

Warner Electric

Boston Gear

TB Wood's

Formsprag Clutch

Wichita Clutch

Marland Clutch

Industrial Clutch

Bauer Gear Motor

Svendborg Brakes

Nuttall Gear

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Excerpted From

Driving Forward



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Driving Forward

by Robert Pell

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Drives and motors are used to power an array of equipment in mining operations, from conveyors, and crushing/grinding equipment to flotation cells and pumps. The major challenges associated with powering mining equipment is the increased scale of operations and the accompanying requirement for increased power, whilst maintaining reliability. There are a range of companies that provide drives and motors for the mining industry, some of which are mining specific whilst others cover a range of industries.

Bauer Gear Motors has launched a new Ex-approved, IE4 Super Premium Efficiency motor. The new S Series is the latest development to Bauer's permanent magnet synchronous motor (PMSM) motor range. The IE4 has the highest achievable energy efficiency rating within the motor technology, making the S Series the most efficient motor that can be used in an explosion hazardous area. Motors for use in explosion hazardous areas are exempt from the EU regulations on minimum energy efficiency because explosion protection takes precedence over energy savings. This has traditionally meant that overall energy efficiency has waned, however, the S Series of Bauer's PMSM motor range, available from 0.55 kW to 15 kW are classified for Zones 1 and 21.

The S Series also has the advantage of maintaining constant speed independent of the load. PMSM synchronous motors offer considerably improved efficiency when compared to induction motors even under partial load conditions; and extremely high efficiency under rated operating conditions. They also have considerably higher power density, which, for geared motors, yields higher system efficiency with minimal installation volume – and also reduced weight. Importantly, PMSM drives can produce higher torque values for the same installation volume as conventional induction motors, a factor that allows cost savings, through the ability to specify a smaller motor size in some applications.

Protecting drive system components

Protecting machinery and systems against expensive failures and costly downtime is indispensable to large scale mining operations; so many technologies are available to protect machinery against overloads. Andrew Bargh of Bibby Turboflex, part of Altra Industrial Motion's couplings division indicated that "large machinery and rotating systems can generate enough rotating energy to cause significant machine damage during a jam, crash stop, or during uncontrolled braking due to, for example, a power failure. At very low speeds, systems can develop a huge amount of unnecessary torque, which can damage drive system components such as shafts, gearboxes, chain and couplings." Some of the technologies available to protect machinery include:

- Shear pins have protected rotating equipment for centuries, but lack accuracy and can require extensive repair time following overload. To maximise plant uptime and improve the accuracy of release torque, vendors have developed a variety of torque overload release devices with integral bearings and simple mechanical reset features.
- Friction clutches are one of the most common types of clutch; however, as a safety device in a higher load application, they can slip and wear, producing inaccurate and changeable torque settings.



The IE4 Super Premium Efficiency PMSM (permanent magnet synchronous motors) S series can achieve energy savings of up to 40% compared to an IE2 inverter-driven squirrel cage motor.

- Sensing devices, such as current sensors, monitor one particular aspect of the drive and provide an output or alarm when that function deviates from preset norms for a preset time period.
- Electronic control devices continuously monitor the machine, comparing, for example, the difference between actual and theoretical positions of various components.

The final two points cover electrical torque limiting solutions, which are increasingly popular in many industries as they offer increased accuracy and reduced downtime following the overload. A sensor is used to detect a problem, and initiate corrective actions such as stopping and reversing the drive, engaging the brake or shutting down the machine. Bargh states that “the protective functions integrated into today’s sensing and control units are an expedient supplement to the mechanical torque limiting clutch, but not a replacement. Thus, mechanical torque limiters still make sense, but not necessarily for every application.” There is also the issue concerning the speed of the collision. For ‘hard’ collisions, when the speed or mass of the rotating components is at a high level, electronic controls may not be able to react before significant damage occurs. At these speeds, only a mechanical overload device can react quickly enough to prevent damage. The complexity of each system should also be considered, especially in applications which are remote or have limited access. Electronic monitoring systems need multiple sensors for data; between the monitoring system and all of its sensors and other components the system has multiple possible points of failure. Once installed, a mechanical limiter can be left *in-situ* with minimal maintenance, and yet offer complete reliability in the case of overload.

Bibby Turboflex has developed a range of UEP modular torque limiters with an emphasis on simple installation, accurate release torque repeatability, simple fast manual re-engagement, and low cost maintenance. The UEP range of modular torque limiters was designed specifically to offer alternatives to shear pin protection for high torque drives where its accurate release torque repeatability coupled with a fast reset feature offers a significant reduction in downtime.

The optimised design of the UEP torque limiters also means that installation is highly flexible, enabling the centre section of the torque limiter to be removed without the need to move the motor or gearbox. Similar design versatility ensures that any maintenance of the modules is a straightforward operation, and that recalibration is a simple removal operation achieved without having to replace the complete torque limiter unit.

When considering how best to protect machinery from overload it is important to consider the different scenarios where this might occur. Electrical monitoring or sensing equipment can initiate corrective actions prior to overload during a slow torque increase, however, there are times when the increase is too fast and the electrical system may be too slow to prevent damage to other components.



Turboflex's UEP (Ultimate Extruder Protection) modular torque limiting devices provide accurate release torque repeatability, simple manual re-engagement and low-cost maintenance.

About Altra Industrial Motion

Altra Industrial Motion (NASDAQ:AIMC) is a leading multi-national designer, producer and marketer of a wide range of electromechanical power transmission products. The company brings together strong brands covering over 40 product lines with production facilities in nine countries.

Altra's leading brands include Boston Gear, Warner Electric, TB Wood's, Formsprag Clutch, Wichita Clutch, Industrial Clutch, Ameridrives Couplings, Kilian Manufacturing, Marland Clutch, Nuttall Gear, Bauer Gear Motor, Svendborg Brakes, Stieber Clutch, Twiflex Limited, Bibby Turboflex, Matrix International, Inertia Dynamics, Huco Dynatork, Lamiflex Couplings, Ameridrives Power Transmission, Delroyd Worm Gear and Warner Linear. For information on any of these technology leaders, visit www.AltraMotion.com or call 815-389-3771.



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