

MATERIAL GAINS IN OFF-HIGHWAY COOLING

Horton launches new heavy-duty thermoset fans and new fan drive systems for heavy-duty applications

BY MIKE BREZONICK

When business is slow, many companies slow down, curtailing R&D and product development until the market improves. Others, however, use slack periods as the time to focus more specifically on new product development and improving technologies so that when things do get better, they're able to come to market with all-new or updated product lines.

Horton Inc. is an example of the latter. As conditions improved after the recession, the Roseville, Minn., specialist in fan system technology has been active in launching new products and enhancements to existing systems. The most recent examples are a new large composite fan and fan drive system for heavy-duty, off-highway machine applications as well as an expansion of its live center viscous fan drive range for medium- and heavy-duty applications.

"Definitely during and after the downturn, we accelerated our development program," said Dave Hennessy, Horton's vice president, Research & Development. "We have a number of products that we have just released, are releasing and will be releasing over the next few quarters. It's been very deliberate.

"One of the benefits from being a private company is that we generally have a longer view of things. We didn't cut back our operations anywhere near what some others did, and we focused on the longer term. We were absolutely investing in product development, and I think you're starting to see the fruits of that labor. And there will be more in



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One of the most recent developments is one of the biggest — literally — in the company's product line: the HTEC 2500 composite fans. Available in diameters of 65 to 95 in., they are targeted toward larger off-highway equipment applications, such as mining, oil and gas and power generation systems with engines 30 L and larger.

"The 'HT' in HTEC stands for 'Horton Thermoset,'" Hennessy said. "It's a thermoset plastic rather than a glass-filled nylon arrangement that would be more typical of our injection-molded fans.

"The limitation of injection molding is that there's only

so much nylon you can shoot at a time, so it does limit how large a blade you can make, and it can be a challenge to get it to flow and get the glass homogenized and things like that. The HTEC is essentially made from a thermoset plastic which is molded, and we're able to put a charge pattern of material into the mold, then the two halves are compressed and heated. So it's a different animal completely. You're not injecting — you're essentially compression molding it."

Kevin Hruby, product manager, Fans at Horton, said the result is a more durable fan with less deflection than nylon and a higher strength-to-weight ratio than nylon, steel or aluminum, with much higher temperature capability — up to 356°F.

"When you look at thermoset versus thermoplastic, with the thermoset, it's essentially bonding the molecules together irreversibly as opposed to a thermoplastic, where if you were to reach the right temperature, it would melt again," Hruby said.

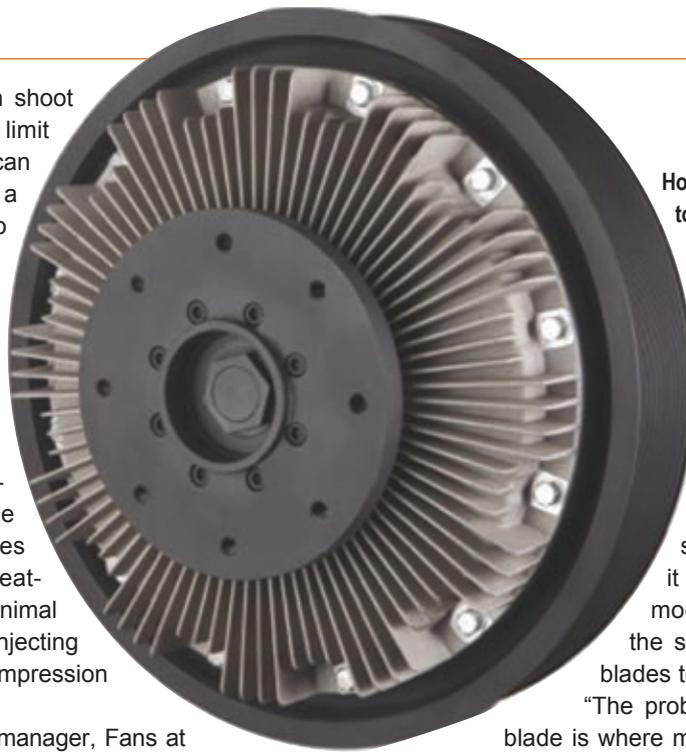
"That's one of the key attributes of the thermoset material. Because you've irreversibly cross-link bonded the molecules together, you end up with higher performance in both temperature and extreme chemical resistance, as well.

"It's spark-resistant for any hazardous environment, and when you compare it to a metal fan, we're able to use a computer-optimized blade design to allow it to have better airflow performance versus a shape that you could not achieve with a metal fan."

The HTEC 2500 fan is also extremely versatile, Hennessy said, with configurations of five to 17 blades and standard and customizable hub mountings, including straight and tapered bores.

"It's highly configurable, so we can make a multiple number of blade counts, and we've taken a little bit different approach with what we call a modular fan blade approach, where we essentially would have two blade lengths as kind of a standard — basically a longer one and a shorter one," Hennessy said. "We configure the center hub piece to match either the longer or the shorter blade and use that to dictate the overall diameter.

"What we want to do is keep as much blade length as possible, and what we don't want is to bolt it all together and then cut off the end of the blade, which is typical of what happens with a molded plastic fan. With our smaller



Horton's new HTEC 2500 fan is designed to pair with the company's new RCV2000 fully variable fan drive, shown here. Part of Horton's Modulator fan drive range, the RCV2000 can accommodate fans up to 96 in. in diameter for use with engines rated 1700 to 4000 hp.

molded fans, we might mold something at 32 in. and then cut it down to 28 in. Even some other modular fans in the market use the same approach — bolt large fan blades to a hub and trim off.

"The problem with that is the end of the blade is where most of the engineering work has been done and where most of the benefit as far as airflow and noise reduction really comes from. So we've taken an approach that we'll customize the center disk and use the right blade so we get the advantages of the tip design."

The modular design also offers advantages beyond performance. The fans are manufactured at Horton's Carmel, Ind., facility, but can be assembled closer to a customer's location. "Ninety-six inches wouldn't fit in a shipping crate," Hruby said. "And you'd end up shipping a lot of air."

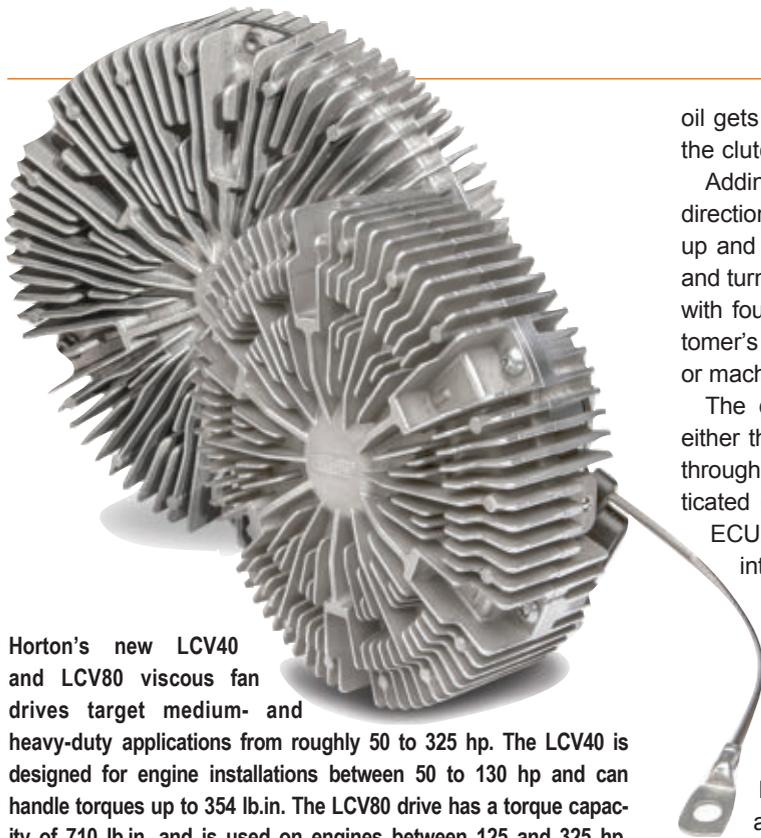
The HTEC 2500 fan is designed to pair with the company's new RCV2000 fully variable fan drive. Part of Horton's Modulator fan drive range, the RCV2000 can accommodate fans up to 96 in. in diameter (including competitive models) and offers torques as high as 22,126 lb.in., for use with engines from 1700 to 4000 hp.

"We sell fan drives for over-the-road trucks, for ag tractors, for gen-sets, but in general, we've been limited to about 600 hp equipment," Hennessy said. "That's been about the upper limit of our drive technology.

"A few years ago, Jeff Lindgren, one of our sales vice presidents, was at a mining operation and was talking to them about engine overhauls, and he saw that they had direct-drive fans on a lot of the equipment and no fan drives. He called me from a mine in Turkey and asked if we could make a clutch that big.

"We made a first-pass proof of concept and found we didn't have any trouble scaling up and developing the torque we needed. So we started a project to commercialize it, and so that's how we got going on it. We do business with all the big manufacturers of mining equipment, and we've talked to them quite regularly and found a fair amount of interest, so we kept the project going. Now things are speeding up really fast, and we've got some of

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Horton's new LCV40 and LCV80 viscous fan drives target medium- and heavy-duty applications from roughly 50 to 325 hp. The LCV40 is designed for engine installations between 50 to 130 hp and can handle torques up to 354 lb.in. The LCV80 drive has a torque capacity of 710 lb.in. and is used on engines between 125 and 325 hp.

these in field tests, and we've been durability testing here for about a year. We're all in on this one."

Hennessy said the RCV2000 drive would essentially disengage entirely. "When we run them in our test cells, the fan will routinely go all the way down to zero rpm," he said. "It won't quite engage all the way, because it is a viscous coupling, but it will essentially turn all the way off. We've had situations where we walked into the test cells and wondered if the tests had stopped.

"Typically in an application, they'll be at 50 rpm or lower, so it has very, very low parasitics."

Several of the key design aspects of the new clutch aim toward more effective cooling, which leads to longer service life and more efficient performance overall. "Probably one of the most innovative things is that the pulley is attached to the oil reservoir system," Hennessy said. "When the oil works its way to the clutch, it absorbs some heat from doing the work to turn the fan, then it returns to the reservoir. In this case, the reservoir is attached to the pulley so it's always spinning at full pulley speed. That's the opposite of most clutches, where the oil would be inside the clutch spinning at a lower speed so you don't have the heat transfer.

"The fins on the back side of the clutch are directly coupled to the reservoir, so the hot oil in the reservoir has direct contact with the fins, and the fins are spinning at full belted speed, so you get very good heat transfer from this drive.

"We've also configured the valve system for flexibility. There are actually multiple valves inside, and we can either populate the valves with elements or not, so we can open up four valves or two valves and really control how much

oil gets in and out, depending on the application and how the clutch needs to perform."

Adding to the flexibility is the ability to change the drive's direction with no real hardware changes. "We can open it up and move the pump feature from one side to the other and turn it into a clockwise or counterclockwise drive literally with four bolts," Hennessy said. "We can tailor it to a customer's needs without having to make whole new castings or machining parts."

The operation of the RCV2000 fan drive is controlled either through the engine's electronic control unit (ECU) or through Horton's own Di control module. "The most sophisticated customers want to control their logic in their own ECU," Hennessy said. "But sometimes when you get into the lower-volume machines, the amount of work it takes to put algorithms into the computers and drive to various devices gets harder to justify. The Di controller can talk along the J1939 link, and we will have a new generation of Di controllers out shortly that will be about half the size of the current units."

Moving down the power band, Horton's new LCV40 and LCV80 viscous fan drives target medium- and heavy-duty applications from roughly 50 to 325 hp.

"The RCVs are what we call rigid center variable, as it's a bracket-mounted drive," Hennessy said. "These are live center drives, with everything spinning inside."

The LCV40 is targeted toward engine installations between 50 to 130 hp and can handle torques up to 354 lb.in. The typical fan used has a maximum 24 in. diameter with six to 11 blades.

The LCV80 drive has a torque capacity of 710 lb.in. and is used on engines between 125 and 325 hp. It can accommodate fans up to 29.5 in. in diameter, also with six to 11 blades.

"The LCV40 and LVC80 are essentially a pair," Hennessy said. "They share a coil, they share a bearing, and they share some valve components — probably better than 50% of the components of the two are the same. So we can get some scale for manufacturing, but then we can offer a larger or smaller option, and depending on the customer needs, we could tailor it."

That tailoring can include the direction of rotation, which allows it to be used with either blower or sucker fans.

"We're having a lot of success with the LCV40 in small towable gen-sets," Hennessy said. "We've seen a lot of overcooling issues with Tier 4 gen-sets in particular. We've been selling retrofit packages for cold-weather applications, and it's been very well received.

"These clutches were really designed around those types of applications. We saw the need for this type of equipment — gen-sets, construction and ag equipment — where a lot of them didn't even use a fan clutch before." **dp**

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