GENERAL SERVICE BULLETIN
Diesel Particulate Filter (DPF) – Diagnostic Information

23-7072
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Model:

Ford 2019-2020 Mondeo	Engine: 2.0L EcoBlue
2021-2022 Ranger	Engine: 2.0L EcoBlue

Summary

This communication provides technical information to aid understanding of the DPF system, operation and diagnostic on vehicles with **2.0L EcoBlue engine**. All vehicles have Symptom Based Diagnosis (SBD) that utilize the same logic as this guide and SBD should be used for DPF diagnostic whenever possible.

DPF SBDs will be offered if DTCs P2463 , P246C, P2002, P2453, P2454, P2455 and P2456 are stored in the Powertrain Control Module (PCM).

Using symptoms: **Driver Aids and Information -> Warning Indicators/Messages/Chimes -> Indicators /Warning Indicators -> Engine**

Service Instruction

Content:

General Information

Symptom Based Diagnosis (SBD) will give guidance and a possible RVC-A for DPF component or regeneration. If the SBD does not indict the DPF it does not require replacement, or the diagnostic has not been able to establish all required conditions, e.g. previously cleared DTCs.

If the SBD indicts DPF regeneration, do NOT replace the DPF.

DPF replacement claims instead of DPF regeneration Repair Validation Code RVC-A and RVC-T claims for wrongly indicted components may be returned.

Diesel engines produce soot when fuel is burned, the DPF has the job of storing the soot and when vehicle conditions are correct, a process called DPF regeneration is performed, this process is autonomous and happens when soot loading in the DPF is above a calibrated threshold, engine temperature and vehicle speed thresholds are met. The process of a DPF regeneration involves very high temperatures across the DPF to ensure the soot is fully burned off.

On early vehicle program applications (DV6/DW10B/DW10C and Puma engines) there were three DTCs that could have been triggered that indicated the health of the DPF, these were:

- **P246B** - Vehicle Conditions Incorrect for Particulate Filter Regeneration. This DTC gives a warning in the instrument cluster advising drive to clean.
- **P246C** - Particulate Filter Restriction - Forced Limited Power (Bank 1) This DTC means that the DPF regeneration can only be performed by the service tool.
- **P24A4** - Particulate Filter Restriction - Soot Accumulation Too High (Bank 1). This indicated the DPF needed to be replaced.

Advancements in DPF technology on later vehicle programs no longer requires the Replace DPF DTC **P24A4**. This DTC is no longer used as the DPF can be regenerated at much higher soot loads.

The current DTC strategy used is:

- **P2463** - Vehicle Conditions Incorrect for Particulate Filter Regeneration. This DTC gives a warning in the instrument cluster advising drive to clean.
- **P246C** - Particulate Filter Restriction - Forced Limited Power (Bank 1). This DTC means that the DPF regeneration can only be performed by the service tool.

Current DTC strategy - Example

PT Level	Soot Level	Dealer Action	Standard Customer Messaging (Non OCR)	Engine Reactions	OBD	
					Telltale	DTC
3	> 200%	Service regen and check for root causes	Exhaust filter over limit Service now	EGR off + Torque lim		P246C
2	165 - 200%	None	Exhaust filter at limit Drive to clean	EGR off*	*	P2463

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The static regeneration can be performed even when soot loads are above 300%. This negates the need to replace the DPF.

Many things can contribute to the soot generation, these being:

- Quality of fuel used
- Blocked cold end exhaust or collapsed Baffles in the exhaust silencer
- Damaged/restricted exhaust pipe
- Customer drive cycle – meaning long idle times/short journeys -conditions are not correct for passive regeneration
- Exhaust Gas Temperature (EGT) sensors swapped, meaning EGT1 in EGT2 location, EGT2 in EGT1 location
- Blocked/damaged DPF Hose
- In range DPF pressure sensor failure
- Inhibiting DTCs

Soot levels are calculated from many engine inputs and is also inferred from the DPF pressure sensor.

- Open loop soot utilizes the PCM calculated model
- Closed loop soot uses the DPF pressure sensor

Depending on the type of drive cycles performed there can be slight differences in open and closed loop soot percentages.

Diagnosing DPF issues

To correctly diagnose DPF issues an understanding of the issue is needed.

- Is the fault attributed to driving style?

• Are there any other DTCs that could impact the DPF soot loadings and Soot loading calculations?

• Are there any DTCs relating to airpath actuators, EGTs etc Is there any physical damage to the DPF or exhaust system?

• Is Open loop soot significantly greater than Closed loop soot, this could be indicative of an air leak or a hose adrift/split off the DPF pressure sensor?

• Is the Closed loop soot significantly greater than the Open loop soot?

The PCM stores the last ten distances when the DPF was regenerated as well as indicating any failed regenerations, if the vehicle had attempted many regenerations this will also severely impact oil quality as the oil will degrade quicker if the DPF is continually attempting to regenerate and failing to complete. Oil quality is also impacted if the vehicle is equipped with the Operator Commanded Regeneration (OCR) (“Disable/Enable Diesel Particulate Filter Manual Regeneration”) function.

The following list of DID = Data Identifiers (DIDS) will assist in correctly diagnosing DPF issues:

DIDS - Table 1

FDRS Datalogger Name	Text
DIST_LST_REGEN1	Buffer Of 10 Last Distances Traveled By Vehicle Between Diesel Particulate Filter (DPF) Regeneration Events
DIST_LST_REGEN2	
DIST_LST_REGEN3	
DIST_LST_REGEN4	
DIST_LST_REGEN5	
DIST_LST_REGEN6	
DIST_LST_REGEN7	
DIST_LST_REGEN8	
DIST_LST_REGEN9	
DIST_LST_REGEN10	
PF_SOOT_PCT_CL	Diesel Particulate Filter (DPF) System Percentage of the Maximum Soot Loading - Inferred Closed Loop
PF_SOOT_PCT_OL	Diesel Particulate Filter (DPF) System Percentage of the Maximum Soot Loading - Inferred Open Loop
PF_OUTP	Diesel Particulate Filter (DPF) Bank 1
DPF_DP	
DPF_INP	

DIDS - Table 2

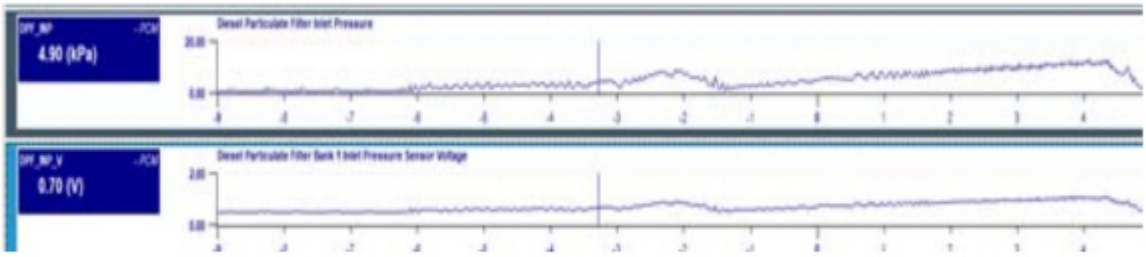
FDRS Datalogger Name	Text
DPF_INP_V	Diesel Particulate Filter Bank 1 Inlet Pressure Sensor Voltage
EGT11	Exhaust Gas Temperature (EGT) Bank 1
EGT12	
DPF_FAILD_DESOX	Number Of Consecutive Failed Exhaust System Regeneration Events Since Last Successful Regeneration Event
DPF_FAILD_REGEN	
DPF_FAILD_DENOX	
DIST_LAST_DESOX	Distance Traveled Since Last Attempted Or Successful Exhaust Gas Regeneration/Purge Event
DIST_LAST_REGEN	
DIST_LAST_DENOX	

FDRS Datalogger Name	Text
RUNTM_LAST_DESOX	Time Engine Running Since Last Exhaust System Regeneration/Purge Event
RUNTM_LAST_REGEN	
RUNTM_LAST_DENOX	
RUNTM_AVG_DESOX	Average Time Engine Running Between Exhaust System Regeneration/Purge Event
RUNTM_AVG_REGEN	
RUNTM_AVG_DENOX	
OIL_REMAINING	Engine Oil Life Remaining
OIL_FUEL_INF	Current Fuel Dilution Of The Engine Oil - Inferred

To determine if the Exhaust Gas Temperature (EGT) sensors are in the correct orientation within the DPF, it is advisable to start from a cold engine reading the EGT sensors at this point will show them to be at 100° C, increase the RPM and continually monitor the EGTs, the first to move from 100° C is EGT1.

To determine if the DPF pressure sensor is not stuck in range connect a suitable hand pressure pump to the rubber hose leading to the DPF pressure sensor, start datalogger and select **DPF_INP_V** signal, whilst monitoring the **DPF_INP_V** signal, apply pressure slowly, the voltage should increase in a linear fashion, if it fails to increase it could be indicative of an in range failure of the DPF pressure sensor.

Example of a correctly functioning DPF pressure sensor



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DPF Errors

If a DPF malfunctions it will in only do so through two error states,

- Soot overload
- Cracked DPF brick

Soot overload

The DPF is a passive device which filters out diesel particulates. As there is nothing more than a passive filter the internal component does not go wrong, soot overload is not a fault with the DPF but another issue that is not allowing the control system to regenerate the filter. Many serviceable DPFs have been replaced and it would have appeared that the fault is corrected but as the root cause has not been established and corrected the DPF will overload again.

For vehicles with an AdBlue® injector the DPF assembly includes a N0x conversion catalyst, although the two functions are performed by the same part, the diesel particulate filtration is not effected by Adblue® system errors, nor Adblue® / N0x conversion effected by particulate filtration.

DPF regeneration increases the temperatures within the DPF up to 650° C , if the control system cannot collect all of the data required it inhibits regeneration for safety, mostly all of the faults that can inhibit DPF regeneration will set the MIL light, if the vehicle is continued to be driven with an inhibiting fault the DPF will overload with soot.

Cracked DPF brick

For all Ford EU 6.2 DPFs the visible front face from the engine side of the DPF assembly is the catalyst this is before the filter part of the DPF assembly, so soot deposits are expected here and does not indicate that the DPF is faulty.

If the DPF is cracked, these cannot be seen from external examination or via an endoscope, the DPF brick cracks within the metalwork, the rear face of a DPF will not show if the DPF has cracked. Ford Motor Company have to X-ray DPF assemblies to understand if the DPF is cracked.

For EU 6.2 vehicles there is a particulate matter sensor, this is calibrated to assess if the DPF is letting high levels of particulate through, DTC P2002 will set with a status byte of 80 or greater, the DPF, in this instance is confirmed as allowing too much particulate through and must be replaced. If the status byte of P2002 is 7F or below this is only an indication that some particulate matter has been detected but not greater than allowed, in this instance the DPF should not be replaced.

Diagnostic Trouble Codes (DTCs) and DTC Status byte

Internal DTC status's are constantly monitored, each one is assigned to monitor a function or component of the Powertrain Control System, many of the DTCs are not instant and require certain conditions, time or occurrences to allow the correct monitoring for that DTC. Clearing the DTCs removes the diagnostic history and does not allow correct analysis of any issue. The same logic as above is not necessarily followed for all DTCs, some are informative or an indication of state, however DTCs that illuminate the MIL must be attended to and corrected before the vehicle can be returned to customer use.

All current production Diesel EU6 and above have had changes made to the internal DTC releasing criteria, these changes will now only release bit 5 of the DTC status after 255 cycles, prior to EU6 the status bit 5 was cleared in 40 cycles. This means that the DTC can be in the PCM memory longer than its predecessor, just because a DTC is present and not illuminating the MIL does not mean that a fault is present, utilize snapshot data to ascertain how long ago or how much distance had been covered when the DTC set.

- Status byte example: P2002-00-E4 – the last two digits of the DTC are the status byte, if this starts with a value of 7 or below the DTC is not confirmed. If the status starts with 8,9,A,B,C,D,E or F then the DTC is confirmed.

A complete list of inhibiting DPF regeneration DTCs is below. Not all vehicle programs will have the same DTCs, the list below is consolidated from all power packs and is for information only.

DTC's that will inhibit DPF Regeneration											
P0045-00	P004B-0E	P0089-00	P0118-00	P026E-00	P02E3-12	P0403-4B	P0489-11	P1103-00	P226C-00	P2398-00	P2560-68
P0045-13	P004B-13	P0089-17	P0191-00	P0299-00	P02E4-00	P0404-00	P0490-00	P1103-22	P226D-00	P2399-00	P2564-00
P0046-00	P004B-14	P0089-18	P0192-00	P2B83-00	P02E5-00	P0405-00	P0490-12	P115A-00	P226D-68	P239B-00	P2565-00
P0046-01	P004C-00	P00BC-00	P0193-00	P0299-84	P02E8-00	P0406-00	P2BC2-00	P115B-00	P22CF-00	P239B-4B	P2598-00
P0046-19	P004C-0B	P00BD-00	P0194-00	P02CA-00	P02E9-00	P0420-00	P04DD-00	P1933-00	P22CF-13	P261B-00	P2598-72
P0047-00	P261C-00	P0100-00	P0219-00	P02CB-00	P0300-00	P042E-00	P04DE-00	P200C-00	P22D0-00	P242B-00	P2599-00
P0047-11	P004D-00	P0102-00	P0234-00	P02E0-00	P0301-00	P042F-00	P0544-00	P200C-68	P22D0-0A	P242C-00	P2599-73
P0048-00	P004D-11	P0103-00	P0234-85	P02E0-13	P0302-00	P045A-00	P0545-00	P200C-92	P22D1-00	P242D-00	P259A-72
P0048-12	P0069-00	P0104-00	P0237-00	P02E0-19	P0303-00	P045A-13	P0545-16	P2031-00	P22D1-10	P244A-00	P259B-73
P004A-00	P0069-21	P0107-00	P0238-00	P02E0-4B	P0304-00	P045A-19	P0546-00	P2032-00	P22D6-00	P2453-00	P259E-00
P004B-04	P0069-22	P261D-00	P023A-00	P02E1-00	P2BC1-00	P045C-00	P0546-17	P2032-16	P22D6-1C	P2453-84	P259F-00
P004B-05	P006A-00	P0108-00	P023B-00	P02E1-16	P0403-00	P045C-11	P06A6-00	P2BC3-00	P22D7-00	P2454-00	P261A-00

DTC's that will inhibit DPF Regeneration											
P004B-07	P007B-00	P0116-00	P023C-00	P02E2-00	P0403-13	P045D-00	P06A7-00	P2033-00	P22D7-19	P2455-00	-
P004B-08	P007C-00	P0116-1F	P0244-00	P02E2-11	P0403-16	P045D-12	P1102-00	P2033-17	P2394-00	P2456-00	-
P004B-0D	P007D-00	P0117-00	P026A-00	P02E3-00	P0403-19	P0489-00	P1102-21	P2084-00	P2395-00	P2560-00	-

Replacement of DPF components

If the DPF is replaced, it is important that the correct service functions are carried out once the physical component is replaced. Failure to carry out the applicable service functions can result in further issues, this is due to the previous adapted values of the component being stored in the PCM, this is particularly important in the case of the combined DPF/SCR systems.

In the service tool, the reset routines are listed as:

- **Reset the Selective Catalytic Reductant (SCR) System Learned Values** – Combines SCR reset and DOC reset. Should be run when the SCR catalyst is replaced.
- **Reset the Particulate Filter Learned Values** – Should be run when the DPF is replaced, is also required when the combined SCR/DPF is replaced.
- **Reset the Diesel Particulate Filter (DPF) Pressure Sensor Learned Values** – Should be run if the DPF pressure sensor is replaced.