

Retrofit Equipment and Your Waste Collection Vehicle:

A Guide to the Technology



Massachusetts
Department
of
ENVIRONMENTAL
PROTECTION

**The MassDEP Diesel Waste Collection Vehicle
Retrofit Program**

July 2009

Introduction

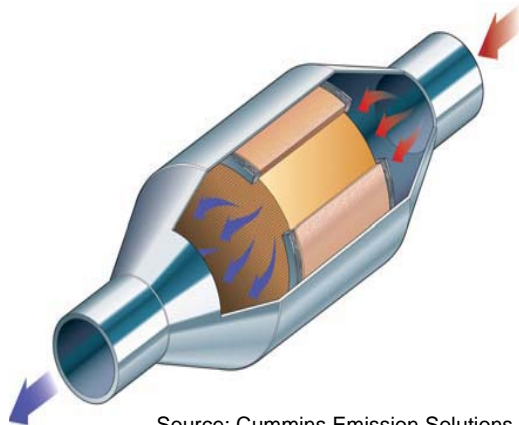
Under the 2009 MassDEP Diesel Waste Collection Vehicle Retrofit (WCV) Program, MassDEP will fund the installation of pollution control devices—at no expense to you—on diesel WCVs, including recycling and refuse vehicles. Funding is provided for the procurement and installation of three possible types of devices:

- * Diesel Oxidation Catalyst (DOC)
- * Flow-Through Filter (FTF)
- * Diesel Particulate Filter (DPF)

This guide presents the operational characteristics and emission reductions of each retrofit technology. Each technology reduces fine particulate matter 2.5 microns or less in diameter (PM_{2.5}), carbon monoxide (CO), and hydrocarbons (HC). This guide also provides information on the installation time, engine temperature, and maintenance requirements of the technologies. WCV owners will need to weigh these factors in making their decision about which retrofit device to install on their vehicle.

Should you have any questions about the devices, please contact Susan Lyon at 617-556-1101 or susan.lyon@state.ma.us, or Richard Blanchet at 617-654-6585 or richard.blanchet@state.ma.us.

Diesel Oxidation Catalyst (DOC)



Source: Cummins Emission Solutions

Operational Characteristics

A DOC is comprised of a stainless steel canister containing a honeycomb structure coated with a precious metal catalyst such as platinum or palladium. As the exhaust flows through the DOC, the catalyst converts some of the unburned fine PM, HC, and CO into relatively benign by-products.

Emission Reductions

A DOC can reduce fine PM by up to 30% and HC and CO by 60% each.

Installation

A DOC is installed in the exhaust stream of the waste collection vehicle. When installed, a DOC resembles an exhaust muffler. Installation time ranges from one to two hours.

Maintenance

A DOC requires virtually no on-going maintenance and typically lasts at least six years.



Source: Regional Air Pollution Control Agency, OH

Flow-Through Filter (FTF)

Operational Characteristics

An FTF is similar to a DOC in that it contains a precious metal catalyst as a core. However, the core is typically made of wire mesh, wire fleece, or sintered metal configured to increase the number of contact sites with the catalyst resulting in greater emissions reduction than a DOC.

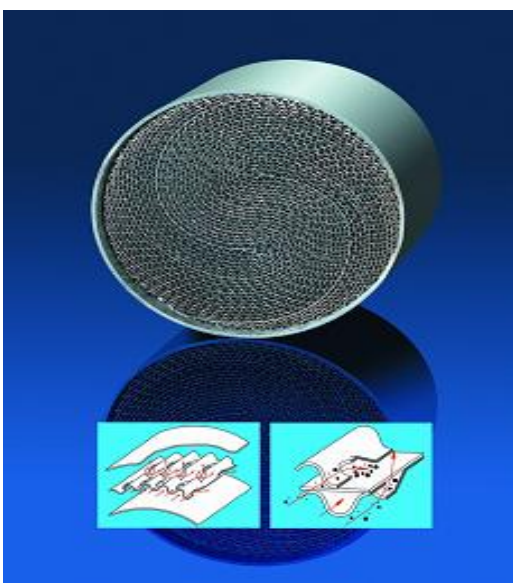
FTFs require a minimum exhaust temperature between 210°C and 230°C for about 40% of the time to work effectively. If you decide you want an FTF, your vendor will need to install a temporary data-logging device on the vehicle to track its temperature over a week of typical operations before installation can occur.



Source: Cummins Emission Solutions

Emission Reductions

An FTF can reduce HC and CO emissions between 50 and 89% and PM emissions by at least 50%.



Source: MECA

Installation

Like a DOC, an FTF is installed in the exhaust stream of the WCV and resembles a muffler when installation is completed. It takes only a few hours to install.

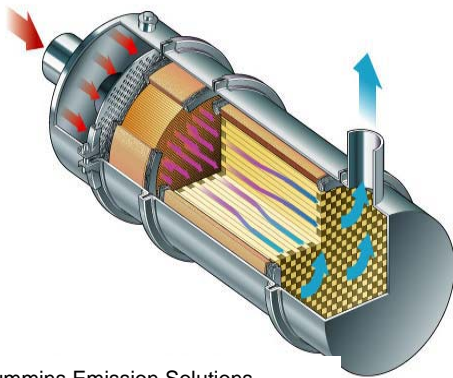
Maintenance

FTFs require virtually no on-going maintenance after installation and typically last at least six years.

Diesel Particulate Filter (DPF)

Operational Characteristics

A DPF can be either a passive (working with the heat in the engine exhaust) or active (using an additional system to add energy to the exhaust to increase temperature) system. Both systems combine an oxidation catalyst with a porous ceramic, sintered metal, or silicon carbide filter in a metal container similar to an exhaust muffler. The DPFs installed under this program will be passive DPFs.

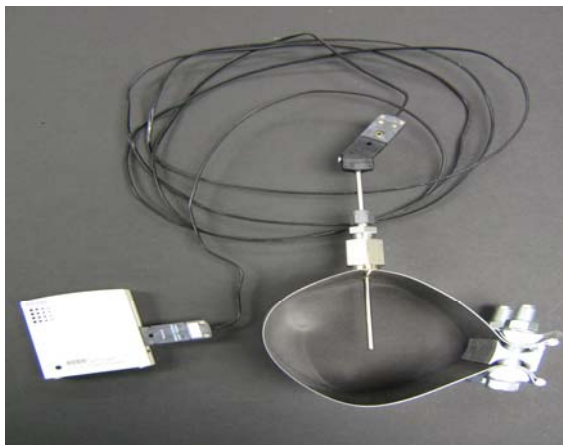


Source: Cummins Emission Solutions

Diesel emissions pass through the porous walls of the filter section, while the solid PM is trapped in the filter walls. The catalyst oxidizes HC, CO and the trapped PM, converting them into relatively benign by-products.

Like FTFs, passive DPFs require a minimum exhaust temperature of 250° C to 290° C for about 35% of the time to work effectively. If you decide you want a DPF, your vendor will need to install a temporary data-logging device (see photo, below left) on the vehicle to track its temperature over a week of typical operations before installation can occur.

Data Logging Device



Source: MJ Bradley & Assoc., LLC

Emission Reductions

DPFs produce significant emission reductions. A DPF can reduce PM emissions by 85% or more and VOC and CO between 60 and 90%.

Installation

A DPF is slightly larger than the original muffler and weighs significantly more. Additional or sturdier mounting hardware is required, which the vendors will provide.

Installation time ranges from six to eight hours per DPF. Installed devices typically last at least six years.

Maintenance

Once every 12 to 24 months, depending on the use of the vehicle, the DPF's filter must be removed from the vehicle and cleaned.

As seen in the photo, a backpressure monitoring system will be installed in the engine compartment and will indicate when maintenance is required. The monitoring system will trigger a maintenance light when the backpressure rises above a

certain threshold. This system will consist of a pressure transducer, an electronic control module (ECM), and a maintenance/warning light mounted in the engine compartment or operator cab. The ECM will require a connection to the vehicle's 12/24 volt power system.

Filter cleaning requires a special machine and can often be done by the engine manufacturer's service representative or a third party for a fee of \$200 to \$400 per filter. The devices are often designed with a filter section connected to inlet and outlet sections with band clamps for easy removal of only the filter section for cleaning. This can be done in as little as half an hour.

DPF



Source: MassDEP

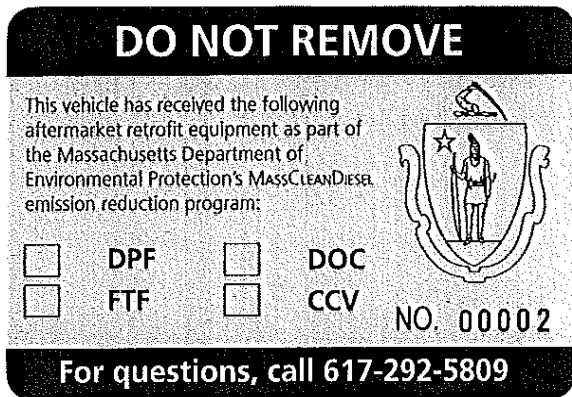
Backpressure Monitoring System



Source: EPA

Certification of Installation of Retrofit Device

MassDEP has developed two methods to track vendor installation of the retrofit devices and to ensure that emission inspectors are aware of the devices installed on the vehicle.



Vendors installing the retrofits will affix a sticker similar to the one shown here to the firewall within the engine compartment. The sticker will indicate which technology has been installed on the vehicle. MassDEP tracks every sticker number affixed to an engine.

As shown on the right, a metal tag should be visible on the outer surface of the retrofit device displaying the manufacturer and serial or part number. This number will match up with MassDEP's internal records tracking retrofit installations.



Source: CleanAIR Systems, Inc.