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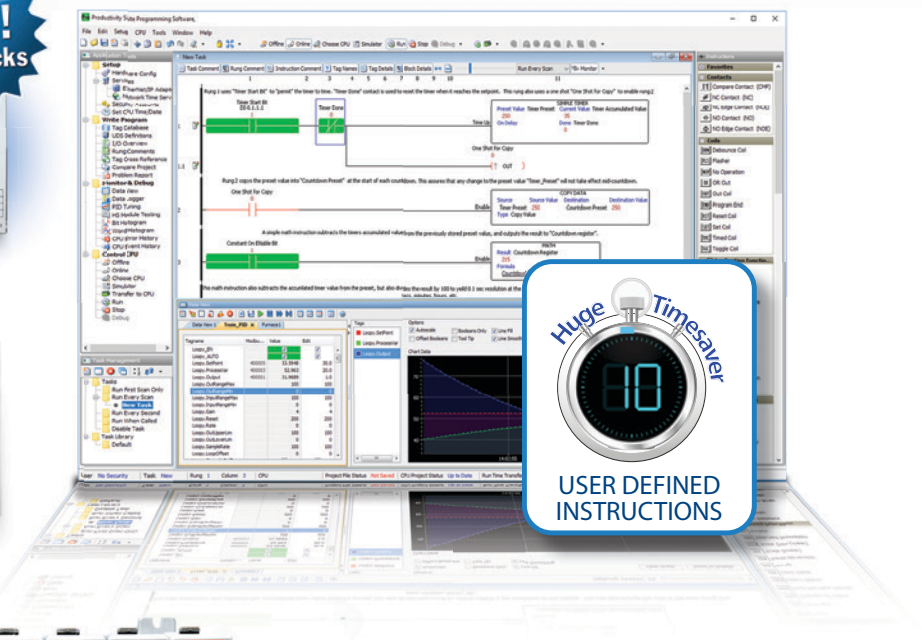

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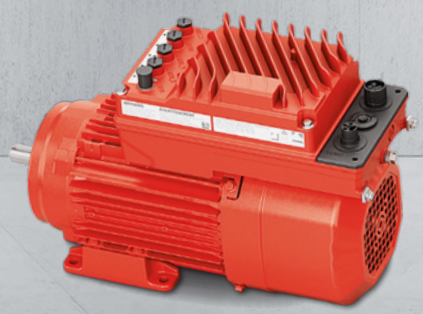

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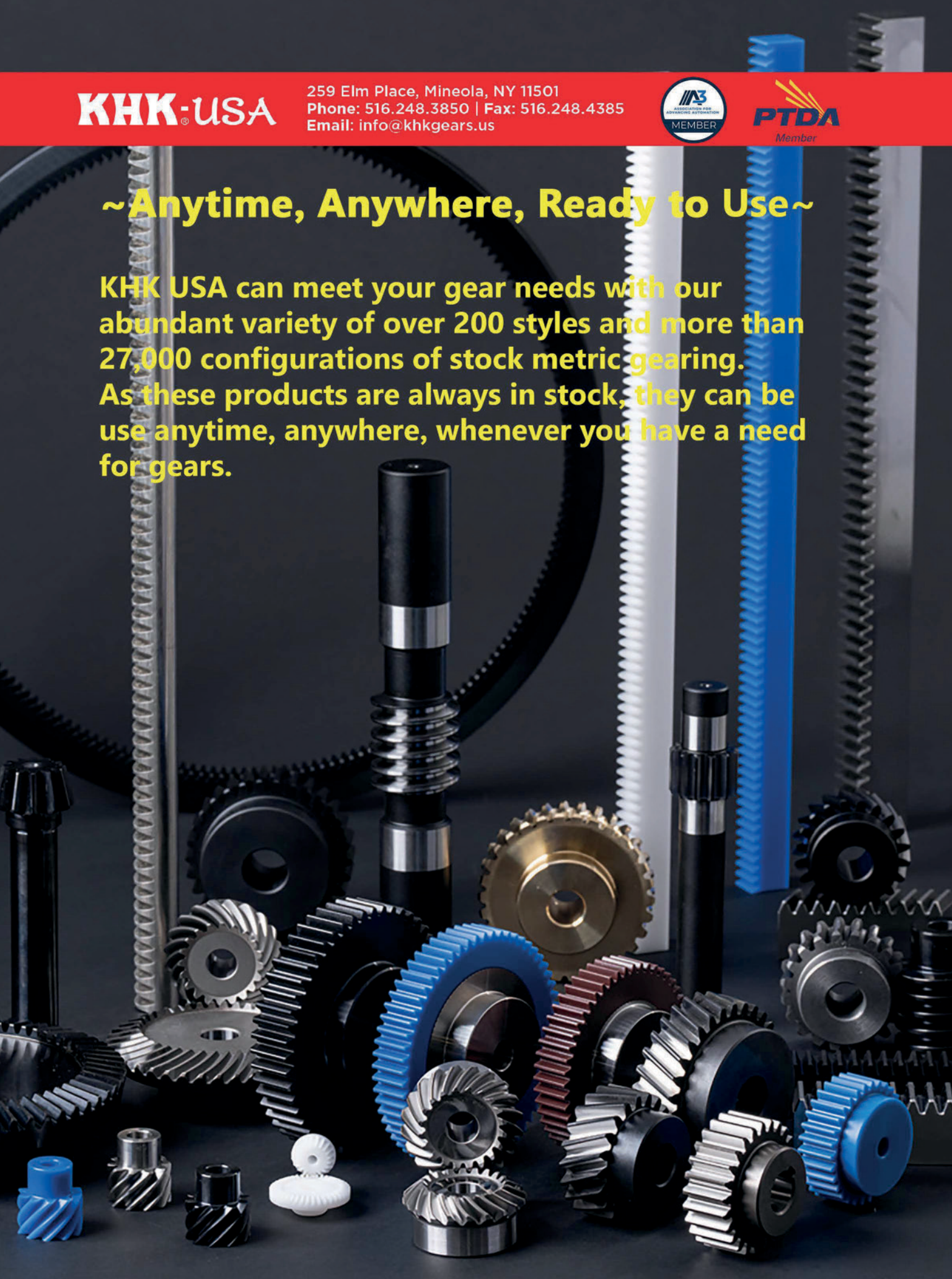


PTE REVOLUTIONS

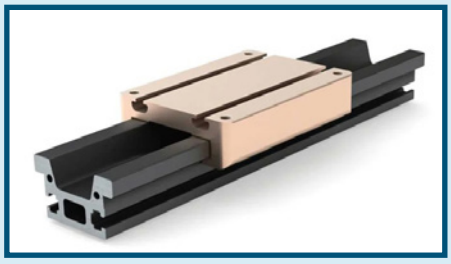
Interact Analysis Examines 2026 Motor Market

Blake Griffin at Interact Analysis examines the market for high-efficiency motors (>IE4 or equivalent) continues to grow at a faster pace than the broader low voltage AC motor market. Through 2030 we are expecting the market to nearly double from its 2025 value of $1.7 billion.

powertransmission.com/interact-analysis-examines-2026-motor-market

PTE VIDEOS

PBC Linear Examines Linear Slide Guides



Linear Slide Guides with a tall profile linear rail resist bending under load, thus enhancing rigidity. Their angled rail surfaces prevent debris accumulation, making them ideal for contaminated environments and cleanrooms.

powertransmission.com/videos/pbc-linear-examines-linear-slide-guides

AS SEEN IN *GEAR TECHNOLOGY*

After the Ruling

In March, when we published "Farewell to an Idea," the gear industry was bracing for the full weight of Section 232 tariffs—25 percent on steel and aluminum, no more exclusion process, no more relief valves. The Supreme Court case challenging the president's broader IEEPA tariffs was still months from oral argument. The question then was how to survive. The question now is different.

geartechnology.com/after-the-ruling

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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 Engagment and Sales
Katie Mulqueen
mulqueen@motionpower.org

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

CIRCULATION
Subscriptions Manager
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.*

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Keep Asking Questions

Matthew Jaster, Director, Editorial Content

BMW recently launched a pilot program in Germany where AI-powered humanoid robots began working the assembly lines. Previously, the company ran a similar 10-month testing program in a U.S. plant in Spartanburg, SC. These steadfast and efficient machines worked for up to 10 hours a day handling rigorous tasks such as placing sheet metal components for welding.

BMW is enamored with the possibilities and reported that the humanoid factory workers contributed to the production of more than 30,000 automobiles. More importantly, they did not replace human workers as much as they reduced the strain of repetitive and challenging shop floor tasks.

I want to be excited about this. I want to live in a world where we eliminate hearing loss, back problems and exposure to harmful chemicals like my grandfather dealt with as an autoworker in Michigan.

I visited his plant once when I was seven years old. I only recall two things about the trip—the factory was enormous and I've never experienced so much noise in my life. My ears were ringing for weeks following my visit.

On paper, giving some of these repetitive and ergonomically challenging tasks to C3PO makes so much sense. We could eliminate carpal tunnel syndrome, cut down on work-related injuries and free up some valuable time to let the humans solve other problems on the shop floor.

But we need to continue asking questions—oh so many questions—on our way towards automation utopia. People are still powering these machines. We have human beings in charge of collecting data, safety compliance and evaluating the potential of humanoid robots in manufacturing. This work is complex and must continue at the highest level.

Conversely, the atmosphere in which our robotic warlords will operate still involves very human environments: slippery floors, poor lighting, constricted space and most importantly, human colleagues. Is it safe to put humans and humanoid robots together in the same manufacturing cells? Can we trust that R2D2 will get better through case studies and testing programs?

Do I want one of these in my house some day—a humanoid robot folding laundry, doing dishes and recording the 17th television spinoff of *Game of Thrones*?

Jeff Burnstein, president of the Association for Advancing Automation (A3) gives us a little sneak peek on robotic innovation on p. 28. This thoughtful piece examines our national robotics strategy, the importance of new industries adopting robotics and he asks plenty of questions about the future of humanoids.

Apart from robotic innovations, our yearly deep dive into automation, smart components and material handling takes us to Pack Expo East in Philadelphia (p. 22) to an industry carefully examining the potential of AI, the need for flexible machines and how digitalization will allow manufacturers to move from reactive to proactive operations.

The manufacturing toolkit continues to grow. No matter the industries you serve, we all have an obligation to see how these innovations can help us build and maintain better gears, bearings, couplings, motors, belts and drive systems in the future.

I urge all our readers to try some new software, see where AI fits into your long-term goals or consider some robotic work cells to increase shop floor productivity.

Just make sure to ask ALL the questions along the way.

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From building motorcycles to fabricating and welding on TV to partnering with big-name manufacturers, fun drives Jeff Tiedeken's creativity. And nothing is more fun than having his mind blown at **IMTS – The International Manufacturing Technology Show.**

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KOLLMORGEN

Looks at the Mechatronic Approach to Designing Motion as a System

When people talk about mechatronics, it's often framed as something futuristic—the next big leap in automation. In truth, it describes something engineers have been working toward for decades: designing machines where the mechanical, electrical, and control systems work together as one. Arne Linder, product manager, drives at Kollmorgen, explores the benefits and key aspects of applying a mechatronic approach to designing motion systems.

A mechatronic approach looks at the entire system as a single organism where the motor, drive, controller, and software are not just compatible, but interconnected. Correctly applied to today's motion systems, this concept can deliver greater precision, faster commissioning, and easier long-term support.

You can see this in how advanced machines are now designed and developed. Rather than treating electrical, mechanical, and control engineering as separate stages, they're part of one continuous process: from virtual design and simulation to physical commissioning and maintenance. Each discipline informs the others, and the result is a machine that moves, and evolves, as a unified system.

For a long time, setting up a servo system meant—rather ironically, for automation projects—doing everything by hand. Engineers had to enter the motor parameters into the drive manually, refer to look-up tables, and hope nothing was mistyped. Small errors in those numbers could lead to poor performance, instability, or unexpected behavior. Even something as minor as a misplaced decimal point could have catastrophic consequences and potentially even cause a motor to damage itself or rapidly overheat.

Modern systems, such as Kollmorgen's own SFD-M feedback device, can take much of that risk away. Today, a properly designed setup can allow the motor and drive to automatically identify and configure each other, loading the correct parameters for torque, current, and speed control without the needs for slow (and potentially incorrect) manual entry. That not only saves time but ensures that the system performs as designed from the first test move.

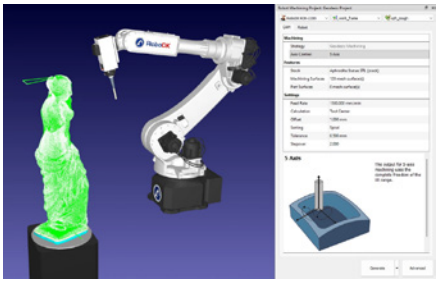
This is what we think of as the first stage of mechatronic integration: getting the key elements to cooperate automatically. It may sound simple, but it represents a big step forward for commissioning and consistency. The engineer can focus less on configuration and more on the dynamics of the machine itself.

The next step is bringing that same simplicity to the control layer. Many OEMs have long-standing automation environments and communication protocols they prefer to use. That's why many of our modern drives are built to operate agnostically, communicating across multiple industrial networks by default. For those developing entirely new systems, fully integrated environments such as the *Kollmorgen Automation Suite* make it possible to handle motion, PLC logic, safety, and visualization within a single workspace. It's a practical example of mechatronics in action—combining mechanical intent and digital control in one place.

kollmorgen.com

ROBODK

Launches CAM Solution Designed to Slash Robotic Machining Deployment Times



RoboDK has launched *RoboDK CAM*, a comprehensive software solution that significantly reduces deployment times for automated machining cells.

Unlike complex traditional approaches which require specialists to manually program each robot and end-effector using vendor-specific languages, *RoboDK CAM* automatically generates robot code from CAD designs and digital simulations,

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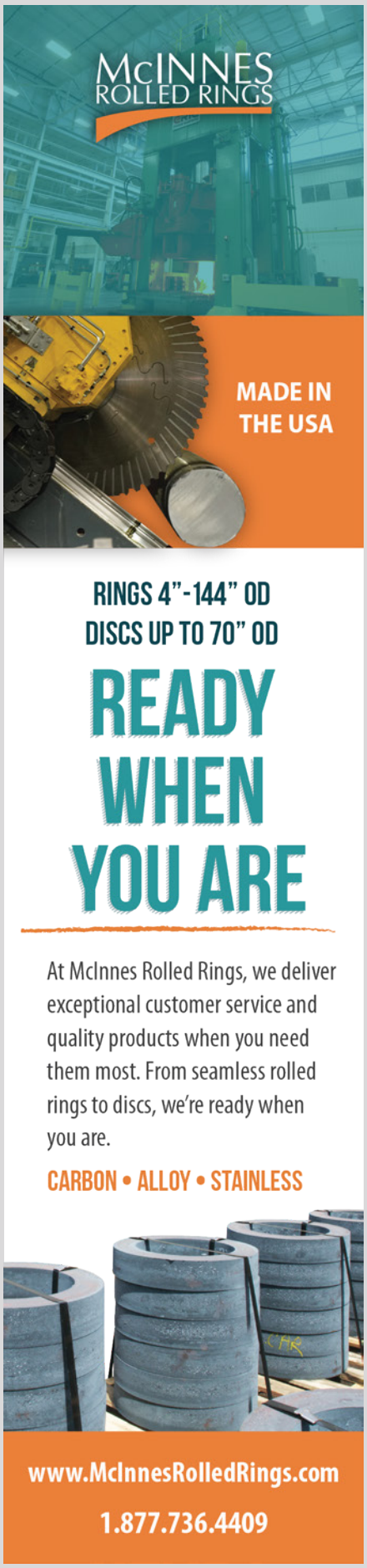


reducing the complexity and cost of machining automation deployments. This allows manufacturers and integrators to move directly from design to production without having to be experts in robot programming.

RoboDK CAM supports a wide range of machining operations, including milling, drilling, deburring, cutting, and additive manufacturing. Users can generate advanced toolpaths, simulate full machining processes, detect collisions, and transition from simple 3-axis tasks to 5-axis machining within a single, intuitive environment. Additionally, instead of having to spend weeks testing and programming various configurations of your machining cell, *RoboDK CAM* allows you to test your setup in a safe, simulated environment in minutes.

The new software is available in two configurations, addressing different manufacturing workflows:

- Standalone: *RoboDK CAM* enables users to manage the entire robotic machining process—from toolpath generation to robot simulation and code generation—within one integrated interface. Key capabilities include advanced surface machining, accurate stock tracking, and full machining simulation.

- Integrated: designed for machining professionals who want to work within established CAD/CAM platforms. *RoboDK CAM* integrates with all leading systems such as *Fusion 360*, *SolidWorks* or *Mastercam* through dedicated Add-ins, enabling users to retain their existing CAM workflow while extending it to industrial robots using RoboDK's simulation and programming engine.

Typically, it takes weeks of testing and programming to deploy machining automation, but as early testers of the software have reported, *RoboDK CAM* reduces testing time significantly—up to 40 percent depending on the complexity of the automation—and cuts overall deployment times from days to just minutes.

"*RoboDK CAM* is a milestone software release that eliminates the complexity associated with programming robots to perform machining tasks," said Albert Nubiola, CEO, RoboDK. "Automation drives efficiency, but complex programming and multi-vendor system integration troubles have been serious roadblocks for companies looking to adopt robots. RoboDK CAM addresses these challenges directly."

For manufacturers, *RoboDK CAM* enables faster automation rollouts, reduced downtime, and quicker iteration on machining processes. For system integrators, the software shortens project timelines and reduces the engineering effort required to deploy robotic machining cells.

"*RoboDK CAM* makes it easier for manufacturers to adopt robotic machining without overhauling their existing processes," said Sergei Kanivets, application engineer at RoboDK. "Because it is built on the RoboDK platform, we can deliver a complete CAM solution at a significantly lower cost than traditional alternatives."

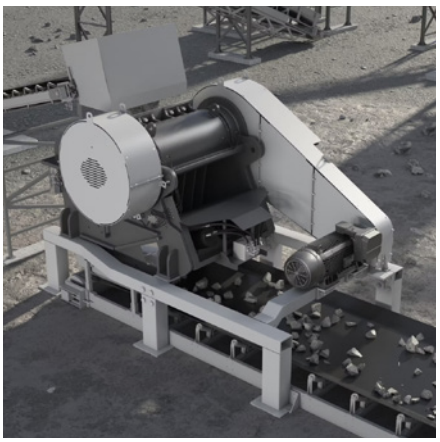
"RoboDK exists to democratize automation for people of all technical skill levels and companies of all sizes," adds Albert Nubiola, RoboDK's CEO. "We plan to keep adding new products and solutions like RoboDK CAM that are designed to make automation easier than ever to deploy—even in advanced manufacturing applications."

robodk.com

ABB
Offers Latest Motor Tech at ConExpo

Concrete and aggregate producers operate in high-dust, high-vibration environments where crushers, conveyors and pumps run under constant load. At ConExpo, ABB showcased motor solutions

engineered to cut downtime, improve efficiency and extend equipment life in these demanding applications. Built for heavy inertia starts and continuous-duty cycles, ABB technologies give facility managers and plant engineers greater reliability, easier maintenance planning and stronger control over total lifecycle costs.



Technologies at the show included ABB Baldor-Reliance Crusher Duty motors, designed for belt-driven rock crushers, pellet mills and other applications requiring motors rated for high starting and peak torques.

The ABB Baldor-Reliance HydroCool XT is a water-cooled motor that is quiet and versatile, requiring little to no maintenance, which can perform in some of the toughest environments.

The water-jacket cooling technology extends motor life while saving space, energy and maintenance costs.

The DP200 Crush+ exceeds demands for reliability and safety in the harshest environments, raising the standard of motors used for crushers and other applications. Engineered with the user in mind, it delivers high starting and breakdown torque alongside flexibility and design modularity. Built upon the proven SD200 framework, its rugged and reliable design optimizes performance, efficiency and total cost of ownership.

SD100 Severe Duty motors are built for demanding applications, offering high efficiency, durability and reliability in harsh environments, making them ideal for industries where long-lasting performance under heavy loads is essential. These powerhouse motors are tailor-made for the rigors of severe duty industries. SD100 motors offer the ultimate in rugged construction, cool operation, high performance and application flexibility.

abb.com

MCLAREN MASTERCARD FORMULA 1 TEAM

Taps Greene Tweed Advanced Sealing Technology to Boost Differential Performance

Greene Tweed has announced the successful development and deployment of its Metal-Spring-Energized (MSE) seals for McLaren Mastercard Formula 1 Team's limited-slip differential clutch pack. The collaboration represents a significant milestone in the ongoing partnership between Greene Tweed and McLaren Racing, which continues to fuel advancements in motorsports engineering.

As the standing Formula 1 (F1) Constructors' Champions, McLaren recognizes that incremental gains in every component deliver a competitive advantage. McLaren turned to Greene Tweed for an advanced

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sealing solution for the hydraulic actuator that clamps the friction clutch inside the differential. This system optimizes torque distribution for maximum traction and cornering speed. Seal integrity is paramount, as significant leakage would cause a catastrophic loss of system function and force the car to be retired.

"This project was a true example of collaborative engineering at its best," said Matthew James, director of engineering and product design at Greene Tweed. "Our teams worked side-by-side to validate seal behavior under real operating conditions, refining the design through testing and iteration. The result is a robust, leak-free sealing solution that supports McLaren's pursuit of marginal gains while meeting the long-term demands of Formula 1 racing."

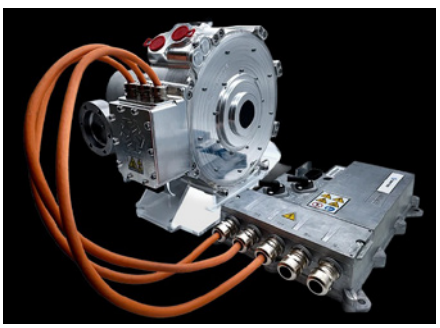
Greene Tweed developed two MSE seal assemblies featuring a unique C-shaped profile and a corrosion-resistant metal spring to provide uniform sealing force. Designed to operate under the application's extreme conditions, including temperatures up to 150°C (302°F), pressures from 5 to 250 bar (72.5–3,625 psi), and exposure to aggressive fluids, the seals use Greene Tweed's proprietary Avalon 44 (PTFE). This material ensures superior wear resistance, high strength, and low friction, meeting the exacting demands of mission-critical industries—from motorsports and aerospace to semiconductor manufacturing and energy—where reliability and precision are crucial.

"Given Greene Tweed's longstanding reputation for excellent quality, choosing them was an obvious choice for us," said James Manning, head of transmission at McLaren Mastercard Formula 1 Team. "The MSE Seal has consistently demonstrated its durability and reliability within our system. We're confident this is only the beginning of a long-term collaboration to drive even greater performance in future seasons."

Following rigorous testing on a dynamic transmission test rig, Greene Tweed and McLaren engineers have successfully qualified the next-generation MSE sealing system for the 2026 season. This more robust version, reinforced with backup ring support and a 301SS finger spring, has enabled McLaren to develop a more compact version of their system for future performance gains.

gtweed.com/mclaren-racing-sealed-for-speed

TURNTIDE
Unveils Scalable Axial Flux EDU During ConExpo



Turntide Technologies (Turntide) unveiled the Turntide Axial Flux Electric Drive Unit (EDU) during ConExpo. This Axial Flux EDU provides electric and hybrid system manufacturers of any size with a configurable, proven and scalable platform that can remove months, if not years, of component-level testing, decreasing time and cost to market.

Many manufacturers are moving away from separate motors, power electronics, and gearing/differential from different manufacturers in favor of fully integrated electric propulsion systems—EDUs. This shift is driven by the need for speed/cost to market and increased efficiency, higher voltage systems, and limited space under the hood. Since validating individual motors, inverters, and power electronics can take months to years, Turntide's fully validated EDU platform is poised to significantly reduce that burden. The Turntide Axial Flux

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EDU enables original equipment manufacturers (OEMs) to simplify and accelerate new/enhanced product development.

"We've created a highly configurable and scalable EDU that easily fits into a wide range of applications from high-performance recreation vehicles to electric construction equipment," said Steve Hornyak, Turntide CEO. "By handling the integration, validation, and testing upfront, our EDU decreases the risk, time and cost of bringing new products to market."

The new Turntide Axial Flux EDU is a modular platform designed for scaling across a wide range of vehicle and equipment architectures as well as lowering total cost of ownership. Compared to a radial flux motor, the axial flux EDU delivers 53 percent higher torque density with 58 percent less size and 37 percent less weight, giving OEMs a highly efficient, space-saving solution for electrified and hybrid vehicles.

turntide.com

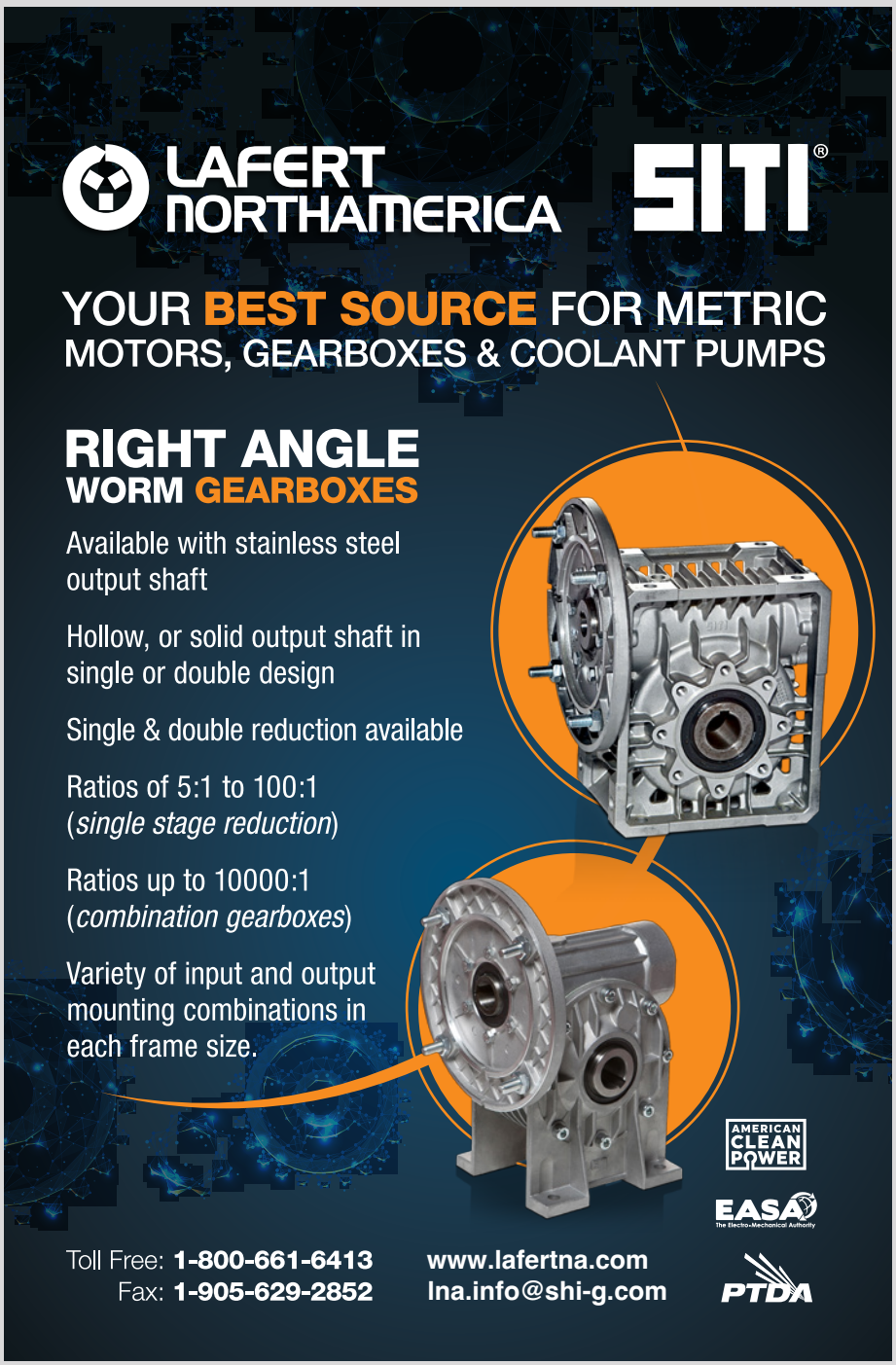
SENSOR TECHNOLOGY LTD.

Introduces Latest Digital Rotary Torque Sensor

Sensor Technology Ltd. introduces the SGR523, a rotary torque sensor equipped with an integrated incremental angle encoder. This addition to the TorqSense SGR series provides torque and angular position monitoring across various industrial applications.

The SGR523 employs non-contact strain gauge technology, eliminating the need for traditional slip rings and enhancing reliability. Its high-resolution angle encoder delivers up to 10,000 pulses per revolution with a resolution of 0.009 degrees, making it ideal for applications requiring meticulous torque-angle analysis, such as mechanical testing, automated assembly, and process control.

The SGR523's advanced capabilities enable engineers to detect mechanical anomalies, such as rotational stiction or thread damage, by analyzing torque versus angle plots. This dual-parameter monitoring is crucial for quality assurance in manufacturing processes, including bottle cap tightening and bolt fastening. Additionally, the sensor's ability to monitor torque at specific shaft angles aids in identifying potential issues in process control



applications, thereby reducing production wastage. Its high-resolution angle measurement also facilitates precise motion control, allowing for better management of inertia in motion platforms and improved safety in automated machinery.

The SGR523's design simplifies system architecture by combining torque and angle measurement into a single unit, reducing component count and enhancing system reliability. Its robust construction and advanced diagnostics, including Built-In Test (BIT) self-diagnostics and shaft temperature monitoring, ensure consistent performance even in demanding environments.

sensors.co.uk

FAULHABER
Presents Low-Noise Gearhead Models for GPT Family

Faulhaber expands its successful GPT family with two high-performance models that stand out with their exceptionally quiet operation: the 22GPT LN and 32GPT LN. These new gearheads have been specifically designed for applications where noise reduction is crucial such as in laboratories, optical devices, medical applications, or testing and measuring systems.

Like all models in the GPT series, the new low-noise variants combine high torques with a compact design and proven reliability. They deliver up to 2.2 Nm and 8 Nm respectively for the 22GPT LN and 32GPT LN in intermittent operation and can manage occasional random peak torques of up to 4 Nm and 12 Nm. Thanks to their optimized design and an input stage with plastic gears, the 22GPT LN and 32GPT LN operate with extremely low noise without compromising performance, robustness or durability. Compared to the standard version, the low-noise variants can reduce noise by up to 10dB.

The stainless-steel housing provides reliable protection even in challenging environments. The gearheads are rated for a wide temperature range from –30°C to +110°C and maintain their high efficiency even during frequent or sudden load changes. This makes them ideal companions for high-torque motors.

faulhaber.com/en

BOSCH REXROTH
Offers Mobile Machine Technology at ConExpo

ConExpo visitors learned about the full range of advanced solutions and components Bosch Rexroth offers the construction, agriculture and off-highway equipment industries recently. Bosch Rexroth technologies continue to transform mobile machines, offering solutions for increased power, safety, efficiency and intelligence. Visitors observed how Bosch Rexroth technology platforms are tailored to seamlessly integrate and scale. This allows manufacturers of different sizes and in various development stages to engineer effective solutions with digital systems alongside groundbreaking drive and working functions. Bosch Rexroth showcased a broad range of construction solutions for a variety of heavy machines including excavators, loaders and more, complete with hydraulic components, mobile automation capabilities, electronic controls and electric drives. Product experts explained how these innovative solutions deliver enhanced performance, efficiency, safety and sustainability with lower emissions. Advanced and integrated assistance solutions were also featured, including modern sensors and intuitive operating devices to make heavy machines safer, more productive and eco-friendlier. Compact hydraulics from Bosch Rexroth included efficient and modular solutions for mobile machines through integrated high-performance components. With advanced control and connectivity for features like smart sensors and CAN communication, booth visitors experienced how compact solutions can deliver space and weight savings, enhanced control and simplified design through the HydraForce i-CHoose online tool. Bosch Rexroth service solutions include OEM and aftermarket support, spare parts sourcing, remanufacturing, component replacement and traditional service for mobile hydraulics, electronics and electric drives.

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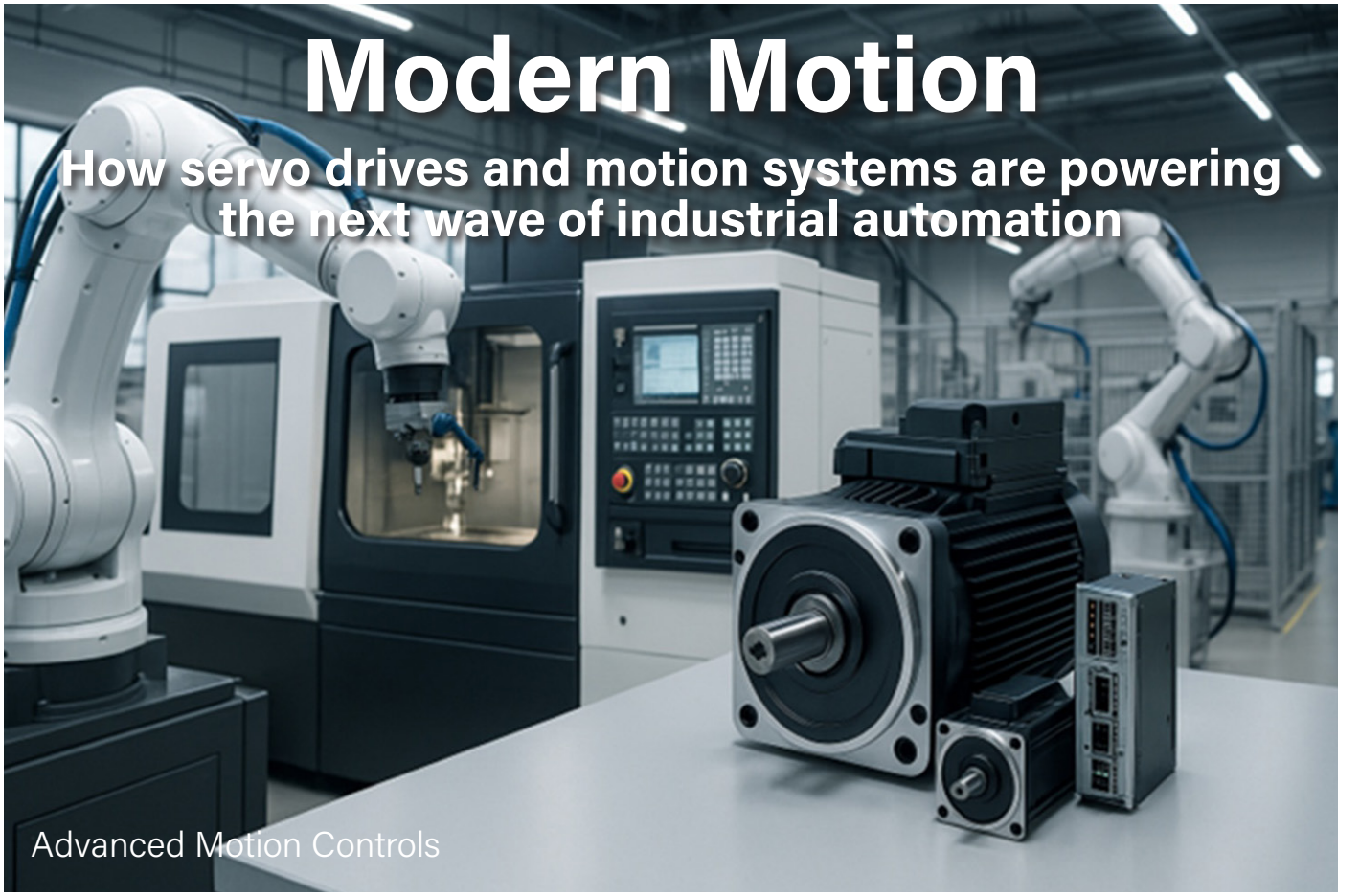
Modern Motion

How servo drives and motion systems are powering the next wave of industrial automation



Today's factories require advanced motion control to provide speed, repeatability and accuracy for continuous manufacturing production. **(All Photos: Advanced Motion Controls)**

Servo drives are electronic devices that control the precise motion of motors in automated systems, and they have become one of the most influential technologies behind today's industrial transformation. Their rise reflects a broader shift toward flexible, intelligent, energy-efficient production. Demand for advanced motion control is accelerating fast, with global industrial automation projected to surpass 400 billion dollars within a few years. That growth is fueled by factories seeking accuracy, repeatability, speed, and the kind of reliability required for round-the-clock manufacturing.

These systems matter because they enable machines to move precisely as required, whether executing micron-level adjustments or coordinating multiple axes simultaneously.

This article will explore what servo drives are, how they enhance accuracy and efficiency, why industries depend on them, how they integrate into CNC and robotics, and how they compare to alternative motion technologies in modern production.

Modern Servo Drives and Motion Systems

Modern servo drives are control devices that manage the movement, torque, and position of servomotors, and motion systems are coordinated assemblies that combine motors, sensors, controllers, and drives into an integrated framework. They fit within the context of industrial automation because they serve as mechanisms that convert digital commands into precise physical motion.

A servo system interprets a command signal, determines the necessary movement, and continuously adjusts its output using real-time feedback.

This closed-loop structure provides the responsiveness required for robotics, advanced CNC machinery, packaging equipment, and semiconductor tools.

Motion systems rely on encoders, controllers, and drives to orchestrate smooth trajectories and repeatable movements, and they maintain accuracy even under fluctuating loads or challenging production conditions.

Servo drive types refer to categories of devices that manage the motion of servomotors, and these types fit the article's context because each design supports different performance requirements in modern automation.

Analog servo drives, for example, regulate current and velocity using continuous control signals whiledigital servo drives use microprocessors for more refined control, tuning, and communication.

AC servo drives dominate industrial environments due to their efficiency and precision, while DC servo drives are used in lower-voltage systems or on mobile platforms.

Integrated servo systems combine the motor, encoder and drive into a single compact unit for rapid deployment.

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Multi-axis controllers coordinate multiple servo drives to execute synchronized tasks and control complex machine behavior.

A servo drive operates by comparing a command position to the motor's actual position and adjusting its output to eliminate the difference.

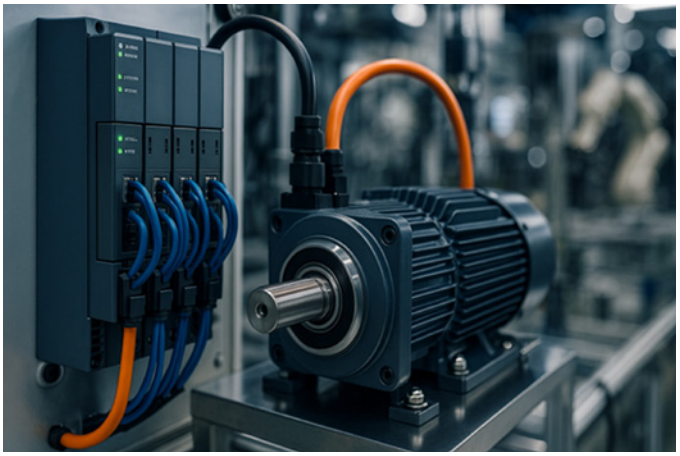
This immediate comparison shows how motion control loops deliver precise, stable movements.

The drive uses encoder or resolver feedback to detect position and velocity, then adjusts the voltage or current to correct deviations.

PID algorithms balance rapid response and smooth transitions, enabling equipment to accelerate, decelerate, and hold positions with remarkable accuracy.

Servo drives improve accuracy, speed, and efficiency by constantly correcting deviations between commanded and actual motion.

This ability ensures that machines maintain tight tolerances and perform fast, consistent movements across repeated cycles.



Energy savings and recovery is an important step in reducing wear and tear on motion control components.

In addition, precise torque management delivers smoother operations and reduces mechanical strain.

Advantages of Using Servo Drives in Automation

Servo drives offer precision, efficiency, and energy savings from the first moment they are integrated into a machine.

They deliver six main advantages that shape modern automation:

- Improve precision by minimizing motion error
- Enhance efficiency with optimized power delivery
- Reduce energy waste by adjusting power dynamically
- Increase throughput with high acceleration capability
- Support advanced automation and robotics through refined control
- Enable safer operations in collaborative environments by using sensitive torque feedback mechanisms

What Industries Rely Most on Servo Drives and Motion Systems?

Many industries rely on servo drives and motion systems because they enable accurate, repeatable, and highly responsive machine movements.

These technologies support complex tasks across assembly, precision machining, packaging, and semiconductor manufacturing.

Seven industries use them extensively including:

- Robotics manufacturing for articulated and SCARA robots
- CNC machining for milling, routing, and multi-axis cutting
- Packaging and material handling for fast pick-and-place cycles
- Automotive production for assembly and welding accuracy
- Semiconductor fabrication for wafer handling
- Medical device manufacturing for micro-scale motion
- Energy and renewable systems for positioning and control

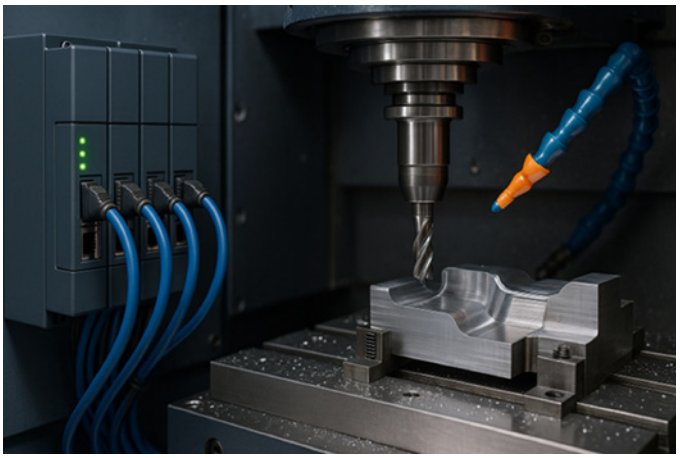
Motion engineers often evaluate servomotor drives when designing new automation platforms.

How Servo Drives Support the Rise of Cobots

Servo drives support collaborative robotics by enabling compliant, smooth, and low-latency motion, allowing people and robots to work side by side safely. This combination of sensitivity and accuracy ensures that robots respond instantly to unexpected changes or human interaction. Torque sensing improves collision detection, while high-resolution feedback produces organic movement patterns that feel natural in shared workspaces.

Their advanced algorithms help robots maintain stable trajectories without generating hazardous forces. Cobots depend on real-time force control, precise positioning, and coordinated multi-axis motion to perform tasks safely. These requirements include maintaining smooth acceleration, modulating torque based on human proximity, and dynamically adjusting speed during collaborative tasks. Compliance ensures the robot adapts to external forces, while synchronized axes enable complex, flowing movements needed for shared assembly or inspection work.

The Role Servo Drives Play in Next-Generation CNC Automation



Servo drives support high-speed machining and play a critical role in CNC automation.

Servo drives play a central role in next-generation CNC automation by enabling precise contour control, rapid acceleration, and the ability to follow complex toolpaths without deviation. They synchronize axes during coordinated cutting or forming, ensuring surfaces remain smooth and dimensionally accurate. This technology supports high-speed machining by maintaining rigidity and eliminating positioning errors, even under variable material loads or abrupt directional changes.

Which CNC Machines Benefit the Most from Advanced Servo Drives?

CNC machines such as laser cutters, press brakes, waterjet cutters, milling centers, and robotic machining cells benefit from advanced servo drives. These machines rely on accurate axis positioning and repeatable motion to shape materials with high precision. Laser cutters require exact toolpath tracking, waterjet systems depend on stable velocity control, and press brakes need controlled bending sequences.

A highly relevant example of servo-enabled CNC technology is the use of a servo-electric press brake, which shows how precise motion improves forming accuracy.

Servo Drives vs. Variable Frequency Drives

Servo drives differ from variable-frequency drives because servo drives control torque, speed, and position with feedback, while VFDs regulate speed only and do not provide precise positioning. Servo systems outperform VFDs in accuracy, dynamic response, and closed-loop feedback. VFDs, however, are simpler and more cost-effective for constant-speed applications.

Limitations of Servo Drives

Servo drives have several limitations despite their advantages.

They can increase project costs, require tuning expertise, and may be sensitive to electrical interference.

Five disadvantages define most challenges:

- Increase cost due to advanced components
- Create installation complexity requiring skilled technicians
- Require tuning for optimal response
- Suffer from electrical noise in harsh environments
- Demand specialized training for long-term maintenance

Most Important Factors When Selecting a Servo Drive

Selecting a servo drive depends on matching torque, speed, inertia, and communication requirements to the machine's intended use.

Engineers evaluate feedback type, environmental conditions, and integration demands before choosing hardware.

The most important considerations include compatibility with controllers, load characteristics, communication protocol, and system scalability.

How Communication Protocol Choice Affects Motion Performance

Communication protocols affect motion performance by determining data speed, synchronization quality, and system responsiveness. High-speed fieldbuses such as EtherCAT enable rapid updates for multi-axis control. CANopen supports distributed motion with moderate bandwidth, while Modbus suits slower or simpler systems.Some proprietary systems may offer enhanced tuning or specialized diagnostics.

Integrating Servo Drives into a Modern Automation Line

Integrating servo drives into an automation line involves defining motion needs, selecting hardware, configuring parameters, establishing communication, and validating performance.

There are five steps in the integration workflow:

1. Define motion requirements by assessing torque, speed, and precision
2. Select compatible servo hardware that matches the load and environment
3. Configure drive parameters and encoder settings for correct operation
4. Integrate controls and communication using the chosen fieldbus
5. Test, tune, and validate performance to ensure long-term reliability

Servo Drive System Costs

A servo drive system typically costs between $300 and $2,000 per axis, depending on power, encoder type, and performance.

Five factors influence final price considerations:

- Power rating defines overall hardware cost
- Feedback encoder type affects accuracy level
- Communication protocol determines controller compatibility
- Environmental rating influences durability
- Application complexity shapes engineering time

Examples of Modern Automation Using Servo Drives Today

Servo drives are used in many advanced automation applications, such as high-speed robotics and micro-positioning systems.

Their ability to deliver stable and responsive motion makes them essential in precision industries.

Six standout applications include the following:

- High-speed pick-and-place robotics using multi-axis coordination
- Semiconductor wafer handling requiring micron-scale precision
- Electric vehicle battery assembly with synchronized movement
- CNC cutting and forming equipment driven by tight tolerances
- Precision dispensing machines managing flow accuracy
- Autonomous material transport with controlled acceleration

Alternative Motion Technologies Competing with Servo Systems

Alternative motion technologies include stepper motors, hydraulic actuators, pneumatic systems, linear motors, and induction motors controlled by VFDs.

Each option offers distinct strengths depending on the application context:

- Stepper motors provide cost-effective positioning
- Hydraulic actuators deliver high force for heavy loads
- Pneumatic systems support simple repetitive actions
- Linear motors achieve rapid acceleration without mechanical transmission
- VFD-controlled induction motors serve constant-speed equipment

Conclusion

Modern servo drives and motion systems define the future of industrial automation by combining precision, speed, and dynamic control across a wide range of applications. They empower robotics, CNC systems, packaging lines, and high-tech manufacturing to achieve consistent performance even under demanding conditions. As factories shift toward flexible, energy-aware, and fully synchronized workflows, servo technology will continue to shape competitive advantage across every industry.

Optimizing Check-In to Takeoff

SEW–Eurodrive offers drive solutions for airport baggage handling systems

SEW–Eurodrive

The SEW-Eurodrive MOVIGEAR features an IE4 motor, gear unit and electronics combined in a single drive unit.
(All photos: SEW-Eurodrive)

Airports where hundreds of airplanes take off and land around the clock require perfect planning and coordination—and the tailor-made drive technology to process thousands of passengers and their baggage securely, every day. The growing focus on capacity and security issues, as well as shorter ground times, are presenting major challenges for the airport industry.

Increasing competition among airports and stricter environmental regulations make the situation even more difficult. All of this means that in the future, airport operators will be expected to transport passengers and their baggage even more quickly and efficiently. One contributing factor will be the ability to keep airplane downtimes as short as possible.

Nearly 450 cutting-edge, decentralized mechatronic systems are now installed and duly performing their task—extremely reliably and with maximum efficiency.

Reliable, energy efficient automation solutions are critical for baggage handling and logistic operations. SEW–Eurodrive has experience in this area serving international airports including Frankfurt, London, Paris, Beijing, Hong Kong, Sydney and LAX in Los Angeles—the end goal being to improve drive technology with mechatronics.

Increasing Efficiency and Reducing Costs

Terminal 4 in the LAX airport needed a thorough upgrade to the baggage handling system (BHS) for both American Airlines and TSA operations. LAX's existing system used typical asynchronous motors that were oversized to handle large starting torque requirements. Unfortunately, that meant they operated well below their ideal efficiency after the load started.

Complying with strict California energy standards and reducing the load on the existing power station were both high priorities. Space constraints and flexibility for future expansion were also important.

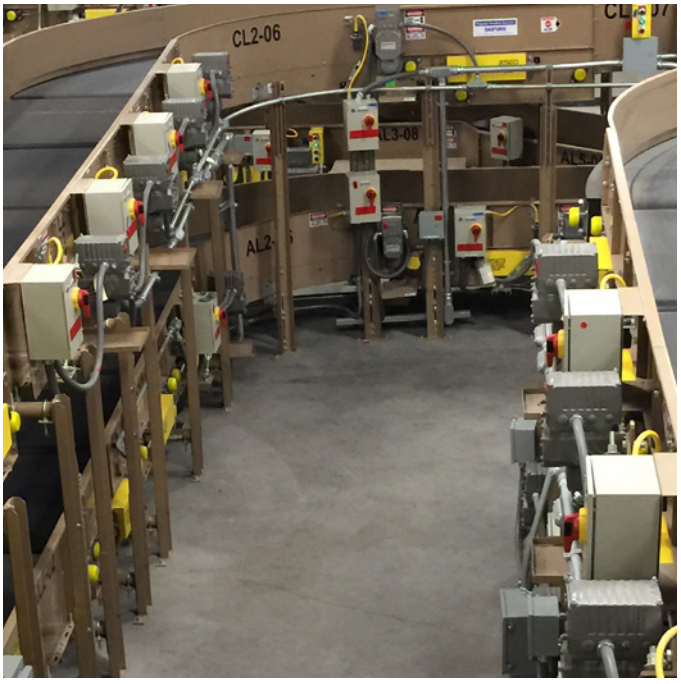
Upgrading to the SEW–Eurodrive MOVIGEAR and DRC mechatronic drive system has been highly reliable, efficient and accurate at screening bags. TSA employees appreciate that the new drives create less noise and radiate less heat due to their advanced electronics and ultra-high operating efficiency. By reducing incoming power, excess heat and extra cooling, the system decreased energy consumption by nearly 40 percent. The system requires fewer unique spares for inventory, and its flexible design can accommodate expansion for future growth.

Baggage handling systems at airports such as Los Angeles operate almost 24/7, but they do not run continuously. Time and again, they are brought to a halt and then need to be started up again. Sometimes a lot of baggage, and thus a heavier load, needs transporting on the conveyor belt; other times it's less—presenting a major challenge for the drive technology involved.

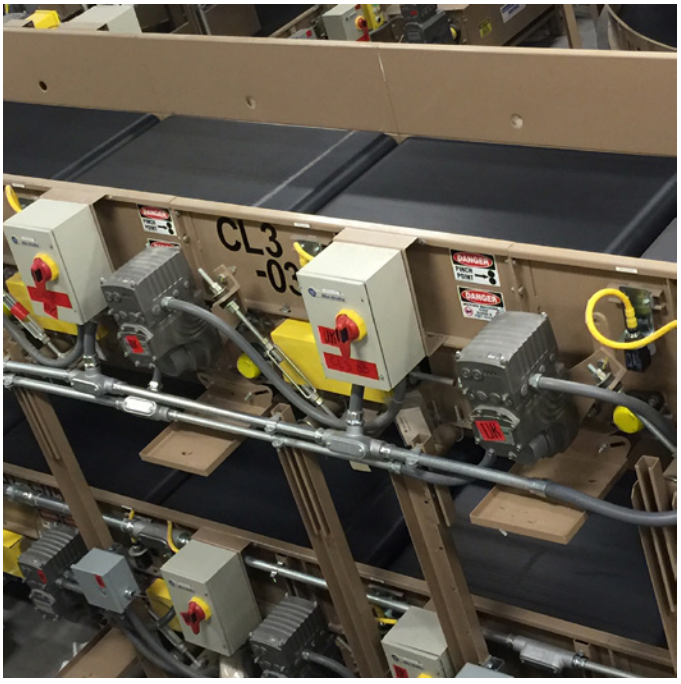
To cope with the high breakaway torque required the asynchronous motors used till then for operation and the far lower nominal torque after start-up were completely disproportionate and inefficient. The resulting accumulation of heat left the operators with no choice but to fit expensive external cooling alongside the drive technology. This measure also increased the noise level, which caused both a predicament for staff at the Los Angeles airport and spiraling costs for American Airlines.

Flexible Design

MOVIEGEAR mechatronic drive system from SEW-Eurodrive is designed for flexible use across various communication infrastructures.



The electronic motors combine an IE4 permanent magnet motor with powerful electronics. The MOVIGEAR drive system also features space-saving parallel-shaft helical gear unit technology in the shared housing.



The MOVIGEAR's unique design delivers high starting torque while halving the full-load amps, requiring much less incoming power.

This makes it ideal for decentralized applications in the field. With its compact design and optimal integration of components with permanent-field synchronous motor, gear unit, and integrated electronics, MOVIGEAR is especially tailored for efficient use in the general materials handling sector.

MOVIGEAR can achieve energy savings of up to 50 percent thanks to the seamless interplay between the IE4 efficiency class motor, the gear unit and integrated electronics. For reliability, long service life, and high system functionality, the drive system is suited for applications in stationary materials handling technology.

By increasing efficiency, the baggage handling industry can virtually double the size of the baggage system using their existing power station.

Results

LAX's existing system used typical asynchronous motors that were oversized to handle large starting torque requirements. Unfortunately, that meant they operated well below their ideal efficiency after the load started. Their high starting current and low operating efficiency created excess heat that required extra cooling. Therefore, the goal was to increase efficiency to reduce both operating costs and cooling costs.

SEW–Eurodrive, in collaboration with Cage, Inc., a U.S. consultancy firm for baggage handling systems, headquartered in Irving, TX, and Daifuku, a provider of automated material handling solutions from Farmington Hills, MI, developed a high performance, energy efficient and operations/maintenance friendly automated baggage handling system. The project aimed to thoroughly upgrade the baggage handling system in LAX Terminal 4 with permanent magnet motor drives (PMM drives). Through their combined efforts the goal became reality. They were able to size each application from scratch, allowing them to determine the most efficient selection.

Furthermore, by taking advantage of MOVIGEAR's unique breakaway torque characteristic, they were able to optimize inventory by using fewer spares to cover a wide range of speeds. Nearly 450 MOVIGEAR mechatronic drives and DRC motors were used in the new outbound installation. Both drives contain a permanent magnet IE4 motor. Their unique design delivers high starting torque while halving the full-load amps, requiring much less incoming power.

SEW–Eurodrive's experience as a system solutions partner with extensive knowledge of versatile drive technology can significantly cut energy consumption for the entire baggage processing system— from check-in and gentle transportation to sorting and reliable returns at the correct baggage claim point.

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A Deep Dive into Automation, Conveyance, Sustainability and AI

Packaging and material handling strategies in 2026

Matthew Jaster, Director, Editorial Content

The VarioFlow belt conveyor from Bosch Rexroth ensures smooth transport with high adaptability, reliability, and easy integration. **(Photo: Bosch Rexroth)**

Pack Expo East drew more than 7,300 attendees and 2,700 exhibitor personnel to highlight the latest advancements in automation, smart manufacturing, sustainable materials, and AI-driven solutions. The regional event provided new machinery, breakthrough materials, advanced automation, and smart manufacturing technologies transforming the industry in 2026.

These meetings led to in-depth discussions on automation strategies, conveyance factors and how software helps manufacturers make well-informed decisions about productivity, maintenance, and efficiency. *PTE* was able to discuss these strategies with key personnel from Bosch Rexroth, Motion AI, and Siemens Digital Industries Software during the show.

Building an Automation Strategy with Bosch Rexroth

I had the pleasure of sitting down and discussing automation with Krupa Ravichandraan, sales product manager, assembly tech, at Bosch Rexroth during Pack Expo East. Most of the conversation involved where (and how) small to mid-sized

manufacturing companies should begin their automation strategy and deployment.

Ravichandraan said not enough personnel understand the variety of processes taking place on the shop floor. They need to walk the entire floor, study each process, and manually observe how each machine operates. Where can automation improve production? How can automation eliminate bottlenecks?

"Once you understand your processes, you can begin to pinpoint the areas on the floor where improvements can help efficiency, throughput, and productivity. That is the first step for small and medium-sized organizations. It is simply seeing where an automation strategy fits," Ravichandraan said.

If an organization needs to hire several people to meet their throughput demands, it is time to zero-in on the real bottlenecks in the production line. These are typically high ROI, low capital investments that organizations first look towards when automating the plant floor.

"Then you ask more questions," he added. "What areas can I automate today? Do I have the money for this upgrade? If I do not, then typically people go for end of line automation because it is high ROI, labor intensive, injury prone assignments, and you can easily take liability away from the process. This is where someone might automate case packing with a robot or gantry system—the low hanging fruit that companies first think about in automation."

Next, they examine the overall structure of the production line. Will they be running multiple types of products, shapes, and formats? What is this going to look like from both a financial and operational perspective? Are they considering what the production line will look like five years down the road?

"Is the space optimized for your production floor? Sometimes you draw up a useful design for your automation needs, but it uses *a lot* of floor space. Now, you are unable to add more capacity in the future. So, having that holistic view at the beginning will save the organization money in the future. How can I get rid of certain equipment, rearrange the manufacturing cell, and capture all the valuable floor space?"

In my previous job I was doing application engineering system integration. I was drawing the lines from end to end for all these big and small end-users for food and beverage companies. We would draw the whole layout, even for five years down the line. What would they need? What will it cost? In the future, when they thought about adding new products, they simply needed to give us a call and we already had a planned layout," he added.

Flexible machines is another growing area of interest across packaging applications and a major talking point on the trade show floor at Pack Expo East in Philadelphia. Ravichandraan said most manufacturers are asking about flexible machines today. They do not want to get tied up with a "one off" or buy a dedicated machine for a single process.

Flexible machines combines automation with adaptability giving manufacturers the ability to manage multiple product types, batch sizes, and process sequences without extensive reconfiguration. This allows for quick adjustments to product design, volume or production orders, a perfect complement to areas like packaging and material handling where variety is key to success.

"In 2026, this should also be something manufacturers consider as they are designing or upgrading their production lines. Where can flexible machines add value to the production?" Ravichandraan said.

For conveyor technology, the topic of sustainability and energy efficiency continues to be an important subject. Although conveyors have not really changed in 40+ years, the industry is attempting to build more with less components. Can we run a large system with twenty motors instead of thirty? If we focus on energy efficiency when choosing conveyor designs, can we increase service time between maintenance intervals?

From electronics to consumer goods, VarioFlow plus fits multiple transport applications. **(Photo: Bosch Rexroth)**

"Flexibility is important here as well," Ravichandraan said. "This ties back to looking at your system and asking how flexible it can be moving forward. Can we change the size and scope of the framing construction? Modular aluminum framing, for example, allows you to have different width connectors to go from a narrow conveyor to a wide conveyor, using the same side frame. If you are using a stainless-steel model, you would have to redesign the whole conveyor system."

In addition, AI was a significant part of the discussions at Pack Expo East.

Many people involved in packaging and material handling are not getting requests from the end users to incorporate AI into their machines quite yet. It is more hype rather than a real feasible solution on the plant floor, but they *are* executing it on the software side (Google, Meta, etc.).

There is a feeling that AI could be extremely valuable in PLC programming to make real-time changes on the production floor. This could involve retrofits or intricate changes to a manufacturing cell.

The biggest use of AI in packaging and material handling might be all the data collected from sensors across production lines.

"These companies are pulling so much data right now and have not found the best way to make sense of this information. AI will be able to process this information faster and produce floor strategies to get the most out of our analytic tools," Ravichandraan added. "On the production floor itself, one day we will have an AI-assistant on each packaging machine to address maintenance or productivity issues. It will not only collect data but produce an action plan at the machine level and solve the problem."

With the addition of AI expansion, Ravichandraan noted other areas where technology will advance in the coming years for packaging applications.

"Everything we are currently seeing in 2D bar coding will be incorporated in other areas like food safety, for example. People will have all the information they need from production to point of sale. This is already taking place today," he said.

The use of vibration, temperature and vision sensors will expand across the board incorporating AI and helping to solve maintenance challenges in real-time on the production floor. Plant managers will receive instant updates on equipment—this conveyor needs to be upgraded, or this motor is going to stop functioning in six months. You will get a detailed predictive analysis report when a chain is worn down or a manufacturing issue you may need to take back to the original vendor.

"The power of predictive maintenance will expand exponentially. Instead of spending money on next day/overnight shipping for conveyor replacement parts, companies will invest in technologies that will catch potential maintenance challenges six months before they take place. There's real power in having a detailed roadmap and an action plan in place before something goes wrong on the shop floor," Ravichandraan said.

At the beginning of the year, Ravichandraan said the conversations he was having with manufacturers included predictive maintenance, digital twins, 3D visual simulation, and the ability to utilize flexible machines in the future.

"There's technology coming into these markets that will make packaging applications more efficient. They will help drive the industry using software, AI, and sensors to make value-added decisions before upgrading machines or expanding shop floors."

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Motion Conveyance Solutions

Conveyor interruptions are often quickly attributed to the belt. But Christian Suarez, division account specialist—fulfillment centers/distribution centers, for Motion Conveyance Solutions, counters that this assumption isn't always correct. "The belt is just a belt. It performs its intended function."

Many factors come into play when optimizing a conveyance solution. While the belt is often blamed, a conveyance system is much more complex and requires a great deal of time and effort to maintain optimal performance. I spoke with Suarez about the factors to consider when selecting the right belt for a packaging application and the changing needs of these components in 2026.

Suarez said every application should start by examining the conveyor characteristics. "It is important that you know your minimum pulley diameters: What kind of belt are you currently running? What are the width and length requirements? What is the maximum elongation we can expect in this spec of belt? How long of a take-up does the system have? You must be cognizant of the number of drives and their location. Not considering these factors can cause premature belt failure and can cost these companies tens of thousands of dollars in unplanned downtime," Suarez noted. "Additionally, the customer should know the belt speed. They should know if it is on an incline or a flat surface."

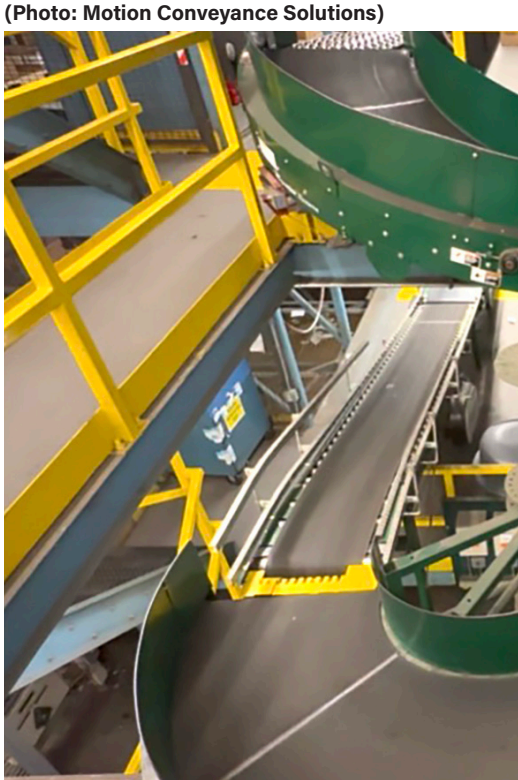
The second factor is the size, weight, and shape of the packages on the conveying system.

"What is the material of that package? Is it a cardboard box, a paper bag, or a plastic bag? Is this package abrasive, or does it have sharp edges? Does this package have characteristics that could damage the belt? These seem like basic questions, but we see these issues all the time, and you need an action plan before the belt is up and running," Suarez said. "I was just with a customer with an incline system made up of 30 individual, 15-inch-long conveyors, and they are having issues with packages rolling back. We are attributing this issue to incorrect belt selection. Larger distribution centers do not consider these minute details."

The manufacturing or warehouse environment is also crucial in determining the components needed for the application. Most distribution centers are climate controlled, but the ambient temperature can spike in the summer (not every place is air conditioned) and temperatures can significantly drop in the winter.

Suarez advised to consider humidity, contaminants, and other environmental factors: "Again,

Size, weight, speed and environmental conditions are factors in belt selection. **(Photo: Motion Conveyance Solutions)**



things are not always thought about during installation, but say we are moving a package that has an oily substance on it. There is no way around that. We must make sure we specify a belt that will have a positive interaction with those oils and not have premature failure.

"By far, the biggest environmental factor is dust. In every location, there will be dust. We might try to spec in a belt that has different properties or compounds on the covers to interact with the dust particles or something that is easily cleanable. Proper belt selection can mitigate the situation," Suarez said.

Another factor is the addition of robots on the production line. If you have packages or belts creating static, this is undesirable. Robots and static are not good together; an antistatic belt should be considered.

Belt material selection is equally important. Suarez named additional factors at play. What is on the conveyor? How will the product react to the belt? Do we want the product to slide across the belt, or do we want a belt that grips the product?

A PVC belt conveyor, for example, is a material handling system using a polyvinyl chloride (PVC) belt reinforced with fabric (polyester/nylon) for light-to-medium–duty transport. It is known for its durability, chemical resistance, ease of cleaning, and versatility in industries like food processing, logistics and packaging.

"This is the bread and butter in the packaging industry," Suarez noted. "This is one of the most popular belts out there, and it is very inexpensive. Now we are getting away from PVCs, and getting into softer, polyurethane material at a higher price point. In some applications, getting away from the traditional PVCs and investing in the more expensive polyurethane belting can aid in increasing the overall life of the belt on the system, decreasing cost of ownership because the maintenance team is replacing the belt less often, ."

As the packaging and material handling sectors evolve, there is more emphasis on longitudinal ribs and rough tops, designed for high grip. "We're having fewer conversations about flat belts. There's character in these belts, and each has its own specific purpose. Our customers are asking for less friction, which results in less energy consumption, and a consolidation of belt specs used throughout their facility."

To get the most out of conveyance equipment, Suarez said it is vital to collaborate with operations managers, engineers, and maintenance teams throughout the process. "One example is an operations manager tasked with increasing throughput across the shop floor. Let's say a system was meant to manage 10,000 packages an hour, but now they have doubled this to 20,000 packages an hour. The maintenance managers call us up because they are having premature failure on the conveyor line, and they immediately blame the belt.

"Problem is, the belt is just one part of the recipe, and very rarely do you see a failure that is exclusively because of the conveyor belt itself. Damage to the belt is usually the most visible, and this is why it is often called out first, but this damage is typically a product of everything else around it. We hear the company directive was to double production per hour, but the system was not designed to manage that," Suarez said. "Now we need to take a deep dive on the power transmission side and see how this impacts the motor gearbox and bearings, for example. This is where those relationships come into play, and we can put our heads together and make the necessary adjustments to get the most out of the system."

For Suarez, the future of belt technology will center on predictive maintenance. This could be an AI vision system or someone tracking sensor data across the conveyor using vibration, heat, and speed analysis. AI reporting will increase in the coming days, months, and years. Maintenance managers will be proactive in their strategies and checking conveyor lines before unplanned failures occur.

"This will save companies thousands of dollars and change the way these distribution centers and warehouses are maintained," Suarez added. "We're going to see many new advancements around the belt in the coming years. This information will prove the belt is not solely responsible for failures that occur in the system."

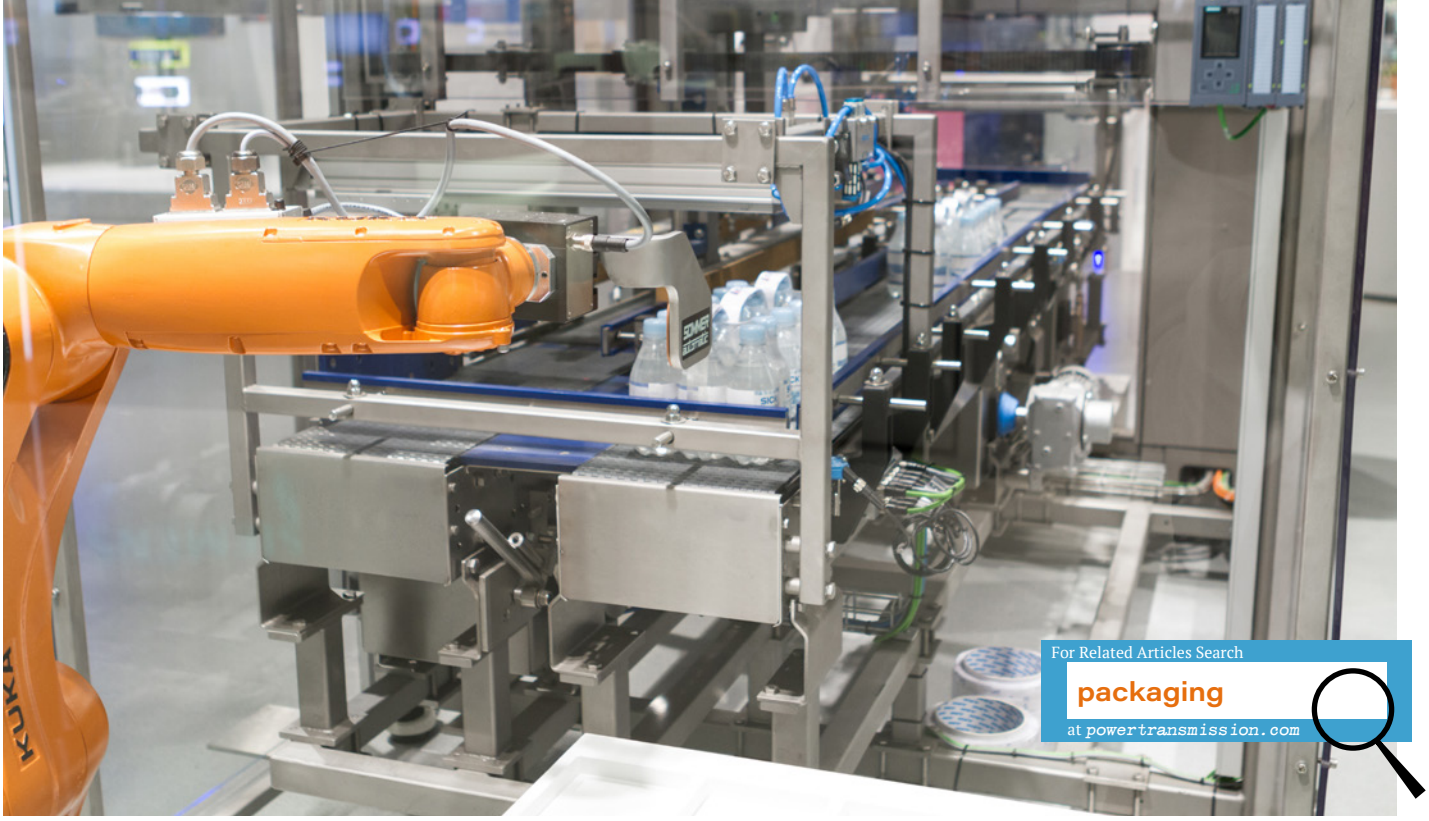
miconveyancesolutions.com

Siemens Packaging Outlook

The following is a conversation with Robert Cook, Ph.D. senior director, Global SMB Program Lead Siemens Digital Industries Software conducted during Pack Expo East:

What are the primary challenges currently faced by small and medium-sized enterprises in the packaging sector?

Small and medium-sized packaging and processing companies are being asked to operate with the sophistication of a large enterprise—but without the same resources. They are managing tighter margins, more frequent product changeovers, and ongoing labor shortages. At the same time, they face increasing compliance



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Siemens provides a digital portfolio from initial concept through full production. This includes digital twin technology for simulating packaging lines. **(Photo: Siemens)**

requirements, sustainability expectations, and pressure to deliver higher throughput and quality.

One of the biggest challenges is visibility. Many SMB manufacturers have strong equipment and experienced people, but their data is fragmented across machines and systems. Without a clear, connected view of operations, it becomes difficult to identify root causes of downtime, optimize performance, or scale efficiently.

In what ways can these businesses utilize digitalization and artificial intelligence to enhance operational efficiency and reduce costs?

Digitalization allows manufacturers to move from reactive to proactive operations. It starts with connecting packaging equipment and collecting performance data-understanding downtime, quality losses, and energy consumption in a structured way.

From there, AI can be applied in very targeted, practical ways. For example, predictive maintenance can identify early warning signs of equipment failure before unplanned downtime occurs. AI can also help identify process inefficiencies, reduce scrap, and optimize machine settings to improve throughput and consistency.

What is important is that this is not about adding complexity. It is about giving operators and engineers better insight so they can make faster, more informed decisions. Siemens helps manufacturers implement these capabilities in a scalable way, so they see measurable improvements in productivity, quality, and cost control.

How can a strategic focus on robotics and automation facilitate the optimization of packaging operations?

Robotics and automation provide both consistency and flexibility—two things that are essential in today's packaging environment.

Robotics can stabilize throughput by performing repetitive tasks like pick-and-place, case packing, and palletizing with high precision and reliability. This improves overall line efficiency while also reducing dependence on manual labor for physically demanding tasks.

Equally important, modern robotic systems enable faster changeovers and greater adaptability. Manufacturers can respond more quickly to new packaging formats, new SKUs, and changing customer requirements.

What steps can companies take to initiate their automation journey on a smaller scale, minimizing initial investments? What are the anticipated long-term advantages of this approach?

The key is to start with a focused, high-impact use case. That might be a bottleneck machine, an end-of-line operation, or a process that experiences frequent downtime.

By connecting that equipment and introducing targeted automation or performance monitoring, companies can quickly demonstrate measurable improvements. This creates immediate ROI while also building a foundation for broader digitalization.

Over time, these incremental improvements compound. Companies reduce downtime, improve throughput, and gain the ability to scale production without proportionally increasing labor or capital costs.

Robotics can stabilize throughput by performing repetitive tasks like pick-and-place, case packing, and palletizing with high precision and reliability.
(Photo: Siemens)

What strategies can smaller organizations adopt to emulate the practices of larger OEMs in the packaging industry?

One of the most important strategies is standardization. Larger OEMs rely heavily on standardized designs, reusable engineering assets, and digital simulation to ensure predictable outcomes. SMBs can leverage the same approach by using digital twins to simulate packaging lines before deployment, validating performance virtually, and reducing commissioning risk. This allows smaller teams to operate more efficiently and avoid costly trial-and-error during installation and ramp-up.

How significant is customization in today's packaging applications, and how is its importance expected to grow in the coming years?

Customization has become a major competitive differentiator. Consumers expect more product variety, more personalization, and more sustainable packaging options. At the same time, regulatory and labeling requirements continue to evolve. This means manufacturers must support shorter production runs and more frequent changeovers without sacrificing efficiency.

Digitalization and automation make this possible. By using standardized automation, recipe driven production, and simulation, manufacturers can adapt quickly and confidently.

This capability will become even more critical in the coming years, as packaging continues to evolve toward greater flexibility and responsiveness.

Why is it crucial for companies, regardless of size, to adopt a comprehensive approach to machinery and automation in 2026?

In today's environment, performance is determined by how well the entire system works together—not just individual machines. Companies need continuity across design, engineering, commissioning, and operations. Without that integration, inefficiencies and risks increase.

A comprehensive approach allows manufacturers to design smarter, deploy faster, and operate more efficiently. It also reduces lifecycle costs and improves long-term scalability.

What solutions is Siemens providing to tackle the challenges present in the packaging industry?

Siemens provides a comprehensive digital portfolio that supports manufacturers from initial concept through full production. This includes digital twin technology for simulating packaging lines, integrated engineering tools that improve development efficiency, and operational analytics that provide real-time performance insights.

We also enable virtual commissioning, which allows manufacturers to validate automation systems before physical deployment, significantly reducing startup time and risk. Our goal is to help manufacturers improve productivity, reduce downtime, and increase flexibility—while making digital transformation accessible and scalable for organiations of all sizes.

How do you foresee technological advancements transforming the packaging industry over the next five to ten years?

Over the next decade, we will see digital twins, AI, and automation become standard capabilities across packaging operations. 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.

The most important message today is that digital transformation does not have to be overwhelming. Companies do not need to do everything at once. The most successful manufacturers start with a clear business objective-reducing downtime, improving throughput, or increasing flexibility—and build from there.

`siemens.com/en-us`

The Year Ahead in Robotics

A3 examines adoption advancements and education

Jeff Burnstein, President, Association for Advancing Automation (A3)

Jeff Burnstein stands with a humanoid robot from NEURA. **(All Photos: A3)**

As someone who has spent more than four decades involved in the robotics industry, I can say unequivocally that this is the most exciting time ever. From a technology that was originally used predominantly by U.S. automotive companies, robotics has now spread to nearly every industry and every country around the world.

Advances in artificial intelligence and robotics have created enormous interest from the press, public and policy makers. We're now constantly hearing about "physical AI," which essentially means giving robots the intelligence to perform far more tasks than ever before, even without being programmed. The real fascination now is around humanoid robots, in part because of the battle for global leadership in this emerging space.

This year A3 is focused on several key projects related to advancing the adoption of robotics and to educating people about what's real and what's hype in this brave new world of robotics. Here are three main areas of emphasis for 2026:

1. Advocating for a U.S. National Robotics Strategy

Robotics was invented in the United States. The first industrial robot was installed in a General Motors plant in 1961. Robots were going to be the next "industrial revolution." But even as the industry grew in the United States, adoption was accelerating faster in Japan, where robotics was more fully embraced by industry and the Japanese government. Japanese robot makers like Kawsaki, Fanuc, and Yaskawa became major players. Our trade association urged U.S. government leaders to provide more incentives for adopting robots or risk losing leadership to Japan. Ultimately, our advocacy efforts fell on deaf ears, and Japan indeed became the world leader, in large part due to government support.

Fast forward 25 years or so and it was China that realized it needed to become a leader in adopting robotics. National strategies were put in place to become not only the world's leaders in the use of robots but ultimately to become the world's leading manufacturer of robots. And while that second goal may not have been achieved yet, the first goal was. China now dwarfs the rest of the world in robot use and the number of robots manufactured locally is rising fast. In the new field of humanoid robots, China is moving quickly to establish leadership.

A3 is once again advocating for a national robotics strategy in the United States, but this time policy makers are listening. Recently more than one piece of legislation has been introduced, including the National Commission on Robotics Act (H.R. 7334) which we believe, if passed, would be the first step towards on the path to a full U.S. robotics strategy. Here is a link to the full text of our strategy recommendations: *https://www.automate.org/a3/advocacy-principles*

The U.S. government is also considering Executive Orders on robotics and is conducting a 232 National Security Investigation into Foreign Robots and Components which could lead to additional tariffs on products made outside of the United States. We believe that in the near-term, if the United States is going to successfully reshore manufacturing at scale, we'll need a tremendous amount of automation, much of which is manufactured in allied nations like Japan, Germany and South Korea. Many of the components aren't readily available in the United States and we will need time to build a stronger supply chain. Increased adoption of robotics would potentially lead more companies to manufacture here, another reason why the United States should consider incentivizing companies to adopt robotics. Therefore, we have not advocated for additional tariffs on traditional industrial robots and key components such as motors, gears, and bearings.

What's New at Automate 2026

As artificial intelligence and robotics accelerate across manufacturing, logistics, healthcare, energy and other industrial sectors, Automate 2026 (June 22–25, 2026) will bring together the companies and leaders shaping the next era of automation.

The 2026 event returns to McCormick Place in Chicago. This four-day trade show and conference will showcase robotics, AI, machine vision, motion control and advanced automation technologies across multiple industries. Key areas of interest will include industry data and trend briefings, product launches and technology demonstrations, interviews with CEOs, founders and engineering leaders and workforce and AI policy discussions shaping U.S. competitiveness.

A new development at the 2026 show is a dedicated Humanoid Robot Pavilion, sponsored by NVIDIA. The pavilion will spotlight a range of humanoid robots and offer live demonstrations. The event also co-locates the third annual Humanoid Robot Forum, offering deep-dive programming on humanoid development, deployment and enabling technologies.

Automation investment is increasingly critical to manufacturing competitiveness, supply chain resilience and workforce transformation. Automate provides a concentrated look at:

- How AI is moving from pilot projects to full-scale deployment on factory floors
- The expansion of robotics beyond automotive into life sciences, food production, construction and logistics
- The emergence of humanoid robotics and real-world deployment pathways
- Workforce implications as automation adoption accelerates across industries
- The role of automation in manufacturing growth and industrial policy discussions

For business, technology and workforce reporters, Automate offers direct access to timely data, real-world case studies and national economic context.

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Jeff Burnstein on the set of CNN's Decoded with host, Anna Stewart.

2. Educating the World on Humanoid Robots

Humanoids are all the rage, as major companies and venture firms are pouring billions of dollars into start-ups. The Chinese government is going all in as well in the hopes of establishing leadership in this emerging field. Elon Musk, who says Tesla plans to build millions of humanoids soon, believes that eventually everyone on the planet will have one or more humanoid robots, that they will do all the work, leaving us with free time to do anything else we want. Is this the future? Maybe. But there is plenty of skepticism as well. What is the best form factor of a humanoid and what can it do better than an existing robot? Does it need to walk on two legs, or is a humanlike torso on a mobile base a better solution? Are two arms the right number, maybe it should have one, or three, or more? Is a humanoid robot safe enough to work around people (there are no standards yet, but A3 and others are working on this)? What will humanoids cost in comparison to other types of robots? Will humanoids be accurate enough to meet customer needs? Will AI allow humanoids to do every task, and if so, will that be more valuable than a single-purpose robot? Will insurance companies insure humanoid applications? What impact will humanoids have on the jobs of the future? Do people trust humanoids in their homes? What happens if the home humanoid breaks down, or falls on our children or pets?

These are just some of the questions we'll discuss at our annual Humanoid Robot Forum on June 23 & 24 during the Automate 2026 trade show and conference at McCormick Place in Chicago, running June 22–25. The show floor will feature a Humanoid Robot Pavilion sponsored by NVIDA. Automate 2026 also includes over 1,000 exhibitors showcasing all types of robots, motion control and motor technology, machine vision, artificial intelligence, systems integrators and more. The concurrent Conference covers a wide range of topics to help companies just starting their automation journey as well as experienced users looking to expand their use of automation. More than 50,000 registrants are expected for Automate 2026 (*automateshow.com*)

Jeff Burnstein receiving the Engelberger Award in 2023.

3. The Importance of Adopting Robotics

In the early days of robotics in the United States more than 75 percent of the robots were sold to the automotive industry. Today, the numbers are about 50 percent to automotive and 50 percent to general industry, which includes electronics, consumer goods, food & beverage, pharmaceuticals, aerospace and more. In recent years we're seeing nearly every industry adopt robots including life sciences, agriculture, construction, warehousing & logistics, hospitals and more. This is true globally as well, as robots are no longer confined to manufacturing applications. Robots also aren't just for big companies anymore; costs and complexity have been reduced, allowing for more applications by small and medium sized companies.

A3 provides a wide range of education to potential customers on all the automation technologies our 1,450 member organizations provide. We offer shows, conferences, webinars, white papers, online training and more. Additionally, we're providing market intelligence resources to our members so that they are prepared to take advantage of all the new market opportunities. Expanding our reach, not just in the US but globally, is a key point of emphasis this year and into the future. If, as we believe, automation is the future, A3 wants to be the trusted resource that the entire automation ecosystem needs to be successful in an increasingly automated world.

automate.org

PTE

The Autonomy Influence

ConExpo/ConAgg highlights future of construction industry

Matthew Jaster, Director, Editorial Content

Liebherr continues to expand its manufacturing, logistics, and service footprint through targeted investments in the construction and off-highway markets. **(Photo: Liebherr)**

Leaders from across the construction and heavy equipment manufacturing industries gathered in Las Vegas recently for ConExpo-ConAgg 2026. The show celebrated the innovation, economic impact and workforce powering the $2.2 trillion U.S. construction sector today.

"Construction touches every community and every industry, and ConExpo brings that impact to life on a global stage," said Megan Tanel, president and CEO of AEM. "The show underscores the significance of the innovation, collaboration and workforce that keeps our industry moving forward and our communities thriving."

The show featured the latest equipment, products, services and technologies for the construction industry, as well as industry-leading education. It is owned in partnership with NRMCA, NSSGA and AEM and managed by AEM. The following article highlights technology displayed at the trade show from Liebherr, Schaeffler, Cat and ZF. (Additional ConExpo highlights can be found in the *PTE* Product News section on p.8).

Liebherr Expands Presence of Components and Construction Equipment

Liebherr's presence at ConExpo reflected a broader long-term strategy in the North American construction market that extends well beyond the exhibition cycle. Active in the United States since 1970, the company continues to expand its manufacturing, logistics, and service footprint through targeted investments. Recent milestones include expanded assembly and manufacturing capabilities in Newport News, VA, and the construction of a new logistics and distribution center in Tupelo, MS.

Once operational, the Tupelo facility will become Liebherr's first major distribution hub outside Europe designed to improve parts availability and service support across the Americas. The site will manage parts and components for earthmoving, crane, concrete technology, maritime, and components business units, while also supporting pre-assembly, kitting, and repackaging activities.

Kai Friedrich, managing director of Liebherr USA, Co., stated, "Liebherr's commitment to the U.S. construction market goes beyond just building machines. We continue our local investments so customers can depend on prompt service, reliable parts support, and effective solutions that consistently deliver at North American jobsites."

Earthmoving and material handling equipment represented the largest share of Liebherr's ConExpo lineup, with a focus on durability,

The LTM 1055-3.3 redefines mobility as a lightweight 3-axle all-terrain crane.
(Photo: Liebherr)

Liebherr continues to invest in the latest in construction equipment technology.
(Photo: Liebherr)

efficiency, and long service life. Under demanding jobsite conditions, this focus is reflected in machine concepts designed for continuous operation, efficient power delivery, and low total cost of ownership.

Central to the exhibit was the articulated dump truck, TA 230 Litronic, shown in live operation throughout the week, engineered for heavy-duty applications, high payload efficiency, and reliable performance over long service lifecycles. Additional highlights included the Generation 8, crawler dozers, including the PR 716, developed for grading and site preparation, as well as the crawler loader LR 636 G8. Both machines are designed for sustained operation in challenging environments, where durability and precise machine control are critical. The machine features hydrostatic drive technology, optional 2D and 3D grade control, and an ergonomically designed cab.

The R 945 crawler excavator is presented as a solution for heavy-duty quarrying and earthmoving, emphasizing precise machine control, fuel-efficient operation, and long-term reliability. Its robust machine design and optimized drive systems are intended to deliver consistent performance and reduced wear in high-load applications. The wheeled excavator A 924 demonstrates Liebherr's approach to compact design and mobility for infrastructure and civil engineering projects, while the mid-sized wheel loader L 546 will be shown in live demonstrations equipped with active personnel detection and the Skyview 360-degree camera system, reinforcing Liebherr's focus on operator awareness and jobsite safety.

Electrification and energy efficiency are represented by machines such as the LH 60 M Industry E, an electrically driven material handler designed for a wide range of applications. Operating emission-free and quietly, the machine uses an energy recovery system to reduce overall consumption while maintaining high handling performance. Liebherr's XPower wheel loaders, including the L 550 and L 586, further illustrate how application-specific kinematics and power-split drive technology are used to balance performance, fuel efficiency, and robustness across recycling, industrial, and classic loading applications, with a clear focus on durability and consistent performance throughout the machine lifecycle.

Liebherr's digital solutions and services were presented in a dedicated pavilion, where visitors explored how software, connectivity, and data-driven tools are applied across construction operations today.

liebherr.com

Schaeffler Advances Autonomy in Construction Sector

Schaeffler is driving the digitalization and automation of construction machinery by integrating advanced sensor technologies that enable intelligent, data-driven autonomy. These sensor systems empower equipment with precise environmental awareness, resource management and regulatory compliance capabilities. By harnessing real-time data from powertrains, cooling and exhaust systems, Schaeffler supports the construction industry's shift to smarter, safer and more connected equipment that anticipates operational needs and adapts dynamically to complex jobsite conditions.

Transitioning from traditional hydraulics to electromechanical actuators, Schaeffler also delivers precise, energy-efficient motion solutions that power intelligent, emissions-free construction machinery. These advanced actuators provide smooth, programmable control with high reliability and durability under the demanding stresses of heavy lifting and material handling. Through a compact and modular design, Schaeffler solutions enable OEMs to build smarter machines that simplify architecture, improve uptime, and accelerate the path to autonomous operation.

Meeting the urgent demand for emissions reduction and fuel efficiency, Schaeffler's portfolio at ConExpo included electric drive systems designed for off-road and construction vehicles. These solutions optimize power density and thermal management, enabling electric and hybrid machinery to deliver high continuous output in a compact design. By integrating scalable, oil-cooled motors and modular e-axles, Schaeffler facilitates cleaner, quieter job sites without compromising productivity or performance.

Schaeffler's advanced bearing and valve train solutions play a

Schaeffler's advanced bearing and valve train solutions play a critical role in reducing friction and extending machinery life across harsh construction environments. **(Photo: Schaeffler)**

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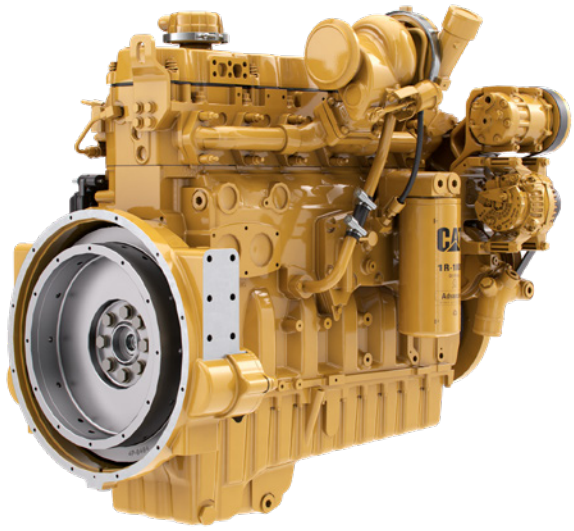


Cat's C9.3B diesel-electric power unit.
(Photo: Caterpillar)

critical role in reducing friction and extending machinery life across harsh construction environments. Engineered for robustness and precision, these components enhance mechanical efficiency, minimize energy losses, and increase reliability. Whether they're enhancing electric motor performance with innovative bearing designs, or optimizing traditional powertrains for lower friction, emissions and fuel consumption, Schaeffler's solutions contribute directly to energy-efficient, cost-effective construction operations.

schaeffler.us/us

Caterpillar Highlights Engines and Power Systems

Caterpillar Industrial Power Systems showcased the strength and breadth of Caterpillar power systems and solutions at ConExpo. The exhibit featured a new high horsepower 173 hp (129 kW) Cat C3.6 engine and the new power-dense C13D, both meet EU Stage V and U.S EPA Tier 4 Final emissions standards.

The booth also highlighted Cat's commitment to extending engine lifecycles, including ongoing support for customers' aftermarket needs with Cat parts and service solutions including connectivity, condition monitoring, service replacement engines, VisionLink and a Cat Reman C7 engine.

A range of optimized and fuel-flexible Cat engines were on display in the Festival Lot including the compact C2.2 which outputs 74 hp (55 kW), the new C3.6 delivering 173 hp (129 kW) and the power-dense series-turbocharged C18TT engine at 800 hp (597 kW).

"As the construction landscape changes, our extensive portfolio of solutions and expertise, from full-fleet jobsites through to a full range of optimized diesel engines, will help solve our customers toughest challenges," said Steve Ferguson, senior vice president of Caterpillar Industrial Power Systems.

To meet customers' ongoing needs for higher power density power systems, which boost machine capability without increasing size or complexity, the twin-turbo C3.6 has been designed to deliver higher torque, greater uptime, and lower total operating costs for a range of equipment including wheel excavators, dumper trucks, soil compactors, backhoe loaders, asphalt pavers and telehandlers.

To achieve up to 173 hp (129 kW) and 546 lb ft (740 Nm) at 1,500 rpm of power density from the proven 3.6 liter, four-cylinder platform, engineers have upgraded the combustion system to achieve maximum power and efficiency and have strengthened many core components.

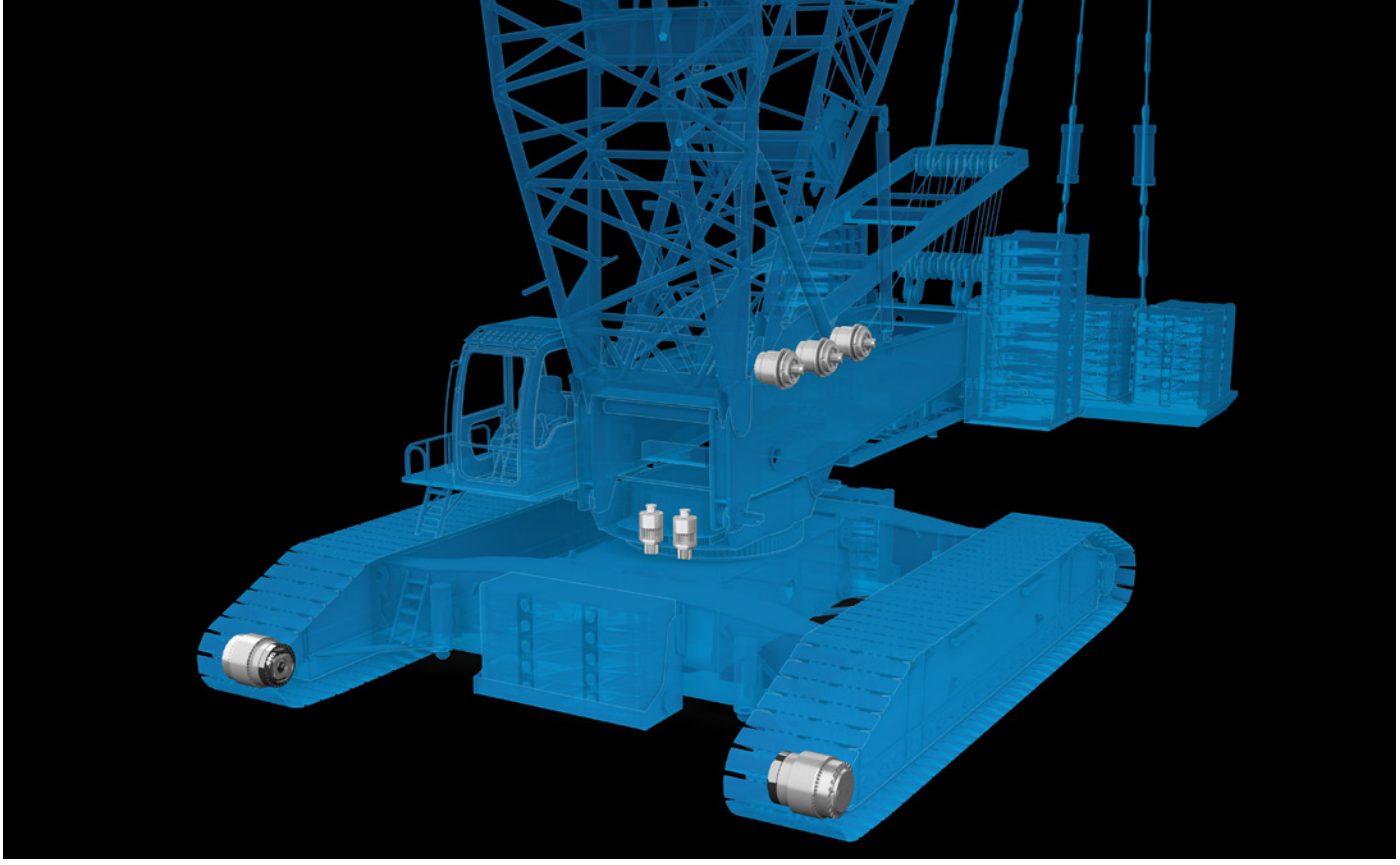
The high horsepower variant has been designed for low fluid consumption while delivering the required power across high, medium and low load operations. With a transparent, maintenance free aftertreatment system with no downtime, the engine is set to deliver serious power in a compact footprint for a wide range of OEMs whose equipment is the bedrock of construction sites around the world.

"The customer requirement for high power density to boost machine capability without increasing engine size or complexity has driven the launch of this new high horsepower C3.6 and the C13D which we unveiled at ConExpo," said Ferguson. "Given that internal combustion engines remain the dominant power solution across global jobsites; we continue to strategically invest in advanced diesel engine technologies that help customers tackle their daily challenges."

The booth featured the C13D diesel engine platform, designed to achieve power density, torque and fuel efficiency for optimizing the performance of heavy duty off-highway applications.

Engineered to Caterpillar's standards for reliability and productivity, the inline, six-cylinder 13-liter engine platform will offer eight power ratings from 456 to 690 hp (340 to 515 kW) with up to 3,200 Nm of peak torque. Engine mounted aftertreatment and cooling packs will also be available from the factory to reduce installation and validation costs. The C13D will meet the emissions standards of highly regulated territories, such as Stage V, Tier 4 Final, China Nonroad Stage IV, Korea Stage V, and Japan 2014, with models available for less regulated territories.

The Cat C13D is designed for use in a wide range of off-highway equipment, including rock crushers, screeners, and grinders; trenchers; agriculture tractors, harvesters and self-propelled sprayers; woodchippers;



ZF presented gearbox solutions for crawler cranes.
(Photo: ZF)

material-handling equipment; and large industrial pumps.

catepillar.com

ZF Offers Intelligent Off-Highway Solutions

In the construction and mining Industry, machine efficiency is a key factor in increasing site productivity and minimizing downtime. Addressing these growing demands, ZF Industrial Drives presented its latest advancements in large drive systems for mobile applications–the GPT 4F Travel Gearbox Series, covering a range from 73,750 to 2,212,500 ft-lbs. (100 – 3,000 kNm) output torque.

The next generation of ZF planetary gearboxes combines a compact design with significantly higher output torque, along with optimized service concepts that support greater availability and reduced maintenance effort

The Travel Gearbox Series GPT 4F is designed for mining excavators, large construction machines and for crawler cranes with machine weights from 50 to 1,000 tons. By using the latest design and manufacturing tools, the gearboxes show a significantly increased torque density, while maintaining a compact design.

In this context, ZF displayed the modified GPT 450 4F Travel Gearbox for excavator and crane applications. The GPT 450 4F is suited for output torques up to 368,000 ft-lbs (500 kNm) and is designed to deliver highest reliability in harshest operating conditions.

The new generation of ZF planetary gearboxes is also available with the performance management system *ProVID*. The sensors and software of the *ZF ProVID* system enable a permanent condition analysis and a significant extension of service life through preventive maintenance measures. To complete the gearbox portfolio for Construction Machinery, ZF also showcased GFB Swing Gearboxes and GFC Pump Distribution Gearboxes in different sizes.

To meet the increasing demands for flexibility, efficiency and reliability throughout the entire machine lifecycle, ZF complements its system expertise with a strong and comprehensive aftermarket portfolio. Built on decades of experience in off-highway applications, ZF Aftermarket supports construction machinery operators and service partners with robust components and integrated service solutions designed for extreme loads, harsh environments and demanding duty cycles.

The portfolio includes for example torque converters, oils and hydraulic brake components, engineered to ensure optimal performance while minimizing downtime. Workshops benefit from comprehensive technical training and detailed documentation, enabling them to maintain consistently high service standards. ZF's global service ecosystem further supports professional repair operations with diagnostics, repair solutions and remanufacturing options, while a strong global logistics network ensures fast delivery times and high parts availability. With this end-to-end aftermarket approach, ZF provides reliable support worldwide—with North America representing a key market for future growth.

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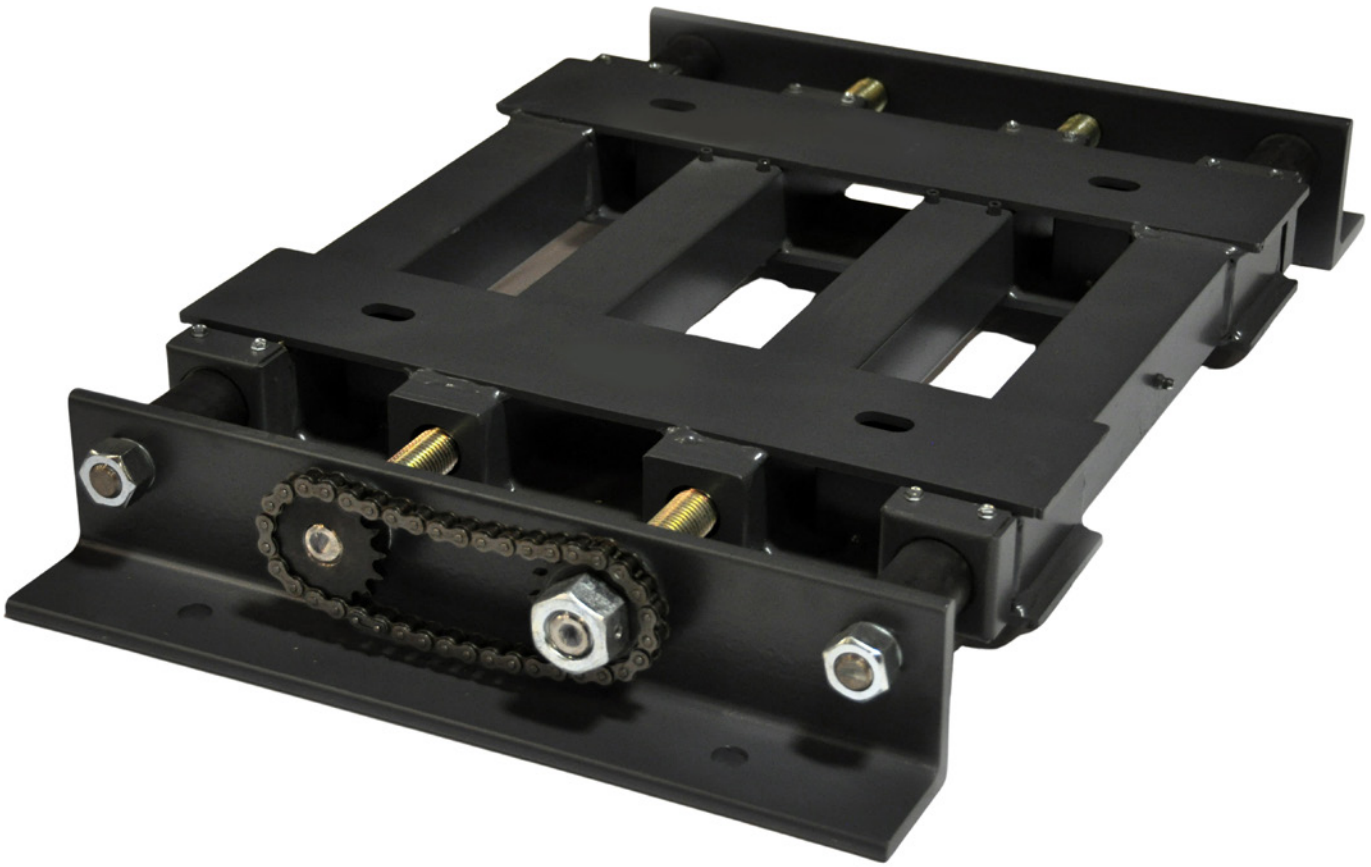
Why the Motor Base Matters in Belt Drive System Performance

Aaron Fagan, Senior Editor



An example of Overly Hautz's Automatic motor base from their DD-1100 Series.

In a belt drive system, the motor, belts, pulleys, and sheaves all receive engineering attention during design and specification. The motor base typically does not. It is the overlooked component, selected on frame size and bolt pattern, specified late in the process, and treated as a passive structural element, something that holds the motor in place and sets belt tension at installation.

But the base is where belt tension is determined, and belt tension is not a static condition. It changes as belts stretch, as loads vary, and as operating conditions shift over the life of the equipment. How the base manages, or fails to manage, those changes has direct consequences for energy consumption, belt life, bearing loads, and maintenance costs. The static base is and will remain the standard for the vast majority of belt drive installations. But there are application conditions (e.g., heavy shock loading, difficult maintenance access, energy-sensitive operations) where an alternative approach to tension management warrants consideration. The base deserves closer examination than it usually receives.

How Belt Tension Behaves on a Static Base

On a conventional static motor base, the installer sets belt tension at commissioning using a tensioning gauge. Tension is typically set above the calculated optimum to allow for belt stretch that occurs after initial operation. Once set, the motor position is fixed. From that point, tension moves in only one direction: it decreases.

As belts stretch during service, tension drops. The system passes through a window of optimal tension and continues

into a range where slippage begins, first intermittently, then progressively. Slippage generates heat at the belt-to-sheave interface, accelerates surface wear, wastes energy, and can reduce the speed of the driven equipment. The correction is a maintenance visit to re-tension the belts. In practice, that visit is usually reactive, scheduled after symptoms appear rather than on a preventive interval.

The result is a repeating cycle. After each tensioning event, belts are tighter than they need to be, increasing bending stress around the pulleys and adding radial load to motor and driven-shaft bearings. As stretch continues, tension falls through the optimal range and into a period of increasing slippage and energy loss until the next re-tensioning.

This cycle compounds under variable loads. A static base provides one tension setting for all operating conditions. When torque demand spikes above what that fixed tension can cleanly transmit, slippage occurs. When load drops well below the belt's capacity, the tension is higher than necessary, the motor works against friction that serves no productive purpose. The belt absorbs every load transient that the fixed mounting cannot accommodate. The visible result is belt flutter: oscillation of the belt span during operation that indicates energy is being lost between the motor and the driven equipment.

How an Automatic Motor Base Manages Tension Differently

The Overly Hautz Automatic Motor Base replaces the fixed mounting with a spring-loaded carriage. The motor sits on cross members attached to tubes that ride on base rails. A spring, sized for the specific motor horsepower, speed, and mounting orientation, pushes the motor away from the driven pulley. The belt's tight side pulls the motor toward the driven pulley. The carriage rests wherever those two forces are in balance.

This balance is continuous. When load increases, higher belt tension pulls the motor inward, compressing the spring. When load decreases, the spring pushes the motor outward, preventing excess tension. The carriage position adjusts mechanically in response to changes in load, without electronics, controls, or manual intervention.

The same mechanism handles belt stretch over time. As belts elongate during their service life, the spring expands, and the carriage moves outward to compensate. Tension is maintained without a re-tensioning visit. Because the carriage moves along fixed rails, pulley alignment set during installation is preserved.

During setup, the automatic base offers a practical advantage: it can be tensioned while the motor is running. The installer adjusts the single drive screw until belt slippage is eliminated under actual operating conditions, rather than relying solely on static gauge readings with the motor stopped.

Comparative Test Results

In 2016, Advanced Energy, an independent testing laboratory, conducted comparative energy measurements between the Overly Hautz automatic base and a standard static base. The test used a 15 hp, 4-pole Leeson motor (NEMA 254T frame, 92.4 percent nameplate efficiency)

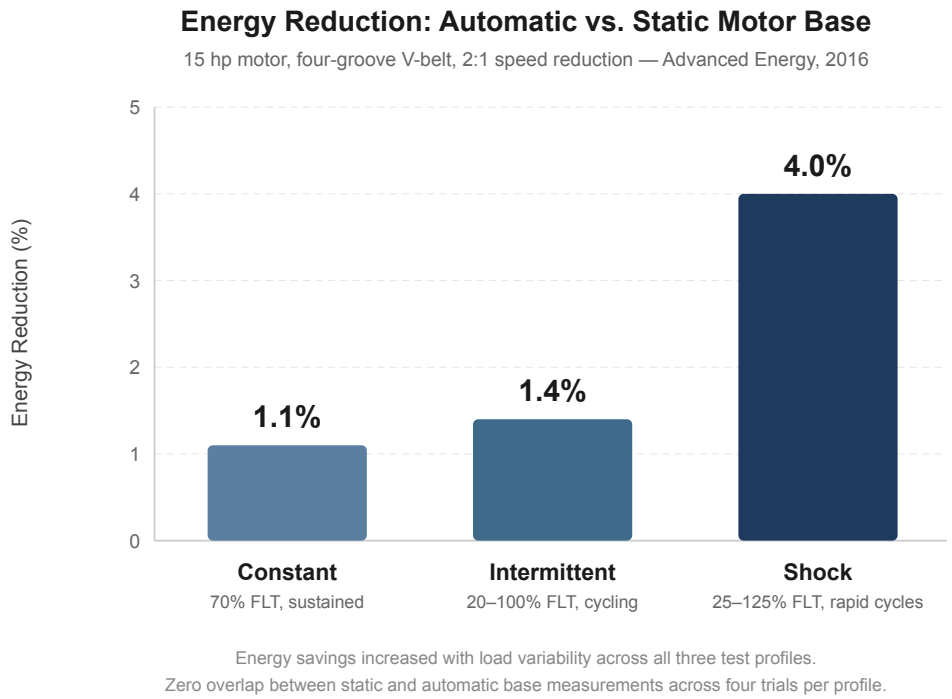


Figure 1—Energy savings increased with load variability in controlled testing using the same motor, belts, and pulleys on both base types.

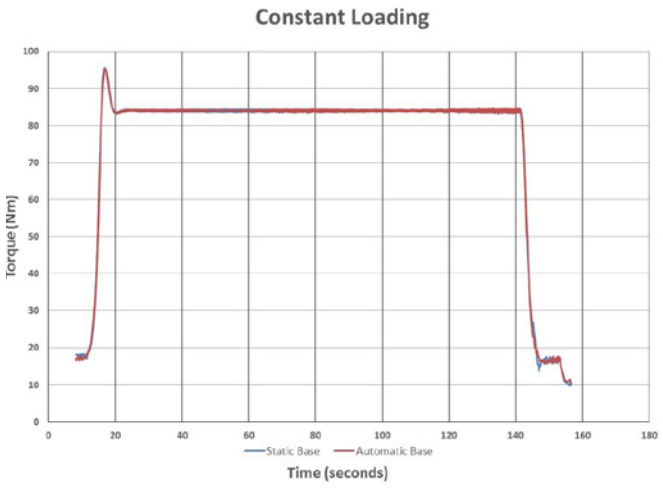


Figure 2—Constant loading (ramped to 70 percent of full load torque, held steady): the automatic base averaged 337.7 Wh versus 341.5 Wh for the static base, a 1.1 percent reduction.

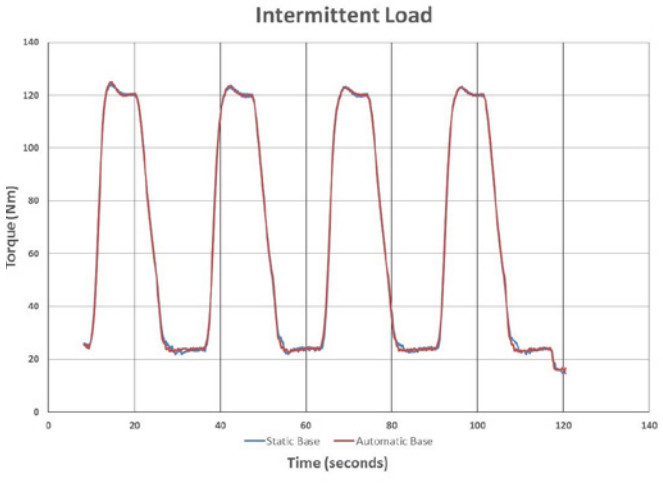


Figure 3—Intermittent loading (controlled transitions cycling between 20 percent and 100 percent of full load torque): the automatic base averaged 225.5 Wh versus 228.6 Wh, a 1.4 percent reduction.

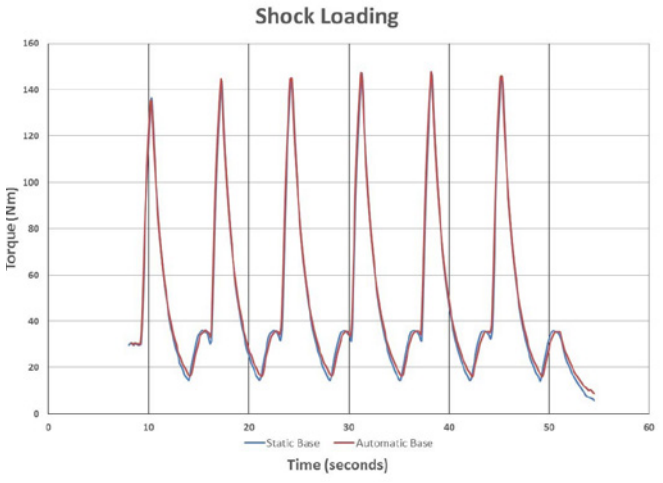


Figure 4—Shock loading (rapid cycles to approximately 125 percent of full load torque from a 25 percent baseline): the automatic base averaged 69.4 Wh versus 72.3 Wh, a 4.0 percent reduction.

coupled to an eddy current dynamometer through a four-groove V-belt system with a 2:1 speed reduction. Energy input was measured at the motor terminals using a Yokogawa WT-3000 precision power analyzer.

The same motor, belts, and pulleys were used on both bases. Before each test series, belt tension was set to approximately 13 lbs. at a half inch of deflection at center span, the belts were warmed under full load, and tension was reset to a consistent baseline. Each of three load profiles was run four times on each base.

Across all three profiles and all four trials per profile, there was zero overlap between the two data sets; every automatic base measurement was lower than every corresponding static base measurement. The WT-3000's basic power accuracy of approximately ±0.02 percent of reading places the instrument uncertainty far below the observed differences.

The individual percentages are modest. The pattern across the three profiles is the more significant finding: energy savings increased as load variability increased. Under constant load, where the gap between fixed tension and optimal tension is smallest, the improvement was nominal. Under shock loading, where rapid and severe load swings create the widest mismatch between a single fixed tension setting and actual demand, the improvement was roughly four times larger.

This is consistent with the mechanical principle. On the static base, every load excursion above the fixed tension threshold produces slippage, and every excursion below it produces unnecessary tension. The more frequent and severe those excursions, the more energy is consumed unproductively. The automatic base tracks those changes through the spring mechanism, reducing both conditions.

This test was conducted on one motor size with one belt configuration. The spring-tension mechanism operates on the same physics regardless of scale, but broader testing across additional horsepower ratings and belt types would strengthen the evidence base.

Belt Life and Maintenance Considerations

It is worth stating plainly: a static base with disciplined maintenance is not an inherently failing system. Many belt drive installations run acceptably for years on static bases when re-tensioning is performed on a preventive schedule, when trained personnel are available to do the work correctly, and when the application doesn't impose severe load variability. The static base has served industry for decades and continues to function in most installations.

The difficulty is the gap between what a static base requires and what it typically receives. Re-tensioning demands a maintenance visit, and maintenance visits are scheduled against competing priorities with limited personnel. In practice, re-tensioning is more often reactive than preventive, performed after symptoms appear rather than before damage accumulates. The problem is not the static base itself. It is the assumption that belt tension, once set, can be left unmanaged until something goes wrong.

Where that gap exists, the over-tension/under-tension cycle takes its toll: elevated bending stress when newly tensioned, heat and surface degradation from slippage as tension decays, and repeated stress cycling each time the belts are reset. By maintaining tension within a narrower operating range, the automatic base reduces the peak stresses that drive these failure modes.

Formal comparative belt life testing has not been conducted. Field experience across a range of industrial and commercial applications indicates extended belt and bearing life, supported by the purchasing behavior of repeat customers, including one data-center-cooling OEM that has purchased more than 10,000 automatic bases for equipment where reliability and reduced in-field maintenance are primary selection criteria. That volume from a sophisticated buyer is suggestive, though it reflects a total-cost-of-ownership evaluation rather than isolated belt-life data.

The maintenance labor reduction is more directly quantifiable. The automatic base eliminates routine re-tensioning visits over the belt's service life. For equipment in accessible locations, this saves periodic labor. For installations where re-tensioning requires scaffolding, rooftop access, confined space entry, or significant travel, cooling towers, elevated conveyors, rooftop HVAC units, each eliminated visit avoids meaningful cost in labor, access, and potential production disruption.

When to Evaluate an Automatic Motor Base

An automatic base warrants engineering evaluation when one or more of the following conditions are present:

Variable or shock loading: Crushers, vibrating screens, foundry shake-outs, reciprocating compressors, batch conveyors, or any application where load changes significantly during operation.

Difficult maintenance access: Cooling towers, rooftop units, elevated conveyors, or installations where re-tensioning requires scaffolding, confined space entry, or significant travel.

High uptime requirements: Data centers, hospitals, continuous process lines, water treatment, or any operation where unplanned downtime is costly relative to component costs.

Limited maintenance staff: Facilities with many belt-driven systems where maintaining a re-tensioning schedule across the full installed base is impractical with available personnel.

History of belt problems: Installations experiencing repeated belt failures, premature bearing replacement, or frequent tension-related maintenance calls.

Applications and Practical Guidance

The applications where the automatic base shows the clearest advantages fall into two categories that reflect the two sides of the value proposition.

In heavy shock-load environments (i.e., rock crushers, vibrating screens and feeders, foundry shake-outs), the energy savings are largest and the belt protection most significant. These are the applications where the mismatch between fixed tension and actual load demand is greatest, and where belt stress from unabsorbed transients most directly shortens component life.

In critical or remote installations (i.e., data center cooling, hospital HVAC, cooling towers, large campus facilities), the energy savings in these typically steadier-load applications are more modest, but the reduction in maintenance access requirements is the primary driver. Equipment that runs continuously in locations where service visits are expensive, disruptive, or hazardous benefits most from a tension system that does not require periodic adjustment.

It is also worth noting that even under constant-load conditions, the Advanced Energy testing showed measurable energy reduction—and across a facility with many belt-driven systems, the aggregate savings may warrant evaluation independent of shock-load or access considerations.

The automatic base is designed for and proven with V-belt drives. Synchronous belts, which transmit power through tooth engagement rather than friction, operate on a different principle and are not applicable.

For engineers evaluating whether an automatic base warrants consideration in a given application, the relevant factors are the degree of load variability during operation, the difficulty and cost of maintenance access, the consequences of unplanned downtime, and whether the installation has a history of tension-related belt or bearing problems. In applications where any of these factors are significant, the base selection becomes a system-level decision rather than a commodity choice.

Acknowledgments

Test data referenced in this article are from "Overly Hautz Motor Base Comparison Tests," conducted by Advanced Energy, March 2016. The full report is available from Overly Hautz (*https://overlyhautz.com/pdf/testreport.pdf*). Special thanks to Tara Copanas, executive vice president, and Trevor Ahlert, COO, of Overly Hautz, for additional clarifications.

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REMEMBERING ROBERT ERRICHELLO

The gear industry has lost one of its most respected figures. Robert Errichello, founder of GEARTECH and a leading authority on gear design, failure analysis, and tribology, has passed away. He was 84. Over a career spanning more than 57 years, Bob made contributions to gear engineering and standards development that will endure for generations.

Bob published more than 80 articles on the design, analysis, and application of gears, authored three widely used computer programs for gear design and analysis, and consulted for more than 50 wind turbine manufacturers, purchasers, operators, and researchers. He taught courses in material science, fracture mechanics, vibration, and machine design at San Francisco State University and the University of California at Berkeley, and presented numerous seminars to professional societies and the gear, bearing, and lubrication industries. He served as technical editor for both *Gear Technology* and STLE's *Tribology Transactions*. A graduate of the University of California at Berkeley, he held BS and MS degrees in mechanical engineering and a Master of Engineering degree in structural dynamics. His contributions were recognized with the AGMA TDEC Award, the AGMA E.P. Connell Award, the AGMA Lifetime Achievement Award, the STLE Wilbur Deutch Memorial Award, the 2015 STLE Edmond E. Bisson Award, and the AWEA Technical Achievement Award.

But the vitae only hints at what made Bob exceptional. He was one of the people doing the foundational technical work that informed AGMA standards, producing dozens of original reports on gear rating, metallurgy, tribology, and nomenclature—not summaries or opinion pieces, but original derivations and analyses that directly supported the standards development process. His work on AGMA 925 alone comprised 23 reports over seven years, methodically addressing gear tribology from elastohydrodynamic lubrication theory to scuffing prediction. Many went through multiple revisions, reflecting his insistence on getting every detail right.

Robert Erichello with his dog, Corny.

"Bob Errichello was a powerhouse within the gearing technical community for 50+ years," noted Jason Daubert, MPMA's Technical Division Executive Committee Chair and Chief Engineer at Fuller. "In 2025 alone, he participated in 54 technical committee calls across 14 technical committees and working groups, providing complex data and sage engineering guidance across a wide range of topics. His mind was truly amazing, and AGMA standards strongly benefited from his support."

For 27 years, Bob and Jane Muller taught the AGMA Gear Failure Analysis seminar, which became AGMA's most popular course. In 2016, he separately gave his Gear Failure Analysis course to MPMA, where it has also become their most popular offering. "His legacy will live on through Gear Failure Analysis, MPMA's most popular class—one Bob gave to MPMA in 2016, and that has since benefited thousands of engineers," said Sara Zimmerman, MPMA Chair and Vice President CX and Product at Sumitomo. "On behalf of the Board of Directors, our sincerest condolences to Jane and the Errichello family and friends for this tremendous loss."

"Bob was great to work with, and I was fortunate to work with him as a colleague and attend his Gear Failure class when I was with Cotta and as a technical contributor with MPMA," noted Todd Praneis, Vice President, Technical Services at MPMA. "His passion was contagious and he was a fierce advocate for the science of our craft, requiring everyone to be on their A-game when forming standards. We will miss him terribly."

Frank C. Uherek, Principal Engineer at Regal Rexnord and a longtime AGMA colleague, pointed to several of Bob's defining technical contributions. Among them was his development of a calculation method for the geometry factor used in bending-strength power capacity, which eliminated the labor-intensive practice of hand-drawing large-scale tooth-root fillets and made it possible to compute the factor accurately by computer. Bob also played a major role in creating the first AGMA information sheet for wind-energy gearboxes—work that ultimately led to an AGMA rating standard and became a major source of technical content for the ISO/IEC joint wind-turbine standard published this year. "Bob was unwavering in his belief that gear rating practices must be grounded in sound science rather than approximations or extrapolations from limited test data," Uherek noted. He added that Bob's insistence that every technical term have a single, authoritative definition shaped AGMA 1012, Gear Nomenclature, and AGMA 1010, the gear failure classification documents. "Thanks to his efforts, gear engineers can communicate with clarity and precision—speaking the same technical language across the industry."

Fellow *Gear Technology* technical editor Chuck Schultz first met Bob at an AGMA committee meeting in 1979. "He was a leader in modernizing the gear rating method, taking it away from pages of charts and into formulas that could be written into computer programs," Schultz recalled. "When Bob started publishing commercial software, I bought a very low serial number and stopped writing my own code. Over the years our paths crossed frequently. When I started consulting in 2008, Bob helped me find clients. He and Jane were instrumental in AGMA being world leaders in wind turbine gear design standards." Schultz noted that quality engineers sometimes conduct "best of the best" studies to identify influence factors on product performance. "Bob, in my mind, was the best of the best in the gear engineering trade. There will never be another like him."

Since joining *Gear Technology* and *Power Transmission Engineering* magazines in 2022, Senior Editor Aaron Fagan had the pleasure of preparing eight technical articles with Bob for publication. "He always seemed particularly pleased to see that his work and collaborations find their way into our pages," Fagan recalled. In every interaction, Bob was kind, grateful, and to the point.

The thousands of engineers who learned failure analysis through his courses, the standards that bear his contributions, and the pages of this magazine that carry his name—these are what Bob leaves behind. On behalf of the entire staff of *Gear Technology* and *Power Transmission Engineering*, we extend our deepest condolences to Jane and the Errichello family. Rest in peace, Bob.

VOITH TURBO

Names Michal Kalita Vice President of Sales for Industry Division in North America

Voith announces the addition of Michal Kalita as Voith Turbo's new vice president of sales for the industry division in North America. Kalita will be based at Voith's Houston location.

Michal Kalita

"Michal's strong global experience and track record of steering data-driven strategies that optimize performance, will bring value for our team and for our customers. We look forward to building on the success achieved so far in North America," said Ralf Dreckmann, president of Voith Turbo, North America.

Kalita has more than 20 years of experience in the rotating machinery industry. Prior to joining Voith, he served as director of global service for Ebara Elliott Energy and held various commercial and operational leadership roles at Sulzer. Kalita has a bachelor's degree in industrial engineering from the University of Houston, completed the Finance and Accounting Executive Education Program from Rice University, and completed the Management Development Program from Berenschot.

"The customer is the central focus of everything the team does at Voith," said Kalita. "I'm looking forward to being at the forefront of continuing that level of dedication for our customers throughout North America."

Voith Turbo is a specialist for intelligent drive technology, systems as well as tailor-made services for customers from highly diverse industries such as oil and gas, energy, mining and mechanical engineering, ship technology and rail. Voith's Houston team provides a variety of OEM services including repairs, retrofitting and overhaul services for Voith products—such as industrial and high-speed gearboxes, Vorecons, torque converters and fluid couplings—as well as non-Voith products.

voith.com/corp-en/index.html

FOREST CITY GEAR PRESIDENT

Joins Greater Rockford Chamber of Commerce Board of Directors

Kika Young

Forest City Gear recently announced that Kika Young, president and shareholder, has joined the Greater Rockford Chamber of Commerce (GRCC) board of directors. In addition to her board role, Young will contribute her expertise as a member of both the GRCC's Talent Committee and the Rockford Area Aerospace Network (RAAN).

"I'm honored to serve on the board of the Greater Rockford Chamber of Commerce and contribute through both the Rockford Area Aerospace Network and the Talent Committee," says Kika Young, President of Forest City Gear. "As a manufacturer, I see every day how critical collaboration is between industry, education, and community partners to strengthen our workforce, support local businesses, and position the Stateline as a competitive, thriving economic hub."

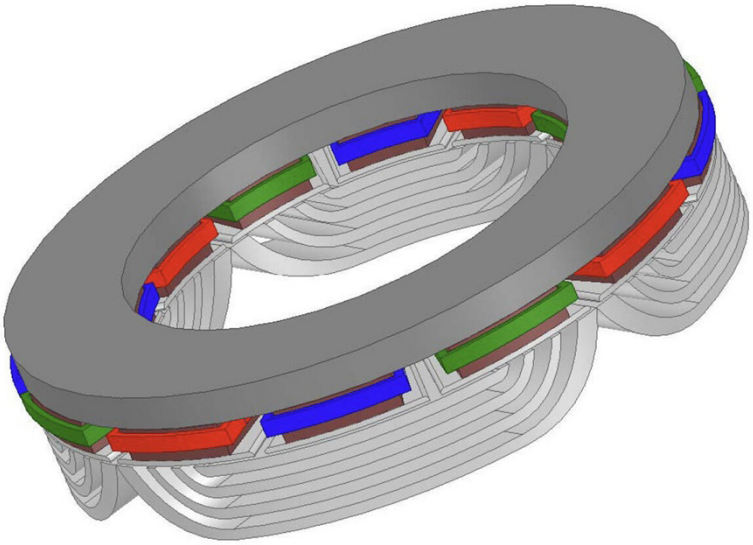
Young brings her years of manufacturing leadership experience to the GRCC, including deep expertise in precision gear manufacturing and aerospace supply chains. As president of Forest City Gear, she has championed the company's continued legacy for investment in workforce development, advancing manufacturing, and regional economic growth.

"As the region's largest most influential network of business owners, executives, and professionals, the Greater Rockford Chamber of Commerce relies heavily on the insights and expertise of our board members," says Angela Kay Larson, CEO of the GRCC. "Our organization will benefit greatly from having Kika's perspective as president of a family-owned business, manufacturing leader, and aerospace expert."

Earlier in her career at Forest City Gear, Young served 10 years in various human resources leadership roles. This experience, in combination with Forest City Gear's important position in the Rockford area's aerospace community, gives Young unique insight to strengthen the region's manufacturing workforce pipeline.

"As part of her board commitment, Kika serves on our RAAN committee and Talent Committee. Her knowledge in both these areas will help inform our region's work in strengthening our aerospace cluster and growing the availability of skilled workers," Larson adds.

forestcitygear.com



The AF-SynRM aims to merge the compact, high torque-density characteristics of axial flux topologies with the rare-earth-free robustness of synchronous reluctance machines. **(Photo: IEEE Explore)**

PEM
Develops Magnet-Free E-Motor to Reduce Production Costs

The Chair of Production Engineering of E-Mobility Components (PEM) of RWTH Aachen University has entered the two-year "NAFTech" research project funded by the German Federal Ministry for Economic Affairs and Energy. Together with the Institute of Electrical Energy Conversion (IEW) at University of Stuttgart and the Chair of Manufacturing Automation and Production Systems (FAPS) at FAU Erlangen, the PEM team will be developing an electric motor as a traction drive that does not require the use of rare-earth elements and will still offer a great degree of compactness, efficiency, and high torque density.

The background to this is that current axial flux machines (AFM) meet these positive criteria but are almost exclusively dependent on rare-earth magnets. To avoid the use of those cost-intensive and increasingly scarce resources, the radial flux synchronous reluctance machine (RF-SynRM) is currently considered a sustainable, robust, and overload-capable alternative. In turn, this entails compromises in terms of installation space and torque density. The "NAFTech" project therefore focuses on the concept of an axial flux synchronous reluctance machine (AF-SynRM) that combines the respective advantages of AFM and RF-SynRM.

Validation through partial demonstrators

"Axial flow machines are currently characterized by relatively low production volumes, manufacturing processes that are not yet fully developed, and special requirements in terms of tolerances and design processes," says PEM Director Professor Achim Kampker. "NAFTech" therefore pursues an integrated approach to topology, multi-domain machine design, and production methods, supported by data-based optimization of tolerance chains. During the project, the simulative design of the machine and the suitability of the manufacturing processes will be validated with the aid of specially constructed partial demonstrators.

AF-SynRM promises economic advantages, especially for small and medium-sized enterprises (SMEs), as it enables stable production costs and reduces dependence on volatile prices, which are prevalent with rare-earth magnets. "A magnet-free motor generally also reduces material costs by up to 50 percent, which can strengthen the competitiveness of SMEs and lower barriers to market entry," Kampker says. Meanwhile, there is growing pressure to develop sustainable solutions to reduce carbon emissions and comply with legal requirements. According to PEM, early investment in magnet-free technologies can give SMEs an innovative edge and open up opportunities in high-growth markets.

pem.rwth-aachen.de/go/id/brigdm/lidx/1

April 13–16

Modex 2026

Modex (Atlanta) is where the manufacturing and supply chain professionals come together for the world's largest supply chain experience. From hands-on product demonstrations to one-on-one meetings and a conference with four keynotes and nearly 200 sessions, Modex 2026 is where they come to see the latest equipment and tech, learn the latest trends, connect with key suppliers and make strategic capital equipment buying decisions for their future operations. Key exhibitors include Beckhoff Automation, Festo, Interroll, Lenze, Misumi, Motion, Nidec Automation, Nord Drivesystems, Regal Rexnord, Siemens and more.

powertransmission.com/events/modex-2026

April 23–25

2026 MPMA Annual Meeting

In an era defined by economic uncertainty, supply chain disruption, and rapid workforce change, senior manufacturing leaders need more than tactical updates—they need strategic clarity. The 2026 MPMA Annual Meeting held at the Sunseeker Resort in Charlotte Harbor, FL, is designed specifically to deliver that clarity. Hosted by the Motion + Power Manufacturers Alliance (MPMA), this member-only gathering convenes top executives from across the power transmission and motion control industry for high-level dialogue, peer connection, and forward-looking insight.

powertransmission.com/events/2026-mpma-annual-meeting

May 19–20

CTI Symposium USA 2026

CTI Symposium USA (Novi, MI) examines the challenges in automotive powertrain development from passenger cars to heavy-duty vehicles. The program offers the latest solutions in the fields of electric drives, power electronics, battery systems, e-machines, components and the supply chain. Market and consumer research results as well as infrastructure related topics supplement the exchange of expertise. Speakers from Stellantis, Toyota, BorgWarner, General Motors, Ford, ZF and more will be on hand to discuss trends in individual and commercial automotive transportation.

powertransmission.com/events/cti-symposium-2026-02-04

June 1–4

Cleanpower 2026

Cleanpower 2026 (Houston) grows businesses by gathering key decision makers and stakeholders across the wind, solar, storage, hydrogen, and transmission industries for discussion, deal making, networking and a whole lot of fun. The trade show not only brings together the different technologies that make up the renewables mix; onshore wind, offshore wind, solar, storage, and transmission but also the different segments within the industries; manufacturers, construction firms, owner operators, utilities, financial firms, corporate buyers and more. Cleanpower will feature the latest products, services and technologies coming to the renewable energy industry.

powertransmission.com/events/cleanpower-2026

June 15–18

Reliable Plant 2026

This event (Reno, NV) offers attendees learning sessions and case studies on the latest industrial lubrication and oil analysis technologies. The comprehensive conference schedule covers every facet of the machinery lubrication industry and includes workshops on topics such as employee performance, lubrication fundamentals, condition-based maintenance and planning. Reliable Plant attendees come to the conference to connect with suppliers and service providers who can help them achieve bottom-line results in maintenance, reliability, and operations. From technicians and planners to management and leadership, you will be able to meet and influence entire buying teams at Reliable Plant.

powertransmission.com/reliable-plant-2026

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

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

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The New York Manufacturing Magic Continues

Matthew Jaster, Director, Editorial Content

The New Year's Ball Drop wouldn't be possible without a sophisticated electromechanical system that must operate reliably during the most critical 60 seconds of the year. In 2023, SEW-Eurodrive was featured in an article in *PTE* on the mechanical and electrical systems responsible for assisting the famous New Year's Ball Drop in Times Square:

powertransmission.com/having-a-ball-the-technology-behind-the-ball-drop

The 2026 Ball featured a refreshed exterior and next-generation LED technology capable of richer colors, smoother animations and more dynamic patterns. These visual upgrades increased the demands on the lifting system, which must manage the Ball's substantial weight while delivering controlled, steady movement.

A powerful winch system beneath the mast platform now handles the motion. Its two-line configuration and 42-inch drum with helical grooving use opposing wire ropes to maintain balance and smooth operation in a compact footprint.

At the center of this system is an SEW-Eurodrive gearmotor, designed to support the full load and provide precise, dependable motion throughout both the rise and the 60-second descent.

The unit's planetary and helical-bevel gearing, combined with an AC motor, encoder, brake and regenerative VFD, delivers accurate speed control and even returns energy to the grid as the Ball descends.

To meet the evolving requirements of the Ball Drop mechanism, the drive system now incorporates a through-going low-speed shaft that allows a second brake to be mounted opposite the gearbox. This added braking capability increases redundancy, which is critical for an event where millions are watching, and the system has one precise minute to perform.

This gearmotor converts high motor speed into slow, powerful, predictable movement. The planetary stage provides the torque needed to support the Ball's weight, while the helical-bevel stage ensures efficient power transfer. Working together with the encoder, brake, and VFD, the system maintains exceptionally tight speed and stopping control.

Although the Ball operates only a few times each year, routine maintenance is essential to ensure continuous readiness. Regular lift-and-lower cycles confirm proper operation of the winch and gearmotor. SEW-Eurodrive service technicians perform inspections, change oil, analyze samples and verify the health of internal components.

Thanks to the system's low duty cycle and durable construction, wear remains minimal. Still, proactive maintenance safeguards performance for years to come. The Ball isn't just part of one night's celebration; it's a year-round landmark viewed by millions.

For 87 years following the first Ball Drop in 1907, the Ball was raised and lowered by six men with ropes and a stopwatch. Obviously, the project's size and scope has increased over time.

The equipment used today is a testament to engineering technology and manufacturing innovation. Every year, as the final seconds tick away, the world focuses on the glowing six-ton sphere towering above Times Square. It's a moment of celebration without any do-overs. When the countdown begins, the entire system must perform with absolute precision with some much-needed assistance from SEW-Eurodrive.

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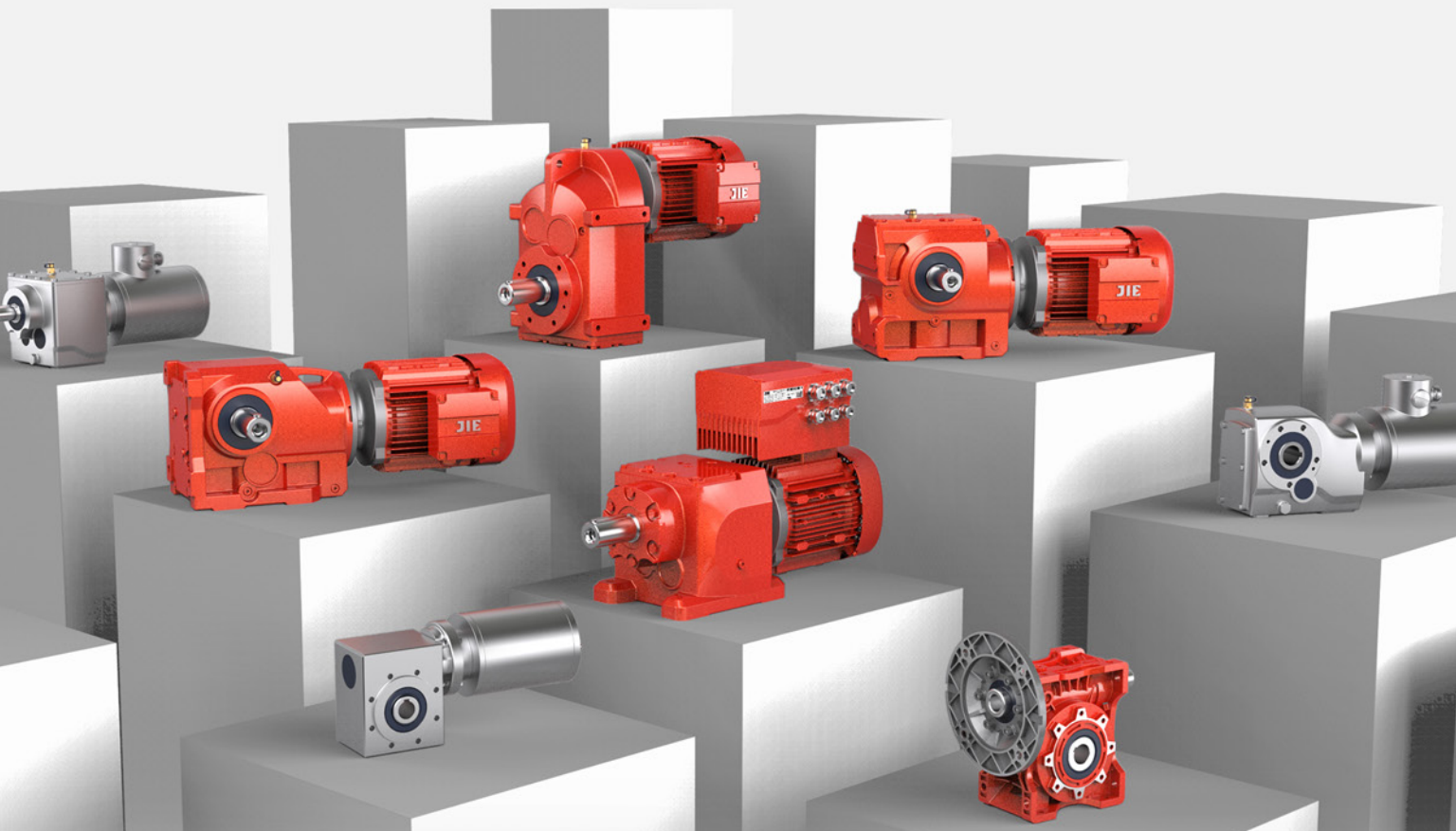


Options are Worm gear unit; Helical inline, Parallel shaft, Helical bevel and Helical worm gearmotor; Available in aluminum, cast iron and stainless steel housing.

JIE USA INC.

493 Mission St. Carol Stream, IL 60188
www.jie-drives.com | Info@jie-drives.com | +1 630 580 9986

BRING ON the BRUTE FORCE LOADS

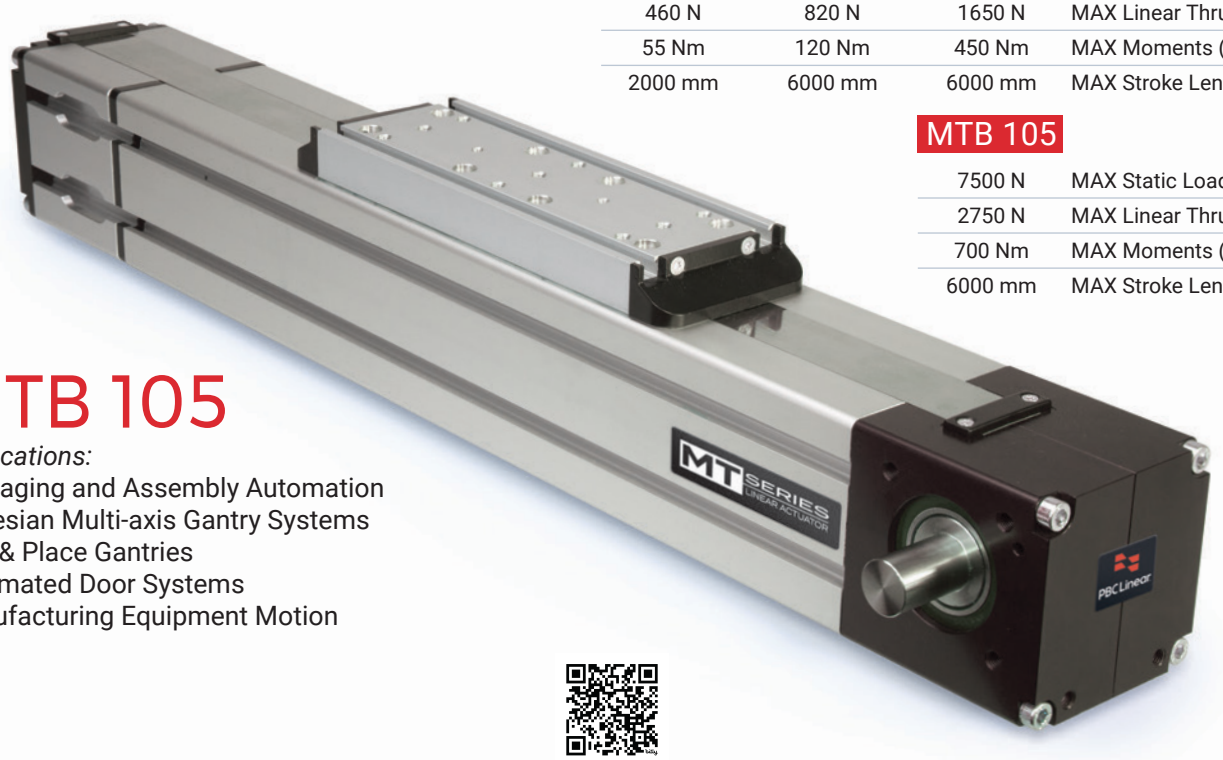
MTB Series Linear Actuator Line

The MTB Series is a belt driven, profile rail linear actuator that has a number of sizes with some design configuration availability to meet high loads and stroke length.

MTB actuators are fully enclosed systems that perform at speeds up to 3000 mm per/second. The newer MTB 105 linear actuator can move a static load of 7500 N and has a thrust capacity of 2750 N.

MTB 42	MTB 55	MTB 80	
1560 N	1850 N	4500 N	MAX Static Load (F_z F_y)
460 N	820 N	1650 N	MAX Linear Thrust (F_x)
55 Nm	120 Nm	450 Nm	MAX Moments (M_z M_y)
2000 mm	6000 mm	6000 mm	MAX Stroke Length

MTB 105	
7500 N	MAX Static Load (F_z F_y)
2750 N	MAX Linear Thrust (F_x)
700 Nm	MAX Moments (M_z M_y)
6000 mm	MAX Stroke Length



MTB 105

Applications:
Packaging and Assembly Automation
Cartesian Multi-axis Gantry Systems
Pick & Place Gantries
Automated Door Systems
Manufacturing Equipment Motion

Learn More at: bit.ly/MTB105Actuator

PBC Linear®

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