

VOLVO DIESEL ENGINES WITH SCR



Technology for the future



Volvo diesel engines with SCR

LOW EMISSIONS. LOW FUEL CONSUMPTION. HIGH PERFORMANCE.

Increasing numbers of countries are introducing ever-stricter emissions requirements for heavy vehicles. At Volvo Buses we view this challenge in a positive light and have chosen to tackle it with advanced diesel engine technology allied to exhaust gas after-treatment with SCR (Selective Catalytic Reduction). The result is not just considerably lower emissions of air pollutants, but also better performance and lower fuel consumption.

A solution to today's and tomorrow's needs

In recent years, emissions of pollutants from new heavy vehicles have been drastically reduced. The introduction of the European Euro IV requirements in 2006 meant that emissions of nitrogen oxides and particulates were cut by 30 and 80 percent respectively. The next stage, Euro V, will be taken in 2009, when emissions of nitrogen oxides will be reduced by just over another 40 percent. 2014 will see the implementation of even stricter requirements with the introduction of Euro VI. With Volvo's solution, the same technology can be used to meet Euro IV, Euro V, EEV and Euro VI. An important advantage, not least for operators on markets where the authorities are encouraging quick implementation of environmentally optimised vehicles.

Reduces particulates and nitrogen oxides

The basis of solution is diesel engines with highly efficient combustion, which itself promotes a high efficiency, low fuel consumption and low emissions of particulates. In order to also reduce nitrogen oxide emissions to low levels, the engine is supplemented with a system for exhaust gas after-treatment. It is known as Selective Catalytic Reduction (SCR) and it converts harmful nitrogen oxides into harmless nitrogen gas and water vapour.

Up to 17 percent lower fuel consumption

Those customers who have so far chosen Volvo buses with SCR have been able to lower their fuel consumption by up to 17 percent compared with the previous engine generation. Volvo's solution thus meets the legislators' requirements for low environmental impact and the customers' demand for low operating costs, high engine power output and high reliability.

Emissions levels, g/kWh

	NO _x	PM
Euro III, ETC	5.0	0.16
Euro IV, ETC	3.5	0.03
Euro V, ETC	2.0	0.03
EEV, ETC	2.0	0.02
*Euro VI, ETC	0.4	0.01
US-04	3.4	0.136
US-07	1.5	0.013
US-10	0.46	0.013

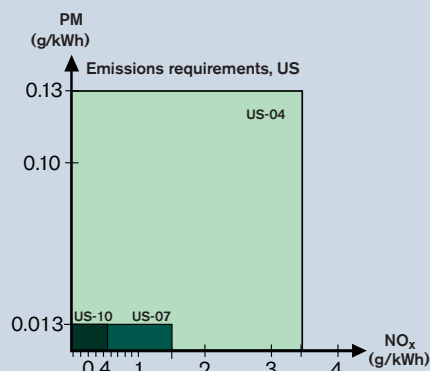
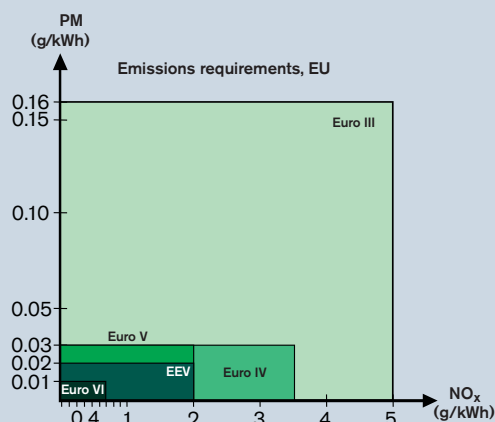
ETC = European Transient Cycle

* Proposed

Forthcoming emissions standards will bring about significantly lower emissions of particulates and nitrogen oxides in particular. The US ratings are converted into g/kWh.

VOLVO'S DIESEL ENGINES WITH SCR

- Meet Euro 4 and Euro 5, as well as EEV.
- Up to 17 percent lower fuel consumption (compared with the previous engine generation).
- Also suitable for high engine power outputs.
- Low service costs and long service intervals.



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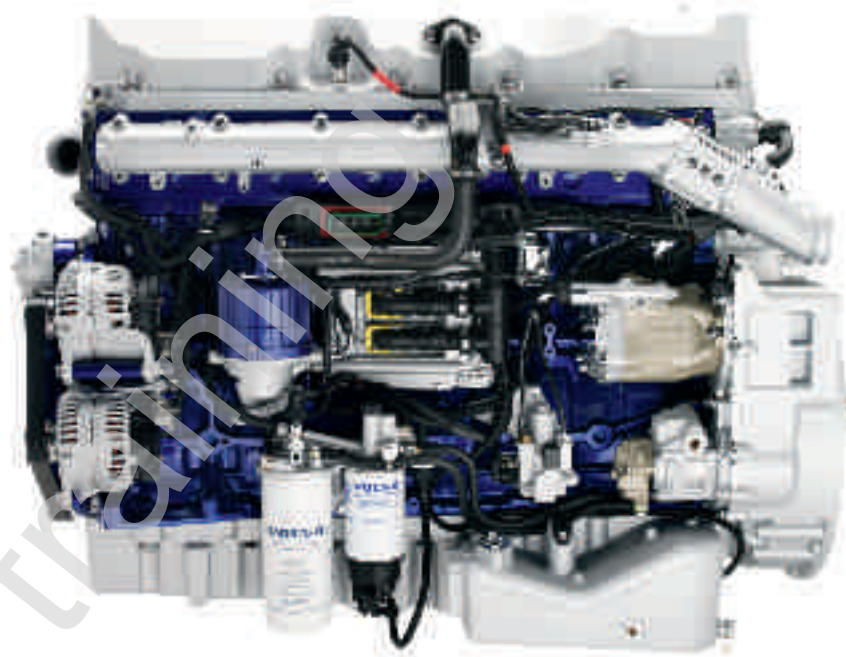
AN EFFICIENT SOLUTION

Volvo's engines have been developed to provide the most complete combustion possible. This means that the energy content of the diesel fuel is exploited very efficiently and that the level of particulates in the exhaust gases is reduced inside the engine to the low levels required by Euro IV, Euro V and EEV.



The fuel injector injects fuel under extremely high pressure and with immense precision, contributing to low fuel consumption and low emissions.

Once the exhaust gases leave the engine, all that remains to be done is to filter out their nitrogen oxides. This is done with the help of SCR (Selective Catalytic Reduction). It is an effective and thoroughly tested method of cleaning up exhaust gases. It has long been used for stationary power units and in recent years been developed and modified to suit heavy duty vehicles. In this method, a mixture of urea and water known as AdBlue is sprayed into the exhaust gases. The heat of the exhaust system transforms the urea into ammonia and carbon dioxide. The ammonia then reacts with the nitrogen oxides in a catalytic converter, converting them into nitrogen gas and water vapour. Any ammonia residues are also transformed into nitrogen gas and water in an integrated clean-up catalytic converter.



Diesel engine optimised for high performance and low fuel consumption.

System with few parts

The main components in Volvo's SCR system are a tank and an injection system for AdBlue, as well as an SCR catalytic converter. The equipment also includes a monitoring system (On Board Diagnostics) that alerts the driver if the level of nitrogen oxides in the exhaust gases is excessive, and also when it is time to refill the reservoir with AdBlue.

Pre-catalytic converter for city buses

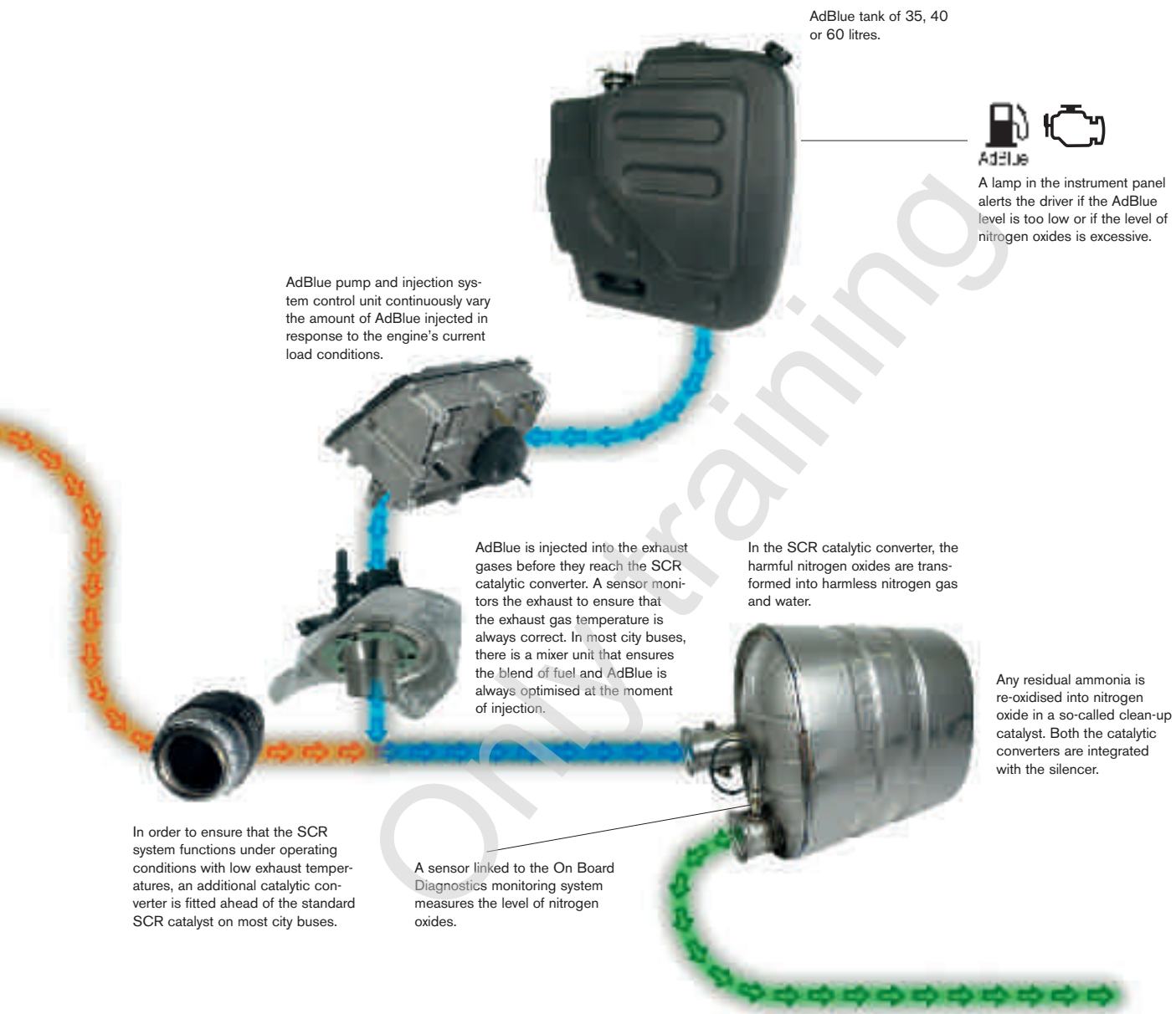
In order to ensure that the SCR system functions under operating conditions with low exhaust temperatures, an additional catalytic converter is fitted ahead of the standard SCR catalyst most city buses. The pre-catalytic converter also reduces emissions of particulates from an already low level. A mixer unit ensures that the blend of fuel and AdBlue is optimised at the very instant of injection.

Volvo leads the way. Volvo has invested considerably in developing and optimising SCR technology for heavy vehicles. Since 2004, Volvo has offered buses with emissions levels on a par with Euro V.



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HOW THE SYSTEM WORKS



In order to ensure that the SCR system functions under operating conditions with low exhaust temperatures, an additional catalytic converter is fitted ahead of the standard SCR catalyst on most city buses.

A sensor linked to the On Board Diagnostics monitoring system measures the level of nitrogen oxides.

Any residual ammonia is re-oxidised into nitrogen oxide in a so-called clean-up catalyst. Both the catalytic converters are integrated with the silencer.

A wide range. The latest generation of engines and SCR has been introduced throughout the Volvo Buses product range. The engine range encompasses engines of 7, 9 and 12 litres.



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DRIVE 6000 KM ON A SINGLE TANK OF ADBLUE



On board the bus, AdBlue is stored in a 35, 40 or 60 litre tank.

Consumption of AdBlue corresponds to 3–5 % of the bus's fuel

consumption. This means that 35 litres of AdBlue lasts as long as

1000 litres of diesel fuel does. With fuel consumption of about 3–4 litres per

10 kilometres and a 60-litre AdBlue tank, it is possible to cover 5500–6000 km

before it is necessary to refill the AdBlue tank.

Solution for cold climates

AdBlue begins freezing at -11°C but is not in a solid state until 24 hours at -25°C . Volvo has a solution where the AdBlue tank and related equipment are heated and within 30 minutes at -20°C the system will be fully operational. The system will effectively control emissions in temperatures as low as -18°C ambient temperature.

A few facts about AdBlue and urea

AdBlue is a stable, colourless, water-like fluid. 32.5% of its content is urea, the rest is deionised water. AdBlue is classified as low-toxic and carries no risk of any chronic health risks. Nor is the fluid flammable or explosive. It is not subjected to any special restrictions for handling or transport. AdBlue is quality-assured and meets ISO 2241.

Urea separates into ammonia and carbon dioxide in the exhaust pipe and it is made in a process where the nitrogen in the air reacts with hydrogen from a source such as natural gas. Urea is used as an artificial fertiliser and is also to be found in certain foodstuffs and other products.

Low AdBlue consumption. The consumption of AdBlue is 3–4 percent that of fuel consumption for a Euro V engine. Consumption may also vary somewhat depending on the route. This is more than offset by the low fuel consumption.



CLEANER AND MORE FUEL-EFFICIENT ENGINES FROM THE WORLD'S LARGEST MANUFACTURER

Volvo is the world's largest manufacturer of heavy diesel engines. This gives us the resources to constantly develop and refine our technology to create ever more fuel-efficient and clean engines. Here are some examples of the latest engine improvements from Volvo.

- Optimised pistons, piston rings and cylinder liners, so as little oil as possible can penetrate into the combustion chamber. This results in extremely low emissions of particles and very low oil consumption.
- Optimised crown pressure in the combustion chamber promotes a higher efficiency rating and lower fuel consumption.
- The latest generation of fuel injectors with high pressure and immense precision gives optimum combustion, low fuel consumption and low emissions.
- Volvo's turbocharger makes it possible to press more air into the combustion chamber at low revs. This provides more power at low engine speeds and high torque across a wider rev range. The bus is easier to drive and more pleasant to ride in.
- Engine control unit with increased capacity means the combustion process is optimised under all conditions. This results in lower fuel consumption and lower emissions.
- The engine control unit also has extended functions for diagnostics and fault-tracing. Any faults that arise can be discovered and corrected more quickly to minimise standstill times and maximise the bus's uptime.
- Engine installation with a new, highly efficient fan motor results in a cooler engine compartment and better, less energy-consuming cooling, which in turn promotes lower fuel consumption.
- Closed crankcase ventilation eliminates oil spillage and crankcase gases.



VOLVO

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