

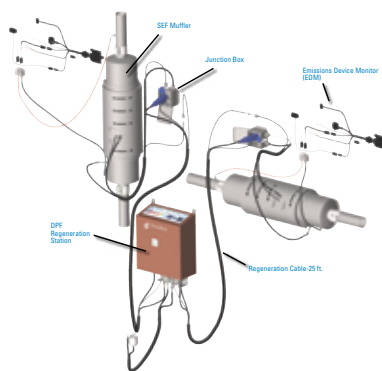


Retrofit Emissions Solutions for Diesel-Powered Vehicles

Donaldson was the first to introduce tailpipe and crankcase retrofit solutions and DPF Cleaning System in support of the U.S. EPA & California ARB voluntary diesel retrofit programs.



Spiracle Crankcase Filtration System allows closure of the engine crankcase vent eliminating blow-by gases and fumes that would normally vent to atmosphere.



SEF Muffler System (vertical and horizontal views)



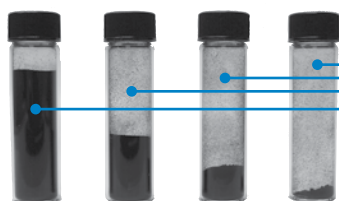
Various tailpipe solutions. Left to right: DPF Muffler, DMF Muffler, LNF Muffler, DOC Muffler

Retrofit Solutions Feature Comparison

Product Family	Spiracle™ CFS	LNF/LXF Mufflers	SEF Mufflers	DMF Mufflers	DOC Mufflers
Technology	Barrier	Partial Filter + Wall Flow (passive)	Flow Through + SiC Wall Flow (active)	Multiple Stage Partial Filter (passive)	Flow Through (passive)
PM Efficiency (%)	100%	90+%	90+%	71-75%	20-30%
with Spiracle CFS	--	90-95+%	90-95+%	75-80%	25-49%
Engine MY Coverage		1993-2006	1993-2006	1991-2002	1988-2006
BACT/BART Level		Level 3+ (>90%)	Level 3+ (>90%)	Level 2 + (>50%)	Level 1 (>25%)
EGT⁽²⁾ Sensitivity	None	Medium	None	Low	None
Fuel Type	N/A	ULSD	Any	ULSD	Any
Install Time⁽¹⁾	2-5 hrs	3-5 hrs	5 hrs	1-3 hrs	1-3 hrs
Maintenance	Filter replacement and annual blow-by flow testing	Ash Cleaning	Periodic on-board regeneration and ash cleaning	None	None

(1) Actual install time varies by application and installer; excludes logistics.

(2) EGT - Exhaust Gas Temperature. Proper application of the wall flow (high efficiency solutions) requires EGT knowledge for the operating vehicle.



PM Regulations Changes - On-Road

PM Level	0.60 g/bhp-hr		0.25 g/bhp-hr		0.10 g/bhp-hr								0.01 g/bhp-hr					
Model Yr.	88	89 90	91	92 93	94	95	96	97	98	99	00	01	02	03	04	05	06	07 ...

Vials of Exhaust Soot / PM

DPF Cleaning System

The DPF Section inside our DPF, LTF, LNF or LXF Mufflers must be cleaned using the Donaldson Pulse Cleaner and Thermal Regenerator or a Donaldson approved DPF cleaning system.

The recommended method and process to clean the DPF Section:

Before Cleaning

- Measure and record weight of DPF Section
- Test and record backpressure of DPF Section in DPF Pulse Cleaner

DPF Section Cleaning

- Pulse clean in Donaldson Pulse Cleaner (removes ash and soot)
- Bake (in Donaldson DPF Thermal Regenerator)
- Pulse clean the DPF Section when cool (removes additional ash created during the regeneration cycle)

After Cleaning

- Test and record backpressure of DPF Section in DPF Pulse Cleaner
- Measure and record weight of DPF Section

DPF Cleaning System

- Simple and easy to operate
- Recommended for OE and retrofit DPF devices
- Effective on Donaldson and competitive DPF designs
- Designed using decades of experience with enclosed filtration systems



DPF Pulse Cleaner (left) and DPF Thermal Regenerator (right).

Verifications

California ARB Site: <http://www.arb.ca.gov/diesel/verdev/verdev.htm>

U.S. EPA Diesel Retrofit Web Site: www.epa.gov/otaq/retrofit/retroverifiedlist.htm

LXF Muffler

CARB EO DE-09-014 - Level 3+ (2009)

LNF Muffler

CARB EO DE-00-009-01 - Level 3+(2009)
CARB EO DE-09-009 - Level 3+ (2009)

SEF Muffler

CARB EO DE-09-003 - Level 3+ (2009)

DMF Muffler

CARB EO DE-05-012 - Level 2+ (2005)

DMF Muffler with Spiracle CFS

CARB EO DE-05-013 - Level 2+(2005)

DOC Muffler (Series 6000)

CARB EO DE-04-009 - Level 1+ (2004)
EPA non-EGR (2003)

DOC Muffler (Series 6000) with Spiracle CFS

CARB EO DE-04-010 - Level 1+ (2004)
CARB Verification Letter off-road (May 2003)
CARB RAS-02-33 - Level 1+ (2002)
EPA non-EGR (2003)

DOC Mufflers (Series 6100)

CARB RAS-02-33 - Level 1+ (Nov. 2002)
EPA (Aug. 2003)

DOC Mufflers (Series 6100) with Spiracle CFS

CARB RAS-02-33 - Level 1+ (Nov. 2002)

DOC Muffler (Series 6400) with Spiracle CFS

CARB EO DE-04-009-01 - Level 1+ (2006)

DOC Muffler (Series 6400)

CARB EO DE-04-010-01 - Level 1+ (2006)

Formerly Verified in California (due to rule changes)

LTF Muffler with and without Spiracle CFS

CARB EO DE-06-004 - Level 3 (2006)
CARB EO DE-06-005 - Level 3 (2006)

DPF Muffler

CARB EO DE-04-005-04 - Level 3 (2005)
CARB EO DE-04-005-03 - Level 3 (2005)
CARB EO DE-04-005-02 - Level 3 (2005)
CARB EO DE-04-005-01 - Level 3 (2004)
CARB EO DE-04-005 - Level 3 (2004)

Donaldson tailpipe and crankcase solutions are patented and patent pending.



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