

DETROIT DIESEL



Installation Instructions

18SP576 – Particulate Filter Installation (Retrofit only) for the Series 50[®] and Series 60[®] engine

DISCLAIMER:

This document does not represent all available knowledge at Detroit Diesel Corporation regarding diesel particulate filters. It is meant to be a general guide for installing and servicing diesel particulate filters. Contact DDC Service Department for additional instruction if necessary.

Introduction

Detroit Diesel Corporation continues its efforts to reduce exhaust emissions. Two primary exhaust gas constituents are oxides of nitrogen (NOx) and particulate matter (PM). Diesel particulate emissions are a mixture of both solid and liquid material. NOx emission reduction can be achieved by lowering combustion temperature. However, this increases particulate emissions. Therefore, when low Nox levels are achieved, an aftertreatment device can be used to simultaneously reduce particulate emissions. Particulate filter technology has been demonstrated to be very effective in the control of particulate emissions.

A diesel particulate filter substrate (core) is comprised of ceramic material. The substrate consists of channels that run the full length, and are blocked off at alternate ends to force the exhaust through porous walls. The channels are coated with platinum washcoat material, which acts as a catalyst, enhancing the oxidation process. The porous walls also collect the particulates. When the exhaust temperature reaches approximately 250° C (482° F), oxidation of particulate matter starts to occur. As the particulate material oxidizes, passive cleaning of the filter takes place. This is called "Regeneration." The key to successful regeneration is high exhaust temperature, above 300° C (572° F) for extended time. Without adequate exhaust temperature over an extended time, the filter will continue to trap particulates and eventually plug.

The purpose of this document is to provide instruction on the proper installation of a filter and the support required to maintain continued service to the customer.

Operating Requirements

As stated above, oxidation of the particulate matter is the key to filter performance. This requires that the catalyzing agent (platinum coated passages) is providing optimum enhancement to the oxidation process. The following requirements must be met, otherwise filter warranty may be compromised:

- Ultra-Low Sulfur Fuel (ULSF) with 15 ppm sulfur content or less should be used, based on ASTM D2622 test procedure.
- Fuel blended with used lube oil should NOT be used.
- Lube oil must have a sulfated ash level of less than 2.0% wt.
- The vehicle duty schedule must result in exhaust temperatures above 300°C (572°F) for a minimum time of 10%, and above 250°C (482°F) at least 40% of the time, measured at the inlet to the particulate filter.

Filter Plugging

If the above operating requirements are not met, the risk of filter plugging increases significantly.

NOTICE:
Filter plugging will result in a power loss and increase the risk of engine damage.

Detroit Diesel Corporation requires the use of an exhaust system backpressure sensor to monitor exhaust backpressure.

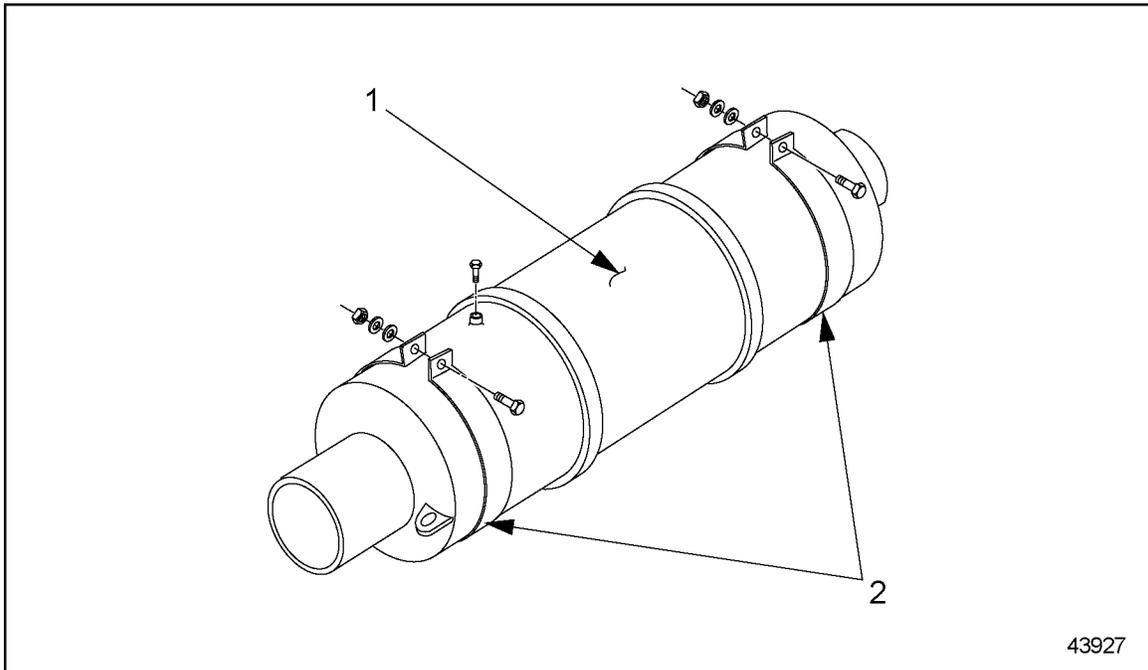
The following service parameters are in place:

- An exhaust system backpressure level of 5" Hg, for more than ten seconds, will illuminate a Check Engine Light (CEL) that will remain lit for the duration of the ignition cycle.
- An exhaust system backpressure level of 6" Hg, for more than ten seconds, will illuminate a Stop Engine Light (SEL) and DDEC will reduce fuel delivery until the backpressure reaches an acceptable level.

NOTICE:
Continued engine operation at high backpressure could damage the filter and subsequently compromise component warranty.

Installation

A particulate filter may weigh twice as much as a conventional muffler; therefore, it is paramount that the filter be mounted with a substantial support system that retains the filter securely in all 3 axes. The filter should be secured by at least two stainless steel mounting straps around the body of the filter can. See Figure 1.



1. Filter Can

2. Stainless Steel Mounting Straps

Figure 1 Diesel Particulate Filter

Normal filter operating vibration levels should not exceed 5 G, measured with an accelerometer. Accelerometers can be purchased from PCB Piezotronics, Inc., 3425 Walden Ave. Depow, NY, 14943-2495, phone number: 888-684-0011 or 716-684-0001. The length of the tubing between the turbo and the filter should be minimized (96" maximum) and include flex tubing to aid in reducing filter vibration.

NOTICE:

Note that filter skin temperatures may reach 260° C (500° F) under certain conditions. Avoid filter contact with vehicle heat-sensitive materials. Do not wrap the filter with insulating material.

For additional information on the installation of particulate filters, please refer to DDC Service Information Letter No. 03 TS-45.

Particulate Filter Degreening

Diesel particulate filters are manufactured in such a way that following the application of the catalytic coating, a burn-off of the excess residue is required. The process of burning off the residue, called degreening, takes place passively during normal in-service operation, and does not affect engine performance or the useful life of the engine. This may take several thousand miles to perform. During this period of time, exhaust backpressure may periodically exceed the limits that DDC considers acceptable for long term operation. To avoid nuisance codes during this period of operation, DDC recommends deactivating the sensor during the degreening period. Deactivation is required whenever a new filter is installed, whether by the OEM or as a field replacement. To accomplish this, the DDC backpressure sensor hose must be disconnected for the first 5,000 miles of operation.

It is the installer's responsibility to disconnect the backpressure hose and to plug the end at the time of initial installation. Refer to 18SP548 or 18SP561 regarding exhaust backpressure installation. It is also the installer's responsibility to reattach the backpressure hose on aftermarket installation when the break-in period is over.

NOTE:

DDC will reimburse service outlets to reconnect the exhaust backpressure hose after completion of the break-in period on OEM vehicles only. A claim type one (1) can be filed for this work using the following information:

Labor operation: 069900
Labor time allowed: 0.3 hr.
Complaint Code: PD
Failure Code: 098
Primary failed part no.: 23529151

NOTICE:

Failure to reattach the backpressure hose following break-in could result in engine damage that would not be considered warrantable.

DDEC Software

An exhaust backpressure sensor kit must be installed with the particulate filter, and DDEC software needs to be updated. Refer to 18SP548 for Series 50 engines built prior to October 1, 2002 or 18SP561 for Series 50 engines built after October 1, 2002. The appropriate 06N04C groups for MY 2003 Series 50 engines are shown in Table 1.

06N04C	DESCRIPTION
400	2003 275 HP, PWM#1 Fan, 750 Idle
401	2003 275 HP, PWM#1 Transmission, Fan on PWM#2, 750 Idle
402	2003 275 HP, PWM#1 Fan, 750 Idle, Exhaust Backpressure Sensor
403	2003 275 HP, PWM#1 Transmission, Fan on PWM#2, 750 Idle, Exhaust Backpressure Sensor
404	2003 330 HP, PWM#1 Fan, 800 Idle, Exhaust Backpressure Sensor
405	2003 330 HP, PWM#1 Transmission, Fan on PWM#2, 800 Idle, Exhaust Backpressure Sensor
411	2003 275 HP, PWM#1 Fan, 750 Idle, Maintenance Alert System*
415	2003 275 HP, PWM#1 Fan, 750 Idle, Exhaust Backpressure Sensor, Maintenance Alert System*

- NOTE: The MAS (Maintenance Alert System) is not available on 330 HP.
- The majority of current applications use J1939 transmission communication. These use PWM#1 fan control. Repower applications where older transmissions are reused may require PWM#1 for transmission controls. These installations will use fan on PWM#2.

Table 1 2003/04 Model Year Series 50 06N04C Groups

Series 50 and Series 60 engines retrofitted with Emitless Filters must also be reprogrammed to utilize a #2 diesel fuel calibration group (06N04D). The DDC mainframe system needs to be updated to change to the appropriate 06N04C and 06N04D groups. An authorized Detroit Diesel Distributor, Regional Office, or DDC Technical Service Group can update the mainframe system. After the groups have been changed on the DDC mainframe, the engine will have to be reprogrammed so that the appropriate sensors and calibration are activated.

NOTE:

Following ECM programming, verify that the backpressure sensor has been activated by viewing the PSG & Sensor tab with the programming station (DRS). Analog D1 510 should display BackPressure.

Maintenance

There is a need to periodically remove accumulated ash, derived from engine lube oil, from the filter. This ash does not oxidize in the filter during the normal regeneration process. The requirement for cleaning retrofitted filters is once every 12 months or every 60,000 miles (100,000 km), whichever comes first. Extending the cleaning interval may compromise engine performance, the useful life of the filter, as well as engine warranty. Some applications, including older higher emission level engines, may require more frequent cleaning. Exhaust backpressure will provide an indication of filter integrity. If the DDEC IV backpressure monitoring system is indicating high backpressure, the engine and particulate filter system must be inspected. The filter system may require service (cleaning) to eliminate the high backpressure condition and resume normal operation. For your convenience, DDC Reman-Central's particulate filter cleaning service is approved by Detroit Diesel Corporation. Contact DDC Reman-Central (phone number 620-343-3790) for service, or refer to DDC Service Information Letter No. 03-TS-01 for details on facilitating filter cleaning. Note that simply reversing the direction of flow through the filter is not an acceptable cleaning procedure.

NOTE:

For filters supplied on new engines, which are emission certified, the recommended maintenance interval is 150,000 miles or 4,500 hours, whichever comes first.

Service Record

It is mandatory that customers or distributors maintain a proper record of the particulate filter servicing and cleaning. This record is an agent to warranty considerations. The record must include information such as:

- Date of installation
- Vehicle mileage at the time of installation
- Particulate filter part number and serial number
- Date and vehicle mileage for each filter cleaning performed

Additional information on this topic, along with a service record form can be found in DDC publication 03 TS-01. Please be aware that if an engine failure is attributed to improper servicing of the particulate filter, engine and filter warranty is void.

Predicting In-Service Filter Performance

Effective filter regeneration is a function of exhaust temperature. It is paramount that the exhaust temperature at the entrance to the filter surpasses minimal requirements, as stated in the “Operating Requirements” section above. Particulate filters will not function properly in all applications. Therefore, it is essential that an analysis of any new application take place prior to filter installation.

The characteristics of a typical duty schedule for a potential application should be analyzed so that normal operating parameters, such as temperatures and pressures, can be profiled and compared to requirements for acceptable filter performance. These parameters should be monitored with the aid of a data logger, sampling at a rate of 10 samples per second. The following data should be recorded:

- Exhaust temperature at the inlet to the particulate filter
- Exhaust temperature at the turbocharger outlet
- Particulate filter can skin temperature
- Exhaust backpressure at the inlet to the particulate filter
- Engine rpm
- Turbocharger boost pressure

Testing should be conducted during the winter, such that “worst case” conditions for regeneration can be evaluated. DDC Engineering must evaluate the data for approval. A DDC Product Support Manager can help facilitate this process.

Troubleshooting

Troubleshooting particulate filter performance involves both mechanical and electrical diagnostics. Physical damage to the filter may show up as an increase or decrease in exhaust backpressure. In the case of an increase in backpressure, there is blockage in the filter, accompanied by poor regeneration, and usually is the result of glazing or melting of the ceramic substrate. A decrease in backpressure is usually the result of the substrate cracking due to the can experiencing an external force or a failed seal between the can and the substrate. Careful inspection of the filter assembly should identify the failure mode.

If there is no physical evidence of mechanical failure, a failure of an electronic nature should be considered. This would include a faulty sensor or sensor hardware related concern. You are advised to consult the DDC DDEC III/IV ECM Troubleshooting Guide (6SE497), for troubleshooting exhaust backpressure sensor codes.

Warranty

In the event that an Emitless Filter is completely soot plugged as a result of a warrantable engine failure, the following procedure should be followed:

1. It is mandatory that the Filter Change Out Form (see 03 TS-01) be filled out and submitted to DDC.
2. Mark the street/exhaust outlet side of the filter.
3. Remove the filter and check for visible blockage in the filter on the inlet side of the filter face.
4. If physical blockage is apparent, send the filter to DDC Remanufacturing-Central (phone no. 620-343-3790) for cleaning (Warranty will not be paid on self-cleaning).

NOTE:

When filing the AFA claim, document the engine serial number, the particulate filter serial number, the mileage on the unit, and the invoice received from Reman-Central. For additional information on filing warrantable claims on particulate filters, please refer to Service Information Letter No. 03 TS-01.

DETROIT DIESEL



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