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Bearing NEWS

BEARING INDUSTRY MAGAZINE

Understanding **vertical shaft mounting** for bearings

How bearing customers can respond to China's changing dynamics

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The Bearing Industry Forges Ahead

Consistent with traditional BearingNews' objectives, this new edition offers a variety of current industry insights, as well as prospective information to help drive the global bearing community forward. Included is a first look at the most important events of 2022. See which global events are taking place in the near future, and explore how companies can maximize their B2B success through new hybrid opportunities.

Next, as many as one in six bearings may fail because of inadvertent damage sustained during mounting. Industry leader, SKF, helps readers understand the vertical shaft mounting procedure and how to overcome potential problems. Later, ZEN shares its latest success in the advancement of corrosion resistant bearings that are proven to outlast standard stainless steel. Read how the eco-friendly, food grade, anti-rust coated bearings are extending bearing life, and improving cost efficiency.

Finally, as Covid-19 continues to affect supply chains around the world, the bearing industry is facing unprecedented disruption, and suppliers, distributors, and end customers need to prepare for change. Discover new perspectives on current market dynamics, responses from manufacturers, and scenarios for the future.

What's Rolling..

What's rolling further in the bearing industry. Learn details about key companies and trends, announcements, and product developments, specifically within the areas of lubrication, software innovation, online monitoring solutions, failure prevention techniques, and other advanced bearing technologies. All this and more can be found in this new issue of BearingNews Magazine.

I hope that you will enjoy it!

Kenan M. Özcan
Editor in Chief

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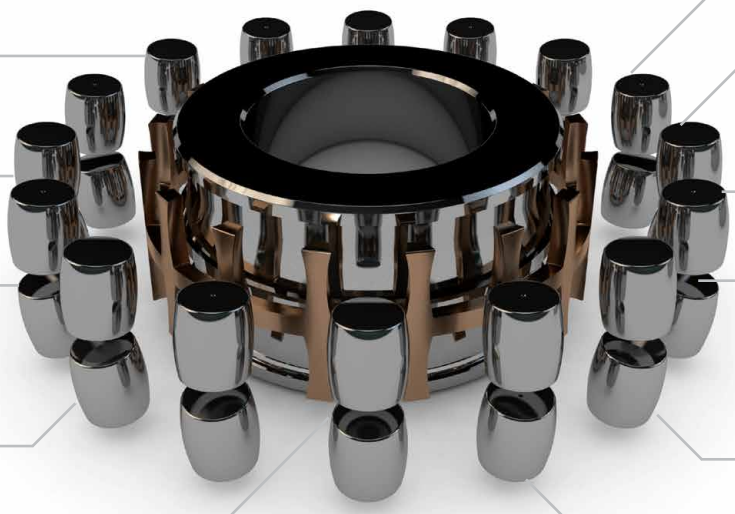

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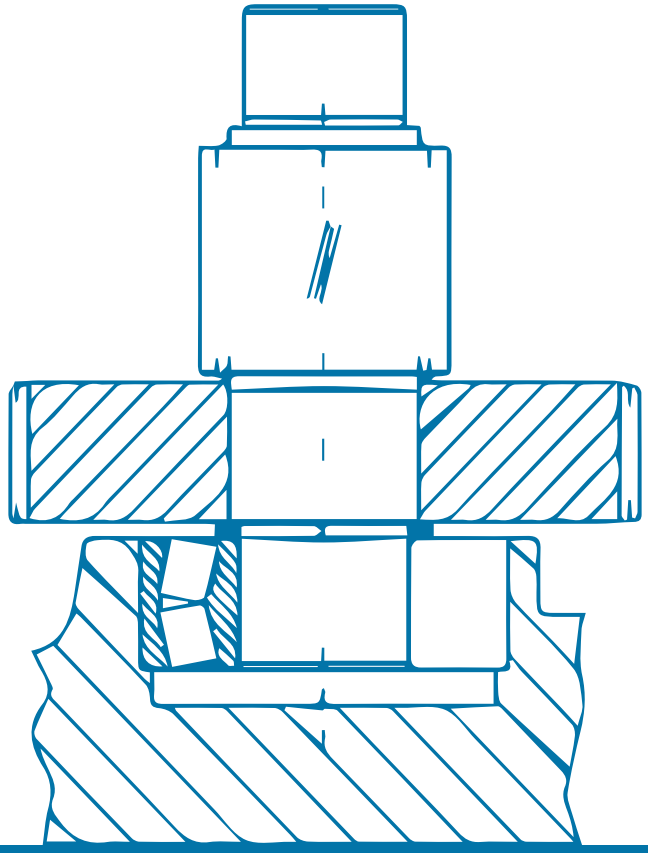
—Fig. 1: Vertical shaft mounting.



Understanding **vertical shaft mounting** *for bearings*

When mounting bearings, one of the most common procedures is to use a vertical shaft mounting position and work with heat. Considering all common mounting methods, as many as one in six bearings may fail because of inadvertent damage sustained during mounting. Commonly used as is, the vertical shaft procedure presents some lesser-known risks. This article discusses potential problems and how to overcome them.

Hot mounting of bearings and other components such as couplings and gears has proven to be very practical. The heating, mounting and shrinking of components is well understood, and induction heating is both fast and cost-effective. Handling components in a vertical position is relatively easy: centring of components mounted vertically is straightforward, and gravity helps to keep a component correctly pressed against the abutment when it cools and shrinks.

It is important that mounting after heating is accomplished rapidly to avoid temperature losses that may cause the component to become stuck in the wrong position or cause other damage.

Options for heating and mounting

There are a number of different options for the mounting procedure using heat.

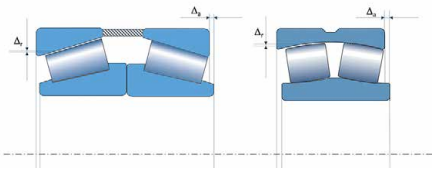
Common ones include:

- warm bearing fitted on a room-temperature shaft seat;
- room-temperature shaft placed in a warm bearing;
- room-temperature bearing placed in a warm housing; and
- warm housing fitted on a room-temperature shaft-mounted bearing.

However, bearings behave differently than other components during vertical mounting. All the options will initiate an increase in clearance in the bearing followed by a decrease during the various heating and cooling cycles. Bearings have a relationship between the axial and the radial clearance that is defined by the contact angle. In double-row bearings this is given by the equation:

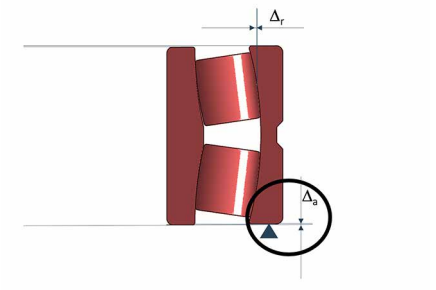
$\Delta_a = 2.3 \times Yo \times \Delta_r$ (Δ_a is typically 5 – 15 times the radial clearance).

So a small radial movement (i.e., a change of clearance) results in a large axial movement.

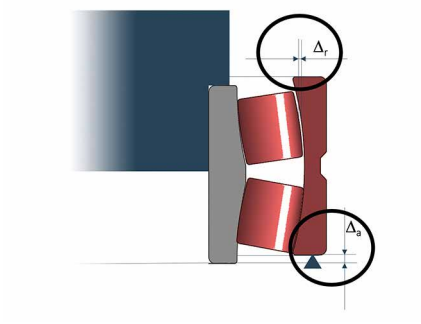


— Fig. 2: Bearings have a relationship between radial and axial clearance.

On a vertical shaft a bearing will undergo axial motion when there is a change in radial clearance. This can be shown (fig. 3) by first considering a warm bearing (shown in red). Both rings are at the same temperature, and there is a small bearing clearance. The bearing is supported on the outer ring. The inner ring is slightly displaced downwards. When a room-temperature shaft is inserted and lowered to the ring, the inner ring becomes cooled by the shaft as indicated by the grey colour (fig. 4). The inner ring becomes smaller, hence increasing the bearing clearance, and the inner ring is now axially displaced downwards, thanks to the enlarged axial clearance.

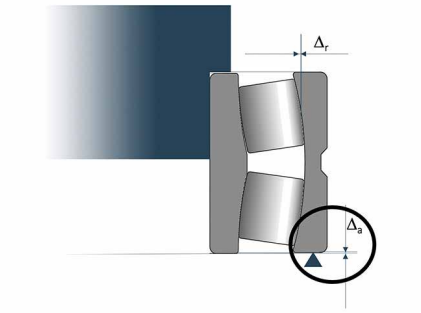


— Fig. 3: On a vertical shaft, radial clearance change results in axial motion.

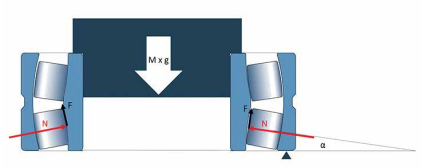


— SFig. 4: The inner ring is slightly displaced downwards.

Eventually the outer ring reaches room temperature (fig. 5) and matches the temperature of the inner ring, resulting in a small bearing clearance. However, the inner ring has now been forced upwards since the clearance was reduced.
While this is interesting from an applied-physics perspective, what are its practical implications? Firstly, we have to consider the movements and forces inside the bearing (fig. 6).
Initially the inner ring moves downwards



— Fig. 5: Sometime later, the outer ring is also at room-temperature.

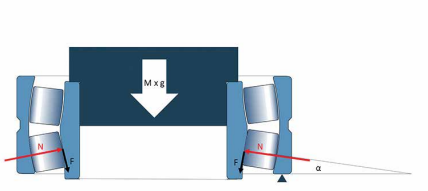


— Fig. 6: Movements and forces inside the bearing. First sequence: Inner ring moves downwards.

and the vertical load (M x g) is carried by the lower row of the bearing. There are roller loads (shown in red) and frictional loads (shown in black). There is also a contact angle, α and a number of rollers, Z.

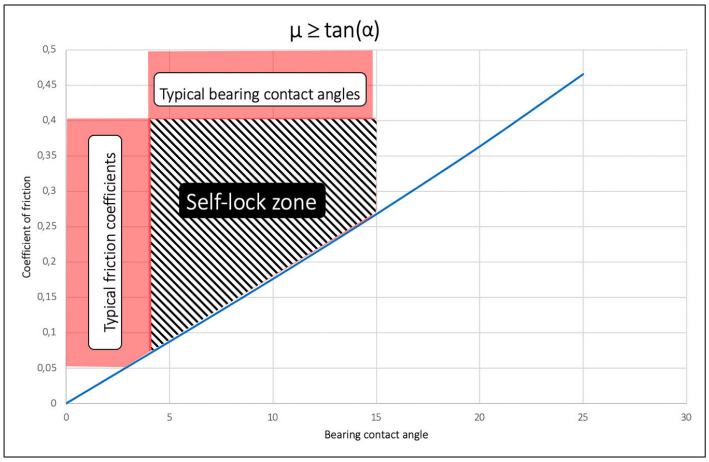
Using the equation:
$N=(M \times g)/Z(\sin(\alpha)+\mu \times \cos(\alpha))$ we see that friction reduces the roller load.

However, in the second sequence, when the inner ring moves upwards, the vertical load (M x g) is now carried by the lower row. Hence the equation becomes $N=(M \times g)/Z(\sin(\alpha)-\mu \times \cos(\alpha))$ and the friction is reversed (fig. 7).
If $\sin(\alpha) = \mu \times \cos(\alpha)$, the upwards motion will create very large roller loads, and the practical consequence is a risk of self-locking or smearing.



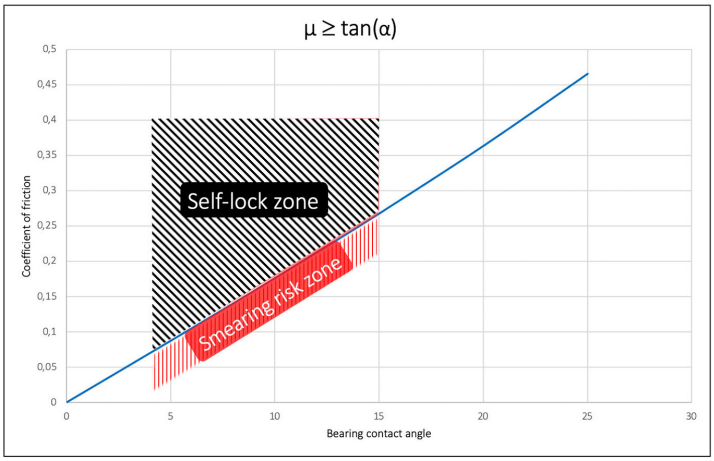
— Fig. 7: Second sequence: Inner ring moves upwards.

There are combinations of coefficients of friction and contact angles that can result in self-locking (fig. 8). From this figure indications for self-locking are when contact angles are 4 to 15 degrees while the coefficient of friction ranges from 0.05 to 0.4. The potential damage associated with self-locking is plastic deformation that results in noise, vibration and early spalling. Furthermore, outside the self-lock zone there is an additional zone where smearing may occur (fig. 9). In this case friction is sufficient to stop the initial motion but not to resist motion at a higher load. While large contact forces develop, the roller eventually moves axially. In this scenario the damages associated with axial motion at high contact force are burnishing or, in the worst case, smearing.



— Fig. 8: Combinations of friction and contact angles that self-lock.

Practical outcomes



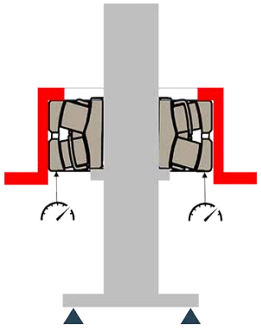
— Fig. 9: Combinations of friction and contact angles that almost self-lock.

From this, two potentially harmful outcomes have been identified for both self-locking and “almost self-locking”, which are often seen in machines but rarely considered as directly related to mounting procedures. Fig. 10 shows some of the common damages to bearings.

— Fig. 10: Potentially harmful situations. Surface distress/wear despite good lubrication.

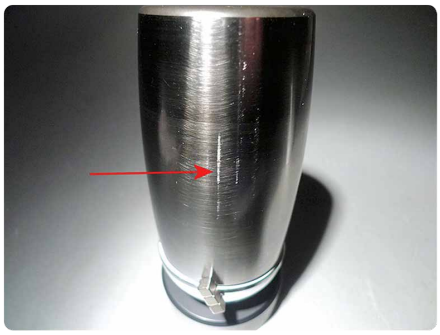
In the case of a wind turbine main shaft, which is standing on the floor, the bearing is warmed and mounted from above. The bearing inner ring then rests on an abutment, and the bearing cools while the housing is warmed. The warmed housing is then mounted from above and rests on the outer ring.

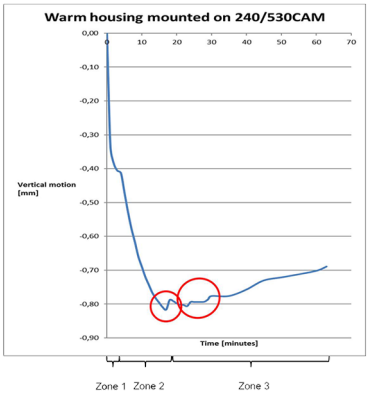
Measurements are taken during the first hour of temperature equalization (fig. 11).



—Fig. 11: Wind turbine main shaft standing on the floor.

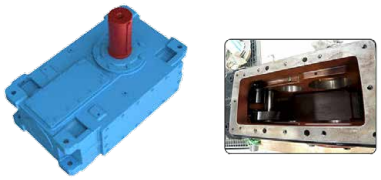
In this diagram there are three different zones. In Zone 1 the warm housing is placed on the outer ring. The outer ring with the housing moves downwards due to the load, causing radial deflection that causes axial motion. In Zone 2 the warm housing heats the outer ring, which expands. Clearance increases. Now the outer ring with the housing moves downwards as long as the temperature of the outer ring increases. In Zone 3 the outer ring is no longer warming, and as the housing cools further, the outer ring moves upwards, since the clearance is reduced. The motion sequence includes an example of stick-slip behaviour (marked by red circles). A mounting inspection was carried out, and there was clear evidence of surface burnishing (fig. 12).





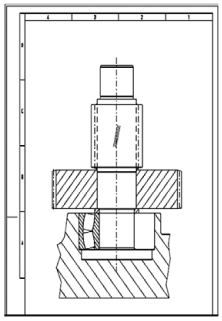
— *Fig. 12: Inspection of roller after completed mounting/cooling sequence. Surface burnishing.*

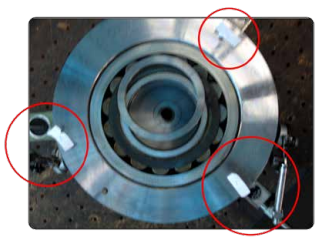
In a second case, ring measurements were carried out in an industrial gearbox application where the shaft and gear are mounted vertically. Firstly, the bearing is placed in the housing and a distance ring is positioned on the inner ring. Then a warmed gear is placed on top of the distance ring/inner ring Finally, a cooled shaft is inserted through the gear and into the inner ring. In this case the axial motion is measured. As this is a monobloc design, the casing is turned sideways (fig. 13).



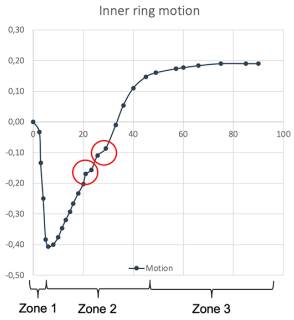
— *Fig. 13: Monobloc design with the casing turned sideways.*

In this instance there were two mounting sequences. In mounting sequence 1, the room-temperature casing rests on a mounting stand and the room-temperature bearing is mounted sideways into the casing and then down. The bearing outer ring rests in the casing and finally a room-temperature distance ring is placed on top of the inner ring. For mounting sequence 2, while the room-temperature casing with the bearing is still resting on the mounting stand, a warm gear is mounted sideways into the casing and then down. The gear now rests on the distance ring and in turn on the inner ring. Then a very cold shaft is mounted from above, through the gear and the distance ring and into the inner ring. Measurements were taken during the first 90 minutes of temperature equalization. A dummy housing was used to facilitate the measurements (fig. 14).





— *Fig. 14: Shaft cooling.*



— *Fig. 15: Measurements of motion during cooling.*

Once again three different zones can be identified. In Zone 1 the inner ring is cooled by the very cold shaft. Clearance then increases. The inner ring with the shaft and gear moves axially downwards. In Zone 2 the warm gear has heated the shaft, and the warm shaft now warms the inner ring. The inner ring then expands. Clearance decreases. The inner ring with the shaft and gear moves upwards. Zone 3 indicates that real motion between rollers and raceway has probably stopped. It is likely that the measurements have included temperature-related dimensional changes of the complete stand. The measurements highlight that there may be two “stick-slip” occasions (marked by red circles).

In this case, the appearance of the lower inner ring raceway in the test bearing was studied after dismounting the test bearing. Thin axially oriented marks were visible.

However, not all roller contacts left such marks. Under the microscope, the thin axially oriented marks showed to partially consist of smeared material.

This damage will copy due to the overrolling and develop into surface distress/wear.

To avoid mounting-initiated damages there are three factors to work on. Firstly, it is important to reduce or eliminate the bearing load during the mounting sequence. The logical path is to avoid vertical mounting and/or to counteract gravity. If this is not possible, mount vertically, but then tilt horizontally to reduce the axial loading during cooling. Try to release friction by rotating to release and avoid motion by centring axially during cooling. Above all, awareness is key, as being aware of the potential damage during mounting helps reduce risk.

SKF has considerable strengths in bearing mounting, and its BearingAssist app can help with mounting issues. SKF can also support with training fitters on best practice as well as help to review machine design and bearing mounting procedures for all types of equipment.

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Liebherr reaches a new milestone in tunnelling

by producing largest TBM main bearing of its kind

- Liebherr-Components Biberach GmbH has produced one of the largest main bearing for tunnel boring machines to date
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- With main bearings for constantly growing tunnel boring machines, Liebherr takes a step towards meeting the increasing demand for tunnel construction systems

—When two become one: The retaining and the support rings are precisely placed on top of each other.

With its main bearing for Shanghai Tunnel Engineering (STEC), a Chinese system provider of tunnel boring machines (TBMs), Liebherr has reached the next dimension in tunnel construction. With the diameter of almost eight metres and the weight of 44 tons, the roller bearing is a real heavyweight to be used in one of the largest tunnel boring machines. At the same time, the bearing is the largest TBM main bearing of its kind produced by Liebherr to date.

— The finishing touch: The slewing bearing is preserved, so that it safely reaches China.

When a main bearing weighs as much as 44 small cars at once, it is expected to be able to do a lot. Used in the cutter head of a TBM, it helps to bore a tunnel about the height of a six-storey building. This is possible due to its double rollers in the bearing track, an extremely precise internal gearing, as well as due to 20 pinions, that drive the bearing on the inner ring.

And that's not the end of it. In addition to the main bearing, Liebherr also manufactures the erector bearing for the said tunnel-boring machine. With a diameter of 7.3 metres and a weight of 5.7 tons, it may not seem quite as big in comparison, but it still has an important function in tunnel construction. It sits behind the cutter head and ensures that precast concrete elements are placed all around the wall during tunnelling. The concrete elements primarily have the task of securing the tunnel. In the second step, these concrete elements support the TBM, when moving forward.

With a height of 15.5 metres, the eight-kilometre tunnel in the city of Foshan in the south of China will ensure that vehicles can travel back and forth in three lanes on two superimposed roadways. In more and more cities, the infrastructure is being newly developed and expanded. Therefore, the demand for subway construction or road tunnels is growing worldwide. Also tunnel systems for mining, hydro power, as well as supply and disposal systems are currently in great demand, showing strong growth. For Liebherr, the production of the TBM main bearing is hence a step in the right direction.

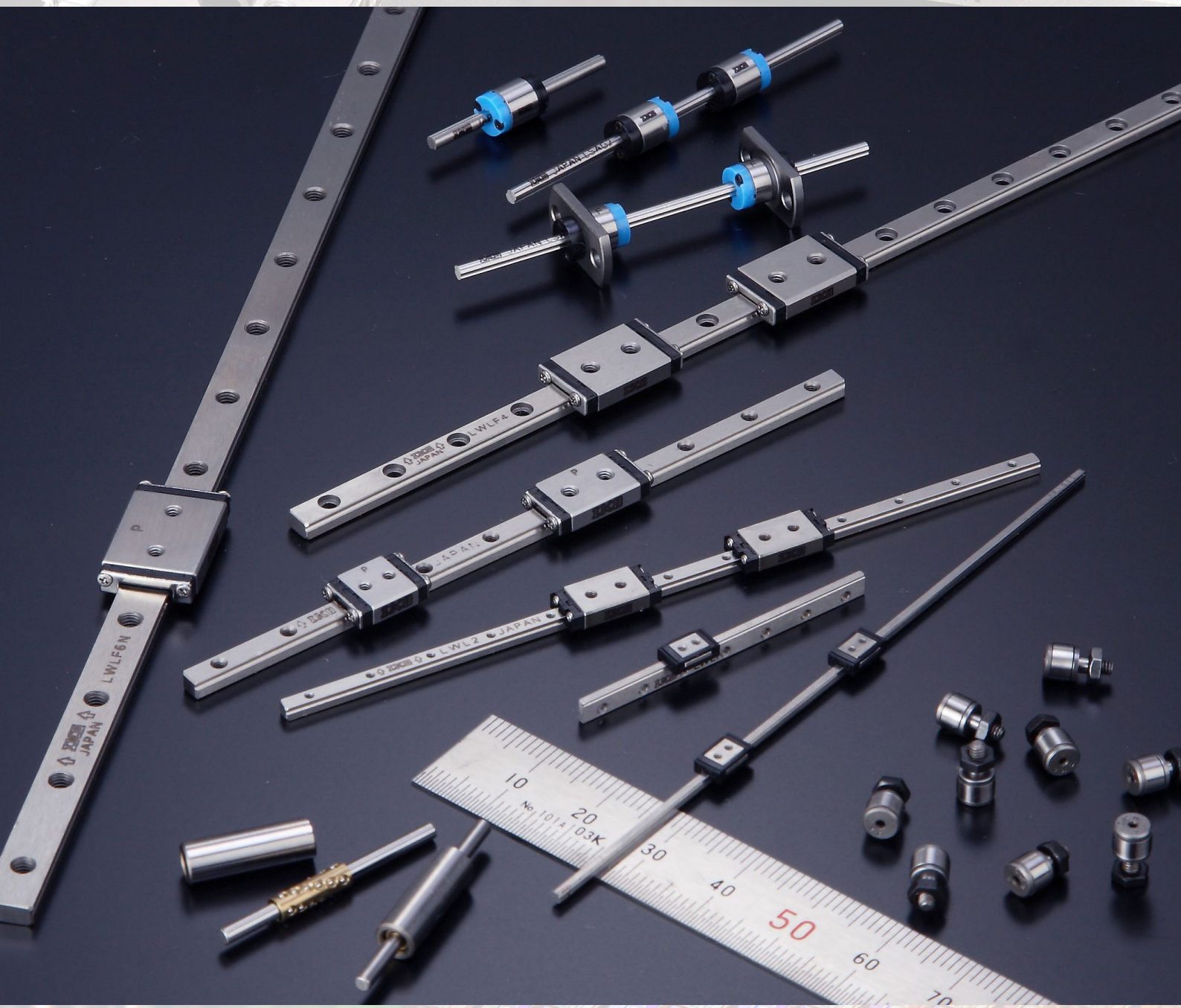
Liebherr has already completed several projects with the STEC company. With this assignment, however, Liebherr-Components contributes to the success of the major project.

About Liebherr-Components AG

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

About the Liebherr Group

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



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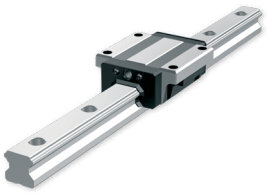

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Investment in quality control of engineered bearings helps green energy initiative

The Dudley, UK factory of **The Timken Company** supplies the engineered bearings it manufactures into a multitude of industries including mining, food and beverage, pulp and paper, cement, marine and waste water. Recently there has been a significant increase in demand for larger bearings up to 1,200 mm in diameter for use in the construction of wind turbines, which promises exponential growth in the coming years as countries across the globe work towards meeting their green energy targets.

In May 2021, to enable the company to inspect these larger bearings, it purchased an AlteraM 15.12.10 ceramic bridge coordinate measuring machine (CMM) with axis travels of 1,500 x 1,200 x 1,000 mm manufactured by **LK Metrology**, Castle Donington. Assisting further in Timken's quality control department is a Mitutoyo CMM capable of measuring ball and roller bearings with bores up to 800 mm in diameter. This machine was upgraded at the same time by LK with a new controller and identical CAMIO 2021 software for measurement, programming, analysis and reporting so that inspectors are able to swap programs conveniently between both machines.

Dozens of high precision geometrical features need to be checked on each bearing to ensure that flatness, circularity, radial run-out and track width meet specified tolerances, some of which are within ± 6 µm. This is achieved quickly, repeatably and automatically on the CMMs at Dudley in computer-controlled cycle times of around 10 minutes.

William Hayes, Quality Improvement Engineer at the Dudley factory commented, "We selected LK Metrology to provide the new inspection facility, as it was the only potential supplier to offer us a new, well-priced, high accuracy machine of

—William Hayes, Quality Improvement Engineer at the Dudley factory of The Timken Company, with the new LK Metrology AlteraM 15.12.10 ceramic bridge coordinate measuring machine.

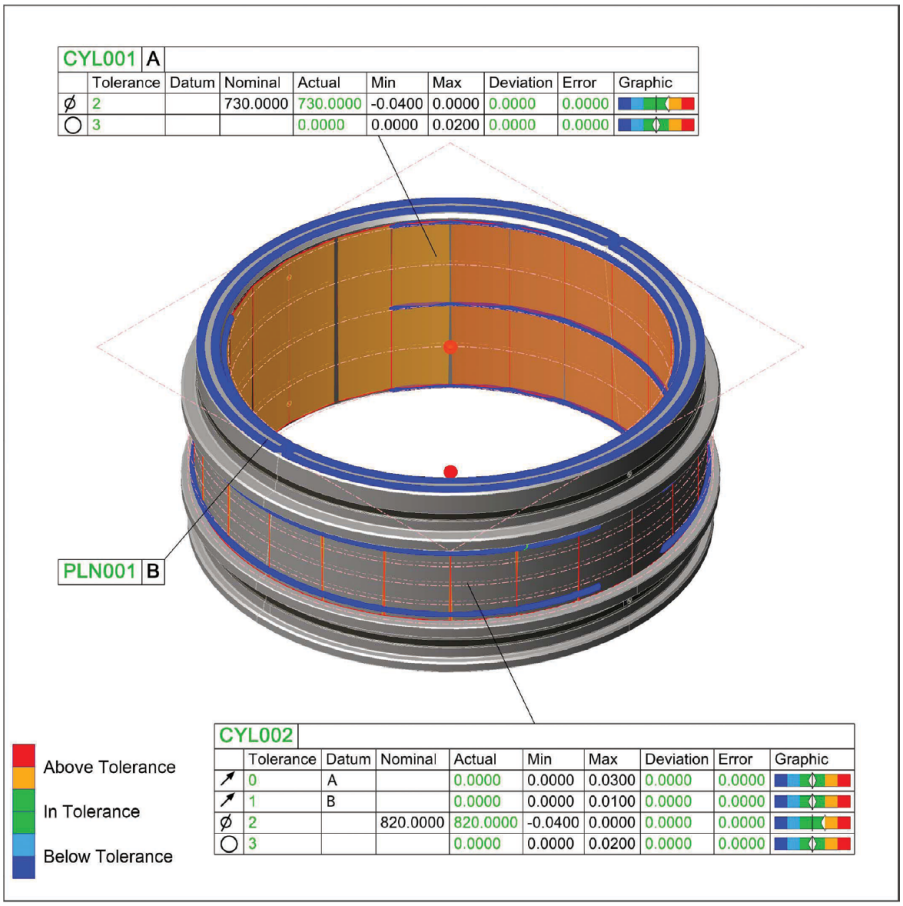
the right capacity. The company was also proactive in offering to retrofit new control software to our Mitutoyo BN710 CMM, as we need two measuring machines to cope with our increasing production throughput.

"Another point in LK's favour was that its CMMs are installed in Timken plants in other parts of the world, including in the US, so the supplier was not an unknown quantity. It would in theory be possible to exchange programs internationally, but in practice this is unlikely to happen as most of our other sites are mass production environments, whereas we specialise in producing small quantities of engineered bearings below 10-off."

He went on to explain that LK also supplied new technology in the form of a Renishaw PH10MQ motorised tilt and rotate head and SP25M scanning probe with interchangeable styli. Together they are able to take measurements at important discrete points, as previously, or to scan large areas very quickly. For example, the system is able to scan a circle at 1.2 m/min, acquiring up to 1,000 measurement points every second as it does so. An additional benefit of the SP25M probe is the possibility to accurately measure with stylus lengths up to 400 mm, allowing awkward areas of a component to be reached, whereas there is a stylus length limit of 100 mm with traditional probes from Renishaw.

The change in functionality from touch trigger probing to scanning is fully programmable. In the case of Timken's cycles there is approximately a 50:50 split between the two modes of operation. They are performed by the SP25M probe, as there are two sensors built into the single housing, so there is no need for probe exchange. The wealth of data obtained is able to provide a very accurate report concerning deviations in size, position, profile and form that can affect bearing performance. Higher speed inspection also enables metrology to provide prompt feedback for adjusting production processes.

Within 10 days of the new CMM installation at Dudley and the simultaneous upgrading of the smaller machine, two of Timken's six inspectors had already undergone training by LK Metrology engineers and



Feature Name	Type	Datums	Min	Max	Dev'n	
CYL001	ø		-0.0400	0.0000	0.0000	
	◯		0.0000	0.0200	0.0000	
CYL002	↗	A	0.0000	0.0300	0.0000	
	↗	B	0.0000	0.0100	0.0000	
	ø		-0.0400	0.0000	0.0000	
	◯		0.0000	0.0200	0.0000	

— Maciej Majchrzak, Quality Inspector, inspecting a Timken engineered bearing outer race.

— Bearing outer race inspection in progress by touch probing and scanning in a single 10-minute cycle.

were checking bearings on both CMMs. The latest version of LK's CAMIO 2021 software has the advantage of helping to increase inspection productivity, enhance the quality of data collected and gain better insight into the components being measured. New inspection programs are prepared quickly by automatically detecting which surfaces of the CAD model should be used to measure a feature. Improvements have also been made to the programming workflow by extending the advanced picking function to touch points and scan paths on a CAD model and to indicate the selection of existing measured features.

About The Timken Company

The Timken Company (NYSE: TKR) designs a growing portfolio of engineered bearings and power transmission products. With more than a century of knowledge and innovation, it continuously improves the reliability and efficiency of machinery and equipment to move the world forward. Timken posted $3.5 billion in sales in 2020 and employs more than 17,000 people globally, operating from 42 countries. Timken is recognised among America's Most Responsible Companies by Newsweek, the World's Most Ethical Companies® by Ethisphere and America's Best Employers by Forbes.

About LK Metrology

LK Metrology is renowned for innovative metrology solutions and services. The company's products, including coordinate measuring machines (CMM), portable measuring arms and metrology software, are used worldwide to control and improve the quality of manufactured components. Its precision technology underpins the process chain from design, development, production and assembly through to quality assurance in global industries such as automotive, aerospace, defence, motorsport, energy, medical and contract inspection.

Established in England in 1963, LK Metrology has an impressive heritage in metrology dating back to the birth of CMM technology. Founded by CMM pioneer Norman Key and his father-in-law Jim Lowther, LK Metrology is credited with many of the CMM industry's firsts including the first bridge-type design, first OEM to integrate computers, first to use a touch trigger probe, first to develop inspection software, first to use all air bearings and granite guideways, first to use carbon fibre composite spindles, first to use microprocessor-controlled drive systems, first to produce a truly thermally stable CMM and first to produce a high-accuracy horizontal-spindle CMM.

In 2018, LK Metrology was relaunched as an independent CMM manufacturer after several years as a division of Nikon Metrology. Headquartered in the UK, LK's CMM development and production are at the company's facility in Castle Donington. Sales and support offices are located in the UK, North America, Belgium, France, Germany, Italy and China, supplemented by a worldwide distributor network.

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We got every link of the chain

ROVSX SERIES

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RKB BEARING INDUSTRIES

Bearing Grease Management using Ultrasound

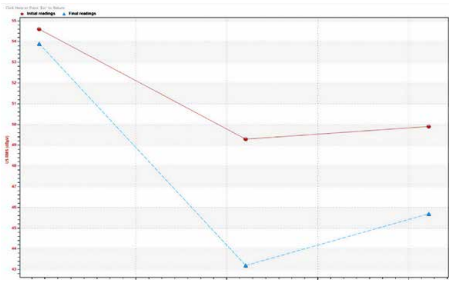
Inspection Technique

Greasing of bearings using ultrasound, often described as best practice, helps us understand how much grease needs to be applied. Ultrasound is a good measure of friction – too little or too much grease in a bearing produces elevated friction levels. Using ultrasound, the right quantity of grease is determined by assessing the levels.

SDT LUBExpert ensures that the right quantity of grease is applied to each bearing using ultrasound, condition-based lubrication.

The Ultranalysis ® Suite 3 software also provides a means of storing valuable lubrication data, trending and traceability where grease replenishment quantity, intervals and ultrasound levels are recorded. Information stored in this database may also be used to optimize lubrication schedules / intervals and for root cause failure analysis.

The **LUBExpert** also facilitates basic screening of bearing condition using the ultrasound crest factor algorithm.



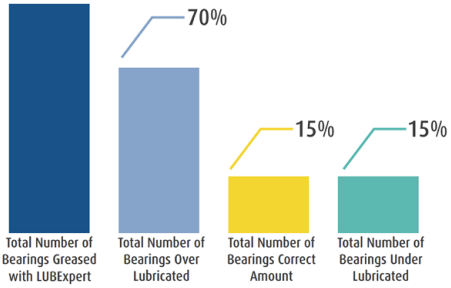
After having conducted numerous trials on a large volume of grease lubricated bearings from various plants which were previously greased using fixed replenishment rates calculated from grease application formulas and / or calculators.

In one example, using ultrasound (LUBExpert) to determine correct quantity of grease, the study indicated that

Level N	RMS	Max	Peak	Crest Fa	Lu	Lube Alarm Level	Grease Nam	Nb. Gr	Grease	Sa	Sof	Se	Date	Time	Manual inp	Se	In	Se	Sens	Instr	Res.F	Mixer	Lengt	Oper
	48.4	48.6	58.5	3.2		Lubrication success	AML-783	7	7	80	0x...	LU	19/09/2019	1:25 PM		54	53	30		11/...	0	0	1	defa.
	56.9	57.9	69.4	4.22						80	0x...	LU	19/09/2019	1:24 PM		54	53	30		11/...	0	0	1	defa.
	46.7	47.6	53.5	2.19		Lubrication success	AML-783	6	6	80	0x...	LU	12/09/2019	1:53 PM		54	53	30		11/...	0	0	1	defa.
	53	53.5	66.6	4.79						80	0x...	LU	12/09/2019	1:51 PM		54	53	30		11/...	0	0	1	defa.
	48.9	48.9	51.7	1.38		Lubrication success	AML-783	5	5	80	0x...	LU	6/06/2019	8:31 AM		54	53	30		11/...	0	0	1	defa.
	49.2	49.9	62.9	4.84						80	0x...	LU	6/06/2019	8:31 AM		54	53	30		11/...	0	0	1	defa.
	39.2	39.5	47.4	2.57		Lubrication success	AML-783	11	11	80	0x...	LU	2/05/2019	2:07 PM		54	53	50		11/...	0	0	1	defa.
	46.2	46.8	57.1	3.51						80	0x...	LU	2/05/2019	2:06 PM		54	53	50		11/...	0	0	1	defa.
	43.9	45	51.6	2.43		Lubrication success	AML-783	6	6	80	0x...	LU	23/04/2019	8:22 AM		54	53	50		11/...	0	0	1	defa.
	49.5	50.7	66.7	7.24						80	0x...	LU	23/04/2019	8:22 AM		54	53	50		11/...	0	0	1	defa.
	43.9	45.3	51.1	2.29		Lubrication success	AML-783	1	1	80	0x...	LU	9/04/2019	10:13 AM		54	53	50		11/...	0	0	1	defa.
	46.5	47.3	60	4.73						80	0x...	LU	9/04/2019	10:13 AM		54	53	50		11/...	0	0	1	defa.

approximately:

- 70% of bearings were being Over Lubricated;
- 15% of bearings were Under Lubricated;
- 15% of bearings had the correct replenishment rate.



Results obtained from this trial were similar to results obtained from other plants.

Result

The greasing of bearings is tailored to the condition of each bearing rather than relying on fixed / calculated quantities condition-based lubrication.

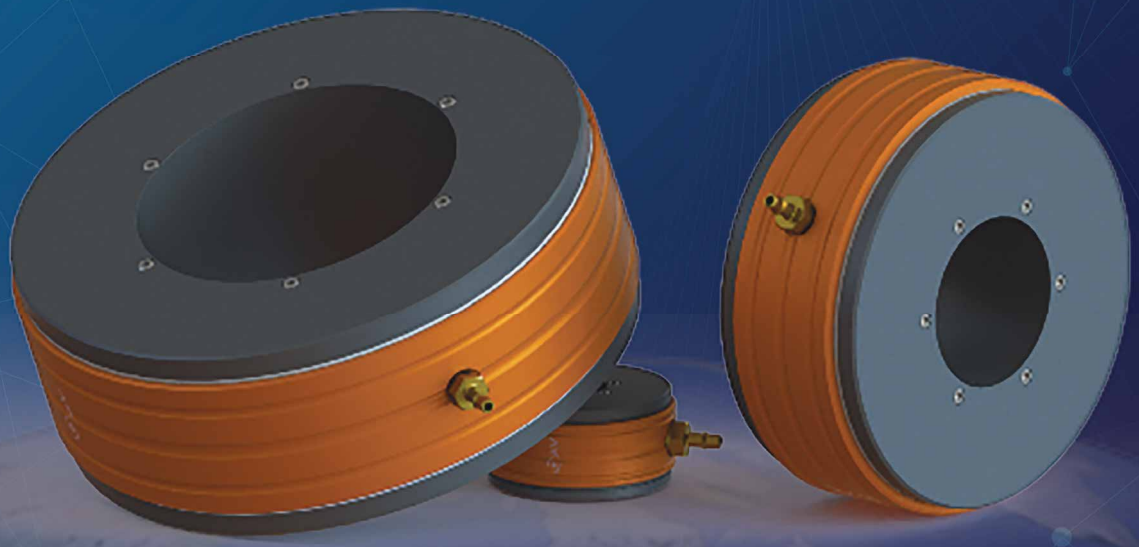
Greasing using ultrasound:

- Improves equipment reliability and availability by ensuring the bearings receive the correct amount of grease;
- Information collected and stored in the lubrication database facilitates further optimization of lubrication schedules and reliability programs;
- Reduction in grease usage and optimization of schedules has costs savings implication.

More details about this case study can be found at: https://gvsensors.com.au/lubexpert-case-study-70-of-bearings-are-still-over-lubricated

ULTRA-HIGH PRECISION AIR BEARING, STAGES, COMPONENTS, AND MOTION SYSTEM

"Supplying top-quality products requires excellent engineering, clever design, and outstanding manufacturing technology."



OAV ROLLER AIR BEARINGS

OAV Air Bearings have higher stiffness and excellent geometric per-formance. OAV Roller Air Bearings pre-loads both the horizontal and vertical surfaces with opposing thin film pressure - this maintains the perfect gap with ultimate precision. OAV Air Bearings surface design equally distributes the air and pre-load over the entire surface area; the result is out-standing stiffness and maximized performance.

OAV air bearing

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ZEN™ Launches Eco-Friendly, Food-Grade, Anti-Rust Coated Bearings for Food & Beverage Industry

ZEN continues to bolster its strong international reputation with the announcement of its echo-friendly, food-grade, anti-rust coated bearings. Currently applied within the food and beverage industry, the new FDA certified, corrosion resistant bearings, vastly outperform stainless steel bearings and improve cost efficiency. Downloadable testing results are available.

Headquartered in Dusseldorf, Germany, The ZEN Group, led by Yago Zens, is the largest manufacturer of stainless-steel bearings in the world. The group maintains global recognition for quality standards, earning them the ISO 9001 certification; the highest standard achievable for quality management in their industry. Today, ZEN continues their dedication to quality achievements, unveiling a safe and effective coating for stainless steel bearings.

ZEN's corrosion resistant coated bearing design for food-grade safety standards, is non-toxic and environmentally friendly, making it multi-dimensional in its usage. Importantly, salt spray testing performed to DIN standards, indicate that the advanced RoHS compliant bearings last twice as long as standard stainless-steel bearings, improving cost efficiency by reducing the expense of bearing replacement and downtime.

While the application is currently being used to improve stainless steel insert, and pop bearings within the food and beverage industry, all industry applications that require enhanced corrosion resistance can benefit from ZEN's advanced products. Simultaneously, the launch coincides with a global incentive to implement echo-friendly solutions aimed at protecting the environment.

The ZEN group is currently shipping direct from their manufacturing facilities in China to customers throughout the world. Outside of the EU, product is being shipped non-stop from China to; the U.S., Canada, India, Australia, Mexico, Brazil, and Korea. The strategy has created vast price advantages for global customers, while simultaneously shortening lead times. With 48 official sell points, ZEN has developed the capability to ship to any location on Earth and plans to expand its resources further.

ZEN FOOD AND BEVERAGE SAFE

Comparing Stainless Bearings to Stainless Bearings with the new AC+ surface treatment

In environments like the food and beverage industry where bearings have to withstand constant washing with high-pressure water or chemicals, avoiding corrosion is decisive. This condition is one of the most common causes of bearing failure and in severe cases, can cause early fatigue failures.

Thinking carefully about the requirements of our intended application and making the correct decision when choosing lubrication, sealing and bearing materials, will help us to prevent corrosion and therefore, to increase productivity, to prevent unplanned downtime and lower the total costs of operations.

As regards the choice of bearing materials, although stainless steel is really effective in preventing corrosion, for high demand industries like food and beverage is, going one step further to prevent corrosion is necessary. With this in mind, the ZEN Group has launched a new range of FDA and RoHS compliant corrosion-resistant coated bearing within its beverage and food safe bearing product line.

According to Yago Zens, who has been the CEO of ZEN Bearings for over 20 years, the salt spray test is one of the most recognized and efficient methods for the evaluation of the corrosion resistance of bearings materials, this being the one, they perform at the ZEN Quality Control Centre in order to give the best advice to its customers.

To test and show us the corrosion resistance of these bearings, Mr Yago Zens exposed three samples of different types of stainless steel bearings to a 120 hours salt spray test including the new AISI 420 AC+.

The three samples tested were as follows:
A = AISI 420 stainless steel.
B = AISI 420 stainless steel AC+
C = AISI 440 stainless steel.

The Salt Spray Test is an accelerated corrosion test that produces a corrosive attack on the tested samples to predict their corrosion resistance.

The appearance of corrosion products (oxides) is evaluated after a period of time. Test duration depends on the corrosion resistance of the material the more corrosion resistant the material is, the longer the period in testing without showing signs of corrosion.The standard testing period for ball bearings is 120 hours.

As we can see, after 120 hours of testing, the AISI 420 stainless steel AC+ has remained virtually untouched by corrosion. There is no rust mark on the inner and outer ring of the bearing, only some rust spots on the oil groove.

So, although stainless steel has excellent anti-corrosion properties, them can vary in each of its grades. For this reason, to count on the advice of experts that can assure us the quality and features of their bearings, as the ZEN Bearings team does, is a key factor when achieving the best performance on the final products.

Founded in 1993 the ZEN Group, is a manufacturer of bearings according to German DIN quality standards for a wide range of industrial applications. From their three production plants in China, their products are distributed globally through their strong distribution network.

Quality is what defines them better. It is a mindset for all members of their team and it's integrated through each step of their manufacturing process, from the sourcing of their raw materials right through to the aftercare once the product has been delivered.

Its ISO 9001 certified quality control centre is a key piece in this process. This facility covers more than 5.000 squares meters, featuring state-of-the-art testing equipment and a great team of highly-qualified inspectors who are working every day to ensure a high level of quality.

If you want to know more about the test results, they are available to download on our web. Also, if you have any further questions the ZEN team would be happy to hear from you.

For more information about the ZEN Group visit www.zen.biz.

	12H	24H	48H
AISI 420 stainless steel AC+			

	12H	24H	48H
AISI 420			

	12H	24H	48H
AISI 440			

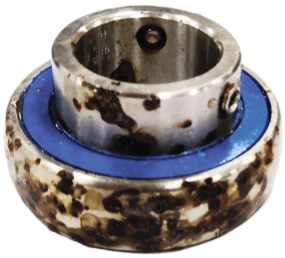
Salt Spray Test report for ZEN Food & Beverage Safe (FBS) Bearings

Criteria	GB/T 10125-1997
Sample solution	50g / l±5g / l NaCl
Application temperature	(35±2) °C
Ph	6.5~7.2
Spray volume	1~2ml / 80cm² / h
Test Duration	120 hours

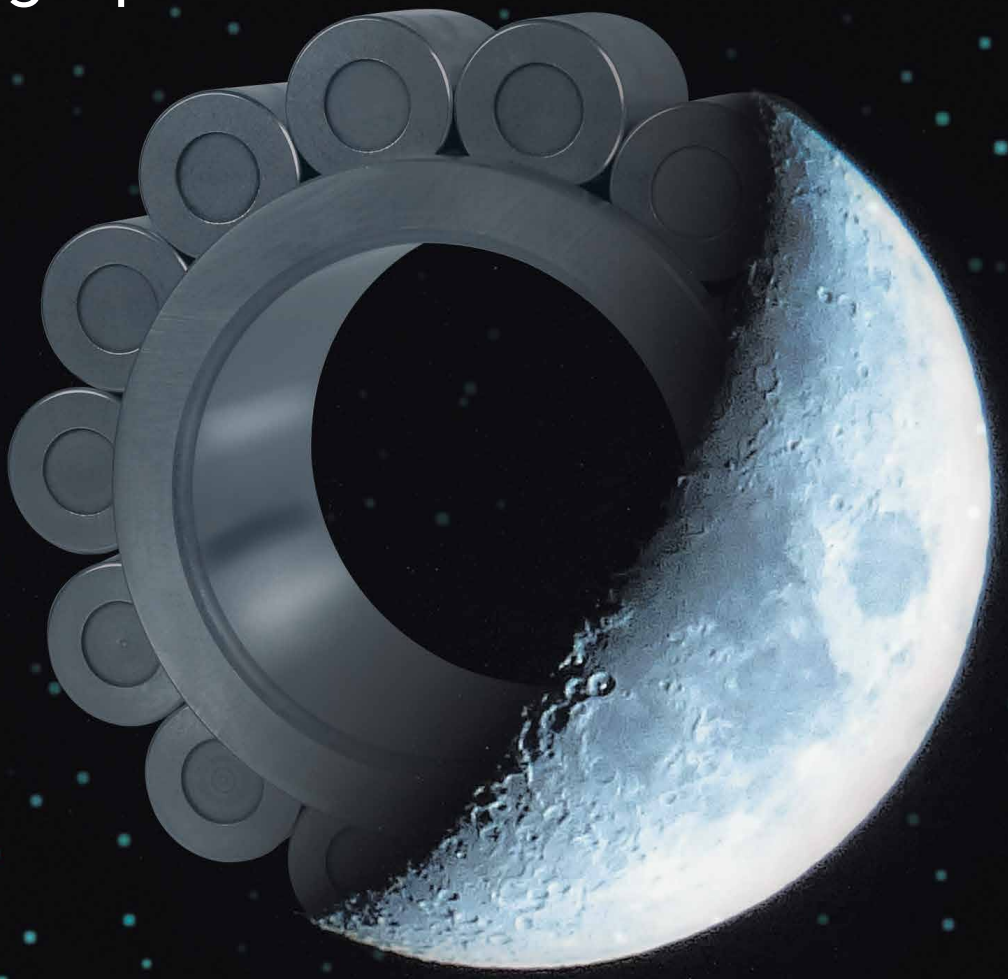
Sample	Ref	Result
Bearing	AISI 420 stainless steel AC+	**No rust mark on the inner and outer ring, only some rust spots on the oil groove**
	AISI 420	**Traces of rust on the inner and outer rings**
	AISI 440	**The inner and outer rings have serious rust marks**

72H	96H	120H
		

72H	96H	120H
		

72H	96H	120H
		

makes things possible



CPM

SPECIAL BEARINGS

www.cpmbearings.com

Ultra-thin deep groove ball bearings *with excellent properties for* **application in robotics**

Koyo Bearings, a division of JTEKT Corporation, specialized in design and engineering of a wide range of roller bearings for numerous applications, ranging from automotive and windmill applications to aerospace and tunnel drilling equipment, has now developed a special ultra-thin deep groove ball bearing for application in speed reducers for robots.

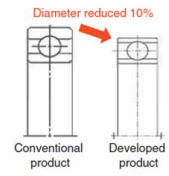
Background of the development

The global application of robots is shifting from mainly manufacturing to other sectors, including medical care (nursing) and other service applications (collaborative robots, etc.). This brings along new requirements for the bearings to make them suitable for specific applications, like high precision reduction gears (example: for the strain wave gearing).

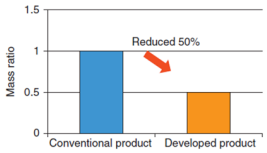
Features of the new product

The bearings for robot precision reduction gears, generally require capabilities such as: small size, light weight, long operating life and high reliability.

The reduction in size and weight has been achieved by applying a new high accuracy machining process, capable of producing the inner and outer ring with a significantly reduced thickness, without losing critical properties. This led to an overall reduction of the bearing weight by 50%, while the OD could be reduced by 10% (downsizing).

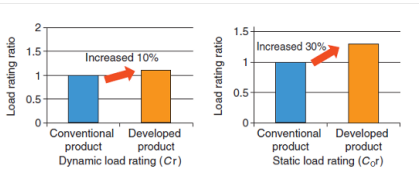


Outside diameter comparison
(between bearings with same bore diameter)

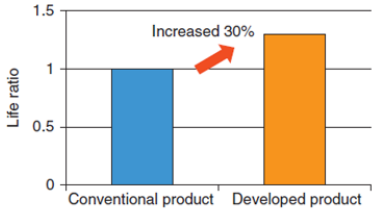


Mass comparison

The life of the bearing could be increased by an improved load carrying capacity, which was realized by increasing the number of rolling elements (balls), using a new manufacturing method. As can be seen below the dynamic load rating (Cr) could be increased by 10% and the static load rating (Cor) by even 30%. This leads to an increased bearing life of 30%.



Load capacity comparison



Life comparison

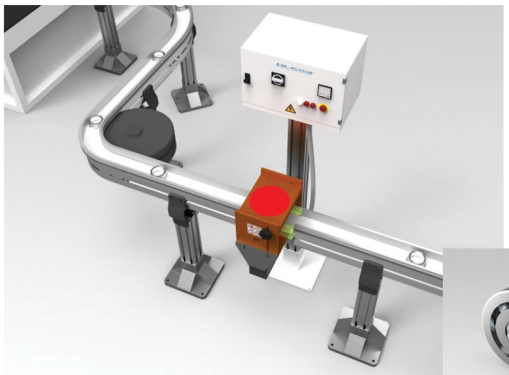
Availability of this product

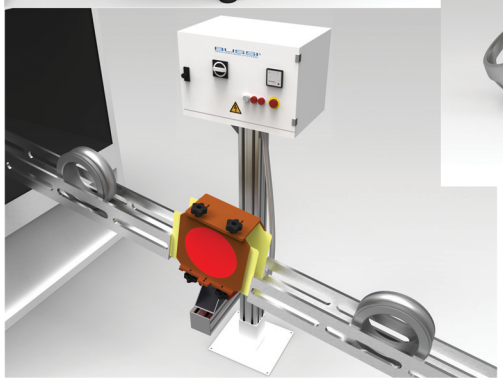
This ultra-thin deep groove ball bearing has been newly developed by JTEKT/ Koyo and is currently in mass production. For more information about available types and sizes, please do not hesitate to contact your regular Koyo contact person.

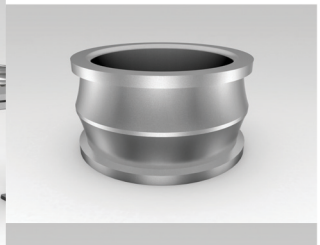
BUSSI®
DEMAGNETIZING SYSTEMS

EXCELLENCE IN DEMAGNETIZATION

EXTEND BEARING LIFE WITH BUSSI ELECTRONIC DEMAGNETIZERS







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

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

DISCOVER OUR SOLUTIONS DEDICATED TO THE BEARING INDUSTRY

DISCOVER BUSSI DEMAGNETIZERS KEY TECHNICAL ADVANTAGES:

- MINIMUM RESIDUAL MAGNETISM
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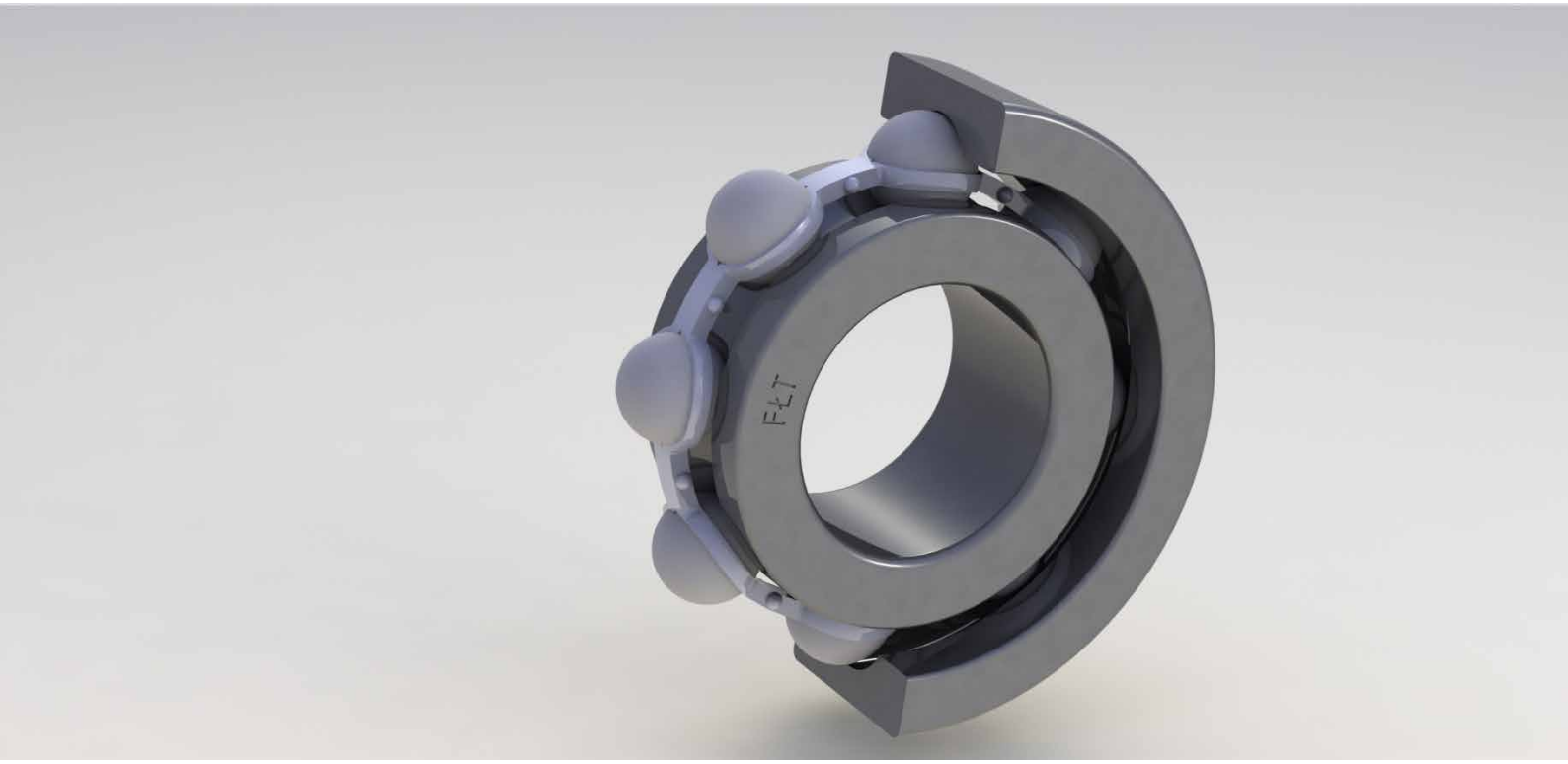
bussi@bussi.it

How FLT Design, Analyse & Optimise Bearings with RomaxDESIGNER



Since the 1950s, FLT Group have provided many industries with specific solutions: for automotive, bearings for passenger car wheels, driving shaft supports, differential gear boxes, axle shaft supports, and main wheels of tractors and trailers; for agricul tural, self-aligning and Y-bearings, tapered roller bearings and deep groove ball bearings (wheel hubs and planetary gearbox bearings) ; for electric motors, ball bearings with low noise; for rail , spherical roller bearings for locomotive axles.

Alongside tools such as SolidWorks and AutoCAD LT (for preparing 3D bearing models and 2D bearing drawi ngs), FLT Polska's engineering team have used Romax software since 2008.

FLT Group provides rolling bearings for various applications. At the forefront of the industry, they continuously develop their existing bearing products whilst also investigating new solutions. With turnover in excess of €75m, **FLT Group** have companies registered in Poland, Germany, Italy, France, the UK and China.

Challenge

To provide customers with bearings that meet required life and other performance targets, and which have an internal design optimized for the particular application.

Solution

RomaxDESIGNER simulation, the industry-standard for bearing companies and vehicle manufacturers, for detailed bearing design, analysis and optimization. Accurate calculation of bearing fatigue life and the effect of modifications to the internal geometry on bearing performance, using a whole-system perspective that considers all components, including FE housings.

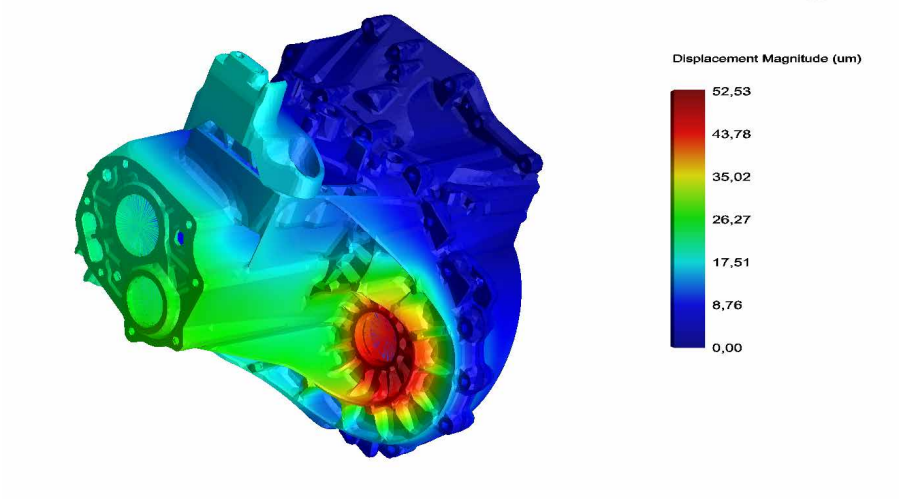
Benefits

Saving time in calculations and design investigation; improving end product quality; increasing customer confidence and satisfaction; reducing risk of large costs associated with bearing failures and warranty claims.

Saving time and improving quality

Integral to accurate prediction of system behaviour, bearing technology has always been at the core of R omaxDESIGNER, and Romax continue to invest in developing new bearing simulation technology. New solutions have included flexible bearing ring analysis, and, most recently, enhanced roller contact and rib loading analysis.

Zalubski says: "The main challenge we face is providing the customer with bearings that meet the required life, and have an internal design appropriate for a particular application and working condition. A particular issue is the design and development of detailed rollers and raceway pro files, and understanding the influence that modifications have on the bearing life. Before we started using RomaxDESIGNER, many calcula tions (including bearing life and how it varies with preload) were done manually or were completely impossible. Romax DESIGNER enables us to save significant time in bearing analysis and design, and to achieve a higher quality product: with Romax software, we can design better bearings more quickly, and provide high quality customer service." see Figure. 1



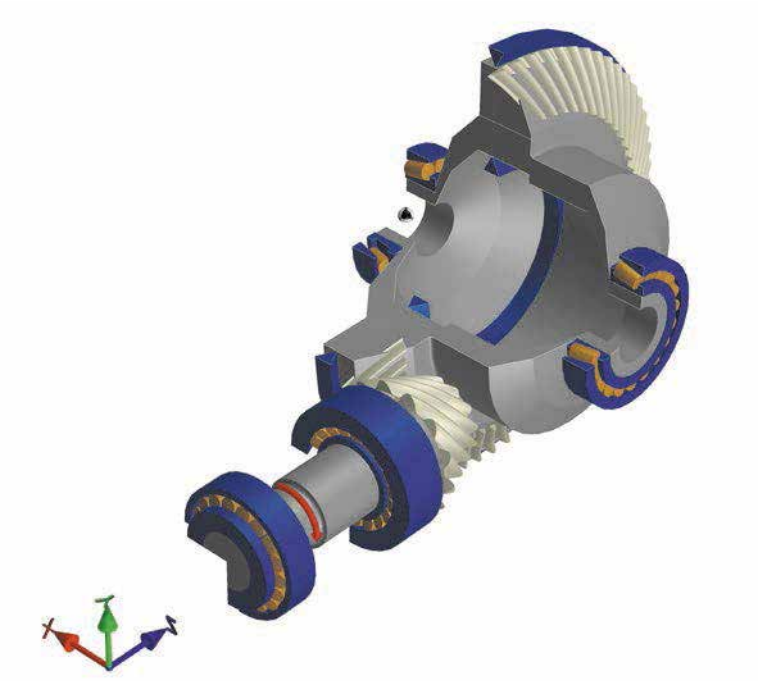
— Fig 1: Example of calculation model with applied housing

FLT Polska use RomaxDESIGNER's advanced bearing analysis,housing influence, flexible bearing and efficiency analysis.

Zalubski comments: "Romax software allows us to improve the quality of our bearing analysis, especially by calculating bearing life, operating radial clearance considering shaft and housing fits, rolling element load distribution, stress distribution along the roller, ball bearing truncation , rotating torque, power loss, and load ra tings." see Figure 2

Zalubski adds: "Romax allows us to very quickly and easily replace a bearing with another type, for rapid comparison and development. Not only does RomaxDESIGNER allow us to use the latest bearing life calculation methods, but we can also consider the effect of the housing and different types of lubricant." see Figure 3

> “We use RomaxDESIGNER far complex analysis of FLT bearings in a particular application and working condition, to provide our clients with bearings of the highest quality possible.”
>
> ***Marek Zalubski , Technical Advisor at FLT Polska***



—Fig 2: Example of calculation model of final drive unit

Project: Flexible Bearing Analysis and Subsequent Roller Profile Redesign

FLT use RomaxDESIGNER's flexible bearing functionality when a customer has supplied detailed housing information , and to create taper roller bearing axial displacement against axial force diagrams (to estimate the necessary axial displacement to achieve the optimum preload force).

A global automotive and aerospace engineering customer provided FLT with a Romax and housing FE model and asked fora bearing to be specified, along with the optimum bearing preload, the bearing preload against force, the bearing preload against temperature, the bearing contact stress and stress distribution, the drag torque, and the torque to turn. At this point, FLT Polska did not have access to the flexible bearing, efficiency, or FE solve capabilities in RomaxDESIGNER, and they tight cooperation between

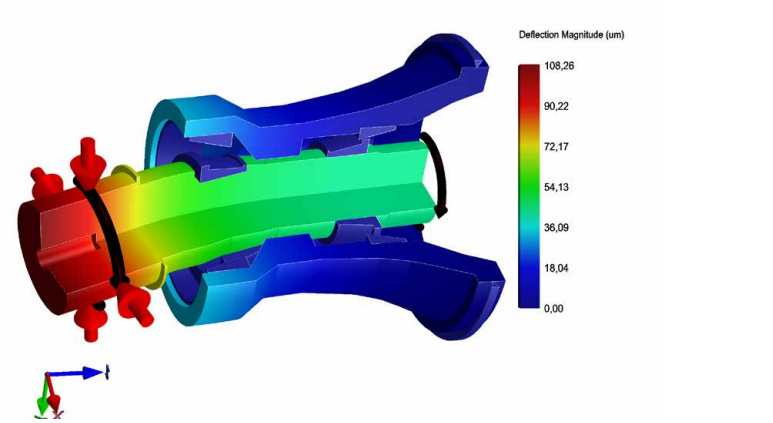
A typical FLT project

Typically, a project starts when a customer requests a bearing of a certain type, capacity or dimensions. Additional design elements may be specified, such as load ratings, lubrication and information about the operating conditions. Whole system design may also be considered for bearing sizing, through housing and shaft models from CAD or Romax software. Most customers request calculations including life against preload diagrams, load distribution and maximum contact stress.

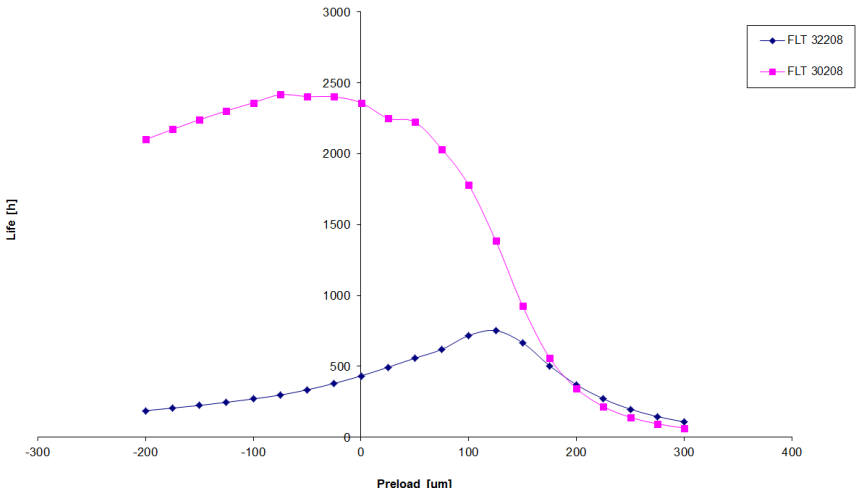
FLT prepare a Romax model, optimise the bearing to specified targets (adjusting in RomaxDESIGNER if required), and then quote the customer for that bearing.

Project: Bearing Life Calculations for Agricultural Wheel Hubs

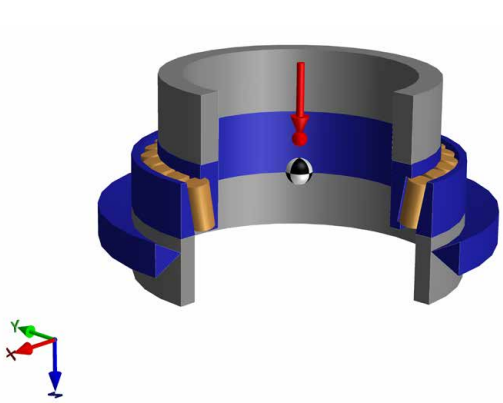
FLT have completed a number of agricultural wheel hub projects. One example was to specify a bearing which met a required life and to evaluate the optimum preload . The customer provided application drawings as well as the required bearing type, expected bearing life, duty cycle and lubrication data. FLT used RomaxDESIGNER to provide the customer with a bearing which would meet their demands, and to recommend the optimum preload (see Figure 4).



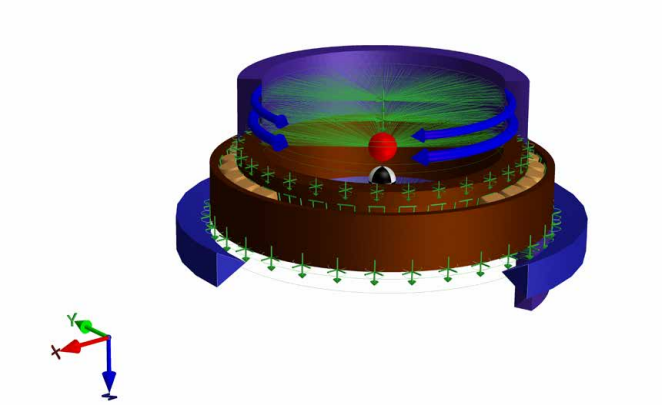
— Fig 3: Example af defiection magnitude diagram



— Fig 4: Predicted life against preload far two FLT bearings



— Fig 5: fvlodel before meshing {rigid rings)



— Fig 6: fvlodel after meshing (flexible rings)

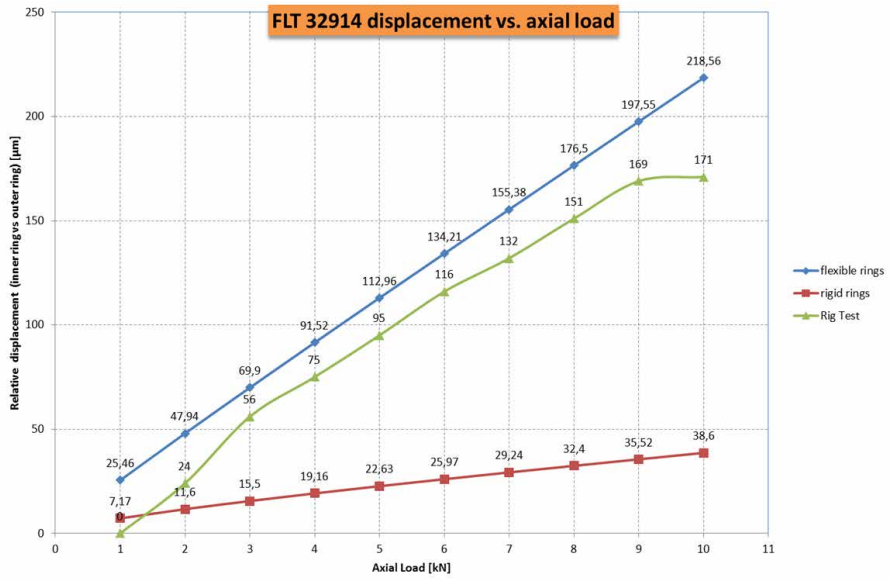
> "For us, what's most important is that we can support our customers with correct bearing life calculations in order to prevent future bearing failures and claims. Our investment in the software is well worth the huge costs at risk with such issues. RomaxDES/GNER gives us the confidence to design bearings which we know will perform to our high standards of quality . We envisage we will use it far many years to come."
>
> ***Marek Zalubski , Technical Advisor at FLT Polska***

FLT engineering team and customer resulting implementation of low friction taper roller bearing for one of leader of automotive industry.

Zalubski comments : "Our experience of working with Romax people is always very positive. Their powerful software is backed up by extremely helpful and professional technical support."

Romax's calculations to the selected ISO standard showed that one bearing failed the required life. The bearing design thus needed to be improved with recommendations provided by Romax experts. The roller profile of the FLT bearing was changed, and the calculation was repeat ed. The bearing subsequently passed the life test s, and the customer ordered the bearing.

Zalubski comments: "The flexible bearing module makes FLT's bearing analysis more complex and more advanced. We find it gives excellent correlation with test rig results" (see Figure 5, 6, 7).



— Fig 7. Bearing displacement against axial load - correlation between Romax model with flexible rings. Romax model with rigid rings, and rig test

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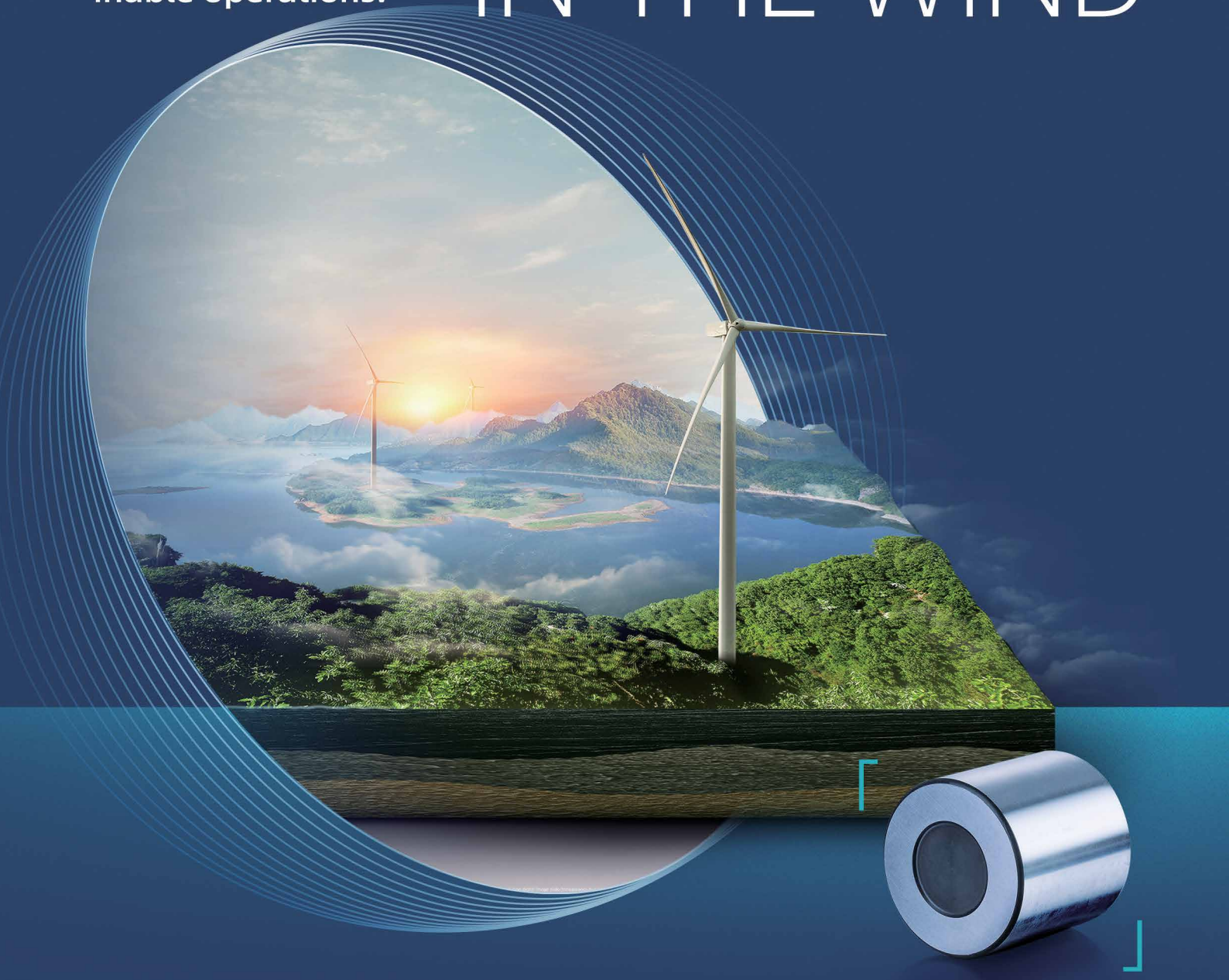
Volution Sp. z o.o. will begin operation in Poland in late 2021 to better serve our European customers

「 」 is creating value for next generations.

「 」 is here to support susta -inable operations.

THE「ANSWER」IS BLOWIN' IN THE WIND



BEAUTY IS IN THE ROTATION

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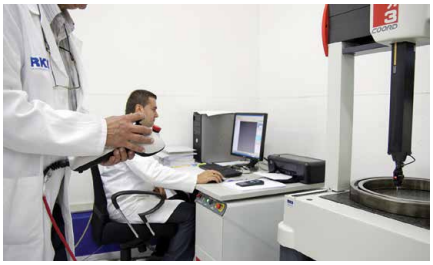
RKB BEARING INDUSTRIES as The Alternative Power

A common feature of all industries is the permanent and increasing need for positive, reliable alternatives in terms of bearings manufacturers and suppliers. During the many years since its foundation, RKB successfully met this need and thus continuously developed and strengthened its market position in an increasing number of industrial sectors and industrial applications. At RKB, we know there is plenty of evidence that supports this statement.

Our over 80 years uninterrupted presence in the bearings industry means RKB achieved extensive know-how, production capacity and distribution network for a wide range of high-quality, reliable bearings. This is our solid basis for providing relevant comparative benefits to clients in terms of bearings performance, delivery, service and training.



In a very competitive industry, we are a rapidly, organically growing producer with, like the current major brands, a fully integrated system. We strongly believe that only through the complete control of the production chain RKB can meet the requirements of, rightly so, increasingly demanding clients and clients' applications.

To be The Alternative Power in the bearing industry is not a simple task. Our target is to provide, in calm periods and in times of strong headwinds, customers worldwide with consistent, tangible competitive advantages thanks to our pioneering business model in the bearing industry.

In a time when overclaims are not rare, proofs for the above achievements have an impact. For example, even in the current very difficult market environment, RKB continues to offer good quality services to all our customers, irrespective of their size and business field, thus sustaining their effort to avoid production disruptions and diminished outputs. Our business model based on bearings stocks played a crucial role in this respect.

RKB is supplying top-quality products at competitive prices, which guarantees customers' good ROI. Our modern plants and strategically located logistics all over the world provide us with the assurance that our clients will always link the word "satisfaction" with our brand name.

In brief, we believe RKB's main strengths are:

- Swiss engineering for cutting-edge solutions and extremely advanced R&D
- Advanced manufacturing technologies
- Long experience gained through the work in the most advanced western markets, also attained through co-engineering with the most challenging and demanding markets leaders
- Directly owned and controlled production facilities
- Fast and flexible production chain
- Capital intensive strategic stock

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- System uses ultrasonic sensors: identify bearing issues beyond lubrication at the earliest possible point
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How bearing customers can respond to China's changing dynamics

Executive Summary

The Bearing Industry is facing unprecedented disruption and suppliers, distributors, and end customers need to prepare for the change

Current Market Dynamics

Difficult Macroeconomic Conditions

- Declining Dollar-Yuan exchange rate
- Increasing global inflation
- Aging and shrinking factory workforce

Increased Price of Raw Materials

Rapidly rising steel prices (72% this year) due to:

- Increasing iron ore prices
- Increasing coal prices
- Fear of further inflation
- Tariffs on steel-related exports

Disruption to Shipping

Surge in shipping expenses (~6x this year) due to:

- Cancelled transportation in 2021 due to COVID
- Port disruption due to COVID outbreaks and congestion
- Reduced ship supply

China's Power Crunch

Factories in 20+ provinces have been forced to cut activity time by 20-50% to meet energy reduction targets. The magnitude and duration of the regulation is unknown causing a price surge and increased uncertainty

Response from Bearing Manufacturers

- ~38-61% average **increase in prices** depending on the bearing type
- **Increase in minimum order quantities,** even for slower moving bearings
- **Passing on shipping cost burden** to suppliers and customers
- **Increased time to quote** and introduction of **price expiry**
- **Longer lead times** by 2-4 months
- **Tightened payment terms**

Scenarios for the Future and No Regrets Actions

We have outlined four plausible scenarios for the future, and have extracted few no-regrets actions regardless of which scenario plays out to help customers plan for the future

- ❑ Improve Business Planning
- ❑ Manage Customer and End User Expectations
- ❑ Increased Transparency and Trust
- ❑ Bring a Problem-Solving Attitude to Relationships
- ❑ Increase Collection of, and Reliance on, Data & Analytics
- ❑ Encourage Suppliers to Invest in Procurement Effectiveness

Current Economic Dynamics Impacting Price and Availability

A Changing Economic Climate is Straining Unit Economics…

A variety on macroeconomic trends are impacting the Bearings Industry, and COVID-19 has increased their impact

Unfavorable Exchange Rates in China

The Chinese yuan has strengthened to three-year highs against the U.S. dollar, spurring concerns about the competitiveness of Chinese exports. Over the last year (2 Oct 2020 – 2 Nov 2021), we have seen a strengthening in the Chinese currency **causing buying prices to increase by approximately 10%.**

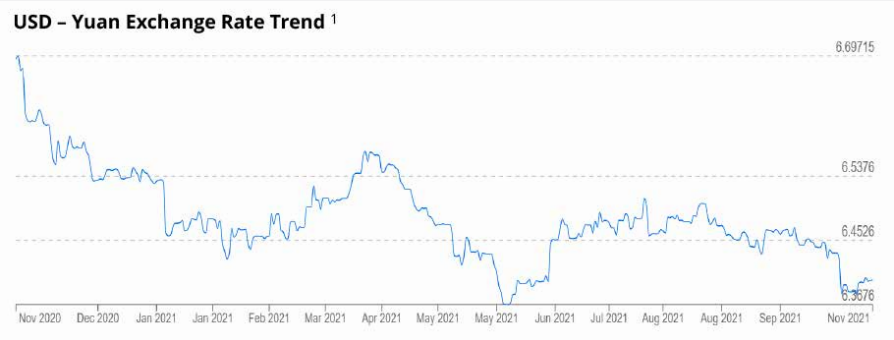
This trend is expected to continue based on expected increasing demand and value for Renminbi-denominated bonds and overall resilience of the Chinese economy[2,3].

Global Inflation [4]

Global Inflation had a very short-lived dip at the onset of the pandemic and has been increasing at a more rapid rate as the world adjusted to the new normal. According to the IMF, this increase is caused by:

1. A pickup in economic activity or closing output gaps supported by accommodative fiscal and monetary policies, along with the release of pent-up demand and accumulated savings
2. Rapidly rising commodity prices
3. Input shortages and supply chain disruptions

Though rates are expected to hit pre-pandemic levels by middle of 2022, this is still a cause for concern and may lead to short term price increases.



SOURCES: *1) XE Currency, 2) Allianz GI Global Economic Prospects, 3) Morgan Stanley 2021 Outlook, 4) IMF October 2021 World Economic Outlook, 5) NPR*

Workforce Issues

China's aging population (5% increase of 65+ population over the last decade)5 is causing serious concern for bearing factories. There is a smaller youthful population to hire from, and that population is preferring to seek less labor-intensive jobs. This struggle to attain talent is underpinned by an increasing number of retirements from the current factory workforce causing a significant talent strain.

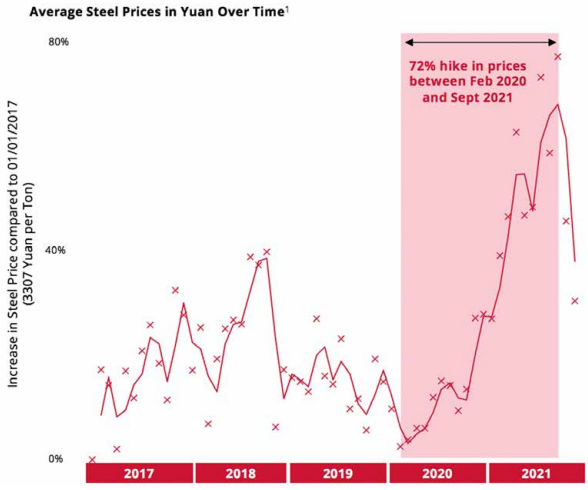
Unless Chinese factories start making significant digital investments, human capital will be the biggest output constraint in the next 5-10 yrs

… Compounded by Adverse Price and Availability of Raw Materials…

Steel price has had a direct impact to bearing manufacturers, but market sentiment indicates that this will start to stabilize

Factors Impacting the Price of Steel

- **Rising raw material prices**: For example, there was a 94% increase in iron ore prices between November 2020 and July 20211. Though this has since shrunk due to reduced demand as a result of China's recent production cut, its impact on prices remains.
- **Surge in coal prices** : by 200% between January 2021 and September 2021[1]. Though coal prices dipped by ~35% in November, they are expected to remain relatively high for the foreseeable future
- **Fears of increasing inflation:** causing producers to preemptively increase prices
- **Tariffs on steel-related exports from China**: For example, beginning Aug. 1, for instance, the tariff on ferrochrome, a stainless steel ingredient, doubled from 20% to 40%. [2]



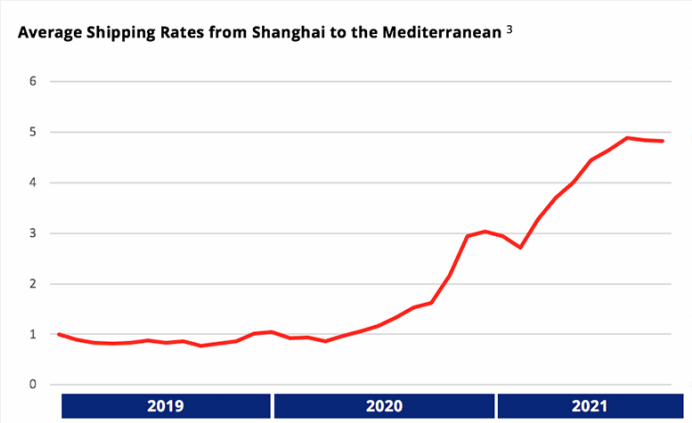
— Steel Prices Have Dramatically Increased Since the Onset of the Pandemic

OUTLOOK: *Prices are expected to reduce and stabilize but at a much higher level than 2020 levels and the overall impact to steel consumers will be long lasting*

SOURCES: *1) TradingEconomics.com, 2) Quartz*

… and Unprecedented Disruption to Global Shipping

Shipping disruption is seriously impacting price and hindering ability to plan and serve customers on time



***SOURCES:** 1) McKinsey: What's going on with shipping rates?, 2) CNBC, 3) Shanghai Shipping Exchange*

Causes of Shipping Disruption

- **Steady increase in container demand [1]:** In the pandemic, there was a drastic purchasing shift from services to goods since ability to deliver services was restricted, this caused significant strain on global shipping operations
- **Pandemic onset caused transportation cancellation [2]:** Thousands of empty containers were left stranded in Europe and the US in the first half of 2020 when shipping lines and air lines cancelled hundreds of trips as coronavirus lockdowns began. This backlog is still causing major port congestion
- **COVID-19 outbreaks at ports causing delays [1]:** Many major ports in China have experienced shutdowns for 1-2 weeks due to COVID outbreaks causing backlogs that are taking months to recover from
- **Strained supply [1] :** due to COVID-impacted crews, managing a long backlog of deliveries, Suez canal closure, increased time to build new ships (18+ months), and port congestions

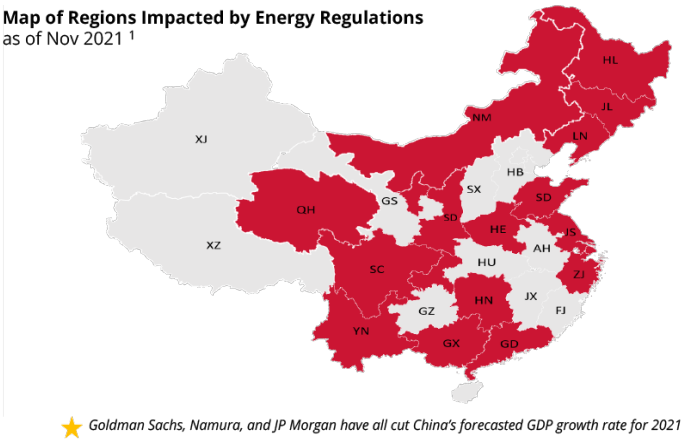
Drastic Increase in Shipping Prices

Standard Forty Foot equivalent unit (FEU) **$increased by 6x or more between January 2019 and October 2021[1].** Even after paying this cost, shippers are unable to meet their required capacity and are not able to rely on prescribed delivery times. Shipping are since slowly starting to stabilize.

***OUTLOOK:** Shipping prices are starting to decrease now that China's shipping demand is decreasing, but it will likely stabilize at a higher level than 2020 for the next year while ports decongest*

China's Power Crunch – The Latest Shock to the Bearing Industry

China's sudden and drastic response to the power crisis is causing major supply impacts and lots of uncertainty



***SOURCES:** 1) Bloomberg, 2) CNBC*

Causes of the Crisis

- **Coal Shortage [1] :** Coal-based producers account for more than 70% of China's electricity generation. However, China's supply couldn't catch up and import from Australia was limited due to political disputes and sanctions which are unlikely to ease during Biden's administration.
- **Xi's Carbon Emission Targets [1] :** Xi's push to reduce greenhouse gas emissions and go "carbon neutral" by 2060 has capped the growth of coal mining. Furthermore, Xi has implemented regulations for coal mine operations, limiting their ability to increase supplies
- **Renewables Not a Viable Option [2] :** China tried to shift to renewables, but a serious draught hit the hydropower center of Yunnan province resulting in a 4% decrease in total renewable output each month. Wind power also slowed down in growth from 25.4% in 2020, to 7% in 2021.

Resulting Regulation and Impact

Power cuts and curbs on electricity use have been reported in at least 20 provinces and regions. In China's tech heartland Jiangsu Province, some manufacturers have been told to reduce their energy use for the rest of September by 10% to 30% from usual levels, while some companies received requests to stop using electricity entirely from last Sunday until the end of the month. The magnitude and duration of the rations remains unclear, causing uncertainty

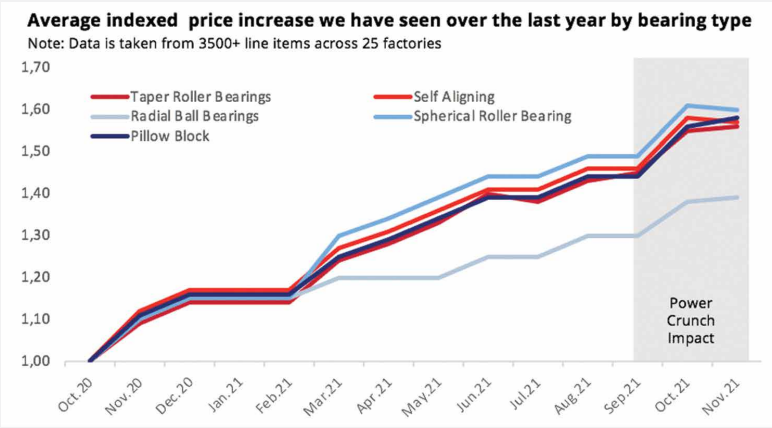
***RESPONSE:** Sudden and Unplanned Power Rationing Across 20+ Provinces*

***IMPACT:** Majority of Bearing Factories Forced to Cut Activity Time by 20-50%. Though this number is decreasing, it is expected to continue until the end of winter*

How Suppliers / Factories are Responding

Market Observations of How Suppliers/Factories are Responding

Suppliers are responding in ways that are making it harder to do business



Sources: KG Procurement Data Analysis

Increase in Prices

Factories are responding to all the market stimuli mentioned in the previous section by increasing prices. Below is a chart detailing the average impact KG has seen across bearing types (including exchange rate, shipping, etc.) We expect that these prices will only increase in the foreseeable future, so have made major bulk orders to ensure that our customer demand is satisfied

Increase in Minimum Order Quantities (MOQs)

Factories are drastically increasing MOQs making it a challenge to stock slower moving or more specialized items. KG is making investments to continue holding a strong stock position, but this has a serious cash flow implications

Changing Shipping Terms

Factories are forcing buyers to totally incur or share shipping costs, a big change from prior commercial arrangements. Since shipping prices are so high, this is causing significant strain to unit economics and profitability.

Increase time to Quote and Introducing Price Expiry

Factories are taking an average of 3-10 days longer to quote. We think this is because: 1) They are continually assessing price increases and ability to produce, 2) they await clarity on power regulations, and/or 3) they are running hidden auction-like processes with buyers and are waiting for the best price they can get. Quoted prices also now have a short expiry to them (2-6 days) making it tough to conduct thorough due diligence.

Longer Lead Times and Shipping Uncertainty

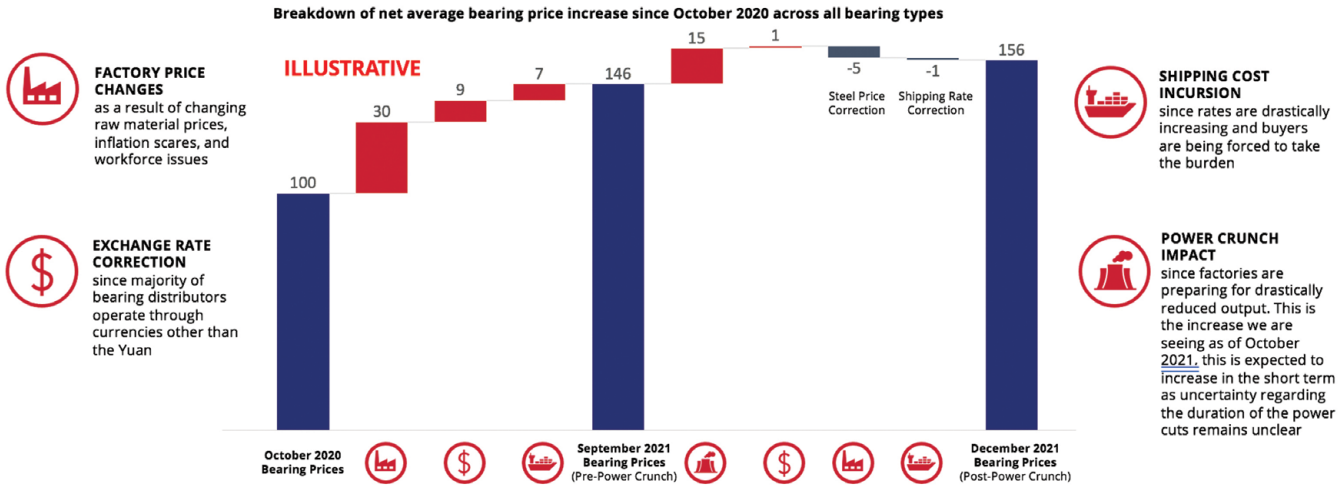
Due to decreased activity hours and labor constraints, factories are quoting much longer delivery times (anywhere from 2–4 months longer than 2019 orders) making it tough to place back-to-back orders and increasing the importance of stocking. This issue is exacerbated by uncertain shipping delays which make serving customers on time much more challenging

Tightened Payment Terms

Factories are extra focused on cash flow and are not accepting reasonable credit options, increasing the financial burden on suppliers and distributors.

Average Impact on Bearing Unit Economics

We have broken down the aggregated impact on bearing economics which is causing major margin strain on suppliers and distributors



SOURCES: 1) TradingEconomics.com, 2) Quartz

We have witnessed an average (weighted) price increase of 56% over the last year. In the first week of October, there was an average 10% increase as a result of the sudden power regulation, this is only expected to increase over the next couple of months

Scenarios for the Future

Since the current price and regulation volatility makes it tough to predict the future, we have constructed 4 plausible scenarios by which the price and power regulation will increase – KG uses these scenarios to anchor our decision-making

Factors Impacting the Future

Additional Magnitude

How will prices and delivery uncertainty increase as a result of the current prevailing industrial and environmental factors?

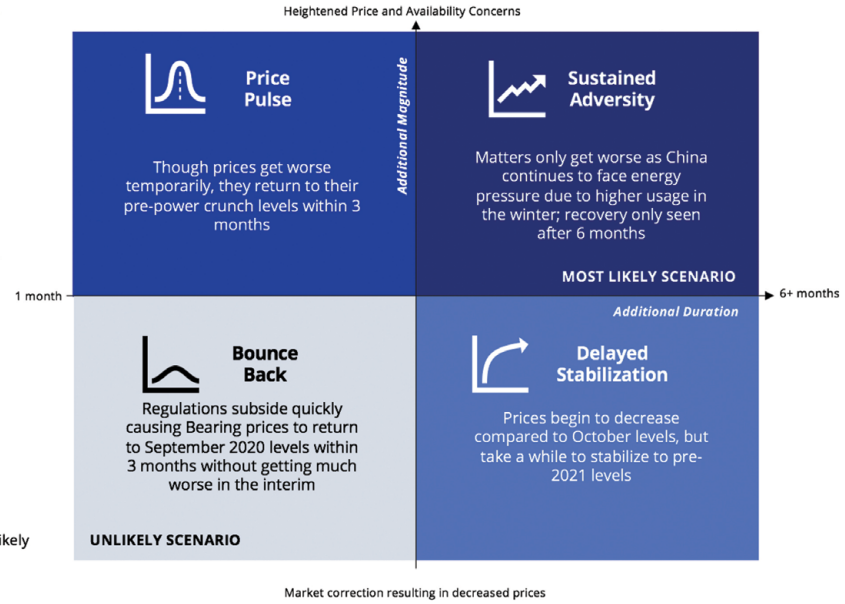
Additional Duration

For how much longer will we experience inflated prices and uncertain delivery/availability?

KG's Perspective on the Likelihood of the Four Scenarios:

Based on our current market knowledge and perspectives of various industry leaders, we have assigned the following probabilities to each of the scenarios. We will present all four scenarios so that our customers can apply their own judgement and respond accordingly

Unlikely — Highly Likely



Key Characteristics and Responses to Each Scenario

We have outlined potential responses to each plausible scenario to mitigate risk and better serve customers

Increasing net impact and scenario likelihood

	Bounce Back	Delayed Stabilization	Price Pulse	Sustained Adversity
Characteristics	▪ Prices begin to decrease to pre-2021 levels within 1-2 months ▪ Sudden increase in clarity from the Chinese government around ending of restrictions in 1-2 months ▪ Sudden and short dip in bearing demand globally as price volatility begins to subside ▪ Decreased panic and uncertainty	▪ Though prices don't increase from October levels, there is no sign of short term recovery (1-2 months) ▪ Factories continue struggling to meet demand and consistently delay orders ▪ Little to no clarity on regulations ▪ Sustained overall panic and uncertainty impacting China's GDP growth	▪ Sizeable hike in prices vs today's levels which don't return to September levels for 2-3 months ▪ Factories find creative solutions to meeting demand in the short term ▪ Chinese government lays out clear plans for the restrictions ending in 3-5 months ▪ Moderate overall panic and uncertainty in the short term	▪ China's winter makes it tough for energy consumption to be reduced significantly and factories have to adjust to new regulations that are long-lasting ▪ Workforce issues ensue ▪ Prices continue to remain high and take a long time to stabilize (6+ months) ▪ Steel and shipping disruption ensues for 6+ months
Responses	✓ Wait out the storm by only stocking what you need in the next 1-3 months ✓ Communicate with customers to delay demand planning until prices stabilize	✓ Assume selling prices will eventually return to September levels and stock accordingly ✓ Communicate with customers to extend their planning so that suppliers/distributors have enough time to find the best sources	✓ Stock for the medium term and place bigger bets only after stock is depleted and prices are stabilized ✓ Communicate with customers to delay demand planning until prices stabilize	✓ Increase stock ASAP for 8+ months to avoid purchasing too much at heightened increases ✓ Communicate with customers to delay demand planning until prices stabilize

No Regret Actions

There are few no regret actions that suppliers and distributors can take to help drive a broader understanding and mitigate risk

Improve Business Planning

Spend more time accurately predicting demand and helping your customers with more accurate order planning.

Bring a Problem-Solving Attitude to Relationships

Bring a positive attitude to meetings to solve problems together and look for win-wins vs. spending time on blame/complaints which tends to be unproductive and diminish relationships.

Manage Customer and End User Expectations

Improve quality and frequency of customer communications to ensure that they are always aware of the market situation and what to expect regarding prices and delivery

Increase Collection of, and Reliance on, Data & Analytics

In today's business environment, the more we can rely on data and analytics, the better our risk management and performance. There are many pre-existing SaaS solutions that companies can leverage to drive efficiency and effectiveness.

Increased Transparency and Trust

COVID has taught us that trust and honesty are the cornerstone of business amidst uncertainty. Improving trust and transparency between customer and suppliers can result in stronger relationships and more fruitful business

Encourage Suppliers to Invest in Procurement Effectiveness

It is important to work with suppliers who are effective in their procurement in terms of order quantities and factory diligence. For example, KG orders from 25+ factories annually to source the best quality and conducts quality checks for an additional 20+.

Author

Karan Gupta - Head of Strategy
karangupta@kginternational.com

Karan leads KG International's growth strategy in terms of partnerships, market/ product expansion and penetration, operating efficiencies, and customer experience. Karan is a seasoned strategist having worked with Deloitte Consulting in the US for a variety of Fortune 500 clients in many industries. He worked across a range of strategic issues such as corporate / business unit strategy, M&A, operating model transformation, offering innovation, new product launches, etc. around the world.

Karan obtained degrees in Mechanical Engineering and Applied Mathematics from the University of California, Riverside where he focused his research on Fault Modeling of Bearings and Induction Motors.

Acknowledgements

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Rohit Gupta, *CEO*
Mazhar Hussein, *Head of Procurement*
Ashish Jain, *Purchasing Manager*

About KG International

KG International is a leading global private Bearing brand and is a key distributor for leading automotive and industrial brands spanning many products, such as: Bearings & Housings, Filters , Linear Motion Products, Gearboxes & Motors Grease & Lubricant, Commercial Vehicle Spare Parts

KG started its journey 53+ years ago and is a pioneer for transforming Dubai into the Global Bearing Hub it is today. Through our journey, we have developed markets for a variety of global brands and have learned a myriad of lessons along the way to better serve our customers and suppliers. Today, we have 80+ team members around the world, we operate out of a 250,000+ sqft facility in Dubai which holds 24m+ items, and we serve customers across 14+ industries in 45+ countries.

Please find more information through our various customer channels, or email us directly for any further questions.

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START SMALL – MAKE IT BIG

At Friedrich PICARD GmbH & Co. KG, apprentices get the best prospects

Annika and Ahmet are first-year apprentices with Friedrich PICARD GmbH & Co. KG in the city of Bochum in Germany's Ruhr region. The expert in rolling bearings and linear motion technology provides on-site training in a variety of occupational fields, including logistics, business administration and IT.

Annika is training to be a wholesale and export management specialist while Ahmet is on his way to becoming a warehouse logistics specialist. Enrolled in a dual education programme, each is learning the practical side of the occupation he or she is training for directly within the company's operational environment. Meanwhile, they receive the theoretical side of their apprenticeship education at a vocational school. We asked them about how they have fared in their first few months at PICARD.

Q: Why did you decide on this apprenticeship?

Annika: I was looking for an apprenticeship that matched my affinity for foreign languages with my outgoing and organised nature.
Ahmet: I chose this apprenticeship because I like to work within a team and because it's important to me to be physically active. Because of my previous experience working in a warehouse, I was sure I wanted to do this apprenticeship.

Q: Why did you choose to do your apprenticeship with PICARD?

Annika: I decided on PICARD because everything clicked, from start to finish. Already during the interview, I felt welcome and much more relaxed than usual in this normally stressful situation. PICARD is also very internationally oriented and really values the importance of a diverse and multicultural work environment.
Ahmet: The decision was relatively easy for me because I had, of course, read up on PICARD beforehand and had checked out the company's social media channels on YouTube and Instagram, for example. I was immediately impressed by the videos there and decided I wanted to be part of the PICARD team.

Q: Did you know what a rolling bearing was before you applied for a job at PICARD?

Annika: No. In fact, the first time I'd ever heard of them was while watching a YouTube video in preparation for my apprenticeship interview.
Ahmet: Honestly, I have to admit that I didn't know initially what a rolling bearing was or what one even looked like.

Q: Why is a rolling bearing at least as thrilling as an iPhone 13?

Annika: A rolling bearing is at least as thrilling as an iPhone 13 because no roller coaster could function without rolling bearings. And let's be honest, who wants to live in a world without thrills?!
And, in case you're still sceptical, you probably couldn't manufacture an iPhone either, if rolling bearings didn't exist.
Ahmet: The rolling bearing business is really fascinating because the products have such a wide variety of applications, due to properties that aren't apparent to the naked eye, such as their varying heat resistances, maximum rotational speed loads, and degrees of high-precision performance. I'd also add that without rolling bearings and linear motion technology, there would be no iPhones, anyway.

Q: What has surprised you the most so far?

Annika: The thousands of different sizes and varieties of rolling bearings. There's nothing that doesn't exist and something for every application – from a 9-millimetre rolling bearing designed for skateboard wheels to one with a diameter of 900 millimetres that goes into wind turbines.
Ahmet: What's surprised me the most so far is the work itself – because I never considered how well everything in a warehouse has to be planned, organised and structured for customers to receive the goods they ordered.

Q: What is special about PICARD?

Annika: The company's modern building with its many leafy green plant walls that create a special and fresh atmosphere, even on grey, drizzly days in November. I also find it remarkable that our 250-person team brings together people from 36 nations in one place.
Ahmet: The special thing about PICARD for me personally is that we supply the specialised trade for rolling bearings worldwide – for example to customers in Italy, Turkey and France. I think that shouldn't be underestimated.

Q: Which area are you currently working in and what are your tasks?

Annika: For the first three months, I was assigned to the sales team and assisted Miriam and Luis, who are responsible for the Spanish and Portuguese markets. During the first few weeks, I mainly watched them work and had them explain and show me each of the process steps and tasks in the sales department. I was then permitted to take an active role, prepare offers, and handle customer enquiries. I also collaborated on a project to market our digital solutions. For the last two weeks, I've been working in the warehouse, where my main task is to pick customer orders and then pack the items safely for shipping.
Ahmet: At the moment I am working in the goods receiving department. We take care of unpacking the delivered goods, inspecting them, and storing them properly on the shelves.

Q: What did you expect from your training and have your hopes been fulfilled?

Annika: From my training at PICARD, I expected to learn a lot about rolling bearings, and hoped to be able to make active use of my foreign language skills, and to be given the opportunity to apply what I have learned independently. These expectations and hopes have been completely fulfilled. I've been offered numerous training courses on rolling bearings and have been able to directly apply my Spanish skills as part of the Spain and Portugal sales team.
Ahmet: When doing an apprenticeship, I think it's important that the general atmosphere in the company is agreeable and positive, and that workmates get along with each other. It's also very important to me that I do my work with enthusiasm and have fun at it – so I can feel good getting up i the morning to go to work. These hopes have all been fulfilled.

Q: What are your prospects after you finish your apprenticeship?

Annika: PICARD invests in its apprentices in order to offer them long-term opportunities, so I'd be delighted to stay with the company once I'm finished – preferably in sales for a foreign-language market. There's also an opportunity to do a business degree, which would deepen and broaden my skill set.
Ahmet: Once you've completed the apprenticeship, you have plenty of prospects. On the one hand, we have a hiring rate of 95 per cent at PICARD, so I have a good chance of being hired here after my training. But I could also just as easily complete my master's degree in warehouse logistics or even study further and then work as a technical business economist.

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Avoiding Unplanned Downtime: Online Monitor of Critical Bearings

Keeping a close eye on the condition of critical equipment is fundamental in any industrial facility. When critical bearings fail, it almost always leads to unplanned downtime and interrupted production process, costing companies thousands in production loses. In this case study we will look at how an online monitoring solution using ultrasonic sensors was able to detect an issue on a critical bearing before it turned into a big problem.

Critical equipment: bleach decker in a pulp and paper plant

Usually, in pulp and paper plants we will find a wash floor or wash area, where the paper comes through to be thoroughly cleaned / bleached. That job is done by a machine called a bleach decker, which is considered a critical and fundamental piece of equipment for production operations.
In this particular plant, which has a predictive maintenance program in place, it was decided to invest in online monitoring for these machines. The maintenance team wants to be alerted as soon as anything unusual is happening with the equipment in order to prevent any failures that would lead to a stop in production. This machine has 4 bearings, of about 48 inch / 120 cm diameter, rotating at 3 RPM.
To enable online monitoring and early failure detection, ultrasonic sensors are being used on the machines' bearings. These are UE Systems Remote Access Sensors, which are permanently installed on the bearings and constantly collect decibel readings and sound recordings. All this data is then sent to a central processing unit called the 4Cast. This unit is connected to the Internet and will alert the maintenance team (e-mail and SMS alerts) when certain decibel levels are reached.

— Bleach decker with the ultrasonic sensor mounted on the bearing

—The sensors are connected to the 4Cast, a central processing unit with internet connection.

Why ultrasound?

The preference for ultrasound technology to monitor these bearings has to do with its obvious advantages: since the ultrasonic sensors monitor the bearings' friction levels, any increase in friction will be noticed. This allows for a very early warning of failure. Also, because the data from the sensors comes in the form of decibel readings, it is easy to interpret: the higher the friction, the higher the dB value. When this value reaches a certain limit above the baseline, an alarm is sent.

And, even more relevant to these bearings, ultrasound is the most efficient technology to inspect slow speed bearings. The bearings on this machine are rotating at 3RPM. At such slow speeds, it is generally extremely challenging to notice any issues using technologies such as vibration analysis or thermography. But ultrasound shines when the subject is slow speed bearing monitoring, especially when you can record the sound from the bearing, analyse it in a sound spectrum software and check if the amplitude shows any peaks, which normally indicate a fault.

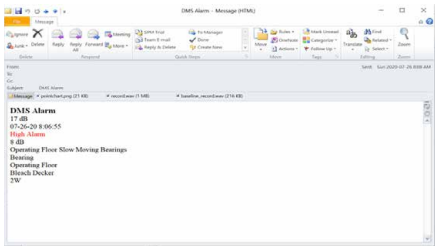
Thus, ultrasound is the perfect technology when we want to online monitor slow speed critical bearings.

Failure detection with online monitoring using ultrasonic sensors

Everything seemed to be fine with the bleach decker at this pulp and paper facility, as the machine was working as expected. However, the 4Cast, an ultrasonic online monitoring system, received an unusual decibel reading from one of the ultrasonic sensors. The NDE (non-drive-end) bearing of this bleach decker was registering 17dB when, normally, a bearing rotating at such

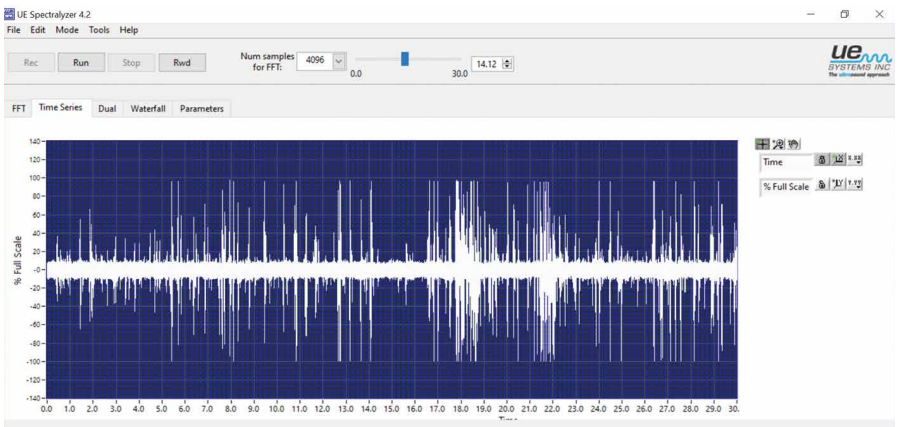
slow speeds like 3RPM should simply show a odB reading.

This, of course, triggered the system to immediately alert the maintenance team. The 4Cast was setup to consider any reding above 8dB on this bearing to be a high alarm, and therefore, the following alert was sent from DMS, the UE Systems software where all the data from the 4Cast is stored:

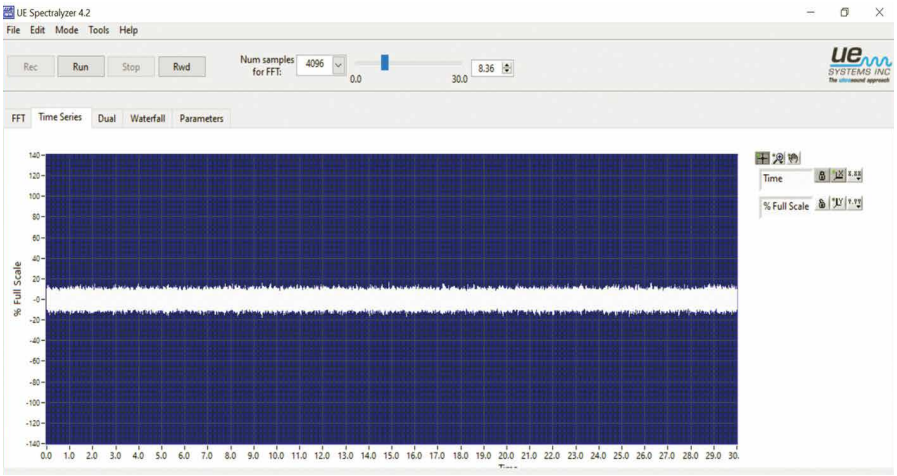


We can clearly see why the alert was triggered: the 4Cast received a 17dB reading from a bearing where the threshold for a high alarm was setup at 8dB. The alert message also contains useful information regarding the machine (operating floor slow moving bearing; bleach decker) and, naturally, a time stamp of when the reading was taken.

When an alarm level is reached, the 4Cast will also take a sound recording from the bearing for further analysis. This is especially useful in slow speed bearings, where the sound spectrum can tell us a lot about what's going on with the asset. In this case, and even though the machine was apparently working as expected, the sound file spectrum showed a very different story.



The peaks shown in this sound sample clearly indicate a problem with the bearing. Also, when reproducing the sound file, we could very clearly hear the impact noises. The failure was even more obvious when the sound file was compared to a sound recording from one of the other bearings.



We can clearly see the differences. In this case, the recording sounds smooth and looks uniform, and we don't see amplitude peaks at all. So, this would be an example of how the sound spectrum of a good bearing should look like.

The next step for the maintenance team was scheduling the replacement of this bearing, without disrupting production. When the bearing was dismantled, the damage was clearly visible.

The signs of impact are obvious. Also, metal fragments were found in the shaft, plus spalling, with some pitting, and slight abrasion were present in the outer race.

Conclusion

By detecting the issue at an early stage, the maintenance team was able to replace the bearing during scheduled downtime and without disrupting the production process. We can imagine the consequences if the issue was not detected at this stage and the bearing was allowed to continue operating: the metal fragments would certainly affect the motor shaft, which would then also need to be replaced; and the facility would have to face unplanned downtime. In such a situation we could be looking at a loss of around 250K GBP. By using the proper technology, with the proper maintenance procedures in place, the team was able to identify and solve the issue before it became a major problem. This case study shows how powerful ultrasound technology can be, especially when used in sensors connected to the network to provide truly online and permanent monitoring solutions.

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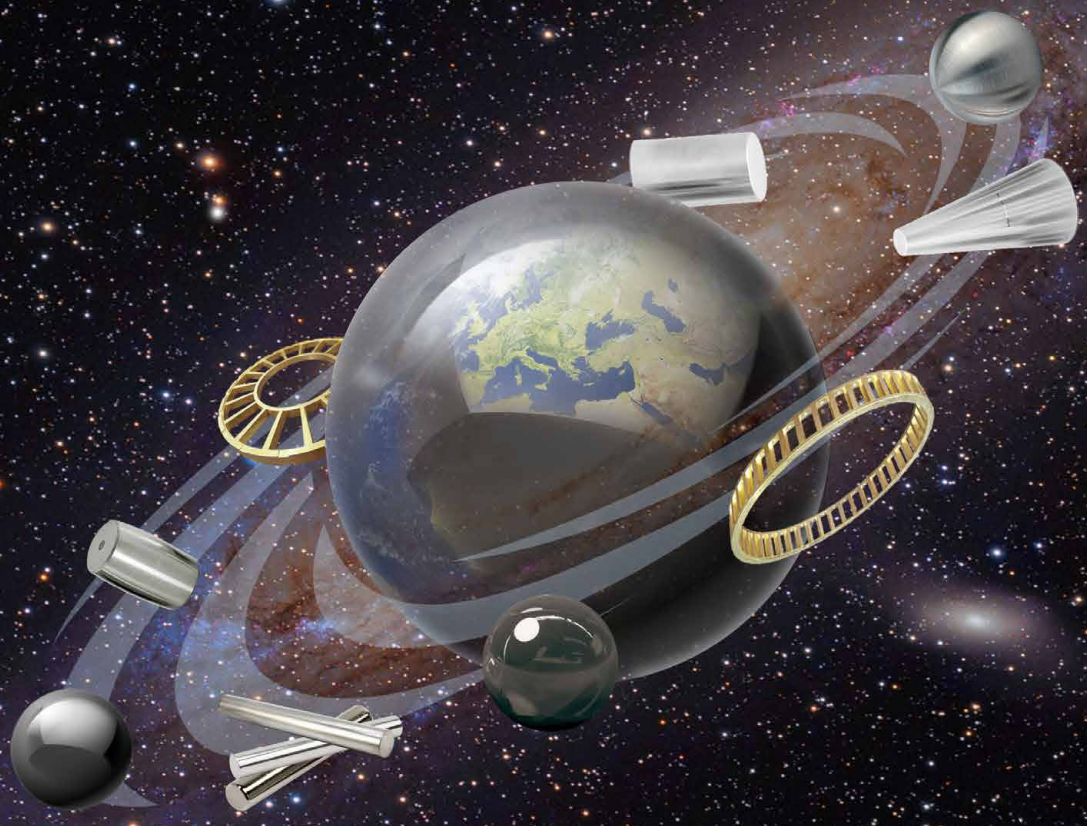

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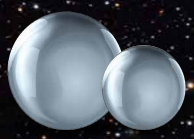

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Why automatic lubrication?

Unplanned production downtimes can be significantly reduced through preventive maintenance. A factor that should not be underestimated is the correct lubrication of bearings, chains, linear guides and spindles. A high percentage of rolling bearing damage is due to incorrect lubrication.

The solution:

With the G-LUBE automatic lubricator from the German company Gruetzner GmbH, the lubrication point is supplied with the correct lubricant in the correct dosage. The sources of error of manual lubrication (over-lubrication, insufficient supply, contamination, mix-up of lubricants) are thus prevented. A continuous, consistent and gentle lubrication is the result, repair costs and production losses are reduced.

Flexibility:

G-LUBE can be visually checked at any time thanks to the transparent housing. Depending on the requirements of the application, emptying times from 1 to 12 months can be set. The sizes of 60 ml, 120 ml and 240 ml enable a lubricant delivery of 0.16 ml / day up to 8 ml / day.

The right lubricant:

Every customer can fill the G-LUBE himself or have it filled with one of the many standard lubricants offered. Special requests are also met by Gruetzner GmbH, even for small quantities. A very wide range of accessories for installation enables a large selection of applications.

Work safety:

With a pressure build-up of up to 5 bar / 73 psi, G-LUBE does not have to be mounted directly on the lubrication point. Supply lines are also possible which lead to areas that the user can comfortably reach.

G-LUBE thus contributes to work safety and significantly reduces the maintenance time required compared to manual lubrication. No tools are needed to activate G-LUBE.

Proven technology:

The function of G-LUBE is based on the proven technology of an electrochemical reaction, which generates inert nitrogen (N_2) through the systematic use of an electrolyte. This type of pressure build-up means that G-LUBE is more temperature-independent than many conventional gas-powered lubricators. It can be used in temperature ranges from -20 ° C / -4F ° up to 55 ° C / 131 ° F, even in sensitive food areas, but also in harsh environments, thanks to its very robust housing. Use in potentially explosive atmospheres is also permitted.

Environmental protection:

Using G-LUBE reduces lubricant consumption and energy costs for drives.
Find more information at www.G-LUBE.com

Five steps to avoid common causes of bearing failure

Bearings may be small, but they play an invaluable role in keeping industrial machinery running smoothly. Improper lubrication, contamination, corrosion, overload, along with improper handling, mounting and storage are all leading causes of bearing failure. Here Chris Johnson, managing director at **specialist bearing supplier** SMB Bearings, outlines five steps to avoid these common problems and future process disruption.

1. Steer clear of improper handling, mounting and storage

Bearings should be stored horizontally in their original packaging in a clean, dry and room temperature environment. When bearings are unnecessarily handled, for example, if their wrappings are prematurely removed, this can expose them to corrosion

or contaminants. Even while they're being stored on shelves, the bearings can still experience harmful vibration because of the facility's daily operations so it is important to store the bearings in an area not exposed to vibration.

Bearings are delicate components and should be treated with care. Consequently, components that have been dropped shouldn't be used, as this could lead to premature failure. Additionally, appropriate equipment should be used when handling and mounting bearings. Tools that are not specialised for use during the bearing mounting and dismounting process can cause damage, denting and wear. Bearing pullers or induction heaters for example, are designed specifically for bearings. Making sure the bearing is mounted properly will avoid equipment imbalance and misalignment.

2. Don't overload the bearing

When selecting the bearing to best fit your needs, it's important to remember that inappropriate loads cause increased fatigue and risk of bearing failure. To get the best life ratings from your bearings, limit the actual load to between six and twelve per cent of the bearing's dynamic load rating. This load rating does however vary according to the bearing material. For example, stainless steel bearings will support approximately 80 to 85 per cent of the load figures indicated for chrome steel bearings.

The more the bearing is overloaded, the shorter the bearing life. Overloaded bearing components will experience premature wear. These bearings should be replaced to safeguard the surrounding equipment.

While overload can be a result of the incorrect specification at the design phase, some overloading may occur due to changes in production requirements, environmental conditions, or operator error. For example, if a steel bearing is heated above the limit that it is designed for, this can permanently deform or soften the bearing material, resulting in a reduced load carrying capacity and leading to equipment failure. Always check the manufacturer's specification to make sure it meets your requirements prior to installation.

3. Avoid contamination

Contamination in the form of dust or dirt entering the bearing's raceway is problematic. Therefore, choosing a closure that protects against these foreign particles entering the bearing and keeps the lubrication inside, is crucial. Closures should be expertly matched to the application, depending on the operating environment. While we'd always recommend seeking the advice of a bearing specialist, here are a few pointers to bear in mind.

Firstly, choose closures that will withstand the environmental and operating conditions. Routinely check bearing seals for hardening or wear. Inspections should also be carried out for lubrication leaks. When conducting maintenance, try to avoid using steam cleaning methods or high-pressure sprays. This may be difficult in the food and beverage industry so sealed bearings with a washout resistant lubricant are recommended. If maintenance isn't conducted appropriately, it can do more harm than good. In fact, it is easy to damage seals and force contaminants into clean equipment if not handled correctly. This is where condition monitoring such as vibration analysis can

provide vital insight into the bearing's operating condition and alert an operator to any changes without invasive action.

4. Limit corrosion

Wearing gloves will ensure that perspiration or other liquids do not affect the bearing in low-corrosive environments. However, corrosion-resistant bearings will be needed in applications where corrodible materials wouldn't suffice — think food processing, chemical manufacturing, pharmaceutical production and bearings for marine applications. Corrosion occurs primarily when the bearings have been exposed to water or more corrosive liquids. In some cases, it leads to etching on the surface, which will eventually develop rust. Flaking and cracks in the bearings can then follow. Common signs of corrosion are dark coloured or reddish-brown areas on the balls and raceways. Eventually, you may see pitting of the raceway surfaces. While the material choice is a crucial first step to combatting corrosion, preventative measures such as the use of lubricants with rust inhibitors are also recommended.

5. Use the correct lubrication for the bearing

Standard lubrication will do its bit in reducing friction and dissipating heat. However, this lubricant may not satisfy the maximum running speed, torque level and temperature requirements of your application. Specialist lubrication may be required.

Similarly, if the lubrication quantity isn't sufficient, the balls, retainers, and raceways will have metal-on-metal contact, and friction will wear down the bearings. By contrast, if the bearings are overfilled with grease, heat cannot be dissipated, causing the bearing to overheat. In both scenarios, this will reduce the efficiency of the equipment and overall process. Choosing the correct lubricant should start with the application conditions but should also consider the correct lubricant quantity and viscosity for the load, avoiding temperatures that are too extreme for the specified bearing, and preventing ingress of dirt or other contaminants.

While these five steps offer a good starting point to reduce bearing failure and extend service life, appropriate design engineering and early intervention are key.

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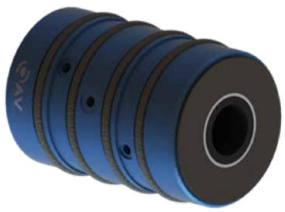
A finite element analysis of OAV Air Bearings used in Ultra-high speed spindles

"Frictionless" Air bearings continue to be a fascinating development for the machine world! Among knowledgeable developers and designers air bearings have created an immense curiosity and appreciation for their benefits. A spindle application is just one of many possible uses for air bearings in the machine development industry.

There is no difference between the static and dynamic coefficients of friction in air bearings, and hence No contact between the surface, no slip-stick phenomenon, virtually No heat generation, No wear, and most important, no maintenance. The elimination of maintenance on the air bearings is invaluable in so far as the reduction or elimination in down time, the reduction in required maintenance labor, and the reduction in replacement costs makes them extremely cost effective.

Air bearing "friction" is a function of air shear from motion. Therefore at zero velocity, there would be zero friction making infinite motion resolution theoretically possible. However, we account for coefficient of friction in log scale .oooooo8 due to the motion of air molecules and gravity. For extremely high-speed applications, coupled with the creative use of specialized materials and, when applicable through the use of OAV's temperature-controlled air bearings we are able to maintain a constant temperature of the bearing.



OAV Temperature controlled Air Bearings are able to maintain similar mechanical properties at very low and very high temperatures. Factoring in Material type, fluid flow, and airflow, OAV engineers can adjust the Air bearing design to keep them at a constant temperature so machines can operate under extremely high speeds, high ambient temperatures, and hot applications without sacrificing precision or quality.

In addition to the above, OAV Air bearings have higher stiffness and excellent geometric performance. The OAV Thrust Air Bearings preload both horizontal and vertical surfaces with opposing thin-film pressure. This maintains the perfect gap of ultimate tolerance. OAV's Air Bearing surface design equally distributes the air over the entire surface area resulting in outstanding stiffness and maximized performance.Ultra-High Precision

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New Bearing Proof Load Testing Machine
Offers Outstanding Accuracy & Flexibility

How we listen and respond to customer feedback can sometimes result in the development of important new products or subtle variants of existing products which help to improve manufacturing processes. A good example of this is a new BEARING PROOF LOAD TEST MACHINE recently introduced by UNASIS International Ltd, the specialist custom bearing and tool manufacturing division of the CARTER MANUFACTURING group of companies.

Initially developed for the aerospace industry for load testing spherical plain bearing applications on airframe structures, landing gear, door systems and engine mounts, the machine enables users to control the amount of load applied to bearings with incredible accuracy to satisfy the most demanding process specifications. The traditional method of using a hydraulic bench press has its limitations, most important of which is its in-ability to control the ramp-up and ramp-down rates which are becoming standard in OEM process specifications.

The bearing proof load machine can precisely increase the axial static loads applied to bearings at a rate of 1% per second and generate highly accurate data with an accuracy of +/- 0.1% of the full scale with a displacement resolution of +/- 0.01%. This ensures a much more accurate and reliable system for users to validate the integrity of their bearing housing assemblies. (See Graph 1).

— Graph 1

The new test machines are designed to be an integral part of mass production processes providing users with the benefits of optimum repeatability, minimised risk and significant time-savings. Following the development of the customer's program supported by Carter Manufacturing and accompanied by operational training with a step-by-step instructional video, the machine can be quickly utilised by a low-skilled worker.

This is important in view of the current supply chain issues affecting global manufacturing as it means users have more control of their operations by having a proven and incredibly accurate testing capability in-house. In addition to proof load testing the machine can also be programmed to operate as a precision tensile testing machine so it offers the flexibility of being a multi-functional system which is highly adaptable for other applications such as bushing installations and strain measurements.

The success of the system and its ability to meet the exacting aerospace specifications it was initially developed for is underlined by its satisfying the demands of the major manufacturer's Boeing and Airbus. For example, conforming to Boeing's BAC5435, NAS0331 specifications, Airbus's AIPS and AIPI03-03-012 and Bombardiers' BAPS 175 range, in addition to many other recognised specifications.

This machine also aligns perfectly in the motorsport industry with critical suspension bearings and is also proven critical for validating bearing assemblies for space exploration vehicles and other spacecraft systems.

Visit www.carterbearings.co.uk/aerospace-bearing-tools/proof-load-test-machine for more details and video

Software Version 08/2021 is available

A new version of the MESYS shaft and rolling bearing analysis software including new functionality is available. The bearing analysis software allows the calculation of the load distribution within the bearing and bearing life according ISO/TS 16281 and it is integrated in a shaft system calculation with additional possibilities like modal analysis, strength calculation for shafts and interfaces to gear calculations. Currently the software is used by customers in 29 countries on 4 continents.

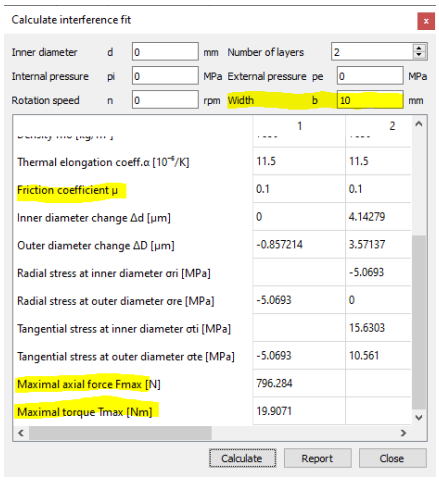
General Extensions

Some start parameters were added to allow an easier interface with PDM systems. Using the COM-Interface now direct access to diagram data is possible and the user can change diagram axes from linear to logarithmic scale.

In the “File” menu an “Export as” was added and template files can now be structured using subdirectories.

Reports can now be generated in XLS or XLSX format and data can be imported from XLSM-Files.

The general interference fit calculator was extended by results for maximal axial force and torque.

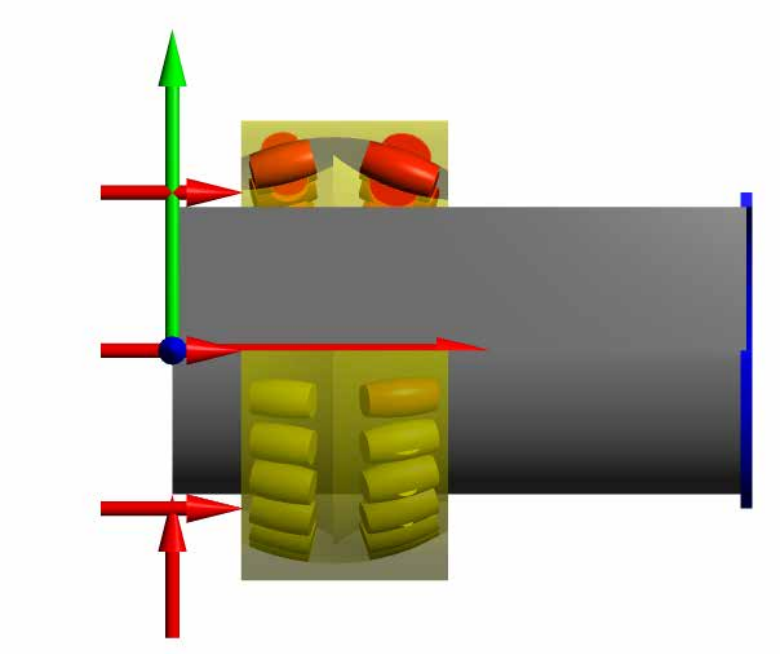


Extensions in the Bearing Calculation

The bearing databases with catalog data from Schaeffler and SKF were updated. Schaeffler now provides the number and dimensions of rolling elements and the database has to be provided in encrypted format with hidden internal geometry. For the SKF database the dimensions of the rolling elements are still approximated. The detail geometry like curvatures or profiles are still approximated in both cases.

Regarding the bearing databases including internal geometry, the database from CSC was extended by additional bearing series. The database from HQW/ Barden is unchanged from last version. On request additional databases are available from some bearing manufacturers, for example from GMN or IBC.

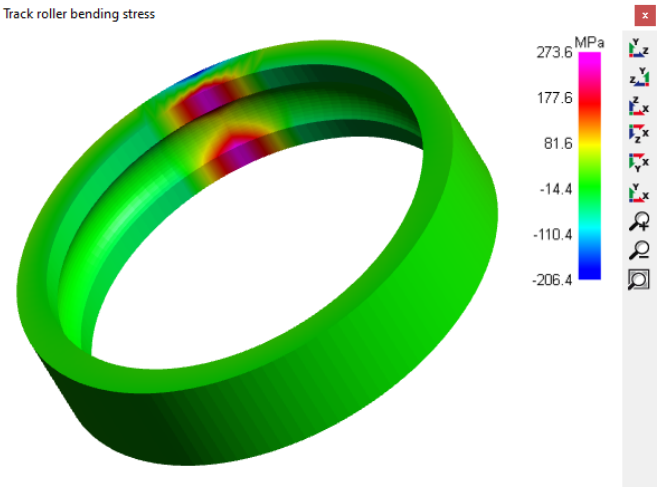
As new bearing type half radial spherical roller bearings are supported. This allows the definition of asymmetric spherical roller bearings within the shaft calculation. The contact angle and also the dimensions of rolling elements can



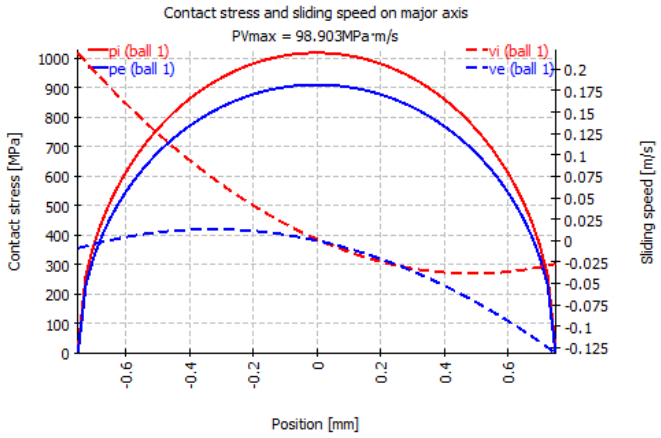
— Asymmetrical spherical roller bearings are now supported within the shaft calculation.

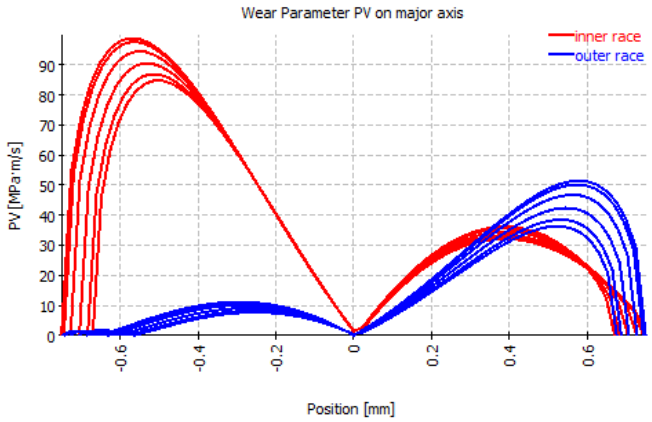
be defined differently for each row. Three-point bearings can now be calculated considering elastic outer rings. The bending stresses for calculations with elastic outer ring can now be shown as 3D-plot in addition to the existing 2D-plot.

Several additional small extensions are mentioned in the update documentation, so for example now diagrams for all load spectrum elements instead of the first 30 can be shown. A calculation of grease operating life analog to Schaeffler 'Wälzlagerpraxis' was added.



— Additional diagrams for sliding speed or PV on the major exis of the contact ellipse have been added.

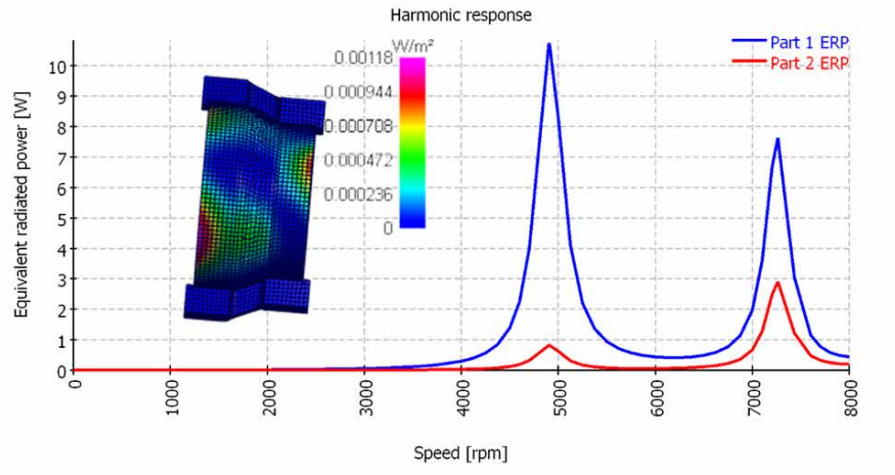




Extensions in the Shaft Calculation

In the shaft calculation for cylindrical gears an axial offset for the load can be defined in case the gears are considered as point loads. This offset can also be varied within load spectra. For masses and imbalances an axial offset can be defined now; this allows a center of mass outside of the shaft geometry.

A generic format was added for the interfaces to gear calculations. For the interface to TBK 2014 or eAssistant now the gear data is saved with the gear elements and therefore kept constant between different calculations.



For 3D-elastic parts the equivalent radiated power (ERP) is added as output and as graphics for harmonic response.

The positioning of 3D-elastic parts can now be done according to selected connections and the mesh can be divided into several subdomains, for example to assign different material properties.

The COM-Interface was extended and now allows to set parameters for force elements and an export in REXS format, which is supported in version 1.3.

A demo version is available for download at https://www.mesys.ag/?page_id=1229, for additional information and contact, you can visit www.mesys.ag.

iMotion .events

industrial motion hybrid meetings
for PT/MC Buyers & Suppliers

March - December 2022

Bearing & Power Transmission Meetings • *21-23 March 2022*
Agriculture & Food Meetings • *13–15 April 2022*
Motion Drives & Automation Meetings • *23-25 May 2022*
Marine & Offshore Meetings • *10-12 October 2022*
Steel & Metals Meetings • *14-16 Novembe 2022*
Mining & Construction Meetings • *05-07 December 2022*

6+ Events in 2022

www.imotion.events

ExpoNext

www.exponext.com

MOST IMPORTANT INDUSTRY EVENTS for 2022

JANUARY - JUNE

2022 MOST IMPORTANT INDUSTRY EVENTS

ExpoNext
www.exponext.com

JANUARY

STEEL & METALS

STEELFAB
10 Jan - 13 Jan 2022
Sharjah / UAE

Steel production and metal manufacturing event

www.steelfabme.com

MOTION & DRIVES
ENGINEERING STEEL & METALS

EUROGUSS NUREMBERG
18 Jan - 22 Jan 2022
Nuremberg / Germany

Euroguss shows the entire die casting value chain under one roof.

www.euroguss.de

STEEL & METALS, MACHINE TOOLS

IMTEX
20 Jan - 26 Jan 2022
Bangalore / India

Imtex is one of the largest metal-cutting machine tool exhibitions in South East Asia.

www.imtma.in

RECOMMENDED Bearing NEWS

MATERIALS HANDLING

EMPACK HAMBURG
26 Jan - 27 Jan 2022
Hamburg / Germany

EMPACK is the regional trade fair for packaging technology, materials and services related to the packaging industry.

www.empack-hamburg.com

RECOMMENDED Bearing NEWS

MATERIALS HANDLING

LOGISTICS & DISTRIBUTION HAMBURG
26 Jan - 27 Jan 2022
Hamburg / Germany

Logistics & Distribution Hamburg is the regional trade fair for intralogistics and material flow.

www.intralogistik-hamburg.de

RECOMMENDED Bearing NEWS

AUTOMATION

AUTOMACION WARSAW
26 Jan - 28 Jan 2022
Mazovia / Poland

Automaticon is an international trade fair for industrial automation in Warsaw.

www.automaticon.pl

FEBUARY

AGRICULTURE, FOOD & BEVERAGE

FIMA AGRICOLA ZARAGOZA
IMA AGRICOLA ZARAGOZ
08 Feb - 12 Feb 2022
Zaragoza / Spain

Fima Agricola is an international exhibition for agricultural machinery in Zaragoza.

www.feriazaragoza.com

MANUFACTURING TECHNOLOGIES

THAILAND INDUSTRIAL FAIR
09 Feb - 12 Feb 2022
Bangkok / Thailand

The Fair is a trade fair for modern industrial technology, machinery, equipment, industrial supplies and services for Thailand and the Asian manufacturing industry.

www.thailandindustrialfair.com

STEEL & METALS, MACHINE TOOLS

EXPO MANUFACTURA MONTERREY
15 Feb - 17 Feb 2022
Monterrey / Mexico

Expo Manufactura Mexico is recognized as Mexico's leader among metalworking and manufacturing events.

www.expomanufactura.com.mx

MOTION & DRIVES ENGINEERING

FORNITORE OFFRESI
17 Feb - 19 Feb 2022
Erba / Italy

Mechanical Engineering exhibition for subcontractors from the engineering sector

www.fornitoreoffresi.com

MACHINE TOOLS

TIMTOS TAIPEI
21 Feb - 26 Feb 2022
Taipei / Taiwan

The Timtos as an international trade fair for tool and machine tool industry is an important meeting place and information platform.

www.timtos.com.tw

AUTOMATION

INDUSTRY AUTOMATION & CONTROL
22 Feb - 25 Feb 2022
Mumbai / India

Industry Automation & Control South World is a fair for automation technology.

www.chemtech-online.com

2022 MOST IMPORTANT INDUSTRY EVENTS

ExpoNext
www.exponext.com

FEBRUARY

AGRICULTURE

AGRITECHNICA HANOVER

27 Feb - 05 Mar 2022
Hannover / Germany

Agritechnica is a leading international exhibition for agricultural machinery and equipment, which takes place every two years in Hanover.

www.agritechnica.com

RECOMMENDED Bearing NEWS

MARCH

FOOD & BEVERAGE

CFIA

08 Mar - 10 Mar 2022
Rennes / France

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

www.cfiaexpo.com

MACHINE TOOLS

METAV DÜSSELDORF

08 Mar - 11 Mar 2022
Düsseldorf / Germany

The Metav is an international trade fair for metal working industry.

www.metav.de

MOTION & DRIVES ENGINEERING

EPTDA CONVENTION

16 Mar - 18 Mar 2022
Warszawa / Poland

Annual event of the EMEA Power Transmission Distributors Association

RECOMMENDED Bearing NEWS

STEEL & METALS

METAL & METALLURGY CHINA

18 Mar - 21 May 2022
Shanghai / China

Largest exhibition in the equipment manufacturing industry in Asia.

www.mm-china.com

MOTION & DRIVES ENGINEERING

iMOTION HYBRID MEETINGS

21 Mar - 23 Mar 2022
Online

Bearing & Power Transmission Meetings

imotion.events

RECOMMENDED iMotion .events

OIL & GAS

OGWA OIL AND GAS WEST ASIA MUSCAT

21 Mar - 23 Mar 2022
Muscat / Oman

Founded in 1998 the Oil and Gas West Asia (OGWA) is a gathering of local and international oil and gas companies.

www.ogwaexpo.com

MAINTENANCE

MAINTENANCE ANTWERP

23 Mar - 24 Mar 2022
Antwerp / Belgium

Maintenance is a showcase for tools, equipment, lubricants, instrumentation and cleaning equipment.

www.maintenance-expo.be/nl

RECOMMENDED Bearing NEWS

PULP & PAPER

PULP&PAPER HELSINKI

29 Mar - 31 Mar 2022
Helsinki / Finland

PulPaper is one of the most important shows for the pulp, paper, board and converting industry worldwide.

www.finnexpo.fi

MAINTENANCE

MAINTENANCE DORTMUND

30 Mar - 31 Mar 2022
Dortmund / Germany

The leading German trade fair for industrial maintenance is a meeting point for companies and experts from maintenance as well as users from industry.

www.maintenance-dortmund.de/en

2022 MOST IMPORTANT INDUSTRY EVENTS

ExpoNext
www.exponext.com

MARCH

MOTION & DRIVES ENGINEERING

ABMA/AGMA ANNUAL MEETING

31 Mar - 02 Apr 2022
Palm Beach County, FL / USA

American Bearing Manufacturers Association & American Gear Manufacturers Association annual meeting.

www.americanbearings.org

APRIL

MOTION & DRIVES ENGINEERING

BEARING WORLD

05 Apr - 06 Apr 2022
Wurzburg / Germany

International academic bearing conference.

www.bearingworld.org

RECOMMENDED Bearing NEWS

MOTION & DRIVES ENGINEERING

DRIVES & CONTROLS BIRMINGHAM

05 Apr - 06 Apr 2022
Birmingham / UK

Drives and Controls covers the very latest in mechanical power transmission, motion control and automation.

www.drives-expo.com

MATERIALS HANDLING

INTRALOGISTICS & ROBOTICS

05 Apr - 06 Apr 2022
Paris / France

The Intralogistics Robotics & Automation in Paris is a trade fair for materials handling in industry and logistics.

www.sitl.eu

STEEL & METALS

COILTECH ULM

06 Apr - 07 Apr 2022
Ulm / Germany

The smartest exhibition in the Coil & Winding sector also arrives in Germany.

www.quickfairs.net

AGRICULTURE

iMOTION HYBRID MEETINGS

13 Apr - 15 Apr 2022
Online

Agriculture & Food Meetings

imotion.events

RECOMMENDED iMotion .events

AUTOMATION

HANNOVER MESSE

25 Apr - 29 Apr 2022
Hanover / Germany

The Hannover Messe is the world's leading trade fair for technology combining leading international trade fair under one roof.

www.hannovermesse.de

RECOMMENDED Bearing NEWS

FOOD & BEVERAGE

ANUGA FOODTEC

26 Apr - 29 Apr 2022
Cologne / Germany

Anuga FoodTec is the leading trade fair for suppliers of the food and beverage industry.

www.anugafoodtec.de

RECOMMENDED Bearing NEWS

MINING

EXPOMINA

27 Apr - 29 Apr 2022
Lima / Peru

The Expomina Peru is an international mining exhibition, which takes place every two years in Lima.

www.expominaperu.com

2022 MOST IMPORTANT INDUSTRY EVENTS

ExpoNext
www.exponext.com

MAY

MANUFACTURING TECHNOLOGIES

FEIMEC
03 May - 07 May 2022
Sao Paulo / Brazil

Machinery and Equipment exhibition.

www.feimec.com.br/en/HOME.html

STEEL & METALS

TUBE DÜSSELDORF
09 May - 13 May 2022
Düsseldorf / Germany

The Tube is the world's leading exhibition for the pipe industry.

www.tube.de

STEEL & METALS

CWIEME
10 May - 12 May 2022
Berlin / Germany

Coil winding, electric motor and transformer manufacturing exhibition.

www.coilwindingexpo.com/berlin

MACHINE TOOLS

GRINDINGHUB
17 May - 20 May 2022
Stuttgart / Germany

The new hub of international grinding technology.

www.grindinghub.de/en

MOTION & DRIVES ENGINEERING

iMOTION HYBRID MEETINGS
23 May - 25 May 2022
Online

Motion Drives & Automation Meetings

imotion.events

RECOMMENDED iMotion .events

MAINTENANCE

LUBE INDONESIA
23 May - 25 May 2022
Jakarta / Indonesia

International lubricants, grease, maintenance and technology exhibition

www.lube-indonesia.net

MINING

CON MINE
23 May - 25 May 2022
Jakarta / Indonesia

International construction, infrastructure and mining exhibition.

www.con-mine.net

STEEL & METALS

SIMTOS
23 May - 27 May 2022
Seoul / South Korea

Simtos is held biannually at Korea International Exhibition Center and leads the advancement of global machine tool industry and the machine tool market of Korea.

www.simtos.org

STEEL & METALS

METALLOOBRABOTKA
23 May - 27 May 2022
Moscow / Russia

The Metalloobrabotka takes place under the patronage of the Russian Chamber of Commerce and Industry.

www.metobr-expo.ru

AUTOMATION

SPS IPC DRIVES
24 May - 26 May 2022
Parma / Italy

Electric automation - systems and components

www.spsitalia.it

CONSTRUCTION

BAUMA CTT RUSSIA
24 May - 27 May 2022
Moscow / Russia

bauma CTT RUSSIA is the leading construction event in Russia and Eastern Europe.

www.bauma-ctt.ru

AGRICULTURE

AGRITECHNICA ASIA
25 May - 27 May 2022
Bangkok / Thailand

The International exhibition for agriculture machinery and engineering.

www.agritechnica-asia.com

2022 MOST IMPORTANT INDUSTRY EVENTS

ExpoNext
www.exponext.com

MAY

AUTOMATION

LAMIERA
25 May - 28 May 2022
Milan / Italy

The international exhibition dedicated to the industry of sheet metal forming machine tools and innovative technologies related to the sector.

www.lamiera.net/en/homepage-en

MACHINE TOOLS

MACH-TOOL POZNAN
31 May - 03 Jun 2022
Poznań / Poland

The Mach-Tool as an international trade fair for machine tools is one of the largest exhibitions in Europe.

www.itm-europe.pl

MACHINE TOOLS

CWIEME
31 May - 03 Jun 2022
Poznań / Poland

Machine tools and metal working exhibition

www.itm-polska.pl

JUNE

FOOD & BEVERAGE

FOOMA
07 Jun - 10 Jun 2022
Aichi / Japan

Food & beverage machinery exhibition.

www.foomajapan.jp

MATERIALS HANDLING, MACHINE TOOLS

IMTOS
07 Jun - 10 Jun 2022
New Delhİ / India

IMTOS - India Machine Tools Show - in New Delhi is an international trade fair for machine tools, material handling, robotics and automation.

www. kdclglobal.com

MINING

UGOL ROSSII & MINING NOVOKUZNETSK
07 Jun - 10 Jun 2022
Novokuznetsk / Russia
Ugol Rossii & Mining is an international trade fair for mining technology, exploration, underground mining, open-cast mining, mineral processing and coal preparation.

www.ugol-mining.com

MATERIALS HANDLING

CEMAT EURASIA
08 Jun - 11 Jun 2022
Istanbul / Turkey

International trade fair for materials handling, automation technology, transport systems and logistics.

www.win-eurasia.com/en

AUTOMATION

WIN EURASIA
08 Jun - 11 Jun 2022
Istanbul / Turkey

Exhibitors and visitors of WIN EURASIA will have a unique opportunity to showcase and experience the 360 degree manufacturing industry.

www.win-eurasia.com/en

CONSTRUCTION, MINING

EURO MINE EXPO
14 Jun - 16 Jun 2022
Västerbotten / Sweden

In the Skellefteå Kraft Arena in Sweden the Euro Mine Expo is held every two years.

www.euromineexpo.com

MINING & CONSTRUCTION

DRC MINING WEEK
14 Jun - 16 Jun 2022
Lubumashi / Congo

The largest mining and industrial platform in the Congo

www.drcminingweek.com

PULP & PAPER

PAPER VIETNAM
15 Jun - 16 Jun 2022
Ho Chi Minh / Vietnam

Paper Vietnam is one of the most grand and significant event in Vietnam and even Asia's papermaking industry.

veas.com.vn

MATERIALS HANDLING

LOGIMAT SHANGHAI
15 Jun - 17 Jun 2022
Shanghai / China

LogiMAT China is the international trade fair for distribution, materials handling and information flow.

www.logimat-china.com

ANNUAL BUSINESS CONVENTION

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→ www.eptdaconvention.org

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