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Bearing NEWS

BEARING INDUSTRY MAGAZINE

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Bearings
Going into Space

POWER TRANSMISSION COMPANIES RESPONDING TO

COVID-19

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What's Rolling...

Reliability-as-a-Service for Proactive Assessment of Bearing Risk

By digitally assessing the health of both the rotating parts and their lubricants, SeerWorks™ Reliability enables risks to be identified during smooth operation, before damage occurs.

An Innovative Way to Increase Reliability and Boost Sustainability

As an essential element of bearing service life, lubricant chemistry has a profound effect on the reliability of rotating equipment. To increase the reliability of these crucial components, an Industrial Analytics solution has been developed for proactive condition monitoring.

Poor Rotating Equipment Performance

About 23 percent of total global energy consumption is attributable to poor lubricating performance in rotating equipment. In the USA alone, an estimated 240 billion USD is lost annually because of operational breakdowns, maintenance and loss of productivity due to the tribological inefficiencies of machine elements. It follows that condition monitoring initiatives to increase the reliability of rotating equipment and at the same time reduce unnecessary oil changes contributes to a more sustainable future.

Risk Assessment via Industrial Analytics

Industrial Analytics is the process of collecting, analyzing, and using data generated from industrial operations with the aim of both increasing cost savings and enhancing the reliability of

rotating equipment. 4LinesFusion, Inc. has developed an Industrial Analytics Software-as-a-Service (SaaS) solution called SeerWorks™ Reliability, which increases bearing reliability by accurately and proactively predicting failure before it happens and taking appropriate action (Reliability-as-a-Service). By digitally assessing the health of both the machine elements and their lubricants, SeerWorks™ Reliability makes it possible to identify risks during smooth operation – before damage occurs – by looking into the future, and deliver precision machine reliability. The technology has been successfully applied in the wind, marine and automotive industries. It reduces downtime and costs, extends service life, improves oil quality control, and promotes evidence-based maintenance for OEMs and aftermarkets.

Assessment of the lubricant's composition, materials and lubricated contacts of rotating equipment are crucial for predicting operational reliability.

Decoding the Lubricant Chemistry

Tribological processes are characterized by sequences of cascading events, and lubricant chemistry is widely regarded as being the missing link when it comes to predicting wear and failure. At the heart of SeerWorks™ Reliability, 4LinesFusion has developed proprietary algorithms (SeerWorks™) whose function is to identify stress points in cascading events in general, and these algorithms have been applied to the field of tribology. As part of the SaaS solution, SeerWorks™ Reliability also supplies digitalized knowledge of lubricant chemistry and its effects on lubricated contacts. "We assess machine reliability by following the same principles as in precision medicine," says Jeff Guerin, CEO and President of 4LinesFusion.

"We analyze the chemical compounds in the lubricant and the interface and provide proactive prescriptions before any damage occurs to guarantee machine reliability. We assess the lubricated contact such as a bearing surface, material and lubricant composition to deliver precision machine reliability and basically use the lubricant as our sensor. Figuratively speaking, SeerWorks™ Reliability lets the lubricant 'do the talking' to gain insight into the apparent situation in the rotating equipment, and this is of greatest benefit during smooth operation." Whether it is computer models of molecular interactions that isolate the perfect lubricant for a specific mechanical system, or real-time monitoring of any rotating equipment: "The future belongs to those who can strategically transform data into action," says Guerin.

> "The future belongs to those who can strategically transform data into action"
>
> Jeff Guerin, President and CEO, 4LinesFusion, Inc.

Recommendations for Reducing Potential Risks

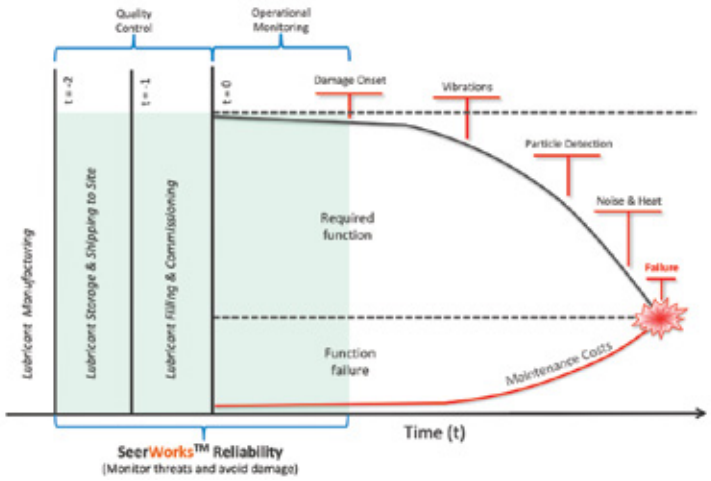
The lubricant and its interactions govern the tribological performance of rotating equipment. SeerWorks™ Reliability delivers an accessible, Industry 4.0-ready, proactive virtual engine. It gathers data, quantifies variables, and runs complex-system and trans-scale molecular models that provide actionable recommendations for significantly reducing the risk of some catastrophic failures.

SeerWorks™ Reliability receives an array of data as input variables such as material surfaces, physical lubricant properties, element counts, trending etc., and performs molecular modelling coupled with proprietary algorithms to identify potential failure risks. After digitally decoding the lubricated machine element interface, the output from these calculations are combined with straightforward recommendations and protocols to reduce the potential risks to the user's applications.

With SeerWorks™ Reliability, 4LinesFusion combines engineering knowledge, tribology, lubricant chemistry, and the proprietary algorithms for cascading events to proactively address and advance current industry-standard assessments. With the click of a button, users receive an easy to understand, fully automated digital status update on their rotating equipment in a holistic review down to the quantum level.

Bearing Failure: Expensive Maintenance and Lost Revenue

The technology is saving companies a



Application of SeerWorks™ Reliability during quality control and operational monitoring as well as some fault signs in relation to maintenance costs of rotating equipment until failure.

lot of headaches – and a lot of dollars. "One of our major markets is the wind industry. If a bearing on a wind turbine were to fail offshore, a replacement can cost millions of dollars," says Guerin. "We're also working with the marine industry. Large ships often use systems that are driven by roller bearings and have multiple propellers. We can proactively assess the risk to which bearings are exposed while they're in operation – the last thing a company needs is to have their ship floating around in the ocean without any means of control because of a failed bearing."

For wind turbines, about 80 percent of gearbox rolling bearing failures are caused by white-etching cracking (WEC), resulting in expensive maintenance and lost revenue. At very irregular stages of operation, WEC leads to sudden failure of the bearing after as little as 5 to 20 percent of the estimated service life as defined in DIN 281 for classic rolling contact fatigue. Although gearboxes are designed to last for more than 20 years, they are known to fail after as little as 6 to 24 months in service due to WEC. If the WEC damage is ignored, further damage can cascade and wear down other crucial machine elements.

Reliability-as-a-Service

A major goal of SeerWorks™ Reliability is to promote proactive, evidenced-based maintenance rather than schedule-based maintenance as a strategy for optimizing maintenance intervals, oil consumption, and facilitate cost savings. Applied to identify hidden inefficiencies in lubricated rotating equipment, the technology provides prescriptive online asset monitoring not only for classifying WEC but also assessing the threat of stress-corrosion cracking, lubricant filterability, advanced oil analysis reporting, and delivering recommendations for reducing risk.

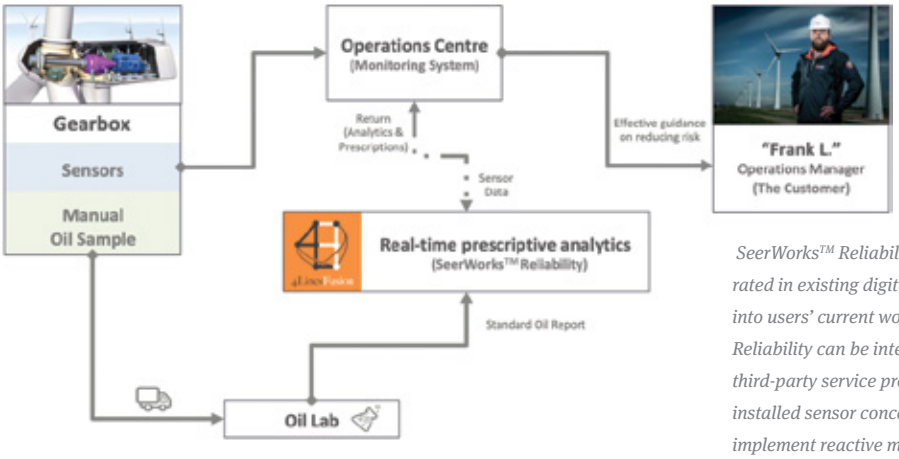
As the primary product, SeerWorks™ Reliability can easily be incorporated in existing digital platforms and integrated into users' current workflows. The services can be provided by securely interfacing SeerWorks™ Reliability directly with a third-party service provider, and/or through installed sensor concepts and other concepts that implement reactive measures. In addition to the SaaS solution SeerWorks™ Reliability, 4LinesFusion also offers its clients consulting services and other custom work relating to lubricated contacts, referred to as SeerWorks™ Digital Labs. Custom solutions are currently provided in the fields of lubricant development (oils and greases), false brinelling, root-cause analysis, and claims management.

4LinesFusion has also worked closely with the Telfer School of Management, University of Ottawa, Canada, to define the business model for SeerWorks™ Reliability and develop a go-to-market strategy. In the words of one of the consultants from the Telfer School of Management, Steven Yankowich, Senior Director and EMBA at General Dynamics Mission Systems: "Predictive analytics is fundamental to an effective condition-based maintenance program. SeerWorks™ Reliability has the potential to enable significant improvements in the operational performance of complex industrial machinery such as wind turbines and marine drive systems."

Unique Technology Reduces Environmental Footprint

"Unlike other companies that monitor conditions after damage occurs, we proactively predict irregular and sudden catastrophic type failures in bearings far before damage onset to allow for preventative measures. We do this based on lubricant chemistry alone." says Guerin. "Our risk assessment provided through SeerWorks™ Reliability is unique and highly focused and thus reduces operating and maintenance costs as well as the environmental footprint as a whole. In the coming years, the implementation of innovative, holistic technologies to manage tribological challenges could reduce CO_2-emissions globally by over 3 billion tons, lead to cost savings as high as 1.1 trillion USD, and reduce energy losses by 40 percent. 4LinesFusion is committed to playing its part by mitigating the environmental footprint and financial burden of poorly performing rotating equipment."

> "SeerWorks™ Reliability provides proactive asset monitoring on irregular, lubricant-mediated failures that deviate from DIN 281"
>
> Dr. Jan-M. Brandt, 4LinesFusion, Inc.



SeerWorks™ Reliability can be easily incorporated in existing digital platforms and integrated into users' current workflows. SeerWorks™ Reliability can be interfaced directly with a third-party service provider, and/or through installed sensor concepts and other concepts that implement reactive measures.

Recently Published Scientific Work

In recent years, 4LinesFusion has been actively involved in a publicly funded project by the German Federal Ministry for Economic Affairs and Energy (BMWi). Major parts of this work were recently published by the team and their colleagues from the University of Southampton, UK, with the title **"Reliability-as-a-Service for bearing risk assessment investigated with advanced mathematical models"** (Internet of Things, Elsevier, 2020; open access: *https://doi.org/10.1016/j.iot.2020.100178*).

As Professor Jörg Fliege, Head of Operational Research, Mathematical Sciences at the University of Southampton, states, "With the help of advanced analytical techniques and modern, state-of-the-art tools from operations research, we confirmed the classifications system of SeerWorks™ Reliability that provides proactive assessment of the lubricants that are at risk of WEC formation. Combining both of our assessment technologies allows us to gain a deeper understanding of the parameters that lead to bearing failure."

4LinesFusion also significantly contributed to additional work by applying SeerWorks™ Reliability to assess the WEC risk potential in 700 oils. This work was performed by Baher Azzam et al., Center of Wind Power Drives (CWD) at he RWTH Aachen University, Germany, using machine-learning techniques to discover patterns and conduct root-cause analyses on WECs using only historic data from previous experiments (open access: *https://www.mdpi.com/2076-3417/9/24/5502*).

About 4LinesFusion

4LinesFusion, Inc. is a Canadian Industrial Analytics company that provides algorithms for cascading processes to deliver proactive, precision machine reliability. Founded in 2016 by Jeff Guerin (President and CEO) and Sean Volkaert (CTO), 4LinesFusion takes a holistic approach to tribology to provide prescriptive monitoring for increased machine reliability. 4LinesFusion's innovative Software-as-a-Service solution SeerWorks™ Reliability ensures advanced and unique monitoring to deliver Reliability-as-a-Service to its customers. By digitally assessing the health of both machine elements and their lubricants, SeerWorks™ Reliability delivers maximum asset protection, cost savings and other valuable features.

Contact

Jan.M.Brandt@4LinesFusion.com or visit *http://4linesfusion.com* for more information.

Dr. Jan-M. Brandt, Business Development Manager (left) and Jeff Guerin, President and CEO of 4LinesFusion, Inc., Canada.

Case Study

GomSpace

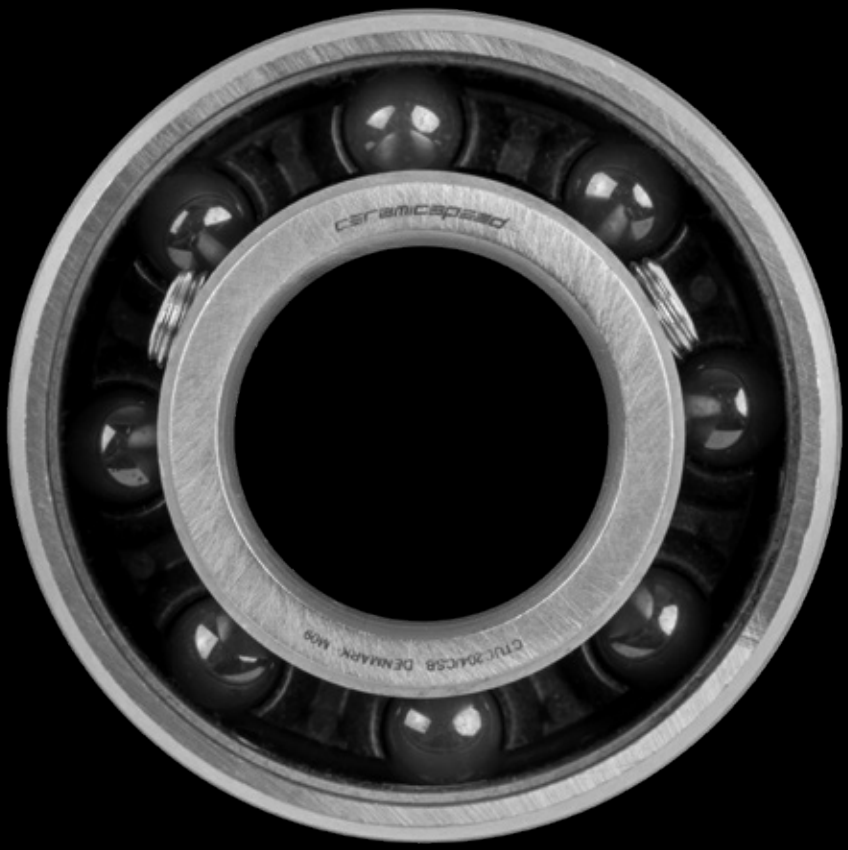
Bearings

Going into Space

For many things out there, the sky is the limit. But not for us.

With a mission to innovate and develop the world's best performing bearings for industrial use, we have recently closed a successful collaboration with the Danish Nano satellite manufacture GomSpace.

GomSpace is a company with a mission to be engaged in the global market for space systems and services. Specialized in introducing new products such as components and platforms. After a complex process and rigorous testing, CeramicSpeed is now a certified and approved producer of high-quality bearings for a new application - our handbuilt bearings are now qualified for use in aerospace technology.



For a bearing to perform and be certified for use in spacecrafts, there are a few crucial attributes it needs to feature. Due to the harsh conditions in space, a bearing needs to perform under demanding factors such as fluctuating temperatures, absolute vacuum and the violent G-forces during a rocket launch. For this purpose, GomSpace has tested and approved the CeramicSpeed Bearings to withstand these challenges, without compromising the bearings' life.

CeramicSpeed Bearings are matched with ceramic Si_3N_4 balls which have an extremely low thermal expansion coefficient. This makes them exceptionally well suited in environments where temperatures are expected to fluctuate between highs and lows, like they do in space.

Through the course of three years, we have tested a series of material combinations and designs that have now converged into a customized ceramic hybrid bearing solution, specially designed to answer the challenges of aerospace technology. During the three years of development, our bearings have passed several difficult tests according to the ESA (European Space Agency) requirements. To this day, the CeramicSpeed Bearings are still running above the expected bearing life, concluding a successful project and collaboration.

More information about the project can be found at *www.ceramicspeed.com*

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Software for Gearbox Development

The Influence of Bearing Selection on Gear Modifications

The FVA-Workbench is a manufacturer-neutral tool for the simulation and calculation of transmission systems. As product development cycles become shorter, powerful modeling approaches and calculation algorithms become increasingly important. The predominantly analytical approaches in the FVA-Workbench deliver fast and reliable solutions to all important issues related to drive technology. For bodies that cannot be accurately described analytically, the results are supplemented by suitable numerical methods. The intuitive modeling techniques in the FVAWorkbench guarantee simulation of consistent, valid, and manufacturable gears every time.

The calculations are developed, analyzed, and validated in research projects by Forschungsvereinigung Antriebstechnik e.V. (FVA, the Research Association for Drive Technology). Through member contributions and public funding, the FVA is able to organize 17 million euros annually in research projects at leading German universities, chairs, and research institutions. The FVA-Workbench serves as a knowledge platform, making the results of FVA research projects available and applicable for all engineers. It is no longer necessary to read through and study countless pages of scientific documentation, making the development of innovative gearboxes considerably more efficient and user friendly.

An important aspect of gearbox development is the practical design of gear modifications. The following article will demonstrate the degree to which the selection of rolling bearings can influence the required gear modifications, using system analysis from the FVA-Workbench.

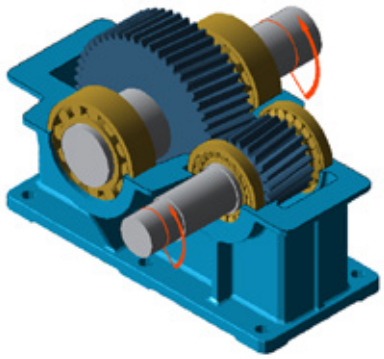
Design of Gear Modifications

Load-induced deformations and displacements in gearboxes can lead to significant gear mesh misalignment. This can cause uneven load distribution across the face width and greatly reduce gearbox safety factors. To avoid this scenario, gear modifications must be designed to compensate for these deformations. This requires detailed analysis of all gear deformations. The single-stage gearbox in Figure 1 will provide an example of how strongly the selection of the bearing type, together with the axial bearing design and bearing clearance, can influence gear modifications.

Calculation Example

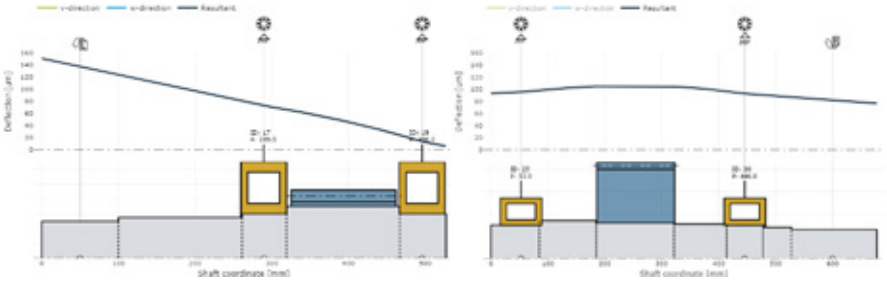
The drive shaft of the gearbox is supported by two type 30324 tapered roller bearings in an X arrangement. The wheel shaft includes two type NJ 2230 cylindrical roller bearings in a floating arrangement. Figure 2 shows the bending lines of the two shafts.

It can be seen that the deflection of both cylindrical roller bearings of the output shaft is nearly identical (Figure 2, right). In contrast, there is significant

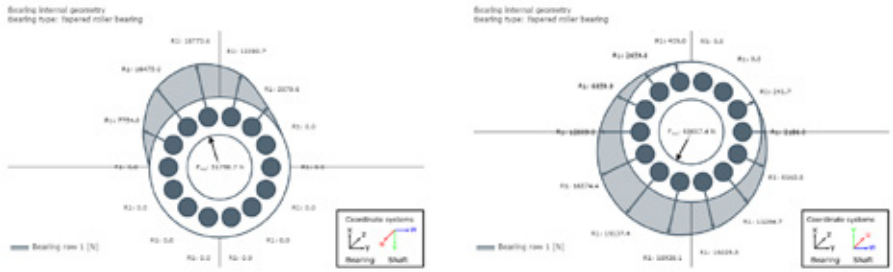


— Figure 1: Representation of a single-stage helical gear unit in the FVA-Workbench

misalignment on the drive shaft. This is largely due to the so-called centering effect on the right tapered roller bearing. In the left bearing, only the rolling elements in the direction of the radial force are loaded (Figure 3, left), causing the bearing to deflect in this direction. In the right bearing, the restoring force on the shaft resulting from the radial force and the contact angle is lower than the applied axial force from the gearing. As a result, the shaft is pushed into the bearing so that the rolling bodies are in contact across the entire circumference (Figure 3, right). Thus, the shaft deflects only slightly in the direction of the radial force.

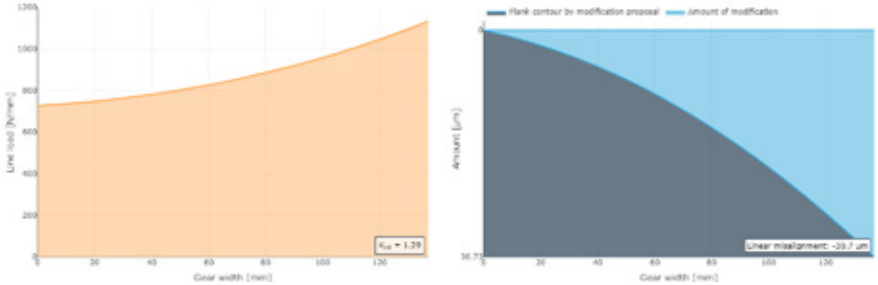


— Figure 2: Representation of the bending lines of the drive shaft (two 30324 tapered roller bearings) and output shaft (two NJ 2230 cylindrical roller bearings) in the FVA-Workbench



— Figure 3: Representation of the left bearing (with a load range < 180°) and right bearing (with a load range across the entire circumference) in the FVA-Workbench

Figure 4 shows the load distribution across the face width, resulting mainly from the misalignment of the drive shaft, and the proposed modification for balanced load distribution determined using the FVA-Workbench.

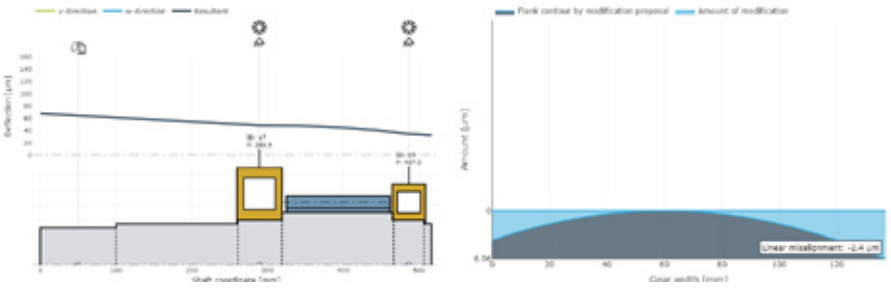


— Figure 4: Representation of the load distribution across the face width and the proposed modification in the FVA-Workbench, based on the shaft deflections from Figure 2.

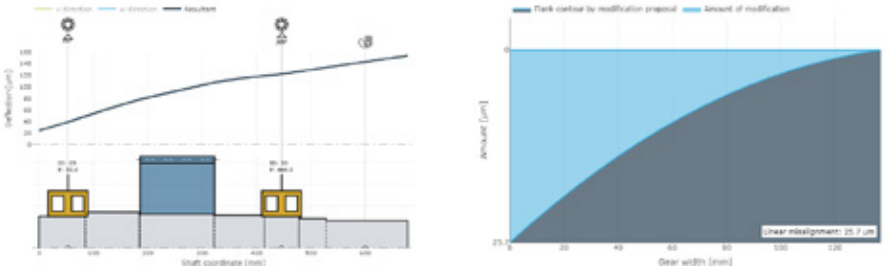
To counteract the centering effect described above, the right bearing can be replaced by a bearing with a larger contact angle, such as type 30224. This larger contact angle results in greater restoring force, which pushes the shaft away from the bearing center. Thus, the shaft lowers further, decreasing the misalignment and significantly reducing the amount of modification required (Figure 5).

A comparable effect can be observed by selecting different bearings for the output shaft, such as replacing both cylindrical roller bearings with type 22230 spherical roller bearings (Figure 6), with a fixed bearing on the left and a floating bearing on the right.

Here too, the shaft is centered on the left cylindrical roller bearing which, as a fixed bearing, absorbs the axial force. The preceding example clearly demonstrates the great influence of the bearing selection on the design of gear modifications. The centering of rolling bearings described above can occur with all bearing types that do not have a cylindrical running surface. The effect is increased with larger bearing clearances. The direction and position of forces can either increase or compensate for the resulting misalignment of the gearbox shafts in the gear mesh. Due to the large number of overlapping influences, consideration of all forces and deformations occurring in the transmission system, as offered by the FVA-Workbench, is required for the appropriate design of gear modifications. The FVA-Workbench can be used to determine the stiffness of a bearing arrangement as well as the associated lifetime and power loss.



— Figure 5: Representation of the bending line of the drive shaft (with 30324 tapered roller bearing on the left and 30224 tapered roller bearing on the right) and the proposed modification in the FVA-Workbench



— Figure 6: Representation of the bending line of the output shaft (with two 22230 cylindrical roller bearings) and the proposed modification in the FVA-Workbench

About FVA GmbH:

FVA GmbH is a joint venture between VDMA (Verband Deutscher Maschinen- und Anlagenbau e.V., the Mechanical Engineering Industry Association) and FVA (Forschungsvereinigung Antriebstechnik e.V., the Research Association for Drive Technology). Founded in 2010, FVA GmbH works hand-in-hand with top-level German research institutions and leading companies from the drive technology industry toward the active application of knowledge gained from FVA research projects in industrial practice. The company's core competencies are the development of calculation and simulation software for drive technology, preparation and transformation of established legacy code structures into modern software architectures, professional service and support, and technical seminars and conferences.

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With the launch of the new digital product configurator, KUKKO is entering into a new age of product recommendation. With just a few clicks, the user is empowered by specific questions to provide the relevant information and measurements for solving the problem.Independent of time and place, it is always possible to find the right tool for the respective situation.

A defective ball bearing must be replaced, but which tool is required? You want to change the pulley on a crankshaft, but how do you get it solved? The bearing race of a wheel hub needs to be replaced, but it is not so easy to remove.

The solution configurator finds the right answer for all these applications. This process is uncomplicated, user-friendly and leads directly to the result you want.

1. The first step is to determine the part that's to be removed and replaced. A pre-selection of different components to freely choose from is available to the user.

2. Then the specific data such as the inner or outer diameter, size of the clamping depth as well as the space next to the part to be removed must be entered. Each individual input from the user affects the product search. This always guarantees that the extraction tool required for non-destructive dismantling is also found.

3. After entering all the necessary data, you will receive your individual product recommendation. You will either be forwarded directly to the product page or you can choose to have alternative work tools displayed.

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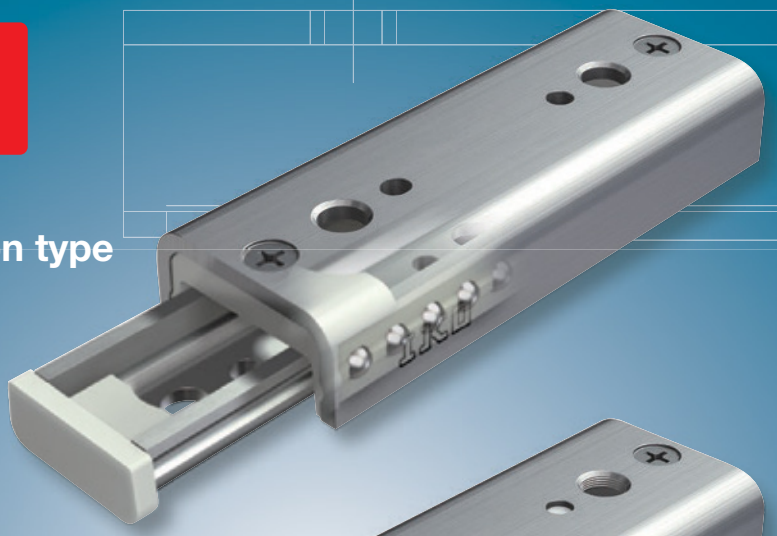
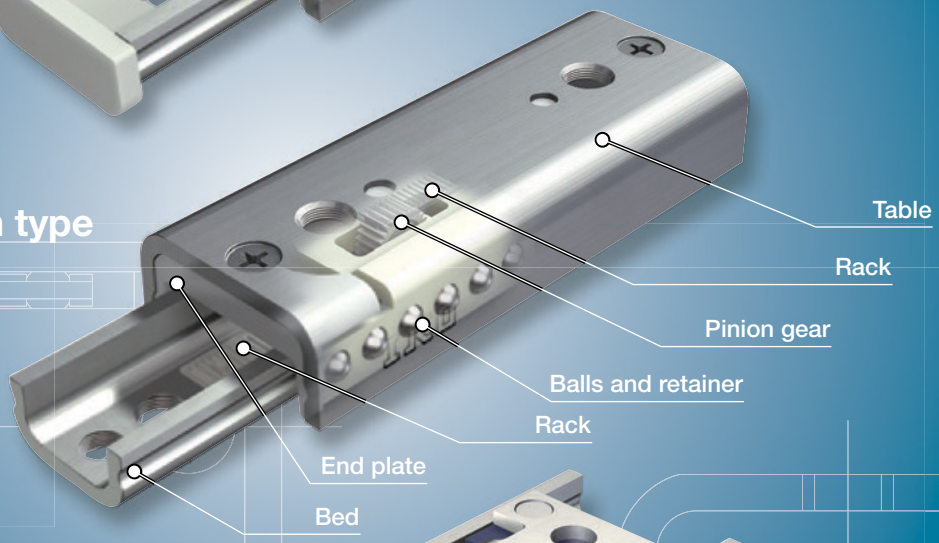
Limited linear motion type

BSP



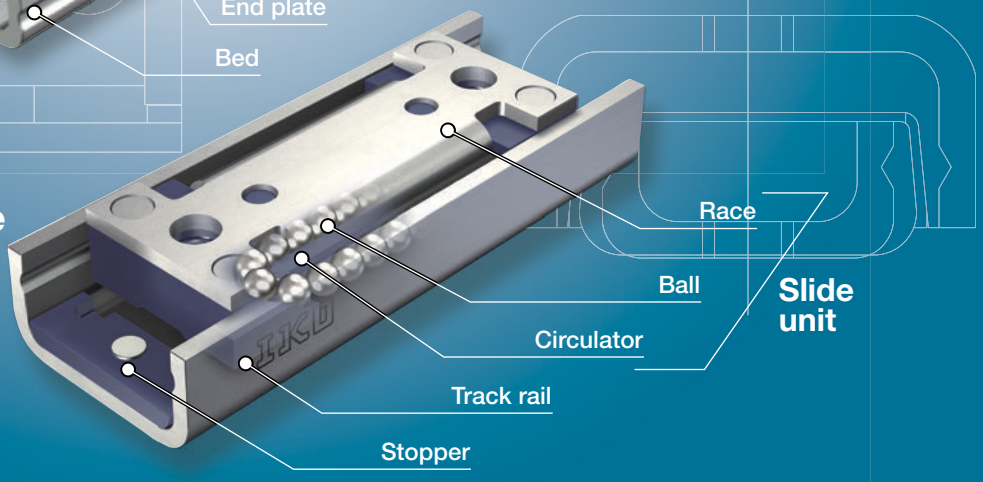
Built-in rack & pinion type

BSPG



Endless linear motion type

BSR



Precision Linear Slide Unit

IKO Precision Linear Motion Slide Units are used in bio-medical, semiconductor manufacturing equipment, industrial robots and precision equipment. This product can receive a complex load and features high performance, excellent total balance and easy handling.

In contrast to conventional rolling bearings used in rotating parts, Linear Motion Rolling Guides are the products applicable to plane sliding surfaces for linear motion in machines and equipment.

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Asset Care and Reliability
in the Mining industry using Ultrasound

Ultrasound applications are diverse and yet many people "know" about it for one or two applications. "I knew it did air leaks but I did not know that you could do all this with it" is therefore a common reaction when I refer to 8 pillars introducing the use of Ultrasound: There are many industries where all of these applications are important and Mining is an example to explore.

1. **Compressed air** is used in so many applications. Compressed air leaks become huge energy losses – in some mines there are megawatts of power used to produce compressed air. Air leaks in pneumatics and control systems however, can become show stoppers bringing production to a stop.

Using Ultrasound for listening to internal air leaks or cracks on the boom of a dragline.

2. **Steam** is of major importance in certain mining processes – consider the steam injection systems used in a SAG-D (Steam Assisted Gravity Drainage) plant for instance. Steam is injected underground to warm up and soften bitumen and heavier oils to make them easier to extract from the earth. The production of steam is thereby clearly linked to the production of oil in this application.

Airborne ultrasound is used to safely identify steam leaks from a distance which is clearly a major safety hazard in any steam process. The steam temperature may be almost 300C corresponding to a pressure of roughly 8,000kPa which means leaks can easily become serious injuries or worse still fatal accidents.

There are sites around the world where the only safe, approved, method to inspect for steam leaks is ultrasound. Contact ultrasound is used to maintain the good operating condition of the steam traps in the system by identifying those failing steam traps which are not removing air, CO_2 and condensate fromn the steam system.

3. **Valves** are used in so many applications and are virtually omni-present in the mining industry – consider how a hydraulic or a water system is going to operate properly without the proper operation of the valves involved. Process failures tracked back to incorrect valve operation can create a large amount

of unwanted downtime – one particular story in a coal mine comes to mind where an internal leak on a valve and also on t he refurbished spare in the maintenance stores resulted in 12 hours of downtime. Ultrasound is now used to provide a predictive maintenance service to identify such defects at a much earlier stage and schedule work on the valve at a convenient time.

Everyone will understand the need to test valves to ensure that they are not passing or blocked, but there are other important failure modes on valves: valves will cavitate for example which will result not only in premature failure of the valve but can also cause premature failure downstream – especially if the particular valve is on the suction side of a pump for example.

4. **Hydraulic systems** are used for motion and for power and there are many valve application involved here too. Failure of hydraulic systems is not an option and yet too few businesses consider any maintenance practice other than breakdown with the corresponding huge expense of downtime. Ultrasound can be used on shovels for example to listen to internal bypassing on boom, stick and bucket cylinders.

The inspection method for cylinders is quite simple: merely place a sensor on the cylinder and allow it to operate in its normal fashion.

5. There are many **electrical systems** involved in the mining industry from DC to HV. In many cases dust is a major contributor to failure. One of the key problems associated with the build-up of dirt, dust and moisture on the surface of components is tracking.
The ceramic insulator pictured here failed because it was covered in dust which was causing the tracking. On-condition cleaning using ultrasound to identify the presence of the tracking is used to eliminate failures by optimising cleaning procedures.

The mining community in South Africa are also leading the way in the adoption of ultrasound as a safety screening tool to protect electricians working in substations. A small ultrasound kit is located at the entrance to the substation and there is a series of assessment measurements to be performed in order to provide approved safe access to the building and proximity to the panels inside. This approach is undoubtedly saving lives by providing a higher level of safety in the work environment than can be provided by flameproof or arc-flash clothing alone.

6. **Tightness** testing of the air intake systems of the large diesel engines in haul trucks using ultrasound has saved one mining Company alone over €14M in three years for an investment of less than €28,000. Additional operational savings have been seen by minimising the time spent ensuring that the drivers' cab environments are dust-free.

7. Mining machinery is diverse– sometimes simple like a conveyor, other times more complex as in the case of a reclaimer. The **condition monitoring** requirements in the mining world are, therefore, quite diverse and frequently not simple.

Airborne ultrasound, sometimes using a parabolic dish pointing out of the window of a pickup is a very quick and reliable means of inspecting the condition of a conveyor – especially if it is 12km long.

There is more than the usual amount of slow-speed equipment in mining which is often in critical operational roles Ultrasound is perfectly capable of listening to bearings rotating at even less than 1rpm and still providing valuable diagnostic information.

Finally, there is the need to consider the condition of machinery which is itself moving – like shovels, or moving violently – like vibrating screens.

This critical bearing rotating at 24rpm was found to have failed during an ultrasound inspection. The bearing had recently been replaced, so it was relatively new. Unfortunately, the replacement bearing was not quite the correct one and was undersized for the load requirement. Very quickly, the new bearing disintegrated.

8. Over-**lubrication** is quite an established tradition in the mining world – "grease that bearing until I can see the grease coming out of the sides".

So there you have it. One technology, Ultrasound, used in either airborne or contact mode to identify problems in 8 major problem areas in mining. Conservatively, in the last decade the savings that customers have achieved must be well beyond €23.5M. Time for you to start?

Author: *Thomas J Murphy C.Eng. - SDT Ultrasound Solutions. visit www.sdtultrasound.com for more information.*

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— Plant 2 was initially used only for the automotive sector, but today the assembly of scanners and the storage of turntable bearings are also carried out here

Key stages of realignment
In-house manufacturing as a growth driver

From a trading company to an own manufacturing: Rodriguez GmbH has experienced a significant change over the last 35 years. The factory in Eschweiler (Germany) boats a comprehensive machine shop for linear technology and precision bearings. Currently the share of in-house production is about 45 %. Due to the in-house production and the short decision-making processes between sales, design and development, Rodriguez is able to respond with much greater flexibility than their competitors. This is mainly because of the fact that all process steps can be done in-house – from the design via manufacturing and assembling up to quality assurance.

— Innovative devices and advanced tools ensure that the production facilities are always state-of-the-art.

Since the company was founded in 1984, Rodriguez has operated as a trading company selling and buying American and European bearings - including Kaydon thin section bearings, stainless steel polymer housing units, RTB bearings, turntable bearings and many other products.

In the early 1990s Rodriguez began offering linear technology products as part of its product portfolio. The decision to commence in-house production was

— *The measuring room allows Rodriguez to test the required tolerances of precision bearings and linear technology at µ.*

taken at about the same time and was necessary in order to be more flexible and act more efficiently when it came to customer-specific solutions. At first, the company concentrated on the assembly of hardened and ground shafts. However, soon linear housings, shaft support blocks, shaft support rails and linear roundrails were also manufactured in-house. Today Rodriguez uses modern CNC turning machines that enable machining of shafts with an outer diameter of up to 100 mm. The machine park, including all tools and measuring instruments as well as employee expertise, is concentrated on hard turning.

— *Rodriguez uses modern CNC turning machines for the production of precision bearings*

About 10 years ago, the company installed its own machining centres and also expanded its machine park so that the production and manufacturing of bearings could start. Nowadays it is possible to manufacture turntable bearings with outer diameters up to 1,400 mm or to meet the increasing demand for rotary units with a smaller diameter. Innovative equipment and advanced tools ensure that the production facilities are always state-of-the-art. For example, a clean room system of clean room class 4 according to ISO 14644-1, which is necessary for the assembling and production of semiconductor components.

The in-house production for precision bearings and linear technology is also used for the construction and manufacturing of complete customized solutions, which Rodriguez has specialised in over the years: Rodriguez develops and manufactures such Value Added Products (VAP) on the basis of entire technology- and system know-how as well as many years of experience. The solutions are based on the thin section bearings and linear technology products, together with a comprehensive all-round service.

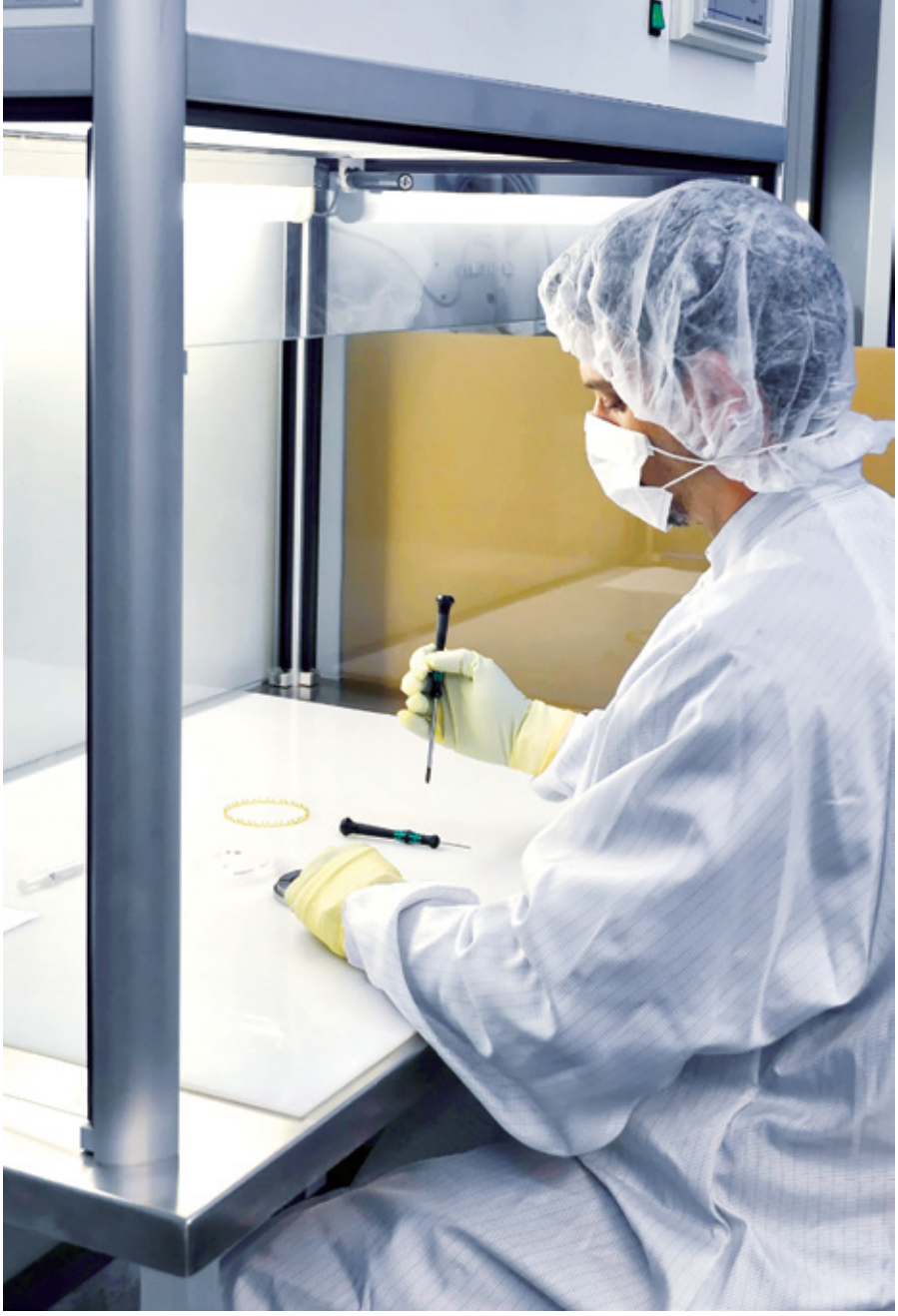
Rodriguez also takes on end machining of linear technical products as part of the customer-specific adaptation of standard parts: this means that shafts, ball screws and trapezoidal screws can be modified in accordance with customer requests. The highest quality is guaranteed because Rodriguez owns 5-axis CNC machines especially designed for hard machining.

Structural changes over the years

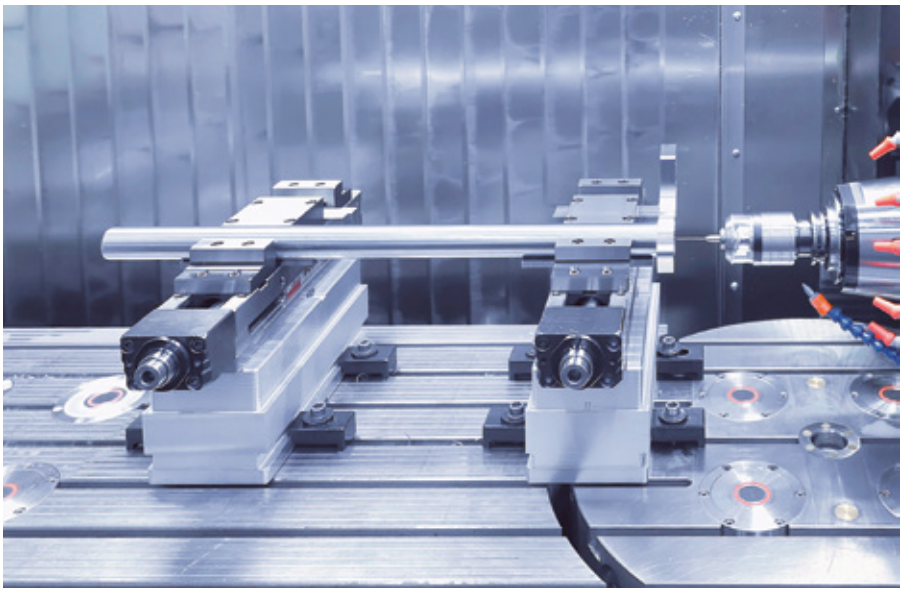
Due to the development of the in-house production there need to be some structural changes over the years. So Rodriguez rented a second plant across the road in 2008, which initially housed only the automotive products. First of all this area of approx. 1,200 sqm was used for offices and warehouse as well as the quality assurance and assembly of the automotive components. But as time passed, the space in the warehouse in plant 1 became too small. This is why the scanner assembly for precision bearings

and Value Added Products moved to plant 2 with a special area for long-term testing. Additional storage space was also created.

The spatial distribution in plant 1 is currently the following: Hall 1 accommodates the small-parts shelf store and the incoming and outgoing goods area, as well as the new measuring room of approx. 65 sqm, which was created in 2017. The assembly of linear technology components takes place in Hall 2.1, where you can also find a separate room for the assembly of precision bearings included the clean room station. The CNC production of precision and turntable bearings takes place in Hall 2.2. Hall 3 is entirely dedicated to linear production. CNC turning and milling machines, polishing machines as well as cut-off machines for raw and shaft material can be found here. Hall 4 was originally a logistics hall, but it is increasingly being turned into a production hall since the middle of 2018. By the end of 2019 a new machine for linear technology arrived at Rodriguez. This Biglia B446T2Y2 with a loading and unloading system, can also work without an operator and thereby advanced the automation process at Rodriguez.



— The Rodriguez clean room is an important requirement for assembling and manufacturing components in the semiconductor technology



— Rodriguez owns 5-axis CNC machines that are especially designed for hard machining.

Measuring room: More precision for proofed quality

The measuring room in Hall 1 is an example of the continuous improvement of equipment for the benefit of the customer. To check the required tolerances of precision bearings and linear technology in the µ-range, Rodriguez relocated the storage racks from Hall 1 to Plant 2 in 2017 and created a separate measuring room. Therefore Rodriguez has invested in a new 3D measuring machine that can analyse bearings with large outer diameters of up to 1.500 mm. Furthermore a tactile system for the measurement of contour and roughness of ball races is in use. Last but not least, a test stand and mobile devices for hardness testing are also in use, as well as a high-resolution length measuring bench and a

roundness testing devices for µ precision.

These devices allow the Eschweiler specialist to check the dimensional accuracy of machined shafts and ball screws, for example, and of milled parts such as bearing housings and shaft supports. Besides complex parts, also individual components, can be inspected: Among other things, this is important for the value added products/customized solutions that Rodriguez designs and manufactures for their customers.

— Rodriguez also takes on end machining of linear technical products as part of the customer-specific adaptation of standard parts

— Rodriguez is able to manufacture turntable bearings with outside diameters of up to 1,400 mm

— The Value Added Products (VAP) are customized solutions based on the thin section bearings and linear technology products.

New machines for the production of linear technology and precision bearings

Throughout the years Rodriguez has invested in a variety of state-of-the-art technology. The 3-axis machining centre of the Hedelius C80 Magnum type, which has been added to the Rodriguez in-house production of linear technology since 2018, is a prime example of this. Rodriguez uses the machine for the production of hardened shafts, including radial bores and milling surfaces. The machining centre features a semi-automatic in shuttle operation, i.e. it can operate on both sides. A new Citizen Miyano ABX-64SYY2 turning machine has been added to the machine park since June 2019. This not only increases production capacity for existing products, but also further expands the product range. This machine enables Rodriguez to manufacture very small rotary high-precision bearings with high accuracy.

The vision of Rodriguez is to further expand the in-house manufacturing and thus respond even better and more flexibly to customer requests. To achieve this the company wants to optimize production processes and material flow.

Author

Nicole Dahlen, Managing Director Sales, Marketing and Organisation, Rodriguez GmbH, visit *www.rodriguez.de* for more information.

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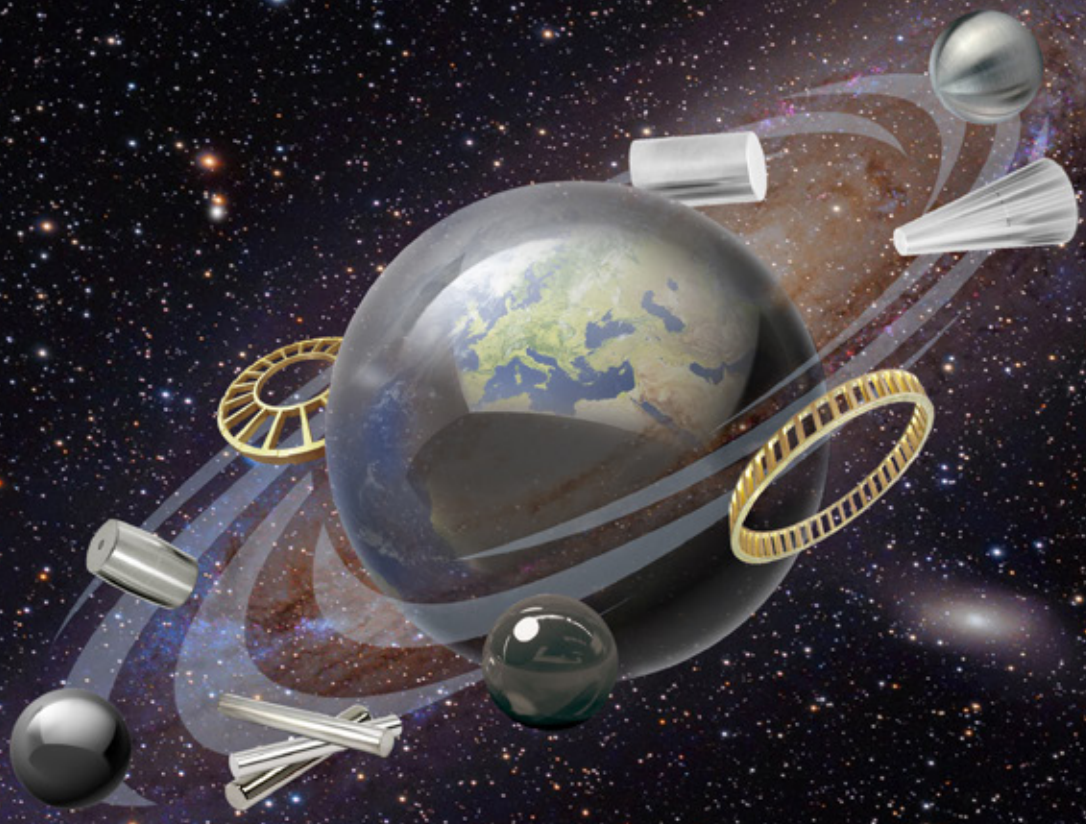

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Ovako first in the world to heat steel using hydrogen

Together with Linde Gas AB, Ovako has conducted a full-scale trial using hydrogen to heat steel before rolling. The trial was performed with good results in one of the company's pit furnaces at the Hofors rolling mill in Sweden. This historic development for the steel industry proves that carbon dioxide emissions from rolling can be eliminated provided the right financial support and infrastructure are in place.

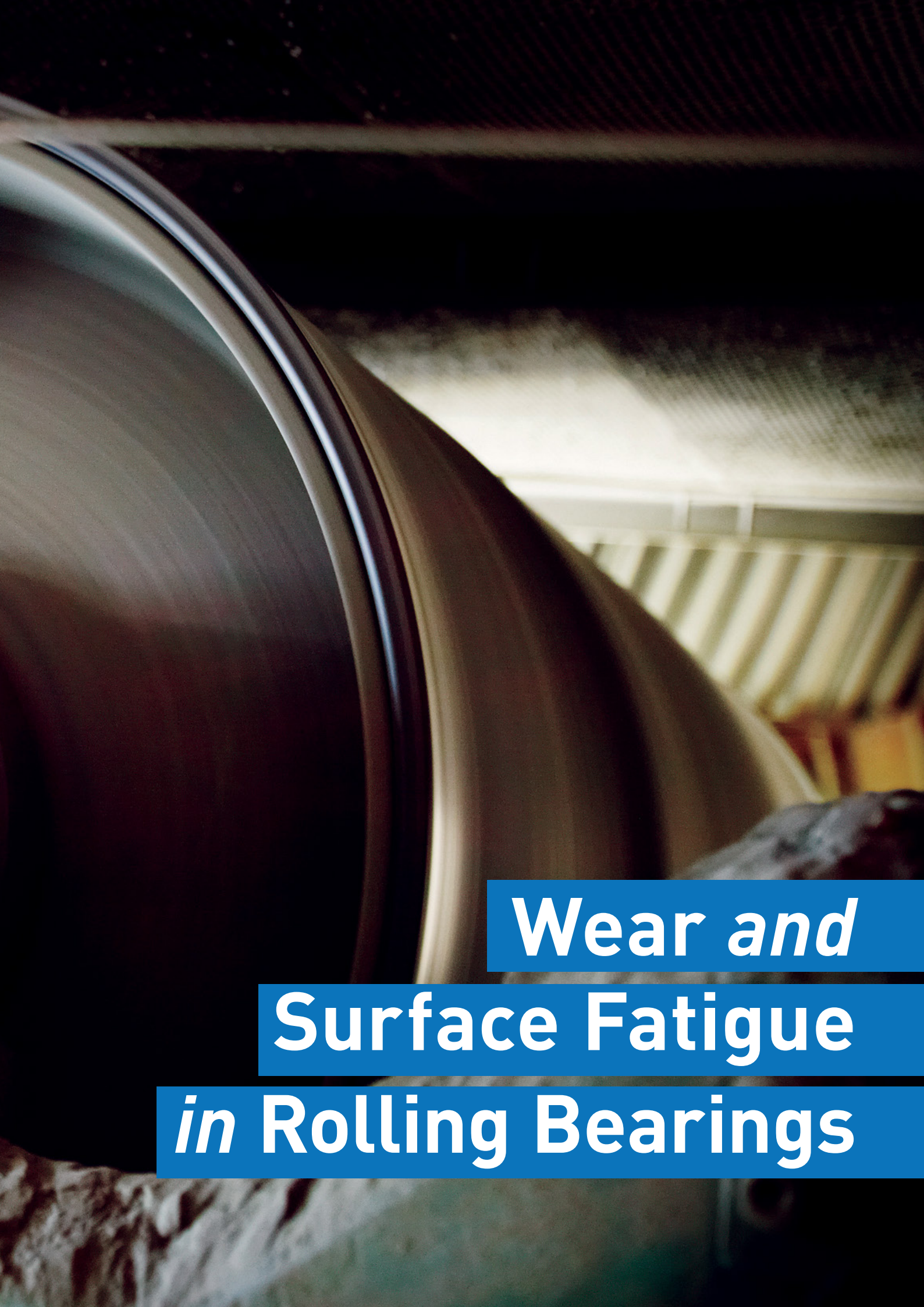
As part of its sustainability efforts, Ovako has worked for a long time to modernize and improve the efficiency of its furnaces. Thanks to this prioritization and the investments made in recent years, including upgraded control and automation systems, Ovako is now ready to take the next step. The use of hydrogen in combustion would have a great positive effect on the environment since the only emission generated is water vapor.

In collaboration with its partner Linde Gas AB, Ovako conducted a trial in which steel was heated using hydrogen instead of LPG (liquefied petroleum gas) before rolling at the mill in Hofors. The trial was successful and testing of the steel produced showed that heating with hydrogen does not affect the quality. Given the right conditions, Ovako could therefore introduce hydrogen heating for furnaces at all its rolling mills and thereby drastically reduce its already world-leading low carbon footprint from cradle to gate.

"This is a major development for the steel industry. It is the first time that hydrogen has been used to heat steel in an existing production environment. Thanks to the trial, we know that hydrogen can be used simply and flexibly, with no impact on steel quality, which would mean a very large reduction in the carbon footprint. We have worked closely with Linde for many years and are proud to be doing this together," says Göran Nyström, EVP Group Marketing & Technology.

Ovako has been conducting sustainability work for many years and already has an 80 percent lower carbon footprint compared to the global average, but is constantly working to get even better.

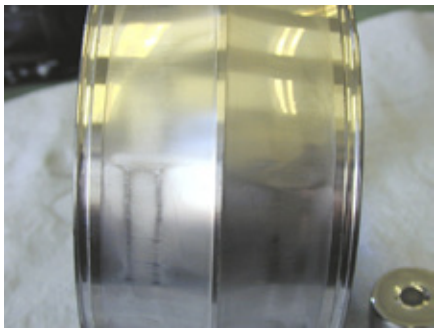
"We have been working on furnace modernization for a long time, to make our furnaces as productive and energy efficient as possible. It is very exciting that we now have proof that it is possible to use hydrogen in heating without affecting the quality of the steel. If we can make this investment, it would have a great positive impact on the environment. Our estimate is that an initial investment would save 20,000 tonnes of carbon dioxide each year, and that is just the beginning. We performed this trial in such a way that it can be reproduced at full scale in Hofors and at our other rolling mills," says Anders Lugnet, Group Technical Specialist, Energy & Furnace Technology at Ovako.



Wear *and* Surface Fatigue *in* Rolling Bearings

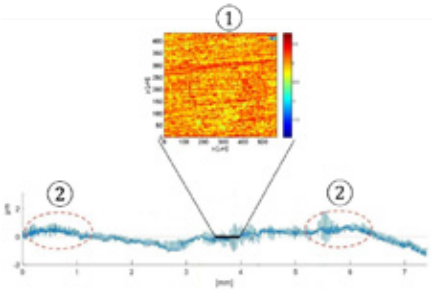
Even with careful observation, measurement and monitoring, wear in rolling bearings is hard to predict. SKF has dedicated considerable research and analysis to the study of sliding and wear and their effect on bearing life.

In some applications, rolling bearings can suffer a substantial loss of material (wear) due to lack of lubrication, the presence of abrasive particles, corrosion, oscillating rotation and other causes. Such wear can in turn have a detrimental effect on bearing operation, from the reduction of preload to potentially catastrophic effects. One common and perhaps unexpected consequence of uneven wear in the bearing raceways is the increasing possibility of surface fatigue. In some applications, it is not uncommon to see bands of surface distress or surface spalling along the raceways. This is associated with the possibility of raceway profile modification from uneven wear, which can give rise to stress concentration in the lines of high pressure and lower film thickness.

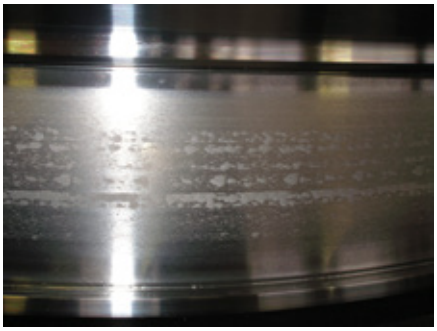


— Fig. 1: Example of abrasive wear in an inner ring of a spherical roller bearing caused by poor lubrication conditions and the presence of abrasive particles.

Rolling bearings operating under poor lubrication conditions in situations of uneven sliding or with the presence of abrasive particles or contamination from liquids can suffer substantial modifications in the raceway profiles (fig. 1). In time, these modifications can develop stress concentrations in the most loaded areas (fig. 2), which potentially can lead to an increase of localized surface fatigue, producing bands of micro-spalling or spalling along the raceways in the areas of higher stress (fig. 3). This potential damage mode can affect any rolling bearing, but applications with the presence of heavy contamination, corrosion, poor lubrication and uneven sliding or variable loading will be the most affected. Typically, examples are found in the mining industry, pulp and paper, wind applications and other areas.



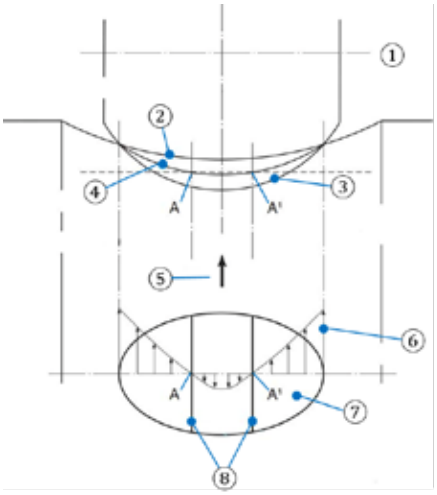
— Fig. 2: Example of a rolling bearing raceway profile and 3D roughness modified after uneven wear.



— Fig. 3: Example of surface distress: spall bands along the raceway, caused by uneven wear in a cylindrical roller bearing inner ring.

Wear in rolling bearings is a non-linear phenomenon, and even observations and measurement of rolling bearing wear in regular intervals show that simple intuition is not sufficient to predict how wear will evolve in time. This is due to a variety of reasons; wear depends mainly on local sliding and local load, and wear itself modifies these two factors, so simple extrapo-lation is not possible. A more rigorous analysis then is necessary, which is why SKF has dedicated efforts to the research of sliding and wear in rolling bearings and their effects on bearing life [1].

Any rolling bearing has some degree of sliding; this is normal. It is produced by the bearing internal geometry and/or the loading conditions. For example, a radial ball or roller bearing, perfectly radially loaded, will also have sliding (Heathcote slip) due to the rolling element/ring contact geometry and elastic deformation from load (figs. 4a and 4b). Since wear depends on sliding, in time (if the conditions are given right) it would be expected that the pure rolling bands (A and A1) will be the only zones where wear will not happen and therefore the only zones that will carry all the load in the contact.



① rolling element axis
② original raceway form
③ original rolling element form
④ contact area
⑤ direction of rotation
⑥ sliding velocity
⑦ contact area
⑧ lines of rolling motion

—Fig. 4a: Rolling element raceway contact with a curved contact surface and the influence of elastic deformation. This depicts how sliding is produced.

influence of elastic deformation
① lines of rolling motion
② sliding, surface considered moving faster
③ sliding, surface considered moving slower

— Fig 4b: Influence of elastic deformation on the inner ring of a deep groove ball bearing.

Fortunately, this only might happen in situations of heavy wear, such as the presence of abrasive particles, heavy corrosion or abnormal sliding due to inappropriate loading or mounting of the bearing. In most cases the bearings work properly, and this sliding will be the normal working environment of a rolling bearing without problems.

The current paper will go a bit deeper into the main mechanisms of the potential wear-fatigue combination damage mode. The modelling and the experiments were carried out to understand it better and to shed some light on ways of prevention.

Modelling

Modelling wear

In [2], different wear models under lubricated conditions are discussed, and it is concluded that in all cases they can be represented by an Archard model [3], sometimes with a sophisticated wear coefficient model. In most cases the wear coefficient is an empirical factor based on experiments. Thus, the most general wear equation is:

$$V = k\frac{F}{H}s$$

— Formula 1

Where:
V = wear volume [m3] in a certain time,
k= dimensionless Archard wear coefficient [-],
F = contact force [N],
H = current surface material hardness [Pa],
s = sliding distance [m] in a certain time.

The wear volume can be expressed as:

$$V = hA_s$$

— Formula 2

Where:
h = removed surface layer thickness [m] in a certain time,
As = sliding area [m2] in a certain time.

Thus, substituting (2) into (1) and considering that the contact mean pressure p = F/A:

$$hA_s = k\frac{pA}{H}s, \text{ which gives:}$$

— Formula 3 row 1

$$hA_s = k\frac{pA}{H}s, \text{ which gives:}$$

— Formula 3 row 2

Now, considering the total contact time t per load cycle, which represents the time of passage of both sliding surfaces throughout the contact zone with the sliding speed, then the sliding area is simply the contact area, thus As = A. The removed layer thickness per number of over-rollings (N) can be calculated by following [2] as:

$$\Delta h(x,y) = k(x,y)\frac{p(x,y)}{H(x,y)}u_s(x,y)\left(\frac{l}{u_1}\right)$$

— Formula 4

Where:
us = the local sliding speed [m/s]
u1 = the mean speed of the analysed surface [m/s]
l = the contact length along the sliding direction [m].

Notice that nearly all quantities are local (x,y.) Here also the hardness of the steel in the raceways and rolling elements will be assumed as constant. Equation (4) gives the local thickness of the worn layer removed at every over-rolling in a bearing contact.

Modelling the interaction wear-fatigue

To model the interaction wear/fatigue in bearings, a rolling contact fatigue (RCF) model needs to be applied at every over-rolling of the raceway with a previously modified profile (on both surfaces) due to wear; in this way both phenomena (wear and fatigue) interact. Every time that wear modifies the profile a new pressure distribution in the contact needs to be calculated for the fatigue model. This process reflects what happens in real life. However, it is very costly computationally speaking, considering that typical RCF lives can cover millions of over-rollings. Thus, there are simplifications that reduce substantially the computational cost:

1. A dry contact calculation is applied rather than a full elastohydrodynamic lubrication (EHL) solution, avoiding in this case the solution of the lubrication problem by simply considering a (measured) fixed friction coefficient.
2. Updating the profile resulting from wear every certain number of over-rollings, instead of updating it at every single over-rolling.
3. Point number (2) has also as a consequence that the update of the contact calculation and the damage (fatigue) calculation can also be done at the same time as the update of the profile by wear, instead of at every single over-rolling.

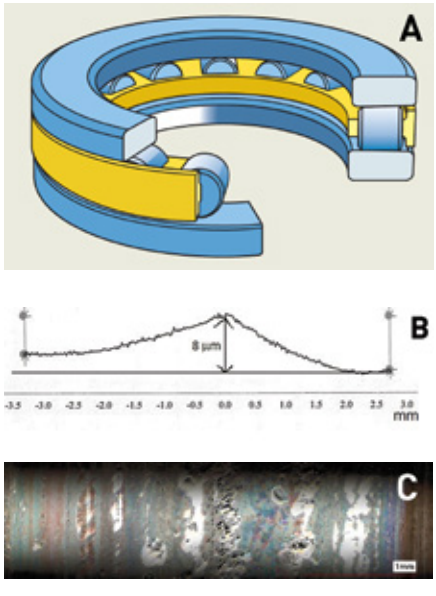
The flow chart of fig. 5 shows a summary of the calculation procedure. Notice that in this case the fatigue criterion of Dang Van [4] is used and the damage accumulation is done via the linear law of Palmgren-Miner [5,6]. But any

other fatigue criterion and damage accumulation load could have been used, if the experiments would suggest that.

Experiments

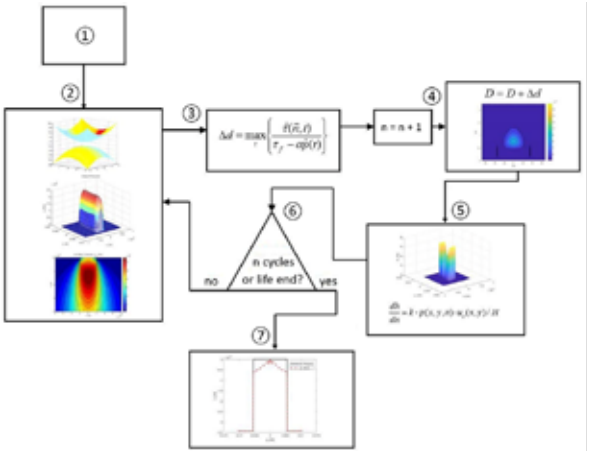
To validate the fatigue model, an endurance test was conducted using a cylindrical thrust roller bearing 81107 TN (fig. 6a), axially loaded with C/P = 6.5 and lubrication conditions given by a k approx.≈ 0.5.

Prior to testing, an artificial profiling (fig. 6b) was made in the new bearings, as if they had been running under heavy wear conditions. During testing, some bearings failed, mainly due to roller damage (fig. 6c), so that the life model could be compared with the results from the short test. Exactly the same worn rollers and new washers were considered in the model of fig. 5; the results showed very good agreement with the lower bound limit of the measured L10 life, considering the Weibull statistics.



— *Fig. 6: a) Cylindrical thrust roller bearing schematics b) Artificially modified profile of tested bearings c) Damaged rolling element of a bearing after test.*

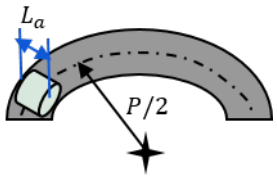
In parallel, wear tests and measurements in full bearings were also carried out to calculate the wear coefficient and then validate the model using different sets of experiments. The agreement between model and experiments was also satisfactory.



— *Fig. 5: Rolling contact fatigue model with the possibility to include wear on the raceway.*

Results

In thrust cylindrical roller bearings the sliding varies linearly (decreases) from the two edges of the roller towards the pitch line, where sliding is zero (fig. 7). Towards the outside diameter of the bearing the roller will be the fastest surface, and towards the inside diameter it will be the slowest one. To illustrate the concurrent effects of wear and fatigue in a rolling bearing with variable sliding across the raceway, another thrust roller bearing case is considered with a larger bearing (81212 TN), as described in the data of Table 1.



— *Fig. 7: Schematic representation of geometrical parameters for sliding calculation in a cylindrical thrust roller bearing. The radius P/2 represents the location of the pitch diameter where sliding is zero.*

Roller diameter	Pitch diameter	Number of rollers	Length of the roller	Bearing load
D_w	P	Z	l	F_a
m	m	-	m	N
0.011	*0.0779*	*19*	*0.011*	*68,500*

— *Table 1: Main geometry parameters of bearing 81212 TN and applied load.*

A simulation was launched enabling the model to modify the profile resulting from wear with a dimensional wear coefficient (defined as Formula 6) of with the load conditions as indicated in Table 1 and the simulation intended to reach nominally 300 million over-rollings.

Instead of updating the profiles for wear at every over-rolling, to save computational time without losing accuracy, it was found that the updates could be done every 15.5 million over-rollings on the roller. For the simulation, the same model represented as in fig. 5 is applied, including the Archard wear model of equation (4).

The results of the simulation are shown in fig. 8. The figure displays:

1. the dimensionless pressures,
2. von Mises shear stresses,
3. the damage map,
4. the original roller and washer profiles,
5. the worn roller and washer profiles, corresponding to the time step of the end of the simulations.

It must be pointed out that the damage map reached a total damage value higher than 1 (crack initiation threshold) after only 31 million over-rollings. The results displayed in fig. 8 are related to the initial and final simulation steps. The initial pressure (fig. 8a) in the first over-rolling looks more or less Hertzian, but shows some edge-stress effect since





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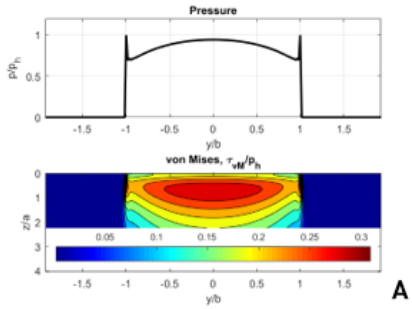
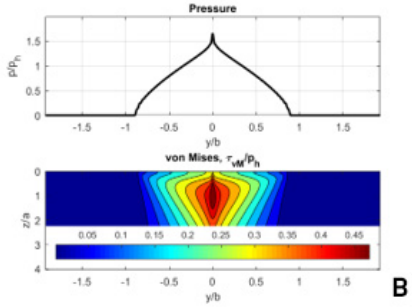
a simple straight roller profile was used, instead of a proper profiled roller that avoids those edge stresses. From the results it is evident that the sliding is zero in the pitch line; also, the Archard wear model part of the simulation indicates zero wear in that location.

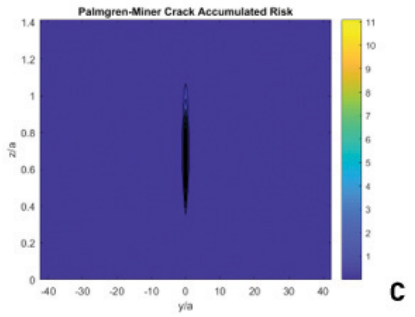
Indeed, wear is linked to the slip distribution across the raceway. Thus, wear will take place at an increased rate as one moves away from the pitch line of the raceway. Note that originally the contact pressure was nearly rectangular (fig. 8a), but as material is being removed from the two sides of the rolling contact the pressure is reduced in the areas of high sliding and is strongly augmented and concentrated in the area of zero sliding (pitch line), (fig. 8b). This increased pressure produces high stresses and fatigue at a faster rate until failure develops at the middle of the roller (fig. 8c). The simultaneous and concurrent effect of wear and fatigue can indeed accelerate the RCF spalling of the contact. This accelerated fatigue spalling is not related to frictional stress induced by sliding, but rather is the result of the modification of the original profile of the rolling bodies (figs. 8d and 8e) leading to a sharp rise in contact stress and localized lower film thickness.



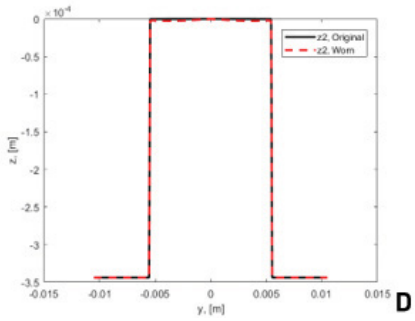
— *Fig. 8: a) Initial dimensionless pressures, von Mises shear stresses*



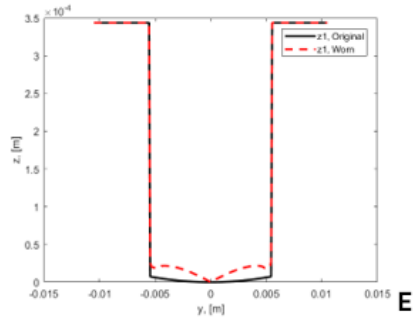
— *Fig. 8: b) Final dimensionless pressures, von Mises shear stresses*



— *Fig. 8: c) Palmgren-Miner damage map after simulation for the same example of Table 1 with a wear coefficient of =0.5x10-11 [s]*



— *Fig. 8: d) Original and worn profiles for the lower washer*



— *Fig. 8: e) Original and worn profiles for the roller end of life after 31 million over-rollings with failure on the roller.*

Conclusions

From the modelling of the concurrent effects of abrasive wear and RCF, it is found that sliding might become an import-ant element in increasing the fatigue damage of a bearing. This requires the presence of abrasive particles and/or very poor lubrication conditions in the bearing. Non-uniform slip distribution within the Hertzian contact also contributes to the development of stress risers that significantly shorten the fatigue life expectancy of the bearing. Indeed, this seems to be the most significant mechanism by which Hertzian sliding might eventually reduce the RCF life of the bearing.

To reduce this risk the following recommendations are given:

1. Make sure there is always adequate lubrication in the bearing, especially in large-size bearings with slow rotational or oscillating speed, bearings in the presence of large amounts of abrasive particles or bearings exposed to corrosion.
2. Optimize sealing solutions; eventually use sealed/shielded bearings.
3. Reduce solid and liquid contamination as much as possible.
4. Avoid shock loads and vibrations that can substantially increase the nominal sliding conditions in the bearing.
5. In the case of large-size bearings, if uneven wear is detected in time, remanufacture can be a cost-reduction aspect to be considered.

The author wants to thank Ralph Meeuwenoord for his kind support in the experimental phase of this project.

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ICT
Int. Consulting & Trading

Core Business: Bearing Components!

How bearing manufacturers can differentiate themselves in terms of quality & cost and remain focused on finished bearings and their applications

Technology to manufacture bearing components like balls, rollers, cages and seals is completely different than process used to produce bearing rings and to assemble them with other parts into finished bearing. This implies that, to produce in competitive way high quality components, a different business and process approach is required.

Historically it is proven that any (large) bearing company who produced components for its own usage – without competing on the free market, both targeting customers other than internal ones and "fighting" with other producers – failed to be competitive in terms of quality or under economical point of view or in both fields. This has resulted in loss of focus and value for the bearings company.

On the other side, to choose the optimal supplier of a bearing component is not simple exercise and requires detailed knowledge and expertise in the sector. At a first glance, for example, any producer of steel balls looks similar to the others: but this is absolutely false!

If it is true that the basic method to press, flash, heat treat, grind and lap chrome steel balls for bearings is always the same, on the other side there are many "small" details that make the difference in terms of consistency of products and reliability of process. We are here referring to parameters like the type of coolants, its flow and temperature, the specifications and dimensions of wheels, process parameters like speed and pressure in stock removal operations, the design of tools and the methods to use and to maintain the tool itself. And this without mentioning the rules to manage the production flow in a logic of pull system, avoiding expensive and dangerous situations of inventory excess, long manufacturing through-put times and confused planning that will affect negatively the cost and the service level to customers.

Similar considerations can be done for each other type of bearing components, proving that a specific know-how is requested to guarantee the best optimization of product quality, service and pricing in function of the final needs of bearings manufacturer.

It's enough to think that any components manufacturer deals with many billions of parts per year (think of balls and rollers companies, for example), much more than the number of bearings that most of bearing companies deal with, and the key point is not to be able to make some few million of these components in conformance ... but to make ALL of them in conformance. The understanding of this simple concept contains in itself the difference between standard and excellent component manufacturer!

ICT was founded in 2012 in Italy by a group of professionals with long technical and marketing experience in bearings industry, developed within large multinational companies in Europe, Asia and USA. The vision of founders was to create a pool of experts and partner companies, each one specialized in specific bearing components, with aim to become the preferred one-single-point contact for bearings organizations in procurement of direct parts for their assembly operations.

ICT network enriched in these years with more than 12 long terms manufacturing partners with operational sites distributed between Europe, Asia and USA, each one specialized in a well defined range of products and materials, in order to offer the optimal products to customers.

ICT offer includes steel and ceramic balls (both silicon nitride, zirconia oxide and allumina), rollers of any type (cylindrical, taper, spherical, needles) with pratically all the possible OD profiles, cages in steel and brass, seals and shields.

Rollers are 100% eddy current tested, MPI tested for larger sizes and with face radius and OD profile as for customer needs. Different raw materials (SAE 52100, SUJ2, 100 CrMnSi6-4, silicon nitride) and heat treatments are possible, while all the key parameters can be certified. Diameter and length can be sorted in classes of 1 micron. All this results in advantages for bearings manufacturers in terms of low bearing noise, reduced friction, high load carrying capacity and higher reliability even in the most demanding applications like railways bearings, for example.

Products are always offered with DDP services, i.e. ICT will take care of all logistic aspects, including any customs clearance process (if required). Only in some few cases DDU incoterms are applied. Furthermore, in case of repetitive supply, there is possibility to offer consignment stock services in location close to the customer plant, with option to set daily or weekly call-off and to define min and max stock levels for control of inventory and for guidance of the consumptions in line with the agreed volumes.

The aim of ICT is to offer a 360° service to the customers, allowing them to be focused on the bearings and simply relying on ICT professionals for the choise of the best technical, strategical and commercial solution for their own needs. In that respect, ICT can provide technical and systems audit of the supplying plant on behalf of the customer, completing also the homologation process and PPAP documents.

Another advantage for bearings manufacturers in getting services from ICT is the possibility to deal with supply of relatively small batches, the same that most of the well known components companies would refuse because considered anti-economical. The rich partner networks, instead, allows ICT to cover most of the potential demand, making synergies in terms of tooling and finished goods stock and so minimizing the costs also for small volumes and/or for very special demands (very strict tolerances and/or special materials, for example). For additional info, please visit *www.consulting-trading.com* and get in touch with ICT professionals writing to info@consulting-trading.com.

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- **Right** Location
- **Right** Interval
- **Right** Quantity
- **Right** Indicators

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Regal's Perceptive Technologies® Services Now Include Wireless Monitoring System

This package of products and services enables companies to perform automated analyses that deliver waveform and spectral data for the best predictive capabilities

Regal Beloit Corporation, a leading manufacturer of electric motors, electrical motion controls, power generation and power transmission components, announced the introduction of new solutions for wireless vibration and temperature monitoring. The Perceptive Technologies® wireless monitoring system provides 24/7 services to help detect abnormalities in equipment before they become problematic.

At a fraction of the cost of a wired system, this new Regal Perceptive Technologies wireless monitoring system eliminates the need to be near operating equipment and is adaptable to any industry. Monitoring can be performed on-site or from a cloud platform on equipment like fans, pumps, motors and blowers.

Regal's wireless monitoring system allows users to take advantage of the extensive industrial experience of the Perceptive Technologies team to monitor and analyze machinery remotely, helping to improve reliability and maximize production.

"Unlike other wireless systems that provide only basic diagnostic data, the Perceptive Technologies wireless monitoring system delivers complete raw and analyzed data to help manage assets and provide flexibility," said Daniel Phillips, director, reliability and maintenance — CMRP for Regal. "Users receive easy-to-understand, actionable information without the need for manual diagnosis."

The Regal team can configure, install and commission a system tailored to a company's specific needs. Expert analysis is also available, if needed, to provide recommendations for improved equipment reliability. For more information, visit *www.regalbeloit.com/Brands/Perceptive-Technologies/Wireless-Monitoring*.

About Regal Beloit Corporation

Regal Beloit Corporation (NYSE: RBC) is a global leader in the engineering and manufacturing of electric motors and controls, power generation products and power transmission products serving customers throughout the world. We create a better tomorrow by developing and responsibly producing energy-efficient products and systems.

Regal Beloit is comprised of four operating segments: Commercial Systems, Industrial Systems, Climate Solutions and Power Transmission Solutions. Regal is headquartered in Beloit, Wisconsin, and has manufacturing, sales and service facilities worldwide. For more information, visit RegalBeloit.com

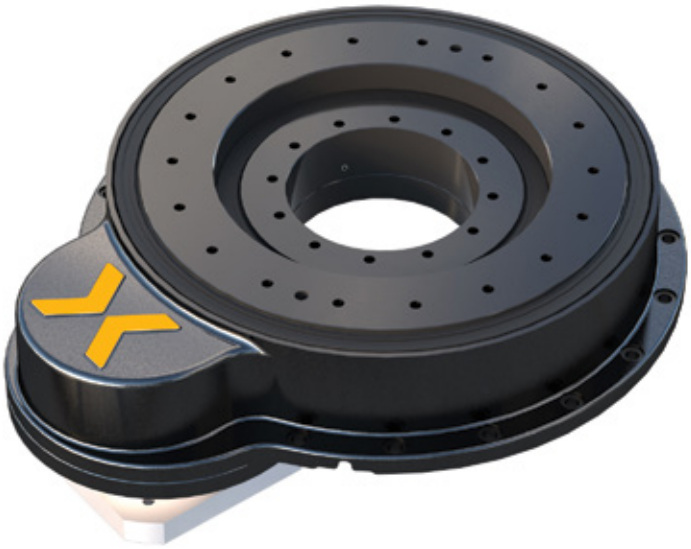
versatility, precision and short lead times: Rotary Indexers from Nexen

A cost-effective solution for automating a wide variety of tasks

Whether due to a bustling economy, reshoring, better technology or a shortage of skilled labour, manufacturers are automating more than ever before. Studies have shown that over the last decade the use of permanently installed automation systems has increased significantly compared with manual assembly processes in manufacturing facilities, and sales numbers are expected to continue their steep upward trend.

The automation boom is welcome news for systems integrators, but there is a snag: lead times for indexers, linear actuators, robots and other automation components have increased. Depending on their size and complexity, delivery times for linear slides can range from 20 to 26 weeks, for robots from 14 to 20 weeks, and indexers can take eight to twelve weeks. “The lead time for certain product groups has increased from 50 to 100 percent in 2018,” says the purchasing manager for a systems integrator. “This is extremely problematic for us. We operate without an on-hand inventory, so it’s critical to have accurate deliveries from our supply chain. When we can’t get components in a timely manner, it affects our lead time commitments to our customers.”

Lead times are a big deal for systems integrators, since designing and building an automated assembly system can take a while. A simple project might take 12 to 14 weeks. A complex one could take 48 to 52 weeks. With a large project, approximately 25 percent of the total project time will be spent on mechanical and electrical design and acquiring long-lead-time items. Another 25 percent will be spent actually building the machine; 25 percent will be spent debugging the machine; and 25 percent will be spent on final run off, tear down, shipping, installation and training. Anything that can shorten this timeline – and thus help a customer get its product to market faster – is welcome. It’s not surprising, then, that delivery time is a major consideration when choosing suppliers of automation components.



— Nexen’s CRD MR line also features zero backlash, high precision, high torque, high acceleration, smooth motion and low maintenance

New indexer ships in three to four weeks

Nexen’s new CRD MR products build on the company’s successful CRD line of precision rotary indexers. The CRD MR line still features all the benefits of the company’s patented precision roller pinion drive design – zero backlash, high precision, high torque, high acceleration, smooth motion and low maintenance.

One of those benefits is flexibility. Until now, the CRD indexer was available in three configurations, giving enineers options for high speed, high torque or both, depending on the application. The CRD PL is equipped with a high-precision planetary gearhead, offering high torque, high speed, low backlash and a flexible gearhead ratio. The CRD HG has a harmonic gearhead, which provides high torque, low speed, zero backlash and a high gearhead ratio. The CRD DD is equipped with a direct-drive motor, which delivers high speed, medium torque and zero backlash.

The CRD MR line gives engineers a fourth option: to drive the indexer with their own motor or gearbox. This provides two big advantages: It lowers the cost, and it enables Nexen to deliver the indexer in just three to four weeks – half the time of a traditional cam-driven indexer. “With our customisable input, the CRD MR product can accommodate a wide range

— With Nexen's customisable input, the CRD MR product can accommodate a wide range of applicable motors and shaft-output gearboxes

of applicable motors and shaft-output gearboxes," says Broc Grell, applications engineer at Nexen. A high roller-pinion-to-gear ratio allows engineers to drive the system directly with a servomotor or even a stepper motor, eliminating the cost of a gearbox. For high-load applications, the customer can drive the system with a gearbox and motor. Additionally, the gear-to-pinion reaction loads are fully supported, so the motor or gearbox shaft is not subjected to radial loading. This eliminates the need for costly high output capacity reducers in high-load applications. All of these features reduce engineering and installation time.

"Increasing the pinion-to-gear ratio allows us to drive higher inertial loads on the output with a smaller motor on the input," says Isaac Klaehn, engineering manager for motion control products at Nexen. "That gives the customer a great deal of flexibility." For example, the CRD PL 250 has a pinion-to-gear ratio of 3.8-to-1, while the CRD MR 250 has a pinion-to-gear ratio of 12.5-to-1. Since there's an inverse square relationship between the gear ratio and output inertia, increasing the ratio from 3.8 to 12.5 is a big deal. It's much better to divide a 50-kilogram load by 156.25 (12.52) than 14.44 (3.82). "When the ratio from the input to the output is increased, the input speed must also increase to maintain the same output speed," says Klaehn. "Design efforts with the new product's development maintained the peak speed of the indexer. Our new CRD MR indexers have the same capacity and speed as the original models while increasing the ratio."

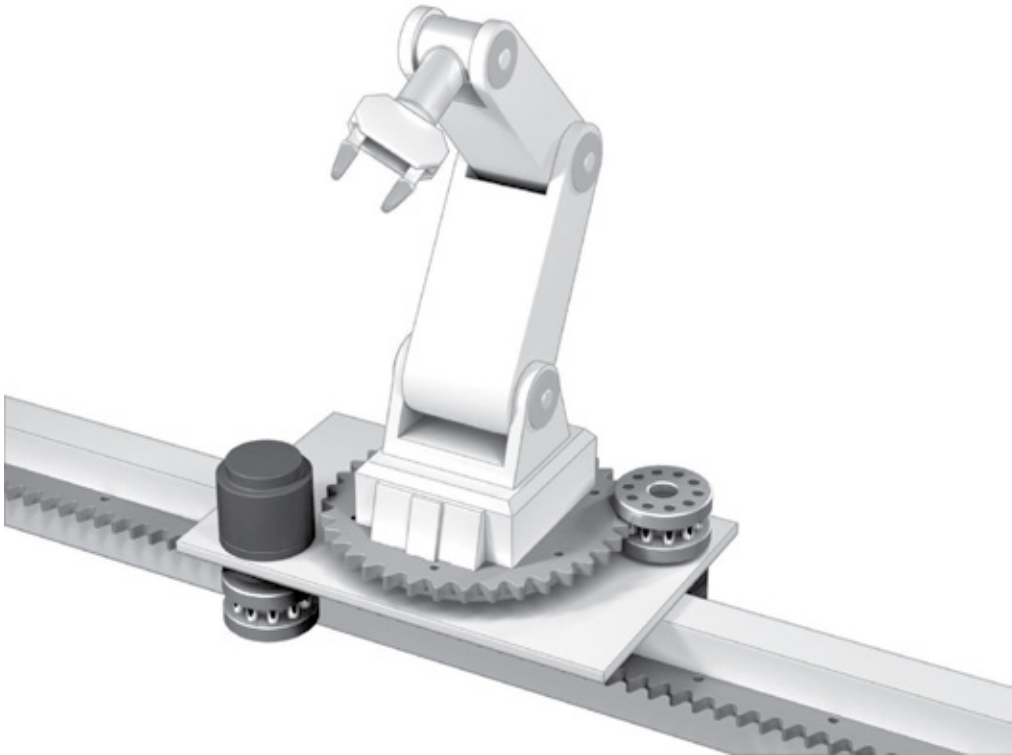
Like the original CRD indexers, the CRD MR indexers have a large, open centre, so engineers can mount cabling, robots, inspection cameras and other devices in the centre of the rotating plate. This saves space and makes for a generally efficient, "clean" machine design. Alternatively, engineers don't have to put anything in the open space. "We're quoting a project right now that will have multiple stations around the indexer. When the part is finished, it will be ejected to the inside of the indexer instead of the outside," says Klaehn. "A conveyor will pass underneath the indexer to take the finished parts to a packaging line."

Three models and three sizes

The CRD MR line is available in three sizes: 150, 250 and 350. The latter two sizes are "drop-in" replacements for Nexen's original CRD 250 and 350. When the Precision Ring Drive product line is included, Nexen's indexer line now spans a range from 150 to 1,500 millimetres in diameter.

To offer engineers even more flexibility, the CRD MR line comprises three models: the MRS (motor ready sealed); the MRG (motor ready guarded); and the MRO

— Application example: robot indexer



(motor ready open). The CRD MRS is fully sealed and carries an IP65 rating. The CRD MRG is guarded but not sealed. This means less protection for the inner workings, but also less overall drag than a fully sealed system, so it's more efficient and the motor doesn't have to provide as much torque. The CRD MRO is for applications that don't require sealing or guarding. "With our new product line extension, engineers only pay for what they actually need," says Klaehn.

Depending on their size, the maximum speed for all three models ranges from 161 to 304 rpm. One-way positional accuracy ranges from 59 to 31 arc-seconds, and one-way positional repeatability ranges from 9.8 to 5.2 arc-seconds. Unlike other drive systems, there is zero backlash from the motor through the driven load.

— Image 4: Application example: RPG indexer

Applications

Like Nexen's other ring drive products, CRD MR systems are typically mounted horizontally to carry an applied load, like any rotary indexing table. They are ideal for precision rotary indexing applications, such as machine tools, semiconductors, robotics, automated welding, medical packaging, assembly and cutting systems. The indexers are even used in non-industrial applications, such as theatrical staging.

In one recent industrial application, a pharmaceutical company uses a CRD MR 150 indexer to quickly and smoothly position vials below a dispensing system that deposits a small amount of material in each vial. The indexer's compact footprint makes it ideal for lab work, and its large open centre enables the dispensing system to be located in the centre of the dial, which saves space.

In another application, a machine shop is using the CRD MR to accurately position parts for external processing. In this application, smooth, precise motion is more important than high speed. In yet another application, the indexer is used to position parts for a hunting stand so they can be welded by a robot.

Unlike other indexer types, Nexen's ring drive products can also be mounted upside down to carry a suspended load, or they can be mounted vertically. The CRD MR units are no exception. For example, one CRD MR system is being used as a trunnion, positioning parts for robotic welding. In this application too, the system's open centre plays an important part. The welding gun passes through the centre of the indexer so that it can weld a seam inside the assembly being rotated.

The ring drive advantage

The key to the performance of Nexen's indexers, including the CRD MR line, is the company's innovative Roller Pinion System (RPS), which was originally designed for linear motion. The RPS is a patented linear drive concept that combines the best attributes of existing technologies while eliminating most of their shortcomings. The RPS converts rotary motion into linear motion. The system advances the traditional rack-and-pinion concept by replacing the spur gear teeth with bearing-supported rollers that engage a unique tooth profile in the rack. Instead of the sliding friction of traditional rack-and-pinion systems, the rollers provide smooth rolling friction that converts rotary motion to linear motion with 99 percent efficiency.

The tooth profile of the rack causes the rollers to be loaded in opposition, which eliminates backlash. With this meshing geometry, each roller glides smoothly into the tooth face following a tangent path. The roller does not slap into the teeth, so there is less noise, vibration and tooth fatigue. In addition, the RPS provides very high positional accuracy, no cumulative error, low-velocity ripple, very high speeds, high rigidity, low maintenance, corrosion resistance and long life. Jams are not an issue because the pinion rollers simultaneously engage several tooth flanks in opposing directions.

To create a ring drive, the linear rack becomes a circular gear. Instead of moving a linear rack side to side, the pinion rotates the gear. The axis of the pinion and the axis of the gear are parallel. A circular plate is bolted on top of the gear to create a rotary indexing table. Unlike some cam-driven rotary indexing systems, the ring drive can start and stop at any incremental position. Engineers can change the motion profile by simply loading a new servo drive program. The ring drive also allows maximum acceleration or deceleration at any point without risk of damage. You can find more information on *www.nexengroup.com*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Ultrasound and the IIoT:
the Future of Bearing Condition Monitoring

When a powerful and versatile technology such as Ultrasound meets the Internet of Things, new solutions arise that will take condition monitoring of bearings to a whole new level. The development of ultrasonic sensors and their integration with data collection points promise to be a game changer when it comes to continuous and remote monitoring of rotating assets.

Why Ultrasound?

Airborne & structure-borne ultrasound has certainly become a major player in condition monitoring. Once considered just a leak detector, more maintenance & reliability professionals are beginning to realize all of the benefits associated with using ultrasound for condition monitoring applications.

The P-F Curve with which we have all become familiar with reflects that trend: ultrasound is considered one of the first lines of defence against unplanned downtime, being able to spot bearing failures at a very early stage.

Besides, ultrasound is well known for its versatility: the technology can be applied to different domains such as leak detection, bearings condition monitoring & lubrication, steam traps & valves inspections and electrical inspections.

Traditionally, and still nowadays more commonly, ultrasound technology is used in maintenance and condition monitoring practices via handheld devices. These have been going through their own enhancements and many of them are sophisticated inspection devices and data collectors which can greatly improve any reliability program.

The Surge of Ultrasonic Sensors

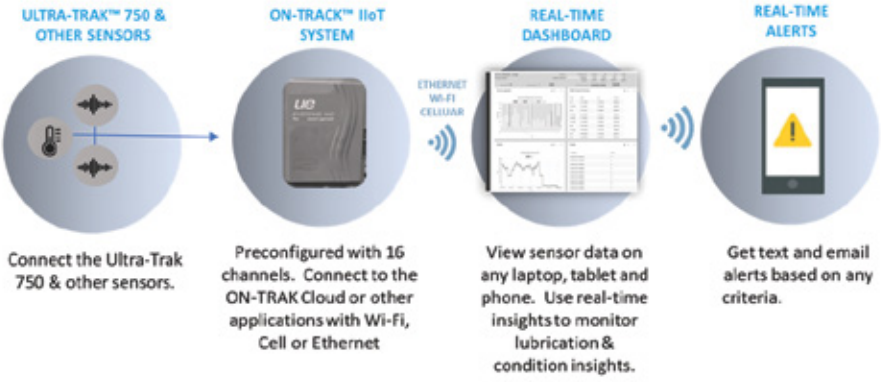
The ultrasonic handheld devices certainly still play an important role, but when we couple the technology with

the capabilities that the internet brings us, we can create powerful monitoring solutions by using ultrasonic sensors connected to network-enabled devices. The sensors are always listening, as if an inspector was always there inspecting the asset, continuously, 24/7. They collect data from bearings in the form of dB readings and send them to central devices who will process the data. This brings, of course, a huge potential for improvements on maintenance & reliability programs. We can now setup alarms, notifications, trend the condition of assets... all automatic, seamless and taking advantage of the well-known benefits of ultrasound technology.

Imagine you have an asset at your facility, let's say a bearing. This is a critical asset that simply can't fail. An ultrasound sensor can be permanently mounted on the bearing, continuously collecting dB readings and sending them to a data processing box. Is the dB reading abnormal? You get notified by email or SMS. You are always on top of your assets condition. Alarms can be setup according to your needs: want to know when a bearing needs lubrication? When there's a damage on it? Want to have a sound recording of the bearing when an alarm is reached? Everything is possible since maintenance managers will be able to setup their own alarm thresholds and notifications. And make unplanned downtime a thing of the past.

New Ultrasound based IIoT Solutions

There are already easy to implement solutions on the market that couple ultrasound technology with sensors and network-connected devices, allowing for truly continuous and remote monitoring. For bearings and other mechanical assets, there is for example the *On-Trak*, a remote IIoT bearing monitoring system using UE Systems' Ultra-Trak 750 sensors. The system is composed of 16 sensors and a central processing box that can be connected to the network via wifi, ethernet or cellular data. Data from the sensors can be easily viewed on any laptop, tablet or phone. Real time insights and notifications can be used to constantly monitor lubrication & condition insights. Additionally, data can be integrated to cloud platforms such as Azure, AWS, Google, IBM Watson, PTC, Thingworkx, etc.



Another solution for bearing monitoring is the *4Cast*, working with the RAS (Remote Access Sensors) from UE Systems. Up to 4 sensors can be connected to a 4Cast box, which then connects to the network via Ethernet to provide data insights from the bearings. Data is then sent to UE Systems DMS 6 software for trending an analysis. The great advantage of the 4Cast is its ability to also record and store sound samples from the monitored bearings – this feature, together with the ability to create instant alarms, makes the 4Cast a great solution for critical and slow speed bearings.

Conclusion

From handheld devices to connected sensors – this is the natural progression of ultrasound technology when used in industrial environments for maintenance, condition monitoring and reliability. Such as other technologies, integration in the IoT world will become a fact, and though the current solutions are already bringing exciting advancements, there is still much to discover and explore. What we know for sure, is that with the currently available solutions, maintenance departments have very effective weapons to fight against issues such as unplanned downtime and electrical equipment failures.

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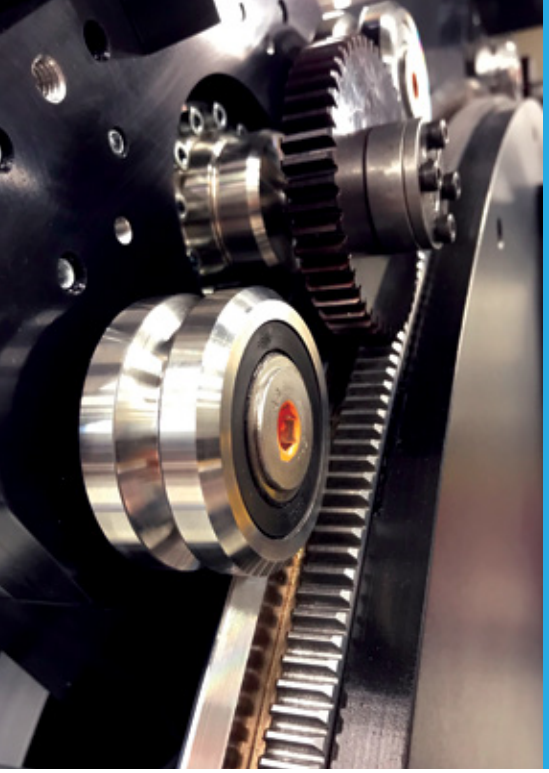


Large Rings for **Big Demands**

Ring guides provide lasting support at **TRIOPTICS**

When it comes to rings and curved guides, it is impossible to overlook HepcoMotion. In the fifty years since its inception, the British company has developed its reputation as a specialist in all sorts of linear guides, successfully occupying a niche in this area.

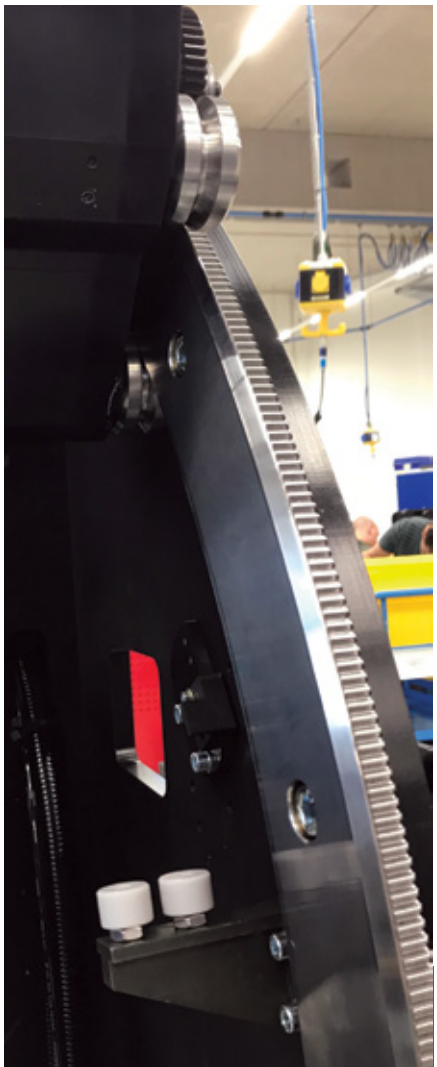
That is also how Dr Stefan Krey, Executive Director at TRIOPTICS, feels about HepcoMotion´s product range. TRIOPTICS is one of the leading manufacturers of precision optical testing equipment for the inspection of lenses and camera components. The company has been relying on HepcoMotion's products for a long time. However, for their latest development the ImageMaster® Cine Flex, a high precision optical measurement system, they only found their way to the British provider of linear motion solutions after a detour.

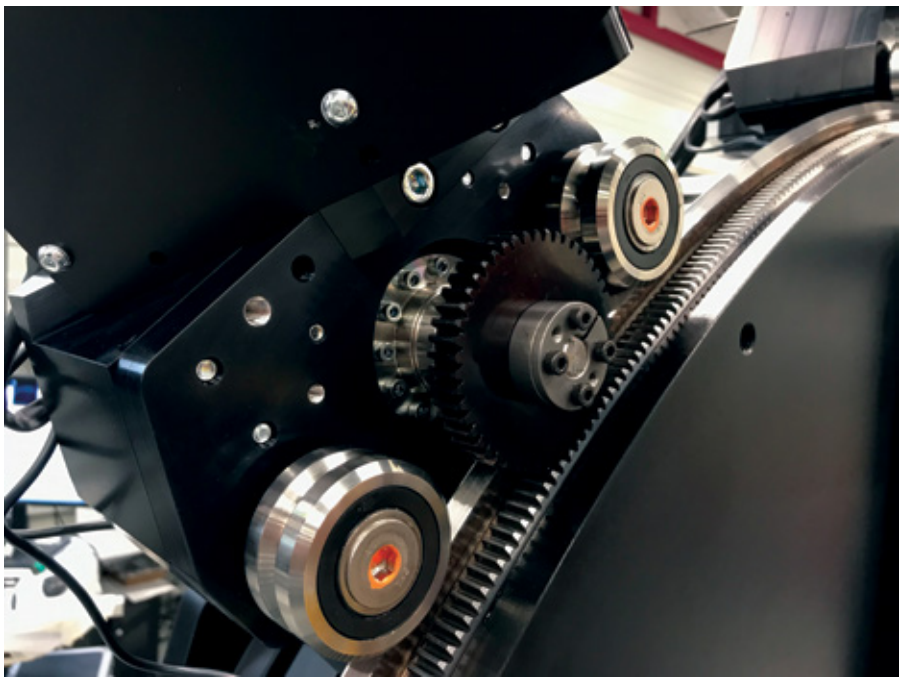
In developing this latest instrument, TRIOPTICS was faced with three major challenges. Firstly, lenses for movie production are much larger and therefore more difficult to handle than normal, smaller and lighter digital camera lenses. Secondly, on top of the already challenging size and weight, the client wanted it to be possible to test the perfect functioning of the lens not only in its horizontal but also in its vertical position while also being able to undertake adjustments in that position if needed. Therefore, the optical measurement system had to be constructed in a manner that would be sufficiently stable without compromising on flexibility. Finally yet importantly, the aim was to create a measurement system that would be able to accommodate up to fifty different lenses.

Just to achieve the required distance between the optical testing equipment and the lens that is being tested, a ring with an impressive 1500mm diameter was required. The first prototypes built by the TRIOPTICS team used polymer pinions and rings to achieve the movement actuating the test cameras. However, it turned out that the plastic pinions could not handle the 10kg weight of the test cameras reliably over time. "But a safe and repeatable positioning of the optical testing telescopes was essential to achieve the needed high quality measurement results," explains Dr Krey.

— Trioptics used HepcoMotion's PRT2 ring with external gear and mounted it to a round metal baseplate.

This is why TRIOPTICS contacted HepcoMotion after the first unsatisfactory results using plastic pinions and a





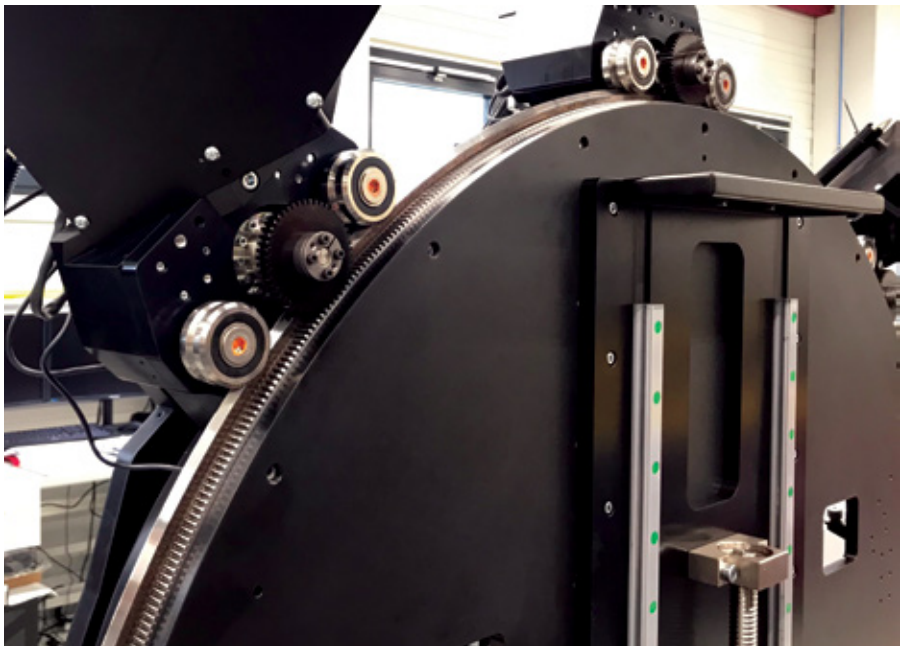
— To ensure a perfect fit, Trioptics combined their own carriage plates and pinion with HepcoMotion's double-row bearings.

toothed belt. "That was it," concludes Dr Krey. HepcoMotion was able to manufacture a ring that met TRIOPTICS design requirements exactly. "We chose a PRT2 ring with integrated gear profile and double-row eccentric bearings," says Krey. "The eccentric bearings can be adjusted to remove play in the system that develops over its lifetime as a result of wear - there is no need to remove and replace the bearings that have worn," explains Mark Völkers, Technical Sales representative for HepcoMotion Germany. Mark was responsible for providing linear motion guidance for the project.

TRIOPTICS´ test machines are shipped across the world, so the ability to easily readjust the bearings is an important feature for customers from a service point-of-view. In addition, the double-row bearings, which comprise a one-piece outer race with two rows of ball bearings, guarantee improved load capacity, service life and strength - essential for handling the weight of the test cameras. "In addition, to minimise the loads on the guidance system, we added a counterweight to the camera assembly," explains Dr Krey. TRIOPTICS designed and manufactured their own carriage plates to ensure a perfect fit with their test cameras and mounted HepcoMotion's bearings to each carriage plate. "No problem for us," says Völkers. "Our products are designed to give the customer freedom of choice to build their own system using components or use one of our pre-fabricated systems. We want to enable designers a great deal of freedom in their design," explains Völkers.

During the measurement process on the test machine, two or three motorised test cameras move approximately seventy degrees to cover the entire field of view of the lens. Whilst these movements are relatively slow at about 10-20cm per second, they must be performed smoothly and with absolute precision. The stainless steel ring and double-row bearings manufactured by HepcoMotion comfortably accommodate the weight of the cameras. The camera lens that is being tested is fixed to a support which is completely independent of the ring. As a result, the entire assembly can be rotated from vertical to horizontal – one of the customer´s key requirements.

"This was quite a lengthy project - it was under development for two years," says Dr Krey. However, for the company it was more important to develop a long-term, perfectly functioning test instrument than to achieve in the short term and take risks on the long-term reliability of a machine. "We wanted to be absolutely sure the machine would function in just the same way 20 years from now and that is now the case", says Krey. The machine's initial success proves him right: the first five of the ImageMaster® Cine Flex have been delivered to the customer´s branches around the world already and are working to their full satisfaction.



— HepcoMotion's double-row V bearings and PRT2 ring with integrated gear form provide precision and stability. Images: Trioptics GmbH, Wedel.

www.cmibearing.com

CMI 西密克轴承
BEARING

CMI BEARING CO., LTD

E-mail: sales@cmibearing.com
NanYan High & New Industry Park
Xinchang, Zhejiang, China

The full-service partner *for* FAA-PMA Certification *and* Manufacturing of Bearings








NES offers Reverse Engineering of type certified aircraft ball and roller bearings in support of FAA-PMA certification. Additionally, NES is a qualified manufacturer of FAA-PMA bearings.

Reverse Engineering (RE) of a type certified bearing is the first step in the PMA process. If carried out by a facility with the proper inspection, testing and bearing design capability, it will satisfy the requirements of CFR14 Subpart K and FAA Order 8110.42 under test and computation. NES is a qualified partner in this process.

"We fill in all the gaps for a customer who wants to be a certified PMA holder for an aircraft bearing. By providing a full-service, highly-qualified Reverse Engineering team," says NES President Chris Napoleon "along with the ability to manufacture custom bearings in-house, we are a full service partner. NES provides a high level of bearing design and manufacturing expertise during the process along with a significant cost-savings to the FAA-PMA holder."

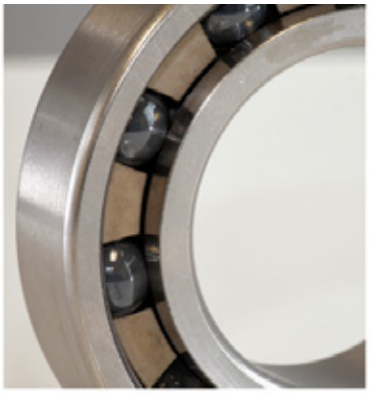
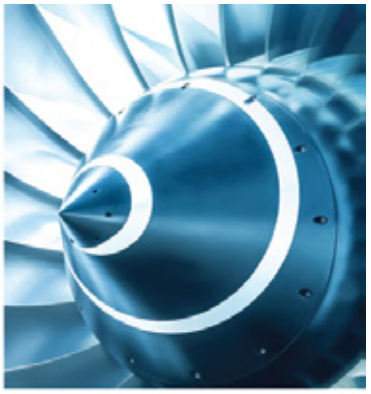
Proper reverse engineering ensures that FAA-PMA aircraft replacement bearings will meet or exceed the same rigorous quality, design and performance standards as those originally specified. To support these requirements, a team of highly experienced NES bearing engineers and technicians perform a thorough physical evaluation of the aircraft bearings, using highly specialized equipment and data analysis tools. The end product is an accurate and detailed analysis which provides all of the necessary inspection data along with a detailed assembly drawing supporting the approval process coupled with manufacturing expertise that ensures that the bearing meets or exceeds the application requirements.

PMA, when used in conjunction with a qualified aerospace bearing manufacturer, such as NES, is an excellent way to reduce the overall cost of aircraft and equipment maintenance, repair and overhaul. According to Napoleon, "We are always customer focused, it's the core of our business model, and as an essential business, we're fully operational and ready to answer customer calls within two rings day in and day out." Customers interested in partnering with NES can reach out via sales@nesbearings.com or call NES at 716-372-6532.

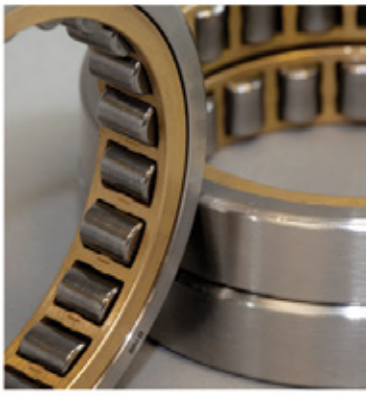
About Napoleon Engineering

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.





DUROLUB© DL-AM:
The anti - microbial
polymer lubrication solution

— Liquid cheese production line

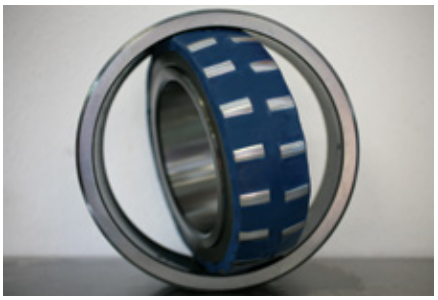
Durolub DL, a thermally treated polymer compound with a high performance synthetic hydrocarbon oil, is well accepted in the food and beverage industry, the pharmaceutical industry and many other branches with typical challenges like:

- incident contact with processed product possible (demands NSF H1 / Halal / Kosher certificates)
- wet environment, process and cleaning water (pressure cleaning)
- cold process lines (low friction torques at starting / in operation)
- low environmental impact, no excess or washed out grease in the production lines)
- reduced maintainance cost

Now the brand new anti - microbial AM additives are available with the 3 standard polymer lubrication solutions

- DL.AM with 68mmÇ/s at 40°C - the standard for ball bearings
- DL150.AM with 140mmÇ/s at 40°C - the standard for roller bearings and large ball bearings
- DL32.AM with 32mmÇ/s for low operating temperatures

Durolub can be applied to any bearing brand with sufficient free space inside the bearing. Therefore either your favourite brand can be boosted with Durolub or alternative solutions can be worked out.



— SRB filled with Durolub DL150

The goal always remains the same:

Maximization of the operating life of your application

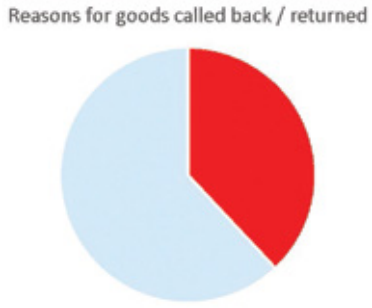
But now there is a second major goal:

Reliable prevention of pathogen germs in the lubricant and subsequently no microbiological contamination of the processed goods caused by the lubricant.

MICROBIOLOGICAL CONTAMINATION

is the number one reason for returned goods or call backs on food and beverage products. Beside high costs for the return of goods, the reputation of the concerned production companies is battered.

Especially if there are difficult to reach places (cavities / openings) and frequent cleaning with water, the growth of pathogen microorganism should be ***actively*** avoided.



— 38% caused by microbiological contamination

By using Durolub AM with antimicrobial additives the safety of processed product is increased significantly, the risk of losing reputation and money seriously reduced.

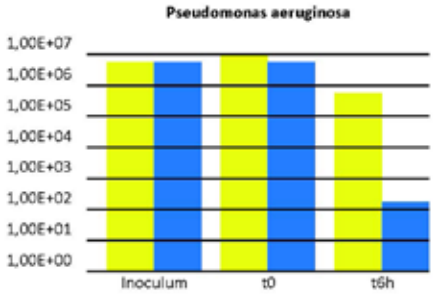
EXAMPLE PSEUDOMONAS AERUGINOSA

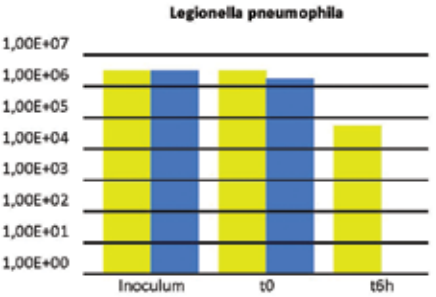
In the WHO list of the most dangerous bacterias this type ranks under the top 3.

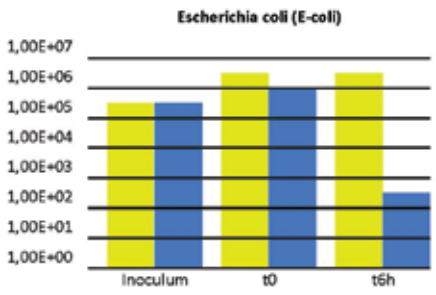
This soil and water germ is widely spreaded and extremely resistant against disinfectants and antibiotics. It is known as food spoiler and as the main hospital germ.

Pseudomonas aeruginosa even survives in destilled water and disinfectants. It builds biofilms and slime what can cause severe problems in the process technology.

Underneath some examples of the effectiveness of the AM additives. The blue column shows the number of germs at inoculum, 0-hours and 6-hours while the yellow is the same without AM. The effectiveness of the AM additive is certified by external independent laboratories. The tribological properties of Durolub Dl / Dl32 / DL150 remain unchanged.





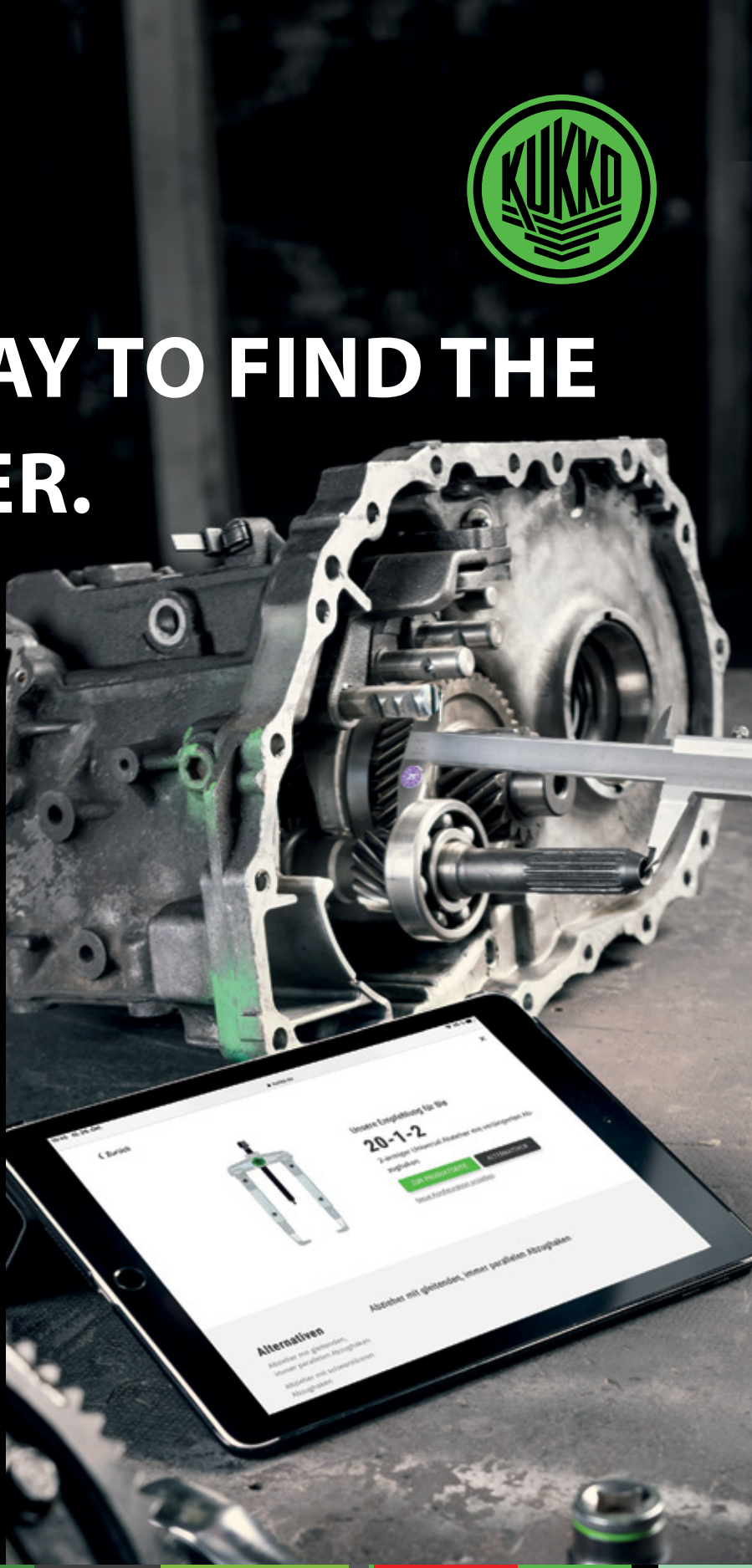


— The effectiveness of the AM additive is certified by external independent laboratories.

For any further details just contact:
Tel. : +43 676 3973077
Mail : office@thb.at
Web : *www.thb.at* / *www.durolub.com*
Address : Langwieserstrasse 134
4802 Ebensee / Austria

KUKKO // *Pull forward*

THE ONLY WAY TO FIND THE RIGHT PULLER.



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Ready to pull in 5 clicks

KUKKO.COM

Original and premium pullers created by KUKKO.

When a factory is in shutdown, sitting still shouldn't be the first option

Making The Most Of Downtime

Injuries in sport are inevitable, but the greatest sporting comebacks haven't been achieved by simply accepting the circumstances and waiting for recovery. The same philosophy can be applied to factory shutdowns. Here, Chris Johnson, managing director at ***specialist bearings supplier*** SMB Bearings explores the factory maintenance opportunities gifted by an unexpected pause in production.

An unexpected factory shutdown can occur for a number of reasons — political, environmental, technical, or, at the moment, virus-related. Whatever the cause, unplanned shutdowns or changes to schedules can have a profound impact on the company operating the facility and its bottom line.

However, what if a plan is developed in advance; one that can be implemented during times of halted production? An alternative way of looking at shutdowns is that they are a fantastic opportunity to conduct preventative maintenance, make incremental equipment upgrades, or even invest in staff development opportunities.

In 2017, it was estimated that ***downtime costs UK manufacturers £180 billion every year.*** Actually, the true cost of downtime goes far beyond the financial data, and can wreak havoc in multiple areas of a business. While avoiding downtime altogether would be an ideal goal, aiming for near-zero downtime should instead be a facilities' first —

and more realistic — line of defence.

It is through preventative maintenance and condition monitoring procedures that downtime associated with equipment failure can be kept to an absolute minimum. Gathering machine data through the use of an automated system can help facility managers plan and foresee production disturbances far more accurately. This allows them to predict failures before they occur and plan maintenance schedules and parts replacements, accordingly.

However, if an unavoidable shutdown does occur, then how should plant managers respond?

Opportunistic maintenance

It might not be possible to accurately predict the length of a production disturbance, so it isn't advisable to implement lengthy maintenance tasks. Instead, manufacturers should focus their efforts on projects that can be completed in a single day, so that the facility can be back up and running if circumstances change.

Opportunistic maintenance to prevent future equipment failures is an ideal undertaking in this scenario. Such an approach to preventative maintenance takes advantage of unscheduled pauses in production to replace components, improve system availability and reduce production losses.

However, for opportunistic preventative maintenance to be successful, managers must be aware of when, and where, replacement components are needed in order to gain the most cost-effective improvement. For instance, if a machine has been idle for some time, temperature changes and condensation may create moisture within the system. Therefore, changing the oil to remove contaminants before start-up is cost-effective, if it prevents future equipment failure.

Equipment upgrades

Aside from part replacements, an unexpected production disturbance can be an ideal opportunity to undertake unscheduled equipment upgrades.

Take bearings for example. As a critical machine component that keeps manufacturing processes running and rotating smoothly, bearings may require relubrication, realigning or for the equipment balance to be addressed to avoid premature equipment failure.

By replacing a standard bearing with a smart bearing, this can provide operators with a real-time overview of the bearing's performance and health. Installing a smart sensor, or a bearing with a sensor integrated into the component's housing, is a simple facility upgrade that is both cost-effective and easy to integrate into existing systems. The self-diagnosing bearing can then send signals to an external condition monitoring unit, which can notify the operator when an action is required.

Having a reliable computerised maintenance management system (CMMS), or a database of unscheduled equipment upgrades, means that plant managers can make decisions quickly and use the downtime period more effectively.

Staff development

A pause in production can also be a

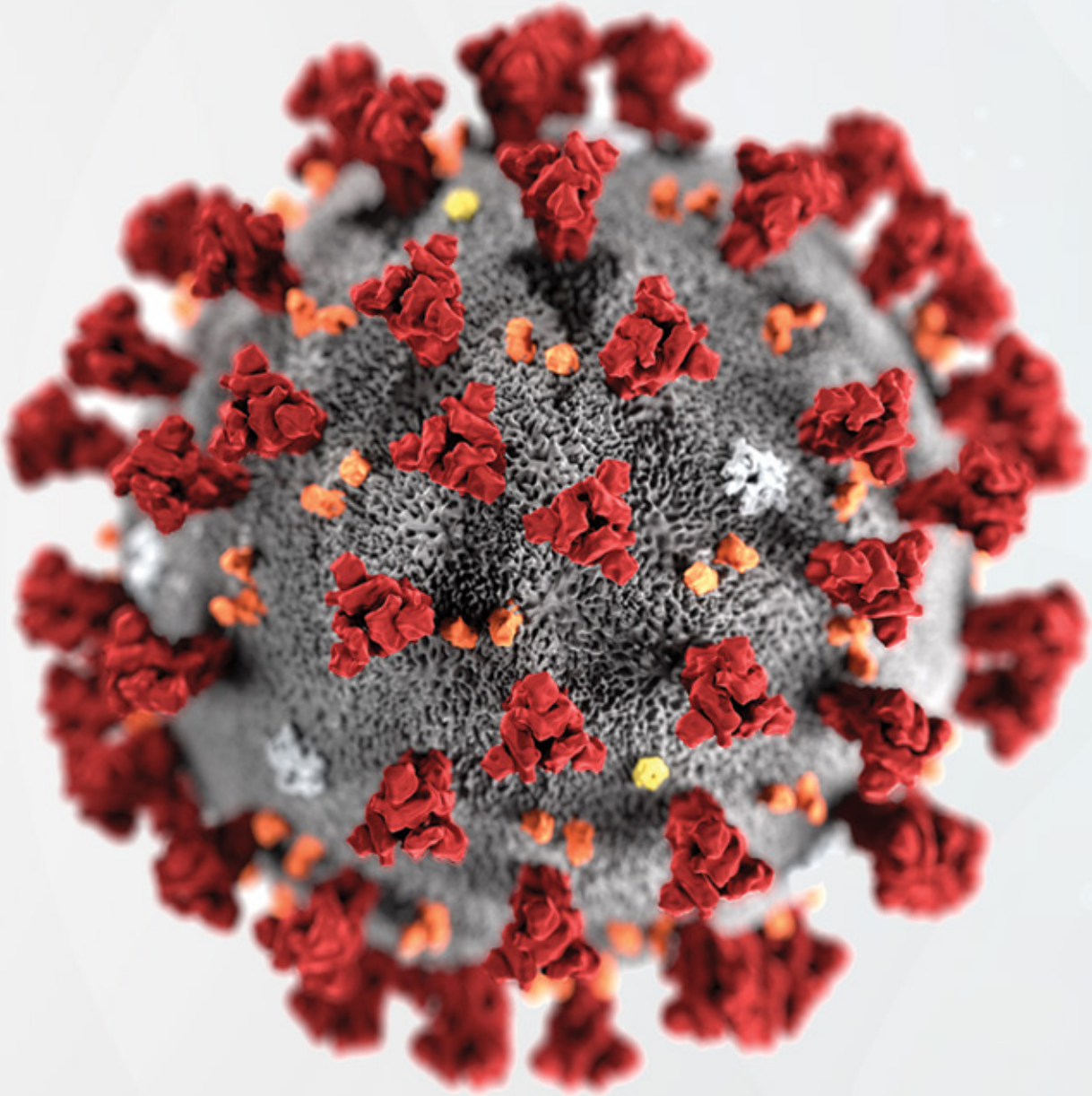
fantastic opportunity to train and upskill employees. Especially as, according to a study, ***23 per cent of all unplanned downtime*** in manufacturing is due to human error. Instead, downtime can be spent enrolling employees onto online courses. If the course is tailored to a specific job role or skill-set, then the worker can develop a deeper understanding of the installation, programming and maintenance of specific pieces of equipment.

Let's use an augmented reality (AR) system as an example. If a facility has recently adopted AR, then a break in production could be an ideal opportunity to use that system to provide new training to less-experienced members of the team. The AR system could superimpose simple step-by-step instructions in the operator's field of view, to indicate specific troubleshooting guidance and provide a digital workflow.

Not unlike preventative maintenance applied to machines, good quality team training can help prevent future instances of human error — and yield valuable advantages once production is back up and running.

Like the athlete recovering from an injury, a robust plan of recovery can be crucial step towards getting the most out of pauses in production. Shutdowns needn't be something to dread but, rather, an opportunity for manufacturers to seize unexpected opportunities and gain competitive advantages.

SMB Bearings offers a comprehensive range of miniature, stainless steel, plastic, ceramic and thin section bearings. For further information on SMB Bearings' range of specialist bearings, visit *www.smbbearings.com*



Power Transmission Companies Responding to **COVID-19**

We have asked several questions to power transmission companies regarding their measures and initiatives taken to ensure business continuity during the pandemic period. You can read the details on how companies react to the **"New Normal"** in the following pages.

ACORN offers support through COVID-19

The challenges that we are facing today, both in the UK and across the globe are unprecedented. In times like this, it is important that we pull together and support one another wherever possible. We need to prioritise health, as well as keeping the world's most critical equipment moving.

Acorn Industrial Services Ltd has been working hard to put measures in place to mitigate risk, protecting their ability to support business continuity through this difficult period.

First and foremost, ACORN® has been prioritising the health and safety of its employees, customers and suppliers since the initial outbreak of the Covid-19 coronavirus. Staff have been given extensive advice and training on optimum hygiene procedures to minimise the risk to both themselves and others. Nothing is more important than health, and ACORN has made sure to highlight this.

When entering buildings, customers will notice we have signs and floor stickers to serve as a reminder to keep a safe distance, wash or sanitise hands and use PPE where available. Hand sanitiser is readily available throughout the building and should be used upon entering the building. This helps to protect both our customers and staff that are working within the building. To keep our warehouse staff protected, despatch benches have been fitted with protective screens. With many of our workforce working remotely, we have been able to maintain an essential 2 metre distancing between workers in our offices and the population of our branches has been reduced.

COVID-19

When moving throughout ACORN's 40,000 sq/ft building, staff are also required to wear specially produced high-vis vests with the 2 Metre distancing message printed on the back, which serves as a reminder to all employees to take the appropriate measures.

In order to continue our usual supply, all ten of ACORN's nationwide trade counters are now operating a 'pre-arranged collections only' policy to minimise the amount of time that customers spend in the branch. Orders can be placed over the phone and collected within the hour, helping to maintain service levels without compromising public health.

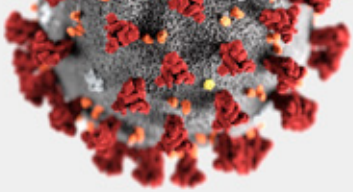
As ACORN continues to provide an invaluable service to customers, all internal meetings have been moved online to using Microsoft Teams. This means the essential communication between teams, departments and branches remains undisturbed and is just another way in which the company continues to operate at full speed. These online meetings are also offered to our customers in place of our usual customer visits, as meeting our customers' needs during this difficult time is extremely important to us.

Distribution customers can also benefit from Acorn's direct shipping offering, enabling them to send goods direct to their customer via our online web shop Acorn Express, minimising contact with packages. With many workers now needing to work from home and staff shortages limiting business capacity, this also benefits a large percentage of distributors who can keep their business moving throughout this challenging time.

Ensuring a continuous supply of the most critical machine components is paramount. With this in mind, ACORN has increased stock levels to minimise the impact of the pandemic and ensure that businesses do not suffer long periods of downtime as a result.

Gavin Stacey, Acorn's Sales Director, commented: "At Acorn, we have always prided ourselves on the high service levels that we offer to our customers. We are committed to supporting both new and existing customers through this pandemic, we remain fully operational, ensuring that their most critical machinery continues to operate without downtime. If there is anything we can do to help businesses through this challenging time, we urge them to contact their local Acorn Regional Distribution Centre for assistance."

For more information about how Acorn are supporting businesses through the Covid-19 coronavirus pandemic, contact your local customer service team today.



Fersa Implements Early Safety Protocols Against The Pandemic

Pedro Pablo Andreu, COO of Fersa Group in Spain, explains about Fersa's early initiatives taken to ensure business continuity during the pandemic period.

— Pedro Pablo Andreu, COO of Fersa Group, Zaragoza, Spain

1. Please tell us about the initiatives taken by your company for business continuity while ensuring employees well-being during these challenging times?

The company implemented strict safety protocols since February, for those ones who need to work in the plant ad hoc PPEs, like masks and gloves, were introduced. All the rest are working remotely. Our ERP is 100% cloud based therefore we had no major issues to adapt to the new situation.

2. What steps have you taken to ensure work from Home? How are you ensuring collaboration amongst internal teams?

We have provided the option of teleworking, fully operational, to all those employees who can work from home. Our ERP is 100% cloud based therefore we had no major issues to adapt to the new situation. Although maintaining communication skills during these times of limited physical interaction may be challenging for others, our workers had no problem to adapt to this new reality. They are used to work this way, since they manage projects involving Austria, Spain, USA, China, Brazil...etc, therefore they are used to an "omnichannel" communication.

3. What initiatives have you taken for smooth customer experience?

We are working on improving our online tools so we can maintain our strong relationship with our customers. In that way, we have developed a special online purchase channel that will be available in May.

4. What would you define as key lessons from this crisis?

Communication during these hard times has been key to us. The whole team needs to understand the goals of the company in this period, not only to survive but to thrive. They need to understand how their work contributes to the overall picture. The pandemic will eventually be under control, and we all will be remembered by how we behaved. We do need to take this opportunity to become a better company and a better employer; we need to take this challenging opportunity to make a positive difference in the world.

About Fersa Bearings:

Fersa Bearings, S.A. has more than 50 years of experience in the design, manufacture and distribution of automotive bearings worldwide. Since 2016, the company is part of Fersa Group together with the Austrian manufacturer NKE. The group has a large international presence that covers more than 100 countries and has four factories, eight logistics centers, five quality control centers and four R&D centers. Fersa Group completed 2018 with a turnover of more than 82 million euros. This year, the multinational corporation expects a turnover of more than 90 million euros.

Fersa® Bearings

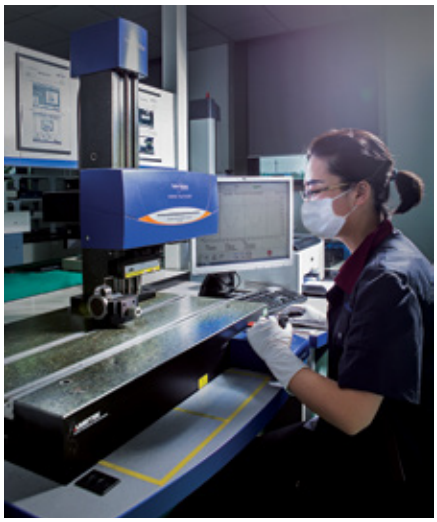
XCC Group Adapts Production to Ensure Continuity

Rong Bin Xu, General Manager of Bearing Division at XCC Group in China explains their measures to ensure the production continuity since early February 2020.

Please tell us about the initiatives taken by your company for business continuity while ensuring employees well-being during these challenging times?

As one of the leading manufacturing enterprises in China, Government approved XCC Group to resume operations in early February. We took appropriate actions to ensure that all of our employees would have a safe working environment to protect them from contracting the virus and preventing the spread of the virus. These precautions included requiring all our employees to wear masks, maintaining a 1.5 meters distance from other employees, measuring the body temperature of every employee two times a day, sterilizing all offices and production areas every four hours and establishing scheduled teleconference calls with our suppliers and our customers to discuss any deviations with the virus.

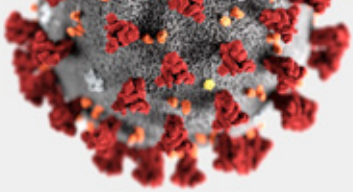
What steps have you taken to ensure Work from Home? How are you ensuring collaboration amongst internal teams?



95% of XCC Group office employees work from home utilizing OA Systems. With OA Systems, we can discuss opened topics by text message, set up team video conferences and communicate via email.

What initiatives have you taken for a smooth customer experience?

We have replaced person to person



meetings with more communications via email, phone calls, video conferencing and Wechat. Our increased use of these modes of communication have helped us to ensure our promised lead times, reduction in product rework and reduction in product expedites. Because the public logistic system has been dramatically reduced, we have increased our fleet of company vehicles to transport raw material, and finished products.

What would you define as key lessons from this crisis?

Over the years, XCC Group has strived to reduce the outsourcing of our manufacturing processes. During this crisis we learned that more in-house operations can be a tremendous benefit. We did not have to rely on other suppliers and we could react quickly during this time of uncertainty. This crisis confirmed our commitment to having more in-house manufacturing operations and it has pushed us to continue to reduce outsourcing so that we can provide our customers with better service.

In your view, what will be the impact of the pandemic on the overall business scenario and especially on your segment? What is your strategy to tackle the economic slowdown?

This pandemic will cause many companies that were not finically stable to fail. We believe that customers will be more proactive in researching and establishing relationships with companies that are manufacturing chain and financially strong.

Customers will also be more focused on working with supplier that are local to reduce lead times, risk and provide better service. This is why XCC Group is actively establishing warehouses, offices and manufacturing facilities in key locations worldwide.

TransDev Is Open For Business and Has Your Back!

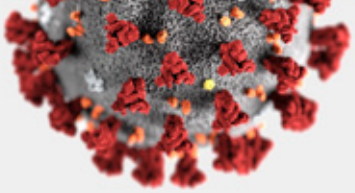
Please tell us about the initiatives taken by your company for business continuity while ensuring employees well-being during these challenging times?

It is important to bear in mind that first and foremost TransDev is both a Manufacturer and Distributor. We source motion components whilst also having a large manufacturing capacity for pulleys, gears, sprockets and belts. Our business philosophy is firmly based on utilising our strong financial position to ensure we have the stock and capabilities to support our customers. How do we do this?

- By investing in high levels of stock availability
- Maintaining multiple sources of supply
- Offering leading brands
- In-house UK manufacturing capacity
- Motion expertise

TransDev is a key player in the UK supply chain and vital to industries, such as medical, pharmaceutical and food production. The Directors of TransDev first response to the Coronavirus pandemic was to develop a detailed and phased Action Plan. This was to help ensure business continuity, minimise the possibility of Coronavirus cross contamination for staff, suppliers and customers, whilst maintaining supplies to industry. As the crisis developed we moved into more stringent phases and kept staff fully informed and also canvassed their opinions as to the alternative solutions or procedures.

To help match hygiene and distancing



measures to business areas, a simple colour code system is in continuous use. One important aspect of our approach was the fact that the TransDev business operates across multiple buildings on its Poole site. This physical separation between Sales, Manufacturing, Special Belts, Plastics and the Distribution warehouses enabled us to immediately reduce and control cross contamination potential. Where possible this has been further leveraged through splitting teams across those buildings, limiting movement between areas and via home working for many team members, either temporarily or on rotation.

This is all in addition to other measures, such as hand gel stations at all entrances, air conditioning decontamination, work station and production cell cleansing using supplied materials, wearing of protective gloves and more stringent cleaning rotas.

What steps have you taken to ensure Work from Home? How are you ensuring collaboration amongst internal teams?

Our Citrix virtual client solution has enabled seamless working wherever team members are currently based. This effectively provides all staff with access to their desktop environment as though they were in the office. All staff are also kept up to date with the measures as they develop or change. Collaboration tools such as project management software is used alongside conferencing applications where necessary.

What initiatives have you taken for a smooth customer experience?

TransDev sources components from Asia, the USA and Europe. The majority of our European belting products are manufactured in Germany. Our Purchasing department undertook an extensive review across all of our suppliers including our current stock and ordering position, adjusting stock levels where appropriate. TransDev can additionally support product shortages through its in-house Manufacturing, ensuring that customers have options when they need them. We graphically show this mix to make this important point in our blog article (see attachments) with detailed Q&A, which was shared via email and socially from the outset. We also updated our Google business profile with key information and opening times, as well as informing contacts via all email signatures.

What would you define as key lessons from this crisis?

Things move and change quickly, so have a plan that can be ramped up or down according to need. People want information and not uncertainty, so share your plans with staff, customers and suppliers. No scenarios are impossible, so consider all of the 'What if?' Accept that things will not move as quickly, happen as fast etc. Then finally, plan for what comes next as we move out of the crisis.

In your view, what will be the impact of the pandemic on the overall business scenario and especially on your segment? What is your strategy to tackle the economic slowdown?

You can read more at: www.transdev.co.uk/transdev-has-your-back/

TransDev
THE POWER IN MOTION

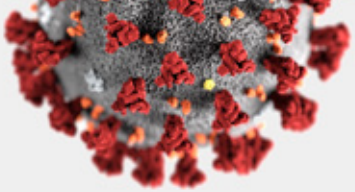
SMB Bearings COVID-19 Measures

Chris Johnson, Managing Director at SMB Bearings explaines the preventive measures that they have implemented in the company to ensure business continuity during the pandemic period.

Please tell us about the initiatives taken by your company for business continuity while ensuring employees well-being during these challenging times?

SMB have a skeleton sales team, warehouse team and relubrication team. Many staff are working remotely but we continue to offer our usual levels of service. We are shipping sales orders on time, every day while the remote sales staff and accounts staff do their jobs from the safety of home.

The few staff who come to work can easily stay 2 meters apart. Goods for collection are left in the entrance to the warehouse so there is no contact with drivers. The same happens with deliveries. We have plenty of hand-washing facilities and hand sanitizer at every workstation. We clean all door handles, bannisters and work surfaces



with sterilising spray every morning and evening. Telephones and keyboards are cleaned weekly but never shared. No visitors are allowed without prior permission and they must keep 2 metres away from any staff. Any surfaces they touch are cleaned with sanitising spray.

What steps have you taken to ensure Work from Home? How are you ensuring collaboration amongst internal teams?

All remote staff have laptops with a separate keyboard/mouse for easier working. We have a very fast internet connection so speeds are not a problem. They communicate with the office and with each other via our main sales email address but can also communicate by telephone if needed. The system is working well.

What initiatives have you taken for smooth customer experience?

Fortunately, our inventory levels are high, so we are able to supply most customers from stock. Deliveries to customers have not been badly affected. When we quote, we advise customers that deliveries may be delayed in their local area. Many customers are using couriers instead of the post for smaller packages. Most of our customers are not experiencing delays but there are some problem areas in the UK and other countries where levels of delivery staff have been reduced by illness or lockdown. Often, the illness is not COVID-19 but anyone feeling unwell is sensibly staying at home for at least a week so if a common cold spreads around a delivery company's depot, deliveries can be badly affected.

We continue to receive deliveries from our suppliers but in some cases, small air shipments from the Far East have been delayed due to lack of air-freight capacity. We notice that air-freight rates have increased from Japan by more than 100%. Courier rates have also increased and most couriers have imposed weight limits on express shipments so we may have to split one shipment into two or more sending's. We continue to import a lot of stock by air. Sea-freight does not seem to have been affected. Our general stock levels are fine but we are ordering earlier from suppliers in case of shipment delays.

What would you define as key lessons from this crisis?

We have learned that a number of things can really help to get through a disruptive situation like this. A good inventory is important for dealing with any delays from suppliers. A good cash-flow allows us to cope with any late customer payments and also helps to finance increased stock levels to protect against supply disruption. We will also continue to make sure our staff have all the necessary equipment to work from home in case this type of situation occurs again.

In your view, what will be the impact of the pandemic on the overall business scenario and especially on your segment? What is your strategy to tackle the economic slowdown?

It is difficult to guess how this will affect the bearing industry. We can imagine demand falling due to a worldwide recession (or even depression). Manufacturing has been affected in many countries as consumer demand is reduced and many business will be forced to close. After lockdowns in most countries are lifted, there may be an increase in business due to pent up demand but this should settle down and it could then take a few years to return to 2019 levels. We can only guess. We may need to adapt to lower levels of business so we are continuing to become more efficient and reduce unnecessary costs. We will continue to re-invest in the business to make sure our inventory continues to meet our customers' needs.

SEPTEMBER - DECEMBER

2020
EVENTS
EXHIBITIONS
CONFERENCES AGENDA

2020 AGENDA

EVENTS, EXHIBITIONS & CONFERENCES AGENDA

**check the possible date changes at the organizers websites PRIOR to plan any visit*

SEPTEMBER

MINING & CONSTRUCTION

CTT

08 Sep - 11 Sep 2020
Moscow / Russia

Part of BAUMA exhibition network

bauma-ctt.ru/en/

AUTOMOTIVE

AUTOMECHANIKA FRANKFURT

08 Sep - 12 Sep 2020
Frankfurt / Germany

International automotive parts exhibition

automechanika.messefrankfurt.com/frankfurt/en/planning-preparation/exhibitors/exhibitor-brochure.html

PAPER

ICE SOUTH EAST ASIA

09 Sep - 11 Sep 2020
Bangkok / Thailand

International paper converting fair

www.neventum.com/tradeshows/ice-south-east-asia

MATERIALS HANDLING

PROPAK VIETNAM

09 Sep - 11 Sep 2020
Ho Chi Minh / Vietnam

Processing, packaging, handling machinery

www.propakvietnam.com

MRO

IMVAC / CBM CONNECT

14 Sep - 17 Sep 2020
Indianapolis / USA

Condition monitoring and relibaility professionals conference & exhibition

www.thecbmconference.com

RECOMMENDED Bearing NEWS

MANUFACTURING

IMTS

14 Sep - 19 Sep 2020
Chicago / USA

International Manufacturing Technology Show

www.imts.com

RECOMMENDED Bearing EXPO & Conference

MOTION & DRIVES

IAMD USA

14 Sep - 19 Sep 2020
Chicago / USA

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RECOMMENDED Bearing EXPO & Conference

BEARINGEXPO

BEARING CONFERENCE

14 Sep - 19 Sep 2020
Chicago / USA

Bearing industry conference with commercial and technical topics

www.bearing-expo.com/events

RECOMMENDED Bearing EXPO & Conference

MATERIALS HANDLING

SIL

15 Sep - 17 Sep 2020
Barcelona / Spain

Exhibition for logistics and material handling

www.silbcn.com

MACHINERY

TURBOMACHINERY & PUMP SYMPOSIA

15 Sep - 17 Sep 2020
Houston / USA

Turbomachinery & pump symponia

tps.tamu.edu

METAL

AMB

15 Sep - 19 Sep 2020
Stuttgart / Germany

International exhibition for metal working

www.messe-stuttgart.de/amb/en

MACHINE TOOLS

MWCS

15 Sep - 19 Sep 2020
Shanghai / China

Metalworking and CNC Machine Tool Show

www.metalworkingchina.com

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- Receive alarms when your bearings need lubrication
- Start a lubrication program

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2020 AGENDA

EVENTS, EXHIBITIONS & CONFERENCES AGENDA

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SEPTEMBER

AUTOMATION

IAS

15 Sep - 19 Sep 2020
Shanghai / China

Largest industrial automation show of China

www.industrial-automation-show.com

RECOMMENDED Bearing NEWS

CONSTRUCTION

KAZCOMAK

16 Sep - 18 Sep 2020
Almaty / Kazakhstan

Kazakhstan road and heavy construction machinery exhibition

www.kazcomak.kz

RECOMMENDED Bearing NEWS

MINING

MINING WORLD CENTRAL ASIA

16 Sep - 18 Sep 2020
Almaty / Kazakhstan

Central Asian mining exploration & mining equipment exhibition

www.miningworld.kz

RECOMMENDED Bearing NEWS

MATERIALS HANDLING

CEMAT RUSSIA

22 Sep - 24 Sep 2020
Moscow / Russia

International Exhibition for materials handling, warehousing equipment and logistics

www.cemat-russia.ru

AGRICULTURE

AGROTECH

22 Sep - 24 Sep 2020
Kielce / Poland

Agriculture machinery fair

www.targikielce.pl/en

AUTOMATION

AUTOMATION EXPO

22 Sep - 25 Sep 2020
Mumbai / India

India's leading automation and instrumentation exhibition

www.automationindiaexpo.com

AUTOMATION

SPS IPC DRIVES

28 Sep - 30 Sep 2020
Parma / Italy

Electric automation - systems and components

www.spsitalia.it

MATERIALS HANDLING

POWTECH

29 Sep - 01 Oct 2020
Nuremberg / Germany

Trade fair for processing, analysis, and handling of powder and bulk solids.

www.powtech.de

MANUFACTURING

PPMA

29 Sep - 01 Oct 2020
Birmingham / UK

Trade show for processing and packaging machinery showcases

www.ppmashow.co.uk

OCTOBER

TEXTILE MACHINERY

TECHTEXTIL NORTH AMERICA

01 Oct - 03 Oct 2020
Atlanta / USA

Technical textile industry fair

www.techtextil-northamerica.us.messefrankfurt.com

ENERGY

EPOCH 2020

05 Oct - 06 Otc 2020
London / UK

Exploration and offshore production congress hub

www.oilepoch.com

AUTOMATION

MOTEK

05 Oct - 08 Otc 2020
Stuttgart / Germany

International trade fair for automation in production and assembly

www.motek-messe.de

2020 AGENDA

EVENTS, EXHIBITIONS & CONFERENCES AGENDA

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OCTOBER

GENERAL INDUSTRY

MSV

05 Oct - 09 Otc 2020
Brno / Czech Republic

International engineering
fair of Czech Republic

www.bvv.cz/en/msv

FOOD & BEVERAGE

AGROPRODMASH

05 Oct - 09 Otc 2020
Moscow / Russia

Machine & equipment for food
and beverage industry

www.agroprodmash-expo.ru

MAINTENANCE

MAINTENANCE ANTWERP

07 Oct - 08 Oct 2020
Antwerp / Belgium

Maintenance trade show, a boost
for the maintenance industry

www.maintenance-expo.be/en

FOOD & BEVERAGE

FISTAL TECNOLOGIA

07 Oct - 10 Oct 2020
Sao Paulo / Brazil

Food and beverage machinery
& processing event

www.fispaltecnologia.com.br

MANUFACTURING

METALEX

08 Oct - 10 Oct 2020
Ho Chi Minh / Vietnam

Metalworking, components
and subcontracting

www.metalexvietnam.com

RAW MATERIAL

COALTRANS CHINA

14 Oct - 16 Oct 2020
Shanghai / China

Coaltrans Conferences

www.coaltrans.com

AGRICULTURE

AGRITECHNICA ASIA

14 Oct - 16 Oct 2020
Bangkok / Thailand

The International exhibition for
agriculture machinery and engineering

www.agritechnica-asia.com

RECOMMENDED Bearing NEWS

AUTOMOTIVE

AUTOMECHANIKA DUBAI

19 Oct - 21 Oct 2020
Dubai / UAE

International automotive parts exhibition

automechanika-dubai.ae.messefrankfurt.com/dubai/en.html

MACHINERY

LESDREVMASH

19 Oct - 22 Oct 2020
Moscow / Russia

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

www.lesdrevmash-expo.ru

BEARING

BEARING WORLD

20 Oct - 21 Oct 2020
Hannover / Germany

International academic
bearing conference

bearingworld.org

RECOMMENDED Bearing EXPO & Conference

GENETRAL INDUSTRY

INDUSTRIAL TRANSFORMATION ASIA PACIFIC

20 Oct - 22 Oct 2020
Singapore / Singapore

Industrial transformation show

www.industrial-transformation.com

RECOMMENDED Bearing NEWS

MINING

MININGWORLD RUSSIA

20 Oct - 22 Oct 2020
Moscow / Russia

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

www.miningworld.ru

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2020 AGENDA

EVENTS, EXHIBITIONS & CONFERENCES AGENDA

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OCTOBER

MINING

MINING MYANMAR

21 Oct - 23 Oct 2020
Yangon / Myanmar

Minreal mining machinery & equipment

www.cpmmyanmar.com

PACKAGING

EURASIA PACKAGING

21 Oct - 24 Oct 2020
Istanbul / Turkey

International packaging machinery fair

www.packagingfair.com

MOTION & DRIVES

PTDA INDUSTRY SUMMIT

21 Oct - 24 Oct 2020
Atlanta / USA

Annual event of the Power Transmission Distributors Association

www.ptda.org

RECOMMENDED Bearing EXPO & Conference

MARINE

MARINTEC SOUTH AMERICA

27 Oct - 29 Oct 2020
Rio de Janeiro / Brazil

Maritieme maintenance and shipbuilding

www.marintecsa.com.br

PUMPS

PCV EXPO

27 Oct - 29 Oct 2020
Moscow / Russia

International exhibition for pumps, compressors, valves and actuators

www.pcvexpo.ru

STEEL

EUROBLECH

27 Oct - 30 Oct 2020
Hanover / Germany

International Sheet Metal Working Technology exhibition

www.euroblech.com/2018/english

MANUFACTURING

MECSPE

29 Oct - 31 Oct 2020
Parma / Italy

Fair for the manufacturing industry

www.mecspe.com

RECOMMENDED Bearing NEWS

NOVEMBER

MATERIALS HANDLING

CEMAT ASIA

03 Nov - 06 Nov 2020
Shanghai / China

Material handling, automation, transport/logistics fair

www.cemat-asia.com

MACHINE TOOLS

ITM POLSKA

03 Nov - 06 Nov 2020
Poznan / Poland

Machine tools and metal working exhibition

www.itm-polska.pl

POWER TRANSMISSION

PTC ASIA

03 Nov - 06 Nov 2020
Shanghai / China

Power transmission and control exhibition

www.ptc-asia.com

RECOMMENDED Bearing EXPO & Conference

2020 AGENDA

EVENTS, EXHIBITIONS & CONFERENCES AGENDA

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NOVEMBER

MINING & CONSTRUCTION

BAUMA CONEXPO INDIA
03 Nov - 06 Nov 2020
New Delhi / India

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

www.bcindia.com/en

RECOMMENDED Bearing NEWS

GRINDING

GRINDTEC 2020
10 Nov - 13 Nov 2020
Augsburg / Germany

The world's leading trade fair for grinding technology

www.grindtec.de/en/

MACHINERY

ANKIROS 2020
12 Nov - 14 Nov 2020
Istanbul / Turkey

International Iron – Steel and Foundry Technology, Machinery and Products Trade Fair

www.ankiros.com/home-en

MINING & CONSTRUCTION

BAUMA CHINA
24 Nov - 27 Nov 2020
Shanghai / China

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

www.bauma-china.com/en

RECOMMENDED Bearing NEWS

PAPER

PAPEREX SOUTH INDIA
26 Nov - 28 Nov 2020
Chennai / India

Paper Industry Trade Fair

southindia.paperex.in/en-GB

TRIBOLOGY

K-TRIB 2020
29 Nov - 02 Dec 2020
Seoul / Korea

2nd Korea-Tribology International Symposium

k-trib2020.org

DECEMBER

LUBRICATION

LUBMAT
01 Dec - 02 Dec 2020
Bilbao / Spain

Lubrication, tribology and condition monitoring technology conference and exhibition

www.lubmat.org/en/home

BEARINGEXPO

BEARING 2020
09 Dec - 12 Dec 2020
Shanghai /China

China International Bearing Industrial Exhibition

www.bearing-expo.com/shanghai2020

RECOMMENDED Bearing EXPO & Conference

WIND ENERGY

WIND ENERGY
01 Dec - 04 Dec 2020
Hamburg / Germany

Wind Energy expo

www.windenergyhamburg.com/en

MAINTENANCE

MAINTENANCE
01 Dec - 03 Dec 2020
Gorinchem / Netherlands

Technologies for industrial maintenance and asset management

www.maintenance-gorinchem.com/en

TUBE

TUBE
07 Dec - 11 Dec 2020
Dusseldorf / Germany

International Tube and Pipe Trade Fair

www.tube-tradefair.com

AUTOMATION

AUTOMATICA
08 Dec - 11 Dec 2020
Munich / Germany

Smart automation and robotics exhibition

www.automatica-munich.com

TRIBOLOGY

TURKEYTRIB
17 Dec - 19 Dec 2020
Istanbul / Turkey

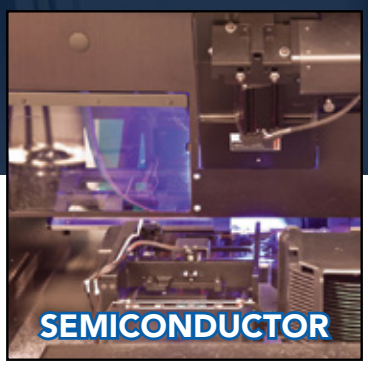
International Conference on Tribology

www.turkeytribconference.com/index.php/en/

Like any other business, the manufacturing sector also has been drawing a lot of attention from first generation entrepreneurs who form the bulk of the MSME segment in India today. This also leads to the most pertinent question as to what are the keys things that an entrepreneur should concentrate upon, before starting the unit.

1. **Market research:** Do a thorough *market research* to understand which is the best industry to setup in your location and budget and identify your key USPs to implement the *manufacturing business idea*. You could either depend primarily on secondary market research or hire professionals to do a complete on ground analysis and submit a complete project report. There are various types of research reports such as feasibility analysis report, preliminary market research report, Techno Economic feasibility report(TEFR) and Detailed Project report (DPR) which cover different aspects of the project proposal.
2. **Site Selection/Land acquisition:** This is mostly done by the industry/ entrepreneurs in consultation with local industrial boards and land acquisition tribunals. But some considerations to keep in mind are food processing plants should not be set up next to chemical units, textile units, abattoirs or poultry units. Similarly there are a few other restrictions based on the type of industry selected.
3. **Plan your finances/Funding:** once you have zeroed on the right *manufacturing business idea*, you should get the best project consultants to help you sort the finances. Most of the MSMEs can get loans at preferential rates and also there are a lot of govt. Schemes from SIDBI etc, that a good industrial consultant can introduce to you.
4. **Approval/Clearance/Certifications:** It is clearly understood that a very well qualified consultant who can liaison with the government and get the required licenses, approvals and certification will not only save money but can also help with the requirements for exports and international markets.
5. **Start BD/Sales activity:** From past experience we have seen that it is imperative that the BD and Sales activity is started as soon as the TEFR is completed as this gives more time to cater to the changing market demands. We have handled projects across different domains pertaining to Sales and BD activities within India and in international markets. The consultant shall also help in getting through entry barriers for new products
6. **Shop layout formation/ Building erection:** On many occasions, the industry looks for capable designers who can suggest best methodology in formulating the shop floor design and erection of building and equipments in the setup phase as reworking the shop floor design later will lead to loss of time and manpower
7. **Plant setup and machinery procurement:** Since the industry layout design and actual implementation requires a lot of technical expertise, we suggest to use the best industrial consultant to help you with this. This will ensure that the manufacturing industry best practices are adhered to from the start itself. Procurement is also a tricky affair and a good manufacturing consultant can guide you in the best way to get the machineries at the best price from domestic or international markets. Most often people rely on Chinese imports but with heavy import duties on imported goods and subsidies for buying from a Make in India entity etc, many times local machines end up being cost effective.
8. **Raw material and human resource:** Raw material procurement is another concern where it is estimated that there could be a difference of 16-19% of the total cost of production based on where the raw material is procured. Hiring the right talent as well plays an important role as most of the times, getting access to the right local talent pool is very crucial
9. **Load production, prototyping and Quality checks:** A key aspect that most new entrepreneurs overlook while setting up of a new plant is the importance of testing and to have very good experts who can help the industry to complete the prototyping and testing phase. Typically industries catering to food, pharma and chemicals have to test their finished goods and get certifications/ quality checks which are very stringent.
10. **Supply chain management:** getting the right market entry may give the best sales but without a good logistics and delivery plan, order execution will be affected which in turn will affect customer satisfaction. Many a times a good distribution and SCM is required to get access to customers especially in B2C and FMCG goods. Also in the machinery and equipment sector, since none of the products are built to last to eternity, a good company always acknowledges that product failures are part of the deal and hence ensures a very robust process to make sure that a highly skilled customer service team shall be responsible for after sales service.

Author: *Guruprasad Bangle, CTO at SolutionBuggy.com*



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

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www.slimsectionbearings.com

2020 CHINA INTERNATIONAL BEARING INDUSTRY EXHIBITION

BEARING 2020

DECEMBER 09-12 2020

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www.bearing-expo.com

CHINA INTERNATIONAL BEARING INDUSTRY EXHIBITION 2020

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

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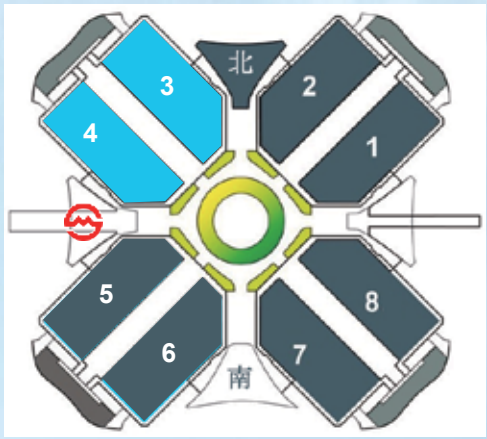
More opportunities for entering the Chinese bearing market, supplier development, and finding new business partners can be realized for International delegates during the B2B program sessions and at BearingEXPO International pavilion.

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

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



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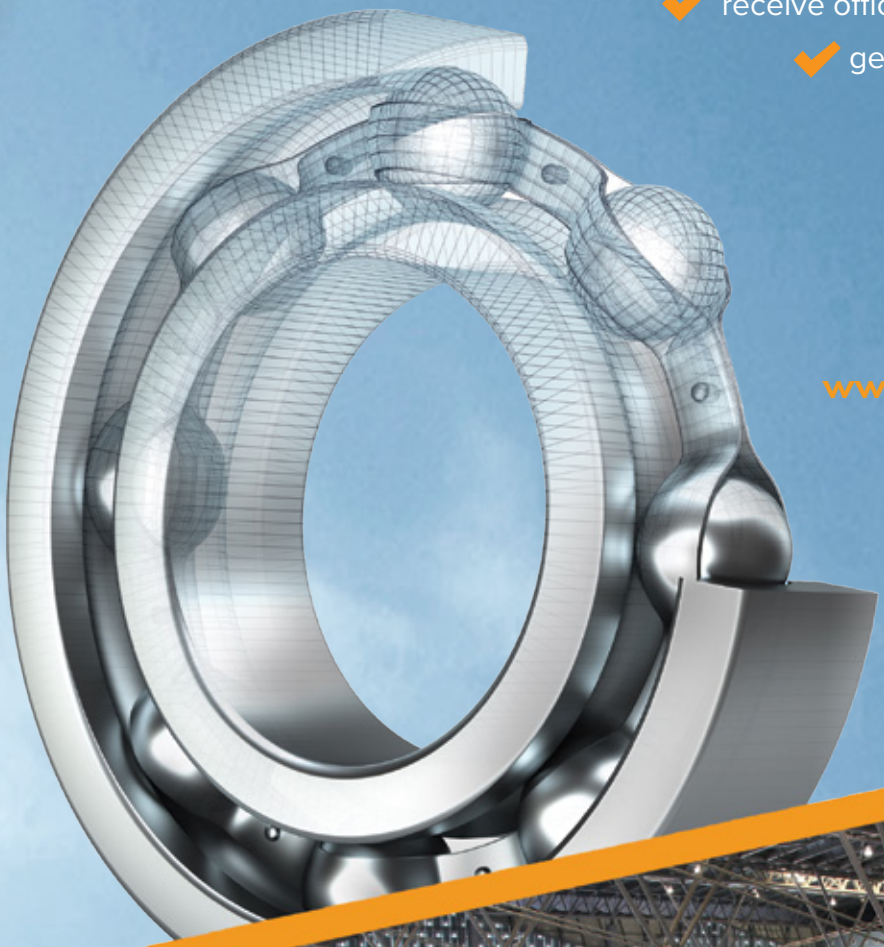
- join the B2B meeting program



Contact Us: info@bearing-expo.com

www.bearing-expo.com/bearing2020

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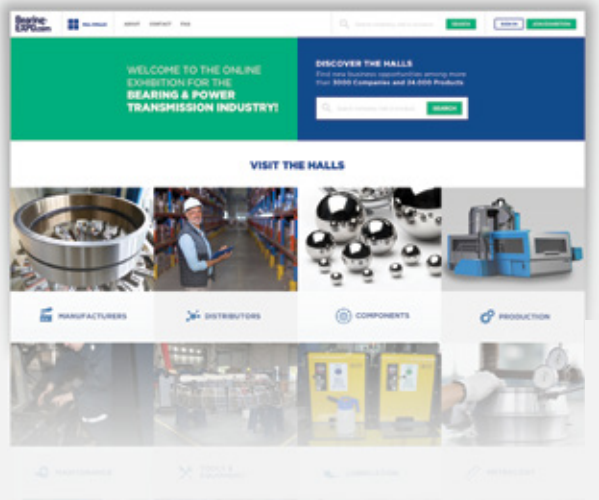
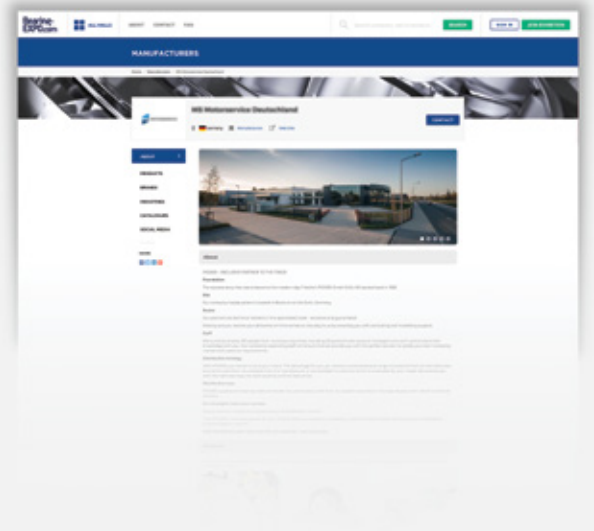


HOMEPAGE

Access ALL BearingEXPO, BearingCLOUD, BearingNEWS and BearingDATA services from one single page!

HALL PAGES

Search and Find easily Product Categories



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