Stable & Streamlined

Gear Drives Focus on Longevity, Quality and Customization

Matthew Jaster, Senior Editor

What drives innovation? Is it the product itself? Is it the engineering team behind the latest technology? Is it simply listening to the customer and determining what needs to be tweaked and modified to work more effectively? These are all acceptable answers, particularly when discussing gear drives.

Whether it's a marine, aerospace, mining, aggregate, packaging or food and beverage applications, manufacturers are focusing on areas like efficiency, flexibility, power-loss reduction and performance to enhance their product offerings in the power transmission industry.

Efficiency On-Demand

For Regal Power Transmission, customers are requiring gearing products that are long-lasting, provide documented cost savings and give them additional options for reducing stockroom inventories.

"We are transitioning from a worm gear design, which, while very popular in the marketplace and economical to produce, is limited because of the inherent sliding friction that is a characteristic of worm gear geometry," said Alton Vilhauer, product/marketing specialist at Regal. "This sliding friction reduces overall efficiency, generates heat and reduces the life of the speed reducer. Instead, we are producing a helical-hypoid product, which we have named the HERA gear drive. The helical-hypoid gearing design is very efficient, has nearly twice the torque capacity of similar sized worm speed reducers, runs cooler and lasts longer because it is rolling action in the gear mesh rather than sliding friction."

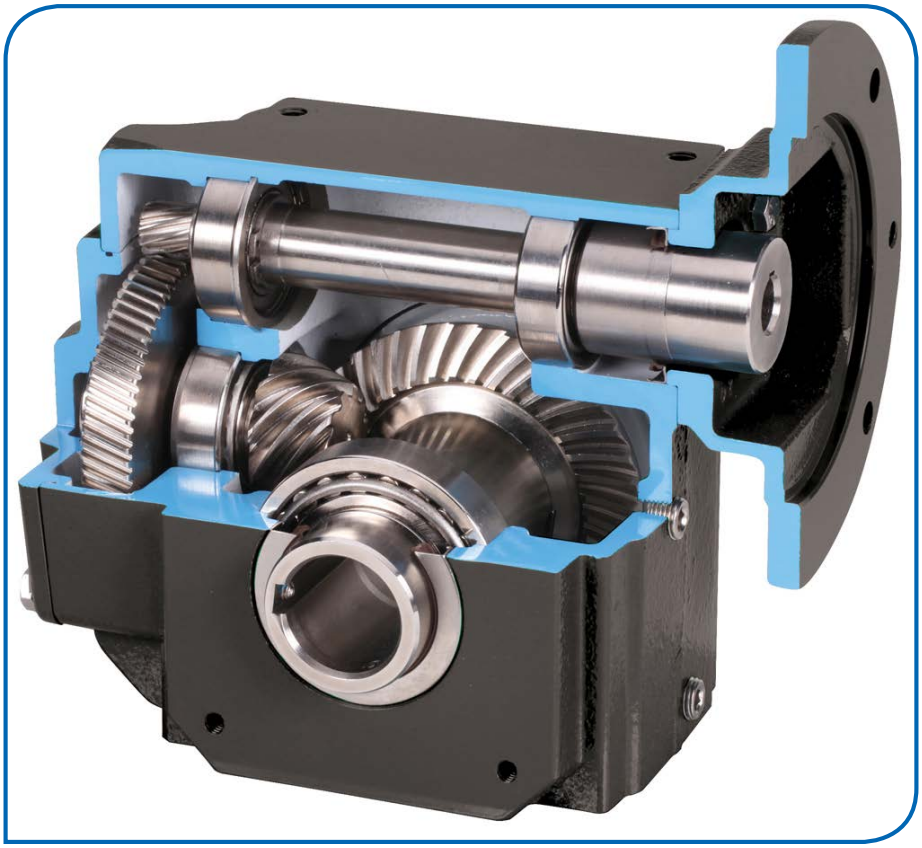
Regal is currently streamlining its manufacturing and assembly equipment and processes in order to produce the HERA gear drive more quickly and efficiently.

"Efficiency is key," added Vilhauer, "As the cost of energy continues to climb, producing a product that saves or reduces energy consumption—not only for our customers, but also in the way we manufacture it—is the direction we are going in our facilities."

One way to become more efficient is to enhance service and support. According to Vilhauer, Regal provides support, expertise and educational training sessions on all of its products and applications as well as on-site diagnostics, product selection assistance, installation commissioning, product monitoring and repair and rebuilds. These offerings all factor in to repeat business and give customers the options they need on the manufacturing floor or in the field.

Another key focal point is getting the product into the customer's hands as quickly and efficiently as possible—a key to success in the industrial environment today.

"Speed to market is one of our biggest challenges," said Vilhauer. "Meeting and exceeding customer expectations is what wins the order these days and keeps customers coming back."



The HERA gear drive solves engineering problems, reduces energy consumption and increases uptime in tough applications.

Application Flexibility

Along with efficiency gains, gears and gear drives need to be much more flexible today than in years past. Meeting the rigorous demands in the marine industry, for example, requires engineering expertise and high levels of customization.

Bonfiglioli offers a robust series of jack-up drives for lifting applications in the maritime sector. Each of the variants has four gear stages. The drives are designed for use on lifting platforms or jack-up vessels, and aside from meeting high performance requirements, they must also be able to deal with the special conditions at sea.

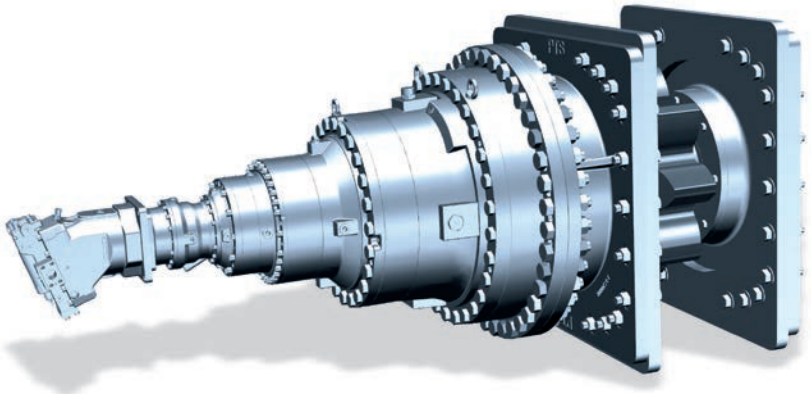
All drives have been approved in accordance with the standards set by the American Bureau of Shipping (ABS). Certificates from Det Norske Veritas and Germanischer Lloyd (DNV GL) and the China Classification Society (CCS) are also available.

The torque range of the lifting application ranges from 163,000 to 1.245 million Nm and the retention force is between 263,000 and 1.766 million Nm. The multistage planetary gears—based on the series 700T by Bonfiglioli—can be powered using a hydraulic or electric motor.

They can also be combined with parallel shaft units, which allow them to be built into smaller spaces. Optimized construction details and highly precise gearing form the basis for high efficiency and reliability of the drives.

Application-specific input and output options complete the offer and provide the necessary flexibility to meet market demands. Additionally, the engineering team is tasked with sizing and project-specific application of the jack-up drives at any time to support its customer base.

Bonfiglioli offers a wide and diverse range of products for lifting, pulling and slewing machinery in marine and offshore applications like shipboard cranes and winches, deck machinery, azimuth thrusters and pipe layers. Products include planetary gearboxes, bevel helical and parallel shaft gearboxes, electric motors and frequency controllers.



Jack-up drives for lifting applications in the maritime sector by Bonfiglioli.

Power Loss Reduction

The Voith BHS AeroMaXX technology for high speed parallel shaft gearboxes is a reliable solution featuring inner housing and optimized sleeve bearings that reduce power loss and oil consumption by 30 percent or more.

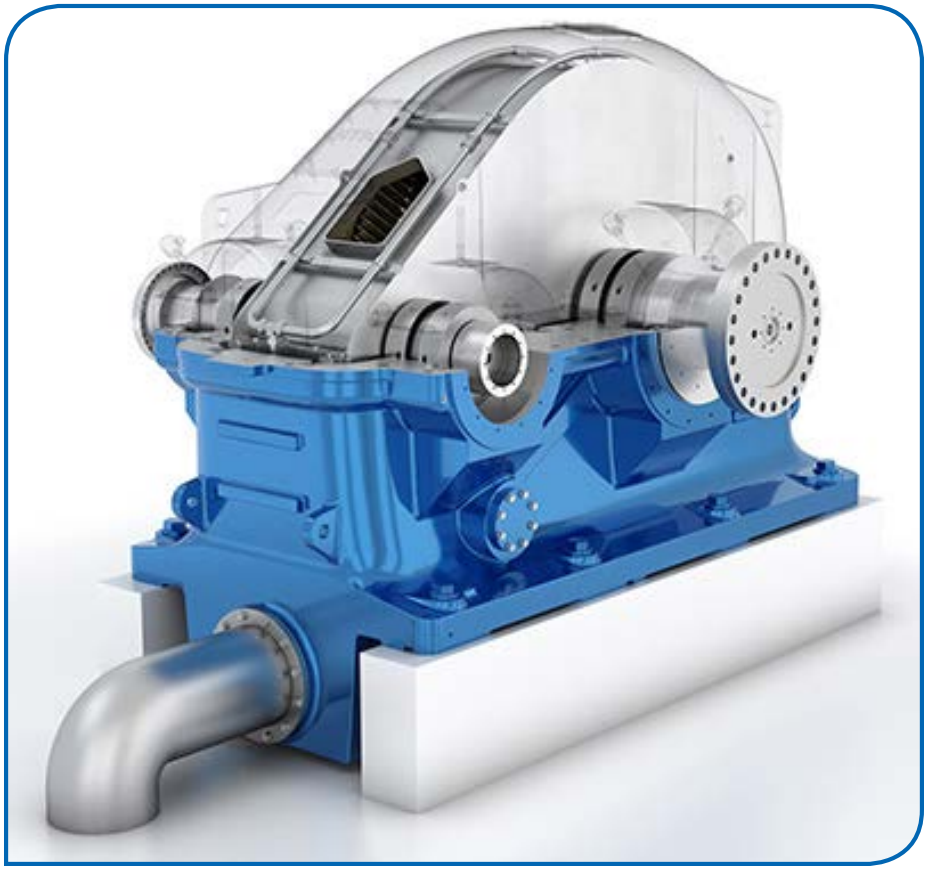
This solution has a passive-mechanical character and does not require any additional accessories. Operators profit from identical design standards, unchanged overall operating behavior and maximum reliability. Voith emphasizes this with a warranty period of 36 months – in both new systems and retrofits. The technology is manufacturer-independent and immediately available.

Due to the high pitch line velocities of up to 200 m/s, oil swirling and oil squeezing in the gear mesh account for a substantial part of the power loss of high-speed turbo gear units. The BHS AeroMaXX technology reduces these losses by separating lubrication and cooling.

An inner housing in the direct vicinity of the gear set absorbs heat and dissipates it into the bottom area on the external surface on the inner housing via cooling oil. As a result, a substantially smaller volume of oil is required for the actual lubrication of the tooth contact surfaces, and the swirling oil/air mixture is minimized.

In addition to the inner housing, the technology also includes new 'BHS EcoMax' sleeve bearings on the pinion shaft. The hydrodynamic bearings are optimized specifically for the application and guarantee high energy efficiency with significant oil savings.

By combining the inner housing and the specifically designed bearings, BHS high speed parallel shaft gearboxes with AeroMaXX technology achieve efficiency of up to 99.3 percent. At the same time, the oil consumption is reduced by at least 30 percent. Since only passive mechanical elements are used, the improvements can be achieved without any additional accessories or components such as pumps or seals. The overall operating behavior, design standards and dimensions of the gear unit are



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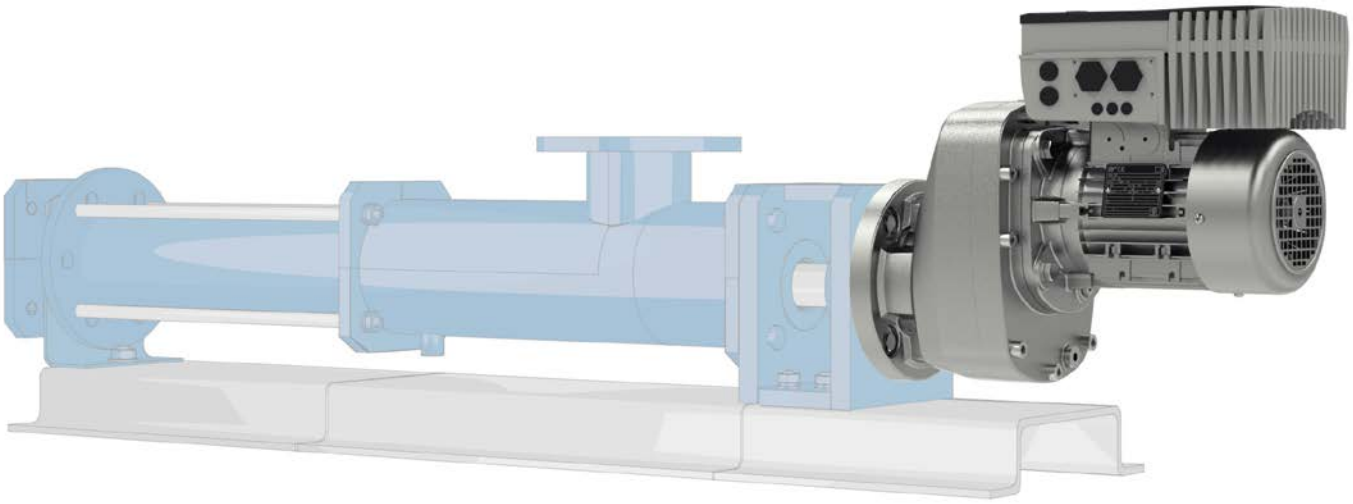

For pump applications, Nord offers highly reliable drive solutions with wide speed ranges and a high radial and axial load capacity.

also not affected by this technology. Related costs for a system operator are amortized by the energy savings alone within one to two years.

BHS AeroMaXX is designed for high pitchline velocities in connection with medium to high powers that, for example, occur in the driveline of power plants with compressors and generators. In these applications, the technology can be retrofitted in previously installed gear units during standard maintenance of the driveline, without additional downtime.

Like other options, Voith emphasizes the simplicity and reliability of BHS AeroMaXX in regards to maintenance and service. An inspection window in the inner housing allows operators to continue checking the condition of the tooth set without opening the top portion of the transmission.

Meeting Performance Demands

Nord Drivesystems offers reliable drive technology with reinforced bearings and increased bearing spacing for the processing industry. This ensures maximum radial and axial load capacities and a higher service life of the gear units.

"Standard gear units are designed to allow for a great number of ratios and, consequently, speeds," said Jörg Niermann, head of global marketing at Nord. "But with regard to component safety, they are sufficiently dimensioned to match the motor power to be expected. The bearings also comply with these expected standard requirements. Usually, a larger gear unit is chosen if the forces at the output shaft exceed the gear unit capacities. This is because a standard housing will not allow the bearing spacing to be increased or a much larger bearing to be implemented."

Nord offers application-specific equipment options that are characterized by high performance and efficiency, specially designed for pumps, agitators, and mixers whose processes result in high radial and axial bearing loads. An agitator version (VL2 bearing) with increased bearing spacing and reinforced bearings as well as a Drywell version (VL3 bearing) with additional oil drip plate and leakage or oil sensor are also available. The bearing spacing of the VL2 and VL3 versions is increased with attachments while the gear unit size remains unchanged.

In addition, Niermann said that the company offers bearings that were intentionally oversized to meet the requirements of applications such as pumps or agitators for the chemical, pharmaceutical, food and water treatment sectors. These reinforced and larger output shaft bearings allow the gear unit to absorb the high axial and radial forces and thus prolong the service life.

Don't Forget the Lubrication

One of the leading causes of gearbox failure is improper lubrication. Viscosity, additives, oil-levels, etc. must be handled correctly in order to get the most out of your equipment. Factors to consider for lubricating your gear drive include the type of gearing, the speed, the materials being used, temperature fluctuations and loading considerations. (*Editor's Note: Read more about lubricating gears and gear drives in the PTE October 2018 issue next month*).

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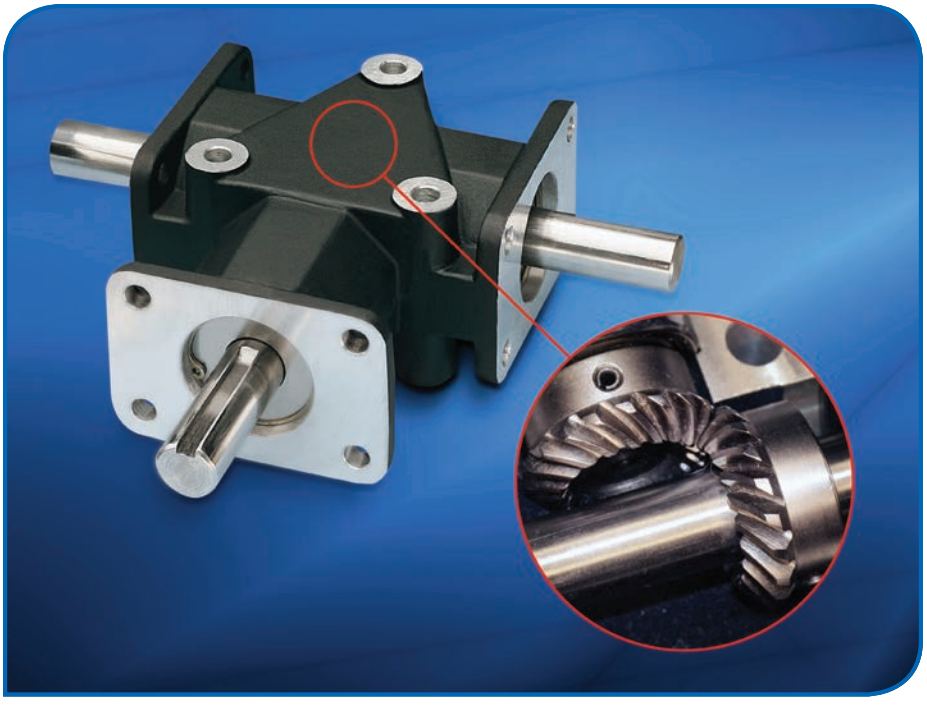
>
> **Alton Vilhauer,**
> Regal Power Transmission Solutions

Zero-Max recently unveiled a crown right angle gear drive that is lubricated for life with Beacon 325 premium grade grease. These drives feature heat treated AGMA Class 10 spiral bevel gears. This combination of bearing design and lubrication formulation ensures long-term, maintenance free operation for high performance, industrial applications.

The drives feature long-life, precision hardened and ground ball bearings handling speeds up to 2,000 rpm in most operating environments. The internal gears are permanently mounted to the shafts with the use of a press-fit and locking pins. This provides a very resilient and durable connection for use in heavy load applications while requiring no maintenance.

Lubrication with Beacon 325 grease ensures optimum performance in temperature ranges from –50°C to +120°C without evaporation. This is especially important in sealed for life systems using motors, generators and similar equipment in industrial applications.

Zero-Max ensures similar model sizes have identical performance characteristics when designed into multiple drive setups. To accomplish this, the drives are precision assembled for perfect bearing and gear alignment. The drives are pre-lubricated during assembly, then completely enclosed in a heavy-duty anodized aluminum housing. This design ensures that internal gears stay permanently aligned, lubricated and free of contamination from outside debris. A must under the extreme environments found in material handling, packaging and food and beverage applications.



Zero-Max Crown Drives have heat treated AGMA Class 10 spiral bevel gears that are lubricated for life.

Future Options

Currently, digitalized automation is a major driver of growth in gear drives where high maintenance costs quickly add up. Thus, IIoT solutions as well as the potential for 3D-printing of gears will create opportunities for additional growth. Both areas will be explored in further detail in upcoming issues of *Power Transmission Engineering*.

In regards to IIoT, Regal Power Transmission has already begun to tap into some of digital manufacturing's potential with its lifecycle services and perceptive technologies capabilities.

"We are integrating sensors and software that can help our customers monitor their systems, predict and prevent costly failures, and in some cases even enable them to control their systems remotely," Vilhauer said. "These solutions will increase the lifecycle and efficiency of our gearing products."

In the future, the company will see much more demand for efficient and power-dense gear technologies similar to the HERA gear drive.

"We will also see more incorporation and integration of smart technologies to monitor, predict and control mechanical systems," Vilhauer said.

Bonfiglioli is also focusing on IIoT solutions.

"We have a number of digital initiatives including some IIoT lab and field tests going on. From condition monitoring systems to predictive maintenance, we are firmly convinced that providing these solutions to our customers has become essential to support their growth," Campana said.

Bonfiglioli is monitoring new additive manufacturing technologies that may also be beneficial to the gear market down the road.

"Today 3D-printed geared units are a great opportunity for us in terms of prototyping and we make use of it in these terms," Campana said. "But the cost of machinery and the components produced is still very high and not convenient for production batches compared to traditional processes. There are also still some remarkable limits in material types than can be 3D printed. However, there are some new interesting 3D technologies which promise to overcome such limits coming into the market. We will keep our eyes open as it is potentially a disruptive process."

As far as the future of the gear drive market, Campana at Bonfiglioli sees trends like electrification (the replacement of hydraulic motors for example), hybridization and more energy efficient products that will surely impact gear unit design and processes.

"What we believe it is going to happen is that we will speak more and more about the system rather than single products," Campana said. "This smart system will incorporate IIoT, power electronics, electrical and mechanical products seamlessly." **PTE**

For more information:

Bonfiglioli
Phone: (859) 334-3333
www.bonfiglioli.com

Nord Drivesystems
Phone: (888) 314-6673
www.nord.com

Regal Power Transmission Solutions
Phone: (888) 626-2120
www.regalpts.com

Voith Turbo
Phone: (717) 792-7099
www.voith.com

Zero-Max
Phone: (763) 546-4300
www.zero-max.com