



MAN Engines presents 16.2-litre D4276 engine for peak performance in agricultural machinery

Highest power-to-weight ratio in its class; innovative charging concept for peak power; optimum torque and performance profile

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At Agritechnica, MAN Engines will be unveiling the MAN D4276 to the world for the first time: its new engine series for agricultural applications with a 142 mm bore and 170 mm stroke. Generating an impressive 581 kW from 16.2 litres of displacement, the diesel engine is setting new standards. Weighing no more than 1,280 kg, this power pack is not only the most powerful inline six-cylinder engine for agricultural machines that MAN Engines has ever developed, but also has the highest power-to-weight ratio in its displacement class. This peak output has been achieved by MAN Engines as a result of its newly developed charging concept with fixed geometry charger, which enables a maximum torque of 3,400 Nm between 1,350 min⁻¹ and 1,600 min⁻¹. "With the D4276, we are offering OEM manufacturers an engine that is easy to integrate and will help set them and their machines apart from the competition, thanks to its unique performance characteristics," commented Reiner Rössner, Head of Sales at MAN Engines. To comply with current emission levels, the D4276 relies on the compact, flexible and modular exhaust gas aftertreatment (EGA) system from MAN Engines, and will be available for the main markets in models meeting the EU Stage V and EPA/CARB Tier 4 emission standards.

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16.2-litre displacement for unparalleled power-to-weight ratio

The D4276 is based on the modern D3876 engine series, which is already successfully established on the market, but has been systematically developed to meet the increased performance demands of heavy applications in agricultural machinery. To achieve this, it was necessary to further improve the already outstanding power-to-weight ratio of the D3876. This meant expanding the bore by four millimetres from 138 mm to 142 mm, which had the effect of increasing the displacement from 15.3 to 16.2 litres. A modification of the Common Rail injection system provides the necessary

MAN Truck & Bus is one of Europe's leading commercial vehicle manufacturers and transport solution providers, with an annual revenue of some 11 billion euros (2018). The company's product portfolio includes vans, trucks, buses/coaches and diesel and gas engines along with services related to passenger and cargo transport. MAN Truck & Bus is a company of TRATON SE and employs more than 36,000 people worldwide.



increase in fuel supply. The use of a fully redeveloped high-pressure pump generates supply quantities up to 40 percent higher while vibration loads and noise emissions remain constant. Diesel injectors that have been further developed especially for the D4276 with improved flow and high injection pressures of up to 2,500 bar ensure an ideal degree of fuel atomisation and penetration. This results in low-emission, low-soot combustion combined with more favourable levels of fuel and AdBlue[®] fluid consumption.

Innovative charging concept for peak performance

To obtain maximum power of 581 kW, MAN Engines has developed a charging concept with a high power output in the upper engine speed ranges. Due to the required power characteristics, a fixed geometry charger is used in the process. As a result, the 6-cylinder engine offers a maximum torque of 3,400 Nm between 1,350 min⁻¹ and 1,600 min⁻¹ – which is sufficient power for large combine harvesters and forage harvesters, for example. During the thermodynamic design process, the engineers at MAN Engines came up with a turbine geometry that has its optimum efficiency level specifically in the main driving range of off-road machines. In addition to this, the turbine geometry was designed in such a way as to prevent the cylinders from interfering with each other during the charge cycle, thereby achieving good response characteristics and an optimal air throughput across all engine speed ranges. Turbine housing made from heat-resistant cast steel and compressor housing made from aluminium that can withstand high temperatures further increase the turbo charger's robustness and create thermal reserves for use at high altitudes, for example.

Transfer of expertise for premium quality and reliability

The basic power unit and a large number of additional components and parts were adopted from the award-winning D3876 engine series without modification. As a result, the D4276 has retained virtually the same compact installation dimensions (1,464 x 978 x 1,131 mm length/width/height) as the "Diesel of the Year 2016", despite offering more power. As the interfaces of the two engine series are also virtually identical, customers require only a single installation variant to allow both the D3876 and the D4276 to be integrated without major design changes. In addition, concepts that have already been successfully tried and tested in the D3876 make a reappearance, such as the "domed valves", which use a convex-shaped reinforcement of the valve plates on the combustion chamber side to minimise seat wear, thereby enabling the valve clearance to be checked at less frequent intervals. Another concept used is top-down cooling, where the coolant is spread along the engine via the upper water jacket of the cylinder head, thereby ensuring an equally high cooling output across all cylinders.



Modifications have also been made to the crankcase and pistons to further improve the D4276's cooling system. As the D3876's lightweight construction concept has also been adopted, the D4276's dry weight of 1,280 kg makes it only slightly heavier than its little brother and also means that it has by far the highest power-to-weight ratio in the 16-litre class. Thanks to the standard parts concept, customers can also rely on fully-developed, tried and tested parts from large-scale production which, in the case of the D3876, have been used in MAN's own commercial vehicles on the road since 2014 and in off-road applications since 2016. This not only ensures that the parts are high quality, but also guarantees ease of service and repair work as well as optimum spare parts logistics across all MAN engine series.

Flexible exhaust gas aftertreatment for every requirement

Differing requirements for compliance with the emissions legislation depending on the application and target market mean that flexible and individual solutions are required for exhaust gas aftertreatment. MAN Engines offers its modular exhaust gas aftertreatment (EGA) system for this purpose, with a broad selection of interchangeable components that can be combined with great versatility. The EGA system essentially consists of the two DOC/DPF modules (diesel oxidation catalytic converter/diesel particulate filter), coupled with an SCR (selective catalytic reduction) system. Due to the engine's low-emission combustion design, an SCR system is all that the D4276 requires to comply with EU Stage V and EPA/CARB Tier 4. The new engine also relies on an exhaust gas recirculation system with water cooling. The engine can do without the DOC/DPF modules on the other hand, which saves additional space and money. In order to meet the requirement and performance profile of the D4276, the SCR catalytic converter used has a vanadium coating that can withstand high temperatures. This provides greater stability and helps maintain the engine's performance in extreme situations such as heat and altitude.

D4276 with 515 kW for high power requirements at low engine speeds

The D4276 is also available in a variant with up to 515 kW. MAN Engines has already presented this model at bauma in Munich in April 2019. The model was designed especially for machines with a large torque and power requirement in the lower engine speed range. A turbo charger with variable turbine geometry (VTG), which is already tried and tested in off-road applications, is used to retain maximum power and torque across a broad range of engine speeds. The turbo charger provides high charging air pressure reserves for torques up to 3,250 Nm at rotational speeds of 950 min⁻¹ to 1,500 min⁻¹. The broad torque plateau of the D4276 not only delivers highly dynamic response characteristics in partial-load and full-load



operation, but also always facilitates the required excess air for low-particle and consumption-optimised engine operation. Here too, the modular EGA system from MAN Engines ensures compliance with EU Stage V and EPA/CARB Tier 4 emissions standards. Solutions are also available for countries with less stringent regulations.

A strong partner for all applications

MAN Engines has been developing and producing diesel engines for agricultural machinery for decades. Customers benefit from the field experience acquired over this period, with a wide range of load profiles and installation situations in the off-road sector. This is the basis on which MAN Engines is continuously developing its portfolio of engines, and is now offering the D4276 engine series to close the previous performance gap between the D3876 (15.3 litres of displacement) and the D2862 (24.2 litres of displacement). As a result, a unique engine portfolio with a continuous power spectrum from 118 to 816 kW is now available to OEM manufacturers, enabling them to position their machines as first-class products in the market. Yet as an all-embracing system partner for OEM customers, MAN Engines not only offers premium engine quality secured by large-scale production standards, but also individual, customised solutions for seamlessly integrating the power units into the system environment. The engines also already have the necessary interfaces in place to digitalise and network components in future. As a business unit of MAN Truck & Bus – and thus part of the Traton Group – MAN Engines also draws on the Group's expertise in large-scale commercial vehicle production when manufacturing its own products. As a result, customers can rely on established technologies and components that have been field tested thousands of times. A global, close-knit MAN service network and on-site support by MAN's own engine specialists around the world make MAN Engines a strong partner for machine manufacturers and operators throughout the entire product lifecycle.

Hydraulic valve clearance adjustment for increased ease of maintenance

Engines by MAN Engines are already impressively reliable and easy to service. To improve even on this in future, MAN Engines is developing a maintenance-free valve train with hydraulic valve clearance adjustment (HVCA). Accessing the cylinder head cover to carry out valve clearance checks can be particularly difficult in agricultural machinery, and often requires extensive disassembly work. With HVCA, there is no need to monitor and adjust valve clearance, meaning that maintenance effort and costs can be significantly reduced. Furthermore, the space above the



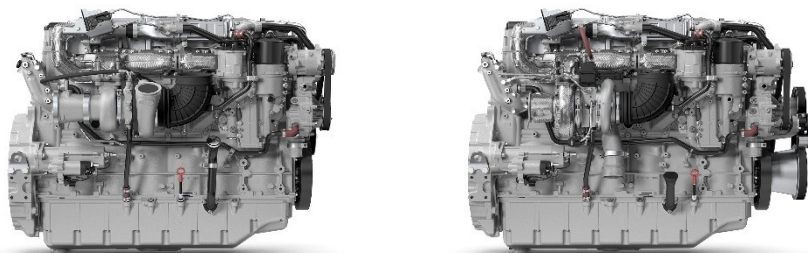
cylinder head that is freed up in the machine can be used more efficiently, for example for positioning increasingly complex exhaust gas aftertreatment systems close to the engine. Besides the D4276, HVCA will also be available for the D1556, D2676 and D3876 engine series, most likely from 2021.

MAN Engines at Agritechnica trade fair

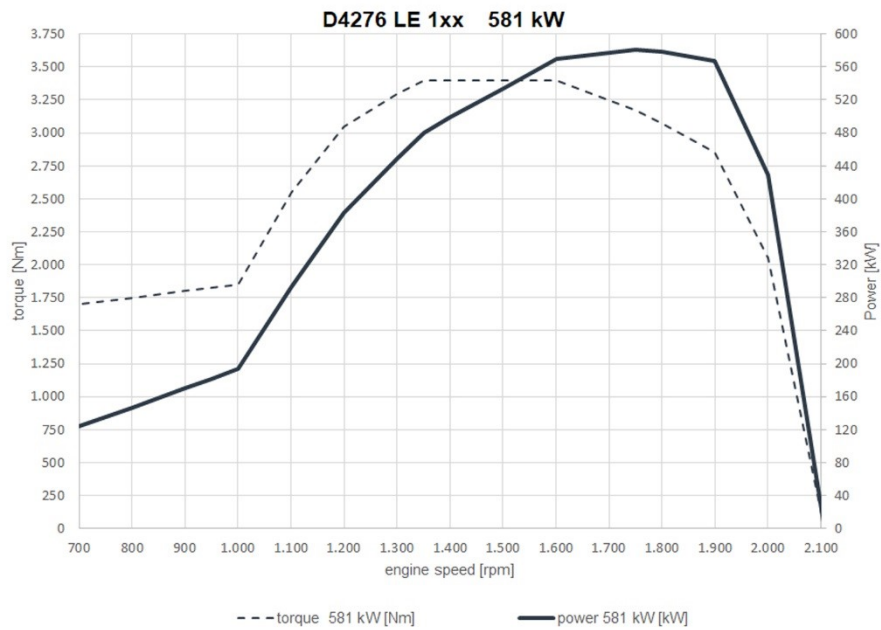
The maintenance-free valve train and the brand new D4276 will be on display at Agritechnica (Hall 16, Stand D41 at the exhibition centre in Hanover) between 10 and 16 November. MAN Engines' exhibition space, which measures more than 200 square metres, will also play host to its 9-litre D1556 diesel engine, the E3268 gas engine and the company's modular exhaust gas aftertreatment system. Alongside these exhibits, MAN Truck & Bus will also showcase a special agricultural truck that demonstrates the versatility of trucks in the agricultural sector.



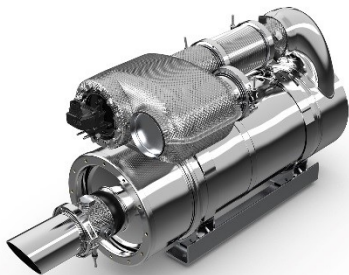
The D4276 is the most powerful inline six-cylinder in MAN's portfolio of engines for agricultural machinery applications



With the help of a newly developed charging concept with fixed geometry charger, the D4276 can achieve peak power of 581 kW (left). MAN Engines is relying on its tried and tested VTG (variable turbine geometry) turbo charger for the 515 kW variant (right).



A newly developed charging concept ensures that the D4276 has a large power output and torque values in the high engine speed ranges.



Modular EAT (exhaust gas aftertreatment) consisting of SCR mixer and SCR catalytic converter. The D4276 with 581 kW does not need DOC/DPF modules (diesel oxidation catalytic converter/diesel particulate filter) to comply with EU Stage V and US Tier 4.