Energy Efficient Motor Coupling

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PPL ELECTRIC UTILITIES

Case Study | **The Hershey Company** | *2010*

Snapshot

Objective: The Hershey Company, North America's largest producer of quality chocolate, is committed to reducing its electrical demand by 2 percent annually, its electrical consumption by 3 percent annually and its carbon footprint by 10 percent, with an emphasis on its plant facilities having zero landfill impact. The company wanted to demonstrate the energy-savings potential of replacing a conventional motor-to-pump connection with a magnetic coupling that transmits torque through an air gap.

Solution: The Hershey Company had a centrifugal-type, raw-water service pump fitted with a magnetic coupling. The physical attributes of a magnetic coupling not only saves energy but extends equipment life because it eliminates vibration. The physical separation the coupling created between the motor and the pump also allows for visual inspections of the movement of the pump shaft, which could detect the need for repair and prevent catastrophic failure. As a result of this demonstration project, the company is able to capture energy savings in an area where it was previously impossible with conventional motor couplings, and anticipates extended equipment life. The Hershey Company has started to identify other potential sites for the new coupling and is evaluating similar technology used for adjustable-speed drives.

Results

Energy Consumption: The calculated decrease in consumption amounted to a 26 percent reduction of nearly 135,000 kWh per year.

Alignment: The Hershey Company's policy is to perform laser-alignments on all of its rotating equipment, but the fact that the magnetic coupling can operate under greater tolerances of alignment makes laser-aligning a customer option. Those who forgo that option will realize additional savings.

Power at Start-up: Higher reliability of new system.

Applications

Conveyors • Bulk Material Handling • Compressors • Fans • Blowers • Chippers • Shredders • Crushers • Mixers and Pumps up to 5000 hp

Background:

The Hershey Company (NYSE: HSY) is the largest producer of quality chocolate in North America and a global leader in chocolate and sugar confectionery. It is headquartered in Hershey, Pennsylvania, and has operations throughout the world with more than 12,000 employees and revenues of more than $5 billion.

The company is engaged in energy and carbon footprint reduction programs with goals to:

- Reduce electrical demand by 2 percent annually.
- Reduce electrical consumption by 3 percent annually.
- Reduce its carbon footprint by 10 percent, with an emphasis on its plant facilities having zero landfill impact.

The Hershey Company worked with PPL Electric Utilities and a coupling manufacturer to demonstrate the energy-savings potential of replacing a conventional motor-to-pump connection with a magnetic coupling that transmits torque through an air gap.

Application:

This project retrofitted a 125-hp, 1780-rpm, raw-water service pump with a magnetic coupling. The magnetic coupling was first installed and placed into operation on November 27, 2009. The pump is a centrifugal-type pump, manufactured by Worthington, which boosts water from the onsite well system to the raw-water storage tank. The pump starts and stops automatically as the tank level fluctuates. Its normal operation is 2 starts per hour after which it runs for 15 minutes continuously, changing to 3 starts per hour during the summer months.

The coupling was installed by a manufacturer that provides magnetic couplings, mechanical soft-starts, torque-limiting couplings and adjustable-speed drives to a wide range of industries. Each of these products operates with rare-earth permanent magnets and copper conductors, the physics of which inherently save energy. Each also physically disconnects the motor from the load, thereby saving energy and extending the life of the drive train. The relative motion between the conductor rotor and extremely powerful permanent magnets contained in the magnet rotor creates a magnetic field in the conductor's rotor, transmitting torque across the space between the components and, in this case, turning the pump shaft. Again, this not only saves energy but extends equipment life because the coupling eliminates vibration transmission and can tolerate up to an eighth of an inch of misalignment between shafts.

The test used a commercially available magnetic coupling with no modifications required to the drivetrain other than a new coupling guard.

After the coupling was first installed, vibration on the motor and the pump dropped significantly. However, observations of visual movement of the pump shaft indicated that the pump had a thrust bearing with abnormal wear. This observation was possible only due to the physical separation the new coupling created between the motor and the pump. Otherwise, it might have gone unnoticed until a complete bearing failure in the pump occurred, causing potential plant downtime.

Since the existing pump needed repair to prevent catastrophic failure, The Hershey Company decided to install a new pump and then compare data based on the benchmark of a typical hard-coupled system versus the system with the magnetic coupling in place.

Conclusion:

The previous data proved this project to be a success. The Hershey Company is able to capture energy savings in an area where it was previously impossible with conventional motor couplings. In addition, the company expects the equipment life (motor, pump and downstream valves) to be extended.

The previous pumping operation required that a downstream valve be throttled significantly to operate the motor under its specifications, about 150 amps. This action would keep the motor from overheating, but it shortened the valve's life by exposing it to unnecessary stresses due to the possibility of cavitation from higher-than-necessary velocities. The use of a magnetic coupling means the valve need not be throttled and can be used as intended, left in the "open" position, and for isolation only. The magnetic drive's inherent energy reduction now allows the pump to run within the motor specifications.

Observed overall reduction in vibration of the motor and pump amounted to 15 percent. This vibration reduction, while difficult to quantify in terms of cost in downtime, man-hours and equipment maintenance, could result in thousands of dollars of additional O&M savings and a shorter overall simple payback. This project's simple payback based on energy savings alone for the coupling and the installation is less than one year.

Next Steps:

As a result of this demonstration project, the Hershey Company has started to identify other potential sites for the new coupling. Decision-making and cost-justification is easy when the payback period is calculated at less than a year.

The Hershey Company is evaluating similar technology used for adjustable-speed drives. And by also taking advantage of PPL Electric Utilities' E-power rebate and incentive programs for energy-efficient equipment, the company may achieve considerable savings financially while moving consistently toward meeting its energy and carbon footprint reduction goals.

Alternative Applications:

Industries that may typically use magnetic-coupling technology are mining, cement, HVAC, agriculture, manufacturing, water and wastewater treatment. Common applications include conveyors, bulk material handling, compressors, fans, blowers, chippers, shredders, crushers, mixers and pumps up to 5000 hp. These applications may provide solid opportunities to evaluate magnetic-drive couplings to reduce electricity use, wear and tear on equipment, and maintenance costs.

Information on PPL Electric Utilities' E-power rebates and incentives is available at www.pplelectric.com/e-power. Rebates are retroactive for projects that were installed after July 1, 2009.