The technology behind air-cooled heat exchangers has been relatively stable and dependable for many years, with several respected manufacturers serving the industry. One of those manufacturers, Alfa Laval ACE (Air-Cooled Exchangers), has been supplying custom-designed air-cooled heat exchangers for upstream, midstream and downstream applications in the gas compression and gas processing markets for over 50 years.

But times are changing. Federal regulations and challenging market conditions demand a smarter air-cooled heat exchanger. Engine-driven, air-cooled heat exchangers have historically been significantly oversized for roughly 99% of their operating time because they’re designed for a worst-case scenario — the dry-bulb summer high ambient temperature.

With the help of MagnaDrive Inc., Alfa Laval ACE, based out of Broken Arrow, Oklahoma, has introduced a new adjustable-speed, air-cooled heat exchanger fan drive that optimizes cooler performance and efficiency, only delivering air at a rate that is needed for the cooling required at any particular time. First announced publicly in March 2016 at the GCA Expo, the new drive — trademarked as the ACE V-speed — has extended the technology of MagnaDrive’s ASD adjustable-speed drive into a unique configuration that is suited specifically for air-cooled heat exchangers.

The MagnaDrive power transmission concept, which is the heart of the ACE V-speed, was first introduced in 1999. Instead of a physical connection between driver and driven shafts, the interaction between rare earth magnets (within a hub attached to the driven equipment shaft) and non-ferrous conductors (in another hub attached to the driver shaft) creates a flux field that transmits torque across an air gap from driver to load. The smaller the gap, the greater the torque transmitted.

By intentionally changing the air gap, the speed of the driven equipment shaft can be efficiently varied and controlled — the larger the air gap, the slower the driven equipment shaft speed. MagnaDrive adjustable-speed drives have been widely applied to centrifugal pumps, fans and blowers at ratings from 24 to 4000 hp (18 to 2983 kW) and speeds up to 3600 rpm.

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The interaction between rare earth magnets (within a hub attached to the fan shaft) and nonferrous conductors (in a hub attached to the driven sheave) creates a flux field that transmits torque across an air gap from driver to load. The smaller the gap, the greater the torque transmitted. By intentionally changing the air gap, the ACE \( V_{\text{speed}} \) efficiently varies and controls the speed of the fan — the larger the air gap, the slower the fan speed.

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Alfa Laval ACE engineers said that the Vspeed adjustable-speed drive has been designed specifically for ease of installation onto new and existing engine-driven cooler fan shafts. The driven sheave that is typically mounted to an engine-driven cooler attaches to the drive assembly, allowing the user to maintain the existing engine-to-cooler speed ratio, idler placement and sheave. The Vspeed is also suited to be attached directly to the fan shaft in electric motor-driven applications, or even directly to the shaft of the engine or electric motor itself.

The ACE Vspeed was designed with field retrofits in mind. “While cooler surroundings vary by application, we find that only the cooler drive guard and driven sheave must be modified to incorporate the Vspeed into the compression packages surveyed by the Alfa Laval ACE and MagnaDrive engineering teams,” said Blake Minton, an Alfa Laval ACE sales engineer. “The existing drive sheave may be modified to attach to the Vspeed drive, or a custom sheave may be purchased from Alfa Laval ACE to minimize installation time. A low-voltage supply power must be run to the actuators, and the control system must be mounted.”

There is no limit to the cooler size to which the ACE Vspeed adjustable-speed drive can be applied. It is designed based on the required fan torque transmission, with initial sizes suitable for up to about 90 hp (67 kW).

The fan drive can provide three major advantages to operators. First, it minimizes the power required for the fan drive. This decreases the fuel consumption on compressor systems with engine-driven cooler fans. The reduced parasitic cooler shaft power consumption can be redirected for increased power into the compressor to increase capacity. Similarly, on motor-driven fans, it reduces the electrical power and energy consumption. For either type of fan driver, this provides a means for increasing overall compressor package efficiency, aiding in compliance with potential efficiency regulations that are currently being discussed by both the U.S. Department of Energy (DOE) and U.S. Environmental Protection Agency (EPA).

Reduced maintenance and downtime is the second advantage of the adjustable drive. It eliminates the need to shut down in the spring and fall to manually reset the fan blade pitch for summer and winter use. In engine-driven applications, the air gap within the ACE Vspeed isolates the cooler fan assembly from cyclical loads transmitted from the reciprocating engine crankshaft. Coupled with the benefit of the lower average fan speed, this can reduce the wear and extend the service intervals of cooler rotating components (belts, bearings, shafts, etc.).

The third advantage is a reduction in cooler fan noise levels during sensitive time periods, especially at night, when ambient temperatures are lower and less air flow is required across the cooler sections. In some cases, the adjustable drive eliminates the need for other temperature control devices, such as louvers and their associated actuators and controls. A further implication for electric motor-driven cooler fans is that the ACE Vspeed can be used instead of high-voltage, variable-frequency drives (VFDs) that may not be suitable for stringent electrical area classifications.

“The ACE Vspeed adjustable-speed drive provides a cost-effective solution for compressor packagers and end users seeking a way to adapt existing and new compressor units to a wide array of dynamic shale gas well conditions,” said Misty Stanton, inside sales manager for Alfa Laval ACE. “By freeing horsepower historically used to drive the cooler fan and redirecting it to compression, the ACE Vspeed provides a method for increasing compressor package capacity.”