

Going green has its dangers – you have been warned

THE increase in diesel passenger vehicle sales in Europe and especially their emissions and impact on the environment have not gone unnoticed by the relevant authorities. Health studies have shown a correlation between the inhalation of diesel particulates and serious illnesses such as cardiovascular disease and lung cancer. Therefore, current Euro5 legislation demands such low particulate emissions from a modern diesel engine that the manufacturers have no choice but to fit highly sophisticated exhaust after-treatment systems on all their diesel powertrains.

General perception assumes that an engine that emits fewer pollutants will also be more fuel efficient – this is not the case with diesel particulate filters (DPFs). Curbing particulate emissions is laudable but do not be fooled that this technology comes without risks to the consumer...

SOOT PRODUCTION

Soot is produced in a diesel combustion process due to the heterogeneous charge and localised rich-mixture pockets (in an otherwise lean mixture), and can visibly be seen as "smoke" from the exhaust. The particulate matter that forms as a by-product of diesel combustion consists mostly of carbon with absorbed organic compounds such as sulphates and nitrates. Although soot production can be minimised by higher injection pressures, optimised injector spray patterns and turbocharging with inter-cooling, it is not enough to meet the strict European emission limits. Manufacturers are forced to use DPFs in the exhaust system to

catch the particulate matter. Fuel quality (or the lack thereof) will also contribute to higher soot production, which can be a problem in a country such as South Africa. The after-treatment system of a modern diesel engine would most likely consist of the following components to aid the removal of soot from the exhaust stream:

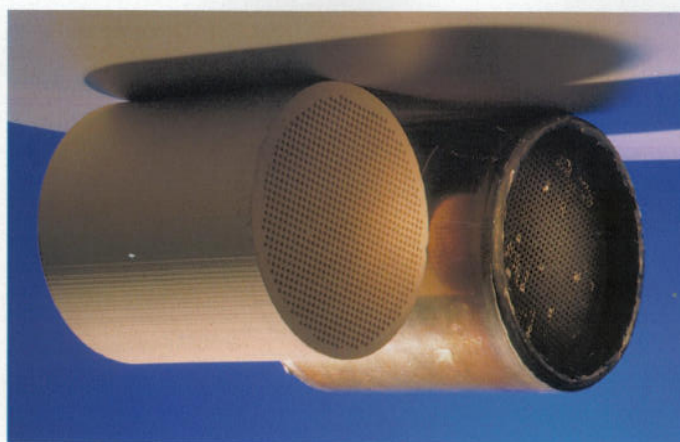
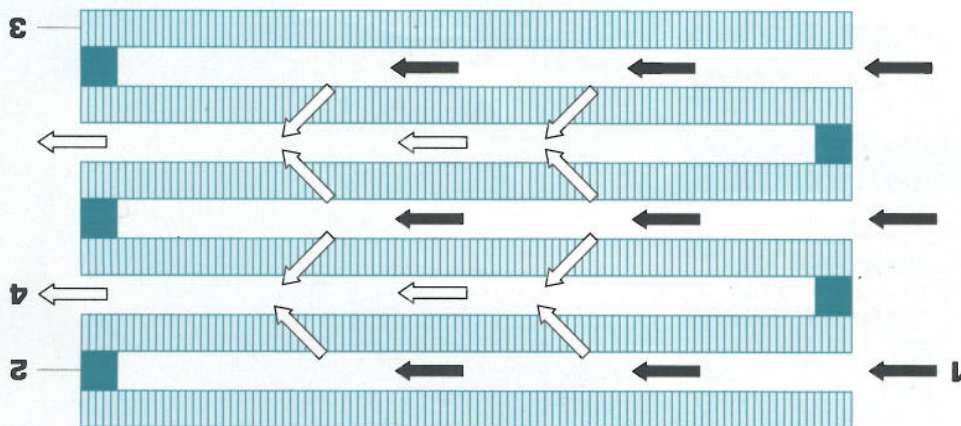
HARDWARE NEEDED

The main component is a filter consisting of a ceramic-monolith substrate (material used for the filtration process) with channels along the flow axis of the exhaust gas. These channels are closed and opened in a way that forces the exhaust gas through the porous honeycomb walls of the structure where the particulates get trapped (see figure). The substrate might be coated with a catalytic wash

DPF

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The soot-filtration process: 1. soot-filled exhaust gas from engine; 2. ceramic plug in substrate channel; 3. substrate cell partition; 4. soot-free exhaust gas leaves the filter.



Filter substrate as found inside the metal-can structure of a DPF. Note the channels running length-wise through the cylinder. Substrate in forefront is new while unit at the back has been subjected to a few regeneration cycles.