1 5 09-15

Service Information Bulletin

SUBJECT	DATE
Symptom Diagnostics - Hard Start/No Start - Three-Filter Fuel System; Symptom Diagnostics - Hard Start/No Start - Two-Filter Fuel System	May 2015

Additions, Revisions, or Updates

Publication Number / Title	Platform	Section Title	Change
DDC-SVC-MAN-0084	DD Platform - EPA07 - EPA10	Test-E - Three-Filter Fuel System	Changed Go to # for answer No in step 10. Changed Go to in step 11 from 13 to 12.
		Test-E - Worksheet	Added a line to change engine oil. Added lines for DPF, DOC, and SCR catalyst.
DDC-SVC-MAN-0084 DDC-SVC-MAN-0184	DD Platform - EPA10 - GHG14 EuroIV DD Platform	Test-E - Two-Filter Fuel System	Changed Go to # for answer No in step 10.
		Test-E - Worksheet	Added a line to change engine oil. Added lines for DPF, DOC, and SCR catalyst.

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2 Test-E - Three-Filter Fuel System

NOTE:

This test is only to be performed if fuel is found in the Exhaust Gas Recirculation (EGR) hot pipe. Fuel in the EGR hot pipe is known to be caused by a faulty fuel injector. This failure mode can lead to extensive damage.

Test E has been written as a repair path to identify all progressive damage. No repairs are to be performed until all progressive damage has been identified prior to step 11. Refer to section "Test-E Worksheet". Print Test-E Worksheet to help record all repairs that will need to be made in the tables provided.

WARNING: EXPLOSION

The air intake manifold contains combustible gas. To avoid injury from explosion, do not connect the air inlet manifold to any devices or lines external to the manifold.

Identifying the Failure

WARNING: ENGINE EXHAUST

To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

NOTE: Crystallization or rust on the fuel filters or in the fuel filter module is a result of Diesel Exhaust fluid (DEF) contamination. Fuel filters will show this contamination if set out in atmosphere about 60 minutes.

1. Check for fuel contamination, including Diesel Exhaust Fluid (DEF), water, gasoline, coolant, etc. Was contamination found?
   a. Yes; record the contaminant in the Contamination Table. Refer to section "Test-E Worksheet" and the corresponding section for "contaminated fluids." Record any parts that may need replacement. Go to step 2.
   b. No; Go to step 2.

NOTE: Loose or failed fuel injector hold-down bolt(s) are normally caused by hydro-locking of the cylinder. Evidence of loose fuel injector hold-down bolt(s) can be identified by carbon/soot deposits above the fuel injector copper washer on the fuel injector body.

WARNING: PERSONAL INJURY

To avoid injury, never remove any engine component while the engine is running.

2. Inspect for loose fuel injector hold down bolt(s). Remove the fuel injectors from the engine. Were any fuel injector hold-down bolt(s) loose?
   a. Yes; in the Test-E worksheet, record an X in the "replace" column for the fuel injector cup(s) on the cylinders that had a loose fuel injector hold-down bolt. Go to step 3.
   b. No; Go to step 3.
3. Inspect the fuel injector tips for damage. Are any fuel injector tips damaged?
   a. Yes; in the Test-E worksheet, record an X in the "replace" column for the EGR cooler. Go to step 4.
   b. No; in the Test-E worksheet, record an X in the "clean" column for record to clean the EGR cooler. Go to step 6.
4. Inspect the turbocharger for damage.
   For DD13: Refer to section "Inspection of the Turbocharger".

For DD15 and DD16: Refer to section "Inspection of the DD15 and DD16 Turbocharger".
Is any damage present?

a. Yes; in the Test-E worksheet, record an X in the "replace" column for the turbocharger.
   For DD13 and DD15AT engine, Go to step 6.
   For DD15TC and DD16 engines, Go to step 5.
b. No; for DD13 and DD15AT engines, Go to step 6.
   For DD15TC and DD16 engines, Go to step 5.

5. Inspect the axial power turbine for damage; Refer to section "Inspection of the DD15 and DD16 Axial Power Turbine".
   Is any damage present?
   Checking If Engine Ran Backwards
   a. Yes; in the Test-E worksheet, record an X in the "replace" column for the Axial Power Turbine. Go to step 6.
   b. No; Go to step 6.

NOTE: Soot, oil or fuel in the air intake system can indicate that the engine ran backwards.

NOTE: When SPN 100/FMI 1 Engine Oil Pressure Low, SPN 636/FMI 2 No Match of Camshaft and Crankshaft Signals, SPN 723/FMI 31 Reverse Engine Rotation Detected or SPN 1636/FMI 4 Intake Manifold Temperature Circuit Failed Low are present in DiagnosticLink ®, this can indicate the engine ran backwards.

NOTE: A fuel injector failure may result in an excessive amount of fuel contamination in the lubricating oil.

NOTE: Do not remove the intake manifold unless there is solid debris that cannot be cleaned with the intake manifold in place.

6. Inspect the Charge Air Cooler (CAC), CAC piping, turbocharger inlet elbow and air filter for signs of soot, oil or fuel.
   Is soot, oil or fuel present?
   a. Yes; in the Test-E worksheet, record an X in the "clean" column to clean all soot, oil or fuel from the CAC, CAC piping, turbocharger inlet elbow, and air filter housing. Record to replace the air filter. Go to step 7.
   b. No; Go to step 8.
7. Remove and inspect the intake manifold temperature sensor, inlet manifold pressure (boost) sensor, and charge air cooler outlet temperature sensor (if equipped) for signs of damage to the sensor tips. Are any sensor tips damaged?
   Inspecting For Possible Bearing Damage
   a. Yes; in the Test-E worksheet, record an X in the "replace" column for damaged sensor(s). Go to step 9.
   b. No; Go to step 9.
8. Has SPN 100/FMI 1 Engine Oil Pressure Low occurred in the last 30 days or 5000 miles?
   a. Yes; Go to step 9.
   b. No; Go to step 10.
9. Inspect rod and main bearings for damage. Refer to section "Inspection of the Main and Connecting Rod Bearings in Chassis". Is any damage present?
   Checking for an Engine Overspeed
   a. Yes; in the Test-E worksheet, record an X in the "replace" column for all damaged components. Go to step 10.
   b. No; in the Test-E worksheet, record an X in the "replace" column for the lower end bearing kit. Go to step 10.

NOTE: If any parts are missing from the engine brake rocker arms they MUST be found and reinstalled or replaced if damaged.

10. Check the maximum engine speed in DDEC Reports. You must view the Life-To-Date data instead of Trip Activity data. Life-To-Date data can be found by selecting the “View” drop down menu, then selecting “Life-To-Date”, and then selecting “Engine”. In the resulting page view, look at the Peak Engine rpm and the date it occurred. Is the maximum engine speed greater than the values shown in the chart below?

Table 1.

12 Lobe Intake Camshaft	2800 rpm
6 Lobe Intake Camshaft	3000 rpm

a. Yes; view past warranty and repair history to determine if both camshafts were replaced after the engine overspeed. If they have not been replaced, record an X in the “replace” column for both camshafts in the Test-E worksheet. Inspect the engine brake rocker arms for loose actuator piston retainers and loose or missing return springs. Record the necessary repairs. Go to step 11.
b. No; Go to step 12.

11. Perform a cylinder leak-down test. Refer to section "Cylinder Leak Down Test ". Did all cylinders pass the leak-down test?
Inspection of Aftertreatment
a. Yes; complete all repairs from Test-E Worksheet. Refer to section "Test-E Worksheet". Go to step 12.
b. No; record necessary repairs. Complete all repairs from Test-E Worksheet. Refer to section "Test-E Worksheet". Go to step 12.
12. Review the fault codes. Is SPN 3250/FMI 0 DOC Outlet Temperature Very High or SPN 3246/FMI 0 DPF Outlet Temperature Very High present?
a. Yes; clean the exhaust system. Replace the DOC(s) and DPF(s). If equipped, replace the SCR catalyst. Go to step 14.
b. No; Go to step 13.

NOTICE: Improper cleaning of the exhaust system may result in damage to the Aftertreatment System (ATS).

13. Remove the DPF(s) from the ATS. Inspect the DPF(s) and ATS for raw fuel. Is any raw fuel present in the DPF(s) or ATS?
a. Yes; clean the exhaust system. For 1-BOX™ emissions package, replace both the DPF and the DOC/SCR module assembly. Prime the fuel system. Go to step 16.
For all others, let the ATS drain for more than 10 hours. Reassemble and install the ATS. Prime the fuel system. Go to step 14.
b. No; clean the exhaust system. Prime the fuel system. Go to step 14.

NOTICE: Running the engine at high idle for one hour MUST be done before performing a parked regeneration. Failure to do so may result in damaging the Aftertreatment System.

WARNING: PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

14. Run the engine at high idle for one hour. Check for leaks and fault codes. Are any leaks or fault codes present?
a. Yes; repair as necessary. Go to step 15.
b. No; Go to step 15.
15. Is any smoke coming from the tailpipe?
a. Yes; run the engine at high idle for a maximum of three hours or until the exhaust system stops smoking. Go to step 16.
b. No; Go to step 16.

NOTE: Increasing the accelerator pedal position to 100% will cancel the parked regeneration and maximize airflow across the ATS for cooling purposes.

WARNING: HOT EXHAUST

During parked regeneration the exhaust gases will be extremely HOT and could cause a fire if directed at combustible materials. The vehicle must be parked outside.

16. Perform a parked regeneration. Monitor Diesel Oxidation Catalyst (DOC) outlet temperature values, Diesel Particulate Filter (DPF) outlet temperature values and Selective Catalytic Reduction (SCR) outlet temperature values. If any of these temperature values rise above 650°C (1200°F), increase the accelerator pedal position to 100% for one minute. Are any fault codes present or did the parked regeneration have to be cancelled?
    a. Yes; if fault codes SPN 3250/FMI 0 or SPN 3246/FMI 0 are present, replace the DOC(s) and DPF(s). If equipped, replace the SCR catalyst. Go to step 18.
    b. If fault codes SPN 3250/FMI 0 or SPN 3246/FMI 0 are not present and the parked regeneration was cancelled. Go to step 17.
    c. No; repairs are complete, Test-E - Three-Filter Fuel System has ended.

WARNING: HOT EXHAUST

During parked regeneration the exhaust gases will be extremely HOT and could cause a fire if directed at combustible materials. The vehicle must be parked outside.

17. After a 30 minute engine cold soak from the first parked regeneration, perform a second parked regeneration. Monitor DOC outlet temperature values, DPF outlet temperature values and SCR outlet temperature values. Did any of these temperature values rises above 650°C (1200°F)?
    a. Yes; replace the DOC(s) and DPF(s). If equipped, replace the SCR catalyst. Go to step 18.
    b. No; repairs are complete; Test-E - Three-Filter Fuel System has ended.

WARNING: HOT EXHAUST

During parked regeneration the exhaust gases will be extremely HOT and could cause a fire if directed at combustible materials. The vehicle must be parked outside.

18. Perform a parked regeneration with new aftertreatment parts. Did the parked regeneration complete with no issues?
    a. Yes; repairs are complete; Test-E - Three-Filter Fuel System has ended.
    b. No; troubleshoot active fault code.

3 Test-E Worksheet

NOTE: Components listed under step * have already been identified from fuel in the hot pipe to be either replaced or cleaned.

NOTE: Do not remove the intake manifold unless there is solid debris that cannot be cleaned with the intake manifold in place.

Table 2.

TEST-E Worksheet				
Step	Component	Action		
		Clean	Replace	No Action
*	All six Fuel Injectors		X	
*	Change Engine Oil		X	
*	EGR hot pipe	X		
*	EGR cold pipe	X		
*	EGR venturi	X		
*	Intake Elbow	X		
*	Intake Manifold	X		
1	Contamination	See Contamination Table below		
3	Fuel Injector Cups			
4	EGR Cooler			
5	Turbocharger			
6	Axial Power Turbine			
7	Charge Air Cooler			
7	Intake Piping			
7	Air Filter housing			
7	Air Filter			
7	Turbocharger elbow			
8	Intake Manifold Temp Sensor			
8	Intake Manifold Pressure sensor			
8	Charge Air Cooler Outlet Temp Sensor			
8	Lower End Bearing Kit			
8	Crankshaft			
8	Connecting Rod			
8	Cylinder Block			
9	Camshafts			
9	Rocker assembly			
10	Cylinder Head			

TEST-E Worksheet				
10	Piston			
10	Liner			
12-17	DPF (s)			
12-17	DOC (s)			
12-17	SCR Catalyst			

Table 3.

Contamination Table	
Contaminant	List of parts to be replaced under "contaminated fluids"
_____	_____

4 Test-E - Two-Filter Fuel System

NOTE:

This test is only to be performed if fuel is found in the Exhaust Gas Recirculation (EGR) hot pipe. Fuel in the EGR hot pipe is known to be caused by a faulty fuel injector. This failure mode can lead to extensive damage.

Test E has been written as a repair path to identify all progressive damage. No repairs are to be performed until all progressive damage has been identified prior to step 11. Refer to section "Test-E Worksheet". Print Test-E Worksheet to help record all repairs that will need to be made in the tables provided.

WARNING: EXPLOSION

The air intake manifold contains combustible gas. To avoid injury from explosion, do not connect the air inlet manifold to any devices or lines external to the manifold.

Identifying the Failure

WARNING: ENGINE EXHAUST

To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

NOTE: Crystallization or rust on the fuel filters or in the fuel filter module is a result of Diesel Exhaust fluid (DEF) contamination. Fuel filters will show this contamination if set out in atmosphere about 60 minutes.

1. Check for fuel contamination, including Diesel Exhaust Fluid (DEF), water, gasoline, coolant, etc. Was contamination found?
   a. Yes; record the contaminant in the Contamination Table. Refer to section "Test-E Worksheet" and the corresponding section for "contaminated fluids." Record any parts that may need replacement. Go to step 2.
   b. No; Go to step 2.

NOTE: Loose or failed fuel injector hold-down bolt(s) are normally caused by hydro-locking of the cylinder. Evidence of loose fuel injector hold-down bolt(s) can be identified by carbon/soot deposits above the fuel injector copper washer on the fuel injector body.

WARNING: PERSONAL INJURY

To avoid injury, never remove any engine component while the engine is running.

2. Inspect for loose fuel injector hold down bolt(s). Remove the fuel injectors from the engine. Were any fuel injector hold-down bolt(s) loose?
   a. Yes; in the Test-E worksheet, record an X in the "replace" column for the fuel injector cup(s) on the cylinders that had a loose fuel injector hold-down bolt. Go to step 3.
   b. No; Go to step 3.
3. Inspect the fuel injector tips for damage. Are any fuel injector tips damaged?
   a. Yes; in the Test-E worksheet, record an X in the "replace" column for the EGR cooler. Go to step 4.
   b. No; in the Test-E worksheet, record an X in the "clean" column for the EGR cooler. Go to step 6.
4. Inspect the turbocharger for damage.
   For DD13: Refer to section "Inspection of the Turbocharger".

For DD15 and DD16: Refer to section "Inspection of the DD15 and DD16 Turbocharger".
Is any damage present?

a. Yes; in the Test-E worksheet, record an X in the "replace" column for the turbocharger.
   For DD13 and DD15AT engine, Go to step 6.
   For DD15TC and DD16 engines, Go to step 5.
b. No; for DD13 and DD15AT engines, Go to step 6.
   For DD15TC and DD16 engines, Go to step 5.

5. Inspect the axial power turbine for damage; Refer to section "Inspection of the DD15 and DD16 Axial Power Turbine".
   Is any damage present?
   Checking If Engine Ran Backwards
   a. Yes; in the Test-E worksheet, record an X in the "replace" column for the Axial Power Turbine. Go to step 6.
   b. No; Go to step 6.

NOTE: Soot, oil or fuel in the air intake system can indicate that the engine ran backwards.

NOTE: When SPN 100/FMI 1 Engine Oil Pressure Low, SPN 636/FMI 2 No Match of Camshaft and Crankshaft Signals, SPN 723/FMI 31 Reverse Engine Rotation Detected or SPN 1636/FMI 4 Intake Manifold Temperature Circuit Failed Low are present in DiagnosticLink, this can indicate the engine ran backwards.

NOTE: A fuel injector failure may result in an excessive amount of fuel contamination in the lubricating oil.

NOTE: Do not remove the intake manifold unless there is solid debris that cannot be cleaned with the intake manifold in place.

6. Inspect the Charge Air Cooler (CAC), CAC piping, turbocharger inlet elbow and air filter for signs of soot, oil or fuel.
   Is soot, oil or fuel present?
   a. Yes; in the Test-E worksheet, record an X in the "clean" column to clean all soot, oil or fuel from the CAC, CAC piping, turbocharger inlet elbow, and air filter housing. Record to replace the air filter. Go to step 7.
   b. No; Go to step 8.
7. Remove and inspect the intake manifold temperature sensor, inlet manifold pressure (boost) sensor, and charge air cooler outlet temperature sensor (if equipped) for signs of damage to the sensor tips. Are any sensor tips damaged?
   Inspecting For Possible Bearing Damage
   a. Yes; in the Test-E worksheet, record an X in the "replace" column for the damaged sensor(s). Go to step 9.
   b. No; Go to step 9.
8. Has SPN 100/FMI 1 Engine Oil Pressure Low occurred in the last 30 days or 5000 miles?
   a. Yes; Go to step 9.
   b. No; Go to step 10.
9. Inspect rod and main bearings for damage. Refer to section "Inspection of the Main and Connecting Rod Bearings in Chassis". Is any damage present?
   Checking for an Engine Overspeed
   a. Yes; in the Test-E worksheet, record an X in the "replace" column for all damaged components. Go to step 10.
   b. No; in the Test-E worksheet, record an X in the "replace" column for the lower end bearing kit. Go to step 10.

NOTE: If any parts are missing from the engine brake rocker arms they MUST be found and reinstalled or replaced if damaged.

10. Check the maximum engine speed in DDEC Reports. You must view the Life-To-Date data instead of Trip Activity data. Life-To-Date data can be found by selecting the “View” drop down menu, then selecting “Life-To-Date”, and then selecting “Engine”. In the resulting page view, look at the Peak Engine rpm and the date it occurred. Is the maximum engine speed greater than the values shown in the chart below?

Table 4.

12 Lobe Intake Camshaft	2800 rpm
6 Lobe Intake Camshaft	3000 rpm

a. Yes; view past warranty and repair history to determine if both camshafts were replaced after the engine overspeed. If they have not been replaced, record an X in the “replace” column for both camshafts in the Test-E worksheet. Inspect the engine brake rocker arms for loose actuator piston retainers and loose or missing return springs. Record necessary repairs. Go to step 11.
b. No; Go to step 12.

11. Perform a cylinder leak-down test. Refer to section "Cylinder Leak Down Test ". Did all cylinders pass the leak-down test?

Inspection of Aftertreatment

a. Yes; complete all repairs from Test-E Worksheet. Refer to section "Test-E Worksheet". Go to step 12.
b. No; in the Test-E worksheet, record an X in the "replace" column for necessary repairs. Complete all repairs from Test-E Worksheet. Refer to section "Test-E Worksheet". Go to step 12.

12. Review the fault codes. Is SPN 3250/FMI 0 DOC Outlet Temperature Very High or SPN 3246/FMI 0 DPF Outlet Temperature Very High present?
    a. Yes; clean the exhaust system. Replace the DOC(s) and DPF(s). If equipped, replace the SCR catalyst. Go to step 14.
    b. No; Go to step 13.

NOTICE: Improper cleaning of the exhaust system may result in damage to the Aftertreatment System (ATS).

13. Remove the DPF(s) from the ATS. Inspect the DPF(s) and ATS for raw fuel. Is any raw fuel present in the DPF(s) or ATS?
    a. Yes; clean the exhaust system. For 1-BOX™ emissions package, replace both the DPF and the DOC/SCR module assembly. Prime the fuel system. Go to step 16.
    For all others, let the ATS drain for more than 10 hours. Reassemble and install the ATS. Prime the fuel system. Go to step 14.
    b. No; clean the exhaust system. Prime the fuel system. Go to step 14.

NOTICE: Running the engine at high idle for one hour MUST be done before performing a parked regeneration. Failure to do so may result in damaging the Aftertreatment System.

WARNING: PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

14. Run the engine at high idle for one hour. Check for leaks and fault codes. Are any leaks or fault codes present?
    a. Yes; repair as necessary. Go to step 15.
    b. No; Go to step 15.
15. Is any smoke coming from the tailpipe?
    a. Yes; run the engine at high idle for a maximum of three hours or until the exhaust system stops smoking. Go to step 16.
    b. No; Go to step 16.

NOTE: Increasing the accelerator pedal position to 100% will cancel the parked regeneration and maximize airflow across the ATS for cooling purposes.

WARNING: HOT EXHAUST

During parked regeneration the exhaust gases will be extremely HOT and could cause a fire if directed at combustible materials. The vehicle must be parked outside.

16. Perform a parked regeneration. Monitor Diesel Oxidation Catalyst (DOC) outlet temperature values, Diesel Particulate Filter (DPF) outlet temperature values and Selective Catalytic Reduction (SCR) outlet temperature values. If any of these temperature values rise above 650°C (1200°F), increase the accelerator pedal position to 100% for one minute. Are any fault codes present or did the parked regeneration have to be cancelled?
    a. Yes; if fault codes SPN 3250/FMI 0 or SPN 3246/FMI 0 are present, replace the DOC(s) and DPF(s). If equipped, replace the SCR catalyst. Go to step 18.
    b. If fault codes SPN 3250/FMI 0 or SPN 3246/FMI 0 are not present and the parked regeneration was cancelled Go to step 17.
    c. No; repairs are complete, Test-E - Two-Filter Fuel System has ended.

WARNING: HOT EXHAUST

During parked regeneration the exhaust gases will be extremely HOT and could cause a fire if directed at combustible materials. The vehicle must be parked outside.

17. After a 30 minute engine cold soak from the first parked regeneration, perform a second parked regeneration. Monitor DOC outlet temperature values, DPF outlet temperature values and SCR outlet temperature values. Did any of these temperature values rise above 650°C (1200°F)?
    a. Yes; replace the DOC(s) and DPF(s). If equipped, replace the SCR catalyst. Go to step 18.
    b. No; repairs are complete; Test-E - Two-Filter Fuel System has ended.

WARNING: HOT EXHAUST

During parked regeneration the exhaust gases will be extremely HOT and could cause a fire if directed at combustible materials. The vehicle must be parked outside.

18. Perform a parked regeneration with new aftertreatment parts. Did the parked regeneration complete with no issues?
    a. Yes; repairs are complete; Test-E - Two-Filter Fuel System has ended.
    b. No; troubleshoot active fault code.

5 Test-E Worksheet

NOTE: Components listed under step * have already been identified from fuel in the hot pipe to be either replaced or cleaned.

NOTE: Do not remove the intake manifold unless there is solid debris that cannot be cleaned with the intake manifold in place.

Table 5.

TEST-E Worksheet				
Step	Component	Action		
		Clean	Replace	No Action
*	All six Fuel Injectors		X	
*	Change Engine Oil		X	
*	EGR hot pipe	X		
*	EGR cold pipe	X		
*	EGR venturi	X		
*	Intake Elbow	X		
*	Intake Manifold	X		
1	Contamination	See Contamination Table below		
3	Fuel Injector Cups			
4	EGR Cooler			
5	Turbocharger			
6	Axial Power Turbine			
7	Charge Air Cooler			
7	Intake Piping			
7	Air Filter housing			
7	Air Filter			
7	Turbocharger elbow			
8	Intake Manifold Temp Sensor			
8	Intake Manifold Pressure sensor			
8	Charge Air Cooler Outlet Temp Sensor			
8	Lower End Bearing Kit			
8	Crankshaft			
8	Connecting Rod			
8	Cylinder Block			
9	Camshafts			
9	Rocker assembly			
10	Cylinder Head			

TEST-E Worksheet				
10	Piston			
10	Liner			
12-17	DPF (s)			
12-17	DOC (s)			
12-17	SCR Catalyst			

Table 6.

Contamination Table	
Contaminant	List of parts to be replaced under "contaminated fluids"
_____	_____

