On-car DPF cleaning

Brendan Sorensen

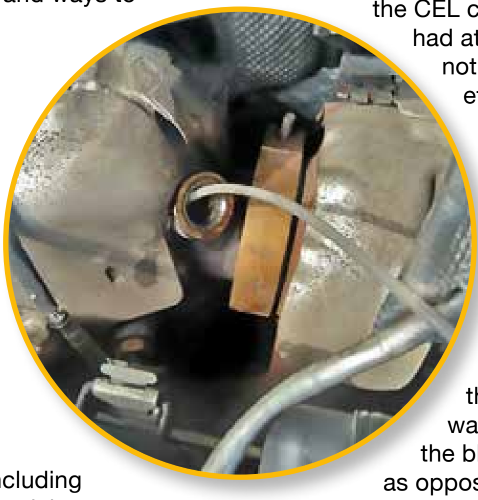
Diesel particulate filters (DPF) are the new normal for diesel vehicles, so no doubt your shop has already had its fair share of DPF issues through the door.

Rather than harp on here about DPF theory, I want to share a real-world case study, along with some tips and ways to repair DPF systems.

Case study:

2015 LW Ford Focus 2.0 TDCi, 53,456km on the clock. Check-engine light (CEL) and DPF warning lights on solid. Fault codes:

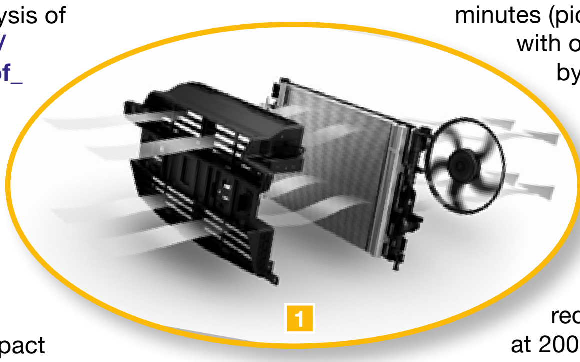
- **P2463-00** – Diesel particulate filter soot accumulation.
- **P246B-00** – Vehicle conditions incorrect for diesel particulate filter regeneration.
- **P165B-07** – Grill shutter A performance/ stuck mechanical failure.



An initial test drive showed the vehicle did indeed have symptoms of a blocked DPF, including sluggish performance and raised DPF differential-pressure sensor readings. Below I have plotted out DPF pressure sensor readings (in millibar) against some trusted maximum values taken from BMW service information. I use these as a general guide for all DPFs.

DPF differential pressure readings	Our partially blocked DPF (mb)	BMW maximum permissible for active regeneration (mb)
Idle	22	3
2000RPM	283	150
Regeneration danger (2000RPM)		300+

At first it's tempting to glance past the active grille shutter-related fault code and charge right to the DPF but we must always remember that DPF faults are most often a symptom rather than the root cause. If you are currently saying, 'active grille what?', check out this great analysis of the system at **www.researchgate.net/publication/276116569_Evaluation_of_Impact_of_Active_Grille_Shutter_on_Vehicle_Thermal_Management**



When we operated the grille shutters – the easiest way to do this on this Focus is by watching the full sweep they do at engine start-up – we could see that some of the vanes were jamming and we could also hear the motor still trying to move them. Impact damage to the vanes from road debris was the cause.

As cited in the aforementioned link, the active grille shutters (pic 1) need to be open during DPF regeneration to allow airflow over the DPF and stop this 600°C-plus exhaust furnace from damaging itself and nearby components.

Because the shutter system was not operating correctly, the powertrain control module (PCM) would not dare attempt an active regeneration for fear it would not be able to open the shutters. The customer swears the CEL didn't come on individually, rather that the DPF light came on and then the CEL came on shortly after, even though they had attempted a highway-speed drive. A CEL not coming on for a shutter issue that will effect DPF regeneration could either be poorly written Ford software strategy or an embarrassed customer stretching the truth but it does lend weight to scanning cars for the fault during servicing.

With a new set of vanes fitted, the Ford's active grille shutter system was now operating correctly and we could turn our attention to the symptom – the blocked DPF. This was a fairly low-kilometre car that had an obvious system fault, so it was reasonable to assume the majority of the blockage in the DPF was burnable soot, as opposed to non-burnable ash that builds up in the DPF over time and eventually requires professional cleaning or DPF replacement to address.

Given the very large back-pressure, close to 300mb, a forced regeneration was not advisable and, in this case, it wasn't even offered on the scan tool. Many manufacturers are now actually starting to take the forced-regeneration option off scan tools because it is abused by many and results in a melted DPF when actuated carelessly.

Instead, we carried out an on-car chemical DPF clean. Many additive suppliers now offer a kit specifically designed for DPF cleaning that involves very little disassembly. We used a Powermaxx product from Bluechem Australia, the main component being a supplied pressurised canister that foams the Powermaxx DPF Top Gun Cleaner solution and is designed to be sprayed into any accessible exhaust port post-turbo, pre-DPF.

In this case, our Ford had a very easily accessible exhaust-gas temperature sensor pre-DPF, so we removed the sensor and, following the supplied instructions, applied the pressurised chemical into the DPF over the course of approximately 10 minutes (pic 2). We have also had great success with other models carrying out the process by spraying into the pre-DPF pressure-sensor hose when that is a more convenient access point. A tray was set up behind the vehicle to catch the sooty foam that is sometimes emitted from the exhaust.

A test of the DPF pressures after this process showed they were greatly reduced, with a maximum reading of 7mb at 2000RPM. The fault codes were now able to be cleared, then a test drive was taken to clear any remaining chemical from the exhaust and give the vehicle the opportunity to carry out a regeneration if it desired. Because DPF pressures were already so greatly reduced, the vehicle did not attempt a regeneration. There was no need for it to; the product had already broken down the soot effectively before the test drive.

This on-car cleaning process has worked well for us on a range of vehicles. Most require it after a split induction hose causes a large blockage.

Holden's Captiva is a common culprit, often arriving in reduced-power (i.e. limp home) mode and with a soot reading of 200 per cent after the intake hose has split underneath the battery.

These chemicals can be a cost-effective and safe way to restore a DPF back to service but there are certainly situations when they are not applicable, such as:

- **A vehicle with a high ash reading.** Ash loading is a theoretical calculated number because ash builds in the DPF during normal use and cannot be burnt out. Removal of ash requires off-car cleaning or DPF replacement. Some manufacturers will bring on a warning and fault code once an ash limit has been reached and many provide the number in their service information (e.g. From Erwin, 2011 VW Amarok 2.0, limit for changing DPF = 175mL).
- **A vehicle with a DPF blockage due to melting of the DPF substrate.** This is often caused by a forced regeneration at excessive soot levels and commonly a result of tricks such as bypassing built-in safety guards. For example, deceiving the ECU by bleeding off some of the pressure in the differential-pressure sensor hose so the ECU sees lower pressure and allows a forced regeneration.
- **DPF plausibility fault codes can be set by a DPF that flows too well.** These codes monitor for at least some back-pressure, or sometimes for temperature change across the DPF during regeneration, and can stop people fitting a straight DPF delete pipe. They can also pick up faults such as an internally cracked DPF.

The Autodocta

Range Rover Evoque: Engine misfire

Question: A customer is complaining that their 2012 Range Rover Evoque 2.0 has an engine misfire

The vehicle's engine malfunction indicator lamp (MIL) is illuminated and several misfire-related trouble codes have been stored in the ECM fault memory. We have checked the spark plugs and ignition coils, which are all OK. Have you any ideas?

Answer: Yes, we are aware of an engine-misfire issue on Freelander 2 and Evoque models up to 2013 with 2.0 petrol engines.

The engine misfire is due to the intake manifold blanking plug being loose or having fallen out. Fit a new blanking plug, available from Land Rover parts department, to the intake manifold. Secure blanking plug with a cable tie (pic 1). Erase trouble codes and carry out road test to ensure the engine misfire has been rectified.

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