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Different Way to Drive

By Richard Babyak

Magnetic coupling offers alternative means of speed control.

As saving energy becomes an increasingly important goal in HVAC systems, variable speed control of pumps, fans or blowers has become a more widely practiced means of getting there. In large-scale applications, speed regulation is often accomplished electronically by means of a variable-frequency drive controlling the motor. There is, however, a simpler alternative now gaining ground.

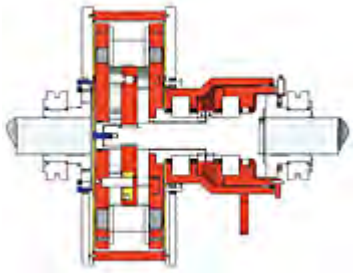

Fig. 1

MagnaDrive Corp., Seattle, Wash., has developed an alternative technology to achieve increased efficiency, while reducing initial cost and operating cost. The MagnaDrive ASD (Adjustable Speed Drive) transfers torque from a motor to a load by means of magnetic induction across an air gap with no shaft-to-shaft connection.

The ASD consists of two independent components that have no physical contact. (See Fig. 1.) A precision-rotor assembly containing high-energy, neodymium-iron-boron permanent magnets is mounted on the load shaft. A conductor assembly with copper rings is connected to the motor shaft. Relative motion between the magnets and the copper rings creates a magnetic field that transmits torque across the gap between the two components. Varying the width of the gap changes the coupling force and the amount of slip, producing a controlled and infinitely variable-output speed. The company says that torque, however, is unaffected, with the output torque always matching the input torque. The width of the gap is changed by actuators linked to the system controller that provides the process signal.

MagnaDrive says its approach has yielded from 25 percent to 66 percent audited energy savings in various installations. For example, in a test installation at the Washington Mutual Tower in Seattle, two MagnaDrive ASD's were installed, one on the condenser-pump motor and one on the chilled-water-pump motor, eliminating the need for energy-consuming pressure control valves. As a result, the system saw a maximum energy demand savings of 66 percent on the condenser-pump motor and 31 percent on the chilled-water-pump motor.

The non-contact means of power transfer in an ASD also eliminates vibration, reduces noise, tolerates misalignment, and provides overload protection. In addition, the magnetic coupling delivers both a soft start and soft stop. The former reduces the motor's start-up power demands and can permit downsizing of motors. Furthermore, the combination of soft-starts and no vibration reduces maintenance and increases motor life.

The MagnaDrive ASD's were initially designed for higher horsepower applications. The energy-saving benefit of using one disappear below the range of 25 HP, but there are still some other reasons for using them in lower horsepower situations instead of VFDs.

VFDs can consume a lot of cabinet space, and because they generate potentially damaging heat, may need to be in an air-conditioned environment. Magna-Drive ASDs are a compact solution with no electronics that require cooling.

Also, as VFDs manipulate power, they can generate significant harmonic distortion, both within the specific facility and beyond, into the power grid. And VFDs themselves are sensitive to poor power quality. By contrast, the MagnaDrive ASDs do not produce any harmonic distortion, nor are they affected by poor power quality.

The company says that power quality issues are the main reason it has seen a demand for lower horsepower solutions, and it has developed and installed MagnaDrive ASDs for applications as low as 3 HP.

MagnaDrive says that while it may be technically possible to scale the technology down even further, it becomes less feasible due to the limitations of the physical components and the fact that its manufacturing costs do not correspondingly scale down with size. In other words, the company could make a _ HP drive but it would be much larger than the motor driving it, and would also be cost-prohibitive. However, the company notes that, as magnet strengths increase relative to size in the future, that part of the equation may change.

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