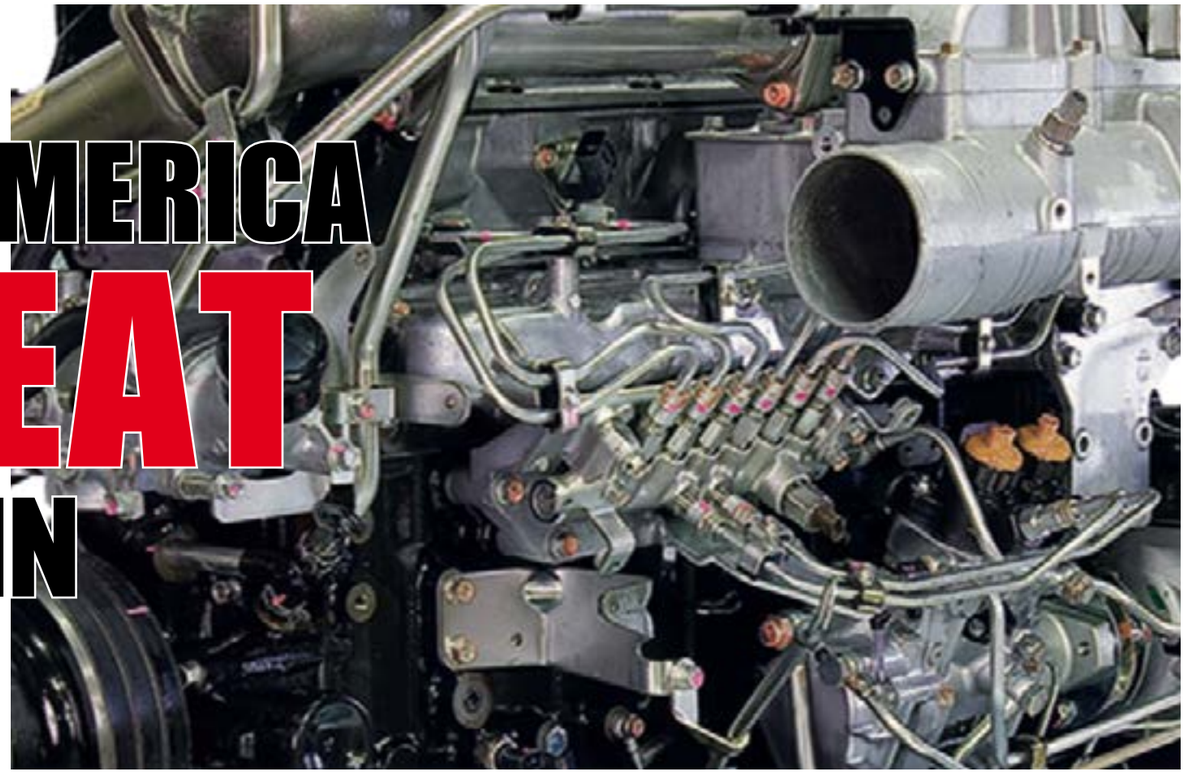
AMONGST 9 AND 11 LITERS

MAKE AMERICA GREAT AGAIN



Segmenting power levels to occupy every niche and become full suppliers. The main route is mapped out, at least judging the efforts of some actors in the diesel scenario. Kohler made the big leap to 100 kilowatts in advance, in the future, who knows? Volvo Penta meets the expectations of on/offroad OEMs and could finalize agreements to complete the portfolio below 5 liters. JCB has frozen the Tier 2 6-cylinder and has the technologies to extend homologation to both sides of the Atlantic. Doosan Infracore has a six-cylinder up his sleeve. FPT Industrial reinforced the lower and upper range with the 2.2 made in Cento and the Cursor 16. MAN gave birth to the D38 and showed up with the little Volkswagens before the Dieselgate.

BRAND MODEL	AGCO POWER 98 CTA SCR	CATERPILLAR C9.3B ACERT	CUMMINS L9	FPT INDUSTRIAL CURSOR 9	JOHN DEERE PSS9.0L	LIEBHERR D936 A7	MAN D20	MTU 6R1100	PERKINS 1706J-E93TA	SCANIA DC9	VOLVO D11 K460
I. D.											
B x S mm - S/B	111 x 145 - 1,31	115 x 149 - 1,30	114 x 145 - 1,27	117 x 135 - 1,15	118 x 136 - 1,15	122 x 150 - 1,23	120 x 155 - 1,29	125 x 145 - 1,16	115 x 149 - 1,30	130 x 140 - 1,08	123 x 152 - 1,24
N. cil. - dm³	7 - 9,82	6 - 9,28	6 - 8,88	6 - 8,70	6 - 8,92	6 - 10,52	6 - 10,51	6 - 10,67	6 - 9,28	5 - 9,29	6 - 10,83
Maximum power kW - rpm	**365** - 2100	340 - 2200	321 - 2100	330 - 1900	317 - 2200	320 - 1900	324 - 1800	320 - 1900	340 - 2200	294 - 2100	339 - 1800
Mep at max power bar	21,7	20,4	21,1	24,4	19,8	19,6	20,9	19,3	20,4	**18,4**	21,3
Piston speed m/s	10,2	10,9	10,2	**8,6**	10	9,5	9,3	9,2	10,9	9,8	9,1
Maximum torque Nm - rpm	1.900 - 1.500	2.075 - 1.400	1.842 - 1.500	1.850 - 1.400	1.686 - 1.600	1.970 - 1.000	2.097 - 1.000	2.100 - 1.000	2.081 - 1.400	1.827 - 1.500	**2.200** - 1.400
Mep at max torque bar	24,8	28,7	26,6	27,2	24,2	**24**	25,6	25,2	28,7	25,2	26
Torque at max power Nm	1.656	1.470	1.460	1.656	**1.372**	1.607	1.715	1.607	1.470	1.333	**1.793**
% power at max torque (kW)	81,8 (299)	89,50 (304)	90,20 (290)	82,20 (271)	89,20 (283)	64,50 (206)	67,80 (220)	68,80 (220)	89,80 (305)	97,70 (287)	95,20 (**323**)
DETAILS											
Specific power kW/dm³	37,1	36,5	36,1	**37,9**	35,5	30,4	30,8	29,9	36,5	31,6	31,2
Specific torque Nm/dm	193,4	223,4	207,4	212,4	188,9	187,2	199,3	196,6	**224,1**	196,6	203
Areal spec. power kW/dm²	53,91	**54,57**	52,45	51,16	48,32	45,65	47,72	43,48	**54,57**	44,28	47,55
RULES AND BALANCE											
Dry weight kg	850	885	778	870	1.044	1.150	975	990	865	970	994
L x W x H mm	1.200x850x1.100	1.119x827x1.066	1.128x790x1.098	1.216x883x1.007	1.271x856x1.265	1.592x918x1.151	1.630x893x1.046	1.325x955x1.230	1.125x791x1.068	1.235x980x1.100	1.309x913x1.227
Volume m³	1,12	0,99	0,98	1,08	1,38	1,68	1,52	1,56	**0,95**	1,33	1,47
Weight/power kg/kW	**2,3**	2,6	2,4	2,6	3,3	3,6	3	3,1	2,5	3,3	2,9
Weight/displacement kg/dm³	**86,5**	95,3	87,6	99,9	117	109,3	92,7	92,7	93,2	104,4	91,7
Power density kW/m³	325,9	343,4	327,6	305,6	229,7	190,5	213,2	205,1	**357,9**	221,1	230,6
Total density t/m³	0,76	0,89	0,79	0,81	0,76	0,68	0,64	0,63	0,91	0,73	0,68
Displacement/volume dm³/m³	8,77	9,38	9,06	8,06	6,47	6,26	6,92	6,84	**9,77**	6,99	7,37

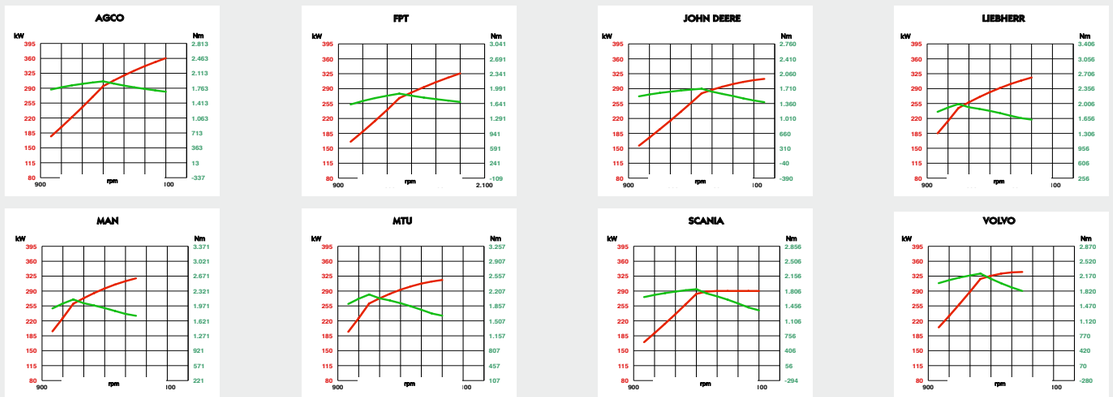
Perkins surprised its competitors at Bauma with the demo of its 3.6 liters, a strategic displacement in offroad applications, and introducing a series of "boosted" models coming from its liaison with Caterpillar. These include the 1706J-E93Ta, same displacement as the yellow American, which testifies the group's confidence in a brand that made the history of diesel engine in agriculture. An engine, Her Majesty's 9.3 litre, which comes with a frenzy once unknown to British 'mechanics'. Rotation speed climbs up to 2,200 rpm and piston speed to 10.9 meters per second, on par with the C9.3 Acert, while the stress index confirms the exuberance of the Anglo-American duet. The performance verve of the 1706J reverberates on specific curves. When it comes to power, power ratio puts Perkins immediately close to the best in class, the surprising and unexpected – due to its in-line 7-cylinder configuration – AGCO Power. In terms of specific torque, the same 6-cylinder sweeps the board delivering 224 Nm per litre, a percentage gap compared with competitors that ranges from 5 to 19%.

Jeff Moore, Caterpillar Product Director, R&D for 7.2 to 18 liters engines: «*Caterpillar has proven the merits of the C9.3B by testing the engine to its limits, both in the lab environment and in actual customer applications.*»

Acert system fades in comparison with its English brother, who also sweeps the board in terms of power at maximum torque, that is 12%. The main applications are large harvesting machines. To name a few, New Holland's CR8.90 even embraces the other potential FPT Industrial protagonist of this scene, the Cursor 11. Claas' Lexion 700 starts from Mercedes 10.7 litres to Perkins' 12.6 and OM 473 LA 15.6-liter.

We also find however big tractors such as Case's boosted Optimums, equipped with the 8.7 Cursor, which we also find on Axions by Claas that in turn mounts MTU on the Xerion. At 8.5 liters we find the top of JCB

THE OTHER 8 OF THE CREW



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Torque	9,2	11,6	9,4	8,4	9,2	12,0	11,1	**12,1**	11,6	9,4	7,5
Performance	7,3	7,9	7,5	7,5	7	6,9	7,2	7	7,9	7,1	7,2
Stress	11,7	13,2	12,3	11,9	11,4	11,2	11,6	**11,5**	13,2	11,7	11,7
Lightness	11,2	12,2	10,9	12,7	15,1	14,1	11,5	11,9	11,7	13,4	11,8
Density	11,0	14,1	13,3	12,4	8,8	7,2	8,3	8,0	**14,8**	9,6	8,8
DIESEL INDEX	7,9	8,2	7,9	7,7	7,4	7,4	7,7	7,7	8,2	7,5	7,2

1 PERKINS

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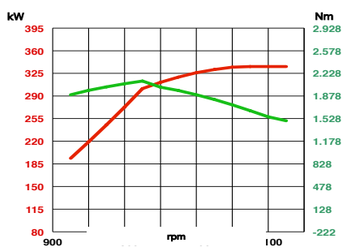
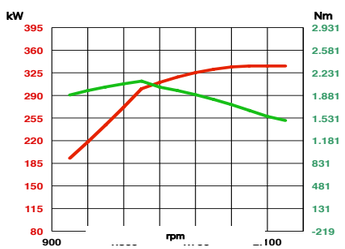


2 CATERPILLAR

CAT



3 CUMMINS

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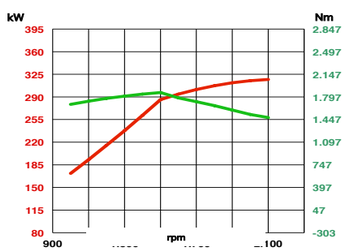

which has chosen AGCO Power, also present under the bonnets of Massey Ferguson and Valtra. Cursor 9 and 11 abound in New Holland's family. Scania is definitely among the pioneers of 9 liters. Scandinavians have a peculiar inclination for odd cylinders. If the former Sisu chose the powerful and bulky 7 in line, Scania folds back to the 5. Second only to Perkins in terms of torque, it loses ground when we move on the curve from newtonmeters to kilowatts, following a profile similar to that of Cummins, who shares with Scania the authorship and use of XPI, although the Americans declare an extremely lower weight and footprint. It should be noted that both Scania and Cummins introduced at Bauma the same 9 liters in Stage V projection, both excluding EGR.

Among the die-hard captives of the lot we find AGCO Power and Caterpillar, which actually has no major say in agriculture and makes its way with this unit in construction and excavation machines, mining and generation sector. FPT features here the Cursor 9 fully made in SFH, the joint venture with SAIC, which loses part of the frenzy of the Cursor family in terms of power, even if specific torque proves the skeptics wrong, placing it second in the ranking. It goes without saying, electronics dominate in every form, from Bosch common rail, almost ubiquitous, to the aforementioned XPI for Cummins and Scania, to the Volvo exception, which still relies on proven pump injectors.

The high-performance 6-cylinder, 10.8 liters from Guthemburg stands on top of displacement range. Also specific values, including areal power, testify the reliability of the injectors and the combustion process. Power density is also good, where the engines are aligned apart from the AGCO, Cat, Cummins and Perkins quartet, which reach over 300 kilowatts per cubic meter. MAN and MTU are quite in tune and aligned in the midrange, without the peaks that they usually reach.

John Deere features the typical PSS package, which channels the gases filtered by the EGR and processed by the VGT through the DOC-DPF module first and then the SCR. Piston speed is textbook at 10 meters, specific power is close to AGCO. Liebherr also has its say with the 10.5 embracing the nouvelle vague of SCR-only and showing off its power at 320 kW and 1,970 Nm.

In Switzerland, autarchy dominates: both control unit and common rail are homemade. The memory of its origins brings this engine to construction sites like the others of Liebherr's D-Series, but reliability is there and Bulle's all-around engines will not be scared by structural oil pans. ■