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IAA 2014

Bosch commercial-vehicles business grows by more than 10 percent

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- ▶ Wolf-Henning Scheider: “Bosch is in the fast lane”
- ▶ Equipment for trucks, vans, and buses accounts for one-quarter of all sales in Automotive Technology business sector
- ▶ Bosch is European market leader for truck and bus infotainment systems

Hannover – With sales growth of more than 10 percent, Bosch’s commercial-vehicles business is making a major contribution to growth in the company’s Automotive Technology business sector. Overall, Bosch’s automotive business is set to register growth of 7 to 8 percent in 2014. In the current year, the company will generate one-quarter of its automotive technology sales with equipment for trucks, vans, and buses. “Bosch’s commercial-vehicle growth is in the fast lane,” said Wolf-Henning Scheider, member of the board of management of Robert Bosch GmbH and spokesperson for the Automotive Group, at the 2014 IAA Commercial Vehicles in Hannover. Diesel technology continues to be the main driver of growth. In this regard, Bosch is benefiting from ever stricter emissions standards for trucks and buses, as well as for off-highway vehicles such as tractors and construction machinery.

Emissions standards boost global sales of diesel systems

China4 is one current example of such standards. As a result of this new emissions standard, electronically controlled high-pressure injection systems and exhaust-gas treatment will be mandatory for new commercial vehicles. Bosch is benefiting from this. The company has sold twice as many common-rail systems as in 2013. Consequently, this year will see the opening of a second Bosch manufacturing site for commercial-vehicle technology in China.

But China is not the only country in which exacting standards are boosting sales figures: worldwide, nearly a million Denoxtronic exhaust-gas treatment systems for trucks and buses will be delivered this year.

Web-enabled trucks: operating efficiency is top priority

Particularly in Europe and the U.S., Bosch is focusing on connectivity in commercial vehicles alongside diesel technology. “We expect that by as early as 2016, every new commercial vehicle in Europe and the U.S. will be web-enabled,” said Wolf-Henning Scheider. Bosch is already the European market leader for truck and bus infotainment systems. Bosch is also using this connectivity to enhance commercial vehicles’ fuel economy. One example of this is Eco.Logic Motion – a system that uses a navigation data-based electronic horizon to calculate an efficient driving strategy. To achieve this, Bosch connects the powertrain and the transmission with the navigation system. This alone results in average fuel savings of 5 percent – according to measurements made by Bosch customers, the saving can even reach 9 percent. In the future, Bosch will also be connecting the engine management and transmission control systems with web-based real-time data. This will allow the commercial vehicle’s powertrain to adapt not only to the topography and geometry of the road network, but also to speed limits and road works. To quote Scheider, the result is an optimization “based on live information.”

Bosch Automotive Technology - close to the customer worldwide

In order to be able to supply customers in China, Europe, and the United States, Bosch relies on local partnerships and local manufacturing. Outside Germany, the company has manufacturing operations for commercial-vehicle diesel systems in the U.S., Brazil, China, the Czech Republic, Japan, and India. The expansion of global competence in the automotive sector is also reflected in headcount: by the beginning of 2015, Bosch Automotive Technology will employ a good 193,000 associates, almost 13,000 more than at the start of 2014. This increase will mainly take place in Asia. In addition, the Automotive Technology business sector will see its research and development workforce grow from almost 35,000 to more than 37,000 associates.

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Automotive Technology is the largest Bosch Group business sector. In 2013, its sales came to 30.6 billion euros, or 66 percent of total group sales. This makes the Bosch Group one of the leading automotive suppliers (NB: Due to a change in accounting policies, the 2013 figures can only be compared to a limited extent with the 2012 figures). Automotive Technology largely operates in the following areas: injection technology for internal-combustion engines, alternative powertrain concepts, efficient and networked powertrain peripherals, systems for active and passive driving safety, assistance and comfort functions, technology for user-friendly infotainment as well as car-to-car and Car2X communication, and concepts, technology, and service for the automotive aftermarket. Bosch has been responsible for important automotive innovations, such as electronic engine management, the ESP® anti-skid system, and common-rail diesel technology.

The Bosch Group is a leading global supplier of technology and services. In 2013, its roughly 281,000 associates generated sales of 46.1 billion euros. (NB: Due to a change in accounting policies, the 2013 figures can only be compared to a limited extent with the 2012 figures). Its operations are divided into four business sectors: Automotive Technology, Industrial Technology, Consumer Goods, and Energy and Building Technology. The Bosch Group comprises Robert Bosch GmbH and its roughly 360 subsidiaries and regional companies in some 50 countries. If its sales and service partners are included, then Bosch is represented in roughly 150 countries. This worldwide development, manufacturing, and sales network is the foundation for further growth. In 2013, the Bosch Group invested some 4.5 billion euros in research and development and applied for some 5,000 patents. This is an average of 20 patents per day. The Bosch Group's products and services are designed to fascinate, and to improve the quality of life by providing solutions which are both innovative and beneficial. In this way, the company offers technology worldwide that is "Invented for life."

Additional information is available online at www.bosch.com, www.bosch-presse.de, <http://twitter.com/BoschPresse>

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**More efficiency, more connectivity:
Bosch is enhancing the utility of commercial vehicles
and growing much faster than the market**

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Presentation by Wolf-Henning Scheider,
member of the Bosch board of management
responsible for the Automotive Group,
at the press conference on September 23, 2014, at
IAA Commercial Vehicles in Hannover

Check against delivery.

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Ladies and gentlemen,

Commercial vehicles fitted with cruise control move at a constant speed – developments in the commercial vehicles business, by contrast, tend to be not as smooth. Currently, this business is developing very dynamically at Bosch. Three things characterize our business: efficiency, connectivity, and growth. My talk today will address all three.

- First, there is still considerable potential to reduce the operating costs of trucks, transporters, and buses. We can do this both with conventional and new drive systems.
- In addition to this, we are networking our systems. Not only are we doing this inside the vehicle, we are also taking the cloud to the streets. We are developing new services via the internet.
- In so doing, we are making commercial vehicles even more useful – and this is also benefiting our own business. At the moment, we are growing particularly fast. Global commercial vehicle production is expected to expand between 2 and 3 percent this year. At Bosch, our sales in this segment are set to increase more than 10 percent. Our growth in the truck and bus market is in the fast lane.

On growth course: clean diesel gets a boost in China

Let us first stay on the topic of our business development.

Bosch Automotive Technology makes a quarter of its sales with equipment for trucks, vans, and buses, and half its sales with diesel systems. As a result of the dynamic growth in our commercial-vehicles business, the business sector is developing significantly better than the market. In 2014, we expect Bosch automotive technology sales to grow by 7 to 8 percent. At the same time, global automobile production will see 3 to 4 percent growth. The positive state of our business is reflected in our headcount: By the beginning of 2015, our Automotive Technology business sector will employ a good 193,000 associates, almost 13,000 more than at the start of 2014. This increase will mainly take place in Asia.

In particular, demand from China is giving our commercial-vehicles business an extra boost, especially in the area of diesel systems. This is largely attributable to the China4 emissions standard, which calls for electronically controlled high-pressure injection and exhaust gas treatment systems. Bosch is well prepared for this development. Our technology for trucks and buses is helping cities like Beijing and Shanghai reclaim their clean air. This year, we expect to sell twice as many common-rail systems in the Chinese commercial-vehicle market as in 2013.

Demand for our diesel systems is also high outside of China. This year, we will be delivering almost a million Denoxtronic exhaust-gas treatment systems worldwide to the truck sector – the first time we have done so. Moreover, unit sales of our common-rail systems for commercial vehicles are developing

very encouragingly across the globe. These systems are installed not only in trucks, vans, and buses, but also in off-highway vehicles such as tractors and construction machinery. We are preparing for stricter emissions standards here as well. Diesel systems are not the only thing we supply to the off-highway segment. We also offer large starters and generators, as well as the mobile hydraulics of our Bosch Rexroth subsidiary.

Our portfolio for commercial vehicles of all types is broad, as is our global presence. And we continue to expand this presence. We already manufacture diesel systems for commercial vehicles in seven countries: the United States, Brazil, Germany, the Czech Republic, Japan, India, and China. This year, will be adding another Chinese location to this manufacturing network. When it comes to the Asian growth market, we are developing special solutions. Our lubricated common-rail pumps, which are robust even in the event of lower-grade fuel quality, are a strong example. We developed this product in China, for China, but also for Russia and India.

In addition, we are stepping up our innovative capabilities. Over the course of this year, our Automotive Technology business sector will see its research and development workforce grow from almost 35,000 to more than 37,000 associates. Of these, 19,000 will be located in Europe, 2,000 in the Americas, and 16,000 in Asia-Pacific. This team is coming up with innovations for the efficient and connected commercial vehicles of the future.

More efficiency: fuel savings with conventional and new powertrains

The currently good development of our business is one thing I wanted to talk about. Another is efficiency, and in the first place fuel savings and climate protection. One percentage point at a time, our engineers are working on further reducing the fuel consumption and thus also the CO₂ emissions of trucks and buses. This is technology “Invented for life,” technology that clearly reflects Bosch’s strategic imperative. It is a green technology that pays off, in economic terms as well. Logistics companies notice its value in their books. Overall, our measures can reduce the fuel consumption of commercial vehicles another 15 percent by the end of this decade. At current fuel prices, this will mean a reduction in operating costs of 10,000 euros per truck each year for vehicles driving an average of 135,000 kilometers.

With our new CRSN3-25 common-rail system, we have already reduced fuel consumption by 1 percent. This amounts to savings of almost 700 euros per truck each year. It offers high-tech in two ways:

- First, with leakage-free injectors, which prevent even the smallest drop of fuel from being returned unused into the rail.
- Second, with injection pressure of 2,500 bar, which enables the fuel mixture to be so finely adjusted that the system can flexibly employ exhaust-gas treatment or recirculation as needed. This allows us to deliberately save AdBlue.

When I say deliberately, I mean that we are reacting to the cost of AdBlue, which can vary widely from region to region. Where the urea solution that is needed to reduce nitrogen oxide emissions is expensive, we reduce its use. Doing so requires higher pressure and more exhaust-gas recirculation. Even in the fight against emissions, Bosch takes efficiency into account. This also enables logistics companies to reduce their operating costs.

All this is the result of the deep systems expertise that our engineers bring to the table. It should be noted here that we can only design the full system so flexibly because we also offer all the necessary components, from sensors and injectors to Denoxtronic. When it comes to technology for diesel commercial vehicles, we are the global market leader and a full-service technology provider. And we can improve efficiency and emissions with two additional levers.

- With our Bosch Mahle Turbo Systems joint venture, we have been offering exhaust-gas turbochargers for commercial vehicles since 2012. The activities of this joint venture focus on our diesel business. The aim is also to deliberately address the needs of truck manufacturers. Its range of turbochargers covers engines delivering between 30 and 520 kilowatts. In other words, they are just as suitable for small machines as for heavy trucks. And this year, we are opening a new turbocharger plant in Shanghai, so that we can serve Asian customers from a local manufacturing base.
- With our Bosch Emission Systems subsidiary, we offer full exhaust-gas treatment packages – solutions that can be tailored to special vehicles. This business is growing as a result

of increasingly strict emissions standards for off-highway vehicles. And demand is also growing in the conventional truck segment. To meet this demand, we are expanding our plant in Neunkirchen, Germany.

All this clearly shows that our product portfolio is based on a profound systems expertise. This know-how is what allows us to keep optimizing the diesel engine in commercial vehicles. When it comes to the necessary efficiency targets, however, we think beyond conventional powertrain systems by complementing them in three areas:

- First, we offer powertrain technology for natural gas, an alternative fuel that is especially affordable and less CO₂-intensive. Here, too, we offer a full portfolio of products that includes control units, sensors, and injection valves. Infrastructure is currently growing with the market, for instance with gas service stations along long-haul routes in the United States, or with local networks in China. As early as 2015, Bosch will fit almost 50,000 commercial vehicle engines with natural gas drives – twice as many as in 2014. In the long term, the exploitation of large gas reserves will support growth in China and North America. Globally, the number of trucks and buses running on CNG will increase by an annual average of 13 percent between now and 2020.
- Second, we are working to electrify powertrains for commercial vehicles. To this end, our EM-motive joint venture will also produce electric motors that are designed for use in trucks as well. By the end of the decade, we aim to develop an electric hybrid for trucks that will pay for itself within

two to three years. With a hybrid solution, the fuel consumption of heavy-duty vehicles on long-haul runs can be reduced by as much as 6 percent, while the figure for vans on delivery runs is between 10 and 15 percent. As a result of their higher mileage, long-haul trucks fitted with an electric hybrid can significantly reduce their operating costs by up to 4,000 euros per truck each year.

- And third, using engine heat recovery allows a 5 percent decrease in the fuel consumption of commercial vehicles. Here, too, we expect the corresponding solutions to be market-ready by the end of the decade. It's important to note that heat recovery reduces fuel consumption in instances where the electric hybrid's strengths come less into play: at constant speeds over long distances.

More connectivity: the internet is enabling new services

There are many ways to make commercial vehicles even more useful, and our approaches complement each other. This will become even clearer when we network our systems. Which brings me to my third main topic. Initially, connectivity is increasing inside the vehicle, and already allows us to significantly increase efficiency.

- My first example is our generator which interfaces digitally with the engine control unit. It can be adjusted based on driving status: it charges during braking and coasting, and turns itself off when the vehicle accelerates. This reduces fuel consumption by 1 percent. Bosch is the first supplier to offer such an intelligent generator for commercial vehicles.

With it, we have set a market trend. By the end of the decade, the installation rate will have risen from 3 to 20 percent.

- The second example is our “Eco.Logic Motion” system, which we took into series production just two years ago. Using an electronic horizon based on navigation data, it calculates an efficient driving strategy for the vehicle’s engine management and transmission control systems. From accelerating ahead of gradients to avoiding unnecessary gearshifts, the technology reduces fuel consumption by 5 percent on average. Customers have even reported savings of up to 9 percent, depending on the topography.

But connectivity is more than the interplay of different vehicle systems. It also connects the truck to the cloud. As soon as 2016, we expect every new commercial vehicle in Europe and the United States to be web-enabled. To this end, we are also developing the necessary hardware. We already offer a connectivity control unit – a box that connects vehicle electronics with external servers via data communication. It can be configured flexibly for a number of purposes, from monitoring truck trailers to serving as an onboard device for truck tolls. And we are developing a second generation that is suitable for LTE wireless communication. It can be used with the software applications of different commercial vehicle manufacturers.

Above all, we are taking advantage of connectivity to come up with new, service-oriented business models. All divisions across the Bosch Group are working together here. Our broad knowledge of the industry allows us to come up with new ser-

vices and benefits on the internet of things. Here at the IAA, we are showing a number of solutions that are specially tailored to the needs of the commercial vehicle and logistics sector, as well as those of OEMs and fleet operators. To give three examples:

- First, using data from the vehicles' control units, logistics companies can monitor wear and tear in their fleets via the internet. As a result, maintenance and repairs can be planned at an early stage. We are standardizing this type of fleet management with leasing and insurance companies. It is also suitable for the logistics industry. For instance, our service can prevent a truck fully loaded with frozen goods from unexpectedly breaking down somewhere along the way.
- Second, we use the internet to ensure the safety of such deliveries. We can do so using an e-call solution, for example, or by monitoring trailers via their GPS position. It is becoming increasingly difficult to find secure parking spaces for trucks along highways. We're offering a new solution to remedy this problem: an online reservation system that makes it possible to book parking spots at truck stops. The next step is planned for the coming year: the video surveillance of these premium parking spots. We will be delivering the camera systems and our security centers will be monitoring the video images. We refer to this service package as "Bosch Secure Truck Parking." With it, we are creating a virtual protective fence for valuable cargo.

- Third, we are broadening the electronic horizon of our “Eco.Logic Motion” system via the cloud. This means, for example, that the engine management and transmission control systems not only adapt to the topography and geometry of the road network, but also to speed limits and road works. Last but not least, we also connect these systems with a warning that signals the tail end of traffic jams. All this means that we are optimizing drive and transmission technologies on the basis of real-time information.

In principle, the following applies: the more internet applications are on wheels, the more user-friendly they must be. With mySPIN, we have already made it possible to display smartphone apps on the dashboard. We introduced this solution for passenger cars this year. But it can also be used to integrate internet applications in trucks. Bosch is Europe’s market leader for infotainment in trucks and buses. The driver’s workplace of the future is on display at our trade show booth. It comprises a cockpit, safety and camera systems, as well as telematics and efficiency functions. But the highlight is not visible to the naked eye: an electronic resource manager ensures that the driver isn’t overwhelmed with too much information from the internet. It only displays information that is immediately relevant and useful for the driving situation.

Growth through savings: the basis for success

Our solutions are designed with the driver in mind. Above all, they are designed to ease his workload. Whether under the hood or at the wheel, efficiency comes first for us. From drive technology to connectivity, the objective behind all our innovations is to increase efficiency. We are aware that economical solutions play an especially important role in the commercial-vehicle segment. Such solutions have driven our success as a supplier in industrialized countries, and especially in emerging markets. Ultimately, another reason we are growing is because we help our customers save money.



Efficiency and connectivity **Bosch commercial-vehicle technology at the IAA 2014**

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Economical networking solutions, from diesel technology to hybridization

Potential savings: In all, Bosch technology can reduce commercial-vehicle fuel consumption by an additional 15 percent by 2020. Given today's fuel prices and a total annual mileage of 135,000 kilometers, this means a reduction in operating costs of some 10,000 euros per vehicle per year.

"Efficiency comes first not only under the hood, but also at the wheel. We know that economical solutions play an especially important role in the commercial-vehicle segment," says Wolf-Henning Scheider, member of the board of management of Robert Bosch GmbH and spokesperson for the Automotive Technology business sector.

Powertrain technology: diesel expertise from injectors to exhaust-gas treatment

Systems supplier: Bosch supplies all necessary core components for commercial-vehicle diesel powertrains from a single source. The portfolio ranges from sensors and injectors to exhaust-gas treatment using Denoxtronic.

Common-rail system: Bosch's CRSN3-25 alone saves up to 1 percent fuel, a saving of nearly 700 euros each year. With an injection pressure of 2,500 bar, the system can be flexibly configured to meet the specific requirements for exhaust-gas treatment and exhaust-gas recirculation. Bosch's CRSN3-25 is leak-free in both low- and high-pressure ranges.

Heavy-duty starter: The new, powerful HEF109-L type starter achieves an 18 percent more dynamic starting performance. It delivers up to 9.2 kilowatts, which is enough to reliably start diesel engines with up to 28 liters displacement. Remarkably compact, the HEF109-L heavy-duty

starter is particularly suitable for use where engine compartment space is limited.

Turbochargers: The Bosch Mahle Turbo Systems GmbH & Co. KG joint venture has been manufacturing exhaust-gas turbochargers for commercial vehicles since 2012. The product portfolio includes six basic variants for engines delivering anything from 30 to 520 kilowatts.

Exhaust-gas treatment: The Bosch subsidiary Bosch Emission Systems GmbH & Co. KG (BESG) supplies complete plug-and-play packages for exhaust-gas treatment. It can tailor systems for individual customers and take over integration into vehicles or machinery, including certification.

Brake control system: ESP 9TE for commercial vehicles up to eight tons will be fitted as standard to a new model of an US truck maker from late September. Designed specifically for the North American market, the brake control system builds up brake pressure quickly. This makes ESP 9TE ideal for vans and pick-up trucks, with their longer wheelbase and larger calipers.

Alternatives: CNG powertrains, electrification, and waste-heat recovery

CNG: This fuel is particularly inexpensive and also emits less CO₂ during combustion. Bosch offers a complete system comprising control units, sensors, and injection valves. In 2015, the company will equip almost 50,000 commercial-vehicle engines with CNG systems, twice as many as in 2014. Over the long term, this market will grow in both China and North America.

Boost recuperation system: Bosch offers a 48-volt entry-level hybrid for light commercial vehicles. This has several benefits: the system makes fuel-efficient coasting possible, while its higher power means it makes better use of energy recovery than applications based on conventional voltage levels, achieving overall system fuel savings of up to 25 percent.

Hybridization: Delivery vans can save as much as 15 percent fuel through electrification, while heavy trucks traveling long distances can save roughly 6 percent. The goal by the end of the decade is to develop an electric hybrid for trucks that pays for itself within two to three years.

Waste-heat recovery: By recovering heat from the engine, fuel savings of up to 5 percent can be achieved. The technology especially reduces fuel consumption at constant speeds on long stretches. Bosch expects to bring this to market by the end of the decade.

Connectivity: from electronic horizons to preventive diagnostics

Smart generator: This component adjusts itself to driving conditions. During braking and overrun it charges the battery, but it turns itself off during acceleration, which translates into a 1 percent fuel saving. Bosch was the first supplier to offer such a smart generator for commercial vehicles. By 2020, the installation rate will have risen from 3 to 20 percent.

Electronic horizon: The Eco.Logic Motion system uses navigation and cloud data to calculate an efficient driving strategy. By accelerating at the right time in advance of inclines and by avoiding unnecessary gear shifts, a fuel saving of up to 5 percent is possible; measurements taken by Bosch customers indicate that the saving could be as much as 9 percent.

Connectivity control unit: This box uses data communications to connect the automotive electronics with external servers – either to monitor truck trailers or as an onboard device for truck toll systems. The second generation is suitable for LTE wireless communication. It can be used with the software applications of various commercial-vehicle manufacturers.

Preventive diagnostics: Using data from the vehicles' control units, logistics companies can monitor the wear and tear of their truck fleets over the internet. As a result, maintenance and repairs can be planned at an early stage. In this way, the risk of incidents such as the breakdown of a fully-loaded frozen food transporter can be significantly reduced.

Secure truck parking: This facilitates the online reservation of secure truck parking spaces at rest areas along the freeway. The next step will see Bosch Secure Truck Parking providing video surveillance of premium parking spaces, effectively offering a virtual protective fence for valuable cargo.

mySPIN: This system displays apps on the dashboard. The Bosch solution, introduced in passenger cars this year, is also suitable for additional web applications in trucks, such as Secure Truck Parking.

Driver's workplace: The cockpit of the future will be one in which security and camera systems are integrated along with telematics and efficiency functions. The ingenious part of the Bosch solution remains hidden – thanks to an electronic resource manager, the driver sees only information that is relevant and useful at any given moment.

Press photos: 1-DS-20431, 1-DS-20501, 1-DS-20507, 1-UBK-20490,
1-UBK-20492, 1-UBK-20509, 1-UBK-20511

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Operating costs

Bosch gears commercial vehicles to maximum efficiency – from injection to exhaust-gas treatment

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- ▶ Bosch reduces costs and emissions for every kilometer driven
- ▶ 2,500 bar common-rail system with significantly reduced return flow
- ▶ Reduced nitrogen oxide emissions even in most demanding situations

In a systematic approach that starts with the peak pressure of 2,500 bar delivered by its common-rail system, Bosch is making commercial-vehicle powertrains energy-efficient, reducing emissions, and slashing the costs for every kilometer driven. “Our efforts to further increase efficiency start with fuel injection systems and continue on through consistently, all the way to exhaust-gas treatment,” says Dr. Markus Heyn, president of the Diesel Systems division at Bosch. At the heart of these efforts lies Bosch’s integrated approach. It ensures that powertrain systems and subsystems harmonize reliably and perfectly.

Advanced Bosch powertrain solutions enable commercial-vehicle operators to lower their operating costs. Even though modern truck diesel engines already work at close to the thermodynamic optimum, Bosch’s innovations enhance powertrain-system efficiency even further. The decisive factors here are developments on the micro level, such as the new CRIN3-25 injector, which prevents fuel from ending up unused in the return line. As a result, the new Bosch common-rail system can achieve fuel savings of up to one percent, shaving costs by as much as 700 euros a year. But truck operating costs also depend on the amount of AdBlue that is required to scrub oxides of nitrogen from exhaust emissions. The Bosch Denoxtronic metering system enhances efficiency by variably matching urea-solution injection to the region of the world in which the vehicle is being used. This allows vehicle manufacturers to precisely customize their powertrain design. In regions where AdBlue is expensive, Bosch can offer a systems

[Video-Link
CRIN3-25](#)

approach that is designed to accommodate high pressures and high levels of exhaust-gas recirculation. In areas where urea is cheaper, the Bosch system aims to maximize combustion efficiency with high excess-air volumes. In this case, the combined effect of the common-rail system and Denoxtronic can produce diesel fuel savings of up to five percent.

Regardless of the configuration, SCR systems are the key to meeting demanding emission standards such as Euro 6 – and the Bosch Denoxtronic urea metering system is the essential part of this solution. As a result of the legislation that came into force in Europe in 2014, pollutant emissions from modern truck engines are around 97 percent lower than they were at the end of the 1980s. Thanks to Bosch's optimized common-rail system, CO₂ emissions are also decreasing. Given the several millions of trucks that transport goods throughout Germany every day, the smallest of improvements can make a big difference. Fuel savings of just one percent per kilometer would lower annual CO₂ emissions by more than 300,000 metric tons.

The following product descriptions describe in detail the improvements Bosch offers and what each technical solution is able to achieve:

CRSN3-25 common-rail system delivering 2,500 bar

Bosch's new 2,500 bar system is based on a modular systems approach. Bosch's CRSN3-25 is leak-free in both low- and high-pressure ranges. Injecting the compressed fuel that has been delivered with as little loss as possible contributes significantly to greater efficiency throughout the powertrain system. Bosch has designed a system that prevents gap leakage through which fuel can escape unused into the return line. It achieves this by subjecting the parts inside the injector, up to and including the control valve, to rail pressure. So that the nozzle needle can open at all under such conditions, the needle is hydraulically coupled to the push rod.

As well as improving efficiency, the ultra-precise, leak-free injector also ensures a cleaner fuel burn, with a corresponding reduction in particulate and other emissions. What's more, because the system pressure is retained for a long time, vehicle operators also benefit from the excellent re-start response this offers in start-stop operation.

Exhaust-gas treatment with Denoxtronic

As the amount of fuel consumed during lean operation goes down, so the nitrogen-oxide emissions of an engine typically increase. This conflict of objectives represents a major challenge for commercial-vehicle

manufacturers. When it comes to making even large commercial vehicles compatible with extremely tough emissions standards such as Euro 6, the Denoxtronic urea metering system is the ideal component for the exhaust-gas system. Because it works without compressed air, it is a system that is as efficient as it is cost-effective. During development, Bosch placed particular emphasis on creating a robust design and compact configuration. Compared with the previous generation, the size of the delivery module in the latest Denoxtronic 6 was reduced by about a third. In addition, the module guarantees a high throughput of AdBlue without allowing fuel to condense on the walls. This increases efficiency. The avoidance of plastics as much as possible allows the metering module to be used for continuous operation at ambient temperatures of up to 140 degrees Celsius. This robustness gives commercial-vehicle manufacturers more freedom when integrating the component in their exhaust systems. For this purpose, Bosch Emission Systems GmbH (BESG) provides turnkey projects, assuming responsibility for the purchasing as well as for the definition and integration of all components for exhaust-gas treatment.

Bosch particulate matter sensor, Departronic, and NOx sensor

Sensors are powertrain sleuths, continuously gathering accurate, up-to-date data from the exhaust system. This data is the basis for all functions, from mixture formation to clean combustion to exhaust-gas treatment. Besides the usual sensors for determining the powertrain's exact operating mode, Bosch also offers NOx sensors for SCR-system monitoring and control, and sensors for monitoring the diesel particulate filter.

The new particle sensor from Bosch is designed specifically for commercial vehicles and for installation in the exhaust emissions box. It is highly sensitive and is therefore able to work reliably even at low exhaust-gas flow rates. In addition, the sensitivity can be increased by adjusting the tilt angle during installation. The sensor enables the reliable detection of malfunctions in the diesel particulate filter, and is compatible with both the CAN data bus and the HDSCS technology that is standard in commercial vehicles.

It goes without saying that the Bosch NOx sensor meets the high standards of reliability that apply in commercial vehicles. It is suitable for worldwide use in commercial vehicles, in both 12- as well as 24-volt systems. It can measure high NOx concentrations of up to 3,000 ppm, but features compact control electronics that are able to evaluate even very small sensor streams as well. A special coating makes it very tough, capable of

withstanding extreme temperature fluctuations and the accumulation of deposits. The sensor signal retains its high measurement accuracy even when the engine has been in operation for a long period and the sensor has grown old. This guarantees the robustness of the overall system. The particulate matter sensor works best in conjunction with Bosch Departronic. By deliberately injecting diesel into the exhaust gas, this system helps to regenerate particulate filters.

Press photos: 1-DS-20499, 1-DS-20500, 1-DS-20501, 1-DS-20502, 1-DS-20503, 1-UBK-20511

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Hybrids, natural gas, and heat-recovery systems
Alternative powertrains for commercial vehicles
How much fuel hybrids and heat recovery will save
in the future, and why natural gas is already a viable
option

September 23, 2014
PI 8640 UBK FF/af

Voluntary commitment: The European Automobile Manufacturers' Association (ACEA) has pledged to reduce commercial vehicle fuel consumption by one-fifth from their 2005 levels by 2020. This target is based on improvements to existing technologies, but even higher fuel savings could be achieved through the use of heat-recovery systems and electrification technology in commercial vehicles.

"The electrification of commercial vehicles and heat-recovery systems offer significant savings potential. In terms of price, these technologies will be competitive by the end of the decade," says Wolf-Henning Scheider, member of the board of management of Robert Bosch GmbH.

Waste-heat recovery can save up to 2,000 liters of diesel each year

Potential savings: Today, some 60 percent of the primary energy used to power commercial vehicles is lost as waste heat. A waste heat recovery (WHR) system can recover some of this energy by means of a steam power cycle. This system reduces fuel consumption by up to 5 percent. Depending on vehicle type and total mileage, a WHR system allows up to 2,000 liters of diesel to be saved per year and vehicle.

How it works: In the steam power cycle, ethanol, the working fluid, is fed into a pump where its pressure is increased, and then into evaporators. These absorb the exhaust waste heat and vaporize the ethanol. The resulting vapor drives the expansion machine before continuing into the condenser, where it is returned to its liquid state, while residual heat dissipates into the environment. The ethanol fluid cycles back into the fluid

pump. The mechanical energy gained as a result can be used to drive the crankshaft or a generator.

Integration: The mechanical energy converted by the expansion machine can be used to drive the crankshaft, either directly or via a gear unit. Alternatively, the steam turbine can drive a generator that allocates the available electric energy to battery storage or to the electrical system, or it can be used directly for an electrical component in a hybrid vehicle's powertrain.

Hybridization reduces consumption by up to 15 percent

Potential savings: Heavy commercial vehicles account for up to two-thirds of Germany's road freight traffic CO₂ emissions. Hybrid systems could significantly reduce fuel consumption and consequently CO₂ emissions. With the Bosch hybrid system, a heavy commercial vehicle used for long-distance hauling could save up to 2,500 liters of diesel fuel per year. The reference cycle is the route Stuttgart-Hamburg-Stuttgart, using a 40-ton truck. Depending on the operating strategy, a reduction in fuel consumption of up to 15 percent is possible for delivery runs. For a conventional 12-ton truck with an average consumption of 20 liters per 100 kilometers which covers 50,000 kilometers per year, this means an annual savings of 1,500 liters of diesel.

[Video-Link
Diesel Hybrid
driving simulation](#)

Customer benefit: With hybrids, fleet operators profit not only from reduced fuel consumption but also from significantly quieter vehicles. Even the most demanding environmental standards can be more easily satisfied than is possible with conventional diesel engines because exhaust gas and particulate emissions are also much lower. In the urban driving cycle, a hybrid vehicle can start in all-electric mode and also cover short distances with zero emissions. The electric energy can also power peripheral systems.

Modular design: Bosch has developed a parallel hybrid system with 120 kW of power for heavy commercial vehicles. Central components for long-haul transport include the electric motor and power electronics. The space-saving electric drive is integrated into the powertrain between the engine and gearbox, so that no extra transmission is needed. It assists the combustion engine, recuperates energy, enables coasting, and makes electric driving possible. The inverter transforms the direct current stored in the battery into alternating current for the motor, and controls the desired torque and engine speed.

Flexibility: The system's modular design means that the components can cover the needs of a wide market, and be adapted to diverse applications in long-haul and multi-drop delivery traffic, as well as in buses. A start-stop function can also be integrated, opening up further fuel-saving potential, especially in urban delivery traffic.

Combination with WHR: Powertrain concepts for heavy goods vehicles that incorporate waste-heat recovery and hybrid-vehicle technologies represent a promising approach for the future, since both systems have individual strengths that can be utilized at different points in the operating cycle. Whereas in hybrid mode the savings potential is relatively limited on long overland routes with few changes in elevation, the consistently high level of waste heat can be easily recovered. Conversely, hybrid powertrains offer a significant reduction in fuel consumption when traversing mountainous regions or other routes requiring frequent gear changes.

CNG powertrains for commercial vehicles

Monovalent: There is an increasing trend toward the use of monovalent engines that run exclusively on natural gas in commercial vehicles. In these vehicles, natural gas is injected at a pressure of roughly 7 bar into the intake manifold of a converted diesel engine. For the combustion of the air-natural gas mix, the engine is also fitted with spark plugs and ignition coils. CNG-powered commercial vehicles emit up to 20 percent less CO₂ than equivalent diesel trucks and very low levels of particulates. Commercial vehicles equipped with CNG engines are also cheaper to run over the engine's service life, enabling operators to achieve potential cost savings of around 50 percent compared with a conventional diesel engine.

DualFuel with diesel and natural gas: For commercial vehicles, Bosch offers a combined natural gas and diesel system that allows up to 90 percent of diesel to be replaced with natural gas. Here, the diesel injection system acts like a kind of liquid spark plug. As it ignites the gas, there is no need for any additional ignition system.

Fleet customers: Compared with conventional diesel engines, DualFuel systems with a natural gas and diesel system emit 15 to 20 percent less CO₂ as well as less particulate matter. And given that natural gas is less expensive than diesel fuel, fuel savings up to 50 percent can be achieved during the vehicle's service life. Vehicles with Bosch DualFuel systems can also be run purely on diesel, and are thus suitable for areas with a limited natural gas infrastructure.

Market: Bosch offers a complete range of components for natural gas engines including control units, sensors, and injection valves. Market growth is dependent on the expansion of infrastructures – whether in the United States, with its many CNG service stations along interstate highways, or in China, with its local networks. Natural gas powertrains are already competitively priced.

Press photos: 1-DS-20504, 1-DS-20505, 1-DS-20506, 1-DS-20507

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Powerful, and perfect for limited installation space **The new Bosch HEF109-L starter motor for commercial vehicles** Extended power range for exceptionally large engines

August 2014
PI 8672 SG FF/SL

- ▶ Powerful solution for diesel engines of up to 28 liters displacement as well as for stationary gas-powered engines
- ▶ Engineered for mileage of up to 800,000 kilometers or 14,000 operating hours in off-highway applications
- ▶ Adaptable to stringent system requirements

Large-volume engines place great demands on starters. At the top end of the power range, Bosch has a new addition to its 24-volt starter motor portfolio: the HEF109-L “large” heavy-duty starter motor for commercial vehicles and off-highway applications. The powerful starter motor generates 18 percent more power than the tried and tested “M” (medium) type starter motor on which it is based, and thus delivers a maximum output of 9.2 kilowatts. This is enough to reliably start engines with up to 28 liters displacement. Ulrich Kirschner, the president of Bosch’s Starter Motors and Generators division, sums up the benefits as follows: “This new high-performance starter motor is an excellent choice for particularly large engines such as construction machinery. These engines were previously very difficult to start with single starter-motor configurations.” This powerful single-starter solution makes a more complex parallel-starter system unnecessary. The technology is designed to achieve a mileage of up to 800,000 kilometers in on-highway use or 14,000 operating hours in off-highway applications.

Compact, robust, and reliable

The design of the HEF109-L with its 6-pole excitation concept is especially compact, making it particularly suitable for applications where installation

space in the engine compartment is limited. The high thermal robustness ensures reliable starting of large engines – even at very low ambient temperatures or in long-lasting starting sequences.

Due to the significantly greater service-life requirements associated with commercial vehicles, the engagement itself is designed as a two-stage process in order to limit the wear of the ring gear and pinion: In the first stage, the pinion shaft including the pinion is moved forward cautiously, engaged, and turned slightly. In the second stage, the main current is released and the actual starting sequence takes place.

A mechanical relay integrated in the starter makes a connection to the engine control unit (ECU) easier. Unlike starts by ignition switch, the ECU can automatically control the starting sequence, which keeps emissions low.

For extreme conditions

The HEF109-L can also be upgraded. One example is the special dust protection, available up to IP57 protection class. An additional feature is the isolation of terminal 31. This separate connection to the battery's minus pole is a feature of special applications such as railroad vehicles or watercraft, where increased safety and protection requirements against moisture and water apply. For maximum flexibility in diverse installation conditions, the starter motor can also be supplied with all common flange geometries, including a rotatable flange.

Parallel starter-motor systems with increased power output

For applications utilizing even larger-displacement engines, Bosch offers parallel starting systems. By setting two or three starter motors of the 109-family in a parallel-system configuration, the output of each individual starter motor can be aggregated. The new HEF109-L also allows the total output of the parallel starter-motor systems to be increased significantly. With a maximum output of almost 28 kilowatts, diesel engines with displacements of up to 84 liters and gas powered engines with displacements of up to 168 liters can be started reliably under normal conditions. Engines of this size are very common in off-highway applications and watercraft. Stationary engines such as generator sets – also need to start quickly and reliably to stabilize the power supply net if there is a power cut. The HEF109-L is an ideal choice for these applications as well.

Press photo: 1-SG-20481

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Customizing exhaust-gas treatment **Bosch Emission Systems: market for clean truck and construction machinery powertrains booming**

August 6, 2014
PI 8648 DS FF/af

- ▶ Manufacturing in Neunkirchen expanded
- ▶ “Market for off-highway segment and commercial vehicles will double by 2020,” says Dr. Markus Heyn
- ▶ Growth of diesel in the United States boosts business

Ambitious emissions standards are boosting business worldwide for Bosch Emission Systems GmbH & Co. KG (BESG). Regulations such as Tier 4 final emission limits and Euro 6 are driving demand for exhaust-gas treatment systems for trucks, diggers, and other mobile machinery. “When it comes to commercial vehicles, the global market for these systems will double by 2020,” predicts Dr. Markus Heyn, president of the Diesel Systems division at Bosch. To keep pace with this rapidly increasing demand, BESG is now bringing new production facilities online in Neunkirchen, in Germany’s Saarland. At 3,500 square meters, the existing production halls reached the limit of their capacity some time ago. Now, nearly 15,000 square meters are ready for use. “In our new plant, we can make sure our manufacturing and logistics processes are ideal and cost-effective from day one,” says Uwe Becker, technical plant manager in Neunkirchen.

This expansion of facilities in Germany is only one of the ways Bosch can benefit from the forecasted market upturn. In addition, Bosch engineers are constantly refining the product portfolio, which covers everything from integration to the manufacture of complete exhaust systems – for both on- and off-highway applications. What’s more, BESG in North America has also started equipping large passenger cars, such as SUVs, with complete exhaust-gas systems. One of the drivers of this is growth in the diesel market in North America, with models such as the Jeep Cherokee or Dodge

Ram 1500 serving as landmark projects. Currently, 37 diesel models are available in the United States; by 2017, that number is expected to jump to 60.

Bosch's innovative integrated systems lower emissions per driven kilometer for passenger cars, commercial vehicles, and construction machinery. BESG can individually configure all systems to customer wishes and integrate them into vehicles or machinery, including certification. In addition, Bosch Emission Systems specialists provide systems for stationary applications such as generators.

Bend, weld, and laser

Three state-of-the-art manufacturing technologies are at the heart of BESG's production operations. First, a fully electronic machine bends pipes measuring 2.5 to 6 inches in diameter; thanks to special tools developed in house, even the tightest bending radii are possible. Second, the latest robotic welding technology ensures efficient synchronous welding of components. Third, Bosch Emission Systems can cut complex shapes in all three dimensions using a globally unique laser system.

The company

Bosch Emission Systems GmbH & Co. KG was founded in 2010 as a joint venture with two other partners. Since then, BESG has been developing, manufacturing, and integrating exhaust-gas treatment systems for construction machinery and commercial vehicles. Bosch assumed sole ownership of the company in October 2012. Altogether, BESG currently employs more than 200 associates at its Stuttgart, Cologne, and Neunkirchen locations. At the Kentwood plant in Michigan, Bosch Emission Systems USA (BESU) also manufactures products for the U.S. market. Bosch Emission Systems is a reliable partner to automakers and engine manufacturers worldwide. This applies in particular to turnkey projects, in which BESG is responsible for purchasing as well as defining and integrating components.

Press photos: 1-DS-20431, 1-DS-20432, 1-DS-20433

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IAA Commercial Vehicles 2014

Driver's workplace and coach cabin of the future

Electronics manages the flood of information

September 23, 2014

PI 8641 CM Si

- ▶ Efficient human-machine interface is the key to progress
- ▶ Close link between the driver, fleet operator and client for greater efficiency and speed
- ▶ Model of Bosch's visions shows how the wealth of information can be handled safely and efficiently

Future commercial vehicles will benefit from a wide variety of information, communication options, and functions. This will offer businesses and drivers alike greater efficiency, flexibility and safety. Furthermore, information and communication diversity will have grown decisively by the end of the decade, driven by the integration of smartphones, new telematics services, software apps, and OEM-specific functions as well as assistance functions, such as driver drowsiness detection, driving lane detection, and emergency braking systems.

As a leading global supplier of automotive technology, Bosch has applied its proven expertise to outline a vision of how instrumentation, controls and operation may be implemented in the driver's workplace and coach cabin of the future. For the international commercial vehicles trade fair in Hannover, Bosch has turned this vision into a reality that visitors can experience, touch, and try out for themselves.

With its futuristic design, the presented model shows how the technical innovations interact with information management conceived by Bosch. "Our visitors will experience a realistic view of how drivers will in future be able to manage the abundance of information, communication options and new functions in their workplace," says Manfred Baden, President of the Car Multimedia division at Bosch. "Above all, we want to make things easier for the driver," he adds. A crucial element in this is the instrument

cluster, working in concert with a central control unit and all its peripheral systems.

Interactive instrument panel within the driver's range of activity

In the Bosch model, the developers have placed the focus on structured and situation-dependent information and communication. The various functional units are networked via a central control unit and can thus communicate with one another and with the driver. The various dashboard instruments and displays are concentrated on a large, freely programmable instrument cluster located directly within the driver's field of vision. Appearing on it are classical looking round instruments, functional displays, graphics for route planning, and video sequences, such as from a rear-view camera or a night vision system. The system adapts the display content to suit the situation: important information is thus shown prominently in the foreground of the instrument cluster, while information of lower priority in the particular situation appears in the background.

Furthermore, the wing mirrors, which are particularly large on commercial vehicles, can be replaced by a camera-monitor system, having the added effect of reducing air resistance. In this driver's workplace of the future, Bosch is for the first time presenting high-resolution displays that satisfy the special requirements of such real-time picture transmission.

Coach cabin of the future

In our increasingly connected society, future infotainment in coaches will also provide personal access to numerous information and multimedia options. Passengers are already bringing their own tablets and smartphones on board with them. With its new Coach Media Router, Bosch gives, depending on the employed data rate, up to around 50 passengers the option to use their own devices and to access the internet directly as well as local content on the vehicle's server.

Already right at the start of the journey, it will be possible to specify particular audio and video content, grant access privileges to selected passengers, and permit access to the internet. Moreover, a new DVB-T tuner from Bosch will provide trouble-free television reception, even during the journey. In addition, coach operators can use the vehicle's server to offer access to movies, electronic magazines, interactive games, and photos taken at the last stop-off, and they can optionally let passengers access all of this on their own tablets or via the cabin monitors.

Perfect in-vehicle smartphone integration with mySPIN

Last but not least, the mySPIN integration solution developed by Bosch SoftTec GmbH now also provides perfect smartphone integration for the truck and coach environment, thus enabling safe in-vehicle device operation there too. The system makes applications vehicle-compatible, that is to say, they are pared down to present the driver with only the relevant information; the applications are subsequently displayed and controlled via the vehicle display. mySPIN lets users use apps for Android smartphones or iPhones® in the way they are accustomed to.

Bosch's model study is therefore also the ideal opportunity for visitors to take a look into the future of mobility and communication and to experience the new technical solutions that commercial vehicle manufacturers must already explore today in order to be able to offer them to their customers tomorrow.

Press photo: 1-UBK-20490

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Connected trucks

Connected functionality makes commercial vehicles safer and more efficient

September 23, 2014

PI 8642 CM Ks/af

- ▶ Connectivity in commercial vehicles helps reduce transportation costs
- ▶ Bosch offers web-based services
- ▶ Bosch connectivity control units provide the technical basis for networking

The truck of the future will be connected. As early as 2016, every new long-haul commercial vehicle in Europe and the United States will be web-enabled. Connected functionality will increase efficiency, and thus reduce transportation costs. Bosch provides the technical basis for networking in the form of connectivity control units (CCU). These devices connect on-board vehicle electronics with external servers via data communication. What's more, Bosch offers web-based telematics services to assist with things such as scheduling maintenance or monitoring valuable freight.

Optimized maintenance reduces downtime

Connectivity enables Bosch to support fleet operators in planning service intervals for their fleets. Vehicles constantly transmit operating data, such as mileage or fuel consumption, over the internet; any faults reported by the various vehicle electronic control units are also recorded. The information is encrypted and sent to a computing center for evaluation. Using this data, fleet operators can then plan maintenance and repairs in advance, which reduces unnecessary downtime.

Lower fuel consumption thanks to Eco.Logic Motion

Using an internet connection, Bosch can also update and optimize its Eco.Logic Motion system solution. On the basis of enhanced navigation data on topography or bend radii, this solution already makes it possible to develop a proactive driving strategy, which reduces fuel consumption by 5 percent on average. In the future, when dynamic, cloud-based data on

speed limits and construction sites can be incorporated into speed-setting and gear-shifting strategies, fuel consumption will drop even more.

Take a safe break with secure truck parking

More safety along the logistics chain is the idea behind the Bosch secure truck parking service. Freight forwarding companies can use this service to reserve one of a current total of over 100 parking spaces in rest areas. The system also serves to deter thieves. In the future, parking spaces will have surveillance cameras, making it easier to identify numerous dangers, property damage, and theft in real time.

Trailer control unit for commercial vehicle trailers

Bosch has developed its own telematics solution specifically for commercial vehicle trailers. Using the trailer control unit, freight forwarders can track the location and condition of their freight at any time. And because the unit has its own power supply, it even works when the trailer is no longer connected to the truck. The trailer control unit delivers valuable information to the computing center, such as tire pressure or open freight-hold doors. Any deviation from planned operations is recognized immediately so that the dispatcher can react accordingly. The system also keeps constant track of the temperatures in trailers containing perishable goods.

On-board unit connects trucks with highway toll system

Since 2013, Bosch has also been supplying a new on-board unit (OBU) for the truck toll system in Germany. The unit is the essential element for automatically logging the vehicle into the German toll system. Using GPS, the OBU constantly tracks the truck's position and, using mobile communications, transmits encrypted data at regular intervals to a computing center. A special map enables the OBU to determine the route traveled and calculate the toll amount. Bosch has greatly expanded the computing and storage capacity of the 1-DIN slot unit, which will thus be able to meet future technical requirements.

Bosch control center monitors trucking

On request, the Bosch Security Systems division can take over truck-monitoring tasks. At any time day or night, the telematics system will notify the Bosch control center of any incidents: when a vehicle deviates from its planned route, for instance, or the trailer doors are opened at an unscheduled time. Trained associates then initiate one of a number of standard operating procedures and inform the police.

eCall: faster help in emergencies

Even in the case of an accident, Bosch can use the internet to ensure safety. Moreover, its eCall system helps save lives. In the event of an accident – and only then – the emergency call system automatically sends relevant data to the Bosch emergency control center, including location, time, and direction of travel. What's more, a voice connection is established to the accident vehicle, and the system also identifies the nearest police station or emergency services. If an eCall is made, and no contact is established with the vehicle occupants, a Bosch associate contacts the closest emergency response center directly. The advantage of the Bosch solution is that multilingual associates can communicate with those involved in the accident as well as with the local authorities. So after an accident in Spain, a German truck driver with no knowledge of the local language can communicate details about the accident or the number of injured persons directly to the Bosch emergency control center, which in turn immediately informs local emergency services.

Bosch's flexible hardware is continuously being improved

A Bosch connectivity control unit is all that is needed for many of the services described above. One advantage of these units is that they are easy to install. Hidden in the foot well or the dashboard, the unit connects to the vehicle electrical system using the standard OBD II diagnostic connector. If a vehicle is taken out of the fleet, the device can easily be removed again. A second generation is already in development. The device is compatible with fast LTE mobile communication and open to software applications, making it ready to meet future needs.

Press photos: 1-UBK-20587, 1-UBK-20489, 1-UBK-20588

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Automotive Technology is the largest Bosch Group business sector. In 2013, its sales came to 30.6 billion euros, or 66 percent of total group sales. This makes the Bosch Group one of the leading automotive suppliers (NB: Due to a change in accounting policies, the 2013 figures can only be compared to a limited extent with the 2012 figures). Automotive Technology largely operates in the following areas: injection technology for internal-combustion engines, alternative powertrain concepts, efficient and networked powertrain peripherals, systems for active and passive driving safety, assistance and comfort functions, technology for user-friendly infotainment as well as car-to-car and Car2X communication, and concepts, technology, and service for the automotive aftermarket. Bosch has been responsible for important automotive innovations, such as electronic engine management, the ESP anti-skid system, and common-rail diesel technology.

The Bosch Group is a leading global supplier of technology and services. In 2013, its roughly 281,000 associates generated sales of 46.1 billion euros. (NB: Due to a change in ac-

counting policies, the 2013 figures can only be compared to a limited extent with the 2012 figures). Its operations are divided into four business sectors: Automotive Technology, Industrial Technology, Consumer Goods, and Energy and Building Technology. The Bosch Group comprises Robert Bosch GmbH and its roughly 360 subsidiaries and regional companies in some 50 countries. If its sales and service partners are included, then Bosch is represented in roughly 150 countries. This worldwide development, manufacturing, and sales network is the foundation for further growth. In 2013, the Bosch Group invested some 4.5 billion euros in research and development and applied for some 5,000 patents. This is an average of 20 patents per day. The Bosch Group's products and services are designed to fascinate, and to improve the quality of life by providing solutions which are both innovative and beneficial. In this way, the company offers technology worldwide that is "Invented for life."

Additional information can be accessed at www.bosch.com, www.bosch-press.com and <http://twitter.com/BoschPresse>

PRESS RELEASE

September 2014

ZF Lenksysteme presents Electric Power Steering for Light Commercial Vehicles

- **0.6 litres less fuel consumption compared with hydraulic power steering systems**
- **Reduction in CO₂ emissions**
- **System capability enables the steering to be networked with driver assistance systems**

After the passenger car market, the ZF Lenksysteme Servolectric, which is designed for optimum fuel consumption, is now also conquering the high-volume light commercial vehicle (LCV) business sector. More than 40 million Servolectric power steering systems have already been produced. Of these, more than seven million are made in the paraxial design with the highest steering rack force. With minor modifications, this electric power steering system can be adapted for light commercial vehicles. Compared with hydraulic steering systems, the ZF Lenksysteme Servolectric saves around 0.6 litres of fuel in the New European Driving Cycle (NEDC). A further advantage is the system capability, i.e. networking with electronic assistance systems. This means increased safety and convenience for the customer.

Less fuel consumption - less carbon dioxide

The ZF Lenksysteme Servolectric only needs power when the driver is actually steering. According to the latest measurements, the

electric power steering system saves 0.6 litres of fuel in 100 km compared with hydraulic power steering systems. With an annual mileage of 25,000 km per year, this means a saving of 150 litres of fuel due to the electric steering system. With a litre of diesel costing 1.40 euros, this amounts to 210 euros per year.

There are also considerable potential savings with regard to CO₂ emissions. The Servolectric produces 16.1 g/km less CO₂ emissions compared with hydraulic power steering. With an annual mileage of 25,000 km, this results in a saving of around 0.4 tonnes of CO₂. For 2015 the legislator is planning to introduce a EU-wide CO₂ penalty tax for commercial vehicles. This would result in substantial additional expenses for this cost-conscious industry. Servolectric contributes significantly in decreasing the total cost of ownership of the LCV.

Power-on-demand

The Servolectric is based on the principle of rack-and-pinion steering which, in the case of electric steering, is linked to a servo unit and a highly developed electronics system. As soon as the driver initiates a steering movement, sensors register the appropriate steering torque and steering speed. From this data, a control unit calculates the necessary steering assistance within milliseconds and the servo motor transmits the optimum torque via a recirculating-ball gear to the rack of the mechanical rack-and-pinion steering. The power limit of this steering system corresponds to a steering axle load of more than 2,000 kg. However, the electric steering system in paraxial design introduced in 2006 offers even more advantages: the space-saving installation due to the absence of steering pump and hoses simplifies assembly and relieves the burden on the environment. Along with passenger car steering systems, Servolectric now also covers light commercial vehicles

(LCV) such as the Mercedes Sprinter and the Volkswagen Crafter. This versatile steering system can therefore be found in vehicles ranging from the mini class via medium and luxury class to the transporter.

System capability allows for safe driving

The Servolectric can be networked with a number of external systems. Information gathered relating to the steering wheel angle is thus available to other systems such as ESP or an adaptive chassis controller. It also facilitates driving safety functions such as lane departure warning and lane change assistant. Depending on the driving situation, the appropriate system intervenes and recommends a steering correction to the driver by visual, acoustic or haptic signals. It is no longer necessary to hold the steering wheel when using the parking assistant feature. In this case, the Servolectric completely takes over the steering by itself.

Caption:

Economic and system-compatible: The Servolectric electric power steering system from ZF Lenksysteme. The power steering makes information available for other safety and driver assistance systems.

Press photo: ZF Lenksysteme GmbH – 1-ZFLS-18554

ZF Lenksysteme GmbH, a 50:50 joint venture of Robert Bosch GmbH and ZF Friedrichshafen AG, is a specialist and technological leader in the field of steering equipment and has a workforce of more than 13.000 at 18 locations in eight countries. In 2013, the Group generated revenues of 4.1 billion euros.

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Diagnostics, Spare Parts and Know-How for Commercial-Vehicle Workshops

Bosch Expanded its Range for Services and Repair Work on Commercial Vehicles

September 2014

PI 8684 AA Dr

- ▶ Intelligent diagnostics, specifically for commercial-vehicle workshops
- ▶ Spare parts in original-equipment quality for vans, trucks and buses
- ▶ New multi-brand workshop concept “Alltrucks” for commercial vehicles – by Bosch, Knorr-Bremse and ZF

When it comes to professional operation of vans, trucks and buses, reliability is the greatest asset. Every breakdown or unplanned repair work costs the haulage company both time and money. For fast and cost-efficient repair and service at the commercial-vehicle workshop, Bosch thus expanded its range of diagnostic and workshop equipment, spare parts and services even more.

New Headlight Tester HTD 815 for Commercial Vehicles

Xenon and LED lights have become original equipment of today’s trucks. To enable testing and adjustment of these modern headlamp systems, the new Bosch headlight tester HTD 815 is equipped with a CMOS camera and an interactive touch screen. The program is operated automatically, but manual operation is also possible.

Range Extension of Heavy-Duty Starters

Even under toughest conditions, starters have to work reliably. For this reason, the heavy-duty starters family HEF/HEP 109 M and MP was now expanded by the L line with increased performance. It allows starting engines with a displacement of up to 28 liters, or in parallel operation of even up to 84 liters. In future, Bosch will continue to expand its commercial-vehicle range currently comprising 350 types of starters and alternators.

New Bosch Battery for High Demands in the Area of Commercial Vehicles

The Bosch battery type TE reliably covers the high energy demand of numerous electrical consumers, long idle times, extreme temperature conditions and vibrations. This is enabled by the EFB (Enhanced Flooded Battery) technology. The positive plates are coated with a polyester scrim providing additional retention of the active material. The result is the outstanding deep-cycle and vibration resistance of the TE battery. The patented PowerFrame stamping process provides protection against corrosion and ensures optimum current flow and a long service life. It guarantees consistently high starting power and a significantly lower self-discharge. The TE Bosch battery is absolutely maintenance-free and leak-proof.

New Line of Driving Lamps: Light-Star

The Light-Star driving lamp is also suitable for extreme operating conditions in both the heavy-duty sector and off-road areas. The computer-calculated free-form reflector of the Bosch Light-Star provides ideal illumination of the road ahead – with high light intensity and minimum scattering loss. The new driving lamp is available in three different versions: Light-Star Halogen and Light-Star LED – each with either white or blue lens – as well as Light-Star Xenon.

New Bosch Rotating Beacons for Commercial Vehicles – Now also with LED Technology

With the three product lines RKLE LED Compact, RKLE 200 and RE 60, Bosch offers rotating beacons for commercial vehicles as original equipment, special accessories or for repairs. The LED technology used in the RKLE LED Compact provides outstanding illumination, low energy consumption and minimized risk of failure. Thanks to its strong warning and signaling character the RKLE 200 suits a broad range of applications – especially for continuous operation thanks to its robust material. RE 60 has proven itself in flexible application and is easy to fit.

Workshop Equipment for Professional Commercial-Vehicle Repairs

Bosch geared the ECU diagnostic tester KTS Truck and the matching workshop software Esitronic 2.0 Truck to the specific requirements of commercial-vehicle workshops. For the widest-possible range of application, it includes vehicle data about more than 90 percent of all common vans, trucks, trailers and buses on the European market. The range of workshop test equipment is expanded by wheel-alignment, emission and vehicle system analysis, air-conditioning service, tire changers and wheel-balancing systems as well as brake testers also

suitable for heavy trucks. The existing broad range of practice-oriented service trainings in Europe is further expanded through specific trainings about commercial-vehicle technology. In addition, the specialists of the Bosch Technical Hotline support workshops with regard to technical questions and problems.

Diesel Components in Original-Equipment Quality from the System Developer

Bosch develops diesel systems and supplies all important commercial-vehicle manufacturers with them. The comprehensive range of spare parts includes all important components for latest common rail and nozzle-and-holder assembly systems as well as for conventional diesel systems.

Bosch Denoxtronic2 Reduces Nitric-Oxide Emissions by 95 Percent

Reducing the nitric-oxide (NOx) emissions of diesel engines is one of the main requirements of the Euro 5 emission standard. Bosch developed the exhaust-gas treatment system Denoxtronic as original equipment. For both maintenance and repair of Denoxtronic systems, Bosch offers spare parts, diagnostic equipment, workshop software including repair instructions and technical trainings.

Reliable Bosch Spare Parts and Accessories

The comprehensive range of spare parts and accessories for commercial vehicles is specifically geared to high mileage. It reaches from drive belts to batteries, fanfares, filters, automotive bulbs, sensors and wiper blades all the way to auxiliary and driving lamps.

Current-Value Commercial-Vehicle Repair with Bosch eXchange and Bosch Electronic Service

The exchange-parts range Bosch exchange provides a cost-efficient solution for the repair of commercial vehicles based on their current value. Compared to new parts, there is a price advantage of some 30 percent despite featuring the same legal warranty. For diesel injection systems alone, more than 1 000 exchange parts, that have been remanufactured professionally and in accordance with the series-production standards, are available for many commercial vehicles. This includes state-of-the-art high-pressure injection systems. Since very recently, Bosch Electronic Service offers the possibility to receive a remanufactured electronic component within 24 hours and in exchange. The defective part is only sent to Bosch Electronic Service once the exchange part is installed.

As a System Supplier, Bosch Supports Commercial-Vehicle Workshops with Matching Workshop Concepts

Since the beginning of this year, the new and joint full-service commercial-vehicle workshop concept “Alltrucks” by Bosch, Knorr-Bremse and ZF exists in Germany. By the end of the decade, the implementation is planned throughout Europe. The goal is to join competences and cross-manufacturer solutions and services concerning the market of commercial-vehicle repairs. The concept is oriented towards all workshops offering cross-brand service for heavy commercial vehicles.

In addition, Bosch unites its commercial-vehicle competences at the technically oriented workshop module Bosch Commercial Vehicles. This complete package is oriented towards commercial-vehicle workshops offering multi-brand service for tractor units and light commercial vehicles.

The strong and worldwide network consisting of Bosch Diesel Services and Bosch Diesel Centers with its on-site repair service for diesel components completes this comprehensive range.

Press photo: 1-AA-20527, 1-AA-20528, 1-AA-20529

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The Automotive Aftermarket division (AA) provides the aftermarket and repair shops worldwide with a complete range of 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. More than 18,000 associates in 150 countries, as well as a global logistics network, ensure that some 650,000 different spare parts reach customers quickly and on time. In its “Automotive Service Solutions” operations, 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 16,500 franchises. In addition, AA is responsible for more than 800 “AutoCrew” partners.

Additional information can be accessed at www.bosch-automotive.com.

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