

CARB/Railroad Statewide 2005 Memorandum of Understanding

SCAQMD Comments Diesel Particulate Control

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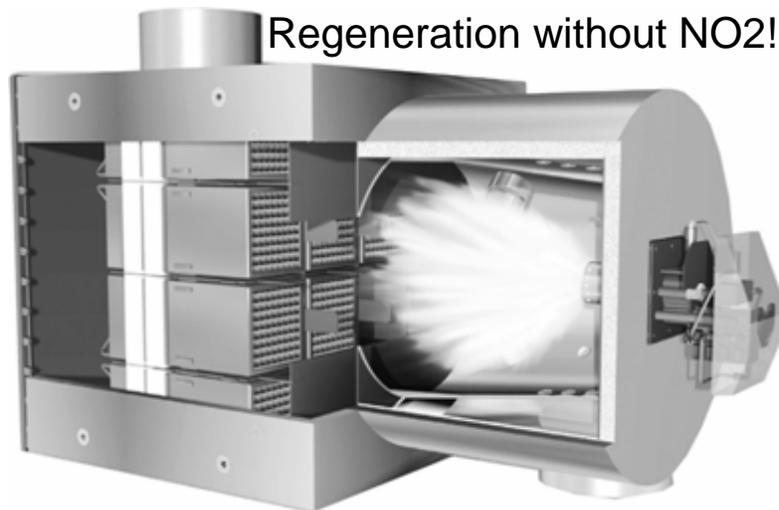
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SOOT PARTICLE FILTER SYSTEMS

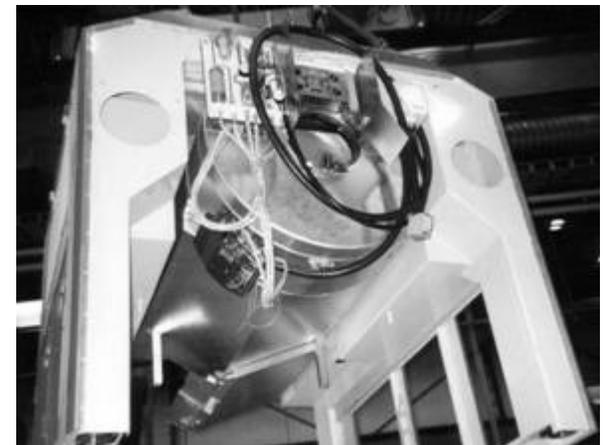
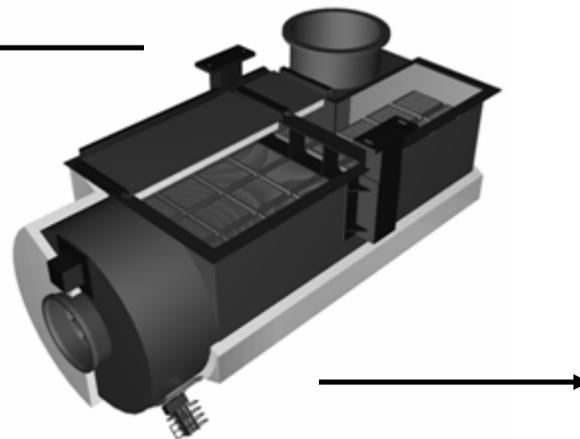
for mobile diesel engines with power outputs from 150 to 3'000 kW



- modular system for engines between 150 and **3'000 kW**
- filter elements made of SiC (Silicon Carbide)
- **active regeneration** burner, also for low exhaust temperatures
- excellent sound absorption (replaces silencer) for cramped places
- very recommended for:
 - locomotives
 - railway construction machines
 - mobile power plants
 - peak load
 - special applications

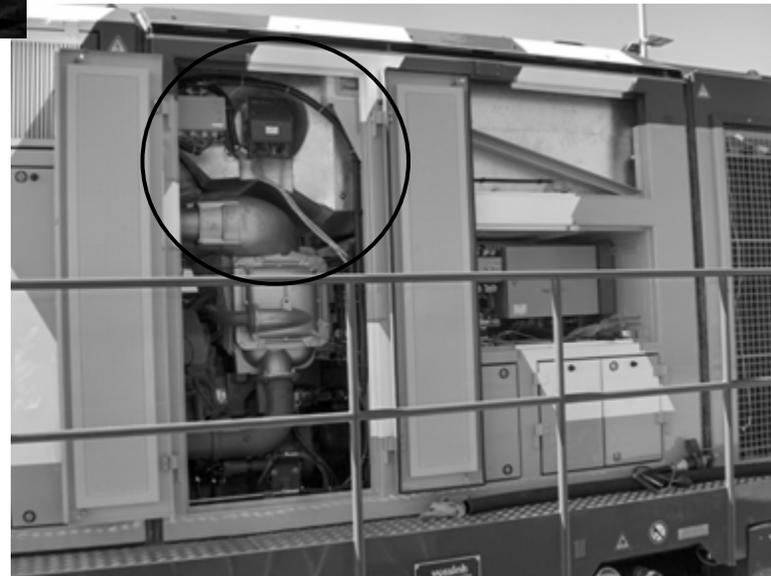
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SBB_Vossloh: Am843 (1'500 kW)
mobiclean S26



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Vossloh Kiel: G2000 (2'700 kW)
mobiclean S56



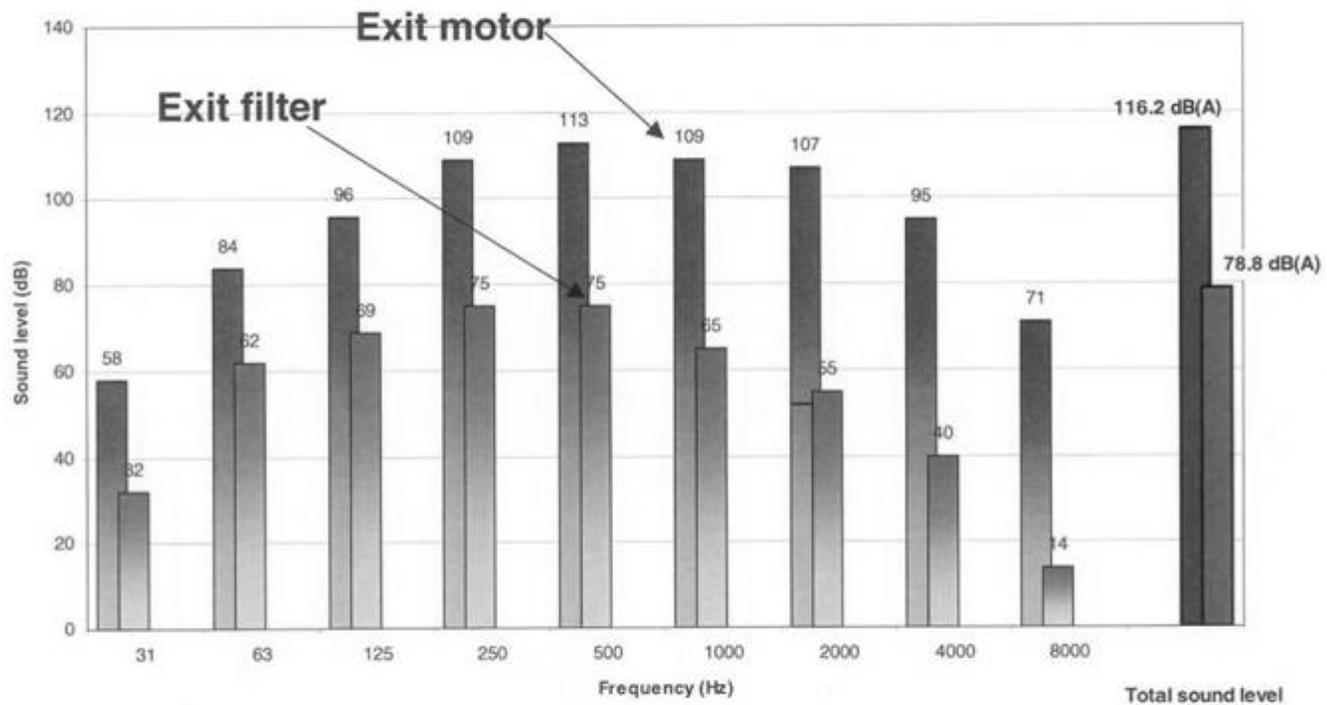












Einfügedämpfung 20 – 40 dB(A)

DPF und SCR bei Lokomotiven

Ateliers SNCF de Pantin - Ourcq, Paris

hugengineering.













VERT Requirements

Filtration Efficiency	New State	After 2000 Hours
Particle Count 20-300 nm	> 95%	> 95%
EC Mass Concentration	> 90%	> 90%

Comparison Between CARB Verification and VERT Procedure

Verification Program	CARB	VERT
Filtration Efficiency	<p>By mass:</p> <p>(1) Level I: 25 to 50% Level II: 50 to 85% Level III: >85% or 0.01 g/bhp-hr</p> <p>(2) At least 15% NOx</p>	<p>At least (by particle count 20-300nm):</p> <p>(1) 95% (new) (2) 95% (> 2000 operating hr)</p> <p>At least (by mass):</p> <p>(1) 90% (new) (2) 90% (>2000 operating hr)</p>
Test Process	<p>On-road:</p> <p>(1) Test bed - FTP HD (2) Chassis test - UDDS</p> <p>Off-road: Appropriate steady state cycle</p>	<p>(1) Engine test bed (ISO 8178/4 C1) (2) Secondary emission test ~200 substances (ISO 8178/all C1) (3) Field test (>2000 operating hr) with data-logging (4) Verification test on engine dyno.</p>

List of Particle-Filter Systems (PFS) that passed the Suitability Test

Particle-filter system for prolonged deployment	Approval number ¹ suitability test				Deployment duty with manufacturer references ⁷					
	VFT1	VFT2	VFT3	VSET	Truck	Bus	Construction site	Fork lift	Ship / Rail	Stationary
Prerequisite for enrollment in this list is successful completion of all 3 standard suitability tests [4] VFT1+VFT2+VFT3, moreover VSET test for catalytic active systems, complying with the criteria of the VERT specifications and verified at a designated (see Appendix) test center.										
DEUTZ PFS Type: DPFS / DPF F ⁴ : CORNING DuraTrap™CO R1 ⁵ : Full-flow Diesel burner R2: Replaceable filter K ⁶ : integrated (R1)	B021/12.95 ³	B049/5.98	B049/5.98	-----	•	•	•	•	○	•
ECS (UNIKAT) PFS Type: V F: CORNING DuraTrap™CO R1: Electric in situ / standstill R2: Replaceable filter K: Loglink FCD-02	B021/12.95	B049/5.98	B049/5.98	-----	•		•	•	○	•
ECS (UNIKAT) PFS Type: K18 F: IBIDEN SIC R1: Electric in situ / standstill R2: Replaceable filter K: Loglink FCD-02	B118/10.02	B118/10.02	B118/10.02	-----	•		•	•	○	•
ECS (UNIKAT) PFS Type: Purifier F: IBIDEN SIC R1: Catalytic coating K: LogLink FCD-02	B132/04.03	B133/04.03	B133/04.03	B138/09.03	•	•	•	•	○	•
HJS PFS Type: SMF® F: Sintered metal filter R1: Fuel additive satacen (Fe) R2: Fuel additive EOLYS (Ce) K: LogLink FCD-02	B021/12.95	B049/5.98	B049/5.98	EMPA 167985			•	•		

Continuation	Approval number suitability test	Deployment duty with manufacturer references
HUS PFS Type CRT [®] F: CORNING DuraTrap TM CO sifter oxidation cat. converter R: NO ₂ from oxidation cat. converter K: LogLink FCD-02	B053/4.98	VFT1
	B097/10.01	VFT2
	B097/10.01	VFT3
	B111/10.02	VSET
		Truck
JOHNSON MATTHEY PFS Type DPF/DPE/SDPF-CRT TM F: IBIDEN SiC cell filter R1: NO ₂ from oxidation cat. converter R2: Electric in situ / standstill R3: Fuel additive satacen (Fe) R4: Fuel additive EOLYS (Ce) K: PIO 120	B059/6.99	Bus
	B050/4.01	Construction site
	B050/4.01	Fork lift
	EMPA 167985	Ship / Rail
		Stationary
JOHNSON MATTHEY PFS Type DPH/DPS/DPP-CRT TM F: CORNING DuraTrap TM CO R1: NO ₂ from oxidation cat. converter R2: Electric in situ / standstill R3: Fuel additive satacen (Fe) R4: Fuel additive EOLYS (Ce) K: PIO 120	B112/10.02	Truck
	B112/10.02	Bus
	B112/10.02	Construction site
	B113/10.02	Fork lift
		Stationary
HUSS PFS Type FoxS-Serie F: IBIDEN SiC cell filter R1: Electric in situ / standstill R2: Replaceable filter K: Loglink FCD-02	B105/4.02	Truck
	B105/4.02	Bus
	B105/4.02	Construction site
		Fork lift
		Stationary
HUSS-Umweltechnik PFS Type FS Filter-Series F: IBIDEN SiC cell filter R: Diesel burner at standstill K: Integrated	B109/7.02	Truck
	B131/4.03	Bus
	B131/4.03	Construction site
		Fork lift
		Stationary

Continuation	Approval number suitability test	Deployment duty with manufacturer references
DCL PFS Type: Titan™ and BlueSky™ F: IBIDEN SIC. R1: Replaceable filter R2: Electric in situ / standstill R3: Fuel additive satacen (Fe) R4: Fuel additive EOLYS (Ce) K: LogLink FCD-02 or DCL AF01	B078/07.00	Truck
	B125/02.03	Bus
	B125/02/03	Construction site
	-----	Fork lift
	-----	Ship / Rail
INTECO PFS Type: ECOPUR Kxx yy F: Metal fiber fleece BEKIPOR® ST R: Fuel additive satacen K: LogLink FCD-02	B082/10.00	Truck
	B124/02.03	Bus
	B124/02.03	Construction site
	-----	Fork lift
	-----	Ship / Rail
ARVINMERITOR PFS Type: B-30 F: CORNING DuraTrap™ RC. R: Full-flow Diesel burner K: Integrated	B115/10.02	Truck
	B126/03.03	Bus
	B126/03.03	Construction site
	-----	Fork lift
	-----	Ship / Rail
ENGELHARD PFS Type: DPX1 F: CORNING DuraTrap™ CO R1: Catalytic coating R2: <input checked="" type="checkbox"/> Electric in situ / standstill K: PDL V3.0	B106/05.02	Truck
	B123/02.03	Bus
	B123/02.03	Construction site
	B114/03.03	Fork lift
	-----	Ship / Rail
ENGELHARD PFS Type: DPX2 F: CORNING DuraTrap™ CO with Flow Through pre-separator R1: Catalytic coating R2: Electric in situ / standstill K: PDL V3.0	B136/09.03	Truck
	B136/09.03	Bus
	B136/09.03	Construction site
	B137/09.03	Fork lift
	-----	Ship / Rail
ENGELHARD PFS Type: DPX2 F: CORNING DuraTrap™ CO with Flow Through pre-separator R1: Catalytic coating R2: Electric in situ / standstill K: PDL V3.0	B136/09.03	Truck
	B136/09.03	Bus
	B136/09.03	Construction site
	B137/09.03	Fork lift
	-----	Ship / Rail

General Electric – Proposed “Retrofittable DPF for Main Line Locomotives”

- Develop DPF for 4500-HP locomotives
- Use fibrous ceramic media
- Use diesel fuel injector - aid regeneration
- 90% filtration, only 1% fuel penalty
- Retrofittable to UP and BNSF locomotives

General Electric – Proposed “Retrofittable Diesel Particulate Filter (DPF) for Main Line Locomotives”

- 6-8-05 Proposed CARB ICAT project
\$534K total, \$250K CARB request
- 6-28-05 **ARB/Railroad MOU announced**
- 7-5-05 Project withdrawn - cost increased
> \$600K
- 7-8-05 Supplemental funding declined

DPF Demonstration in 2005 MOU

- (a) **Diesel Particulate Filters and Oxidation Catalysts.** The parties previously agreed to cooperatively evaluate the feasibility of developing Diesel Particulate Filters or Oxidation Catalysts for use on Roots Blown **switcher engines**. This Agreement included provisions for the Participating Railroads to commit up to \$5 million dollars towards this evaluation. Within 120 days after the Effective Date, the parties will determine whether to continue this evaluation. Unless the parties agree to terminate the evaluation before it is completed, the evaluation, including recommendations on the feasibility of this technology, shall be completed by December 31, 2005. A detailed description of the evaluation findings to date, as well as an assessment of the current application of this technology to locomotives in Europe, will also be **completed by December 31, 2005.**