

Diesel Particulate Filters (DPFs)

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Since the 'Euro 5' standard came into force in 2009 the exhaust emissions standards for new cars have effectively required fitment of a DPF in the exhaust of diesel cars. In fact, many cars registered before 2009 will have had one fitted too in anticipation of the change in standards. The aim of the technology is an 80% reduction in diesel particulate (soot) emissions, but the device is not without problems as garages are regularly having to deal with customers concerned about the activation of the particulate filter warning light. If you are planning on using a new car for mainly town-based, stop/start driving, you should avoid a diesel car fitted with a Diesel Particulate Filter (DPF) due to the possible issues caused by incomplete 'DPF regeneration'. Even if your driving isn't mainly urban/stop-start, changes to driving style may be required to keep these systems working properly.

How do they work?

Located within the exhaust system, a DPF captures small soot particles, preventing them from being expelled into the atmosphere. As with any filter it needs emptying periodically and this is done automatically by burning up the particulates in a process called regeneration.

Regeneration is either passive or active

Passive regeneration

Passive regeneration takes place automatically on motorways or fast A-road runs when the exhaust temperature is high. Because many cars don't get this sort of use, vehicle manufacturers have had to design-in 'active' regeneration, where the engine management computer (ECU) takes control of the process.

Active regeneration

When the soot loading in the filter reaches a set limit (about 45%) the vehicle's ECU will initiate post combustion fuel injection to increase the exhaust temperature and trigger regeneration. For them to work efficiently, the car needs to be

driven at a constant speed for at least fifteen minutes, to allow the DPF to heat up enough to regenerate. Certain motorists, such as urban commuters, might find this impossible. If the journey is too short while the regeneration is in progress, it may not complete and the warning light will come on to show that the filter is partially blocked.

Symptoms of active regeneration

During active regeneration you may notice the following symptoms:

- Cooling fans running
- Increased idle speed
- Deactivation of automatic Stop/Start
- A slight increase in fuel consumption
- A hot, acrid smell from the exhaust.
- Engine note change

If the regeneration is unsuccessful due to an insufficient driving cycle the extra fuel injected into the cylinders will not burn and will drain into the sump. As a result, oil quality will deteriorate and the level will rise. Most DPF equipped engines will have an oil quality/viscosity sensor but it is important that you check that the oil level does not increase above the maximum level on the dipstick as diesel engines can run on their own oil if the level is excessive – often to the point of destruction.

If after 2 attempts of 15 minutes, a successful regeneration has not been possible, the loading will increase. At 50% soot loading, the ECU will continue to maintain maximum exhaust temperatures of 600°C to 650°C to cause a regeneration process. The system will try to run a regeneration process for 15 minutes. If unsuccessful, the system will repeat this process for a further 15 minutes, if still unsuccessful, the DPF light on the driver display panel will then be lit.

When the warning lamp comes on, the driver should drive at a constant speed of at least 60 km/h for about 10 minutes. If they ignore this information and continue driving the vehicle until the soot loading reaches 70% without successful regeneration, additional warning lamps will light up.

Forced regeneration

Forced regeneration is required where 'Active' regeneration criteria have not been met or where soot levels have increased within the DPF to a point where normal regeneration cannot be performed: typically around 70% soot loading. At this point the vehicle will enter a 'restricted performance' mode to prevent further damage. If left the soot loading will keep rising. At this level of soot loading a VAS tester must be used to force regeneration. Above around 85% soot loading regeneration can no longer be performed on the vehicle and the DPF will need removing to be cleaned or replaced.

What can prevent normal regeneration taking place?

- Frequent short journeys where the engine does not reach normal operating temperature
- Wrong oil type - DPF equipped cars require low ash, low sulphur engine oils
- A problem with the inlet, fuel or Exhaust Gas Recirculation (EGR) system causing incomplete combustion will increase soot loading.
- A warning light on or diagnostic trouble code logged in the engine management system may prevent active or catalyst regeneration
- Low fuel level will prevent active regeneration taking place. As a general rule ¼ tank is required
- Oil counter/service interval - exceeding the service interval may prevent regeneration
- Additive tank low or empty

Expensive repairs

If you continue to ignore warnings and soot loading keeps increasing then the car won't run properly and the most likely outcome will be that you will have to get a new DPF costing at least £1000 plus labour and diagnostic time.

The ash residue which remains after successful regeneration cannot be removed and will eventually fill the filter. The latest diesel engines are less prone to problems, because they are more efficient and burn off soot faster. Even in normal use, however, DPFs tend to need replacement after a certain mileage has elapsed, the rate of which varies between 80,000 and 150,000 miles, dependent on the car make and model, the type of use and whether or not the engine has had regular oil changes with a lubricant that does not contain additives that block the filter.

Instead of having a new DPF fitted, it is possible to have it cleaned. A handful of companies offer a mail-order chemical cleaning service, which means your car will be off the road for at least 48 hours, but which could potentially save you hundreds of pounds.

Another alternative is to buy a new aftermarket DPF, which could save you up to 65% compared with the main dealership price. While car makers might argue that the alternative part is inferior, all DPFs for cars made from 2009 and many prior to that date, are subject to independent Type Approval tests for performance and longevity.

DPF additives

The most commonly fitted type of DPF has an integrated oxidising catalytic converter and is located very close to the engine where exhaust gases will still be hot. This heat means that passive regeneration is more likely to be successful.

Some models, across a wide range of manufacturers, use a different type of DPF which relies on a fuel additive containing Cerium Oxide which ignites at a lower temperature and adheres to the soot particles meaning regeneration can occur at a lower temperature.

The additive is stored in a separate tank next to the fuel tank and is automatically mixed with the fuel whenever you fill up. A litre of additive should treat around 2800 litres of fuel – enough to cover 25,000 miles at 40mpg. It lasts about 70000 miles and is replenished during a service. You will have to pay to get the additive tank refilled at some time in the car's life costing anywhere between £150 and £200 including fluid and labour.

Don't ignore a warning light showing that the additive tanks need refilling. It's absolutely essential this tank is refilled as without it regeneration is unlikely to be successful and replacing a DPF is significantly more expensive.

Check the handbook

If you buy a car with a DPF it's important to read the relevant section of the vehicle handbook so that you understand exactly what actions to take if the warning light illuminates and how, if at all, your driving style may need to be adjusted to ensure maximum DPF efficiency and life.

In most cases there is only a relatively short time between the DPF being partially blocked and becoming so blocked that it requires manual regeneration.

Removal is not a legal option

It is suggested from time to time that the answer to failed DPF regeneration is get the DPF removed from the exhaust system rather than pay to get it repaired/renewed. Indeed there are companies advertising just such a service including reprogramming of the engine management software, but DPFs are fitted to meet European emissions regulations designed to reduce vehicle emissions of particulate matter. Use of a vehicle which has been modified in such a way that it no longer complies with the air pollutant emissions standards it was designed to meet is illegal, and the Government has moved to tighten up the regulations concerning such practices.

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