

# DPFs

## Diagnostics & Testing



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***Diesel Help Australia***  
***Diagnostics & Training***

**[www.dieselhelp.com.au](http://www.dieselhelp.com.au)**



**Bulletin Number:** TB1087- DPF Diagnosis and Testing

**Bulletin Date:** January 2020 - revised July 14, 2022

**Models:** Engine applications fitted with a Diesel Particulate Filter (DPF)

**Symptoms:** DPF fault codes present, DPF light illuminating or flashing, vehicle experiencing performance issues.

**Failure/Issue:** Inability to clear DPF and related fault codes, performing DPF regenerations, misunderstanding of the DPF system and the diesel engine operation. Excessive and unnecessary DPF forced regenerations can cause additional soot and ash to remain trapped in the DPF. These particles grow and agglomerate and result in complete failure of the DPF.



## What is a Diesel Particulate Filter (DPF)?

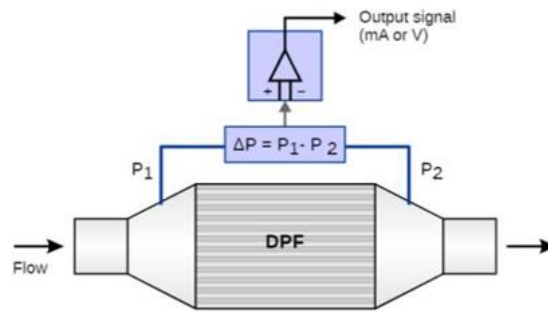
A DPF is an emission reduction component fitted to diesel engine applications to ensure they are compliant to Euro 5 emission standards. These include passenger cars, light commercial and heavy transport. For off road applications including earthmoving, agricultural and stationary applications using a diesel engine are fitted with a DPF to comply with Tier 4 Emissions.

A DPF is an exhaust filter and unlike other filters, it does not require regular replacement. Cleaning a DPF which is referred to as regeneration, is controlled by the engine computer unit (ECU) but only when the conditions are met or at intervals predetermined by the manufacturer. This regeneration is known to reduce emissions by increasing the engines combustion temperatures, thus removing harmful particles Nitrogen Oxide (NO), Hydrocarbons (HC) Carbon Dioxide (CO<sub>2</sub>).

## Regeneration

To perform a regeneration, the ECU DPF parameters are determined by monitoring both exhaust temperatures and pressures before and after the DPF which is located within the exhaust canister after the Diesel Oxidation Catalyst (DOC). Combining this information, the ECU uses an algorithm reference by calculating pressure, temperatures, drive time, previous service and regeneration frequency history. This in turn will determine soot accumulation, ash count and particulate matter (PM) amount. When reading these levels do not immediately think the DPF is blocked. Without accessing the vehicles OEM workshop manual, you will not be able to determine a safe level of ash count, soot accumulation or PM.

On most DPF systems, regeneration happens after diesel fuel is injected on the engines exhaust stroke. There



**Figure 1.** Schematic representation of differential pressure ( $\Delta P$ ) sensor

$\Delta P$  sensor measures the pressure drop across a DPF. The  $\Delta P$  signal is then used by the ECU to estimate soot mass inside the filter using calibration maps.

are other designs of DPF regeneration systems including AdBlue also known as Selective Catalyst Reduction (SCR), 5<sup>th</sup> injectors and vaporisers. These are covered in other technical bulletins and training provided by Diesel Help Australia. Refer to [TB1191 – Ford Everest AdBlue P204F, P20C1, P208A includes operation and diagnosis](#) and [TB1152 – Mazda BT50 UR 2016 fault code P244C DPF related](#)

An important feature of a DPF we focus on in this bulletin, is its capability to be used as a diagnostic tool to assist determining other issues on the diesel engine.

**Diagnosis and/or early detection of the fault:** Often when a DPF fault code is present, the technician wants to carry out a forced regeneration using the scan tool. This is not the recommended course of action and must not be performed during the diagnosis. This procedure does not fix the problem. It is important not to conduct a force regeneration whilst a vehicle is stationary unless instructed in the genuine OEM workshop manual. Without this information, you are at risk of damaging the DPF, Diesel Oxidation Catalyst (DOC), turbo and other engine components. A vehicle must meet the OEM parameters in most cases the vehicle is required to be in a driving motion. Check with your scan tool supplier support team if the OEM forced regeneration function is available.

1. During the initial scan, if there are any codes present other than a DPF related code, do not replace components without testing and confirming their operation first. When a fault code references a component description, the component itself is not often the failure.

2. A DPF related fault code present or the filter light illuminates on the dash, is informing the operator that a DPF regeneration has not been complete.
3. Use the scan tool data to determine when the previous regeneration took place or number of regens that have been performed since the previous service.



Mass Air Flow(g/s)	0.08	Regulating Valve Position Sensor(mm)	0.63
Mileage when the last time injection learning w...	0	Sedimentor Switch(On,Off)	0.28
Number Of DPF Regeneration(k)	0.36	Time Since Engine Start	0
Oxygen Sensor Activation Status	0	Turbocharger Compressor Inlet Pressure Sens...	6:13
Parking/Neutral Switch	Closed	Variable Fan Duty Cycle 2(%)	13
PM Accumulation Amount(g/l)	1413.00	Vehicle Speed(km/h)	0
PM Generation Amount	1887.00	Water Level Counts	0

4. Check the engine oil level. Is there excessive diesel fuel in the engine oil?
5. If yes, then use the previous information (refer to step 3) to determine whether this has been caused by excessive regenerations or other underlying issues.
6. An overfull sump does not necessarily mean the vehicle has been over regenerating especially if it is only oil that has caused the sump to be overfull.
7. To determine if the sump is over full of diesel fuel or oil, conduct an oil dilution test. Refer to [Instructional video 2 – Testing for oil dilution – diesel fuel in the oil.](#)
8. If the sump is filling quite rapidly with diesel fuel and a regeneration has not been performed recently, investigate other dilution issues. These include an undetected internal fuel leak, stretched timing chain, valve clearances, low engine compression or a catch can has been installed.
9. Using the scan tool data, locate the differential pressure readings and record.
10. To confirm the differential sensor is operating correctly, compare pressure readings on the scan tool with a calibrated analogue pressure gauge. Diesel Help Australia can provide you with the correct tool for this test- [DPF & Turbo Boost Test Kit.](#)
11. Using a T connector, install gauge before the differential pressure sensor into the hose closest to the engine side of DPF. Do not mistake the differential sensor with exhaust back pressure sensor.
12. **DPF pressure specifications-**  
**Idle:** no greater than 1.0 Kpa  
**No load cruising:** No greater than 6 Kpa



**Under load:** No greater than 20 Kpa

13. If the pressures do not match the scan tool data, first check the feed hoses are clear, not damaged and installed the correct way. How dependable is this analogue gauge method?

Case study: Mitsubishi Outlander P1499 DPF High temp, P1299 VGT low pressure codes. A split pipe was replaced and several forced regens later, a P244A DPF Differential pressure too low appeared. The scan tool read 14kpa under load and the gauge was reading 96kpa.

14. Test all DPF temperature sensors are working. This can be done using a temperature reading gun to confirm the figures correspond with the scan tool data. Alternatively read the voltage output. Some DPFs use Radio Frequency (RF) Based Soot Sensors.

15. We have technical bulletins relating to failed temperature sensors on specific vehicles which can assist in assessing these temperature sensors:

[TB1139 – VW Amarok P0544 Exhaust temp sensor 1 – circuit malfunction P2463 DPF soot accumulation](#)

[TB1140 – Toyota Hiace P242D Exhaust Gas Temp sensor 3 circuit high](#)

### **Solution:**

- Once you have confirmed the cause of the DPF code whether it is a part failure- replace if necessary, or an adjustment is required or cleaning of the intake and EGR system due to excessive carbon, make sure you determine if the DPF is required to be removed and cleaned.
- Remove the entire DPF for full inspection. With the DPF in place on the vehicle you cannot see what has collapsed internally. From one end to another the DPF looks perfectly fine inside. It's the internal substrate that often fails.
- We can only recommend that you have a professional DPF cleaner carry out the clean. They are the only ones with the appropriate cleaning and flow testing facility to determine if a replacement DPF will be required or just a clean.
- Alternatively, if you are confident, you can obtain successful results without sending the DPF away for cleaning, ensure you use an approved DPF cleaning liquid.
- Once you are satisfied the DPF is clean, clear and ready for use (refitted or replaced), repeat pressure and temperature test. If the sensors are not reading correctly, replace them as necessary.
- If a new or reconditioned DPF is being fitted, replace all sensors.
- Use your scan tool to readapt and code all items before starting the engine.
- In some cases, it may be required to carry out a regeneration after readaptation. A passive regeneration must be performed (only in extreme cases where the passive regen criteria cannot be met) should you consider a forced regen.
- Passive regeneration procedure: Drive the vehicle at a constant speed of approx. 80kmh with the rpm between 1800 and 2200 for 20 minutes. Do not fluctuate the revs, do not try to go full revs or change rpm if possible. You may be required to select a lower gear to ensure correct speed and rpm are obtained.

**Special notes:** Do not tamper, delete, or remove emission systems components such as DPF and EGR. Removing these components is not diagnosing or resolving the fault. Australian laws prohibit this action, and anyone found guilty of this activity will face harsh penalties. The DPF must assist to meet stringent world emission requirements, thus reducing the impact of harmful carcinogens on human, animal, and plant life. Diesel exhaust is a Group 1 carcinogen, which causes lung cancer and has a positive association with bladder cancer.



# DPF & TURBO BOOST TEST KIT

**The DPF & Turbo Boost Test Kit is designed & developed by Diesel Help Australia**




To avoid misdiagnosis and confirm the system is operating within specification, connecting an analogue gauge will provide accurate readings to compare with scan tool data.

DPF & turbo boost kit is a valuable diagnostic test as the two components often influence each other. For example if the DPF blocks, a turbo will not be able to produce adequate boost pressure. whilst in the event of a turbo failure a DPF blockage may occur as a result.

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### Not all mechanics signed up for diesel



In the past 10 years there has been a significant increase in the number diesel-powered passenger vehicles on our roads. The majority of these being the more advanced common rail diesel fuel system. This has resulted in a sharp increase in the number of general mechanical workshops servicing diesels.

Mechanics are finding themselves in unfamiliar territory having to diagnose issues with diesel engines. Access to some of the best diagnostic scan tools is at times proving to be a difficult task, especially if there are no fault codes and little knowledge of what vehicle data you should be looking for.

Diesel Help Australia is just a phone call away for members. We will help you systematically work your way through a proven process to arrive at the source of the problem, and provide you with the best solution.

For more information visit [www.dieselhelp.com.au/joindieselhelp](http://www.dieselhelp.com.au/joindieselhelp)