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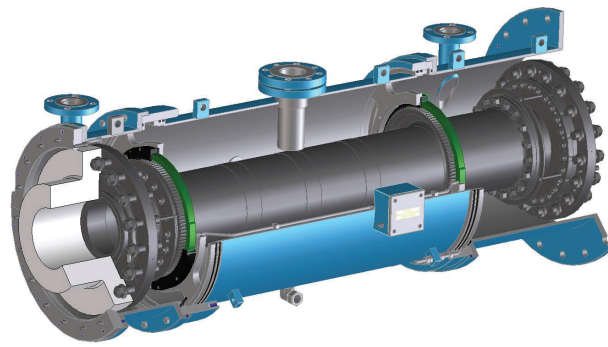
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Smart Couplings Remove Guesswork



As seen in
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Smart Couplings Remove Guesswork from Measurements in Machinery Applications

By Jack McGuinn

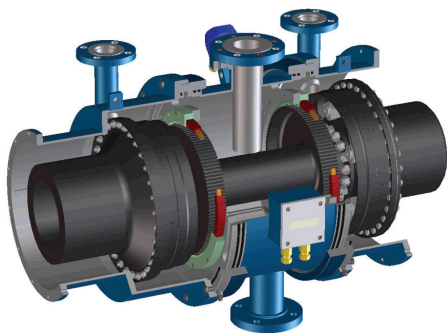
Senior Editor, Power Transmission Engineering

Quite often, the collection of precise data in drive technology applications can be problematic. Data monitoring in a rotating drivetrain is difficult because a direct networking cable connection is often not an available option. Nothing sends shivers down the spine of for example, a production line manager or a system integrator like uncertainty. That's why achieving precise measurement of things like torque and other parameters in machinery applications is, while daunting, a dearly desired goal, especially if those measurements are only available at the drive and motor.

Accordingly, couplings used in machinery and other applications today are being developed with a "smarts" and "intelligence" never seen before in such hardware. Coupling manufacturers are now producing couplings with leading edge measuring capabilities by virtue of adding sensors and software to the equation. These custom coupling are thus creating a new paradigm in manufacturing by enabling the wireless transmission of mechanical data from directly within components like, for example, a rotating drivetrain.

Call it "smart" or "intelligent" coupling (take your pick), this new technology provides a coupling system with measurement capabilities that are taken directly in the drivetrain, providing enhanced data acquisition and enhanced transparency in the drivetrain in a timely manner.

Following in much greater detail is a discussion regarding this latest advance in coupling technology. Our responders include: Tim Nageli (TN), global sales manager-mill products-Ameridrives and Mark O'Neil (MO), chief principal engineer, Altra Couplings.



Continuous-duty torque monitoring system installed on coupling within an isolated enclosure for oil & gas/ petrochem installations. When torque is applied to a rotating shaft a twist is produced. This twist is directly proportional to the torque applied. The spacer shaft of the coupling is a convenient place to measure the twist. Twist is measured from phase between two signals generated at either end of the spacer. Illustration courtesy of Torquemeters Ltd.

In drive technology, why is accurate measurement of torque and other parameters in machinery (drivetrain) applications so important?

Tim Nageli/Mark O'Neil: Measuring torque, vibration and other machinery conditions significantly reduces machine failures, downtime for repairs and stock of spare parts while increasing efficiency, production and component service life.

O'Neil: On turbomachinery in a petrochemical plant, for example, a single day of an individual out-of-service compressor can shut down the entire process and cost millions of dollars. Monitoring systems can identify performance deterioration. A decrease in torque indicates a problem such as excessive turbine or compressor wear that causes an efficiency loss. Proper monitoring allows users to trend the torque transmission and performance of their equipment. The data collected allows the user to schedule and perform any required preventative maintenance in a more controlled time frame versus the stress associated with a costly, unplanned equipment failure.

Special precautions are often taken in oil refineries, petrochemical plants and other potentially explosive environments, where torque monitors and strain gages are installed. Couplings are often positioned within isolated enclosures that can be gas purged since these monitoring systems require electric current to operate and can potentially emit a spark. Incorporating “intrinsically-safe” ATEX-approved equipment that does not cause sparks is preferred.

Continuous-duty torque monitoring is often a requirement on natural gas pipelines. Compressor stations, typically placed 40 to 70 miles apart along the pipeline, are required to boost/maintain proper pressure through the pipeline’s entire length. To control costs, usually only every 4th or 5th station is manned. The remaining stations utilize continuous torque and vibration monitoring systems that relay data to a central pipeline control room. In this way, the performance of all turbine/coupling/compressor drivetrains along the pipeline can be viewed in real-time to identify any potential problems as they arise that can lead to a potentially catastrophic system failure.

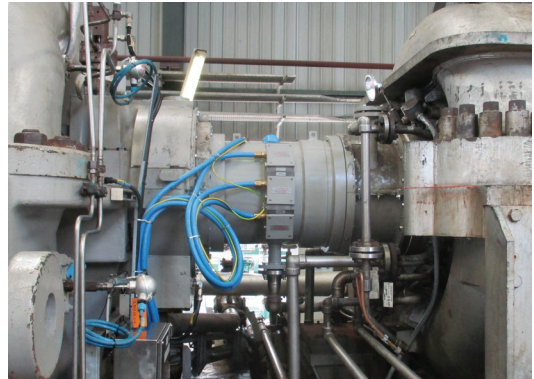
Why are measurements taken at the drive and motor in drive technology often insufficient?

Nageli: On metal mill applications, U-Joint and gear spindle measurements taken at the motor are often a motor current reading average over a certain length of time. It has been proven that within that time length, the mill can experience significant torque spikes at the roll end that are averaged out with the current or not read as high as they are. Also, the gearing and equipment through the complete drivetrain dampens the torque spikes.

How sophisticated is the software used in conjunction with the sensors?

Nageli: Permanent systems that can be measured remotely in real time can be quite elaborate. Temporary systems, installed for troubleshooting certain applications that aren’t as sophisticated, collect data that is read and analyzed later.

O’Neil: Many drivetrains utilize sophisticated VFD/ AFD controls. Care must be taken when monitoring equipment in these applications since these types of variable frequency drives can cause a 20% variation in torque in extreme cases. Special software with very high data sampling rates are required to evaluate these types of applications.



Enclosed coupling with a torque monitoring system that provides 3 independent readings at an oil & gas refinery in Tunisia. Photo courtesy of Torquemeters Ltd.

How are the sensors incorporated into the couplings?

Nageli: In mill applications, strain gages are added to the spacer section of universal joints or gear spindles along with a protective casing, power, and remote antenna. Strain gages are a good diagnostic tool. There are cost-effective short-term systems and more robust long-term continuous-duty systems available.

Is this enhanced measurement regimen IIoT-driven?

O'Neil: Torque monitoring systems have been available and widely used throughout various industries for many years. The growth of the IIoT has raised awareness of these types of remote performance monitoring devices. While most large couplings could benefit from torque monitoring, the reality is that many of the sophisticated torque monitoring systems currently on the market have associated costs that exceed the cost of the actual coupling being monitored. Hopefully, as newer technologies evolve, the cost of these important devices will begin to come down.



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