

ONE ENGINE, MANY ADVANTAGES

It is hard to think of an invention that has had a greater impact on the contemporary world than the internal combustion engine. DEUTZ AG was a co-founder of this technology and been has been a driving force for innovation in its continuing success over the past 150 and more years.

When N.A. Otto & Cie., one of our present company's predecessors, began series production of internal combustion engines almost 150 years ago, DEUTZ was signalling the start of global motorisation. The revolutionary four-stroke engine invented in 1876 by the pioneer and company founder, Nicolaus August Otto, still forms the basis of every combustion engine produced today. We have continued to demonstrate our engine construction skills ever since then. DEUTZ is renowned for the long service life and great reliability of its engines and for its tremendous expertise when advising on the installation of its engines in numerous different applications. Customers throughout the world particularly value the very compact design, the purpose-built exhaust aftertreatment system and the extremely low fuel consumption of our current engine portfolio. DEUTZ demonstrates its great technological expertise through its more than 800 sales and service partners in 130 countries throughout the world.

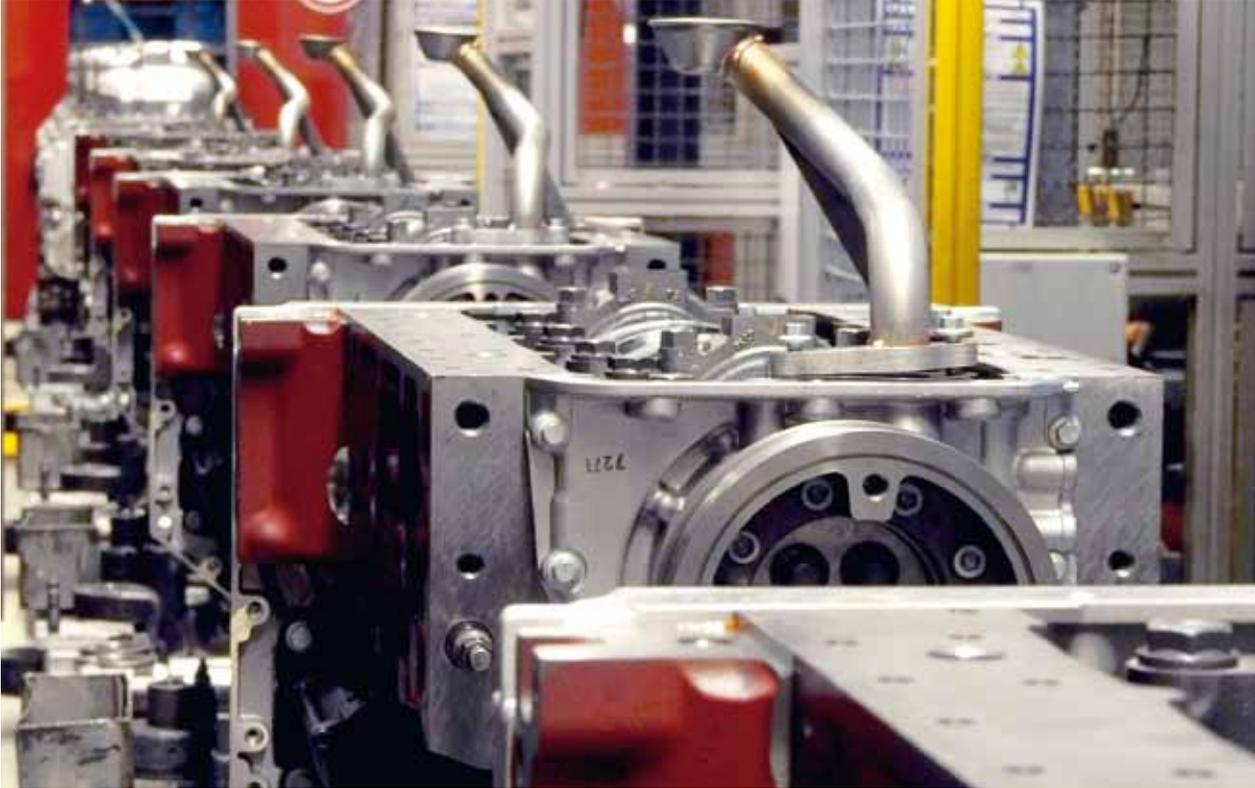
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High-tech saves costs

The entire breadth of the latest engine technology is displayed by the TCD 3.6, one of DEUTZ's most recent developments. Like all DEUTZ TCD engines, it meets the current EU Stage IV and the US EPA Tier 4¹⁾ emissions standards; re-designed, this water-cooled 4-cylinder in-line engine offers top-level performance combined with low fuel consumption, considerably below the market average. It also requires little servicing, thus ensuring high equipment availability. The improved technology is particularly effective in reducing overall running costs in the target application. Exhaust aftertreatment is customer-specific, based on a modular system; maintenance-free operation is possible by using an open system. To meet more stringent local emission requirements, a sealed diesel particulate filter (DPF) is available as an optional extra. DEUTZ always provides its customers with the technology that meets their specific requirements most effectively.



¹⁾ The annual report mentions the Tier 4 Interim and Tier 4 Final emissions standards in various places. This refers to the US-regulations EPA Tier 4 Interim or EPA Tier 4 for diesel engines and the EU 97/68 III B or IV emission standards. The latter are not always mentioned for reasons of simplification.



“We opted for DEUTZ engines because they meet the high quality standards of our tractors. By taking this step, we aim to strengthen our position in international markets and improve customer satisfaction levels.”

Martin Blaskovic, proprietor of Zetor, Czech Republic





One step ahead

As part of its advanced exhaust aftertreatment development, DEUTZ has taken the bold step of introducing DPF technology early on into series production. By making this leap, we are already in a position to meet the EU Stage V emissions standard, expected to apply from 2019. On the basis of the EU Commission's Stage V proposals,¹⁾ the TCD engines in the 2.9 to 7.8 litre cubic capacity range already meet the limits envisaged for 2019. Certification will be awarded as soon as possible. This offers DEUTZ customers decisive advantages in that the dimensions and design of the Stage V ready engines will remain the same when the changeover to the next emissions standard is made. Our customers will, consequently, enjoy long-term planning certainty; those who already operate DPF-equipped engines or who opt to buy them now will not need to carry out costly modifications to their applications. This gives our customers an assured technology and the option of implementing it at a time when it suits them. So that the market is clearly informed, DEUTZ is already applying a 'Stage V ready' seal to its engines. DEUTZ's forward-looking strategy lays the foundation for continuous growth and, even after 150 years of engine construction, the Company continues to assert its leading role in the market.

¹⁾ The EU Commission's Stage V proposals as published on 25 September 2014.

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- ▶ The DEUTZ TCD diesel-particulate-filter-equipped engines in the 2.9 to 7.8 litre cubic capacity range already meet the EU Stage V emissions standard, expected to apply from 2019.
- ▶ This means that no expensive modifications to customers' equipment are needed for them to meet the next emissions standard, because engine dimensions and design remain the same.
- ▶ Because the Stage V ready engine systems are already in series production, customers will enjoy an assured technology which can be implemented at a time that suits them, plus long-term planning certainty.



OUR CONTRIBUTION TO ENVIRONMENTAL PROTECTION

At DEUTZ, environmental protection is not an ambitious aspiration but the philosophy by which we live. Using the latest technology, DEUTZ engines reduce pollutant emissions to a significant degree throughout the entire world. At the same time, carefully targeted environmental management ensures efficient processes along the entire value chain.

- ▶ *The particulate mass has been reduced by a factor of **13**¹⁾*
- ▶ *Carbon monoxide emissions has been reduced by a factor of **666**¹⁾*

Combustion engines produce emissions. Soot particles, nitrogen oxides and other toxic gases harm people and pollute the environment. It is the duty of politicians and industrial concerns to constantly advance the development of low-emission technologies; the framework which underpins this obligation is ever more stringent emission limits.

North America, Europe and Japan have introduced the strictest emissions standards and have largely harmonised them in the industrial engine sector – DEUTZ's core business sector. The BRIC countries (Brazil, Russia, India, and China), of equally huge importance when measured by global sales, are aligning themselves to these standards and will catch up in the medium term.

¹⁾ TD 2.9 L4 Tier 4 as against a comparable Tier 3 engine.



To meet the current EU Stage IV and US Tier 4 in the 56 to 560 kW power output range, the nitrogen oxide limit is now set at 0.4 g/kWh and the maximum for particulate emissions at 0.025 g/kWh.

This means that nitrogen oxide limits have been reduced by 95.7 per cent between 1999 and 2014 in North America, Europe and Japan and by 96.5 per cent for particulate mass (essentially soot particles). DEUTZ engines equipped with particulate filters to meet the most recent emissions standard already reduce particulate mass by more than 99 per cent. Consequently, the exhaust from the latest DEUTZ engines which meet the most stringent emissions standard contain no more nitrogen oxides or particulate mass than the ambient air in many of the world's greatest cities. To this extent, our highest emissions standard sets us on the way towards zero emissions.

In the technological lead

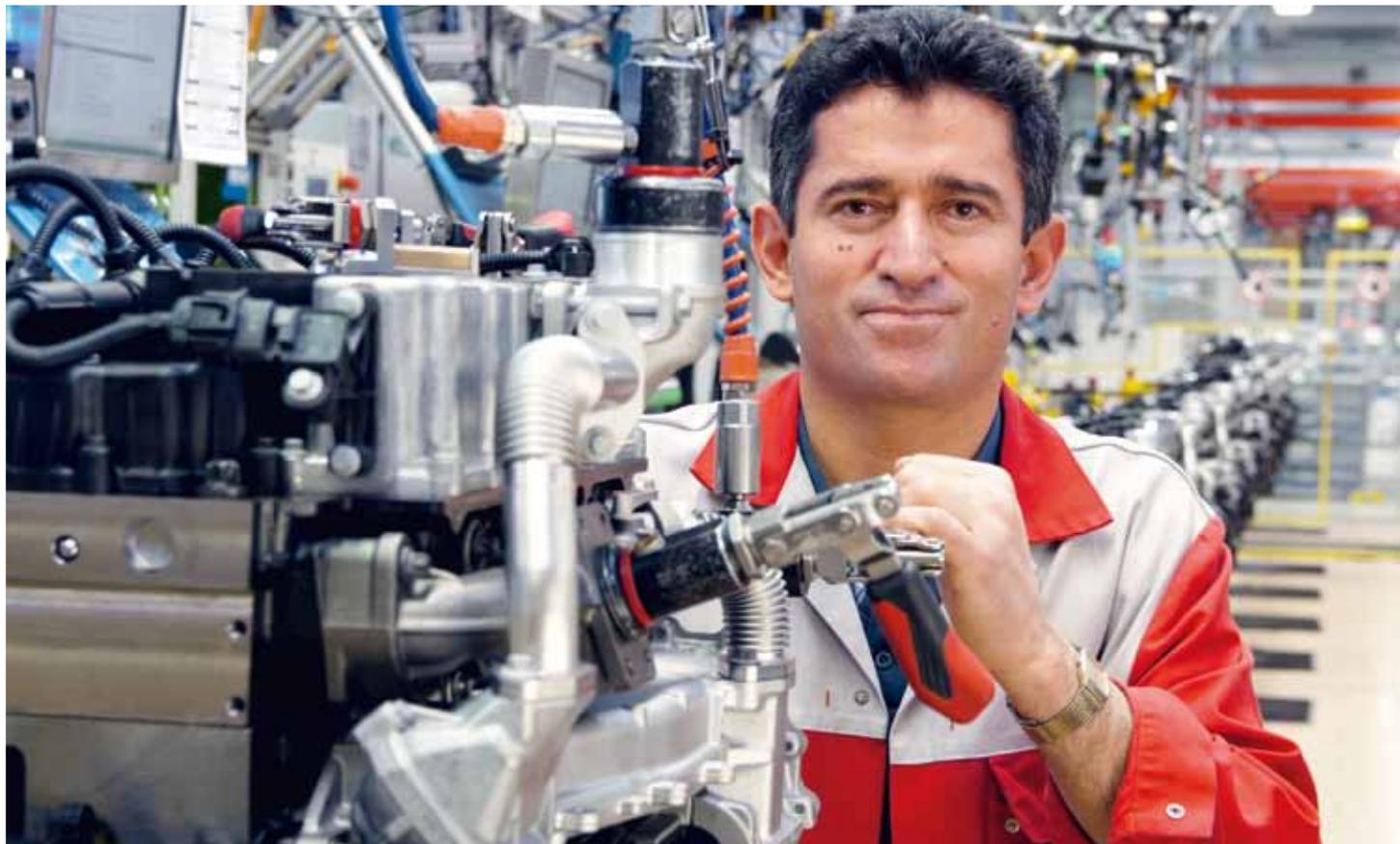
DEUTZ has always assumed a leading technological role. The Company has built up great expertise in the field of emissions reduction and exhaust aftertreatment and has gained a competitive lead through its substantial investment in R&D. Our diesel-particulate-filter-equipped TCD engines in the 2.9 to 7.8 litre cubic capacity range, designed for the EU Stage IV/US EPA Tier 4 emissions standard, already meet the limits of the next EU emissions standard, envisaged for 2019. This tightening of the standard is expected to lower the permitted particulate mass limit still further from 0.025 to 0.015 g/kWh. In addition, it will limit the number of particles as the debate about fine dust continues. This will considerably reduce fine dust pollution, particularly in urban areas.



Chemical fuel analysis is part of DEUTZ's internal quality assurance procedures.

- ▶ *Fuel consumption has been reduced by up to **10 per cent**¹⁾*
- ▶ *Our agricultural customer, Fendt, boasts the **lowest consumption** for its class – with DEUTZ engines*

¹⁾ TCD 3.6 industrial engine Tier 4 compared with competitors' engines in the 4.5 litre range.



We are constantly working hard to reduce both the resources we consume and the emissions produced by our own commercial operations.

DEUTZ places great importance on low fuel consumption by its engines and is an active supporter of the trend towards downsizing. It is in the lower power output range, in particular, that we have completely re-developed our engine models. These engines exhibit the best power density in their class and can compete with engines with a greater cubic capacity produced by our competitors. DEUTZ engines, with high injection pressures and turbocharged, offer high performance from small cubic capacities, reducing fuel consumption at the same time. Our customers and the environment both benefit from this as less CO₂, the main contributor to global warming, is released into the atmosphere.

Environmental protection and resource conservation during production

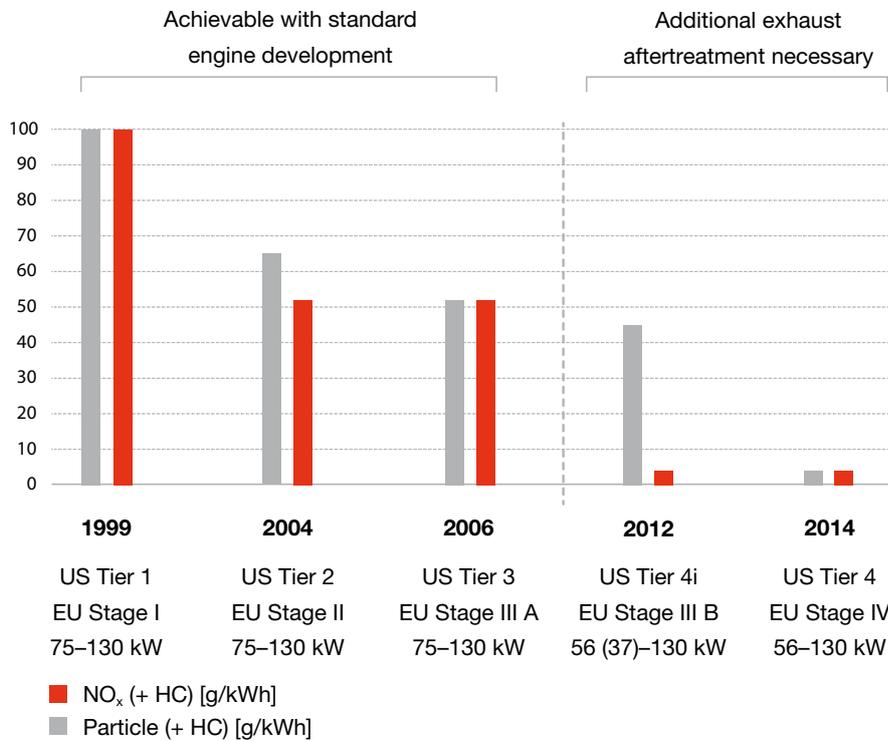
However, DEUTZ does not contribute to environmental protection solely through its advanced products. We are also constantly working hard to reduce both the resources we consume and the emissions produced by our own commercial operations. We are, for example, consistently expanding both our energy and our environmental management systems. The three management systems - quality, environment and energy - have also once again met the requirements for ISO certification. Additional potential has been exploited by implementing an extremely varied range

of technical and organisational measures. For example, the time spent on post-production engine testing has been reduced in order to reduce emissions and save resources. The test stands in the development division are increasingly being fitted with generators in order to feed the energy recovered back into the power grid. Also, as part of our waste management policy, we are continuing to replace disposable packaging with returnable packaging used in a closed-loop system. More details of these arrangements are given in the 'Environment' section on page 43 et seq.

A decision was taken during 2014 on optimising our production sites. In addition to improving economic efficiency, there will also be environmental benefits. For example, the planned construction of a new shaft centre at the Cologne-Porz site using the latest building engineering techniques will allow considerably more efficient operation, consume less energy and produce fewer emissions. At the same time, as part of a scheme to greatly improve land use in an inner city location, we are vacating an area of some 160,000 square metres at the Cologne-Deutz site. The area can in future be used for residential apartments, commercial activity and open green spaces.



Changes over time to emissions standards (%)



From 1999 till 2014 NO_x was reduced by 95.7% and particle emissions by 96.5%

FOR OUR CUSTOMERS ON THE MOVE

Companies throughout the world favour DEUTZ engines for a huge range of applications. As a result, DEUTZ has numerous long-term customer relationships as well as an encouraging level of new customer business.

Sturdy, durable and dependable – these are the distinctive characteristics of our engines. Anyone deciding to buy a DEUTZ engine can be certain that it will cope with whatever the future may hold; longevity is something that we aim to build into every single one of our engines. The development and product planning departments work hand in hand to design engines to meet the individual requirements and needs of each of our customers. The product planners consolidate the market's requirements for the main applications, both today's requirements and those expected in the future, while the developers produce the appropriate technical concepts.

Our engines are tailored to the individual needs of our customers in various application segments, thus fulfilling our commitment to performance and quality over a broad range of applications. We occupy, for example, a strong position in the Mobile Machinery segment; this mainly relates to construction equipment and material handling vehicles but also includes airport ground support equipment and machinery used in mines. DEUTZ also focuses strongly on agricultural machinery, predominantly on tractors. We are, in addition, active in the Stationary Equipment market – generators, compressors and pumps – and in the market for niche applications. The focus of our automotive business, trucks and buses in particular, is increasingly shifting towards Asia.



- ▶ *DEUTZ enjoys numerous long-term customer relationships*
- ▶ *The introduction of the new emissions standards gives us the opportunity to expand and diversify our customer base*



“We value, in particular, the compact engine design, the purpose-built exhaust aftertreatment system and the engines’ extremely low fuel consumption – in conjunction with their long service life and great reliability.”

Amicarle Merlo, Merlo S.p.A., Italy

“The feature of the water-cooled 4-cylinder in-line engine which particularly impressed us was its excellent cold-start ability even in extreme conditions.”

Kang Young Sun, Head of R&D,
Tong Yang Moolsan Co., LTD, South Korea





Installing our engines and equipment in our customers' equipment is becoming increasingly more complex, just like the engines and machines themselves. However, our experience of providing installation advice over many years has given us the necessary know-how. The essential requirement is very close and detailed collaboration with our customers and this forms the basis for long-term customer relationships. We are also delighted that our latest generation of engines has gained us numerous new customers in all parts of the world by convincing them of the benefits of these products.

For this reason, the DEUTZ service division maintains a stock of spare parts for decades after the discontinuation of series production. And if, after many operating hours in certain applications, the engine at last reaches the end of its service life, DEUTZ's 'Xchange' engine concept gives the equipment what amounts to a second life.

DEUTZ – the engine company. We are happy to keep on the move for our customers.

“The very compact design of these engines and the customer-oriented, modular system of optional add-on parts has lowered installation costs.”

Valerio Morra, President of ARGO Tractors, Italy

“We have been working together with DEUTZ for many years now, and it’s a relationship that we greatly value. The combination of engine technology and local support that DEUTZ gives us in China is like nothing else on the market.”



Ma Yunkun, Chairman and Corporate Representative of
China Railway Large Maintenance Machinery Co., Ltd., People’s Republic of China



“We have maintained a close and stable working relationship with DEUTZ for many years. Our customers benefit in particular from the excellent quality, reliability and efficiency of DEUTZ engines.”

Helmut Lorch, Managing Director of Atlas Weyhausen GmbH, Germany