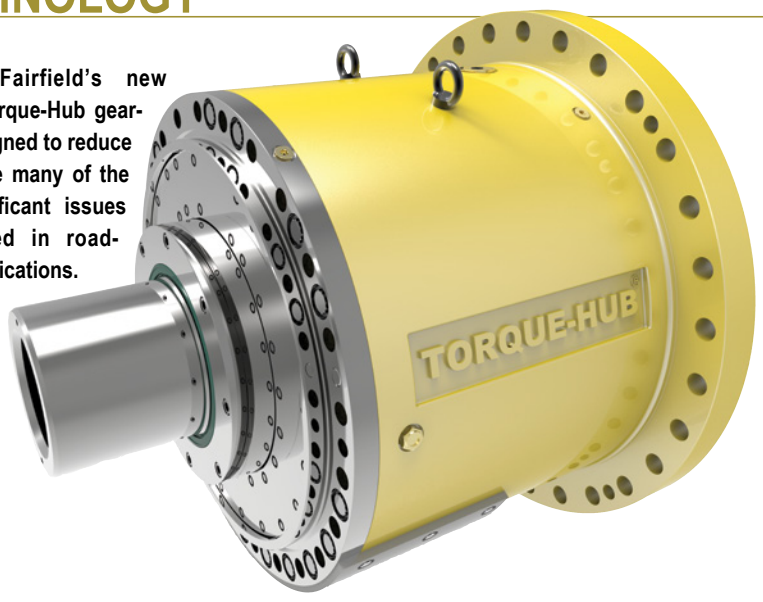


Oerlikon Fairfield's new RHD260 Torque-Hub gearbox is designed to reduce or eliminate many of the most significant issues encountered in roadheader applications.

CUTTING THE STRESS

Gear systems specialist Oerlikon Fairfield develops new gearbox for roadheader applications

BY MIKE BREZONICK

All machines undergo a variety of mechanical stresses as part of their normal duty cycles. Yet there are probably few that face the same level of sheer physical demand as roadheaders.

Used mainly in mining and tunneling applications, roadheaders typically utilize a specialized boom-mounted cutter head that is worked vertically and laterally along a rock wall surface, slicing and grinding materials from the wall, allowing them to be collected. The machines have carved a significant niche in many areas of soft- and medium-mineral mining, as they can work a rock face more precisely than a mining longwall or a full-face tunnel borer.

The area on the roadheader that faces greatest mechanical stresses is the cutter head. Larger machines typically incorporate an electric motor connected to a gearbox that transmits torque to the rotating head. The gearbox is subject to extreme loads during continuous operation that generates both mechanical and thermal stresses as well as shock loads triggered by the cutter head's interaction with some particularly tough material in the rock face. Over the long term, it can result in reduced reliability, uptime and service life of the cutter head, which ultimately impacts overall machine productivity.

In an effort to address the specialized demands of the roadheader market, Oerlikon Fairfield, the Lafayette, Ind.-based division of Oerlikon Drive Systems, has developed the RHD260, a new patent-pending Torque-Hub gearbox for roadheader cutter heads that is designed to reduce or eliminate many of the most significant issues with existing units while providing greater torque capacity and reliability. The RHD260 offers dual motor inputs with a capacity of 348 hp.

"In our industry, it's fairly common to have an inline drive for the cutter head," said Dan Phebus, head of the business unit and vice president of engineering at Oerlikon Fairfield. "Typically, the electric motor is connected to the gearbox that directly drives the cutter head. It's a configuration that works, but it does have some drawbacks and limitations as to how far it can go.

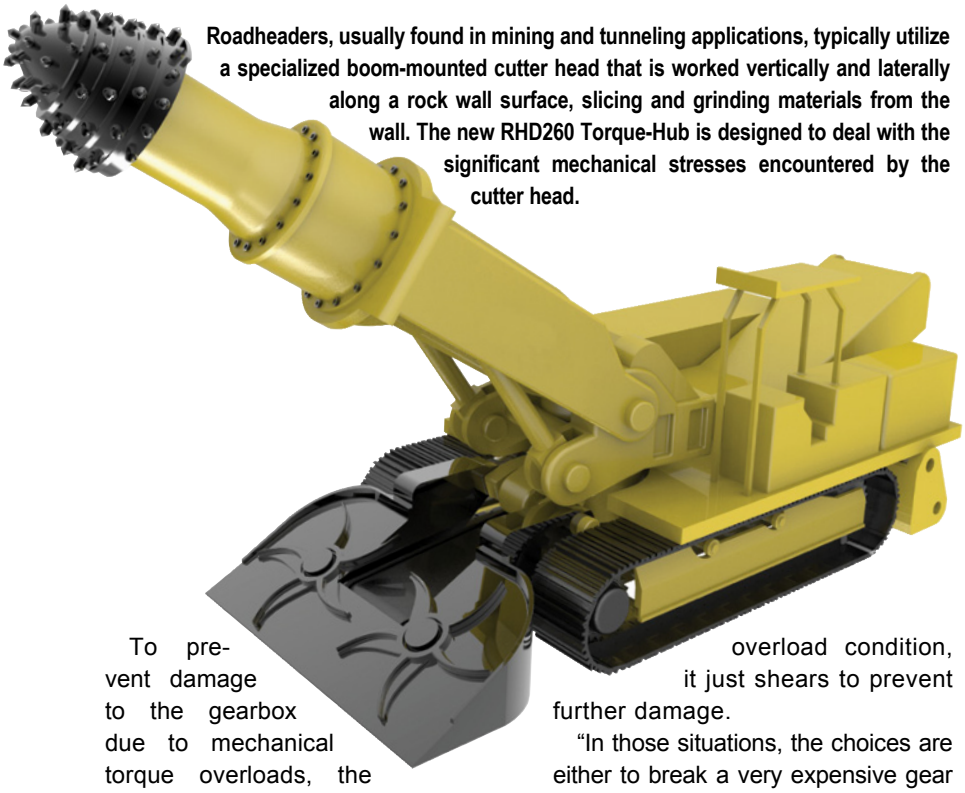
"One of the drawbacks is getting cutting fluid down to the cutting head. In most types of inline drives, it's very hard to get cutting fluid down to the cutting head. So in our design, we created a dual motor input, with the motors attached to the drive on both the left and right sides of the centerline. This allows the center to be free, so a cutting fluid supply line can be passed through the center of the gearbox and into the cutter head."

The dual-motor configuration also provides greater transfer of horsepower through the gearbox than is normally possible through use of a single motor, the company said.

Special attention was also paid to controlling internal thermal and lubrication issues, as well as the stresses caused by sudden overloads, Phebus said. "We've added some unique cooling and lubrication characteristics," he said. "We've also done some load isolation not only to deal with high internal loads, but external loads as well and we've allowed for torque overload."

On the cooling side, the gearbox incorporates coolant cavities on both ends, designed to improve thermal transfer efficiency. "The water jacket inside the housing allows for a number of circulation points," Phebus said. "So we have the means to provide more cooling to the gearbox, which is important especially if the customer is needing extended hours or running in especially harsh applications.

"We also have some unique channels for lubrication. In roadheaders, there are some vertical 'down' applications and vertical 'up' applications and it's very difficult to get lubrication to all the corners of the gearbox that need it. We have a self-circulation system for the internal areas that keeps the oil in the critical areas. This is one of the patented features."



Roadheaders, usually found in mining and tunneling applications, typically utilize a specialized boom-mounted cutter head that is worked vertically and laterally along a rock wall surface, slicing and grinding materials from the wall. The new RHD260 Torque-Hub is designed to deal with the significant mechanical stresses encountered by the cutter head.

To prevent damage to the gearbox due to mechanical torque overloads, the new design incorporates electric motor shaft inputs designed to "fuse" when predefined torque limits are reached.

"Our torque overload system is also part of our patent-pending configuration," Phebus said. "It helps isolate the tremendous overload situations. Basically, it's a mechanical fuse, like in an electrical fuse box. When the demand reaches an overload condition, it just shears to prevent further damage.

"In those situations, the choices are either to break a very expensive gear through dynamic inertia or an inexpensive mechanical fuse that's replaceable from outside the gearbox. It's possible that a drive would never see that kind of overload, but in the event that it does, we don't want the drive itself to be destroyed or damaged."

The RHD260 drive also incorporates a two-stage planetary gear set with an optimized gear design and enhanced gear geometry, which combined with heavy-duty bearings, results in a stronger, more durable assembly that delivers greater durability and longer service life, the company said.

In addition, Phebus said Oerlikon Fairfield implemented a patent-pending shape milling technique to increase the drive's power density.

"This manufacturing process allows us to have connections that provide for a more compact design and it allows us to have a very high-capacity torque connection without taking the load directly through the gearing," he said. "It also allows the gearing load to be independent of the load seen by the external housing structure."

Phebus said the gearbox housing is engineered to essentially absorb more of the mechanical stresses than conventional designs, also contributing to the longevity of the internal gearing and the service life of the unit as a whole.

"We've worked closely with the customers in this market to determine what limitations the products have had in the past," Phebus said. "And we believe we've been able to address the major ones." dp

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