

Outlook to further AECC work on RDE testing on GDI-GPF and Diesel vehicles

AECC Technical Seminar
on Real-Driving Emissions

Brussels, 29 April 2015

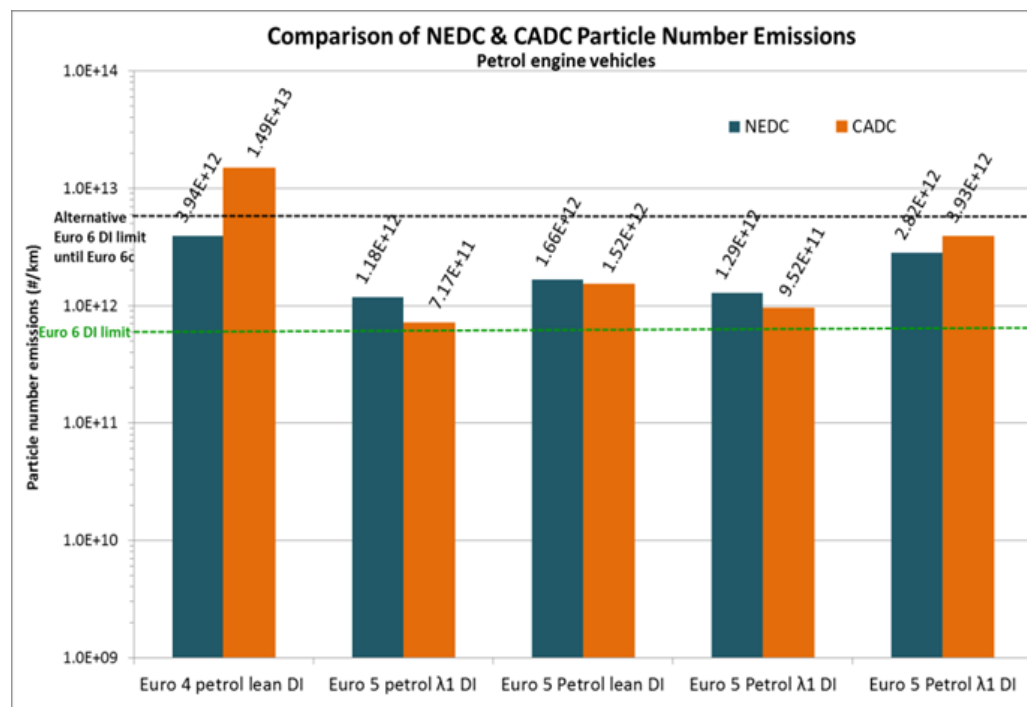


Association for Emissions Control by Catalyst AISBL

GASOLINE DIRECT INJECTION

The GDI Particles issue

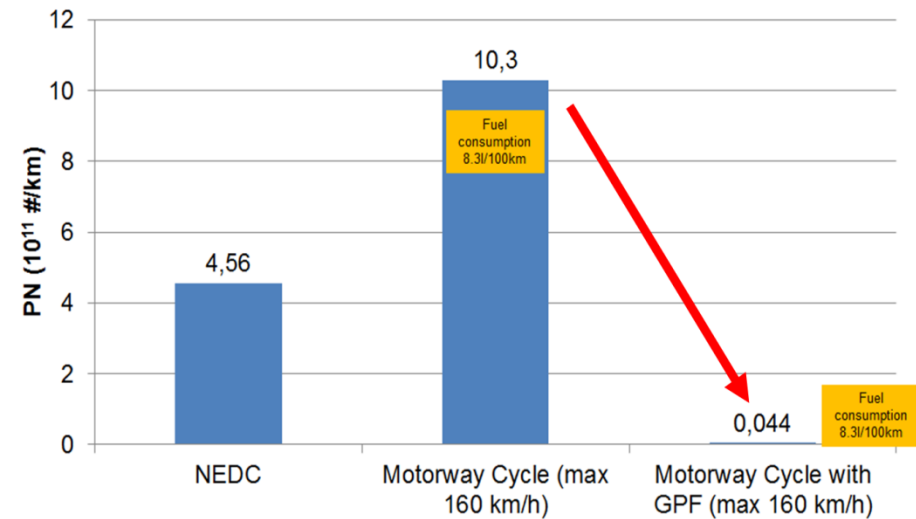
- CO₂ legislation promotes fuel-efficient Gasoline Direct Injection (GDI) in the EU.
- The number of particles emitted by DI gasoline vehicles is higher than the PN levels allowed for diesel cars.
- Euro 6b introduced a PN limit for GDI in 2014, 10 times higher than the Diesel limit.
- PN limit will align with Diesel in 2017 (6×10^{11} #/km)



Source: AECC light-duty test programmes

The GDI Particles RDE issue

- Real-world particle number emissions from GDI can be substantially higher than on regulatory test cycle.



Source: Deutsche Umwelthilfe Press Conference Berlin, 29 October 2013
Pictures and test results: AFHB Bern, Switzerland

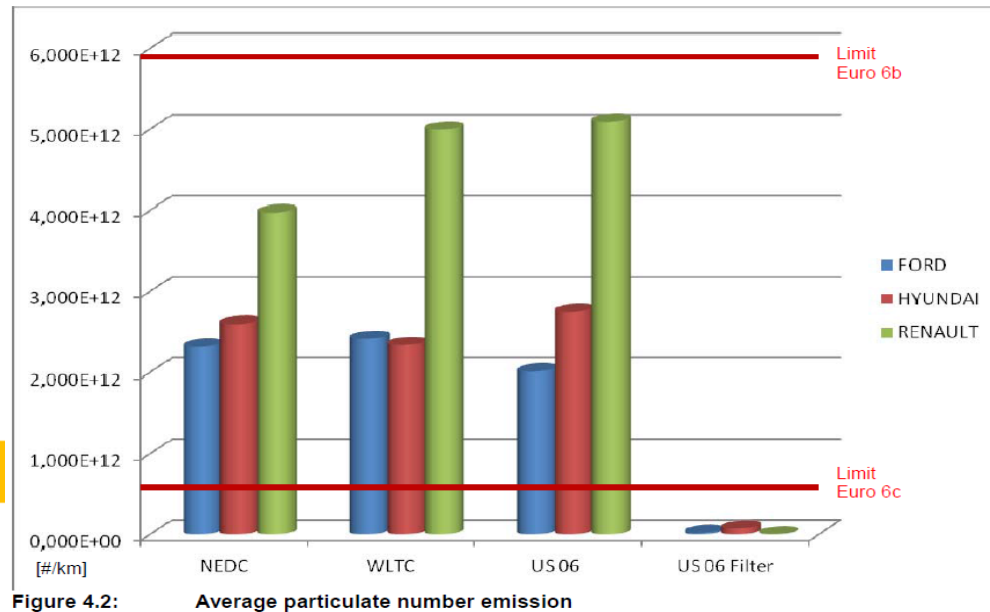


Figure 4.2:

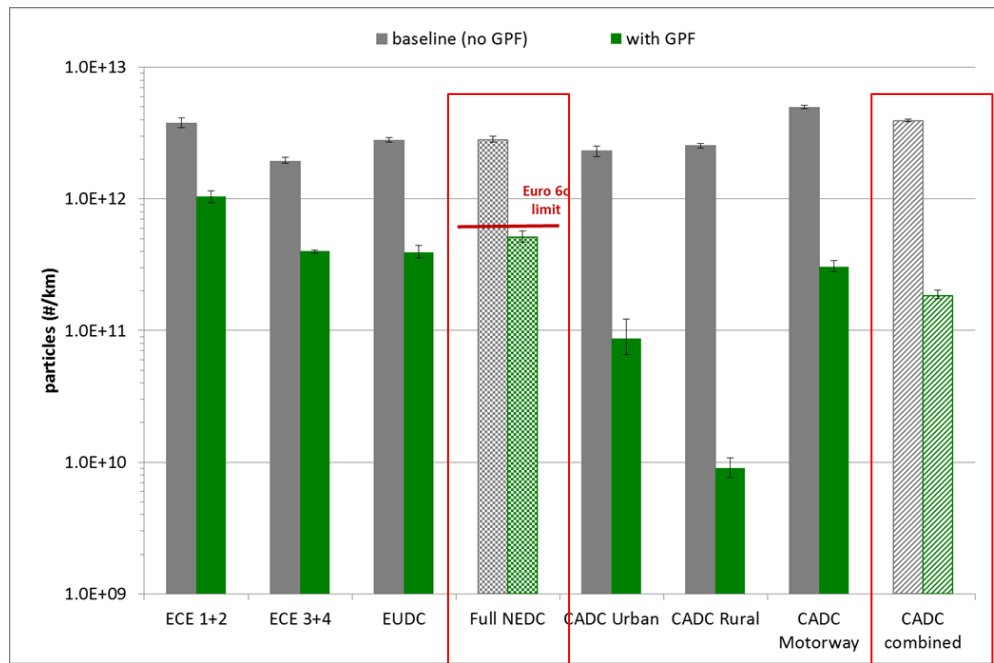
Average particulate number emission

Source: T&E Briefing Particle emissions from petrol cars, November 2013

- Legislation needs to ensure that gasoline engine particle emissions are controlled also in real world.

Gasoline Particulate Filters (GPF)

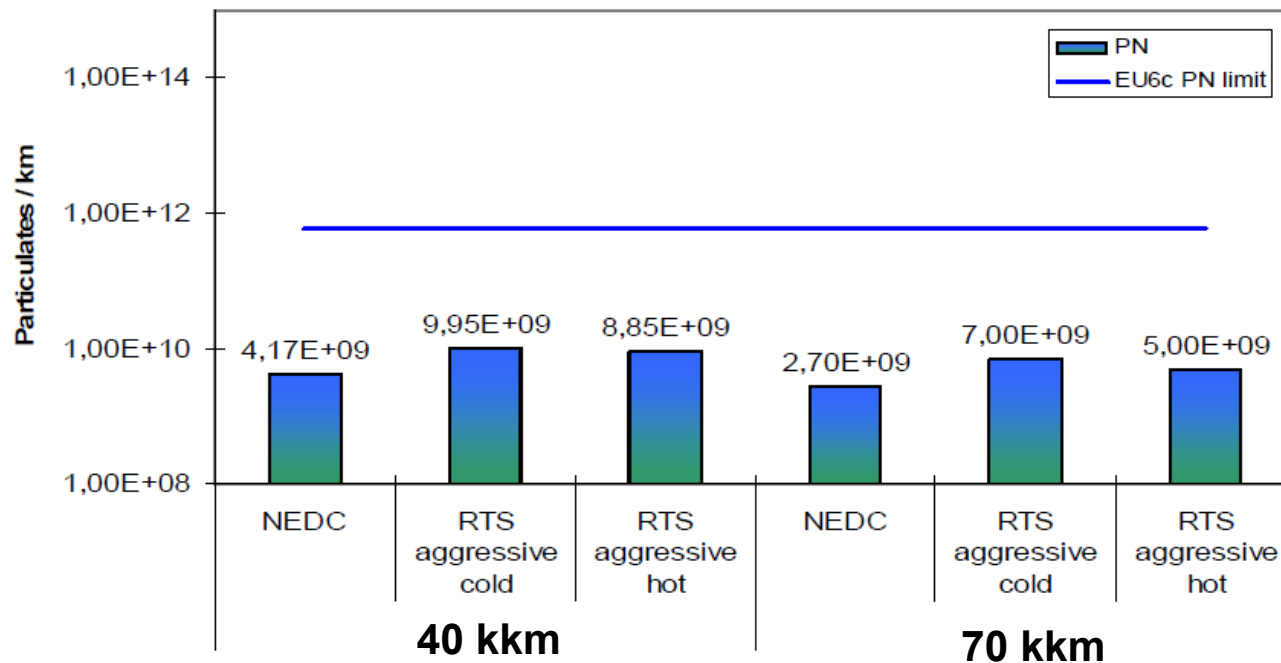
- GPF offer the most effective route for control of PN emissions under a wide range of driving conditions.



Source: Particulate Emissions from Petrol-Engined Light-Duty Vehicles taken from the European Fleet, AECC, Cambridge Particles Meeting 24 May 2013.

Gasoline Particulate Filters (GPF)

- GPF offer a durable solution to control ultrafine particles emissions even in aggressive driving conditions.



Source: *Comprehensive Gasoline Exhaust Gas Aftertreatment, an Effective Measure to Minimize the Contribution of Modern Direct Injection Engines to Fine Dust and Soot Emissions*, Kern et al, Umicore, SAE 2014-01-1513, April 2014.

GPFs can meet Euro 6c PN Limit

Durability Run Completed

2.0 L Audi TFSI



Test converter layout

Close-Coupled Three Way Catalyst + Underfloor coated GPF

TWC 1.24L 64g/ft³

GPF 1.68L 10g/ft³

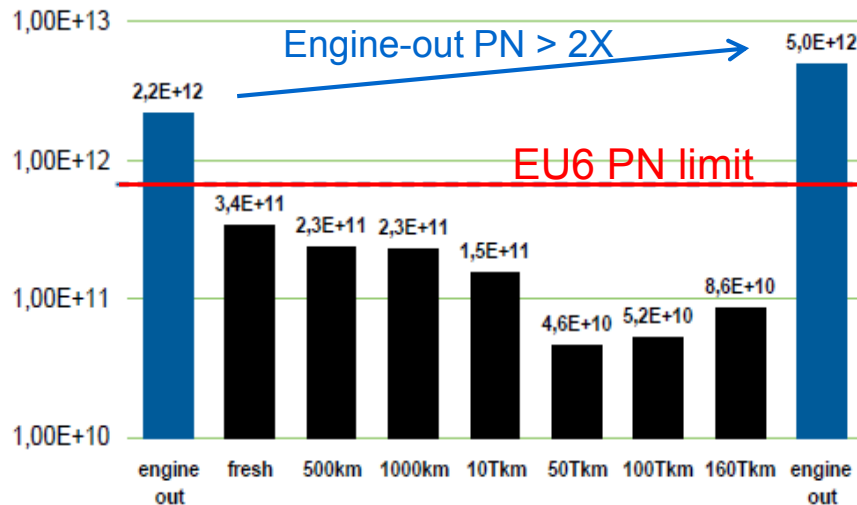
Replacing series catalyst

Close-Coupled Three Way Catalyst TWC

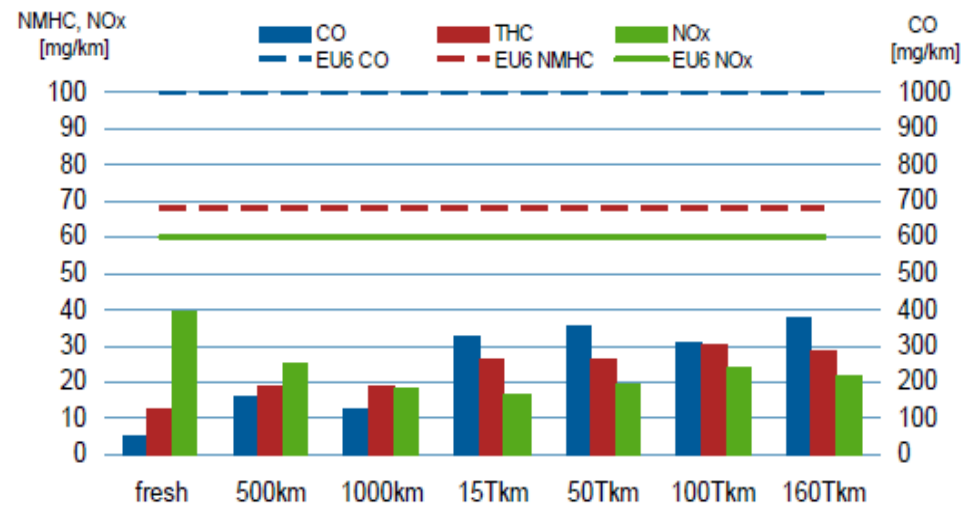
TWC 1.24L 80g/ft³

Averaged Particulate Number in NEDC test [# /km]

logarithmic scale



Tailpipe emissions for NEDC phases



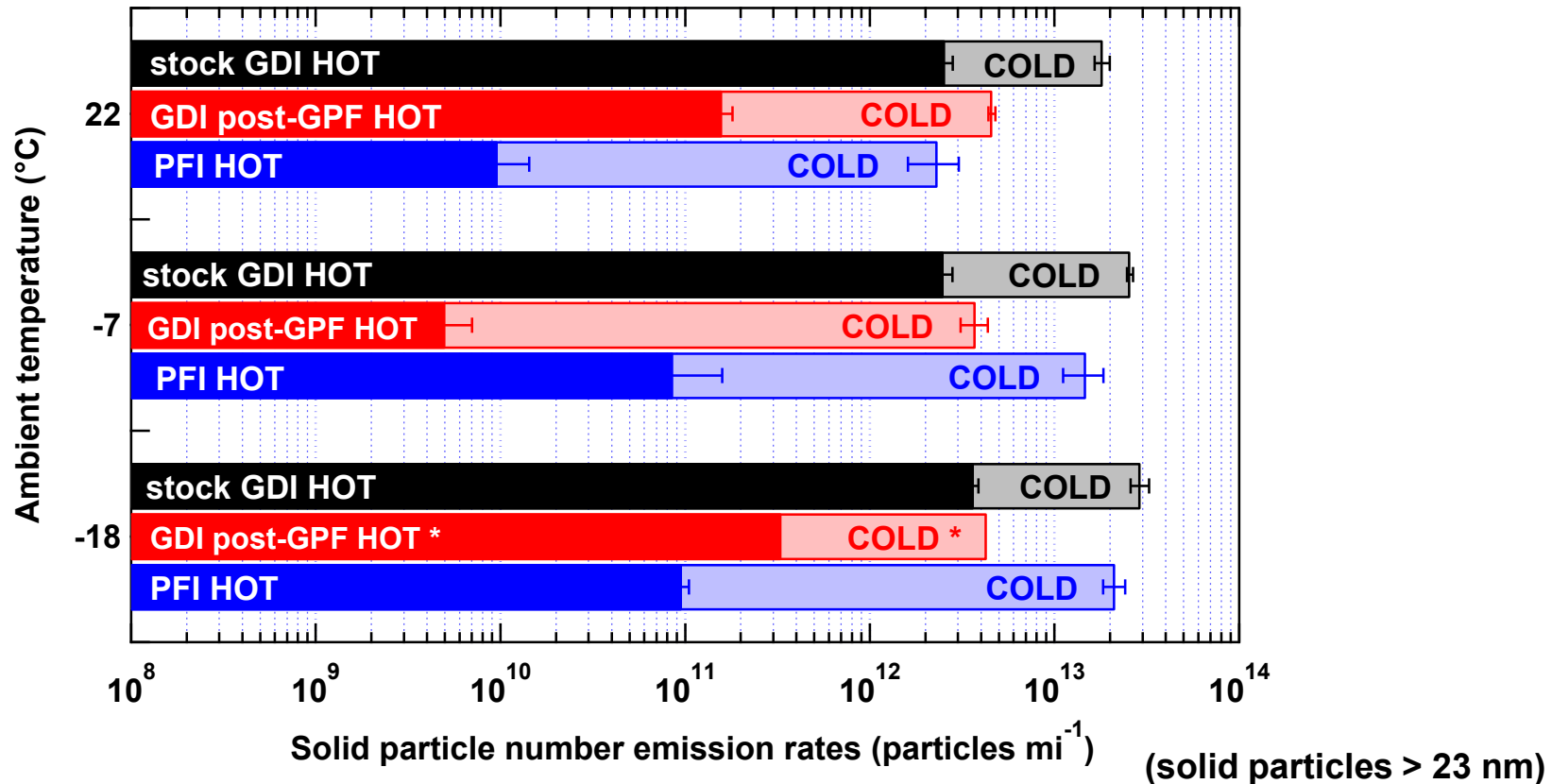
Source: MECA - CAPoC 9, August 2012



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GPF reduces particle emissions even at cold ambient temperatures

FTP Particle Emissions
in Bag 1 (Cold-start) and Bag 3 (Hot-start)



Exhaust system suppliers' GPF offer

- 1 April 2015: TENNECO announces developing Gasoline Particulate Filter technology for European light vehicles

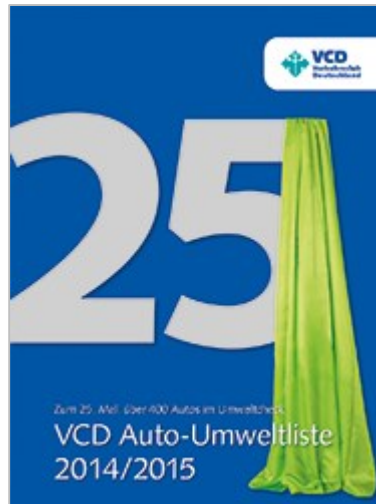


- 20 April 2015: FAURECIA introduces world's first GPF for passenger vehicles.



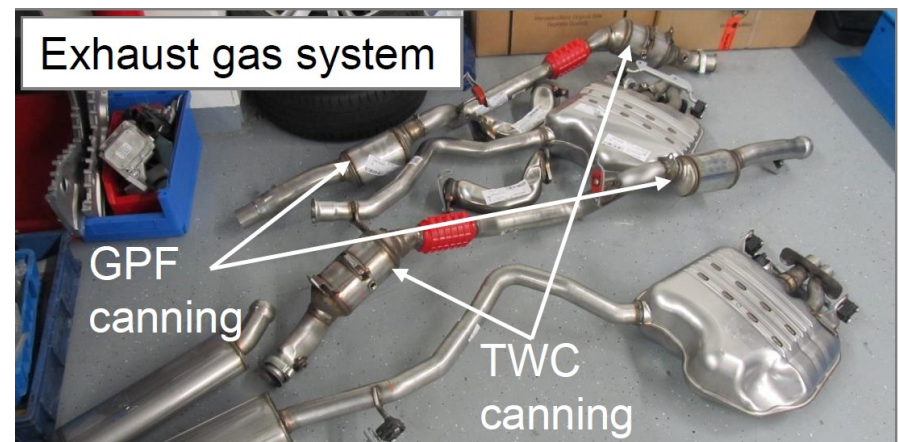
GPF first series production application

- Daimler has equipped the serial production Mercedes S500 V8 gasoline engine with a GPF.
- Source: VCD's Auto-Umweltliste 2014/2015 report
 - published by the Verkehrsclub Deutschland (VCD, German Traffic Club).



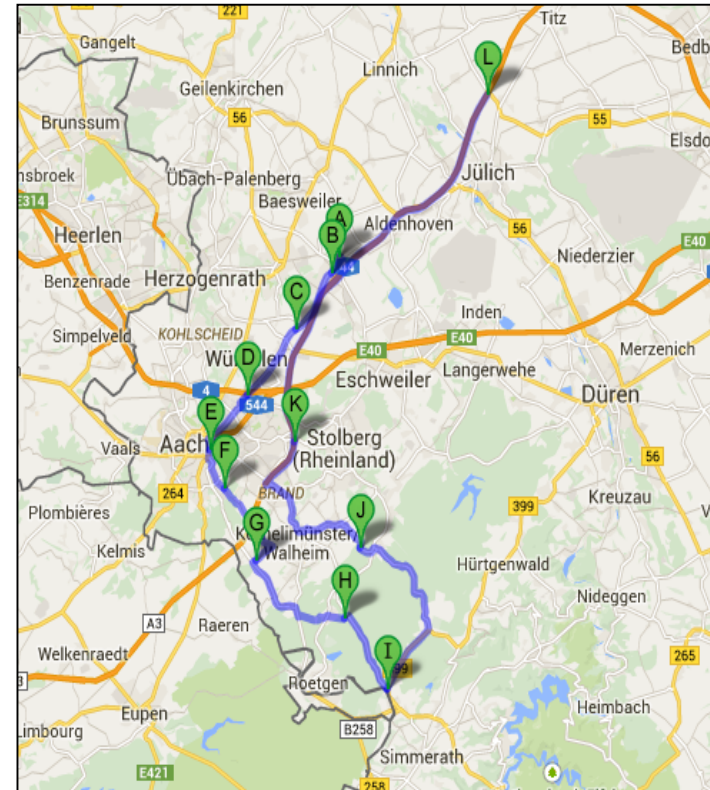
AECC GPF-GDI Test Programme

- AECC and Concawe have contracted a test programme
 - Vehicle: Mercedes S500, 4.7 litre, 335 kW V8 twin turbo gasoline engine, 7-speed automatic transmission, 2-wheel drive.
 - Twin exhaust systems with GPF in each line.
- Testing is currently on-going.
 - NEDC and WLTC chassis dyno tests
 - On-road tests with same route as Clean Diesel RDE tests.
 - PEMS instrument for gaseous and PN emissions



Scheduled PEMS route for RDE evaluation

Distance	107 km
Typical duration	119 min
Average speed	~57 km/h
Maximum speed	160 km/h
Altitude	101 to 594 m

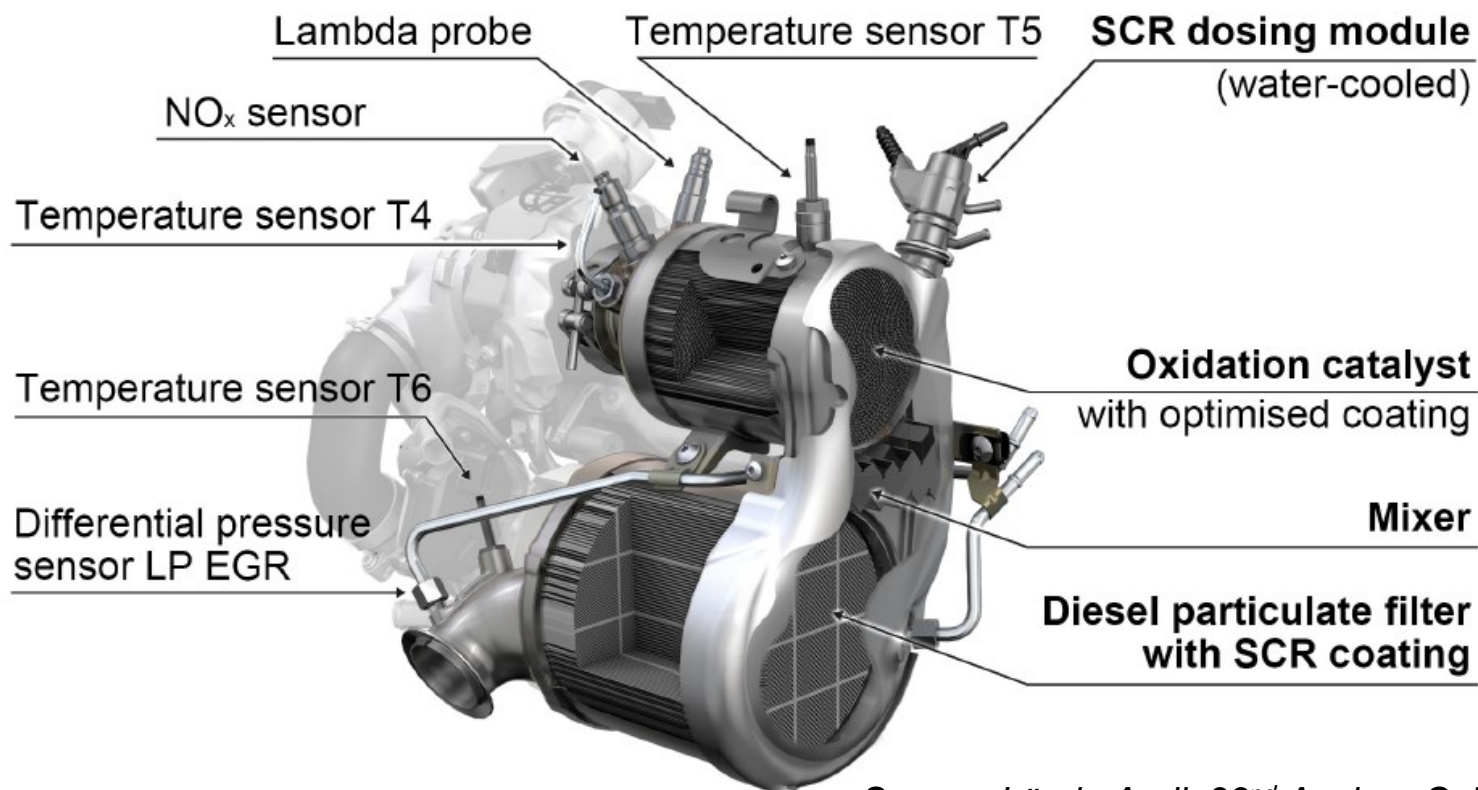


CLEAN DIESEL



Commercial S-DPF application

- Audi 2.0l TDI Ultra engine uses close-coupled SCR on DPF (S-DPF).



Source: Lörch, Audi; 22nd Aachen Colloquium
Automobile and Engine Technology 2013

AECC clean Diesel benchmark

- AECC has contracted Ricardo, UK to test an Audi A5 TDI Ultra. Testing is currently on-going.
- NEDC and WLTC chassis dyno tests
- On-road tests with PEMS measurement of gaseous and PN emissions.



Results to date

- Certification data: CO₂ 111g/km and NOx 56.4 mg/km (from KBA database).
- Emissions Analytics' database indicates on-road NOx emissions of 73 mg/km on trip including 79% urban, 6% rural, and 16% motorway driving.
- ...



- ◉ Home
- ◉ AECC
- ◉ Air Quality & Health Effects
- ◉ Emissions Legislation
- ◉ Engine & Vehicle Emissions
- ◉ Technology
- ◉ Applications
- ◉ Conservation
- ◉ Newsletter
- ◉ Publications

Who are AECC and what do we do ?

AECC is an international non-profit scientific association of European companies making technologies for engine exhaust emissions control.

The members of AECC are companies operating worldwide in the research, development, testing and manufacture of key technologies for emissions control.

Their products are the ceramic and metallic substrates for catalysts and filters; autocatalysts (substrates with catalytic materials incorporated or coated); adsorbers; filter-based technologies to control particulate emissions from diesel and other lean burn engines; and speciality materials incorporated into the catalytic converter or filter.

Catalyst-equipped cars were first introduced in the USA in 1974 but only appeared on European roads in 1985 and in 1993 legislation forced their use on cars. Now more than 275 million of the world's 500 million cars and over 85% of all new cars produced worldwide are equipped with autocatalysts. Catalytic

What are the emission control technologies?

Exhaust gas contains carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NOx) and particulate matter (PM). The main technologies used to treat exhaust to remove harmful gases and particles are:

- autocatalysts
- adsorbers (traps)
- filters

There are more details on the technology pages.



Thank you for your attention

Dieselretrofit

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