

DIESEL

international

DIESEL SUPPLEMENT
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AND...
Eurotrans, worldwide tractor
market, the engines of Tractor of the year,
Jcb and Volvo for sprayers, comparisons

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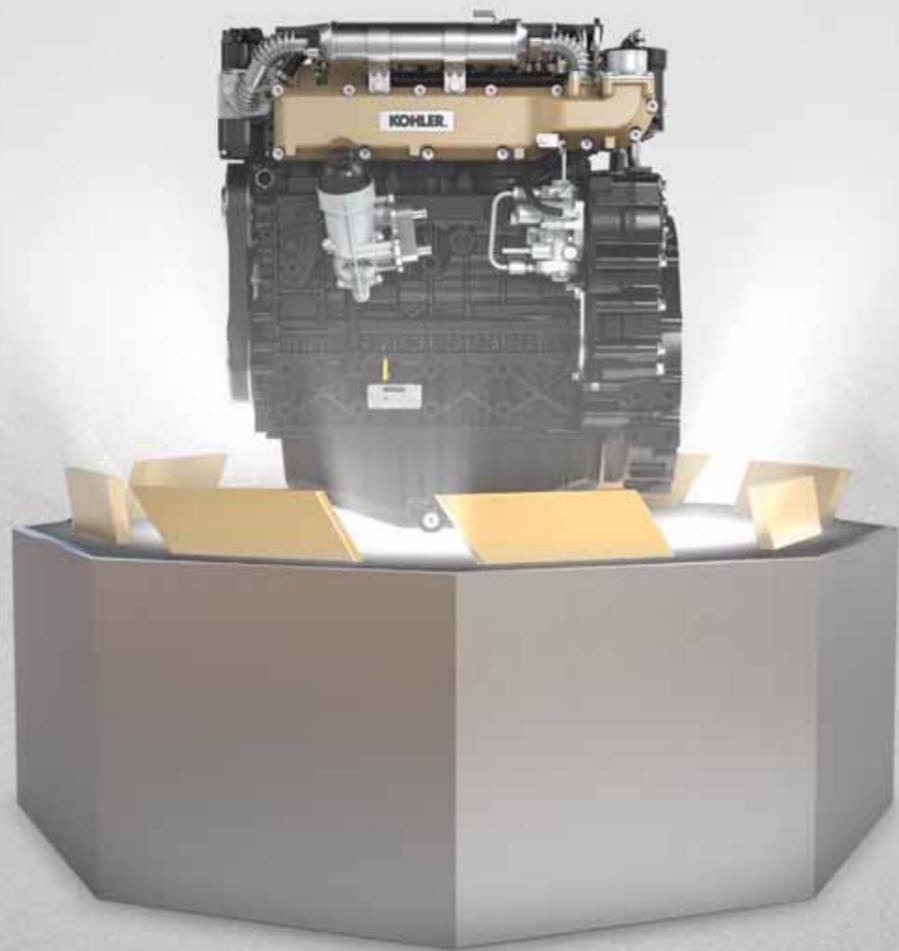
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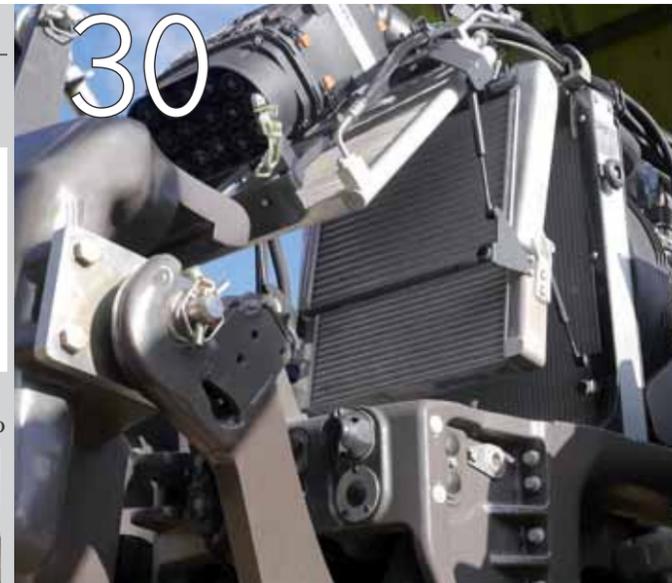
DIESEL international CONTENTS

ABOUT DIESEL

4 The time of Eco rating. Diesel Index is the core



12 Eurotrans: talking with President. Tomaso Carraro



DIESEL @ HANNOVER

FISH-EYE

32

JCB, VOLVO AND THE SPRAYERS

Face to face between two Italian sprayers. Caffini is equipped by Volvo Penta, Mazzotti choose Jcb, in the Geminiani powerpack version



14



14. Tractors: a big depression. China means 35 % of the global market

REPORT

PREVIEW

18. Man: D28 and D38 are ready to experience countryside

HI-TECH

8. Expo Milan: Cursor 16 shines into the New Holland pavillion

10. Teco15: European transmission and gears under the spots

10. Oerlikon: Physical vapour deposition. Coating is a hard work

10. Oleodynamics: focus on the fields by Modena University

10. Others: Schaeffler, Cattini and Carraro Drive tech

TRACTORS&ENGINES

20. High altitude: propulsion for the 'climbers' specializeds

26. Arbos: Chinese in Europe? With Kohler, the Diesel of the year 2015



28. John Deere: Battery boost is the hybrid way

30. Tractor of the year: Agco Power and Man. And Deutz, Fpt, Kubota

COMPARISONS

38. 2 to 3 liters: the smallest are the best performers: Hatz and VW Ps

42. 3 to 4 liters: 12 looking at the 100 kW roof. A balanced grid

46. 6 to 7 liters: take a run-up to performances

Vado e Torno publishing group at a glance. Our passions: trucks...

Mobility revolution: truck, bus, tractors

GREEN INDEX

The collaboration between Trattori, Autobus, Vado e Torno Publishing and LifeGate has spawned Mobility Revolution Truck, Bus and Tractor, the only rating that measures the impact and sustainability of all vehicles for transporting goods, people or for farm work. And the revolution has only just begun ...

On one side, the magazines Vado e Torno, Autobus and Trattori, and on the other, LifeGate, a reference point for sustainable development for people and businesses, a community (LifeGate) it has about 5 million users) and a channel for disseminating awareness and new ways of living, even in the world of transportation.

In 1993, Vado e Torno introduced the Diesel Index, flanked by a huge database amassed since 1989 with Diesel magazine, that has accompanied the release of every new engine, whether automotive or industrial, marine or stationary, to highlight their technological capabilities.

Over the years, LifeGate's Mobility Revolution and its MR rating tools (available online at lifegate.it) have increasingly become one of the criteria Italians use in choosing a car, assessing its true ecological impact, CO2 and NOx emissions, fuel consumption

and factors such as savings on operating costs stemming from the incentives various Italian cities offer more environmentally-friendly vehicles.

A Green index that, for the first time, rates the entire vehicle and its design, including evaluation criteria that take their cue from the accumulated technical and technological experience of Vado e Torno Publishing and the sensibility for sustainability and environmental impact that has always been part of LifeGate's DNA. A compendium of knowledge which, in fact, has led to constructing an indispensable standard for the future. «The environmental impact of road transport, agriculture and passenger transport is remarkable,» said Stefano Corti, general manager of LifeGate. «We like to think that the birth of this new variation on Mobility Revolution will contribute beneficial effects to these specific areas of transport».

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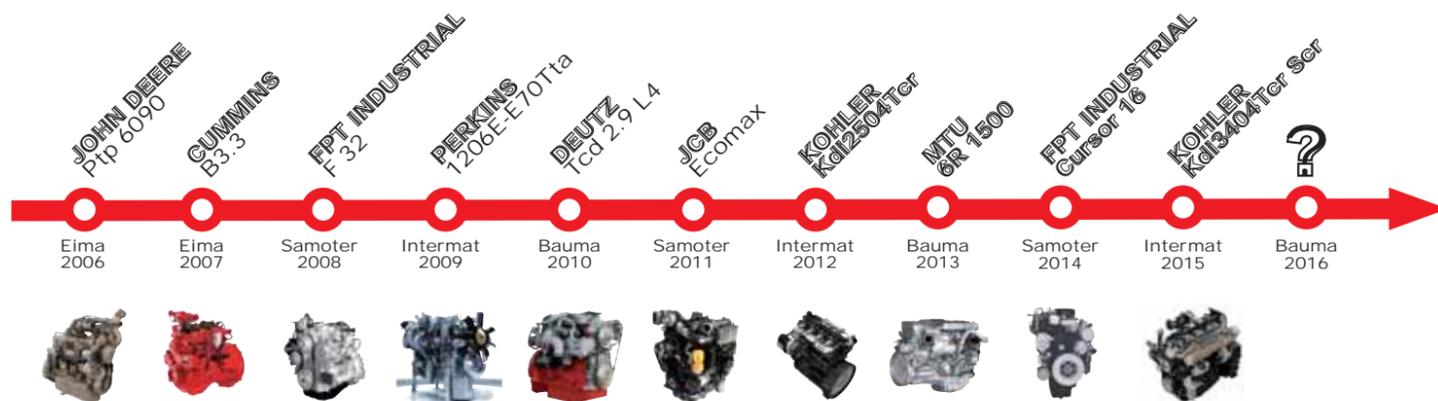


The Tractor of the Year® is an international award that, yearly, a group of European journalists, specialized in agricultural machinery, gives to the best tractor of the year. Twenty independent technical magazines are members of the jury and evaluate open field tractors, specialized tractors (orchard/wineyard) 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

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- 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
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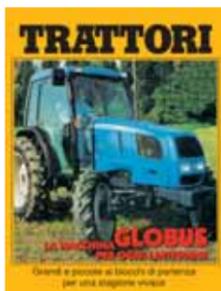
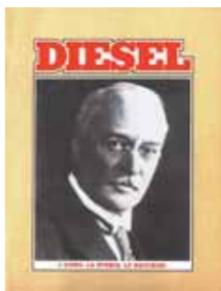
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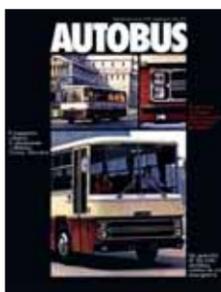
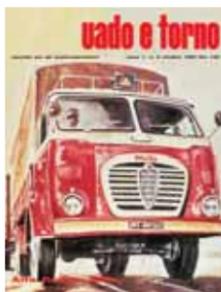


...bus&coach, tractors, engines. This is how *Diesel International* was born



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 were 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.



When Alfa Romeo introduced the 'Mille' model and the 'millepiedi' truck and trailer, Vado e Torno was already a well established magazine. When in 1962 the first trucker's union was founded, Vado e Torno was in print. A long time has passed, since trucks were naphtha run, the steering wheel was on the right side and there were two drivers in the cab. Since then, in the past 50 years, Vado e Torno punctually recorded the technical evolution of trucks and trailers: a field in which Italy is still today one of the most important European countries. Vado e Torno is on the top of editorial sector media with news about technical, economical and legislative evolution of goods transport by road. The main topics are the review of the technical improvements of trucks and trailers.

Born in 1975, in the middle of the fuel crisis, Autobus was at first a special issue dealing with the Italian big buses plan. Immediately afterwards it became bi-monthly and by 1991 monthly. For the bus world it was an exceptional period: in the whole of Europe buses were thought to be the only way to resolve the problems of the big cities urban traffic and pollution. But it only lasted a short time: in 1994 the biggest crisis in the history of buses sales began. But Autobus keeps growing steadily: each year more complete, with more pages, news, road tests. Autobus remains nowadays the only monthly magazine in Italy. Readers are private and public bus operators. Autobus is a totally independent magazine and it covers all international show.

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MILAN EXPO 2015. NEW HOLLAND AND THE CURSOR 16

Diesel of the year 2014 footlights

With an N67 methane-powered tractor that stands alone at the top and the Cursor 16 in the heart of the pavilion, New Holland, working hand in hand with Fpt Industrial's flagship Cursor line, establishes an imposing presence at Expo 2015

Diesel of the Year 2014 on the Samoter podium now at the New Holland pavilion at Expo 2015: a succinct summary of this past year for the Cursor 16, the project so jealously-guarded in the Arbon R&D vaults on Lake Constance. A strategic marketing operation has monopolized all talk of agricultural mechanization at a Universal Exposition dedicated

to 'Feeding the Planet, Energy for Life'. Both New Holland's mission to optimize and accelerate food cultivation and yield, as well as Fpt Industrial's call to save energy and enrich the supply chain come into play. Standing on the lawn bordering the slanted roof of the pavilion a methane-powered T6 reminds the public of New Holland and Fpt's ambition to break away from NOx, PM and HC.

The entire building, including the integrated photovoltaic and water recycling systems, was constructed without mortar or cement to minimize demolition waste and bolster biosustainability. Installed under the hoods of the Case and New Holland combines, six cylinders with 2.65 liters of cylinder displacement are designed to vary from a base version of 570 kilowatts

at 1,900 rpm, waste gate valve included, to the future-release of the 630 dual-turbo, capable of 3,500 Nm. The pressure calibration of the 2,200-bar Bosch common rail and the refinement of the thermodynamic parameters guarantee the desired compactness. With a mere six mm increase in length (a 141 mm stroke compared to 135 mm of the Cursor 13) the narrow engine responds to agrarians' feedback. The piston is unprecedented, using Cgi (Compact graphite iron) in the cylinder head and the double re-entrant piston bowl, with its 2 different turbulent vortices, in the combustion chamber. In keeping with N and Cursor line standards, the Hi-eScr system minimizes the recirculation of exhaust gases and meets all emission specifications. Applying AdBlue® ensures the efficient hydrolysis of diesel urea and a thorough exhaust gas distribution flow. **Effebi**



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TECO 15: TRANSMISSIONS AND GEARS. OERLIKON AND PVD

Gears speak Italian

During the two-days event organized by Assiot, Anie and Assofluid, the best components took the scene. Oerlikon brought in Physical Vapor Deposition, a process that enhances the resistance of outer layers



Two in-depth sessions, with lots of papers from experts, entitled 'Feeding Technology' and 'Energy for Business', and the academic session. These are the contributions to 4.0 economy from Teco 15, the two-days event organized in Milan by three Italian industrial associations, Assiot, power and transmission systems, Anie, automation, and Assofluid (Italian Association

of Manufacturing and Trading Companies in Fluid Power Equipment and Components). Among the papers summarized here, let's start with Oerlikon and the PVD, the Physical Vapor Deposition process, which aims to implement durability and strength. Different kinds of applications were presented as case studies by Claudio Torrelli, from Oerlikon Graziano, and

Paola Recanati, from Oerlikon Balzers: there's room for pure industrial applications, such as a wheel loader transmission; the Torque-Hub transmission; plugs for endothermics working at high loads and low lubrication; crowns for industrial vehicles definitely the coating for cylindrical and bevel gears for Aston Martin.

Ugo Righi

CATTINI REDUCES WASTE

Three standardization projects since 2008: 1) of grinding for cylindrical gears, resulting in reduced waste; 2) of dry tapered teeth, even in this case non-conformities have been almost totally eliminated; 3) of manufacturing stations by product lines, which reduced dents.



CARRARO DRIVE TECH

Several suggestions to save in off road. A backhoe loader, for example, can reduce the transmission line pressure from 16 to 3 bar, resulting in about 1.5 kW less in 60 percent of the working cycle.



SCHAEFFLER EFFICIENCY

How to maximize bearings efficiency and performance? For example, by smoothing rough crests, improving the internal geometry and minimizing the friction between the tapered and cylindrical roller. Schaeffler offers its tapered roller bearings for an effective distribution of contact pressures and an increased dynamic load capacity.



HYDRAULICS IN THE FIELDS FROM MODENA AND REGGIO UNIVERSITY

The paper of Mr. Pintore from University of Modena and Reggio Emilia was: 'Study of hydraulic components and systems for mobile applications characterized by reduced energy dissipation'. The premises are the absence of standardized load cycles for tractors, with overflows in idle state (stand-by) and critical impact on low-pressure circuit; excessive losses between remote distributors; a third of the working cycle takes place at 2,200 rpm.

The crossroad to maximize energy savings, reducing losses and optimizing pressures, is the electronic control unit. Possible solutions involve changing the hydraulic layout, while other solutions are in progress, e.g. improving the coupling between engine and hydraulic pump.

ET



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A DIFFERENT SCOPE

That's what Tomaso Carraro tried to imprint to Eurotrans, which brings together Europe's major associations of transmission elements manufacturers. As president of both Assiot and Eurotrans he claims a commitment towards stronger integration

Tomaso Carraro, zodiac sign that in the period 2014-2016 was found at the intersection of his family business, the Carraro Drive Tech, 728 million turnover, the presidency of Assiot, the Italian association of gears, transmission and power elements manufacturers, and that of Eurotrans, the European Committee of systems for power transmission manufacturers. There's no better partner to understand where we stand. Before starting the interview, a statement issued when he settled at the top of the European Committee: «My hope is that Eurotrans may become the house of all the companies in our sector, going beyond national specificities and developing European strategies aiming to global markets. An association where the protagonists will be the European companies, knowing that the economic and technological leadership we enjoy today should be maintained and strengthened even further».

Good morning, Mr. Carraro. Can you confirm the 1 – 2% growth forecast estimated in the first half of 2015?

Growth forecast seems confirmed. Agricultural area still faces difficulties, especially

in US and Brazilian markets which focus on machines from 160 HP up. In Europe the stagnation continues for decades. India, after all, can boast more positive figures than China, which is facing a severe decline at least for earthmoving.

What are the products in the Assiot basket having more appeal than other competitors?

I want to underscore our leadership in the gears business, where the Italian industry is very strong both in markets and technology, even more than the Germans, although gears still remain a subcomponent. We are very strong in the planetary gears area, see Bonfiglioli, and in transmissions and axles market thanks to Carraro Drive Tech, who is the leader, and Dana, who although being an American company has manufacturing plants here in Italy (Arco, Rovereto, Como and Crescentino). ZF is in third place.

Who are your main partners?

In alphabetical order, Brevini, Bonfiglioli, Carraro Drive Tech, Comer Industries, Oerlikon Graziano. We also have

German companies such as Schaeffler, that has important factories and significant resources, even intellectuals, here in Italy.

The need to create a 'system' is often underlined. Is it possible to figure a stronger vertical and horizontal integration?

Surely we are competing in a market where innovation in technology, process and product is paramount. To do this, we need significant investments that Italian companies can hardly guarantee because of their small to medium size. Often our competitors are larger and related to automotive, then with considerable investment capacity and technological outcome. I'm not saying that stock integration is the only solution, but collaboration should be definitely welcomed and pursued.

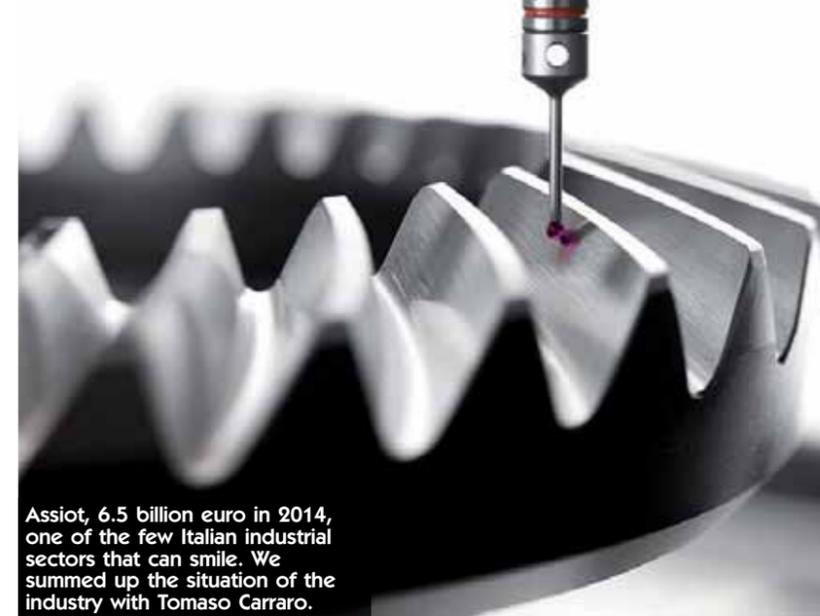
Going back to gears...

That's an area with a process know-how that should not be underestimated, because it is an industry that requires high investments and represents an important competitive factor. We must not forget that end users are also manufacturers, and third part products



are used when flexibility is required. Rarely gears manufacturers are independent designers not following the customer's design. Anyway, it's still a market where we are strong.

From Stage IIIA on transmissions, axles, gearboxes and hydraulic systems in general have risen to the role of 'engine of Engine'. What will be their strategic role in



Assiot, 6.5 billion euro in 2014, one of the few Italian industrial sectors that can smile. We summed up the situation of the industry with Tomaso Carraro.



ply the local market. To date, the total cost of production of an axle in China and in Italy - not only material and work, but also quality, logistics and finance - begin to be similar, then reshoring is becoming significant. This will not mean bringing everything back to Italy, but to end markets.

To what extent are European companies penalized by the embargo to Russia?

Russia's role is most significant in vehicles and oil and gas areas, although it has always been seen as a big potential market. In Eurotrans, Germany is likely to pay the highest price.

What are Eurotrans and Assiot asking to European Commission and Italian government?

I don't think politics is the only to blame. This crisis has its roots in economic and demographic changes worldwide and is more complicated than a temporary crisis. We definitely ask to work more easily in terms of bureaucracy and tax burden. Markets are often affected by the financial crisis of nations. Agriculture receives subsidies everywhere. We battle against nations that have the size of a sub-continent. Competing as single companies is illusory, and even for individual European countries this becomes very difficult. We need more economic, technological and financial integration. It is hard to work for government institutions, also in the industrial world national identities are so strong that the concept of Europe as a whole system is a step back.

Your mandate is almost concluded. How is the working group of national associations going? What would you ask the next President of Eurotrans?

I would have hoped to influence more on the integration of European interests than the promotion of the interests of individual nations. We are still at the beginning, a stone has been thrown, it will take patience and persistence to achieve results. Integration is the key word and the heritage of Tomaso Carraro. And the 'hot potato' in the hands of the next Eurotrans president. **Fabio Butturi**

ASSIOT

Gears and mechanical drives, transmission components, bearings and supports. The Italian industry in this sector is the fourth power on a global scale, second only to Germany in Europe. This industry - excluding minor companies - counts 300 companies which in 2014 had a turnover of 6.546 billion euro, 58.2 percent from export. The president in charge until next year is Tomaso Carraro from Carraro Drive Tech.

EUROTRANS

Approximately 160 thousand employees, a 40 billion euro turnover, more than 600 companies. These are the main figures of the European Committee of Manufacturers of gears and transmissions which includes, in addition to Assiot, VDMA (Germany), Artema (France), BGA (United Kingdom), Swissmem (Switzerland) and Tif (Finland). The mission of the association is "supporting the industries of the sector to be among the best performing and most innovative suppliers in the world."

motors and so on. There's lot of work to do and we have good opportunities that will arise from new technical solutions and new materials. It will be very important to integrate new technologies - electronics, pneumatics et cetera - used in the end product to design it in detail. This is a trend that will continue for many years.

Stage V? Their importance is going to grow or will be overshadowed by radically alternative solutions such as dual fuel, gas and hybrid - electric?

This industry stays tied to costs, then mechanical and semi-mechanical solutions are not absolutely destined to disappear. The first step will be to push the efficiency of traditional components, transmissions,

An Assiot press release says: «we underline an utilization growth of manufacturing capacity forecast very shy and slightly more courageous in Italy than those showed by those who made investments

abroad». What does that mean?

One of the pluses of the Italian industry is having been internationalized in very difficult times, when no one thought it was necessary because the internal market had rather large volumes, inventing an export orientation that saved us in times of crisis. Once this meant only to export, then manufacturing more and more abroad, thinking that we could relocate especially in China and India. The trend in fact is to manufacture on site. We will not go to China to export anymore but also to sup-



From left to right: Bonfiglioli, Brevini, Carraro Drive Tech, Comer Industries e Oerlikon Graziano.

THE WORLD THANKS THE GREAT WALL

After years of robust growth, 2015 has seen a brusque turnaround. Brazil, Russia, Europe, India and Canada have shifted into reverse; US, Japan and Korea are trading water at 2014 levels; only Turkey and China have taken off. The Asian giant, with its sensational results, totals a third of worldwide volume limiting a global-scale retreat to just three percentage points

According to Agrievolution projections, sales of tractors over 22 kW in the first six months of 2015 should have reached 1.08 million units; a slight downward revision in the order of three points. Well, excluding China from the 'rest of the world', the loss incurred by the tractor segment in the first half of 2015 would have amounted to 17 percent. Apparently indifferent to what is happening outside its borders, China ignores the broad market saturation combined with low prices for used vehicles and the reduced spending power of buyers elsewhere.

ARGENTINA
For the past 20 years, indus-

try experts have continuously maintained that to make the most of its partially-untapped agricultural potential, Argentina should be putting at least 10,000 tractors/year on the market. The current fleet is burdened by about 160 thousand tractors spinning their wheels for more than ten years, while not even 30 thousand machines run below the 10-year threshold. The 2,200 units matriculated in the first half of 2015 suggest an annual trend valued at less than 4,500 units. About the same as has been found for the last ten years now, where the market is stable at around 4,400/4,600 units.

AUSTRALIA

While it may look like a continent on the map, it has the same weight as a medium-sized European country. We are talking about... Australia. In all of 2014, 10,400 vehicles were registered, a sizeable increase compared to 2013. In 2015, sales are going great, with a growth rate topping 12 percent (5,800 deliveries in the first half). Despite this significant step forward, as can be seen, the numbers are quite limited and, in the total world tractor market, Australia weighs in at less than 1 percent (about 0.6). It should be noted however that down under, size counts, with major sales between 73.5 and 147 kW and beyond (about a

Also the Chinese engines benefit of the Chinese tractors boom. The rest of the world loses the 17 percent. 105,170 tractors in the first half 2015.



THE WORLD TRACTOR MARKET (>22 kW) IN THE FIRST HALF 2015

Area	The world tractor market (> 22 kW) in the first half 2015		var. %
	1st Half 2015	1st Half 2010	
United States	105,170	84,500	24.5
Canada	11,960	11,500	4
TOTAL NORTH AMERICA	117,130	96,000	22
Brazil	24,700	29,070	-15
Argentina	2,200	2,450	-10.2
Others: Central-South America	8,600	8,500	1.2
TOTAL CENTRAL-SOUTH AMERICA	35,500	40,020	-11.3
Italy	9,515	12,000	-20.7
France	14,300	14,320	-0.1
Great Britain	6,350	7,770	-18.3
Spain	4,610	5,265	-12.4
Germany	15,760	13,270	18.8
Others: Western Europe	15,365	20,445	-24.8
TOTAL WESTERN EUROPE	65,900	73,070	-9.8
Russia	12,760	10,550	20.9
Turkey	29,720	18,050	64.7
China	376,250	227,500	65.4
India	213,000	235,000	-9.4
Japan	13,650	8,200	66.5
Korea	7,200	7,600	-5.3
Others: Asia	135,000	109,200	23.6
TOTALE ASIA	745,100	587,500	26.8
Australia	5,800	4,750	22.1
Rest of the World	68,090	55,200	23.4
TOTAL	1,080,000	885,140	22

* Over 22 kW - Diesel Estimates: data from Agrievolution





STILL AHEAD IN THE COMPARISON WITH 2010

An abrupt fall or just a stumble? The data from the first half of 2015 in the world tractor market can be read in two different ways, depending on the time variable. If you compare only the last twelve months, as fully described in this article, we are currently confronted with a contraction. Yet, if you look further back to 2010, a different reality emerges. The moderate decline that we are experiencing is part of a larger trend of

strong growth and development. Today, therefore, the market is much stronger than it was five years ago. Excluding micro tractors (around 15 kW), the first half of 2015 is expected to close at 1,080,000 units compared to 885,000 in the first half of 2010. Two hundred thousand more vehicles translates into an increase of 22 percent. In this scenario, it's interesting to see how most areas of the world are growing. Driven by

China, Asia is soaring; up more than 27 percent. North America is going great (plus 22 percent) and Turkey triumphs (climbing 65 percent). Even Russia, which is experiencing a total collapse in sales, will close 2015 at values higher than those of five years ago. However, things in the period 2010-2015 have been more difficult in Europe and South America, neither of whom have been able to improve sales.



For India 2015 has opened with a dramatic drop: down 22 percent. For China an increase of 23 percent over the previous year. Us are ok, Europe has a decrease of 8 percent.

A BAROMETER FOR TRACTORS

Area	The trend in the first half 2015	The calculated weight on the world market
- United States	stable	9.7
- Canada	dip	1.1
TOTAL NORTH AMERICA	slight drop	10.8
- Brazil	serious drop	2.3
- Others: Central-South America	stable	0.9
TOTAL CENTRAL-SOUTH AMERICA	serious drop	3.3
- Italy	dip	0.9
TOTAL WESTERN EUROPE	drop	6.1
Russia	serious drop	1.2
Turkey	serious growth	2.8
- China	serious growth	34.8
- India	serious drop	19.7
- Japan	growth	1.3
- Korea	growth	0.7
- Others: Asia	growth	12.5
TOTAL ASIA	growth	68.9
Australia	growth	0.5
Rest of the World	stable	6.3

Diesel Estimates: data from Agrievolution



fifth of the market is over 147 kW).

BRAZIL

The queen of South America has lost both its scepter and its crown. After an initial drop in sales in 2014, the prospects for 2015 appear even darker. The 24,700 registrations in the first six months of the year represent a decrease of 22 percent. And it gets no better with other forms of mechanized equipment: 32 percent fewer sales for large machines, and minus 36 for equipment.

In this framework, then, it is currently estimated that 2015 can not reach more than 47,000 registrations. Small change for a country that in its heyday had broken through the 60,000 barrier.

CANADA

The figures for the period January-June 2015 (11,960 registrations) are significantly worse than those reported in 2014 (down 9.7 percent) and in many ways indicate the

market is saturated.

This is confirmed by another well-documented element in a note from Agrievolution; «Hobby farmers are still willing to spend their money in new media while professional farmers, after a long period of massive investments, appear more hesitant». It was therefore the amateur tractor market that kept deliveries afloat.

CHINA

Taking into consideration the entire global tractor market cake, China alone accounts for over 35 percent of sales. Six times that of Europe, three times America and forty times Italy, just for reference...

Perhaps most impressive is the fact that the home of the Great Wall does not yet seem to have any barriers stopping it. In the first six months of 2015, registrations for tractors above 22 kW reached 376,000 units, an increase of 23 percent over the previous year. On an annual basis we are therefore talking about a market of 700 thousand units.

The value rises above 2 million

when including mini and micro tractors under 22 kW (this last model is, however, in decline).

KOREA

After the contraction of 2014, where tractor sales suffered a decline of about 20 percentage points compared to 2013, the sector is recovering quite well. Taking into account the first half of 2015, new registrations stand at 7,200, an increase of 6 percent over the previous year. The goal of 15,000 tractors/year is not unattainable, but the same Agrievolution experts invite us to be very cautious. «Korea is a reality characterized by high volatility, not only from one year to another, but also from one month to the next».

EUROPE

Betrayed by its big guns. From January to June 2015, Europe has fielded less than 66,000 tractors, thus exposing a decrease of 8 percent compared with the same period in 2014. The decline can be attributed to the principal markets, those capable of generating the most signifi-

cant numbers. Again considering the first half, sales stopped at 14,330 units in France (down 7 percent), 15,760 in Germany (minus 8 percent), 9,515 in Italy (3 percent less), 6,350 in Great Britain (down 12 percent). It's little consolation to know that little Portugal, Greece and the Baltic States are instead producing great results.

With the recent economic contraction continuing, the role of the Old Continent in the global landscape declined further. Today, in terms of sales, we are worth about 6 percent of the global total; Italy can not even reach 1 percent.

JAPAN

The market trend in Japan seems to reserve some pleasant surprises. The reduction in the price of rice registered in 2014 had raised fears tractor sales, especially low power categories, would drop. Instead, the first six months of 2015 recorded 13,650 registrations compared to 13,000 in the same period of 2014, an increase of 4 percent.

Barring unexpected surprises, the current year should close with approximately 26,000 units sold.

Then, if one also includes tractors under 22 horsepower, the figures grow further and the potential purchase of Japanese farmers doubles, reaching around 58/60 thousand units/year.

INDIA

For a long time China and India competed for the world record for tractor sales, but this head-to-head challenge has been abruptly interrupted. For India in fact, 2015 has opened with a dramatic drop: down 22 percent. First-half sales stopped at 213,000 units, among tractors above 22 kW; lower power sales topped out at 240,000. Last year the figures were, respectively: 276,000 and 310,000. In the remaining months of the year we expect a general recovery in sales, but it will be difficult to exceed the threshold of 450,000 pieces; consequently, India's weight on the world stage declines to about 20 per-

cent.

RUSSIA

When talking about tractors in the great empire of mechanized transport, Moscow shrinks disproportionately, more so after the drubbing of recent months. Sales in January-June 2015 stumbled to 12,760 units compared to 22,000 units in the same period of 2014. A frightening 43 percent collapse that makes Russia the low man on the totem pole, particularly among countries of this size. The drop in tractor deliveries is the same across all power classes (down 41 percent under 29 kW, minus 49 percent over 73 kW) and regardless of brand; even the country's combines are shamefully red-faced thanks to a fall of 33 percent.

TURKEY

Confirming itself as a country with enormous potential in terms of both the domestic market (worth as much as France, Germany, and Spain taken together) and as regards production capacity (even more than

60 thousand tractors/year). The first half of 2015 marks an acceleration in sales of 24 percent (a total of about 29,700 units), even better than the amazing Chinese managed. «At this point it is realistic to think» say Agrievolution experts «that at the end of the year, total sales could exceed every previous record, in particular the apex of 60,500 units achieved in 2011».

If you want to find a flaw in the Turkish market, concerns center around the high level of unpredictability and the lack of medium and long-term trends. Just read the data for the past 5-7 years: the spikes shoot up, only to shoot back down again.

SOUTH AFRICA

To unleash the dark continent would take millions of tractors but, instead, the current market is confronted with negligible numbers. In the period from January to August, tractor sales in South Africa barely scraped together 3,870 units compared to 4,250 in the same period of

2014. This indicates a predictable decline of close to 10 percentage points which translates to settling for around 5,800 tractors/year. Less than Austria, by way of comparison.

USA

Among mature economies, the States represent a rare exception. 2015 promises to be not such a bad year: the first six months ended with around 105,000 deliveries, in line with that recorded a year earlier. Seen in the context of generalized global economic weakness, this break-even point should be interpreted as a semi-victory. However, there are some disturbing signs of concern. There was a strong contraction above 29 kW sales (down 15 percent, with further setbacks in the months of August and September). On the other hand, there is a lot of exuberance in the segment under 29 kW and substantial stability in the mid-range. In short, the small power models are keeping the market alive.



Man D2862 and D3876



GLOBAL ENGINES

Two goals at home for Germany, represented by Man's nominations for agricultural applications: the 24-liter D28 and the 15.2 D38. The latter features advanced electronics, partially redesigned for each use

The first strike was the D28, designed jointly with Liebherr in 2007 in the transition from Man's TGA line to the heavy-duty TGX. This gamma describes a dramatically improved range of power, offering 588, 650, 780 and 816 kilowatts at 1,800 rpm, 100 less than the truck-version, and torques between 3,750 and 5,000 Nm to 1,300 and 1,400 rpm, with a performance / capacity of 33.6 kW and 206.2 Nm. The turbo for each cylinder bank and waste gate, along with the 1,600 bar common rail are all signed Bosch, author of the Edc17 unit and Cp3.4 injection pump as well. Over 560 kW in size, the D28 has made a clean sweep of Dpf, Egr and Doc, while relying on Scr.

The true star, however, is the 15.2-liter D3876 unveiled to the IAA public last year. Moving beyond lower power level, they come in three ratings, 415, 450 and 485 at 1,800 rpm, with torque between 2,700 and 3,000 Nm, in the 1,050 and 1,400 range; even in the agricultural cab the 6 cylinder reaffirms the massive Nm, in line with the Cursor 16, which still holds a slight lead. What is striking about this

engine is not the peak performance, the torque rise or the compactness, but the upgraded technology. The D38 guarantees the high pressure Egr, albeit in a simplified version compared to its 'trucker brother' which recycle as much as 40 percent more by using double Egrs. Of course, the aqueous urea tank is still featured, with dosing and dispensing nozzles, net interdiction of the Doc-Dpf module. The 'brains' are the same control unit as the D28, the Edc17, compatible with any mechanical or hydrostatic transmission and governing almost two-thirds of the components (unthinkable in the field just a few years ago). Other functions include nozzles that can withstand 2,500 bar of pressure to regulate the atomization in the chamber. Turbocharging is provided by the variable geometry turbine, replacing previous two-stage truck models. The oil pan can be tilted from 22 to 40° to cover many different applications depending on the cantilever and the layout: allowing combines to use pans with a minimum tilt. On request, both the V12 and the 6 inline cylinders will be available with structural sump.

Lou Bee

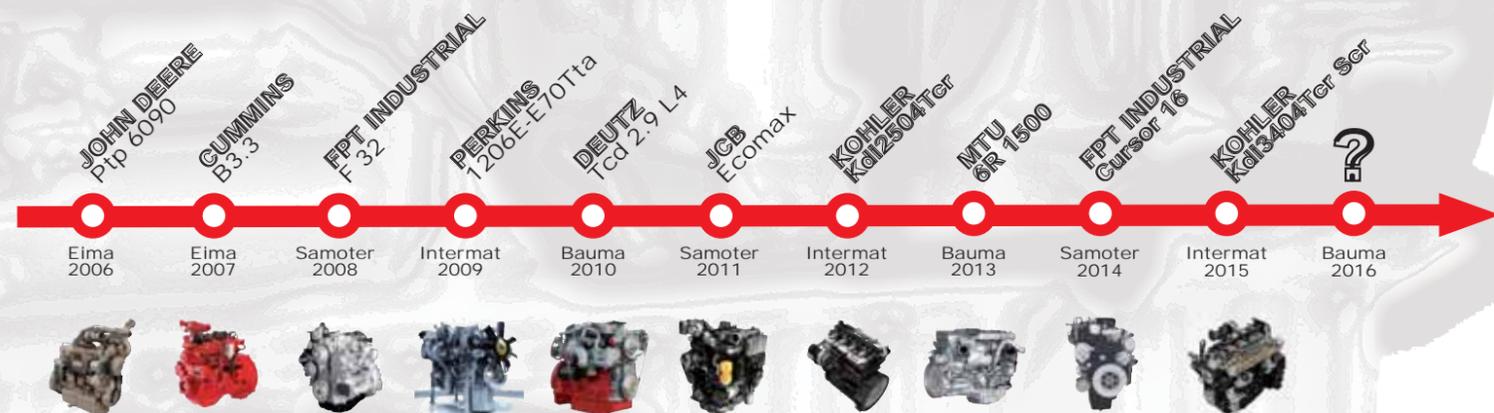
NEWS ON THE FIELD

Brand / Model	MAN D3876 LE12	MAN D2862 LE13
I. D.		
B x S mm - S/B	138 x 170 - 1.23	128 x 157 - 1.23
Cylinder n - dm ³	6 - 15.25	12 - 24.24
Maximum power kW - rpm	485 - 1,800	816 - 1,800
Mep at max power bar	21.6	22.9
Piston speed m/s	10.2	9.4
Maximum torque Nm - rpm	1,050 - 1,450	5,000 - 1,400
Mep at max torque bar	8.8	26.5
Torque rise %	11.6	51.3
Torque at max power Nm	2,577	4,332
% power at max torque (kW)	32.9 (160)	89.90 (733)
Work range rpm	350	400
DETAILS		
Specific power kW/dm ³	31.8	33.6
Specific torque Nm/dm ³	68.8	206.2
Areal spec. power kW/dm ²	54.07	52.85
RULES AND BALANCE		
Dry weight kg	1,345	1,950
L x W x H mm	1,685x978x1,162	1,660x1,333x1,391
Volume m ³	1.91	3.08
Weight/power kg/kW	2.8	2.4
Weight/displacement kg/dm ³	88.2	80.4
Power density kW/m ³	253.9	264.9
Total density t/m ³	0.70	0.63
Displacement/volume dm ³ /m ³	7.99	7.87
SPECIFICATION		
Emission level	Tier 4 F/Stage IV	Tier 4 F/Stage IV
Injection system	common rail	common rail
Air intake - Techno	in line Vgt Scr	V waste gate Egr Scr

2015 DIESEL OF THE YEAR

KOHLER Kdi3404Tcr Scr

See you at the next stop



www.vadoetorno.com



Vm Motors definitely entered the Fiat (better said FCA) world, considering its massive presence under the hoods of Chrysler and Jeep, but it preserves the memory of its agricultural success. Always a close friend of specialized tractors, it is fitted on the Reform Mounty 100 V in 72 kW version.



Engines who like climbing

RIGHT TO THE TOP

Torque is needed to drive attachments and power up specialized tractors working in the mountains. Vm Motors makes an encore, Deutz, FPT Industrial and Perkins are also in the game

Vm scores twice, Yanmar and Perkins are ubiquitous under the hood of specialized tractors along with Deutz, more and more present at these engine latitudes, while FPT Industrial features its 6,7 liters, the big

REFORM	
Model	Mounty 100 V
Transmission	Hydrostatic
Hydraulic capacity l/min	32,5
Rear lifting capacity kg	2.500
Front lifting capacity kg	1.800
Rear Pto giri/min	540/750
Front Pto giri/min	1.000
Wheelbase mm	2.225
Lenght mm	4.275
Width mm	2.085
Height mm	2.260
Weight kg	3.625

VM MOTORI	
Model	R754EU5
I. D.	
B x S mm - S/B	94 x 107 - 1,14
Cylinder n - dm ³	4 - 2,97
Maximum power kW - rpm	72 - 2.300
Mep at max power bar	12,9
Piston speed m/s	8,2
Maximum torque Nm - rpm	340 - 1.300
Mep at max torque bar	14,7
% torque rise	37,2
Torque at max power Nm	304
% power at max torque (kW)	64,3 (46)
Work range rpm	1.000
DETAILS	
Specific power kW/dm ³	24,2
Specific torque Nm/dm ³	114,4
Areal spec. power kW/dm ²	25,90
RULES AND BALANCE	
Dry weight kg	257
L x W x H mm	702x557x736
Volume m ³	0,29
Weight/power kg/kW	3,6
Weight/displacement kg/dm ³	86,5
Power density kW/m ³	248,3
Total density t/m ³	0,89
Displacement/volume dm ³ /m ³	10,24

RIGITRAC	
Model	Skh 95
Transmission	Hydrostatic
Hydraulic capacity l/min	60
Rear lifting capacity kg	3.500
Front lifting capacity Kg	2.500
Rear Pto giri/min	540/750
Front Pto giri/min	1.000
Wheelbase mm	2.350
Lenght mm	4.040
Width mm	2.100
Height mm	2.430
Weight kg	3.800

DEUTZ	
Model	TCD3.6
I. D.	
B x S mm - S/B	98 x 120 - 1,22
Cylinder n - dm ³	4 - 3,62
Maximum power kW - rpm	81 - 2.000
Mep at max power bar	13,7
Piston speed m/s	8
Maximum torque Nm - rpm	480 - 1.600
Mep at max torque bar	17
% torque rise	49,3
Torque at max power Nm	382
% power at max torque (kW)	99,4 (80)
Work range rpm	400
DETAILS	
Specific power kW/dm ³	22,3
Specific torque Nm/dm ³	132,5
Areal spec. power kW/dm ²	26,82
RULES AND BALANCE	
Dry weight kg	350
L x W x H mm	592x947x989
Volume m ³	0,55
Weight/power kg/kW	4,3
Weight/displacement kg/dm ³	96,7
Power density kW/m ³	147,3
Total density t/m ³	0,64
Displacement/volume dm ³ /m ³	6,58



Deutz continues its expansion in off-road market with its engines from 4.1 liters to 2.9. Here we have the middle version among the above mentioned, the 3.6 liters in 81 kW version (up to 100), also fitted on Rigitrac SKH in 4 cylinders version.

brother of this overview. In this segment things get more complicated than the usual tractors scenario, since these applications are designed to work in the mountains. Under the hoods are installed units that span between IIIA and IIIB, which are required to be robust, to endure thermal shock and atmospheric pressure at high altitudes, and to provide the torque needed to power attachments and pass over slopes. It's not easy to see them at work but they are widely present at trade shows, where they draw attention and stimulate the curiosity of farmers thanks to their unusual and often very advanced technical solutions. These are 'strange', hyper specialized tractors, essential for those who need to work in

extreme conditions, resulting from research and development of manufacturers such as Bm from Italy, Reform and Lindner from Austria or Rigitrac from Switzerland, that find their living space in these niche products sheltered from the fierce competition of the 'normal' tractors big manufacturers. These tractors are mostly working in mountain areas, where they are used for carrying attachments or haymaking on strong slopes. But the above mentioned tractors are not alone. Even more famous manufacturers are in fact interested in developing niche products, such as the case of Antonio Carraro and BCS that started to offer tractors with tires on the front axle and tracks on the rear axle



The 6 cylinders engine screams out, the only one among the applications in these pages, with its medium to low power vocation. Bm Tractors, a small company located in the Emilian Apennines, chose the N series that found in Tier 4 Final its definitive success thanks to HI-eSCR, which avoids recirculation.



BM TRACTORS

Model	Better 180
Transmission	Hydrostatic
Hydraulic capacity l/min	60
Rear lifting capacity kg	4.500
Front lifting capacity kg	3.000
Rear Pto giri/min	540/1.000
Front Pto giri/min	1.000
Wheelbase mm	2.800
Length mm	4.500
Width mm	2.200
Height mm	2.650
Weight kg	5.300

FPT INDUSTRIAL

Model	Fpt industrial N67ENT
I. D.	
B x S mm - S/B	104 x 132 - 1,27
Cylinder n - dm ³	6 - 6,72
Maximum power kW - rpm	138 - 2.200
Mep at max power bar	11,4
Piston speed m/s	9,7
Maximum torque Nm - rpm	810 - 1.500
Mep at max torque bar	15,4
% torque rise	48,6
Torque at max power Nm	598
% power at max torque (kW)	92,3 (127)
Work range rpm	700

DETAILS

Specific power kW/dm ³	20,5
Specific torque Nm/dm ³	120,3
Areal spec. power kW/dm ²	27,06

RULES AND BALANCE

Dry weight kg	520
L x W x H mm	1.062x681x1.018
Volume m ³	0,74
Weight/power kg/kW	3,8
Weight/displacement kg/dm ³	77,3
Power density kW/m ³	186,5
Total density t/m ³	0,70
Displacement/volume dm ³ /m ³	9,09

LINDNER

Model	Lintrac 90
Transmission	Continuous
Hydraulic capacity l/min	88
Rear lifting capacity kg	3.500
Front lifting capacity kg	2.000
Rear Pto giri/min	430/540/750/1.000
Front Pto giri/min	1.000
Wheelbase mm	2.264
Length mm	3.469
Width mm	2.015
Height mm	2.375
Weight kg	3.750

PERKINS

Model	854F-E34T
I. D.	
B x S mm - S/B	99 x 110 - 1,11
Cylinder n - dm ³	4 - 3,38
Maximum power kW - rpm	75 - 2.200
Mep at max power bar	12,3
Piston speed m/s	8,1
Maximum torque Nm - rpm	420 - 1.400
Mep at max torque bar	15,9
% torque rise	46,0
Torque at max power Nm	323
% power at max torque (kW)	82,2 (62)
Work range rpm	800

DETAILS

Specific power kW/dm ³	22,1
Specific torque Nm/dm ³	124
Areal spec. power kW/dm ²	24,35

RULES AND BALANCE

Dry weight kg	270
L x W x H mm	747x660x830
Volume m ³	0,41
Weight/power kg/kW	3,6
Weight/displacement kg/dm ³	79,7
Power density kW/m ³	182,9
Total density t/m ³	0,66
Displacement/volume dm ³ /m ³	8,26



Only two fingers are needed to lift the hood operated by gas springs of Lindner tractor and access the Perkins 854-E. This 4 cylinders is in effect the compact engine from Peterborough, made in collaboration with FPT, and relies on common rail and waste gate. A viscocstatic fan provides cooling.

for some specific vineyards requirements. Let's go into detail. In Zocca, a village in the Emilian Apennines, Bm Tractors manufactures Better isodiametric tractors, equipped with 4 and 6 cylinders FPT Industrial engines providing 80 to 220 kW in Tier4 Final configuration. The Better backbone is made of an integral steel frame, featuring a rear axle directly linked to the hitch to ensure perfect adaptability of the attachments to the ground both in normal and reversible drive. The seat may in fact be rotated 180 degrees along with its controls through a single lever. Hitch and PTO are also present on the front side, while the steering system operates on independent axles allowing to turn front

wheels, rear wheels or all four wheels concentrically. The transmission is hydrostatic, featuring a variable displacement hydraulic motor and a Betcam System 6 speed transmission driving a 3-speed manual gearshift.

18 speed

The machine works in a continuous 18 speeds range with automatic downshifting in case of excessive advancement resistance. The transmission controls are grouped on a stick along with those driving the hitch and auxiliary circuits. Comfort is excellent thanks to the cab suspended on pneumatic shock absorbers. Even the Austrian Reform choose the isodiametric wheels solution for its Mounty 100 V, powered by a

Vm R754 engine. The 3 liters engine from Ferrara provides 72 kW and is IIIB compliant thanks to the cooled EGR positioned upstream and the dpf downstream. Engine and cab lie on an integral steel frame and the transmission is hydrostatic with three speed ranges electronically controlled in two different driving modes, manual or transport. In the first case the driver adjusts translation speed and engine rotation acting on the accelerator pedal and the multifunction lever. In the second, once the speed set by the multifunction lever is reached, engine rotation speed is automatically reduced to optimize fuel consumption. The steer acts on all wheels in 4 modes, also in parallel mode (crab)

to easily adjust the position without maneuvering. When the tractor is stopped, the Hillholder function prevents tractor from moving downhill. Also the Lintrac 90, the technological jewel, tailor made compact tractor designed by Lindner for agricultural-livestock companies working in the mountains is born in Austria.

Lindner and the English

In this case we have a classic configuration with different wheels, but the rear axle may steer up to 20 degrees when needed, even in crab mode. Perkins provides the compact 3.4 liters 854E Stage IIIB, delivering 75 kW @2,200 rpm (roughly the power limit, with the exception of the FPT 6 cylinders), while ZF pro-



Yanmar challenges what has been the top of TNV range up to IIB, the 98T. A precursor of recirculation on low power, this engine is fitted on Mach by Antonio Carraro in 64 kilowatts and up to 286 Newtonmeter version.



ANTONIO CARRARO	
Model	Mach 2
Transmission	16/16
Hydraulic capacity l/min	44
Rear lifting capacity Kg	2.300
Front lifting capacity Kg	-
Rear Pto. giri/min	540/750
Front Pto giri/min	-
Wheelbase mm	1.607
Length mm	3.550
Width mm	1.475
Height mm	2.195
Weight kg	3.100

YANMAR	
Model	4TNV98T GA
I. D.	
B x S mm - S/B	98 x 110 - 1,12
Cylinder n - dm ³	4 - 3,31
Maximum power kW - rpm	64 - 2.500
Mep at max power bar	9,4
Piston speed m/s	9,2
Maximum torque Nm - rpm	286 - 1.850
Mep at max torque bar	11,1
% torque rise	34,7
Torque at max power Nm	245
% power at max torque (kW)	86,7 (55)
Work range rpm	650

DETAILS	
Specific power kW/dm ³	19,2
Specific torque Nm/dm ³	86,2
Areal spec. power kW/dm ²	21,19

RULES AND BALANCE	
Dry weight kg	284
L x W x H mm	938x703x925
Volume m ³	0,61
Weight/power kg/kW	4,4
Weight/displacement kg/dm ³	85,6
Power density kW/m ³	104,9
Total density t/m ³	0,47
Displacement/volume dm ³ /m ³	5,44

BCS	
Model	Sky Jump V 950
Transmission	16/16
Hydraulic capacity l/min	28,5
Rear lifting capacity Kg	2.700
Front lifting capacity Kg	800
Rear Pto. giri/min	540/750
Front Pto giri/min	-
Wheelbase mm	1.607
Length mm	3.717
Width mm	1.350
Height mm	1.850
Weight kg	2.838

VM MOTORI	
Model	R754EU5
I. D.	
B x S mm - S/B	94 x 107 - 1,14
Cylinder n - dm ³	4 - 2,97
Maximum power kW - rpm	72 - 2.300
Mep at max power bar	12,9
Piston speed m/s	8,2
Maximum torque Nm - rpm	340 - 1.300
Mep at max torque bar	14,7
% torque rise	37,2
Torque at max power Nm	304
% power at max torque (kW)	64,3 (46)
Work range rpm	1.000

DETAILS	
Specific power kW/dm ³	24,2
Specific torque Nm/dm ³	114,4
Areal spec. power kW/dm ²	25,90

RULES AND BALANCE	
Dry weight kg	257
L x W x H mm	702x557x736
Volume m ³	0,29
Weight/power kg/kW	3,6
Weight/displacement kg/dm ³	86,5
Power density kW/m ³	248,3
Total density t/m ³	0,89
Displacement/volume dm ³ /m ³	10,24



Vm strikes again in an all - Italian duet with BCS. The version mounted is 64 kW D, less performing than the most automotive R adopted by Reform. The 420 Nm torque is however very aggressive, following the spirit of the manufacturer from Cento (Northern Italy).

vides a continuous variable speed transmission. Bosch hydraulic system features an 88 liters per minute axial piston pump driving up to 5 electronically controlled auxiliary distributors and the 3,500 kg rear hitch. Cab is equipped with an air-suspension Grammer seat, a passenger seat and an IBC digital monitor showing all tractor information; air conditioning and mechanical suspensions are available on request.

Rigitrac from Switzerland features 3 different models, SKH 75, 95 and 120 equipped by the actual (post Bauma 2010) Deutz Tcd 3.6 in 74 and 80 kW version, and the older 2012 delivering 93 kW. These tractors feature permanent traction on all four isodiametric wheels and a chas-

sis with central articulation to allow front and rear axle acting independently for better grip and stability.

Hydrostatic transmission

The tractors feature a hydrostatic transmission delivering a maximum speed of 40 km/h reached at only 1,600 rpm, while the hydraulic system adopts a 90 l/min axial piston pump with load sensor. The rear hitch features a Ehr electronic control and a maximum capacity of 3,500 kg, while the cat. 2 front hitch reaches 2,500 kg. Even other Italian specialists like Antonio Carraro and BCS enter the isodiametric tractors market. The goal for both manufacturers are the vineyards located in Alps and Apennines, where in addition

to stability even compactness is a critical factor. Antonio Carraro started with Mach 4 articulated reversible tractor built on the Ergit SRX 100 but featuring four triangular rubber tracks, then enriched the series with Mach 2, which is also reversible but with two rear tracks and two driving and steering front wheels. From the mechanical point of view the main features of the two tractors are similar: both are powered by a 87 HP, 4 cylinder Yanmar engine and feature a 16 speed mechanical transmission in both directions thanks to a synchronized reverse shuttle. In the case of the Mach 4 the maximum road speed is 30 km/h, while Mach2 reaches 35 km/h. Then came BCS, that combined on his Sky Jump

V 950 rear triangular tracks and Dualsteer, the hydrostatic steering system which acts simultaneously through two double-acting hydraulic rams on the front axle and a third double-acting cylinder on the central articulation, bringing the steering angle to 70 degrees so to get the best in manoeuvrability and traction.

Vm and the synchronized

Here we have again the Vm 67 kW, 420 Nm 3 liters, coupled with a 4 ranges, 4 speeds synchronized gearshift providing a total of 16 speeds in both directions. Available with folding structure or low profile cab, the Sky Jump shows the same features of the 4 wheels Dualsteer.

Sergio Bolis

WINNING COUPLE

Lovol revives Arbos historic brand to introduce the 5000 series in Europe. Four models (5100, 5110, 5120 and 5130) equipped with KDI's top of the range, the 3404Tcr Scr. Together they're competing for Tractor of the Year in Best Utility category

As engineers told us back in time, the 3.4-liter is a candidate for industrial applications such as earthmoving but still looking to agriculture, its first love. Its structural design featuring a tunnel and a reverse-mounted turbo, with an upward outlet positioned upon the cab, flirts patently with agricultural applications. Kohler pulled out of the hat Foton Lovol, renamed Lovol Arbos starting from September, named after the defunct Italian brand Arbos resurrec-

ted by Foton along with Bubba brand, which in the first half of the last century rivaled with Landini tractors. Chinese roots in Weifang, and an European outpost in Bologna, to design a tractor set to meet the demanding European taste. We're talking about the 5000 series, which goes above and beyond to please the western farmers with the common denominator of engines. There's a Kdi3404TCR SCR, 4 valves, pneumatic waste gate and 2,000 bar Denso common rail under the bonnet, that finds its consecration in agriculture thanks to its most brilliant version, the top of the range 100 kW, after the onset of the low entry Kdi on Farmtrac and specialized BCS such as

the Valiant 500 and Ferrari Corbaram. The design philosophy is well known: SCR is a must to encourage high temperatures in the combustion chamber thus allowing to avoid DPF as in Tier 4 Interim/Stage IIIB. And this was a very blessed debut: the Arbos 5130 was among the seven finalists in the 'Best utility' category of 2016 Tractor of the Year. A versatile category, ubiquitous in farms, providing from 70 to 100 kW used for on-road towing, materials handling and medium intensity plowing/harvesting operations. The 3.4-liter by Kohler is coupled to a modular transmission, available



Foton Lovol is 'disembarked' to Europe with the name of Arbos. He's competing for Tractor of the Year in Best Utility category together to Kdi3404TCR SCR, the Diesel of the year 2015.



in synchronized mechanical standard version and three-gears clutch-free semi powershift version, within a range of 12 speeds from 4 to 12 km/h. The hydraulic system features a capacity of 110 liters per minute, 70 of which for the equipment, driving up to three mechanical distributors with a switch for an electrical distributor, and a four-speed PTO. The cabin features an automotive design, favors visibility and has a 7" digital TFT display.

Huang Hoo

BRAND Model	KOHLER KDI 3404TCR SCR
I. D.	
B x S mm - S/B	96 x 116 - 1.21
Cylinder n - dm ³	4 - 3.35
Maximum power kW - rpm	100 - 2,200
Mep at max power bar	16.6
Piston speed m/s	8.5
Maximum torque Nm - rpm	500 - 1,400
Mep at max torque bar	19.1
% rise torque	40
Torque at max power Nm	431
% power at max torque (kW)	73.4 (73)
Work range rpm	800
DETAILS	
Specific power kW/dm ³	29.7
Specific torque Nm/dm ³	148.8
Areal spec. power kW/dm ²	34.48
RULES AND BALANCE	
Dry weight kg	394
L x W x H mm	718x580x816
Volume m ³	0.34
Weight/power kg/kW	3.9
Weight/displacement kg/dm ³	117.3
Power density kW/m ³	294.1
Total density t/m ³	1.16
Displacement/volume dm ³ /m ³	9.88
SPECIFICATION	
Emission level	
Injection system	common rail
Valves - Air intake - Techno	4V wg scr doc egr

LOVOL ARBOS 5130 IN PILLS



Engine	Kohler Kdi3404TCR SCR
Cyl - Displ.	4 - 3.4
KW/Nm	100/500
Transmission	Advanced
Clutch	WET clutch
Gearstep	5
Shuttle	Powershuttle with lever
Front axle	Conventional
Rear lifting capacity kg	4,400
Wheelbase mm	2,400

DIESEL OF THE YEAR: THE REASONS FOR A PRIZE

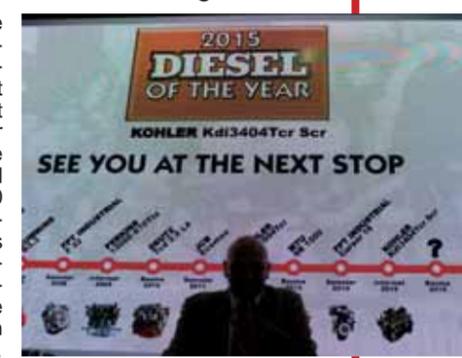
The ability to amaze. This sentence sums up the spirit of Diesel of the Year prize, that reached the tenth edition. You may find this spirit in technological innovation, which often coincides with a skillful management of electronics, the courage to dare, to provide solutions that do not penalize dimensions, in specific curves able to amaze, in engines that unleash the very product range of manufacturers and challenge competitors.

Within this decade, since the first debut at EIMA 2006 in Bologna, KDI won the award twice over the last three years, because they were able to revive the image of Lombardini brand and invested in no regeneration technologies. The embargo on DPF is surely going to come to an end before the next Stage V, considering the current technology, but it has been rewarding so far because of its advantages in terms of housing,

seen as simplifying layout, reduced fuel consumption and extended service intervals. Last April, at Intermat in Paris, it was the turn of the KDI 3404TCR SCR consecrating Reggio Emilia in the Kohler era and bringing the brand where no one Lombardini had ever dared before. Delivering 100 kW at 2,200 rpm and 500 Nm at 1,400 rpm, this engine aims at a wide range of offroad OEM that were not even approachable before. MEP reaches 19 bar at maximum torque, with a 'reservoir' of power at 1,400 rpm that

In the middle, Vincenzo Perrone, Ceo of Kohler diesel engine division.

corresponds to three quarters of the available peak power. Arbos 500 series is a clear demonstration. Compared to smaller 1.9 and 2.5 liters it makes use of urea after-treatment technique as expected. The muffler is designed to host the particulate filter without changing the overall dimensions, keeping the actual 900 mm cylinder. This is how Kohler challenges the European legislation.





John Deere and the hybrid way to tractors

AGRICULTURE GOES ELECTRIC

The goal of the first all-electric tractor is no longer a pipe dream but a concrete project with great potential. Thanks to some experiences and experiments that begin to find practical applications. John Deere is among the pioneers

The use of combustion engines, even in the more biocompatible versions, is likely to remain the fundamental drive technology in short and medium term. At the same time, however, there is no doubt that electricity is likely to play a leading role, not only with regard to propulsion but also in many other applications in agriculture (automation, storage, etc.). In this context John Deere experiences began almost a decade ago thanks to the introduction in 2007 of a 6RE series tractor equipped with a high-voltage

system to power electric equipment, awarded at Agritechnica in the same year. The success of this experiment has been the launching pad for a number of

projects, where the manufacturer is still actively involved, trying to manufacture a first all-electric prototype tractor. The eE-Tour Allgäu and



eConnect projects in particular resulted in Battery Boost, an award-winning solution at the latest edition of SIMA that is the first ever power solution for tractors directly connected to the power grid.

Battery Boost

The tractor technology with Battery Boost is based on high-performance batteries that store the energy generated by photovoltaic or biogas plants and deliver extra power on request. Once connected to a modified John Deere 6RE tractor, BatteryBoost module delivers up to 107 kW extra power, increasing the tractor capacity regardless of operating mode. In addition, the AEF (Agricultural Industry Electronics Foundation) standardized socket included in this system opens up new opportunities for agricultural e-mobility, for manually or automatically controlled hybrid electric applications and for bi-directional (CC) battery charge, the latter supported by a CCS (Combined Charging System) socket. The key advantages of the 'plug and play' Battery Boost system are ease of use, reduced fuel costs - thanks to the use of sustainable energy - and the ability to use smaller tractors for applications that require extra power only occasionally.

DIESEL international

DIESEL international

DIESEL international

DIESEL international

DIESEL international

bauma 2013

bauma 2016

ARBO AND KOHLER

ELECTRO ENGINE

107 KW

MAN D3876 LE12X: Chip rules even

AGRI TECHNICA

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Follow us on the next issue at Bauma Munich, April, 11 - 17.

FINAL PUSH FOR FINALISTS

As class and power drop, the presence of free market engines intensifies. Only Man and Agco Power reach the top, powering the Fendt 1050 Vario with the D26 and the JCB Fastrac with the Finnish 6.6 liter engine



The Man D38. Below, a Agco Power detail.



Unlike what happens between utility and specialized (see the respective boxes for details), among open field tractors the captive engine is king. And so, Case and New Holland use the same six-cylinder N-series with different capacities, 132 kW for Case and 220 kW for New Holland, John Deere grabs the 9-liter PowerTech for home gardening and Agco provides Valtra and Challenger with the ex-Sisu, furnishing the two extremes, respectively 4.9 (below this displacement there are only the 4.4-liter and 3-cylinder



engines) and 16.8 liters. Waving the flag for the free market engines are again Man and Agco Power under the guise of OEM suppliers. Let's start with the latter: the Finns have beco-

me the motor branch of Agco and are hermetically integrated into the tractor manufacturing circuit of the group's five brands (Challenger, Fendt, Laverda, Massey Ferguson and Valtra). This strategy has enabled them to preserve from extinction the 3-cylinder with its one-liter barrel and to give birth to an unusual 1.4-liter seven-cylinder, while still flirting with other OEMs. JCB has chosen 6.6 liters for their Fastrac 4220, engines ranging from 120 to 185 kW at 2,100 rpm and from 650 to 1,000 Nm. Under the yellow ultra-fast almost at the top

BEST UTILITY. 'THE GANG OF FOUR'

Includes all models from 3.4- to 4.4-liter four-cylinder utility vehicles with power stretching from 74-99 kilowatts. A versatile category of agricultural machines plowing through the Tractor of the Year scene bringing a dowry of three... and a half... OEM motors. The joke refers to Deutz-Fahr, until recently using motors from their principal shareholder SAME, now offering the Interim 3.8-liter engines that have replaced the 1000 series while conserving the hitches and capacity. Before this latest development, catalytic conversion and recirculation guaranteed meeting required standards. For the first of the trinity composed of Kohler, Fpt Industrial and Deutz, see our article on page 26. The other Italian, se-



lected by Claas, rounds FPT's evergreen 1 liter cylinder displacement engine up to 1.1 and has met the Tier 4 Final standards with its Hi-eSCR system, just like the Cursor series. FPT Industrial's emission strategy above four liters focu-

ses on avoiding the recirculation of exhaust gases which 'dirty' combustion and could trigger a spiral leading to the OEMs having to mount larger radiators, pure heresy in agriculture. The other player is Deutz's Tcd3.6 that has topped growth with 100 kilowatt of power on display in the Landini, with its 74.2 kW and 420 Nm stake.

Deutz has conquered the Italian manufacturer's hitches by fitting them under the hood in the Tier 4 Interim, which excludes SCR from after-treatment, but not the PM10 filters and the Dvert oxidation catalyst. Turbocharging to step Tier 4 Interim / Stage IIIB is available with or without a charge air cooler, with 4 valves and Bosch common rail.



Brand Model	MAN D2676 LE131
-------------	-----------------

I. D.	
B x S mm - S/B	126 x 166 - 1.32
Cylinder n - dm ³	6 - 12.41
Maximum power kW - rpm	382 - 1,950
Mep at max power bar	19.3
Piston speed m/s	10.8
Maximum torque - rpm	2,401 - 1,150
Mep at max torque bar	24.8
Torque at max power Nm	1,872
% power at max torque (kW)	75.7 (289)
Work range rpm	950

NELLO SPECIFICO	
Specific power kW/dm ³	30.7
Specific torque Nm/dm ³	193.3
Areal spec. power kW/dm ²	51.07

METRO E BILANCIA	
Dry weight kg	1.070
L x W x H mm	1,376x925x1,288
Volume m ³	1.64
Weight/power kg/kW	2.8
Weight/displacement kg/dm ³	86.2
Power density kW/m ³	232.9
Total density t/m ³	0.65
Displacement/volume dm ³ /m ³	7.57

Brand Model	AGCO POWER 66
-------------	---------------

I. D.	
B x S mm - S/B	108 x 120 - 1,11
Cylinder n - dm ³	6 - 6.59
Maximum power kW - rpm	176.5 - 2,100
Mep at max power bar	15.6
Piston speed m/s	8.4
Maximum torque Nm - rpm	1,000 - 1,500
Mep at max torque bar	19.4
Torque at max power Nm	804
% power at max torque (kW)	89.1 (157)
Work range rpm	600

DETAILS	
Specific power kW/dm ³	26.7
Specific torque Nm/dm ³	151.6
Areal spec. power kW/dm ²	32.09

RULES AND BALANCE	
Dry weight kg	590
L x W x H mm	1,180x620x1,110
Volume m ³	0.81
Weight/power kg/kW	3,3
Weight/displacement kg/dm ³	89.4
Power density kW/m ³	217.9
Total density t/m ³	0.73
Displacement/volume dm ³ /m ³	8.14

BEST OF SPECIALIZED. 'FREE SPIRIT'

Specialized Italian manufacturers are a prized hunting ground for free marketers. The shadow of the Rising Sun, however, is a regular presence among the engine finalists for Hannover's Best of Specialized. Two years ago Yanmar powered Antonio Carraro's TTR, today instead Kubota is propelling the Venetian company's TGF with its workhorse, the V3800. The 3.77-liter comes calibrated at 73 kW at 2,600 rpm and with a renewed electronics framework, which says a lot about the transformation in agricultural mechanization. Therefore the signal coming from specialized is loud and clear: common rail and turbo can no longer be separated from control units that manage external recirculation and process unburned hydrocarbons and particulates while piloting DOC and DPF. Linked to Tier 4 Interim there's no need for



AdBlue. As was widely announced, Deutz Tcd3.6 appears again on the Rigitrac SKH. The third is a captive and is called Same. The 3-cylinder diesel with its one-liter barrel and 66 kW is an old acquaintance for the Same Fruteto 3 90.3S.



with 176.5 kW, they are showing off more conventional weapons in this final phase (which is to say... final until Stage V), such as the post-treatment urea solution. The Bosch common rail and control unit appeared as early as Stage 3A.

Man and Fendt

It's Man that hit the jackpot, however, entrusting its traditional partner and countryman, Fendt, to provide an agricultural beachhead for their jewel, the D26. Once again, the two-liter cylinder displacement meets the 1,800 common rail bar and vgt, under the supervision of the single control unit, the Ecd17, which also controls the delivery of urea solutions; instead, changes include the 12 and 24 V electronic systems. Other modifications are designed to strengthen the engine and make it suitable for heavy duty uses, such as the aluminum cylinder cover to protect the heads from hot/cold deviations. A third PTO is housed on the flywheel.

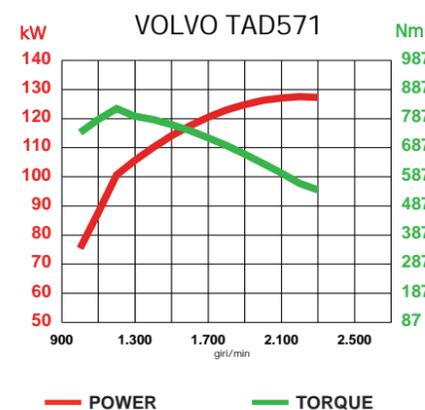


Two specialists face off on the playfield on an even footing, relying on engines that provide ultimate performances for their scope and refined solutions to optimize operative efficiency. Mazzotti AllCrop 3180 and Caffini Striker self-propelled sprayers

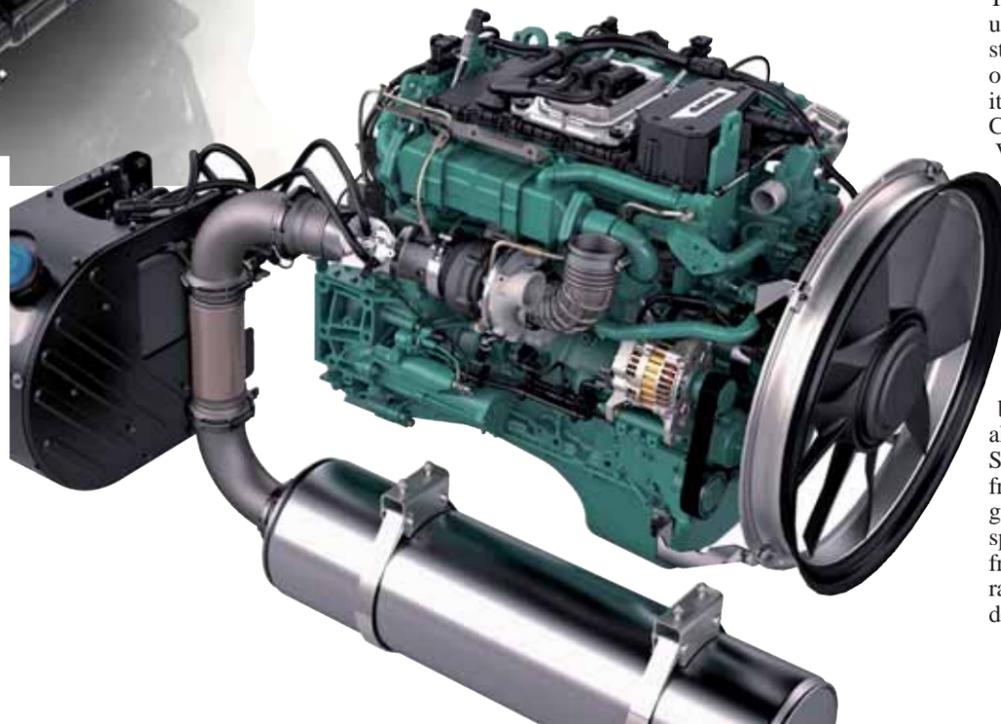


Jcb for Mazzotti and Volvo for Caffini

EURO SPRAYERS



Brand	JCB	VOLVO PENTA
Model	ECOMAX 129	TAD571VE
I. D.		
B x S mm - S/B	106 x 135 - 1,27	110 x 135 - 1,23
Cylinder n - dm ³	4 - 4,76	4 - 5,13
Maximum power kW - rpm	129 - 2.050	129 - 2.300
Mep at max power bar	16,2	13,4
Piston speed m/s	9,2	10,4
Maximum torque Nm - rpm	690 - 1.500	810 - 1.200
Mep at max torque bar	18,6	20,2
Torque rise %	43,6	53
Torque at max power Nm	598	529
% power at max torque (kW)	84,1 (108)	79 (102)
Work range rpm	550	1.100
DETAILS		
Specific power kW/dm ³	27	25
Specific torque Nm/dm ³	144,8	157,8
Areal spec. power kW/dm ²	36,54	33,95
RULES AND BALANCE		
Dry weight kg	590	556
L x W x H mm	787x701x921	946x870x992
Volume m ³	0,51	0,82
Weight/power kg/kW	4,6	4,3
Weight/displacement kg/dm ³	123,8	108,3
Power density kW/m ³	252,9	157,3
Total density t/m ³	1,16	0,68
Displacement/volume dm ³ /m ³	9,34	6,26
SPECIFICATION		
Emission level		
Injection system	common rail	common rail
Valves - Air intake - Techno	vgt egr scr	vgt egr scr
INDEX		
Torque	8	13,6
Performance	5,7	6
Stress	9,3	10,2
Lightness	14,8	12,7
Density	17,4	11,6
DIESEL INDEX	6,5	7,1



Caffini and Mazzotti, two Italian manufacturers that carved out a space in specialized applications such as sprayers, are dealing with engines in times when diesel are in the spotlight. These industrial applications, more specialized than popular automotive applications, require absolute reliability to provide maximum yield with no risk of thermodynamic shocks and issues related to electronics, in accordance with regulations. The result is peculiar and takes us to northern Europe: Mazzotti stopped in the UK, choosing the oversized JCB (still waiting for its 6-cylinder evolution), while Caffini landed in Sweden, on Volvo's side, with a smaller engine from Guthenteburg. The engines are specular: both are 4-cylinders, the British featuring a 1.2-liter cylinder while the Swedish a 1.3 cylinder. Both deliver 129 kW, with a power density rewarding JCB Power Systems and curves that show Volvo's better elasticity. Specific curves also emphasize the torque of the Swedish, with 810 Nm available from 1,200 rpm, and a 120 Nm gap compared to Jcb, even if specific torque lowers this gap from 17% to 9%. While acceleration rewards Volvo and power density are the same, a few extra

kg favors JCB instead, thanks to the compact British monoblock. Similarities however don't stop here. Injection is obviously entrusted to common rail but not made by Bosch, although being the main European manufacturer. We find Delphi on JCB and Denso on Volvo. The common denominator to the two engines (same stroke and 4 mm difference in bore) is also the refusal of after treatment, that have to be tolerated for SCR but is avoided for unburned hydrocarbons and particulate treatment. This idiosyncrasy won to JCB the Diesel of the Year prize in 2011 and helped to spread Volvo Penta new age in offroad. The engines also share Indian roots: 5.1 and 7.1 are assembled at Eicher factory in India, JCB manufactures 4.4 and 4.8 in Foston, UK, but 6-cylinder Tier 2 is also made in Ballabgarh, India, for the local market. Their distinguishing marks are the start/stop after 5-10 seconds that Volvo brought to industrial applications, and the JCB powerpack which is managed in Italy by Geminiani, that customizes outfits based on OEM design. In this case, the engine features a standard outfit except for the front hood (radiator side), modified by applying an anti-clogging grid which prevents dust accumulation coming from its specific application.



SUSPENSION SYSTEM

Stable and comfortable

The AllCrop 3180 frame is coupled to a particular independent suspension system on each wheel, coming from long Mazzotti experience in hydraulic suspension. The

excursion of each wheel is adjusted by a simple and effective suspension system, regulated by two calibrated hydro-pneumatic accumulators and a hydraulic shock absorber with two compression chambers with high speed seals. A junction box mounted on each pair of wheels makes the work and the setting of the suspension easier. Thanks to this particular solution, the AllCrop 3180 maintains the same comfort and stability in all conditions from empty tank to full tank, with a few millimeters stroke on the stem, delivering speed and accuracy of treatment, working and transfer safety and allowing to work in low crops, even over 15 km/h.



The AllCrop 3180 provides three steering modes: four steering wheels during work, two steering wheels during work and transfers and four steering wheels with crab for tight manoeuvres



MAZZOTTI

Powered by a 129 kW JCB engine with powerpack by Geminiani, the AllCrop 3180 has been specifically designed for companies that need to process crops with high and low stem, maintaining maximum precision and efficiency thanks to constructive choices thought for specific functionality and ergonomic working. The sprayer features a sturdy frame that has undergone a particularly careful process to protect it from corrosion. The complete painting process includes, besides sandblasting, eight washing cycles, two anti-rust treatments, two epoxy powder varnish coats and 190° baking. The frame is coupled to a particular independent suspension system on each wheel, coming

from long Mazzotti experience in hydraulic suspensions, while the steering is hydraulic, but with a single shaft final drive, offering precise and safe steering on all 4 wheels, eliminating any delay in steering and maintaining a very high accuracy over time. The machine is equipped with 320/95R46 standard wheels for greater stability, and may use wheels up to 600 mm for spraying in different conditions. Manoeuvrability is assured by the four-wheel steering and the specific positioning of the tanks, that provide a steering radius of 4,000 mm only; furthermore, to avoid damaging crops, the rear wheels always follow the front wheels in steering. The AllCrop 3180 provides three steering modes: four steering wheels for

manoeuvres during work, two steering wheels during work and transfers and four steering wheels with crab for tight manoeuvres. The 3900 mm wheelbase ensures safety and maximum comfort without compromising manoeuvrability.

Sauer Poclain

Engine is coupled to a Sauer – Poclain transmission, designed to solve any difficult driving situation. Two Sauer pumps control the Poclain rear and front motors, without electronic control devices, providing two speeds (0-20 and 0-40 km/h). The AllCrop 3180 comes as standard with 2,250 mm fixed track or with 2,250 - 3,000 mm automatic track as option. The first one is designed to treat sown crops in 45, 70, 75, 78 or

110 cm and work indifferently on even or odd rows. Automatic track change is carried out in a simple and safe way through a switch located in the cab with the machine in motion. Intermediate positions can be reached with special brackets. The machine is also equipped with a particular boom lifting solution. An exclusive lifting system with double parallelogram, dampened with hydropneumatic accumulators, raises the boom from 50 up to 480 cm. The two parallelograms may operate independently in order to spray at different heights. The AllCrop 3180 features Ti-M 21 to 28 m-long lattice booms with or without air-system and Ci-F 32m-long. The booms are equipped with variable geometry arms and



the cab for an excellent ride comfort. The cabin can be positioned at different heights, for transport or treatments in high or low crops system.

nitrogen accumulator, an effective self-leveling system and independent closure of the arms for an easy overcoming of obstacles during the work. The safety joint protects the boom in case of impact, and the sprayers

remain well protected inside the structure of the boom. The Ti-M booms are also available with stainless steel arms to prevent oxidation which, in the long run, can weaken the structure.

Top class visibility

The AllCrop 3180 features a spacious cab with excellent visibility in work and in transfer. The view of the wheels inside the cabin is useful during field insertion manoeuvres and the positioning of the boom in transport does not obstruct the visibility on the road. The double adjustable mirror allows to always look at the wheels or the boom in the different heights which the cabin can be positioned. The cabin comes as standard with a CD player, heated and pressurized with active carbon filters, and with level 4 safety standard, the highest available today. The noise level is only 67.4 dBA, providing high acoustic comfort. The cab is equipped with ergonomic Joystick and Bravo 400s computer with GPS system with automatic closing of the sections; the Terra Display allows an efficient check of every function concerning motion, hydraulic and electronic steering system management in real time. Cabin is lifted by a high range parallelogram, which rises it up to 3,350 mm from the ground. Nitrogen accumulators cushion



The very low positioning of the tanks, inserted between the two axles, lowers the center of gravity of the machine increasing its stability. This solution leaves a 2800 mm clearance under the machine, and the crop flows easily under the frame.



The exclusive lifting system with double parallelogram, dampened by hydropneumatic accumulators, raises the boom from 50 up to 480 cm.



Water and chemical fertilizer loading and cleaning can be managed via a panel located behind the cab by filling valves located on the side.



The realm of hydrostatics

Regarding the transmission, Caffini decided to adopt on the Striker range an electronically controlled hydrostatic solution by Bosch Rexroth based on a main pump, intended to supply four hydraulic motors placed directly on the hub of each wheel. The system is driven by a control unit manufactured by Bosch Rexroth on a customized project, which also includes an on-demand flow sharing system that emulates the differential lock function, the anti-skid and safety locking functions. The system provides three hydrostatic speed ranges with continuous variation, two of which are dedicated to field operations and one for transfers, which respectively deliver speeds from 0 to 14, 0 to 18 and 0 to 40 km/h. The traction and control management are constantly checked by an electronic system by Bosch, with alarms visualization on the machine display. The system also includes a hydrostatic brake system and mechanical braking on the front wheels only. light kit.



Caffini striker is available in four different models, with tank capacity from 3,000 to 4,000 liters and weeding booms from 21 to 36 meters with or without air hose

ALL AT YOUR FINGER TIPS

One of the hallmarks of the Striker sprayers range is the Hub Service, a real workstation positioned on the side of the machine that includes all ground functions, including the mixing of chemicals, the circuit cleaning system and the tank loading. Next to the Hub Service are located the dedicated valves for water supply, for taking the products from the premixing tank and for its washing, and for the washing of the main tank and the whole circuit. This solution allows a quick management of all stages of preparation for field work, as well as a rapid cleaning of all components and the circuits involved. In addition, an accurate sealing of such devices with crankcase, fenders and hoods preserves the various electro-hydraulic components from mud, water and dust, ensuring a superior reliability and durability, giving valuable support to project managers, site managers and maintenance supervisors.



Some comfortable water-tight containers, positioned on the right side of the machine, allow the storage of personal protective equipment for the operator and the safe transport of chemical products.

Striker self-propelled sprayers feature a frame mounted on independent hydropneumatic suspensions on all four wheels with three steering modes implemented - front wheels, all four wheels and crab, with automatic return of the rear axle to the central position at the end of the turn.



CAFFINI Officially introduced during the latest edition of Agritechnica, thanks to the partnership with Volvo Penta started last year, the Striker range of self-propelled sprayers is now manufactured by Caffini in an interesting range of engines in three class Tier 4 Final power solutions - 107, 132 and 162 kW. Along with the engine, which can deli-

Plant protection products are quickly dissolved into the "Premixer" through special nozzles operating at high pressure, and once ready they are incorporated into the tank through a hydrojector, avoiding any contact with the operator. The "Premixer" is equipped with a rotary jet wash system which allows to completely recover the product in the tanks and dispose of it properly.

ver in the four cylinders version 129 kW and an excellent 810 Nm peak torque, a bunch of interesting technical and manufacturing solutions: an excellent weight distribution between the two axles, almost perfectly split (51 % front and 49% rear), a powerful Bosch Rexroth hydrostatic transmission, solid and reliable booms and superior cabin comfort.

Striker sprayers can be equipped with booms from 21 to 36 m, with parallelogram vertical adjustment, variable geometry and optional air sleeve. All boom joints use steel pins and self-lubricating bearings.



Available in four different models, with tank capacity from 3,000 to 4,000 liters and weeding booms from 21 to 36 meters with or without air hose, Striker sprayers rest on a solid high strength, structural steel frame, powder coated after an electroplating treatment by immersion to ensure an adequate durability. Caffini engineers coupled the chassis to



The automatic leveling of the boom is assured by a pendulum mechanism driven by a hydraulic cylinder, whose actuation is controlled by special ultrasonic sensors located at the end of the boom

an independent hydropneumatic suspension system on each wheel, which in addition to an increased driving comfort both at work and in road transfers gives optimum stability to the booms. Manoeuvrability is top class, as this type of machines requires, and is ensured in this case by a steering system with three modes: only front steering wheels, four wheels steering in

The spacious cab is equipped with a multi-function armrest and a color display which shows the management parameters of the machine and security alarms. Another display controls the management of the sprayer.



circle and crab steering. The system also provides for automatic locking of the steering on the rear wheels, a functionality that's particularly useful during work in rows. All this translates into a particularly low minimum turning radius, only 6.3 meters.

All models in the Striker range are equipped with variable track (mechanically or hydraulically actuated with vehicle in motion, the latter as an option) in two different versions, from 1.80 to 2.25 meters and from 2.25 to 3 meters; both versions provide a considerable ground clearance, which in the first case is 1.25 meters, while in the second it is adjustable to three different heights (1.25, 1.50 and 1.70 meters). Translation is ensured by a Bosch Rexroth hydrostatic traction, which provides four hydraulic motors directly fitted on each wheel. The large and bright cabin im-

plemented on the whole range already provides cat. 4 filtration class and is equipped with air-suspension seat, instructor seat, multifunction armrest, color display for information system and machine management including various safety alarms. There is a second color display and Isobus for spraying management, the automatic closure of the jets and the fully automatic drive (optional). A fully automatic driving system is available on the whole Striker range as an optional. The full package includes a so-called 'electronic wheel', a control panel and a high-precision Dgps module. A steering sensor improves the overall performance of the system, especially when following the rows, and the stability of the machine during the distribution phase. The implementation of the Rtk option further improves the precision of the driving system.

From 2 to 3 liters <56kW

SHELTERED FROM UREA

The one under the Gothic Line of 56 kW is a crowded and multifaceted grid, where engines from 2 to 4.5 liters and rotation speeds from 2.000 to 3.000 rpm congregate. Different engines for different applications

The point of this comparison is to show the strategies behind 56 kW engines that will represent until Stage V the watershed between the tolerance of NOx in decimal or integer digits, a textbook for oems that want to avoid Scr until 2019 and have to calibrate loads and duty cycles for different applications, thus requiring adequate perform-

ance compromises. The question is, what is the best solution at the same power for a specific machine in terms of dimensions, loads, rpm and specific torque? Engines are grouped between 50 and 55.4 kW and in the range from 2 to 3 liters. Engineering differences are highlighted by different rotation intervals, with consequences on torque curves

and, above all, on specific fuel consumption. Yanmar, one of the stars of the (until now) less regulated range, has been shifted to over 3 liters page with the supercharged (51.7 kW) and aspirated (53.7 kW) 4Tnc98C, which exceeds 319 cc (10 percent of the established threshold). Let's start from the two super-compact Germans that



Looking for acceleration and pick-up. This is the keynote of engines under 56 kW in a race decided by power and overall dimensions. This last aspect rewards smaller engines like Hatz and Volkswagen.

Between 2 and 3 liters

provide a different ergonomic reading: Hatz and Volkswagen Power Systems.

Driving Volkswagen

Let's start with the leader of the Wolfsburg Group, which includes Man and Scania. The popular Vw acronym translates into 2.0 Tdi, almost the quintessential automotive engine. In its industrial version this engine is at ease on forklifts and features an excellent specific torque, although at not very low rpm. The threshold representing the unsurmountable upward limit are the 300 Nm of Cummins, the Chinese replacement of B3.3, and the base model from Deutz, which benefits from superior displacements. The relative value is the prerogative of 4H50TIC, which features a technical design squeezed to get the most (see Mep); it is a pure industrial engine, coming from a diametrically opposed design compared to the other automotive - derived two liters engine. The two engines reach ex aequo

THE 12 APOSTLE

Brand Brand - Model	CUMMINS Qsf2.8	DEUTZ Tcd 2.9	DOOSAN INFRACORE D24	FPT INDUSTRIAL R22	HATZ 4H50Tic	ISUZU 4JJ1T	JOHN DEERE Ewx 2.9	KOHLER Kdi 2504T CR	KUBOTA V2607CR	PERKINS 404F-22T	VM R753	VOLKSWAGEN POWER SYSTEMS Tdi 2.0 - 455 MD
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	84 x 100 - 1,19	94 x 107 - 1,14	81 x 95 - 1,18
Cylinder n - 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 - 2,21	3 - 2,22	4 - 1,96
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	50 - 3.000	50 - 2.600	55 - 2.700
Mep at max power bar	10,1	10,5	11,3	11	12,4	10,6	10,5	10,4	10,3	9,2	10,6	12,7
Piston speed m/s	8	8,1	7,8	9,3	8,2	7	8,1	8,8	8,8	10	9,3	8,6
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	300 - 1.500	235 - 1.500	208 - 1.800	250 - 1.000	240 - 1.750
Mep at max torque bar	13,9	13,2	15,7	14,4	15,8	10,9	13,4	15,5	11,5	12	14,4	15,6
% power at max torque (kW)	44,4	44,4	40,8	37,9	33,5	38,9	45,1	44,4	34,4	31,6	40	33,5
Torque at max power Nm	216	235	206	196	186	245	235	206	206	157	186	196
% power at max torque (kW)	91,5 (50)	90,80 (50)	85,40 (47)	90,70 (47)	72,60 (40)	77,10 (40)	92,70 (51)	85,70 (47)	69,70 (37)	78,50 (39)	52,40 (26)	80,00 (44)
Work range rpm	800	600	1.000	800	1.200	500	600	1.100	900	1.200	1.600	950
DETAILS												
Specific power kW/dm ³	19,8	18,8	24	23,4	28,2	17,4	18,9	22,2	20,2	22,5	22,4	28
Specific torque Nm/dm ³	108	102,5	122,2	112,2	123	85	104,4	120,8	89,8	93,8	112,2	121,9
Areal spec. power kW/dm ²	19,78	20,83	21,65	25	24,95	18,18	20,75	22,63	22,27	22,52	24,04	26,70
RULES AND BALANCE												
Dry weight kg	214	237	204	210	173	322	251	267	235	228	225	150
L x W x H mm	642x655x718	648x560x685	673x556x690	519x524x723	680x540x595	886x757x762	676x577x956	704x521x715	650x475x680	727x635x772	614x557x723	575x627x674
Volume m ³	0,30	0,25	0,26	0,20	0,22	0,51	0,37	0,26	0,21	0,36	0,25	0,24
Weight/power kg/kW	3,9	4,3	3,7	4	3,1	6,2	4,6	4,9	4,4	4,6	4,5	2,7
Weight/displacement kg/dm ³	77,1	81	89,1	94,3	88,7	107,4	86,2	107,6	89,8	102,8	101	76,2
Power density kW/m ³	183,3	221,6	211,5	260	251,8	102	148,7	211,5	252,4	138,9	200	229,2
Total density t/m ³	0,71	0,95	0,78	1,05	0,79	0,63	0,68	1,03	1,12	0,63	0,90	0,63
Displacement/volume dm ³ /m ³	9,25	11,70	8,81	11,14	8,87	5,88	7,87	9,55	12,46	6,16	8,91	8,20
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	common rail	common rail
Air intake - Techno	waste gate	egr dpf	waste gate	2V waste gate	waste gate	turbo afterc. egr	2 V turbo afterc.	waste gate	waste gate	turbo afterc.	2V waste gate	waste gate
INDEX												
Torque	10,1	8	12,2	10,1	14	6,7	8,1	13,1	10,7	13,8	17,7	11,6
Performance	4,3	4,2	4,7	4,7	4,8	3,7	4,3	4,7	4,1	4,2	4,7	4,9
Stress	7,3	7,1	7,8	7,9	8	6	7,2	8,1	6,8	7,3	7,9	8,1
Lightness	8,7	9	9,7	10,8	9,8	12,3	10,2	12,2	10,3	11,8	11,7	8,5
Density	20,3	23,3	26,2	32,4	31,1	9,6	16,6	25,9	24,6	14,8	25,8	28,3
DIESEL INDEX	6,6	6,2	7,1	6,6	7,4	5,6	6,2	6,7	6,2	6,5	6,6	7,4



BREAKING 3 LITERS WALL

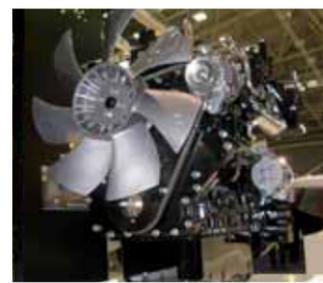
More torque

In this heterogeneous bunch there is room for visibly increased units. The most striking case is JCB, that having only the 1.1 liters cylinder (AxC 103x132 mm), and a 1.2 version to equip its home – made machines had to depower the Ecomax up to 55 kW. What could be the advantage of using a clearly overdimensioned unit as Terex recently did on mini-dumpers? The answer

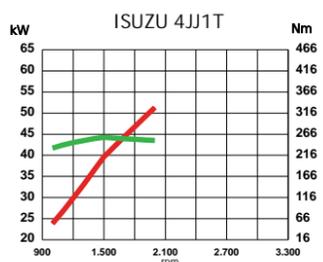
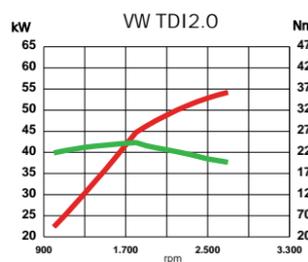
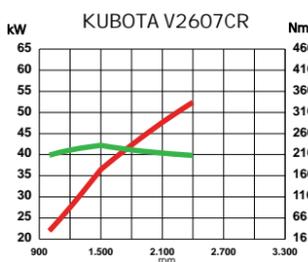
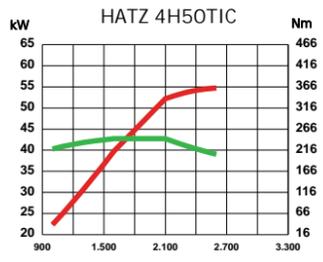
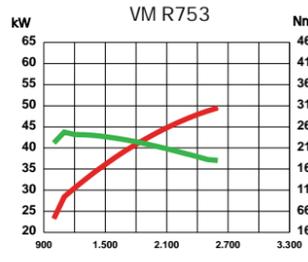
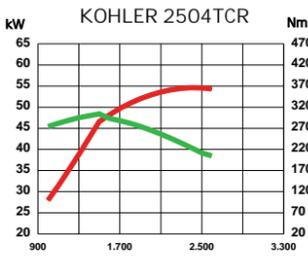
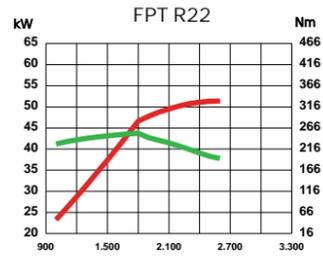
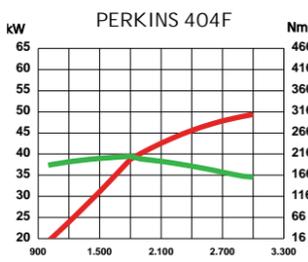
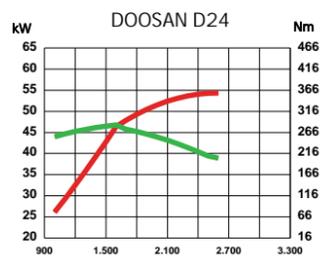
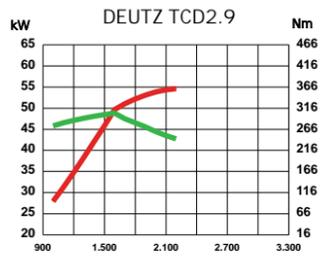
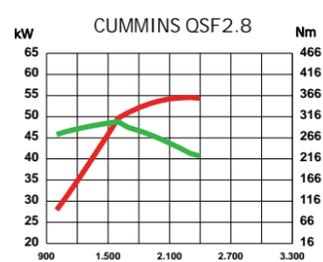
lies in 400 Nm torque, or even in commercial strategies (as in the cited example). Within the common rail range YANMAR plays with its 3.3 liters (AxC 98x110 mm), 53.7 kW and 275 Nm at 1,625 rpm, which includes in the same housing the catalyst and the DPF, calibrating the regeneration in three steps. This is just a theoretical process because three levels are not mandatory. Depending on load, only



than the increased JCB. Another increased engine showing the same displacement of the Ecomax is the JOHN DEERE 4 EWX Series, which challenges competitors with the odd. KUBOTA gives its best with the V3307 (AxC 94x120 mm), which is also converted to common rail, bringing in 260 Nm and post-treatment, which may be limited to the catalyst or even feature the integrated DPF. The compact by PERKINS, born from the agreement with FPT Industrial, is segmented in 4-cylinder and gets 3,4 liters from its 99 mm bore and 110 stroke. At this power rate, this engine is less competitive than the 404 common rail, with a torque of 308 Nm. Little is known about the evolution towards Tier4 Final, but SISU and MITSUBISHI deserve a note. The odd with 1.1 liter cylinder by AGCO POWER is the heaviest in its class, at least until the Interim. The Last Samurai features a 2,2 that could satisfy this audience, if only could show a better MEP. At the moment, the Final version stops at 42,7 kW.



assist, which acts automatically, or reset, which makes use of fuel injection and the heat of the DOC to control the temperature in the filtering body, may be sufficient. Stationary regeneration is manually activated by the operator. At these latitudes KOHLER has even the Diesel of the year winner, but without scr - the same fitted on the Haulotte seen in the Fish - Eye - which offers good torque, slightly lower



the best Diesel index. To see something different we need to focus on the not – so – different twins Fpt Industrial - Vm and John Deere. **American goes to the three** The latter, although being recovered after a few years of oblivion, is certainly the most original having given up the recirculation, according to the strategy adopted on under 56 kW (hence on 4.5 liters low entry). The 740 cc cylinder from Fpt-Vm boasts brilliance and modernity, also featuring two valves for a satisfying volumetric efficiency. Perkins raises adopting common rail on Shibaura and bridging the 854 gap. The piston runs fast (featuring the

highest rotation speed), aiming to heavy duty applications. Looking at figures, Doosan gets a good placement: the 2.4 liters from Incheon is looking for European admirers. **The Japanese side** The Rising Sun is represented by Kubota with its 2.6 liters that is appreciated for its specific power, although the V3307 shows better absolute values. Isuzu also features a 3 liters with common rail that looks a bit subdued in terms of specific values and runs very low, aiming at low duty applications. Mep at maximum torque shows improvement margins as for 4Le2X Tier4 F (46 kW @2,400 kW and 215 Nm @1,800).

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From 3 to 4 and from 70 to 100 kW

DUTY OF COMPACTNESS

Everybody aim for 100 kW target, Deutz, Kohler and Same get it, other competitors just get close. The battle takes place in the fields of power density and elasticity. In addition to the above mentioned, Cummins and Yanmar show good performances. The latter, however, is the only featuring Tier 4 Interim

Super-compact engines reach Tier 4 Final with a significant increase in power, which meant for some of them getting close to 100 kW. This threshold was set by Kohler four years ago, while introducing the Kdi project, and realized in two step: firstly with the unveiling at last year's

Eima, then with the triumph celebrated at Intermat. A stock of kilowatt that only four 1/1.1 liter cylinders could give a decade ago. Compact engines were traditionally limited to the borderline of 75 kW. Today, however, apart from the KDI 3404Tcr Scr, Same made a huge leap ahead, leaving HC

and Nox treatment to SCR and DOC, with just a partial recirculation, thus correctly managing backpressure. Same reaches the top of the torque curve with 540 Nm. Tcd3.6 Deutz also performed well, looking for an extended version as its younger brother Tcd 2.9. Figures are identical



Cummins gets the highest Diesel index among Final engines thanks to a balanced project, Kohler shows off outstanding specific curves, Same has the best torque, Perkins enjoys the line. The 3 liters Yanmar, however, was the best of all until Interim.

between 3 and 4 liter

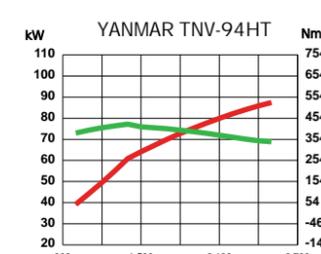
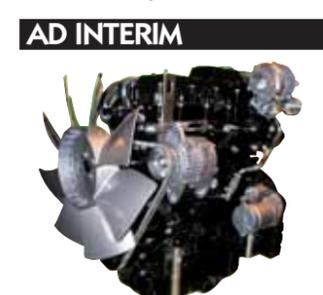
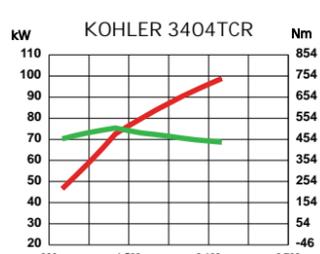
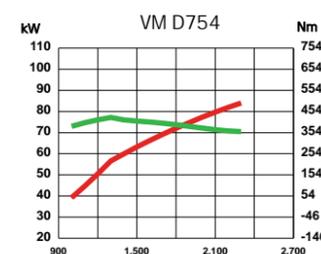
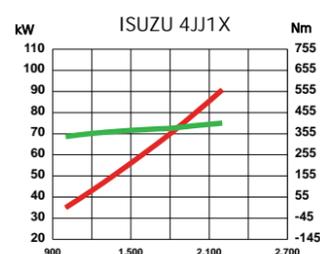
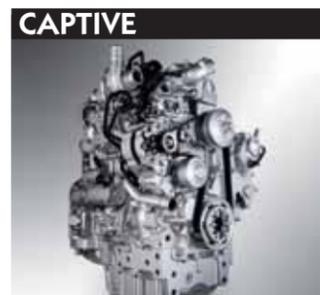
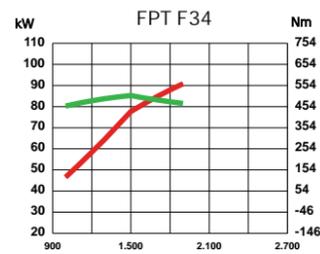
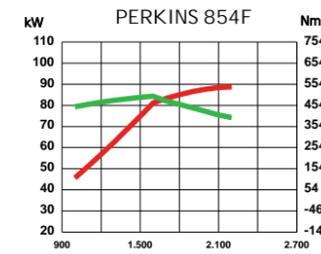
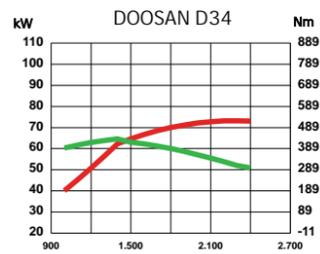
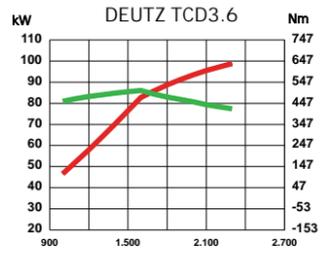
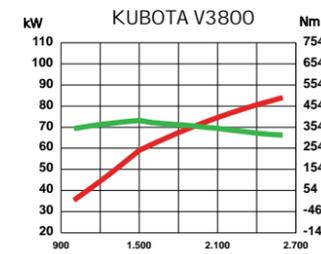
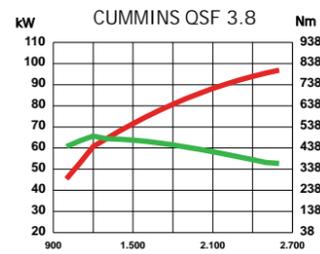
to those of Kohler, even if the torque curve of the engine from Reggio Emilia plays in advance on the scale. Also Cummins gets pretty close to the top, replacing the B3.3 with the 3.8-liter which gets 98 kW, while at higher rpm than Deutz, Kohler and Same and reaching torque at very low engine speed.

John Deere and Sisu are out

Here we have two stone guests: **John Deere**, which features the odd EWX in 3 liters range stopping at 55 kW, and **Sisu**. News from Finland about the compact made in China are expected for years. Talking about China, let's start with **Cummins** QSB, born from the collaboration with Foton, which is not afraid to show its automotive roots shown by the torque curve: the engine is assembled in Middle Earth together with 2.8 and Isb 4. 5, made to run on the road. The above mentioned **Deutz** raise the bar of a 5 per cent from the previous 480 Nm and tends to show fairly flat curves and work-

TARGET 100 KW

Brand - Model	CUMMINS Cummins QSF3.8	DEUTZ Tcd 3.6	DOOSAN INFRACORE D34	FPT INDUSTRIAL F34	ISUZU 4JJ1X	KOHLER KDI 3404TCR SCR	KUBOTA V3800	MITSUBISHI D04EG	PERKINS 854F-E34TA	SAME KE 4	VM D754TE3	YANMAR TNV94HT-CR
I. D.												
B x S mm - S/B	102 x 115 - 1,13	98 x 120 - 1,22	98 x 113 - 1,15	99 x 110 - 1,11	95 x 105 - 1,11	96 x 116 - 1,21	100 x 120 - 1,20	94 x 120 - 1,28	99 x 110 - 1,11	103 x 115 - 1,12	94 x 107 - 1,14	94 x 110 - 1,17
Cylinder n - dm ³	4 - 3,75	4 - 3,62	4 - 3,40	4 - 3,38	4 - 2,97	4 - 3,35	4 - 3,77	4 - 3,33	4 - 3,38	4 - 3,85	4 - 2,97	4 - 3,05
Maximum power kW - rpm	98 - 2.600	100 - 2.300	74 - 2.400	92 - 1.900	92 - 2.200	100 - 2.200	85 - 2.600	74 - 2.000	90 - 2.200	100 - 2.000	85 - 2.300	88,4 - 2.500
Mep at max power bar	12,3	14,7	11,1	17,5	17,2	16,6	10,6	13,6	14,8	15,9	15,2	14,2
Piston speed m/s	10	9,2	9	7	7,7	8,5	10,4	8	8,1	7,7	8,2	9,2
Maximum torque Nm - rpm	488 - 1.200	500 - 1.600	430 - 1.400	500 - 1.500	375 - 1.800	500 - 1.400	375 - 1.500	375 - 1.500	490 - 1.600	540 - 1.600	420 - 1.300	420 - 1.400
Mep at max torque bar	16,7	17,7	16,2	18,9	16,2	19,1	12,8	14,4	18,6	18	18,1	17,6
Torque rise %	39,9	40	47,9	44,4	30,8	40	34	40,5	44,6	44	39,2	37,6
Torque at max power Nm	363	412	294	461	402	431,0	314	353	392	480	353	333
% power at max torque (kW)	62,6 (61)	83,80 (84)	85,20 (63)	85,40 (79)	76,90 (71)	73,40 (73)	69,30 (59)	79,70 (59)	91,30 (82)	90,50 (91)	67,30 (57)	69,70 (62)
Work range rpm	1.400	700	1.000	400	400	800	1.100	500	600	400	1.000	1.100
DETAILS												
Specific power kW/dm ³	26	27,6	21,7	27,1	30,8	29,7	22,6	22,2	26,4	25,9	28,7	28,8
Specific torque Nm/dm ³	129,8	138	126,1	147,6	125,9	148,8	99,4	112,5	144,6	140,2	141,4	137,5
Areal spec. power kW/dm ²	29,97	33,11	24,50	29,87	32,39	34,48	27,07	26,62	29,22	30,03	30,58	31,80
RULES AND BALANCE												
Dry weight kg	280	350	265	360	320	394	345	360	270	540	257	235
L x W x H mm	818x728x786	592x947x989	701x580x769	678x586x896	928x823x888	718x580x816	844x581x835	715x625x750	739x623x805	751x611x679	702x557x736	719x496x717
Volume m ³	0,47	0,55	0,31	0,36	0,68	0,34	0,41	0,34	0,37	0,31	0,29	0,26
Weight/power kg/kW	2,9	3,5	3,6	3,9	3,5	3,9	4,1	4,9	3	5,4	3	2,7
Weight/displacement kg/dm ³	74,5	96,7	77,7	106,3	107,5	117,3	91,5	108,1	79,7	140,3	86,5	76,9
Power density kW/m ³	208,5	181,8	238,7	255,6	135,3	294,1	207,3	217,7	243,2	322,6	293,1	340
Total density t/m ³	0,60	0,64	0,85	1	0,47	1,16	0,84	1,06	0,73	1,74	0,89	0,90
Displacement/volume dm ³ /m ³	8	6,58	11	9,41	4,38	9,88	9,20	9,80	9,15	12,42	10,24	11,75
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	common rail	common rail
Air intake - Techno	waste gate egr dpf	turbo afterc. egr dpf doc	waste gate doc	waste gate egr dpf	turbo afterc. egr dpf	waste gate egr doc scr	turbo afterc. egr dpf	turbo afterc. egr doc dpf	turbo afterc. egr dpf	waste gate egr doc	turbo afterc. egr dpf	turbo afterc. egr dpf
INDEX												
Torque	16,1	9,4	12,2	6,5	6,2	10,4	12,8	7,0	8,5	6,5	12,2	13,2
Performance	5,3	5,5	4,9	5,4	5,1	5,7	4,5	4,6	5,4	5,3	5,4	5,4
Stress	8,9	9	8,4	8,6	8	9,2	7,7	7,5	8,9	8,6	8,8	8,9
Lightness	9,1	11,6	9	12,2	12,4	13,4	11	13,1	9,3	16,5	10,2	8,9
Density	16,4	14,8	23,3	23,7	11	25,6	14,7	19,3	22,6	26,7	28,1	30,7
DIESEL INDEX	7,4	7	7,1	6,6	6,5	7,1	6,6	6,1	7,2	6,1	7,4	7,6



ing range. Only doc is standard for the 3,620 cc, while DPF is on request. **Doosan Infracore** pulled out. Even Koreans, that are expected to double the production of compact engines this year - at least according to original plans - chose to avoid DPF. That choice was confirmed moving from IIB/Interim to Final thanks to scr. **FPT Industrial** pulled out of the hat the 3.4 liters, assembled under contract (see Perkins) and used on some CNH machines. Some adjustments upwards in performances (acceleration at low rpm and torque close to Deutz and Kohler) and - according to official data- also in weight that drags down the Diesel Index (we speak of a structural version, perhaps loaded by tweaks to the engine base or balance shafts). **Isuzu** also rejects DPF presenting the JJ, with T letter for the supercharged version and X which indicates the af-

tercooler. The Japanese engine limits its displacement, space and consumption, keeping up with competitors in terms of power. **Here's the Diesel of the Year** Now is the turn of **Kohler**, which stands up in the Diesel Index along with Same, behind Cummins and Yanmar (which is the only Tier4 Interim). Diesel of the Year prize is full of top players and bears the name of Arbors, the European agricultural branch of Lovol Foton, after the investiture of Haulotte at Intermat. It does not miss anything. Its highlights range from the extended torque curve to all specific figures. **Kubota** pulls out of the hat its most refined monoblock, the top of V3 Series, which followed the strategy of the complete package using the scr on a formula that embraced DPF and doc featuring a great amount of kW available at maximum

torque. **Mitsubishi** makes use of the D04Eg to enter the elite over 56 kW. The 4 cylinders adopt the SCR and pumps up performances (still improvable) compared to Tier 3, embracing Bosch common rail without affecting fuel consumption (as stated by the manufacturer). His Majesty **Perkins** boasts the 3.4 that indirectly calls the companion (in this project) FPT Industrial. This engine shows good specific curves and lightness, which confirms Perkins as candidate for the rush of specialized. **Same** and Farmotion, a combination that works in captive area after divorcing from Deutz, points to stationary market, motor pumps but not only (it's congenitally structural). Torque is top class: no one equals its 540 Nm. Too bad only for that extra weight, that means however strength and firmness of the crankcase. **Vm** is a guarantee for the entire offroad range. Since the incorporation

with FCA everything seems to be silent in Cento, even if news should be forthcoming. Meanwhile, the 3 liters stays overboosted, equipped with Bosch injection system (common rail has replaced rotative pump since Tier 4 Interim), with an excellent power/weight ratio. The show ends with **Yanmar**, which is the true exception, being the only one not to have moved this power range to Final. In Interim, Yanmar was top class. It's a shame because this engine, introduced at Bauma 2010, shows in Tier 4 Interim record figures that earned an enviable Diesel index, a top class line and weight (until Interim the bulk of the SCR was not necessary). Intermat staged the future: the 4Tnv94Fht, pointing to Stage V, which showed (thus being a prototype) 88.4 kW @2,500 rpm and 410 Nm @1,700rpm, tracing the curves of 4Tnv94Ht. ■

What's on the offroad market in one liter cylinder range

'D' LETTER WINS

D stands for double stage. That's the letter that inspired Caterpillar/Perkins, John Deere and Man, with obvious repercussions on performances. Cummins also takes advantage of vgt, but Man wins thanks to its D08 Tier 4 interim

These engine latitudes begin to show more complicated and intriguing solutions. Double stage is one of the most visible, both in terms of size, placement in engine layout and performance. Although even other overcharging systems are intercepting air starting from low rpm thanks to the blower

fins, no one is able to boost up as the twin turbo.

Twin for four

Caterpillar, Man, Perkins and John Deere feature this solution, with the 'deer' allocation, the larger impeller active from 1,000 rpm to intercept air through variable geometry, and the smaller one operative

at the start with fixed geometry. This is the calling card of the increased six-cylinders, heirs of the now obsolete one liter cylinder, that in order to meet emission requirements and push on the accelerator without affecting reliability and penalize stress resistance were forced to increase stroke and consequently displace-



Some manufacturers made a revolutionary choice increasing cylinder size, reaching behind the 8 liters to compete directly with the 9-liter (see box). The sextet groups in a fairly cohesive range of kilowatts and Nm.



Between 6 and 7 liter

MAGNIFICENT SIX (+ ONE)

Brand Model	CUMMINS Q5B6.7	FPT INDUSTRIAL N67ENT210	JOHN DEERE 6081H (3)	LIEBHERR D934 A7-04	MAN D0836	PERKINS 1206E-ETTA
I. D.						
B x S mm - S/B	107 x 124 - 1.16	104 x 132 - 1.27	116 x 129 - 1.11	122 x 150 - 1.23	108 x 125 - 1.16	105 x 135 - 1.29
N. cil. - dm3	6 - 6.69	6 - 6.72	6 - 8.18	4 - 7.01	6 - 6.87	6 - 7.01
Maximum power kW - rpm	201 - 2,000	210 - 2,200	222 - 1,500	200 - 1,900	250 - 2,100	225 - 2,200
Mep at max power bar	18.4	17.4	22.1	18.4	21.2	17.8
Piston speed m/s	8.3	9.7	6.5	9.5	8.8	9.9
Maximum torque Nm - rpm	990 - 1,500	1,143 - 1,500	1,057 - 1,600	1,245 - 1,150	1,250 - 1,200	1,282 - 1,400
Mep at max torque bar	19	21.8	22.1	22.8	23.3	23.4
% power at max torque (kW)	39.3	44.3	53.5	52.3	40	47
Torque at max power Nm	960	911	1,411	1,009	1,137	980
% power at max torque (kW)	77.4 (156)	85.60 (180)	55 (12)	75 (150)	62.90 (157)	83.60 (188)
Work range rpm	500	700	700	750	900	800
DETAILS						
Specific power kW/dm ³	30	31.2	27.1	28.5	36.3	32
Specific torque Nm/dm ³	147.9	169.8	172.5	177.5	181.9	182.7
Areal spec. power kW/dm ²	37.22	41.18	35.02	42.74	45.45	43.27
RULES AND BALANCE						
Dry weight kg	536	520	776	900	642	715
L x W x H mm	1,059x726x960	1,062x681x1,018	1,209x599x1,151	1,173x918x1,131	1,180x877x994	1,063x820x907
Volume m ³	0.74	0.74	0.83	1.22	1.03	0.79
Weight/power kg/kW	2.7	2.5	3.5	4.5	2.6	3.2
Weight/displacement kg/dm ³	80.1	77.3	94.9	128.3	93.4	101.9
Power density kW/m ³	271.6	283.8	267.5	163.9	242.7	284.8
Total density t/m ³	0.72	0.70	0.93	0.74	0.62	0.91
Displacement/volume dm ³ /m ³	9.04	9.09	9.86	5.75	6.67	8.88
SPECIFICATION						
Emission level						
Injection system	common rail	common rail	common rail	common rail	common rail	common rail
Air intake - Techno	vgt scr doc	wg scr doc	fixed+vgt egr doc dpf scr	wg only scr	double stage egr doc dpf scr	double stage doc dpf scr
INDEX						
Torque	7.5	9.8	10.7	10.4	11.8	11
Performance	5.8	6.4	6.2	6.6	6.7	6.7
Stress	9.1	10.5	10.1	10.8	10.7	11.1
Lightness	10.1	9.3	13.9	16.3	11.8	12.2
Density	12.3	13.8	9.5	9.3	10.9	13.9
DIESEL INDEX	7.1	7.7	7.3	7	7.9	7.6

ment. Therefore here we have boosted monoblocks in a segment where several players are out of the cast, significantly exceeding 1.2 liter per cylinder. Among these Deutz, Mtu and Volvo will be the protagonists of the box in this page. Others, such as Jcb, could be join the group in a reasonable time. At present, apart from the above mentioned, Cummins, Fpt Industrial and Liebherr enter the arena.

'Eng.' native speaker twin

Let's start from Caterpillar. The yellow engine does not appear in the grid being perfectly symmetrical to Perkins, who is on the other side of the grid. The legacy is the collaboration/compensation agreement between Cat and Perkins, in which Britons have especially racked the base models, where Cat was weak, and the Americans the Acert Technology. Until Interim it was possible to couple the Scr only with DOC or DPF. Now everything is in place. Let's stay in America with the red engines from Columbus.

Cummins in second only to the Nuremberg hare, with 230 kilowatts at just 2,000 rpm, although the low engine speed is accompanied by a torque without peaks, just over 1,000

Nm, slightly higher in Tier 4 interim setting. The variable geometry turbo, adopted as a corporate flag on the entire IIB range, is against the flow.

Fpt Industrial features the N series, adopting the same anti-emissions strategy of Cursor family with urea and the catalyst as the only addition. In a balanced segmentation, where only Man stands for specific curves, the engine from Turin stands out for its compactness, with an index in line with Perkins and a mass that shines for lightness. According to official figures, the gap with competitors is in the tens of percentage points, except Cummins, just 16 kg heavier (3 percent).

Within 10% kW

John Deere plays with Cat and Perkins for the second place, and although sharing the same displacement with FPT Industrial it expresses a completely different project. Power specific curve is good, just a step back. Not so good on the scale, just Liebherr is heavier. Pss is the acronym that involves 4.5, 6, 6.8 and 9 liters, with the castle on the block that blows the air from the second blower in DOC-DPF module, then in SCR via the exhaust pipe, driven up-



DEUTZ BETWEEN 6.1 AND 7.8

The 7.8 Deutz introduced at Agritechnica dates back to 2011. The six-cylinder (AxC 110x136 mm) is larger than the predecessor, the 2013 7.1, enabling him to face the 9 liters with 276 kW @2,200 rpm and 1,450 Nm @1,450 rpm, and a Mep of nearly 20 bar. These figures would lead to a onroad future too, although 'mother Volvo' opted at the moment for industrial applications. On the other side we find the Tcd6.1 (AxC 101x126 mm), featuring 180 kW @2,300 rpm and 1,000 Nm @1,450 rpm.



JCB AND THE 6 CYLINDERS TO COME

He's two years old, yet it remains a mysterious object, at least in Europe. This is the elapsed time since summer 2013, when the 6 cylinders - 1.2-liter per cylinder was introduced in Rocester. It seemed an ideal completion at the top of the range, coinciding with the liquidation of Isuzu, but the 672 development stopped at Tier2. Designed for the JS360 crawler excavator and oriented to the Chinese market, the 7.14 liter (AxC 106x135 mm) delivers 225 kW @2,000 rpm and a torque of 1,200 Nm @1,400 rpm.



THE 1000 FROM MTU

With 4 and 6-cylinder, the 1.3 liter cylinder of the 1000 series comes in the usual reversible dress, industrial and onroad. The 6 cylinders engines are manufactured in Mannheim with twin turbo over 220 kW, a power rate that is positioned in the middle of the curve: in truck-version, power ranges from 175 to 260 kW. Other models feature a waste gate with aftercooler. The common rail is made by Delphi, an exotic exception for Daimler/Mtu, working at 2,400 bar. 24 valves are actuated by dual overhead camshaft.



VOLVO AND THE MAGIC SEVEN

Up to Tier 4 Interim Volvo Penta relied on Tad765Ve 7.15 liters (6 at the top, AxC 108x130 mm). The next step shows a change similar to that of Deutz, with the introduction of Tad870-873Ve, 7.7 liters (AxC 110x135 mm). The Swedish six cylinders ranks behind the Man D08, delivering 235 kW @2,200 rpm and 60 Nm less, exactly 1,310 Nm. Volvo technology tacked on high temperatures, relying on Egr and Scr to curb nitrogen oxides.



stream by a sensor and down-stream by a mixer. Liebherr shows the very original base model of its range. It is the only 4-cylinder in the game, it has been designed with an eye for home appli-

cations like other Swiss-German engines and introduced on the engines market thanks to home made components and a long association with Man. Its weight is definitely over the top, its acceleration

is very good thanks to a brilliant rise (the torque reserve is the best). You say Man, you hear the lion roaring. An abused but very actual figure of speech, considering the onroad voca-

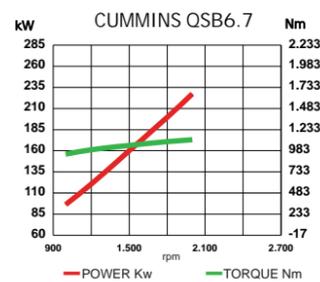
tion of this 6.87 liters with head distribution, 4 congenital valves and two fixed turbines. Tier 4 Final is only on request, but this engine wins the Diesel index; after all, its 250 kW exceed all competitors by 10 -

20 percent, and even specific torque is over the top, with only Perkins showing a few Nm more. Perkins is the best equipped to meet the Nuremberg challenge; we cited its excellent

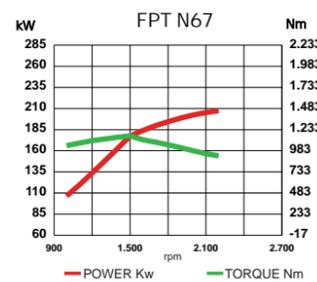
torque, its power remains a step back Cummins. Some cubic centimeters helped the 7 liters which developed its thermodynamic parameters thanks to a cautious design which promoted

double stage, Denso 2,000 bar common rail, external recirculation and full post-treatment without undermining the volumetric balance. Dpf is passive, urea consumption should be 5 percent less.

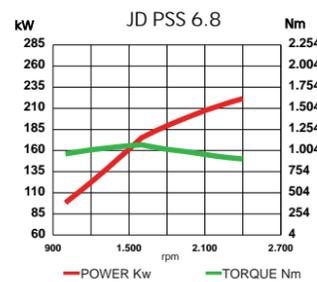
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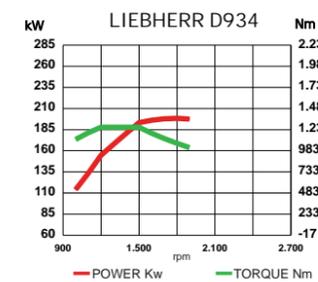
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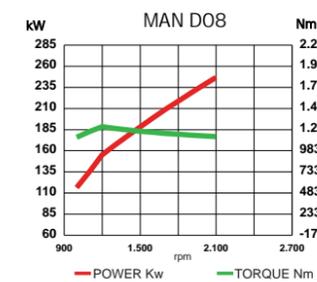
FIXED AND VGT



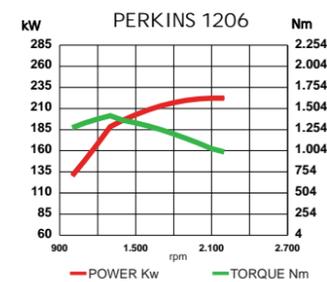
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QUOTES

A

AGCO - 30, 31, 41
AGRITECHNICA - 28
ANIE - 10
ANTONIO CARRARO - 24, 31
ASSIOT - 10, 12, 13
ASSOFLUID - 10

B

BAUMA - 4, 24, 45
BCS - 22, 25, 26
BM TRACTORS - 22
BONFIGLIOLI - 12
BOSCH - 8, 18, 23, 30, 31, 36, 37, 45
BREVINI RIDUTTORI - 12

C

CAFFINI - 32, 33
CARRARO, Tomaso - 12, 21
CARRARO DRIVE TECH - 10, 12
CASE - 4, 8, 30
CATERPILLAR - 46, 47
CATTINI - 10
CHALLENGER - 30
CHRYSLER - 20
CLAAS - 4
CNH - 44
COMER - 12
CUMMINS - 4, 38, 39, 40, 42, 43, 44, 46, 47, 48, 49

D

DELPHI - 49
DENSO - 26, 49
DEUTZ - 4, 20, 21, 24, 30, 31, 38, 40, 42, 43, 44, 45, 47, 49
DOOSAN - 38, 40, 41, 42, 44

E

EICHER - 33
EIMA - 4, 27, 42
EUROTRANS - 12, 13
EXPO - 8

F

FARMTRAC - 26
FCA - 20
FENDT - 4, 30, 31
FERRARI - 26
FIAT - 20
FOTON LOVOL - 26, 44
FPT - 4, 8, 20, 22, 23, 30, 38, 40, 41, 42, 44, 45, 46, 47, 48

G

GEMINIANI - 33, 34
GRAMMER - 23

H

HATZ - 38, 40
HAULOTTE - 41, 44

I

IAA - 18

INTERMAT - 4, 27, 44
ISUZU - 38, 40, 42, 44, 49

J

JCB - 4, 30, 32, 33, 34, 41, 47, 49
JOHN DEERE - 4, 28, 30, 39, 40, 41, 43, 46, 47, 48

K

KOHLER - 4, 26, 39, 40, 41, 42, 43, 44
KUBOTA - 31, 39, 40, 41, 41, 43, 44, 45

L

LAVERDA - 30
LIEBHERR - 18, 46, 47, 48
LINDNER - 21, 23

M

MAN - 18, 30, 31, 39, 46, 47, 48
MASSEY FERGUSON - 4, 30
MAZZOTTI - 32, 33, 34
MCCORMICK - 4
MITSUBISHI - 41, 43, 45
MTU - 4, 47, 49

N

NEW HOLLAND - 4, 8, 30

O

OERLIKON - 10, 12

P

PERKINS - 4, 20, 23, 39, 40, 41, 43, 44, 45, 46, 47, 49

R

RECANATI, Poala - 10
REFORM - 20
RIGITRAC - 21

S

SAME - 30, 42, 43, 44, 45
SAMOTER - 4
SAUER POCLAIN - 35
SCANIA - 39
SCHAEFFLER - 10, 12
SIMA - 28
SISU - 41

T

TORRELLI, Claudio - 10

V

VALTRA - 30
VM - 20, 22, 25, 39, 40, 41, 43, 45
VOLKSWAGEN - 39, 41
VOLVO - 32, 33, 47, 49

Y

YANMAR - 24, 25, 31, 38, 41, 42, 43, 44, 45

Z

ZF - 12, 23

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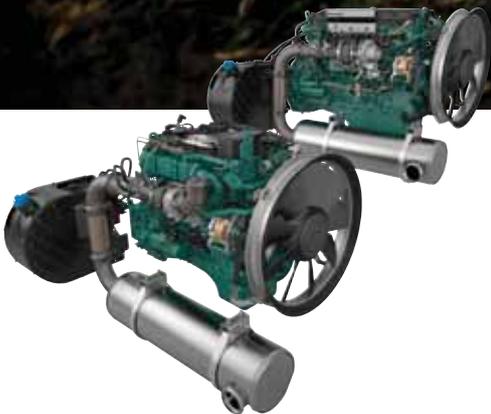


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