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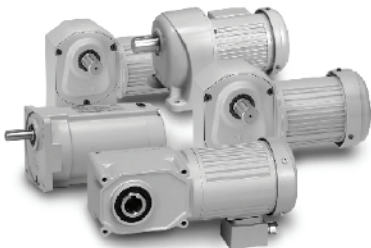


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Owner and Engineer Manager
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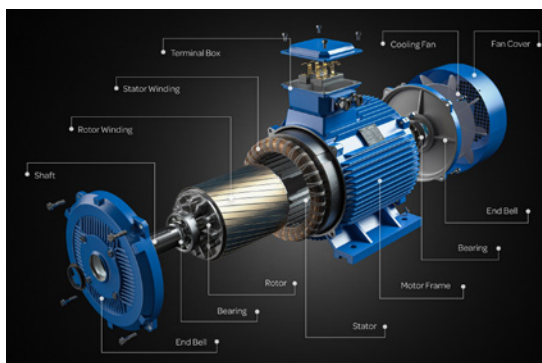
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Power Transmission Engineering

SEPTEMBER 2022



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The American Gear
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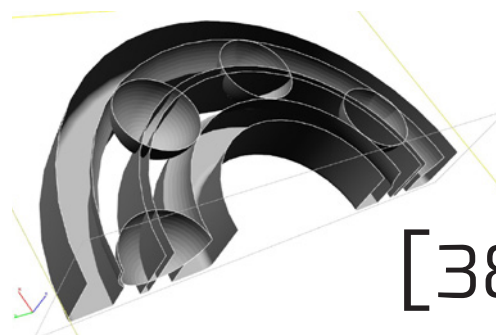
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Videos

Celera Motion Inductive Encoders

Celera Motion Incoder Inductive Angle Encoders are noncontact, inductive angle encoders for high-precision, reliable measurement in harsh medical, industrial, and aerospace environments.

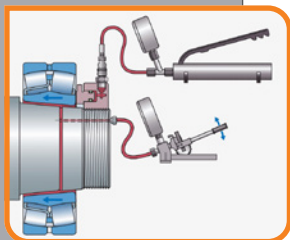
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SKF Oil Injection Method

This video shows how easy it is to remove a component from a cylindrical shaft, using the SKF Oil Injection Method.

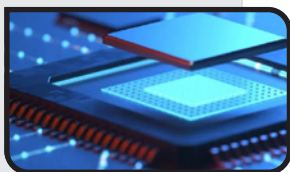
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PTE Revolutions Smart Solutions for Bearings, Motors and Drives

IIoT and digital solutions from Iigus, ABB, Telit, and Maxon continue to advance component technology into the future. Learn some of the latest smart manufacturing news in this recent *PTE* blog:

powertransmission.com/blogs/1-revolutions/post/8766-cti-symposium-germany-reflects-push-toward-e-mobility



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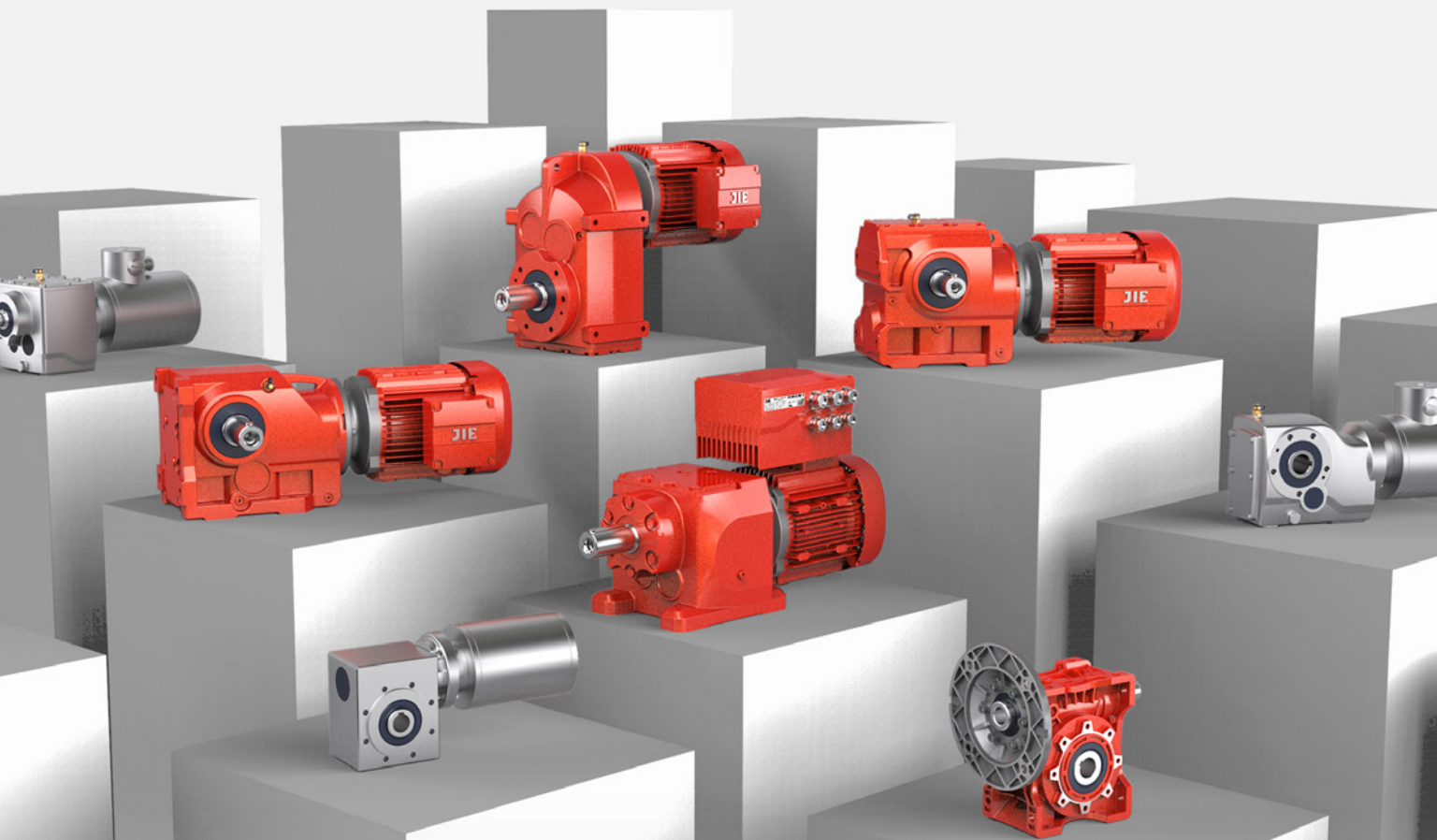
Michael Goldstein founded *Gear Technology* in 1984 and *Power Transmission Engineering* in 2007, and he served as Publisher and Editor-in-Chief from 1984 through 2019. Michael continues working with both magazines in a consulting role and can be reached via e-mail at michael@geartechnology.com.

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Why You Should Write



In 1946, George Orwell wrote a rather famous essay titled, "Why I Write." In it, he outlined four basic reasons why writers do what they do: 1) sheer egoism, 2) aesthetic enthusiasm, 3) historical impulse, and 4) political purpose. And while those reasons may have been sufficient for the author of *1984* and *Animal Farm*, I think there may be a couple of other reasons that apply especially to what we do here at *Power Transmission Engineering*.

You see, we're looking for a few good contributors, and I've got a couple of good reasons to encourage you to do so:

1. To help us educate and train the next generation of power transmission and motion control specialists.

We work in a very technical field, with ever increasing demands for more torque in less space, running more efficiently and quietly than last year's models. The technical specifications for gears, bearings, motors and all the related components and machinery are continuously evolving, and it's our mission to help keep the industry informed of those changes. On top of that, both new engineers and seasoned veterans can always use a refresher course on the basics.

So help us with that mission. Help us educate and train the workforce on the technology of mechanical power transmission. If you have experience in our industry and you've learned a thing or two, why not share that knowledge and pass it on?

2. To give back to the industry that has supported your career..

We come across many individuals who are at or near the end of their careers, having worked decades with power transmission components. Those individuals are often grateful for the opportunities they've received and the careers they've been able to build. If that sounds like you, then one of the ways you can give back to the industry is by sharing the knowledge you've earned. *Power Transmission Engineering* is the perfect vehicle for doing so.

We're looking for unbiased technical information that helps our readers understand how machines work. The articles don't have to be university-level research (although we

welcome that, too). What we need most are practical, hands-on articles that show engineers how to build better power transmission and motion control systems. We need pro tips that help maintenance professionals choose the right components and keep them running at peak efficiency and minimum cost. Both engineers and maintenance professionals are often in a position of deciding or recommending which components or systems to buy. Help us help them make the right choices.

If you need a good example for inspiration, just turn to page 38 for Norm Parker's article, "Ball Bearing Limiting Speeds." It's good, hands-on, practical knowledge that our readers can use. Maybe you have similar practical knowledge on gears, couplings, clutches or brakes? If so, we'd love to hear from you.

For even more ideas, you can download our Editorial Guidelines at powertransmission.com/contribute.

While I can't promise you that your writing will have the kind of lasting impact that George Orwell's writing has had, I can promise you that it will have impact. Knowledge shared is far more powerful than knowledge hoarded. If you have some ideas, we'd love to help you share them. Reach out at stott@agma.org.

Randy Stott

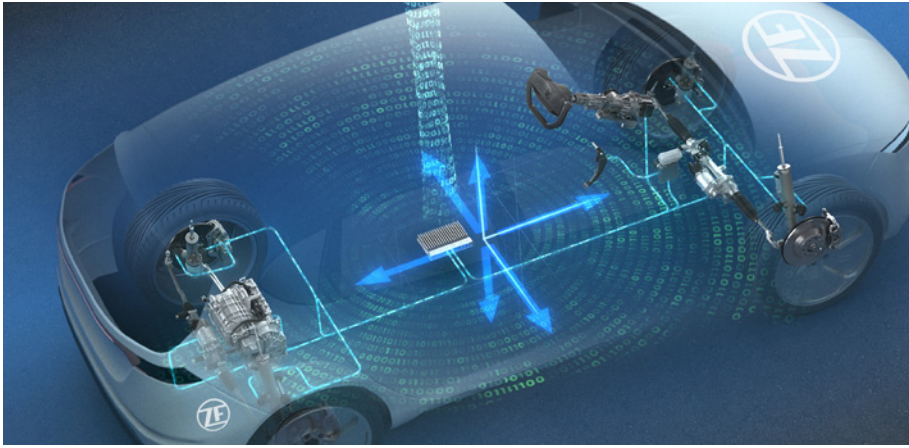


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ZF

ENHANCES E-MOBILITY AND MOTION CONTROL PLATFORM

As vehicles become increasingly electrified, automated, and software controlled, ZF is at the forefront of developing and industrializing advanced chassis systems with the industry's most comprehensive offering of by-wire technologies that no longer require a mechanical connection or system fluids. A primary example is ZF's steer-by-wire solution. ZF revealed that it has been awarded significant volume contracts by multiple major car manufacturers that will launch in all major regions as of 2023.

"ZF's smart by-wire systems end the era of mechanical connections and enable a new era of vehicle control," said ZF's CEO Wolf-Henning Scheider. "ZF's steer-by-wire technology enables new safety and comfort features, like autonomous emergency evasive maneuvers or parking in very confined spaces. It marks a breakthrough on the way to fully self-driving cars and trucks by adding new design and engineering freedom."

For example, ZF steer-by-wire systems enable fully autonomous vehicle control for shuttles and robotaxis. For personal passenger vehicles it also offers unique capabilities like retractable steering wheels for fully automated driving modes, fully adaptable steering control reducing the hand-wheel angle for parking or low-speed maneuvers and enhanced crash safety through the removal of the steering column. By-wire represents the

perfect fit for future electric and automated vehicles.

ZF recently premiered its advanced steer-by-wire system to international media and announced that this technology will be launched with industrial scale by a major global automaker within the next year.

And ZF has procured additional customer contracts in all major regions for its steer-by-wire systems for series production, establishing itself as a leader in this technology field. Similarly, on the braking side of the equation ZF is the global leader in the production of its Integrated Brake Control system that is also primarily controlled using by-wire technology.

Thanks to its complete portfolio, ZF is very well positioned to capture further significant market share in the growing by-wire chassis systems field and expects a significant share of the steer-by-wire market by 2030.

"ZF is actively shaping the clean and autonomous future of mobility by launching advanced suspension-, steer-, and brake-by-wire systems that will become more commonplace due to the many advantages they offer. And ZF's software and high-performance computing platforms such as cubiX and the Vehicle Motion Domain Controller complete the picture and together create a new level of system performance. This is a perfect demonstration of how much ZF has changed into a tech company by understanding digitalization and decarbonization as opportunities for its development," Scheider said.

ZF is a leading developer and produces a full range of by-wire systems

that do not require a direct physical connection: Steer-by-wire including rear wheel steering, brake-by-wire with integrated brake control and electronically controlled active suspension.

These technologies are being combined to yield system solutions that offer enhancements greater than they can alone. Here software and combined E/E architectures play a key role in adding value. By-wire systems offer greater degrees of vehicle control offering shorter stopping distances, more degrees of freedom in maneuvering, better stability at high speeds and greater range and efficiency.

With by-wire technologies the amount of steering assist or brake torque can be tuned to mimic the typical feel that drivers expect but can also be instantly adjusted to enhance brake force to reduce stopping distances or steer around an obstacle more expertly than drivers can do themselves.

zf.com

MESYS

SOFTWARE VERSION 06/2022 IS AVAILABLE

A new version of the *MESYS* shaft and rolling bearing analysis software including new functionality is available. The bearing analysis software allows the calculation of the load distribution within the bearing and bearing life according to ISO/TS 16281 and it is integrated in a shaft system calculation with additional possibilities like modal analysis, strength calculation for shafts and interfaces to gear calculations. Currently the software is used by customers in 30 countries on four continents.

General Extensions

Some start parameters were added to allow an easier integration with other systems. Using the COM-Interface, now the parameter calculation can be called to generate additional results. The default for the Help system was set to an external viewer, which can also be started from network drives. Custom formulas can now be used within the parameter variation.



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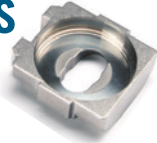
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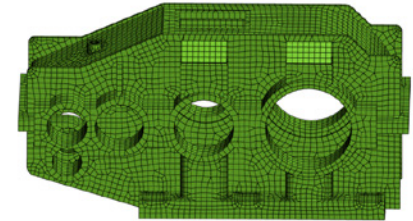
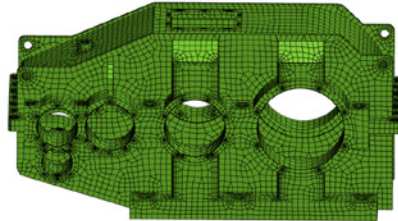
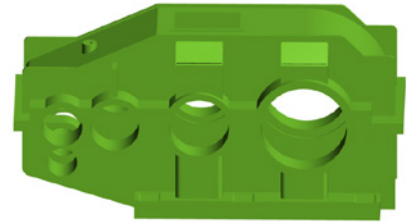
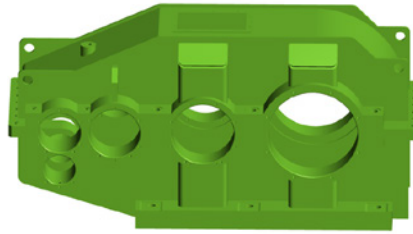
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Extensions in the Bearing Calculation

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

Regarding the bearing databases including internal geometry, the databases from CSC and HQW/Barden are unchanged from the last version. On request, additional databases are available from some bearing manufacturers, for example from GMN or IBC.

As new bearing types, toroidal roller bearings and double row thrust cylindrical roller bearings were added. In contrast to barrel roller bearings, toroidal roller bearings have no shoulders and allow larger axial displacements. The radial clearance is dependent on axial displacements. The double row thrust cylindrical roller bearings have the same roller dimensions for both rows.

The track roller calculation with elastic outer ring is now also supported for double row deep groove ball bearings. Previously, a configuration of two single row bearings had to be used.

Interference fits affect the operating clearance of bearings. As there had been some customer requests

now also multilayer interference fits can be defined. For the inner and outer ring fit several layers using different materials can now be defined. Influence of centrifugal forces and temperature is considered.


Extensions in the Shaft Calculation

For the calculation of frequency response, a new dialog was added. It allows users to calculate the response to periodic excitations in a frequency range and shows the resulting displacements, velocities, or forces for several locations in one diagram.

An extended calculation model for bearings allows to specify three contacts for each bearing ring. The bearing ring can be connected to one part radially and to one part on each axial contact. Clearance between bearing ring and shaft or housing is considered automatically if the fitting is defined for the bearing. This leads to tension in the inner shaft and to pressure in the spacers.

For 3D-elastic parts a new import library is used for STEP import. This allows to do some defeaturing on import. By removing chamfers, radii and small bores, the number of elements can be reduced and therefore reduction time and memory usage.

For 3D-elastic shafts, orthotropic material can now be defined in cartesian coordinates in addition to cylindrical coordinates as before.



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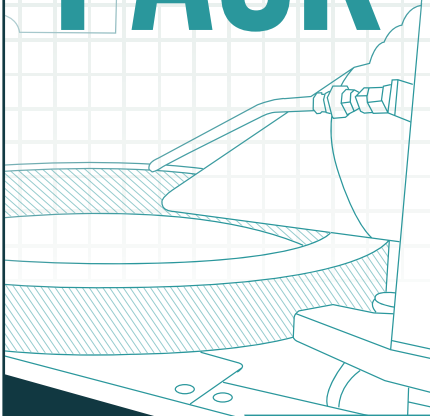
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Extensions in the Ball Screw Calculation

Several diagrams are added to the ball screw calculation which already had been available in the bearing calculation. So, diagrams for contact stress and sliding speed or wear parameters have been added.

mesys.ag

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NORD's LogiDrive complete drive solution reduces planning and commissioning efforts by offering an energy efficient, standardized, and service-friendly system that is Industry 4.0 Ready. Permanent Magnet Synchronous Motor (PMSM) technology enables the LogiDrive system to maintain high efficiency even in partial load ranges and low speeds—making the solution especially suited towards intralogistics, warehousing, and airport applications.

This solution reduces system variants through standardized geared motor selections tailored specifically to application needs and a large operable speed range via variable frequency drive technology. Simplifying engineering and selection into a compact, modular design significantly reduces spare parts inventory, enables fast commissioning through plug-and-play technology, and allows replacement of individual components. The plug-in connections on the base product also enable easy maintenance, service, and installation.

When it comes to gearbox options for the LogiDrive package, two-stage helical bevel gear units or the new DuoDrive integrated gear unit and motor are available. Two-stage helical

bevel gear units are made from high-strength aluminum alloy and feature an open housing option for better heat dissipation for high axial and radial loads. They excel in conveying and processing applications while providing a more efficient and reliable solution than typical worm units. The DuoDrive integrated gear unit and motor features a compact, UNICASE™ housing and delivers an extremely high gear efficiency of up to 92 percent. These drives also feature high power density, quiet operation, and fewer wear parts for low maintenance and a long service life.

NORD's IE4 and IE5+ synchronous motors provide some of the highest efficiencies currently available. The use of this technology in the LogiDrive system minimizes overall costs during service life, provides a faster return on investment, and maximizes system availability. When these motors are paired with the NORDAC LINK VFD, high precision regulation and increased system accuracy is achieved. This optimized combination also results in large overload capacities capable of constant torque over a wide speed range.

NORDAC LINK variable frequency drives offer quick installation and servicing thanks to their quick disconnect cable options, integrated maintenance switch, and local manual control options. These decentralized VFDs feature functional safety options, an internal braking resistor for controlled, dynamic braking, and parametrization via plug-in control modules, NORDCON software, or NORDCON app. As part of the complete LogiDrive package, NORDAC LINK supports a large speed range—enabling automation for a variety of applications such as stacker cranes, automated transports, baggage handling systems, and conveyor systems.

nord.com



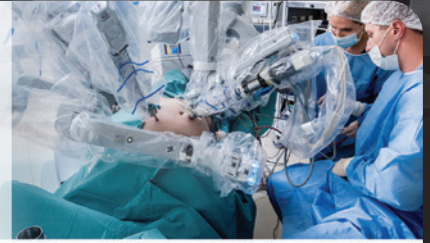
JW Winco

INTRODUCES SMART INDEXING PLUNGERS

JW Winco expands its indexing plungers' range while adding new technical functionality. The latest addition, type

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GN 817.7, is pneumatically actuated and can be integrated seamlessly into automated processes thanks to state-of-the-art sensors.

JW Winco offers a wide assortment of indexing plungers with various features. Their development team consistently succeeds at integrating new functionality that provides new application possibilities.

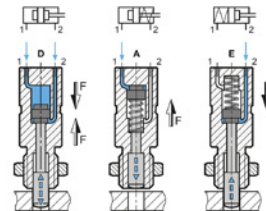
The most recent indexing plunger development is pneumatically actuated. In addition, the part also detects both end positions with just a single sensor. This makes the GN 817.7 a logical advancement over the manually operated indexing plunger GN 817.6. The GN 817.7 can replace the GN 817.6 without changing dimensions or signal processing. The new plunger can also be used in hard-to-reach locations and integrates into automated processes.

The position detection of GN 817.7 is proven magnet technology with added innovation. Not only are both end positions now detectable, but they can also be individually defined. Perform the sensor teaching directly on-site with a small operating element on the sensor, held in place by a clip and supported by a cable. There are even LEDs for visual feedback. The other option for teaching is to use the convenient IO-Link feature via the system control unit. This standardized interface makes teaching easy and allows immediate replacement in the case of faults, significantly reducing downtime.

The high signals upon reaching the respective end positions are transmitted directly over the 4-pin M8 cable plug to the control unit of the system.

The GN 817.7 is made of robust stainless steel and is available in four plunger diameters and three functional variants. Type D is double-acting, meaning the plunger is pneumatically retracted and extended. Types A and E are single-acting, meaning the pneumatic actuation retracts the plunger in the case of type A and extends it in the case of type E. Note: The spring-loaded plunger always returns independently to its initial position if air pressure is lost.

The indexing plunger operates with pressures between 4 and 6 bar, while



the IP 67-compliant sensor emits DC signals between 12 and 30 volts.

jwwinco.com

GKN Powder Metallurgy

ENTERS EV PERMANENT MAGNET MARKET

GKN Powder Metallurgy, a provider of powder metal solutions, recently announced its commitment to enter the permanent magnets for the electric vehicle (EV) market, in response to the supply challenges the industry is facing.

GKN PM is perfectly positioned to meet the ever-increasing demand for a stable, local supply of permanent magnets, which are a vital component of EV motors.

GKN PM possesses automotive experience, and as a trusted supply and innovation partner to automotive OEMs and Tier 1 suppliers has witnessed first-hand the supply-chain challenges arising from the exponential growth of the EV market. Using its industry expertise, existing production processes, and manufacturing capabilities in North America and Europe, GKN PM will bring much needed stability in the manufacturing of permanent magnets.

Significant progress in product development has been made and the business is now entering the phase of industrialization planning. A dedicated magnets project team, bringing together multidisciplinary experts, operates out of the



company's Innovation Centers for metal powders (in Cinnaminson, N.J.) and for sinter metal manufacturing (in Radevormwald, Germany).

"The key driver behind this strategic decision is our understanding of the challenges facing the automotive industry today and tomorrow. The stability in manufacturing is an ongoing concern, but with our expertise, scale, and reputation, we can provide a robust solution," said Diego Laurent, CEO at GKN PM. "As a trusted provider of metal powders and components for the industry, we already have a scalable production footprint. We will leverage our well-established processes and capabilities to align these with the requirements of permanent magnet production. Automakers are looking for a reliable, local supply. We aim to have in place the capacity for 4,000 tonnes of permanent magnets by 2024, which will see us become a key player in driving the future of the electric mobility market."

Underpinning the move into the permanent magnets for EV market is GKN PM's business-wide commitment to sustainability. With ambitious environmental targets in place, including achieving net zero greenhouse gas emissions in all operations worldwide by 2050, the company is contributing to a more responsible and sustainable future for all.

gknpm.com/magnets

Neugart

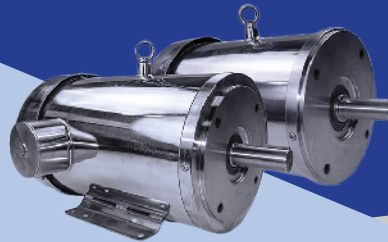
OFFERS ECONOMICAL RIGHT-ANGLE GEARBOX

Axially space-saving, economical, IP65-compliant and designed for high

radial and axial forces at the output: The Neugart WPLHE combines all the advantages of the successful PLHE, as a right-angle variant.

Specifically, the WPLHE features both the gearing of a proven economy gearbox and a high-performance output bearing with preloaded tapered roller bearings, which are otherwise commonly used in precision gearboxes (such as the PLN and the PSN). This means that the new right-angle gearbox tolerates high radial and axial forces of up to 8,000 N at the output.

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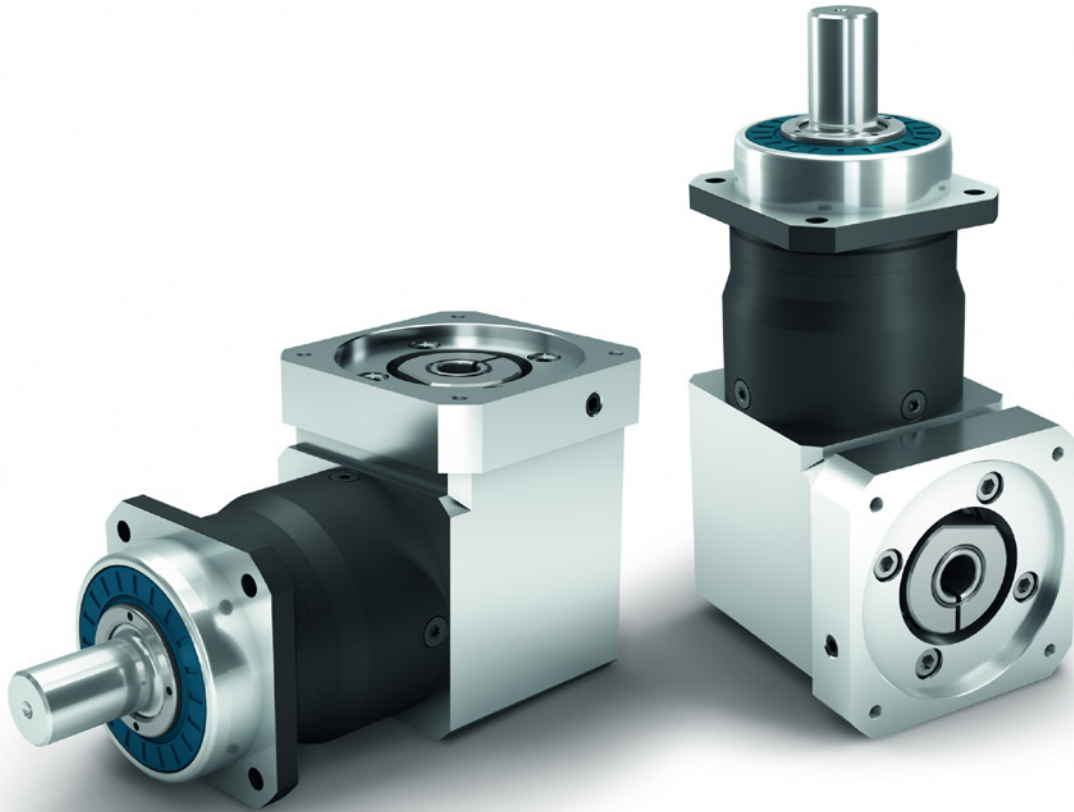


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For example, pulley drives with high radial loads can also be implemented in right-angle designs.

Compared to the coaxial PLHE the motor is rotated by 90° in this case, the WPLHE offers the ideal solution in confined spaces, for example in packaging and other special machines. It is an economy right-angle gearbox offered with a pre-mounted pinion as an option. This makes it particularly suitable for space and cost-sensitive rack-and-pinion drives. There are 13 different pinions from which to choose: with choice of straight-cut or helical-cut teeth, from module 2 to 3, with numbers of teeth from 15 to 27.

Thanks to the output geometry with square output flange and long centering flange that has become established on the market, the WPLHE is easy to implement. Several different output shaft variants—smooth, keyed, splined or with pre-mounted pinion—mean that the right-angle gearbox can be used in a wide range of applications. It also offers IP65 protection, making it suitable for harsh, dusty and dirty environments. Food-grade and

low-temperature lubricants are also available for the lifetime lubrication commonly provided by Neugart.

The new WPLHE is now available in the three sizes 060/080/120, either as a single-stage version (in the ratio range 3 to 10) or as a two-stage version (ratios 9 to 100).

neugartusa.com



Miki Pulley

PROVIDES BRAKES FOR ROBOTIC APPLICATIONS

Editor's Note: See additional information on Neugart's products at Hannover Messe USA on pg. 24

Robotic applications in manufacturing need precise movement and positioning in manufacturing operations from teach pendant programming through full, automated production with exact sequential motion and timed positioning. Miki Pulley BXR Brakes apply holding torque after the motor joint stops and provides dynamic braking in the event of an emergency such as a power interruption.

The Miki Pulley brake opens and allows for free rotation during robot arm movements and snaps closed when power is disengaged thus halting position of the arm. When the robot arm is in position for long periods of time, the brake consumes no voltage. The brake's internal compression springs mechanically hold the armature plate against the rotor disc, ensuring no movement. When voltage is re-applied, the brake opens and allows for free movement.

These Miki Pulley brakes are a cost-effective safety device for all robot holding arms, joints including cobot systems. They are a positive "halt and hold" device to mitigate potential mechanical damage to an automated system.

An important operating feature: when compared to most other electric brakes, the unique Miki Pulley brake design is one-half the overall size thickness.

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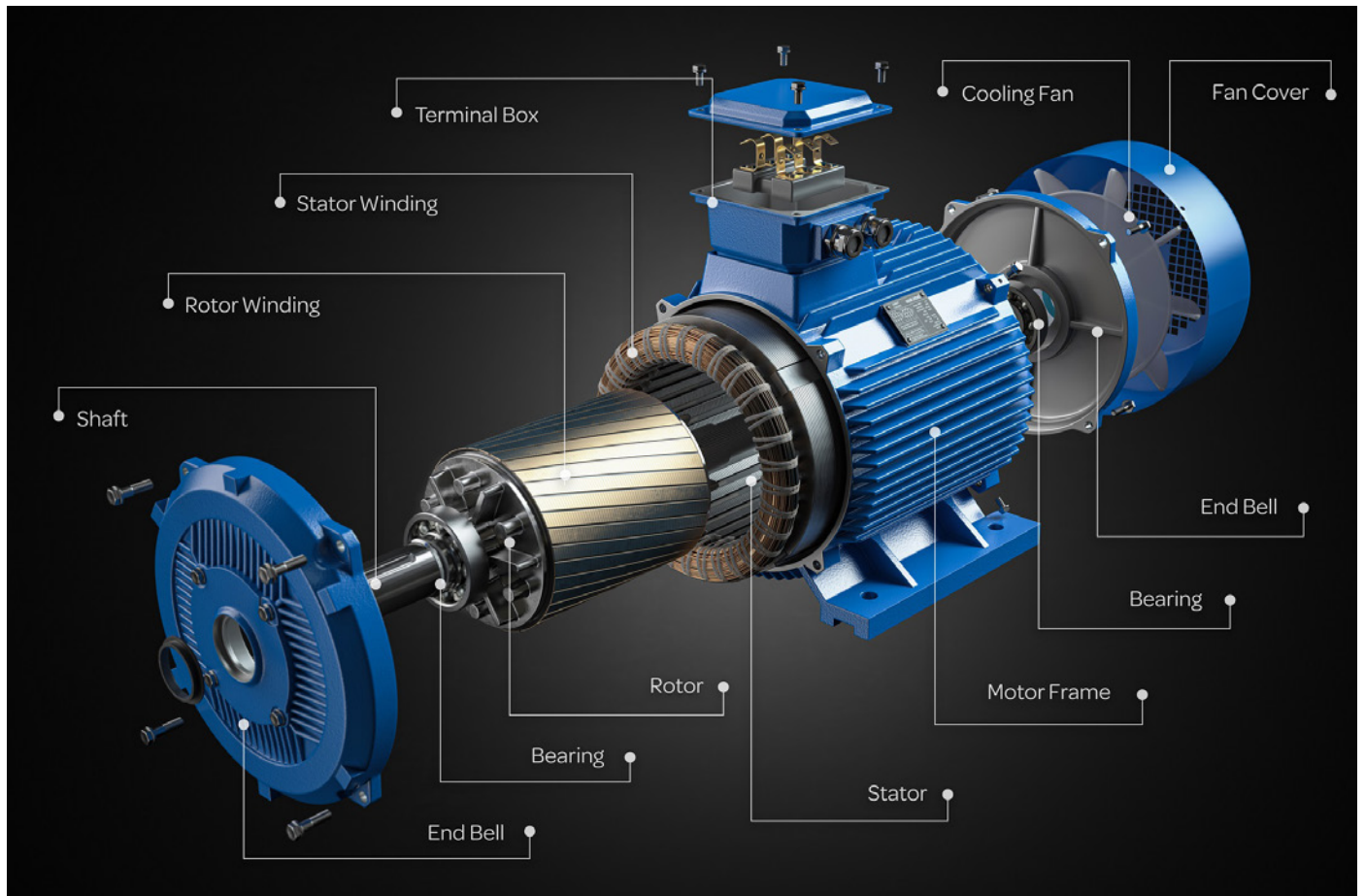


Partnering with QualityReducer to provide Gearbox repair, rebuilding and reverse-engineering.

The Electric Steel Dilemma & Its Impact on Motor Vendors

How Material Demand Causes Longer Lead Times and Higher Prices

Blake Griffin, Interact Analysis

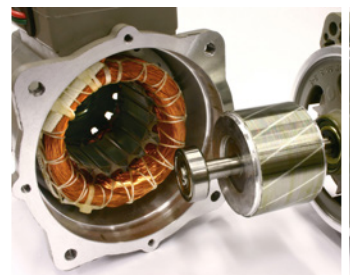


Industrial and commercial motor suppliers are at the helm of a major problem. Historically, vendors like ABB, WEG, Siemens, and Nidec have had minimal difficulty securing supply of key raw materials used in the manufacturing of their motors. Of course, there have been many supply disruptions throughout the market's life, but very few have evolved into longer-term issues. However, we are beginning to observe one supply disruption that will likely challenge motor vendors' ability to produce for years to come.

Electric steel is used heavily in the manufacturing of electric motors. The material is key to producing the electromagnetic field used to turn the rotor. Without the electromagnetic properties associated with this iron alloy, the performance of electric motors would be substantially compromised. Historically, motors used in commercial

and industrial applications have represented a major customer base for electric steel suppliers, and motor vendors have resultingly had little difficulty ensuring prioritized supply lines. However, the share of business held by commercial and industrial electric motor vendors is being threatened by the automotive sector in the wake of electric vehicles.

As electric vehicle production continues to grow, so does the associated demand for the electric steel used in the motors to power them. Resultingly, the bargaining power between commercial/industrial electric motor vendors and their



steel suppliers is becoming increasingly undermined. As this trend progresses, it will impact vendors' ability to secure the electric steel necessary for production, resulting in longer lead times, and higher prices for customers.

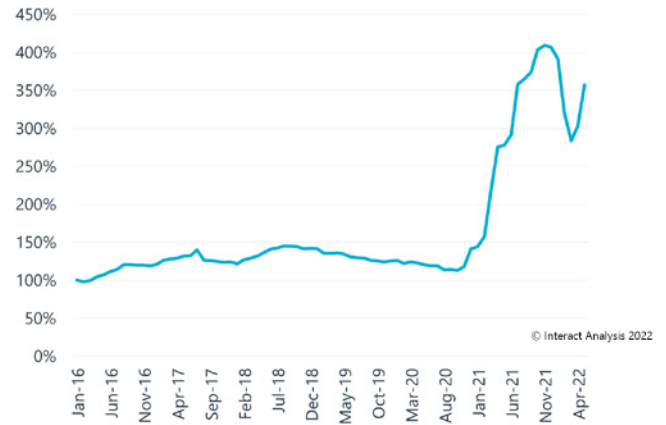
The State of This Problem Today

The process which takes place after crude steel is formed dictates the kinds of things the material can be used for. One of these processes is referred to as "cold-rolling", which produces what is known as "cold-rolled steel"—the type used in electric steel. Cold-rolled steel makes up a relatively small portion of overall steel demand and the process is notoriously capital intensive. Resultingly, increases in production capacity are slow.

Over the last 1-2 years we've seen the price of cold-rolled steel climb to historic levels. The federal reserve tracks the price of cold rolled steel globally. Shown in the right table, the price of the commodity rose to more than 400 percent of its price in January of 2016.

Short term COVID related supply shocks have been one reason for the price performance of cold-rolled steel. However, increased demand from the automotive sector via electric vehicles is, and will continue to be, a contributing factor to the staying power of higher prices. Within electric motor manufacturing, electric steel can make up as much as 20 percent of the bill of material. It is no surprise then that the average selling price of an electric motor is up 35-40 percent compared to January of 2020.

Federal Reserve Cold Rolled Steel Price Index - Jan 2016 = 100%



We are currently conducting interviews with commercial and industrial motor suppliers as part of the new edition of our low voltage AC motor market report. During our research, we've heard multiple reports of vendors having difficulty fulfilling their supply of electric steel due to steel suppliers favoring automotive customers who are placing larger orders. We first began hearing instances of this in mid-2021 and the frequency at which this gets mentioned in vendor interviews is rising.

The Scale of the Problem

The number of vehicles utilizing an electric motor in the drive-train is still relatively small compared with those utilizing a

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traditional internal combustion engine. However, ambitions from the largest auto manufacturers indicate a rapid shift in this balance over the next decade. The question is then, how significant will demand be from the automotive sector, and what is the timeline surrounding this?

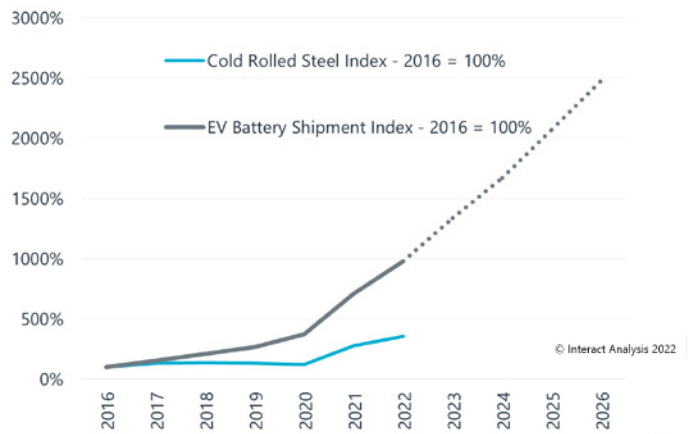
To answer the first part of the question, let's take three of the largest auto manufacturers in the world: Toyota, Volkswagen, and Honda. Together, they comprise 20-25 percent of the automotive market globally in terms of vehicles shipped. In 2021, 21.2 million cars were produced between these three manufacturers alone. This would imply a production of ~85 million cars in 2021. For simplicity's sake, let's assume a 1 to 1 ratio between the number of motors utilizing electric steel and the number of electric vehicles sold. If just 23.5 percent of the ~85 million vehicles produced were to be electric, the number of motors needed to support this production volume would be larger than the 19.2 million low voltage AC induction motors sold into commercial and industrial applications during 2021.

The Timeline

The trend towards electrified vehicles is inevitable but determining the speed of adoption can be a difficult task. It is clear however that announcements by automotive manufacturers like General Motors, which in 2021 pledged to go all electric by 2035, have pushed the electric vehicle market into a new gear.

At Interact Analysis, we track the production of lithium-ION batteries used within electric vehicles as part of our ongoing

Cold Rolled Steel Price Index vs. EV Battery Shipment Index



research within the battery market. This series can be used as an indicator for the speed at which electric vehicles are being produced. In the table above, we are showing this series, along with the cold-rolled steel series shown earlier. Showing these together helps demonstrate the relationship between increased EV production and the price of electric steel.

The gray line represents the number of shipments of Li-ION batteries into electric vehicle applications. This is presented as an index value with the 2016 value representing 100 percent. The blue line represents the price of cold-rolled steel presented again as an index value with the price

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in 2016 representing 100 percent. We are also displaying our forecast for shipments of batteries into EV applications which is represented by the dotted gray bar.

Quickly you will recognize the sharp uptick in battery shipments between 2021 and 2022; hitting nearly 10 times the number of shipments seen in 2016. Alongside this increase you can observe the price of cold-rolled steel ticking up during the same time-period. Our expectations for the rate at which EVs are being produced is demonstrated by the dotted gray line. We expect that over the next five years, the gap between supply and demand for electric steel will widen as increases in production capacity lags the sharp increase in demand for the commodity coming from the electric vehicle sector. This will ultimately result in supply shortages which will manifest into longer lead times and higher prices for motors.

Final Thoughts

The solution to this problem lies in the hands of steel suppliers. Ultimately, more electric steel needs to be produced to close the gap between supply and demand. We expect this will happen, albeit slowly. While the steel industry works to resolve this, we expect that motor suppliers which are more vertically integrated within their supply chains (particularly their steel supply) will begin winning share based on lower lead times and lower prices while the rest of the market struggles to secure the materials necessary for production.

Motor suppliers have been discussing this as a coming trend for years. It is now safe to say that the trend has officially arrived. **PTE**

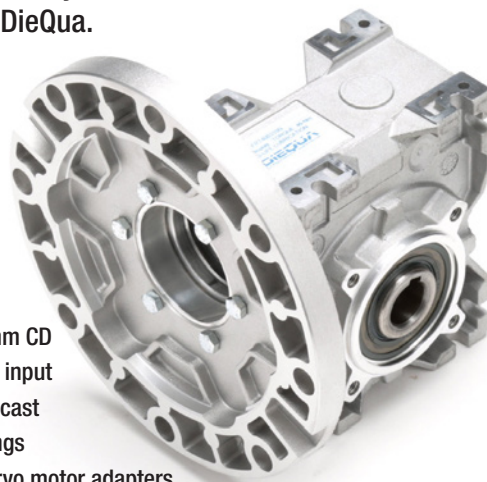


Blake Griffin is an expert in automation systems, industrial digitalization, and off-highway-electrification. Since joining Interact Analysis in 2017, he has written in-depth reports on the markets for low voltage AC motor drives, predictive maintenance, and mobile hydraulics.



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Hannover Messe USA 2022 Booth Previews

A Walk-through of the East Building

Aaron Fagan, Senior Editor



Since 2012, Hannover Messe USA has collocated with IMTS, bringing new industrial technology together at a single venue and establishing the ideal platform for change. These two events connect world-leading suppliers and forward-thinking manufacturers to unlock new efficiencies. Today, with a focus on sustainability, efficiency, and cost-effectiveness, Hannover Messe USA is accelerating the future of automation.

As the largest gathering of industrial manufacturers in North America, this

comprehensive automation-focused event attracts proven decision-makers looking to develop relationships and strengthen partnerships. It presents the world-leading technologies these leaders need to win amid the industry disruption and transformation of Industry 4.0. And it continues to adapt in 2022 to meet attendee and exhibitor needs in a unique way. Here we gather a few offerings from the East Building.

NB Corporation of America—#134829

NB Linear Systems are linear motion mechanisms using the recirculating movement of ball or roller elements to provide smooth and accurate linear travel. All products are designed to minimize size and weight while providing superior performance in high-precision equipment. NB's products are characterized by low friction and low noise and are available as total systems or as individual components.

Visit the website for downloadable CAD drawings of all slide guides, ball splines, round shaft products such as Topball, slide shafts, slide way products including tables, gonio ways, Studroller, slide tables, actuators, slide rotary bush products, as well as many flanged products, mounted units, and mounting accessories.

nbcorporation.com

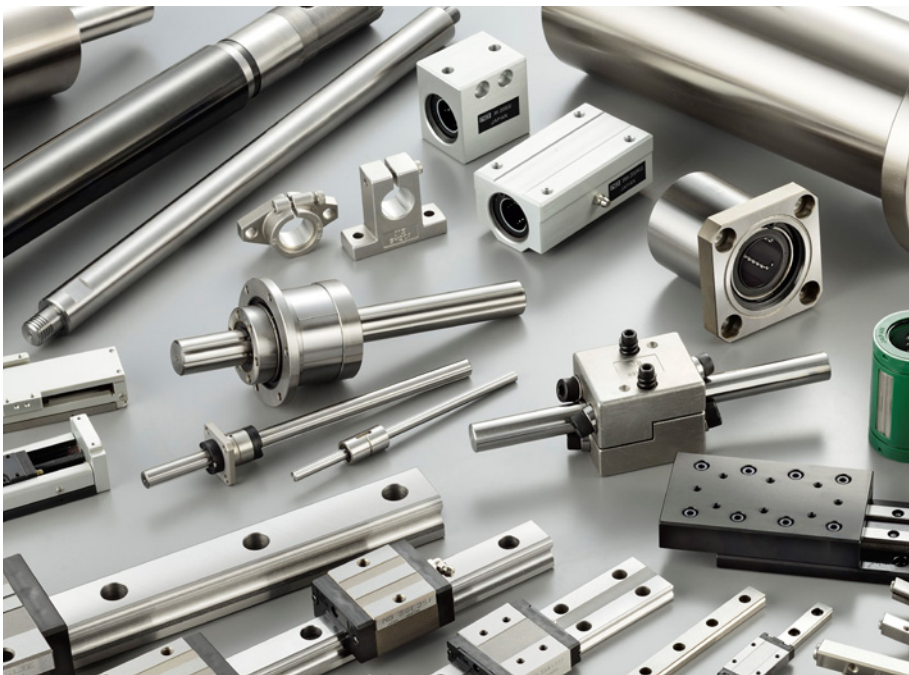
Schneeberger—#134837

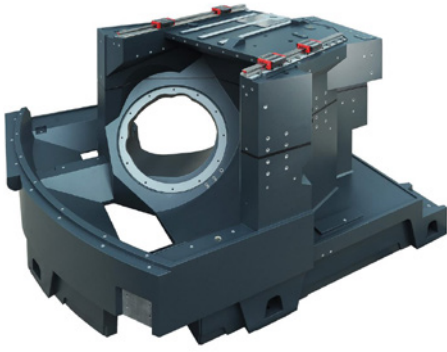
Schneeberger Linear Technology will spotlight its mineral cast machine structures, precision positioning and motion systems, Minirail miniature guideways, linear ball guideways, Monorail AMS distance measuring system, gear racks, ball screws, and more at Hannover Messe USA.

Schneeberger mineral casting technology, as well as the company's 30 years of experience in manufacturing precision systems, the most comprehensive range of solution capabilities, and the broadest line of components, will be on display.

Highlights include:

- Mineral Casting takes center stage as George Blaha presents "Mineral Casting: The 'Organic' Solution for Eliminating Vibration in Production Machinery for Greater Speed, Precision and Environmental Protection," Tuesday, Sept. 13, at 3:15 p.m. in the McCormick Place West Building—W193-A. Blaha will detail mineral casting technology as the organic solution to use in production machinery bases and foundations as a strategy to achieve exceptional vibration damping, chemical resistance, and environmental sustainability. Applications include metal

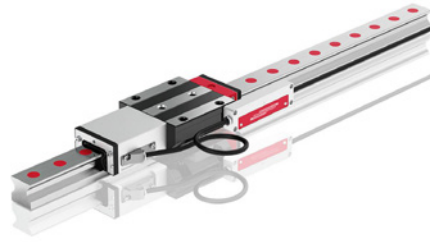




This mineral cast was produced for a 5-axis milling machine for a large machine tool manufacturer.

grinding machines as well as the solar, electronics, packaging, and medical device sectors. Blaha is general manager, Schneeberger Mineralgusstechnik s.r.o., and Executive Board Member, Schneeberger Group.

- Schneeberger's Precision Positioning and Motion Systems engineering expertise is spotlighted in the form of a fully functioning demonstration of a complete linear motion technology system featuring the company's leading and most innovative linear motion components. When linear technology components are designed as a system to work together to create the most effective solution for machine movement, OEMs are enabled to accelerate design and manufacturing speed, reduce assembly time and labor—and achieve a lower total cost of ownership.
 - Minirail miniature guideways provide high precision, robustness, reliability, and versatility. As a result, Minirail guideways are ideal for medical equipment, additive manufacturing, and other applications when space is at a premium and where high acceleration and/or extreme load values are involved.
 - Monorail AMS integrates a measuring head and scale onto Monorail profiled linear guideways for distance measurement when space constraints and performance.
- Monorail AMS solutions boast a 25-year track record as a proven technology, are machine-compatible, and are ready to install to reduce the lifetime costs of mechanical engineering and automation applications.
 - Monorail BM profiled linear guideways (with balls) deliver maximum precision and increased service life—with minimal maintenance. All carriages feature longitudinal cross wipers for efficient sealing against dirt and debris.
 - Monorail MR profiled linear roller guideways feature high precision, high rigidity, great dynamic and static load carrying capacity, outstanding running smoothness, and total enclosure of the carriage as required for use worldwide in many machine tool applications. The results: Higher machining rates and enhanced geometrical accuracy and surface quality for workpieces, and improved vibration behavior and smaller vibration amplitudes for extended tool life.
 - Gear racks enable linear movements over almost limitless stretches. They are well-suited to use in large machines and systems as an economical solution when machine components with large axial forces require long linear movement with consistent stiffness over the rack length. Dirty working environments are no problem, and there are cost-efficient solutions for all applications.
 - SBS ball screws efficiently deliver high precision positioning and repeat accuracy, operate smoothly, and hold constant torque due to their precision-ground and hardened ball contact



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surfaces. Equally suitable for use at high and low speeds, as well as oscillating short stroke movements, SBS ball screws are ideal for demanding applications such as machine tools and measuring and testing equipment.

- SLA Actuators meet the demands of any precision linear motion control application with unique high-performance linear positioning and quality engineering in a compact design. SLA Actuators utilize recirculating ball linear guides that ensure smooth motion and high load capacity—all at an economical price.

Schneeberger Linear Technology has been offering precision innovative linear motion solutions since 1923. Headquartered in Switzerland with its US base in Woburn, Mass., the group operates worldwide as an established OEM supplier in several sectors. Its high-quality standard and customized offerings include linear bearings, profiled guideways, measuring systems, gear racks, ball screws, positioning systems, and mineral casting. All Schneeberger solutions featured at Hannover Messe USA 2022 are immediately available.

schneeberger.com

Neugart USA Corp.—#134639

Axially space-saving, economical, IP65-compliant, and designed for high radial and axial forces at the output: The new WPLHE combines all the

advantages of the successful PLHE, the world's first combination of the economy and precision gearboxes, as a right-angle variant.

The WPLHE features both the gearing of a proven economy gearbox and a high-performance output bearing with preloaded tapered roller bearings, which are otherwise commonly used in precision gearboxes (such as the PLN and the PSN). This means that the new right-angle gearbox tolerates high radial and axial forces of up to 8,000 N at the output. For example, pulley drives with high radial loads can also be implemented in right-angle designs.

Compared to the coaxial PLHE the motor is rotated by 90° in this case, the WPLHE offers the ideal solution in confined spaces, for example in packaging and other special machines. It is the only economy right-angle gearbox to be offered with a premounted pinion as an option. This makes it particularly suitable for space- and cost-sensitive rack-and-pinion drives. There are 13 different pinions from which to choose: with a choice of straight-cut or helical-cut teeth, from module 2 to 3, with numbers of teeth from 15 to 27.

Thanks to the output geometry with square output flange and long centering flange that has become established on the market, the WPLHE is easy to implement. Several different output shaft variants - smooth, keyed, splined, or with premounted pinion—mean that the right-angle gearbox can be used in a wide range of applications.

It is also the only economy right-angle gearbox with IP65 protection class, making it suitable for harsh, dusty, and dirty environments. Food-grade and low-temperature lubricants are also available for the lifetime lubrication commonly provided by Neugart.

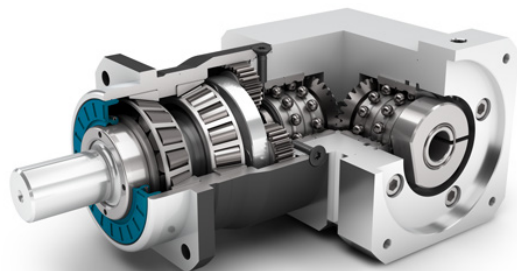
The new WPLHE is now available in three sizes 060 / 080 / 120, either as a single-stage version (in the ratio range of 3 to 10) or as a two-stage version (ratios 9 to 100). Thanks to an efficient supply chain, Neugart can continue to guarantee attractive delivery times for quantities starting at one.

Neugart is extending its portfolio of planetary gearboxes, especially for rack-and-pinion drives, with an additional option for a mounted pinion from its in-house production.

Two specific types of pinion are available: the PK1 pinion is mounted to the splined output shaft of the gearbox, whereby the secure connection that is required is provided by internal teeth in accordance with DIN



5480. The PM1 pinion, on the other hand, is designed for gearboxes with a flange output shaft, and is equipped with a mechanical interface which is standardized in accordance with EN



ISO 9409-1. Both types are available with a helical cut, and the PK1 is also available with a straight cut. The pinions are also available in four different modules and with different numbers of teeth.

The pinion option can also be combined with a total of eight gearbox series: including a coaxial planetary gearbox with an output shaft (PLHE) and an output flange (PFHE) from the Economy Line, which include durable and powerful standard gearboxes with an outstanding price/performance ratio. Two coaxial planetary gearboxes with an output shaft (PSN and PLN) or output flange (PSFN and PLFN) and right-angle planetary gearboxes (WPLN and WPSFN) are available in the Precision Line, which represents the outstanding accuracy of precision gearboxes.

These numerous pinion/planetary gearbox type combination options ensure that not only can a solution be found for a wide range of applications, but usually several, meaning that the torsional stiffness of the flanged gearboxes is greater than that of gearboxes with an output shaft. If the construction space situation is the decisive criterion, the constructor can use the short gearbox with the output flange or the right-angle precision gearboxes. If precision is the decisive factor, the constructor can opt for the greater accuracy and torsional stiffness of the precision gearboxes. On the other hand, economy gearboxes are a solution that is financially more attractive for standard applications.

Complex load trends in the drivetrain can be calculated in the NCP,



and the optimum application-specific motor/gearbox combination is determined on this basis. With the update, it is now also possible for propulsion drives in Automated Guided Vehicles (AGVs) and the new NGV gearbox range that is tailored to these vehicles. Existing projects from current or older NCP versions can now also be loaded for newly designed controlled systems and compared with them.

As well as these new functions, Neugart has simplified the operation of the tool with version 4.2 and improved user-friendliness: conversions are no longer required when importing read-out motor data, for example. Users of popular CAD programs can now also use the familiar full stop as a separator as well as the comma. Calculations can also be carried out in the input fields. And the gearbox documentation has also been optimized, meaning that the user detects whether the selected gearbox is suitable on the basis of utilization bars.

And finally, NCP 4.2 has an example

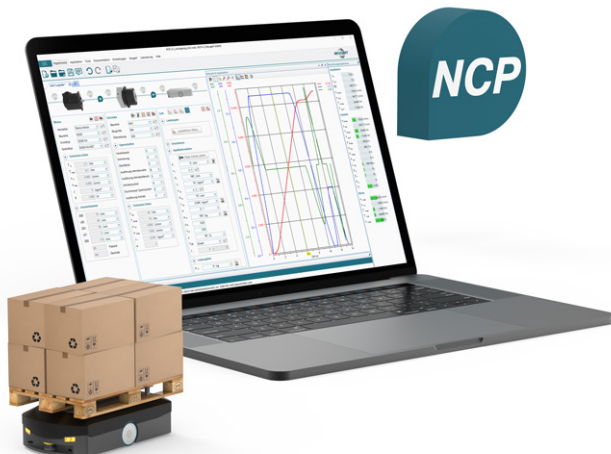
for every application, which makes it easy to learn how to use the tool.

neugartusa.com

Hiwin—#134514

Torque Motor Rotary Tables (TMRT) are ideally suited to high-accuracy machine tool manufacturing where multiple axis operations must take place simultaneously. Hiwin offers several styles including RAB Series, widely used in 3+2 axis, 4+1 axis positioning processing, or 5-axis simultaneous processing.

Datorker strain wave gearing systems allow higher gear reduction ratios than other types in a more compact space. Widely used in robots, automation equipment, semiconductor equipment, machine tools, and other industries, Hiwin has developed



various specifications and reduction ratios to provide customers with a wide range of choices. Hiwin can provide customized services to meet customers' various designs and requirements.

hiwin.us

Hexagon—#135202

Hexagon's Manufacturing Intelligence division will feature its recently released 6D laser tracking system—the Leica Absolute Tracker AT500—in Booth 135202 in the Quality Assurance Pavilion. The AT500 platform delivers improved performance to both reflector and probing measurement, as well as plug-and-play setup times. Its new, customer-centric design includes several significant features including a battery-powered, integrated controller, full IP54-rated environmental

protection, minimized cabling, and an expanded operating temperature range. Users no longer need to level the tracker or initialize a reflector before measurement begins. These enhancements and more translate to the most portable and robust laser tracker in Hexagon's metrology portfolio.

Overall, the AT500 is built to provide exceptional user productivity and reduced time-to-results workflow. The laser tracker's expanded operating temperature range of -15°C to 50°C provides accurate results for challenging measurement environments from mountaintops to foundries. With a measurement volume up to 320 meters and IP54-rated ingress protection, the AT500 stands alone in its field as the go-to technology for large-scale inspection applications

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Your Robotic Coworker

FANUC Examines the Role of Collaborative Robots on the Automated Shopfloor

Matthew Jaster, Senior Editor

“Nobody wants to work anymore.” It’s a statement that’s been making the rounds since the start of the pandemic. Bloomberg recently reported that the real issue—that’s been around as far back as the 1870s—is that people don’t want to work for what companies are willing to pay them. The trick is providing training and career development that will keep workers from looking for their next best offer somewhere else.

This summer, we learned at Automate 2022 that robotics and automation technology is offering an opportunity to keep frontline skilled workers happier in areas where repetition and hazardous work environments tend to lead to job loss. “Most industries today, including gear manufacturers face labor issues in one or more areas of production. The jobs most affected are often tedious and can lead to repetitive motion injuries. In a tight job market, it’s especially difficult to fill jobs that people consider dull and strenuous. That’s why companies are looking for automation solutions that will allow them to resolve labor issues and increase their flexibility to quickly adapt to meet customer needs,” said Virgil Wilson, staff engineer material removal, general industry, and automotive segment at FANUC America.



Easy programming technology allows FANUC’s CRX Cobots to work safely alongside people in a variety of industrial and manufacturing jobs.

The Cobot Zone: Freedom and Collaboration

FANUC recently expanded its popular series of CRX collaborative robots with the new CRX-5iA, CRX-20iA/L and CRX-25iA. The new CRX cobots complement FANUC’s existing line of CR and CRX cobots that now total 11 model variations able to handle products from 4 to 35 kg. Designed for companies looking to increase their capabilities and overcome labor issues, FANUC’s CRX cobots are extremely robust and can run for up to eight years without maintenance.



The new CRX-5iA cobot, featuring a 5 kg payload and 994 mm reach made its first appearance in North America at Automate 2022. The CRX-5iA picked and assembled small gears using integrated force control.

A CRX-10iA welding cobot allowed attendees to weld joints using hand guidance or a tablet interface with drag and drop icons. The CRX welding cobot supports FANUC’s advanced features including iRVision, Torch Angle Control, Touch Sensing and Thru Arc Seam Tracking (TAST).

A new CRX-25iA robot, offering a 25 kg payload and 1,889 mm reach will demonstrate case palletizing. Guided by a 3DV/200 vision sensor mounted to the arm, the CRX-25iA will palletize boxes to nearly seven feet high.

A CRX-20iA/L with FANUC QSSR (Quick and Simple Start-up of Robotization) demonstrated the easy connection of a FANUC CRX cobot and a machine tool. QSSR simplifies the automation of machine tool load/unload applications using the CNC.



FANUC’s CRX Cobots are safe, easy-to-use, reliable, and a versatile solution for a wide range of applications, including inspection, machine load/unload, packing, palletizing, sanding, welding, and more.

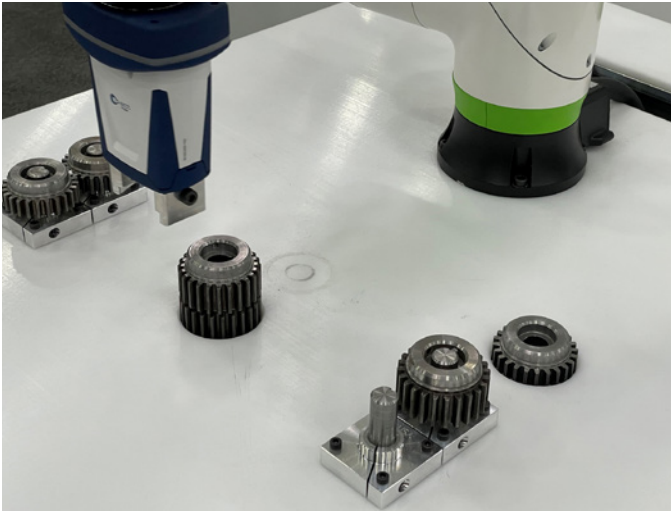
Answering the Labor Shortage

“FANUC’s line of CRX cobots are safe, easy-to-use, reliable and a versatile solution for a wide range of applications, including inspection, machine load/unload, packing, palletizing, sanding, welding, and more,” Wilson said.

CRX cobots can detect external forces in the workspace, stopping safely when contacting a person or object. “This technology allows the CRX to work safely alongside people without the need for expensive guarding. Going forward, as more companies look for tools to assist their workforce, they will likely move towards a cobot to work within the same space as a person,” he added.

Automating some tasks with cobots allows companies to redeploy workers to help solve the current labor shortage situation. Instead of workers performing repetitive tasks, they can take on more challenging, complex, and rewarding jobs that only people can do.

“Companies all over the world are evaluating their production operations to determine how to increase productivity. That’s a key reason why the demand for robotics and automation is growing at a rapid pace. When companies reach out to FANUC, they are looking to solve some sort of production problem,” Wilson said. “We take pride in the fact that we help customers solve their problems, achieve their manufacturing goals, increase profits, and stay competitive.”



The CRX Cobot demonstrated a gear manufacturing application during Automate 2022 in Detroit.

Functionality and Education

The CRX series supports several of FANUC’s advanced features including iRVision and is a perfect fit for any company looking to achieve higher efficiencies – even those that have yet to use their first robot.

The CRX comes equipped with integrated force control and software at no additional cost. Integrated Force Control provides the user with several force control functions such as, push, insert, face match, phase match and contouring. These functions would benefit applications requiring Force Control. Examples include:

- 1) Assembling wire connector is one example that Force Push could be used for.
- 2) Shaft insert type application would use Force Insert.
- 3) Force Face Matching is useful for applications requiring normalizing a part to a surface.
- 4) Gear assembly is one application that would use Force Phase Match.
- 5) Force Contouring would be useful for material removal applications, such as deburring or sanding.

“Using drag and drop icons a user can drag the desired Integrated Force Control Icon into the timeline for easy programming and visualization,” Wilson said. Easy Programming and setup allow engineers to utilize these technologies without the need for long classroom time or training workshops.

CRX cobot e-Learning training modules, for example, are available to help operators get up to speed very quickly. Online tutorials cover a product overview with features, unboxing and setup, programming and iRVision courses.

From a tablet perspective—the phase matching Tablet TP programming icon guides novice users through setup of gear meshing operations and could reduce an end-user’s dependence on a robot expert to set up new part styles.

Hand Guidance is the ability for the operator to be able to control the robot motion by guiding or leading the robot through the desired motions. “This is useful in teaching applications where the path points or paths are recorded as the user guides the robot, and in heavy lifting applications where the process requires manual placement or movement of a large part but the smooth and gentle motion of a robotic arm,” Wilson said.

The Future is Safety First

Many applications become more efficient by offloading the repetitive motion, such as picking each part, from the operator thus freeing them up for more value-added jobs. So, when the cobot goes to work, an operator can safely do other tasks in the same space, according to Wilson.

This is just a hint of what the factory of the future will soon look like. Cobots are breaking into a larger variety of applications including smaller platforms for miniature components as well as large systems capable of handling the heaviest payloads.

“FANUC’s CRX cobots are designed for every type of manufacturer—small or large—looking to expand their capabilities and overcome labor issues,” Wilson said. “With several new models introduced in 2022, FANUC now offers the most extensive lineup of easy-to-use cobots available on the market today. Cobots will continue to be extremely important for manufacturers looking to increase production output and maximize efficiency.” **PTE**

Editor’s Note: Read more about FANUC’s expansion to accommodate automation demand on page 43

fanucamerica.com



Automate attendees learn about the advantages of collaborative robots at FANUC’s booth in Detroit.

An Automotive and Industrial Difference Maker

The Unique Story of Schaeffler's Needle Roller Bearing Design

Matthew Jaster, Senior Editor

Dr.-Ing. E.h. Georg Schaeffler filed a patent for a component known as the cage-guided needle roller bearing (NRB) in 1950. A component offering a simple design, robust operation, and a very small design envelope that helped put Schaeffler on the map in the automotive and industrial markets. The company's application expertise—from manual to automatic transmissions, followed later by e-mobility—evolved along with its NRB bearing technology.

History of the NRB

The lightest and smallest option in the roller bearing family is the NRB, according to Victoria Bigham, NRB product line manager at Schaeffler. They provide instant advantages for bearing applications that require reduced weight and space. A needle roller is defined as two end faces and a lateral surface with a length approximately 3–11 times larger than diameter.

“As we look at different bearing applications, everything, in my mind, is just a fancy NRB,” Bigham said. “When you get into ball bearings, cylindricals, tapers, you’re using that same roller cage/raceway combination in theory. So, our job is to go after a variety of different applications to determine how we can best use our bearing expertise to enhance these components for our customers.”

In 1950, Dr. Schaeffler filed a patent application for the caged NRB, shortly after founding the company, then known as Industrie GmbH, in 1946. The first practical tests involving cage-guided needle roller bearings began in February 1950. The results were convincing—the components exhibited extremely low wear and friction. The application for a patent in September 1950 laid the foundation for the product's success. In February 1951, just one year after construction of the first prototype, the first volume production

orders were obtained from automotive manufacturers. Industrial applications soon followed.

“Schaeffler was the first to offer the separation between the rollers for large-scale production volumes,” Bigham added. “As the automotive industry was taking off, you were able to get the speed that you couldn’t get beforehand with a full complement roller bearing. The rise of the caged NRB essentially went together with the rise of the automotive industry.”

With his invention, Dr. Schaeffler eliminated the serious disadvantages associated with the full-complement needle roller bearings that had previously been used as standard: The long needle rollers tended to move in a transverse direction during rotation of the bearing (skewing), which would then cause the bearing to jam. Furthermore, a substantial amount of sliding friction was generated between the counter-rotating needle rollers.

Schaeffler's development of the new needle cage overcame these disadvantages and permitted considerably higher speeds and less friction. This allowed engineers to substitute other bearing designs for cage-guided NRBs and significantly improve the performance of their applications. The use of needle roller bearings in mechanical and plant engineering, construction, and agricultural machinery, and in conveyor technology, was also being gradually introduced.

Evolution of the NRB

Needle rollers can be used in several different assemblies for different applications, including loose rollers, rollers, and cage assemblies, drawn cup, and machined products. How the



The company's early quality controls, as shown in this photo of the assembly plant from the early 1950s. Courtesy of Schaeffler.

bearing will be housed in an application will dictate whether a drawn cup, machined, or cage and roller assembly is needed.

Schaeffler developed -D- types that use longer needles within the same total bearing diameter; this increases load capacity and allows for load increases without design changes. Alternatively, you can achieve the same load with less space.

The D-XL series boasts an improved cage design that allows a higher number of needle rollers with higher load-carrying capacity, less friction and weight as well as reduced operating costs. D-XL bearings are part of Schaeffler's X-life lineup of premium bearings, which optimizes the contact outer raceway's contact surface for less friction, especially with plastic cages, and longer operating life.

As customers continued to pursue components for their high speed, light weight, low cost, and simplified fitting, the NRB continued to gain traction in areas like medical equipment, robotics, hand tools, and, of course, mobility solutions such as e-bikes.

"To this day, we're working with a hand tool manufacturer that was using a plain bearing and they switched it to an NRB for the speed and load advantages, as well as a more compact design," Bigham said. "Frictional benefits improve the longevity of the component but also potentially provide

less friction for the overall system."

Automatic transmissions, which often have several NRB positions, use the cage and roller assemblies, thrust bearings, drawn cup and machined-type NRBs.

In the planetary train, cage and roller assemblies are used for the planets with the inner raceway directly on the planet pin, while the outer raceway functions as the planet pinion's bore, where it supports high rotational speeds and centrifugal forces.

In addition, Schaeffler offers KZK- and KBK-type NRBs specifically for crank and piston pins.

Needle roller and cage assemblies for connecting rod bearing arrangements are used in the crank mechanisms of two- and four-stroke engines as well as in compressors for supporting crank pins and piston pins. Consisting of cages equipped with needle rollers, they support high centrifugal and acceleration forces and are suitable for high speeds.

They require very little radial space since the radial section height only corresponds to the diameter of the needle rollers. They give bearing arrangements high runout accuracy which is, however, influenced by the geometrical accuracy of the raceways. The radial internal clearance is dependent on the needle sort as well as the shaft and housing tolerances and can be adjusted by means of the needle roller sort.

Needle roller and cage assemblies for crank pins (i.e., KZK NRBs) are externally guided, which means that the connecting rod bore guides the cage radially with defined clearance. The radial movement of the cage in relation to the connecting rod bore and the rolling elements is as small as possible.

The cages are made from quenched and tempered steel, have good wear resistance, exhibit high strength and their large guidance surfaces are designed for optimum lubrication.

Needle roller and cage assemblies for piston pins (i.e., KBK NRBs) are internally guided, which means that the piston pin guides the cage radially with defined clearance. Due to their small radial internal clearance, tilting of the connecting rod is reduced to a

minimum. The needle roller and cage assemblies support high frequency oscillating loads and are available for most piston pin diameters in various widths, in accordance with the piston boss spacing. The steel cages are case hardened or quenched and tempered, exhibit good wear resistance, and have high strength.

Drawn cup roller clutches are one-way clutches comprising thin-walled outer rings, cage, and needle rollers. Drawn cup roller clutches can be used in a wide range of applications such as shifting elements, back-stopping clutches, overrunning clutches, or any highly dynamic application that needs an increased power density or reduced shift angle. In terms of components utilized in e-mobility applications, they also offer increased ride comfort—a necessity as the e-bike drivetrain continues to evolve each year.

An Electric Future

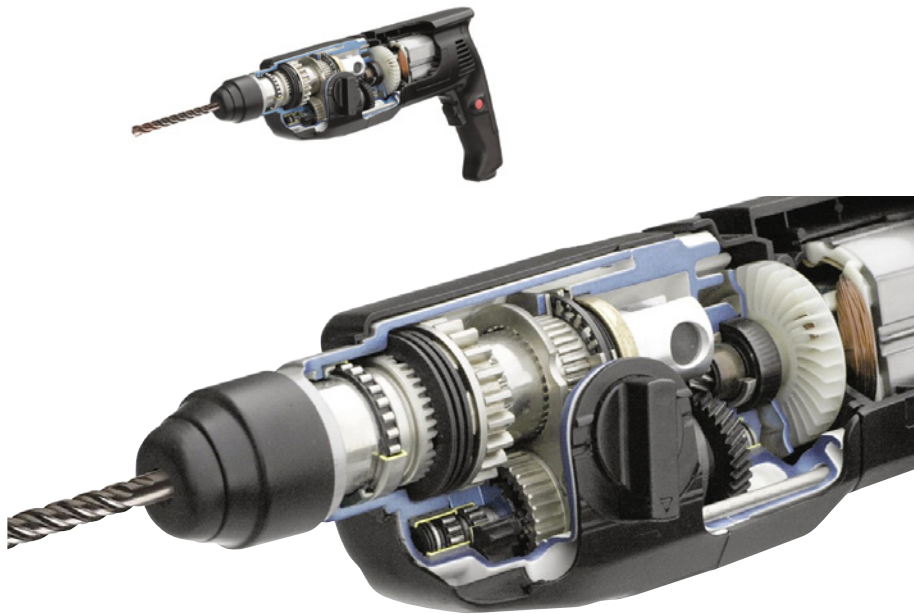
Needle roller bearings will continue to play a key role in the future. In e-mobility, needle roller bearings are vital for the function of numerous electrified transmissions. Needle roller and cage assemblies facilitate bearing arrangements with a minimal design envelope, since their section height only corresponds to the diameter of the needle rollers. In addition, they have a high load-carrying capacity and are inexpensive compared with other bearing designs. KZK needle roller bearings (crank pin cages) are used, for example, in e-axles with a coaxial design.

One application example is the Schaeffler e-axle drive, which has been produced for Audi's e-tron brand of electric and hybrid-electric vehicles since 2018. In the Audi e-tron, Schaeffler electric axle transmissions, with different structural designs, are used on both axles for all-wheel drive capability. Meanwhile, Porsche's all-electric Taycan sports sedan is fitted with a high-efficiency Schaeffler coaxial electric axle transmission to provide the required transmission ratio on the front axle.

In 2020, the coaxial electric axle transmission earned Schaeffler the



In 1950, Dr. Schaeffler filed a patent application for the caged NRB, shortly after founding the company, then known as Industrie GmbH, in 1946.



As customers continued to pursue components for their high speed, light weight, low cost, and simplified fitting, the NRB continued to gain traction in areas like medical equipment, robotics, hand tools, and, of course, mobility solutions such as e-bikes.

prestigious PACE Award, regarded by the industry worldwide as the hallmark for successful automotive projects. Schaeffler has also secured multiple orders for its complete “3-in-1 electric axles,” which combine the electric motor, drive unit and power electronics in a single system. These are high-performance electric axles with advanced power density.

Over the last few years, Schaeffler has progressively strengthened its electric mobility expertise through a series of targeted acquisitions. The purchase of Elmotec Statomat at the end of 2018 added new expertise in winding technology, providing Schaeffler with comprehensive coverage of all aspects of electric motor industrialization. Another highly successful addition to the Schaeffler Group back in 2016 was the acquisition of Compact Dynamics, a specialist in the development of innovative electric drive concepts. Meanwhile, the Schaeffler Paravan Technologie joint venture is developing its proprietary Space Drive steer-by-wire system, a key technology for autonomous driving.

Schaeffler supplies technologies for all electrified drivetrains. Mass production of the electric axle transmission, a key component of electric axle systems, has been running successfully since 2017, providing optimum

transmission ratios and power transfer from the electric motor to the wheels. This is a highly versatile component with a wide range of applications.

On the industrial side, where lightweight robots are increasingly in demand, the use of needle bearings permits light and compact joint designs by means of downsizing. The needle bearings provide minimal variability and the highest level of safety. The most recent example



On the industrial side, where lightweight robots are increasingly in demand, the use of needle bearings permits light and compact joint designs by means of downsizing.

is Schaeffler’s XZU angular contact needle roller bearing, which is used both as an articulated arm bearing in lightweight robots and cobots, and as the main bearing arrangement in the

company’s new RTWH precision gearbox, a ready-to-install reduction gear unit for robot joints.

In the development of electric powertrain components, Schaeffler benefits from the experience the company has gained in conventional powertrains with IC engines, for instance in digital simulation. The know-how from the development of starting elements like the torque converter or the double-clutch broadens the development and manufacturing expertise available at Schaeffler.

“We have successfully transformed ourselves into a drive system supplier for sustainable electric mobility solutions and established ourselves as a reliable partner for our customers,” says Matthias Zink, CEO Automotive Technologies at Schaeffler AG. Schaeffler’s key point of difference is its know-how on components and system levels. “We have been engaged with electric mobility for more than 20 years and we understand the drive train requirements. Our innovation capacity as a global automotive and industrial supplier plus our strong industrial skills make us a preferred partner for our customers.”

And to think this evolution began with a very simple, yet extremely reliable bearing design concept. **PTE**

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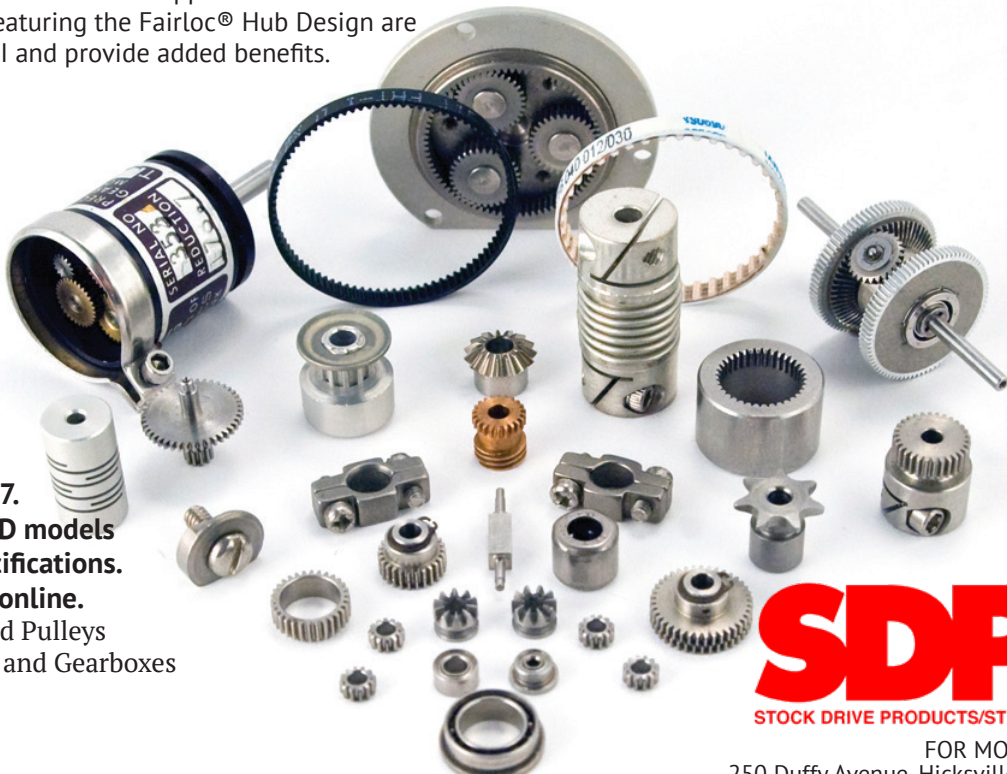


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The Quest for the Perfect Turbine

Condition Monitoring Software Takes Systematic Approach to Wind Farm Maintenance

Mirelle Ball, ONYX InSight



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Condition monitoring systems can identify wind turbine issues before they worsen. All photos courtesy of ONYX InSight.

There is no perfect turbine. Each one offers a set of component limitations, site challenges for offshore, availability onshore, as well keeping the turbines turning with limited to no downtime. Extending the life of the turbines and maximizing energy production and performance is, in fact, the very nature of engineering: the continual drive to make things better.

That's the case for any system of electrical generation, where energy will leak out somewhere along the way; it's a hard-coded truth.

Wind farm owners and operators are rising to the challenge of net-zero emissions admirably but have found their ambitious digitalization strategies hampered by software solutions that are built for a smaller, less dynamic sector. As wind scales, so does the ambition of industry stakeholders. Operators require access to their data, simplified to give them the insight they need to boost asset profitability but often adopt short-term thinking rather than long-term solutions.

In the wind industry, though, we're a far cry from thermodynamics being the only barrier to maximizing output. And we can look at the most common lost energy issues that wind farm operators contend with daily including anything

from temperature issues, pitch misalignment/calibration, rotor imbalance to leading-edge blade erosion.

Condition monitoring systems can identify issues before they worsen and cause failure later—allowing servicing teams to manage multiple minor faults, and not just a few catastrophes, at a time. CMS systems have become proven technology, with the return on investment (ROI) shown as 20-1 but the systems themselves need to be treated as part of the turbine for holistic and optimized use.

An issue compromising the capacity of an individual turbine could span a whole fleet; a challenge which could, in theory, be dealt with on a turbine-by-turbine basis.

The problem is knowing where to start. Which issues are most urgent? How can engineers and operational supervisors coordinate to solve them in the most efficient way possible?

When wind operators are alerted to multiple faults happening simultaneously, they need to formulate and carry out plans based on the answers to those questions. But with so much of the necessary information trapped in data silos—indecipherable spreadsheets, clogged-up inboxes, or disparate software systems—it's hard to do act with certainty.

The costs of scattergun maintenance work are age-old and

no different from those you'd expect from any other kind of inefficient business: time and money. To save on both and boost efficiency and profit, wind operators need to see and prioritize which leaks in their energy pipelines to plug, with machine-like precision.

With wind farm efficiencies averaging between 30–45 percent, untold gigawatts will continue to be left on the table as long as inefficient approaches to lost energy problems persist. 62 percent of wind industry stakeholders believe that access to data is their biggest barrier to advancement.

Having a single, predictive analytics software to manage your fleet-wide intelligence is key in integrating multiple data feeds to streamline and enhance operations and maintenance (O&M) decision-making.

Wind operators are therefore able to efficiently manage their fleets and asset owners to manage their growing portfolios more profitably, reducing their cost of energy by up to 12 percent.

Last-generation software platforms are increasingly unable to keep pace with sophisticated, scalable approaches to O&M. Since they can only handle one data source at a time, they might require site engineers to use dozens of separate software platforms in isolation.

Too often, wind O&M engineers spend valuable time trawling through email chains to bring up historical cases or reprioritize ongoing issues.

Data is often held offline in spreadsheets, increasing data silos are neglected and inefficiencies often occur when managing large, geographically diverse fleets and data from inspection, service, and maintenance with much of them still being paper based. Having one platform that centralizes critical data streams such as vibration, oil sensor, and pitch bearing monitoring, allows operators to benefit from engineering-enhanced machine learning.

Operators are looking to upgrade their approaches to O&M from turbine-by-turbine analysis to fleet-level strategic control.



With a single platform connecting engineering and site teams, automating labor-intensive, data standardization and case management functions to free up resources allowing them to see the history of their turbines to empower smarter decisions.

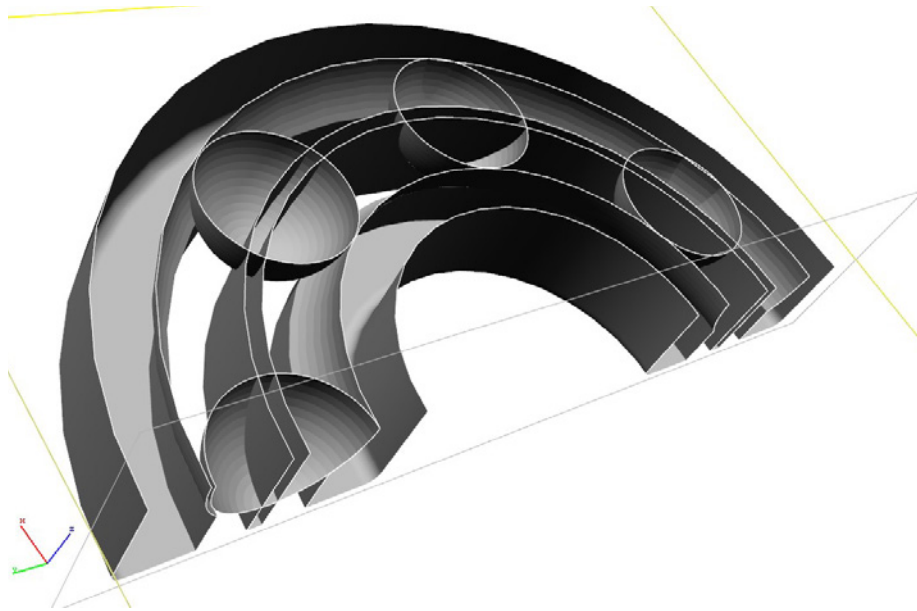
Components are replaced earlier, with known data proof sources and we can reuse as many of them as possible, looking at remaining useful life. Once condition monitoring becomes part of the process, with a long-term view operators and owners can move from calendar-based maintenance to condition-based maintenance, enabling simpler scale-up and O&M decisions. With condition monitoring plus all data integrated, alongside an experienced engineering view, the gap closes slightly more on our quest to keep turbines turning for longer. Owner/operators gain confidence in being able to look at the bigger picture. **PTE**

onyxinsight.com



Ball Bearing Limiting Speeds

Norm Parker, Stellantis



Well, I am happy to be back here at *PTE*! It has been a few years since I have been able to write casually due to some legal structures in my company. Coincidentally, those barriers were removed not long before *PTE* Sr. Editor Matt Jaster reached out to me to ask if anything had changed with my disposition. Additionally, I recently started working on a couple of topics with ABMA (now managed by AGMA), which I won't get into just yet, and then discovered through Matt that AGMA and *PTE* have also joined ranks. What a great combination, very exciting developments in bearing land, indeed!

While we have been out of contact, COVID has been running almost in parallel with the unprecedented electric revolution in the automotive industry. When the COVID shutdowns started, I thought we had—maaaybe—five years before everything looked like a post-nuclear apocalypse out of a movie. Somehow, in a page out of bizarro-land, this electrification wind sprint started around the same time as COVID and made us all busier than ever!

Electrification has really brought ball bearings back into focus as the primary bearing in our drive systems. Some boxes have tapers on the

slower shafts for stiffness and others are using a ball/cylindrical combo for efficiency. Regardless, we all face the same challenge on the primary shaft in dealing with the potential of 18,000–20,000+ rpm speeds coming out of the motor. Plenty of applications run 20,000 rpm; what makes the automotive motor unique is, in

addition to speed, we are driving huge torques, frequent torque reversals and a huge range of temperatures both internally and geographically. Of course, this all needs to be suited for high-volume manufacturing as well. Adding full ceramic balls, a PEEK cage and a high precision classification is a really easy way

SINGLE-ROW DEEP GROOVE BALL BEARINGS
Bore Diameter 25 – 45 mm

Boundary Dimensions (mm)	Basic Load Ratings (N)				Factor		Limiting Speeds (min ⁻¹)			Bearing Numbers						
	<i>d</i>	<i>D</i>	<i>B</i>	<i>r</i> min.	<i>C_r</i>	<i>C_{0r}</i>	<i>C_r</i>	<i>C_{0r}</i>	<i>f₀</i>	Grease Open Z · ZZ V · VV	Oil DU DDU	Oil Z	Open	Shielded	Sealed	
25	37	7	0.3		4 500	3 150	455	320	16.1	18 000	10 000	22 000	6805	ZZ	VV	DD
	42	9	0.3		7 050	4 550	715	460	15.4	16 000	10 000	19 000	6905	ZZ	VV	DDU
	47	8	0.3		8 650	5 800	905	570	15.1	15 000	—	18 000	16005	—	—	—
	47	12	0.6		10 100	5 850	1 030	595	14.5	15 000	9 500	18 000	6005	ZZ	VV	DDU
	52	15	1		14 000	7 850	1 430	800	13.9	13 000	9 000	15 000	6205	ZZ	VV	DDU
28	62	17	1.1		20 600	11 200	2 100	1 150	13.2	11 000	8 000	13 000	6305	ZZ	VV	DDU
	52	12	0.6		12 500	7 400	1 270	755	14.5	14 000	8 500	16 000	6405	ZZ	VV	DDU
	58	16	1		16 600	9 500	1 700	970	13.9	12 000	8 000	14 000	6505	ZZ	VV	DDU
	68	18	1.1		26 700	14 000	2 730	1 430	12.4	10 000	—	—	—	—	—	—
30	42	7	0.3		4 700	3 650	480	370	16.4	15 000	—	—	—	—	—	—
	47	9	0.3		7 250	5 000	740	510	15.8	15 000	—	—	—	—	—	—
	55	9	0.3		11 200	7 350	1 150	750	15.8	15 000	—	—	—	—	—	—
	55	13	1		13 200	8 300	1 350	—	—	—	—	—	—	—	—	—
	55	16	1		19 500	11 300	—	—	—	—	—	—	—	—	—	—

Figure 1: NSKE1102k 2012. B10

to run greater than 20,000 rpm all day but is an expensive option. One bearing alone could hurt the cost competitiveness of your gearbox. In the case where a single bearing can change the landscape of your project, it is worth taking a little time to understand exactly what the drivers of our speed limitations are.

Due to the extensiveness of this subject, we will only discuss catalog Limiting Speed today which is a mechanical based speed rating. Thermal-based speed ratings are rooted in ISO 15312 and DIN 732 which we will cover next time. Those ratings discuss speed limitations solely based on the ability to keep the bearings thermally stable and make no assumptions about mechanical limitations.

While pinning down the origins of the original limiting speed is vague, it is loosely based on a metric called DmN, a simple calculation of bearing pitch diameter ((inner diameter + outer diameter) / 2) x rpm. This value is completely mechanical and mostly concerns the integrity of the cage, though as we will discuss, the cage is influenced by everything else. The catalog limiting speeds are based on a DmN of 500,000 for sealed bearings and between 600,000–750,000 for open bearings. For example, the top line in Figure 1: $[(25+37)/2] \times 18,000 = 558,000$ for grease and 682,000 for oil.

The catalog is considered a safe, continuous operating speed. Somewhere between 700,000–1,000,000 DmN is considered moderate speed, which is still probably OK, but we must start dialing in clearances, making sure we don't have large misalignments, our component tolerances are reasonably good, and we have a good supply of lubrication. When we go over one million, this is considered the high-speed region. Again, an off-the-shelf bearing may be fine in the low one-millions, but now our shaft, housing and absolute position tolerances should be very good (in the IT5/6 region which we will discuss another time) we also need to start thinking about cage strength, cage materials, fillers—glass and carbon fiber, and the dynamic mechanisms that we are going to discuss below.

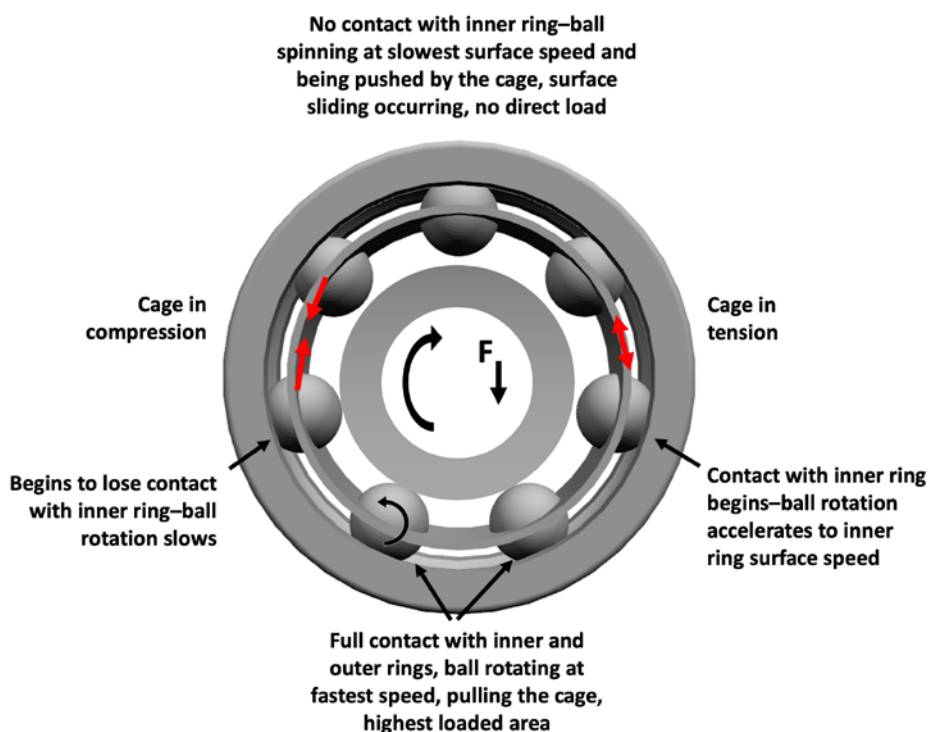
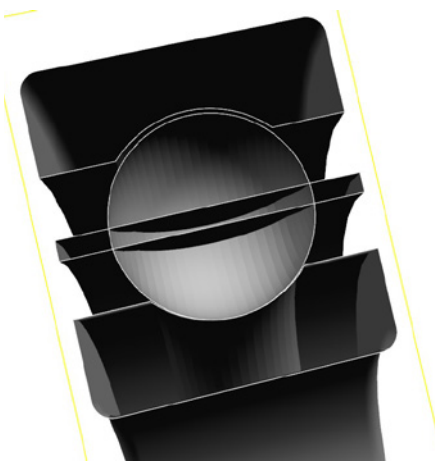


Figure 2: Different travel areas in and out of the load zone.

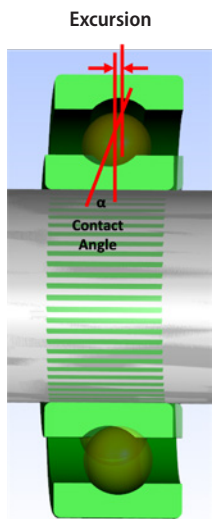
Let's talk about forces acting on the cage. If you are wondering where these cage forces are coming from, you are not alone. If the bearing is perfectly aligned and the balls are turning with the rings, there should not be a lot of external forces, right? In many cases, the forces are negligible and why you find very thin plastic cages in many consumer-type products. When we get into higher speeds (beyond the catalog rating), the small forces can develop into forces large enough to compromise the cage integrity.



Outside of the obvious centrifugal force, there is a push-pull mechanism on a cage that is developed from the internal clearance of the bearing. If the bearing has zero clearance, as with a set of preloaded angular contact bearings, then the ball would be in perfect rolling contact 360 degrees around the raceway and there would be no tendency for the balls to slow down or speed up around the raceway. However, when we are dealing with a single-row deep groove ball bearing, we have an internal radial clearance to deal with. While this clearance is small, at high speeds it becomes a factor.

Figure 2 highlights the different areas of the bearing as it travels in and out of the load zone. At moderate to high speeds, the balls will stay in contact with the outer ring as they exit the loaded zone due to centrifugal force. From the point of losing contact, the only driving mechanisms for the balls are inertia and the cage. As the ball traverses the top of the bearing, some sliding is likely occurring as inertia is lost and the cage is pushing the balls. As the ball begins to reenter the load

zone, they begin to accelerate to the inner ring speed again. During this brief acceleration area, the ball begins to pull on the cage. This dynamic is the elusive push-pull mechanism that you may have heard about. Perspective is important here. We might be running with 20 microns of clearance during operation, so these effects are small and happen in microseconds, but can easily occur over a billion times during the life of the bearing. You can see here that the amount of internal clearance will have an impact on how long the bearing is in and out of the load zone



and the relative rotational speeds of the balls. You can begin to quantify these values with relatively simple math (though a lot of it) and we may tackle that in a future post.

If the bearing is supporting a gear set, we likely have an axial load to deal with as well. This imparts yet another dynamic

which we call excursion. After understanding the dynamics of clearance, this is an intuitive secondary mechanism that we need to understand—even if only understanding that axial loads put further stress on the cage. For a ball bearing under axial load, there is an offset between the inner and outer rings. This, in turn, forces the ball to run off-center. We refer to the angle that the ball is running on relative to the center of the raceway, the contact angle. Unlike angular contact bearings, this contact angle is not fixed and fluctuates with load. Just as with radial clearance, when the balls are in the load zone, they are locked into this contact angle by both rings. As the ball leaves the load zone and loses contact with the inner ring, the ball will drift back towards the center of the raceway due to centrifugal forces. This creates somewhat of an axial “wobble” as the ball goes in and out of the load zone and the magnitude is referred to as excursion.



As you may know, axial clearance can be 10 times or more than the radial clearance just due to the geometry of the bearing. This means that a hard axial load can be much harder on the cage than a pure radially loaded bearing. In addition to the push-pull mechanism, the ball now radially pushes on the bearing pocket. One potential countermeasure for this is to loosen up the cage pockets a little or adjust the geometry to distribute the loads around the pockets more evenly.

When the required speed exceeds the limiting speed of the desired bearing; then the accuracy grade, internal clearance, cage type and material, lubrication, etc., must be carefully studied in order to select a bearing capable of the required speed. In such a case, forced-circulation oil lubrication, jet lubrication, oil mist lubrication, or oil-air lubrication must be used.

If all these conditions are considered. The maximum permissible speed may be corrected by multiplying the limiting speed found in the bearing tables by the correction factor shown in Table 6.1. It is recommended that NSK be consulted regarding high speed applications.

Table 6.1 Limiting Speed Correction Factor for High-Speed Applications

Bearing Types	Correction Factor
Cylindrical Roller Brgs. (single row)	2
Needle Roller Brgs. (except broad width)	2
Tapered Roller Brgs.	2
Spherical Roller Brgs.	1.5
Deep Groove Ball Brgs.	2.5
Angular Contact Ball Brgs. (except matched bearings)	1.5

As a parting note to limiting speeds, I found this gem above in a hard-to-find corner of an NSK catalog. This corrections factor suggests that if we optimize all our parameters, we can multiply our limiting speed by 2.5 for ball bearings, as we calculated earlier, which is around 1.2–1.3 million DmN—a fairly reasonable estimate. We will see how this compares to our thermal limiting speeds next time. **PTE**

powertransmission.com/blogs/5-bearings-with-norm



Norm Parker is currently the Sr. Specialist Roller Bearings—Propulsion Systems at Stellantis. He’s been contributing to *PTE*’s “Bearings with Norm” blog since 2014.

GREAT SCOTT!

It's the future!

OK, you blinked and missed last month's issue of *Power Transmission Engineering*. Fortunately, you don't need a DeLorean to travel back in time, just a computer and working fingers.

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SKF and ABB

INCREASE COLLABORATION ON INDUSTRIAL AUTOMATION



SKF and ABB have entered a Memorandum of Understanding (MoU) to explore the possibilities for a collaboration in the automation of manufacturing processes. The MoU was signed at ABB's Robotics Experience Center in Västerås, Sweden, by SKF CEO Rickard Gustafson and ABB CEO Björn Rosengren.

Following the successful delivery of several projects in SKF's global manufacturing network, including in Gothenburg, where a fleet of industrial robots from ABB are installed in the bearing manufacturer's state-of-the-art factory, the two companies are now taking the next step in their collaboration.

Through the partnership, SKF and ABB will identify and evaluate solutions to improve manufacturing capabilities and support clients' increased production efficiency. As a first step, SKF's investments in automation and clean manufacturing processes will act as a testbed, focused on decreasing CO₂ emissions from SKF's operations. Longer-term, the parties intend to explore new business opportunities in both traditional and new market segments, where both companies bring experiences within a wide range of industries.

Rickard Gustafson, president and CEO of SKF, says: "We are increasing the automation of our production facilities



in all our regions, in order to stay ahead of our competition and improve our environmental performance. This also enables a more flexible and safer working environment. ABB is an important partner for us in this area and we, as two leading industrial companies, will continue to develop innovative solutions to further increase the competitiveness of our customers."

Björn Rosengren, CEO of ABB, says: "The demand for automation is increasing, driven by declining working age populations, rising labor costs, and industry's efforts to create resource-efficient operations in the transition to more sustainable manufacturing. I am therefore pleased to announce this deepened partnership alongside SKF, further strengthening our technical leadership."

Recently, the two companies have signed contracts for delivery of specific projects in the field of advanced manufacturing automation, robotic random bin-picking, or installations of innovative logistics automation solutions in more complex industrial workshops within SKF's manufacturing footprint, thus making it possible to see how robots can enable quality assurance of detail management.

skf.com, abb.com

JIE USA Inc.

INTRODUCES 3D CAD CONFIGURATOR

JIE USA has released a 3D CAD gearbox and gearmotor configurator to help engineers choose motors and drives on-demand. The online tool enables engineers to identify the correct product for their design or application based on custom parameters and deliver the CAD model or PDF data-sheet they need to do their job efficiently.



"Previously, customers would send us all their application information, and our engineers selected the right product for them. This meant a lot of back-and-forth with the customer if we had any questions, which took a lot of time," said Bo Chen, president of JIE USA Inc. "Now customers can self-serve online. They enter the parameters of their application, like input power, ratio, torque, and output RPM, and the configurator recommends a compatible gearbox or gearmotor. It's more efficient and lets the customer work on their own time rather than contacting us directly."

JIE has also introduced configurable 3D PDF datasheets that include essential product data that their customers need.

“With these PDFs, customers don’t have to come back to us for missing data points for the product,” Chen said. “The PDF shows everything related to the product.”

“We’re really excited about this configurator. It lets customers build a compatible system on their own, and it shows everything they need to know right on the page. It’s putting design power in the customer’s hands,” he added.

jje-drives.com
jje-drives.com/configurator/

Velo3D

PROVIDES ADDITIVE SOLUTION TO PRATT & WHITNEY

Velo3D, Inc. recently announced that Pratt & Whitney has acquired an end-to-end solution from Velo3D to evaluate the Sapphire printer for manufacturing production jet engine components. This is the first Sapphire printer to be located at Pratt & Whitney; it previously utilized Velo3D’s contract manufacturer network to produce printed and finished parts.

Pratt & Whitney and Raytheon Technologies are experienced and accomplished users of Additive Manufacturing (AM) technologies with extensive knowledge across various platforms and applications. Raytheon Technologies is a launch participant of President Biden’s AM Forward initiative, a new program encouraging companies to explore the use of additive manufacturing to transform supply chains and drive innovation. Raytheon Technologies’ commitment includes seeking small-medium-enterprise manufacturers’ involvement in over 50% of its requests for quotes on products manufactured using additive technologies, as well as seeking to simplify and accelerate the procurement process of AM parts.

“Metal additive manufacturing can transform aviation and space systems by delivering unprecedented part consolidation, lighter weight components, and more efficient systems,” said Benny Buller, Velo3D founder and CEO. “We’re pleased to see Pratt & Whitney move forward with their own Sapphire XC printer. We’re eager to see how they innovate their most mission-critical designs using our end-to-end solution, and how the economies of scale of an in-house system help increase addressable use-cases.”

“Pratt & Whitney looks forward to future applications using the Sapphire XC printer, and collaborations with other potential suppliers with the Velo3D capability, for Pratt & Whitney GTF and advanced engine programs,” said Jesse Boyer, fellow, Additive Manufacturing, Pratt & Whitney.

The company’s new Sapphire XC printer is calibrated to print in Inconel 718, a nickel-based superalloy well-suited for extreme temperatures.

The Raytheon Technologies Research Center is the company’s central innovation hub where engineers, scientists and researchers explore and develop new, transformative technologies. The center provides the company’s businesses with groundbreaking innovations and solutions to critical customer problems in a wide range of research



areas, including complex integrated systems, advanced materials and manufacturing, autonomy-enabling technologies, electrification, and sustainability.

This is made possible by Velo3D’s end-to-end solution, which includes Flow print preparation software, the Sapphire family of printers, Assure quality assurance software, and Intelligent Fusion underlying manufacturing processes. The system uses a set of known recipes to achieve the geometries desired without using supports and monitors the build process layer-by-layer to ensure the highest quality.

velo3d.com

FANUC America

NEARLY DOUBLES MICHIGAN CAMPUS TO ACCOMMODATE AUTOMATION DEMAND

FANUC America announces a West Campus expansion that will push its operational space in Oakland County, Mich., to nearly two million square feet. The construction will include a 655,000 square foot state-of-the-art facility to house manufacturing, engineering, and R&D projects.

This investment in Michigan’s growing manufacturing area includes the purchase of 67 acres of land as well as the site of the former Thomas M. Cooley Law School Campus, which will provide future growth in the education of the next generation of robotics and automation workers. Including the existing building, FANUC will add a total of 788,000 square feet of additional operational floor space.

“We’re excited to announce the addition of the new West Campus and our ability to continue to expand in Oakland County, Mich.,” said FANUC America’s President and CEO Mike Cicco. “This investment in the future of US manufacturing will help FANUC America meet the tremendous demand for automation solutions.”

In October 2019, FANUC America opened North Campus, a 461,000 square-foot facility built by General Development Company, who is also constructing the new West Campus.

“We’re happy to be brought onboard once again by FANUC,” said Bruce Brickman, principal at General Development Company.

North Campus, located in Auburn Hills, Mich., is walking distance from FANUC America’s headquarters in Rochester Hills, Mich. The addition continues to be crucial in growing the company’s engineering, R&D, manufacturing, and



warehousing capabilities and has supported record-breaking orders and deliveries in a short period of time.

“Interest in robotics and automation remains strong with new demand coming from a variety of industries,” said Cicco. “EV, warehousing and logistics as well as food and beverage are all looking to automation to increase production and solve the growing labor shortage.”

“In addition, advanced automation requires new skills and training to keep manufacturing strong in North America as well as in Michigan,” added Cicco. “We’re committed to fueling the growth of manufacturing in Michigan. We’re proud of our roots here, starting with the design and build of our first line of NC Painter robots in 1982 to today with the local production of our entire paint robot line.”

The future FANUC America West Campus site is located in Auburn Hills, Mich., a suburb of Detroit. With its historical links to the automotive industry, the town has become a thriving business center and home to more than 80 international corporations.

“We are grateful that FANUC has chosen to expand their already impressive footprint in Auburn Hills, an example that our community continues to be regarded as a premier destination for innovation and advanced technologies,” said Kevin McDaniel, mayor of Auburn Hills, Mich. “As a leader in the robotics industry, their expertise will complement our diverse business base and will contribute to the city’s strong local economy through jobs and investment. This development may very well earn us the designation as the community with the largest robotics footprint in the United States. We appreciate our trusted partnership with the General Development team who will build the project and look forward to another quality development in Auburn Hills.”

After the City of Auburn Hills approves plans, FANUC America plans to break ground in the fall of 2022 and is expected to be completed in the spring of 2024.

fanucamerica.com

Winsmith

REDESIGNS WEBSITE AND LAUNCHES NEW PERFECTION GEAR WEBSITE

Winsmith, a diversified manufacturer of highly engineered gearing products, recently announced the redesign of their website and the launch of a new Perfection Gear website.

The updated Winsmith website re-organized the product pages by gearing type and includes new content and

product images. Additionally, Winsmith product configurators are more easily accessible.

Perfection Gear products now have their own website for swing and rotation drive solutions. The new website (perfectiongear.com) features dependable gearing solutions for aerial trucks and lifts, service trucks and other lift equipment.

“Our websites have been designed to help visitors quickly find information on the gearing or drive solutions they need,” said Alan Kupchanko, product manager, Winsmith. “And we have a system in place for customers to quickly reach out to our team with product inquiries and other questions.”

winsmith.com

3DX Industries

TARGETS LAND SPEED RECORD AT BONNEVILLE SALT FLATS

3DX Industries Inc., a state-of-the-art advanced manufacturer specializing in additive 3D metal printing and subtractive manufacturing technologies, attended Bonneville Speedweek at the Salt Flats in Wendover, Utah in August.

The Bonneville Salt Flats is home to all kinds of speed-shattering records that are usually set at a myriad of racing events held here including: the Bonneville Motorcycle Speed Trials and Bonneville Speed Week—the largest meet of the year, attracting hundreds of drivers in all racing classes who compete to set new land speed records in all kinds of racing categories.

3DX Industries, Inc. has been involved in the design and printing of custom racing parts for years and is sponsoring Jessco Racing in their quest to set a new land speed record in the 3000CC, partial Streamliner, pushrod class.

“The team at 3DX has built custom racing parts for over 10 years, including 3D metal printed intake manifolds, billet machined brake calipers, blower bearing end caps, an intake for a Toyota Supra Race Team, custom control switch for KTM off road Motorcycles and other racing components,” said Vice President Nicholas Coriano.

“We manufacture custom and production parts with complexity and precision more efficiently through our additive manufacturing capabilities,” added Roger Janssen, 3DX president and CEO.

3dxindustries.com



October 27–29—PTDA 2022 Industry Summit

The Power Transmission Distributors Association (PTDA) will convene for the PTDA 2022 Industry Summit in Nashville, Tenn. on October 27–29, 2022. With more than 500 delegates in the power transmission/motion control (PT/MC) industry expected to attend, representing over 200 PTDA distributor and manufacturer companies, the Industry Summit—themed “Amp Up”—will offer cross-channel networking, shared learning and collaborative experiences. New for 2022, the signature event of the PTDA Industry Summit—the Manufacturer-Distributor Idea Exchange (MD-IDEX)—has been increased to two days. MD-IDEX is a time- and cost-effective forum bringing together distributor and manufacturer executives for high-level discussions on market strategies and issues. Distributor and manufacturer members alike laud MD-IDEX as one of the best face-to-face cross-channel business programs with a measurable ROI for participants.

powertransmission.com/events/904-ptda-2022-industry-summit

November 8–10—Smart Production Solutions (SPS) 2022

With its unique concept, Smart Production Solutions (SPS) covers the entire spectrum of smart and digital automation – from simple sensors to intelligent solutions, from what is feasible today to the vision of a fully digitalized industrial world. SPS, located in Nuremberg, Germany, is an innovative platform for the automation industry with topics on control technology, electric drive systems, HMIs, software, sensors, and mechanical infrastructure. Whether keynote, expert lectures, or panel discussions, the SPS 2022 lecture program brings together high-profile speakers across a wide variety of channels, providing additional exchange opportunities beyond physical boundaries. Industry 4.0 is changing the entire world of industrial manufacturing. Increasing digitalization and intelligent networking of machines, systems, and products along the value chain opens a whole new range of possibilities. Exhibitors at the “Automation meets IT” stand will present digital solutions for automation specialists on the road to Industry 4.0.

powertransmission.com/events/905-smart-production-solutions-sps-2022

November 15–18—Formnext 2022



Formnext (Frankfurt, Germany) is an entire platform for companies from the world of additive manufacturing. Here, additive design and product development, industrial tooling, production solutions, quality management, and

measurement technology comes together with leading providers in basic materials and component construction. It will also explore clever ways in which AM can be integrated into process chains in industrial production. In addition, top international speakers and other experts will be on hand to engage conference attendees.

powertransmission.com/events/908-formnext-2022

November 16–17—Automation Fair 2022

The Automation Fair (Chicago) offers an immersive experience showcasing the value and power of Rockwell's IT/OT expertise. This two-day event brings together industrial automation experts and leaders to guide attendees through the latest breakthroughs, strategies, and proven best practices, and to work with you on how to enhance your operation and achieve greater results. From engaging keynote presentations, interactive training and learning, industry-centric discussions, and a signature show floor featuring the latest innovations from Rockwell Automation and members of the company's PartnerNetwork program, this year's event will provide end-to-end insights to expand your business.

powertransmission.com/events/907-automation-fair-2022

December 5–8—CTI



Symposium Berlin 2022

CTI Symposium Berlin starts with two introductory days dealing with the basics and practice of automotive transmissions, hybrid and electric drives for newcomers and those who want to refresh their knowledge. This is followed by the main program with keynote speeches, panel discussions and technical presentations. This includes the exchange of experiences, R&D results, and opinions with leading representatives of automobile manufacturers, suppliers, engineering consultants as well as officials. The Symposium offers active discussion of the latest technologies and strategies on automotive transmissions, HEVs and EV drives for passenger cars and commercial vehicles. CTI Test Drives are available to experience automotive transmissions and drives in practice.

powertransmission.com/events/910-cti-symposium-berlin-2022



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Bearing with Norm: After a several-years hiatus, we're pleased to welcome back our bearings blogger, Norm Parker.

Revolutions: Our editorial staff provides relevant and timely articles on a variety of PT industrial topics.

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Kraftwerk and Man as Industrial Palace

What can electronic music teach us about robots?

Aaron Fagan, Senior Editor

The members of Kraftwerk are often referred to as “the godfathers of electronic music.” While they are pioneers of the use of electronic equipment in music, they have also had considerable influence on disco, rap, electro, synth-pop—a ubiquitous influence from Detroit techno to London grime. From their home in Germany, they have created a legacy that has had an enduring effect and has informed the development of pop culture for over fifty years. My wife and I had the good fortune to see their live 3D performance in Dallas back in June, and my colleagues suggested I write a “Power Play” piece about it. The more I thought about it, the more I liked the idea. And seeing as *kraftwerk* means “power plant,” that should naturally interest readers of *Power Transmission Engineering*.

As we know, a power plant is an engine and related parts supplying the motive power of a self-propelled object. And Kraftwerk was modeled after the man-machine (*die mensch-maschine*), a concept inspired by German polymath Fritz Kahn who laid the foundations of modern information graphics and is best known today for his famous 1926 poster *Man as Industrial Palace*.

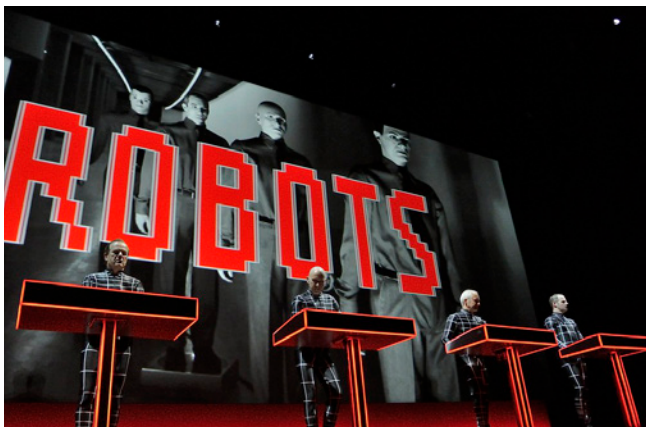
What can Kraftwerk teach us about robots? The answer is both very little and a lot. For Kraftwerk, the man-machine is a philosophical and acoustic concept with the group functioning as the power plant—the ultimate fusion of culture and technology. Not the role of technology in an as-yet-unrealized future, but the integration of technology and human life in the present.

For Kahn, factories, engine rooms, and laboratories do not work on their own but are operated and driven by large numbers of workers. These human figures keep the man-machine running. In Kahn’s pictorial world, he sees metaphysics and science not as opposites but as two sides of the same coin, or as he put it, the “heaven and earth of the human soul.”

As Kraftwerk has often claimed, “The machines are part of us, and we are part of the machines. They play with us, and we play with them. We are brothers.” These ideas were given concrete form in *The Man-Machine* album of 1978, which showed Kraftwerk’s relationship to technology is bound up in their relation to their immediate environment—rather than using postmodern technology to map out an escape route towards the further reaches of the cosmos, it is used to recreate the mechanized soundscapes of the modern, industrialized city.

As my wife and I entered the Music Hall at Fair Park in Dallas we were given 3D glasses and directed to our seats on a balcony which gave us an angled view down to the stage. At 7:00 p.m., the four members dressed in matching grid suits took to their iconic control desks all outlined in neon changing color synchronized with the music. At times, against the backdrop of 3D visuals, the four members seem to be suspended in space. In his seminal novel *Neuromancer* (1984), William Gibson prophetically coined the term “cyberspace” which he described as a “consensual hallucination,” which perfectly captures the live experience of Kraftwerk’s futurist aesthetic. The aural and visual synesthesia was so perfectly integrated we were swept away in a hypnotic state that felt closer to a consensual hallucination than anything originating from the gigantic screens and speakers.

Kraftwerk once said in an interview, “When you play electronic music, you have control of the imagination of the people in the room and it can go to the extent where it’s almost physical.” This sentiment is further echoed in another interview in which they say, “Kraftwerk finds some energy in the environment of people who come to see us and who make us play in another dimension. Electronics are beyond nations and colors. It speaks a language everyone can understand. It expresses more than just stories the way most conventional songs do. With electronics, everything is possible. In front of the loudspeakers, everyone is equal.” **PTE**





Stop paying twice!

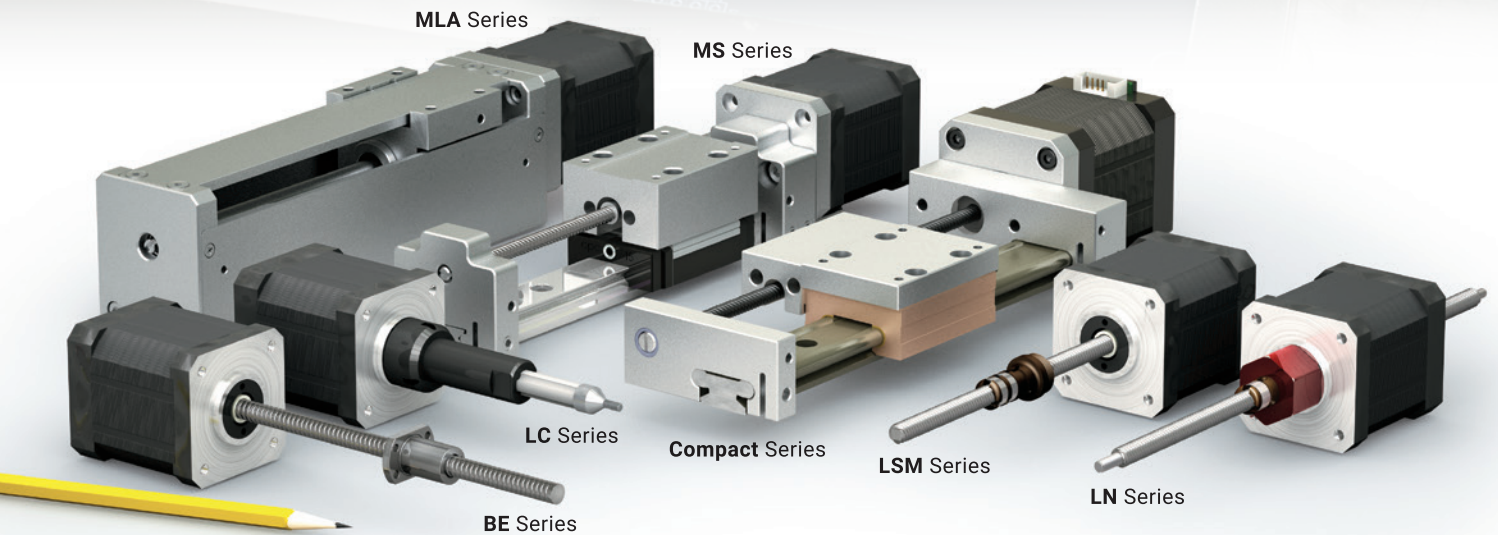
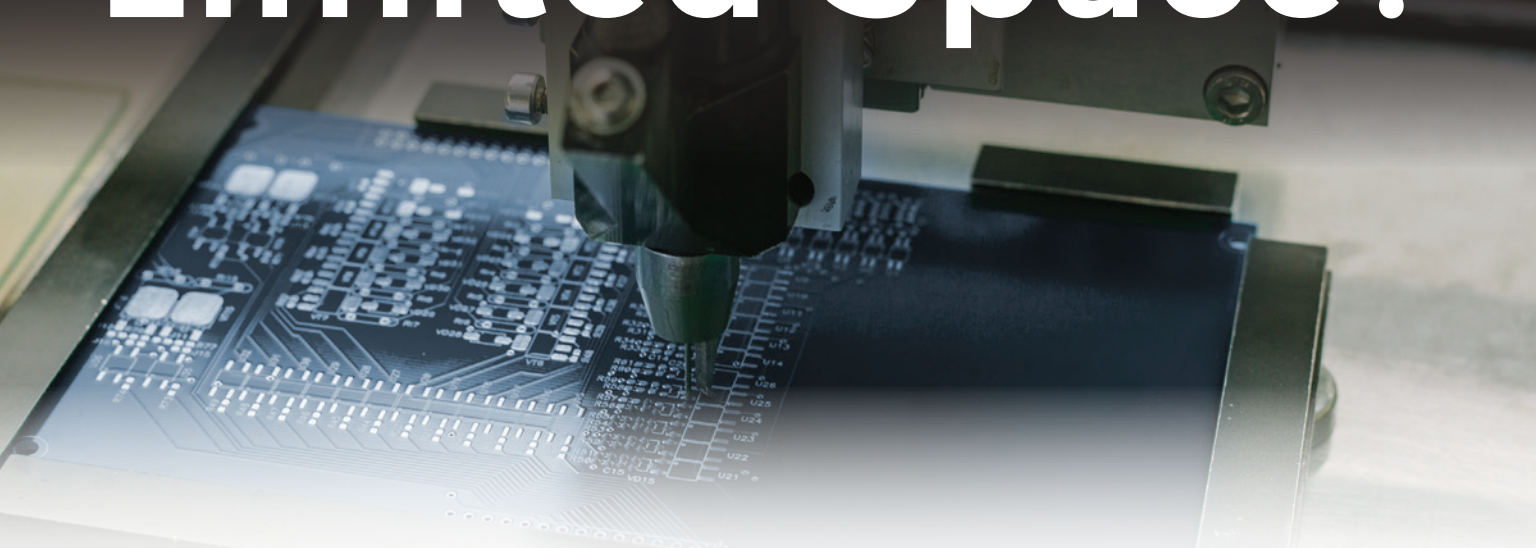
Problem: Inefficient drive systems create heat. And, hundreds of drives = a ton of heat. So, you pay for energy twice - first to move the conveyor and second to cool the air. Time to switch gears . . .



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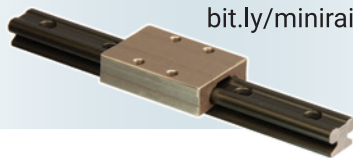
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