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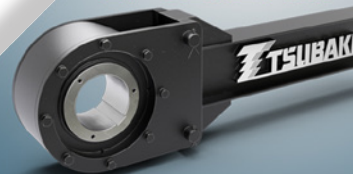
DECEMBER 2019

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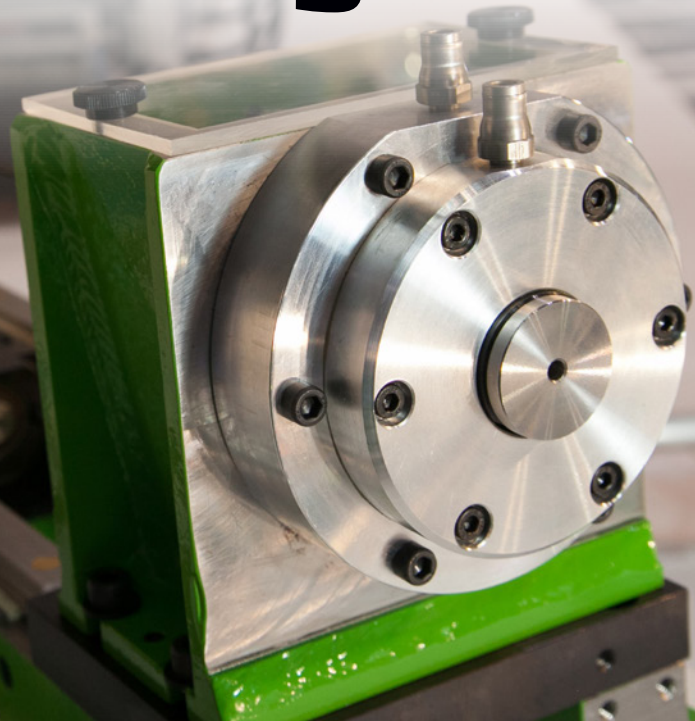
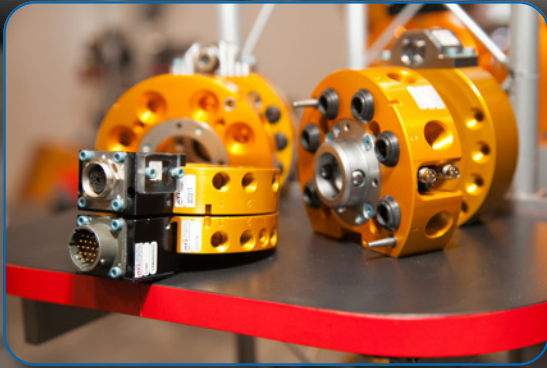
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**BUYERS GUIDE**

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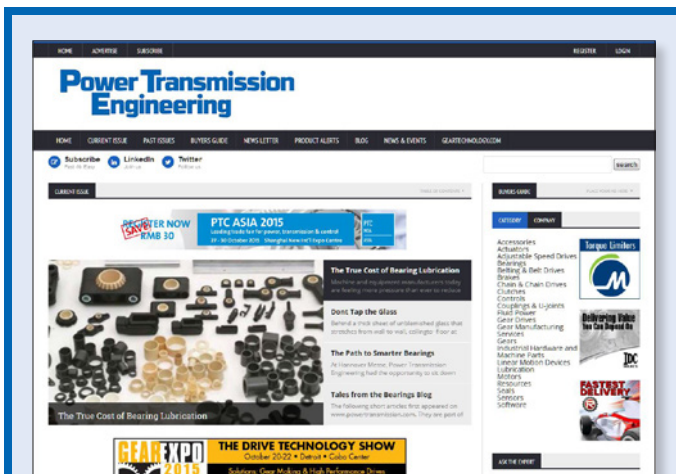
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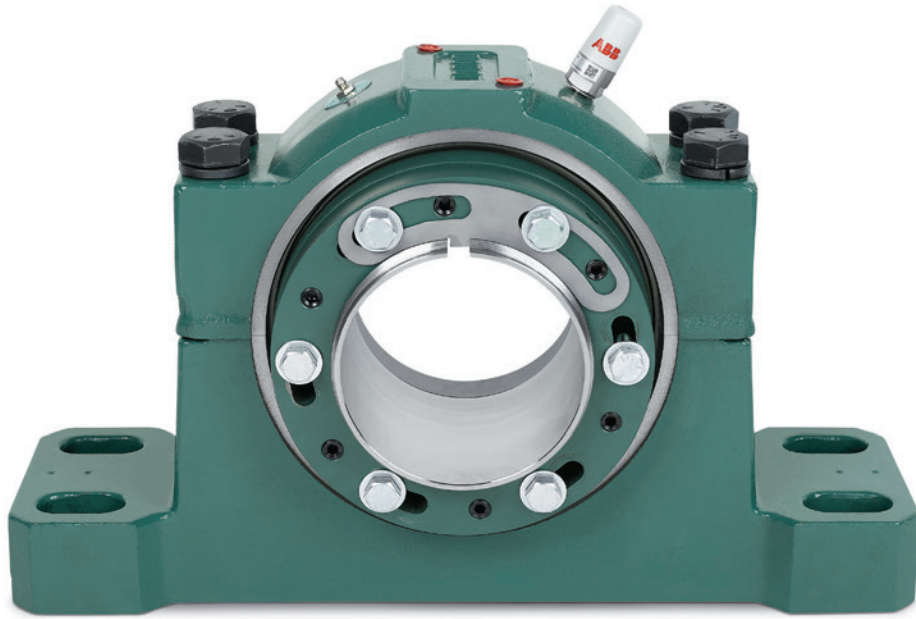
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#### PTE Videos

### SKF Explorer Deep Groove Ball Bearings

Rolling bearings form the heart of all rotating machinery. This means it's vital to ensure that you're selecting the right bearing for your application. This video explains the features and benefits of SKF's versatile, high performance SKF Explorer deep groove ball bearings. Learn more here:

[www.powertransmission.com/videos/SKF-Explorer-Deep-Groove-Ball-Bearings-/](http://www.powertransmission.com/videos/SKF-Explorer-Deep-Groove-Ball-Bearings-/)



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#### Editor's Choice:

### Vesconite Supplies Bushings for Miniature Steam Train

Read how Vesconite's self-lubricating bushings helped Keyser Locomotive Works and the Pietermaritzburg Model Engineering Society break a Guinness World Record for distance covered by a miniature steam train.

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#### Event Spotlight: IEEE Aerospace Conference

This annual, week-long conference is designed for aerospace experts, academics, military personnel, and industry leaders. Conference topics include aerospace systems, military, civilian or commercial aerospace endeavors, government policies, aerospace engineering and management, and more. The event features over 175 hours of technical sessions and 20 hours of networking events. Learn more here:

[www.powertransmission.com/news/9191/IEEE-Aerospace-Conference-2019-/](http://www.powertransmission.com/news/9191/IEEE-Aerospace-Conference-2019-/)

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# Embracing Change

**Change can be daunting, nerve-wracking or even downright scary.** But when we're faced with change in our lives, it's not the change itself we fear. It's the unknown elements that come with it.

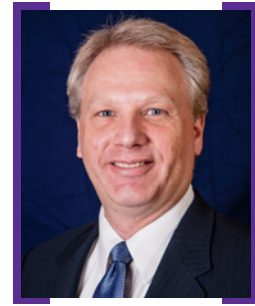
"You don't know what you don't know," a wise man once told me.

He wasn't advising me to accept my ignorance. Rather, he was challenging me to continue learning. Knowledge, after all, is how you overcome the fear associated with change. Understanding all those unknown elements helps you figure out whether to run and hide, stand and fight or watch from the sidelines.

Nowhere is fear of change more clear than when we're faced with new technology, which continues to evolve in ways we never expected—even in mundane fields like mechanical power transmission. When that change has the potential to disrupt or even threaten our business, fear is natural. But when you attack the unknowns, you begin to see how that change might offer benefits and opportunity in addition to its challenges.

I've just returned from the SPS trade show in Nuremberg, Germany, where I had the opportunity to visit with many suppliers of gear drives, motors, bearings, couplings and other mechanical power transmission products. Although the company names are familiar, most of them are no longer the traditional component suppliers you remember. They're evolving with and creating new technology, embedding sensors in their equipment, connecting motion devices to the cloud, and embracing technology. Most of these companies no longer see themselves as providers of components. They see themselves as providers of systems and solutions. You don't really need a gear drive, after all. What you need is so much torque and speed, and the ability to control it.

I learned from R+W about how sensors are being integrated into components to create intelligent couplings. I learned from Schaeffler about the ways plant maintenance is becoming simpler, more robust and better connected through the use of smart components and systems. I saw how NORD has developed an app for monitoring gear drives in industries like agriculture, mining and more. I also saw how Warner Electric is providing contactless monitoring solutions for electric clutches and brakes to create machine intelligence at the component level. I saw a lot more, too, and it all has to do with technology—and change. Stay tuned to these pages, because these and many other stories from SPS will be told in detail over the coming months. We're committed to bringing you the knowledge you need to navigate the technology so you can embrace the changes as they come.



You may have heard, but here at *Power Transmission Engineering*, we're in the midst of some significant change ourselves. Effective January 1, 2020, *Power Transmission Engineering*, along with our sister publication, *Gear Technology*, will become part of the American Gear Manufacturers Association.

Michael Goldstein (that wise man I mentioned earlier) founded *Gear Technology* in 1984, and we began publishing *Power Transmission Engineering* in 2007. When Michael began to think about retirement, he didn't just want to sell the magazines. Instead, he wanted to find a permanent home for our publications that had a similar focus on high-quality technical content, education and service to the industry. Over 35+ years, Michael has instilled those values in us, and I'm confident that the tradition will continue under AGMA.

Besides adding our publications, AGMA is undergoing a transformation in other ways, too, with an eye toward the future and an attitude that embraces change and looks for opportunities for its members and the industry. Their trade show, Gear Expo, became the Motion+Power Technology Expo in 2019. They have a robust emerging technologies initiative, and they've recently become the managers of the American Bearing Manufacturers Association. The association's goal is to be at the center of innovation for power transmission technology.

And that's a pretty good place for us to be, too.

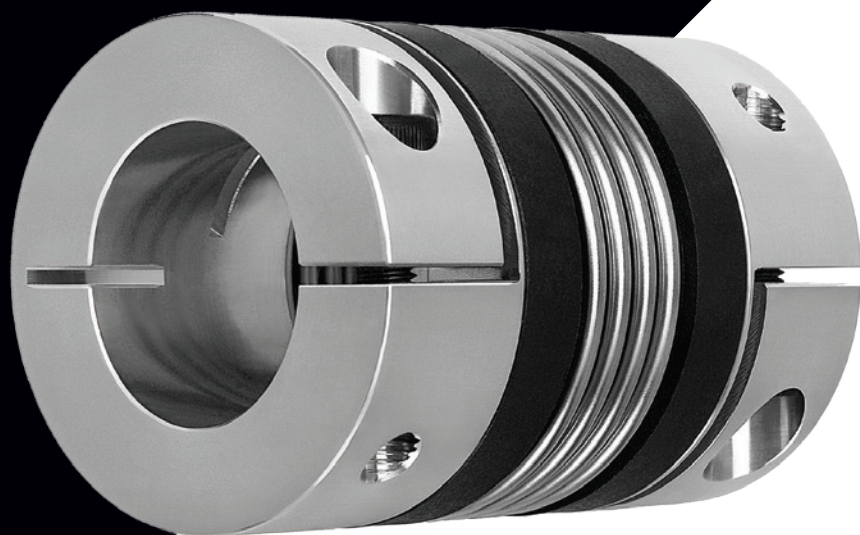
Our transition should be a smooth and easy one. Michael Goldstein will continue providing wisdom in a consulting role over the next year. The rest of our staff will remain the same, and we don't expect you'll notice any difference with regard to the content in our magazines and on our websites. In fact, if anything, we hope you'll notice that we're more closely engaged with the industry than ever. We plan to take full advantage of the connections and insights that our new relationship with AGMA affords, and that should only help to make our content better.

All that considered, we're embracing the change. We hope you do, too.



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# SKF

CONNECTION TO KISSSOFT

HEDZER TILLEMA, PRODUCT LINE MANAGER, SKF B.V., NETHERLANDS

Recently, the Swedish rolling bearing manufacturer SKF and the Swiss gearbox design software developer KISSsoft have incorporated SKF's bearing calculation service within



KISSsoft's software. With the so-called 'SKF Bearing Module' in KISSsoft, engineers will have direct access to SKF's bearing technology and bearing performance data. This connection allows for a seamless experience when working on a new gearbox design. Without noticing, an engineer designs a gearbox in KISSsoft 'as usual', but is actually connecting to the SKF cloud to retrieve the bearing performance results. These results are based on extremely fast, cloud-based calculation services by SKF in which the operating conditions of the full system are considered when calculating the performance of each individual bearing. As such, a gearbox design is verified more realistically and efficiently as it enables making appropriate bearing choices right from the start.

The user flow is quite simple: First, the user creates a full (gearbox) model in KISSsoft. Then, after registering once for the SKF Bearing Module (using the embedded "SKF Registration Tool"), SKF's calculation service is called, whenever the bearing performance is calculated according to the *modified rating life method according to ISO 281*. This method can be selected in KISSsoft in the 'basic data' window of the bearing and is mandatory if the effects of lubrication and contamination are to be considered.

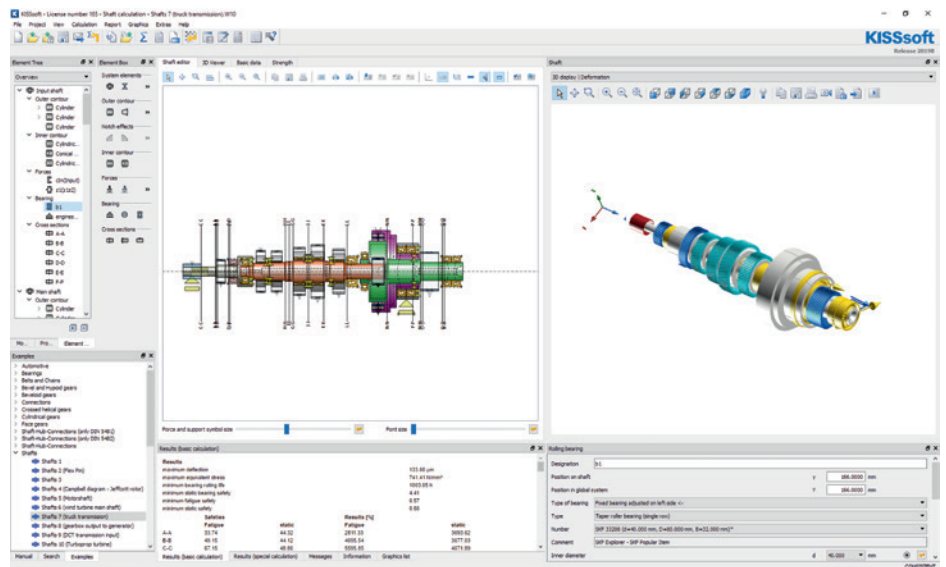
## Modified rating life according ISO 281

If the modified rating life option is not selected, the ISO 281 basic rating life ( $L_{10}$ , here referred to as 'basic ISO 281') of the bearing is calculated which accounts for the load and speed only. For modern high-quality bearings, the calculated basic rating life can deviate significantly from the actual service life in a given application. Service life in a particular application depends not only on load and bearing size, but also on a variety of influencing factors including lubrication, degree of contamination, proper mounting and other environmental conditions. The ISO 281:2007 modified rating life method ( $L_{10m}$ , here referred to as

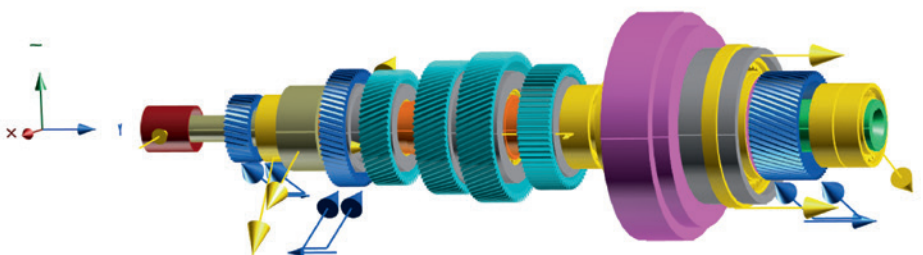
'modified ISO 281') uses a modified life factor ( $a_{ISO}$ ) to supplement the basic rating life. Similarly, for "SKF Rating Life", the life modification factor  $a_{SKF}$  applies the same concept of a fatigue load limit  $P_u$  as used in modified ISO 281. Just as in modified ISO 281, to reflect three of the important operating conditions, the life modification factor  $a_{SKF}$  takes the lubrication conditions, the load level in relation to the bearing fatigue load limit, and a factor  $\eta_c$  for the contamination level into consideration.

## SKF Rating Life instead of modified ISO 281

The modified rating life according to ISO 281, considering lubrication and contamination conditions, can also be calculated without activating the SKF Bearing Module in KISSsoft. This ISO method may be necessary to use for design certification purposes, however it is not necessarily the most reliable method for bearing performance prediction. One can actually say that the SKF Rating Life is an enhanced version of modified ISO 281, where latest findings of tribology and materials in rolling bearings are taken into account. The difference between the two methods is in the calculation of the life modification factor ( $a_{ISO}$  vs  $a_{SKF}$ ) which can have a significant effect on calculated bearing rating life.



"SKF Bearing Module" integrated in the shaft calculation of KISSsoft.



Truck transmission model built in KISSsoft.



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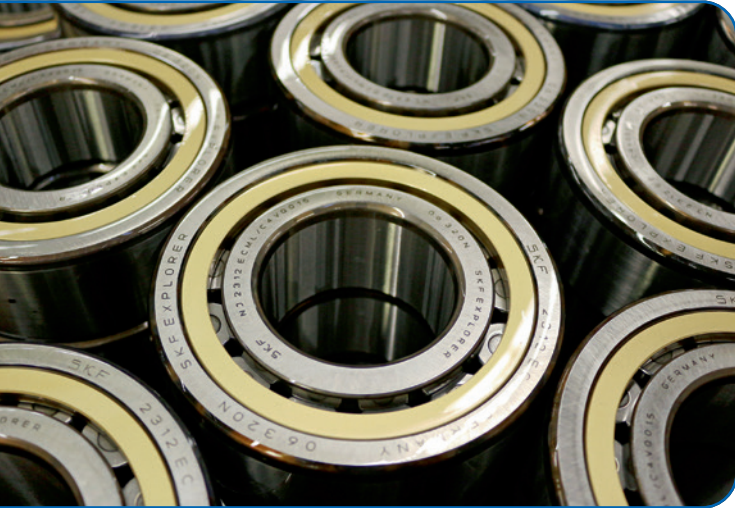


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### SKF Rating Life for an SKF Explorer bearing

The difference between SKF Rating Life and ISO 281 modified rating life is most significant for the SKF Explorer bearings. SKF Explorer rolling bearings accommodate higher load levels and provide extended service life. Their optimized internal geometry reduces friction, wear and heat generation, allowing heavier loads to be accommodated. Moreover, advanced surface finish reduces friction and enhances lubricating conditions.



SKF Explorer bearings.

SKF Rating Life fully accounts for the benefits of SKF Explorer bearings whereas they are only partly accounted for in the modified ISO 281 method. To fully utilize the improved performance of this bearing performance class, and therewith optimizing machine performance, the SKF Rating Life calculation by the SKF Bearing Module is needed. The two different life method results will both be displayed in a KISSsoft report and can thus be easily compared.

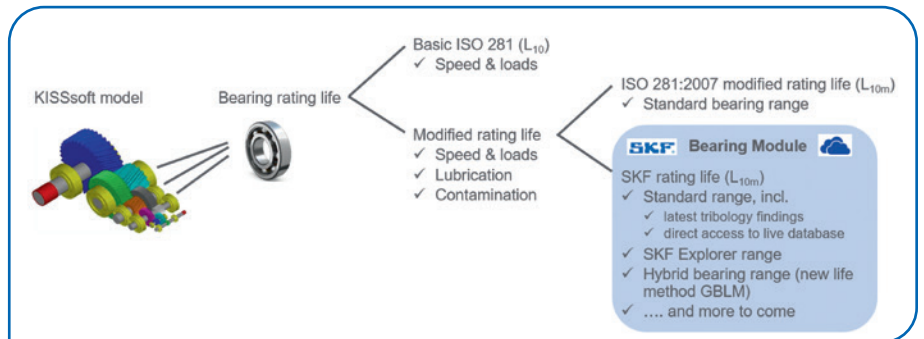
### Always connected to the latest bearing design

With the bearing module, a direct connection is established to SKF's core proprietary knowledge, the bearing internal geometry and manufacturing data. Only SKF has the full (internal) geometry description of the products they manufacture. Not all this data will be revealed to the user but its effect on bearing performance will always be accounted for in the calculation. Design and manufacturing updates as well as bearing assortment changes will be reflected almost instantly as the cloud-based service is constantly receiving updates from the bearing database. This gives the user access to the latest assortment with up-to-date geometry data, independent from the (static) bearing database in KISSsoft itself.

### Bearing performance parameters

The Bearing Module performs the calculation of the following bearing performance results: SKF rating life ( $L_{10m}$ ), ISO 281 basic rating life ( $L_{10}$ ), equivalent dynamic bearing load ( $P$ ), load ratio  $C/P$ , viscosity ratio ( $\kappa$ ), contamination factor ( $\eta_c$ ) and the life modification factor ( $a_{SKF}$ ). These output parameters are all related to bearing load and rating life under the applied operating conditions of the system.

The development of the Bearing Module does not end here, in fact more bearing performance parameters will be added in future versions of the module. Hereby one can think of bearing friction and power loss, grease life and grease re-lubrication interval, static safety, bearing excitation frequen-



Benefits of SKF Bearing Module.

Results of the calculation with the SKF Bearing Module			
Load ratio	[C/P]	6.070	
Operating viscosity	[v]	424.334	mm <sup>2</sup> /s
Reference viscosity	[v <sub>r</sub> ]	14.150	mm <sup>2</sup> /s
Viscosity ratio	[κ]	29.988	
Contamination characteristic quantity	[ε <sub>c</sub> ]	0.470	
Life modification factor	[a <sub>SKF</sub> ]	4.360	
Basic rating life	[L <sub>10</sub> ]	6930.00	h
SKF rating life	[L <sub>10m</sub> ]	30200.00	h

Results according to ISO 281:

Load ratio	[C/P]	6.070	
Operating viscosity	[v]	425.092	mm <sup>2</sup> /s
Reference viscosity	[v <sub>r</sub> ]	18.367	mm <sup>2</sup> /s
Viscosity ratio	[κ]	23.144	
Contamination factor	[ε <sub>c</sub> ]	0.436	
Life modification factor	[a <sub>ISO</sub> ]	2.207	
Basic bearing rating life	[L <sub>10</sub> ]	6936.70	h
Modified bearing rating life	[L <sub>10m</sub> ]	15310.93	h
Static safety factor	[S <sub>0</sub> ]	7.20	

Comparison of results from SKF Bearing Module and ISO 281 calculation methods in the KISSsoft report.

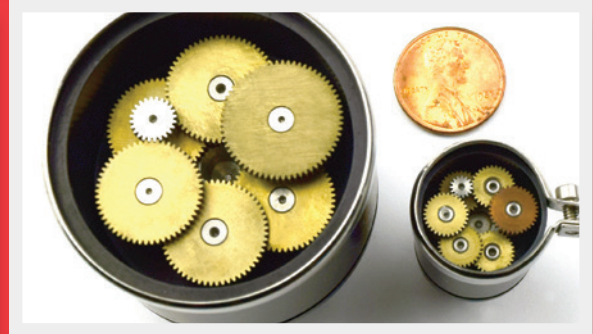
cies, etc. In addition to the technical evaluation, a design engineer can already from the beginning make a choice of selecting within so-called 'Popular items', i.e. bearing items that have a high availability level and thus provide an especially attractive cost-performance ratio.

The SKF Bearing Module is a fast and modern cloud service, easily accessible to design engineers and therefore step by step one will have access to the complete play-field of bearing engineering technology.

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**SKF's new life method (GBLM)**

Up-to-now, none of the common bearing rating life models, neither the ISO life models nor SKF Rating Life or more advanced methods, were able to fully quantify the benefit of hybrid bearings. Hybrid bearings have rings made of bearing steel and rolling elements made of bearing grade silicon nitride, which make the bearings electrically insulating. They can extend bearing service life by offering enhanced bearing performance, even under difficult operating conditions.

Based on the substantial progress made in the surface life modelling area, SKF has successfully integrated this knowledge into a new rolling bearing rating life calculation, called the SKF Generalized Bearing Life Model (GBLM), which currently is used for hybrid bearings only. This model effectively separates surface failure modes from sub-surface fail-



Hybrid bearings.

ure modes and therefore can capture in a better way the performance of hybrid bearings, which usually perform better in harsh lubrication and contaminated conditions or at high speeds. However, due to their higher stiffness, hybrid bearing can concentrate higher sub-surface stresses in high load conditions. GBLM is able to represent this behaviour well and is also accessible through the SKF Bearing Module in KISSsoft.

The KISSsoft Release 2019 offers the possibility to calculate bearing performance by SKF through a cloud calculation service. Bearing rating life and other performance parameters are calculated based on direct access to SKF bearing geometry data and SKF formulas which have been validated by extensive testing at SKF facilities. The results are separately displayed in KISSsoft, but can quickly be compared with ISO results. With the SKF bearing module in KISSsoft, a machine designer gets right into the heart of SKF, the world leading bearing supplier. As a result, the prediction of bearing performance becomes more realistic, especially for the SKF Explorer range and hybrid bearings.

For more info, please send an e-mail to [skfbearingmodule@skf.com](mailto:skfbearingmodule@skf.com) or [info@kisssoft.ag](http://info@kisssoft.ag).



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# Merry Christmas

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# Eaton

## ANNOUNCES 4-SPEED TRANSMISSION FOR ELECTRIC COMMERCIAL VEHICLES

Eaton recently announced its eMobility business will launch an all-new 4-speed transmission for heavy-duty electric commercial vehicles to meet growing demand in a number of segments, including pickup and delivery and port drayage in North America, China and Europe.

The new transmission, designed for Class 7 and 8 commercial vehicles, is currently in the testing phase with major OEMs and is set to debut in 2022. The announcement was made at the North American Commercial Vehicle Show (NACV) in Atlanta, Georgia, USA.

The transmission is the latest addition to Eaton's growing eMobility portfolio of electrified vehicle (EV) transmissions and other components, which also includes medium-duty 2- and 4-speed models that are also currently in production with several OEMs.

"Electric buses and trucks need to be able to go up hills and run at highway speeds when they are fully loaded," said Scott Adams, senior vice president, eMobility, Eaton. "Our solution is to expand the range of the motor by adding an EV transmission. With this addition, the vehicle can perform well on hills and efficiently at highway speeds with a smaller, less costly motor."

The heavy-duty 4-speed EV transmission solves the primary issue related to single-speed drives: contradictory requirements for high efficiency at top speeds and increased torque at launch and low speeds. Fine-pitch helical gears ensure

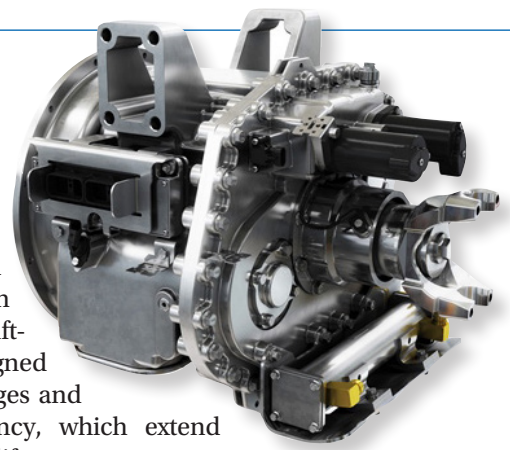
a smooth, low-noise operation, while the Eaton Transmission Control Unit's shifting strategy is designed for fast gear changes and maximum gear efficiency, which extend range and battery life.

The transmission is based on traditional, robust and efficient lay shaft architecture typical of AMTs but is designed specifically for electric commercial vehicle applications. Unlike traditional commercial vehicle transmissions, Eaton's 4-speed EV gearbox does not have a clutch, and shifts are synchronized using the traction motor. It also operates at higher speeds than its traditional internal combustion gearbox counterparts, and gears are optimized for electric motor performance.

By providing higher output speed capability and torque range than a direct-drive system, the transmission enables the usage of a smaller, lighter electric motor for large commercial vehicles.

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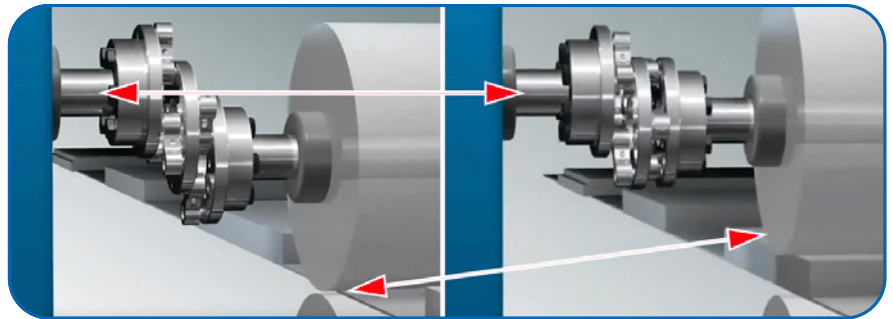
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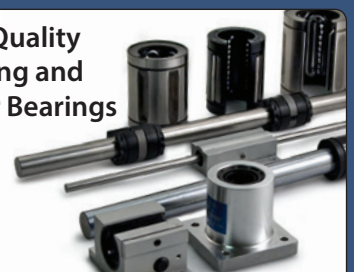
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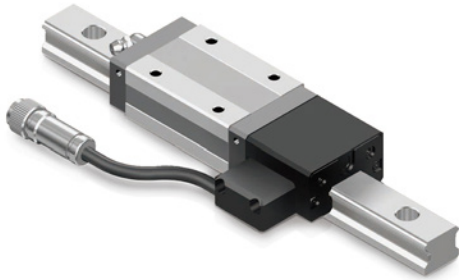
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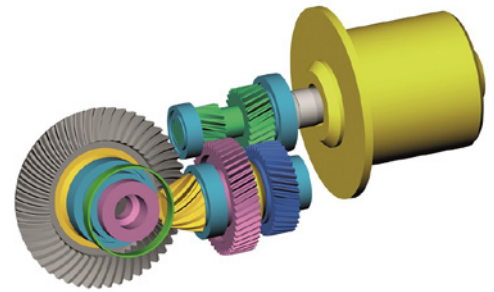
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Dodge gear reducers provide an enclosed gear train between a motor and the machinery it is driving. They enable the output speed to be reduced while increasing torque. This is a vital function on a variety of industrial equipment, including the bulk material handling conveyors typically found in the

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# Reduce Your Linear Motion Assemblies to a Single Component with Motorized Lead Screw Actuators

Julian Anton, Thomson Industries, Inc. and Chris Diak, Motion Industries

When it comes to specifying linear motion within a machine, system designers have many options from which to choose. Making the right choice can impact the ease of installation, footprint and cost of operation. A common driving mechanism for achieving linear motion is a stepper motor and externally supported lead screw-based assembly. A simpler, easier-to-install approach, however, is to select a drive mechanism with built-in guidance and support, thus removing the need for external components that would normally perform these functions and the complexity that comes with them.

## Obtaining linear motion the traditional way

The core components of a traditional stepper motor and lead screw-based driving mechanism are the following:

- Stepper motor
- Motor to lead screw coupler
- Lead screw
- Lead nut

For this core to support a load and induce motion, however, additional components are required, including, for example, radial bearings and bearing mounts, linear bearings and guides, and mounting plates for all components. (Figure 1)

In these traditional mechanisms, powering on the motor usually produces motion by rotating the motor shaft that is coupled to a lead screw, causing it to rotate as well. The rotating lead screw then engages the lead nut that is attached to the load, and if it is properly supported and guided as shown in Figure 1, the nut and load translate axially across the lead screw.

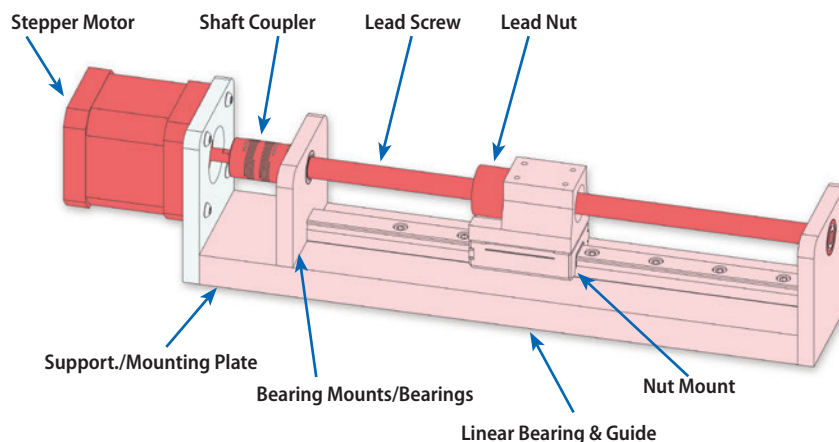


Figure 1 A traditional stepper motor and lead screw-based drive mechanism. Linear bearing and guide components not only provide guidance for the lead nut but also support the load attached to the lead nut. (All images courtesy of Thomson Industries, Inc.)

## Downside of external guidance and supports

While external assemblies can secure the nut effectively, there are drawbacks to this design approach. Primarily, the high component count contributes to a longer and more complex installation process. Installation is a challenge when utilizing external supports and guides because it is absolutely critical to ensure alignment is nearly perfect between all mating components. For proper motion to occur, all corresponding components will need to be carefully and properly positioned and secured. For example, if the lead screw and linear guides are not parallel with one another in both axes, there is a high likelihood of binding occurring, causing the entire drive mechanism to stall out.

In addition to a tedious and time-consuming installation process, prior to installation, a proper sizing and selection exercise to select the appropriate external guides and supports must be completed. Undersizing guides and supports can lead to premature failure of the entire mechanism, and oversizing can bring a significant increase in overall assembly cost and weight.

A third potential drawback of utilizing external guidance and supports is that the lead screw, lead nut, linear bearings and guides are completely exposed to the environment, which introduces the risk of contamination. Whether it is to prevent outside contaminants from penetrating the surfaces of the lead screw/lead nut and causing excess friction or to protect from wear debris generated by the sliding nut and leaking out in the overall system, a proper barrier is important.

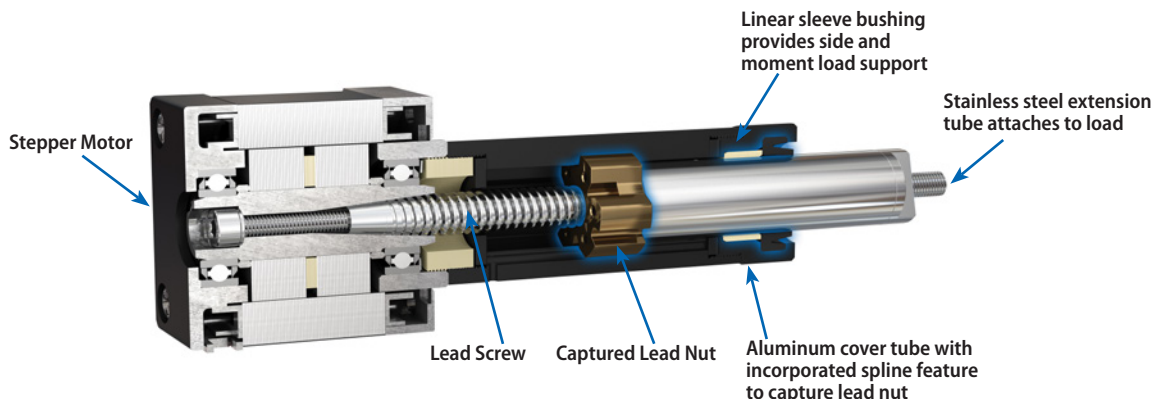


Figure 2 Motorized lead screw actuator (MLA) with integrated linear guidance and support.

### A simplified solution

Designers of applications requiring shorter strokes with minimal radial and moment loads can avoid the drawbacks of the lead screw-based assemblies by choosing motorized lead screw actuator (MLA) -based drive mechanisms that integrate the guidance and support directly within itself. (Figure 2) This design choice completely eliminates the need for cumbersome external guidance and support.

MLAs enforce guidance by utilizing a splined cover tube that completely captures the mating lead nut and prevents rotation, while allowing axial translation. The integrated linear sleeve bushing within the end-cap at the front of the cover tube provides radial and moment load support.

A configuration like this offers many potential benefits to both the design engineer and the machine builder. As mentioned above, integrating support and guidance directly into the MLA unit significantly reduces complexity and time of installation. Instead of having to install and tediously align external guides and supports with the drive mechanism, a simple MLA can be utilized.

Also, if particulate contamination is of concern, use of an actuator eliminates the need for an outside protective barrier because the MLA unit has the lead screw, lead nut, guide and support completely housed within the cover tube.

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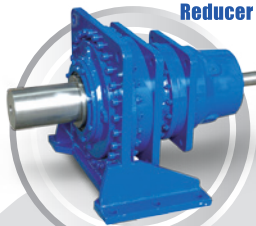
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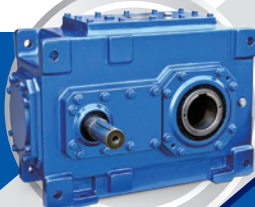
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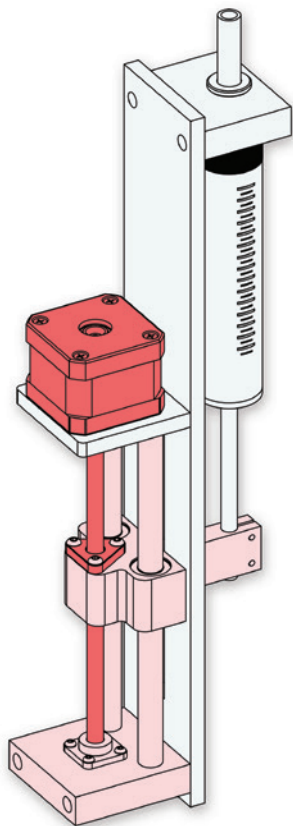


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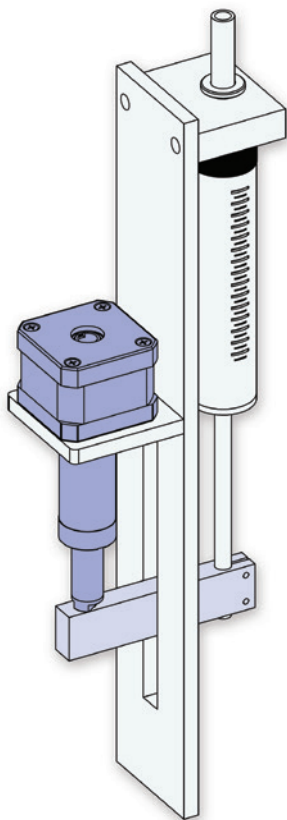


More than 25 total components required for full guidance and support

Guidance and support directly integrated into MLA unit



**Figure 3a** Fluid pump utilizing a traditional integrated stepper motor and lead screw-based drive mechanism with external guides and support.

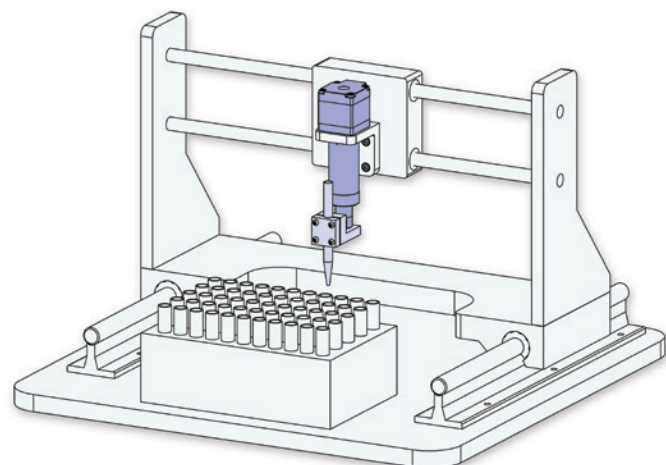


**Figure 3b** Fluid pump utilizing an MLA as the drive mechanism.

### Comparing traditional and MLA configurations in two sample applications

If the conditions are right, MLAs can be a simple and elegant driving mechanism for linear motion assemblies. The following sections highlight ideal applications where MLAs can offer a considerable benefit.

#### Comparing drive options for medical fluid pumping



**Figure 4a** Traditional stepper motor lead screw requires a profile rail guide and corresponding carriage assembly to translate axial motion.

	Traditional stepper motor lead screw integration option	MLA option
Total component count	25+	2
Approximate installation time (minutes)	90+	5

In a medical or laboratory environment, fluid pumps are commonly used to accurately deliver fluids into a patient's body or test tubes for mixing or analysis. This fluid is usually expelled from a syringe reservoir by actuating a piston attached to a linear drive mechanism. Although not optimal, a traditional stepper motor and lead screw-based drive mechanism with external guidance and supports can accomplish this movement (Figure 3a).

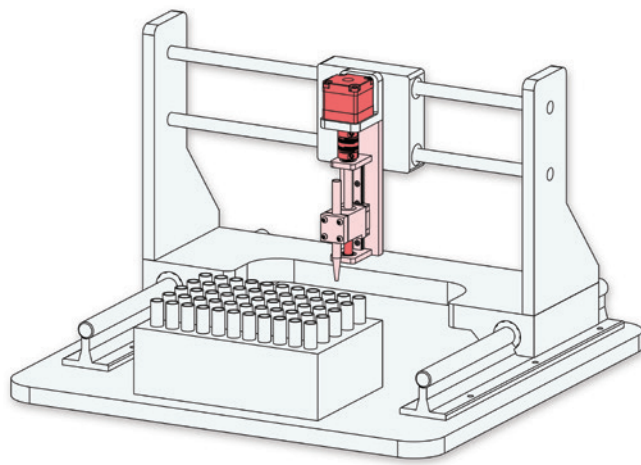
However, since fluid pumps must often fit within space-constricted areas, minimizing components and shrinking the drive mechanism's footprint can be of great value. MLAs improve fluid pumping in such applications by removing the need for external guides and supports that could consume valuable real estate within the machine where the pump is placed (Figure 3b). As MLAs have a completely self-contained guidance and support, the component count and simplicity of the fluid pump assembly can be dramatically improved. (Table 1)

Furthermore, because fluid pumps are used primarily in hygienic areas, the sealed enclosures of the MLAs prevent contamination from either entering or leaving the system.

#### Comparing Drive Options for Liquid Handling and Pipetting

A liquid handler is a multipurpose machine intended to sample, mix and combine liquid samples automatically. Fully automated workflows simplify repetitive fluid dispensing tasks. These operations require a pipette to dispense fluids into sample locations such as test tubes. The motion often requires complex guidance and support structure. (Figure 4a)

For such applications, designers prefer simpler and more compact drive mechanisms, which an MLA can provide. The pipetting motion itself is rather simple, and the loads tend to be very light, making it an ideal candidate for an MLA drive



**Figure 4b** MLA assembly eliminates the need for external guidance and support.

Table 2 Comparing drive options for vertical pipetting applications		
	Traditional stepper motor lead screw integration option	Motorized lead screw actuator (MLA) option
Total component count	30+	8
Approximate installation time (minutes)	120+	5

mechanism. And because the guidance and support are directly integrated within the MLA unit, the need for external guidance and support components is eliminated, thus reducing the component count and dramatically simplifying the pipetting sub-assembly. (Table 2) The enclosed system of the MLA is also well-suited to the purity of the laboratory environment.

**Selecting the right drive mechanism**

In addition to fluid pumping and liquid handling, other applications in which MLAs offer advantages can include vertical plate or surface adjustment, pipetting, microscope slide positioning, proportional valve control and monitor/screen tilting. Considering the following factors will help determine whether an MLA option would be a good fit for a specific application.

**Motion parameters**

MLAs are most suitable for applications requiring strokes of less than 2.5 inches (63 mm); moderate loads (up to 200 lbf or 90 kgf for larger motors), and speeds from approximately 0.5 in/s (13 mm/s) for low leads to approximately 8 in/s (200 mm/s) for higher leads.

**Side and moment load handling**

While most stepper motor and lead screw-based drive mechanisms can handle considerable axial load, if side and moment loads are present, guidance and support from linear bearings, guides and supports will be required. However, if the side and moment loads are light enough — up to approximately 10% of axial load capacity of the motor — the integrated guidance and support design of an MLA is sufficient.

**Simplicity**

If reducing component count and simplifying are priorities, designers can benefit from a fully integrated MLA configuration, removing the need for complex external guidance and support components.

**Installation**

Reducing component count simplifies installation, dramatically shortening total assembly time. Instead of having to mount external linear guides, linear bearings and mounts, and having to carefully align them, installers can simply mount a single MLA unit that has all guidance and support directly integrated within the unit. MLAs traditionally come with a standard NEMA motor bolt hole mounting pattern, making them easy to install as a near drop-in replacement to previous stepper motor-based drive mechanisms.



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### Customization

If none of the available offerings meet your needs, you may consider working with your vendor to create a custom option that does. Most vendors offer options to customize motor windings, encoders, cabling and connectors, end mounting, linear travel per step, and stroke lengths.

### An overall simpler solution

MLAs may not be suitable for all applications. However, for those with the right motion parameters, side and moment load handling needs, simplicity preferences, and installation requirements, specifying MLAs brings numerous benefits for designers. Instead of having to design the external guidance and support assembly, they can specify a single drive unit with anti-rotational guidance and support built in. This solution would reduce double-digit component counts down to a single part number. Alternatively, with multiple, externally integrated components, there is a greater risk for system failure and extended process downtime, while parts are located and repairs made. Having only a single component to deal with, chances of failure are lower and the time required for repair is shorter.

Another benefit of MLA technology is reduction in installation time from over an hour to mere minutes, which decreases associated labor costs. Because there is only one primary part, it saves the time needed to size and align multiple components necessary in an equivalent system. Finally, being enclosed, this type of product is packaged to provide improved environmental protection — thus sealing the deal on a better solution for your application.

**For more information** visit [MotionIndustries.com/pte](http://MotionIndustries.com/pte), or view the MiHow2 video, “How to Install and Align a Ball Screw Assembly and Profile Rail” (<https://tinyurl.com/y5wproem>).

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# In the News: Linear Motion

The following article is a round-up of the latest linear motion product and industry news items featured at [www.powertransmission.com](http://www.powertransmission.com) and on social media.

## ANCA Explores Hiring for the Factory of the Future

SIMON RICHARDSON, ANCA PRODUCT MANAGER, ANCA

In the factory of the future, technology will of course be key. Factories will integrate networked machines, sensors and advanced robotics IT systems into existing processes. They will thrive on data, real-time figures and unprecedented access to information to be more efficient, less wasteful and better connected. As your operations are transformed, you will need a workforce that knows how to take your business into the future time and time again. This means



already available—like the cloud, robotics and in-process measurement. This brings new skill requirements. Knowing how to use these tools to their full potential means having a team of critical thinkers. The FoF will require a workforce that's computer savvy and driven by problem solving. Staff will need to be analytical, knowing how to use data to continuously improve. Teams should incorporate good software development skills and programmable logic controls experience. You will need people who can network machines and those who are able to capitalize on the immense value of automation. With the speed of the tooling industry increasing, they will need to become their own innovation hub, constantly looking for

opportunities to grow and improve through technology.

### How to hire for the factory of the future

People working in factories of the future will need to be more fluid. They will have to think cross-functionally and collaborate to make the most of their complementary skills. Much like a software programming team, these

workforces will need an agile mindset, be open to new approaches and ready to adapt to work better, harder, smarter. Finding and hiring these people will mean understanding what's involved in their different roles. You will likely find you need to fill a mix of existing and new positions, some of which you might not have come across before. Look for staff with a STEM—science, technology, engineering and mathematics—background—they are more and more likely to be university graduates. But their education should only be a starting point. Look for applicants who demonstrate lateral thinking and problem-solving skills, signals that they can put their technical background into practical use. Existing roles are evolving. Machinist skills such as operation monitoring, systems evaluation and quality control analysis can be applied to new systems. Tool and die makers can use their technology design and operations analysis background to build better processes and create new tools. New roles will also appear: robotics engineers, automation engineers, and roles that combine elements of both. Positions will also be created for people to bring new ideas into the business. Factories may start hiring senior IT staff such as a CTO or CIO. These tech leaders will become champions of innovation—sourcing, internally promoting and working to imple-



rethinking how you hire, and how you upskill existing staff. This doesn't have to mean starting from scratch. You may be well on your way to a great future workforce already.

### The skills you need are changing

You may already be using technology to move forward. As factories shift to a future focus, they are adapting what's

ment the very best for the factory. In such a new field, having their authority on hand to assist with interviews can be a game-changer. Senior tech staff will have the right knowledge to spot candidates who can apply their expertise to your business. You may also be able to leverage specialized recruitment agencies that can make sure you're only interviewing people who can bring the right combination of technical nous and creativity.

**When you've got the right team — nurture it**

In the factory of the future the focus is shifting from working the production line to building a better one. Automation and robotics have changed the way the factory floor looks, and those changes will keep coming. Just as with technology, setting yourself up with the right people doesn't have to mean starting all over again. As long as you have clarity around where you're going and how, you will give yourself the best chance to identify potential in your existing workforce. Factor in training. Most businesses will need a training officer, not only to train staff on the existing production methods but to bring them on board with new operations. Support your people to work together. A collaborative, agile approach should apply across the whole business, from learning how to use existing equipment to working together to implement new products. A team of champions will work side-by-side to make sure every element of operation is adding value and working to its full capability. Engage your staff. Use your trainers and tech champions to communicate the vision and future of the factory. Motivate them to feel excited about the future by offering clarity and direction. With competition increasing, the most important thing in the factory of the future is to retain skilled people. The next generation is demonstrating more of these diverse, flexible skills, but increasing demand means there is a global skills shortage. Finding and keeping good staff will make your workforce more efficient and save on hiring and training costs. Giving staff members opportunities to

try out new tasks, upskill in their existing roles, undertake further education and create ownership of the factory's direction will all help to strengthen their loyalty to the business.

**Give your team the tools to perform**

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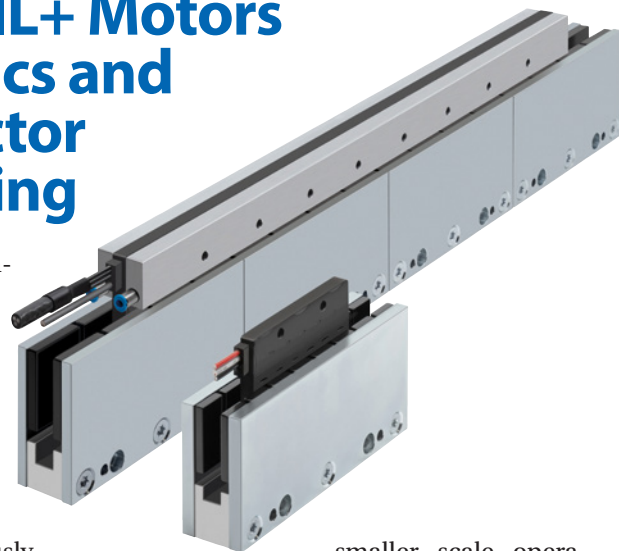
## Etel Offers IL+ Motors for Electronics and Semiconductor Manufacturing

Etel, a direct drive motor manufacturer of the Heidenhain Group, now offers updated ironless linear motors optimized for electronics and semiconductor manufacturing. Called the IL+ product lines, these motors are offered in the same profile as Etel's previously established ironless linear motors but now specially re-designed to allow for increased performance to benefit these two industries.

Unique to the IL+, a change in material selection now allows the Etel ironless motors to operate up to 600 VDC and reach a temperature limit up to 130°C, as opposed to the previous market standard of 300VDC and 80°C. This allows an increase in overall speed along with a greater force operating range. Track sizes are available in increments of 128, 256, and 512 mm.

Compared to the previous models, the IL+ series offers up to 20 percent temperature reduction at the same working point, reducing thermal expansion in both the glider and Magway as well as lowering any reduction in precision. The improvement of the forced air-cooling option now available on all sizes also allows an increase in continuous force by a factor of two.

Along with a new improved cooling option and other updates, the Etel IL+ ironless linear motors are available in two size ranges: the ILF+ focuses on



smaller scale operations with a reduced size and length, while the ILM+ targets higher force operations with a greater variety of lengths. Both contribute to high precision and throughput during the electronics and semiconductor manufacturing processes.

The ILF+ ironless linear motors are small size motors perfectly suited for very high dynamic and low moving mass applications. In addition, the total absence of force ripple ensures perfect speed stability and makes ILF+ suited for scanning applications where speed control is a key specification.

The ILM+ ironless linear motors are a more powerful version of the ILF+ motors. The ILM+ series combine all advantages of ironless motors and provides high continuous force. This motor family is suited for the most demanding mid- to high-mass scanning applications where zero attraction forces and outstanding speed stability are required. The low mass per force ratio also makes ILM+ suited for very high dynamic applications. ([www.heidenhain.us](http://www.heidenhain.us))

## Intellidrives Expands Large Open Center Stage Series

The demand for a high accuracy, robust, open-frame stages is met with Intellidrives dual-axis, large aperture stages that address the unique needs of scanning microscopy, wafer and printed circuit board inspection, automated

assembly and wide range of specimens and samples scanning in many types of imaging techniques and applications.

Very precise fine positioning and control is easily achieved through the combination of a stable closed-loop



control system and an associated joystick option. In addition, the stages can be combined with the company's Z Stages to form an XYZ stage ideally suited for laser scanning microscopy.

These stages can be motorized with stepper motors and brush-less servo motors with encoders. Optional

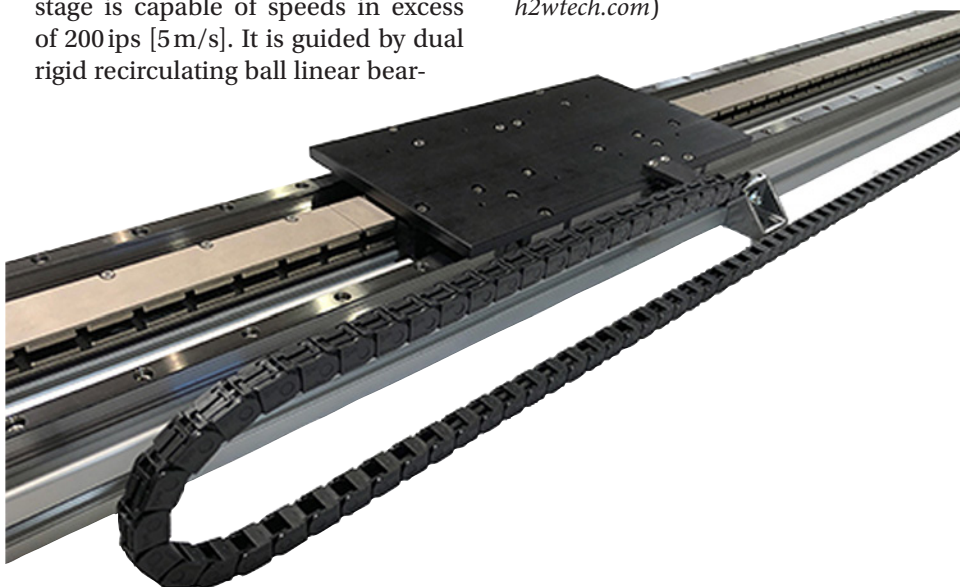
high-resolution, non-contact linear encoder is available. This non-contact encoder offers exceptional repeatability and stability over a range of operating conditions. Both digital and analog output versions are available with resolutions in sub-micron range.

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

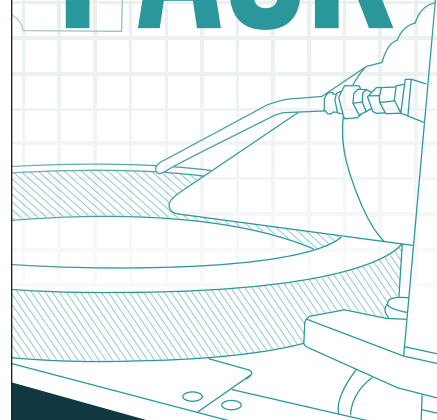
## H2W Technologies Introduces Single-Piece Extrusion Stage

The DRS-206-05-012-01-EX dual rail positioning stage is ideal for applications that require long travel distances. It uses a cog-free brushless linear motor to generate a continuous force of 12.4lbs [55.6N] and a peak force of 37.4lbs [167N] with a total stroke length of 210 in. [5341 mm]. The non-contact 1.0-micron resolution encoder allows for precise positioning. The stage is capable of speeds in excess of 200 ips [5 m/s]. It is guided by dual rigid recirculating ball linear bear-

ings. The entire stage is assembled on a single piece of aluminum extrusion, thus reducing the overall weight of the system and easily allowing for long strokes and prevents the need for reassembly at the customer facility. There are also provisions that allow customer cables to be routed within the cable carrier. It has end-of-travel rubber bumper stops. ([www.h2wtech.com](http://www.h2wtech.com))



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## Precision Drive Systems Hires Midwest Regional Sales Manager

Precision Drive Systems (PDS), a global provider of precision motor spindle support and repair based near Charlotte in Bessemer City, NC, has announced that it has hired Tom Kessler as its Midwest Regional Sales Manager to support US metalworking manufacturers.

"We are happy to welcome Tom Kessler to PDS as our new Midwest Regional Sales Manager," said Allen Turk, CEO of PDS. "Prior to joining PDS, Tom dedicated 22 years to working in the industrial services industry. We look forward to adding Tom's extensive experience to the spindle repair services we offer." As Midwest Regional Sales Manager, Kessler will work out of southeast Michigan to serve PDS' metalworking customers throughout the region.

Kessler began his industrial career with Applied Industrial Technologies as a Service Center Manager and was then promoted to Linear Component Center Manager where he created the company's state-of-the-art linear-motion service

center in Detroit, Michigan. He was then hired by SKF to create their own linear-motion service center from scratch to establish a more competitive North American presence. Kessler spent a total of 17 years with SKF where he served in various roles including Program Manager, Product Specialist



and Territory Manager. Throughout his career, he has worked with both OEM and MRO distributors and end-users in a variety of industries. ([expertspindlerepair.com](http://expertspindlerepair.com))



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## Igus Introduces Linear Robots for Cost-Effective Automation

Simple, precise, fast processes: these are the requirements of Cartesian robots. They are used for such things as pick-and-place applications, sorting systems and medical technology. Igus

has now developed a linear and room linear robot for large workspaces. The two new kinematics systems allow users to move up to five kilograms. Both linear robots are available directly from stock. They can also be customized to suit the customer application in question—no minimum order quantity.

To survive on the market, both large industrial players and small companies need automated solutions that will quickly pay for themselves. For years, Cartesian robots have



## Bosch Rexroth Offers New Motion and Automation Software Tools

Nowadays, mechanical engineering is software development. The new *ctrlX Automation* platform is Bosch Rexroth's answer to this market requirement. It encompasses the latest engineering software technologies and all PLC and motion tasks. Software functions are combinable in any number of ways with ready-made, customized and customizable apps. These apps can be created in a variety of programming languages such as C++, script languages such as Python, or new graphical languages such as Blockly. This gives machine manufacturers new-found freedom.

This system offers users a choice: they decide whether to program in IEC 61131, PLCopen or G-Code, or in conventional high-level or Internet languages. This liberates machine manufacturers from dependency on the availability of PLC specialists and proprietary systems.

Configuration and commissioning of the automation components is completely web-based, eliminating the need to install software. Within minutes of switching the system on, the software is programmed. A completely virtual *ctrlX Automation* system environment is

available, enabling programming without hardware. System functionalities can be extended at any time via the user's own process functions, apps, and open source software. In total, *ctrlX Automation* cuts the engineering time and effort by 30 to 50%, which significantly reduces time to market for new machines.

More than 30 direct connection options and communication standards offer maximum networking flexibility for economical end-to-end connectivity from field level up to the cloud. *ctrlX Automation* is also equipped for future communication

standards such as TSN and 5G, making it the best system on the market in terms of networking capability. *ctrlX Automation* is based on a new generation of multicore processors which provide sufficient processing power for almost all automation tasks. These high-performance CPUs can be integrated into embedded PCs and industrial PCs or directly into drives. The all-new hardware and software module will cover all automation tasks—from simple control applications and IoT solutions to high-performance motion control. ([www.boscrexroth.com](http://www.boscrexroth.com)) **PTE**



been a means of choice in automation technology. They allow users to complete their tasks quickly, easily and cost-effectively. All that is required is a little bit of programming effort. Igus' lubrication-free linear axes developed in several stages are now available. Depending on the application's requirements, two-axis linear or flat linear robots and three-axis room linear robots can be selected. At Motek, Igus introduced a new line robot and a new room linear robot with an enlarged workspace, which allows users to move even greater loads across an even larger area.

The two linear robots consist of pre-configured linear modules, aluminium linear axes, NEMA stepper motors and

encoders. The new line robot can transport loads of up to 50N in a workspace of 800×500 mm at a maximum speed of up to 1 m/s. "The investment risk of €2,100 for the line robot is manageable, so that our automated pick-and-place applications for assembly tasks pay for themselves in less than six months. This means that decision makers have a low level of risk," says Alexander Mühlens, head of automation technology at Igus. The new room linear robot is a good option for more complex tasks. It can transport loads of up to 50N in a workspace of 800×800×500 mm at a maximum speed of 0.5 m/s. Two ZLW toothed belt axes and one GRR gear rack axis ensures precise guidance and lubrication-free

operation.

The new linear robot solutions are used in pick and place, bin picking and sorting tasks. Most of these processes have been moved to the end of the production line. This was also true at FachPack 2019 in the showcase of SSI Schäfer, the intralogistics specialist. The new drylin room linear robot automated the provision of sensitive products using a transport box with a thermoform insert. The specially developed packaging and the use of a linear robot allowed various colored handles to be pre-sorted for the production of a household appliance. There are other linear robot use scenarios in microelectronics and automated testing. ([www.igus.com](http://www.igus.com))

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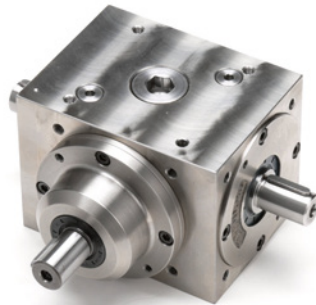
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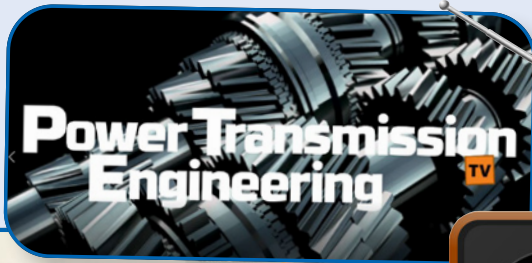
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# Global Bearing Sources for the Power Transmission Industry

## THE QUESTION

What is the general consensus on the current quality and viability of global bearing sources for the power transmission industry?

**EXPERT RESPONSE PROVIDED BY CHRIS NAPOLEON.** There is no broad brush answer to this question. The power transmission industry can utilize the global supply chain successfully. The global supply chain can successfully support the application demands of the power transmission industry. These are factual statements; however, they unequivocally must be followed up by the statement that a very thorough technical analysis of the supplier one intends on using is required to ensure success. There are literally thousands of bearing manufacturers in the world—all wanting your business and all claiming they can meet both commercial requirements of price and lead time and technical needs of the application. The commercial needs are fairly easy to evaluate. The technical aspects of overall bearing quality are far more difficult to identify and evaluate by an OEM design engineer. This is because their area of expertise is typically not in bearing design and even less in understanding and establishing bearing manufacturing control limits that construct the basis of bearing quality. Indeed, most critical bearing characteristics are not under the direct control of any national or international standard.

So, if a power transmission OEM intends on utilizing the global bearing supply chain—which is almost a necessity, since even the most notable bearing manufacturers are global in their production—one needs to have, develop or partner with someone who understands bearing qualification practices. When this is executed properly, certain global bearing suppliers can viably provide acceptable quality for the power transmission industry. I've traveled and inspected bearing product from around the world and have seen the best and worst that's out there, and year after year I see OEMs successfully sourcing bearings to meet extremely demanding applications in all industrial applications. Every successful outcome started with the development and execution of a specific technical bearing analysis process. One other important point is that those that are successful fully understand that there is a cost associated with the process necessary to gain sufficient knowledge to ensure one's

success. There is no golden egg. Success in the utilization of the global bearing market requires time and money, and must be part of the equation. Additionally, the road to success might include initial failure of a supplier and the need to make changes and re-inspect and test to meet the necessary requirements. This is common and, although painful, it pales in comparison to the time, cost and pain associated with catastrophic field failure prior to the expiration of the warranty period.

In conclusion, all industries, including power transmission, can look to the global bearing supply chain for solutions. There are plenty of world class suppliers out there; you simply need to develop a plan consistent with the risk associated with the application and plan accordingly with time and both financial and technical resources. (*Chris Napoleon is president/chief engineer of Napoleon Engineering Services, [www.nesbearings.com](http://www.nesbearings.com); [cnapoleon@nesbearings.com](mailto:cnapoleon@nesbearings.com).*) **PTE**



# Gearmotor Paint Coatings

## A Focus on Electrodeposition Coating (E-Coat) in the Gearmotor Industry

Thomas Colacino, Brother International Corporation

### Introduction

The following article explains the commonly used paint components and methods within the gearmotor industry, with a focus on electrodeposition coating (E-Coat). These processes will be described in general, with a closer examination of the E-Coat applications steps. Some pros and cons of each method will be presented along with comparative test results showing the benefits of E-Coat.

### Explanation & Components of Paints

In the gearmotor industry, there are different paint options available from a myriad of manufacturers. Generally, most paints are made from three primary components: resins, solvents, and pigments (Table 1).

### Common Application Methods of Paint in the Gearmotor Industry

There are multiple ways to apply these paints to the gearmotor. The three application methods discussed in this article are: spraying, powder coating, and electrodeposition coating (E-Coat).

Spray painting is a method that is used across many industries. This application method involves a paint composed of solvents and pigments that is sprayed through a paint gun. This atomizes the paint into small particles and the spray is directed at the workpiece. Once the paint is applied, the workpieces are left out to dry through natural convection (air drying). The thickness of the coating varies during each application, but a common thickness for spray paints would be around 20+  $\mu\text{m}$ . It is best used when a company has a lot of workpieces that are all similar or the same in low quantities.

Spray painting uses solvents which are usually VOCs (volatile organic compounds) and dangerous to both

the environment and human health. A way to rectify the problem of paint toxicity is to use a method of painting called electric painting. Both powder coating and E-Coat utilize the concept of electric painting to avoid using toxic solvents and ensure better paint adhe-

(cationic) and the workpiece is given a negative charge (anionic). The workpiece is then submerged in the paint, and the difference in charge causes the paint to attract to the piece. This ensures complete and even coverage with paint. This is one of the reasons

**Table 1** Description of Paint Components

Component	Properties / Use	Examples
Resin	Main component in clear coatings Provides a translucent top-layer Protects the paint and surface underneath	Synthetic resin, fats and oils
Solvent	Component in sprayed paints Excludes powder coating Allow the pigments to disperse and adhere to the workpiece	Esters, ketones, water, etc.
Pigment	Gives the paint its color Can give the paint special properties i.e. chemical resistance, anti-corrosion, etc.	Color pigments, anticorrosive pigments, etc.

sion to the workpiece. An electric potential difference is applied between the paint and the workpiece to attract the paint onto the substrate.

Powder coating is a method in which powdered paint is charged by a powdered gun and applied to a grounded object using static electricity. After painting, the workpiece is baked in a drying oven to form a hard-exterior coating. The thickness of the coating varies during each application, but a common thickness for powder coat paints would be around 50-90  $\mu\text{m}$ . It is best used when a company has a moderate amount of workpieces, in moderate variety. This method does not involve any solvents, due to its use of an electric charge to adhere the paint, so it has minimal negative environmental and human impact.

E-Coat is a method in which a vat of paint is given a positive charge

why it is used extensively in the automotive industry. After painting, the workpiece is baked in a drying oven for the paint to form a hard, electrically-insulated exterior. The thickness of the coating is the most consistent out of the three methods mentioned. A common thickness for E-Coat would be around 20-30  $\mu\text{m}$ , uniformly distributed across the work surface. It is best used when a company has only a few different pieces to be painted, in large quantities. This method uses water as a solvent and since there are no VOCs, it has minimal negative environmental and human impact.

See Table 2 for a summary of the differences between the paint application methods mentioned above.

With this outlined, it is safe to say any of the three painting methods can be a viable option depending on the variety and quantity of gearmotors to be

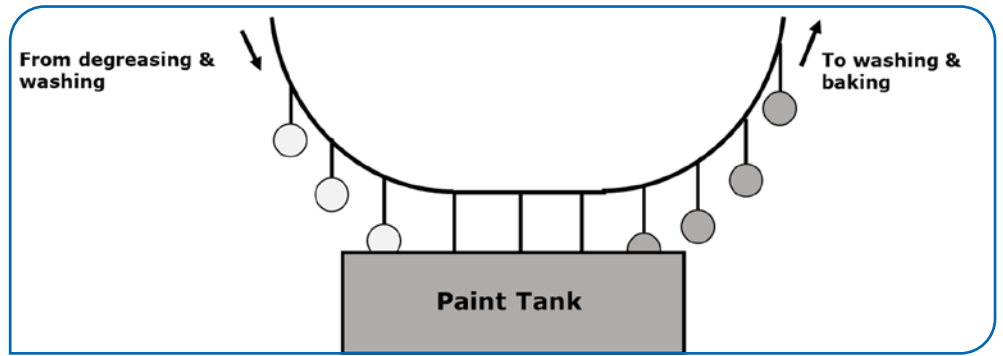
**Table 2**

Coating Method	Solvent	Drying Method	Coating Film Thickness ( $\mu\text{m}$ )	Use	Environmental Impact
Spray	Yes (VOC)	Convection, Baking	20+	High variety, low quantity	High
Powder	None	Baking	50~90	Intermediate variety and quantity	Minimal
E-Coat	Water	Baking	20~30 (Uniform)	Low variety, high quantity	Minimal

Painted. Due to inconsistent coating thicknesses, certain coatings are more susceptible to problems such as paint coverage, uniform distribution, peeling, bubbling, cracking, etc. In the long run this may lead to issues with corrosion of the gearmotor case, contamination (in food processing applications), and a poor appearance. E-Coat is a simple process that can minimize the chances of these issues occurring because it ensures a uniform paint distribution across the surfaces it is applied to. These results can be achieved without E-coat by using powder coating, but it requires more effort, skill, and overall care to ensure a high-quality finish.

**E-Coat Application Stages**

There are not many steps in the E-Coat application process, making it simple to perform and replicate. A simplified diagram of the process can be found in Figure 1.



**Figure 1** To prepare for painting, the workpiece is first washed in water. Then, the surface is degreased using an alkali-based degreaser and washed again. This applies to both iron and aluminum workpieces. If the workpiece is made from a non-chrome type of aluminum alloy, a coating agent must be applied to the piece to chemically convert the surface to one that will accept the E-Coat paint. After, the pieces are given a negative electric charge, and immersed in a tank of positively charged paint; the paint is now adhered to the piece. The pieces are then washed again to remove and paint solids that may have adhered to the surface, to ensure a smooth finish. They then move to a drying oven, where the paint will harden. Lastly, the pieces must cool down, and the process will be complete.

**Potential Benefits and Comparative Testing Results**

Depending on the quality of the application process, the following benefits can be realized:

- Provide protection from impacts
- Resist paint wear from oil exposure
- Stay adhered regardless of humidity
- Won't chip or peel under extreme temperature changes

- Won't corrode when in contact with salt water
- Won't corrode after washdowns with acidic or alkali solutions
- Ensure a uniform coating thickness
- The flatness of the mounting surface is always uniform

Paint performance testing was conducted, and results that support these claims can be found in Table 3.

Table 3 Test Results: Brother Gearmotor E-Coat vs. Comparable Paint Test Results*								
Test Items	Brother E-Coat	Result	Brother Powder Coat	Result	Computer 1 (Standard powder coat)	Computer 2 (Standard powder coat)	Computer 3 (Food)	Standard/Test Coat
Adhesiveness	Pass		Pass		Fail	Fail	Fail	Cut the coating to the work surface using a single blade knife, grid pattern (100 squares, 1 mm x 1 mm) Use tape with adhesion strength of 10±1 N or more per 25 mm to peel the squares
Oil resistant (grease)	Pass		Pass		Pass	Fail	Pass	ISO 2409-1992 50°C, RH98% or more, 240 hours
Moisture resistance (humidity)	Pass		Pass		Pass	Fail	Pass	50°C, RH98% or more, 240 hours
Boiling water resistance	Pass		Pass		Fail	Fail	Pass	95°C or more, 1 hour
Pencil hardness	Pass	4H	Pass	4H	Pass (2H)	Pass (H)	Fail (F)	ISO/DIS 15184 Determined film hardness using the pencil test
Salt-resistant spraying	Pass		Pass		Fail	Fail	Pass	5% NaCl, 35°C, 240 hours
Acidic resistance	Pass		Pass		Pass	Pass	Pass	5% H <sub>2</sub> SO <sub>4</sub> , 48 hours
Alkali resistance	Pass		Pass		Fail	Fail	Fail	5% NaOH, 48 hours
Coating film thickness (µm)	15.8		90.2		77.63	97.2	368.8	Film thickness meter (µm)

Sample size = 1, case material = aluminum

## Conclusion

There are three primary methods used for painting gearmotors: spray painting, powder coating, and E-Coat. While all three can be used, the uniform paint coverage that E-coat provides allows it to potentially prevent many problems that may arise with inconsistent coating thicknesses. E-Coat paint has a lower environmental impact, is easy to scale, and provides a hardened, electrically insulated paint coating to protect gearmotors for their usage life.

Brother Gearmotors offers E-Coat as a standard coating on almost all gearmotor products. They are permanently sealed for a high-quality finish that ensures consistently tough, water-tight, chemically-resistant units that withstand harsh conditions.

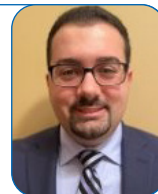
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Phone: (866) 523-6283  
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Figure 2 Brother Gearmotors offers E-Coat as a standard coating on almost all gearmotor products.

**Thomas Colacino** is an Applications Engineer at Brother International Corporation. Brother Gearmotors offers a full line of gearmotors and accessories to meet virtually any manufacturing power generation need. The company's portfolio includes interior permanent magnet motors (IPM), brushless DC, AC Induction and other high-quality gearmotors and reducers for industries such as food & beverage, packaging and material handling. All Brother Gearmotors products are backed by a five-year limited warranty.



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# 2019 PTE Buyers Guide

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## How to Get Listed in the Buyers Guide

Although every effort has been made to ensure that this Buyers Guide is as comprehensive, complete and accurate as possible, some companies may have been inadvertently omitted. If you'd like to add your company to the directory, we welcome you. Please visit [www.powertransmission.com/getlisted.php](http://www.powertransmission.com/getlisted.php) to fill out a short form with your company information and Buyers Guide categories. These listings will appear online at [www.powertransmission.com](http://www.powertransmission.com), and those listed online will automatically appear in next year's printed Buyers Guide.

## Handy Online Resources

The *Power Transmission Engineering* Buyers Guide – The listings printed here are just the basics. Visit our online buyers guide for the most comprehensive directory of suppliers of gears, bearings, motors, clutches, couplings, gear drives and other mechanical power transmission components, broken down into sub-category by type of product manufactured:

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

### Artec Machine Systems

[www.artec-machine.com](http://www.artec-machine.com)

### Ascent Precision Gear Corporation

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

### Ashutosh Power TransBelts Limited

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

### ASI Technologies Inc.

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

### AST Bearings

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

### Atlanta Drive Systems Inc.

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

### ATO Inc

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

### Avalon International Corp.

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

### AV Industrial Products Ltd

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

### Axu s.r.l.

[www.axu.it](http://www.axu.it)

### B&B Manufacturing, Inc.

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

### Baart Industrial Group

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

### Bartlett Bearing Company, Inc.

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

### BDI - Bearing Distributors Inc.

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

### Bearing Boys Ltd

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

### Bearing Engineering Company

[bearingengineering.com](http://bearingengineering.com)

### Bearing Headquarters

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

### Bearings and Industrial Supply Company, Inc.

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

### Bearing Service Company

[www.bearing-service.com](http://www.bearing-service.com)

### Bearings Limited

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

### Beijing THC Limited

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

### BellowsTech, LLC

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

### Bevel Gears India Pvt. Ltd.

[bevelgearsindia.com/](http://bevelgearsindia.com/)

### Bishop-Wisecarver Corp.

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

### BK Power Systems - An Integrated Corrosion Co.

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

### BRECOflex CO., L.L.C.

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

### Brewer Machine & Gear Co.

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

### BSF, Inc.

[www.bsfinc.net](http://www.bsfinc.net)

### C-Flex Bearing Co., Inc.

[www.c-flex.com](http://www.c-flex.com)

### Canto Engineering Company

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

### CCTY Bearing

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

### CENTA Power Transmission

[www.centa.info](http://www.centa.info)

### Challenge Power Transmission (Aust) Pty Ltd

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

### Challenge Power Transmission PLC

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

### Checkfluid

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

### Cleveland Gear Co.

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

### CMS Vibration Solutions Ltd.

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

### Collars and Couplings Inc.

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

### ComInTec

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

### Comtec Mfg., Inc.

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

### Cross + Morse

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

### C R Products Ltd.

[www.c-rproducts.com](http://www.c-rproducts.com)

### Currie Enterprises

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

### Custom Machine & Tool Co. Inc.

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

### Cyclo-Index

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

### Daemar Inc.

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

### Daido Corporation of America

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

### Dalton Bearing Service, Inc.

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

### Darbar Belting

[www.darbarbelting.co.in](http://www.darbarbelting.co.in)

Datasyst Engineering & Testing Services, Inc.  
[www.datasysttest.com](http://www.datasysttest.com)

Daubert Cromwell LLC  
[www.daubertcromwell.com](http://www.daubertcromwell.com)

Davall Gears Ltd.  
[www.davall.com](http://www.davall.com)

Del-Tron Precision Inc.  
[www.deltron.com](http://www.deltron.com)

Distag QCS  
[www.distag.com](http://www.distag.com)

Dover Motion  
[www.dovermotion.com](http://www.dovermotion.com)

Drive Components LLC  
[www.drivecomponentsllc.com](http://www.drivecomponentsllc.com)

Drive Systems Technology Inc.  
[www.gear-doc.com](http://www.gear-doc.com)

Dynatec Manufacturing Inc. (fka A & A Mfg.)  
[www.dynatec.com](http://www.dynatec.com)

Eagle PLC  
[www.eagleplc.com](http://www.eagleplc.com)

Electro Steel Engineering Company  
[www.fenner.in](http://www.fenner.in)

Elkem Silicones  
[www.silicones.elkem.com](http://www.silicones.elkem.com)

Emerson Industrial Automation - Drives & Motor  
[www.emerson.com/en-us/automation-solutions](http://www.emerson.com/en-us/automation-solutions)

Ensinger Precision Components  
[www.plastockonline.com](http://www.plastockonline.com)

EquipNet  
[www.equipnet.com](http://www.equipnet.com)

Filter Pumper / Hydraulic Problems, Inc.  
[www.filterpumper.com](http://www.filterpumper.com)

Fixtureworks  
[www.fixtureworks.net](http://www.fixtureworks.net)

Flux Drive Inc.  
[www.fluxdrive.com](http://www.fluxdrive.com)

Forgital Group  
[www.forgital.com](http://www.forgital.com)

Framo Morat Inc.  
[www.framo-morat.com](http://www.framo-morat.com)

Friel Metal Resurfacing  
[www.frielmetalresurfacing.com](http://www.frielmetalresurfacing.com)

G.L. Huyett  
[www.huyett.com](http://www.huyett.com)

Gallagher Fluid Seals, Inc.  
[www.gallagherseals.com/](http://www.gallagherseals.com/)

Gates Corporation  
[www.gates.com](http://www.gates.com)

Gayatri Gear Industries  
[www.gayatrigear.com](http://www.gayatrigear.com)

Gear Master Inc.  
[www.gearmaster.us](http://www.gearmaster.us)

Gleason Plastic Gears  
[www.gleasonplasticgears.com](http://www.gleasonplasticgears.com)

Hangzhou Ocean Industry Co., Ltd.  
[www.hzoic.com](http://www.hzoic.com)

Hangzhou Xingda Machinery Co. Ltd.  
[www.xdmade.com](http://www.xdmade.com)

Hayes Manufacturing Inc.  
[hayescouplings.com](http://hayescouplings.com)

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

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

Hi-Grade Inc.  
[www.higradeinc.com](http://www.higradeinc.com)

HVH Industrial Solutions  
[hvhindustrial.com](http://hvhindustrial.com)

IBT Industrial Solutions  
[www.ibtinc.com](http://www.ibtinc.com)

IDA Motion Inc.  
[www.idamotion.com](http://www.idamotion.com)

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

Industrial Automation Co.  
[www.industrialautomation.co](http://www.industrialautomation.co)

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

Industrial Pulley & Machine Co, Inc.  
[www.industrialpulley.com](http://www.industrialpulley.com)

Industrial Spares Manufacturing Co.  
[www.industrialsparesfromindia.com](http://www.industrialsparesfromindia.com)

Intech Corporation  
[www.intechpower.com](http://www.intechpower.com)

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

Intellidrives, Inc  
[www.intellidrives.com](http://www.intellidrives.com)

Involute Powergear Pvt. Ltd.  
[www.involutetools.com](http://www.involutetools.com)

ISC Companies  
[isccompanies.com](http://isccompanies.com)

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

Jason Industrial Inc.  
[www.jasonindustrial.com](http://www.jasonindustrial.com)

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

Juncera Automations  
[junceraautomations.com/](http://junceraautomations.com/)

JVL Industri Elektronik A/S  
[www.jvl.dk](http://www.jvl.dk)

K+S Services  
[www.k-and-s.com](http://www.k-and-s.com)

Kamar Industries  
[www.kamarindustries.com](http://www.kamarindustries.com)

KBK Antriebstechnik GmbH  
[www.kbk-antriebstechnik.de](http://www.kbk-antriebstechnik.de)

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[keblog.com](http://keblog.com)

Kiesler Machine Inc.  
[www.kieslermachine.com/](http://www.kieslermachine.com/)

Kinematics Manufacturing, Inc.  
[www.kinematicsmfg.com](http://www.kinematicsmfg.com)

Klüber Lubrication North America L.P.  
[www.kluber.com](http://www.kluber.com)

Kollmorgen  
[www.kollmorgen.com](http://www.kollmorgen.com)

KTR Corporation  
[www.ktr.com/us](http://www.ktr.com/us)

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MISSISSAUGA ON L4Z 2A9  
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Phone: (905) 629-1939 or (800) 661-6413  
Fax: (905) 629-2852  
[sales@lafertna.com](mailto:sales@lafertna.com)  
[www.lafertna.com](http://www.lafertna.com)

LM76 Linear Motion Bearings  
[www.LM76.com](http://www.LM76.com)

Lovejoy, Inc. (A Timken Brand)  
[www.lovejoy-inc.com](http://www.lovejoy-inc.com)

Machine Guard & Cover Co.  
[machineguard.com](http://machineguard.com)

Machinists Inc.  
[machinistsinc.com](http://machinistsinc.com)

Magnum Manufacturing  
[magnum-mfg.com](http://magnum-mfg.com)

Magtrol, Inc.  
[www.magtrol.com](http://www.magtrol.com)

Maguire Technologies  
[www.maguiretech.com](http://www.maguiretech.com)

Malloy Electric  
[www.MalloyWind.com](http://www.MalloyWind.com)

Martin Sprocket & Gear  
[www.martinsprocket.com](http://www.martinsprocket.com)

MasterDrive, Inc.  
[www.masterdrives.com](http://www.masterdrives.com)

Maurey Manufacturing Corporation  
[www.maurey.biz](http://www.maurey.biz)

Maxcess  
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Maxon Precision Motors  
[www.maxonmotorusa.com](http://www.maxonmotorusa.com)

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Metric & Multistandard Components Corp  
[www.metricmcc.com](http://www.metricmcc.com)

MFG Components Oy  
[www.mfg.fi](http://www.mfg.fi)

Micronor Inc.  
[www.micronor.com](http://www.micronor.com)

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PLYMOUTH, MN 55441  
Phone: (800) 533-1731  
Fax: (763) 546-8260  
[sales@mikipulley-us.com](mailto:sales@mikipulley-us.com)  
[www.mikipulley-us.com](http://www.mikipulley-us.com)

Ming Chang Traffic Parts Mfg.  
[www.mcchain.com.tw](http://www.mcchain.com.tw)

Mini-Broach Machine Company  
[minibroach.com](http://minibroach.com)

Minsk Gear Works  
[www.mgw.by](http://www.mgw.by)

MMB Bearing Co. Inc.  
[www.mmbbearings.net](http://www.mmbbearings.net)

Motion Industries  
[www.motionindustries.com](http://www.motionindustries.com)

Moventas Ltd.  
[www.moventas.com](http://www.moventas.com)

MPT Drives, Inc.  
[www.mptdrives.com](http://www.mptdrives.com)

MRO Electric and Supply  
[www.mroelectric.com/](http://www.mroelectric.com/)

MROSupply  
[www.mrosupply.com](http://www.mrosupply.com)

MT Tool & Manufacturing  
[www.mttoolinc.com](http://www.mttoolinc.com)

Muratech Engineering Company  
[www.muracopower.co.in](http://www.muracopower.co.in)

NDE Power Transmissions  
[www.ndepower.com](http://www.ndepower.com)

Netshape Technologies, Inc.  
[www.netshapetech.com](http://www.netshapetech.com)

New England Belting Company  
[www.newenglandbelting.com](http://www.newenglandbelting.com)

**Nordex, Inc.**  
426 FEDERAL ROAD  
BROOKFIELD, CT 06804  
Phone: 203-775-4877  
Fax: 203-775-6552  
[sales@nordex.com](mailto:sales@nordex.com)  
[www.nordex.com](http://www.nordex.com)

Northwest Electric Motor Company  
[northwestmotor.com](http://northwestmotor.com)

Novotec Argentina SRL  
[www.novotecargentina.com](http://www.novotecargentina.com)

Ondrives US Corp.  
[www.ondrivesus.com/](http://www.ondrivesus.com/)

Onvio LLC  
[www.onvioallc.com](http://www.onvioallc.com)

Orttech  
[www.orttech.com](http://www.orttech.com)

P.T. International Corp. (PTI)  
[www.ptintl.com](http://www.ptintl.com)

PI (Physik Instrumente) L.P. Piezo Actuator Nano  
[www.pi-usa.us](http://www.pi-usa.us)

PIC Design  
[www.pic-design.com](http://www.pic-design.com)

Pinpoint Laser Systems  
[pinpointlaser.com](http://pinpointlaser.com)

Pioneer Motor Bearing Co.  
[www.pioneer1.com/](http://www.pioneer1.com/)

Pix Transmissions Limited  
[www.pixtrans.com](http://www.pixtrans.com)

Plastock - Putnam Precision Molding, Inc.  
[www.plastockonline.com](http://www.plastockonline.com)

Popular Mechanical Works  
[www.popularmechworks.com](http://www.popularmechworks.com)

Potomac Electric  
[www.potomacelectric.com/](http://www.potomacelectric.com/)

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www.powerdrive.com

**Precipart**  
www.precipart.com

**Productivity Inc.**  
www.productivity.com/

**PTD Outlet: Power Transmission Distributors**  
www.ptdoutlet.com

**Pulley Manufacturers International Inc.**  
www.pulleys.com

**QA1**  
www.qa1.net/industrial

**Quality Bearings & Components**  
250 DUFFY AVENUE  
HICKSVILLE, NY 11801  
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www.qbcbearings.com

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www.regalpts.com

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www.renebaerag.ch

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www.renishaw.com

**Resistoflex Private Limited**  
www.resistoflex.in

**Rexnord**  
www.rexnord.com

**RGW Sales Canada**  
www.rgwsalescanada.com

**Ringball Corporation**  
www.ringball.com

**Ringfeder Power Transmission USA Corp.**  
www.ringfeder.com

**Ringspann Corporation**  
www.ringspanncorp.com

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www.ritbearing.com

**RMR-Rotating Machine Builders**  
www.rmrbuilder.com

**Rockwell Automation**  
www.rockwellautomation.com

**Romax Technology Limited**  
www.romaxtech.com

**Rotor Clip Company, Inc.**  
www.rotorclip.com

**RTC**  
www.rtc.net.br

**Rubena a.s.**  
www.rubena.cz

**Ruland Manufacturing Co., Inc.**  
www.ruland.com

**Schenck USA**  
www.schenck-usa.com

**Servometer**  
www.servometer.com

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Fax: (864) 439-7830  
www.seweurodrive.com

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www.syptworld.com

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**SIPCO**  
www.sipco-mls.com

**SKF USA Inc.**  
www.skf.com

**SMT - Smart Manufacturing Technology**  
www.smartmt.com

**Special Ingranaggi**  
www.specialingranaggi.com/en/

**Spiroid Gearing**  
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ALEXANDRIA, MN 56308  
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www.spiroidgearing.com

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www.spn-hopf.de

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sprocketsoz.com.au

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www.spxcooling.com/

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www.sspseals.com

**Stearns**  
www.stearnsbrakes.com

**Steinmeyer Inc.**  
www.steinmeyer.com

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www.stoffelpolygon.com

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www.teusa.net

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www.tpg-tw.com

**Tampa Armature Works- TAW**  
www.tawinc.com

**Tapeswitch Corporation**  
www.tapeswitch.com

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www.team-ind.com

**Technico**  
www.technico.com

**Thomson Industries Inc.**  
www.thomsonlinear.com

**Torque Transmission**  
www.torquetrans.com

**Transmission Machinery Co., Ltd**  
www.transcyko-transtec.com

**Transply Inc.**  
www.transply.com

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www.trojon-gear.com

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www.tssr.nl

**Tsubaki of Canada Limited**  
www.tsubaki.ca

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unitedgearworks.com

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www.USABorescopes.com

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www.vcst.be

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www.visionqci.com

**VL Motion Systems Inc.**  
www.vlmotion.com

**Voith Turbo Inc**  
voith.com/usa/en/index.html

**W.M. Berg**  
www.wmberg.com

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**Warner Linear**  
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**WD Bearing America**  
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Phone: (888) 334-3777  
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America@wd-bearing.com  
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whittet-higgins.com

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www.wjbgroup.com

**WMH Transmissions Ltd**  
www.wmh-trans.co.uk

**York Industries**  
www.york-ind.com

**Zerelli Technologies Inc**  
www.zerelli.com

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www.acmegear.com

**Acorn Industrial Services Ltd.**  
www.acorn-ind.co.uk

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www.aerotech.com

**Affiliated Distributors**  
www.adhq.com

**AGI Automation Components**  
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**ATO Inc**  
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**Avion Technologies Inc.**  
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**Buehler Motor, Inc.**  
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**Central Gear & Machine**  
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**Curtis Machine Co. Inc.**  
curtismachine.com

**Dalton Bearing Service, Inc.**  
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**Del-Tron Precision Inc.**  
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**Discovery Technology International, Inc.**  
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**Drive Lines Technologies Ltd**  
www.drivelines.co.uk

**Duff Norton Australia**  
www.duffnorton.com.au

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www.dynamic-structures.com

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**Emerson Industrial Automation - Drives & Motor**  
www.emerson.com/en-us/automation-solutions

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www.ersgearbox.com/gear-boxes/

**Exlar Actuation Solutions**  
www.exlar.com

**Festo Corporation**  
www.festo.com/usa

**FMC Engineering**  
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**Gleason Plastic Gears**  
www.gleasonplasticgears.com

**H2W Technologies**  
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**Hidrax**  
www.hidrax.eu/en/

**Houston Pump and Gear**  
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www.icpltd.co.uk

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www.integratedcomponentsinc.com

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www.intellidrives.com

**ISC Companies**  
isccompanies.com

**JoVal Machine Company**  
www.jovalmachine.com

**Juncera Automations**  
junceraautomations.com/

**K+S Services**  
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**Kamar Industries**  
www.kamarindustries.com

**KEB America, Inc.**  
kebblog.com

**Kinematics Manufacturing, Inc.**  
www.kinematicsmfg.com

**Kollmorgen**  
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**LYC North America Inc**  
lycbearings.com

**Machinists Inc.**  
machinistsinc.com

**Malloy Electric**  
www.MalloyWind.com

**Mavilor Motors, S.a.**  
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**Maxcess**  
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**Midwest Motion Products**  
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**Motion Industries**  
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**MPT Drives, Inc.**  
www.mptdrives.com

**MROSupply**  
www.mrosupply.com

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**Ningbo Zhongyi Hydraulic Motor Co. Ltd.**  
www.zihyd.com

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BROOKFIELD, CT 06804  
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**Northwest Electric Motor Company**  
northwestmotor.com

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**Optimal Part**  
optimalpart.com/mechanical-coupling

**Orbitless Drives, Inc**  
www.orbitless.com

**Parker Hannifin SSD Drives Div.**  
www.parker.com/ssdusa

**Performance Gear Systems, Inc.**  
www.performance-gear.com

**PI (Physik Instrumente) L.P. Piezo Actuator Nano**  
www.pi-usa.us

**Popular Mechanical Works**  
www.popularmechworks.com

**Portescap**  
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**Potomac Electric**  
www.potomacelectric.com/

**Power Electric**  
www.powerelectric.com

**Power Jack Motion**  
www.powerjackmotion.com/

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www.precipart.com

**Precision Pump and Gear Works**  
www.ppg-works.com

**PST Group (Precision Screw Thread)**  
www.thepstgroup.com

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**Rex Engineering Corp.**  
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**Riley Gear Corporation**  
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www.venturemfgco.com

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www.vlmotion.com

Voith Turbo Inc  
voith.com/usa/en/index.html

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www.specialtyring.com

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sprocketsoz.com.au

**SPX Cooling Technologies, Inc.**  
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**Stock Drive Products/Sterling Instrument (SDP/SI)**  
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**Thomson Industries Inc.**  
www.thomsonlinear.com

**Thyssenkrupp Rothe Erde USA Inc.**  
www.thyssenkrupp-rotheerde.com/

**Top Machinery & Equipment (Zhengzhou) Ltd**  
www.top-rol.com

**Torque Transmission**  
www.torquetrans.com

**Transmission Machinery Co., Ltd**  
www.transcyko-transtec.com

**Transply Inc.**  
www.transply.com

**Trojon Gear Inc.**  
www.trojon-gear.com

**TSS Rotterdam B.V.**  
www.tssr.nl

**Tsubaki of Canada Limited**  
www.tsubaki.ca

**United Gear Works**  
unitedgearworks.com

**Vision Quality Components, Inc**  
www.visionqci.com

**VL Motion Systems Inc.**  
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**W.M. Berg**  
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www.bwc.com

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www.bocabearings.com

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www.steelbelt.jp/index.php

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**Rush Gears Inc.**  
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www.desch.de

Dings Company  
www.dingsbrakes.com

Drive Lines Technologies Ltd  
www.drivelines.co.uk

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EIDE Industrial Clutches and Brakes  
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Inertia Dynamics, Inc.  
www.idicb.com

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isccompanies.com

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sprocketsoz.com.au

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**MT Tool & Manufacturing**  
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**Muratech Engineering Company**  
www.muracopower.co.in

**Nordex, Inc.**  
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Phone: 203-775-4877  
Fax: 203-775-6552  
sales@nordex.com  
www.nordex.com

**Nu-Teck Couplings Pvt. Ltd**  
www.nuteckcouplings.com

**Orbitless Drives, Inc**  
www.orbitless.com

**P.T. International Corp. (PTI)**  
www.ptintl.com

**Pacific Industries**  
www.pacificindustries.com

**PEER Chain**  
www.peerchain.com

**Performance Gear Systems, Inc.**  
www.performance-gear.com

**PIC Design**  
www.pic-design.com

**Pix Transmissions Limited**  
www.pixtrans.com

**Plastock - Putnam Precision Molding, Inc.**  
www.plastockonline.com

**PowerDrive LLC**  
www.powerdrive.com

**PTD Outlet: Power Transmission Distributors**  
www.ptdoutlet.com

**Pulley Manufacturers International Inc.**  
www.pulleys.com

**RBI Bearing Inc.**  
1055 STEVENSON COURT, SUITE 102W  
ROSELLE IL 60172  
PHONE: (800) 708-2128  
Fax: (630) 295-5490  
info@rbibearing.com  
www.rbibearing.com

**Regal Power Transmission Solutions**  
www.regalpts.com

**René Baer AG**  
www.renebaerag.ch

**Renold Jeffrey**  
www.renoldjeffrey.com

**Rexnord**  
www.rexnord.com

**Ringball Corporation**  
www.ringball.com

**Rockwell Automation**  
www.rockwellautomation.com

**Roto-tech Technologies**  
www.rototech.in

**RTC**  
www.rtc.net.br

**Serapid Inc.**  
www.serapid.us

**Silcoms Ltd**  
www.silcoms.com/conveyor-chain-division/

**SKF USA Inc.**  
www.skf.com

**Snow Nabstedt Power Transmissions Inc**  
www.snpt.biz

**Special Ingranaggi**  
www.specialingranaggi.com/en/

**Sprockets Australia Pty. Ltd.**  
sprocketsoz.com.au

**ST Gear & Machine LLC**  
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www.sdp-si.com

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**Team Industries**  
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**Torque Transmission**  
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**Transply Inc.**  
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www.trojon-gear.com

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**Yogi Bearings**  
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**Accent Bearings Co. Inc.**  
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**Affiliated Distributors**  
www.adhq.com

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www.aiscoinc.com

**Andantex USA Inc.**  
www.andantex.com

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**Coremo Ocmea S.r.l.**  
www.coremo.ocmea.it

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**Dalton Bearing Service, Inc.**  
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**RTC**  
www.rtc.net.br

**SBT Gearing Solutions**  
sbt-gears.co.uk/

**SEPAC Inc**  
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**Snow Nabstedt Power Transmissions Inc**  
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**Sprockets Australia Pty. Ltd.**  
sprocketsoz.com.au

**SPX Cooling Technologies, Inc.**  
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**SSS Clutch Company**  
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**Stephenson Gobin Transmissions**  
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**Stieber Clutch**  
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### Bonfiglioli USA

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### CNC Center

www.cnccenter.com

### Control Switches International Inc

www.controlswitches.com

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www.emerson.com/en-us/automation-solutions

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### Hoffmann Technics AG

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### HPB Motion Control Co. Ltd.

www.hpb-industry.com

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isccompanies.com

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### JVL Industri Elektronik A/S

www.jvl.dk

### K+S Services

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### KB Controls

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keblog.com

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### Malloy Electric

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### Maxcess

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### Maxon Precision Motors

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### MICO, Incorporated

www.mico.com

### Micronor Inc.

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### Midwest Motion Products

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### Mitsubishi Electric Automation, Inc.

us.mitsubishielectric.com/fa/en

### Modicon PLC

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### Molon Motor and Coil

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ARLINGTON HEIGHTS, IL 60005  
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### Motion Industries

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### MROSUPPLY

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### New Power Electric (USA) LLC

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### New Torque, Inc.

newtorque.com

### Northwest Electric Motor Company

northwestmotor.com

### Novotec Argentina SRL

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### Onvio LLC

www.onviollc.com

### Ormec

www.ormec.com

### Parker Hannifin SSD Drives Div.

www.parker.com/ssdusa

### Phytron, Inc.

www.phytron.com

### PI (Physik Instrumente) L.P. Piezo Actuator Nano

www.pi-usa.us

### Potomac Electric

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### Power Electric

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### Power Inverter Inc.

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### Power Jack Motion

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### Precipart

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Sesame Motor Corp.  
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www.sei-automation.com

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www.spxcooling.com/

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www.stearnsbrakes.com

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

Houston Pump and Gear  
[www.houstonpumpandgear.com](http://www.houstonpumpandgear.com)

Huco Dynatork  
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HVH Industrial Solutions  
[hvhindustrial.com](http://hvhindustrial.com)

IBT Industrial Solutions  
[www.ibtinc.com](http://www.ibtinc.com)

Industrial Clutch Parts Ltd.  
[www.icpltd.co.uk](http://www.icpltd.co.uk)

Industrial Spares Manufacturing Co.  
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Inertia Dynamics, Inc.  
[www.idfc.com](http://www.idfc.com)

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

ISC Companies  
[isccompanies.com](http://isccompanies.com)

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

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[www.mav.it](http://www.mav.it)

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Netshape Technologies, Inc.  
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voith.com/usa/en/index.html

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www.andec.ca

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www.ato.com/

**BDI - Bearing Distributors Inc.**  
www.bdiexpress.com

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bearingengineering.com

**Bearing Headquarters**  
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**Bearings and Industrial Supply Company, Inc.**  
www.bearingsnow.com

**BK Power Systems - An Integrated Corrosion Co.**  
www.bkpowersystems.com

**CENTA Power Transmission**  
www.centa.info

**Cone Drive**  
www.conedrive.com

**Cotta Transmission Co. LLC**  
cotta.com

**Dalton Bearing Service, Inc.**  
www.daltonbearing.com

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www.dynexhydraulics.com

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www.silicones.elkem.com

**Filter Pumper / Hydraulic Problems, Inc.**  
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www.oeminternational.com

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www.orttech.com

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**Popular Mechanical Works**  
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**Precision Pump and Gear Works**  
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**RGW Sales Canada**  
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**RMR-Rotating Machine Rebuilders**  
www.rmrebuilders.com

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hydraulicvanepump.com

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voith.com/usa/en/index.html

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[inquiry@brgear.com](mailto:inquiry@brgear.com)  
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www.industrialjigandfixture.com

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www.integratedcomponentsinc.com

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www.kamarindustries.com

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www.keancn.com

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www.koroind.com

**Li Gear**  
www.ligear.com

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machinistsinc.com

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magnum-mfg.com

**Marshall Gears**  
www.marshallgears.com

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www.martinsprocket.com

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mijno.com

**Mini-Broach Machine Company**  
minibroach.com

**Minsk Gear Works**  
www.mgw.by

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www.motorgearengineer.com/

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**Muratech Engineering Company**  
www.muracopower.co.in

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www.neugart.com/en-us/

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www.allenberrygears.com

**Niebuhr Gears**  
www.niebuhr.dk

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Phone: 203-775-4877  
Fax: 203-775-6552  
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www.nordex.com

**Northwest Electric Motor Company**  
northwestmotor.com

**Oerlikon Fairfield**  
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**Ondrives US Corp.**  
www.ondrivesus.com/

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**Optimal Part**  
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**Orbitless Drives, Inc**  
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[www.ronsongears.com.au](http://www.ronsongears.com.au)

Rotek  
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[www.rototech.in](http://www.rototech.in)

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SBT Gearing Solutions  
[sbt-gears.co.uk/](http://sbt-gears.co.uk/)

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

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

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[www.sipco-mls.com](http://www.sipco-mls.com)

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[www.sixstar.com.tw](http://www.sixstar.com.tw)

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Taiwan Precision Gear Corp.  
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Team Industries  
[www.team-ind.com](http://www.team-ind.com)

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Tien Yi Gear Works Co., Ltd  
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Bearing Headquarters  
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[www.blazmangear.com](http://www.blazmangear.com)

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www.gearench.com/products/gears-pinions.asp

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**Pulley Manufacturers International Inc.**  
www.pulleys.com

**Pulsgetriebe GmbH & Co. KG**  
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www.qtcgears.com

**Quality Bearings & Components**  
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qbcsupport@qbcbearings.com  
www.qbcbearings.com

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**Rave Gears LLC**  
www.ravegears.com

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Fax: (630) 295-5490  
info@rbibearing.com  
www.rbibearing.com

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**Regal Power Transmission Solutions**  
www.regalpts.com

**Reliance Gear Corporation**  
www.reliancegear.com

**Renold**  
www.renold.com

**Riley Gear Corporation**  
www.rileygear.com

**Ringball Corporation**  
www.ringball.com

**Ritbearing Corp.**  
www.ritbearing.com

**Riverside Spline and Gear**  
www.splineandgear.com

**Rj Link International, Inc.**  
www.rjlink.com

**RMR-Rotating Machine Rebuilders**  
www.rmrebuilders.com

**Ronson Gears Pty. Ltd.**  
www.ronsongears.com.au

**Rotek**  
www.rotek-inc.com

**Roto-tech Technologies**  
www.roto-tech.in

**Rush Gears Inc.**  
www.rushgears.com

**Sam Gears India Pvt.ltd**  
www.samgears.com

**SBT Gearing Solutions**  
sbt-gears.co.uk/

**Schaeffler Group USA Inc.**  
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www.schafergear.com

**Shanghai Shine Transmission Machinery Co. Ltd.**  
www.syptworld.com

**Shivam Autotech Ltd.**  
www.shivamautotech.com

**Sinotech**  
www.sinotech.com

**SIPCO**  
www.sipco-mls.com

**Siti Spa Riduttori**  
www.sitiriduttori.it

**Six Star**  
www.sixstar.com.tw

**SKF USA Inc.**  
www.skf.com

**Snow Nabstedt Power Transmissions Inc**  
www.snpt.biz

**Sokhi Heli-Wom Gears Pvt. Ltd.**  
www.gearboxindia.com

**Source Engineering Inc.**  
www.sei-automation.com

**Southern Gear & Machine**  
3685 NW 106TH STREET  
MIAMI, FL 33147  
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sales@southerngear.net  
www.southerngear.net

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**Special Ingranaggi**  
www.specialingranaggi.com/en/

**Spencer Pettus**  
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**Spiroid Gearing**  
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Phone: (320) 762-7132  
www.spiroidgearing.com

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**SPN Schwaben Praezision**  
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**Sprockets Australia Pty. Ltd.**  
sprocketsoz.com.au

**ST Gear & Machine LLC**  
www.stgearandmachine.com

**STM Riduttori SpA**  
www.stmspa.com

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www.suhner.com

**Sumitomo Drive Technologies**  
www.sumitomodrive.com/

**Supreme Gear Co.**  
www.supremegear.com

**Suzhou Asia Pacific Metal Co., Ltd.**  
www.szapmc.com

**Systrand Manufacturing Corporation**  
www.systrand.com

**T.E.A. Machine Components**  
www.teausa.net

**Taiwan Precision Gear Corp.**  
www.tpg-tw.com

**Team Industries**  
www.team-ind.com

**Thyssenkrupp Rothe Erde USA Inc.**  
www.thyssenkrupp-rotheerde.com/

**Tien Yi Gear Works Co., Ltd**  
www.tienyigear.com.tw

**Tirex Transmission**  
www.tirextransmission.com

**Toledo Gearmotor**  
www.toledogear.com

**Torque Transmission**  
www.torquetrans.com

**Transmission Machinery Co., Ltd**  
www.transcyko-transtec.com

**Transply Inc.**  
www.transply.com

**Triumph Gear Systems - Acr Industries**  
www.triumphgroup.com

**Trojon Gear Inc.**  
www.trojon-gear.com

**Tsubaki of Canada Limited**  
www.tsubaki.ca

**Turner Uni-Drive**  
www.turnerunidrive.com

Unique Forgings (India) Pvt. Ltd.  
www.uniqueforgings.in

United Gear Works  
unitedgearworks.com

VCST LP  
www.vcst.be

Venture Products International  
www.ventureproducts.com

Victrex Gear Solutions  
www.victrex.com/en/gears/

Vision Quality Components, Inc  
www.visionqci.com

Voith Turbo Inc  
voith.com/usa/en/index.html

VW Broaching Service Inc.  
www.vwbroaching.com

W.M. Berg  
www.wmberg.com

Wajax  
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www.wd-bearings.com

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Yieh Chen Machinery (Six Star Group)  
www.yiehchen.com

York Industries  
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www.adhq.com

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bearingengineering.com

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Comtec Mfg., Inc.  
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Daemar Inc.  
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Dendoff Springs  
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www.huyett.com

Gear Master Inc.  
www.gearmaster.us

Hi-Grade Inc.  
www.higradeinc.com

Houston Pump and Gear  
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HVH Industrial Solutions  
hvhindustrial.com

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isccompanies.com

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www.jwwinco.com

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www.kieslermachine.com/

Koro Industries, Inc.  
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machinistsinc.com

Martin Sprocket & Gear  
www.martinsprocket.com

Melfast  
www.melfast.com

Metric & Multistandard Components Corp  
www.metricmcc.com

Motion Industries  
www.motionindustries.com

Mubea  
www.mubea-discsprings.com

National Bearings Company  
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Netshape Technologies, Inc.  
www.netshapetech.com

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SIPCO  
www.sipco-mls.com

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www.aerotech.com

Affiliated Distributors  
www.adhq.com

AGI Automation Components  
www.agi-automation.com

AISCO Industrial Couplings  
www.aiscoinc.com

Allied International  
www.alliedinter.com

Amacoil, Inc.  
www.amacoil.com

Ametric / American Metric Corporation  
www.ametric.com

Andantex USA Inc.  
www.andantex.com

Area Distributors Inc.  
areadist.com

Arnold Magnetic Technologies  
www.arnoldmagnetics.com

AST Bearings  
www.astbearings.com

Atlanta Drive Systems Inc.  
www.atlantadrives.com

BDI - Bearing Distributors Inc.  
www.bdiexpress.com

Bearing Engineering Company  
bearingengineering.com

Bearing Headquarters  
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www.beaver-online.com

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clarkegear.com

CUI Inc  
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Drive Lines Technologies Ltd  
www.drivelines.co.uk

Duff Norton Australia  
www.duffnorton.com.au

Dunkermotoren USA Inc.  
www.dunkermotoren.com

Durabond Slide  
www.durabondslide.com

Dynamic Structures and Materials, LLC  
www.dynamic-structures.com

**Dynatect Manufacturing Inc. (fka A & A Mfg.)**  
www.dynatect.com

**Dynex/Rivett Inc.**  
www.dynexhydraulics.com

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www.elliottmfg.com

**Emerson Industrial Automation - Drives & Motor**  
www.emerson.com/en-us/automation-solutions

**Equipment Rebuilding Services**  
www.ersgearbox.com/gear-boxes/

**Exlar Actuation Solutions**  
www.exlar.com

**Festo Corporation**  
www.festo.com/usa

**FMC Engineering**  
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**Framo Morat Inc.**  
www.framo-morat.com

**H2W Technologies**  
www.h2wtech.com

**Hallmark Industries Inc.**  
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**Houston Pump and Gear**  
www.houstonpumpandgear.com

**HPB Motion Control Co. Ltd.**  
www.hpb-industry.com

**HVH Industrial Solutions**  
hvhindustrial.com

**IAI America, Inc.**  
www.intelligentactuator.com

**IBT Industrial Solutions**  
www.ibtinc.com

**IDA Motion Inc.**  
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**IKO International Inc.**  
www.ikont.com

**Industrial Clutch Parts Ltd.**  
www.icpltd.co.uk

**Intellidrives, Inc**  
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**ISC Companies**  
isccompanies.com

**K+S Services**  
www.k-and-s.com

**Kollmorgen**  
www.kollmorgen.com

**Leeson Electric**  
www.leeson.com

**Machinists Inc.**  
machinistsinc.com

**Mavilor Motors, S.a.**  
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**Melfast**  
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**Midwest Motion Products**  
www.midwestmotion.com

**Mitsubishi Electric Automation, Inc.**  
us.mitsubishielectric.com/fa/en

**Modern Linear Inc.**  
www.modernlinear.com

**Molon Motor and Coil**  
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www.molon.com

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**Motion Industries**  
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sales@nordex.com  
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northwestmotor.com

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www.ondrives.com

**Optimal Part**  
optimalpart.com/mechanical-coupling

**Ormec**  
www.ormec.com

**Orttech**  
www.orttech.com

**Parker Hannifin SSD Drives Div.**  
www.parker.com/ssdusa

**Performance Gear Systems, Inc.**  
www.performance-gear.com

**Phytron, Inc.**  
www.phytron.com

**PI (Physik Instrumente) L.P. Piezo Actuator Nano**  
www.pi-usa.us

**PIC Design**  
www.pic-design.com

**Portescap**  
www.portescap.com

**Power Electric**  
www.powerelectric.com

**Precipart**  
www.precipart.com

**Precision Technologies Group (PTG) Ltd.**  
www.ptg ltd.com

**PST Group (Precision Screw Thread)**  
www.thepstgroup.com

**PTD Outlet: Power Transmission Distributors**  
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**Rex Engineering Corp.**  
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**RGW Sales Canada**  
www.rgwsalescanada.com

**Ringball Corporation**  
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**RMR-Rotating Machine Rebuilders**  
www.rmrebuilders.com

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**Tampa Armature Works- TAW**  
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**TDK InvenSense**  
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**Technico**  
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**Tecnotion BV**  
www.tecnotion.com

**TelcoMotion**  
www.telcointercon.com

**Thomson Industries Inc.**  
www.thomsonlinear.com

**Tolomatic, Inc.**  
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**TVT America, Inc.**  
www.tvtamerica.com

**Venture Mfg. Co.**  
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**VL Motion Systems Inc.**  
www.vlmotion.com

**W.M. Berg**  
www.wmberg.com

**Wajax**  
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**Warner Linear**  
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**WEG**  
www.weg.net

**Whittet-Higgins Company**  
whittet-higgins.com

**Wittenstein**  
www.wittenstein-us.com

**WMH Transmissions Ltd**  
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**Yaskawa America, Inc.**  
www.yaskawa.com

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**Acorn Industrial Services Ltd.**  
www.acorn-ind.co.uk

**Affiliated Distributors**  
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**American Chemical Technologies, Inc.**  
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**Atlanta Drive Systems Inc.**  
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**Avalon International Corp.**  
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**BDI - Bearing Distributors Inc.**  
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**Bearing Boys Ltd**  
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**Bearing Engineering Company**  
bearingengineering.com

**Bearing Headquarters**  
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**Bearings and Industrial Supply Company, Inc.**  
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**Bibby Turboflex**  
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**BK Power Systems - An Integrated Corrosion Co.**  
www.bkpowersystems.com

**Checkfluid**  
www.checkfluid.com

**Chesterton**  
chestertonlubricants.chesterton.com/en-us

**Cortec Corporation**  
www.cortecvci.com

**Dalton Bearing Service, Inc.**  
www.daltonbearing.com

**Daubert Cromwell LLC**  
www.daubertcromwell.com

**Elkem Silicones**  
www.silicones.elkem.com

**Extreme Industrial Lubricants**  
www.extremelubricants.com

**Filter Pumper / Hydraulic Problems, Inc.**  
www.filterpumper.com

**G.L. Huyett**  
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**Gleason Plastic Gears**  
www.gleasonplasticgears.com

**Houghton International Inc.**  
www.houghtonintl.com

**HVH Industrial Solutions**  
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**IBT Industrial Solutions**  
www.ibtin.com

**Integrated Components Inc.**  
www.integratedcomponentsinc.com

**ISC Companies**  
isccompanies.com

**Isel Inc.**  
iselinc.com

**Kluber Lubrication North America L.P.**  
www.kluber.com

**Kyodo Yushi USA Inc.**  
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www.kyodoyushiusa.com

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thelubricantstore.com

**Lubriplate Lubricants Co.**  
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**Malloy Electric**  
www.MalloyWind.com

**Microsurface Corporation**  
www.ws2coating.com

**Motion Industries**  
www.motionindustries.com

**MROSupply**  
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**Rexnord**  
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**RMR-Rotating Machine Rebuilders**  
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**Transmission Machinery Co., Ltd**  
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**Transply Inc.**  
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**Allied Motion**  
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**Ametric / American Metric Corporation**  
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**Applied Dynamics**  
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**Arc Systems, Inc**  
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**Area Distributors Inc.**  
areadist.com

**Arnold Magnetic Technologies**  
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**ASI Technologies Inc.**  
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**Assun Motor Pte Ltd**  
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**ATO Inc**  
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# Cost-Effective, High-Performing Motors without Neodymium Magnets - Part II

George Holling

In Part I we explored various motor technologies used today for industrial and traction motor design. Here in Part II we will explore another motor option: reluctance motors.

Although invented in the 1800s, the variable switched reluctance (VSR or SR) motor was re-discovered in the 1990s when the electronic power switches, FETs, IGBTs, became readily available on a commercial basis. In recent years the VSR has once again attracted a lot of attention as a cost-effective

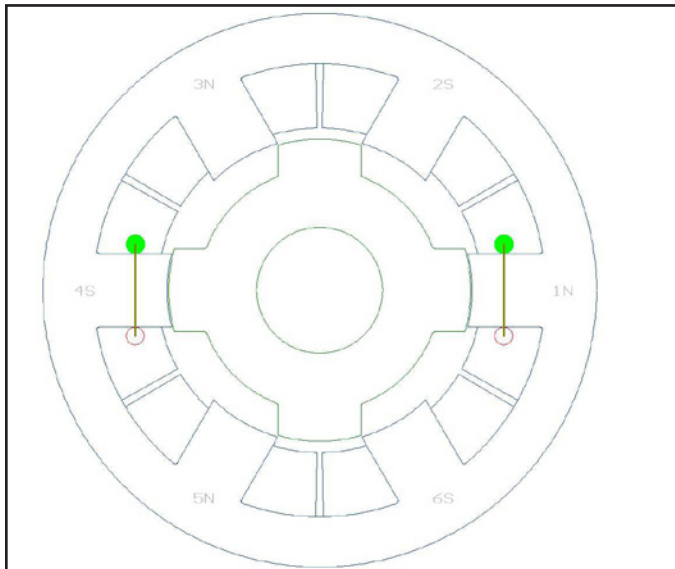


Figure 1 Basic lamination design of a VSR motor.



Figure 2 Key components of the VSR motor.

alternative to the permanent magnet (PM) motor.

In Figure 1 we show the basic diagram of the VSR lamination. Other key parts of the VSR motor are shown in Figure 2. Finally, a picture of a production VSR motor is shown (Fig. 3).

The VSR has a number of rotor and stator teeth where the number of rotor teeth  $n_r$  is typically  $\pm 2$  of the number of stator teeth  $n_s$ , and  $n_s$  is an integer multiple of 2 times the number of phases  $n_p$ . The VSR is characterized by its ratio of rotor-to-stator teeth and common ratios are 6:4 and 12:8 for a 3-phase motor and 8:6 for a 4-phase motor.

Unlike most other brushless motors, the coils are wound concentrically around a single stator tooth (Fig. 2) which reduces the end-turn length, copper weight and copper losses. It also reduces the cost to manufacture the VSR motor due to its simple winding patterns.

The VSR motor can be very efficient; for example, a 5 KW VSR motor can reach up to 95% efficiency. And a larger VSR motor can have even higher efficiency. The VSR delivers constant torque—from starting torque up to a “base” speed—and the constant power above up to  $3\times$  the base speed without a significant loss in efficiency. The speed/torque curve of a typical VSR motor is shown (Fig. 4).

An added advantage of the VSR is that it can be largely controlled by properly turning the phases “ON” and “OFF” at the correct times when running at a constant speed, and no additional current control will be required; this increases the drive efficiency and can reduce the controller cost.

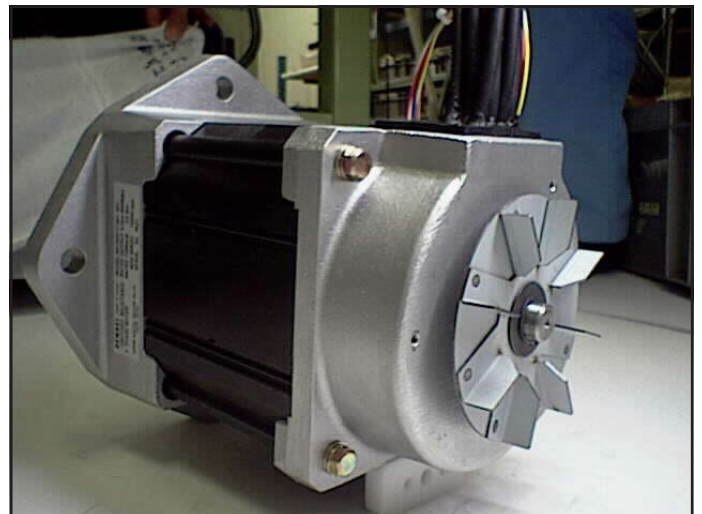


Figure 3 Full VSR motor.

The main drawback of the VSR motor is that each of its phases must be controlled independently — which requires two motor leads to be brought out from the motor to the controller for each phase — and the controller requires additional components, compared to a permanent magnet (PM) brushless motor (BL). In Figure 5 we show the flux pattern of a typical VSR lamination.

The VSR motor design requires high flux concentrations in the lamination steel for efficient operation and VSR motors typically operate at 1.8T-2.2T flux density, which is higher than those of similar PM BL motors. Due to the high flux densities in the steel, it is very important to minimize the back-iron and tooth width, which can result in a mechanically “weaker” lamination compared to that of a similar-sized PM or induction motor.

Also, the airgap of the VSR is small, i.e. 10–20 mils — which presents mechanical challenges — and it results in strong, radial magnetic forces acting on the rotor. These forces, coupled with the thin outer lamination ring, result in acoustical noise that is generated in the VSR motor; so they can be noisy unless additional design measures are taken.

An additional concern typically associated with VSR motors is the torque ripple, as shown in Figure 6.

The VSR motor is commonly considered “noisy,” but many successful designs exist where the motor runs very quietly, i.e. — the Neptune washer VSR motor made by Emerson. We have also compared noise levels of a PM traction motor versus a properly designed VSR motor and found the noise measurements in the passenger compartment to be within  $\pm 3$ dB from each other, with neither motor being clearly quieter.

However, there is a second type of reluctance motor which, until recently, did not gain much attention, — the synchronous reluctance motor (SYR) — and it has only recently generated serious interest.

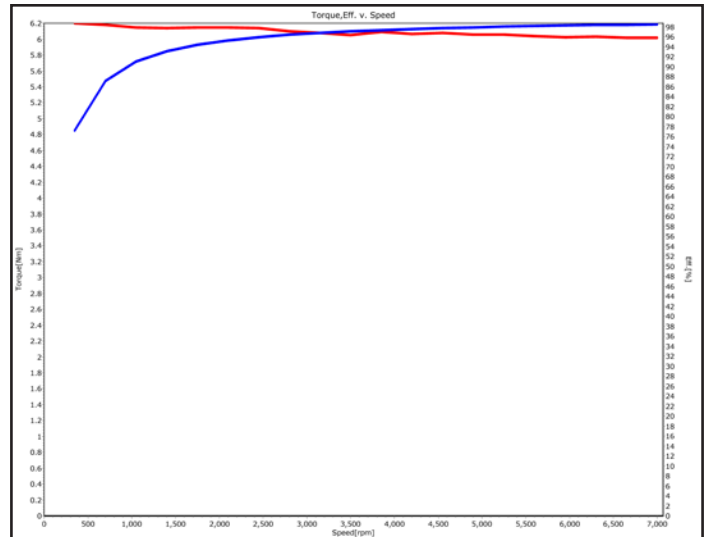


Figure 4 Speed/torque curve of a VSR motor.

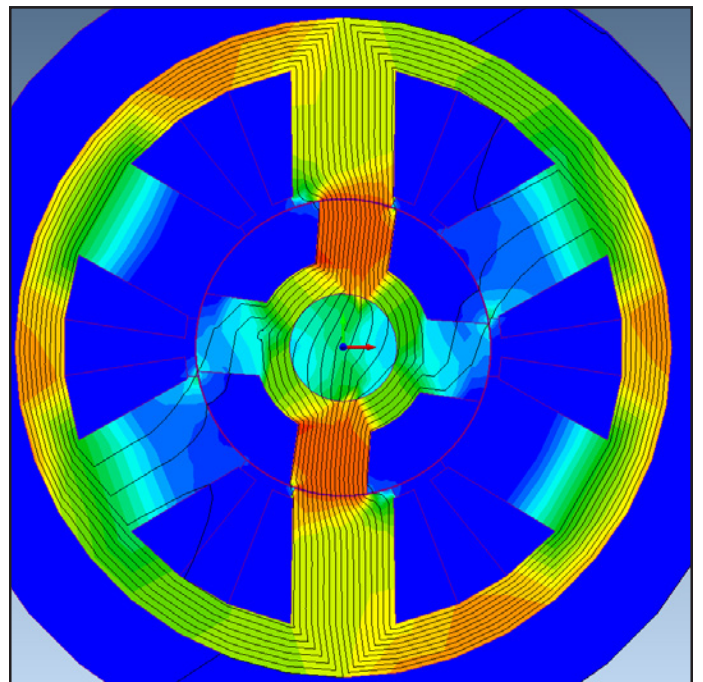


Figure 5 Flux distribution of a typical VSR motor.

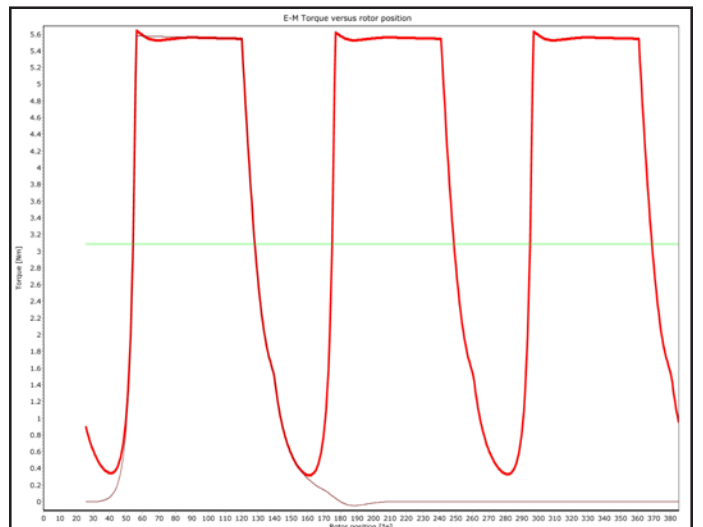


Figure 6 Torque ripple of the VSR motor.

Figure 7 shows the lamination design of a synchronous reluctance motor and Figure 8 shows the flux distribution in the SYR lamination; and in Figure 9 is a photo of a SYR motor.

In Figure 10 we show the speed/torque curve of a SYR motor.

The SYR delivers constant torque from stall (0 RPM) up to a “base” speed, and the constant power above the base speed. The SYR can be operated in this constant power region up to 3× the base speed without a significant loss in efficiency. Furthermore, the SYR can achieve very high operating efficiencies at high speed and we are designing a 3" diameter SYR motor with a 1.5" stack that can operate at 10 KW at 36,000 rpm, while maintaining above 93% motor operating efficiency.

The SYR has a distributed winding, just like the PM BL motor and the AC induction (ACI) motors, e.g.—the ABB SYR in Europe uses an existing AC stator and simply added a reluctance rotor. This ABB motor has become a very

successful SYR motor product line, but most SYRs today are custom-designed specifically as SYR motors—especially in the U.S— which yield smaller and more efficient SYR motors.

The SYR can be manufactured with the same winding equipment and facilities as existing brushless and induction motors. No magnets need to be glued and/or retained, which further simplifies SYR manufacturing and results in cost savings.

Like the PM brushless and the ACI, the SYR requires one motor lead per phase and, with minor software changes, it can run with the same controller hardware as the PM brushless motor.

Because the stator backiron is generally thicker than that of the VSR motor, the SYR runs quieter. Testing on some motor comparisons has shown that the SYR has a noise signature that is comparable to that of a PM BL motor in specific applications.

The operating efficiencies of the SYR motor are slightly

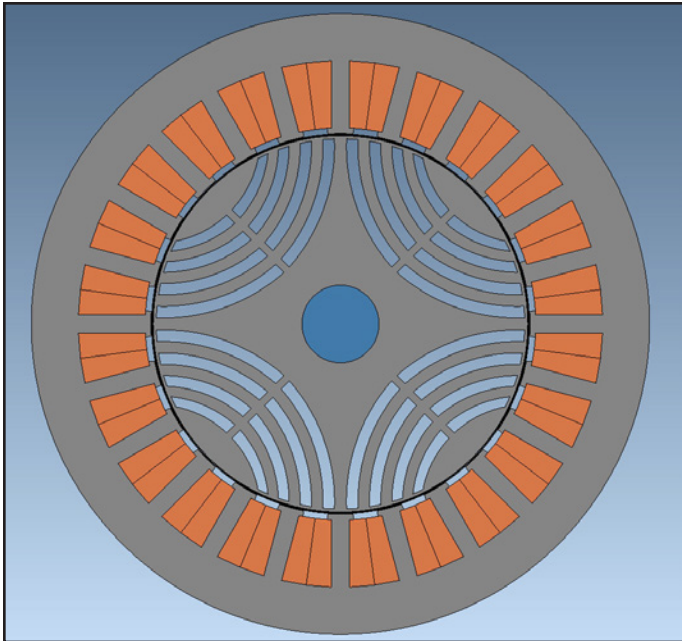


Figure 7 Lamination of the SYR motor.

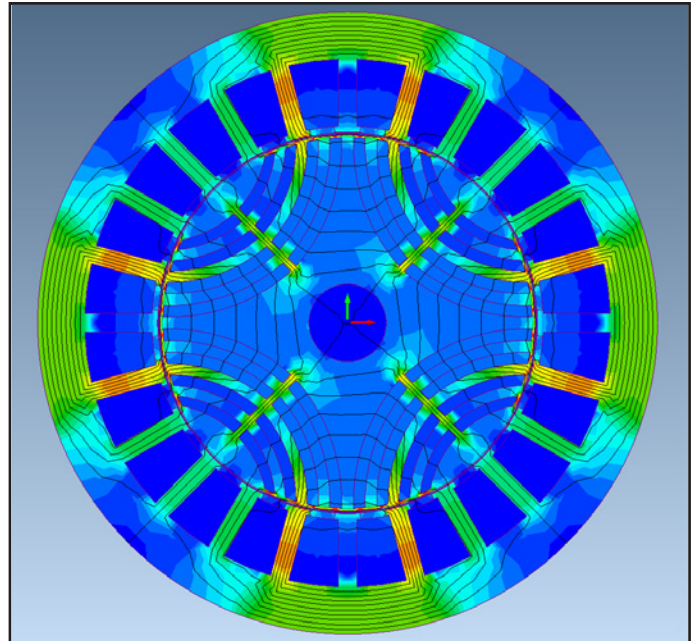


Figure 8 Flux distribution of typical SYR motor.

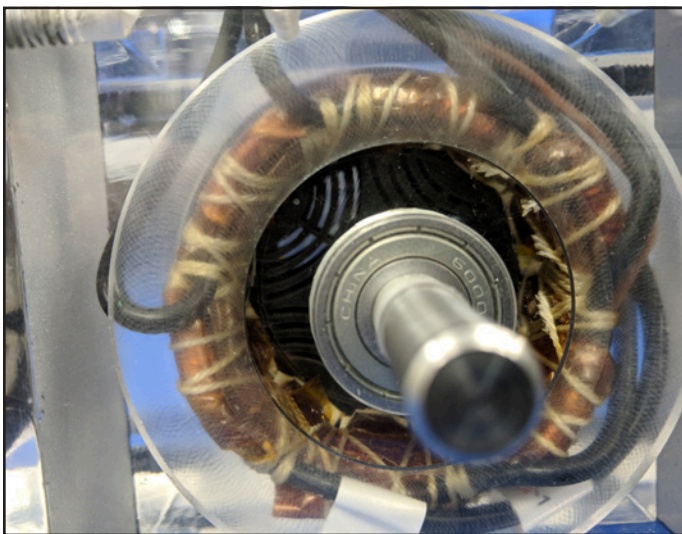


Figure 9 Synchronous reluctance test motor.

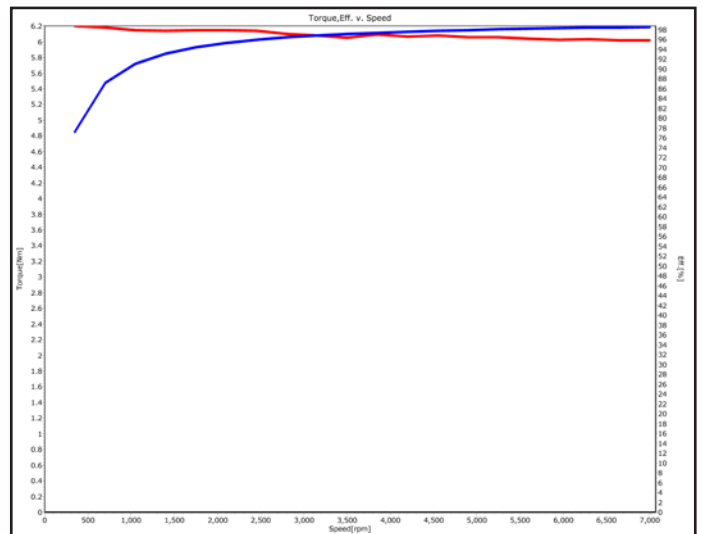


Figure 10 Speed torque of SYR motor.

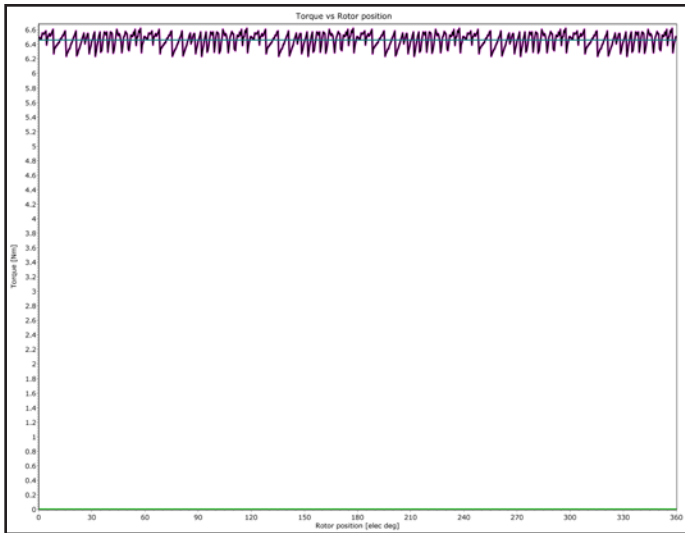


Figure 11 The torque ripple of a SYR motor.

less than those of a high-performance neodymium PM BL, but that is offset by a lower manufacturing cost compared to the brushless motor and a significantly lower controller cost compared to the VSR.

The SYR also has an almost constant torque. A typical torque ripple curve is shown in Figure 11; it shows only a small variation of the motor’s torque as a function of its position.

Also, while the SYR will have its highest operating efficiencies when excited with sinusoidal waveforms (AC), the SYR will also perform very efficiently when energized with trapezoidal waveforms — just like the brushless DC motor. This allows for low-cost Hall sensors to be used for feedback. Both the VSR and SYR can be operated sensor-less, using proprietary sensorless controls for positioning and speed control of SYR motors without loss in performance for high-temperature automotive and military applications.

Also, since the SYR motor has no magnets, there is no risk of demagnetization during overload conditions and the motor can easily operate in higher ambient temperature environments — a key feature for some advanced automotive, down-hole drilling and military applications.

In Table 1 we show a comparison of material weights: one

Table 1 Comparison of material weights.			
	PM brushless	VSR	SYR
Laminations (lb)	0.48	0.53	0.42
Copper (lb)	0.22	0.28	0.16
Magnet (lb)			
Magnet Assembly	2.75	0.00	0.00
Shaft	1.50	1.50	1.50
Bearings	2.00	2.00	2.00
Endbells			
Housing			
Assembly			
Lamination \$/lb	2.00	3.00	3.00
Copper \$/lb	10.00	10.00	10.00
Magnet \$/lb	5.60		
Total Cost	9.41	7.88	6.35

component in the cost comparison used when deciding which motor to use.

This comparison clearly favors the SYR in this specific example and, if the controller cost were taken into account, the SYR and the PM brushless will be the prime candidates.

Potential customers have been quite receptive, and working designs are under development to replace offshore PM BL motors with SYRs that can be cost-effectively produced domestically.

Next time you need a low-cost, high-performance motor, you should look beyond the PM BL motors and consider the reluctance motors — specifically the SYR — as an alternative to a lower-cost motor drive system. **PTE**

### For more information.

Questions or comments regarding this paper? Contact the author at Rocky Mountain Technologies at 406-225-7120 or [info@RockyMountainTechnologies.com](mailto:info@RockyMountainTechnologies.com).

**George Holling** holds significant influence in two companies — as technical director of Electric Drivetrain Technologies (2011– present) Moab, UT and as CTO of Rocky Mountain Technologies (2001– present), Basin, MT; contact George Holling at [George.Holling@RockyMountainTechnologies.com](mailto:George.Holling@RockyMountainTechnologies.com).

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# Reliability Safeguarding for an 8 MW Wind Energy Gearbox in Serial Production: Prototype and Process Development Ensuring Stable Quality at the Highest Level

Dr.-Ing. Dirk Strasser, Dipl.-Ing. Stefan Troll, Dipl.-Ing. Ralf Sperlich,  
Dipl.-Ing. Jörg Münch, ZF Industrieantriebe GmbH, Witten

## Market Challenges and Motivation

The offshore market segment is forecasted to grow with a 16% cumulative annual growth in 2015 to 2020. The recent tender process leads to low power prices for offshore wind, e.g. — Dutch Borssele III and IV with 54.5 EUR/MWh. Therefore, offshore has the potential of reducing the levelized cost of energy, particularly when leveraging economies of scale and industrial maturity.

At the same time, a gearbox exchange on an offshore turbine causes repair costs of at least a million Eur.; thus, the highest product reliability is required to safeguard business certainty.

## Project and Design Characteristics

In 2010, ZF (formerly Bosch Rexroth) started the development of the 8 MW gearbox. In 2013 ZF delivered the first prototype. The gearbox design was validated within a huge validation program on the customer's system test rig, as well as on the prototype turbine.

After passing more than 10 gate reviews and design reviews according to the customer's development process, and having implemented some design improvements, the 0-series production began in 2015. The qualification of the manufacturing process was ensured by applying four audits per year, together with the turbine manufacturer and end-customers. Also a certification body proved and released the processes.

The manufacturing processes' quality has continuously improved. Meanwhile, the 100<sup>th</sup> gearbox has been supplied successfully in May 2017.

ZF uses the differential gearbox for this application — a proven design applied in more than 2,500 gearboxes in the power range from 2.5 to 3 MW since 2003.

The 8 MW design consists of three planetary stages with a total ratio of about 38 (Fig. 1). The gearbox weight is about 71.5 metric tons, with a diameter and length of about 3,000 mm.

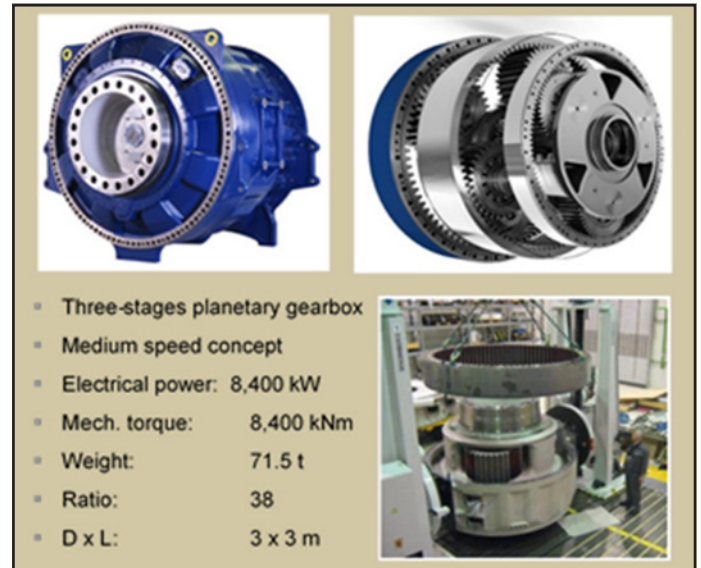


Figure 1 Design and main data of the 8 MW differential gearbox.

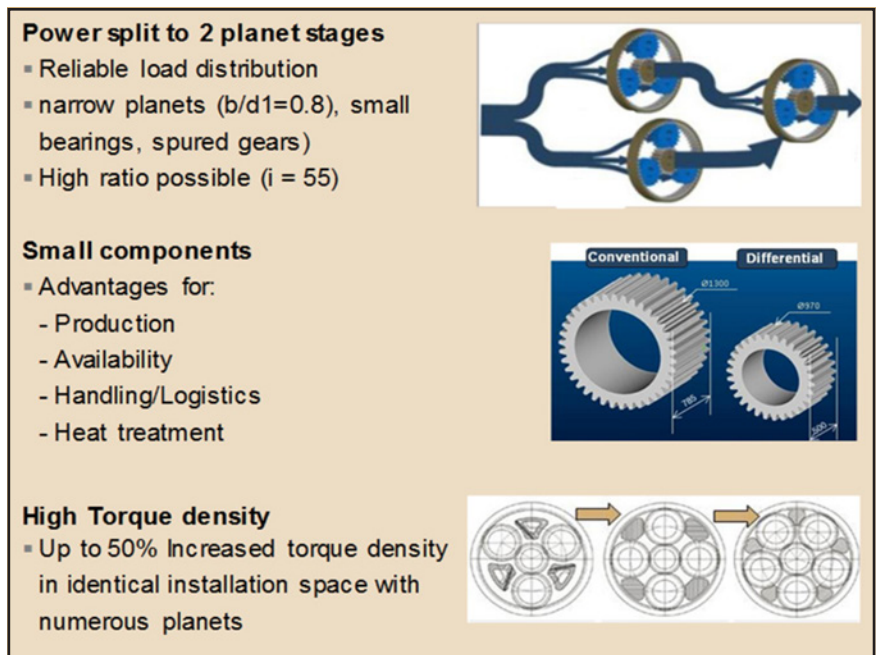


Figure 2 Characteristics of the differential gearbox concept.



The gearbox is originally rated for 8,400 kNm, with an up-rate margin up to significantly more than 9,000 kNm without design changes.

The concept is characterized by a power split on two planetary stages on the high torque input side. A further planetary stage combines the power flow again (Fig. 2). The concept allows using comparably small gear wheels and small bearings. At the same time, high total ratios up to  $i = 50$  can be achieved, since the stationary gear ratio is only in the range of 3.2-3.5 in each stage. The small stationary gear ratio provides the space for implementing further alignment functionality like, e.g., the double-cardanic sun system. The gear's aspect ratio is approximately 50% smaller than in conventional planetary gearbox architectures. The torque split allows using comparable small modules, which in turn lead to small gear diameters and small teeth. The component sizes and weight lead to advantages for logistics, material handling and heat treatment processes.

The differential gearbox concept provides possibilities for a 50% power density increase in the same volume by using numerous planets.

### Prototype Development

**Reliability engineering.** A strong focus was put on reliability during the entire prototype development (Fig 3). Starting with comprehensive field experience with the differential gearbox concept, engineering experience of about 25 years in wind business and knowledge in applying sophisticated

simulation tools, three elements of reliability engineering became important:

- The reliability prognosis focuses on the prediction of the component's reliability and the overall gearbox system. By an additional sub-project, applicable calculation methods have been developed (see also ZF's report on International Conference on Gears 2015 (Ref. 3)). The fundamentals of that approach are based on Bertsche (Ref. 1).
- Proper risk management by using structured methods like the failure mode effect analyses (FMEA) for designs — but also for processes. The FMEA has been carried out and updated throughout the entire development process. The method delivers input for the simulation tasks, as well as for the validation program.
- The validation program is adjusted to the verification topics. The results are processed in the FMEA and the risks are mitigated accordingly. The main pillars of the validation program are component, rig and field testing.
- Many of the described actions exceed the requirements of the IEC 61400-4 standard (Ref. 2).

**Simulations.** The theoretical reliability has to be safeguarded by comprehensive simulations considering all drivetrain loads. The simulation is necessary to predict early failure risks and thus reduce the validation time and costs as good as possible.

Therefore, a complete model of the drivetrain has been set up in a finite element model, as well as in a multi-body model, to adequately examine the static and dynamic influence from the overall system on the individual components (Fig. 4).

Due to the huge size of the model it was important to find

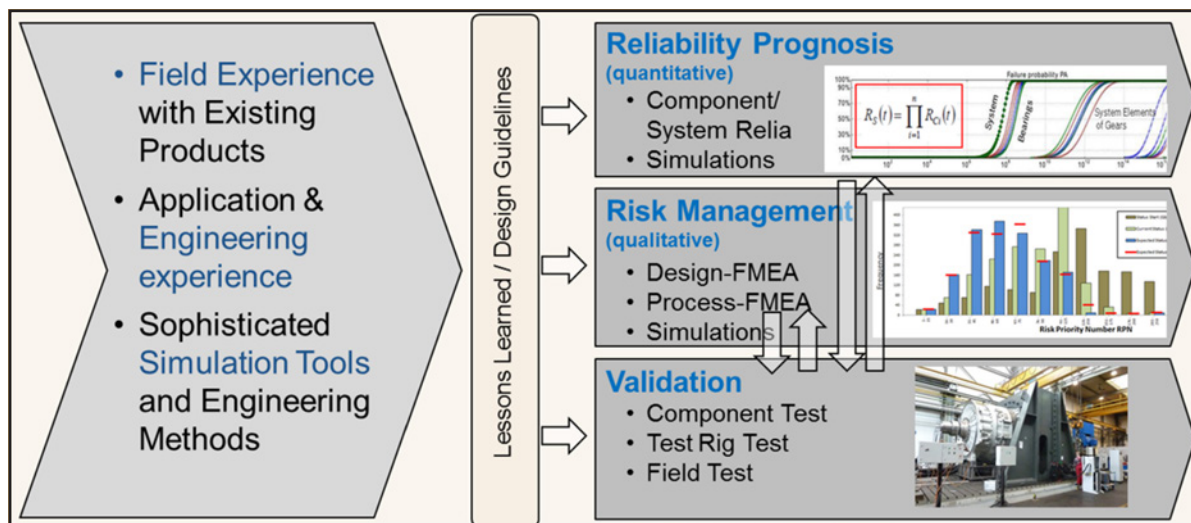


Figure 3 Basic focus points for reliability engineering.

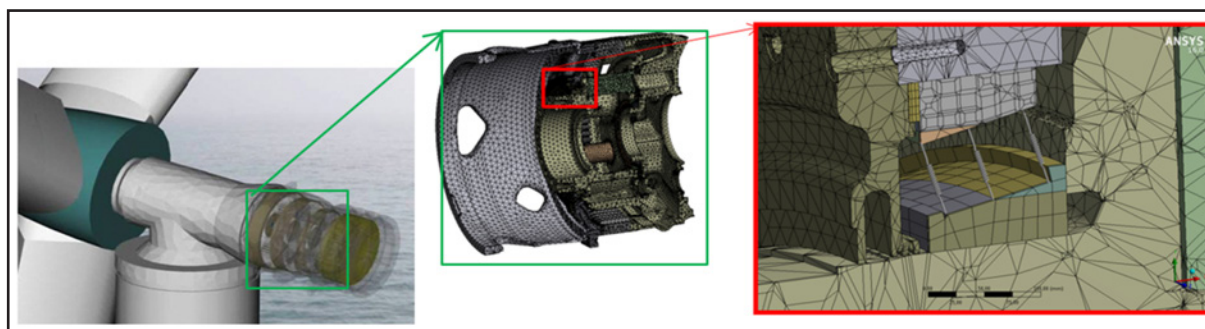


Figure 4 Simulation on system and component level.

the right modelling strategy, safeguarding the needed accuracy on one hand but keeping the computing time under control on the other hand. This means e.g. applying small mesh elements only locally or using so called “super elements” providing required physical characteristics. Particularly a suitable modelling of contact areas plays an important role to simulate accurate deformations. Using sub-models turned out to be suitable for the model exchange with the customer and the component suppliers.

For the loads and dimensions of an 8MW turbine, the drivetrain deflections are in the order of magnitude of 1-3 mm. These influences have to be taken into account in a variety of ways in the design — especially on the component level; for example, for the bearing load distribution and the tooth modifications, which are in the order of magnitude of 10 to 30  $\mu\text{m}$ .

As an example, Figure 5 shows the load distribution of a pre-loaded taper roller bearing set supporting the planet carrier; each circle represents the force on an individual roller element. Two bearing rows are shown (red: generator side bearing, blue: rotor side bearing). The state-of-the-art rigid calculation shows a proper load distribution over the rolling elements, whereas the advanced calculation reveals an unequal distribution caused by the varying stiffness of the bearing seat. Applying such an advanced method for all bearings provides an accurate assessment of the structure's influence on bearing contact pressure at static and dynamic conditions.

The structure deflection has also been taken into account to optimize tooth modifications. For example, the fixation of the ring gear by 52 pieces of M52 stud bolts leads to an axial curvature. This deflection is superposed to the usually applied crowning to determine a most accurate face load distribution in the planet/ring gear contact (Fig. 6).

The dynamic behavior of the

entire drivetrain was investigated by means of multi-body simulations (MBS); thus, the interaction of drivetrain structure and gearbox was optimized. On one hand, the Eigen frequencies of the components were adjusted in order to avoid harming resonance conditions; on the other hand, the gear mesh excitation was reduced by investigating the total pitch error of each planetary stage as well as the stiffness variation in the gear meshes (Fig. 7).

Applying a proper teeth number so that a synchronous or asynchronous mesh of sun/planet and planet/ring gear occurs, has been well proven; the right choice depends on the interaction with the gearbox structure. Also, the stiffness variation over the path of contact for both — sun/planet and planet/ring gear mesh — plays an important role for the total pitch error. Finally, a proper microgeometry is useful to influence the mesh frequency. In this case it turned out to be important to focus on the right excitation mode, i.e. — the basic mesh frequency or one of their harmonics.

The structure-borne noise could thus be reduced by approximately 95% — comparing the origin to the optimized design. This means excitation amplitudes in the range of 10 mm/s were simulated with a non-optimized design respective in the order of magnitude of 1.5 mm/s for the optimized design.

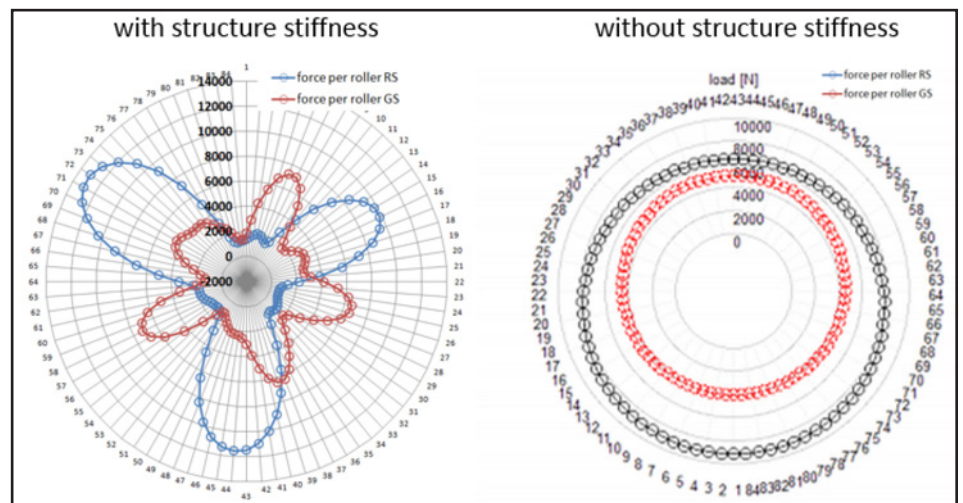


Figure 5 Bearing load distribution with state-of-the-art and advanced simulations.

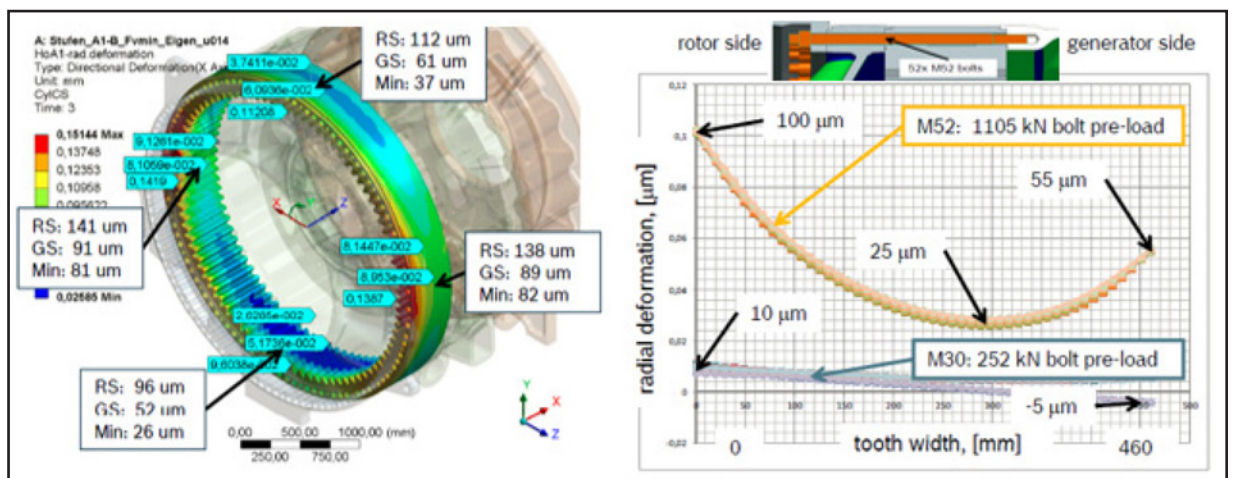


Figure 6 Gear modifications by considering structure deflections.

**Validation.** According to the risks detected during FMEA and simulation a validation procedure was set up. Different tests were conducted like component tests, robustness and endurance tests as well as a field test (Fig. 8).

With various component tests, several sub-assemblies and process steps were validated; special attention was paid to the roller bearings. Several ZF-owned bearing test rigs were used for that purpose. Also the heat treatment process for

the present gears, comprising a module of 29.5 mm, was investigated safely. Destructive component tests supported by heat treatment simulations were conducted. The target was to find a proper combination of surface and core hardness for case hardening depths of around 3-6 mm. Choosing the right quenching technology is a success factor.

The overall system behavior was investigated on the system test rigs, applying dynamic overloads up to 190% of the rated

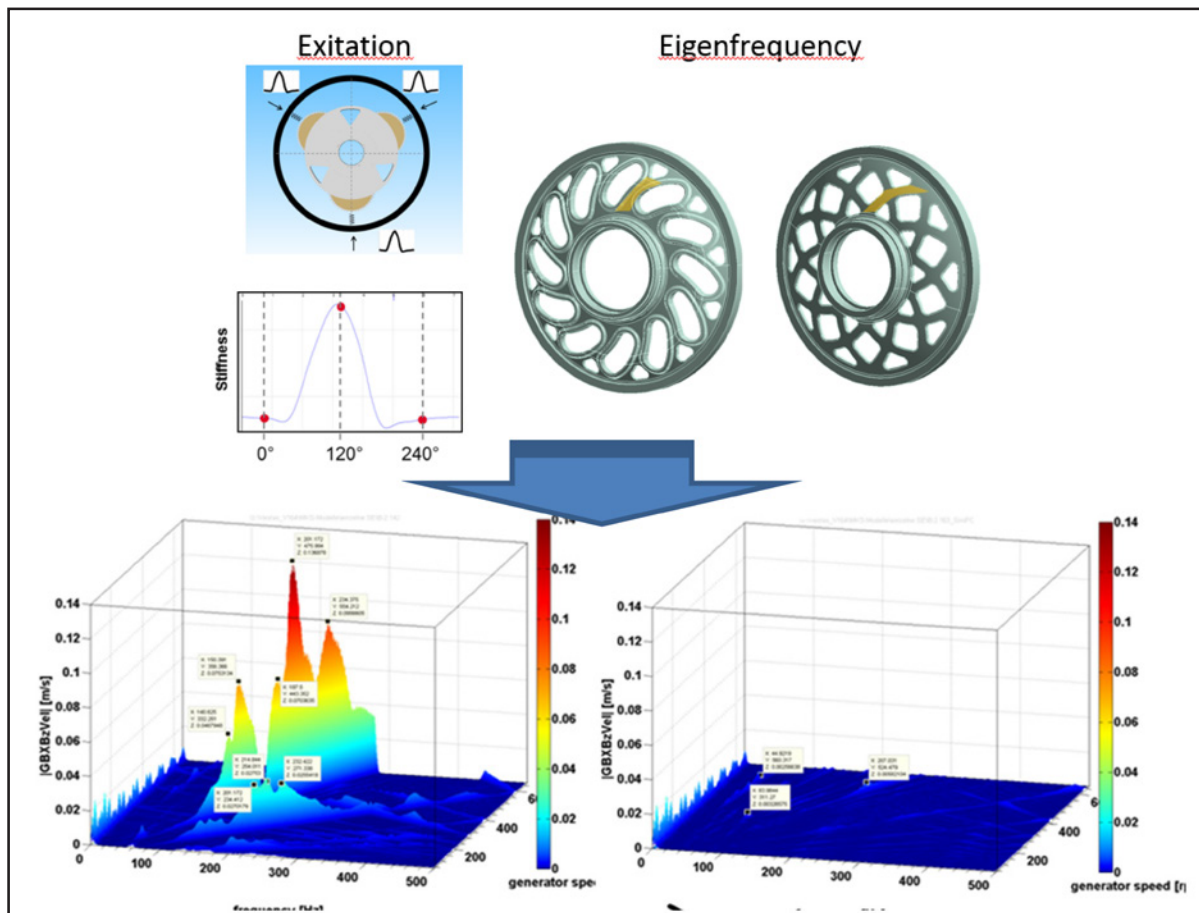


Figure 7 Prediction of structure-borne noise by optimization of structure shape, gear macro- and micro-geometry.



Figure 8 Validation procedure with component, system and field tests.

torque with a duration of more than 1,500 hours. The focus here was on the load distribution in contact elements and on the deformation of the structure. After the system tests the gearboxes were disassembled. All contact surfaces — meaning rolling contact elements as well as flange connections — have been inspected and compared to the simulation.

The inspection revealed that the contact pattern of functional surfaces, as well as the observed micro-movement in flange surfaces, appeared as simulated.

In the upper part (of Fig. 9 as an example), a connection element of the first and second planetary stage is shown. The inspection (left-hand side) demonstrates that the contact location to the mating part is of the same size and at the same location as previously simulated (right-hand side). A reverse calculation of the occurred deformation and pressure was possible.

The lower left part shows the flange connection of the ring gear to the housing. The dark grey zones reveal micro-movement in the flange connection. The lower right picture shows the corresponding simulation. One can see that the micro-movement area (red color) correspond to the inspected

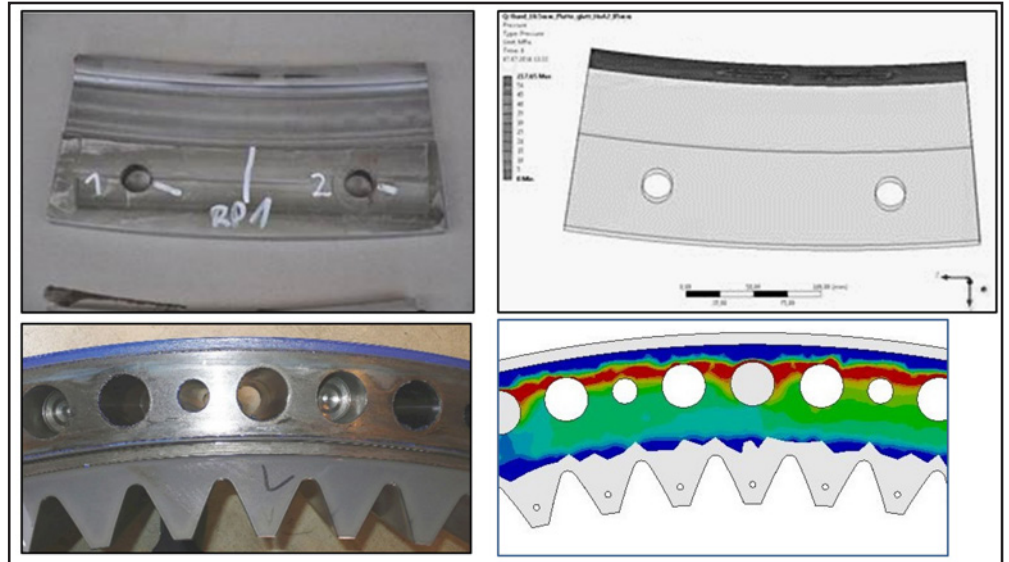


Figure 9 Comparison of system deformation and micro-movement to predicted values.

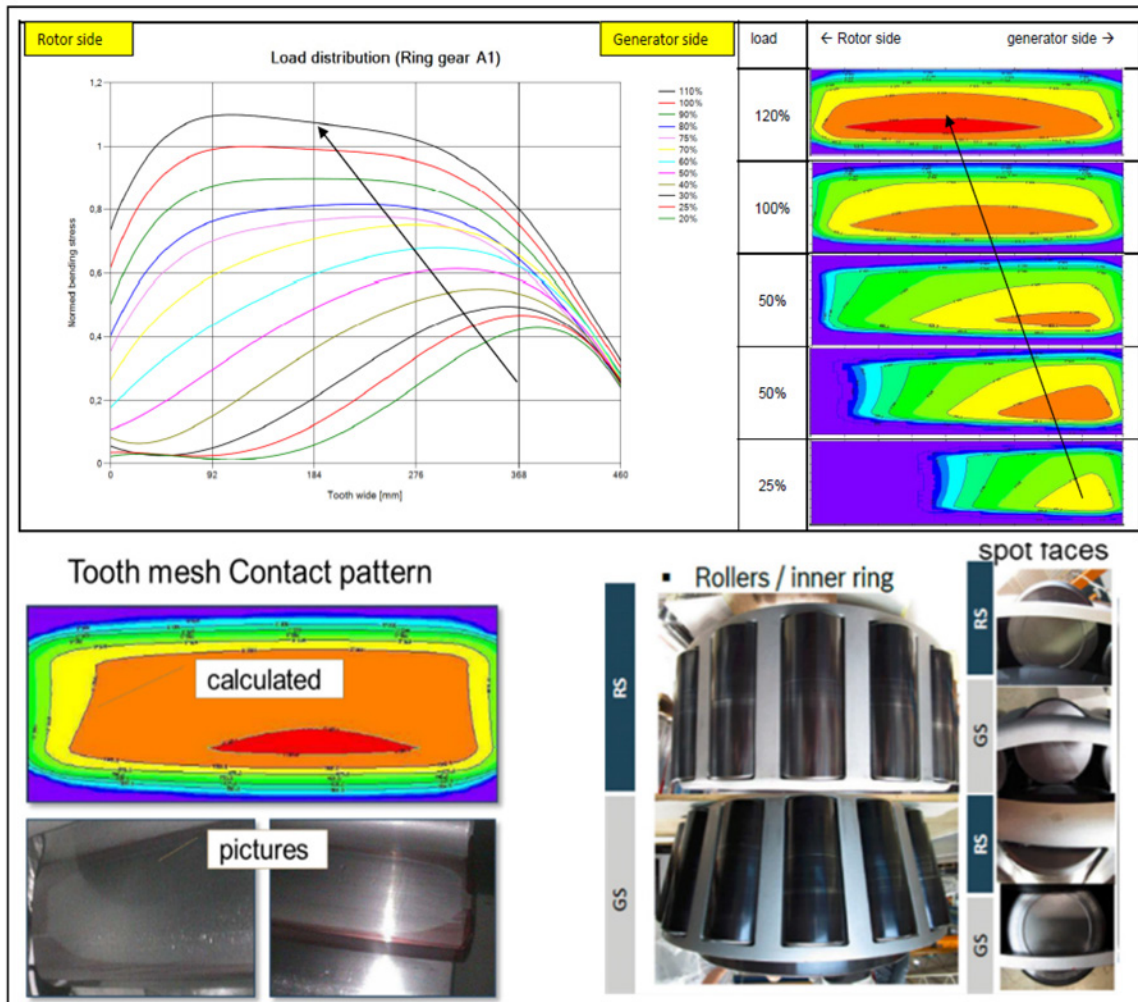


Figure 10 Contact pattern of gears and bearings and comparison to measurement values.

micro-movement. By means of an accurate simulation the flange and pin/screw design can be optimized such that the amount of micromovement is kept in a controlled and acceptable value. The acceptable values could be derived from field experience.

As usual for wind gearboxes, all meshes have been instrumented by strain gauges to measure the face load distribution, as well as the load sharing between the planets. Also the contact pattern development over several load stages has been visually inspected.

A measured face load distribution of  $K_{H\beta}$  1.15...1.17 and a load sharing of  $K_y < 1.05$  has confirmed the gear mesh simulations (Fig. 10). Also, the pre-loaded taper roller bearings revealed an expected contact pattern.

Also the structure-borne noise measurement confirmed the simulated values, i.e. — a deviation of below 5% occurred

between simulation and measurement (Fig. 11). The excitation levels are in the range of approximately 1.6 mm/s (e.g. first order of gear mesh frequency), and the Eigen frequencies modes are as predicted. The finally applied airborne noise measurement demonstrated that no tonal audibility occurred and that the turbine fulfills onshore noise requirements.

### Optimization of Serial Production

Already during the prototype development phase, manufacturing design was a significant factor. Further process optimization had been reached in a subsequent project, which started with entering the zero-series phase.

Complex correlations between machine and process influences on one hand, and measurement results, on the other hand, have been identified by production-oriented tolerance evaluation with statistical methods (Fig. 12).

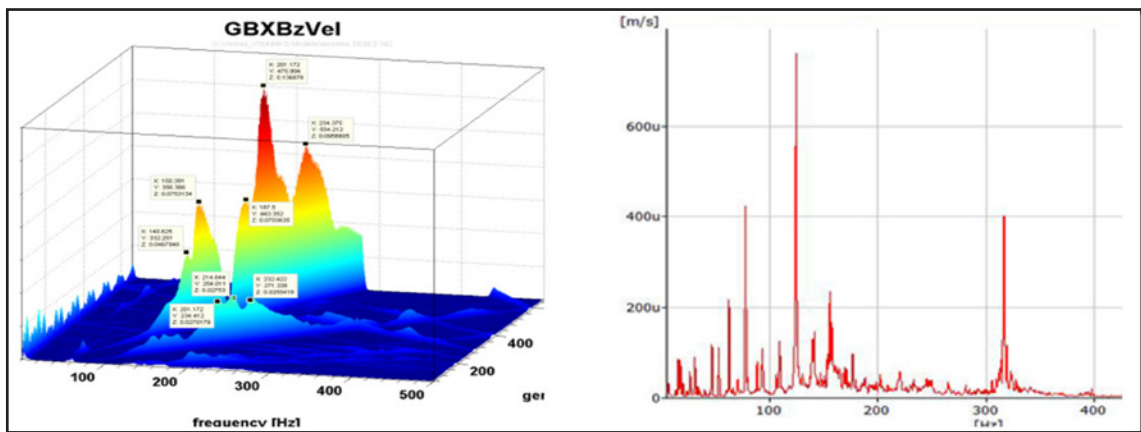


Figure 11 Structure-borne noise prediction (left) and measurement (right).

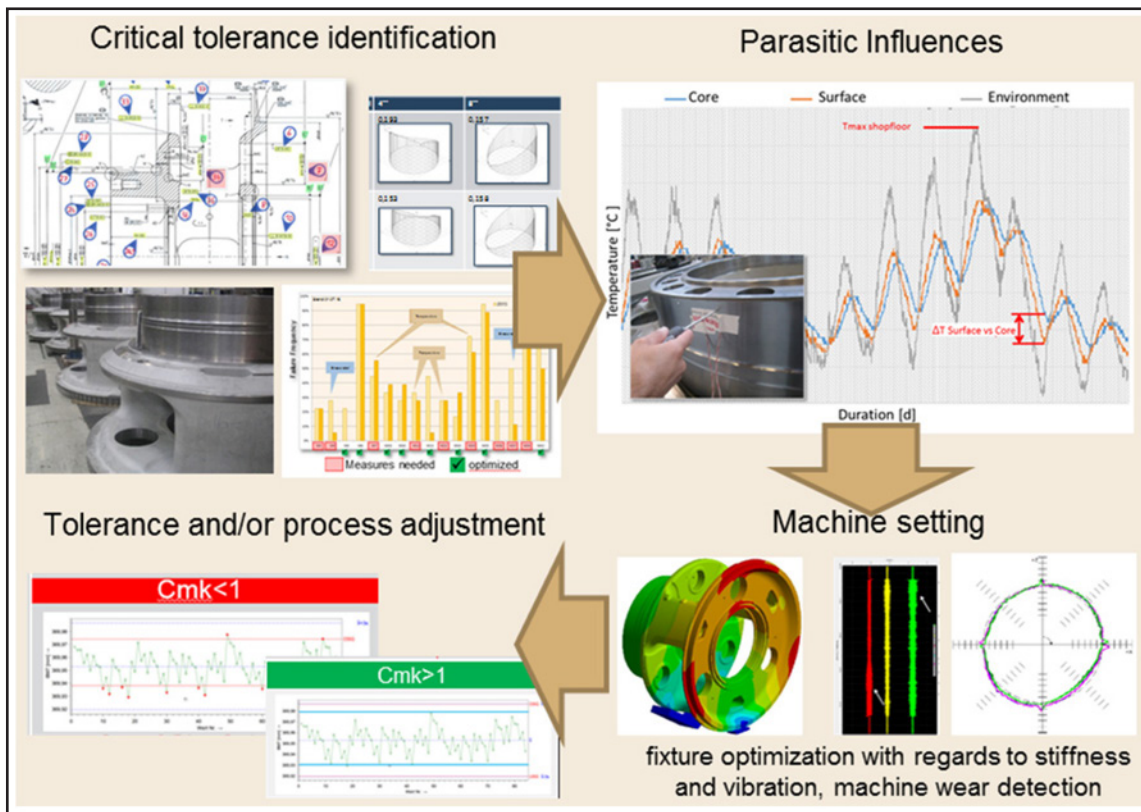


Figure 12 Process and tolerance optimization with focus on cost and quality.

Amongst others, the temperature behavior of big-size structure components (e.g. the temperature development from surfaces to core at different wall thicknesses and shapes), has been investigated and implemented in the measurement strategy.

For a better understanding of the component's deformation in clamping devices, their behavior has been investigated by using FEM analysis; the findings could be used for an enhanced manufacturing strategy with optimized fixations. Additionally, a regular monitoring of the machine conditions has been introduced. Besides the geometrical measurement, frequency analysis of selected units leads to a permanent view on the process conditions and allows measures at an early stage.

A calculation tool has been developed and implemented with the start of series production. Based on the analysis and display of the grinding stock data of gears before grinding, this tool permits quality and cost improvements (Fig. 13).

This tool enables a systematic regulation of the grinding allowance for each type of work piece, and a systematic reduction of the allowance variation spread by identifying and eliminating its root causes.

By using all these strategies on fields of environment, machine, process management and measurement, it is possible to obtain process capability and to face the triangle of tension: time, cost and reliability.

Not only for manufacturing but also for assembly of the 8MW gearbox, special adaptations to the processes had to be done (Fig. 14).

One major aspect concerns the health and safety of the operators. Exemplary for several special tools, the picture on the left side (Fig. 14) shows the adjustable gantry in the main assembly. With respect to the dimensions of components and sub-assemblies, one critical process is the mounting of gears.

To minimize the risk of damage, as well as assembly time and efforts for mounting devices, it is necessary to optimize the shape of the facing edge. The shape has to fulfill the requirements of the two different mounting phases, i.e. — “finding” and “sliding.” The angle of the front edge needs to be big enough for parts finding and the angle for transition into the flank needs to be small enough to ensure a smooth sliding.

For a permanent, stable operation of the gearbox, the quality and the process capability of screw connections are of vital importance. All internal screws and all torque-transmitting

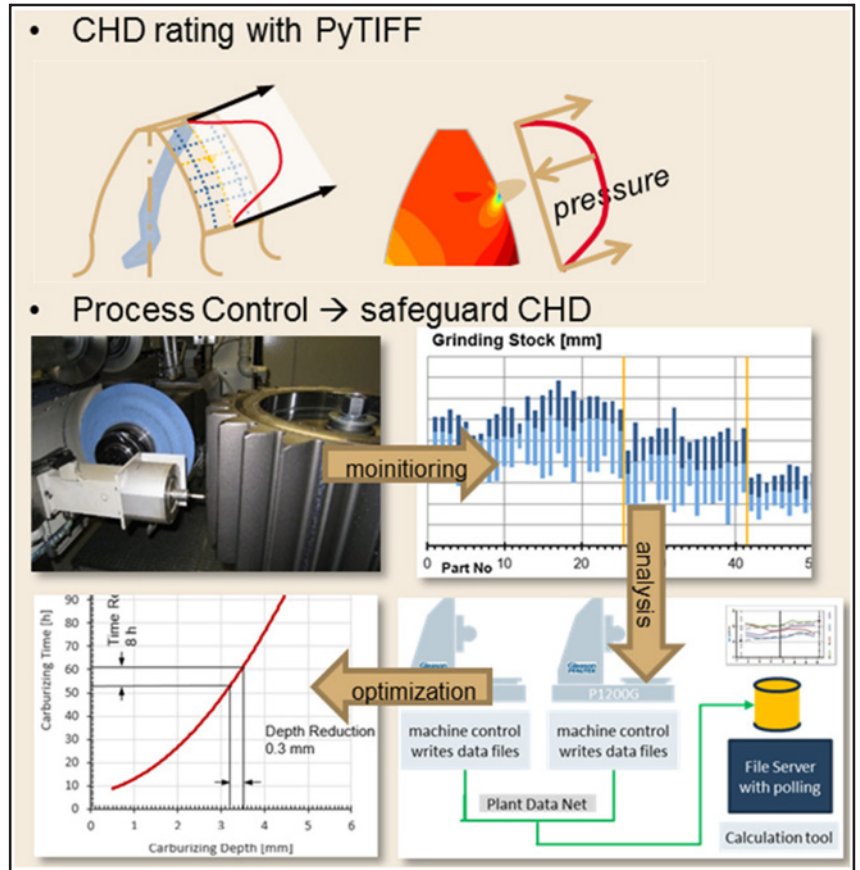


Figure 13 Process optimization with focus on reliability.

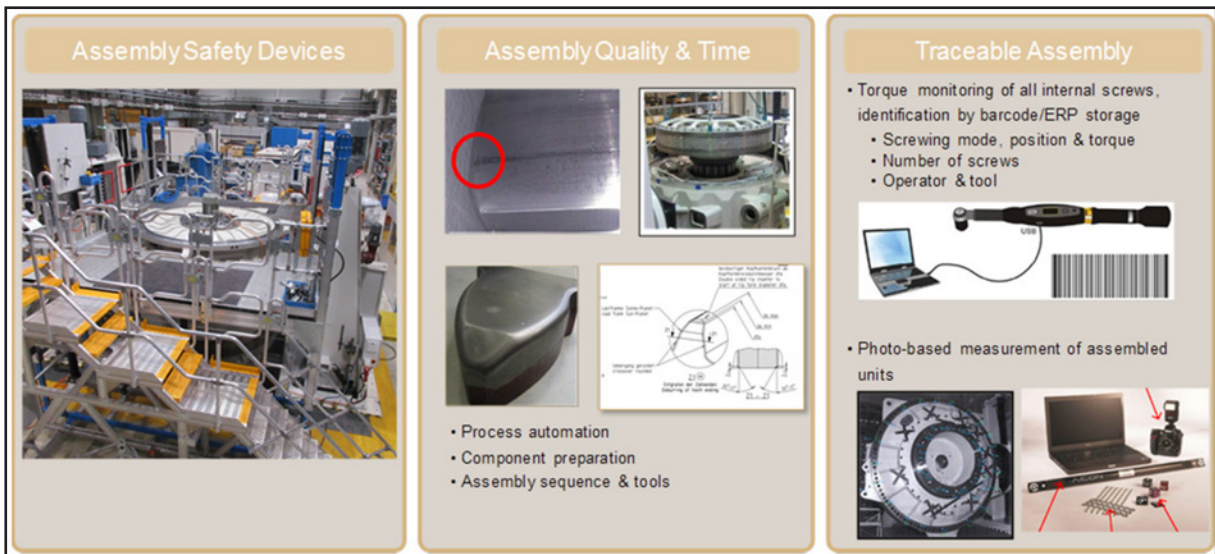


Figure 14 Stabilization of serial production with focus on quality, health and safety.

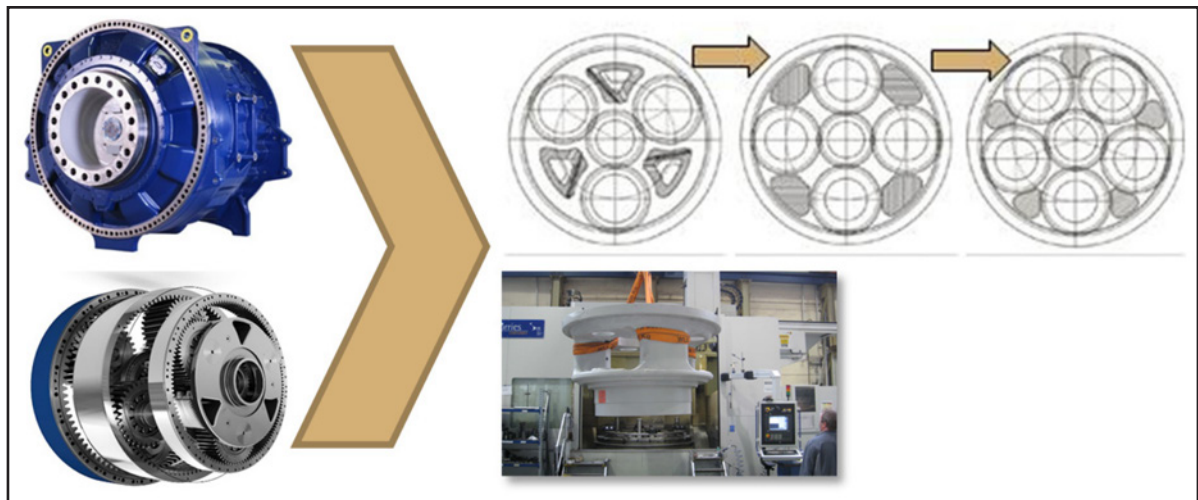


Figure 15 Power increase with differential gearbox concept.

screws are tightened with electronic torque control.

The interface dimensions of the assembled product are measured by means of advanced measurement methods—here, with a photo-based system. For this reason the gearbox is equipped with reference points and then photographed. With a special software tool, the interfaces dimensions are evaluated with accuracy in the range of about 0.05 to 0.15 mm, depending on the kind of tolerance. This method allows a quick measurement without any need for accessing a measurement machine.

### Summary and Outlook

The offshore application requires the highest reliability to safeguard business certainty. At the same time, increasing component sizes challenge the entire supply chain. Thus, ZF focused consequently on reliability engineering for the 8 MW differential gearbox, as well as on reliable serial processes.

In future the focus will be on operational and field data exchange in order to close the information loop and verify further the reliability models. The proven differential gearbox concept yields a power increase up to at least 12 MW by use of same gearbox size and utilization of the existing supply chain and facilities (Fig. 15). **PTE**

#### For more information.

Questions or comments regarding this paper? Contact Dirk Strasser at [dirk.strasser@zf.com](mailto:dirk.strasser@zf.com).

### References

1. Bertsche, B. "Reliability in Automotive and Mechanical Engineering," *Berlin Heidelberg: Springer-Verlag* 2008.
2. International Electro-Technical Commission. IEC 61400-4 Ed.1: Wind turbines - Part 4: "Design Requirements for Wind Turbine Gearboxes," IEC 2012.
3. Thoma, F., D. Strasser, P. Schmaltz and S. Yükses. "Determination of the Reliability for a
4. Multi-Megawatt Wind Energy Gearbox," *VDI International Conference on Gears*, Munich 2015.
5. Vath, A. "Intelligent Gearbox— a Contribution to the Cost of Energy Reduction," *Conference for Wind Power Drives*, Aachen, 2017.
6. Dr.-Ing. Dirk Strasser, Dipl.-Ing. Stefan Troll, Dipl.-Ing. Ralf Sperlich, Dipl.-Ing. Jörg Münch, ZF Industrieantriebe GmbH, Witten

**Dr. Dirk Strasser** in 2000 graduated from FH Iserlohn and Ruhr University Bochum with a degree in mechanical engineering, focusing on construction. His professional work includes (2000-2005) research associate, Institute of Machine Elements, Transmissions and Motor Vehicles, with Prof. Predki, Ruhr University Bochum; (2005-2010) in various positions in the field of industrial and wind gear design for medium-sized transmission companies in the Ruhr area; and (2010-2015) as head of wind gearbox development, Bosch-Rexroth, Witten. Strasser currently (since 2015) has global responsibility for the development of wind gearboxes for ZF Wind Power Antwerp (after sale of Bosch Windbusiness to ZF in 2015).



**Dipl.-Ing. Stefan Troll** studied (1992-1999) mechanical engineering/faculty of production engineering, Gerhard Mercator University Duisburg and Rheinisch Westfälisch Technical University Aachen. From (2000-2003) he worked in production planning at mini-factory diode, Automotive Electronics Division, Robert Bosch GmbH Reutlingen; from (2003-2007) in production planning in the mini-factory sensors, Automotive Electronics Division, Robert Bosch GmbH Reutlingen; and from (2007-2011) in production planning for industrial travel and swivel gearboxes, mobile applications, Bosch Rexroth, Witten. Troll has since 2011 worked as project manager for new wind turbine products, Witten (after sale of Bosch Windbusiness to ZF in 2015).



**Dipl.-Ing. Ralf Sperlich** began his schooling in 1988-1991 with an apprenticeship as tool mechanic at VDO Adolf Schindling AG, Frankfurt/M, Germany. From 1994-1997 he pursued mechanical engineering studies at the University of Applied Sciences FH, Frankfurt/M, Germany. From 2005 thru 2007 he took up French Language Studies at the Centre d'Enseignement du Français, Albertville, France and theological studies at Emmaüs, St-Légier, Switzerland. He was later (1997-1998) a design engineer for the mechanical components of robots and hydraulic presses (up to 200kN) at Reis Robotics, Obernburg, Bavaria; (1999-2005) calculation engineer for cranes and components, focus area calculation of machine elements for helical, hypoid and bevel gearboxes for industrial use DEMAG Cranes & Components GmbH, Wetter/Ruhr, Germany; (2006-2012) social welfare development work, in cooperation with international partner organizations and the Evangelical Church in Chad and director of an orphanage there for SAHEL LIFE, Kirchheim/Teck, Germany. Since 2012 Sperlich is design engineer for multi-megawatt offshore wind turbine gearboxes, design lead engineer, for ZF Industrieantriebe Witten GmbH, Witten, Germany.



**Jörg Münch** in 1983 received vocational training as a mechanic. In 1988 received his degree in mechanical engineering from the University of GHS Wuppertal. Upon graduation, his professional work includes: (1998) gear factory at Köllmann GmbH, in the design and development of extruder and special gearboxes; (2001) at Jähnel-Kestermann GmbH & Co. KG designing and developing special gearboxes (rolling mill, drives chemical plants dredger pumps, water turbine drive); and, since 2007, at Bosch Rexroth AG Witten, in the design and development of transmissions for wind power transmissions. Most recently, Münch is in charge of the 8 MW GPC 840 D gearbox.



## Amsted Seals and Forming

ACQUIRES CLARK SEALS NINGBO

Amsted Seals and Forming has acquired Clark Seals Ningbo, to be renamed Amsted Seals Ningbo (ASN). The IATF-certified seal production facility, built in 2012, incorporates the latest in manufacturing, testing, and quality control systems to supply oil, grease, and bearing seals to customers in Asia and the wider global market.

“With 128,000 square feet and future capacity of 96 presses, the acquisition of ASN is part of the ongoing commitment of Amsted Seals and Forming to produce and deliver the highest quality seals in the world,” said Michael Carter, president of Amsted Seals and Forming.

Amsted Seals and Forming is committed to long-term investment in the people, quality, technological innovation, and talent development in Ningbo. As manufacturers, engineers, service providers, and innovators, Amsted’s goal is to provide sustainable growth for the people and communities where we operate.



ASN will produce shaft seals, bearing seals and other sealing products for a broad range of applications including rail, heavy duty truck, appliance, automotive, agriculture/ construction, industrial, and outdoor power/recreation.

“We’re excited to welcome the Ningbo facility into our worldwide network of manufacturing excellence,” stated Michael Carter, “and be better positioned to respond to our customers’ needs in the most cost-efficient manner.”

As part of the transaction, Amsted Seals and Forming and previous owner Clark Seals LLC out of Tulsa, Oklahoma, entered into a 10-year commercial agreement, establishing Clark Seals as the preferred distributor for certain sealing products.

Amsted Seals and Forming is a part of Amsted Industries, a diversified, global manufacturer of industrial components with a long heritage of cutting-edge manufacturing and continuous product innovation. The Amsted companies are leaders in providing solutions for rail, trucking, automotive, construction and industrial applications. ([www.amstedseals.com](http://www.amstedseals.com))

## MPIF

ELECTS NEW OFFICERS

**Dean Howard**, PMT, president, North American Höganäs Co., a subsidiary of Höganäs AB, Hollsopple, Pennsylvania, has been elected the 30<sup>th</sup> president of the Metal Powder Industries Federation (MPIF), succeeding John F. Sweet, PMT, FMS Corporation, Minneapolis, Minnesota. His two-year term began at the conclusion of the Federation’s annual Powder Metallurgy (PM) Management Summit and 75<sup>th</sup> Annual MPIF Business Meeting, October 26–28, 2019, in Miami, Florida.



One of the Federation’s six associations also instated a new president following the Summit. Jill Spaulding, Kymera International, Research Triangle Park, North Carolina, has been elected president of the Metal Powder Producers Association (MPPA) and will serve a two-year term. Howard has worked for North American Höganäs Co. for nearly 20 years. He most recently served as president of the MPPA and has served the association and actively for many years.

Howard received MPIF’s Distinguished Service to Powder Metallurgy Award during PowderMet2017 in Las Vegas. He has been a member of APMI International for 26 years. He was chairman of APMI’s Southeast Chapter, served as president of APMI International (2010–2014), and received certification as a Level I Powder Metallurgy Technologist in 1998.

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

## Forest City Gear

HIRES NEW DIRECTOR OF SALES

Forest City Gear has hired **Brad Lindmark** as director of sales to help meet the growing demands of its wide and diverse customer base throughout the world’s gear-making industries.

Lindmark brings a wealth of sales and marketing experience and a deep familiarity with all facets of inside and outside sales and customer service, along with a strong background in the metalworking industries. This background, combined with his sales and marketing leadership skills, made him an ideal candidate for the position, says Forest City Gear President and CEO Wendy Young.

“Manufacturing the world’s best gears has always been the company’s focus — Brad will help take our sales efforts to that same level,” says Young. “Our sales representatives, and the customers they serve, will benefit greatly from Brad’s hands-on approach, as he works to strengthen existing customer relationships and build new ones.” ([www.forestcitygear.com](http://www.forestcitygear.com))

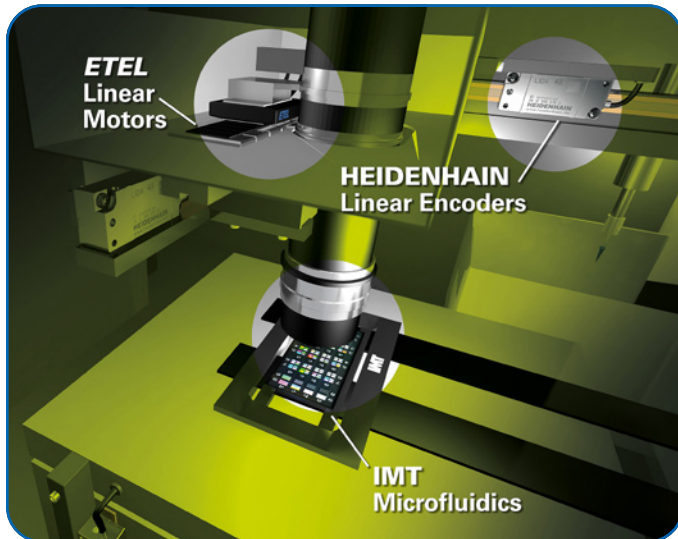




# Heidenhain

ANNOUNCES LIFE SCIENCES PARTNERSHIP

The new Heidenhain Life Sciences brand partnership is now in place offering ground-breaking technology that enables lab automation for the advancement of medical technology. This development consists of the business partnerships from the Heidenhain Group that include Heidenhain, IMT and Etel brands.



It is well known that delivering high throughput and extraordinary precise platforms are necessary requirements in the effort to speed up life science equipment solutions and at the same time do so cost effectively. This new dedicated Heidenhain partnership helps leverage the synergies of specialized brands to offer such customer-oriented solutions.

The component product lines for laboratory automation within this new partnership include linear scales from Heidenhain, linear motors and controls from Etel, as well as detection systems enabling exceptional positioning and read-out accuracy while maintaining high throughput in sample analysis.

IMT AG Microfluidics offers customized micro- and nano-patterns structures in glass, integration of electrodes, waveguides and structured functionalization for life science applications. IMT provides flexible process offerings from design consultancy, prototyping to scalable manufacturing. ([www.heidenhain.us/applications/lifesciences/](http://www.heidenhain.us/applications/lifesciences/))

## Hy-Tech Engineered Solutions

ACQUIRES BOTH BLAZ-MAN AND GEAR PRODUCTS & MANUFACTURING

Hy-Tech Engineered Solutions is pleased to announce the acquisition of Blaz-Man Gear and Gear Products & Manufacturing; both Chicago based companies specializing in the manufacture and distribution of custom gears and power transmission gear products. The addition will triple Hy-Tech's capacity in gear production, as well as bring new

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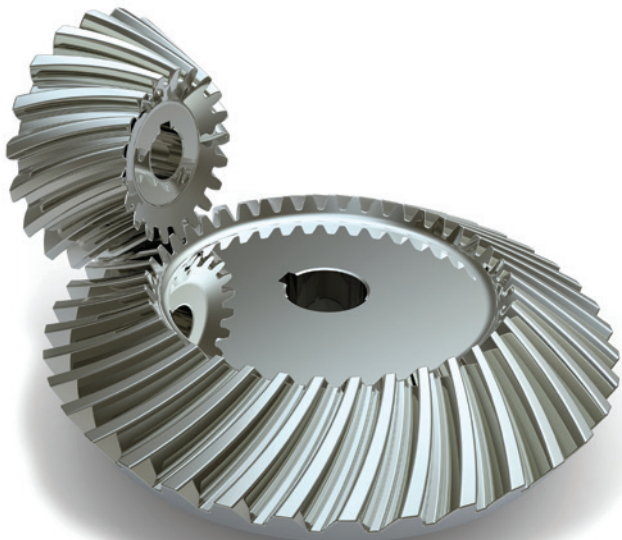
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expertise to expand into more complex spiral and straight bevel gear design and manufacture.

“Aside from the advantages this brings to new and existing customers in terms of expanded gear product availability, additional gear design engineering know-how and improved responsiveness, we expect it to help lower costs across the board as the new economies of scale come into play” observes Doug Ciabotti, Hy-Tech’s president. “Adding Blaz-Man and Gear Products means we can better address the needs of dozens of industries for highly engineered gearing, design consulting and reverse engineering”.

“We’re most excited about our expanded capability to handle complex spiral, straight and hypoid bevel gearing applications which have traditionally been difficult to design and manufacture. Combining this bevel gear expertise with our dedicated production capacity for rush and breakdown requirements, as well as for “one-off” special orders, allows us to be a full-service partner to our customers, offering them complete gear solutions”.

The new companies will operate together with Hy-Tech’s current gear company, Quality Gear, forming a new “Power Transmission Division” in Punxsutawney, PA. ([www.hy-techinc.com](http://www.hy-techinc.com))

## FANUC America

OPENS NEW ROBOTICS AND AUTOMATION FACILITY

FANUC America recently held a grand opening celebration at its new 461,000 square-foot North Campus robotics and automation facility in Auburn Hills, MI. Guests included customers, local officials, educators, suppliers, and the media to an official program, ribbon cutting ceremony and facility tour. Special guests include Michigan’s Governor Gretchen Whitmer, Auburn Hills Mayor Kevin McDaniel, and Rochester Hills Mayor Bryan Barnett.

Constructed and in full operation just one year after breaking ground, the new facility houses several departments including engineering, product development, manufacturing and warehousing. Now, to keep pace with the growing

demand for robots and automation, FANUC occupies over one million square feet of building space in Oakland County, Michigan.

FANUC displayed an automation tour path that included over 20 robot demonstrations, from its smallest M-11a delta robot, to the mighty M-2000iA, the world’s strongest robot able to lift 2.3 tons. There was also a variety of hands-on cobot demonstrations highlighting easy setup and programming.

Additional demonstrations included real-world robotic solutions for assembly, material handling, packaging, palletizing, painting and welding. Most of the solutions included FANUC intelligence like integrated iRVision that gives the robots a sense of sight.

A key tour stop during the grand opening featured two FANUC CR-15iA collaborative robots packing bags of weekend nutrition for a local Michigan chapter of Blessings in a Backpack, a non-profit organization that provides children living in food-insecure households with bags of food for the weekend.



FANUC’s products are used in a wide range of industries including automotive, aerospace, consumer goods, e-commerce, food and beverage, medical device and pharmaceuticals to name a few. The company’s line of painting robots, and a variety of automation software products have been designed and built in Michigan since 1982. ([www.fanucamerica.com](http://www.fanucamerica.com))

## Yaskawa Motoman

CELEBRATES 30-YEAR ANNIVERSARY

The Motoman Robotics Division of Yaskawa America, Inc. (Yaskawa Motoman) recently celebrated its 30<sup>th</sup> anniversary.

Previously known as Motoman, Inc., the company was incorporated on July 18, 1989 as a 50/50 joint venture between Hobart Brothers Company and Yaskawa Electric America, and officially began operations on August 1, 1989. In 1994, Motoman Inc. became a wholly-owned subsidiary of Yaskawa Electric Corporation (Kitakyushu, Japan), a worldwide leader in mechatronics and robots.

The company started with just 59 employees and now has nearly 700 employees serving from 11 strategically placed facilities throughout the Americas. Employees are committed to complete customer satisfaction and remain dedicated to delivering high quality innovative robotic solutions that help customers and partners compete globally. Yaskawa Motoman is also committed to supporting the nation’s STEM initiatives and promoting the use of robotics for education and workforce development.



“This is an incredible milestone for our company,” offered Steve Barhorst, Yaskawa Motoman’s president and COO. “The hard work and dedication of talented team members has enabled us to constantly push the boundaries of innovation and provide the highest level of customer satisfaction in the automation industry.” ([www.motoman.com](http://www.motoman.com))

## Cloyes Gear

MAINTAINS MANUFACTURING EXCELLENCE WITH ARKANSAS PLANT PURCHASE

After opening its Paris, Ark., manufacturing plant in 1963, Cloyes Gear and Products announced it has successfully regained ownership of the manufacturing operation from American Axle & Manufacturing (AAM). AAM held ownership of the plant following its 2017 acquisition of Metaldyne Performance Group Inc. (MPG), which included Cloyes. In April 2018, Hidden Harbor Capital Partners, an operationally focused private equity firm specializing in control investments in lower middle market companies, acquired Cloyes and immediately started the process of purchasing the Paris plant to continue Cloyes’ nearly 100-year-old manufacturing history in the United States.

“Cloyes came to Paris in 1963 and has been a big part of the town’s economy for more than 56 years. Many of our employees have worked for Cloyes their entire adult life and have more than 30 years of seniority with the company,” said Steve Fairbanks, vice president of manufacturing for Cloyes.



“It is a huge advantage for our company to be able to stay in this area and retain our employees’ skill set and wealth of knowledge.”

The 155,000-square-foot manufacturing plant manufactures highly machined powertrain gears, sprockets, and idler assemblies for automotive original equipment manufacturers, the automotive aftermarket, marine, and high-performance applications. The plant’s key processes include machining, hobbing and shaping, heat treatment, and finishing, and is also home to a quality and metrology laboratory that supports both manufacturing and engineering product development.

“Our team is focused on growing the Cloyes brand and business which is evident with our continued investments in marketing, sales personnel, global expansion, manufacturing and overall operations,” said John Bohenic, chief executive officer for Cloyes. ([www.cloyes.com](http://www.cloyes.com))

## Continental

HOSE PLANT RECEIVES SANITARY STANDARDS CERTIFICATION

Continental’s industrial hose plant here has received a major sanitary standards certification from the independent U.S. organization 3-A SSI for a selected range of food and beverage hoses.

Based in McLean, VA, the 3-A SSI is an independent, non-profit organization that leads the development of standards for equipment and accepted practices for processing systems through a modern consensus processes based on ANSI (American National Standards Institute) requirements. The company represents the interests of regulatory sanitarians, equipment fabricators and processors in “Promoting food safety through hygienic design.”



The certification No. 3727 and the designation 18-03 (for rubber and rubber like materials) received by Continental’s Granby plant places them in a unique category. “There is a distinct difference between compliance and certification,” said Laszlo Dobo, Continental’s product manager for industry hoses in North America. “Anyone can claim ‘compliance,’ but certification comes only from an independent organization. 3-A SSI has very strict standards because they represent the end-users and the public. They provide special knowledge resources on hygienic equipment design to enhance professionalism and to serve the public health sector.

Continental’s Granby plant manufactures industrial hose on special mandrels for a variety of markets including dairy, wine, breweries, food processing and beverage. The facility is located about an hour east of Montreal and supports a global market. ([www.continental.com](http://www.continental.com))

# IFPE 2020

## Trade Show Season Kicks Off in March with Focus on Fluid Power and Power Transmission

Matthew Jaster, Senior Editor

**If you've never attended IFPE and the co-located CONEXPO-CON/AGG at the Las Vegas Convention Center, prepare to be overstimulated by the sights and sounds of the construction, fluid power and power transmission industries.** This show is BIG. So much so that the parking lots surrounding the convention center are repurposed as additional outdoor exhibit halls. Need a crane? Need hydraulics? Need pneumatics? Need an excuse to spend five days in Las Vegas? You've come to the right place!

IFPE is the leading international exposition and educational resource dedicated to the integration of fluid power with other technologies for power transmission and motion control applications. Held every three years, the next IFPE is set for March 10-14, 2020.

### Who Should Attend?

The IFPE show attracts design engineers and other decision-makers from industries including off-highway vehicles (includes construction, mining, forestry, agriculture, lawn and garden, and airport support vehicles), fluid power/power transmission products, electrical machinery, instruments/controls, distribution, material handling (includes overhead/straddle cranes, industrial trucks, tractors and stackers), manufacturing/production automation/machine tools (includes chemical, petroleum, metal, plastics, and rubber processing), automotive/commercial vehicles (includes Class 8 trucks, vocational trucks, and trucks for other applications), engineering services, defense/aerospace, and amusement/entertainment technology.

IFPE exhibits showcase the latest technologies and innovations in equipment, products and services for

fluid power/motion control/power transmission. The show also features product-focused exhibit pavilions and international exhibit pavilions. IFPE is owned by the National Fluid Power Association (NFPA) and the Association of Equipment Manufacturers (AEM). AEM is show producer.

### Educational Opportunities

"AEM and the National Fluid Power Association are proud to bring together a unique combination of engineers and

to mix and match sessions between both IFPE and CONEXPO-CON/AGG. Attendees will be able to pay one price and select education from both shows. Presenters for IFPE's education sessions come from across the United States from distinguished universities.

To add to the great education sessions and the over 400 exhibitors, in 2020 IFPE will be hosting for the first time a special networking reception for engineers and executives, right on the show floor. The IFPE's Fluid Power



executives at IFPE 2020, both in booths and in aisles, to share ideas, educate one another, and ultimately shape the future of the construction industry through collaboration and consensus," said John Rozum, director, ag events at AEM and IFPE show director.

For many attendees, part of the IFPE show experience includes participation in IFPE's education program, including college courses and timely sessions to help them stay on top of their game.

New this year, attendees will be able

Hour, presented by Bosch Rexroth, will be held on March 11<sup>th</sup> from 4 p.m. to 6 p.m. on the IFPE show floor. The event includes a bonus hour on the IFPE show floor, complimentary hors 'd oeuvres and cocktails and entertainment.

"We encourage all exhibitors to bring their top engineers and executives to take advantage of a great networking experience and interact with industry peers," said Rozum.

Attendees at the 2020 shows can take advantage of more than 180 education



sessions packed with timely information, developed with the guidance of leading industry groups, and delivered by industry experts.

“The line-up of programming is not only larger than it has ever been but includes a fresh line-up of speakers stacked side-by-side with core programming that is always highly attended,” said Eileen Dickson, vice president education, National Ready Mixed Concrete Association and CONEXPO-CON/AGG Education Committee chair.

CONEXPO-CON/AGG 2020 education tracks will offer the latest trends and best practices focused on: aggregates; asphalt; concrete; cranes, rigging & aerial lifts; earthmoving & site development; equipment management & maintenance; business management; and safety, plus technology solutions and attracting, engaging and retaining talent.

“The education committee took great care in putting together a program that grows attendee knowledge on building their business on all fronts, whether the technical skills needed in the field or best practices to build their business,” said Graham Brent, CEO of the NCCCO Foundation and CONEXPO-CON/AGG Education Committee vice chair.

CONEXPO-CON/AGG 2020 education includes:

- Driving New Innovation at Complacent Companies - James Benham, JB Knowledge
- Drones on Construction Sites for All Contractors - Ryan Murguia/Zach Pieper, Quantum Land Design
- Gain a Competitive Advantage Through Construction Technology - Tauhira Hoossainy, Milwaukee Tool
- How to Win the War for Talent - Gregg Schoppman, FMI
- Safety Training Ninja - Regina McMichael, The Learning Factory, Inc.
- Technology Trends: Lessons Learned - Helga Jacobsen, United Rentals
- Top 10 Reasons Why Construction Businesses Fail - Larry Kokklenberg, Center for Business Development

### IFPE Education – Focused on Fluid Power

IFPE education is grouped in two tracks: Hydraulics & Pneumatics at Work and The Business of Fluid Power. Its popular College Courses return, and new is an IFPE Research Symposium.

The IFPE College Courses emphasize hands-on technical knowledge on the effective use of hydraulics in mobile equipment. Content includes Fundamentals of Hydraulic Systems; Electro Hydrostatic Actuation; Safety Hydraulics, Best Practices for Modern Machinery; Hydraulics in the Digital Age: Hydraulic Fluid Properties, Efficiency and Contamination Control; and Digital Design.

The IFPE Research Symposium is hosted by IFPE co-owner National Fluid Power Association (NFPA) and runs during lunch (11:30 am–12:30 pm) March 11–13. Sessions will showcase the latest fluid power research at U.S. universities being funded by the U.S. Department of Energy to improve energy efficiency of off-road vehicle hydraulic systems.

“We focused on developing education programs that offer attendees the latest ideas and innovations in fluid power technology, applications and research. Our classes and sessions deliver critical information for engineers and others involved in the design and manufacturing process,” said Eric Lanke, president/CEO, NFPA.

IFPE 2020 education includes:

- Additive Manufacturing - Vince Anewenter, Milwaukee School of Engineering
- Industry of the Future - Prasad Ganorkar, McKinsey & Company
- IoT – Sharing Data Across Customer Boundaries - Adam Livesay, Elevat
- Mobile Hydraulic Robotics - Autonomous Machines - Chris Woodard and John O’Neill, Danfoss
- Workforce Development - Lynn Beyer, NFPA

### More to Come

IFPE booth previews, product spotlights and new technologies will continue to be a part of *PTE’s* online editorial coverage in the coming months. Come back early and often to see what’s new in power transmission and motion control for the fluid power and construction industries. **PTE**

### For more information:

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**January 6–10—SciTech 2020** Orlando, Florida. From its creation in 1963, the American Institute of Aeronautics and Astronautics (AIAA) has organized conferences to serve the aerospace profession as part of its core mission. Spanning over 70 technical discipline areas, AIAA's conferences provide scientists, engineers, and technologists the opportunity to present and disseminate their work in structured technical paper and poster sessions, learn about new technologies and advances from other presenters, further their professional development, and expand their professional networks that furthers their work. Five focus areas include science and technology, aviation, space, propulsion and energy/defense. For more information, visit [scitech.aiaa.org/](http://scitech.aiaa.org/).

**January 13–15—A3 Business Forum 2020** Orlando, Florida. The Association for Advancing Automation (A3) Business Forum is the world's leading annual networking event for robotics, vision & imaging, motion control, and motor professionals. Over 650 global automation leaders attended the 2018 show. The event includes keynote and breakout sessions on the human exploration of Mars, a global economic outlook, automation market update, trends in robotics, responsible artificial intelligence and others to be announced. Networking opportunities include a golf scramble, a wellness walk, and a first timer's reception. For more information, visit [www.a3automate.org](http://www.a3automate.org).

**January 24–25—EASA Principles of Medium and Large AC Motors** Cincinnati, Ohio. The seminar and its companion manual have been developed by Austin Bonnett, EASA's education and technology consultant, in collaboration with EASA's Technical Support Specialists and members of EASA's Technical Education Committee. While the course covers horizontal and vertical squirrel-cage induction motors in the 300 to 5,000 horsepower range, low and medium voltage, most of the principles covered apply to other sizes as well. This seminar focuses primarily on NEMA motors. Highlights include motor theory, applications, safety, root cause failure, testing, vibration/noise and more. EASA Members (\$489 per person) Non-Members (\$589 per person). For more information, visit [easa.com](http://easa.com).

**January 28–30—AGMA Gear Manufacturing and Inspection** Garden Grove, California. Attendees will discover key factors in the inspection process that lead to better design of gears, develop a broad understanding of the methods used to manufacture and inspect gears and interpret how the resultant information can be applied and interpreted in the design process. The class will be from 8:00 am–5:00 pm each day. This course also includes a tour of Western Precision Aero in Garden Grove, CA. Participants will be required to fill out paperwork prior to the tour and must be US citizens. AGMA will distribute the paperwork upon registration. Gear design engineers, management involved with design, maintenance, customer service, and sales should consider attending the event. Ray Drago, chief engineer of Drive Systems Technology, Inc., will be the instructor. For more information, visit [www.agma.org](http://www.agma.org).

**January 28–30—IPPE 2020** Atlanta, Georgia. The International Production & Processing Expo is the world's largest annual poultry, meat and feed industry event of its kind. A wide range of international decision-makers attend this annual event to network and become informed on the latest technological developments and issues facing the industry. Combining the expertise from the American Feed Industry Association, North American Meat Institute and U.S. Poultry & Egg Association, IPPE will also feature more than 200 hours of dynamic education sessions focused on the latest industry issues. The International Production & Processing Expo (IPPE) is a collaboration of three shows—International Feed Expo, International Meat Expo and the International Poultry Expo—representing the entire chain of protein production and processing. For more information, visit [ippexpo.org](http://ippexpo.org).

**February 3–7—World of Concrete 2020** Las Vegas, Nevada. Original equipment manufacturers from around the world and exclusive U.S. distributors of equipment, tools, products and services for the commercial construction, concrete and masonry industries attend World of Concrete. The show attracts approximately 1,500 exhibitors and occupies more than 700,000 net square feet of indoor and outdoor exhibit space. World of Concrete is the premier event for the commercial construction trades. Education tracks include engineering, safety and risk management, general business, business and project management and concrete 101. Interactive workshops include trainer training, construction boot camp, sales and more. For more information, visit [www.worldofconcrete.com](http://www.worldofconcrete.com).

**February 18–20—AGMA Fundamentals of Worm and Crossed Axis Helical Gearing** Alexandria, Virginia. Provides an introduction and emphasize the differences between parallel (the experience base) axis and worm and crossed axis helical gears. Describe the basics of worm and crossed axis helical gears, their fundamental design principals, application guidelines and recommendations, lubrication requirement, a discussion of accuracy and quality and summarize with a brief review of common failure modes. Class will take place at AGMA Headquarters and class times will be 8:00 am–5:00 pm each day. The course will be instructed by William "Mark" McVea, president and principal engineer at KBE+, Inc. For more information, visit [www.agma.org](http://www.agma.org).

**March 7–14—IEEE Aerospace Conference 2020** Big Sky, Montana. The International IEEE Aerospace Conference, with AIAA and PHM Society as technical co-sponsors, is organized to promote interdisciplinary understanding of aerospace systems, their underlying science and technology, and their application to government and commercial endeavors. The annual, week-long conference, set in a stimulating and thought-provoking environment, is designed for aerospace experts, academics, military personnel, and industry leaders. The 2020 conference is the 41st in the series. Conference topics include aerospace systems, military, civilian or commercial aerospace endeavors, government policies, aerospace engineering and management, and more. The event features over 175 hours of technical sessions and 20 hours of networking events. For more information, visit [aeroconf.org](http://aeroconf.org).

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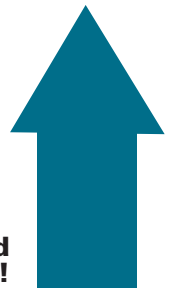
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# Vesconite Bushings Assist Record-Breaking Steam Train

**Andries Keyser built his first steam locomotive at the age of 19 and completed the project five-years later.** It was named after his mother, Doreen and is based on a Beira Railways Lawley design from way back in 1895. Since then, he has built a variety of coaches, three electric engines and restored a UVE<sub>2</sub> steam engine named after his mother-in-law this time (Anna).

Now his team (that was awarded the Guinness World Record in 2017 for the longest distance covered by a miniature steam train) is setting its sights on improving its record.

Keyser Locomotive Works, together with the Pietermaritzburg Model Engineering Society, in South Africa, was able to cover 330km in 24 hours in its record-breaking attempt, which outstripped the previous 1994 record of 269km covered in 24 hours.

It did so for many reasons, one of which was the self-lubricating Vesconite polymer bushings that were fitted to the connecting and coupling rods.

These internal, hard-to-reach turning components did not need to be oiled, and this helped reduce stopping times during the record attempt.

“The Vesconite has no heat expansion and, using a sloppy fit, didn’t heat up at all,” Keyser notes. “The engine output was not compromised in any way and still runs today on the same bushes, two years and many kilometers later,” he says.

Another innovation that will assist Keyser to further improve the record is the fact that he is building the longest straightest track that he can in the Stellenbosch Winelands, in South Africa. This will enable the locomotive to run at higher speeds on a track gauge of only 184 mm.

Known as the Winelands Light Railway, Keyser is establishing a theme park with 1/3-scale trains, matching buildings, bridges and tunnels, and a hobbies expo for locomotive enthusiasts once a year. Presently there are four steam and one electric locomotive in the engine shed, with 13 wagons able to haul up to 50 people per train. Everything is hand-made and based on narrow-gauge prototypes from all over the world.

Starting on December 14, 2019, the park will be open on weekends, public and school holidays if the weather allows. This unique attraction aims to become the biggest family-friendly destination in the Western Cape within the next 10 years.



“You can’t oil these bushings on the run,” says Keyser.

This was not the case with many of the original bronze bushings that had to be oiled every hour when the locomotives stopped and the drivers were changed.

Six of the main crank bushings are currently made from Vesconite polymer bushings on the record-breaking locomotive named Doreen, but the intention is to replace all the bushings with Vesconite eventually to reduce oiling requirements in future record-breaking bids.

Keyser will make another world-record attempt sometime in the future and expects that between 30 and 60km will be added to the current distance record.

You can follow his steam train adventures here ([www.facebook.com/keyserlocomotiveworks/?\\_tn\\_=CR](http://www.facebook.com/keyserlocomotiveworks/?_tn_=CR)) and learn more about the Vesconite bushings here ([www.vesconite.com](http://www.vesconite.com)). **PTE**

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