Technical Bulletin

Diesel Particulate Filter Operation and Maintenance

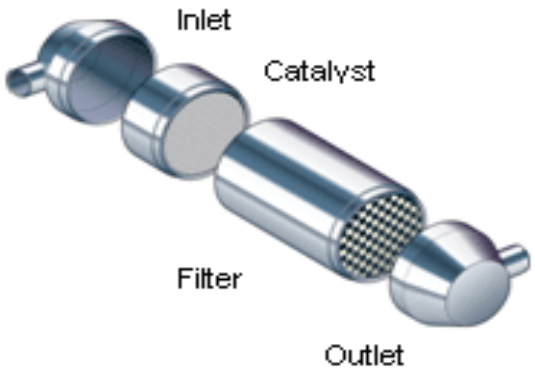
National Clean Diesel Campaign

www.epa.gov/cleandiesel

This bulletin is intended to provide general guidance. Diesel Particulate Filter (DPF) manufacturers and product suppliers should provide more detailed device-specific information and training to vehicle service technicians on proper retrofit product maintenance procedures for a specific product. DPFs are currently installed on all new on-highway engines in the United States, and DPFs may also be installed on most vehicles as a retrofit device.

DPF Operation

DPFs work by physically trapping and removing particulate matter (PM) from the engine's exhaust. The DPF can accumulate and combust PM within the filter element to achieve greater than 85 percent reductions in PM emissions. The combustion of PM in a filter occurs during regeneration. During normal operation a DPF will cause fluctuations in exhaust backpressure as PM is accumulated. Consequently, a DPF is used in conjunction with an exhaust backpressure monitoring system.



Diesel Particulate Filter (DPF)

Backpressure Monitoring

As a DPF collects PM, the passage of exhaust gas through the pores of the filter element may be progressively blocked, causing an increase in exhaust backpressure. Collected PM is combusted and reduced to ash during filter regeneration, effectively unblocking the pores of the filer element and decreasing exhaust backpressure. Normal filter operation will include fluctuations in exhaust backpressure; however, over time the accumulation of ash will gradually continue to increase backpressure. Long term buildup of ash is remedied by periodic filter cleaning.

Engine manufacturers place limits on the exhaust backpressures for their engines; therefore, an exhaust backpressure monitoring and operator notification system must be installed with every DPF. If exhaust backpressure exceeds certain thresholds, the operator is notified that maintenance is needed. It is important that all vehicle/equipment operators and fleet service technicians are properly trained to recognize and respond to high backpressure alert signals. Backpressure monitoring systems should be periodically inspected for proper operation.

Filter Regeneration

Regeneration occurs when the filter element reaches the temperature required for the combustion of the accumulated PM, converting it primarily to ash, gaseous carbon dioxide (CO_2) and water (H_2O).

"Passive" regeneration occurs when the exhaust gas temperatures are high enough to initiate combustion of the accumulated PM in the DPF, without added fuel, heat or driver action. "Active" regeneration may require driver action and/or other sources of fuel or heat to raise the DPF temperature sufficiently to combust accumulated PM. Active regeneration can be accomplished either during normal vehicle operation or during a controlled event while the vehicle is stationary. During operation, active regeneration may use extra fuel to raise the DPF temperature to combust accumulated PM. An active system that requires the vehicle to remain stationary dictates the time required every shift or every day that the vehicle must be out of service. The frequency of regeneration is determined by the engine's duty cycle, PM emission rate, filter technology, and other factors. When using an active filter, it is particularly important to follow the manufacturer's instructions for regeneration.

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DPF Maintenance

In addition to PM, the filter also traps noncombustible materials resulting primarily from lubrication oil and fuel additives (ash). Cleaning of ash from retrofit DPFs is typically required every 6 to 12 months. An engine emitting excessive PM or experiencing inadequate regeneration will cause a DPF to require more frequent cleaning. Diagnostics should be performed to identify the cause for more frequent cleaning intervals. It is important to avoid excessive PM and ash accumulation in a DPF, so proper maintenance and cleaning instructions should be followed closely. A backpressure monitoring system should always be used with a DPF and periodic inspection of the monitoring system should be performed to confirm proper operation.

In general, cleaning requires heating the filter and using compressed air combined with a vacuum system to blow the ash from the filter and capture it in a sealed container. Cleaning requires manually removing the DPF from the vehicle and placing it in a cleaning station designed for this purpose. Highly automated cleaning stations are becoming available, allowing fleet service technicians to perform cleaning on-site. Professional filter cleaning services are also available. Costs for cleaning stations or professional cleaning services should be considered when purchasing DPFs.

If equipment down time during cleaning is a concern, fleets may consider buying extra filters to have in stock at the time of cleaning. The filter must be reinstalled in the correct flow direction to maintain proper operation. Removal of the DPF for filter cleaning and reinstallation is typically performed by fleet service technicians.

It is important that all vehicle/equipment operators and fleet service technicians are properly trained on filter cleaning procedures.

Documentation should remain with the vehicle and/or in fleet records which lists installation and vehicle information such as mileage, opacity readings, date, device model number, DPF serial number, installer, etc. Records should also be maintained to document when service is performed and when the DPF is cleaned. If a fleet moves a DPF between different vehicles, records should be carefully monitored to identify if a particular vehicle or device appears to require different service intervals than another.

Engine Maintenance

It is important to properly maintain vehicles and monitor fuel and lubrication oil consumption. A bad fuel injector or increase in oil consumption may be masked by a DPF. The DPF may be damaged by a poorly maintained engine. When a DPF is removed for cleaning, it may be useful to check the opacity of the vehicle to determine if a potential engine problem exists. Maintaining service records is advisable to track potential concerns or changes in operation.