

## Verified Technologies

The following emission reduction performance information for diesel engine retrofit technologies has been independently verified by the US Environmental Protection Agency (EPA) and the California Air Resources Board (CARB). EPA Verified Technologies

This information is current as of May 16, 2008. The current EPA list can be found at:

http://www.epa.gov/otaq/retrofit/verif-list.htm		EPA Verified Retrofit Technologies				Manufacturer						
Technology	Applicability	Reductions (%)		PM	CO	NOx	HC					
Caterpillar, Inc.	Catalyzed Converter/Muffler (CCM)	Highway, heavy-heavy and medium-heavy duty, 4 cycle, non-EGR, model year 1998 - 2003, turbocharged or naturally aspirated engines		20	20	n/a	40					
Caterpillar, Inc.	Diesel Particulate Filter	Nonroad, 4 cycle, non-EGR equipped, model year 1996-2005, turbocharged engines with power ratings 130 &le; KiloWatts < 225 (174.2 &le; Horsepower < 301.5)		89	90	n/a	n/a					
93	Caterpillar, Inc.	Emissions Upgrade Group		Caterpillar model 3306 diesel engines for nonroad applications with model years from 1988 to 1995 with mechanical direct fuel injection.								
71	Clean Diesel Technologies, Inc.	Platinum Plus Purifier System (fuel borne catalyst plus DOC)		Highway, medium heavy- and heavy heavy-duty, 4 cycle, model year 1988 - 2003, turbocharged or naturally aspirated engines	25 to 50	16 to 50	0 to 5	40 to 50	Clean Diesel Technologies, Inc.			
50 to 66	0 to 9	75 to 89	Cummins Emission Solutions	Platinum Plus Fuel Borne Catalyst/Catalyzed Wire Mesh Filter (FBC/CWMF) System		Highway, medium heavy-duty, 4 cycle, model year 1991 - 2003, non-EGR, turbocharged or naturally aspirated engines		55 to 76				
13 to 23	n/a	50 to 52	Donaldson	Cummins Emission Solutions & Cummins Filtration Diesel Oxidation Catalyst (DOC) and Closed Crankcase Ventilation (CCV) System		Highway, heavy-heavy and medium-heavy duty, 4 cycle, non-EGR, model year 1991 - 2003, turbocharged or naturally aspirated engines		30a	50	n/a	74	Donaldson
			Donaldson	Series 6000 DOC & Spiracle (closed crankcase filtration system)		Highway, heavy heavy- and medium heavy-duty, 4 cycle, non-EGR, model year 1991 - 2003, turbocharged or naturally aspirated engines		25 to 33 a				
			Donaldson	Series 6100 DOC		Highway, heavy heavy- and medium heavy-duty, 4 cycle, non-EGR, model year 1991 - 2003, turbocharged or naturally aspirated engines		20 to 26	38 to 41	n/a	49 to 66	Donaldson
			Engelhard	Series 6100 DOC & Spiracle (closed crankcase filtration system)		Highway, heavy heavy- and medium heavy-duty, 4 cycle, non-EGR, model year 1991 - 2003, turbocharged or naturally aspirated engines		28 to 32 a				
			Engelhard	DPX Catalyzed Diesel Particulate Filter		Highway, heavy-duty, 4 cycle, model year 1994 - 2002, turbocharged or naturally aspirated engines		60	60	n/a	60	Engelhard
			Engelhard	CMX Catalyst Muffler		Highway, heavy-duty, 2 cycle engines		20	40	n/a	50	Engelhard
			Engine Control Systems	CMX Catalyst Muffler		Highway, heavy-duty, 4 cycle engines		20	40	n/a	50	Engine Control Systems
			Engine Control Systems	Purifier - Diesel Particulate Filter		Highway, heavy and medium heavy-duty; Urban Bus; 4 cycle; model years 1994 - 2003; turbocharged or naturally aspirated; non-EGR engines		90	75	n/a	85	Engine Control Systems
			Engine Control Systems	AZ Purimuffler or AZ Purifier		Highway, heavy-duty, 4 cycle, mechanically or electronically injected, turbocharged or naturally aspirated, originally manufactured from 1991 through 2004 model years which meet a 5 or 4 g/bhp-hr NOx standard with open crankcase ventilation and no aftertreatment engines		40a	60	n/a	75	Engine Control Systems
			Engine Control Systems	AZ Purifier		Highway, medium heavy-duty, 4 cycle, model years 1991 - 2003 Cummins and Navistar/International engines originally manufactured with no aftertreatment, turbocharged or naturally aspirated, non-EGR engines		40	40	n/a	70	Engine Control Systems
			Engine Control Systems	AZ Purifier		Highway, heavy heavy-duty, 4 cycle, model years 1991 - 1993 Cummins engines originally manufactured without exhaust aftertreatment, turbocharged or naturally aspirated, non-EGR engines		35	40	n/a	70	Engine Control Systems
			Control Systems	AZ Purimuffler		Highway, heavy duty, 2 cycle engines		20	40	n/a	50	Engine
			Truck & Engine Corp.	AZ Purifier		Highway, heavy duty, 4 cycle engines		20	40	n/a	50	International
				Green Diesel Technology-Low NOx Calibration plus Diesel Oxidation Catalyst with Ultra Low								

Sulfur Diesel (ULSD)	Highway, light heavy-duty, 4 cycle, Navistar/International engines, model years 1999 - 2003 in the following families:				
XNVXH0444ANA,					
YNVXH0444ANB,					
1NVXH0444ANB,					
2NVXH0444ANB,					
3NVXH0444ANB	0 to 10	10 to 20	25	50	[Johnson Matthey]b [Partial
Continuously Regenerating Technology2 (PCRT2) Particulate Filter]b	[Highway, heavy-heavy and medium-heavy				
duty, 4 cycle, non-EGR, model year 1988 - 1993, turbocharged or naturally aspirated non-urban bus engines]b	[50]b				
[60]b n/a [80]b	Johnson Matthey Catalyzed Continuously Regenerating Technology				
(CCRT) Particulate Filter	Highway, heavy-duty, urban bus, 4 cycle, non-EGR model year 1994 - 2006, turbocharged				
or naturally aspirated engines.	90	85	n/a	95	Johnson Matthey Continuously
Regenerating Technology (CRT) Particulate Filter	Highway, heavy-duty, 4 cycle, model year 1994 - 2006,				
turbocharged or naturally aspirated engines	90	85	n/a	95	Johnson Matthey
CEM&trade; Catalytic Exhaust Muffler and/or DCC&trade; Catalytic Converter	Highway, heavy-duty, non-urban bus,				
4 cycle, non-EGR model year 1991 - 2003, turbocharged or naturally aspirated engines	20	40	n/a	50	
Johnson Matthey CEM Catalyst Muffler	Highway, heavy-duty, 2 cycle engines				
n/a	50	Lubrizol	PuriNOx		
Water emulsion fuel	Highway & Non-road, heavy-duty, 2 & 4 cycle				
-30 to -120				16 to 58	-35 to 33 9 to 20
	Paceco Corporation				
MES diesel particulate filter (MES-DPF)	Pre-1996 nonroad, 4-cycle, heavy-duty diesel engines in the				
225 - 450 kW (NR7) power range in electrical generation applications	39	90	n/a	95	
PUREM	PMF Green-Tec Particulate Filter/Catalyst Highway, medium-heavy duty up to 280 hp, 4 cycle, non-				
	90	85	n/a	90	
EGR, model year 1998 - 2003, turbocharged or naturally aspirated engines	PUREM PMF Green-Tec 230 Particulate Filter/Catalyst Highway, medium-heavy duty up to 230 hp, 4 cycle,				
non-EGR, model year 1998 - 2003, turbocharged or naturally aspirated engines	90	80	n/a	95	
Various Biodiesel (1 to 100%)	Highway, heavy-duty, 2 & 4 cycle				
0 to 67	0 to 47	0 to 47	-10 to 0		
n/a n/a 0 to 5 n/a	Various Cetane Enhancers Highway, heavy-duty, 4 cycle, non-EGR-equipped engines				

a - Total PM reduction figures reflect reductions from both tailpipe and crankcase emissions.  
 b - This verification is conditional. Full verification will be achieved upon completion of additional testing and other requirements.

Note: For after-treatment devices the reductions are based on the installation of retrofits to engines that were originally produced without diesel oxidation catalysts or diesel particulate filters. California Air Resources Board (CARB) Verified Technologies

This information is current as of May 16, 2008. The current CARB list can be found at:

<http://www.arb.ca.gov/diesel/verdev/vt/cvt.htm>

Plus (+) designates these systems as compliant with 2009 N02 requirements. PM Level

Product Name	P				
L					
U					
S	Technology Type	PM Reduction	NOx Reduction	Applicability	

L  
 E  
 V  
 E  
 L

## Caterpillar

DPF

85%

N/A Conditionally verified for 1996-2008 model years; off-road, rubber tired; CARB diesel.  
 Claire Horizon +

DPF

85%

N/A Most on-road diesel engines through 2006 model year; Certain MY 2006 and 1993 or older engines with OEM diesel oxidation catalysts; CARB diesel; biodiesel.\* Conditionally verified for off-road engines.  
 Claire Longview Lean NOx Catalyst and DPF 85% 25% 1993-2003 model year on-road; CARB diesel. . CleanAIR Systems PERMIT + DPF 85% N/A  
 Stationary emergency and prime generators; CARB diesel; biodiesel.\* DCL International Inc.  
 DPF 85% N/A Conditionally verified for 1996-2008 model year, rubber tired off-road ; CARB diesel. Donaldson DPM DPF 85% N/A. 1993-2004 on-road; CARB diesel; biodiesel.\* EGR Technologies LLC/CleanAIR Systems

EGR/DPF

85%

50% Conditional verification for stationary prime and emergency standby generator sets and pumps < 600 hp and < 0.4 g/bhp-hr PM. Biodiesel.\* Engine Control System Purifilter (Low Load) + DPF  
 85% N/A 1994-2004 on-road; CARB diesel; biodiesel.\* Engine Control System Purifilter (High Load) DPF 85% N/A 1993-2006 on-road; CARB diesel; biodiesel.\*  
 Engine Control System Combifilter + DPF 85% N/A 2007 or older off-road; CARB diesel; biodiesel.\* HUSS Umwelttechnik  
 FS-MK +

DPF

85%

N/A Most on-road and off-road diesel engines through 2006 model year. CARB diesel; biodiesel.\* International Truck and Engine Corporation DPX DPF 85% N/A. 1994-2003 on-road Navistar (International); CARB diesel. Johnson Matthey CRT DPF 85% N/A.  
 Stationary emergency and prime generators. Conditionally verified for stationary pumps. CARB diesel; biodiesel.\* Johnson Matthey Reformulated CRT DPF 85% N/A.  
 1994 - 2006 on-road; CARB diesel; biodiesel.\* Johnson Matthey EGRT + EGR/DPF  
 85% 40% 2000 International DT-466, 2000 Cummins ISB, 1998-2002 Cummins ISC, 2001 Cummins ISL, 2001 MY DDC - 50, and 2001 DDC - 60. on-road; CARB diesel.

MIRATECH Corporation combiKat +

DPF

85%

N/A Stationary emergency and prime generators with a PM emission rate of 0.2 g/bhp-hr or less.  
 Rypos, Inc. HDPF/C&trade; +

Hybrid DPF

85%

N/A 1996-2007 stationary emergency standby generators and pumps with a PM emission rate of 0.2 g/bhp-hr or less and certified to Tier 1, Tier 2, or Tier 3 off-road diesel engine standards; CARB diesel; biodiesel.\*

Süd-Chemie Inc  
 EnviCat-DPF&trade; +

DPF

85%

N/A Stationary prime and emergency standby generators and pumps; CARB diesel; biodiesel.\*

L  
 E  
 V  
 E  
 L 2 Donaldson +

Flow Through Filter

50%

N/A	1991-2002 on-road; CARB diesel; biodiesel.*	Engine Control System AZ
Purimuffler/Purifier	+ DOC + Alt Fuel 50% 20%	1996-2002 off-road; PuriNOx
	Environmental Solutions Worldwide Particulate Reactor&trade;	DOC 50%
N/A	Select model years 1991-1997. Biodiesel.*	Lubrizol PuriNOx +
Emulsified Fuel	50% 15% 1988-2003 on-road.	Rypos ADPF +

DPF

50%

N/A 1996-2006 stationary engines; CARB diesel.

Thermo King PDPF&amp;trade;

+

FTF

50%

N/A 1985-2002 transport refrigeration unit engines; 15 ppm sulfur diesel. Read Executive Order for detailed engine matching requirements. L

E  
 V  
 E  
 L

1	Donaldson DCM 6000	+	DOC	25%	N/A	1988-1990 on-road;
	CARB diesel; biodiesel.*		Donaldson 6000 + Spiracle	+	DOC + crankcase filter	25%
N/A	1988-2002 on-road; CARB diesel; biodiesel.*		Donaldson DCM 6100 + Spiracle			
+	DOC + crankcase filter	25%	N/A	1991-2002; CARB diesel; biodiesel.*		
Donaldson DCM 6100	+ DOC	25%	N/A	1994-2002; CARB diesel; biodiesel.*		
Donaldson 6000 + Spiracle (off-road)		+	DOC + crankcase filter	25%	N/A	Off-

road port equipment; CARB diesel; biodiesel.\*  
 + DOC 25% N/A 1991-2003 Cummins and Navistar on-road; 1973-1993 DDC 2 stroke;  
 1991-2002 HHD certain model Cummins and DDC; CARB diesel; biodiesel.\*  
 System AZ Purifier & Purifmuffler + DOC 25% N/A 1996-2002 off-road; CARB  
 diesel; biodiesel.\* Extengine + DOC + SCR 25% 80% 1991-1995  
 Cummins 5.9 liter off-road; CARB diesel. Paceco Corporation

DPF 25% N/A Pre-1996 model year or Tier 1, 2, or 3 certified off-road diesel engines on  
 rubber-tired gantry cranes; biodiesel. \* Vycon REGEN System + Energy Storage System

25%

30% Pre-1996 model year or Tier 1, 2, or 3 certified off-road diesel engines on rubber-tired gantry  
 cranes; biodiesel. \* PLUS Systems (+) indicate 2009 N02 compliance.

\* These systems have been verified for use with biodiesel blends subject to certain requirements.