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Bearing NEWS

BEARING INDUSTRY MAGAZINE

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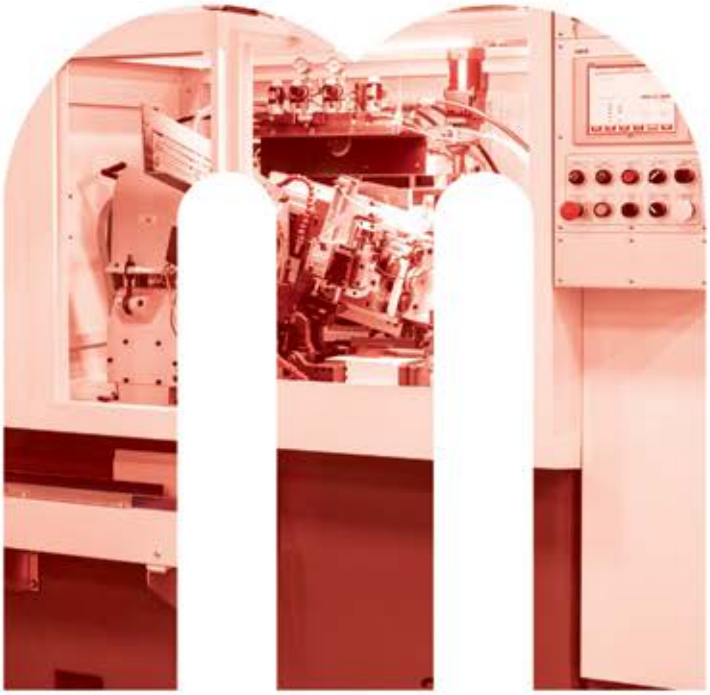

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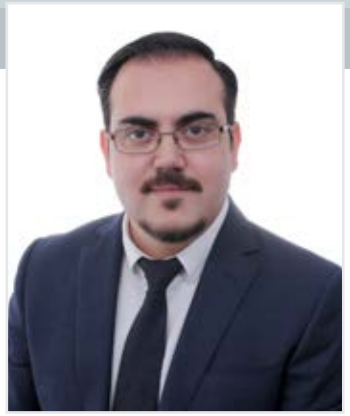

The Bearing Industry in 2018 and beyond

We have been publishing several articles and case studies about predictive and preventive maintenance, which is very closely connected to bearing reliability and the current state of various new technologies. In the coming years, echnological developments are expected to reshape the industrial environement at fast pace. The evolution of the Internet of Things, industrie 4.0, machine learning and the revolution in the automotive industry will define the future of the manufacturing industry; and makes further changes inevitable for the bearing engineering, manufacturing, distribution and maintenance as well.

Each time some technological development emerges, the industry involved must adapt to make the best use of it. That can be particularly difficult in the industrial setting, often driven by the mantra, "If it's not broken, don't fix it.". Maintenance is no longer a guessing game and companies now know in advance when a system will or can fail and take necessary measures to avoid failures and optimize the efficiency of thier assets. The ability to monitor the condition of bearings 24/7, from any location, is becoming the new trend in maintenance practices. Bearing condition monitoring by ultrasound will play a key role in this trend. You will be able to read various articles in this issue which will help you gain more insight in the latest trends for condition monitoring, ultrasound, lubrication optimization and other subject that can help avoid system failures.

Further in this issue, we have 'a BearingNEWS classic': four exclusive interviews with the leaders of important production and distribution organizations in the bearing and related industries. The first interview is with Mr. Luca Chiesa, Managing Director of Cemp Motors, a Regal brand and leading manufacturer of electric motors for the global industrial market and specialized in motors for hazardous atmospheres.

The second interview is with Dr. Arbogast Grunau, who is in charge of Corporate R&D Competence and Services at Schaeffler AG in Germany. We tried to reveal why Schaeffler is sponsoring the Bearing World Conference and had the chance to discuss Schaeffler's presentation topics about the development of a new asymmetrical spherical roller bearing for wind turbine applications and the prediction of bearing noise.

SKF is also one of the main sponsors and supporters of the Bearing World conference, and sees it as a leading event to exchange state of the art technology and latest research results, in order to make machines more powerful and more reliable. We tried to reveal why SKF, one of the global bearing suppliers and leading company in bearing research and technology, is sponsoring the Bearing World Conference, during an interview with Mr. Bernd Stephan, President Automotive & Aerospace at AB SKF.

Mineral Circle Bearings is the first company in the UAE who specializes in automotive bearings, making it one of the top aftermarket institutions in the region. For more than 30 years, MCB has served as the preferred supplier of a wide range of quality and cost effective brands for automotive, industrial or agricultural bearings, cv joints, universal joints, grease, tools, as well as oil seals from leading manufacturers. We tried to find out the story behind the company during an interview with Mr. Hassanein Alwan, the Managing Director at Mineral Circles Bearings.

What's rolling in the bearing industry? A brief summary of what happened during the last six months in the bearing industry; preparation and approach to Bearing Damage Analysis, rolling-contact fatigue and wear testing, new production technologies, preparation and approach to bearing damage analysis, new products releases, the importance of bearing selection on gearbox performance, a new volume of top 100 bearing reliability tips from Per Arnold Elgqvist, and what you need to know if you're buying bearings from China... Together with all these interesting topics, many other bearing industry related articles, case studies, insights and developments can be discovered in this February issue of the BearingNEWS magazine.

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

Kenan M. Özcan

Editor in Chief
BearingNEWS

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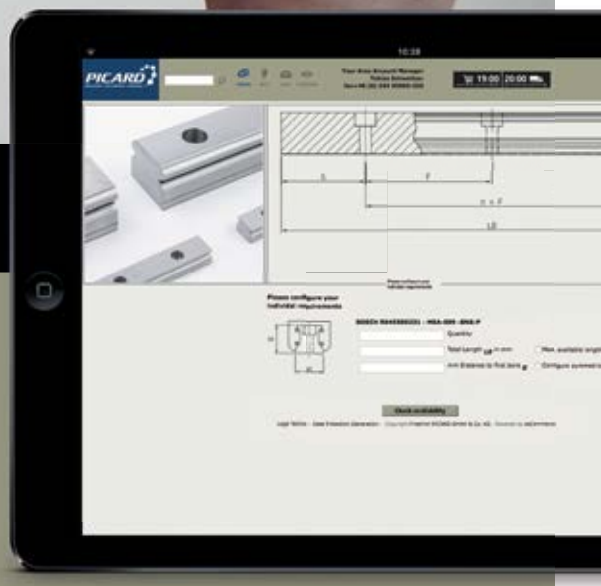

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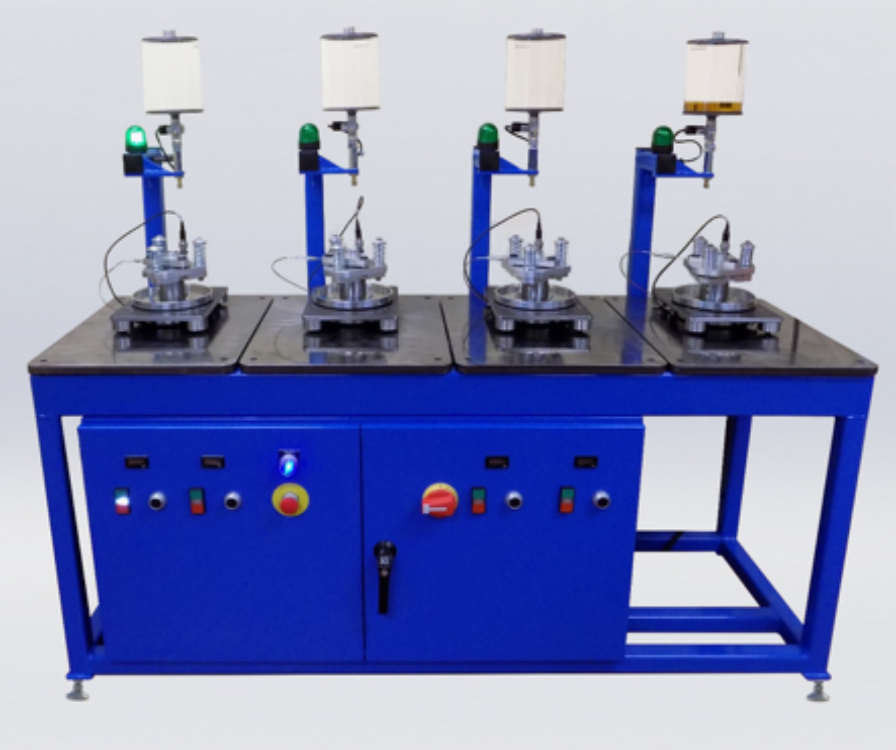
Rolling-Contact Fatigue & Wear Testing

The largest independent bearing testing and inspection facility in the United States, Napoleon Engineering Services (NES) has announced their advancements in proven test technology offering expanded test opportunities for low-cost, proof-of-concept research.

Ball-on-Rod RCF Tester

The NES Three-Ball-on-Rod Tester represents one of the most economical rolling contact fatigue proof of concept tests available in the industry. Testing is performed to evaluate the influence of heat treatment, material, lubricant, and coatings on fatigue life.

The advantage of the NES tester is that run times are short and a single rod specimen can provide many failure data points, thereby containing overall project costs. High stress cycle accumulation per revolution and stress levels up to 900 ksi (6.2 GPa) provide many options to the test engineer. NES has designed these RCF testers with oil heaters, lubricant flow control, test fixture temperature monitoring and vibration sensors with a dedicated data acquisition and monitoring system to ensure test integrity.



Five-Ball Tester

The NES Five-Ball tester captures many of the intricate mechanics of bearing fatigue making it very attractive for simulation of full scale bearing testing of ball bearings without full scale costs.

The upper drive ball simulates the inner ring, the cup supporting the lower four balls models the outer ring and the four planetary balls replicate the balls in a bearing. Five-Ball testing can be used to qualify ball manufacturers, verify material lot integrity, investigate lubricant effects on fatigue life, study ceramic ball material and process quality, and determine heat treatment life factors. This modern version of the original NASA testers is designed to run at speeds up to 10,000 rpm and stress levels up to 900 ksi (6.2 GPa) on ball diameters up to 1¼". The NES tester controls lubricant flow, oil temperature, rotational speed and applied load while monitoring support cup temperature and system vibration for automatic shutdown.

Cylindrical Roller Tester

Testing of individual cylindrical rollers

The NES Five-Ball tester captures many of the intricate mechanics of bearing fatigue making it very attractive for simulation of full scale bearing testing of ball bearings without full scale costs.

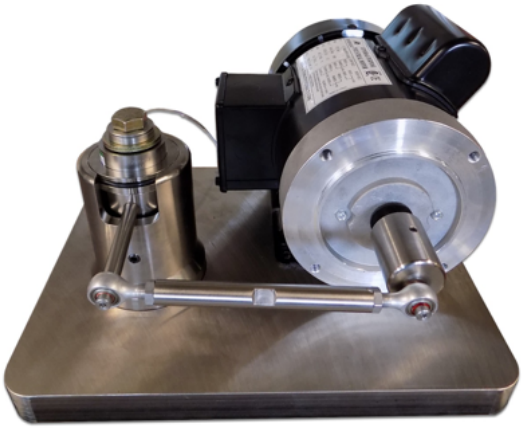
outside of a full scale bearing can now be achieved using the NES Cylindrical Roller Tester (CRT). Testing ceramic roller quality or evaluating the influence of crown geometry on roller life can now be done cost effectively and without the risk of inner or outer ring failure. The NES CRT can accommodate 7mm x 7mm rollers up to 14mm x 14mm making it an ideal test bed for aerospace roller geometry and material research and development. Testing of ceramic roller to validate material and process integrity at high stress levels can be achieved on the CRT. Stress levels as high as 450 ksi (3.1 GPa) can be achieved with multiple stress cycles per roller rotation, resulting in short test times without the need for complete bearing testing and resulting ring failures. The CRT allows for validation of material, surface, form, and process integrity for end users, roller manufacturers and bearing manufacturers alike.

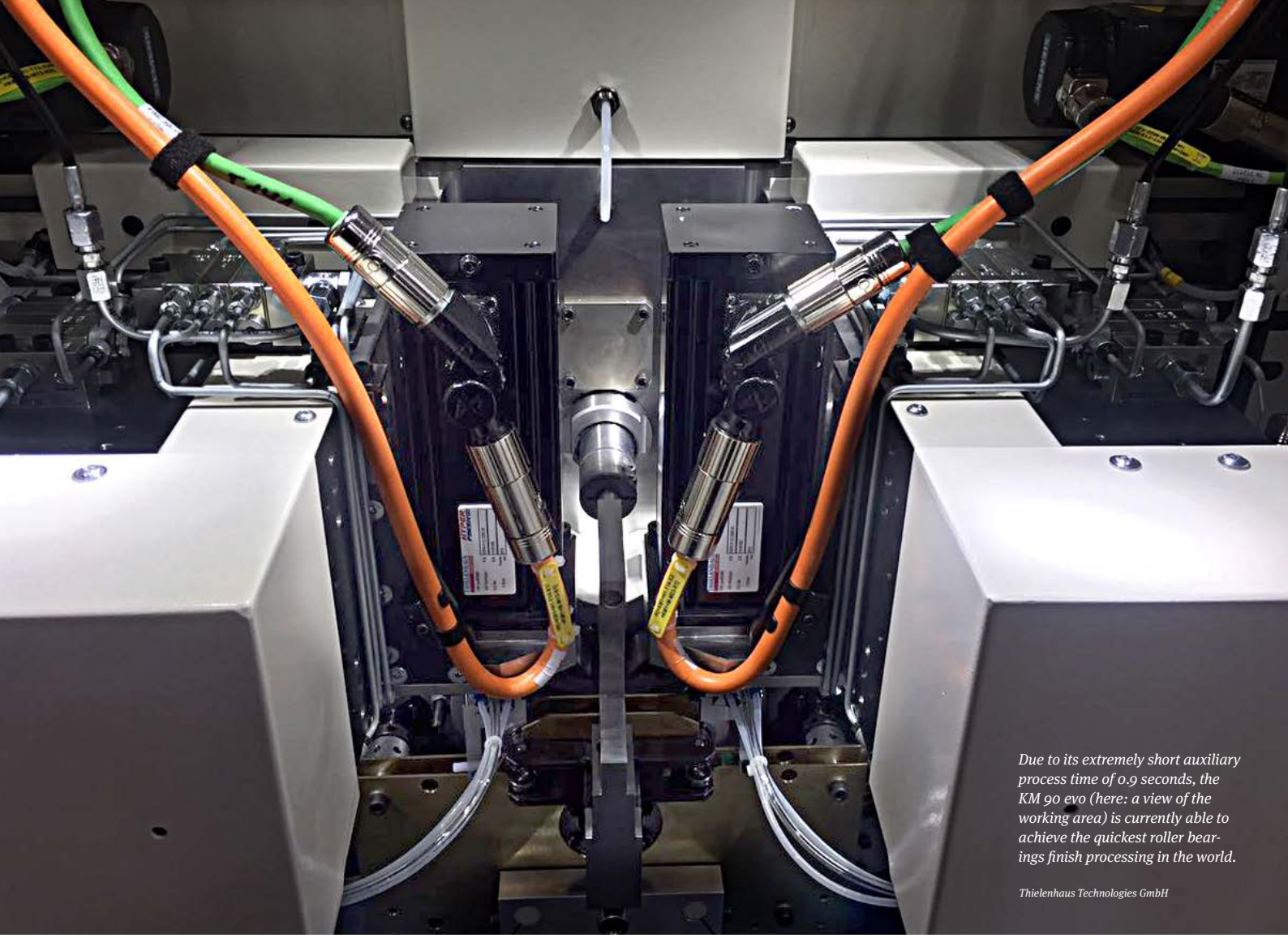
NES Fretting Wear Tester

The NES fretting wear tester is based on ASTM D4170 standard test method for fretting wear protection of lubricating greases; however, it is also designed to allow for increased oscillation angles and can be used to validate proof of concept wear solutions under aggressive fretting and oscillating conditions.

The NES fretting wear tester is an ideal platform to evaluate the influence that material, dry film lubricant, coatings, plating, cage material, grease, or manufacturing processes have on wear. The machine tests two thrust ball bearings with an axial load applied at oscillation angles up to ± 30°. This tester provides test results within days with low cost sample preparation.

Napoleon Engineering Services, founded in 1997 in Olean, NY, is a privately-owned, one-stop shop for engineered bearing products, specializing in Bearing Inspection, Bearing Testing and Custom Bearing Manufacturing. Napoleon Engineering Services prides itself on providing bearing solutions to a vast number of industries and is the largest independent bearing inspection and testing facility in the United States. NES can be reached at (877) 870-3200 or through www.nesbearings.com





Due to its extremely short auxiliary process time of 0.9 seconds, the KM 90 evo (here: a view of the working area) is currently able to achieve the quickest roller bearings finish processing in the world.

Thielenhaus Technologies GmbH

FASTEST BEARING FINISH IN THE WORLD WITH THE NEW KM 90 EVO FROM THIELENHAUS

Thielenhaus Microfinish has introduced a new high-performance machine for the finest processing of the inner and outer rings of one and two rowed ball bearings and roller bearings and wave-like special types.

The KM 90 evo, which has been designed both for quantity production as well as flexible production in small and medium scale production, is a further development of KM 90, a longstanding proven anti-friction bearing processing solution from the market-leading manufacturer. All of the new technologies from direct drive are available for the new oscillation unit through to double oscillation HyperFinish with overlapping high frequency oscillation and a small stroke. The complete tooling process of the previous model can also be used for the new machine.

Due to the extremely short auxiliary process time of 0.9 seconds, the KM 90 evo is currently able to achieve the quickest roller bearings finish processing in the world. The floor to floor time can be a sensational 3.5 seconds under the conditions of a direct link with an upstream grinding machine, for example,

a deep groove ball bearing of an outer and inner ring Type 625. Furthermore, the changeover time between two good parts can be reduced to less than 20 minutes. The new fast runner for mass production can even be flexibly converted from radial to axial bearing rings and from ball bearing to roller bearing processing.

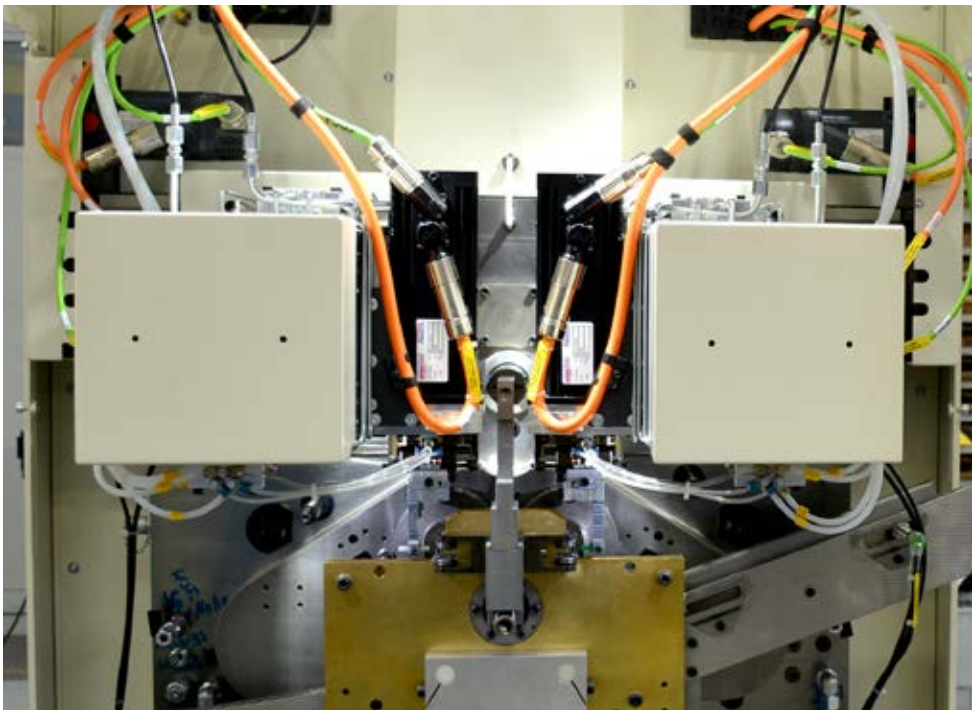
With the optionally available HyperFinish technology 2.0, up to 30% shorter cycle times can be achieved by overlapping the main oscillation with an additional high frequency oscillation. Thanks to the increased productivity, you will be able to do without additional machining stations and/or machines, resulting in operational cost savings. Due to the reduced oscillation angle, quality and shape parameters are also improved so that optimal dimensional accuracy can be achieved, particularly with 4 point bearing rings, for example.

The direct drive radial oscillation for ball bearing rings makes it possible to adjust the oscillation and approach angle, as well as oscillation frequency and stroke using the program. With the changeable direct drive for linear oscillation for roller bearing rings, the adjustment of the linear stroke can also be recorded in the program. This also applies for the X-Z track position.

The menu and image-driven programming with automatic program generation and calculation of the process parameter speed and stone grinding pressure from known indicators of cutting speed in m/min and specific grinding pressure in N/mm² makes for easier handling of the machine. Menu-driven set up is also optionally offered. An innovative compensation for wear on the workpiece driver makes it possible to use reground drivers and significantly reduces tooling costs.

The option of time recording for setbacks even with the KM 90 evo, demonstrates that Thielenhaus has developed in the direction of Industry 4.0. The machine comes with an integrated control cabinet in the extraordinarily compact dimensions of 2,063 x 1,026 mm so that it can even fit in spatially limited production chains.

With the KM 90 evo, Thielenhaus Microfinish has brought a high performance machine onto the market, which can be used with distinctively quick cycle and setup times, both for economic mass production of ball bearing rings, as well as for flexible production on a small and medium scale.



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simalube IMPULSE is the perfect complement to the well-established simalube lubricator – wherever high-pressure is required. It has no problem overcoming counterpressures of up to 10 bar, making it the perfect solution for long lubrication lines. Simply affix the simalube IMPULSE to the lubrication point, then screw on the required simalube lubricator and activate it for the desired dispensing time. The simalube IMPULSE requires no additional adjustments and the LED display continuously signals its proper functioning. Once it is completely empty, the simalube IMPULSE can be used multiple times if it is equipped with a new simalube lubricator and battery pack.

Impressive functionality

The **simalube IMPULSE**, together with simalube lubricators in sizes of 60, 125 or 250 ml, ensures reliable lubrication when faced with lubrication lines of up to four metres and high counter pressure. Continuous lubrication impulses of 0.5 ml supply the lubrication point with oil or grease up to NLGI 2. This action is gentle on the lubricant, as only the dosing volume is placed under pressure. The intelligent pressure booster also continually signals its operating state. When properly installed, the LED indicator on the **simalube IMPULSE** flashes green at regular intervals. Red flashes signal overpressure, inactive and empty conditions.

Easy to install and use

The **simalube IMPULSE** starts operating as soon as a battery pack is inserted and the lubricator is screwed on. The simalube lubricator sets the dispensing intervals. When changing a lubricator, the **simalube IMPULSE** remains firmly affixed to the lubrication point. It must only be ensured that a fresh battery pack will be inserted before screwing on a new simalube lubricator. Therefore, the connection point remains sealed during the change of the lubricator and there is no back-flow of lubricant.

Exceptionally versatile and – thanks to its reusability – very cost-efficient

The compact size of the **simalube IMPULSE** enables installations in the smallest of spaces and in all positions. As an IP68 protection class device, the pressure booster is dustproof, waterproof and suitable for use in a wide range of industries. Equipped with a new battery pack at each refilling, the **simalube IMPULSE** can be used for ten dispensing cycles of simalube 125 ml or for up to three years.

Company profile of simatec ag

simatec ag is an independent, international, family business with its head office in Switzerland (Wangen an der Aare). Since 2005 it has been run by the second generation of the Wyssmann family. Since the company was founded in 1983, motivated staff have been developing and producing innovative products for the maintenance of roller bearings under the simatherm, simatool and simalube brands. At the end of 2007, the simatec inc. subsidiary successfully started operations in Charlotte, NC, USA.

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Bearing Grease REPLENISHMENT

On-Condition or Time-Based?

By Allan Rienstra, SDT Ultrasound Solutions

Maintaining plant assets in an optimal state of lubrication is a topic receiving lots of attention. Maintenance and Reliability practitioners dedicate teams to the task, but not every organization achieves world-class results. As much as 80% of all bearing failures are attributed to poor lubrication practices, including:

- Using the wrong lubricant
- Lubricant deterioration
- Lack of lubricant
- Too much lubricant
- Contamination
- Mixing grease types
- Using sealed bearings, but still providing a grease nipple access point on the motor (whoops!)

One glaring mistake that contributes to early bearing failure is over/under lubrication. Over and under lubrication is the product of scheduling grease replenishment on a time-based instead of a condition-based schedule, and not knowing how much grease to inject. Too often bearings are being fed new grease before its required. Other times the grease gun comes out too late. Some lubrication technicians guess at the quantity of grease to inject and don't even know how much grease is dispensed with a stroke of their grease gun. Bearing manufacturers provide formulae for calculating a theoretical grease capacity for each bearing, but not everyone knows how to use them. Still, others simply

Figure 1 - Collecting ultrasound data with SDT270 while replenishing lubricant.

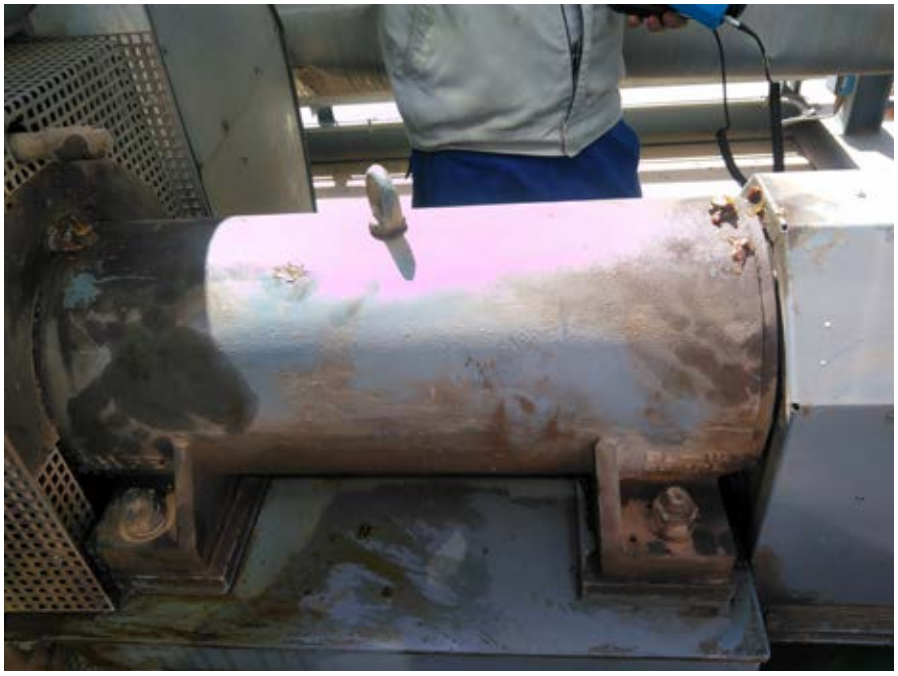

Figure 2 - Two fan bearings with different load. Why do they share the same grease replenishment protocol?

follow guidelines given by the motor manufacturer. Often, this "bad advice" is stamped directly on the motor.
To drive home this point, Haris Trobradovic, one of SDT's many globe-trotting corporate trainers, recently delivered training to a petrochemical facility in the Middle East.
"During the training, we performed measurement practice on several machines (Figure 1). One of the machines was a fan, scheduled for re-lubrication in a few days." recalls Haris. "The customer's standard greasing practice is to follow manufacturer's recommendations for both interval and amount. In other words, they grease on a time-based schedule and trust the motor manufacturer to guide on quantity."

Figure 1 - Collecting ultrasound data with SDT270 while replenishing lubricant

Trobradovic used the opportunity and performed re-greasing exactly as recommended by the OEM, even though the Condition Monitoring team had a different opinion. Their ultrasound data did not indicate any need for grease replenishment. The CM team members are strong advocates for on-condition lubrication and doing away with time-based.

Following the facility's lubrication procedure raised several red flags. Figure 2 shows two bearings driving the fan. Why would two identical bearings, but with different loads, have the exact same grease replenishment protocols? Maybe,z it's purely out of convenience; Since the lubricator is there to grease the drive end bearing, might just as well pump a few strokes into the non-drive end.
Another issue that disturbed the SDT trainer was the instructions stamped on the motor plate. See Figure 3 – Maintenance of the bearings with grease quantity regulator. This stamp instructs the owner of the motor to add 32.7 grams of grease (grease type not identified) every 3,068 operating hours. Haris wondered if the OEM took into consideration the installation of the motor in a climate that is very hot and humid in the summer time, but cold, snowy, and dry in the winter.
One refreshing fact was an additional plate (Figure 4) with details about the grease type used in the bearing. Mixing incompatible grease types is an often cited cause of premature bearing failure. This same reminder is provided by the SDT LUBExpert Ultrasound Tool. Prior to beginning a lubrication task LUBExpert reminds the operator of the correct grease type to use.

Continuing with the experiment, Haris and the CM team attached the grease gun to the SDT equipment and greased the drive end bearing following OEM recommendations. Figure 5 is a screen shot captured from UAS, the companion software to LUBExpert. The top trend is the drive end bearing. Within four minutes the overall RMS increased by 7 dBµV, while the Crest Factor and Peak spiked sharply.

The bottom trend is from the non-drive end bearing. Adding the requisite amount of grease had no positive outcome for the Overall RMS which stayed stable at 26 dBµV. The drop in Crest Factor and Peak readings, however, indicates the bearing may be entering a failed state. More frequent condition monitoring with complimentary technologies, such as vibration analysis, will ensure any machine downtime is scheduled on the client's terms, not the machine's.
For those unfamiliar with these data formats, Overall RMS, Max RMS, Peak,

Figure 3 - OEM instructs the owner to grease on a time-based schedule without considering the operating environment.

Figure 4 - This motor had a secondary plate reminding lube-techs which grease type to use.

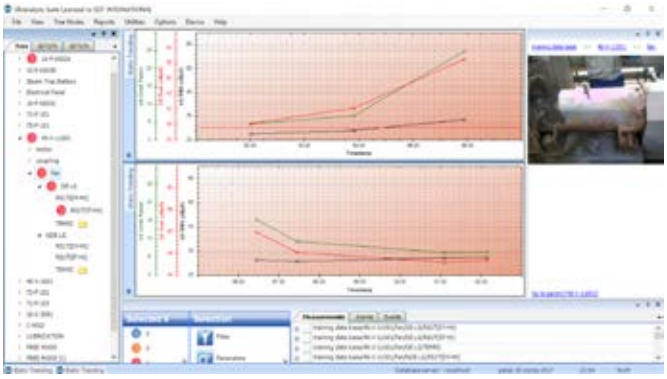

Figure 5 - Top trend graph illustrates drive end bearing after lubrication. It is badly over-greased.

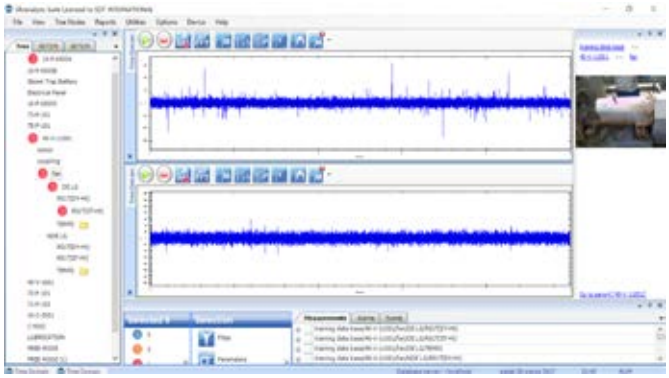

Figure 6 - Dynamic data from drive end shows the emergence of defects (top) after bearing was over-greased following OEM recommendations

and Crest Factor are unique condition indicators developed by SDT to bring analytical meaning to ultrasound STATIC data. Sadly, following OEM procedure resulted in over-lubrication of the DE bearing.

To drive home the point, Haris also captured DYNAMIC time signals from the drive end bearing. As seen in Figure 6 the time signal before (bottom) and after (top) reveals new peaks and impacts forming. Over-lubrication causes pressure to build inside the bearing. Ideally, the oil wants to feed from the thickener to form a thin film between the rolling elements and the race. It can't do this if there's too much grease and pressure. The result is increased friction and impacting, two phenomena easily detected with ultrasound specialty tools like SDT's LUBExpert.

Finally, Haris collected DYNAMIC time signals on the non-drive end bearing. In Figure 7 the bottom time signal shows dominant peaks that are clearly non-sinusoidal and indicative of impacting. After lubrication those peaks are gone. It appears that replenishing the grease in the non-drive end had some positive benefits, and those benefits are clearly illustrated in UAS time view.

The bottom line is that following OEM recommendations to replenish lubrication on a time-based or time-in-service protocol are proven wrong time and again. Following the greasing instructions stamped on the motor plate led to the drive end bearing being over greased and reducing life expectancy.

Another interesting takeaway here is that while an ultrasound lubrication solution – LUBExpert – was used to monitor the effects of adding grease, the added benefit for the CM team is the indication that a failure state may exist. There was a day not too long ago when the lubricator was counted on for keeping his finger on the pulse of the plant. Solutions like SDT's LUBExpert are restoring important responsibilities to a task that recently has been given to "lower-skilled" tradespeople.

It's past time that lube-techs be recognized for the important role they can play contributing to plant reliability.

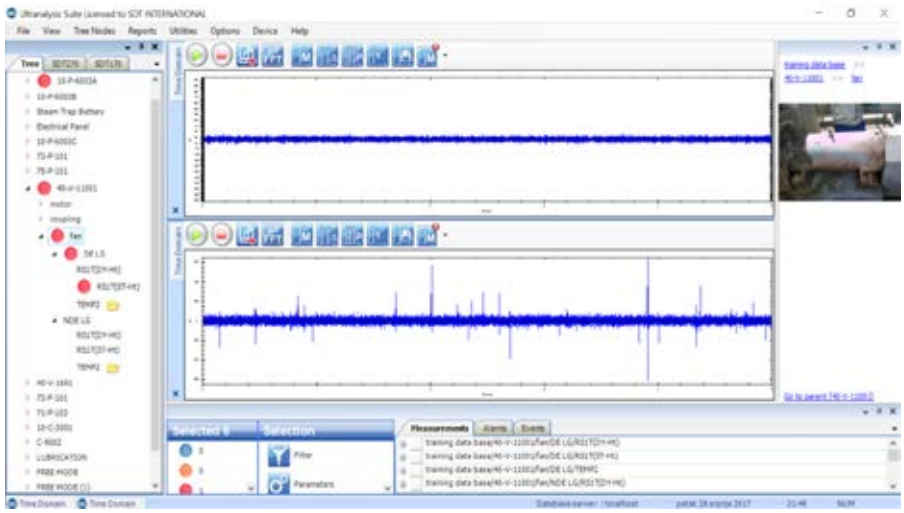

Figure 7 - The non-drive end bearing has defects as shown by this dynamic time signal. Ultrasound assisted lubrication with SDT allowed the CM team to identify this potential fault.

Allan Rienstra is the Director of Business Development *for SDT International, a Belgium manufacturer of ultrasound technology providing solutions that contribute to plant reliability and energy efficiency. He has 27 years of experience helping create ultrasound programs in 6 continents. He is the co-author of* ***"Hear More, A Guide to Using Ultrasound for Leak Detection and Predictive Maintenance".***

Mr. Rienstra lives in Cobourg, Ontario, Canada and can be reached at ***allan@sdthearmore.com.***

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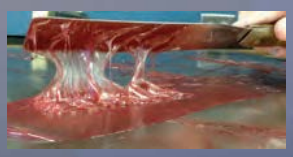

Very tacky
Almagard clings tenaciously to metal, and will not pound out or sling off, even in extreme conditions.

Highly resistant to water
Almagard (left) stays in place, while the competitor's grease (right) washes away.

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THE VERY BEST OF NTN'S MADE-IN-JAPAN BALL BEARINGS, AT NO EXTRA COST

NTN -SNR/Pedro Studio Photo

NTN-SNR is revamping its range of NTN deep-groove ball bearings with an improved version with CM internal clearance.

NTN-SNR has launched its range of NTN deep-groove ball bearings with CM internal clearance, which will progressively replace the current range with normal internal clearance. Initially designed for applications with stringent requirements – electric motors in particular – NTN deep-groove ball bearings with CM internal clearance make up the brand's new offer. They feature major improvements in terms of internal radial clearance and noise levels. These qualities are guaranteed by strict control procedures during the manufacturing process in Japan. With this range, NTN-SNR is offering higher-quality deep-groove ball bearings that can take the place of the standard references used in industry, with no difference in price. By further enhancing its own standard, NTN-SNR has once again highlighted its determination to provide all its customers, distributors and end users with the very best of NTN Japanese manufacturing.

100% control of silence and internal clearance

NTN's made-in-Japan quality at the service of industry NTN deep-groove ball bearings with CM internal clearance were originally designed specially for advanced applications, and above all for electric motors, which require particularly quiet bearings.

These CM bearings feature radial internal clearance that lies within the limits of normal internal clearance, but with reduced clearance tolerances (for example, for a bore diameter of 50 mm, a bearing with normal internal clearance would have a clearance of 6 to 23 microns, whereas a product with CM internal clearance has one of 9 to 17 microns). This makes it possible to considerably reduce vibration levels and therefore noise as well. These vibratory and acoustic performance levels provide enhanced user comfort. These results are obtained thanks to excellent control of the manufacturing process and NTN's recognised know-how. Every part we manufacture is inspected to guarantee clearance and noise levels over the full production range.

The range of NTN deep-groove ball bearings with CM internal clearance

170 references in individual boxes

- *Bore diameters of 35 to 160 mm*

Deep-groove ball bearings

- *Open*
- *With deflectors, 5K grease*
- *With contact seals, 5K grease*
- *With non-contact seals, 5K grease*

These bearings with CM internal clearance feature assembly parameters that are identical to those of their counterparts with normal internal clearance and they are fully interchangeable. They have the same load capacities and identical performance levels as regards rotation speed. For the sealed references (deflectors and seals), the products are provided greased for life using a highperformance grease (suffix 5K).

Enhanced quality at no extra cost Progressive upgrades for customers

NTN-SNR proposes NTN ball bearings with CM internal clearance at no extra cost as compared with products featuring normal internal clearance. The bearing designation systematically includes the CM suffix so that customers can easily identify the upgrade. The initial parts are already on sale. Full roll-out of this range of ball bearings should be completed during the first quarter of 2018.

NTN-SNR is the only actor on the European market to offer ball bearings of this quality at the same price, thus confirming its premium positioning and its determination to deploy NTN's made-in-Japan quality on its industrial markets.

NTN-SNR ROULEMENTS, headquartered in Annecy (Haute-Savoie, France), belongs to The Japanese Group NTN Corporation, a global leader in bearings. NTN-SNR manages and develops all NTN's activities for the EMEA region and Brazil. NTN-SNR, a major force as a designer, developer and manufacturer of bearings and sub-assemblies for the automotive sector, industry and aeronautics, offers a comprehensive range by also developing maintenance services and solutions. NTN-SNR employs 4,225 people at nine production sites, including six in France, as well as 18 sales offices. Contact +33 (0) 450 653060 or abelia.dekindt@ntn-snr.fr for more information.

NTN-SNR/Pedro Studio Photo

Condition Monitoring Solution for a **Cement Tube Mill**

By implementing a temporary monitoring solution for assessing the condition of the trunnion drive end bearing on a cement tube mill, Schaeffler has helped Sunstate Cement prolong the operating life of its mill, thus avoiding the significant cost of replacing the bearing and the associated downtime.

Sunstate Cement Ltd. is one of Australia's leading manufacturers and suppliers of high quality cement products to commercial businesses throughout Queensland and Northern New South Wales. With a production capacity of more than 1.5 million tonnes of cement per year, Sunstate Cement has a long history as a major contributor to Queensland's largest and most impressive infrastructure projects for over 25 years.

The plant primarily produces two types of cement: Flyash blend and GP cement. The three Tube Mills at the site have each a production capacity of 60 to 100 tonnes of cement per hour.

During a visual inspection of the trunnion drive end bearing on Tube Mill No.1, Sunstate Cement engineers discovered that the bearing was in a reasonable condition despite 28 years of service. A decision was made to extend the service life by rotating the outer ring by 180 degrees, which is a common practice for this type of application. After this rotation, Schaeffler technicians were asked to provide a condition monitoring solution for the trunnion end bearing in order to assure Sunstate Cement that the bearing was still fit for purpose.

Due to unpredictable operating times and despite the slow speed of the tube mill, the customer considered collecting vibration data. Schaeffler recommended a temporary solution that comprised of two FAG SmartCheck online condition

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monitoring systems (one axial and one radial), as well as a remote wireless network system for communication, monitoring and diagnostics from Schaeffler's Online Centre in Sydney, Australia.

The two FAG SmartCheck units were configured to suit slow speed bearings and set up only to collect vibration data when the tube mill was operating, which ensured that only relevant data was obtained. This temporary solution proposed by Schaeffler was accepted by the customer for a period of one month. After this time, a machine condition report was provided by Schaeffler technicians outlining that the trunnion end bearing was fit for purpose.

By implementing the temporary FAG SmartCheck monitoring solution, Schaeffler was able to supply a prompt, cost effective monitoring system to assess the condition of the trunnion drive end bearing for continued service. The FAG SmartCheck provided high quality vibration data at slow speeds. Subsequently, Schaeffler technicians analysed the data and made recommendations to the customer for continuation of service for the trunnion bearing. The benefit and value to Sunstate Cement was being given assurance that the bearing was suitable for further operation, thereby avoiding the significantly higher costs of replacing the bearing.

In the same plant, two of the three tube mills were already equipped with FAG ProCheck and a remote monitoring service. The customer has since equipped its third mill with a permanent FAG ProCheck monitoring system to effectively continue monitoring the remaining life of its bearing, using Schaeffler's monitoring services. FAG ProCheck can be used to monitor bearing vibration behaviour and other process parameters, such as bearing temperature and speed.

Once set up, FAG ProCheck can operate automatically without further intervention from the user, to measure, record, analyse and issue alerts on vibration data from rotating plant. By continuously monitoring a machine or piece of rotating equipment, FAG ProCheck can detect changes in their early behaviour and alert maintenance personnel about a potential problem before it actually occurs. Maintenance teams can therefore improve their planning and scheduling and production downtime is significantly reduced.

Two FAG SmartCheck units temporarily monitored the condition of the trunnion drive end bearing over a period of one month (Image: Schaeffler).

Customer Benefit

Cost of a new trunnion end bearing	:	105,000 euros
Average downtime cost per hour	:	1500 to 3,500 euros
Average downtime for a bearing replacement	:	3 to 5 days (min. 72 hours)
Cost savings for every bearing replacement avoided	:	200,000 euros

The FAG ProCheck system monitors all critical assets of the tube mill (Image: Schaeffler).

The FAG ProCheck system can be easily expanded and customised through an expansion slot system and digital filter algorithms. The unit is therefore easy to integrate into a company's existing production data management system, statistical process control (SPC) system or PLC network.

Luca Chiesa
Managing Director of Cemp Motors

THE EUROPEAN SPECIALIST
IN FLAMEPROOF MOTORS

In BearingNews Magazine, Regal is mainly known for its bearing brands Rollway®, Sealmaster® and McGill®. The Regal® product portfolio is much broader though with also couplings, conveyor solutions and electric motors. Today we speak with Luca Chiesa, managing director of Cemp motors, a Regal brand and leading manufacturer of electric motors for the global industrial market and specialized in motors for hazardous atmospheres. Luca Chiesa is a graduate from University Politecnico di Milano, has a vast sales experience in electric motors and started at Cemp motors in 2006.

Luca: "Hazardous atmospheres can be understood as many applications. For instance, any application like ventilators, pumps or compressors in a hazardous location like a refinery or a chemical plant are powered by the Cemp® type of motors. A much larger, but also hazardous application is the hoist of an offshore crane. Imagine you are on the North Sea, it's raining and rough waves are beating against the platform, but you still have to unload that boat. Conditions are very hard, but you need to rely on all your equipment operating flawlessly. We take pride in manufacturing electric brake motors that help secure these people's safety and efficiency."

European manufacturing, global engineering

Established in Italy in 1954, Cemp motors was among the first companies in Europe to manufacture flameproof motors. Over the years, production was oriented to higher customized products such as flameproof motors with brake, flameproof electric pumps for printing machines, flameproof motors for Group IIC gases, motors for mining and the very last development which is a complete series of IE3 (and IE4 on demand) efficiency level Atex and IEC-EX certified motors. Cemp motors operate in hostile environments throughout the world on offshore oil & gas rigs, production platforms, onshore terminals, refineries, chemical works and coal mines. One of their strengths is the minimal attention they need over long periods.

Quality, customization and lead time as strengths

"For more than 60 years we have been differentiate ourselves by providing highly customized and quality motors to our customers with incredibly short delivery time. Many motor manufacturers have a lead time of 5 to 7 weeks for a standard motor. We can do the job in 2 weeks for a customized motor," Luca proudly tells us. "We have the right components in stock in Italy, a skilled and experienced staff in our workshop and an excellent synergy with the global Regal engineering teams."

" Rollway bearings have low friction losses and wide working temperature range from -60°C up to 80°C and even up to 120°C with special feature "

"Our motors are used in oil refineries in Qatar at +60°C ambient temperature, in water treatment facilities in Kazakhstan and also on offshore platforms in the North Sea or Siberia at -60°C," Luca explains. "We are operating in these remote places because of our excellent relationship with the main EPC (Engineering, Procurement, Construction) Contractors, which demonstrates our expertise and reputation for the products and services we provide."

Cemp motors has created one of the most comprehensive ranges of electric motors for hazardous areas available today, including flameproof – explosionproof motors, "non sparking" motors and

"Cemp motors are used in oil refineries in Qatar at +60°C, in water treatment facilities in Kazakhstan and also on offshore platforms in the North Sea or Siberia at -60°C,"

motors for dusty environments. Furthermore, Cemp motors supplies customers with consulting services for designing and manufacturing motors with special features.

Rollway® bearings in flameproof motors

The Cemp motors team works on continuous product improvement and innovation every single day. Recently, this resulted in the introduction of a complete range of flameproof motors with premium efficiency IE3 and capability to reach IE4 super premium efficiency with a special version. The IE4 range offers an optimized sustainability through lower operating costs over the complete service life.

For the IE3 motors product range, Cemp motors team reduced all the losses in the motor, including for the bearings. Rollway bearings have low friction losses and wide working temperature range to satisfy all customer need in terms of site conditions (from -60°C up to 80°C and even up to 120°C with special feature).

"The 120°C ambient temperature project required a low friction Rollway bearing with special grease up to a working temperature of 200°C. Having bearing specialists in our Regal family is a true asset. The very high ambient temperature requires special care to seal the bearing in order to reduce the temperature rise."

Temperature rise in the bearing area is reduced up to 20 degrees Kelvin, starting from a rated value of 29 degrees Kelvin temperature, by using synthetic hydrocarbon oil as base for the grease and by derating electrical rotor losses with special winding (motor slip reduction). Bearings working temperature would be about 140°C and the product has 60K of thermal margin, increasing product reliability also at high temperature.

Luca Chiesa concludes: "Being part of a global organization like Regal offers a lot of advantages: we have a lot of expertise within the company and the natural synergies make us respond more quickly and more adequately our customer needs. The Rollway® bearing engineering team is a great supporting factor."
If you want to learn more about Regal and its brands, please contact Steve Quintijn (steve.quintijn@regalbeloit.com) from the Regal Marketing Department. He will tell you more about Regal's increasing presence in various industries.

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

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VOL. 02

LET'S FACE IT – BEARINGS WORK IN A TOUGH WORLD.

EXCESSIVE CONTAMINATION. POOR LUBRICATION. HIGH HEATS. HEAVY VIBRATIONS. THESE MERELY SCRATCH THE SURFACE OF ALL THE WEAR AND TEAR YOUR BEARINGS GO THROUGH ON A GIVEN DAY.

That's where the knowledge and precision of Timken come into play. Our sales and service engineering teams solve problems and offer solutions for customers in virtually every industry. Couple this experience with a long-standing history in material science and tribology, and you gain a team of experts uniquely qualified to help you analyze bearing damage. And we want to share this knowledge with you. We developed this reference guide to help you identify some of the most common types of bearing damage, explaining the possible causes and discussing the necessary actions needed to avoid them. We also include useful bearing references and lubrication guidelines you can follow. If your bearing damage goes beyond what we cover, or if you just need help getting started, call us. Our service engineers can work with you – often on-site – to get to the root cause of your problems. We even offer in-depth training that's customized to your specific industry or application. It's a tough world out there. Let us help you make your business roll forward more smoothly.

PREPARATION AND APPROACH TO BEARING DAMAGE ANALYSIS

BEARING DAMAGE: OVERVIEW OF THE FACTS

Timken analyzes bearings from operations across the world. Our bearing service and repair specialists find that fully 50 percent of the bearings submitted to us haven't reached their calculated lives. In some cases, the cause is contact fatigue (inclusion origin, point surface origin, geometric stress concentration and micro-spalling). In 90 percent of the cases, though, the cause is non-fatigue factors, including:

- Foreign materials.
- Corrosion.
- Inadequate lubrication.
- Improper handling.
- Bad running conditions.

If you're concerned that your bearing is deteriorating, look for the following signs:

- Vibrations – whether felt by hand or measured with a frequency analyzer.
- Abnormal noises.
- Displacement of rotational centerline.
- Running temperature increase.
- Odd smells.
- Lubricant deterioration.
- Lubricant leakage.
- Visual discovery during routine maintenance check.

SUGGESTED PROCEDURE FOR BEARING ANALYSIS

Follow the steps below for an accurate and complete analysis when investigating any bearing damage or system breakdowns. If you need help, contact one of our sales or service engineers.

1. Gather operating data from bearing monitoring devices; analyze service and maintenance records and charts; and secure application diagrams, graphics or engineering drawings.

2. Prepare an inspection sheet to capture all your observations. Take photographs throughout the procedure to help document or describe the damaged components.

3. Extract any used lubricant samples from bearings, housing and seal areas to determine lubricant conditions. Package it separately and label it properly.

4. Secure a sample of new, unused lubricant. Record any specification or batch information from the container. Obtain the technical specifications and any related material safety data (handling, disposal, toxicological) documentation to accompany lubricant shipments.

5. Check the bearing environment for external influences, like other equipment problems, that preceded or occurred at the same time bearing damage was reported.

6. Disassemble the equipment (either partially or completely). Record an assessment of the mounted bearing condition.

7. Inspect other machine elements, especially the position and condition of components adjacent to the bearing, including locknuts, adapters, seals and seal wear rings.

8. Mark and record the mounted position of the bearings and components prior to removal.

9. Measure and verify shaft and housing size, roundness and taper using certified gauges.

10. Following removal, but before cleaning, record observations of lubricant distribution and condition.

11. Clean parts and record the manufacturers' information from markings on the bearing rings (part number, serial number, date code).

12. Analyze the condition of the internal rolling contact surfaces, load zones and the corresponding external surfaces.

13. Apply preservative oil and repackage the bearings to avoid corrosion.

14. Compile a summary report of all data for discussion with Timken sales or service engineers.

Damaged Bearing Cages or Retainers

Careless handling and using improper tools during installation may cause cage or retainer damage. Cages or retainers are usually made of mild steel, bronze or brass and can be easily damaged, which can cause premature bearing performance problems.

In some applications, environmental and operating conditions can cause fractured cages or retainers. This type of damage is too complex to cover in this reference guide. If you experience this problem, contact your Timken sales or service engineer.

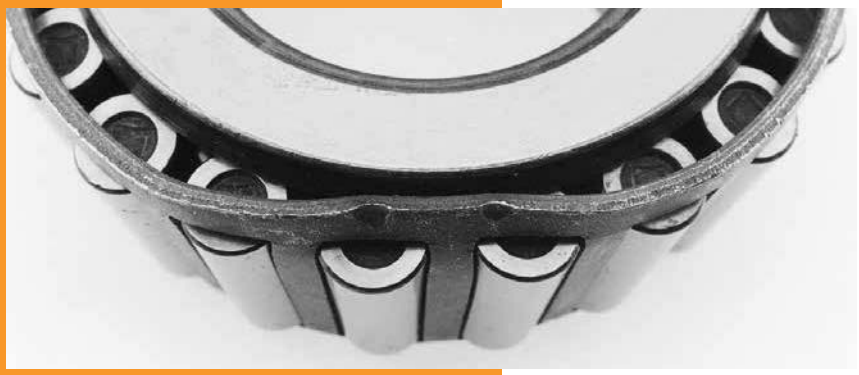


Fig. 43. This cage deformation was caused by an improperly installed or dropped bearing.

Fig. 44. Binding and skewing of these tapered rollers was due to compression of cage ring during installation or interference during service.

Fig. 45. Poor handling practices caused a deep dent on this spherical roller bearing cage bridge. This damage will result in a lack of proper roller rotation, possible roller skidding, increased temperatures and decreased life.

High Spots and Fitting Practices

Careless handling or damage caused when driving outer races out of housings or wheel hubs can create burrs or high spots in the outer race seats. If a tool gouges the housing seat surface, it will leave raised areas around the gouge. If you don't scrape or grind down these high spots before reinstalling the outer race, the high spot will transfer through the outer race and cause a corresponding high spot in the outer race's inside diameter. Stresses increase when the rolling elements hit this high area, which can result in lower than predicted service life.

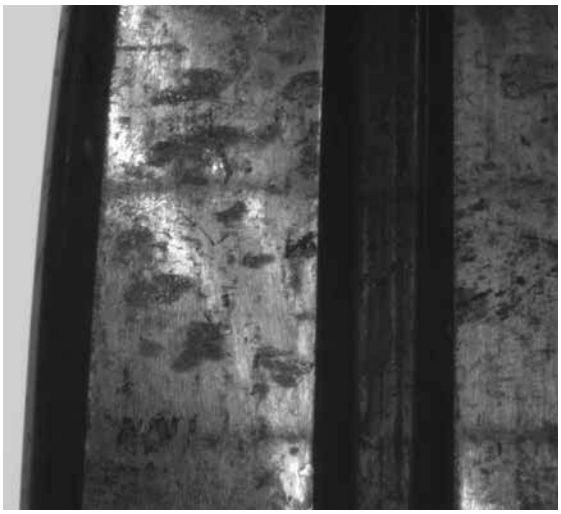


Fig. 46. A worn-out housing caused this bearing to lose fit and fret (move) during service. As a result, metal tearing and wear occurred on this spherical outer ring.

Fig. 47. Classic fretting corrosion from poor fitting practice is depicted here. Relative movement under load between the bearing and its seat caused this worn and corroded condition.

Fig. 48. The marks on the outside diameter of this cup are caused by a high spot on the housing. The cup race is spalled at the spot that corresponds to the spot on the outside of the cup marked from heavy contact

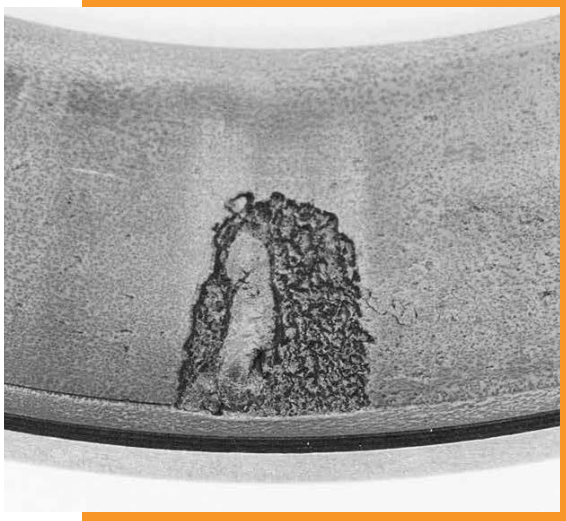


Fig. 49. Localized spalling on this cup race resulted from a stress riser created by a split housing pinch point.

Improper Fit in Housings or Shafts

Follow the manufacturer's recommended bearing fit to ensure your bearings perform properly.

In general, you should apply the bearing race – where the rotating load exists – with a press or tight fit. An example is a wheel hub, where the outer race should be applied with a press fit. The races on a stationary axle would normally be applied with a light or loose fit. Where the shaft rotates, the inner race should normally be applied with a press fit and the outer race may be applied with a split fit or even a loose fit, depending on the application.

Fig. 50. A loose cup fit in a rotating wheel hub (typically tight) caused this bearing race damage.

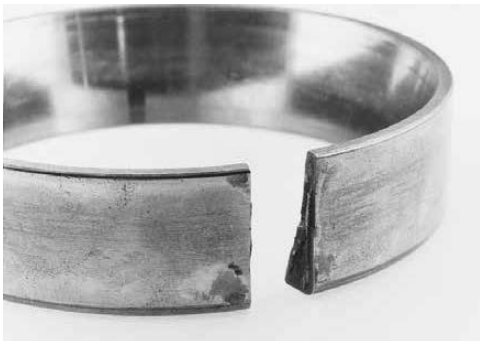


Fig. 51. This is what happens to a cup that is loose in a wheel hub. The cup turns and wears the cup seat so the fit becomes more loose. Then the cup starts to stretch or roll out. The cup, as it rolls out, continues to wear the cup seat and the cup continues to stretch. This process continues to the point where the stretch of the metal reaches the breaking point and the cup cracks open.

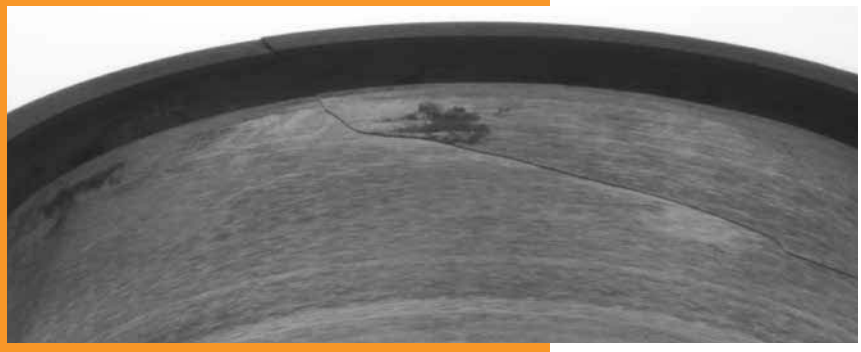


Fig. 52. This ball bearing inner ring fracture results from installation on top of a metal contaminant or raised metal nick.

Fig. 53. An out-of-round or oversized shaft caused this fracture on a tapered roller bearing cone.

Brinell and Impact Damage

Improper mounting and disassembly methods and/or extremely high operational impact or static loads may cause brinelling.
Brinell from improper assembly and disassembly happens when a force gets applied against the unmounted race. When mounting a bearing on a shaft with a tight fit, pushing the outer race will exert an excessive thrust load and bring the rolling elements into sharp contact with the race, causing brinell.

Fig. 55A shows incorrect removal of a bearing, while Fig. 55B shows the correct way to mount or dismount a bearing by applying the force to the tight-fitted race.

Extremely heavy impact loads, which may be short in duration, can result in brinell of the bearing races. Sometimes, they can even fracture the races and rolling elements.

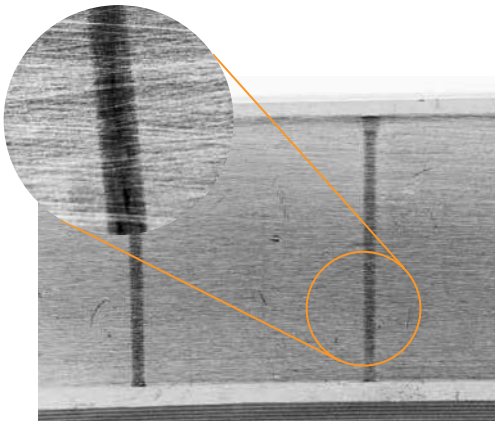


Fig. 54. A heavy impact load on this tapered bearing cup race caused brinell and impact damage. These same indentations are evident on the cone race. This is true metal deformation and not wear as with false brinelling. The close-up view of one of the grooves shows the grinding marks still in the groove.

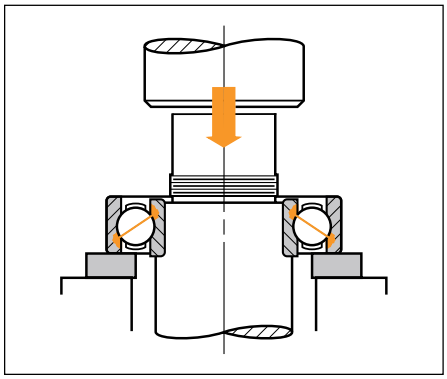


Fig. 55A. Incorrect.

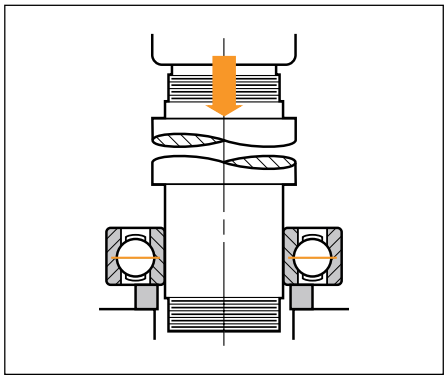


Fig. 55B. Correct.

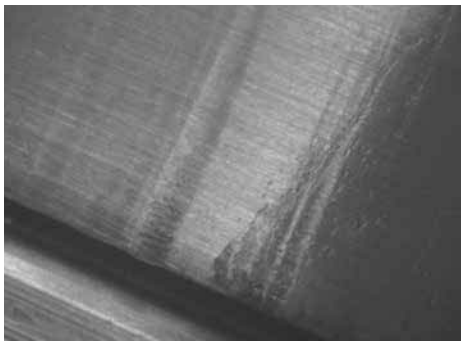


Fig. 56. This inner ring of a spherical roller bearing shows roller impact damage from shock loading.

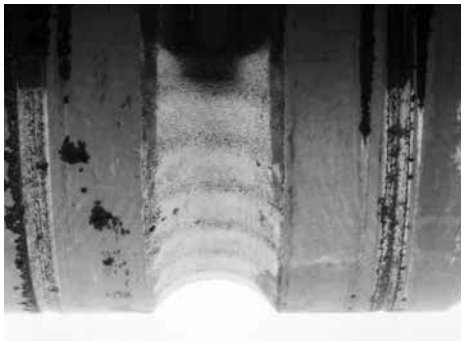


Fig. 57. Note shock loading caused brinell damage on this ball bearing inner ring.

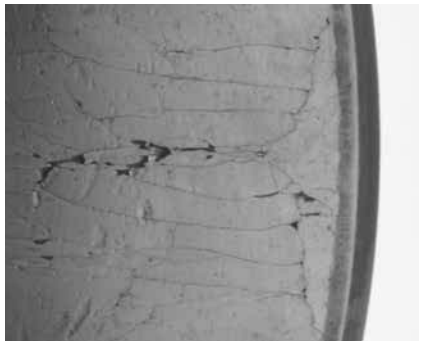


Fig. 58. This cylindrical roller bearing inner ring was crushed by an application failure during service.

False Brinelling

As the name indicates, false brinelling isn't true brinelling or denting. It's actually fretting wear caused by slight axial rolling-element movements while the bearing is stationary. Vibration can make the rolling element slide back and forth across the race, wearing a groove into the race.

There are times when this can't be prevented, such as when automobiles or other types of equipment are shipped by rail, truck or ocean freight for relatively long distances. The vibration may cause enough movement to generate false brinelling. It can be greatly reduced or eliminated by reducing the potential for relative movement and decreasing the static weight present during shipment or storage.

Roller bearings also exhibit false brinelling when they're used in positions that encounter very small reversing angular oscillation (less than one complete rotation of the rolling element).

You can distinguish false brinelling from true brinelling by examining the depression or wear area. False brinelling will actually wear away the surface texture, whereas the original surface texture will remain in the depression of a true brinell.

Fig. 59. Wear caused by vibration or relative axial movement between the rollers and races is depicted in this tapered roller bearing outer ring.

NEXT ISSUE VOL. 03 :

- Burns from Electric Current
- Cam Fracture
- Understanding Bearing Life
- Factors that Impact Lubrication Performance

Koyo®

Introduces new Tapered Roller Bearing with fourth generation

LOW FRICTION TORQUE TECHNOLOGY (LFT IV)

A new generation of Koyo TRB's

Koyo Bearings, a division of JTEKT Corporation, is introducing its new range of "LFT IV" Low Friction Torque tapered roller bearings providing further reduction of the friction torque, reaching a similar level as ball bearings but with a better load rating performance.

History of Koyo's LFT developments

Koyo has provided low friction torque (LFT) tapered roller bearings to the market for over 25 years.

The conventional way to reduce the torque was to concentrate on sliding resistance and viscous rolling resistance. Later the influence of oil agitation resistance was recognized and considered for further improvement. These contributing factors to the friction torque and their relative influence are shown in Fig. 1.

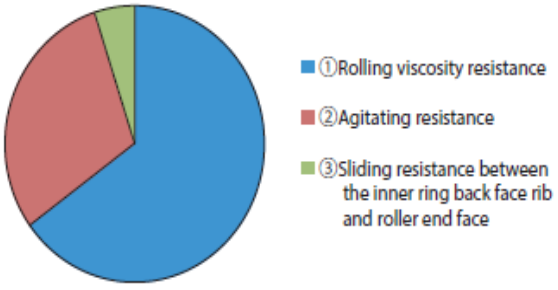


Fig.1 Factor contributing to friction torque and their relative influence

Tackling the sliding resistance factor first, Koyo engineers originally decided to optimize the profile & roughness of the large rib and roller end face, leading to the LFT I generation (Fig. 2 – no. 3).

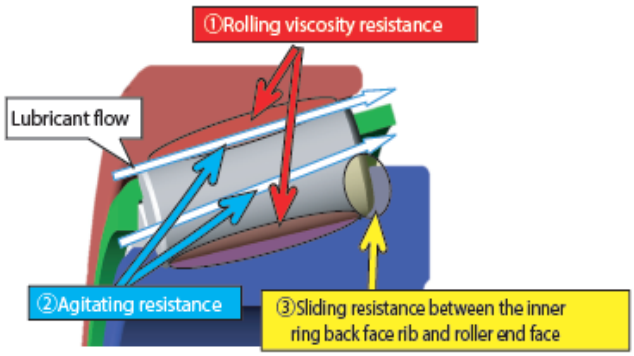


Fig.2 Areas of internal desing improvement for LFT

A further improvement to reduce the viscous rolling resistance was realized by special "crowning" of the raceways, leading to LFT II (Fig. 2 – no. 1).

As a next step the steel cage was redesigned to better control the inflow of lubricating oil (tackling oil agitation resistance) and the internal geometry & raceways were further optimized (tackling rolling viscosity resistance), leading to LFT III in ~2006 (Fig. 2 – no. 1&2).

Additionally, by applying special heat treatment to the outer surfaces of the bearing material, a smaller tapered roller bearing

could be selected, further reducing the friction while keeping durability at the same level (LFT III 2). The effects of all these developments on the bearing friction torque can be seen in Table A1&2.

Development of LFT IV

During LFT III development activities, tests had shown that limiting the inflow of lubrication oil was a significant contributor to limiting oil agitation resistance. However, the possibilities to reduce the inflow by a modified steel cage design where limited, due to the need to keep a minimum clearance between cage and rings, while considering tolerances.

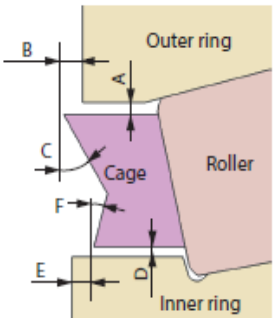


Fig.3 Parameter study

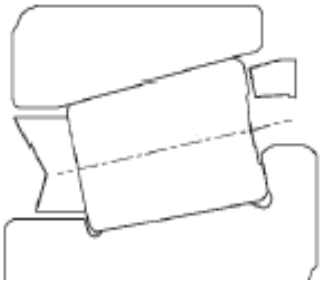


Fig. 4 Optimized cage shape for LFT IV

Therefore, for LFT IV, Koyo engineers decided to introduce a resin cage, providing much more design freedom & precision, resulting in better possibilities to control the inflow clearance between cage and rings.

Using the latest CAE- and Fluid Analysis technologies a parameter study was made (Fig. 3) to find the best compromise of dimensions, leading to the optimized design of the cage for LFT IV (Fig. 4).

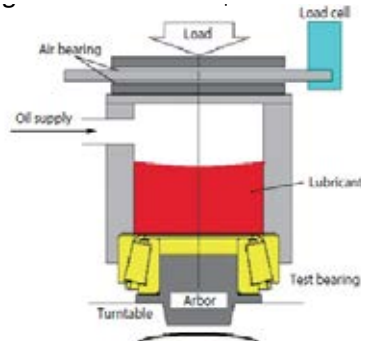


Fig.5 Oil flow rate test set up

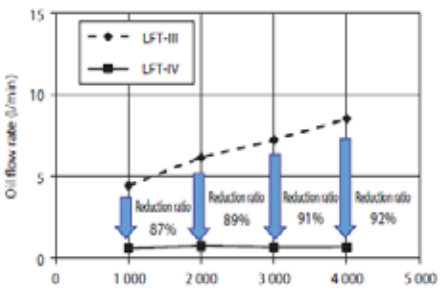


Fig.6 Result of oil flow rate test

Through bench testing (Fig. 5) an oil flow rate reduction between LFT III and LFT IV of up to 92% was measured (Fig. 6). The final influence of the redesigned LFT IV resin cage was a reduction of bearing friction torque of 30% versus LFT III.

Also, for LFT IV an additional reduction of friction can be realized by reducing bearing size in combination with special heat treatment to keep the required durability. The overall effects can be seen in tables A1&2.

Table A1 LFT Generations	Enhancement features	Design effects	Rotation torque index
St. TRB			100
LFT I	a		~90
LFT II	a+b1		~80
LFT III (1)	a+b2+c+d1		~50
LFT III (2)	a+b2+c+d1+e		~20
LFT IV (1)	a+b2+c+d2		~35
LFT IV (2)	a+b2+c+d2+e		~14

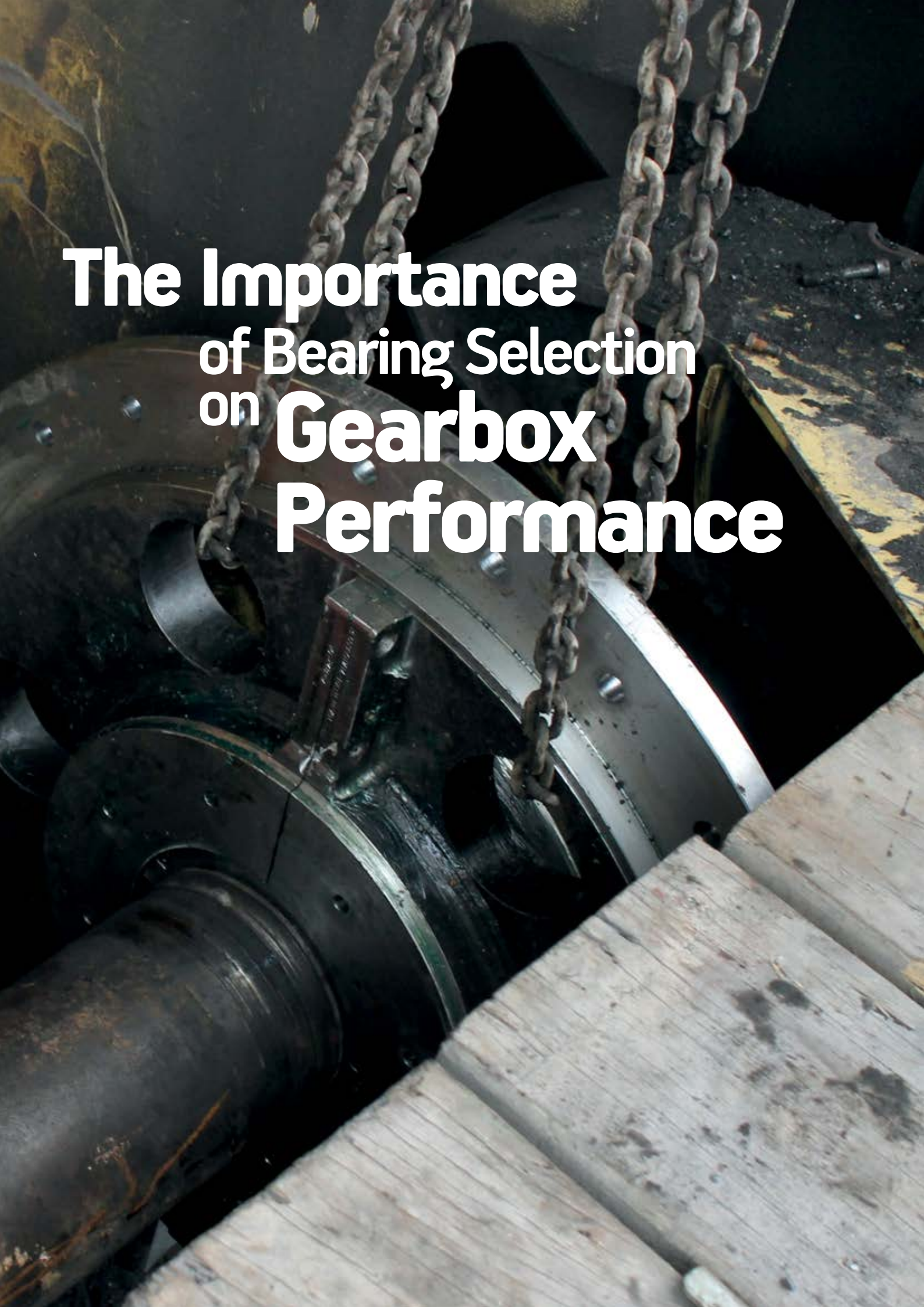
Table A2 - LFT technology - enhancement features
a. Optimization of roughness and profile of large rib and roller end face
b1. Special raceway crowning
b2. Further improved raceway crowning
c. Optimization of internal geometry
d1. In-flow control of lubricating oil
d2. Further improved in-flow control
e. Compact design + heat treatment for same durability

Summary

With the fourth generation TRB using LFT technology, JTEKT's Koyo has been able to realize an internal friction level similar to that of ball bearings, but with a load rating performance associated with a tapered roller bearing. The applications for the new Koyo TRB LFT IV can be found in many area's including Automotive and numerous Industrial applications, where the need to further reduce friction, leading to lower power consumption and the associated lower CO_2 emission are pursued.

For further general information on Koyo's LFT series of TRB's, please do not hesitate to contact your local Koyo office or Koyo distributor. You can also visit our European website: www.koyo.eu. For more technical details about the LFT IV generation of TRB's we refer to the JTEKT Engineering Journal from May 2017, which can be obtained via our global website: www.jtekt.co.jp

David Beattie
Bearing Consultant
at DASH Engineering



The Importance of Bearing Selection on Gearbox Performance

Large reduction gearboxes are designed to transmit high torque by reducing the high input speed to the desired output speed. This being the reason a gearbox is widely used and a common piece of equipment through heavy industry driving conveyors, mills, crushers and pumps.

The gears throughout a gearbox are precision manufactured with high accuracy that require trained technicians to assemble and install. It is not unusual for a simple reduction gearbox to have many stages that may include bevel and pinion gears for drive/input direction changes, as well as multiple helical gears of differing ratios to achieve the desired output.

The objective is to have the gearbox operate as quietly as possible. To assist with this, helical gears are generally used in preference to spur (or cross-cut) gears to reduce audible gear mesh noise. We all recall the 'whine' of our manual cars when we reversed? In these cases, reverse is a spur gear.

Helical gears are excellent for power transmission, durability and quiet operation, however there is a downside to this design. As these gears are manufactured with an angle, there is always a resultant axial (thrust) force that requires attention.

In applications where this axial load becomes extremely large, the helical gears are cut in opposing directions, often referred to as 'herringbone gears'. This design requires:

- increasing the gearbox sizing
- more accuracy in assembly and
- adds additional cost in the precision machining.

In operation however, this gear design will not result in axial (thrust) loads. In the more common helical and bevel/pinion gear drives, the resulting axial (thrust) loading must be borne by the supporting bearings. Often, the choice of bearings is based on load carrying capacity and theoretical bearing life, without an essential understanding of the bearing and its fundamental design.

There are many different bearings available, each having a unique set of load-carrying characteristics. These characteristics should be clearly understood along with the application load characteristics prior to installation. In most applications, the shaft requires location as well as the ability to rotate.

Bearing loads can be pure radial, pure axial or a combination of the two. Generally, most applications have a combination of these two. Bearings are designed to take different loads, with most able to accommodate combinations of loads. A ball bearing, for example, is designed to accommodate radial loads, however, it is able to support some axial (thrust) loading and therefore is excellent to use in an electric motor, as this bearing will positively locate the rotor. In this example there will also be some shaft thermal growth. To eliminate the risk of bearing 'cross-location', a cylindrical roller bearing can be utilised. This

type of bearing is available in many configurations. It can be used as there are configurations that will allow for axial movement within the bearing itself, while still maintaining radial load carrying.

Some bearings are also designed to allow for misalignment. This can be beneficial where there is a possibility of housing to shaft inaccuracy, or a possibility of shaft deflection. Similar to the helical gear design, these bearings have advantages and disadvantages.

In the case of spherical roller bearings, the ability to misalign whilst allowing rotation without compromising load carrying capacity is excellent. These bearings are an excellent design for use

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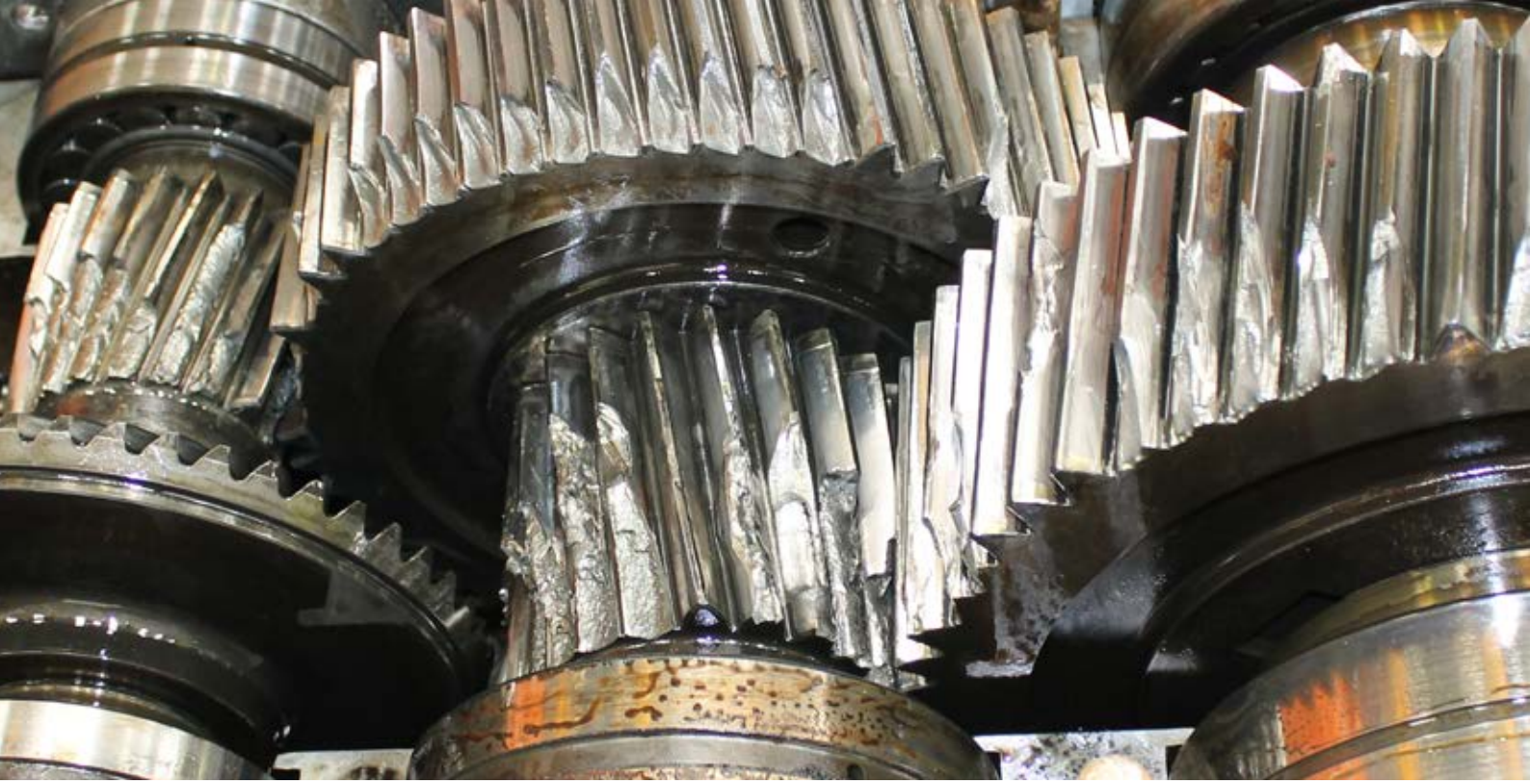

in a conveyor pulley as there is always difficulty in maintaining accurate alignment and the applied radial loading is usually high. Furthermore, these bearings also have the ability to 'locate' the shaft by accommodating small axial (thrust) loads.

The disadvantage, or downside, to a spherical roller bearing is that by nature of its internal design, there is a compromise to rolling efficiency. Imagine trying to roll a wine barrel down a hill – it's not likely roll straight. The same is occurring within the spherical roller bearing – the rolling elements have a tendency to skew and slide, increasing operating temperatures. The critical component that maintains rolling element alignment is the cage. Without the cage, the rolling elements skew easily, resulting in catastrophic failure.

The rolling inefficiencies of a spherical

roller bearing can be easily compared by referring to the speed ratings in any bearing manufacturers catalogue. Review the speeds of bearings of the same overall size – ID, OD and Width. Compare this speed for ball bearings, cylindrical roller bearings, even tapered roller bearings and it is very likely that the speed rating for the spherical roller bearing will be significantly less.

Why? Speed ratings are based on a standard that requires a specific load be applied with the bearing able to maintain a prescribed temperature at this 'limiting' speed. Some manufacturers have 'reference speeds' which differ from the 'limiting speed. The measurement however is fundamentally the same. Gearboxes often have spherical roller bearings installed on slower speed reduction shafts which is interesting from a bearing application perspective.

Gearboxes are accurate by design. Gear mesh, backlash and alignment are critical to gear life and reliable operation. Shaft design must maintain this accuracy without deflection. Housing bore alignment must ensure the shaft maintains the gear accuracy requirements.

Given these accuracy constraints, there appears to be a lack of fundamental bearing engineering knowledge on bearing selection. The application does not require the ability to misalign. There is likely to be resulting axial (thrust) loading and the gear separating forces are insufficient to maintain the minimum bearing load requirement to maintain rolling contact. The internal rolling inefficiencies and insufficient radial loading can combine with axial (thrust) loading to result in premature bearing failure. A bearing that is ideal for a conveyor pulley being used in a gearbox application may not be the best option.

A bearing that is designed specifically to have the ability to accommodate a combination of radial and axial (thrust) loading, along with a load rating that maintains the minimum loading requirements can be considered. The tapered roller bearing is often an excellent alternative if spherical roller bearings are failing prematurely, or not providing adequate service life in gearbox applications.

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The Latest Trend in Bearing Condition Monitoring

The ability to monitor the condition of bearings 24/7, from any location, is becoming the new trend in maintenance practices. Ultrasound, being a key technology in bearing condition monitoring, will play a key role in this trend.

Just as technology has been rapidly developing in fields like telecom, data analytics, smart devices and infrastructure, the same can be said of asset condition monitoring. Just how far has technology come in asset maintenance, and what does that mean going forward? What current technology is the equivalent of cutting-edge developments in those other fields – playing the role of RFID or the Internet of Things? For asset maintenance, it's remote monitoring – the ability for technicians to utilize modern tools to collect and parse through continuous data sets from a given asset without the need for 24/7 in-person attention.

It's important to recognize that new technology often calls into question old methodologies or habits. Each time some development emerges, the industry involved must adapt to make best use from it. That can be particularly difficult in the industrial setting, often driven by the mantra "If it's not broken, don't fix it."

But plant maintenance technicians have increasingly recognized the benefits of predictive maintenance in terms of keeping equipment online, preventing unplanned shutdowns, increasing plant efficiency and saving money for the organization.

The paradigm shifts of bearing condition monitoring

The book "Asset Condition Monitoring Management" by Jack Nicholas, Jr., outlines four ways asset condition monitoring has changed over the decades, including nowadays:

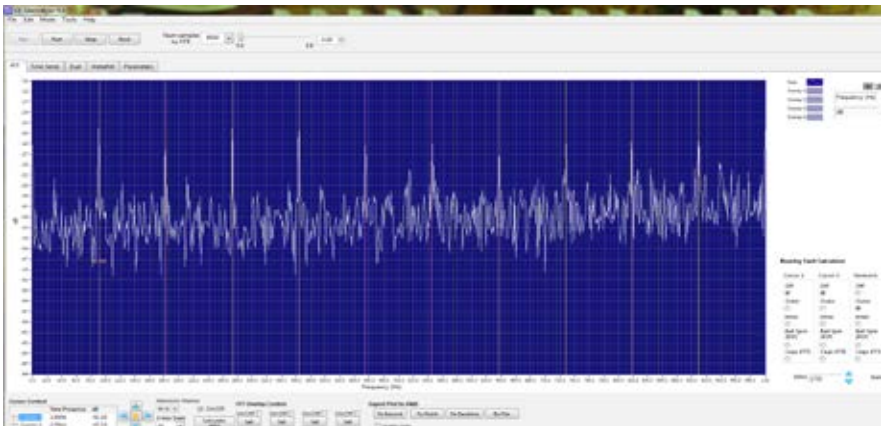
1. In the 1980s, microprocessors made way for more portable data collection devices.
2. In the 1990s, laptops emerged while software packages gave all computers better memory storage.
3. In the 2000s, wireless data transfer arrived as the methods for reporting and analysing data grew more sophisticated.
4. In this decade, the condition monitoring paradigm shifts include the Internet of Things, cloud computing, big data, tablets, virtual and augmented reality, wearables devices and so on.

Though the technologies have changed, many of the challenges remain the same: will technicians and practitioners accept the change and alter their behaviour? Can IT departments keep newly online assets safe from cybercrime? Is the infrastructure available for massive amounts of data? Do we have the skilled workers necessary to champion these tools and then pass their knowledge along to other? And finally – what do we even do with all this data?

Finally, to add a bit of perspective, consider this: today's college graduates were born after Amazon opened, eBay came online and Yahoo registered its domain name. They have largely grown up with technology – that's a good thing. Those who go into engineering and maintenance will be comfortable using modern tools and techniques – and organizations must be prepared for a generation of laborers who expect the most up-to-date tools to be available.

Ultrasound remote monitoring

Ultrasound technology has emerged as an essential tool in its own right. It's no longer simply a leak detector – it is a valuable technology that allows maintenance teams to identify mechanical faults earlier in the P-F Curve and even develop a more effective lubrication practice.



Coupling remote monitoring with ultrasound could prove to be one of those paradigm-shifting developments. Ultrasound works best when you have as much sound information to work with as possible – that makes it easier to identify patterns, establish baselines and pinpoint inconsistencies. Moreover, as much as today's maintenance technicians want to avoid reactive maintenance, there are certain assets that take priority over others. Anything that's closer to failure will earn more attention, meaning other assets could fly under the radar if they're assumed to be newer and in better shape. Remote monitoring can give technicians a way to keep an eye – or ear – on assets that aren't being monitored. That's true for ultrasound monitoring on both mechanical and electrical assets.

There are few limitations on the application for ultrasound remote monitoring. Any instance where maintenance professionals are collecting manual data through handheld devices might be an opportunity to monitor remotely. In other cases, equipment that is difficult to access – dangerous, remote, isolated, submerged – can receive the type of regular monitoring that extends useful life. Additionally, slow speed assets are great candidates for remote monitoring because it would otherwise require the maintenance technician to take a longer time to gather enough information manually.

Beyond the advantages of larger data sets and remote collection, remote monitoring comes with an easy installation and the potential for a wireless setup. Compared to other systems, ultrasound remote monitoring is a cost-effective choice.

Bearings, rotating equipment, and condition-based lubrication are all good candidates for regular remote ultrasound inspection. The best practice here is to establish a route, find baseline readings, determine trends and identify alarm levels. Ultrasound is particularly helpful with slow speed bearings.

The 4Cast and Remote Access Sensors

UE Systems' remote monitoring tool, 4Cast, interfaces with a bearing asset to continuously collect data and send an alert to the technician's route-planning software if any alarm levels are surpassed. It works together with ultrasonic Remote Access Sensors (which can be very useful by themselves to inspect enclosed or hard-to-reach bearings) – the sensors, which are permanently mounted on the bearings, pick up the ultrasound emissions and send them to the 4Cast, which then sends that information to a data management software in the form of decibel readings. The tool collects these readings from the sensors on a regular basis, but allows the user to specify how often to send information to the software. It will also send a sound file to the Spectralyzer (software for deep sound analysis) when necessary.

With an available Ethernet connection, the 4Cast sends all its readings and recordings using the plant's network, which bring obvious advantages: maintenance personnel will be able to access these readings & sound files even outside of the plant's network – thus allowing for true 24/7 remote monitoring.

Today's facilities should capitalize on the latest trend in reliable maintenance to ensure they get the most out of their assets. As technologies like remote monitoring emerge, they have a positive net effect on industry. Remote monitoring is the latest important plant maintenance technology, enhancing an already valuable tool and allowing plants to build a predictive maintenance culture.


SKF


BEARING
RECONDITIONING
LOOKS AFTER BOTH
YOUR
WALLET!
&
THE
ENVIRONMENT

Even the most robust roller bearing eventually suffers from wear and tear. Sooner or later the need to repair or replace the bearing is inevitable to let the machine in question continue to perform its job as intended. However, it is not necessary to use a new roller bearing - as the reconditioning experts at SKF know: in many cases, a professionally reconditioned roller bearing is sufficient. This saves resources, reduces maintenance costs and is still “as good as new”.

Bearings are essential components that are used in countless machines and in a wide variety of industries: deep in the heart of each application, they ensure that the rotating parts move as smoothly and efficiently as possible. The bearing structures are often highly specialised in order to function even in the most demanding environments, e.g. in the suction rollers of paper machines, where they are constantly exposed to moisture, or in the drying sections, where high temperatures and humidity prevail. Similarly unfavourable conditions can also be found in rolling lines of steel plants, industrial transmissions or wheelsets of rail vehicles, etc.: roller bearings are, in part, exposed to extreme influences in all these applications.

If properly installed and maintained and protected by suitable lubrication systems, bearing units typically ensure long and trouble-free operation. However, bearings cannot always be maintained under ideal conditions, as bearing expert Hannes Leopoldseder, Business Unit Manager of the Industrial Services Centre at SKF in Austria, explained: “Roller bearings can wear out prematurely and fail unexpectedly for many different reasons. The most common causes include insufficient lubrication, seal failure, shaft misalignment and changes to the operating conditions. In paper factories, such failures are often a result of attempts to increase line speeds or steam temperatures in dryers in order to improve production output. However, this may cause the bearing performance curve to shift outside the original specification.”

Reconditioning in trend

In principle, the completely unexpected failure of a bearing is quite unusual nowadays - after all, modern health monitoring systems can provide advance warnings early enough. Nevertheless, it is quite common for bearings to have indentations and hairline cracks on rolling and running surfaces that reduce their performance and efficiency over time, and therefore also impair the performance of the supported shafts and cylinders. Ultimately, no matter how carefully designed, installed and maintained they are, bearings that run continuously eventually reach a point where they need to be repaired or

As good as new: in global competition with the intense price pressure, more and more companies are following the trend of reconditioning their technical equipment instead of replacing it with completely new equipment.

Wide range: reconditioning is possible in numerous applications and industrial sectors - as shown here with the example of a tapered roller bearing unit for rail vehicles

replaced. There are certain arguments in favour of each of the two approaches, but in global competition with the intense price pressure, more and more companies are following the trend of reconditioning their bearings rather than replacing them.

Various advantages

Hannes Leopoldseder heads one of the SKF Industrial Service Centres, which specialises in the reconditioning of bearings (particularly large bearings) for a wide range of industries. His opinion: "One of the biggest challenges for production or maintenance engineers is minimising downtime and maintenance costs. Reconditioning is possible in over 50 percent of all applications and can usually be carried out within a few days. It also offers genuine price benefits compared to a new bearing."

In addition to greater productivity and lower maintenance costs, Leopoldseder also sees environmental benefits: "On the one hand, the factory operators benefit from tangible economic and technical advantages, and on the other hand, the environment benefits from greater sustainability. After all, reconditioning consumes up to 90 percent less energy and resources than the production of a new component!"

Longer overall lifecycle

The purpose of such reconditioning is generally to extend the overall lifecycle of a roller bearing. However, reconditioning is an extremely demanding process that requires a great deal of expertise and special equipment. This is the only way to ensure that the bearing properties are maintained and that

"Our experiences have shown that many industrial companies can significantly reduce their annual maintenance costs through reconditioning"

Hannes Leopoldseder,
Business Unit Manager of the Industrial Services Centre at SKF in Austria

the product continues to work reliably after re-commissioning. “A specialised partner is simply indispensable here,” as Leopoldseder emphasised. “Not only do specialist partners have the necessary skills to carry out the work in the shortest possible time and according to the highest quality standards, they can also explain to customers why the bearing was damaged in the first place. They can then assist customers in the process of optimising the machines to minimise the risk of consequential damage.”

Rolling bearings that are severely damaged or even broken are basically only suitable for recycling. Against this backdrop, each reconditioning process starts with an expert analysis of the exact current condition: the “reconditioning potential” of the bearing is determined and the required measures are specified. One particularly important aspect here is the assessment of the bearing condition in the context of the respective application, i.e. taking into account the bearing load, lubrication conditions and previous operating life. This makes it clear, among other things, where exactly the causes of the damage lie.

Type of fatigue critical

A distinction needs to be made here between problems of deep and surface fatigue: the former describes the shear stresses that occur cyclically directly below the load bearing surface of rings and rolling elements. These stresses cause microscopic cracks that gradually spread to the surface. When the rolling elements run over these cracks, fragments of the surface material break or peel off. Bearing running surfaces that are damaged as a result of deep fatigue are not normally suitable for reconditioning, whereas those with surface fatigue can generally be reconditioned by honing or grinding.

Bespoke reconditioning

At SKF Industrial Services Centre for bearing reconditioning, the bearing is first visually inspected. In addition, the parameters such as residual magnetism and bearing clearance are checked. The bearing is then dismantled and cleaned before the parts are carefully inspected and the dimensions measured. This includes the standard measurement of ring wall thickness fluctuation and ovality; with the option of an ultrasonic inspection to detect deep micro cracks. Depending on the bearing condition and the criticality of the application, the hardness, diameter variation of the roller set and the main dimensions can also be measured.

This first evaluation phase is followed by the preparation of a customer report and a recommendation for further action. In subsequent reconditioning, intelligent automation and control systems as well as the practical knowledge of experienced technicians are used.

Maintenance costs down, productivity up

Hannes Leopoldseder is convinced that bearing reconditioning offers considerable advantages. “Our experiences have shown that many industrial companies can significantly reduce their annual maintenance costs through reconditioning. Of course, the savings can vary depending on the business model and industry, but as a rough guide: in the paper industry, we have found that savings between 10 and 12 percent can usually be achieved. Another important factor: due to the relatively short lead times, the bearings can be reconditioned during normal line shutdown - with careful planning - and productivity losses can therefore be minimised. And finally, the potential energy savings make reconditioning an extremely attractive option from an environmental point of view.”

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READY FOR THE WAVE OF CHANGE IN 2018

Mineral Circles Bearings Top Bills *Organizational Changes This 2018*

Mineral Circles Bearings is the first company in the UAE who specialized in automotive bearings, making it one of the top aftermarket institutions in the region. With its head office located in Jebel Ali Free Zone; their branches and subsidiaries are situated in Deira, Dubai, as well as throughout the Middle East, Africa, East Asia, and Europe.

For more than 30 years, MCB serves as the preferred supplier of a wide range of quality and cost effective brands for automotive, industrial or agricultural bearings, cv joint, universal joint, grease, tools, as well as oil seals from leading manufacturers.

We tried to find out the story behind Mineral Circles Bearings during an interview with Mr. Hassanein Alwan, MCB's Managing Director.

Mineral Circles Bearings (MCB) formally announced Hassanein Alwan as its new Managing Director, who will be responsible for the company's commercial strategic growth. Under his leadership, he will be overseeing the sales, marketing, and human resources departments to fulfill the goals of the next decade.

When asked about what is expected of his tenure, Alwan said: "We will do what is profitable for the company and we'll align our priorities to achieve this goal. However, the most important department that I will handle this year is Human Resources to ensure that we have the right people and that they grow with us." Joining him in MCB's management team is founder Amar Ridha, whose new designation is Product and Technical Director, as well as Safaa Alwan, with his new title of Finance and Investment Director.

Industry Game Changer

Mineral Circles Bearings' 34 years of bearing know-how and market intelligence enabled continuous resiliency in the ever shifting business trends. Challenging traditional industry practices, it continously strengthens and diversifies its sales and marketing platforms, technical expertise, and, most importantly, its talent pool. Today, MCB "speaks the customer's language" due to more than 13 languages spoken by its multi-national workforce.

Social media and e-mail campaigns have similarly contributed to the 65% increase in sales leads, a record breaking feat for the marketing team in 2017.
Finally, the company's rebranding efforts on its own economical brand, which started in the fourth quarter of 2016, proved to be another bearing industry game changer as its current value increased more than 10 times according to

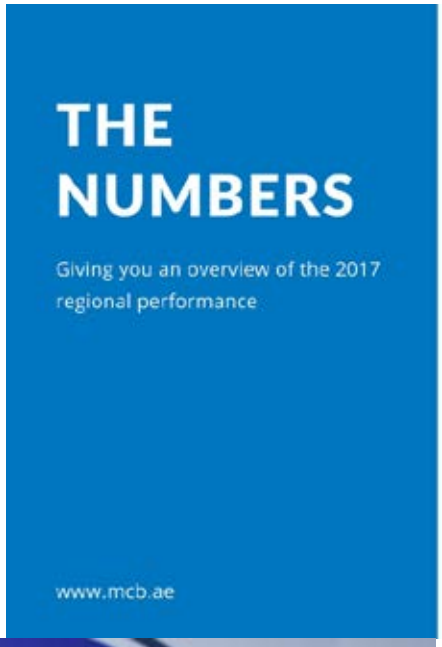
"Automotive is a big market share but we relentlessly continue expanding to the industrial sector while deepening our footprint in key areas such as the MEA region."

industry sources.

2017 Sales At A Glance

Having once again proved its unshakable hold on Middle East and Africa (MEA), Mineral Circles Bearings' sales reached 61% in 2017 despite the economic and political risks experienced in the region.

In terms of automotive aftermarket products, it championed wheel bearing sales and made it the most sought after product of 2017, followed by tapered roller bearings (TRB), and deep groove ball bearings (DGBB). As for growth compared to 2016, tensioner bearings gained 58%



followed by DGBB for automotive, and spherical roller bearings (SRB) for the industrial sector.

Meanwhile for brands, NTN reached a milestone by leading the most sellable list for the first time in MCB's history. When combined with SNR's, it covered a 3rd of the company's 2017 sales by brand.

Closer to the Market

This 2018, Mineral Circles Bearings conveys to its clients, suppliers, and partners its determination to open new sales and logistics channels, while streamlining new products and services. "Automotive is a big market share, but we relentlessly continue expanding to the industrial sector while deepening our footprint in key areas such as the MEA region.", says Hassanein Alwan.

To start the new year, MCB is set to showcase its aftermarket products in the first ever Automechanika event in Riyadh from February 5-7, 2018 at the Riyadh International Convention and Exhibition Center. Visitors at hall 2, stand 2-D09 will experience the latest in bearings and grease from leading brands such as NTN-SNR, MCB, MBS, and ILJIN, and will be welcomed by the following delegates: Hassanein Alwan, Managing Director and In-House Engineer, Michel Peltier, Regional Sales Manager and In-House Engineer and Tamer Farid, Sales Executive .

IF YOU'RE BUYING CHINESE BEARINGS, YOU SHOULD KNOW THIS

I wasn't around when Leonardo da Vinci sketched the first ball bearing in the 1500s, or even when Germany developed the first high production bearing factories in the 1940s, however, my short 40 years of experience in the bearing industry has taught me a few things, much of which is beneficial to anyone buying bearings, and particularly, Chinese bearings.

In the late 1940s and 50s, bearing manufacturing in the U.S. took off, with a proliferation of many small bearing companies ranging from divisions of General Motors to the Timken Bearing Company and hundreds of others. Growing up in Connecticut, there were dozens in Connecticut alone. But over time, the number of bearing producers in the U.S. began to shrink. Through consolidation, agglomeration and migration from Europe and Japan, only a few very large players now dominate the U.S. and world market.

It was in the 1960s when the Japanese bearing producers started expanding into the North American market, led by a small number of now well-known names in the industry from the multitude of companies making bearings in Japan at that time. While the rest of the world had gone through a massive consolidation process, it wasn't until the mid-1980s that China's policy towards privately owned enterprise changed. The Chinese Government identified the bearing industry, and targeted that market by using their resources in an effort to make China a world-class bearing producer. This resulted in thousands of small bearing companies being started and, over time, in the restructure of many of the large state owned companies.

I started selling bearings from China in 1990 and began working directly with China in 1996. By this time, the Chinese Government was well on their way to establishing China as a world-class bearing producer. The government had set up bearing industry standards, most of which were patterned after ISO and ABMA standards.

Government run research and test facilities spread around China to help producers make quality product. For comparison, in the early 1990s the product I was selling from China was good for luggage wheels, roller skates, and low speed conveyers, but by the late 1990s, electric motor quality bearings were available for medium speed applications like power tools, vacuum cleaner motors, and other consumer products. These thousands of small bearing companies that were born are now just starting the evolutionary cycle, which has already transformed the US, European, and Japanese bearing industries.

I have personally made over 500 visits to Chinese bearing factories over the past 22 years and it is astonishing to me how far China has come from replacing nonprecision bearings with precision bearings, to making machine tool spindle aircraft quality products. In my earlier years, I was not surprised to visit factories that had dirt floors and conditions that would give an OSHA inspector a heart attack. In recent years, I have visited state of the art manufacturing facilities with real time data collection of ground raceway dimensions automatically fed into a computer with instantly updated

manufacturing statistics of every single piece that is ground. Some factories have become fully automated, without a single person touching the finished parts.

The world bearing industry is dominated by multibillion-dollar multinational bearing producers. China on the other hand is dominated by thousands of bearing producers, all ranging in their capabilities. To give you perspective, there are over 2,000 producers in Jiangsu Province alone. It's not unlikely for one company or purchasing department to be burned by one or even several Chinese companies before becoming completely turned off by all other Chinese products. When I explain this to my clients, my favorite example is a statement made by my international trade attorney: "99% of lawyers give the rest of us a bad name." Which, unfortunately, is also a great statement when replacing the word 'lawyers' with 'Chinese bearing companies.' There are world-class producers in China, but the key is finding them.

Size also doesn't dictate capability. I have visited companies in the $50 million range that only produce a handful of sizes. Some others that only make 608 ball bearings, no other sizes. Also, the bigger bearing companies will generally quote everything on your list of requirements. You need to figure out which ones they make in house and which ones they outsource as well as the consistency of their outsourcing.

China has come a long way since the 1990s, but still today there are many bearing

understand the mindset of a potential U.S. customer.

They assume everyone wants the least expensive product available and so they start out cheap and when the parts do not pass they expect another chance.

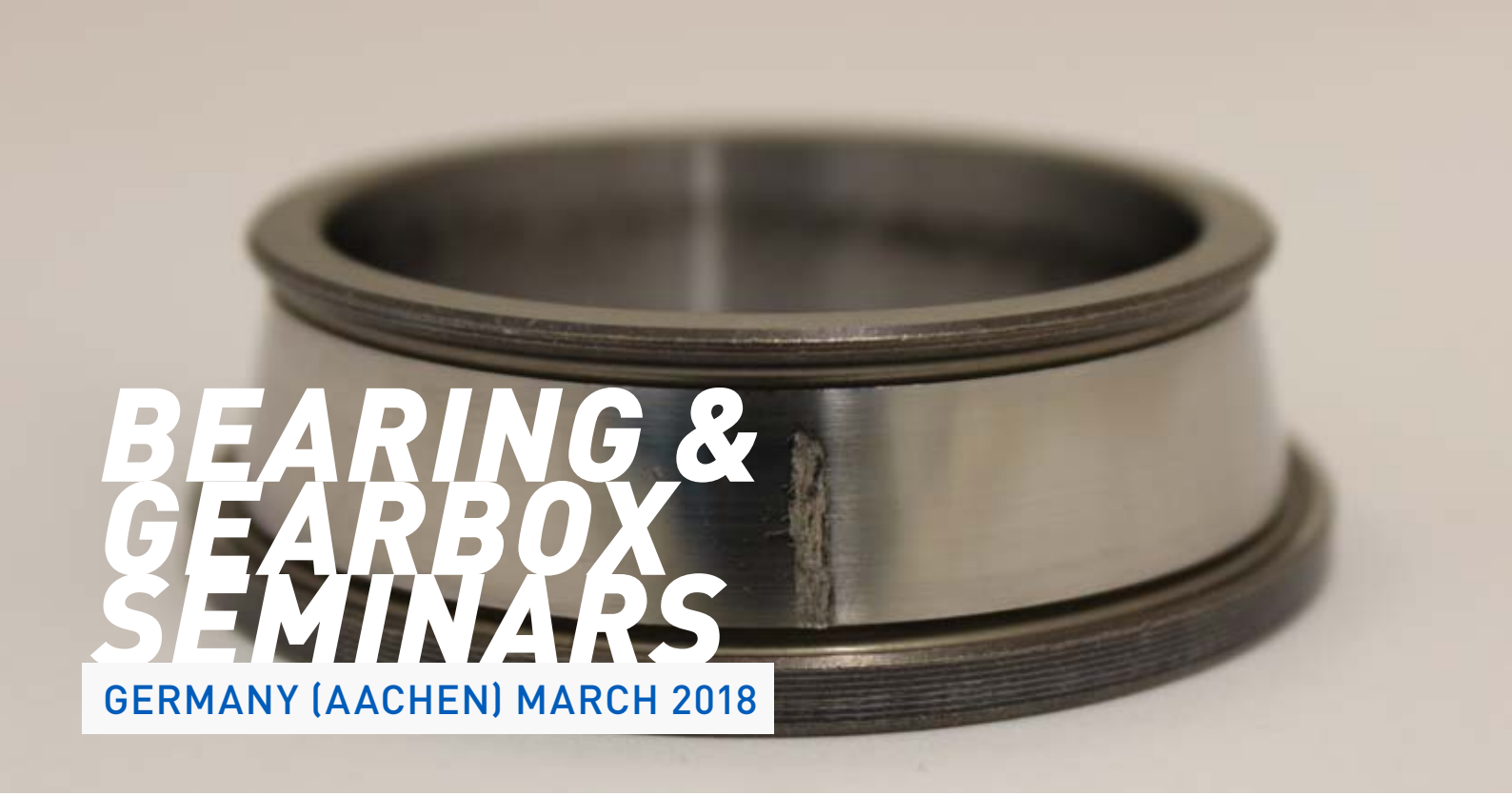
Having spent almost 4 months of my life on a plane, and 3 years of compiled time living in China devoting my life to this industry, my recommendations have afforded me a career worth of knowledge that cannot be confined to this article. However, in order to provide some direction, anyone buying bearings should at least adhere to the following when buying from China.

The key to success is identifying your needs and goals. Evaluate the types of bearings you need. Separate size range, preferably by machine size and volume requirements. Prioritize these groups. Evaluate the dollar potential to see if Chinese bearing companies might be interested, and determine your expectations for savings. Remember, China operates in a mass production mindset. Going to China for small specialized sizes is most likely not in your best interest. This will help make the project feasible. And overall, you must visit the factory. If you don't travel to China, you are wasting your time. Finally, don't get discouraged. My original business model, which currently includes two full time offices in Shanghai and Beijing, was to help small to medium size companies save money in China. I believed smaller companies who could not afford the expense of opening offices in China would find benefit from our offered

have spent the majority of my career servicing the needs of Fortune 500 companies who had teams of representatives in China on countless occasions and still came up empty handed. The companies that have succeeded in finding reliable Chinese partners more often than not saved millions of dollars.

The rest of the world has consolidated, however, China is still evolving. If you can navigate your way through the sea of endless suppliers, you will succeed. And if you still don't believe in Chinese bearings, just remember, unless you haven't traveled in the last 5 years, you have likely flown on an airplane, ridden in a car, truck, or train with Chinese bearings supporting the most critical components of that vehicle.

Dave Hull is the founder and president of PRECISION COMPONENTS, INC, which for the last 27 years has provided engineered metal products and services to major manufacturers. For information on Mr. Hull, you can read his BIO on www.pcomponents.com.



BEARING & GEARBOX SEMINARS

GERMANY (AACHEN) MARCH 2018

SEMINAR PROGRAM

BEARINGS

5th of March 2018
Development of bearing suppliers and quality control during purchasing

6th of March 2018
Basics of bearing technology

7th of March 2018
Bearing failures: Investigation and analysis of practical examples

GEARBOXES

8th of March 2018
Preventive maintenance and condition monitoring of industrial gearboxes

9th of March 2018
Supplier development for large industrial gearboxes and quality control

10th of March 2018
Basics of machine acoustics – reduction of noise by design measures

BEARING SEMINARS

Development of bearing suppliers and quality control during purchasing

5th of March 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:

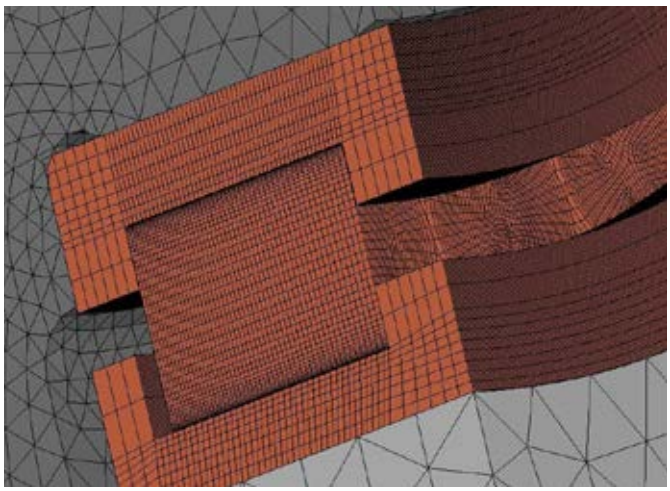
1. Definition of quality requirements, technical specifications
2. Approach during supplier visits and audits
3. Requirements related to documentation of production
4. Methods for incoming inspection
5. Concepts for quality control

Basics of bearing technology

6th of March 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 assessement



Bearing Failures: Investigation and analysis of practical examples

7th of March 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

8th of March 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

9th of March 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

Basics of machine acoustics – reduction of noise by design measures

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

Avoidance of noise emission belongs to the important requirements of technical systems while noise protection covers frequently are expensive and go along with other disadvantages. In this context, it can be much more efficient to prevent noise emission by proper design measures instead of capsuling noisy machines. Such measures refer especially to design of housings for which reason the following subjects will be discussed during this seminar:

1. Basics of machine acoustics
2. Excitation forces
3. Structure born noise
4. Noise radiation

You can download the registration form and all the seminar details on our website at **www.elgeti-engineering.de** in order to susbcribe for one or more of the training seminars or contact Ms. Alexandra Becker on **ab@elgeti-engineering.de**

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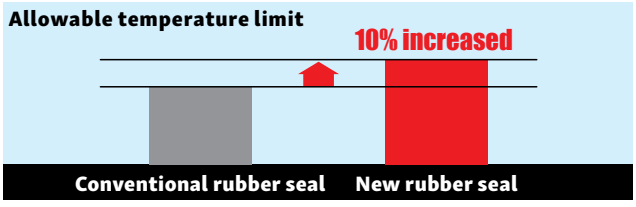
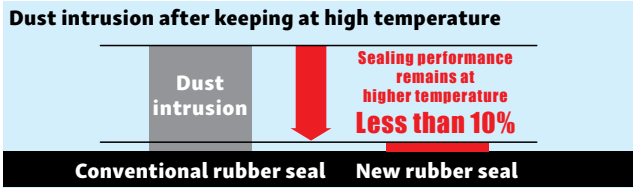
At high temperatures, rubber hardens degrading the seal performance. This allows foreign matter to enter the bearing. New heat-resistant nitrile rubber seals maintain sealing performance at high temperature.





Test bearing	6206-2NSE, 6206-2NSE9
Circumstance	Muddy water sprayed
Rotating speed	1000 rpm (Inner ring rotation), Intermittent Test period 20 hours
Test method	Compare the amount of intruded dust in test bearings with rubber seals degradated at high temperature (140°C x 70 hours)

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- Modifying the base oil improves high-temperature performance without sacrificing the low noise and low torque properties of the conventional grease.
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Test bearing	6203-2NKE
Rotating speed	10000 rpm (Inner ring rotation)
Radial load	Fr=500 N
Ambient temp.	120°C

Environmentally-Friendly – conforms to ELV and RoHS directive | Free from hazardous substances such as hexavalent chromium

SKF

AT THE BEARING WORLD CONFERENCE

Bernd Stephan – AB SKF
President Automotive & Aerospace

SKF is one of the main sponsors and supporters of the Bearing World conference, and sees it as a leading event to exchange state of the art technology and latest research results in order to make machines more powerful and more reliable.

We tried to reveal why SKF, one of the global bearing suppliers and leading company in bearing research and technology is sponsoring the Bearing World Conference during an interview with Mr. Bernd Stephan, President Automotive & Aerospace at AB SKF.

Why is SKF supporting the Bearing World conference?

As a global bearing supplier and leading company in bearing research and technology, SKF is sponsoring the Bearing World Conference to distribute the current knowledge in rolling bearing technology to different industries. SKF sees this conference as a leading event to exchange state-of-the-art technology and the latest research results to make machines more powerful and more reliable. For us, it is very important that development and design engineers understand the technology and the development tools available to utilize the power of rolling bearings in the best way possible.

"SKF wants to be the right partner for the new automotive powertrain developments and wants to offer the right bearing and seal technology for our customers."

The automotive drivetrain is evolving from the classic combustion engine drivetrain to different hybrid drives and pure electric drivetrains. These changes also require new rolling bearings with different features. SKF wants to be the right partner for these new automotive powertrain developments and to offer the right bearing and seal technology for our customers. At the fist Bearing World 2016 in my keynote speech I talked about the new hybrid bearing technology with ceramic rolling elements, which will be even more important for these new powertrains. SKF is also able to calculate the life of these bearings with our General Bearing Life Model (GBLM). We believe that the high-speed electric drivetrains of the future with very high power density will need these new technologies.

"We see clearly that the demand in hybrid bearings will increase in electric drive trains. "

What is your role at the company?

President, Automotive & Aerospace
In this position, I am also driving the technological development of rolling bearings and seals to meet new challenges in the Automotive and Aerospace industries.

On which R&D activities are you currently working?

Can you tell us more about your presentation topic at Bearing World?

SKF will contribute a keynote speech as well as presentations on bearings for e-mobility, bearing damage, and heat treatment processes for bearing steel.

What is the impact of Industry 4.0 on bearings and applications?

Industry 4.0 is discussed everywhere, and there are also other titles with the same meaning used outside of Germany. For SKF it means the full digitalization and automation of Product Lifecycle Management (PLM), from the initial idea to the 3D design of products and processes with digital twins, to simulation and testing, manufacturing processes, quality, and supply chain, and finally to field performance, traceability, condition monitoring, field service, and all kinds of maintenance, including final recycling. To make this happen we need to digitalize everything we do and to connect all

C 30 900 MB L4

Hybrid ACBB VC444

Hybrid DGBB

systems with an automated solution, taking advantage of big data collection and analysis.

What will be the challenges of drive technology for bearings in the future?

Bearing performance and reliability have always been a challenge in new and demanding applications, and we at SKF have always found ways to tune bearings for these new applications. Rolling bearings have improved immensely over the last 100 years, and there is no end in sight. The electrification of powertrains in all industries will require rolling bearings with next-generation performance, and we are sure that we will be able to meet these requirements.

It seems that electric cars need fewer rolling bearings (especially needle rolling bearings) and no sliding crankshaft bearings at all. How will this affect the future of the automotive bearing industry?

Hybrid vehicles need even more rolling bearings than conventional ICE vehicles. Battery Electric Vehicles (BEV) may not need combustion engine plain bearings, but they still require rolling bearings for the electric traction motors and gearboxes. As I explained earlier, these bearings also need new technical features. We see no real problem for our rolling bearing business. It is surely a bigger challenge for companies focusing on combustion engines.

"The rolling bearing industry has to continue with bearing research to move the performance and reliability of rolling bearings to the next level."

Is it true that the use of bearings with ceramic balls will increase in electric cars?

We clearly see that the demand for hybrid bearings will increase in electric drivetrains.

Hybrid bearings are better insulated against electric current flow and can achieve much higher speeds with less lubrication. Today, we already have a lot of electric motor and generator applications in different industries using high performance hybrid bearings. With the expected increase in motor speeds, hybrid bearing technology will be even more important.

Electric cars include fewer small parts, especially precision ones. Does this mean that manufacturers will use fewer grinding operations and grinding spindles with high speed super-precision bearings?

We also see that pure electric vehicles have fewer mechanical parts, but we don't see that the parts in the electric powertrain are any less precise. The electric drivetrain has very low noise levels at high motor speeds, and therefore the precision of all components must meet very low noise requirements. The lower demand for mechanical parts per vehicle does have an impact on the industry, but on the other hand new components will also be needed.

In your opinion, what are the main challenges for the bearing industry in the future?

The rolling bearing industry has to continue to follow market demands very closely.

The new requirements will generate new bearing technology. The rotating shaft with rolling bearings will have a bright future in all kinds of applications. The rolling bearing industry must continue with bearing research to move the performance and reliability of rolling bearings to the next level. The digitalization of bearings, with sensors and condition management and full traceability, will also play a more important role for trouble-free operation.

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SCHAEFFLER AT THE BEARING WORLD CONFERENCE

Dr. Arbogast Grunau
Corporate R&D Competence and Services,
Schaeffler AG, Germany

Schaeffler is one of the main sponsors and supporters of the Bearing World conference, since they attach a lot of importance and value for a meeting of international experts in order to exchange ideas.

We tried to reveal why Schaeffler, one of the global bearing suppliers and leading company in bearing research and technology is sponsoring the Bearing World Conference during an interview with Dr. Arbogast Grunau, Corporate R&D Competence and Services at Schaeffler AG, Germany.

Why is Schaeffler supporting the Bearing World conference?

As the bearing business is a global and international business, a meeting of international experts should be supported by one of the leading bearing manufacturers like Schaeffler.

What is your role at the company?

Bearings are needed in each of Schaeffler's three divisions: Industrial, Automotive and Automotive Aftermarket. For this reason, bearing development is conducted both centrally and in the divisions. My responsibility is to support this development with specific development expertise and services.

On what R&D activities are you currently working?

We are currently carrying out research in several fields because Schaeffler's strategic goal is "mobility for tomorrow," and bearings are used nearly everywhere motion has to be facilitated. Materials, surface technology and the simulation of system behavior are still research topics. Coating is becoming more and more important, and with our coating know-how we offer our customers various kinds of coating, i.e. to reduce friction or the sensitivity to white etching cracks (WEC). Additionally, the role of bearings in components for Industry 4.0 and electromobility are main points of current research.

Can you tell us more about your presentation topic at the Bearing World?

We have several presentation topics, but let me give you two examples. We will talk about the development of a new asymmetrical spherical roller bearing for wind turbine applications, and give an insight into the complex simulation and design verification work that is necessary for successful product development. Another topic is the prediction of bearing noise. We all know that noise is becoming more and more important, even with the electrification of drivetrains. So it's very important to be able to predict the noise behavior of bearings. This can typically be done with expert simulation tools like very specialized multi-body simulation. But it's also necessary to be able to get an initial feeling for the noise behavior of different bearings in an early stage of product development. For this reason Schaeffler has developed the Schaeffler Noise Index. It allows a quick rating of the noise emitted by a bearing at reference conditions, and is thus a hands-on rating during application engineering. Schaeffler is the first bearing manufacturer to provide noise information for bearings in the catalog.

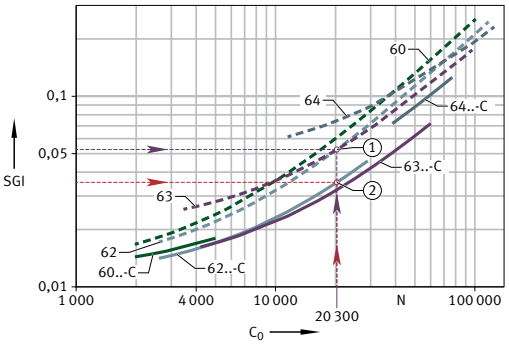


Figure 1: SGI diagram for deep groove ball bearings. GenC bearings have a lower SGI than standard bearings.

What is the impact of Industry 4.0 on bearings and applications?

Bearings determine the performance of an application in a substantial way, and therefore they are ideal for obtaining data for process control and machine monitoring. In this way, Schaeffler's sensorized components and mechatronic products are becoming fundamental "enablers" for digital services and Industry 4.0. So, Schaeffler is offering consistent hardware, software, and IT infrastructure that encompasses all stages of digital added value.

What will be the challenges of drive technology for bearings in the future?

While in the past bearings were rated by static or dynamic load rating, today they are distinguished by the friction momentum. In the future,

bearings will have to perform by load rating, but low friction momentum and noise will be the real performance indicators.

It seems that electric cars require a lot fewer rolling bearings and no plain crankshaft bearings at all. How will this affect the future of the automotive bearing industry?

Named trends are given and inescapable due to technological transformations. This will be a long-term change. Nevertheless, Schaeffler has been dedicating efforts to expand the product portfolio towards the requirements of the electromobility market. Even if the bearing content might shrink, the technological excellence of Schaeffler offers possibilities to extend business.

Is it true that the use of bearings with ceramic balls will increase in electric cars?

The importance of insulation will increase because bearings are usually not made for conducting currents, and parasitic currents may occur more frequently due to the increased use of mechatronic components. Ceramic balls are one of the well-established methods to avoid damage due to electric current in rolling bearings.

In addition to this, insulating of the rings is well established and some other solutions are topics of our research.

Electric cars include fewer small parts and especially precision ones. Does this mean that manufacturers will use fewer grinding operations and grinding spindles with high speed super-precision bearings?

Indeed, purely electrical cars show a reduced number of named high precision components. Today, motors and components of complex gearboxes in particular lead to high machining efforts, which will be reduced in a long-term view with the transition to e-motors. Concurrently, speeds of motors and transmissions are increasing, and high-speed as well as high precision is partially shifted to these applications.

In your opinion, what are the main challenges for the bearing industry in the future?

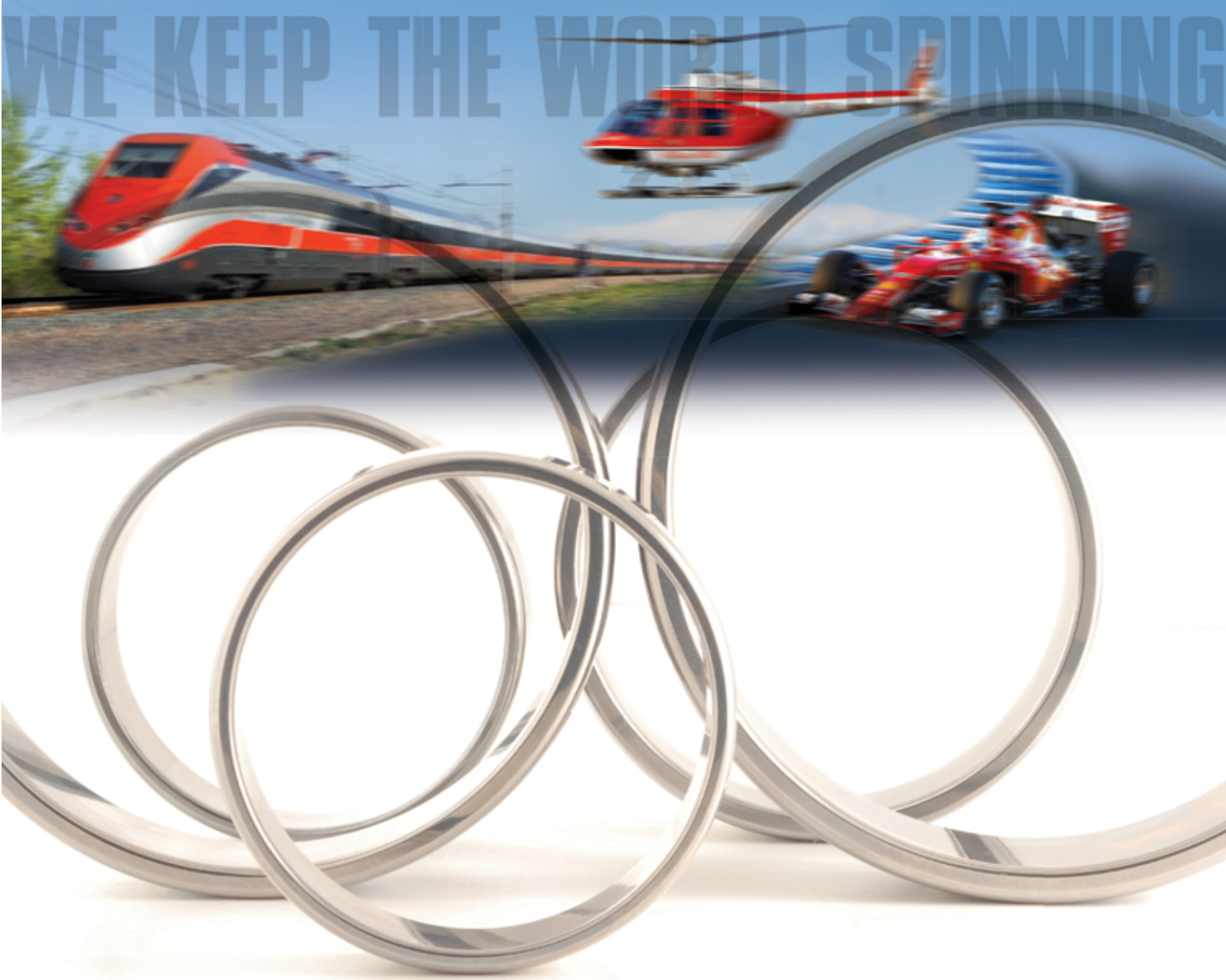
As bearings are needed nearly everywhere motion occurs, the scope of applications will increase. One of the main challenges will be to handle this wide range of applications in an effective and competitive manner.

In many applications, the bearing is the place where all information such as speed, load, and temperature of the device is available, and therefore the additional purpose of bearings will be to act as an information generator. The bearing of the future is more than just a bearing, it will also become an integrated sensor. Therefore, the importance of bearings will increase in the future with digitalization and Industry 4.0

The FAG VarioSense is a rolling bearing system that is based on standard products and can be configured in a modular fashion using a range of different sensors, which allows virtually every desired bearing position to be equipped with sensors. Schaeffler is thus paving the way towards a future in which even simple assemblies and machines will have access to digitalization and the Internet of Things.

FAG spindle bearing VCM in X-life quality: With Vacrodur, extraordinarily robust spindle bearings can be created, that can make a significant contribution toward reducing unit costs in comparison to existing spindle bearing solutions.

In the Schaeffler cloud, Schaeffler's rolling bearing domain expertise is made usable in the form of digital services. For example, automated rolling bearing diagnosis and remaining useful life calculation can be used to provide precise information on the condition of the bearing and thus of the machine being monitored, which in turn allows specific actions to be recommended.



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Prof. Gerhard Poll,
Leibniz University
Hannover, Germany,
Bearing World Program
Committee Speaker

"Come to Bearing World, the international expert forum dedicated to bearings. Rolling bearings are still the main focus, but this year we will also include an interesting look at plain bearings. The conference provides a comprehensive overview of the current state of technology, research, and development as well as an opportunity to engage in dialog with leading national and international experts."

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Rewarding:	Present your company to interested experts at the technical exhibition
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>> The World of Bearings – key topics: Innovative concepts ++ White Etching Cracks (WEC) ++ Reliability and functional safety ++ Tribology and energy ++ Damage diagnosis and avoidance ++ other issues

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BEARING WORLD 2018

Program

6 March, 2018: 9:30 – 18:00, Evening Event at 19:30

> Opening

Prof. Gerhard Poll, Leibniz University Hannover,
Institute of Machine Design and Tribology (IMKT), Germany
Prof. Bernd Sauer, University of Kaiserslautern,
Institute of Machine Elements, Gears and Transmissions (MEGT), Germany
Christian Kunze, Forschungsvereinigung Antriebstechnik e. V. (FVA), Germany

> Keynotes

Title TBD
Dr. Victoria van Camp, SKF Group, Sweden

Shaping the mobility for tomorrow through innovation bearing technology for a smarter, cleaner and safer world
Prof. Dr. Tim Hosenfeldt, Schaeffler Technologies AG & Co. KG, Germany

> Energy efficiency

Investigation of the frictional torque and temperature behavior of tapered roller bearings
Marco Schwarz, ZF Friedrichshafen AG, Germany
Co-author: Jürgen Liebrecht, Technische Universität Kaiserslautern,
Institute of Machine Elements, Gears and Transmissions (MEGT), Germany

Friction losses optimized rolling bearing for substitution of highly loaded tapered rolling bearings
Prof. Bernd Sauer
Co-author: Margarita Marmol Fernandez
University of Kaiserslautern, Institute of Machine Elements,
Gears and Transmissions (MEGT), Germany

Development and efficiency testing of new generation „High Efficiency" tarped roller bearings to meet efficiency of angular contact ball bearings on pinion shafts
Thorsten Klähn
Co-authors: Jean Merckling; Dragos Oprescu, Timken Europe, France
Mike Gromosiak, Caleb Chovan, Timothy Crabill, The Timken Company, France

Temperature behavior of rolling bearings exposed to centripetal acceleration
David Hochrein
Co-authors: Dr. Stephan Tremmel; Prof. Sandro Wartzack
Friedrich-Alexander-Universität Erlangen-Nürnberg, Engineering Design,
Germany; Oliver Graf-Goller, Schaeffler Technologies AG & Co. KG, Germany

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Bernd Stephan, AB SKF, Gothenburg, Sweden; CTO SKF Group

> Failure modes

Formation of White Etching Cracks under rolling loading and the detection of preliminary stages
Dr. Ralf Martin Dinter, Flender GmbH, Germany
Co-author: Francisco Gutierrez Guzman, RWTH Aachen University,
Institute for Machine Elements and Machine Design (IME), Germany

WEC failure at the inner ring of roller bearings under dynamic conditions
Prof. Hubert Schwarze, Clausthal University of Technology,
Institute of Tribology and Energy Conversion Machinery, Germany
Co-author: Dr.-Ing. Jörg Loos, Schaeffler Technologies AG & Co. KG, Germany

The relation of White Etching Cracks with (very) high cycle fatigue
Dr. Reinder Hindrik Vegter
Co-author: Junbiao Lai
SKF Research & Technology Development, Netherlands

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Steve Ooi, University of Cambridge, United Kingdom

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Dr. Christoph Mayer, Klüber Lubrication München SE & Co. KG, Germany

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Marc Paquien, NTN-SNR Roulements, France

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Markus Grebe, Competence Center for Tribology at the Mannheim University of Applied Sciences, Germany

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Fabian Schwack, Leibniz Universität Hannover, Insitute of Machine Design and Tribology (IMKT), Germany
Co-author: Matthias Stammler, Fraunhofer Institute for Wind Energy and Energy System Technology (IWES), Germany

Relationship of smearing criteria and transient lubrication analysis
Prof. Wen Wang
Co-author: Liang Guo
Shanghai University, China

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Non-linearly coupled modelling of spindle bearing systems
Jens Falker
Co-authors: Prof. Christian Brecher; Marcel Fey
RWTH Aachen, Laboratory for Machine Tools and Production Engineering (WZL), Germany

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Dr. Nadine Nagler
Co-author: Daniel Hast
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Philipp Abele
Co-author: Ermalt Lamaj, Dr. Jörg Hermes
SEW-Eurodrive GmbH & Co. KG, Germany

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Marko Ebermann
Co-author: Prof. Erhard Leidich
Chemnitz University of Technology, Department of Mechanical Engineering, Institute of Design Engineering and Drive Technology, Germany

Is surface texturing really efficient in hydrodynamic sliding bearings?
Prof. Michel Fillon
University of Poitiers, Institut Pprime, CNRS, France

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Dr. Hannes Grillenberger
Co-author: Joachim Schleifenbaum
Schaeffler Technologies AG & Co. KG, Germany

Radially preloaded cylindrical roller bearings – experimental studies regarding axial roller kinematic
Roman Böttcher
Co-author: Prof. Gerhard Poll
Leibniz Universität Hannover, Insitute of Machine Design and Tribology (IMKT), Germany

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Co-author: Franz Pätzold, Kugel- und Rollenlagerwerk, Leipzig GmbH, Germany

Dynamic analysis of railway gearbox: from rotating system simulation to dynamics of a rolling bearing
Dr. Witold Marek Smolenski
Co-author: Dr. Andrei Degtiarev
Schaeffler Technologies AG & Co. KG, Germany

> Lab testing vs. field performance / validation

Experimental bearing cage vibration and corroboration with bearing cage dynamic modeling
Prof. Farshid Sadeghi
Co-author: Lijun Cao
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Investigation of rolling bearing condition monitoring techniques: a study based on long term run-to-failure vibration data
Reza Golafshan
Co-author: Prof. Georg Jacobs
RWTH Aachen University, Institute for Machine Elements and Machine Design (IME), Germany

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Dr. Houssein Janbein
Co-author: Lutz Heuser
Vestas Wind Systems, Germany

Hydrogen evolution in rolling contact
Dr. Dominik Kürten
Co-author: Dr. Andreas Kailer
Fraunhofer Institute for Mechanics of Materials (IWM), Germany

Non-invasive load measurement of hertzian contact within a cylindrical roller bearing
Gary Nicholas
Co-author: Rob Dwyer-Joyce
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> Lubrication

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Dr. Petr Šperka
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Brno University of Technology, Czech Republic

Lubricant formulations in rolling bearing simulation based upon friction mapping results
Torben Fruth, FUCHS Schmierstoffe GmbH, Germany
Co-author: Dr.-Ing. Timo Kiekbusch, University of Kaiserslautern, Institute of Machine Elements, Gears and Transmissions (MEGT), Germany

Observation of grease film evolution in rolling point contacts
Dr. Xinming Li, Qingdao University of Technology, China

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Ping Yang, Qingdao University of Technology, School of Mechanical Engineering, China

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Timo Kiekbusch
Co-author: Prof. Bernd Sauer, University of Kaiserslautern, Institute of Machine Elements, Gears and Transmissions (MEGT), Germany

> Drive technology applications and challenges for bearings

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Sven Tröger
Co-author: Prof. Matthias Kröger
Technische Universität Bergakademie Freiberg, Institute for Machine Elements, Engineering Design and Manufacturing, Germany

An experimental study of the effects of dynamic shaft movements on friction in cylindrical roller bearings
Andreas Meinel
Co-author: Dr. Stephan Tremmel
Friedrich-Alexander-Universität Erlangen-Nürnberg, Engineering Design, Germany

Interdisciplinary product development of optimized spherical roller bearings for wind main shaft applications
Andreas Bierlein, Schaeffler Technologies GmbH & Co. KG, Germany

Reliable calculation of slewing bearings for the industrial practice
Dr. Martin Neidnicht
Co-authors: Dr. Thomas Handreck; Dr. Bernd Lüneburg
thyssenkrupp Rothe Erde GmbH, Germany;
Dr. Thomas Griggel, Thomas Gellermann, Allianz Risk Consulting GmbH, Germany

An analytical method to account for spinning friction in axial ball bearings using the standard DIN ISO 281
Paul Sauvage
Co-authors: Christopher Sous; Prof. Georg Jacobs
RWTH Aachen, University, Institute for Machine Elements and Machine Design (IME), Germany
Martin Correns, Schaeffler Technologies AG & Co. KG, Germany

> Life and durability

Bearing fatigue life of a multi-material shaft with an integrated raceway
Timm Coors
Co-author: Prof. Gerhard Poll
Leibniz Universität Hannover, Institute of Machine Design and Tribology (IMKT), Germany

The effect of retained austenite and carbide distribution on the wear resistance of the bearing raceway
Zeren Ozgeneci, ORS Bearings, Polatlı-Ankara, Turkey
Co-author: Bilgehan Ogel, Middle East Technical University, Metalurgical and Material Engineering Department, Turkey

Integrity assurance of silicon nitride balls for hybrid bearings
Junbiao Lai
Co-authors: Charlotte Vieillard; Yuri Kadin
SKF Research & Technology Development, Netherlands

A new through-hardenable high hardenability bearing steel designed by means of simultaneous optimisation of multiple responses using the desirability function approach
Dr. Urszula Sachadel
Co-authors: Mohamed Sherif; Boris Minov; Wijbe Buising
SKF, Netherlands

Evaluation of multiple-flaw failure of bearing steel 52100 in the VHCF regime and mathematical description of the single-flaw fatigue behavior
Dr. Klaus Burkart
Co-authors: Prof. Hans-Werner Zoch; Prof. Brigitte Clausen
Stiftung Institut für Werkstofftechnik (IWT) Bremen, Germany

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Dr. Arbogast Grunau, Corporate R&D Competence and Services, Schaeffler AG, Germany

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vol.04

TOP100 TIPS *for* BEARING REABILITY

by Mr. Per Arnold Elgqvist

Bearing Tip No. 41: Particle contamination reduce bearing service life far below the required according to ISO 281/2

It has always been known that particle contamination affects bearing life a lot, but how much is “a lot”? Now we can calculate the effects of particle contamination using the ISO 281/2

formula that was published year 2000 plus later editions. There is still a lot of work to be done to get more precise calculations being able to take in account the material, form and hardness of the particles, but as it is today we can get a rough idea of the effects applying the particle contamination as a cleanliness/ contamination code according to ISO 4406/99, which indicates the number of particles equal or larger than 4, 6 and 14 microns per milliliter of the lubricant. In this way, we can justify the costs for installing more efficient filtering to increase the bearing life substantially. For example, how much would the bearing life increase in an application with coarse filtering being improved to a filtering by a ß5 = 200?

Bearing Tip No. 42: Bearing root cause failure analysis will confirm if the proposed corrective actions are the correct in order to avoid recurrent failures

When a bearing fails we generally have several ideas about the possible causes of the failure. Especially if this bearing has been monitored by predictive maintenance, for example vibration analysis or ultrasonic monitoring, thus we may have programmed various corrective actions.

The most accurate way to confirm whether the supposed corrective actions are the most adequate is to perform a bearing

root cause failure analysis. If the failure is detected in time and the bearing dismounted before the failure advances too far, the original failure patterns may still be clear and will then indicate the precise failure mode and confirm if the proposed corrective actions were correct.

In the case below, spherical roller bearings mounted in especial flange houses on a washing machine for glass bottles, 5 different causes were identified based on the failure mode and very precise information on the operation and maintenance. In this case, all 5 corresponding corrective actions must be taken in account, in order to obtain the optimum result.

Bearing Tip No. 43: Avoid collateral damages attending a failing bearing before it harms other components

Besides the enormous benefit of predictive maintenance of detecting bearing failures as soon as possible and be able to plan the repair avoiding unplanned stops, a second huge benefit is that it allows us to stop the operation before the failure damages advances too far and damages other important components, as the shaft and the bearing housing. If the shaft and the housing are unharmed, most of the corrective actions require very short time, as the replacement of the bearing, lubrication, etc. But when the shaft and housing are damaged, these must be repaired, which may take considerable time, especially when the repair is outsourced.

Another benefit that is most ignored is that no general repair shop is capable to restore the quality of the shaft and housing as they were manufactured by the corresponding OEM. The OEM's have special manufacturing machinery and measuring equipment dedicated to manufacture the shafts and housing to the utmost highest quality, as the performance of the bearings will depend on this. Thus, when endusers need to repair shafts and housings, these will never have the same quality again and the performance of the corresponding bearings won't reach the original.

I have several times confirmed this by the questions from customers on why the replacing bearings work at higher operating temperatures and noisier then the original. Conclusion: Stop failing bearings in time to avoid collateral damages on shafts and housings - Short repair time and continued smooth bearing operation.

Bearing Tip No. 44: Never try to reduce the cost of the lubrication by buying low cost lubricants

Time to time I hear from customers that they are looking for cheaper lubricants with the intention to reduce costs. This is one of the greatest mistakes they can do! On the contrary, they should look for "High Performance Lubricants"! It is not possible for a low-price lubricant to reach the same performance as a high-tech quality manufactured lubricant, both due to the manufacturing process and the quality of the raw materials, as the base oil, additives and thickener in the case of greases. On the contrary, the high-quality lubricant will have a better performance, lubricate the machine components better increasing their service life and itself, have a longer service life reducing the consumption of the lubricants themselves. Besides, unnecessary unplanned downtime will be avoided and the process availability will be increased. I have seen several cases where the reduction of the consumption of a higher quality lubricant by itself has paid its higher price difference.

A typical phenomenon that confirms the above is that low price greases tend to soften very fast due to their low mechanical stability and start to leak causing several serious problems in the plants.

Bearing Tip No. 45: It is essential to identify the positions of the bearings in order to perform a bearing failure analysis correctly

In order to perform an accurate bearing failure root cause analysis for any bearing it is indispensable to gather the most possible complete information on its operating conditions. Within this information it is an absolute requirement to know the exact position of the failed bearing in order to identify the directions and the magnitudes of the loads it must have supported. This information must be complete and nothing should be left out for guessing when we look at the path patterns in the bearing rings and compare with the operating load conditions.

A typical example of the above: If a bearing that is said to have been the axially free mounted bearing shows running load path patterns from an axial load, this indicates that this Bearing was not acting as the free axial bearing as it was meant and the application must be analyzed.

Another very common example: API centrifugal pumps, by design, have 2 single row angular contact ball bearings mounted back to back, one to support the heavy thrust loads generated by the suction at the impeller and the other only to support light radial loads. This means that these 2 bearings have totally different operating conditions. So, if we do not know the positions of these 2 bearings it will be impossible to perform an accurate failure analysis. Please look how the 2 bearings below were marked before their dismounting in order to avoid any confusion as mentioned above.

Bearing Tip No. 46: Specify the seals correctly - Design and material

Bearing reliability is also depending on the efficiency of the seals to avoid leakage of the lubricant and/or any kind of contamination. Therefore,

it is most important to use the right seals, which means not only the right dimensions, but also the right design and material of the seal for the corresponding operating conditions.

There is often a number of seal variants as regards design and material for the same dimensions, thus seals must be specified in the right way for purchase: single lip, double lip, without or with spring for very different functions of sealing.

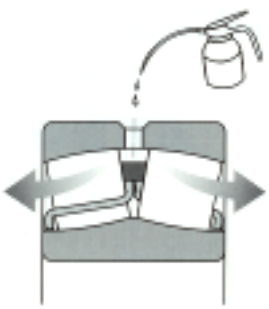
And upon this there are different materials, as different kinds of nitrile, polyacrylate, silicone, Viton or Teflon, with different temperature ranges and chemical and wear resistance.

It still happens that seals are ordered just based only on dimensions, as for example 100 x 120 x 12 mm. The purchasers will, in these cases, logically ask for the least expensive seal that comply with the required dimensions.

Bearing Tip No. 47: Whenever possible use NLGI consistency 3 for vertical mounted bearings

The greases with consistency NLGI 3 are recommended for the lubrication of vertical mounted bearings. These greases are stiffer than the more normal NLGI 2 greases. This is with the intention that the grease being stiffer will stay longer in its position and lubricate these bearing more efficiently.
A softer grease, as the normal NLGI 2 will tend more to flow downwards, leaving the bearings faster, causing a starvation lubricating regime and reducing bearing life. Even when NLGI 3 greases are used it is recommended to shorten the relubrication interval for vertical bearings. Grease has such a low cost compared with the costs caused by bearing failure.
As I have already indicated in earlier Bearing Tips, a higher quality grease with high mechanical stability will improve bearing life in vertical applications, thus look for greases with good results in the ISO 2137/ASTM D217 (100,000 strokes) or the Shell Roll Test ASTM D1831.

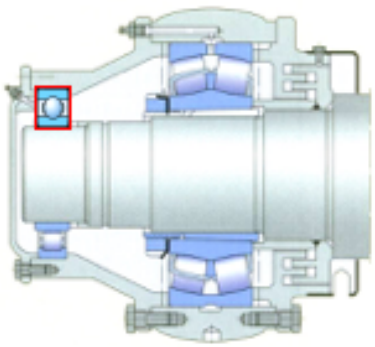
Bearing Tip No. 48: Spherical roller bearings should always be lubricated through the W33 holes



Whenever possible, radial spherical roller bearings should be lubricated through the holes according to the W33 design, which is through the holes in the grooves on the outer diameter of the outer rings. This way of lubrication has the following advantages:
- The new injected lubricant is introduced into the heart of the bearing, displacing the old lubricant in the most efficient way, cleaning the inside of the bearing and lubricating all the surfaces;
- Facilitates the use of ultrasonic sensors to determine the precise quantity of grease necessary for a perfect relubrication, avoiding over-lubrication;
- Reduces the consumption of grease with 60%, compared with the relubrication at the side of the bearing.

Bearing Tip No. 49: Costs for bearings are most insignificant compared with the total cost of the failure

The costs (= prices) for the bearings in the vast majority of industrial applications are very low in comparison with the total costs their failure may generate, especially when extreme values of lost production will take place.
Let's take an extreme case: One of the largest paper machines, installed in China, has a production capacity of 28,200 tons of liner per 24 hours. A machine of this size has more than 2000 installed bearings and all the sections of the machine are directly connected. This means that a failure of just only one of these 2000 bearings will cause the stop of the production of the whole machine. Just imagine the value of the lost production per hour!



I had a success story in a papermill, where deep groove ball bearings 6210/C4 installed in the felt rolls failed (see drawing above), causing 2 unplanned downtimes per month. The cost of the bearings was 60 Usd. According to the plant manager each downtime had a total cost of 20,000 Usd. Conclusion: Consider the bearings as assets, not as consumables and take utmost care of them.

Bearing Tip No. 50: Courses on site are those with most advantages.

Courses on site have shown very high improvements in the reliability of rolling element bearings. This is due to the following advantages of this kind of courses:

1. The subjects of these courses are determined totally in accordance with the priorities and requirements of the corresponding customer.
2. The course is dedicated to one single customer and his opportunities for improvements.
3. Practical exercises may be performed within various of the course subjects:
a. Evaluation of the bearings in the inventory in the warehouse. ("The Reliability starts with the initial condition of the bearings") (conditions, variants, brands, etc.)
b. Evaluations of the Workshops in the corresponding plant (conditions, maintenance tools and instruments).
c. Evaluation of the quality of the repair of shafts and housings (fittings and precision of the machining).
d. Bearing mounting and dismounting exercises.
e. Analysis of equipment with repetitive bearing failures.
4. Identification of opportunities for improvement and establishing of Improvement Projects with specific objectives and responsible persons. These projects will have the support and follow up from my side.
5. The participants are many enough to form strong teams to be able to implement the Improvement Projects in the corresponding plant.
The experience from these courses has shown the identification and implementation of large number of Improvement Projects, some being simple and immediate, and several have not required any extra investment at all.

The bearing applications may vary a lot in between different industries, thus the opportunities for improvements may be very different according to the different industrial processes which emphasize the advantages of courses on site. For information please contact **proactivo.news@gmail.com**

Per Arnold Elgquist

Mr. Per Arnold Elgqvist has 34 years of experience in SKF as Quality, Product Engineering and Reliability Services Manager. He works for 10 years as private consultant for the industry in Mexico, Venezuela, Brazil, Colombia, Peru and Argentina.

Learn more about "Bearing Failures and Their Causes" at

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What Happened

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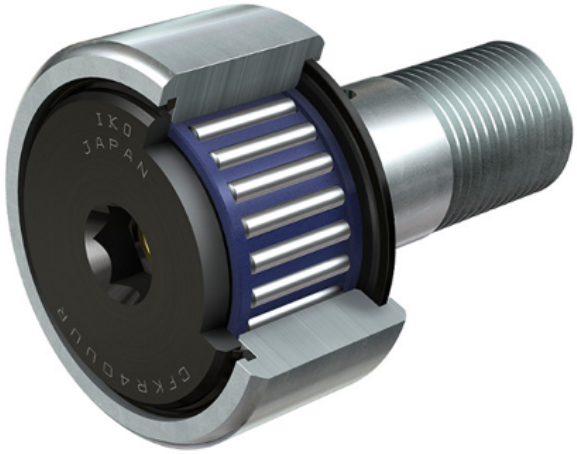
July 01

IKO Expands Line of CFKR Cam Followers



IKO International has expanded its line of CFKR series of Double Hex Hole Cam Followers. The outside diameter of the outer ring is now available in 22 and 26 mm, with current models as high as 90 mm.

These bearings are designed for outer ring rotation and have superior rotational performance with a small coefficient of friction and high load capacity. Consider the CFKR 90 model, which features a dynamic load rating in excess of 45,000 N, compared to 40,500 N for similar cam followers on the market.
Because the structure of the CFKR series features hexagon holes on both stud ends, it can be tightened from the roller or stud end. Variations are available for roller construction (cage or full complement), shape of the outer ring outside the surface (crowned or cylindrical) and seal structure (shield or sealed type).

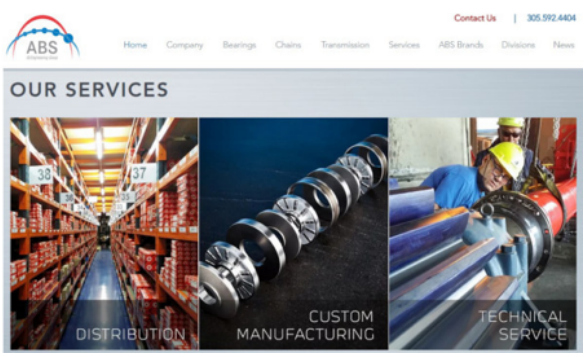
IKO's CFKR series meets the diverse needs of applications including transfer systems on machine equipment and production lines. Modifications can be made according to customer requirements. To learn more, visit www.ikont.co.jp.

July 09

RYASA takes a relevant positon into Atlantic Bearing Services Equity

Rodamientos y Accesorios SA (RYASA) takes a relevant positon into IQ Engineering Group (IQE)'s Atlantic Bearing Services LLC (ABS) Equity. The merger of our US and Latin-American Operations builds a fundamental synergy as well as increasing customer service in Mexico.
ABS will profit from the extensive RYASA branch network to commercialize ABS' Special and Custom-made Bearings and Transmission Products as well as proprietary brands registered such as ACB-USA™ (Bearings) and AEC-USA™ (Engineering Chains). RYASA benefits by acquiring these registered brands as well as ABS's Engineering know-how in special products. Additionally, ABS will lead the international expansion of the ABS-RYASA partnership leaving RYASA focused on the Mexican Market.

In words of Jose Aguirre, President of RYASA "It is a strategic purchase for us which will help us to expand within our current customers in Mexico with new products and solutions". Alejandro Pardinas, VP Sales & Engineering in ABS also mentioned "Our alliance will bring ABS to a new level and we will accomplish many projects that were on hold waiting for a partner like RYASA" ABS's management team will continue to operate without changes. ABS will reinforce its presence in those markets where ABS is now present through Branch offices and new ones will be opened when considered necessary.



July 15

HARP established cooperation with ArcelorMittal

Kharkov Bearing Plant (HARP) concluded a cooperation agreement with the leading metallurgical company and global steel producer ArcelorMittal, which Ukrainian representative office and production site are located in Kryvyi Rih.

According to the Contract concluded in April 2017, HARP will supply industrial bearings to PJSC ArcelorMittal Kryvyi Rih for repair of production facilities. At the moment, the first deliveries have already been performed.

"PJSC ArcelorMittal Kryvyi Rih is a part of the international corporation ArcelorMittal, which holds leading positions on the core metallurgical markets of the world, – says Vitaliy Bugrov, Director of Bearings Sales Department of UPEC TRADING. – ArcelorMittal has representative offices in 60 countries and production sites in 19 countries. Being an authorized supplier of ArcelorMittal in Ukraine, we are facing opportunities to supply our products to foreign branches of the corporation".

At the moment, HARP is establishing cooperation with ArcelorMittal in Kazakhstan, Poland and Romania.

August 15

SKF to supply bearings to Morocco's national railway operator, ONCF

SKF has won a three-year contract to supply railway wheelset bearings to the Moroccan national rail operator, Office Nationale des Chemins de Fer du Maroc (ONCF).

The Moroccan rail operator, ONCF has placed an order with SKF for the delivery of 15,000 railway wheelset bearings over a period of three years for both passenger and freight rolling stock. SKF was chosen because it was the only supplier who could meet the client's strict technical specifications while being in a position to deliver ready-certified railway bearings on a lead time of just three months.

The units being delivered to ONCF include SKF's spherical roller bearings (SRBs) which are typically applied as sets of two double-row bearings in a configuration where the two rows of rollers share a common spherically profiled raceway in the outer ring and the two inner raceways are inclined at an angle to the bearing axis. Single spherical roller bearings are also deployed in axleboxes to gain greater design flexibility. In both cases, these bearing configurations are highly tolerant of misalignment and shaft deflection.

SKF railway certified SRBs have a higher load carrying capacity compared with that of competing products, which is of particular benefit to heavy freight carrying rolling stock applications. Moreover, the new cage design of these bearings ensures higher reliability and longer service life, as well as greater tolerance of the high temperatures and harsh climatic conditions that are typical on this continent.

Rail development across Africa is gathering pace; in 2015, ONCF became the first rail operator in Africa to take delivery of high-speed trainsets, which will be deployed on its Tanger-Casablanca line. Mahdi Sebti, the Paris based Managing Director of SKF's North African operations said: "SKF has longstanding experience of railway engineering and the company's bearings are in use throughout the world, delivering high reliability and long service life under all operating conditions. This new contract with ONCF demonstrates our ability to meet the toughest of specifications while also being ready to react to an exceptionally tight deadline."

August 20

Liebherr supplies a bearing for the world's largest compact bucket wheel excavator

The Components Division of the Liebherr Group has produced the largest non-segmented large diameter bearing ever manufactured by Liebherr. The roller bearing slewing ring is intended for use in a compact bucket wheel excavator.
The Components Division of the Liebherr Group has produced the largest non-segmented large diameter bearing ever manufactured by Liebherr. The roller bearing slewing ring, with a diameter of 7.5 meters, is intended for use in a compact bucket wheel excavator, and weighs around 20 tonnes. Based on the available installation dimensions, the roller bearing was design-optimised in close cooperation with the customer, Sandvik Mining and Construction Materials Handling GmbH & Co KG. Thanks to the new raceway system, it offers a longer service life and better emergency running characteristics.
For its production, a hardening machine in the Biberach plant was modified to enable Liebherr to produce large diameter bearings with a diameter of up to 8,000 mm in the future. In this way, the company once again demonstrates its competence and extensive experience in the manufacturing of large diameter bearings, which can be used not only in the fields of mining and material handling, but also in a broad variety of applications.
"The short and rapid decision-making at Liebherr makes it possible to implement such projects within a short period of time.", says Oliver Friedrich, Sales Manager for Europe – Business Unit Large diameter bearings.
Site acceptance tests of the roller bearing took place in mid-June in the presence of the customer and mine operator at the Liebherr site in Biberach (Germany). The large diameter bearing was then delivered by special transportation to the brown coal open pit mine in Hungary, which supplies the Mátra power station.

Compact bucket wheel excavator from Sandvik Mining and Construction Materials Handling GmbH & Co KG

September 20

IPH and Brammer combine to create a European leader in industrial distribution

IPH and Brammer are combining to create a European leader in the distribution of industrial supplies. Advent International, which took Brammer private from the London Stock Exchange earlier this year, completed the acquisition of IPH today to enable this combination.
The combined entity, IPH Brammer, will draw on the complementary strengths and legacies of both businesses to provide its customers with an expanded technical product range and offering, supported by an enlarged geographic footprint across Europe and strong brands such as Brammer, Minetti, Zitec or Orexad. With close to €2.2 billion in combined revenues and more than 8 000 employees, IPH Brammer has operations in 23 European countries and will be headquartered in London. Pierre Pouletty, the former CEO of IPH, will serve as Chief Executive Officer of IPH Brammer, alongside Hermann Maier, the former CEO of Brammer, in the capacity of Chief Operating Officer.
"During the past four years, with the support of PAI, IPH has transformed into a leading pan European company achieving more than 50 acquisitions, entering in five new countries, building an e-business platform and gathering a fully fledged European group management team. Merging IPH and Brammer is a major step for the European industrial supplies market consolidation and in the evolution of the two companies." commented Pierre Pouletty, Chief Executive Officer of IPH-Brammer.
"The skills and assets of both businesses give IPH Brammer a strong foundation for future growth. Leveraging our combined knowledge, technical skills and experience, especially in serving Key Accounts, IPH Brammer is uniquely placed to take advantage of the exciting opportunities in our markets. The support of our experienced investor, Advent International, will further aid our ability to continue growing both organically and

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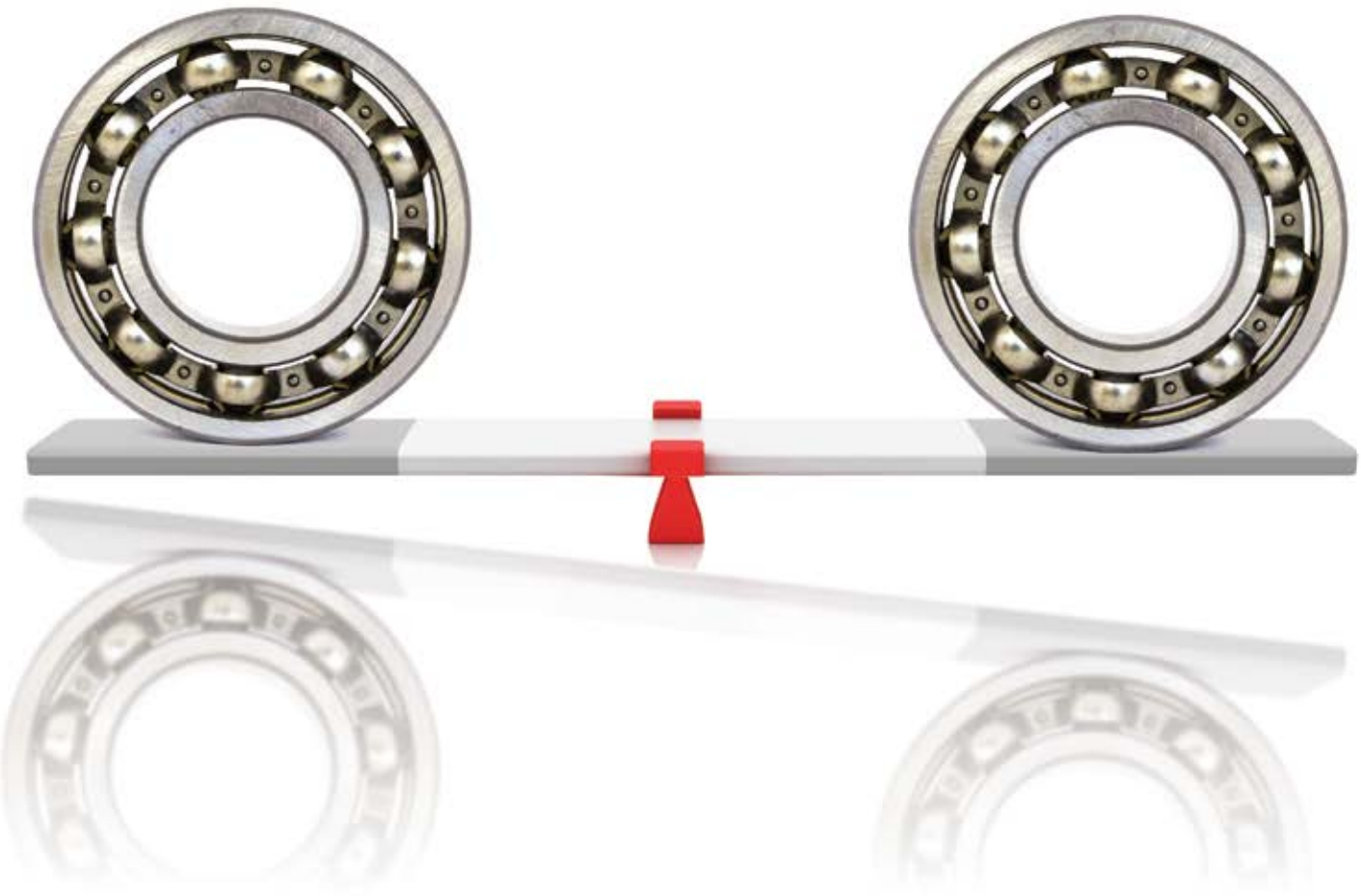
IS THERE REALLY A DIFFERENCE?
ARE YOU WILLING TO RISK THE UNKNOWN?



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.

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through acquisitions", added Pierre Pouletty.
"The creation of IPH Brammer is excellent news for our customers and suppliers. Thanks to the skill combination of both teams, IPH Brammer will offer its clients an enhanced technical knowledge, in Power transmission in particular, services and product availability across Europe. We have the skills, knowledge and drive to continue to innovate, take advantage of market opportunities and ultimately offer an unbeatable customer proposition", added Hermann Maier, Chief Operating Officer, IPH Brammer.

September 21

Ovako introduces new Hybrid Steel – opens up new design possibilities

Ovako introduced its new Hybrid Steel family at Euromat 2017. It is one of the most significant developments in steel metallurgy for decades, offering properties of tool steel, maraging steel and stainless steel combined with the production economy of engineering steel. Hybrid Steel opens up new possibilities to use steel components in very demanding applications.

Hybrid Steel offers exceptional performance, especially at elevated temperatures, and can be produced in high volume to meet customer demand at an attractive price. The properties of Hybrid Steel are made possible by an innovative hybrid combination of secondary hardening and precipitation hardening mechanisms. The new steel can also reduce the number of manufacturing steps required to produce a finished component.

The development of Hybrid Steel has been driven by Ovako's ongoing program to help its customers meet the challenge of designing highly stressed components. These require high levels of mechanical and fatigue performance, especially at elevated temperatures. The normal solution is to use a highly alloyed secondary hardening steel that is strengthened by the precipitation of fine alloy carbides during the tempering process. However, these steels can be prone to 'segregation' with some alloying elements migrating to areas where they cause weakness. The need for careful control of segregation makes the steelmaking process, and especially the casting procedure, more complicated and often more expensive compared to normal steel making.

Ovako's Hybrid Steel is relatively low in carbon and contains a number of carefully controlled alloying elements, most importantly chromium, molybdenum, vanadium, nickel and aluminum. These enable it to develop its full properties after tempering at elevated temperature (500- 600°C). The chromium and aluminum content also improves corrosion resistance very significantly.

Hybrid Steel offers superior mechanical and fatigue strength compared to conventional steels at ambient temperatures. However, it is at elevated temperatures that it really comes into its own, offering three times the yield and fatigue strength at temperatures up to 500°C.

The potential to reduce manufacturing steps

Hybrid Steel is special for much more than just its strength. Because the steel develops its hardness after tempering, production engineers now have new possibilities to machine a component in a softer condition and then harden it without any risk of distortion. This mean that a conventional process might be reduced to fewer stages for a very significant reduction in manufacturing cost and complexity.

An added advantage of Hybrid steel is that it is particularly suitable for nitriding, which can take place at the same temperature as its tempering temperature. The result is a thin nitrided surface layer that provides the strong, hard-wearing properties required by critical components such as in power transmission systems, while maintaining a high core hardness. This core hardness also means that Hybrid Steel is ideal for plasma nitriding, enabling it to challenge specialized tool steels.

Furthermore, while welding processes often result in a loss of steel properties, Hybrid Steel opens up the capability to create welded components in which a post-welding heat treatment will result in enhanced strength.

The development of Hybrid Steel has been carried out at Ovako's production and R&D facilities in Hofors, Sweden with the support of Swerea KIMAB, the Stockholm-based materials research institute.

September 25

Schaeffler Invests €180 Million in new assembly and packaging center at Saxony-Anhalt

The Automotive Aftermarket business division of Schaeffler will build an assembly and packaging center in the coming years at the 'Star Park' industrial zone of Halle (Saale), in the German state of Saxony-Anhalt.

- Investment to fund construction of state-of-the-art assembly and packaging center and create 900 jobs
- Long-term agreement signed with Neovia Logistics as general contractor
- Logistic center to be commissioned in late 2019
- Optimized processes and shorter throughput times to improve delivery quality

Automotive spare parts and repair solutions that Schaeffler provides to the Automotive Aftermarket will be assembled and packaged at a 40,000 square meters facility in the future. It is planned to go into operation at the end of 2019. The facility will be run by the logistics supplier Neovia Logistics, who will employ about 900 people at the new assembly and packaging center as well. Choosing Neovia Logistics successfully ends an intensive tender and selection process.
"We are pleased to have found a property at 'Star Park' industrial zone of the city of Halle, that offers us outstanding conditions for building our assembly and packaging center", said Michael Soeding, President, Schaeffler Automotive Aftermarket. "Together with our partner Neovia Logistics, we are now preparing for the logistic challenges of the next decade. Thanks to shorter turn-around times and optimized processes, we will be able to meet the needs of our customers over the long-term in a way that is even more binding, fast and flexible."

Mayor Dr. Bernd Wiegand said: "The city of Halle is proud that Schaeffler Automotive Aftermarket is settling here. The commitment from a business division belonging to a leading, global automotive and industrial supplier proves how appealing both 'Star Park' and Halle (Saale) are. The city was successful in the competition for the location through its excellent infrastructure, central contacts and fast decision-making."
Schaeffler will commission, package and ship over 40,000 different articles for passenger cars, light and heavy commercial vehicles, as well as tractors at the new assembly and packaging center. The comprehensive portfolio under the LuK, INA, FAG and Ruville brands contains products for clutches and release systems, as well as engine, transmission and chassis applications. The new assembly and packaging center is supposed to further optimize logistic processes in the Automotive Aftermarket and raise delivery capacity. The new center will represent the most important supply point for all other European regional warehouses of the business division. Parallel to this, it will also function as a regional warehouse for Germany, Austria and Switzerland. Customers in these countries will profit from even faster deliveries from here.

October 04

SKF creating new European aeronautical test centre

SKF is increasing its capacity to innovate by opening a new European Test Centre dedicated to high-speed aeronautical bearings.

The new European High-Speed Aeronautical Bearings Test Centre, located at the SKF Aeroengine site in Valenciennes, France, will enable full-scale, high-speed bearing testing under representative operating and environmental conditions.

Due to their critical role in aircraft and helicopter engines and transmissions, development cycle times for engine shaft bearings, accessory drives and transmission gearboxes remain significant. The test centre will be developed to continuously improve the representativeness, reliability and repeatability required by major aeronautical manufacturers.

Beyond bearing-related technologies, the test centre will also make it possible to speed up the maturity ramp-up for advanced technologies, such as those linked to sensors and signal processing.

Rutger Barrdahl, Head of Aerospace at SKF says, “Our customers are looking for weight-savings, increased service life and better lifetime predictability to improve the operational, economic and environmental performance of their aircraft. In this sense, our new test centre is a catalyser and accelerator for innovation in the area of high-speed aeronautical bearings.”

The timetable for the development of SKF’s European High-Speed Aeronautical Bearings Test Centre will be aligned with SKF customer roadmaps, and with the European Clean Sky 2 programme, for which SKF has been selected for several projects.

October 05

NSK inaugurates new expansion at the Fujisawa Plant

NSK President and CEO Mr. Toshihiro Uchiyama, inaugurated the newly constructed expansion of the Kirihara building at the Fujisawa Plant on October 5, 2017. The new facilities expand NSK’s large size bearing production capabilities to meet demand across a wide range of industrial fields including wind turbine, railcar, and steelmaking equipment manufacturers. The expansion represents the newest in bearing manufacturing technology, with improved productivity and consistent, reliable output, to provide advanced solutions to industrial machinery customers around the world.

NSK manufactures high quality industrial machinery bearings in the Shinmeichi and Kirihara districts of Fujisawa City. As part of its business continuity plan, NSK has doubled the area of the Kirihara manufacturing facilities, and is bringing in some of the equipment currently in use at the Shinmeichi district section of the Fujisawa plant. With cutting-edge automated manufacturing machinery and unmanned transportation robots, the new facilities have greatly increased productivity, and offer reduced manufacturing lead times.

The Kirihara building is used to manufacture product for the renewable energy industry and other products that contribute to protecting the environment. NSK’s environmental efforts are not limited to these products, and thanks to our efforts to reduce the environmental impact of manufacturing activities, Kanagawa prefecture nominated NSK a “Kanagawa Select Top 100” company. Kanagawa pays out incentives to companies in this category for their environmental initiatives.

October 11

Schaeffler buys autinity systems GmbH

• Autinity systems GmbH specialises in digital condition monitoring and machine data recording
• Purchase contract for 100% of the shares concluded on 4th October 2017
• An important step in implementing the digital agenda

The Schaeffler Group has been consistently implementing its digital agenda. This includes the takeover of autinity in early October 2017. The Chemnitz-based IT company specialises in digital machine data recording and evaluation.

The availability of machine data and the near real-time recording thereof, as well as storage and analysis, is decisive for the digitalisation of production. For this reason, Schaeffler is focusing on technically simple and scalable integration of machines and equipment into a digital ecosystem for its production. Moreover, available analysis technologies are to be made applicable to production data.

Chief Digital Officer Gerhard Baum said: "We have been using software solutions by autinity for many years now. The acquisition of this company will help us to intensify our collaboration and accelerate further developments in the fields of machine data recording and condition monitoring. Both topics are key essential elements of Schaeffler's digital agenda, which are in strong demand both from internal and external customers."
As part of its "Mobility for tomorrow" strategy, Schaeffler has defined digitalisation as a core future opportunity. Establishing internal structures, the partnership with IBM, the cooperation with the Friedrich-Alexander-University of Erlangen-Nuremberg (SHARE at FAU), the active involvement in the industrial data space in collaboration with the Fraunhofer Institute, and the takeover of autinity are important components in implementing Schaeffler's digital agenda. Schaeffler is currently working on 30 digitalisation projects. The number of projects is planned to double by next year. The acquisition of autinity is part of the M&A strategy adopted by the Schaeffler Group. This supports the strategy "Mobility for tomorrow" by providing additional technological capabilities for Industrial and Automotive in seven strategic focus areas.

October 15

The longest v-belt ever which is produced in Hungary

The beltmakers at Moltech are used to getting urgent and special requests for v-belts from industrial spare-part dealers all over the world, but this time they got a real big challenge.

Their 23 meter long workshop would not fit this request for a 63,500mm Li belt for a large woodprocessing machine. With open minded approach (and open windows) they managed to produce this particular StarkLine belt within a few hours and sent it to their foreign customer to supply it to a factory producing wooden doors. Definitely the longest truly endless v-belt ever produced in Hungary.

Moltech is specialized in manufacturing industrial belts, in all sorts and all sizes, standard and non-standard. Thanks to the flexible technology they manufacture belts immediately upon order. Because of the very fast delivery times, the company have helped many distributors to serve their customers right away. More info about the company can be found at www.vbelt.eu

October 15 Schaeffler Opens New Plant in the Czech Republic

- Investments of almost 100 million euros and 900 new jobs
- Opening ceremony with high-ranking guests
- Production of thermal management modules (TMM) for the automotive industry

The Schaeffler Group reinforces its lasting course for growth in Eastern Europe with investments worth around 100 million euros and the creation of 900 new jobs within the next three years. Among the guests at the opening ceremony for the new plant were Oliver Jung, Chief Operating Officer at Schaeffler, Marián Macháček, plant manager Schaeffler Production CZ, Svitavy plant, Zbyněk Pokorný, Head of the Department for Investments and Industrial Areas of the Czech Ministry of Industry and Trade, David Šimek, Mayor of Svitavy, Karel Kučera, CEO of Czechinvest, and other public figures. "With our new plant in Svitavy, the Schaeffler Group is further strengthening the already very strong Eastern European plant network. With the thermal management modules, which are produced in Svitavy, Schaeffler is manufacturing a product that can be applied both in internal combustion engines and in mobility concepts of the future, thereby supporting the Schaeffler Group's "Mobility for tomorrow" strategy", said Oliver Jung. Marián Macháček added: "We are delighted that so many distinguished guests attended the opening ceremony. This is an honor for us and at the same time, it lays the foundation for future collaboration."

October 19 Jim Williams and Chris Curran to Lead PTDA in 2018

The Power Transmission Distributors Association (PTDA) elected its 2018 Board of Directors and Manufacturer Council at the annual business meeting during the NIBA/PTDA Joint Industry Summit in Hollywood, Fla. Jim Williams, vice president corporate purchasing & supplier relations, Motion Industries Inc. (Birmingham, Ala.) will become PTDA's president in 2018. He succeeds Tom Clawser. Williams has been active in PTDA since 2005, when he joined the Motion Control Task Force. A past chair of the Programs & Products Committee, Jim has served on the PTDA Board of Directors since 2015.

Following his election, Williams said: "This is a great honor and I look forward to serving PTDA in 2018. We have successfully begun to implement the new four-goal strategic plan. This new plan will ensure the Board is in a strong position to further the Association's mission to advance our industry and empower members to be successful, profitable and competitive in this changing environment."

Chris Curran

Jim Williams

October 20

TimkenSteel Introduces New Endurance Steels

NSK President and CEO Mr. Toshihiro Uchiyama inaugurated the newly built Cheonan plant (Cheonan City, Korea) on October 20, 2017.
The average car has anywhere from 20 to 140 needle bearings. Due to this relatively high number of bearings per vehicle, the growing Chinese auto market, and automatic transmissions with more gear stages than conventional units, global demand for high-precision needle bearings is expected to continue to see strong growth. The newly built Cheonan plant expands manufacturing capacity through state-of-the-art automated manufacturing facilities capable of meeting increasing demand in the market.
Excerpt of Mr. Uchiyama's speech at the inauguration ceremony
"The Cheonan plant was built with the goal of creating an environmentally friendly and clean plant. The employees each independently contributed to the project to create highly reliable manufacturing facilities that meet the needs of our customers, and that can serve as a model for NSK operations worldwide."

POWERHOUSE IN COMPACT FORM

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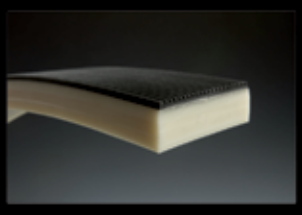
STARKLINE

In the machine-parts industry it regularly happens that customers urgently need a replacement belt that is not on-stock....and delivery of the needed belt from the OEM or a regular belt-supplier often takes weeks.
What can you do?

STARKLINE transmission belts are produced immediately upon order (no Minimal Order Quantity requested).
Exactly tailored to your customer's needs. You can service your customer within only few days!
You save your customer costly downtime!

We produce belts for machine applications in food, agriculture, construction and mining.
We also make special conveyor-belts for large heavy-duty machines such as edgebanders and cable-pullers.

We made a belt of over 60 meters long (!) for a producer of wooden doors in Czech Republic.

Some other urgent orders that we solved:

- D32CON 24570mm, fully-white for woodindustry in Lithuania
- D32CON 20055mm + PKR0 for furnituremaker in Italy
- 8VX4325 25NX 10986mm for miningindustry in Jordan
- HSPC2 12970mm for agriculture machine in Slovenia
- 100×17 6121mm haul-off belt for cablefactory in Egypt

For STARKLINE it really does not matter: we produce any form in any size, tailored exactly to the machine specifications. Contact us anytime. We are happy to send a competitive offer.

Please register on www.vbelt.eu

See your discounted prices for industrial belts.

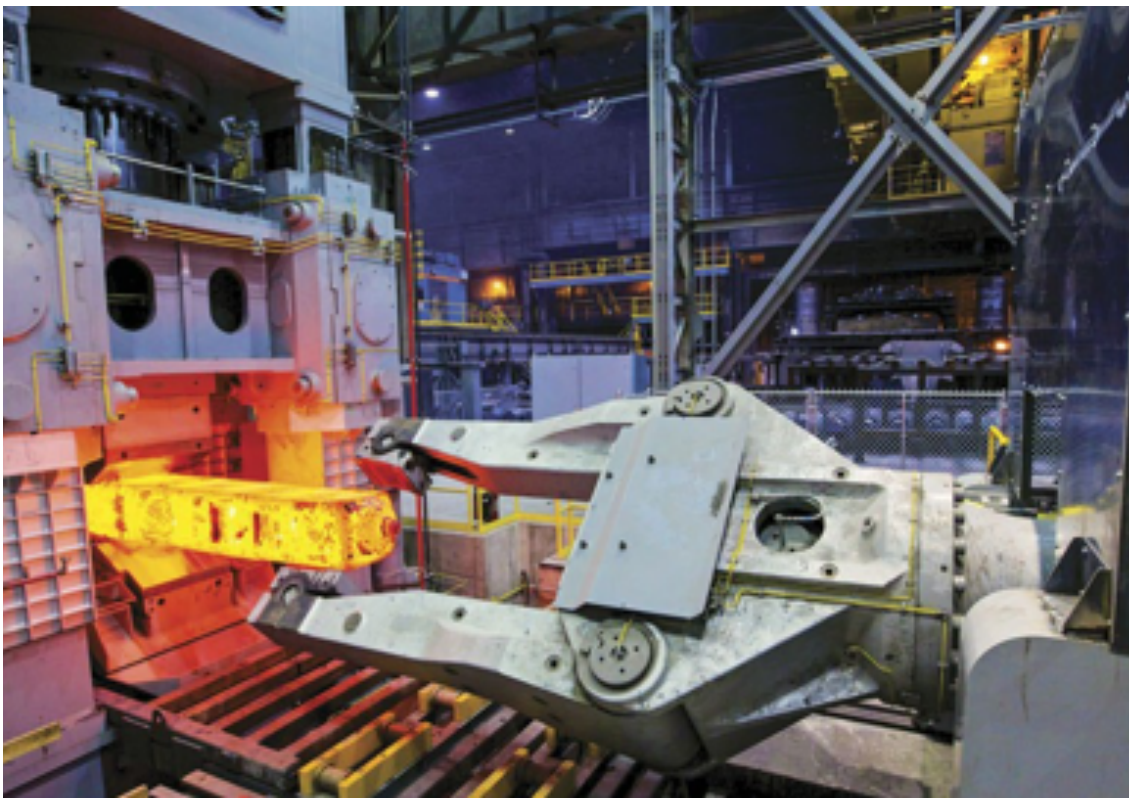
TimkenSteel Introduces New Endurance Steels

TimkenSteel's Endurance family of steels includes three new, patent-pending, ultra-high-strength, high-toughness grades, offering gear manufacturers the ability to achieve lighter weight, longer life and/or more power.

TimkenSteel has created some of the cleanest and best-performing special bar quality (SBQ) steel in the industry. Today, the company offers customers more than 500 grades, including its new Endurance product line, which is being introduced at Gear Expo in Columbus, Ohio.

This family of Endurance steels, comprised of both TimkenSteel's existing high-strength and/or high-toughness grades, as well as three new, patent-pending, ultra-high-strength, high-toughness steels, results from close collaboration with a broad range of industrial, oil and gas and automotive customers to achieve enhanced performance in extremely demanding applications.

"We've always been a leader in developing high-performance steels, and now we're making our



offering even better", said Ray Fryan, TimkenSteel's vice president of technology and quality. "Endurance steels combine higher levels of strength and toughness, driven by an application's unique requirements. For our customers and, in turn, their customers, this can translate to increased power transmission, lighter weight, and/or extended product life and reduced component failure. Better yet, using Endurance steels, customers don't have to redesign their components or processes to reap the benefits."

Endurance grades are suited for demanding applications in oil and gas, mining, military, marine, construction and more. In fact, a primary benefit of the Endurance line is that it provides multiple material options that can satisfy a range of performance objectives.

In highly engineered components like gears, these grades' higher levels of strength and toughness offer gear designers/manufacturers the ability to create improved gears that can achieve significant savings and performance advantages over those produced from more traditional steel grades. Additional benefits may include reduced downtime and lower warranty costs.

"These steels serve demanding, energy-intensive environments where components are handling very high loads and also moving at very high speeds," Fryan said. "They offer an incredible amount of strength and toughness in a small envelope."

"Our technology team is constantly working to push the bounds of what's possible to meet not only today's needs, but what our customers are looking for five, 10 and even 100 years from now," Fryan said.

November 01

Announcement of takeover of Bega Special Tools

Bega Special Tools aims to keep you up to date with key developments within the organisation.
It gives us great pleasure to announce that Bega Special Tools has been acquired by Henk van Essen. The last share transfer will take place on 1 January 2019. As a result of this, Frank Garritsen will step down as CEO after 35 years of service. This is an important step towards a healthy future for Bega and its employees.

Frank Garritsen has very impressively led the company since 1982. Under his leadership, Bega expanded into a specialist in the field of special tools for maintenance in drive technology. Partly thanks to his efforts, Bega now exports to more than 60 countries and the company enjoys a sterling reputation in the world of drive technology. Frank will continue to carry out his tasks at Bega until 1 January 2019.

Henk van Essen – who has now worked at Bega for nearly 20 years – has been charged for some time now with the daily running of the business. He also continues to carry out his commercial tasks in his entrusted regions in Europe and in North and South America, and in the development of Private Label Distributors.

This takeover will not involve any noticeable changes for you. We remain the place to be for special tools for mounting and dismounting of bearings and other transmission parts. If you have any questions, please don't hesitate to contact us at c.poelma@bega.nl.

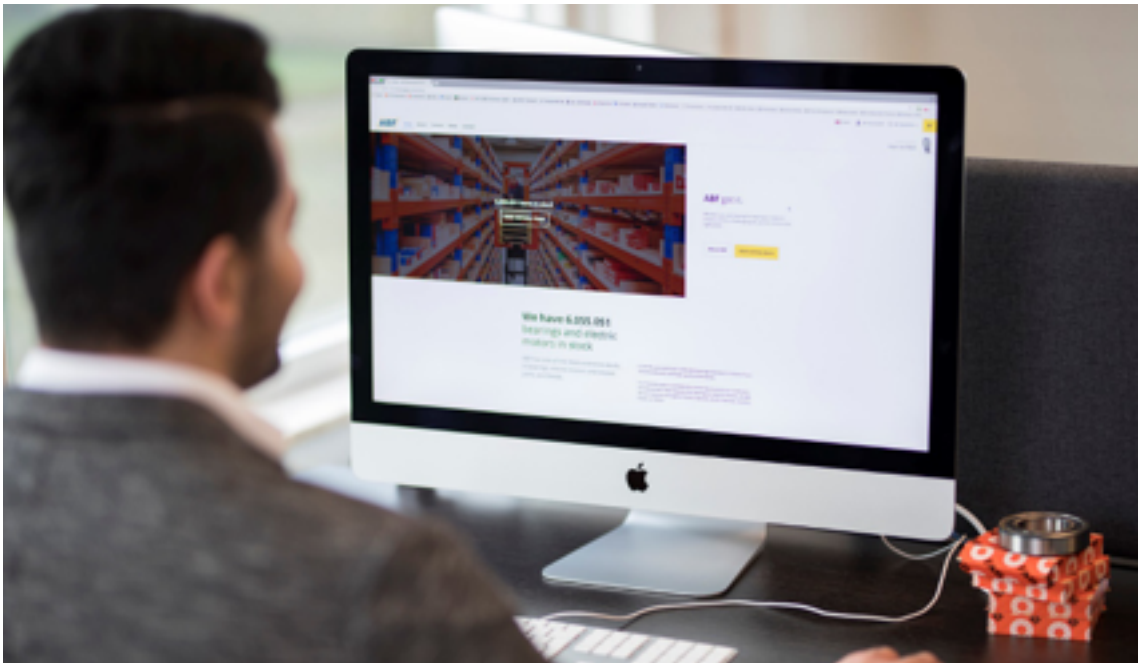
November 04

The Online Exhibition for the Bearing & Power Transmission Industry is launched

World's most important network and online exhibition for the bearing and power transmission industry, BearingEXPO has been launched recently. The platform covers a wide range of categories within the bearing and power transmission segments and offers exhibitors the opportunity to expand their activities worldwide, within the distributors network and several key industry segments.

The portal will be connected to +40 BearingNEWS bi-weekly, monthly, exhibitions and segment newsletters with reach upto 150.000 industrial professionals worldwide. The exhibitors will have the option to target their solutions within the requested industry segment. More information can be found at
www.bearing-expo.com

ABF launches new online store



ABF launched its new bearing and electric motor online store on December 18: www.abf.store. This optimized and user-friendly online store means customers can rapidly find and order parts.
“When our customers need a product, they want it right away. Searching for a part costs time, especially when you’re looking for that needle in the haystack. Now everyone can find that specific bearing or electric motor in ‘no time’,’’ explains Arjen van Beek, Marketing Manager at ABF, enthusiastically.

User friendly

The mobile-friendly online store has a split-second search function in combination with improved usability. “Customers can now find all our product information and stock availability in one place. And complete their order with just a couple of mouse clicks,” adds Arjen van Beek.

Advice in 7 languages

Choose from 7 languages at the multilingual online store. Customers who seek tailored advice can directly contact their account manager in one of these languages as well.

Broad product range

“Chances are that whatever bearing or electric motor you’re looking for, we’ve got it,’’comments Arjen. The ABF online store’s assortment is enormous - more than 6,000,000 bearings and electric motors. And its stock continues to expand every month.
Interested in ordering from the new ABF online store? Start by registering now on: www.abf.store. ABF customers always have access and only need to set their password.

SCHAEFFLER

LUK INA FAG

The Godiva Bearings and INA partnership started over 30 years ago and in that time, we have grown to be one of the largest Stockists of INA in the World.

In 2005, the FAG brand joined the INA brand in what was a massive step within the Bearing Industry. The prestigious Schaeffler Group are leading Global manufacturers of outstanding and technologically engineered products designed for the automotive and industrial market. Constantly building on their product innovation enables Godiva Bearings to offer the UK an extensive range of quality Bearings.

What's new? Godiva Bearings now stock the full range of FAG Black Series Pillow Blocks. The innovative Black Series boosts decreasing product lifecycle costs, shorter production downtime and improving maintenance systems. We hold both metric and imperial sizes in our main warehouse in the West Midlands for Same-day collection or dispatch, delivered with instantly recognisable single-boxed FAG packaging, which creates a great visual impact too!

Did you know... Our warehouse holds quantities of the full range of INA Needle Roller Bearings in abundance. Our Superhero expertise extends to all types of applications, in both metric and imperial. In fact, our experience and knowledge with INA Needle Bearings simply cannot be beaten. Whether it be an HK or a large SL Bearing, we have them all and everything in between!

We hold the smallest to the largest sizes, even including the eccentric versions of INA Cam-Followers which are used all over the World and in various types of applications.

FAG Ball Bearings cover an enormous range of sizes. We stock in-depth the ever popular metric series but we always ensure larger types are available to our customers too; these include the ZZ and 2RS versions as well as C2, C3 and C4. We can also supply these with special Lubricants (on request).

Our stock of FAG Cylindrical Roller Bearings are predominantly used in heavier duty applications, from high speed, high quality gearboxes to the quarry and mining industries - we have the full range available. We also supply and stock Cage versions such as plastic, steel and brass.

What can we offer? Our very experienced Sales force are able to offer you help with identifying your Bearing and can offer full technical back up; on occasions, we can even organise an engineer visit your customer. Being Trade-Only means we only supply to the Trade and your customers always remain your customers.

We are the Bearing Superheroes ready to support and assist you in meeting your customers' needs. If you need to find a particular size, have an urgent query or require technical support, contact us today on either our Dudley Sales Line: 0845 345 5955 or Newcastle Sales Line: 0845 345 5920.

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Newcastle: **+44 (0) 845 345 5920**
Email: **sales@godiva-bearings.co.uk**

WWW.GODIVA-BEARINGS.CO.UK

January 20

CRAFT Bearing Dakar Rally Team took 12th place overall

The 40th edition of the world famous Dakar Rally was brutal for the car category drivers – only 43 teams reached the finish line after 14 days of racing in the South America. Toughest ever for some, it was named fairly easy and very interesting by the Lithuanian CRAFT Bearings Dakar Rally team. Led by 9-time Dakar starter Antanas Juknevicius together with his co-pilot Darius Vaiciulis, the team has thrived in the treacherous conditions.

Starting from the 21st position on the grid, the crew took the start of the Dakar slow and steady, however, came back to its original pace in stage two, where the crew finished in P19. As every competitor in the Dakar Rally would say – there's always one day in the competition, when you have to go through hell to reach the finish line. That was the case with stage 4 for Antanas Juknevicius. After crossing the dune section, the crew was planning to get out in order to increase the tire pressure for the rocky terrain ahead, however, made a decision to risk and payed the price.

Eventually, the team fell into the dust of roaring KAMAZ, the Overdrive Hilux jumped on a sharp rocks and blew three tires in one hit. This was just the beginning of all the troubles as the crew later had to change additional tow tires and after borrowing some from the competitors, the crew finished the last 40 km with blown-out rear tires. Nevertheless, Antanas Juknevicius and Darius Vaiciulis ploughed on with a smile on their faces and eventually started going back up the leader board. After the unexpected rest day, when stage 9 was cancelled due to the weather conditions, CRAFT Bearings Dakar Rally team was in P16, but cranked up the rhythm and climbed 4 additional positions into the record-breaking 12th overall at the finish line. This was the third time Antanas Juknevicius has broken the record of the Baltic states – the first being in 2009, when he finished 25th overall, and the second last year – 21st place overall. Full CRAFT Bearing Dakar team's odyssey can be found at: http://www.craft-bearings.com/en/lifestyle/dakar


Dakaras.LT
CRAFT BEARINGS


CRAFT BEARINGS


CRAFT BEARINGS
KÄRCHER


CRAFT BEARINGS
KÄRCHER

JANUARY- MAY

2018 EVENTS EXHIBITIONS CONFERENCES AGENDA

150 KEY INDUSTRIAL EVENTS IN 45 COUNTRIES

2018 AGENDA
EVENTS, EXHIBITIONS & CONFERENCES

150 KEY INDUSTRIAL EVENTS IN 45 COUNTRIES

2018 AGENDA
EVENTS, EXHIBITIONS & CONFERENCES

150 KEY INDUSTRIAL EVENTS IN 45 COUNTRIES

JANUARY

LUBRICATION / TRIBOLOGY

21st INTERNATIONAL COLLOQUIUM TRIBOLOGY

09 - 11 Jan 2018
Stuttgart / Germany

Europe's largest international conference on tribology and lubrication.

MEDIA PARTNER Bearing NEWS

STEEL

STEELFAB
15 Jan - 18 Jan 2018
Dubai / UAE

Steel production and metal manufacturing event.

www.steelfabme.com

AGRICULTURE

LAMMA
17 Jan -18 Jan 2018
Peterborough / UK

Farm machinery, equipment and services show

www.lammashow.com

AGRICULTURE

POLAGRA-PREMIERY
18 Jan - 21 Jan 2018
Poznan / Poland

International fair of agricultural mechanization

www.polagra-premiery.pl

MINING

OMAN MINERAL & MINING
22 Jan - 24 Jan 2018
Muscat / Oman

Oman minerals & mining exhibition & conference

www.omanexpo.com

MATERIALS HANDLING

UPAKOVKA
23 Jan - 26 Jan 2018
Moscow / Russia

Russian version of Interpack

www.upakovka-tradefair.com

AUTOMATION

ALL AUTOMATION
24 Jan - 25 Jan 2018
Hamburg / Germany

Regional automation show of Hamburg

www.automation-hamburg.com

AGRICULTURE

AGROMACH EXPO
24 Jan - 27 Jan 2018
Budapesta / Hungary

International agriculture and agricultural machinery exhibition

www.agromashexpo.hu

TEXTILE MACHINERY

GARMENTECH
24 Jan - 27 Jan 2018
Dhaka / Bangladesh

Show for textile machinery

www.garmentechdhaka.com

MACHINE TOOLS

IMTEX 2018
25 Jan - 30 Jan 2018
Bengaluru / India

An initiative of IMTMA, IMTEX FORMING is a flagship event for the Indian metal forming industry.

www.imtex.in

AUTOMOTIVE

AUTOMECHANIKA
31 Jan - 02 Feb 2018
Jeddah / Saudi Arabia

International automotive parts exhibition

www.automechanikaJeddah.com

2018 AGENDA
EVENTS, EXHIBITIONS & CONFERENCES

150 KEY INDUSTRIAL EVENTS IN 45 COUNTRIES

FEBRUARY

AGRICULTURE

FIERAGRICOLA
31 Jan - 03 Feb 2018
Verona / Italy

International Agricultural Technologies Show

www.fieragricola.it

AGRICULTURE

AGROTICA
01 Feb - 04 Feb 2018
Thessalonika/ Greece

International Fair for Agricultural Machinery, Equipment and Supplies

www.agrotica.helexpo.gr

MACHINE TOOLS

BIEMH CEVISAMA
05 Feb - 09 Feb 2018
Valencia / Spain

Metal cutting, metal forming and machine-tools

www.cevisama.feriavalencia.com

MANUFACTURING

SOUTHERN MANUFACTURING
06 Feb - 08 Feb 2018
Hampshire / UK

Regional manufacturing technology, electronics and subcontracting exhibition

www.industrysouth.co.uk

MANUFACTURING

EXPO MANUFACTURA
06 Feb - 08 Feb 2018
Monterrey / Mexico

Manufacturing and equipment expo

www.expomanufactura.com.mx

MEDICAL TECHNOLOGY

MD&M WEST
06 Feb - 08 Feb 2018
Anaheim / USA

Cutting-edge medical technology

www.mdmwest.mddionline.com

MAINTENANCE

MAINTENANCE SCHWEIZ
07 Feb - 08 Feb 2018
Zurich / Switzerland

Switzerlands leading trade fair for industrial maintenance

www.easyfairs.com

AUTOMATION

AUTO EXPO - COMPONENTS
08 Feb - 11 Feb 2018
New Delhi / India

Auto components Show

www.autoexpo.in

MAINTENANCE

MAINTENANCE DORTMUND
21 Feb - 22 Feb 2018
Dortmund / Germany

Regional maintenance show

www.easyfairs.com

MARCH

BEARING

BEARINGS WORLD

06 Mar - 07 Mar 2018
Kaiserslautern / Germany

International academic conference for bearing industry experts

www.bearingworld.org

MEDIA PARTNER Bearing NEWS

AUTOMATION

ALL AUTOMATION
07 Mar - 08 Mar 2018
Friedrichshafen / Germany

Regional automation show of Friedrichshafen

www.automation-friedrichshafen.com

2018 AGENDA
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MARCH

MANUFACTURING

MANUFACTURING EXPO
13 Mar - 15 Mar 2018
Lagos / Nigeria

Manufacturing and equipment expo

www.nigeriamanufacturingexpo.com

MATERIALS HANDLING

CFIA
13 Mar - 15 Mar 2018
Rennes / France

Dedicated to production, maintenance, packaging and logistics for the manufacturers in the food-processing

www.cfiaexpo.com

OIL & GAS

AOG
14 Mar - 16 Mar 2018
Perth / Australia

Australia's oil & gas event

www.aogexpo.com.au

MINING & CONSTRUCTION

BAUMA CONEXPO AFRICA
13 Mar - 16 Mar 2018
Johannesburg / South Africa

International Trade Fair for Construction Machinery, Building Material Machines, Mining Machines and Construction Vehicles

www.bcafrica.com

AGRICULTURE

EXPOAGRO
13 Mar - 16 Mar 2018
Buenos Aires / Argentina

Agriculture machinery exhibition

www.expoagro.com.ar

AUTOMOTIVE

AUTOMECHANIKA
14 Mar - 16 Mar 2018
Mexico City / Mexico

International automotive parts exhibition

www.paaceautomechanika.com

CONSTRUCTION

CONSTRUCTECH
15 Mar - 17 Mar 2018
Beijing / China

6th China International Building Technologies, Building Materials & Construction Equipment Expo

www.constructech.com

GENERAL INDUSTRY

WIN EURASIA

15 Mar - 18 Mar 2018
Istanbul / Turkey

Manufacturing technology, automation, material handling exhibition

www.win-automation.com

MEDIA PARTNER Bearing NEWS

AUTOMATION

IAMD EURASIA
15 Mar - 18 Mar 2018
Istanbul / Turkey

International Trade Fair for Integrated Automation, Motion & Drives at WIN EURASIA

www.messe.de

MEDIA PARTNER Bearing NEWS

STEEL

METAL WORKING EURASIA
15 Mar - 18 Mar 2018
Istanbul / Turkey

International Trade Fair for Integrated Automation, Motion & Drives at WIN EURASIA

www.messe.de

MEDIA PARTNER Bearing NEWS

MATERIALS HANDLING

CEMAT EURASIA
15 Mar - 18 Mar 2018
Istanbul / Turkey

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

www.messe.de

MEDIA PARTNER Bearing NEWS

EPTDA

2018 EXHIBITION & EPTDA PAVILION

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2018 AGENDA
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150 KEY INDUSTRIAL EVENTS IN 45 COUNTRIES

MARCH

AGRICULTURE

AGROTECH
16 Mar - 18 Mar 2018
Kielce / Poland

Agriculture machinery

www.targikielce.pl

MATERIALS HANDLING

PROPAK VIETNAM
20 Mar - 22 Mar 2018
Ho Chi Minh / Vietnam

Processing, packaging, handling machinery

www.propakvietnam.com

MATERIALS HANDLING

CEMAT SOUTHEAST ASIA
20 Mar - 22 Mar 2018
Jakarta / Indonesia

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

www.messe.de

MEDIA PARTNER Bearing NEWS

MATERIALS HANDLING

INTRA LOGISTICS
20 Mar - 23 Mar 2018
Paris / France

Materials handling exhibition for industry and distribution

www.intralogistics-europe.com

MAINTENANCE

MAINTENANCE 2018

21 Mar - 23 Mar 2018
Antwerp / Belgium

Maintenance trade show, a boost for the maintenance industry

www.easyfairs.com

Bearing NEWS

PUMPS & VALVES

PUMPS & VALVES
21 Mar - 23 Mar 2018
Antwerp / Belgium

Exhibitions for industrial pumps and valves

www.easyfairs.com

MANUFACTURING

MECSPE
22 Mar - 24 Mar 2018
Parma / Italy

Fair for the manufacturing industry

www.mecspe.com

MACHINERY

EUROSTAMPI
22 Mar - 24 Mar 2018
Parma / Italy

European die, mold and injection machines exhibition

www.mecspe.com

MACHINE TOOLS

MACCHINE & UTENSILI
22 Mar - 24 Mar 2018
Parma / Italy

Machine tools and metal working exhibition

www.mecspe.com

MACHINERY

INDUSTRIE LYON
27 Mar - 30 Mar 2018
Paris / France

French exhibition for production technologies

www.industrie-expo.com

MACHINERY

TOL EXPO
27 Mar - 30 Mar 2018
Paris / France

International exhibition for sheet metal, coil, tube machinery and section equipment

www.tolexpo.com

2018 AGENDA
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MARCH

STEEL

BORUTELRULO
28 Mar - 30 Mar 2018
Istanbul / Turkey

Metal pipe, wire and coil manufacturing exhibition

www.tube-wire-coil-fair.com

MINING

UZMINING EXPO
28 Mar - 30 Mar 2018
Tashkent / Uzbekistan

International Mining Industry Exhibition

www.ieg.uz

GENERAL INDUSTRY

MIDEST PARIS
27 Mar - 30 Mar 2018
Paris / France

Maintenance, subcontracting and industrial equipment

www.midest.com

APRIL

AUTOMOTIVE

KIAE
03 Apr - 05 Apr 2018
Astana / Kazakhstan

International automotive parts exhibition

www.kiae.kz

MINING

MONGOLIA MINING
04 Apr - 06 Apr 2018
Ulaanbaatar / Mongolia

International Mining and Oil/Gas Expo

www.mongolia-mining.org

AUTOMOTIVE

AUTOMECHANIKA
05 Apr - 08 Apr 2018
Istanbul / Turkey

International automotive parts exhibition

automechanika-istanbul-tr.messefrankfurt.com

AGRICULTURE

CCMT 2018
09 Apr - 13 Apr 2018
Shanghai / China

China CNC Machine Tool Fair

www.ccmtshow.com

ENERGY

COALTRANS
10 Apr - 11 Apr 2018
Beijing / China

Coaltrans Conferences

www.coaltrans.com

CEMENT

CEMENTTECH
10 Apr - 13 Apr 2018
Nanjing / China

China International Cement Industry Exhibition and Conference

www.cementtech.org

STEEL

TUBE
16 Apr - 20 Apr 2018
Dusseldorf / Germany

International Tube and Pipe Trade Fair

www.tube-tradefair.com

MINING

MININGWORLD RUSSIA
17 Apr - 19 Apr 2018
Moscow / Russia

International exhibition of machines and equipment for mining, processing and transportation of minerals

www.miningworld.ru

MAINTENANCE

MAINTENANCE
17 Apr - 19 Apr 2018
Gorinchem / Netherlands

Technologies for industrial maintenance and asset management

www.easyfairs.com

2018 AGENDA
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APRIL

MATERIALS HANDLING

KOREA MAT
17 Apr - 20 Apr 2018
Kintex / Korea

Materials handling & logistics

www.koreamat.org

GENERAL INDUSTRY

HANNOVER MESSE

23 Apr - 27 Apr 2018
Hannover / Germany

Industrial exhibition for motion drive automation & industrial supply

www.hannovermesse.de

MEDIA PARTNER Bearing NEWS

MATERIALS HANDLING

CEMAT
23 Apr - 27 Apr 2018
Hannover / Germany

World leading trade fair for intralogistics & supply chain management

www.messe.de

MEDIA PARTNER Bearing NEWS

MINING

MINING WEEK KAZAHSTAN
24 Apr - 26 Apr 2018
Karaganda / Kazakhstan

The 14th international exhibiton for mining and exploration, mineral and coal processing and metallurgical technologies

www.miningweek.kz

AUTOMOTIVE

AUTOMECHANIKA
25 Apr - 27 Apr 2018
Ho Chi Minh / Vietnam

International automotive parts exhibition

www.automechanika-hcmc.com

AGRICULTURE

AGRISHOW
30 Apr - 04 May 2018
Sao Paulo / Brazil

Agriculture machinery exhibition

www.agrishow.com.br

MARINE

OTC
30 Apr - 03 May 2018
Houston / USA

The Offshore Technology Conference

www.2018.otcnet.org

MAINTENANCE

MCM
Apr. 2018
Milano / Italy

Maintenance conference and expo

www.mcmonline.it

MAY

AUTOMOTIVE

AUTOMECHANIKA
01 May - 03 May 2018
Dubai / UAE

International automotive parts exhibition

www.automechanikadubai.com

FOOD & BEVERAGE

IFFA
04 May - 09 May 2018
Frankfurt/Main / Germany

The No. 1 for the Meat Industry - "Meet the Best!"

www.messefrankfurt.com

MINING

CIM
06 May - 09 May 2018
Vancouver / Canada

Canada's mining market place

www.convention.cim.org

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- 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

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2018 AGENDA
EVENTS, EXHIBITIONS & CONFERENCES

150 KEY INDUSTRIAL EVENTS IN 45 COUNTRIES

MAY

GENERAL INDUSTRY

IAMD BEIJING

9 May - 11 May 2018
Beijing / China

International Intelligent Manufacturing Exhibition

www.messe.de

MEDIA PARTNER Bearing NEWS

MANUFACTURING

NATIONAL MANUFACTURING WEEK

09 May - 11 May 2018
Sydney / Australia

General industry and manufacturing expo

www.nationalmanufacturingweek.com.au

MACHINE TOOLS

METALLOOBRABOTKA

14 May - 18.May 2018
Moscow / Russia

Instruments and tools for the metal working industry

www.metobr-expo.ru

MARINE

NAVEXPO

15 May - 17 May 2018
Lorient / France

The maritime business meeting and expo

www.navexpo.com

OIL & GAS

OGU

16 May - 18 May 2018
Tashkent / Uzbekistan

Oil & Gas conference and exhibition

www.oilgas.uz

MACHINE TOOLS

MTA2018

16 May - 19 May 2018
Bangkok / Thailand

The International Precision Engineering, Machine Tool and Metalworking Exhibition & Conference

www.mta-asia.com

STEEL

METAL + METALLURGY CHINA

16 May - 19 May 2018
Beijing / China

Largest exhibition in the equipment manufacturing industry in Asia

www.mm-china.com

AUTOMOTIVE

AUTOMECHANIKA

20 May - 27 May 2018
Madrid / Spain

International automotive parts exhibition

www.motortec-automechanika-iberica.com

CEMENT

TECHTEXTIL NORTH AMERICA

22 May - 24 May 2018
Atlanta / USA

Techtextil North America assembles all vertical aspects of the technical textile industry

techtextil-northamerica.us.messefrankfurt.com

MINING

KAIVOS

23 May - 24 May 2018
Oulu / FInland

Mining Trade Fair and Meeting Forum for the Mining Industry

www.kaivos.fi

MATERIALS HANDLING

LET CHINA

23 May - 25 May 2018
Guangzhou / China

China International Logistics Equipmemnt & Technology Exhibition

www.chinalet.cn

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www.bearing-expo.com

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INDUSTRIE 4.0
REACHES THE NEXT STAGE

With the lead theme ***"Integrated Industry – Connect & Collaborate"***, HANNOVER MESSE 2018 spotlights the potential of this development.

The interplay between automation and energy technology, IT platforms and artificial intelligence is driving the digital transformation of industry. With the lead theme "Integrated Industry – Connect & Collaborate", HANNOVER MESSE 2018 spotlights the potential of this development.

Humans, machines and IT – these are the cornerstones of tomorrow's factories. However, only with networking will they reach their full potential. "The new connectivity – that is, the organization of networks – is taking Industrie 4.0 to the next stage," said Dr. Jochen Köckler, Chairman of the Managing Board, Deutsche Messe AG. "With 'Integrated Industry – Connect & Collaborate' we highlight how connectivity in industry facilitates completely new forms of business, work and collaboration. The result: more competitiveness, better jobs and new business models."

Factory and energy technologies are more efficient than ever. So is data analysis. Industrial IT platforms push their way into the market. Artificial intelligence and machine learning enable machines to make decisions. Engineers digitally simulate entire production chains. New players and new business models emerge, blurring boundaries between industries.

"HANNOVER MESSE is the place to experience the rapid development and impact of Industrie 4.0," emphasized Köckler. "Companies from all over the world demonstrate robots, automation technology, IT solutions and software as well as platforms for networking. Only in Hannover will you see the digital transformation of industry as a complete system."

The lead theme "Integrated Industry – Connect & Collaborate" is relevant to many branches of industry. For example, companies of all sizes can easily use human-robot collaboration. The digital twin, a virtual representation of a product connected to manufacturer and customer data, optimizes production processes. Energy is another area where digitalization and networking are proceeding rapidly. For example, virtual power plants feed energy from various producers precisely into the electricity grid. Or in the areas of energy transition and mobility, electric vehicles store energy and can then distribute their electricity to consumers to stabilize fluctuations in the grid.

Smart Supply in the age of digitalization opens up new perspectives for industrial subcontractors: Supply chain management, simultaneous engineering, optimized production runs, and minimal error rates – all of this is possible when suppliers and customers see each other as development partners and collaborate as equals.

The new connectivity also changes the role of factory workers, who now have direct access to all relevant production and machine data. Intelligent machines support them in their decision-making.

Industrial IT platforms play a crucial role. Collecting, analyzing and merging large amounts of data from different sources, combined with the respective industry expertise, makes it possible to develop internet-based services that bridge traditional industry boundaries.

Industrie 4.0 is also changing production logistics as well as the demands placed on logistics companies. More and more, customers want individual solutions from a single source. The intralogistics tradeshow CeMAT, which runs parallel to HANNOVER MESSE, reflects this trend. Consequently, visitors at the Hannover Exhibition Center will profit from the

complete “Industrie 4.0 meets Logistics 4.0” experience.

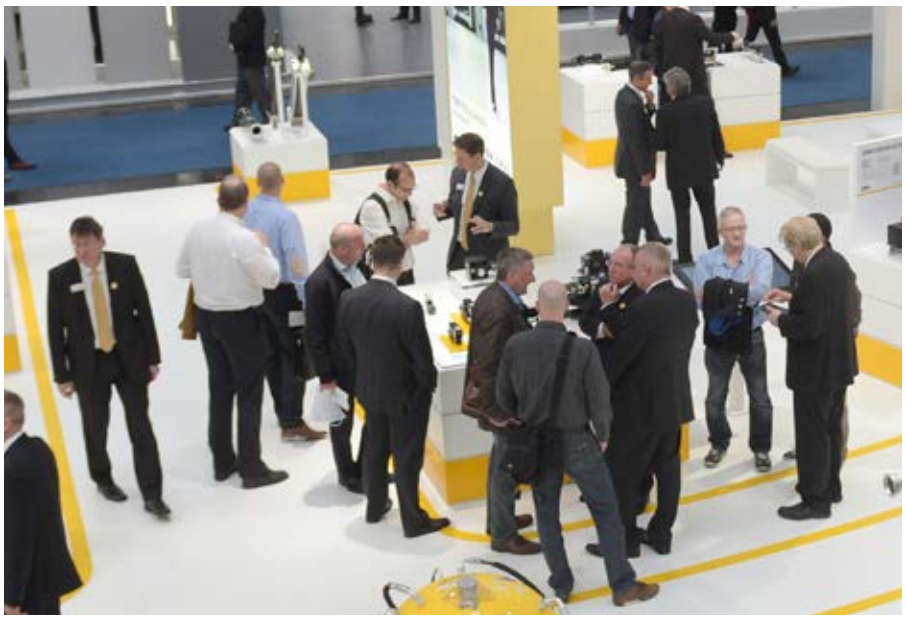
All of the above are examples of connectivity and collaboration that exhibiting companies from around the world will present at HANNOVER MESSE 2018. Furthermore, more than 80 conferences and forums will explore the lead theme, once again confirming HANNOVER MESSE as industry’s innovation platform and catalyst for trends.

HANNOVER MESSE USA To Premier In Chicago September 2018

The world’s leading trade show for industrial technology is spreading its wings. In September of 2018, Deutsche Messe is staging its first-ever HANNOVER MESSE in the USA.

HANNOVER MESSE is the world renowned trade show brand synonymous with industrial innovation, key trends and business leads. The event has long made a name for itself as a global hotspot for Industry 4.0 technologies. CEOs of global corporations, managers of SMEs and leaders of the world’s major industrial nations all use HANNOVER MESSE (currently staged annually in Hannover, Germany) to keep up with the latest trends and developments in industrial digitalization. This strong profile has yielded steady growth in the show’s German and international exhibitor and visitor following. This year, more than half of HANNOVER MESSE’s exhibitors and some 70,000 of the show’s visitors came from outside Germany.

“There is no other trade show brand like it anywhere in the world,” commented Deutsche Messe Managing Board Chairman Dr. Jochen Köckler. “We now want to leverage the power of the HANNOVER MESSE brand to speed up growth in our foreign markets. “Therefore, we are premiering HANNOVER MESSE USA co-located with IMTS September 2018 in Chicago.”



Internationalizing its strong, German-grown trade show brands is a strategy Deutsche Messe has been successfully pursuing for many years, and the company now stages some 60 events outside Germany every year. The bulk of these are industrial trade shows, dealing with specific sectors such as industrial robotics, factory automation, energy technology and industrial supply.

Deutsche Messe has had a presence in the U.S. market for many years and has been running trade shows in Chicago since 2012. Starting in September 2018, it will now cluster these Chicago-based shows under the brand name "HANNOVER MESSE USA". "As a brand, HANNOVER MESSE has been steadily adding to its acclaim in the U.S. market, in part thanks to the country's Partner Country showcase in 2016 – a momentous event attended by President Barack Obama. By launching HANNOVER MESSE on U.S. soil, we hope to attract even more exhibitors and visitors to Chicago while also generating positive spin-off effects for HANNOVER MESSE at its home base in Hannover, Germany," said Köckler.

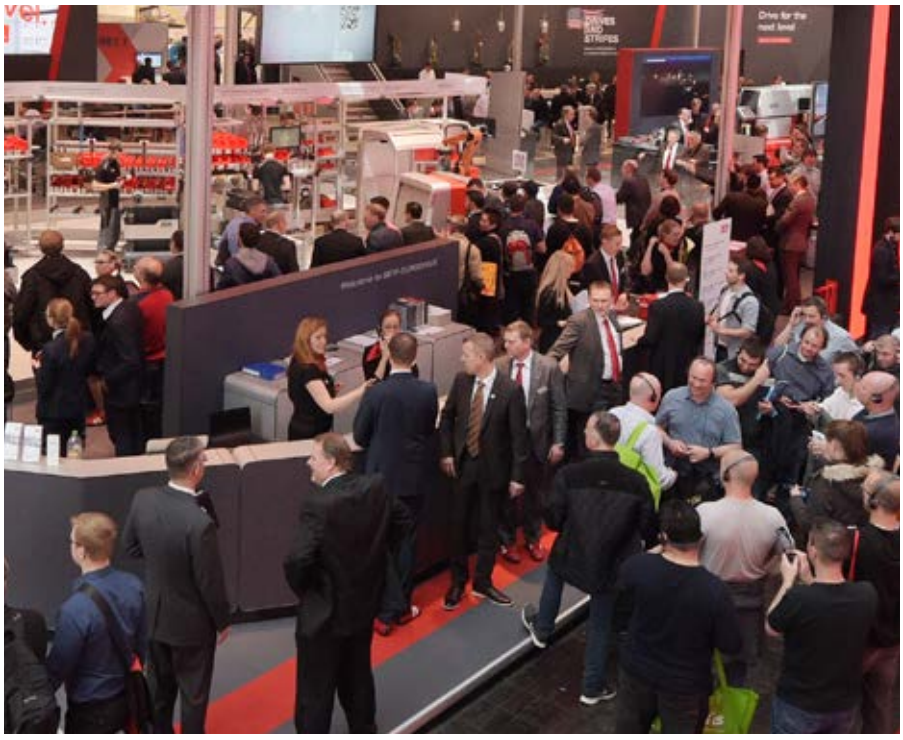
The premiere of HANNOVER MESSE USA is expected to attract some 550 exhibitors and more than 100,000 visitors and will occupy about 130,000 square feet of display space. For comparison, next year's HANNOVER MESSE in Hannover, Germany is likely to attract more than 5,000 exhibitors and about 200,000 visitors. Köckler added, "Our trade shows outside Germany are aimed exclusively at local and regional visitors. Our trade shows in Hannover, Germany, on the other hand, will continue to be pitched as the global flagships of their respective target industries, and will thus remain focused on an international clientele."

Merger driven by leading companies and major industry associations

The merger culminating in the new IAMD show comes at the express wish and initiative of leading HANNOVER MESSE exhibitors and major German industry associations. "Transmission and fluid power systems play a key role in engine performance," comments Christian Kienzle, Chairman of the Fluid Power Association within VDMA (the German Engineering Federation) and CEO of the Argo-Hytos Group. "With digitalization, these systems have now also become important data sources. Two years are an eternity in the age of digitalization. That's why it's important that we have the opportunity to put our latest solutions in front of customers without undue delay," he adds.

"The automation industry's sensor, control and networking products, systems and solutions are the 'enablers' of the fourth industrial revolution. And by bringing them together with electronic and mechanical drive systems under the Integrated Automation, Motion & Drives umbrella, Deutsche Messe has created a flagship fair that covers the entire factory shop floor and shows how it can be integrated into the Industry 4.0 environment," remarks Dr. Gunther Kegel, the head of German industry association ZVEI's measurement technology and process automation division and Managing Director of Pepperl + Fuchs GmbH.

The new IAMD show comprises production, process and energy automation systems; robotics; industrial IT; hardware and services; production



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from 6th – 8th October 2015

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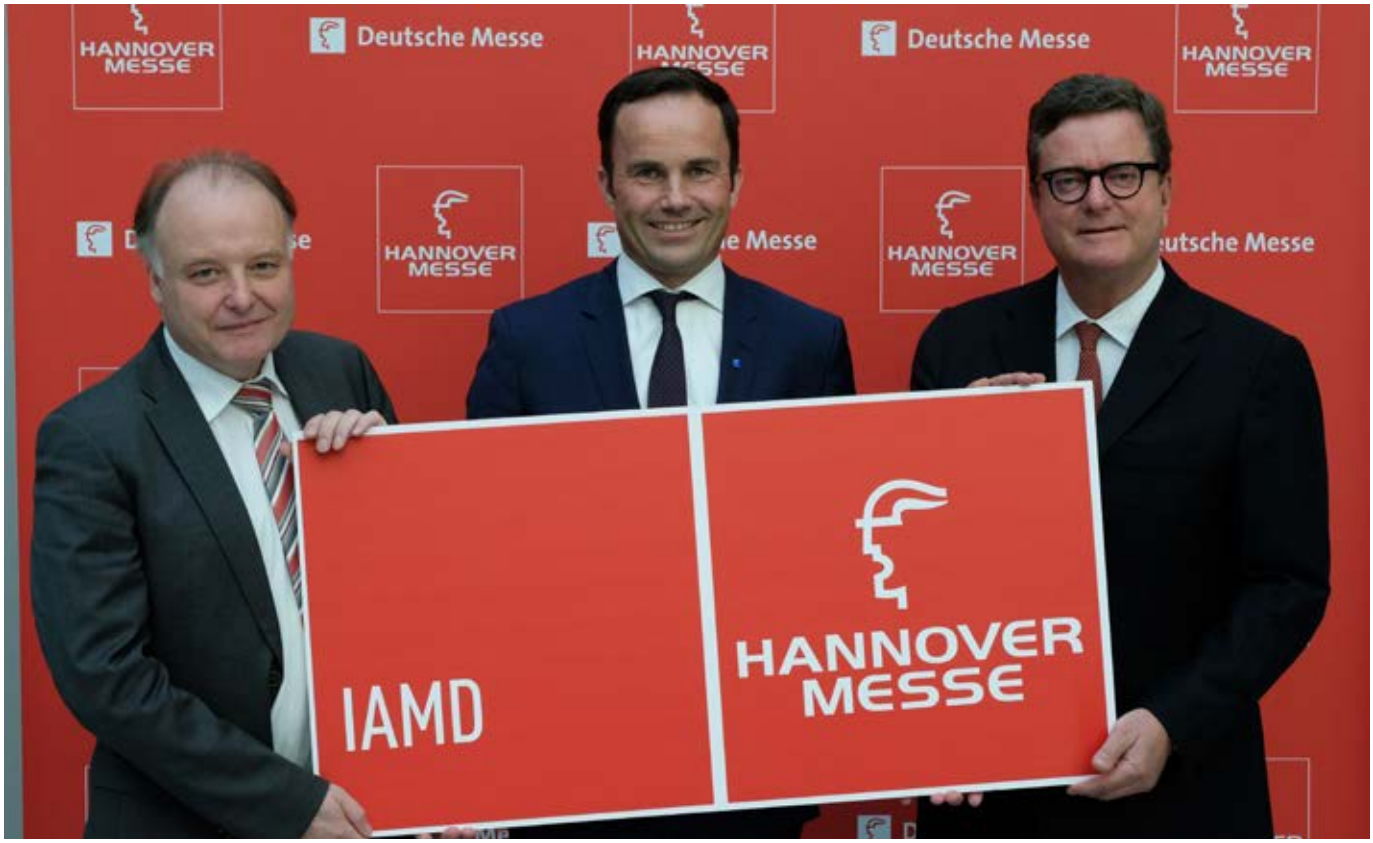


technologies and services; transmission and fluid power components and systems; pneumatic and hydraulic systems; plain and rolling bearings; geared motors; linear technology; and sealing technology. A comprehensive, topical program of supporting events, including the Industry 4.0 Forum and the Predictive Maintenance special display, will further boost the show's innovation credentials.

IAMD to build worldwide presence

Deutsche Messe plans to roll out the IAMD brand to key markets around the globe. This will open up further opportunities for companies wishing to export to emerging and fast-growing economies with an enhanced need for automation solutions, such as China. Deutsche Messe's existing offshoot tradeshows in China, Canada, the US and Turkey will be successively restructured and rebranded in line with the parent event in Germany. The company also has plans to establish IAMD shows in other key markets.

HANNOVER MESSE – Get new technology first!

HANNOVER MESSE is the world's leading trade show for industrial technology. With its core focus on "Integrated Industry" and "Integrated Energy", it is the No. 1 global platform for Industry 4.0. The show will next be held from April 23 to 27,

2018 in Hannover, Germany, and will provide a comprehensive overview of the latest visions and technologies for the digitization of production and energy systems. The upcoming HANNOVER MESSE will feature five parallel shows: IAMD (Integrated Automation, Motion & Drives), Digital Factory, Energy, Industrial Supply and Research & Technology. It will also be co-staged with CeMAT, the world's leading trade fair for intralogistics and supply chain management. Mexico will star as the Partner Country of HANNOVER MESSE 2018.

WIN
EURASIA

BEARING
ROOT CAUSE FAILURE
ANALYSIS WORKSHOP

AT THE WIN FAIR **IN ISTANBUL**
ON FRIDAY 16 MARCH 2018

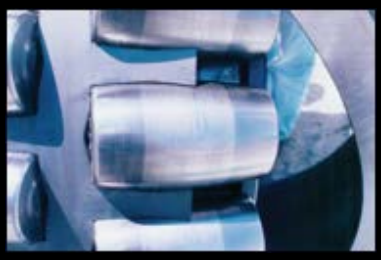
Presented by **PER ARNOLD ELGQVIST**

- 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 dismounting 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.

You can reserve your seat by registering online.
Register today as **there are only 50 seats available.**

Kenan Özcan

Workshop Regsitrations

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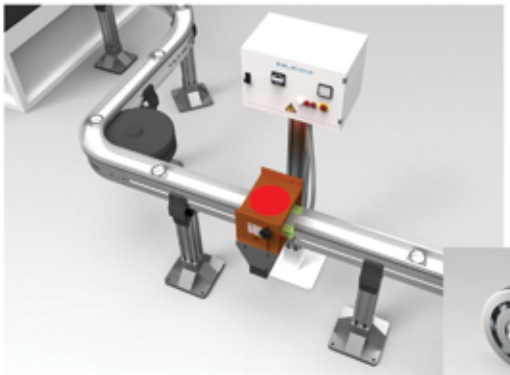

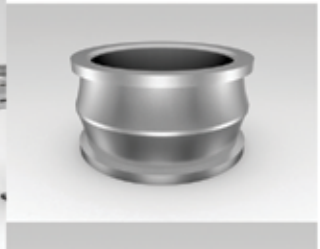

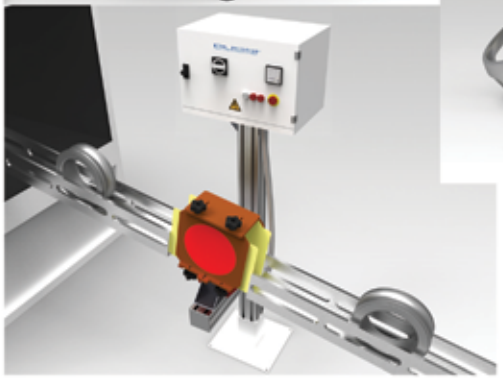

During the manufacturing process, the demagnetization, as magnetic pre-washing, is the optimal preparation for the bearing components cleanliness.

Bussi Demagnetizers prevent from friction, limited fluency, early wear and reduced life of the bearings.

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THE ELECTRO-MECHANICAL AUTHORITY

EASA 2018 International Conferences & Exhibitions

The Electrical Apparatus Service Association (EASA, www.easa.com) is the premier international trade association serving companies that repair, service and sell electro-mechanical equipment, including electric motors, generators, pumps, drives, controls, transformers and more. EASA provides unparalleled technical training, education and engineering support services to more than 1,800 member companies in nearly 80 countries.

EASA's global outreach continues to grow, and in 2014 it established an office in Luxembourg to manage its European & World Chapter. General Manager Frederic Beghain oversees events, training and membership in Europe, the Middle East, Africa and Western Asia. Representatives of 43 companies from 17 countries attended the Chapter's 2017 general meeting in Valencia, Spain. The Chapter's Annual General Membership Meeting for 2018 will be in conjunction with EuroMaintenance 4.0 in Antwerpen, Belgium, on September 23-26.

EASA also hosts an annual international convention and trade show that brings together manufacturers, distributors and service centers from all over the world for three days of product exhibition, education, technical training and networking. The 2018 EASA Convention will be held June 24-26 in Milwaukee, Wisconsin, USA. The event annually attracts about 2,500 attendees and 220 exhibitors from around the world. Highlights of the 2018 EASA Convention will include a large exhibition of industrial electric motors, drives, controls, motor brakes, pumps, bearings and seals, as well as motor and component repair parts and materials, tools and equipment, testing instruments and panels, condition monitoring devices and systems, balancing machines and vibration analysis instruments–i.e., everything that involves application, maintenance and repair/rewinding of rotating electro-mechanical equipment.

EASA's 2018 convention also will feature three days of conference sessions that focus on repair, maintenance and testing of rotating electro-mechanical equipment like motors, drives and pumps. Topics will include root cause failure analysis methods, ISO balancing grades, and new shaft alignment standards. Other sessions will deal with the interaction of pumps, motors and drives, and how to select replacement DC and three-phase AC motors. Presentations also will cover the effects of digitization on

electro-mechanical maintenance and repair operations, advanced rotor bar testing techniques, detection of static partial discharge, and improvements in insulation technology. A variety of sessions also will address the management, sales and marketing aspects of EASA member businesses.

EASA members are “The Electro-Mechanical Authority” with unique services and products. Unlimited technical engineering support and free access to EASA’s Motor Rewind Database, which contains data on more than 260,000 motors, are just the beginning when it comes to supporting members. A robust catalogue of resources that includes technical training manuals, reference materials, safety information and an accreditation program gives members many tools to succeed in an ever-changing industry.
For more information about EASA, visit www.easa.com. For information about EASA’s European & World Chapter, go to www.easa9.org or contact Frederic Beghain at fbeghain@easa9.org.

WORLD'S BIGGEST

Bearing Data's Interchange System – overview

Bearing Data is the most comprehensive and reliable database of industrial bearings interchange and aims to become a global reference.
More than 3 million bearing designations are available in Bearing Data's database, providing roughly 200,000 interchange reports from more than 100 of the most important bearing manufacturers worldwide.
In using Bearing Data, you can find several alternative brands for your bearing applications, coupled with a detailed explanation of prefixes and suffixes for all bearing designations, as well as cage material.
You can conduct searches by simply entering the bearing designation you wish to find cross-references for, and then receive a clean, precise report. It is also possible to print and save reports. You can also use the report for a quotation request, purchase request or even for detailed inventory control.

"200,000 interchange reports from more than 100 of the most important bearing manufacturers worldwide."

This product is the result of eight years of research on the part of engineering professionals with experience in many application fields who made this database project possible.
At Bearing Data, you'll find standard bearings as well as bearings specifically designed for special applications. In terms of special applications, you can find bearings for high temperatures, electrically insulated bearings, bearings with special coatings, sealed bearings, ceramic bearings, corrosion-resistant bearings, split bearings, precision bearings, energy efficient bearings, special and large size bearings for the steel, paper and mining industries.

Benefits of the Interchange System

Bearing Data's Interchange Reports match different manufacturer part numbers you may have in stock, thus reducing duplicate inventory, eliminating unnecessary purchase expenses, delivery waiting time and avoiding unplanned downtime.

In just a few seconds, you'll have all possible alternatives and can select best-fit based on the detailed specifications provided in our reports, as well as even optimize design cost. Finding options from alternative brands is another advantage of the system.

Bearing Data's database is updated on a monthly basis.

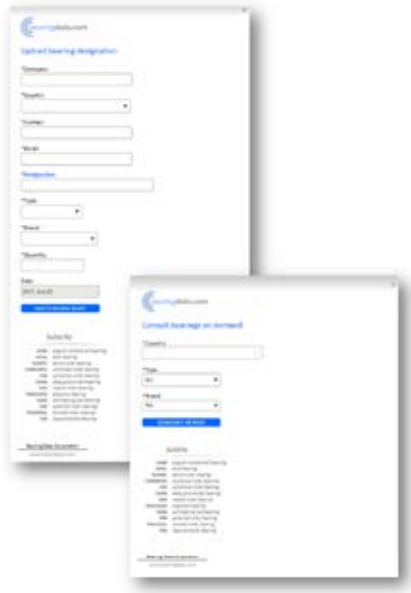
Easy to use

The tool is easy to use and requires no training.
By entering information about a bearing (bearing designation, dimensions, clearance, tolerance, preload and manufacturer), Bearing Data will generate a detailed report for your search. You can also do searches by looking for a specific bearing type or for a specific bearing application. At Bearing Data, you will find more than 600 bearing types in order to obtain the best option for your particular application.

Bearing Basket

Another Bearing Data feature is the Bearing Basket, which is a very simple tool that helps you find the bearing you need.

How does it work? Quite simple. Enter the data regarding the bearing you're looking for (designation, quantity) and the part number will be uploaded into the Bearing Basket, which is a list of bearings on demand. The distributor with the respective bearing in inventory will send a quotation directly to your email.
You may find more information about this tool on Bearing Data's homepage.



Summary

- 3 million bearings in the interchange database (radial bearings, precision bearings, axial bearings and combined bearings)
- Over 600 bearing types listed
- More than 100 manufacturer part numbers listed
- Search by part number, dimensions, bearing type or manufacturer
- Prefix and suffix descriptions
- Simple to use, no training required
- Easy and intuitive
- Comprehensive and reliable

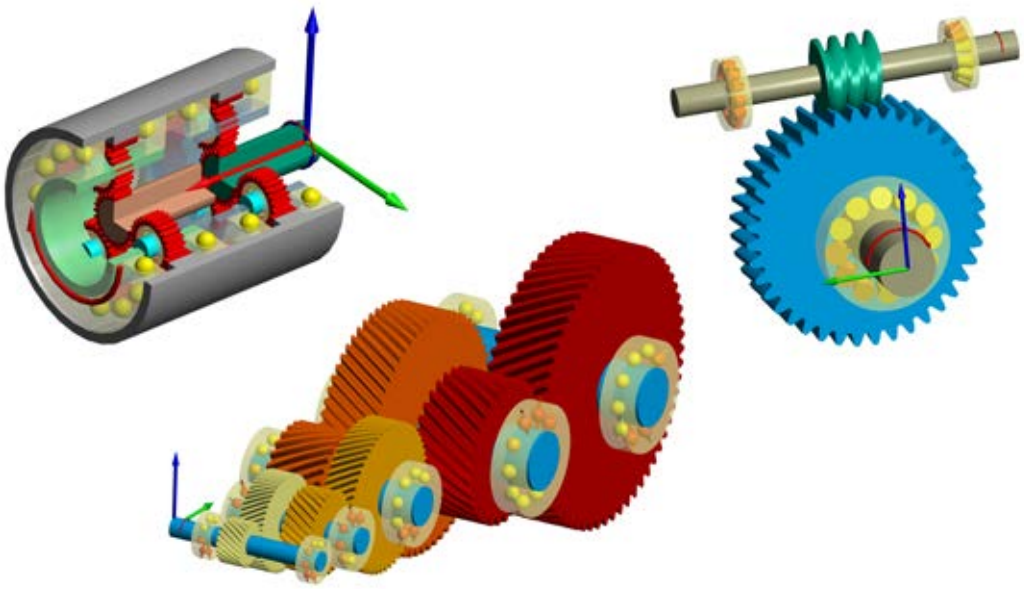
Homepage

Visit our homepage now for:

- Sample reports
- Map of bearing types
- List of manufacturers
- User manual

Website : www.bearingdata.com
Contact : sales@bearingdata.com

Bearing Interference Fit Calculation



A bearing ring rotating relative to the load should be mounted with an interference fit to avoid slipping of the ring. The interference fit will then reduce the effective clearance of the bearing. Temperature and centrifugal forces will have an additional influence on the effective clearance and the properties of the interference fit. An online calculation of interference fits considering interference, temperature and centrifugal forces is provided at **https://www.mesys.ag/?page_id=2077**

Usually, the interference fit is calculated using thick ring theory assuming two cylindrical rings and plane stress. The interference between the parts is determined by manufacturing tolerances and some embedding due to surface roughness can be considered. DIN 7190 (2001) proposed a reduction of effective interference by 0.8*Rz, which was reduced to 0.4*Rz in DIN 7190 (2017). The sum of surface roughness of the two parts in contact should be considered, but, as in most cases, the bearing ring will have a much smoother surface than the shaft and the housing, it should be sufficient to consider the surface roughness of the shaft/housing only.

For the calculation of the interference fit, the ratio of inner and outer diameter of each ring is required. For the outer diameter of the inner ring and the inner diameter of the outer ring, the question is how to determine this diameter. Some bearing catalogs mention the raceway diameters, others an average diameter between raceway diameter and the shoulders.

To get an estimate about the influence of the shoulders of the bearing rings on the change of effective clearance, an axisymmetric FEA calculation was added to the MESYS bearing calculation software. The diametral expansion on the outer contour of the ring is shown in a diagram, in comparison to the calculation of cylindrical rings according to thick ring theory. Two options are considered for thick ring theory. Either the pitch diameter plus/minus ball diameter Dpw±Dw is used for the second diameter of the ring, or a diameter leading to the same cross section area as the real cross section including shoulders.

Figure 1 shows the diametral expansion of a 71910C bearing inner ring considering an interference of Iw = 13 µm and speed zero. The solid line shows the expansion of the outer contour of the ring according to the FEA calculation, the dotted line shows the expansion using thick ring theory and a diameter for the equivalent cross section, and the dashed line shows the expansion

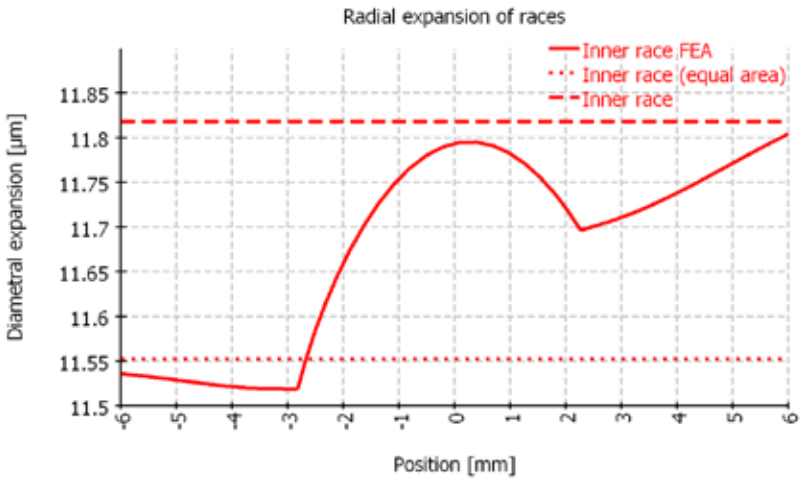


Figure 1: Expansion of a 71910C with interference Iw = 13 µm and n = 0 rpm

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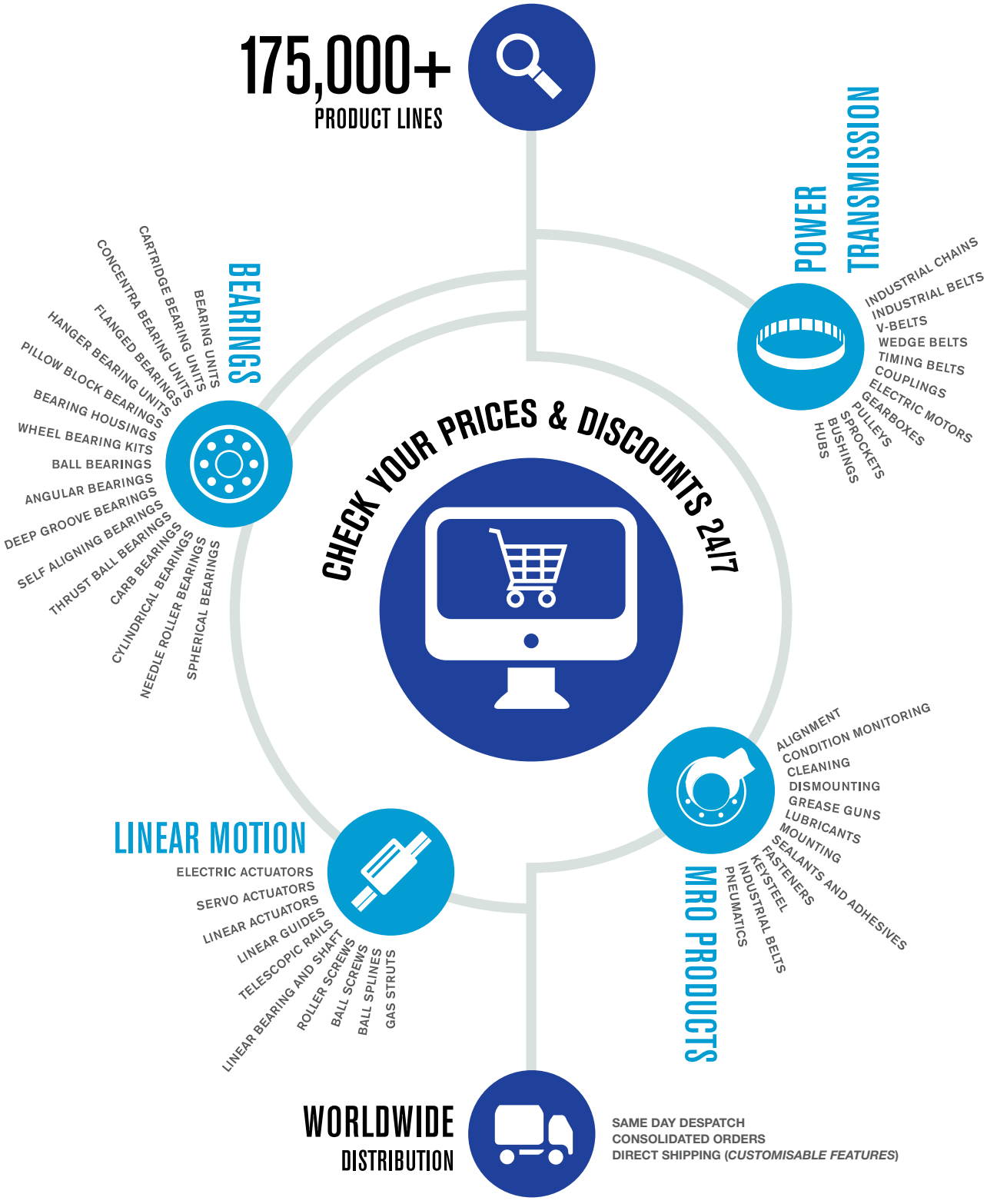

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for thick ring theory and the outside diameter Dpw-Dw.

It can be seen that the expansion in the middle of the bearing is very close to the value not considering the shoulders and the value at the left shoulder is closer to the value for the equivalent cross section. It should be noted that the difference is about 0.3 µm, so the effect of unreliable smoothing of the surface roughness is larger than this variation.

Figure 2 shows the result of the same example, but with rotation speed of 30000 rpm. Here, the expansion of the equal cross section case is larger than in the case without considering the shoulders. The reason is the larger mass and the larger effective diameter for the centrifugal forces.

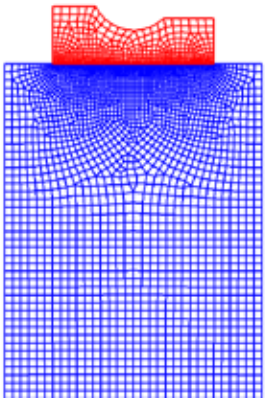

Figure 3: The FEA mesh used for above calculations

Figure 3 shows the mesh used in these two calculations. The width of the shaft is a little larger than the bearing width as it is in real applications. Quadratic elements are used.

For the same example, a hollow shaft with inner diameter dsi = 30mm instead of a solid shaft is considered in figures 4 and 5. Figure 4 shows a larger difference for the two cases based on thick ring theory. The case with equivalent cross section is too stiff here. Including centrifugal forces, the differences are small again.

These examples show that the consideration shoulders for the calculation of fits is not required in many cases and a calculation using a simplified approach with

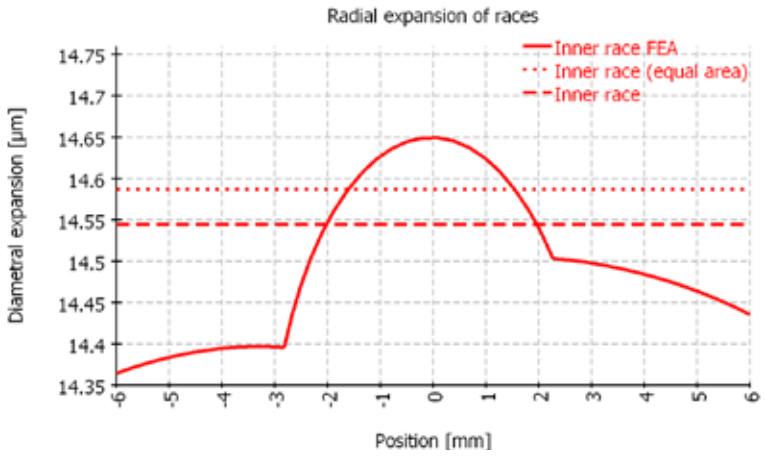

Figure 2: Expansion of a 71910C with interference Iw = 13 µm and n = 30000 rpm

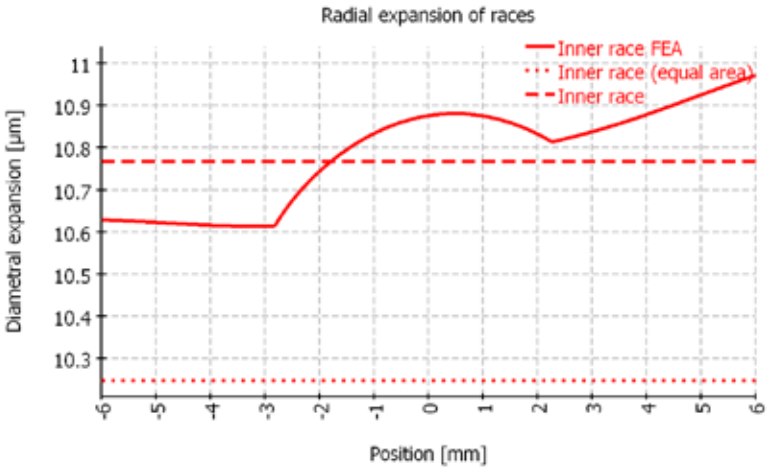

Figure 4: Expansion of a 71910C with interference Iw = 13 µm, n = 0 rpm, and dsi = 30 mm

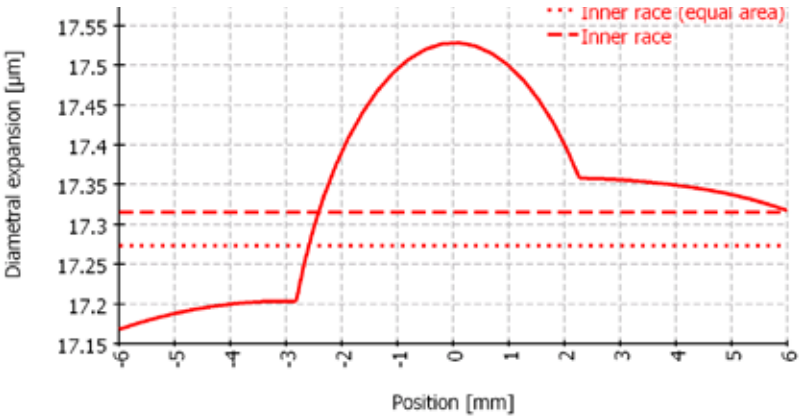

Figure 5: Expansion of a 71910C with interference Iw = 13 µm, n = 30000 rpm and dsi = 30 mm

section. But as in real Dpw±Dw can lead to more accurate results for low speed cases. Still, mostly the differences are much smaller than the effect of surface roughness would be.

If a shaft width equal to the bearing width would be used, the expansion of the ring based on the FEA calculation would be smaller and closer to the results considering the equivalent cross

applications the shaft and housing width is larger than the bearing width in almost all cases. This was assumed for the FEA calculation, too.

New Features in version 12/2017 of MESYS Shaft and Bearing Calculation software

A new version of the MESYS shaft and rolling bearing analysis software

including new functionality is available. The bearing analysis software allows the calculation of the load distribution within the bearing and bearing life according ISO/TS 16281 and it is integrated in a shaft system calculation with additional possibilities like modal analysis, strength calculation for shafts and interfaces to gear calculations. Currently, the software is used by customers in 25 countries on 4 continents.

General program features

A COM-interface was added to the software, which allows remote control of the calculations using other programs. It can be used for example to post-process bearing loadings calculated by time integration in MBS programs.
The software documentation is finally available as context sensitive help allowing faster access of information to certain inputs. An online version of the help is available at **https://www.mesys.ch/manual**. Graphics can be frozen inside the program to allow comparisons and a copy option using the system clipboard was added for graphics for quicker transfer into other documents. The default format for reports is now PDF/A instead of standard PDF.

New functionality in the bearing calculation

An addition option for roller crowning was added. Until now, a tangential crowning was available. Now, on customer request, a crowning with a non-tangential arc is available too.

The track roller calculation with elastic outer ring requires the geometry of the outer ring. Now, a proposal of the geometry can be generated by the software and the geometry can be imported using a XLS-file with point data. In case of a track roller calculation with load spectra, now the axial position and the angle of each load can be varied within the load spectra. The selection for tolerances and the tolerance report now also include a probable minimum clearance and a probable maximum clearance, in addition to minimum, mean and maximum values. Based on the assumption of normal distributions for fits and bearing clearance, the resulting probable values are calculated and can be selected for the calculation of the load distribution and life.

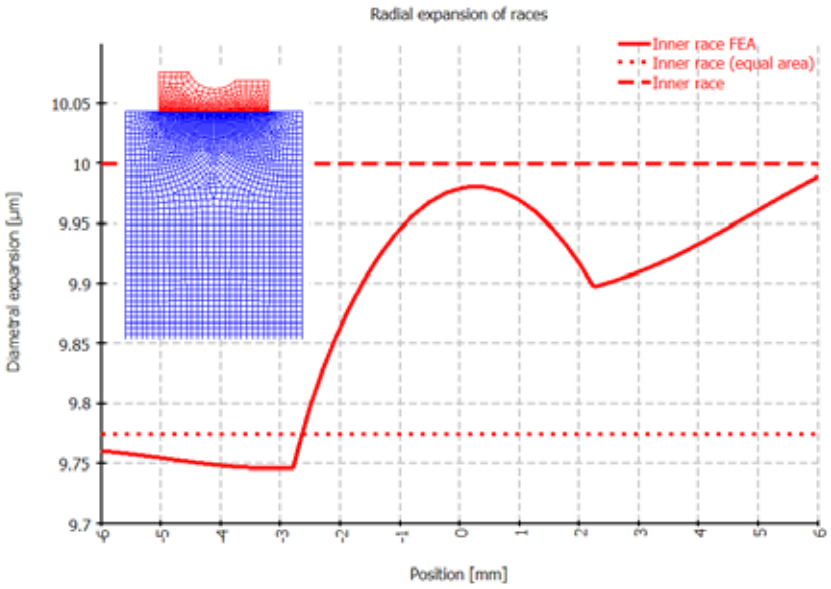

Figure 6: Radial expansion of inner race compared with axisymmetric FEA results

The radial expansion of bearing rings because of rolling element loads can be considered. In version 12/2017 not only the expansion of the bearing rings as before, but also the influence of the shaft or housing is considered. This has an effect in case of thin shafts or housings.
For the calculation of interference fits according to the thick ring theory, two options for the race diameter are available now. Both options can be compared with axisymmetric FEA results using a new diagram.

The SKF bearing database was updated and now includes information about bearing availability.

New functionality in the shaft calculation

The modal reduction of imported CAD geometry was already supported for fixed housings. Now, the modal reduction is also possible for free 3D elastic parts like planet carriers or shafts. So far, the modal reduction does not include gyroscopic matrices, therefore there is still a limitation for high speed applications.

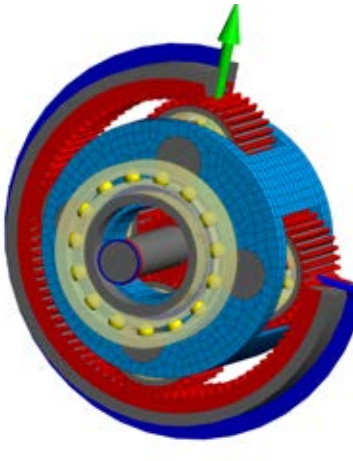

Figure 7: Parametric planet carrier with static and model reduction

All bearings types are now drawn

Figure 8: Supported bearing types

with separated bearing rings in 2D and 3D-views. The animations for 3D mode shapes, therefore allow a better understanding of the movement in the bearings.

For shaft systems in addition to connections by gears or belts, a generic coupling connection with a user defined ratio is available. This allows to consider hydraulic or electric connections between subsystems.

Many small extensions had been added like splitting or merging shafts, applying options to all bearings in one operation, or adding comments to load spectra elements.

For further information visit **www.mesys.ag** *or contact* **info@mesys.ch**

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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.

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Methods used in the past may not work anymore and in order to keep up with the force of change, an enterprise has to mobilize all its resources. There is where the enthusiasm, energy, and new ideas of young management teams can make a competitive advantage.

Proving its commitment to growing the talent of the future and to continuous people development, EPTDA hosts every year since 2010 a special Next Generation (NexGen) event at the Annual Convention, the NexGen seminars. After the successful NexGen Forums & Contests in the past Annual Conventions, that have created a structured community from all NexGen Delegates, EPTDA has formed a NexGen Taskforce who is constantly looking into finding new innovative ways to stimulate and develop the future leaders of the PT/MC industry.

The main objectives of this orientation are meant to raise awareness about what Next Generation means for the industry and create a structured workgroup, acknowledging their value and contribution.

Besides the dedicated NexGen programme held each year at the association's annual conventions, EPTDA strives to organize thought-provoking Next Generation education programmes every year in March at its All Committees' Days meetings, based on the actual challenges from the market in order to engage this young audience to the next level. These events organised as a one day workshops are created to advance young managers' ability to think outside the enterprise's historical business planning methods to better plan for the future. Besides the opportunity to network with peers, learn innovative management approaches and exchange ideas on how to plan best and prepare for the ongoing disruptive markets and conditions that will shape the next 30 years of their career and business cycles globally.

NEXGEN managers are invited to strengthen their knowledge about key concepts that will enhance their skills and business practices, and thus reaffirming their values and commitment to their company.

Involving the Next Generation in the association's committee work is another way to facilitate the exchange between the generations of managers of top companies in the industry while bringing their own contribution to creating value and challenging the way decisions are made.

Last but certainly not least, young managers know the importance of real time communication so EPTDA is eager to make their voices heard. Already active on EPTDA's social media channels, this experience will be leveraged in the next future to an industry online platform where EPTDA members can use the power of the community to find together innovative solutions to keep decisions upstream and make each challenge a growth opportunity.

> At these Spring meetings, EPTDA's NexGen participants can mingle with the association's leaders and volunteers and get to know about the latest developments in the industry. Again this year in Rome, we expect more than 50 NexGen representatives to be present and take part in the NexGen Seminar and Workshop, which are now an integral part of the association's Convention programme.
>
> **Hans Hanegreefs** | Executive Vice President of EPTDA

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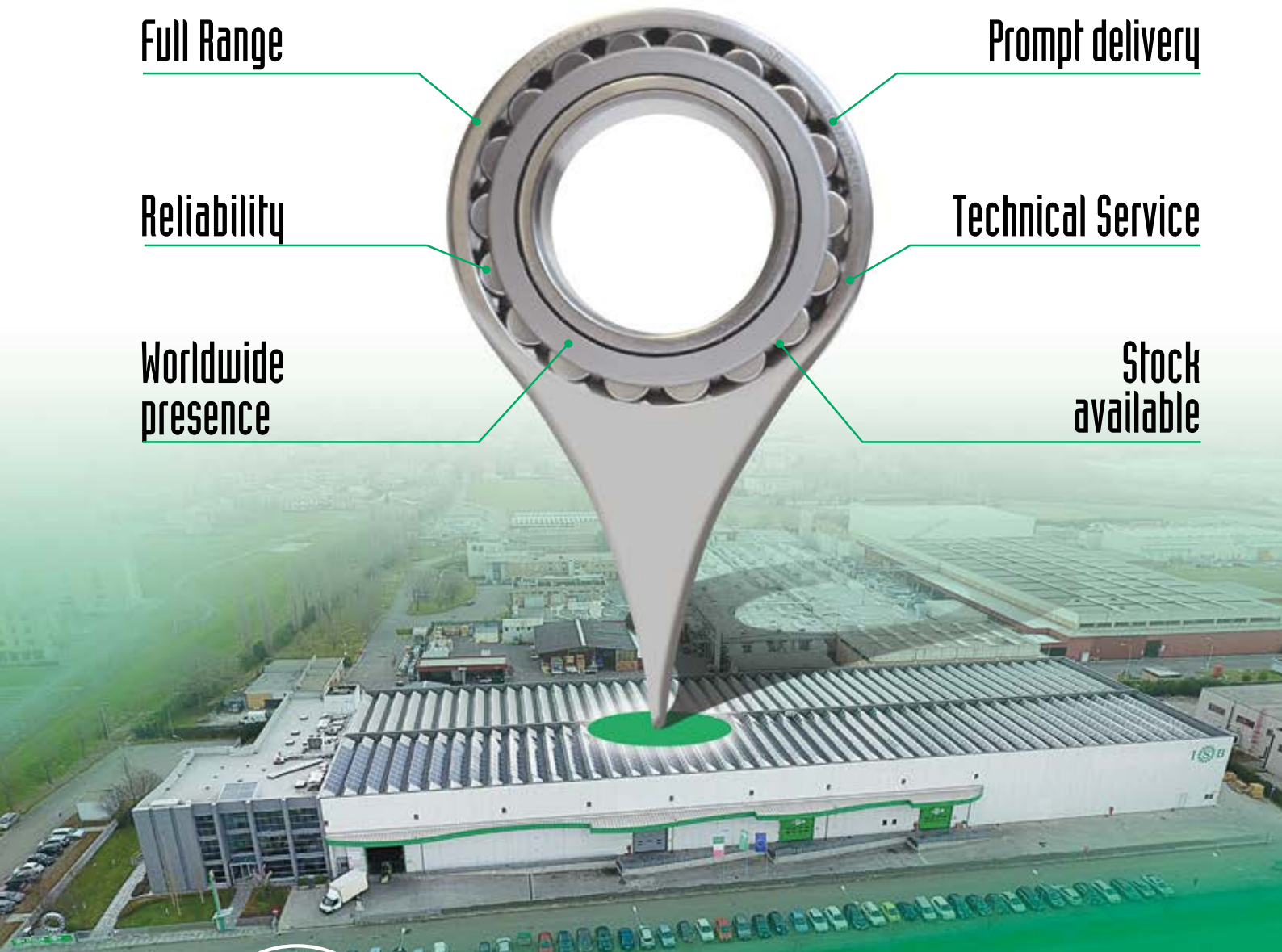

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