



Iveco and FPT Industrial Announce Unique SCR Technology to meet Euro VI Emission Standard

(Watford, 24 May 2011): Iveco and FPT Industrial announce their readiness to meet the new Euro VI regulation by means of a unique SCR (Selective Catalytic Reduction) technology, which will be introduced on the two new Cursor and Tector engine ranges for heavy-duty trucks and buses.

The new engines, equipped with FPT Industrial “SCR only” technology, will feature optimised combustion and after-treatment systems to retain Iveco class leading vehicle fuel economy with enhanced environmental respect thanks to breakthrough patented control technology in which a very high NOx conversion efficiency (over 95% versus 80-85% of best competitors) is achieved.

FPT Industrial CEO, Giovanni Bartoli, said: *“Our activity is constantly aimed to increase customer productivity and emissions reduction; that is why we take into consideration every solution enabling us to reach these targets. Actually, the ‘SCR Only’ approach is the evidence of our technological leadership and commitment to satisfy the needs of a more and more demanding market.”*

Iveco Chief Executive Officer, Alfredo Altavilla stated: *“We were the first to announce our Euro VI engine technology strategy back in April 2010 at the Analyst and Investor day meeting in Turin. I said then that we would meet Euro VI standards without Exhaust Gas Recirculation. EGR as a technology has its place in the transport sector but for heavy commercial vehicles that may significantly exceed more than one million kilometres during the course of their life, the technology that reduces fuel consumption and additional operating costs to their minimum is the correct technical choice. FPT Industrial’s ‘SCR Only’ exhaust after-treatment fulfils this important need. It is clear that Euro VI vehicles will be more expensive; technology has a price and a value. We will introduce suitably equipped vehicles when our customers ask us to do so.”*

The new Euro VI scenario

The new Euro VI exhaust emission regulations, which are planned to apply to all new heavy commercial vehicles and buses registered from 1st January 2014,

introduce significant reductions in permitted tail-pipe emissions and other operational aspects. Notably:

- New world-wide transient and steady state test cycles including cold start and normal running temperature components. The transient cycle will be in two parts; a part in which a cold engine is used and a second part, following a stationary rest time.
- NOx emissions reduced by 80% compared to Euro V.
- PM mass reduction by 66% compared to Euro V and the further introduction of a particle number limit that will result in an overall particulate matter reduction of 95%.
- Introduction of an ammonia emission limit.
- Inclusion of crank-case emissions if a closed system is not used.
- Enhanced emissions durability requirements of up to 700,000 km or 7 years for the largest vehicles.
- A further enhanced On Board Diagnostic system performance.

The introduction of the Euro VI regulation represents a milestone in the development of world emissions standards since for the first time a World Harmonised Test Cycle is used for engine certification.

Our Choice, “SCR Only” technology

Iveco has a strong history of technical innovations aimed at reduced operating costs of which fuel consumption has long been a fundamental point. For the Euro IV/V emission standard introduced in 2005, Iveco chose the SCR path. This choice was made purely from a cost of ownership point of view, allowing the engines to be tuned to fully optimise combustion efficiency, and hence fuel efficiency, at the expense of high engine-out NOx emissions that could be reduced by the SCR exhaust after-treatment.

For Euro VI, neither Iveco's strategy nor our customers demand for fuel efficient vehicles has changed. In the face of a general acceptance that all cannot be achieved either in the combustion chamber or the exhaust system, Iveco is able to exploit the technological strides taken by FPT Industrial in its tireless developments to further improve the efficiency of the SCR technology. This has led to a fully

patented SCR control system that allows unprecedented reduction efficiencies to be achieved. The result is the “SCR Only” technology for medium and heavy duty engines.

The “SCR Only” after-treatment technology is exclusively unique in that it is able to comply with the extremely stringent NOx limits by means of the catalytic reduction system alone without the need for exhaust gas recirculation.

The realisation of such a highly efficient SCR system is mainly achieved thanks to the system management in which AdBlue dosing and the thermal properties of the after-treatment system are carefully and precisely controlled. The “SCR Only” system sees the introduction of new generation after-treatment hardware that is the result of intensive research activities by FPT Industrial protected by a number of significant patented solutions:

- Optimised fluid-dynamics modelling of exhaust gas and AdBlue injection on SCR catalysts.
- Feed forward control logic to enable precise AdBlue dosing in order to abate incoming sensed NOx emissions.
- Ammonia and NOx sensor technology for extremely accurate exhaust gas sensing, enabling adaptive AdBlue dosing to compensate for any aging of the SCR catalyst.
- Insulated tube turbulence mixer technology to allow a homogeneous urea hydrolysis and distribution in the exhaust gas stream by introducing a swirling motion.

This combination of the above patents allows NOx reduction efficiencies in excess of 95%, reaching levels very close to 100% under specific circumstances.

New Euro VI Tector and Cursor Engines

By way of continuous technical advances to an already state of the art engine range, Euro VI sees the introduction of new Tector and Cursor engines, allowing Iveco vehicles to retain their class leading fuel economy.

Key to the optimisation of combustion efficiency is high mean effective cylinder pressure and high injector nozzle pressures. To achieve these aims, important

changes to the crankcase and cylinder head designs incorporate increased structural rigidity, higher coolant flow capacity and increased swept volume.

The Tector and Cursor engines both received the latest generation of multiple event common rail fuel injection equipment with peak nozzle pressures of up to 2200 bar.

A new electronic control unit has been introduced to manage both engine parameters and accurate control of the after-treatment system. The new control unit has been designed to optimise packaging and to fully integrate all engine, SCR and DPF functions. For Cursor engine versions using the variable geometry turbocharger, electronic control has been introduced to optimise load response at low engine speeds and to increase the effectiveness of the engine brake. In addition, all engines will now make use of the flap type engine brake valve in order to support passive DPF regeneration and to improve engine brake performance by up to 30% compared to current Euro V engines.

For the very best in environmental performance, Tector and Cursor engines were equipped with closed circuit engine breathing systems even at Euro IV/V level and this feature is retained for Euro VI. In order to prevent any oil mist carried in engine blow-by gases, very high performance oil separation systems have been introduced serving to reduce to the absolute minimum any oil burning with consequent DPF contamination. For Cursor engines, an oleophobic centrifugal oil separation is used while for the Tector engine, a high efficiency valve cover integrated coalescent type blow-by filter is used.

The introduction of the new Euro VI compliant engines emphasises Iveco's and FPT Industrial's continuous push towards sustainable mobility. In terms of fuel consumption, serviceability, carbon footprint and corporate image, Iveco has put its customers in the front row, achieving vehicles meeting the full requirements of this important new environmental standard and retaining the lowest possible cost of ownership.

By means of the optimised combustion regime, engine-out particulate emissions are already low, meaning that forced regeneration of the DPF is not required, an important aspect in terms of fuel use and periodic servicing. In addition, since the engine only breathes clean filtered air, rather than recirculated exhaust gases, engine wear is maintained very low and oil change intervals are maintained high, with service intervals of up to 150,000 km. This too brings advantages in terms of operating costs and reduced down time for scheduled maintenance.

After-Treatment System

A fundamental aspect of diesel combustion is the emission from the engine of oxides of nitrogen and particulate matter, both very difficult to eliminate together in the combustion chamber. Diesel fuel contains neither nitrogen nor oxygen and so NOx creation results from chemical changes to combustion air due to the high cylinder pressures and temperatures experienced during the combustion process. In cylinder NOx reduction techniques involve measures to reduce maximum cylinder temperatures and pressures that, paradoxically, increase the creation of particulate matter and reduce combustion efficiency resulting in increased fuel consumption. Once the need for exhaust after-treatment is accepted, it is clearly necessary to make the system work as hard as possible in order to not compromise the engine combustion process. The choice made by Iveco and FPT Industrial is to reduce particulate matter to the absolute minimum, allowing engine-out NOx emissions to increase due to the improved combustion efficiency resulting from this measure and the "SCR Only" technology in the exhaust system allows the NOx reduction to be made. The modest engine-out PM emissions are brought to the necessary levels using a full-flow Diesel Particulate filter that will achieve continuous regeneration due to the high exhaust NOx levels and the high gas temperature. Forced filter regeneration will not be necessary under normal circumstances.

A new generation Zeolite based compact SCR after-treatment system with all integrated components has been designed to optimise layout and minimise weight impact, resulting in a single, simple box shaped including DOC (Diesel Oxidant Catalyst), DPF (Diesel Particulate Filter), SCR (Selective Catalytic Reduction) and CUC (Clean-Up Catalyst). All these components have been installed with extreme compactness, achieving superior conversion efficiencies for all pollutants. In the very same box the AdBlue injection/mixing devices, as well as all exhaust gas sensors needed for the after-treatment management, are carefully integrated.

This allows the entire exhaust after-treatment to be contained in a compact, fully enclosed structure thereby not impeding body building or chassis equipment mounting activities.

More in detail, Euro VI tailpipe emission levels have been achieved with a robust engineering margin by means of innovative design and accurate testing and modelling activities. The result is perfect tuning of DOC, DPF, SCR and CUC coatings to grant maximum conversion efficiency without significant ageing for the full vehicle life. A clear-cut design of inlet and outlet substrate areas allows for the

complete exploitation of the catalyst installation in its confined volume, including the AdBlue injection area with controlled turbulence and optimised thermal insulation. This guarantees perfect AdBlue aerosol mixing and urea hydrolysis prior to reaching the SCR. With precise positioning of exhaust gas sensors, a rapid and precise monitoring of all catalytic substrates and on-going chemical reactions is achieved.

Tector Engine Technical Data

Engine	N° Cylinders	Displ. (litre)	Turbocharger	Power (kW@ rev/min)	Power (hp)	Torque (Nm @ rev/min)
Tector 4	4	4,5	With waste-gate	118 @ 2500	160	580 @ 1250
			With waste-gate	137 @ 2500	186	680 @ 1250
			With waste-gate	152 @ 2500	206	750 @ 1400
Tector 6	6	6,7	With waste-gate	162 @ 2500	220	800 @ 1250
			With waste-gate	184 @ 2500	250	850 @ 1250
			With waste-gate	206 @ 2500	280	1000 @ 1250
			With waste-gate	235 @ 2500	320	1100 @ 1250

Cursor Engine Technical Data

Engine	N° Cylinders	Displ. (litres)	Turbocharger	Power (kW @ rev/min)	Power (hp)	Torque (Nm @ rev/min)
Cursor 9	6	8,7	With waste-gate	228 @ 2200	310	1300 @ 1200
			With waste-gate	243 @ 2200	330	1400 @ 1200
			With waste gate	265 @ 2200	360	1650 @ 1200
			Electronic variable geometry	294 @ 2200	400	1700 @ 1200
Cursor 11	6	11,1	With waste gate	309 @ 1900	420	1900 @ 1050
			Electronic variable geometry	338 @ 1900	460	2150 @ 1050
			Electronic variable geometry	353 @ 1900	480	2250 @ 1050
Cursor 13	6	12,9	With waste gate	302 @ 1900	410	2100 @ 1000
			With waste gate	331 @ 1900	450	2200 @ 1000
			Electronic variable geometry	368 @ 1900	500	2300 @ 1000
			Electronic variable geometry	412 @ 1900	560	2500 @ 1000

Iveco

Iveco, a Fiat Industrial company, designs, manufactures, and markets a broad range of light, medium and heavy commercial vehicles, off-road trucks, city and intercity buses and



coaches as well as special vehicles for applications such as fire fighting, off-road missions, defence and civil protection.

Iveco employs almost 25,000 people and runs 24 production units in 11 Countries in the world using excellent technologies developed in 6 research centres. Besides Europe, the company operates in China, Russia, Australia and Latin America. Around 5,000 sales and service outlets in over 160 Countries guarantee technical support wherever in the world an Iveco vehicle is at work.

FPT Industrial

FPT Industrial is the Fiat Industrial company specialised in the design, production and sale of propulsion and transmission systems for on- and off-road trucks and commercial vehicles, as well as engines for marine application and power generation. The sector employs some 7,800 people worldwide at 10 production units and 6 R&D centres; the existence of a distribution network of more than 100 dealers and 1000 service points ensures FPT Industrial presence in around 100 countries. With an extensive product portfolio (5 engine families ranging in output from 50 hp to 870 hp and transmissions with maximum torque from 300 to 400 Nm) and a strong emphasis on research and development, FPT Industrial is one of the world's leading producers of powertrains for industrial application.

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