Automotive Electronic Control Systems

AECS
Training, Equipment and Data for Automotive Diagnostic Specialists

March 2015 - Technical Newsletter

DPF Really faulty?

This article is a true description of an AECS technical help desk problem and how it was solved.

Vehicle
2012 Mercedes ML 300 V6 3.0L Turbo Diesel 66.000 kms

Problem
On this vehicle, the engine check light comes on intermittently. The fault codes code logged is:

Diagnostic Trouble Code

MERCEDES > Diagnostic Trouble Code

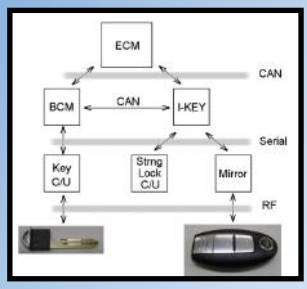
DTC	Description	State
118D00	Component B28/8(Differential pressure sensor(DPF)) has a plausibility error.	Stored

Picture 1: *Launch Pro3 scan tool fault code screen shot.*

Questions
At AECS, we get lots of questions about Diesel Particular Filters (DPFs). In our DMS 1-3 common rail Diesel training we spend a lot of time on what goes on and what goes wrong with DPFs. We also deal with what you can do to rectify DPF problems.
From this perspective, I thought that it would be a good idea to look at one particular case a little bit more in depth.

EMS1-5 Immobiliser & Anti-theft devices –

26 - 27 March 2015 - Auckland



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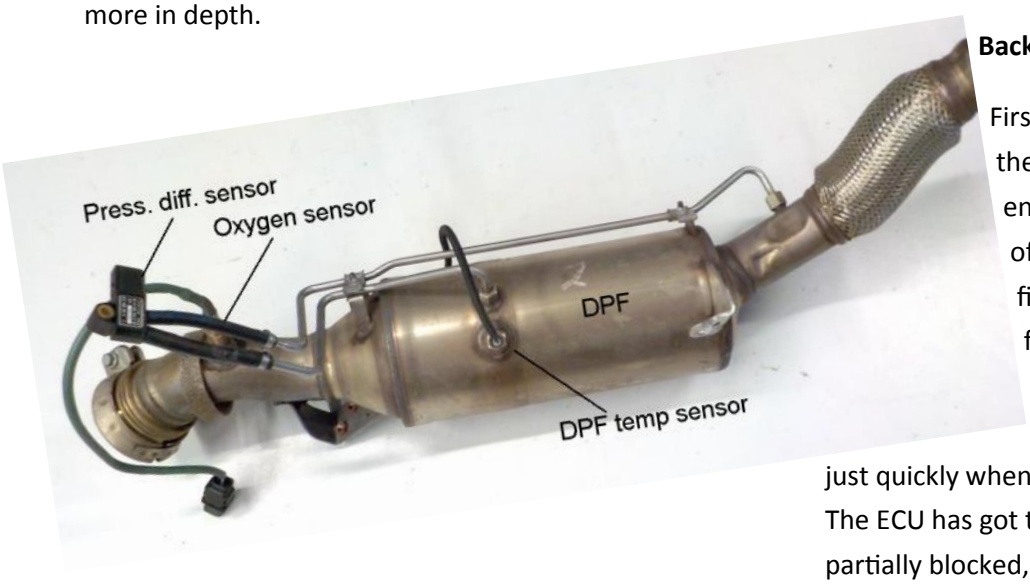

Picture 2: *DPF 2014 Sprinter*

Background

Firstly, a DPF is an actual filter fitted in the exhaust of a modern Diesel engine. Like any filter after a period of time it gets blocked. Unlike any filter, you do not replace a blocked filter, as they range from a mere $1000 to some at $12,000! This filter is not an item you replace just quickly when you think it might be faulty.
The ECU has got the ability to sense that the filter is partially blocked, through a pressure differential sensor. When it deems necessary through the pres-

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VTEQ 3080 Testlane

sure differential sensor or as a result of distance/time travelled, it will initiate a regeneration of the filter.

Regeneration of the DPF is in almost all instances done by injecting an excess of fuel into the engine or directly into the exhaust, together with an excess of air through wide open throttle.

Same on this Mercedes. Regeneration can be noticed by a slightly higher RPM at idle and a clear wide open throttle sound from under the bonnet. This V6 has under normal running conditions the throttle nearly shut, to reduce energy losses from compressing unused air.

Data Stream List		AECS...
Name	Value	Unit
Ash content of diesel particulate filter	1	g
B16/14(Exhaust gas recirculation temperature sensor)	0	degree C
B19/11(Temperature sensor upstream of diesel particulate filter)	586	degree C
B19/11(Temperature sensor upstream of turbocharger)	412	degree C
B28/8(Pressure differential sensor(DPF))	54	mbar
B60(Exhaust back pressure sensor)	1321	mbar

Picture 3: *Screen dump DPF temp recording while regeneration takes place.*

Also the exhaust temperature just in front of the DPF measured by the ECU is normally around 350°C. When the engine is regenerating the DPF the temperature of the burning Diesel (with the excess of air) raises that temperature to about 600°C.

The heat burns the carbon soot particles caught in the filter, combining C (carbon particles) with O_2 (oxygen from the air) and turning it into CO_2, which is a gas that passes through the filter.

When air flows through a filter the restriction of that filter will cause a pressure difference, the pressure on the intake of the filter should be higher than the pressure on the outlet of the filter. Also; a low exhaust gas flow is hardly affected by a filter, a high gas flow will have a higher pressure difference as result. The ECU 'knows' what is should be. This is also why it is so hard to replace on some cars the DPF with an aftermarket unit.

Back to the car

So on the Mercedes the fault code indicated NOT that the DPF was faulty, nor that the differential sensor was faulty, just that the signal from the sensor was not plausible. Nice!

What does that mean?? What would be "implausible pressure" in your mind, if you had to write the software?

I can name a few:

- Pressure on the outlet of the DPF higher than on the inlet (negative pressure difference), for example hoses on the sensor back to front.
- Pressure difference constant, while the air mass has increased, for example hoses removed from DPF, or DPF removed from exhaust.

- Pressure difference too low or too high under all circumstances. The ECU looks at airmass and fuel, as that combination determines the flow through the DPF. This can be caused by for example power supply voltage to the pressure differential sensor being too high or too low, airmass sensor signal too high or too low, or calibration error in ECU
- Pressure difference signal outside acceptable limits, for example as a result of interference (hash) on the signal wire.

I am sure there are more conditions but this will do for now.

History

During the last service the air filters had been replaced (about 1 year ago), ever since this service the engine did an automatic regeneration about every 50 km's or so.

This is rather subtle, but shows up when you are idling (rpm 950 instead of 850), and you can hear that both the throttles are wide open, rather than almost shut.

Also during driving it does not shift into 7th gear (rpm are a little higher during cruise) when regenerating.

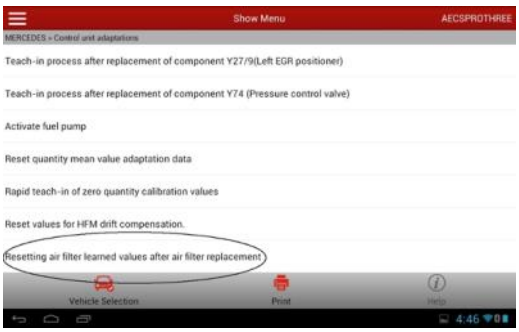
On the scantool the DPF temp sensor shows >500° C.

Picture 4: *Contaminated air filters*

A few weeks before the service the check engine light came on several times, code:

"118D00 DPF pressure differential sensor plausibility Error" is stored.

During the service this time, the awful small air filters were partially blocked again and replaced.



Picture 5: *Air filter relearn function.*

With the **Launch Pro3**, the faults got cleared and "Resetting air filter learned values after air filter replacement" function was performed

We had never noticed this function before, and frankly I am unsure of why there would be such a function. I guess that it is to let the ECU adapt to new airmass sensor values when the engine is running. In my mind the function "reset values for HFM drift compensation" (airmass sensor relearn) would nicely take care of this. You need to note that this V6 engine has two airmass sensors and two air filters.

After the fitting the new filters and performing the adapt to new airmass sensor function there was an immediate effect; no more auto regen every 40 or 50 km's, and the fault code has only reappeared again once over a period of 2 months.

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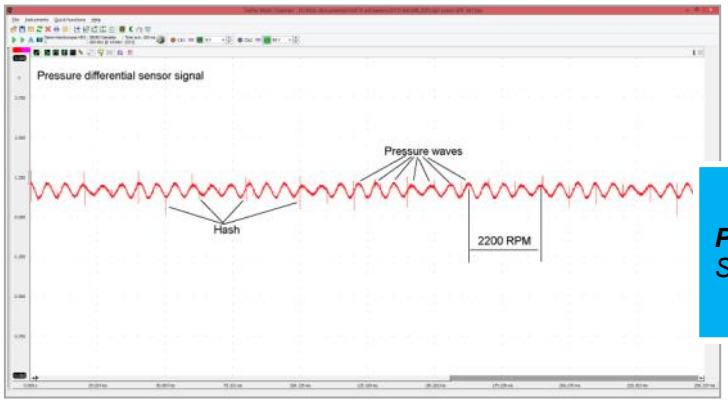
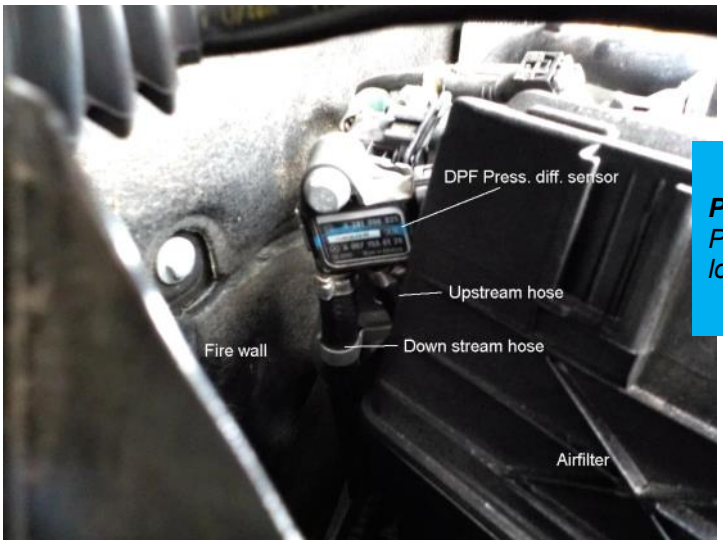


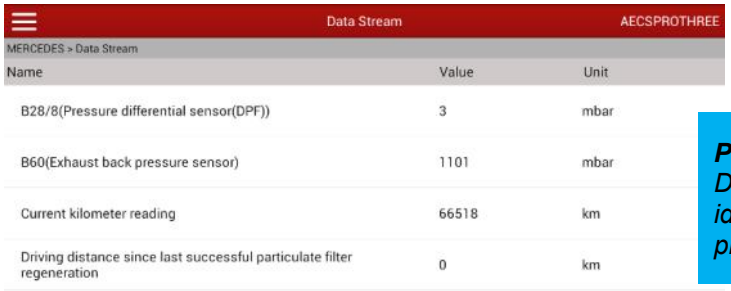
This was enough to have a look at the sensor's signal, after all it could be faulty.

Picture 6:
Signal sensor

The signal in picture 6 was measured when the engine was running fine, so inconclusive

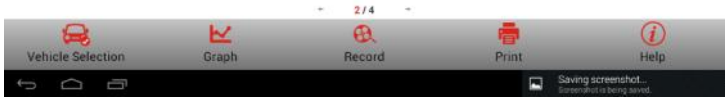


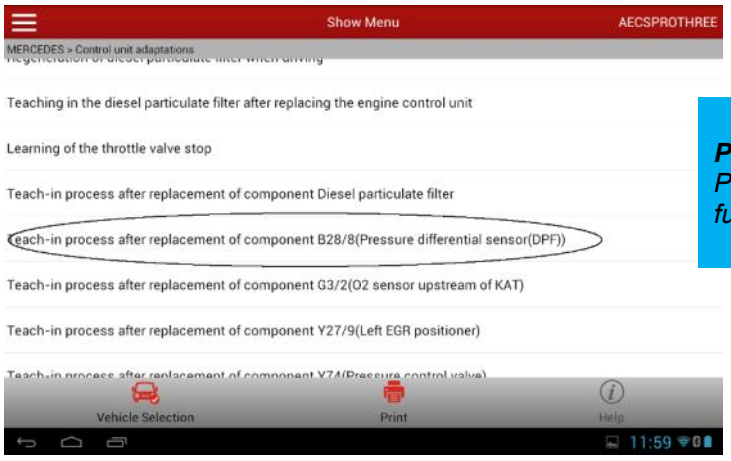
Picture 7:
Press diff sensor location.



Picture 8:
Data lines showing at idle no real differential pressure (3mbar).

Also the life data indicated no real problems:





Picture 9:
Press diff sensor learn function

It was decided to perform the function "pressure differential sensor adaption", to see if that would solve the issue.

Till now, no codes have been logged anymore in a period of two months driving.

Conclusion

Even late model vehicles have faults. No, you should not shy away from such vehicles, as long as you have the equipment, knowledge and backup to see you through. Equipment like the Launch is not expensive, yet it does give you full access to all these functions on late model upmarket cars. These cars do not get any younger, so very much sooner than later problems like this will arrive at your door step. Are you going to tell the person who has been trusting you for years with their work, to go away to another garage, just because you have not kept up? Will they ever come back once you have caught up? I know the effort we at AECS put into keeping up (and in some cases ahead). We are happy to share this knowledge with you through our training seminars throughout NZ and Australia!

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NB: Course dates subject to change, please check our website for current course dates.