

Diesel Particulate Filter Maintenance

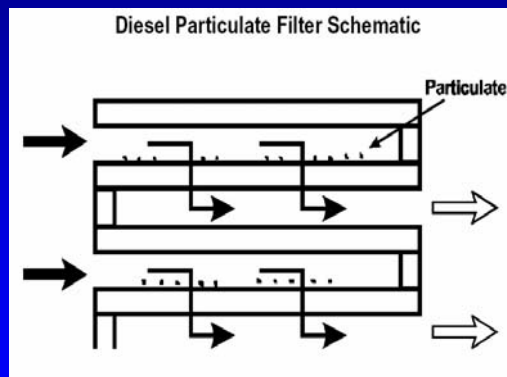
Manufacturers of Emission Controls Association

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How a Diesel Particulate Filter (DPF) Works

- A DPF forces the diesel exhaust through a ceramic wall with micro pores
- Gases and vapors pass through...the particles are almost all trapped inside the filter
- In addition, the soot itself forms a "cake" layer that provide additional filtration



Applications of DPF

- DPFs are typically packaged in a round shroud and are designed to replace the muffler.



On-Road Application



Non-Road Application



DPFs Require “Cleaning”

- Regeneration: Carbonaceous PM (Soot) collected in the filter must be periodically combusted to avoid high backpressure or damage to the filter.
 - Passive regeneration: uses a combination of exhaust heat and a catalyst to combust the soot
 - Active regeneration: uses a heat source such as an electrical heater, a flame based burner, or a catalytic burner to combust the soot
- Cleaning: Inorganic ash, which is not combustible, will collect in the DPF over time and require cleaning
 - Comes primarily from lubricating oil
 - Must be physically removed periodically



Inorganic Ash Content

- Sources
 - Phosphates and metal oxides (including zinc) from lubricating oils
 - Wear metals from the engine
 - Contaminants from the refining of biodiesel
- Inorganic ash is a hazardous material in California:
 - Zinc concentrations from California Waste Extraction Test exceed total and soluble threshold concentration limits set by California regulations
 - Ash may not be a hazardous material in other states
- Anything removed from a DPF can be characterized as a potential health hazard



Filter Maintenance: Out of the Air and Into a Hazardous Waste Facility

Captured in tail pipe . . .

Collected in filter bag . . .



Sealed in containers . . .



and sent to hazardous waste facility.



Cleaning Event

- Failure to clean a filter when necessary can potentially lead to:
 - Engine performance problems
 - Damage or destruction of the filter
 - Voiding the manufacturer's warranty
 - More complex and expensive ash removal processes
- Approved filter cleaning is required:
 - To assess the filter is still in good working order
 - To maintain warranty coverage
 - To ensure safe practices around worker exposure and disposal



Fleet Manager Checklist

- CARB or EPA verified DPFs have specific application requirements including:
 - Minimum average exhaust temperature (determined through data logging)
 - Engine Application: on or non-road
 - Engine model year and emissions class
 - Engine displacement and/or horsepower.



Fleet Manager Checklist (cont.)

- ❑ Vehicle Downtime for Filter Cleaning can vary significantly depending on many factors
 - Ease of removal and replacement of the filter system
 - Use of “swing” filters
 - Location of filter cleaner
 - In your own shop
 - Using a filter cleaning service
 - Shipping a filter to a remote site for cleaning

- ❑ Owning your own cleaning machine
 - You become a Hazardous Waste Generator in California
 - Look for a machine that meets OSHA standards
 - Look for a machine that verifies that the filter is completely clean
 - A cleaning machine is an air toxics SOURCE and may require an air permit from your local or state air agency



Filter Cleaning Processes

Level	Process	Time	Estimated Frequency
1	Use compressed air jet and/or pulsed air to backflow material out of the filter.	0.5 – 1 hr	90-95%
2	Heat the filter in an oven, kiln, or other device to combust sticky soot, fuel, or lube oil.	4-8 hours	5-10%
3	Intensive treatment (usually proprietary). Required if too much ash has been accumulated through engine issue or neglect.	unknown	<5%
4	Discard the filters		< 1%



Filter Cleaning Options

	Fleet Operation	Distributor Operation	Reconditioning Service
Description	The Fleet owns and operates filter cleaning practice	Cleaning machine owned and operated by authorized organization. In shop and mobile services	Drop off or send in a dirty filter and pick up or receive a clean one. "Recondition model"
Pros	Maximize cleaner availability to minimize downtime Keep filters on site Well suited for large fleets	Local expert handles all the aspects of cleaning	Minimum capital and resource investment (no swing filters, no
Cons	Fleet must be responsible for: Personnel training Maintenance and repair Filter assessment Hazardous material storage and disposal May not be able to clean all filters.	Engine may be 'down' while filter is being cleaned. Swing or spare filters may be required.	Not available in all areas



Other Diesel Retrofit Maintenance Items

- **DPFs**
 - **Periodic inspections should include:**
 - warning lights from backpressure monitor
 - mounting brackets & clamps
 - presence of soot in the tailpipe
 - condensation in tubing associated with pressure sensors/monitors
- **DOCs**
 - **Generally maintenance free; periodic inspections recommended**
- **Crankcase Filters**
 - **Filter change generally required at normal oil change intervals**

