

PTE

POWER TRANSMISSION ENGINEERING™

**OCTOBER
2026**

**BELT TECHNOLOGY
PACK EXPO 2026
SOLVING HIGH RISK
MRO CHALLENGES**

TECHNICAL

Gear Scuffing Analysis Comparison Study

powertransmission.com

PTE is POWERED by the
MOTION + POWER
MANUFACTURERS' ALLIANCE™

ABMA

ABMA

ABMA

ABMA

ABMA

ABMA

ABMA

We're sensing big savings in your future...

when you buy process instrumentation from AutomationDirect



NEW! Gefran GRM-H Series Power Controllers

Starting at \$295.00 (GRM-H-10-48-AN-0-1)

Keep critical heating processes running smoothly with Gefran GRM-H series power controllers. Designed for industrial heating systems, these SCR-based controllers offer specialized functions to reduce startup inrush currents, improve temperature stability, and help extend heater life.



NEW!

- 10 to 75A range supports industrial heating loads from light to heavy duty
- Burst and phase-angle firing modes deliver precise heating control



NEW! Ashcroft T4 Series Temperature Switches

Starting at \$464.00 (T424TS027-40/60F)

When temperature control can't fail, Ashcroft T4 series switches deliver. High-current switching capability, simple field-adjustable setpoints, and rugged environmental protection provide reliable performance in industrial facilities and outdoor installations.



NEW!

- Wide -40° to 525°F (-40° to 274°C) setpoint range in one product family
- 15A SPDT contacts eliminate the need for interposing relays



NEW! Wenglor weFlux2 Series Thermal Flow Sensors

Starting at \$300.00 (FXFF901)

Monitor flow and temperature with confidence using Wenglor weFlux2 insertion-style thermal flow sensors. They provide accurate measurements independent of installation orientation or flow direction. IO-Link models simplify integration and provide access to process and diagnostic data.



NEW!

- 10 to 400 cm/s (0.33 to 13.12 ft/s) flow range offers versatile flow monitoring
- Switch, analog, or IO-Link output options provide flexibility



NEW! AchieVe LPPS and S18-1C Series Pressure Switches

Starting at \$33.00 (S18-1C-10)

AchieVe LPPS and S18-1C series mechanical pressure switches offer reliable pressure control with rugged construction, straightforward adjustment, and dependable relay outputs for cost-effective control circuits.



NEW!

- Setpoint ranges up to 3000 psig (LPPS) or 120 psig (S18-1C) cover low- to high-pressure applications
- Easy mechanical setpoint adjustment simplifies setup

Also Available

Process Controllers

Load Cells

Flowline Level Controllers

Point-to-Point Wireless I/O



Research, price, and buy at:

www.automationdirect.com/process

Order Today. Ships Fast!

* See our Web site for details and restrictions.
© Copyright 2020 AutomationDirect, Camming, GA USA. All rights reserved.



AUTOMATIONDIRECT.com

1-800-633-0405

the #1 value in automation

FEATURE ARTICLES



22

14 The Predictive Maintenance Playbook

How HECO keeps critical components one step ahead of failure

18 The Right Linear Drive Starts With the Right Questions

Thomson Industries deconstructs drive technology selection

22 The Search for Flexible and Sustainable Packaging Solutions

Pack Expo International 2026 aims to tackle operational challenges

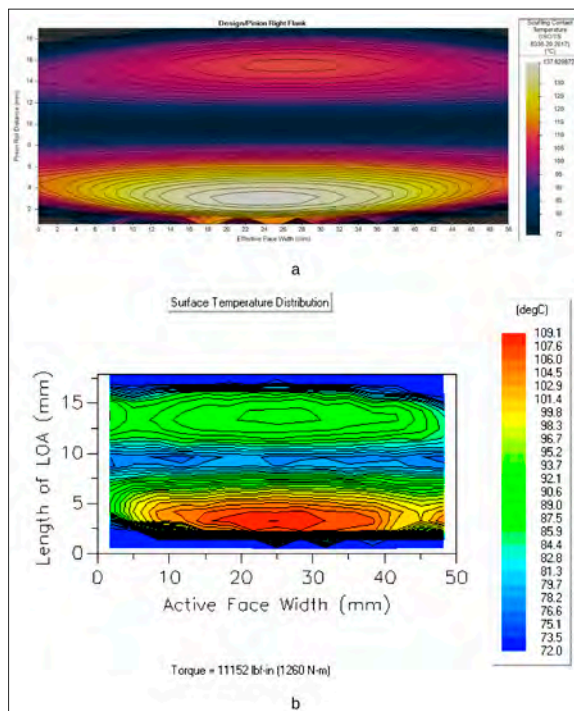
28 Building an Automated Community

MotionTech expands automation reach to US market

27 Systematic Solutions

Schaeffler showcases motion technology at Automotive Symposium 2026

TECHNICAL ARTICLES



36

36 Gear Scuffing Analysis Comparison Study

Gear scuffing poses a substantial challenge to the durability and longevity of EV gearboxes. To address the challenges posed by gear scuffing, researchers have turned to ISO standards and advanced analytical software tools.

STAY CONNECTED



Connect with us on LinkedIn
[linkedin.com/company/power-transmission-engineering/](https://www.linkedin.com/company/power-transmission-engineering/)



Subscribe Online
powertransmission.com/subscribe

MOTION + POWER
 MANUFACTURERS ALLIANCE™



American
 Gear Manufacturers
 Association®



American Bearing
 Manufacturers Association



BRAIN TEASER

Saving Energy or Burning Up?

An engineer slows a conveyor's AC induction motor from 60 Hz to 30 Hz using a VFD to save energy during light-load periods. Motor current is well below nameplate. After a few weeks, the motor's winding temperature alarm trips.

Question:

The motor isn't overloaded—so why is it overheating?

Join the discussion



Comment at
[linkedin.com/company/
 power-transmission-engineering](https://www.linkedin.com/company/power-transmission-engineering)
 on LinkedIn or use
 #PTEBrainTeaser
 to share your answer.

Selected responses may be featured in an upcoming issue.
 Answer revealed in the next issue.

Last issue we asked: A wind turbine gearbox transmits power at 97 percent efficiency. When the grid back-drives the rotor during low wind, is it still 97 percent efficient in reverse?

Answer: No. Gear mesh friction that aids power flow in one direction opposes it in the other, so reverse efficiency is always lower. For a 97 percent efficient helical stage, reverse efficiency drops only slightly. But in designs using worm or high-reduction planetary stages, the penalty is severe—and in some cases, reverse power flow is nearly impossible. Engineers designing for bidirectional loads need to calculate efficiency in both directions independently.

PTE™

VOL. 20, NO. 7

04 PTE Extras

Hyperdrives Opens New HQ; Vesconite Marine Bearings; The Function of Couplings

06 Editor's Desk

Where Do They Get Those Wonderful Toys?

08 Product News

Schaeffler humanoid components;
SEW-Eurodrive expands servo portfolio;
Dunkermotoren BLDC motor solutions; and more.

33 Engineering sMart

Products and services marketplace.

42 Industry News

B&R Automation safety engineering;
BCA Bearings training program; **Siemens**
 strengthens infrastructure leadership.

45 Calendar

Pack Expo International 2026; Automation Fair 2026; SPS 2026; CTI Symposium Berlin 2026.

46 Advertiser Index

Contact information for every advertiser in this issue.

47 Subscriptions

Renew your free subscription today.

48 Power Play

Norms and Standards

KHK-USA

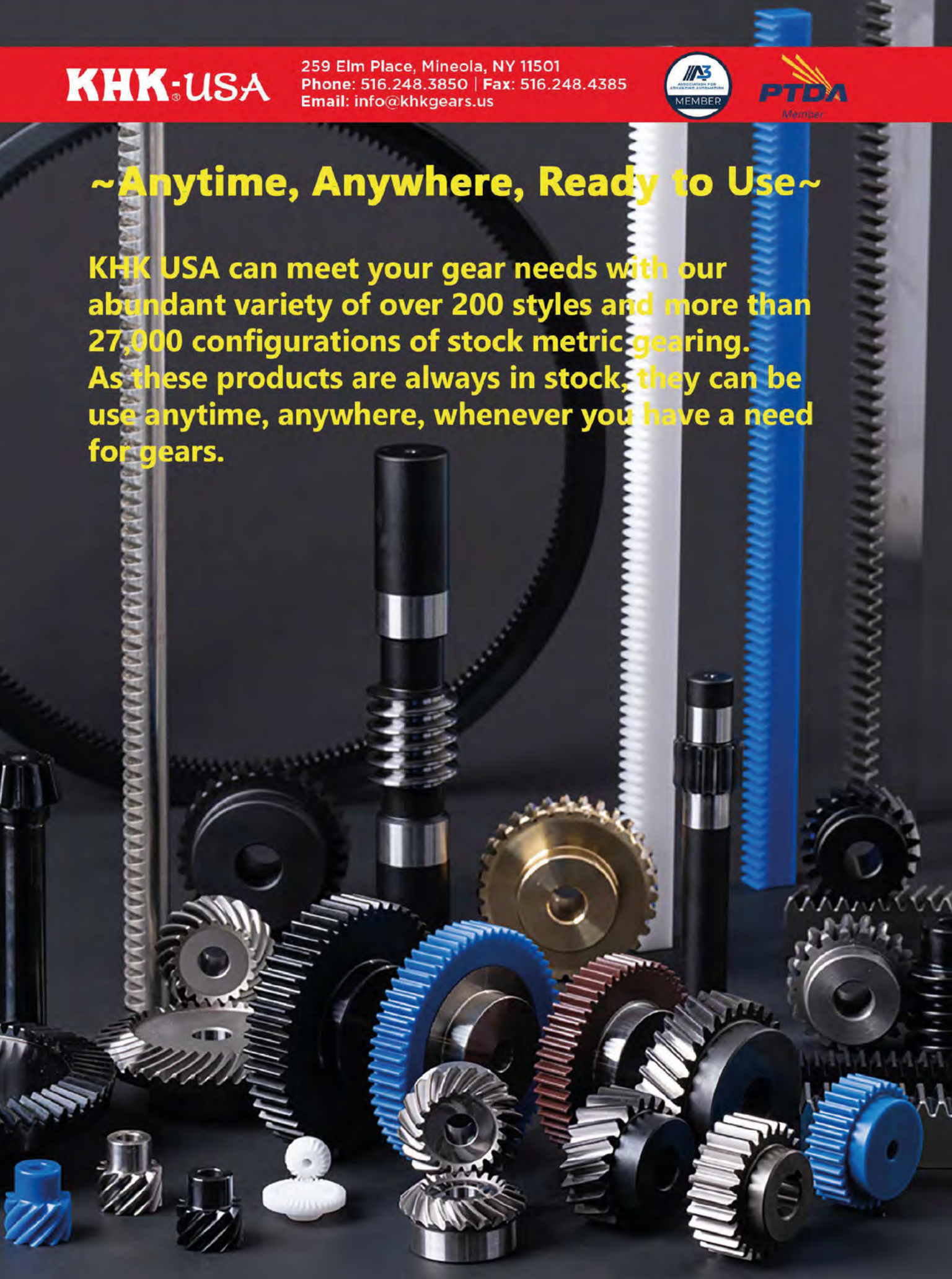
259 Elm Place, Mineola, NY 11501
Phone: 516.248.3850 | Fax: 516.248.4385
Email: info@khkgears.us



~Anytime, Anywhere, Ready to Use~

KHK USA can meet your gear needs with our abundant variety of over 200 styles and more than 27,000 configurations of stock metric gearing.

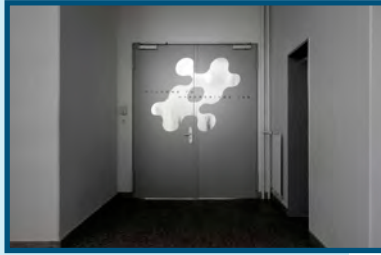
As these products are always in stock, they can be use anytime, anywhere, whenever you have a need for gears.



PTE REVOLUTIONS

Hyperdrives Opens New Munich HQ to Expand Electric Propulsion Engineering and Validation Capacity

Hyperdrives, the Munich-based electric propulsion technology company, has expanded its engineering capabilities with the opening of a new headquarters and engineering facility in Munich's Obersendling district, marking an important step in the company's transition from technology development to industrial-scale deployment.



powertransmission.com/hyperdrives-opens-new-munich-hq-to-expand-electric-propulsion-engineering-and-validation-capacity

Vesconite Rudder Bearings Selected for New Zealand-Built Sportfishing Superyacht

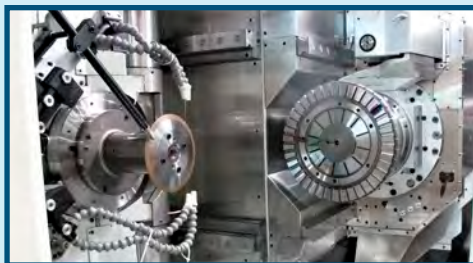


Vesconite Bearings supplied bearings and washers in July 2026 for a custom-built 60-m sportfishing yacht under construction at one of New Zealand's leading custom yacht builders. Two upper rudder bearings and two lower rudder bearings were supplied, with the lower rudder bearings being longer since they carry a much higher reaction load and need a larger bearing area to keep the bearing pressure within acceptable limits.

powertransmission.com/vesconite-rudder-bearings-selected-for-new-zealand-built-sportfishing-superyacht

AS SEEN IN GEAR TECHNOLOGY

The Function of Couplings



Couplings are designed for a variety of duties. Hardy disks, for example, are compliant elements that connect a transmission output in a vehicle with the propeller shaft. Compliance is required to accommodate the misalignments the propeller shaft encounters when the vehicle is loaded with passengers, or if the vehicle drives on uneven pavement.

geartechnology.com/couplings-and-clutches

powertransmission.com

MOTION + POWER

MANUFACTURERS ALLIANCE™

MPMA MEDIA

1001 N. Fairfax Street, Suite 500, Alexandria, VA 22314
Phone: (847) 437-6604
Fax: (847) 437-6618

EDITORIAL

Director, Editorial Content
Matthew Jaster
jaster@motionpower.org

Senior Editor
Aaron Fagan
fagan@motionpower.org

Associate Editor
Jennifer Jensen
jensen@motionpower.org

GRAPHIC DESIGN
Design Manager
Jess Oglesby
oglesby@motionpower.org

ADVERTISING

Manager, Member Engagement and Sales
Katie Mulqueen
mulqueen@motionpower.org

Media Fulfillment & Member Services Coordinator
Baillie Bodle
bodle@motionpower.org

CIRCULATION

Membership Specialist
Jessica Schuh
schuh@motionpower.org

MANAGEMENT

President
Matthew Croson
croson@motionpower.org

FOUNDER

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 mwg42@hotmail.com.



MotionTech now offers end-of-line packaging, storage systems and conveying solutions to American customers in 2026. (Image: MotionTech)

POWER TRANSMISSION

Engineered for
your application

Backed by 200+ engineers and
technical specialists, custom
manufacturing capabilities,
and a global supply chain.



atlantic-bearing.com

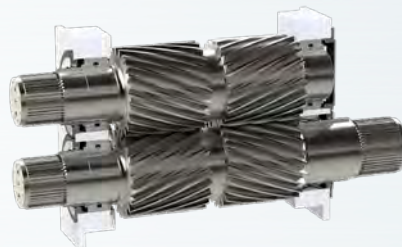
ABS Specialized Brands



AEC
ATLANTIC ENGINEERING CHAIN



ACB
ATLANTIC CUSTOM BEARINGS



MGS GEARS
ITALY

Where Do They Get Those Wonderful Toys?

Matthew Jaster, Director, Editorial Content

Universal Robots Global Head of UR+ Ecosystem Christopher Savoia presents Gen 7, the company's seventh generation robotics platform, to media and industry at IMTS in Chicago. (Image: Universal Robots)

The “World’s Fair of Metalworking” was back in town recently showing the world how AI, robotics, automation, manufacturing cells and machine integration is changing manufacturing technology today. IMTS in Chicago is still THAT PLACE, a physical trade show where people discuss the opportunities and challenges customers are encountering across all facets of manufacturing. It remains the one stop on the trade show circuit where you get a firm grasp on where manufacturing is and where it’s going.

One new development from Siemens at IMTS is their “Meet at the Machine” initiative where machine tool builders utilize software and automation technologies to become much more productive long term. Traditionally, many programming, validation and training activities begin only after a machine is installed. This initiative shifts these activities earlier in the process, allowing manufacturers to prepare for production even before the machine is delivered.

“We, as manufacturers, must produce increasingly more complex cyber physical systems,” said Mark Hindsbo, head of operations software at Siemens Digital Industries. “We live in a world where supply chains are changing, regulations are changing. Most of us face skilled work shortages. Yet at the same time, we must be more adaptable, produce more shifting product mixes, and be productive much faster because our time to market is shrinking for our products all the time.”

Built in collaboration with TRAK Machine Tools, the first phase of this initiative is focused on enabling part manufacturers to be productive from day one. It addresses one of the most common challenges manufacturers face when purchasing a new machine: the time required to move from delivery to productivity. The solution combines software, automation and machine expertise into a connected workflow that allows manufacturers to program, simulate and validate production while a machine is still being built.

“Like our customers, we’re on the path of using these powerful tools for increasingly demanding work. As a

supplier, we’ve also seen how much time and effort is consumed in machine startup by simply getting applications to work together and connected,” said Steve Pinto, president, TRAK Machine Tools. “When our customers invest in a new machine, their goal is to achieve productivity and business results as quickly as possible.”

Universal Robots unveiled its Gen 7 robot platform during IMTS (pictured above). Gen 7 represents a unified system upgrade, enhancing the user experience that operators, engineers and integrators prefer to work with every day—AI-powered from the very beginning.

“The robots of the AI era must be advanced, not complicated,” said Jean-Pierre Hathout, president of the Teradyne Robotics Group. “Built on what we have learned from over 20 years of cobot innovation and more than 100,000 industrial deployments worldwide, Gen 7 is an end-to-end redesign of our platform that reduces integration friction and dramatically expands application capabilities. It will enable our customers to deploy advanced AI-powered applications in real-world operations.”

In the Emerging Technology Center, attendees could see firsthand how drone production uses a hybrid manufacturing process that includes additive, subtractive and robotic systems working in sequence. This automated manufacturing cell will produce, assemble, test and fly drone quadcopters.

The working exhibit shows how flexible production systems rapidly move from design to finished product using Fanuc robots and Mazak’s VC EZ 20X and 5-axis WAAM system. These three examples highlight the continuous push toward automation, robotics, physical/industrial AI and digital transformation across the shop floor.

AMT reports that the aerospace, energy and forging/stamping markets are building momentum and contract machine shops are investing in additional manufacturing capacity. What IMTS tools can you add to your toolbox to maintain a competitive advantage?

COMPONENTS, ENGINEERING DEVELOPMENT, AND MANUFACTURING

SDP/SI
STOCK DRIVE PRODUCTS/STERLING INSTRUMENT

Standard Components Extraordinary Quality!

EXPLORE ALL THE OPTIONS

U.S. Manufacturer of Power Transmission
and Motion Control Components since 1950.

Pulleys
Belts
Gears
Shafts
Bearings
Couplings
Fasteners



Designatronics inc.
Engineered Solutions for a World in Motion

SDP/SI
STOCK DRIVE PRODUCTS/STERLING INSTRUMENT

QBC
QUALITY BEARINGS & COMPONENTS

QTC
METRIC GEARS

Web: sdp-si.com ◀ Email: sdp-sisupport@sdp-si.com ▶ Phone: +1 516.328.3300

SCHAEFFLER Expands Humanoid Robotics Portfolio



Schaeffler is expanding its humanoid robotics product portfolio and bringing formed strain wave gearboxes to market. Strain wave gearboxes are key components in actuators, which make up around half of the total costs of manufacturing a humanoid. Strain wave gearboxes can transmit movements precisely and with a high torque capacity and a high gear reduction ratio in extremely compact spaces and offer high accuracy and stiffness. They thus satisfy the central requirements of humanoid robot joints. The manufacturing method currently established in the market for strain wave gearboxes is precision machining. However, it is time-consuming and capital-intensive and could turn into a major bottleneck in the scaling of humanoid robots in coming years. Using an innovative forming technology, Schaeffler now offers a manufacturing method for the strain wave gearbox with a whole new level of efficiency: with manufacturing steps for key components that can be completed in seconds instead of minutes, it paves the way for the scaling of humanoid robot component manufacturing to high volumes. At the same time, it cuts manufacturing costs by more than 25 percent and material consumption by more than 75 percent.

Schaeffler has successfully concluded the extensive validation testing of the formed strain wave gearboxes and thereby laid the foundations for the start of mass

manufacturing in 2027. Production will start in Germany and successively be rolled out to other regions. Schaeffler has been accumulating know-how in the manufacturing of strain wave gearboxes for the automotive sector using forming for many years. The company has already supplied more than 2 million formed strain wave gearboxes to all major markets in the world in this sector in the last 10 years. Now Schaeffler has successfully transferred this manufacturing expertise to the global growth field of humanoid robotics.

David Kehr, president of Humanoid Robotics at Schaeffler, said: "Schaeffler will take a leading role in the market for humanoid robots. We deploy humanoids along our entire global value chain and therefore have first-hand knowledge of the requirements of this technology and can develop key components based on our know-how. Using this knowledge in combination with our decades of manufacturing experience and our automotive DNA, we can create solutions geared toward quality, economy, and scalability. The formed strain wave gearbox is another example of how we are readying key robot components for industrial high-volume mass manufacturing."

Innovative Forming Technology for Strain Wave Gearboxes

Schaeffler has developed a novel forming process for humanoid robot strain wave gearboxes based on its innovative manufacturing technologies. Unlike conventional machining, in which high-precision gear geometries are created through material removal, this forming process gets the component into the desired geometrical shape in seconds with high pressing forces. The formed strain wave gearboxes achieve comparable torques and efficiencies to those achieved by conventionally manufactured components. The method offers a high dimensional accuracy, reduces material consumption, and at the same time, improves process stability. With this, Schaeffler has created a

manufacturing approach that unites precision, efficiency, and industrial scalability and forms the technological basis for the provision of these key components with a high-quality level and considerably improved manufacturing efficiency.

[schaeffler.com](https://www.schaeffler.com)

SEW-EURODRIVE Expands PxG Servo Portfolio With New Economy Series



SEW-Eurodrive has expanded its PxG planetary servo gear unit portfolio with the introduction of the PxG economy series, adding three performance classes for machine builders and OEMs seeking cost-effective servo performance for standard industrial automation applications.

The new P1.G, P2.G and P3.G gear units extend the existing PxG family below the P5.G, P6.G and P7.G precision range. The expanded portfolio allows customers to match gear unit performance more closely to application requirements rather than specifying higher levels of precision, torque capacity or load capability than the machine requires.

The PxG economy series is designed for applications with low to medium technical requirements. Typical uses include packaging equipment, assembly machinery, material handling systems, carton erectors, gantry robots, and machine tool portals.

Each performance class addresses a different level of mechanical demand. P1.G is intended for standard applications with relatively low overhung loads. P2.G provides additional load capacity for applications with increased radial forces. P3.G combines cost-optimized straight



VECTOR

COMPANIES

**ONE SOURCE.
EVERY CAPABILITY.**

A global platform of gear, shaft, and custom
component manufacturers.

vectorcompanies.com

gearing with higher-capacity bearings for applications requiring greater mechanical strength while remaining within project budget constraints.

The PxG economy series is available in five sizes with peak torque ratings from 11 to 500 Nm. The gear units are offered in one- and two-stage configurations, provide rotational clearance from 6 to 12 arc-minutes, and have a rated service life of more than 20,000 hours.

The modular system includes solid-shaft designs with smooth, keyed or splined output options, depending on the performance class. Food-grade lubrication options and multiple mounting interfaces support use across a range of machine designs. The series is also integrated into SEW-Eurodrive engineering tools, including *SEW-Workbench*, *DriveCAD* and *DriveConfigurator*, to support selection and system design.

“Every automation application has different performance requirements. The PxG economy series gives machine builders more flexibility to select the performance their machines actually need while maintaining the quality, engineering support and long-term reliability they expect from SEW-Eurodrive,” said Anecia Hoffield, servo product manager, SEW-Eurodrive USA.

seweurodrive.com

ABB SD200 SP4 Motor Stays Ahead of Efficiency Regulations

Industrial operators preparing for the U.S. Department of Energy’s 2027 motor efficiency requirements now have a simple, yet advanced, solution with ABB’s new SD200 SP4 severe-duty motor.

Designed for maximum compatibility with existing SD200 motors, the SD200 SP4 delivers NEMA Premium 4 efficiency while simplifying upgrades, reducing energy consumption and minimizing supply chain complexity.

Beginning June 1, 2027, manufacturers will no longer be permitted to produce 100–250 hp motors that

meet current NEMA Premium efficiency standards. Companies that delay upgrading risk longer lead times, limited product availability, last-minute redesigns and higher project costs as demand for compliant motors increases.

“ABB’s SD200 SP4 gives customers a proven, practical path to DOE compliance today before market pressure builds,” said Courtney Pickett, product specialist, ABB NEMA Motors. “Operators can transition to higher efficiency without redesigning applications, helping ensure compliance while keeping operations running.”

Built on ABB’s SD200 severe-duty platform, the motor features heavy-duty cast iron frames, C-4140 high-strength steel shafts, Class H insulation systems and IP55 ingress protection for demanding environments, including mining, chemical processing, petroleum refining, pulp and paper, water and wastewater.

SD200 SP4 combines NEMA Design B performance with rugged severe-duty construction to increase energy performance without compromising reliability. Compared to NEMA Premium motors, it reduces motor losses by an average of 20 percent, lowering electricity consumption in continuously running applications. SD200 SP4’s reduced heat generation also supports cooler operation, longer service intervals and dependable long-term operation.

Because ABB’s SD200 SP4 is fully frame-by-frame compatible with existing SD200 motors, operators can replace motors without costly equipment redesigns. Drop-in compatibility streamlines specification,

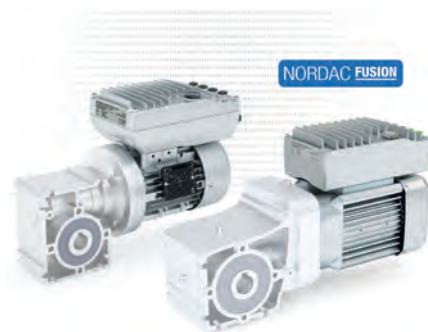
installation and maintenance, while an oversized conduit box wiring access and serviceability.

SD200 SP4 is available now in 125–250 hp, two- and four-pole configurations, through ABB’s authorized distribution network. Six-pole configurations within the same horsepower range will be available later this year.

abb.com



NORD DRIVESYSTEM Combines Motor, Inverter Into Compact High-Performance Unit



With Nordac Fusion, Nord Drivesystems launched a powerful drive system that combines the motor and inverter into a compact unit.

Thanks to the optimal electrical and mechanical adjustment of both components, Nordac Fusion achieves high power density, while keeping the installation space as small as possible. Users benefit from a ready-to-use system that operates reliably once connected. This eliminates extensive

parameterization or time-consuming selection of components.

For logistics projects with a high level of automation, this means less engineering efforts per drive axle, faster commissioning and consistently high drive quality. Nordac Fusion's decentralized design allows for direct mounting on the unit. Centralized control cabinets are no longer required and wiring efforts are reduced.

Nordac Fusion combines asynchronous motors (IE3) and permanent magnet synchronous motors (IE5+) in ventilated and unventilated versions with a decentralized Nordac On frequency inverter. The optimized motor/inverter combinations cover a power range from 0.31 to 3.7 kW. They feature consistent safety and communication properties, are suitable for worldwide use, and can be complemented with a gear unit from the manufacturer's modular product range.

The decentralized frequency inverters are characterized by their compact design, full plug-in capability and high reliability. Special features include the integrated PLC and their multi-protocol Ethernet interface.

Profinet, EtherNet/IP and EtherCAT can be set via parameters. Integrated safety functions enable safe operation of almost all motion sequences in automated production.

Apart from STO and SS1, the Nordac On series will also feature the motion monitoring function SLS, SMS or SSM for fail-safe control of the rotary movement. They can be integrated via PROFIsafe or FSoE into a fail-safe application within an existing industrial Ethernet network. Stand-alone use is also possible. The safe digital inputs and outputs can be used to incorporate fail-safe peripheral components or functions. Emergency stop buttons, safety door switches, photoelectric sensors, etc. can be connected directly. Two safe single-channel digital inputs can be combined into one safe two-channel digital input, and two safe outputs can be combined into one safe two-channel output. The level of functional safety can be

Precision Gearing for Complex Applications

With decades of expertise, we provide engineers with reliable, high-torque gearing solutions designed for the most demanding mechanical applications.

Discover how Spiroid Gears can maximize your designs. Contact us today to speak with our engineers.

(320) 762-7133 • SpiroidGearing.com

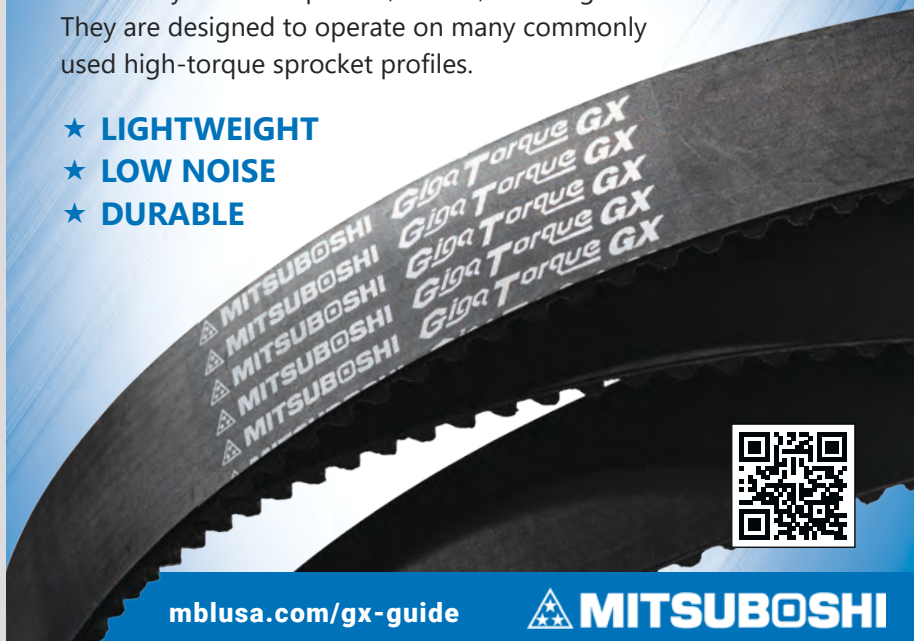


ROBOTICS • AEROSPACE • DEFENSE • TRANSPORTATION • MEDICAL

Comparing High-Torque Timing Belt Options?

Mitsuboshi GigaTorque GX timing belts are available in industry-standard pitches, widths, and lengths. They are designed to operate on many commonly used high-torque sprocket profiles.

- ★ **LIGHTWEIGHT**
- ★ **LOW NOISE**
- ★ **DURABLE**



mblusa.com/gx-guide

 **MITSUBOSHI**

individually set with Nordac Fusion as well.

Another advantage is the encoderless control of Nordac Fusion with the manufacturer's IE5+ synchronous motors (PMSM). Using the CFC open-loop injection method, the motor's rotor position and speed can be captured without additional sensors.

Nord's IE5+ permanent magnet synchronous motors (PMSM) are characterized by a high efficiency of up to 95 percent over a wide torque

range, according to the company. In partial load and partial speed ranges, they achieve optimum energy consumption performance and allow for a reduction of variants for more streamlined production, logistics, warehousing and service processes.

The Nordac Fusion drive solution can be used up to a temperature of -30°C. The combination of IE5+synchronous motors and Nordac On Pure with NXD tupH is suitable for washdown applications

in the food sector. Ethernet on board, hybrid cables and daisy chain technology enable efficient and hygienic topologies that are streamlined and easier to clean.

nord.com

DUNKERMOTOREN Offers Configurable BLDC Motor Solutions for Pump Manufacturers

As pump manufacturers face increasing demands for energy efficiency, precise flow control, reduced noise, longer service life, compact design, and digital connectivity, Dunkermotoren is helping OEMs address these challenges with configurable brushless DC (BLDC) motor solutions engineered specifically for pump applications.

Rather than treating the motor as a stand-alone component, Dunkermotoren takes a system-level approach. The company works with pump manufacturers and system developers to combine motor technology, drive electronics, feedback systems, communication interfaces, and application engineering into a complete drive concept tailored to the pump, its load profile, and the operating environment.

By replacing multiple independently sourced components with a single modular motion platform, OEMs can significantly reduce engineering effort, simplify BOM management, and accelerate system integration while maintaining flexibility for different pump requirements.

"Pump performance today depends on far more than motor selection alone," said Michael Burgert, product manager at Dunkermotoren. "Manufacturers increasingly benefit from modular motion solutions that combine motor technology, intelligence, connectivity and application engineering in a single platform. This approach simplifies integration while helping customers achieve the precision, efficiency and reliability their applications demand."

The demands placed on a pump drive vary significantly by



YOUR BEST SOURCE FOR METRIC MOTORS, GEARBOXES & COOLANT PUMPS

RIGHT ANGLE WORM GEARBOXES

Available with stainless steel output shaft

Hollow, or solid output shaft in single or double design

Single & double reduction available

Ratios of 5:1 to 100:1
(single stage reduction)

Ratios up to 10000:1
(combination gearboxes)

Variety of input and output mounting combinations in each frame size.



Toll Free: **1-800-661-6413**
Fax: **1-905-629-2852**

www.lafertna.com
lna.info@shi-g.com



application. Flow rate, pressure, duty cycle, installation space, ambient conditions, and communication requirements all influence the optimum drive configuration.

In dialysis equipment and other medical systems, precision and consistency are essential. Accurately controlled pumps manage blood flow, dialysate and other fluids throughout lengthy treatment sessions. Stable motor control helps maintain reproducible flow rates, while quiet operation and low vibration contribute to a more comfortable environment for patients and healthcare professionals. Compact motor dimensions and integrated electronics also help equipment designers optimize limited installation space within increasingly sophisticated medical devices.

Hydraulic pumps used in rail vehicles, mobile equipment and industrial machinery often operate under changing loads and within tight installation spaces. They may also be exposed to vibration, shock, temperature fluctuations and frequent start-stop cycles. Closed-loop BLDC motor control enables hydraulic pressure to be generated as required and adjusted according to actual system demand, helping designers balance dynamic performance with energy consumption.

For cooling circuits, HVAC systems, and process-fluid circulation, efficiency is a primary consideration. Instead of operating continuously at full output, variable-speed BLDC

motors allow flow rates and pressure levels to respond to real-time cooling requirements or process conditions. This can reduce unnecessary energy use while maintaining reliable thermal management and process stability.

Water treatment, chemical processing, laboratory equipment, and automated filling lines depend on the precise delivery of defined fluid volumes. Responsive, repeatable motor control supports consistent dosing performance even when operating conditions change.

Across these applications, accurate and responsive control is a common requirement. Electronically commutated BLDC motors enable precise speed and torque regulation, which can translate into more stable flow rates, improved pressure control, and greater dosing accuracy. Eliminating mechanical brushes minimizes wear, reduces maintenance requirements, supports quiet operation, and contributes to extended service life.

Efficiency is another important advantage. Reduced energy losses can lower operating costs and minimize heat generation, particularly in pumps that run continuously or for long periods. These characteristics make BLDC technology increasingly attractive for applications ranging from compact medical devices and connected dosing systems to industrial process equipment and electro-hydraulic power units.

dunkermotoren.com

1.877.695.0280

McINNES
ROLLED RINGS

FAST STARTS HERE

**Speed isn't just a promise,
it's our process.**

From fast quoting to efficient production and industry leading shipping, we deliver seamless rolled rings and discs with the quality you expect and the timeline you need.



MADE IN THE USA

RINGS | **DISCS** | **CARBON ALLOY STAINLESS**
4-144" OD | UP TO 70"

McInnesRolledRings.com

A large yellow industrial motor is being worked on in a workshop. A person is standing next to the motor, which is mounted on a wooden pallet. The workshop has a high ceiling with exposed steel beams and various tools and equipment are visible in the background. The text "The Predictive Maintenance Playbook" is overlaid on the right side of the image.

The Predictive Maintenance Playbook

How HECO keeps critical components one step ahead of failure

Matthew Jaster, Director, Editorial Content

HECO specializes in serving power generation, steel and other metals, chemical processing, pharmaceutical, paper and pulp, wastewater, aggregate, and cement industries. (All images: HECO)

Kalamazoo earned the nickname “Paper City” thanks to a papermaking industry that dominated its economy for more than a century. The industry began in 1866 when the Kalamazoo Paper Co. built the city’s first paper mill. The area was well-suited to papermaking because of abundant water from the Kalamazoo River, good rail access, and proximity to timber resources in northern Michigan.

At its height, Kalamazoo was home to roughly a dozen paper mills and related operations, and papermaking was the city’s dominant employer. While large-scale mill operations are mostly gone, the “Paper City” identity persists in local branding, museums (like the Kalamazoo Valley Museum), and some smaller specialty paper operations that remain.

“When my grandfather started our company, he would go into the paper mills and ask to take a crack at the motor that always had issues. He asked if he could take a shot at fixing it the *right* way. This is really who we still are today,” said Justin Hatfield, president at HECO. “We’re the organization that wants to provide a long-lasting system solution in a motor repair industry that doesn’t always have the best reputation.”

Family Owned and Experienced

Hatfield’s grandfather, Terrell Hatfield, founded the Hatfield Electric Co. in 1959. He was an electrician’s mate in the Navy, and, once he left the service, he looked for motor repair work in paper mills, building a reputation to assist the local industrial markets by fixing the toughest, most troublesome motors other repair shops could not fix.

“He started the company in his basement, moved to the garage, built a shop, then moved in the 1960s to our

headquarters here in Kalamazoo. We are still a family-owned business. My father and his two brothers purchased the company from my grandfather. My father is still my partner, but he is mostly retired at this point and works on a part-time basis.”

With three additions completed between 1968 and 1975, Hatfield Electric became the largest independent electric motor sales and service center in Michigan by both square footage and personnel. The company later changed its name from Hatfield Electric Co. to HECO Inc.

Solving Maintenance and Reliability Challenges

Today, HECO specializes in serving power generation, steel and other metals, chemical processing, pharmaceutical, paper and pulp, wastewater, aggregate and cement industries. They specialize in maximizing the reliability of rotating equipment through a purposeful mix of repair, product sales, predictive, equipment management and field services.

“Since 2013, we started focusing a lot on acquisitions particularly in the predictive maintenance market with the acquisition of a company called Predictive Maintenance Services Inc.,” Hatfield added. “In fact, many of these acquisitions were companies we had worked closely with in the past.”

The company has continued growing through additional acquisitions, including Warwood Armature Repair Co. in West Virginia and Fife-Pearce Electric Co. in Detroit.

Most recently, HECO announced the acquisition of Reliability Concepts LLC, and Alignment Supplies, Inc. The acquisition expands HECO’s vibration analysis, predictive

maintenance services, ecommerce-based reliability product sales and practical reliability tools for industrial customers—marking HECO’s fifth acquisition in the predictive maintenance and reliability space since 2013.

The company has become part of HECO’s Predictive Service Group. HECO will continue Reliability Concepts’ existing products while also expanding sales, marketing, training, and support around the Belt Alignment Tool (B.A.T.), Digi-Belt digital belt tension tester, Fin-Loc motor mount, and related offerings.

The acquisition complements HECO’s broader investment in predictive and reliability technologies, including its involvement with Skyler.

Skyler includes partners from the electromechanical industry who share a common vision to leverage disruptive technology to create actionable insights for industrial solutions. One product, known as Rotate, is not just a remote condition-monitoring solution but a comprehensive approach to deliver transformative equipment reliability and performance.

“What’s really interesting is that we used many of these products ourselves here at HECO before we acquired these various technologies,” Hatfield said. “The B.A.T. is an example. Our field service team used it for belt alignment for years, and we thought it was a great fit to add to our portfolio.”

These moves have created a “one-stop shop” for rotating equipment technologies and services, a role that

HECO has fully embraced as the organization continues to grow. “We have our service side and our products, and by adding good people we’re strengthening our predictive maintenance team and offering a variety of practical solutions,” he added.

Adding Tools to the Toolbox

Hatfield’s favorite talking point about the technologies added to HECO’s portfolio is that they are “built by technicians for technicians.”

“Mike Olszewski [founder of Reliability Concepts] is a product development guy at heart. He’s always taking products back to the lab to find out how he can optimize the technology. How can we improve this product’s performance? That is just how his brain works,” Hatfield said.

This motor, pump, gearbox, and repair technology provides HECO with a unique opportunity to support customers, share product knowledge, and enhance maintenance and reliability moving forward.

The B.A.T. is a laser-based belt alignment system designed to help maintenance teams quickly and accurately align belt-driven equipment. Misaligned belts and pulleys can contribute to premature belt wear, bearing problems, vibration, energy loss, and unplanned downtime. The B.A.T. helps maintenance and reliability teams identify alignment issues more clearly and make corrections more efficiently in the field. The product line includes laser alignment tools and related kits used for



(877) 870-3200
sales@nesbearings.com

Champion athletes possess an impressive arsenal.



MADE IN THE USA

So does NES Bearing Company.

NES Bearing Co. is your one-stop shop for engineered bearing products, specializing in bearing inspection & testing and custom bearing manufacturing for aerospace & aviation.

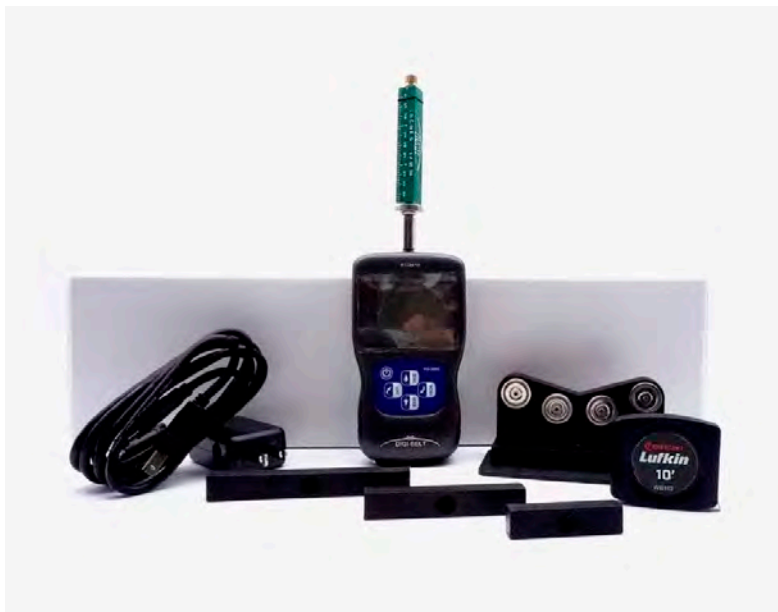


Angelina Napoleon
2025 3000m Steeplechase
3rd–NCAA Championships
2nd–U.S. Championships
9th–World Championships
(No. 1 American)

- | | | | |
|--------------------|------------------------|-------------------------|------------------------|
| ✓ Short lead times | ✓ Temperature extremes | ✓ Condition analysis | ✓ Endurance testing |
| ✓ Unique materials | ✓ Corrosion resistance | ✓ Environmental testing | ✓ Source qualification |



Fin-Loc Multi Mount is a fast, reusable sensor mounting solution for finned motors and machinery.



The Digi-Belt Digital Belt Tension Tester is an industrial digital force-deflection tool designed to ensure precise belt tensioning and extend machine life.

belt and pulley alignment across a wide range of industrial applications.

Digi-Belt complements the B.A.T. by helping technicians measure and verify belt tension, giving customers a more complete approach to belt-driven equipment reliability. Additionally, Fin-Loc adds another practical reliability product to the platform, supporting faster and more consistent vibration data collection on equipment with cooling fins.

"I am presenting a keynote address at the upcoming RPM Symposium where we will discuss how to connect all this data together and make a significant impact on MRO. We can diagnose an issue, we can fix it, we can replace the components, and then manage equipment inventory as well," Hatfield said.

A Data-Driven Future

The end goal with these predictive maintenance acquisitions is to collect all the useful data and provide a technology platform that allows customers to identify all the areas where component failures occur and make the necessary updates.

"Vibration says one thing, ultrasound says another, and your repair vendor says a third thing, and these don't always line up," Hatfield said. "Right now, it is up to the maintenance team to diagnose all these issues and figure out what to do. We want all that connected in one spot with everything living in one hub. The only way to safely navigate labor issues in manufacturing today is through technology by making smarter decisions."

Today's MRO teams do not have the lengthy resume and work experience of those retired workers. There is not always a 30-year-old employee anymore that knows everything about the component and knows all the reasons why it did or did not work. Hatfield said new

employees need a good set of tools and resources to help solve these challenges.

"This is what we're seeing today—increased adoption of predictive tools across the marketplace. People need assistance, and they want to be successful at their jobs. So, let's get a tool that allows them to do it right from the start," Hatfield added.

The future of component repair will involve doing more with less manpower. We will see staff shrinking, industrial plants consolidating, and manufacturers turning toward IoT solutions to help carry the load.

"We're already at a point where we all have analysis paralysis, right?" Hatfield said. "The future will work best when we can bring all this data together to make quick and cohesive decisions on the shop floor."

He also suggested that AI will continue to provide a blueprint for future MRO technologies.

"Most AI platforms for machinery are only seeing this tiny little portion of condition monitoring data. That is not a big enough picture. So once again, connecting all that data together with an AI layer that knows the repair history of the machine, knows if you have a spare, and knows how to catch a component failure before it happens, this is what the data scientists at Skyler are interested in moving forward."

At its core, HECO is still a repair shop. Hatfield said motor and belt alignment is often compared to auto repair, where customers may wonder whether they are receiving the best value.

"We want to be as transparent as possible, and that is the best way to run a shop today. Our customers know that. We continue adding tools and product technologies that will strengthen our maintenance strategies moving forward."

hecoinc.com

PTE

GEAR OILS WITH THE POWER TO PROTECT

Lubriplate's complete line of premium quality gear oils has been formulated to provide unsurpassed performance in a wide range of gear reducers.

Available products include...



SYN LUBE SERIES 150 - 1000 100% SYNTHETIC PAO-BASED GEAR OILS

- High-performance, 100% synthetic, polyalphaolefin (PAO)-based gear oils.
- Compatible with petroleum-based oils and most seals for easy conversion.
- Available in ISO viscosity grades 150, 220, 320, 460, 680 and 1000.

SYN LUBE HD SERIES HEAVY-DUTY, EXTREME PRESSURE (EP) 100% SYNTHETIC, PAO-BASED OILS

- Super heavy-duty, polyalphaolefin (PAO)-based synthetic gear lubricants.
- Formulated to meet AGMA EP (Extreme Pressure) requirements.
- For Heavy-duty, high load applications where an EP oil is required.

SPO SERIES HIGH-PERFORMANCE, ANTI-WEAR FORTIFIED, PETROLEUM OIL-BASED, INDUSTRIAL GEAR OILS

- Petroleum oil-based anti-wear, rust & oxidation inhibited (R&O) gear oils.
- Can be used with silver alloy, copper, and copper alloy bearings.
- Premium quality, high-performance, petroleum oil-based gear oils.

SFGO ULTRA SERIES NSF H1 REGISTERED FOOD GRADE 100% SYNTHETIC, PAO-BASED GEAR OILS

- NSF H1 registered and NSF ISO 21469 certified food machinery grade.
- 100% synthetic, PAO-based fluids for food processing and bottling plants.
- Available in ISO viscosity grades 150, 220, 320, 460, 680 and 1000.
- Fortified with Lubriplate's proprietary anti-wear additive Xtremity.

PGO & PGO-FGL SERIES ADVANCED 100% SYNTHETIC PAG-BASED GEAR OILS

- Ultra high-performance, polyalkylene glycol (PAG)-based, gear lubricants.
- ECO-friendly-Inherently biodegradable, provides long service life, energy conserving.
- PGO-FGL Series is NSF H1 registered and NSF/ISO 21469 certified food grade.

SYNTHETIC WORM GEAR LUBRICANT

- 100% Synthetic, ISO 460 grade, polyalphaolefin (PAO)-based worm gear oil.
- Formulated especially for worm gear applications.
- Provides excellent lubricity and oxidation resistance.

APG SERIES HEAVY-DUTY PETROLEUM OIL-BASED EXTREME PRESSURE (EP) GEAR OILS

- High-quality, petroleum-oil based, extreme pressure (EP) gear oils.
- Meets military specification MIL-PRF-2105E and MIL-L-2105D.
- Conforms to API categories GL-3, GL-4, GL-5, MT-1.

KLING GEAR OILS HEAVY-DUTY, TACKY RED, PETROLEUM OIL-BASED EXTREME PRESSURE (EP) GEAR OILS

- Heavy-duty, tacky, red, extreme pressure (EP) petroleum-based gear oils.
- These tacky, adhesive, extreme pressure oils cling tenaciously to gear teeth.
- Formulated for heavy equipment and heavy service industrial applications.
- Meets military specification MIL-PRF-2105E and API classification GL-5.



Lubriplate®
LUBRICANTS

Newark, NJ 07105 / Toledo, OH 43605 / 800-733-4755
To learn more visit us at: www.lubriplate.com



INCLUDED AT NO ADDITIONAL CHARGE

**Lubriplate's
ESP**

Complimentary Extra Services Package

COLOR CODED LUBE CHARTS & MACHINERY TAGS
PLANT SURVEYS / TECH SUPPORT / TRAINING
LUBRICATION SOFTWARE / FOLLOW-UP OIL ANALYSIS

The Right Linear Drive Starts With the Right Questions

Thomson Industries deconstructs drive technology selection

Thomson Industries

Engineers rarely approach a linear motion project without some idea of the drive technology they expect to use. Previous experience may suggest a ball screw for an application requiring high precision, a lead screw where simplicity and low maintenance are priorities, or a belt-driven system for a long, high-speed axis. Motion designers therefore often begin discussions with manufacturers by requesting a particular solution. The questions that follow, however, are largely the same regardless of the technology specified. Instead of confirming the requested product, the focus tends to be more on understanding what the machine is expected to accomplish.

Load, operating speed and required stroke provide an initial picture of the application but not a complete one. Duty cycle, positioning accuracy, mounting orientation and the operating environment can all influence the final drive technology choice, while complete information about force direction and applied moments is essential if the system is to be sized correctly. A payload figure on its own does not explain how a linear unit will be loaded. The position and center of gravity of the load, together with the forces generated during acceleration and deceleration, can introduce lateral loads or overturning moments that materially affect system capacity and expected service life. Until those requirements are defined, even a technically plausible recommendation is based on an incomplete understanding of the machine.

Specifying a predetermined drive technology can also prevent



Figure 1—Specifying a predetermined linear drive such as a lead or ball screw or belt-driven unit without first understanding the application's operating requirements can lead to significant wastes in time, effort and expense. All images: (Regal Rexnord)

designers from considering alternatives that may be better suited to the overall operating requirements. A lead screw often appears to be the logical choice for a simple, cost-effective axis, but the required speed or duty cycle could move the application beyond its practical operating range. A ball screw may provide the necessary load capacity and positioning accuracy yet become unsuitable where a long stroke and high rotational speed introduce critical speed limitations. Conversely, a belt-driven system may easily accommodate the required travel and velocity but offer either more positioning capability than the application needs or insufficient accuracy for the task. Successful drive technology selection therefore begins by eliminating those that cannot satisfy the application's operating requirements, rather than comparing ball screws, lead screws and belt drives as though they were interchangeable solutions. The drive technology is the outcome of the engineering process, not its starting point (Figure 1).

Defining the Application

Considering alternatives to the preferred drive technology allows the discussion to focus on the operating

requirements that ultimately determine whether that technology is appropriate. In most cases, five parameters quickly narrow the field: load, speed, stroke, duty cycle and positioning accuracy. None should be considered in isolation. A change to one can influence the importance of another, which is why experienced application engineers consider them together rather than as a checklist.

Load, for example, involves considerably more than just the weight being moved. The linear unit must be sized for the forces it will experience, including their direction and any moments applied to the carriage. The mounting arrangement, center of gravity and dynamic forces generated during acceleration can all influence the final calculation. Two machines carrying the same payload may therefore place very different demands on the drive system. Understanding how those forces are transmitted through the mechanism is essential if the calculated service life is to reflect real operating conditions rather than theoretical loading.

Speed and stroke begin to define the practical limits of each drive technology. A screw-driven system operating over a relatively short travel may perform exceptionally well but increasing the

stroke while maintaining the same operating speed can introduce critical speed limitations as the screw length increases. At that point, a belt-driven solution may become the more practical option, not because it is inherently better, but because it is better suited to the application's combination of travel and velocity. Looking at these requirements together allows unsuitable technologies to be eliminated early, simplifying the drive technology selection process before detailed sizing begins (Figure 2).

Operating pattern is equally important. An axis that indexes only a few times each hour places very different demands on a drive system than one operating continuously throughout every production shift—even when load and travel remain the same. Likewise, specifying positioning accuracy beyond what the machine requires may increase cost without improving performance, while underestimating that requirement can compromise the finished design. The objective is to match the capabilities of the drive system to the machine's actual requirements, rather than specifying for performance the application does not need.

Matching the Drive Technology to the Application

Once the operating requirements are understood, the range of suitable drive technologies has usually narrowed considerably. Rather than comparing every available option, determine which solution offers the

best balance of performance, service life and cost for the operating requirements that have been established. Although there is often some overlap between technologies, each has characteristics that naturally suit particular types of applications.

Long-stroke, high-speed applications are a good example. Engineers from a motion control solutions manufacturer recently worked with a customer developing a camera system that needed to travel more than 20 feet at several meters per second. Those requirements immediately changed the drive technology selection process. A screw-driven system of that length would be constrained by critical speed limitations as rotational speed increased, making it more difficult to achieve the required performance. A belt-driven actuator, however, could accommodate both the travel distance and operating speed while maintaining the motion profile the application demanded. Similar considerations apply to gantries, transfer systems and other applications where long travel and high velocity are more important than achieving the highest possible positioning accuracy.

Lead screws suit a different range of operating conditions. Because the nut slides along the screw rather than rolling on recirculating ball bearings, lead screws operate with greater friction and lower mechanical efficiency than a ball screw. This characteristic limits their suitability for higher loads and continuous, high-speed operation, but it can also offer advantages where those

demands do not exist. Compact medical equipment, laboratory instruments and desktop automation systems often place greater value on quiet operation, simple construction and reduced maintenance than maximum speed or load capacity. Polymer lead screw nuts can also operate with minimal lubrication, while certain screw and lead combinations can provide self-locking characteristics that help resist backdriving in vertical applications.

Where higher loads, greater positioning accuracy and demanding duty cycles are combined, ball screws frequently become the preferred solution. Their rolling contact delivers high mechanical efficiency, reducing friction and the torque required from the motor while supporting heavier loads and repeatable positioning performance over long operating lives. A vertical manufacturing axis, for example, may require the combination of high load capacity, speed and precision that naturally favors a ball screw. That high efficiency also makes ball screws susceptible to backdriving, however, so vertical applications will typically require an appropriate braking solution to hold the load if power is removed. The final specification is therefore driven by the complete operating requirement rather than the characteristics of the screw alone.

Looking Beyond Basic Performance Specifications

Once the primary motion requirements have narrowed the range of

Linear Drive Operating Conditions							
Linear Drive Technology	Friction	Mechanical Efficiency	Load Capacity	Speed	Positioning Accuracy	Duty Cycle	Ideal Applications
Lead Screws	Medium	Medium	Low	Low	High	Medium	IV pumps, laboratory analyzers, diagnostic instruments, valve actuators, packaging machinery, HVAC dampers, vending machines, access control systems, agricultural equipment
Ball Screws	Low	High	High	Medium	High	High	MRI/CT patient tables, surgical robots, industrial automation stages, machine tools, semiconductor wafer handling, CNC machines, inspection equipment, battery manufacturing, precision assembly systems, aerospace actuators
Belt-Driven Linear Units	High	Low	Low	High	Low	High	Gantry robots, pick-and-place systems, warehouse automation, AMRs, packaging equipment, palletizing systems, logistics conveyors, large-format printers, machine tending, e-commerce fulfillment systems

Figure 2—When the operating requirements of an application are considered up front, the linear drive selection process can be greatly simplified. This table details the operating conditions of three popular linear drive technologies: lead screws, ball screws and belt-driven linear units.

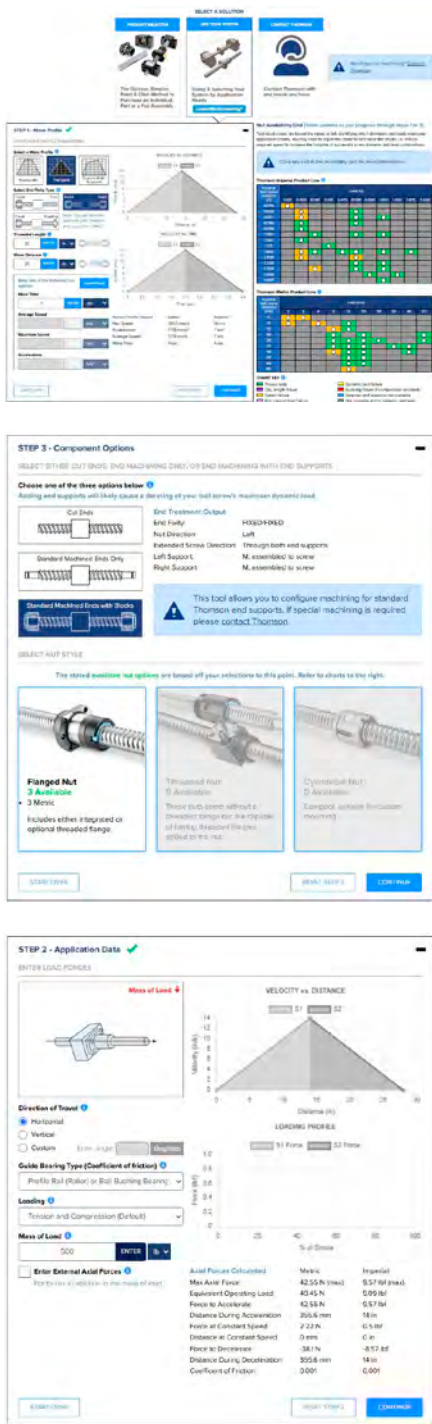


Figure 3—Sizing and selection software such as Thomson Industries' Linear Motioneering online tool helps engineers determine the optimal drive system using key application parameters.



suitable drive technologies, engineers can evaluate the remaining options against a broader set of application considerations. Service life, efficiency, maintenance requirements and environmental conditions may not determine the initial technology choice on their own, but they can become decisive when several solutions satisfy the basic load, speed, stroke, duty cycle and positioning requirements. These factors should therefore be considered as part of the same application-led selection process rather than as isolated specifications.

One of the most common misconceptions is that remaining within a published load rating automatically means a system has been sized correctly. In reality, the load rating simply indicates that the product is capable of carrying that load. Service life decreases as loading increases, so two separate systems may both satisfy the basic load requirement while offering very different operating lives. An application engineer may therefore recommend moving to a larger screw or actuator even though the original selection remains within its published capacity. The larger system may require more installation space and increase initial cost, but it can also provide the service life the machine requires. Equally, where a shorter design life is acceptable or installation space is restricted, a smaller solution may still represent the most appropriate engineering decision. The objective is to achieve the required service life while balancing performance, package size and overall machine requirements.

Environmental conditions can have an equally significant influence on the final specification. Exposure to moisture, washdown procedures, abrasive contamination or corrosive chemicals may require anodized components, stainless steel hardware, plated screws or enhanced sealing arrangements. These considerations should be identified as part of the original application review rather than addressed after the drive has been selected. A system

that performs exceptionally well in a clean manufacturing environment may require a very different specification when installed in food processing, outdoor equipment or other demanding operating conditions. Considering these factors from the outset helps ensure the selected system will perform reliably throughout its intended operating life.

Using Software to Support Selection

Modern sizing software has become an important part of the selection process because it allows engineers to evaluate application data against a wide range of products quickly and consistently. Entering parameters such as load, stroke, travel speed, force direction and applied moments enables the software to eliminate unsuitable options, compare expected service life and identify technically viable solutions far more efficiently than manual calculations alone (Figure 3).

The software, however, is only as effective as the information entered, and it cannot make the engineering decisions on the designer's behalf. Experienced application engineers are still needed to interpret the results, understand the trade-offs between performance, service life, package size and cost, and recognize when a technically acceptable solution may not be the most appropriate one for the machine. The software accelerates and simplifies the selection process; engineering judgment ensures the right decision is made.

The Application Remains the Starting Point

Successful linear drive selection begins with understanding the application rather than choosing a preferred technology. Once the operating requirements have been properly defined, the most suitable solution usually becomes clear as the alternatives that cannot meet the application's demands have already been eliminated.

thomsonlinear.com

PTE

ZERO EXCUSES. ZERO ROOM FOR GEAR DRIVE FAILURE.

KEEP CRITICAL EQUIPMENT
RUNNING WITH **PHILADELPHIA GEAR®**

When communities count on uninterrupted power, Philadelphia Gear delivers the mission-critical gear drive support to keep entire cities moving.

Access end-to-end services — including OEM parts and aftermarket repair — to ensure your equipment runs reliably for decades to come.

GET STARTED TODAY AT
[PHILAGEAR.COM/POWER](https://philagear.com/power)

**PHILADELPHIA
GEAR**
POWER SYSTEMS BY TIMKEN





The Search for Flexible and Sustainable Packaging Solutions

Pack Expo International 2026 aims to tackle operational challenges

Matthew Jaster, Director, Editorial Content

Pack Expo International 2026 features the latest in automation, sustainability, digitalization and food safety for packaging and processing.
(Image: PMMI)

With sustainability now shaping equipment specifications, material selection, and operational decisions across packaging and processing, Pack Expo International 2026 will give manufacturers a one-stop destination to compare sustainable packaging technologies, learn from experts, and find solutions that support measurable environmental and business goals. The need is clear: more than 82 percent of end users say they are actively engaged in sustainability adoption, according to “2026 The Ripple Effect: CPG Sustainability and the New OEM Spec Sheet,” a new report from PMMI, The Association for Packaging and Processing Technologies.

“Manufacturers have moved beyond asking whether sustainability matters; they are now determining which investments can deliver measurable environmental and operational results,” says Jim Pittas, president and CEO of PMMI. “That’s why Pack Expo International 2026 gives them one place to compare technologies in operation, learn from experts, and identify practical solutions for their businesses.”

Taking place Oct. 18–21 at McCormick Place in Chicago, Pack Expo International 2026 will feature 2,600 exhibitors and 48,000 attendees from 40-plus vertical markets. As the largest and most influential packaging and processing trade show in North America, the event gives attendees

unmatched access to machinery, materials, automation, and sustainability-focused solutions in action.

Key sustainability-focused destinations and tools at Pack Expo International 2026 include:

Innovation Stages—Three stages will feature fast-paced, 30-minute sessions led by suppliers and technical experts, offering practical insights into the latest advances in packaging machinery, materials, automation, digital tools and real-world applications. Sustainability-focused sessions include:

- Sustainable Load Stability: Reducing Plastic Without Sacrificing Performance
- Packaging Sustainability Myth Busters: Beliefs that Brands Still Get Wrong
- Navigating EPR: Source Reduction Strategies and the Levers Brand Owners Can Pull in Flexible Packaging
- Flexible Packaging That WOWs Consumers: Material That Excites, Surprises, and Delights

Additional features include:

Sustainability Central—Presented by *Packaging World* and sponsored by EFP LLC, this dedicated education hub will feature expert-led presentations, case studies and trends shaping sustainable packaging. Attendees will learn how material choices, system design and

operational changes can reduce environmental impact while supporting business goals.

Thought leaders and innovators will share strategies to help attendees improve recyclability, advance circularity, reduce environmental impact, and stay ahead of customer and regulatory demands. Sessions include:

- Design for Recyclability is Required by Law. Are You Ready?
- Advancing the Circular Economy: How Collaboration Delivers Value
- Protect the Product, Reduce the Footprint
- 2026: The Year EPR Stopped Being Optional

Reusable Packaging Learning Center, sponsored by the Reusable Packaging Association (RPA)—This educational stage gives attendees a practical look at how reusable packaging systems are being implemented across supply chains. Session topics include the State of the Industry 2026, technology AI & leveraging Data, public policy and retail automation.

Reusable Packaging Pavilion, sponsored by the Reusable Packaging Association (RPA)—Here, show attendees can explore reusable packaging systems from members of RPA and uncover solutions designed to reduce waste, improve durability, streamline logistics, and deliver measurable supply chain cost savings.

Sustainability Solutions Finder—This online tool helps attendees locate vetted PACK EXPO Green Exhibitors that offer eco-friendly materials, components, machinery and services. Attendees can search by sustainability attribute, package type or solution category.



Pack Expo International features more than 2,600 exhibitors and a comprehensive educational program to stay ahead with the latest packaging trends and new product technologies. (Image: PMMI)

Showcase of Packaging Innovations, sponsored by Smurfit Westrock—This special show-floor display features award-winning packaging designs from around the world, including formats that push the boundaries of sustainability, recyclability and material efficiency.

In addition, Dow is the official sustainability partner and sponsor of show-floor recycling. Dual-stream recycling and trash bins will be placed throughout every exhibit hall.

“Achieving sustainability goals requires more than a single material or technology; it takes a systems-level approach,” Pittas says. “Pack Expo International gives manufacturers the opportunity to see how packaging design, equipment, reusable systems and operational improvements can work together to reduce environmental impact while strengthening performance and long-term competitiveness.”

Exhibitor Previews

Kuka Robotics Demonstrates Automated Packaging and Food Manufacturing at Pack Expo 2026

Kuka Robotics will highlight its advanced automation solutions for various packaging operations and food manufacturing applications at Pack Expo 2026. In Booth #N-5530, the company will feature live demonstration cells that represent real-world applications in collaboration with its System Partners: the Compendium Group, FOCUS Integration and Acieta. Kuka will also have an interactive podium for visitors to experience the company's LBR iiwa cobot together with the advanced iiQKA. OS2 robot operating system.

Kuka System Partner Compendium Group will demonstrate robotic case erecting with two compact KR Agilus six-axis robots. Working in tandem, one robot holds a carton while the second robot loads a cardboard insert, showcasing fast, precise handling for high-speed packaging operations. Compendium programmed the cell using *KUKA.PLC mxAutomation* programming software, which enables intuitive robot programming directly within the PLC environment to simplify integration, accelerate commissioning and provide greater flexibility.

As a universal PLCopen-certified PLC interface, *KUKA.PLC mxAutomation* allows users to program and operate all key robot functions directly in their familiar control environment. Not only are commands sent to the robot, diagnostics and status information flow back to the controller.



The CUBE robotic palletizing and depalletizing cell will be featured at Pack Expo International in Chicago. (Image: Kuka Robotics)

In a material handling application, Kuka System Partner FOCUS Integration will feature its double-sided CUBE robotic palletizing and depalletizing cell equipped with a KR Iontec industrial robot and a KMP 1500P autonomous mobile robot (AMR) that transports pallets for a seamless automated workflow. The double-sided configuration enables uninterrupted production and higher throughput by autonomously removing completed pallets while allowing palletizing to continue on the opposite side. The cell incorporates Kuka's iiQKA.OS2 operating system, KR C5-2 controller and *iiQWorks.Sim* simulation software.

The iiQKA.OS2 operating system is scalable, customizable and includes a complete virtual robot controller (VRC). Because it's AI-capable, the controller allows users to meet new ISO 10218:2025 and cyber-resilient needs for future-proof digital manufacturing.

The Kuka robot controller system KR C5-2 enables tailored controller solutions for a wide range of applications involving industrial robots and additional kinematic systems. The custom-fit combination of controller modules, interface modules, peripheral modules, and a scalable cabinet system allows for integration into diverse automation environments.

With *iiQWorks.Sim*, FOCUS programmed, tested and optimized the cell's Kuka industrial robots offline before deployment. The simulation software supports robot simulation, process validation and virtual commissioning to reduce risk, improve efficiency, and accelerate project implementation. All without interrupting ongoing production.

For case blank loading in packaging applications, the Acieta cell demonstration incorporates a KR20 R1820 robot from Kuka's KR Cybertech series. The robot offers a compact design for high integration density and reduced interference contours. In this application, the KR Cybertech will remove straps from bundles of flattened boxes then loads the boxes into the magazine of a case erector.

As an interactive experience at Pack Expo 2026, Kuka will display its LBR iisy cobot together with the company's iiQKA.OS2 operating system. The LBR iisy is highly versatile, intuitive to operate, and reliable for working in contact with humans. Applicable to all production areas, it combines the know-how of industrial automation with the flexibility and simplicity of an intelligent tool, paired with the speed of a traditional industrial robot.

The iiQKA.OS2 incorporates a modern user interface and modular safety while enabling the simulation of multiple robots and their peripherals. Backed by decades of Kuka development experience, the operating system incorporates the latest web technologies for expanded functionality, enhanced user experience, and streamlined workflows. It can also detect errors at an early stage due to its various engineering functions such as simulation, offline programming, and comprehensive tests in a virtual environment, all of which drastically reduces risk and overall cost.

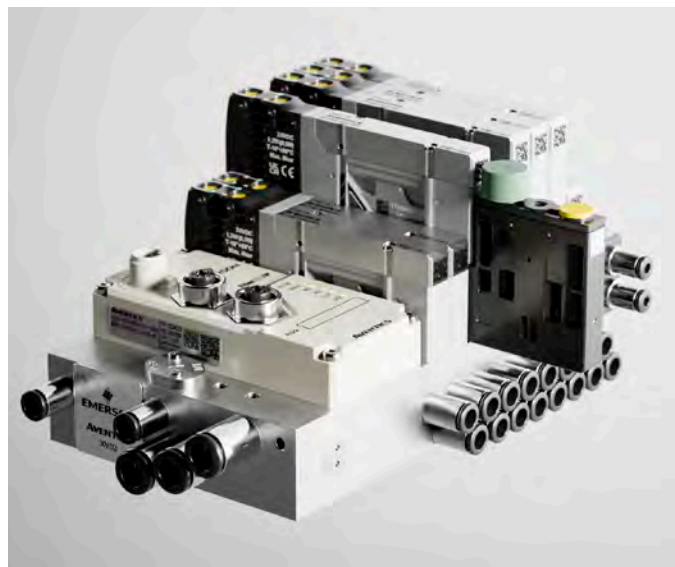
As a featured speaker at the Pack Expo 2026 Innovation Stage 1 (N-4570), Kuka Account Manager, Mobile Robotics, Brendan Turner will discuss how autonomous mobile robots (AMRs) are being rapidly adopted across warehousing and manufacturing, but that successful automation requires far more than deploying the right mobile robots. In his "From Napkin Sketch to Lights-Out Logistics: Building Autonomous Material Handling Systems," presentation—scheduled for Tuesday, October 20 at 10 a.m.—Turner will focus on what it takes to implement a fully autonomous material handling solution in real-world production and distribution environments, along with key considerations behind designing a turn-key system.

Attendees will learn about the essential components of a successful "lights-out" operation, including AMR fleet management, interfacing with physical equipment, and the software infrastructure that ties systems together. Using examples from food and beverage to demanding automotive manufacturing, Kuka's presentation will demonstrate how automation concepts are developed into scalable, operational solutions on the plant floor. The session will also address planning mixed fleets using VDA 5050 standards, helping manufacturers prepare for the next generation of flexible automation through collaboration between robotics providers, software developers and system integration partners.

my.kuka.com

Emerson Highlights Comprehensive Portfolio

Emerson will exhibit its packaging solutions in the North Building, Booth #N-5449 where visitors can view highlights from the comprehensive Emerson portfolio and product demonstrations from Emerson's packaging automation experts.



The XV Valve Series will be one of the key product technologies at the Emerson booth during Pack Expo International. (Image: Aventics)

The Aventics XV Valve Series pneumatic valves are designed with interoperability in mind to provide machine builders in the food and packaging industry with a flexible and cost-effective valve platform. The valves provide higher flow rates in a compact valve package that enables more efficient and flexible pneumatic system performance for factory automation and food and packaging applications. This helps manufacturers boost productivity and allows them to offer products customized for specific markets and customer preferences.

emerson.com/en/corporate

Bosch Rexroth Offers Complete Factory Automation Solutions

Few industries face the kind of complex, constantly shifting trends and customer preferences that consumer packaged goods (CPG) manufacturers deal with daily. CPG companies prioritize solutions to manufacturing challenges such as supply chain transparency, digital transformation and production line flexibility.

Rexroth will display automation product technologies and solutions for the packaging industry in Booth #S-1654 at Pack Expo 2026.

Bosch Rexroth has the industry's most complete factory automation solutions engineered to meet the unique needs of CPG manufacturers. At Pack Expo, attendees will be able to experience this for themselves and interact with a selection of exhibits from Bosch Rexroth's various technology groups, as well as speak one-on-one with product experts on the latest advancements in automation technology.

Bosch Rexroth offers the critical automation technology packaging OEMs and manufacturers depend on—controls and drive, conveyance, assembly and more fully integrated into complete automation platforms that advance CPG productivity and flexibility.

Highlights will include the latest version of ctrlX Automation, eliminating the classic boundaries between machine controls, the IT world and the Internet of Things. With the real-time capable operating system Linux, consistently open standards, app programming technology, web-based engineering and a comprehensive IoT connection, ctrlX Automation reduces components and engineering costs by 30 to 50 percent.

The consumer packaged goods (CPG) industry is undergoing rapid change. Considerable competitive pressure requires methods to increase productivity—while maintaining high quality standards. At the same time, CPG manufacturers are challenged with having more flexible processes to adapt to the pace of change in the market.

With the ctrlX FLOW product family, Bosch Rexroth offers easy-to-integrate solutions for optimal and highly efficient material and goods flows. As a linear motion system, ctrlX FLOWHS brings flexibility and high speed to manufacturing. The space-saving high-speed system can be flexibly configured for different topologies and, consequently, a wide range of applications.



Bosch Rexroth will feature several technologies in areas like controls, drives, conveyance and assembly on the Pack Expo International show floor. (Image: Bosch Rexroth)

Individual, space-saving and flexibly expandable solutions are more important than ever in mechanical engineering as is a fast time to market. ctrlX DRIVE is an important enabler. The servo drive requires very little installation space, enabling companies to quickly implement economical solutions that are precisely tailored to their specific needs. The drive systems grow alongside the requirements: from cost-effective entry-level versions to high-end applications. The open system architecture offers maximum freedom and allows scaling without architectural breaks.

boschrexroth.com/en/us

SEW-Eurodrive Brings Drives, Motion Control and Automation Solutions to Pack Expo

Design, build and optimize food, beverage, and packaging equipment, machines, and systems with integrated drive technology, motion control, and automation from SEW-Eurodrive at Booth #S-3783. From hygienic processing and packaging machines to conveyors, palletizers and warehouse logistics, their scalable solutions help OEMs and end users improve reliability, efficiency and uptime.

Highlights include hygienic gearmotors with acid- and alkali-resistant surfaces for washdown applications. These are available in helical, bevel and Spiroplan right-angle designs for reliable, cool-running performance.

Movimot performance ELV delivers high-efficiency, extra-low voltage motion control for safer, decentralized conveyor, packaging and shuttle systems.

CM3C.. medium-inertia synchronous servomotors provide high-torque, precise motion for heavy-load applications, while CM2H.. stainless steel servomotors deliver hygienic, corrosion-resistant performance for washdown environments.

More flexibility in production, modularized systems, Industry 4.0, energy-efficient drive technology, decentralized automation structures, frequency converters directly on the drive—decentralized electrical drive technology is and can do all this and more. But how exactly, why and when is a decentralized approach to drives and automation worthwhile?



The PxG economy series is designed for applications with low to medium technical requirements. Typical uses include packaging equipment, assembly machinery, material handling systems, carton erectors, gantry robots and machine tool portals. (Image: SEW-Eurodrive)

Many machines and systems are controlled centrally from a control cabinet. This control cabinet contains controllers, frequency inverters, power supply, safety devices and much more. But, control cabinet space is expensive. The larger a machine or system becomes, the larger the control cabinets become, and the more complex the changes in the system can be.

With a decentralized concept, many functions migrate from the control cabinet to the system or machine—close to the places where, for example, controllers or inverters are also required. The system can be configured and tested in a modular manner, the cabling effort in the control cabinet is reduced massively, and energy efficiency is increased. Components such as the Movi-Switch gearmotor with motor starter fit into decentralized drive technology.

Lastly, the PxG economy planetary servo gear units provide a cost-effective solution for industrial automation and motion control. Available in performance classes P1 to P3, these planetary servo gear units deliver reliable performance and efficient operation for applications requiring moderate precision, torque, and power density.

seweurodrive.com

The Flexibility Factor

AI and automation will become standard across packaging and material handling in the future. As reported in *PTE's* Pack Expo East analysis from Siemens Digital Industries Software earlier this year, manufacturers will increasingly simulate and optimize production before implementing changes physically. AI will help predict issues, optimize performance, and guide operational decisions in real time. Robotics will become more flexible and easier to deploy, enabling faster adaptation to new packaging requirements. These technologies will enable manufacturers to operate with greater agility, efficiency and resilience.

According to *roboticscenter.com*, we've moved on from experimentation to infrastructure. AMRs (autonomous mobile robots) are outpacing older AGV technology because they navigate dynamically instead of following fixed paths—AMRs now outsell AGVs roughly 3-to-1

in new deployments and remain the fastest-growing robotics segment at around 35 percent. AS/RS (automated storage and retrieval) systems are being paired with this for dense vertical storage, which matters a lot as warehouse real estate gets more expensive.

The MTLI Group reports that historically, robotics investment went almost entirely into outbound picking and fulfillment. That's changing today as receiving and putaway concepts have stayed largely manual and become the bottleneck limiting throughput no matter how efficient downstream operations are, so 2026 is seeing real investment in robotic depalletizers and AI vision inspection for inbound work.

Robotics-as-a-Service is letting companies rent rather than capitalize automation—ABI Research expects roughly 1.3 million RaaS installations by the end of 2026, letting facilities scale automation up or down without heavy upfront spend. This matters especially for midsize operators who couldn't previously justify huge spends (as reported by Olimp Warehousing).

Olimp also cites Warehouse Execution Systems as the "central nervous system" unifying robots, conveyors and AS/RS, with digital twins increasingly used to simulate layouts before physical implementation. Industry framing has shifted accordingly—one analysis put it as: the buying question in 2026 isn't which robot to purchase, it's who owns the core technology and is accountable for how the whole system performs.

So, what's the throughline for both packaging and material handling in 2026? Both segments are being forced to do more with less. This means less cheap labor, less tolerance for waste (regulatory and reputational), and less room to just build bigger buildings. By 2030, the consensus is packaging will be simpler in material composition but carry much more data. Many warehouses will be automated end-to-end from receiving to shipping rather than just at the picking stage. We've also reached the point where the software controlling the robots is just as vital as the robots themselves.

packexpo.com
PTE



PRECISE. ROBUST. AVAILABLE.

SERVO
✓ **RATED**

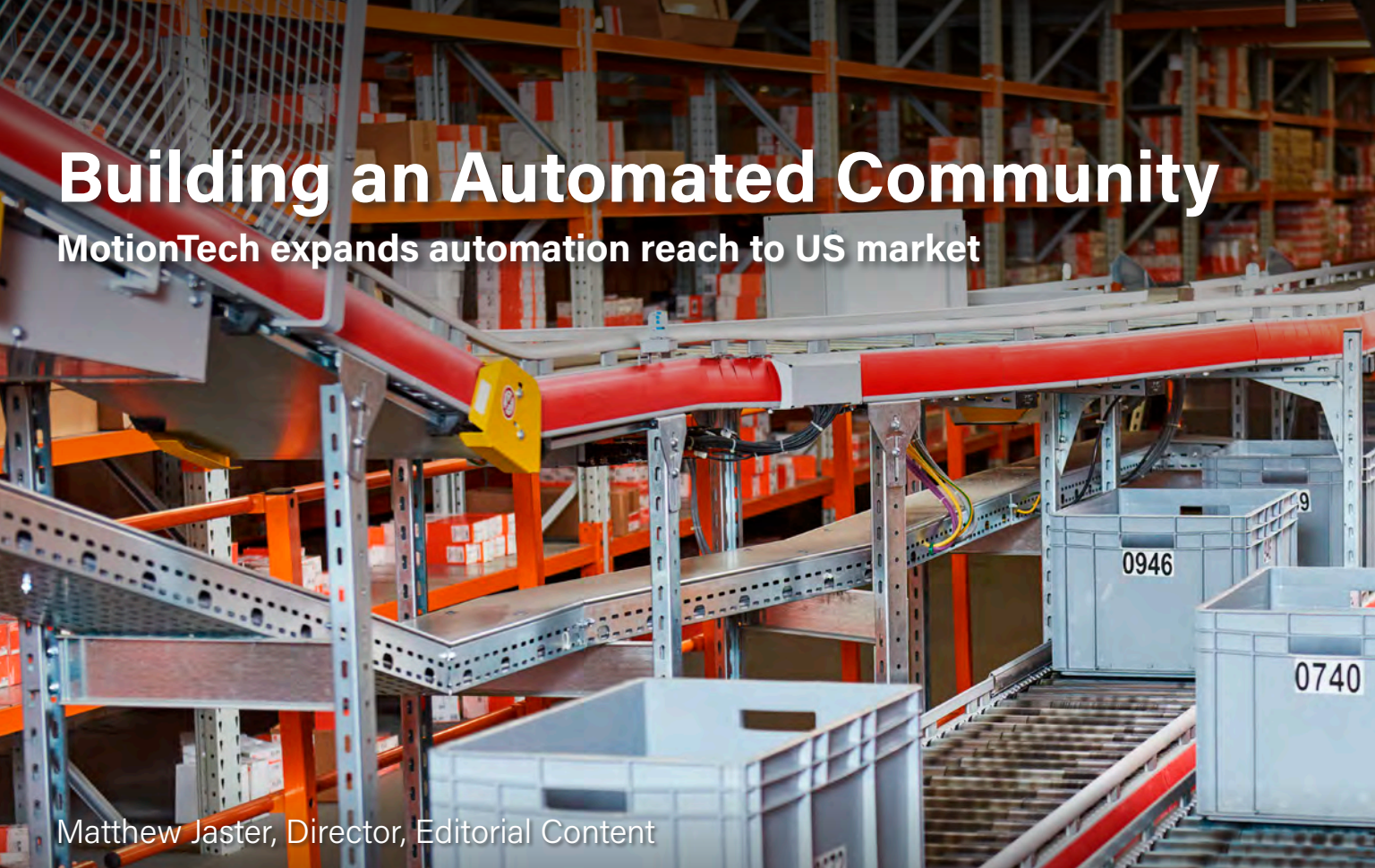


ServoClass® Couplings

- Zero-Backlash & High Torsional Stiffness
- Engineered Performance for Reliable 24/7 Operation
- Servo-Rated for Reversing, Positioning, Precision
- Low Inertia / Low Misalignment Reaction Loads
- Perfect for High Accuracy Actuator Systems
- Engineering Assistance / **-Fast** Delivery

www.zero-max.com 800.533.1731

/////// ZERO-MAX®



Building an Automated Community

MotionTech expands automation reach to US market

Matthew Jaster, Director, Editorial Content

MotionTech is entering the U.S. automation market with packaging, material handling and conveyor solutions. (All images: MotionTech)

MotionTech, headquartered in Stockholm, recently announced its entry into the United States market. The launch marks a significant milestone in the company's international growth strategy, bringing a proven portfolio of automation and packaging technology to North American customers.

To spearhead the expansion, MotionTech has appointed Kristian Hulgard as executive sales director for the U.S. market. An experienced business builder with a strong track record of establishing and scaling commercial operations in the automation industry, Hulgard will lead the U.S. business from the Dallas-Fort Worth area and drive the company's next phase of growth in the region.

The initial focus of the U.S. launch is bringing MotionTech's end-of-line packaging, storage systems and conveying solutions to American customers, building on the automation and material-handling solutions that have made the group a trusted partner across Europe.

Over time, the U.S. location intends to build out a full commercial and service presence to support customers throughout their automation journey. MotionTech has completed more than 30 installations for U.S. customers—such as large warehouse automation partners Dematic and Knapp.

"Customers have repeatedly asked for a dedicated local point of contact for both sales and service," said Louise Ringström Grandinson, CEO, MotionTech. "Hulgard's appointment lays that groundwork as MotionTech positions itself to serve a U.S. automation market set for substantial growth in the coming years."

"The U.S. represents an enormous opportunity," said Kristian Hulgard, MotionTech's new sales director for North America. "I'm excited to build something meaningful here from the ground up. American manufacturers and distributors are investing heavily in automation to stay competitive, and MotionTech brings exactly the kind of proven,

high-quality technology they're looking for. My focus from day one will be on getting our products in front of the right customers, build up a distribution network, and establish MotionTech as a serious partner in this market."

With Hulgard at the helm, MotionTech's U.S. operations will begin ramping up immediately. "We are delighted to have Kristian leading this effort," added Grandinson. "His experience building commercial operations and the combined strengths of our different technologies, gives us real confidence as we enter one of the world's most dynamic markets. Dallas-Fort Worth gives us an excellent foundation from which to serve customers across North America, and this launch reflects our long-term commitment to making motion smarter for businesses around the world."

Earlier this year, MotionTech announced the acquisition of Induser, a specialist that designs and manufactures high performance



weighing and packaging machinery for the fresh produce industry delivering fully automated, end-to-end packaging solutions that improve efficiency, accuracy and throughput.

The acquisition marks an important milestone for both companies. By joining MotionTech, Induser becomes part of a global group that brings together leading companies across the intralogistics and industrial automation sector, while continuing to operate under its own organization, and leadership. “

“Induser has built a strong and respected business over more than two decades, driven by quality, innovation and close customer relationships. These values are fully aligned with MotionTech’s decentralized philosophy. Ever since meeting them for the first time in Almeria, I was impressed by their visionary approach together with engineering craftsmanship. Something they have in common with the other entrepreneurs in MotionTech,” said Grandinson.

Automate Show Heads West in 2027

Automate, North America’s largest robotics and automation event, celebrated its most successful show to date, drawing more than 50,000 registrants and 1,230 exhibitors to McCormick Place in Chicago from June 22–25.

Hosted by the Association for Advancing Automation (A3), Automate 2026 filled 425,000 square feet of show floor space with the latest technologies in robotics, artificial intelligence (AI), machine vision, motion control and industrial automation. The record-setting event reflected the continued growth of automation across industries as companies look for practical ways to improve productivity, address workforce challenges, strengthen supply chains and remain competitive.

“Automate 2026 was the strongest show we have ever had, not just in size, but in the quality of the technology, conversations and connections taking place across the show floor,” said Jeff Burnstein, president of A3. “The energy in Chicago was incredible. From humanoid robots and industrial AI to machine vision, motion control, autonomous mobile robots and industrial automation systems, attendees saw firsthand how quickly this industry is moving and how much opportunity lies ahead.”

According to Burnstein, the Humanoid Pavilion displayed an enormous collection of humanoid robots and A3 received excellent feedback from attendees at the show. “Currently, China is ahead of the game as far as humanoid adoption is concerned, especially with government support, but this is likely going to change in the next few years, and the West will start catching up.”

In general, Burnstein saw robotic and automation technologies expanding out of automotive and into areas such as photonics, life sciences and food and beverage. “Pay close attention in the near future to what automation is going to look like in our hospitals as well as our bio labs,” he added. “And though safety and government standards still need to be addressed, we see a path down the road for the use of consumer robotics in households. It’s been vacuum cleaners for a long time, but when will we see robots doing mundane tasks such as folding laundry or washing dishes? We’re just not sure what this timeframe realistically looks like.”

If the Automate Show in Chicago was any indication, we’re merely scratching the surface on the potential of robotics and Physical AI technology in manufacturing moving forward.

Next Stop Las Vegas

Automate 2027 will move West for the first time next year, taking place May 10–13 at the Las Vegas Convention Center in Las Vegas. Per the A3 blog:

“Automation is becoming more accessible and more capable at the same time. Tools that once required heavy customization are easier to deploy. Machine vision is handling more complex tasks. AI is making systems more adaptable in real environments, not just controlled ones. Ideas that felt early or experimental even a couple of years ago are starting to show up in day-to-day manufacturing. The shift is something more immediate, more usable and increasingly widespread. Las Vegas, with its scale and visibility, is built for moments like this, where a lot of attention is focused on one place. A perfect backdrop for where the industry is right now.”

Burnstein urges attendees heading to Las Vegas to plan for next year’s show by downloading the app, planning your exhibitor visits and schedule appointments as early as possible.

“We had a record sign-up for booth space for the 2027 show this summer,” Burnstein added. “We’re adding more floor space, a larger humanoid pavilion, more conferences, everything about Automate Las Vegas is getting bigger. We’re extremely excited to share what’s happening in robotics and automation next year.”

After reflecting on the success of Automate 2026 in Chicago, Burnstein discussed how the rebranding of the show back in 2009 really set the stage for future growth.

“The show was formerly known as the International Robots, Vision & Motion Control Show, not exactly the easiest thing to say,” Burnstein said. “The rebrand to Automate happened in 2011. Outside of the COVID years, attendance and exhibitor numbers have steadily grown each year. 2027 should be an incredible year for robotics and automation.”

[automateshow.com](https://www.automateshow.com)



MotionTech's mission is to help customers automate across production and warehouse environments.



MotionTech specializes in conveyor and belt applications where curve technology is critical.

For Induser, the change represents a natural next step in its long-term development.

"This is an exciting step for Induser," said Elvis Moreira, managing director at Induser. "After more than 20 years of building our business, we are joining a group that shares our values and our commitment to quality, innovation and long-term partnerships."

The acquisition further strengthens MotionTech's position within the Fresh Food segment, also in Iberia and supports the group's strategy of partnering with high-quality, entrepreneurial companies focused on sustainable, long-term value creation.

A second acquisition happened in January when MotionTech acquired Kairos Global, an OEM focusing on powered belt curves, merges, and specialized modules for warehouse, logistics and airport applications.

The acquisition represented a strategic expansion of MotionTech's conveyor offering and geographical reach, further building on the group's strong position within full-cycle automation services.

Kairos Global's products and capabilities expand MotionTech's portfolio with a broader range of standard and tailored curved belts and merges, which strengthens MotionTech's role in supply

to parcel, e-commerce and airport projects where high-performance curve technology is critical. The MotionTech platform creates synergies as well as new opportunities by providing Kairos Global with a stronger base for global growth in intralogistics applications.

Founded in Malaysia in 2014 by Steve King, Kairos Global serves customers across Asia-Pacific, Europe, the United Kingdom, and North and South America, and employs approximately 50 people.

MotionTech's mission is to help customers automate across production, warehouse and intralogistics settings through an end-to-end offering that spans integration, products, software and maintenance. The company makes motion smarter for more than 3,000 businesses across Europe, the Americas, and Asia-Pacific, including Coca-Cola, DHL, PepsiCo, DP World, Tesco, Marks & Spencer, Ball, JCB, Domino's and H&M. MotionTech delivers more than 500 projects each year with a team of more than 500 coworkers.

motiontech.com

PTE

powertransmission.com

For Related Articles Search

automation

at powertransmission.com



Systematic Solutions

Schaeffler Showcases Motion Technology at Automotive Symposium 2026

Matthew Jaster, Director, Editorial Content

All-solid-state battery (ASSB) technology can also be valuable for humanoid robots where reduced weight, improved safety and extended operating time are vital. (All images: Matthew Jaster)

Supply chain challenges, global tariffs and rising energy prices make it extremely difficult to collaborate with multiple vendors on a mechanical engineering project. The biggest takeaway from Schaeffler's incredibly informative and insightful Automotive Symposium in Detroit is how lucky the organization is to avoid these challenges thanks to an extremely robust product portfolio.

"Our steer-by-wire technology is a great example of this," said Jeff Hemphill, CTO, Schaeffler, as he took the media on a tour of the 100-plus technology exhibits displayed at the historic Department at Hudson's building. "Instead of needing to contact a variety of customers or vendors, we simply gather our internal engineering experts involved in components, hardware, software, electronics, etc. and put them in a meeting together."

Being able to pull resources from different departments—under various engineering specialties—is an advantage many companies simply do not have. Combining mechanical, software, electronics and mechatronics experience under one roof is how you successfully plan a road map toward automated mobility in the future.

Chassis & Body Technologies

Schaeffler's approach connects steering, suspension, vehicle access, sensing technologies, and electro-mechanical actuation technologies into intelligent vehicle functions.

"As vehicle architectures become increasingly interconnected, success depends on understanding how every system influences the next," said Matt Frary, president, Powertrain & Chassis. "Schaeffler's expertise enables us to develop integrated solutions that create greater value, improve the driving experience and enhance comfort in the next generation of vehicles."

Sensors play a significant role in this process as Schaeffler's sensor portfolio continuously monitors vehicle motion and environmental conditions, enabling real-time data processing that supports advanced driver assistance systems, automated driving functions and active chassis control.

EV Battery Performance

Schaeffler's all-solid-state battery (ASSB) technology represents a significant step forward in energy storage. By replacing conventional liquid electrolytes with solid electrolytes, ASSBs offer the potential for improved safety and higher energy density. The use of ultra-thin metallic lithium anodes can increase energy density significantly compared with today's lithium-ion batteries, supporting lighter and more compact battery systems.

Beyond automotive applications, ASSBs have the potential to benefit from emerging mobility solutions, including humanoids, where reduced weight, improved safety and extended operating time are especially valuable. Schaeffler continues to advance these required technologies to bring next-generation solid-state batteries to market.

Schaeffler's conventional battery module is a standard building block for EV energy storage that groups individual cells into a structured, scalable unit for assembly into a larger battery pack. It stores electrical energy, supports the electric drivetrain and makes battery systems easier to build, service and integrate.

Comprehensive Vehicle Control

Today's automakers require integrated systems that intelligently coordinate vehicle functions across a centralized

architecture. Schaeffler's production-ready portfolio of technologies works together to manage energy, process vehicle data and coordinate critical vehicle functions. Through the integration of intelligent power electronics, battery management, zonal control and centralized computing, Schaeffler enables a scalable vehicle architecture capable of supporting over-the-air updates, advanced driver assistance systems, electrified propulsion and future software-enabled features.

"By integrating software, electronics and hardware, Schaeffler is helping accelerate the industry's transition to centralized vehicle architectures and delivering future-ready solutions across a wide range of vehicle platforms," said Jerry Dixon, head of Controls and Mechatronics & Modules, Schaeffler.

Integrated Power Electronics Platform

One highlight on the media tour was the SuperBox, combining the inverter, onboard charger, high-voltage DC booster and auxiliary power module (12V & 48V) into a single compact system. This innovative technology reduces the number of components compared to similar architectures.

By consolidating these technologies, the SuperBox reduces system complexity, minimizes weight, optimizes packaging space, enhances vehicle interconnectivity and enables software-defined functionality throughout the vehicle's lifecycle.

Schaeffler's next-generation inverter technology converts direct current (DC) from the battery into alternating current (AC) required by the electric motor. The inverter precisely manages motor speed, torque and regenerative braking to maximize energy efficiency, vehicle performance and battery utilization.

Integrated Powertrain Technologies

Schaeffler highlighted a variety of technologies in this area including bearings, actuators, electronic control units, e-axes and transmission components. Engineered to work together as complete systems, these technologies reduce complexity, improve efficiency, optimize installation space and shorten development cycles for passenger cars and commercial vehicles.

"The future of mobility will require a range of powertrain solutions tailored to different markets, applications and customer needs," said Patrick Lindemann, president, E-Mobility, Americas. "Schaeffler's strength is our ability to combine expertise across components, electric drives, hybrid systems, electronics and software to deliver integrated technologies that help automakers develop efficient and flexible vehicles for the road ahead."

E-Axle Solutions

Schaeffler's e-axle supports both battery electric vehicles (BEVs) and hybrid electric vehicles (HEVs), integrating key propulsion and power management functions into a compact, highly efficient system. By combining the electric motor, transmission and power electronics, Schaeffler's e-axle solutions reduce installation space,

Editor's Note: Stay tuned for future updates on these new bearing technologies in upcoming issues of *PTE*.

simplify vehicle integration, and give automakers greater flexibility to meet application-specific performance and packaging requirements. The modular architecture also enables different levels of integration and power output, helping optimize efficiency, performance and overall vehicle design across the evolving mobility mix.

A key technology within the portfolio is Schaeffler's Externally Excited Synchronous Motor (EESM), which replaces permanent magnets with electrically excited rotor windings. By eliminating the need for rare earth magnets, the EESM provides a more sustainable motor solution while delivering permanent magnet performance across the entire operating range with enhanced power and efficiency at high speeds.

Bearing Solutions Built for Electrification

The electric powertrain portfolio is enhanced by Schaeffler's advanced bearing technologies, engineered specifically for the demanding operating conditions of electrified powertrains.

VoltShield bearings feature electrically insulated overmolding that block harmful current flow through the bearing, protecting electric motors from premature failures caused by high frequency circulating currents, delivering up to 50 percent cost savings compared with ceramic coatings or ceramic balls. Together with Schaeffler's precision bearing portfolio, these technologies improve powertrain durability, enhance system reliability, and support higher power densities and rotational speeds required by next-generation electric vehicles.

VoltPath bearings provide a controlled electrical current path through the bearing, safely diverting stray shaft currents away from sensitive components to help prevent electrical damage and extend bearing life.

Jitesh Modi, director of engineering, gave an educational presentation on the current and future state of bearing technology during the symposium—one of 19 technical presentations that took place during the event.

Final Thoughts

Few companies pull off a symposium that equally balances superb technical content with in-depth product displays on the exhibit floor. Schaeffler seems to take a page out of its very own engineering departments and consistently offers great content for customers, partners and media professionals covering all aspects of mechanical design—a truly systematic approach to everything they do.

I look forward to this event every four years and encourage the mechanical power transmission and motion control industries to attend the symposium in the future. Schaeffler will exhibit next at CES 2027, taking place January 6–9 in Las Vegas.

[schaeffler.us/us/](https://www.schaeffler.us/us/)
PTE

[powertransmission.com](https://www.powertransmission.com)



B&R

MACHINE AND GEAR CORP

BRGEAR.COM

FIELD SERVICE

**Gearbox emergency?
Minimize your downtime
and get back to
production sooner by
letting our national field
service team rebuild
your gearbox in place.**

*From emergencies to planned outages — all supported by
precision mechanical services and field machining.*

**Gearbox Repair • Custom Gearboxes • Custom Gearing
PIV Parts & Units • Field Machining & Services**

Visit us at AtlantaGear.com or contact us at
info@AtlantaGear.com or 706.216.5040

AGW
Atlanta Gear Works

TIMKEN | PRECISION
DRIVES

PRECISION & POWER
FOR CONTINUOUS
MOTION

CONNECT WITH OUR TEAM TO
EXPLORE WHAT'S POSSIBLE.

TIMKENPRECISIONDRIVES.COM



GEARS | PULLEYS | SHAFTS |
BEARINGS | COUPLINGS |
FASTENERS | CUSTOM GEAR BOXES



ISO9001:2015 & AS9100D,
ITAR Registered,
NIST.SP800-171R1,
Trace Certified,
Class 100 clean room

Nordex.com

Sales@nordex.com | Eng@nordex.com
800-243-0986 | 203-775-4877

Custom Engineering

Prototype Work

Precision Machining

Assemblies and Standard Components

Has Your Company Solved a Manufacturing Challenge?

Share your
success with the
mechanical power
transmission
market!

Submit an article
to PTE for an
upcoming issue.

Contact the Editorial Team:

| Matthew Jaster: jaster@motionpower.org |
| Aaron Fagan: fagan@motionpower.org |

PERFORMANCE POWER

ENGINEERED FOR THE FUTURE

Precision-built drivetrain and propulsion systems
for conventional, hybrid, and electric powertrains,
with innovative mechatronics and high-torque
components designed to power what lies ahead.

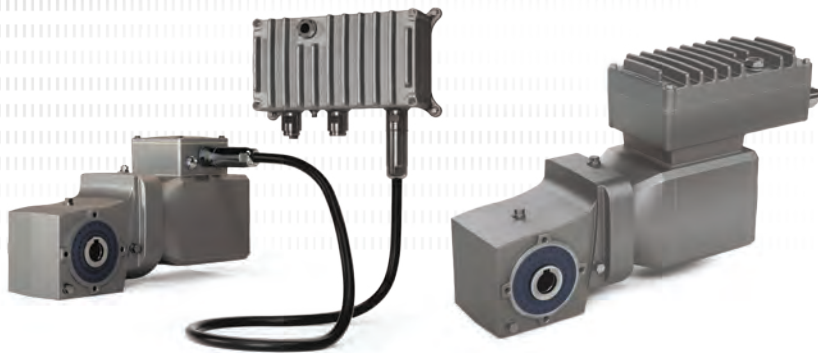
CONTACT US AT TREMEC.COM/OEM

TREMEC®

Elevating Performance™
tremec.com | (248) 859-6500
Global Operations: USA • Mexico • Belgium

NXD^{tuPH}

Sealed Surface Conversion System



State-of-the-Art
Surface Protection for
Wash-Down Environments



Engineering sMart

Your resource for the latest in great ideas from our advertisers. Check this section every issue for sMart Engineering ideas and technology.

For information about advertising, contact

Katie Mulqueen
(703)838-0066
mulqueen@motionpower.org

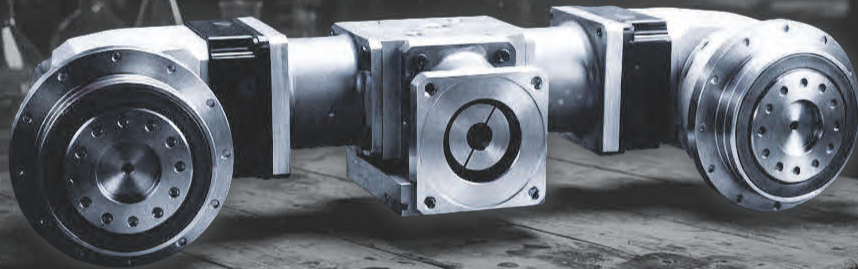


Subscribe TODAY

*IT's FAST. IT's EASY.
IT keeps YOU in the KNOW.*

powertransmission.com/subscribe

IT'S ALIVE!



**Bring your design ideas to life
with a DieQua custom gearbox.**

DIEQUA
Corporation

ISO9001:2015

info@diequa.com
630-980-1133
diequa.com



Gear Scuffing Analysis Comparison Study

Dr. Zhiyuan Yu

The rapid advancement of electric vehicles (EVs) has significantly increased the demand for reliable and efficient transmission systems. This has brought the study of gear scuffing to the forefront of research in automotive engineering (Ref. 1). Gear scuffing, a form of surface damage caused by metal-to-metal contact under high load and speed conditions (Ref. 2), poses a substantial challenge to the durability and longevity of EV gearboxes. With pitch line velocities reaching up to 100 m/s (Ref. 3), the risk of scuffing becomes more pronounced, necessitating a deeper understanding and innovative solutions to mitigate this issue.

To address the challenges posed by gear scuffing, researchers have turned to ISO standards (Ref. 4) and advanced analytical software tools (Refs. 5–7]. These tools are designed to predict scuffing failure and evaluate the effectiveness of various mitigation strategies. By simulating the operating conditions of EV gearboxes, these software tools can identify critical factors that contribute to scuffing and suggest design modifications to enhance gearbox durability. The integration of such predictive tools into the design and testing phases of EV transmission systems is crucial for developing more robust and reliable gearboxes, ultimately contributing to the overall performance and sustainability of electric vehicles.

There are two primary categories of analytical software used to predict gear scuffing. The first category includes software based on ISO 6336, such as *Masta* and *KISSsoft* (Refs. 5,6). This type of software relies heavily on empirical correlations derived from the ISO 6336 standard, incorporating factors like gear geometry, material properties, lubrication properties and operating conditions. These empirical methods provide a structured approach to understanding gear scuffing by utilizing established standards and correlations.

The second category involves software that utilizes the Elastohydrodynamic Lubrication (EHL) model, with *Windows LDP* (Ref. 7), developed by the Gear and Power Transmission Research Laboratory at Ohio State University, being a prime example. The EHL model considers the formation of a lubricant film under high pressure and shear conditions, which is crucial for preventing metal-to-metal contact and subsequent scuffing. This physics-based approach accounts for the dynamic behavior of the lubricant film, which might offer a more detailed and accurate prediction of scuffing phenomena compared to empirical methods.

Scuffing largely depends on contact stress. References (Refs. 8,9) benchmarked various software tools, including FE-based gear software like *Windows LDP*, ISO AGMA-based software like *KISSsoft*, and general FE software like *Abaqus*. These tools show no conclusive or consistent results. If general FE software is used as a baseline, *Windows LDP* can predict up to 20–130 percent higher contact stress than the baseline. *KISSsoft* shows a similar trend, with deviations up to 200 percent. Even within *Windows LDP*, different methods based on FEM or BEM can lead to up to a 36 percent difference in maximum contact stress. A similar situation exists for *Masta*, although there is no paper discussing this. According to its manual (Ref. 6), the Basic LTCA module yields different contact results compared to the Advanced LTCA module. The primary difference lies in whether the solver is ISO-based or FE-based. These variations highlight the challenges in achieving accurate gear scuffing ratings through analytical or numerical methods in the gear industry.

The reason for the differences in results is that gear contact stress from analytical or numerical methods usually falls in the 1GPa to 2GPa range. Current contact stress sensors, such as Fuji contact stress pre-scale film (Ref. 10), are well below this range. Therefore, experimental data can only validate the software based on contact pattern position or surface durability under various assumptions (Ref. 11), but not the actual contact stress value. This also explains why the contact factor of safety (FOS) in ISO standards, or ISO-based software, is empirical.

Recent advancements in analytical tools have significantly improved the accuracy of contact stress and scuffing surface temperature predictions. However, a large margin of error still exists in practical applications. Software ratings often tend to be conservative, leading to overly redundant designs. Consequently, companies must undergo extensive testing and development cycles to establish their in-house databases and correlate these findings with new designs. For surface durability caused by contact stress, companies often rely on software for contact stress analysis but need to perform in-house tests to determine material strength and life cycles, creating a database for future designs. For gear scuffing ratings, often initiated by lubrication suppliers who rate the oil in a standard FZG 4-square machine (Ref. 12,13), gear engineers use the lubrication

load stage to rate the gear for scuffing by analytical or numerical methods. The accuracy of these results remains a challenge in the gear industry, often leading to long development cycles or customer test rigs for testing without satisfactory results or reference values for future designs. Essentially, while software provides stress or scuffing surface temperature solutions, users must calibrate the software with in-house experiments for accurate ratings.

- The objectives of this paper are as follows:
- Establish a controlled macro/micro gear design case in *Masta* and *Windows LDP*;
 - Compare contact pattern, contact stress, and scuffing surface temperature results;
 - Identify the parameters affecting scuffing results and conduct a parametric study;
 - Propose a scuffing rating process for the two software packages, which will be able to integrate test rig results to calibrate the software.

Methodology

To make an apple-to-apple comparison between *Windows LDP* and *Masta*, the following strategy is employed:

- **Gear Design:** Use gears with the same macrogeometry and symmetrical microgeometry in the lead direction to avoid potential modeling errors. The modifications should be just enough to prevent any edge contact, which could lead to inaccuracies or singularities in the contact stress results.
- **Misalignment:** No misalignment input for *Windows LDP*, ensuring no system deflection. Achieve no misalignment in *Masta* by using a very stiff shaft and concept bearing, making system deflection negligible.
- **Lubrication Model and Temperature:** Set up the lubrication model and system temperature identically in both software to ensure consistency.

This approach ensures an accurate and fair comparison between the two software tools. Several parameters are known to affect gear scuffing, and four have been chosen for parametric study:

- **Surface Roughness:** Smoother surfaces reduce the risk of scuffing by promoting better lubricant film formation.
- **Torque Load:** Higher loads increase the risk of scuffing due to higher contact stress.
- **Speed:** Higher speeds can lead to increased frictional heating and reduced lubricant film thickness.
- **Lubrication Selection:** Different lubricants have varying scuffing resistance properties, influenced by their viscosity, additive package, and thermal stability.

It is known that scuffing is a complex phenomenon resulting from the coupled effects of these parameters (Ref. 1). For example, the lubrication properties will interact with the contact stress. They are not directly considered in the input stage but rely on the software solver. The lubrication spraying into or out of meshing, nozzle configuration, and lubrication flow rate are also not considered in the software comparison study.

Case Study and Results Discussion

Table 1 is the gear parameter table for the case study. The gear size is typical for the second stage in a passenger car EDU. The nominal operating load for the gear is 1,260 Nm, max speed is 2,500 RPM, the surface roughness is $R_z = 0.4\text{ }\mu\text{m}$, with ISO VG 460 lubrication, at a sump temperature of 85°C. Table 2 summarizes the range for the parametric study.

The parametric study is conducted by varying one parameter at a time, with other values at nominal values underlined in the table. *Windows LDP* uses $R_q = 0.22 \cdot R_z$ for surface roughness.

The contact stress results for the nominal load case are shown in Figure 1. There are noticeable differences in contact pattern position, with *Masta*’s contact pattern position lower than *Windows LDP*. The max contact stress in *Masta* is three percent lower than in *Windows LDP*.

Scuffing surface temperature results are used in both software for scuffing rating. *Masta* uses flash temperature. *Windows LDP* uses temperature calculated analytically based on physics. Both temperatures cannot be verified by physical measurement. Figure 2 shows the nominal case results.

The pitch has the lowest temperature due to zero sliding velocity. Each software predicts the highest scuffing surface temperature below the pitch line toward the pinion root. *Masta*’s max scuffing surface temperature is 20 percent higher than *Windows LDP*.

The contact stress and scuffing surface temperature contours under different load conditions are summarized in Table 3 and Table 4.

Name	Pinion	Wheel
Number of Teeth	25	78
Normal Module (mm)	2.662	
Normal Pressure Angle (°)	17.5	
Helix Angle (°)	19.8	
Hand	Right	Left
Tip Diameter (mm)	77.1	224
Root Diameter (mm)	62.07	208.617
Profile Crowning Relief (μm)	20	0
Lead Barreling Relief (μm)	50	20

Table 1—Gear parameters for the case study.

Surface Roughness R_z (μm)	Torque (N*m)	Speed (RPM)	Lubrication
0.1	630	1250	75W90
0.4	945	2500	ISO VG 460
2	1260	3750	
	1575	5000	
	1890	6250	

Table 2—Parameter range.

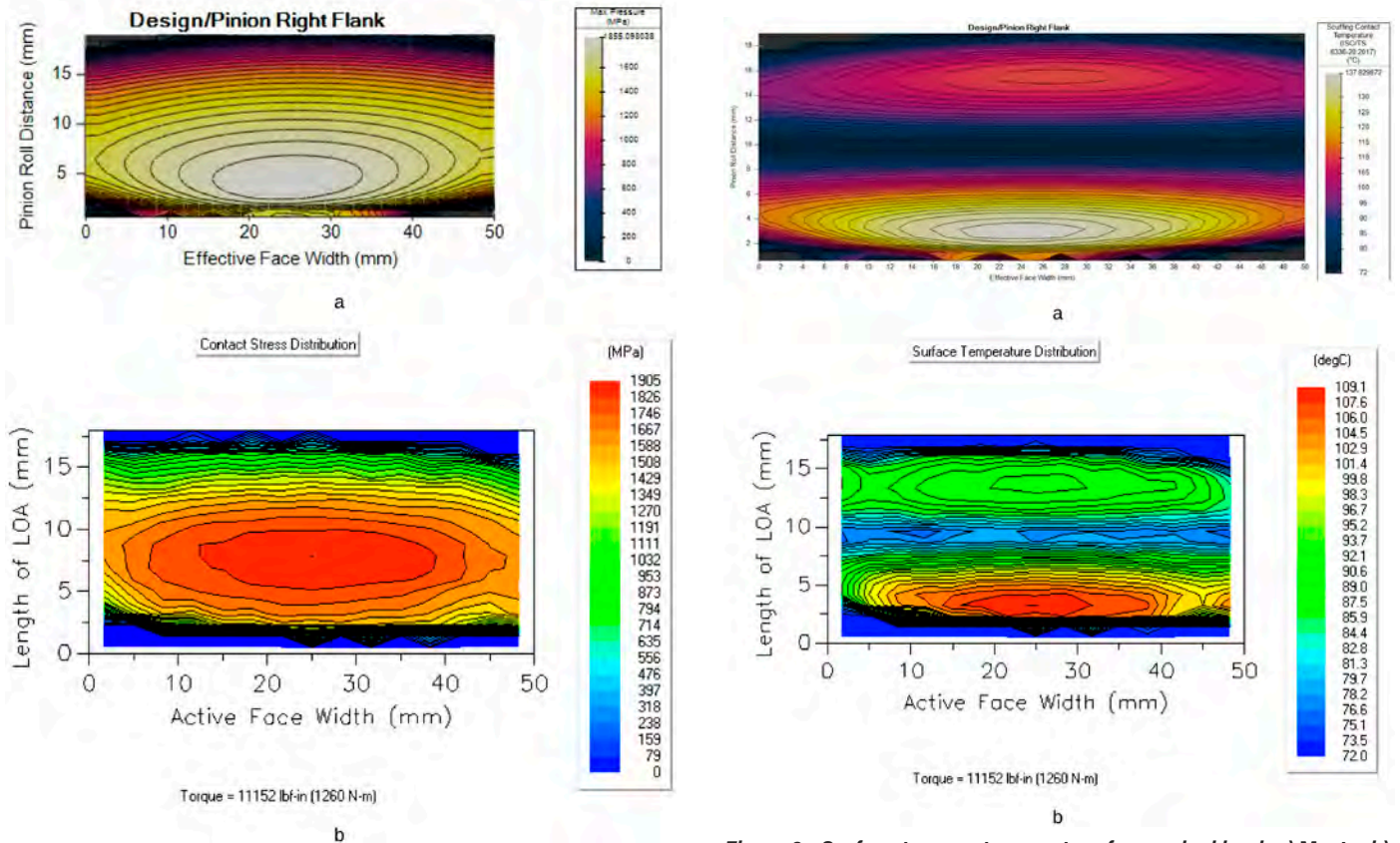


Figure 1—Contact stress contour for nominal load: a) Masta, b) Windows LDP.

Figure 2—Surface temperature contour for nominal load: a) Masta, b) Windows LDP.

	630 N*m	1260 N*m	1890 N*m
Masta			
Windows LDP			

Table 3—Contact pattern at various torques.

	630 N*m	1260 N*m	1890 N*m
Masta			
Windows LDP			

Table 4—Surface temperature at various torques.

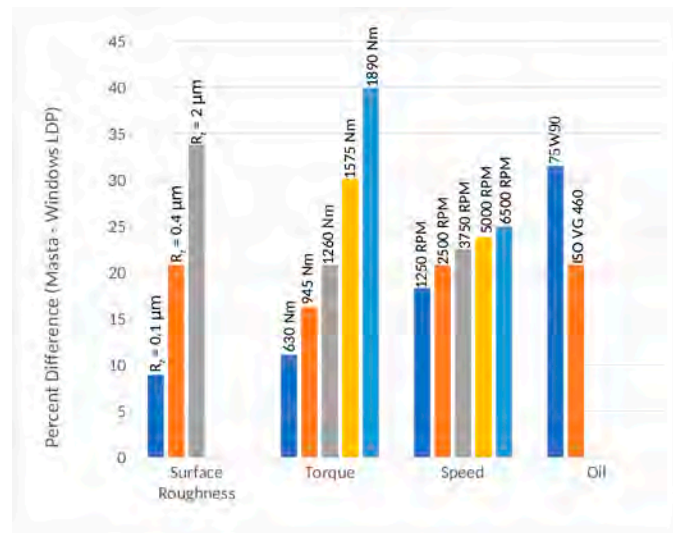


Figure 3—Parametric study result summary.

When torque increases, the contact pattern on the pinion spreads larger and shifts toward the pinion root. Both software predict a similar trend. However, *Masta* predicts edge contact at high torque, which is not reflected in *Windows LDP*. The tooth bending model in *Masta* is based on the Lewes bending assumption used in ISO standards, while *Windows LDP* uses an FE-based solver. Detailed discussion can be found in Refs. 8,9. The scuffing surface temperature results are largely based on the contact stress distribution. *Masta* scuffing surface temperature result is 40 percent higher than *Windows LDP* at high torque, compared with 11 percent at low torque.

The parametric results summary is shown in Figure 3.

Masta scuffing surface temperature solution is consistently higher than the *Windows LDP* prediction, with the percentage deviation varying across different parameters. As surface roughness increases from $0.1 \mu\text{m}$ to $2 \mu\text{m}$, the deviation rises from eight percent to 34 percent.

Similarly, torque increases from $630 \text{ N}\cdot\text{m}$ to $1,890 \text{ N}\cdot\text{m}$, resulting in a deviation growth from 11 percent to 40 percent. Speed changes from 1,250 RPM to 6,500 RPM lead to a deviation shift from 18 percent to 25 percent. Regarding lubrication, 75W90 shows a 32 percent deviation, while ISOVG460 has a 21 percent deviation.

Testing Method

Physical testing for gear scuffing is a standalone activity and does not need to be correlated with scuffing analytical software. However, if the sample is not well analyzed in relation to the test rig's capacity, the rig may lack sufficient RPM, torque, or power to cause the expected scuffing failure. Additionally, the stiffness of the test rig components, such as bearings and shafts, can affect the test results.

Therefore, a dual approach is needed for physical testing. The system model in *Masta* should be used to assess

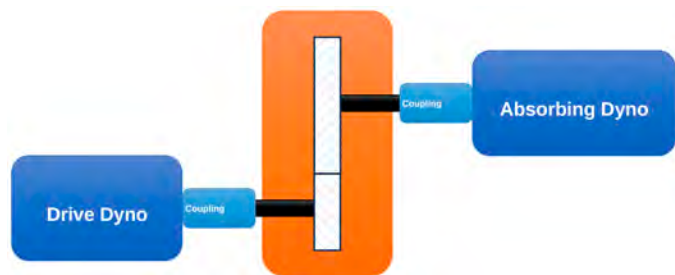


Figure 4—Test rig layout.

	Acceptable: radial marks, no material removal, surface is smooth for stylus testing
	Critical: material removal, the surface is rough for stylus testing
	Failure: heat discoloration

Table 5—Scuffing visual assessment guide.

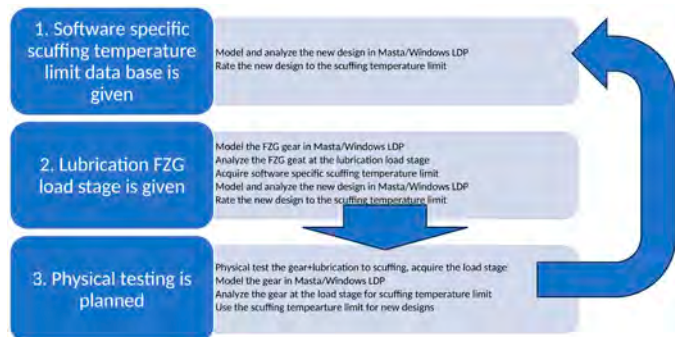


Figure 5—Software correlation and scuffing rating process.

the sample-test rig requirements to ensure the test leads to the intended scuffing results.

Figure 4 shows the layout for the testing dyno, which uses two dynos for driving and loading. Compared to the four-square layout (Refs. 12,13), each test takes less time to set up, and the torque and RPM of the testing are not affected by the test rig's secondary gear pair.

The selected gears are tested by loading them stepwise in five stages, operating for 15 minutes at each load stage while maintaining the assigned pitch line velocity and an initial lubrication temperature of 85°C. The lubrication nozzle type, diameter, jet type and nozzle position can be altered, allowing control over lubrication flow rate and lubrication starvation, which is not directly reflected in the analytical software. The analytical software assumes sufficient lubrication, but the data can be fed into the software calibration database for that specific lubrication condition.

After each load stage, the gear flanks are visually inspected for scuffing marks. The failure load stage is identified when the gears reach a critical condition or failure, as listed in Table 5. Exit lubrication temperature and test rig vibration can be monitored to help identify the occurrence of scuffing failure.

Software Correlation and Scuffing Rating

To use either *Masta* or *Windows LDP* for scuffing rating, the process shown in Figure 5 is proposed. In most applications, the lubrication FZG stage is provided at the initial design stage. Method 2 can be used to obtain initial results for the scuffing rating. Scuffing is a phenomenon resulting from gear-lubrication interaction. The new gear design will exhibit different scuffing performance compared to standard FZG gears. Method 3 can be employed as a validation or correction for the analytical solution. Subsequently, the data can be fed into a scuffing surface temperature limit database. A key takeaway from this research is that the database is software-specific and cannot be transferred between different software due to the use of different solvers based on varying theories.

Conclusion

This study provides a comprehensive comparison between *Windows LDP* and *Masta* for evaluating gear scuffing performance. Key findings include:

- Using identical macrogeometry and symmetrical microgeometry ensures accurate modeling and comparison. The two software predict different contact stress and pattern positions, especially at high torque, which contributes to the scuffing result differences.
- A parametric study was conducted, including the impact of torque and speed, surface roughness, and lubrication. There is up to a 40 percent deviation between the software.
- Differences in solver methodologies between *Masta* and *Windows LDP* result in varying predictions, emphasizing the need for software-specific calibration and validation.
- Methodology for calibrating the software with physical testing and testing methods.

Despite a large amount of research in analytical solutions for scuffing, physical testing is still required. The results of the paper provide guidelines for scuffing rating.

PTE





Dr. Zhiyuan Yu is an actuation engineer at Mind Robotics, where he architects geared powertrains for robotic systems. He earned his Ph.D. in Mechanical Engineering from Tennessee Technological University in 2017. Previously at Drive System Design and American Axle, he specializes in gear theory, powertrain design and finite element analysis.

References

1. T. Chen, C. Zhu, J. Chen, and H. Liu, "A review on gear scuffing studies: Theories, experiments and design," *Tribology International*, Vol. 109741, 2024.
2. S. Li and A. Kahraman, "A scuffing model for spur gear contacts," *Mechanism and Machine Theory*, Vol. 156, pp. 104161, 2021.
3. J. Vorgerd, P. J. Tenberge, and M. Joop, "Scuffing of cylindrical gears with pitch line velocities up to 100 m/s," 2021.
4. ISO/TS 6336, Calculation of load capacity of spur and helical gears.
5. *KISSsoft*, [Online]. Available: kisssoft.com
6. *SmartMT*, [Online]. Available: smartmt.com/masta
7. *GearLab*, [Online]. Available: mae.osu.edu/gearlab
8. F. Bejar, J. Perret-Liaudet, O. Bareille, M. Ichchou, and M. Fontana, "Review and benchmarking study of different gear contact analysis software in terms of the static transmission error response," *Results in Engineering*, Vol. 22, pp. 102286, 2024.
9. M. A. Adnan and A. Shehata, "Stress Analysis Validation for Gear Design," 2018.
10. *FujiprescaleUSA*, [Online]. Available: fujiprescaleusa.com
11. S. Vijayakar, Contact and Bending Durability Calculation for Spiral-Bevel Gears, No. GRC-E-DAA-TN31732, 2016.
12. D. J. Hargreaves and A. Planitz, "Assessing the energy efficiency of gear oils via the FZG test machine," *Tribology International*, Vol. 42, No. 6, pp. 918-925, 2009.
13. *Symbrium*, [Online]. Available: symbrium.com

TECHNICALLY SPEAKING

We're looking for in-depth insight and technical papers on subjects like gears, lubrication, linear motion, sustainability and food and beverage applications. Submit your technical articles to fagan@motionpower.org.

B&R AUTOMATION

Discusses Safety Engineering in Automation Today



As machines grow faster and become more adaptive, safety engineering often continues to operate in a parallel world of isolated workflows and fixed constraints. In this interview, Franz Kaufleitner (global product manager, safety) and Stefan Schönegger (CTO, ABB Machine Automation division, B&R) share why the time for a shift is right and how Safety+ from B&R aims to close the gap between modern automation and safety engineering.

What brought you into the world of industrial safety, and how does your experience shape what you do today?

Kaufleitner: I've spent the past two decades working in functional safety, seeing firsthand how essential it is for both protecting people and ensuring machines run as productively as possible. Safety engineering has traditionally been seen as a constraint, but I see it as an enabler. My focus is on making safety solutions more intuitive, more efficient, and more adaptable to modern automation needs. And importantly, users are not left alone when it comes to safety: Safety+ is designed to guide them through the workflow with built-in checks and validation

support, so safety remains manageable even as machines and projects get more complex.

Schönegger: My background is in industrial automation, controls and networking. Over the years, I've seen how innovation in standard machine control outpaced safety engineering. That's why Safety+ is so important—it closes that gap, making safety an integral part of modern automation instead of an afterthought. Safety should empower engineers, not limit them.

Safety engineering has been evolving for decades. Why is now the right time for a shift like Safety+?

Kaufleitner: Machines are becoming more complex, production cycles are shorter, and the pressure on engineers is increasing. Yet, safety tools have lagged, often requiring separate workflows, limited programming options, and cumbersome validation steps. We saw an opportunity to re-think safety engineering with the same modern approach as standard automation – more open, more flexible and better integrated.

Schönegger: Another big factor is adaptability. Manufacturing is moving toward smaller batches, customized production, and higher

efficiency. But rigid safety implementations don't fit this new reality. With Safety+, we're giving engineers more freedom to build smarter safety functions that enhance—not hinder—machine performance. By making safety a natural extension of automation software, we create more opportunities for efficiency and productivity.

Engineers don't adopt new tools just because they're new. What makes Safety+ a real step forward?

Kaufleitner: The biggest difference is that we've opened up safety engineering. Safety+ removes artificial restrictions that made safety programming slow and rigid. Now, engineers can use an open code base, integrate third-party tools, and take advantage of features like headless applications for CLI interaction. This makes safety programming as efficient as standard control programming, ensuring that machine builders don't have to compromise between safety and agility. At the same time, SafeDesigner+ adds its own independent safety layer, which detects unintended code changes and helps prevent accidental modifications from slipping into a validated project—and of course, SafeDesigner+ is TÜV certified.

Schönegger: We also focused on improving machine productivity. Smart safety reactions allow machines to respond to events in a more targeted way, reducing unnecessary stops. For example, instead of shutting down an entire production line, Safety+ allows controlled deceleration—keeping machines running safely while avoiding waste and downtime. This is a direct benefit for manufacturers looking to optimize their output.

What are the key advantages for OEMs and end users?

Schönegger: For OEMs, it's about speed and efficiency—developing safety functions as quickly as other automation tasks. Open architecture enables faster iteration, easier collaboration, and more streamlined validation. For end users, it's about

reducing downtime and maintenance costs. Automated safety updates and integrated diagnostics mean fewer interruptions and lower total cost of ownership.

Kaufleitner: There's also a space-saving benefit. Faster safety reactions mean machines can operate with smaller clearance zones, making it possible to design more compact production lines. That's a major advantage for manufacturers optimizing factory floor space. Additionally, with improved motion control integration, machine performance is not only safer but also smoother and more predictable, which is a key factor in high-speed production environments.

Five years from now, what role do you see Safety+ playing in industrial automation?

Schöneegger: I think we'll see a shift where safety engineering is no longer seen as a separate discipline but fully embedded in automation workflows. The same efficiency gains we've seen in standard control engineering will apply to safety. More advanced diagnostics, predictive safety algorithms, and real-time analytics will further reduce risk while improving machine uptime.

Kaufleitner: Safety+ is setting a new standard—one where safety isn't just about compliance but about smarter, more productive automation. Five years from now, I believe adaptive safety functions will be as common as adaptive machine control, allowing for more flexible and reconfigurable production environments without compromising worker safety.

br-automation.com

BCA BEARINGS Launches BCA in the Bay Trainer Program

NTN, the parent company of BCA Bearings, has launched its BCA in the Bay Technician Training Program, a nationwide initiative that delivers hands-on technical training directly to professional automotive repair facilities. Building on a

PROGRAM LAUNCH



BCA IN THE BAY TRAINING PROGRAM

successful soft launch and growing industry demand, BCA in the Bay delivers practical, real-world instruction focused on bearing diagnostics, wheel-end service procedures, installation best practices, and troubleshooting techniques. The program reflects BCA Bearings' ongoing commitment to supporting the technicians who install and recommend its products every day.

"The BCA in the Bay program allows us to connect directly with technicians where they work, helping them solve real-world service challenges while reinforcing the importance of proper wheel-end diagnosis and repair," said Charles Harris, vice president of automotive aftermarket for NTN Bearing Corporation of America. "This program is about more than training. It's about building relationships, sharing expertise, and demonstrating BCA's commitment to the professional technician."

At the heart of the program are regional technical trainers who travel throughout North America, conducting on-site training sessions for repair shops, distributors, and automotive service professionals. These trainers not only deliver the training but also develop and continually refine the curriculum, ensuring content remains relevant, practical and aligned with the evolving needs of today's technicians.

Each trainer operates a fully wrapped and specially outfitted BCA in the Bay training van, creating a mobile classroom capable of delivering engaging, hands-on educational experiences directly at customer locations. The vehicles also enhance BCA brand visibility throughout the aftermarket, reinforcing the program's presence in the communities and markets it serves.

Training sessions are offered in multiple formats, including hands-on demonstrations, classroom-style instruction, lunch-and-learn programs, and after-hours workshops. Course content covers bearing fundamentals, bearing failure analysis, diagnostic procedures, NVH troubleshooting, proper removal and installation techniques, and best practices designed to reduce comebacks and improve vehicle reliability.

The BCA in the Bay curriculum is designed for technicians, service advisors, service managers and parts professionals seeking a deeper understanding of wheel-end systems and the factors that impact vehicle performance and repair quality. Training participants gain practical knowledge they can immediately apply in the service bay to improve diagnostic accuracy, increase productivity, and enhance customer satisfaction.

bcabearings.com/technical-resources/training

E TECH GROUP Expands US Collaborative Robotics Portfolio

E Tech Group recently announced an Authorized System Integrator Agreement with Rainbow Robotics that expands E Tech Group's collaborative robotics offering for customers across the United States. Under the agreement, E Tech Group serves as a Servicing System Integrator for Rainbow Robotics' collaborative robot lineup.

E Tech Group will deploy and integrate Rainbow Robotics collaborative robots across laboratory and industrial automation applications, including machine tending, welding, palletizing, inspection, and assembly.

"E Tech Group's systems integration expertise, particularly in laboratory automation, made the company a natural fit for Rainbow Robotics," said Luke (Woochang) Jung, director of Rainbow Robotics USA. "Pairing that experience with our collaborative robot portfolio gives customers a strong combination of robotics technology and engineering expertise across laboratory and industrial automation applications."

Rainbow Robotics offers collaborative robot models for laboratory, life sciences, and food and beverage environments, including NSF/ANSI169-certified models with IP66 protection and full-aluminum construction to support hygienic and washdown applications. The company's collaborative robot lineup also includes application-specific capabilities such as a dedicated welding interface with built-in weaving patterns.

For laboratory automation projects, E Tech Group provides robotic work cell integration, connectivity among laboratory instruments, schedulers and LIMS platforms, controls and data integration, and validation and documentation support. These capabilities help customers integrate robotics into existing laboratory automation environments.

"Expanding our collaborative robotics offering gives customers

greater flexibility to select the right technology for their application," said Sura Hadi, director of lab automation and industrial robotics at E Tech Group.

"Rainbow Robotics brings capabilities that complement our existing robotics offering, particularly for applications with specialized hygienic, washdown and laboratory requirements. Combined with E Tech Group's engineering and integration expertise, we can help customers move from selecting the right robotic platform to implementing a complete automation solution."

Rainbow Robotics collaborative robots are commercially available in the United States. Under the agreement, E Tech Group will provide installation at customer sites and first-level service, including authorized warranty-related support.

etechgroup.com

SIEMENS Strengthens AI Infrastructure Leadership With US Manufacturing Investments

Siemens will invest more than \$200 million in two new U.S. manufacturing facilities in Pendergrass, Georgia, and Grand Prairie, Texas. These investments will expand Siemens' production capacity to deliver the critical electrical infrastructure required to power the next wave of AI. Siemens will create more than 1,500 jobs and strengthen its ability to serve the rapidly growing demand for AI-ready data centers. The investments are part of a move to expand Siemens' global capacity. In July 2026, the company already announced an investment of €300 million in its factories in Germany to support the rapid growth of AI and data centers.

"For anyone building or operating a data center today, the challenge is simple: scale faster, run reliably and use every watt wisely. Siemens brings together the technology and

expertise to help them do it," said Roland Busch, president and CEO of Siemens AG. "We are present across the AI value chain—from chip design and data center infrastructure to the electrical systems and smart grids that power accelerated computing. With these investments, we are strengthening our global leadership in the electrical backbone of AI and helping customers build efficient, resilient, AI-ready data centers."

The new facilities will produce the electrical equipment that keeps AI data centers running: systems essential for distributing, monitoring and controlling power across highly complex, energy-intensive environments. This enables customers to expand capacity while maintaining reliability, responding flexibly to changing loads, and using energy and equipment more efficiently. Strong demand for these solutions is already visible in Siemens' results. In the first nine months of its current fiscal year, the company recorded triple-digit order growth in its data center business, with orders reaching around €6 billion.

"The AI revolution will only scale if the infrastructure around it is efficient, resilient and trusted by the communities it serves. Siemens helps customers build more efficient AI-ready data centers and connect them to the wider energy stack—from power distribution and building technologies to grid software, load and energy management. That is how we help deliver the reliable and affordable power AI requires, while using resources as responsibly as possible," said Peter Koerte, member of the Managing Board and CEO of Siemens Smart Infrastructure.

Siemens is positioned on both sides of the AI buildout: providing the infrastructure AI relies on while bringing domain-specific AI into real-world engineering and operations. Its industrial AI capabilities combine software, automation and digital twins to help customers design, build and operate complex physical systems more efficiently and resiliently.

siemens.com

October 18–21

Pack Expo International 2026



Pack Expo International 2026 (Chicago) is where 48,000 attendees from more than 40 vertical markets come together with more than 2,600 suppliers to shape the future of packaging and processing. It's the industry's global hub for innovation, collaboration and growth. Attendees represent a wide range of industries, including consumer packaged goods (CPG), life sciences, retail and industrial sectors. Education topics include robotics, cybersecurity, sustainability, digital transformation and more.

powertransmission.com/events/pack-expo-international-2026

November 17–20

Automation Fair 2026



The Automation Fair (Boston) is dedicated to industrial automation and digital transformation. Attendees will experience inspiring keynotes from notable thought leaders, dive deep into training from knowledge experts on the latest technology advancements and explore the newest innovations showcased across an expansive Expo with 120-plus exhibitors. Each year, Automation Fair hosts more than 10,000 problem solvers, makers and leaders who are shaping the future of industrial operations. From C-suite executives to operations management to engineers across a range of industries, this four-day event provides opportunities for learning, inspiration and connections for all who attend.

powertransmission.com/events/automation-fair-2026

November 24–26

SPS Smart Production Solutions 2026



SPS (Nuremberg, Germany) highlights smart and digital automation solutions. Around 1,000 exhibitors from across the globe present forward-looking technologies and high-impact solutions for industrial applications. Industrial AI is the driving focus topic of SPS 2026 demonstrating how automation, in combination with solutions from drive technology, sensor technology, software and industrial communication, is shaping the future. Four stages will present current trends, technologies and practical applications offering insights for decisionmakers, developers and young talent.

powertransmission.com/events/sps-smart-production-solutions-2026

December 8–9

CTI Symposium Berlin 2026



CTI Symposium Berlin offers active discussions on the latest technologies and strategies on automotive transmissions and HEV & EV drives for passenger cars and commercial vehicles. At CTI Symposium Berlin, more than 650 senior experts and decisionmakers from OEMs, Tier 1 suppliers, technology companies, and research institutions come together to discuss the latest developments in electrified drivetrains, hybrid technologies, energy systems, software integration, and future mobility strategies. The CTI Symposium is neutral, international and insight driven. It is not guided by any corporate or political agenda—but by the shared commitment to innovation, technical excellence and open exchange across the global powertrain community.

powertransmission.com/cti-symposium-berlin-2026

AD INDEX

Atlanta Gear Works

Page 33

atlantagear.com

Atlantic Bearing Services

Page 5

atlantic-bearing.com

Automation Direct

Inside Front Cover

automationdirect.com

B&R Machine and Gear

Page 33

brgear.com

Designatronics

Page 7

sdp-si.com

DieQua Corporation

Page 35

diequa.com

ITW Heartland

Page 11

spiroidgearing.com

JIE USA Inc.

Inside Back Cover

jie-drives.com

KHK USA

Page 3

khkgears.us

Lafert North America

Page 12

lafertna.com

Lubriplate

Page 17

lubriplate.com

McInnes Rolled Rings

Page 13

McInnesRolledRings.com

Mitsuboshi Belting Ltd.

Page 11

mblusa.com

Napoleon Engineering Services

Page 15

nesbearings.com

Nord Gear Corporation

Page 35

nord.com

Nordex Inc.

Page 34

nordex.com

PBC Linear

Outside Back Cover

pbclinear.com

Philadelphia Gear

Page 21

philagear.com

SDP/SI

Page 5

sdp-si.com

Timken Precision Drives

Page 33

timkenprecisiondrives.com

Tremec

Page 34

tremec.com

Vector Companies

Page 9

vectorcompanies.com

Zero-Max

Page 27

zero-max.com

Join the Revolution!

PTE and GT Revolutions is a diverse department featuring original online content, new video releases, Ask the Expert columns and more. These articles tend to piggyback off the “editorial” calendar topics with additional website content for our readers.



Submit your PTE articles to Matt Jaster at jaster@motionpower.org and your Gear Technology articles to Aaron Fagan at fagan@motionpower.org.

CALL FOR PAPERS!

Are you sitting on an idea for a technical paper but wondering where to present it? Do you have one already written, sitting on your desk, gathering machine dust?

How about *Power Transmission Engineering*? We are always looking for gearing- and power transmission component-relevant technical papers for publication in the magazine and in its digital version. Having your work appear in *Power Transmission Engineering* guarantees you an audience of the most experienced and discriminating industry players. You say your work has not been peer-reviewed? Not a problem, as we are lucky — and thankful — to have on-hand some of the most experienced and brilliant minds in the industry — our technical editors. So if your work “passes muster” and is published, you’ll know you were reviewed by the best — and most demanding.

Chances are you’ll be creating the paper under the auspices of the company for whom you work or own, or for one of the various industry-relevant associations. That means they as well will bask in the reflected glory that accrues with publication in *Power Transmission Engineering*.

For publication guidelines and more information, please contact Matthew Jaster at jaster@motionpower.org.

☐ Renew my subscription ☐ NEW subscriber

25PTEALL

☐ **YES** I want to receive/continue to receive **PTE**

☐ **NO**

Name _____

Job Title _____

Company Name _____

Company Address _____

City _____

State _____

Zip Code _____

Signature: _____

(required)

Date: _____

How is THIS LOCATION involved with power transmission products?

(Check all that apply)

- ☐ WE **MAKE** power transmission products
- ☐ WE **BUY** power transmission products
- ☐ WE **SELL** power transmission products
(distributors, sales reps, etc.)
- ☐ WE **DESIGN** products with power transmission components in them
- ☐ Other (please describe) _____

What is your company's principal product or service?

Please send

- ☐ PRINT Version
- ☐ DIGITAL Version (E-mail required)
E-MAIL: _____
- ☐ BOTH Print and Digital

*You can OPT OUT at any time.

Your mailing label on the cover looks like this:



X/Y - means you have received a complimentary copy. Please complete this form to continue receiving your FREE copy of PTE.

Q14 (shown above) - means you have 14 issues remaining in your subscription (a NEW subscription has 16 issues).

Q1 - means you have 1 remaining issue before your PTE subscription expires. Please complete this form to renew.

Norms and Standards



Aaron Fagan, Senior Editor

Norman Normal is on the Looney Tunes Golden Collection, Volume 6, and on YouTube. It is worth six minutes of your time.

It is God's own private mystery how the algorithms work, but somehow an old Warner Bros. cartoon titled *Norman Normal* entered my feed this week. Released in February 1968, it runs six minutes and is about a ball-bearing salesman caught in an ethical conundrum.

Noel Paul Stookey, the *Paul* in Peter, Paul and Mary, recorded the song "Norman Normal" in 1966. He and Paul Dixon wrote the story and share the voice credit, with Stookey as Norman. Alex Lovy directed. The studio's signature anvil-and-dynamite grammar is altogether absent.

The song's refrain is "He looks a lot like you." Norman tells us up front that the cartoon is about what goes on inside his head, a hall filled with the doors of his consciousness. Behind one, his boss wants a contract signed by a client with a weakness for liquor. Norman is to get him "real juiced up" and slide the contract under his nose before he passes out. Norman says it isn't right. The boss keeps turning into people from Norman's past: a kid daring him to steal Tommy's glove, a voice calling him chicken, then the boss again, doubting he is "mature enough to accept executive responsibility." Norman caves. Alone, he rehearses: "Either we've got a good ball bearing, or we haven't. You don't buy favors with alcohol."

Behind the next door, he seeks out his father for advice and gets his ghost. The old man drifts around the room reciting his own life, the 10-mile walk to school, the Depression, the two cars, while Norman asks the real question: "Something's not *right* or *wrong* just because it's convenient today, is it?" They talk past each other. The father is as unreliable as the boss; his only wisdom on offer is, "Don't make waves, Norman. Fit in." Behind yet another door, at a party, Norman declines to listen to inappropriate jokes and orders a ginger ale, and is

mocked for both. It ends with him apologizing to us. "It's just that there are so many doors in here."

Why a bearing salesman? Partly because a bearing is small, hidden inside whatever it makes work, and unthought of until it fails. None is ever shown. But there is a sharper reason. A bearing is governed by standards. Its tolerances, load ratings, and grades are written down and can be measured, and it either meets them or it doesn't. The people around Norman live by norms, which shift with whoever is in the room. "I know what's right and wrong," he tells his father, "but everybody seems to have their own kind." Remember, his answer was a standards man's answer: "Either we've got a good ball bearing, or we haven't."

Fifty-eight years later, that ubiquitous commodity, the modest ball bearing, is one of the harder things in the American industrial base to source. Much of what runs in this country comes from overseas, and much of the domestic capacity of 1968 is gone. Where the United States can get bearings made at home, in the quantities and grades it needs, is now a serious question. Nobody expected to be asking it in the age of artificial intelligence. But a data center needs fans and pumps that need bearings because chips do not cool themselves.

Norman would have understood this dilemma. For a long time, the bearing was a line item that would always come from somewhere, and now that somewhere is in question. The people working on it, like him, decline to pretend the problem isn't there. Without bearings, American industry comes to a grinding halt. Without people who take bearings seriously, supply is left to chance. The cartoon certainly picked the right product to illustrate a real issue.

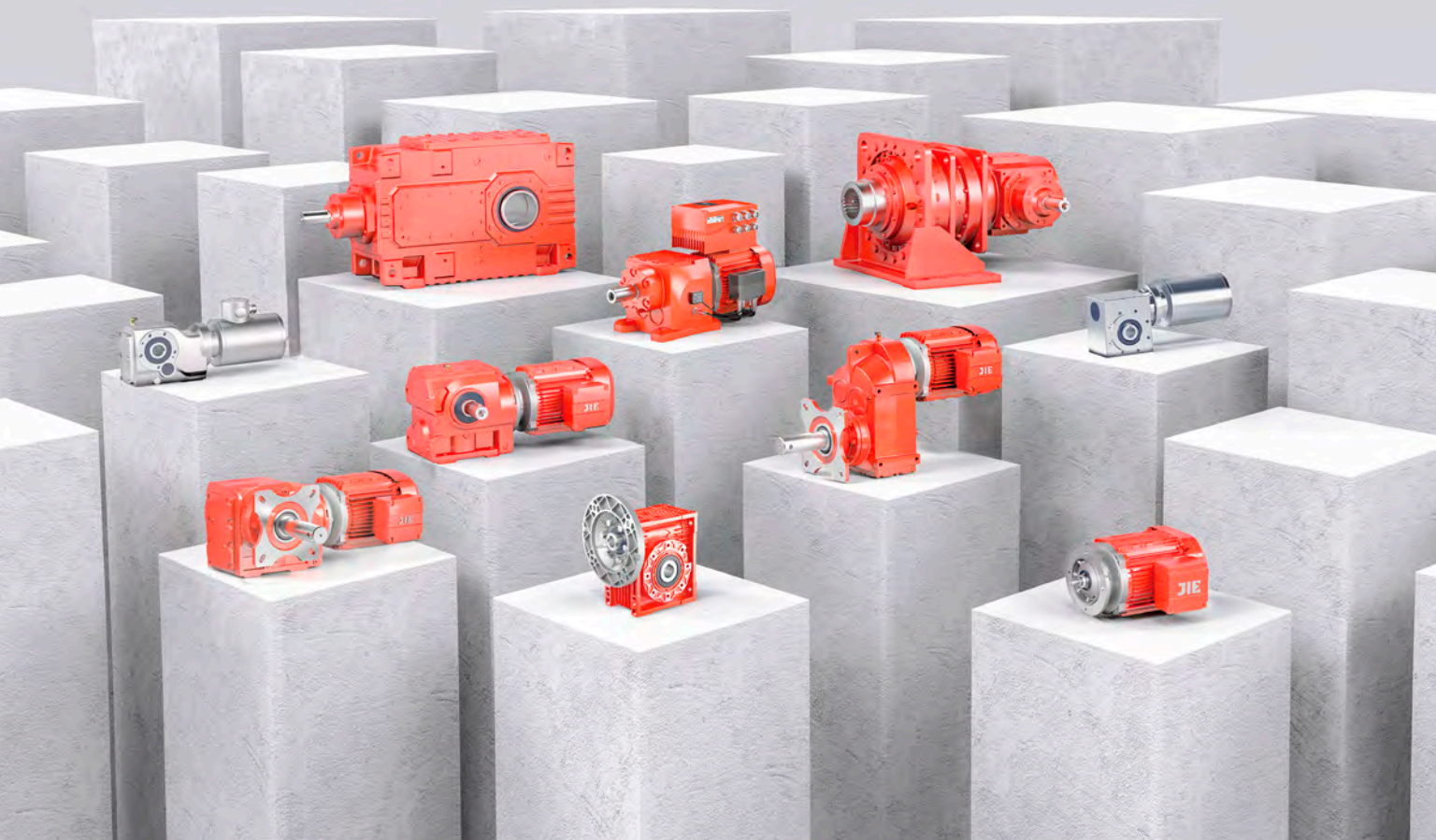


TOTAL DRIVE SOLUTIONS PROVIDER

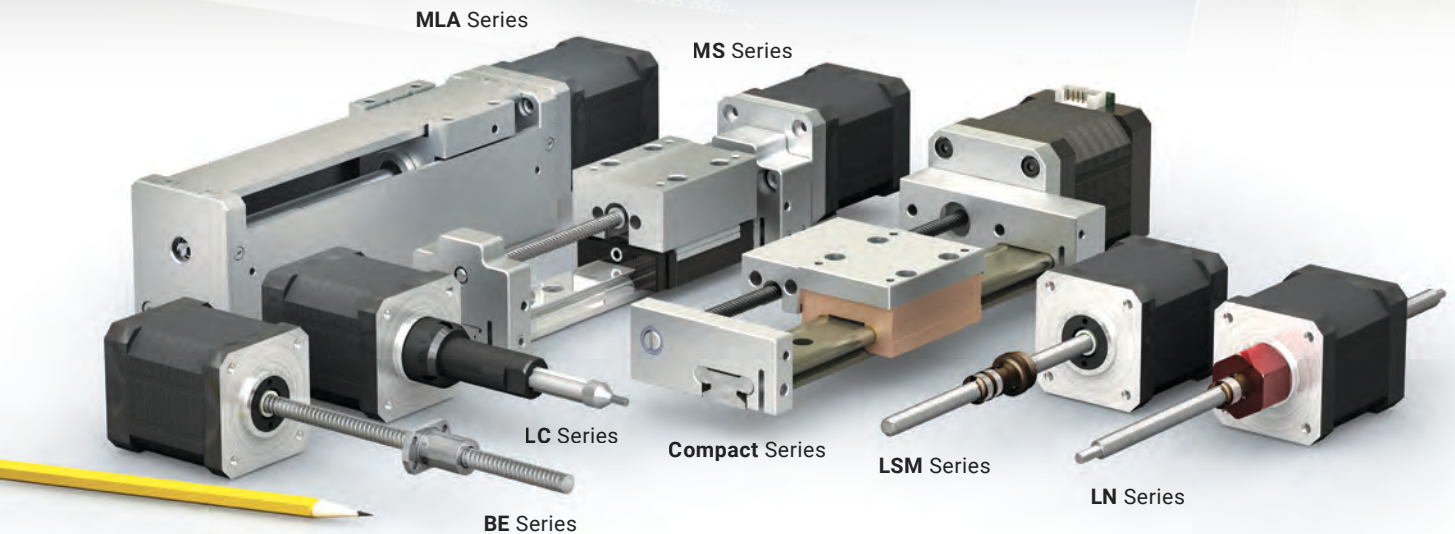
www.jie-drives.com

Info@jie-drives.com

+1 630 580 9986



Limited Space?



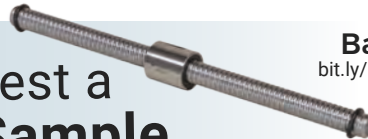
Driven to Excel in Compact Spaces

Motors that provide high torque, high precision, and high efficiency to fit many application needs where space is limited.

Lead Screw
bit.ly/LeadScrew2026



Request a
FREE Sample



Ball Screw
bit.ly/BallScrew2026



6402 E. Rockton Road, Roscoe, Illinois 61073 USA • +1.800.962.8979 • pbclinear.com