Iveco and FPT Industrial present the High Efficiency SCR system for an efficient and clean transport

Press Release

At a technology forum in Turin, Iveco and FPT Industrial showcased their technology: a unique solution to meet Euro VI requirements, announced last year, and their plans to meet future customer demand for reduced fuel consumption and operating costs.

Iveco and FPT Industrial have a strong history of technical innovations aimed at low operating costs of which fuel consumption has long been a fundamental point. For the Euro IV/V emission standards introduced in 2005 Iveco and FPT Industrial have already chosen the SCR path. A choice that allowed the engines to be tuned to fully optimise combustion efficiency, and hence fuel efficiency, at the expense of high engine-out NOx emissions that is reduced by the SCR exhaust after-treatment.

For Euro VI, neither Iveco's and FPT Industrial's strategy nor the final customers' demand for fuel efficient engines has changed. In the face of a general acceptance that interventions are needed both in the combustion chamber and in 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. FPT Industrial has developed a fully patented High Efficiency SCR system that allows unprecedented efficiencies.

The after-treatment technology of FPT Industrial, which is based on a SCR only technology for the Euro VI vehicles, 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 emissions: scenario

The emissions in Diesel engines, because of the chemistry of combustion, consist of a series of pollutants, of which the most harmful are NOx (Nitrogen Oxides) and Particulate Matter (PM).

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 of these harmful pollutants:

- NOx emissions reduced by 80% compared to Euro V (ETC test cycle, equivalent emissions).
- PM mass reduction by 66% compared to Euro V (ETC test cycle, equivalent emissions). It is planned further introduction of a particle number limit, that will result in an overall particulate matter reduction of more than 95%.
- Introduction of an ammonia emission limit.

On top of this Euro VI also sees the introduction of a series of additional operational aspects:

- New world-wide transient and steady state test cycles. The transient cycle will be in two parts: a part in which is used a cold engine and a second part, following a stationary rest time.
- 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.
- Measures for implementing the use of portable measurement systems (PEMS) for verifying the actual in-use emissions and verifying and limiting the off-cycle emissions.
- Measures aimed to make vehicle repair and maintenance information readily accessible, so as to ensure that independent operators have access to such information.

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

High Efficiency SCR system

Euro VI emission limits can be reached only through the use of SCR (Selective Catalytic Reduction), either with or without EGR (Exhaust Gas Recirculation).

The use of an EGR system reduces the NOx emissions in the combustion chamber, through exhaust gas recirculation with a consequential increase in the production of particulate matter and a reduction in combustion efficiency. Furthermore, with high engine-out particulate emissions, a forced regeneration of the DPF (Diesel Particulate Filter) is required.

FPT Industrial has chosen instead to increase the engine efficiency and reduce the particulate matter produced by the combustion, due to the absence of recirculated exhaust gasses. While the remaining particulate matter is reduced in the passive DPF, the NOx is reduced in the exhaust system, while improving fuel consumption, performance and reliability.

FPT Industrial's High Efficiency SCR is able to reduce the NOx levels more than 95%.

More in detail the system is composed of the following elements:

- The Diesel Oxidation Catalyst (DOC)
- The Passive Diesel Particulate Filter (DPF)
- The AdBlue dosing module.
- The AdBlue mixer
- The Selective Catalytic Reduction (SCR)
- The Clean Up Catalyst (CUC)

The whole system is fitted with a network of integrated sensors to control the NOx and any excess of NH_3 (ammonia) emitted.

The “SCR-Only” technology sees the introduction of a new integrated approach that is the result of extensive research by FPT Industrial, research that has led to the creation of numerous significant patents for:

- "Closed" control to allow precise dosing of AdBlue in order to cut the level of NOx emissions entering the SCR catalyst.
- Adaptive AdBlue dosing system thanks to control technology based on the use of NOx and ammonia sensors to provide accurate information on the composition of the exhaust gases.

- Thermally insulated high turbulence mixing, to allow homogeneous hydrolysis of urea and correct distribution in exhaust gas flow.
- Improved thermal management to speed up SCR light-off in the cold part of emission cycle

All the components of the entire exhaust after-treatment system are contained in a compact, fully enclosed structure thereby not impeding body building or chassis equipment mounting activities and minimizing the weight impact.

Euro VI Engines

By way of continuous technical advances to an already state of the art engine range, Euro VI sees also the introduction of reengineered engines, allowing Iveco vehicles to retain their class leading features.

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 engines received the latest generation of multiple events 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, the 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.

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.

Advantages can be summarized as follows:

- Increased reliability
- Higher power potential without a mandatory sophisticated air handling system
- Low operating costs due to low engine wear and high maintenance intervals (up to 150.000 km, depending on the mission)
- Compact and lean design, both of the engine and the High Efficiency after-treatment system, lowering weight and installation space.

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 in 11 Countries in the world using excellent technologies. 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 a company of FIAT Industrial dedicated to the design, production and sale of powertrains for on/off-road vehicle, marine and power generation applications. The company employs approx. 8,000 persons worldwide, in 9 plants and 5 R&D Centres. The FPT Industrial's sales network consists of 100 dealers

and over 1,300 service centres in about 100 countries. A wide range of products (5 engine ranges from 37 up to 640 kW, and transmissions with maximum torque from 300 up to 500 Nm) and a close focus on R&D activities, make FPT Industrial a world leader in industrial powertrains.