

**State of California
AIR RESOURCES BOARD**

The diesel emission control strategy described herein qualifies as a potential compliance option for the Air Resources Board's (ARB) in-use diesel fleet rules.

EXECUTIVE ORDER DE-09-014-04

Pursuant to the authority vested in the ARB by Health and Safety Code, Division 26, Part 5, Chapter 2; and pursuant to the authority vested in the undersigned by Health and Safety Code Sections 39515 and 39516 and Executive Order G-02-003;

Relating to Exemptions under Section 27156 of the Vehicle Code, and Verification under Sections 2700 through 2711 of Title 13 of the California Code of Regulations (CCR):

Donaldson Company, Incorporated
Low Oxides of Nitrogen (also known as NO_x) Filter (LXF) System

ARB has reviewed Donaldson Company, Incorporated's (Donaldson) request for the verification of the LXF system. Based on an evaluation of the data provided, and pursuant to the terms and conditions specified below, the Executive Officer of ARB hereby finds that the LXF system reduces emissions of diesel particulate matter (PM) consistent with a Level 3 Plus device (greater than or equal to an 85 percent reductions) (Title 13, CCR, Sections 2702 (f) and 2708) and is compliant with the 2009 nitrogen dioxide emissions limit. Accordingly, the Executive Officer determines that the system merits verification and, subject to the terms and conditions specified below, classifies the LXF system as a Level 3 Plus system for heavy-duty on-road applications that use heavy-duty diesel engines. Engines for which the LXF system is verified, the verified parts list, the verified labels, swapping and re-designation information, and other product information can be found here:

<http://www.arb.ca.gov/diesel/verdev/companies/donaldson/LXF.htm>

The aforementioned verification is subject to the following terms and conditions:

- The engine must be model year 2002 through 2006 and have an engine family name listed on the website.
- The engine must be certified for on-road applications.
- The engine must be certified to a PM emission level of at most 0.1 grams per brake horsepower hour (g/bhp-hr), and greater than 0.01 g/bhp-hr.
- The NO_x to PM ratio of the engine, calculated using the certified values for NO_x and PM, must be at least 21.

- The engine must be used by an on-road motor vehicle with a manufacturer's Gross Vehicle Weight Rating of over 14,000 pounds.
- For engines with NO_x to PM ratio of 23 or greater, other than model year 2004 to 2006 Caterpillar Acert engines (C7, C9, C11, C13, and C15), the application must have a duty cycle with an exhaust temperature profile that:
 - Results in a Weighted Average Temperature (WAT) that is at least 263 degrees Celsius; or
 - Is either greater than 245 degrees Celsius for at least 40 percent of the time or, greater than 310 degrees Celsius for at least 10 percent of the time.
- For engines with NO_x to PM ratio of less than 23 and model year 2004 to 2006 Caterpillar Acert engines (C7, C9, C11, C13, and C15), the application must have a duty cycle with an exhaust temperature profile that:
 - Results in a WAT that is at least 270 degrees Celsius; or
 - Is greater than 275 degrees Celsius for at least 40 percent of the time.
- The engine must be rated to at least 100 horsepower (hp) and no more than 600 hp.
- The engine may or may not be certified as having exhaust gas recirculation.
- The engine must not have a pre-existing original equipment manufacturer (OEM) diesel particulate filter.
- The engine may or may not have a pre-existing OEM oxidation catalyst.
- The engine must remain in its original certified configuration, except that if an OEM oxidation catalyst is present, it may be removed if the LXF system is installed. Should the LXF system be removed, the OEM oxidation catalyst must be re-installed, returning the engine to its original certified configuration.
- The engine must have a four-stroke combustion cycle.
- The engine must be turbocharged.
- The engine may be mechanically or electronically controlled.
- The engine must be well maintained and must not consume lubricating oil at a rate greater than that specified by the engine manufacturer.
- The engine must be operated on fuel that has a sulfur content of no more than 15 parts per million by weight.

- Lube oil, or other oil, must not be mixed with the fuel.
- The product must not be operated with a fuel additive, as defined in Section 2701 of Title 13, CCR, unless explicitly verified for use with the fuel additive.
- The product must not be used with any other systems or engine modifications without approval from ARB and the manufacturer.
- Each vehicle that is a candidate for installation of the LXF system based on the WAT criterion must first have its exhaust temperature measured and recorded for an appropriate period of time during typical operation. Donaldson or its authorized representative must maintain these data for each LXF-equipped vehicle and make them available to ARB upon request.
- The other terms and conditions specified below.

IT IS ALSO ORDERED AND RESOLVED: That installation of the LXF system, manufactured by Donaldson Company, Incorporated, of Post Office Box 1299, Minneapolis, Minnesota, 55440-1299, has been found not to reduce the effectiveness of the applicable vehicle pollution control system, and therefore, the LXF system is exempt from the prohibitions in Section 27156 of the Vehicle Code for installation on heavy-duty on-road vehicles. This exemption is only valid provided the engines meet the aforementioned conditions.

The LXF system consists of the following major system components, listed in order from exhaust inlet to outlet as they are arranged within the exhaust system of the vehicle: one inlet section, one catalyzed flow-through filter, one catalyzed wall-flow diesel particulate filter, and one outlet section. With a common inlet assembly, two sets of catalyzed flow-through filter, catalyzed wall-flow diesel particulate filter, and outlet section may also be installed in parallel. The LXF system also includes a backpressure monitor and warning system. The major components of the LXF system are identified in the parts list. The parts list and schematics of the approved product and engine labels are available on the website shown above. The WAT criterion is described in Attachment 1.

The LXF system is comprised of one or two catalyzed flow-through filters and one or two catalyzed wall-flow diesel particulate filters (DPF) designed to filter the exhaust from a single engine. LXF systems with multiple flow-through filters or DPFs that are individually-canned in parallel or in series (or any combination thereof) are not valid under this Executive Order. Channeling exhaust from a single engine through multiple individually-canned LXF systems, deployed in parallel or in series or any combination thereof, is also not valid under this Executive Order unless the engine has a dual exhaust system as described above.

This Executive Order is valid provided that installation instructions for the LXF system do not recommend tuning the vehicle to specifications different from those of the vehicle manufacturer.

Changes made to the design or operating conditions of the LXF system, as exempted by ARB, which adversely affect the performance of the vehicle's pollution control system shall invalidate this Executive Order.

Donaldson Company, Incorporated, must ensure that the installation of the LXF conforms to all applicable industrial safety requirements.

No changes are permitted to the device without the written approval of ARB. Changes from the verified design without written approval of ARB shall invalidate this Executive Order.

No changes are permitted to the device. ARB must be notified, in writing, of any changes to any part of the LXF system. Any changes to the device must be evaluated and approved in writing by ARB. Failure to do so shall invalidate this Executive Order.

Marketing of the LXF system using identification other than that shown in this Executive Order or for an application other than that listed in this Executive Order shall be prohibited, unless prior written approval is obtained from ARB.

Identification must include both device and engine labels consistent with the requirements of Title 13, CCR, Section 2706, and the label schematic shown on the website. Changes or modifications to the label or label placement are prohibited without prior written approval from ARB.

This Executive Order shall not apply to any LXF system advertised, offered for sale, offered for lease, sold with, leased with, or installed on a motor vehicle prior to or concurrent with transfer to an ultimate purchaser.

A copy of this Executive Order must be provided to the ultimate purchaser at the time of sale.

As specified in Section 2706(j) (Title 13, CCR) of *Verification Procedure Warranty and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines* (Procedure), ARB assigns each Diesel Emission Control Strategy a family name. The designated family name for the verification as outlined above is:

CA/DON/2009/PM3+/N00/ON/DPF03

As stated in the Procedure, Donaldson Company is responsible for honoring the warranty for the LXF system (Section 2707), record keeping requirements (Section 2702), and conducting in-use compliance testing (Section 2709).

Use of system parts or replacement parts not authorized by Donaldson may be grounds for denial of a warranty claim.

This Executive Order is valid provided that the diesel fuel used in conjunction with the device complies with Title 13, CCR, Sections 2281 and 2282, and if biodiesel is used, the biodiesel blend shall be 20 percent or less subject to the following conditions:

- The biodiesel portion of the blend complies with the American Society for Testing and Materials Specification D6751 applicable for 15 parts per million sulfur content; and
- The diesel fuel portion of the blend complies with Title 13, CCR, Sections 2281 and 2282.

Other alternative diesel fuels such as, but not limited to, ethanol diesel blends and water emulsified diesel fuel are excluded from this Executive Order.

The LXF system must not be located over any occupied space (e.g., driver or passenger compartments), or installed in a way which would result in noncompliance with any applicable safety standards including but not limited to Federal Motor Carrier Safety Administration, Subpart G, Miscellaneous Parts and Accessories, Section 393.83 Exhaust Systems, and any other location deemed unacceptable by Donaldson.

Proper engine maintenance is critical for the proper functioning of the diesel emission control strategy. The owner and/or operator of the vehicle on which the diesel emission control strategy is installed are strongly advised to adhere to all good engine maintenance practices. Failure to document proper engine maintenance, including keeping records of the engine oil consumption may be grounds for denial of a warranty claim.

In addition to the foregoing, ARB reserves the right in the future to review this Executive Order, and the exemption and verification provided herein, to assure that the exempted and verified add-on or modified part continues to meet the standards and procedures of Title 13 CCR, Section 2222, et seq, and CCR, Title 13, Sections 2700 through 2711.

The terms and conditions of this Executive Order must be satisfied regardless of where the system is sold in order for the system to be considered verified.

Systems sold as verified, or which carry ARB approved labels, must satisfy all the terms and conditions of this Executive Order.

Systems verified under this Executive Order shall conform to all applicable California emissions regulations.

This Executive Order does not release Donaldson Company from complying with all other applicable regulations.

Violation of any of the above conditions shall be grounds for revocation of this Executive Order.

This Executive Order hereby supersedes Executive Orders DE-09-014-03 (dated June 29, 2012), DE-09-014-02 (dated June 30, 2011), DE-09-014-01 (dated August 12, 2010) and DE-09-014 (dated October 23, 2009).

Executed at El Monte, California, and effective this 28st day of October 2013.



Annette Hebert, Chief
Mobile Source Control Division