

# FUTURE DRIVEN.

Engine technology for tomorrow

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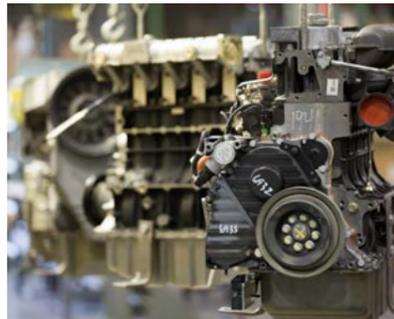
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Note: Gender differentiation has not been applied in this document for reasons of improved legibility. The relevant terms apply for both genders in the sense of equal treatment.

Dear readers,

An exhibition area of 570,000 square metres with more than 535,000 international visitors from roughly 200 countries – the dimensions of the world’s largest trade fair for construction machines are overwhelming. With a total turnover of EUR 472.6 million in 2015, the segment of mobile working machines constitutes the largest share for DEUTZ. Of course, DEUTZ would not miss the opportunity to present itself at Bauma – the leading event of the construction machine industry is the main focal point of the current issue of our customer magazine (page 6). Under the headline, “Future driven – Engine technology for tomorrow”, DEUTZ will be presenting its new diesel engine, the TCD 2.2, for the first time. It is a new, particularly compact three-cylinder version of the successful TCD 2.9 four-cylinder model. And DEUTZ has more highlights up its sleeve for Bauma, including two new gas engines with a cubic capacity of 2.2 and 2.9 litres, respectively. With the introduction of the G 2.2 and G 2.9 four-cylinder engine, we are focusing increasingly on the promising gas engine segment. We are very pleased to have already acquired a high-profile lead customer: the KION Group.

But what does the future hold in store for diesel engines, and how environmentally-friendly are their modern incarnations? Our DEUTZ experts, Dr Markus Schwaderlapp and Knut Feisel, will be answering these questions in the interview on page 12. In this issue, we will be reporting on interesting events from the inter-



national world of DEUTZ. The Deutz Corporation has acquired a new partner in the segment of DEUTZ Xchange engines, and DEUTZ France is celebrating its 35th anniversary. But DEUTZ remains very active even in remote corners of the world. Did you know that the Indonesian government was able to keep an important promise to its citizens thanks to DEUTZ aggregates? The article on page 15 tells the full story. We are particularly proud of our trainees, who have repeatedly been named as some of the best in Cologne and even North-Rhine Westphalia (p.17). This wonderful success shows that DEUTZ is a future-oriented company, not only in terms of its products.

We hope you enjoy reading this magazine.

Kind regards

Dr Helmut Leube

Dr Margarete Haase

Michael Wellenzohn

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## New service director at DEUTZ



Thorsten Müller has been the new Director of the DEUTZ AG Business Team Service since 1 October 2015. Besides his responsibility for the global service business, he predominantly focuses on the further expansion of the service division. In this capacity, he reports to Michael Wellenzohn, Chief Sales/Service and Marketing Officer. After finishing his degree in industrial engineering in Karlsruhe, Thorsten Müller first worked in a management consultant firm before joining Robert Bosch GmbH, where he held several leading positions in product management, marketing and after-sales.

## DEUTZ helps



The DEUTZ team wore their proverbial big hearts on their sleeves during our internal fundraising campaign for the benefit of refugees, organised in cooperation with the Cologne section of the German Red Cross (DRK) in November. By donating warm clothes, shoes, children's toys, and hygiene products through the DEUTZ Sicherheit subsidiary in Cologne-Porz, employees contributed to fulfilling a great need for these items. And the DEUTZ team helped: they were so keen to donate that one transporter and another vehicle were filled to the brim with items. The numerous donations of clothes and other items were handed over to the German Red Cross in Cologne, who then distributed them to the organisations in the individual Cologne districts. DEUTZ says "thank you!" for this overwhelming commitment.

## French DEUTZ dealers visit Cologne

On 13 January, 20 representatives of French DEUTZ dealers marked the new year by visiting the Cologne headquarters. Their visit gave them insights into the engine manufacture and the production processes. After eating lunch together in the engine museum, the so-called Technical Centre, an information session was held to discuss the latest company developments and product innovations. Three sales prizes were awarded to the most successful of the French dealers. Andreas Reiter, Directeur Général, DEUTZ FRANCE SAS, looked after the group during their visit. He explains: "Our local dealers do excellent work every year. We want to honour their work by giving them this trip to Cologne and organising the award ceremony on the occasion of this meeting. This also strengthens their connection with DEUTZ and allows us to communicate our goals and products to our colleagues in person."



## A christmas concert with the DEUTZ Choir Cologne



The DEUTZ Choir Cologne hosted a true Cologne Christmas in December. In the Gürzenich convention centre, the choir performed songs and melodies that touched the soul – a Christmas concert performed entirely in the Cologne dialect, imparting a festive atmosphere that reached beyond the local audience. Heinz Walter Florin, the Artistic Director of the choir, assembled a colourful repertoire of amusing dialectal titles, e.g. "Stelle Naach, hellije Naach" (Silent night, holy night) and many more. The DEUTZ Choir was joined on its wintry trip by the Domstadt Philharmonic Orchestra and the popular soloists Lotti Kregel and Ernst Hilbich. During their concerts, the DEUTZ Choir habitually demonstrates its generosity by raising funds for a good cause. Last year, they collected donations for the Kölner Klinikclowns association.

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## DEUTZ supports RWTH Aachen graduation festivities

During the past year, DEUTZ sponsored the graduation festivities of RWTH Aachen University in Aachen. It is a joint party for graduates from all faculties and degree courses. During the event, the graduates additionally have the option of approaching potential future employers at their information stalls. DEUTZ contributed an exhibition tent, too – not only did the company sponsor the event, but it also maintains close contacts to RWTH Aachen University, e.g. by collaborating in joint projects with departments of the university. Bachelor and Master students of RWTH Aachen (predominantly from the faculty for mechanical engineering) also frequently complete their practical placements at DEUTZ or prepare their practical final project here. We contributed to the event both in order to make it possible in the first place and to present DEUTZ to the graduates and their relatives.

## "DEUTZ makes dreams come true"



Once again, the Christmas tree in the DEUTZ lobby in Cologne-Porz stayed true to the motto "DEUTZ makes dreams come true" and turned into a genuine "wishing tree". About 130 children from the Sommerberg youth centre in Rösrath had submitted their Christmas wishes on paper cards, and the DEUTZ employees had the opportunity of making them come true. Among some of the Christmas wishes on the list were RC race cars, goalkeeper gloves, dolls, and many other things. And once again, the DEUTZ team showed that they have big hearts and made every single wish come true. Just before Christmas Eve, all the carefully wrapped packages – including a bicycle! – were handed over to the Sommerberg centre, who made sure that the kids received their Christmas presents on time.

## Rapid construction progress: the DEUTZ Shaft Centre



It is not even complete, yet its sight has long since become an integral part of the DEUTZ facilities for the employees working here: the DEUTZ Shaft Centre. Even though the sprawling hall with its 13,000 square metres looks finished from the outside, the construction project on the Ottostraße is still a few steps away from completion. But the construction is currently progressing so smoothly that DEUTZ and Goldbeck, the construction company realising the project, are right on schedule. The inside of the soon-to-be Shaft Centre already allows for a glimpse of its future layout, including the manufacturing areas of crankshafts and camshafts and the lo-

cations of main control rooms and dressing rooms. The extensive air conditioning system is already in place, too. The interior of the Shaft Centre is scheduled to be complete in May 2016, when the first machines and installations will find their way from their current Deutz location to the new facilities in Cologne-Porz. The teams of the "Fit for the Move" employment campaign also finished their last workshop at the board mill in late February. Many ideas and measures are currently being implemented on time for the move. Once the time comes, DEUTZWORLD will keep you up to date, as always.

## DEUTZ at the Educational Trade Fair in Ulm

The 8th IHK Educational Trade Fair was held in Ulm this year. A large number of intrigued visitors had the opportunity of getting to know approximately 300 exhibitors including regional companies from all sectors. Instructors and apprentices from the Ulm DEUTZ plant joined the event. Interested applicants got to inquire about DEUTZ AG and the training professions offered at the Ulm location. Questions were answered, contents of the apprenticeship were explained, and further education opportunities were discussed. Prior to the educational trade fair, DEUTZ Ulm produced a video about the commercial and business apprenticeships, portraying the apprentices during their everyday work. This allowed for a practical presentation of the training professions, which immediately caught the attention of passing visitors. The true eye-catcher of the DEUTZ stall, however, was an electrically operated sectional model of the 912 engine, which is manufactured in Ulm. The DEUTZ apprentices felt entirely at home, and their technical expertise allowed them to explain the functionality of an engine to many interested visitors.

**bauma 2016**  
April 11–17, Munich

Visit us in hall A4,  
booth 337.

# FUTURE DRIVEN.

## Engine technology for tomorrow

Bauma in Munich is the ultimate meeting spot for the international construction machine sector, which is one of the most important target markets for DEUTZ engines. At this year's trade fair on 11–17 April, DEUTZ will be presenting its latest product innovations over an area of 400 square metres.

Engine manufacturers need to keep an eye on the future: requirements are steadily increasing, especially in terms of emission values. At the same time, newly emerging technological trends need to be identified early. DEUTZ is constantly driven by the future. Its appearance at this year's Bauma takes place under an appropriate motto: "Future Driven. Engine technology of tomorrow."

Bauma in Munich is the world's leading trade fair for construction machines. 3,421 exhibitors from a total of 57 countries present their businesses on an exhibition area measuring 570,000 m<sup>2</sup>. The event is held every three years. More than 535,000 international visitors from approximately 200 countries are expected as well as 1,400 journalists and media representatives. According to the organisers, the fair experienced a surge of 85,000 additional professional visitors from abroad in 2013. The exhibits include the full range of construction machines, building material machines, construction vehicles, equipment, accessories, and mining products. In 2013, the event drew record numbers of visitors and reinforced its leading position once again.

*Global début: The DEUTZ TCD 2.2 expands the lower performance range and will also be available as a G 2.2 gas-powered version.*



The DEUTZ stall spans an exhibition area of approximately 400 square metres, which provides a great opportunity to communicate with clients and partners from all over the world. "To us, Bauma is the perfect stage for presenting our products to a large audience of professionals. Be it new engines or innovative versions of our successful products – we always offer our customers the solutions of tomorrow well in advance," Michael Wellenzohn, Member of the DEUTZ AG Management Board in the Sales, Service & Marketing Department, explains.

### Global début: DEUTZ introduces gas engines

As a Bauma highlight, DEUTZ will be introducing not one, but two new gas engines with a cubic capacity of 2.2 and 2.9 litres, respectively. This marks both a move towards a promising future business and a return to its own roots.

Everything started with the atmospheric gas-powered engine. Nicolaus August Otto, the founder of what is DEUTZ AG today, invented this so-called "engine no. 1", in 1867. In 1876, Otto presented the first four-stroke engine, effectively laying the

foundation for global motorisation. That engine also ran on gas. To this day, positive-ignition engines, i.e. mostly petrol and gas engines, are still referred to as "Otto engines" in his honour.

This makes the gas engine a quintessential DEUTZ product, which has, time and time again, been a part of its engine range over the course of the 150 years of the company's history. In the recent past, DEUTZ has increasingly specialised in producing highly developed Diesel engines for mobile working machines and agricultural technology. This will soon change significantly. The new Otto engines are fuelled by liquefied petroleum gas (LPG), which is frequently used as an alternative to petrol, including in the automotive sector.

### Gas engines are based on the latest generation of engines

The G 2.2 and G 2.9 four-cylinder models, in turn, are based on the latest generation of TCD engines. The 2.9 is a version of the successful TCD 2.9 self-igniter, which is used in many mobile working machines and agricultural equipment. The 2.2 version is a derivation of its 'big brother', featuring one less cylinder. This particularly compact



three-cylinder machine will simultaneously be introduced as a TCD 2.2 diesel engine at Bauma, expanding the DEUTZ product range to 34-697 hp in the low-end segment. The G 2.2 gas-powered version will have a performance of up to 56 hp; the G 2.9, up to 73 hp. This gives customers a convenient, uniform engine platform, within which they can choose between diesel and gas engines of largely identical designs. The result are extensive synergies in the integration of the engines, including

in terms of their connectors and spare parts. This saves money and expenditure in terms of development. Some deviations, however, are inevitable due to the nature of the respective systems. LPG varieties are set apart predominantly by their fuel preparation system, cylinder head, sensors, and exhaust gas treatment. And, of course, their most distinguishing feature: the fuel injector of the diesel variety is replaced by a spark plug with a pencil coil. This ultimately transforms the diesel engine back into an

Otto engine. The engines will be launched in 2019, on time for the EU Stage V emission standard.

The compact gas engines are an attractive option, especially for applications in the fields of material handling and compact construction machines. DEUTZ has successfully acquired a high-profile lead client for the G 2.2: the KION Group, one of the two leading suppliers of forklifts, warehouse technology, and related services.

Both companies are expanding their long-standing cooperation on large forklifts by the KION premium brand, Linde, with multiple large-volume series of the premium platforms, which are successively equipped with the newly developed 2.2-litre engine as a diesel and an LPG version by DEUTZ.

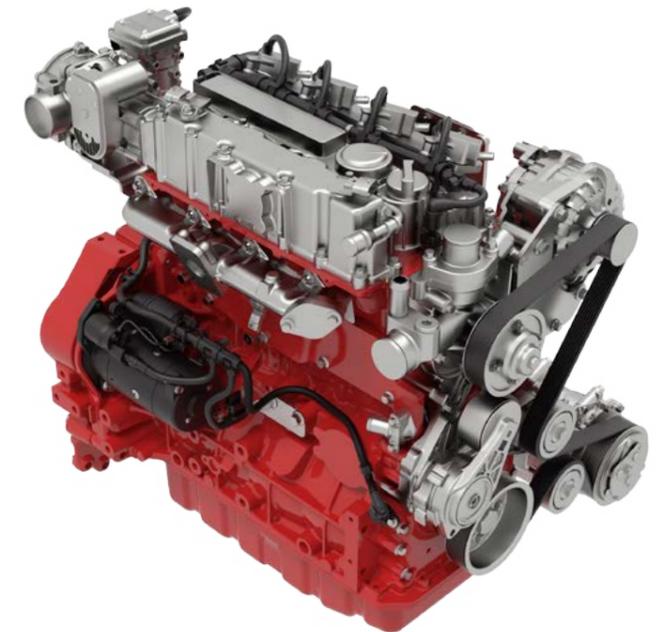
Ottmar Neuf, Director Engines and Drive-train KION, explains: "The DEUTZ engine is a sturdy industrial engine with a design that allows us to offer compact vehicles to our customers. Thanks to its gear train, the engine is also suitable for application in extreme conditions, which ensures the maximum scope of application of the forklifts. The diverse equipment options of the engine allow us to optimally fulfil the special requirements of our customers, such as air conditioning or a large generator."

**A promising business**

With its release of the new G 2.2 and G 2.9 engines, DEUTZ sets out to explore a promising market, as the LPG engines have a number of benefits. They are, for instance, particularly well-suited for machines used in closed buildings, as liquefied petroleum gas has considerably lower emissions than diesel fuel. Additionally, the engines meet the requirements of EU Stage V by merit of their

3-way catalytic converter, which eliminates the need for a sophisticated exhaust gas treatment system. LPG engines are already widespread on the market, especially in the segment of forklifts, which are frequently in operation in warehouses or large logistics centres. DEUTZ is focusing on the growing potential of alternative fuels. Additional

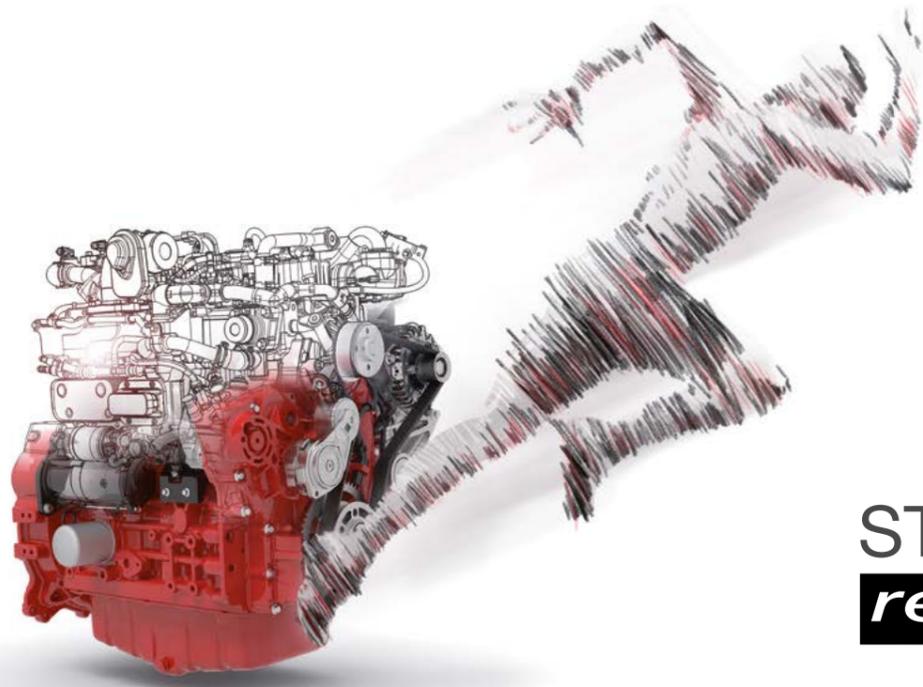
application categories such as lifting platforms, ground support equipment (i.e. transport equipment for airports) or communal vehicles, which must fulfil particularly strict emission guidelines, will be possible in the future. DEUTZ is already actively involved in relevant projects.



*The new G 2.9 is the LPG version of the successful TCD 2.9 diesel engine.*

*At its booth, DEUTZ introduces the latest product innovations on a space of 400 square metres.*





## STAGE ready V

In addition, the further diversification of gas types, such as the use of natural gas (CNG), for example, is under consideration. This makes gas engines an important component of the drive inventory, including for off-road use. DEUTZ will be making an active contribution to this trend in the future – just as Nicolaus August Otto did back in his day by developing the atmospheric gas-powered engine.

### Ready for stage V

The impending EU Stage V emission standard is a key topic for the future. DEUTZ will present its established “Stage-V-ready” TCD product range at Bauma 2016, which consists of the four-cylinder engines, TCD 2.9, 3.6, and 4.1 and the six-cylinder versions, TCD 6.1 and 7.8. In addition, the highly successful TCD 3.6 will be present at Bauma as a power pack, comprising the engine, cooling, and an exhaust treatment system.

All TCD engines with a diesel particulate filter (DPF) already meet the EU Stage V emission standard, which will be valid from 2019 (based on the draft by the EU Commission dated 25 September 2014) and are available on the market with the “Stage V ready” seal. This is facilitated by the modular system construction kit for the after-treatment of exhaust gases DVERT® (DEUTZ Variable Emission Reduction Technology). Here, the core components consist of a diesel particulate filter (DPF), diesel oxidation catalyst (DOC) and Selective Catalytic

Reduction (SCR). Virtually all elements of this module can be combined with one another to ensure the desired outcome in terms of engine capacity, compliance with emission limits and competitiveness.

While the DOC focuses on reduction of particle mass, the DPF reduces the actual number of particles. Due to the particle concentration limit as imposed by EU Stage V, the DPF is indispensable to standard compliance. The SCR system with urea metering ultimately reduces NOx to the desired level.

The components will be exhibited at the trade fair stall in Munich using the so-called EAT display and will be explained in detail.

### Extra-powerful compact engines

The so-called High Torque varieties constitute another DEUTZ highlight in the segment of compact engines with less than 4 litres of cubic capacity. The TCD 2.9 High Torque generate up to 277 lb/ft and the TCD 3.6 High Torque generate up to 299 lb/ft

of maximum torque each, which places them comfortably below the 75 hp performance threshold that is relevant for the coming emission stage V. This means that they can be used without a sophisticated SCR system and fulfil the currently valid EU Stage IV exclusively by means of an open diesel oxidation catalyst (DOC) for exhaust gas treatment. These so-called “DOC-only solutions” are currently very popular with our customers.

The TCD 2.9 and TCD 3.6 will debut at the fair as high-power versions for mobile work machinery with a performance of 100 hp and 141 hp, respectively. This allows for the replacement of a larger engine in the client machine, in accordance with the principle of downsizing. The result is an advantage in terms of weight, installation space, and overall cost.

### Service – before and after the purchase

Besides learning about the latest engines in detail, visitors of the event get to familiarise themselves with the expansive range of services offered by DEUTZ. For DEUTZ, a business relationship does not end with the sale of an engine; quite the contrary: Service means Life Time Support: For the entire service life of the engine and machine, DEUTZ offers a comprehensive offer of products and services. With a contemporary and clearly-designed appearance, Service presents its varied performance spectrum such as the development services included in the “Engine Plus” programme. These



Michael Wellenzohn, Board of Management for Sales/Service and Marketing

► “To us, Bauma is the perfect stage for presenting our products to a large audience of professionals. Be it new engines or innovative versions of our successful products – we always offer our customers the solutions of tomorrow well in advance.”

comprise the customised system integration solutions regarding the required hardware components and software functions.

Here, the development services are closely interlocked with marketing and sales. Already in the planning phase of a new device, DEUTZ offers the possibility of optimally aligning the engine and exhaust gas treatment system to the different requirements and mission profile. Thanks to this, the customer receives a turn-key solution and, as such, has the possibility of reducing internal development capacities. What is more, the customer benefits from DEUTZ know-how, which is constantly growing in numerous applications. The offer additionally includes standard components such as a device-specific SCR tank. This comprehensive adjustment of the engines to customer requirements simultaneously represents one of DEUTZ’s greatest strengths.

### Short blocks as a new DEUTZ Xchange product

Also forming a part of the service offer is the so-called “Xchange” programme. This refers to professionally remanufactured engines and components, which are a fast, economically-feasible and environmentally friendly alternative to purchasing a new vehicle. The programme now also comprises short blocks, including for the popular 2011

The DEUTZ Bauma booth online: [www.future-driven-deutz.com](http://www.future-driven-deutz.com)



engine type. DEUTZ Xchange engines and parts guarantee optimum functionality and safety: The same quality standards apply that are used for the serial production of new parts. All engines and parts are diligently inspected to verify quality, function and precision fit. The result: technical

products that are as good as new and that comply with the original in every aspect – and this also applies for serial production lines that have been discontinued for years. As a result, DEUTZ Xchange engines and parts always comply with state-of-the-art technology, because the reworking always incorporates that latest technical insights regarding serial parts. An Xchange engine will be presented as an example of this at the booth in Munich. The warranty for Xchange products is equal to that of a new part or engine and for DEUTZ customers, this means series-identical quality.

### The DEUTZ Bauma booth online

Clients and other interested parties can now find out about the highlights of the trade fair in advance. The new DEUTZ website, [www.future-driven-deutz.com](http://www.future-driven-deutz.com), contains everything there is to know about our presence at Bauma. DEUTZ is also launching its official Facebook fan page. Interested users can now follow DEUTZ on [www.facebook.com/deutzofficial](http://www.facebook.com/deutzofficial) to receive the latest news about the company and its products. The diverse variety of communication possible through the social network enables a direct exchange of information with different groups related to DEUTZ. Customers, business partners, employees, and DEUTZ fans all over the world – everyone can make an active contribution to the dialogue on a wide variety of topics.

**DEUTZ SERVICE**  
Life Time Support

# The environmentally-friendly diesel

**Environmentally-friendly diesel engines – the concept is frequently met with amusement. Prognoses for the future of the self-igniting engine are bleak, and the general consensus seems to predict that it will be replaced by cleaner drive units. How does DEUTZ, as an independent engine manufacturer, feel about the future of the diesel engine? We have interviewed: Dr Markus Schwaderlapp, Director of Research and Development, and Knut Feisel, Advisor on Emissions Regulations, of DEUTZ AG.**

**DEUTZWorld:** *The public reputation of the diesel engine is currently far from rosy due to its emission volume. Is this criticism valid?*

**Dr Schwaderlapp:** We consider this alleged bad reputation to be unfounded, considering the spectrum of industrial application of modern DEUTZ diesel engines. Diesel engines of the latest generation are amongst the cleanest drive units compared to other combustion engines. Between 1999 and 2014, the threshold values of nitrogen oxides for non-road diesel engines in North America, Europe, and Japan were reduced by 95.7 %, while the corresponding values for particulate matter (primarily soot particulates) were reduced by 96.5 %. DEUTZ engines designed to comply with the latest exhaust emission standards have

a diesel particulate filter (DPF) that is continuously active and reduces more than 99 % of particulate emissions. This effectively means that the amount of nitrogen oxide or particulate mass in the exhaust emissions barely exceeds that of many megacities around the world. In addition, the treatment of exhaust emissions for non-road diesel engines is effective across the full performance range. Emissions are reduced effectively even at heavy use conditions and high speeds.

**DEUTZWorld:** *How does a modern diesel engine compare to the emissions of other drive units, such as petrol or gas engines?*

**Dr Schwaderlapp:** There are some fundamental differences to petrol or gas engines, regardless of the exhaust gas

treatment. Diesel engines, for instance, are at a disadvantage in terms of nitrogen oxide emissions and soot particulates, but these are eliminated almost entirely by modern exhaust gas treatment systems, consisting of a diesel oxidation catalyst (DOC), diesel particulate filter (DPF), and Selective Catalytic Reduction (SCR). This effectively means that diesel engines even perform better than current petrol engines with direct injection in terms of particulate emissions. Gas engines are generally very clean with regard to nitrogen oxides and particulates, but they cause methane emissions and the resulting greenhouse effect. This makes the diesel engine at its present stage of development a low-emission drive with several advantages over other types of drive.



*DEUTZ engines with diesel particulate filters cut particulate emissions by more than 99 %. This is particularly beneficial for the air qualities in urban centres, where high concentrations of particulates are currently being measured on a regular basis.*

**DEUTZWorld:** *How are the so-called “non-road” diesel engines used in mobile machinery different from car diesel engines?*

**Dr Schwaderlapp:** Non-road diesel engines are significantly tougher drive units for heavy-duty application. They have a long lifespan of 8,000 hours of operation or more. Depending on application, they can also operate at full throttle for longer periods of time and cope with extreme environments in terms of dust, vibration, uneven terrains, or temperatures. They are used e.g. in mobile work equipment such as construction vehicles and tractors, and their load profile is considerably different from that of commercial vehicle applications. As I mentioned earlier, the exhaust gas treatment system of non-road diesel engines is effective across the full performance range. A study conducted by the department of mobile machinery at the Karlsruhe Institute of Technology has recently found that the emission values of cars are at best equal to those of mobile machinery, but usually higher during operation.

**DEUTZWorld:** *How can you ensure that non-road engines comply with the statutory emission limits?*

**Mr Feisel:** The compliance with statutory emission thresholds is verified in the course of the certification process. The running production is subject to regular compliance audits. In addition, the integrity of the emission reduction strategy in the field is continuously assured by diagnostic and monitoring functions in the control unit. The upcoming Emission Stage V for non-road mobile machinery will further introduce an obligation to report on emissions in the field (in-service monitoring).

**DEUTZWorld:** *What improvements of emission values will be achieved by the EU Stage V?*

**Mr Feisel:** Besides the factual alignment of all performance categories, in particular of engines with a fixed speed (i.e. predominantly gensets), with the US Tier 4f, a particle count limit of  $1 \times 10^{12}/\text{kWh}$  at a performance range between 19 and 560 kW will be introduced by Stage V. This is expected to apply also to railcar and barge engines with an output exceeding 300 kW. A particle-count limit will contribute to the improvement of the air quality in urban centres, where high concentrations of particulate matter are currently being measured on a regular basis.



*Knut Feisel, Advisor on Emissions Regulations, DEUTZ AG.*

**DEUTZWorld:** *What technological concepts is DEUTZ using to face these challenges?*

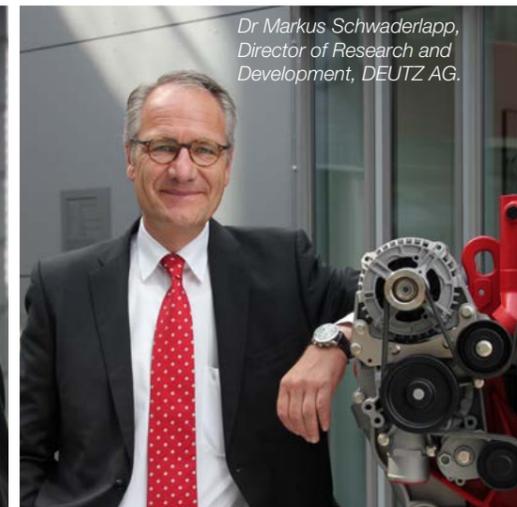
**Dr Schwaderlapp:** The EU Stage V will effectively make closed diesel particulate filters mandatory, as they are currently the only technological means of keeping within the particle count limit. DEUTZ has already been using diesel particulate filters since Stage IIIB, and is therefore well-prepared for Stage V in the sector of 2.9 to 8-litre engines. We have been testing the diesel particulate filter over a period of many years in a wide range of applications and countless hours of operation. This has given us a considerable edge in terms of our expertise.

**DEUTZWorld:** *Do you have any predictions regarding the “next step” after Stage V?*

**Mr Feisel:** We can expect future additions and adjustments of the emission regulations. The draft bill on Stage V contains revision clauses concerning a potential tightening of the threshold values. This may include the introduction of the particle count limit to power ranges that are currently exempt from it, or an adjustment of the specifications regarding the compliance of operating engines and machines. In the long term, the focus may shift to additional elements of the Euro VI standards for commercial vehicles, such as on-board diagnostics or CO<sub>2</sub> emissions.

**DEUTZWorld:** *What are the particular strengths of diesel engines?*

**Dr Schwaderlapp:** One decisive advantage of the high-torque diesel engine is its low fuel consumption and correspondingly low CO<sub>2</sub> emission rates. Thanks to the higher compression rate, lack of throttling



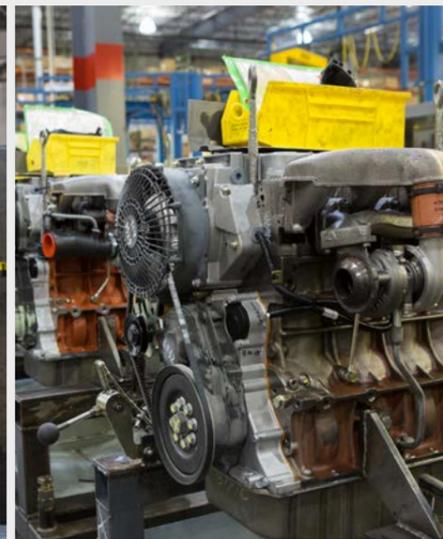
*Dr Markus Schwaderlapp, Director of Research and Development, DEUTZ AG.*

loss, and low heat loss in the combustion chamber, diesel engines are particularly efficient. At the same time, their emission levels are very low, provided the exhaust gas treatment systems I have described earlier are in place. This makes it the right choice whenever efficient performance and high torque are relevant criteria.

**DEUTZWorld:** *One final question: how do you envision the significance of the diesel engine in 50 years?*

**Dr Schwaderlapp:** The current mixture of different drive types will continue to compartmentalise on the basis of applications. For lower load ranges, e.g. in forklifts, electric or gas engines will be increasingly widespread. But we expect that even in 50 years, diesel engines will still be in demand for applications such as construction or agricultural machinery. Electric drives are inapt for these purposes: the machines work autonomously, and the required amount of energy would be too high to carry in a battery. Let me illustrate this: a 590-litre diesel tank in a tractor is sufficient for 10 hours of ploughing work in the fields. A battery providing the same amount of energy would have a volume of 4,500 litres and weigh more than 15 tonnes.

When synthetic fuels are used, diesel engines can be operated at a CO<sub>2</sub>-neutral level, in perspective. Researchers are currently developing a process for converting environmentally friendly green electricity into synthetic diesel fuel using a special process of electrolysis. The result can be mixed and used with fossil diesel at any proportion thanks to its chemical properties. Against the background of this so-called “e-fuel”, we predict lasting long-term potential for diesel engines.



## JLG partners DEUTZ Xchange to bolster reconditioning program together with DEUTZ Xchange

JLG Industries, Inc. – the global market and technology leader for telescopic forklifts and aerial work platforms – has entered into a cooperation with the DEUTZ Corporation in Georgia (USA). The DEUTZ subsidiary will be supplying remanufactured engines as part of the total unit, complete with a full warranty, for the reconditioning of aerial work platforms.

JLG is conducting a program at their Bedford, Pennsylvania facility to recondition aerial work platforms (AWP) that have spent between 7 and 19 years in service. As part

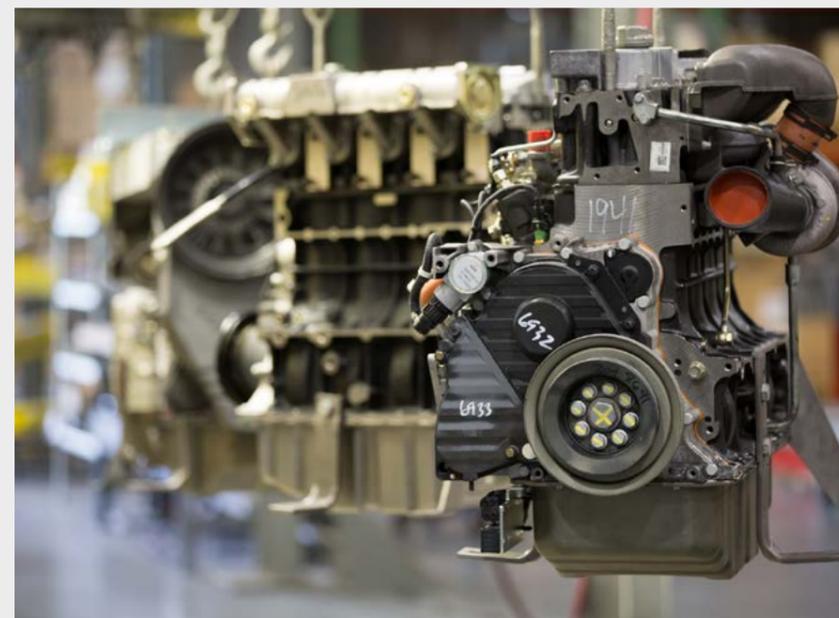
of the program, engines are being overhauled or resealed in addition to the general refurbishment work. Jens Huettner, OEM Business Development Manager for DEUTZ Corporation, reports that JLG is particularly pleased with the standard transferrable 3-year warranty offered with all DEUTZ Xchange engines. “The warranty, which is equivalent to our warranty for new engines, and the option of having the engines serviced by any DEUTZ distributor, was highly important to JLG.”

Prior to its recently agreed upon partnership with the DEUTZ corporation, JLG had

commissioned a local engine repair shop with the engine work. The DEUTZ Xchange products will accelerate the respective processes considerably, and the remanufacturing capacities of the Pendergrass facility will be increased from 4–5 to a total of 8 DEUTZ 2011 engines per day. Manufacturing schedules will be ramped up.

Robert Mann, President and CEO of DEUTZ Corporation, explains: “We are expecting to provide between 600 and 800 remanufactured engines to JLG in 2016, creating additional revenue of more than \$2 million.” Preparations for implementing the agreement are currently in full swing, as the first deliveries are set to begin at the end of March. Jim Oldham, Operations Manager for DEUTZ Xchange, adds: “The team here at Pendergrass is very proud of this cooperation; we are looking forward to the first delivery. We have recruited additional staff and expanded our equipment in order to get the program off to a solid start.”

The new agreement pays off for both JLG and DEUTZ. The machine hire service Sunbelt Rentals recently purchased 137 remanufactured AWP units from JLG, explicitly requiring that DEUTZ Xchange engines be installed in each of the units. In some cases, engines from other manufacturers will be replaced by a DEUTZ Xchange engine.



## Mission impossible? Not for DEUTZ.

The Republic of Indonesia consists of more than 17,000 islands. Many towns and islands are so remote that reaching them with conventional means of transport is difficult. On the occasion of the 70th anniversary of the independence of Indonesia, the government decided to build new power stations on remote islands and in remote towns, where the local population had previously been without electricity.

“We were told to install an electricity supply network in 47 locations on these remote islands, as quickly as possible, in order to make sure the government can keep their promise,” an employee of the Directorate General of Electricity recounts. The state electricity company, PT PLN, then issued a tender for a project that needed to be completed within two months. Despite PT PLN’s extensive experience in defining specifications for engines and generators in terms of e.g. their ensured performance, fuel consumption, and transformer power, the schedule seemed to make this project an impossible task.

The tender consisted of four packages of 149 units in the range of 100–1,000 kW. It called for a turnkey package comprising silent gensets, synchronised panels, step-up transformers, cables, and installation.

### Energy, powered by DEUTZ

The DEUTZ engines scored the best results for performance and fuel efficiency during the tests. PT Maxi Utama Energy, DEUTZ’s Indonesian distribution partner, received the order for supplying 67 units with the BF6M1013EC (134hp) and TCD2013L06 (268hp) DEUTZ engines for two of the tender packages. They had to face the demanding task of completing the delivery for the first phase of the project by 31 August 2015. DEUTZ organised the airfreight of the engines to PT Maxi Utama Energy.



Due to the geographical location of the installation sites, finding an appropriate means of transport proved the greatest challenge. Some of the sites are only accessible through narrow streams, whose water levels during the summer months are too low to transport the equipment by boat. If a river is unavailable for transport, the genset must be disassembled and transported in a different way. Some roads and bridges may have become impassable, too, making it necessary to repair them for overland transport. During monsoon season, the islands are difficult to reach by boat due to the strong waves. All of the above factors needed to be taken into account. As the Islamic month of fasting took place in July this year, there was an added risk of delays during that month. A backup team was set up to cover for the Muslim workers in the case of an emergency.

After two months of working for 24 hours a day, the first phase of the project was completed successfully, and the locals got to enjoy their new electricity supply on time for Independence Day.

“We are currently still working on the tasks for the second package, which we will hopefully win for DEUTZ in 2016,” says Sandy Wuinanto Jong, Director of PT Maxi Utama Energy explains. The company sells DEUTZ engines and components in Indonesia. All parties involved are confident that the work will be completed within the shortest possible time.





## A great success

DEUTZ celebrates 35 years of successful service and sales activities in France

DEUTZ France has been a service and sales subsidiary of DEUTZ AG for 35 years. Established in 1981 by the then Klöckner-Humboldt-Deutz AG, the contemporary DEUTZ France SAS was founded from Valcke Frères, then an official DEUTZ dealership, which had been active in France since 1952.

The French DEUTZ subsidiary covers a diverse range of regional responsibilities. It spans France, Morocco (with Magideutz in Casablanca), Algeria (with BCA, a representative office in Algiers), the francophone African countries, and, since 2015, Luxembourg. The direct personnel responsibility in France, Algeria, and Morocco comprises 85 staff members.

The overall sales responsibility for the region amounts to an average of EUR 100 million. The region of France accounts for the largest share at EUR 50 million, followed by Algeria at 30 million and Morocco at 25 million. In France, DEUTZ France has allocated its service structure



for customer service tasks and the distribution of spare parts to three service centres and ten retailers. In francophone Africa, DEUTZ France carries out business activities in eleven countries, where it is also represented by a corresponding network of retailers.

Especially the sale of new engines in the agricultural, airfield equipment, and construction machine markets and segments in France is particularly attractive for DEUTZ France. The French DEUTZ subsidiary has been particularly successful with the introduction of the 2.9 and 3.6 engines: its

newly acquired serial customers include the renowned forklift manufacturer MANITOU. Andreas Reiter, General Director of DEUTZ France SAS, knows that the customers value not only the high quality and reliability of the DEUTZ engines, but also the professionalism of the team, their fast response rates, and their client-oriented approach both to service tasks and the sale of new engines.

In Morocco, the Magideutz holding company is responsible for installing electric generators. Currently, approximately 1,000 generators are installed per year (see picture).

In Algeria, DEUTZ France looks after the sales of its licensees EMO (for air cooling) and SAFMMA (for BFM2012) and other Algerian equipment manufacturers. Thanks to the new licence of the BFM2012, revenue has increased by 90% to EUR 30 million in 2015. A great success.

When an education centre is described as „outstanding“, this alone is already great praise. However, when this not only refers to a verbal statement, but in fact also to an award by the Chamber of Industry and Commerce, the joy is all the greater. In 2015, the Cologne education centre of DEUTZ AG was particularly delighted about just this.

## DEUTZ Education among the

# „Best“



For the fifth time in a row, both an apprentice and the Cologne education centre as a whole were awarded a certificate deeming them "The Best" by the Chamber of Industry and Commerce for their outstanding performance. That's not all, however: after a DEUTZ apprentice was already honoured as the best production mechanic country-wide in the past year, another DEUTZ apprentice was called to the stage in the Oberhausener Metronom theatre in December 2015, where the 16 Chambers of Industry and Trade in North Rhine-Westphalia presented the coveted "The Best" award under the motto of "Big Stage for Top Class". In the stylish theatre atmosphere, DEUTZ trainee Wilhelm Steinbrecher was awarded the prize as best trainee 2015 in the examination as "Specialist for Metal Technology/ Field of Assembly Technology". The 23-year old was already among the best examination participants in 2015 in the Chamber of Industry and Commerce region in Cologne and, with his very good

examination results, he was able to also convince in the countrywide competition.

DEUTZ AG was also honoured in Oberhausen, as a symbol of recognition for its outstanding performance as a training company. Because the Cologne training centre brought forth the country's best apprenticeship performance in 2015 in the occupation of "Specialist for Metal Technology", after having received the award by the Cologne Chamber of Industry and Commerce, it was also honoured for this by the Industry and Commerce Chambers of North Rhine-Westphalia, in the form of a certificate. By means of this, they simultaneously acknowledged the exceptional commitment in dual training. "I am particularly proud that

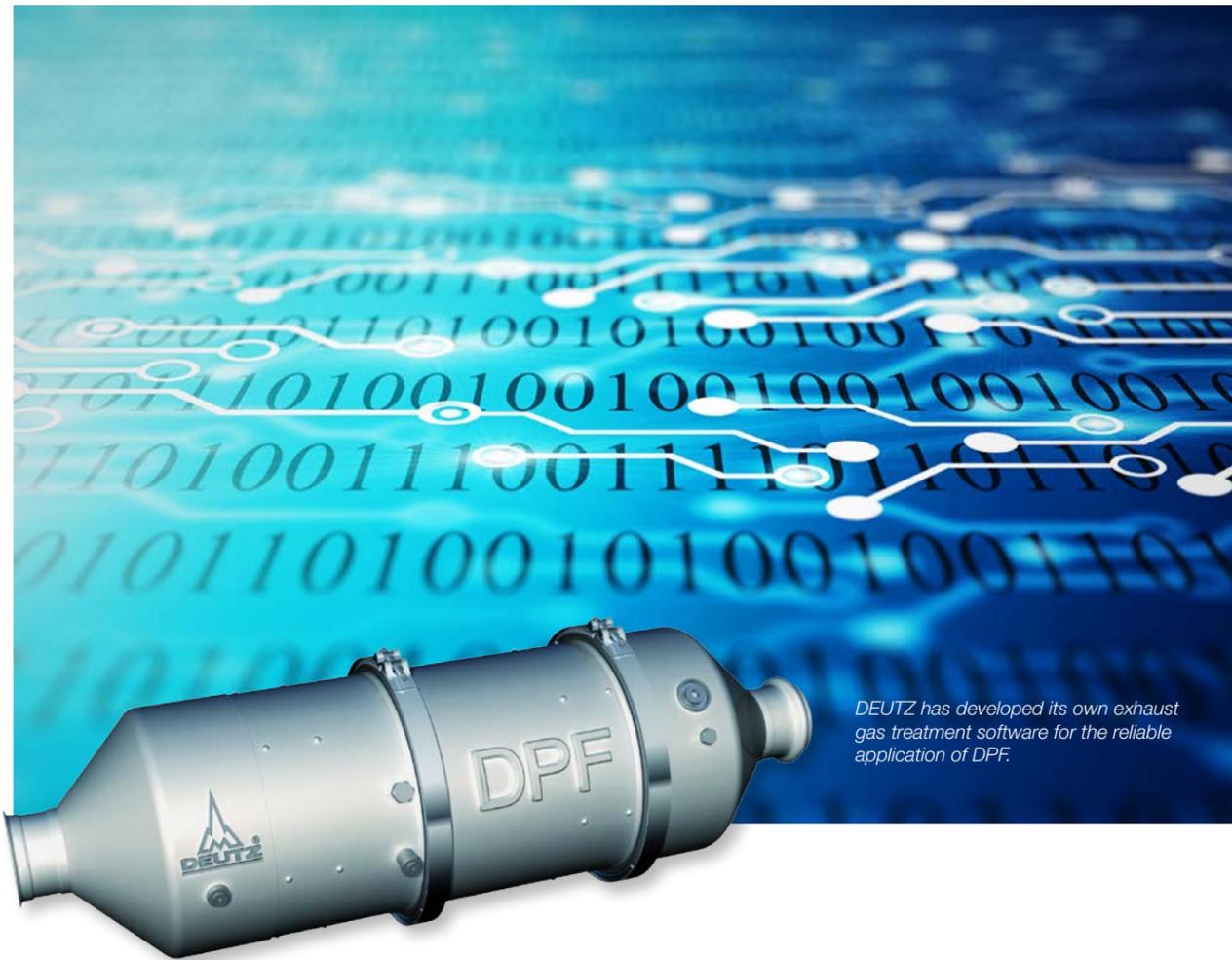


Martin Strecker, SVP Human Resources

► "I am particularly proud that our trainees have repeatedly been included among the best in Cologne and even in North-Rhine Westphalia."

our trainees have repeatedly been included among the best in Cologne and even in NRW. This provides evidence for the continually good training work performed by all parties involved," says Martin Strecker, Head of Human Resources at DEUTZ.

In 2016, there will still be a major change for the apprentices and trainers of DEUTZ. This summer, the training team will be leaving its "apprentice workshop" in Deutz-Mülheimer-Straße, which it has been using to date, and move into its new rooms on the DEUTZ premises in Cologne-Porz. Here, the team surrounding training leader Frank Opitz will not only find new training and office rooms but also a newly designed technical area.



DEUTZ has developed its own exhaust gas treatment software for the reliable application of DPF.

# Correct DPF management

Exhaust gas treatment is not just a question of the right components. The true challenge is the management of the overall system to operate the machine stably. The coming EU Stage V emission standard will make diesel particulate filters (DPF) indispensable. DEUTZ has faced this challenge in advance.

The next European exhaust gas standard for mobile working machines is set to come into effect in January 2019. Based on a suggestion by the EU Commission with regard to EU Stage V dated 25 September 2014, the particulate mass limit will be reduced from 25 to 15 mg/kWh, and a particulate count limit of  $1 \times 10^{12}$ /kWh will be introduced in addition. While diesel oxidation catalysts (DOC) were still sufficient for the reduction of particulate mass, the required particulate count limits can only be met by means of a diesel particulate filter (DPF). EU Stage V therefore entails an obligation to use DPF, which poses a completely new challenge for many manufacturers of engines and machinery. DEUTZ offers ready-made solutions and already has extensive experience with the use of DPF systems. The TCDs currently with a cubic capacity of 4–8 litres used in Stage

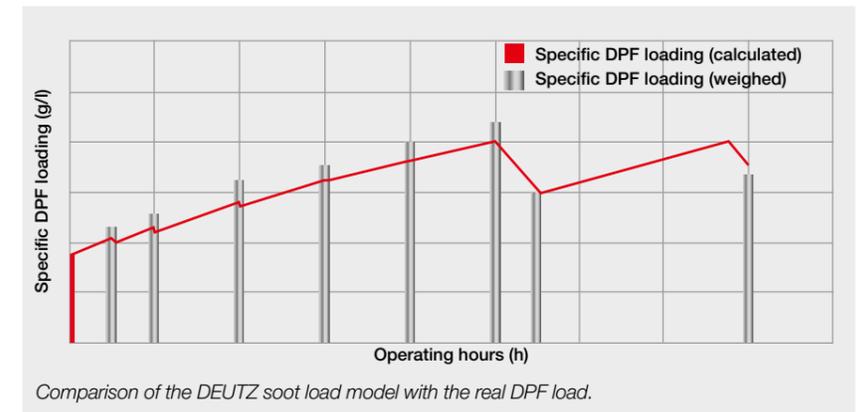
IV are equipped with a DPF as standard – the compact TCD 2.9 and 3.6 are available with an optional DPF. The engines thus already meet the thresholds of Stage V today, and DEUTZ is distributing them with its well-known “Stage-V-ready” label.

Customers of DEUTZ now benefit from the resulting production experience: the reliable operation of a DPF within a complete system requires deep-reaching integration skills and a thorough understanding of the respective application. The integration is based on completely different load profiles, depending on the machine in which the engine is being installed. A tractor, for instance, is typically driven under full load, which is fairly unproblematic for the use of a DPF: the temperature of the exhaust gas is high enough for the continuous regeneration of the filter. The load profile of a forklift, by contrast, is considerably more

complicated. Forklifts are frequently operated at low speeds, in short intervals or without a load. A forklift in a standard customer profile operates at only 22% of its maximal performance on average. As a result, the exhaust gas temperature normally stays under 250°C, and the soot particles collected in the DPF do not burn. Any solution for this problem requires intelligent heat management. DEUTZ has therefore developed a so-called “heat mode”, which is specifically intended to increase the exhaust gas temperature and thus ensure safe operation of the machine.

To apply the heat mode optimally, however, the soot load in the DPF must be calculated correctly. This is achieved by means of a chemical-physical soot load system, which is integrated into the exhaust gas treatment software developed by DEUTZ and determines the quantity of soot. Depending on the load factor, the engine can then be switched to four different settings. In “normal mode”, the engine is set up for maximum performance and efficiency. At normal use levels, the DPF is passively regenerated on a continuous basis without the need for further heat management measures.

If the previously defined DPF load threshold is exceeded by lasting low-load conditions in “normal mode”, the controller will switch to “heat mode”, which supports the regenerative process in two escalation stages (heat mode 1 and 2). This essentially increases the temperature in the partial load range. The machine can continue to operate without any performance concessions.



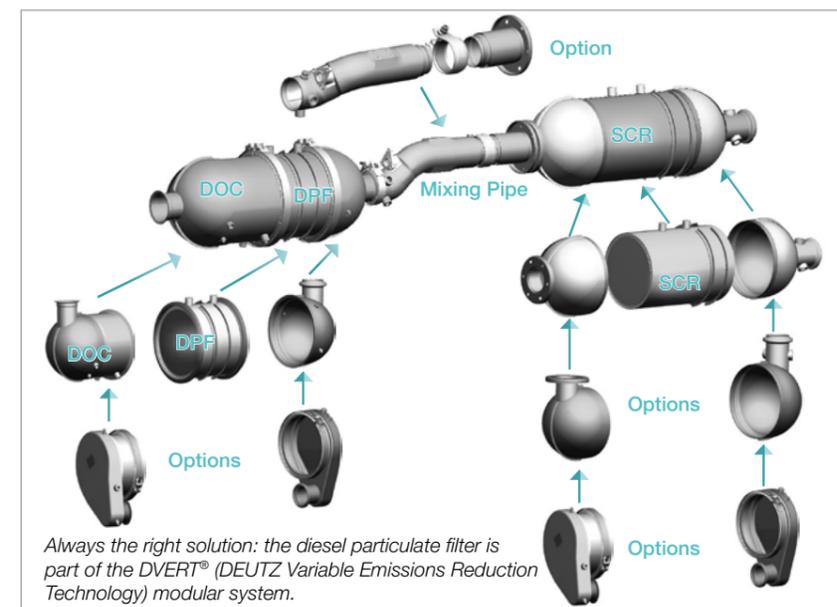
Comparison of the DEUTZ soot load model with the real DPF load.

In rare cases, it is possible that the maximum load volume is reached due to extreme operating conditions – e.g. lasting light-load operation at very low temperatures – despite the “heat mode” being active. In this situation, standstill regeneration becomes necessary. The intelligent control system will switch to “stand-still mode” to clean the DPF completely by means of an active service measure while parked. To achieve this, the engine spins at a high, idle speed and changes the air volume and injection parameters such that the required exhaust gas temperature is reached, and the machine becomes operable again after a short period of time.

When configuring a DEUTZ engine for a particular application, however, this process of stand-still regeneration is to be avoided. Instead, the stable operation of the machine in “normal mode” or by temporarily activating “heat mode” should be ensured. This is based on many years of

DEUTZ experience in developing, integrating, and serially operating DPF systems. It is reflected in the soot load calculation described above. As the load factor of the DPF cannot be measured in real terms during operation, it must be calculated on the basis of exhaust gas and temperature values and the chemical-physical model. Upon comparing the calculated and the real load factor by analysing the soot collected inside the DPF, it becomes clear that the values are identical: any rule based on the calculation will be reliable.

The highly complex model on which this calculation is based was programmed at DEUTZ’s own software engineering department, which has expanded the internal value creation and expertise. The calibration of the heat mode is also the brainchild of the DEUTZ development department. It has been developed over the course of many projects with a wide variety of customers and load profiles. The database that has been assembled in the process simultaneously benefits future projects. This gives DEUTZ a strong, unique selling point on the market.



Always the right solution: the diesel particulate filter is part of the DVERT® (DEUTZ Variable Emissions Reduction Technology) modular system.

The diesel particulate filter (DPF) is a fundamental component of the DEUTZ exhaust gas treatment strategy, available to our customers in our tried-and-tested DVERT® (DEUTZ Variable Emissions-Reduction-Technology) system construction kit. Virtually all elements of this exhaust gas post-treatment module can be combined with one another in order to ensure the desired outcome in terms of engine capacity, compliance with emission limits and competitiveness. In addition to the DPF, the basic components of the module are the diesel oxidation catalytic converter (DOC) and selective catalytic reduction (SCR). All of the components are coordinated during the system control. Only by mastering the whole system can the effective and reliable treatment of exhaust gas be ensured – this is one of the greatest strengths of DEUTZ.

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# Floorplan – DEUTZ at Bauma 2016



You can find DEUTZ engines in various applications of our customers.

Customer	Location
AGCO GmbH, Marktoberdorf	B4.313
Ahern Industries Inc.	FS.911A/4
American AUGERS	FN.831/3
Amman Verdichtung GmbH	FS.909/910
Anaconda Equipment Intern. Ltd.	B2.131
ASTEC Industries	FS.1111/3
Atlas Copco MCT GmbH	FS.1108
Atlas Maschinen GmbH	FM.612/1
Atlas Weyhausen GmbH	FM.808/1
AUSA CENTER SLU	FM.808/2
Bell Equipment Deutschland	B5.148
Beretta Alfredo s.r.l.	FN.623/1
Bobcat	FM.612/3
Bomag GmbH	FS.1008/1 u. 1009
CASAGRANDE S.p.A.	FN.521/5
CHARLES MACHINE WORKS	B3.412
CIFA S.p.A	FS.901/1
CIFA S.p.A	FS.905/2
Claas Vertriebsgesell. mbH	FN.724/1
COMACCHIO s.r.l.	FN.722/2
COMBILIFT Ltd.	FN.720/9
CompAir Drucklufttechnik Gardner Denver Deutschland	FS.911/3
CORINSA	B5.226
Diamond Products	A1.238
Doosan Portable Power	FM.612/3
DRILLMEC SpA (Soilmec group)	FN.522
Dynapac GmbH	FS.1108
FARESIN INDUSTRIES S.p.A.	FS.1208/3
GHH Fahrzeuge GmbH	C2.437
GIANT-Tobroco Machines	FM.616/7
GIPO AG Aufbereitungssysteme	FN.924/1
Goldhofer AG	FN.823/1
GREEN POWER SYSTEMS s.r.l.	A6.444
Gruas Saez S.L.	FS.1104/1
Hamm AG	FS.1011
HAULLOTTE GROUP	FS.903/5
Herbst Machinery Ltd.	B2.131
HIDROMEK A.S.	B5.126
Hitachi Construction Mach. (EU)	FM.515
Idrofoglia s.r.l.	A6.444
JANO s.r.o.	FN.816/1
JLG EMEA B.V.	FS.904/5
Joseph Vögele AG	FS.1011
Kaeser Kompressoren SE	FM.708/15/17
Kee-track Group N.V., Belgien	FN.817/2
KGHM ZANAM Ltd.	C2.315
Kobelco Construction Mach. (EU)	FN.817/3/1
Kramer - Werke GmbH	FS.1208/A
Liebherr Hydraulikbagger GmbH	A4.213 / B0.210A / FM.809/810
LINDE Hydraulics GmbH & Co.	A5.248

Customer	Location
LLAMADA Constr. Mecanicas	FN.623/11
MAGNI Telescopic Handlers	FS.1107/9
MAIT S.p.A.	FN.622/5
Manitou B.F. S.A.	FS.908/1
Manitowoc	FS.1202
Maximus Crushing & Screening	FN.618/9
Mc DRILL TECHNOLOGY S.P.A.	FN.722/5
McCloskey Intern.	FN.618/2
Mecalac Baumaschinen GmbH	FM.715/1
Menzi Muck AG	FS.1212/2
Merlo S.p.A.	FS.1008/3
MULTIQUIP, Inc.	FS.1106/7
Nagel Baumaschinen Augsburg	FM.811B
NC Engineering Ltd.	B5.227/F4
NICOLAS	FN.828
Niftylift Ltd.	FS.1002/10
NORMET OY	B3.229
PALFINGER AG	FN.826/5
Paus Maschinenfabrik GmbH	C2.339
PAUSELLI S.R.L.	B3.142
Portafill Intern. Ltd.	FN.620/1
POWER CURBERS	FS.1206/1
PRAMAC IBERICA S.A.U.	A5.335 / FS.907/5
PTC	FN.721/5
Putzmeister Mörtelmaschinen	B6.100
ROTAIR S.p.A.	B3.238
SANY	FN.620/9
Scarab Sweepers Ltd.	FS.1009
SCHWING GmbH / Stetter	FS.1005/2
SDMO Industries	A5.224
SECMAIR	FS.1009
SELWOOD PUMPS	A6.231
Sennebogen Maschinenfabrik	FM.712
Shuttlelift	FS.1002/2
Skyjack	FS.1002/3
Snorkel	FS.1103/2
Soilmec Spa	FN.522
Somero	FS.1106/8
Takeuchi, Schäfer GmbH (Import.)	FN.1016/6
Telestack Intern. Ltd.	FN.620/1
Terex Corporation	FM.616/1 FM.711
Thwaites Ltd.	FM.615/14
Ultra Plant Ltd.	B2.131
VARISCO S.p.A.	A6.337
VARISCO S.p.A.	FN.623/10B
Vermeer Corporation	FN.621/1
VF Venieri S.p.A.	B5.149
VISA S.p.A.	FN.1018/2C
VOLVO CONSTRUCTION EQUIPMENT	C4.650 / FM.510
Wacker Neuson	FS.1109-1209
Wirtgen	FS.1010/1110/1111
Xylem Water Solutions Deutschl.	A6.449
Zoomlion Heavy Industry	FS.905/2

# FUTURE DRIVEN.

ENGINE TECHNOLOGY FOR TOMORROW.



G 2.2/2.9 | 54 kW



TCD 2.2 | 55 kW



TCD 2.9 | 75 kW



TCD 3.6 | 105 kW



TCD 4.1 | 115 kW



TCD 6.1 | 180 kW



TCD 7.8 | 260 kW



TCD 12.0 | 390 kW

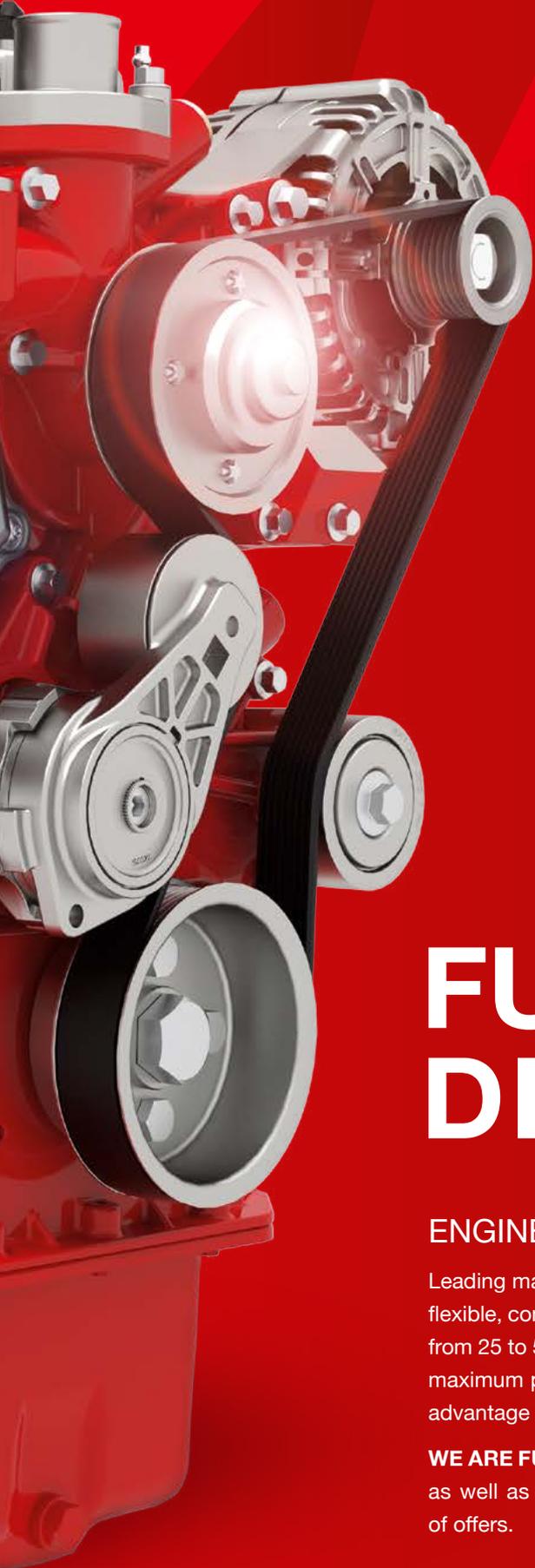


TCD 16.0 | 520 kW



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Leading manufacturers build on the innovative capability of a strong brand and choose flexible, compact engine systems from DEUTZ. Our wide range of products with engines from 25 to 520 kW already meet tomorrow's emission limits. What that means for you is: maximum planning security and greater freedom in development and production. Take advantage of our technological edge.

**WE ARE FUTURE DRIVEN:** The new 2.2 litre engine available in diesel and gas versions as well as the well-established 2.9 litre engine in a gas version complete our range of offers.

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