

The customer magazine of DEUTZ AG

## ► Stage V for agricultural engineering

Page 6

### The employee is the success factor

DEUTZ CEO Dr Helmut Leube  
talking about the zero-defect  
strategy at DEUTZ

Page 16

### Small tractor, great performance

Landini relies on the compact  
DEUTZ power packs

Page 18



The engine company.







**6 HIGHLIGHTS**  
**Stage V for agricultural engineering**  
  
DEUTZ at Agritechnica in Hanover



**14 IN FOCUS**  
**The natural gas tractor**  
  
First DEUTZ natural gas engine integrated in a tractor



**18 TEAMWORK**  
**Small tractor, great performance**  
  
Landini relies on the compact DEUTZ power packs

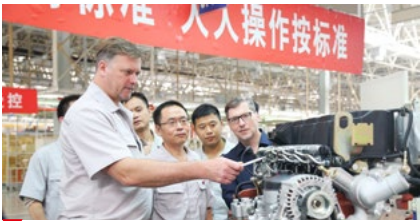
**NEWS**  
**Notifications and information regarding DEUTZ** .....p. 4

**HIGHLIGHTS**  
**Stage V for agricultural engineering**  
DEUTZ at Agritechnica in Hanover .....p. 6

Interview: Michael Wellenzohn, Member of the DEUTZ AG management board .....p. 10



**DEUTZ WORLDWIDE**  
**DDE starts new engines**  
DEUTZ expands its locally produced product range in China .....p. 12



In dialogue: Dr André Philipp, Chief Technical Officer at DEUTZ (Dalian) Engine (DDE).....p. 13

**IN FOCUS**  
**Clean machine: the natural gas tractor**  
DEUTZ has successfully integrated its first natural gas engine in a tractor. ....p. 14

**IMAGE**  
**The employee is the success factor**  
DEUTZ CEO Dr Helmut Leube in an interview.....p. 16

**TEAMWORK**  
**Small tractor, great performance**  
Landini relies on the compact DEUTZ power packs .....p. 18

**ENGINEERING**  
**Scrum: Consistently innovative – with agility** .....p. 20



Statistical evaluation of End-of-Line Tests .....p. 22

Visit DEUTZ at the Agritechnica ....p. 23

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,**

From 8 -14 November 2015, Agritechnica, the largest agricultural technology trade fair worldwide, is taking place in Hanover. It goes without saying that DEUTZ will also be present, as it is, after all, a pioneer in agricultural technology. Guests visiting our booth can expect to see a special highlight true to the motto “DEUTZ is Stage V ready”, we will take you along on a trip to the future, because our current engines already satisfy tomorrow’s emission regulations. How we succeeded at finding the market solution even before having been given the challenge, and what benefits this will allow us to offer our clients, can be found in our cover story beginning on p. 6.

To be globally successful, it’s important to be where your customers are. We have already been represented with the joint venture of DEUTZ (Dalian) Engine (DDE) Ltd. in Dalian since 2007 and are continually expanding our range of locally manufactured products. In the article on p. 12, we introduce to you the latest members of the DDE family.

You can also expect another novelty in this issue: DEUTZ has, within the context of a research project, successfully integrated its first natural gas engine in a tractor. The result? The same performance with less pollutant emissions. Read how DEUTZ implemented this project in cooperation with the University of Rostock on p.14.

Best regards

Dr Helmut Leube

Dr Margarete Haase

Michael Wellenzohn



Success is also always a question of quality. And quality concerns everyone in the company, because it is quality that distinguishes our products and makes DEUTZ a reliable partner for our customers. But quality is also a promise that has to be kept. On this terrain, we have clearly established our goal: Zero Defect Quality. What lies behind this and what we are doing to establish a zero-defect culture at DEUTZ is explained by Dr Helmut Leube in an interview on p.16.

These and many more topics are awaiting you in the present issue of our customer magazine. We hope you enjoy the read.

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## New DEUTZ centre for empties



For more than 30 years DEUTZ has been relying on standardised reusable packaging in its sourcing of material supplies. In the autumn of 2015, with the closure of the Cologne-Deutz site, DEUTZ AG is relocating its centre for empties to Hansesstraße near the head office in Cologne-Porz and the logistics centre in Cologne-Kalk. The new centre for empties handles all empties activities related to sorting, cleaning, administration, supervision and general

processes. As of October 2015, some 40 DEUTZ employees will work in up to three shifts in the renovated and modernised 10,000 m² hall space and the 8,000 m² outdoor space.

Every day the new centre will handle up to 30 incoming RoRo trucks and up to 40 outgoing orders. The new centre will process a total of 1,000 large containers and 3,000 small containers as well as approx. 1,500 accessory components. The move of the centre for empties was used to optimise the processing of incoming soiled empties in a scheduled way. On a conveyor belt, the content is removed from the incoming empties and the residual dirt is sorted and recycled. Similar to a car wash, all large containers are completely cleaned on another station using industrial vacuum cleaners. Small containers are checked and, if necessary, passed on for further processing to a fully automatic wash plant. The entire process has been optimised with ergonomic workplaces and higher quality containers in mind.

## New head of marketing



Matthias Burmeister has been the new head of marketing at DEUTZ since 1 October 2015. The 45-year-old has been working in the print media industry for 25 years. Until 2004 he worked for the Eastman Kodak Company in Rochester/NY, and most recently he was head of brand management & marketing communication at Heidelberger Druckmaschinen AG. In his new role he is responsible for all marketing activities of DEUTZ AG and reports directly to Michael Wellenzohn, head of sales/service and marketing.

## Accolades for the DEUTZ Annual Report



DEUTZ AG can look forward to receiving a distinction at this year's first FOX Finance Awards. The DEUTZ Annual Report was awarded gold in the "FOX Finance" category. In this category, both the concept and the content of the respective report were the decisive criteria for the jury's decision. At the FOX Finance Awards, only communication solutions from the field of Corporate Reporting are audited and evaluated. Also receiving gold in the LACP competition was the DEUTZ Annual Report, one of the most important international competitions for Annual Reports. The DEUTZ Annual Report received 98 of a possible 100 points and, placing it among the 50 best German reports.

## Member of the diesel board of trustees

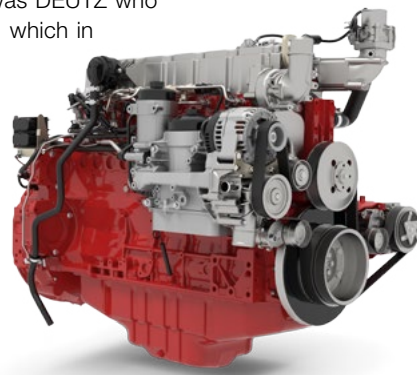
As of 1 July 2015, CEO of DEUTZ, Dr Helmut Leube, became a member of the board of trustees of the German Institute of Inventions (DIE). His appointment reflects his expertise and his contributions in the areas of technology, inventions and innovations.

## DEUTZ produces nine-millionth engine since 1867

DEUTZ AG started the industrial serial production of engines in 1867 with engine no. 1, the atmospheric gas-powered engine. 151 years later, in mid-2015, the nine-millionth engine rolled off the production line at DEUTZ.

The anniversary illustrates the special role played by combustion engines, which continue to be the basis of mobile drive technology to this day. Cutting-edge exhaust gas treatment systems and continuous efficiency improvements means that DEUTZ engines are sought-after around the world and will continue to play a significant part in advancing industrial engines through innovative solutions. After all, it was DEUTZ who developed the world's first four-stroke engine in 1876, which in honour of its inventor is still called Otto engine today.

Dr Helmut Leube, CEO of DEUTZ AG, likes to look back on this tradition which continues to this day: "We are proud to have significantly contributed to the motorisation of the world with more than nine million engines and to be able to maintain the tradition of the DEUTZ brand. It is our mission to continue to develop high-quality engine systems and to consolidate our leading position in the market."



## Efficient and ergonomic: the DEUTZ Shaft Centre

Construction work on the DEUTZ Shaft Centre is well under way and, day-by-day, the employees at the Porz location can see how the future centre for crankshaft and camshaft production is taking shape. Also in the Deutz plant, attention is paid to the interior design of the shaft centre and here, first and foremost, the focus is on quality, efficiency and workplace ergonomics.

A miniature version of the DEUTZ shaft centre is currently being created in what used to be the tube production area in Hall 96. Here, a team of employees from shaft production, the DEUTZ production system, maintenance as well as planners and apprentices are currently working on designing the future workplaces in the shaft centre in Porz within the context of the zero-error strategy of DEUTZ AG, in the most efficient and ergonomic manner possible. This is achieved by the replication of selected workplaces, including machines and manufacturing equipment in the scale 1:1, made from cardboard. With the replication in cardboard (referred to as cardboard engineering), a realistic simulation of all work sequences is made possible. By means of this, not only can the space that is required be established but, first and foremost, optimisation potential regarding quality and efficiency is pointed out. One objective of the simulation is to improve product and process quality. This is because it can be used to determine possible errors and sources resulting in delays at the workplace. The team captures the data regarding waste, red error charts, etc. at the workplace and conducts a cause analysis. Thus error causes and process weaknesses are recognised and rectified by targeted measures.

Another important objective is found in the value chain alignment to the so-called takt time. The takt time prescribes how much time is available for the production of a shaft, so as to satisfy the customer requirements in a timely manner. Paths and working positions, as well as the sequence and times of the activities for the employee, in comparison to the desired takt time at the workplaces, are to be collected and determined. At the same time, the workplace layout and job contents are to be optimised within the context of layout planning and capacity planning. Thus, for instance, the employee can define his work paths by using the cardboard simulated workplace and immediately recognise possible delays in the work sequence. Simultaneously, the simulation offers the employees the opportunity of adjusting their workplaces to their personally applicable ergonomic needs. Potentials in the ergonomic workplace layout can be recognised, thus achieving ergonomic improvements by means of direct measures. Here, quality-promoting, efficient and ergonomic solutions go hand in hand.

## First relocation stage successfully completed

On 8 June, the final milestone for the relocation of the Xchange engine assembly ensued, with the "SOP" (Start of Production) of the 4-8 litre series in the Ulm plant. Prior to this, the Xchange, series 1011/2011, 1015/2015, 413/513, as well as 91x were already relocated to Ulm. Apart from assemblies, the commercial divisions order processing centre, and order controlling and pricing divisions were also relocated to Ulm. Particularly gratifying in this regard is that about 25% of the affected employees of Stage 1 moved from the Übersee location to the location in Ulm, which is about 250 km away. Here, DEUTZ could retain decades of Xchange know-how, while the new processes could remain safeguarded in Ulm.

A positive résumé: Thanks to increased order income, both the budgeted and the previous year production volumes were exceeded. Simultaneously, in this time period, the throughput times of the customer orders could be returned to the good level of the Übersee plant, after their deterioration at the respective SOPs. The technical and commercial challenges brought on by the relocation were executed very well. "Without the exceptional dedication on the part of the involved employees in Ulm and Übersee, this would never have been possible. The Übersee colleagues directly impacted by the relocation supported the company and its products with high loyalty, right until the very last day," says Tobias Schiele, Commercial Director for Xchange and Head of Human Resources and Social Affairs for the Ulm and Übersee plants at DEUTZ. In 2017, the second stage of the relocation will be completed and the Übersee location will have been vacated. During this stage the disassembly, parts diagnostics as well as component reconditioning will be relocated to Ulm.



## DEUTZ branch in Moscow has new head

With effect from 1 October 2015 Alexander Kalachyk is the new head of the DEUTZ branch in Moscow. He will simultaneously hold the position of managing director of the service company 'LLC DEUTZ Vostok'. On 30 September 2015, the former head, Rolf-Dieter Heinzen, stepped down from his roles as head of the Moscow branch and managing director of the service company 'LLC DEUTZ Vostok' in Moscow following three years of intense development work. He will retire on 31 December 2015. In both roles Alexander Kalachyk reports directly to Georg Diderich, head of sales and service of EMEA (Europe, Middle East & Africa).

## The DEUTZ training centre has a new head



Dirk Fischer is the new head of the DEUTZ training centre in Cologne-Porz. The 41-year-old has been the team leader of Application Engineering since 2010 and in April 2015 he became the head of the DEUTZ training centre. The training centre offers courses for the DEUTZ organisations as well as for customers and equipment manufacturers. Using specially equipped test benches as well as tools and teaching materials, attendees are taught, among other things, how to deal with errors in the engine/EAT system, where they originate from and how to remedy them.



# ► Stage V for

## Agricultural Engineering

**AGRI  
TECHNICA**  
The World's No.1

Hanover / Germany  
8 – 14 November 2015  
Preview Days 8/9 November

DEUTZ is a pioneer in agricultural engineering and specialist for powerful diesel engines. The environmentally friendly and efficient drive technologies from Cologne are in global demand, and already satisfy the emission laws of tomorrow. Thus, at this year's Agritechnica 2015, the DEUTZ motto is: Stage V ready!

From 8 to 14 November, Hanover is dominated by the agricultural sector. About 2,800 exhibitors from 52 countries will be presenting their latest developments at Agritechnica 2015. Worldwide, this trade fair is the leading specialist exhibition for manufacturers and suppliers of agricultural machines. It is held every two years and more than 400,000 visitors attended in 2013.

Within this branch, DEUTZ sees itself as a technology leader for trend-setting drive technologies. Apart from efficiency and performance, it is particularly the exhaust emissions of diesel engines that are constantly being improved. Thereby, with the EU Stage IV standard that has applied since 2014, engine technology has already attained a very high standard. Here, in the time period between 1999 and 2014,

nitrogen oxide emissions have been reduced by 95.7 per cent and particle emissions by 96.5 per cent. DEUTZ engines with diesel particulate filters already reduce the soot particle mass by more than 99 per cent today. By means of this, especially fine dust pollution – which soot particles contribute to – is countered. Here, industry and policy-makers bear the responsibility for limiting environmental pollution to a minimum by means of clean technologies. DEUTZ and its customers are proud of not just complying with, but surpassing the statutorily prescribed threshold values, and thus actively conserving the environment. Consider this for comparison: At the highest level of emissions, the exhaust of a modern DEUTZ engine contains no more nitrous oxides or particle mass than the ambient air in many metropolitan centres around the world. This brings the vision of emission-free combustion engines one step closer to reality.

With the introduction of a new emission guideline, the engine manufacturers will have to attain the more stringent limits by means of targeted optimisations and the introduction of new technologies. This will involve both engine-internal solutions, such as improved fuel injection, and post-treatment of exhaust gases. With EU Stage V, which is anticipated as of January 2019, the emission legislation once again places the machine and engine manufacturers before a great challenge. The regulation is expected to be finalised at the beginning of 2016. In accordance with the current status, EU Stage V will then stipulate a reduction of the current 25 mg/kWh particle mass limit to 15 mg/kWh and introduce a particle concentration limit of  $1 \times 10^{12}/\text{kWh}$ . Based on current insights, this can only be attained with the use of a diesel particulate filter (DPF). This can lead to costly machine alterations for the manufacturers of agricultural vehicles if the engine's installation space requirement or after-treatment of exhaust gases changes. Here DEUTZ gives its customers the required security – and this applies for the whole TCD product range from 2.9 to 7.8 litre capacity.



*Urgently required: The emission limits of EU Stage V can only be attained with diesel particulate filters (DPF).*

### Ready for EU Stage V with DPF

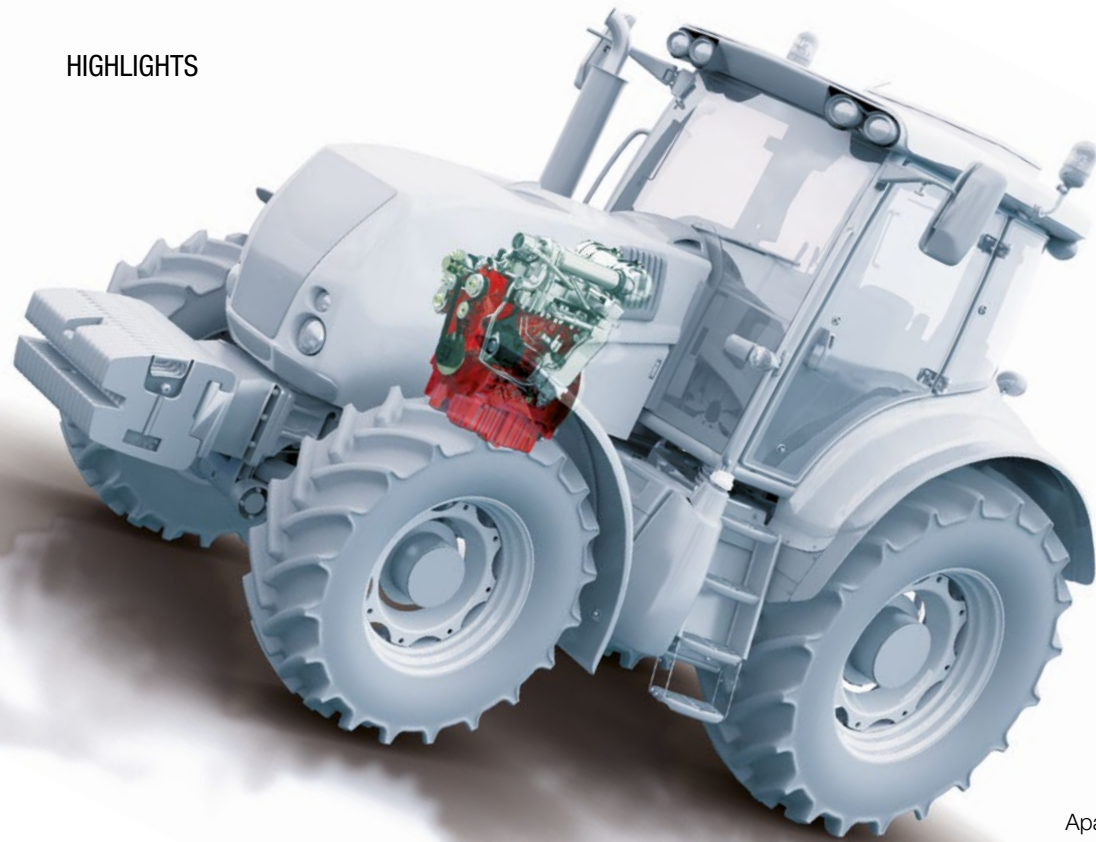
To live up to its own ambitious standards yet again, DEUTZ now already announces that, with its modern TCD engines for agricultural engines, it will satisfy the EU Stage V exhaust emission standard (based on the suggestion of the EU Commission regarding the EU Stage V, dated 25 September 2014) in the range of 2.9 to 7.8 litre capacity. In so doing, in the agricultural sector, DEUTZ covers an output ranging between 45 and 291 kW, which is a powerful USP (unique selling proposition) on the market. By means of DPF, DEUTZ is already successfully implementing the required after-treatment of exhaust gases with serial deliveries today. Thus DEUTZ customers are given long-term planning security, as well as sophisticated DPF solutions. Accordingly, the engines come with a special "Stage V ready" seal, thus assuring that the market is informed.

The Stage V-ready engines will also come with comprehensive service support provided by DEUTZ. With over 800 independent sales and service partners in over 130 countries worldwide, customers can be assured full, competent support. Aside from engine integration, certainty in terms of planning also benefits all after-sales processes. Thus, for instance, training modules or service guidelines can be defined over the long term.

### Customers save time and costs

In EU Stage IV, the DEUTZ TCD 4.1, 6.1 and 7.8 are already equipped with a diesel particulate filter as standard today. Therefore, with the change to Stage V, neither the size nor the technical design of the engines will change for DEUTZ customers. Also the two particularly compact TCD 2.9 and 3.6 engines now already offer the option of a Stage V suitable DPF solution. In the agricultural engineering version, Stage IV is currently still equipped with a diesel oxidation catalyst (DOC), which will be supplemented by a DPF in Stage V. Whilst retaining the same diameter, the complete DOC+DPF system will be a few centimetres longer, however the compatibility with the installation spaces of the target applications was ensured during development. In addition to this, DEUTZ utilises its experience-based advantage to further downsize the systems for the future.





*Fits under the bonnet: With DEUTZ Stage V ready engines, no costly changes must be made to the customer's device.*

Michael Wellenzohn, member of the DEUTZ AG management board for the Area Sales / Service & Marketing, explains: "With our Stage V ready engines, we would like to provide the best possible support for our customers when changing their products to Stage V. We achieve this by applying our experience-based advantage in exhaust gas treatment, in particular with the use of diesel particulate filters. With this, we offer fail-safe technology at an early stage as well as a time-flexible implementation framework, and this without costly changes to the customer's machine."

#### Emission Downgrade

There will also be so-called emission downgrade engines, by means of which the use of a comprehensive engine platform on Stage V markets and regions with less stringently regulated standards will be possible. This is ensured by the modular system construction kit for 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.

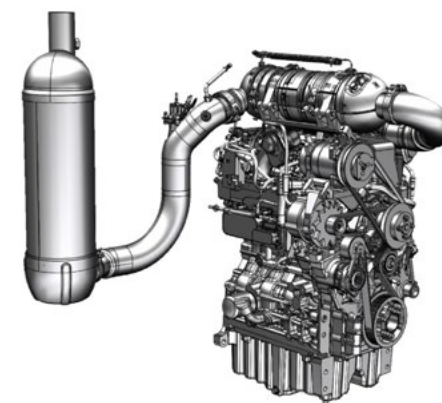
While the DOC focuses on reduction of particle mass, the DPF reduces the actual number of particles. Due to the particle concentration limit as imposed by Stage V, the DPF is indispensable to standard compliance. The SCR system with urea metering ultimately reduces NO<sub>x</sub> to the desired level.

All Stage V ready engines have a water-cooling, turbocharging, intercooling and cooled external exhaust gas recirculation. Each is an outstanding product in its class, with a very compact design and a customer-friendly, modular system of optional

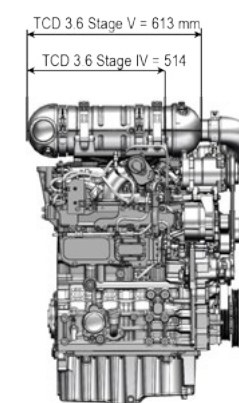
components. This reduces installation costs and expands the range of possible uses. A high-performance common rail injection system and high-efficiency combustion ensures excellent engine performance in tandem with low fuel consumption. The engines and exhaust gas after-treatment are geared in every point to the optimum efficiency of the overall system, ensuring that operational costs are kept to a minimum. The long intervals between oil changes and simple replacement of engine fluids will also improve engine uptime.

Service for the entire service life  
Apart from detailed information regarding the topic of Stage V ready, as well as the exhibited engines and technologies behind this, trade fair visitors also can find out more about the comprehensive service offer at the DEUTZ booth. 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, e.g. DEUTZ Engineering Service. This includes the customer-individual system integration of the necessary 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, he benefits from DEUTZ know-how, which is constantly growing in numerous appli-



*With the development of the complete DOC+DPF system, compatibility with the installation spaces of the target applications was ensured.*



cations. An example is the so-called best efficiency point alignment of the engine control device with the machine control. Thus optimum performance, dynamics and fuel consumption is attained. Additionally, standard components such as a device-specific SCR tank, are offered.

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. DEUTZ Xchange engines and parts

guarantee optimum functionality and safety: The same quality standards apply that are used for serial production of new parts.



► „With this, we offer fail-safe technology at an early stage as

well as a time-flexible implementation framework, and this without costly changes to the customer's machine.“

*Michael Wellenzohn, DEUTZ Executive Board – Sales / Service & Marketing*

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 which comply with the original in every aspect - and this also applies for serial production lines that have been discontinued for years. Thereby, DEUTZ Xchange engines and parts always comply with state-of-the-art technology, because the re-working always incorporates that latest technical insights regarding serial parts. An

Xchange engine will be presented as an example of this at the booth in Hanover. By

the way: the warranty for Xchange products corresponds with that of a new part or engine. For DEUTZ customers this means series-identical quality – with cost savings of up to 40 per cent.

#### Modern trade-fair appearance

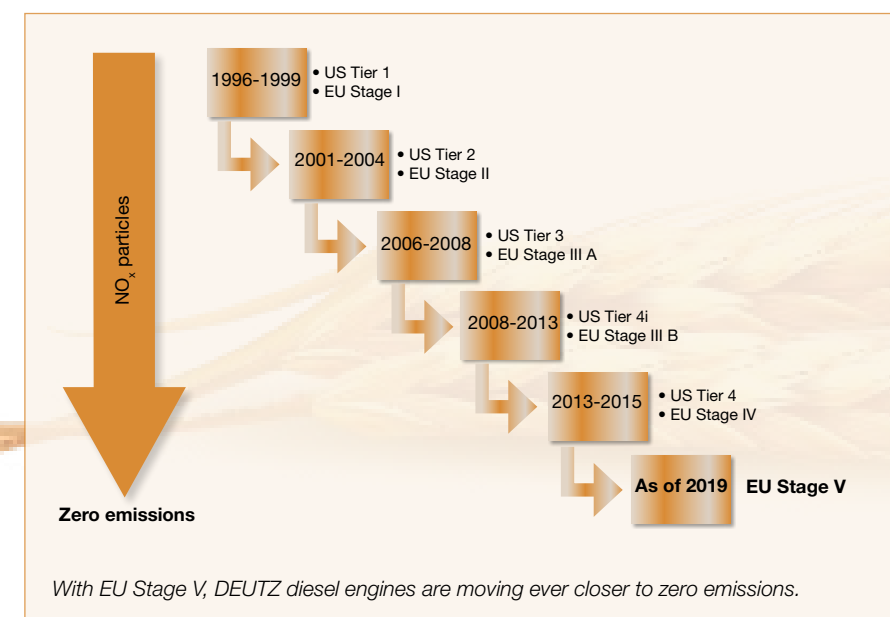
DEUTZ presents itself with a modern trade-fair concept at Agritechnica. The visitors are guided through semi-circular design elements – so-called half tubes, leading them to the current engine pallets in a targeted manner, where DEUTZ experts are happy to answer every question about the products. The pleasant lounge area invites visitors to discuss more detailed technical aspects, while enjoying a coffee or some cool beverages. The conference room in the interior also offers larger groups a means to withdraw for some quiet. Those who rather prefer exploring the booth on their own, can gain all information on every exhibit with the help of touch screens. The so-called EAT display provides information on the topic of exhaust gas treatment. Here, as examples, a 5.66 inch oxidation catalyst as well as a diesel particulate filter and selective catalytic reduction are presented.

Thus, there are many new things to be discovered at DEUTZ during Agritechnica. The trade fair team is looking forward to your visit in Hall 17, booth number D08.

You can find further information on page 23.



*In the range of 2.9 to 7.8 litre capacity, the DEUTZ TCD engines with DPF are already prepared for EU Stage V.*







## Interview: Michael Wellenzohn

Member of the DEUTZ AG management board for the Area Sales / Service & Marketing,

**M**ichael Wellenzohn, Agritechnica is considered the world's leading agriculture trade fair. What significance does it have for DEUTZ?

**Michael Wellenzohn:** For DEUTZ, agricultural technology is a part of our DNA. Since early in the 20th century, DEUTZ engines and agricultural machines have played a significant role in agricultural technological development – and we will continue to pursue this aspiration in future. Therefore, it goes without saying that Agritechnica is one of the most important industry events for us. Our engines stand for a high level of efficiency and performance and, simultaneously, low pollutant emissions. Especially

in the field of exhaust gas treatment, we have advanced solutions that don't merely follow trends but take into account and address future requirements.

*One of the key requirements for machine and engine manufacturers is found in the respectively applicable emission laws. The next Stage, EU Stage V, which is also more stringent, is coming as of 2019. How has DEUTZ prepared itself for this?*

**Michael Wellenzohn:** Very well! The entire DEUTZ TCD product range from 2.9 to 7.8 litre capacity is already Stage V ready. We also communicate this with the Stage V ready seal on our engines. By means of this, our customers are given the necessa-

ry security as regards the emission Stage change, allowing flexible implementation at an early stage. Here, the decisive advantage is that the engines remain identical as regards their size and design, so that the customer needs no expensive changes to his device.

*What is new with Stage V, and what does the technical solution you use to comply with the limit values look like?*

**Michael Wellenzohn:** New, first and foremost, is the introduction of a particle concentration limit. With this stipulation, the DPF will be a must-have so as to ensure compliance. In Stage IV, we already fit our TCD 4.1, 6.1 and 7.8 engines with DPFs

as a standard serial feature. As an industry-version, a PDF is now also available as an option for the compact TCD 2.9 and 3.6 models. For agricultural engineering, diesel particulate filters will also be available with the introduction of Stage V; these are already available with regard to the installation space.

*Why did DEUTZ decide to embark on the path of DPF early on?*

**Michael Wellenzohn:** When considering the emission legislation development, using a DPF was a logical consequence. To date, however, many other manufacturers only offer DPF solutions in individual cases or not at all, whereas DEUTZ already embarked on this path with the Stage IV standard and offers DPFs across the entire range. Whilst this might have created the impression that we were a little too over-engineered in the past, this experience advantage is paying off now. With the introduction of Stage V, we will already have gained about 10 years of DPF experience. This is an important USP on the market, because the ability to master this DPF technology is essential. A major issue in this regard is found with the downtimes needed for regeneration. So that the filter doesn't get clogged with soot, high exhaust gas temperatures must be reached. Essentially, this depends on the load profile of the machine in which the engine is installed. Thus, DEUTZ developed an intelligent "Heat Mode Model" for the different machine profiles. With this, the downtime regeneration periods are almost completely excluded. This saves time and costs for the user.

*How is this strategy paying off to date?*

**Michael Wellenzohn:** One of our strengths is always to provide our customers customised solutions that are tailored to satisfy their requirements. Here, with our Stage V ready strategy, we have placed ourselves in a comfortable position. Hence, we already have a solution on the market even before we have to satisfy this requirement. In so doing, we assume the technological leadership position. Generally speaking, we have already completely reworked our engine portfolio for Stage IV. Back then, we decided to comply with the upper technological limit, and this is paying off now. When compared with our competitors, our new engines are characterised, in particular, by the extremely compact construction size, high output density, low fuel consumption and low life-cycle costs. With our modular DVERT® (DEUTZ Variable Emission-Reduction-Technology) system construction kit, we tailor the exhaust gas treatment concepts to the customers' needs. The customers acknowledge all of this by plac-

ing their faith in DEUTZ, since, apart from numerous orders from existing customers, we are also delighted at a diverse range of new customers, who cover all regions and applications.

*Which services are offered by DEUTZ apart from the engines?*

**Michael Wellenzohn:** Our business relations do not end with the sale of the engine. For DEUTZ, service means offering a comprehensive range of services and products throughout the entire service life of engines and devices. The foundation for this is provided by our global service network, with representatives in more than 130 countries. The DEUTZ diagnostics tool SERDIA, which is continually developed further, allows the Service department a rapid and simple analysis of the engine and exhaust gas treatment systems and, as such, ensures speedy fault removal in the field. User-oriented graphic interfaces, extensive training courses and regular further development of the tool, simplify intuitive and efficient operation by service personnel. DEUTZ also offers the integration of the SERDIA features in the diagnostic system of the OEM within the context of customer-specific projects. By the way, our customised services already apply prior to the purchase of the engine. With the Engine Plus programme, we offer Engineering Service, among others. When referring to Engineering Service, we are talking about services for integration development in the application machine, right up to the complete field trial and production launch.

*How do you see the growth potential in the field of agricultural engineering and which opportunities arise for DEUTZ?*

**Michael Wellenzohn:** Globally seen, this is an interesting branch offering strong growth potential. Against the backdrop of the constantly increasing global population,

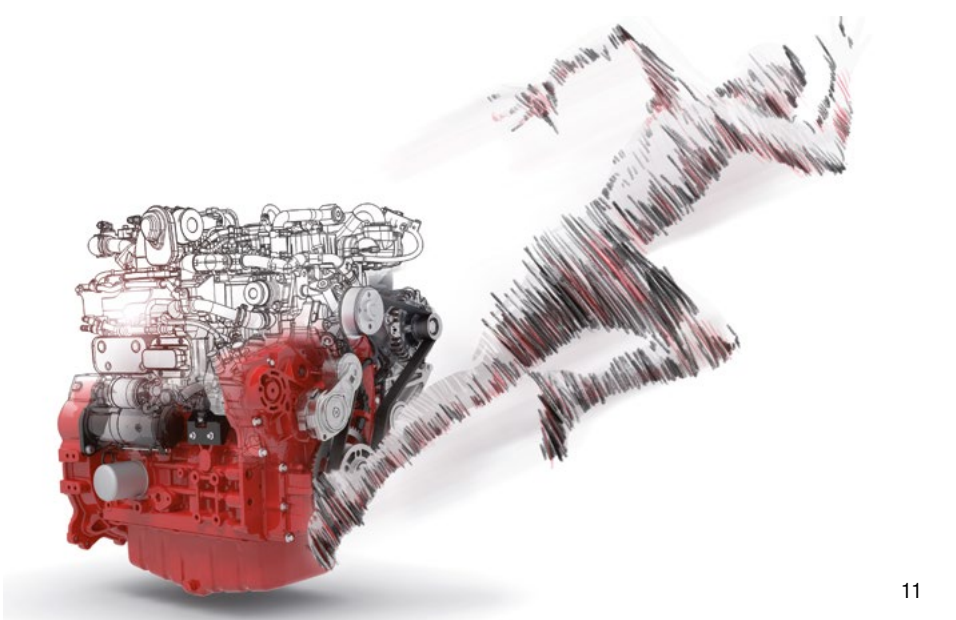
the demand for food and as such for agriculture, is growing. The increasing global population to 9 billion in 2050 requires an even greater degree of mechanisation in farming and thereby leads to a great demand for machines. We would like to participate in this demand. However, farmers are frequently subjected to enormous price pressure, which is why their work must be characterised by an extremely high level of efficiency; simultaneously, emission legislation is becoming more and more stringent worldwide. As a specialist for environmentally friendly and efficient drive technologies, we believe that we have very good chances to remain a technological leader also in future, and that we will further expand our business.

*In the past months there has been high-profile reporting regarding the manipulation of emission values with automobile diesel engines. How does DEUTZ deal with this topic?*

**Michael Wellenzohn:** We have, in fact, received the occasional query in this regard. However, we can clearly state that all DEUTZ diesel engines are correctly aligned and certified to the respectively applicable emission standards. The emission values recorded there comply with the statutorily prescribed limit values, and this can be demonstrated under real conditions at any time.

*DEUTZ stands for quality and reliability. How do you safeguard these values also in future?*

**Michael Wellenzohn:** High quality is a basic requirement for our business. We definitely still have improvement potential, which we are pushing with our programme for error avoidance in processes and products. With this approach, we would like to strengthen the fundamental values of the DEUTZ brand further, also in future.







Dr André Philipp at the DDE production line of the TCD 2013 4V engine in Dalian.

# DDE launches new engines

DEUTZ has been represented in China with the joint venture DEUTZ (Dalian) Engine (DDE) since 2007 and is expanding its range of locally manufactured products. The newest members of the DDE family are the proven TCD 2012 and TCD 2013 engines; featuring modern common rail fuel injection systems, they constitute another technological leap.

To be globally successful you have to be where your customers are. DDE serves the local needs in China with short delivery times and a high level of flexibility, ensuring that the engines are integrated in line with the requirements of both with local and international OEMs. The engines produced by DEUTZ – or the joint venture partner FAW, one of China's leading automobile manufacturers – are primarily used in the automotive and off-highway sector.

The localisation of products is one of the core competences of DDE. Even if an engine assembly line in the main factory in Ger-

man is already firmly established, this cannot simply be transferred one-to-one to the DDE production halls. Rather, a new supply chain has to be set up, employees have to be trained and machines configured. This is where DDE leverages its experience to meet the high quality requirements of DEUTZ, which are consistent around the world.

At the end of 2014 the production of the DEUTZ TCD 2013 4V as an automotive variant was launched in Dalian. The inline four or inline six cylinder diesel engine with its common rail injection system, turbocharging and intercooling delivers advanced technology that calls for increased production com-

plexity. Furthermore, in 2016 the TCD 2012 2V and TCD 2013 2V will find their way into the DDE halls as industrial engine versions. These engines have primarily been designed for mobile construction machines.

Before the new engines are launched, however, the DEUTZ colleagues in Dalian first have to deal with the ambitious project. In an interview with DEUTZWORLD, Dr André Philipp, Chief Technical Officer at DEUTZ (Dalian) Engine, explains the main steps.

## In dialogue

**Dr André Philipp, Chief Technical Officer at DEUTZ (Dalian) Engine**

**DEUTZWORLD:** *Why is this the right time for the TCD engines at DEUTZ (Dalian) Engine?*

**Dr André Philipp:** The emission limit equivalent to Euro 4 was introduced in China at the beginning of 2015 for the automotive sector. Euro 5 will follow in January 2017. There will be a slight delay for off-highway engines; here the Tier 3 level has already been implemented. This means that the clean engine standards here in China are rising at very short intervals. DDE is able to meet these standards with the DEUTZ TCD engines and thus position itself with our customers in the Chinese market.

**DEUTZWORLD:** *Which customers are you addressing with the products?*

**Dr André Philipp:** At the production sites in ChangChun and Qingdao, the TCD2013 4V is being used successfully in J6L, J6M, HanV and LongV lorries by our joint venture partner and customer, FAW. The target customers of the 2V engines include well-known names and the target applications are predominantly excavators and road construction machines.

**DEUTZWORLD:** *To what extent does manufacturing complexity increase with the new engines in Dalian?*

**Dr André Philipp:** The main technical innovation is the common rail injection system, which entails greater demands on the cleanliness of components. What's more, our production and quality personnel as well as the supply chain department have to undergo further training to be able to work with the TCD components. Due to the large number of new components in all three TCD engines, the supply chain department faces increased complexity with regard to the provision of components because the DDE BFM engines will continue to be produced at the same volume for the time being.

**DEUTZWORLD:** *How do you ensure that the engines are of the same quality as the German "originals"?*

**Dr André Philipp:** First of all, DDE uses many internationally recognised methods and tools, such as Six Sigma, VDA6.3 and ISO TS 16949. Secondly, DEUTZ and DDE have agreed on an extensive training and support programme (called "Technical Assistance") during the licensing of the TCD engines. This year, several groups of DDE



employees visited DEUTZ in Cologne to attend training sessions, which focused in detail on the challenges posed by the TCD engines. At the same time, DEUTZ experts from Cologne and Zafra DDE visited Dalian to provide assistance with specific problems and issues related to the TCD engines. The programme was a great success: the DEUTZ experts provided outstanding assistance, and the working atmosphere was excellent. Especially concerning the subject "Lessons learned" DDE has profited by the experience of the DEUTZ colleagues. The training and technical assistance programme as a whole also helps the DDE employees to perceive DEUTZ as a very technically experienced joint-venture partner.

**DEUTZWORLD:** *What quality standards do your customers expect of the DEUTZ engines?*

**Dr André Philipp:** DDE customers now need to be able to hold their own in international competition. DDE specifically addresses these challenges and cooperates with our customers in order to meet the necessary quality standards.

**DEUTZWORLD:** *How do you create quality awareness among DDE employees?*

**Dr André Philipp:** Of course, the ongoing Technical Assistance programme helps create quality awareness at DDE; however, a new mindset can only be sustained through the daily efforts of the DEUTZ expats here on site. We also hold regular meetings that specifically focus on quality issues.

**DEUTZWORLD:** *How do you select your suppliers?*

**Dr André Philipp:** The degree of localisation of all three DDE TCD engines already exceeds 90 percent. The TCD 2013 4V is, of course, far ahead with 97 percent localised parts. For the selection of suppliers in China, DDE relies on tools that are conventionally used around the world, such as the VDA auditing process. Depending on the complexity of the component in question, DDE decides whether to go for a fully local supplier, or for an experienced international supplier who produces locally. Of course, DDE needs to provide significantly higher levels of support to local suppliers who cannot draw from international expertise.

**DEUTZWORLD:** *What other engines will be produced in the future at DDE in Dalian?*

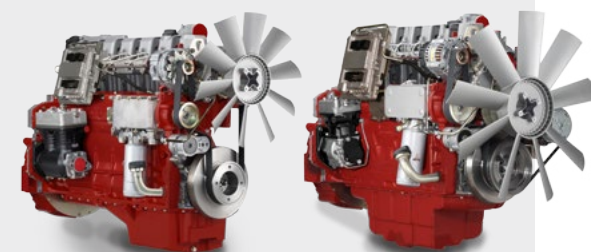
**Dr André Philipp:** DDE has developed its own BFM8 engine in coordination with DEUTZ. It is based on a TCD2013 4V cylinder head and a BFM1013 cylinder block. The BFM8 is essentially the DDE version of the DEUTZ TCD 7.8 engine. Considering the price sensitivity of our target customers, we believe that DDE will be more successful in the local market with a DDE BFM8 at this stage.

**DEUTZWORLD:** *In a nutshell: what is the formula for successful localisation?*

**Dr André Philipp:** Good planning and choosing the right local supplier, ongoing support for the supplier in the event of problems and tracking progress, and effective teamwork.



At the end of 2014 the production of the DEUTZ TCD 2013 4V as an automotive variant was launched in Dalian.



Furthermore, in 2016 the TCD 2012 2V and TCD 2013 2V will find their way into the DDE halls as industrial engine versions.



# Clean machine: the natural gas tractor



Note: The natural gas project was supported by the "DBU" (Federal Foundation for the Environment).

Easing the burden on the global climate by avoiding greenhouse emissions is one of the central tasks of the industry. In this regard, natural gas is considered a particularly climate-friendly fuel. Therefore, within the context of a research project, DEUTZ has successfully integrated its first natural gas engine in a tractor.



For the first time ever, DEUTZ has equipped a tractor with a natural gas engine.

With tractors, one immediately thinks of the powerfully humming diesel engine. Natural gas engines, on the other hand, are more commonly known for their deployment in cars, whereas the cars generally run with an Otto engine. Natural gas as a fuel offers a number of benefits: When compared with petrol or diesel, the combustion is much cleaner. Less CO<sub>2</sub> is created, and the emission of nitric oxides and particles is significantly lower. Whilst the latter two can be curbed quite well with modern exhaust after-treatment systems, the emission of CO<sub>2</sub> depends, first and foremost, on the quantity and type of fuel that is used. By using natural gas, a CO<sub>2</sub> emission saving of up to 24 per cent can be attained.

Against this background and in cooperation with DEUTZ as the industry partner, the University of Rostock commenced the research project in 2012 to develop a natural gas engine. Here, the DEUTZ engineers, in cooperation with the Faculty for Piston Engines and Combustion Engines, took a serially produced diesel engine, developed a natural gas-operated engine that works in line with the Otto principle, and subsequently built it into a tractor. The result: "The same performance as a diesel engine but less pollutant emissions, less CO<sub>2</sub> emissions, more tractor," is how Sascha Prehn, graduate engineer for mechanical engineering from the University of Rostock puts it. A significant sponsor of this project is the Federal Foundation for the Environment (Deutsche Bundesstiftung Umwelt, DBU). The test tractor was provided by another project partner, the well-known agricultural machine manufacturer Same Deutz-Fahr.

## From a diesel to a natural gas engine

A DEUTZ TCD 3.6 was used as the basis for the engine. The particularly compact inline four-cylinder has an output of 50 to 90 kW and a torque of max. 480 Nm. A number of essential conversion measures were needed to convert the engine for natural gas operation. Because it is known that diesel engines function in accordance with the principle of self-ignition, to start with, a spark ignition had to be integrated. For this, the diesel injectors that inject the fuel into the combustion chamber were replaced by spark

plugs. By means of this, the key step in direction Otto engine was completed. In addition to this, the engineers replaced the common rail injection system that allows the internal carburetion in the TCD 3.6, with a natural gas fuel system with an external carburetion. Mechanical alterations were needed to adjust the piston and the cylinder head to operation with natural gas. The decisive element, however, was the analysis and controlling of the combustion process in the gas engine. The tuning required numerous experiments and the understanding of complicated processes.

An important point with the development of the engine was found with the methane emission. Unlike with diesel, methane is the main component of natural gas and has the 23-fold greenhouse gas effect of CO<sub>2</sub>. If larger amounts of this now entered the atmosphere during the operation with natural gas, this would not offer any benefit from an environmental point of view, and there would be no savings potential in comparison with diesel engines. However, the researchers could demonstrate that there is no risk with a methane emission of lower than 0.5 g/kWh. Consider this for comparison: A methane emission of 1.0 g/kWh corresponds with a greenhouse gas potential of 23 g/kWh CO<sub>2</sub>.

Another benefit with the combustion of natural gas arises with the exhaust gas treatment. In contrast to a diesel engine, the currently valid exhaust emission EU stage IV / US Tier 4 final can be complied with without a complex and cost-intensive exhaust after-treatment system, which consists of an oxidation catalyst, particulate filter and SCR catalyst. Instead, a methane-optimised three-way catalytic converter can be used, which offers a clear cost benefit. Also as regards performance, the natural gas engine is in no way inferior to its diesel counterpart.

## From the testing bench into the tractor

Following the successful conversion and exhaustive engine testing, both safe operation with natural gas as well as a clear potential for saving pollutant emissions could be ensured. In total, a CO<sub>2</sub> saving of 12 per cent was attained, and the emission of nitrous gases was reduced by more than 90



The natural gas is stored in a total of 8 pressure storage tanks.

per cent. The mounting in the test tractor now followed in a second step. This was done under the management of the DEUTZ engineer Klaus-Peter Bark in the workshop of the Thünen Institute for Ecological Agriculture in Trenthorst. On the face of it, the first aspect that draws attention are the numerous additional tanks on the tractor. This is because, unlike liquid diesel fuel, natural gas, also referred to as CNG (Compressed Natural Gas), can only be stored in special pressure storage tanks. All in all, the tractor can accommodate 8 CNG tanks. Together, the tanks have a volume of 316 litres and thus hold about 60 kg of CNG. This quantity corresponds with about 77 litres of diesel fuel.

The first test drives with the natural gas tractor followed in September 2015. Wolfgang Beberdick, Head of Thermodynamik Compact, Air and V Engines at DEUTZ, explains: "The test drives were a complete success. Safe operation was immediately possible. The cooperation with the University of Rostock was extremely content-rich for both sides, and important insights were gained regarding the development of gas engines. Additional test drives will follow at the end of November, where the application situations such as, e.g. mulching will also be tested."

The theoretical and practical results attained during the research project demonstrate that natural gas is generally suited as fuel for engines in agricultural use, and that corresponding engines can be derived from the existing serial diesel engines. With the utilisation of tried-and-tested diesel engines, as well as the adaptation of market available and tested systems for fuel, charging and exhaust gas treatment, the costs can also be kept at a low level. Thus nothing stands in the way of a future serial solution.



In an interview with DEUTZWORLD, DEUTZ CEO, Dr Helmut Leube, explains how DEUTZ will implement the zero-defect strategy.

► Only once our engines have run through the most stringent quality tests and we are 100 per cent satisfied with our product, may it reach the customer.

Dr Helmut Leube

# The employee is the success factor

**D**r Leube, the Zero Error Strategy at DEUTZ is at the forefront. What exactly does this mean?

**Dr Helmut Leube:** The zero-defect strategy is an approach known from quality management. Its purpose is to recognise errors before they occur and embed this preventative approach in daily operational procedures by means of a zero-defect culture. Here, first and foremost, the idea is to learn from errors made, recognise and use these as learning potential and ensure that the same mistake is not repeated and tolerated. Because a mistake that is made once is an error; yet if the same mistake is made again, this is careless, and this

is something we cannot allow and also do not want to do. This is because we cannot and also do not want to afford making errors, as they disappoint our customers and could have a negative effect on our reputation in the long run.

*In your opinion, what are the most important aspects of the zero-defect strategy?*

**Dr Helmut Leube:** I believe the most important aspect is to establish a zero-defect culture. All employees, regardless of their hierarchy level, operational areas and tasks must incorporate this mode of thinking in their daily work. Because, only with this attitude can we assure zero-defect process-

es and, as a result, also zero-defect quality with our products and services.

*In your view, how challenging is it to implement this?*

**Dr Helmut Leube:** We offer customised solutions that are individually tailored to the respective needs and requirements of the equipment manufacturers and their customers. The result of this is a great diversity of variants with, in part, small lot sizes. Process safety and efficiency is attained, on the one hand, by means of repetition – i.e. large lots – and the standardisation of products and processes. It is our challenge to offer first-class products and services within these

given framework conditions at all times. Here, the success factor is the employee, and his or her ability to optimally combine standard processes and, most importantly, execute these with a zero-defect aspiration.

*How important is the zero-defect strategy with regard to customer relationships?*

**Dr Helmut Leube:** It is the decisive criterion, because it guarantees that we keep our promise: delighting our customers. An engine of first-class quality confirms our quality aspiration at DEUTZ and our objective has to be that of not only satisfying our customers' expectations but, where possible, even to exceed these. Our custom-

ers and their requirements are at the heart of everything we do, since – at the end of the day – it is their satisfaction we measure ourselves against.

*In your opinion, what characterises the "(zero-defect) quality made by DEUTZ"?*

**Dr Helmut Leube:** The name DEUTZ has to stand for exemplary quality. We would like our products to inspire, and we would like to offer our customers the best cost-benefit ratio and, as such, complete satisfaction. We can only succeed at this if we know our customers' expectations, align our own understanding of quality to comply with this and measure ourselves against these expectations. This includes the ability to take criticism but also the willingness to understand this and make the necessary adjustments. Only once our engines have run through the most stringent quality tests and we are 100 per cent satisfied with our product, may it leave our plant and reach the customer. When we satisfy these standards, our engines deserve the seal "(zero-defect) quality made by DEUTZ".

*In the short- and medium-term, how important is the zero-defect strategy at DEUTZ for you?*

**Dr Helmut Leube:** It is very important. Quality means delivering the agreed upon products or services at the agreed time, at the agreed location, at the agreed costs and in the agreed quality. This means first-class quality is a factor that the customer expects as a matter of course and which, most importantly, the customer can also expect to receive. The customer purchases a product from DEUTZ because he hopes to receive top-class quality, and we must satisfy these expectations. We have a very good stand-

ard, because DEUTZ has been renowned for premium products and innovative, customised solutions for years. In the future we not only aim to secure what we have achieved, but to further strengthen and improve it.

*Measures for attaining zero-defect quality. To which extent is this strategy compatible with the current yield situation of DEUTZ?*

**Dr Helmut Leube:** Our main focus is not on costs, but rather on the satisfaction of our customers. We want to be sure we meet the high level of quality we strive to for the benefit of our customers, and we can only do that if we set ourselves the highest standards, which is the zero-defect strategy. This is entirely in line with our current business situation, because ultimately quality does not just drive up costs, it also effectively contributes to customer satisfaction. And customer satisfaction pays off.

*How long will it take for successes arising from this kind of project to become visible or, by when will the project success be embedded within the company?*

**Dr Helmut Leube:** When it comes to implementing the zero-defect strategy, the main thing for us is to cement our zero-defect quality goal in the minds of our employees. We want to establish a zero-defect culture as a natural part of working life and which, for the benefit of customer satisfaction in particular, is not seen as a temporary measure but as an integral part of our corporate culture. This, no doubt, will be a permanent process; but ultimately our concern is what customers want, and customers want defect-free products. And when it comes to the quality of our products we do not compromise.

## Personal commitment to quality

### 1. I create added value for my customers

All activities must be aligned to satisfy customers, be it indirectly or directly; internal or external customers. The objective is the constant improvement of my actions.

### 2. I know the expectations of my customers

By means of regular and active enquiring / feedback, I am aware of the customers' expectations and adjust my actions accordingly.

### 3. I work without making errors

I recognise potential errors early on and correct these. Having discovered errors, I communicate these in a neutral manner and correct these as soon as possible in the customers' interest, so that I can prevent these errors from being repeated.

### 4. I assume responsibility

I assume responsibility that the customers' expectations regarding my work will be satisfied and that both products and processes will function without any errors.

### 5. I communicate clearly and understandably

With the communication toward internal and external customers, I comply with standards and prepare information in such a manner that it satisfies its intended purpose.

### 6. I comply with agreements that have been made

I comply with processes that have been agreed to and always optimise these so that my customer's expectations are satisfied.

### 7. I adhere to deadlines

I plan realistic deadlines by taking account of existing resources. I communicate unexpected delays in a timely manner.





*The 4 series is an absolute novelty, which supplements the lower and mid-range output range of the Landini tractor programme.*

**Ploughing, harrowing, tilling or implementation in the fields of fruit production and fodder crops – here you need power and manoeuvrability. Therefore, in the brand new 4 series, the tractor manufacturer Landini relies on the compact DEUTZ powerhouses TCD 2.9 and 3.6.**

## Small tractor, great performance

Like DEUTZ, the Italian tractor manufacturer Landini is among the traditional brands in the sector. The company, which was founded by Giovanni Landini in 1884, belongs to the ARGO Group today and offers tractors in a variety of different performance categories. In this regard, the 4 series is an absolute novelty, which supplements the lower and mid-range output range of the Landini tractor programme. The tractors, which are both light and powerful, are designed for highest productivity and versatility and are ideally suited for deployment in the field of soil cultivation, where power and stability is required. The same applies for the area of fruit production and fodder crops, where mobility and manoeuvrability, in part also on slopes, are needed.

The product range consists of six models, all of which run with the new DEUTZ four-cylinder turbo engines with intercooling and common-rail fuel injection. The models 4-090, 4-100 and 4-105 have the TCD 3.6 engine with 90, 99 and 107 HP, which comply with the Tier 4 Interim exhaust emission standard. The models 4-060, 4-070 and 4-080 are equipped with TCD 2.9 in accordance with Tier 4 Final and have 64, 69 and 76 HP.

The DEUTZ common-rail fuel injection system ensures high performance with low fuel consumption and simultaneously offers a high torque rise, which enables greater application flexibility. With the innovative exhaust gas recirculation (EGR) and the diesel oxidation catalyst (DOC), the exhaust emission stage Tier 4 Interim is also satisfied without diesel particulate filter (DPF).

For simple engine block access during maintenance and control work, the one-piece engine cover can be opened widely, and the cooler pack can be opened easily for cleaning. What is more, the compact, modern design of the 4 series also mirrors the brand's typical family look; the flat roof of the cabin minimises the overall height. Both versions can optionally be equipped with slim fenders and tyres, thereby reducing the minimal width of the tractor to 1,750 mm, and as such simplifying work in the very narrow orchard and vineyard rows.

### Plenty of power from little displacement

Dirk Jungen, Sales Manager – Business Team AGRI at DEUTZ, explains: "In the Landini 4 series, our engines can fully demonstrate their strong suits. The tractors are particularly manoeuvrable so that

they can also work comfortably in confined spaces. However, for soil cultivation, high performance is needed at low engine speeds and a simultaneous decrease in fuel consumption. These very features are offered by TCD 2.9 and 3.6. The compact size allows a short wheelbase; simultaneously, the modern engines heave just as much power on the drive shafts as is else only managed by significantly higher displacement aggregates. What is more, this so-called downsizing improves fuel efficiency and, in so doing, reduces operating costs."

Furthermore, DEUTZ TCD 2.9 and 3.6 engines have a modular exhaust after-treatment system that can optionally be mounted onto the engine. This significantly simplifies the device integration. The super-compact engine design as well as a customer-oriented modular system of optional parts for attachment additionally reduce installation costs, while also increasing the number of applications. 500 h oil change intervals and maintenance-free valve operation result in low maintenance costs and high equipment availability. As is the case with all DEUTZ engines, best cold starting ability is demonstrated, also under extreme conditions.

### High-tech engine meets high-tech transmission

A strong engine alone is not enough to drive a tractor; the power is to be brought to the field in an accurately dosed manner. For this reason, the Landini 4 series utilises a completely newly-developed manual



*Thanks to the compact DEUTZ engines, the tractors offer optimal mobility and manoeuvrability with fruit production or fodder crops, also on slopes.*

transmission, planetary end drive at the rear axle and an all-wheel drive front axle with an optional integral braking system. Thereby, two different wheelbase sizes are available: 2,230 mm for the three larger models and 2,100 mm for the three smaller ones.

In the basic version, the versatile, modular transmission has a total of 12 forward and 12 reverse gears. For the rear wheel version, the transmission is offered as a 30 km/h model. At crawling speed, the number of gears increases to 16 forward and reverse gears. Optionally, with the all-wheel driver version, a Hi-Lo power shift transmission can be selected, which either allows a transmission or gear reduction of the selected gear by up to 18 per cent, and as such has 24 forward and 24 reverse gears at its disposal. What is more, an Eco mode is available for this parcel which, with a top speed of 40 km/h, at a reduced engine revolution of 1900 rpm, ensures high fuel efficiency and a low noise level during transportation. Furthermore, the transmission has a so-called de-clutch feature that, in combination with the electrohydraulic shuttle operation, allows convenient gear changes and the change of direction, yet without this requiring the use of the clutch pedal.

With the large range of features – ranging from the economically-priced entry-level model, right up to a fully-equipped model

– the tractors satisfy the broadest range of customer and operational requirements. Every user can select the ideal configuration for the required work. A mechanically or electronically regulated rear lift ensures the load suspension with a lifting capacity of up to 3,900 kg with the larger, and up to 3,400 kg with the smaller 4 series models. If desired and for even more versatility, the tractor can be equipped with a front linkage, with a lifting force of 1,750 kg. If this is used in the front of the engine hood, a transparent roof hatch ensures optimal visibility to the top.

Here, the power is transmitted from the engine to the lifter via a hydraulic system with two independent pumps for the steering and hydraulic functions. The models

with a 2.9 litre engine offer an output of 28 + 49 l/min. With the larger models, the standard output is 32 + 44 l/min. Then, for instance, a joystick steers the operation of the front linkage or the front loader. Thanks to this and other systems, the power of the DEUTZ engines is deployed exactly where it is needed.

"Landini focusses on innovative technology in all fields," says Dirk Jungen. "We at DEUTZ stand for compact, high-performance and likewise cost-efficient systems that are precisely tailored to the customers' needs. All of these elements are united in the modern 4 series tractor, which perfectly satisfies its field of application."



► **DEUTZ TCD 2.9 and 3.6 engines have a modular exhaust after-treatment system that can optionally be mounted onto the engine. This significantly simplifies the device integration.**





Consistently innovative  
– with agility

# Scrum

In complex projects, DEUTZ relies on the agile, customer-oriented Scrum process. Here, for instance, product requirements can still be changed during the product development process, and critical user feedback can also still be incorporated in the early stages of development.

It's Thursday morning, 11:15 a.m. The interdisciplinary team of electronics development meets for its "Daily Scrum", a 15-minute, daily work meeting that is used for exchanging information. Gathering around the so-called task board, which lists the tasks and goals for the next two weeks, the team reviews which requirements it implemented the previous day, which goals are to be tackled today and whether there are any current delays that have to be eliminated quickly. Concentration is called for – every day. Because, at the end of the 14-day cycle, the development team presents its results to the customers or the adjacent specialist department, where it has to provide feedback to their questions. To have an up-to-date overview regarding the proc-

ess status, DEUTZ relies on the customer-oriented, agile Scrum process.

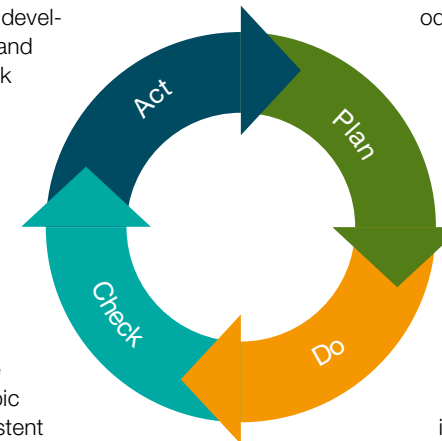
Agility comprises the abilities to constantly adjust to new requirements and consistently concentrate on customer benefits. In comparison to the classic waterfall model, where the development process



is embedded in stringently successive stages and where interdisciplinary departments work less closely together, agile methods are more flexible, especially in complex projects. Here, previously determined requirements pertaining to the product can be constantly changed during the development process and critical user feedback can also be incorporated in early stages of development. Especially in complex systems, this has an enormous benefit.

To ensure that the value creation topic remains in consistent focus, agile organisations bank on the smallest unit: the creative team. Consequently, a team-based approach leads to a new approach at the organisational level, because the team is put together in a cross-functional manner and every involved person has a high degree of self-responsibility for the overall success. Here, the focus is on close and direct communication and cooperation, as the name "Scrum" also implies: it comes

from rugby and describes a formation where the team is closely interlinked in a so-called scrum, with the goal of moving forward in unison and gaining control over the rugby ball.

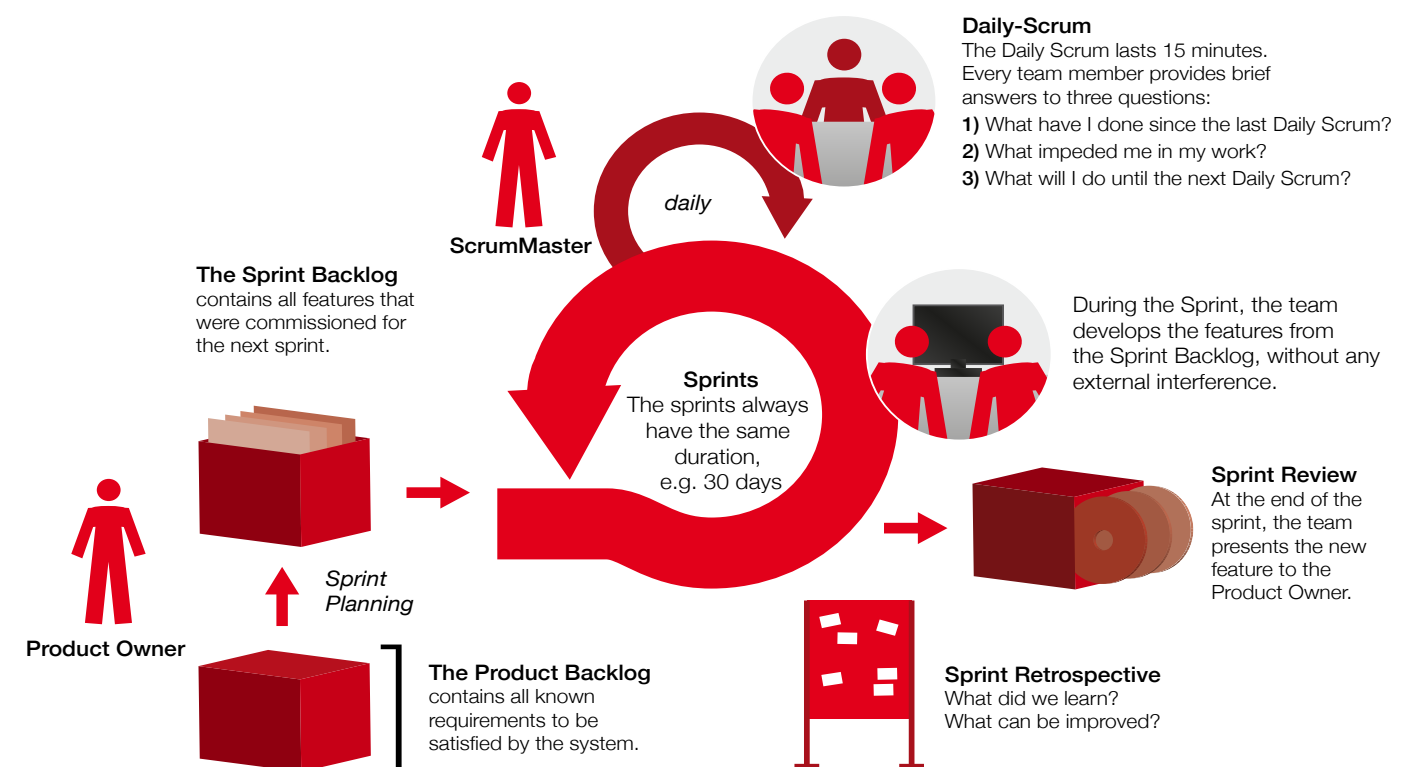


In the past years, agile methods such as Scrum have rapidly gained in importance in software and are increasingly expanding to engineering. The goal of Scrum is, on the one hand, faster and better-developed products and, on the other, the pleasure of working in a team. Thereby, the process is very lean, with a few, effective meetings, documents and defined roles.

For almost two years now, DEUTZ AG has been using the Scrum approach in electronics development. "We applied the new method in a pilot project and tested whether Scrum would be suitable for us. Already after half a year, we succeeded at significantly improving cooperation and effectiveness," reports Michael Halfen, di-

vision head in electronics development and responsible for the introduction and implementation of Scrum at DEUTZ. What is more, the quality of the delivered products and features could be increased once more, says Halfen. Consistently innovative – with agility. This is Scrum.

The process consists of numerous feedback loops with the phases planning, implementation, inspection and adjustment. A so-called ScrumMaster is responsible for optimal process implementation. From a list (Product Backlog), in which all requirements have been prioritised, the team selects for every delivery the functions with the highest "value creation" (Sprint Backlog). These are developed into a "potentially deliverable package" in 2-4 weekly sprints. At the end of a sprint, this is directly followed by the technical presentation at the user (Sprint Review). This is immediately followed by the next sprint. Thereby, the software can be implemented in real applications by users earlier on and is always flexible for feedback.





Statistical Evaluation of  
End-of-Line-Tests  
in Serial Production



on the test) are simply fed into. Together, a concept was developed for the evaluation of the End-of-Line tests. A proof of concept was used to examine the extent to which this tool is also able to improve efficiency in the evaluation of production measurement data, which in turn would also make the inspections faster and more effective. The results of this first concept study were promising. It's becoming apparent that the data can be evaluated significantly faster.

The implementation then ensued under the aegis of Thomas Plum, and the Process Technology division and external support. The Information Services sector was responsible for the automatic preparing of the measurement data from SAP and the transfer to a defined directory of the Research and Development sector. This was also supported by the Production division, which also reported its requirements regarding the evaluation.

Now the daily measurement data is transferred from SAP to a drive in the evening. These measurements are indexed in a special database. By means of this, data can rapidly be filtered according to search parameters. The filtered results are then

available to all engineers working with DET. In the meantime, more than 450,000 End-of-Line tests have been recorded. The data is retrieved within minutes, sometimes even within a few seconds. Thanks to the successful cooperation between Research and Development, IT and Production, a timely analysis of the data is now possible. Here, first results can already be pointed out and discussed in revision meetings. Another step to ensure the DEUTZ quality.

In serial production at DEUTZ AG each completed engine has to undergo an acceptance test, the so-called hot test or End-of-Line test. Here measurement data is accumulated that is stored in SAP and, e.g. is used for engine-specific customer documentation. In addition to this, the data is evaluated by quality engineers with the purpose of identifying abnormalities that can indicate problems with the engines, production process or specific component lots.

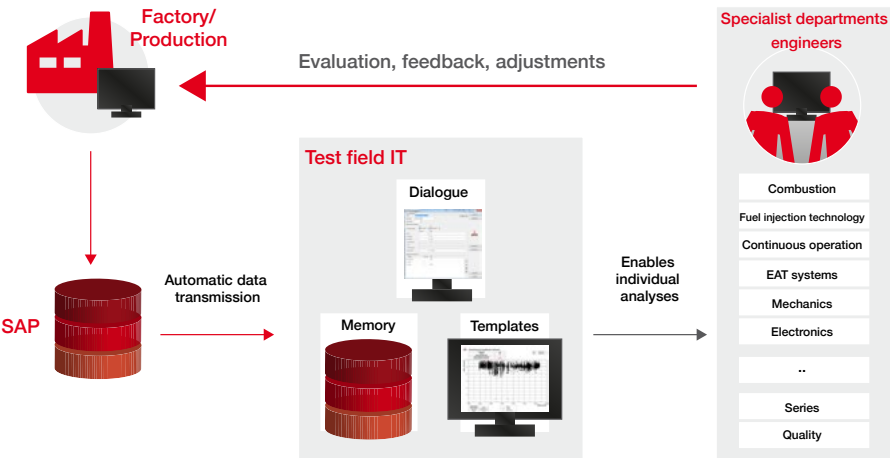
For the analyses, the measurement data had to be downloaded from SAP until recently. This sometimes meant having to wait for several hours, and the complete results were often not available for analysis until sometime the next day. The data were then graphically represented in Excel. In this prepared form, the data was then available for the participants. Especially with pressing questions or problems, the sluggishness of this process and the type of analysis proved extremely unsatisfactory.

The Research and Development division of DEUTZ came up with a suggestion on how to improve the process of evaluating the production acceptance data: The engineer Thomas Plum (basic engine/test module), responsible, among others, for inspections regarding the acceptance of serial-production engines, was dependent on the evaluations and, as such, impacted by the time-

consuming process. In collaboration with Dr Michael Röbel (Process Technology division), he recognised the potential of the DEUTZ Evaluation Tool, DET for short. This tool has been successfully deployed in Research and Development for years for the graphic evaluation of test data from the development test field. The advantage of this tool is that it can be used to create a standard graphic display using ready-made layouts, which the measurement data (depending

► „In the past, merely the provision of data already needed numerous hours. Now the retrieval time required for data and evaluations is frequently only a matter of seconds, sometimes a few minutes.“

Thomas Plum, DEUTZ R&D



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Customer	Location at fairground
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Atlas Weyhausen GmbH	06 / D47
Bobcat Emea	06 / B37a
Dewulf	25 / H23a
Faresin Industrie Spa	02 / A02
Giant - TOBROCO Machinery	06 / A 38
HARDI GmbH	09 / E10
Idrofoglia Srl	21 / F16
MANITOU BF S.A.	06 / D13
MATROT EQUIPEMENTS S.A.S.	09 / A24
Merlo SpA Industries + Merlo Deutschland	06 / D38; FA13
PLA S.A.	13 / D57j
PRONAR Sp. z o.o.	15 / B56; 04 / E12
SAME DEUTZ -FAHR Group	04 / C36
Schäffer Maschinenfabrik	06 / B15
Storti International SpA	25 / B13
Tecnomat (PRECICULTURE)	09 / E14
Tong Yang Moolsan Co. Ltd.	05 / E03
URSUS	17 / A08; 05 / D22
Vredo Dodewaard BV	21 / A03
Wacker Neuson / Kramer Werke GmbH	06 / C37a
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