

Innovative PTO under development by NexxtDrive

A compact, variable-speed, mechanical PTO system, designed to improve efficiency and flexibility compared to simple belt-driven types, is being developed by power transmission specialist **NexxtDrive**. The system could also be configured to act as an engine starter and alternator, providing micro-hybrid functionality.

Mechanical PTOs are an essential element of the powertrain in many off-highway applications. Used to power anything from cooling fans to sophisticated auxiliary equipment, conventional PTOs using a simple belt or chain drive are inexpensive and robust. But because the PTO speed cannot be varied in relation to engine speed, efficiency is low in some operating conditions. Variable-speed hydraulic PTOs overcome these problems, but at considerable additional cost and complexity.

The NexxtDrive system—called NexxtPTO—is being developed to overcome these limitations cost-effectively. As with all of the company's transmission technologies, NexxtPTO operates by combining electrical and mechanical power transmission using a patented system of epicyclic gears. A belt drive from the engine simultaneously runs a compact electric motor/generator and a sun gear in the epicyclic gear train. A second electric motor/generator uses power generated by the first to turn a second sun gear. The electrical and mechanical power inputs are combined by two sets of planet gears to run the auxiliary load connected to the planet carrier.

"The major advantage of our approach is that most of the power is transmitted by the highly efficient mechanical transmission," said Frank Moeller, NexxtDrive Director and Chief Engineer. "The relatively small electric machines will facilitate full control over the speed of the output, and the transmission is designed so that the electrical load drops to zero at the most commonly used operating speed."

An early application for the new system is likely to be the operation of engine cooling fans for large diesel engines in off-highway applications. It is also appropriate for commercial vehicles; the power overhead required to run the cooling fan in a typical truck engine installation accounts for around 10% of fuel consumption. As cooling fans are sized and geared to cope with the most arduous low speed, high-load driving conditions, they are wasting power most of the time, according to Moeller.

"NexxtPTO allows fan speed to be matched precisely to engine cooling requirements, resulting in overall fuel savings of about 5%," he said. "With fuel efficiency likely to remain at the top of the agenda for off-highway and commercial vehicle manufacturers, the ability of the system to offer low-cost, micro-hybrid functionality is another fundamental advantage."

The electric motor/generators in the unit can be sized to replace the engine's conventional starter and alternator to give smooth, instant stop/start and mild-hybrid functionality. Moeller added that NexxtPTO could also deliver efficiency and control advantages when any kind of auxiliary PTO is used. "Agricultural and construction equipment sectors are particular examples," he said.

The system could provide controllable mechanical power or be used to generate sufficient electricity to support significant electrical loads. With the ability to control the speed of the PTO totally independently of engine speed, the fuel consumption overhead required by ancillary equipment is minimized.

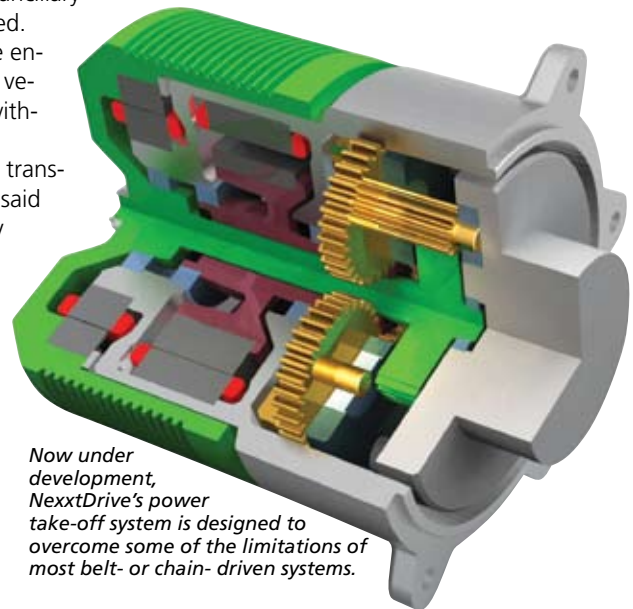
NexxtPTO could be engineered into existing vehicle configurations without the need to redesign any fundamental transmission components, said Moeller. The company has completed computer simulations of the system and has initiated a development program for the electric motors, which are at the heart of the system.

"A lot of the fundamental motor and transmission technology is already being proved in other areas of our technology portfolio," added Moeller. "Our SuperGen variable-speed supercharger system uses very similar core components to NexxtPTO and is currently undergoing hardware evaluation."

All NexxtDrive systems are based around a power-combining transmission comprising two electric motor-generator units coupled to a basic gearing system to provide a transmission with infinitely variable gear ratios.



NexxtDrive's Frank Moeller: "NexxtPTO allows fan speed to be matched precisely to engine cooling requirements, resulting in overall fuel savings of around 5%."



Now under development, NexxtDrive's power take-off system is designed to overcome some of the limitations of most belt- or chain- driven systems.

Stuart Birch

Taking control of navigation, diagnostics

Siemens VDO says its Vehicle Control Center (VCC) is under development to address some of the more intense challenges facing fleet operators, including generating intelligently calculated routes, maximizing vehicle availability, providing a functional logistics chain in which every link is fully networked with the others, and maintaining high safety levels.

Essentially, the VCC is an open and scalable hardware and software platform in the vehicle that bundles complex functions and provides an external interface. It brings numerous current and future electronics systems together and networks the vehicle, the driver, and the outside world with respect to a series of functions, such as navigation, communications, and telematics. According to Siemens, the software is being developed in such a way that the applications and the human-machine interface can be designed flexibly by the OEM.

In the truck navigation system, the operating software was adapted in such a way that when routes are calculated, the system not only takes vehicle-specific attributes such as height and weight into account, but also the driving characteristics of large trucks. In addition, the system uses an expanded commercial vehicle map database and the truck driver's particular destinations.

Because the VCC is the truck's nerve center, it can read out a great deal of data from the CAN bus and transmit it to the fleet operator's central office or workshop. This way, service intervals can be organized better, and the risk of downtime can be reduced. An additional strength of the VCC is its fleet management functions, which are already offered by Siemens VDO in its onboard computers and accompanying office software. A new feature is that mobile terminals, from cell phones to trans-



Siemens VDO expects its Vehicle Control Center, which it refers to as the "nerve center" of commercial vehicles, will be ready for series production by about 2010.

The basis of the VCC is a computer with a high-performance processor unit and additional central modules that include a component that uses GPS receivers and other vehicle sensors to determine the vehicle's location, an interface module that organizes data exchange with other vehicle systems via the CAN bus, and a communications module that controls the connection to the outside world—for example, by GSM, WLAN, or Bluetooth.

Many components such as the GSM module and the GPS component do not, as in the past, have to be installed several times in the vehicle, because the VCC, acting as an intelligent switching center, bundles many functions together. This advantage reduces piece costs, the effort and expense of cabling, and time spent on installation. Because the hardware and software have been designed to be scalable, equipment variants can be installed in different vehicle types through a single platform, which optimizes research and development costs and reduces parts complexity. Additional functions specific to the OEM can also be realized on this platform. For the driver, the integration of numerous vehicle functions with one display and operation contributes to increased convenience and safety.

With the VCC, Siemens VDO is enabling fleet operators to carry out a number of improved or new functions, such as nav-

port companies' goods scanners, can be integrated into the system.

In addition, the VCC covers all the functions performed by a conventional information and entertainment system. It is an onboard computer, plays music, provides the necessary interfaces for air-conditioning systems and rearview cameras, and can display electronic operating instructions. Integration of the automatic emergency calling function (e-Call/b-Call) that is currently under discussion is also possible.

Through the VCC, other vehicle systems will be able to access the navigation computer's route data. With the route information, for example, it is conceivable that an automatic transmission could switch into the optimum gear before beginning a climb, or the cruise control system would no longer accelerate to the set maximum speed following a braking maneuver shortly before a highway exit.

Long-term cost reduction will come by so-called predictive remote diagnosis because unplanned downtime can be reduced. With the VCC, all the important key data from the engine, cooling system, transmission, and brakes can be accessed and analyzed at regular intervals. Technical problems can be detected before they cause damage or downtime.

Jean L. Broge

KPS gets heavy with new APU

Leveraging its 85-plus-year history in the power-generation market, **Kohler Power Systems (KPS)** is expanding its generator product line to include an auxiliary power unit (APU) for the heavy-duty trucking industry.

The new 5-kW APU will provide fleets, OEMs, and owner/operators the only air-cooled APU in the 5-kW, side-rail-mounted size, claims KPS, adding that the self-contained engine means less intrusion into the truck's critical systems. The company's first APU is one of the smallest and lightest air-cooled generators on the market, at 27 x 26 x 23 in (686 x 660 x 584 mm) and less than 350 lb (159 kg).



Kohler Power Systems (KPS) says it designed its first auxiliary power unit product to be one of the smallest and lightest air-cooled generators on the market.



The APU comes standard with a digital controller that will allow drivers to start and stop the generator from inside the cab.


KPS's 120-V ac and 50-A dc APU is also designed with a direct connection between the engine and alternator. The elimination of alternator belts contributes to increased reliability and reduced maintenance issues, says the company. Additionally, the APU has an oil service interval of 500 h for reduced standard maintenance costs.

The Kohler Advanced Digital Controller (ADC) will come standard on the new APU product. The ADC allows the driver to start and stop the generator, as well as adjust the heating and cooling, from inside the cab. It also features an easy-to-read LED screen that displays up to 13 operational conditions.

Additional features of the APU include a custom sound-attenuated enclosure for quiet operation and a full in-cab climate control system providing both heating and cooling output with a remote digital gauge for in-cab monitoring and operation.

Besides stationary, mobile, residential, and marine generators, and now APUs—which will be available in second quarter 2007—KPS also provides automatic transfer switches, switchgear, monitoring controls, and accessories for emergency, prime power, and energy-management applications.

Jean L. Broge



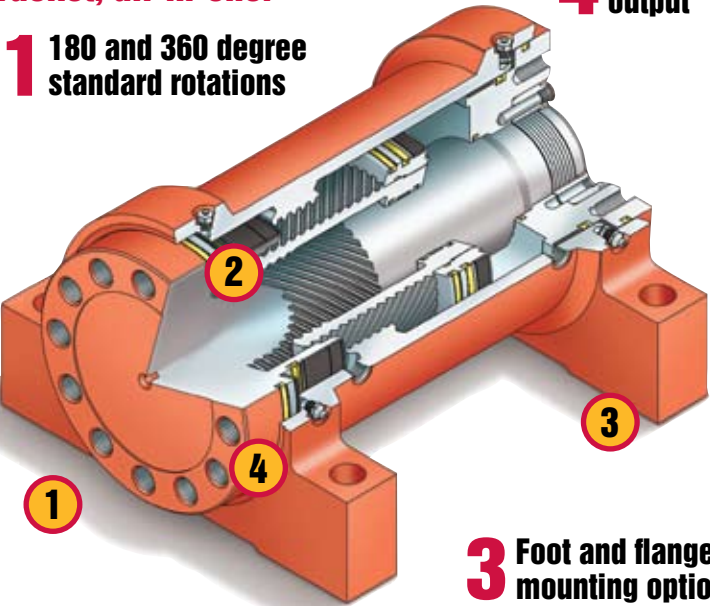
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Collaboration rapidly gaining popularity

The auto industry was one of the leaders in the early stages of globalization, and now it is pushing the concept of collaboration forward. Collaboration takes many forms, linking design teams inside and outside the company, as well as tapping ideas from other industries.

Once considered a technique that fit only in specific jobs, collaborative group efforts are expanding rapidly. In an age when global communication is no longer an issue, group efforts are rapidly becoming the norm for automakers.

"Collaboration is a fundamental part of the design process," said Maryann Combs, Executive Director of **General Motors'** Electrical Controls and Software Group.

When companies begin to collaborate globally, they gain many benefits, observers agree. Along with the new ideas that often arise when disparate groups examine a project from different viewpoints, there is the advantage of passing projects around different time zones.

and blind-spot detection."

However, even major corporations often turn to outsiders to expand their knowledge base. Though there are a number of joint ventures signed each year, observers note that these collaborations must be made in a spirit of cooperation.

Companies must balance the benefits of sharing information with the problems that can arise by giving it away. There must be a fair amount of trust even in agreements that are governed by strict legal boundaries.

"Intellectual property is a big factor in collaborations," said Peter Pao, Lead of Executive Technology at **Raytheon**.

Veterans of the process noted that not every proposal ends in a positive outcome. If companies try to set too many rules, there is a chance those rules will get in the way. "If it takes longer to negotiate a nondisclosure agreement than the time allotted for the project, there probably won't be a good result," GM's Combs said.



Convergence panelists addressing the total vehicle said collaboration is a mainstay of product development. From left to right: Siemens' Paul Camuti, GM's Maryann Combs, Consumer Electronics Association's Connectivity Committee Chair Chris Cook, Raytheon's Peter Pao, and Bosch's David Robinson.

"You won't be successful unless you're working globally," said David Robinson, President of Robert **Bosch** Body Electrical and Electronics Division. "There are big benefits to writing software 24/7."

Once companies have success in projects that link unrelated groups together, they typically add more in fairly short order. As more teams are linked together, they form loosely linked operations that range from internal groups to those in other cities or countries.

"Collaboration runs in concentric circles inside and outside your building," said Paul Camuti, President of **Siemens** Corporate Research.

The various types of collaboration are somewhat easier for huge corporations, since they can tap the knowledge of different divisions. Large, broad-based companies such as Siemens can use developments made in one field in another.

"We're doing a lot of signal processing and using other techniques to improve imaging in medical equipment," Camuti said. "The same technology is being used for pedestrian detection

Whether the development teams are internal or external, they require a change in management style. Keeping engineers focused on a project is never simple, particularly when they are located in different countries. "There are challenges to global collaboration, but there are also huge benefits," Combs said.

That is prompting many companies to focus on best practices, standards, and common tools.

"There is a cultural element, you need to manage programs differently," Camuti said. "The key focus for us is to have a common set of processes throughout the company."

Another facet of the changing environment is an increase in technical standards. Using common interfaces between hardware and software is one way to reduce the number of the relatively mundane elements of a design, making it easier for engineers to focus on higher-level aspects.

"When you're dealing with OEMs around the world, standardization is key," Bosch's Robinson said. "That's why AUTOSAR is so important."

Terry Costlow

On the go with logic controllers

Hirschmann Automation and Control's iFLEX2 is a mobile programmable logic controller specially designed for use in harsh environments. Using integrated CANopen interfaces, it can be networked with other iFLEX2 systems or other controls and extended with intelligent sensors and actuators to build a distributed network. Such attributes make iFLEX2 suitable both for safe load moment indication and for a number of control tasks for cranes and construction machines.

The iFLEX2 meets the requirements for a high-performance, universal control. In addition, this IP65 system is designed for a temperature range of -30 to +75°C (-22 to +167°F) and offers a very high EMC and vibration resistance, claims Hirschmann.

Information from conventional sensors and actuators can be processed by digital and analog inputs/outputs. Since these inputs/outputs are individually configurable, they can be optimally adapted to the respective application purpose. Proportional valves can be operated without additional amplifiers via pulse-width modulation outputs with internal current measurement. In addition to the standard CANopen interfaces, iFLEX2 also offers the possibility of transmitting motor data in



The iFLEX2 mobile controller from Hirschmann was designed specifically for harsh applications, such as those found in cranes and other construction machines.

accordance with SAE J1939.

The mobile controller uses the same software tools for programming, configuration, and diagnostics as the other systems in the iFLEX family, enabling the application software to be written in high-level C language or with a PLC programming language according to IEC 61131-3.

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Timken collaborates on steel solution

Working with one of its major automotive customers, **Timken** engineers developed a hot-rolled temper process to produce steel that could be more easily machined for a **Bosch** diesel fuel injector used on truck engines.



Timken engineers developed a hot-rolled temper process to produce steel that can be more easily machined for a Bosch diesel fuel injector used on truck engines.

Bosch previously used a low-alloy steel that was hot-rolled and annealed at its plant in Charleston, SC. According to Timken, this process produced steel with a high surface-to-core hardness gradient that was difficult for Bosch to machine. Excessive metal buildup on the tool edges led to reduced drill and tool life.

In 2005, Timken suggested a hot-rolled temper process, which would produce steel that would machine more efficiently and respond more effectively during Bosch's heat-treatment process. This hot-rolled process produced tempered steel with a higher hardness and reduced the temperature required for heat treatment by 350°F (194°C), according to David Henderson, Technical Services

Specialist with the Timken Steel Group.

Henderson explained that the annealing process requires that the steel be heated to about 1650°F (900°C) and then slow-cooled. "The microstructure consists of ferrite and pearlite," he said. "Carbon segregates somewhat from the original hot-rolled structure. Since the surface of the bar cools faster than the center of the bar, the surface tends to be about 15 BHN [Brinell hardness number] harder than the center of the

bar." The center hardness was typically 185 BHN and the surface 200 BHN.

"From Timken's own bearing business, [we have] learned that steel hardness levels less than 200 BHN can sometimes result in more expensive machining due to soft metal building up on tool surfaces," said Henderson. "Some steel materials machine better at hardness levels in the range of 210 to 235 BHN."

The grade of steel used in this Bosch application has a hardness of about 320 to 360 BHN as rolled off of the rolling mill, according to Henderson. The microstructure consists of predominantly bainite. "As rolled, the hardness of the steel is too high to machine. It needs to be softened, but a better choice than softening by annealing is to soften using a temper instead," he said.

Temperature and time required to do this is grade-dependent and has to be determined by trial and error, Henderson said. "A temperature under 1300°F and time was chosen to temper the bainite down to a hardness near 215 BHN."

After conducting machining trials and component testing, Bosch confirmed the improved machinability of the steel using the Timken process. "The high-pressure pulsation fatigue life of the hot-rolled tempered steel improved notably over that of the hot-rolled annealed steel," said Wilt Staples, Senior Purchasing Engineer at the Bosch Charleston plant.

Besides improved machinability, subsequent heat-treat response and improved cyclic fatigue are a few of the main benefits of this process. "An added advantage of the hot-rolled temper process over the annealed is that the surface and core hardness and microstructure are essentially the same, as microstructure is determined by the diffusion process rather than a cooling rate process," Henderson said.

According to Henderson, this process can be used for other supplier applications. "Any place where steel is ordered in the annealed condition could be investigated," he said.

Ryan Gehm

Testing to ensure low-noise hydraulic components and systems

Eaton has opened a sound-testing facility at its Hydraulics Operations headquarters in Eden Prairie, MN. According to the company, startup of the state-of-the-art hemi-anechoic chamber is an important part of its initiative to address the "global, market-driven demand" for low-noise hydraulic components and systems.

"Our mission is to provide hydraulic components and systems that exceed our customers' expectations regarding overall noise level and sound quality," said Sohan Uppal, Vice President of Technology-Fluid Power Group. "In effect, our goal is to become NVH-transparent to the marketplace."

Primary functions of the sound chamber include validating acoustic boundary-element method models and benchmarking competitive components; providing complete noise and/or vibration testing of hydraulic components, integrated systems, and customer applications for vehicles; testing per industry standards (ISO, NFPA, DIN, GM, etc.); and supporting customer-specific NVH issues.



Easton's new sound chamber will enable it to validate models and benchmark the competition—capabilities it considers to be critical to support its emphasis on NVH modeling and simulation efforts.

Perception of noise directly influences customer acceptance of hydraulic products.

"Both mobile and industrial markets demand low-noise components and systems in efforts to maintain a competitive advantage in a constantly evolving global arena," said Mike Beyer, Technical Specialist-NVH at Eaton.

"The overall noise level of our piston pumps, vane pumps, and steering control units is the parameter that is documented in product literature, but it's the customer's perception of sound quality that is the true measure of perceived product quality," said Beyer. "The sound chamber is a critical component in our methodology for low-noise design and increases customer confidence in our ability to design and develop hydraulic components that are inherently quiet, thereby illustrating our commitment to the future of hydraulics.

Substantial investments were made in the sound chamber, which will enable Eaton to rank noise levels in general on customer's vehicles. The chamber will also be able to provide Eaton engineers with noise-reduction solutions outside the realm of hydraulic components, which it says in most applica-



Eaton says that it is the customer's perception of sound quality that is the true measure of perceived product quality, and its new chamber is an effort to exceed customer expectations.

tions are not the leading contributor to the overall noise level of mobile and industrial equipment.

The internal dimensions of the hemi-anechoic chamber (meaning all but the floor is sound-absorbing) accommodate vehicles up to nearly 19 x 8 x 12 ft (5.8 x 2.4 x 3.7 m). The chamber is certified to an 80-Hz cut-off frequency and provides 600-hp (447-kW) drive capability.

Jean L. Broge

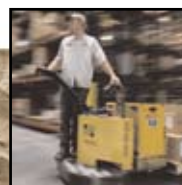
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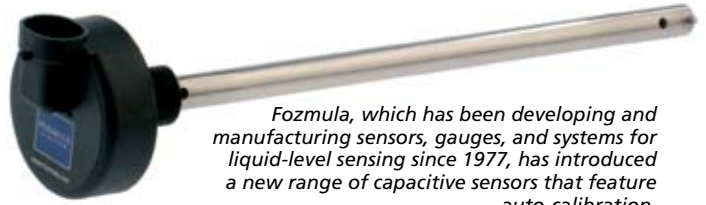
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Getting smart with liquid-level sensing

Fozmula says its new intelligent capacitive liquid-level sensor, the T/LL130, will build upon the success of its existing T/LL100 range. Unlike the T/LL100, the T/LL130 can be programmed to incorporate user-selectable switching at any level. The new sensor can also be recalibrated via a push of a button to enable it to work in a wide range of different fluid types, including oil, diesel, water, and water-based solutions.

The T/LL130 achieves this level of intelligence because it incorporates a state-of-the-art circuit board that can be factory-programmed to meet a wide variety of application requirements. At the simplest level it can be programmed to operate in exactly the same way as the T/LL100, but for more complex situations it can become an intelligent sensor for an onboard data network or an electronic engine-management system.

For more than 10 years Fozmula has been producing capacitive sensors that have traditionally been used extensively in the manufacture of electricity-generating sets and compressors because the sensors have no moving parts to clog up or break down—especially when used in extreme conditions. However, the lack of an easy method of recalibration when the same device is deployed for use with different types of liquid has somewhat limited their application. Even diesel fuel of different types (e.g. mineral and bio-diesel) and from different supply sources can result in widely different gauge measurements for the same levels of liquid, making some form of easy recalibration essential. With the T/LL130 this is no longer a limitation because of the addition of a re-calibration feature that enables the same device to be used for level measurement in oil and diesel fuels or water.



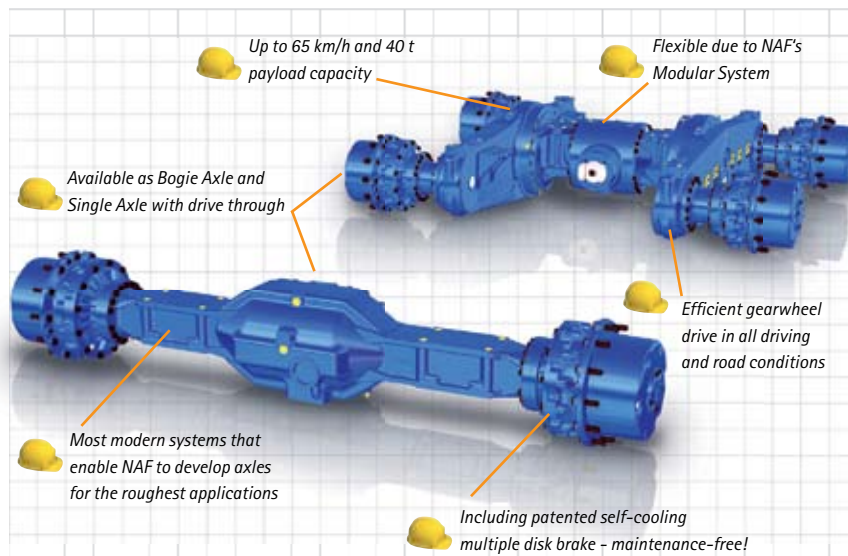
Fozmula, which has been developing and manufacturing sensors, gauges, and systems for liquid-level sensing since 1977, has introduced a new range of capacitive sensors that feature auto-calibration.

“Our ability to incorporate greater intelligence into our sensor will enable us to introduce facilities such as true auto-calibration and will also enable us to produce solid-state sensors that can be easily calibrated for tanks of different shapes and sizes,” said Chris Hands, Fozmula’s Head of Engineering. “That latter requirement is becoming an increasing challenge for manufacturers trying to make the best use of available space in the products they are developing by making their fuel tanks in more flexible materials and more bizarre shapes and sizes.”

Fozmula released the T/LL130 in October and it is now being delivered to customers as a direct replacement for the T/LL100 in all existing applications. New applications are now currently being developed with existing and new customers in sectors such as construction, agricultural vehicles, utility vehicles, and the marine industry. Fozmula manufactures and distributes its products from its factory in Leamington Spa in Warwickshire but also manufactures high-volume products in Latin America and through its subsidiary company in the Far East.

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