

# FAIRREPORT

A special edition of DEUTZ LIVE magazine



## TECHNOLOGY

Versatile all-rounder  
Lord of the aviators

## INNOVATION

New options for the future  
Engine goes online

Power in the  
twin pack

EQUIPMENT +++ GROUND SUPPORT EQUIPMENT +++ GRO

The new TCD 2015

## A versatile all-rounder

With the stage 3 emission limits coming into effect, DEUTZ has commenced production of the TCD 2015. The water-cooled 6 and 8 cylinder engines are versatile, compact and powerful

In order to ensure compliance with the stage 3 pollutant limits, the engineers at DEUTZ put the series 1015 on the test stand. Using the series 1015 as a starting point ensured the potential for the continued development of the TCD 2015 in the long term. While the DCR® system is used for stage 3 and EURO 4 engines with powers ranging from 75 to 250 kW, the magnetic valve system (MVS\*) was selected for the TCD 2015 in the upper performance class. In this system, the injection point and volume in the pump-line-nozzle system is regulated by electronically controlled magnetic valves.

### Fewer emissions, plenty of power

The targets set for stage 3 were clear: in the 130 – 560 kW range, nitrogen oxide (NO<sub>x</sub>) and hydrocarbon (HC) emissions must be reduced to a maximum of four g/kWh and in the case of particulate matter, to 0.2 g/kWh. A decisive factor in this respect for the 2015 series was the introduction of an internal exhaust gas recirculation created by modifying the camshaft and the

exhaust gas turbocharger. This has proven successful: by optimising combustion and using 4 valve technology, the TCD 2015's emissions are significantly under the limits. Despite the improved emissions, it was possible to improve the power of the engine by up to twelve percent.

### Excellent efficiency

An intake system was integrated in the space between the V-arranged cylinders, which reduced the assembled height of the V6 and V8 engines by about 100 mm to just 850 mm including the dry sump oil pan. In addition, a version of the engine was designed with a front-mounted turbocharger, making it particularly suited for under-floor installation. Apart from its fabled longevity, the newly developed engine also shows an increased efficiency – a key factor for the engine's use in mobile machinery. The new TCD 2015 can be used not just at airports and in special-purpose vehicles, but also in construction machinery, power generators or locomotives. [jp]

### ENGINE | TCD 2015 – the versatile solution

The 2015 series stands for a high level of performance. These engines are stage 3 emissions compliant and use the latest technology to ensure outstanding reliability. The electronic, magnetic valve controlled MVS\* injection system means guaranteed low fuel consumption. Low noise emissions and very smooth running are also the results of tried and tested DEUTZ technology, as are the compact dimensions of the TCD 2015.



	TCD 2015 V6	TCD 2015 V8
Power (kW)	360	500
Swept volume (l)	11.91	15.87
Max. torque (Nm/min <sup>-1</sup> )	2,080/1,300	2,090/1,400
Max. speed (min <sup>-1</sup> )	1,900/2,100	1,900/2,100
Bore/Stroke (mm)	132/145	132/145

Photo: DEUTZ, Rolls-Royce



An aircraft mover with the new Airbus A380 in tow

Aircraft Movers

## Lord of the aviators

The market for airport ground support equipment has picked up momentum. New exhaust emissions requirements and not least the Airbus A380 are fueling demand for a generation of modern, long-term solutions for so-called aircraft movers

In spite of all difficulties: The Airbus A380 has the stuff to permanently change the face of modern air travel. With a take-off weight of just under 600 tonnes, this ultimate aircraft is heralding in a new age of air transportation. This bird is not only something special in the sky: The A380 is the jewel in the crown of passenger aircraft.

Even on the ground, the new aircraft pays homage to size. An entirely new infrastructure has had to be created for this flying giant with its impressive 80 metre wingspan to be able to operate at all. As a result, international hubs have not only had to build longer runways for takeoff and landing, but also larger maintenance hangars.

The manufacturers of aircraft movers also have a role to play in ensuring that this new class of aircraft becomes a model for success. The manufacturers TLD (FRA), Schopf, Goldhofer, and GHH-Fahrzeuge (all GER) have taken different paths in their search for the best solution for manoeuvring the giant aircraft on the ground. However, they are unanimous with regard to the engine: they are placing their confidence in the powerful and robust

V-engines of the DEUTZ series TCD 2015 with 4 valve technology. At the heart of the 70 tonne top of the range tractor F396 P from the Swabian manufacturer Schopf is a 6 cylinder variant with 330 kW of power. For the TPX-500MTS their competitor TLD relies on a 8 cylinder engine with a power output of 500 kW. Goldhofer's AST-1 X 1200 aircraft movers are powered by two 8 cylinder variants that give the tractor a combined power boost of 880 kW. Finally, GHH-Fahrzeuge has decided on a 8 cylinder engine with 480 kW for its AM 500XL model.

### Roadway adherence for the super-ailiners

A weight of up to 600 tonnes stresses not only the tires and wheels of the aircraft. The aircraft mover must also be able to withstand the demands placed on it. Furthermore, aircraft movers must cover comparatively large distances: 15 kilometres from the runway to the maintenance hangar is not uncommon. This makes for extremely hard work with the colossal Airbus in tow. Despite this, the fastest movers can reach speeds of up to 30 km/h. [jp]

**Airbus A380.** After more than 36 years, the Airbus A380 is set to supersede the Boeing 747 as the largest passenger aircraft in the world. The Airbus consortium is reckoning with an anticipated demand of 1300 aircraft. 165 A380s have been sold to date. The first aircraft is due to be delivered to Singapore Airlines in the autumn of 2007.

Hybrid drive

# Power in the twin pack

Modern hybrid technology having made a breakthrough in the car sector, DEUTZ is the first manufacturer to plan to use it in mobile machinery

By presenting a hybrid drive for mobile machinery, the Cologne engine manufacturer is showing that it takes environmental protection seriously, and that the use of a combined internal combustion and electric engine need not be restricted to cars.

The prototype of the newly developed hybrid drive is designed in a way to be used in as many different applications as possible. To ensure this, the project will be taken through to serial production in close cooperation with equipment manufacturers.

### Applications with a large amount of partial load operation

The development efforts are being driven by the advantages offered by hybrid drives. The combined use of an internal combustion engine and an electric machine – which can be operated both as an engine and a generator – reduces fuel consumption considerably, depending on the application. The additional power of the electric motor enables the diesel engine to be made smaller – so-called downsizing – without entailing any reduction in the equipment’s power. A smaller diesel engine means reduced consumption and, thus, also reduced emissions. Exhaust gas after-treatment is also simplified. Moreover, depending on the powertrain model, temporary emission-free operations are also possible. DEUTZ is aiming to use the hybrid drive to exploit these opportunities in the mobile machinery segment. Applications with high peak performance but a lower mean load are the target for the innovative drive design. On that basis, the developers expect that the hybrid engine will be used for wheel loaders, stackers, aircraft movers and telescopic loaders. One can also envisage them being fitted in equipment such as excavators or scrap sorters. In

view of the high full load ratio, DEUTZ’s experts believe that it would, as yet, be unwise to fit them in compactors, tractors and drilling equipment.

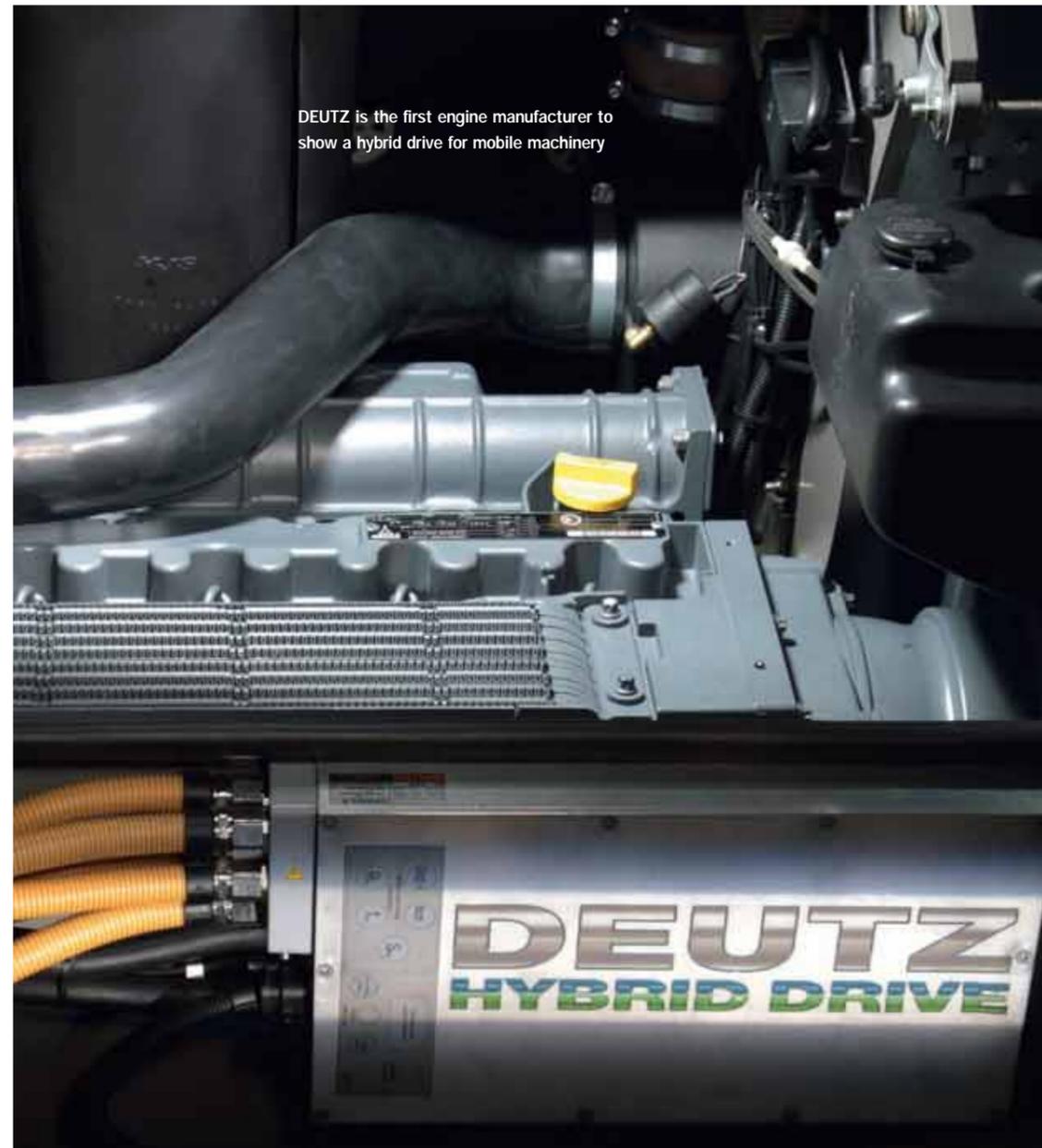
### Lower fuel consumption, lower emission levels

The developers’ specification book is bulging at the seams. To enable it to be marketed at a cost-effective yet competitive price, the diesel engine will only be subjected to minor changes and the machine will remain unchanged, as will the interface to the machine. This will ensure that the new drive solution can continue to be used by as many customers and applications as possible. The following system functions are important to the DEUTZ-customers:

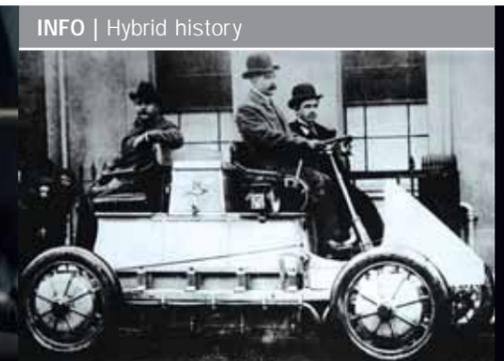
- **Start and stop:** engine stops automatically when idle and automatically starts when power is needed.
- **Power boost:** the electric machine is switched on to cover peak power requirements and improve the engine’s dynamics.
- **Load battery:** during operational phases, when the system only requires part of the diesel engine’s output, the battery is loaded in the diesel engine’s output range which is ideal for fuel consumption.
- **Recuperation:** braking energy is rerouted from the electric machine to the battery.

The intelligent interaction of the two drive designs enables fuel consumption to be reduced by up to 20 percent. Energy is “managed” using a permanently actuated synchronous machine integrated in the flywheel housing. The stator required here, i.e. the fixed part of the electric motor, is integrated in the SAE housing. The flywheel of the internal combustion engine is replaced by a rotor. [jp]

*DEUTZ hybrid drive DEUTZ customers, too, are set to benefit from the increasing use of hybrid technology in the car sector. Hybrid components such as reservoirs and power electronics are more sophisticated and readily available. Engine components such as the generator and the starter are no longer needed. Secondary benefits in terms of consumption and costs are derived from supplementary, electrically operated units that are map-controlled and demand-driven, such as water pumps, oil and fuel pumps, the fan, the heating and the air-conditioning compressor*



DEUTZ is the first engine manufacturer to show a hybrid drive for mobile machinery



INFO | Hybrid history

1900: Ferdinand Porsche co-driving a Lohner-Porsche racing e-mobile with four 2.5 HP hub motors

The idea of combining an internal-combustion engine and an electric motor is anything but new. When, late in the 19th century, it became evident that the age of the horse-drawn carriage was over, most experts were certain – the electric motor was a better bet than the internal-combustion engine. Of course, things turned out differently. Although, for example, most cars were electrically driven in New York around 1900, the technology was never fully accepted. The disadvantages, such as their short range and large, heavy batteries, outweighed the advantages. Up to the mid-1990s, all attempts to combine the benefits of both drives failed. It was only when developers finally dispensed with equality for the two systems, and supplemented the internal combustion engine with a supporting electric drive, that the technology was developed to suit serial car production. Since then, the main task of the electrical unit is to support the internal combustion engine and to reduce fuel consumption. The far smaller battery only acts as a short-term reservoir.



Photo: DEUTZ AG, Flughafen München Gesellschaft GmbH, Porsche

With the water-cooled 2008 and 2009 series for the power output range up to 50 kW now successfully in production, the 2010 series is now also beginning to herald its arrival. After field tests in numerous applications the serial production for these engines in the 50 to 74.9 kW output range is planned to get started in the second half of 2008.

Engine developments

# New options for the future

With the new 2010 series and the also new water-cooled engines of the 2011 series DEUTZ sets new highlights in the GSE segment

Visitors at Bauma 2007 in Munich were able to see what the current development status looks like. The outcome is impressive – the location for the presentation was ideal because it suited the developers' objectives perfectly. When designing and creating it, the engineers took into account the tough working environment for mobile machinery. While borrowing design details from the 2008/2009 series, the developers went to great lengths to make the new models compatible with the 2011 series.

Right from the start of serial production, the standard model comes with the choice of either

mechanical or electronic engine management, which means that the 2010 can be used within a powertrain management system. DEUTZ's modular system enables the engines to be easily adapted. With their compact sizing and low weight the engines, which are being produced with 64 kW at 2,600 min<sup>-1</sup> as the TD 2010 and 74.9 kW at 2,600 min<sup>-1</sup> as the charge air-cooled TCD 2010, were also a hit among visitors at the fair.

Now water cooling for successful 2011 model

Already in March, the most successful industrial engine of its class accomplished an unusual feat when the millionth unit came off the production line. Just days later there was another reason to celebrate when the newly developed, water-cooled 2011 model was presented. Serial production will start late this year. The water-cooled engines are available in three versions: the naturally aspirated D 2011 with 50 kW, the turbocharged diesel TD 2011 with 68 kW and the charge air-cooled TCD 2011 with 74.9 kW (in all cases at 2,600 min<sup>-1</sup>). Field trials with the four-cylinder engines have been running since late 2006.

To turn the 2011 into a water-cooled model, the engineers faced a huge task – they had to increase the power, maintain the installation dimensions and comply with the emission limits. The challenge was met through a mechanical injection system. A dip into the "developer's box of tricks" and the engines were further optimised – the recess cylinder head, for which a patent has been applied, enabled the capacity to be enlarged whilst losing almost no power and the cylinder head cooling to

**Compliance** The 2010 series engines do not only comply with the Stage 3 emission standards. They have also been designed to conform with the limits imposed by the next stage

**Top of the class** One million engines sold since 1988 make the 1011/2011 series the most successful industrial engine of its class. The construction sector particularly appreciates its integrated cooling system, user-friendly maintenance intervals and compact dimensions.



TCD 2011



TCD 2010

ENGINE | The new 2010 series and the water-cooled version of the 2011 series

	TD 2010	TCD 2010 (charge-air cooling)	D 2011	TD 2011	TCD 2011 (charge-air cooling)
Power (kW)	64	74.9	50	68	74.9
Swept volume (l)	3.47	3.47	3.62	3.62	3.62
Max. torque (Nm/min <sup>-1</sup> )	300/1,400	350/1,400	210/1,700	280/1,600	350/1,600
Max. speed (min <sup>-1</sup> )	2,600	2,600	2,600	2,600	2,600
Bore/Stroke (mm)	96/120	96/120	96/125	96/125	96/125



Telemetry

## Engine goes online

A high-tech system like DEUTZ Telematics for industrial engines offers many options. What revolutionised Formula 1 works reliably with mobile machinery, too

Engineers have always wanted to be given continuous information about their engines' up-to-the-minute condition. With its DEUTZ Telematics system for industrial engines, DEUTZ is now making this wish a reality. Months-long field trials

coolant, oil and fuel levels and, where drives have no EMR, the speed too, via GPRS (Global Packet Radio Service) to a server," explained Christof Schmickler, who works in Customer Service and is the DEUTZ Telematics project manager. This enables the engine's current condition to be analysed from (almost) anywhere on earth. The only other requirements are an Internet-capable computer and a browser. The engine can, for example, be "remote-controlled" over the Internet while it is running. Error messages from the electronic motor regulator are sent straight to the Internet platform. The intelligence of the DEUTZ Telematics system is underlined by so-called geofencing. The Internet interface can be used to define an area of activity for the machine. And the machine's movements can also be shown on a map as a GPS track.



DEUTZ telematics: positive feedback

have been showing that the technology is reliable.

Worldwide monitoring

"A test system at Düsseldorf International Airport has been 'broadcasting' engine data such as

Intelligent system

DEUTZ Telematics offers customers many benefits. They can not just fix machinery's positions but also get notifications if the level of lubricant, coolant or fuel falls below a minimum. Other engine data such as operating hours can also be transmitted. The engines of stationary equipment can even be stopped.

INFO | DEUTZ Telematics

DEUTZ Telematics is the perfect solution for monitoring engines and machinery online. Benefits: By permanently controlling utilisation and availability, customers are not just able to reduce over-capacities

but to optimise many other business processes (e.g. scheduling). At the same time, by using DEUTZ Telematics, downtimes in machinery and engines can be cut because the system sends relevant information at an early stage. DEUTZ Telematics also offers advantages when carrying out maintenance tasks: Because the condition of the engine is permanently known, maintenance tasks can be planned and adjusted to suit usage requirements.



DEUTZ Telematics is made up of only a few components. The DEUTZ Telematics controller that receives position data via a GPS (Global Positioning System) is attached to the engine. Using a CAN (Controller Area Network) bus or digital/analogous inputs, the controller records engine data such as speed, operating hours, and oil and fuel levels and transmits it at freely-configurable intervals by GPRS (Global Packet Radio Service) to a central server. The server receives the engine data and readies it for Internet access. Then anyone with the appropriate access permissions can communicate from anywhere in the world via the server with the DEUTZ Telematics controller and thus also access the engine's settings.

Photo: DEUTZ AG, Steven Roller

Photo: DEUTZ AG

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**The engine company.**

