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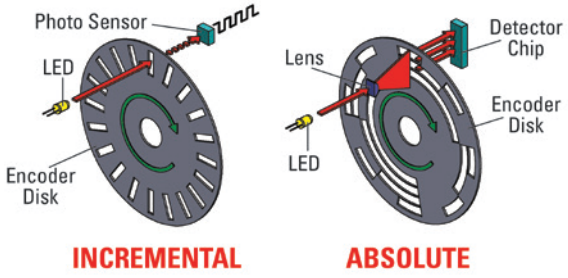

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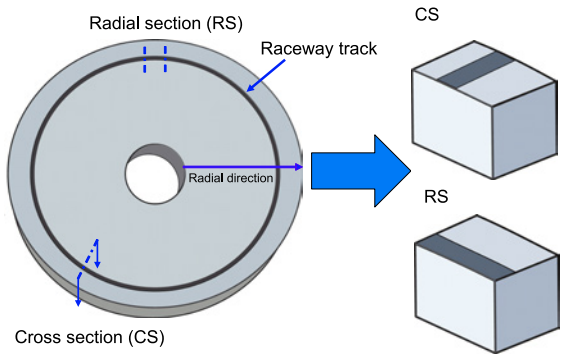
TECHNICAL ARTICLES



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PTE™
VOL. 19, NO. 5

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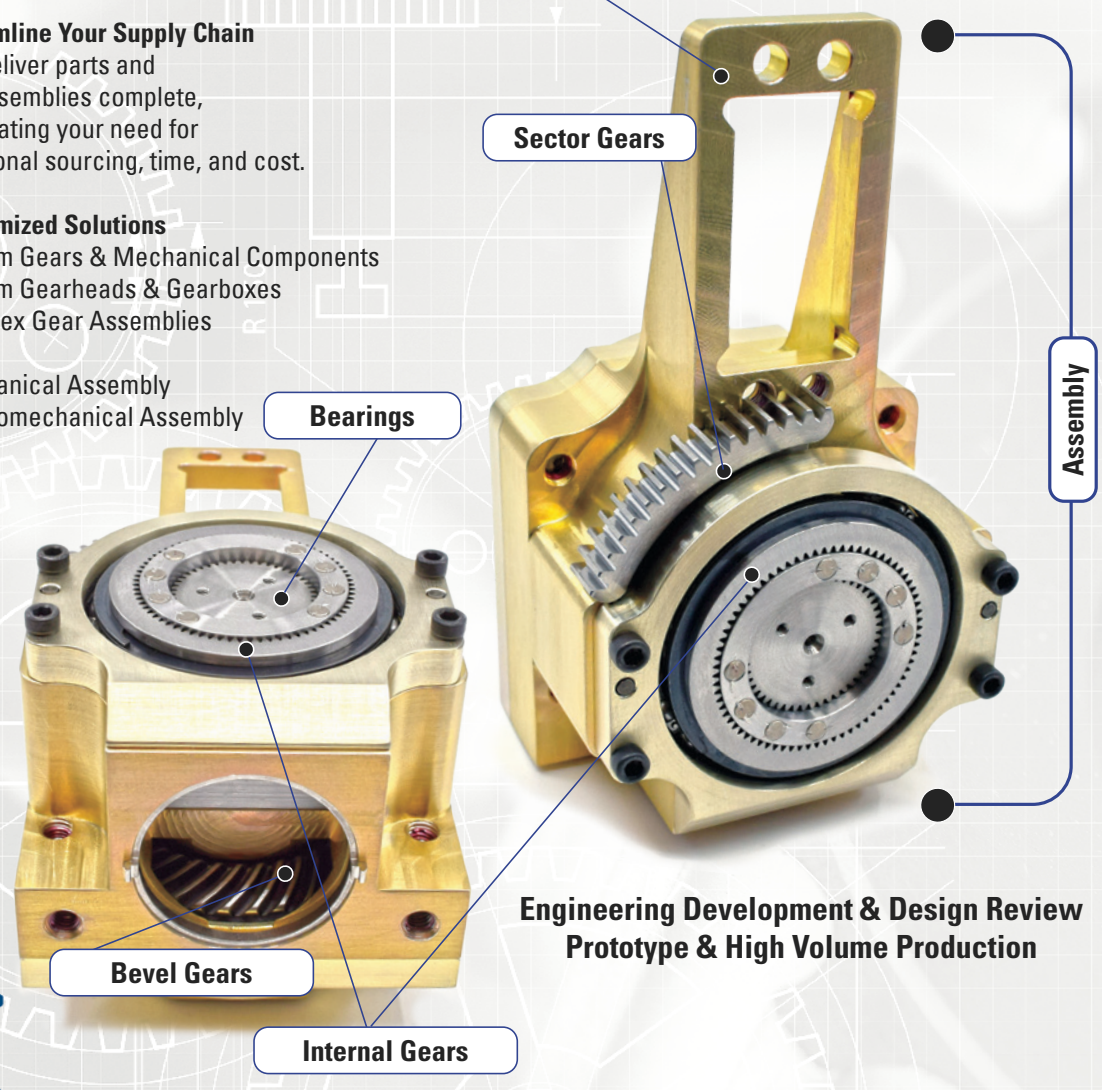

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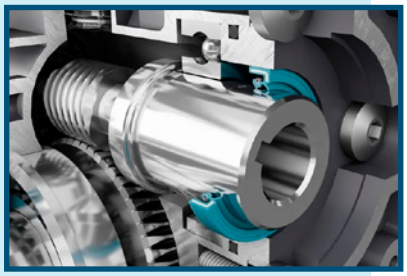
PTE REVOLUTIONS

Trelleborg Presents Sealing Solutions for Speed Reducers



The spectrum of machinery and equipment used in industrial automation includes everything from electric motors to robotics and each has its own unique attributes and sealing requirements. David Kaley, Trelleborg global segment manager for industrial automation, shares his expertise on speed reducers covering what they are, how they work and key considerations for correct sealing in this article.

powertransmission.com/trelleborg-presents-sealing-solutions-for-speed-reducers

PTE VIDEOS

Marine Application Advantages with Igus Inc.

The dry-running, corrosion-resistant plastic components offered by Igus are ideal for use in the marine and boat building industries. Watch this video to learn the specific advantages these components offer, and some of the ways they can be used to improve boat designs.

powertransmission.com/videos/marine-application-advantages-with-igus-inc

AS SEEN IN *GEAR TECHNOLOGY*

The Hazards of Heavy Lifting

A rope shovel is a bucket-equipped machine used for digging and loading earth or fragmented rock. Rope shovels are a type of rope/cable excavator, where the digging arm is controlled and powered by winches and steel ropes, rather than hydraulics. In mining applications, the rope shovel distributes materials such as iron ore into larger-than-life dump trucks. David Brown Santasalo (DBS) Canada delivers an extensive range of gear systems for shovels, draglines and other surface mining equipment.

geartechnology.com/the-hazards-of-heavy-lifting

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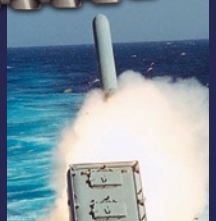


AGMA
American Gear Manufacturers Association®

Share Your Expertise

One of the core missions of *PTE* is to educate the industry about power transmission technology—from the basics to the cutting edge. Our articles aim to help those just starting their careers as well as established engineers and MRO professionals.

There's a couple of ways you can help us.

1. Many of you out there have knowledge that needs to be shared. You've been working in the industry for years or decades, and you have a solid understanding of gears, bearings, electric motors, motion control and all the devices and components that go along with them.

   Take a look at this issue's article on linear actuators and rotary encoders (p. 14). This is a very back-to-basics article that explains several different types of linear actuators based on lead screws and stepper motors. The article describes how incremental or absolute encoders can be used to provide positioning feedback and control motion in different circumstances.

   It's information that anyone who's been around the block already knows. But that new kid who's just learning the ropes? He needs this.

   Do you have similar basic knowledge that could be put down on paper to help the next generation of machine designers and plant engineers? Do you have practical, hands-on experience to share? If so, please reach out. Our industry needs this information, and we're here to help get it out there. Learn more about how to write for us here:

   powertransmission.com/pte-contribute

2. And that new kid I was talking about earlier? Help us make sure he's getting this information, too. *PTE* should be part of the training regimen for every new employee involved with designing, installing, operating or maintaining mechanical power transmission or motion control equipment.

   So don't hoard *PTE* for yourself. Seek out the young people in your organization and help ensure they have access to this kind of information. Give them your copy of the magazine when you're done with it. Or better yet, share the link for them to subscribe for themselves.

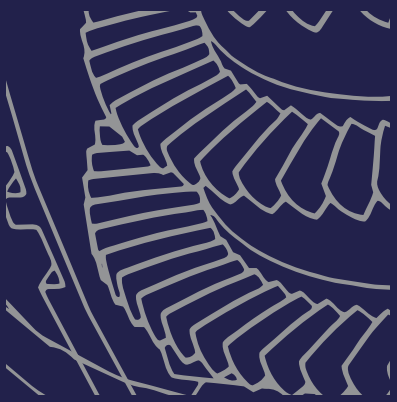
   powertransmission.com/subscribe

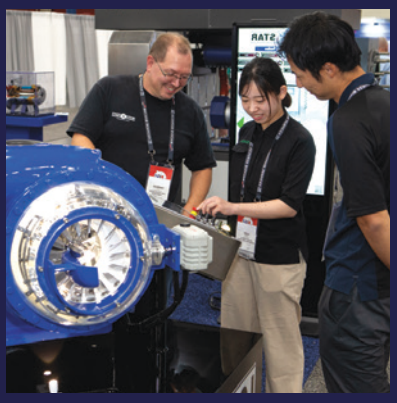
A digital subscription to *PTE* is free anywhere in the world, and subscribing takes only a few minutes. When we publish a new issue, we'll send you a notification via e-mail with links to the new content. You can read *PTE* on your phone, tablet or computer. Articles are generally available in HTML, PDF or our interactive flipbook version.

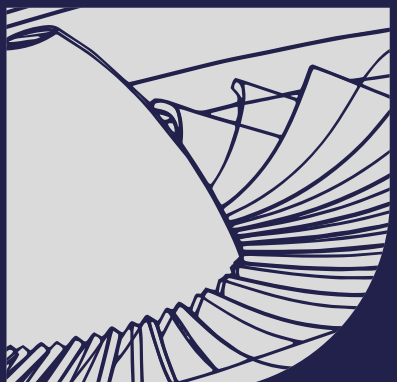
These two things will go a long way to helping us achieve our mission and ensure that the industries relying on power transmission products will continue to thrive.

PTE

Randy Stott
Publisher & Editor-in-Chief







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FORCE CONTROL

Offers Considerations When Choosing an Industrial Motor Brake System

Industrial motors are used in various applications, such as manufacturing, mining, forest products, materials handling, oil and gas and more. Often paired with brakes to improve performance, they work together to accomplish the intended purpose, acting as a safety measure against uncontrolled machinery operations or to enable accurate positioning.

Because of the vast selection of industrial brake systems available, choosing the right one for your specific application can be challenging. For instance, OEM manufacturers who include brakes on their equipment prioritize initial costs over operating costs including maintenance, repairs and adjustment to keep the brakes running within desired parameters. However, replacing your brakes with the same model is not necessarily the best option. With the number of brake systems on the market and the variety of factors to consider, here are some guidelines to follow for your next motor brake system selection.

Brake System Application

Whether you are constructing a new braking system or reconfiguring an existing system, one of the first considerations is to determine the intended use of your industrial brake. Numerous options exist, but all brake types share the same fundamental purpose and employ comparable methods. Specifically, they all involve activated friction discs to impede the motor's motion, halting the associated mechanical equipment.

The load applied to the brake and how often it is engaged directly affects the lifespan of the friction discs and the necessary maintenance and adjustment to ensure their optimal performance. With this information, you can determine if a wet or dry brake is better suited for your application.

Dry or Wet Brakes

Dry braking systems are a straightforward and cost-effective solution. They employ a steel drive plate that compresses against a sacrificial friction disc to stop the motor shaft rotation. However, each engagement generates heat. Without a way to dissipate it, the heat can cause the surface of the friction plate to glaze over. Allowing air to flow through the dry brake can alleviate some of the heat, but doing so also introduces dust, dirt, scale and moisture into the brake, which can cause corrosion, rust and failed components—especially clips, coils, levers, springs and bearings.

The maintenance and adjustment of dry brakes can be significant, often monthly or more, depending on the number of cycles the system undergoes. Moreover, the cycles affect the brake's service life, as there are only a limited number of engagements a mechanical item can endure. Higher cycle counts accelerate the failure date, regardless of maintenance and adjustment. If the brakes are spring set, the wear on friction discs can cause a change in torque and may cause unintended release issues.

If accurate positioning is required, the wearing away and glazing over of the dry brakes friction disc can elongate the stopping period and cause a positioning error. Depending on how critical the positioning is, this may be a mitigating factor in opting for an alternative means of stopping the load.

Wet brakes utilize the same basic principles of sacrificial surfaces and steel drive plates as dry brakes, but they introduce transmission fluid in a totally enclosed housing to achieve deceleration. When the liquid is compressed, its molecules shear, causing torque transmission to the other side and decelerating the rotating discs against the stationary plates. The design results in virtually no wear on the friction disc, eliminating the need for adjustment and maintenance. These brakes also use a patented fluid recirculation system that dissipates the heat generated by brake engagement, a major issue in dry braking systems. The transmission fluid also lubricates all components of the oil shear brake, extending their service life.

Because there is no wear on the friction disc, the positioning is precise over the lifespan of the oil shear brake, with no adjustment required. Oil Shear Brakes often perform at higher cycle counts than traditional dry brakes, enhancing machine performance.

The decision between dry or wet brakes also will have a significant impact on your budget when it comes to the overall cost of your braking system, but it is important to consider not only up-front purchase costs, but ongoing maintenance costs as well.

Initial Cost vs. Operating Cost

While dry brake systems have a relatively low initial cost, they require regular adjustment and maintenance. In addition to labor this also involves stocking materials like friction plates. Since dry brakes generate a lot of heat and cannot dissipate it, working on them can be dangerous, requiring cooldown periods before any adjustments, repairs or replacements can be made. The location of the brake can also come into play. Crane brakes, for example, require that maintenance and adjustment be made at height, which introduces safety concerns. Whether for cooling down of the brake, assembling parts, or the actual labor to perform maintenance and adjustment, all this downtime adds up, becoming very costly, very quickly.

Wet, oil-shear brakes require no adjustment, and are maintenance-free except for an annual transmission fluid change. That can be good news for plants where maintenance personnel are in short supply. No maintenance and no adjustment mean there are no parts to stock, so inventory carrying costs are reduced. The positioning is precise over the oil shear brake's lifetime as well, so there are no process changes or adjustments required of your production line. However, whether wet or dry brakes are employed, each has a finite number of engagements before they must be replaced. Brakes in high-cycle count operations, like a crane that is jogged into place, or will inherently wear out sooner, and are prime considerations for an oil-shear brake.

Because initial setup costs and ongoing maintenance costs can differ so greatly, it's important to do the math. Estimate the brake's service life in comparing total costs over the estimated life of the longer-lasting brake system. This will provide you with a more realistic full-cost comparison to help determine the most economical braking option.

The Overall Plant Layout

Another factor to consider in your brake system selection is your plant's layout. If multiple production lines can be used while brakes are being serviced, the cost of downtime will be lower than if the brake is critical to operate a single production or process line. Essentially brake downtime will be more costly the more it impacts your overall production. In a critical path environment, where stopping at any point halts the entire facility, shutting down the whole plant increases the system's overall cost. This should also be factored into the economic considerations.

In determining the right industrial braking system for your needs, it pays to take the time to consider your application, the type of brakes being used, your plant layout and the overall cost considerations of your potential setup.

forcecontrol.com

JOHN CRANE
Introduces Versatile Next-Generation Coaxial Seal

John Crane recently announced the launch of the Type 93AX Coaxial Separation Seal—a next generation dry gas sealing solution engineered to help customers reduce emissions, improve equipment reliability and lower operational costs.

The Type 93AX builds on John Crane's legacy of industrial sealing expertise with a robust, fail-safe design that remains operational even in the event of multiple failure scenarios. Designed based on direct customer feedback, the mechanical seal reduces nitrogen consumption by up to 80 percent, compared to

conventional radial separation seals—offering significant efficiency and sustainability benefits.

Addressing Real Industry Challenges

Research has shown that contamination is a significant contributor to dry gas seal failures, making it one of the leading causes of unscheduled maintenance and equipment downtime. The Type 93AX is engineered to prevent oil ingress from the compressor bearing chamber, minimizing this risk and supporting more reliable, continuous operation.

According to Deloitte, unplanned downtime costs the global process industries an estimated $50 billion annually, with equipment failure responsible for 42 percent of unplanned downtime. In energy and process applications, this can result in losses of up to $42 million per facility per year, on average.

The Type 93AX is designed to mitigate both performance and financial risks by extending the reliability of the dry gas seal system and reducing demand on supporting infrastructure such as nitrogen (N_2) generators and air compressors.

Three Operating Scenarios for Added Resilience

The seal supports three operating states and automatically adapts in failure situations to minimize disruption and contain gas or oil migration:

Scenario 1: Standard operation: Non-contacting operation provides positive oil ingress mitigation.

Scenario 2: Separation gas loss: Maintains non-contacting operation and oil control even without separation gas.

Scenario 3: Dry gas seal failure: Restricts process gas leakage during compressor shutdown (up to 35 bar), while maintaining seal integrity up to 70 bar.

Supporting Operational and Sustainability Goals

The Type 93AX helps contribute to sustainability goals through reduced emissions and lower energy usage. By cutting nitrogen use by up to 80 percent, it decreases demand on N2 generation systems—a source of both energy consumption and cost. According to the International Energy Agency (IEA), improving industrial efficiency could cut global energy use by 12 percent by 2040, further underlining the importance of solutions like the Type 93AX.

Mike Eason, chief technology officer at John Crane, said: "Our customers told us they wanted a separation seal that increases safety, efficiency and reliability. The Type 93AX delivers on these priorities. It's designed to keep working in real–world failure conditions to protect their most critical assets, and reduce environmental impact, while driving down OPEX and CAPEX."

Eason continued: "The new seal is compatible with John Crane's dry gas seal portfolio and is supported by a global network of over 200 facilities, including manufacturing, sales and services and 13 global turbo service centers in more than 50 countries. It can be sold as part of a bundled first–fit order or compressor upgrade or supplied as a stand-alone product to meet customer-specific requirements."

johncrane.com

BOSCH REXROTH

Introduces Dual Belt Axis for High Payload Applications

Bosch Rexroth is expanding its CKR series of compact modules with an innovative dual belt axis for dynamic handling with a total load capacity of up to 770 kg. The new CKR-280 heavy-duty axis combines the functions of two linear axes into one linear system. Two, independently driven carriages in a single frame enable dynamic applications with high drive torques and short cycle times. The compact, dual-handling system reduces valuable installation space and increases productivity, while saving time and costs for engineering, assembly and commissioning. The new solution can

be utilized as a single axis or combined with other linear axes into a multi-axis system, with the option also to include a drive package.

Whether in battery production, intralogistics or machine tool automation, many industries are increasingly seeking compact handling solutions that can move large payloads with high dynamics. With the new dual belt version of the CKR compact module series in size 280, Bosch Rexroth offers a space-optimized, heavy-duty axis that can handle two payloads up to 385 kg each and drive torques up to 250 Nm.

To enable fast and easy engineering, the compact modules can be configured online in lengths up to 5.50 m. Bosch Rexroth can also deliver longer travel ranges on request. High accelerations of up to 5g and a maximum speed of 5 m/s provide the optimal conditions for short cycle times with high precision and a repeatability of ±0.05 mm. Depending on the requirements, a variety of travel profiles can be implemented independently.

After its market launch, the CKR-280 heavy-duty axis will also be integrated into the e-tool chain as a new size for single-axis and multi-axis systems.

boschrexroth-us.com

SEW-EURODRIVE

Announces Availability of GearOil for Heavy Industrial Gear Units

SEW-Eurodrive GearOil is now available as an option with its heavy industry gear units. This synthetic lubricant, formulated and tested by SEW-Eurodrive engineers specifically for SEW-Eurodrive gear geometries and thermal loads, is now offered as part of the factory build and service ecosystem for products such as the X.e and MC-series gear units.

"This marks a significant evolution in how we deliver our industrial gear solutions," said Austin Burdette, IG productmanager,SEW-Eurodrive,USA. "By offering GearOil by SEW-Eurodrive directly within our heavy-duty gearbox line, we're giving customers a complete, performance-optimized system from day one."

GearOil is a high-performance synthetic oil designed to meet the mechanical, thermal and sealing requirements of SEW-Eurodrive's most demanding gear units. It ensures longer life, fewer oil changes, and greater thermal stability, especially in applications where uptime is critical.

Key benefits include:

- Optimized wear protection from startup through full duty cycle
- Exceptional thermal performance—ideal for splash, pressure, or oil-to-air cooled systems
- System-wide compatibility—fully compatible with SEW-Eurodrive's pressure lubrication systems, splash lubrication configurations and oil-to-air cooling assemblies.
- Eliminates the initial 500-hour oil change on X.e and MC-series gear units.
- GearOil is now stocked in the U.S. for simplified service and refill
- GearOil is now available in:

- New builds of X.e and MC series gear units, and other heavy industrial gearboxes
- SEW-Eurodrive assembly centers in North America
- 205L (55-gallon) drums for aftermarket service and planned maintenance
- Available as part of SEW-Eurodrive service kits for long-term support

This integrated solution is ideal for mining and aggregate conveyors, steels and metal processing, pulp and paper, water treatment, energy systems and more.

seweurodrive.com

ABB
Introduces Compact, AI-powered AMR

ABB is extending its leadership in AI-powered autonomous mobile robotics with the launch of the Flexley Mover P603 platform AMR, the most compact model in its class to handle payloads of up to 1,500 kg. Designed to boost intralogistics efficiency, the P603 combines compact design with AI-driven Visual SLAM navigation and the latest version of AMR Studio software that maximizes flexibility by enabling different modules to be integrated into the AMR.

"Our Autonomous Mobile Robots combine 3D vision with autonomous path planning to give our customers an unprecedented offering: robots that see, sense, and think," said Marc Segura, president, ABB Robotics. "Our leap in technology brings new levels of intelligence, adaptability, and ease of use to intralogistics. For manufacturers, automakers, and logistics providers, it enables safer, smarter workflows with minimal complexity, enabling transformation with immediate impact."

The AMR P603 is part of ABB's new era of autonomous versatile robotics, where robots can seamlessly switch between tasks, in real time and with minimal effort. With its AI-driven Visual SLAM navigation, the AMR P603 is smarter, faster and safer (meeting ISO 3691-4 and ANSI 56.5 standards) while delivering industry-leading agility and positioning accuracy of ±5 mm, with no need for reflectors or change in infrastructure. Its differential bidirectional drive system enables smooth movement in tight production and warehouse layouts, while its integrated load detection capabilities optimize stability and safety during transport.

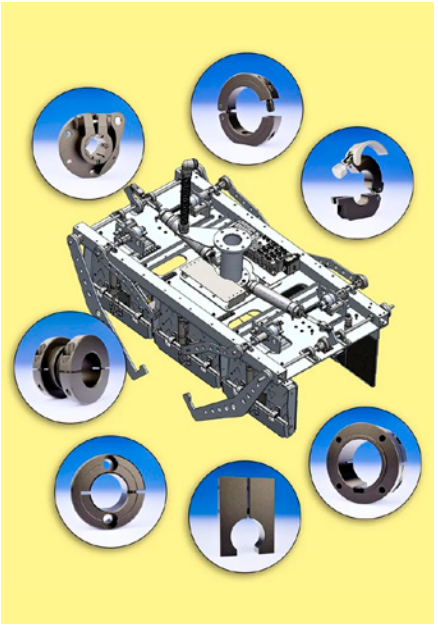
The P603's agility and compact design makes it ideal for intralogistics applications, including end of line, goods to robot, line supply, inter-process connection and kitting. It supports a wide range of load types and dimensions, including open and closed pallets, containers, racks and trolleys, all handled with a single AMR and flexible top model configuration.

Designed with modularity in mind, the AMR P603 can be easily adapted with various 'top modules' to handle different load types. Combined with the *AMR Studio* upgrade, it enables rapid setup and seamless customization, with system integrators and end users able to build and modify applications using drag-and-drop tools. With this and other features such as intuitive no-code mission programming, *AMR Studio* reduces commissioning time by up to 20 percent. ABB's *Fleet Manager* software is also integrated, allowing users to coordinate multiple AMRs in real time across large and dynamic production environments.

ABB will continue to focus on fusing its precision hardware with artificial intelligence and software, towards further autonomy and versatility.

abb.com

STAFFORD MFG
Shaft Collars and Mounts Meet Automation Design Requirements



Stafford Components for Automation include flanged shaft collars and mounts, rigid shaft couplings and quick-adjust collars for securely attaching components such as drive systems, control arms, conveyors, sensors and vision systems. Featuring multiple designs for both fixed and rotating shafts, the firm provides over 4,000 standard off-the-shelf parts.

Available in aluminum, steel and stainless steel, Stafford Components for Automation are offered with round-, square-, hex- and threaded-bores. Mounting components include Accu-Clamp precision products which are non-marring with pre-drilled holes and mounting hubs. Custom designs can be made from various materials and engineering plastics. Stafford Components for Automation are priced according to configuration and quantity. Their website provides e-commerce and a CAD library.

staffordmfg.com

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Thomson offers precise loading information for real-time motion capabilities

Thomson Industries, Inc.

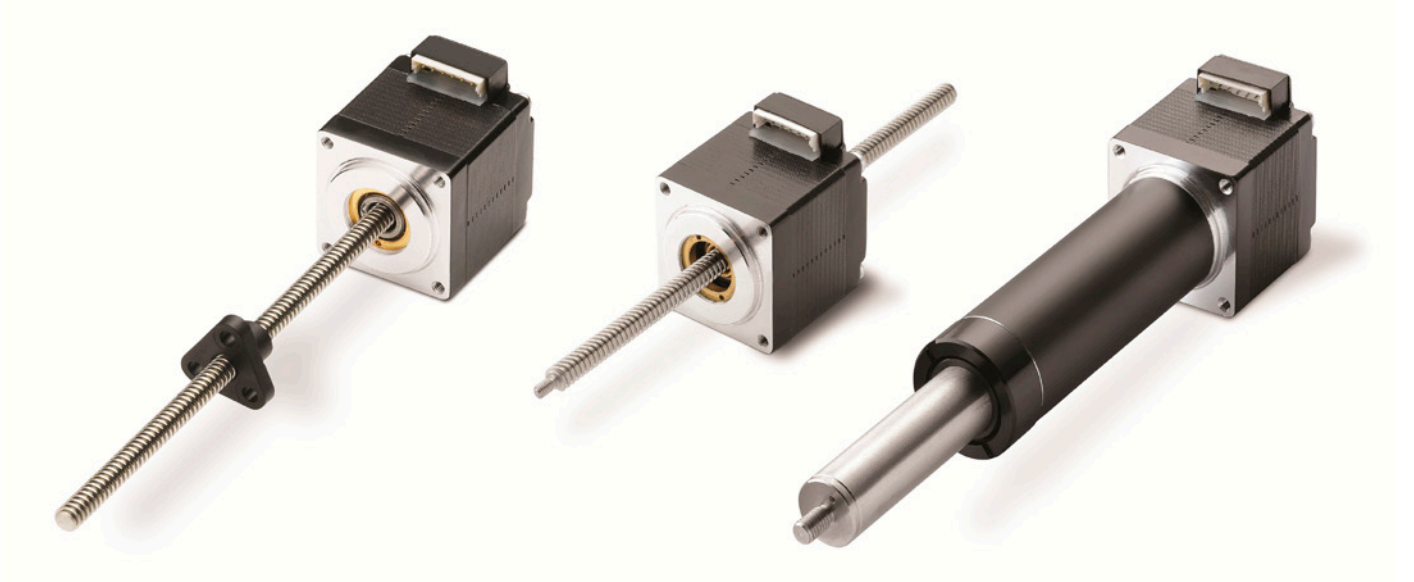

Figure 1—SMLA types (From left to right: MLS, MLN and MLA). All images courtesy of Thomson Industries, Inc.

Stepper motor linear actuators (SMLAs) combine a stepper motor, precision lead screw and nut in one compact envelope, providing a highly configurable, customizable and robust solution for linear motion. With the help of a motion controller and a stepper driver, all SMLAs can be programmed to position a load to a precise location. However, standard configurations do not provide a feedback mechanism that tells the operator whether the move is completed or not.

Although not essential for many applications, feedback can be a powerful tool to utilize in more sophisticated linear motion systems. Because of this and the increasing demand for precise load positioning information, outfitting an SMLA with an encoder can be an effective and simple solution to get real-time motion feedback about your application.

SMLA Core Configurations

Figure 1 (above) shows three of the most common SMLA constructions: a motorized lead screw (MLS), motorized lead nut (MLN) and motorized linear actuator (MLA). Each of these constructions has a stepper motor, lead screw and nut at its core, but differ in how it obtains motion.

For MLS units, the lead screw attaches directly to the motor shaft, which translates the nut on rotation. MLN units integrate the nut inside the motor shaft, which when rotated, translates the lead screw instead of the nut. MLA configurations are essentially MLS units with additional components that house the lead screw and nut while also providing integrated support and guidance.

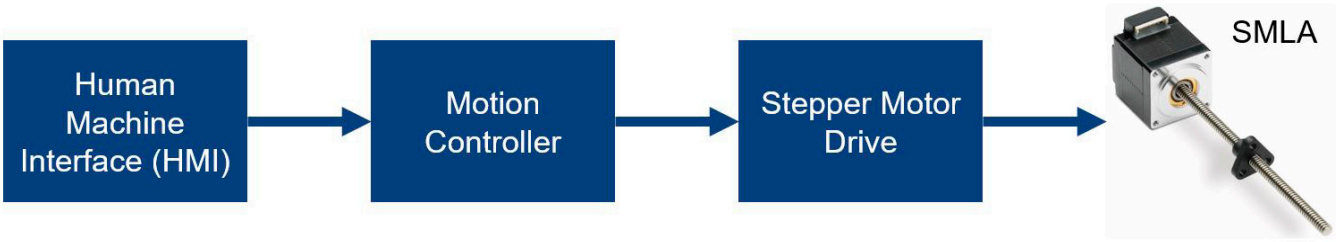

Figure 2—Architecture for a basic open loop system setup to drive an SMLA.

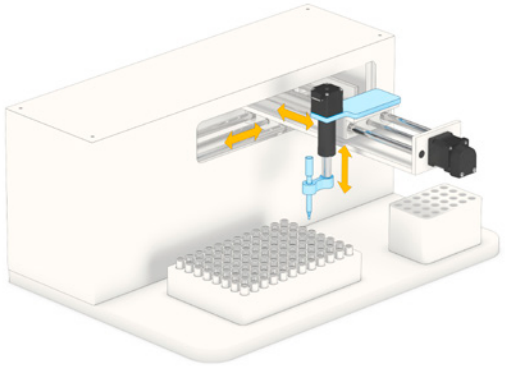

Figure 3—Automated pipetting machines can utilize an encoder on their horizontal axis.

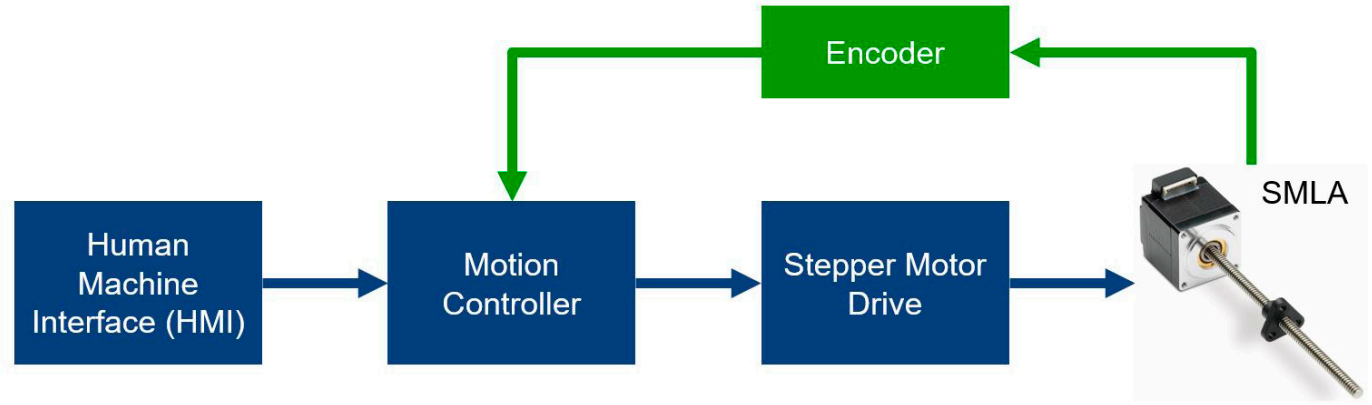

Figure 4—Architecture for a basic closed loop system setup to drive an SMLA.

Open Loop Linear Actuation

Figure 2 depicts open-loop SMLA architecture that applies to all configurations. Users interact with the system through a human machine interface (HMI). They program the desired motion sequence into the motion controller, which sends it to the stepper motor drive for conversion and amplification before transmitting it to the SMLA, which makes the moves. The communication pathway is unidirectional; neither the motion controller nor the HMI ever receives any notification that the intended move has been completed successfully.

Knowing exactly where a load is positioned is critical for many high-precision applications such as medical instruments, measuring devices and laboratory equipment. Also, certain applications can power off unexpectedly or have their load forced out of position. In such scenarios, it would be impossible to know the exact position of the load without using a feedback mechanism.

A good example of an application that benefits from the functionality of an encoder is automated pipetting machine (Figure 3). These devices utilize an encoder on the horizontal axis to accurately track the location of the dispensing pipette and ensure fluid is transferred to the proper test tube. Other examples include fluid pumps, 3D printers and XY stages.

Closing the Loop with Optical Rotary Encoders

Many SMLAs can be outfitted to provide feedback by adding a rotary encoder. Rotary encoders, also known as shaft encoders, convert the angular position of a shaft to analog or digital output signals. Optical rotary encoders are the most common option for adding feedback functionality to SMLA assemblies. Figure 4 illustrates how adding an encoder to an SMLA can provide feedback to the controller and share important motion data such as position, speed or direction.

Getting Position with Encoders

There are two main types of rotary encoders: incremental or absolute (Figure 5).

Incremental rotary encoders use a rotating disk connected to a shaft and positioned between a light source and a photo sensor. Multiple slits arranged uniformly around the perimeter of the disk allow light to pass to the sensor in patterns of pulses representing motion characteristics.

Applications requiring even more detailed motion data or an added level of protection, if power is lost, would benefit from an absolute encoder. Like incremental encoders, absolute encoders are center mounted to spin with the motor shaft between a light source and a photo sensor. Instead of using uniformly arranged slits like an incremental encoder, absolute encoders use an intricate arrangement of unique openings over a much larger surface of the disk. These interrupt the light signals in patterns that a detector chip can read as higher-fidelity representations of every angular position of the stroke—even without a homing device.

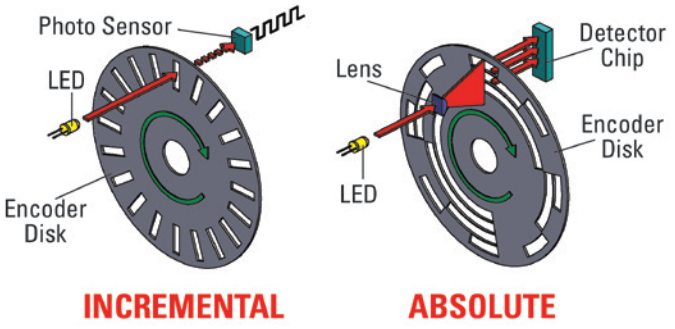

Figure 5—The processes for incremental (left) and absolute encoders (right) are illustrated above.

Implementing Rotary Encoders

In many cases, encoders can be integrated into all three SMLA configuration types (MLS, MLN and MLA). Only a flat surface is required to bolt the encoder body onto and a shaft on which to mount the optical disk. The shaft must be an extension of the original motor shaft so that the optical disk can rotate with it to capture the motor's motion accurately, as shown in Figure 6.

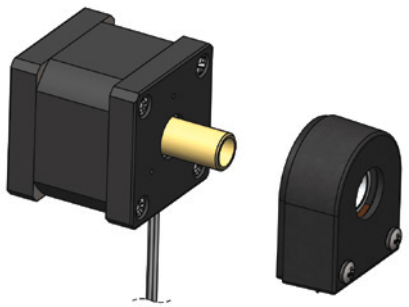

Figure 6—Installation of an encoder onto an encoder-ready motor with the required protruding shaft and mounting surfaces.

Stepping Up

While open-loop SMLA systems are suitable for many applications, stepper motor users wanting real-time feedback on load position should consider adding encoders to their motors. Encoders can provide position feedback, real-time data on speed, direction and other characteristics, while improving control and monitoring of the load. For basic positioning feedback, users should specify incremental encoders, but if high precision is required or the ability to maintain position once the equipment is powered on, they should consider absolute encoders.

Figure 7—SMLAs with added optical encoders (From left to right: MLS, MLN and MLA)

Closing the feedback loop with optical rotary encoders not only meets the demands of today's precision applications but also positions SMLAs as valuable components in the evolving landscape of Industry 4.0 and digital connectivity innovation, ensuring their continued relevance and effectiveness in the next generation of industrial automation.

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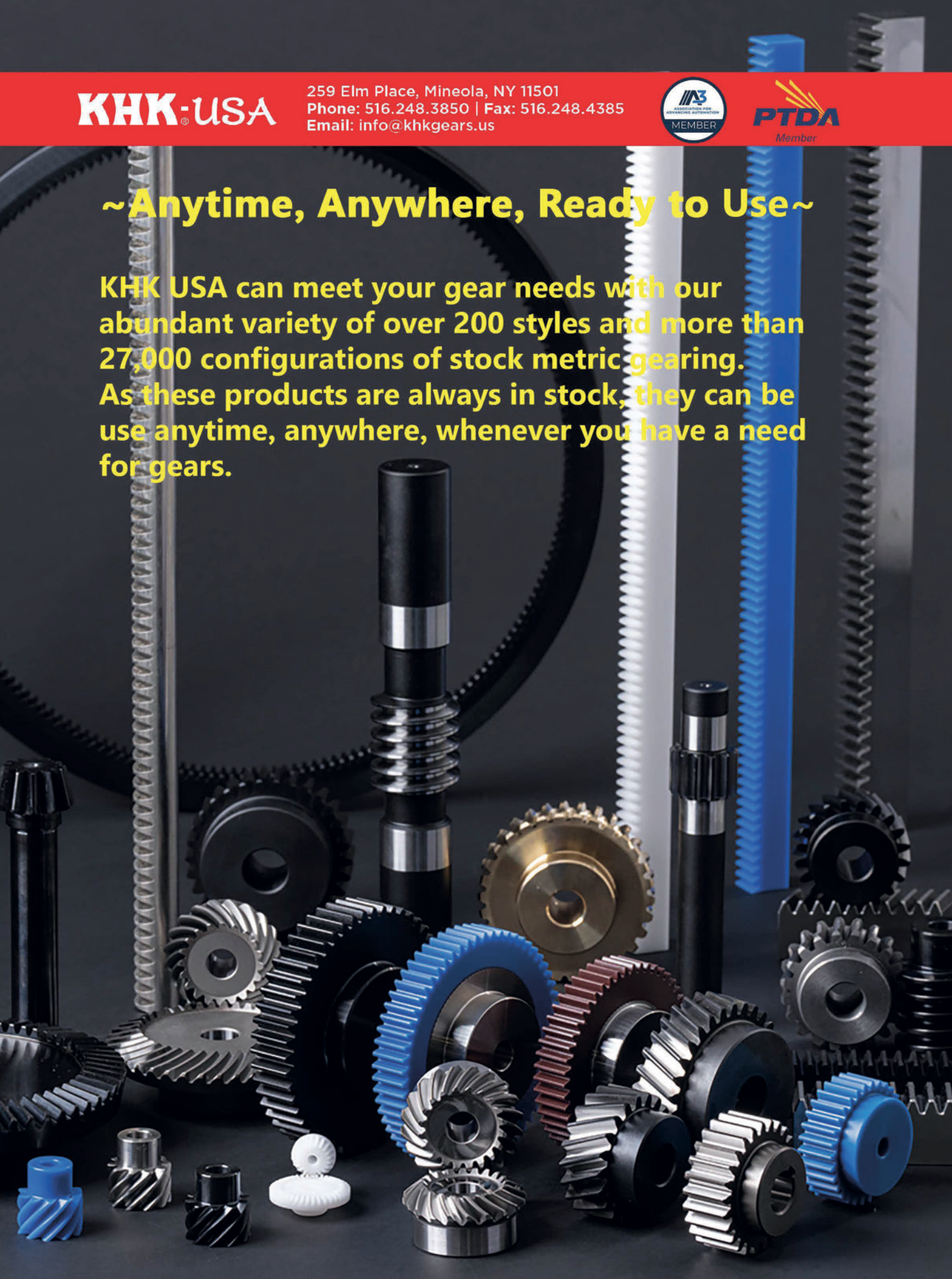


Reducing Rolling Bearing Friction

Construction machinery reaps benefits of increased efficiency and sustainability

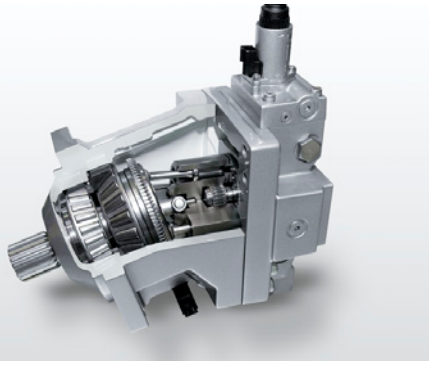
Stefan Scharting, Schaeffler KG, Schweinfurt, Germany

Rolling bearings possess especially low friction characteristics. They make it possible to reduce bearing friction by half, offering the construction machinery sector the opportunity to achieve significant carbon dioxide savings without imposing high development costs. This article will examine the current solutions from Schaeffler.

Rolling bearings with optimized friction and performance characteristics can have a significant influence when it comes to reducing the power loss, design envelope, and weight of hydraulic motors and pumps, as well as gearboxes and axles in construction machinery. If correctly designed, rolling bearings can make a significant contribution to reducing carbon dioxide emissions.

X-life: Reduced Friction, Higher Dynamic Load Ratings

The vast majority of today's construction machinery is still operated conventionally, using diesel engines and hydraulic components. In the widely used adjustable axial piston pumps and motors, the input and output shaft are usually supported by two tapered roller bearings that are adjusted against each other. When designing the bearing support, it is advisable to reduce the preload to precisely the required minimum allowed by the load spectrum. The lower bearing preload leads to permanently lower axial forces between the tapered roller end face and inner ring rib and, therefore, to a corresponding reduction in frictional torque.

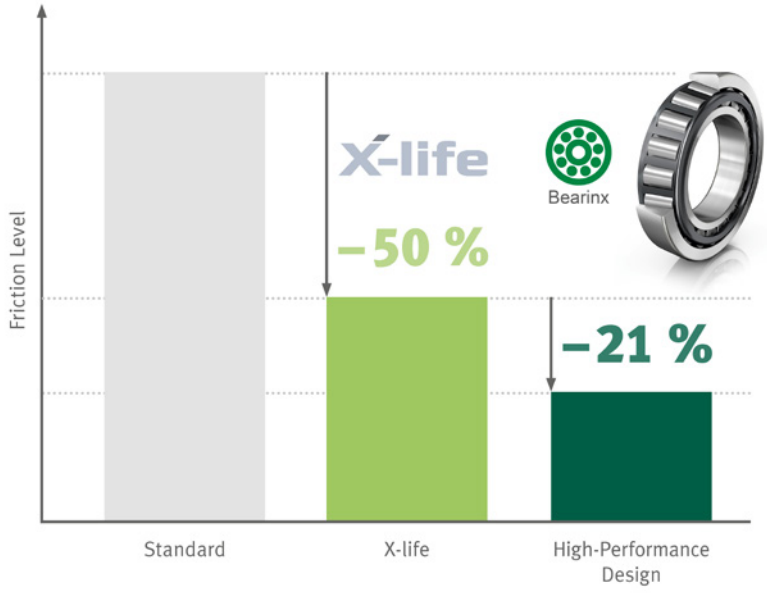


Adjusted bearing support: If the bearing preload is precisely matched to the load spectrum, it helps to reduce bearing friction.

Schaeffler tapered roller bearings in X-life quality are another option for reducing friction without making a design change. Friction can be halved compared to conventional bearings through specially machined raceway and roller surfaces as well as optimized geometry in the contact between the end face of the rolling element and the inner ring rib. Even at the low speeds during the start-up process, an elastohydrodynamic lubricant film forms due to the improved surfaces and osculations, which reduces the wear and friction under the already very low viscosity lubrication conditions. The optimizations to the internal design also led to a significant noise reduction along with approximately 25 percent higher dynamic load ratings as compared to standard tapered roller bearings from Schaeffler, resulting in a calculated rating life increase of more than 100 percent. Similar progress can be achieved by using cylindrical roller bearings in X-life quality. The high dynamic load ratings allow a changeover from full-complement cylindrical roller bearings to cage-guided cylindrical roller bearings with significantly less friction.

Friction-Reducing Coating

For rolling bearings and cylindrical roller bearings with radial and axial loads as well as tapered roller bearings, Schaeffler offers its proprietary friction-reducing coating Triondur C. This diamond-like carbon (DLC) coating is specifically optimized for loads in the rolling element contact and reduces the friction in a "dry steel-to-steel contact" by around 80 percent.



Friction levels of tapered roller bearings.

Reduced Friction Through Downsizing

Downsizing or higher power density is not only associated with a lower consumption of materials and energy during manufacturing; it also leads to reduced friction in drive systems. As described above, rolling bearings in X-life quality offer the required reserves thanks to their load ratings. With high-performance rolling bearing steels from Schaeffler, such as Cromadur, it is possible to unlock further potential for increasing the power density.

Reduced Friction Through Use of CAE Tools

Using specialized simulation software, Schaeffler can achieve efficiency improvements as early as during the product development phase. For example, with the aid of computational fluid dynamics (CFD) simulations, it is possible to reduce the churning losses in hydraulic units and gearboxes to a minimum. Schaeffler's *Bearinx* design and simulation software allows very efficient optimization of bearing supports. *Bearinx's* "OptiKit" optimization module can compare various load case analyses or also determine suitable parameters for specific target values, so that, for example, the optimum bearing preload can be calculated.

Verifiable Savings Potential

By using X-life tapered roller bearings in combination with optimized preload, it was possible to increase the efficiency of hydraulic pumps and hydraulic motors by approximately two percent in efficiency projects. Accordingly, a wheel loader equipped with such an optimized hydraulic pump and two hydraulic motors could yield a significant 6 percent energy savings. For a drive power of 140 kW, this corresponds to around 9 kW. Extrapolated to 1,000-wheel loaders working for eight hours per day, this results in an annual savings potential of around 26,000 MWh—which amounts to a savings of approximately 16,000 tons of carbon dioxide.

Outlook

The solutions for not only hydraulic drives as described above, but also for gearboxes, differentials and axle drives, allow the frictional torque generated by rolling bearings to be reduced by half using standard catalog products. By exploiting all the possibilities, including a bearing design that is based on the load spectrum of the customer's application, Schaeffler has verified a friction reduction of more than 71 percent as compared to conventional catalog bearings. These advancements are certain to resonate with the demands of the market.

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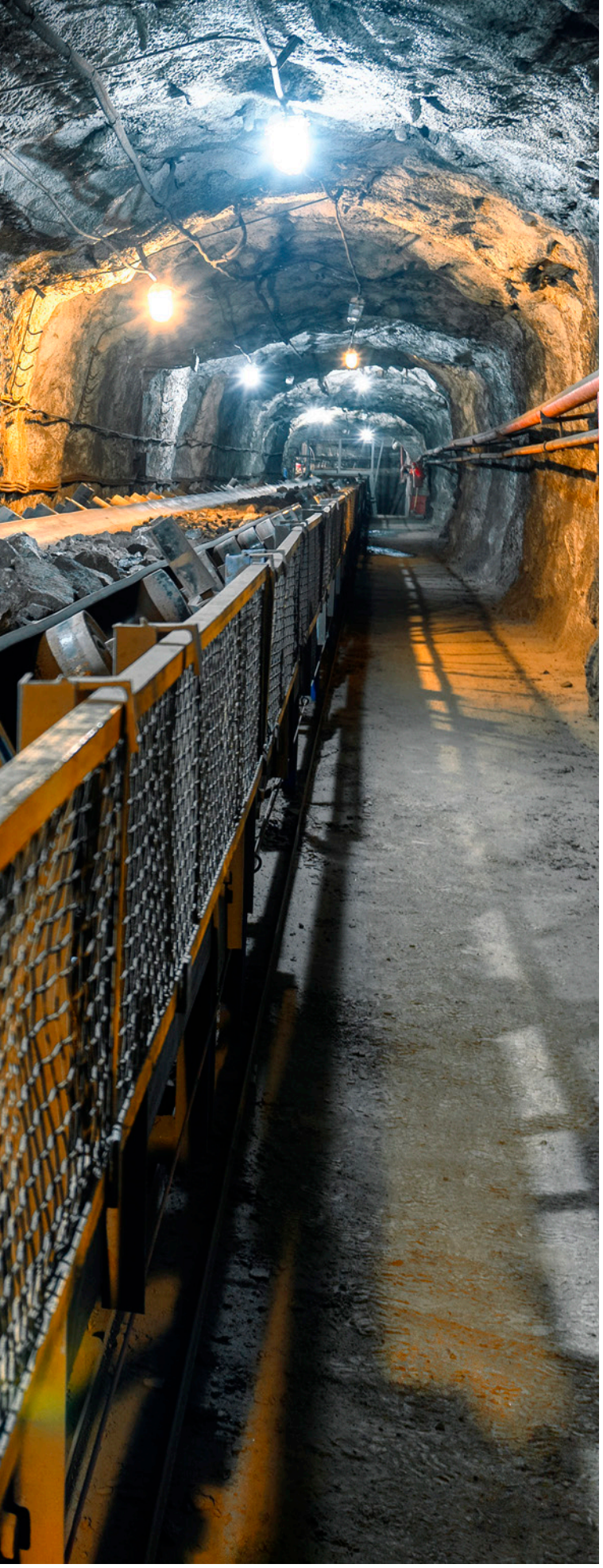
Stefan Scharting is the application engineering manager for hydraulic and electric drives within the power transmission sector at Schaeffler's Bearings & Industrial Solutions division in Schweinfurt, Germany. He holds a graduate degree in engineering (Diplom-Ingenieur) from the TU Darmstadt, one of Germany's leading technical universities.

Trends in Belt and Conveyor Technology

Sustainability, Efficiency and Portability Highlight Supplier Efforts

Matthew Jaster, Senior Editor



The global belt market is projected to experience steady growth from 2025 to 2035, according to a forecast by Future Market Insights (*futuremarketinsights.com*) This growth is driven by increasing demand across industries such as manufacturing, automotive, agriculture and mining, where V-belts play a crucial role in power transmission systems.

The market is benefiting from advancements in material technology, the rising adoption of energy-efficient belt systems and the expansion of industrial automation. Stringent regulations promoting energy-efficient machinery are expected to drive further innovation in the sector. The industrial V belts market is also poised for steady expansion due to the rising demand for efficient power transmission systems in heavy industries. The following is a collection of the latest trends and technologies in belts, belt drives and conveyors.

Conveyance and Mining Solutions with Continental

Continental's group sector ContiTech recently hosted its Total Conveyance Event in celebration of the expansion of its conveyor belt manufacturing facility in Ponta Grossa, Paraná, Brazil. The two-day event featured a ribbon-cutting ceremony and welcomed approximately 100 guests, including customers, industry professionals and local leaders.

"It's a pleasure to welcome our customers and guests to Ponta Grossa for the ContiTech Total Conveyance and Ribbon-Cutting Event," Gerstenberger said. "This milestone not only marks the official expansion of our Ponta Grossa facility but also reinforces our long-term commitment to our customers, to innovation, and to our deep materials expertise in conveyor belt technology."

The new 7,000 square-meter conveyor belt plant expansion is designed to enhance ContiTech's competitiveness, doubling, or even tripling, its capacity in the coming years. The expansion includes production lines featuring advanced new rubber mixing, rubber blanket calendering, vulcanization, and inspection technologies, with the aim of guaranteeing excellence at every stage of the process. The expanded facility underscores ContiTech's strategy to deliver safe, efficient and innovative material handling solutions through its full ecosystem of belts, systems, services and expertise.

"We were honored to have our valued customers and partners attend our Total Conveyance Event," said Sven Hlywiak, vice president of customer engineered solutions, industrial solutions Americas. "Their presence underscores our commitment to the region and our shared vision for the future of conveying. Alongside our investment in the Ponta Grossa plant expansion, this event reflects our long-term commitment to be the first choice for material-driven solutions for our customers."

Last year's MINExpo in Las Vegas provided a unique opportunity to learn more about Continental's diverse mining portfolio including technologies for:

Pulley lagging

Continental's pulley lagging solutions are now available at their new facility in West Virginia, which also has splice kits and repair materials available on-demand. The location, an Elastotec Approved Installer, houses a recently installed autoclave, offering hot vulcanized lagging, as well as cold bonding. Continental is a distributor of Elastotec lagging in North America, including sole rights to their proprietary finishing equipment, and with authorization to certify people in the installation of their lagging.

Steel cord belts

Continental's Phoenix Phoenocord ST10000 belt is considered one of the world's strongest according to belt rating. Phoenix Phoenocord steel-reinforced conveyor belts are made for the harshest applications, delivering extreme durability and reliable performance with high-capacity and high-breaking strength, making it a suitable solution for above and below ground use.

Comprehensive conveying solutions services

Continental's comprehensive conveyor belt services include installation, maintenance, repair and splicing, and various components, all from one single source.

Conti+ 2.0

Continental has enhanced its app-based service platform Conti+, making it much simpler, faster and more comprehensive. The technology provides advanced options to manage conveyor systems and increases efficiency and profitability of an operation across all components and processes.

Hoses, air springs, power transmission belts

The company offered numerous other products supporting the mining industry, including fluid hoses and specialty mining hoses, suspensions and power transmission belts, monitoring and more. Additional industries served include agriculture, aggregates, cement processing, metal processing, material handling and more.

continental-industry.com

Sustainability with Gates Corporation

Earlier this year, Gates received the 2025 Environmental Initiative SEAL Awards for its innovative Chain-to-Belt initiative. With it, Gates is redefining industry standards by offering synchronous belts as a superior alternative to traditional roller chains. Gates is proud to be recognized as one of the winners of the prestigious SEAL Awards, which celebrates global leaders in Sustainability, Environmental Achievement, and Leadership. This honor highlights the company's commitment to impactful environmental initiatives that drive lasting positive change and positions Gates among other leading global organizations.

The 2025 SEAL Business Sustainability Awards honors leadership, innovation and commitment to sustainable business practices.

Matt Harney, chairperson and founder of the SEAL Awards said, "2025 represents our ninth SEAL Business Sustainability Award event. This year's award recipients follow a 9-year trendline of greater impact materiality and deeper granularity. Across all industries and geographies, companies are going deep and granular—into materials, chemistry, processes, R&D, supply chains and more—to generate sustainability improvements."

Industrial operations have historically relied on numerous roller chain drives, creating multiple opportunities for conversion to belt drives. Gates is on a mission to replace roller chain systems with their cutting-edge synchronous belt technology. To prove this initiative is both highly viable and impactful, they conducted a third-party comprehensive analysis comparing the environmental impact of the Gates Poly Chain GT Carbon belts to traditional roller chain systems. The study found that the Gates belt driven systems have a potential reduction of 90 percent in CO_2 equivalent emissions or more over a 10-year period compared to roller chain systems.

gates.com

AMMEGA Launches Belting Technology Connect Program

AMMEGA Group, global provider of belting solutions for conveying and power transmission, announces the launch of its Belting Technology Connect Program. Available to customers in the Americas, the BTConnect program is a year-round vehicle for AMMEGA's belting experts to deliver customizable technical seminars on belting optimization shaped by customer needs. The new program was inspired by the company's bi-annual live Belting Technology Conference (BTC) event, whose latest edition was this May in Braselton, GA, attracting more than 200 attendees from approximately 35 companies across the Americas.

Sessions for the BTConnect program are available in three modalities: at a customer site, at AMMEGA's facilities, or virtual, with the possibility to choose sessions that matter most to a customer's business. Topics range from logistics, food and beverage, automotive, material

handling, packaging and more, and include subsegments such as parcel, postal (for logistics), and baking and snack, meat (for food), among others.

"AMMEGA's close collaboration with customers, and deep knowledge of their challenges and needs, is what has always propelled AMMEGA's innovation forward," said Tom Doring, President of Americas at AMMEGA. "We pride ourselves in understanding underlying problems and anticipating desired outcomes and are thrilled to offer a personalized experience to our valued customers." BTConnect is the latest customer-centric offering by AMMEGA with sessions taking into consideration an array of trends in today's dynamic business environment. Most recently, topics of AI and predictive maintenance, as well as reducing noise levels, and confidently navigating belt selection. Consulting is also available on more niche industry-specific issues, such as food safety or managing tariffs, to ensure customers are meeting their business, operational, and sustainability goals.

ammega.com

RISE Robotics Collaborates with U.S. Army to Develop Portable Structural Systems

RISE Robotics, a provider of next-generation actuation technologies, has been awarded a Phase I Small Business Innovation Research (SBIR) contract from the U.S. Army to explore the feasibility of developing collapsible, ultra-lightweight cranes for rapid deployment in resource-constrained and expeditionary environments.

The eight-month, $250,000 contract is sponsored by Letterkenny Army Depot and was awarded under the Army's Mobile Sustainment Tools Open Topic (A244-P056). The effort aims to evaluate how RISE's proprietary Beltdraulic actuation system can be leveraged to develop portable structural systems that are easy to transport, quick to assemble, and capable of withstanding harsh conditions.

"This effort reflects the Army's growing focus on enabling rapid mobility and logistical efficiency in the field," said Tom Phelps, COO of RISE Robotics. "With this Phase I award, we're excited to explore how our Beltdraulic technology can address critical operational gaps through lighter, more agile lifting equipment."

The Phase I work builds on RISE's proven track record of delivering defense-grade lifting systems. RISE previously completed a Phase III production contract with the U.S. Air Force for the Common Lifting Device (CLD), a compact, electronic-free lift system developed to support the MC-130J Silent Knight Radar program. The CLD features a lift capacity of 200 pounds, a maximum lift height of 11 feet 10 inches, and a total system weight of just 215 pounds. Its successful transition to production highlights RISE's ability to deliver innovative, field-deployable solutions at scale.

RISE's Beltdraulic actuation system can be leveraged to develop portable structural systems.

Under this new Army contract, RISE will investigate how its CLD platform and Beltdraulic architecture can be adapted to meet Army-specific needs. This includes exploring structural modifications, such as moving boom-type crane arms, evaluating the use of larger wheels for off-road mobility, and developing design variants for lower-profile lifting use cases. RISE team members will engage directly with Army personnel to gather operational insights and define mission-driven requirements for future development.

The Phase I effort will include demonstrating CLD capabilities to Army stakeholders, developing a tailored document based on end-user feedback, and a roadmap identifying high-impact Army applications for a next-generation collapsible crane. The outcome will help shape a potential Phase II program to deliver a prototype that meets expeditionary mission requirements.

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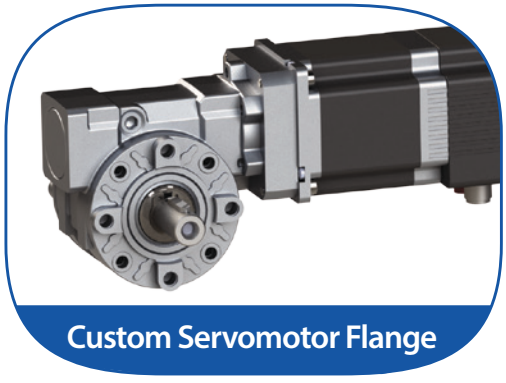

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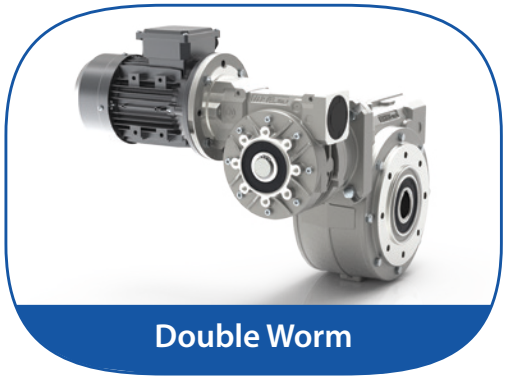
Precision Worm



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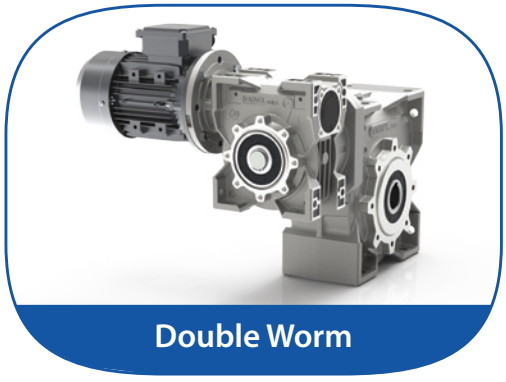

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Revolutionizing Mine Safety and Efficiency with IoT Monitoring

Regal Rexnord examines backstops safeguarding torque transmission in clutches

Willem J. Sullivan, Manager, Engineering, Regal Rexnord

The mining industry is known for operating within some of the most complex and demanding environments possible. Equipment reliability, efficiency, and operational safety are absolutely essential. The challenges come when the longevity and reliability aspect of machinery on site comes into question.

In this industry, ensuring long-term sustainability has drastic effects on preventing catastrophic failures leading to injury, downtime, and financial insecurity. With an ever-evolving landscape, the ability to monitor your equipment in real time to assess operational health has never been more important.

One of the most transformative innovations in this space is the implementation of IoT monitoring systems for your operation. As an example, consider its effectiveness with backstops, which safeguard torque transmission in externally mounted clutches. These systems usher in a new era of predictive maintenance, operational resilience, and data-driven decision making that allow mining operations to move beyond reactive problem solving to proactive intervention strategies. By leveraging intelligent telemetry systems, coal mines are improving efficiency, reducing downtime, and fortifying their asset longevity which are all critical steps towards a safer, more sustainable, and cost-effective industry.

Shifting from Reactive to Predictive Maintenance

For decades, mining maintenance has relied on traditional methodologies like scheduled maintenance and reactive responses to failures on-site, which most often leads to costly downtime and unexpected repairs. This approach, while conventional, has clear limitations and downsides: mechanical failures can occur without warning, operations unexpectedly come to a halt, and production schedules are immediately thrown into uncertainty.

With IoT-driven monitoring this common cycle is instantly challenged. Telemetry equipment continuously gathers and analyzes real-time operational data and tracks important factors like temperature fluctuations, vibrations levels, lubrication presence, torque transmission efficiency, and overall backstop performance. This data allows experienced engineers and maintenance teams to detect potential failure points long before they advance and become a more serious issue that would otherwise cause catastrophic breakdowns and interrupt productivity. Instead of reacting to these problems, operators can now predict, and address, these issues by transforming maintenance into a calculated and planned process.

Enhancing Operational Efficiency and Cost Savings

Mining sites understandably function within tight production windows where equipment downtime heavily

impacts profitability. IoT solutions alleviate this challenge by offering early warning systems and automated alerts that can enable strategic scheduling of maintenance during planned shutdowns rather than the unfortunate and costly emergency stoppages that occur.

Beyond minimizing site disruptions however, these intelligent monitoring systems optimize cost efficiency in more unique ways like:

- **Reducing Manual Inspections** – IoT monitoring eliminates the need for frequent on-site evaluations which reduces overall labor costs and improves efficiency when those inspections are taking place.
- **Data-Backed Decision Making** – Instead of relying on subjective assessments and timed evaluations, operators can now leverage real-time performance data to dictate maintenance schedules.
- **Minimized Equipment Replacement Costs –** Early detection prevents severe breakdowns, allowing targeted repairs before severe replacements are needed.
- **Optimized Energy Consumption –** Intelligent Monitoring Systems ensure backstops (and other equipment) function at peak efficiency, reducing excess energy expenditures and improving sustainability metrics.

IoT Monitoring in Action with Backstops

This kind of detailed monitoring opens the possibility to catch and detect anomalies that would otherwise turn into larger issues and potential shutdowns if allowed to grow. For example, being able to monitor the temperature data of a backstop in operation helps identify overheating issues that can indicate issues with lubrication or excessive friction. You can monitor bearing information to understand the current wear and tear loads on your backstops and help plan maintenance around keeping these systems operational. Similarly, monitoring the vibration that is present in a backstop can help identify misalignment, wear, or mechanical faults. By establishing a healthy baseline for a vibration profile, you can understand when significant issues arise before they grow into larger, more demanding problems for the operation.

Temperature and vibration analysis is incredibly important for keeping a backstop properly operating, but those are only a couple parameters that are beneficial to monitor. Beyond those, you can monitor lubrication levels for preventing added wear on components, operational speed and torque to monitor performance under varying load conditions, environmental conditions to ensure humidity, corrosion, and temperature aren't significantly impacting the machinery, and even seal integrity to help detect leaks that might turn a small problem into a much larger one if it had gone unnoticed.

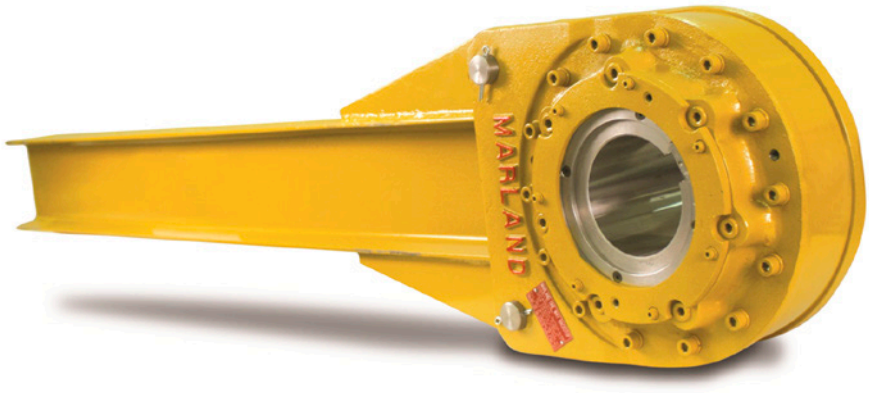
Even though these data points alone may seem simple or insignificant, combining them allows you to see standard operating conditions and notice any deviations that can in turn combine to create much larger stressors on your operation.

Conquering Environmental Challenges with Innovation

Mining sites present harsh conditions by anyone's standards: High dust levels, extreme temperatures, and corrosive elements all present significant challenges beyond the structural barriers that obstruct wireless signal transmission. Traditional sensors often struggle to perform reliably and lead to inconsistencies in data collection. However, advanced telemetry solutions are now equipped to overcome these obstacles by ensuring continuous monitoring regardless of these conditions.

Some of these breakthroughs include:

- **Rugged Sensor Technology** – IoT monitoring devices are constructed with materials resistant to the dust, temperature, and corrosion ensuring reliability you can count on.
- **Signal-Bouncing Techniques** – Mining environments contain metal-framed structures that heavily disrupt wireless signals important to these systems. Advanced communication networks leverage strategic repeater nodes that effectively bounce signals through and around obstacles to ensure uninterrupted data transmission.



Backstops, like this Marland BCMA backstop, safeguard torque transmission in externally mounted clutches and can reap many benefits from remote monitoring and data analysis.

- **Secure Data Protection –** IoT telemetry systems incorporate end-to-end encryption safeguarding your operation's sensitive mining data transmission.

These innovations allow telemetry systems to operate seamlessly despite previous environmental challenges enabling precise and constant data acquisition which is key for long-term sustainability. The true testament to IoT monitoring's value is its impact on real mining sites, where data-driven optimization is actively reshaping day-to-day operations.

Preventative Maintenance in Action

A leading coal mining operation implemented IoT telemetry systems to help monitor externally mounted backstops on-site. Early data analytics detected misalignment within torque transmission components, which would typically be a failure that would result in full site stoppage within weeks. By catching this issue early on in its development, engineers were able to resolve this misalignment during scheduled downtime and prevented thousands of dollars in repair costs and uninterrupted operations.

Improving Workplace Safety, Compliance and Risk Management

Beyond financial and operational benefits, IoT monitoring also significantly aids in improving worker safety. By mitigating severe equipment failure risks, mining teams are protected from sudden breakdowns that could result in dangerous environments. Predictive analytics ensure structural integrity isn't being compromised and machinery safety and personnel are monitored closely.

Strict industry regulations are required from all mining operations and detailed maintenance documentation on equipment performance is mandatory to be compliant. IoT monitoring provides automated data logs to ensure compliance with environmental, safety, and operational regulations. Having access to comprehensive data records helps mining companies with tracking maintenance and strengthens adherence to the regulations that make the mining industry safer.

A Smarter Future for Mining Efficiency

Mining efficiency depends on a lot of factors, but notably precision, resilience, and predictive information for maintenance. IoT monitoring isn't a simple upgrade to current industry norms; it's an evolution toward a fundamental shift in how industrial sites approach equipment reliability, maintenance protocols, and data intelligence.

While installation remains a necessary stepping stone, the true value lies in long-term data acquisition, continuous performance optimizations, and proactive decision-making. The mining industry is embracing new standards of intelligence and foresight, proving that the future of industrial efficiency is rooted in data-driven sustainability efforts.

The New Era of Mining Intelligence

The ability to predict failures, optimize workflows, enhance equipment longevity, and safeguard operational efficiency is no longer something far off in the future. It's achievable right now. This technology is scalable and essential for the modern mining industry and should be an immediate goal for operations globally. IoT monitoring marks a technological shift ensuring mining operations don't just keep running but thrive in their environments.

Through innovation, expertise, and proactive intelligence, mining sites are collectively moving towards a future of smarter, safer, and more efficient operations while redefining industry standards along the way.

regalrexnord.com

PTE

Intelligent monitoring solutions support coal mine operations by communicating encrypted end-to-end sensor data from the operating equipment to a remotely accessible reporting dashboard.

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Essential Exhibitors at TPS 2025

A curated list of companies showcasing advanced solutions in rotating equipment

Aaron Fagan, Senior Editor

For over 50 years, the Turbomachinery & Pump Symposia (TPS) has remained one of the most important annual events for rotating equipment professionals. The 2025 event takes place September 16–18 at the George R. Brown Convention Center in Houston. Hosted by the Turbomachinery Laboratory at Texas A&M University, TPS brings together engineers, operators, and manufacturers from across the oil & gas, petrochemical, power, aerospace, chemical, and water industries.

TPS offers a dual focus: a peer-reviewed technical program and a world-class exhibition. The technical program is selected by advisory committees of industry experts and led by respected practitioners. It features short courses, lectures, tutorials, case studies, and discussion groups covering reliability, maintenance, troubleshooting, and emerging technologies. All proceedings are made freely available online six months after the event.

The exhibit hall spans approximately 216,000 square feet and features more than 300 companies showcasing the latest in turbomachinery and pump systems—including gears, bearings, couplings, seals, drives, and full-scale equipment. With over 4,500 attendees from more than 50 countries, TPS offers valuable opportunities to explore new technology, connect with solution providers, and gain practical insights for improving system performance.

For engineers focused on the performance, efficiency, and reliability of rotating equipment, TPS provides direct access to the people and products driving innovation in the field. I hope you find this curated list of exhibitors useful—and I look forward to seeing you there. Be sure to stop by AGMA's booth (1751) as you make the rounds!

tps.tamu.edu

PTE

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Recommended Floor Visits for 2025

ABB (Booth 2617)
Motors, variable speed drives, integrated power transmission solutions.

AGMA – American Gear Manufacturers Association (Booth 1751)
Gear standards, education, technical resources.

Artec Machine Systems (Booth 1836)
Custom gear drives, high-speed gearboxes, overhaul services.

Atlas Copco Gas & Process (Booth 1736)
Turbocompressors, expanders, gas processing systems, sealing and transmission tech.

Bently Nevada (Booth 1912)
Condition monitoring, rotating equipment protection.

Cerobear GmbH (Booth 2242)
Advanced ceramic bearings and components for high-speed, high-precision applications.

Coupling Corporation of America (Booth 1625)
High-performance flexible couplings, vibration damping, torque accuracy.

EagleBurgmann Industries LP (Booth 2323)
Mechanical seals, gaskets, bearing isolators.

Elliott Group (Booth 1937)
Turbomachinery, compression systems, drive components.

F. W. Gartner & Curtiss-Wright (Booth 1309)
Thermal spray coatings, surface durability enhancement.

Flowserve Corporation (Booth 2127)
Pumps, mechanical seals, flow control solutions.

Goodrich Industrial Couplings (Booth 2037)
Gear and disc couplings, high-torque applications.

Greene Tweed (Booth 1406)
Sealing solutions, composite bearings, high-temp applications.

Honeywell | CCC (Booth 1821)
Control systems, automated protection for rotating assets.

Ingersoll Rand (Booth 2429)
Air compressors, motion-control components.

John Crane (Booth 1722)
Mechanical seals, bearing isolators, lubrication management.

Kaydon Ring & Seal (Booth 1744)
Custom bearing solutions, precision rings, engineered seals.

Kingsbury, Inc. (Booth 2437)
Hydrodynamic tilting pad and journal bearings for turbines and compressors.

Lone Star Turbo (Booth 2511)
Turbine internals, retrofit components, seals and bearings.

Miba Industrial Bearings/TCE (Booth 2611)
High-performance industrial bearings and power transmission components.

Petroleum Products & Solutions (Booth 2827)
Specialty lubricants and fluids to extend gear and bearing life.

Phoenix Laser Solutions (Booth 2350)
Laser welding, cladding, and gear repair services.

Regal Rexnord (Booth 2229)
Bearings, gear drives, couplings, motor controls.

RENK Group (Booth 2637)
High-performance gear units, slide bearings, industrial couplings.

Schunk Carbon Technology LLC (Booth 1622)
Carbon-graphite bearing materials and mechanical seals.

Siemens Energy (Booth 2329)
Motors, gearboxes, couplings, digital diagnostics.

SKF Magnetic Mechatronics (Booth 1742)
Magnetic bearings, mechatronic systems, high-speed rotating equipment.

Sundyne, LLC (Booth 2421)
Gear-driven pumps, compressors, engineered rotating equipment.

Thordon Bearings Inc. (Booth 1205)
Polymer bearing solutions with corrosion resistance and long life.

Waukesha Bearings (Booth 1442)
Hydrodynamic bearings and systems for turbines, compressors, gearboxes.

EASA 2025 Celebrates Pumps, Motors and Drives

Highlights include new motor technology, replacement parts and predictive maintenance solutions

Matthew Jaster, Senior Editor

The 2025 EASA Convention at the Gaylord Opryland Resort & Convention Center in Nashville took place in July 2025. The event focused on companies involved in the service and sale of electric motors, pumps, drives, controls, gearboxes and other rotating machinery. Highlights included market trends, economic outlook, harnessing AI, rotor testing, new motor technologies, supply chain and more.

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IPS Booth #169

Integrated Power Services (IPS) featured in-shop and field services, including distribution and coil manufacturing, as well as breaker and transformer repairs.

IPS provides turnkey distribution services—whether this means sourcing from the company's extensive inventory of off-the-shelf products or design and manufacturing to meet customer needs.

"In all things, we know that our customers count on us to be responsive and ready to provide optimal solutions on time and on budget," explains Sam Patrick, IPS director of distribution. "Whether it be catalog items or one-off designs, we can provide motors, pumps, and other rotating or power distribution replacement parts all in record time. This efficiency extends to our shop services as well, where we can deliver short production runs of replacement parts, fleet-level motor modifications, and e-houses.

IPS is also a trusted manufacturer of high-voltage coils. "The coils we manufacture in-house are subjected to rigorous testing to ensure superior performance and reliability," said Patrick. "We supply coils to customers worldwide across the spectrum of industries, including wind, power generation, pulp and paper, water and wastewater, and oil and gas,"

In addition, IPS provides dedicated, high-value remanufacturing of customer-supplied circuit breakers,

switchgear and related parts, along with proven, experienced remanufacturing, rebuilds, and reconditioning of electrical distribution equipment.

ips.us

Hansford Sensors Booth #536

Hansford Sensors designs, develops and manufactures a wide range of high-performance industrial accelerometers, vibration sensors, 4-20mA loop powered transmitters, vibration modules and switches, cable assemblies, industrial enclosures and ancillary equipment. These products play a vital role in predictive or preventative maintenance and condition monitoring routines, for all forms of rotating machinery, this includes pumps, fans and motors. These products can be used in a wide range of industries (from petrochemical, marine and cement to paper, wind and mining). Hansford vibration sensors and systems deliver precision measurements time after time, under the most demanding conditions, helping customers improve the reliability, performance and profitability of their manufacturing and process systems.

hansfordsensors.com

Techtop Motors Booth #355

Techtop is a global leader in electric motor manufacturing, delivering high-quality, energy-efficient solutions for industrial and commercial applications. With a commitment to innovation, reliability, and customer satisfaction, Techtop offers a diverse range of motors designed for superior performance and durability. Using its state-of-the-art electrical, processing, and finishing equipment, Techtop produces over 2 million+ electric motors annually in both IEC and NEMA design. Techtop produces aluminum and cast-iron frame motors of IEC standard (FR56-355) and NEMA standard (FR48-449), with all products meeting the IE1, IE2, IE3, IE4, IE5, NEMA Epact, and premium efficiency requirements. Techtop's R&D division is investing significant efforts into developing IE4 and EC motors.

techtopind.com

Schaeffler Booth #265

Schaeffler highlighted solutions engineered to support safer, more efficient motor repair. Key technologies included current-insulating bearings designed to help prevent premature failure, as well as the Optime Ecosystem for predictive maintenance. The booth also featured induction heaters, smart lubricators, and scalable condition monitoring systems.

Electrical current passing through bearings can lead to premature bearing failure and expensive machine downtime. FAG current-insulated bearings from Schaeffler—including hybrid ceramic or ceramic-coated versions featuring proprietary Insutect coating—are specially engineered to stop stray electric current in its tracks.

Optime is Schaeffler's condition monitoring system designed to prevent unplanned machine downtime. It monitors all plant assets across entire manufacturing facilities—seamlessly, cost-effectively and completely automatically. For just pennies per day, Optime provides 15,000 measurements (based on six different vibration measurements plus temperature at preset intervals) per sensor per year.

Schaeffler's Concept1 single-point automatic lubricator uses an electrochemical reaction to precisely and continuously supply the proper amount of lubricant to rolling bearings inside electric motors and other industrial machinery. Easy to install and operate, Concept1 can reduce plant maintenance costs by as much as 25 percent when compared to manual lubrication procedures.

schaeffler.us/us

WEG Booth #101

WEG is one of the largest manufacturers of electric motors in the world producing more than 10 million units annually. Committed to growth on a global scale, WEG continually invests in state-of-the-art manufacturing facilities and processes, and the development of reliable and more efficient industrial electrical solutions. WEG offers a diverse and integrated product line that includes motors, drives, soft starters, controls, gearing, panels, transformers, alternators, generators, turbines, and custom solutions. WEG has also become a signatory of the United Nations Sustainable Development Goals.

weg.net

ABB Booth #407

ABB helps facilities reach new levels of efficiency and savings, even under the most demanding conditions. Combining the best available materials with superior technology, ABB's industrial electric motors and condition monitoring solutions are designed to operate reliably no matter how challenging the process or application, and to have low life cycle costs.

EC Titanium is a highly efficient motor that combines synchronous reluctance and permanent magnet technologies. The rotor design incorporates non-rare earth elements, resulting in a motor solution that is highly efficient, quiet, reliable and easy to operate - all in an eco-friendly package. The EC Titanium motor is designed to be paired with a variable speed drive and is optimized for energy management and sustainability and ideal for fans, pumps, blowers, compressors, vacuum pumps, HVAC systems and other variable speed applications. Available as a motor only or integrated motor drive (IMD) unit, EC Titanium provides excellent performance across a wide speed load range and above base speed conditions.

abb.com

Novel Steel Grade Resists Fatigue as Life Becomes Harder for Bearings

Dr. Tania Loaiza Uribe and Dr. Mikael Thunman

Finding new steel grades with robust fatigue properties is becoming increasingly important for heavy vehicles. A key driver is the accelerating trend towards electrification that imposes additional loads on the powertrain.

Specifically, the electrification of large goods vehicles requires improved fatigue properties under both high cycle fatigue (HCF) and very high cycle fatigue (VHCF). There are three main contributing factors. First, electric motors in large goods vehicles operate typically at a much wider range of rpm than internal combustion engines and second, they generate increased torque compared with cars. This requires superior fatigue strength to ensure an adequate life for powertrain components. Third, the substantial weight of the traction batteries, crucial for long range, exerts considerable additional stress on the vehicle's structure, and especially bearings.

It is possible to improve fatigue resistance by increasing the thickness of material used in critical components. However, this imposes a weight penalty that would impact the load-carrying capacity of a vehicle already challenged by the weight of its traction batteries. This is creating interest in novel steel grades that can deliver enhanced fatigue properties with no increase in component size. This is where Ovako's Hybrid Steel 60 shows particular promise.

Fatigue failure generally results from the accumulation of microplastic deformation under repeated cyclic conditions. The term microplastic refers to the microscopically small areas of the component where the material is subject to plastic deformation while the bulk retains its elastic properties.

This type of failure affects the service life of a wide range of machine components, such as gears, rolling bearings, and camshafts. Rolling bearings often operate under elastohydrodynamic lubrication (EHL). This is a regime where significant elastic deformation of the surfaces takes place, with a considerable effect on the shape and thickness of the lubricant film. This leads to alternating contact stresses within a small area that can cause subsurface damage known as rolling contact fatigue (RCF). The result is microstructural changes in the contact areas that ultimately manifest as fatigue damage.

Previous Research Work on the Most Common Bearing Steel

Previous investigations focused on the microstructural decay resulting from RCF with the most common bearing steel, grade 52100. The microstructure of 52100 steel comprises tempered carbides, residual cementite (RC), and a martensitic matrix. Types of microstructural decay identified during RCF include the formation of dark etching regions, white etching bands, and carbide dissolution (RC and tempered carbides). This decay becomes apparent after a high number of stress cycles, leading to a decrease in hardness and subsequent degradation of the bearing.

The ability of a material to withstand RCF depends on its composition and heat treatment. Using materials that resist softening can extend the lifespan of bearings.

The Promise of Hybrid Steel

In recent years, Ovako has introduced Hybrid Steel 60. This is a novel grade combining secondary hardening and intermetallic precipitates. It was developed to overcome the limitations of existing materials, particularly for bearings subject to challenging operational conditions such as in corrosion and hydrogen environments. However, a more comprehensive understanding of how it behaves under RCF is crucial to predict its response to cyclic loading. This was the basis for this PhD project which comprised extensive laboratory testing and analysis to identify how Hybrid Steel 60 decays under RCF.

Test Materials

The test program compared 52100 and Hybrid Steel 60 bearing steels with the chemical compositions shown in Table 1. Both steels were manufactured and heat-treated by Ovako.

Before heat treatment the samples were machined into disc shapes suitable for RCF testing. After heat treatment, a 0.5 mm layer of material was removed by grinding to eliminate the decarburized layer for both materials.

Steel	C	Si	Cr	Ni	Mn	Al	V	Cu
52100	1.0	0.35	1.6	0.2	0.40	0.03	-	0.09
Hybrid 60	0.28	0.10	5.61	5.94	0.28	2.41	0.49	-

Table 1—Chemical composition of the tested steels (wt.%).

Test Method

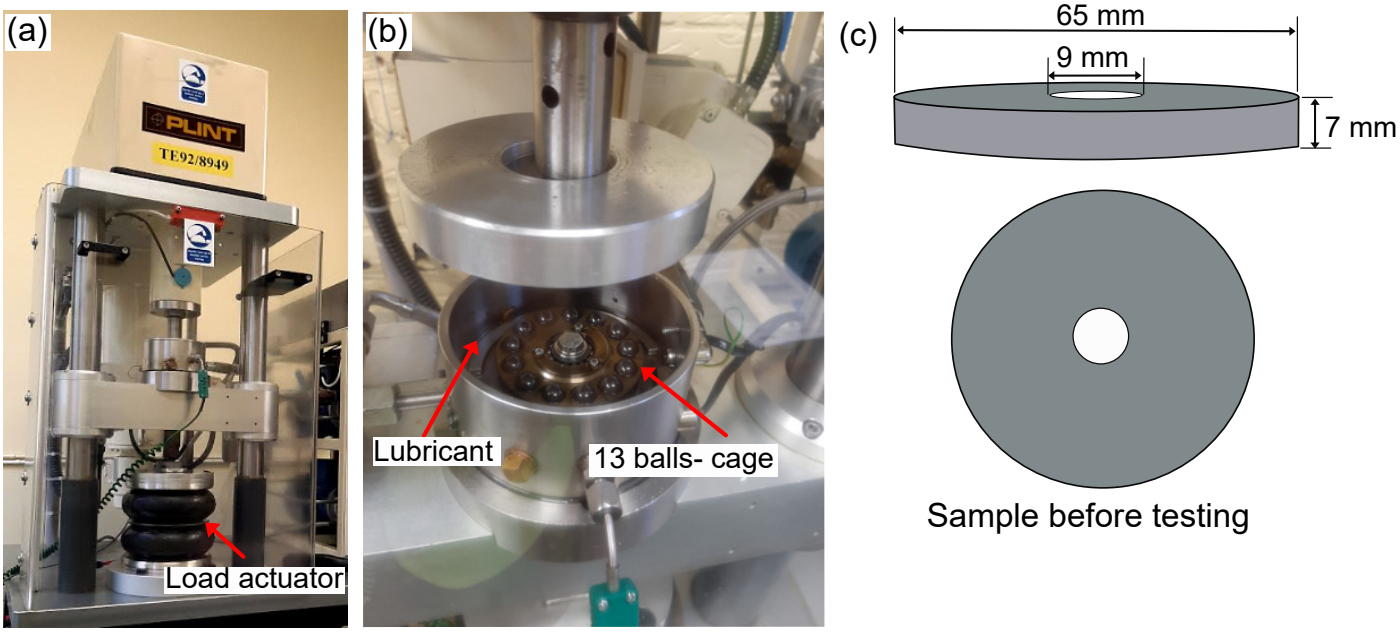


Figure 1—RCF test setup.

The disc-shaped samples had outer and inner diameters of 65 and 9 mm, respectively, and a thickness of 7 mm, the sample geometry is shown in Figure 1(c). Final preparation before RCF testing included grinding and polishing of the surface to ensure a smooth and consistent surface finish.

The RCF tests were carried out in a flat washer test rig, which is a microprocessor-controlled rotatory tribometer. This has 13 silicon nitride balls in a cup that is the outer race of a bearing. SAE 5W-40 oil was used as the lubricant, with the temperature set at 100°C. A summary of the test conditions is given in Table 2.

The test conditions and surface finish of the specimen and balls resulted in an elastohydrodynamic film thickness ratio of $h_{min} = 0.053$ and $\lambda = 2.6$, as calculated through the Hamrock & Dowson method. A single circular contact track was formed on the sample's surface during testing over 1.0×10^8 stress cycles.

Examination of Samples

Following the RCF test, samples were extracted from areas both parallel (circumferential-section) and transverse (radial-section) to the rolling direction (see Figure 2). The samples were ground and polished in preparation for microscopic inspection. For the circumferential-section care was taken to polish until the center of the microstructural decay region was reached. For both materials, the virgin microstructure and the microstructural decay were examined using scanning electron microscopy (SEM) and electron backscatter diffraction (EBSD).

Parameter	Value
Lubricant	Motor oil/SAE 5w-40
Temperature	100°C
Contact Pressure	2.8 GPa
Stress Cycles	1.0×10^8
Ball Material	Silicon Nitride (Si_3N_4)
Ball Diameter, D	10 mm
Young's Modulus (Ball Material)	315 GPa
Poisson's Ratio (Ball Material)	0.28
Young's Modulus (52100/Hybrid 60)	200–210 GPa
Poisson's Ratio (52100/Hybrid 60)	0.3
Surface Roughness, R_a	0.02 µm

Table 2—RCF experimental parameters used for testing of Hybrid Steel 60 and 52100 steels.

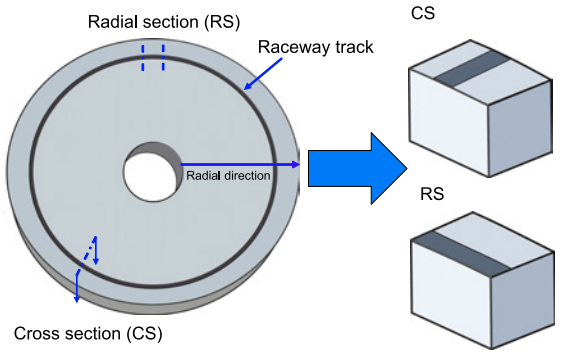


Figure 2—The circular contact track formed after the RCF test is shown as a dark grey line. The red line and arrow indicate the circumferential and radial sections before cutting. The extracted circumferential and radial section samples with the contact track are also shown.

After investigation by backscattered electron (BSE) imaging and EBSD, the samples were etched for SEM examination using secondary electron (SE) imaging.

The electron micrographs were then processed using specialist image processing software to analyze the average size distribution of residual cementite (RC) and tempered cementite. Seven SE micrographs at 6000x magnification were used, and a binary threshold was set to identify the carbides. The size of tempered carbides was evaluated using fitted ellipses. Their aspect ratio was obtained by dividing the length of the major axis by the length of the minor axis. Moreover, the size of RC was defined by the diameter.

The area fraction of material decay was determined using the Point Count method from the ASTM 562-19 protocol.

Four high-resolution images were obtained at four different depths (50, 75, 100, and 125 µm.) for each material, with each image size being 22 × 17 µm^2 (see Figure 3).

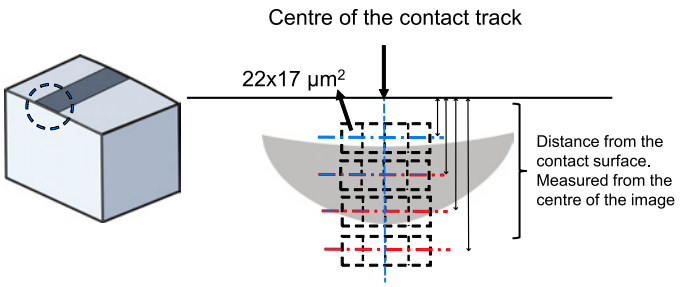


Figure 3—The sample orientation for determining the area fraction of microstructural decay in the radial section sample. The schematic indicates the size, number and position of the SEM images.

For the analysis, 374 grid points were used in each image to calculate the area fraction of material decay on the radial section of the raceway track. Figure 3 illustrates the configuration and the position of the images.

Hardness Testing

A nanoindenter with a diamond tip was used to test for hardness in the microstructural decay area on the radial section. In addition, a Knoop indenter was used for microhardness measurements on the radial sections of unetched samples.

The variation in hardness concerning depth beneath the raceway track was evaluated with the measured values from the Knoop indenter converted to Vickers hardness (HV). The first hardness indentation was performed 30 µm below the raceway track, and the hardness was measured until a depth of 350 µm below the track. Three measurements were made at each depth to increase the confidence of the measured average hardness.

Results and Discussion

Virgin Materials

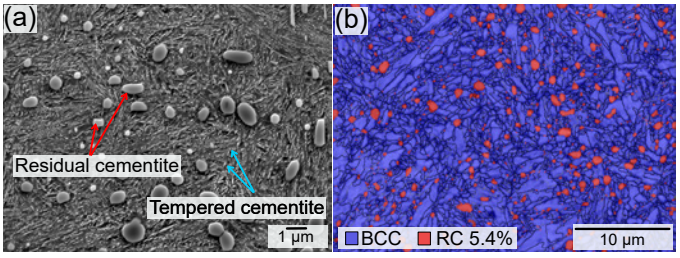


Figure 4—52100 virgin material. (a) SEM/SE micrograph showing tempered cementite and RC. (b) EBSD image quality and phase map overlaid showing martensite in grey (94.6 percent) and RC in red (5.4 percent).

Figure 4(a) shows the SEM image of the as-heat-treated virgin sample of 52100 steel. The steel has a martensitic structure with the average diameter of RC determined to be 0.72 ± 0.22 µm with an aspect ratio of 1.58 ± 0.39. The volume percentage of RC determined from the EBSD phase map is 5.40 ± 0.42, see Figure 4(b). The image analysis using the SEM micrographs indicates that the volume percentage of tempered cementite is about 15 percent.

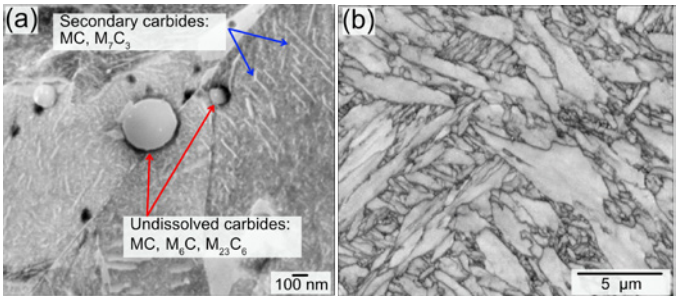


Figure 5—Hybrid Steel 60 virgin material. (a) SEM/SE image showing secondary carbides and undissolved carbides within the martensitic microstructure. (b) EBSD image quality map showing martensite laths.

The as-heat-treated microstructure of Hybrid Steel 60 is shown in Figure 5(a)(b), it comprises lath martensite, Figure 5(a)(b), secondary carbides such as MC and M_7C_3 (plate-like carbides), NiAl intermetallic precipitates, and a small number of undissolved precipitates MC, M_2C, and M_6C.

Microstructural Decay

52100 Steels

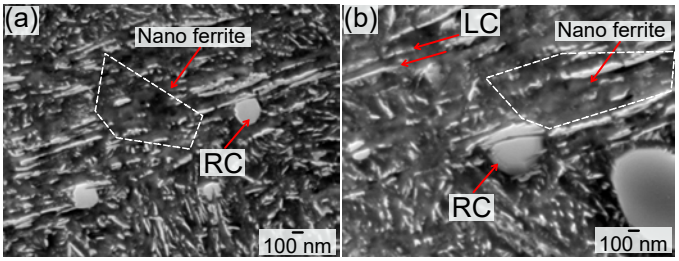


Figure 6—SEM/SE imaging of decay in 52100 steel after RCF in the CS at 80 µm from the contact surface. (a) Decay at 1.0 × 10^8 stress cycles, tempered carbides dissolution, nano ferrite patches, residual cementite decay. (b) Residual cementite decay, by ferrite intersecting the carbides, surrounded by nano ferrite patch.

The microstructural decay observed in the region of maximum shear stress (40–130 µm) in 52100 steel after testing is shown in Figure 6(a)(b). Here, the original martensite laths disappear combined with dissolution of residual cementite and tempered carbides. The disappearance of the martensite laths is related to the formation of ferrite microbands and nano-sized ferrite, as shown by the enclosed dotted white line. Figure 6(b) shows the decay of RC, where the accumulation of dislocations at the RC interface induces partial dissolution of the cementite. The figure also shows that the elongated ferrite penetrates the cementite. No tempered cementite is observed near and within the elongated ferrite and ferrite microband, indicating the tempered cementite has been dissolved.

During the initial stages of RCF, the emergence of lenticular cementite adjacent to elongated ferrite was detected. The bright contrast of the lenticular cementite resembles the tempered cementite observed in SEM/SE imaging but other than the contrast, the lenticular cementite (LC) varies in size, alignment, and position compared to the tempered cementite. Further proof is presented in Figure 7(a)(b), and has also been shown in previous research.

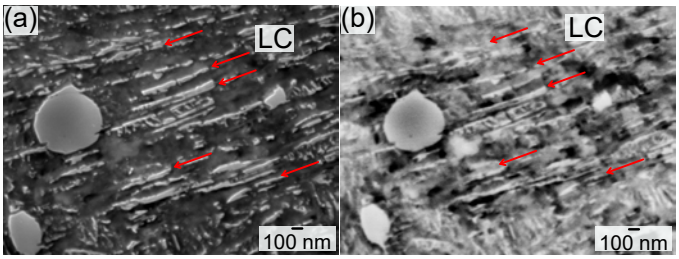


Figure 7—Microstructural decay in 52100 steel after RCF at 1.0 × 10^8 stress cycles in the CS, at 40–130 µm from the contact surface. (a) SEM/SE image reveals the presence of LC, indicated by yellow arrows. (b) SEM/BSE image of the same area as (a), bright contrast (yellow arrows) indicated the presence of LC.

Hybrid Steel 60

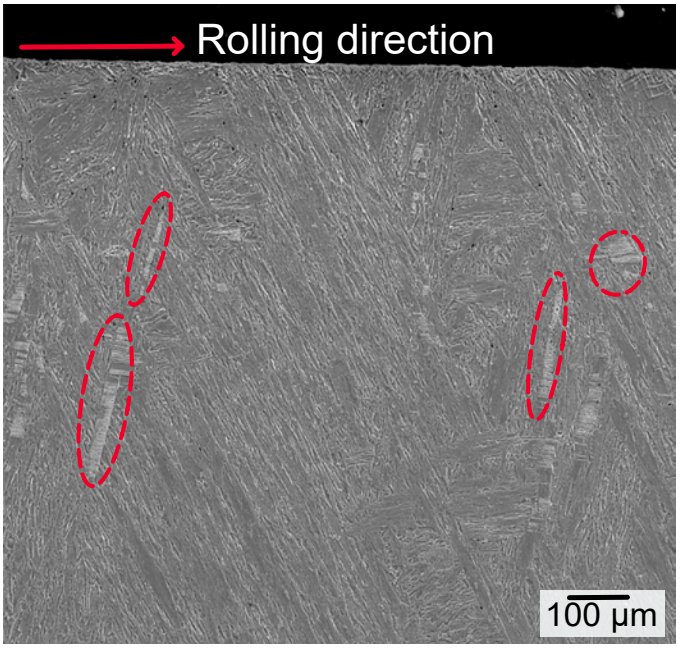


Figure 8—Microstructural decay of Hybrid Steel 60 was observed in the CS and close to the contact surface after RCF at 1.0 × 10^8 stress cycles; the red ovals highlight the decayed microstructure (ferrite microband).

Figure 8(a)(b) shows a lower magnification image of the microstructure in Hybrid Steel 60. The microstructural decay is indicated by the ellipses with a red dashed line. Not all martensitic laths contain ferrite microbands after RCF, which indicates ferrite microbands mainly form in preferred crystal orientations during RCF, i.e., in the martensite lath that is favorably oriented concerning the stress exerted during RCF.

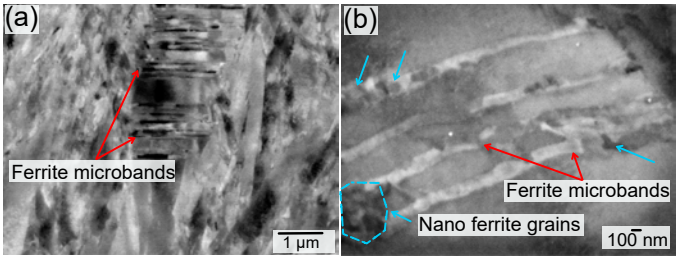


Figure 9—The microstructural decay of Hybrid Steel 60 after RCF, at 1.0 × 10^8 stress cycles in the CS, obtained at a depth of 60 µm from the contact surface with SEM/BSE imaging. (a) Ferrite microband formation across martensite lath. (b) Nano ferrite grains + ferrite microbands. This sample is not etched.

Figure 9(a)(b) shows the formation of parallel bands within martensite laths known as ferrite microbands. Some nano-sized ferrite grains are also formed adjacent to the ferrite microbands. The ferrite microbands have a size of 150 ± 28 nm and appear to form within the martensite laths that are favorably oriented for slip.

Figure 9(b) shows that the tempered martensite is replaced by the formation of ferrite microbands and nano ferrite grains (encircled with the yellow dashed line). The microstructure decay observed here is similar to that found during RCF in the 52100 steel, which the rearrangement of dislocations can explain due to cyclic microdeformation.

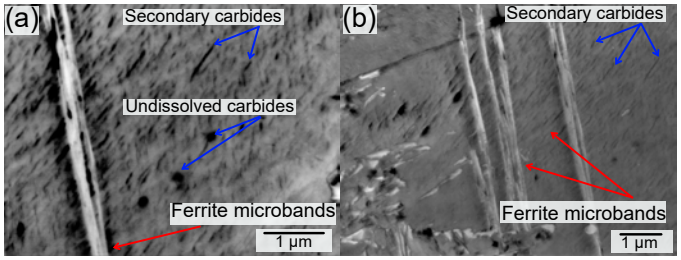


Figure 10—Microstructural decay n the Hybrid 60 steel in the CS at a depth of 60 µm beneath the raceway surface. (a)SEM/BSE image of ferrite microbands, surrounded by secondary carbides. (b) SEM/SE image of secondary carbides.

Figure 10(a)(b) illustrates the presence of secondary carbides within the martensite laths, as well as ferrite microband formation in Hybrid Steel 60 after RCF. The results show that the secondary carbides remain undissolved within the martensite lath region close to the ferrite microband, indicating their high mechanical stability. This is the critical factor for the material's high decay resistance. Alloy carbides exhibit high thermodynamic stability, making them less susceptible to dissolution due to dislocation movement and variations in dislocation density.

Comparison of Microstructural Decay in Hybrid Steel 60 and 52100 Steel

Quantification

A comparison of the different microstructural decay is shown in Figure 11a-b and Figure 12a.

In Figure 11, the area encircled by the dashed white lines shows examples of decayed microstructure. In these areas, elongated ferrite, ferrite microband, and nano-sized equiaxed ferrite can be observed.

Figure 12(a) shows the change in the area percentage of microstructural decay from the contact surface toward the interior of the sample. The shear stress distribution across the depth calculated using Hertz theory is also shown in Figure 12(b).

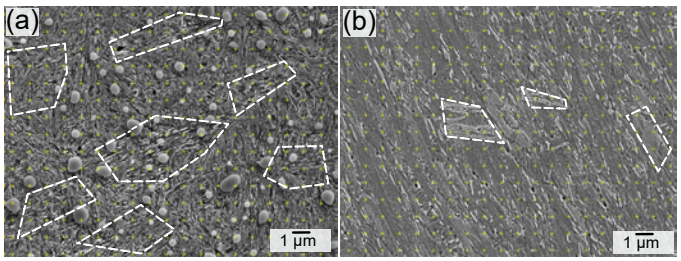


Figure 11—SEM/SE image of microstructural decay in the region of maximum shear stress after 1.0 × 10^8 stress cycles, in the radial section at 75 µm from the raceway surface). (a) 52100 steel. (b) Hybrid Steel 60.

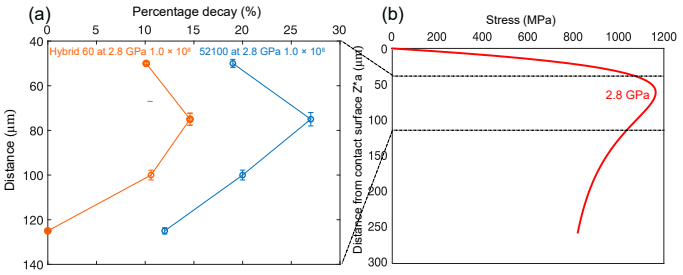


Figure 12—(a) The effect of distance from the surface on the percentage of microstructural decay for 52100 steel and Hybrid Steel 60. (b) The calculated shear stress along the center line of rolling contact. Region of maximum shear stress is indicated.

The microstructural decay increases with the depth from the surface, having a maximum value between the depths of 75 and 100 µm, where the Hertzian stress is the highest during RCF. The percentage of microstructural decay is also higher for 52100 steel than for Hybrid Steel 60.

Hardness

Figure 13a shows SE micrographs of the hardness testing indents in the decayed microstructure with elongated and equiaxed ferrite in 52100 steel. These areas have a hardness of around 7.3 ± 0.45 GPa. Figure 13b shows an indent on the ferrite microband within the martensitic lath structure of Hybrid Steel 60 steel. The hardness here is 9.03 ± 0.43 GPa.

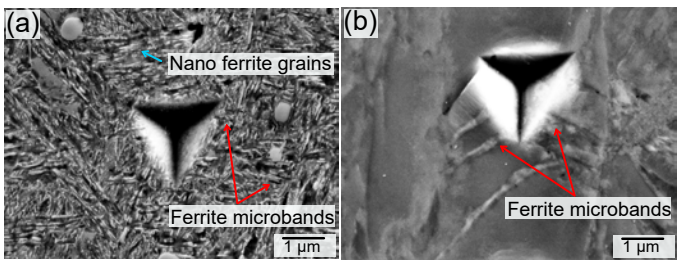


Figure 13—Nanoindentation in the region of maximum shear stress at 1.0 × 10^8 stress cycles, measured in the radial section sample and at the depth of 75 µm from the raceway surface. (a) SEM/SE image of an indent in the microstructural decay region (yellow arrows) observed in 52100 steel. (b) SEM/BSE image of an indent in ferrite microbands in Hybrid Steel 60.

The elongated ferrite in the 52100 steel has a lower hardness compared to the virgin matrix (8.73 ± 0.18 GPa), and the Hybrid Steel 60 has a slightly higher hardness in the ferrite microbands compared with the virgin matrix (8.12 ± 0.19 GPa).

It should also be noted that the Hybrid Steel 60 has a slightly lower hardness in areas with nano ferrite grains. The hardness here was 6.61 ± 0.44 GPa, and it indicates that localized softening will occur for materials that tend to form nano ferrite grains after stress cycling. The results of the nano-hardness measurements are shown in Table 3 and Table 4.

Figure 14 shows the hardness profile for the two materials after RCF for 1.0 × 10^8 stress cycles. The 52100 steel shows a softening in the region of maximum shear stress (between 40–130 µm from the surface), with a hardness value of 700 ± 15 HV. However, no change of hardness was observed in the region of maximum shear stress for Hybrid Steel 60. This indicates that Hybrid Steel 60 has more resistance toward softening during RCF.

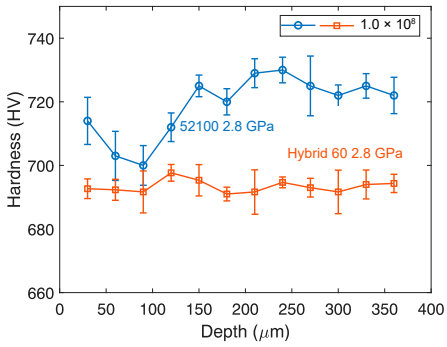


Figure 14—Micro-Vickers hardness (HV) values obtained from Knoop measurement from the radial section sample after RCF testing for 1.0 × 10^8 stress cycles.

	Matrix [GPa]	Ferrite microbands [GPa]	Nanoferrite [GPa]
Hardness	8.12 ± 0.19	9.03 ± 0.43	6.61 ± 0.44

Table 3—Measured nanohardness for Hybrid 60 steel (after 1.0 × 10^8 stress cycles).

	Matrix [GPa]	Elongated ferrite + nanoferrite [GPa]
Hardness	8.73 ± 0.18	7.3 ± 0.45

Table 4—Measured nanohardness for 52100 steel (after 1.0 × 10^8 stress cycles).

The reason for the drop in hardness in 52100 at the region of maximum shear stress is that this steel experiences higher cyclic softening due to the dissolution of cementite, including both residual and tempered cementite. This is illustrated in Figure 6(a)(b). This process occurs through the intersection of residual cementite by elongated ferrite, as well as the accumulation and interaction of dislocations at the interface between the cementite and the matrix. This aligns with findings from various previous researchers, which suggest that the binding energy between carbon atoms and the dislocation core is greater than the bonding between carbon and iron atoms in cementite.

In contrast, the reduced cyclic softening observed in Hybrid Steel 60 is attributed to the increased resistance towards dislocation rearrangement (and the formation of ferrite microband and elongated ferrite) during RCF. This is related to the increased stability of NiAl and resistance of secondary carbides to dissolution during RCF.

Conclusions and Further Work

This research program focused on using various characterization techniques to investigate the damage behavior of Hybrid Steel 60 and 52100 steel when subjected to rolling contact fatigue (RCF).

In precipitation-strengthened steels like Hybrid Steel 60, the presence of carbides and NiAl precipitates effectively inhibits the formation of dislocation cell structures, which typically cause microstructural softening in other martensitic steels such as 52100. Although partial dissolution of NiAl precipitates occurs, there is a reduced tendency for dislocation rearrangement. Our analysis demonstrated that 52100 steels exhibit a greater degree of microstructural decay compared to Hybrid Steel 60. This difference is attributed to the higher stability of precipitates in Hybrid Steel 60 under similar stress loading conditions, contributing to its enhanced resistance.

The indications are that Hybrid Steel 60 may be better suited for special bearing applications where corrosion and hydrogen resistance are required, as 52100 does not offer these additional properties. However, future work is needed to clarify the relationship between microstructural decay and fatigue crack initiation.

Another important area of research will be Tribo-corrosion fatigue testing to evaluate the impact of water-based lubricants that could potentially emerge as the leading environmentally friendly lubricant in a wide range of applications, including electric vehicles (EVs) and offshore applications.

Further Reading and References

The full results of this research program, as well as references to other work and a bibliography, can be found in Tania Loaiza Uribe's doctoral thesis with the KTH Royal Institute of Technology:

"Microstructural Decay in High-Strength Bearing Steels under Rolling Contact Fatigue."

PTE

Dr. Tania Loaiza Uribe is a research engineer in Ovako's R&D department. She has a bachelor's degree focused on materials characterization in high-strength steels and a Master's degree in advanced materials science and engineering. The research in this article was carried out in pursuit of her PhD in high-strength steels, specifically in rolling contact fatigue for bearing applications.

Dr. Mikael Thunman is Ovako Group Segment Leader for Bearings and Strategic Account Manager. He has been with Ovako for 10 years with previous roles including VP Technical Customer Service and Quality BU Hofors-Hellefors, Director Technology and Quality BU Hellefors and Director Technology and Quality BU Bright Bar.

MPIF
Announces 11 Grand Prize Powder Metal Designs

The Metal Powder Industries Federation (MPIF), demonstrates outstanding examples of PM's diversity and ability to meet critical requirements. From electric vehicles to musical instruments to semiconductors, once again, parts fabricators have demonstrated PM's versatility and unique ability to challenge competing technologies. These award-winning components use PM's flexibility to push forward new concepts and process controls to demonstrate the inexhaustible range of PM's capabilities. Eleven Grand Prizes and twelve Awards of Distinction were given in this year's competition, segmented into 3 categories: Conventional Press and Sinter PM; Metal Injection Molding (MIM); and Metal Additive Manufacturing (AM).

In the Automotive—Engine Category for Conventional PM components, a Grand Prize has been awarded to DSB Technologies for a stainless-steel flange that connects a urea injector to the exhaust system of a diesel engine.

A Grand Prize in the Automotive—Transmission Category for Conventional PM components has been awarded to PMG Holding GmbH for a sliding sleeve used in a synchronizer for a dedicated hybrid transmission. The parts are produced net-shape except for the external fork groove.

A Grand Prize in the Automotive Electric Vehicle Category for Conventional PM components has been awarded to GKN Sinter Metals for an electric selectable one-way-clutch wedge washer that enables seamless gear changes and provides regenerative braking capabilities. The wedge washer is made using a sinter-brazing process to join two compacted PM parts.

In the Automotive Electric Vehicle Category for MIM components, a Grand Prize has been awarded to Hangzhou Sino-MIM Technology Co. Ltd. for a MIM-316L stainless steel grounding diaphragm bracket that supports structural parts for optical lenses inside an automotive LiDAR (Light Detection and Ranging) unit. This challenging part has relatively high requirements for the overall dimensional accuracy, the edge chamfering, and the flatness of the product.

A Grand Prize in the Military/Firearms Category for MIM components has been awarded to ARC Group Worldwide, for a pistol slide that encapsulates the barrel of the pistol and pushes the hammer back into the ready-to-fire position after every shot of the firearm.

A Grand Prize in the Lawn & Garden Category for Conventional PM components has been awarded to Metco Industries, Inc. for a throttle pedal for off-highway construction equipment. The part is compacted conventionally to near-net shape using a hydraulic press with fill compensation and selective ejection.

A Grand Prize has been awarded in the Electronic/Electrical Components Category for MIM components to Hangzhou Sino-MIM Technology Co. Ltd. for a copper alloy optical module housing used for efficient heat dissipation. The heat generated by the components inside the product need to be dissipated through the housing.

In the Hand Tools/Recreation Category for MIM Components, a Grand Prize has been awarded to ARC Group Worldwide for a knife blade used in a consumer pocketknife.

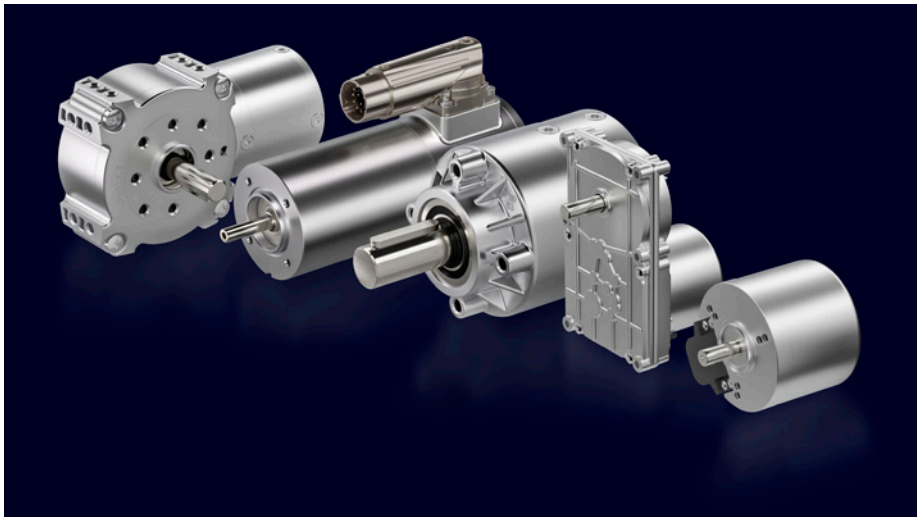
A Grand Prize in the Hardware/Appliances Category for MIM components has been awarded to INDO MIM LIMITED for pocket and keeper module parts for caravan door hinges. The parts are made from a niobium-stabilized austenitic chromium-nickel stainless steel.

In the Medical/Dental Category for MIM components, a Grand Prize has been awarded to INDO-MIM LIMITED for an A-to-Z expander assembly used in dental orthodontic treatment and sleep apnea. The palatal expander widens a narrow palatal arch helping to normalize the shape of the palate and promote nasal cavity expansion.

A Grand Prize has been awarded in the Electronic/Electrical Components Category for Metal AM components to 3DEO, Inc. for a copper heat sink used in semiconductor

manufacturing. The heat sink's complex lattice design was developed in conjunction with the customer to maximize heat transfer efficiency while maintaining printability.

mpif.org



SIEMENS

Completes Acquisition of Ebm-Papst's Industrial Drive Technology Business

Siemens AG closed its acquisition of ebm-papst's industrial drive technology business. In the future, it will be marketed using the name "Mechatronic Systems" at Siemens. The business has about 650 employees and its portfolio includes intelligent, integrated mechatronic systems in the extra-low voltage protection range, innovative driving systems used in free-moving, driverless transport systems, and other applications. This acquisition complements the Siemens *Xcelerator* portfolio, strengthening Siemens' position as a leading provider of flexible manufacturing automation solutions. Integrating the new portfolio into the existing automation portfolio and leveraging Siemens' global sales network will open new markets and significant business potential in the field of intelligent, battery-powered drive and robot solutions.

"The new portfolio elements significantly expand and enhance our offerings to customers who want to automate and digitalize their production processes in smart factories. Our integrated mechatronic drive systems offer increased flexibility, productivity and efficiency in the growing global market for conveyor and autonomous transport systems, including mobile robots, driverless transport systems and shuttles," explains Achim Peltz, CEO of the Motion Control Business Unit at Siemens Digital Industries. Their seamless compatibility with Simatic controllers and the software-based safety solution *Safe Velocity* for mobile robotics offer extra advantages.

The expanded portfolio includes two main variants: the Simotics E-1EE1 (brushless internal rotors), which are particularly suitable for battery-powered conveying, storage and sorting systems; and the Simotics E-1EV1 (brushless outrunners), which impress with their high efficiency and compact design in intralogistics applications. The portfolio is available in 24 V and 48 V versions. The portfolio also offers transmission solutions, which are only available in conjunction with Simotics E motors. A notable innovation is the Simotics E ArgoDrive driver steering system, which was specially developed to meet the growing demands of intralogistics and automated production. Available in Light, Standard and Heavy variants, it enables the safe and precise omnidirectional control of automated guided vehicles, even when carrying heavy loads.

These systems support Siemens' sustainability goals by providing energy-efficient solutions and helping create flexible, scalable and secure digital factories. The newly integrated business comprises three locations: two in Germany (St. Georgen and Lauf an der Pegnitz) and one in Romania (Oradea).

The ebm-papst Group first announced its intention to sell its Industrial Drive Technology (IDT) division to Siemens AG in March of 2024, and both parties signed an agreement to this effect. The sale to Siemens AG has now been completed, giving IDT access to the international market through Siemens' global Sales organization. This creates new opportunities for innovation and continued business growth. All the division's employees have been taken on by Siemens. The parties involved have agreed to not disclose the price.

siemens.com

NORD DRIVESYSTEMS

Expands Training Programs with In-Person, Online and Customized Sessions

Nord Drivesystems offers a comprehensive range of mechanical and electronic solutions that power industries worldwide. They've established themselves as a trusted manufacturing partner thanks to a strong commitment to quality and service, focus on innovation, and full customer support from idea to implementation. To further help their customers, they offer numerous training opportunities.

One type of training Nord offers is Open Training for their Authorized Distributor network, hosted several times per year across their US facilities. This free, in-person training is designed to deepen understanding of Nord's products and services, helping attendees build upon their existing knowledge base and solidifying confidence in their products. These three-day sessions are led by industry experts and cover Nord's gear units, Maxxdrive industrial gear

units, electric motors, and electronic control products. They also provide in-depth discussions on general gear unit selection, Nord nomenclature, literature, as well as an introduction to the *myNord* online configurator and experience building Universal SI worm gear units. Each Open Training additionally features a guided plant tour providing an inside look at Nord's manufacturing processes.

For distributors and OEMS with larger groups who prefer to have closed training sessions, Nord offers private training opportunities. These sessions can be held where requested by the distributor such as their facility, a customer or other off-site location, at one of Nord's facilities, or online. The training curriculum is matched entirely to the distributor's needs, ensuring they have what they need to support their customers.

Nord also offers trainings on the myNord online customer portal presented by the eBusiness team. These trainings provide a comprehensive overview of how to effectively utilize Nord's online tools to configure products in the online configurator, generate quotes with account-specific pricing, track existing orders, and place orders through the Spare Parts Shop. How to access previous order history, download CAD files, and look up serial number documentation, operation, and maintenance manuals is also discussed in the training. These trainings are open to customers and distributors in person at a designated facility, during Open Distributor trainings at Nord facilities, or via an interactive online course.

In addition to in-person and virtual training sessions, Nord now offers live online seminars. These 45-minute short format training sessions offer flexibility to learn from work, home, or anywhere you choose. Each session focuses on specific topics, going in-depth for comprehensive subject knowledge. Following each presentation is a Q&A session with the Nord expert presenter, enabling direct answers to any questions that arise. The webinars are recorded, so if you can't attend at the scheduled time, you can play it back and not miss out on the course information.

If you have a training idea that Nord doesn't currently offer, they are open to new ideas and customized training programs. Their trainers will work with you to create a program that meets your needs and focuses on the topics that are most important to your company.

info.nord.com/en-us/training-opportunities

MOTION INDUSTRIES

Opens New Branch in Quebec

Motion Industries, Inc. is pleased to announce the opening of a new sales branch in Quebec, Canada. The new facility, located at 2903 7th Street, Val-d'Or, officially opened on June 2, 2025. This strategic location strengthens the company's ability to better serve and expand its customer base in Northern Quebec.

The Val-d'Or facility joins an extensive network of approximately 70 Motion branches across Canada, further expanding the company's market footprint. Services include product order fulfillment supported by a large inventory network, as well as engineering and repair services in pneumatics, hydraulics and power transmission. The location also offers industry training opportunities for customers.

Motion's new Val-d'Or branch enhances customer service in Northern Quebec. Brent Pope, Motion's senior group vice president, Canada & Sales Excellence, said: "This new branch is set up for success thanks to its experienced team, innovative services and strategic industrial park location. It reflects our commitment to supporting Quebec's economy by delivering expert solutions and fostering strong community connections."

James Howe, president of Motion, added: "By establishing a foothold in Northern Quebec, we can now provide local customers with faster, more responsive service to help keep their facilities running smoothly. We're eager to build lasting relationships through exceptional service."

In addition to providing industry-leading services, the branch will create opportunities for skilled jobs in Quebec, stimulating the local economy and supporting a thriving community.

motion.com

August 19–21

ABMA Essential Concepts of Bearing Technology

This course is specially designed for engineers and others with technical backgrounds that have had limited exposure to bearings and need to adapt their technical training to bearings or seek an upgrade to their technical knowledge. The Essentials Course focuses on understanding basic internal geometry, tribology, bearing attributes and applications and explores the basic concepts around manufacturing methods, loads, internal load contacts, lubrication and failure.

powertransmission.com/events/abma-essential-concepts-of-bearing-technology-2025-04-18

September 10–12

11th International VDI Conference on Gears 2025

The 11th International VDI Conference on Gears 2025 will be held in Garching, Munich at the Gear Research Centre (FZG) of the Technical University of Munich. Supported by national and international associations, the conference brings together 500+ leading experts from the international gear and transmission industry. Visiting the conference gives attendees the opportunity to take part in this leading international forum and learn about the latest developments and research results in the powertrain industry and academia. The conference is a unique meeting point for propulsion system manufacturers and researchers of gear and transmission systems.

powertransmission.com/events/11th-international-vdi-conference-on-gears-2025

September 15–17

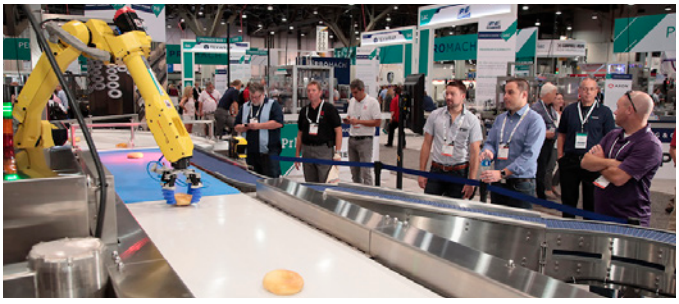
CAR Management Briefing Seminars 2025

The Center for Automotive Research (CAR) MBS leads the industry in providing a context for auto industry stakeholders to discuss critical issues and emerging trends while fostering new industry relationships in daily networking sessions. The CAR Management Briefing Seminars take place at Michigan Central Station in Detroit. Seminars include sessions on manufacturing strategy, connected and automated vehicles, advanced powertrain, supply chain, sales forecasting, purchasing, talent and designing for technology, future factories, design optimization, the mobility ecosystem and more. Roundtables will focus on cybersecurity, policy updates, sustainability, decarbonizing, electrification and more.

powertransmission.com/events/car-management-briefing-seminars-2025

September 29–October 1

Pack Expo Las Vegas 2025

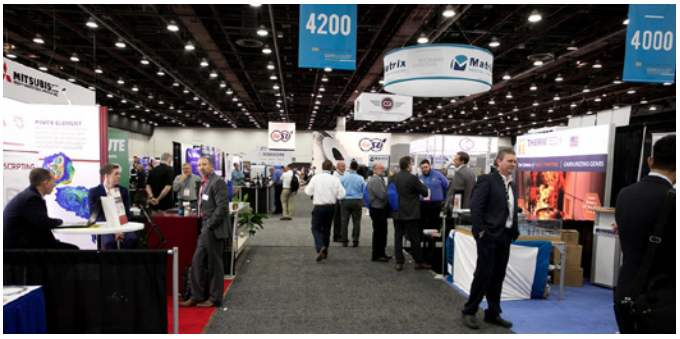


Pack Expo Las Vegas features targeted pavilions or "shows within a show" featuring solutions that address many industry challenges. All of the pavilions have expanded, reflecting the tremendous market growth in packaging and processing. The Logistics Pavilion: With the rapid expansion of e-commerce, this pavilion will feature cutting-edge supply chain solutions, including warehousing, fulfillment, distribution logistics, and transportation providers. The Processing Zone: This area showcases the latest processing innovations, including homogenizing, heat treating, forming/sizing, and coating solutions. The Healthcare Packaging Pavilion: Focused on life sciences, this pavilion will showcase packaging innovations for pharmaceuticals, biopharmaceuticals, nutraceuticals, and medical devices. The Showcase of Packaging Innovations: Sponsored by Smurfit Westrock, this attendee favorite will display award-nominated packaging solutions.

powertransmission.com/events/pack-expo-las-vegas-2025

October 21–23

Motion + Power Technology Expo 2025



Produced by AGMA, Motion + Power Technology Expo (Detroit) is a three-day show that connects professionals looking for motion power solutions with manufacturers, suppliers, and buyers. Attendees will find new power transmission parts, materials, and manufacturing processes. Buy, sell, and get business done with organizations in aerospace, automotive, agricultural, energy, construction and more. Forge partnerships at one of the largest gatherings of CEOs, owners, engineers, sales managers, and other professionals in the electric, fluid, mechanical and gear industries. End-users can shop the latest technology, gear products, and services from leading manufacturers. No matter your industry, you will find new ideas and solutions that can benefit your plant and company. Hundreds of exhibitors and attendees means MPT Expo is a unique opportunity to find partners that can help fulfill your specific production needs.

powertransmission.com/events/motion-power-technology-expo-2025

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The Hidden Workforce Behind Smart Automation

A book review of *Waiting for Robots*

Aaron Fagan, Senior Editor

In an industry built on motion, efficiency, and precision, it's easy to accept the idea that artificial intelligence and automation are ushering in a post-labor future. We hear daily that machines are learning, adapting, and replacing human intervention across the supply chain—from predictive maintenance to intelligent inspection and beyond. But *Waiting for Robots* (a title that knowingly echoes Samuel Beckett's play *Waiting for Godot*) by Antonio A. Casilli offers a critical counterpoint that deserves attention from anyone working in automation or industrial systems. Like Beckett's elusive Godot, the fully autonomous future we're promised never quite arrives—and meanwhile, humans keep doing the work.

Waiting for Robots: The Hired Hands of Automation ***by Antonio A. Casilli, translated by Saskia Brown (University of Chicago Press, 2025).***

Casilli, a sociologist of technology, argues that today's automation is far from autonomous. Whether it's the AI in your smart sensor or the algorithm managing your warehouse logistics, it almost always relies on a vast layer of invisible human labor: underpaid workers tagging images, verifying outputs, or providing the training data these systems can't function without.

Casilli's analysis hits close to home for industries embracing digital transformation. Behind the dashboards of AI-enabled condition monitoring, vision systems, and predictive maintenance tools are thousands of human workers performing repetitive digital tasks—like labeling vibration signatures, validating image recognition outputs, or cleaning sensor data—often under contract in low-wage regions. Far from being fully autonomous, many so-called intelligent systems still rely on this hidden layer of human input to function reliably.

For readers in mechanical power transmission and manufacturing, Casilli's insights are a wake-up call. As companies integrate more AI-enabled tools into operations, from predictive maintenance software to generative design, understanding the human scaffolding behind these systems is crucial. Not just for ethical sourcing or supply chain transparency, but because recognizing the real limits of automation leads to better planning, smarter systems, and more sustainable strategies.

Casilli doesn't argue against automation; he argues against magical thinking. Automation, he reminds us, doesn't eliminate labor—it redistributes it, often invisibly and unjustly. His call for greater transparency and accountability in how digital systems are built and maintained is especially relevant as industries integrate AI tools more deeply into operations. "We are the ones who make the robots, with our own labor," he writes. "We make the criteria according to which they operate. And then we teach them to learn how to improve. The problem is not that robots are stealing our work, but that we continue to work more and more, and that the platforms are fragmenting and rendering invisible the labor that is necessary to make the algorithms work." In a world increasingly shaped by hidden hands, recognizing the real human costs of seamless technology is not just ethical—it's strategic.

This is a provocative, well-researched, and timely read for engineers, executives, and system designers. In the age of smart machines, the most powerful force in automation may still be human labor—only now it's harder to see. And just like Godot, the robots we're waiting for might never come—at least not without us working quietly behind the curtain, keeping the show running.

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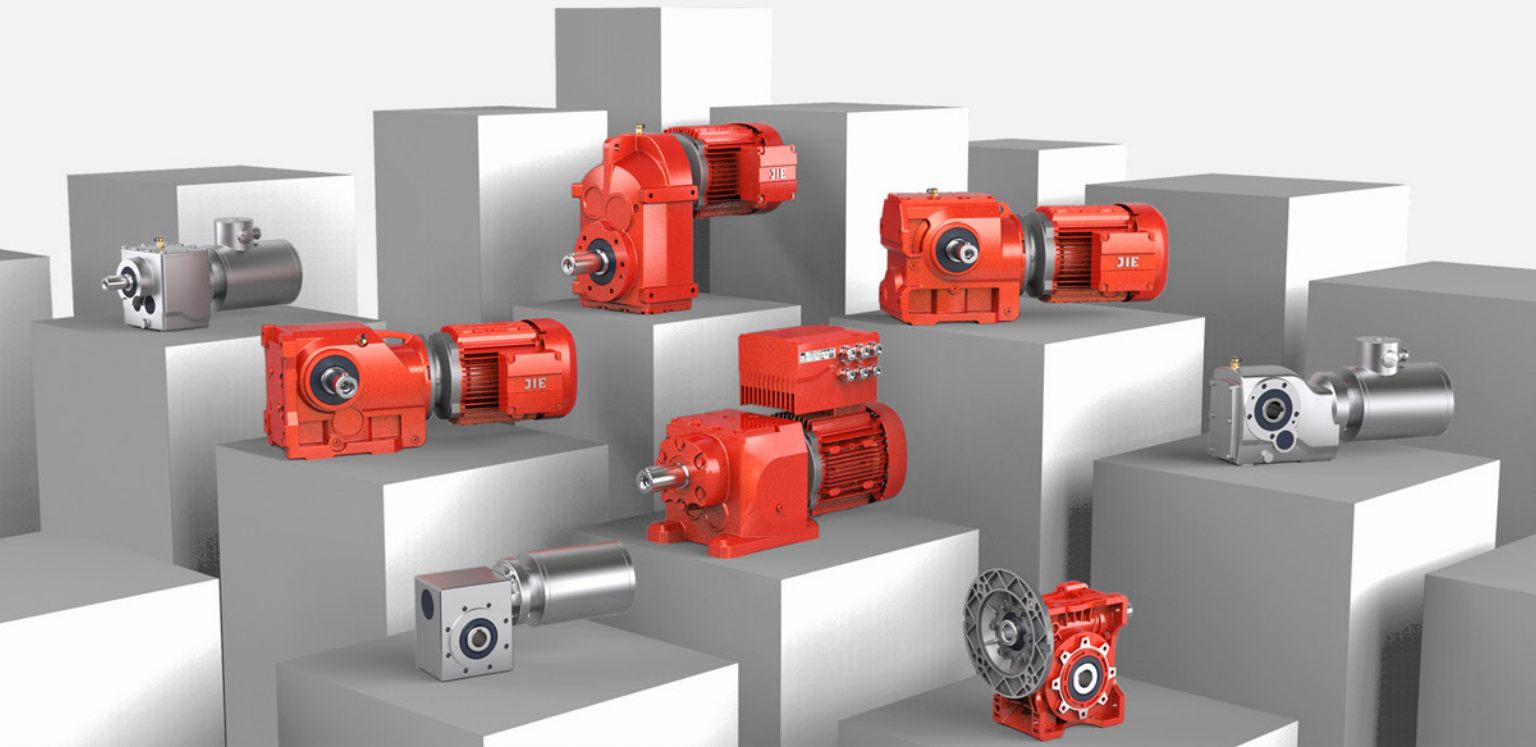

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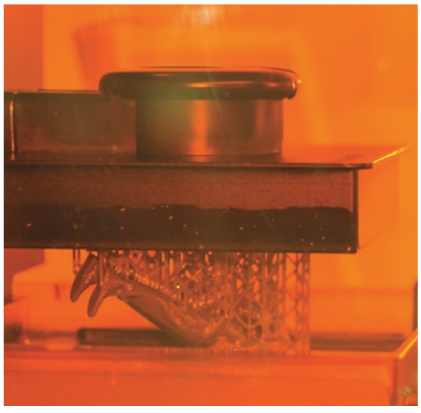

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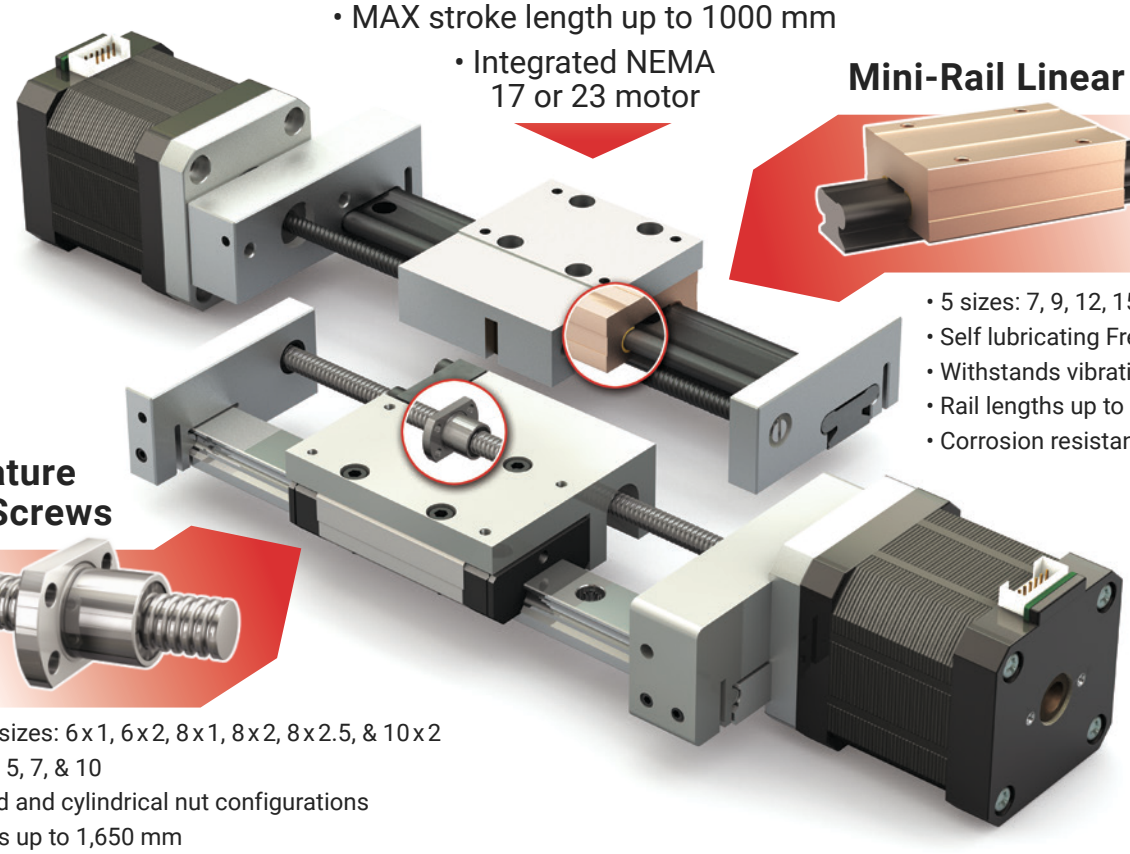

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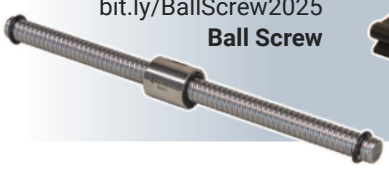

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