

# Energy Efficient Solution Packages Integrate Motor Drive Sizing and Technologies

CRAIG DAHLQUIST, AUTOMATION TEAM LEADER, LENZE AMERICAS

Virtually every aspect of automation and plant infrastructures rely on electric drives. Given that electric drives account for such a high proportion of overall energy consumption and are in such widespread use, they are also the most effective means of increasing energy efficiency. Saving energy can be one of the toughest challenges in power system design.

The greater the efficiency of a drive, the more efficiently it runs and same is true not just of individual components, but the complete system. Uniform drive systems not only optimize processes, but permanently reduce life-cycle costs. To avoid squandering energy, the right choices must be made from the point at which drive components are selected. By using intelligent and integrated drive solution packages, energy consumption can be reduced up to 30 percent.

Motor drive sizing and technologies have expanded support for multiple applications, with fully integrated energy efficient packages comprised of engineering design software, MF (multiple frequency) gear motors with beveled gearboxes and highly efficient and economical variable frequency inverter drives. In designing and specifying 'right sized' motor drive and control components, the ideal energy efficient package comprises a powerful trifecta of tools that take into account the entire drive system.

## Efficiency At-A-Glance with Drive Solution Software

An efficient design process starts with the right design software to ensure precision drive dimensioning by tailoring the drive system specifically to the application requirements. This can prevent the common problem of overdimensioning of motors and inverter control and regulation of the drive systems. Lenze *Drive Solution Designer (DSD)* software can record and save the resulting projected energy consumption. By using *DSD* to select drive packages with MF motors, the

engineer can quickly achieve optimal energy balance with efficient drive dimensioning and assure fully integrated system components. Design software shows potential energy savings options at a glance, which makes it possible to compare several different solutions and ensure selection of the right sized components for the task.

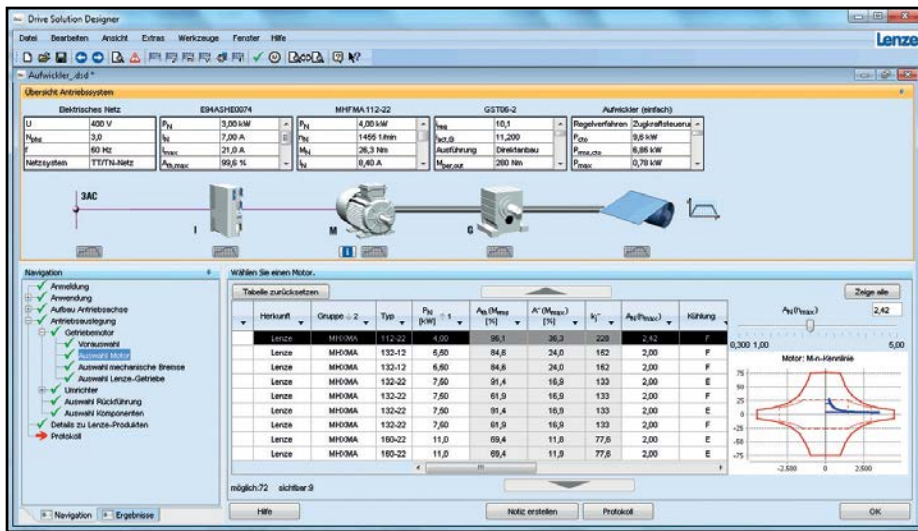
In a side-by-side project comparison, one can compare the different mechanical concepts and the different drive components with respect to their energy demands and energetically optimize them. It generally applies that a complete drive system should take into account motion, mechanical components, and drive components. The total energy efficiency can be calculated, e.g. for a complete production

line, and the energy part of the production costs and, additionally, CO<sub>2</sub> emissions can be determined. Additionally, it is possible to determine the potential savings by using DC power recovery instead of a brake resistor. Overdimensioning should be avoided, but the components should not be subjected to extreme overloads. In general, the longer the drive operating time, the higher the cost savings.

## Small, Yet Powerful MF Three-Phase AC Geared Motor

Classic three-phase AC motors generally increase in size as their energy efficiency improves. This not only leads to space issues inside the machine, but other negative effects, since greater inertia actually increases energy con-





assumption when changing speeds. An energy efficiency solution package offers greater design freedom and ensures a 'right sized' motor providing equal or greater output to replace larger, more costly and less energy efficient motors.

The ideal operating condition for the most commonly used 4-pole three phase AC motor is roughly 120 Hz to achieve high power output, a wide speed range and a high degree of efficiency. Multiple frequency motors provide a wide speed range and a high degree of efficiency, while concurrently reducing cost and energy usage. High performance Lenze L-force MF three-phase AC motors were developed based on these goals. The electrical winding design is geared to a rated frequency of 120 Hz with a supply voltage of around 400 V or roughly 3,500 rpm can increase both dynamic performance and productivity. Compact and highly efficient MF three-phase AC geared motors with a 96 percent efficient GKR bevel gearbox are inverter optimized for variable motion in power ranges of 0.55 to 22 kW. Two stage GKR bevel gearboxes are characterized by high efficiency, lightweight aluminum housing and wear-free gear teeth.

For variable speed applications, L-force MF three-phase AC motors provide added value, including a compact design for space savings. Designed for tasks demanding variable setting rang-

es with minimal sizes, MF geared motors exceed efficiency class IE2 and deliver constant torque in speed ranges of 24:1. In comparison, conventional motors offer an adjustment range of only 12:1. Since the speed setting range is double that of conventional motors, MF motors allow applications that require both slow and fast speeds to be implemented using a single motor, with constant torque throughout the entire setting range. A single MF motor version can serve varied application for standardized processes. Compact L-force MF three-phase motors enable energy-efficient drive solutions without costly design alterations. Inverter-optimized asynchronous MF motors can be up to two frame sizes smaller than conventional IE2 motors, while offering the same performance output. The inertia is lower than standard AC motors, which results in high dynamic response time from 0-3500 rpm in 500 milli-seconds.

### Optimized Frequency Inverter Drive for Intelligent Energy Savings

Optimized for frequency inverter operation, more than a third of newly installed three-phase AC motors are now operated using electronic control systems. The advantages of L-force MF three-phase AC motors become even more apparent in drive packages with gearboxes and frequency inverters. By combining a decentralized inverter

drive with a high efficiency geared MF three-phase AC motor, the connection is straightforward, energy efficient—and eliminates the need for a control cabinet.

Proven in a range of industries to deliver not only optimal energy efficiency, but longer service life, the Lenze 8400 motec features a power range of 0.5-10.0 hp (0.37-7.5 kW) and offers an innovative eco energy saving function for optimizing energy in no-load and partial load operation. In parallel with MF geared motors, they form a complete mechatronic unit, with a compact structure ideal for installation directly in the system outside the control cabinet for additional space savings. The motec can eliminate wiring by daisy chain the power source among the adjacent units and with built in 24vdc to handle onboard I/O. No additional wiring is needed if a brake is required due to the brake output.

The decentralized 8400 inverter is particularly compact with a low peak height when mounted directly on the MF motor. Thanks to efficiency levels of 92 to 98 percent, the right-angle and axial gearboxes in the L-force range ensure that the energy output by the motor is transferred directly to the application with minimal losses. The inverter features the innovative energy-saving function VFC eco (Voltage Frequency Control economic). This intelligent energy saving function adapts the motor magnetizing current to actual process needs and, consequently, reduces losses, particularly in partial load operation, which in turn dramatically improves efficiency and reduces energy consumption by up to 30 percent.

### For more information:

Lenze Americas Corporation  
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[www.lenzeamericas.com](http://www.lenzeamericas.com)

# Brevini

DELIVERS CUSTOM GEARBOXES FOR OFFSHORE OPERATION

By the end of 2014, the world's largest platform installation/decommissioning and pipe laying vessel will be ready for offshore operations; and on board will be 32 high power gearboxes from Brevini Power Transmission. Capable of producing 2,000 tonnes of tension, the abandon and recovery winches will be used as part of the pipe laying equipment on board the Pieter Schelte, which is currently being built by the Korean shipyard Daewoo.

In the world of offshore oil and gas, everything is built big, and the Pieter Schelte is no exception. Owned by the Swiss-based Allseas Group, this vessel will surpass the current largest platform installation/decommissioning and pipe laying vessel by 50 percent. Measuring 382 m long and 124 m wide, the vessel is designed for the installation and removal of entire gas/oil rig topsides and their corresponding steel jacket-based platforms, as well as being able to lay pipe up to 68 inches in diameter. Once complete, the Pieter Schelte will be able to lift entire topsides weighing 48,000 tonnes and steel jackets weighing up to 25,000 tonnes in a single lift. Specialist pipelaying equipment will allow the vessel to operate in ultra-deep water and continue to push the boundaries of what was previously possible.



During pipe laying operations, it is crucial to keep the pipe under tension to maintain the bending and axial stresses within acceptable range. Through continually controlling the tension on the pipeline being laid, integrity of the pipeline is guaranteed without the necessity of extensive support structures. If poor sea conditions result in an unworkable situation, i.e. the pipeline integrity cannot be guaranteed anymore, then the abandon and recovery (A&R) winches are used

to lower the pipeline to the seabed in a precautionary abandonment procedure. When the conditions have improved, the pipe is recovered and the pipe laying operation can be continued.

The A&R winch manufacturer required a reliable and very compact design as well as fast production times, and for these reasons Brevini was selected to supply the gearboxes. The custom-made gearboxes were based on the Posired 2 High Power series, a combination of the Posired 2 product and the S series planetary reduction. This extremely powerful and efficient gearbox is capable of an output torque of 135 kNm at a speed of 23.1 rpm with an installed power of 520 kW.

The custom gearboxes were supplied with a custom-made bell housing and an integrated disc brake as well as temperature sensors for bearing and oil temperature. The specification also called for an offshore coating to be applied to ensure the package could withstand operating in the tough marine environment.

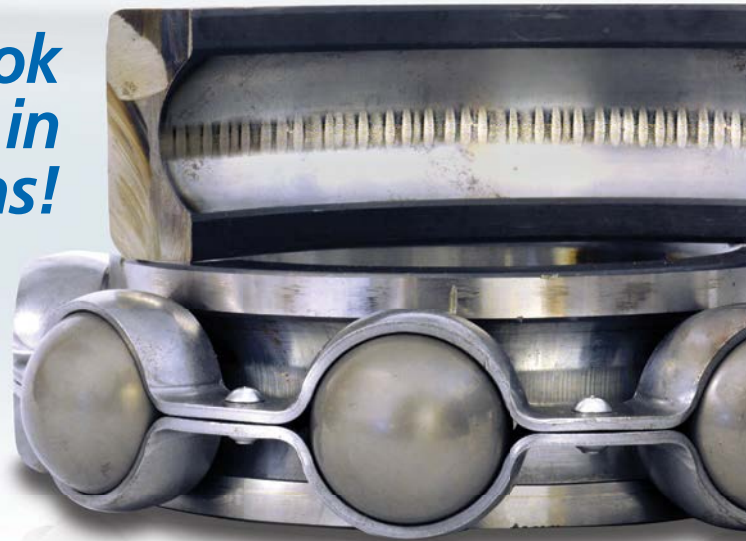
Part of the procurement process required a complete factory acceptance test (FAT), where eight units were tested under full load for eight hours. As part of this process, four of the tests were witnessed by a surveyor from the own-





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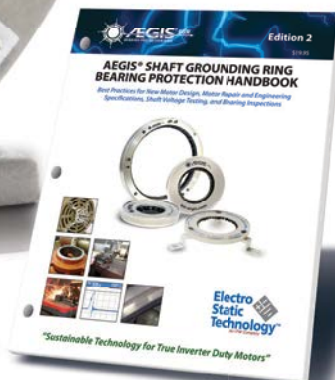


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ers of the vessel as well as the winch manufacturer. Having successfully completed assembly and testing, all 32 gearboxes were delivered, with eight being fitted to each winch assembly.

Jeff van Nobelen, project engineer at Brevini, comments, "The scale and capacity of the Pieter Schelte demanded a high powered, high quality transmission with a proven track record. We were able to provide a flexible, adaptable product that could be designed around their requirements and still delivered at a competitive price and on realistic time scale. The High Power series basically combines the benefits of both the Posired 2 range and the S series gearboxes to produce a very compact gear drive with high thermal efficiency and high torque output. Our very compact design coupled with our ability to produce 32 units of a bespoke design within a tight timeframe was instrumental in being awarded this contract."

**For more information:**  
Brevini Power Transmission U.K.  
Phone: +(44) 1925-636682  
[www.brevini.co.uk](http://www.brevini.co.uk)

## Igus

SUPPORTS URBAN COMMUTING VEHICLE

Igus recently announced that iglide self-lubricating, maintenance-free plastic bearings are being used in the design and development of a single-passenger, urban commuting vehicle. The Personal Transport Vehicle - Ground, or "PTV-G," is the brainchild of Redbud Technology LLC of Union Grove, Alabama. Its unique design uses an articulated steering geometry, which means

the inclined steering pivot is positioned just behind the occupant, and as a result reacts like a high-performance, two-wheeled motorcycle.

Iglide plastic plain bearings are used in both the independent rear suspension and in the rear wheel lean-and-tilt mechanisms. Iglide plastic bearings are suitable for the harsh, dirty operating environment



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of the vehicle since they will not corrode and require no maintenance or external lubrication. The low cost and easy installation of the bearings is also an important benefit.

In conjunction with the company's Y.E.S. (Young Engineers Support) Program, Igus donated the bearings at no cost to a group of students working on the project. This vehicle's subsystems are being assigned to high school seniors and community college and university programs as special projects in order to encourage a younger generation to participate and excel in the study of science, engineering and manufacturing technologies.

Redbud is committed to projects which serve as educational resources to advance the knowledge of those who study and practice design, engineering and manufacturing in the United States of America. Redbud seeks to establish relationships with educational institutions and seasoned mentors to foster new learning models. Igus' Y.E.S. Program has a similar mission: to foster the mechanical design ideas of students with a passion for engineering, while at the same time educating them on the merits and benefits of plastic components.

Redbud Technology is actively evolving the design and engineering of an urban commuting vehicle based on the plan form of a delta trike. The Redbud PTV-G will serve as an educational resource to help technical high school, community college and university students develop and analyze advanced single passenger commuting concepts through fundamental 3-D CAD/CAE/CAM, design, innovative engineering and economical manufacturing, assembly and lifecycle maintenance.

### For more information:

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Siemens Opens Geared Motor Assembly Plant in South Carolina  
Randy Stott, Managing Editor

Need customized gearmotors in a hurry? With the opening of its Mauldin, SC assembly facility, Siemens now believes it has a solution. At the facility's grand opening May 21, company executives explained how assembling its Simogear geared motors closer to the customers allows them to provide exactly the right configuration in a timely fashion...

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# Nexen

CLUTCHES/BRAKES HELP REDUCE MAINTENANCE COSTS

Nexen Group, Inc. announces that its high-capacity clutches and brakes, including pilot-mounted clutches, are designed for high torque, up to 302,000 inch pounds. Nexen engineered the clutches and brakes without expensive air bladders, with a design that reduces maintenance costs and improves efficiency. Specifically, the brakes and clutches include a simple piston and cylinder actuator, which is sealed with O-rings that require minimal servicing. Designed for heavy-duty industrial applications that require high torque and low inertia, the air-actuated, dual-faced brakes (DFE) and clutches as well as the quad-faced brakes (QFE) and clutches have double-disc assemblies. They are intended for applications such as conveyors, punch presses, shears, rock crushers, mills, agitators, wire winders, spoolers and similar equipment. They are available in disc sizes from 11.5 to 25 inches. The rugged clutch and brake elements have static torque ratings up to 302,000 inch pounds at 80 psi, with a bore range of up to 6.5 inches. Combined with bearing supported devices such as flywheels, pulleys or gears, the brake and clutch elements efficiently perform high torque starts and stops, reaching speeds up to 1,600 rpm and a horsepower rating of 14.7. Nexen's dual-faced, air-engaged friction clutches—DFC-1650 and DFC-2200—have a bearing mounted plate (pilot) for mounting pulleys or sprockets. Pilot mount clutches have torque capacities up to 66,800 inch pounds at 80 psi and bore sizes up to 3.375 inches. DFC clutches are capable of speeds up to 1,200 rpm and thermal horsepower dissipation of up to 10 horsepower. The clutches also have a heat sink capacity of 1.46 million foot-pounds.

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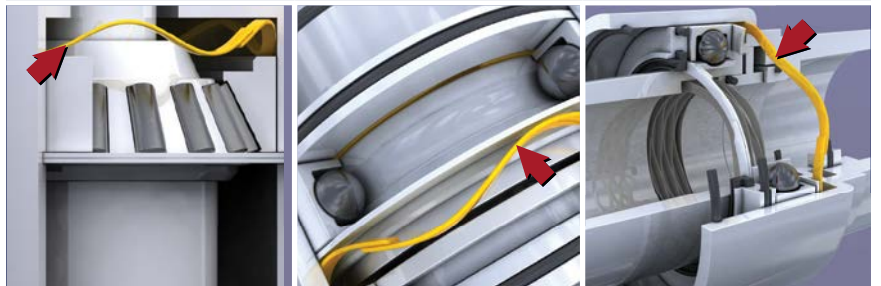
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# Micronor

## INTRODUCES ABSOLUTE ROTARY ENCODER

Micronor introduces an MRI-compatible fiber optic absolute rotary encoder system. The all-optical, non-metallic MR338 passive sensor provides precision absolute angular measurement from 0° to 360° with 13-bit (8,192 count) resolution and 12-bit multi-turn tracking. A duplex multimode fiber optic link connects the passive MR338 Sensor to the active MR330 Controller Module installed outside the MRI area. This absolute encoder system is designed for use in functional-MRI research, MRI training phantoms, EMC test facilities and other challenging electromagnetic environments where EMF and RF transparency is required.

The Micronor MR330 series absolute encoder system uses a novel optical technique. The controller transmits a burst of light to the code disk in the sensor, which accurately modulates the spectral components of the light based on angular position. The position information is imprinted in the

optical spectrum of the light and guided back to the controller for a precise position readout. The sensor requires no electrical power and houses

no electronic components whatsoever. The innovative technique was recently awarded U.S. patent 8,461,514.

Model MR330-1 SSI Controller’s powerful embedded processor and firmware offers performance plus an extended set of built-in functions and interfaces not available with resolvers or conventional electronics-based encoders. Built-in interfaces include SSI, USB, RS485, RS232, Modbus RTU, programmable digital set points and analog outputs (4-20 mA and ±10 V). The DIN-rail mount module operates from 24 VDC and supports encoder links extending up to 2,500 meters.

The MR338 MRI Absolute Position Sensor complements Micronor’s

MR328 MRI Incremental Rotary Encoder introduced three years ago. Users can now select the encoder type that best matches the feedback needs of their application. The MR338 13-bit absolute encoder is ideal for MRI applications requiring precision monitoring of absolute angular position. The MR328 incremental encoder provides 360 ppr resolution and A/B quadrature (pulse) outputs which are suited for monitoring speed and relative position tracking. Linear encoders are in development.

### For more information:

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# ABB

PLC SIMPLIFIES EXTREME ENVIRONMENT CONTROLS

A new rugged PLC system from ABB provides an easy-to-implement solution for controlling equipment operating in harsh conditions and extreme climates. ABB's "extreme conditions" AC500-XC PLC is protected against a wide variety of threats, including high and low temperatures, high humidity, low air pressure, salt mist and hazardous gases, and vibration and shock. This typically reduces system building costs by eliminating the need for sophisticated protective enclosures with special seals, HVAC, shock absorbers, EMC protection, etc.

The embedded protection features ensure that AC500-XC PLC based control systems stay functional and reliable even when operating in hostile environments. Such conditions can be found in many common automation applications including mines, tunnels, vessels, cranes, water and wastewater plants, offshore platforms, wind turbines, solar trackers and weather and navigation stations.

The AC500-XC PLC is a ruggedized variant of ABB's well-known modular AC500 PLC. Almost all of the modules in the extensive AC500 range are available in XC (eXtreme Conditions) variants, providing users with a modular control platform offering almost limitless flexibility and scalability.

AC500-XC PLCs also run exactly the same program code as the AC500, allowing users to migrate to more robust solutions easily, and simplifying development for large systems that require control systems for both standard and extreme conditions. This inter-range compatibility also extends to ABB's safety PLC, the AC500-S-XC. The mechanical dimensions and electrical specifications of connections are also the same as the standard AC500, allowing existing panel layouts and wiring harnesses or designs to be re-used.

Embedded environmental protection opens up extensive applications potential for the ABB AC500-XC. Extended



temperature operation allows the PLCs to operate in temperatures from -30 to +70 degrees C, with reliable system start-ups in temperatures as low as -40 C. With few limitations, the AC500-XC operates at up to 70 C. Circuit boards are coated to protect against high humidity levels. The PLC has extended immunity against salt mist and atmospheres with corrosive gases such as H<sub>2</sub>S, SO<sub>2</sub>, Cl<sub>2</sub> and NO<sub>2</sub>. High levels of vibration and shock can be tolerated, with accelerations up to 4 g from random vibrations up to 500 Hz, or 2 g from sinusoidal vibration. The PLC is capable of operating at altitudes up to 4,000 m. It also offers extended EMC protection against voltage surges and fast transients, as well as electrostatic discharge. "ABB's extreme conditions PLC allows automation to be sited right where the control I/O is needed," says ABB's Thomas Boenig. "The technology opens up new and more profitable design approaches for a very wide variety of automation users."

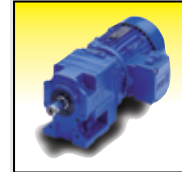
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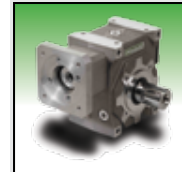
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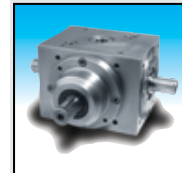
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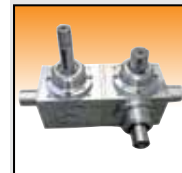
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## Tsubakimoto

LAUNCHES LN SERIES OF COUPLINGS

Tsubakimoto Chain has launched its LN Series of Jaw-Flex coupling to the European market. The high-precision coupling is specifically designed for use with servomotor drives such as those on machine tool feed shafts. Featuring vibration damping characteristics, and a simple design which makes installation extremely easy, the new range is suitable for OEM and maintenance requirements alike.

Derek Mack, sales director for Tsubaki U.K., comments: "Tsubaki is dedicated to manufacturing power transmission solutions for its customers that will improve productivity and offer industry leading reliability. The LN Series offers a choice of materials to suit specific requirements and a design which is designed to provide excellent shock absorbing qualities and superior vibration damping; both of which improve overall machine performance."

The coupling consists of two hubs, which use a simple clamping design to locate onto the drive shaft, and a spider which is available in two different materials types depending on the application. End-users can specify between material type 98A, which features excellent vibration damping, or 64D, which offers rigidity and high wear resistance. Currently there are six couplings available in the LN Series range with the ability to deliver a torque transmission range of 60 Nm to 405 Nm and accommodate shaft diameters from 12 mm to 42 mm. In applications where precision and reliability is key, such as robotic servomotor control and machine tool applications, the LN Series offers the key characteristics required within these and similar applications.

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## Thomson Industries, Inc.

INTRODUCES MAX JAC ACTUATOR

Thomson introduces Max Jac - a heavy-duty linear actuator that delivers reliable and virtually maintenance free operation while maintaining accuracy in the harshest application conditions. The IP69K rated Max Jac has a stainless steel adapter and extension tubes to help prevent leakage. Additionally, a non-contact feedback signal assures accuracy over time and eliminates the



need for re-calibration. The Max Jac has been subjected to rigorous testing and was proven to withstand: 500 hours of salt spray, exposure to aggressive substances such as fertilizers, acid, oil, grease and cleaning agents, rigorous vibration testing and continuous operation in extreme temperatures ranging from -40°C to +85°C.

"The Max Jac offers stroke lengths from 50 to 300 mm with a potential speed of 60 mm/s giving a very short overall length versus stroke. Using the latest technology and best materials available, Thomson has created an electric linear actuator designed specifically for rugged use in mobile

off-highway vehicle applications, including fertilizer or salt and sand spreaders, throttle or seeding applications, in marine, offshore, rail, mining and any other application with a large amount of wash down or exposure to aggressive substances,” says Håkan Persson, product line manager, Thomson Actuators.

The Max Jac can be custom designed by Thomson engineers to fit the widest

possible range of application needs. It comes with the option of an analogue or digital encoder output, as well as self-locking worm screw or ball screw models to accommodate the demands of the specific application.

**For more information:**

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## Boston Gear

### EXPANDS STAINLESS STEEL GEAR DRIVE LINE

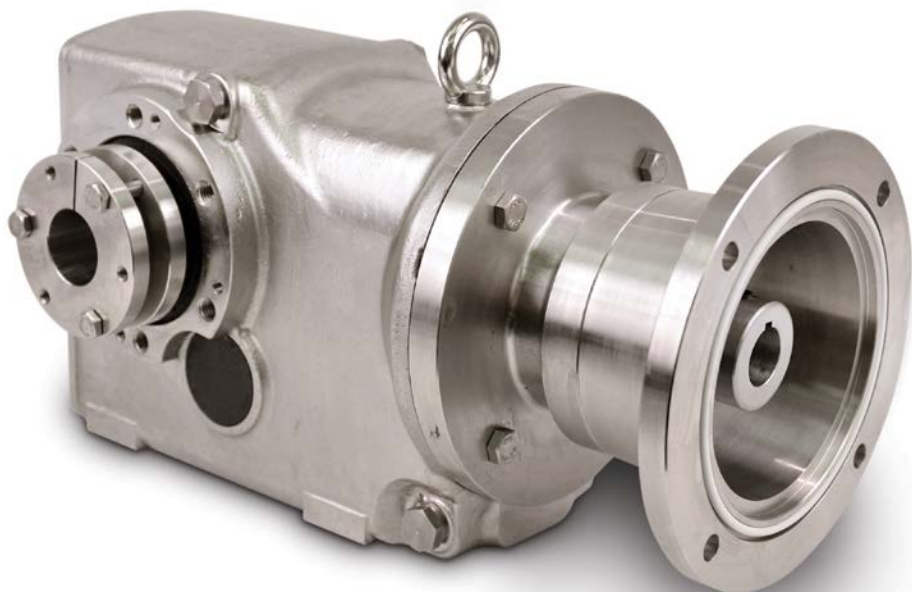
A new line of Boston Gear stainless steel, right angle helical bevel gear drives is now available with output torque up to 7,700 lb.in. (870 Nm) and input power to 10 HP (7.5kW). SS2000R models are designed to meet the demands of washdown applications including cheese slicers, dairy and bakery mixers, spiral heating and cooling racks, produce drying bins (tumblers), meat forming and carcass processing equipment, bottling lines, conveyors and palletizers.

Units feature a 316 Series stainless steel housing with domed crown and rounded corners for superior wash-down runoff in harsh environments where high-pressure caustic solvents and cleaners are utilized. A laser-marked nameplate is impervious to the effects of caustic washdowns. Stainless steel shafts and a high-pressure wash-down deflector are also available. Boston Gear Series SS2000R C-face gear

drives feature unique mounting registers and keyless tapered bushings for fast and easy installation. Other advantages include automatic entrapment of wear debris, large diameter oil fill/drain holes, synthetic lubrication and O-rings for high leak and ingress resistance. Design flexibility is enhanced with a large assortment of shaft options, a variety of optional hollow bore sizes and input styles. With the premium efficiency of ground helical gearing (98 percent per gear mesh) and increased tooth contact area, SS2000R helical bevel drives are suitable for use in high torque applications with continuous or high duty cycle operations, high-ratio reduction, and limited access installations where long life is a necessity.

**For more information:**

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# CONNECT WITH **QA1** C SERIES ROD ENDS



QA1's C Series two-piece rod ends feature a carbon steel body and a protective coating designed for corrosion resistance. Your options are endless with multiple sizes, including metric and inch measurements, right and left hand threads and optional grease fittings or PTFE lined races. For quality rod ends and great customer service, get connected with QA1.



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