DETROIT™

Service Information Bulletin

NUMBER: S**.M. REF.:** See Table **ENGINE:** DD Platform **DATE:** September 18

Subject: Heavy Duty Aftertreatment Failure Guide

ADDITIONS, REVISIONS, OR UPDATES

Publication Number	Platform	Section Title	Change
DDC-SVC-MAN-0208	DD Heavy Duty	HD Platform Aftertreatment Failure Guide A Note on Warranty Design of the Aftertreatment Service Advisor Questionnaire Identifying Codes of Interest Duty Cycle DPF Maintenance – Optimal Duty Cycle Warranty History– Optimal Duty Cycle DPF Maintenance – Less Than Optimal Duty Cycle Warranty History– Less Than Optimal Duty Cycle DPF Maintenance – No Codes of Interest Warranty History– No Codes of Interest Upstream Failure Check List DPF Maintenance Check List Duty Cycle Check List Previous Failures Check List Degraded SCR Check List Appendix How to identify a fault code time stamp How to identify DPFs serial numbers How to view warranty history	New manual

NOTE: Page numbers are based on the most recent version of the individual publication and may be adjusted throughout the annual print cycle.

Heavy Duty Aftertreatment Failure Guide

NOTE: Do not complete this guide unless directed to by the troubleshooting manual.

The purpose of this failure guide is to help repair outlets identify the root cause of aftertreatment failure on a DD Platform engine. This is an educational resource guide to enhance knowledge of these failures.

Prior to following this guide, all applicable symptom and/or fault code troubleshooting should be completed. This includes any active or inactive aftertreatment, fuel system, engine combustion, EGR and air system codes, which were present at the time the vehicle arrived.

This failure guide will assist in determining the following root causes of aftertreatment failure:

- Upstream Failures
- Poor DPF Maintenance
- Less than Optimal Duty Cycle
- Previous Upstream Failures
- Degraded SCR

Determining the root cause or Primary Failed Part (PFP) is necessary before deciding responsibility for the failure and making a proper repair. It is important to know that accurate failure analysis can be a time consuming exercise and is more of an investigation than a diagnosis.

This information applies to all EPA10/GHG14/GHG17 DD13, DD15 and DD16 On-Highway engines.

The flow chart below is a representation of the different paths this failure guide can take the reader on.

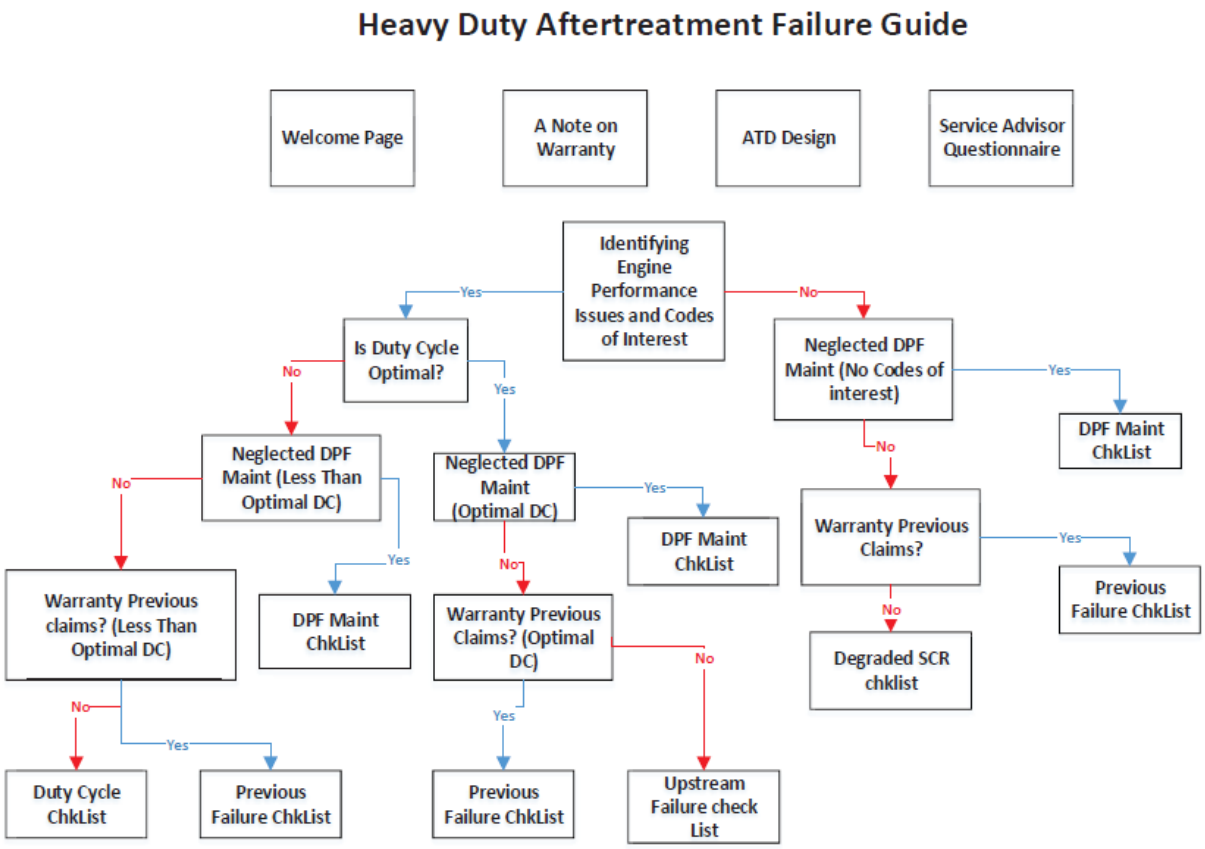


Figure 1.Aftertreatment Failure Guide Overview

A Note on Warranty

Detroit™ Warranty covers aftertreatment repairs to correct any malfunction occurring during the warranty period resulting from defects in material or manufacturer workmanship of a Detroit product. Determining the root cause of failure or Primary Failed Part (PFP) is essential in determining the warranty eligibility. There are several factors that should be considered when determining the PFP and its failure mode. These factors include:

Workmanship

- Refer to the service policy manual for how to proceed in repairs with a failure that is a result of improper workmanship by a service outlet.

Contaminated fluids. Examples include, but are not limited to:

- Contamination as a result of the incorrect fluid being added to the unit.

Operator-induced failures, abuse, negligence or certain modifications. Examples include, but are not limited to:

- Misapplication, misuse, or storage damage.
- Failing to follow the correct maintenance schedule.
- Failure due to a modification exceeding Detroit specifications.

Accidents or acts of nature. Examples include, but are not limited to:

- Flood damage.
- Hurricane damage.
- Lightning damage.
- Vehicular accidents.

The above are some examples of situations that would exclude the failure from warranty eligibility.

If the failure is identified to be eligible for warranty, the unit should be restored to operating condition by repairing or replacing only the defective or damaged parts that are necessary, according to the terms of the appropriate warranty statement. Other parts removed in the repair process will be reinstalled as is, unless the user authorizes the additional expense. The intent of a warranty repair is to repair or replace the warranted parts and restore the rest of the engine and aftertreatment to its operating condition prior to the warrantable failure, not to restore the engine and aftertreatment to like-new condition.

Design of the Aftertreatment

Each Aftertreatment configuration consists of a Diesel Oxidation Catalyst (DOC), Diesel Particulate Filters (DPF) and a Selective Catalytic Reduction (SCR) Catalyst. A description and operation of each of these components is below:

Diesel Oxidation Catalyst: The DOC assists in elevating temperatures into the DPF to initiate the regeneration process. Fuel is injected into the exhaust by the Hydrocarbon (HC) fuel dosing system. The injected fuel is oxidized in the DOC, which raises the temperatures above passive mode operating temperatures.

Diesel Particulate Filter: The DPF substrate is comprised of a ceramic material. The substrate consists of channels that run the full length and are blocked off at alternate ends to force the exhaust through the porous walls. As the DPF collects ash and soot and the exhaust temperature reaches the appropriate level, oxidation of the soot occurs. This process is called DPF Regeneration.

The key to a successful regeneration is elevated exhaust temperatures for extended periods of time. This is achieved automatically by the engine electronic system while being driven over the road. Without adequate exhaust temperatures for regeneration, the filter will become saturated with soot and a parked regeneration will be requested. If the driver ignores this request and continues driving, the engine electronic system will initiate a derate, and will eventually shut down the engine, therefore requiring a parked regeneration to continue driving. In cases where the DPF zone reaches zone 4, a parked regeneration is required.

Selective Catalytic Reduction Catalyst: The SCR catalyst converts a mixture of nitrogen oxides and Diesel Exhaust Fluid (DEF) into nitrogen and water. DEF is pressurized by a pump and is then sprayed into the exhaust between the DPF and the SCR catalyst within the SCR hydrolysis chamber.

Service Advisor Questionnaire

The following is a questionnaire for the service advisor to obtain information from the driver. Detroit understands the driver may not always be available or may not know the answers to all of these questions. This is simply an attempt to gather more information that could help with determining the root cause of the failure.

1. Where did the failure occur? (physical location)
   _____
   _____
   _____
   _____
2. Are there any complaints of excessive oil or coolant consumption?
   _____
   _____
   _____
   _____
3. Were there any abnormal issues prior to the failure? Please describe.
   _____
   _____
   _____
   _____
4. When and where was the last Diesel Particulate Filter (DPF) change performed?
   _____
   _____
   _____
   _____
5. Were there any recent repairs? Please describe.
   _____
   _____
   _____
   _____
6. Has the truck been in any recent accidents or sustained any damage? Please describe.
   _____
   _____
   _____
   _____
7. Any other helpful information?
   _____
   _____
   _____
   _____

Identifying Engine Performance Issues and Codes of Interest

Prior to following this guide, all applicable engine performance issues and/or fault code troubleshooting should be completed. This includes any active or inactive aftertreatment, fuel system, EGR and air system codes, which were present at the time the vehicle arrived.

A review of fault codes data (**within the last year**) must take place to identify any code that could relate to plugging or over-temperatures failure. Fault Code History (also referred to as Datamining), DiagnosticLink and Virtual Technician fault code information should be reviewed to identify any codes of interest.

Codes of Interest for ATS Failure or Plugging

SPN	FMI	Description
3246*	0	Diesel Particulate Filter Outlet Temperature - Very High
3246	15	Diesel Particulate Filter Outlet Temperature - High
4363	0	Selective Catalyst Reduction Outlet Temperature High
3250	0	Diesel Oxidation Catalyst Outlet Temperature Very High
3250	15	Diesel Oxidation Catalyst Outlet Temperature High
3556	0	Regeneration Temperature - Out of Range High
3556	1	Regeneration Temperature - Out Of Range Low
2631	1	Low Air Flow
3556	18	Diesel Oxidation Catalyst Outlet Temperature Low (Low Temp Regeneration)
3251	0	Diesel Particulate Filter Pressure Out of Range Very High
3251	16	Diesel Particulate Filter Pressure Out of Range High
3251*	20	Diesel Oxidation Catalyst Inlet Pressure - Not Plausible
3251**	2	Diesel Oxidation Catalyst (DOC) Inlet Pressure - Not Plausible
102	18	Intake Manifold Pressure Too Low
2659	0	Exhaust Gas Recirculation Flow Target Error Diagnostic - High Flow
3720***	15	DPF Ash Clean Request

(*) If this code logged the DPFs should have been replaced.
(**) Indicates EPA10 ATS code only
(***) If only this code is active refer to section “DPF Maintenance – Check List”.

Figure 2. Sample code list

It should be noted that a fault code may not be directly associated with the failure event. The time stamp and number of occurrences must be evaluated with relation to the time of the failure in question (for information on how to review fault code time stamp click here). A high occurrence of a code above could indicate a duty cycle issue or a failure to an upstream component. The cause of the plugging or over-temperatures code needs to be identified before replacing the Aftertreatment. There are two main causes for plugging:

1. A less than optimal duty cycle.

2. An upstream engine issue that effects the air/fuel ratio.

Fault Code History (Datamining)
Use DiagnosticLink to review Datamining information by going into the Fault Code History tab in DiagnosticLink. Compare the Fault Code History codes to the list of codes in Table 1.

DiagnosticLink Log File
During initial diagnostics, a log file should have been created/ reviewed. Review and record fault codes.

Virtual Technician

If the vehicle is equipped with Virtual Technician (VT), the VT Dashboard can be a valuable tool for accessing historical fault code data. Certain aftertreatment codes can store log files that may help with determining the cause of the failure. VT can also provide the geographical location of the failure, if fault codes were logged. The VT Dashboard can be found in Access Freightliner.

Check the powertrain modules software levels and make sure the vehicle's software package is up to date, if necessary update to the latest software level.

Were any engine performance issues/or codes of interest identified within the last year?

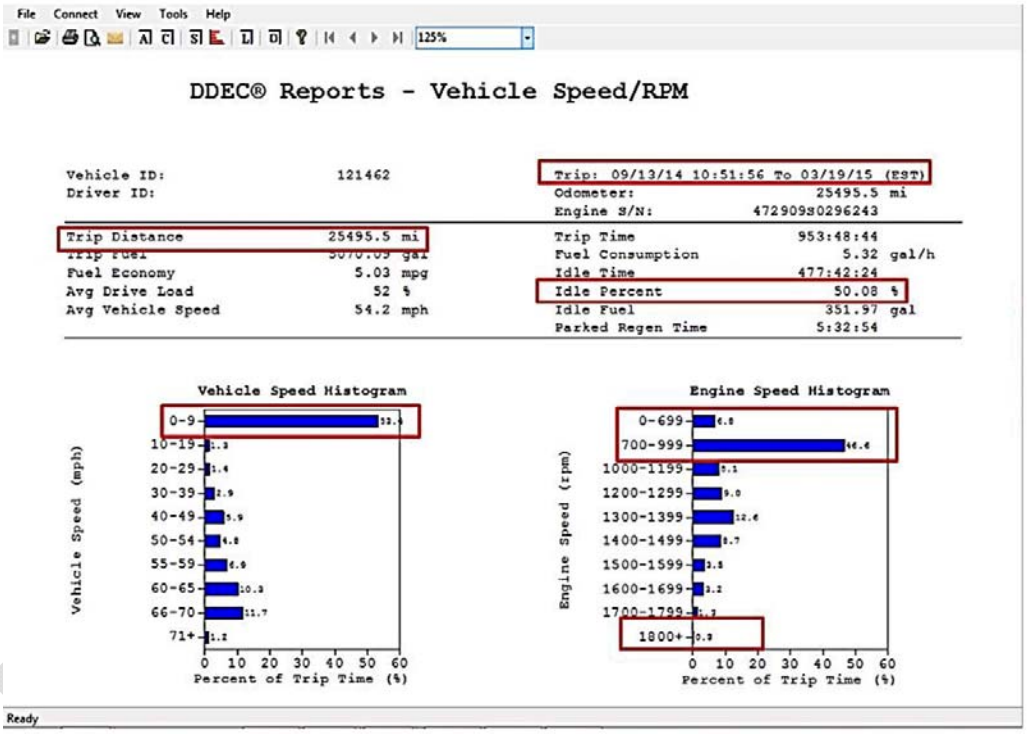
- ☐ Yes; refer to section "Duty Cycle".
- ☐ No; refer to section "DPF Maintenance – No Codes of Interest".

Duty Cycle

DDEC Reports

Obtain and review DDEC reports. Reviewing DDEC reports can help determine the duty cycle of a unit. Refer to section "How to Retrieve DDEC Reports"

Review the duty cycle in the DDEC reports for “Monthly Data”, “Trip Data” and “Life to Date Report Data” (click on view and change to time cycle view).



Required Information:
- Trip Dates
- Trip Distance
- Idle Percent
- 0-9 mph Percent
- 0-999 rpm Percent
- 1800+ Percent

d500255

Figure 3. Sample DDEC Report-Vehicle Speed/RPM

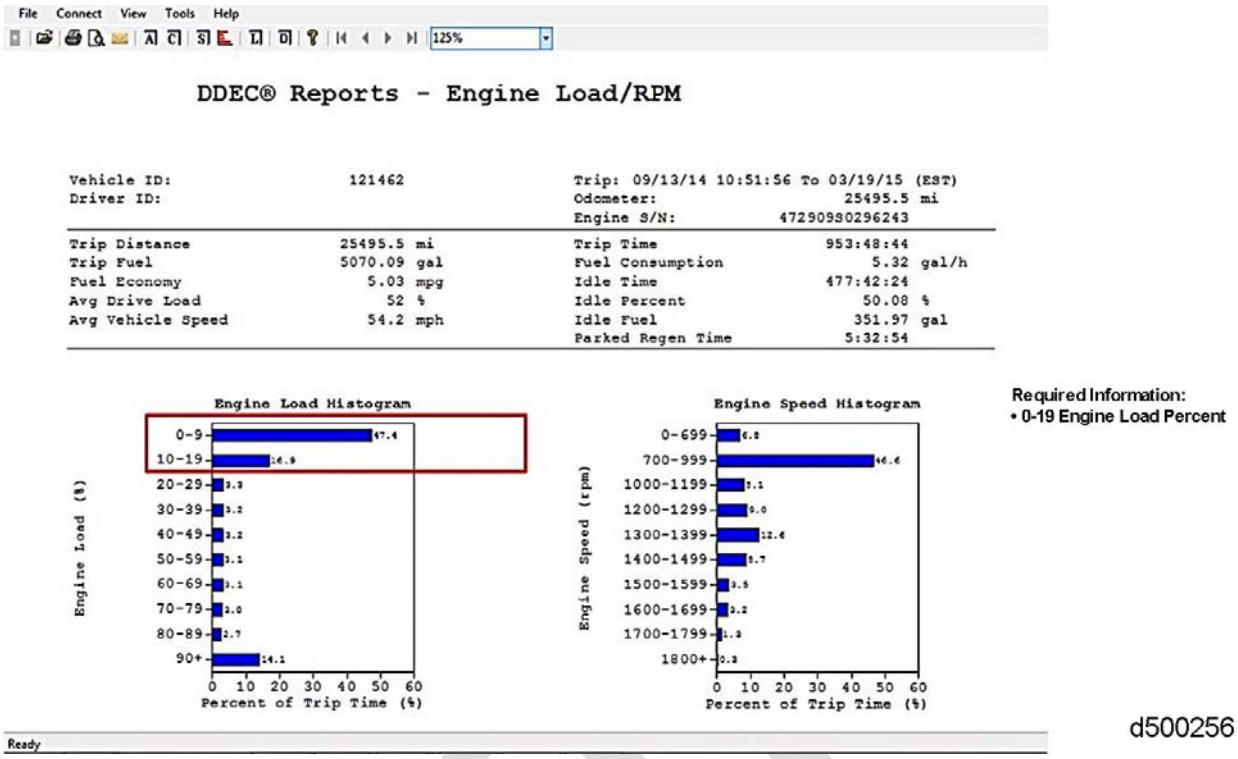


Figure 4. Sample DDEC Report-Engine Load/RPM

Use DDEC Reports to fill in the chart below:

	Monthly Data	Trip Data	Life to Date Report Data
Average vehicle speed			
Average drive load			
Idle percentage			
Percentage of operation between 30-65 mph (Vehicle Speed Histogram)			
Percentage of operation above 1,200 rpm (Engine Speed Histogram)			
Percentage of operation below 1,800 rpm (Engine Speed Histogram)			
Percentage of operation below 1,800 rpm (Engine Speed Histogram)			
Percentage of operation below 19% engine load (Engine Load Histogram)			
Percentage of Driving Regenerations. [Driving Regens / (Driving Regens + Parked Regens)] = Driving Regen Percentage			
Percentage of Parked Regenerations. [Parked Regens / (Driving Regens + Parked Regens)] = Parked Regen Percentage			

Duty Cycle

Review the tables below to determine whether the unit has an “optimal” or “less than optimal” duty cycle.

EPA10 and GHG14 Engines

Duty Cycle	Average Vehicle Speed	Average Drive Load	Idle Percent	Vehicle Speed Histogram	Engine Speed Histogram	Engine Load Histogram	Driving/Parked Regenerations
"Optimal"	40 to 65 MPH	30% and above	Less than 40%	50% or more between 30 to 65 MPH	50% or more above 1200 RPMs and below 1800 RPMs.	50% or more of the time above 20% engine load	75% driving/25% parked
"Less Than Optimal"	Below 40 MPH	Below 30%	40% and above	50% or more below 30 MPH	50% or more below 1200 RPM or 2% or more above 1800 RPMs.	50% or more of the time below 19% engine load	25% driving/75% parked

* Duty cycle is considered "Optimal" unless 2 or more categories fall into "Less Than Optimal" in a given time period.
* It is important to look at “Monthly Data”, "Trip Report Data" and "Life to Date Report Data".
* Duty cycle does not determine warranty coverage. Submit a warranty inquiry sheet to determine warranty coverage.
* The duty cycle specifications above are related to aftertreatment health only and are NOT related to optimal fuel economy.
* These are general guidelines and are not rigid rules with no exceptions.

GHG17 Engines

Duty Cycle	Average Vehicle Speed	Average Drive Load	Idle Percent	Vehicle Speed Histogram	Engine Speed Histogram	Engine Load Histogram	Driving/Parked Regenerations
"Optimal"	40 to 65 MPH	30% and above	Less than 40%	50% or more between 30 to 65 MPH	**DD13** - 50% or more above 1200 RPM and below 1625 RPM (Below 1800 RPM when in PTO). **DD15** - 50% or more above 1200 RPM and below 1625 RPM. **DD16** - 50% or more above 1200 RPM and below 1800 RPM.	50% or more of the time above 20% engine load	75% driving/25% parked
"Less Than Optimal"	Below 40 MPH	Below 30%	40% and above	50% or more below 30 MPH	50% or more below 1200 RPM or 2% or more above 1800 RPMs.	50% or more of the time below 19% engine load	25% driving/75% parked

* Duty cycle is considered "Optimal" unless 2 or more categories fall into "Less Than Optimal" in a given time period.
* It is important to look at “Monthly Data”, "Trip Report Data" and "Life to Date Report Data".
* Duty cycle does not determine warranty coverage. Submit a warranty inquiry sheet to determine warranty coverage.
* The duty cycle specifications above are related to aftertreatment health only and are NOT related to optimal fuel economy.
* These are general guidelines and are not rigid rules with no exceptions.

Figure 5. Duty Cycle

Does the vehicle have optimal duty cycle?

- ☐ Yes; refer to section “DPF Maintenance – Optimal Duty Cycle”.
- ☐ No; refer to section “DPF Maintenance – Less Than Optimal Duty Cycle”.

DPF Maintenance – Optimal Duty Cycle

A review of DPF maintenance should be performed. Check mileage and service records to see if DPF maintenance has been properly followed or if it has been neglected. If maintenance records are not available check the DPF serial numbers to identify whether the DPFs are original or replacement (for information on how to identify DPFs serial numbers click here).

93K222(CK-4) and 93K223(FA-4) Oil Service Interval	
Component	
DPF GHG17	Normal DPF ash clean interval is 500,000 miles (800,000 km) 11,000 hours to 550,000 miles (880,000 km) 11,500 hours
DPF EPA10/GHG14	A Check Engine Light will illuminate when ash requires removal. Normal DPF ash clean intervals are 300,000 miles (480,000 km) 9,000 hours to 400,000 miles (640,000 km) 10,250 hours

93K218(CJ-4) Oil Service Interval				
Component	**Long Haul**	**Short haul**	**Severe**	**Recreational Vehicles**
DPF GHG17	Normal DPF ash clean interval is 500,000 miles (800,000 km) 11,000 hours to 550,000 miles (880,000 km) 11,500 hours.	Normal DPF ash clean interval is 400,000 miles (640,000 km) 10,250 hours to 500,000 miles (800,000 km) 11,000 hours.	Normal DPF ash clean interval is 390,000 miles (627,000 km) 10,000 hours.	Normal DPF ash clean interval is 500,000 miles (800,000 km) 11,000 hours to 550,000 miles (880,000 km) 11,500 hours
DPF EPA10/GHG14	A Check Engine Light will illuminate when ash requires removal. Normal DPF ash clean intervals are 300,000 miles (480,000 km) 9,000 hours to 400,000 miles (640,000 km) 10,250 hours			

Figure 6. Maintenance Schedule

Cleaning accumulated ash from the DPF is a necessary part of vehicle maintenance. The recommended service is to remove the DPF and replace with a Reliabilt® clean DPF.

NOTE: Using alternate cleaning methods may result in the cleaned DPF failing to reach the next ash clean interval. The customer may experience damage to the DOC or DPF assemblies as a result of alternate cleaning methods.

Has DPF Maintenance been neglected?

- ☐ Yes; improper DPF maintenance lead to premature aftertreatment failures. Consult with the customer prior to proceeding. Perform the appropriate maintenance and replace the aftertreatment then Refer to section “DPF Maintenance Check List”.
- ☐ No; or information is not available; refer to section “Warranty History– Optimal Duty Cycle”.

Warranty History– Optimal Duty Cycle

Review the warranty repair history for any engine or aftertreatment repairs (within the last 6 months) that could lead to ATD plugging or over-temperatures (click here for how to view warrant history).

See the sample warranty claim history below. There are several repairs listed that should be reviewed.

PFP Description	Claim Type	Claim Status	Repair Date	Distance	Units
INJ LINE SEAL, CAM FRAME	--	--	16-Apr-17	300249	MILES
SCREW	--	--	12-Mar-17	299028	MILES
TURBOCHARGER	--	--	12-Mar-17	299028	MILES
DD15/16 INJ EPA07/10/GHGTC	--	--	12-Mar-17	299028	MILES
DEF PUMP	--	--	26-Oct-16	260817	MILES
ENIGNE BRAKE SOLENOID/ VALVE	--	--	2-Jul-16	236417	MILES
CAM HSG 14L	--	--	25-Jul-16	230513	MILES
INJ LINE SEAL, CAM FRAME	--	--	25-Jul-16	230513	MILES
INJ HARNESS 4-6	--	--	25-Jul-16	230513	MILES
IDLER PULLEY	--	--	15-May-16	212514	MILES
DD15/16 INJ EPA07/10/GHGTC	--	--	6-Jan-16	170390	MILES

Figure 7. Sample Warranty History

- Injector replacement at 299,028 miles
    - Possible over-fueling injectors, overheating the Aftertreatment

PFP Description	Claim Type	Claim Status	Repair Date	Distance	Units
DOC & CLAMP KIT	--	--	16-Nov-17	65070	MILES
SENSOR NOX INLET	--	--	16-Nov-17	65070	MILES
SENSOR NOX OUTLET	--	--	16-Nov-17	65070	MILES
DEF METERING UNIT	--	--	9-Mar-17	60025	MILES
CLAMP KIT	--	--	19-Jan-17	55469	MILES

Figure 8. Sample Warranty History

- Several aftertreatment related repairs around 60,000 miles
    - Look over warranty narrative for more information on the repair

PFP Description	Claim Type	Claim Status	Repair Date	Distance	Units
EXH GAS CLR	--	--	16-Feb-17	70070	MILES
VALVE	--	--	12-Feb-17	13266	MILES
REPROGRAM	--	--	1-Jan-17	5873	MILES

Figure 9. Sample Warranty History

- EGR valve repairs at 13,266 miles
    - EGR failures can introduce factors that will inhibit the exhaust flow and temperatures. Read warranty narrative for more information on the repair.

PFP Description	Claim Type	Claim Status	Repair Date	Distance	Units
HARNESS	--	--	24-Jul-17	81503	MILES
TURBO	--	--	11-Jul-17	81276	MILES

Figure 10. Sample Warranty History

- Turbocharger replacement at 81,276 miles
    - Some turbocharger failures can create a downstream failure. Read warranty narrative for more information on the repair.

The above claim examples indicate a need to look further into those claims and repairs to ensure they have not led to the aftertreatment failure. When reviewing warranty history look for a correlation between the aftertreatment failure, fault codes, the mileage and date of the previous repair.

A component that leads to aftertreatment failure should have related ATD fault codes for plugging or over-temperatures near the time of the previous component failure. If a fault code was not found within the same time period of the failure the fault code may have been cleared during a previous repair.

Did the warranty history review identify any related previous failures?

☐ Yes; a recent previous failure has been identified. Refer to section “Previous Failure Check List”.

☐ No; the aftertreatment has failed as a result of a current upstream failure that should be diagnosed. Refer to section “Upstream Failure Check List”.

DPF Maintenance – Less Than Optimal Duty Cycle

A review of DPF maintenance should be performed. Check mileage and service records to see if DPF maintenance has been properly followed or if it has been neglected. If maintenance records are not available check the DPF serial numbers to identify whether the DPFs are original or replacement (for information on how to identify DPFs serial numbers click here).

93K222(CK-4) and 93K223(FA-4) Oil Service Interval	
Component	
DPF GHG17	Normal DPF ash clean interval is 500,000 miles (800,000 km) 11,000 hours to 550,000 miles (880,000 km) 11,500 hours
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93K218(CJ-4) Oil Service Interval				
Component	**Long Haul**	**Short haul**	**Severe**	**Recreational Vehicles**
DPF GHG17	Normal DPF ash clean interval is 500,000 miles (800,000 km) 11,000 hours to 550,000 miles (880,000 km) 11,500 hours.	Normal DPF ash clean interval is 400,000 miles (640,000 km) 10,250 hours to 500,000 miles (800,000 km) 11,000 hours.	Normal DPF ash clean interval is 390,000 miles (627,000 km) 10,000 hours.	Normal DPF ash clean interval is 500,000 miles (800,000 km) 11,000 hours to 550,000 miles (880,000 km) 11,500 hours
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Figure 6. Maintenance Schedule

Cleaning accumulated ash from the DPF is a necessary part of vehicle maintenance. The recommended service is to remove the DPF and replace with a Reliabilt® clean DPF.

NOTE: Using alternate cleaning methods may result in the cleaned DPF failing to reach the next ash clean interval. The customer may experience damage to the DOC or DPF assemblies as a result of alternate cleaning methods.

Has DPF Maintenance been neglected?

- ☐ Yes; improper DPF maintenance lead to premature aftertreatment failures. Consult with the customer prior to proceeding. Perform the appropriate maintenance and replace the aftertreatment then refer to section “DPF Maintenance Check List”.
- ☐ No; or information is not available; refer to section “Warranty History– Less Than Optimal Duty Cycle”.

Warranty History– Less Than Optimal Duty Cycle

Review the warranty repair history for any engine or aftertreatment repairs (within the last 6 months) that could lead to ATD plugging or over-temperatures (click here for how to view warrant history).

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Did the warranty history review identify any related previous failures?

☐ Yes; a recent previous failure has been identified. Refer to section “Previous Failure Check List”.

☐ No; a less than optimal duty cycle has degraded the SCR. Refer to section “Duty Cycle Check List”.

DPF Maintenance – No Codes of Interest

A review of DPF maintenance should be performed. Check mileage and service records to see if DPF maintenance has been properly followed or if it has been neglected. If maintenance records are not available check the DPF serial numbers to identify whether the DPFs are original or replacement (for information on how to identify DPFs serial numbers click here).

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See the sample warranty claim history below. There are several repairs listed that should be reviewed.

PFP Description	Claim Type	Claim Status	Repair Date	Distance	Units
INJ LINE SEAL, CAM FRAME	--	--	16-Apr-17	300249	MILES
SCREW	--	--	12-Mar-17	299028	MILES
TURBOCHARGER	--	--	12-Mar-17	299028	MILES
DD15/16 INJ EPA07/10/GHGTC	--	--	12-Mar-17	299028	MILES
DEF PUMP	--	--	26-Oct-16	260817	MILES
ENIGNE BRAKE SOLENOID/ VALVE	--	--	2-Jul-16	236417	MILES
CAM HSG 14L	--	--	25-Jul-16	230513	MILES
INJ LINE SEAL, CAM FRAME	--	--	25-Jul-16	230513	MILES
INJ HARNESS 4-6	--	--	25-Jul-16	230513	MILES
IDLER PULLEY	--	--	15-May-16	212514	MILES
DD15/16 INJ EPA07/10/GHGTC	--	--	6-Jan-16	170390	MILES

Figure 7. Sample Warranty History

- Injector replacement at 299,028 miles
    - Possible over-fueling injectors, overheating the Aftertreatment

PFP Description	Claim Type	Claim Status	Repair Date	Distance	Units
DOC & CLAMP KIT	--	--	16-Nov-17	65070	MILES
SENSOR NOX INLET	--	--	16-Nov-17	65070	MILES
SENSOR NOX OUTLET	--	--	16-Nov-17	65070	MILES
DEF METERING UNIT	--	--	9-Mar-17	60025	MILES
CLAMP KIT	--	--	19-Jan-17	55469	MILES

Figure 8. Sample Warranty History

- Several aftertreatment related repairs around 60,000 miles
    - Look over warranty narrative for more information on the repair

PFP Description	Claim Type	Claim Status	Repair Date	Distance	Units
EXH GAS CLR	--	--	16-Feb-17	70070	MILES
VALVE	--	--	12-Feb-17	13266	MILES
REPROGRAM	--	--	1-Jan-17	5873	MILES

Figure 9. Sample Warranty History

- EGR valve repairs at 13,266 miles
    - EGR failures can introduce factors that will inhibit the exhaust flow and temperatures. Read warranty narrative for more information on the repair.

PFP Description	Claim Type	Claim Status	Repair Date	Distance	Units
HARNESS	--	--	24-Jul-17	81503	MILES
TURBO	--	--	11-Jul-17	81276	MILES

Figure 10. Sample Warranty History

- Turbocharger replacement at 81,276 miles
    - Some turbocharger failures can create a downstream failure. Read warranty narrative for more information on the repair.

The above claim examples indicate a need to look further into those claims and repairs to ensure they have not led to the aftertreatment failure. When reviewing warranty history look for a correlation between the aftertreatment failure, fault codes, the mileage and date of the previous repair.

A component that leads to aftertreatment failure should have related ATD fault codes for plugging or over-temperatures near the time of the previous component failure. If a fault code was not found within the same time period of the failure the fault code may have been cleared during a previous repair.

Did the warranty history review identify any related previous failures?

☐ Yes; a recent previous failure has been identified. Refer to section “Previous Failure Check List”.

☐ No; the SCR has become degraded. Refer to section “Degraded SCR Check List”.

Upstream Failure Check List

This check list should only be completed if the following criteria is meet:

- If codes of interest have been identified
- If Duty Cycle is optimal
- If proper DPF maintenance has been followed
- If no previous related warranty repairs have been identified

Do not complete this check list unless directed here from another area. Prior to replacing the aftertreatment perform the following checks to ensure no other issues are present.

NOTE: Complete steps in numerical order. If any of the items below have been previously inspected during this visit, do not inspect a second time.

1. ☐ Inspect for a plugged or restricted air filter, refer to OEM guidelines.
2. ☐ Delta P (EPA10 only). Inspect the Delta P ports for plugging.
3. ☐ Allow the engine and ATD to fully cool down to ambient temperatures. At Key On Engine Off (KOEO), compare all the temperature readings to each other to identify a drifted sensor reading. Engine temperature readings should be within 15°F (8°C) of each other. ATD temperatures readings should be within 45°F (25°C) of each other.
4. ☐ Using DiagnosticLink check the pressure sensors. At KOEO, DPF and DOC pressure sensor voltages should read between 0.44 to 0.56 volts. Absolute pressure sensors should read within 10.3 kPa (1.5 psi) of barometric pressure, all other sensors will read zero at KOEO.
5. ☐ Check for rear engine brake stuck on. Using DiagnosticLink monitor fuel mass at idled, fuel mass should be less than 40 at idle, a value greater than 40 would indicate the rear engine brake are stuck on.
6. ☐ Visually inspect the fuel for signs of fuel contamination, at the filters, tanks and water drain bowl.
7. ☐ Test the EGR cooler, refer to Testing of the EGR Cooler – In Chassis in the appropriate workshop manual.
8. ☐ Inspect the Turbocharger, refer to Inspection of the Turbocharger in the appropriate workshop manual.
9. ☐ Inspect the APT (if applicable) for the presence of oil on/in the outlet side.
10. ☐ If equipped, perform a wastegate actuator functional check, refer to section “Functional Check of the Wastegate Actuator”.
11. ☐ Check for drifted low DOC outlet temperature sensor or wiring issue (DOC temperature high/low codes). During a regeneration logfile a drifted sensor will often show a temperature reading that is either stuck or too low for the conditions when comparing to the DPF outlet temperature sensor. DPF outlet should be about 25°F - 75°F cooler than DOC outlet temperatures.

12. ☐ Check the overhead adjustment, refer to Setting the Valve and Engine Brake Lash in the appropriate workshop manual.
13. ☐ If none of the above checks have identified a failure, check mechanical compression, refer to Mechanical Cylinder Compression Test of the appropriate troubleshooting manual.
14. ☐ If none of the above checks have identified a failure, replace the fuel injectors.

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DPF Maintenance Check List

This check list should only be completed if the following criteria is meet:

- If DPF maintenance has been neglected

Do not complete this check list unless directed here from another area. Prior to replacing the aftertreatment perform the following checks to ensure no other issues are present.

NOTE: Complete steps in numerical order. If any of the items below have been previously inspected during this visit, do not inspect a second time.

1. ☐ Inspect for a plugged or restricted air filter, refer to OEM guidelines.
2. ☐ Delta P (EPA10 only). Inspect the Delta P ports for plugging.
3. ☐ Allow the engine and ATD to fully cool down to ambient temperatures. At Key On Engine Off (KOEO), compare all the temperature readings to each other to identify a drifted sensor reading. Engine temperature readings should be within 15°F (8°C) of each other. ATD temperatures readings should be within 45°F (25°C) of each other.
4. ☐ Using DiagnosticLink check the pressure sensors. At KOEO, DPF and DOC pressure sensor voltages should read between 0.44 to 0.56 volts. Absolute pressure sensors should read within 10.3 kPa (1.5 psi) of barometric pressure, all other sensors will read zero at KOEO.
5. ☐ Check for drifted low DOC outlet temperature sensor or wiring issue (DOC temperature high/low codes). During a regeneration logfile a drifted sensor will often show a temperature reading that is either stuck or too low for the conditions when comparing to the DPF outlet temperature sensor. DPF outlet should be about 25°F - 75°F cooler than DOC outlet temperatures.
6. ☐ Perform a Relative Compression test, refer to Relative Cylinder Compression Test of the appropriate troubleshooting manual.
7. ☐ If none of the above checks have identified a failure, poor DPF maintenance caused the aftertreatment failure. The SCR can fail due to neglected DPF.

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Duty Cycle Check List

This check list should only be completed if the following criteria is meet:

- If codes of interest have been identified
- If less than optima duty cycle has been identified
- If proper DPF maintenance has been followed
- If no previous related warranty repairs have been identified

Do not complete this check list unless directed here from another area. Prior to replacing the aftertreatment perform the following checks to ensure no other issues are present.

NOTE: Complete steps in numerical order. If any of the items below have been previously inspected during this visit, do not inspect a second time.

1. ☐ Inspect for a plugged or restricted air filter, refer to OEM guidelines.
2. ☐ Delta P (EPA10 only). Inspect the Delta P ports for plugging.
3. ☐ Allow the engine and ATD to fully cool down to ambient temperatures. At Key On Engine Off (KOEO), compare all the temperature readings to each other to identify a drifted sensor reading. Engine temperature readings should be within 15°F (8°C) of each other. ATD temperatures readings should be within 45°F (25°C) of each other.
4. ☐ Using DiagnosticLink check the pressure sensors. At KOEO, DPF and DOC pressure sensor voltages should read between 0.44 to 0.56 volts. Absolute pressure sensors should read within 10.3 kPa (1.5 psi) of barometric pressure, all other sensors will read zero at KOEO.
5. ☐ If equipped, perform a wastegate actuator functional check, refer to section “Functional Check of the Wastegate Actuator”.
6. ☐ Check for drifted low DOC outlet temperature sensor or wiring issue (DOC temperature high/low codes). During a regeneration logfile a drifted sensor will often show a temperature reading that is either stuck or too low for the conditions when comparing to the DPF outlet temperature sensor. DPF outlet should be about 25°F - 75°F cooler than DOC outlet temperatures.
7. ☐ Perform a Relative Compression test, refer to Relative Cylinder Compression Test of the appropriate troubleshooting manual.
8. ☐ If none of the above checks have identified a failure, a less than optimal duty cycle caused the aftertreatment failure. Review the following with the customer, these improvements can help optimize duty cycle:
    - Auto-Elevate Idle (Extended Idle Auto RPM Elevate); refer to appropriate section of the A&I manual.
    - PTO Dosing (if equipped with PTO); refer to appropriate section of the A&I manual.
    - Optimized Idle or reduction of idle time
    - Reduction of time spent over rated RPM

- Elimination of time spent with the PTO enabled but not in use
- To aid in achieving optimal duty cycle refer to Figure 4 Duty Cycle.

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Previous Failure Check List

This check list should only be completed if the following criteria is meet:

- If proper DPF maintenance has been followed
- If previous related warranty repairs have been identified that lead to ATD plugging or over-temperatures

Do not complete this check list unless directed here from another area. Prior to replacing the aftertreatment perform the following checks to ensure no other issues are present.

NOTE: Complete steps in numerical order. If any of the items below have been previously inspected during this visit, do not inspect a second time.

1. ☐ Inspect for a plugged or restricted air filter, refer to OEM guidelines.
2. ☐ Delta P (EPA10 only). Inspect the Delta P ports for plugging.
3. ☐ Allow the engine and ATD to fully cool down to ambient temperatures. At Key On Engine Off (KOEO), compare all the temperature readings to each other to identify a drifted sensor reading. Engine temperature readings should be within 15°F (8°C) of each other. ATD temperatures readings should be within 45°F (25°C) of each other.
4. ☐ Using DiagnosticLink check the pressure sensors. At KOEO, DPF and DOC pressure sensor voltages should read between 0.44 to 0.56 volts. Absolute pressure sensors should read within 10.3 kPa (1.5 psi) of barometric pressure, all other sensors will read zero at KOEO.
5. ☐ Check for drifted low DOC outlet temperature sensor or wiring issue (DOC temperature high/low codes). During a regeneration logfile a drifted sensor will often show a temperature reading that is either stuck or too low for the conditions when comparing to the DPF outlet temperature sensor. DPF outlet should be about 25°F - 75°F cooler than DOC outlet temperatures.
6. ☐ If none of the above checks have identified a failure, a previous failure caused the aftertreatment failure. A previous failure or over-temperatures can sometimes take an extended period of time to cause the SCR failure.

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Degraded SCR Check List

This check list should only be completed if the following criteria is meet:

- If no codes of interest have been identified in Fault Code History, DiagnosticLink or Virtual Technician
- If proper DPF maintenance has been followed
- If no previous related warranty repairs have been identified

Do not complete this check list unless directed here from another area. Prior to replacing the aftertreatment perform the following checks to ensure no other issues are present.

NOTE: Complete steps in numerical order. If any of the items below have been previously inspected during this visit, do not inspect a second time.

1. ☐ Inspect for a plugged or restricted air filter, refer to OEM guidelines.
2. ☐ Delta P (EPA10 only). Inspect the Delta P ports for plugging.
3. ☐ Allow the engine and ATD to fully cool down to ambient temperatures. At Key On Engine Off (KOEO), compare all the temperature readings to each other to identify a drifted sensor reading. Engine temperature readings should be within 15°F (8°C) of each other. ATD temperatures readings should be within 45°F (25°C) of each other.
4. ☐ Using DiagnosticLink check the pressure sensors. At KOEO, DPF and DOC pressure sensor voltages should read between 0.44 to 0.56 volts. Absolute pressure sensors should read within 10.3 kPa (1.5 psi) of barometric pressure, all other sensors will read zero at KOEO.
5. ☐ Check for drifted low DOC outlet temperature sensor or wiring issue (DOC temperature high/low codes). During a regeneration logfile a drifted sensor will often show a temperature reading that is either stuck or too low for the conditions when comparing to the DPF outlet temperature sensor. DPF outlet should be about 25°F - 75°F cooler than DOC outlet temperatures.
6. ☐ If none of the above checks have identified a failure, the SCR has become degraded causing the aftertreatment failure.

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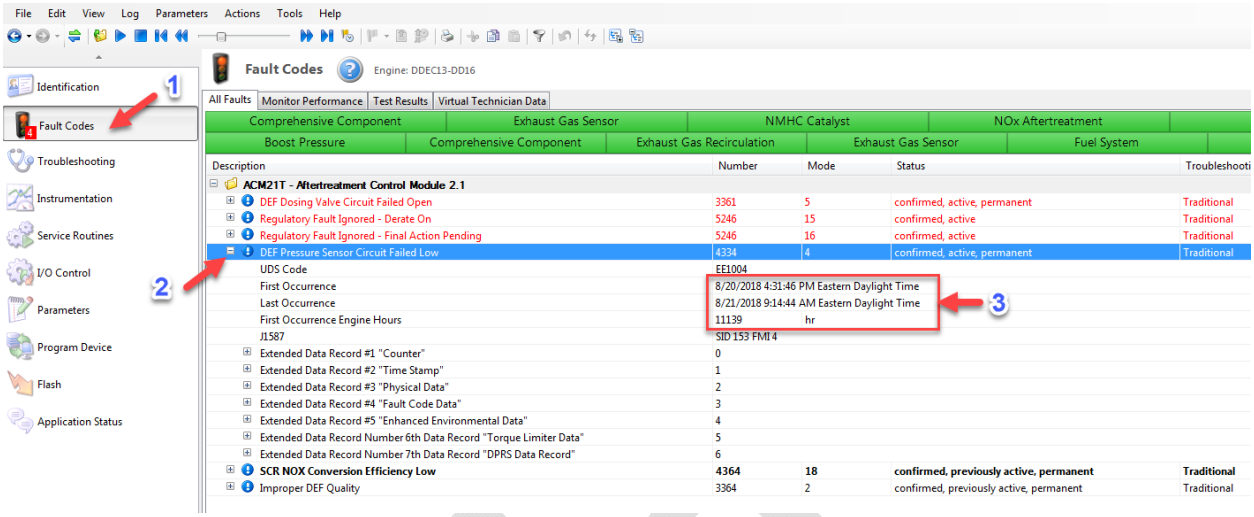
Appendix

How to identify a fault code time stamp

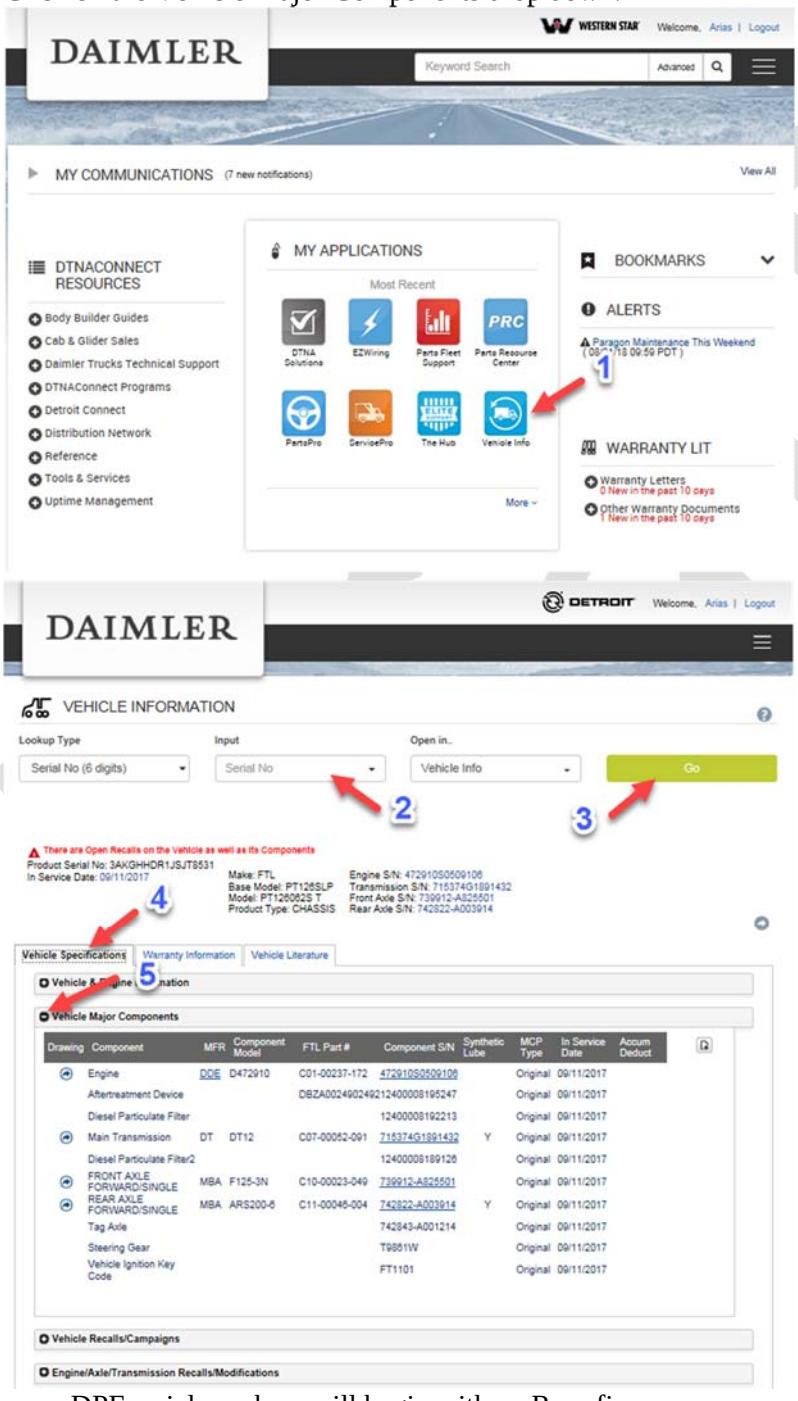
1. In DiagnosticLink, click on the fault code tap.
2. Click on the fault code drop down.
3. Time stamp occurrence will be displayed.



How to identify DPF Serial Numbers

Identifying DPF Serial Numbers using DTNA Connect

1. Login to DTNA Connect and clink on vehicle info.
2. Enter the VIN.
3. Click Go.
4. Click the Vehicle Specification tab.
5. Click on the Vehicle Major Components drop down.



Note: Reman DPF serial numbers will begin with an R prefix

Identifying DPF Serial Numbers on the vehicle

1. The DPF serial number will be located on the side of the DPF
2. Reman DPF serial numbers will begin with an R prefix and will have a Reman tag welded to the DPF with the part number and serial number information.

3. Non Reman DPFs will have the serial number and part number etched on the side of the DPF, see example below.

How to view warranty history

1. Login to DTNA Connect and clink on vehicle info.
2. Enter the VIN.
3. Click Go.
4. Click the Warranty Information tab.
5. Click on the Engine Claims History drop down.