

Producing Better Bearings with KISSsoft and SKF

JOHANNES WÜTHRICH, DEVELOPMENT, KISSOFT AG, SWITZERLAND

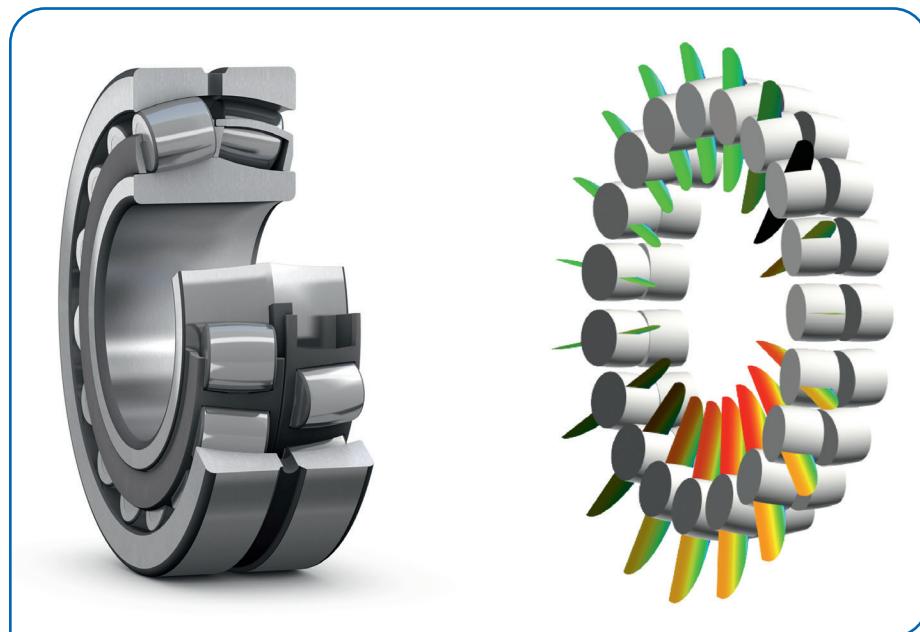
HEDZER TILLEMA, PRODUCT LINE MANAGER ENGINEERING TOOLS, SKF B.V., THE NETHERLANDS

Prediction of Bearing Performances

Predicting rolling bearing performance in operation is an essential task when designing and developing transmission systems. On one hand, bearings must meet the requirements for the desired service life. But the bearing arrangement is also a major factor defining the system stiffness. In the context of gear systems, an accurate prediction of shaft displacement is of fundamental importance, especially when sizing gear tooth modifications. The accuracy of shaft and bearing modeling is thus a key element to ensure reliable operation of such systems.

A comprehensive approach to consider rolling bearing stiffness is described in the ISO/TS 16281. By modeling the internal geometry of a bearing, realistic bearing reaction characteristics can be obtained using Hertzian theory. KISSsoft had implemented this method years ago and continuously improved its application. In combination with its efficient finite difference solver, this allows an adequate and fast shaft analysis and helps to quickly design and size gear systems including tooth modifications.

To calculate the bearing reaction, the ISO/TS 16281 requires details on the internal geometry such as number of rolling elements, rolling element diameter, length, and pitch diameter. This is typically referred to as the bearing's internal macrogeometry. Bearing designers and manufacturers



Calculations according to ISO/TS 16281 accurately predict bearing stiffness and rating life by modeling and considering the bearings' internal geometry.

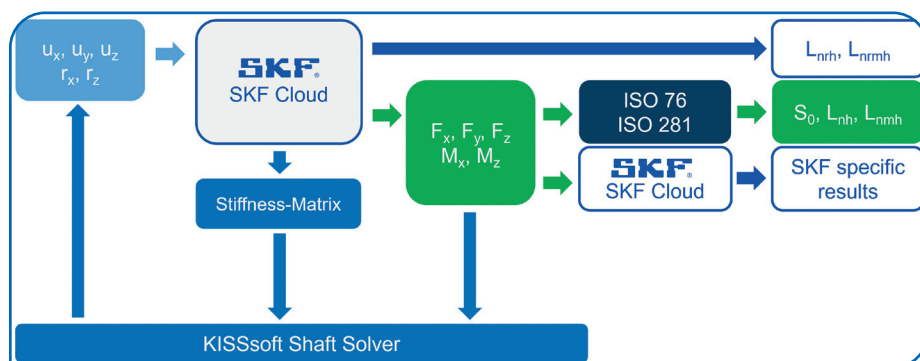
also optimize and tune further details, such as raceway and rolling element profiling. Since these details are sensitive intellectual property, usually no information is available about this so-called microgeometry. On the other hand, it is typically not very difficult to obtain the macrogeometry from a bearing. Although mostly not available as bulk data, these values can usually be derived from the drawings provided by the manufacturers.

KISSsoft: Features and Methods


KISSsoft comes with a large bearing database with catalog data of thousands of bearings from several man-

ufacturers. Most of these bearing records do not include internal geometry data. For the user of the software, it would be inefficient having to input more than just a handful of bearing internal geometry details. To still enable the profound bearing stiffness and rating life model of the ISO/TS 16281, KISSsoft estimates a bearings internal geometry based on the rating numbers, dimensions and other characteristics.

Unlike the catalog methods such as the ISO 76 or the ISO 281, which are more of a postprocessing kind, the ISO/TS 16281 is an integral part of a gear system calculation. A bearings stiffness is nonlinear and therefore very much dependent on the operating point, i.e., the load, displacement/misalignment as well as the bearing clearance. From a calculation point of view, this means that an iterative approach is required. The bearing stiffness affects a bearings reaction force, the bearing reactions forces affect the bending of a shaft system and that bending again defines the operating bearing stiffness. The calculation is considered successful, also referred to as converged, if no more relevant changes between the



The SKF cloud services seamlessly integrate into KISSsoft's modular calculation structure.



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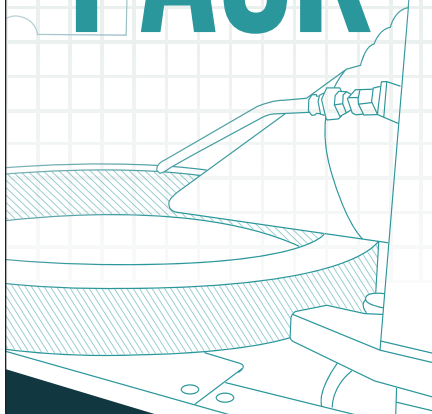
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iterations are detected.

In a single iteration step, the bearing calculation can be considered independent of the surrounding shaft system and encloses distinct boundaries, or more appropriately, a clear interface. As a main input, simply the displacement and rotation of the inner versus the outer ring are required. In return, the calculation provides the corresponding reaction forces and moments as well as an operating bearing stiffness matrix. These results can then be used in the shaft calculation for the next iteration step.

SKF Bearing Stiffness Cloud Service

This well-defined interface makes the underlying bearing calculation interchangeable and allows for a very modular setup. Following exactly this design philosophy, a new SKF bearing stiffness cloud service was integrated as part of collaboration project into the latest *KISSsoft* release: The shaft systems calculation remains the same, but the bearing calculations themselves are performed in the SKF cloud, connected through a web API. That approach gives *KISSsoft* users significant benefits for their SKF bearing calculations: The SKF calculation service itself has access to detailed macro and microgeometry and involves decades of experience in calculation-based prediction of bearing performance. There is no need for the *KISSsoft* user to have access to any of these internal details, as the modular interface simply requires the cloud service to return a bearings reaction force, reaction moment and operating stiff-

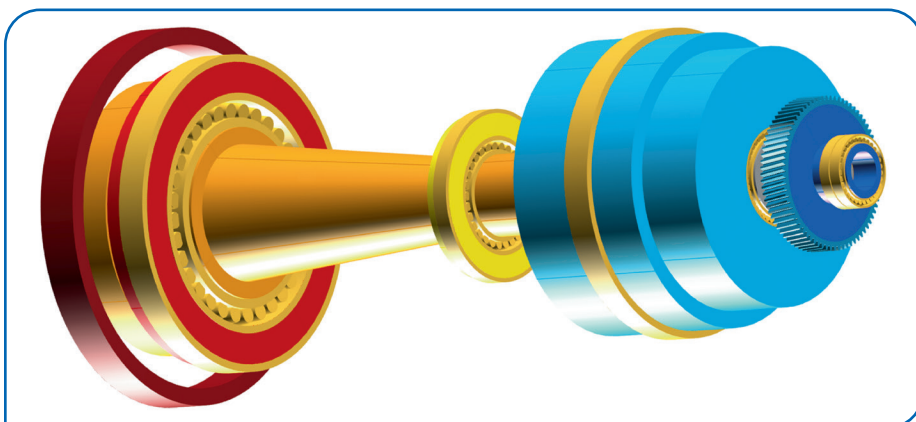
ness. Furthermore, the new SKF service also provides nominal and modified reference rating life results, considering those internal geometry details as well.

System Calculation with Cloud Benefits

Running a shaft system calculation with several bearing calculations performed on a cloud service would typically result in a major increase of calculation time, as each iteration incurs a call to the interface through the internet. Therefore, *KISSsoft* internally first runs the calculation with its own implementation of the ISO/TS 16281. Like this, a reasonable initial state can be used when switching to the SKF bearing cloud service, thus requiring only a couple of additional iterations through the web interface.

By using the new SKF bearing stiffness cloud service in *KISSsoft*, users can obtain more realistic calculation results for their shaft designs with SKF bearings. This propagates to all subsequent and connected gear and system calculations including tooth modifications sizing and improves the design scope. It is considered that cloud-based calculation and data access are an overall trend and other bearing manufacturers are expected to provide similar services in the next years as well. For the users of gear design software, such as *KISSsoft*, this is well appreciated as it drastically reduces the gap between standardized and publicly available information and nondisclosed, proprietary manufacturer know-how.

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Binder USA

ANNOUNCES SHORT VERSION OF SERIES 423 M16 CONNECTORS

Binder USA recently announced a new short version of its series 423 M16 connectors. These compact shieldable cable plugs and sockets, each with a cable clamp, are available in 10 solder and 5 crimp male and female versions to suit various pin counts. They are ideal for applications where space is tight and IP67-level protection is required, such as sensor and actuator technology, test and measurement, automation and industrial controls, and process technology.

Solder versions are designed for maximum wire gauges of 0.75 mm² or AWG 18 (2 to 8 pins), and 0.25 mm² or AWG 24 (12 to 19 pins). Rated voltages are 32 V or 150 V, depending on the pin count, with rated impulse voltages 500 V or 1.500 V, respectively. Rated currents at 40°C range from 3 A to 7 A. All solder products are equipped with brass contacts as well as bronze sockets and are specified for a temperature range from -30°C to +95°C.

Crimp products are designed for wire gauges of 0.14 to 1.0 mm² or AWG 26 to AWG 18 (4 to 6 pins), and for 0.14 to 0.75 mm² or AWG 26 to AWG 20 (7 to 8 pins). Rated voltages are 32 V or 150 V, with rated impulse voltages are 500 V or 1500 V, and the rated currents are 5 A or 6 A, respectively. The temperature range extends from -40°C to +100°C.

binder-usa.com



SMT

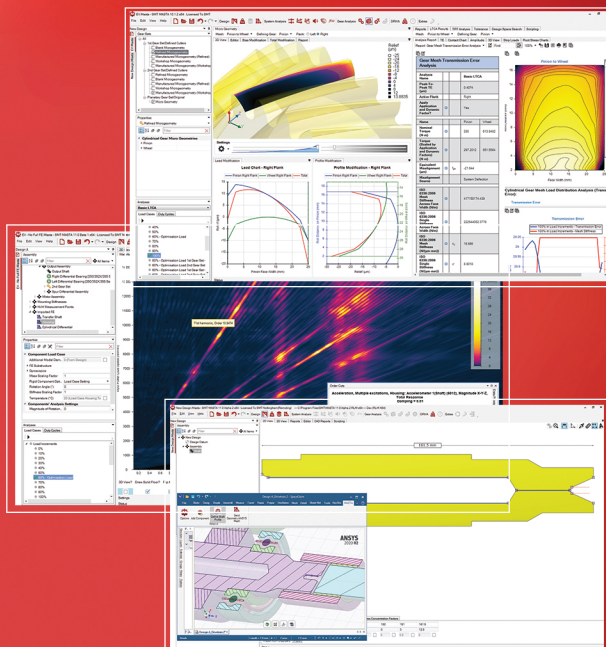
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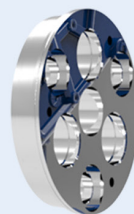
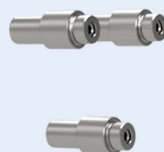
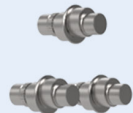
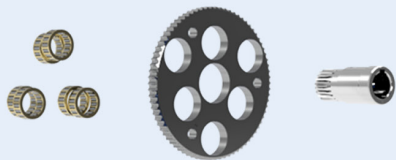
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JW Winco

EXPANDS COUPLING PORTFOLIO

Couplings from JW Winco transmit rotary motions and torques from shaft to shaft. They also even out tolerances and mechanical deflection that would otherwise result in damage to drive or measurement configurations.

JW Winco recently added couplings of aluminum and stainless steel that include designs for positive and non-positive connections. Multiple bore

diameters, various, stiffness and hardness levels of the coupling body as well as an optional keyway allow very specific customization to the given use case. In general, all couplings compensate for offsets and misalignments, accommodate runout error and axial motion, and dampen vibrations and impacts to varying degrees.

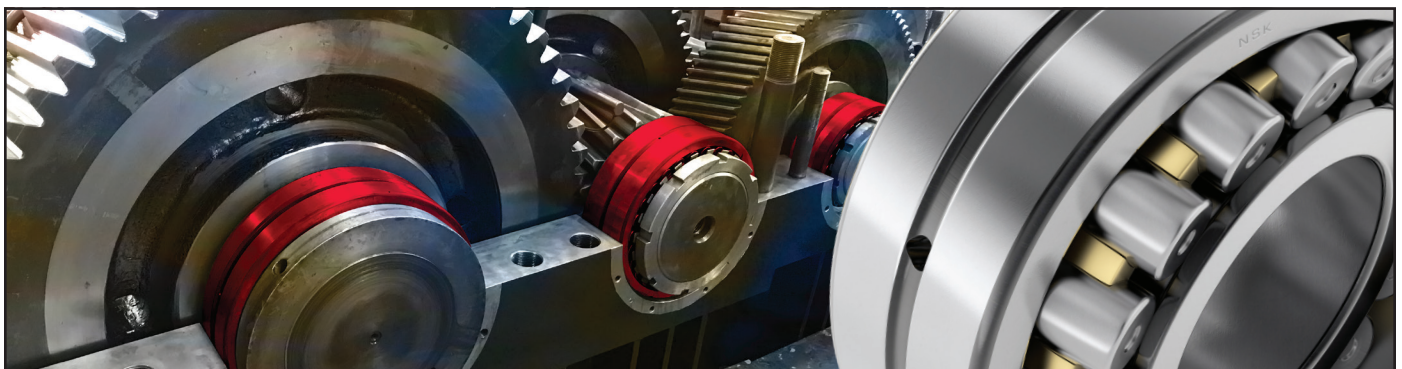
At the application level, there is a

choice between position and motion control or torque and power transmission.

For position and motion control, the rotary motion must be transmitted with very high precision and accuracy. This requires a coupling type that functions with zero backlash in the direction of rotation and has high torsional stiffness. Typical applications include servo and stepper motors for linear axes, industrial robots and test benches.

For torque and power transmission, on the other hand, the focus is on pure force transmission. This calls for couplings that can withstand high torques and heavy loads while functioning reliably in harsh conditions. Typical applications include conveyor systems, pumps and agitators, and packaging machines.

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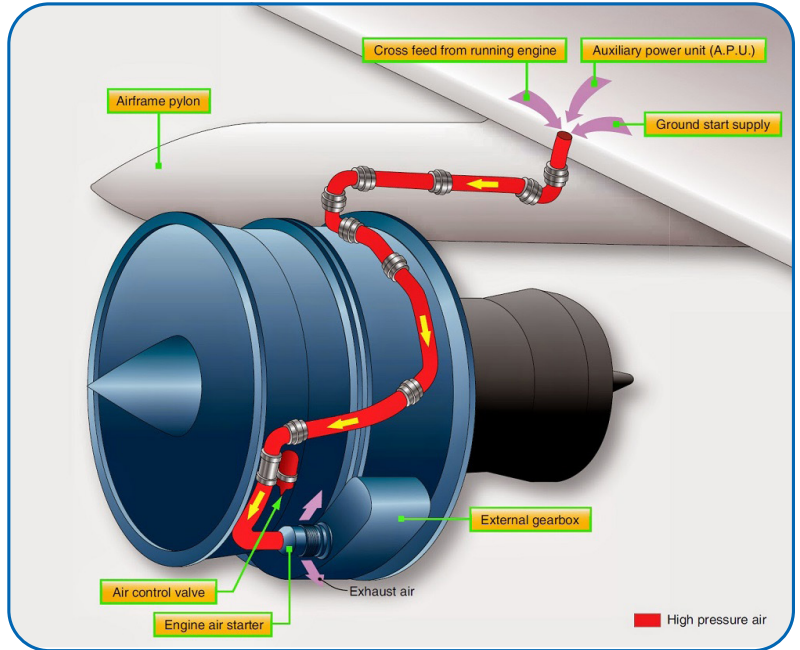
S.S. White

FEATURES ROTARY SHAFTS IN STARTER AIR VALVE

S. S. White Technologies is supplying flexible rotary shafts specifically designed to transmit rotary torque for the manual override on the Honeywell Aerospace Starter Air Valve used on GE9X turbo-fan engines selected to power Qatar Airways 777-8 freighters and Singapore Airlines 777-9 aircraft.

The Honeywell Aerospace Air Turbine Starter (ATS) consists of two components, the Starter and the Starter Air Valve. The Starter Air Valve controls air flow from the Engine Bleed, APU or Ground supply to the ATS and has significant built-in operational and protection features. One of the many features incorporates an S. S. White flexible rotary shaft that allows ground crews to manually actuate the Starter Air Valve in case of an operational failure thus enabling the aircraft to still be dispatched avoiding flight delays and cancellations.

In addition, all S. S. White aerospace flexible shaft products are designed utilizing a unique computer modeling software program developed by S.S. White called *Perflexion*. This program allows the design engineers to more fully model the behavioral characteristics of the wire bundles within the shaft core and arrive at an optimum product that provides maximum bending flexibility and torsion strength while



allowing minimal torsion deflection with up to a 30 percent improvement over competitive products.

sswhite.net

Rollon

OFFERS SMART SYSTEM ACTUATORS

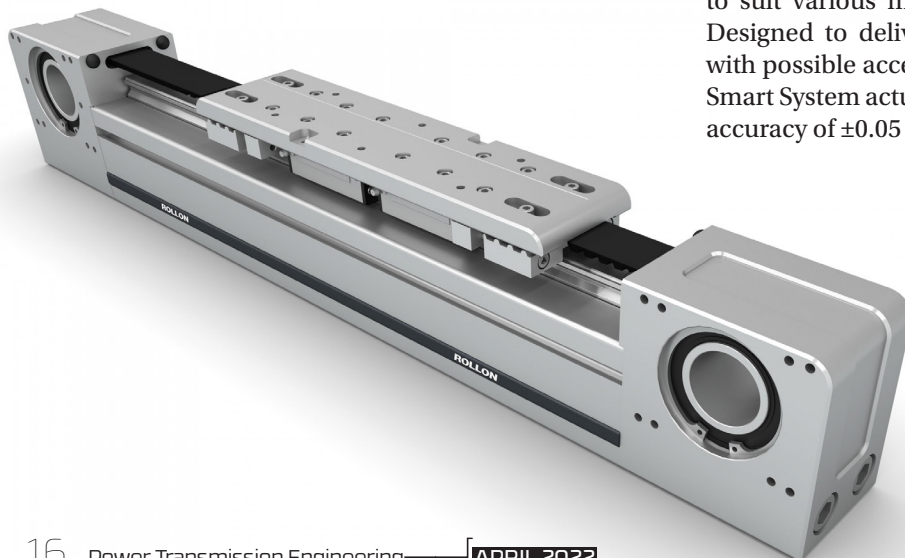
Rollon has updated its Smart System lineup of belt-driven linear actuators with a new design that supports heavy loads and ensures low maintenance operation in automated manufacturing, packaging machines and food and beverage equipment.

The actuators have a self-sustaining anodized aluminum frame and a steel reinforced driving belt, and they are engineered to provide stiffness for greater load

capacity. Symmetrical heads on both ends of the actuators allow users to assemble the gearbox in one of four different positions. The Smart System is designed to make it easy for customers to create multi-axis systems such as a two-axis Y-Z system, two parallel axis system or a three-axis X-Y-Z system using simple brackets and plates.

Rollon offers three types of Smart System actuators to suit various motion and installation requirements. Designed to deliver speeds up to five meters/second with possible acceleration of 50 meters/second², Rollon Smart System actuators also achieve a high repeatability accuracy of ± 0.05 mm.

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Southern Gear

EXPANDS BEVEL GEAR PRODUCTION

Southern Gear has added two rebuilt Gleason No. 102 Generators to its production capabilities to meet growing demand for smaller, high-precision straight bevel gears produced with the Coniflex process.

The 102s add capacity to Southern Gear's straight bevel gear production capability, which also includes Gleason No. 14 and No. 104 Coniflex Generators.

"While these dedicated, manually operated machines might seem out of place alongside the advanced CNC machines occupying most of our shop floor, they are still an excellent solution for the production of small straight bevel gears using the highly desirable Coniflex method," explains Southern Gear President Karen Malin. "Most importantly, we have the experience and operators needed to take full advantage of these machines."

The addition of the Gleason 102 Generators is part of a multi-million dollar, company-wide investment in new technologies, methodologies and processes that, over the last several years, has, according to Malin, added much needed capacity to Southern Gear's vertically integrated shop floor.

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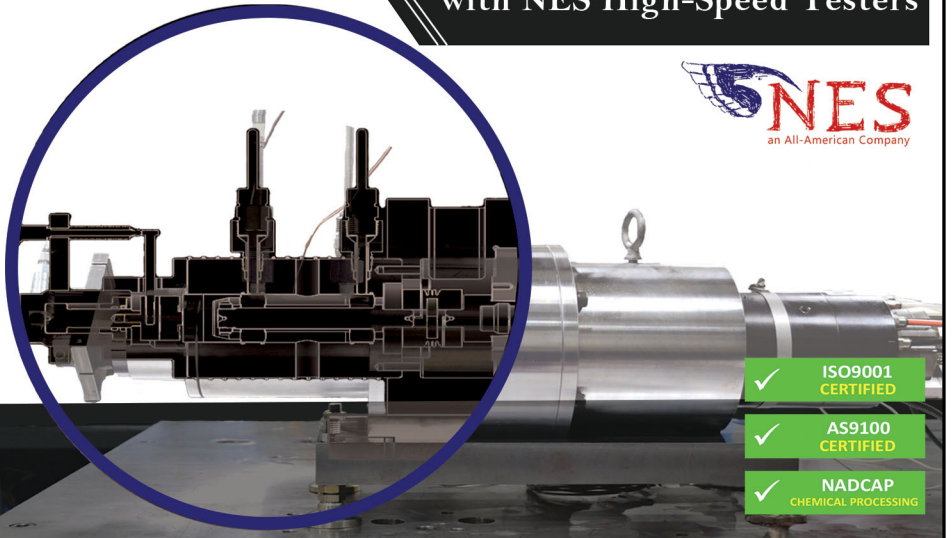
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SKF

CHOCKS ALLOW FOR EASY MOUNTING
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PERFORMANCE

SKF has developed a new range of adjustable chocks with higher load capacity and an increased adjustment range.

The Vibracon E series—which includes four different models—has improved self-leveling and height adjustment. The chocks allow all types of rotating equipment to be mounted easily and accurately to base frames and either steel or concrete foundations.

“They help to simplify the installation of rotating machinery, which improves technical and economic performance,” says Rene Vermeulen, senior engineering sales manager at SKF.

The chocks accommodate angular differences of up to 4° between machine and mounting base—without having to machine the base or install epoxy resin chocks. This self-levelling ability, combined with height adjustment, reduces the possibility of a soft foot in the production line. The chocks can also lower the cost of equipment foundations—whether designed-in or retrofitted.

The four products in the Vibracon E range are: carbon steel chocks; surface treated chocks; stainless steel chocks; and low-profile elements.

Carbon steel chocks are suitable for indoor applications, such as on the factory floor. Surface-treated products are for more extreme environments such as humid or salty climates. Stainless steel variants are aimed at the most demanding conditions, such as in the oil & gas industry. Low-profile elements offer an economic alternative to more expensive milled chocks, shims, or epoxy resins.

A broad range of specialist adjustment tools—available from SKF—allows technicians to alter chock height with maximum safety and comfort. In addition, the chocks are backed by SKF’s expertise in maintenance and shaft alignment.

SKF also offers a product selection tool that simplifies the process of choosing exactly the right chock for a particular application.

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NORD's newly redesigned 100 frame motors are the first step in updating their asynchronous motor portfolio with an optimized electrical, mechanical and visual design. The new 3 hp and 4 hp premium efficient motors offer a simplified assembly including the elimination of a copper rotor as the motors produce the same energy efficiency without it. This change results in reduced costs and sell price to the consumer. Not changing in the design are the outer dimensions and the mounting options available — direct mount, NEMA and IEC, making the new motors drop-in compatible for existing systems. While the new motors will be the preferred offering beginning Q1 2022, legacy versions are not being immediately discontinued and will still be available for a period.

The exterior of the motor has new curved cooling fins that have been adapted in depth and shape. These fins curve around the terminal box and the motor to enhance airflow and optimize cooling. Sharp edges and corners have been removed from the terminal box to smooth the design and provide easier maintenance. The need for NPT adapters has been eliminated as there are now directly integrated imperial and metric conduit connections for ease of use and reduction of parts.

Additionally, curved feet on the new design give the motor greater strength, stability and a streamlined appearance. The fan cover has also received an updated radial design and the screws of the hood have been rotated by 45 degrees, making them accessible in case a variable frequency drive is installed.

Along with visual updates, the 100 frame motors have several mechanical updates such as an optimized rotor fan assembly and encoder installation. The rotor fan has been designed



with a quick click mechanism for simple install or removal, making maintenance and replacements fast and easy. The incremental encoders have full impact protection and improved torque support added to the bearing shield. The encoder position itself has been moved between the fan and the B-end bearing shield. These assembly changes result in protection against mechanical influences and better cooling of the motor as the encoder is not blocking the fan inlet. In addition to moving the encoder position, retrofitting of encoders is now possible and with the aid of a plug-on shaft, incremental encoders can easily be retrofitted to a standard motor without replacing or reworking the rotor. Special options such as a CAN-based absolute encoder, hand wheel and cast-iron fan are still available for configuration.

nord.com

Dana

LAUNCHES BREVINI S-SERIES FOR BIOGAS AND WASTEWATER APPLICATIONS

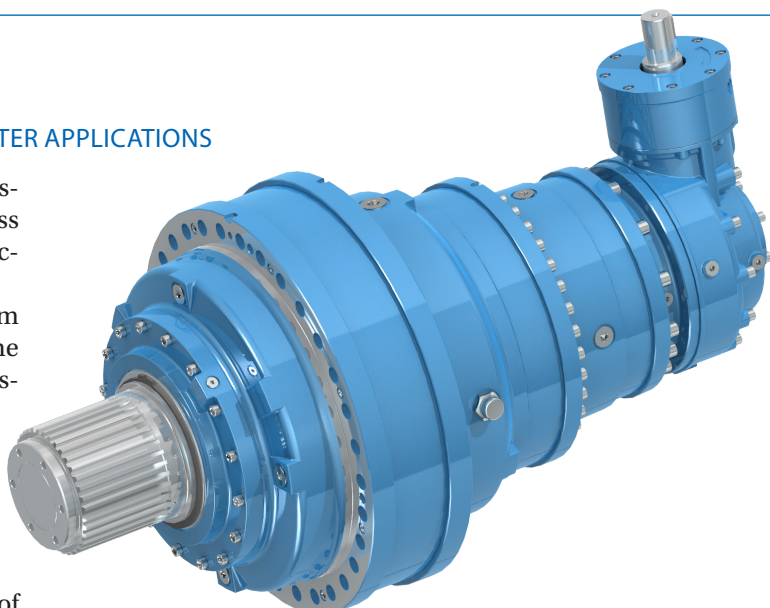
Dana Incorporated recently launched Brevini S-Series industrial planetary gearboxes specifically engineered to address the durability and reliability requirements of biogas production and wastewater treatment facilities.

Available now, Brevini S-Series gearboxes with maximum output torques up to 290 kNm are customized to drive the mixing systems used in digesters to facilitate heat transfer and keep temperatures uniform for the production of fuel-quality biogases.

Brevini S-Series gearboxes have been installed in hundreds of biogas plants throughout Europe and the Asia-Pacific region over the past 10 years. They are configured with water- and corrosion-resistant seals to propel drag chains and flights in the sedimentation tanks of wastewater treatment plants, and they meet strict international standards for preventing the ignition of flammable gases.

Providing maximum output torques of up to 140 kNm, Brevini S-Series gearboxes for wastewater treatment plants are custom-built with corrosion-resistant designs, special seals allowing for continuous submersion, and a high reduction range for improved torque.

"Dana has made a deep, robust commitment to supporting environmental responsibility in our operations, supply



chain, and the products we create," said Jeroen Decleer, senior vice president, Off-Highway Drive and Motion Systems for Dana Incorporated. "Brevini S-Series gearboxes contribute to our sustainability initiatives by playing an integral role in the production of renewable biogases that reduce the reliance on fossil fuels."

brevinipowertransmission.com

spiral bevel gearboxes



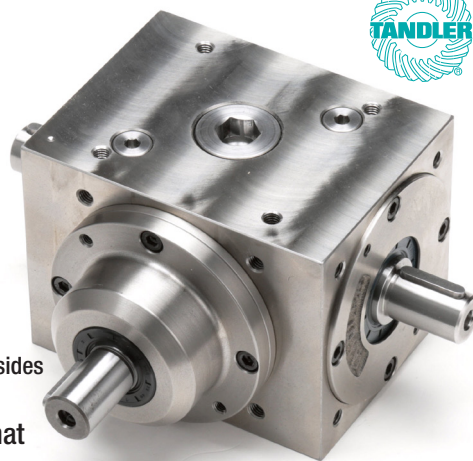
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Heidenhain

SPEED SENSOR OPTIMIZES MACHINE TOOLS

The new WMK 3010S rotational speed sensor from AMO is now available, and provides users of milling and turning machines a better option for operation of their main spindle. Besides providing speed data, the WMK 3010S also supports the capturing of operating status data of that spindle thus optimizing many costs related to the operation of the machine.

Available in North America through parent company Heidenhain, this new AMO speed sensor includes a USB interface which allows the operating status of the spindle to output to the machine control. This enables the user to record rotational speed, operating time, temperature and more.



The rugged, inductive, incremental scanning head on the WMK 3010S is available with a 1Vpp interface. It has a minimalist modular design, allowing this IP67-rated product to be installed in existing customer designs without significant modifications. It is available in the common industry line count increments and can be operated up to a max of 50,000 rpm.

heidenhain.us

Mach III

CUSTOM CLUTCH SIMPLIFIES SALMON CROWDER SYSTEM

Mach III recently supplied custom torque limiters for a salmon hatchery in Port Armstrong, Alaska. This hatchery uses moving fences — or “crowders” — to push adult salmon from one end of a 50-foot raceway to the other end, corralling the fish for egg and milt harvesting. The hatchery uses a direct drive motor system that must be manually operated.

Once the fish density reaches its predetermined limit, the operator turns off the drive. As the salmon are removed from the crowder’s receiving end, the density lessens and the operator turns the drive on again to push more fish forward. In an ideal situation, the operator would activate the crowder, which would continuously push the fish forward as other salmon are removed, thus maintaining a consistent density.

Although the company had friction torque limiters in place, these components required frequent disc replacement. What this company needed was a hands-off motion control solution that could begin slipping once the system reached its preset resistance point, all while inching the salmon forward with constant pressure.

To meet these application requirements, Mach III engineers designed a custom C5D2K-002 clutch to retrofit the

hatchery’s crowder system, enabling the operators to monitor the operation without worrying about manually turning the drive on and off. The clutch incorporates a dual port rotary union for actuation and is sealed for protection against the wet environment. The drive disc is ventilated via an air inlet and filter vent, allowing cool air to flow through the case and dissipating the 213-watt thermal load from the disc’s continuous slipping.

Additional specifications of this custom clutch included 1,557 inch-pound (in-lb) capacity, operating pressure of 30–40 pounds per square inch (psi), and cooling air pressure at 5–10 psi.

In addition, because the initial rotations per minute specification was higher than needed, the hatchery installed a variable frequency drive (VFD) to reduce the drive motor speed, cutting down the friction temperature from 240° to 120°F. After installing the new clutch, the company has informed us that it has been functioning flawlessly, enabling the hatchery to successfully harvest 50 million eggs with zero problems. Thanks to the hatchery system’s higher efficiency and throughput, our client can now begin its egg-take procedures without worry.

machiii.com



Thordon Bearings

INTRODUCES WATER LUBRICATED SHAFT SEAL

Thordon Bearings BlueWater Seal is a new propeller shaft seal with a unique Safe Return to Port (SRTTP) design that specifically meets commercial shipping industry needs for low maintenance and robust shaft seals. The Thordon BlueWater Seal completes the COMPAC open seawater lubricated propeller shaft bearing system.

Commenting on the development, Thordon Bearings' Technical Director, Anthony Hamilton, said: "The BlueWater Seal meets growing market demand for a complete propeller shaft line solution from a single source. Although we can offer the seal as an individual component, it forms a fundamental part of the Thordon COMPAC open seawater lubricated propeller shaft bearing system."

The COMPAC system includes Thordon's proprietary seawater lubricated COMPAC bearings, shaft liners, ThorShield anticorrosion shaft coating, a Thordon Water Quality Package, a Thordon Bearing Condition Monitoring System and the new BlueWater Seal.

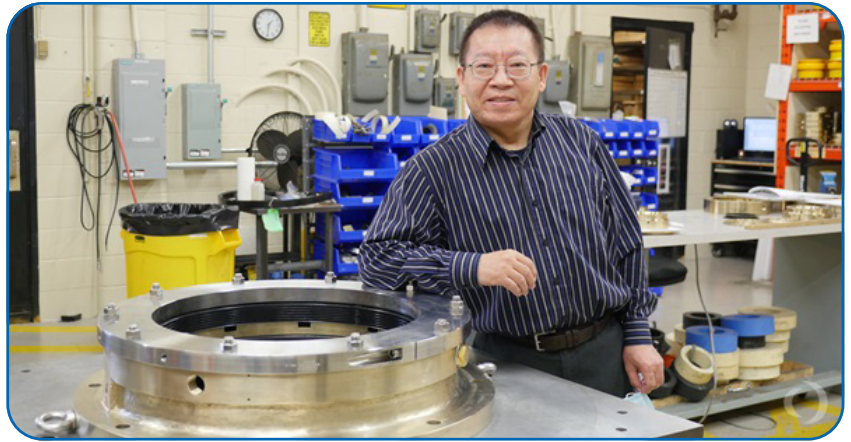
The seal can be installed to all vessels with shaft diameters between 300 mm to 1,000 mm (11.8 to 39.4 in) and is simple to install, operate and maintain.

This technology, developed in-house by Chief Research Engineer Gary Ren, allows the facing elements of the seal to operate almost without any friction. In practical terms, it means the seal is much better suited to variable and low draught conditions — a key benefit to a globally operating merchant ship.

During comparative trials on Thordon's full-scale test rig in Burlington, Ontario, Canada, the seal operated without friction spikes and considerably less friction than similar seals leading to reduced wear, longer life and less maintenance.

"This seal minimizes water leakage and dramatically improves hydrodynamic and lubrication efficiency," explained Hamilton. "The development is a real boon to those ship owners and operators looking to adopt an open seawater lubricated shaft line arrangement as the entire propeller shaft line system can now be sourced from one company," he said.

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