



Preventive Maintenance for Heavy Duty Trucks

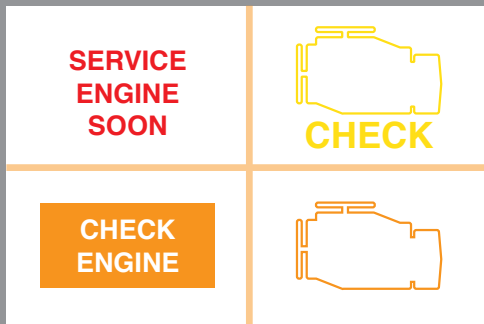
Published by the California Council on Diesel Education and Technology (CCDET), a non-profit cooperative group of California Community Colleges, the diesel industry, and government agencies, supporting training and educational programs for diesel mechanics.

A Preventive Maintenance Program Helps to:

- Save fuel costs!
 - Maximize truck performance!
 - Maximize engine life!
 - Reduce downtime!
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Follow these practices to improve operational efficiency:

- Newer heavy duty diesel vehicles have undergone tremendous advances in technology. Diesel vehicle technicians and drivers should understand how these changes affect their vehicle operation. For example, diesel engines sold since 2007 achieve greater than 98 percent reduction in soot emissions with diesel particulate filters (DPFs) and computer controls. To operate as designed, these newer engines, like all engines, require proper maintenance.
- If your truck has a diesel particulate filter (DPF), even more attention is required. Protect your investment. A DPF is not a "fit and forget" device.
- Improper care of your engine and DPF can lead to:
 - Expensive repairs and replacement parts
 - Voided warranty
 - Engine malfunction or breakdown
 - Non-compliance with air pollution laws
 - Loss of horsepower and eventually a de-rated engine



Vehicle Maintenance is Critical!

Incorporate these tasks to maximize fuel efficiency and protect the environment. These tasks supplement your owner's manual scheduled maintenance information.

Task	Why?
Watch your Engine Oil Use	Increased oil use indicates engine problems. This can also cause an increase in ash load in the DPF and more frequent DPF cleanings.
Watch your Coolant Use	Excess coolant consumption without a visible leak indicates a problem. Coolant leakage can poison the DPF and cause plugging.
Check Fuel for Contamination	Dirty fuel causes engine and DPF problems.
Check your DEF Tank Level	Diesel Exhaust Fluid is used with trucks equipped with an SCR (Selective Catalytic Reduction) system. Make sure you only use appropriate DEF and that your DEF tank is at least half full, so the SCR system works properly.
Look for Visible Smoke	Visible smoke indicates problems with the DPF and more serious issues upstream.
Check your Air Filter	Dirty air filters reduce fuel economy and air flow to the engine, leading to more soot generation.
Update your ECM (Engine Control Module)	Make sure the engine is running at top performance by checking for updates annually by an authorized dealer. Refer to manufacturer for necessary updates.
Check your Warning Lights	Warning lights can indicate serious engine and DPF issues.
Check Turbocharger/ EGR	A bad turbo or EGR valve can cause engine failure and DPF plugging.
DPF/Engine Check	A plugged DPF full of ash can cause engine problems. Watch your warning lights. Service the DPF by proper cleaning and ash disposal.
Service and Opacity Records	Good service records help maintain engine warranty (OEM or after-market part). The Periodic Smoke Inspection Program (www.arb.ca.gov/enf/hdvip/adv351.pdf) require fleets to maintain at least the last two years of opacity test records.

PREVENTIVE MAINTENANCE TASKS

Preventive maintenance tasks are similar to a pre-trip inspection. The minimum inspection steps required by the Federal Motor Carrier Safety Administration or FMCSA can be found at: www.dmv.ca.gov (search "section 11")

Preventive maintenance tasks have varying levels of difficulty. Tasks that have a low level of difficulty can be performed by the driver or owner/operator. More difficult tasks must be performed by a technician and/or the dealer that has specialized training and equipment. Always follow retrofit device manufacturer recommendations. Links to videos provide an overview of requirements to perform each task.



Diesel Truck Drivers







Diesel Technicians



Videos

Check Engine Oil

Who	How Often	Task	Why
	Daily or upon pre-trip inspection	Check the engine oil	An increase in engine oil consumption raises the ash load in the DPF, causes more frequent DPF cleanings, which can increase the possibility of filter plugging. Check to ensure that the engine is not consuming oil at a rate higher than recommended by the engine manufacturer. Track the oil by logging the amount added to the engine between oil changes.
	Per Manufacturer	Change the oil according to manufacturer's specifications.	Noncombustible components in the oil collect as ash in the DPF. Use only low ash oil as specified by the engine manufacturer. Do NOT overfill the oil or "top off" if the vehicle does not require it as this can cause serious engine problems.
	When Serviced	Check oil leaking from vent tube	Oil leaking from the vent tube could mean that the engine is worn, and compression is getting past the rings and pressurizing the crankcase. Power will be lost and emissions will increase and could result in plugging of the DPF. (Most engines sold since 2007 utilize a closed crank case ventilation system and do not vent to the atmosphere.)
	Annually	Oil analysis by laboratory	Analyze oil for metal fragments, coolant and other contaminants. The results of the analysis can alert for catastrophic failure. Analysis costs between \$15 to \$30.





Engine oil consumption video ccdet.org/video-oil-consumption/



Engine oil sampling video ccdet.org/video-oil-sampling/

MAINTENANCE TIP: Track engine oil and coolant use. Excessive consumption of oil or coolant will cause problems for the engine and the DPF.

Check Coolant



Who	How Often	Task	Why
	Daily or upon pre-trip inspection	Look for coolant leaks.	A leak can indicate a break in the system, hose, or a faulty radiator cap.
	At service	Check for leaks, contamination and excess consumption. Pressure-test the radiator to check for leaks.	Coolant consumption in the engine can poison the DPF and lead to filter plugging. Track coolant to make sure the engine is not consuming coolant at a higher rate than recommended by the manufacturer.



Coolant consumption and contamination video
ccdet.org/video-coolant/

MAINTENANCE TIP: Looking for coolant leaks and monitoring your coolant level in your heavy duty truck can help prevent problems that may lead to damage of your engine and DPF.

Check Fuel System




Who	How Often	Task	Why
	Upon refueling	Prior to refueling, observe fuel for contamination. A blackening of the fuel may indicate engine oil present.	Fuel that is contaminated with engine oil or debris can damage the engine and DPF. Oil contamination is rare in newer vehicles with common rail fuel systems.
	At scheduled service	Sample fuel for contamination prior to refueling. Check fuel filter. Replace fuel injectors.	Fuel: Blackening of fuel may indicate oil-fuel mixing and an engine issue. Fuel filter: Replace at prescribed intervals. Fuel injectors: Replace at intervals required by the manufacturer.



Fuel sampling for contamination video
ccdet.org/video-fuel-sampling/



MAINTENANCE TIP: Watch for signs of fuel contamination to prevent further engine damage.

Check DEF (Diesel Exhaust Fluid) Level (2010 and newer engine model year with SCR)

Who	How Often	Task	Why
	Daily or upon pre-trip inspection	Check the DEF level and top off tank as necessary to keep tank at least half full.	Engines equipped with SCR systems (selective catalytic reduction) require DEF to work properly. Operating these engines without DEF may severely de-rate the engine.
		Note unusual rate of DEF consumption.	DEF consumption is generally 2% of the diesel fuel consumption. An excessively high or low consumption may indicate a leak or other problem.
		Only fill DEF tank with manufacturer approved DEF.	The concentration (32.5% urea) and purity of the DEF is important for proper operation of the SCR system.
	At scheduled service	Check DEF concentration	For proper operation of the SCR system and economy.
		Check for DEF system leaks	
	Per manufacturer	Flush DEF tank, clean or replace filler, dosing or pump filters	For proper operation and longevity of the SCR system.

**MAINTENANCE TIP: Keep the DEF tank more than half full.
(Use the blue cap.)**

Check for Visible Smoke

Who	How Often	Task	Why
	Daily or upon pre-trip inspection	Observe tailpipe exhaust while engine is running for any signs of smoke.	Black smoke indicates engine and DPF issues that must be addressed immediately. Ignoring this can damage the DPF and emission control equipment.
	When servicing	Perform smoke emissions test. Diagnose any related engine, turbo, EGR or combustion issues. Check DPF for damage.	If it smokes, it's broke. Poor combustion can lead to DPF damage, de-rate the engine, and void the warranty.





Smoke emissions test video ccdet.org/video-smoke/



Snap idle test video ccdet.org/video-snap-idle/

MAINTENANCE TIP: Diesel vehicles equipped with a DPF should not have visible smoke from the tailpipe.

Check Air Filter



Who	How Often	Task	Why
	Monthly	Check the restriction gauge on the air filter monthly to see if the filter is dirty and needs replacing.	Air impurities can affect combustion and damage the engine. Dirty air filters reduce air flow and fuel economy, which leads to more soot generation and DPF damage.
	As needed	Replace air filter when necessary	Dirty air filters reduce air flow and fuel economy. They also cause increased soot generation, leading to DPF damage.



Air filters video ccdet.org/video-air-filter/

MAINTENANCE TIP: Maintaining your air filter by checking for proper air flow can prevent future engine problems and increase operational efficiency.

Engine Control Module (ECM)



Who	How Often	Task	Why
	Daily or upon pre-trip inspection	Make sure warning lights are operational.	Warning lights alert driver of engine/DPF issues. Preventive maintenance is the key to prevent costly repairs and voided warranty.
	When servicing or as required	Make sure engine is equipped with current software.	Current ECM software ensures that the engine and emission control equipment are working to manufacturer specifications.



ECM video ccdet.org/video-ecm/

MAINTENANCE TIP: Update diesel engine software as required by your engine manufacturer.

Check Malfunction Indicator Lights (MIL)



Who	How Often	Task	Why
	Daily or upon pre-trip inspection	Check the MIL lights on the DPF monitoring system. Keep the manufacturer's quick reference card in your cab, as lights can vary between manufacturers.	Understanding the MIL lights and what they mean, and responding accordingly helps prevent engine de-rate and DPF damage. Never disconnect, tape over, or ignore warning lights. Continuing to operate a vehicle that requires attention may severely de-rate and damage the engine and DPF, and void the warranty.
	When serviced	Check all MIL lights for proper operation. Do not disable or obstruct indicator lights.	Properly working MIL lights help drivers to alert technicians of engine and DPF problems.



MIL lights video ccdet.org/video-mil/

MAINTENANCE TIP: Emissions system warning lights prevent DPF and engine damage.

Check Turbo/EGR Valve



Who	How Often	Task	Why
	Daily or upon pre-trip inspection	Check for power loss issues / MIL lights illuminated.	Heavy duty diesel vehicles equipped with a turbocharger require more preventive maintenance such as: possible more frequent oil changes for some engines and making sure that the EGR is functioning as designed.
	Scheduled service	OEM does not require inspection unless there is an issue.	Turbos that do not produce sufficient air or have leaking seals lead to more soot or the presence of engine oil in the exhaust. This can lead to filter plugging or permanent damage to the DPF.



Turbo/EGR failure video ccdet.org/video-turbo-egr/

MAINTENANCE TIP: Watch for power loss and Malfunction Indicator Lights (MIL).

Check DPF and Engine



Who	How Often	Task	Why
	Daily	Understand how your DPF works. Pay attention to the MIL lights.	A retrofit DPF can mask engine problems that were formerly detectable by observing exhaust smoke characteristics. An engine producing excessive smoke will prematurely plug the DPF. When a DPF is clogged with ash, your engine will de-rate on the road or your DPF may get damaged.
	Yearly or as needed due to back-pressure buildup.	Remove DPF can and clean accumulated non-combustible ash from the filter.	<p>The DPF must be removed and cleaned periodically to remove accumulated noncombustible ash from the filter.</p> <ul style="list-style-type: none"> • Replacing a broken filter is expensive! • Use only DPF or manufacturer approved cleaning methods. Ash must be handled and disposed as a California Hazardous waste. Proper cleaning and disposal is essential for filter operation and compliance with CA laws and regulations. It is your responsibility to make sure that your filter cleaning service follows these requirements. • Check the engine oil opacity at the time the filter is removed for cleaning. A high opacity can indicate upstream engine problems that need fixing prior to installing a clean filter. • Never steam clean a DPF. • Never tap on the filter element to remove the ash. • Make sure filter elements are installed correctly after cleaning. • Do not operate engine without DPF filter elements.



DPF maintenance video ccdet.org/video-dpf/

MAINTENANCE TIP: Reference the engine manufacturer's suggested DPF cleaning interval to remove accumulated ash. Always use a cleaning service that uses an approved ash cleaning and disposal method, as the material contains hazardous waste, and the truck owner is responsible.

Maintain Service Records

Who	How Often	Task	Why
	As needed basis	Retain service and opacity test records for at least two years.	Prevent voiding the warranty by documenting proper care of the DPF. Maintain service and smoke opacity test records to document compliance with regulations. Keep at least the last two years of smoke test records at all times. Check to make sure the ECL is present and legible. See the ECL Advisory 354 .
	Annually	Conduct smoke opacity testing yearly. Retain records for at least two years.	



Maintaining service records video
ccdet.org/video-service-records/

MAINTENANCE TIP: Maintaining good service and smoke opacity records can help to maintain your vehicle warranty. Check that your engine emission control label (ECL) is intact and legible.

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DISCLAIMER: This handbook is not a substitute for the detailed instructions/warranty limitations supplied by the manufacturer. BUYER BEWARE: Use only approved equipment and installers.