

DRAFT 10-1-2008



**Expanded Retrofit Product Line...
Donaldson LNF Mufflers
for the Highest Tailpipe PM Reduction**



Passive Diesel Particulate Filter (DPF) technology provides the highest tailpipe PM reduction available today (>90%), making them a popular choice for retrofit programs. However, DPFs are sensitive to exhaust temperature and can plug unless they are exposed to minimum exhaust temperatures that will burn the soot they capture.

Donaldson LNF Mufflers are designed for on-road 1994 - 2006 model year engines using ULSD fuel where the Weighted Average exhaust Temperature (WAT) of the application is greater than 237°C for non-EGR and 263°C for EGR engines.

Donaldson®

The Preferred Solution for PM and NO₂ Emissions

... every Low NO₂ Filter (LTF) Muffler Kits includes our new and improved Emissions Device Monitor (EDM)!



LNF Mufflers are verified by CARB for use in the Diesel Risk Reduction Program as a Level 3+ device.

Voluntary Retrofit Program.

* Removes 85% or greater diesel particulate matter

Cut-away of a Donaldson LNF Muffler



LNF Muffler Kit

Features

Customer-preferred passive DPF technology

Proprietary pre-filter design enhances device operation

Innovative catalyst coating on 200 cpsi ceramic DPF substrate

Optimized flow distribution provides uniform flow across entire DPF face

Similar application temperature criteria compared to current DPF technology

Modular design permits installation flexibility

Gasket-free design

New "Weighted Average Temperature" (WAT) analysis method for data logging

Upgraded Emissions Device Monitor (EDM).

Advantages

- Lowest cost approach to high-efficiency exhaust filtration
- Lowest complexity product

- Removes up to 1/3 of PM, reducing load on wall-flow DPF
- Produces NO₂ for DPF regeneration

- Provides high filtration efficiency at lower backpressure
- Produces NO₂ in zone where needed
- Prevents excess NO₂ emissions

- Increases flow (hp) capacity
- Provides uniform soot loading for improved operation
- Reduces product cost
- Eliminates excess NO₂ emissions

- Broader application range

- Reduces installation and service time when cleaning the DPF

- Lower cost during DPF ash cleaning

- Provides more accurate indication of likelihood of successful regenerations for a given duty-cycle
- Accounts for higher soot burn rates associated with higher temps

- Improves operator interface
- Increases memory increases for data and fault collection to support troubleshooting
- Permits temperature monitoring
- Provides convenient push button reset
- Expands voltage range (12-24V)

Donaldson LNF Mufflers and system components are protected internationally by patents, both issued and pending.

Emissions Technology = Partial Filter + DPF

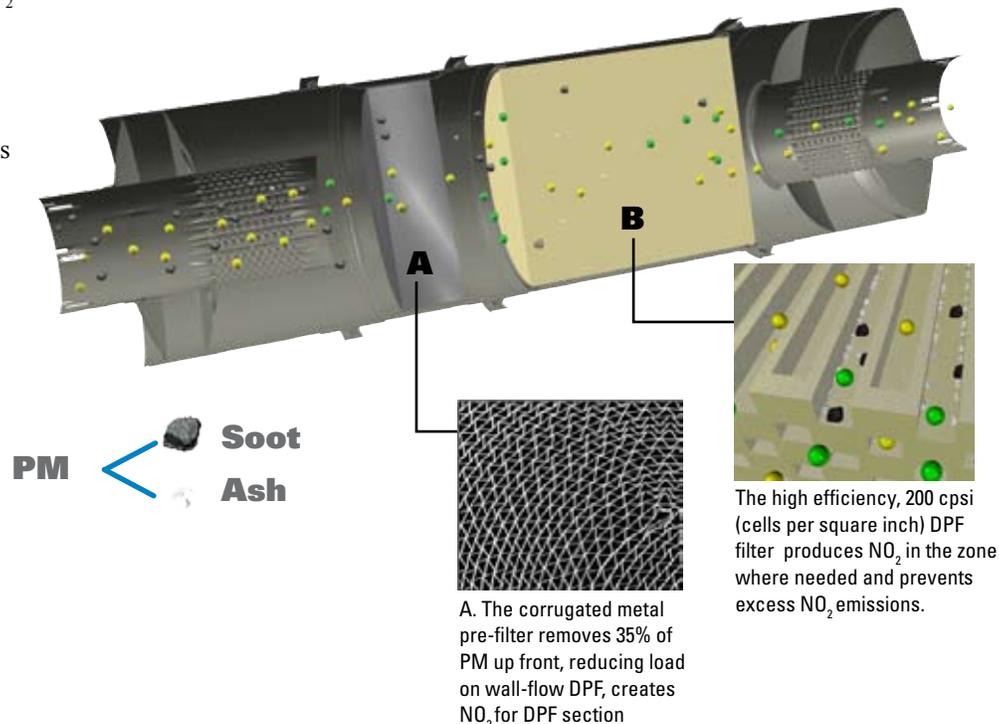
Efficiency: 85%+ PM and 0% NOx

Controlling NO₂ Emissions

Many catalyst-based diesel particulate filters, or diesel oxidation catalysts, promote the oxidation of nitric oxide (NO), the main component of NO_x, to nitrogen dioxide (NO₂), thus increasing the NO₂ proportion in NO_x emissions. Even though the total NO_x is not increased, this may present a potential health and environmental issue, as NO₂ is a more reactive and toxic gas than NO.

Source: : California ARB

NO_x < ● NO₂ (Nitrogen Dioxide)
● NO (Nitric Oxide)



LNF Muffler Selection Procedure & Criteria

Donaldson has a nine-step selection procedure (page 7) that is required in order to apply the LNF Muffler.

This tailpipe solution is applicable for non-EGR engines when data logging results show your weighted average temperature is greater than 237° C.

For EGR engines, the weighted average exhaust temperature must be greater than 263° C.

The LNF Muffler application requires the use of ULSD fuel and CJ-4 engine lube oil.

Service Requirements

- Under normal operation, the filter requires cleaning annually, every 50,000 miles, 1,800 hours or when the EDM alerts are tripped.
- Severe or "cold" service applications may require more frequent cleaning
- DPF cleaning system is available from Donaldson (see back page)

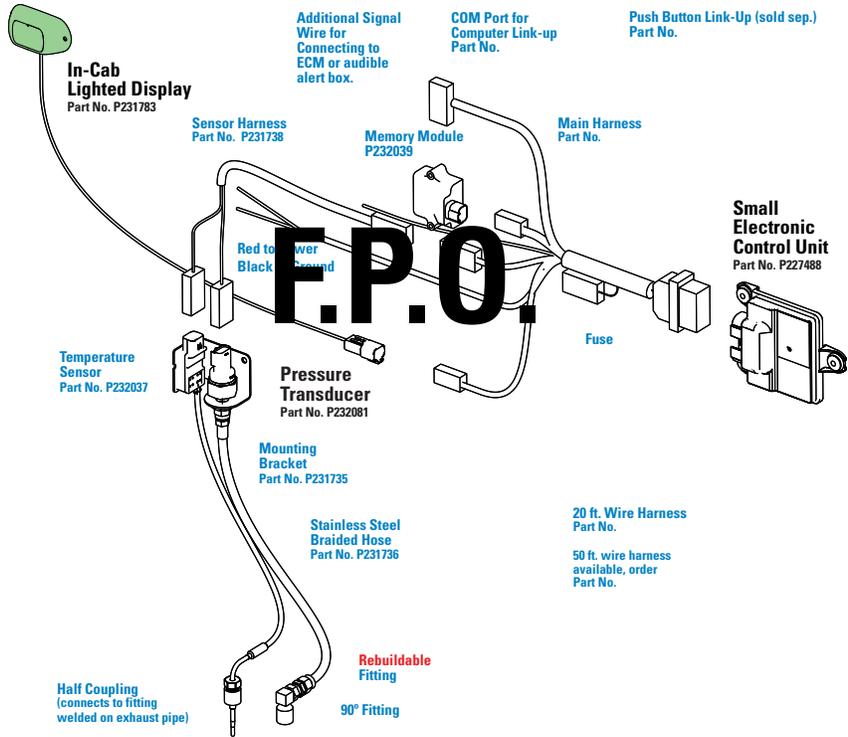


Emissions Device Monitor (EDM)

Kit# X009650

Included with every LNF Muffler Kit

The Emissions Device Monitor detects excessive engine backpressure created by the flow restriction of an overloaded diesel particulate filter. Lights indicate when filter cleaning is required. The small, solid-state monitor mounts inside the cab.



Memory Module Stores 10x more hours than previous monitor!

Monitoring software and cable
Kit No. X007999
Sold separately



Features

Advantages

Standardized, solid-state filter service monitor	<ul style="list-style-type: none"> Small package size High reliability
Self-diagnostic filter service monitor	<ul style="list-style-type: none"> Facilitates troubleshooting of electronics and LNF Muffler performance Smaller size compared to competitive designs
Remote mount indicator	<ul style="list-style-type: none"> Increases flexibility of location and reduces cost of installations
Remote-mount pressure transducer and thermocouple converts readings into electronic signal	<ul style="list-style-type: none"> Increases accuracy Reduces installation time Eliminates cost/challenge of long copper tubing runs to filter monitor Reduces risk of copper tubing kinks/damage and erroneous readings
Serviceable pressure transducer and thermocouple	<ul style="list-style-type: none"> Reduces cost of component replacement (sensor only vs. entire monitor)
All wires terminated in standard connectors (Bosch or Delphi) and covered in protective looms	<ul style="list-style-type: none"> Reduces installation time Environment-proof design increases reliability
Stores last 500 hours of backpressure, temperature and faults	<ul style="list-style-type: none"> Provides picture of operating trends Facilitates troubleshooting
Removable memory module	<ul style="list-style-type: none"> Remove and transfer data simply to another device for data analysis
Engine signal wire	<ul style="list-style-type: none"> May be connected to engine ECM and/or an audible alarm
Monitor communicates through USB connector	<ul style="list-style-type: none"> Easier access to computer compared to competitive RS-232 connection ports
Keyed power vs. always on	<ul style="list-style-type: none"> Does not draw on battery nor record unneeded information Lengthens life of monitor
Fixed backpressure and temperature monitor measurement set-points	<ul style="list-style-type: none"> Prevent inadvertent changes that may impact product integrity Reduces installation time
Push button reset tool (sold separately)	<ul style="list-style-type: none"> Can reset warning lights and retrieve data without use of PC

The Key to Reliable Operation

an accurate reading of the

Exhaust Temp. Profile



Donaldson data logger kit - X007947

Data Logger X007947 (blue plastic case)

- 1/8" NPT half coupling (P226616)
- 1/8" NPT compression fitting (P227812)
- Installation and operation manual (P480348)

Items you'll need for data logging:

- Profile Form available from Donaldson
- Software and PC interface cable - order separately from Donaldson (item X007948)
- Computer with Microsoft® Windows® operating system

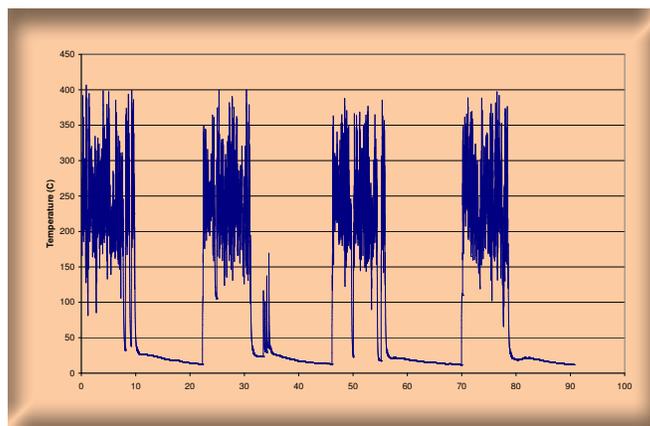
Steps to Capture Exhaust Temp Profile With a Donaldson Data Logger

- 1 Set-up Data Logger from computer to record data at a prescribed time.
- 2 Weld the half coupling into the exhaust system for data logger temperature probe.
- 3 Mount the Data Logger case to exhaust tube or frame rail.
- 4 Route the thermocouple cable from the compression fitting to the data-logger case.
- 5 Operate the vehicle for three days under 'normal operating conditions'
- 6 Download data from the Data Logger and uninstall data logger.
- 7 Forward data and vehicle profile form to Donaldson at emissions@donaldson.com

It is important to understand the exhaust temperature profile before applying a DPF muffler. Insufficient temperatures may lead to premature DPF plugging and increased maintenance to keep the filter clean and engine running.

A data-logger is a device used to record the exhaust temperature during engine operation. The recorder is operated for several days under 'normal operating conditions to provide a reasonable snapshot of the exhaust temperature profile. Engine duty-cycle plays a big role in exhaust temperatures, and is influenced by factors such as vehicle speed, load, idling, geography, ambient temperatures and driver tendencies.

Donaldson recommends capturing three days of normal daily operation using the Donaldson data logger.



Line graph created from data downloaded from data logger in Donaldson field test. Engineers will analyze the data to notify you that the vehicle is suitable for an LNF Muffler retrofit.

Over 40 Kits Available

designed for **EGR & Non-EGR Engines**

Selection Procedure

Step 1

Retrieve the following engine and vehicle information. (Hint: The Donaldson Profile Form [in MS-Excel] is a great guide to use. Contact Donaldson Retrofit Sales for a copy.)

<u>Engine Data</u>	<u>Vehicle Data</u>
Make	Make
Model	Model
Year	Year
Family Number	VIN
Serial Number	Vehicle No. or ID No.
Displacement	
Power	
Exhaust Flow Rate (cfm)	
Turbo	

Step 2

Check the engine's family number against those listed on the CARB web site for the LNF Muffler. The engine family number listing is an attachment to the California ARB Executive Order.

If your engine decal family number is found on the Approved Engine Family Listing for the approved technology, proceed to Step 3. If not, you *can not* apply our product to the vehicle.

Step 3

Install a temperature data logger per Donaldson guidelines and retrieve a temperature trace representative of that vehicle's typical duty cycle. (We recommend Donaldson data logger X007947)

Step 4

E-mail the temperature trace with a completed Donaldson profile form to emissions@donaldson.com. (Hint: The temperature trace can be attached to the Profile Form by clicking on the "Import Temp Data" tab at the top of the Profile Form.)

Step 5

Donaldson engineers will review data logging results and respond (via email) with a recommendation to proceed with LNF Muffler retrofit or not. If approval is granted, proceed to next step.

Step 6

Retrieve the engine's exhaust flow (cfm) data. (It is recommended this information comes from the engine manufacturer, but if not available, use Donaldson Engine & Exhaust HP guide on our web site or contact Donaldson Emissions Retrofit engineering.)

Step 7

Using the the most current LNF Muffler sales brochure, select and order the model that best matches (1) your exhaust flow rate (cfm) and (2) your existing muffler configuration.

Step 8

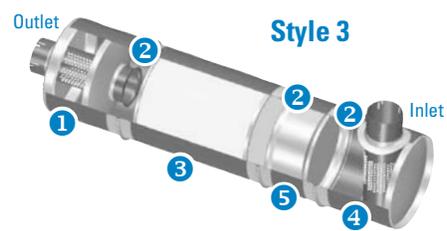
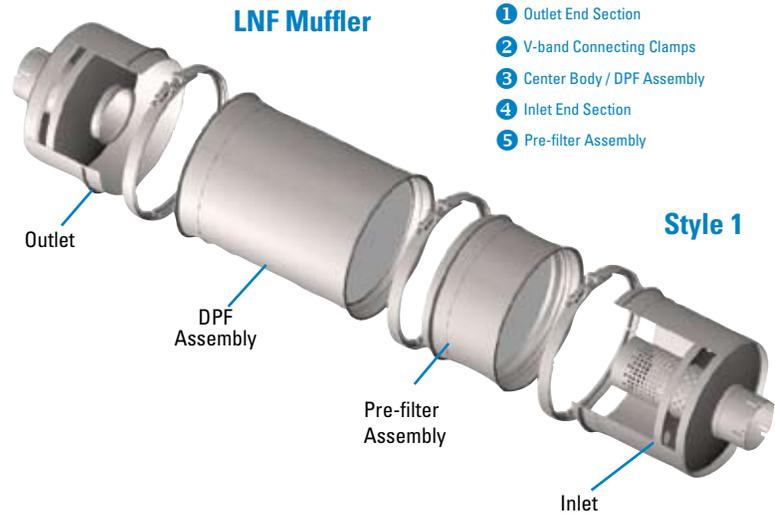
Upon receipt of your LNF Muffler kit, locate and review the documentation packages included with the kit. Proceed with your retrofit installation per the instructions included in the documentation package. Be sure to:

- Attach the supplied engine tag to the vehicle (compliance requirement)
- Activate your warranty
- Add DPF filter service into the vehicle maintenance schedule

Step 9

Retain all emissions retrofit documentation on each vehicle. Including:

- Temperature data / profile form
- Donaldson response letter that approved retrofit application
- Date of install
- Mileage/hours at install
- Installation and owner information



ID - Inner Diameter Dia. = Diameter

LNF Muffler Kits

Service Parts

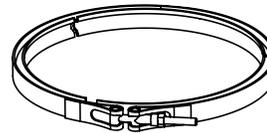
Inlet I.D.	Outlet I.D.	Body Length	Body Dia.	Kit Part No.	Inlet Section	Outlet Section	Pre-Filter Assembly	DPF Assembly
Exhaust Flow Up to 1750 CFM								
Style 1								
3.0	3.0	36.0	10.0	X009603	P232532	P232380	P232371	P232374
3.5	3.5	36.0	10.0	X009604	P232217	P232381	P232371	P232374
	4.0	36.0	10.0	X009605	P232533	P232382	P232371	P232374
4.0	4.0	36.0	11.0	X009245	P232218	P232383	P232535	P232536
	5.0	36.0	11.0	X009636	P232218	P232384	P232535	P232536
5.0	5.0	36.0	11.0	X009628	P232227	P232384	P232535	P232536
Style 2								
3.5	4.0	36.0	11.0	X009609	P232220	P232386	P232535	P232536
4.0	4.0	36.0	11.0	X009613	P232221	P232386	P232535	P232536
Style 3								
4.0	4.0	36.0	11.0	X009617	P232224	P232383	P232535	P232536
	5.0	36.0	11.0	X009638	P232224	P232384	P232535	P232536
Style 4								
3.5	4.0	40.0	11.0	X009643 ¹	P232220	P232388	P232535	P232536
4.0	4.0	40.0	11.0	X009642	P232218	P232388	P232535	P232536
Exhaust Flow Up to 2100 CFM								
Style 1								
4.0	4.0	36.0	11.0	X009606	P232218	P232383	P232372	P232375
	4.0	36.0	11.0	X009610 ²	P232218	P232386	P232372	P232375
	5.0	36.0	11.0	X009607	P232218	P232384	P232372	P232375
5.0	5.0	36.0	11.0	X009608	P232227	P232384	P232372	P232375
Style 2								
3.5	4.0	36.0	11.0	X009611	P232220	P232386	P232372	P232375
4.0	4.0	36.0	11.0	X009612	P232221	P232386	P232372	P232375
5.0	5.0	36.0	11.0	X009614	P232223	P232387	P232372	P232375
Style 3								
4.0	4.0	36.0	11.0	X009615	P232224	P232383	P232372	P232375
	5.0	36.0	11.0	X009616	P232224	P232384	P232372	P232375
5.0	5.0	36.0	11.0	X009618	P232226	P232384	P232372	P232375
Style 4								
3.5	4.0	40.0	11.0	X009619 ¹	P232220	P232388	P232372	P232375
4.0	4.0	40.0	11.0	X009620	P232218	P232388	P232372	P232375
	4.0	40.0	11.0	X009621 ¹	P232221	P232388	P232372	P232375
5.0	5.0	40.0	11.0	X009622	P232227	P232389	P232372	P232375
Style 6								
4.0	4.0	40.0	11.0	X009623	P232224	P232388	P232372	P232375
5.0	5.0	40.0	11.0	X009624	P232226	P232389	P232372	P232375

LNF Muffler Kits

Service Parts

Inlet I.D.	Outlet I.D.	Body Length	Body Dia.	Kit Part No.	Inlet Section	Outlet Section	Pre-Filter Assembly	DPF Assembly
Exhaust Flow Up to 2400 CFM								
Style 1								
4.0	4.0	37.5	11.0	X009625	P232218	P232383	P232372	P232376
	5.0	37.5	11.0	X009626	P232218	P232384	P232372	P232376
5.0	5.0	37.5	11.0	X009627	P232227	P232384	P232372	P232376
Style 2								
5.0	5.0	38.0	11.0	X009641	P232223	P232387	P232372	P232376
Style 3								
4.0	4.0	37.5	11.0	X009629	P232224	P232383	P232372	P232376
	5.0	37.5	11.0	X009630	P232224	P232384	P232372	P232376
5.0	5.0	37.5	11.0	X009631	P232226	P232384	P232372	P232376
Style 4								
5.0	5.0	41.5	11.0	X009632	P232227	P232389	P232372	P232376
Style 6								
4.0	4.0	41.5	11.0	X009633	P232224	P232388	P232372	P232376
5.0	5.0	41.5	11.0	X009634	P232226	P232389	P232372	P232376
Exhaust Flow Up to 2700 CFM								
Style 1								
5.0	5.0	37.0	13.0	X009635	P232524	P232390	P232523	P232377
Style 3								
5.0	5.0	37.0	13.0	X009637	P232527	P232390	P232523	P232377
Style 4								
5.0	5.0	40.0	13.0	X009639	P232524	P232393	P232523	P232377
Style 6								
5.0	5.0	40.0	13.0	X009640	P232527	P232393	P232523	P232377

V-Band Clamps



The separate sections of LNF Muffler are connected by heavy-duty V-band clamps that create a reliable joint seal.

- 10" Body Dia. P227750
- 11" Body Dia. P212925
- 13" Body Dia. P229851

Footnotes:

- (1) = Inlet offset from center position
- (2) = Outlet offset from center position



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

DPF Filter 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

The maintenance of the emissions devices has become more complex and vehicle owners may find the dealer shop to be their best choice for repair and maintenance.

All new trucks will have a removable Diesel Particulate Filter (DPF) that will require cleaning.

As you consider your options for shop tools to maintain the new emissions devices on trucks, we think the Donaldson two-stage DPF cleaning system is your best choice!

For more information, contact Donaldson or visit our Emissions+Exhaust web site at www.donaldson.com/emissions



Donaldson

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