DIESEL international

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Fpt Industrial
Feeling
with records

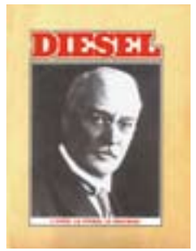
CONTENTS

The Tractor of the Year® is an international award that, yearly, a group of European journalists, specialized in agricultural machinery, gives to the best tractor of the year. Twenty independent technical magazines are members of the jury and valuate open field tractors, specialized tractors (orchard/wineyard) and the design of both categories. Before including each tractor in the final shortlist of the nominees, the jury members must have had the opportunity to evaluate it under field conditions. The prize was an idea of **TRATTORI**

The winners:

1998 Fendt Vario
1999 Fendt Favorit 700 Vario
2000 Case IH Magnum Mx
2001 Case IH Cvx
2002 John Deere 8020 series
2003 New Holland Tm 190
2004 Fendt 930 Vario Tms
2005 MF 8480 Dyna-Vt
2006 McCormick Xtx 215
2007 John Deere 8530
2008 New Holland T 7060
2009 Massey Ferguson 8690
2010 NH T 7070
2011 Fendt 828 Vario
2012 John Deere 7280 R
2013 Deutz Agrotron 7250 Ttv
2014 Claas Axion 850
www.tractoroftheyear.com

Diesel and Trattori at a glance



Development, manufacturing, use and applications of the diesel engines are the main themes of Diesel. Published for the first time in 1986, Diesel stems from the experience of the Vado e Torno magazine. A mass-media style for a very specific group of readers: engine designers and specialists, engine application experts and retailers. A balance of text and photos, Diesel puts the emphasis on the aesthetic side of the engine and at the same time on the high-tech side. Pictures of engines and applications are enhanced by graphs, tables and Diesel own tech indexes. Diesel's documentations on many segments of the market, both Italian and foreign, are essential for the professional readers.

When Trattori came to light, more than 100 magazines where already published in the Italian market: some were and are very authoritative, but none of them was centered on the tech side of the machines. Trattori was the first, then other followed in Europe. But Trattori remains with a strong leadership, due to a very important factor: the technical know-how in all kind of machines. Tractors and all agricultural machines, used on a daily basis by land owners, are introduced in articles featuring images, graphs, tables and operative costs. Comparisons between similar models of different brands, market analysis and the most complete price lists of every model on sale in Italy give to Trattori a sure leadership in the editorial agricultural field.

Diesel of the year

BIG COMPACT

During the Intermat in Paris the winner of Diesel of the Year 2015 - which will take the place of the Fpt Industrial Cursor 16 awarded at Samoter 2014 - will be revealed

It's an award in the name of power density. And this could also be the slogan of the Fpt Industrial Cursor 16, top range of the Cursor series. The engineering has managed to keep the size of this 13 liters compact, storing 570 kW and 3,320 Nm (630 and 3,500 with two-stage) in the engine block of the 16 liters, 6 cylinders engine. Like all Cursor engines, no filter and Hi-eScr is the solution. The appointment for the 10th edition of Intermat is in April, in Paris. ■

From mid 2016, Liebherr 16 and 20 cylinder and new common rail will be manufactured. In the photos below, the common rail system, engines production and shipping.

LIEBHERR AND THE SWISS TREASURE

Ready for the boom

Works in progress in Bulle, where Liebherr is manufacturing engines and components. New developments are expected for the common rail. The 16 and 20 cylinder diesel and gas are announced

The engine division at Liebherr at Bulle, in Switzerland (it's exactly the area of gruyere cheese) is in constant turmoil, and it announces substantial upgrading adjustments to the V platform: starting from mid 2016 the 8 and 12 cylinder engines from Man (B x S 128 x 157. The project is a four handed effort) will be followed by two considerable improvements, the 16 and 20 cylinders, 36 and 45 litre respectively, able to range between 900 and 1,200 and 1,125 and 1,400 kW. They will be called D9616 and D9620 and will be destined, at least initially, to mining applications of the German firm, such as big escavators, trucks, crawler vehicles and large cranes and to some genset big ratings.
With this operation Liebherr will be freed for good from Man's embrace, the latter remaining a solid technological partner and a possible future competitor in the free market arena, since their catalogs overlap. Especially for gas cogeneration, that will witness the appearance of the G9616 and G9620 new entries in 2017. The stroke remains the same whereas the bore gains 3 millimetres (the 2.25 litre swept volume therefore measures 135 x 157 mm) in a context of validation of the whole range of domestic components: from electronic control units to hydraulic systems to common rail, which next year may officialise the interest of some oem trying to escape Bosch's monologue (with the significant exceptions of Denso and Delphi). The goal for 2020 is of approximately 60 thousand per year. To face the burden of such onerous applications (at least in terms of workload) the piston has been reshaped to sustain the increased termic stress. Besides the supercharger with waste gate the two-stage is also under construction. The gear drives are a new design to be able to work in combination with the bigger flywheel.
The formula for the Tier4F confims the supremacy of the scr, without the aid of any other device. For the stage V it will work together with the doc. Liebherr's investments for the expansion of the manufacturing plant in Bulle (engines and components) are worth 160 million euros. **Fabio But**

All fuels are on the scope.

EMISSIONS: THE STAGE V COMES TRUE

None excluded

From 2018 the oem must cut down on the number of particulates. The regulation extends across all fuels. Flexibility only under 50 machines manufactured per year

The 581 final Com proposal (2014) was approved on September 25 and starting on January 1 2018 – depending on the type – will hit non-road mobile machinery, responsible, according to the legislators, for 15 percent of the NOx emissions and for 5 percent of the particulates in the EU. All power sources have been targeted, even those with cng, lng and lpg, with no power limits. Just as had been anticipated, the legislation will regulate the number of particulates emitted – and not the particle size alone – broadening its targets from 19 to 560 kW. The oem were still in the 'process of digesting' the Final tier IV standards when stage V burst loudly onto the scene, especially for specialized engines and small building sites applications. No more flexibility is allowed and a new limit of 12 months following the implementation of the directive is established for the production of non-emissioned machinery and of 18 months for their sale. The only exception is for those who manufacture less than 50 vehicles per year.
The regulation will also concern the whole of the railway and inland water marine engines.
Jean-Pierre Le Roux

JOHN DEERE'S 250 KVA

This 6.8 litre genset delivers 250 kVA and is built on common rail technology. It offers power density as well as a double set-up, bare and integrated with cooling and air filter, and is able to switch rpm from 1,500 to 1,800. In non-emissioned countries it becomes a candidate for off-road propulsion.

COMER INDUSTRIES AND THE A-613

For the trailed vertical feed mixers Comer Industries has designed the A-613 unit with parallel axls and a 2 or 3 position electric actuator. The product features an internal pre-load mechanism that enables easy gear change. The transmittable power reaches 132.3 kW (180 hp) at 540 rpm. The available speed ratios are the following: 1:1/1.8:1 e 1:1/1.5:1.

THE KEY BEYOND EURO6

If scr seems to prevail in the struggle against NOx, the exhaust gases recirculation has still something to say nowadays and in the future. In these pages, an in-depth analysis of the egr, inside and outside, focused on high pressure recirculation

The massive introduction of the egr dates back to the '90 and was fundamentally quiet: the amount of recirculated gases was modest, the recirculation was driven by pneumatic valves and there was no need to cool down the gases.

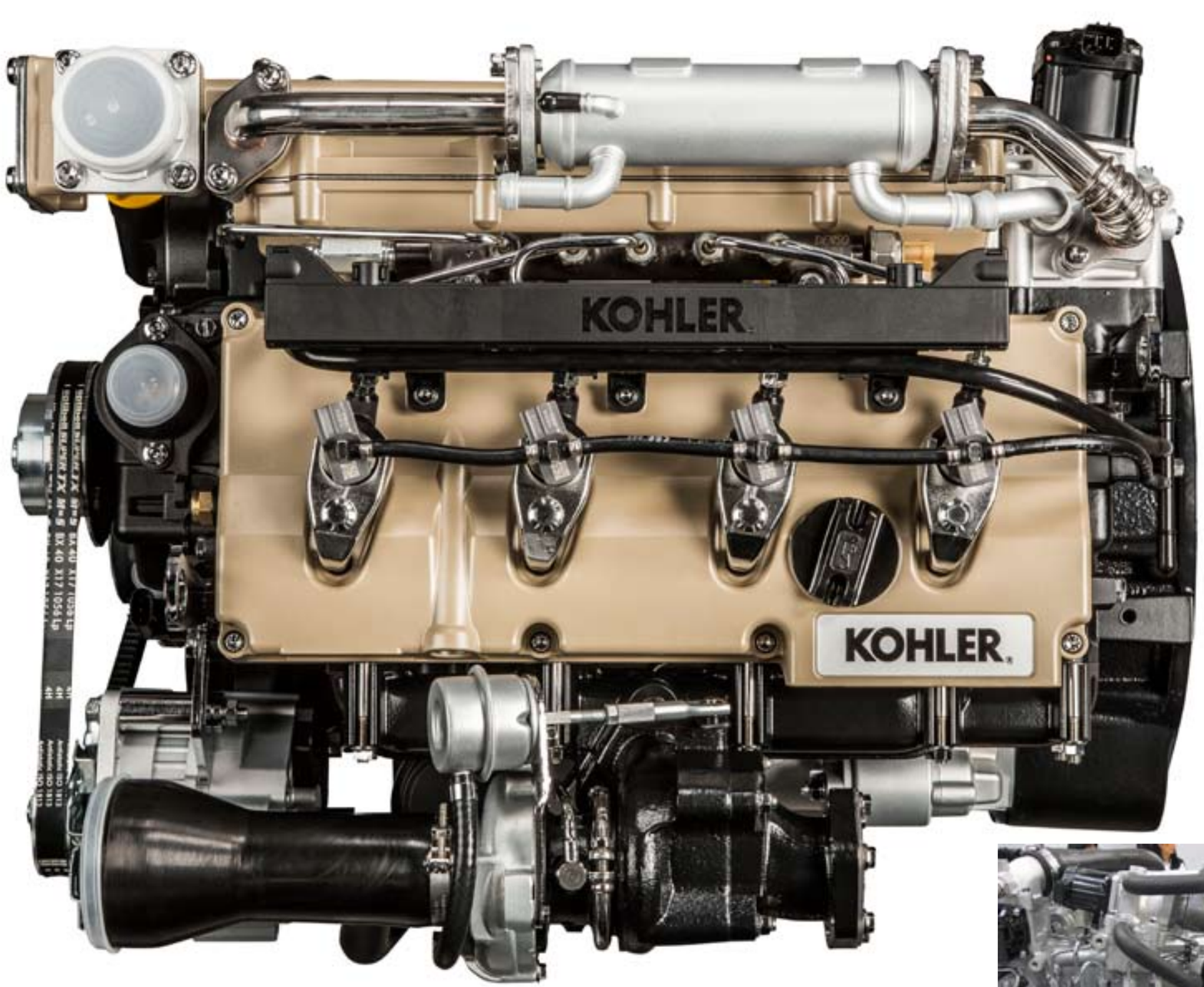
Egr spreads after Euro4

Only after the introduction of Euro4 and Euro5 standards the egr made a real leap ahead, becoming a complex system with massive recirculation driven through electric valves and heat exchangers. Its largest market is the European union, followed by India, thanks to a favorable diesel fuel fiscal regulation, and United States, stimulated by the regulation of CO_2 and fuel consumption.

Different markets

Different engine sizes need different egr, from 1 to 1,5 liters for the Indian market, from 3 to

A fundamental condition to flow the exhaust gases back to the intake is that the pressure inside the exhaust pipe must be greater than the pressure inside the pipe.



5 liters in the United States and from 1,5 to 2 liters in Europe. The exhaust gas recirculation may be internal or external. In the internal recirculation a portion of exhaust gases stays inside the cylinder. Simpler diesel engines adopted this technique in the beginning, then progressively abandoned for the more efficient external recirculation that takes the gases out of the exhaust pipes and in the intake manifold.
A fundamental condition to flow the exhaust gases back to the intake is that the pressure inside the exhaust pipe must be greater than the pressure inside the intake pipe. In aspirated gasoline engines working at small and medium loads the partial aspiration generates enough negative pressure to get an adequate recirculation.

In aspirated engines

In aspirated diesel engines there is no such partial aspiration and the pressure differential is very limited, making the internal recirculation easier. In turbo engines exhaust gases are generally taken out before the turbine, in high backpressure conditions, then reintroduced after the turbine: this is the high pressure recirculation technique. The emission tests for heavy – duty engines also consider high load test points, where the aspiration pressure is similar, if not superior, to that of exhaust.
Unidirectional reed-valves are often used in this case to allow the exhaust gases flow toward the aspiration but not vice versa, thus maximizing the egr flow exploiting the pressure fluctuation and avoiding backflows.

More gas more cooling

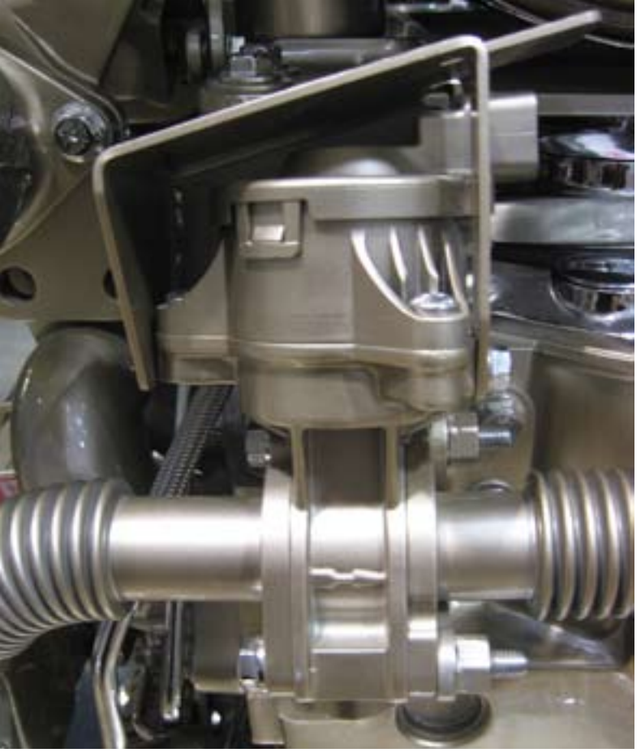
Stricter regulation on emissions has initially induced an increase of the recirculation flow and subsequently the exhaust gases cooling to maximize the NOx reduction while minimizing the impact on fuel consumption.
This evolution of the egr has


The flow increase has been obtained by increasing the section of the egr valve and improving its outflow coefficient.

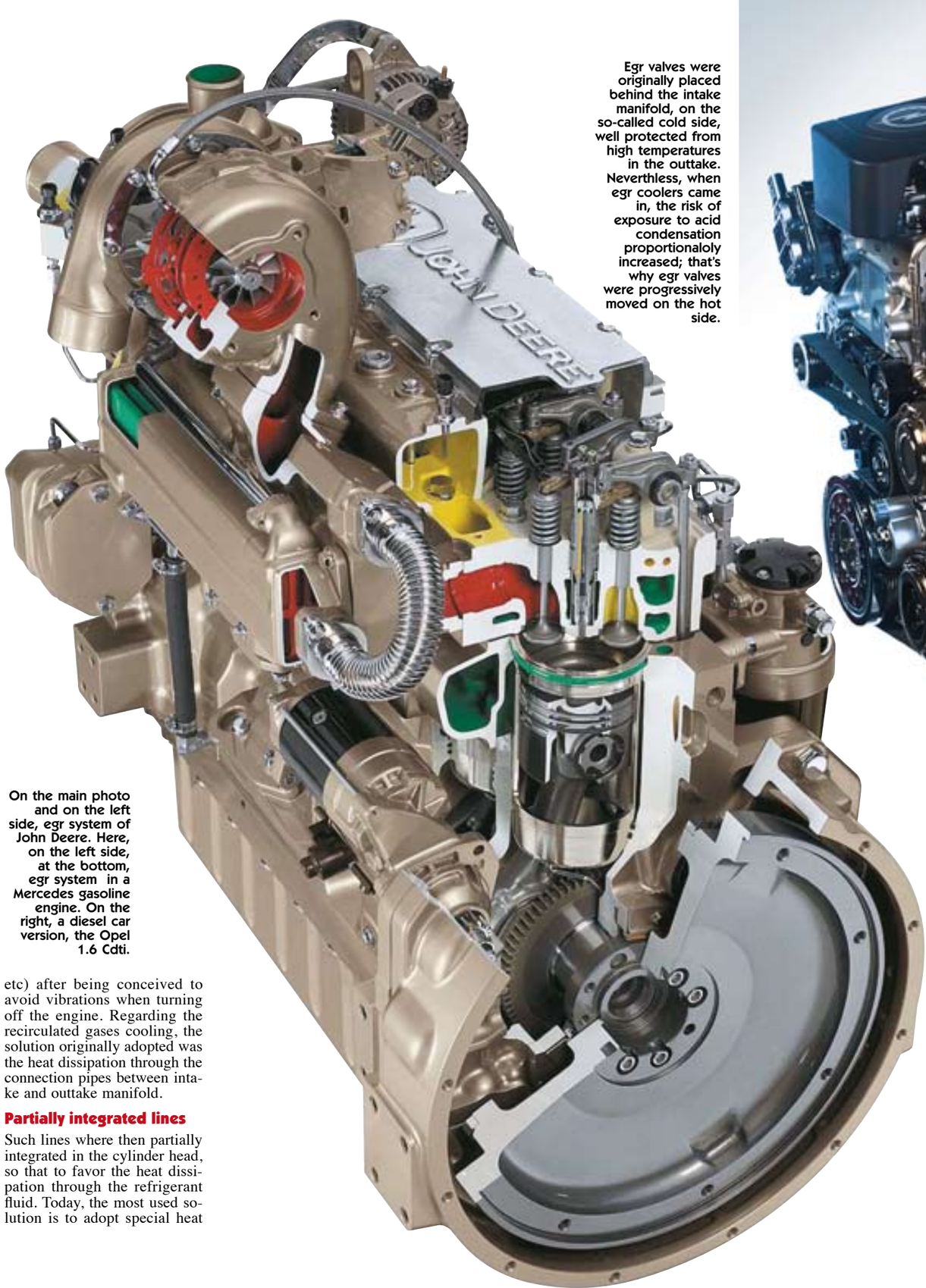
come together with higher supercharge ratios and lower compression ratios, always aiming to improve efficiency and reduce emissions. The flow increase has been obtained by increasing the section of the egr valve and improving its outflow coefficient.
It's worth mentioning that in high pressure valves it is important to guarantee that the valve is tightly sealed when closed, so that to avoid unwanted gas recirculation in case of high pressure differential between outtake and intake.
That's why poppets are the best solution. In this case, working conditions are a little different because the engine valves open and close at the same frequency of the engine rotation, while egr valves are slower but, on the other hand, are exposed to constant flows of chemically aggressive gases due to acid condensation, soot and laques. That's why valves and seats are generally made of stainless steels, while its body can be made of cast iron or aluminum alloy, provided that a suitable heat dispersion through adjacent surfaces or refrigerant fluid is assured. By increasing the valve section the force of the pressure differential between intake and outtake increases proportionally and so the force needed from the actuator.

One stem two poppets

That's why over a certain flow threshold it is often necessary to adopt a double poppet on single stem. In this case the pressure differential acts in opposite sense on the poppets which balance each other. To assure valve seal the geometric details of seat and valve profile



On the main photo and on the left side, egr system of John Deere. Here, on the left side, at the bottom, egr system in a Mercedes gasoline engine. On the right, a diesel car version, the Opel 1.6 Cdti.



Egr valves were originally placed behind the intake manifold, on the so-called cold side, well protected from high temperatures in the outtake. Neverthless, when egr coolers came in, the risk of exposure to acid condensation proportionaloly increased; that's why egr valves were progressively moved on the hot side.

are also important, as well the intake and outtake links. The geometry of the poppet and its seat is also important to obtain a gradual flow progression depending on the valve opening, which assures good control in the low flow range.

Throttle valves

Sometimes, as for instance in the recent Honda 1.6 automotive engine, but also in some Mercedes and John Deere engines, throttle valves are used to reach a better outflow ratio, even if the valve seal requires some additional complexity. Seal bands are sometimes used, for instance, or shaped pipes with support and seal edges for the closed valve.
Among the various solutions conceived to manage the pressure differential between outtake and intake are the narrowings in intake and outtake obtained through an accurate control of variable geometry turbine and/or the throttle valves that are used for several purposes (filter regeneration, egr management, etc) after being conceived to avoid vibrations when turning off the engine. Regarding the recirculated gases cooling, the solution originally adopted was the heat dissipation through the connection pipes between intake and outtake manifold.

Partially integrated lines

Such lines where then partially integrated in the cylinder head, so that to favor the heat dissipation through the refrigerant fluid. Today, the most used solution is to adopt special heat exchangers, the so-called egr coolers. In these devices, generally made of stainless steel, the gases dissipate through the engine refrigerant fluid. These heat exchangers are generally made in order to improve heat dissipation without generating excessive flow obstacles.

Egr and radiators size

Egr coolers caused a sensitive increase in radiators size, especially for those applications where recirculation is active also under middle-high loads. This characteristic is less evident in automotive engines that generally use recirculation under lower loads. On the other hand, in that case emissions are measured since the motor start; that's why egr cooler bypass circuits with valves operated pneumatically were adopted. In this way is it possible to recirculate hot gases right after the engine start without jeopardizing the combustion stability, actually favoring the catalytic reactions. Egr valves were originally placed behind the intake manifold, on the so-called cold side, well protected from high temperatures in the outtake. Nevertheless, when egr coolers came in, the risk of exposure to acid condensation proportionally increased; that's why egr valves were progressively moved on the hot side, setting a whole series of engineering issues solved thanks to solutions tested through termo-fluid dynamics simulations and experimental surveys on thermocoupled valves.

Last but not least

Other significant issues are the homogeneous egr – air mixing and the uniform distribution among the cylinders, that can be obtained through an opportune geometry of the nozzle that sprays the recirculated gases in the air and a careful conformation of the intake manifold.
Egr is in any case introduced after the intercooler to avoid exchanger oversizing and, above all, its contamination.

Carlo Pifferi

GERMANY IS WORTH HALF

Germany features 72 percent of biogas plants, followed at a distance by Italy, France and Austria. In particular waste feeded plant are tipically Germans:the 85.5 percent. The rest of European continent invests mainly in landfil gas

LUBRICANTS FOR GAS

Chevron Texaco offers in the HdaX range for cogeneration Group II hydrogenated oils treated in high pressure hydrocracker with catalyst that saturates the aromatics compounds and creates Iso standards compliant paraffins. The oils show oxidation stability, low volatility and are sulphur free. The lubricants are designed to reduce deposits and oil consumption and extend replacement intervals.

The 80 per cent of the biogas plants in Europe is localized in three countries - Germany, Italy and France; among them Germany is the only to show double figures and leads the standings with 72 per cent. According to the latest official statistics - the European Bioenergy Outlook by European biomass association is updated to 2011 - about 8,400 out of 11,600 biogas plants have German passport. If we focus on agricultural waste-feeded plants, the gap widens: 7,215 out of 8,438 plants (85.5 per cent) are German. Similar figures for sewage sludge biogas; 57 percent of plants are located in Germany. The rest of the European continent hosts the majority of investments in landfill gas. **Peter Slow**

BIOGAS PLANTS IN THE MAIN EUROPEAN STATES

Nation	Crop	Landfil	Sewage	Others	Total
Belgium	29	25	21	43	118
Czech Republic	212	61	54	0	327
Denmark	87	32	68	9	169
Germany	7,215	0	980	205	8.400
France	48	301	60	89	480
Italy	324	197	0	0	521
Luxembourg	26	0	4	3	33
Hungary	21	8	13	1	43
Netherlands	98	41	75	21	235
Austria	200	15	94	124	433
Slovenia	22	4	4	0	30
Slovakia	34	9	9	4	56
Finland	10	39	18	8	75
Sweden	32	57	135	5	229
UK	29	75	146	49	299
Others	51	32	31	10	124
Europe	8,438	896	1,712	571	11,617

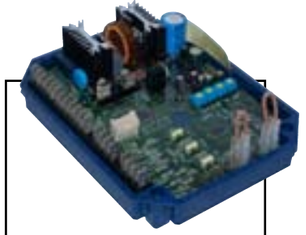
KILLER OF SULPHUR

The German company solution to drain nitrogen oxides also provides a carbon pre-filter to avoid sulphur contamination. The integrated system consysts of NOx sensor, AdBlue dispenser, catalyst, control unit and sensors

Within its DeNox system, Emission Partner has developed an active carbon pre-filter that manages sulphur with a tolerance of up to 100 ppm. The integrated system consists of Nox sensor, technical urea dispenser, catalyst, AdBlue intake from tank, control unit for dosage electronic management and, upon request, downstream NOx sensor. The technique, now familiar, supplies the outtake with technical urea, where the gas temperature varies between 300° C and 500° C, depending on the use of a heat exchanger. **E.T.**

PARKER HYPERCHILL COOLS DOWN

Ice Hyperchill by Parker lowers the biogas temperature coming from the digester through a heat exchanger, which makes use of chillers water. All parameters are processed by proprietary software; among protection systems there's the water by-pass, which protects the circulation pump in double configuration to comply with redundancy principle.



MECCALTE AND VOLTAGE

Der1 is a digital controlled voltage regulator based on Dsp ('Digital signal processor', which performs control, protection and diagnostics functions in the same device), working from -25 °C to + 75 °C, power connection via Fast-On 20-pin connector and signal connections on 10-pin mini Fast-On separate connector.

GEMS PREVENTS WITH CAP-300

The cooling level sensors measure the capacity difference between the two dielectrics, air and refrigerant. Mineral residues from liquid may deposit in time on the sensors, impairing its function. The sensors can also lose efficiency due to modified proportions of the mixture. Gems solution is Cap-300, which encapsulate the sensor probe in a frequency – inert protective plastic cap.

MOTORTECH CHECKS OIL

The Oil level controller solves problems such as manual continuous monitoring of the level (very expensive with Ups) and service interruption for refilling, excluding human error. Lubrication prevents engine seize and prolonges lifetime, preventing wear and reducing friction.

TWO EXAMPLES

How does Espe develop the syngas paradigm (a portmanteau that identifies the synthesis gas)? We can start from an industrial application concerning a drying system. 1.5 MW electric power, 3.3 MW thermal power and a preliminary challenge: the low water content. The thermal power feeds the drying system, 'digesting' 367 tons per year per module (the Chip50 powered by Tedom) at 10 per cent humidity level.
The second case is a textbook, a cogeneration plant fueled by wood biomass from conifer. 1.650.000 kWh generated by the modules replace an agri oil boiler and will warm up a greenhouse. The electric power is 735,000 kilowatts.

WHAT IS WOODCHIPS

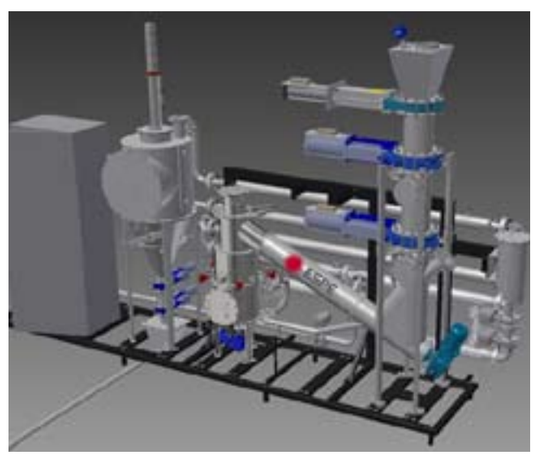
Biomass from agriculture and forestry, it consists of woody material cut up by a special machine (wood chipper). The calorific power of wood chips mainly depends on water content and specific gravity.

It's tailor-made for syngas the Tedom six cylinder - twelve liter able to generate electrical and thermal power by woodchips.

Tedom Tw80 and Espe ChiP50

THE METAMORPHOSIS OF WOOD

The 12 liters Tedom engine which is fitted in the Espe ChiP50 module is specifically tested for syngas. Linear lambda sensor, Can open and a calorific value of 5.4 Mj/m^3 are among the key features of this system



THE TW80 G5V AND THE ADVANTAGES OF MITTELEUROPA

There is an automotive derivation at the root of this 12 liters which condenses the 'savoir faire' of Tedom, based on Liaz truck engines, bus calenders and rail traction. Specifically tested for synthesis gas applications, it has a simple architecture, with two valves per cylinder, is available either in aspirated or supercharged version, low or high pressure, with or without aftercooler, is calibrated 80 kilowatts and 509 Newtonmeter in standard version, and obviously has a low mep, being this a fixed speed application.
Alloys of high-tensile steel are used for rods and pistons in order to avoid the wear from corrosive agents such as hydrogen sulphide (H2S).
The shape of the piston has increased the volume of the combustion chamber to support the specificity of syngas from biomass combustion. The combustion is delayed to let more air in, with an integral movement of camshaft, valves and piston crown, which is cooled by a nozzle which injects oil from above the piston.
Tedom offers the Re-man (Re-manufacturing) program that provides units partially assembled with revamped components, taken from exhaust engines. Warranty covers twelve months.

A Tedom engine ready for delivery.

CZECH POWER

Brand- Model	Tedom Tw 80 G5V Nx 86
I.D.	
B x S mm - S/B	130x150 - 1,15
N.cil.- dm^3	6 - 11,94
Maximum power kW/rpm	80 - 1.500
Maximun torque Nm	509
Mep at max power bar	5,47
Piston speed m/s	7,5
RULES AND BALANCE	
Dry weight kg	920
L * W * H mm	1,716.8*832,1*1,301.8
Mass/power kg/kW	11,5
Compression ratio :1	9,5
Fuel input power at 100% kW	276,6
Valves per cylinder	2
Mixture	Stoichiometric

It is tailor-made for syngas, has a linear lambda sensor and reads all Can parameters; it's the six-cylinder engine with two-liters cylinder displacement by Tedom that Espe chose to power the CHiP50 module. The term 'modular' fits the strategy of the installer, able to prepare up to six Tw80 motorized groups, each of which produces 50 kilowatts and then extend the system power range up to 300 kW. Tested and configured to process wood chips, the system is set to lambda 1, thanks to the sensor that allows to maintain a stable stoichiometric combustion. Concluding the premises, Tedom prepares the 12 liters with Can open interface, which handles a specific signals library and can be integrated with a transducer to transform Can open to Can J1939 able to read via plc all otherwise non-translatable parameters. The remote function displays the engine parameters - for example, pressure and temperature of the intake manifolds - and any anomaly such as knocking.

How semplify maintenance

Speaking about cylinder head, that of Tw80 is divided into three parts to simplify maintenance and replacement and is interchangeable in pairs of cylinders. The injection is done through Altronic conventional coils: from 2015 Bosch-derived pencile coils will be available (currently only on natural gas engines), directly mounted on the spark plugs so to avoid cables and limit energy dissipation.
Espe provides the control logic and the global setup of the system, that is capable to transform a kilogram of wood (preferably of coniferous and deciduous trees) at a 10 percent humidity level in a kilowatt. The injectors are made of inconel - a high – temperature, oxidation and corrosion resistant special alloy - and spray controlled amounts of oxygen which burns with the dried wood chips in the reactor, where the temperature reaches at specific points a peak of 1,200 °C, with a tolerance of 30-40 degrees. The gas

ESPE AND THE ENERGY OF THE WORLD

'Profession energy' is the slogan of Espe, that has its roots and heart in the North East of Italy, branches all over the world and has just turned 40 years of activity (the company was established in 1974). There is not only wood in its portfolio. Espe Ro and Espe Energy manage photovoltaic projects and hydroelectric plants in the area of the former Warsaw Pact (five hydropower plants in Romania, in the district of Maramureş), Espe Sunparc America provides know how and turnkey projects in the field of solar energy for North America customers. At present, portfolio includes more than 200 peak MegaWatts (MWp) in the photovoltaic area. Espe provides all components both for roof and ground panels; the assistance contract may include the supervision service Esacontrol, with 24 hours a day remote tracking.
The diversification of the sources involved some other natural elements such as wind and water. Espe small wind turbines are named from Fx 60 kW generators and take advantage of the synergy with the Universities of Padua and Naples. Among the areas of installation is also Norfolk, in the east of the UK.
Hydroelectric power plants are all located in Italy and Romania. The skills of Espe allow the construction and installation of Pelton, Francis and Kaplan turbines.

At the end of the process, the Pm10 not exceed 0.4 mg/m³, the syngas is desulphurized and purifiedfrom chlorine and potassium, with a low ash residue and a calorific value ranging from 4.5 to 5.4 Mj/m³.

ALTRONIC DRESSES IN BLUE

Altronic, the American competitor of Motortech, provides Tedom with standard injection coils, those colored in blue, for instance, because the Czechs six-cylinder does not require the hi-charger red version. This solution is made possible by the combustion efficiency of Tedom and flexibility of Altronic, which provides ignition system individually placed on each cylinder, wiring and powered ignition unit. The permanent autonomous multipolar magnet alternator charges a capacitor, magnetically activated coils provide pulses to tap into that reservoir and release energy in sequence.

TEDOM AND BOHEMIA: NOT ONLY CRYSTAL

Tedom crossed his story with Liaz (abbreviation of Liberecke automobilove zavody, 'Liberec car works') from the beginning. It's 1953, actually half a century after the birth of the progenitor of the Czech motor company named Raf (1907), but it is only in Czechoslovakia under Soviet tutelage that in Jablonec, near the border with Germany and Poland, that the production of engines takes off: from Karosa buses (1985), then transferred to Iveco bus, to stationary engines (1990) and to he acquisition of Liaz (2003).
At the moment the Euro 6 is not on the agenda, but Tedom gas units keep expanding in compressors, pumps, biomass and natural gas Chp, cng-powered automotive, locomotives, available in three ratings, 242, 265 and 310 kilowatts at 1,900 rpm with a torque of 1,600 Newton-meter. Truck derivation, it has strong roots in bus market and a rich variety of Chp declinations (natural gas, biogas, lpg, diesel, biodiesel, syngas, pyrolysis and cbm - methane from coal). The six ratings for 6-cylinder 12-liter, from 86 to 212.7 kilowatts, are all natural gas powered.
Tedom is distributed in Italy by Rama Motori, based in Reggio Emilia.

THE THREE WAYS OF DCL

The after-treatment to limit emissions in engines with rich mix or stoichiometric combustion is called three-way catalyst. Specifically, the abbreviation is Dc45-100 and the author's signature is that of the Canadian Dcl (Diesel controls limited), a global player in genset, co-generation and gas compression applications aftertreatment. In its syngas version, compared to catalysts for natural gas, this device has two fundamental differences, the Pt/Pd (Platinum and Palladium) charge of the Twc catalytic converter - which compensates for syngas fluctuations in CO and NOx - and Osc (Oxigen storage capacity) altering the concentration of CeO_2 (cerium oxide) expanding the λ window.
The Dcl best seller are the catalytic converters for drives up to 520 kW Mine-X, made of substrate soldered metal to preserve the integrity of honeycomb cells.
The main objectives of Dcl treatment are well known names for automotive diesel, off-road and marine operators: NOx, CO, HC. Also the CH_2O appears, better known as formaldehyde, linked to methane combustion.

passes through a post-reformer and is processed to separate the carbon and other heavy chains into more elementary compounds through thermal crack. From 800 °C syngas and ashes pass through a syngas/air exchanger (hot air is reintroduced into the system), which reduces the gas temperature so to flow it safely into a primary filter, which separates ashes. Another syngas/water exchanger lowers the gas temperature up to 60/75 °C and a secondary filter separates condensation. After the downdraft fixed-bed Espe treatment, which conveys the wood chips and gas flows in the same direction, the particulate does not exceed 0.4 mg/m³, the syngas is desulphurized and purified from chlorine and potassium, with a low ash residue and a calorific value ranging from 4.5 to 5.4 Mj/m³, due to the higher methane density. **F.B.**

PIECEMEAL MARKET

The agricultural machinery market is holding up. Things are looking good in the US, Turkey and Russia, while Brazil and Western Europe struggle to keep the pace. Including the vehicles under 22 kW, China's figures are shocking. Italy is in the shadows, and relies on export

It's not only a matter of Brics! At least when considering agricultural mechanization.
For example, North America is picking up and Turkey is hanging on, dealing in huge figures despite the uncertainty of its market, which is able to alternate abrupt arrests and equally sudden accelerations within a few months; Russia, for its part, stands out for the sales data regarding large machinery; China fills up with small tractors under 22 kW. Brazil, on the contrary, is rapidly decreasing, and India is still drowsy. Similarly, Europe is having trouble emerging due to the complex juxtaposition of the difficulty of some countries with the energy of others.
However, between the highs and lows, the global evaluation is still (slightly) positive and sales are reported to be increasing worldwide. Due to the delay in the statistical surveys, the updates vary between different countries.

AUSTRALIA

Australia's surface measures approximately 15 times that of the Iberian Peninsula, however the sales data are almost equal. Last year, in fact, only 10,561 tractors were registered, with a 7.5 percent decrease compared to the 2012 performance (when the units were 11,420). The current year seems to be heading towards a further decrease: «It is unlikely that we will reach 10 thousand – Tractor & Machinery Association assures – but we will come close anyway». If that were the case, the difference would only be of 5-7 percentage points. More comforting are the data relative to the heavy-duty tractors – between 73 and 147 kW (100 -200 horsepower) – which are moving in counter trend: last year in fact, in a context of clear contraction, they scored an improvement in sales of 6 percent.
The orders of the over 147 kW, representing more than a fifth of the entire market in the area, remain stable.

BRAZIL

The carioca national football team isn't the only one going through an awful 2014. Agricultural mechanization here, too, seems to be a little offside. These first 7 months have shown a drastic drop in the tractor sales, up to 17 percent (from 38.600 to less than 32,000 units). In general, the market of agricultural mechanization has been cut by 19.2 percent. Exports are also decreasing (6 percent less) as a sign that the whole of Latin America is struggling, though to a lesser extent than Brazil.
Regarding the internal market, the top four global brands of the market are: Massey Fergusson with 25.3 percent, Cnh with 24.2, Valtra with 21.7 percent and JD with 21.2 percent.

CANADA

Canada is aiming for a tie. Following last year's promising results, a slight decrease is being observed for 2014. The same trend has been confirmed

An overview of the worlwide market empasizes the lights and shadows trend. Non all the 'tigers' are really growing up. For instance, Brazil market is experiencing a drastic drop.

In this year's first quarter Chinese manufacturers sold 170,000 tractors over 22 kW, a 9 percent growth compared to the same period in 2013.
India is the second market on the planet. In the first six months of 2014 the sales increase of 4 per cent.
The leader European countries are suffering.
Russia market has seen more than 1,200 harvesters in the first four months of this year.

both in the spring and summer months. Between January and August 2014, 17,400 tractors had been registered, showing a slight fall of 0.7 percentage points. However, as mentioned, 2013 had been very successful, and to be reaching almost the same results confirms this market's excellent health. The decrease for heavy-duty machinery certainly appears to be more considerable (25 percent).

CHINA

In this year's first quarter 170,000 tractors (over 22 kW) should be in the pipeline; these figures confirm a 9 percent growth compared to the same period in 2013 (156,000 units sold). When considering also the machines in the power range of under 22 kW, very popular at these latitudes, the numbers become even higher and more surprising by European standards. Estimates from the first three months of 2014 show 612 thousand units have been put on the market (compared to the 608 thousand between January and March 2013).

CONTINENTAL EUROPE

The leader countries of the Old Country are the ones which have suffered the most from the point of view of production. The overall sales in the continent are not suffering as much due only to the vitality of the so called second class countries (such as Belgium, Portugal, Spain, Sweden).
France, the queen, has closed the first eight months of the year with a very strong 29 percent decline (from over 20 thousand deliveries to less than 14,300 'pure' tractors). In the first six months Germany has struggled to go beyond 17 thousand deliveries, with a reduction of 2 percent. Italy is closing yet another year in a downward trend but is comforted by exports (the sales volume will outclass the 7.7 billion euros of 2013, which already was worth 5.8 percent more than the amount in 2012) Within the top market, only the UK is able to pull it together (more than 8,300 deliveries in the first 8 months of the year, 5.6 percent higher than the same time period in 2013). All things considered, the year 2014 for tractors in Continental Europe should close with a decrease of 5-6 percentage points compared to 2013. Which means an annual drop from 157 to 150 thousand units.

612

Thousand units put on the market on 2014 first quarter. These are the gigantic figures of China. 170,000 are over 22 kW

JAPAN

The land of the rising sun plays a remarkable role also in this sector. 153 thousand tractors were produced in 2013, with almost 51 thousand over 37 kW and as many as 58 thousand under 22 kW. In terms of value and not of units, 32 percent of the production was exported, compared to the 68 percent which was destined to fulfil the requirements of the internal market.
It is highly improbable that in 2014 internal sales will achieve similar results to the previous year. Though in the first 6 months the delivered units were just under 29 thousand (more than half of which under 22 kW) compared to 29,500 of the first semester 2013, the second trimester of this year has seen an abrupt arrest in sales compared to the first.

INDIA

In the medium-long term the outlook remains really exciting for the second market on the planet for tractors (at least in terms of absolute numbers), though 2014 seems to be heading towards a halt. In the first six months of 2014 the sales almost reached 310 thousand units, with an increase of only (by local standards) 4 percent.

RUSSIA

We cannot define it an explosive market, however it is clearly a healthy one. The first semester has closed with just under 22 thousand deliveries compared to 20,800. However it should be mentioned that the spring season appeared slightly slow after the excitement of the first quadrimester sales.
The deliveries of combined harvesters remain stable, hence at very high figures (more than 1,200 units in the first quadrimester). This is possibly the market with the biggest window worldwide on large machines: on average, one large machine is sold every 12/14 tractors.

TURKEY

In the last few years we have got used to the rapid acceleration and equally abrupt halts of the Anatolian Peninsula, unparalleled in any other large market worldwide. The results taking shape in 2014, therefore, only partially amaze us. The first three months closed with a number of registrations that exceeded 10 thousand (compared to 8,300 of the previous year). Hence with a significant increase of 18 percent. Subsequently, a definite decline brought the profit from the first semester down to only 10 points. If this trend were to be maintained throughout the year (although, as mentioned, it is hard to predict), the sales at the end of 2014 would come close to 50 thousand units.

2,8

US exports are suffering, local market is good. In the first eight months the tractors sales reached 141,700 units, plus 2,8%

SOUTH AFRICA

In the last few years some had referred to this market as one with very high potential. Until today, frankly, it appears that those expectations have been largely unmet. In the first 8 months of 2014, the local market has been able to assimilate less than 4,500 tractors (with a 4.9 percent decrease) and only 274 combined harvesters (minus 4 percent). The prediction by the local manufacturers' association is of a possible reduction, on a yearly bases, of between 5 and 10 percentage points, due also to the recent reduction of the price of corn.
As for the main brands present, Europe is widely represented (Italy included) and likewise is America. Everyone is waiting for this country - at the moment equal to about half of Great Britain or a third of Italy in terms of sales - to really become big.

USA

The United States are living a two-sided reality: while exports are suffering, the local market is giving great satisfaction. In the first eight months of 2014 the tractor sales reached 141,700 units (plus 2.8 percent; or just under 4 thousand units more compared to the same period in 2013). The increase was focused on medium and high power machinery (6.3 percent increase for sales under 30 kW, 4.7 increase for deliveries between 30 and 73 kW), whereas the over 73 suffered slightly (minus 8.8 percent). In any case, everything leads us to believe that this will be the best of the last five years in terms of tractor sales in the States. On the contrary, harvesters are suffering a considerable decrease (around 17 percentage points).
As already mentioned, bad news comes from the sales abroad. In the first six months of 2014, exports have seen a reduction of 27 percent (from 6.53 to 4.77 billions of dollars). In particular, sales are suffering in Asia (minus 36 percent), Canada and Europe. Africa and Oceania are also falling. To a lesser extent, Central and South America (around 8 percentage points).

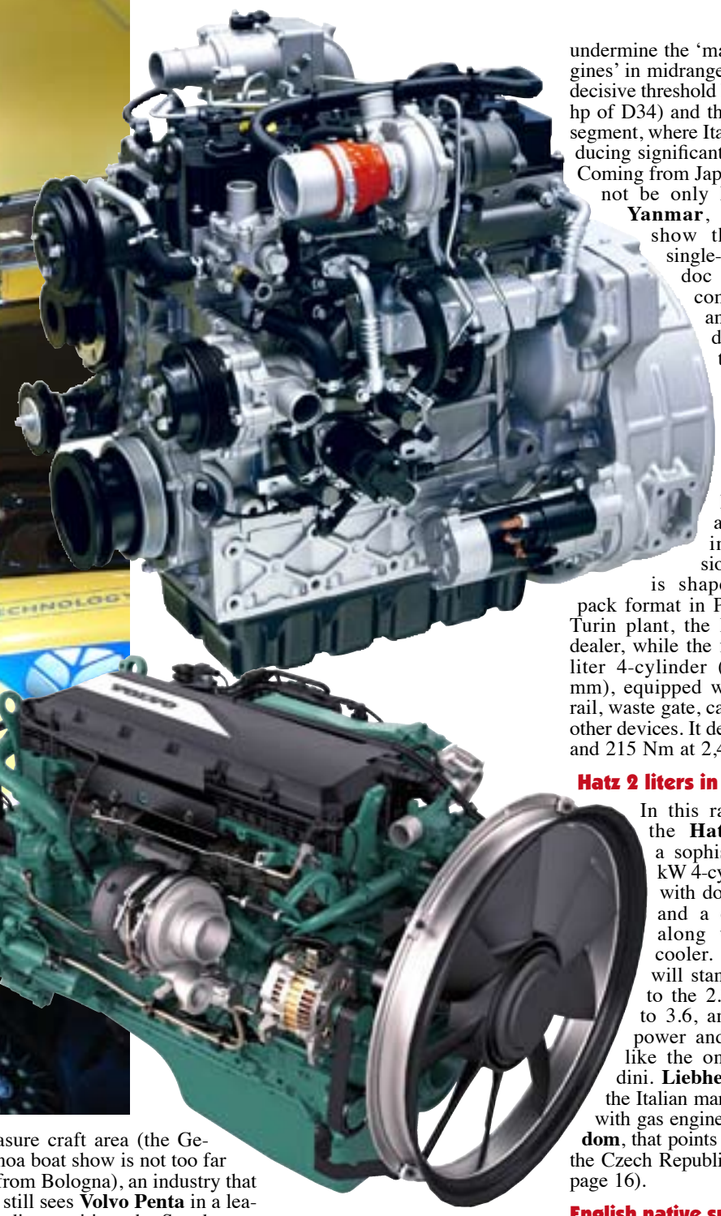
David Peirce

High expectations for Eima 2014

FARMLAND IS ALIVE

Bologna shows a countertrending euphoria and several new products. Above all, the Kohler 3.4-liter, the Fpt Industrial Cursor 16, and VolvoPenta and Doosan Infracore booths. Isuzu introduces the tier 4 final 4L2X

Eima International is a vibrant place for agricultural machinery in the Mediterranean basin. On the right, from top, Doosan D34, Volvo Tad 873 Ve, Isuzu 4L2X and the Diesel of the year 2014, Fpt Industrial Cursor 16.

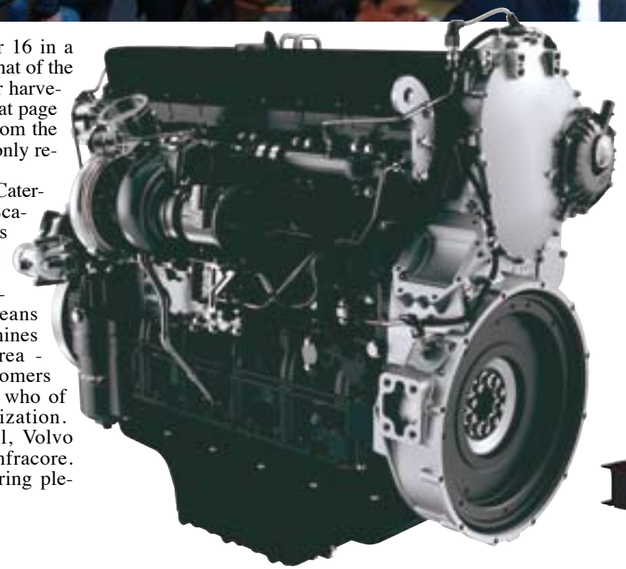


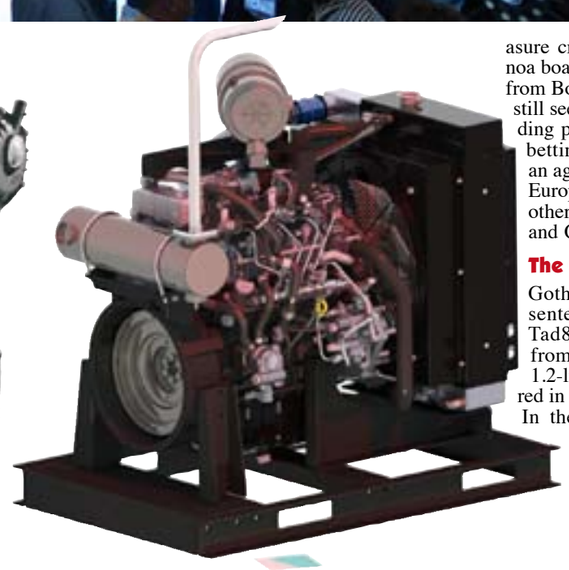
Exhibitors in waiting list and a high level of expectations are attributes almost disappeared from Southern Europe fairs, with rare exceptions. One of these is Eima, highly appreciated by the primary sector both in Italy and in the entire area that overlooks the Mediterranean.

Kohler 100 kW premiere

Alternating Agritechnica in Hannover, the Eima in Bologna hosts the premiere of the Kdi Series 3.4-liter (see page 28), which takes **Kohler** to the 100 kilowatts club. After the Samoter preview in Verona (Italy), where it was awarded the *Diesel of the year 2014*, it is time for the official introduction of **Fpt Industrial** Cursor 16 in a real kinematic chain (that of the New Holland 10.90 Cr harvester. In-depth analysis at page 30). The good news from the fair, however, are not only regarding products.

Beside the absence of Caterpillar, Man, Mtu and Scania, which nevertheless could have interesting words to say primarily on high power range - which essentially means large harvesting machines in the agricultural area - there are other newcomers that enrich the who's who of agricultural mechanization. Two names above all, Volvo Penta and Doosan Infracore. After living the suffering ple-





asure craft area (the Genoa boat show is not too far from Bologna), an industry that still sees **Volvo Penta** in a leading position, the Swedes are betting on agriculture after an aggressive strategy that in Europe brought them, among others, on Agrifac harvesters and Caffini sprayers.

The Gothenburg pearls

Gothenburg will be represented by Tad 572Ve and Tad873Ve that flourished from the investment in the 1.2-liter cylinder manufactured in India along with Eicher. In the spotlight is also scr module, the system on which Volvo has invested in both marine and offroad areas. The urea-based after-treatment technique - and could not be otherwise – is the Trojan horse to force the emission limit, derived as vgt and 'start & stop' from automotive. Directly from Korea, **Doosan Infracore** will show the products introduced at Bauma, ie the modular 600 cc cylinder in 3 and 4 cylinder segmentation and the supercharged 3.4 liters, 4-cylinders, which enters the competition in the compact range. Designed for Bobcat, the D18, the D28 and the D34 undermine the 'mainstream engines' in midrange tractors (the decisive threshold being the 100 hp of D34) and the specialized segment, where Italy keeps producing significant volumes.

Coming from Japan, there will not be only **Kubota** and **Yanmar**, which will show the L series single-cylinder with doc and a Final compliant three and four-cylinder series. The third Japanese striker will be **Isuzu**, which has two picklocks: the 4L2X in Final version and the 4L1 in IIIA version. The latter is shaped in silent pack format in Pitteri Violini Turin plant, the Isuzu Italian dealer, while the first is a 2.2-liter 4-cylinder (AxC 85x96 mm), equipped with common rail, waste gate, catalyst and no other devices. It delivers 46 kW and 215 Nm at 2,400 rpm.

Hatz 2 liters in 4 cylinder

In this range will be the **Hatz** 4H50Tic, a sophisticated 55.4 kW 4-cylinder, 2-liter with doc, waste gate and a egr working along with a precooler. Even **Deutz** will stand out thanks to the 2.9-liter, equal to 3.6, an increase in power and agreements like the one with Landini. **Liebherr** will enter the Italian market primarily with gas engines besides **Tedom**, that points directly from the Czech Republic to chp (see page 16).

English native speakers

Cummins will show the whole Bauma range with the Qsg series, which looks to agriculture with an automotive background that has Sino-American roots. Last but not least, as the saying goes, two brands that rhyme with tractor: **Perkins** and **John Deere**. The British have completed the transition to Tier 4 Final, trying to regain places at Eima. Americans are strongly oriented to the rich captive audience, but they can have their say under the bonnets and, above all, in some special applications and generators area.

Gabriel Prince

Compact scr and more kilowatts for the higher ratings. Same 'flies' in tier 4 final.

Same Farmotion becomes Ke with the Tier 4 F

COMPACTING FOR THE FINAL

The unavoidable scr does not alter the Farmotion layout, which gains kilowatts both on the 3 and 4 cylinders. The final debuts on the Same tractors. And not only

Compared to the tier 4 interim launch, something has changed for the 962 cc cylinder displacement: the 6 cylinder is remained just a drawing – for the moment: Same is most definitely not inclined towards high powers but their intentions to complete the range is still present. Furthermore a 'layout friendly' scr module and the fatidic 100 kW have appeared on the 4-cylinder. The Same modular engine is fulfilling the pre-established terms, and it crosses the finishing line confirming the 2 valves, driven by pushrods and rockers, waste gate, 2,000 bar common rail by Bosch as well as sensors, pump and injectors, the inclination has gone from 27° to 13°.

No dpf for the soot

Still no trace of the filter, after all the problems of the particulate are dealt with by raising the bar of the injection pressure and cutting down on consumption and oil leakage, responsible for a considerable percentage of the formation of soot. The external cooled egr and the doc give the scr a hand with the unburned material. For a better understanding of the engineering work carried out in Treviglio (not far from Milan) a clear example are the preserved spaces despite the stress. One in particular, the intercooler, which has grown in dimension by 22 percent between the second and fourth emission stage to preserve adequate levels of efficiency. And the inevitable peak of heat due to recirculation that would have impacted the heat exchanger cores.

The Farmotion, on the other hand, reaffirms the call for a long, slimline agricultural engine, with a short stroke structural monoblock that allows for a reduced turning radius. The intake hoses have been shortened, and there are single cylinder heads, replaceable cylinder liners, hydraulic tappets. To optimise the elements that weigh on the final price and life cycle costs – to which consumers pay more and more attention, where legislation is pushing towards electronics – the components have been rationalised: several of the parts involved in the combustion process are interchangeable, like the head, injectors, pistons, liners, egr and ecu. Not only. Some of the mechanical elements – for example con-rods and bearings - , sensors and more are common to the 3 and 4 cylinders.

Soon Farmotion will also show itself in a different livery to that of Same.

Fabio Butturi

FARMOTION GROWTH

Brand Model	SAME KE 3	SAME KE 4
I. D.		
B x S mm - S/B	103 x 115 - 1,12	103 x 115 - 1,12
N. cil. - dm³	3 - 2,88	4 - 3,85
Maximum power kW - rpm	75 - 2.000	**100** - 2.000
Mep at max power bar	**15,9**	**15,9**
Piston speed m/s	**7,7**	**7,7**
Maximum torque Nm - rpm	370 - 1.600	**540** - 1.600
Mep at max torque bar	**16,4**	18
% power at max torque (kW)	39,3	**44**
Torque at max power Nm	363	**480**
% power at max torque (kW)	82,7 (62)	90,5 (**91**)
Work range rpm	**400**	**400**
DETAILS		
Specific power kW/dm³	**25,9**	25,9
Specific torque Nm/dm³	128,1	**140,2**
Areal spec. power kW/dm²	30	**30,03**
RULES AND BALANCE		
Dry weight kg	420	540
L x W x H mm	621x611x679	751x611x679
Volume m³	**0,26**	0,31
Weight/power kg/kW	5,6	**5,4**
Weight/displacement kg/dm³	145,5	**140,3**
Power density kW/m³	288,5	**322,6**
Total density t/m³	1,62	1,74

PERRONE TAKES THE LEAD

His name is Vincenzo Perrone, his cv is that of an engineer loaned to public relations with the oems, he comes from John Deere and is the new Ceo at Lombardini which at Eima Bologna is unveiling the 100 kW 3.4 litres

From business manager at John Deere Power Systems to a role of higher prestige (and responsibilities) as Ceo of the Diesel Division of Kohler Engine. This is the recent history of Vincenzo Perrone, a trained engineer, who is bringing into Reggo Emilia (Italy) twenty years of management experience developed with the oems. His knowhow in this sector will represent one of the focal points of what, to this day in Europe, is still known as Lombardini. One of the quintessential brands of the agricultural sector, it is about to emerge from the medium-low power sector, and will officialise the longed-for 3.4 litre engine which will deliver up to 100 kW, dispelling the myth that relegated the engines from Reggio solely to use in specialised and gardening machinery (in the context of the Eima). During this phase, new horizons will finally be opened.

Q&A

* Will Kohler try to catch up in the agricultural sector or will it change its focus towards the earth moving machinery?

«The agricultural market is more piecemeal and vertically integrated than it used to be. Several agreements are being established with manufacturers from North America, an area that offers great opportunities: from specialised to telescopic machinery, diggers, chippers, motor pumps, power units and generators».

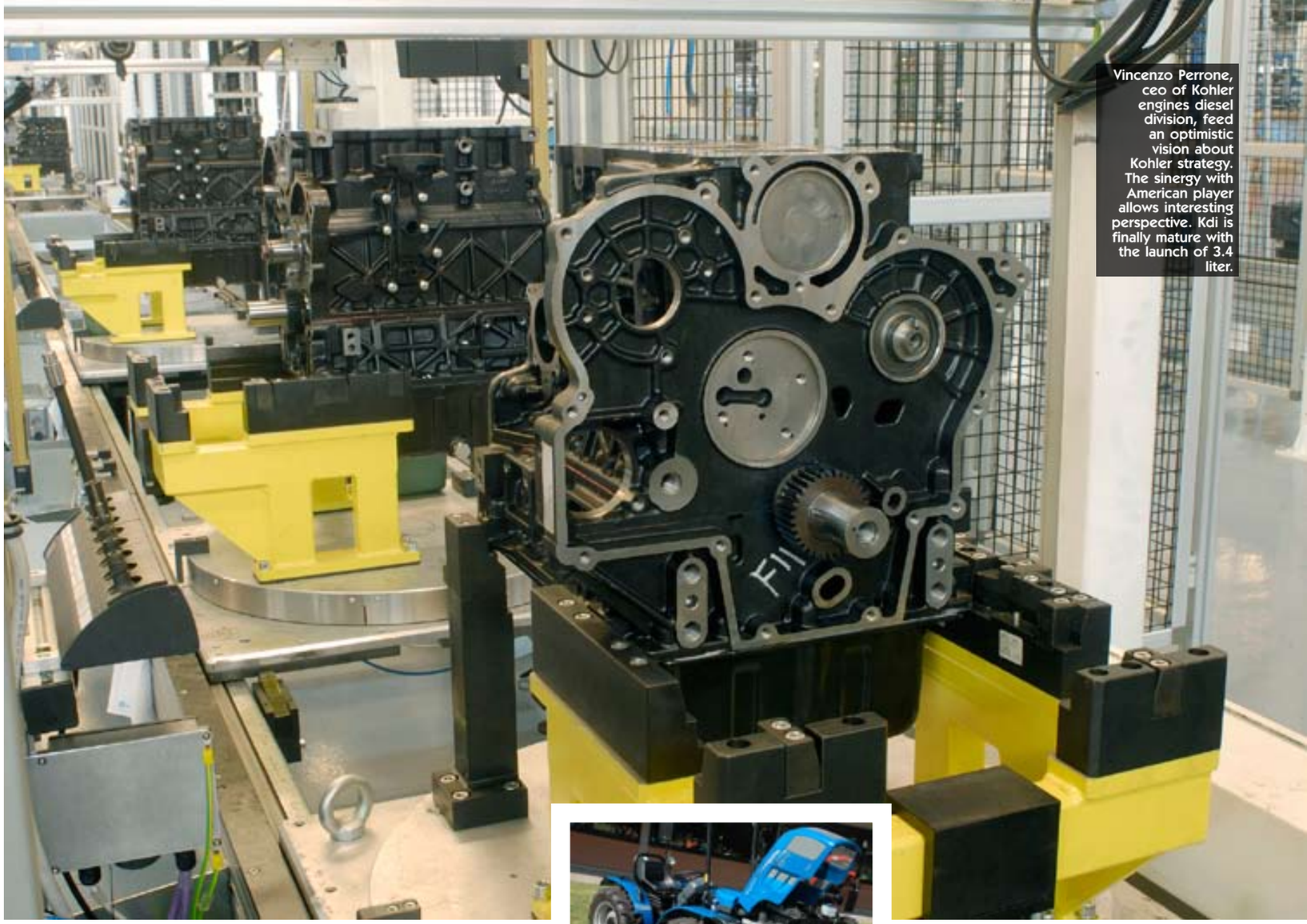
These are Vincenzo Perrone's considerations, as he points out: *«these are the advantages of the synergy between Kohler and Lombardini, certainly generating a 'win-win' situation. Lombardini has put its technology on the table and Kohler has brought its capital and marketing connections in North America».*

* Another break with the past at Reggio is the emerging identity of captive supplier.

KDI MAKES 100

Anticipated like a true messiah, the 3.4 litre engine has finally been revealed on the Eima stage. A solid swept volume, which jumps from the Kdi 1903's 620 cc to the 840 cc (more precisely, 0.8375 litres) of the Kdi 3404 (BxS 96 x 116 mm) relegating the 3 cylinder to the low entry range. In fact, the 3.4 litre is strictly a 4 cylinder engine and will be devoted to legitimate Lombardini in the Kohler era, enabling it to reach the threshold of 100 kW. The firm in Reggio Emilia will now not only work on isodiametric tractors, mini excavators, small garden and small telescopic tractors, but will hinge on the 100 kW to wheedle higher performing machines (with interesting figures such as the 56-130 kW range of emission for the earth moving machinery and open field tractors around 70 horsepower). Other features include a 2,000 bar Denso common rail with G3S solenoids, four valves per cylinder operated by pushrods and rocker arms, wastegate and aftercooler. The all-rounder control unit also regulates the dialog between can bus and electronic peripheral appliances. The reluctance towards the particulate filter was worth the Diesel of the year 2012, re-circulation and catalyst complement the 3B equipment.

Here, on the left picture, the Tcr 2504 Kdi, 2,4 liter, both mechanical and electronic, under 56 kW. Down, the new born, Tcr 3404, able to reach up to 100 kW and 500 Nm.



Vincenzo Perrone, ceo of Kohler engines diesel division, feed an optimistic vision about Kohler strategy. The sinergy with American player allows interesting perspective. Kdi is finally mature with the launch of 3.4 liter.

«Sdmo (Société de distribution des moteurs de l'ouest) and Kps (Kohler power system) are making important contributions in the power gen sector, especially in prime power».

* Besides the leadership, what else is going to change in the organisational chart?

«Lombardini is and will remain independent» was the concise response.

* Regarding the differences between John Deere and Kohler, his frank comment: *«There are two important factors from my perspective: the first is to sell engines, the second I cannot recall…*

Machine efficiency is becoming more important in this context» the new Ceo continues *«the Kdi bring with them a competitive advantage for the oem, both in terms of performances and in terms of customer support. As for the latter, we are carefully merging the customer service networks from the US and EU, and perfecting the web support for dealers' access to technical files».*

About the possibility of renovating the manufacturing, Perrone reassures: *«nothing will change. The Kdi will remain our focus, however we will carry on manufacturing all the other ranges for non-emissionized markets. Rieti* - close to Rome - *will also remain in the marine sector».*

The Kdi has earned the IIIB without dpf. Will you have to rethink this arrangement?

«In view of the fifth step, the particulate filter is a viable option, but we won't necessarily adopt it».

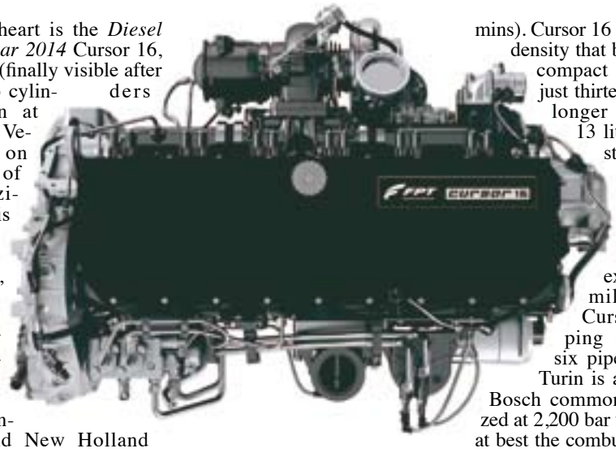
For the Tier 4 final the scr has been the winning card.

And what now? The European commission has just regulated the number of particulates released by the exhaust and it will be hard for anyone to omit a dpf. Kohler managed to do so for the IIIB stage. The future is a gamble.

Cursor 16 for the Cr 10.90 combine. A Cnh Industrial story

A VERY BIG HEART

Conceived in the name of power density, the Diesel of the year 2014 winner Fpt Industrial 16 liter is fitted in its waste gate version on the Cr10.90 combine, the largest on the market, that shares the same dimensions of the Cr 9.90



Its very heart is the *Diesel of the year 2014* Cursor 16, its body (finally visible after the 'bare' 6 cylinders was shown at Samoter in Verona and on the pages of our magazine *Diesel*) is that of the queen of Cr combines, the 10.90. The common family is Cnh Industrial, which owns both Fpt Industrial and New Holland brands. The result is the first class 10 combine in the world, which ranks in the exclusive family of more-than-650 hp power (equivalent to 478 kilowatts, a goal reached thanks to a margin of just 2 hp). Behind the scenes of this exploit stands the Cursor series 15.9 liter, a six-in-line, overhead camshaft, blow by, intended to climb the rankings of its direct competitors as soon as the two-stage version will be released, capable of 630 kW and 3,500 Nm. The C16 fitted on the Cr10.90 features a fixed turbo with waste gate and ball bearings instead of oil bearings to reduce the clearance between impeller and case thus improving the transient response. Today the highest calibration totals 570 kW and 3,320 Nm, near the V8 Man, which scores a few decimals higher in terms of specific power and just three per cent over in terms of torque/displacement ratio. Only Scania can match these figures, with a gap of just 4 kW and 137 Nm, while the gap with the two Americans is much larger (the average power density being 25 percent higher compared with Cat and Cummins). Cursor 16 shows a power density that benefits from a compact engine block, just thirteen millimeters longer compared to 13 liters. Fpt Industrial designed a narrow engine 'overhang shaped', even vertically, since its stroke exceeds only six millimeters the Cursor 13. Pumping diesel in the six pipes organ from Turin is a work for the Bosch common rail, optimized at 2,200 bar to homogenize at best the combustion.

Duble re-entrant bowl

To support this key feature, the double re-entrant bowl piston allows to trigger two different turbulences inside the chamber. Combustion exhausts are processed downstream through the doc, compatible with the Hi-eScr formula, which relies entirely on technical urea. This solution is rewarding both Cursor and N series, relieving the thermodynamic parameters from exogenous stresses without affecting the specific curves profiles and lowering the heat. No changes in the radiant masses and overall dimensions are required, enabling the 10.90 to faithfully reproduce the 9.90 silohuette, which precedes in the hierarchy of Cr range and is equipped with the Cursor 13 (12,87 liter/500 kW).
While power density proved to be strategic in the award winning, the Fpt Industrial engineering worked on materials, molding head and cylinders in compact graphite (Cgi) and using the steel - made pistons. But it's not only the engine that makes the Cr series combines extraordinary. Twin rotor is the technology that can make use of the optional Dynamic feed roll device, which compensates the roller power absorption with flow regularity and increased feed rate - electronically adjustable – allowing a better rotors feeding and protection against rocks.

Productivity improvement

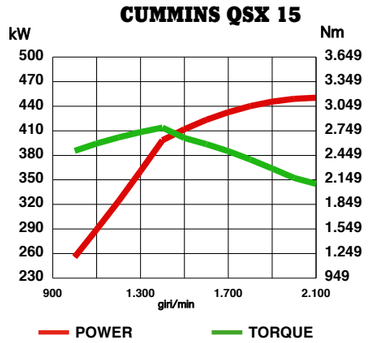
New Holland has thus declared a productivity improved up to 15 percent, even in wet conditions. This result also comes from the adjustable blades of the Twin pitch axial rotors, which allow to vary the configuration for small grains, corn or rice, and SmartTrax rubber tracks with Terraglide suspensions, compatible with the coupled independent suspension of the four support rollers and a 40 km/h road speed. The footprint is higher than the past combines, 1.49 square meters for 610 mm model and 1.77 mm for 725 mm model. **Fabio Butturi**

NEW HOLLAND CR 10.90 IN PILLS

Marca Modello	New Holland Cr 10.90
	
Header width m	9.15/12.500
Rotor (diam/length) m	0.559/2.638
Cleaning area m²	6.5
Grain tank l	14.5
Diesel/AdBlue tank l	1,300/120
Unloading speed l/sec	142

DIESEL OF THE YEAR 2014

The Cursor 16 won the ninth edition of Diesel of the Year. The prize is awarded by the editorial board of *Diesel* magazine to the most innovative engine.



Brand	Cummins
Model	**Qsx 15**
I. D.	
B x S mm - S/B	137 x 159 - 1,16
N. cil. - dm³	6 - 14,06
Maximum power kW - rpm	456 - 2.100
Mep at max power bar	18,9
Piston speed m/s	11,1
Maximum torque Nm - rpm	2.750 - 1.400
Mep at max torque bar	25,1
% power at max torque (kW)	50,3
Torque at max power Nm	2.068
% power at max torque (kW)	88,5 (403)
Work range rpm	700
DETAILS	
Specific power kW/dm³	32,4
Specific torque Nm/dm³	195,5
RULES AND BALANCE	
Dry weight kg	1.365
L x W x H mm	1.443x1.032x1.298
Volume m³	1,93
Weight/power kg/kW	3
Weight/displacement kg/dm³	97,1
Power density kW/m³	236,3
Total density t/m³	0,71
Displacement/volume dm³/m³	7,29
DIESEL INDEX	7,6

THE SUPERCHARGED

In its power range the Qsx 15 looks from bottom to top Deutz, Fpt Industrial, Man, Scania and Volvo. When it comes to specific performances (power and torque), however, the results are top class: the 33.67 kW per liter are surpassed (and not that much) only by Man (thanks to the almost retired V8, not the latest D38, currently designed only for made in Munich trucks) and Fpt. That's because of two main reasons: among the 500 - 600 kW range and roughly 15 liters or a little more, the Qsx 15 is the smallest one with its 14.9 dm³ (considering a range that reaches the Scania 16.3 liters). The second reason is to be found in the Cummins devices that make up the backbone of the 6-cylinder: the variable geometry turbine and the common rail. The latter is known to all operators, and is the Xpi which is also used in Södertälje by Scania, companion of Columbus in the design of common rail high-capacity injection, calibrated to 2,400 bar, which was the most powerful for years (currently, including direct competitors of the Dc16 and the Qsx15, the Man D38 reaches 2,500 bar). The vgt with electric actuator is also made by Cummins, which integrates the functionality of these devices into a control unit capable to drive multiple injections and the air pressure in a teamwork that favors timing advance and acceleration. Stresses are high (only Cat has a higher piston speed) but overall dimensions are limited, thanks to the layout of this long-stroke 15 liters conceived to control the engine block extra volumes. The devices used to limit emissions come in full force: dpf works along with egr - scr, which limits NOx both upstream, lowering the temperature, and downstream through urea. The concept mirrors the one adopted by John Deere, which engines are however limited up to 13,5 liters.

An American tractor with big figures and a powerful American engine. It's unusual to find so many kilowatts under a tractor bonnet. These applications are tipically expression of American sizes. For its 9R series top-of-the-range John Deere then chose an engine bigger than its own top-range 13.5 liters

John Deere 9620R & Cummins Qsx 15

AMERICAN STORY

HYDRA CUSHION SYSTEM

Less hop less lope

Accumulators dampen energy from bumps to produce a smooth ride for maximum operator comfort

The new 'Hydra Cushion suspension system' is one of the new key features of the 9620R, and has been conceived to help mitigate the power hop and road lope that can occur when pulling large implements across loose soil and roadways. The hydraulic system consists of suspension cylinders, a control valve manifold, and hydraulic accumulators. Accumulators dampen energy from bumps to produce a smooth ride for maximum operator comfort. The electrical system contains position sensors, solenoids for the control valves, and a master controller for complete automatic control of the Hydra Cushion. The hydraulic and electrical systems work together to maintain a level and vertically centered position of the front differential case in relation to the tractor's chassis, independent of tractor weight or dynamic loading. The system's ability to maintain a vertically centered position provides full suspension travel of 10.16 cm (4 in.). This translates to consistent soil contact for improved power to the ground. The system also dampens the energy from bumps that cause a rough ride. Tractors with the 'Hydra Cushion suspension system' use electronic and computer controls that monitor tractor functions and axle position. Based on those inputs, the electrical system automatically triggers hydraulic functions to raise, lower, or remain static. The front axle has been specifically designed to accommodate additional options, such as a front blade or saddle tanks.

e18 Powershift provides smooth shifting, with an additional automatic mode for Efficiency manager that's designed to increase performances.

Command View

Thanks to the laminated glass and front console barrier, noise intrusion and vibration have been reduced, while the views have been improved even thanks to the possibility to rotate the seat to the right 40-degrees for a nearly unobstructed view of your implement. The cab features the new high - resolution 'Command center' display and the new 'Command arm', giving control of all the key tractor functions like the throttle, transmission speed and direction, scvs and pto. Hydraulic controls utilize fingertip paddle pods for raise/lower and extend/retract functions, while the throttle design incorporates buttons which control Field Cruise speed, and transmission eco settings. Located just to the right of the throttle is the Auto-Trac-activation button and four sequence controls for iTec functions. Behind the iTec sequence controls there are buttons which control the activation and deactivation of differential lock. Differential lock can also be activated by the foot switch on the cab floor.

The Active Command steering option is available on all 4WD tractors. It reduces fatigue and improves line holding and steering feel during transport which boosts productivity.

Large-scale farmers who need to cover a lot of acres under tough conditions need high-horsepower tractors, with high–efficiency hydraulics, total operational control and a large and comfortable cab. And these are the driving concepts of new 9R Series tractors from John Deere, a brand new lineup that features more horsepower across all models and high hydraulic capacity in a durable, articulated four-wheel-drive platforms. These machines are ideal for row-crop applications and large-acre small-grain operations with tough field conditions and hillside terrain, as well as the high-performance demands of the scraper market. The 9R series features 10 models, with the 9620R on top powered by the Tier 4 Final-compliant 15L Cummins Qsx15 engine, capable to deliver the horsepower and torque required for increased machine performance. Let's take a look at the key features of the latest Deere creature.

The 9620 features the new improved 'e18 PowerShift' transmission with 'Efficiency manager' that provides smooth shifting power shift, with an additional automatic mode for efficiency manager that's designed to increase machine fluid productivity.

Efficiency manager allows for Ivt-like operation on the 18-speed PowerShift transmission. With the system engaged, the operator no longer has to manage rpm and gear selection; Efficiency manager does that automatically by shifting up and throttling back depending on the load on the tractor. With the tractor sitting still, in neutral, or once the tractor is in motion, the operator pushes either the F1 or F2 switch on the Command arm to activate the feature. Once Efficiency manager is activated, the operator can set and adjust the desired ground speed by using the thumbwheel on the shift lever. An icon and the desired ground speed will appear on the corner post display once Efficiency manager is activated. The operator can program two ground speeds by pushing either the F1 or F2 switch. The F1 setting will typically be set for field work while the F2 setting will be used for field/road transport. F1 can be set at any speed from 2 mph (3.2 km/h) to 12.6

One of the key features of the 9620R is new improved e18 PowerShift transmission with Efficiency manager that provides smooth shifting power shift, with an additional automatic mode for efficiency manager that's designed to increase machine fluid efficiency and productivity.

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TRACTION FIRST

9R Series Tractors feature a hydraulically operated locking rear differential to assist the tractor in limited-traction conditions. A hydraulically pressurized clutch locks both axles to turn at the same speed for maximum traction capability. This solution improves traction in conditions such as slopes, wet, soft or dry loose materials, and increases side draft control and traction when operating on hillsides, which is important for controlling power hop on side hills. If one wheel begins to slip, the differential lock can be engaged on the go, and the axles are hydraulically locked together for maximum traction. Differential lock can be engaged in two different ways. In Manual differential lock mode, differential lock can be engaged manually using switch on the floor or by manual depressing button on Command Arm. When brakes are depressed, differential lock will disengage. In Auto differential lock mode, differential lock is engaged when tractor is driving forward. Differential lock will disengage when the turn angle meets the disengage wheel angle setting defined by operator or when either brake pedal is depressed. Differential lock will automatically engage when brakes are released or front wheels are turned straight. To simplify end-of-row turns, the differential lock can be programmed to turn on and off in the intelligent total equipment control (iTEC) system sequence of events. Differential lock is engaged by depressing either the manual or full auto switch on the Command Arm and be disengaged by pressing the same activation switch, by touching the brake pedal, or the decelerator pedal. The differential lock on the front axle of double reductions axles tractors activates when brakes are applied.

Functions that require high flow and low pressure can be conbined on one system, while functions that require high pressure and low flow can be connected by remaining system

(20.3 km/h) mph, and F2 can be set at any speed from 2 mph (3.2 km/h) to 25 mph (40 km/h). By navigating through the Command center, the operator can adjust the rpm shift points while operating in custom mode. The operator can set it to automatic or custom. In automatic mode, the tractor will predict the optimum shift points under load to maintain the highest level of performance and operation. Custom mode allows the operator to adjust how high or low he/she would like the engine rpm to pull down before shifting under load.

In the 9620R, as in the whole 9R series, hydraulic flow has been increased up to 115 gpm (435 L/min) thanks to an optional high-flow hydraulic system, giving these tractors plenty of capacity to handle large implements with ease. The 9620R has two parallel hydraulic systems, which allows functions to be splitted between the two systems. Functions that require high flow and low pressure can be combined on one system (for example, air seeder fans, and planter motors), while functions that require high pressure and low-flow can be connected to the remaining system (for example, implement lift, fold, and constant down-pressure systems). This allows the hydraulic system to run cooler as it prevents both hydraulic pumps from running at high pressure. The system operates with two hydraulic pumps. Pump 1 provides hydraulic flow of up to 58 gpm (215 L/min) to Scvs 1, 2, and 3; these Scvs are useful for operating lift/lower and other cylinder type hydraulic needs. Pump 2 attaches in front of pump 1 and provides hydraulic flow of up to 57 gpm (215 L/min) to Scvs 4, 5 and 6; these Scvs are useful for operating hydraulic motors to drive air/fan or vacuum systems on seeding/planting equipment. All Scv oil returns to one common hydraulic reservoir. This system is recommended for agricultural implements with continuous flow requirements. When maximum hydraulic pump capacity is reached, multiple functions will continue to operate at the same proportional flow rate.

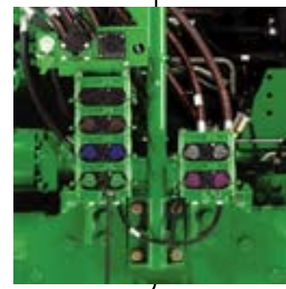
Beside a new engine, high flow hydraulics and advanced management systems, the 9620R features some of the latest innovations introduced by John Deere in its lineup. An industry exclusive feature is the 'Hydra Cushion' suspension system. Located on the front axle, Hydra Cushion mitigates power hop and road lope, allowing all of the horsepower to get to the ground for a high level of traction. Another new feature is the Command View III cab, providing increased operator comfort and ease of operation with a redesigned Command arm, featuring a John Deere '4600 Command center' display for convenient control of tractor functions and settings.

Comfortable imputs

This puts everything needed to do the job at the operator's fingertips while sitting in a seat that swivels 40 degrees to reduce strain when viewing rear implements. The new 9R/9RT series comes with a new premium led lighting package for brilliant nighttime work illumination. Optional 'Active command' steering provides improved line hold and steering feel at high speeds (26 mph transport speed) and reduces steering effort in the field. **Robert Underwood**

SELECTIVE CONTROL

The 9R and 9RT Scraper series tractors feature controller area network (Can) controlled electrohydraulic Scvs that provides precise adjustability of hydraulic flow, enabling operators to fine-tune flow rates for any application. Each Scv has its own controller making field installing additional Scvs simple. All hydraulic settings are adjusted through the Command Center, that offers a simple way to monitor and adjust hydraulic flow settings. By navigating to the Scv settings page in the CommandCenter display and pressing the hydraulic shortcut key, the operator can select which Scv to adjust and set it to the appropriate time and flow rates. The hydraulic flow rate settings can range from approximately 3.4 L/min (0.9 gpm) to 132 L/min (35 gpm) and up to 159 L/min (42 gpm) for tractors equipped with the 19.1 mm (3/4 in.) couplers. The CommandCenter on 9R and 9Rt Scraper also has the ability to view and adjust Iso implement settings that are connected through the tractor's Iso implement connector. 9R and 9Rt Scraper have color-coded Scv levers on the Command Arm and dust covers on the valves. This enables the operator to more easily identify the correct Scv on the rear of the tractor and corresponding control lever on the Command Arm with what is displayed on Command Center.



Designed for high-power heavy loads that require full horsepower, the heavy-duty pto features a safety start system, internal lubrication with oil-cooled plates and a shaft that can be slightly rotated or indexed to aid in drive hookups. All 9R and 9Rt Series Ag Tractors feature a fully-independent 1000-rpm Pto available as a factory or field-installed option, with full-power capability for maximum utilization (9R and 9RT Series Tractors derate Pto hp when tractor is stationary). The 9R Series tractors utilize an electrohydraulic Pto-engagement switch to activate the optional 1000 - rpm Pto.

With electronic draft-sensing relays and intuitive electro-hydraulic controls, the 3-point hitch with Quik-Coupler provides fast, smooth, accurate hitch corrections. Easily adjustable lift links ensure productivity in the feld. The 9R Series offers two different hitch options, 6,940 kg and 9,071 kg.

A front weight-mount kit utility box bolts on easily without compromising headlight visibility or tractor functions, allowing to keep essential items within reach without taking up valuable cab space.

EUROPE IS NOT FAR AWAY

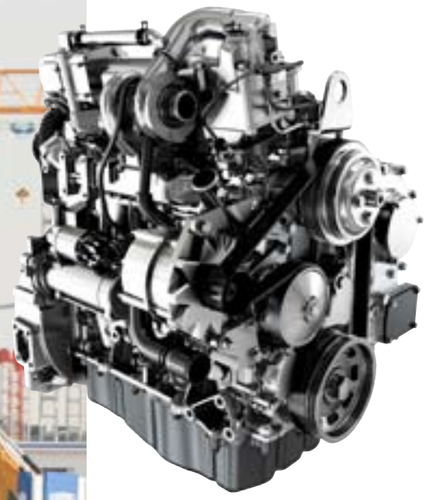
Well in the running for becoming the institutional fair for construction in the complex setting of China, Bauma will host large foreign industries such as Kohler, Fpt Industrial, Volvo Penta, Deutz, Mtu and Yanmar and joint ventures like Shf and Dalian

The Bauma organisational 'war machine' is responsible for the constantly growing trend of the biannual exhibition in Shanghai (from the 40 thousand sq.m. of 2002 to the 300 thousand of this year's edition, the seventh), stretching the limits of the most crowded events in China, which do not always meet the requirements of the explosive manufacturing industry. No better occasion, then, to have a closer look at what is going on in the Middle Kingdom. This is clear for some Western brands like **Kohler**, which will bring the Kdi family and launch the 3.4 litre engine in the 'construction scenery' for the first time. Following their appearance at the Eima in Bologna (Italy), a few km from the headquarters of the diesel division, the black multi-cylinder engines are displayed both with a cylinder displacement of 620 cc, three and four cylinders, which was established in 2011, and in the newly born four-cylinder with a 840 cc cylinder displacement, which has brought Lombardini beyond its usual target market to reach 100 kW, the top of the range for Kohler.

Kohler Kdi series

The two have in common the 4 valves and egr. The common rail, that for Kohler is the Denso 2,000 bar, is obviously the element that differentiates mechanical engines (for non emissioned markets), equipped with rotary pump, from electronic engines. The mono-cylinder Kdi15 that substantiates the bulkiness of the Ld, change the injection pump and air and oil filters, and soundproofs the recoil pulley.

Again from Italy, **Fpt Industrial** turns up with the second *Diesel of the year* displayed here, after the Kdi: the F32, a four-cilinder, semi-uniflow with crankcase-mounted camshaft and 2 valves per cylinder, available both with mechanical injection (rotary pump) and with common rail, and fixed turbo. The 4.5 litre of the N-series (BxS 104x132 mm) will impress the audience with a 1,600 bar common rail and counter-rotating mass incorporated in the drive shaft arms, a cooled-egr (the scr is on the Tier 4 F). Of



cylinder block, replaceable cylinder liners, overhead camshaft, 4 valves, waste gate and to certify its maturity (meaning that it has fulfilled its legal obligations) the after treatment with urea, a must since 2014. The common rail, on the other hand, is present only on the 7.7; the 10.8 displays electronic pump injector units, a trademark of the Swedish company. Maximum torque curves range from 160 to 235 kW (1,060 – 2,310 Nm) on the small engine and from 235 to 285 kW (1,581 and 1,938 Nm) on the bigger one.

Deutz and Dalian

Deutz appears on the scene both with the head office in Cologne and also with the joint venture **Deutz Dalian**, for which the Chinese contracting party is the omnipresent giant Faw. Initially established for vehicular applications, since 2011 it has leapt into the off-road scrum and deploys the 3.16 litre C-series as catalog entry and then follows with the 6.6 litre E-series. The F series appears segmented (4.7 – 7.1 – 8.1 and 8.4). The Deutz range, the 4 and 6 cylinder Bfm, duplicates, with cylinder displacements of 1 and 1.2 litres. Germany again, with **Mtu**, orchestrates the operations in China from Shanghai and Suzhou, on the Blue River, and makes the 2000 series for power generation redundant by producing in Datong both for stationary and moving applications.

Yanmar, **Kubota** and **Isuzu** will bear the flag with the rising sun.

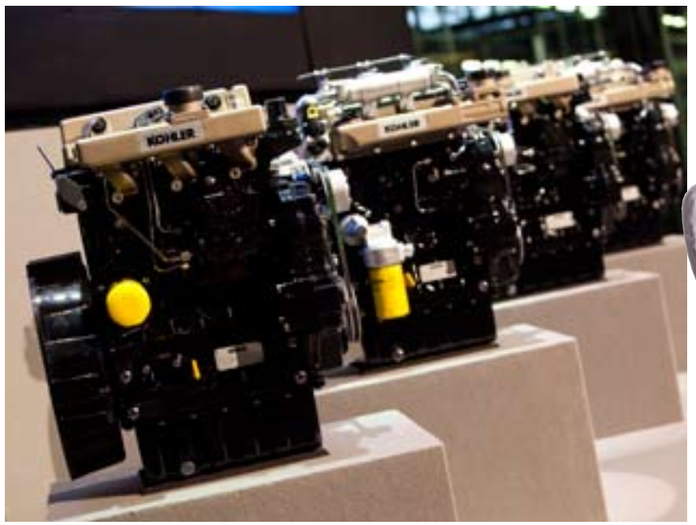
Michael Hu

AVAILABLE COMPONENTS

Amongst the familiar elements to *Diesel* readers, we found **Federal Mogul**, that in Shanghai emphasises a strategy strongly orientated towards saturated and emissioned markets, and will be able to find great ways to penetrate into the Far East: freeing alloys and other materials from lead. The lead-free version of the self-lubricating material for bearings 'deva. bm' is in the spotlight with its solid lubricants such as graphite or polytetrafluoroethylene, to reduce friction and consequently the temperature of the surfaces. Federal Mogul supports the competitiveness of these bearings, compared to those in lead, also as far as resistance to wear is concerned.

The Italian **Bonfiglioli** is also present, and it offers a plethora of drives to the earth-moving sector.

Liebherr debuts in the components sector – hydraulic pumps and motors with axial pistons swashplate design and, for the first time on the Asian territory, the common rail for engines up to 5 litres per cylinder designed and manufactured in Bulle (Switzerland).



the Cursor series, there will be the 13 and 9 litre (on its home ground, as it is manufactured in China). Speaking of China, the engines exhibited will be of Italian-French plants but also those originating from the joint venture with **Saic** (Shf), manufactured in Chongqing.

An important name that of **Volvo Penta**, which scores double: 8 and 11 litres in stage IIIA (Tad851Ve and Tad1350Ve) and 8 and 11 litres in Tier 4F (Tad873Ve and Tad1179Ve). For the emissioned sector, a 6-cylinder architecture with a different cylinder displacement (BxS 110 x 135 mm for the 7.7 litre and 123 x 152 for the 10.8), cast iron

Tier 4 Final under 56 kW and 3 liters

CHALLENGE FOR THIRTEEN

Far from the EU clutches, they're subject to the US Epa. A trio made by a 3 cylinders, the Fpt Industrial and Vm Italian twins and John Deere. Five from the Far East, four are samurai, one is Korean. Isuzu is the oversized

It is an army that swelled like a river in flood and enlists 3 and 4 cylinders engines with an output just below the decisive 56 kilowatts threshold, regulated in North America but still not subject to Stage IIIB standard and its Stage IV evolution, which requires a 0.4 g/kWh NOx limit for engines between 56 and 560 kW. A legislative gap that the European Union is about to fill after 2020 (it will be really after 2018, as the recent rule say), a year full of expectations, from exhaust soot numerical reduction (current regulations control the volumetric index) to CO_2 emission. The selection criteria used for the compared units cover the entire 2 liters range, from the Hatz 1.95 liters to the Deutz 2.92 liters.

The goal of this choice is to find a balance between the limit of regulation requirements, the need for a relatively balanced framework in terms of weight and size and the representation of the greater number of players in a field that involves a thousand applications, especially in the construction area.

Among the recent entries stands out the Fpt Industrial break-in

European technology leads this comparison. Basically, it's a challenge between Old Country and Asian continent. Some engines features dpf, egr is a must. Kohler and Yanmar double the valves. Hatz gains the best specific values.

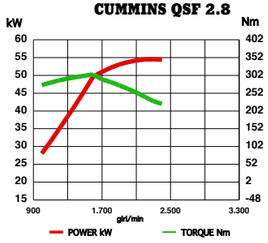
that set up the collaboration with its sister company Vm Motori, that fully entered into the FCA group (Fiat Chrysler Automobiles). Vm Motori has consolidated competences in the industrial area that can integrate with the Fpt line-up, even if the Cento factory (Italy) is mainly committed to FCA automotive engines.

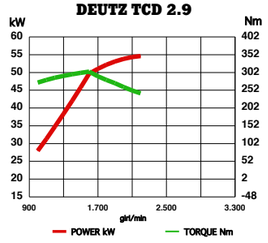
The 3 cylinders return

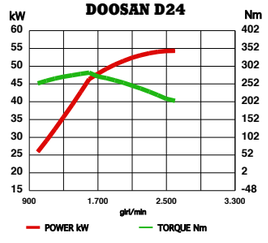
The 3 cylinders group underlines the strategy change adopted by the engineers regarding segmentation and numerically legitimates the 3 cylinders in the middle-low power range. This group includes players such as the one from Turin and its alter ego from Ferrara, the Vm R753, and John Deere that proposed again the 3 cylinders at Bauma. We're not that far from one liter per cylinder, a must in the offroad range. Sprung from the need to customize the compact range for captive, that sees Yanmar as a key partner, it carries out its role without involving a completely new platform that would be vulnerable in the en-

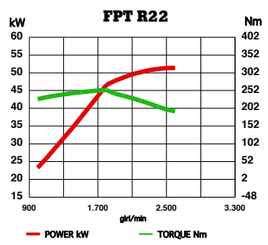
COMPETITION IS COMPETITION

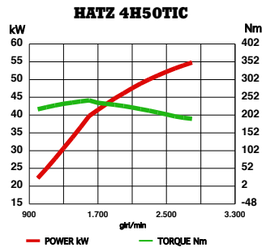
Brand Brand - Model	CUMMINS Cummins QSF2.8	DEUTZ TCD 2.9	DOOSAN D24	FPT INDUSTRIAL R22	HATZ 4H50TIC	ISUZU 4JJ1T	JOHN DEERE EWX 2.9	KOHLER KDI 2504T CR	KUBOTA V2607CR	MITSUBISHI 4CJ	PERKINS 404F-22T	VM R753	YANMAR TNV86T
I.D.													
B x S mm - S/B	94 x 100 - 1.06	92 x 110 - 1.20	90 x 90 - 1.00	94 x 107 - 1.14	84 x 88 - 1.05	95 x 104 - 1.10	106 x 110 - 1.04	88 x 102 - 1.16	87 x 110 - 1.26	86 x 95 - 0.00	84 x 100 - 1.19	94 x 107 - 1.14	86 x 90 - 1.05
N, cil, - dm^3	4 - 2.77	4 - 2.92	4 - 2.29	3 - 2.22	4 - 1.95	4 - 2.99	3 - 2.91	4 - 2.48	4 - 2.61	4 - 2.20	4 - 2.21	3 - 2.22	4 - 2.09
Maximum power kW - rpm	55 - 2,400	**55.,4** - 2,200	55 - 2,600	52 - 2,600	**55.4** - 2,800	52 - 2,000	55 - 2,200	55 - 2,600	53 - 2,400	44 - 2,500	45.5 - 3,000	50 - 2,600	44 - 3,000
Mep at max power bar	10.1	10.5	11.3	8.2	12.4	10.6	10.5	10.4	10.3	9.7	8.4	10.6	8.6
Piston speed m/s	8	8.1	7.8	9.3	8.2	7	8.1	8.8	8.8	7.9	10	9.3	9
Maximum torque Nm - rpm	300 - 1,600	300 - 1,600	280 - 1,600	250 - 1,800	240 - 1,600	255 - 1,500	**304** - 1,600	299.9 - 1,500	235 - 1,500	-	192 - 1,700	250 - 1,000	180 - 1,600
Mep at max torque bar	13.9	13.2	15.7	10.8	15.8	10.9	13.4	15.5	11.5	-	11.1	14.4	11
% power at max torque (kW)	44.4	44.4	40.8	37.9	2.9	38.9	**45.1**	44.4	34.4	-	32.1	40	30.8
Torque at max power Nm	216	235	206	196	186	**245**	235	206	206	-	147	186	137
% power at max torque (kW)	91.5 (50)	90.8 (50)	85.4 (47)	90.7 (47)	72.6 (40)	77.1 (40)	92.7 (**51**)	85.7 (47)	69.7 (37)	-	75.20 (34)	52.4 (26)	68.6 (30)
Work range rpm	800	600	1,000	800	**1,800**	500	600	1,100	900	-	1,300	1,600	1,400
DETAILS													
Specific power kW/dm^3	19.8	18.8	24	17.5	**28.2**	17.4	18.9	22.2	20.2	19.94	20.5	22.4	21.1
Specific torque Nm/dm^3	108	102.5	122.2	84.1	**123**	85	104.4	120.8	89.8	-	86.6	112.2	86
Areal spec, power kW/dm^2	19.78	20.83	21.65	18.71	**24.95**	18.18	20.75	22.63	22.27	18.5	20.5	24.04	18.97
RULES AND BALANCE													
Dry weight kg	214	237	204	210	173	322	251	267	235	270	228	225	210
L x W x H mm	642x655x718	648x560x685	673x556x690	519x524x723	680x540x595	886x757x762	676x577x956	704x520x715	650x475x680	631x505x651	727x635x772	614x557x723	890x543x766
Volume m^3	0.30	0.25	0.26	**0.20**	0.22	0.51	0.37	0.26	0.21	0.207	0.36	0.25	0.37
Weight/power kg/kW	3.9	4.3	3.7	4	3.1	6.2	4.6	4.9	4.4	6.14	5	4.5	4.8
Weight/displacement kg/dm^3	77.1	81	89.1	**70.7**	88.7	107.4	86.2	107.6	89.8	111.38	102.8	101	100.4
Power density kW/m^3	183.3	221.6	211.5	**260**	251.8	102	148.7	211.5	252.4	211.1	126.4	200	118.9
Total density t/m^3	0.71	0.95	0.78	1.05	0.79	0.63	0.68	1.03	1.12	1.3	0.63	0.9	0.57
Displacement/volume dm^3/m^3	9.25	11.7	8.81	**14.85**	8.87	5.88	7.87	9.55	12.46	10.64	6.16	8.91	5.65
SPECIFICATION													
Emission level													
Injection system	common rail	common rail	common rail	common rail	common rail	common rail	common rail	common rail	common rail	common rail	rotary pump	common rail	common rail
4V egr dpf	waste gate egr ccc	2V turbo afterc, egr	waste gate egr doc	waste gate	waste gate doc egr	egr dpf	2v egr dpf doc	waste gate.	2v turbo dpf	2v egr doc dpf	2V egr doc dpf	2v wg egr dpf doc	4V egr dpf
INDEX													
Torque	10.1	8	12.2	9.8	**19.4**	6.7	8.1	13.1	10.7	-	14.7	17.7	15.6
Performance	4.3	4.2	4.7	3.9	0.5	3.7	4.3	4.7	4.1	-	4.1	4.7	3.9
Stress	7.3	7.1	7.8	6.7	56.4	6.0	7.2	8.1	6.8	-	7	7.9	6.7
Lightness	8.7	9	9.7	8.1	1.4	12.3	10.2	12.2	10.3	-	12.3	11.7	10.8
Density	20.3	23.3	**26.2**	24.3	2.9	9.6	16.6	25.9	24.6	-	13.6	25.8	13.1
DIESEL INDEX	6.6	6.2	7.1	6.2	3	5.6	6.2	6.7	6.2	-	6.3	6.6	6.4

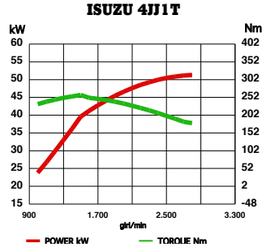


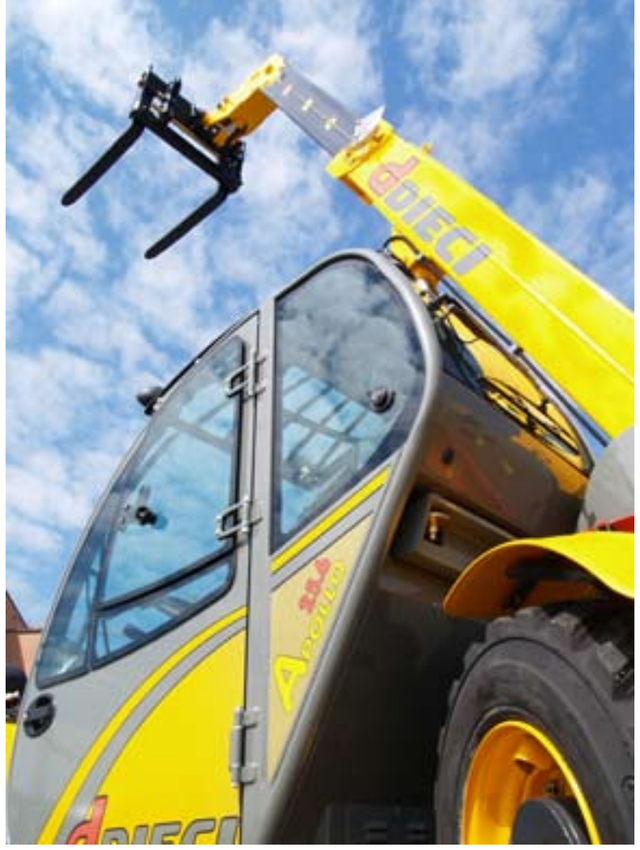












gine market of countries subject to emission standards in a phase of stagnation or slow growth in the best case. The two engines by 'Fiat' are very close (even if Vm Motori and Fpt Industrial belong to two separate areas, respectively automotive and industrial), featuring the well proven 750 cc cylinder from Vm, slightly modified in the power range, and the 1.600 bar common rail with waste gate.
The confirmation of the 2 valves, anything but obsolete considering the reference applications, in general mobile applications with a gross weight ranging from 1,6 to 3,1 tons, is looking for reliability. The approach to the emission issue is quite soft, coupling a maintenance free open filter without back pressure problems with catalytic converter and egr. The uniflow head (in & out manifolds on the same side) and the tunnel engine block allow reduced overall dimension.
John Deere did not quit completely the unique displacement (being the size adopted here 960 cc) but used the same technology of the Final series such as common rail, with a torque that fully takes advantage of the engine displacement (near the limits of the 3 liters threshold) also showing good relative values (the specific torque is just behind the 3 cylinders Hatz, Kholer and Doosan). Even in this case filter, catalytic converter and egr are used.
The Hatz H Series introduced in 2013, the smallest engine of the lot, features 4 cylinders. After a long wait, an ultra – small four cylinders with pto for three hydraulic pumps, camshafts with cogwheel, injectors and pump for heavy loads, 15 percent egr and doc has been released.

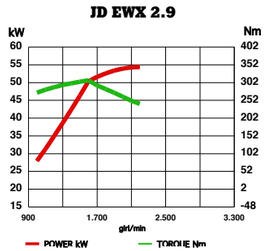
Synonymous of tractor

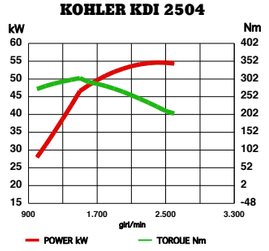
Among the evergreen in this range Perkins - the historic agricultural brand that endured some problems in the osmosis with some historic oems from Peterborough - during the transition to Final stage almost reach the threshold with the 854F that however exceeds in displacement; that's why the brand is represented by the 400 Series flagship, that besides a few adjustments (egr, doc and dpf with a maintenance interval of 3,000 hours) is still linked to its roots, being the 2 valves and the

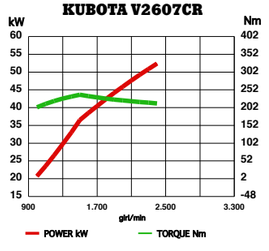
rotary pump the only dissonant note in comparison to the unanimous praised rail. In comparison to the series derived from Fpt Industrial, the 2.2 liters doesn't exceed the 44 kW.
Among the major displacements there are the 2.9 liters Deutz and the 2.77 liters Cummins. The Tcd 2.9 continues his career after the Diesel of the year 2010 prize that followed the stage Final, with successful upward limits (the 77 kW has been introduced exactly one year ago at Agritechnica, not to mention the agreement with Landini). Cummins made his debut in Paris, at Intermat 2012, and started the Chinese phase of Columbus. Engineered to power commercial vehicles (see the 4 valves), it replaces with the Final version the B3.3 and the A series, derived from the Korean Kukje. Featuring an interval power between 37 and 55 kW, aspirated and supercharged, it meets the emission standards thanks to common rail, egr and dpf.
In the 2.5 liters range we find the Kdi Kohler that stands beside its 3.4 liters bigger brother and lines up the second *Diesel of the year* included in the comparison, that was awarded thanks to its ability to meet the emission standards without using any dpf. The 2504T Cr (acronym means - Denso - common rail) features egr and doc only, (the 2.5 liters are also available in mechanical version based on the isodiametric engines made by the Bcs group), 2,000 bar pressure, pre and post injections of the solenoids. The Kdis compete against the Hatz 4 cylinders for the record in the specific values.

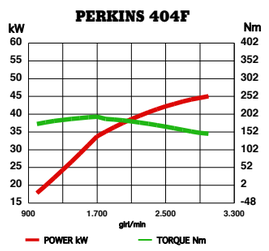
At the end... Far East!

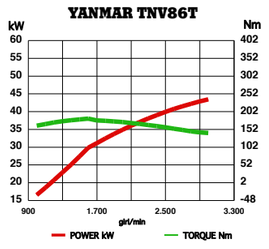
The competitors from the Far East close the competition. Nothing from China, brands such Mitsubishi a little reluctant when it comes to information release, other brands well established in Usa and UE such as Yanmar and Kubota, the maximum weight being Isuzu, but its 2.99 liters is the largest of the parade. The real newcomers from the East belong to the Doosan family - the D Series introduced for the first time at Bauma 2013 that is now pointing to the western oems thanks to its presence on Bobcat machines. The Koreans will join the competition at Eima. ■

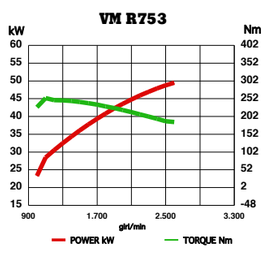












12 to 13 liters offroad

IN THE TRUCK SHADE

There's so many automotive in the 12 to 13 liters range, which aims primarily on forage harvesters and large excavators. The two-stage pushes up Fpt Industrial, Swedes are going well, while Liebherr and the Qsg by Cummins, that dismisses from China the Qsx11.9, enter the competition

This displacement has witnessed the looting of trucks engines from the industrial, and a substantial caution in range innovation except for Cummins.

The Columbus brand have in fact closed the Qsx 11.9 era with the Qsg12 introduced at Bauma 2013, with the Qsm initials. This projects developed with Foton (the Isg twin powers the Auman truck series of the Chinese brand) is manufactured in China, and compared to the Qsx has reduced the stroke and increased the bore, especially tweaking the torque (approximately 6 percent).

Another new entry into the table is Liebherr, which torque curve gets the upper class, while the kilowatt value is far from the top.

DOUBLE STAGE PRIMACY

Brand Model	CATERPILLAR C13	CUMMINS QSG12	DEUTZ TCD 12.0 V6	FPT Industrial CURSOR 13	JOHN DEERE PSS13.5L (7)	LIEBHERR D946 A7-04	MAN D26	MTU 6R 1300	SCANIA DC13 083A	VOLVO TAD1375VE
										
I. D.										
B x S mm - S/B	130 x 157 - 1.21	134 x 142 - 1.06	132 x 145 - 1.10	135 x 150 - 1.11	132 x 165 - 1.25	130 x 150 - 1.15	126 x 166 - 1.32	132 x 156 - 1.18	130 x 160 - 1.23	131 x 158 - 1.21
N. cil. - dm³	6 - 12.5	6 - 12.01	6 - 11.9	6 - 12.88	6 - 13.54	6 - 11.94	6 - 12.41	6 - 12.80	6 - 12.74	6 - 12.77
Maximum power kW - rpm	388 - 2,100	382 - 2,100	390 - 2,100	**509** - 2,100	448 - 2,100	380 - 1,900	397 - 1,900	390 - 1,700	405 - 2,100	405 - 1,900
Mep at max power bar	**18.1**	18.5	19.1	23	19.3	20.5	20.6	21.9	18.5	20.4
Piston speed m/s	11	9.9	10.2	10.5	11.6	9.5	10.5	**8.8**	11.2	10
Maximum torque Nm - rpm	2,381 - 1,400	2,300 - 1,400	2,127 - 1,400	**2,940** - 1,400	2,754 - 1,550	2,600 - 1,250	2,401 - 1,100	2,450 - 1,300	2,430 - 1,500	2,587 - 1,150
Mep at max torque bar	24.4	24.6	**22.9**	29.3	26.1	27.9	24.8	24.5	24.5	26
Torque at max power Nm	1,764	1,735	1,774	**2,313**	2,038	1,911	1,999	2,185	1,842	2,038
% power at max torque (kW)	90 (349)	88.3 (337)	80 (312)	84.7 (431)	99.8 (**447**)	89.6 (341)	69.7 (277)	85.6 (334)	94.3 (382)	77 (312)
Work range rpm	**1,100**	700	**1,100**	**1,100**	**1,100**	650	900	700	**1,100**	900
DETAILS										
Specific power kW/dm³	31	31.8	32.7	**39.5**	33	31.8	31.9	30.4	31.7	31.7
Specific torque Nm/dm³	190.4	191.4	178.6	**228.2**	203.2	217.6	193.3	191.2	190.7	202.4
Areal spec. power kW/dm²	48.74	45.15	47.50	**59.25**	54.57	47.74	53.07	47.5	50.88	50.06
RULES AND BALANCE										
Dry weight kg	1.143	862	995	1.430	1.542	1.341	1.068	1.140	1.050	1.237
L x W x H mm	1,272x996x1,132	1,294x931x1,002	899x925x1,116	1,365x912x1,213	1,547x961x1,542	1,428x903x1,151	1,430x1,255x910	1,375x980x1,260	1,406x889x1,108	1,148x868x1,237
Volume m³	1.43	1.21	**0.93**	1.51	2.29	1.48	1.63	1.7	1.38	1.23
Weight/power kg/kW	2.9	**2.3**	2.6	2.8	3.4	3.5	2.7	2.9	2.6	3.1
Weight/displacement kg/dm³	91.4	**71.7**	83.6	111	113.8	112.3	86	89	82.4	96.8
Power density kW/m³	271.3	315.7	**419.4**	337.1	195.6	256.8	243.6	229.4	293.5	329.3
Total density t/m³	0.8	0.71	1.07	0.95	0.67	0.91	0.66	0.67	0.76	1.01
Displacement/volume dm³/m³	8.74	9.93	**12.8**	8.53	5.92	8.07	7.62	7.53	9.23	10.39
SPECIFICATION										
Emission level	IIIB/tier 4 f	IIIB/tier 4 f	IIIB/tier 4 f	IIIB/tier 4 f	IIIB/tier 4 f	IIIB/tier 4 f	IIIB/tier 4 f	IIIB/tier 4 f	IIIB/tier 4 f	IIIB/tier 4 f
Injection system	meui	xpi	common rail	common rail	common rail	common rail	common rail	common rail	Xpi	common rail
Valves - Air intake - Techno	egr doc dpf scr	scr dpf	egr scr doc dpf	scr doc 2T	egr scr doc dpf	wg scr	egr scr dpf	egr scr	egr scr	egr scr
INDEX										
Torque	**23.9**	10.4	12	**23.9**	11.8	10.1	22.4	10.2	11.6	23.4
Performance	7.9	7	9	11.1	9.6	7.6	9	9.7	8.3	9.3
Stress	264	**11.5**	266.4	346	305.8	12.5	269.5	263.9	275.3	275.1
Lightness	1.2	9.4	1.3	1.2	1.1	14.8	1.3	1.2	1.3	1.2
Density	2.9	**10.5**	3.7	3.2	2.5	9.5	2.7	2.7	3	3.3
DIESEL INDEX	10	8	8.7	10.5	9.2	7.5	8.5	8.6	8.4	9.3

The table on left displays the evolution of the 12-13 liter range. Double stage turbocharger is the key of the Fpt Industrial Cursor 13. The engine from Turin features 500 kW and 2,900 Nm, leaving far behind all the competitors. Some of the players are trying to avoid dpf, to save layout and consumption.

Supercharging is the key

With Stage IIIB all players worked on supercharging.

Cummins and Scania, for example, now use the variable geometry turbocharger.

John Deere goes further with a sequential twin turbo coupling a fixed turbine with a bigger variable geometry turbine.

Man also has two blowers, but in this case the German brand sports two fixed turbines.

Fpt Industrial is the star of 13 liters range, and its 500 kilowatts (38.8 kW is the specific power) seems out of reach. Vgt is an automotive gem, that intercepts the gases according to the engine load by adjusting the intake section. Before continuing, a honorable mention is due to the winner of the tier 4 final, the scr, which monopolized this grid, as all those above 56 kW, overcoming even the reluctance of Caterpillar.

Common rail

At these latitudes, the latest generation of common rail system is shown to insiders all dressed up. John Deere, for example, relies on the Denso one capable of a maximum pressure of 2,000 bar, while Cummins and Scania feature its home made 2,400 bar Xpi, regularly used in its highest range and in the heavy duty applications.

The 1300 Series by Mtu (now Rolls-Royce Power systems) is a well-established 6-cylinder engine with a 2.13 liters displacement and a clean layout, even if the devices used to meet emissions standards don't go unnoticed. Originally derived from Detroit Diesel (DD13) it is now available in Mercedes Euro 6 version.

Mtu vs Deutz

In the competition between German brands Mtu is well appreciated for torque, Deutz for power density. Scania shows its 12.7 which seems to be less aggressive than its 16 liters elder brother (best in class in the truck area).

The Swedish cousins, placed in the same position, declare mep and stress indicators (rpm and piston speed) that reward Volvo. Scania could definitely work on mep to improve acceleration and torque.

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