



# **Non-Road Diesel Emission Reduction Measures Guide**

Vancouver Fraser Port Authority

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## 1. Introduction

The Vancouver Fraser Port Authority's Non-Road Diesel Emissions (NRDE) Program aims to reduce diesel particulate matter emissions associated with non-road equipment. The NRDE Program includes requirements for reporting and labelling for each piece of non-road diesel equipment operated on Federal land leased from the port authority. This document provides guidance to tenants who operate or permit the operation of older diesel non-road equipment and are interested in reducing the emissions from those diesel engines. This guide is provided for information only, and does not provide any product recommendations. It is the responsibility of equipment owners or operators to work with technicians and emission reduction manufacturers to select the most appropriate technology for their situation. For more information about the NRDE Program and its requirements, please visit our website.

For the purpose of this document and the NRDE Program, non-road diesel engines do not include those with a maximum horsepower below 25 hp (19 kW), refrigerated containers, or emergency backup power devices, such as gensets, intended to be operated only in the case of emergencies, or equipment operated on the water.

## 2. Overview of Emission Reduction Measures

An emission reduction measure (ERM) is any technology or system that achieves emission reductions beyond what are required by the regulations set by Canada's *Off-Road Compression-Ignition Engine Emission Regulations* (which adopt the US Environmental Protection Agency (EPA) standards). For the purposes of the NRDE Program, all non-certified (Tier 0) and certified Tier 1, 2 and 3 engines are required to pay fees to operate on port authority land. Installing ERMs that result in emissions improving an engine to the particulate matter emission standard of the next Tier may result in reduced or eliminated fees. For example, a Tier 1 equipment that installs an approved ERM and achieves Tier 2 equivalent emission levels for particulate matter may reduce their fees, once approved by the port authority.

The most appropriate ERM for an engine will vary significantly according to the engine age / remaining usable life, value of the equipment, duty cycle, etc. For cases where a piece of equipment is due to retire, replacement and repowering can be very effective means of reducing emissions, as the new equipment or engine will meet more stringent emission standards, or eliminate diesel particulate matter altogether if replaced with an alternative fuel using natural gas or electricity.

For equipment and engines that have considerable life in them remaining, and are in good operation, there are several options, including a number that have been identified and verified by the US Environmental Protection Agency (EPA) and the California Air Resources Board (ARB). **This guide provides information on specific products that have been verified by the EPA and/ or ARB for non-road diesel equipment, and provides a summary of other options for reducing emissions.**

## a. 2.1 EPA and California ARB Verified ERMs

The EPA and ARB have verified a variety of ERMs according to agency regulation. The verified technologies, and the corresponding manufacturers and models, can be found on the EPA and ARB websites:

- EPA: <https://www.epa.gov/verified-diesel-tech/verified-technologies-list-clean-diesel>
- ARB: <http://www.arb.ca.gov/diesel/verdev/vt/cvt.htm>

EPA and ARB only verify ERMs for specific engines, and these are stated in an EPA verification letter or ARB executive order. However, the NRDE Program will recognize a verified ERM for a non-verified engine if it meets certain conditions (described in **Section 2.2** of this guide).

It should be noted that there are many other ERMs that are not verified by EPA or ARB. Non-verified ERMs that are excluded from this guide are not currently recognized by the NRDE Program. Contact the Environmental Programs department if you have questions about a product that is not included in this guide.

There are seven primary types of verified ERMs for non-road equipment. These are listed in Table 1, along with the expected level of Particulate Matter (PM) emissions reductions that can be expected when best practices are followed (**Section 3.2**).

**Table 1. Types of Verified ERMs and Expected PM Emission Reductions**

Type of Verified ERM	Expected PM Emissions Reduced
<ul style="list-style-type: none"> <li>• Diesel particulate filters</li> <li>• Diesel oxidation catalysts</li> <li>• Closed crankcase ventilation systems</li> <li>• Selective catalytic reduction</li> <li>• Engine replacement systems</li> <li>• Engine upgrade kits</li> <li>• Biodiesel</li> </ul>	<ul style="list-style-type: none"> <li>• 85% +</li> <li>• 23% +</li> <li>• up to 25%</li> <li>• 10 – 25%</li> <li>• depends on replacement tier</li> <li>• 22%</li> <li>• 0 – 20%</li> </ul>

Some manufacturers use a combination of these ERMs to optimize the removal of particulate matter and nitrogen oxides (NO<sub>x</sub>) from the exhaust. The focus for the NRDE Program is PM reduction. Each type of verified ERM is described in greater detail below.

### i. 2.1.1 Diesel Particulate Filters (DPF)

Diesel particulate filters (DPF) reduce diesel PM emissions through filtration of the exhaust, catching the particles or “soot” before they are released to the atmosphere. This technology is very efficient and has been demonstrated to reduce diesel PM emissions by over 90%. Due to these considerable reductions, all verified DPFs installed on Tier 0 or Tier 1 engines are expected to achieve Tier 2 or lower emission levels, making them eligible for no fees and an 80% rebate on fees already paid in the NRDE program once approval is received from the Environmental Programs Department.

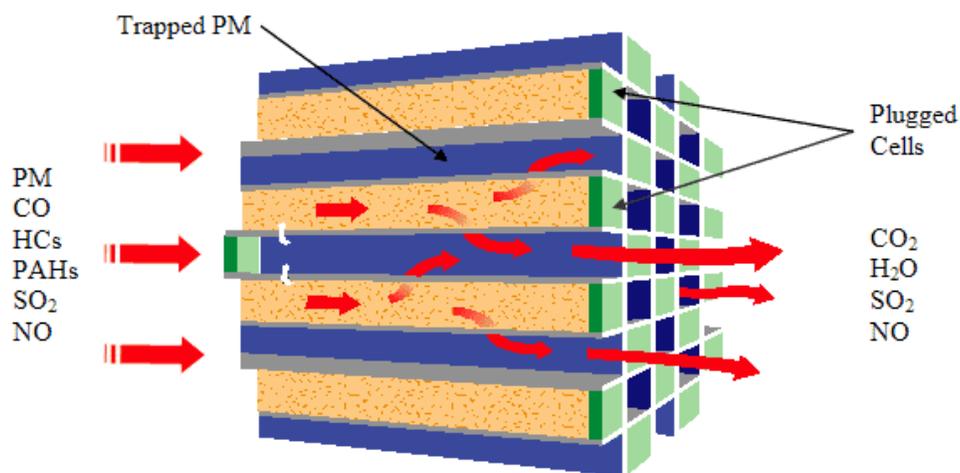
The PM collected by a DPF builds up and needs to be removed – a process called regenerating the filter. DPFs vary by the methods used to regenerate filters. The DPFs listed here can be categorized into two classifications: passive or active regeneration, as explained further below.

Since DPFs are so effective at capturing diesel PM emissions, they require de-ashing or cleaning every 12 to 18 months to remove non-combustible materials that have accumulated during normal operation. While the de-ashing process is easily integrated into normal equipment maintenance, poor engine maintenance practices can lead to increased soot production and engine oil consumption resulting in more frequent DPF regeneration and de-ashing. Thus, it is important to have proactive engine maintenance practices.

**Passive Diesel Particulate Filter** technologies require no user input to regenerate. They provide the highest tailpipe PM reduction available today (>90%), making it a popular choice for retrofit programs. However, passive DPFs are sensitive to exhaust temperature and temperature minimums must be met to ensure consistent and reliable DPF regeneration. Passive DPF systems require logging to ensure that the usage cycle is creating high enough engine temperatures to regenerate the filter. Passive systems are not suitable for applications with short periods of operation and frequent stops and starts.

**Active Diesel Particulate Filters** perform the same function as a passive DPF, but the temperature of the filter must be actively raised to about 600°C in order to combust the PM. The active DPF does not rely on heat from the engine exhaust to oxidize the trapped PM, therefore an active DPF is better suited for low exhaust temperatures or engines with high PM emissions. Common regeneration methods use electrical regeneration by passing an electrical current through the filter medium, injecting fuel to provide additional heat to oxidize the trapped PM, or adding fuel-borne catalyst or other reagents to initiate regeneration.

Some DPFs induce regeneration automatically on-board the vehicle when a specified backpressure is reached. Others use an indicator, such as a warning light, to alert the operator that regeneration is needed, requiring the operator to initiate the regeneration process. Some active DPFs need to be removed and regenerated externally by a regeneration station. Unlike passive systems, which become ineffective if the usage of the vehicle changes, active systems do not rely on engine temperature and are therefore effective for all vehicle usage cycles. Further, some active DPFs that are electrically controlled may regenerate under any engine load condition or exhaust temperature (e.g. Rypos DPFs).



**Figure 1: Diesel Particulate Filter**

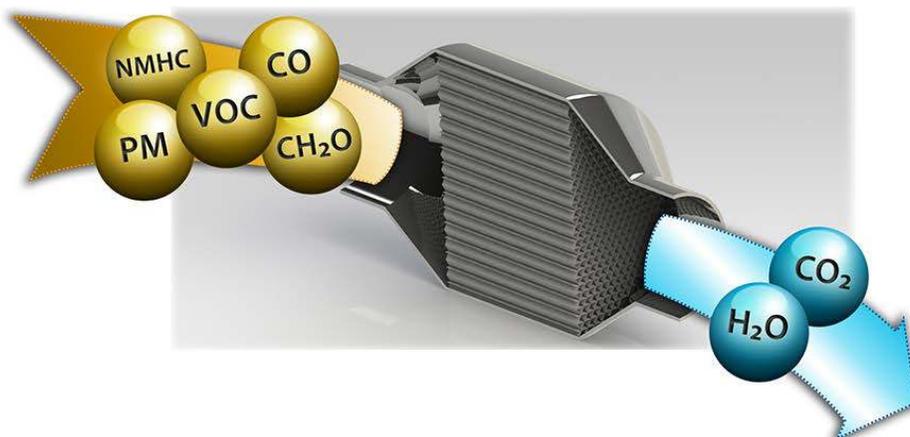
Source: MECA (<http://www.meca.org/diesel-retrofit/what-is-retrofit>)

Manufacturers with DPFs verified for non-road applications by EPA and ARB include:

- Catalytic Exhaust Products
- Caterpillar
- Clariant Caterpillar
- CDTi, Clean Diesel Technologies Inc. (formerly Engine Control System)
- DCL International Inc.
- Donaldson
- ESW CleanTech
- Global Emissions Systems, Inc.
- IAC Acoustics (formerly GTE Industries)
- HUSS Filters
- Johnson Matthey
- MIRATECH Corporation
- Nett Technologies, Inc.
- RYPOS, Inc.

### ***ii. 2.1.2 Diesel Oxidation Catalyst (DOC)***

A diesel oxidation catalyst (DOC) is a device that uses a chemical process to break down pollutants in the exhaust stream into less harmful components. More specifically, it is a physical device with a porous ceramic honeycomb-like structure that is coated with a material that catalyzes a chemical reaction to reduce pollution. DOCs are 20 to 40% effective at reducing PM but are less effective at low engine temperatures. The main advantage of DOCs is that they can be retrofitted to virtually any vehicle and do not require regular maintenance.



**Figure 2: Diesel Oxidation Catalyst**

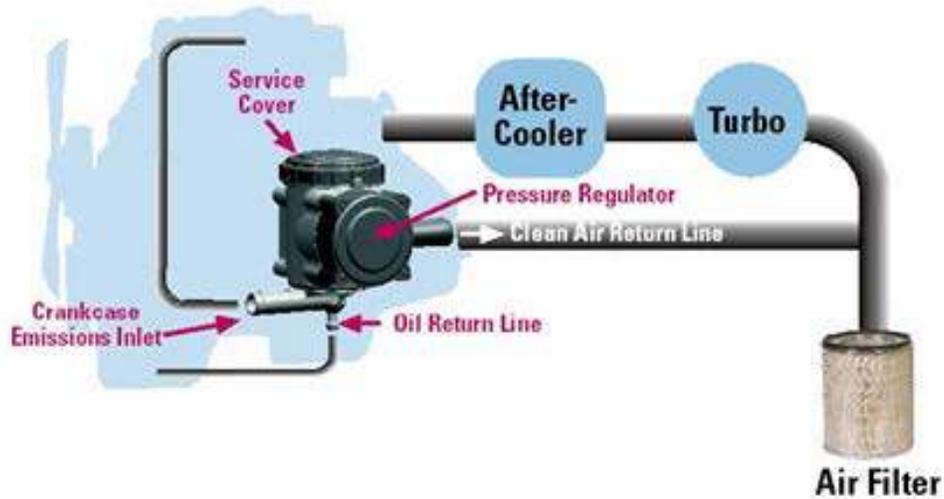
Source: Clean Emissions Products (<http://www.cleanemissions.com/our-technology/oxidation-catalyst/>)

Manufacturers of DOCs verified by EPA and ARB for non-road applications include:

- Donaldson
- Nett Technologies, Inc.

### ***iii. 2.1.3 Closed Crankcase Ventilation System (CCV)***

A closed crankcase ventilation (CCV) system can be used in conjunction with a DOC or DPF to improve the level of exhaust emission reduction by eliminating crankcase emissions, also known as “blow-by”, which are directly released from the engine into the atmosphere through a vent. For equipment manufactured between 1994 and 2006, the PM reductions achieved by CCV systems is usually up to 25%. Equipment manufactured since 2007 typically come equipped with CCV systems.



**Figure 3: Closed Crankcase Ventilation System**

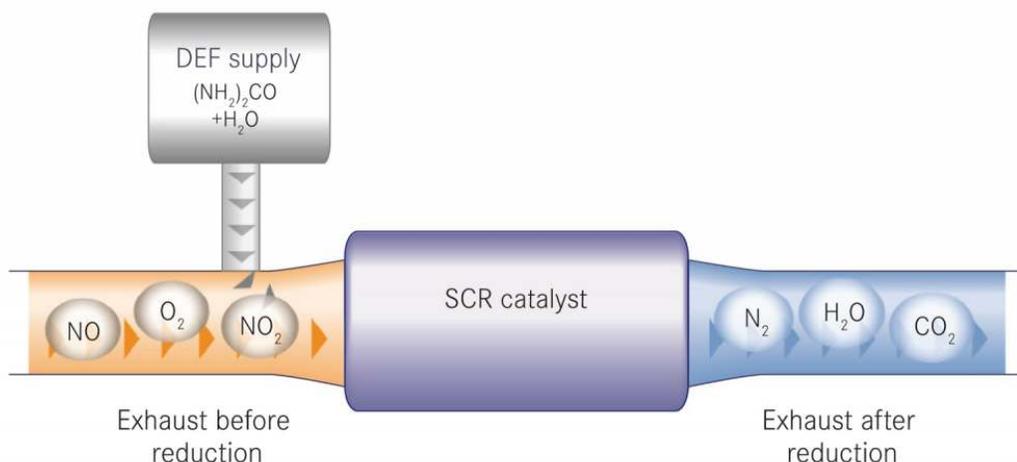
Source: MECA (<http://www.meca.org/diesel-retrofit/what-is-retrofit>)

Currently, Donaldson is the only manufacturer with a verified CCV that can be used on non-road engines. Their CCV technology is only verified in conjunction with DOCs. The emission reductions are sufficient to upgrade the PM emission rate of a Tier 0 engine to a Tier 1 in certain cases (depending on the engine model year and horsepower of the engine being retrofit).

#### ***iv. 2.1.4 Selective Catalytic Reduction (SCR)***

Selective catalytic reduction (SCR) has been used in stationary applications for more than a decade to reduce NO<sub>x</sub> emissions in diesel engines. An SCR system uses a metallic or ceramic wash-coated catalyzed substrate, or a homogeneously extruded catalyst and a chemical reductant to convert nitrogen oxides to molecular nitrogen and oxygen in diesel engines.

In stationary engines, NO<sub>x</sub> emissions can be reduced by 95% or more. SCR can also reduce PM emissions by 20 to 30%, and it can reduce the characteristic odor produced by diesel engines. When combined with a DPF or DOC, SCR catalysts can reduce PM emissions by up to 99%. At the time of publication, four SCR catalysts were verified by EPA and ARB for non-road use, and all four were manufactured by Nett Technologies.



**Figure 4: Selective Catalytic Reduction (SCR) System**

Source: Upstream Pumping Solutions (<http://upstreampumping.com/article/well-completion-stimulation/understand-nonroad-diesel-engine-emissions-regulations?page=2>)

#### **v. 2.1.5 Engine Replacement Systems**

There is one engine replacement system currently verified by EPA. It is manufactured by MJ EcoPower Hybrid Systems, Inc., and is used exclusively on rubber-tired gantry (RTG) cranes. The system replaces a conventional RTG diesel engine generator and other original power system components, and includes a new genset equipped with a new diesel engine, battery energy storage system, rectifier, auxiliary inverter and regenerative brake/energy recovery system.

#### **vi. 2.1.6 Engine Upgrade Kits**

Currently, there are two verified engine upgrade kits that contain components to effectively improve the emission performance of an existing engine. Both are manufactured by Caterpillar, Inc. The primary upgrade components are the turbocharger, fuel pump/governor, fuel injection nozzles, pistons/rings/liners, and, if necessary, the jacket water aftercooler.

#### **vii. 2.1.7 Alternative Fuels - Biodiesel**

Biodiesel is a renewable fuel that can be made from new and used vegetable oils and animal fats and has similar physical characteristics as diesel. Biodiesel is typically blended with petroleum-based fuels at low levels, i.e., 20% (B20) or less. In British Columbia, all diesel is currently required to have at least 4% bio-content (i.e., essentially all diesel used in BC is B4 or higher).

When used in place of conventional diesel (B0), B20 typically reduces CO emissions by 10%, 13% for PM, 20% for sulphate, and 10% for hydrocarbons. As the impact on PM reduction is linear, it can be assumed that PM reduction for B4 would be just over 2.5%. Thus, compared to B4, B20 achieves more than a 10% reduction in PM emissions.

With regards to impact on performance, typical winter weather conditions in Metro Vancouver allow B20 to be used year round (as has been done by operators such as BC Transit). For very cold weather (e.g. -20°C), however, additives should be added or lower biodiesel blends should be used to prevent flow issues.

B20 has been verified as a retrofit technology option under EPA's Voluntary Retrofit Program. However, on its own, B20 would not be sufficient to meet the PM emissions of a higher Tier. It would need to be used in combination with other ERMs, such as DOCs and DPFs, which have been verified by ARB and EPA for use with biodiesel blends up to B20. The biodiesel blend needs to conform to appropriate biodiesel specifications (e.g., the available ASTM specifications for biodiesel) and meet the fuel sulphur specification required by the retrofit technology supplier for that specific diesel retrofit technology (typically < 15 ppm, which is found in ultra low sulphur diesel).

### ***viii. 2.1.8 Other Verified ERMs***

**Energy Storage System** – There is currently one flywheel based energy storage system that has been verified by ARB to reduce PM emissions by at least 25% for RTG cranes. It does this by capturing regenerated power of a container lowering cycle of an RTG crane and using this power during a high load lifting cycle to reduce peak loads on the diesel fueled generator set. This technology is manufactured by Vycon.

**Fuel Additive** – Viscon has developed a verified fuel additive that can be used in diesel engines that will reduce PM emissions by at least 25%. It is added to diesel at a low dosage.

### ***ix. 2.1.9 Summary tables listing all verified products***

This section provides a summary of the ERMs that are verified by EPA and ARB at the time of publication. It is organized into tables by type of ERM. As the verification information for ERMs is often updated, the EPA and ARB website links provided in Section 1 should always be consulted. The EPA and ARB websites also list the verified engine families for each ERM. Detailed product information, including approximate costs and installation timelines for some of these technologies is provided in Section 4.

**Note that this section contains a list of all verified ERMs for non-road use, including several ERMs that would achieve a smaller reduction in PM emissions than a full Tier change.** As such, they alone may not change the Tier level of the engine on which they are installed or used, and therefore may not be eligible for a fee rebate or reduction in the NRDE program.

**Table 2. Verified Diesel Particulate Filters (DPF) by Manufacturer**

Manufacturer and Address	Model	Application	Verification	Engine Model Yr	Engine hp Limits	PM Reduction	Tier Prior to ERM	Tier with ERM	Contact Information for Manufacturer and Distributor
<b>Catalytic Exhaust Products Ltd.</b> Brampton, ON	Dieselytic SXS-SC DPF	Stationary	ARB	1996-2008	Not specified	≥85%	1, 2 or 3	3 or 4	John Stekar 1-800-551-5525, 905-799-9770 <a href="mailto:john@catalyticexhaust.ca">john@catalyticexhaust.ca</a>
<b>Caterpillar</b> Peoria, IL	Diesel Particulate Filter (DPF)	Multiple (mobile & stationary)	EPA	1996-2005	175-300hp	89%	1 or 2	4	309-675-1000
	DPF for Stationary	Stationary	ARB	1996-2013	50-75hp or >750hp	≥85%	1, 2, 3 or 4i	2, 3 or 4	
<b>Clean Diesel Technologies, Inc. (CDTi)</b> Formerly Engine Control System Thornhill, ON	Combifilter	Multiple (mobile and stationary)	ARB	1996-2007	<600hp	≥85%	0, 1, 2 or 3	3 or 4	David Scarfe 805-320-6222 <a href="mailto:dscarfe@cdti.com">dscarfe@cdti.com</a> <i>Distributor (also see section 4)</i> Darell Beldeo Williams Machinery Surrey, BC 604-930-3354, 604-930-3300 <a href="mailto:dbaldeo@williamsmachinery.com">dbaldeo@williamsmachinery.com</a> <i>More distributors in section 4.</i>
	Purifilter OR DPF for Non-Road Applications System	Multiple (mobile and stationary)	EPA	Not specified	100-603hp	90%	1, 2 or 3	4	
<b>Clariant Corporation</b> Charlotte, NC	EnviCat® - DPF	Stationary	ARB	1996-2010	Not specified	≥85%	1, 2 or 3	3 or 4	704-331-7000
<b>DCL International Inc.</b> Concord, ON	Mine-X Sootfilter (mobile non-road equip)	Mobile non-road only	ARB	1996-2011	100-1000hp	≥85%	1, 2 or 3	2, 3 or 4	Tony Almeida, Sales Manager- North America 1-800-872-1968, 905-660-6450 Ext. 268 <a href="mailto:talmeida@dcl-inc.com">talmeida@dcl-inc.com</a> <i>Distributor:</i> Diesel Emissions Service Steve Hoke, President 530-241-3950 <a href="mailto:steve@dieseemissionservice.com">steve@dieseemissionservice.com</a>
	Mine-X Sootfilter (stationary engines)	Stationary	ARB	1996-2014	50-75hp or >750hp	≥85%	1, 2, 3 or 4i	2, 3 or 4	
<b>Donaldson</b> Bloomington, MN	Semi-Active Electric Filter for Non-Road (NR-SEF)	Multiple (mobile and stationary)	EPA	1996-2010	100-400hp	90%	1, 2 or 3	3 or 4	310-683-8353 <i>Distributors:</i> Inland Kenworth Bob Curtis, Parts Manager

Manufacturer and Address	Model	Application	Verification	Engine Model Yr	Engine hp Limits	PM Reduction	Tier Prior to ERM	Tier with ERM	Contact Information for Manufacturer and Distributor
	Low NO2 DPF for Non-Road (NR-LNF DPF)	Multiple (mobile and stationary)	EPA	Not specified	100-603hp	90%	1 or 2	3 or 4	604-607-8425, 778-229-0195 <a href="mailto:bcurtis@inland-group.com">bcurtis@inland-group.com</a> Diesel Emissions Service Steve Hoke, President 530-241-3950 <a href="mailto:steve@dieseemissionservice.com">steve@dieseemissionservice.com</a>
<b>ESW CleanTech</b> Woodbridge, ON	Phoenix	Non-road, except RTGs	ARB	1996-2014	100-450hp	≥85%	1, 2 or 3	4	Raafat Habib, Business Development Specialist 905-695-4141 ext. 287, 416.671.2243 <a href="mailto:rhabib@eswgroup.com">rhabib@eswgroup.com</a> <i>Distributor:</i> Diesel Emissions Service Steve Hoke, President 530-241-3950 <a href="mailto:steve@dieseemissionservice.com">steve@dieseemissionservice.com</a>
	Skyline	Non-road, except RTGs	ARB	1996-2014	100-400hp	≥85%	1, 2 or 3	4	
	ThermaCat	Non-road, except RTGs	ARB	1996-2010	100-350hp	≥85%	1, 2 or 3	4	
<b>Global Emissions Systems, Inc.</b> Whitby, ON	GESi6000DP F	Stationary	ARB	1996-2014	Not specified	98.5%	1, 2 or 3	4	Gary W. Jarosz, Vice President 905-433-9640, 416-543-8839 <a href="mailto:gjarosz@gesi.us">gjarosz@gesi.us</a>
<b>HUSS</b> Palm Desert, CA	FS-MK Off-Road	Non-road, except RTGs	ARB	1996-2012	<810hp	≥85%	0, 1, 2, 3 or 4i	3 or 4	Christian Bayer 760-322-5692 ext 309 <a href="mailto:Christian.Bayer@hussfilters.com">Christian.Bayer@hussfilters.com</a> <i>Distributor (more in section 4):</i> MasonLift, Jeff Larsen Delta BC, 604-517-6500 <a href="mailto:jlarsen@masonlift.com">jlarsen@masonlift.com</a>
<b>IAC Acoustics</b> (formerly GTE Industries) Lincoln, NE	Purity DPF	Stationary	ARB	1996-2014	Not specified	≥85%	1, 2 or 3	2, 3 or 4	Bruce Holtmeier, Customer Service Technical Engineer 402-323-7283, 402-937-3482 <a href="mailto:bruce.holtmeier@iac-acoustics.com">bruce.holtmeier@iac-acoustics.com</a>
<b>Johnson Matthey</b> Brampton, ON	CRT	Stationary	ARB	1996-2013	Not specified	≥85%	1, 2 or 3	3 or 4	Melanie Pastore 484-320-2240 <a href="mailto:pastore@jmus.com">pastore@jmus.com</a>
	combiKat	Stationary	ARB	1996-2014	>50hp	≥85%	1, 2 or 3	3 or 4	Don Lambert, Business Development Engineer

Manufacturer and Address	Model	Application	Verification	Engine Model Yr	Engine hp Limits	PM Reduction	Tier Prior to ERM	Tier with ERM	Contact Information for Manufacturer and Distributor
<b>MI RATECH Corporation</b> Calgary, AB	LTR™ DOC/DPF System	Stationary	ARB	1996 - 2014	> 50hp	≥85%	1, 2 or 3	3 or 4	403-815-7372 <a href="mailto:dlambert@miratechcorp.com">dlambert@miratechcorp.com</a>
<b>Nett Technologies, Inc.</b> Mississauga, ON	BlueMAX™ PLUS 100 [SCR + DPF]	Multiple (mobile and stationary)	EPA	Not specified	100-750hp	≥85%	1, 2 or 3	3 or 4	Julia Ruslys, Inside Sales Executive 905-672-5453 ext. 119, 1-800-361-6388 <a href="mailto:jruslys@nettinc.com">jruslys@nettinc.com</a>
	VorTEQ 100	Non-road, except RTGs	ARB	1996-2014	65-175hp	≥91%	1, 2 or 3	3 or 4i	
	GreenTRAP™ 300 DPF	Stationary	ARB	1996-2010	68-680hp	≥85%	1, 2 or 3	3 or 4i	
	BlueMax™ NOVA 300e System [DPF + SCR]	Stationary	ARB	1996-2014	> 75hp	≥85%	1, 2 or 3	3 or 4	
<b>RYPOS, Inc.</b> Santa Ana, CA	ActiveDPF/C3 +™	RTG cranes only	ARB	1996-2014	> 50hp	≥85%	1, 2 or 3	2, 3 or 4	Peter Ellison, Western Region Sales Manager 949-395-4190 <a href="mailto:pre@rypos.com">pre@rypos.com</a>
	ActiveDPF/C™	RTG cranes only	ARB	Not specified	> 50hp	≥50%	1, 2 or 3	1, 2 or 3	
	HDPF/C™	Stationary	ARB	1996-2010	> 50hp	≥85%	1, 2 or 3	2, 3 or 4	

**Table 3. Verified Diesel Oxidation Catalyst (DOC) by Manufacturer**

Manufacturer and Address	Model	Application	Verified By	Engine Model Yr	Engine hp Limits	PM Reduction	Tier Prior to ERM	Tier with ERM	Contact Information for Manufacturer and Distributor
<b>Donaldson</b> Bloomington, MN	6000 + Spiracle (off-road); [DOC + CCV crankcase filter]	Multiple (mobile and stationary)	ARB	1996-2003	150-600hp	≥25%	0, 1 or 2	May change tier in some cases	310-683-8353 <i>Distributors:</i> Inland Kenworth Bob Curtis, Parts Manager 604-607-8524, 778-229-0195 <a href="mailto:bcurtis@inland-group.com">bcurtis@inland-group.com</a> Diesel Emissions Service Steve Hoke, President 530-241-3950 <a href="mailto:steve@dieselemissionservice.com">steve@dieselemissionservice.com</a>
<b>Nett Technologies,</b>	MD300 DOC	Stationary	EPA	1996-2011	100-750hp	23%	1, 2 or 3	May change	Julia Ruslys, Inside Sales Executive

Manufacturer and Address	Model	Application	Verified By	Engine Model Yr	Engine hp Limits	PM Reduction	Tier Prior to ERM	Tier with ERM	Contact Information for Manufacturer and Distributor
<b>Inc.</b> Mississauga, ON								tier in some cases	905-672-5453 ext. 119, 1-800-361-6388 <a href="mailto:jruslys@nettinc.com">jruslys@nettinc.com</a>

**Table 4. Verified Selective catalytic reduction (SCR) by Manufacturer**

Manufacturer and Address	Model	Application	Verified By	Engine Model Yr	Engine hp Limits	PM Reduction	Tier Prior to ERM	Tier with ERM	Contact Information for Manufacturer and Distributor
<b>Nett Technologies, Inc.</b> Mississauga, ON	BlueMAX™ 100 Urea-Based SCR System	Multiple (mobile and stationary)	EPA	1996-2008	100-496hp	12%	1, 2 or 3	May change tier in some cases	Julia Ruslys, Inside Sales Executive 905-672-5453 ext. 119, 1-800-361-6388 <a href="mailto:jruslys@nettinc.com">jruslys@nettinc.com</a>
	BlueMAX™ 300D SCR System	Stationary	EPA	1996-2011	100-750hp	25%	1, 2 or 3	May change tier in some cases	

**Table 5. Verified Engine Replacement Systems by Manufacturer**

Manufacturer and Address	Model	Application	Verified By	Engine Model Yr	Engine hp Limits	PM Reduction	Tier Prior to ERM	Tier with ERM	Contact Information for Manufacturer and Distributor
<b>MJ EcoPower Hybrid Systems, Inc.</b> Brossard, QC	EcoCrane Hybrid System	RTG cranes only	EPA	Not specified	Not specified	74%* (*if T2 replaced by T3)	0, 1 or 2	Dependent on the new diesel engine	Harvey Schmidt, Vice President Technical Support, Mi-Jack Products, Inc. 708-469-6804 <a href="mailto:hschmidt@mi-jack.com">hschmidt@mi-jack.com</a>

**Table 6. Verified Engine Upgrade Kits by Manufacturer**

Manufacturer and Address	Model	Application	Verified By	Engine Model Yr	Engine hp Limits	PM Reduction	Tier Prior to ERM	Tier with ERM	Contact Information for Manufacturer and Distributor
<b>Caterpillar</b> Peoria, IL	Emissions Upgrade Group	Multiple (mobile and stationary)	EPA	1970-1995 (model 3306 non-road)	Not specified	22%	0	1	Head office number: 309-675-1000
	Emissions Upgrade Group	Multiple (mobile and stationary)	EPA	1973-1995 (model 3406 non-road)	200-600hp	To Tier 1	0	1	

**Table 7. Verified Energy Storage System by Manufacturer**

Manufacturer and Address	Model	Application	Verified By	Engine Model Yr	Engine hp Limits	PM Reduction	Tier Prior to ERM	Tier with ERM	Contact Information for Manufacturer and Distributor
<b>Vycon</b> Cerritos, CA	REGEN System	RTG cranes only	ARB	Not specified	> 50hp	≥25%	0, 1, 2 or 3	Likely no change in Tier	Frank DeLattre, President 562-282-5502, 858-361-9558 <a href="mailto:fdelattre@vyconenergy.com">fdelattre@vyconenergy.com</a>

**Table 8. Verified Fuel Additives by Manufacturer**

Manufacturer and Address	Model	Application	Verified By	Engine Model Yr	Engine hp Limits	PM Reduction	Tier Prior to ERM	Tier with ERM	Contact Information for Manufacturer and Distributor
<b>Viscon California</b> Bakersfield, CA	LLC (Viscon)	Mobile non-road only	ARB	1985-1995	175-300hp	≥25%	0	Likely no change in Tier	661-327-7061

## 1.1 Verified ERMs in Non-Specified Applications

EPA and ARB verify ERM technologies for specific engines. This results in a limited number of ERM options for some non-road engines. The NRDE Program may recognize verified ERMs that are used in non-specified applications, including ERMs verified for other non-road diesel engines, and for on-road diesel engines.

### 1.1.1 Conditions for Approval of Non-Specified Applications

Verified ERMs applied to non-specified engines will be eligible for fee rebates and/or fee reductions under the following conditions:

1. Best practices such as, but not limited to, those outlined for verified ERMs in Section 2 are adhered to;
2. Tenants obtain and submit to the port authority an assurance letter from the ERM manufacturer indicating the PM percent reduction achieved by the ERM in the proposed application; and
3. The PM emission reductions result in the emissions being upgraded to the next Tier standard.

### 1.1.2 How Emission Reductions will be Determined

The Environmental Programs department will determine whether the ERM is eligible for a fee reduction or rebate based on the PM Emission Standards table, available at: <http://www.portvancouver.com/wp-content/uploads/2015/07/Fact-Sheet-Emissions-Standards.pdf>. Note that legislation for non-road diesel engines allowed these emission standards to be phased in over several years; therefore, not all engines purchased in a particular year meet the emission standards set out for that year. The tier level of an engine is more accurately determined by contacting the engine manufacturer with the Engine Family Name, which is located on the engine plate. Any engine that is pre-Tier (i.e. Tier 0) does not have an Engine Family Name. As a general guideline, the port authority will recognize the following emission reductions from verified DPFs and DOCs:

- A diesel particulate filter (DPF) that achieves 85% PM reduction will upgrade the PM emission rate of any Tier 0 or Tier 1 non-road engine to a Tier 2 or greater emission standard.
- A diesel oxidation catalyst (DOC) that achieves 20% PM reduction will upgrade the PM emission rate of a Tier 0 non-road engine to a Tier 1 emission standard only for the following horsepower ranges:
  - 50-99hp; and
  - 300-1199hp for engines that are 1988 or newer.
- An assurance letter is obtained from the ERM manufacturer indicating the PM percent reduction achieved by the ERM in the non-specified application.

To discuss any of these options further, contact the Environmental Programs department.

## 1.2 Other ERMs – Engine Replacements

Where a piece of equipment is due to retire, replacement and repowering can be an effective means of reducing emissions because the new equipment or engine will meet more stringent emission standards or eliminate diesel particulate matter altogether if replaced with an alternative fuel using natural gas or electricity.

### 1.2.1 Engine Replacement with On-Road Diesel Engines

Replacing a non-road diesel engine with a 1994 or newer on-road engine will result in particulate matter emissions equivalent to Tier 2 non-road standards or better. For on-road engines built prior to 1994, **Table 9** summarizes the equivalencies to non-road Tier standards with respect to particulate emissions:

**Table 9. On-road/ Non-road Engine Equivalency Table**

Engine power	On-road engine model year	Non-road tier equivalency
25 up to 175 HP	1991 and newer	Tier 2+
	1987 – 1990	Tier 1
	1986 and older	Tier 0
175 up to 1,200 HP	1994 and newer	Tier 2+
	1991 – 1993	Tier 1
	1990 and older	Tier 0
1,200 HP and up	1991 and newer	Tier 2+
	1987 – 1990	Tier 1
	1986 and older	Tier 0

### 1.2.2 Engine Replacement with Alternative Fuels

Replacing a non-road diesel engine with an alternative fuel such as natural gas or electricity will result in eliminating diesel particulate matter. Once approved by the Environmental Programs department, fees paid for the removed diesel engine would be eligible for rebate.

### 1.2.3 Engine Replacement with Newer Non-Road Diesel Engine

Once approved, replacement of an older diesel engine with a newer, higher-tier engine would be eligible for fee rebates and reduced or eliminated fees under the NRDE program, depending on the Tier level of the new engine.

## 1.3 Factors to Consider when Selecting an ERM

In the NRDE Program, engines are eligible for reduced or eliminated fees and/or rebates for applying ERMs that result in PM emission levels equivalent to or better than the next Tier level. For example, if a non-certified engine reaches Tier 1 PM emission levels, those engines will be eligible for paying the Tier 1 rate, upon approval from the Environmental Programs department. Rebates are available to all engines that achieve Tier 2 PM emission levels or better.

When selecting an emission control technology, several factors must be considered, including but not limited to:

- Engine size and backpressure specification
- Engine duty-cycle and resultant exhaust gas temperatures
- Desired emission reductions
- Vehicle integration and safety

As well, the engine family, engine horsepower, and PM certification level of the engine will dictate which ERM will be appropriate for a given piece of equipment. Discuss these items with the ERM technology provider when selecting an ERM.

## 1.4 Installation and Maintenance of ERMs

ERMs are only effective when they are installed and used according to the manufacturer's instructions. To ensure proper installation, an emission control device needs to be installed by someone authorized by the control device's manufacturer. This can be the end-user, dealer, or an installation company, but they must be properly trained to install the particular device. Often, manufacturers will offer online training and certification so that the installation can be done locally.

It is also essential to have good maintenance practices when using ERMs. A properly maintained engine is necessary for ERMs to effectively reduce emissions, maintain durability, and have reduced maintenance requirements. In the experience of other operators, including port equipment operators, emission control devices have often failed when they have not been maintained properly.

A good maintenance program includes performing all of the maintenance recommended and required by an emission control manufacturer. Tracking fuel and oil consumption before and after an ERM is installed or introduced is also important, as abrupt changes in fuel or oil consumption can be a sign of needed engine repair.

Conducting annual opacity tests is also critical, as the filter cores of DPFs can become irreparably damaged if the equipment's opacity does not meet the DPF manufacturer's opacity criteria. To prevent damage, check the engine's opacity each time a DPF is removed for cleaning. ERM installers should have the equipment to conduct opacity tests. Providing refresher training to staff also ensures that they know how to adequately maintain an emission control device and the engine on which it is installed.

The following websites provide more information on selection, installation and maintenance of ERMs:

- <http://www.arb.ca.gov/msprog/decsinstall/decsinstall.htm>
- <https://www.epa.gov/verified-diesel-tech>

## 2. Fee Reduction or Rebate Application Process

Tenants will need to work with manufacturers and approved installers to select the appropriate ERM for their engine and operating conditions. The port authority requires tenants to follow best practices to be eligible for reduced fees and/or rebates.

### 2.1 Apply for Fee Reduction or Rebate

During the NRDE annual report process, apply to the Environmental Programs department for a fee rebate and/or fee reduction by submitting the NRDE Annual Report Tool completed with equipment and engine information requested, including the EPA Family Name (for Tier 1 or newer engines only), engine tier, type of ERM installed, date of installation, and corresponding hour meter reading.

**By submitting the Annual Report Tool, the tenant representative is declaring that any ERMs identified in the Annual Report Tool have been installed in accordance with best practices, such as those described in this Guide.**

If required, the port authority may request maintenance records or other additional information from tenants to confirm use of best practices listed below. Upon receipt of all required information, the port authority will review the application to determine the level of reimbursement and/or fee reduction that the ERM is eligible for. If an ERM is replaced, removed or modified, the tenant must inform the Environmental Programs department during annual reporting, including the date the change occurred and the corresponding hour meter reading.

## 2.2 ERM Installation Best Practices

Best practices for ERM installation include the following:

1. Have an engine pre-assessment conducted by an installer that is authorized by the ERM manufacturer prior to installation, and keep record of the results;
2. Have the ERM installed by an authorized installer and obtain written confirmation of ERM compatibility from the ERM installer stating that the ERM was installed in accordance with the EPA Verification Letter or ARB Executive Order (if applicable), and the manufacturer's pre-installation instructions. See guidance at:
  - <http://www.arb.ca.gov/msprog/mailouts/msc1111/msc1111.pdf>
3. Take a photograph of the installation;
4. Keep the receipt for the installation;
5. Download and keep a copy of the EPA verification letter or ARB Executive order for the selected ERM (if applicable). Letters are available here:
  - EPA: <http://www3.epa.gov/otaq/diesel/verification/index.htm>
  - ARB: <http://www.arb.ca.gov/diesel/verdev/vt/cvt.htm>
6. Keep ERM maintenance records to demonstrate adherence with ERM manufacturer specifications.

## 3. Detailed Information for Verified Products

This section contains detailed information on some of the ERMs that are verified by EPA and ARB, as of February 2016. This information, which is organized by type of application, is provided as a resource to support decision making about which ERM to purchase and install. The product summaries include information provided by the product manufacturers; however, this is not a complete list of all verified products. More details about the requirements of each technology, as well as additional verified technologies, can be found on the EPA and ARB websites. Also, the cost information and timeframes provided are only approximations. Actual costs and timeframes are dependent on the specific application.

### 3.1 Verified DPFs

<b>Manufacturer Name</b>	Clean Diesel Technologies, Inc.
<b>Model Name</b>	Combifilter (DPF)
<b>Application</b>	Multiple Types of Non-Road Equipment (Mobile and Stationary) Model years: 1996 – 2007 Engine horsepower: < 600hp Engine Tiers before ERM installation: 0, 1, 2, 3
<b>Verified Engine Families</b>	<a href="http://www.arb.ca.gov/diesel/verdev/pdf/attachments/de-04-012-02.pdf">http://www.arb.ca.gov/diesel/verdev/pdf/attachments/de-04-012-02.pdf</a>
<b>Unit Price</b>	\$6,000 to greater than \$20,000 USD
<b>Annual Maintenance Cost</b>	\$200 - 400 USD (for de-ashing)
<b>Other Additional Costs</b>	Wall mounted Regeneration panel- \$5,000 - \$6500 USD
<b>No. units typically in stock</b>	Continuous stock; standard lead time 2 weeks
<b>Minimum Order</b>	As per CDTi distributor
<b>Payment Terms</b>	As per CDTi distributor
<b>Delivery time to mechanic</b>	Standard lead time 2 weeks
<b>Installation Time (mechanics)</b>	CDTi trained and authorized installers only; licensed electricians required for regeneration panel installation
<b>Installation time depends on:</b>	
Equipment type	
<b>Maintenance requirements</b> (as per ARB/EPA verification requirements, and other)	
The engine must be well maintained and not consume lubricating oil at a rate greater than that specified by the engine manufacturer.	
<b>Biodiesel Compatibility</b>	B20
<b>Product Lifetime</b>	Nominal 20,000 engine hours
<b>Data Logging Required? (Y/ N)</b>	N
<b>Other useful information on process for ordering and installation</b>	
Typically used on equipment operating indoors or with very cold duty cycles - forklifts, sweepers, cargo handling equipment, other industrial equipment.	
<b>Manufacturer and Distributor Information</b>	
Manufacturer: Clean Diesel Technologies, Inc. <a href="http://www.cdti.com">www.cdti.com</a> , Thornhill, ON	Contact Name: David Scarfe Tel: 805-320-6222 Email: <a href="mailto:dscarfe@cdti.com">dscarfe@cdti.com</a>
Distributor: Williams Machinery <a href="http://www.williamsmachinery.com">http://www.williamsmachinery.com</a> Surrey, BC	Contact Name: Darell Baldeo Tel: 604-930-3354, 604-930-3300 Email: <a href="mailto:dbaldeo@williamsmachinery.com">dbaldeo@williamsmachinery.com</a>
Distributor: Cadell <a href="http://ecommerce.cadell.ca">http://ecommerce.cadell.ca</a> Langley, BC	Contact Name: Fred McGinn Tel: 604-882-9966 Email: <a href="mailto:fmcginn@uapinc.com">fmcginn@uapinc.com</a>
Distributor: Re-flow Filter Cleaning Solutions <a href="http://www.reflowsolutions.com">www.reflowsolutions.com</a> Port Coquitlam, BC	Contact Name: Richard Gagne Tel: 604-474-4388 Email: <a href="mailto:rick.gagne@reflowsolutions.com">rick.gagne@reflowsolutions.com</a>
Distributor: Diesel Emissions Service <a href="http://www.dieseemissionservice.com">www.dieseemissionservice.com</a>	Contact Name: Steve Hoke, President Tel: 530-241-3950 Fax: 530-241-0870 Email: <a href="mailto:steve@dieseemissionservice.com">steve@dieseemissionservice.com</a>
<b>Manufacturer Name</b>	Clean Diesel Technologies, Inc.
<b>Model Name</b>	Purifilter OR Diesel Particulate Filter (DPF) for Non-Road

<b>Application</b>	Multiple Types of Non-Road (Mobile and Stationary) Model years: Not specified Engine horsepower: 100 – 603hp Engine Tiers before ERM installation: 1, 2, 3
<b>Verified Engine Families</b>	Not specified
<b>Unit Price</b>	\$7,500 - \$19,000 USD
<b>Annual Maintenance Cost</b>	\$200 - \$400 USD (for de-ashing)
<b>Other Additional Costs</b>	N/A
<b>No. units typically in stock</b>	Continuous stock; standard lead time 2 weeks
<b>Minimum Order</b>	As per CDTi distributor
<b>Payment Terms</b>	As per CDTi distributor
<b>Delivery time to mechanic</b>	Continuous stock; standard lead time 2 weeks
<b>Installation Time (<i>mechanics</i>)</b>	CDTi trained and authorized installers only; typical times are 6 – 8 hours depending upon the specific piece of equipment.
<b>Installation time depends on:</b>	Equipment type
<b>Maintenance requirements (as per ARB/ EPA verification requirements, and other)</b>	
The engine must be well maintained and not consume lubricating oil at a rate greater than that specified by the engine manufacturer.	
<b>Biodiesel Compatibility</b>	B20
<b>Product Lifetime</b>	Nominal 20,000 engine hours
<b>Data Logging Required? (Y/ N)</b>	Y
<b>Other useful information on process for ordering and installation</b>	
N/A	
<b>Manufacturer and Distributor Information</b>	
Manufacturer: Clean Diesel Technologies, Inc. <a href="http://www.cdti.com">www.cdti.com</a> Thornhill, ON	Contact Name: David Scarfe Tel: 805-320-6222 Email: <a href="mailto:dscarfe@cdti.com">dscarfe@cdti.com</a>
Distributor: Williams Machinery <a href="http://www.williamsmachinery.com">http://www.williamsmachinery.com</a> Surrey, BC V3V 3V6	Contact Name: Darell Baldeo Tel: 604-930-3354, 604-930-3300 Email: <a href="mailto:dbaldeo@williamsmachinery.com">dbaldeo@williamsmachinery.com</a>
Distributor: Cadel <a href="http://ecommerce.cadel.ca">http://ecommerce.cadel.ca</a> Langley, BC	Contact Name: Fred McGinn Tel: 604-882-9966 Email: <a href="mailto:fmcginn@uapinc.com">fmcginn@uapinc.com</a>
Distributor: Re-flow Filter Cleaning Solutions <a href="http://www.reflowsolutions.com">www.reflowsolutions.com</a> Port Coquitlam, BC	Contact Name: Richard Gagne Tel: 604-474-4388 Email: <a href="mailto:rick.gagne@reflowsolutions.com">rick.gagne@reflowsolutions.com</a>
Distributor: Diesel Emissions Service <a href="http://www.dieseemissionservice.com">www.dieseemissionservice.com</a> Redding, CA 96001	Contact Name: Steve Hoke, President Tel: 530-241-3950 Fax: 530-241-0870 Email: <a href="mailto:steve@dieseemissionservice.com">steve@dieseemissionservice.com</a>

<b>Manufacturer Name</b>	DCL International
<b>Model Name</b>	Mine-X Sootfilter (for non-road equipment other than stationary engines, including portable generators and compressors) (DPF)
<b>Application</b>	Multiple Types of Non-Road Equipment (Mobile and Stationary) Model years: 1996 – 2010 Engine horsepower: 100 – 1,000hp Engine Tiers before ERM installation: 1, 2, 3
<b>Verified Engine Families</b>	<a href="http://www.arb.ca.gov/diesel/verdev/pdf/attachments/de-09-012-02.pdf">http://www.arb.ca.gov/diesel/verdev/pdf/attachments/de-09-012-02.pdf</a>
<b>Unit Price</b>	\$7,250 - \$57,000 (dependent on size of engine)
<b>Annual Maintenance Cost</b>	\$500 - \$1,000 (for annual cleaning)
<b>Other Additional Costs</b>	More frequent cleaning if excessive idling of engine
<b>Number of units typically in stock</b>	Made to order - 1 to 3 week lead time
<b>Minimum Order</b>	1 unit
<b>Payment Terms</b>	Prepayment or 30 days net on approved credit
<b>Delivery time to mechanic, if unit in stock</b>	1 - 3 weeks lead time
<b>Installation Time (mechanics)</b>	8 - 14 hours
<b>Installation time depends on: application and original exhaust configuration</b>	
N/A	
<b>Maintenance requirements</b> (as per ARB/EPA verification requirements, and other)	
1,000 Hours of operation before cleaning of filter required. The engine must be well maintained and not consume lubricating oil at a rate greater than that specified by the engine manufacturer.	
<b>Biodiesel Compatibility</b>	B20
<b>Product Lifetime</b>	4,200 hours or more
<b>Data Logging Required? (Y/ N)</b>	Y - However, there may be cases where not required
<b>Other useful information on process for ordering and installation</b>	
N/A	
<b>Manufacturer and Distributor Information</b>	
Manufacturer: DCL International <a href="http://www.dcl-inc.com/">http://www.dcl-inc.com/</a> 241 Bradwick Drive Concord, ON L4K 1B2	Contact Name: Tony Almeida, Sales Manager- North America Tel: 1-800-872-1968 Fax: 905-660-7566 Email: <a href="mailto:talmeida@dcl-inc.com">talmeida@dcl-inc.com</a>
Distributor: Diesel Emissions Service <a href="http://www.dieseemissionservice.com">www.dieseemissionservice.com</a> 17011 Clear Creek Rd Redding, CA 96001	Contact Name: Steve Hoke, President Tel: 530-241-3950 Fax: 530-241-0870 Email: <a href="mailto:steve@dieseemissionservice.com">steve@dieseemissionservice.com</a>

<b>Manufacturer Name</b>	DCL International
<b>Model Name</b>	Mine-X Sootfilter (for stationary prime and emergency standby generators, pumps, and compressors) (DPF)
<b>Application</b>	Stationary engines Model years: 1996 – 2014 Engine horsepower: 50-75hp, or >750hp Engine Tiers before ERM installation: 1, 2, 3, 4i
<b>Verified Engine Families</b>	<a href="http://www.arb.ca.gov/diesel/verdev/vt/stationary/dcl/dclengfam06.pdf">http://www.arb.ca.gov/diesel/verdev/vt/stationary/dcl/dclengfam06.pdf</a>
<b>Unit Price</b>	\$7,250 - \$250,000 (dependent on size of engine)
<b>Annual Maintenance Cost</b>	\$500 - \$1,000 (for annual cleaning)
<b>Other Additional Costs</b>	More frequent cleaning if excessive idling of engine
<b>Number of units typically in stock</b>	Made to order
<b>Minimum Order</b>	1 unit
<b>Payment Terms</b>	Prepayment or 30 days net on approved credit
<b>Delivery time to mechanic, if unit in stock</b>	1 - 4 weeks lead time
<b>Installation Time (mechanics)</b>	8 - 14 hours
<b>Installation time depends on:</b>	
Application and original exhaust configuration.	
<b>Maintenance requirements</b> (per ARB/EPA verification requirements, and other)	
The engine must be well maintained and not consume lubricating oil at a rate greater than that specified by the engine manufacturer.	
<b>Biodiesel Compatibility</b>	20
<b>Product Lifetime</b>	4,200 hours or more
<b>Data Logging Required? (Y/ N)</b>	Y - However, there may be cases where not required.
<b>Other useful information on process for ordering and installation</b>	
N/A	
<b>Manufacturer and Distributor Information</b>	
Manufacturer: DCL International Inc. <a href="http://www.dcl-inc.com">www.dcl-inc.com</a> 241 Bradwick Drive Concord, ON L4K 1B2	Contact Name: Tony Almeida, Sales Manager- North America Tel: 1-800-872-1968 Fax: 905-660-7566 <a href="mailto:talmeida@dcl-inc.com">talmeida@dcl-inc.com</a>
Distributor: Diesel Emissions Service <a href="http://www.dieselemissservice.com">www.dieselemissservice.com</a> 17011 Clear Creek Rd Redding, CA 96001	Contact Name: Steve Hoke, President Tel: 530-241-3950 <a href="mailto:steve@dieselemissservice.com">steve@dieselemissservice.com</a>

<b>Manufacture Name</b>	Donaldson
<b>Model Name</b>	SEF-NR Filter (DPF)
<b>Application</b>	Multiple Types of Non-Road Equipment (Mobile and Stationary) Model years: 1996 – 2010 Engine horsepower: 100 – 603 hp Engine Tiers before ERM installation: 1, 2, 3
<b>Verified Engine Families</b>	Not specified
<b>Unit Price</b>	\$7,500 - \$20,000 USD
<b>Annual Maintenance Cost</b>	\$300 - \$500 USD for de-ashing
<b>Other Additional Costs</b>	Regeneration wall panel - \$6,500 USD
<b>Number of units typically in stock</b>	Made to order
<b>Minimum Order</b>	1
<b>Payment Terms</b>	When delivered and/or completed
<b>Delivery time to mechanic, if unit in stock</b>	Standard lead time is 2 weeks
<b>Installation Time (mechanics)</b>	N/A
<b>Installation time depends on:</b>	
Application.	
<b>Maintenance requirements</b> (as per ARB/EPA verification requirements, and other)	
The engine must be well maintained and not consume oil at a greater rate than specified by the engine manufacturer.	
<b>Biodiesel Compatibility</b>	B20
<b>Product Lifetime</b>	Up to 20,000 hours
<b>Data Logging Required? (Y/ N)</b>	N
<b>Other useful information on process for ordering and installation</b>	
Good system for non-road equipment that work in or return back to a home base. The SEF is a catalyzed filter with some passive regeneration capabilities.	
<b>Manufacturer and Distributor Information</b>	
Manufacturer: Donaldson <a href="http://www.donaldson.com">www.donaldson.com</a> 1400 W 94th Street Bloomington, MN 55431	Contact Name: [TBD], Territory Manager Tel: 310-683-8353 Fax: 310-943-2779 Email: [TBD]
Distributor: Diesel Emissions Service <a href="http://www.dieselemissonsservice.com">www.dieselemissonsservice.com</a> 17011 Clear Creek Rd Redding, CA 96001	Contact Name: Steve Hoke, President Tel: 530-241-3950 Fax: 530-241-0870 Email: <a href="mailto:steve@dieselemissonsservice.com">steve@dieselemissonsservice.com</a>

<b>Manufacture Name</b>	Donaldson
<b>Model Name</b>	LNF-NR Filter
<b>Application</b>	Multiple Types of Non-Road Equipment (Mobile and Stationary) Model years: No specified Engine horsepower: 100 – 603hp Engine Tiers before ERM installation: 1, 2
<b>Verified Engine Families</b>	Not specified
<b>Unit Price</b>	\$7,500 - \$20,000 USD
<b>Annual Maintenance Cost</b>	\$300-500 USD for de-ashing
<b>Other Additional Costs</b>	N/A
<b>Number of units typically in stock</b>	Made to order
<b>Minimum Order</b>	1
<b>Payment Terms</b>	When delivered and/or completed
<b>Delivery time to mechanic, if unit in stock</b>	Standard lead time is 2 weeks
<b>Installation Time (mechanics)</b>	N/A
<b>Installation time depends on:</b>	
Application.	
<b>Maintenance requirements</b> (as per ARB/EPA verification requirements, and other)	
The engine must be well maintained and not consume oil at a greater rate than specified by the engine manufacturer.	
<b>Biodiesel Compatibility</b>	B20
<b>Product Lifetime</b>	Up to 20,000 hours
<b>Data Logging Required? (Y/ N)</b>	Y
<b>Other useful information on process for ordering and installation</b>	
Temperature profile difficult to achieve on non-road equipment. If temperature requirement is met, the filter is very effective.	
<b>Manufacturer and Distributor Information</b>	
Manufacturer: Donaldson <a href="http://www.donaldson.com">www.donaldson.com</a> 1400 W 94th Street Bloomington, MN 55431	Contact Name: [TBD], Territory Manager Tel: 310-683-8353 Fax: 310-943-2779 Email: [TBD]
Distributor: Diesel Emissions Service <a href="http://www.dieselexmissionservice.com">www.dieselexmissionservice.com</a> 17011 Clear Creek Rd Redding, CA 96001	Contact Name: Steve Hoke, President Tel: 530-241-3950 Fax: 530-241-0870 Email: <a href="mailto:steve@dieselexmissionservice.com">steve@dieselexmissionservice.com</a>

<b>Manufacturer Name</b>	ESW CleanTech
<b>Model Name</b>	Phoenix (DPF)
<b>Application</b>	Non-Road Equipment Other Than RTG Cranes Model years: 1996 – 2014 Engine horsepower: 100 – 450hp Engine Tiers before ERM installation: 1, 2, 3
<b>Verified Engine Families</b>	<a href="http://www.arb.ca.gov/diesel/verdev/pdf/attachments/de-13-004.pdf">http://www.arb.ca.gov/diesel/verdev/pdf/attachments/de-13-004.pdf</a>
<b>Unit Price</b>	\$13,000 – \$15,000 (dependent on various factors)
<b>Annual Maintenance Cost</b>	\$500 - \$1,500 (dependent on engine oil consumption and duty cycle)
<b>Other Additional Costs</b>	None
<b>Number of units typically in stock</b>	Made to order
<b>Minimum Order</b>	1
<b>Payment Terms</b>	Net 30 days
<b>Delivery time to mechanic, if unit in stock</b>	4 - 6 weeks
<b>Installation Time (mechanics)</b>	8 - 20 hours
<b>Installation time depends on:</b>	
Equipment design, level of fabrication, installer's experience and application specifics	
<b>Maintenance requirements</b> (as per ARB/ EPA verification requirements, and other)	
The engine must be well maintained and in sound mechanical shape. A pre-installation inspection, which includes an opacity test, is required. The engine cannot exceed 20% maximum opacity. Excessive consumption of lubricating oil will shorten the service interval.	
<b>Biodiesel Compatibility</b>	B20
<b>Product Lifetime</b>	5 years or 4,200 hours of operation
<b>Data Logging Required? (Y/ N)</b>	N
<b>Other useful information on process for ordering and installation</b>	
The equipment voltage needs to be specified.	
<b>Manufacturer and Distributor Information</b>	
Manufacturer: ESW CleanTech <a href="http://www.eswgroup.com">www.eswgroup.com</a> 3800 Steeles Av. West, Suite 205, Woodbridge, ON, L4L 4G9	Contact Name: Raafat Habib, Business Development Specialist Office: 905-695-4141 xt. 287 Mobile: 416.671.2243 <a href="mailto:rhabib@eswgroup.com">rhabib@eswgroup.com</a>
<b>Distributor: Diesel Emissions Service</b> <a href="http://www.dieselectionsservice.com">www.dieselectionsservice.com</a> 17011 Clear Creek Rd Redding, CA 96001	Contact Name: Steve Hoke, President Tel: 530-241-3950 Fax: 530-241-0870 Email: <a href="mailto:steve@dieselectionsservice.com">steve@dieselectionsservice.com</a>

<b>Manufacturer Name</b>	ESW CleanTech
<b>Model Name</b>	Skyline (DPF)
<b>Application</b>	Non-Road Equipment Other Than RTG Cranes Model years: 1996 – 2014 Engine horsepower: 100 – 400hp Engine Tiers before ERM installation: 1, 2, 3
<b>Verified Engine Families</b>	<a href="http://www.arb.ca.gov/diesel/verdev/pdf/attachments/de-14-002.pdf">http://www.arb.ca.gov/diesel/verdev/pdf/attachments/de-14-002.pdf</a>
<b>Unit Price</b>	\$13,000 – \$15,000 (dependent on various factors)
<b>Annual Maintenance Cost</b>	\$500 - \$1,500 (dependent on engine oil consumption and duty cycle)
<b>Other Additional Costs</b>	The Skyline requires a 208 or 240 VAC / 20 amp electrical connection on site. Contact your local electrical contractor for the cost of this service.
<b>Number of units typically in stock</b>	Made to order
<b>Minimum Order</b>	1
<b>Payment Terms</b>	Net 30 days
<b>Delivery time to mechanic, if unit in stock</b>	4 - 6 weeks
<b>Installation Time (mechanics)</b>	8 - 20 hours
<b>Installation time depends on:</b>	
Application.	
<b>Maintenance requirements (as per ARB/ EPA verification requirements, and other)</b>	
The engine must be well maintained and in sound mechanical shape. A pre-installation inspection, which includes an opacity test, is required. The engine cannot exceed 20% maximum opacity. Excessive consumption of lubricating oil will shorten the service interval.	
<b>Biodiesel Compatibility</b>	B20
<b>Product Lifetime</b>	5 years or 4,200 hours of operation.
<b>Data Logging Required? (Y/ N)</b>	N
<b>Other useful information on process for ordering and installation</b>	
This is an active system that regenerates by plugging into an electrical outlet. The available AC voltage (either 208 or 240) must be specified.	
<b>Manufacturer and Distributor Information</b>	
Manufacturer: ESW CleanTech <a href="http://www.eswgroup.com">www.eswgroup.com</a> 3800 Steeles Av. West, Suite 205, Woodbridge, ON, L4L 4G9	Contact Name: Raafat Habib, Business Development Specialist Office: 905-695-4141 xt. 287 Mobile: 416.671.2243 <a href="mailto:rhabib@eswgroup.com">rhabib@eswgroup.com</a>
Distributor: Diesel Emissions Service <a href="http://www.dieseemissionservice.com">www.dieseemissionservice.com</a> 17011 Clear Creek Rd Redding, CA 96001	Contact Name: Steve Hoke, President Tel: 530-241-3950 Fax: 530-241-0870 Email: <a href="mailto:steve@dieseemissionservice.com">steve@dieseemissionservice.com</a>

<b>Manufacturer Name</b>	ESW CleanTech
<b>Model Name</b>	ThermaCat (DPF)
<b>Application</b>	Non-Road Equipment Other Than RTG Cranes Model years: 1996 – 2014 Engine horsepower: 100 – 350hp Engine Tiers before ERM installation: 1, 2, 3
<b>Verified Engine Families</b>	<a href="http://www.arb.ca.gov/diesel/verdev/pdf/attachments/de-09-010-03.pdf">http://www.arb.ca.gov/diesel/verdev/pdf/attachments/de-09-010-03.pdf</a>
<b>Unit Price</b>	\$12,000 - \$20,000 (dependent on engine size)
<b>Annual Maintenance Cost</b>	\$500 - \$1,500 (dependent on engine oil consumption and duty cycle)
<b>Other Additional Costs</b>	None
<b>Number of units typically in stock</b>	Made to order
<b>Minimum Order</b>	1
<b>Payment Terms</b>	Net 30 days
<b>Delivery time to mechanic, if unit in stock</b>	4 - 6 weeks
<b>Installation Time (mechanics)</b>	8 - 20 hours
<b>Installation time depends on:</b>	
N/A	
<b>Maintenance requirements (as per ARB/ EPA verification requirements, and other)</b>	
The engine must be well maintained and in sound mechanical shape. A pre-installation inspection, which includes an opacity test, is required. The engine cannot exceed 20% maximum opacity. Excessive consumption of lubricating oil will shorten the service interval.	
<b>Biodiesel Compatibility</b>	B20
<b>Product Lifetime</b>	5 years or 4,200 hours of operation.
<b>Data Logging Required? (Y/ N)</b>	Y
<b>Other useful information on process for ordering and installation</b>	
N/A	
<b>Manufacturer and Distributor Information</b>	
Manufacturer: ESW CleanTech <a href="http://www.eswgroup.com">www.eswgroup.com</a> 3800 Steeles Av. West, Suite 205, Woodbridge, ON, L4L 4G9	Contact Name: Raafat Habib, Business Development Specialist Office: 905-695-4141 xt. 287 Mobile: 416.671.2243 <a href="mailto:rhabib@eswgroup.com">rhabib@eswgroup.com</a>
Distributor: Diesel Emissions Service <a href="http://www.dieseemissionservice.com">www.dieseemissionservice.com</a> 17011 Clear Creek Rd Redding, CA 96001	Contact Name: Steve Hoke, President Tel: 530-241-3950 Fax: 530-241-0870 Email: <a href="mailto:steve@dieseemissionservice.com">steve@dieseemissionservice.com</a>

<b>Manufacturer Name</b>	Global Emissions Systems Inc.
<b>Model Name</b>	GESi@ 6000 Diesel Particulate Filter (DPF)
<b>Application</b>	Stationary engines Model years: 1996 – 2014 Engine horsepower: Not specified Engine Tiers before ERM installation: 1, 2, 3
<b>Verified Engine Families</b>	<a href="http://www.arb.ca.gov/diesel/verdev/vt/stationary/ges/gesengfam.pdf">http://www.arb.ca.gov/diesel/verdev/vt/stationary/ges/gesengfam.pdf</a>
<b>Unit Price</b>	Varies based on size of engine and design requirements
<b>Annual Maintenance Cost</b>	None
<b>Other Additional Costs</b>	Filter cleaning for ash every 16,000 hours or earlier if engine is burning excessive oil
<b>Number of units typically in stock</b>	5 – 10
<b>Minimum Order</b>	No minimum order quantity. Volume discounts are available.
<b>Payment Terms</b>	50% with purchase order, 50% net 30 days with no credit history, net 30 days with satisfactory credit history
<b>Delivery time to mechanic, if unit in stock</b>	2- 3 weeks (6 weeks if back ordered)
<b>Installation time (mechanics)</b>	Less than 1 hour for DPF and one hour maximum for back pressure monitor
<b>Installation time depends on:</b>	
Size of engine and design requirements, including size and weight	
<b>Maintenance requirements</b> (as per ARB/ EPA verification requirements, and other)	
2,000 hours of operation before filter needs to be cleaned. The engine must be well maintained and not consume lubricating oil at a rate greater than that specified by the engine manufacturer.	
<b>Biodiesel Compatibility</b>	B20
<b>Product Lifetime</b>	With proper maintenance and engine maintenance, as long as the engine
<b>Data Logging Required? (Y/ N)</b>	N
<b>Other useful information on process for ordering and installation</b>	
Requires a back pressure monitor kit which includes a thermocouple, pressure switch, audible alarm and digital temperature display	
<b>Manufacturer and Distributor Information</b>	
Contact Global Emissions Systems Inc. directly for list of authorized dealers <a href="http://www.gesi.us">www.gesi.us</a> 1700 McEwen Drive, Unit 1 Whitby, Ontario, L1N 0A2	Contact name: Gary Jarosz, Vice-President Tel: 905-433-9640 Email: <a href="mailto:gjarosz@gesi.us">gjarosz@gesi.us</a>

<b>Manufacturer Name</b>	HUSS Filters
<b>Model Name</b>	FS-MK Off-Road (DPF)
<b>Application</b>	Non-Road Equipment other than RTG Cranes Model years: 1996 – 2012 Engine horsepower: <810hp Engine Tiers before ERM installation: 0, 1, 2, 3, 4i
<b>Verified Engine Families</b>	<a href="http://www.arb.ca.gov/diesel/verdev/pdf/attachments/de-06-007-08.pdf">http://www.arb.ca.gov/diesel/verdev/pdf/attachments/de-06-007-08.pdf</a> . May also retrofit certified engines, and non-certified engines 2012 and earlier.
<b>Unit Price</b>	Depending upon filter size and engine size: 80 hp: \$5,800 USD, 150 hp: \$7,980 USD, 200 hp: \$8,413 USD, 300 hp: \$9,900 USD.
<b>Annual Maintenance Cost</b>	Typically, \$650 USD per HUSS filter, but figure is dependent upon dealer labour rate, and work scope
<b>Other Additional Costs</b>	Installation cost typically \$3,000 - \$6,000 USD, dependent on dealer's assessed workload
<b>Number of units typically in stock</b>	On average approximately 150 units in stock in all different sizes
<b>Minimum Order</b>	N/A
<b>Payment Terms</b>	Dependent upon payment terms granted by dealer in Vancouver as the manufacturer only sells to dealers
<b>Delivery time to mechanic</b>	3 to 5 days (Up to 4 weeks if unit is back ordered)
<b>Installation Time (mechanics)</b>	1 to 3 days
<b>Installation time depends on:</b>	
Amount of fabrication required to mount filter, and route exhaust	
<b>Maintenance requirements</b> (as per ARB/EPA verification requirements, and other)	
Service every 600-1,000 hours to clean the DPF filter element and burner, replace selected components, and conduct functional checks	
<b>Biodiesel Compatibility</b>	B20
<b>Product Lifetime</b>	Not limited. Warranty is 5 years / 4200 hours.
<b>Data Logging Required? (Y/ N)</b>	N - Operation is independent of exhaust temp.
<b>Other useful information on process for ordering and installation</b>	
HUSS will determine the appropriate filter size for each application, using engine and equipment information provided by dealer.	
<b>Manufacturer and Distributor Information</b>	
Manufacturer: HUSS Filters <a href="http://www.hussgroup.com">www.hussgroup.com</a> 77524 El Duna Court Ste. H Palm Desert, CA 92211	Contact Name: Christian Bayer Tel: 760-322-5692 ext 309 <a href="mailto:Christian.Bayer@hussfilters.com">Christian.Bayer@hussfilters.com</a>
Distributor: MasonLift, Ltd. <a href="http://www.masonlift.com">www.masonlift.com</a> 1605 Cliveden Ave, Annacis Island Delta, BC V3M 6P7	Contact Name: Jeff Larsen Tel: 604-517-6500 Email: <a href="mailto:jlarsen@masonlift.com">jlarsen@masonlift.com</a>
Distributor: Diesel Emissions Service <a href="http://www.dieselemissionservice.com">www.dieselemissionservice.com</a> 17011 Clear Creek Rd Redding, CA 96001	Contact Name: Steve Hoke, President Tel: 530-241-3950 Fax: 530-241-0870 Email: <a href="mailto:steve@dieselemissionservice.com">steve@dieselemissionservice.com</a>

<b>Manufacturer Name</b>	Johnson Matthey
<b>Model Name</b>	CRT + DPF
<b>Application</b>	Stationary engines Model years: 1996 – 2013 Engine horsepower: Not specified Engine Tiers before ERM installation: 1, 2, 3
<b>Verified Engine Families</b>	<a href="http://www.arb.ca.gov/diesel/verdev/vt/stationary/jm/jmcrteqfam080813.pdf">http://www.arb.ca.gov/diesel/verdev/vt/stationary/jm/jmcrteqfam080813.pdf</a>
<b>Unit Price</b>	\$9,500 - \$25,000 USD
<b>Annual Maintenance Cost</b>	\$300-500 USD for de-ashing
<b>Other Additional Costs</b>	N/A
<b>Number of units typically in stock</b>	Made to order
<b>Minimum Order</b>	1 unit
<b>Payment Terms</b>	When delivered and/or completed
<b>Delivery time to mechanic, if unit in stock</b>	Standard lead time is 2 weeks
<b>Installation Time (mechanics)</b>	N/A
<b>Installation time depends on:</b>	
Application.	
<b>Maintenance requirements</b> (as per ARB/EPA verification requirements, and other)	
The engine must be well maintained and not consume oil at a greater rate than specified by the engine manufacture.	
<b>Biodiesel Compatibility</b>	B20
<b>Product Lifetime</b>	Up to 20,000 hours
<b>Data Logging Required? (Y/ N)</b>	Y
<b>Other useful information on process for ordering and installation</b>	
For stationary emergency / standby generators	
<b>Manufacturer and Distributor Information</b>	
Manufacturer: John Matthey <a href="http://www.matthey.com">www.matthey.com</a> 130 Glidden Road Brampton, ON L6W 3M8	Contact Name: Melanie Pastore Tel: 484-320-2240 Email: <a href="mailto:pastore@jmusa.com">pastore@jmusa.com</a>
<b>Distributor: Diesel Emissions Service</b> <a href="http://www.dieseemissionservice.com">www.dieseemissionservice.com</a> 17011 Clear Creek Rd Redding, CA 96001	Contact Name: Steve Hoke, President Tel: 530-241-3950 Fax: 530-241-0870 Email: <a href="mailto:steve@dieseemissionservice.com">steve@dieseemissionservice.com</a>

<b>Manufacturer Name</b>	MIRATECH Corporation
<b>Model Name</b>	combiKat (DPF)
<b>Application</b>	Stationary engines Model years: 1996 – 2014 Engine horsepower: > 50hp Engine Tiers before ERM installation: 1, 2, 3
<b>Verified Engine Families</b>	<a href="http://www.arb.ca.gov/diesel/verdev/vt/stationary/miratech/miratechengfam04302014.pdf">http://www.arb.ca.gov/diesel/verdev/vt/stationary/miratech/miratechengfam04302014.pdf</a>
<b>Unit Price</b>	Varies by engine size. \$30 - \$50 USD per bkW
<b>Annual Maintenance Cost</b>	DPF and DOC cleaning is required every 2,000 operating hours. Cleaning cost varies by unit size and service provider: \$2.50 - \$3.50 USD per bkW is typical per cleaning.
<b>Other Additional Costs</b>	N/A
<b>Number of units typically in stock</b>	Built to Order
<b>Minimum Order</b>	\$150 USD
<b>Payment Terms</b>	Net 30 days
<b>Delivery time to mechanic</b>	2 - 6 weeks after receipt of order
<b>Installation Time (mechanics)</b>	Varies by engine size and exhaust piping layout.
<b>Installation time depends on:</b>	
N/A	
<b>Maintenance requirements</b> (as per ARB/EPA verification requirements, and other)	
Typically filter needs to be cleaned after 2,000 hours of operation, but it is application-dependent. The engine should be well maintained and not consume lubricating oil at a rate greater than that specified by the engine manufacturer.	
<b>Biodiesel Compatibility</b>	B20
<b>Product Lifetime</b>	16,000 operating hours
<b>Data Logging Required? (Y/ N)</b>	Y
<b>Other useful information on process for ordering and installation</b>	
N/A	
<b>Manufacturer and Distributor Information</b>	
Contact MIRATECH Corporation directly for list of authorized dealers <a href="http://www.miratechcorp.com">www.miratechcorp.com</a> 888 Tuscany Drive NW Calgary, AB T3L 2K5	Contact Name: Don Lambert, Business Development Engineer Tel: 403-815-7372 Fax: 918-933-6244 Email: <a href="mailto:dlambert@miratechcorp.com">dlambert@miratechcorp.com</a>

<b>Manufacturer Name</b>	MIRATECH Corporation
<b>Model Name</b>	LTR™ DOC/DPF System
<b>Application</b>	Stationary engines Model years: 1996 – 2014 Engine horsepower: > 50hp Engine Tiers before ERM installation: 1, 2, 3
<b>Unit Price</b>	Varies by engine size. \$30 - \$50 USD per bkW
<b>Verified Engine Families</b>	<a href="http://www.arb.ca.gov/diesel/verdev/vt/stationary/miratechltr/miratechltrlengfam07232014.pdf">http://www.arb.ca.gov/diesel/verdev/vt/stationary/miratechltr/miratechltrlengfam07232014.pdf</a>
<b>Annual Maintenance Cost</b>	DPF and DOC cleaning is required every 2,000 operating hours. Cleaning cost varies by unit size and service provider: \$2.50 - \$3.50 USD per bkW is typical per cleaning.
<b>Other Additional Costs</b>	N/A
<b>Number of units typically in stock</b>	Built to Order
<b>Minimum Order</b>	\$150 USD
<b>Payment Terms</b>	Net 30 days
<b>Delivery time to mechanic, if unit in stock</b>	2 - 6 Weeks after receipt of order
<b>Installation Time (mechanics)</b>	Varies by engine size and exhaust piping layout.
<b>Installation time depends on:</b>	
N/A	
<b>Maintenance requirements (as per ARB/ EPA verification requirements, and other)</b>	
Typically filter needs to be cleaned after 2,000 hours of operation, but it is application-dependent. The engine should be well maintained and not consume lubricating oil at a rate greater than that specified by the engine manufacturer.	
<b>Biodiesel Compatibility</b>	B20
<b>Product Lifetime</b>	16,000 operating hours
<b>Data Logging Required? (Y/ N)</b>	Y
<b>Other useful information on process for ordering and installation</b>	
N/A	
<b>Manufacturer and Distributor Information</b>	
Contact MIRATECH Corporation directly for list of authorized dealers <a href="http://www.miratechcorp.com">www.miratechcorp.com</a> 888 Tuscany Drive NW Calgary, AB T3L 2K5	Contact Name: Don Lambert, Business Development Engineer Tel: 403-815-7372 Fax: 918-933-6244 Email: <a href="mailto:dlambert@miratechcorp.com">dlambert@miratechcorp.com</a>

<b>Manufacturer Name</b>	Nett Technologies, Inc.
<b>Model Name</b>	BlueMAX™ PLUS 100 (DPF + SCR)
<b>Application</b>	Multiple Types of Non-Road Equipment (Mobile and Stationary) Model years: Not specified Engine horsepower: 100 – 750hp Engine Tiers before ERM installation: 1, 2, 3
<b>Verified Engine Families</b>	Not specified
<b>Unit Price</b>	Contact Nett Technologies, Inc.: 1-800-361-6388
<b>Annual Maintenance Cost</b>	\$400 - \$550 + labour
<b>Other Additional Costs</b>	Replacement gaskets, compressor air filter, brushes, urea filter and injection nozzle cleaning
<b>Number of units typically in stock</b>	0 – Custom design – raw materials in stock
<b>Minimum Order</b>	1
<b>Payment Terms</b>	Net 30 days
<b>Delivery time to mechanic, if unit in stock</b>	4 - 7 days (6 – 8 weeks if back ordered)
<b>Installation Time (mechanics)</b>	14 - 20 hours
<b>Installation time depends on:</b>	
Complexity of piping	
<b>Maintenance requirements</b> (as per ARB/EPA verification requirements, and other)	
Typically it can handle 2,000 hours of operation before filter (ash) needs to be cleaned. Should also monitor alarms, drain and flush urea tank, clean air filter and urea injection nozzle filter, and change compressor brushes at 1,500 hours of operation and then at 800 hour intervals after that.	
<b>Biodiesel Compatibility</b>	B20
<b>Product Lifetime</b>	Useable life of the engine, dependent on engine condition
<b>Data Logging Required? (Y/ N)</b>	Y
<b>Other useful information on process for ordering and installation</b>	
Must be Nett Authorized distributor and trained installer. Equipment make, model, engine make and model required	
<b>Manufacturer and Distributor Information</b>	
Contact Nett Technologies directly for list of authorized dealers <a href="http://www.nettinc.com">www.nettinc.com</a> 2-6707 Goreway Drive Mississauga, ON L4V 1P7	Contact Name: Julia Ruslys, Inside Sales Executive Tel: 905-672-5453 xt. 119 Fax: 905-672-5949 <a href="mailto:jruslys@nettinc.com">jruslys@nettinc.com</a>

<b>Manufacturer Name</b>	Nett Technologies, Inc.	
<b>Model Name</b>	VorTEQ™100 Active Diesel Particulate Filter (DPF)	
<b>Application</b>	Non-Road Equipment Other Than Rubber-Tired Gantry Cranes Model years: 1996 – 2014 Engine horsepower: 65 – 175hp Engine Tiers before ERM installation: 1, 2, 3	
<b>Verified Engine Families</b>	<a href="http://www.arb.ca.gov/diesel/verdev/pdf/attachments/13-944-1757.pdf">http://www.arb.ca.gov/diesel/verdev/pdf/attachments/13-944-1757.pdf</a>	
<b>Unit Price</b>	Contact Nett Technologies, Inc.: 1-800-361-6388	
<b>Annual Maintenance Cost</b>	Filter cleaning \$350 - \$450 + labour	
<b>Other Additional Costs</b>	Replacement gaskets + water separator filter, glow plug	
<b>Number of units typically in stock</b>	5 - 15 of specific custom design models – raw materials are available in stock	
<b>Minimum Order</b>	1	
<b>Payment Terms</b>	Net 30 days	
<b>Delivery time to mechanic, if unit in stock</b>	3 - 7 days (6 – 8 weeks if unit is back ordered)	
<b>Installation Time (mechanics)</b>	8 - 14 hours	
<b>Installation time depends on:</b>		
Complexity of piping		
<b>Maintenance requirements</b> (as per ARB/EPA verification requirements, and other)		
Typically, it can handle 2,000 hours of operation before filter needs to be cleaned.		
<b>Biodiesel Compatibility</b>	B20	
<b>Product Lifetime</b>	Useable life of the engine and dependant on engine condition	
<b>Data Logging Required? (Y/ N)</b>	N	
<b>Other useful information on process for ordering and installation</b>		
Must be Nett Authorized distributor and trained installer. Equipment make, model, engine make and model required.		
<b>Manufacturer and Distributor Information</b>		
Contact Nett Technologies directly for list of authorized dealers <a href="http://www.nettinc.com">www.nettinc.com</a> 2-6707 Goreway Drive Mississauga, ON L4V 1P7	Contact Name: Julia Ruslys, Inside Sales Executive Tel: 905-672-5453 xt. 119 Fax: 905-672-5949 <a href="mailto:jruslys@nettinc.com">jruslys@nettinc.com</a>	

<b>Manufacturer Name</b>	Nett Technologies, Inc.
<b>Model Name</b>	GreenTRAP™ Passive Diesel Particulate Filter (DPF)
<b>Application</b>	Stationary engines Model years: 1996 – 2010 Engine horsepower: 68 – 680hp Engine Tiers before ERM installation: 1, 2, 3
<b>Verified Engine Families</b>	<a href="http://www.arb.ca.gov/diesel/verdev/vt/stationary/nett/nettengfam.pdf">http://www.arb.ca.gov/diesel/verdev/vt/stationary/nett/nettengfam.pdf</a>
<b>Unit Price</b>	Contact Nett Technologies, Inc.: 1-800-361-6388
<b>Annual Maintenance Cost</b>	\$350 - \$450 + labour
<b>Other Additional Costs</b>	Replacement gaskets
<b>Number of units typically in stock</b>	10 – 20
<b>Minimum Order</b>	1
<b>Payment Terms</b>	Net 30 days
<b>Delivery time to mechanic, if unit in stock</b>	5 - 7 days (3 - 4 weeks if back ordered)
<b>Installation Time (mechanics)</b>	4 - 6 hours
<b>Installation time depends on:</b>	
Complexity of piping	
<b>Maintenance requirements</b> (as per ARB/ EPA verification requirements, and other)	
Typically it can handle 2,000 hours of operation before filter (ash) needs to be cleaned.	
<b>Biodiesel Compatibility</b>	B20
<b>Product Lifetime</b>	For the useable life of the engine & highly dependent on the engine's condition
<b>Data Logging Required? (Y/ N)</b>	Y
<b>Other useful information on process for ordering and installation</b>	
Must be Nett authorized distributors and trained installers. Equipment make, model, engine make and model required	
<b>Manufacturer and Distributor Information</b>	
Contact Nett Technologies directly for list of authorized dealers <a href="http://www.nettinc.com">www.nettinc.com</a> 2-6707 Goreway Drive Mississauga, ON L4V 1P7	Contact Name: Julia Ruslys, Inside Sales Executive Tel: 905-672-5453 xt. 119 Fax: 905-672-5949 <a href="mailto:jruslys@nettinc.com">jruslys@nettinc.com</a>

<b>Manufacturer Name</b>	Nett Technologies, Inc.
<b>Model Name</b>	BlueMAX™ NOVA 300e System (DPF+ SCR+ HCl)
<b>Application</b>	Stationary engines Model years: 1996 – 2014 Engine horsepower: > 75hp Engine Tiers before ERM installation: 1, 2, 3
<b>Verified Engine Families</b>	<a href="http://www.arb.ca.gov/diesel/verdev/vt/stationary/netttech/engfam061814.pdf">http://www.arb.ca.gov/diesel/verdev/vt/stationary/netttech/engfam061814.pdf</a>
<b>Unit Price</b>	Contact Nett Technologies, Inc.: 1-800-361-6388
<b>Annual Maintenance Cost</b>	\$350 - \$450 + labour + materials (filters: \$100-300)
<b>Other Additional Costs</b>	Replacement gaskets and compressor air intake filters
<b>Number of units typically in stock</b>	0 – Custom Design – raw materials are readily available in stock
<b>Minimum Order</b>	1
<b>Payment Terms</b>	Net 30 days
<b>Delivery time to mechanic, if unit in stock</b>	4 - 6 weeks (6 – 8 weeks if back ordered)
<b>Installation Time (mechanics)</b>	14 - 20 hrs
<b>Installation time depends on:</b>	
Complexity of piping	
<b>Maintenance requirements</b> (as per ARB/EPA verification requirements, and other)	
Typically, it can handle 2,000 hours of operation before filter (ash) needs to be cleaned. HCl & DES injection filters need to be cleaned.	
<b>Biodiesel Compatibility</b>	B20
<b>Product Lifetime</b>	15,000.00-25,000.00 hours
<b>Data Logging Required? (Y/ N)</b>	N
<b>Other useful information on process for ordering and installation</b>	
Must be a Nett authorized distributor and trained installer. Equipment make, model, engine make and model required.	
<b>Manufacturer and Distributor Information</b>	
Contact Nett Technologies directly for list of authorized dealers <a href="http://www.nettinc.com">www.nettinc.com</a> 2-6707 Goreway Drive Mississauga, ON L4V 1P7	Contact Name: Julia Ruslys, Inside Sales Executive Tel: 905-672-5453 xt. 119 Fax: 905-672-5949 <a href="mailto:jruslys@nettinc.com">jruslys@nettinc.com</a>

### 3.2 Verified DOCs

<b>Manufacture Name</b>	Donaldson
<b>Model Name</b>	6000 + Spiracle (off-road) (DOC + CCV)
<b>Application</b>	Multiple Types of Non-Road Equipment (Mobile and Stationary) Model years: 1996 – 2003 Engine horsepower: 150 – 600hp Engine Tiers before ERM installation: 0, 1, 2
<b>Verified Engine Families</b>	Not specified
<b>Unit Price</b>	\$1,500 - \$6,000 USD
<b>Annual Maintenance Cost</b>	N/A
<b>Other Additional Costs</b>	N/A
<b>Number of units typically in stock</b>	Made to order
<b>Minimum Order</b>	1
<b>Payment Terms</b>	When delivered and/or completed
<b>Delivery time to mechanic, if unit in stock</b>	Standard lead time is 2 weeks
<b>Installation Time (<i>mechanics</i>)</b>	
<b>Installation time depends on:</b>	
Application.	
<b>Maintenance requirements</b> (as per ARB/EPA verification requirements, and other)	
The engine must be well maintained and not consume oil at a greater rate than specified by the engine manufacturer.	
<b>Biodiesel Compatibility</b>	B20
<b>Product Lifetime</b>	Up to 20,000 hours
<b>Data Logging Required? (Y/ N)</b>	N
<b>Other useful information on process for ordering and installation</b>	
N/A	
<b>Manufacturer and Distributor Information</b>	
Manufacturer: Donaldson <a href="http://www.donaldson.com">www.donaldson.com</a> 1400 W 94th Street Bloomington, MN 55431	Contact Name: [TBD], Territory Manager Tel: 310-683-8353 Fax: 310-943-2779 Email: <a href="mailto:[TBD]">[TBD]</a>
Distributor: Diesel Emissions Service <a href="http://www.dieselectionsservice.com">www.dieselectionsservice.com</a> 17011 Clear Creek Rd Redding, CA 96001	Contact Name: Steve Hoke, President Tel: 530-241-3950 Fax: 530-241-0870 Email: <a href="mailto:steve@dieselectionsservice.com">steve@dieselectionsservice.com</a>

<b>Manufacturer Name</b>	Nett Technologies, Inc.
<b>Model Name</b>	MD300 Diesel Oxidation Catalyst (DOC)
<b>Application</b>	Stationary engines Model years: 1996 – 2011 Engine horsepower: 100 – 750hp Engine Tiers before ERM installation: 1, 2, 3
<b>Verified Engine Families</b>	Not specified
<b>Unit Price</b>	Contact Nett Technologies, Inc.: 1-800-361-6388
<b>Annual Maintenance Cost</b>	N/A
<b>Other Additional Costs</b>	N/A
<b>Number of units typically in stock</b>	10 – 20
<b>Minimum Order</b>	1
<b>Payment Terms</b>	Net 30 days
<b>Delivery time to mechanic, if unit in stock</b>	2 - 5 days (1 – 2 weeks if back ordered)
<b>Installation Time (<i>mechanics</i>)</b>	2 hours
<b>Installation time depends on:</b>	
Mechanic's skill level	
<b>Maintenance requirements</b> (as per ARB/EPA verification requirements, and other)	
The engine should be well maintained and not consume lubricating oil at a rate greater than that specified by the engine manufacturer. ULSD or better must be used.	
<b>Biodiesel Compatibility</b>	B20
<b>Product Lifetime</b>	Useable life of the engine and dependant on engine condition
<b>Data Logging Required? (Y/ N)</b>	Y
<b>Other useful information on process for ordering and installation</b>	
Equipment make, model, engine make and model are required.	
<b>Manufacturer and Distributor Information</b>	
Contact Nett Technologies directly for list of authorized dealers <a href="http://www.nettinc.com">www.nettinc.com</a> 2-6707 Goreway Drive Mississauga, ON L4V 1P7	Contact Name: Julia Ruslys, Inside Sales Executive Tel: 905-672-5453 ext. 119 Fax: 905-672-5949 <a href="mailto:jruslys@nettinc.com">jruslys@nettinc.com</a>

### 3.3 Verified SCR Systems

<b>Manufacturer Name</b>	Nett Technologies, Inc.
<b>Model Name</b>	BlueMAX™ 100 Urea-Based Selective Catalytic Reduction (SCR) System
<b>Application</b>	Multiple Types of Non-Road Equipment (Mobile and Stationary) Model years: 1996 – 2008 Engine horsepower: 100 – 496hp Engine Tiers before ERM installation: 1, 2, 3
<b>Verified Engine Families</b>	Not specified
<b>Unit Price</b>	Contact Nett Technologies, Inc.: 1-800-361-6388
<b>Annual Maintenance Cost</b>	\$50 - \$100 + labour
<b>Other Additional Costs</b>	Compressor air filter, brushes, urea filter and injection nozzle cleaning
<b>Number of units typically in stock</b>	0 – Custom design – raw materials in stock
<b>Minimum Order</b>	1
<b>Payment Terms</b>	Net 30 days
<b>Delivery time to mechanic, if unit in stock</b>	4 - 7 days (6 – 8 weeks if unit is back ordered)
<b>Installation Time (mechanics)</b>	14 - 20 hours
<b>Installation time depends on:</b>	
Complexity of piping	
<b>Maintenance requirements</b> (as per ARB/EPA verification requirements, and other)	
Monitor alarms, every 1000 hrs or 6 months. Drain & flush urea tank, clean air filter, urea injection nozzle & filter, change compressor brushes at 1500 hrs of operation and at 800 hrs afterwards.	
<b>Biodiesel Compatibility</b>	B20
<b>Product Lifetime</b>	Useable life of the engine, dependent on engine condition
<b>Data Logging Required? (Y/ N)</b>	Y
<b>Other useful information on process for ordering and installation</b>	
Must be Nett Authorized distributor and trained installer. Equipment make, model, engine make and model required	
<b>Manufacturer and Distributor Information</b>	
Contact Nett Technologies directly for list of authorized dealers <a href="http://www.nettinc.com">www.nettinc.com</a> 2-6707 Goreway Drive Mississauga, ON L4V 1P7	Contact Name: Julia Ruslys, Inside Sales Executive Tel: 905-672-5453 xt. 119 Fax: 905-672-5949 <a href="mailto:jruslys@nettinc.com">jruslys@nettinc.com</a>

<b>Manufacturer Name</b>	Nett Technologies, Inc.
<b>Model Name</b>	BlueMAX™ 300D Selective Catalytic Reduction (SCR) System
<b>Application</b>	Multiple Types of Non-Road Equipment (Mobile and Stationary) Model years: 1996 – 2011 Engine horsepower: 100 – 750hp Engine Tiers before ERM installation: 1, 2, 3
<b>Verified Engine Families</b>	Not specified
<b>Unit Price</b>	Contact Nett Technologies, Inc.: 1-800-361-6388
<b>Annual Maintenance Cost</b>	\$50 - \$100 + labour
<b>Other Additional Costs</b>	Cost of compressor air filter/brushes, cost of cleaning the urea filter and injection nozzle
<b>Number of units typically in stock</b>	0 – Custom design – raw materials stocked
<b>Minimum Order</b>	1
<b>Payment Terms</b>	Net 30 days
<b>Delivery time to mechanic, if unit in stock</b>	4 - 7 days (6 – 8 weeks if back ordered)
<b>Installation Time (mechanics)</b>	14 - 20 hrs
<b>Installation time depends on:</b>	
Complexity of piping	
<b>Maintenance requirements</b> (as per ARB/EPA verification requirements, and other)	
Typically it can handle 2,000 hours of operation before filter needs to be cleaned. Urea tank filling when notified and tank cleaning.	
<b>Biodiesel Compatibility</b>	B20
<b>Product Lifetime</b>	Useable life of the engine and dependant on engine condition – estimated 15,000 - 25,000 hours.
<b>Data Logging Required? (Y/ N)</b>	Y
<b>Other useful information on process for ordering and installation</b>	
Equipment make, model, engine make and model required	
<b>Manufacturer and Distributor Information</b>	
Contact Nett Technologies directly for list of authorized dealers <a href="http://www.nettinc.com">www.nettinc.com</a> 2-6707 Goreway Drive Mississauga, ON L4V 1P7	Contact Name: Julia Ruslys, Inside Sales Executive Tel: 905-672-5453 xt. 119 Fax: 905-672-5949 <a href="mailto:jruslys@nettinc.com">jruslys@nettinc.com</a>