[01] bauma 2019: Making construction and agricultural machinery more efficient – Bosch presents innovative powertrain solutions

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Press release
Powertrain Solutions
Bosch compact

April 4, 2019
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bauma 2019
Making construction and agricultural machinery more efficient – Bosch presents innovative powertrain solutions

- Plan more efficiently with the IoT-based connectivity solution Bosch TRACI
- The VCU – a high-performance control unit for the powertrains of the future
- Connected exhaust-gas treatment leads to shorter development times
- Common-rail systems – the right solution for every application Optional bullet point

Stuttgart – From excavators and dump trucks to tractors, Bosch offers a variety of solutions for construction and agricultural machinery that significantly reduce both operating costs and emissions in off-road applications. The technology and service provider is now expanding its proven portfolio with innovative solutions like connected exhaust-gas treatment. Bosch will present its range of products at the “bauma” trade fair from April 8 to 14, 2019 in Munich.

Bosch TRACI – bringing cloud computing to construction machinery
On large construction sites in particular, the location and current running performance of construction machinery are often unclear. The “Bosch Asset Tracing Solution”, or Bosch TRACI for short, provides this data in real time, helping operators plan vehicle deployment as efficiently as possible. The IoT-based connectivity solution enables further improvements in the efficiency and utilization of the vehicle fleet. The Bosch solution is comprised of the highly robust sensor box, the cloud-based analysis software, and a range of digital services. It is easy to retrofit in existing vehicles.

Vehicle control unit – high-performance control with cross-domain functions
The off-road segment is also seeing increasing diversity and complexity in the powertrain. Legal provisions require better exhaust-gas treatment systems, while new drive solutions like natural gas, electric motor or fuel cell are increasingly

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being used alongside diesel and gasoline. With the vehicle control unit (VCU), Bosch offers an extremely flexible, high-performance control unit that coordinates all components in the powertrain. By partially taking on some of their tasks, it enables simplification and standardization of the subordinate control units closer to the components. The VCU can also connect the powertrain with other domains like infotainment, telematics, or driveline. This makes it easier to introduce cross-domain functions.

Exhaust-gas treatment systems – the future is connected

AdBlue injection systems, combined with SCR catalytic converters (selective catalytic reduction), ensure comprehensive exhaust-gas treatment. These systems help vehicle manufacturers make sure that their construction machinery comply with statutory exhaust-gas standards up to US Tier 4 final or EU Stage 5. The metering system Denoxtronic 2.2 evo is a more robust version of Bosch's Denoxtronic 2.2. Bosch designed the highly compact version Denoxtronic 6-5 for smaller construction machinery. The 6-HD variant features a metering rate of up to 15 kg/h, making it particularly suitable for large engines.

Bosch's new IoT application Web-based Validation will shorten development times in future. The cloud-based function constantly transfers powertrain data from the connected vehicles. This information allows Bosch and the customer to adjust exhaust-gas treatment systems and their components more quickly and precisely to various applications.

Bosch common rail – the right solution for every diesel application

Bosch offers injection systems for a range of diesel engines in both the on and off-highway sectors, from cars and medium-duty to heavy-duty and large engines. In addition, the portfolio includes engine control and a range of sensors, as well as exhaust-gas treatment systems. The electronic engine control unit takes care of engine management. Together with the sensors, it forms the central control unit for the injection system. The sensors deliver precise and up-to-date information from the engine and exhaust tract, forming the basis for all functions from mixture generation to exhaust-gas treatment.

<u>Off-highway applications up to 19 kilowatts:</u>

Smaller off-highway motors, such as those for vibrating plates and small emergency power generators, require a robust but compact injection system specifically tailored to their requirements. For engines up to 19 kilowatts, Bosch now offers the unit control valve (UCV). This ingenious expansion augments the existing injection system. Together with the right sensors, it allows users to electronically control the start and end of the injection. This approach offers much greater stability compared to mechanical systems. Users have more precise

control over engine speed when operating a vibrating plate, for example. The unit control valve helps engines comply with the emission requirements in US Tier 4 final, EU Stage 5, and comparable standards. For engine manufacturers, the application-specific mechanical controller used previously is now also a thing of the past. This function is performed by a dataset stored in the control unit.

Off-highway applications up to 130 kilowatts:
Bosch's CRS2-OHW common-rail systems tend to be used in engines of up to 130 kilowatts. They are specially adjusted to the specific requirements of off-highway use. In particular, they are designed for periods of full-load use and larger injection quantities, making them highly robust, efficient, and powerful. The high-performance injectors of the second generation offer engine developers a great degree of freedom when designing the injection course. They cover up to eight individual injections per cycle in a tight time frame. This helps further reduce fuel consumption and therefore the emissions of CO_2, pollution, and noise from the powertrain.

Medium-duty and heavy-duty off-highway applications up to 560 kilowatts:
For larger diesel engines, Bosch's modular common-rail injection system CRSN offers efficient fuel supply and injection for off-highway applications and commercial vehicles. A range of system components and modules can be combined depending on the needs of the engine manufacturer. This enables pressures of between 1,800 and 2,500 bar. The system can be used variably in engines with up to eight cylinders and engine powers of between 560 and 850 kilowatts. It is designed to last up to 15,000 hours in off-highway operation, depending on the segment and market. High nozzle flow rates make it possible to optimize the combustion strategy and maximize engine power. The system is also compatible with electric powertrains.

Modular common rail system for large engines over 560 kilowatts:
With the modular common-rail injection system (MCRS), Bosch also offers perfect fuel injection for engines over 560 kilowatts. This solution is suitable for both mobile and stationary industrial applications, engines in ships and locomotives, and stationary generators. Compared to mechanical injection systems, the common-rail system for large engines can help significantly reduce both fuel consumption and operating costs. The special design features high-pressure accumulators in the pump and injectors, and removes the need for a rail. This enables flexible engine design, minimizes pressure fluctuations, and ensures a constantly high injection pressure at the nozzle, even for multiple injections. Thanks to the variable size and performance range of the pumps and injectors, the injection system can be adjusted to different engine sizes and powers. The high-pressure pump is scaled via the number of pump elements,

while the injector uses different nozzle types with varying flow rates. The system is available in two pressure levels of 1,600 or 2,200 bar. For engines at the bottom end of the large-engine segment, it is possible to combine the MCRS injection pump with the CRIN injectors of the modular CRSN system.

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Mobility Solutions is the largest Bosch Group business sector. According to preliminary figures, it generated sales of 47 billion euros in 2018, and thus contributed 60 percent of total sales from operations. This makes the Bosch Group one of the leading automotive suppliers. The Mobility Solutions business sector pursues a vision of mobility that is accident-free, emissions-free, and stress-free, and combines the group's expertise in the domains of automation, electrification, and connectivity. For its customers, the outcome is integrated mobility solutions. The business sector's main areas of activity are injection technology and powertrain peripherals for internal-combustion engines, diverse solutions for powertrain electrification, vehicle safety systems, driver-assistance and automated functions, technology for user-friendly infotainment as well as vehicle-to-vehicle and vehicle-to-infrastructure communication, repair-shop concepts, and technology and services for the automotive aftermarket. Bosch is synonymous with important automotive innovations, such as electronic engine management, the ESP anti-skid system, and common-rail diesel technology.

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Press release
Automotive Aftermarket

March 2019
PI 10903 AA Dr

At the Bauma trade fair, Bosch presents new solutions for efficient machine diagnoses and repairs on construction and agricultural machinery
Development of diagnostic and repair applications via Bosch Grade-X platform

- Intelligent diagnostic platform complying with industrial standards for manufacturers of construction and agricultural machinery
- Well-proven Bosch Grade-X platform used by more than 30 vehicle manufacturers worldwide
- Time and money savings by means of Grade-X applications

Munich – At the Bauma construction machinery trade show in Munich from April 8 to 14, 2019, the Bosch Automotive Aftermarket Division will present several products related to vehicle diagnoses at a joint booth with Bosch Rexroth in Hall A3/Stand 327 – both for manufacturers of construction and agricultural machinery and for workshops maintaining and repairing these machines.

Car manufacturers around the world already use the well-proven Bosch Grade-X diagnostic platform for the efficient development of software solutions for vehicle diagnoses and repairs. Bosch now adjusted this successful platform – meeting international industrial standards which make it suitable for cross-manufacturer applications – to the specific requirements of the market of construction and agricultural machinery. After all, the demand for intelligent, electronic and connected solutions is growing on the construction/agricultural-machinery sector as well. To ensure operational readiness of these machines at any time, the manufacturers develop sophisticated functions including cloud-based diagnoses and service over the air (SOTA). This results in a technical complexity which requires handling of large data volumes and the use of faster analytical tools. The Bosch Grade-X platform provides vehicle and machinery manufacturers with an ideal solution for the straightforward and timely creation of diagnostic solutions for new series and reduces the development times by up to 50 percent.

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So far, more than 30 vehicle manufacturers worldwide already use this well-proven platform.

Bosch Grade-X – the platform and its possible applications at a glance:
Integration into existing manufacturer platforms is possible
The Grade-X platform can be integrated into existing customer platforms. It features a modular and scalable design and allows the integration of tools of other manufacturers. The platform supports several industrial standard thus allowing simple and easy data exchange. End-to-end encryption and additional security features protect it against hacker attacks and ensure safe data transfers.

Applications for troubleshooting and repair at automotive workshops
Diagnostic solutions developed via Grade-X can be used on different devices and systems – no matter whether for a telediagnoses on machinery or embedded into a control unit, whether on the workshop computer or on a tablet. These diagnostic solutions support the members of the workshop staff concerning symptom-based troubleshooting. The workshop software's intuitive user interface can be branded individually for each manufacturer. In a step-by-step manner, it guides the user through the diagnoses. Once the mechatronic connected the diagnostic tester and identified the machine, for instance, by its serial number, he is only provided machine-specific information at the subsequent steps. As soon as the error pattern has be read out of the fault memory, Bosch-developed and innovative ActiveSchematics software creates the relevant circuit diagrams for the specific error pattern. Doing so, it only takes those components into consideration that are actually installed at the machine.

Via Augmented Reality (AR), additional text and image information as well as the location of hidden components are shown on the screen of the mechatronic's tablet computer or on his Augmented Reality glasses. To create AR applications in an easy and straightforward manner, Bosch developed the Common Augmented Reality Platform (CAP). It uses development-originated data and draws information from different databases to feed the respective AR applications.

Two powerful tools: Augmented Reality and ActiveSchematics
The combination of Augmented Reality and ActiveSchematics accelerates repair procedures and helps avoiding mistakes. It eases both the fault isolation and the identification of the components affected. In addition, it saves time as the mechatronics don't have to go through the manuals to find the solution. They can start repairing right away. Focusing on information relevant for a specific vehicle and error pattern also helps avoiding unnecessary repair steps and thus costs.

Press photo: #1845673

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The Automotive Aftermarket division (AA) provides the aftermarket and repair shops worldwide with modern diagnostic and repair shop equipment and a wide range of spare parts – from new and exchange parts to repair solutions – for passenger cars and commercial vehicles. Its product portfolio includes products made as Bosch original equipment, as well as aftermarket products and services developed and manufactured in-house. About 17,000 associates in more than 150 countries, as well as a global logistics network, ensure that spare parts reach customers quickly and on time. AA supplies testing and repair-shop technology, diagnostic software, service training, and information services. In addition, the division is responsible for the "Bosch Service" repair-shop franchise, one of the world's largest independent chains of repair-shops, with some 15,000 workshops, and more than 1,000 "AutoCrew" partners.

Additional information can be accessed at www.boschaftermarket.com

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Press release
Powertrain Solutions

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Bosch is digitalizing construction sites
Interconnected sensors enhance efficiency and utilization rates of vehicle fleets

- The IoT solution Bosch TRACI locates and monitors vehicles on construction sites and farms
- Wait, search, and transportation times are kept to a minimum
- Data transmitted by the sensors helps improve processes, decision making, and machinery utilization
- Energy-saving communication via the LoRaWAN network

Stuttgart – It is a real headache, as well as a potential cause of delay, when vehicles such as excavators or dump trucks cannot be located on huge construction sites. Where exactly are my vehicles? And how many hours have they been in operation? It is questions like these that fleet operators in the construction industry and agricultural sector have to be able to answer if they want to deploy their vehicles as efficiently as possible. This is where the Bosch asset tracing solution – or Bosch TRACI for short – comes into its own. The robust, IoT-based connectivity solution can be easily retrofitted to existing vehicles. “Bosch TRACI provides all the relevant data needed to enhance the efficiency and utilization rate of any vehicle fleet,” says Jan Philipp Büchner, the product manager responsible for Bosch TRACI. “It helps keep wait, search, and transportation times to a minimum.” The Bosch solution comprises a sensor box, cloud-based evaluation software, and a wide array of digital services.

Improvements through tracking

Productivity growth is substantially lower in the construction industry than elsewhere, and the reasons for this include the growing difficulty of keeping track of all pieces of machinery on increasingly larger and more complex building projects. Bosch TRACI helps improve how much the machinery is used, while speeding up the process of materials distribution. Every vehicle is first equipped with a Bosch TRACI tag, a compact sensor box with its own power supply that captures the vehicle’s position, state of motion, as well as a lot of other data.

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The data is encrypted and transmitted via a LoRaWAN network to the Bosch IoT cloud, where it is decrypted. Customers and users can then access the sensor data, integrating it into their existing software systems for logistics, scheduling, and operations planning. Of course, the data can also be visualized directly on a smartphone app or in a web browser.

Keeping tabs on vehicle fleets and machinery

In agricultural scenarios, Bosch's asset tracing solution dovetails with existing agricultural machinery systems as well as with the sensor-based monitoring solutions provided by the Bosch startup Deepfield. It can also be used to record the operating hours of coupled machines (such as seeding machines without an independent power supply) and to determine when the operators should be reminded of important maintenance work. That can substantially lower the risk of breakdowns and expensive repairs. Bosch's Connected Agriculture platform ensures an easy exchange of data and trouble-free interaction with existing Bosch solutions.

Robust, long-lasting, versatile

During Bosch TRACI's development, special emphasis was placed not only on data security and ease of integration, but also on the need to withstand rough ambient conditions on construction sites and farm fields. Bosch TRACI tags are tested to meet such stringent tightness requirements that the machines on which they are installed can be cleaned with high-pressure jets of steam. The tags are also especially resistant to shock and liquids.

In typical applications, the service life of a sensor is three to six years. That can be extended to ten years if the measurement and transmission intervals for sensor data are reduced. The sensor's clever software algorithms achieve this, for example, by limiting the capture of positional data to situations in which the sensor is moved. High levels of robustness and a long service life also point to potential use cases in other markets. Deployed in smart-city scenarios, for instance, the sensors can make the management of local-government vehicles and technology easier. They can capture movements in infrastructure such as power pylons, enabling fatigue and damage to be detected in good time. In open-cut mines, they can serve to check the condition of machinery and conveyor belts so that maintenance work can be performed as needed.

LoRaWAN – a cost-efficient, energy-saving network

Bosch TRACI uses the LoRaWAN (long-range wide-area network) IoT wireless network. The development of this standard is being promoted by the LoRa Alliance. The standard allows users to set up their own networks, in similar fashion to a wi-fi network at home. Unlike wi-fi, a LoRa network has a range of several kilometers, but with lower bandwidths. Nonetheless, these bandwidths are more than adequate for the data the Bosch TRACI tag transmits. There are also publicly accessible LoRaWAN networks run by commercial operators. Like existing mobile networks, these collect and transmit data from LoRa sensors. Virtually seamless LoRaWAN networks are already in place in France, Switzerland, and the Benelux countries, and a public one is under construction in Germany. Bosch is already working together with several providers in these countries, and can offer its customers the option of using such public networks for its TRACI solution. Bosch TRACI can also be utilized in The Things Network, an open, community-based initiative that invites everyone to form part of a global IoT network and make use of it themselves. As of early 2018, there were over 3,400 LoRa stations in operation in more than 80 countries.

Press photos: #1453317, #1453318, #1453319

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