Eaton Airflex Torque Limiting Couplings

DECREASES MAINTENANCE COSTS AND DOWNTIME FOR MINERAL PROCESSING APPLICATIONS

Eaton has been well-versed in clutches for mineral processing applications for decades. "I was visiting a Canadian mining operation and looking over drawings from an Eaton air clutch from the 1960s," said Mike Williams, product line manager for Airflex at Eaton. "It was pretty amazing to see the decades of design and application experience that Eaton has maintained in this industry. We've taken this knowledge and applied it to our new generation of torque limiting couplings."

Eaton has been providing coupling technology in mineral processing since the early 1990s, according to Williams. "We're now just beginning to commercialize these products as we're seeing a significant shift from clutch-based drivelines to variable frequency drive (VFD) systems in grinding mills."

The Airflex TLCs are available in a wide range of sizes, from 51 to 76 inches, with a torque range capacity of 2.5 to 12.1 million inch-pounds on grinding mill applications of 4,000 hp and above. These couplings protect equipment from damage during torque overloads. They are designed to reset and restart automatically and instantaneously, allowing maximum uptime for mill operators.

"The Airflex TLC is electromechanical to a point," Williams said. "There's an automatic control system built in so when a torque overload or slip is detected it will automatically disengage the coupling between the motor and pinion. By varying the applied air pressure, the coupling automatically resets."

An operator doesn't have to enter the driveline area to reset the component. "You simply have to reset the external control panel and hit the go button," Williams added. "This leads to significant time and cost savings. Additionally, the torque settings remain constant through service life, requiring no periodic adjustments, lubrication, calibration or other preventative maintenance."

Eaton took decades of mill operational field data to come up with this technology. The company has utilized both its clutches and couplings to upgrade mining operations in Canada, Chile and Mexico, and are actively pursuing other opportunities globally. As is the case with most industrial applications, the trend is to develop components with a smaller footprint by offering weight and size reductions. "Shrinking the size of the clutches and couplings will have a positive effect on the longevity of the equipment," Williams said. "We recently worked with a mining operation in Mexico, for example, where we offered the option of downsizing from a 76-in. TLC to a 66-in. version. A lot of these components are interchangeable and, despite being a newer product, they were willing to trust Eaton's capabilities without previous experience in their application."

As this technology becomes more popular, Eaton will continue to target opportunities in mineral processing. "We have to make sure we're adapting our components to help solve the problems associated with torque spikes and overloads," Williams said.

Additionally, Eaton is paying close attention to the Industrial Internet of Things (IIoT). "We have a lot of resources as a power management company, particularly in electronics and hydraulics to really look into feedback control. As safety requirements become more restricted in this industry, it would be beneficial to give our operators the ability to remote-in utilizing a tablet, for example," Williams said. "There are plenty of opportunities in this area that we're currently looking into."

In the near future, Williams would like to meet with Eaton engineers to see how products like *Pro-FX* software

Amy Sovina
Lead Gear Inspector

She'll put 27,000 hours into your gear inspection

In an increasingly complex industry where quality is paramount, it's nice to know that Amy Sovina's in our Quality Assurance Lab. Yes, we've invested millions in one of the industry's most advanced and productive quality rooms, but you can't put a price on experience. Or reliability. Or results. With 27,000 hours' of inspection experience, there's almost nothing that Amy, or our other FCG quality experts, haven't seen.

Gear quality challenges? Relax. Amy's got this.

Excellence Without Exception

FOREST CITY GEAR

or the AxisPro line can be adapted to the company's Airflex couplings, (*Ed's note: See sidebar right*).

"I think we're going to start seeing a lot of this technology in our coupling, clutch and brake products," Williams added. "The ability to get metrics on everything we're doing in real-time will be extremely helpful to our customers moving forward."

For more information:
Eaton
Phone: (800) 386-1991
www.eaton.com

Adapting to the Industrial Internet of Things (IIoT)

Mike Williams, product line manager for Airflex at Eaton, believes the next step in the evolution of the Airflex product line is to incorporate some of the technologies Eaton is already offering in areas like electronics and hydraulics. "We'd like to take some of the technologies found in our AxisPro products or *Pro-FX* controls and software and see how they can be used in our torque limiting couplings," Williams said.

Eaton's AxisPro product helps simplify machine control for demanding applications including injection and blow molding machines, large press applications, die casting, primary metals, test and simulation and wood processing applications. These valves offer on-board motion control, enabling closed loop drive control without the need for expensive motion control cards. Together with the ability to configure the valve using *Pro-FX Configure* software, an AxisPro valve simplifies machine control for distributors and end users alike. The valve also features built-in diagnostic light-emitting diodes (LEDs) and a CANopen bus that makes system commissioning and debugging easier.

With *Pro-FX* electronic controls and software, Eaton has the ability to simplify electric control integration without sacrificing customization options. The software comes with six programming languages, including graphical and textual, as well as an extensive set of function block libraries. The libraries contain pre-configured software objects to help customers rapidly develop their applications.

Eaton's ability to combine knowledge from electrical, hydraulic and mechanical solutions will be pivotal in the company's drive toward improving productivity, machine efficiency and operator safety," Williams said.

To learn more about these Eaton products please visit *www.eaton.com/axispro* or *www.eaton.com/pro-fx.com*.

PART FAILS. FINGERS POINT. PROGRESS HALTS.

NOT A PRETTY PICTURE.

Reliability earned us our reputation. With more products than ever, it will also ensure we keep it. At Schafer Industries, our reputation for superior gear solutions has led us into a more diverse product offering. Our capital investments mean tighter tolerances, more efficient automation and expanded capabilities including large-scale gears for construction/mining applications and driveline extensions resulting in reduced gear noise and improved strength.

Here at Schafer, we're continually investing in our future in terms of technology and the caliber of people we hire. Backed by a workforce committed to quality, our engineering teams provide innovative, custom solutions. Our customer service staff understands the value of business relationships and and our on-time delivery record is second to none. So whether you're in the automotive, truck, marine, off-road leisure, heavy equipment or aviation industry, Schafer has the capabilities to deliver. For more information visit us online.

SCHAFER
INDUSTRIES

SchaferIndustries.com

Suhner

MANUFACTURES LOW-BACKLASH, LOW-NOISE SPIRAL BEVEL GEARS

Suhner Manufacturing Inc. offers low-backlash and low-noise spiral bevel gears within its diverse range of power transmission products utilizing the Palloid and Zyklo-Palloid hobbing processes which the company began using in the late 1950s.

Palloid-toothed gears are based on a technical development from straight-toothed to spiral-toothed bevel gears. Thereby the teeth are hobbed in a continuous procedure with a conical hob. The combination of this continuous process on a single thread tool leads to a very accurate pitch of the teeth.

Since the Zyklo-Palloid gear hobbing meets and exceeds all high-quality manufacturing prerequisites, one-off, small and large lot size production can be applied equally. In the Palloid-System, since the teeth are hobbed in a continuous process, the Module (Mn) can be freely selected. Therefore, a very high flexibility for the gear dimensioning and bevel gear calculation is provided.

While both tooth systems have similar insensitivity characteristics for bearings, a high contact ratio as well as a very accurate pitch, the cost efficiency and the high load root radius of the Palloid-System should be specially mentioned.

A further development on the proven Zyklo-Palloid-Toothing (soft-cut) is named "HPG-S hard cut". The thermal deformation, caused from heat treatment, will be eliminated with boron nitride coated knifes. Therefore, the surface quality on the tooth flanks will reach grinding quality, according to DIN 3965, Part 3 (Quality 4 – 6 is available). "Better quality, approaching grinding quality (*without grinding*) is the key to our process," said Todd Newsom, product manager at Suhner.

In combination with the material, the surface treatment and the adjustment of the required lubrication, spiral bevel gears are a suitable solution when it comes to redirecting the maximum torque. All these can be achieved with small space and high mechanical efficiency. "The difference using HPG and HPG-S spiral bevel gears is the tooth flank surfaces – HPG is Rt < or = 4 µm/20 micro-inch and HPG-S is Rt < or = 2 µm/10 micro-inch, even

smoother. The result is getting up to 30 percent greater load carrying capacity due to desired tooth contact pattern without heat treatment allowances. There is a longer tooth contact pattern with HPG and HPG-S than with cut and lapped gears," Newsom said.

Engineering Considerations

Because of the sophisticated combination of the different spiral bevel gear angles, the circumferential force is divided in several components that can lead to significant axial forces. Therefore, gear design depends a lot on the bearings. The bearings have to absorb all the axial forces so the bevel gears do not move under load.

Any movement would affect the contact pattern of the teeth, which would result in edge wear that could destroy the entire gear. Just as important as the bearing, is the stiffness and the geometrical accuracy of the case. The advantages of spiral bevel gears can be obtained when gears are optimally positioned and perfect tooth contact is maintained. When dimensioning the gear geometry, several criteria must be considered: required ratio, number of teeth and space/conditions. The criteria must be decided at the start of the engineering process.

"In order to prevent teeth from breaking, all spiral gear teeth have a slight amount of "flex" under a load. However, these deflections are very small in comparison to the flexibility of the gear support shaft and bearings. Proper engineering considerations must be made at the beginning of designing any application requiring spiral bevel gears. If the elastic motions on the gear and pinion supporting shafts and bearing are 'too much,' no spiral bevel gear set is going to survive very long," Newsom said.

For more information:
Suhner Manufacturing, Inc.
Phone: (706) 235-8046
www.suhner.com

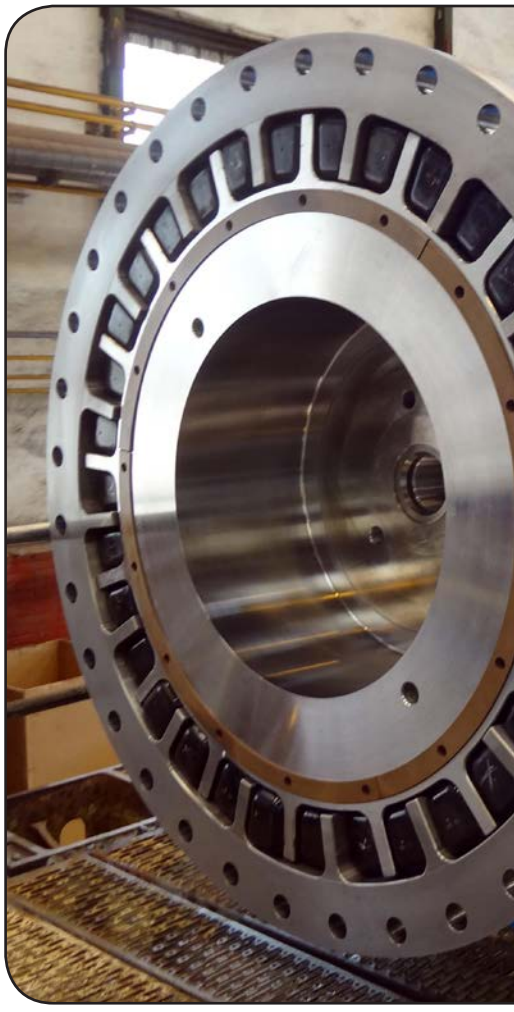
Regal Power Transmission

LAUNCHES TORQUE-AMPLIFICATION ANALYSIS PROGRAM

Regal Power Transmission Solutions (PTS) has launched a torque-amplification measurement and analysis program for precisely measuring the true torque loads and vibration frequencies experienced by rolling mill drives, as part of a program to help mills process tougher alloys, increase output with thicker slabs or higher speeds, protect against cold-end slabs, or mitigate torsional vibration. Developed under Regal's Kop-Flex brand, the Perceptive Technologies TqM torque amplification analysis program combines computer modeling of complex drives with true torque measurements to determine the actual torque amplification factor (TAF) on the drive, instead of inferring it from motor current readings. Kop-Flex then engineers solutions that

reduce TAF and torsional vibration using alterations of coupling stiffness, improved overload protection, resilient couplings and other strategies.

"TAF can be defined as the peak torque divided by the rolling torque," explained Chris Carrigan, director of application engineering and lifecycle services at Regal PTS. "It's a unit-less factor that illustrates the severity of a torque spike in terms of magnitude. It is affected by system dynamics or how the inertias and stiffnesses are distributed across a complex drivetrain. Entry conditions, such as slab temperature, speed, angular clearances and backlash in gear components all play a role. The old rule of thumb for mill drives was to keep the TAF under 2.5, but with motor sizes increasing, slab thickness increasing and new alloys being processed, the old rules don't apply. As rolling torque increases, so will peak torque, degrading overload protection devices, bearings, couplings, work rolls, etc. Often the first sign of a torsional problem is equipment failure."



TAF analysis applies measured torque readings to 3D mode shape analysis to visualize how a drive train twists at various locations to determine where to alter stiffness or increase damping. "We use torque monitoring hardware developed by Regal Kop-Flex for high-speed turbomachinery drives, so it is already mill-hardened, accurate and capable of high-rate data sampling," said Carrigan. "High-rate sampling using strain gages allows the system to capture momentary torque spikes that would normally be unseen on motor current readings because of the high-inertia in these drives. At lower sampling rates, peak torque measurements are often truncated because the system cannot capture them. High-rate sampling is a must to capture these events in a complex, high-inertia drive."

According to Carrigan, Kop-Flex has used the technology to engineer TAF reductions as high as 50 percent. TAF data capture and analysis can be a temporary service or it can be integrated with a mill's condition monitoring system as an ongoing service. Regal PTS offers Perceptive Technologies condition monitoring equipment and diagnostics for the steel industry to track bearing vibration, temperature and other data. Additional data on torque loads allows the mill to correlate the measured torque with slab temperature, force on the work rolls, speed, gap, etc., so engineers can better understand the root cause and make needed changes on scheduled downtime, before cumulative damage leads to an unscheduled outage.

For more information:
Regal Power Transmission
Phone: (410) 787-8430
www.regalbeloit.com

Force Control

HAZARDOUS BRAKES PROVIDE LONGER SERVICE LIFE

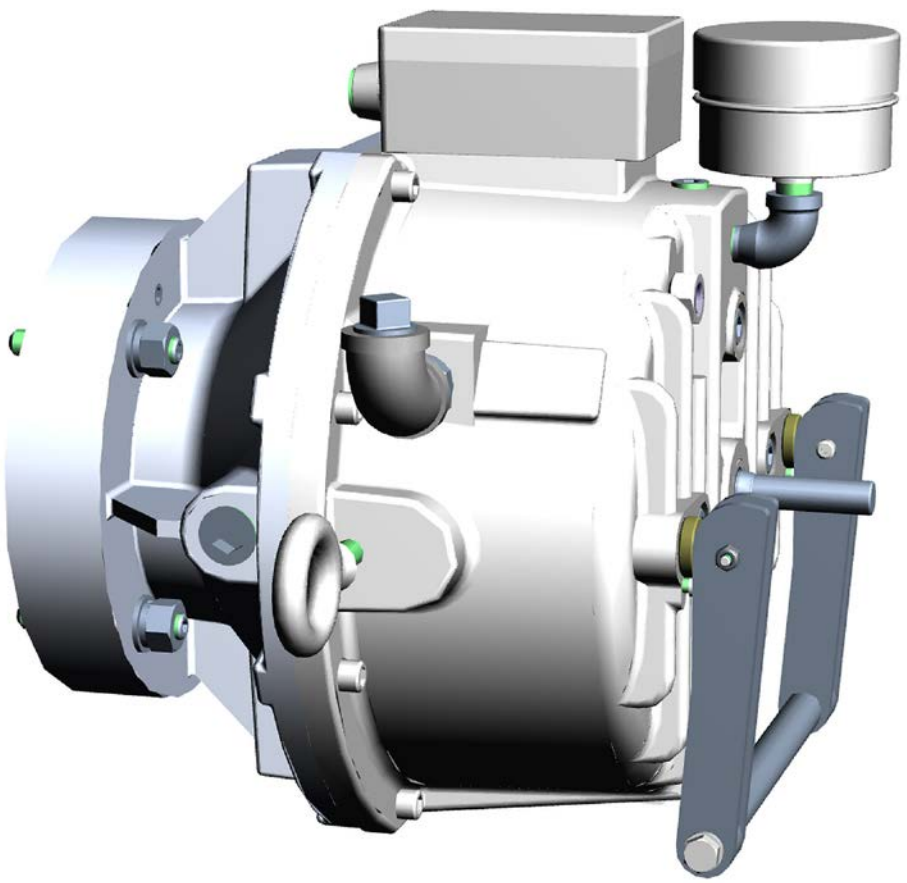
Force Control MagnaShearT hazardous duty brakes, which employ oil shear technology, now meet Class I and Class II Div 2 specifications (Div 1 in process with approval forthcoming). With spring set torque ratings from three to 900 foot-pounds available, MagnaShearT motor brakes can be sized to the correct torque independent of the motor frame size or horsepower. They also feature "quick mount" features for quick and easy mounting to drive motors in NEMA frame sizes 56 to 405.

These proven motor brakes are totally enclosed from outside contaminants, with seal integrity for harsh and washdown environments. A modular design /assembly allows for ease of servicing and maintenance. MagnaShearT motor brakes are suitable for applications where the motor is reversed each cycle such as cranes, winches, and hoists as well as ship and railcar loader/unloader conveyors, tippers, sweep samplers and more.

Proven oil shear technology transmits torque between lubricated surfaces - thereby eliminating wear on friction surfaces, providing longer service life with no maintenance or adjustment. A patented fluid recirculation system dissipates heat - eliminating heat build-up which is the most common problem in dry braking systems.

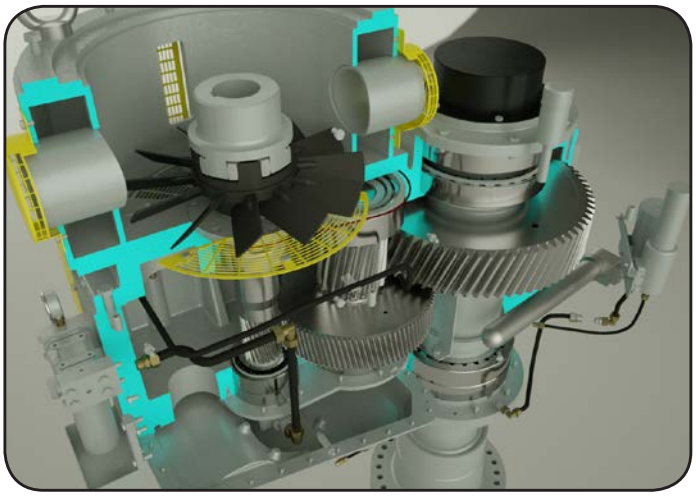
The oil shear technology also provides a smooth "cushioned" stop which reduces shock to the drive system, further extending service life of downstream components. The totally enclosed MagnaShearT brakes are impervious to moisture, dirt and dust that is common in coal prep plants as well as the bulk handling of coal, aggregates and more.

For more information:
Force Control Industries
Phone: (800) 829-3244
www.forcecontrol.com



Santasalo

LAUNCHES VERTICAL MOUNTED GEAR UNITS



Santasalo is pleased to announce the launch of the AMF vertical mounted gear unit series. The AMF is purpose-built for the most demanding vertical applications with high external forces without the need for external cooling. By incorporating a bidirectional axial fan, optimized housing design and additional new features, Santasalo's AMF vertical gear unit provides high thermal capacity and eliminates the need for external cooling in extreme ambient conditions.

The AMF gear units feature Santasalo's proven drive technology, in operation in thousands of vertical mixing applications around the world. Direct drive construction with electrical motor and flexible HSS coupling ensures high efficiency, while the highly optimized gear unit layout results in cost savings and a smaller footprint. More on the AMF design can be seen on the product animation at the website below.

These two or three-stage vertically mounted helical gear units feature a power range of up to 750 kW and nominal output torque of up to 200 kNm, as well as a reversible operational direction. Their robust design ensures they're easy to transport and install without risk of damages.

Santasalo already delivered the first order for the AMF gear unit series in Kazakhstan (five units) and two additional projects are currently being delivered for fine grinding applications in the United States (six units), and Australia (three units).

"We are very pleased to introduce this completely new product for very demanding process industry mixing applications. It reflects our deep understanding of the tough requirements within process industries which we have gained over the decades," said Pasi Jokela, senior vice president of global capital sales at Santasalo.

"Our R&D team has made high performance gear units suitable for the most demanding agitating and mixing applications. Some of our key customers have already selected products from this new AMF line which tell us the real story of the AMF gear unit's superior features to meet demanding customer's needs."

For more information:
Santasalo Gears Inc.
Phone: (864) 627-1700
www.santasalo.com/products/flotation-drive