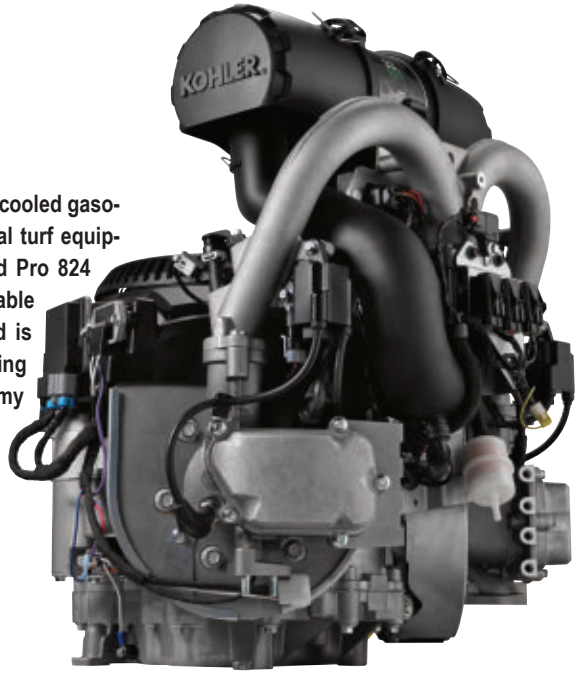
AIMING FOR A CUT ABOVE

Kohler launching new Command Pro EFI 824 cc gasoline engine for commercial mowers



Kohler is launching a new air-cooled gasoline engine for the commercial turf equipment industry. The Command Pro 824 cc EFI engine will be available in ratings of 27 to 33 hp and is designed to meet the growing horsepower and fuel economy demands of ZTR mowers.

BY MIKE BREZONICK

In any business, a key to success is understanding where your customers are going and what they're going to need when they get there.

When Kohler Engines studied the trends in the commercial mowing industry in recent years, it identified a growing push for greater power and performance, as well as a need for better fuel economy.

The company also didn't see anything in the market that it thought was effectively addressing those somewhat contradictory requirements.

"When we boiled down the market opportunity," said Mark Johansen, director of marketing for Kohler Engines, "we saw that the commercial mower market was trending toward a space that was not being well served by any engine or engine manufacturer."

To address that deficiency, Kohler has developed an all-new engine in its Command Pro range of electronic fuel injection, air-cooled gasoline engines. The Command Pro 824 EFI will be available in four models with ratings from 27 to 33 hp, all targeting commercial mowing equipment, particularly zero-turn radius (ZTR) mowers. Kohler has also developed a propane-fueled version (see related story) for the growing alternative fuel mower markets.

"I've been with Kohler 5½ years and of any gasoline engine we've launched during that time, this is the product I am most excited about," said Tom Cromwell, president, Kohler Power. "It provides both great power and great fuel efficiency, which is a tremendous combination that really fits the market needs."

Those market trends, at least in the ZTR segment, have all been going in one direction, Johansen said. "Since 2005, deck sizes 54 in. and larger went from 55% to just over 67%," Johansen said. "In 2005, average ground speed was somewhere between 6 and 8 mph. By 2011, that crept up to 12 to 15 mph.

"Larger decks, faster ground speeds, all driven by bigger hydraulic motors — it really required a shift in horsepower. It's a pretty phenomenal shift — 28 hp and higher went from under 10% to just less than 40% from 2005 to 2011.

"Some additional research we did shows that over the life of a commercial ZTR, fuel costs account for 48% of the total cost of owning that machine. Fuel efficiency is extremely important to this group."

Kohler aims to address the ZTR market needs through a combination of displacement and technology. In terms of displacement, the Command Pro 824 EFI has a bore and stroke of 86 x 71 mm and is a significant step up in terms of displacement from Kohler's current EFI offering in the commercial mower space, the Command Pro 747 cc EFI engine. "We did think about,whether we could stretch our current engine to meet the requirements we saw coming," said Dale Snyder, director of engineering, Gas Engines, Kohler. "In reality, that engine has been stretched somewhat already from the original design.

"To hit the torque level we wanted, the mean effective pressure would have needed to be much higher — and it was higher than we were comfortable with."

"That could have added a lot of durability risks," Cromwell added. "At the same time, a higher displacement will typically produce more torque but it also starts to use more fuel so the goal is to keep displacement as small as you can.

"We also considered the new emissions limits coming in California. Knowing they're going to go to a new standard for engines 825 cc and above — and typically what we see is that what California does gets

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The new Kohler 824 cc EFI engine is designed to fit within the same general envelope as the company's existing 747 cc EFI engine and is also engineered to fit in the same space as many carbureted engines.

adopted across the industry at some point — we knew we could get to where we wanted to be from a torque standpoint and stay below that emissions threshold."

In the new engine platform, Kohler is relying on some familiar technologies, teamed with some new designs to deliver improved fuel economy and high power and torque. The Command Pro 824 will utilize the same tried-and-true Delphi closed-loop EFI system used on the 747 cc engine. Kohler and Delphi were among the pioneers in fuel injection for small gasoline engines and there are thousands of Kohler engines with the system operating in the field. The system can be teamed with a mechanical or electronic governor.

"The closed-loop Delphi EFI system is an enabler for fuel economy," Snyder said. "Another thing we focused on was reducing engine friction. We spent a lot of time trying to minimize engine pumping and friction

More Powerful Propane Players

BY JACK BURKE

Kohler Engines' new line of 824 Command Pro engines will include two propane versions.

The 27 hp PCV850 and 29 hp PCV860 engines are expected to go into production during the second quarter of 2015, said Eric Hudak, senior product manager, Gas Engines Americas, Kohler Engines.

"There's been a significant boom in the production of natural gas in North America, specifically in the United States," Hudak said. "That boom of natural gas production has caused a fundamental shift in the economics of propane, such that it's really a 20 to 40% advantage for propane over gasoline on a per Btu basis."

Hudak said Kohler has been producing gaseous-fueled engines for more than 50 years and currently has more than 10 models, ranging from 0.6 to 1 L, in production. The company introduced its first closed-loop, electronic fuel-injected (EFI) propane engine in 2011. The 747 cc Command Pro EFI PCV680 engine is rated 22 hp and was released on zero-turn radius (ZTR) mowers in 2012.

But because propane doesn't have the same power density as gasoline, there was concern that the 747 cc engine wasn't providing enough power for some landscaping applications, especially in machines with 60 in. cutting decks, said Tom Cromwell, president, Kohler Engines.

Kohler Engine's new Command Pro 824 cc EFI propane engine will be manufactured at the company's commercial plant in Kohler, Wis. The company recently redesigned its production line and added new robotics and inspection technology.

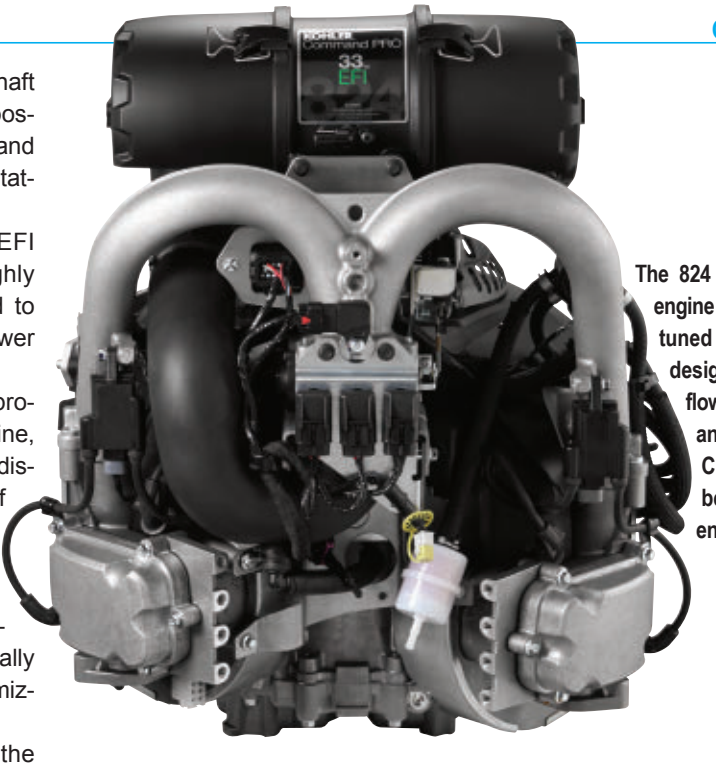
"By changing from gasoline to propane, the engine power drops by about 2.0 to 2.5 hp which, on a 60 in. deck and running higher ground speeds, is enough to be substantial and that's been one concern," Cromwell said.

losses, making sure the crankshaft bearing supports are as stiff as possible to eliminate edge loading and avoid getting more friction in the rotating assembly."

The 824 cc Command Pro EFI engine also incorporates a highly tuned air intake system designed to enhance airflow and maximize power and torque.

The 17.5 in. manifold runners provide for better airflow into the engine, Snyder said. "This is a smaller displacement compared to some of the competition, so we need to get this engine to breathe better and we put a lot of effort into doing just that," he said. "The key to making power in any gas engine is really to get enough air into it while minimizing pumping and frictional losses.

"We draw air in through the intake manifold into the intake port and we focused on getting a downward slope of the port to increase the inside radius and improve the airflow as the air goes in through the valve. Traditional die-cast cylinder heads usually make the air flow on a 90° angle and that doesn't work as well. We did a lot of CFD simulation on the airflow into the engine."



The 824 cc Command Pro EFI engine incorporates a highly tuned air intake system designed to enhance airflow and maximize power and torque. Kohler used CFD analysis to develop better airflow into the engine.

That simulation work included

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Kohler's new engines will still offer all the fuel benefits of propane but with more power than the smaller propane, Cromwell said.

"It's going to absolutely fit into that 27 to 29 hp sweet spot, which is where ZTRs are today," Cromwell said. "From a propane EFI offering, it's really going to be a great solution for the core of where the ZTR market is today."

Hudak said that because of the efficiency of Kohler's EFI system as well as the low cost of propane, the new propane engines could deliver $2 per hour savings over carbureted gasoline engines. With the average commercial user operating his ZTR mower approximately 600 hours a year, that equates to savings of $2000 a year.

Hudak said Kohler is the only company manufacturing a closed-loop EFI engine designed and optimized for propane that produces equivalent power and torque to carbureted gasoline engines. The factory-direct propane EFI models eliminate the need for less effective aftermarket propane kits that typically need fuel adjustment, priming and often don't perform as well, he said.

As in the gasoline versions, the Kohler propane engines incorporate Delphi's closed-loop EFI technology designed to deliver optimal fuel efficiency along with a variety of other benefits, including easy starting, improved power and increased life span, Kohler said.

The engine control unit (ECU) is engine mounted, as is the fuel pressure regulator, to simplify packaging, Hudak said.

Exmark introduced the Lazer Z propane mower powered by Kohler's PCV740 EFI engine in 2013. Kohler is launching larger EFI propane engines, the 27 hp PCV850 and 29 hp PCV860, in early 2015.

"The new engines are really a drop-in place design, so the package size is nearly identical to our gasoline EFI, so it is very easy for an OEM to put that into a piece of equipment," Hudak said.

The new engines will come standard with heavy-duty air cleaner system and high-capacity PTO sleeve bearing,

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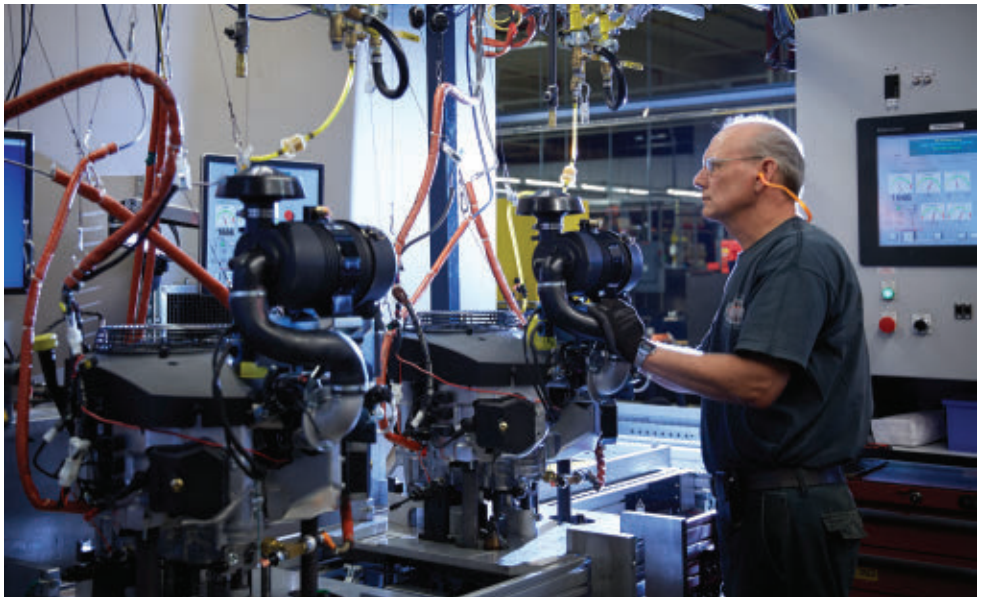

All of the new Command 824 EFI engines undergo a two-minute hot test at no load before the engine's electronic control module is flashed.

the Kohler-designed heavy-duty air cleaner, which is engineered to optimize centrifugal separation of debris and reduce air cleaner depression.

Along with the optimized intake manifold, Kohler spent a lot of design effort on the cylinder head and combustion chamber that incorporate a multi-angle valve seat configuration and fast-burn combustion chamber with twin spark plugs.

"We spent some time asking ourselves, did we really need two plugs or not?" Cromwell said. "We did a lot of testing and said initially that definitely could give us a faster flame front — a faster burn rate resulting in less negative work from the engine, usually attributed to significant ignition advance — and could help us from a torque perspective. Then we considered whether we could get by with one spark plug, which is less cost.

"We found through testing that there was a substantial difference between one spark plug and two spark plugs. Using two helped us accomplish what we wanted both from a power and emissions standpoint. It was an important feature that we ended up verifying we needed.

"We don't think there is really a risk. Adding an additional spark plug adds a little bit of cost, but spark plugs are well known, the ignition modules are well known so there isn't any part that should feel risky to customers. I don't think anybody's going to look at it and say, 'Two spark plugs per cylinder, wow, that's really scary.'"

The company also did significant development work related to engine cooling, which manifested itself in highly engineered baffles, cylinder heads and specially designed crankcase fins engineered to provide efficient engine cooling for maximum reliability and

Hudak said. A horizontal shaft orientation will also be available.

Along with fuel savings, the new engines offer a "green" bonus that should appeal to operators, Hudak said. The engines produce 50% fewer hydrocarbons than typical carbureted engines and can operate on Ozone Action Days that are in place in more than 200 communities in the U.S., he said.

Propane-fueled equipment can also help commercial cutters win business contracts with municipalities and other organizations seeking green fuels and technologies, he said. Additionally, there are numerous incentives for using propane, including a $1000 rebate from the Propane Education and Research Council (PERC) on new equipment purchases, additional state incentives of up to $2500 offered by 11 states around the country, and municipal incentives in many local areas.

While growing, the propane market is still a sliver of business for Kohler. In model year 2014, four products on the market used Kohler's EFI propane engines. In 2015 that number will likely be more than 10, Hudak said, including one product from a new partnership with Gravely.

"Could propane be 10% of the commercial cut market in the future?" Cromwell said. "I'd say yes, I think that is realistic, I think that's possible.

"But the current trends would have to continue. We don't want to drive the market necessarily to propane, we think we have a great gasoline-based EFI system — we think we have the best solution out there. But we also think we have the best propane EFI solution out there.

"So let those chips fall where they are and I think we'll be well positioned in either case."

Kohler will produce the 824 cc Command Pro EFI propane models at its commercial plant in Kohler, Wis.

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durability. “Heat is the root of all evils for an air-cooled engine,” Snyder said. “If you’re not cooling the source of the heat, you run into a lot of issues — vapor locking, leaking oil seals, leaking gaskets, structural failures.

“So we focused a lot of upfront analysis to cool the source of the heat, which is the cylinder head, the combustion chamber and the top third of the cylinder bore, to get all that heat out. That way you’re not relying upon an oil cooler to cool the oil which typically picks up heat from the power cylinder internally on an inefficient air-cooled engine design.

“This could be the first engine in its class that does not need an oil cooler to go into an application. That was a challenge that was thrown out to us and initially, we weren’t sure we could do it, but it worked out pretty well.”

To make sure it did, the Command Pro 824 cc EFI engine underwent a comprehensive program of testing and verification that included nearly 13,000 hours of computer simulations, more than 22,000 hours of runtime in the lab and approximately 5000 hours of application testing.

“We’ve invested in a work-hour equivalent of six years of design simulation,” Johansen said. “The 824 exceeds commercial duty standards and is being released to the market after more than 27,500 hours of testing, so the Kohler team and our OEM partners are confident that the engine will offer lasting performance and durability.”

To support easy maintenance, all Kohler Command Pro EFI engines are supported by proprietary diagnostic software, which can be used to tap into an engine’s critical performance data. The software provides automotive-grade diagnostic capabilities and a variety of information to help simplify upkeep and repairs, including a log of operating conditions, total hours, oil temperatures, detailed load parameters.

Kohler will produce the 824 cc Command Pro EFI models at its commercial plant in Kohler, Wis., using new computer numerical control (CNC) machining centers and a newly designed production line outfitted with new robotics and inspection technology. All engines go through hundreds of quality checks throughout the production process and each is individually tested before shipment, Kohler said. All Kohler Command Pro EFI engines offer a three-year commercial warranty.

The Command Pro 824 EFI engines will make their official debut at the GIE-Expo in Louisville, Ky., later this month and Kohler said the engines would be in several model-year 2015 commercial mowers. dp

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