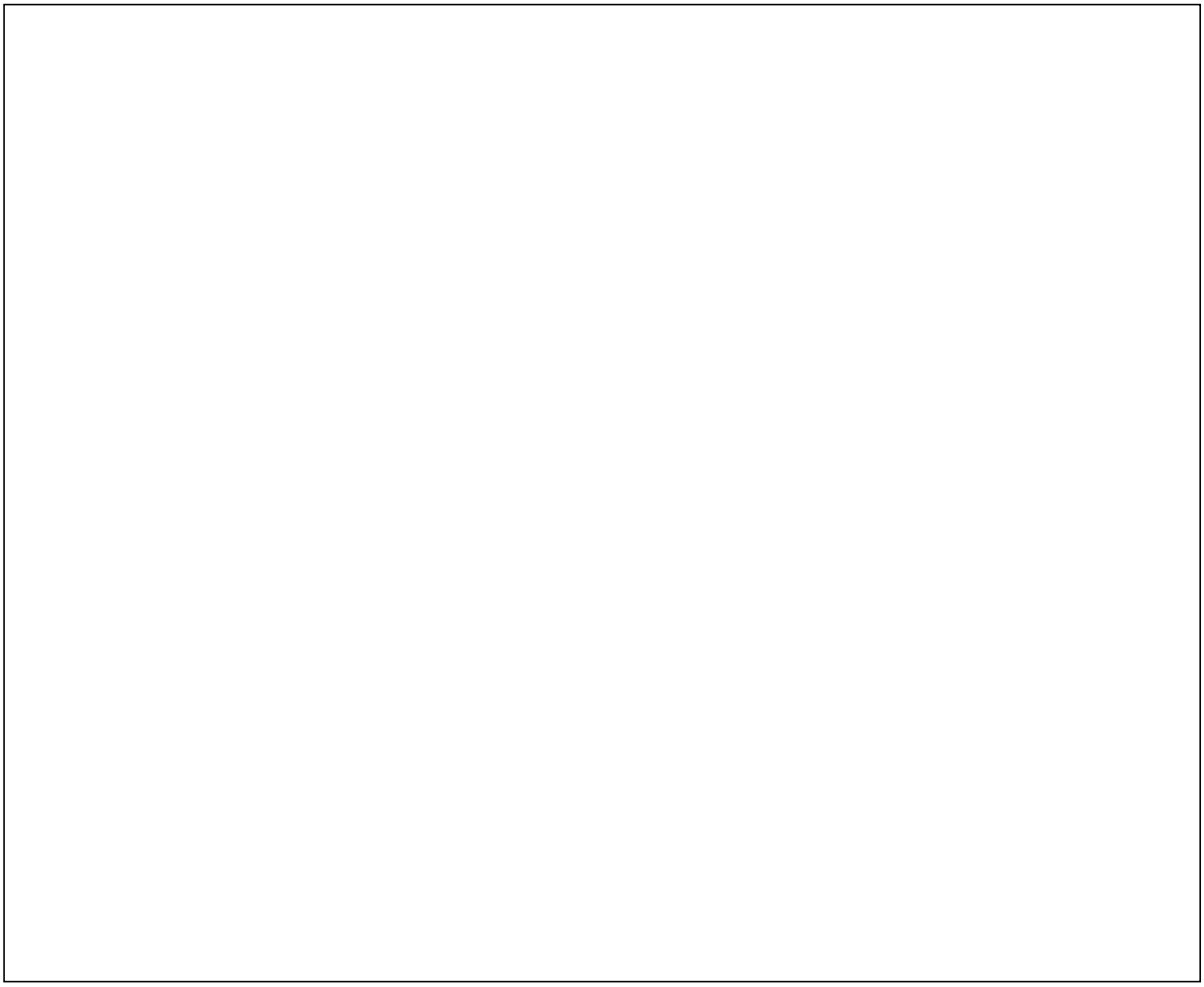
SPN 51 (MCM) (GHG17)

37.1 SPN 51/FMI 2 - GHG17

Intake Throttle Position Deviation Error

SPN 51/FMI 2	
Description	This Code Sets When The Intake Throttle Valve Position Has A 15% Deviation From The Position Commanded By The Motor Control Module (MCM) When The Engine Coolant Temperature Is Above 60°C (140°F)
Monitored Parameter	Intake Throttle Valve (ITV)
Typical Enabling Conditions	Coolant Temperature Is Greater Than 60°C (140°F)
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Five Seconds
Dash Lamps	MIL, CEL
Engine Reaction	10% Derate
Verification	Engine rpm = 600 rpm or Higher



Possible causes:

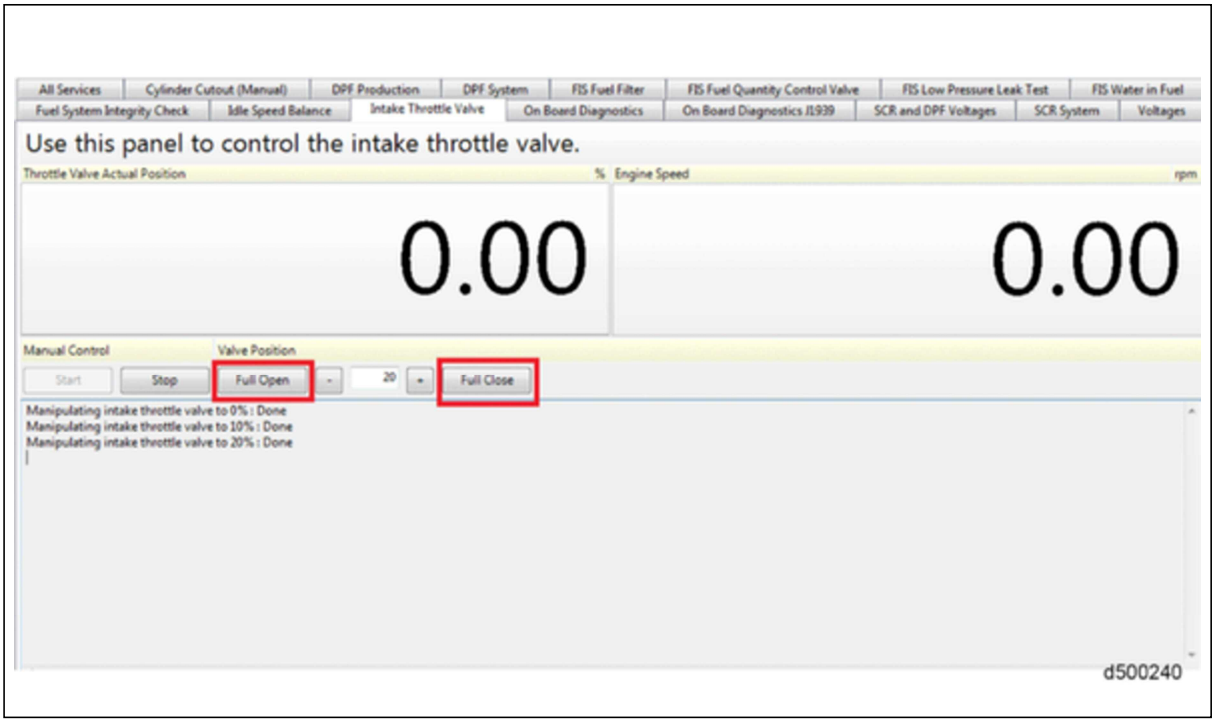
- Faulty ITV motor
- Faulty ITV position sensor
- Sticking ITV

Check as follows:

1. Turn the ignition OFF.
2. Remove the hose from the Charge Air Cooler (CAC) to the ITV.
3. Visually inspect the ITV butterfly valve. Is there damage to the butterfly valve?

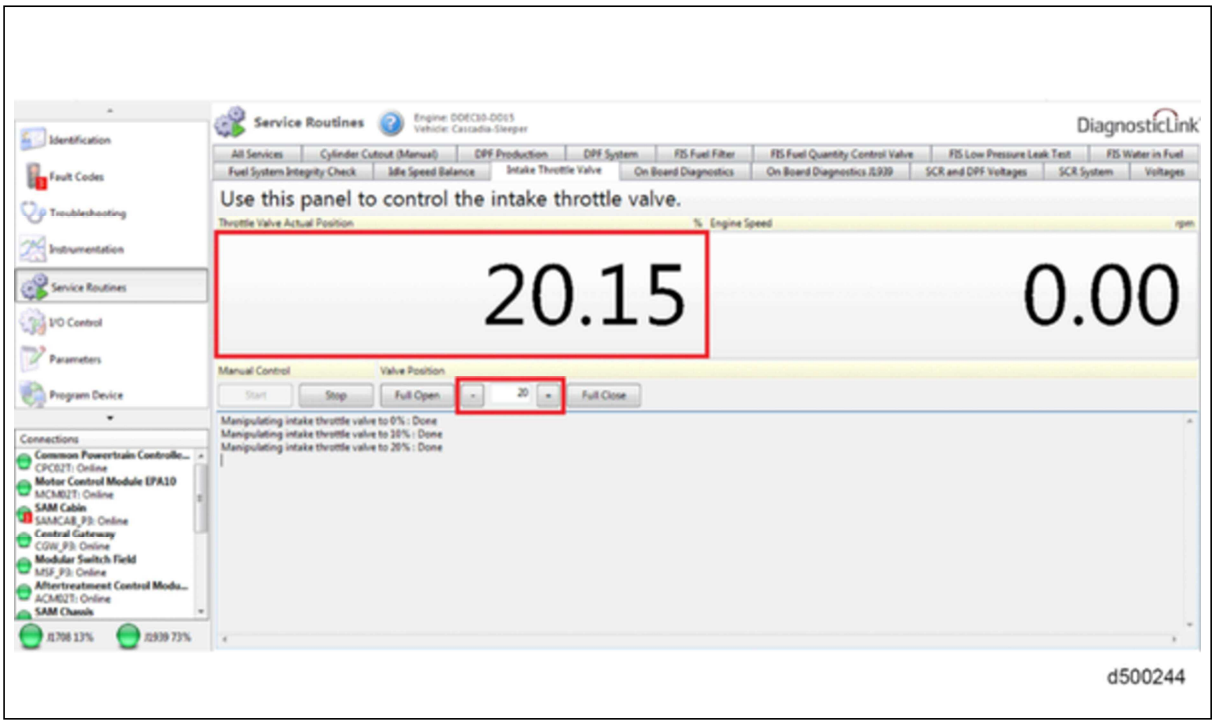
   3.a Yes; replace the ITV. Refer to section "Removal of the Intake Throttle Valve and Adaptor" . Verify repair.

   3.b No; Go to step 4.
4. Connect Diagnostic Link .
5. Turn the ignition ON, (key ON, engine OFF).
6. Using DiagnosticLink, command the ITV by clicking the "full open" and "full closed" buttons while watching the ITV flap. Does the ITV butterfly valve fully close and fully open when commanded?



   6.a Yes; Go to step 7.

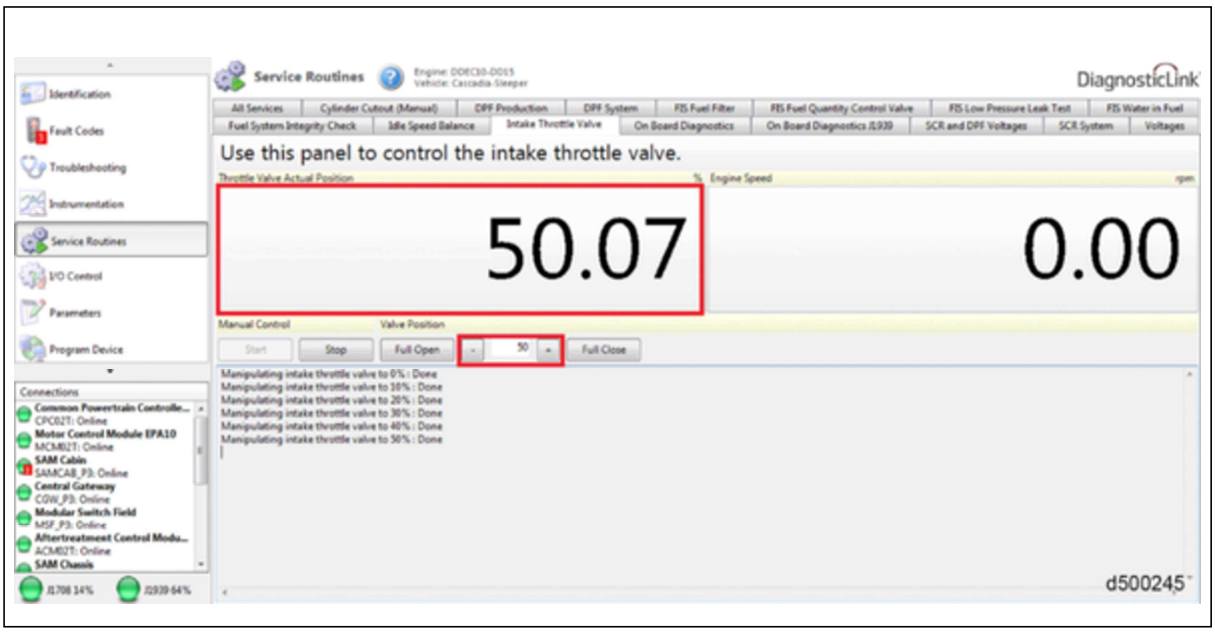
   6.b No; replace the ITV. Refer to section "Removal of the Intake Throttle Valve and Adaptor" .
7. Using the Air Intake Throttle service routine, command the ITV to 20% while monitoring the ITV actual position. Is the actual valve position between 14% and 26%?



7.a Yes; Go to step 8.

7.b No; replace the ITV. Refer to section "Removal of the Intake Throttle Valve and Adaptor" . Verify repair.

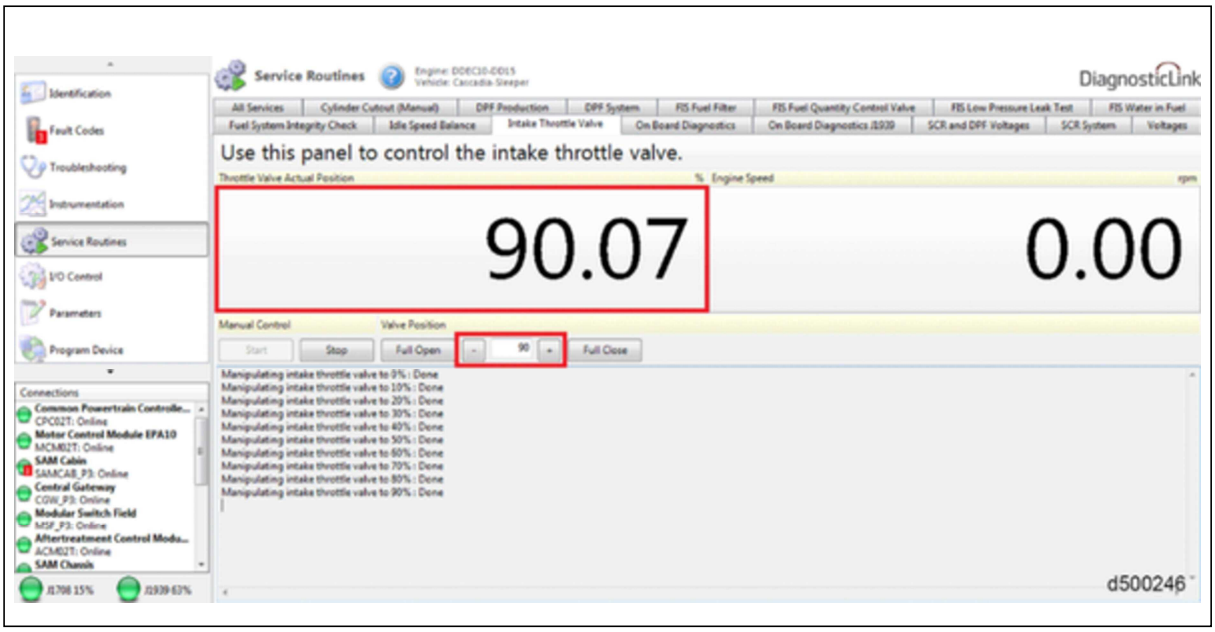
8. Command the ITV to 50% while monitoring the ITV actual position. Is the actual valve position between 44% and 56%?



8.a Yes; Go to step 9.

8.b No; replace the ITV. Refer to section "Removal of the Intake Throttle Valve and Adaptor" . Verify repair.

9. Command the ITV to 90% while monitoring the ITV actual position. Is the actual valve position between 84% and 96%?



9.a Yes; Go to step 10.

9.b No; replace the ITV. Refer to section "Removal of the Intake Throttle Valve and Adaptor" . Verify repair.

10. Turn the ignition OFF.
11. Disconnect and inspect the ITV 5-pin connector. Are there any damaged pins, spread pins, corrosion present or is the retainer clip missing?

11.a Yes; repair as necessary.

11.b No; Go to step 12.

12. Measure the resistance across pins 4 and 5, component side, of the ITV motor connector. Is the resistance less than 10 ohms?

12.a Yes; Go to step 13.

12.b No; replace the ITV due to a shorted motor. Refer to section "Removal of the Intake Throttle Valve and Adaptor" . Verify repair.

13. Measure the resistance across pins 4 and 5, component side, of the ITV motor connector. Is the resistance less than 10 ohms?

13.a Yes; Go to step 14.

13.b No; replace the ITV due to a shorted motor. Refer to section "Removal of the Intake Throttle Valve and Adaptor" . Verify repair.

14. Disconnect the 120-pin MCM connector.
15. Measure the resistance between pin 4 of the 5-pin Intake Throttle Valve electrical connector harness side and pin 100 of the 120-pin MCM electrical connector harness side. Is the resistance less than 5 ohms?

15.a Yes; replace the ITV. Verify repair.

15.b No; replace the MCM. Verify repair.

16. Measure the resistance between pin 5 of the 5-pin Intake Throttle Valve electrical connector harness side and pin 101 of the 120-pin MCM electrical connector harness side. Is the resistance less than 5 ohms?

16.a Yes; Go to step 17.

16.b No; repair the circuit between pin 5 of the 5-pin Intake Throttle Valve electrical connector harness side and pin 101 of the 120-pin MCM electrical connector harness side.

17. Install a test MCM.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

18. Start and run the engine until the engine coolant temperature is above 60°C (140°F).
19. Erase fault code SPN 51/FMI 2.
20. Road test the vehicle. Does code SPN 51/FMI 2 return?

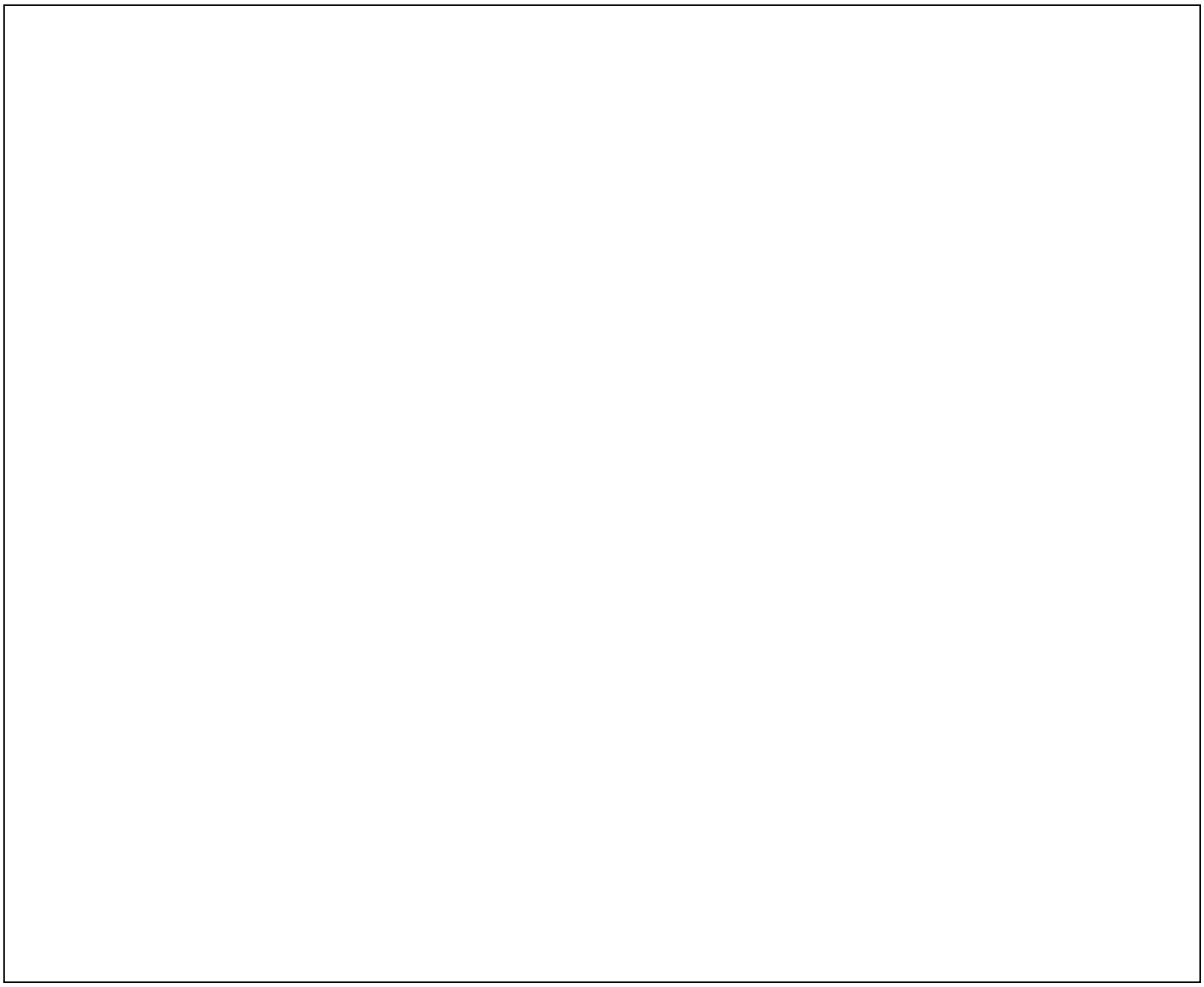
20.a Yes; replace the ITV. Refer to section "Removal of the Intake Throttle Valve and Adaptor" .

20.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

37.2 SPN 51/FMI 3 - GHG17

Intake Throttle Valve Circuit Failed High

SPN 51/FMI 3	
Description	This Fault Code Sets When There Is A Short To Voltage On The Intake Throttle Valve Circuit
Monitored Parameter	Intake Air Throttle
Typical Enabling Conditions	Key On
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	Engine Idle (1 minute)



Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Is fault code 3509 FMI 3 also present?

3.a Yes; diagnose fault code SPN 3509/FMI 3.

3.b No; Go to step 4.

4. Disconnect and inspect the Intake Throttle Valve (ITV) electrical connector. Is there any damage or corrosion present?

4.a Yes; repair as necessary.

4.b No; Go to step 5.

5. Turn the ignition ON (key ON, engine OFF).

6. Recheck for the fault code. Did SPN 51 FMI 3 become inactive and fault code SPN 51 FMI 4 become active?

6.a Yes; replace the ITV. Refer to section "Removal of the Intake Throttle Valve and Adaptor" .

6.b No; Go to step 7.

7. Turn the ignition OFF.

8. Disconnect and inspect the MCM 120-pin electrical connector. Is the MCM connector damaged?

8.a Yes; repair as necessary.

8.b No; Go to step 9.

9. Turn the ignition ON (key ON, engine OFF).

10. Recheck for the fault code. Is SPN 31 FMI 3 still present?

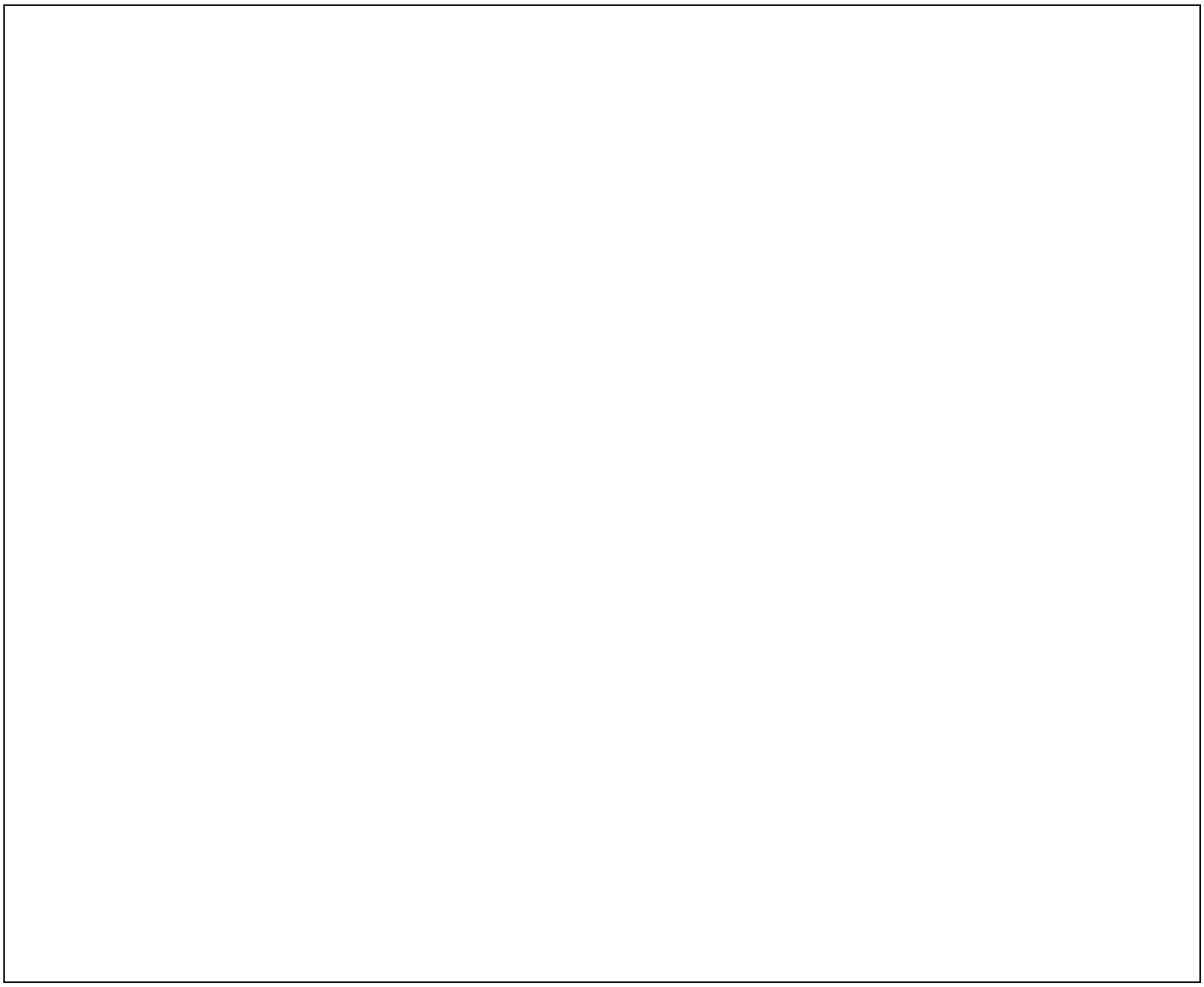
10.a No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

10.b No; repair the circuit between pin 1 of the ITV electrical connector harness side and pin 90 of the 120-pin MCM electrical connector harness side.

37.3 SPN 51/FMI 4 - GHG17

Intake Throttle Valve Circuit Failed Low

SPN 51/FMI 4	
Description	This Fault Code Sets When There Is an open On The Intake Throttle Valve Circuit
Monitored Parameter	Intake Air Throttle
Typical Enabling Conditions	Key On
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	Engine Idle (1 minute)



Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Is fault code SPN 3509 FMI 4 also present?

3.a Yes; diagnose fault code SPN 3509/FMI 4.

3.b No; Go to step 4.

4. Turn the ignition off.
5. Disconnect and inspect the ITV electrical connector. Is there damage or corrosion present?

5.a Yes; repair as necessary.

5.b No; Go to step 6.

6. Measure the resistance across pins 2 and 3, component side, of the ITV motor connector. Is the resistance less than 10 ohms?

6.a Yes; Go to step 7.

6.b No; replace the ITV. Refer to section "Removal of the Intake Throttle Valve and Adaptor" . Verify repair.

7. Measure the resistance across pins 1 and 2, component side, of the ITV motor connector. Is the resistance less than 10 ohms?

7.a If resistance is greater than 5 ohms, repair open circuit between pin 90 of the MCM 120-pin connector and pin 1 of the ITV connector.

7.b If resistance is less than 5 ohms, replace the ITV.

8. Turn the ignition ON.
9. Measure the voltage between pin 2 and pin 3 of the ITV electrical connector harness side. Is the voltage between 4.5 and 5.5 volts?

9.a Yes; Go to step 10.

9.b No; Go to step 13.

10. Turn the ignition OFF.
11. Disconnect and inspect the MCM 120-pin electrical connector. Is there damage or corrosion present?

11.a Yes; repair as necessary.

11.b No; Go to step 9.

12. Measure resistance between pin 1 of the ITV electrical connector harness side and pin 90 of the 120-pin MCM electrical connector harness side. Is the resistance less than 5 ohms?

12.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the circuit between pin 1 of the ITV electrical connector harness side and pin 90 of the 120-pin MCM electrical connector harness side.

13. Measure the voltage between pin 3 and ground. Is the voltage between 4.5 and 5.5 volts?

13.a Yes; repair the circuit between pin 2 of the ITV electrical connector harness side and the splice.

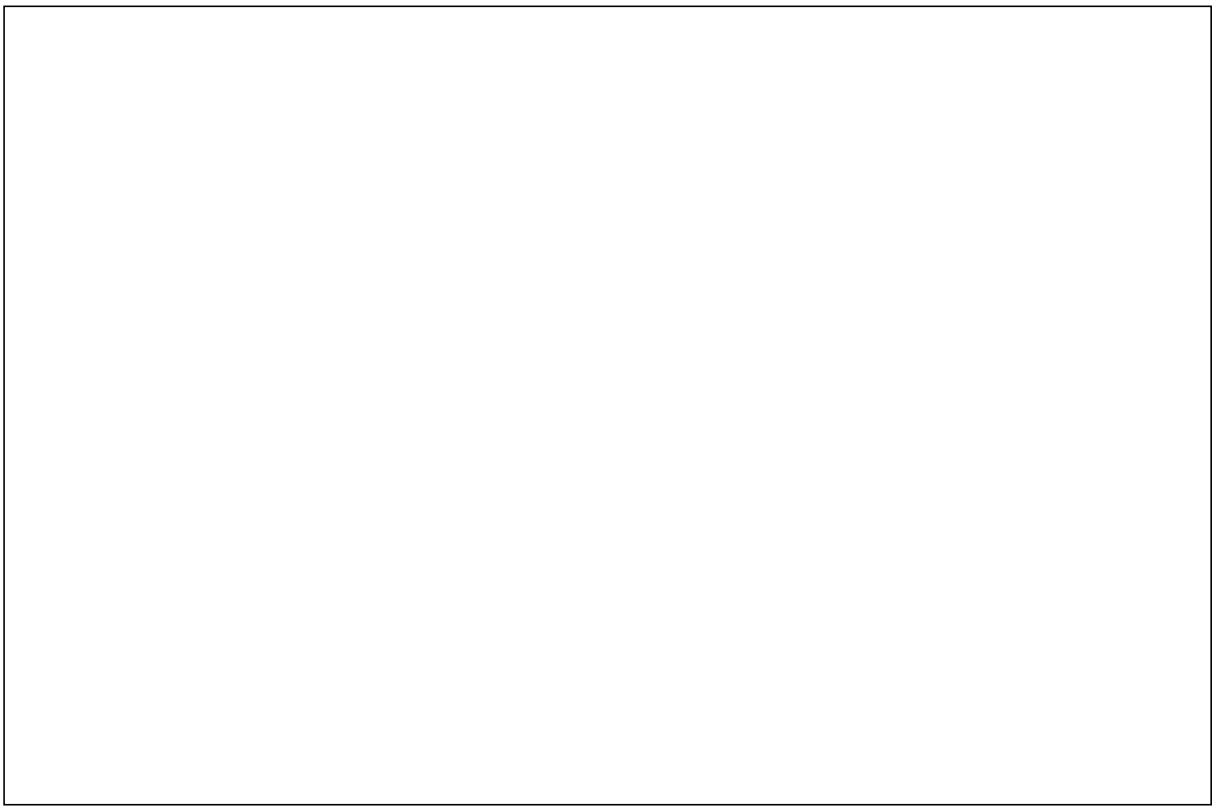
13.b No; repair the circuit between pin 3 of the ITV electrical connector harness side and the splice.

37.4 SPN 51/FMI 10 - GHG17

Intake Throttle Position Abnormal Rate of Change

This code sets when the Intake Throttle Valve (ITV) position is not within 30% of the commanded position during freezing conditions.

SPN 51/FMI 10	
Description	Intake Throttle Position Abnormal Rate Of Change
Monitored Parameter	Intake Throttle Valve
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Five seconds
Dash Lamps	None
Engine Reaction	No Derate
Verification	Engine rpm = idle or higher



Possible causes:

- Faulty ITV motor
- Faulty ITV position
- Frozen (ice buildup) ITV butterfly

Note : With the new strategy when the ignition key is turned on, the ITV will cycle two full times and then the ITV will be commanded short increments.

Check as follows:

1. Connect Diagnostic Link™. Go to step 2.
2. Turn ignition ON (key ON, engine OFF). Go to step 3.
3. Check the Engine Coolant Temperature and Ambient Air Temperature in the Motor Control Module (MCM) when the fault code is set. Were temperatures below freezing when the code set?
   - 3.a Yes; Go to step 4.
   - 3.b No; Go to step 8.
4. Turn the ignition OFF. Go to step 5.
5. Remove the hose from the charge air cooler to the ITV. Go to step 6.
6. Inspect the hose and the ITV for signs of ice or moisture. Are there signs of ice or moisture?
   - 6.a Yes; clean the hose and ITV as necessary. Inspect the air intake system/air cleaner for signs of water intrusion. Repair as necessary. Verify repair.
   - 6.b No; Go to step 7.
7. Turn the ignition ON (key ON, engine OFF). Go to step 8.
8. Remove the hose from the charge air cooler to the ITV. Go to step 9.
9. Use the Service Routines greater than Intake Throttle Valve in DiagnosticLink to command the Intake Throttle Valve fully open and fully closed while watching the ITV flap. Does the ITV butterfly valve fully close and fully open when commanded?
   - 9.a Yes; Go to step 10.
   - 9.b No; replace the ITV. Refer to section "Removal of the Intake Throttle Valve and Adaptor" . Verify repair.
10. Using the Intake Throttle Valve service routine, command the ITV to 20% while monitoring the ITV actual position. Is the actual valve position within +/- 5% of the commanded position?
    - 10.a Yes; Go to step 11.
    - 10.b No; replace the ITV. Refer to section "Removal of the Intake Throttle Valve and Adaptor" . Verify repair.
11. Command the ITV to 50% while monitoring the ITV actual position. Is the actual valve position within +/- 5% of the commanded position?
    - 11.a Yes; Go to step 12.
    - 11.b No; replace the ITV. Refer to section "Removal of the Intake Throttle Valve and Adaptor" . Verify repair.
12. Command the ITV to 90% while monitoring the ITV actual position. Is the actual valve position within +/- 5% of the commanded position?
    - 12.a Yes; Go to step 13.
    - 12.b No; replace the ITV. Refer to section "Removal of the Intake Throttle Valve and Adaptor" . Verify repair.
13. Turn the ignition OFF. Go to step 14.
14. Disconnect and inspect the ITV 5-pin connector. Are there any damaged pins, spread pins or the retainer clip missing?
    - 14.a Yes; repair as necessary. Verify repair.
    - 14.b No; Go to step 15.
15. Measure the resistance across pins 4 and 5 of the component side of the ITV motor connector. Is the resistance less than 10 ohms?
    - 15.a Yes; Go to step 16.
    - 15.b No; replace the ITV due to a shorted motor. Refer to section "Removal of the Intake Throttle Valve and Adaptor" . Verify repair.
16. Install a test Motor Control Module (MCM). Go to step 17.
17. Road test the vehicle. Is code SPN 51/FMI 2 still present?
    - 17.a Yes; replace the ITV. Refer to section "Removal of the Intake Throttle Valve and Adaptor" . Verify repair.
    - 17.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repair.

37.5 SPN 51/FMI 18 - GHG17

Intake Throttle Position Rationality Error

SPN 51/FMI 18	
Description	This Fault Sets When Intake Throttle Position Does Not Match Requested Range
Monitored Parameter	Intake Throttle Valve (ITV)
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Five seconds
Dash Lamps	MIL
Engine Reaction	No Derate
Verification	Engine rpm = idle or higher

Possible causes:

- Damaged ITV Butterfly Flap
- Faulty ITV Motor
- Faulty ITV Sensor

> **WARNING**
>
> PERSONAL INJURY
>
> Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Check as follows:

1. Remove the hose from the Charge Air Cooler (CAC) to the ITV.
2. Visually inspect the ITV butterfly valve. Is there damage to the butterfly valve?
   - 2.a Yes; replace the ITV. Refer to section "Removal of the Intake Throttle Valve and Adaptor" . Verify repair.
   - 2.b No; Go to step 3.
3. Connect Diagnostic Link .
4. Turn the ignition ON (key ON, engine OFF).
5. Use the ITV service routine in DiagnosticLink to command the ITV fully open and fully closed while watching the ITV flap. Does the ITV butterfly valve fully close and fully open when commanded?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the ITV. Refer to section "Removal of the Intake Throttle Valve and Adaptor" . Verify repair.
6. Using the ITV service routine, command the ITV to 20% while monitoring the ITV actual position. Is the actual valve position within +/- 5% of the commanded position?
   - 6.a Yes; Go to step 7.
   - 6.b No; replace the ITV. Refer to section "Removal of the Intake Throttle Valve and Adaptor" . Verify repair.
7. Command the ITV to 50% while monitoring the ITV actual position. Is the actual valve position within +/- 5% of the commanded position?
   - 7.a Yes; Go to step 8.
   - 7.b No; replace the ITV. Refer to section "Removal of the Intake Throttle Valve and Adaptor" . Verify repair.
8. Command the ITV to 90% while monitoring the ITV actual position. Is the actual valve position within +/- 5% of the commanded position?

8.a Yes; Go to step 9.

8.b No; replace the ITV. Refer to section "Removal of the Intake Throttle Valve and Adaptor" . Verify repair.

9. Turn the ignition OFF.

10. Disconnect and inspect the ITV 5-pin connector. Are there any damaged pins, spread pins or the retainer clip missing?

10.a Yes; repair as necessary. Verify repair.

10.b No; Go to step 11.

11. Measure the resistance across pins 4 and 5, component side, of the ITV motor connector. Is the resistance less than 10 ohms?

11.a Yes; Go to step 12.

11.b No; replace the ITV due to a shorted motor. Refer to section "Removal of the Intake Throttle Valve and Adaptor" . Verify repair.

12. Install a test Motor Control Module (MCM). Go to step 13.

13. Road test the vehicle. Is code SPN 51/FMI 18 still present?

13.a Yes; replace the ITV. Refer to section "Removal of the Intake Throttle Valve and Adaptor" . Verify repair.

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repair.

SPN 70 (CPC) (GHG17)

38.1 SPN 70/FMI 2 - GHG17

J1939 Park Brake Switch Signal from Source #1, #2, or #3 Data Erratic, Intermittent or Incorrect

SPN 70/FMI 2	
Description	Park Brake Switch Signal Data Incorrect
Monitored Parameter	Park Brake Switch
Typical Enabling Conditions	Always On
Monitor Sequence	Key ON
Execution Frequency	Continuous When Enabling Conditions are Met
Typical Duration	Two Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Key ON, Engine OFF

1. Check for multiple codes; are fault codes (CPC) SPN 168/FMI 0/14/18 present?
   1.a Yes; troubleshoot and repair these first.
   1.b No; Go to step 2.
2. Is (MCM) SPN 625/FMI 9 present?
   2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   3.a Yes; check the proper configuration of the CPC.

   3.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

38.2 SPN 70/FMI 13 - GHG17

J1939 Park Brake Switch Signal from Source #1, #2, or #3 is Missing

SPN 70/FMI 13	
Description	Park Brake Switch Signal Data Missing
Monitored Parameter	Park Brake Switch
Typical Enabling Conditions	Always On
Monitor Sequence	Key ON
Execution Frequency	Continuous When Enabling Conditions are Met
Typical Duration	Two Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Key ON, Engine OFF

1. Check for multiple codes; are fault codes (CPC) SPN 168/FMI 0/14/18 present?
   1.a Yes; troubleshoot and repair these first.
   1.b No; Go to step 2.
2. Is (MCM) SPN 625/FMI 9 present?
   2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   3.a Yes; check the proper configuration of the CPC.

   3.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

38.3 SPN 70/FMI 19 - GHG17

J1939 Park Brake Switch Signal from Source #1, #2, or #3 is Erratic

SPN 70/FMI 19	
Description	Park Brake Switch Signal Erratic
Monitored Parameter	Park Brake Switch
Typical Enabling Conditions	Always On
Monitor Sequence	Key ON
Execution Frequency	Continuous When Enabling Conditions are Met
Typical Duration	Two Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Key ON, Engine OFF

1. Check for multiple codes; are fault codes (CPC) SPN 168/FMI 0/14/18 present?
   1.a Yes; troubleshoot and repair these first.
   1.b No; Go to step 2.
2. Is (MCM) SPN 625/FMI 9 present?
   2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   3.a Yes; check the proper configuration of the CPC.

   3.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

SPN 84 (CPC) (GHG17)

39.1 SPN 84/FMI 0 - GHG17

Vehicle Speed Above Programmable Threshold 1 While Driving

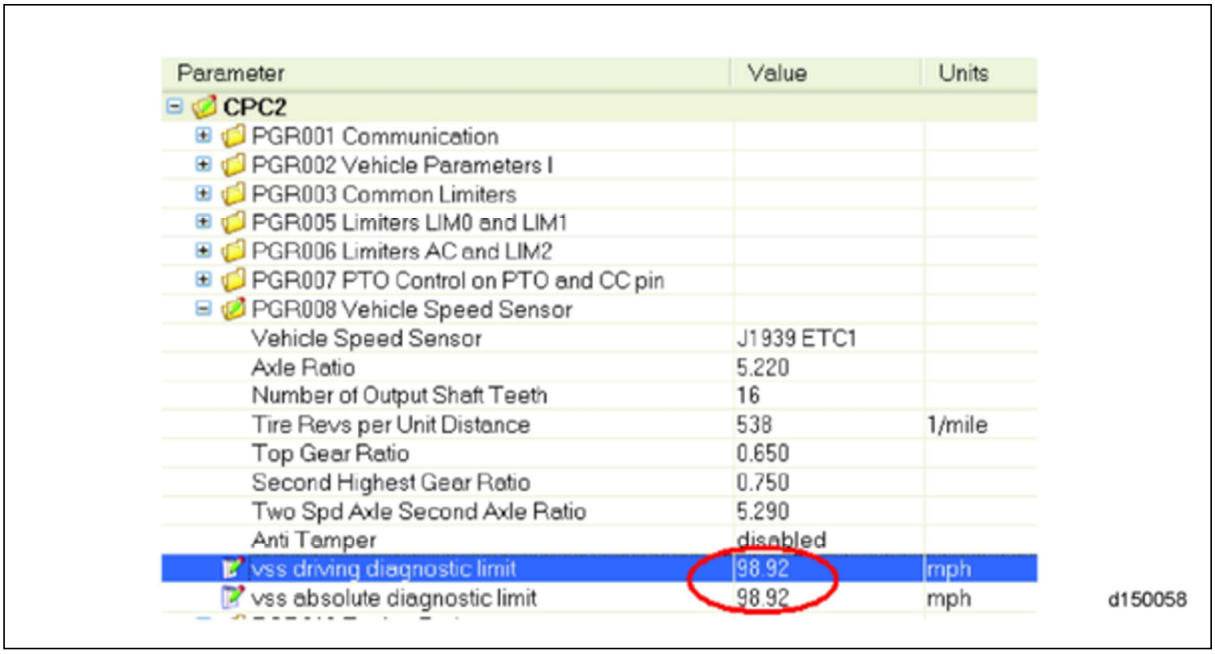
Note : This is an information-only fault. It indicates that vehicle speed is above a programmable threshold. It may be necessary to contact the truck owner or fleet manager to see if they have this feature enabled.

1. Does the fleet operator have this feature enabled?

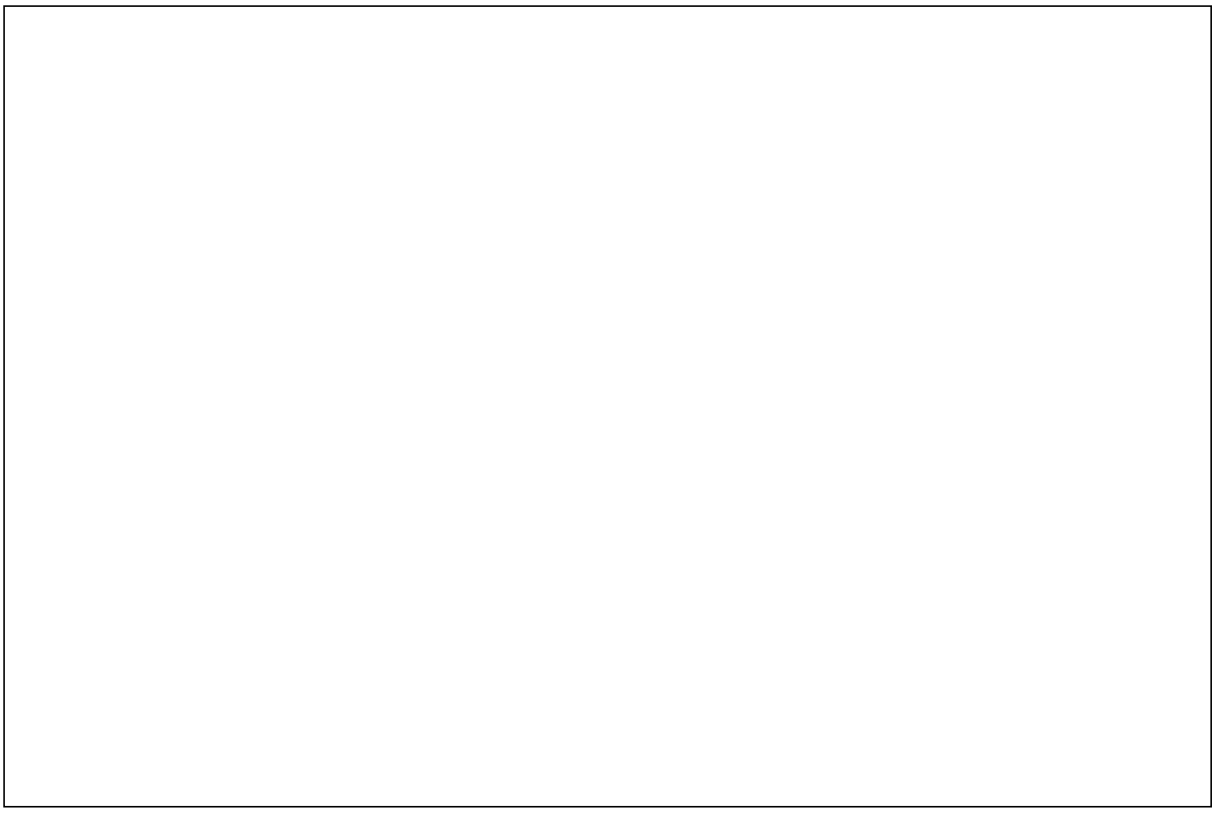
   1.a Yes, note the fault code in the repair order and clear the code only if the fleet or owner requests it. Release the vehicle.

   1.b No, Go to step 2.

2. Using DiagnosticLink , change the Common Powertrain Controller (CPC) parameters highlighted below to 99 (actual value which will be displayed in window is 98.92).



39.2 SPN 84/FMI 2 - GHG17



1. Are there any battery faults (SPN 168/FMI any) or Controller Area Network (CAN) faults (SPN 625/FMI any) present?
   1.a Yes; repair those faults first.
   1.b No; Go to step 2.
2. Has the Common Powertrain Controller (CPC) been recently reprogrammed?
   2.a Yes; ensure the VSS parameters are configured correctly for the vehicle application. If OK, Go to step 3.
   2.b No; Go to step 3.
3. Disconnect the VSS harness connector. Refer to Original Equipment Manufacturer (OEM) literature for location.
4. Inspect the VSS harness connector for bent, spread, or corroded pins. Is any pin damage found?
   4.a Yes; repair as necessary. Verify repairs.
   4.b No; Go to step 5.
5. Is the vehicle equipped with a Hall Effect sensor? Refer to OEM literature for application.
   5.a Yes; Go to step 6.
   5.b No; Go to step 10.
6. Turn the ignition ON (key ON, engine OFF).
7. Measure the voltage between pin 3 of the VSS harness connector and ground. Is the voltage greater than 4.5 volts?
   7.a Yes; Go to step 10.
   7.b No; Go to step 8.

8. Disconnect CPC #3 connector.
9. Measure the voltage between pin 8 of the CPC #1 connector component side and ground. Is the voltage greater than 4.5 volts?
   - 9.a Yes; repair wire between pin 8 of the CPC #1 harness connector and pin 3 of the VSS harness connector. Verify repairs.
   - 9.b No; replace the CPC. Refer to OEM literature.
10. Turn the ignition OFF (key OFF, engine OFF).
11. Disconnect CPC #3 connector.
12. Measure the resistance between pins 13 and 14 of the CPC #3 harness connector. Is resistance greater than 10K ohms?
    - 12.a Yes; Go to step 13.
    - 12.b No; repair short between pins 13 and 14 of the CPC #3 harness connector to the VSS harness connector. Verify repairs.
13. Measure the resistance between pin 13 of the CPC #3 harness connector and the VSS + harness connector. Is resistance less than 5 ohms?
    - 13.a Yes; Go to step 14.
    - 13.b No; repair wire between pin 13 of the CPC #3 connector and the VSS + harness connector. Verify repairs.
14. Measure the resistance between pin 14 of the CPC #3 harness connector and the VSS - harness connector. Is resistance less than 5 ohms?
    - 14.a Yes; refer to OEM literature for VSS sensor and sensor wheel diagnostics.
    - 14.b No; repair wire between pin 14 of the CPC #3 harness connector and the VSS - harness connector. Verify repairs.

39.3 SPN 84/FMI 3 - GHG17

SPN 84/FMI 3	
Description	Vehicle Speed Sensor Circuit Short to Voltage
Monitored Parameter	Vehicle Speed Sensor
Typical Enabling Conditions	Key ON and Engine ON
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Three Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	rpm greater than 600

Check as follows:

1. Disconnect the Vehicle Speed Sensor (VSS).
2. Measure the resistance between pin 13 of the Common Powertrain Controller (CPC) #3 21-pin connector and pin 1 of the VSS. Is the resistance greater than three ohms?
   - 2.a Yes; repair the open between pin 13 of the CPC #3 21-pin connector and pin 1 of the VSS.
   - 2.b No; Go to step 3.
3. Measure the resistance between pin 14 of the CPC #3 21-pin connector and pin 2 of the VSS sensor. Is the resistance greater than three ohms?
   - 3.a Yes; repair the open wire between pin 14 of the CPC #3 21-pin connector and pin 2 of the VSS.
   - 3.b No; Go to step 4.
4. Measure the resistance between pins 13 and 14 of the CPC #3 21-pin connector. Is the resistance greater than three ohms?
   - 4.a Yes; replace the VSS.
   - 4.b No; repair the short in the harness between pins 13 and 14 of the CPC #3 21-pin connector.

39.4 SPN 84/FMI 4 - GHG17

SPN 84/FMI 4	
Description	Vehicle Speed Sensor Circuit Short to Ground
Monitored Parameter	Vehicle Speed Sensor
Typical Enabling Conditions	Key ON and Engine ON
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Three Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	rpm greater than 600

Check as follows:

1. Disconnect the Vehicle Speed Sensor (VSS) connector.
2. Disconnect the Common Powertrain Controller (CPC) #3 21-pin connector.
3. Measure the resistance between pins 1 and 2 of the VSS harness connector. Is the resistance measurement less than five ohms?
   - 3.a Yes; repair the short between pins 13 and 14 of the CPC #3 21-pin connector.
   - 3.b No; Go to step 4.
4. Measure the resistance between pin 1 of the VSS harness connector and ground. Is the resistance measurement less than five ohms?
   - 4.a Yes; repair the short to ground between pin 13 of the CPC #3 21-pin connector and pin 1 of the VSS harness connector.
   - 4.b No; Go to step 5.
5. Measure the resistance between pin 2 of the VSS harness connector and ground. Is the resistance measurement less than five ohms?
   - 5.a Yes; repair the short to ground between pin 14 of the CPC #3 21-pin connector and pin 2 of the VSS harness connector.
   - 5.b No; replace the VSS.

39.5 SPN 84/FMI 5 - GHG17

SPN 84/FMI 5	
Description	Vehicle Speed Sensor Circuit Open
Monitored Parameter	Vehicle Speed Sensor
Typical Enabling Conditions	Key ON and Engine ON
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Three Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	rpm greater than 600

Check as follows:

Note : This SPN is broadcast to the Motor Control Module (MCM) via the Common Powertrain Controller (CPC).

1. Disconnect the Vehicle Speed Sensor (VSS).
2. Measure the resistance between pin 13 of the Common Powertrain Controller (CPC) #3 21-pin connector and pin 1 of the VSS. Is the resistance greater than three ohms?

   2.a Yes; repair the open between pin 13 of the CPC #3 21-pin connector and pin 1 of the VSS.

   2.b No; Go to step 3.
3. Measure the resistance between pin 14 of the CPC #3 21-pin connector and pin 2 of the VSS sensor. Is the resistance greater than three ohms?

   3.a Yes; repair the open wire between pin 14 of the CPC #3 21-pin connector and pin 2 of the VSS.

   3.b No; Go to step 4.
4. Measure the resistance between pins 13 and 14 of the CPC #3 21-pin connector. Is the resistance greater than 10K ohms?

   4.a Yes; replace the VSS.

   4.b No; repair the short in the harness between pins 13 and 14 of the CPC #3 21-pin connector.

39.6 SPN 84/FMI 6 - GHG17

Vehicle Speed Sensor Anti-Tamper Detection via Antilock Brake System Vehicle Speed Comparison

This fault code indicates a missing message from the Antilock Brake System (ABS) module. Refer to Original Equipment Manufacturer (OEM) material for J1939 troubleshooting for the ABS module.

39.7 SPN 84/FMI 7 - GHG17

SPN 84/FMI 7	
Description	Vehicle Speed Sensor Rationality Fault
Monitored Parameter	Vehicle Speed Sensor
Typical Enabling Conditions	Key ON and Engine ON
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Three Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	rpm greater than 600

Check as follows:

1. Check for multiple codes. Is (CPC) SPN 168/FMI 0/14/18 (battery voltage) present?
   - 1.a Yes; troubleshoot and repair these first.
   - 1.b No; Go to step 2.
2. Is (MCM) SPN 625/FMI 9 code present?
   - 2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   - 2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   - 3.a Yes; check the proper configuration of the CPC.
   - 3.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate wiring schematic information. Refer to Original Equipment Manufacturer (OEM) literature.

39.8 SPN 84/FMI 11 - GHG17

Vehicle Speed Above Programmable Threshold 2 While Driving

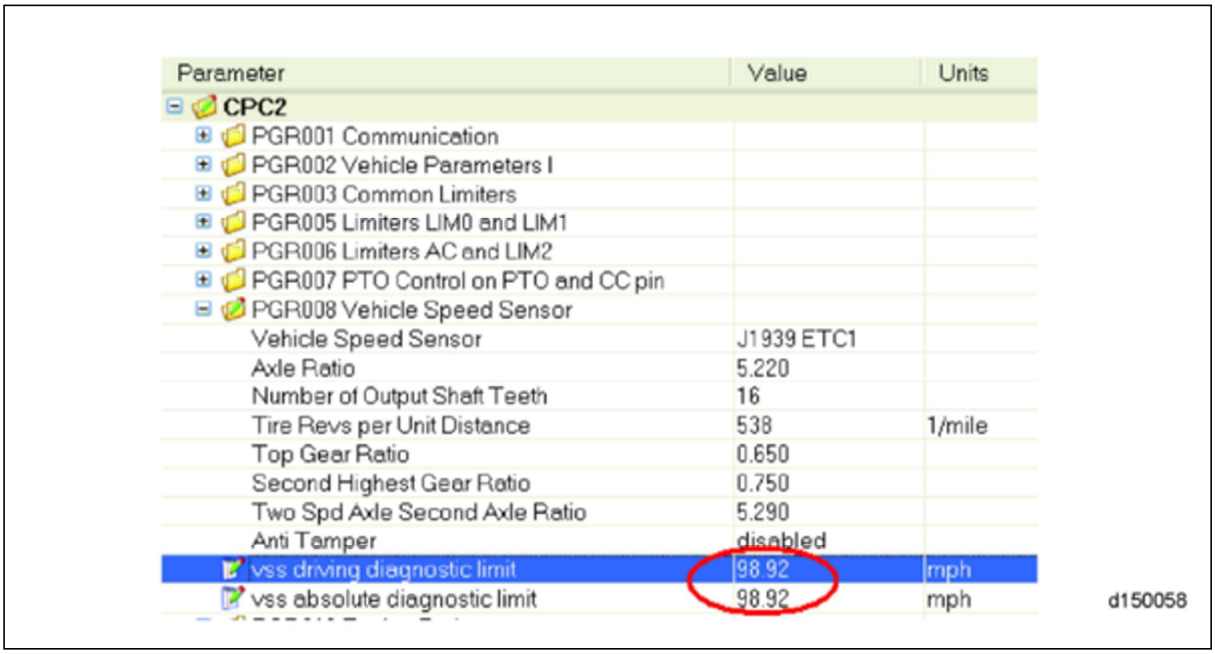
Note : This is an information-only fault. It indicates the vehicle speed is above a programmable threshold. It may be necessary to contact the truck owner or fleet operator to see if they have this feature enabled.

1. Does the fleet operator have this feature enabled?

   1.a Yes; note the fault code in the repair order and clear the code only if the fleet or owner requests it. Release the vehicle.

   1.b No; Go to step 2.

2. Using DiagnosticLink®, change the Common Powertrain Controller (CPC) parameters highlighted below to 99 (actual value which will be displayed in window is 98.92).



39.9 SPN 84/FMI 13 - GHG17

SPN 84/FMI 13	
Description	Vehicle Speed Over PTCAN SNA
Monitored Parameter	Vehicle Speed Sensor (VSS)
Typical Enabling Conditions	Key ON Engine ON
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Three Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	rpm Greater Than 600

1. Connect DiagnosticLink and check for other fault codes. Are fault codes SPN 168/FMI 0 or 18 (battery voltage) fault codes present?
   1.a Yes; troubleshoot these fault codes first.
   1.b No; Go to step 2.
2. Is the Motor Control Module (MCM) SPN 625/FMI 9 present?
   2.a Yes; repair the Controller Area Network (CAN) line faults.
   2.b No; Go to step 3.
3. Has the Common Powertrain Controller (CPC) been recently reprogramed?
   3.a Yes; check proper configuration of the CPC.
   3.b No; Go to step 4.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

4. Reprogram MCM and verify repairs. Did the code return?
   4.a Yes; Go to step 5.
   4.b No; release the vehicle.
5. Replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs. Did the code return?
   5.a Yes; Go to step 6.
   5.b No; release the vehicle.
6. Check the other vehicle modules for Communication or VSS related faults. Follow the appropriate module troubleshooting procedures for the fault.

39.10 SPN 84/FMI 14 - GHG17

SPN 84/FMI 14	
Description	Vehicle Speed Sensor Signal Missing
Monitored Parameter	Vehicle Speed Sensor
Typical Enabling Conditions	Key ON and Engine ON
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Three Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	rpm greater than 600

1. Check for multiple codes: Are (CPC) SPN 168/FMI 0/14/18 (battery voltage) codes present?
   1.a Yes; troubleshoot and repair these first.
   1.b No; Go to step 2.
2. Is (MCM) SPN 625/FMI 9 code present?
   2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   3.a Yes; check the proper configuration of the CPC.
   3.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate wiring schematic information. Refer to Original Equipment Manufacturer (OEM) literature.

39.11 SPN 84/FMI 19 - GHG17

J1939 Wheel-based Vehicle Speed Signal from Source #1, #2, or #3 is Erratic

SPN 84/FMI 19	
Description	J1939 Wheel-Based Vehicle Speed Signal from Source#1, #2, or #3 is erratic
Monitored Parameter	Vehicle Speed Sensor (VSS)
Typical Enabling Conditions	rpm greater than1500, Torque Demand On
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	10 Seconds
Dash Lamps	MIL
Engine Reaction	
Verification	rpm greater than 1500, Torque Demand On

1. Check for multiple codes. Are fault codes SPN 168/FMI 0/14/18 (CPC) present?
   1.a Yes; troubleshoot and repair these first.
   1.b No; Go to step 2.
2. Is SPN 625/FMI 9 (MCM) present?
   2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   2.b No; Go to step 3.
3. Has the Common Powertrain Controller (CPC) been recently reprogrammed?
   3.a Yes; check the proper configuration of the CPC.
   3.b No; connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

39.12 SPN 84/FMI 20 - GHG17

Vehicle Speed Sensor Erratic

SPN 84/FMI 20	
Description	Vehicle Speed Sensor Erratic
Monitored Parameter	Vehicle Speed Sensor (VSS)
Typical Enabling Conditions	RPM greater than 1500, Torque Demand On
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	10 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	RPM greater than 1500, Torque Demand On

1. Are there any battery (SPN 168/FMI any) or Controller Area Network (CAN) (SPN 625/FMI any) faults present?
   - 1.a Yes; repair those faults first.
   - 1.b No; Go to step 2.
2. Has the Common Powertrain Controller (CPC) been recently reprogrammed?
   - 2.a Yes; insure the VSS parameters are configured correctly for the vehicle application. If OK, Go to step 3.
   - 2.b No; Go to step 3.
3. Is the VSS hardwired?
   - 3.a Yes; Go to step 4.
   - 3.b No; refer to the Application and Installation manual for the correct parameter configuration. If configuration is correct, refer to the Original Equipment Manufacturer (OEM) material for J1939 troubleshooting.
4. Disconnect the VSS harness connector; refer to OEM literature for location.
5. Inspect the VSS harness connector for bent, spread, or corroded pins. Is damage found?
   - 5.a Yes; repair as necessary.
   - 5.b No; Go to step 6.
6. Disconnect CPC connector #3.
7. Measure the resistance between pins 13 and 14 of the CPC connector #3. Is the resistance less than 1K ohms?
   - 7.a Yes; repair the short between pins 13 and 14 of the CPC connector #3 and the VSS connector.
   - 7.b No; Go to step 8.
8. Measure the resistance between pin 13 of the CPC connector #3 and the VSS+ harness connector. Is the resistance less than 1K ohms?
   - 8.a Yes; repair the wire between pin 13 of the CPC connector #3 and the VSS+ harness connection.
   - 8.b No; Go to step 9.
9. Measure the resistance between pin 14 of the CPC connector #3 and the VSS- harness connector. Is the resistance less than 1k ohms?
   - 9.a Yes; repair the wire between pin 14 of the CPC connector #3 and the VSS- harness connection.
   - 9.b No; refer to OEM literature for VSS sensor diagnostics.

39.13 SPN 84/FMI 21 - GHG17

Vehicle Speed Sensor Erratic

SPN 84/FMI 21	
Description	Vehicle Speed Sensor Erratic
Monitored Parameter	Vehicle Speed Sensor (VSS)
Typical Enabling Conditions	rpm greater than 1500, Torque Demand On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	10 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	rpm Greater than 1500, Torque Demand On

1. Are there any battery (SPN 168/FMI any) or Controller Area Network (CAN) (SPN 625/FMI any) faults present?
   - 1.a Yes; repair those faults first.
   - 1.b No; Go to step 2.
2. Has the Common Powertrain Controller (CPC) been recently reprogrammed?
   - 2.a Yes; ensure the VSS parameters are configured correctly for the vehicle application, if OK Go to step 3.
   - 2.b No; Go to step 3.
3. Is the VSS hardwired?
   - 3.a Yes; Go to step 4.
   - 3.b No; refer to the Application and Installation manual for the correct parameter configuration. If configuration is correct, refer to the Original Equipment Manufacturer (OEM) material for J1939 troubleshooting.
4. Disconnect the VSS harness connector, refer to OEM literature for location.
5. Inspect the VSS harness connector for bent, spread, or corroded pins. Is damage found?
   - 5.a Yes; repair as necessary.
   - 5.b No; Go to step 6.
6. Disconnect CPC connector #3.
7. Measure the resistance between pins 13 and 14 of the CPC connector #3 . Is the resistance less than 1K ohms?
   - 7.a Yes; repair the short between pins 13 and 14 of the CPC connector #3 and the VSS connector.
   - 7.b No; Go to step 8.
8. Measure the resistance between pin 13 of the CPC connector #3 and the VSS+ harness connector. Is the resistance less than 1K ohms?
   - 8.a Yes; repair the wire between pin 13 of the CPC connector #3 and the VSS+ harness connection.
   - 8.b No; Go to step 9.
9. Measure the resistance between pin 14 of the CPC connector #3 and the VSS- harness connector. Is the resistance less than 1k ohms?
   - 9.a Yes; repair the wire between pin 14 of the CPC connector #3 and the VSS- harness connection.
   - 9.b No; refer to OEM literature for VSS sensor diagnostics.

SPN 84 (CPC3) (GHG17)

40.1 SPN 84/FMI 0 - GHG17

Vehicle Speed Above Programmable Threshold 1 While Driving

This is an information only code that indicates the vehicle speed exceeded its programmable limit while in drive. No action required.

40.2 SPN 84/FMI 6 - GHG17

VSS Anti-Tamper Detection via ABS Vehicle Speed Comparison

This fault only occurs on vehicles equipped with a manual transmission. It indicates the Vehicle Speed Sensor (VSS) speed is different than Antilock Brake (ABS) wheel speed.

Check as follows:

1. Connect DiagnosticLink 8.04 SP2 or higher.
2. Are any ABS system faults also present?
   2.a Yes, repair those faults first.
   2.b No; Go to step 3.
3. Inspect VSS harness for defeat devices such as signal generators or added resistors in the harness. If found return vehicle to original factory configuration.

40.3 SPN 84/FMI 11 - GHG17

Vehicle Speed Above Programmable Threshold2 While Driving

This is an information-only code that indicates the vehicle speed exceeded its programmable limit while coasting. No action required.

40.4 SPN 84/FMI 20 - GHG17

Check as follows:

1. Disconnect the VSS.
2. Inspect the VSS harness connector for bent, spread or corroded pins. Is pin damage found?
   - 2.a Yes; repair as necessary.
   - 2.b No; Go to step 3.
3. Remove the VSS, inspect sensor magnetic tip and the tone wheel for damage. Is damage found?
   - 3.a Yes; replace the VSS and tone wheel.
   - 3.b No; replace the VSS.

40.5 SPN 84/FMI 21 - GHG17

Vehicle Speed Sensor Failure

Check as follows:

1. Disconnect the Vehicle Speed Sensor (VSS).
2. Inspect the VSS harness connector for bent, spread or corroded pins. Is pin damage found?
   2.a Yes; repair as necessary.
   2.b No; Go to step 3.
3. Remove the VSS, inspect sensor magnetic tip and the tone wheel for damage. Is damage found?
   3.a Yes; replace the VSS and tone wheel.
   3.b No; replace the VSS.

SPN 84 (MCM) (GHG17)

41.1 SPN 84/FMI 13 - GHG17

SPN 84/FMI 13	
Description	Vehicle Speed Over PTCAN SNA
Monitored Parameter	Vehicle Speed Sensor
Typical Enabling Conditions	Key ON Engine ON
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Three Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	rpm Greater Than 600

Check as follows:

1. Connect DiagnosticLink and check for other fault codes. Are there any TCM faults or fault codes SPN 168/FMI 0 or 18 (battery voltage) fault codes present?
   1.a Yes; troubleshoot these fault codes first.
   1.b No; Go to step 2.
2. Is the Motor Control Module (MCM) SPN 625/FMI 9 present?
   2.a Yes; repair the Controller Area Network (CAN) line faults.
   2.b No; Go to step 3.
3. Has the Common Powertrain Controller (CPC) been recently reprogramed?
   3.a Yes; check proper configuration of the CPC.
   3.b No; Go to step 4.

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

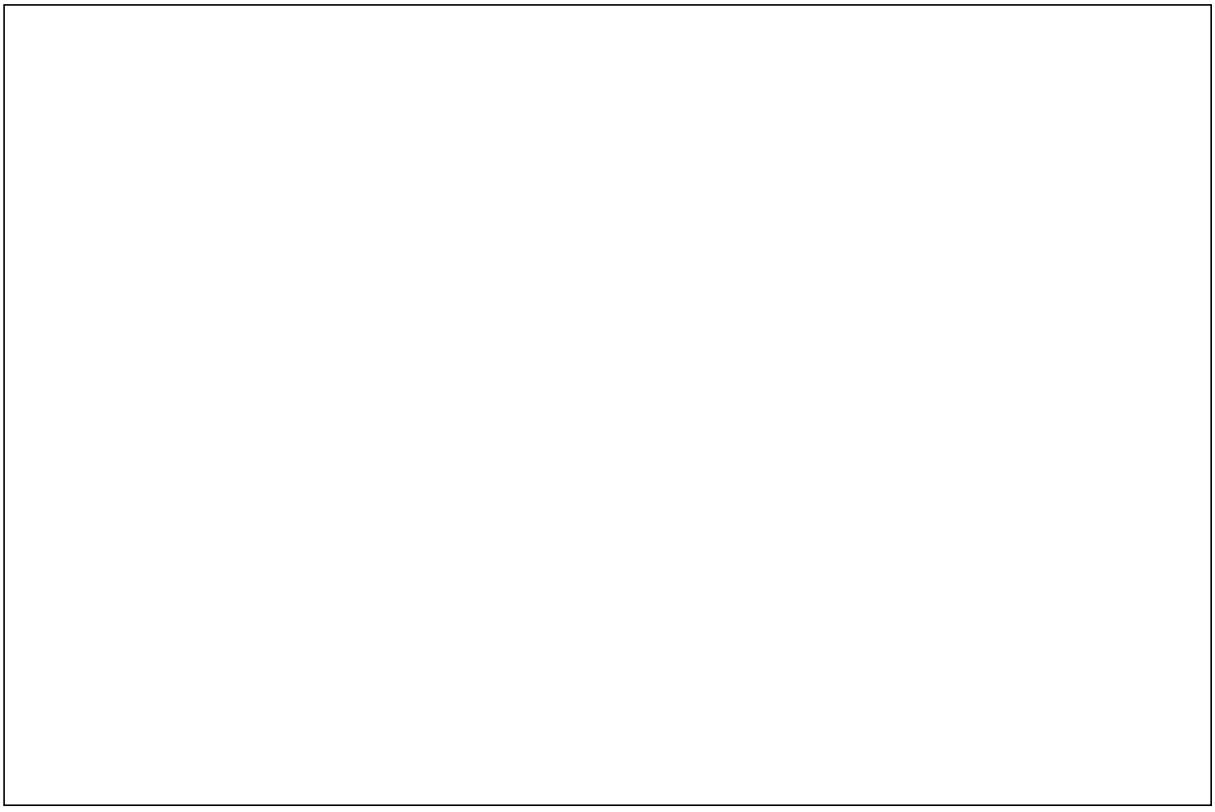
4. Reprogram MCM and verify repairs. Did the code return?
   4.a Yes; Go to step 5.
   4.b No; release the vehicle
5. Replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs. Did the code return?
   5.a Yes; Go to step 6.
   5.b No; release the vehicle.
6. Check the other vehicle modules for Communication or VSS related faults. Follow the appropriate module troubleshooting procedures for the fault.

41.2 SPN 84/FMI 19 - GHG17

Vehicle Speed outside the Allowable range

SPN 84/FMI 19	
Description	This fault code sets when the vehicle speed sensor reads the maximum value 255kph (185 mph)
Monitored Parameter	Vehicle Speed Sensor (VSS)
Typical Enabling Conditions	rpm greater than 1500, Torque Demand On
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	10 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	rpm greater than 1500, Torque Demand On

Note : OEM VSS connectors may vary. Refer to OEM literature for details



Check as follows:

1. Connect DiagnosticLink and check for other fault codes. Are there any TCM codes present?
   1.a Yes; troubleshoot the other codes first.
   1.b No; Go to step 2.
2. Turn the ignition ON (key ON, engine OFF).
3. Has the Common Powertrain Controller (CPC) been recently reprogrammed?
   3.a Yes; ensure the VSS parameters are configured correctly for the vehicle application. If OK, Go to step 4.

3.b No; Go to step 4.

4. Turn the ignition OFF.
5. Disconnect the VSS harness connector. Refer to OEM literature for location.
6. Inspect the VSS harness connector for bent, spread, or corroded pins. Is any damage found?
   - 6.a Yes; repair as necessary. Verify repairs.
   - 6.b No; Go to step 7.
7. Disconnect CPC connector #3.
8. Measure the resistance between pins 13 and 14 of the CPC connector #3. Is the resistance greater than 10k ohms?
   - 8.a Yes; Go to step 9.
   - 8.b No; repair short between pins 13 and 14 of the CPC connector #3 and the VSS connector. Verify repairs.
9. Measure the resistance between pin 13 of the CPC connector #3, harness side and battery ground. Is the resistance greater than 10k ohms?
   - 9.a Yes; Go to step 10.
   - 9.b No; repair the short to ground between pin 13 of the CPC connector #3 and the VSS+ harness connection. Verify repairs.
10. Measure the resistance between pin 14 of the CPC connector #3, harness side and battery ground. Is the resistance greater than 10k ohms?
    - 10.a Yes; Go to step 11.
    - 10.b No; repair the short to ground between pin 14 of the CPC connector #3 and the VSS- connector. Verify repairs.
11. Measure the resistance between pin 13 of the CPC connector #3 and the VSS(+) harness connection. Is the resistance less than five ohms?
    - 11.a Yes; Go to step 12.
    - 11.b No; repair the wire between pin 13 of the CPC connector #3 and the VSS (+) harness connection. Verify repairs.
12. Measure the resistance between pin 14 of the CPC connector #3 and the VSS (-) harness connection. Is the resistance less than five ohms?
    - 12.a Yes; refer to OEM literature for VSS sensor diagnostics.
    - 12.b No; repair the wire between pin 14 of the CPC connector #3 and the VSS(-) harness connection. Verify repairs.

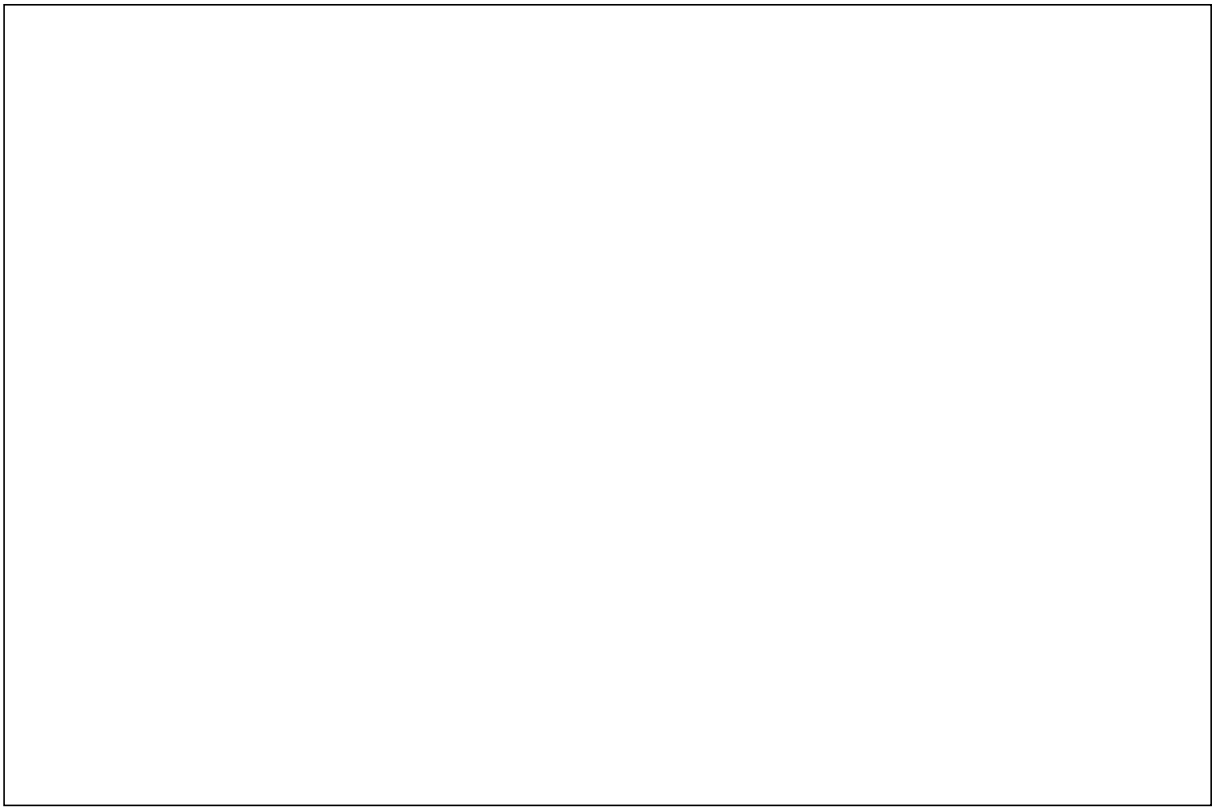
41.3 SPN 84/FMI 21 - GHG17

Vehicle Speed Sensor Failure

SPN 84/FMI 21	
Description	Vehicle Speed Sensor Rationality
Monitored Parameter	Vehicle Speed Sensor (VSS)
Typical Enabling Conditions	RPM greater than 1500, Torque Demand On
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	10 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	RPM greater than 1500, Torque Demand On

Check as follows:

Note : OEM VSS connectors may vary. Refer to OEM literature for details.



1. Connect DiagnosticLink and check for other fault codes. Are there any TCM codes present?
   1.a Yes; troubleshoot the other codes first.
   1.b No; Go to step 2.
2. Turn the ignition ON (key ON, engine OFF).
3. Has the Common Powertrain Controller (CPC) been recently reprogrammed?
   3.a Yes; ensure the VSS parameters are configured correctly for the vehicle application. If OK, Go to step 4.

3.b No; Go to step 4.

4. Turn the ignition OFF.
5. VSS programming options are either hardwired or transmitted via J1939. Is the VSS hardwired?

5.a Yes; Go to step 6.

5.b No; refer to the Application and Installation Manual for the correct parameter configuration. If configuration is correct, refer to Original Equipment Manufacturer (OEM) material for J1939 VSS troubleshooting.

6. Disconnect the VSS harness connector. Refer to OEM literature for location.
7. Inspect the VSS harness connector for bent, spread, or corroded pins. Is any damage found?

7.a Yes; repair as necessary. Verify repairs.

7.b No; Go to step 8.

8. Disconnect CPC connector #3.
9. Measure the resistance between pins 13 and 14 of the CPC connector #3. Is the resistance greater than 10K ohms?

9.a Yes; Go to step 10.

9.b No; repair short between pins 13 and 14 of the CPC connector #3 and the VSS connector. Verify repairs.

10. Measure the resistance between pin 13 of the CPC connector #3 and battery ground. Is the resistance greater than 10K ohms?

10.a Yes; Go to step 11.

10.b No; repair the short to ground between pin 13 of the CPC connector #3 and the VSS+ harness connection. Verify repairs.

11. Measure the resistance between pin 14 of the CPC connector #3 and battery ground. Is the resistance greater than 10K ohms?

11.a Yes; Go to step 12.

11.b No; repair the short to ground between pin 14 of the CPC connector #3 and the VSS- connector. Verify repairs.

12. Measure the resistance between pin 13 of the CPC connector #3 and the VSS+ harness connection. Is the resistance less than five ohms?

12.a Yes; Go to step 13.

12.b No; repair the wire between pin 13 of the CPC connector #3 and the VSS+ harness connection. Verify repairs.

13. Measure the resistance between pin 14 of the CPC connector #3 and the VSS- harness connection. Is the resistance less than five ohms?

13.a Yes; refer to OEM literature for VSS sensor diagnostics.

13.b No; repair the wire between pin 14 of the CPC connector #3 and the VSS- harness connection. Verify repairs.

SPN 91 (CPC) (GHG17)

42.1 SPN 91/FMI 0 – GHG17

SPN 91/FMI 0	
Description	Pedal Sensor Supply Signal Short Or Open Ground Circuit
Monitored Parameter	Pedal Position
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key Cycle - Ignition ON

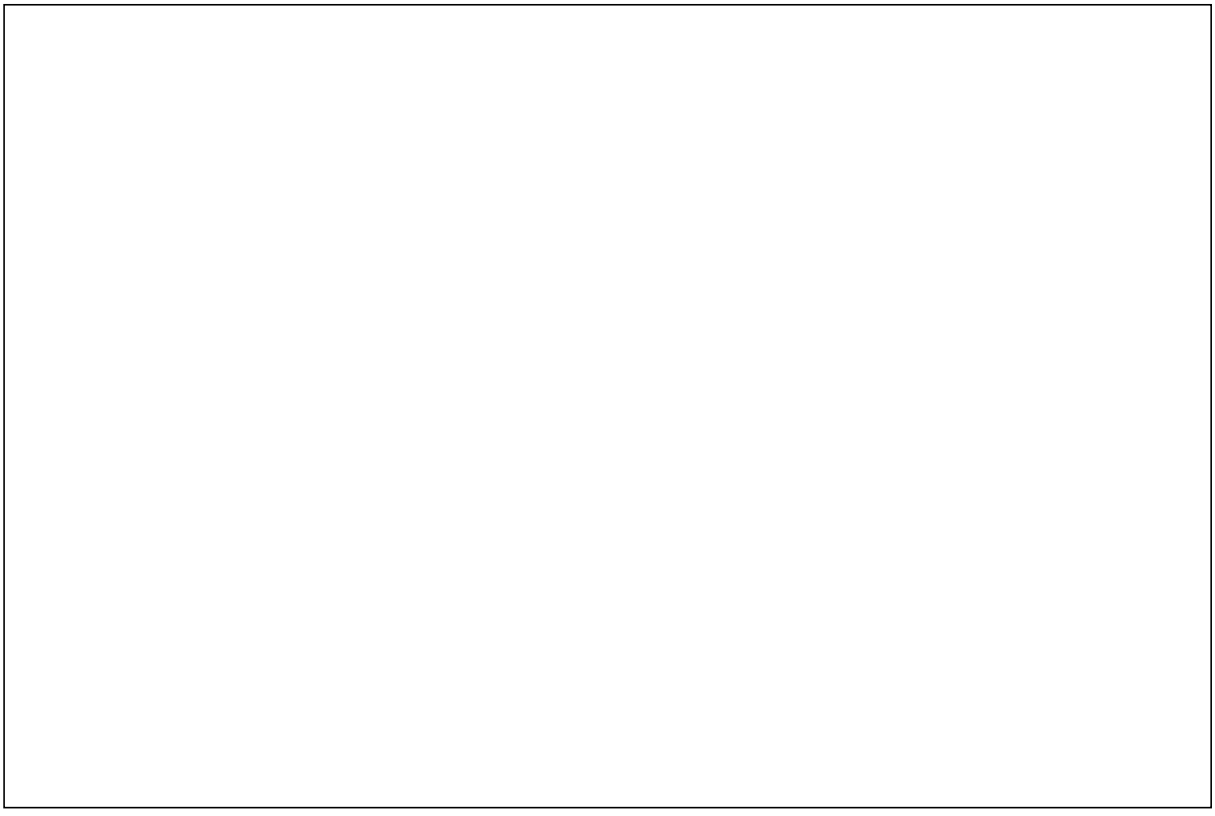


Fig 42.1, Analog Pedal Type

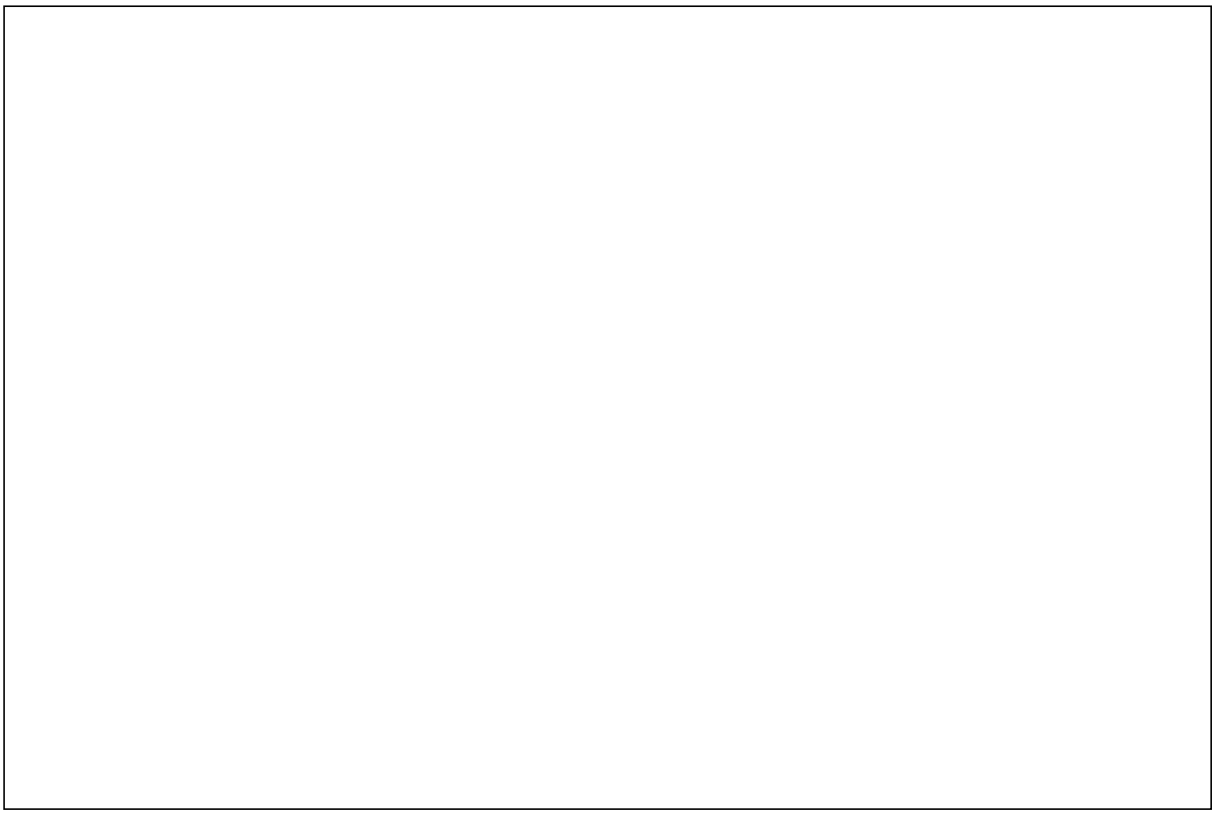


Fig 42.2, Williams Dual-Channel Analog Pedal

Williams Dual-Channel Pedal Connector and Pinout				
Function	**CPC pinout**	**Connector Pinout**	**Comments**	**Harness Connector Body**
APS1	1/7	A	SENSOR 1	
GND1	1/4	B	APS1 GND	
VCC1 (+5V)	1/8	C	APS1 Power Supply	
VCC2 (+5V)	3/3	D	APS2 Power Supply	
GND2	3/2	E	APS2 GND	The image above is the front side looking into the pins on the Harness Connector.
APS2	4/14	F	SENSOR 2	Harness Connector and Seal (P/N: 12066317) Terminal Female (P/N: 12103881)

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

Check as follows:

1. Disconnect the Accelerator Pedal (AP).
2. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 2.a Yes; repair as necessary. Verify repair.
   - 2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin A of the AP harness connector and ground. Is voltage present?
   - 4.a Yes; repair the short to voltage between pin A of the AP harness connector and pin 7 of the CPC # 1 connector. Verify repair.
   - 4.b No; Go to step 5.
5. Measure the voltage between pin B of the AP harness connector and ground. Is the voltage greater than five volts?
   - 5.a Yes; repair the short to voltage between pin B of the AP harness connector and pin 4 of the CPC # 1 connector. Verify repair.
   - 5.b No; Go to step 6.
6. Turn the ignition OFF.
7. Measure the resistance between pin B of the AP harness connector and ground. Is the resistance greater than five ohms?
   - 7.a Yes; repair the open circuit between pin B of the AP harness connector and pin 4 of the CPC #1 connector. Verify repair.
   - 7.b No; replace the Accelerator Pedal. Refer to Original Equipment Manufacturer (OEM) literature.

42.2 SPN 91/FMI 2 - GHG17

SPN 91/FMI 2	
Description	Pedal Sensor Supply Signal Erratic
Monitored Parameter	Pedal Position
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key Cycle - Ignition ON

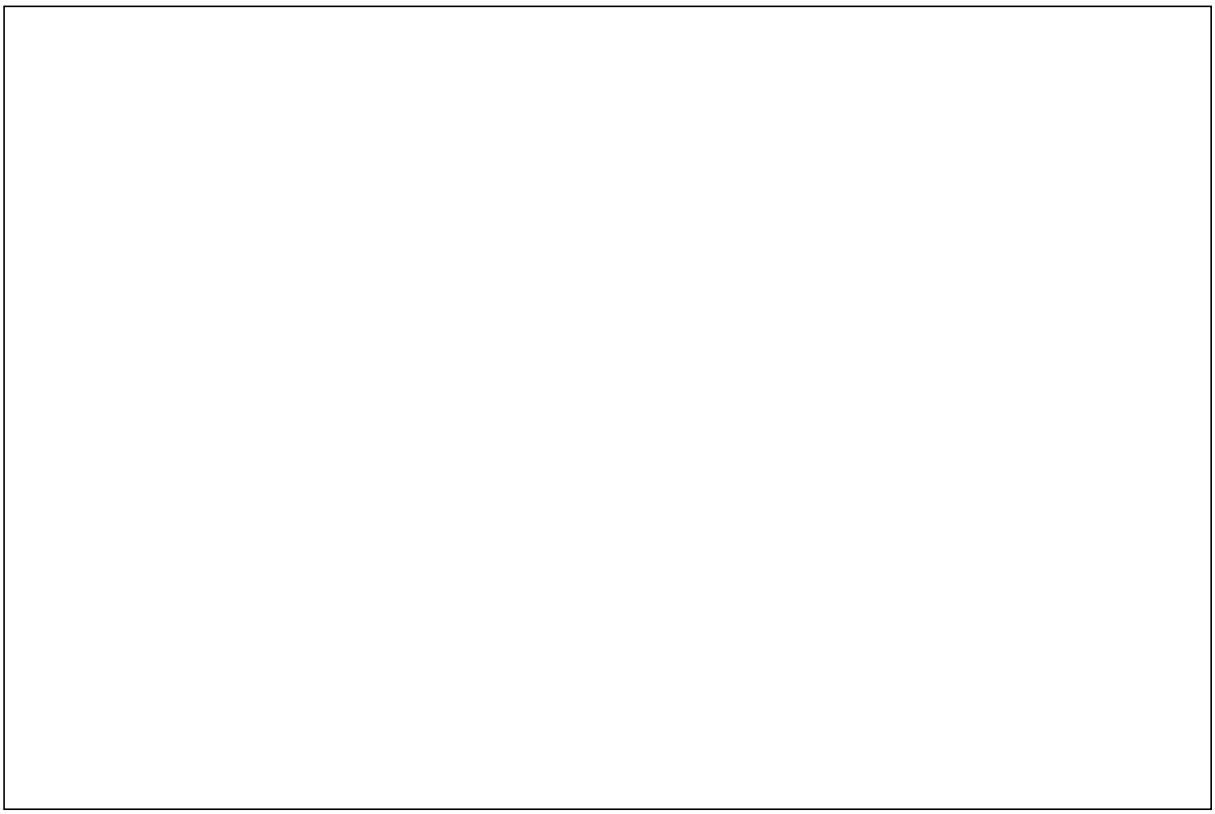


Fig 42.3, Analog Pedal Type

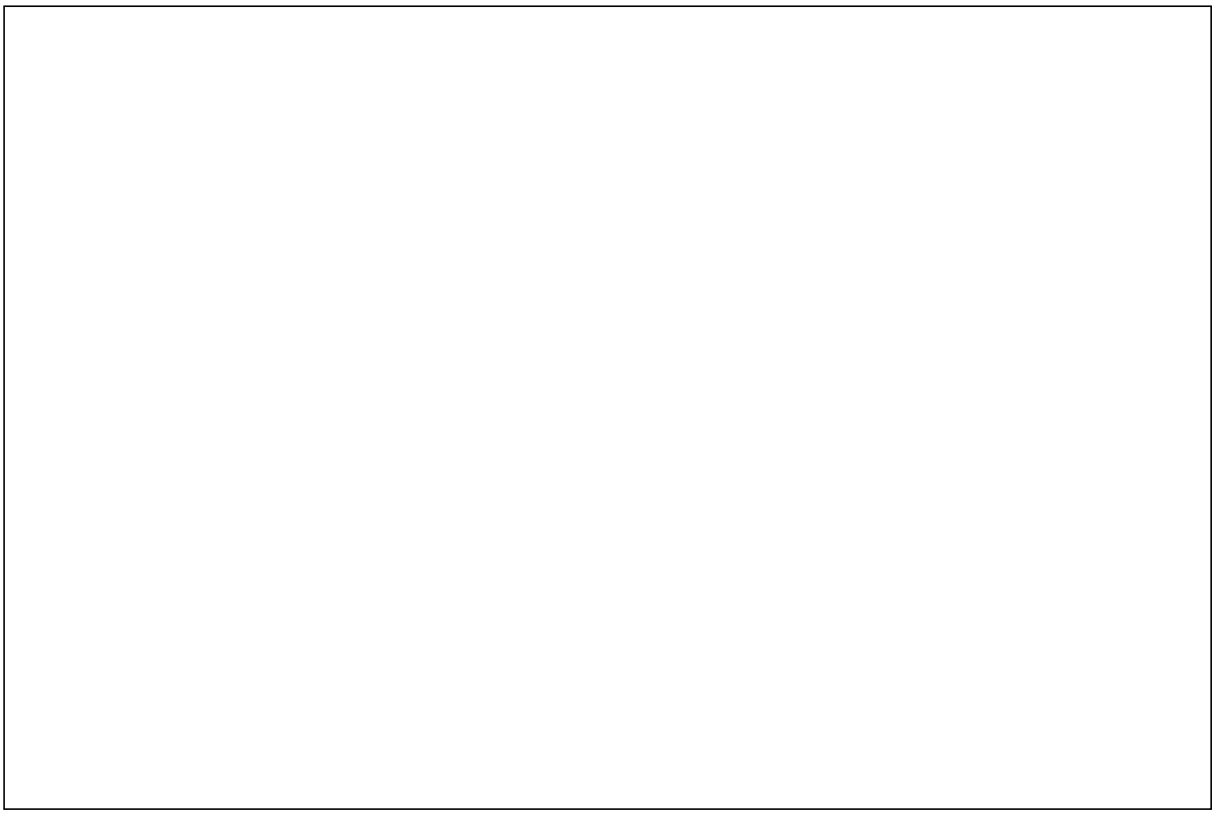


Fig 42.4, Williams Dual-Channel Analog Pedal

Williams Dual-Channel Pedal Connector and Pinout				
Function	**CPC pinout**	**Connector Pinout**	**Comments**	**Harness Connector Body**
APS1	1/7	A	SENSOR 1	
GND1	1/4	B	APS1 GND	
VCC1 (+5V)	1/8	C	APS1 Power Supply	
VCC2 (+5V)	3/3	D	APS2 Power Supply	
GND2	3/2	E	APS2 GND	The image above is the front side looking into the pins on the Harness Connector.
APS2	4/14	F	SENSOR 2	Harness Connector and Seal (P/N: 12066317) Terminal Female (P/N: 12103881)

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

Check as follows:

1. Connect DiagnosticLink .
2. Check for multiple codes. Are SPN 91 / FMI 0, or 8 present?
   - 2.a Yes; troubleshoot those codes first.
   - 2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Gently wiggle the pedal and harness connector to simulate road vibrations. Go to step 5.
5. While wiggling the circuit, measure the voltage between pin C of the AP harness connector and ground. Is voltage consistently present?
   - 5.a Yes; Go to step 6.
   - 5.b No; repair an open between pin C of the AP harness connector and pin 8 of the CPC #1 connector. Verify repair.
6. While wiggling the circuit, measure the voltage between pins C and B of the AP harness connector. Is voltage consistently present?
   - 6.a Yes; Go to step 7.
   - 6.b No; repair an open between pin B of the AP harness connector and pin 4 of the CPC #1 connector. Verify repair.
7. Check for proper configuration of the CPC against the server information. Does the CPC pedal type have the proper configuration?
   - 7.a Yes; replace the Accelerator Pedal. Refer to Original Equipment Manufacturer (OEM) literature.
   - 7.b No; reprogram the CPC with the correct information as necessary. Verify repair.

42.3 SPN 91/FMI 4 - GHG17

SPN 91/FMI 4	
Description	Accelerator Pedal Sensor Shorted or Open Circuit
Monitored Parameter	Pedal Position
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key Cycle - Ignition ON

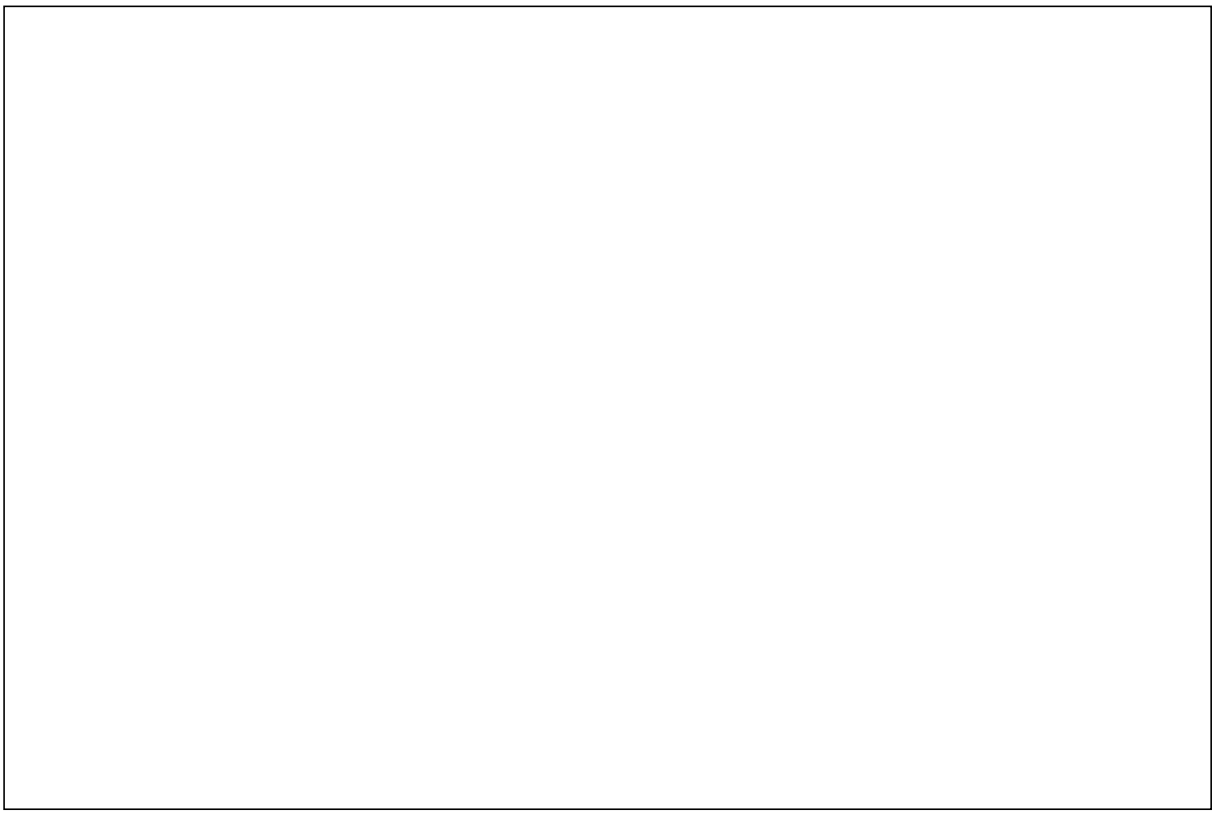


Fig 42.5, Analog Pedal Type

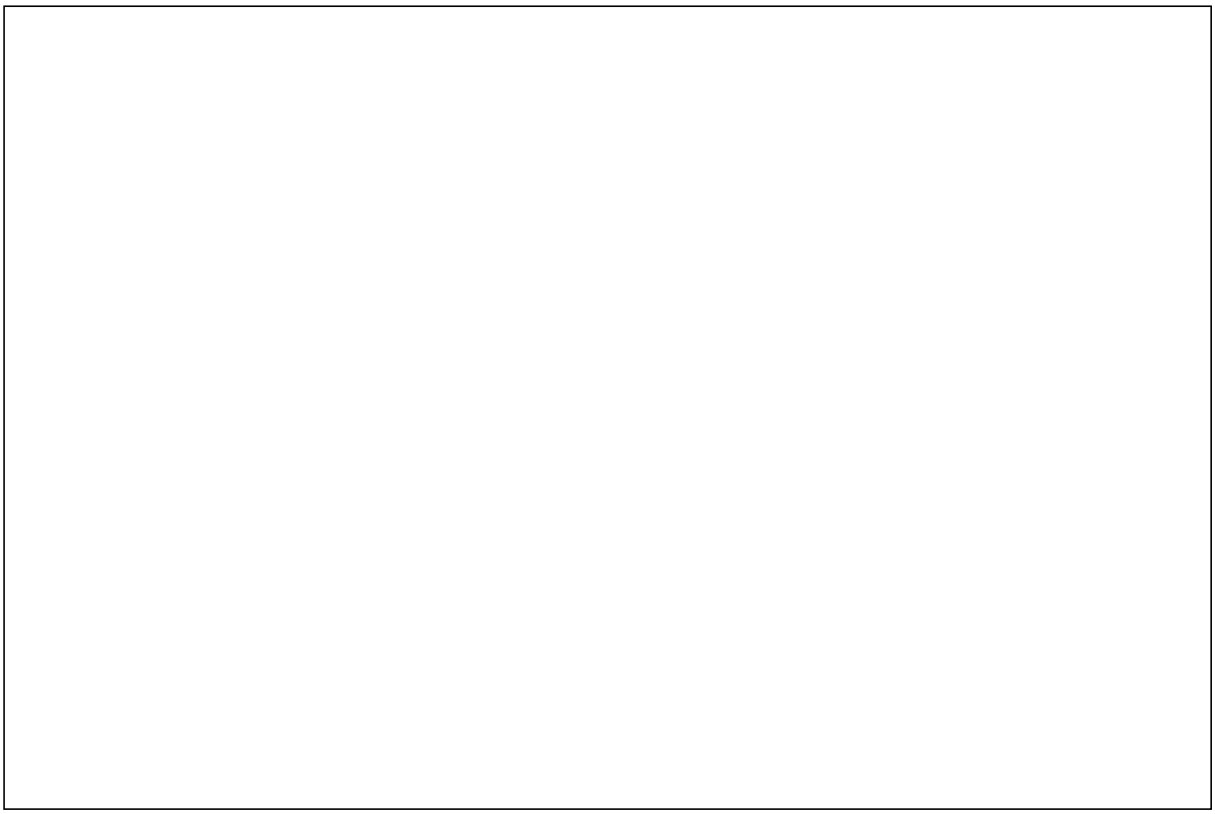


Fig 42.6, Williams Dual-Channel Analog Pedal

Williams Dual-Channel Pedal Connector and Pinout				
Function	**CPC pinout**	**Connector Pinout**	**Comments**	**Harness Connector Body**
APS1	1/7	A	SENSOR 1	
GND1	1/4	B	APS1 GND	
VCC1 (+5V)	1/8	C	APS1 Power Supply	
VCC2 (+5V)	3/3	D	APS2 Power Supply	
GND2	3/2	E	APS2 GND	The image above is the front side looking into the pins on the Harness Connector.
APS2	4/14	F	SENSOR 2	Harness Connector and Seal (P/N: 12066317) Terminal Female (P/N: 12103881)

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

Check as follows:

1. Has the CPC been recently programmed ?
   - 1.a Yes; Go to step 2.
   - 1.b No; Go to step 3.
2. Check for proper configuration of the CPC against the server information. Does the CPC pedal type have the proper configuration?
   - 2.a Yes; Go to step 3.
   - 2.b No; reprogram the CPC with the correct information as necessary. Verify repair .
3. Turn the ignition ON (key ON, engine OFF).
4. Disconnect the Accelerator Pedal (AP).
5. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 5.a Yes; repair as necessary. Verify repair.
   - 5.b No; Go to step 6.
6. Is the vehicle equipped with a Williams Dual-Channel Analog Pedal?
   - 6.a Yes; Go to step 7.
   - 6.b No; Go to step 8.
7. Measure the voltage between pin E of the AP harness connector and ground. Is voltage present?
   - 7.a Yes; repair a short to voltage between pin E of the AP harness connector and pin 2 of the CPC #3 connector. Verify repair.
   - 7.b No; Go to step 10.
8. Measure the voltage between pin E of the AP harness connector and ground. Is voltage present?
   - 8.a Yes; repair a short to voltage between pin E of the AP harness connector and pin 6 of the CPC #1 connector. Verify repair.
   - 8.b No; Go to step 9.
9. Measure the voltage between pin F of the AP harness connector and ground. Is voltage present?
   - 9.a Yes; repair a short to voltage between pin F of the AP harness connector and pin 2 of the CPC #2 connector. Verify repair.
   - 9.b No; Go to step 10.
10. Measure the voltage between pin B of the AP harness connector and ground. Is voltage present?
    - 10.a Yes; repair a short to voltage between pin B of the AP harness connector and pin 4 of the CPC # 1 connector. Verify repair.
    - 10.b No; Go to step 11.
11. Measure the resistance between pin B of the AP harness connector and ground. Is the resistance greater than 10 ohms?
    - 11.a Yes; Go to step 12.
    - 11.b No; repair the short to ground between pin B of the AP harness connector and pin 4 of the CPC #1 connector. Verify repair.
12. Measure the resistance between pin A of the AP harness connector and ground. Is the resistance less than five ohms?

12.a Yes; repair a short to ground between pin A of the AP harness connector and pin 7 of the CPC #1 connector. Verify repair.

12.b No; Go to step 13.

13. Measure the resistance between pin C of the AP harness connector and ground. Is the resistance less than five ohms?

13.a Yes; repair a short to ground between pin C of the AP harness connector and pin 8 of the CPC #1 connector. Verify repair.

13.b No; Go to step 14.

14. Turn the ignition OFF.

15. Disconnect the CPC #1 connector.

16. Inspect the CPC and the harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

16.a Yes; repair as necessary. Verify repair.

16.b No; Go to step 17.

17. Measure the resistance between pin A of the AP harness connector and pin 7 of the CPC #1 connector. Is the resistance less than five ohms?

17.a Yes; Go to step 18.

17.b No; repair an open between pin A of the AP harness connector and pin 7 of the CPC #1 connector. Verify repair.

18. Measure the resistance between pin C of the AP harness connector and pin 8 of the CPC #1 connector. Is the resistance less than five ohms?

18.a Yes; replace the Accelerator Pedal. Refer to Original Equipment Manufacturer (OEM) literature.

18.b No; repair an open between pin C of the AP harness connector and pin 8 of the CPC #1 connector. Verify repair.

42.4 SPN 91/FMI 7 - GHG17

2-Channel Accelerator Pedal Idle Not Recognized

SPN 91/FMI 7	
Description	Pedal Idle Position Not Reached Two Minutes After Ignition On.
Monitored Parameter	Pedal Position
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key Cycle - Ignition ON for Two Minutes

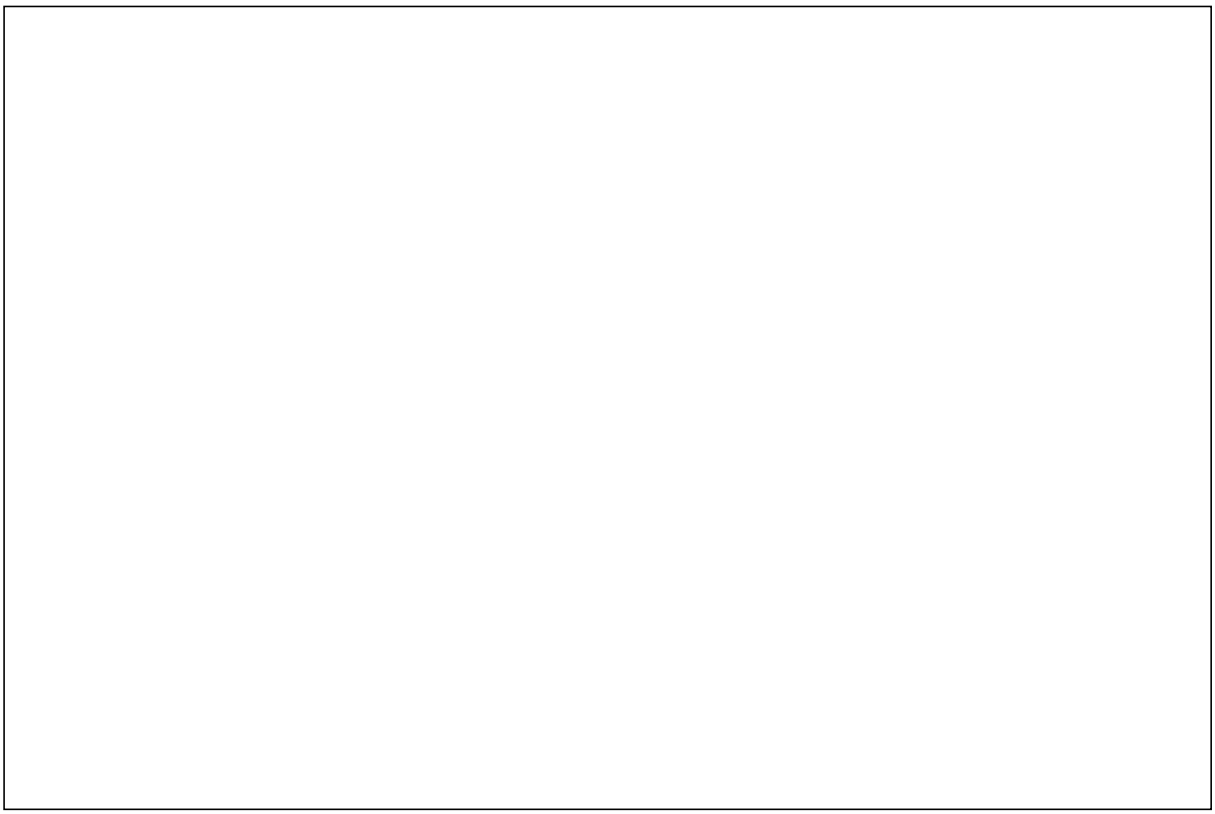


Fig 42.7, Analog Pedal Type

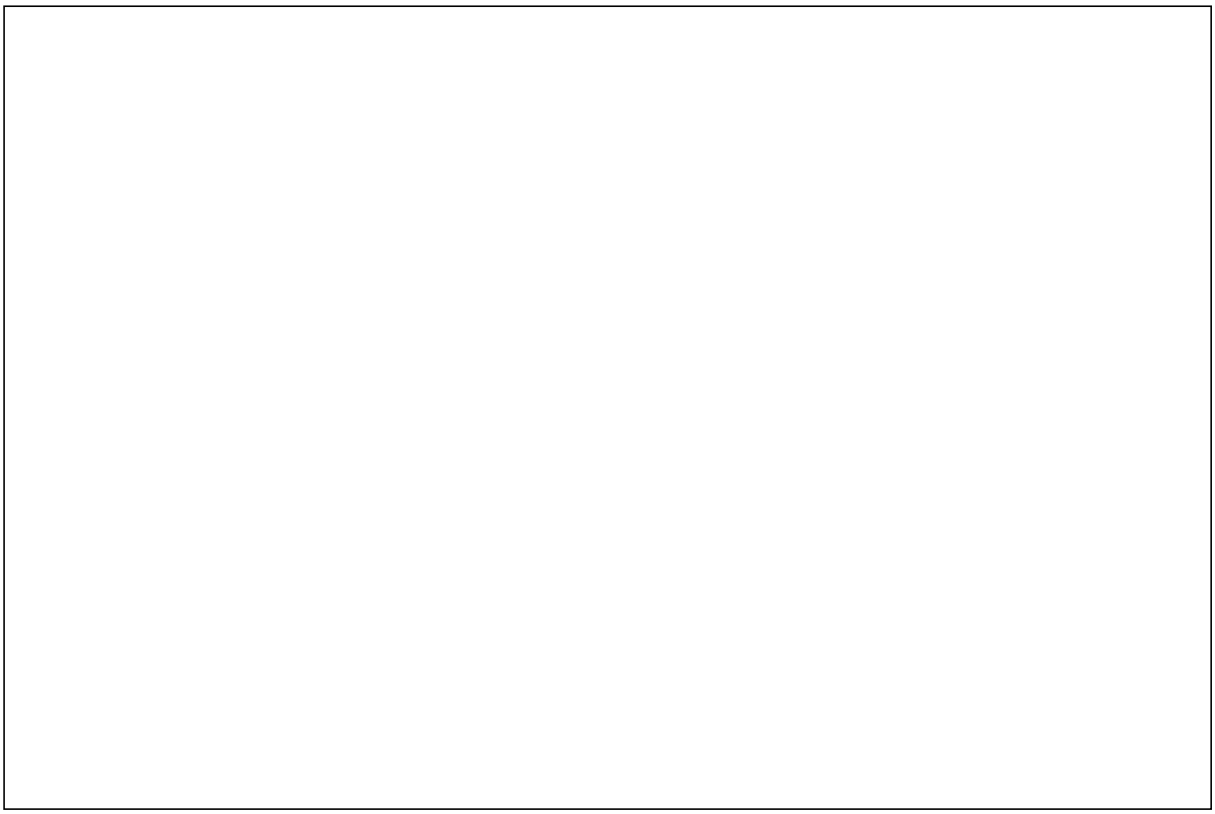


Fig 42.8, Williams Dual-Channel Analog Pedal

Williams Dual-Channel Pedal Connector and Pinout				
Function	**CPC pinout**	**Connector Pinout**	**Comments**	**Harness Connector Body**
APS1	1/7	A	SENSOR 1	
GND1	1/4	B	APS1 GND	
VCC1 (+5V)	1/8	C	APS1 Power Supply	
VCC2 (+5V)	3/3	D	APS2 Power Supply	
GND2	3/2	E	APS2 GND	The image above is the front side looking into the pins on the Harness Connector.
APS2	4/14	F	SENSOR 2	Harness Connector and Seal (P/N: 12066317) Terminal Female (P/N: 12103881)

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

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Connect DiagnosticLink ; are any other SPN 91/FMI 0, FMI 2, FMI 4, or FMI 8 fault codes active?
   - 2.a Yes; troubleshoot any other faults first.
   - 2.b No; Go to step 3.
3. Check for proper configuration of the CPC against the server information. Does the CPC pedal type have the proper configuration?
   - 3.a Yes; Go to step 4.
   - 3.b No; reprogram the CPC with the correct information as necessary. Verify repair.
4. Using DiagnosticLink, monitor PWM Pedal Signal GAS1 and PWM Pedal Signal GAS2 under the Instrumentation/Chart tab.
5. Cycle Accelerator Pedal (AP) slowly several times with a full sweep from top to bottom of travel. Does voltage sweep smoothly in relation to pedal travel?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the AP. Refer to Original Equipment Manufacturer (OEM) literature.
6. Clear codes and cycle ignition off.
7. Turn the ignition ON (key ON, engine OFF).
8. Does the code return?
   - 8.a Yes; Go to step 9.
   - 8.b No; release the vehicle.
9. Gently wiggle pedal and harness connector to simulate road vibration. Go to step 10.

Note : Do not disconnect the Accelerator Pedal (AP) connector at this time.

> **NOTICE**
>
> **Do not tap on AP with metal object or tool as this may damage component.**

Note : A second technician may be required to monitor values during wiggle testing.

10. While performing wiggle test, monitor PWM Pedal Signal GAS1 and PWM Pedal Signal GAS2 under the DiagnosticLink Instrumentation/Chart tab.
11. Cycle Accelerator Pedal (AP) slowly several times with a full sweep from top to bottom of travel. Do the percentages sweep smoothly in relation to pedal travel?
    - 11.a Yes; Go to step 12.
    - 11.b No; isolate that section of harness and inspect for wire chaffing, corrosion, improper connections or physical damage and repair as necessary . Verify repair.
12. Disconnect the Accelerator Pedal (AP).
13. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
    - 13.a Yes; repair as necessary. Verify repair.
    - 13.b No; reconnect the AP. Go to step 14.

14. Gently wiggle CPC harness connectors to simulate road vibration. Go to step 15.
15. While performing wiggle test , monitor PWM Pedal Signal GAS1 and PWM Pedal Signal GAS2 under the DiagnosticLink Instrumentation/Chart tab. Go to step 16.
16. Cycle Accelerator Pedal (AP) slowly several times with a full sweep from top to bottom of travel. Do the percentages sweep smoothly in relation to pedal travel?

    16.a Yes; Go to step 17.

    16.b No; isolate that section of harness and inspect for wire chaffing, corrosion, improper connections or physical damage and repair as necessary . Verify repair.
17. Disconnect the CPC #1 connector.
18. Disconnect the CPC #3 connector.
19. Disconnect the CPC #4 connector.
20. Inspect the CPaC and the harness connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connectors. Is any damage found?

    20.a Yes; repair as necessary. Verify repair.

    20.b No; replace the Common Powertrain Controller (CPC). Verify repair.

42.5 SPN 91/FMI 8 - GHG17

2-Channel Accelerator Pedal Signal 1 Missing

SPN 91/FMI 8	
Description	Accelerator Pedal Sensor Signal Missing
Monitored Parameter	GAS1
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key Cycle - Ignition ON

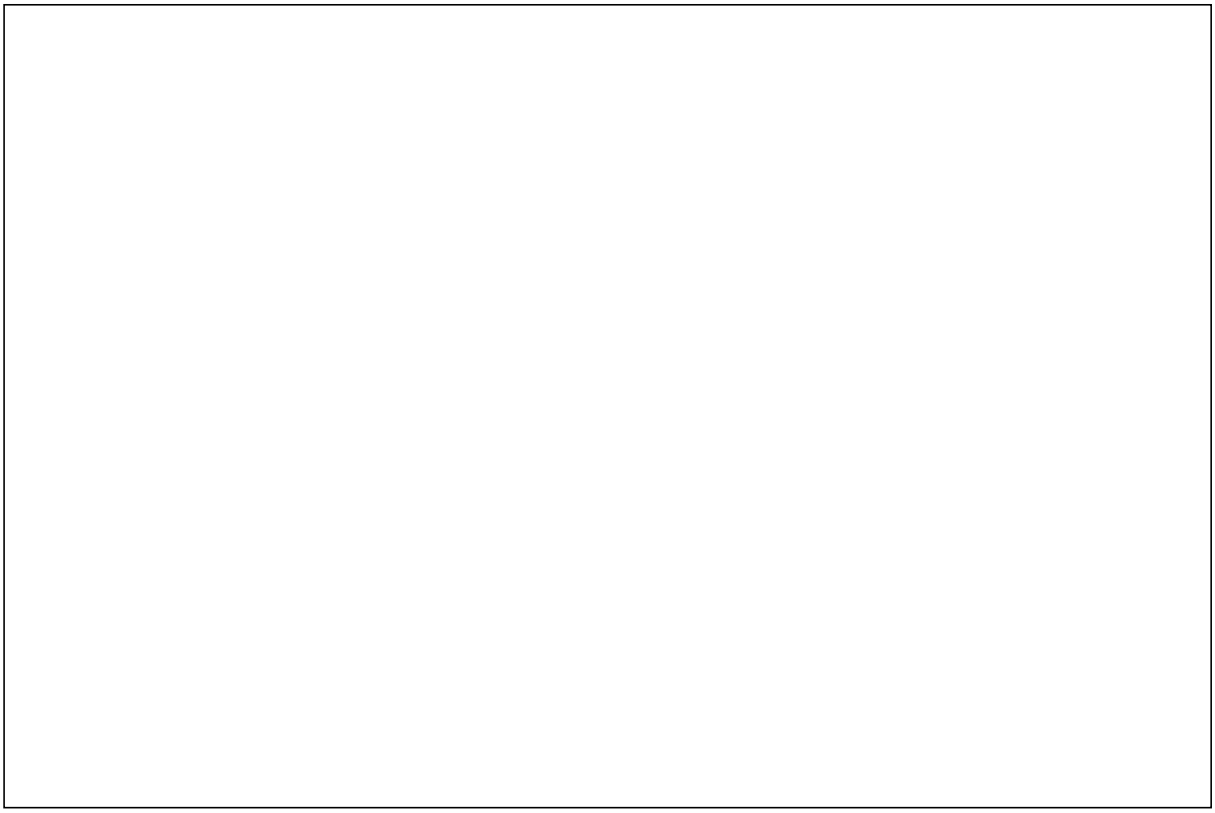


Fig 42.9, Analog Pedal Type

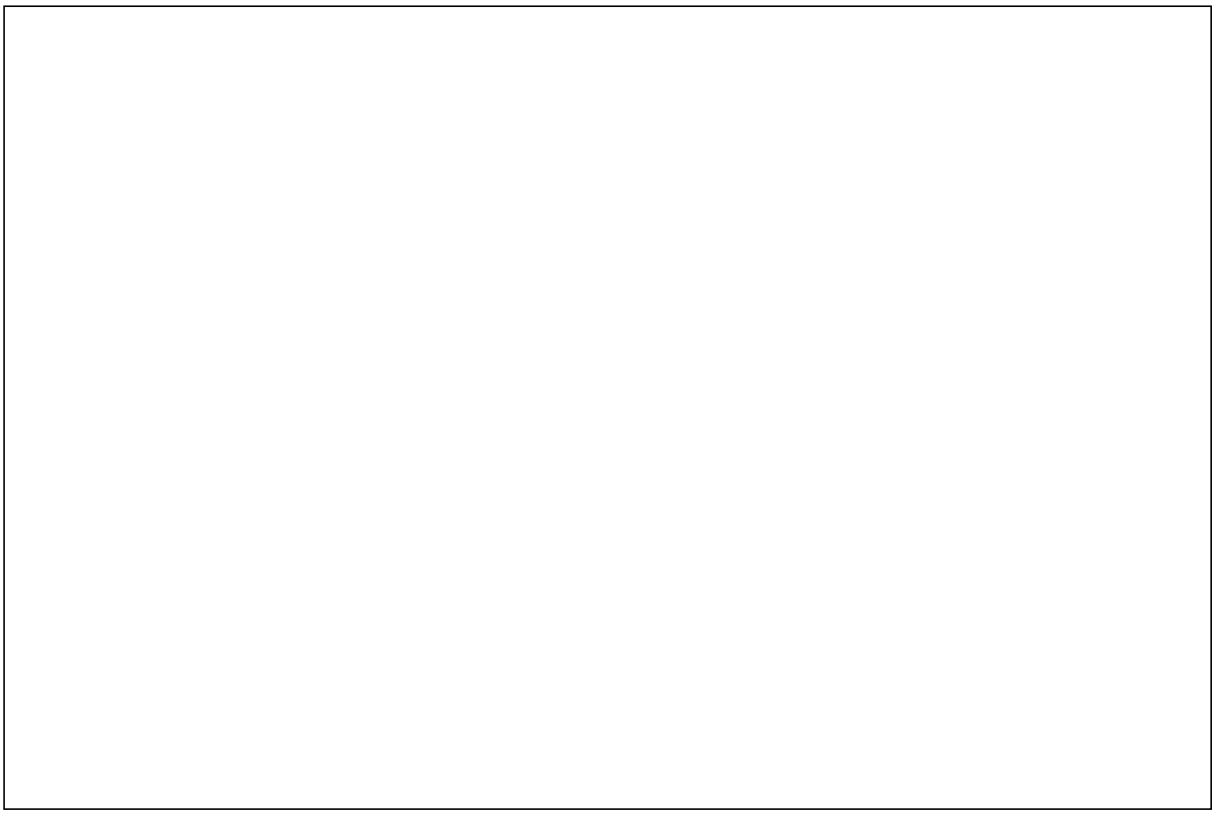


Fig 42.10, Williams Dual-Channel Analog Pedal

Williams Dual-Channel Pedal Connector and Pinout				
Function	**CPC pinout**	**Connector Pinout**	**Comments**	**Harness Connector Body**
APS1	1/7	A	SENSOR 1	
GND1	1/4	B	APS1 GND	
VCC1 (+5V)	1/8	C	APS1 Power Supply	
VCC2 (+5V)	3/3	D	APS2 Power Supply	
GND2	3/2	E	APS2 GND	The image above is the front side looking into the pins on the Harness Connector.
APS2	4/14	F	SENSOR 2	Harness Connector and Seal (P/N: 12066317) Terminal Female (P/N: 12103881)

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

Check as follows:

1. Turn the ignition ON (key ON, engine OFF) and connect DiagnosticLink®.
2. Check for proper configuration of the CPC against the server information. Does the CPC pedal type have the proper configuration?
   - 2.a Yes; Go to step 3.
   - 2.b No; reprogram the CPC with the correct information as necessary. Verify repair.
3. Disconnect the Accelerator Pedal (AP).
4. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repair.
   - 4.b No; Go to step 5.
5. Turn the ignition ON (key ON, engine OFF).
6. Is the vehicle equipped with a Williams Dual-Channel Analog Pedal?
   - 6.a Yes; Go to step 7.
   - 6.b No; Go to step 8.
7. Measure the voltage between pin E of the AP harness connector and ground. Is voltage present?
   - 7.a Yes; repair a short to power between pin E of the AP harness connector and pin 2 of the CPC #3 connector. Verify repair.
   - 7.b No; Go to step 9.
8. Measure the voltage between pin F of the AP harness connector and ground. Is voltage present?
   - 8.a Yes: repair a short to power between pin F of the AP harness connector and pin 2 of the CPC #2 connector. Verify repair.
   - 8.b No; Go to step 9.
9. Measure the voltage between pin B of the AP harness connector and ground. Is voltage present?
   - 9.a Yes; repair the short to power between pin B of the AP harness connector and pin 4 of the CPC #1 connector. Verify repair.
   - 9.b No; Go to step 10.
10. Measure the voltage between pin C of the AP harness connector and ground. Is the voltage greater than 5.5 volts?
    - 10.a Yes; repair a short to 12 volt battery power between pin C of the AP harness connector and pin 8 of the CPC #1 connector. Verify repair.
    - 10.b No; Go to step 11.
11. Measure the voltage between pin A of the AP harness connector and ground. Is voltage present?
    - 11.a Yes; repair a short to power between pin A of the AP harness connector and pin 7 of the CPC #1 connector. Verify repair.
    - 11.b No; Go to step 12.
12. Measure the resistance between pin A of the AP harness connector and ground. Is the resistance less than five ohms?
    - 12.a Yes; repair a short to ground between pin A of the AP harness connector and pin 7 of the CPC #1 connector. Verify repair.

12.b No; Go to step 13.

13. Turn the ignition OFF.
14. Disconnect the CPC #1 connector.
15. Inspect the CPC and the harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

    15.a Yes; repair as necessary. Verify repair.

    15.b No; Go to step 16.

16. Measure the resistance between pin B of the AP harness connector and pin 4 of the CPC #1 connector. Is the resistance less than five ohms?

    16.a Yes; Go to step 17.

    16.b No; repair the open circuit between pin B of the AP harness connector and pin 4 of the CPC #1 connector. Verify repair.

17. Measure the resistance between pin A of the AP harness connector and pin 7 of the CPC #1 connector. Is the resistance less than five ohms?

    17.a Yes; Go to step 18.

    17.b No; repair the open circuit between pin A of the AP harness connector and pin 7 of the CPC #1 connector. Verify repair.

18. Measure the resistance between pin C of the AP harness connector and pin 8 of the CPC #1 connector. Is the resistance less than five ohms?

    18.a Yes; replace the Accelerator Pedal. Refer to Original Equipment Manufacturer (OEM) literature.

    18.b No; repair the open circuit between pin C of the AP harness connector and pin 8 of the CPC #1 connector. Verify repair.

42.6 SPN 91/FMI 10 - GHG17

SPN 91/FMI 10	
Description	Pedal Sensor Signal Data Abnormal
Monitored Parameter	Pedal Position
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key Cycle - Ignition ON

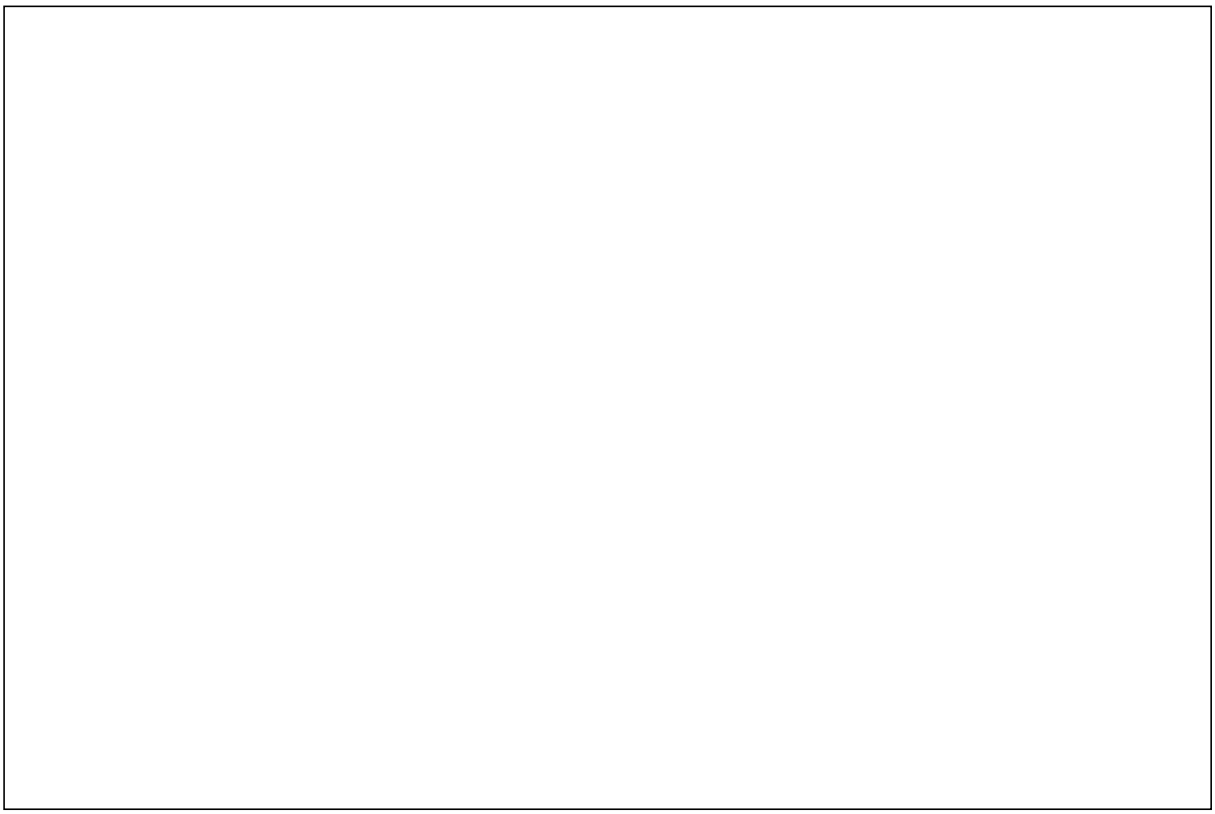


Fig 42.11, Analog Pedal Type

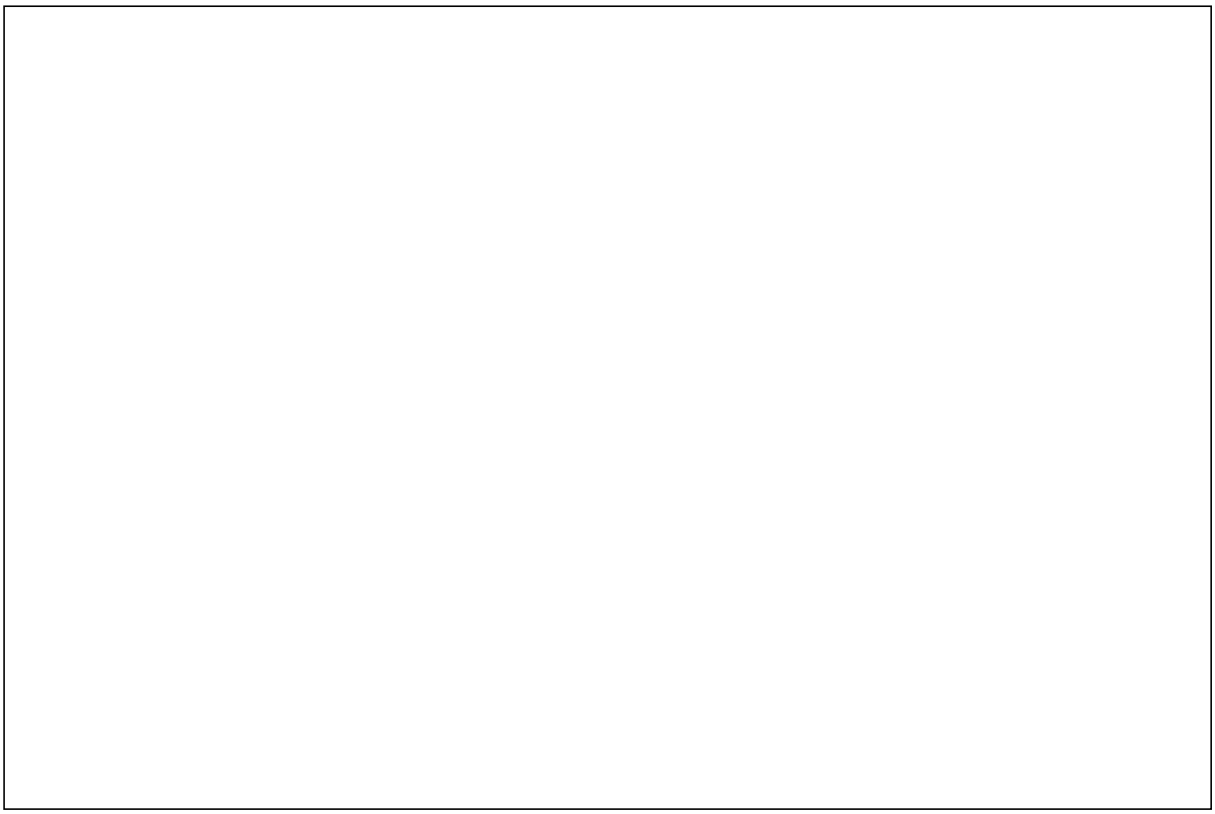


Fig 42.12, Williams Dual-Channel Analog Pedal

Williams Dual-Channel Pedal Connector and Pinout				
Function	**CPC pinout**	**Connector Pinout**	**Comments**	**Harness Connector Body**
APS1	1/7	A	SENSOR 1	
GND1	1/4	B	APS1 GND	
VCC1 (+5V)	1/8	C	APS1 Power Supply	
VCC2 (+5V)	3/3	D	APS2 Power Supply	
GND2	3/2	E	APS2 GND	The image above is the front side looking into the pins on the Harness Connector.
APS2	4/14	F	SENSOR 2	Harness Connector and Seal (P/N: 12066317) Terminal Female (P/N: 12103881)

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

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Connect DiagnosticLink®; are any other SPN 91/FMI 0, FMI 2, FMI 4, or FMI 8 fault codes active?
   - 2.a Yes; troubleshoot any other faults first.
   - 2.b No; Go to step 3.
3. Check for proper configuration of the CPC against the server information. Does the CPC pedal type have the proper configuration?
   - 3.a Yes; Go to step 4.
   - 3.b No; reprogram the CPC with the correct information as necessary. Verify repair.
4. Using DiagnosticLink, monitor PWM Pedal Signal GAS1 and PWM Pedal Signal GAS2 under the Instrumentation/Chart tab.
5. Cycle Accelerator Pedal (AP) slowly several times with a full sweep from top to bottom of travel. Does voltage sweep smoothly in relation to pedal travel?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the AP. Refer to Original Equipment Manufacturer (OEM) literature.
6. Clear codes and cycle ignition off.
7. Turn the ignition ON (key ON, engine OFF).
8. Does the code return?
   - 8.a Yes; Go to step 9.
   - 8.b No; release the vehicle.
9. Gently wiggle pedal and harness connector to simulate road vibration. Go to step 10.

Note : Do not disconnect the Accelerator Pedal (AP) connector at this time.

> **NOTICE**
>
> **Do not tap on AP with metal object or tool as this may damage component.**

Note : A second technician may be required to monitor values during wiggle testing.

10. While performing wiggle test, monitor PWM Pedal Signal GAS1 and PWM Pedal Signal GAS2 under the DiagnosticLink Instrumentation/Chart tab.
11. Cycle Accelerator Pedal (AP) slowly several times with a full sweep from top to bottom of travel. Do the percentages sweep smoothly in relation to pedal travel?
    - 11.a Yes; Go to step 12.
    - 11.b No; isolate that section of harness and inspect for wire chaffing, corrosion, improper connections or physical damage and repair as necessary. Verify repair.
12. Disconnect the Accelerator Pedal (AP).
13. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
    - 13.a Yes; repair as necessary. Verify repair.
    - 13.b No; reconnect the AP. Go to step 14.

14. Gently wiggle CPC harness connectors to simulate road vibration. Go to step 15.
15. While performing wiggle test, monitor PWM Pedal Signal GAS1 and PWM Pedal Signal GAS2 under the DiagnosticLink Instrumentation/Chart tab. Go to step 16.
16. Cycle Accelerator Pedal (AP) slowly several times with a full sweep from top to bottom of travel. Do the percentages sweep smoothly in relation to pedal travel?

    16.a Yes; Go to step 17.

    16.b No; isolate that section of harness and inspect for wire chaffing, corrosion, improper connections or physical damage and repair as necessary. Verify repair.
17. Disconnect the CPC #1 connector.
18. Disconnect the CPC #3 connector.
19. Disconnect the CPC #4 connector.
20. Inspect the CPC and the harness connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connectors. Is any damage found?

    20.a Yes; repair as necessary. Verify repair.

    20.b No; replace the Common Powertrain Controller (CPC). Verify repair.

42.7 SPN 91/FMI 13 – GHG17

J1939 EEC2 Message is Missing or Not Available

SPN 91/FMI 13	
Description	Pedal Sensor Signal Out of Calibration
Monitored Parameter	Pedal Position
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key Cycle - Ignition ON

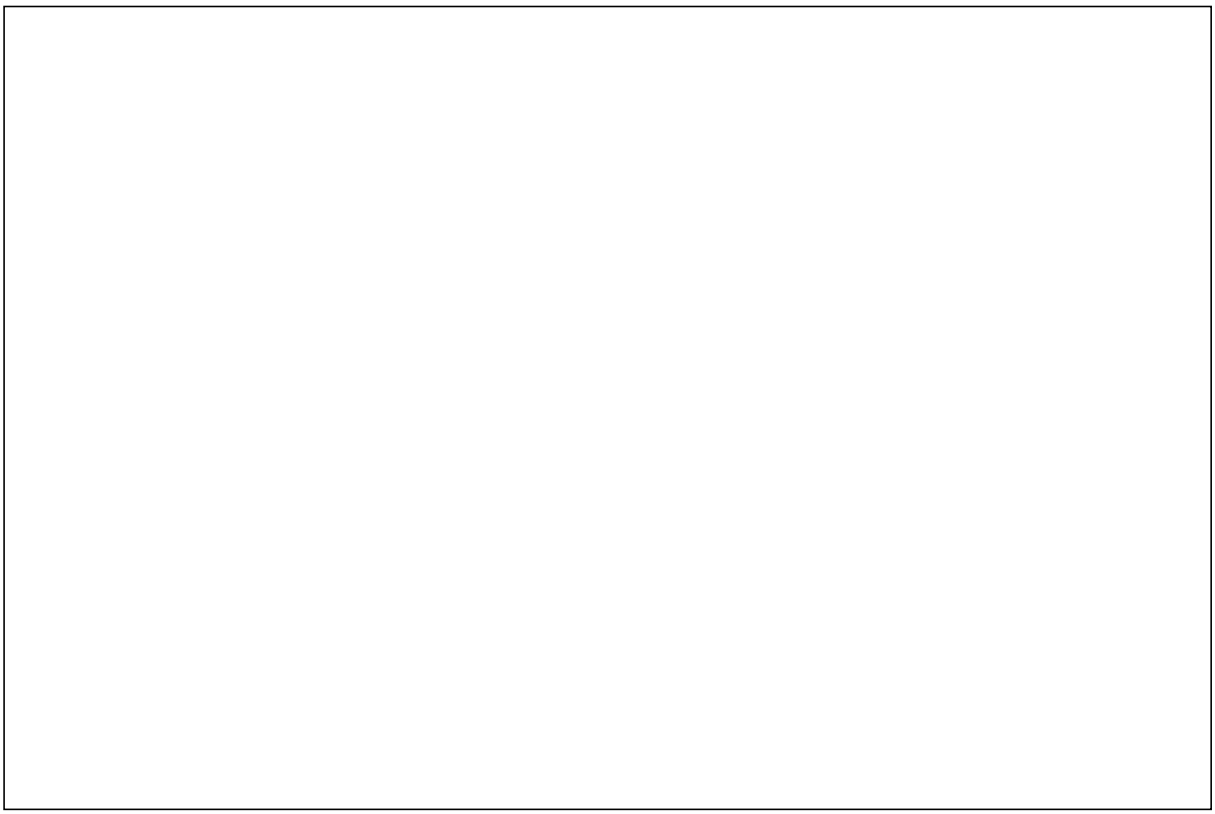


Fig 42.13, Analog Pedal Type

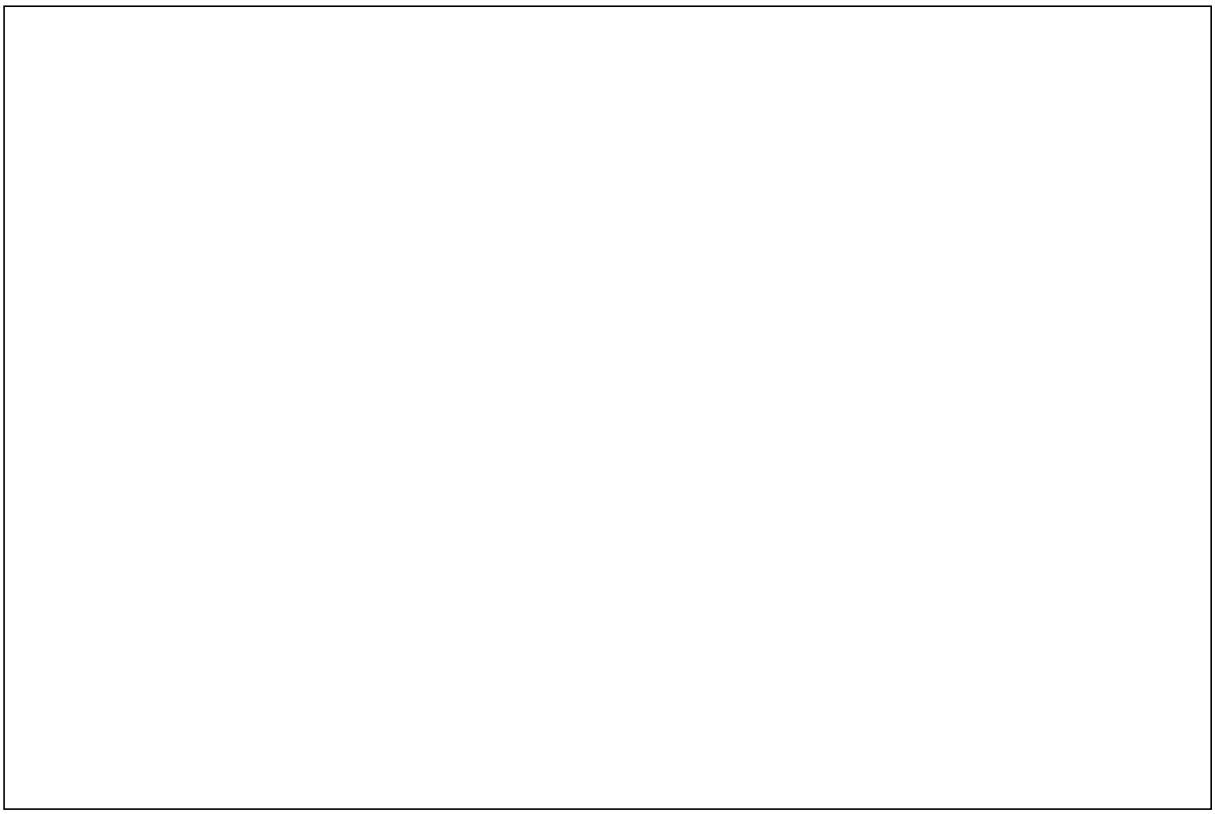


Fig 42.14, Williams Dual-Channel Analog Pedal

Williams Dual-Channel Pedal Connector and Pinout				
Function	**CPC pinout**	**Connector Pinout**	**Comments**	**Harness Connector Body**
APS1	1/7	A	SENSOR 1	
GND1	1/4	B	APS1 GND	
VCC1 (+5V)	1/8	C	APS1 Power Supply	
VCC2 (+5V)	3/3	D	APS2 Power Supply	
GND2	3/2	E	APS2 GND	The image above is the front side looking into the pins on the Harness Connector.
APS2	4/14	F	SENSOR 2	Harness Connector and Seal (P/N: 12066317) Terminal Female (P/N: 12103881)

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

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Connect DiagnosticLink®; are any other SPN 91/FMI 0, FMI 2, FMI 4, or FMI 8 fault codes active?
   - 2.a Yes; troubleshoot any other faults first.
   - 2.b No; Go to step 3.
3. Check for proper configuration of the CPC against the server information. Does the CPC pedal type have the proper configuration?
   - 3.a Yes; Go to step 4.
   - 3.b No; reprogram the CPC with the correct information as necessary. Verify repair.
4. Using DiagnosticLink, monitor PWM Pedal Signal GAS1 and PWM Pedal Signal GAS2 under the Instrumentation/Chart tab.
5. Cycle Accelerator Pedal (AP) slowly several times with a full sweep from top to bottom of travel. Does voltage sweep smoothly in relation to pedal travel?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the AP. Refer to Original Equipment Manufacturer (OEM) literature.
6. Clear codes and cycle ignition off.
7. Turn the ignition ON (key ON, engine OFF).
8. Does the code return?
   - 8.a Yes; Go to step 9.
   - 8.b No; release the vehicle.
9. Gently wiggle pedal and harness connector to simulate road vibration. Go to step 10.

Note : Do not disconnect the Accelerator Pedal (AP) connector at this time.

> **NOTICE**
>
> **Do not tap on AP with metal object or tool as this may damage component.**

Note : A second technician may be required to monitor values during wiggle testing.

10. While performing wiggle test, monitor PWM Pedal Signal GAS1 and PWM Pedal Signal GAS2 under the DiagnosticLink Instrumentation/Chart tab.
11. Cycle Accelerator Pedal (AP) slowly several times with a full sweep from top to bottom of travel. Do the percentages sweep smoothly in relation to pedal travel?
    - 11.a Yes; Go to step 12.
    - 11.b No; isolate that section of harness and inspect for wire chaffing, corrosion, improper connections or physical damage and repair as necessary. Verify repair.
12. Disconnect the Accelerator Pedal (AP).
13. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
    - 13.a Yes; repair as necessary. Verify repair.
    - 13.b No; reconnect the AP. Go to step 14.

14. Gently wiggle CPC harness connectors to simulate road vibration. Go to step 15.
15. While performing wiggle test, monitor PWM Pedal Signal GAS1 and PWM Pedal Signal GAS2 under the DiagnosticLink Instrumentation/Chart tab. Go to step 16.
16. Cycle Accelerator Pedal (AP) slowly several times with a full sweep from top to bottom of travel. Do the percentages sweep smoothly in relation to pedal travel?

    16.a Yes; Go to step 17.

    16.b No; isolate that section of harness and inspect for wire chaffing, corrosion, improper connections or physical damage and repair as necessary. Verify repair.
17. Disconnect the CPC #1 connector.
18. Disconnect the CPC #3 connector.
19. Disconnect the CPC #4 connector.
20. Inspect the CPC and the harness connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connectors. Is any damage found?

    20.a Yes; repair as necessary. Verify repair.

    20.b No; replace the Common Powertrain Controller (CPC). Verify repair.

42.8 SPN 91/FMI 14 - GHG17

2-Channel Accelerator Pedal Not Learned

SPN 91/FMI 14	
Description	Pedal Sensor Signal Not Recognized
Monitored Parameter	Pedal Position
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key Cycle - Ignition ON

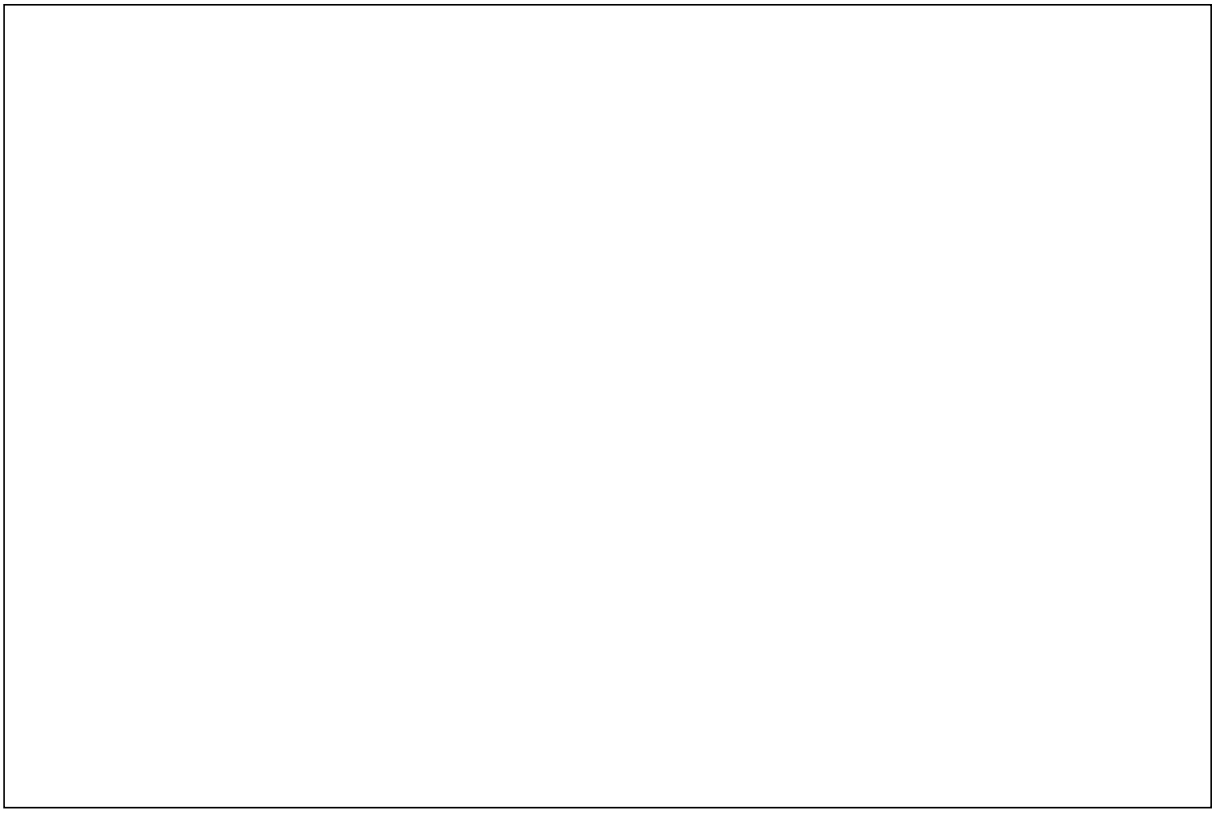


Fig 42.15, Analog Pedal Type

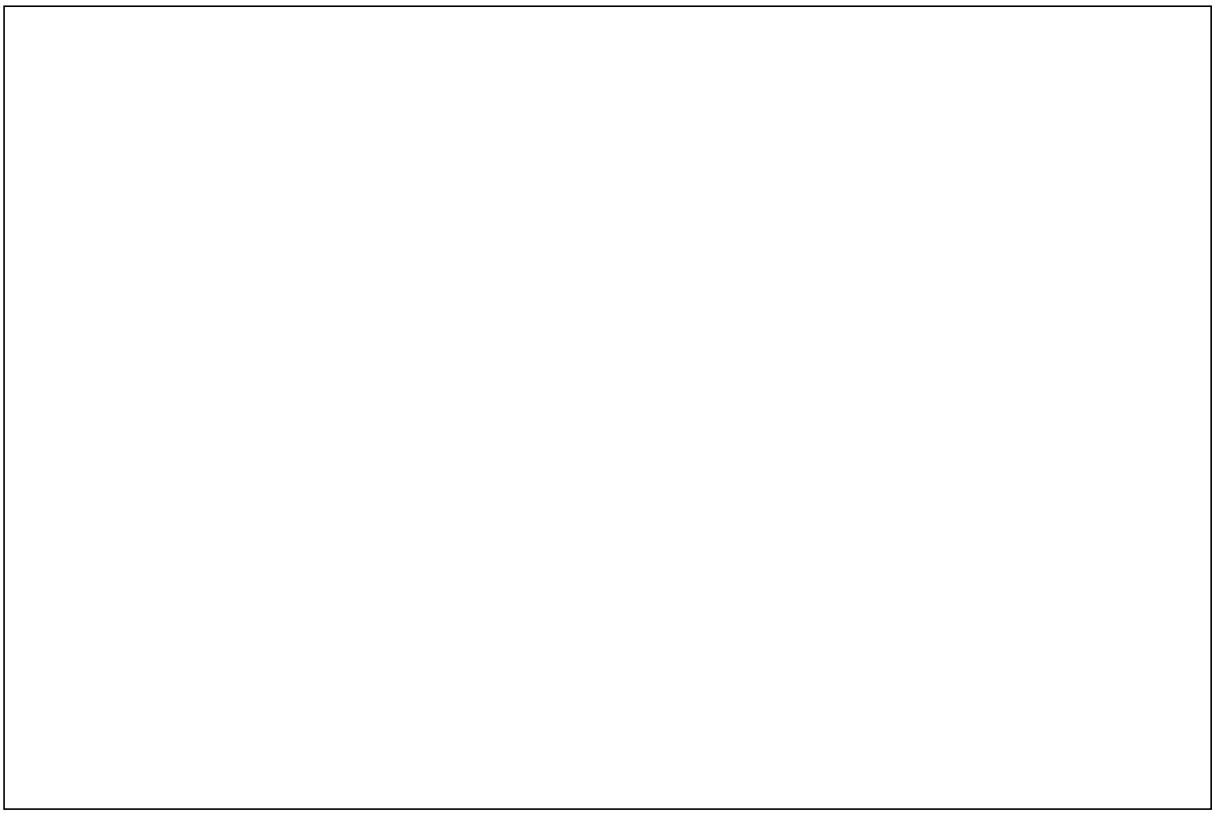


Fig 42.16, Williams Dual-Channel Analog Pedal

Williams Dual-Channel Pedal Connector and Pinout				
Function	**CPC pinout**	**Connector Pinout**	**Comments**	**Harness Connector Body**
APS1	1/7	A	SENSOR 1	
GND1	1/4	B	APS1 GND	
VCC1 (+5V)	1/8	C	APS1 Power Supply	
VCC2 (+5V)	3/3	D	APS2 Power Supply	
GND2	3/2	E	APS2 GND	The image above is the front side looking into the pins on the Harness Connector.
APS2	4/14	F	SENSOR 2	Harness Connector and Seal (P/N: 12066317) Terminal Female (P/N: 12103881)

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

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Connect DiagnosticLink®; are any other SPN 91/FMI 0, FMI 2, FMI 4, or FMI 8 fault codes active?
   - 2.a Yes; troubleshoot any other faults first.
   - 2.b No; Go to step 3.
3. Check for proper configuration of the CPC against the server information. Does the CPC pedal type have the proper configuration?
   - 3.a Yes; Go to step 4.
   - 3.b No; reprogram the CPC with the correct information as necessary. Verify repair.
4. Using DiagnosticLink, monitor PWM Pedal Signal GAS1 and PWM Pedal Signal GAS2 under the Instrumentation/Chart tab.
5. Cycle Accelerator Pedal (AP) slowly several times with a full sweep from top to bottom of travel. Does percentage sweep smoothly in relation to pedal travel and return to idle (zero percent)?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the AP. Refer to Original Equipment Manufacturer (OEM) literature.
6. Clear codes and cycle ignition off.
7. Turn the ignition ON (key ON, engine OFF).
8. Does the code return?
   - 8.a Yes; replace the AP, clear codes and verify repair. Refer to Original Equipment Manufacturer (OEM) literature.
   - 8.b No; Go to step 9.
9. Gently wiggle pedal and harness connector to simulate road vibration. Go to step 10.

Note : Do not disconnect the Accelerator Pedal (AP) connector at this time.

> **NOTICE**
>
> **Do not tap on AP with metal object or tool as this may damage component.**

Note : A second technician may be required to monitor values during wiggle testing.

10. While performing wiggle test , monitor PWM Pedal Signal GAS1 and PWM Pedal Signal GAS2 under the Diagnostic Link Instrumentation/Chart tab.
11. Cycle Accelerator Pedal (AP) slowly several times with a full sweep from top to bottom of travel. Do the percentages sweep smoothly in relation to pedal travel?
    - 11.a Yes; Go to step 12.
    - 11.b No; isolate that section of harness and inspect for wire chaffing, corrosion, improper connections or physical damage and repair as necessary. Verify repair.
12. Disconnect the Accelerator Pedal (AP).
13. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
    - 13.a Yes; repair as necessary. Verify repair.

13.b No; reconnect the AP. Go to step 14.

14. Gently wiggle CPC harness connectors to simulate road vibration. Go to step 15.
15. While performing wiggle test, monitor PWM Pedal Signal GAS1 and PWM Pedal Signal GAS2 under the DiagnosticLink Instrumentation/Chart tab. Go to step 16.
16. Cycle Accelerator Pedal (AP) slowly several times with a full sweep from top to bottom of travel. Do the percentages sweep smoothly in relation to pedal travel?

    16.a Yes; Go to step 17.

    16.b No; isolate that section of harness and inspect for wire chaffing, corrosion, improper connections or physical damage and repair as necessary. Verify repair.

17. Disconnect the CPC #1 connector.
18. Disconnect the CPC #3 connector.
19. Disconnect the CPC #4 connector.
20. Inspect the CPC and the harness connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connectors. Is any damage found?

    20.a Yes; repair as necessary. Verify repair.

    20.b No; replace the AP, clear codes and verify repair. Refer to Original Equipment Manufacturer (OEM) literature. Verify repair.

42.9 SPN 91/FMI 31 - GHG17

2-Channel Accelerator Pedal Learned Range to Large

SPN 91/FMI 31	
Description	Pedal Sensor Signal Outside of Learned Range
Monitored Parameter	Pedal Position
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key Cycle - Ignition ON

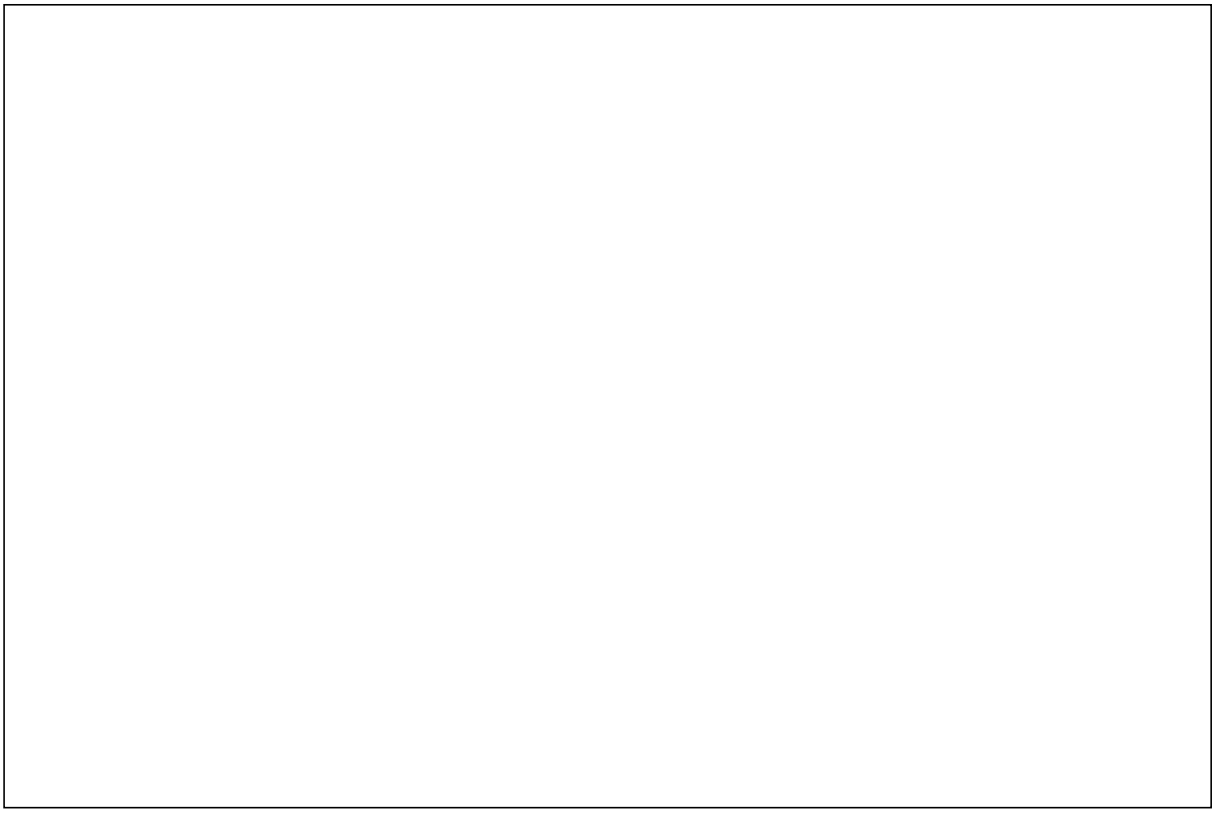


Fig 42.17, Analog Pedal Type

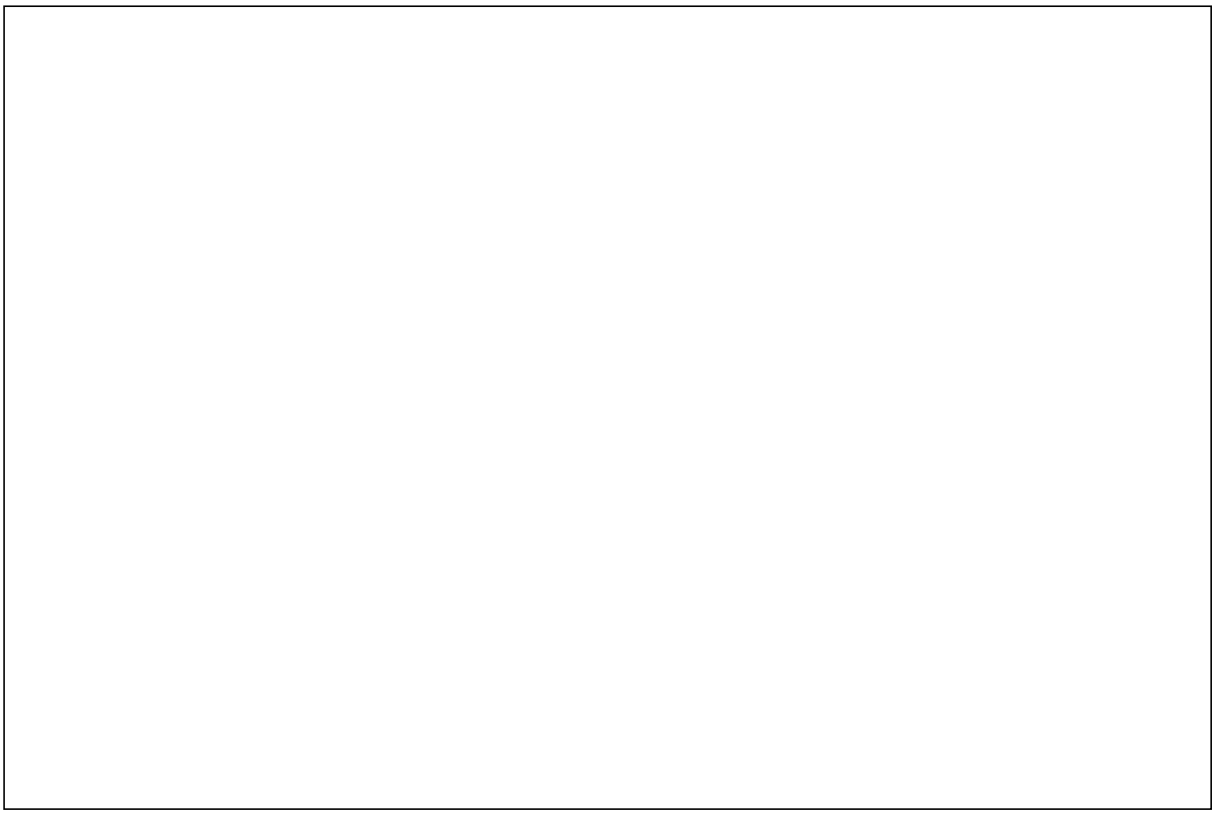


Fig 42.18, Williams Dual-Channel Analog Pedal

Williams Dual-Channel Pedal Connector and Pinout				
Function	**CPC pinout**	**Connector Pinout**	**Comments**	**Harness Connector Body**
APS1	1/7	A	SENSOR 1	
GND1	1/4	B	APS1 GND	
VCC1 (+5V)	1/8	C	APS1 Power Supply	
VCC2 (+5V)	3/3	D	APS2 Power Supply	
GND2	3/2	E	APS2 GND	The image above is the front side looking into the pins on the Harness Connector.
APS2	4/14	F	SENSOR 2	Harness Connector and Seal (P/N: 12066317) Terminal Female (P/N: 12103881)

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

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Connect DiagnosticLink ; are any other SPN 91/FMI 0, FMI 2, FMI 4, or FMI 8 fault codes active?
   - 2.a Yes; troubleshoot any other faults first.
   - 2.b No; Go to step 3.
3. Check for proper configuration of the CPC against the server information. Does the CPC pedal type have the proper configuration?
   - 3.a Yes; Go to step 4.
   - 3.b No; reprogram the CPC with the correct information as necessary. Verify repair.
4. Using DiagnosticLink, monitor PWM Pedal Signal GAS1 and PWM Pedal Signal GAS2 under the Instrumentation/Chart tab.
5. Cycle Accelerator Pedal (AP) slowly several times with a full sweep from top to bottom of travel. Does voltage sweep smoothly in relation to pedal travel?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the AP. Refer to Original Equipment Manufacturer (OEM) literature.
6. Clear codes and cycle ignition off.
7. Turn the ignition ON (key ON, engine OFF).
8. Does the code return?
   - 8.a Yes; replace the AP, clear codes and verify repairs. Refer to Original Equipment Manufacturer (OEM) literature.
   - 8.b No; Go to step 9.
9. Gently wiggle pedal and harness connector to simulate road vibration. Go to step 10.

Note : Do not disconnect the Accelerator Pedal (AP) connector at this time.

> **NOTICE**
>
> **Do not tap on AP with metal object or tool as this may damage component.**

Note : A second technician may be required to monitor values during wiggle testing.

10. While performing wiggle test, monitor PWM Pedal Signal GAS1 and PWM Pedal Signal GAS2 under the DiagnosticLink Instrumentation/Chart tab.
11. Cycle Accelerator Pedal (AP) slowly several times with a full sweep from top to bottom of travel. Do the percentages sweep smoothly in relation to pedal travel?
    - 11.a Yes; Go to step 12.
    - 11.b No; isolate that section of harness and inspect for wire chaffing, corrosion, improper connections or physical damage and repair as necessary. Verify repair.
12. Disconnect the Accelerator Pedal (AP).
13. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
    - 13.a Yes; repair as necessary. Verify repair.

13.b No; reconnect the AP. Go to step 14.

14. Gently wiggle CPC harness connectors to simulate road vibration. Go to step 15.
15. While performing wiggle test, monitor PWM Pedal Signal GAS1 and PWM Pedal Signal GAS2 under the DiagnosticLink Instrumentation/Chart tab. Go to step 16.
16. Cycle Accelerator Pedal (AP) slowly several times with a full sweep from top to bottom of travel. Do the percentages sweep smoothly in relation to pedal travel?

    16.a Yes; Go to step 17.

    16.b No; isolate that section of harness and inspect for wire chaffing, corrosion, improper connections or physical damage and repair as necessary. Verify repair.

17. Disconnect the CPC #1 connector.
18. Disconnect the CPC #3 connector.
19. Disconnect the CPC #4 connector.
20. Inspect the CPC and the harness connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connectors. Is any damage found?

    20.a Yes; repair as necessary. Verify repair.

    20.b No; replace the AP, clear codes and verify repair. Refer to Original Equipment Manufacturer (OEM) literature. Verify repair.

SPN 91 (CPC3) (GHG17)

43.1 SPN 91/FMI 7 - GHG17

SPN 91/FMI 7	
Description	Pedal Idle Position Not Reached Two Minutes After Ignition On
Monitored Parameter	Pedal Position
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key Cycle - Ignition ON for Two Minutes

1. Disconnect the Accelerator Pedal (AP).
2. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   2.a Yes; repair as necessary. Verify the repair.

   2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).

Williams Dual-Channel Pedal Connector and Pinout				
Function	CPC3 Cavity	Pedal Connector Pin	Comments	Pedal Harness Connector Body
APS1	2/3	A	SENSOR 1	
GND1	2/20	B	APS1 GND	
VCC1 (+5V)	2/15	C	APS1 Power Supply	
VCC2 (+5V)	2/21	D	APS2 Power Supply	
GND2	2/14	E	APS2 GND	
APS2	2/4	F	SENSOR 2	

4. Measure the voltage between pin C and B of the AP harness connector. Is the voltage between 4.5 and 5.5 volts?

   4.a Yes; Go to step 6.

   4.b No; Go to step 5.
5. Measure the voltage between pin C of the AP harness connector and ground. Is the voltage between 4.5 and 5.5 volts?

   5.a Yes; repair the open circuit between pin B of the AP harness connector and pin 20 of the CPC3 #2 connector. Verify the repair.

   5.b No; repair the circuit between pin C of the AP harness connector and pin 15 of the CPC3 #2 connector. Verify the repair.

6. Measure the voltage between pin A of the AP harness connector and ground. Is any voltage present?
   - 6.a Yes; repair the short to power between pin A of the AP harness connector and pin 3 of the CPC3 #2 connector. Verify the repair.
   - 6.b No; Go to step 7.
7. Turn the ignition OFF.
8. Disconnect the CPC3 #2 connector.
9. Inspect the CPC3 #2 connector and the harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 9.a Yes; repair as necessary. Verify the repair.
   - 9.b No; Go to step 10.
10. Measure the resistance between pin A of the AP harness connector and pin 3 of the CPC3 #2 connector. Is the resistance less than five ohms?
    - 10.a Yes; Go to step 11.
    - 10.b No; repair the circuit between pin A of the AP harness connector and pin 3 of the CPC3 #2 connector. Verify the repair.
11. Measure the resistance between pin A of the AP harness connector and ground. Is the resistance greater than 10K ohms?
    - 11.a Yes; replace the Accelerator Pedal. Verify the repair.
    - 11.b No; repair the shorted circuit between pin A of the AP harness connector and pin 3 of the CPC3 #2 connector.

43.2 SPN 91/FMI 8 - GHG17

SPN 91/FMI 8	
Description	Accelerator Pedal Sensor Signal Missing
Monitored Parameter	GAS1
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key Cycle - Ignition ON

1. Disconnect the Accelerator Pedal (AP).
2. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 2.a Yes; repair as necessary. Verify repair.
   - 2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).

Williams Dual-Channel Pedal Connector and Pinout				
Function	CPC3 Cavity	Pedal Connector Pin	Comments	Pedal Harness Connector Body
APS1	2/3	A	SENSOR 1	
GND1	2/20	B	APS1 GND	
VCC1 (+5V)	2/15	C	APS1 Power Supply	
VCC2 (+5V)	2/21	D	APS2 Power Supply	
GND2	2/14	E	APS2 GND	
APS2	2/4	F	SENSOR 2	

4. Measure the voltage between pin C and B of the AP harness connector. Is the voltage between 4.5 and 5.5 volts?
   - 4.a Yes; Go to step 6.
   - 4.b No; Go to step 5.
5. Measure the voltage between pin C of the AP harness connector and ground. Is the voltage between 4.5 and 5.5 volts?
   - 5.a Yes; repair the open circuit between pin B of the AP harness connector and pin 20 of the CPC3 #2 connector. Verify repair.
   - 5.b No; repair the circuit between pin C of the AP harness connector and pin 15 of the CPC3 #2 connector. Verify repair.
6. Measure the voltage between pin A of the AP harness connector and ground. Is any voltage present?
   - 6.a Yes; repair the short to power between pin A of the AP harness connector and pin 3 of the CPC3 #2 connector. Verify repair.

6.b No; Go to step 7.

7. Turn the ignition OFF.
8. Disconnect the CPC3 #2 connector.
9. Inspect the CPC3 #2 and the harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   9.a Yes; repair as necessary. Verify repair.

   9.b No; Go to step 10.

10. Measure the resistance between pin A of the AP harness connector and pin 3 of the CPC3 #2 connector. Is the resistance less than five ohms?

    10.a Yes; Go to step 11.

    10.b No; repair the circuit between pin A of the AP harness connector and pin 3 of the CPC3 #2 connector. Verify repair.

11. Measure the resistance between pin A of the AP harness connector and ground. Is the resistance greater than 10K ohms?

    11.a Yes; replace the Accelerator Pedal. Verify repair.

    11.b No; repair the shorted circuit between pin A of the AP harness connector and pin 3 of the CPC3 #2 connector.

43.3 SPN 91/FMI 12 - GHG17

Check as follows:

1. Connect DiagnosticLink SP2 or higher.
2. Turn the ignition ON (key ON engine OFF).
3. Is SPN 91/FMI 12 active?
   - 3.a Yes; Go to step 4.
   - 3.b No; no action required.
4. Are CPC2 SPN 91/FMI 8/13 or CPC3 SPN 2623/FMI 8 also present?
   - 4.a Yes; repair those fault codes first.
   - 4.b No; Go to step 5.
5. Physically inspect accelerator pedal for any obstructions, binding, loose mounting bracket, and that pedal has full travel. Is any damage found?
   - 5.a Yes; repair as necessary.
   - 5.b No; replace accelerator pedal.

43.4 SPN 91/FMI 13 - GHG17

Accelerator Pedal Incorrect Parameterization

This fault indicates the Accelerator Pedal is incorrectly parameterized. Reprogram the CPC3 to the latest server settings.

SPN 94 (MCM) (GHG17)

44.1 SPN 94/FMI 2 – GHG17

SPN 94/FMI 2	
Description	Low Side Fuel Pressure Out of Range
Monitored Parameter	Low Side Fuel Pressure Sensor Circuit
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (One minute)

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ WARNING

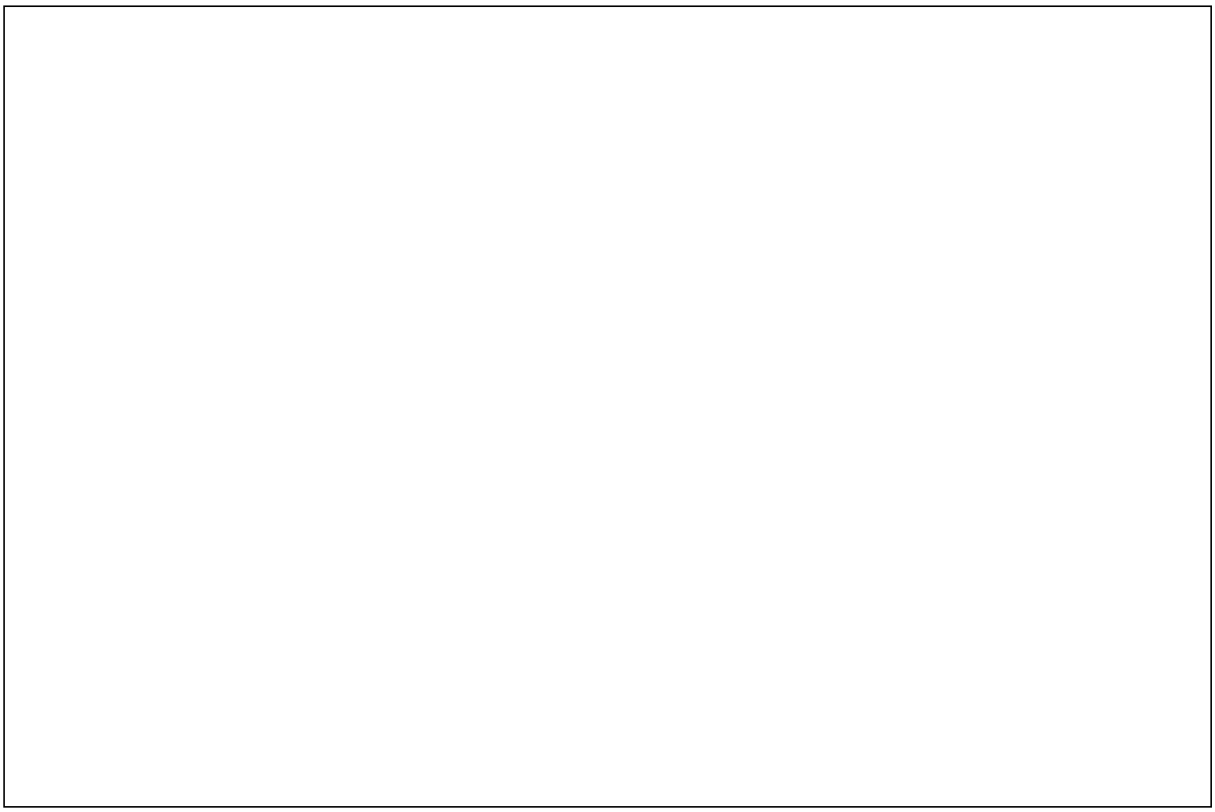
PERSONAL INJURY

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.

⚠ WARNING

ENGINE EXHAUST

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



Check as follows:

1. Check and record fuel level using parameter AS044 Fuel Tank Level. Is the fuel level under ¼ tank (25%)?
   - 1.a Yes; add fuel and road test vehicle. If code does not become active during road test, release the truck. If code becomes active during the road test with over ¼ tank of fuel, Go to step 3.
   - 1.b No; Go to step 2.
2. Check fuel tank level in the extended fault code data. Was fuel tank level over ¼ tank (25%) when the code logged?
   - 2.a Yes; Go to step 3.
   - 2.b No; fuel sloshing in the tank may have caused aerated fuel and set this code. Road test vehicle. If code does not come active during road test, release the truck. If code does come active, Go to step 3.
3. Disconnect the Low Pressure Pump Output (LPPO) fuel pressure sensor.
4. Turn the ignition ON (key ON, engine OFF).
5. Measure the voltage between pins 2 and 3 on the harness side of the LPPO fuel pressure sensor connector. Is the voltage between 4.75 and 5 volts?
   - 5.a Yes; Go to step 7.
   - 5.b No; Go to step 6.
6. Measure the voltage between pin 3 on the harness side of the LPPO fuel pressure sensor connector and battery ground. Is the voltage between 4.75 and 5 volts?
   - 6.a Yes; repair the wire between pin 2 of the LPPO fuel pressure sensor harness connector and pin 102 of the MCM 120-pin connector.
   - 6.b No; repair the wire between pin 3 of the LPPO fuel pressure sensor harness connector and pin 117 of the MCM 120-pin connector.
7. Turn the ignition OFF.
8. Disconnect the MCM 120-pin connector.
9. Measure the resistance between pin 1 of the LPPO fuel pressure sensor harness connector and pin 113 of the MCM 120- pin connector. Is the resistance less than three ohms?

9.a Yes; replace the LPPO fuel pressure sensor.

9.b No; repair the wire between pin 1 of the LPPO fuel pressure sensor harness connector and pin 113 of the MCM 120-pin connector.

44.2 SPN 94/FMI 3 - GHG17

SPN 94/FMI 3	
Description	Low Side Fuel Pressure Circuit Short to Voltage
Monitored Parameter	Low Side Fuel Pressure Sensor Circuit
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (One minute)

Check as follows:

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.

> **WARNING**
>
> PERSONAL INJURY
>
> Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

1. Check for multiple codes. Are the following codes present?

- SPN 100/FMI 3
- SPN 4077/FMI 3
- SPN 94/FMI 3

1.a Yes; repair short to power between pin 82 of the Motor Control Module (MCM) 120-pin connector and the engine oil pressure, fuel line, and fuel compensation pressure sensors.

1.b No; Go to step 2.

2. Are the following codes present?

- SPN 4407/FMI 3
- SPN 94/FMI 3

2.a Yes; repair short to power between pin 104 of the MCM 120-pin connector and the fuel line and fuel compensation pressure sensors.

2.b No; Go to step 3.

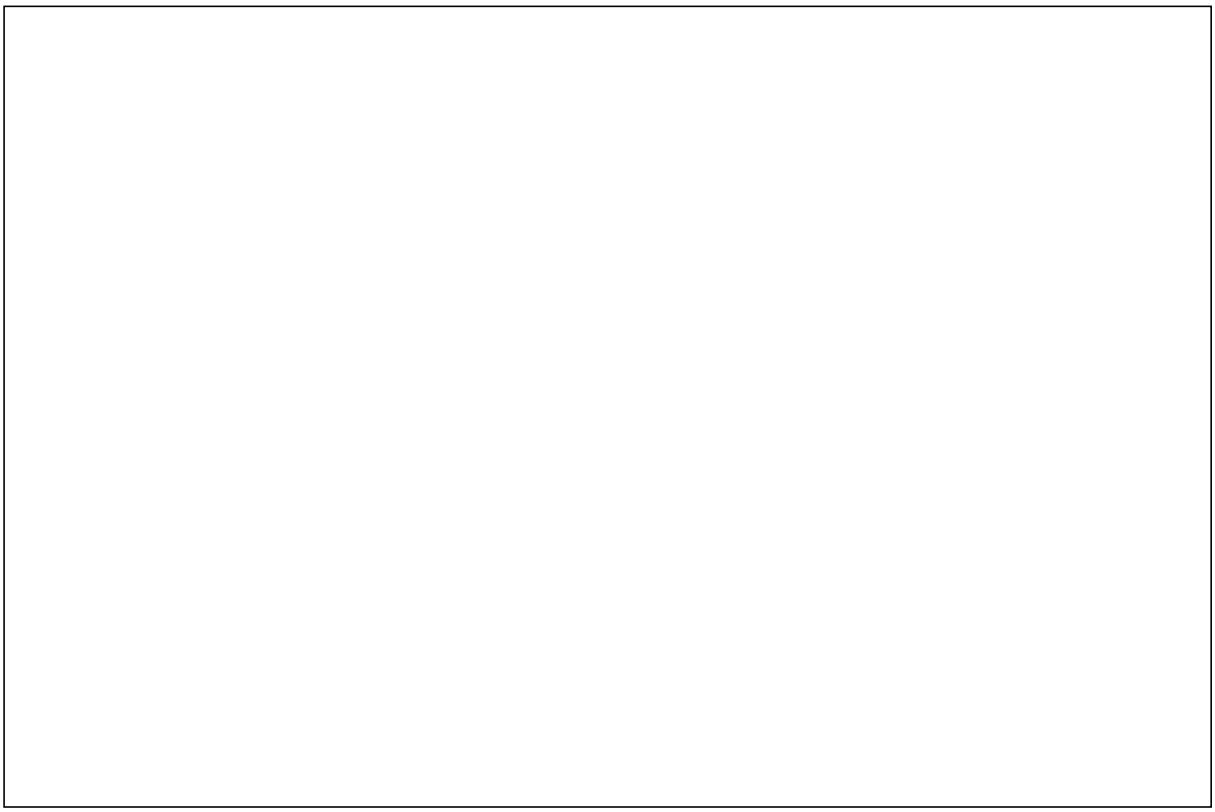
3. Disconnect FCP sensor electrical harness connector.
4. Disconnect the MCM 120-pin connector.
5. Measure the resistance across pins 1 and 2 of the FLP sensor connector. Is the resistance less than five ohms?

5.a Yes; repair the short between wires 82 and 84 of the MCM 120-pin connector.

5.b No; repair the short to power on circuit between pin 84 of the MCM 120-pin connector and pin 4 of the FCP sensor connector.

44.3 SPN 94/FMI 4 - GHG17

SPN 94/FMI 4	
Description	Low Side Fuel Pressure Sensor Circuit Short to Ground
Monitored Parameter	Low Side Fuel Pressure Sensor Circuit
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (One minute)



Check as follows:

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.

> **WARNING**
>
> PERSONAL INJURY
>
> Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple codes. Are the following codes also present?

- SPN 411/FMI 4
- SPN 51/FMI 4
- SPN 94/FMI 4

3.a Yes; repair open 5V supply between pin 117 of the Motor Control Module (MCM) 120- pin connector and the Low Pressure Pump Output (LPPO) fuel pressure sensor, EGR delta P sensor, and the intake throttle harness connectors. Clear codes. Verify repairs.

3.b No; Go to step 4.

4. Disconnect the LPPO sensor.
5. Inspect the LPPO sensor harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is damage present?

5.a Yes; repair as necessary. Go to step 14.

5.b No; Go to step 6.

6. Measure the voltage between pins 3 and 2 of the LPPO sensor harness side connector (5V supply from MCM) and (ground circuit to MCM). Is the voltage greater than 4.5 volts?

6.a Yes; Go to step 8.

6.b No; Go to step 7.

7. Measure the voltage between pin 3 of the LPPO sensor harness side connector (5V supply from MCM) and ground (battery ground lug by starter). Is the voltage greater than 4.5 volts?

7.a Yes; repair open wire between pin 102 of the MCM 120-pin connector and the Oil Separator speed sensor, the Intake Manifold Pressure/Temperature sensor, and the LPPO sensor harness connectors. Go to step 14.

7.b No; repair open wire between pin 117 of the MCM 120-pin connector and the EGR delta P sensor, and the intake throttle, and LPPO sensor harness connectors. Go to step 14.

8. Turn the ignition OFF.
9. Disconnect the MCM 120-pin connector.
10. Inspect the MCM harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is damage present?

10.a Yes; repair as necessary. Go to step 14.

10.b No; Go to step 11.

11. Measure the resistance between (signal circuit) pin 113 from MCM harness connector to pin 1 of the LPPO sensor harness connector. Is the resistance less than five ohms?

11.a Yes; Go to step 12.

11.b No; repair open wire between pin 113 of the MCM 120-pin harness side connector and the LPPO sensor harness side connector. Go to step 14.

12. Measure the resistance between pins 1 and 2 of the LPPO sensor harness connector (signal and ground circuits). Is the resistance less than 10K ohms?

12.a Yes; repair short between pins 113 and 102 of the MCM 120-pin harness side connector and the LPPO sensor harness side connector. Go to step 14.

12.b No; Go to step 13.

13. Measure the resistance between pin 1 of the LPPO sensor harness side connector (signal circuit) and ground (battery ground lug by starter). Is resistance less than 10K ohms?

    13.a Yes; repair short to ground between pin 113 of the MCM 120-pin harness side connector and the LPPO sensor harness side connector. Go to step 14.

    13.b No; replace the LPPO sensor. Refer to section "Removal of the Low Pressure Fuel Sensor" . Go to step 14.

14. Clear codes and verify repairs. If fault returns, install a test MCM and retest. If code does not return, replace MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs.

44.4 SPN 94/FMI 15 - GHG17

Fuel Filter Service Warning

1. Replace fuel filters. Refer to section "Removal of the Coalescer/Final Filter – Two Filter System " .

> **⚠ WARNING**
>
> PERSONAL INJURY
>
> Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

> **⚠ 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.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

2. Start engine and check Low Pressure Pump Out (LPPO) fuel pressure. Is fuel pressure within specified range? Refer to section "Normal Fuel System Pressures - Two-Filter System" .

   2.a Yes; release vehicle.

   2.b No; Go to step 3.

3. Using Fuel Filter Module Inlet/Outlet Hoses (J-48707) and Fuel Flow Tool (J-48708-1), run the supply and return lines to the Fuel Flow Tool. Prime the fuel system and start the engine. Is LPPO fuel pressure within specified range? Refer to section "Normal Fuel System Pressures - Two-Filter System" .

   3.a Yes; repair the restriction on the OEM fuel system.

   3.b No; Go to step 4.

4. Remove and inspect the two-stage valve. Refer to section "Removal of the Two-Stage Valve - Two-Filter System " . Was damage found?

   4.a Yes; replace the two-stage valve. Refer to section "Installation of the Two-Stage Valve - Two-Filter System" .

   4.b No; Go to step 5.

5. Remove and inspect the high pressure flange and all low pressure fuel lines. Refer to section "Removal of the High Pressure Fuel Flange - Two-Filter System" . Was damage or a restriction found?

   5.a Yes; replace damaged component.

   5.b No; replace fuel filter module. Refer to section "Removal of the Fuel Filter Module - Two-Filter System" .

44.5 SPN 94/FMI 16 - GHG17

Fuel Filter Replacement Required

1. Refer to section "SPN 94/FMI 15 - GHG17" .

SPN 96 (CPC) (GHG17)

45.1 SPN 96/FMI 13 - GHG17

Fuel Level Sensor Received Network Data in Error

SPN 96/FMI 13	
Description	This Fault Indicates an Error in the Fuel Level Signal at the Common Powertrain Controller (CPC).
Monitored Parameter	Fuel Level Status Byte
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	10 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key Cycle

Check as follows:

Note : Fuel level sensor is hardwired to instrument cluster. Fuel level signal is multiplexed from instrument cluster to the CPC.

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   - 1.a Yes; repair the battery voltage concern. Verify repair.
   - 1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   - 2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   - 2.b No; Go to step 3.
3. Has the Common Powertrain Controller (CPC) been recently programmed?
   - 3.a Yes; check the proper configuration of the CPC.
   - 3.b No; refer to Original Equipment Manufacturer (OEM) literature for instrument cluster troubleshooting.

45.2 SPN 96/FMI 19 - GHG17

Fuel Level Sensor Missing or Not Available

SPN 96/FMI 19	
Description	This Fault Indicates a Missing Fuel Level Signal at the Common Powertrain Controller (CPC).
Monitored Parameter	Fuel Level Status Byte
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	10 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key Cycle

Check as follows:

Note : Fuel level sensor is usually hardwired to instrument cluster. Fuel level signal is multiplexed from instrument cluster to the CPC.

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   - 1.a Yes; repair the battery voltage concern. Verify repair.
   - 1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   - 2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   - 2.b No; Go to step 3.
3. Has the Common Powertrain Controller (CPC) been recently programmed?
   - 3.a Yes; check the proper configuration of the CPC.
   - 3.b No; refer to Original Equipment Manufacturer (OEM) literature for instrument cluster troubleshooting.

SPN 96 (MCM) (GHG17)

46.1 SPN 96/FMI 2 - GHG17

Fuel Tank Level Sensor Stuck in Position

Note : Obtain information from the customer about Check Engine Lamp (CEL) occurrences, performance concerns or exhaust smoke.

SPN 96/FMI 2	
Description	Fuel Tank Level Sensor Stuck in Position
Monitored Parameter	Fuel Tank Level
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Five Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Engine rpm = idle or higher

Check as follows:

1. Did SPN 96/FMI 2 appear after the fuel system was repaired or fuel filter maintenance was performed?
   - 1.a Yes; clear codes and road test to verify complaint. If code does not set, release the vehicle. If code sets, Go to step 2.
   - 1.b No; Go to step 2.
2. Turn the ignition ON (key ON, engine OFF).
3. Check and record fuel level in all fuel tanks. Is the fuel level below ¼ tank (25%)?
   - 3.a Yes; add fuel and road test vehicle. If code does not become active during road test, release the truck. If the code becomes active during the road test with over ¼ tank (25%) of fuel, Go to step 4.
   - 3.b No; question the driver about the fuel level when the code was set. If the level was under ¼ tank (25%), fuel sloshing in the tank could create aerated fuel that could cause this code. If the fuel level was over ¼ tank (25%) when the code was set, Go to step 4.
4. Check for fuel contamination, including Diesel Exhaust Fluid (DEF), water, gasoline, kerosene, or coolant. Is any contamination found?
   - 4.a Yes; refer to section "Contaminated Fluids" in this manual.
   - 4.b No; Go to step 5.
5. Visually inspect for external fuel leaks on the engine and on the chassis. Are fuel leaks present?
   - 5.a Yes; repair leak. Refer to section "Verify Repairs" .
   - 5.b No; replace fuel level sensor. For additional information, refer to the OEM service procedures.

46.2 SPN 96/FMI 13 - GHG17

Fuel Level Sensor Missing or Not Available

SPN 96/FMI 13	
Description	This Fault indicates the Motor Controller Module (MCM) is not receiving Fuel Tank Level signal from another device.
Monitored Parameter	Fuel Tank Level
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Key ON Engine OFF

Check as follows:

Note : Fuel level sensor is hardwired to instrument cluster. Fuel level signal is multiplexed from instrument cluster to the MCM.

1. Connect DiagnosticLink .

Note : Faults are listed in diagnostic priority from top to bottom.

2. Are there any of the following faults present in the CPC, MCM, or instrument cluster?

- SPN 168/FMI any
- SPN 625/FMI any

2.a Yes; repair fault with the highest priority listed above.

2.b No; refer to Original Equipment Manufacturer (OEM) literature for proper Fuel Tank Level sensor installation and wiring.

46.3 SPN 96/FMI 19 - GHG17

Fuel Level Sensor Signal Error

SPN 96/FMI 19	
Description	This fault indicates Motor Control Module (MCM) has received an error indicator from the ECU transmitting fuel level signal source.
Monitored Parameter	Fuel Tank Level
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Key ON Engine OFF

Check as follows:

Note : Fuel level sensor is usually hardwired to instrument cluster. Fuel level signal is multiplexed from instrument cluster to the CPC.

1. Connect DiagnosticLink .

Note : Faults are listed in diagnostic priority from top to bottom.

2. Are there any of the following faults present in the CPC, MCM, or instrument cluster?

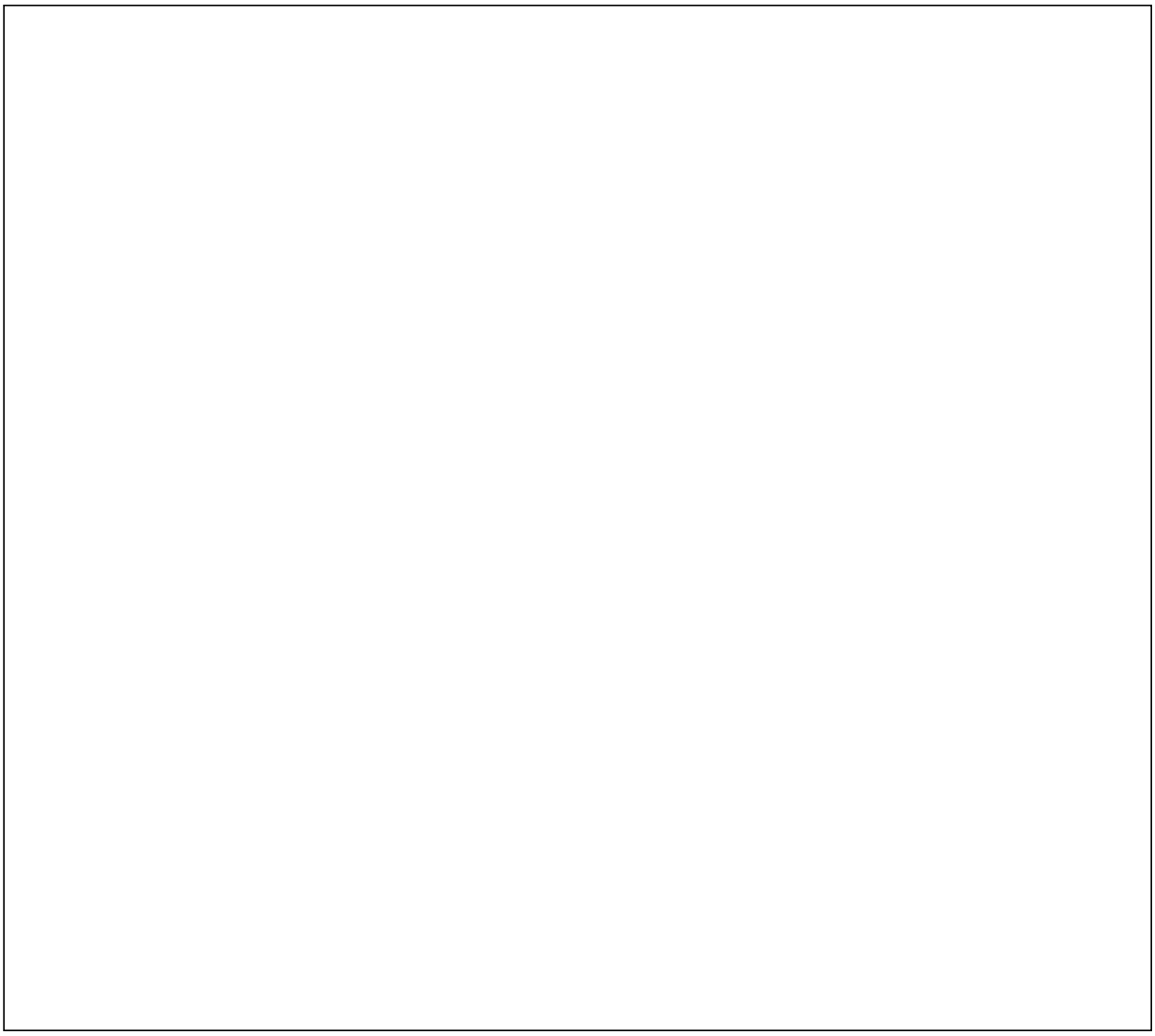
- SPN 168/FMI any
- SPN 625/FMI any

2.a Yes, repair fault with the highest priority listed above.

2.b No; refer to Original Equipment Manufacturer (OEM) literature for troubleshooting circuits between Fuel Level Sensor and Vehicle instrument cluster.

SPN 97 (MCM) (GHG17)

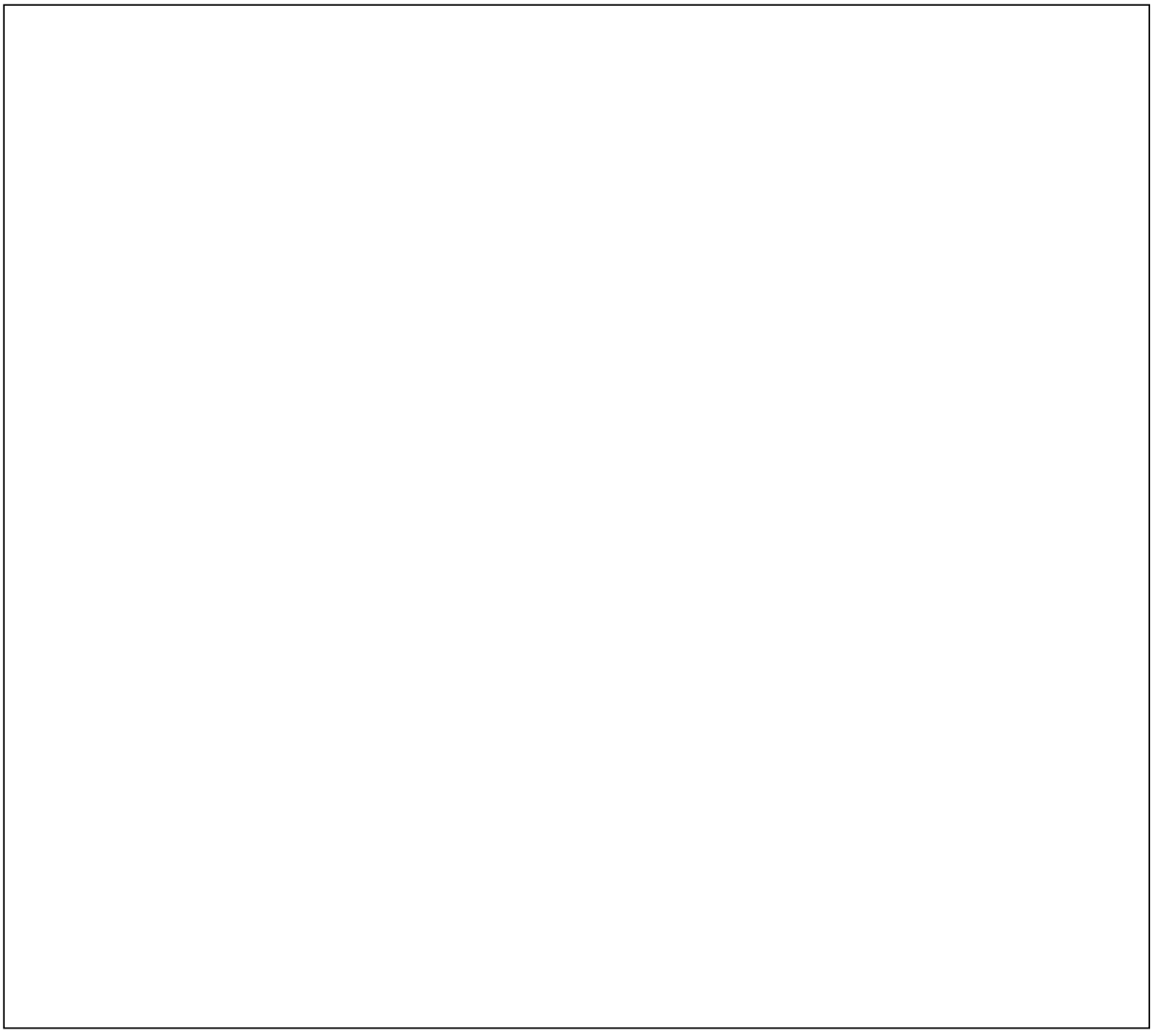
47.1 Electronic Diagram



47.2 SPN 97/FMI 3 - GHG17

Water-in-Fuel Circuit Failed High

SPN 97/FMI 3	
Description	Short to Voltage or Open on Water-In-Fuel (WIF) Sensor Circuit
Monitored Parameter	Water in Fuel Sensor
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	90 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Two Minute Idle



Check as follows:

1. Check for multiple codes. Is SPN 2791/FMI 3 also active?

   1.a Yes; repair the open circuit from pin 67 of the MCM 120-pin connector to pin 4 of the WIF sensor harness connector and Pin 2 of the Exhaust Gas Recirculation (EGR) actuator harness connector.

   1.b No; Go to step 2.

2. Turn the ignition OFF.
3. Disconnect the WIF sensor harness connector.
4. Inspect the sensor harness connector for signs of damage, water intrusion, bent, spread, corroded, pushed out (unseated) pins or frayed wiring. Is damage present?

   4.a Yes; repair as necessary.

   4.b No; Go to step 5.

5. Turn the ignition ON (key ON, engine OFF).
6. Measure the voltage between pins 1 and 4 of the WIF sensor harness connector. Is the voltage greater than 11.5 volts?

   6.a Yes; Go to step 7.

   6.b No; Go to step 8.

7. Measure the voltage between pins 2 and 4 of the WIF sensor harness connector. Is the voltage greater than 5.5 volts?

   7.a Yes; Go to step 10.

   7.b No; Go to step 8.

8. Was the voltage in Step 7 less than 4.5 volts?

   8.a Yes; repair the wire between pin 2 of the harness side of the WIF sensor and pin 57 of the MCM 120-pin connector. Verify repairs.

   8.b No; replace the WIF sensor referring to the proper procedure for the engine being serviced. Refer to section "Removal of the Water-in-Fuel Sensor" .

9. Measure the voltage between pin 1 of the WIF sensor harness connector and engine ground (Battery Ground). Is the voltage greater than 11.5 volts?

   9.a Yes; repair the wire between pin 4 of the WIF sensor harness connector and pin 67 of the MCM 120-pin connector. Verify repairs.

   9.b No; repair the wire between pin 1 of the WIF sensor harness connector and pin 71 of the MCM 120-pin connector. Verify repairs.

10. Turn the ignition OFF.
11. Disconnect the MCM 120-pin connector.
12. Inspect the MCM 120-pin connector and harness connector for signs of damage, water intrusion, bent, spread, corroded or pushed out (unseated) pins. Is damage present?

    12.a Yes; repair as necessary.

    12.b No; Go to step 13.

13. Measure resistance between the following pins on the MCM 120-pin harness connector and pins on the WIF sensor harness connector.

- Signal circuit wire; 120-pin connector pin 57 and WIF harness connector pin 2
- Ground circuit wire; 120-pin connector pin 67 and WIF harness connector pin 4
- Power circuit wire; 120-pin connector pin 71 and WIF harness connector pin 1

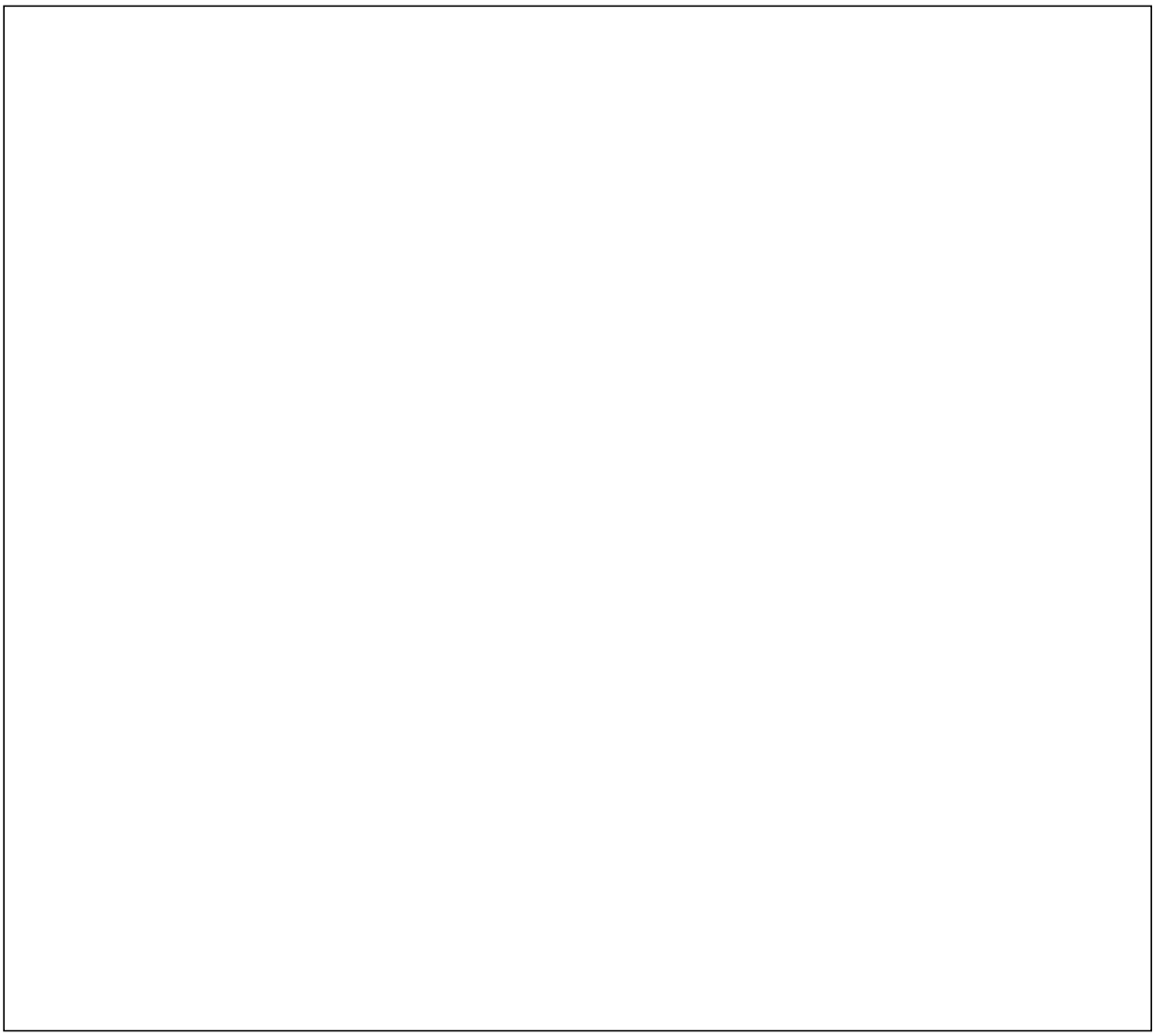
Is the resistance value greater than five ohms in any of the above tests?

13.a Yes; repair the wire for the pin pairs tested. Verify repairs.

13.b No; replace the Water-In-Fuel sensor.

47.3 SPN 97/FMI 4 - GHG17

SPN 97/FMI 4	
Description	Short to Ground on Water-in-Fuel (WIF) Sensor Circuit
Monitored Parameter	Water in Fuel Sensor
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	90 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Two Minute Idle



Check as follows:

1. Check for multiple codes. Is SPN 168/FMI 1 also active?

   1.a Yes; active troubleshoot that fault first.

1.b No; Go to step 2.

2. Turn the ignition OFF.
3. Disconnect the WIF sensor.
4. Inspect the sensor harness connector for signs of damage, water intrusion, bent, spread, corroded, pushed out (unseated) pins or frayed wiring. Is damage present?

4.a Yes; repair as necessary.

4.b No; Go to step 5.

5. Disconnect the Motor Control Module (MCM) 120-pin connector.
6. Inspect the MCM 120-pin connector and harness connector for signs of damage, water intrusion, bent, spread, corroded, pushed out (unseated) pins or frayed wiring. Is damage present?

6.a Yes; repair as necessary.

6.b No; Go to step 7.

7. Check for shorted power wire: Measure the resistance between pin 1 of the WIF sensor connector and ground. Is resistance less than 10K ohms?

7.a Yes; repair the wire between pin 1 of the WIF sensor harness and pin 71 of the MCM 120-pin connector.

7.b No; Go to step 8.

8. Check for shorted signal wire: Measure the resistance between pin 2 of the WIF sensor harness connector and ground. Is resistance less than 10K ohms?

8.a Yes; repair the wire between pin 2 of the WIF sensor harness and pin 57 of the MCM 120-pin connector.

8.b No; Go to step 9.

9. Check for shorted ground wire. Measure the resistance between pin 3 of the WIF sensor harness connector and ground. Is resistance less than 10K ohms?

9.a Yes; repair the wire between pin 3 of the WIF sensor harness and pin 39 of the MCM 120-pin connector.

9.b No; Go to step 10.

10. Check for a short between the power and ground wires. Measure the resistance between pins 1 and 4 of the WIF sensor harness connector. Is resistance less than 10K ohms?

10.a Yes; repair the short circuit between pins 1 and 4 of the WIF sensor harness.

10.b No; replace the WIF sensor.

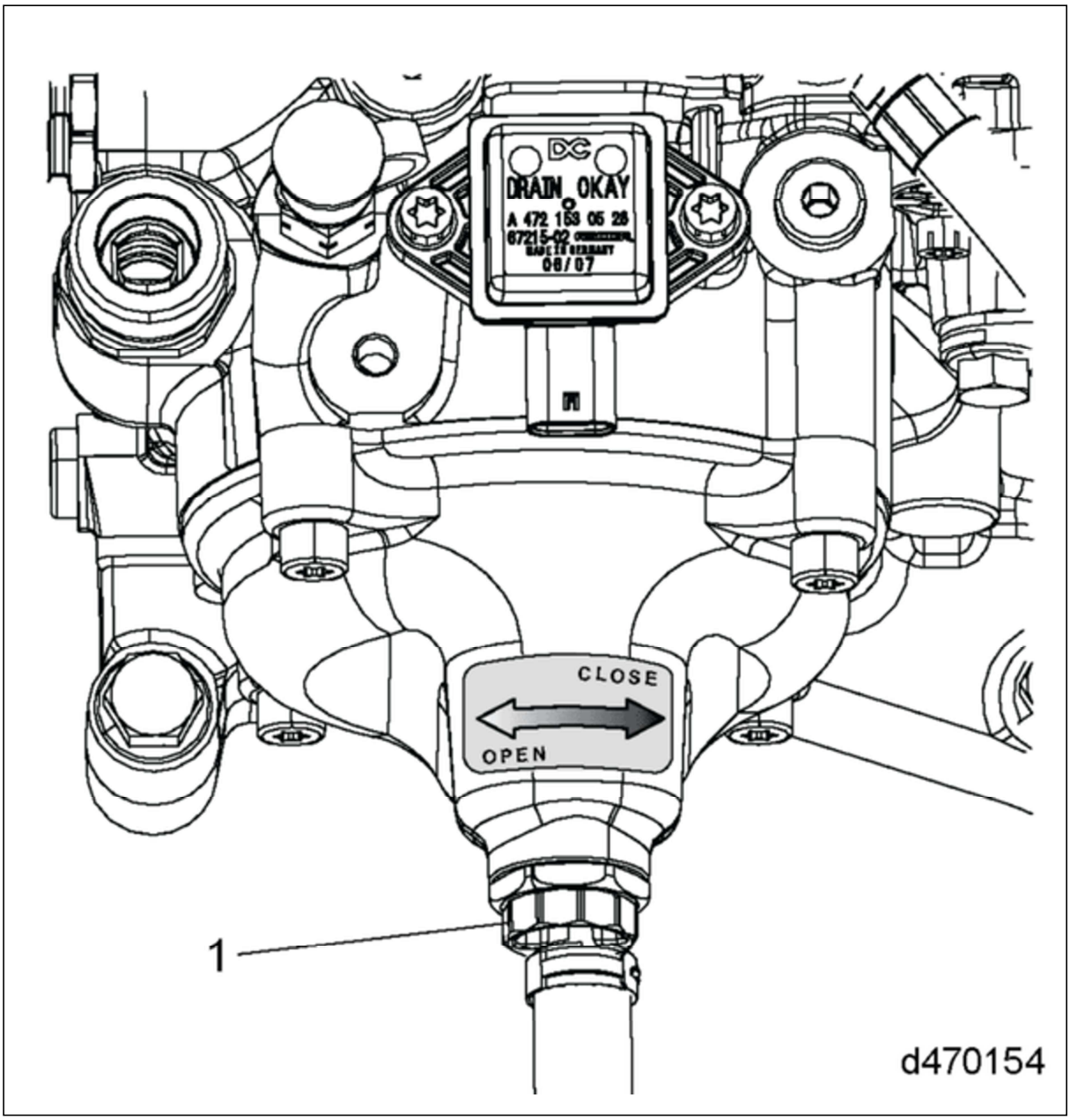
47.4 SPN 97/FMI 14 – GHG17

SPN 97/FMI 14	
Description	Fault Logs Once the Water In Fuel Sensor Detects a Certain Level of Water
Monitored Parameter	Water in Fuel Sensor
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	90 Seconds
Dash Lamps	WIF Light
Engine Reaction	None
Verification	Two Minute Idle

Note : This fault code will set if Water in Fuel (WIF) sensor detects water in the fuel after a five-hour driving cycle or three engine-start, key-ON cycles.

NOTICE

Do not over-tighten the water drain valve. Failure to properly tighten the water drain valve may cause damage to the water drain valve and housing.



Check as follows:

1. Turn the ignition OFF.
2. Take a one-quart fuel sample from the fuel filter module by opening the water bowl drain valve and fully draining the fuel filter in to a clear container.
3. Check for fuel contamination, including Diesel Exhaust Fluid (DEF), gasoline, kerosene, or coolant. Is the fuel sample contaminated?

   3.a Yes; refer to section "Contaminated Fluids".

   3.b No; close the water drain valve. Go to step 4.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

4. Prime the fuel filter module via hand pump (approximately 250 times). Clear the fault code, start the engine and let it run for 15 minutes. Does the fault become active?

   4.a Yes; repeat steps 1 through 4. If the fault code is still active after steps 1 through 4 have been performed, drain all water from fuel tank(s) and if equipped, drain the frame-mounted filter. Refer to appropriate OEM manual for fuel tank cleaning/flushing procedure. Clear fault codes, Verify repairs with a 15-minute road test.

   4.b No; release vehicle.

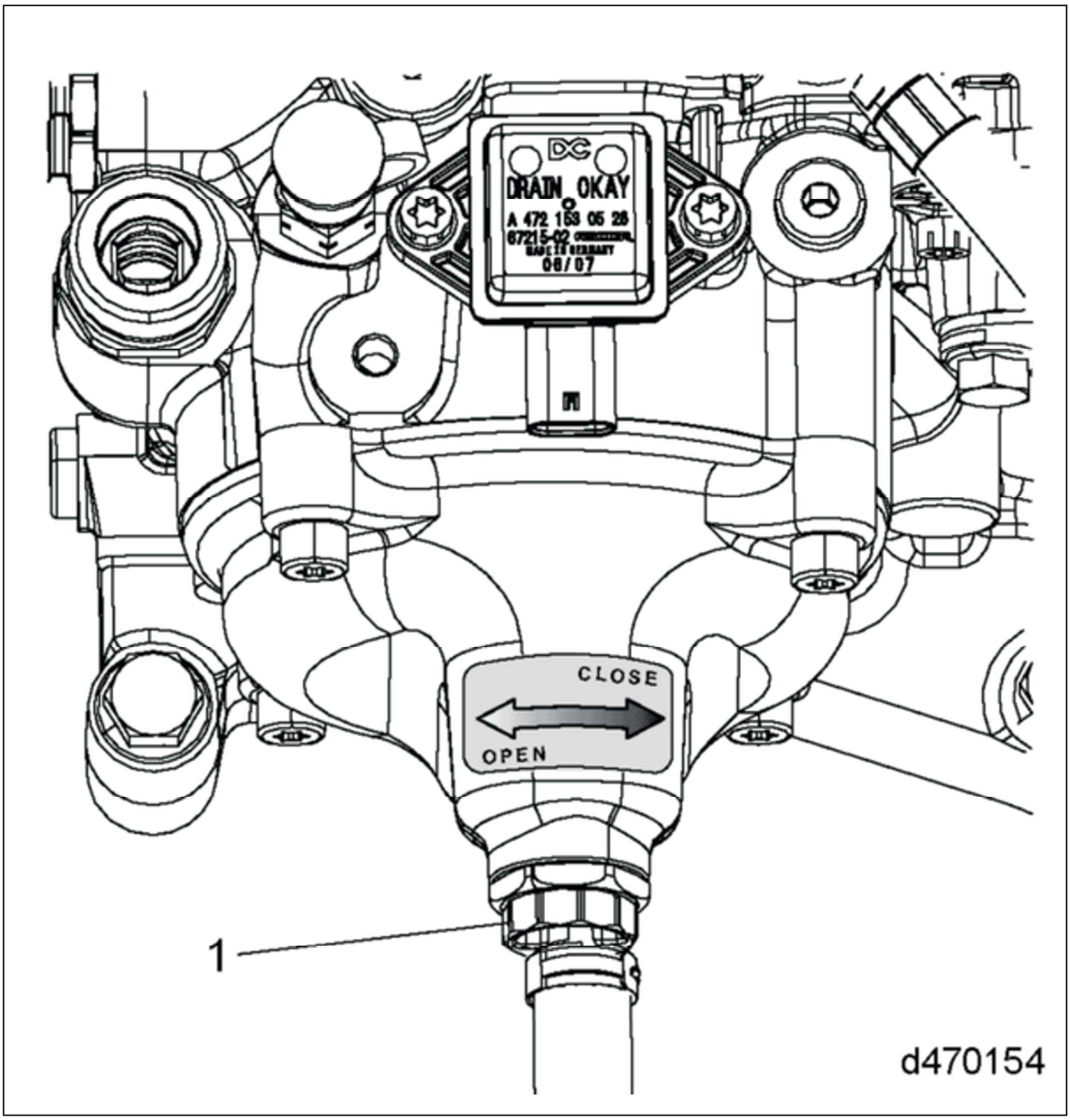
47.5 SPN 97/FMI 15 - GHG17

SPN 97/FMI 15	
Description	Fault Logs Once the Water In Fuel Sensor Detects a Certain Level of Water
Monitored Parameter	Water in Fuel Sensor
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	90 Seconds
Dash Lamps	WIF Light
Engine Reaction	None
Verification	Two Minute Idle

Note : This fault code will set if Water in Fuel (WIF) sensor detects water in the fuel after a five-hour driving cycle or three engine-start, key-ON cycles.

NOTICE

Do not over-tighten the water drain valve. Failure to properly tighten the water drain valve may cause damage to the water drain valve and housing.



Check as follows:

1. Turn the ignition OFF.
2. Take a one-quart fuel sample from the fuel filter module by opening the water bowl drain valve and fully draining the fuel filter in to a clear container.
3. Check for fuel contamination, including Diesel Exhaust Fluid (DEF), gasoline, kerosene, or coolant. Is the fuel sample contaminated?

   3.a Yes; refer to section "Contaminated Fluids" of this manual.

   3.b No; close the water drain valve. Go to step 4.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

4. Prime the fuel filter module via hand pump (approximately 250 times) or using Detroit approved priming tool. Clear the fault code, start the engine, and let the engine run for 15 minutes. Does the fault become active?

   4.a Yes; repeat steps 1 through 4. If the fault code is still active after steps 1 through 4 have been performed, drain all water from fuel tank(s) and if equipped, drain the frame-mounted filter. Refer to appropriate OEM manual for fuel tank cleaning/flushing procedure. Clear fault codes, Verify repairs with a 15-minute road test.

   4.b No; release vehicle.

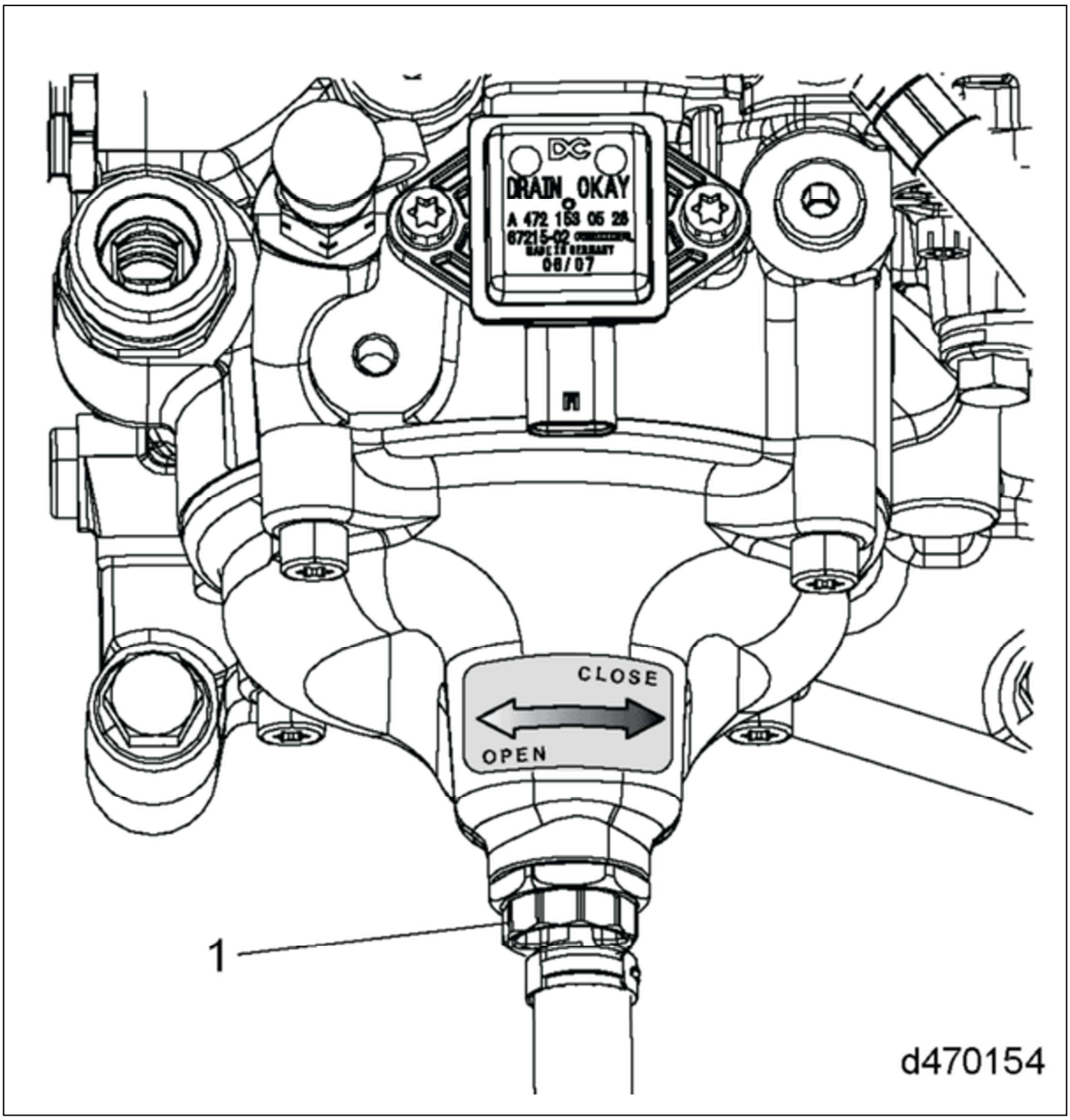
47.6 SPN 97/FMI 16 - GHG17

SPN 97/FMI 16	
Description	Fault Logs Once the Water In Fuel Sensor Detects a Certain Level of Water
Monitored Parameter	Water in Fuel (WIF) Sensor
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	90 Seconds
Dash Lamps	WIF Light
Engine Reaction	None
Verification	Two Minute Idle

Note : This fault code will set if Water in Fuel (WIF) sensor detects water in the fuel after a five-hour driving cycle or three engine-start, key-ON cycles.

NOTICE

Do not over-tighten the water drain valve. Failure to properly tighten the water drain valve may cause damage to the water drain valve and housing.



Check as follows:

1. Follow troubleshooting procedure for SPN 97/FMI 15 - GHG17. Refer to section "SPN 97/FMI 15 - GHG17" .

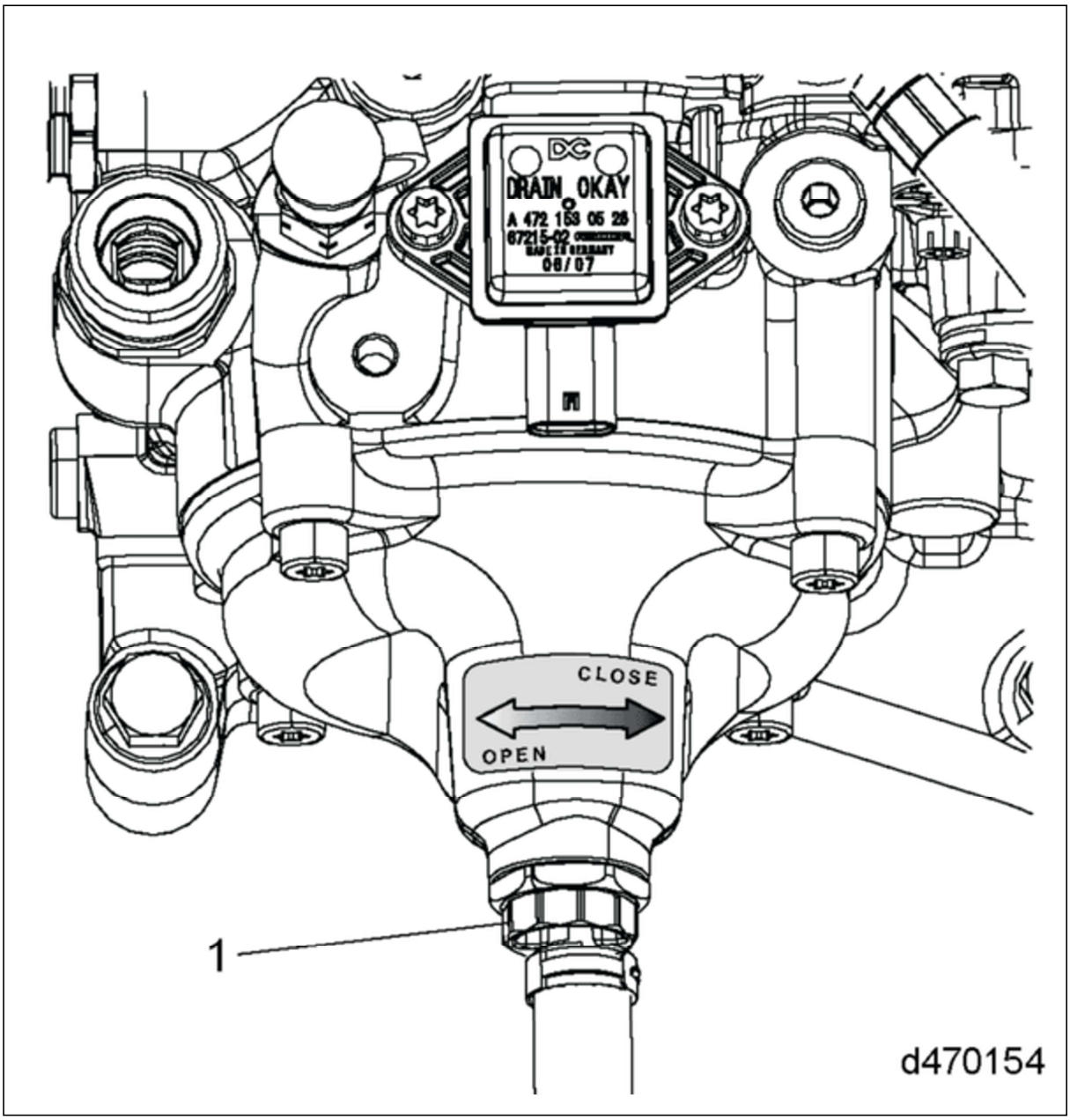
47.7 SPN 97/FMI 31 - GHG17

SPN 97/FMI 31	
Description	Fault Logs Once the Water In Fuel Sensor Detects a Certain Level of Water
Monitored Parameter	Water in Fuel Sensor
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	90 Seconds
Dash Lamps	WIF Light
Engine Reaction	None
Verification	Two Minute Idle

Note : This fault code will set if Water in Fuel (WIF) sensor detects water in the fuel after a five-hour driving cycle or three engine-start, key-ON cycles.

NOTICE

Do not over-tighten the water drain valve. Failure to properly tighten the water drain valve may cause damage to the water drain valve and housing.



Check as follows:

1. Turn the ignition OFF.
2. Take a one-quart fuel sample from the fuel filter module by opening the water bowl drain valve and fully draining the fuel filter in to a clear container.
3. Check for fuel contamination, including Diesel Exhaust Fluid (DEF), gasoline, kerosene, or coolant. Is the fuel sample contaminated?

   3.a Yes; Refer to section "Contaminated Fluids"of this manual.

   3.b No; close the water drain valve. Go to step 4.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

4. Prime the fuel filter module via hand pump (approximately 250 times). Clear the fault code, start the engine and let the engine run for 15 minutes. Does the fault become active?

   4.a Yes; repeat steps 1 through 4. If the fault code is still active after steps 1 through 4 have been performed, drain all water from fuel tank(s) and if equipped, drain the frame-mounted filter. Refer to appropriate OEM manual for fuel tank cleaning/flushing procedure. Clear fault codes, Verify repairs with a 15-minute road test.

   4.b No; release vehicle.

SPN 98 (CPC) (GHG17)

48.1 SPN 98/FMI 0 - GHG17

Oil Level High

SPN 98/FMI 0	
Description	This Code is Not Configured for NAFTA Applications. If this Code is Active, CPC Configuration is Incorrect.
Monitored Parameter	Engine Oil Level Signal from MCM
Typical Enabling Conditions	Not Enabled
Monitor Sequence	None
Execution Frequency	None
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, engine OFF

1. Connect DiagnosticLink .
2. Reprogram the CPC with the proper server configuration.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down.
4. Connect DiagnosticLink and check for codes. Did SPN 98/FMI 0 return?

   4.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; release the vehicle.

48.2 SPN 98/FMI 1 - GHG17

Oil Level Very Low

SPN 98/FMI 1	
Description	This Code is Not Configured for NAFTA Applications. If this Code is Active, CPC Configuration is Incorrect.
Monitored Parameter	Engine Oil Level Signal from MCM
Typical Enabling Conditions	Not Enabled
Monitor Sequence	None
Execution Frequency	None
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, engine OFF

1. Connect DiagnosticLink .
2. Reprogram the CPC with the proper server configuration.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down.
4. Connect DiagnosticLink and check for codes. Did SPN 98/FMI 1 return?

   4.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; release the vehicle.

48.3 SPN 98/FMI 18 - GHG17

Low Engine Oil Level

SPN 98/FMI 18	
Description	This fault code sets when the engine oil level is low.
Monitored Parameter	Engine Oil Level
Typical Enabling Conditions	Always On
Monitor Sequence	Key On Engine Running
Execution Frequency	Continuous When Enabling Conditions Are Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None, Engine Derate or Engine Shut Down - Calibration Dependent
Verification	Key on engine off

1. Check for multiple codes. Are SPN 100/ FMI any active?
   1.a Yes; diagnose the other codes first.
   1.b No; Go to step 2.
2. Inspect the engine for leaks. Are there any leaks present?
   2.a Yes; refer to section "Symptom Diagnostics - Engine Oil Leaks".
   Refer to section "Engine Oil Leaks" .
   Refer to section "Engine Oil Leaks - Oil Developer Method" .
   2.b No; Go to step 3.
3. Inspect the engine for any signs of oil consumption, Refer to section "Check for Excessive Oil Consumption" . Are there any oil consumption concerns present?
   3.a Yes; repair as necessary.
   3.b No; Go to step 4.
4. Check the oil level. Is the oil level low?
   4.a Yes; fill oil to proper level.
   4.b No; Go to step 5.
5. Check the operation of the oil level gauge. Is the oil level reading erratic?
   5.a Yes; repair or replace the oil gauge as required.
   5.b No; replace the oil level sensor.

SPN 100 (CPC) (GHG17)

50.1 SPN 100/FMI 1 – GHG17

SPN 100/FMI 1	
Description	This fault code sets when the engine oil pressure is less than a calibrated threshold.
Monitored Parameter	Engine Oil Pressure
Typical Enabling Conditions	Always On
Monitor Sequence	Key On Engine Running
Execution Frequency	Continuous When Enabling Conditions Are Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None, Engine Derate or Engine Shut Down - Calibration Dependent
Verification	Check At Engine Operating Temperature

J-49181	Oil System Priming Adapter	
J-45299	Oil System Priming Pump	

This fault will illuminate the Check Engine Lamp (CEL) and Shutdown Engine Lamp (SEL).

Note : The Common Powertrain Controller (CPC) digital outputs have the same SPN as some Motor Control Module (MCM) faults. DiagnosticLink® makes the distinction between the MCM and CPC when diagnosing a fault.

DD15TC and DD16 Minimum Oil Pressure at operating Temperature		
rpm	**Bar**	**psi**
600	0.758	11
1200	1.65	24
1800	2.55	37

DD15AT Minimum Oil Pressure at operating Temperature		
rpm	**Bar**	**psi**
600	0.689	10
1200	1.65	24
1800	2.55	37

DD13 Minimum Oil Pressure at operating Temperature		
rpm	**Bar**	**psi**
600	0.758	11
1200	1.65	24
1800	2.55	37

Note : The oil gauge in the dash is NOT used to diagnose or verify low oil pressure concerns.

Note : If diagnostic leads to a mechanical (non-electrical) low oil pressure condition, all mains and connecting rods should be inspected. Refer to section "Inspection of the Main and Connecting Rod Bearings in Chassis".

Check as follows:

1. Check for multiple codes. Are there multiple oil pressure sensor circuit fault codes?
   - 1.a Yes; diagnose the oil pressure sensor circuit fault codes first.
   - 1.b No; Go to step 2.
2. With the vehicle parked on a flat, level surface, check the engine oil level after the engine has been shut off for at least 20 minutes. Is the engine oil at the correct level?
   - 2.a Yes; Go to step 7.
   - 2.b No; Go to step 3.

Note : An increase in the oil level suggests that there may be fuel or coolant entering the engine oil.

3. Is the oil level overfilled?
   - 3.a Yes; Go to step 5.
   - 3.b No; Go to step 4.
4. Use the manufacturer recommended oil to fill the engine oil to the correct level. Check for external engine oil leaks and repair as necessary. Verify repair.
5. Check the oil for signs of coolant intrusion. When there is coolant intrusion, the oil will exhibit a milky appearance or become thick and sludgy. Are there signs of coolant in the oil?
   - 5.a Yes; Refer to section "Coolant in Oil". Verify repair.
   - 5.b No; Go to step 6.
6. Check the oil for signs of fuel intrusion. When there is fuel intrusion into the oil, the oil becomes thin and has a fuel odor. Are there signs of fuel in the oil?
   - 6.a Yes; determine the cause of fuel in the oil. Change the oil and filter. Verify repair.
   - 6.b No; the oil level may have been over filled by the customer. Correct the oil level. Go to step 7.
7. Turn the ignition ON (key ON, engine OFF).
8. Connect DiagnosticLink® and check for a biased oil pressure sensor at key ON, engine OFF. Does the oil pressure sensor read zero psi?
   - 8.a Yes; Go to step 9.
   - 8.b No; replace the oil pressure sensor. Refer to section "Removal of the Engine Oil Pressure Sensor" . Verify repair.

> **⚠ 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.

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

9. Start the engine and observe the stability of the oil pressure using the chart. Is the oil pressure stable and within normal operating range as per the chart?

   9.a Yes; clear the code. Release the vehicle.

   9.b No; Go to step 10.

10. Inspect the vehicle for aftermarket components plumbed into the oil system. Are there any aftermarket components installed?

    10.a Yes; isolate the aftermarket components. Recheck the oil pressure.

    10.b No; Go to step 11.

> **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.

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

Note : A code will be set when the oil temperature sensor is unplugged.

11. Remove the oil temperature sensor and connect a manual gauge into the oil temperature sensor port. Refer to section "Removal of the Engine Oil Temperature Sensor" . Start and run the engine at the rpm listed in the chart. Is the oil pressure, observed on the manual gauge, stable and within normal operating range as per the chart?

    11.a Yes; reinstall the oil temperature sensor; Refer to section "Installation of the Engine Oil Temperature Sensor" . Replace the oil pressure sensor. Refer to section "Removal of the Engine Oil Pressure Sensor" . Verify repair. Clear the code. Release the vehicle.

    11.b No; Go to step 12.

12. Remove and inspect the inlet air temperature sensor, intake manifold pressure sensor, and charge air temperature sensor for signs of damage. Is there damage present?

    12.a Yes; Refer to section "Test-E - Two-Filter Fuel System" .

    12.b No; Go to step 13.

13. Remove the oil filter and verify that the correct oil filter is installed. Refer to section "Replacement of the Oil Filter" . Is the correct oil filter installed?

    13.a Yes; Go to step 14.

    13.b No; install the correct oil filter. Verify repair.

14. Inspect the outside of the oil filter for signs of metal or bearing material. Is there an excessive amount of metal or bearing material present on the outside of the filter?

    14.a Yes; determine the cause of the excessive metal in the oil. Repair as necessary.

    14.b No; Go to step 15.

15. Inspect the oil filter stand pipe and oil bypass valve (located on the top of the stand pipe) for damage. Is there any damage present or is the oil bypass valve missing?
    15.a Yes; replace the oil filter module. Verify repair.
    15.b No; Go to step 16.
16. Inspect the oil filter drain back valve located in the bottom of the oil filter housing. Is the oil filter drain back valve damaged or missing?
    16.a Yes; replace the oil filter module. Verify repair.
    16.b No; reinstall the oil filter . Refer to section "Replacement of the Oil Filter" . Go to step 17.
17. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" . Go to step 18.
18. Use the oil system adapter J-49181 and oil primer pump tool J-45299 to check for leaks in the upper portion of the engine. Refer to section "Priming the Engine Lubrication System" . Are there any leaks present?
    18.a Yes; repair as necessary. Verify repair.
    18.b No; Go to step 19.
19. Remove the oil pan. Refer to section "Removal of the Oil Pan" . Go to step 20.
20. Check the torque on the oil suction manifold bolts and oil pump using a torque wrench. Refer to section "Installation of the Oil Pump, Oil Suction Manifold, and Oil Lines" . Are the bolts torqued to specification?
    20.a Yes; Go to step 21.
    20.b No; Remove the oil suction manifold and the oil pump. Replace the O-rings, then reinstall the oil pump and oil suction manifold. Refer to section "Removal of the Oil Pump, Oil Suction Manifold, and Oil Lines" . Verify repair.
21. Remove the oil pump, oil suction manifold, and oil lines. Refer to section "Removal of the Oil Pump, Oil Suction Manifold, and Oil Lines" . Check the condition of the oil pump, oil suction manifold, suction lines, and O-rings. Is there any damage present?
    21.a Yes; repair as necessary. Verify repairs.
    21.b No; Go to step 22.
22. Inspect the rod and main bearings. Are the rod and main bearings excessively worn or damaged?
    22.a Yes; repair as necessary. Verify repair.
    22.b No; replace the oil pump, Refer to section "Installation of the Oil Pump, Oil Suction Manifold, and Oil Lines" . Verify repair.

50.2 SPN 100/FMI 18 – GHG17

SPN 100/FMI 18	
Description	This Fault Code Sets when the Engine Oil Pressure is Less than a Calibrated Threshold
Monitored Parameter	Engine Oil Pressure
Typical Enabling Conditions	Always On
Monitor Sequence	Key ON Engine Running
Execution Frequency	Continuous When Enabling Conditions Are Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None, Engine Derate or Engine Shut Down - Calibration Dependent
Verification	Check At Engine Operating Temperature

J-49181	Oil System Priming Adapter	
J-45299	Oil System Priming Pump	

Note : The Common Powertrain Controller (CPC) digital outputs have the same SPN as some Motor Control Module (MCM) faults. DiagnosticLink® makes the distinction between the MCM and CPC when diagnosing a fault.

DD15TC and DD16 Minimum Oil Pressure at Operating Temperature		
rpm	**Bar**	**psi**
600	0.758	11
1200	1.65	24
1800	2.55	37

DD15AT Minimum Oil Pressure at Operating Temperature		
rpm	**Bar**	**psi**
600	0.689	10
1200	1.65	24
1800	2.55	37

DD13 Minimum Oil Pressure at Operating Temperature		
rpm	**Bar**	**psi**
600	0.758	11
1200	1.65	24
1800	2.55	37

Note : The oil gauge in the dash is NOT used to diagnose or verify low oil pressure concerns.

Note : If diagnostic leads to a mechanical (non-electrical) low oil pressure condition, all mains and connecting rods

should be inspected. Refer to section "Inspection of the Main and Connecting Rod Bearings in Chassis".

Check as follows:

1. Check for multiple codes. Are there multiple oil pressure sensor circuit fault codes?
   1.a Yes; diagnose the oil pressure sensor circuit fault codes first.
   1.b No; Go to step 2.
2. With the vehicle parked on a flat, level surface, check the engine oil level after the engine has been shut off for at least 20 minutes. Is the engine oil at the correct level?
   2.a Yes; Go to step 7.
   2.b No; Go to step 3.

Note : An increase in the oil level suggests that there may be fuel or coolant entering the engine oil.

3. Is the oil level overfilled?
   3.a Yes; Go to step 5.
   3.b No; Go to step 4.
4. Use the manufacturer recommended oil to fill the engine oil to the correct level. Check for external engine oil leaks and repair as necessary. Verify repair.
5. Check the oil for signs of coolant intrusion. When there is coolant intrusion, the oil will exhibit a milky appearance or become thick and sludgy. Are there signs of coolant in the oil?
   5.a Yes; Refer to section "Coolant in Oil" . Verify repair.
   5.b No; Go to step 6.
6. Check the oil for signs of fuel intrusion. When there is fuel intrusion into the oil, the oil becomes thin and has a fuel odor. Are there signs of fuel in the oil?
   6.a Yes; determine the cause of fuel in the oil. Change the oil and filter. Verify repair.
   6.b No; the oil level may have been over filled by the customer. Correct the oil level. Go to step 7.
7. Turn the ignition ON (key ON, engine OFF).
8. Connect DiagnosticLink and check for a biased oil pressure sensor at key ON, engine OFF. Does the oil pressure sensor read zero psi?
   8.a Yes; Go to step 9.
   8.b No; replace the oil pressure sensor. Refer to section "Removal of the Engine Oil Pressure Sensor" . Verify repair.

> **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.

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

9. Start the engine and observe the stability of the oil pressure using the chart. Is the oil pressure stable and within normal operating range as per the chart?
   9.a Yes; clear the code. Release the vehicle.
   9.b No; Go to step 10.
10. Inspect the vehicle for aftermarket components plumbed into the oil system. Are there any aftermarket components installed?

10.a Yes; isolate the aftermarket components. Recheck the oil pressure.

10.b No; Go to step 11.

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.

WARNING

ENGINE EXHAUST

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

Note : A code will be set when the oil temperature sensor is unplugged.

11. Remove the oil temperature sensor and connect a manual gauge into the oil temperature sensor port. Refer to section "Removal of the Engine Oil Temperature Sensor" . Start and run the engine at the rpm listed in the chart. Is the oil pressure, observed on the manual gauge, stable and within normal operating range as per the chart?

    11.a Yes; reinstall the oil temperature sensor; Refer to section "Installation of the Engine Oil Temperature Sensor" . Replace the oil pressure sensor. Refer to section "Removal of the Engine Oil Pressure Sensor" . Verify repair. Clear the code. Release the vehicle.

    11.b No; Go to step 12.

12. Remove and inspect the inlet air temperature sensor, intake manifold pressure sensor, and charge air temperature sensor for signs of damage. Is there damage present?

    12.a Yes; Refer to section "Test-E - Two-Filter Fuel System" .

    12.b No; Go to step 13.

13. Remove the oil filter and verify that the correct oil filter is installed. Refer to section "Replacement of the Oil Filter" . Is the correct oil filter installed?

    13.a Yes; Go to step 14.

    13.b No; install the correct oil filter. Verify repair.

14. Inspect the outside of the oil filter for signs of metal or bearing material. Is there an excessive amount of metal or bearing material present on the outside of the filter?

    14.a Yes; determine the cause of the excessive metal in the oil. Repair as necessary.

    14.b No; Go to step 15.

15. Inspect the oil filter stand pipe and oil bypass valve (located on the top of the stand pipe) for damage. Is there any damage present or is the oil bypass valve missing?

    15.a Yes; replace the oil filter module. Verify repair.

    15.b No; Go to step 16.

16. Inspect the oil filter drain back valve located in the bottom of the oil filter housing. Is the oil filter drain back valve damaged or missing?

    16.a Yes; replace the oil filter module. Verify repair.

    16.b No; reinstall the oil filter . Refer to section "Replacement of the Oil Filter" . Go to step 17.

17. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

18. Use the oil system adapter J-49181 and oil primer pump tool J-45299 to check for leaks in the upper portion of the engine. Refer to section "Priming the Engine Lubrication System" . Are there any leaks present?

    18.a Yes; repair as necessary. Verify repair.

18.b No; Go to step 19.

19. Remove the oil pan. Refer to section "Removal of the Oil Pan" .

20. Check the torque on the oil suction manifold bolts and oil pump using a torque wrench. Refer to section "Installation of the Oil Pump, Oil Suction Manifold, and Oil Lines" . Are the bolts torqued to specification?

    20.a Yes; Go to step 21.

    20.b No; Remove the oil suction manifold and the oil pump. Replace the O-rings, then reinstall the oil pump and oil suction manifold. Refer to section "Removal of the Oil Pump, Oil Suction Manifold, and Oil Lines" . Verify repair.

21. Remove the oil pump, oil suction manifold, and oil lines. Refer to section "Removal of the Oil Pump, Oil Suction Manifold, and Oil Lines" . Check the condition of the oil pump, oil suction manifold, suction lines, and O-rings. Is there any damage present?

    21.a Yes; repair as necessary. Verify repairs.

    21.b No; Go to step 22.

22. Inspect the rod and main bearings; Refer to section "DD Platform Bearing Failure Guide" in the *DDC-SVC-MAN-0196 "DD Platform Bearing Failure Guide."* Are the rod and main bearings excessively worn or damaged?

    22.a Yes; repair as necessary. Verify repair.

    22.b No; replace the oil pump, Refer to section "Installation of the Oil Pump, Oil Suction Manifold, and Oil Lines" . Verify repair.

SPN 100 (MCM) (GHG17)

49.1 SPN 100/FMI 0 - GHG17

Oil Pressure Stuck

SPN 100/FMI 0	
Description	This fault code sets when the engine oil pressure is higher than a calibrated pressure for the specific RPM.
Monitored Parameter	Engine Oil Pressure
Typical Enabling Conditions	Always On
Monitor Sequence	Key On Engine Running
Execution Frequency	Continuous When Enabling Conditions Are Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None, Engine Derate or Engine Shut Down - Calibration Dependent
Verification	While the engine is at normal operating temperature, road test performing several decelerations.

Note : If diagnostic leads to a mechanical (non-electrical) low oil pressure condition, all mains and connecting rods should be inspected. Refer to section "Inspection of the Main and Connecting Rod Bearings in Chassis".

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON, (key ON, engine OFF).
3. Check for multiple fault codes. Are fault codes SPN 100/FMI 3 or FMI 4 present?
   - 3.a Yes; diagnose the other fault codes first.
   - 3.b No; Go to step 4.
4. With the ignition ON (key ON, engine OFF), go to Service Routines and click on the Voltages tab. Monitor the engine oil pressure voltage. Does the engine oil pressure voltage read between 0.703 and 1.023 volts?
   - 4.a Yes; Go to step 5.
   - 4.b No; replace the engine oil pressure sensor. Refer to section "Removal of the Engine Oil Pressure Sensor" .
5. Turn the ignition OFF.
6. Remove the engine oil temperature sensor; Refer to section "Removal of the Engine Oil Temperature Sensor" .
7. Reconnect the oil temperature sensor to the electrical connector while the engine oil temperature sensor is still removed.
8. Plumb a manual gauge into the oil temperature sensor port.

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

> **⚠ 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.

9. Start and warm the engine to operating temperature.
10. Perform several neutral run-ups. Does the oil pressure reading on the manual gauge match the engine oil pressure sensor reading in DiagnosticLink?
    - 10.a Yes; Go to step 11.
    - 10.b No; replace the engine oil pressure sensor. Refer to section "Removal of the Engine Oil Pressure Sensor" . Reinstall the engine oil temperature sensor; Refer to section "Installation of the Engine Oil Temperature Sensor" and verify repair.
11. Road test the vehicle. Does the engine oil pressure reading on the manual gauge match the engine oil pressure reading in DiagnosticLink when the fault is present?
    - 11.a Yes; replace the oil pump. Refer to section "Removal of the Oil Pump, Oil Suction Manifold, and Oil Lines" . Reinstall the engine oil temperature sensor; Refer to section "Installation of the Engine Oil Temperature Sensor" and verify repair.
    - 11.b No; replace the engine oil pressure sensor. Refer to section "Removal of the Engine Oil Pressure Sensor" . Reinstall the engine oil temperature sensor; Refer to section "Installation of the Engine Oil Temperature Sensor" and verify repair.

49.2 SPN 100/FMI 1 - GHG17

SPN 100/FMI 1	
Description	This Fault Code Sets When the Engine Oil Pressure is Less Than a Calibrated Threshold
Monitored Parameter	Engine Oil Pressure
Typical Enabling Conditions	Always ON
Monitor Sequence	Key ON, Engine ON
Execution Frequency	Continuous When Enabling Conditions Are Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None, Engine Derate or Engine Shut Down - Calibration Dependent
Verification	Check at Engine Operating Temperature

J-49181	Oil System Priming Adapter	
J-45299	Oil System Priming Pump	

DD15AT Minimum Oil Pressure at Operating Temperature		
RPM	**BAR**	**psi**
600	0.689	10
1200	1.65	24
1800	2.55	37

DD13 and DD16 Minimum Oil Pressure at Operating Temperature		
RPM	**BAR**	**psi**
600	0.758	11
1200	1.65	24
1800	2.55	37

Note : The oil gauge in the dash is NOT used to diagnose or verify low oil pressure concerns.

Note : If diagnostic leads to a mechanical (non-electrical) low oil pressure condition, all mains and connecting rods should be inspected. Refer to section "Inspection of the Main and Connecting Rod Bearings in Chassis".

Check as follows:

1. Check for multiple codes. Is either SPN 100/FMI 3, SPN 100/FMI 4 or SPN 100/FMI 5 also present?
   1.a Yes; diagnose the oil pressure sensor circuit fault codes first.
   1.b No; Go to step 2.
2. With the vehicle parked on a flat, level surface, check the engine oil level after the engine has been shut off for at least 20 minutes. Is the engine oil at the correct level?

2.a Yes; Go to step 7.

2.b No; Go to step 3.

Note : An increase in the oil level suggests that there may be fuel or coolant entering the engine oil.

3. Is the oil level overfilled?

   3.a Yes; Go to step 5.

   3.b No; Go to step 4.

4. For engine low on oil or exhibiting oil consumption concerns (including oil leaks), Refer to section "Check for Excessive Oil Consumption" . After the oil consumption concern has been repaired, use the manufacturer-recommended oil to fill the engine oil to the correct level. Verify repair.

5. Check the oil for signs of coolant intrusion. When there is coolant intrusion, the oil will exhibit a milky appearance or become thick and sludgy. Are there signs of coolant in the oil?

   5.a Yes; diagnose the cause of coolant in oil. Refer to section "Coolant in Oil" and replace the crankshaft main bearings, the connecting rod bearings and the oil pump.

   Refer to section "Installation of the Crankshaft" .

   Refer to section "Installation of the Piston and Connecting Rod Assembly" .

   Refer to section "Installation of the Oil Pump, Oil Suction Manifold, and Oil Lines" .

   5.b No; Go to step 6.

6. Check the oil for signs of fuel intrusion. When there is fuel intrusion into the oil, the oil becomes thin and has a fuel odor. Are there signs of fuel in the oil?

   6.a Yes; diagnose the cause of fuel in the oil. Refer to section "Fuel in Oil" .

   6.b No; the oil level may have been over filled by the customer. Correct the oil level. Go to step 7.

7. Turn the ignition ON (key ON, engine OFF).

8. Connect DiagnosticLink® and check for a biased oil pressure sensor. With the ignition ON (key ON, engine OFF), go to Service Routines and click on the Voltages tab. Monitor the engine oil pressure voltage. Does the engine oil pressure voltage read between 0.703 and 1.023 volts?

   8.a Yes; Go to step 9.

   8.b No; replace the oil pressure sensor. Refer to section "Removal of the Engine Oil Pressure Sensor" . Verify repair.

> **⚠ 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.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

9. Start the engine and observe the stability of the oil pressure using the chart. Is the oil pressure stable and within normal operating range as per the chart at the top of this procedure?

   9.a Yes; Go to step 11.

   9.b No; Go to step 10.

10. Inspect the vehicle for aftermarket components plumbed into the oil system. Are there any aftermarket components installed?

    10.a Yes; isolate the aftermarket components. Recheck the oil pressure.

10.b No; Go to step 11.

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.

WARNING

ENGINE EXHAUST

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

Note : A code will be set when the oil temperature sensor is unplugged.

11. Remove the oil temperature sensor and connect a manual gauge into the oil temperature sensor port. Refer to section "Removal of the Engine Oil Temperature Sensor" . Start and allow the coolant temp to reach 77°C (170°F). Run the engine at the rpm listed in the chart. Is the oil pressure, observed on the manual gauge, stable and within normal operating range as per the chart at the top of this procedure?

    11.a Yes; reinstall the oil temperature sensor; Refer to section "Installation of the Engine Oil Temperature Sensor" . Replace the oil pressure sensor. Refer to section "Removal of the Engine Oil Pressure Sensor" . Verify repair. Clear the code. Release the vehicle.

    11.b No; Go to step 12.

12. Remove and inspect the inlet air temperature sensor, intake manifold pressure sensor, and charge air temperature sensor for signs of damage. Is there damage present?

    12.a Yes; the diagnostics in “Test E” will need to be performed. Refer to section "Test-E - Two-Filter Fuel System" .

    12.b No; Go to step 13.

13. Remove the oil filter and verify that the correct oil filter is installed. Refer to section "Replacement of the Oil Filter" . Is the correct oil filter installed?

    13.a Yes; Go to step 14.

    13.b No; install the correct oil filter. Verify repair.

14. Inspect the outside of the oil filter for signs of metal or bearing material. Is there an excessive amount of metal or bearing material present on the outside of the filter?

    14.a Yes; determine the cause of the excessive metal in the oil. Repair as necessary.

    14.b No; Go to step 15.

15. Inspect the oil filter stand pipe and oil bypass valve (located on the top of the stand pipe) for damage. Is there any damage present or is the oil bypass valve missing?

    15.a Yes; replace the oil filter module. Verify repair.

    15.b No; Go to step 16.

16. Inspect the oil filter drain back valve located in the bottom of the oil filter housing. Is the oil filter drain back valve damaged or missing?

    16.a Yes; replace the oil filter module. Verify repair.

    16.b No; reinstall the oil filter . Refer to section "Replacement of the Oil Filter" . Go to step 17.

17. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

18. Use the oil system adapter J-49181 and oil primer pump tool J-45299 to check for leaks in the upper portion of the engine. Refer to section "Priming the Engine Lubrication System" . Are there any leaks present?

    18.a Yes; repair as necessary. Verify repair.

    18.b No; Go to step 19.

19. Remove the oil pan. Refer to section "Removal of the Oil Pan" .
20. Remove the oil pump, oil suction manifold, and oil lines. Refer to section "Removal of the Oil Pump, Oil Suction Manifold, and Oil Lines" . Check the condition of the oil pump, oil suction manifold, suction lines, and O-rings. Is there any damage present?

    20.a Yes; repair as necessary. Verify repairs.

    20.b No; Go to step 21.

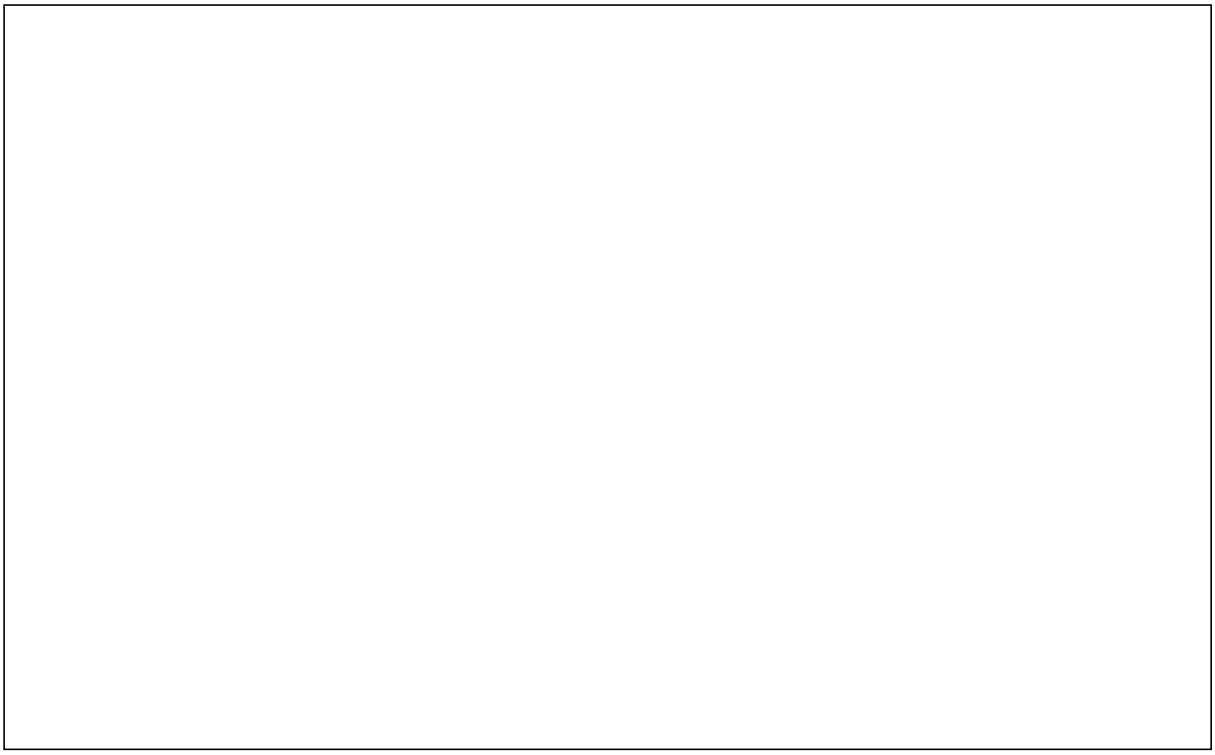
21. Inspect the rod and main bearings; Refer to section "Inspection of the Main and Connecting Rod Bearings in Chassis" . Are the rod and main bearings excessively worn or damaged?

    21.a Yes; repair as necessary. Verify repair.

    21.b No; replace the oil pump, Refer to section "Installation of the Oil Pump, Oil Suction Manifold, and Oil Lines" . Verify repair.

49.3 SPN 100/FMI 3 - GHG17

SPN 100/FMI 3	
Description	This Fault Sets When Either Short to Voltage or Open circuit on Engine Oil Pressure (EOP) Sensor Circuit Are Present.
Monitored Parameter	Engine Oil Pressure
Typical Enabling Conditions	Always On
Monitor Sequence	Key ON Engine Running
Execution Frequency	Continuous When Enabling Conditions Are Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Check at Engine Operating Temperature



Note : If diagnostic leads to a mechanical (non-electrical) low oil pressure condition, all mains and connecting rods should be inspected. Refer to section "Inspection of the Main and Connecting Rod Bearings in Chassis".

Check as follows:

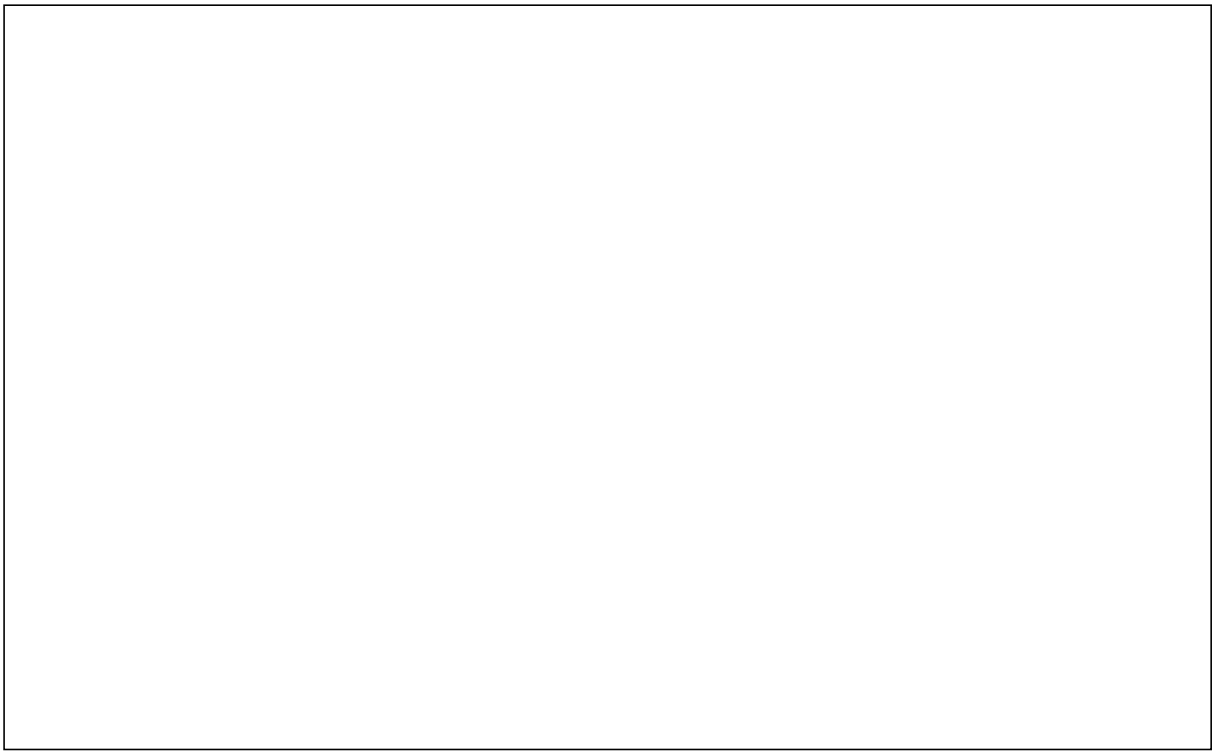
1. Turn the ignition ON (key ON, engine OFF).
2. Check for multiple codes. Is SPN 3510/FMI 3 also present?
   - 2.a Yes; diagnose 3510/FMI 3 fault first.
   - 2.b No; Go to step 3.
3. Disconnect the Engine Oil Pressure (EOP) sensor and inspect the electrical connector for damage, corrosion or spread pins. Is damage, corrosion or spread pins present?
   - 3.a Yes; repair as necessary.
   - 3.b No; Go to step 4.

4. Measure the resistance between pin 2 of the EOP sensor harness connector and ground. Is the resistance greater than five ohms?
   - 4.a Yes; repair open between pin 2 of the EOP sensor and pin 105 of the MCM 120-pin connector.
   - 4.b No; Go to step 5.
5. Measure the voltage between pin 3 of the EOP sensor harness connector and ground. Is voltage present?
   - 5.a Yes; Go to step 6.
   - 5.b No; repair open between pin 3 of the EOP sensor and pin 82 of the MCM 120-pin connector.
6. Is the voltage from previous step greater than five volts?
   - 6.a Yes; repair short to battery power between pin 3 of the EOP sensor and pin 82 of the MCM 120-pin connector.
   - 6.b No; Go to step 7.
7. Measure the voltage between pin 2 of the EOP sensor harness connector and ground. Is voltage present?
   - 7.a Yes; repair the short to power between pin 2 of the EOP sensor and pin 105 of the MCM 120-pin connector.
   - 7.b No; Go to step 8.
8. Measure the voltage between pin 1 of the EOP sensor harness connector and ground. Is voltage present?
   - 8.a Yes; repair the short to power between pin 1 of the EOP sensor and pin 54 of the MCM 120-pin connector.
   - 8.b No; Go to step 9.
9. Measure the resistance between pin 1 of the EOP sensor harness connector and pin 54 of the MCM 120-pin connector. Is the resistance greater than five ohms?
   - 9.a Yes; repair an open between pin 1 of the EOP sensor harness connector and pin 54 of the MCM 120-pin connector.
   - 9.b No; replace the EOP sensor. Refer to section "Removal of the Engine Oil Pressure Sensor" .

49.4 SPN 100/FMI 4 - GHG17

Engine Oil Pressure Sensor Circuit Failed Low

SPN 100/FMI 4	
Description	This Code Sets When a Short to Ground on Engine Oil Pressure (EOP) Sensor Circuit is Present.
Monitored Parameter	Engine Oil Pressure
Typical Enabling Conditions	Always On
Monitor Sequence	Key ON Engine Running
Execution Frequency	Continuous When Enabling Conditions Are Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Check At Engine Operating Temperature



Note : If diagnostic leads to a mechanical (non-electrical) low oil pressure condition, all mains and connecting rods should be inspected. Refer to section "Inspection of the Main and Connecting Rod Bearings in Chassis".

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple codes. Are there additional circuit failed low codes (FMI 4) for the Camshaft Position (CMP) sensor, fuel line pressure sensor and fuel compensation pressure present?

   3.a Yes, Go to step 8.

   3.b No, Go to step 4.
4. Turn the ignition OFF.

5. Disconnect the EOP sensor harness connector.
6. Inspect the EOP connector and EOP harness connector for damage, bent, spread or unseated (pushed out) pins, corrosion or wire damage. Is damage present?
   - 6.a Yes, repair as necessary.
   - 6.b No, Go to step 7.
7. Measure the resistance between pin 1 of the EOP sensor and ground. Is the resistance greater than 10k ohms?
   - 7.a Yes; Go to step 8.
   - 7.b No; repair the short to ground between pin 1 of the EOP sensor and ground.
8. Measure the resistance between pin 3 of the EOP sensor and ground. Is the resistance greater than 10k ohms?
   - 8.a Yes; replace the EOP sensor. Refer to section "Removal of the Engine Oil Pressure Sensor" .
   - 8.b No; repair the short to ground between pin 3 of the EOP sensor and ground.

     NOTE: This could include a short to ground on pin 3 of the EOP sensor, pin 1 of the camshaft position sensor, pin 2 of the fuel line pressure sensor, and pin 2 of the fuel compensation pressure sensor.

49.5 SPN 100/FMI 5 - GHG17

SPN 100/FMI 5	
Description	This diagnosis is Typically Oil Pressure Stuck
Monitored Parameter	Engine Oil Pressure
Typical Enabling Conditions	Always Enabled
Monitor Sequence	Key On Engine Running at Speeds Below 625 rpm
Execution Frequency	Continuous When Enabling Conditions are Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None, Engine Derate or Engine Shut Down - Calibration Dependent
Verification	While the Engine is at Normal Operating Temperature, Road Test Performing Several Decelerations

Note : If diagnostic leads to a mechanical (non-electrical) low oil pressure condition, all mains and connecting rods should be inspected. Refer to section "Inspection of the Main and Connecting Rod Bearings in Chassis".

Check as follows:

WARNING

ENGINE EXHAUST

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

1. Connect DiagnosticLink .

2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are fault codes SPN 100/FMI 3 or FMI 4 present?
   - 3.a Yes; diagnose the other fault codes first.
   - 3.b No; Go to step 4.
4. Disconnect the engine oil pressure sensor. Inspect the connector for damage, bent, spread or unseated (pushed out) pins, corrosion or wire damage. Is damage present?
   - 4.a Yes; repair as necessary .
   - 4.b No; Go to step 5.
5. Measure the resistance between pin 2 of the engine oil pressure sensor and ground. Is the resistance greater than five ohms?
   - 5.a Yes; repair the open circuit between pin 2 of the engine oil pressure sensor and pin 105 of the MCM 120-pin connector.
   - 5.b No; replace the engine oil pressure sensor. Refer to section "Removal of the Engine Oil Pressure Sensor" .

49.6 SPN 100/FMI 10 - GHG17

SPN 100/FMI 10	
Description	This Fault Code Sets When the Engine Power has Been Limited to Prevent Engine Damage Due to a Low Oil Pressure Condition
Monitored Parameter	Engine Oil Pressure
Typical Enabling Conditions	Always On
Monitor Sequence	Key ON Engine Running
Execution Frequency	Continuous When Enabling Conditions Are Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	Engine Derate or Engine Shut Down - Calibration Dependent
Verification	Check at Engine Operating Temperature

Tools Used		
J-49181	Oil System Priming Adapter	
J-45299	Oil System Priming Pump	

- Failed oil pressure sensor
- Initial start after oil maintenance
- Vehicle is parked on a steep incline
- Improper oil level
- Oil dilution
- Leaks in the oil suction manifold
- Leaks at the oil suction pipes
- Failed oil pump

DD15AT Minimum Oil Pressure at Operating Temperature		
rpm	**Bar**	**psi**
600	0.689	10
1200	1.65	24
1800	2.55	37

DD13 and DD16 Minimum Oil Pressure at Operating Temperature		
rpm	**Bar**	**psi**
600	0.758	11
1200	1.65	24
1800	2.55	37

Note : The oil gauge in the dashboard of the vehicle is NOT used to diagnose or verify low oil pressure concerns.

Note : If diagnostic leads to a mechanical (non-electrical) low oil pressure condition, all mains and connecting rods

should be inspected. Refer to section "Inspection of the Main and Connecting Rod Bearings in Chassis".

1. Check for multiple codes. Is either SPN 100/FMI 3, SPN 100/FMI 4 or SPN 100/FMI 5 also present?
   1.a Yes; diagnose the oil pressure sensor circuit fault codes first.
   1.b No; Go to step 2.
2. With the vehicle parked on a flat, level surface, check the engine oil level after the engine has been shut off for at least 20 minutes. Is the engine oil at the correct level?
   2.a Yes; Go to step 7.
   2.b No; Go to step 3.

Note : An increase in the oil level suggests that there may be fuel or coolant entering the engine oil.

3. Is the oil level overfilled?
   3.a Yes; Go to step 5.
   3.b No; Go to step 4.
4. For engine low on oil or exhibiting oil consumption concerns (including oil leaks), Refer to section "Check for Excessive Oil Consumption" . After the oil consumption concern has been repaired, use the manufacturer-recommended oil to fill the engine oil to the correct level. Verify repair.
5. Check the oil for signs of coolant intrusion. When there is coolant intrusion, the oil will exhibit a milky appearance or become thick and sludgy. Are there signs of coolant in the oil?
   5.a Yes; diagnose the cause of coolant in oil. Refer to section "Coolant in Oil" . Replace the crankshaft main bearings, the connecting rod bearings and the oil pump.
   Refer to section "Installation of the Crankshaft" .
   Refer to section "Installation of the Piston and Connecting Rod Assembly" .
   Refer to section "Installation of the Oil Pump, Oil Suction Manifold, and Oil Lines" .
   5.b No; Go to step 6.
6. Check the oil for signs of fuel intrusion. When there is fuel intrusion into the oil, the oil becomes thin and has a fuel odor. Are there signs of fuel in the oil?
   6.a Yes; diagnose the cause of fuel in the oil. Refer to section "Fuel in Oil" .
   6.b No; the oil level may have been over filled by the customer. Correct the oil level. Go to step 7.
7. Turn the ignition ON (key ON, engine OFF).
8. Connect DiagnosticLink® and check for a biased oil pressure sensor. With the ignition ON (key ON, engine OFF), go to Service Routines and click on the Voltages tab. Monitor the engine oil pressure voltage. Does the engine oil pressure voltage read between 0.703 and 1.023 volts?
   8.a Yes; Go to step 9.
   8.b No; replace the oil pressure sensor. Refer to section "Removal of the Engine Oil Pressure Sensor" . Verify repair.

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.

WARNING

ENGINE EXHAUST

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

9. Start the engine and observe the stability of the oil pressure using the chart. Is the oil pressure stable and within normal operating range as per the chart at the top of this procedure?

   9.a Yes; Go to step 11.

   9.b No; Go to step 10.

10. Inspect the vehicle for aftermarket components plumbed into the oil system. Are there any aftermarket components installed?

    10.a Yes; isolate the aftermarket components. Recheck the oil pressure.

    10.b No; Go to step 11.

> **⚠ 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.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

Note : A code will be set when the oil temperature sensor is unplugged.

11. Remove the oil temperature sensor and connect a manual gauge into the oil temperature sensor port. Refer to section "Removal of the Engine Oil Temperature Sensor" . Start and allow the coolant temp to reach 77°C (170°F). Run the engine at the rpm listed in the chart. Is the oil pressure, observed on the manual gauge, stable and within normal operating range as per the chart at the top of this procedure?

    11.a Yes; reinstall the oil temperature sensor; Refer to section "Installation of the Engine Oil Temperature Sensor" . Replace the oil pressure sensor. Refer to section "Removal of the Engine Oil Pressure Sensor" . Verify repair. Clear the code. Release the vehicle.

    11.b No; Go to step 12.

12. Remove and inspect the inlet air temperature sensor, intake manifold pressure sensor, and charge air temperature sensor for signs of damage. Is there damage present?

    12.a Yes; the diagnostics in “Test E” will need to be performed. Refer to section "Test-E - Two-Filter Fuel System" .

    12.b No; Go to step 13.

13. Remove the oil filter and verify that the correct oil filter is installed. Refer to section "Replacement of the Oil Filter" . Is the correct oil filter installed?

    13.a Yes; Go to step 14.

    13.b No; install the correct oil filter. Verify repair.

14. Inspect the outside of the oil filter for signs of metal or bearing material. Is there an excessive amount of metal or bearing material present on the outside of the filter?

    14.a Yes; determine the cause of the excessive metal in the oil. Repair as necessary.

    14.b No; Go to step 15.

15. Inspect the oil filter stand pipe and oil bypass valve (located on the top of the stand pipe) for damage. Is there any damage present or is the oil bypass valve missing?

    15.a Yes; replace the oil filter module. Verify repair.

    15.b No; Go to step 16.

16. Inspect the oil filter drain back valve located in the bottom of the oil filter housing. Is the oil filter drain back valve damaged or missing?

16.a Yes; replace the oil filter module. Verify repair.

16.b No; reinstall the oil filter. Refer to section "Replacement of the Oil Filter" . Go to step 17.

17. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

18. Use the oil system adapter J-49181 and oil primer pump tool J-45299 to check for leaks in the upper portion of the engine. Refer to section "Priming the Engine Lubrication System" . Are there any leaks present?

18.a Yes; repair as necessary. Verify repair.

18.b No; Go to step 19.

19. Remove the oil pan. Refer to section "Removal of the Oil Pan" .

20. Remove the oil pump, oil suction manifold, and oil lines. Refer to section "Removal of the Oil Pump, Oil Suction Manifold, and Oil Lines" . Check the condition of the oil pump, oil suction manifold, suction lines, and O-rings. Is there any damage present?

20.a Yes; repair as necessary. Verify repairs.

20.b No; Go to step 21.

21. Inspect the rod and main bearings; Refer to section "Inspection of the Main and Connecting Rod Bearings in Chassis" . Are the rod and main bearings excessively worn or damaged?

21.a Yes; repair as necessary. Verify repair.

21.b No; replace the oil pump. Refer to section "Installation of the Oil Pump, Oil Suction Manifold, and Oil Lines" . Verify repair.

49.7 SPN 100/FMI 17 - GHG17

SPN 100/FMI 17	
Description	Engine Oil Pressure Plausibility Error
Monitored Parameter	Engine Oil Pressure
Typical Enabling Conditions	Always On
Monitor Sequence	Key ON Engine Running
Execution Frequency	Continuous When Enabling Conditions Are Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None, Engine Derate or Engine Shut Down - Calibration Dependent
Verification	Check at Engine Operating Temperature

J-49181	Oil System Priming Adapter	
J-45299	Oil System Priming Pump	

DD15AT Minimum Oil Pressure at Operating Temperature		
rpm	**Bar**	**psi**
600	0.689	10
1200	1.65	24
1800	2.55	37

DD13 and DD16 Minimum Oil Pressure at Operating Temperature		
rpm	**Bar**	**psi**
600	0.758	11
1200	1.65	24
1800	2.55	37

Note : The oil gauge in the dash is NOT used to diagnose or verify low oil pressure concerns.

Note : If diagnostic leads to a mechanical (non-electrical) low oil pressure condition, all mains and connecting rods should be inspected. Refer to section "Inspection of the Main and Connecting Rod Bearings in Chassis".

Check as follows:

1. Check for multiple codes. Is either SPN 100/FMI 3, SPN 100/FMI 4 or SPN 100/FMI 5 also present?
   1.a Yes; diagnose the oil pressure sensor circuit fault codes first.
   1.b No; Go to step 2.
2. With the vehicle parked on a flat, level surface, check the engine oil level after the engine has been shut off for at least 20 minutes. Is the engine oil at the correct level?
   2.a Yes; Go to step 7.

2.b No; Go to step 3.

Note : An increase in the oil level suggests that there may be fuel or coolant entering the engine oil.

3. Is the oil level overfilled?

   3.a Yes; Go to step 5.

   3.b No; Go to step 4.

4. For engine low on oil or exhibiting oil consumption concerns (including oil leaks), Refer to section "Check for Excessive Oil Consumption" . After the oil consumption concern has been repaired, use the manufacturer-recommended oil to fill the engine oil to the correct level. Verify repair.

5. Check the oil for signs of coolant intrusion. When there is coolant intrusion, the oil will exhibit a milky appearance or become thick and sludgy. Are there signs of coolant in the oil?

   5.a Yes; diagnose the cause of coolant in oil. Refer to section "Coolant in Oil" . Replace the crankshaft main bearings, the connecting rod bearings and the oil pump.

   Refer to section "Installation of the Crankshaft" .

   Refer to section "Installation of the Piston and Connecting Rod Assembly" .

   Refer to section "Installation of the Oil Pump, Oil Suction Manifold, and Oil Lines" .

   5.b No; Go to step 6.

6. Check the oil for signs of fuel intrusion. When there is fuel intrusion into the oil, the oil becomes thin and has a fuel odor. Are there signs of fuel in the oil?

   6.a Yes; diagnose the cause of fuel in the oil. Refer to section "Fuel in Oil" .

   6.b No; the oil level may have been over filled by the customer. Correct the oil level. Go to step 7.

7. Turn the ignition ON (key ON, engine OFF).

8. Connect DiagnosticLink® and check for a biased oil pressure sensor. With the ignition ON (key ON, engine OFF), go to Service Routines and click on the Voltages tab. Monitor the engine oil pressure voltage. Does the engine oil pressure voltage read between 0.703 and 1.023 volts?

   8.a Yes; Go to step 9.

   8.b No; replace the oil pressure sensor. Refer to section "Removal of the Engine Oil Pressure Sensor" . Verify repair.

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.

WARNING

ENGINE EXHAUST

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

9. Start the engine and observe the stability of the oil pressure using the chart. Is the oil pressure stable and within normal operating range as per the chart at the top of this procedure?

   9.a Yes; Go to step 11.

   9.b No; Go to step 10.

10. Inspect the vehicle for aftermarket components plumbed into the oil system. Are there any aftermarket components installed?

    10.a Yes; isolate the aftermarket components. Recheck the oil pressure.

    10.b No; Go to step 11.

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.

WARNING

ENGINE EXHAUST

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

Note : A code will be set when the oil temperature sensor is unplugged.

11. Remove the oil temperature sensor and connect a manual gauge into the oil temperature sensor port. Refer to section "Removal of the Engine Oil Temperature Sensor" . Start and allow the coolant temp to reach 77°C (170°F). Run the engine at the rpm listed in the chart. Is the oil pressure, observed on the manual gauge, stable and within normal operating range as per the chart at the top of this procedure?
    - 11.a Yes; reinstall the oil temperature sensor; Refer to section "Installation of the Engine Oil Temperature Sensor" . Replace the oil pressure sensor. Refer to section "Removal of the Engine Oil Pressure Sensor" . Verify repair. Clear the code. Release the vehicle.
    - 11.b No; Go to step 12.
12. Remove and inspect the inlet air temperature sensor, intake manifold pressure sensor, and charge air temperature sensor for signs of damage. Is there damage present?
    - 12.a Yes; the diagnostics in “Test E” will need to be performed. Refer to section "Test-E - Two-Filter Fuel System" .
    - 12.b No; Go to step 13.
13. Remove the oil filter and verify that the correct oil filter is installed. Refer to section "Replacement of the Oil Filter" . Is the correct oil filter installed?
    - 13.a Yes; Go to step 14.
    - 13.b No; install the correct oil filter. Verify repair.
14. Inspect the outside of the oil filter for signs of metal or bearing material. Is there an excessive amount of metal or bearing material present on the outside of the filter?
    - 14.a Yes; determine the cause of the excessive metal in the oil. Repair as necessary.
    - 14.b No; Go to step 15.
15. Inspect the oil filter stand pipe and oil bypass valve (located on the top of the stand pipe) for damage. Is there any damage present or is the oil bypass valve missing?
    - 15.a Yes; replace the oil filter module. Verify repair.
    - 15.b No; Go to step 16.
16. Inspect the oil filter drain back valve located in the bottom of the oil filter housing. Is the oil filter drain back valve damaged or missing?
    - 16.a Yes; replace the oil filter module. Verify repair.
    - 16.b No; reinstall the oil filter . Refer to section "Replacement of the Oil Filter" . Go to step 17.
17. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
18. Use the oil system adapter J-49181 and oil primer pump tool J-45299 to check for leaks in the upper portion of the engine. Refer to section "Priming the Engine Lubrication System" . Are there any leaks present?
    - 18.a Yes; repair as necessary. Verify repair.
    - 18.b No; Go to step 19.
19. Remove the oil pan. Refer to section "Removal of the Oil Pan" .

20. Remove the oil pump, oil suction manifold, and oil lines. Refer to section "Removal of the Oil Pump, Oil Suction Manifold, and Oil Lines" . Check the condition of the oil pump, oil suction manifold, suction lines, and O-rings. Is there any damage present?

    20.a Yes; repair as necessary. Verify repairs.

    20.b No; Go to step 21.

21. Inspect the rod and main bearings. Refer to section "Inspection of the Main and Connecting Rod Bearings in Chassis" Are the rod and main bearings excessively worn or damaged?

    21.a Yes; repair as necessary. Verify repair.

    21.b No; replace the oil pump, Refer to section "Installation of the Oil Pump, Oil Suction Manifold, and Oil Lines" . Verify repair.

SPN 103 (MCM) (GHG17)

51.1 SPN 103/FMI 0 - GHG17

Turbocharger Speed Below Threshold (Low Box)

SPN 103/FMI 0	
Description	Turbocharger Speed Below Threshold (Low Box)
Monitored Parameter	
Typical Enabling Conditions	Turbocharger Speed Below Threshold
Monitor Sequence	
Execution Frequency	
Typical Duration	
Dash Lamps	MIL, CEL
Engine Reaction	none
Verification	

1. Inspect the entire air intake system for leaks and/or restrictions including air filter and CAC.
   1.a If leaks or restrictions are found, repair as necessary.
   1.b If no air intake system leaks or restrictions are found, Go to step 2.
2. Connect to DiagnosticLink
3. Turn the ignition ON (key ON, engine OFF).
4. Road test vehicle and record a log file with Instrumentation Mechanical Panel data; Temperatures, Engine and Road Speed, Torque, Manifold and Boost psi. Do all readings pass specification?
   4.a Yes; replace the Turbocharger Speed Sensor (TSS).
   4.b No; follow the appropriate component troubleshooting procedure for the affected component.

51.2 SPN 103/FMI 1 - GHG17

Turbocharger Speed Below Threshold (High Box)

SPN 103/FMI 1	
Description	Turbocharger Speed Below Threshold (High Box)
Monitored Parameter	
Typical Enabling Conditions	Turbocharger Speed Above Threshold
Monitor Sequence	
Execution Frequency	
Typical Duration	
Dash Lamps	MIL,CEL
Engine Reaction	10% Derate
Verification	

1. Inspect the entire air intake system for leaks and/or restrictions including air filter and CAC.
   1.a If leaks or restrictions are found, repair as necessary.
   1.b If no air intake system leaks or restrictions are found, Go to step 2.
2. Connect to DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Road test vehicle and record a log file with Instrumentation Mechanical Panel data; Temperatures, Engine and Road Speed, Torque, Manifold and Boost psi. Do all readings pass Specification?
   4.a Yes; replace the Turbocharger Speed Sensor (TSS).
   4.b No; follow the appropriate component troubleshooting procedure for the affected component.

51.3 SPN 103/FMI 2 - GHG17

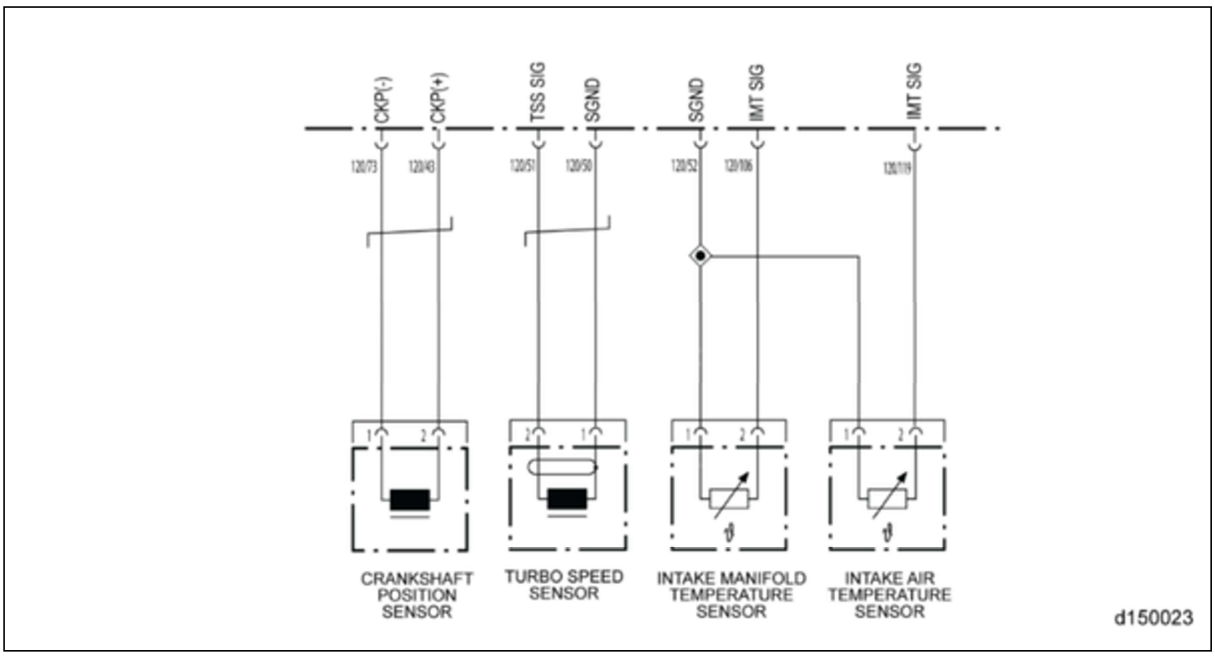
Turbocharger Speed Not Plausible

SPN 103/FMI 2	
Description	Turbocharger Speed Not Plausible
Monitored Parameter	Turbo speed sensor
Typical Enabling Conditions	Turbocharger Speed Above Threshold
Monitor Sequence	None
Execution Frequency	Always enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Road test

1. Inspect the entire air intake system for leaks and/or restrictions including air filter and CAC. Were leaks or restrictions found?
   1.a Yes; repair as necessary.
   1.b No; Go to step 2.
2. Visually inspect the EGR system for leaks, obstructions, loose clamps or damage. Were leaks, obstructions, loose clamps or damage found?
   2.a Yes; repair as necessary. Go to step 4.
   2.b No; Go to step 3.
3. Inspect the EGR valve for physical damage such as a broken butterfly. Was damage found?
   3.a If EGR valve is damaged, replace the EGR valve. Go to step 4.
   For the DD13 and DD15: Refer to section "Removal of the DD13 and DD15 Exhaust Gas Recirculation Valve" .
   For the DD16: Refer to section "Removal of the DD16 Exhaust Gas Recirculation Valve" .
   3.b If no damage is found, Go to step 4.
4. Connect to DiagnosticLink .
5. Turn the ignition ON (key ON, engine OFF).
6. Road test vehicle and record a log file with Instrumentation Mechanical Panel data; Temperatures, Engine and Road Speed, Torque, Manifold and Boost psi. Do all readings pass specification?
   6.a Yes; replace the Turbocharger Speed Sensor (TSS).
   6.b No; follow the appropriate component troubleshooting procedure for the affected component.

51.4 SPN 103/FMI 4 - GHG17

SPN 103/FMI 4	
Description	This fault Sets when the Motor Control Module (MCM) Detects a Short to Ground on the Turbocharger Speed Sensor Circuit.
Monitored Parameter	Turbocharger Speed Sensor
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous when Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Cycle Key



Check as follows:

1. Connect DiagnosticLink .
2. Disconnect and inspect the turbocharger speed sensor electrical connector harness side. Is there corrosion present?
   - 2.a Yes; replace the turbocharger speed sensor and the electrical connector. Refer to section "Removal of the Turbocharger Speed Sensor" . Verify repair.
   - 2.b No; Go to step 3.
3. Are any of the pins or the connector damaged?
   - 3.a Yes; Go to step 4.
   - 3.b No; Go to step 5.
4. Inspect the turbocharger speed sensor electrical connector component side. Are any of the pins or the connector damaged?
   - 4.a Yes; replace the turbocharger speed sensor and the electrical connector. Refer to section "Removal of the Turbocharger Speed Sensor" . Verify repair.

4.b No; replace the turbocharger speed sensor electrical connector harness side. Verify repair.

5. Turn the ignition ON (key ON, engine OFF).
6. Is fault code SPN 103/FMI 4 active?

6.a Yes; Go to step 7.

6.b No; replace the turbocharger speed sensor. Refer to section "Removal of the Turbocharger Speed Sensor" . Verify repair.

7. Turn the ignition OFF.
8. Disconnect and inspect the MCM 120-pin electrical connector harness side. Is there corrosion present?

8.a Yes; replace the MCM and the engine harness. Refer to section "Removal of the Motor Control Module" . Verify repair.

8.b No; Go to step 9.

9. Is the connector damaged?

9.a Yes; Go to step 10.

9.b No; Go to step 11.

10. Inspect the MCM 120-pin electrical connector component side. Are any of the pins or the connector damaged?

10.a Yes; replace the MCM and the engine harness. Refer to section "Removal of the Motor Control Module" . Verify repair.

10.b No; replace the engine harness. Verify repair.

11. Measure the resistance between pin 2 of the turbocharger speed sensor electrical connector harness side and pin 52 of the MCM 120-pin electrical connector harness side. Is the resistance less than 10k ohms?

11.a Yes; repair the circuit between pin 2 of the turbocharger speed sensor electrical connector harness side and pin 52 of the MCM 120-pin electrical connector harness side.

11.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repair.

SPN 107 (CPC) (GHG17)

52.1 SPN 107/FMI 0 - GHG17

Check as follows:

1. Check the air cleaner for restriction. Is the air filter restricted?
   1.a Yes; repair or replace the air filter as necessary. Refer to Original Equipment Manufacturer (OEM) procedures.
   1.b No; Go to step 2.
2. Check for multiple codes. Is CPC SPN 107/FMI 2, FMI 3, or FMI 4 present?
   2.a Yes; repair other FMIs first.
   2.b No; Go to step 3.

> **WARNING**
>
> PRESSURIZED FUEL
>
> To avoid injury to eye or face, wear a face shield or goggles when conducting a pressure test.

3. Perform pressure check/visual inspection of the following and repair as necessary.

- Plugged inlet air filters
- Charge air cooler leaks or restriction
- Leaking or plugged intake manifold
- Exhaust leaks/plugging

52.2 SPN 107/FMI 2 - GHG17

Air Filter Sensor plausibility error

Check as follows:

Note : This fault code is not calibrated for NAFTA Market. If this fault code is active, the Common Powertrain Controller (CPC) parameter is incorrectly set.

1. Connect DiagnosticLink .
2. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. Go to step 3. to verify repair.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

52.3 SPN 107/FMI 3 - GHG17

Air Filter Sensor failed high

Check as follows:

Note : This fault code is not calibrated for NAFTA Market. If this fault code is active, the Common Powertrain Controller (CPC) parameter is incorrectly set.

1. Connect DiagnosticLink .
2. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. Go to step 3. to verify repair.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

52.4 SPN 107/FMI 4 - GHG17

Air Filter Sensor failed low

Check as follows:

Note : This fault code is not calibrated for NAFTA Market. If this fault code is active, the Common Powertrain Controller (CPC) parameter is incorrectly set.

1. Connect DiagnosticLink .
2. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. Go to step 3. to verify repair.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

SPN 108 (ACM) (GHG17)

53.1 SPN 108/FMI 13 - GHG17

SPN 108/FMI 13	
Description	Ambient Air Pressure Signal Not Available via CAN
Monitored Parameter	Barometric Pressure Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (One Minute)

1. Has the ACM/MCM/CPC been recently reprogrammed?
   1.a Yes; clear faults codes if they do not become active. Release vehicle.
   1.b No; Go to step 2.
2. Turn the ignition OFF and disconnect DiagnosticLink . Wait five minutes for all modules to power down.
3. Turn ignition ON (key ON, engine OFF).
4. Reconnect DiagnosticLink; are fault codes active?
   4.a Yes; Refer to section "SPN 625/FMI 9 – GHG17" under ACM for further PT CAN troubleshooting.
   4.b No; clear faults codes and release vehicle.

SPN 108 (MCM) (GHG17)

54.1 SPN 108/FMI 13 - GHG17

Ambient Air Pressure Signal Not Available via CAN

1. Has the ACM/MCM/CPC been recently reprogrammed?
   1.a Yes; clear faults codes if they do not become active. Release vehicle.
   1.b No, Go to step 2.
2. Turn the ignition OFF and disconnect DiagnosticLink . Wait five minutes for all modules to power down.
3. Turn ignition ON (key ON, engine OFF).
4. Reconnect DiagnosticLink; are fault codes active?
   4.a Yes; Refer to section "SPN 625/FMI 9 - GHG17" for further PT CAN troubleshooting.
   4.b No; clear faults codes and release vehicle.

54.2 SPN 108/FMI 4 - GHG17

Barometric Pressure (BP) Sensor Circuit Failed Low

Note : The BP sensor is internal to the MCM.

SPN 108/FMI 4	
Description	Barometric Pressure Circuit Failed Low
Monitored Parameter	Barometric Pressure Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)

Check as follows:

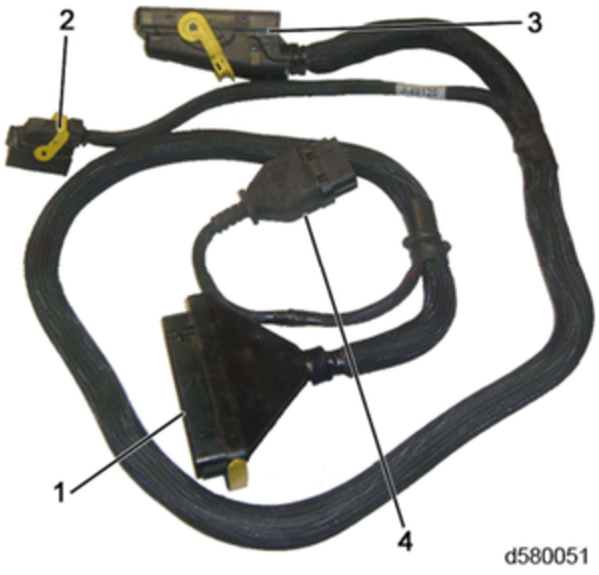
1. Connect DiagnosticLink .
2. Are there other codes present?
   - 2.a Yes; diagnose other codes first.
   - 2.b No; if SPN 108/FMI 3 is the only code present, replace the Motor Control Module (MCM). Refer to section "Removal of the Motor Control Module" . Verify repair.

SPN 110 (ACM) (GHG17)

57.1 SPN 110/FMI 9 – GHG17

Coolant Temperature Signal Not Available via Controller Area Network (CAN)

SPN 110/FMI 9	
Description	This fault code Sets when the Coolant Temperature Signal is Not Received from the MCM.
Monitored Parameter	Outlet Coolant Temperature
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	10 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Ignition On

W470589036300	

Check as follows:

1. Connect DiagnosticLink®.
2. Turn the ignition ON (key ON, engine OFF).
3. Check the MCM software level. Is the MCM software level 6.4.0.5 ZGS 005 or greater?
   - 3.a Yes; Go to step 4.
   - 3.b No; Update the MCM using the latest server information. Perform the repair verification. If the fault returns, Go to step 4.
4. Has the Aftertreatment Control Module (ACM) or Motor Control Module (MCM) been reprogrammed?
   - 4.a Yes; Go to step 5.

4.b No; Go to step 10.

5. Verify that the module has been programmed correctly using the server information. Are the modules programmed correctly?

5.a Yes; Go to step 6.

5.b No; program the modules using the latest server information. Go to step 6.

6. Clear the fault code.
7. Turn the ignition off for five minutes to let the modules power down.
8. Turn the ignition ON (key ON, engine OFF).
9. Check the fault codes. Has fault code SPN 110/FMI 9 become active?

9.a Yes; Go to step 10.

9.b No; the fault code was set during the module reprogram event. No further diagnostics or repairs are needed. The vehicle can be released to the customer.

10. Check for multiple fault codes. Are any of the following fault codes present?

- SPN 110/FMI 2
- SPN 110/FMI 3
- SPN 110/FMI 4
- SPN 625/FMI 9

10.a Yes; diagnose the other fault codes first.

10.b No; Go to step 11.

11. Turn the ignition OFF.
12. Install a test MCM; use the MCM extension harness W470589036300, if available. Refer to Tool Letter 13 TL-21 for more information.
13. Turn the ignition ON (key ON, engine OFF).
14. Is fault code SPN 110/FMI 9 active?

14.a Yes; replace the ACM.

For the 1-BOX™, Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" .

For the Two-Box (2V2) , Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module" .

14.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

SPN 110 (CPC) (GHG17)

56.1 SPN 110/FMI 0 - GHG17

SPN 110/FMI 0	
Description	This Code Sets Once the Motor Control Module (MCM) Detects that the Outlet Coolant Temperature is Above 112°C (234°F)
Monitored Parameter	Engine Coolant Outlet Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Outlet Coolant Temperature Above 112°C (234°F) Followed by One Minute of Idling

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Check the MCM software level. Is the MCM software level 6.4.0.5 ZGS 005 or greater?
   - 1.a Yes; Go to step 2.
   - 1.b No; update the MCM using the latest server information. Perform the repair verification. If the fault returns, Go to step 2.
2. Check for multiple codes. Are codes SPN 110/FMI 3, SPN 110/FMI 4, SPN 4814/FMI any or SPN 5927/FMI any present?
   - 2.a Yes; repair those faults first.
   - 2.b No; Go to step 3.

WARNING

PERSONAL INJURY

To avoid injury from hot surfaces, wear protective gloves, or allow engine to cool before removing any component.

3. Compare coolant inlet and coolant outlet temperatures. Are the temperatures within 13.9°C (25°F) of each other?
   - 3.a Yes; Go to step 4.
   - 3.b No; replace both the coolant inlet and coolant outlet temperature sensors.
     Refer to section "Removal of the Engine Coolant Inlet Temperature Sensor"
     Refer to section "Removal of the Engine Coolant Outlet Temperature Sensor"
4. Visually check the engine coolant level in the surge tank. Is the coolant level within the specified range?
   - 4.a Yes; Go to step 5.
   - 4.b No; determine the cause of low coolant level. Refer to section "Symptom Diagnostics - Coolant Loss" .
5. Visually inspect the engine belts. Refer to section "Inspection of the Poly-V-Belts" . Do the belts show damage or signs of excessive wear?
   - 5.a Yes; replace the damaged belt(s). Refer to section "Removal of the Poly-V-Belts" .
   - 5.b No; Go to step 6.
6. Inspect the radiator and Charge Air Cooler (CAC) for any external restrictions or clogged fins (winter fronts, plows and other front vehicle accessories can sometimes create a restriction). Use a flashlight on one side of the radiator/CAC assembly and check to see if the light can be seen through the other side of the assembly. Was a restriction present?
   - 6.a Yes; clear the restriction and/or clean the radiator/CAC assembly using compressed air or water from a hose.
   - 6.b No; Go to step 7.
7. Check the fan shroud for proper installation or damage. Is fan shroud not properly installed or damaged?
   - 7.a Yes; adjust or replace the fan shroud as necessary, refer to OEM literature for removal and installation instructions.
   - 7.b No; Go to step 8.
8. Inspect the engine cooling fan operation, inspect the fan blades. Is damage present?
   - 8.a Yes; replace the engine cooling fan, refer to OEM literature for removal and installation instructions.
   - 8.b No; Go to step 9.

WARNING

PERSONAL INJURY

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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.

WARNING

ENGINE EXHAUST

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

9. Run the engine until temperature reaches 106°C (223°F). Does the engine cooling fan activate?
   - 9.a Yes; Go to step 10.
   - 9.b No; verify proper fan parametrization and diagnose the faulty engine cooling fan.
10. Pressure test the radiator cap according to Original Equipment Manufacturer (OEM) procedure. Does the radiator cap pass the pressure test?
   - 10.a Yes; Go to step 11.
   - 10.b No; replace the radiator cap.

WARNING

PERSONAL INJURY

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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.

WARNING

ENGINE EXHAUST

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

11. Start the engine and inspect the belt and belt tensioner for excessive noise, chatter, or movement while idling and at 100 rpm increments for 15 seconds each until you reach 1200 rpm. Is there an excessive amount of noise, chatter, or movement?
   - 11.a Yes; Refer to section "Belt Drive Noise" .
   - 11.b No; Go to step 12.
12. Check for proper radiator hose condition. Are the hoses damaged or collapsed?
   - 12.a Yes; determine the cause of a damaged or collapsed coolant hose and repair, as necessary.
   - 12.b No; Go to step 13.
13. Is the vehicle equipped with a variable speed water pump?
   - 13.a Yes; replace the thermostat. Refer to section "Removal of the Engine Coolant Thermostat and Seal" , then Go to step 15.
   - 13.b No; Go to step 14.
14. Inspect the fixed speed water pump. Refer to section "Inspection of the Water Pump" . Is damage present?
   - 14.a Yes; replace the water pump. Refer to section "Removal of the Water Pump" .

14.b No; replace the thermostat, then Go to step 15. Refer to section "Removal of the Engine Coolant Thermostat and Seal" .

⚠WARNING

PERSONAL INJURY

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⚠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.

⚠WARNING

ENGINE EXHAUST

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

15. Bring the outlet coolant temperature to 112°C (234°F) or above and run the engine at idle for one minute and check for codes. Is SPN 110 FMI 0 active?

15.a Yes; inspect the radiator for flow and thermal efficiency. Refer to OEM guidelines.

15.b No; repair is complete.

56.2 SPN 110/FMI 16 - GHG17

Coolant Temperature High

1. Check for multiple codes.
   1.a If fault codes SPN 110/FMI 3 or SPN 110/FMI 4 are also present, repair those faults first.

   Refer to section "SPN 110/FMI 3 - GHG17" .

   Refer to section "SPN 110/FMI 4 - GHG17" .

   1.b If fault codes SPN 110/FMI 3 or SPN 110/FMI 4 are not present, Go to step 2.
2. With engine cold, compare coolant inlet and coolant outlet temperatures. Are the temperatures within 25°F of each other?
   2.a Yes; Go to step 3.
   2.b No; replace both the coolant inlet and coolant outlet temperature sensors.
3. Check for coolant loss.
4. Check thermostat operation.
5. Check for blockage in radiator and charge air cooler.
6. Check fan belt condition (slippage).
7. Check for proper location of fan shroud.
8. Check for proper radiator hose condition (no collapsed hoses).
9. Check for proper viscous fan operation.

SPN 110 (MCM) (GHG17)

55.1 Coolant Sensor Resistance Chart

Temp (°C)	Temp (°F)	Resistance () Nominal	Resistance Low ()	Resistance High ()	Nominal Voltage (V)	Voltage Low (V)	Voltage High (V)
0	32	5872.8	5496.4	6249.2	2.56	2.51	2.61
10	50	3769	3640.3	3897.7	2.37	2.33	2.41
20	68	2480.7	2260.0	2701.4	2.14	2.05	2.22
30	86	1693.2	1613.4	1773.0	1.89	1.83	1.95
35	95	1401.1	1338.4	1463.8	1.75	1.69	1.81
40	104	1166.8	1117.5	1216.1	1.62	1.56	1.67
50	122	829.5	798.2	860.8	1.36	1.30	1.41
60	140	593.8	574.5	613.1	1.12	1.07	1.17
70	158	435.4	423.1	447.7	0.91	0.86	0.95

55.2 SPN 110/FMI 0 - GHG17

SPN 110/FMI 0	
Description	This Code Sets Once the Motor Control Module (MCM) Detects that the Outlet Coolant Temperature is Above 112°C (234°F)
Monitored Parameter	Engine Coolant Outlet Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Outlet Coolant Temperature Above 112°C (234°F) Followed by One Minute of Idling

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

Check as follows:

1. Check the MCM software level. Is the MCM software level 6.4.0.5 ZGS 005 or greater?
   - 1.a Yes; Go to step 2.
   - 1.b No; update the MCM using the latest server information. Perform the repair verification. If the fault returns, Go to step 2.
2. Check for multiple codes. Are codes SPN 110/FMI 3, SPN 110/FMI 4, SPN 4814/FMI any or SPN 5927/FMI any present?
   - 2.a Yes; repair those faults first.
   - 2.b No; Go to step 3.

WARNING

PERSONAL INJURY

To avoid injury from hot surfaces, wear protective gloves, or allow engine to cool before removing any component.

3. Compare coolant inlet and coolant outlet temperatures. Are the temperatures within 13.9°C (25°F) of each other?
   - 3.a Yes; Go to step 4.
   - 3.b No; replace both the coolant inlet and coolant outlet temperature sensors.
     Refer to section "Removal of the Engine Coolant Inlet Temperature Sensor"
     Refer to section "Removal of the Engine Coolant Outlet Temperature Sensor"
4. Visually check the engine coolant level in the surge tank. Is the coolant level within the specified range?
   - 4.a Yes; Go to step 5.
   - 4.b No; determine the cause of low coolant level. Refer to section "Symptom Diagnostics - Coolant Loss" .
5. Visually inspect the engine belts. Refer to section "Inspection of the Poly-V-Belts" . Do the belts show damage or signs of excessive wear?
   - 5.a Yes; replace the damaged belt(s). Refer to section "Removal of the Poly-V-Belts" .
   - 5.b No; Go to step 6.
6. Inspect the radiator and Charge Air Cooler (CAC) for any external restrictions or clogged fins (winter fronts, plows and other front vehicle accessories can sometimes create a restriction). Use a flashlight on one side of the radiator/CAC assembly and check to see if the light can be seen through the other side of the assembly. Was a restriction present?
   - 6.a Yes; clear the restriction and/or clean the radiator/CAC assembly using compressed air or water from a hose.
   - 6.b No; Go to step 7.
7. Check the fan shroud for proper installation or damage. Is fan shroud not properly installed or damaged?
   - 7.a Yes; adjust or replace the fan shroud as necessary, refer to OEM literature for removal and installation instructions.
   - 7.b No; Go to step 8.
8. Inspect the engine cooling fan operation, inspect the fan blades. Is damage present?
   - 8.a Yes; replace the engine cooling fan, refer to OEM literature for removal and installation instructions.
   - 8.b No; Go to step 9.

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

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

9. Run the engine until temperature reaches 106°C (223°F). Does the engine cooling fan activate?
   - 9.a Yes; Go to step 10.
   - 9.b No; verify proper fan parametrization and diagnose the faulty engine cooling fan.
10. Pressure test the radiator cap according to Original Equipment Manufacturer (OEM) procedure. Does the radiator cap pass the pressure test?
    - 10.a Yes; Go to step 11.
    - 10.b No; replace the radiator cap.

> **WARNING**
>
> PERSONAL INJURY
>
> Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

> **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.

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

11. Start the engine and inspect the belt and belt tensioner for excessive noise, chatter, or movement while idling and at 100 rpm increments for 15 seconds each until you reach 1200 rpm. Is there an excessive amount of noise, chatter, or movement?
    - 11.a Yes; Refer to section "Belt Drive Noise" .
    - 11.b No; Go to step 12.
12. Check for proper radiator hose condition. Are the hoses damaged or collapsed?
    - 12.a Yes; determine the cause of a damaged or collapsed coolant hose and repair, as necessary.
    - 12.b No; Go to step 13.
13. Is the vehicle equipped with a variable speed water pump?
    - 13.a Yes; replace the thermostat. Refer to section "Removal of the Engine Coolant Thermostat and Seal" , then Go to step 15.
    - 13.b No; Go to step 14.
14. Inspect the fixed speed water pump. Refer to section "Inspection of the Water Pump" . Is damage present?
    - 14.a Yes; replace the water pump. Refer to section "Removal of the Water Pump" .

14.b No; replace the thermostat, then Go to step 15. Refer to section "Removal of the Engine Coolant Thermostat and Seal" .

⚠WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠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.

⚠WARNING

ENGINE EXHAUST

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

15. Bring the outlet coolant temperature to 112°C (234°F) or above and run the engine at idle for one minute and check for codes. Is SPN 110 FMI 0 active?

15.a Yes; inspect the radiator for flow and thermal efficiency. Refer to OEM guidelines.

15.b No; repair is complete.

55.3 SPN 110/FMI 3 - GHG17

SPN 110/FMI 3	
Description	Engine Coolant Outlet Temperature Circuit Short to Voltage or Open
Monitored Parameter	Engine Coolant Outlet Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate
Verification	Engine Idle (One Minute)

WARNING

ENGINE EXHAUST

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

Check as follows:

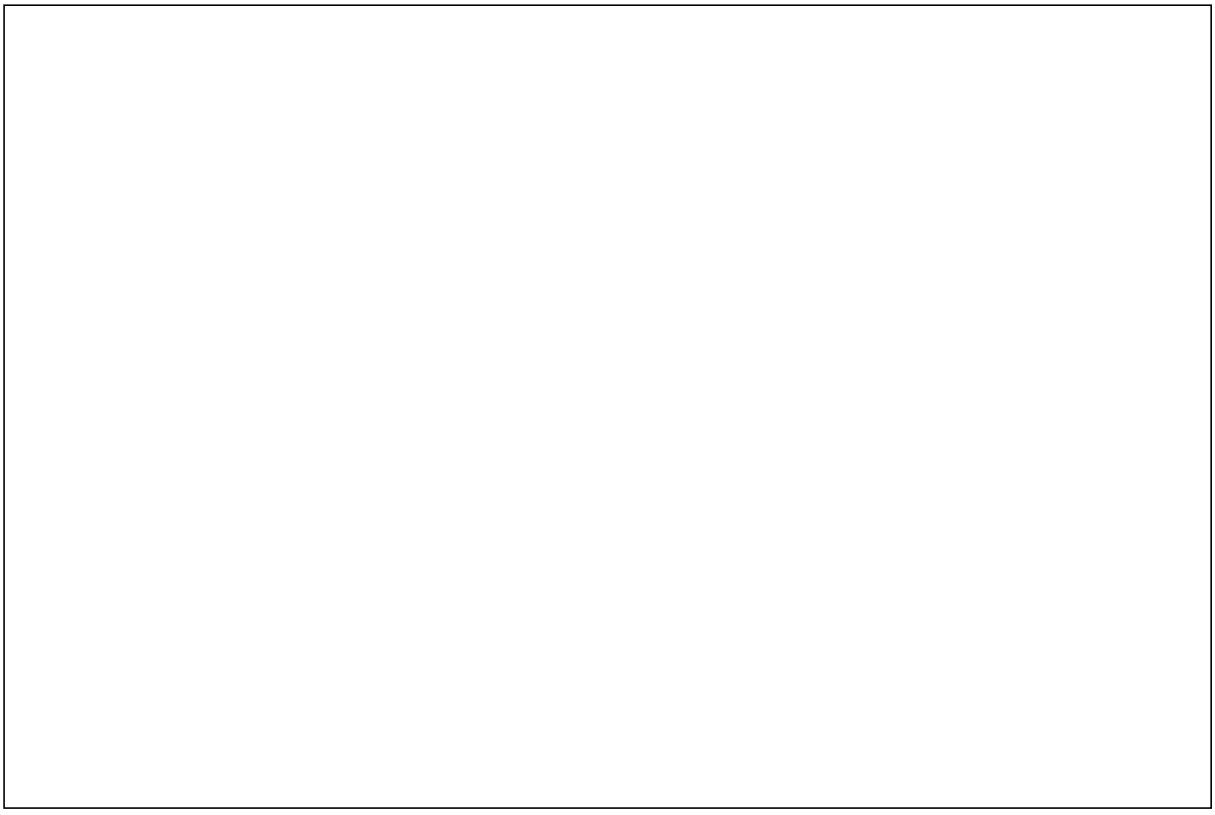
1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).

3. Check for multiple codes. Are fault codes SPN 174/FMI 3, SPN 175/FMI 3 or SPN 4193/FMI 3 also present?
   - 3.a Yes; repair the circuit between pin 55 of the MCM 120-pin electrical connector harness side and the circuit splice.
   - 3.b No; Go to step 4.
4. Turn the ignition OFF.
5. Disconnect and inspect the engine coolant outlet temperature sensor electrical connector harness side. Is there corrosion present?
   - 5.a Yes; replace the engine coolant temperature sensor and electrical connector. Refer to section "Removal of the Engine Coolant Outlet Temperature Sensor" . Verify repair.
   - 5.b No; Go to step 6.
6. Inspect the engine coolant outlet temperature sensor electrical connector harness side. Is the connector or any of the pins damaged?
   - 6.a Yes; Go to step 7.
   - 6.b No; Go to step 8.
7. Inspect the engine coolant outlet temperature sensor electrical connector component side. Is the connector or any of the pins damaged?
   - 7.a Yes; replace the engine coolant temperature sensor and electrical connector. Refer to section "Removal of the Engine Coolant Outlet Temperature Sensor" . Verify repair.
   - 7.b No; replace the engine coolant temperature sensor electrical connector. Refer to Technical Service letter 13 TS-16 . Verify repair.
8. Use the correct flex probe to check the pins in the connector. Are there any spread pins?
   - 8.a Yes; replace engine coolant temperature sensor electrical connector. Refer to Technical Service letter 13 TS-16 . Verify repair.
   - 8.b No; Go to step 9.
9. Turn the ignition ON (key ON, engine OFF).
10. Measure the voltage between pins 1 and 2 of the engine coolant outlet temperature sensor harness connector. Is the voltage greater than 3.5 volts?
    - 10.a Yes; repair short to power between pin 2 of the engine coolant temperature sensor and pin 110 of the MCM 120-pin connector.
    - 10.b No; Go to step 11.
11. Measure the voltage between pins 1 and 2 of the engine coolant outlet temperature sensor harness connector. Is the voltage between 2.5 and 3.5 volts?
    - 11.a Yes; replace the engine coolant outlet temperature sensor. Refer to section "Removal of the Engine Coolant Outlet Temperature Sensor" .
    - 11.b No; Go to step 12.
12. Measure voltage between pin 2 of the engine coolant outlet temperature sensor and ground. Is the voltage between 2.5 and 3.5 volts?
    - 12.a Yes; repair the wire between pin 2 of the engine coolant outlet temperature sensor connector and pin 110 of the Motor Control Module (MCM) 120-pin connector.
    - 12.b No; repair the wire between pin 1 of the engine coolant outlet temperature sensor connector and pin 55 of the MCM 120-pin connector.

55.4 SPN 110/FMI 4 - GHG17

Engine Coolant Outlet Temperature Circuit Failed Low

SPN 110/FMI 4	
Description	This Fault Code Sets when the Motor Control Module (MCM) Detects a Short to Ground on the Engine Coolant Temperature Sensor Circuit.
Monitored Parameter	Engine Coolant Outlet Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (One minute)



⚠ WARNING

ENGINE EXHAUST

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

Check as follows:

1. Connect DiagnosticLink .
2. Disconnect and inspect the engine coolant electrical connector harness side. Is there corrosion present?
   - 2.a Yes; replace the engine coolant temperature sensor and the electrical connector. Refer to section "Removal of the Engine Coolant Outlet Temperature Sensor" and Technical Service letter 13 TS-16 . Verify repair.
   - 2.b No; Go to step 3.
3. Are any of the pins or the connector damaged?
   - 3.a Yes; Go to step 4.
   - 3.b No; Go to step 5.
4. Inspect the engine coolant outlet electrical connector component side. Are any of the pins or the connector damaged?
   - 4.a Yes; replace the engine coolant temperature sensor and the electrical connector. Refer to section "Removal of the Engine Coolant Outlet Temperature Sensor" and Technical Service letter 13 TS-16 . Verify repair.
   - 4.b No; replace the engine coolant outlet temperature sensor electrical connector. Refer to Technical Service letter 13 TS-16 . Verify repair.
5. Turn the ignition ON (key ON, engine OFF).
6. Is fault code SPN 110/FMI 4 still active?
   - 6.a Yes; Go to step 7.
   - 6.b No; replace the engine coolant temperature sensor. Refer to section "Removal of the Engine Coolant Outlet Temperature Sensor" . Verify repair.
7. Turn the ignition OFF.
8. Disconnect and inspect MCM 120-pin electrical connector harness side. Is there corrosion present?
   - 8.a Yes; replace the MCM and the engine harness. Refer to section "Removal of the Motor Control Module" . Verify repair.
   - 8.b No; Go to step 9.
9. Are any of the pins or the connector damaged?
   - 9.a Yes; Go to step 10.
   - 9.b No; Go to step 11.
10. Inspect the MCM 120-pin electrical connector component side. Are any of the pins or the connector damaged?
    - 10.a Yes; replace the MCM and the engine harness. Refer to section "Removal of the Motor Control Module" . Verify repair.
    - 10.b No; replace the engine harness. Verify repair.
11. Measure the resistance between pin 2 of the engine coolant electrical connector harness side and pin 110 of the MCM 120-pin electrical connector harness side. Is the resistance less than five ohms?
    - 11.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repair.
    - 11.b No; repair the circuit between pin 2 of the engine coolant electrical connector harness side and pin 110 of the MCM 120-pin electrical connector harness side. Verify repair.

55.5 SPN 110/FMI 16 - GHG17

SPN 110/FMI 16	
Description	This Code Sets Once the Motor Control Module (MCM) Detects that the Outlet Coolant Temperature is Above 112°C (234°F)
Monitored Parameter	Engine Coolant Outlet Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (One minute)

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

Check as follows:

1. Check for multiple codes. Are codes SPN 110/FMI 3 or SPN 110/FMI 4 present?
   1.a Yes; repair those faults first.
   1.b No; Go to step 2.

⚠ WARNING

PERSONAL INJURY

To avoid injury from hot surfaces, wear protective gloves, or allow engine to cool before removing any component.

2. Compare coolant inlet and coolant outlet temperatures. Are the temperatures within 13.9°C (25°F) of each other?

2.a Yes; Go to step 3.

2.b No; replace both the coolant inlet and coolant outlet temperature sensors.

Refer to section "Removal of the Engine Coolant Inlet Temperature Sensor" .

Refer to section "Removal of the Engine Coolant Outlet Temperature Sensor" .

3. Visually check the engine coolant level in the surge tank. Is the coolant level within the specified range?

3.a Yes; Go to step 4.

3.b No; determine the cause of low coolant level. Refer to section "Symptom Diagnostics - Coolant Loss" .

4. Visually inspect the engine belts. Refer to section "Inspection of the Poly-V-Belts" . Do the belts show damage or signs of excessive wear?

4.a Yes; replace the damaged belt(s). Refer to section "Removal of the Poly-V-Belts" .

4.b No; Go to step 5.

5. Inspect the radiator and Charge Air Cooler (CAC) for any external restrictions or clogged fins. Use a flashlight on one side of the radiator/CAC assembly and check to see if light can be seen through the other side of the assembly. Is a restriction present?

5.a Yes; clean the radiator/CAC assembly using compressed air or water from a hose.

5.b No; Go to step 6.

6. Check the fan shroud for proper installation or damage. Is the fan shroud improperly installed or damaged?

6.a Yes; adjust or replace the fan shroud as necessary, refer to Original Equipment Manufacturer (OEM) literature for removal and installation instructions.

6.b No; Go to step 7.

7. Inspect the engine cooling fan operation; inspect the fan blades. Is damage present?

7.a Yes; replace the engine cooling fan. Refer to OEM literature for removal and installation instructions.

7.b No; Go to step 8.

8. Pressure-test the radiator cap according to OEM procedure. Does the radiator cap pass the pressure test?

8.a Yes; Go to step 9.

8.b No; replace the radiator cap.

9. Start the engine and inspect the belt and belt tensioner for excessive noise, chatter, or movement from idle and at 100 rpm increments for 15 seconds each until you reach 1200 rpm. Is there an excessive amount of noise, chatter, or movement?

9.a Yes; Refer to section "Belt Drive Noise" .

9.b No; Go to step 10.

10. Check for proper radiator hose condition. Are the hoses damaged or collapsed?

10.a Yes; determine the cause of a damaged or collapsed coolant hose. Repair as necessary.

10.b No; Go to step 11.

11. Test the water pump operation. Connect a coolant pressure tester tool to the surge tank. Start and run the engine at 1200 rpm. Monitor the pressure gauge for five minutes. Did the pressure in the cooling system increase above 69 kPa (10 psi)?

11.a Yes; replace the thermostat. Refer to section "Removal of the Engine Coolant Thermostat and Seal" .

11.b No; replace the water pump. Refer to section "Removal of the Water Pump" .

55.6 SPN 110/FMI 18 – GHG17

SPN 110/FMI 18	
Description	This Fault Sets when the Engine Coolant Temperature has not Increased to Match a Modeled Temperature Range
Monitored Parameter	Engine Coolant Outlet Temperature
Typical Enabling Conditions	Ambient Temp greater than -8°C (18°F) Ambient Pressure greater than 755 mbar (11 psi) Vehicle Speed greater than 45 km/hr (27 mph) Engine Run Time After Engine Start greater than 5 Minutes
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Five Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Road Test the Vehicle for 40 Minutes

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON; engine OFF).
3. Check for multiple fault codes. Are fault codes SPN 110/FMI 3, FMI 4, FMI 14; SPN 4193/FMI 2, FMI 3, FMI 4, or FMI 17 present?
   - 3.a Yes; diagnose the other fault codes first. Verify repair.
   - 3.b No; Go to step 4.
4. Is this vehicle a bus?
   - 4.a Yes; replace the thermostat. Refer to section "Removal of the Engine Coolant Thermostat and Seal" .
   - 4.b No; Go to step 5.
5. Inspect the vehicle for any aftermarket components plumbed into the cooling system. Are there any aftermarket components plumbed into the cooling system on the vehicle?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the thermostat. Refer to section "Removal of the Engine Coolant Thermostat and Seal" .
6. Isolate the aftermarket components and retest. Does fault code SPN 110/FMI 18 become active?
   - 6.a Yes; replace the thermostat. Refer to section "Removal of the Engine Coolant Thermostat and Seal" .
   - 6.b No; inform the customer that the aftermarket component(s) plumbed into the cooling system are the cause of the concern.

SPN 111 (CPC) (GHG17)

58.1 SPN 111/FMI 1 - GHG17

SPN 111/FMI 1	
Description	Coolant Level Below Normal Range
Monitored Parameter	Coolant Level
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Cycle Key

1. Check for multiple codes. Are there any coolant level circuit codes?
   1.a Yes; repair those codes first.
   1.b No; Go to step 2.
2. Check the coolant level in the reservoir. Is the coolant level in the reservoir below limit level 2.
   2.a Yes; Refer to section "Symptom Diagnostics - Coolant Loss" .
   2.b No; Go to step 3.

Note : Make sure that the coolant is not overfilled. The min/low and max/full marks on the coolant surge tank represent the acceptable operating range of the coolant level. During normal operation, the coolant level will expand and contract between the two lines, depending on temperature. Overfilling the coolant reservoir will cause the surge tank to push coolant out.

3. With the coolant filled to the proper level (1), clear the code and run the engine for five minutes. Check for codes. Did SPN 111/FMI 1 return?

   3.a Yes; replace the Engine Coolant Level (ECL) sensor and verify the repair.

   3.b No; the code was likely cause by a previously low coolant level condition. Ask the driver about coolant loss. If necessary, Refer to section "Symptom Diagnostics - Coolant Loss" .

58.2 SPN 111/FMI 3 - GHG17

1. Turn ignition OFF.
2. Disconnect the Engine Coolant Level (ECL) sensor.
3. Inspect sensor and harness connector for bent, spread, or corroded pins. Is any damage found?
   3.a Yes; repair as necessary. Verify repairs.
   3.b No; Go to step 4.
4. Is ECL sensor a magnetic float type? Refer to Original Equipment Manufacturer (OEM) literature.
   4.a Yes; Go to step 5.
   4.b No; Go to step 6.
5. Measure the resistance between pins 1 and 2 of the ECL sensor with the sensor submerged (float up, circuit closed). Is the resistance between 120 to 140 ohms?
   5.a Yes; Go to step 7.
   5.b No; replace the ECL sensor. Refer to section "Description and Operation of the Engine Coolant Level Sensor" .
6. Measure the resistance between pins 1 and 2 of the ECL sensor. Is the resistance less than 600K ohms while submerged?
   6.a Yes; Go to step 7.
   6.b No; replace the ECL sensor. Refer to section "Description and Operation of the Engine Coolant Level Sensor" .
7. Turn the ignition ON (key ON, engine OFF).
8. Measure the voltage between pin 1, or pin A for magnetic float type, of the ECL sensor harness connector and ground. Is the voltage above 4.0 volts?
   8.a Yes; repair the open circuit between pin 2 of the ECL sensor harness and ground. Verify repairs.
   8.b No; Go to step 9.
9. Turn the ignition OFF.
10. Disconnect the CPC #3 connector.
11. Inspect CPC #3 connector for bent, spread, or corroded pins. Is any damage found?
    11.a Yes; repair as necessary. Verify repairs.
    11.b No; Go to step 12.
12. Measure the resistance between pin 1 of the ECL harness connector and pin 11 of the CPC #3 connector. Is the resistance greater than five ohms?
    12.a Yes; repair the open circuit between pin 1 of the ECL sensor harness connector and pin 11 of the CPC #3 connector. Verify repairs.
    12.b No; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature. Go to step 13.
13. Clear the code and cycle the ignition on and off. Is SPN 111/FMI 3 active?
    13.a Yes; follow the appropriate Coolant Level Sensor testing service bulletin procedure, listed below:

- Freightliner Service Bulletin 20-70
- Western Star Service Bulletin 20-27

    13.b No; release the vehicle.

58.3 SPN 111/FMI 4 - GHG17

SPN 111/FMI 4	
Description	This Fault Sets when the Common Powertrain Controller (CPC) Detects that there is a Short to Ground on the Coolant Level Circuit or the Engine Coolant Level is Low.
Monitored Parameter	Coolant Level
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Cycle Key

Check as follows:

1. Connect DiagnosticLink .
2. Disconnect and inspect the engine coolant level sensor harness side. Is there corrosion present?
   - 2.a Yes; replace the engine coolant level sensor and the electrical connector. Refer to Original Equipment Manufacturer (OEM) literature for removal and installation procedures. Verify repair.
   - 2.b No; Go to step 3.
3. Inspect the engine coolant level sensor harness side. Are any of the pins or the connector damaged?
   - 3.a Yes; Go to step 4.
   - 3.b No; Go to step 5.
4. Inspect the engine coolant level sensor component side. Are any of the pins or the connector damaged?
   - 4.a Yes; replace the engine coolant level sensor and electrical connector. Refer to Original Equipment Manufacturer (OEM) literature for removal and installation procedures. Verify repair.
   - 4.b No; replace the electrical connector. Refer to Original Equipment Manufacturer (OEM) literature for removal and installation procedures. Verify repair.
5. Turn the ignition ON (Key ON, Engine OFF).
6. Is fault code SPN 111/FMI 4 still present?
   - 6.a Yes; Go to step 7.
   - 6.b No; replace the engine coolant level sensor. Refer to Original Equipment Manufacturer (OEM) literature for removal and installation procedures. Verify repair.
7. Turn the ignition OFF.
8. Disconnect and inspect the brown CPC electrical connector #3 harness side. Is there any corrosion present?
   - 8.a Yes; replace the CPC and the engine harness. Refer to Original Equipment Manufacturer (OEM) literature for removal and installation procedures. Verify repair.
   - 8.b No; Go to step 9.
9. Are any of the pins or the connector damaged?
   - 9.a Yes; Go to step 10.
   - 9.b No; Go to step 11.
10. Inspect the CPC electrical connector #3 component side. Is the connector or are the pins damaged?
    - 10.a Yes; replace the CPC and the brown electrical connector #3. Refer to Original Equipment Manufacturer (OEM) literature for removal and installation procedures. Verify repair.
    - 10.b No; replace the brown electrical connector #3 harness side. Refer to Original Equipment Manufacturer (OEM) literature for removal and installation procedures. Verify repair.

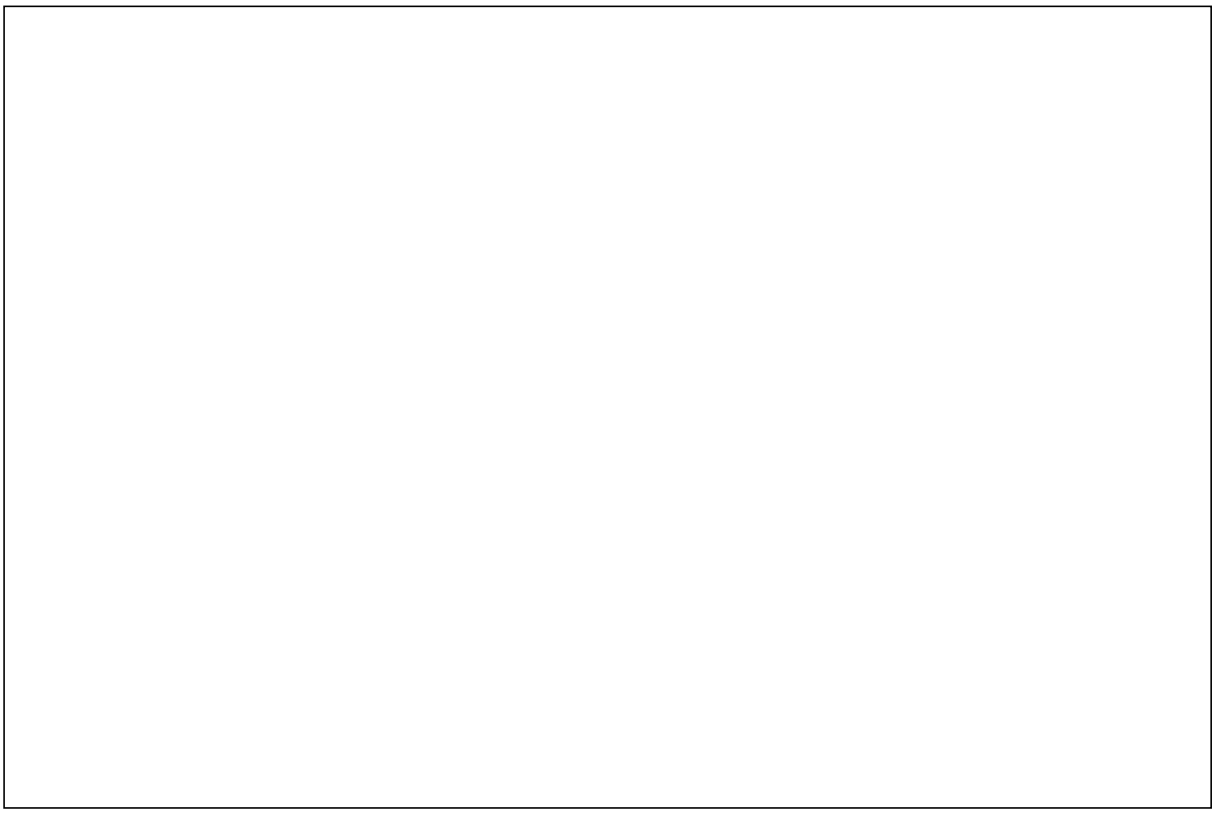
11. Measure the resistance between pin 2 of the engine coolant electrical connector harness side and pin 11 of brown CPC electrical connector #3 harness side. Is the resistance less than 10k ohms?

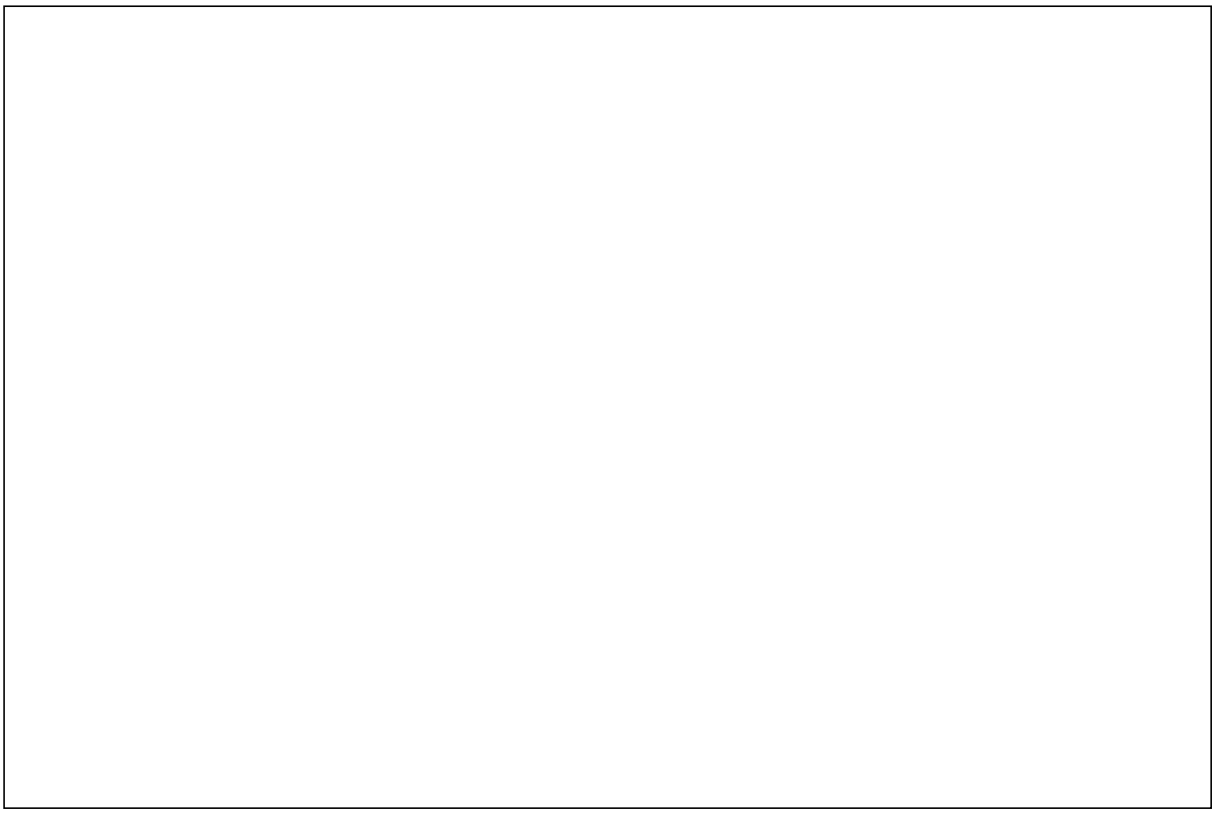
    11.a Yes; repair the circuit between pin 2 of the engine coolant electrical connector harness side and pin 11 of brown CPC electrical connector #3 harness side. Verify repair.

    11.b No; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature for removal and installation procedures. Verify repair.

58.4 SPN 111/FMI 6 - GHG17

SPN 111/FMI 6	
Description	Coolant Level Circuit Signal Below Normal Range
Monitored Parameter	Coolant Level
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Cycle Key





Check as follows:

1. Turn ignition OFF.
2. Disconnect the Engine Coolant Level (ECL) sensor.
3. Inspect sensor and harness connector for bent, spread, or corroded pins. Is any damage found?
   - 3.a Yes; repair as necessary. Verify repairs.
   - 3.b No; Go to step 4.
4. Disconnect the Common Powertrain Controller (CPC) #3 21-pin connector.
5. Inspect CPC #3 connector for bent, spread, or corroded pins. Is any damage found?
   - 5.a Yes; repair as necessary. Verify repairs.
   - 5.b No; Go to step 6.
6. Measure the resistance across pins 1 and 2 of the ECL sensor harness side connector. Is the resistance greater than 10K ohms?
   - 6.a Yes; Go to step 7.
   - 6.b No; repair the short between pin 1 and pin 2 of the ECL sensor harness side connector.
7. Measure the resistance between pin 1 of the ECL sensor harness connector and ground. Is the resistance greater than 10K ohms?
   - 7.a Yes; replace the ECL sensor. Refer to section "Description and Operation of the Engine Coolant Level Sensor" .
   - 7.b No; repair the short to ground between pin 1(A) of the ECL sensor harness connector and pin 11 of the CPC #3 connector. Verify repairs. If fault returns, replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature. Go to step 8.
8. Clear the code and cycle the ignition on and off. Is SPN 111/FMI 4 active?
   - 8.a Yes; follow the appropriate Coolant Level Sensor testing service bulletin procedure, listed below:

- Freightliner Service Bulletin 20-70

- Western Star Service Bulletin 20-27

8.b No; release the vehicle.

58.5 SPN 111/FMI 18 - GHG17

1. Check for multiple codes. Are there any coolant level circuit codes?
   1.a Yes; repair those codes first.
   1.b No; Go to step 2.
2. Check the coolant level in the reservoir. Is the coolant level in the reservoir below limit level 2?
   2.a Yes; Refer to section "Symptom Diagnostics - Coolant Loss" .
   2.b No; Go to step 3.

Note : Make sure that the coolant is not overfilled. The min/low and max/full marks on the coolant surge tank represent the acceptable operating range of the coolant level. During normal operation, the coolant level will expand and contract between the two lines, depending on temperature. Overfilling the coolant reservoir will cause

the surge tank to push coolant out.

3. With the coolant filled to the proper level (1), clear the code and run the engine for five minutes. Check for codes. Did SPN 111/FMI 18 return?

   3.a Yes; replace the Engine Coolant Level (ECL) sensor and verify the repair.

   3.b No; the code was likely cause by a previously low coolant level condition. Ask the driver about coolant loss. If necessary, Refer to section "Symptom Diagnostics - Coolant Loss" .

SPN 111 (CPC3) (GHG17)

59.1 SPN 111/FMI 1 - GHG17

Check as follows:

1. Are any coolant level circuit codes present?
   1.a Yes; repair those codes first.
   1.b No; Go to step 2.
2. Check the coolant level reservoir, is the coolant level within the Min/Max indicator lines on the reservoir?
   2.a Yes; replace the coolant level sensor.
   2.b No; fill reservoir to proper level. Go to step 3.
3. Check for coolant leak at cylinder head gasket. Verify repairs.
4. Check for coolant leak at air compressor head gasket. Verify repairs.
5. Check for external coolant leak at hose connections. Verify repairs.
6. Check for coolant in oil. Verify repairs.
7. Check for loose or faulty radiator cap. Verify repairs.
8. Check cab heating system for leaks. Verify repairs.

59.2 SPN 111/FMI 4 - GHG17

SPN 111/FMI 4	
Description	This Fault Sets when the Common Powertrain Controller (CPC) Detects that there is a Short to Ground on the Coolant Level Circuit or the Engine Coolant Level is Low
Monitored Parameter	Coolant Level
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Cycle Key

1. Disconnect the coolant level sensor.
2. Inspect the coolant level sensor harness connector for bent spread or corroded terminals. Is pin damage found?
   - 2.a Yes; repair as necessary.
   - 2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 1 and 2 of the coolant level sensor harness connector. Is the voltage between 4.5 and 5.0 volts?
   - 4.a Yes; replace the coolant level sensor.
   - 4.b No; Go to step 5.
5. Measure the voltage between pin 1 of the coolant level sensor harness connector and ground. Is the voltage between 4.5 and 5.0 volts?
   - 5.a Yes; repair wire between pin 2 of the coolant level sensor harness connector and connector 2 pin 11 of the CPC3.
   - 5.b No; repair wire between pin 1 of the coolant level sensor harness connector and connector 2 pin 22 of the CPC3.

59.3 SPN 111/FMI 14 - GHG17

SPN 111/FMI 14	
Description	This Fault Sets when the Common Powertrain Controller (CPC) Detects an Erratic Coolant Level Sensor Signal
Monitored Parameter	Coolant Level
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Cycle Key

1. Disconnect the coolant level sensor.
2. Inspect the coolant level sensor harness connector for bent spread or corroded terminals. Is pin damage found?
   - 2.a Yes; repair as necessary.
   - 2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 1 and 2 of the coolant level sensor harness connector. Is the voltage between 4.5 and 5.0 volts?
   - 4.a Yes; replace the coolant level sensor.
   - 4.b No; Go to step 5.
5. Measure the voltage between pin 1 of the coolant level sensor harness connector and ground. Is the voltage between 4.5 and 5.0 volts?
   - 5.a Yes; repair wire between pin 2 of the coolant level sensor harness connector and connector 2 pin 11 of the CPC3.
   - 5.b No; repair wire between pin 1 of the coolant level sensor harness connector and connector 2 pin 22 of the CPC3.

59.4 SPN 111/FMI 18 - GHG17

SPN 111/FMI 18	
Description	This Fault Sets when the Common Powertrain Controller (CPC) Detects Coolant Level is Low
Monitored Parameter	Coolant Level
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Cycle Key

1. Are any coolant level circuit codes present?
   1.a Yes; repair those codes first.
   1.b No; Go to step 2.
2. Check the coolant level reservoir, is the coolant level within the Min/Max indicator lines on the reservoir?
   2.a Yes; replace the coolant level sensor.
   2.b No; fill reservoir to proper level and then Go to step 3.
3. Check for coolant leak at cylinder head gasket. Verify repairs.
4. Check for coolant leak at air compressor head gasket. Verify repairs.
5. Check for external coolant leak at hose connections. Verify repairs.
6. Check for coolant in oil. Verify repairs.
7. Check for loose or faulty radiator cap. Verify repairs.
8. Check cab heating system for leaks. Verify repairs.

SPN 120 (CPC) (GHG17)

60.1 SPN 120/FMI 13 – GHG17

J1939 Retarder Fluid Message is Missing or Not Available

1. Check for multiple codes. Are (CPC) SPN 168/FMI 0/14/18 (battery voltage) codes present?
   1.a Yes; troubleshoot these first.
   1.b No; Go to step 2.
2. Is (MCM) SPN 625/FMI 9 present?
   2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   3.a Yes; check the proper configuration of the CPC.
   3.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

SPN 157 (MCM) (GHG17)

61.1 SPN 157/FMI 10 – GHG17

Under-Capacity in the High Pressure Circuit

The Motor Control Module (MCM) monitors the rail pressure and when rail pressure deviation is greater than 200 bar, the MCM sets the code. This fault can occur due to the conditions listed below:

- External fuel leakage between the high pressure pump and fuel injectors
- Pressure Limiting Valve (PLV) leakage (internal)
- Fuel filter integrity (loose caps, plugged filters)
- Fuel supply issues (fuel level, fuel aeration, leaking fuel lines, fuel restrictions)
- Intermittent loss of engine speed signal
- High pressure pump internal failure
- Fuel injector (amplifier or needle) leakage
- Fuel Contamination
- Rail pressure sensor failure
- Faulty Motor Control Module (MCM)

Service Tools Used in the Procedure	
Tool Number	**Description**
J-48876	Test Gauge, Primer Port, HDE
J-48704	Caps, HP Fuel Rail, HDE
DiagnosticLink®	Electronic Diagnostic Tool

Note : It is important to obtain information from the customer regarding Check Engine Lamp occurrences, performance concerns, or exhaust smoke.

1. Did SPN 157/FMI 16 or SPN 520268/FMI 18 appear after the fuel system was repaired or fuel filter maintenance was performed?
   - 1.a Yes; the code may be set due to air in the fuel system. Clear codes and road test to verify complaint. If code does not set, release the vehicle. If code sets, Go to step 2.
   - 1.b No; Go to step 2.
2. Turn the ignition ON (key ON, engine OFF).

Note : Fuel tank level at the time the fault triggered can be viewed in extended data #5, “Enhanced Environmental Data” Fuel Tank Level.

3. Check and record fuel level in all fuel tanks.
   - 3.a If fuel level is below ¼ tank (or 25%), add fuel and road test vehicle. If code does not become active during road test, release the truck. If the code becomes active during the road test with over ¼ tank (or 25%) of fuel, Go to step 4.
   - 3.b If the fuel level is over ¼ tank (or 25%), question the driver about the fuel level when the code was set. If the level was under ¼ tank (or 25%), fuel sloshing in the tank could be the cause of aerated fuel that could cause this code. If the fuel level was over ¼ tank (or 25%) when the code was set, Go to step 4.
4. Check for fuel contamination, including Diesel Exhaust Fluid (DEF), water, gasoline, kerosene, coolant, etc.
   - 4.a If contamination is found, contact the Detroit™ Customer Support Center at 800-445-1980.
   - 4.b If no contamination is found, Go to step 5.
5. Visually inspect for external fuel leaks on the engine and on the chassis.
   - 5.a If a leak is found, repair leak. Refer to section "Verify Repairs" .

5.b If no leaks are found, Go to step 6.

6. Using DiagnosticLink , check for multiple codes.

6.a If any of the additional fault codes are active, perform the associated diagnostics first:

- SPN 94/FMI 15 Fuel Filter Plugged
- SPN 94/FMI 16 Fuel Filter Plugged
- SPN 97/FMI 15 Water in the Fuel
- SPN 157/FMI 1 Rail Pressure Too High
- SPN 164/FMI (All) Rail pressure Sensor Faults
- SPN 174/FMI 0 Fuel Temperature Too High
- SPN 679/FMI 7 PLV Stuck Open
- SPN 723/FMI (all) Cam Sensor Codes
- SPN 636/FMI (all) Crank Sensor Codes
- SPN 1077/FMI 5, 6 or 14

6.b If only SPN 1077/7, SPN 157/FMI 16 or SPN 1077/FMI 31 is present, Go to step 7.

Note : Do not reset this counter unless the PLV is being replaced.

7. Using DiagnosticLink, check the value of Pressure Limiting Valve (PLV) openings. With the ignition ON (key ON, engine OFF), select the Actions tab in the top tool bar. Select Fuel System, then Pressure Limiting Valve (PLV). Change or view (E2P_RPG_CTR_PLV_OPEN) under “Extended Data Record Number 5th” list. View and record the PLV open counts.

7.a If the counter is greater than 50, replace the PLV.

Refer to section "Removal of the Pressure Limiting Valve - Two-Filter System" .

Verify repairs. Refer to section "Verify Repairs" .

7.b If counter is less than 50, Go to step 8.

8. Perform automatic Fuel System Integrity Check (FSIC) routine using DDDL 7.09 SP2 or newer. With the ignition ON (key ON, engine OFF), start the Automatic FSIC. The software/tool will ask to start the engine when required. Once the engine is running, the software will have the engine enter and exit several engine operating conditions. Once the engine shuts down, leave the key on for five minutes. Disconnect DDDL and open the log file. The next part of the troubleshooting will require reviewing the FSIC log file. Go to step 9.

9. Monitor rail pressure bleed-off time.

9.a If bleed-off time is below 35 seconds, perform a low pressure leak test.

Refer to section "FIS Low Pressure Leak Test" .

9.b If bleed-off time is between 35 seconds and 2 minutes 30 seconds, Go to step 10.

9.c If bleed-off time is greater than 2 minutes 30 seconds with engine warm, Refer to section "Idle Speed Balance Test" .

10. Does Kw/Nw show/stay “ON / Enabled / True” while the engine is running during the Automatic FSIC routine?

10.a Yes; Go to step 11.

10.b No; refer to troubleshooting for SPN 723/FMI 10.

11. Was the fuel temperature rise greater than 10 degrees?

11.a Yes; Go to step 13.

11.b No; Go to step 12.

12. At 600 rpm, is ASL003 Fuel Compensation Pressure within range per the fuel pressure chart?

Refer to section "Normal Fuel System Pressures - Two-Filter System" .

12.a Yes; Go to step 14.

12.b No; Go to step 13.

13. Monitor AS124 LPPO sensor (if equipped) or use manual gauge J-48706. Is the pressure in range at 600 and 1800 rpm?

Refer to section "Normal Fuel System Pressures - Two-Filter System" .

13.a Yes; Go to step 14.

13.b No; Repair cause of incorrect fuel pressure.

Refer to section "Normal Fuel System Pressures - Two-Filter System" .

14. Monitor AS124 LPPO (if equipped) and ASL003 Fuel Compensation Pressure at all engine speeds. Are pressures stable with no oscillations?

14.a Yes; Go to step 15.

14.b No; pressures are unstable WITH oscillations of more than 1.5 psi at a steady rpm, check for aerated fuel.

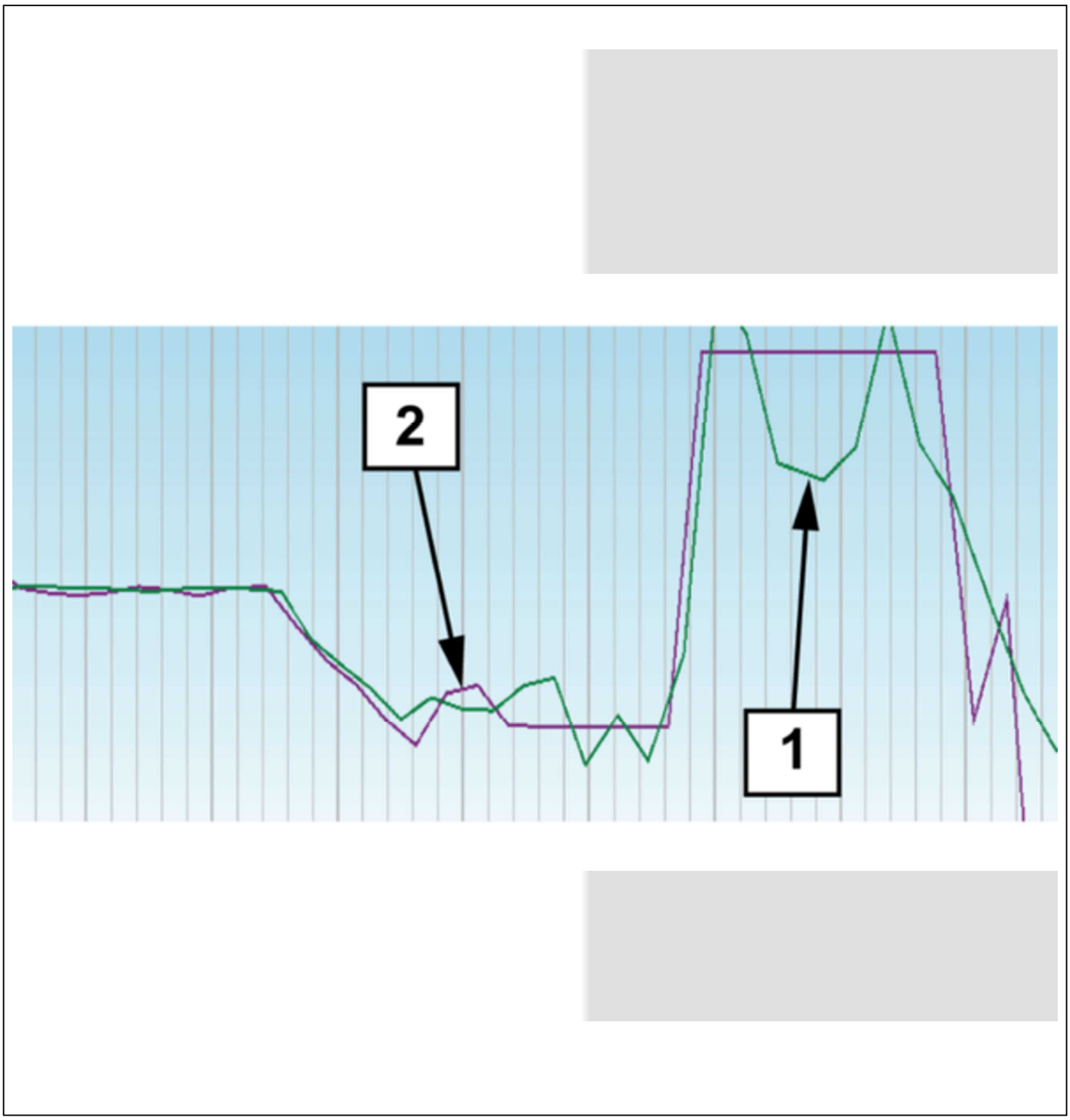
Refer to section "Aerated Fuel Test – Two-Filter Fuel System" .

15. Check the Idle Speed Balance (ISB) Values. Refer to section "Idle Speed Balance Test" . Are there any cylinders above 70% or below -70%?

15.a Yes; Follow repair procedures in “Idle Speed Balance (ISB) Test” and verify repairs. Refer to section "Verify Repairs" .

15.b No; Go to step 16.

16. Is ASL001 Rail Pressure erratic or does it have a saw-tooth pattern?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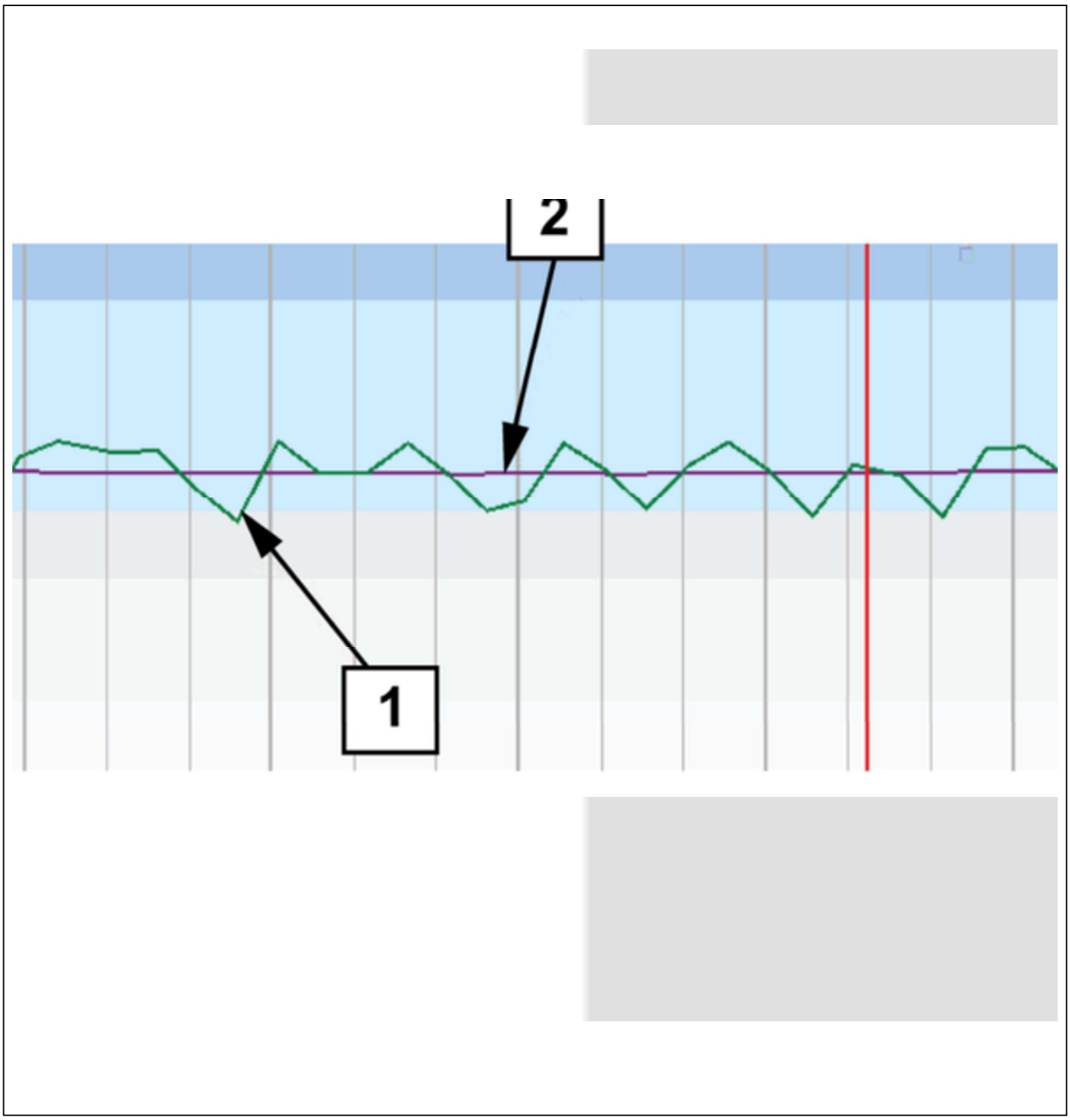


16.a Yes; Go to step 17.

Note : See examples of erratic pressure showing (1) ASL001 Rail pressure and (2) AS098 Desired rail pressure.

16.b No; Go to step 18.

17. Perform the aerated fuel test. Was fuel aerated?

Refer to section "Aerated Fuel Test – Two-Filter Fuel System" .

17.a Yes; repair cause of aerated fuel.

17.b No; replace the Quantity Control Valve (QCV).

Refer to section "Removal of the Quantity Control Valve - Two-Filter System" .

18. Perform Pressure Limiting Valve (PLV) flow test. Did the PLV flow test pass?

Refer to section "Pressure Limiting Valve Flow Test – Two-Filter Fuel System"

18.a Yes; Go to step 19.

18.b No; replace the PLV.

Refer to section "Removal of the Pressure Limiting Valve - Two-Filter System"

Note : Prime the fuel system after performing the low pressure fuel system leak test.

19. Inspect the low pressure fuel system for leaks. Are leaks present?

Refer to section "FIS Low Pressure Leak Test" .

19.a Yes; Repair as necessary.

19.b No; Go to step 20.

20. Cap the fuel rail at all six fuel injector feed connections using J-48704 injector rail caps and crank the engine for 10 seconds. Does the ASL001 rail pressure reach AS098 desired rail pressure?

20.a Yes; Go to step 21.

20.b No; Replace high pressure fuel pump.

Refer to section "Removal of the High Pressure Fuel Pump - Two-Filter System" .

21. With the fuel injectors still capped after cranking engine for 10 seconds, does the rail pressure bleed down under 100 bar in less than five minutes?

21.a Yes; replace the high pressure fuel pump.

Refer to section "Removal of the High Pressure Fuel Pump - Two-Filter System" .

21.b No; Go to step 22.

22. Using DiagnosticLink 8.x, navigate to Service Routines and Fuel System Integrity Check test and select Manual FSIC. Test drive the truck to see if the code sets. Does the code become active

22.a Yes; Go to step 23.

22.b No; replace the fuel filters and release vehicle to customer.

23. Remove the MCM 120-pin connector. Inspect for damage including fuel, water corrosion or bent terminals. Is damage found?

23.a Yes; repair as needed.

23.b No; Go to step 24.

24. Install a test MCM using the extension harness and test drive the truck. Does the code come active?

24.a Yes; contact the Detroit Customer Support Center at 800-445-1980. Be prepared to provide the FSIC log files and completed troubleshooting.

24.b No; replace MCM and verify repair.

61.2 SPN 157/FMI 15 - GHG17

Rail Pressure Level For Injection Enabling Not Reached

The Motor Control Module (MCM) monitors the rail pressure and when rail pressure deviation is greater than 200 Bar, while under a load, the MCM sets the code. This fault can occur due to the conditions listed below:

- External Fuel Leakage between the High Pressure Pump and Fuel Injectors
- Pressure Limiting Valve Leakage (Internal)
- Fuel Filter Integrity (Loose Caps, Plugged Filters)
- Fuel Supply Issues (Fuel Level, Fuel Aeration, Leaking Fuel Lines, Fuel Restrictions)
- Intermittent Loss of Engine Speed Signal
- High Pressure Pump Internal Failure
- Fuel Injector (Amplifier or Needle) Leakage
- Fuel Contamination
- Rail Pressure Sensor
- Motor Control Module (MCM)

Service Tools Used in the Procedure	
Tool Number	Description
J-48876	Test Gauge, Primer Port, HDE
J-48704	Caps, HP Fuel Rail, HDE
DiagnosticLink 8.x	Electronic Diagnostic Tool

Note : It is important to obtain information from the customer about check engine lamp occurrences, performance concerns, or exhaust smoke.

1. Did SPN 157/FMI 15 or SPN 520268/FMI 18 appear after the fuel system was repaired or fuel filter maintenance was performed?
   - 1.a Yes; the code may be set due to air in the fuel system. Clear codes and road test to verify complaint. If code does not set, release the vehicle. If code sets, Go to step 2.
   - 1.b No; Go to step 2.
2. Turn the ignition ON (key ON, engine OFF).

Note : Fuel tank level at the time the fault triggered can be viewed in extended data #5, “Enhanced Environmental data” Fuel Tank Level. Is the fuel tank level below ¼ tank (or 25%)?

3. Check and record fuel level in all fuel tanks. Is fuel level blow ¼ tank (25%)?
   - 3.a Yes; add fuel and road test vehicle. If code does not become active during road test, release the truck. If the code becomes active during the road test with over ¼ tank (or 25%) of fuel, Go to step 4.
   - 3.b No; view fuel tank level in extended data (EPA10) or question the driver about the fuel level when the code was set. If the level was under ¼ tank (or 25%), fuel sloshing in the tank could be the cause of aerated fuel that could cause this code. If the fuel level was over ¼ tank (or 25%) when the code was set, Go to step 4.
4. Check for fuel contamination, including Diesel Exhaust Fluid (DEF), water, gasoline, kerosene, coolant, etc. Is contamination found?
   - 4.a Yes; refer to section "Contaminated Fluids" in this manual.
   - 4.b No; Go to step 5.
5. Visually inspect for external fuel leaks on the engine and on the chassis. Was a leak found?
   - 5.a Yes; repair leak. Refer to section "Verify Repairs" .
   - 5.b No; Go to step 6.
6. Using DiagnosticLink , check for multiple codes. Are any of the fault codes below active?

6.a Yes; perform the associated diagnostics first:

- SPN 94/FMI 15 Fuel Filter plugged
- SPN 94/FMI 16 Fuel Filter plugged
- SPN 97/FMI 15 Water in the fuel
- SPN 157/FMI 1 Rail Pressure Too High.
- SPN 164/FMI (All) Rail pressure sensor faults
- SPN 174/FMI 0 Fuel Temperature too High
- SPN 679/FMI 7 PLV Stuck Open
- SPN 723/FMI (all) Cam Sensor Codes
- SPN 636/FMI (all) Crank sensor codes
- SPN 1077/FMI 5, 6 or 14

6.b No; only SPN 1077/FMI 7, SPN 157/FMI 16 or SPN 1077/FMI 31 is present, Go to step 7.

Note : Do not reset this counter unless the PLV is being replaced.

7. Using DiagnosticLink check the value of Pressure Limiting Valve (PLV) openings. With key ON, engine OFF, select the Actions tab in the top tool bar. Select Fuel System, then Pressure Limiting Valve (PLV) Change or view (E2P_RPG_CTR_PLV_OPEN) under “Extended Data Record Number 5th” list. View and record the PLV open counts. Is the counter greater than 50?

   7.a Yes; replace the PLV. Verify repairs.

   Refer to section "Removal of the Pressure Limiting Valve - Two-Filter System" .

   Refer to section "Verify Repairs" .

   7.b No; Go to step 8.

8. Perform Automatic Fuel System Integrity Check (FSIC) routine using DiagnosticLink. With key ON, engine OFF, start the Automatic FSIC routine. The software/tool will ask to start the engine when required. Once the engine is running, the software will have the engine enter and exit several engine operating conditions. Once the engine shuts down, leave the key on for five minutes. Disconnect DiagnosticLink. and open the log file. The next part of the troubleshooting will require reviewing the FSIC log file. Go to step 9.

9. Monitor rail pressure bleed-off time. Is bleed-off time less than 35 second?

   9.a Yes; perform an HP leak test.

   9.b No; Go to step 10.

10. From the previous step, is rail pressure bleed-off time greater than 2 minutes 30 seconds?

    10.a Yes; with engine warm, Refer to section "Idle Speed Balance Test" .

    10.b No; Go to step 11.

11. Does Kw/Nw show/stay “ON / Enabled / True” while the engine is running during the Automatic FSIC routine?

    11.a Yes; Go to step 12.

    11.b No; refer to troubleshooting for SPN 723/FMI 10.

12. Was the fuel temperature rise greater than 10 degrees?

    12.a Yes; Go to step 14.

    12.b No; Go to step 13.

13. At 600 rpm, is ASL003 Fuel Compensation Pressure within range per the fuel pressure chart?

    Refer to section "Normal Fuel System Pressures - Two-Filter System"

    13.a Yes; Go to step 15.

    13.b No; Go to step 14.

14. Monitor AS124 LPPO sensor (if equipped) or use manual gauge J-48706. Is the pressure in range at 600 and 1800 rpm?

    Refer to section "Normal Fuel System Pressures - Two-Filter System"

14.a Yes; Go to step 15.

14.b No; Repair cause of incorrect fuel pressure.

15. Monitor AS124 LPPO (if equipped) and ASL003 Fuel Compensation Pressure at all engine speeds. Are pressures stable with no oscillations?

15.a Yes; Go to step 16.

15.b No; pressures are unstable WITH oscillations of more than 1.5 psi at a steady rpm check for aerated fuel.

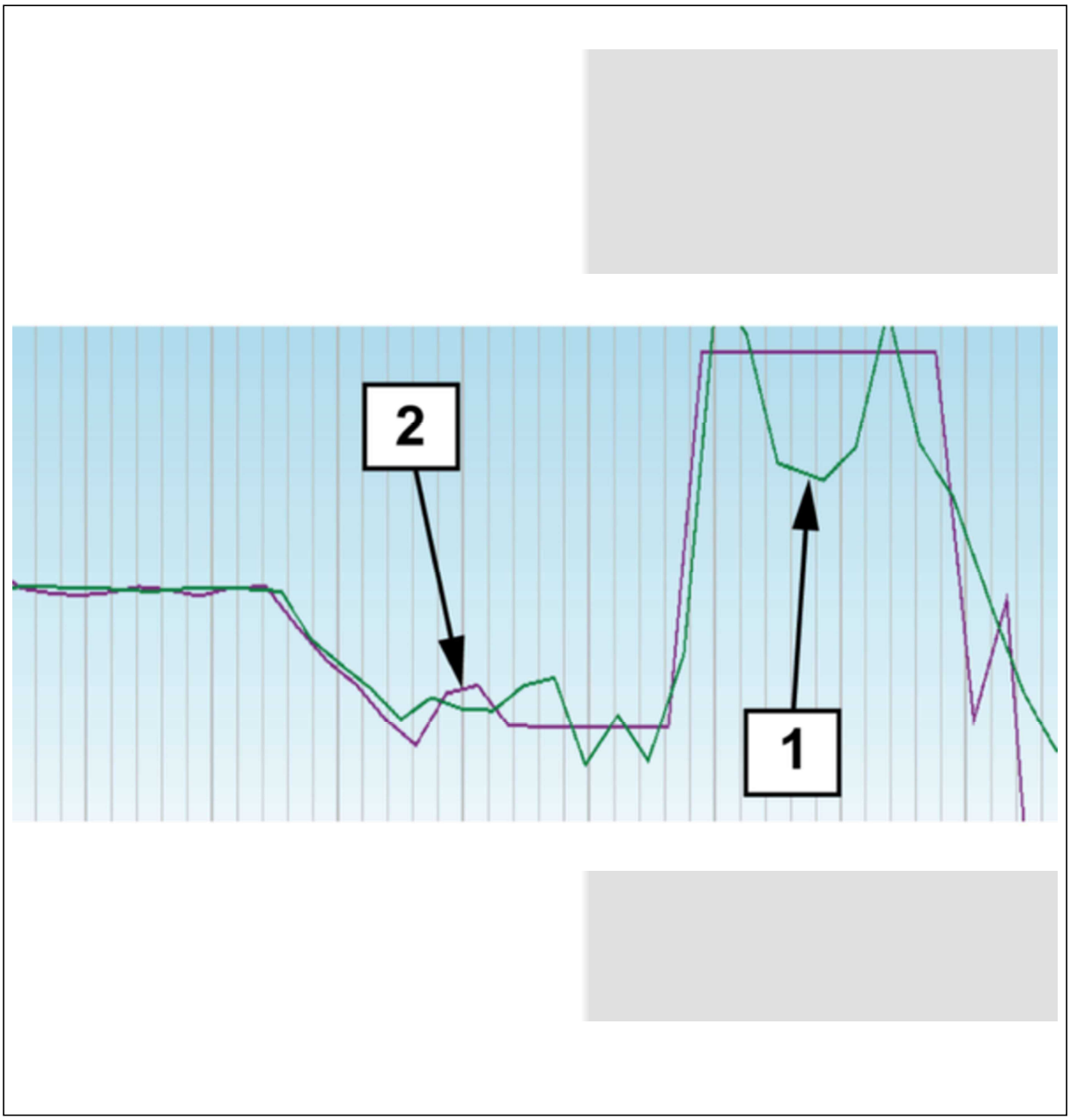
Refer to section "Aerated Fuel Test – Two-Filter Fuel System"

16. Check the Idle Speed Balance (ISB) Values. Refer to section "Idle Speed Balance Test" . Are there any cylinders above 70% or below -70%?

16.a Yes; Follow repair procedures in Idle Speed Balance (ISB) test and verify repairs. Refer to section "Verify Repairs" .

16.b No; Go to step 17.

17. Is ASL001 Rail Pressure erratic or does it have a saw-tooth pattern?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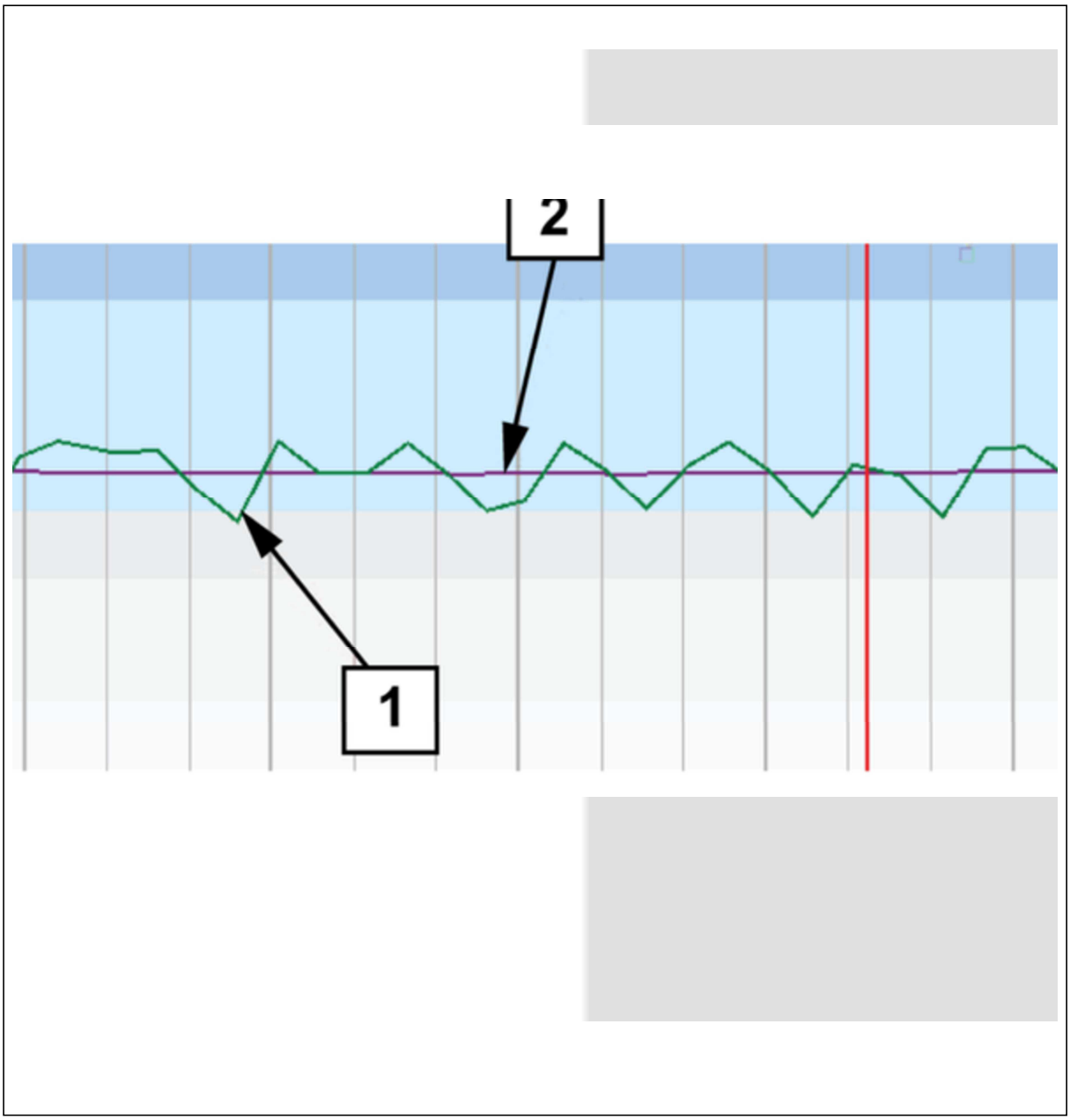


17.a Yes; Go to step 18.

Note : See examples of erratic pressure showing (1) ASL001 Rail pressure and (2) AS098 Desired rail pressure.

17.b No; Go to step 19.

18. Perform the aerated fuel test. Was fuel aerated?
Refer to section "Aerated Fuel Test – Two-Filter Fuel System"

18.a Yes; repair cause of aerated fuel.

18.b No; replace the Quantity Control Valve.
Refer to section "Removal of the Quantity Control Valve - Two-Filter System"

19. Perform Pressure Limiting Valve (PLV) flow test. Did the PLV flow test pass?
Refer to section "Pressure Limiting Valve Flow Test – Two-Filter Fuel System"

19.a Yes; Go to step 20.

19.b No; replace the PLV.

Refer to section "Removal of the Pressure Limiting Valve - Two-Filter System"

Note : Prime the fuel system after performing the low pressure fuel system leak test.

20. Inspect the low pressure fuel system for leaks. Are leaks present?

Refer to section "FIS Low Pressure Leak Test"

20.a Yes; Repair as necessary.

20.b No; Go to step 21.

21. Cap the rail at all six injector feed connections using J-48704 injector rail caps and crank the engine for 10 seconds. Does the ASL001 rail pressure reach AS098 desired rail pressure?

21.a Yes; Go to step 22.

21.b No; Replace high pressure pump.

Refer to section "Removal of the High Pressure Fuel Pump - Two-Filter System" .

22. With the injectors still capped after cranking engine for 10 seconds, does the rail pressure bleed down under 100 bar in less than five minutes?

22.a Yes; Replace the high pressure fuel pump.

Refer to section "Removal of the High Pressure Fuel Pump - Two-Filter System" .

22.b No; Go to step 23.

23. Using DiagnosticLink 8.x, navigate to Service Routines and Fuel System Integrity Check test and select Manual FSIC. Test drive the truck to see if the code sets. Did the code set?

23.a Yes; Go to step 24.

23.b No; replace the fuel filters and release vehicle to customer.

24. Remove the MCM 120-pin connector. Inspect for damage including fuel, water corrosion or bent terminals. Is damage found?

24.a Yes; repair as needed.

24.b No; Go to step 25.

25. Install a test MCM using the extension harness and test drive the truck. Does the Code come active?

25.a Yes; contact the Detroit™ Customer Support Center at 800-445-1980. Be prepared to provide the FSIC log files and completed troubleshooting.

25.b No; replace MCM and verify repair.

61.3 SPN 157/FMI 16 - GHG17

Note : It is important to obtain information from the customer on when the check engine lamp occurs and if there were any performance concerns or exhaust smoke.

Check as follows:

1. Did SPN 157/FMI 16 appear after the fuel system was repaired or fuel filter maintenance was performed?
   - 1.a Yes; the code may be set due to air in the fuel system. Clear codes and road test to verify complaint. If code does not set, release the vehicle. If code sets, Go to step 2.
   - 1.b No; Go to step 2.
2. Turn the ignition ON (key ON, engine OFF).
3. Check and record fuel level using parameter AS044 Fuel Tank Level. Is the fuel level under ¼ tank (25%)?
   - 3.a Yes; add fuel and road test vehicle. If code does not become active during road test, release the truck. If the code becomes active during the road test with over ¼ tank (25%) of fuel, Go to step 5.
   - 3.b No; Go to step 4.
4. Check fuel tank level in extended fault code data. Was fuel tank level over ¼ tank (25%) when the code logged?
   - 4.a Yes; Go to step 5.
   - 4.b No; fuel sloshing in the tank may have caused aerated fuel and set this code. Road test vehicle. If code does not come active during road test, release the truck. If code does come active, Go to step 5.
5. Check for fuel contamination, including Diesel Exhaust Fluid (DEF), water, gasoline, kerosene, or coolant. Is any contamination found?
   - 5.a Yes; refer to "Contaminated Fluids" in this manual.
   - 5.b No; Go to step 6.
6. Visually inspect for external fuel leaks on the engine and on the chassis. Are any leaks found?
   - 6.a Yes; repair leak. Refer to section "Verify Repairs" .
   - 6.b No; Go to step 7.
7. Using DL 8.03 or higher, check for other active codes. Are any of the following codes active?
   - 7.a Yes; perform the associated diagnostics first:

- SPN 94/FMI 15 Fuel Filter Plugged
- SPN 94/FMI 16 Fuel Filter Plugged
- SPN 97/FMI 15 Water in the Fuel
- SPN 157/FMI 1 Rail Pressure too High
- SPN 164/FMI (All) Rail Pressure Sensor Faults
- SPN 174/FMI 0 Fuel Temperature too High
- SPN 679/FMI 7 PLV Stuck Open
- SPN 723/FMI (all) Cam Sensor Codes
- SPN 636/FMI (all) Crank Sensor Codes
- SPN 1077/FMI 5, 6 or 14

   - 7.b If only SPN 1077/7, 157/16 or 1077/31 is present, Go to step 8.

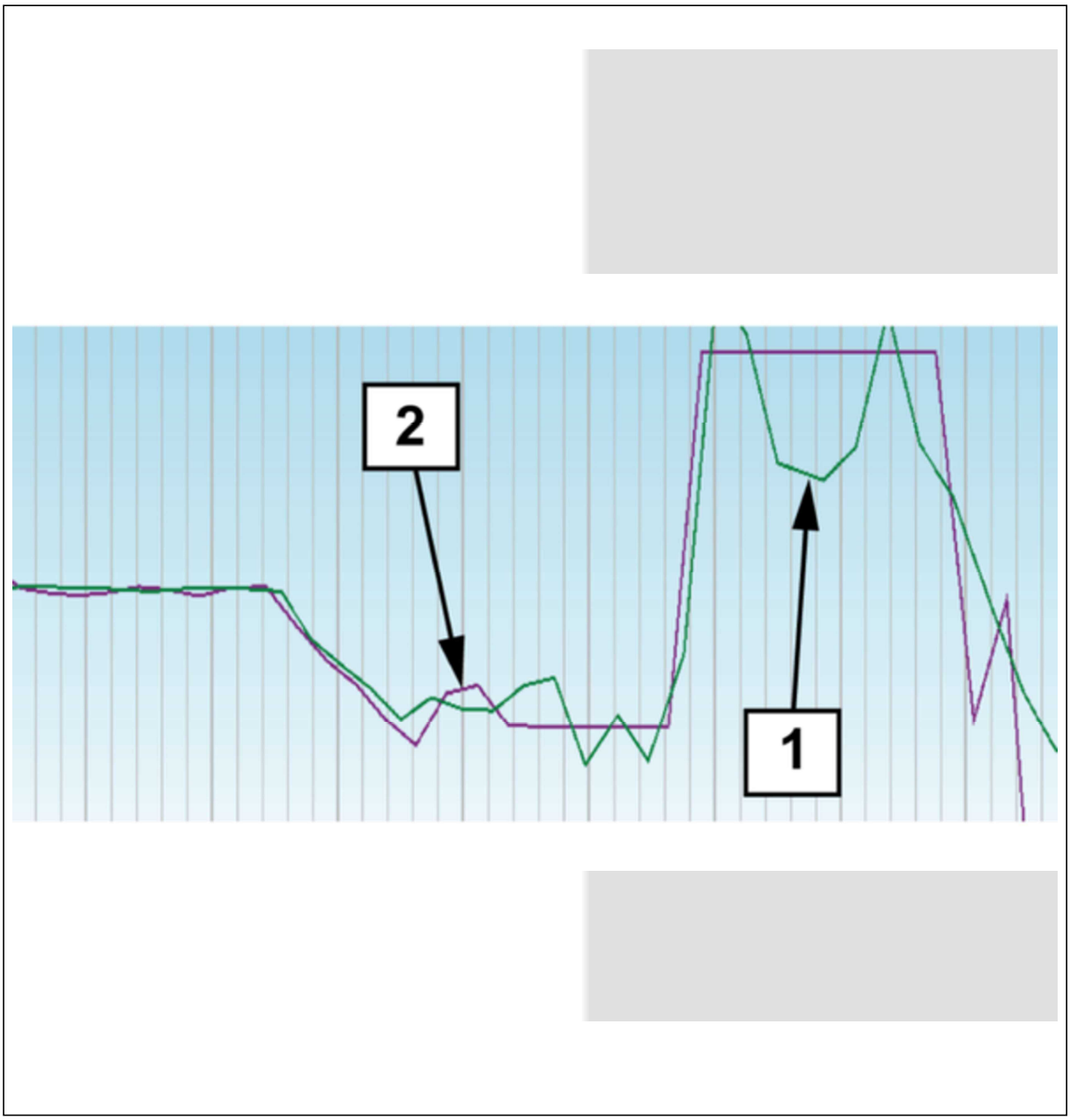
Note : Do not reset this counter unless the PLV is being replaced.

8. Using DL 8.03 or higher, check the value of Pressure Limiting Valve (PLV) openings. With key ON, engine OFF, select the Actions tab in the top tool bar. Select Fuel System, then Pressure Limiting Valve (PLV) Change or view (RPG_CTR_PLV_OPEN) under "Extended Data Record #5" list. View and record the PLV open counts. Is the counter greater than 50?
   - 8.a Yes; replace the PLV. Refer to section "Removal of the Pressure Limiting Valve - Two-Filter System" . Verify repairs. Refer to section "Verify Repairs" .

8.b No; Go to step 9.

Note : Engines not equipped with a Low Pressure Pump Outlet (LPPO) sensor should utilize J-48876 Test Gauge, Priming Port to monitor LPPO.

9. Perform Automatic Fuel System Integrity Check (FSIC) routine using DL 8.03 or higher. With the ignition ON (key ON, engine OFF) start the Automatic FSIC. The software/tool will ask to start the engine when required. Once the engine is running, the software will have the engine enter and exit several engine operating conditions. Once the engine shuts down, leave the key on for five minutes. Disconnect DiagnosticLink and open the log file. The next steps of the troubleshooting will require reviewing the FSIC log file. Go to step 10.
10. Monitor rail pressure bleed-off time. Is bleed off time below 35 seconds?
    - 10.a Yes; Refer to section "High Pressure Fuel System - Leak Test - Two-Filter System " .
    - 10.b No; Go to step 11.
11. In the previous step, was bleed off time greater than two minutes and thirty seconds?
    - 11.a Yes; Refer to section "Idle Speed Balance Test" .
    - 11.b No; Go to step 12.
12. Does Kw/Nw show/stay "ON / Enabled / True" while the engine is running during the Automatic FSIC routine?
    - 12.a Yes; Go to step 13.
    - 12.b No; Refer to section "SPN 723/FMI 10 - GHG17" .
13. Was the fuel temperature rise greater than 5.6°C (10°F)?
    - 13.a Yes; Go to step 15.
    - 13.b No; Go to step 14.
14. At 600 rpm, is ASL003 Fuel Compensation Pressure between 586 kPa (85 psi) and 6 kPa (100 psi)?
    - 14.a Yes; Go to step 16.
    - 14.b No; Go to step 15.
15. Monitor AS124 LPPO sensor (if equipped) or use manual gauge J-48706. Is the pressure between 496 kPa (72 psi) and 551 kPa (80 psi) at 600 rpm and 689 kPa (100 psi) to 869 kPa (126 psi) at 1800 rpm?
    - 15.a Yes; Go to step 16.
    - 15.b No; repair cause of incorrect fuel pressure.
16. Monitor AS124 LPPO (if equipped) and ASL003 Fuel Compensation Pressure at all engine speeds; are pressures stable with no oscillations? Unstable pressures will have oscillations greater than 1.5 psi at stable engine speed.
    - 16.a Yes; Go to step 17.
    - 16.b No; Refer to section "Aerated Fuel Test – Two-Filter Fuel System" .
17. Check the Idle Speed Balance (ISB) values. Refer to section "Idle Speed Balance Test" . Are there any cylinders above 70% or below -70%?
    - 17.a Yes; follow repair procedures in "Idle Speed Balance (ISB) Test" and verify repairs. Refer to section "Verify Repairs" .
    - 17.b No; Go to step 18.
18. Is ASL001 Rail Pressure erratic or does it have a saw tooth pattern?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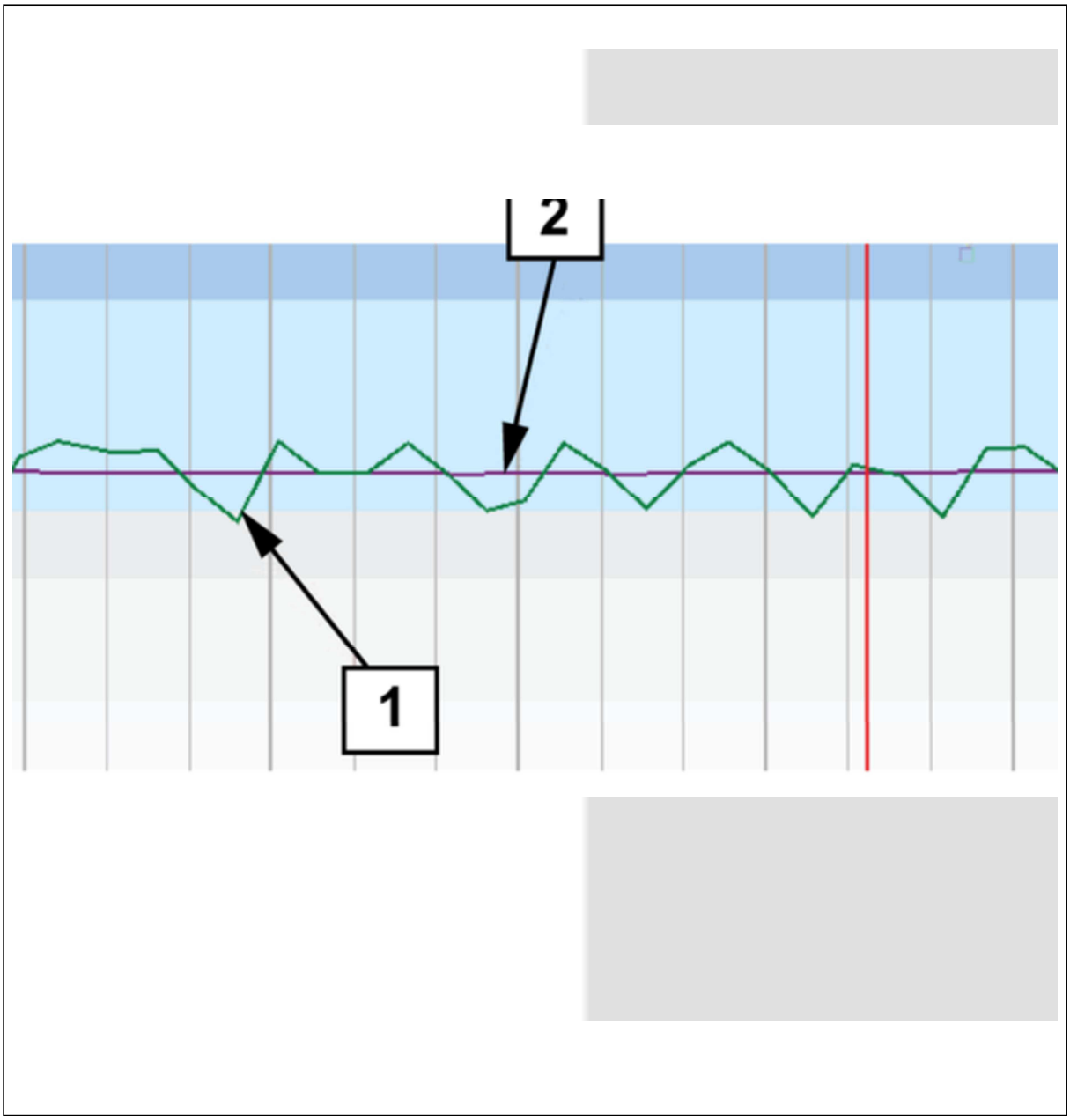


18.a Yes; Go to step 19.

Note : See examples of erratic pressure showing (1) ASL001 Rail pressure and (2) AS098 Desired rail pressure.

18.b No; Go to step 20.

19. Perform the Aerated Fuel test. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was fuel aerated?

19.a Yes; repair cause of aerated fuel. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" .

19.b No; replace the Quantity Control Valve. Refer to section "Removal of the Quantity Control Valve - Two-Filter System" .

20. Perform Pressure Limiting Valve Flow test. Refer to section "Pressure Limiting Valve Flow Test – Two-Filter Fuel System" . Did the PLV flow test pass?

20.a Yes; Go to step 21.

20.b No; replace the PLV. Refer to section "Removal of the Pressure Limiting Valve - Two-Filter System" .

21. Inspect the low pressure fuel system for leaks. Refer to section "FIS Low Pressure Leak Test" . Are leaks present?

21.a Yes; Go to step 22.

NOTICE

Prime fuel system prior to going to next step. Refer to section "Priming the Fuel System - KM63 GEN2 - Two-Filter System"

21.b No; repair as necessary. Refer to section "FIS Low Pressure Leak Test" .

22. Cap the rail at all six injector feed connections using J-48704 injector rail caps and crank the engine for 10 seconds. Does the ASL001 rail pressure reach AS098 desired rail pressure?

22.a Yes; Go to step 23.

22.b No; replace high pressure pump. Refer to section "Removal of the High Pressure Fuel Pump - Two-Filter System" .

23. With the injectors still capped after cranking engine for 10 seconds, does the rail pressure bleed down under 100 bar in less than five minutes?

23.a Yes; replace the high pressure fuel pump. Refer to section "Removal of the High Pressure Fuel Pump - Two-Filter System" .

23.b No; Go to step 24.

24. Using DL 8.03 or higher, navigate to Service Routines and Fuel System Integrity Check test and select Manual FSIC. Road test the truck. Does the code set?

24.a Yes; Go to step 25.

24.b No; replace fuel filters and release unit to customer.

25. Remove the MCM 120-pin connector. Inspect for damage including fuel, water corrosion or bent terminals. Is damage found?

25.a Yes; repair as needed.

25.b No; Go to step 26.

26. Install a test MCM using the extension harness and test drive the truck. Does the code come active?

26.a Yes; install original MCM. Go to step 27.

26.b No; replace MCM and verify repair.

27. Inspect chassis fuel system for restrictions or debris. Refer to OEM procedures. Is there a chassis fuel system issue?

27.a Yes; identify source of issue and repair as necessary.

27.b No; replace fuel filters and release to customer.

SPN 157/FMI 16	
Description	Fuel Rail Pressure Too Low
Monitored Parameter	Rail Pressure
Typical Enabling Conditions	Fuel Rail Pressure desired - Fuel Rail Pressure Actual > 200 bar
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Eight Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One Minute)

The fault can occur due to the conditions listed below:

- External fuel leakage between the high pressure pump and fuel injectors
- Pressure limiting valve leakage (internal)
- Fuel filter integrity (loose caps, plugged filters)
- Fuel supply issues (fuel level, fuel aeration, leaking fuel lines, fuel restrictions)

- Intermittent loss of engine speed signal
- High pressure pump internal failure
- Fuel injector (amplifier or needle) leakage
- Fuel contamination
- Rail pressure sensor
- Motor Control Module (MCM)

Service Tools Used in the Procedure	
Tool Number	Description
J-48876	Test Gauge, Primer Port, HDE
J-48704	Caps, HP Fuel Rail, HDE
	DiagnosticLink

Note : It is important to obtain information from the customer on when the check engine lamp occurs and if there were any performance concerns or exhaust smoke.

Check as follows:

1. Did SPN 157/FMI 16 appear after the fuel system was repaired or fuel filter maintenance was performed?
   1.a Yes; the code may be set due to air in the fuel system. Clear codes and road test to verify complaint. If code does not set, release the vehicle. If code sets, Go to step 2.
   1.b No; Go to step 2.
2. Turn the ignition ON (key ON, engine OFF).
3. Check and record fuel level using parameter AS044 Fuel Tank Level. Is the fuel level under ¼ tank (25%)?
   3.a Yes; add fuel and road test vehicle. If code does not become active during road test, release the truck. If the code becomes active during the road test with over ¼ tank (25%) of fuel, Go to step 5.
   3.b No; Go to step 4.
4. Check fuel tank level in extended fault code data. Was fuel tank level over ¼ tank (25%) when the code logged?
   4.a Yes; Go to step 5.
   4.b No; fuel sloshing in the tank may have caused aerated fuel and set this code. Road test vehicle. If code does not come active during road test, release the truck. If code does come active, Go to step 5.
5. Check for fuel contamination, including Diesel Exhaust Fluid (DEF), water, gasoline, kerosene, or coolant. Is any contamination found?
   5.a Yes; refer to "Contaminated Fluids" in this manual.
   5.b No; Go to step 6.
6. Visually inspect for external fuel leaks on the engine and on the chassis. Are any leaks found?
   6.a Yes; repair leak. Refer to section "Verify Repairs" .
   6.b No; Go to step 7.
7. Using DL 8.03 or higher, check for other active codes. Are any of the following codes active?
   7.a Yes; perform the associated diagnostics first:

- SPN 94/FMI 15 Fuel Filter Plugged
- SPN 94/FMI 16 Fuel Filter Plugged
- SPN 97/FMI 15 Water in the Fuel
- SPN 157/FMI 1 Rail Pressure too High
- SPN 164/FMI (All) Rail Pressure Sensor Faults
- SPN 174/FMI 0 Fuel Temperature too High

- SPN 679/FMI 7 PLV Stuck Open
- SPN 723/FMI (all) Cam Sensor Codes
- SPN 636/FMI (all) Crank Sensor Codes
- SPN 1077/FMI 5, 6 or 14

7.b If only SPN 1077/7, 157/16 or 1077/31 is present, Go to step 8.

Note : Do not reset this counter unless the PLV is being replaced.

8. Using DL 8.03 or higher, check the value of Pressure Limiting Valve (PLV) openings. With key ON, engine OFF, select the Actions tab in the top tool bar. Select Fuel System, then Pressure Limiting Valve (PLV) Change or view (RPG_CTR_PLV_OPEN) under "Extended Data Record #5" list. View and record the PLV open counts. Is the counter greater than 50?

   8.a Yes; replace the PLV. Refer to section "Removal of the Pressure Limiting Valve - Two-Filter System" . Verify repairs. Refer to section "Verify Repairs" .

   8.b No; Go to step 9.

Note : Engines not equipped with a Low Pressure Pump Outlet (LPPO) sensor should utilize J-48876 Test Gauge, Priming Port to monitor LPPO.

9. Perform Automatic Fuel System Integrity Check (FSIC) routine using DL 8.03 or higher. With the ignition ON (key ON, engine OFF) start the Automatic FSIC. The software/tool will ask to start the engine when required. Once the engine is running, the software will have the engine enter and exit several engine operating conditions. Follow the on-screen instructions and key ON and OFF as necessary. Go to step 10.
10. Did the FSIC detect a leak?

    10.a Yes; perform the High Pressure Fuel System - Leak Test. Refer to section "High Pressure Fuel System - Leak Test - Two-Filter System " .

    10.b No; Go to step 11.

11. Did the rail pressure take longer than two minutes and thirty seconds to bleed down under 10 bar?

    11.a Yes; perform the idle speed balance test to attempt to identify a faulty injector. Refer to section "Idle Speed Balance Test" .

    11.b No; Go to step 12.

12. Does Kw/Nw show/stay "ON / Enabled / True" while the engine is running during the Automatic FSIC routine?

    12.a Yes; Go to step

    12.b No; Refer to section "SPN 723/FMI 10 - GHG17" .

13. At 600 rpm, is ASL003 Fuel Compensation Pressure between 586 kPa (85 psi) and 6 kPa (100 psi)?

    13.a Yes; Go to step 15.

    13.b No; Go to step 14.

14. Monitor AS124 LPPO sensor (if equipped) or use manual gauge J-48706. Is the pressure between 496 kPa (72 psi) and 551 kPa (80 psi) at 600 rpm and 689 kPa (100 psi) to 869 kPa (126 psi) at 1800 rpm?

    14.a Yes; Go to step 15.

    14.b No; repair cause of incorrect fuel pressure.

15. Monitor AS124 LPPO (if equipped) and ASL003 Fuel Compensation Pressure at all engine speeds; are pressures stable with no oscillations? Unstable pressures will have oscillations greater than 1.5 psi at stable engine speed.

    15.a Yes; Go to step 16.

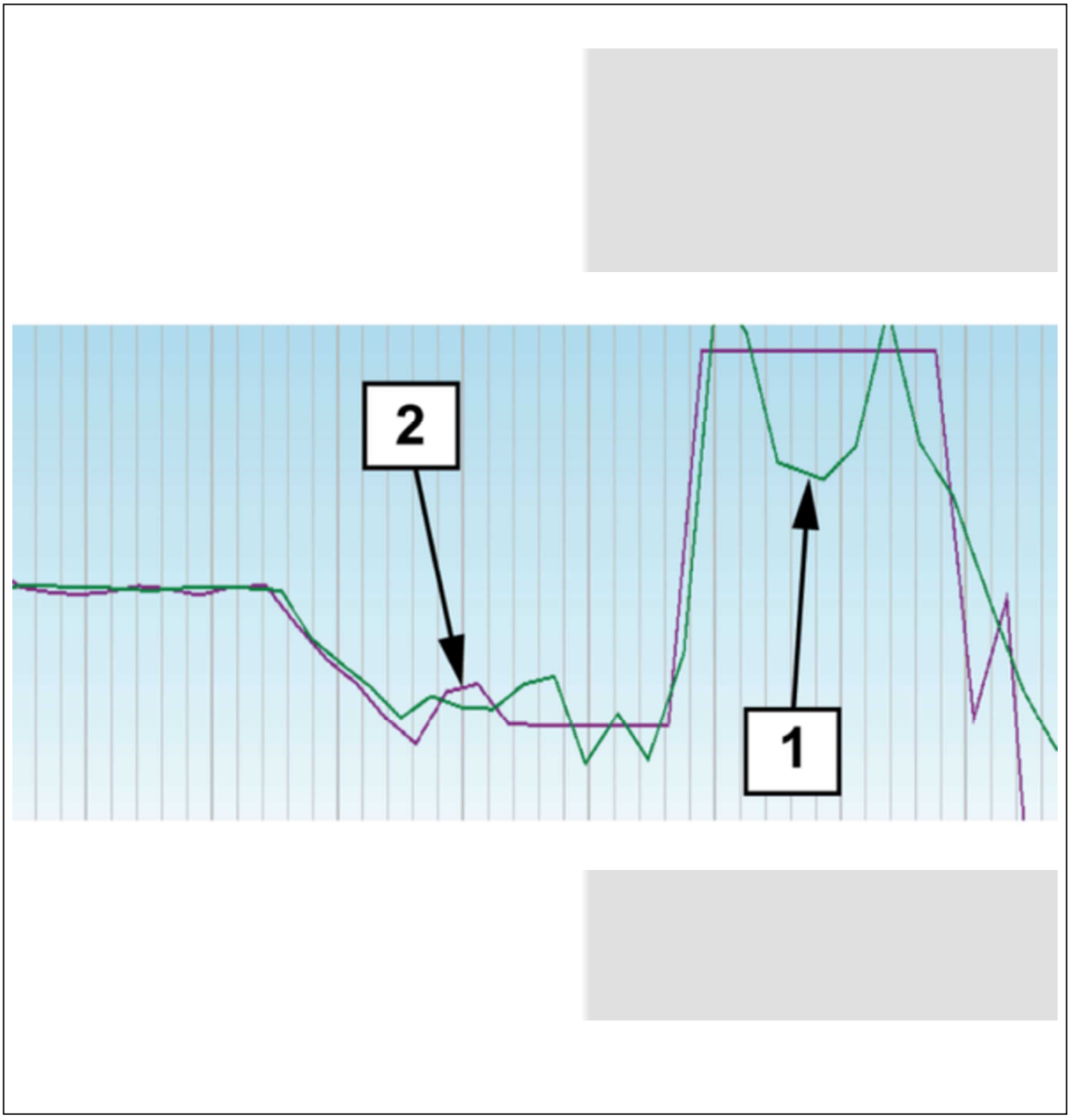
    15.b No; Refer to section "Aerated Fuel Test – Two-Filter Fuel System" .

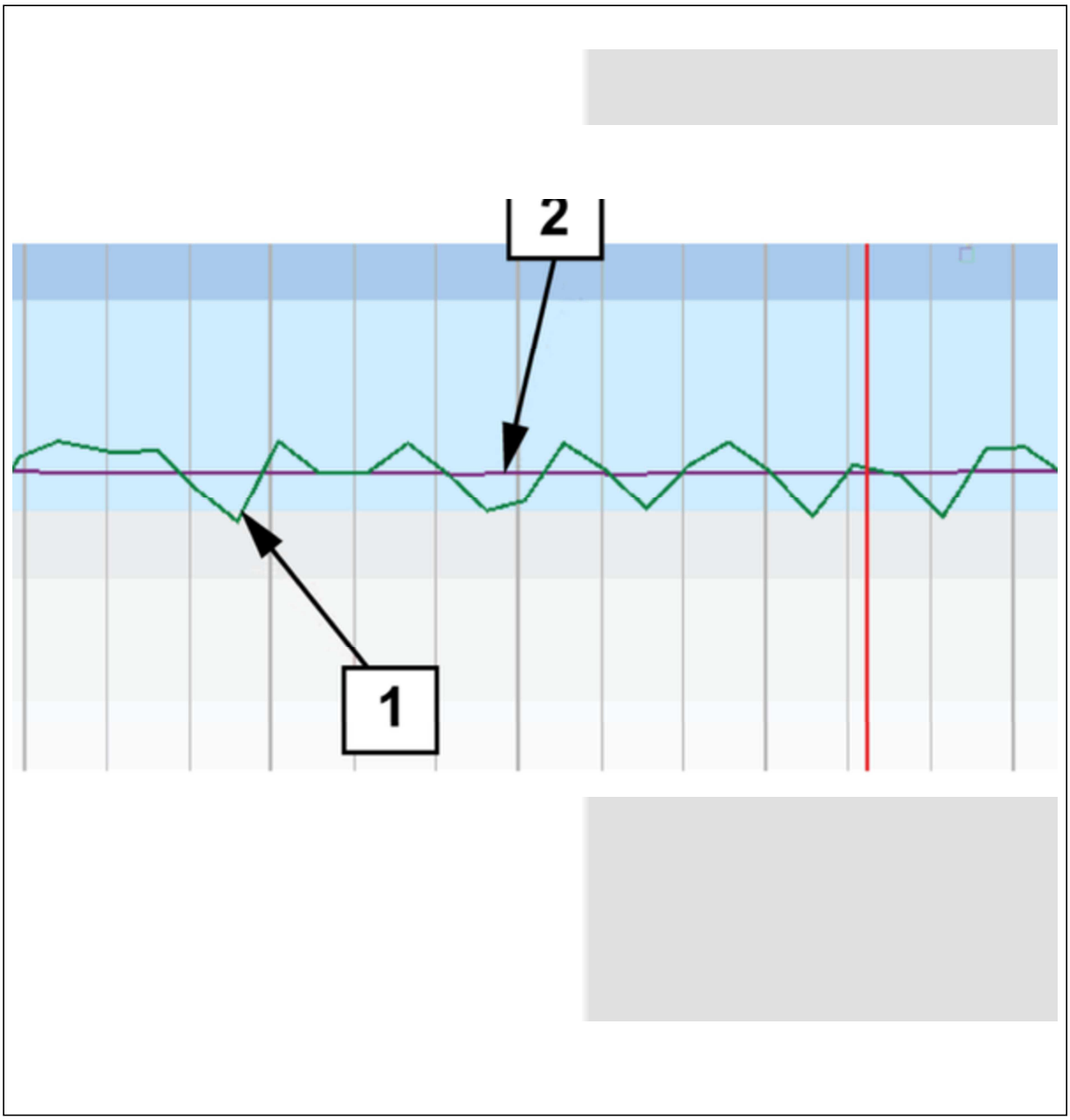
16. Check the Idle Speed Balance (ISB) values. Refer to section "Idle Speed Balance Test" . Are there any cylinders above 70% or below -70%?

    16.a Yes; follow repair procedures in "Idle Speed Balance (ISB) Test" and verify repairs. Refer to section "Verify Repairs" .

    16.b No; Go to step 17.

17. Is ASL001 Rail Pressure erratic or does it have a saw tooth pattern?





17.a Yes; Go to step 18.

Note : See examples of erratic pressure showing (1) ASL001 Rail pressure and (2) AS098 Desired rail pressure.

17.b No; Go to step 19.

18. Perform the Aerated Fuel test. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was fuel aerated?

18.a Yes; repair cause of aerated fuel. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" .

18.b No; replace the Quantity Control Valve. Refer to section "Removal of the Quantity Control Valve - Two-Filter System" .

19. Perform Pressure Limiting Valve Flow test. Refer to section "Pressure Limiting Valve Flow Test – Two-Filter Fuel System" . Did the PLV flow test pass?

19.a Yes; Go to step 20.

19.b No; replace the PLV. Refer to section "Removal of the Pressure Limiting Valve - Two-Filter System" .

20. Inspect the low pressure fuel system for leaks. Refer to section "FIS Low Pressure Leak Test" . Are leaks present?

20.a Yes; Go to step 21.

NOTICE

Prime fuel system prior to going to next step. Refer to section "Priming the Fuel System - KM63 GEN2 - Two-Filter System"

20.b No; repair as necessary. Refer to section "FIS Low Pressure Leak Test" .

21. Cap the rail at all six injector feed connections using J-48704 injector rail caps and crank the engine for 10 seconds. Does the ASL001 rail pressure reach AS098 desired rail pressure?

21.a Yes; Go to step 22.

21.b No; replace high pressure pump. Refer to section "Removal of the High Pressure Fuel Pump - Two-Filter System" .

22. With the injectors still capped after cranking engine for 10 seconds, does the rail pressure bleed down under 100 bar in less than five minutes?

22.a Yes; replace the high pressure fuel pump. Refer to section "Removal of the High Pressure Fuel Pump - Two-Filter System" .

22.b No; Go to step 23.

23. Using DL 8.03 or higher, navigate to Service Routines and Fuel System Integrity Check test and select Manual FSIC. Road test the truck. Does the code set?

23.a Yes; Go to step 24.

23.b No; replace fuel filters and release unit to customer.

24. Remove the MCM 120-pin connector. Inspect for damage including fuel, water corrosion or bent terminals. Is damage found?

24.a Yes; repair as needed.

24.b No; Go to step 25.

25. Install a test MCM using the extension harness and test drive the truck. Does the code come active?

25.a Yes; install original MCM. Go to step 26.

25.b No; replace MCM and verify repair.

26. Inspect chassis fuel system for restrictions or debris. Refer to OEM procedures. Is there a chassis fuel system issue?

26.a Yes; identify source of issue and repair as necessary.

26.b No; replace fuel filters and release to customer.

61.4 SPN 157/FMI 17 - GHG17

SPN 157/FMI 17 - GHG17	
Description	Minimum Rail Pressure For Injection Not Achieved
Monitored Parameter	Fuel Rail Pressure
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	MIL
Typical Duration	DD13 - 90 Seconds of Cranking
	DD15 - 60 Seconds of Cranking
	DD16 - 60 Seconds of Cranking
Dash Lamps	MIL
Engine Reaction	None
Verification	Turn the ignition on.
	Clear codes using DiagnosticLink®.
	Start the engine.
	Check for codes.

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

Check as follows:

The Motor Control Module (MCM) monitors the fuel rail pressure and when fuel rail pressure does not reach a minimum 150 bar within three cranking cycles, the MCM sets the code. One cranking cycle for the DD13 is 30 seconds. One cranking cycle for the DD15 and DD16 is 20 seconds. This fault can occur due to the conditions listed below:

- Fuel Filter Integrity (Loose Caps, Plugged Filters)
- Fuel Supply Issues (Fuel Level, Fuel Aeration, Leaking Fuel Lines, Fuel Restrictions)
- High Pressure Pump Internal Failure
- Fuel Contamination
- Rail Pressure Sensor

- Motor Control Module (MCM)

1. Check and record fuel level using parameter AS044 Fuel Tank Level. Is the fuel level under ¼ tank (25%)?
   1.a Yes; add fuel and road test vehicle. If code does not become active during road test, release the truck. If code becomes active during the road test with over ¼ tank of fuel, Go to step 3.
   1.b No; Go to step 2.
2. Check fuel tank level in the extended fault code data. Was fuel tank level over ¼ tank (25%) when the code logged?
   2.a Yes; Go to step 3.
   2.b No; fuel sloshing in the tank may have caused aerated fuel and set this code. Road test vehicle. If code does not come active during road test, release the truck. If code does come active, Go to step 3.
3. Did SPN 157/FMI 17 set after the fuel system was repaired, fuel filter maintenance was performed or the vehicle was run out of fuel?
   3.a Yes; the code may have set due to air in the fuel system. Clear the codes and road test the vehicle. If the code does not reset, release the vehicle to the customer.
   3.b No; Go to step 4.
4. Check for any external fuel leaks. Are there any external fuel leaks present?
   4.a Yes; repair the fuel leaks as necessary. Verify repair.
   4.b No; Go to step 5.
5. Connect DiagnosticLink and check for other codes. Are there other codes present?
   5.a Yes; diagnose the other codes that are present. Verify repair.
   5.b No; Go to step 6.
6. Does the vehicle exhibit a no start or hard start concern?
   6.a Yes;

   Refer to section "Hard Start/No Start - Two-Filter Fuel System (This Test Must Be Done First)" .
   6.b No; Go to step 7.
7. Clear the code and start the engine. Does the SPN 157/FMI 17 become active?
   7.a Yes; Install a test MCM and restart the engine. If the code is no longer present, install a new MCM.
   7.b No; inform the customer that the fault was set due to a hard start or no start condition. Return the vehicle to the customer.

SPN 157/FMI 17 - GHG17	
Description	Minimum Rail Pressure For Injection Not Achieved
Monitored Parameter	Fuel Rail Pressure
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	MIL
Typical Duration	DD13 - 90 Seconds of Cranking
	DD15 - 60 Seconds of Cranking
	DD16 - 60 Seconds of Cranking
Dash Lamps	MIL
Engine Reaction	None
Verification	Turn the ignition on.
	Clear codes using DiagnosticLink®.
	Start the engine.
	Check for codes.

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

Check as follows:

The Motor Control Module (MCM) monitors the fuel rail pressure and when fuel rail pressure does not reach a minimum 150 bar within three cranking cycles, the MCM sets the code. One cranking cycle for the DD13 is 30 seconds. One cranking cycle for the DD15 and DD16 is 20 seconds. This fault can occur due to the conditions listed below:

- Fuel Filter Integrity (Loose Caps, Plugged Filters)
- Fuel Supply Issues (Fuel Level, Fuel Aeration, Leaking Fuel Lines, Fuel Restrictions)
- High Pressure Pump Internal Failure
- Fuel Contamination
- Rail Pressure Sensor
- Motor Control Module (MCM)

1. Check and record fuel level using parameter AS044 Fuel Tank Level. Is the fuel level under ¼ tank (25%)?
   - 1.a Yes; add fuel and road test vehicle. If code does not become active during road test, release the truck. If code becomes active during the road test with over ¼ tank of fuel, Go to step 3.
   - 1.b No; Go to step 2.
2. Check fuel tank level in the extended fault code data. Was fuel tank level over ¼ tank (25%) when the code logged?
   - 2.a Yes; Go to step 3.
   - 2.b No; fuel sloshing in the tank may have caused aerated fuel and set this code. Road test vehicle. If code does not come active during road test, release the truck. If code does come active, Go to step 3.
3. Did SPN 157/FMI 17 set after the fuel system was repaired, fuel filter maintenance was performed or the vehicle was run out of fuel?
   - 3.a Yes; the code may have set due to air in the fuel system. Clear the codes and road test the vehicle. If the code does not reset, release the vehicle to the customer.
   - 3.b No; Go to step 4.
4. Check for any external fuel leaks. Are there any external fuel leaks present?
   - 4.a Yes; repair the fuel leaks as necessary. Verify repair.
   - 4.b No; Go to step 5.

5. Connect DiagnosticLink and check for other codes. Are there other codes present?
   - 5.a Yes; diagnose the other codes that are present. Verify repair.
   - 5.b No; Go to step 6.
6. Does the vehicle exhibit a no start or hard start concern?
   - 6.a Yes;

     Refer to section "Hard Start/No Start - Two-Filter Fuel System (This Test Must Be Done First)" .
   - 6.b No; Go to step 7.
7. Clear the code and start the engine. Does the SPN 157/FMI 17 become active?
   - 7.a Yes; Install a test MCM and restart the engine. If the code is no longer present, install a new MCM.
   - 7.b No; inform the customer that the fault was set due to a hard start or no start condition. Return the vehicle to the customer.

61.5 SPN 157/FMI 18 - GHG17

Fault of the Fuel Rail Pressure Sensor, Wiring or Quantity Control Valve

The motor control module (MCM) monitors the fuel rail pressure and when fuel rail pressure deviation is greater than 200 bar higher than requested fuel rail pressure for eight seconds, the MCM sets the code. This fault can occur due to the conditions listed below:

- Faulty fuel rail pressure sensor
- Faulty Quantity Control Valve (QCV)
- Faulty MCM
- Faulty wiring

SPN 157/FMI 18	
Description	Fuel Rail Pressure High
Monitored Parameter	Fuel Rail Pressure
Typical Enabling Conditions	Closed Loop & Actual RP greater than 200 Bar of Desired RP
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	8 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Steady Engine rpm 1400 - 1500 (2 minute)

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink , check for multiple codes.
   - 2.a If additional codes (with the exception of DPF codes) are present along with SPN 157/FMI 18, service the additional codes first.
   - 2.b If only SPN 157/FMI 18 is present, Go to step 3.
3. Check actual fuel rail pressure (key ON, engine OFF).
   - 3.a If actual fuel rail pressure is greater than 5 bar, Go to step 4.
   - 3.b If actual rail pressure is less than 5 bar, Go to step 5.
4. Remove the fuel rail pressure sensor and reconnect the sensor to the harness. Refer to section "Removal of the Fuel Rail Pressure Sensor" . Is the fuel rail pressure sensor reading greater than 5 bar with sensor removed from rail?
   - 4.a Yes; replace the fuel rail pressure sensor. Refer to section "Installation of the Fuel Rail Pressure Sensor" .
   - 4.b No; install the removed fuel rail pressure sensor. Refer to section "Installation of the Fuel Rail Pressure Sensor" . Go to step 5.
5. Perform the Fuel System Integrity Check (FSIC) test using DDDL 7.X.
6. Is the actual fuel rail pressure (ASL001) 200 bar higher than the desired rail pressure (AS098) at any point during the FSIC test?
   - 6.a Yes; replace the quantity control valve.

     Refer to section "Removal of the Quantity Control Valve - Two-Filter System" .
   - 6.b No; the deviation is less than 200 bar, Go to step 7.
7. Does the fuel rail pressure bleed down below 5 bar after the test is complete?
   - 7.a Yes; fuel rail pressure is below 5 bar. Check the fuel rail pressure sensor connector and 120-pin connector for corrosion. If OK, replace the fuel rail pressure sensor. Refer to section "Removal of the Fuel Rail Pressure Sensor" .
   - 7.b No; fuel rail pressure will not drop below 5 bar. Contact the Customer Support Center (CSC).

Fault of the Fuel Rail Pressure Sensor, Wiring or Quantity Control Valve

The motor control module (MCM) monitors the fuel rail pressure and when fuel rail pressure deviation is greater than 200 bar higher than requested fuel rail pressure for eight seconds, the MCM sets the code. This fault can occur due to the conditions listed below:

- Faulty fuel rail pressure sensor
- Faulty Quantity Control Valve (QCV)
- Faulty MCM
- Faulty wiring

SPN 157/FMI 18	
Description	Fuel Rail Pressure High
Monitored Parameter	Fuel Rail Pressure
Typical Enabling Conditions	Closed Loop & Actual RP greater than 200 Bar of Desired RP
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	8 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Steady Engine rpm 1400 - 1500 (2 minute)

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink , check for multiple codes.
   - 2.a If additional codes (with the exception of DPF codes) are present along with SPN 157/FMI 18, service the additional codes first.
   - 2.b If only SPN 157/FMI 18 is present, Go to step 3.
3. Check actual fuel rail pressure (key ON, engine OFF).
   - 3.a If actual fuel rail pressure is greater than 5 bar, Go to step 4.
   - 3.b If actual rail pressure is less than 5 bar, Go to step 5.
4. Remove the fuel rail pressure sensor and reconnect the sensor to the harness. Refer to section "Removal of the Fuel Rail Pressure Sensor" . Is the fuel rail pressure sensor reading greater than 5 bar with sensor removed from rail?
   - 4.a Yes; replace the fuel rail pressure sensor. Refer to section "Installation of the Fuel Rail Pressure Sensor" .
   - 4.b No; install the removed fuel rail pressure sensor. Refer to section "Installation of the Fuel Rail Pressure Sensor" . Go to step 5.
5. Perform the Fuel System Integrity Check (FSIC) test using DDDL 7.X.
6. Is the actual fuel rail pressure (ASL001) 200 bar higher than the desired rail pressure (AS098) at any point during the FSIC test?
   - 6.a Yes; replace the quantity control valve.

     Refer to section "Removal of the Quantity Control Valve - Two-Filter System" .
   - 6.b No; the deviation is less than 200 bar, Go to step 7.
7. Does the fuel rail pressure bleed down below 5 bar after the test is complete?
   - 7.a Yes; fuel rail pressure is below 5 bar. Check the fuel rail pressure sensor connector and 120-pin connector for corrosion. If OK, replace the fuel rail pressure sensor. Refer to section "Removal of the Fuel Rail Pressure Sensor" .
   - 7.b No; fuel rail pressure will not drop below 5 bar. Contact the Customer Support Center (CSC).

SPN 158 (CPC) (GHG17)

62.1 SPN 158/FMI 2 – GHG17

SPN 158/FMI 2	
Description	Ignition Switch Status of CPC and MCM Do Not Match
Monitored Parameter	Ignition Switch
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON

1. Connect to DiagnosticLink®.

> **⚠ WARNING**
>
> PERSONAL INJURY
>
> Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

> **⚠ 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.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

2. Clear the fault code, cycle ignition switch and start the engine. Does SPN 158/FMI 2 become active after 10 seconds?
   - 2.a Yes; Go to step 3.
   - 2.b No; release the truck back to service.
3. Disconnect the Motor Control Module (MCM) 21-pin connector.
4. Turn the ignition ON (key ON, engine OFF).
5. Measure the voltage between pin 7 of the MCM 21-pin connector and ground. Is the voltage greater than 11.5 volts?
   - 5.a Yes; Go to step 6.
   - 5.b No; repair the cause of the low/no voltage to pin 7 of the MCM 21-pin connector.

6. Turn the ignition OFF.
7. Disconnect the Common Powertrain Controller (CPC) connector #2.
8. Turn the ignition ON (key ON, engine OFF).
9. Measure the voltage between pin 3 of the CPC connector #2 and ground. Is the voltage greater than 11.5 volts?

   9.a Yes; repeat this procedure. If the results are the same, replace the CPC. Refer to Original Equipment Manufacturer (OEM) procedures.

   9.b No; repair the cause of the low/no voltage to pin 3 of the CPC connector #2.

SPN 158 (MCM) (GHG17)

63.1 SPN 158/FMI 2 - GHG17

Ignition Switch Not Plausible

1. If SPN 158/FMI 2 is active, Go to step 3.

> **⚠ WARNING**
>
> PERSONAL INJURY
>
> Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

2. If SPN 158/FMI 2 is inactive, clear the fault code, cycle ignition switch and start the engine. Does SPN 158/FMI 2 become active after 10 seconds?
   - 2.a Yes; Go to step 3.
   - 2.b No; release the truck back to service.
3. Disconnect the Motor Control Module (MCM) 21-pin connector.
4. Turn the Ignition ON, (key ON, engine OFF).
5. Measure the voltage between pin 7 of the MCM 21-pin connector and ground. Is the voltage greater than 11.5 volts?
   - 5.a Yes; Go to step 6.
   - 5.b No; repair the cause of the low/no voltage to pin 7.
6. Turn the Ignition OFF.
7. Disconnect the Common Powertrain Controller (CPC) connector #2.
8. Turn the Ignition ON (key ON, engine OFF).
9. Measure the voltage between pin 3of the CPC connector #2 and ground. Is the voltage greater than 11.5 volts?
   - 9.a Yes; repeat this procedure. If the results are the same, replace the MCM. Refer to section "Removal of the Motor Control Module" .
   - 9.b No; repair the cause of the low/no voltage to pin 3 of the CPC connector #2.

SPN 164 (MCM) (GHG17)

64.1 SPN 164/FMI 2 - GHG17

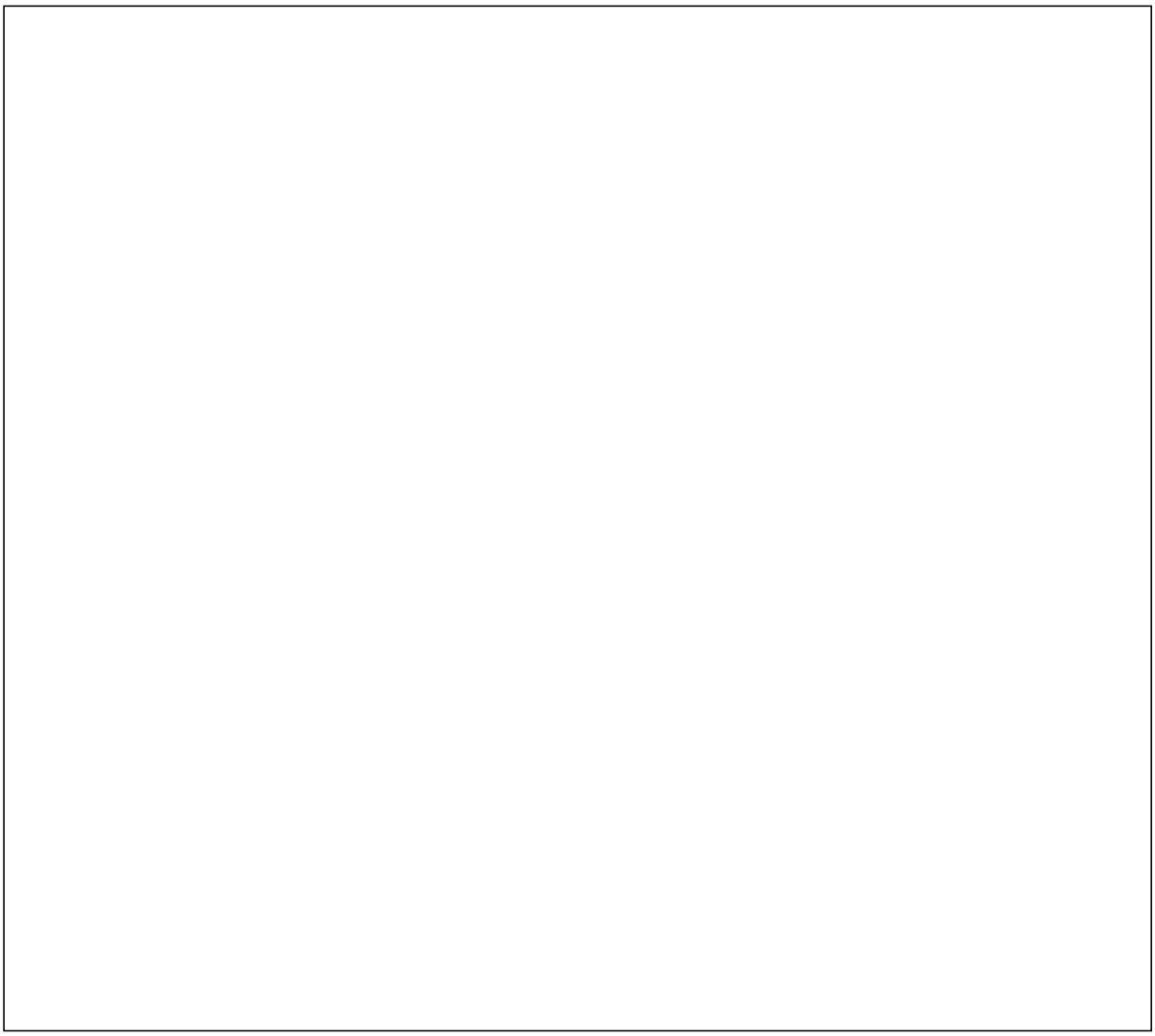
SPN 164/FMI 2	
Description	Fuel Rail Pressure Drift High
Monitored Parameter	Fuel Rail Pressure
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)

Check as follows:

1. Disconnect the fuel rail pressure sensor.
2. Inspect the fuel rail pressure harness connector and sensor housing for signs of damage: bent, spread, broken corroded or unseated (pushed out) pins or wire damage near the connector. Is damage present?
   - 2.a Yes; repair as needed.
   - 2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pins 1 and 3 of the fuel rail pressure sensor harness connector. Is the voltage between 4.5 and 5.5 volts?
   - 4.a Yes; Go to step 6.
   - 4.b No; Go to step 5.
5. Measure the voltage between pin 3 of the fuel rail pressure sensor harness connector and battery ground. Is the voltage between 4.5 and 5.5 volts?
   - 5.a Yes; repair the wire between pin 1 of the fuel rail pressure sensor harness connector and pin 120 of the MCM 120-pin connector.
   - 5.b No; repair the wire between pin 3 of the fuel rail pressure sensor harness connector and pin 58 of the MCM 120-pin harness connector.
6. Turn the ignition OFF.
7. Disconnect the MCM 120-pin harness connector.
8. Inspect the MCM 120-pin module connector housing and harness connector for signs of damage, bent, spread, broken, corroded or unseated (pushed out) pins or wire damage near the connector. Is damage present?
   - 8.a Yes; repair as necessary.
   - 8.b No; Go to step 9.
9. Measure the resistance between pin 2 of the fuel rail pressure sensor harness connector and pin 78 of the MCM 120-pin harness connector. Is the resistance less than five ohms?
   - 9.a Yes; Go to step 10.
   - 9.b No; repair the wire between pin 2 of the fuel rail pressure sensor harness connector and pin 78 of the MCM 120-pin harness connector.
10. Measure the resistance between pin 1 of the fuel rail pressure sensor harness connector and pin 102 of the MCM 120-pin harness connector. Is the resistance less than five ohms?
    - 10.a Yes; Go to step 11.
    - 10.b No; repair the wire between pin 1 of the fuel rail pressure sensor harness connector and pin 102 of the MCM 120-pin harness connector.
11. Measure the resistance between pin 3 of the fuel rail pressure sensor harness connector and pin 58 of the MCM 120-pin harness connector. Is the resistance less than five ohms?
    - 11.a Yes; Go to step 12.
    - 11.b No; repair the wire between pin 3 of the fuel rail pressure sensor and pin 58 of the MCM 120-pin harness connector.
12. Reconnect the MCM 120-pin connector.
13. Turn the ignition ON (key ON, engine OFF).
14. Measure the voltage between pins 1 and 3 of the fuel rail pressure sensor harness connector. Is the voltage between 4.5 and 5.5 volts?
    - 14.a Yes; replace the Fuel Rail Pressure sensor. Refer to section "Removal of the Fuel Rail Pressure Sensor" .
    - 14.b No; repeat this procedure. If the results are the same, replace the MCM. Refer to section "Removal of the Motor Control Module" .

64.2 SPN 164/FMI 3 - GHG17

SPN 164/FMI 3	
Description	Fuel Rail Pressure Sensor Circuit Failed High
Monitored Parameter	Fuel Rail Pressure Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

1. Check for multiple codes. Are two or more of the following codes present SPN 2631/FMI 3, SPN 2630/FMI 3, SPN 164/FMI 3, or SPN 94/FMI 3?

1.a Yes; repair the open in the common ground wire from pin 102 of the MCM 120-pin harness connector to the respective sensor ground pin on the sensor connector. See above diagram.

1.b No; Go to step 2.

2. Disconnect the fuel rail pressure sensor connector.
3. Inspect the harness connector for signs of damage: bent, spread, corroded, broken or unseated (pushed out) pins, signs of water or oil intrusion and signs of wire damage near the connector. Is damage present?

3.a Yes; repair as needed.

3.b No; Go to step 4.

4. Turn the ignition ON (key ON, engine OFF).
5. Measure the voltage between pins 1 and 3 of the fuel rail pressure sensor harness connector. Is the voltage between 4.5 and 5.5 volts?

5.a Yes; Go to step 7.

5.b No; Go to step 6.

6. Measure the voltage between pin 3 of the fuel rail pressure sensor harness connector and battery ground. Is the voltage between 4.5 and 5.5 volts?

6.a Yes; repair the wire between pin 1 of the fuel rail pressure sensor harness connector and pin 102 of the MCM 120-pin connector.

6.b No; repair the wire between pin 3 of the fuel rail pressure sensor harness connector and pin 58 of the MCM 120-pin connector.

7. Turn the ignition OFF.
8. Disconnect the MCM 120-pin harness connector.
9. Inspect the MCM 120-pin module connector housing and harness connector for signs of damage: bent, spread, corroded, broken or unseated (pushed out) pins, sign of water or oil intrusion and signs of wire damage near the connector. Is damage present?

9.a Yes; repair as needed.

9.b No; Go to step 10.

10. Measure the resistance between pin 2 of the fuel rail pressure sensor harness connector and pin 78 of the MCM 120-pin harness connector. Is the resistance less than five ohms?

10.a Yes; Go to step 11.

10.b No; repair the wire between pin 2 of the fuel rail pressure sensor harness connector and pin 78 of the MCM 120-pin harness connector.

11. Reconnect the MCM 120-pin harness connector.
12. Turn the ignition ON (key ON, engine OFF).
13. Measure the voltage between pins 1 and 3 of the fuel rail pressure sensor harness connector. Is the voltage between 4.5 and 5.5 volts?

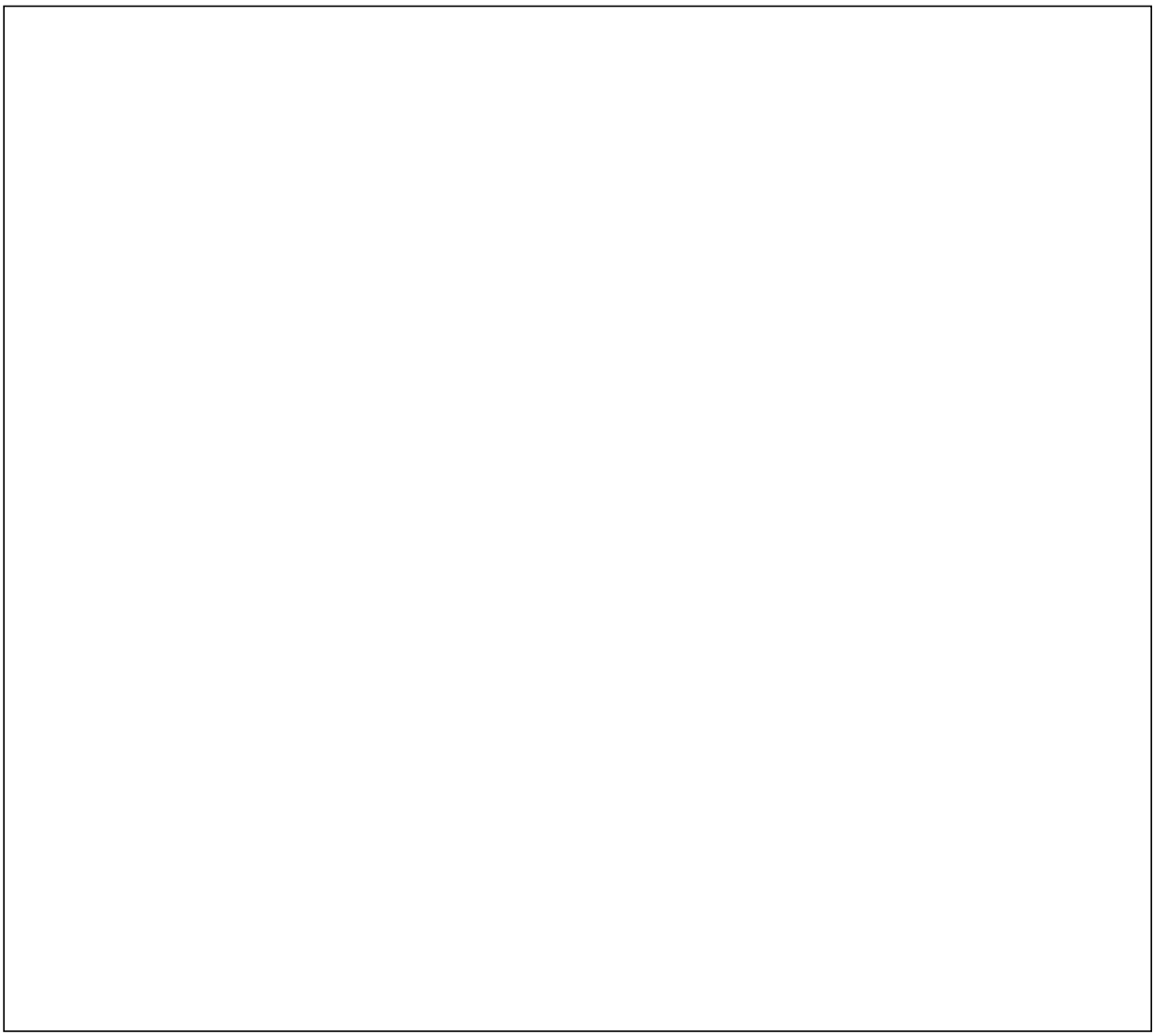
13.a Yes; replace the fuel rail pressure connector. Refer to section "Removal of the Fuel Rail Pressure Sensor" .

13.b No; repeat this procedure. If the results are the same, replace the MCM. Refer to section "Removal of the Motor Control Module" .

64.3 SPN 164/FMI 4 - GHG17

Note : Fault may be induced by low battery voltage.

SPN 164/FMI 4	
Description	Fuel Rail Pressure Sensor Circuit Failed Low
Monitored Parameter	Fuel Rail Pressure Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

1. Is battery voltage SPN 168/FMI (any) also present?

1.a Yes; repair battery voltage fault code.

1.b No; Go to step 2.

2. Disconnect the fuel rail pressure sensor connector.
3. Inspect the harness connector for signs of damage: bent, spread, broken, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is damage present?

3.a Yes; repair as necessary.

3.b No; Go to step 4.

4. Turn the ignition ON (key ON, engine OFF).
5. Measure the voltage between pins 1 and 3 of the fuel rail pressure sensor harness connector. Is the voltage between 4.5 and 5.5 volts?

5.a Yes; Go to step 7.

5.b No; Go to step 6.

6. Measure the voltage between pin 3 of the fuel rail pressure sensor harness connector and battery ground. Is the voltage between 4.5 and 5.5 volts?

6.a Yes; repair the wire between pin 1 of the fuel rail pressure sensor harness connector and pin 102 of the MCM 120- pin harness connector.

6.b No; repair the wire between pin 3 of the fuel rail pressure sensor harness connector and pin 58 of the MCM 120-pin harness connector.

7. Turn the ignition OFF.
8. Disconnect the MCM 120-pin harness connector.
9. Inspect the MCM 120-pin module connector housing and harness connector for signs of damage: bent, spread, corroded, broken or unseated (pushed out) pins, signs of water or oil intrusion and signs of wire damage near the harness connector. Is damage present?

9.a Yes; repair as necessary.

9.b No; Go to step 10.

10. Measure the resistance between pin 2 of the fuel rail pressure sensor and pin 78 of the MCM 120-pin harness connector. Is the resistance less than five ohms?

10.a Yes; Go to step 11.

10.b No; repair the wire between pin 2 of the fuel rail pressure sensor and pin 78 of the MCM 120-pin harness connector.

11. Measure the resistance between pin 2 of the fuel rail pressure sensor harness connector and battery ground. Is the resistance less than 10k ohms?

11.a Yes; repair the short to ground in the wire between pin 2 of the fuel rail pressure sensor and pin 78 of the MCM 120-pin harness connector.

11.b No; Go to step 12.

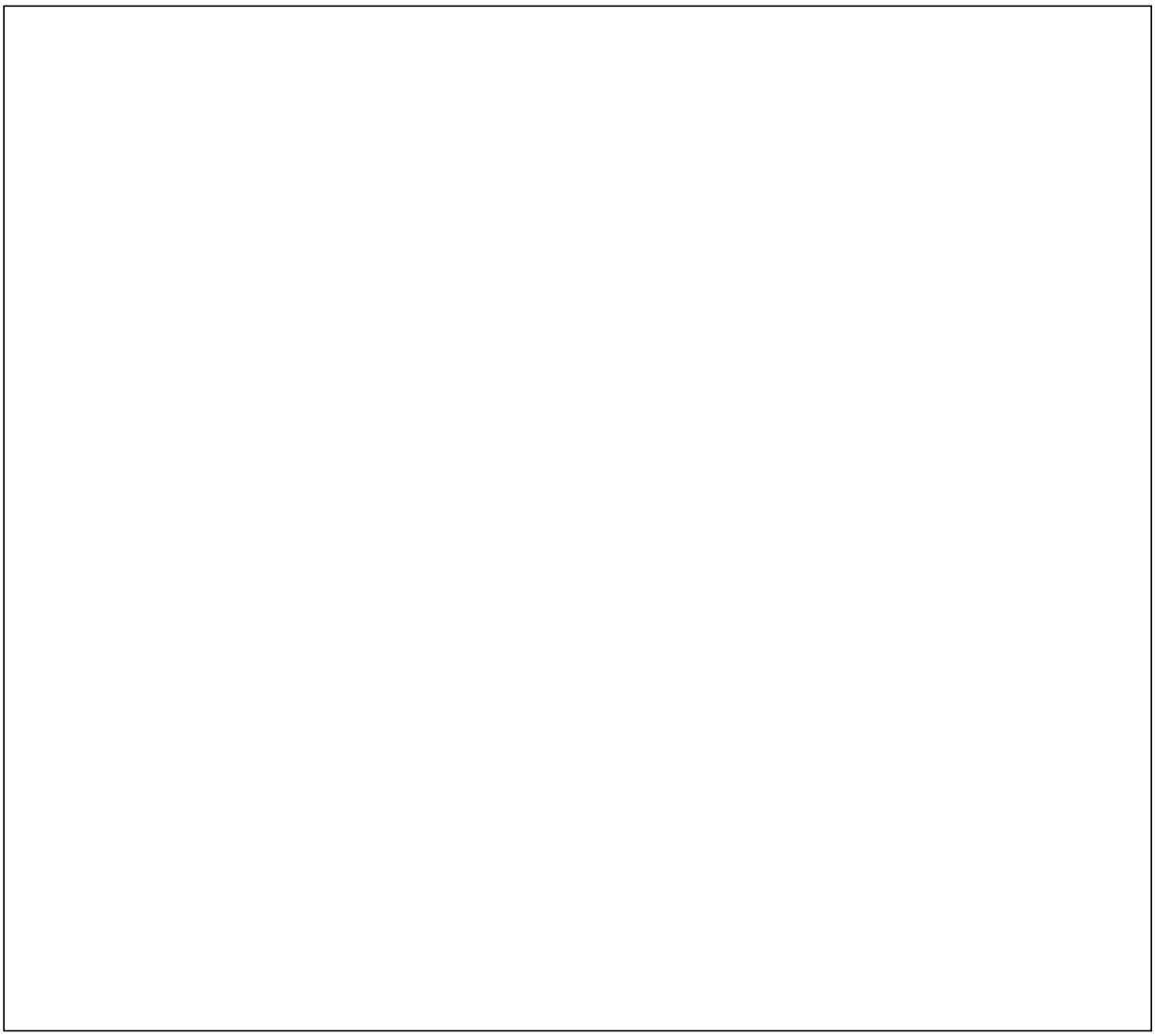
12. Reconnect the MCM 120-pin harness connector.
13. Turn the ignition ON (key ON, engine OFF).
14. Measure the voltage between pins 1 and 3 of the fuel rail pressure sensor harness connector. Is the voltage between 4.5 and 5.5 volts?

14.a Yes; replace the fuel rail pressure sensor. Refer to section "Removal of the Fuel Rail Pressure Sensor" .

14.b No; repeat this procedure. If the results are the same, replace the MCM. Refer to section "Removal of the Motor Control Module" .

64.4 SPN 164/FMI 5 - GHG17

SPN 164/FMI 5	
Description	Fuel Rail Pressure Sensor Circuit Failed Open
Monitored Parameter	Fuel Rail Pressure Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

1. Disconnect the fuel rail pressure sensor.
2. Inspect the harness connector for signs of damage: bent, spread, broken, corroded, or unseated (pushed out) pins or wire damage near the connector. Is damage present?

2.a Yes; repair as necessary.

2.b No; Go to step 3.

3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pins 1 and 3 of the fuel rail pressure sensor harness connector. Is the voltage between 4.5 and 5.5 volts?

4.a Yes; Go to step 6.

4.b No; Go to step 5.

5. Measure the voltage between pin 3 of the fuel rail pressure sensor harness connector and battery ground. Is the voltage between 4.5 and 5.5 volts?

5.a Yes; repair the wire between pin 1 of the fuel rail pressure sensor harness connector and pin 102 of the MCM 120-pin harness connector.

5.b No; repair the wire between pin 3 of the fuel rail pressure sensor harness connector and pin 58 of the MCM 120-pin harness connector.

6. Turn the ignition OFF.
7. Disconnect the MCM 120-pin connector.
8. Inspect the MCM 120-pin module connector housing and harness connector for signs of damage: bent, spread, broken, corroded or unseated (pushed out) pins, signs of water or oil intrusion and signs of wire damage near the harness connector. Is damage present?

8.a Yes; repair as necessary.

8.b No; Go to step 9.

9. Measure the resistance between pin 2 of the fuel rail pressure sensor harness connector and pin 78 of the MCM 120-pin harness connector. Is the resistance less than five ohms?

9.a Yes; Go to step 10.

9.b No; repair the wire between pin 2 of the fuel rail pressure sensor and pin 78 of the MCM 120-pin harness connector.

10. Reconnect the MCM 120-pin harness connector.
11. Turn the ignition ON (key ON, engine OFF).
12. Measure the voltage between pins 1 and 3 of the fuel rail pressure sensor harness connector. Is the voltage between 4.5 and 5.5 volts?

12.a Yes; replace the fuel rail pressure sensor. Refer to section "Removal of the Fuel Rail Pressure Sensor" .

12.b No; repeat this procedure. If the results are the same, replace the MCM. Refer to section "Removal of the Motor Control Module" .

64.5 SPN 164/FMI 15 - GHG17

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

The Motor Control Module (MCM) monitors the rail pressure and when rail pressure deviation is greater than 200 bar, while under a load, the MCM sets the code. This fault can occur due to the conditions listed below:

- External fuel leakage between the high pressure pump and fuel injectors
- Pressure Limiting Valve (PLV) leakage (internal)
- Fuel filter integrity (loose caps, plugged filters)
- Fuel supply issues (fuel level, fuel aeration, leaking fuel lines, fuel restrictions)
- Intermittent loss of engine speed signal
- High Pressure (HP) pump internal failure
- Fuel injector (amplifier or needle) leakage
- Fuel contamination
- Rail pressure sensor
- Motor Control Module (MCM)

Service Tools Used in the Procedure	
Tool Number	Description
J-48876	Test Gauge, Primer Port, HDE
J-48704	Caps, HP Fuel Rail, HDE
J-48706	Fuel Diagnostic Gauge Set LP, HDE
DiagnosticLink	

Note : It is important to obtain information from the customer about the check engine lamp occurrence and any performance concerns or exhaust smoke occurrence.

Check as follows:

1. Did SPN 157/FMI 16 or 520268/FMI 18 appear after the fuel system was repaired or fuel filter maintenance was performed?

1.a Yes; the code may be set due to air in the fuel system. Clear codes and road test to verify complaint. If code does not set, release the vehicle. If code sets, Go to step 2.

1.b No; Go to step 2.

2. Turn the ignition ON (key ON, engine OFF).

Note : Fuel tank level at the time the fault triggered can be viewed in extended data #5, “Enhanced Environmental Data” Fuel Tank Level.

3. Review fault code extended data. Was the fuel tank level below 25% when the fault triggered?

3.a Yes; make sure the fuel tank level is now above ¼ tank (25%). If not, add fuel and road test the vehicle. If code does not become active during road test, release the truck. If the code becomes active during the road test with over ¼ tank (25%) of fuel. Go to step 4.

3.b No; if the fuel level is over ¼ tank (25%), view fuel tank level in extended data (EPA10) or question the driver about the fuel level when the code was set. If the level was under ¼ tank (25%), fuel sloshing in the tank could be the cause of aerated fuel that could cause this code. If the fuel level was over ¼ tank (25%) when the code was set. Go to step 4.

4. Check for fuel contamination, including Diesel Exhaust Fluid (DEF), water, gasoline, kerosene, or coolant. Is fuel contaminated?

4.a Yes; refer to "Contaminated Fluids."

4.b No; Go to step 5.

5. Visually inspect for external fuel leaks on the engine and on the chassis. Are leaks present?

5.a Yes; repair leak and verify repair.

5.b No; Go to step 6.

6. Using DiagnosticLink, check for multiple codes. Are any of the below fault codes active?

- SPN 94/FMI 15 Fuel Filter Plugged
- SPN 94/FMI 16 Fuel Filter Plugged
- SPN 97/FMI 15 Water in the Fuel
- SPN 157/FMI 1 Rail Pressure too High.
- SPN 164/FMI (All) Rail Pressure Sensor Faults
- SPN 174/FMI 0 Fuel Temperature too High
- SPN 679/FMI 7 PLV Stuck Open
- SPN 723/FMI (All) Cam Sensor Codes
- SPN 636/FMI (All) Crank Sensor Codes
- SPN 1077/FMI 5, 6 or 14

6.a Yes; troubleshoot those codes first.

6.b No; Go to step 7.

Note : Do not reset this counter unless the PLV is being replaced.

7. Using DiagnosticLink, check the value of PLV openings. With key ON, engine OFF, select the Actions tab in the top tool bar. Select Fuel System and then Pressure Limiting Valve (PLV). Change or view (E2P_RPG_CTR_PLV_OPEN) under "Extended Data Record Number 5th" list. View and record the PLV open counts. Is the PLV counter greater than 50?

7.a Yes; replace the PLV. Refer to section "Removal of the Pressure Limiting Valve - Two-Filter System" .

7.b No; Go to step 8.

8. Perform the Automatic Fuel System Integrity Check (FSIC) routine using DiagnosticLink. With the ignition ON (key ON, engine OFF), start the Automatic FSIC. The software/tool will ask to start the engine when required. Once the engine is running, the software will have the engine enter and exit several engine operating conditions. Once the engine shuts down, leave the key on for five minutes. Disconnect DiagnosticLink and open the log file. The next part of the troubleshooting will require reviewing the FSIC log file.

9. Monitor rail pressure bleed-off time. Is the bleed-off time below 35 seconds?

9.a Yes; Refer to section "High Pressure Fuel System - Leak Test - Two-Filter System " .

9.b No; Go to step 10.

10. Was the bleed-off below two minutes and 30 seconds?

10.a Yes; Go to step 11.

10.b No; Refer to section "Idle Speed Balance Test" .

11. Does KW/NW show/stay "ON / Enabled / True" while the engine is running during the Automatic FSIC routine?

11.a Yes; Go to step 12.

11.b No; refer to troubleshooting for SPN 723/FMI 10.

12. Was the fuel temperature rise greater than 10 degrees?

12.a Yes; Go to step 14.

12.b No; Go to step 13.

13. At 600 rpm, is ASL003 Fuel Compensation Pressure within range per the fuel pressure chart? Refer to section "Normal Fuel System Pressures - Two-Filter System" .

13.a Yes; Go to step 15.

13.b No; Go to step 14.

14. Monitor AS124 LPPO sensor or use manual gauge J-48876 to measure priming port pressure. Is the pressure in range at 600 and 1800 rpm? Refer to section "Normal Fuel System Pressures - Two-Filter System" .

14.a Yes; Go to step 15.

14.b No; repair cause of incorrect fuel pressure. Refer to section "Normal Fuel System Pressures - Two-Filter System" .

15. Monitor AS124 LPPO (if equipped) and ASL003 Fuel Compensation Pressure at all engine speeds. Are the pressures stable with no oscillations greater than 1.5 psi at a steady rpm?

15.a Yes; Go to step 16.

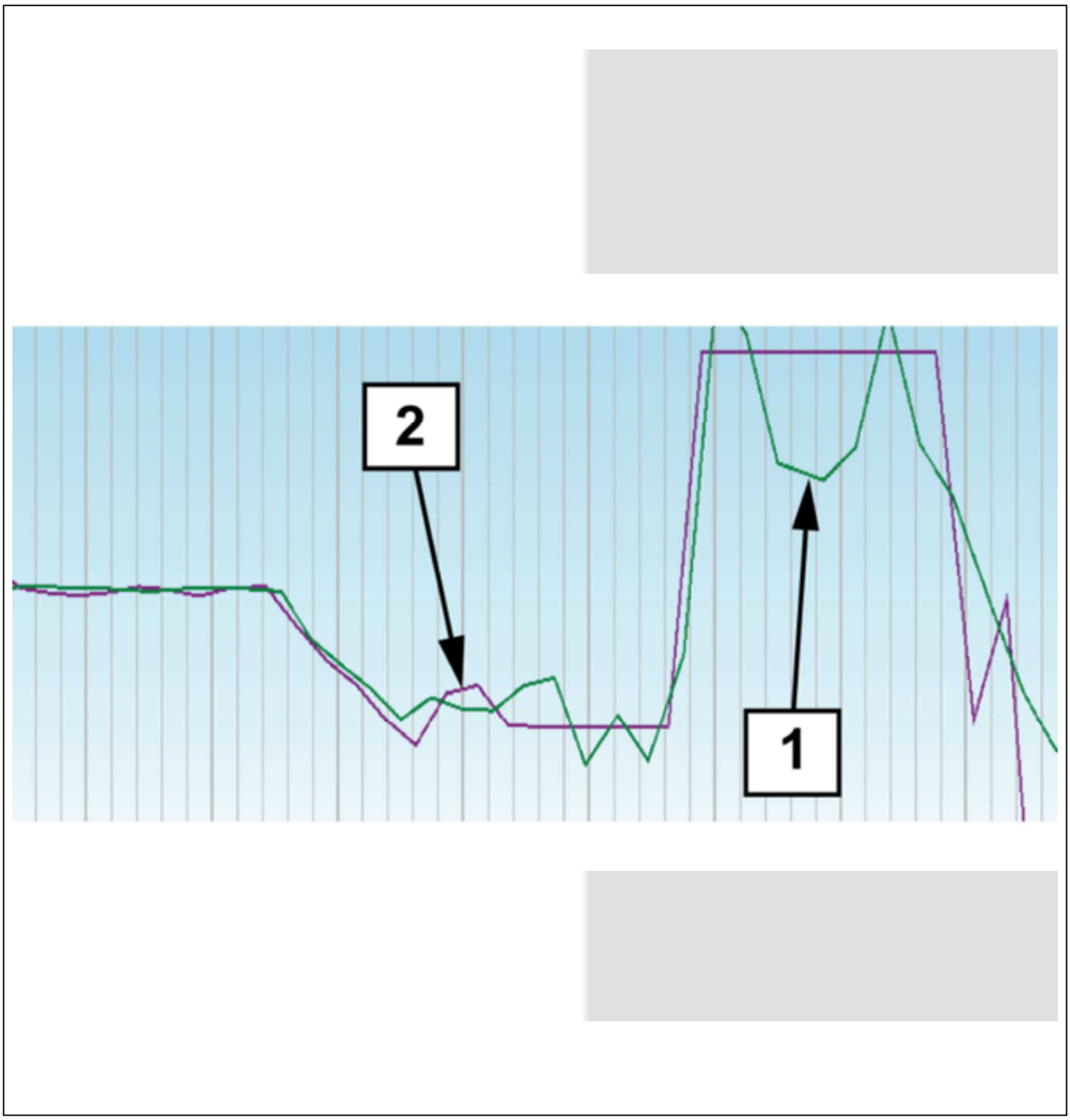
15.b No; Refer to section "Aerated Fuel Test – Two-Filter Fuel System" .

16. Check the Idle Speed Balance (ISB) values. Refer to section "Idle Speed Balance Test" . Are there any cylinders above 70% or below -70%?

16.a Yes; follow repair procedures in "Idle Speed Balance (ISB) test" and verify repairs.

16.b No; Go to step 17.

17. Is ASL001 Rail Pressure erratic or does it have a sawtooth pattern?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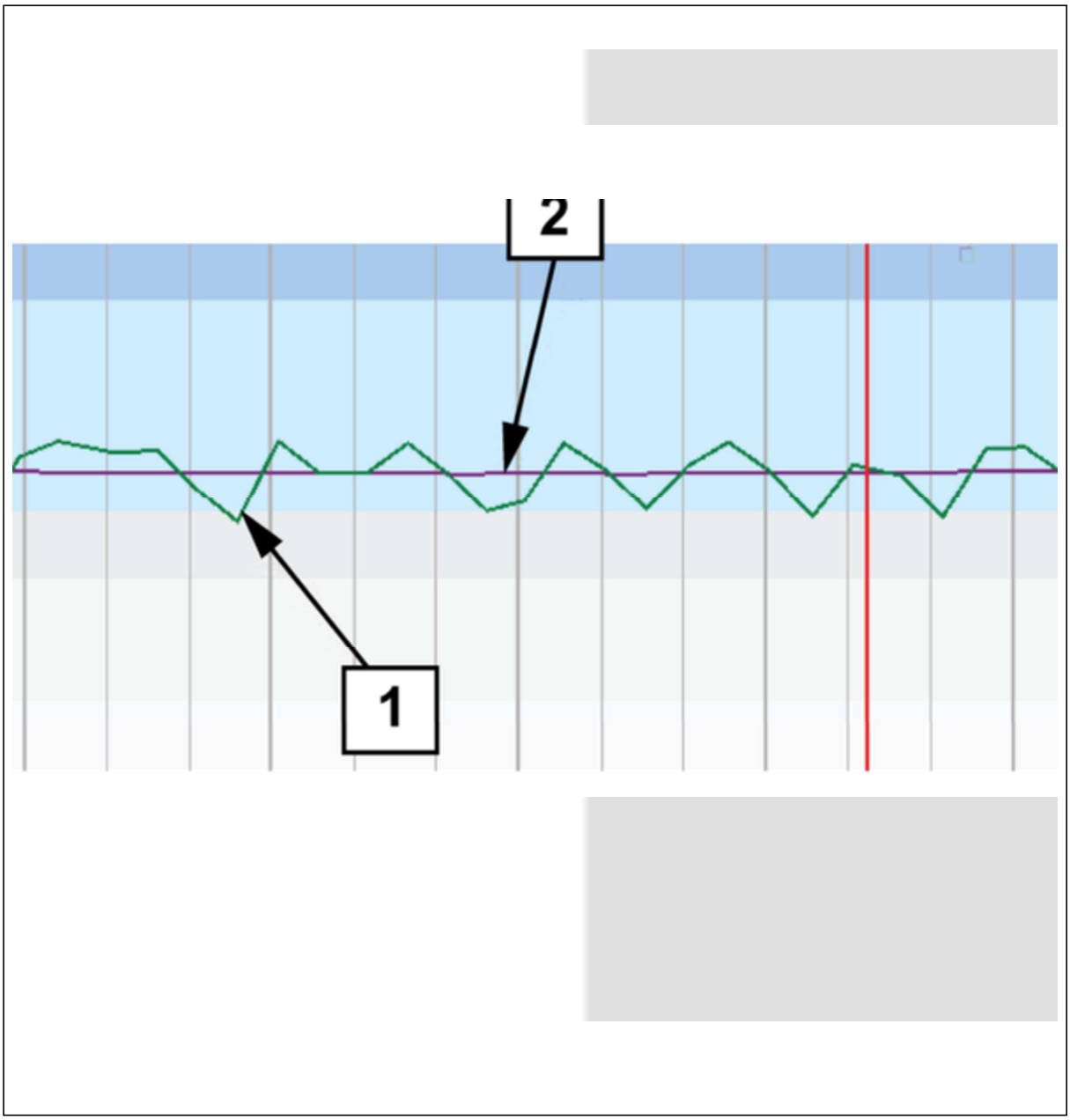


17.a Yes; Go to step 18.

Note : See examples of erratic pressure showing (1) ASL001 rail pressure and (2) AS098 desired rail pressure.

17.b No; Go to step 19.

18. Perform the aerated fuel test. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was fuel aerated?

18.a Yes; repair cause of aerated fuel. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" .

18.b No; replace the Quantity Control Valve. Refer to section "Removal of the Quantity Control Valve - Two-Filter System" .

19. Perform PLV flow test. Refer to section "Pressure Limiting Valve Flow Test – Two-Filter Fuel System" . Did the PLV flow test pass?

19.a Yes; Go to step 20.

19.b No; replace the PLV. Refer to section "Removal of the Pressure Limiting Valve - Two-Filter System" .

20. Inspect the low pressure fuel system for leaks. Refer to section "FIS Low Pressure Leak Test" . Are leaks present?

20.a Yes; repair as necessary. Refer to section "FIS Low Pressure Leak Test" .

20.b No; Go to step 21.

Note : Prime fuel system prior to going to next step.System PrimingRefer to section "Priming the Fuel System - KM63 GEN2 - Two-Filter System"Refer to section "Priming the Fuel System - KM59 GEN1 - Two-Filter System"

21. Cap the rail at all six injector feed connections using J-48704 injector rail caps and crank the engine for 10 seconds. Does the ASL001 rail pressure reach AS098 desired rail pressure?

    21.a Yes; Go to step 22.

    21.b No; replace high pressure pump. Refer to section "Removal of the High Pressure Fuel Pump - Two-Filter System" .

22. With the injectors still capped after cranking engine for 10 seconds, does the rail pressure bleed down under 100 bar in less than five minutes?

    22.a Yes; replace high pressure pump. Refer to section "Removal of the High Pressure Fuel Pump - Two-Filter System" .

    22.b No; Go to step 23.

23. Using DiagnosticLink, navigate to Service Routines and Fuel System Integrity Check test and select Manual FSIC. Test drive the truck to see if the code sets. Does SPN 164/FMI 15 come active?

    23.a Yes; Go to step 24.

    23.b No; Go to step 25.

24. Remove the MCM 120-pin connector. Inspect for damage including fuel, water corrosion or bent terminals. Is damage found?

    24.a Yes; repair as needed.

    24.b No; Go to step 25.

25. Install a test MCM using the extension harness and test drive the truck. Does the code come active?

    25.a Yes; Refer to section "Aerated Fuel Test – Two-Filter Fuel System" .

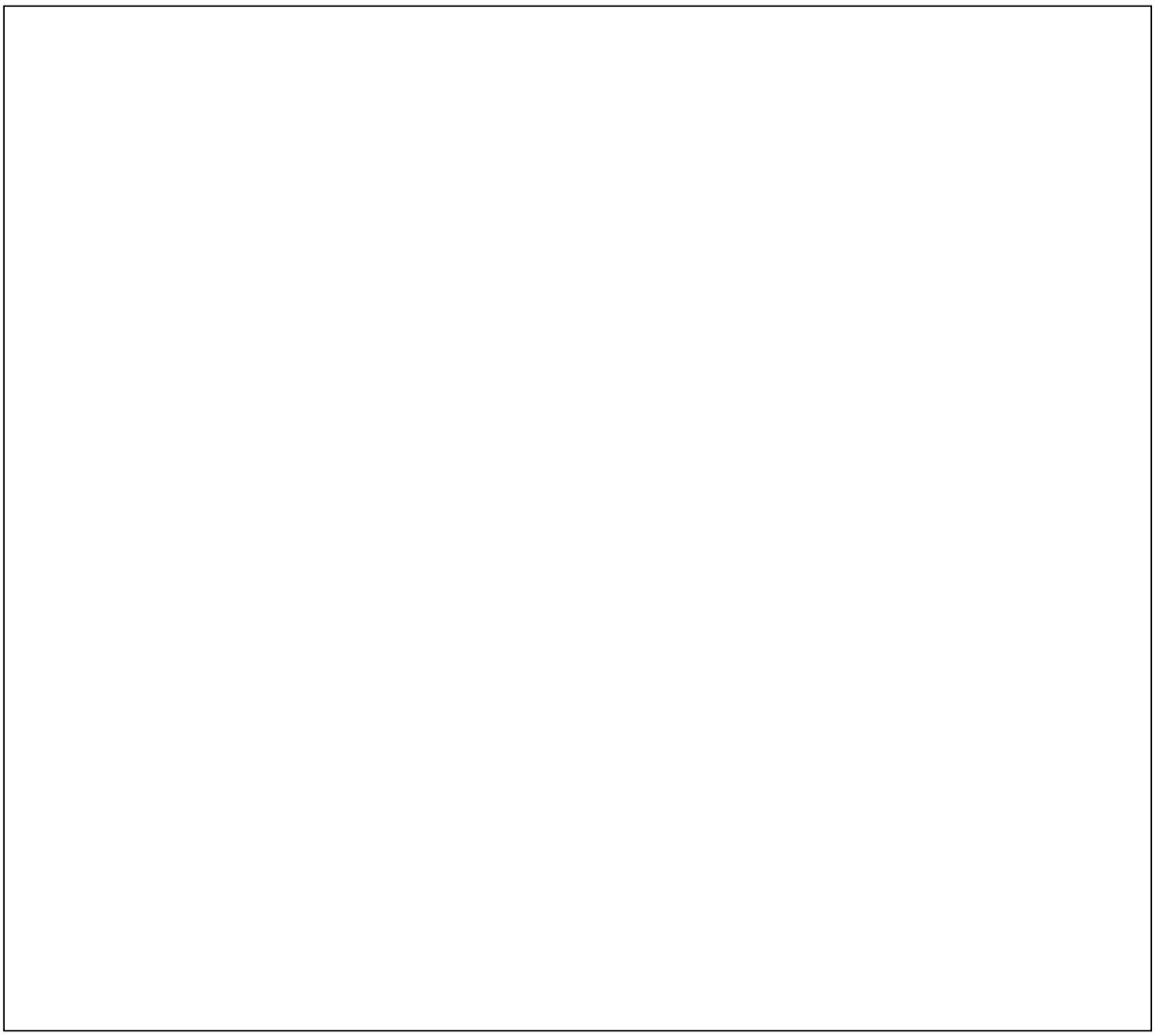
    25.b No; replace MCM and verify repair. Refer to section "Removal of the Motor Control Module" .

SPN 164/FMI 15	
Description	Fuel Rail Pressure Deviation Under Load
Monitored Parameter	Fuel Rail Pressure Sensor
Typical Enabling Conditions	Code Sets When Rail Pressure Deviation is Greater than 200 Bar, While Under a Load
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)

1. Complete the troubleshooting for SPN 157/FMI 16. Refer to section "SPN 157/FMI 16 - GHG17" .

64.6 SPN 164/FMI 20 - GHG17

SPN 164/FMI 20	
Description	Fuel Rail Pressure Sensor - Drift High
Monitored Parameter	Fuel Rail Pressure Sensor
Typical Enabling Conditions	Key ON, Engine OFF
Monitor Sequence	None
Execution Frequency	Once when enabling conditions met
Typical Duration	10 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Key ON, Engine OFF



Check as follows:

1. Disconnect the fuel rail pressure sensor.
2. Inspect the fuel rail pressure sensor connector and harness connector for signs of damage: bent, spread, broken, unseated (pushed out) or corroded pins, signs of water intrusion or damaged wiring near the connector. Are signs of damage present?

2.a Yes; repair as necessary.

2.b No; Go to step 3.

3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pins 1 and 3 of the fuel rail pressure sensor harness connector. Is the voltage between 4.5 and 5.5 volts?

4.a Yes; Go to step 6.

4.b No; Go to step 5.

5. Measure the voltage between pin 3 of the fuel rail pressure sensor harness connector and battery ground. Is the voltage between 4.5 and 5.5 volts?

5.a Yes; repair the wire between pin 1 of the fuel rail pressure sensor harness connector and pin 102 of the MCM 120-pin connector.

5.b No; repair the wire between pin 3 of the fuel rail pressure sensor and pin 58 of the MCM 120-pin connector.

6. Turn the ignition OFF.
7. Disconnect the MCM 120-pin connector.
8. Inspect the MCM 120-pin connector and harness connector for signs of damage: bent, spread, broken, unseated (pushed out) or corroded pins, signs of water intrusion or damaged wiring near the connector. Is there damage present?

8.a Yes; repair as necessary.

8.b No; Go to step 9.

9. Measure the resistance between pin 2 of the fuel rail pressure sensor harness connector and pin 78 of the MCM 120-pin connector. Is the resistance less than five ohms?

9.a Yes; Go to step 10.

9.b No; repair the wire between pin 2 of the fuel rail pressure sensor harness connector and pin 78 of the MCM 120-pin connector.

10. Measure the resistance between pin 1 of the fuel rail pressure sensor harness connector and pin 102 of the MCM 120-pin connector. Is the resistance less than five ohms?

10.a Yes; Go to step 11.

10.b No; repair the wire between pin 1 of the fuel rail pressure sensor harness connector and pin 102 of the MCM 120-pin connector.

11. Measure the resistance between pins 2 and 3 of the fuel rail pressure sensor harness connector. Is the resistance greater than 10K ohms?

11.a Yes; Go to step 12.

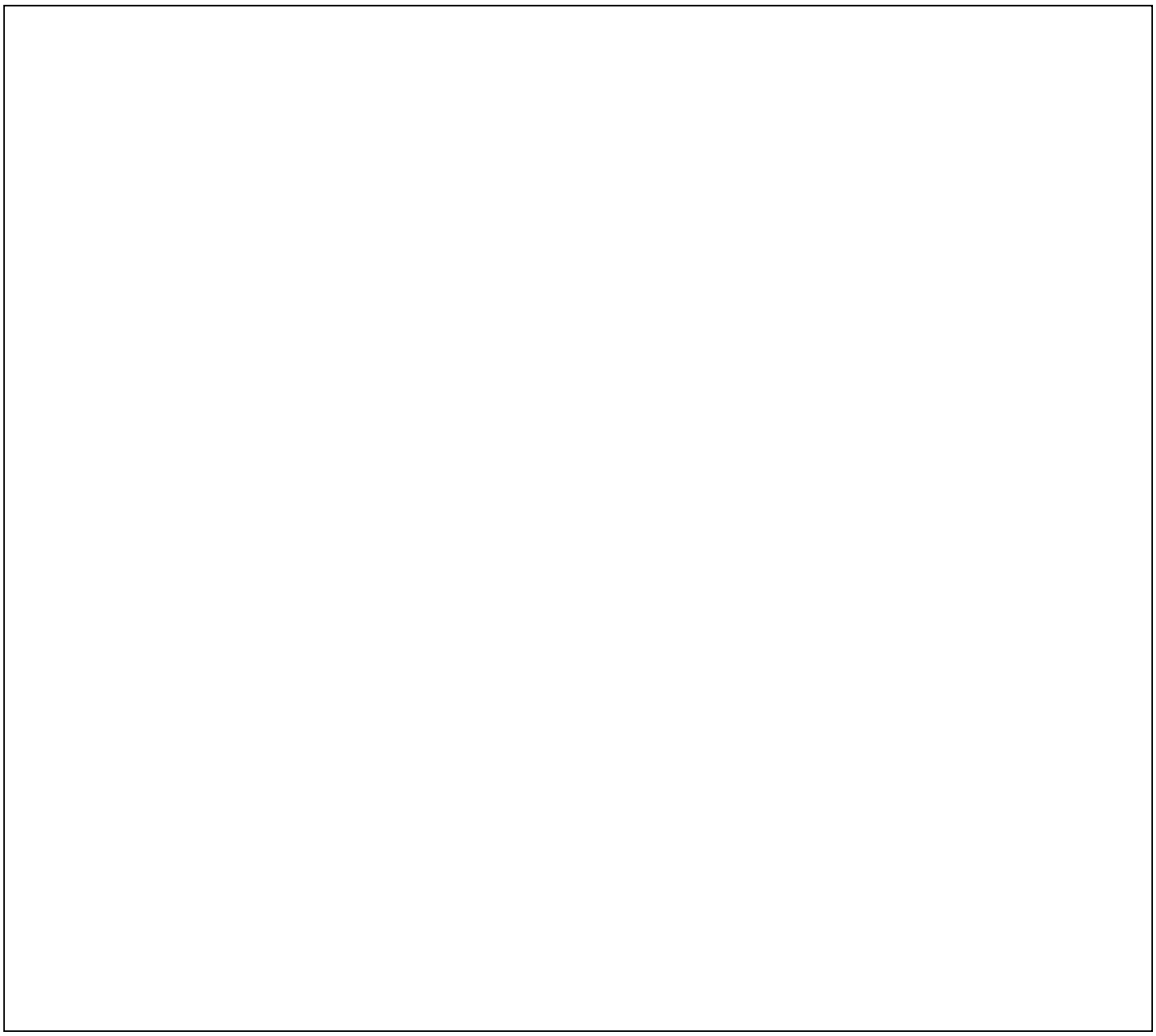
11.b No; repair the short in the wires between pins 2 and 3 of the fuel rail pressure sensor harness connector.

12. Reconnect the MCM 120-pin harness connector.
13. Turn the ignition ON (key ON, engine OFF).
14. Measure the voltage between pins 1 and 3 of the fuel rail pressure sensor harness connector. Is the voltage between 4.5 and 5.5 volts?

14.a Yes; replace the fuel rail pressure sensor. Refer to section "Removal of the Fuel Rail Pressure Sensor" .

14.b No; repeat this procedure. If the results are the same, replace the MCM. Refer to section "Removal of the Motor Control Module" .

SPN 164/FMI 20	
Description	Fuel Rail Pressure Sensor - Drift High
Monitored Parameter	Fuel Rail Pressure Sensor
Typical Enabling Conditions	Key ON, Engine OFF
Monitor Sequence	None
Execution Frequency	Once when enabling conditions met
Typical Duration	10 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Key ON, Engine OFF



Check as follows:

1. Disconnect the fuel rail pressure sensor.
2. Inspect the fuel rail pressure sensor connector and harness connector for signs of damage: bent, spread, broken, unseated (pushed out) or corroded pins, signs of water intrusion or damaged wiring near the connector. Are signs of damage present?

   2.a Yes; repair as necessary.

2.b No; Go to step 3.

3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pins 1 and 3 of the fuel rail pressure sensor harness connector. Is the voltage between 4.5 and 5.5 volts?

   4.a Yes; Go to step 6.

   4.b No; Go to step 5.

5. Measure the voltage between pin 3 of the fuel rail pressure sensor harness connector and battery ground. Is the voltage between 4.5 and 5.5 volts?

   5.a Yes; repair the wire between pin 1 of the fuel rail pressure sensor harness connector and pin 102 of the MCM 120-pin connector.

   5.b No; repair the wire between pin 3 of the fuel rail pressure sensor and pin 58 of the MCM 120-pin connector.

6. Turn the ignition OFF.
7. Disconnect the MCM 120-pin connector.
8. Inspect the MCM 120-pin connector and harness connector for signs of damage: bent, spread, broken, unseated (pushed out) or corroded pins, signs of water intrusion or damaged wiring near the connector. Is there damage present?

   8.a Yes; repair as necessary.

   8.b No; Go to step 9.

9. Measure the resistance between pin 2 of the fuel rail pressure sensor harness connector and pin 78 of the MCM 120-pin connector. Is the resistance less than five ohms?

   9.a Yes; Go to step 10.

   9.b No; repair the wire between pin 2 of the fuel rail pressure sensor harness connector and pin 78 of the MCM 120-pin connector.

10. Measure the resistance between pin 1 of the fuel rail pressure sensor harness connector and pin 102 of the MCM 120-pin connector. Is the resistance less than five ohms?

    10.a Yes; Go to step 11.

    10.b No; repair the wire between pin 1 of the fuel rail pressure sensor harness connector and pin 102 of the MCM 120-pin connector.

11. Measure the resistance between pins 2 and 3 of the fuel rail pressure sensor harness connector. Is the resistance greater than 10K ohms?

    11.a Yes; Go to step 12.

    11.b No; repair the short in the wires between pins 2 and 3 of the fuel rail pressure sensor harness connector.

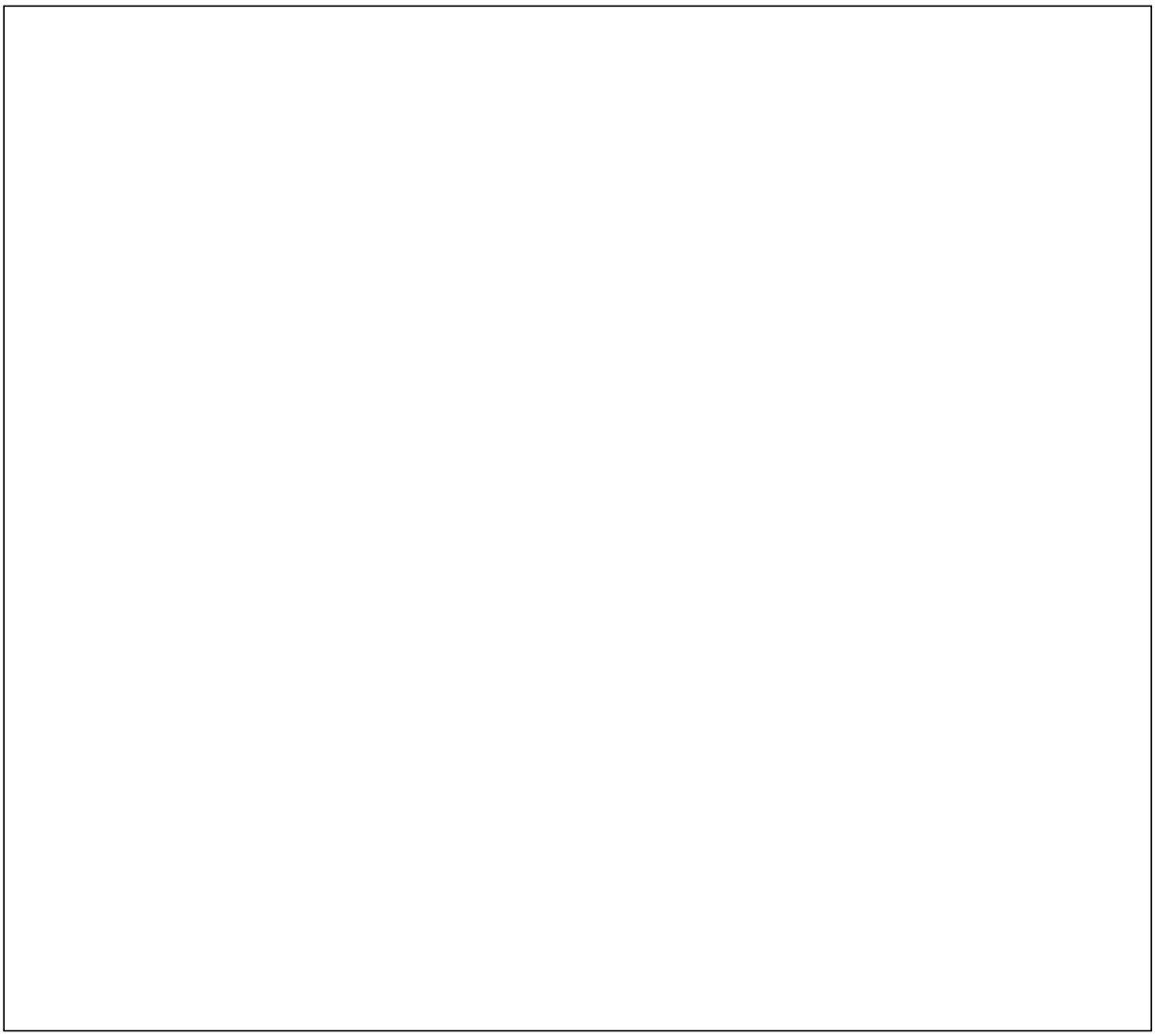
12. Reconnect the MCM 120-pin harness connector.
13. Turn the ignition ON (key ON, engine OFF).
14. Measure the voltage between pins 1 and 3 of the fuel rail pressure sensor harness connector. Is the voltage between 4.5 and 5.5 volts?

    14.a Yes; replace the fuel rail pressure sensor. Refer to section "Removal of the Fuel Rail Pressure Sensor" .

    14.b No; repeat this procedure. If the results are the same, replace the MCM. Refer to section "Removal of the Motor Control Module" .

64.7 SPN 164/FMI 21 - GHG17

SPN 164/FMI 21	
Description	Fuel Rail Pressure Sensor - Drift Low
Monitored Parameter	Fuel Rail Pressure Sensor
Typical Enabling Conditions	Key ON, Engine OFF
Monitor Sequence	None
Execution Frequency	Once when enabling conditions met
Typical Duration	10 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Key ON, Engine OFF



Check as follows:

1. Disconnect the fuel rail pressure sensor.
2. Inspect the fuel rail pressure sensor connector and harness connector for signs of damage: bent, spread, broken, unseated (pushed out) or corroded pins, signs of water intrusion or damaged wiring near the connector. Is damage present?

2.a Yes; repair as necessary.

2.b No; Go to step 3.

3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pins 1 and 3 of the fuel rail pressure sensor harness connector. Is the voltage between 4.5 and 5.5 volts?

4.a Yes; Go to step 6.

4.a No; Go to step 5.

5. Measure the voltage between pin 3 of the fuel rail pressure sensor harness connector and battery ground. Is the voltage between 4.5 and 5.5 volts?

5.a Yes; repair the wire between pin 1 of the fuel rail pressure sensor harness connector and pin 102 of the MCM 120-pin connector.

5.b No; repair the wire between pin 3 of the fuel rail pressure sensor and pin 58 of the MCM 120-pin connector.

6. Turn the ignition OFF.
7. Disconnect the MCM 120-pin connector.
8. Inspect the MCM 120-pin connector and harness connector for signs of damage; bent, spread, broken, unseated (pushed out) or corroded pins, signs of water intrusion or damaged wiring near the connector. Is damage present?

8.a Yes; repair as necessary.

8.b No; Go to step 9.

9. Measure the resistance between pin 2 of the fuel rail pressure sensor harness connector and pin 78 of the MCM 120-pin connector. Is the resistance less than five ohms?

9.a Yes; Go to step 10.

9.b No; repair the wire between pin 2 of the fuel rail pressure sensor harness connector and pin 78 of the MCM 120-pin connector.

10. Measure the resistance between pin 3 of the fuel rail pressure sensor harness connector and pin 58 of the MCM 120-pin connector. Is the resistance less than five ohms?

10.a Yes; Go to step 11.

10.b No; repair the wire between pin 3 of the fuel rail pressure sensor harness connector and pin 58 of the MCM 120-pin connector.

11. Measure the resistance between pins 1 and 2 of the fuel rail pressure sensor harness connector. Is the resistance greater than 10K ohms?

11.a Yes; Go to step 12.

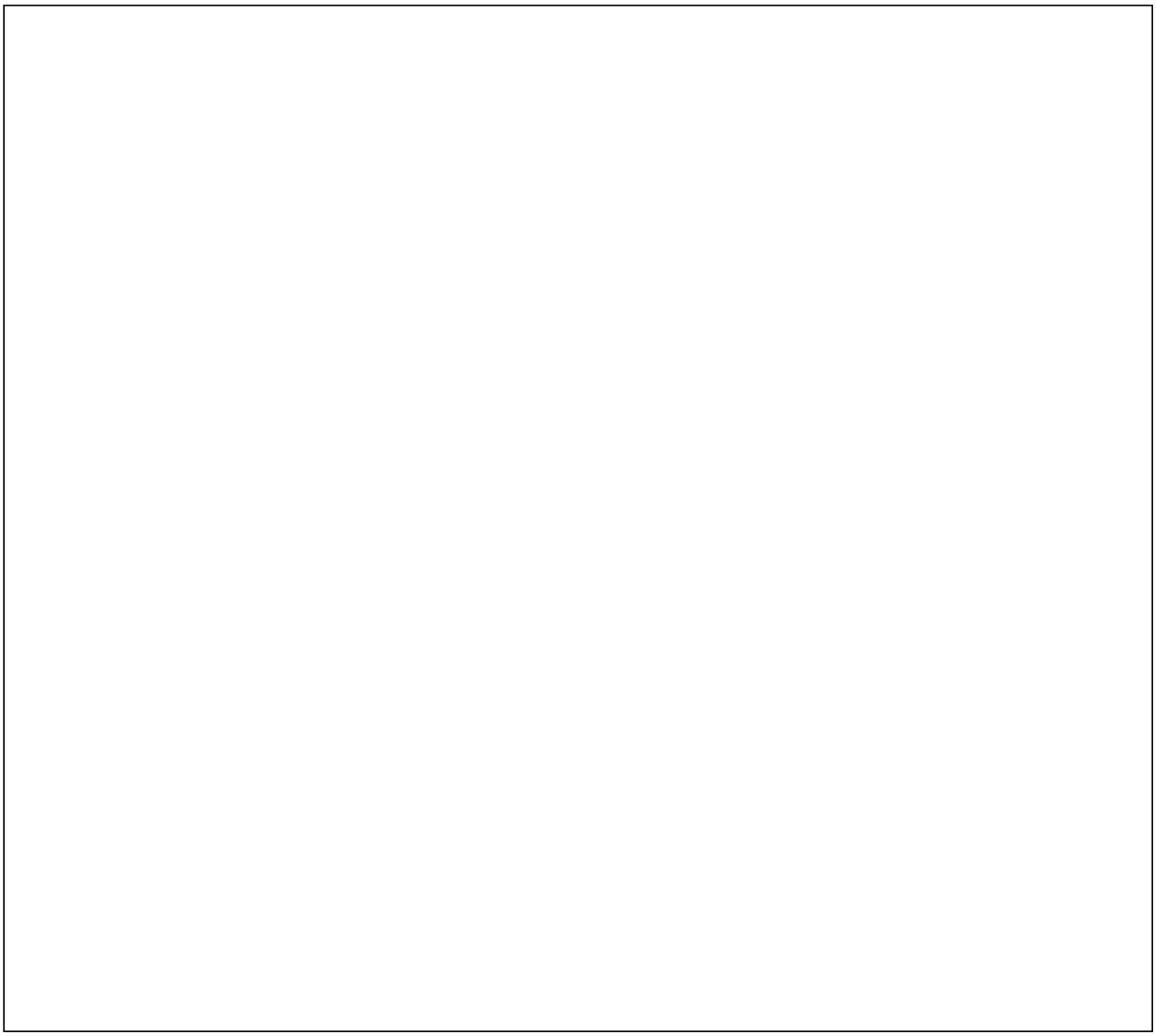
11.b No; repair the short in the wires between pins 1 and 2 of the fuel rail pressure sensor harness connector.

12. Reconnect the MCM 120-pin harness connector.
13. Turn the ignition ON (key ON, engine OFF).
14. Measure the voltage between pins 1 and 3 of the fuel rail pressure sensor harness connector. Is the voltage between 4.5 and 5.5 volts?

14.a Yes; replace fuel rail pressure sensor. Refer to section "Removal of the Fuel Rail Pressure Sensor" .

14.b No; repeat this procedure. If the results are the same, replace the MCM. Refer to section "Removal of the Motor Control Module" .

SPN 164/FMI 21	
Description	Fuel Rail Pressure Sensor - Drift Low
Monitored Parameter	Fuel Rail Pressure Sensor
Typical Enabling Conditions	Key ON, Engine OFF
Monitor Sequence	None
Execution Frequency	Once when enabling conditions met
Typical Duration	10 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Key ON, Engine OFF



Check as follows:

1. Disconnect the fuel rail pressure sensor.
2. Inspect the fuel rail pressure sensor connector and harness connector for signs of damage: bent, spread, broken, unseated (pushed out) or corroded pins, signs of water intrusion or damaged wiring near the connector. Is damage present?

   2.a Yes; repair as necessary.

2.b No; Go to step 3.

3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pins 1 and 3 of the fuel rail pressure sensor harness connector. Is the voltage between 4.5 and 5.5 volts?

   4.a Yes; Go to step 6.

   4.a No; Go to step 5.

5. Measure the voltage between pin 3 of the fuel rail pressure sensor harness connector and battery ground. Is the voltage between 4.5 and 5.5 volts?

   5.a Yes; repair the wire between pin 1 of the fuel rail pressure sensor harness connector and pin 102 of the MCM 120-pin connector.

   5.b No; repair the wire between pin 3 of the fuel rail pressure sensor and pin 58 of the MCM 120-pin connector.

6. Turn the ignition OFF.
7. Disconnect the MCM 120-pin connector.
8. Inspect the MCM 120-pin connector and harness connector for signs of damage; bent, spread, broken, unseated (pushed out) or corroded pins, signs of water intrusion or damaged wiring near the connector. Is damage present?

   8.a Yes; repair as necessary.

   8.b No; Go to step 9.

9. Measure the resistance between pin 2 of the fuel rail pressure sensor harness connector and pin 78 of the MCM 120-pin connector. Is the resistance less than five ohms?

   9.a Yes; Go to step 10.

   9.b No; repair the wire between pin 2 of the fuel rail pressure sensor harness connector and pin 78 of the MCM 120-pin connector.

10. Measure the resistance between pin 3 of the fuel rail pressure sensor harness connector and pin 58 of the MCM 120-pin connector. Is the resistance less than five ohms?

    10.a Yes; Go to step 11.

    10.b No; repair the wire between pin 3 of the fuel rail pressure sensor harness connector and pin 58 of the MCM 120-pin connector.

11. Measure the resistance between pins 1 and 2 of the fuel rail pressure sensor harness connector. Is the resistance greater than 10K ohms?

    11.a Yes; Go to step 12.

    11.b No; repair the short in the wires between pins 1 and 2 of the fuel rail pressure sensor harness connector.

12. Reconnect the MCM 120-pin harness connector.
13. Turn the ignition ON (key ON, engine OFF).
14. Measure the voltage between pins 1 and 3 of the fuel rail pressure sensor harness connector. Is the voltage between 4.5 and 5.5 volts?

    14.a Yes; replace fuel rail pressure sensor. Refer to section "Removal of the Fuel Rail Pressure Sensor" .

    14.b No; repeat this procedure. If the results are the same, replace the MCM. Refer to section "Removal of the Motor Control Module" .

SPN 168 (ACM) (GHG17)

66.1 SPN 168/FMI 0 - GHG17

SPN 168/FMI 0	
Description	Battery Voltage is Higher than 16 Volts
Monitored Parameter	ACM Battery Voltage
Typical Enabling Conditions	Key ON Engine OFF
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	10 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine Idle (One Minute)

⚠WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

CAUTION

ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

⚠WARNING

PERSONAL INJURY

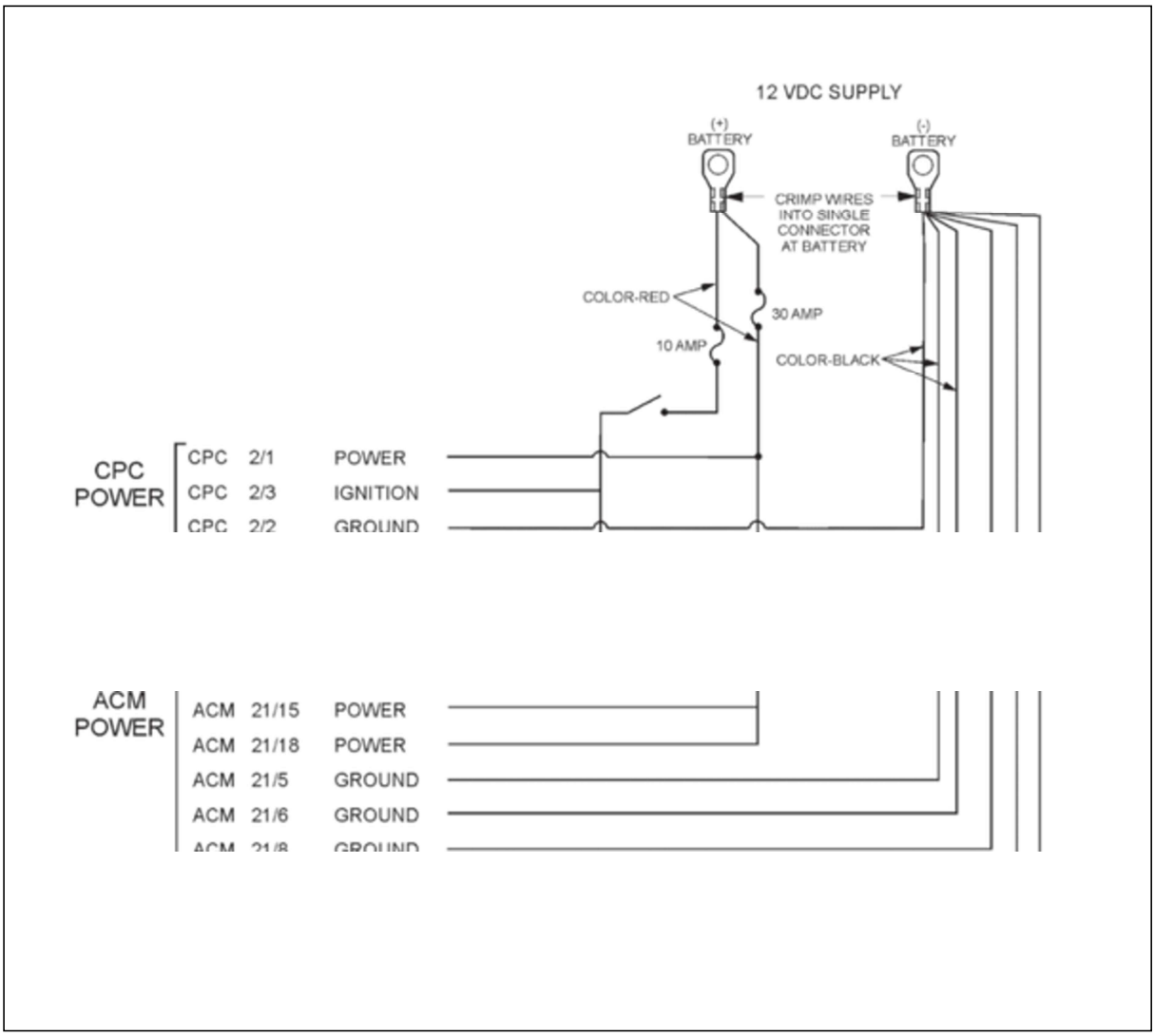
To avoid injury, never remove any engine component while the engine is running.

Check as follows:

1. Measure battery voltage with the engine running at maximum rpm.
2. If greater than 16 volts, check for proper alternator operation and repair or replace, as required.

66.2 SPN 168/FMI 1 - GHG17

SPN 168/FMI 1	
Description	Battery Voltage Below 10.5 Volts
Monitored Parameter	ACM Battery Voltage
Typical Enabling Conditions	Key ON Engine OFF
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	10 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine Idle (One Minute)



⚠ WARNING

ENGINE EXHAUST

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

CAUTION

ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

⚠ WARNING

PERSONAL INJURY

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

Check as follows:

1. Check for multiple battery voltage faults. Are there other ECU voltage fault codes present?
   - 1.a Yes; Go to step 2.
   - 1.b No; Go to step 6.
2. Check the condition of the alternator drive belt and replace, if required. Is fault still active?
   - 2.a Yes; Go to step 3.
   - 2.b No; verify repairs.
3. Check for loose alternator mounting and retighten or repair, as required. Is fault still active?
   - 3.a Yes; Go to step 4.
   - 3.b No; verify repairs.
4. Check for proper alternator operation and repair or replace, as required. Is fault still active?
   - 4.a Yes; Go to step 5.
   - 4.b No; erase fault code memory.
5. Check the condition of the battery; does it hold the charge? Replace if required. Is fault still active?
   - 5.a Yes; Go to step 6.
   - 5.b No; verify repairs.
6. Turn the ignition OFF.
7. Disconnect the ACM 21-pin connector. Inspect the harness for bent, spread, or corroded pins. Is damage found?
   - 7.a Yes; repair as necessary.
   - 7.b No; Go to step 8.
8. Measure the resistance of the Aftertreatment Control Module (ACM) ground circuits located on pins 3, 5, 6, 8, and 9 of the ACM 21-pin connector to battery ground. Is the resistance less than five ohms?
   - 8.a Yes; Go to step 9.
   - 8.b No; repair the wire(s) with the high resistance reading.
9. Turn the ignition ON (key ON, engine OFF).
10. Measure the battery voltage of the individual wires in the power circuits at pins 11, 12, 14, 15, and 18 on the ACM 21-pin connector. Is battery voltage less than 10.5 volts?

10.a Yes; repair the circuit(s) in question.

10.b No; reconnect ACM 21-pin connector. Go to step 11.

11. Connect DiagnosticLink . Monitor (chart) the following parameters.

- ASL: Ignition Switch Voltage
- ASL: Main Battery Voltage
- AAS: Battery Voltage
- ASL: Battery Voltage

12. Wiggle test the harness, looking for abnormal voltage spikes. Is a voltage spike detected?

12.a Yes; isolate that section of harness and inspect for wire chaffing, corrosion, improper connections or physical damage and repair as necessary.

12.b No; Go to step 13.

13. Using DiagnosticLink, clear codes. Does fault return?

13.a Yes; install a test ACM and retest.

13.b No; verify repairs and release vehicle.

SPN 168 (CPC) (GHG17)

67.1 SPN 168/FMI 0 - GHG17

SPN 168/FMI 0	
Description	Battery Voltage Above 16 Volts
Monitored Parameter	MCM Battery Voltage
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	10 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine Running

⚠ 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.

⚠ WARNING

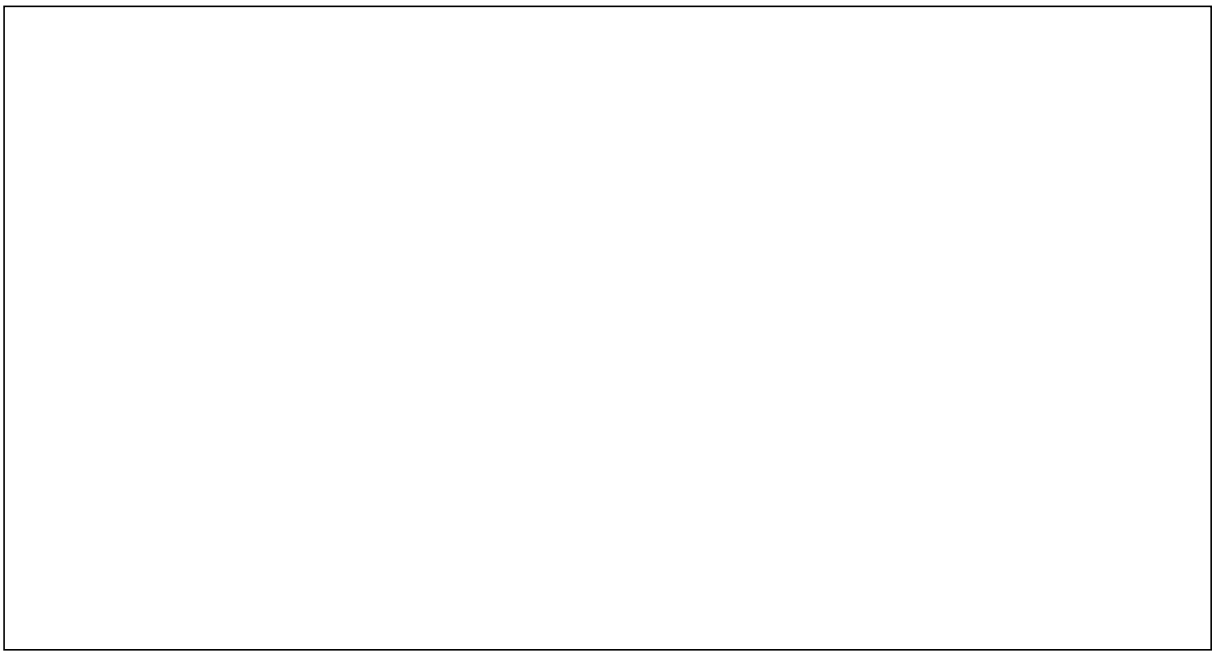
ENGINE EXHAUST

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

1. Measure battery voltage with the engine running at maximum rpm without exceeding 1700 rpm. Is battery voltage greater than 16 volts?
   - 1.a Yes; check for proper alternator operation, repair as necessary. Verify repair.
   - 1.b No; refer to Original Equipment Manufacturer (OEM) literature for the vehicle battery schematics.

67.2 SPN 168/FMI 1 - GHG17

SPN 168/FMI 1	
Description	Battery Voltage Below 10.5 Volts
Monitored Parameter	MCM Battery Voltage
Typical Enabling Conditions	Key On Engine Off
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	10 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine Idle (One Minute)



⚠WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

CAUTION

ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

> **WARNING**
>
> PERSONAL INJURY
>
> To avoid injury, never remove any engine component while the engine is running.

Check as follows:

1. Check for multiple battery voltage faults. Are there other ECU voltage fault codes present?
   - 1.a Yes; Go to step 2.
   - 1.b No; Go to step 6.
2. Check the condition of the alternator drive belt and replace, if required. Are faults still active?
   - 2.a Yes; Go to step 3.
   - 2.b No; verify repairs.
3. Check for loose alternator mounting and retighten or repair, as required. Are faults still active?
   - 3.a Yes; Go to step 4.
   - 3.b No; verify repairs.
4. Check for proper alternator operation and repair or replace, as required. Are faults still active?
   - 4.a Yes; Go to step 5.
   - 4.b No; erase fault code memory.
5. Check the condition of the battery; does it hold the charge? Replace if required. Are faults still active?
   - 5.a Yes; Go to step 6.
   - 5.b No; verify repairs.
6. Turn the ignition OFF.
7. Disconnect the MCM 21-pin connector. Inspect the harness for bent, spread, or corroded pins. Is damage found?
   - 7.a Yes; repair as necessary.
   - 7.b No; Go to step 8.
8. Measure the resistance of the Motor Control Module (MCM) ground circuits located on pins 5, 6, 8, and 9 of the MCM 21-pin connector to battery ground. Is the resistance less than five ohms?
   - 8.a Yes; Go to step 9.
   - 8.b No; repair the wire(s) with the high resistance reading.
9. Turn the ignition ON (key ON, engine OFF).
10. Measure the battery voltage of the individual wires in the power circuits at pins 11, 12, 14, 15 of the MCM 21-pin connector. Is battery voltage less than 10.5 volts?
    - 10.a Yes; repair the circuit(s) in question.
    - 10.b No; reconnect MCM 21-pin connector. Go to step 11.
11. Connect DiagnosticLink . Monitor (chart) the following parameters.

- ASL: Ignition Switch Voltage
- ASL: Main Battery Voltage
- AAS: Battery Voltage
- ASL: Battery Voltage

12. Wiggle test the harness; look for abnormal voltage spikes. Is a voltage spike detected?
    - 12.a Yes; isolate that section of harness and inspect for wire chaffing, corrosion, improper connections or physical damage and repair as necessary.
    - 12.b No; Go to step 13.

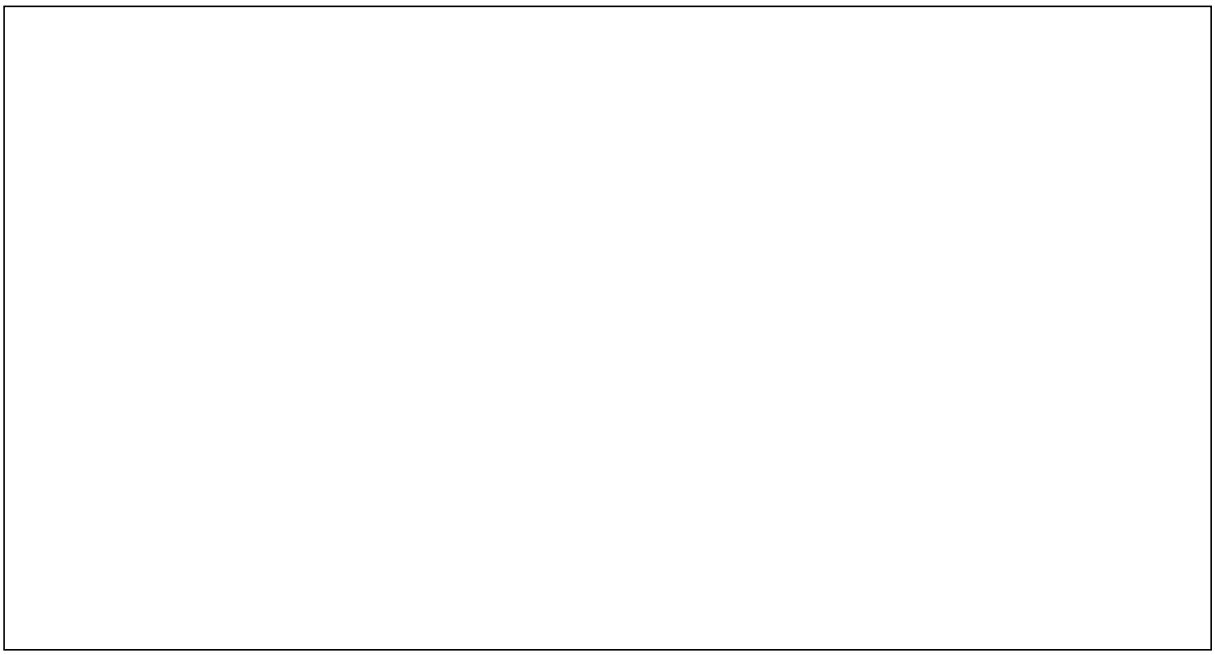
13. Using DiagnosticLink, clear codes. Does fault return?

13.a Yes; install a test CPC and retest.

13.b No; verify repairs and release vehicle.

67.3 SPN 168/FMI 7 - GHG17

SPN 168/FMI 7	
Description	Battery Voltage Low Failure
Monitored Parameter	MCM Battery Voltage
Typical Enabling Conditions	Key On Engine Off
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	10 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine Idle (One Minute)



⚠WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

CAUTION

ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

> **WARNING**
>
> PERSONAL INJURY
>
> To avoid injury, never remove any engine component while the engine is running.

Check as follows:

1. Inspect the following and Go to step 2.

- Alternator mounting, drive belt and operation
- Battery condition and charge

2. Measure the resistance of the ground circuit pins 5, 6, 8, and 9 of the MCM 21-pin connector and pin 2 of the Common Powertrain Controller (CPC). Is the resistance greater than 0.5 ohms in any wire?

   2.a Yes; repair or replace the wire and connector, verify repairs.

   2.b No; Go to step 3.

3. Measure the resistance of the power circuit pins 11, 12, 14 and 15 of the MCM 21-pin connector and pin 1 of the CPC with the engine running and battery voltage greater than 12.5 V. Is the resistance greater than 0.5 ohms in any wire?

   3.a Yes; repair or replace the power circuit wires and connector.

   3.b No; Go to step 4.

4. Measure the current drop of the ground circuit pins 5, 6, 8, and 9 of the MCM 21-pin connector and pin 2 of the CPC. Is the current drop more than 0.2 volts in any wire?

   4.a Yes; repair or replace the ground circuit wires and connector.

   4.b No; Go to step 5.

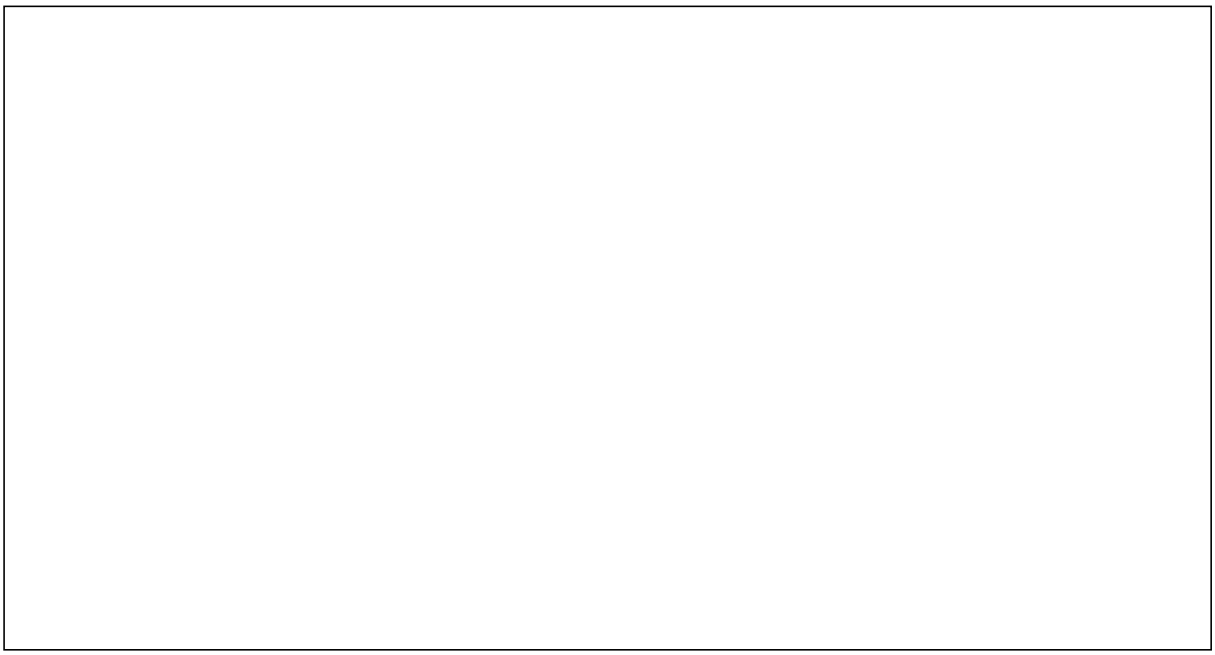
5. Measure the current drop of the power circuit pins 11, 12, 14, and 15 of the MCM 21-pin connector and pin 1 of the CPC. Is the current drop more than 0.2 volts in any wire?

   5.a Yes; repair or replace the power circuit wires and connector.

   5.b No; check and verify repairs.

67.4 SPN 168/FMI 9 - GHG17

SPN 168/FMI 9	
Description	Battery Voltage Missing
Monitored Parameter	Motor Control Module (MCM) Battery Voltage
Typical Enabling Conditions	Key On Engine Off
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	10 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine Idle (One Minute)



⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

CAUTION

ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

> **WARNING**
>
> PERSONAL INJURY
>
> To avoid injury, never remove any engine component while the engine is running.

Check as follows:

1. Inspect the following and Go to step 2.

- Alternator mounting, drive belt and operation
- Battery condition and charge

2. Measure the resistance of the ground circuit pins 5, 6, 8, and 9 of the MCM 21-pin connector and pin 2 of the Common Powertrain Controller (CPC). Is the resistance greater than 0.5 ohms in any wire?

   2.a Yes; repair or replace the wire and connector, verify repairs.

   2.b No; Go to step 3.

3. Measure the resistance of the power circuit pins 11, 12, 14, and 15 of the MCM 21-pin connector and pin 1 of the CPC with the engine running and battery voltage greater than 12.5 V. Is the resistance greater than 0.5 ohms in any wire?

   3.a Yes; repair or replace the power circuit wires and connector.

   3.b No; Go to step 4.

4. Measure the current drop of the ground circuit pins 5, 6, 8, and 9 of the MCM 21-pin connector and pin 2 of the CPC. Is the current drop more than 0.2 volts in any wire?

   4.a Yes; repair or replace the ground circuit wires and connector.

   4.b No; Go to step 5.

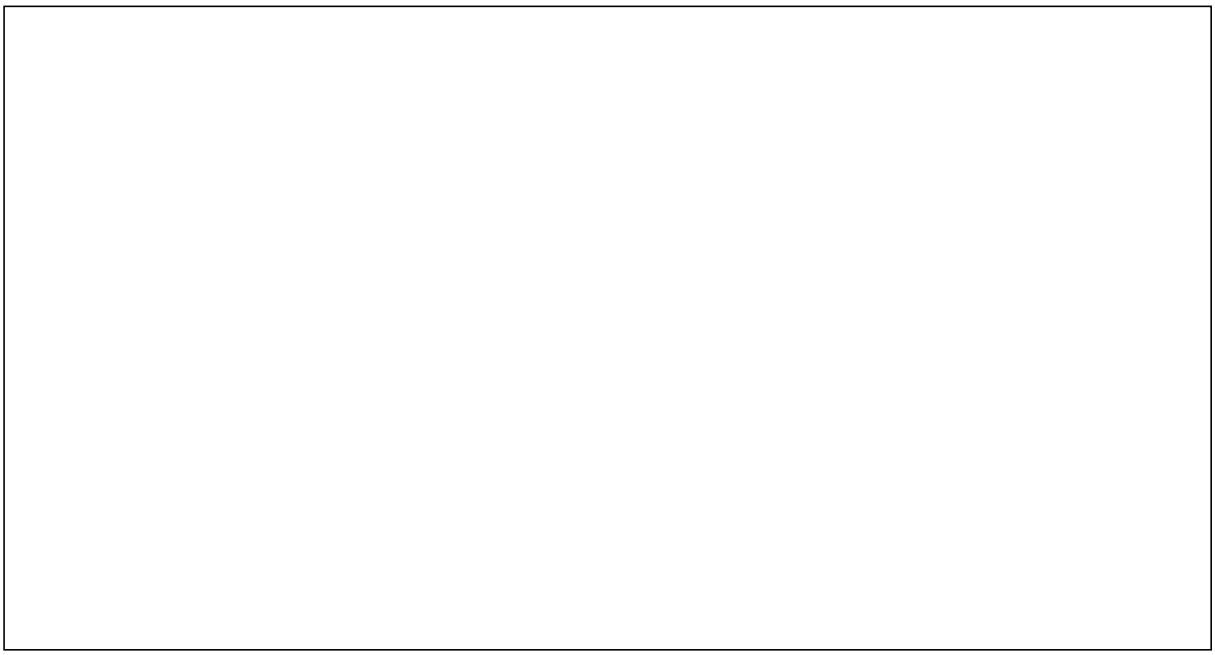
5. Measure the current drop of the power circuit pins 11, 12, 14, and 15 of the MCM 21-pin connector and pin 1 of the CPC. Is the current drop more than 0.2 volts in any wire?

   5.a Yes; repair or replace the power circuit wires and connector.

   5.b No; check and verify repairs.

67.5 SPN 168/FMI 18 - GHG17

SPN 168/FMI 18	
Description	Battery Voltage Low Failure
Monitored Parameter	Motor Control Module (MCM) Battery Voltage
Typical Enabling Conditions	Key On Engine Off
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	10 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine Idle (One Minute)



⚠WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

CAUTION

ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

> **WARNING**
>
> PERSONAL INJURY
>
> To avoid injury, never remove any engine component while the engine is running.

Check as follows:

1. Inspect the following and Go to step 2.

- Alternator mounting, drive belt and operation
- Battery condition and charge

2. Measure the resistance of ground circuit pins 5, 6, 8, and 9 of the MCM 21-pin connector and pin 2 of the CPC. Is the resistance greater than 0.5 ohms in any wire?

   2.a Yes; repair or replace the wire and connector, verify repairs.

   2.b No; Go to step 3.

3. Measure the resistance of the power circuit pins 11, 12, 14, and 15 of the MCM 21-pin connector and pin 1 of the CPC with the engine running and battery voltage greater than 12.5 V. Is the resistance greater than 0.5 ohms in any wire?

   3.a Yes; repair or replace the power circuit wires and connector.

   3.b No; Go to step 4.

4. Measure the current drop of the ground circuit pins 5, 6, 8, and 9 of the MCM 21-pin connector and pin 2 of the CPC. Is the current drop more than 0.2 volts in any wire?

   4.a Yes; repair or replace the ground circuit wires and connector.

   4.b No; Go to step 5.

5. Measure the current drop of the power circuit pins 11, 12, 14, and 15 of the MCM 21-pin connector and pin 1 of the CPC. Is the current drop more than 0.2 volts in any wire?

   5.a Yes; repair or replace the power circuit wires and connector.

   5.b No; check and verify repairs.

SPN 168 (CPC3) (GHG17)

68.1 SPN 168/FMI 0 - GHG17

SPN 168/FMI 0	
Description	Battery Voltage Above 16 Volts
Monitored Parameter	MCM Battery Voltage
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	10 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine Running

Check as follows:

Note : This fault indicates the CPC3 has detected voltage greater than 16 volts on pin 9 of connector #5.

1. Connect DiagnosticLink 8.04 or higher.

> **⚠ WARNING**
>
> PERSONAL INJURY
>
> Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

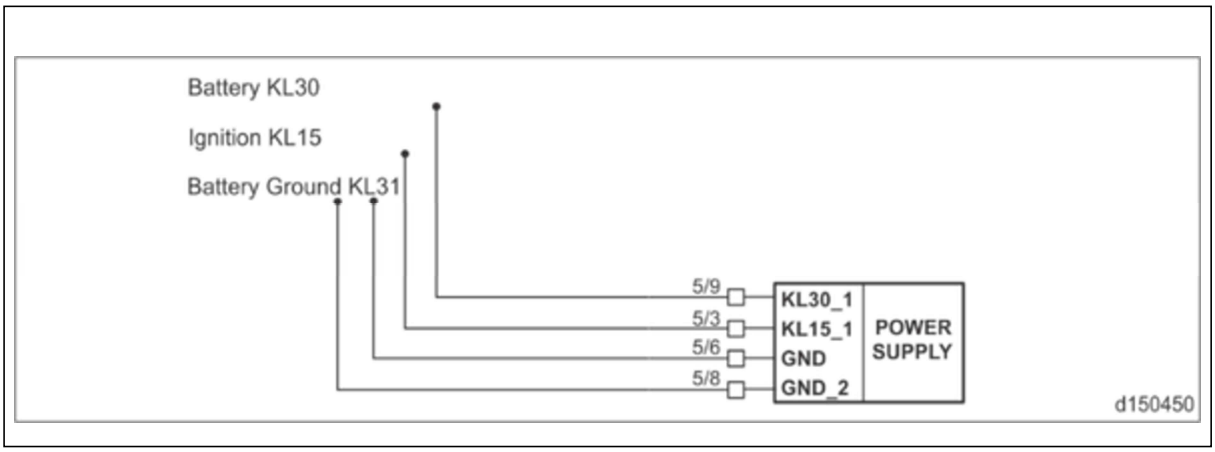
> **⚠ WARNING**
>
> PERSONAL INJURY
>
> To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

2. Start the engine.
3. Is SPN 168/FMI 0 active?
   - 3.a Yes; Go to step 4.
   - 3.b No; clear fault codes. If fault does not become active, release vehicle. If fault becomes active, Go to step 4.
4. Refer to New Cascadia Electrical Systems and Troubleshooting Manual section 2.06 for battery and charging system diagnostics.

68.2 SPN 168/FMI 1 - GHG17

SPN 168/FMI 1	
Description	Battery Voltage Below 10.5 Volts
Monitored Parameter	MCM Battery Voltage
Typical Enabling Conditions	Key ON, Engine OFF
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	10 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine Idle (One Minute)



Note : This fault indicates the CPC3 has detected voltage difference while comparing pins 9 and 3 voltages on connector #5.

Check as follows:

1. Connect DiagnosticLink 8.04 or higher.

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ WARNING

PERSONAL INJURY

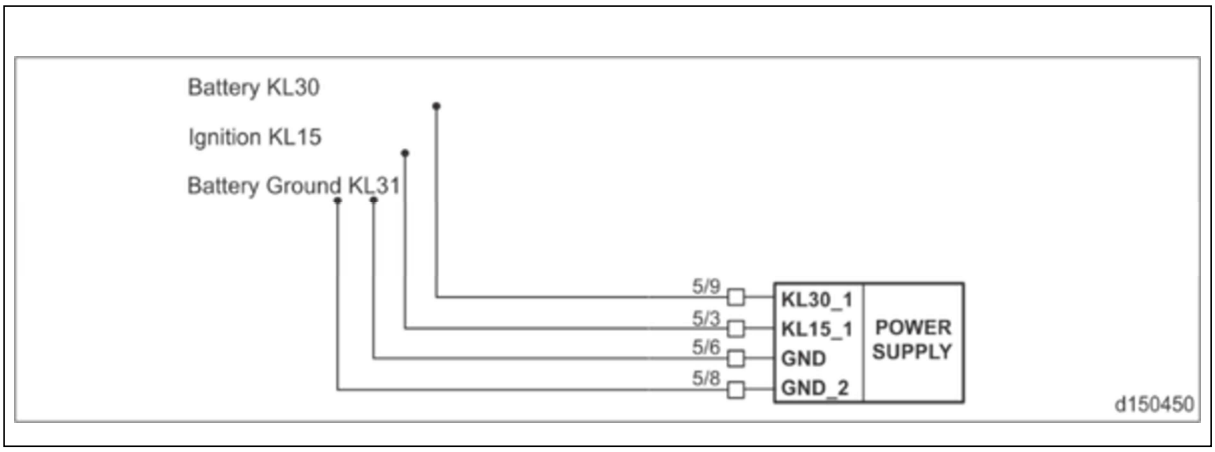
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

2. Start the engine. Is SPN 168/FMI 5 active?
   - 2.a Yes; Go to step 3.
   - 2.b No; clear all faults. If fault remains inactive, release vehicle. If fault becomes active, Go to step 3.
3. Turn the ignition OFF.
4. Disconnect CPC3 connector #5.
5. Inspect harness connector for bent, spread, or corroded pins. Is pin damage found?
   - 5.a Yes; repair as necessary.
   - 5.b No; Go to step 6.
6. Turn the ignition ON (key ON, engine OFF).
7. Measure the voltage between pin 9 on connector #5 and ground. Is voltage reading equal to battery voltage?
   - 7.a Yes; replace the CPC3.
   - 7.b b. No; restore battery voltage to pin 9. Refer to New Cascadia Electrical Systems and Troubleshooting Manual section 2.06 for battery and charging system diagnostics.

68.3 SPN 168/FMI 2 - GHG17

Ignition Circuit Voltage Erratic



Note : This fault indicates the CPC3 has detected erratic voltage on pin 3 of the CPC3 connector #5.

Check as follows:

1. Connect DiagnosticLink 8.04 or higher.

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

2. Start the engine. Is SPN 168/FMI 2 active?
   2.a Yes; Go to step 3.
   2.b No; clear all faults. If fault remains inactive, release vehicle. If fault becomes active, Go to step 3.
3. Turn the ignition OFF.
4. Disconnect CPC3 connector #5.
5. Inspect harness connector for bent, spread or corroded pins. Is pin damage found?

5.a Yes; repair as necessary.

5.b No; Go to step 6.

6. Turn the ignition ON (key ON, engine OFF).
7. Measure the voltage between pin 3 of the CPC3 connector #5 and ground. Is voltage reading equal to battery voltage?

7.a Yes; verify ignition voltage at pin 7 of the MCM 21-pin connector and pin 13 of the ICU4 connector X1. Refer to Original Equipment Manufacturer (OEM) wiring schematics for harness layout.

7.b No; restore battery voltage to pin 3. Refer to New Cascadia Electrical Systems and Troubleshooting Manual section 2.06 for battery and charging system diagnostics.

68.4 SPN 168/FMI 5 - GHG17

SPN 168/FMI 5	
Description	Common Powertrain Controller (CPC) Battery Voltage Open, Connector 5, Pin 9
Monitored Parameter	CPC Battery Voltage
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	10 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine Running

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

Check as follows:

Note : This fault indicates the CPC3evo has detected no/low voltage on pin 9 of the CPC3 connector #5.

1. Connect DiagnosticLink 8.05 SP1 or higher.
2. Turn the ignition ON (key ON, engine OFF). Is SPN 168/FMI 5 active?
   - 2.a Yes; Go to step 3.
   - 2.b No; clear all faults. If fault remains inactive, release vehicle. If fault becomes active, Go to step 3.
3. Turn the ignition OFF.
4. Disconnect CPC3evo connector #5.
5. Inspect harness connector for bent, spread or corroded pins. Is pin damage found?
   - 5.a Yes; repair as necessary.
   - 5.b No; Go to step 6.
6. Turn the ignition ON (key ON, engine OFF).

7. Measure the voltage between pin 9 of the CPC3 connector #5 and ground. Is voltage reading within .25v of battery voltage?

   7.a Yes; replace the CPC3.

   7.b No; restore battery voltage to pin 9. Refer to EZ wiring schematics module 149, 285 and 164 for further information.

68.5 SPN 168/FMI 14 - GHG17

Optimized Idle: Charging System or Battery Failure

This is an information fault. The CPC3 has detected a battery/charging system failure while operating in Optimized Idle Mode. When this fault is detected, the engine will continuously run while optimized idle is activated. Refer to Original Equipment Manufacturer (OEM) literature for battery and charging system diagnostics.

SPN 168 (MCM) (GHG17)

65.1 SPN 168/FMI 0 - GHG17

SPN 168/FMI 0	
Description	Battery Voltage is higher than 16 Volts
Monitored Parameter	MCM Battery Voltage
Typical Enabling Conditions	Key On Engine Off
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	10 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine Idle (One Minute)

⚠WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

CAUTION

ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

⚠WARNING

PERSONAL INJURY

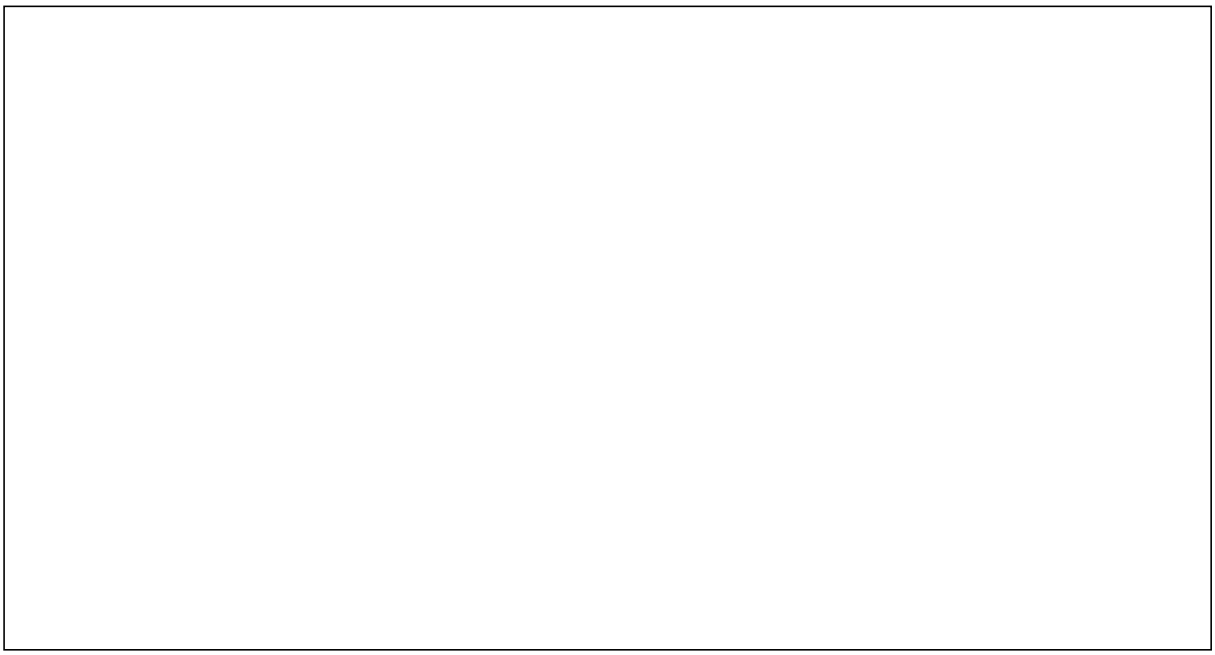
To avoid injury, never remove any engine component while the engine is running.

Check as follows:

1. Measure battery voltage with the engine running at maximum rpm.
2. If greater than 16 volts, check for proper alternator operation and repair or replace, as required.

65.2 SPN 168/FMI 1 - GHG17

SPN 168/FMI 1	
Description	Battery Voltage Below 10.5 Volts
Monitored Parameter	MCM Battery Voltage
Typical Enabling Conditions	Key On Engine Off
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	10 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine Idle (One Minute)



⚠WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

CAUTION

ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

> **WARNING**
>
> PERSONAL INJURY
>
> To avoid injury, never remove any engine component while the engine is running.

Check as follows:

1. Check for multiple battery voltage faults. Are there other ECU voltage fault codes present?
   - 1.a Yes; Go to step 2.
   - 1.b No; Go to step 6.
2. Check the condition of the alternator drive belt and replace, if required. Are faults still active?
   - 2.a Yes; Go to step 3.
   - 2.b No; verify repairs.
3. Check for loose alternator mounting and re-tighten or repair, as required. Are faults still active?
   - 3.a Yes; Go to step 4.
   - 3.b No; verify repairs.
4. Check for proper alternator operation and repair or replace, as required. Are faults still active?
   - 4.a Yes; Go to step 5.
   - 4.b No; erase fault code memory.
5. Check the condition of the battery; does it hold the charge?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace if required. Verify repairs.
6. Turn the ignition OFF.
7. Disconnect the MCM 21-pin connector. Inspect the harness for bent, spread, or corroded pins. Is damage found?
   - 7.a Yes; repair as necessary.
   - 7.b No; Go to step 8.
8. Measure the resistance of the Motor Control Module (MCM) ground circuits located on pins 5, 6, 8, and 9 of the MCM 21–pin connector to battery ground. Is the resistance less than five ohms?
   - 8.a Yes; Go to step 9.
   - 8.b No; repair the wire(s) with the high resistance reading.
9. Turn the ignition ON (key ON, engine OFF).
10. Measure the battery voltage of the individual wires in the power circuits at pins 11, 12, 14, 15 on the MCM 21-pin connector. Is battery voltage less than 10.5 volts?
    - 10.a Yes; repair the circuit(s) in question.
    - 10.b No; reconnect MCM 21-pin connector. Go to step 11.
11. Connect DiagnosticLink . Monitor (chart) the following parameters.

- ASL: Ignition Switch Voltage
- ASL: Main Battery Voltage
- AAS: Battery Voltage
- ASL: Battery Voltage

12. Wiggle test the harness; look for abnormal voltage spikes. Is a voltage spike detected?
    - 12.a Yes; isolate that section of harness and inspect for wire chaffing, corrosion, improper connections or physical damage and repair as necessary.
    - 12.b No; Go to step 13.

13. Using DiagnosticLink, clear codes. Does fault return?

13.a Yes; install a test MCM and retest.

13.b No; verify repairs and release vehicle.

SPN 171 (ACM) (GHG17)

71.1 SPN 171/FMI 13 - GHG17

Ambient Air Temperature Signal Not Available via the Controller Area Network

1. Has the ACM/MCM/CPC been recently reprogrammed?
   1.a Yes, clear faults codes if they do not become active release vehicle.
   1.b No, Go to step 2.
2. Turn the ignition OFF and disconnect DiagnosticLink . Wait 5 minutes for all modules to power down.
3. Turn ignition ON (key ON, engine OFF).
4. Reconnect DiagnosticLink, are fault codes active?
   4.a Yes; Refer to section "SPN 625/FMI 9 – GHG17" . Follow the entire procedure for further PT-CAN troubleshooting.
   4.b No; clear faults codes and release vehicle.

SPN 171 (CPC) (GHG17)

69.1 SPN 171/FMI 2 - GHG17

Ambient Temperature Sensor Data Erratic

SPN 171/FMI 2	
Description	Ambient Temperature Sensor Data Signal Error
Monitored Parameter	Ambient Temperature
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key Cycle - Five Minutes Off - Engine Idle (Two minute)

1. Connect to DiagnosticLink .
2. Is the Common Powertrain Controller (CPC) parameter group PRG031 configured correctly?
   2.a Yes; Go to step 3.
   2.b No; correct as necessary. Verify repairs.
3. Disconnect the ambient air temperature sensor.
4. Turn the ignition ON (key ON, engine OFF).

5. Measure the voltage between pins A and B on the harness side of the ambient air temperature sensor connector. Is the voltage between 4.5 and 5.2 volts?

   5.a Yes; replace the ambient air temperature sensor.

   5.b No; Go to step 6.

6. Measure the resistance between pin 2 of the CPC connector #3 and ground. Is the resistance less than five ohms?

   6.a Yes; repair the open between pin 15 of the CPC connector #3 and the ambient air Temperature sensor.

   6.b No; repair the open between pin 2 of the CPC connector #3 and the ambient air temperature sensor.

69.2 SPN 171/FMI 3 - GHG17

Ambient Temperature Sensor Failed High

SPN 171/FMI 3	
Description	Ambient air temperature sensor input (AI_01 or AI_07) - Short to UBATT or Open Circuit
Monitored Parameter	Ambient Temperature
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key Cycle - 5 Minutes Off - Engine Idle (2 minute)

Check as follows:

1. Connect DiagnosticLink .
2. Check for multiple fault codes. Are SPN 2630/FMI any (Temperature Sensor) faults present?
   2.a Yes; repair those fault codes first.
   2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   3.a Yes; check for proper configuration of the CPC against the server information. To verify repair, Go to step 4.

3.b No; Go to step 5.

4. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.
5. Disconnect the CPC #3 21-pin connector.
6. Inspect the CPC #3 harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   6.a Yes; repair as necessary. Verify repairs.

   6.b No; Go to step 7.
7. Turn the ignition ON (key ON, engine OFF).
8. Measure the voltage between pin 15 of the CPC connector #3 harness side and ground. Is any voltage present?

   8.a Yes; repair the short to power on the ambient air sensor harness. Refer to Original Equipment Manufacturer (OEM) literature for schematic information Verify repairs.

   8.b No; Go to step 9.
9. Turn ignition OFF.
10. Disconnect the ambient air temperature sensor. Refer to Original Equipment Manufacturer (OEM) literature.
11. Inspect the ambient air temperature sensor harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

    11.a Yes; repair as necessary. Verify repairs.

    11.b No; Go to step 12.
12. Measure the resistance between pin A of the ambient air sensor connector, harness side and pin 15 of the CPC #3 connector harness side. Is the resistance less than 5 ohms?

    12.a Yes; Go to step 13.

    12.b No; repair the open wire between pin A of the ambient air sensor connector and pin 15 of the CPC #3 connector.
13. Measure the resistance between pin B of the ambient air sensor connector, harness side and ground. Is the resistance less than 5 ohms?

    13.a Yes; replace the ambient air temperature sensor. Refer to Original Equipment Manufacturer (OEM) literature. Go to step 14. to verify repairs.

    13.b No; repair the open wire between pin B of the ambient air sensor connector and ground.
14. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair. Does fault code return?

    14.a Yes; replace CPC. Verify repairs.

    14.b No; release vehicle.

69.3 SPN 171/FMI 4 - GHG17

Ambient Temperature Sensor Failed Low

SPN 171/FMI 4	
Description	Ambient air temperature sensor input (AI_01 or AI_07) - Short to GND
Monitored Parameter	Ambient Temperature
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key Cycle - 5 Minutes off - Engine Idle (2 minute)

Check as follows:

1. Disconnect the ambient air temperature sensor. Refer to Original Equipment Manufacturer (OEM) literature.
2. Inspect the ambient air temperature sensor harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   2.a Yes; repair as necessary. Verify repairs.

   2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Using DiagnosticLink , monitor fault code SPN 171/ FMI 4 with the ambient air sensor disconnected. Does the fault code change or go inactive?

4.a Yes; replace the ambient air temperature sensor. Refer to Original Equipment Manufacturer (OEM) literature. Verify repair.

4.b No; Go to step 5.

5. Turn the ignition OFF.
6. Disconnect the CPC #3 21-pin connector. Refer to Original Equipment Manufacturer (OEM) literature for schematic information.
7. Inspect the CPC #3 harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   7.a Yes; repair as necessary. Verify repairs.

   7.b No; Go to step 8.

8. Measure the resistance between pins A and B of the ambient air sensor connector, harness side. Is the resistance greater than 10K ohms?

   8.a Yes; Go to step 9.

   8.b No; repair the short between pin A and pin B of the ambient air sensor harness. Verify repairs.

9. Measure the resistance between pin A of the ambient air sensor connector, harness side and ground. Is the resistance greater than 10K ohms?

   9.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature. Verify repairs.

   9.b No; repair the wire shorted to ground between pin A of the ambient air sensor connector and pin 15 of the CPC #3 connector.

69.4 SPN 171/FMI 9 - GHG17

SPN 171/FMI 9	
Description	Ambient Air Temperature Sensor Input Loss CAN
Monitored Parameter	Ambient Temperature
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key Cycle - Five Minutes Off - Engine Idle (Two minutes)

Check as follows:

1. Has the ACM/MCM/CPC been recently reprogrammed?
   - 1.a Yes; clear faults codes if they do not become active and release vehicle.
   - 1.b No; Go to step 2.
2. Turn the ignition OFF and disconnect DiagnosticLink . Wait five minutes for all modules to power down.
3. Turn ignition ON (key ON, engine OFF).
4. Reconnect DiagnosticLink; are fault codes active?
   - 4.a Yes; Refer to section "SPN 625/FMI 9 – GHG17" . Follow the entire procedure for further PT-CAN troubleshooting.
   - 4.b No; clear faults codes and release vehicle.

69.5 SPN 171/FMI 14 - GHG17

SPN 171/FMI 9	
Description	Ambient Air Temperature Sensor Input Loss CAN
Monitored Parameter	Ambient Temperature
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key Cycle - Five Minutes Off - Engine Idle (Two minutes)

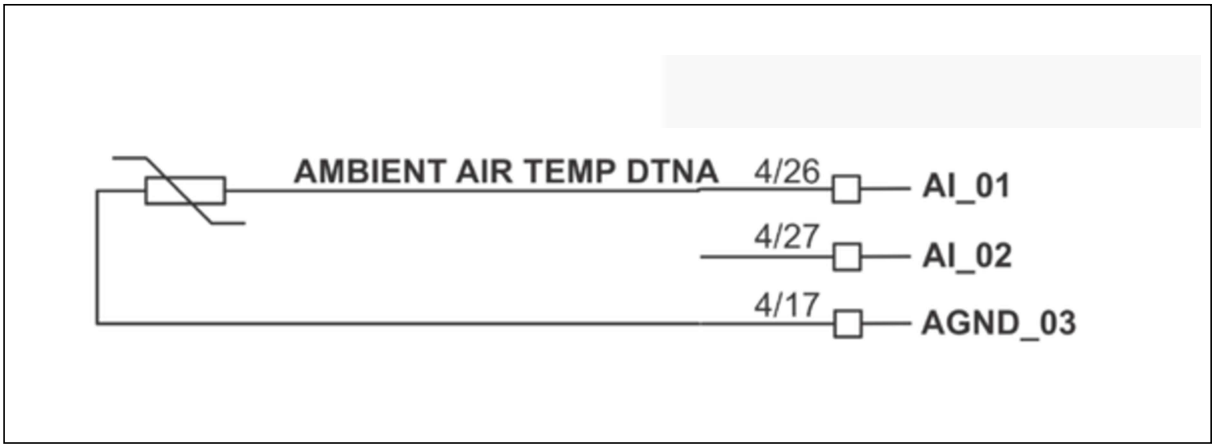
Check as follows:

1. Has the ACM/MCM/CPC been recently reprogrammed?
   - 1.a Yes; clear faults codes if they do not become active and release vehicle.
   - 1.b No; Go to step 2.
2. Turn the ignition OFF and disconnect DiagnosticLink . Wait five minutes for all modules to power down.
3. Turn ignition ON (key ON, engine OFF).
4. Reconnect DiagnosticLink; are fault codes active?
   - 4.a Yes; Refer to section "SPN 625/FMI 9 – GHG17" . Follow the entire procedure for further PT-CAN troubleshooting.
   - 4.b No; clear faults codes and release vehicle.

SPN 171 (CPC3) (GHG17)

70.1 SPN 171/FMI 3 - GHG17

SPN 171/FMI 3	
Description	Ambient Air Temperature Sensor Input Open Circuit
Monitored Parameter	Ambient Temperature
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key Cycle - Five Minutes Off - Engine Idle (Two Minute)

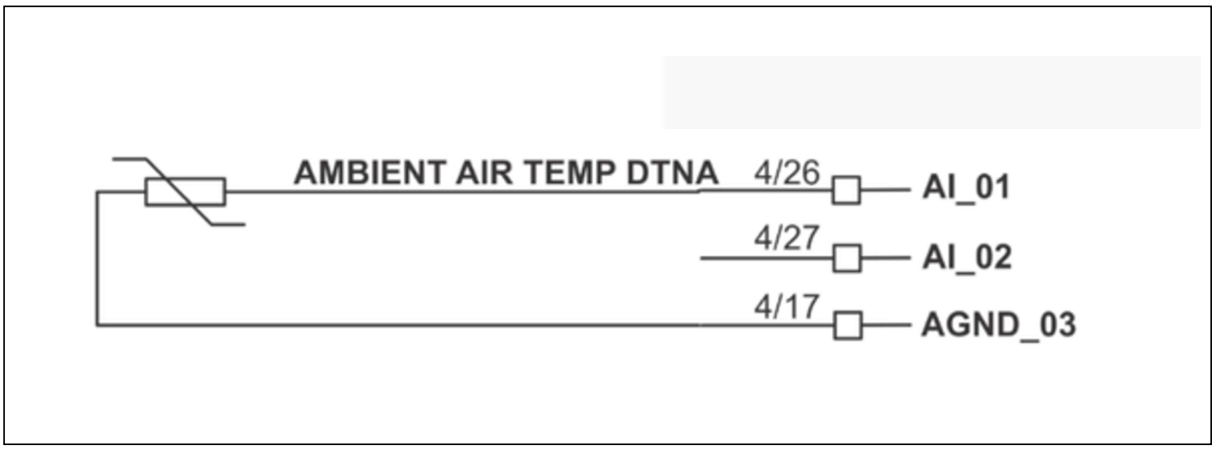


Check as follows:

1. Disconnect the ambient temperature sensor.
2. Inspect the ambient temperature sensor harness connector for bent, spread, or corroded terminals. Is pin damage found?
   - 2.a Yes; repair as necessary.
   - 2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pins 1 and 2 of the ambient temperature sensor harness connector. Is the voltage between 4.5 and 5.0 volts?
   - 4.a Yes; replace the ambient temperature sensor.
   - 4.b No; Go to step 5.
5. Measure the voltage between pin 1 of the ambient temperature sensor harness connector and ground. Is the voltage between 4.5 and 5.0 volts?
   - 5.a Yes; repair wire between pin 2 of the ambient temperature sensor harness connector and pin 16 of the CPC3 connector #2.
   - 5.b No; repair wire between pin 1 of the ambient temperature sensor harness connector and pin 2 of the CPC3 connector #3.

70.2 SPN 171/FMI 4 - GHG17

SPN 171/FMI 4	
Description	Ambient Air Temperature Sensor Input - Short to GND
Monitored Parameter	Ambient Temperature
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key Cycle - Five Minutes Off - Engine Idle (Two Minute)



Check as follows:

1. Disconnect the ambient temperature sensor.
2. Inspect the ambient temperature sensor harness connector for bent, spread, or corroded terminals. Is pin damage found?
   - 2.a Yes; repair as necessary.
   - 2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pins 1 and 2 of the ambient temperature sensor harness connector. Is the voltage between 4.5 and 5.0 volts?
   - 4.a Yes; replace the ambient temperature sensor.
   - 4.b No; Go to step 5.
5. Measure the voltage between pin 1 of the ambient temperature sensor harness connector and ground. Is the voltage between 4.5 and 5.0 volts?
   - 5.a Yes, repair wire between pin 2 of the ambient temperature sensor harness connector and pin 16 of the CPC3 connector #2.
   - 5.b No, repair wire between pin 1 of the ambient temperature sensor harness connector and pin 2 of the CPC3 connector #3.

SPN 171 (MCM) (GHG17)

72.1 SPN 171/FMI 20 - GHG17

Ambient Temperature Sensor Signal Not Plausible

SPN 171/FMI 20	
Description	This fault code sets when the Motor Control Module (MCM) detects that the ambient air temperature is greater than 20°C (36°F) degrees from the expected temperature after the engine has been turned off for 8 hours.
Monitored Parameter	Ambient air temperature
Typical Enabling Conditions	Key ON, engine OFF, battery voltage greater than 11 volts, engine rpm at zero, ambient temperature less than 40°C (104°F), engine OFF for no less than 8 hours.
Monitor Sequence	None
Execution Frequency	Once per cool down cycle
Typical Duration	5 seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Road test the vehicle for 30 minutes until the coolant reaches operating temperature. Then verify that the ambient temperature is within 10°C (18°F) of the compressor inlet temperature.

1. Has the Common Powertrain Controller (CPC) recently been reprogrammed or has the internal clock time been changed?
   - 1.a Yes; this fault may have been caused by the change in the CPC time.
   - 1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Check for multiple fault codes. Are fault codes SPN 171//FMI 3 or 4 present?
   - 4.a Yes; diagnose the other fault codes first.
   - 4.b No; Go to step 5.
5. Disconnect and inspect the ambient temperature sensor electrical connector. Refer to Original Equipment Manufacturer literature for location information. Is there damage or corrosion present?
   - 5.a Yes; repair as necessary. Verify repair.
   - 5.b No; replace the intake ambient temperature sensor. Refer to OEM literature for remove and installation procedures. Verify repair.

SPN 174 (MCM) (GHG17)

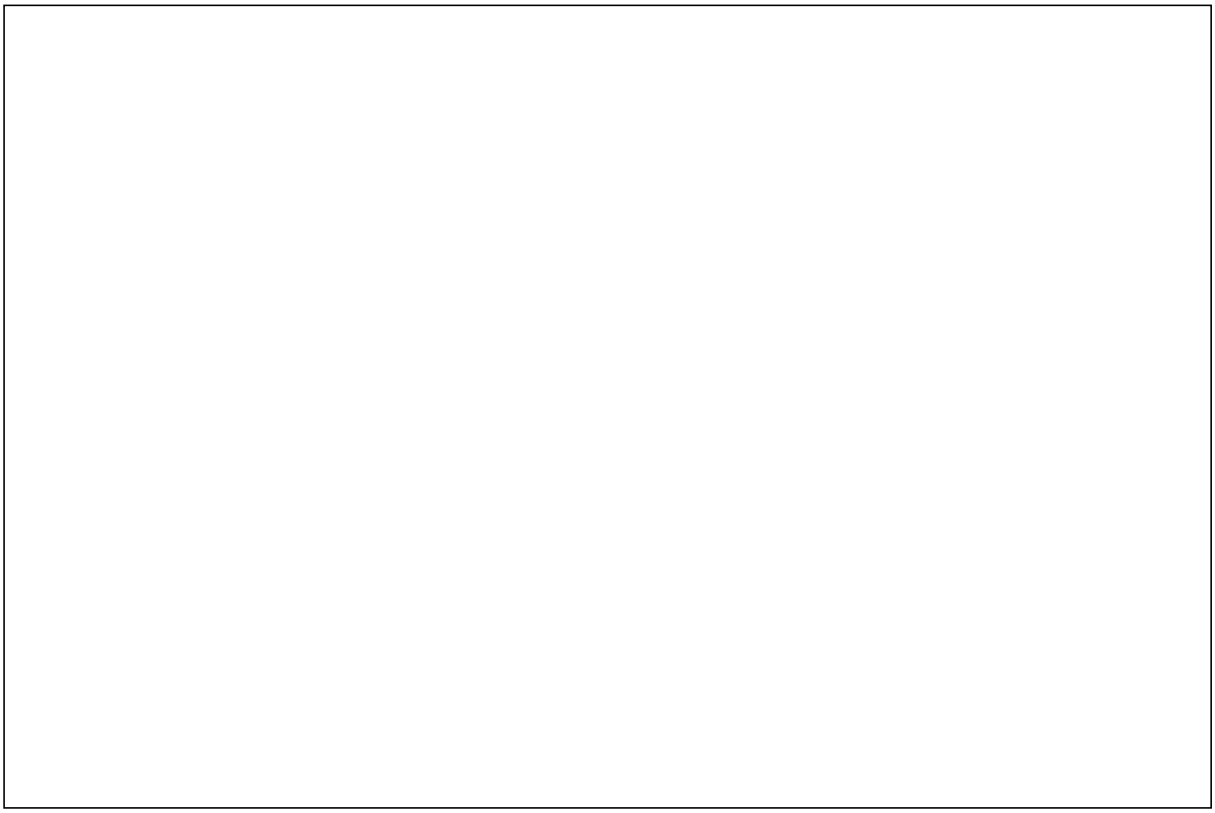
73.1 SPN 174/FMI 0 - GHG17

Supply Fuel Temperature Sensor Too High

1. Are any cooling system fault codes present?
   1.a Yes; repair those faults first.
   1.b No; Go to step 2.
2. Is SPN 174/FMI 3 or 4 also present?
   2.a Yes; repair those faults first.
   2.b No; Go to step 3.
3. For further diagnosis, Refer to section "Low Pressure Fuel System – Measuring Fuel Pressure Using Fuel System Integrity Check – Two-Filter Fuel System" .

73.2 SPN 174/FMI 3 - GHG17

SPN 174/FMI 3	
Description	Fuel Temperature Circuit Failed High
Monitored Parameter	Fuel Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (One minute)



1. Check for multiple codes. Are the following codes active at the same time?

- SPN 174/FMI 3
- SPN 175/FMI 3
- SPN 4076/FMI 3

1.a Yes; repair the open circuit between pin 55 of the Motor Control Module (MCM) 120-pin connector and pin 1 of the supply fuel temperature sensor, (or) pin 1 of the engine oil temperature sensor, (or) pin1 of the engine coolant inlet temperature sensor, (or) pin 1 of the engine coolant outlet temperature sensor.

1.b No; Go to step 2.

2. Disconnect the supply fuel temperature sensor.
3. Measure the resistance across pins 1 and 2 of the supply fuel temperature sensor. Is the resistance greater than 2.2K ohms?

3.a Yes; replace the supply fuel temperature sensor. Refer to section "Removal of the Supply Fuel Temperature Sensor" .

3.b No; Go to step 4.

4. Turn the ignition ON (key ON, engine OFF).
5. Measure the voltage between pins 1 and 2 of the supply fuel temperature sensor harness connector. Is the voltage between 2.75 and 3.25 volts?

   5.a Yes; Go to step 7.

   5.b No; Go to step 6.

6. Measure the voltage between pin 2 of the supply fuel temperature sensor harness connector and ground.

   6.a Yes; repair the open circuit between pin 1 of the supply fuel temperature sensor harness connector and pin 55 of the MCM 120-pin connector.

   6.b No; repair the open circuit between pin 2 of the supply fuel temperature sensor harness connector and pin 77 of the 120-pin MCM connector.

7. Disconnect the 120-pin MCM connector and measure the resistance between pins 1 and 2 of the supply fuel temperature sensor harness connector. Is the resistance greater than 10k ohms?

   7.a Yes; replace supply fuel temperature sensor. Refer to section "Removal of the Supply Fuel Temperature Sensor" .

   7.b No; repair the short between pins 55 and 77 of the MCM 120-pin connector.

73.3 SPN 174/FMI 4 - GHG17

SPN 174/FMI 4	
Description	This Fault Code Sets when the Motor Control Module (MCM) Detects a Short to Ground on the Supply Fuel Temperature Circuit.
Monitored Parameter	Fuel Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (One minute)

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Turn the ignition OFF.

2. Disconnect and inspect the fuel temperature sensor electrical connector (2) harness side. Is there any corrosion present?
   - 2.a Yes; replace the fuel temperature sensor and the electrical connector. Refer to section "Removal of the Supply Fuel Temperature Sensor" . Verify repair.
   - 2.b No; Go to step 3.
3. Are any of the pins or the connector damaged?
   - 3.a Yes; Go to step 4.
   - 3.b No; Go to step 5.
4. Inspect the fuel temperature sensor electrical connector components side. Are any of the pins or the connector damaged?
   - 4.a Yes; replace the fuel temperature sensor and the electrical connector. Refer to section "Removal of the Supply Fuel Temperature Sensor" . Verify repair.
   - 4.b No; replace the fuel temperature sensor electrical connector. Verify repair.
5. Use the appropriate flex probe to check the pins in the fuel temperature sensor electrical connector harness side. Are the pins spread?
   - 5.a Yes; replace the fuel temperature sensor electrical connector. Verify repair.
   - 5.b No; Go to step 6.
6. Connect DiagnosticLink .
7. Turn the ignition ON (key ON, engine OFF).
8. Check the fault codes. Is fault code SPN 174/FMI 3 inactive and SPN 174/FMI 4 active?
   - 8.a Yes; replace the fuel temperature sensor. Refer to section "Removal of the Supply Fuel Temperature Sensor" . Verify repair.
   - 8.b No; repair the circuit between pin 2 of the of the fuel temperature sensor electrical connector harness side and pin 77 of the MCM 120-pin electrical connector harness side.

73.4 SPN 174/FMI 17 - GHG17

Fuel Temperature Sensor, Minimum Temperature Plausibility

SPN 174/FMI 17	
Description	Fuel Temperature Sensor Plausibility Error when Compared to Other Group 3 Sensors
Monitored Parameter	Fuel Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Engine Idle (One minute)

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

Check as follows:

Note : During cold ambient temperatures, this fault can be induced if vehicle is equipped with auxiliary oil or coolant heaters. If unit is equipped with an auxiliary heater, clear fault code and release. Advise driver of this issue. This is a Malfunction Indication Light (MIL) - only fault.

1. Are any cooling system fault codes present?
   - 1.a Yes; repair those faults first.
   - 1.b No; Go to step 2.
2. Is SPN 174/FMI 3 or 4 also present?
   - 2.a Yes; repair those faults first.
   - 2.b No; Go to step 3.
3. Disconnect the supply fuel temperature sensor.
4. Inspect the supply fuel temperature harness connector for bent, spread or corroded pins. Is pin damage found?

4.a Yes; repair or replace the electrical connector as necessary.

4.b No; replace the supply fuel temperature sensor. Refer to section "Removal of the Supply Fuel Temperature Sensor" .

SPN 175 (MCM) (GHG17)

74.1 SPN 175/FMI 0 - GHG17

Oil Temperature High Warning

SPN 175/FMI 0	
Description	This Code Sets When the Motor Control Module (MCM) Detects High Oil Temperature.
Monitored Parameter	Engine Oil Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Run the Engine at 1200 rpm Until Coolant Temperature Reaches 49°C (120°F)

WARNING

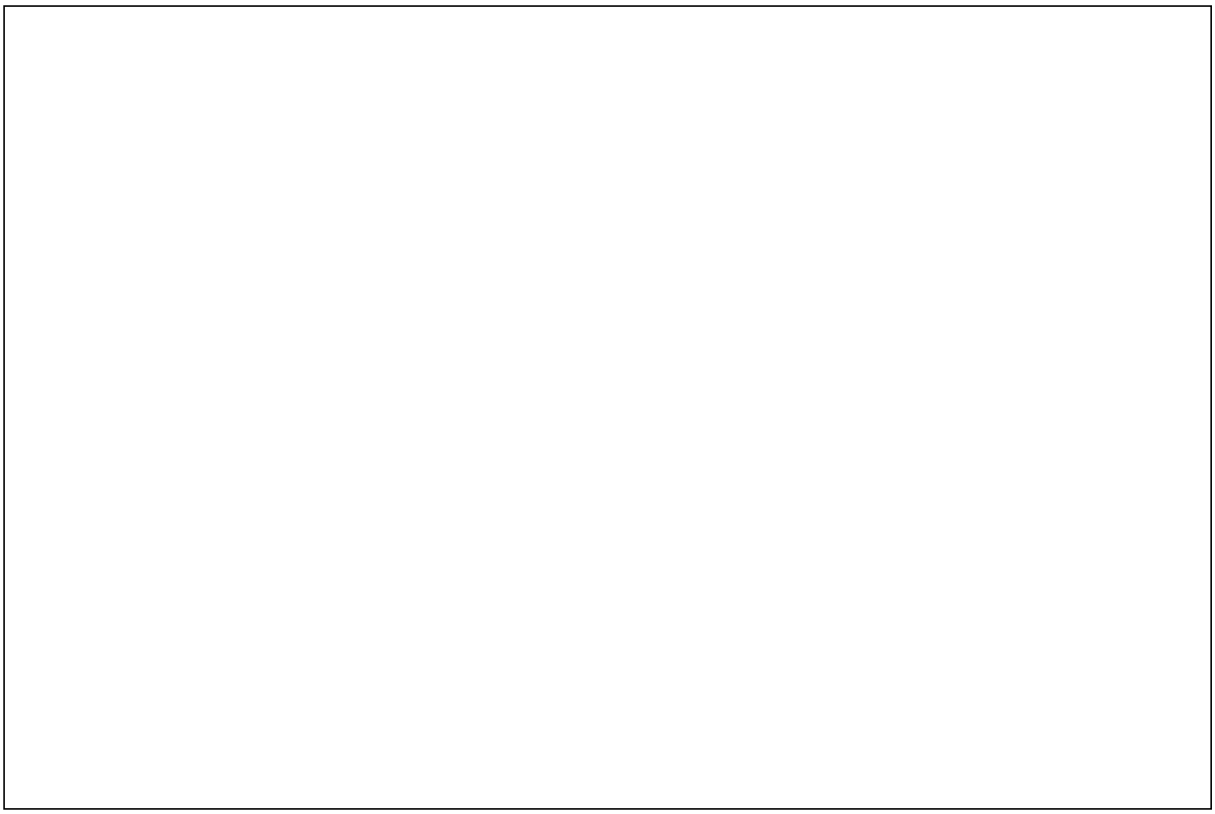
ENGINE EXHAUST

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

1. Check engine oil level. Is the oil level low?
   - 1.a Yes; add appropriate oil to bring level to full mark.
   - 1.b No; Go to step 2.
2. Are Fault codes SPN 110/FMI Any or SPN 100/FMI Any present?
   - 2.a Yes; repair those first.
   - 2.b No; Go to step 3.
3. Are SPN 175/FMI 3 or 4 also present?
   - 3.a Yes; repair those faults first.
   - 3.b No; replace the engine oil temperature sensor. Refer to section "Removal of the Engine Oil Temperature Sensor" .

74.2 SPN 175/FMI 3 - GHG17

SPN 175/FMI 3	
Description	Short to Voltage or Open on Engine Oil Temperature Sensor Circuit
Monitored Parameter	Engine Oil Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (One Minute)



1. Turn the ignition the ON (key ON, engine OFF).
2. Check for multiple codes. Are there any additional circuit failed high codes (FMI 3) present for the supply fuel temperature sensor, engine oil temperature sensor, and coolant inlet temperature sensor?
   - 2.a Yes; repair a short to power or open between pin 55 of the MCM 120-pin harness connector and pin 1 of the supply fuel temperature sensor, pin 1 of the engine oil temperature sensor, pin 1 of the coolant inlet temperature sensor, and pin 1 of the coolant outlet temperature sensor.
   - 2.b No; Go to step 3.
3. Disconnect the engine oil temperature sensor.
4. Inspect the sensor harness for bent, spread, or corroded pins. Is damage present?
   - 4.a Yes; repair as necessary. Verify repair.

4.b No; Go to step 5.

5. Measure the voltage between pin 2 of the engine oil temperature sensor and ground. Is the voltage less than 2.75 volts?

   5.a Yes; repair the open circuit between pin 2 of the engine oil temperature sensor harness connector and pin 108 of the 120-pin MCM connector.

   5.b No; Go to step 6.

6. Measure the voltage between pin 1 of the engine oil temperature sensor harness connector and ground. Is the voltage less than 2.75 volts?

   6.a Yes; Go to step 7.

   6.b No; repair the short to power between pin 1 of the engine oil temperature sensor harness connector and pin 55 of the 120-pin MCM connector.

7. Measure the resistance between pin 1 of the engine oil temperature sensor harness connector and ground. Is the resistance less than 5 ohms?

   7.a Yes; Go to step 8.

   7.b No; repair the open circuit between pin 1 of the engine oil temperature sensor harness connector and pin 55 of the 120-pin MCM connector.

8. Disconnect the 120-pin MCM connector and measure the resistance between pins 1 and 2 of the engine oil temperature sensor harness connector. Is the resistance less than 5 ohms?

   8.a Yes; repair the short between pins 55 and 108 of the MCM 120-pin connector.

   8.b No; replace engine oil temperature sensor. Refer to section "Removal of the Engine Oil Temperature Sensor" .

74.3 SPN 175/FMI 4 - GHG17

Engine Oil Temperature Circuit Failed Low

SPN 175/FMI 4	
Description	This Fault Code Sets when the Motor Control Module Detects a Short to Ground on the Engine Oil Temperature Circuit.
Monitored Parameter	Engine Oil Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (One Minute)

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Disconnect and inspect the Engine Oil Temperature sensor electrical connector harness side. Is there corrosion present in the connector?

1.a Yes; replace the Engine Oil Temperature sensor and the electrical connector. Refer to section "Removal of the Engine Oil Temperature Sensor" and Technical Service letter 13 TS-16 . Verify repair.

1.b No; Go to step 2.

2. Inspect the Engine Oil Temperature sensor electrical connector harness side. Are the pins or the connector damaged?

2.a Yes; Go to step 3.

2.b No; Go to step 4.

3. Inspect the Engine Oil Temperature sensor electrical connector component side. Are the pins or the connector damaged?

3.a Yes; replace the Engine Oil Temperature sensor and the electrical connector. Refer to section "Removal of the Engine Oil Temperature Sensor" and Technical Service letter 13 TS-16 . Verify repair.

3.b No; replace the Engine Oil Temperature electrical connector. Refer to Technical Service letter 13 TS-16 . Verify repair.

4. With the Engine Oil Temperature sensor disconnected, turn the ignition ON (Key On, engine OFF).

5. Is fault code SPN 175/FMI 4 still active?

5.a Yes; Go to step 6.

5.b No; replace the Engine Oil Temperature sensor. Refer to section "Removal of the Engine Oil Temperature Sensor" . Verify repair.

6. Turn the ignition OFF.

7. Disconnect and inspect the MCM 120-pin electrical connector harness side. Are the pins or the connector damaged?

7.a Yes; Go to step 8.

7.b No; Go to step 9.

8. Inspect the MCM 120-pin electrical connector component side. Are the pins or the connector damaged?

8.a Yes; replace the MCM and the engine harness. Refer to section "Removal of the Motor Control Module" . Verify repair.

8.b No; replace the engine harness. Verify repair.

9. Measure the resistance between pin 2 of the engine oil temperature sensor electrical connector harness side and pin 108 of the MCM 120-pin electrical connector harness side. Is the resistance less than 10k ohms?

9.a Yes; repair the short to ground between pin 2 of the Engine Oil Temperature sensor electrical connector harness side and pin 108 of the MCM 120-pin electrical connector harness side. Verify repair.

9.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .Verify repair.

74.4 SPN 175/FMI 15 - GHG17

Engine Oil Temperature High Pre Warning

SPN 175/FMI 15	
Description	This Code Sets When the Motor Control Module (MCM) Detects Engine Oil Temperature Above Normal Range.
Monitored Parameter	Engine Oil Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Run the Engine at 1200 rpm Until Coolant Temperature Reaches 49°C (120°F)

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Check engine oil level. Is the oil level low?
   - 1.a Yes; add appropriate oil to bring level to full mark.
   - 1.b No; Go to step 2.
2. Are Fault codes SPN 110/FMI Any or SPN 100/FMI Any present?
   - 2.a Yes; repair those first.
   - 2.b No; Go to step 3.
3. Is SPN 175/FMI 3 or 4 also present?
   - 3.a Yes; repair those faults first.
   - 3.b No; replace the engine oil temperature sensor. Refer to section "Removal of the Engine Oil Temperature Sensor" .

74.5 SPN 175/FMI 18 - GHG17

SPN 175/FMI 18	
Description	This Fault Code Sets When the Engine Oil Temperature Rises Too Slowly.
Monitored Parameter	Oil Temperature
Typical Enabling Conditions	Coolant Outlet and Oil Temperature Sensors
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Run the Engine at 1200 RPM Until Coolant Temperature Reaches (49°C) 120°F

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Check engine oil level. Is the oil level low?
   - 1.a Yes; bring the oil level to full mark.
   - 1.b No; Go to step 2.
2. Disconnect the engine oil temperature sensor.
3. Inspect the engine oil temperature sensor connector and engine oil temperature sensor harness connector for damage, bent, spread or unseated (pushed out) pins, corrosion or wire damage. Is damage present?
   - 3.a Yes; repair as necessary. Verify repairs.
   - 3.b No; replace the engine oil temperature sensor. Refer to section "Removal of the Engine Oil Temperature Sensor" .

74.6 SPN 175/FMI 20 - GHG17

Engine Oil Temperature Signal Not Plausible

SPN 175/FMI 20	
Description	This fault code sets when the Motor Control Module (MCM) detects that the engine oil temperature is greater than 20°C (36°F) degrees from the expected temperature after the engine has been turned off for 8 hours.
Monitored Parameter	Engine Oil Temperature
Typical Enabling Conditions	Key ON, engine OFF, battery voltage greater than 11 volts, engine rpm at zero, ambient temperature less than 40°C (104°F), ignition OFF for no less than 8 hours.
Monitor Sequence	None
Execution Frequency	Once per cold soak cycle
Typical Duration	5 seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Road test the vehicle for 30 minutes until the coolant reaches operating temperature. Then verify that the engine oil temperature is within 20°C (36°F) of the engine coolant outlet temperature.

Possible causes:

Note : The use of an external heating unit while the engine has been shut down for a minimum of 8 hours can cause this fault code to set erroneously.

1. Has the Common Powertrain Controller (CPC) recently been reprogrammed or has the internal clock time been changed?
   1.a Yes; this fault may have been caused by the change in the CPC time. Go to step 8.
   1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Check for multiple fault codes. Are fault codes SPN 175/FMI 3 or 4 present?
   4.a Yes; diagnose the other fault codes first.
   4.b No; Go to step 5.
5. Monitor and record the engine oil temperature.

> **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.

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

6. Start the engine.
7. Road test the vehicle for 30 minutes until the coolant reaches operating temperature.
8. Monitor engine oil temperature. Has the temperature increased from the previously recorded value?
   - 8.a Yes; Go to step 9.
   - 8.b No; Go to step 10.
9. Compare the engine oil temperature to the engine coolant outlet temperature. Is the difference greater than 20°C (36°F)?
   - 9.a Yes; Go to step 10.
   - 9.b No; the fault may have been caused by an external heating unit.
10. Disconnect and inspect the engine oil temperature electrical connector. Is there damage or corrosion present?
    - 10.a Yes; repair as necessary. Verify repair.
    - 10.b No; replace the engine oil temperature sensor. Verify repair.

SPN 188 (MCM) (GHG17)

75.1 SPN 188/FMI 31 - GHG17

Idle Speed is Higher than Targeted Idle Speed

SPN 188/FMI 31	
Description	Idle Speed Out of range
Monitored Parameter	Engine RPM
Typical Enabling Conditions	Engine RPM = idle
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	10 Seconds
Dash Lamps	MIL
Engine Reaction	
Verification	Engine Idle (1 minute)

1. Turn the ignition ON (key ON, engine OFF).
2. Are there any camshaft or crankshaft sensor faults present?
   - 2.a Yes; repair those faults first.
   - 2.b No; Go to step 3.
3. Are there any throttle pedal or idle validation switch faults present?
   - 3.a Yes; repair those faults first.
   - 3.b No; Go to step 4.
4. Perform idle speed balance test. Are any faulty fuel injectors identified?
   - 4.a Yes; replace suspect fuel injector.
   - 4.b No; Refer to section "Aerated Fuel Test – Two-Filter Fuel System" .

SPN 190 (ACM) (GHG17)

76.1 SPN 190/FMI 9 - GHG17

Engine Speed Signal not Available via Controller Area Network (CAN)

1. Has the Aftertreatment Control Module (ACM), Motor Control Module (MCM), or Common Powertrain Controller (CPC) been recently reprogrammed?
   1.a Yes; clear faults codes if they do not become active. Release vehicle.
   1.b No; Go to step 2.
2. Turn the ignition OFF and disconnect DiagnosticLink . Wait five minutes for all modules to power down.
3. Turn ignition ON (key ON, engine OFF).
4. Reconnect DiagnosticLink; are fault codes active?
   4.a Yes; follow entire CPC SPN 625/FMI 9 procedure for further PT CAN troubleshooting.
   4.b No; clear faults codes and release vehicle.

SPN 190 (MCM) (GHG17)

77.1 SPN 190/FMI 0 - GHG17

SPN 190/FMI 0 is an information code which indicates the Motor Control Module (MCM) detected an engine speed greater than 2500 rpm for a specific amount of time.

Note : If the unit is a crank no-start, Refer to section "Hard Start/No Start - Two-Filter Fuel System (This Test Must Be Done First)"Refer to section "Hard Start/No Start - Two-Filter Fuel System (This Test Must Be Done First).

1. Inspect the Exhaust Gas Recirculation (EGR) hot pipe for fuel. Is fuel present in the EGR hot pipe?
   - 1.a Yes, fuel is present. Refer to section "Test-E - Two-Filter Fuel System" Refer to section "Test-E - Two-Filter Fuel System.
   - 1.b No; Go to step 2.
2. Connect using DiagnosticLink . Go to step 3.
3. Turn the ignition ON (key ON, engine OFF). Go to step 4.
4. Review the extended fault data for SPN 190/FMI 0 Engine Speed High in DiagnosticLink. Is the engine speed 3000 rpm or higher?
   - 4.a Yes; replace both camshafts. Inspect engine brake rocker arms for loose actuator piston retainers and loose or missing return springs. Repair as necessary; Go to step 6.
   - 4.b No; Go to step 5.
5. Check the maximum engine speed on DDEC reports. Is the maximum engine speed 3000 rpm or higher?
   - 5.a Yes; replace both camshafts. Inspect engine brake rocker arms for loose actuator piston retainers and loose or missing return springs. Repair as necessary; Go to step 6.
   - 5.b No; no repair is necessary. If no other issues are present, release the vehicle.
6. Perform a cylinder leak-down test. Refer to section "Cylinder Leak-Down Test" Refer to section "Cylinder Leak Down Test . Did all cylinders pass the leak-down test?
   - 6.a Yes; reassemble the engine and road test to verify repairs.
   - 6.b No; remove the head and inspect for damage. Repair as necessary.

77.2 SPN 190/FMI 9 - GHG17

Engine Speed Signal not Available via Controller Area Network (CAN)

1. Has the Aftertreatment Control Module (ACM), Motor Control Module (MCM), or Common Powertrain Controller (CPC) been recently reprogrammed?
   1.a Yes; clear faults codes if they do not become active. Release vehicle.
   1.b No; Go to step 2.
2. Turn the ignition OFF and disconnect DiagnosticLink . Wait five minutes for all modules to power down.
3. Turn ignition ON (key ON, engine OFF).
4. Reconnect DiagnosticLink; are fault codes active?
   4.a Yes; follow entire CPC SPN 625/FMI 9 procedure for further PT CAN troubleshooting.
   4.b No; clear faults codes and release vehicle.

77.3 SPN 190/FMI 14 - GHG17

Engine Overspeed while Driving

Check as follows:

SPN 190/FMI 14 is an information code only. It is used to provide the operator a message on the instrument cluster. The function is to warn the operator that the engine speed is getting high and the service brakes should be applied to avoid engine/transmission damage, typically on a steep grade deceleration. The code will self-delete with each ignition cycle. Driver should be questioned about vehicle driving conditions. Obtain a copy of DDEC reports and review the data with the customer.

77.4 SPN 190/FMI 15 - GHG17

Engine Over Speed Pre-Warning

SPN 190/FMI 15	
Description	This Fault Code Sets When the Engine Speed is Above 2300 rpm.
Monitored Parameter	Engine Speed
Typical Enabling Conditions	Engine Speed Greater than 2300 rpm
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	Engine Brakes are Activated
Verification	Start and Run the Engine

Check as follows:

This fault is an information code only. It is used to provide the operator a message on the instrument cluster. The function is to warn the operator that the engine speed is getting high and the service brakes should be applied to avoid engine/transmission damage, typically on a steep grade deceleration. The code will self-delete with each ignition cycle. Once the engine rpm is within normal operating range the message in the IC and the CEL will no longer be present.

1. Connect DiagnosticLink .
2. Check for multiple fault codes. Is fault code SPN 190/FMI Any also present?
   - 2.a Yes; diagnose the other fault code first.
   - 2.b No; SPN 190/FMI 15 is an information code only. It is used to provide a warning to the instrument cluster. Question the driver about driving conditions and driving habits.

77.5 SPN 190/FMI 16 - GHG17

Engine Overspeed while Stationary

Check as follows:

SPN 190/FMI 16 is an information code only. It is used to provide the operator a message on the instrument cluster. The function is to warn the operator that the engine speed is getting high and the service brakes should be applied to avoid engine/transmission damage, typically on a steep grade deceleration. The code will self-delete with each ignition cycle. Driver should be questioned about vehicle driving conditions. Obtain a copy of DDEC reports and review the data with the customer.

SPN 191 (CPC) (GHG17)

78.1 SPN 191/FMI 9 - GHG17

SPN 191/FMI 13	
Description	J1939 Transmission Message is Missing
Monitored Parameter	CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL
Engine Reaction	
Verification	Engine Idle (One minute)

Check as follows:

Note : Fault will set during Eaton transmission module reprogramming. If fault occurs while programming, clear code and release vehicle.

1. Check for multiple codes. Are CPC SPN 168/FMI 0/14/18 (battery voltage) codes present?
   - 1.a Yes; troubleshoot these first.
   - 1.b No; Go to step 2.
2. Is MCM SPN 625/FMI 9 code present?
   - 2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   - 2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   - 3.a Yes; check the proper configuration of the CPC.
   - 3.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

78.2 SPN 191/FMI 13 - GHG17

SPN 191/FMI 13	
Description	J1939 Transmission Output Shaft Speed Signal is Missing
Monitored Parameter	CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL
Engine Reaction	
Verification	Engine Idle (One minute)

Check as follows:

1. Check for multiple codes. Are CPC SPN 168/FMI 0/14/18 (battery voltage) codes present?
   - 1.a Yes; troubleshoot these first.
   - 1.b No; Go to step 2.
2. Is MCM SPN 625/FMI 9 code present?
   - 2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   - 2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   - 3.a Yes; check the proper configuration of the CPC.
   - 3.b No; determine which modules are configured for the vehicle and their communication status. Then follow the appropriate module communication troubleshooting procedures for the affected module.

78.3 SPN 191/FMI 19 - GHG17

Transmission Output Speed Shaft Signal is Erratic

SPN 191/FMI 19	
Description	J1939 Transmission Output Shaft Speed Signal is Erratic
Monitored Parameter	Controller Area Network (CAN) Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL
Engine Reaction	
Verification	Engine Idle (One minute)

Check as follows:

1. Check for multiple codes. Are CPC SPN 168/FMI 0/14/18 (battery voltage) codes present?
   - 1.a Yes; troubleshoot these first.
   - 1.b No; Go to step 2.
2. Is MCM SPN 625/FMI 9 code present?
   - 2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   - 2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   - 3.a Yes; check the proper configuration of the CPC.
   - 3.b No; determine which modules are configured for the vehicle and their communication status. Then follow the appropriate module communication troubleshooting procedures for the affected module.

SPN 247 (CPC) (GHG17)

79.1 SPN 247/FMI 0 - GHG17

Note : The Common Powertrain Controller (CPC) digital outputs have the same SPN as some Motor Control Module (MCM) faults. DDDL 7.X makes the distinction between the MCM and CPC when diagnosing a fault.

This diagnostic is typically MCM engine hours data higher than expected. This fault usually occurs after reprogramming the CPC or MCM. The internal clocks of the CPC or MCM do not match. After reprogramming either module, all fault codes must be cleared.

79.2 SPN 247/FMI 1 - GHG17

Note : The Common Powertrain Controller (CPC) digital outputs have the same SPN as some Motor Control Module (MCM) faults. DiagnosticLink® makes the distinction between the MCM and CPC when diagnosing a fault.

This diagnostic is typically MCM engine hours data lower than expected. This fault usually occurs after reprogramming the CPC or MCM. The internal clocks of the CPC or MCM do not match. After reprogramming either module, all fault codes must be cleared.

79.3 SPN 247/FMI 9 - GHG17

Note : The Common Powertrain Controller (CPC) digital outputs have the same SPN as some Motor Control Module (MCM) faults. DiagnosticLink® makes the distinction between the MCM and CPC when diagnosing a fault.

This diagnostic is typically MCM engine hours data not received or stopped arriving. This fault usually occurs after reprogramming the CPC or MCM. The internal clocks of the CPC or MCM do not match. After reprogramming either module, all fault codes must be cleared.

79.4 SPN 247/FMI 10 – GHG17

Note : The Common Powertrain Controller (CPC) digital outputs have the same SPN as some Motor Control Module (MCM) faults. DDDL 7.08 SP2 makes the distinction between the MCM and CPC when diagnosing a fault.

This diagnostic is typically MCM Engine Hours Data Increasing at an Implausible Rate. This fault usually occurs after reprogramming the CPC or MCM. The internal clocks of the CPC or MCM do not match. After reprogramming either module, all fault codes must be cleared.

79.5 SPN 247/FMI 14 - GHG17

Aftertreatment Control Module Reported Ash Mileage is Lower than the Common Powertrain Controller Stored Value

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Select Diesel Particulate Filter (DPF) ash accumulator from the actions drop-down menu.
4. Choose Aftertreatment Control Module (ACM) replacement option, then select set ash volume button.
5. Verify that the ACM value has changed in the DPF ash accumulator window and that the 247/14 CPC fault is no longer active. ACM will change to a value that should be within 5% of the CPC displayed volume within 5-10 seconds of executing the routine. Clear all faults and release vehicle.

SPN 411 (MCM) (GHG17)

80.1 SPN 411/FMI 2 - GHG17

Exhaust Gas Recirculation Delta P Sensor Out Of Calibration

SPN 411/FMI 2	
Description	EGR delta Pressure Sensor Out Of Calibration
Monitored Parameter	EGR delta Pressure
Typical Enabling Conditions	Coolant Temperature greater than 176F
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	15 seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Coolant Temperature greater than 176F, then engine off for 15 seconds, then Key ON

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink , monitor EGR delta P voltage (pin 109).
3. Is the EGR delta P voltage between 0.55 and 0.83 volts?
   - 3.a Yes, Go to step 7.
   - 3.b No, Go to step 4.
4. Remove the EGR delta P sensor from the mounting pad, leave electrical harness connected. Refer to section "Removal of the Delta P Sensor" .
5. Is the EGR delta P voltage between 0.55 and 0.83 volts?
   - 5.a Yes, Go to step 6.
   - 5.b No, Go to step 14.
6. Inspect the EGR Delivery pipe delta P pressure ports for blockage.

6.a If excessive build up or blockage is found, clean the venturi pipe and reinstall the sensor. Refer to section "Cleaning of the Exhaust Gas Recirculation Venturi Pipe Delta P Sensor Ports" .

6.b If no blockage is found, Go to step 7.

7. Disconnect the EGR delta P sensor harness connector.
8. Inspect the EGR delta P sensor harness connector for loose, bent, spread or corroded pins.

8.a If pin damage is found, repair as necessary.

8.b If no damage is found, Go to step 9.

9. Disconnect the Motor Control Module (MCM) 120–pin connector.
10. Measure the resistance between pins 1 and 2 of the EGR delta P sensor.

10.a If the resistance is greater than 5 ohms, Go to step 11.

10.b If the resistance is less than 5 ohms, repair the short between pins 103 and 117 of the MCM 120–pin connector.

11. Measure the resistance between pins 2 and 3 of the EGR delta P sensor.

11.a If the resistance is greater than 5 ohms, Go to step 12.

11.b If the resistance is less than 5 ohms, repair the short between pins 103 and 109 of the MCM 120–pin connector.

12. Measure the resistance between pin 1 of the EGR delta P sensor and ground.

12.a If the resistance is greater than 3 ohms, Go to step 13.

12.b If the resistance is less than 3 ohms, repair the short circuit between pin 1 of the EGR delta P sensor harness connector and ground.

13. Measure the resistance between pin 3 of the EGR delta P sensor and ground.

13.a If the resistance is greater than 3 ohms, repeat the previous steps. If the results are the same, call the Detroit™ Customer Support Center (800-445-1980).

13.b If the resistance is less than 3 ohms, repair the short circuit between pin 3 of the EGR delta P sensor harness connector and ground.

14. Disconnect the EGR delta P sensor harness connector.
15. Inspect the EGR delta P sensor harness connector for loose, bent, spread or corroded pins.

15.a If pin damage is found, repair as necessary.

15.b If no damage is found, Go to step 16.

16. Disconnect the MCM 120–pin connector.
17. Measure the resistance between pins 1 and 2 of the EGR delta P sensor.

17.a If the resistance is greater than 5 ohms, Go to step 18.

17.b If the resistance is less than 5 ohms, repair the short between pins 103 and 117 of the MCM 120–pin connector.

18. Measure the resistance between pins 2 and 3 of the EGR delta P sensor.

18.a If the resistance is greater than 5 ohms, Go to step 19.

18.b If the resistance is less than 5 ohms, repair the short between pins 103 and 109 of the MCM 120–pin connector.

19. Measure the resistance between pin 1 of the EGR delta P sensor and ground.

19.a If the resistance is greater than 3 ohms, Go to step 20.

19.b If the resistance is less than 3 ohms, repair the short circuit between pin 1 of the EGR delta P sensor harness connector and ground.

20. Measure the resistance between pin 3 of the EGR delta P sensor and ground.

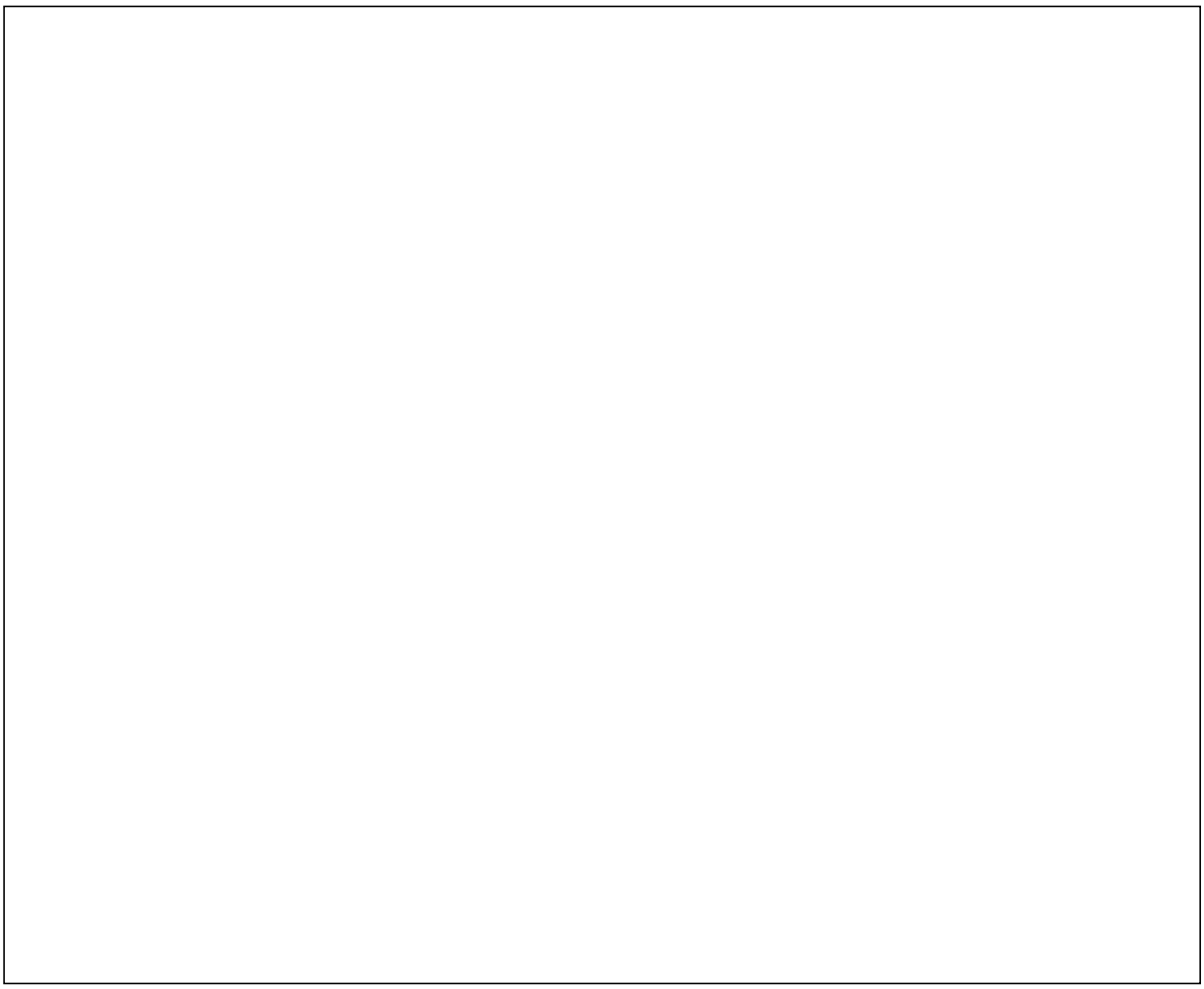
20.a If the resistance is greater than 3 ohms, repeat the previous steps. If the results are the same, replace the EGR delta P sensor. Refer to section "Removal of the Delta P Sensor" . After sensor replacement, perform EGR delta P sensor re-calibration service routine.

20.b If the resistance is less than 3 ohms, repair the short circuit between pin 3 of the EGR delta P sensor harness connector and ground.

80.2 SPN 411/FMI 3 - GHG17

EGR Delta Pressure Sensor Circuit Failed High

SPN 411/FMI 3	
Description	This fault code sets when there is short to ground on the signal return circuit.
Monitored Parameter	EGR Delta Pressure Sensor return signal
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)



WARNING

ELECTRICAL SHOCK

To avoid injury from electrical shock, follow OEM furnished operating instructions prior to usage.

WARNING

ELECTRICAL SHOCK

To avoid injury from electrical shock, do not touch battery terminals, alternator terminals, or wiring cables while the engine is operating.

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Is fault code SPN 3509/FMI 3 also present?
   - 3.a Yes; Diagnose fault code SPN 3509/FMI 3.
   - 3.b No; Go to step 4.
4. Disconnect and inspect the EGR Delta P sensor electrical connector. Is there any damage or corrosion present?
   - 4.a Yes; repair as necessary.
   - 4.b No; Go to step 5.
5. Turn the ignition ON (key ON, engine OFF).
6. Recheck for the fault code. Did SPN 411/FMI 3 become inactive and fault code SPN 411/FMI 4 become active?
   - 6.a Yes; replace the EGR Delta P sensor. Refer to section "Removal of the Delta P Sensor" .
   - 6.b No; Go to step 7.
7. Turn the ignition OFF.
8. Disconnect and inspect the MCM 120-pin electrical connector. Is the MCM connector damaged?
   - 8.a Yes; repair as necessary.
   - 8.b No; Go to step 9.
9. Turn the ignition ON (key ON, engine OFF).
10. Recheck for the fault code. Is SPN 411/FMI 3 still present?
    - 10.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" .
    - 10.b No; repair the short to ground on the circuit between pin 3 of the EGR Delta P sensor electrical connector harness side, and pin 109 of the 120- pin MCM electrical connector, harness side.

80.3 SPN 411/FMI 4 - GHG17

SPN 411/FMI 4	
Description	This Fault Code Sets when there is an Open in the Voltage Supply Circuit, an Open or Short to Ground on the Signal Return Circuit
Monitored Parameter	EGR Delta Pressure Sensor Return Signal
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One Minute)

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ WARNING

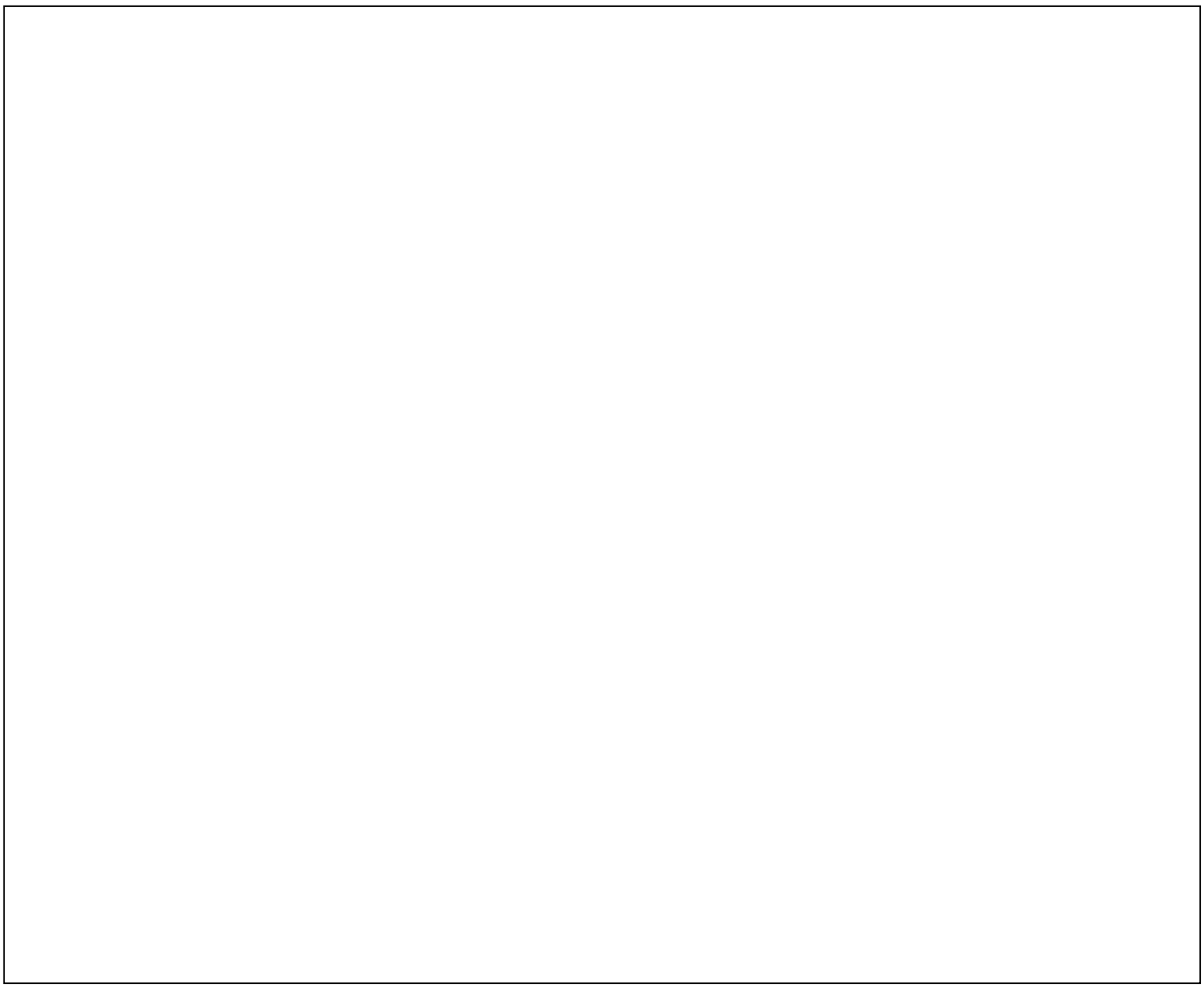
PERSONAL INJURY

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.

⚠ WARNING

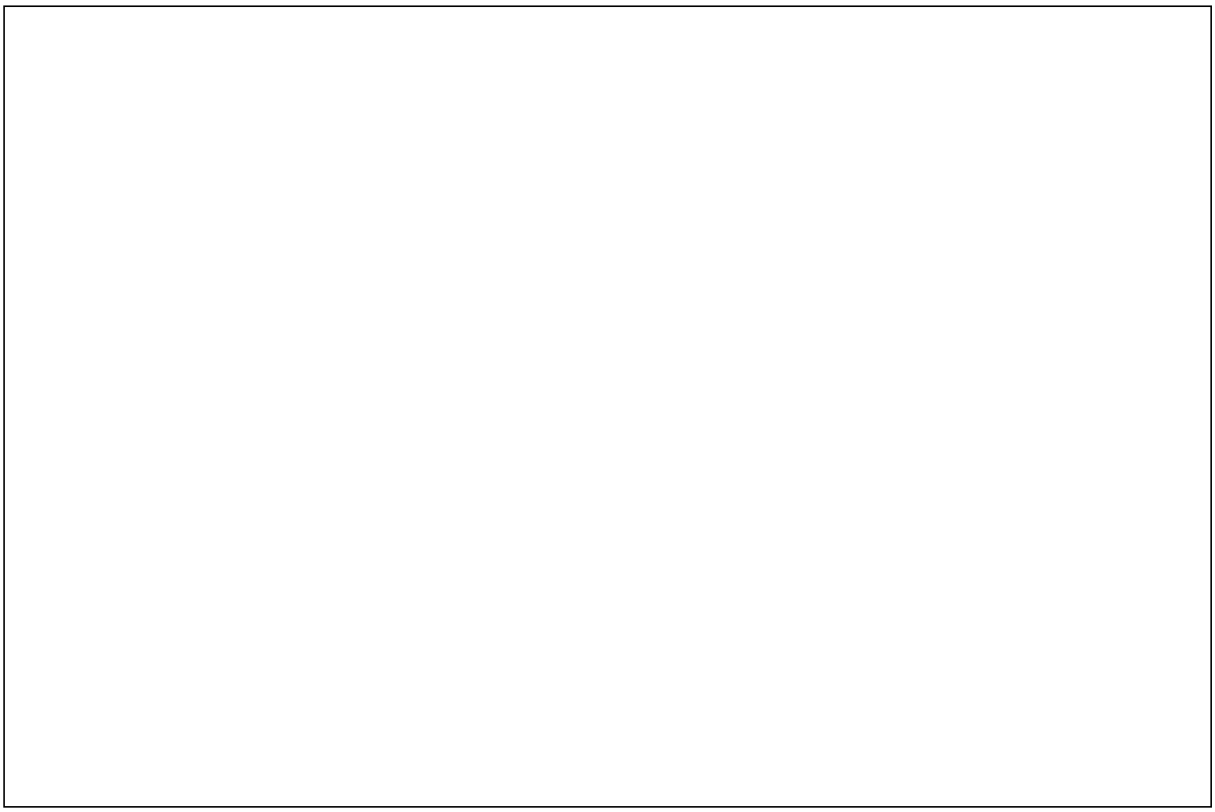
ENGINE EXHAUST

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



Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Is fault code SPN 3509/FMI 4 also present?
   3.a Yes; diagnose fault code SPN 3509/FMI 4.
   3.b No; Go to step 4.
4. Turn the ignition OFF.



5. Disconnect and inspect the EGR Delta P sensor electrical connector harness side. Is there any corrosion present?
   - 5.a Yes; replace the EGR Delta P sensor and the electrical connector. Refer to section "Removal of the Delta P Sensor" . Verify repair.
   - 5.b No; Go to step 6.
6. Is the connector or any of the pins damaged?
   - 6.a Yes; Go to step 7.
   - 6.b No; Go to step 8.
7. Inspect the EGR Delta P sensor electrical connector component side, is the connector or are any of the pins damaged?
   - 7.a Yes; replace the EGR Delta P sensor and the electrical connector. Refer to section "Removal of the Delta P Sensor" . Verify repair.
   - 7.b No; replace the EGR Delta P sensor electrical connector.
8. Turn the ignition ON (key ON, engine OFF).
9. Measure the voltage between pin 1 and pin 2 of the EGR Delta P sensor electrical connector harness side. Is the voltage between 4.5 and 5.5 volts?
   - 9.a Yes. Go to step 11.
   - 9.b No; Go to step 10.
10. Measure the voltage between pin 1 and ground. Is the voltage between 4.5 and 5.5 volts?
    - 10.a Yes; repair the circuit between pin 1 of the EGR Delta P sensor electrical connector harness side and the splice. Verify repair.
    - 10.b No; repair the circuit between pin 2 of the EGR Delta P sensor electrical connector harness side and the splice. Verify repair.
11. Use the appropriate flex probes to jump pin 1 and pin 3 of the EGR Delta P sensor electrical connector harness side together.

12. Check the fault codes, does fault code SPN 411 FMI 4 become inactive and fault code SPN 411/FMI 3 become active?

    12.a Yes; replace the EGR Delta P sensor. Refer to section "Removal of the Delta P Sensor" . Verify repair.

    12.b No; repair the circuit between pin 3 of the EGR Delta P sensor electrical connector harness side and pin 109 of the 120-pin MCM electrical connector harness side.

80.4 SPN 411/FMI 13 - GHG17

EGR Delta Pressure Sensor Out Of Calibration

SPN 411/FMI 13	
Description	EGR delta Pressure Sensor Out Of Calibration
Monitored Parameter	EGR delta Pressure
Typical Enabling Conditions	Coolant Temperature greater than 176F
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	15 seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Coolant Temperature greater than 176F, then engine off for 15 seconds, then Key ON

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink , monitor EGR delta P voltage (pin 109).
3. Is the EGR delta P voltage between 0.55 and 0.83 volts?
   3.a Yes; Go to step 7.
   3.b No; Go to step 4.
4. Remove the EGR delta P sensor from the mounting pad; leave electrical harness connected.
5. Is the EGR delta P voltage between 0.55 and 0.83 volts?
   5.a Yes; Go to step 6.
   5.b No; Go to step 14.
6. Inspect the EGR delivery pipe delta P pressure ports for blockage.
   6.a If excessive build up or blockage is found, clean the venturi pipe and reinstall the sensor.

6.b If no blockage is found, Go to step 7.

7. Disconnect the EGR delta P sensor harness connector.
8. Inspect the EGR delta P sensor harness connector for loose, bent, spread or corroded pins.

8.a If pin damage is found, repair as necessary.

8.b If no damage is found, Go to step 9.

9. Disconnect the Motor Control Module (MCM) 120–pin connector.
10. Measure the resistance between pins 1 and 2 of the EGR delta P sensor connector on the engine sensor harness.

10.a If the resistance is greater than 5 ohms, Go to step 11.

10.b If the resistance is less than 5 ohms, repair the short between pins 103 and 117 of the MCM 120–pin connector.

11. Measure the resistance between pins 2 and 3 of the EGR delta P sensor connector on the engine sensor harness.

11.a If the resistance is greater than 5 ohms, Go to step 12.

11.b If the resistance is less than 5 ohms, repair the short between pins 103 and 109 of the MCM 120–pin connector.

12. Measure the resistance between pin 1 of the EGR delta P sensor connector on the engine sensor harness and ground.

12.a If the resistance is greater than 3 ohms, Go to step 13.

12.b If the resistance is less than 3 ohms, repair the short circuit between pin 1 of the EGR delta P sensor harness connector and ground.

13. Measure the resistance between pin 3 of the EGR delta P sensor connector on the engine sensor harness and ground.

13.a If the resistance is greater than 3 ohms, repeat the previous steps (Go back to Step 1). If the results are the same, call the Detroit™ Customer Support Center (800-445-1980).

13.b If the resistance is less than 3 ohms, repair the short circuit between pin 3 of the EGR delta P sensor harness connector and ground.

14. Disconnect the EGR delta P sensor harness connector.
15. Inspect the EGR delta P sensor harness connector for loose, bent, spread or corroded pins.

15.a If pin damage is found, repair as necessary.

15.b If no damage is found, Go to step 16.

16. Disconnect the MCM 120–pin connector.
17. Measure the resistance between pins 1 and 2 of the EGR delta P sensor connector on the engine sensor harness.

17.a If the resistance is greater than 5 ohms, Go to step 18.

17.b If the resistance is less than 5 ohms, repair the short between pins 103 and 117 of the MCM 120–pin connector.

18. Measure the resistance between pins 2 and 3 of the EGR delta P sensor connector on the engine sensor harness.

18.a If the resistance is greater than 5 ohms, Go to step 19.

18.b If the resistance is less than 5 ohms, repair the short circuit between pin 103 and 109 of the MCM 120-pin connector.

19. Measure the resistance between pin 1 of the EGR delta P sensor connector on the engine sensor harness and ground.

19.a If the resistance is greater than 3 ohms, Go to step 20.

19.b If the resistance is less than 3 ohms, repair the short between pin 1 of the EGR delta P sensor harness connector and ground.

20. Measure the resistance between pin 3 of the EGR delta P sensor connector on the engine sensor harness and ground.

20.a If the resistance is greater than 3 ohms, repeat the previous steps; Go to step 1. If the results are the same, replace the EGR delta P sensor. Refer to section "Removal of the Delta P Sensor" Refer to section "Removal of the Delta P Sensor". After sensor replacement, perform EGR delta P sensor re-calibration service routine.

20.b If the resistance is less than 3 ohms, repair the short circuit between pin 3 of the EGR delta P sensor harness connector and ground.

SPN 513 (ACM) (GHG17)

81.1 SPN 513/FMI 9 - GHG17

Actual Torque Signal Not Available via CAN.

1. Has the Aftertreatment Control Module (ACM), Motor Control Module (MCM), or Common Powertrain Controller (CPC) been recently reprogrammed?
   - 1.a Yes; clear faults codes. If they do not become active, release the vehicle.
   - 1.b No; Go to step 2.
2. Turn the ignition OFF and disconnect DiagnosticLink ; then wait 5 minutes for all modules to power-down.
3. Turn ignition ON (key ON, engine OFF).
4. Reconnect DiagnosticLink; are fault codes active?
   - 4.a Yes; Refer to section "SPN 625/FMI 9 - GHG17" troubleshooting procedure for further PT Controller Area Network (CAN) troubleshooting.
   - 4.b No; clear faults codes and release vehicle.

SPN 520 (MCM) (GHG17)

82.1 SPN 520/FMI 1 - GHG17

SPN 520/FMI 1	
Description	This Fault Code Sets When the engine brake power has been limited to prevent engine damage due to a fault in the Exhaust Gas Recirculation (EGR), intake or aftertreatment system.
Monitored Parameter	Engine brake
Typical Enabling Conditions	Engine brake request active.
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Based on other fault codes present
Verification	Road test vehicle using engine brakes.

Check as follows:

Note : This fault code is an information fault code that sets when there is a fault with the EGR, intake or aftertreatment system.

1. Connect DiagnosticLink .
2. Turn the ignition ON(key ON, engine OFF).
3. Check for multiple fault codes. Are there any EGR, intake system or aftertreatment fault codes present?
   3.a Yes; diagnose the other fault codes first.
   3.b No; Go to step 4.
4. Clear the fault codes.

> **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.

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

5. Start and run the engine until the coolant temperature reaches 85°C (185°F).
6. Road test the vehicle and use the engine brakes. Does fault code SPN 520/FMI 1 become active?
   6.a Yes; replace the MCM., Refer to section "Removal of the Motor Control Module" . Verify repair.
   6.b No; release the vehicle.

82.2 SPN 520/FMI 18 - GHG17

SPN 520/FMI 18	
Description	This Fault Code Sets When the Engine Brake Power has Been Limited to Prevent Engine Damage Due to a Fault in the Exhaust Gas Recirculation (EGR), Intake or Aftertreatment System
Monitored Parameter	Engine Brake
Typical Enabling Conditions	Engine Brake Request Active
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Based on Other Fault Codes Present
Verification	Road Test Vehicle Using Engine Brakes

Note : This fault code is an information only code that sets when there is a system fault that results in derated engine brake performance. Troubleshoot the other active faults.

SPN 523 (CPC) (GHG17)

83.1 SPN 523/FMI 13 - GHG17

SPN 523/FMI 13	
Description	Transmission Gear Signal Not Available
Monitored Parameter	Gear Signal
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On Engine On

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Check as follows:

1. Connect DiagnosticLink .
2. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   - 2.a Yes; repair the battery voltage concern. Verify repair.
   - 2.b No; Go to step 3.
3. Is SPN 625/FMI 9 fault code present?
   - 3.a Yes; diagnose SPN 625/FMI 9 fault code first. Verify repair.
   - 3.b No; Go to step 4.
4. Has the CPC been recently reprogrammed?
   - 4.a Yes; check the proper configuration of the CPC.
   - 4.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

83.2 SPN 523/FMI 19 - GHG17

SPN 523/FMI 19	
Description	Transmission Gear Signal Erratic
Monitored Parameter	Gear Signal
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On Engine On

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Check as follows:

1. Connect DiagnosticLink .
2. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   - 2.a Yes; repair the battery voltage concern. Verify repair.
   - 2.b No; Go to step 3.
3. Is SPN 625/FMI 9 fault code present?
   - 3.a Yes; diagnose SPN 625/FMI 9 fault code first. Verify repair.
   - 3.b No; Go to step 4.
4. Has the CPC been recently reprogrammed?
   - 4.a Yes; check the proper configuration of the CPC.
   - 4.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

SPN 523 (MCM) (GHG17)

84.1 SPN 523/FMI 13 - GHG17

Check as follows:

1. Check for multiple codes: Is (CPC) SPN 168/FMI 0/14/18 (Battery Voltage) present?
   - 1.a Yes; troubleshoot these first.
   - 1.b No; Go to step 2.
2. Is (MCM) SPN 625/FMI 9 present?
   - 2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   - 2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   - 3.a Yes; check the proper configuration of the CPC.
   - 3.b No; determine which modules are configured for the vehicle and their communication status. Then follow the appropriate module communication troubleshooting procedures for the affected module.

84.2 SPN 523/FMI 19 - GHG17

Check as follows:

1. Check for multiple codes: Is (CPC) SPN 168/FMI 0/14/18 (Battery Voltage) present?
   1.a Yes; troubleshoot these first.
   1.b No; Go to step 2.
2. Is (MCM) SPN 625/FMI 9 present?
   2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   3.a Yes; check the proper configuration of the CPC.
   3.b No; determine which modules are configured for the vehicle and their communication status. Then follow the appropriate module communication troubleshooting procedures for the affected module.

SPN 524 (CPC) (GHG17)

85.1 SPN 524/FMI 9 - GHG17

J1939 ETC2 Message Missing

Note : Fault will set during Eaton transmission module reprogramming. If fault occurs while programming, clear code and release vehicle.

Check as follows:

1. Check for multiple codes: Is (CPC) SPN 168/FMI 0/14/18 (Battery Voltage) code present?
   - 1.a Yes; troubleshoot these first.
   - 1.b No; Go to step 2.
2. Is (MCM) SPN 625/FMI 9 code present?
   - 2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   - 2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   - 3.a Yes; check the proper configuration of the CPC.
   - 3.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

SPN 525 (CPC) (GHG17)

86.1 SPN 525/FMI 7 - GHG17

Internal Error with the DT12 Shift Stalk Lever

Shift Lever Pin Number	Signal Description	CPC Connector Pin
1	12V Ignition	2/3 Ignition
2	LIN	2/4 LIN COM
3	GND	2/2 Main Battery Ground
4	No Connection	No Connection

Check as follows:

1. Disconnect shift stalk lever.
2. Turn ignition ON (key ON, engine OFF).
3. Measure voltage between pin 1 of the shift stalk harness connector and ground. Is the voltage between 11.5 and 12 volts?
   - 3.a Yes; Go to step 4.
   - 3.b No; Go to step 9.
4. Turn ignition OFF.
5. Disconnect the Common Powertrain Controller (CPC) connector #2.
6. Inspect CPC connector #2 for bent, spread or corroded pins . Was any damage found?
   - 6.a Yes; repair as necessary.
   - 6.b No; Go to step 7.
7. Measure the resistance between pin 4 of the CPC connector #2 and pin 2 of the shift stalk lever harness connector. Is the resistance less than 5 ohms?
   - 7.a Yes; Go to step 8.
   - 7.b No; repair wire between pin 4 of the CPC connector #2 and pin 2 of the shift stalk lever harness connector.
8. Measure the resistance between pin 2 of the CPC connector #2 and pin 3 of the shift stalk lever harness connector. Is the resistance less than 5 ohms?
   - 8.a Yes; replace the shift stalk lever.
   - 8.b No; repair wire between pin 4 of the CPC connector #2 and pin 3 of the shift stalk lever harness connector.
9. Turn the ignition OFF.
10. Disconnect CPC connector #2.
11. Measure the resistance between pin 4 of the CPC connector #2 and pin 2 of the shift stalk lever harness connector. Is the resistance less than 5 ohms?
    - 11.a Yes; refer to Original Equipment Manufacturer literature for chassis side harness information on Ignition supply voltage to pin 3 of the CPC connector #2.
    - 11.b No; repair wire between pin 4 of the CPC connector #2 and pin 2 of the shift stalk lever harness connector.

86.2 SPN 525/FMI 9 – GHG17

J1939 Powertrain Message (Transfer Case/PTO) is Missing

Check as follows:

1. Connect DiagnosticLink .
2. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   2.a Yes; repair the battery voltage concern. Verify repair.
   2.b No; Go to step 3.
3. Is SPN 625/FMI 9 fault code present?
   3.a Yes; diagnose SPN 625/FMI 9 fault code first. Verify repair.
   3.b No; Go to step 4.

Note : This fault code may be set by two or more source inputs configured with the same address. Verify proper parameter settings.

4. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   4.a Yes; replace CPC. Refer to Original Equipment Manufacturer (OEM) literature.
   4.b No; reprogram the CPC with the correct information as necessary. To verify repair, Go to step 5.
5. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

SPN 527 (CPC) (GHG17)

87.1 SPN 527/FMI 9 - GHG17

J1939 Cruise Control Vehicle Speed (CCVS) Message From Source #1, #2, or #3 Missing

SPN 527/FMI 9	
Description	Missing Message form J1939 Source Address
Monitored Parameter	J1939 Source Address
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON engine ON

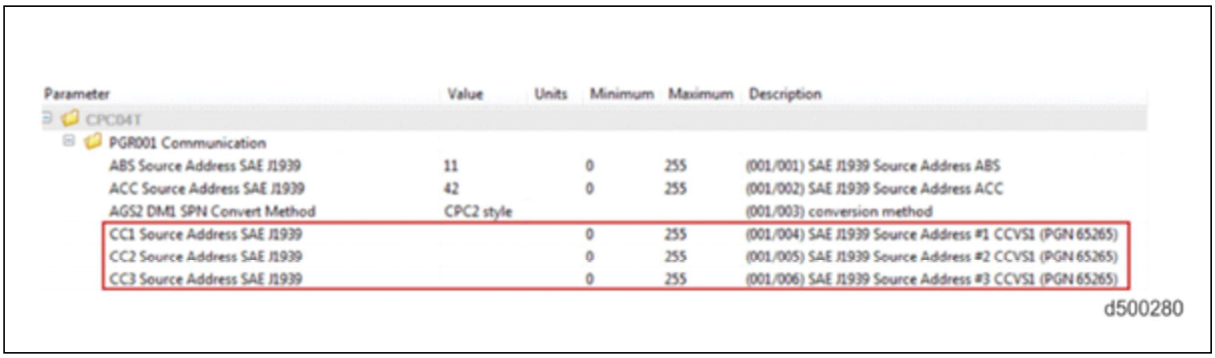
WARNING

ENGINE EXHAUST

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

Check as follows:

1. Check for multiple codes: Is (CPC) SPN 168/FMI 0/14/18 (Battery Voltage) present?
   1.a Yes; troubleshoot these first.
   1.b No; Go to step 2.
2. Is (MCM) SPN 625/FMI 9 code present?
   2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   2.b No; Go to step 3.



3. Has the CPC been recently reprogrammed?
   3.a Yes; check the proper configuration of the CPC.
   3.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

SPN 556 (CPC) (GHG17)

88.1 SPN 556/FMI 9 - GHG17

SPN 556/FMI 9	
Description	J1939 Message is Missing
Monitored Parameter	CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key ON, Engine OFF

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   1.a Yes; repair the battery voltage concern. Verify repair.
   1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   2.b No; Go to step 3.
3. Has the Common Powertrain Controller (CPC) been recently programmed?
   3.a Yes; check the proper configuration of the CPC.
   3.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

SPN 558 (CPC) (GHG17)

89.1 SPN 558/FMI 2 - GHG17

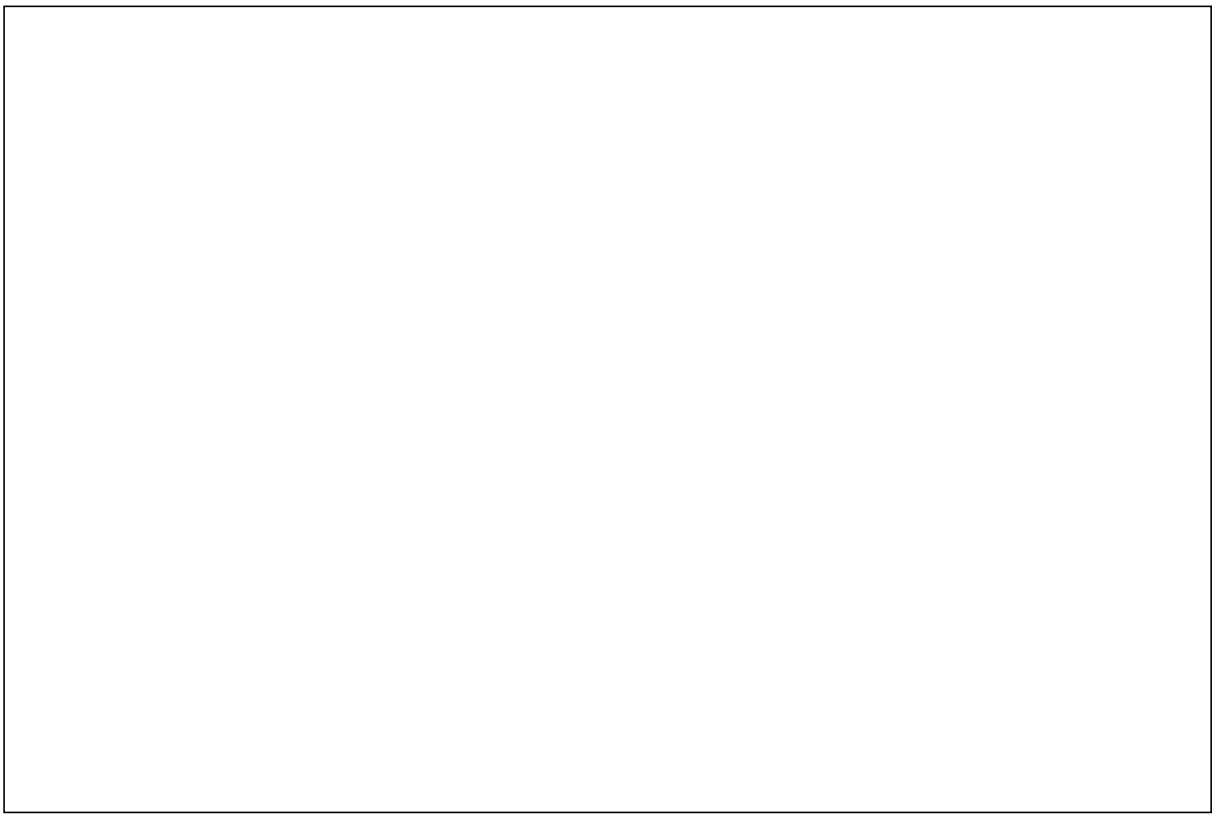
Idle Validation Switch Inputs Reversed

Check as follows:

1. Verify correct wiring of idle validation switch 1 and 2 from switch to Common Powertrain Controller (CPC) connector #1 and #2. If wired correctly, replace the throttle position sensor.

89.2 SPN 558/FMI 3 - GHG17

SPN 558/FMI 3	
Description	IVS Short to Voltage or Open Circuit
Monitored Parameter	Idle Validation Switch
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, Engine ON



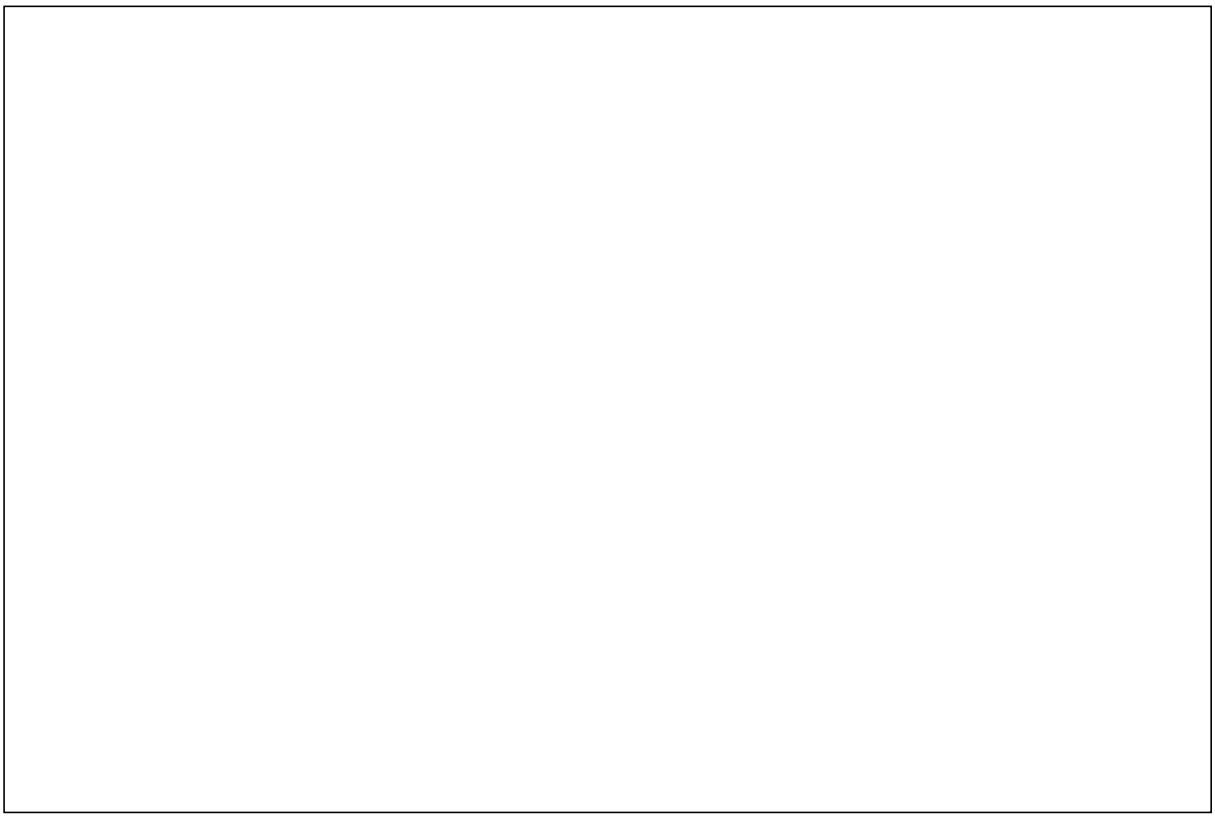
Check as follows:

1. Disconnect the Idle Validation Switch (IVS).
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between the IVS pins 4 and 6. Is the voltage greater than 11.5 volts?
   - 3.a Yes; Go to step 7.
   - 3.b No; Go to step 4.
4. Measure the voltage between the IVS pin 4 and ground. Is the voltage greater than 11.5 volts?
   - 4.a Yes; Go to step 5.
   - 4.b No; repair the open wire between pin 6 of the Common Powertrain Controller (CPC) #1 connector and pin 4 of the IVS.

5. Disconnect the CPC #2 connector.
6. Measure the resistance between pin 2 of the CPC #2 connector and pin 6 of the IVS. Is the resistance greater than five ohms?
   6.a Yes; repair the open the wire between pin 2 of the CPC #2 connector and pin 6 of the IVS.
   6.b No; replace the IVS. Refer to OEM procedures.
7. Measure the voltage between the IVS pins 5 and 6. Is the voltage greater than 11.5 volts?
   7.a Yes; replace the IVS. Refer to Original Equipment Manufacturer (OEM) procedures.
   7.b No; repair the open the wire between pin 3 of the CPC #1 connector and pin 5 of the IVS.

89.3 SPN 558/FMI 4 - GHG17

SPN 558/FMI 4	
Description	IVS Short to Ground
Monitored Parameter	Idle Validation Switch
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, Engine ON



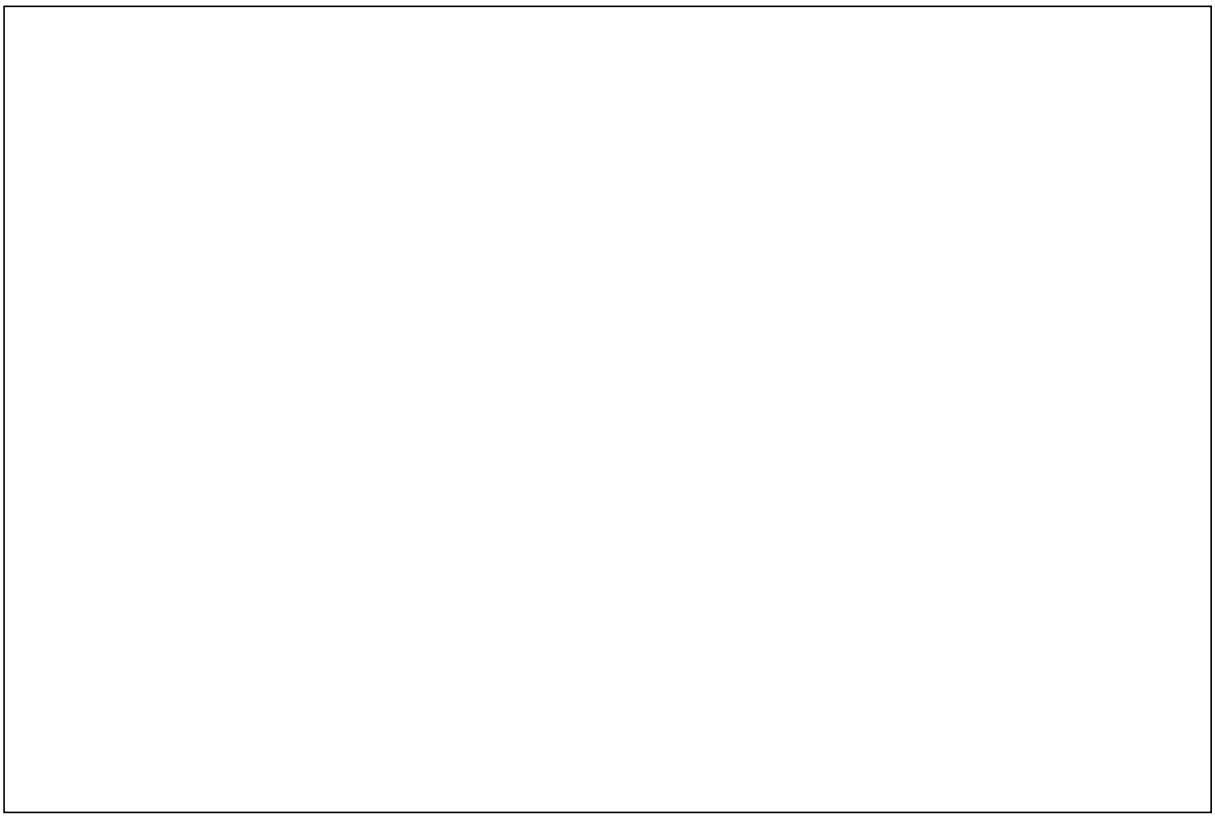
Check as follows:

1. Disconnect the Idle Validation Switch (IVS).
2. Disconnect the Common Powertrain Controller (CPC) #1 connector.
3. Measure the resistance between pin 4 of the IVS connector and ground. Is the resistance less than five ohms?
   - 3.a Yes; repair the short to ground between pin 6 of the CPC #1 connector and pin 4 of the IVS connector.
   - 3.b No; Go to step 4.
4. Measure the resistance between pin 5 of the IVS connector and ground. Is the resistance less than five ohms?
   - 4.a Yes; repair the short to ground between pin 3 of the CPC #1 connector and pin 5 of the Idle Validation Switch connector.

4.b No; replace the IVS. Refer to Original Equipment Manufacturer (OEM) procedures.

89.4 SPN 558/FMI 5 - GHG17

SPN 558/FMI 5	
Description	IVS Short to Voltage or Open Circuit
Monitored Parameter	Idle Validation Switch
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, Engine ON



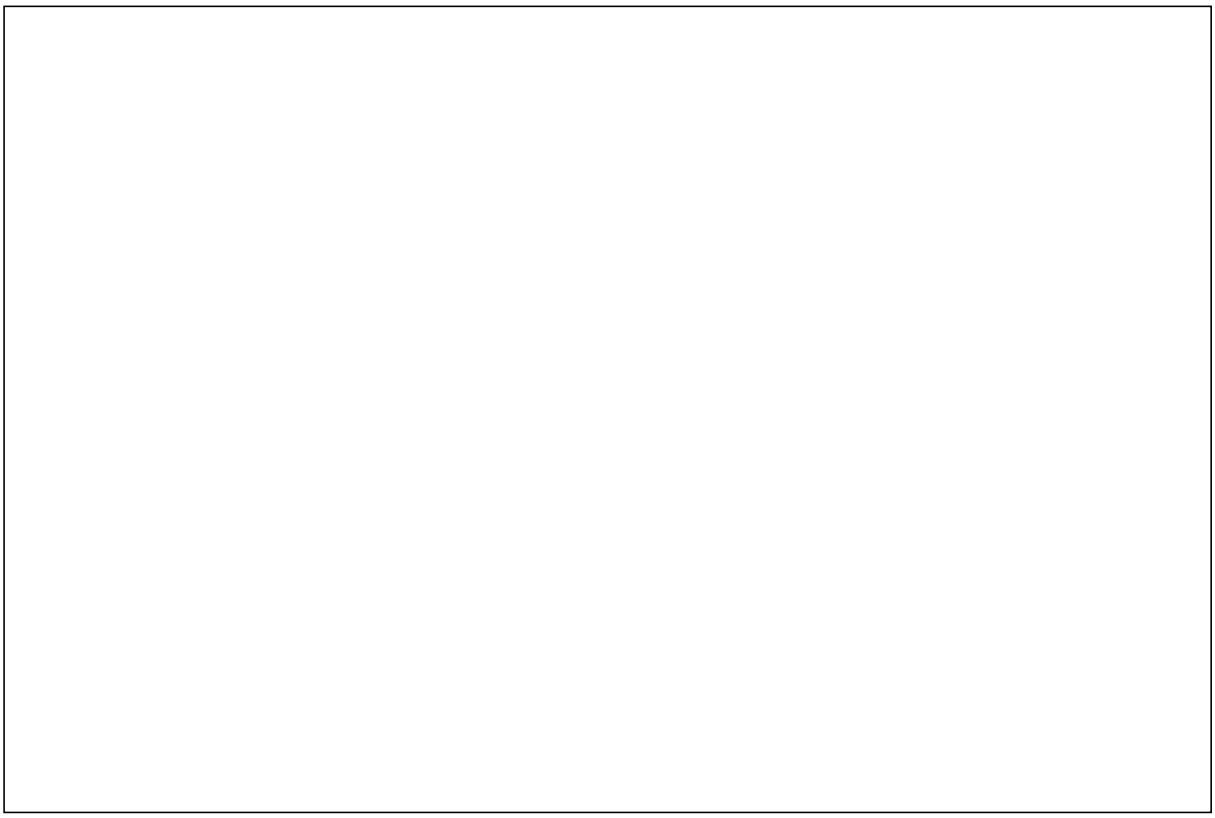
Check as follows:

1. Disconnect the Idle Validation Switch (IVS).
2. Disconnect the Common Powertrain Controller (CPC) #1 connector.
3. Measure the resistance between pin 4 of the IVS connector and ground. Is the resistance less than 10K ohms?
   - 3.a Yes; repair the short to ground between pin 6 of the CPC #1 connector and pin 4 of the IVS connector.
   - 3.b No; Go to step 4.
4. Measure the resistance between pin 5 of the IVS connector and ground. Is the resistance less than 10K ohms?
   - 4.a Yes; repair the short to ground between pin 3 of the CPC #1 connector and pin 5 of the Idle Validation Switch connector.

4.b No; replace the IVS. Refer to Original Equipment Manufacturer (OEM) procedures.

89.5 SPN 558/FMI 6 - GHG17

SPN 558/FMI 6	
Description	IVS Circuit Short to Voltage or Open Circuit
Monitored Parameter	Idle Validation Switch
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, Engine ON



Check as follows:

1. Disconnect the Idle Validation Switch (IVS).
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between the IVS pins 4 and 6. Is the voltage greater than 11.5 volts?
   - 3.a Yes; Go to step 7.
   - 3.b No; Go to step 4.
4. Measure the voltage between the IVS pin 4 and ground. Is the voltage greater than 11.5 volts?
   - 4.a Yes; Go to step 5.
   - 4.b No; repair the open wire between pin 6 of the Common Powertrain Controller (CPC) #1 connector and pin 4 of the IVS.

5. Disconnect the CPC #2 connector.
6. Measure the resistance between pin 2 of the CPC #2 connector and pin 6 of the IVS. Is the resistance greater than five ohms?
   6.a Yes; repair the open wire between pin 2 of the CPC #2 connector and pin 6 of the IVS.
   6.b No; replace the IVS. Refer to Original Equipment Manufacturer (OEM) procedures.
7. Measure the voltage between the IVS pins 5 and 6. Is the voltage greater than 11.5 volts?
   7.a Yes; replace the IVS. Refer to OEM procedures.
   7.b No; repair the open wire between pin 3 of the CPC #1 connector and pin 5 of the IVS.

SPN 558 (CPC3) (GHG17)

90.1 SPN 558/FMI 7 - GHG17

Check as follows:

1. Connect DiagnosticLink 8.04 SP2 or higher.
2. Turn the ignition ON (key ON, engine OFF).
3. Are CPC2 SPN 91/FMI 8/13 or CPC3 SPN 2623/FMI 8 also present?
   - 3.a Yes; repair those fault codes first.
   - 3.b No; Go to step 4.
4. Physically inspect the accelerator pedal for any obstructions, binding, loose mounting bracket, and that pedal has full travel. Is damage found?
   - 4.a Yes; repair as necessary.
   - 4.b No; replace accelerator pedal.

SPN 569 (CPC) (GHG17)

91.1 SPN 569/ FMI 9 - GHG17

J1939 EAC1 Message (Electronic Axle Controller 1) is missing

SPN 569/FMI 9	
Description	J1939 EAC1 message has not been received within expected time
Monitored Parameter	
Typical Enabling Conditions	
Monitor Sequence	
Execution Frequency	
Typical Duration	
Dash Lamps	CEL
Engine Reaction	Default values for the J1939 Message are used
Verification	

Check as follows:

1. Connect DiagnosticLink .
2. Is SPN 625/FMI 9 fault code present?
   - 2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   - 2.b No; Go to step 3.

Note : This fault code may be set by two or more source inputs configured with the same address. Verify proper parameter settings.

3. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   - 3.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.
   - 3.b No; reprogram the CPC with the correct information as necessary. To verify repair, Go to step 4.
4. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

SPN 571 (CPC) (GHG17)

92.1 SPN 571/FMI 4 - GHG17

SPN 571/FMI 4	
Description	Input 4/18 Short To Ground
Monitored Parameter	4 18 DI Selection
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, Engine OFF

1. Check for multiple codes. Is Common Powertrain Controller (CPC) SPN 168/FMI 0/14/18 (battery voltage) code present?
   1.a Yes; troubleshoot these first.
   1.b No; Go to step 2.
2. Is Motor Control Module (MCM) SPN 625/FMI 9 code present?
   2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   3.a Yes; check the proper configuration of the CPC.
   3.b No; clear fault and retest. Go to step 4.
4. Turn the ignition ON (key ON, engine OFF).
5. Does active fault return?
   5.a Yes; Go to step 6.
   5.b No; testing is completed. Release vehicle.
6. Disconnect CPC connector #4.
7. Measure the resistance between pin 18 of the CPC connector #4 and ground. Is the resistance more than 10k ohms?
   7.a Yes; replace the engine brake disable push-button (switch).
   7.b No; repair the short to ground on the wire between pin 18 of the CPC connector #4 and the engine brake disable push-button.

SPN 596 (CPC) (GHG17)

93.1 SPN 596/FMI 13 - GHG17

SPN 596/FMI 13	
Description	J1939 Cruise Control Enable Has Not Been Received Within Expected Time
Monitored Parameter	Cruise Control Enable
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Cruise Control Operation

Check as follows:

1. Check for multiple codes:
   - 1.a Yes; troubleshoot these first.
   - 1.b No; Go to step 2.
2. Is (MCM) SPN 625/FMI 9 present?
   - 2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   - 2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   - 3.a Yes; check the proper configuration of the CPC.
   - 3.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

93.2 SPN 596/FMI 19 - GHG17

SPN 596/FMI 19	
Description	J1939 Cruise Control Enable Has Not Been Received Within Expected Time
Monitored Parameter	Cruise Control Enable
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Cruise Control Operation

Check as follows:

1. Check for multiple codes: Is (CPC) SPN 168/FMI 0/14/18 (Battery Voltage) present?
   - 1.a Yes; troubleshoot these first.
   - 1.b No; Go to step 2.
2. Is (MCM) SPN 625/FMI 9 present?
   - 2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   - 2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   - 3.a Yes; check the proper configuration of the CPC.
   - 3.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

SPN 597 (CPC) (GHG17)

94.1 SPN 597/FMI 2 - GHG17

SPN 597/FMI 2	
Description	Engine Service Brake Not Plausible
Monitored Parameter	Service Brake Status
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Service Brake Operation

Check as follows:

1. Check for multiple codes: is Common Powertrain Controller (CPC) SPN 168/FMI 0/14/18 (Battery Voltage) present?
   - 1.a Yes; troubleshoot these first.
   - 1.b No; Go to step 2.
2. Is Motor Control Module (MCM) SPN 625/FMI 9 present?
   - 2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   - 2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   - 3.a Yes; check the proper configuration of the CPC.
   - 3.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

94.2 SPN 597/FMI 13 - GHG17

SPN 597/FMI 13	
Description	J1939 Service Brake Signal has not been Received Within Expected Time
Monitored Parameter	Service Brake
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Service Brake Operation

Check as follows:

1. Check for multiple codes: is Common Powertrain Controller (CPC) SPN 168/FMI 0/14/18 (Battery Voltage) present?
   - 1.a Yes; troubleshoot these first.
   - 1.b No; Go to step 2.
2. Is Motor Control Module (MCM) SPN 625/FMI 9 present?
   - 2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   - 2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   - 3.a Yes; check the proper configuration of the CPC.
   - 3.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

94.3 SPN 597/FMI 19 - GHG17

SPN 597/FMI 19	
Description	J1939 Service Brake Signal Has Not Been Received Within Expected Time
Monitored Parameter	Service Brake Status
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Service Brake Operation

Check as follows:

1. Check for multiple codes: is Common Powertrain Controller (CPC) SPN 168/FMI 0/14/18 (Battery Voltage) present?
   - 1.a Yes; troubleshoot these first.
   - 1.b No; Go to step 2.
2. Is Motor Control Module (MCM) SPN 625/FMI 9 present?
   - 2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   - 2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   - 3.a Yes; check the proper configuration of the CPC.
   - 3.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

SPN 598 (CPC) (GHG17)

95.1 SPN 598/FMI 2 - GHG17

Clutch Switch Not Plausible.

SPN 598/FMI 2	
Description	Clutch Switch not Plausible
Monitored Parameter	Clutch Switch Status
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Clutch Switch Operation

Check as follows:

1. Check for multiple codes: Is (CPC) SPN 168/FMI 0/14/18 (Battery Voltage) present?
   - 1.a Yes; troubleshoot these first.
   - 1.b No; Go to step 2.
2. Is (MCM) SPN 625/FMI 9 present?
   - 2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   - 2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   - 3.a Yes; check the proper configuration of the CPC.
   - 3.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

SPN 599 (CPC) (GHG17)

96.1 SPN 599/FMI 4 - GHG17

Both Cruise Control switches, Set and Resume, are shorted to ground.

SPN 599/FMI 4	
Description	Set and Resume short to ground
Monitored Parameter	Set switch and Resume switch
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Cruise Control Operation

Check as follows:

1. Turn the ignition ON (key ON, engine OFF) and place the cruise control switch in the OFF position. DO NOT start the engine.
2. Check the driver console display. Is cruise control switch resume status displayed?
   - 2.a Yes; Go to step 3.
   - 2.b No; Go to step 4.
3. Unplug the cruise control resume switch. Is resume status no longer displayed?
   - 3.a Yes; replace the cruise control resume switch.
   - 3.b No; repair the short to ground in the wire from the resume switch to pin 16 of the CPC #1 connector.
4. Unplug the cruise control set switch. Is set status no longer displayed?
   - 4.a Yes; replace the cruise control set switch.
   - 4.b No; repair the short to ground in the wire from the set switch to pin 12 of the CPC #1 connector.

SPN 600 (CPC) (GHG17)

97.1 SPN 600/FMI 13 - GHG17

J1939 Cruise Control Coast Switch Signal from Source #1, #2, or #3 is Missing or Not Available

SPN 600/FMI 13	
Description	Cruise Control Coast Switch Signal from Source #1, #2, or #3 is Missing
Monitored Parameter	Cruise Control Signal
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON engine ON

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Check as follows:

1. Connect DiagnosticLink .
2. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   - 2.a Yes; repair the battery voltage concern. Verify repair.
   - 2.b No; Go to step 3.
3. Is SPN 625/FMI 9 fault code present?
   - 3.a Yes; diagnose SPN 625/FMI 9 fault code first. Verify repair.
   - 3.b No; Go to step 4.
4. Has the CPC been recently reprogrammed?
   - 4.a Yes; check the proper configuration of the CPC.
   - 4.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

97.2 SPN 600/FMI 19 - GHG17

J1939 Cruise Control Coast Switch Signal from Source #1, #2, or #3 is Erratic

SPN 600/FMI 19	
Description	Cruise Control Coast Switch Signal from Source #1, #2, or #3 is Erratic
Monitored Parameter	Cruise Control Signal
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON engine ON

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Check as follows:

1. Connect DiagnosticLink .
2. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   - 2.a Yes; repair the battery voltage concern. Verify repair.
   - 2.b No; Go to step 3.
3. Is SPN 625/FMI 9 fault code present?
   - 3.a Yes; diagnose SPN 625/FMI 9 fault code first. Verify repair.
   - 3.b No; Go to step 4.
4. Has the CPC been recently reprogrammed?
   - 4.a Yes; check the proper configuration of the CPC.
   - 4.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

SPN 602 (CPC) (GHG17)

98.1 SPN 602/FMI 13 - GHG17

SPN 602/FMI 13	
Description	Cruise Control Signal Not Available
Monitored Parameter	Cruise Control Signal
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON Engine ON

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Connect DiagnosticLink .
2. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   - 2.a Yes; repair the battery voltage concern. Verify repair.
   - 2.b No; Go to step 3.
3. Is SPN 625/FMI 9 fault code present?
   - 3.a Yes; diagnose SPN 625/FMI 9 fault code first. Verify repair.
   - 3.b No; Go to step 4.
4. Has the CPC been recently reprogrammed?
   - 4.a Yes; check the proper configuration of the CPC.
   - 4.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

98.2 SPN 602/FMI 19 - GHG17

SPN 602/FMI 19	
Description	Cruise Control Signal Erratic
Monitored Parameter	Cruise Control Signal
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON Engine ON

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Connect DiagnosticLink .
2. Check for multiµple codes. Are there any SPN 168 (battery voltage) fault codes present?
   - 2.a Yes; repair the battery voltage concern. Verify repair.
   - 2.b No; Go to step 3.
3. Is SPN 625/FMI 9 fault code present?
   - 3.a Yes; diagnose SPN 625/FMI 9 fault code first. Verify repair.
   - 3.b No; Go to step 4.
4. Has the CPC been recently reprogrammed?
   - 4.a Yes; check the proper configuration of the CPC.
   - 4.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

SPN 609 (CPC) (GHG17)

99.1 SPN 609/FMI 12 - GHG17

SPN 609/FMI 12	
Description	Common Powertrain Controller (CPC) Failure
Monitored Parameter	CPC Hardware
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Idle

Check as follows:

1. Check for multiple codes. Are (CPC) SPN 168/FMI 0/14/18 (battery voltage) codes present?
   - 1.a Yes; troubleshoot these first.
   - 1.b No; Go to step 2.
2. Is Motor Control Module (MCM) SPN 625/FMI 9 code present?
   - 2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   - 2.b No; Go to step 3.
3. Turn on the ignition (key ON, engine OFF).
4. Does active fault return?
   - 4.a Yes; replace CPC. Refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; testing is completed. Release vehicle.

99.2 SPN 609/FMI 13 - GHG17

CPC Software Diagnostics

SPN 609/FMI 13	
Description	This fault sets when the CPC software is corrupt or when two or more source inputs are configured with the same address
Monitored Parameter	CPC source address inputs
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Idle

Check as follows:

1. Check for multiple codes:
   1.a If any other fault codes are present, troubleshoot these first.
   1.b If only SPN 609/FMI 13 fault is present, reprogram CPC with the proper configuration for the vehicle.

Note: The tables below shows a set of commonly miss configured source inputs that will set the code.		
Parameter Name	**Cascadia Chassis Parameter Value**	**M2 Chassis Parameter Value**
CM1 DPF Source Addr SAE J1939	49	33
CM1 Fan Source Addr 1 SAE J1939	25	49
CM1 Fan Source Addr 2 SAE J1939	49	33

99.3 SPN 609/FMI 16 - GHG17

SPN 609/FMI 16	
Description	Common Powertrain Controller (CPC) Failure
Monitored Parameter	CPC Hardware
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Idle

Check as follows:

1. Check for multiple codes. Are (CPC) SPN 168/FMI 0/14/18 (battery voltage) codes present?
   - 1.a Yes; troubleshoot these first.
   - 1.b No; Go to step 2.
2. Is Motor Control Module (MCM) SPN 625/FMI 9 code present?
   - 2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   - 2.b No; Go to step 3.
3. Turn on the ignition (key ON, engine OFF).
4. Does active fault return?
   - 4.a Yes; replace CPC. Refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; testing is completed. Release vehicle.

SPN 625 (ACM) (GHG17)

102.1 SPN 625/FMI 2 - GHG17

SPN 625/FMI 2	
Description	CPC Message Not Received Or Has Stopped Arriving
Monitored Parameter	CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None

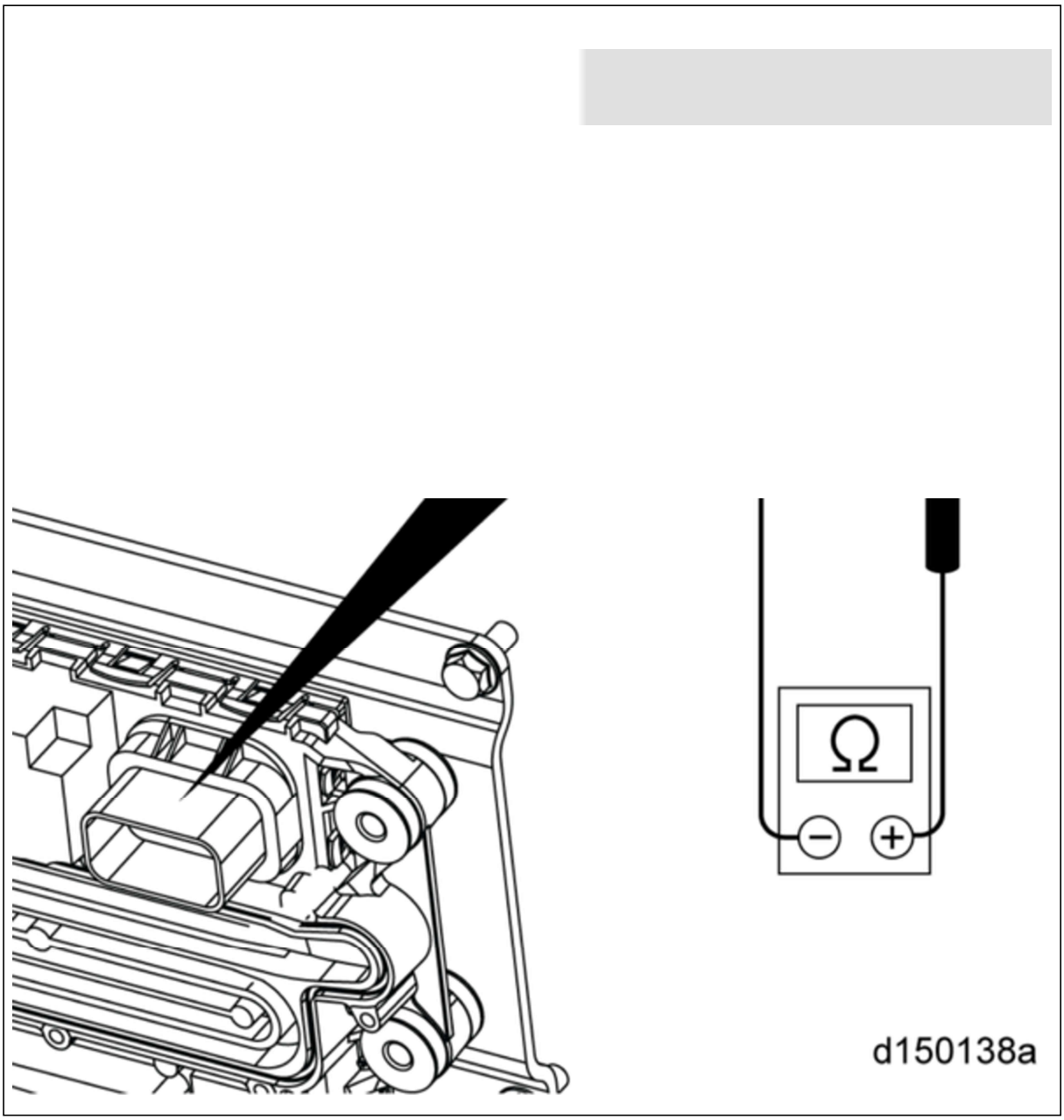
Check as follows:

1. Are there any battery voltage faults (SPN 168/FMI any)?
   - 1.a Yes; troubleshoot battery voltage faults first.
   - 1.b No; Go to step 2.
2. Has the Aftertreatment Control Module (ACM), Motor Control Module (MCM), or Common Powertrain Control Module (CPC) been recently programmed?
   - 2.a Yes; clear the fault codes. If faults do not become active, release the vehicle. If faults become active, Go to step 3.
   - 2.b No; Go to step 5.

Note : Main battery power must be left ON.

Note : The five minute timeframe allows the ACM to go completely offline.

3. Disconnect the ACM 21-pin connector.
4. Check ACM internal terminating resistor by measuring and recording the resistance across pins 10 and 20 of the ACM 21-pin connector. Is the resistance between 120 plus or minus 10 ohms?



4.a Yes; Go to step 8.

4.b No; replace the ACM.

5. Disconnect the CPC electrical harness connector #3.

6. Check CPC internal terminating resistor by measuring and recording the resistance across pins 19 and 21 of the CPC electrical harness connector cavity #3. Is the resistance between 120 plus or minus 10 ohms?

6.a Yes; Go to step 10.

6.b No; replace the CPC.

7. Check for continuity between pin 19 of the CPC connector #3 and pin 20 of the ACM 21-pin connector. Is there continuity?

   7.a Yes; Go to step 11.

   7.b No; repair the wire between CPC connector #3 pin 19 and the ACM 21-pin connector pin 20.

8. Measure and record the resistance between pin 21 of the CPC connector #3 and pin 10 of the ACM 21-pin connector. Is there continuity?

   8.a Yes; Go to step 12.

   8.b No; repair the wire between pin 21 of the CPC connector #3 and pin 10 of the ACM 21-pin connector.

9. Measure and record the resistance between pin 19 of the CPC connector #3 and pin 19 of the MCM 21-pin connector. Is there continuity?

9.a Yes; Go to step 13.

9.b No; repair the wire between pin 19 of the CPC connector #3 and pin 19 of the MCM 21-pin connector.

10. Measure and record the resistance between pin 21 of the CPC connector #3 and pin 13 of the MCM 21-pin connector. Is there continuity?

10.a Yes; Go to step 14.

10.b No; repair the wire between pin 21 of the CPC connector #3 and pin 13 of the MCM 21-pin connector.

11. Measure and record the resistance between pin 19 of the MCM 21-pin connector and pin 20 of the ACM 21-pin connector. Is there continuity?

11.a Yes; Go to step 15.

11.b No; repair the wire between pin 19 of the MCM 21-pin connector and pin 20 of the ACM 21-pin connector.

12. Measure and record the resistance between pin 13 of the MCM 21-pin connector and pin 10 of the ACM 21-pin connector. Is there continuity?

12.a No; replace the ACM. Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" .

12.b No; repair the wire between pin 13 of the MCM 21-pin connector and pin 10 of the ACM 21-pin connector.

13. Disconnect the ACM 21-pin connector.

14. Turn the ignition ON (key ON, engine OFF).

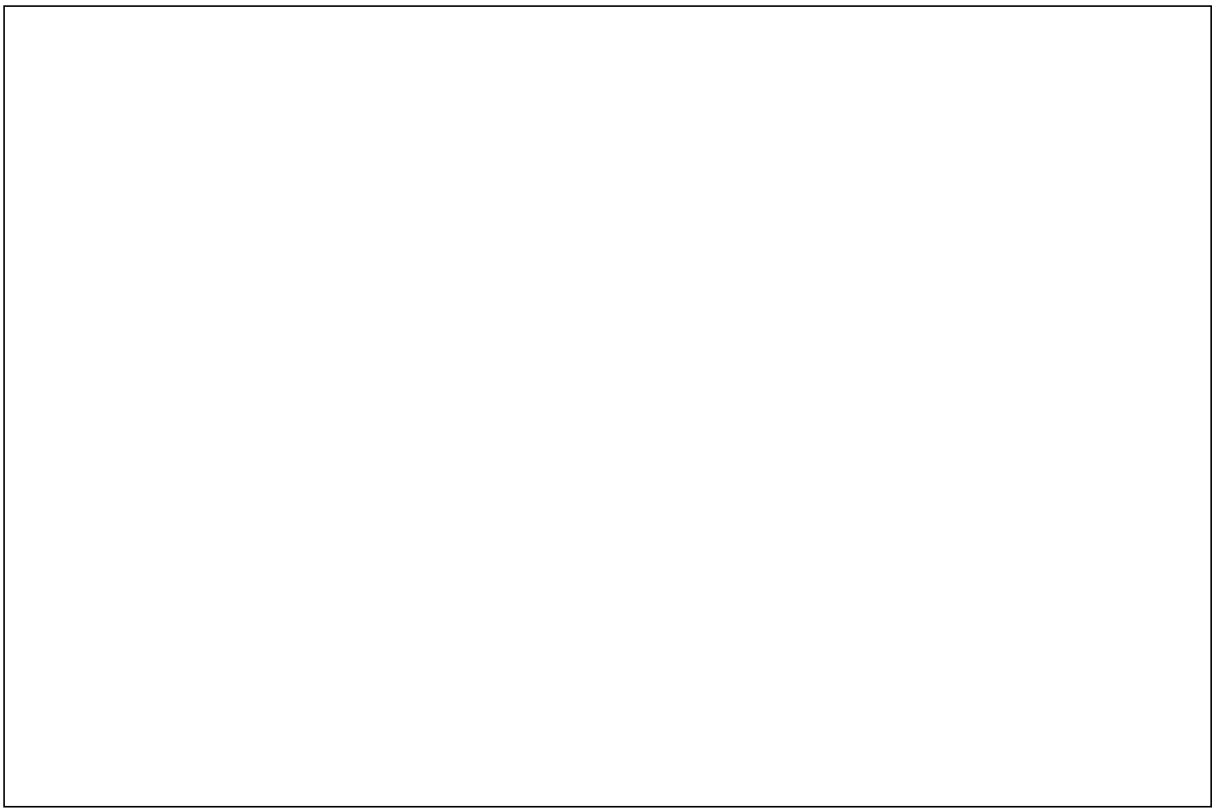
15. Measure the voltage between pins 11, 12, 14, 15 and 18 (battery voltage), pin 16 (ignition voltage) of the ACM 21-pin connector and ground. Is the voltage less than 11.5 volts?

15.a Yes; restore voltage to pins 11, 12, 14, 15 and 18 of the ACM 21-pin connector.

15.b No; restore ground connection to pins 3, 5, 6 and 9 of the ACM 21-pin connector.

102.2 SPN 625/FMI 9 – GHG17

PT-CAN Heartbeat Missing



SPN 625/FMI 9	
Description	PT-CAN Heartbeat Missing
Monitored Parameter	CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Ignition Cycle

1. Are there any battery voltage faults (any SPN 168 FMI faults)?
   1.a Yes; troubleshoot battery voltage faults first.
   1.b No; Go to step 2.
2. Has the Aftertreatment Control Module (ACM), Motor Control Module (MCM), or Common Powertrain Controller (CPC) been recently programmed?
   2.a Yes; clear the fault codes. If faults do not become active, release the vehicle. If faults become active, Go to step 3.
   2.b No; Go to step 3.

Note : ACM, MCM, and CPC all communicate on the same CAN line. If water penetrates any connector, it can short the CAN line and may prevent communications with other ECUs.

Note : Main battery power must be left ON.

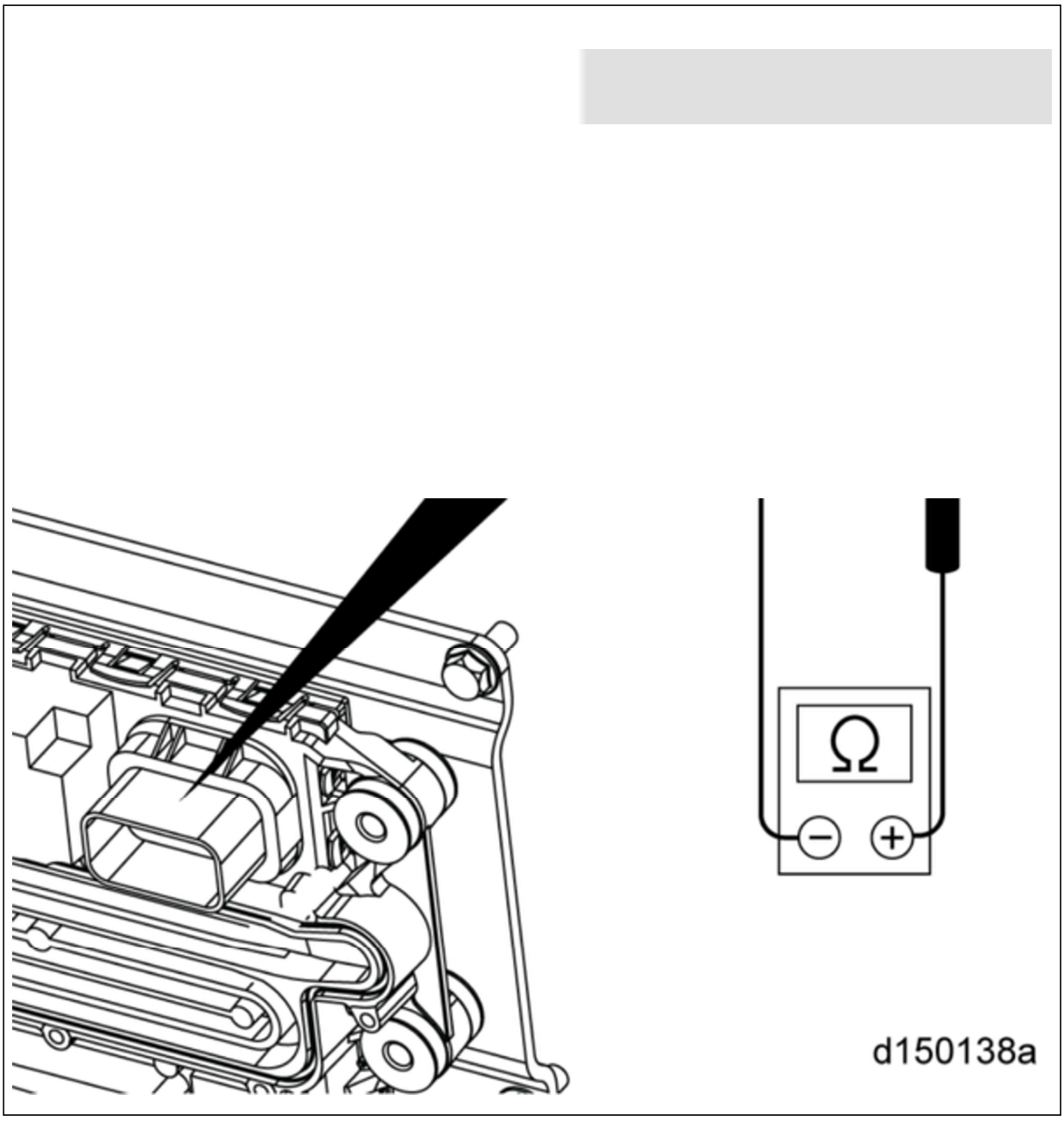
Note : The five minute time-frame allows the ACM to go completely offline.

3. Turn ignition OFF and wait five minutes before proceeding.
4. Disconnect ACM 21-pin connector.
5. Inspect the 21–pin ACM connector for corroded, unseated (pushed out) or damaged pins, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion).

   5.a If contamination or damage is found, repair as necessary. Go to step 21.

   5.b If no contamination or damage is found, Go to step 6.

6. Check ACM internal terminating resistor by measuring and recording the resistance across pins 10 and 20 of the ACM 21-pin connector, component side.



6.a If the resistance is between 110 to 130 ohms, Go to step 7.

6.b If the resistance is not between 110 to 130 ohms, replace the ACM. Go to step 21.

7. Measure the resistance between pin 10 of the ACM 21-pin harness connector and battery ground.

7.a If the resistance is greater than 10K ohms, Go to step 8.

7.b If the resistance is less than 10K ohms, repair the short to ground on pin 10 of the ACM 21-pin harness connector. Refer to Original Equipment Manufacturer (OEM) literature for wiring schematic information. Go to step 21.

8. Measure the resistance between pin 20 of the ACM 21-pin harness connector and battery ground.

8.a If the resistance is greater than 10K ohms, Go to step 9.

8.b If the resistance is less than 10K ohms, repair the short to ground on pin 20 of the ACM 21-pin harness connector. Refer to Original Equipment Manufacturer (OEM) literature for wiring schematic information. Go to step 21.

9. Disconnect the CPC electrical harness connector #3.

10. Inspect the CPC connector for corroded, unseated (pushed out) or damaged pins, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion).

10.a If contamination or damage is found, repair as necessary. Go to step 21.

10.b If no contamination or damage is found, Go to step 11.

11. Check CPC internal terminating resistor by measuring the resistance across pins 19 and 21 of the CPC electrical connector #3 component side.

11.a If the resistance is between 110 to 130 ohms, Go to step 12.

11.b If the resistance is not between 110 to 130 ohms, replace the CPC. Go to step 21.

12. Check the resistance between pin 19 of the CPC harness connector #3 and pin 20 of the ACM 21-pin harness connector.

12.a If the resistance is less than 5 ohms, Go to step 13.

12.b If the resistance is greater than 5 ohms, repair the wire between pin 19 of the CPC harness connector #3 and pin 20 of the ACM 21-pin harness connector. Go to step 21.

13. Measure the resistance between pin 21 of the CPC harness connector #3 and pin 10 of the ACM 21-pin harness connector.

13.a If the resistance is less than 5 ohms, Go to step 14.

13.b If the resistance is greater than 5 ohms, repair the wire between pin 21 of the CPC harness connector #3 and pin 10 of the ACM 21-pin harness connector. Go to step 21.

14. Disconnect MCM 21-pin connector.

15. Inspect the 21–pin MCM connector for corroded, unseated (pushed out) or damaged pins, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion).
    - 15.a If contamination or damage is found, repair as necessary. Go to step 21.
    - 15.b If no contamination or damage is found, Go to step 16.
16. Measure the resistance between pin 19 of the CPC harness connector #3 and pin 19 of the MCM 21-pin harness connector.
    - 16.a If the resistance is less than 5 ohms, Go to step 17.
    - 16.b If the resistance is greater than 5 ohms, repair the wire between pin 19 of the CPC harness connector #3 and pin 19 of the MCM 21-pin harness connector. Go to step 21.
17. Measure the resistance between pin 21 of the CPC harness connector #3 and pin 13 of the MCM 21-pin harness connector.
    - 17.a If the resistance is less than 5 ohms, Go to step 18.
    - 17.b If the resistance is greater than 5 ohms, repair the wire between pin 21 of the CPC harness connector #3 and pin 13 of the MCM 21-pin harness connector. Go to step 21.

Note : Ensure ACM and MCM connectors are disconnected during this step.

18. Measure the resistance between pins 19 and 21 of the CPC harness connector #3.
    - 18.a If the resistance is greater than 10K ohms, Go to step 19.
    - 18.b If the resistance is less than 10K ohms, repair the harness shorted wires between pin 19 and pin 21 of the CPC harness connector #3. Refer to Original Equipment Manufacturer (OEM) literature for schematic information. Go to step 21.
19. Measure the resistance between pin 19 of the MCM 21-pin harness connector and pin 20 of the ACM 21-pin harness connector.
    - 19.a If the resistance is less than 5 ohms, Go to step 20.
    - 19.b If the resistance is greater than 5 ohms, repair the wire between pin 19 of the MCM 21-pin harness connector and pin 20 of the ACM 21-pin harness connector. Go to step 21.
20. Measure the resistance between pin 13 of the MCM 21-pin harness connector and pin 10 of the ACM 21-pin harness connector.
    - 20.a If the resistance is less than 5 ohms, install a test ACM and retest. If code does not return, replace ACM. Refer to OEM procedures. Go to step 21.
    - 20.b If the resistance is greater than 5 ohms, repair the wire between pin 13 of the MCM 21-pin harness connector and pin 10 of the ACM 21-pin harness connector. Go to step 21.
21. Verify repairs. Restore all connections. Cycle the ignition key. Is fault code still active?
    - 21.a Yes; replace the ACM. Refer to OEM procedures.
    - 21.b No; If fault does not become active, clear the fault codes and release the vehicle.

SPN 625 (CPC) (GHG17)

101.1 SPN 625/FMI 2 - GHG17

PTCAN Incorrect MCM System ID Received

SPN 625/FMI 2	
Description	Invalid Data on Engine Controller Area Network (CAN) Link
Monitored Parameter	CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (One Minute)

Check as follows:

1. Have the Motor Control Module (MCM) and/or the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct MCM calibration and/or the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Disconnect the MCM 21–pin connector.
3. Turn the ignition ON (key ON, engine OFF).

Note : Poor battery grounds can be a possible cause of low battery voltage.

4. Measure the battery voltage at pin 7 on the MCM 21-pin connector. Is the battery voltage less than 10.5 volts?
   - 4.a Yes; restore the battery voltage at pins 7, 11, 12, 14, and 15 on the MCM 21-pin connector.
   - 4.b No; Go to step 5.
5. Turn ignition OFF. Leave the MCM 21-pin connector disconnected.
6. Disconnect the CPC connector #3.
7. Measure the resistance between pins 21 and 19 of the CPC connector #3. Is the resistance greater than five ohms?
   - 7.a Yes; Go to step 8.
   - 7.b No; repair the short circuit in the wires between pins 21 and 19 of the CPC connector #3 and pins 13 and 19 of the MCM 21-pin connector.
8. Measure the resistance between pin 21 of the CPC connector #3 and ground. Is the resistance greater than five ohms?
   - 8.a Yes; Go to step 9.
   - 8.b No; repair the short circuit to ground between pin 21 of the CPC connector #3 and ground.
9. Check the resistance between pin 19 of the CPC connector #3 and ground. Is the resistance greater than five ohms?
   - 9.a Yes; Go to step 10.
   - 9.b No; repair the short circuit to ground between pin 19 of the CPC connector #3 and ground.
10. Measure the resistance between pin 19 of the CPC connector #3 and pin 19 of the MCM 21-pin connector. Is the resistance greater than five ohms?
    - 10.a Yes; repair the open circuit between pin 19 of the CPC connector #3 and pin 19 of the MCM 21-pin connector.
    - 10.b No; Go to step 11.
11. Measure the resistance between pin 21 of the CPC connector #3 and pin 13 of the MCM 21-pin connector. Is the resistance greater than five ohms?
    - 11.a Yes; repair the open circuit between pin 21 of the CPC connector #3 and pin 13 of the MCM 21-pin connector.
    - 11.b No; replace the CPC. Refer to OEM procedures.

101.2 SPN 625/FMI 4 - GHG17

ECAN Link Circuit Failure

SPN 625/FMI 4	
Description	Erratic Data on Engine Controller Area Network (CAN) Link
Monitored Parameter	CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (One Minute)

Check as follows:

Note : This diagnostic is typically erratic data or the CAN propriety data link has failed between the MCM and the

CPC.

1. Have the Motor Control Module (MCM) and/or the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct MCM calibration and/or the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Disconnect the MCM 21-pin connector.
3. Turn the ignition ON (key ON, engine OFF).

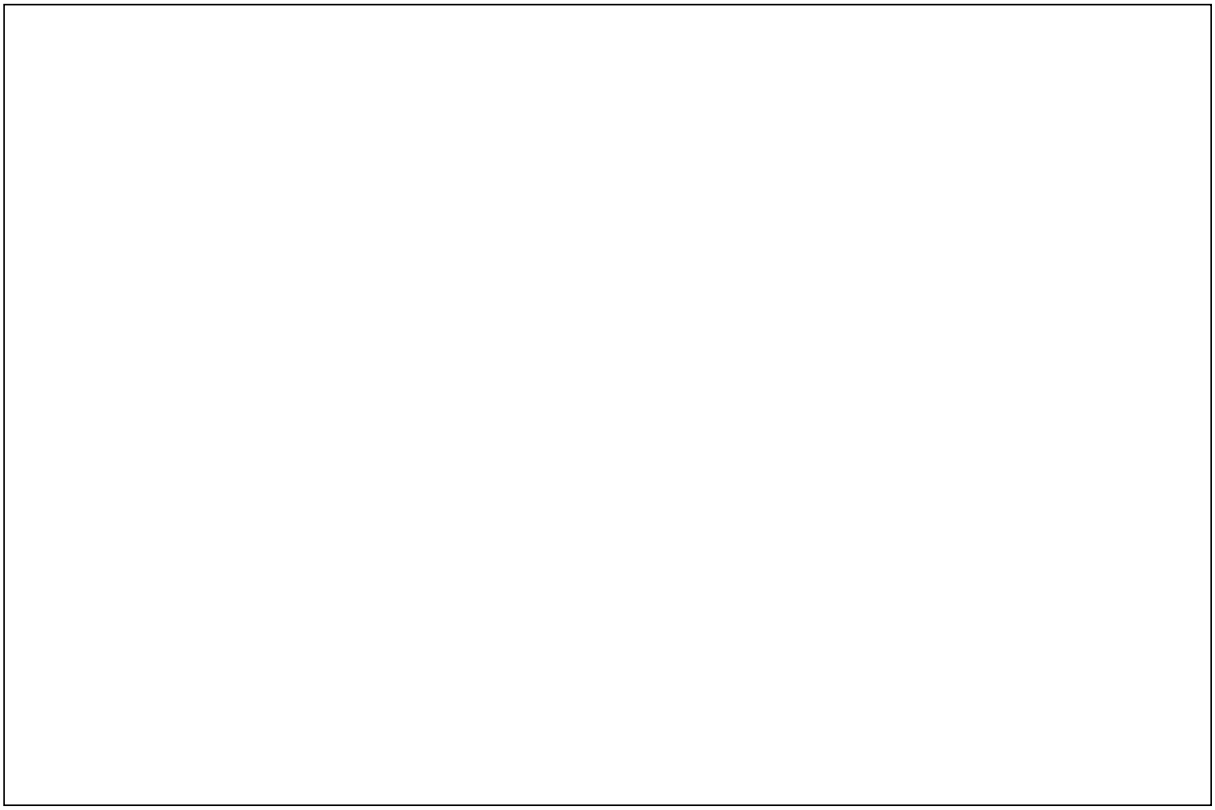
Note : Poor battery grounds can be a possible cause of low battery voltage.

4. Measure the battery voltage at pin 7 on the MCM 21-pin connector. Is the battery voltage less than 10.5 volts?
   - 4.a Yes; restore the battery voltage at pins 7, 11, 12, 14, and 15 on the MCM 21-pin connector.
   - 4.b No; Go to step 5.
5. Turn ignition OFF; leave the MCM 21-pin connector disconnected.
6. Disconnect the CPC connector #3.
7. Measure the resistance between pins 19 and 21 of the CPC connector #3. Is the resistance greater than five ohms?
   - 7.a Yes; Go to step 8.
   - 7.b No; repair the short circuit in the wires between pins 19 and 21 of the CPC connector #3 and pins 13 and 19 of the MCM 21-pin connector.
8. Measure the resistance between pin 19 of the CPC connector #3 and ground. Is the resistance greater than five ohms?
   - 8.a Yes; Go to step 9.
   - 8.b No; repair the short circuit to ground between pin 19 of the CPC connector #3 and ground.
9. Check the resistance between pin 21 of the CPC connector #3 and ground. Is the resistance greater than five ohms?
   - 9.a Yes; Go to step 10.
   - 9.b No; repair the short circuit to ground between pin 21 of the CPC connector #3 and ground.
10. Measure the resistance between pin 19 of the CPC connector #3 and pin 19 of the MCM 21-pin connector. Is the resistance greater than five ohms?
    - 10.a Yes; repair the open circuit between pin 19 of the CPC connector #3 and pin 19 of the MCM 21-pin connector.
    - 10.b No; Go to step 11.
11. Measure the resistance between pin 21 of the CPC connector #3 and pin 13 of the MCM 21-pin connector. Is the resistance greater than five ohms?
    - 11.a Yes; repair the open circuit between pin 21 of the CPC connector #3 and pin 13 of the MCM 21-pin connector.
    - 11.b No; replace the CPC. Refer to OEM procedures.

101.3 SPN 625/FMI 8 - GHG17

MCM PT-CAN DM1 Message Not Received or has Stopped Arriving

SPN 625/FMI 8	
Description	Powertrain Controller Area Network DM1 Message Not Received Or Has Stopped Arriving
Monitored Parameter	CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None



Check as follows:

1. Are there any battery voltage faults present (SPN 168/FMI any)?
   - 1.a Yes; troubleshoot battery voltage faults first.
   - 1.b No; Go to step 2.
2. Have the Aftertreatment Control Module (ACM), Motor Control Module (MCM) or Common Powertrain Controller (CPC) been recently programmed?
   - 2.a Yes; verify that the correct MCM, CPC and/or ACM parameter list has been installed, then clear the fault codes. If faults do not become active, release the vehicle. If faults become active, Go to step 3.
   - 2.b No; Go to step 3.

3. Turn ignition OFF and wait five minutes before proceeding. Main battery power must be left ON (the five-minute time frame allows the ACM to go completely offline).
4. Disconnect the MCM 21-pin connector.
5. Inspect the MCM 21-pin connector for corroded, unseated (pushed out) or damaged pins, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

6. Measure and record the resistance across pins 13 and 19 of the MCM 21-pin connector. Is the resistance greater than 80 ohms?

   6.a Yes; Go to step 9.

   6.b No; Go to step 7.

7. Is the resistance reading from step 6 less than five ohms?
   - 7.a Yes; replace the PT-CAN harness.
   - 7.b No; Go to step 8.
8. Is the resistance from step 6 between 40 and 80 ohms?
   - 8.a Yes; Go to step 21.
   - 8.b No; Go to step 9.
9. Disconnect the ACM 21-pin connector.
10. Inspect the ACM 21–pin connector for corroded, unseated (pushed out) or damaged pins, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?
    - 10.a Yes; repair as necessary.
    - 10.b No; Go to step 11.
11. Check ACM internal terminating resistor by measuring and recording the resistance across pins 10 and 20 of the ACM 21-pin connector. Is the resistance between 110 and 130 ohms?

11.a Yes; Go to step 12.

11.b No; replace the ACM.

12. Disconnect the CPC connector #3.

13. Inspect the CPC connector for corroded, unseated (pushed out) or damaged pins, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

13.a Yes; repair as necessary.

13.b No; Go to step 14.

14. Check CPC internal terminating resistor by measuring the resistance across pins 19 and 21 of the CPC electrical connector #3, component side. Is the resistance between 110 and 130 ohms?

14.a Yes; Go to step 15.

14.b No; replace the CPC.

15. Measure and record the resistance between pin 19 of CPC connector #3, and pin 20 of the ACM 21-pin connector. Is resistance less than five ohms?

15.a Yes; Go to step 16.

15.b No; repair the wire between pin 19 of the CPC connector #3, and pin 20 of the ACM 21-pin connector.

16. Measure and record the resistance between pin 21 of the CPC connector #3, and pin 10 of the ACM 21-pin connector. Is resistance less than five ohms?

16.a Yes; Go to step 17.

16.b No; repair the wire between pin 21 of the CPC connector #3, and pin 10 of the ACM 21-pin connector.

17. Measure and record the resistance between pin 19 of the CPC connector #3, and pin 19 of the MCM 21-pin connector. Is resistance less than five ohms?

17.a Yes; Go to step 18.

17.b No; repair the wire between pin 19 of the CPC connector #3, and pin 19 of the MCM 21-pin connector.

18. Measure and record the resistance between pin 21 of the CPC connector #3, and pin 13 of the MCM 21-pin connector. Is resistance less than five ohms?

18.a Yes; Go to step 19.

18.b No; repair the wire between pin 21 of the CPC connector #3, and pin 13 of the MCM 21-pin connector.

19. Measure and record the resistance between pin 19 of the MCM 21-pin connector and pin 20 of the ACM 21-pin connector. Is resistance less than five ohms?

19.a Yes; Go to step 20.

19.b No; repair the wire between pin 19 of the MCM 21-pin connector and pin 20 of the ACM 21-pin connector.

20. Measure and record the resistance between the pin 13 of the MCM 21-pin connector and pin 10 of the ACM 21-pin connector. Is resistance less than five ohms?

20.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" .

20.b No; repair the wire between pin 13 of the MCM 21-pin connector and pin 10 of the ACM 21-pin connector

21. Turn the ignition ON (key ON, engine OFF).

22. Measure the voltage between pins 7, 11, 12, 14, and 15 of the MCM 21-pin connector (ignition/battery voltage) and ground. Is the voltage less than 11.5 volts?

    22.a Yes; restore voltage to pins 7, 11, 12, 14, and 15 of the MCM 21-pin connector.

    22.b No; Go to step 23.

23. Turn the ignition OFF.

24. Measure the resistance between pins 5, 6, 8 and 9 of the MCM 21-pin connector and the negative battery post. Is resistance greater than five ohms?

    24.a Yes; restore the battery ground to pins 5, 6, 8 and 9 of the 21-pin connector.

    24.b No; Go to step 25.

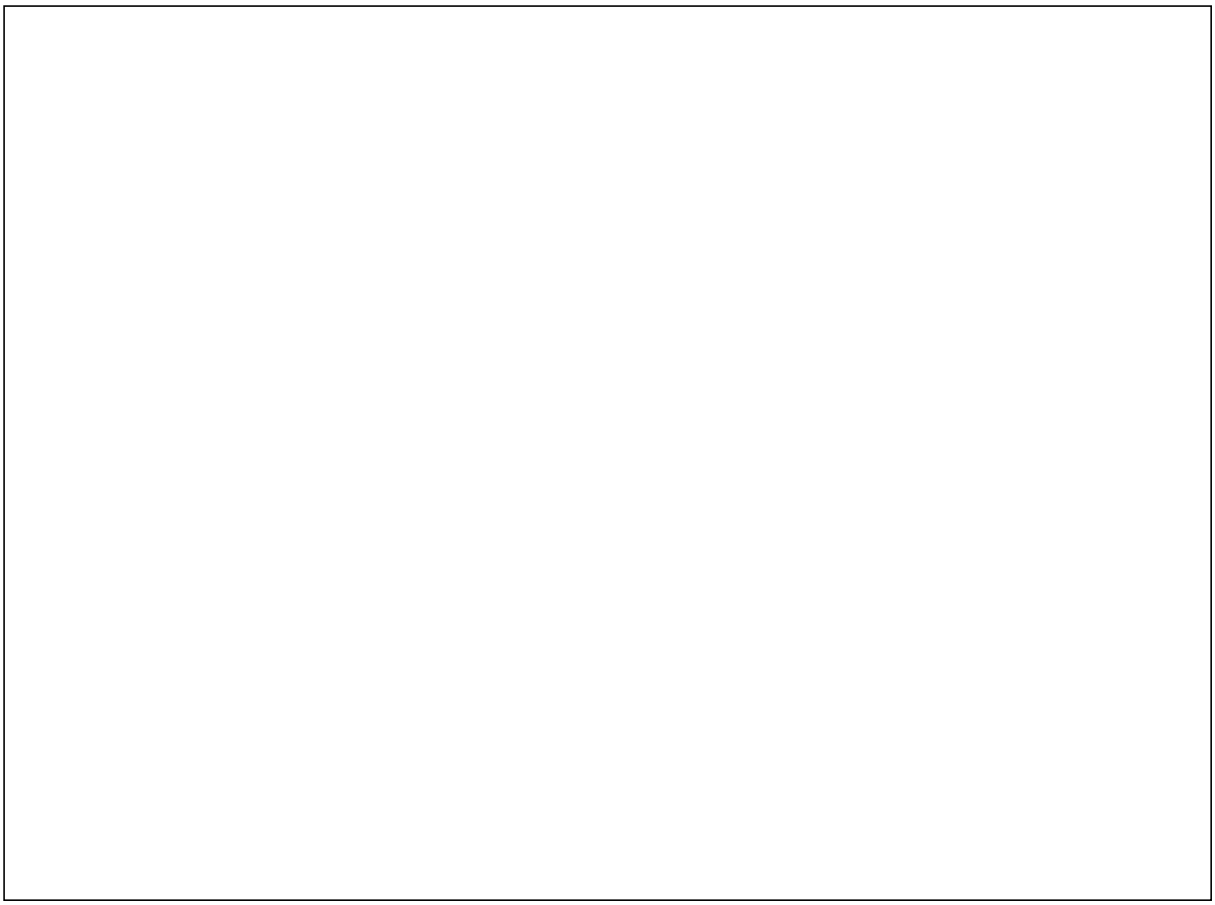
25. Disconnect MCM 120-pin connector and inspect connector for corrosion, or oil, fuel or water intrusion. Is contamination found?

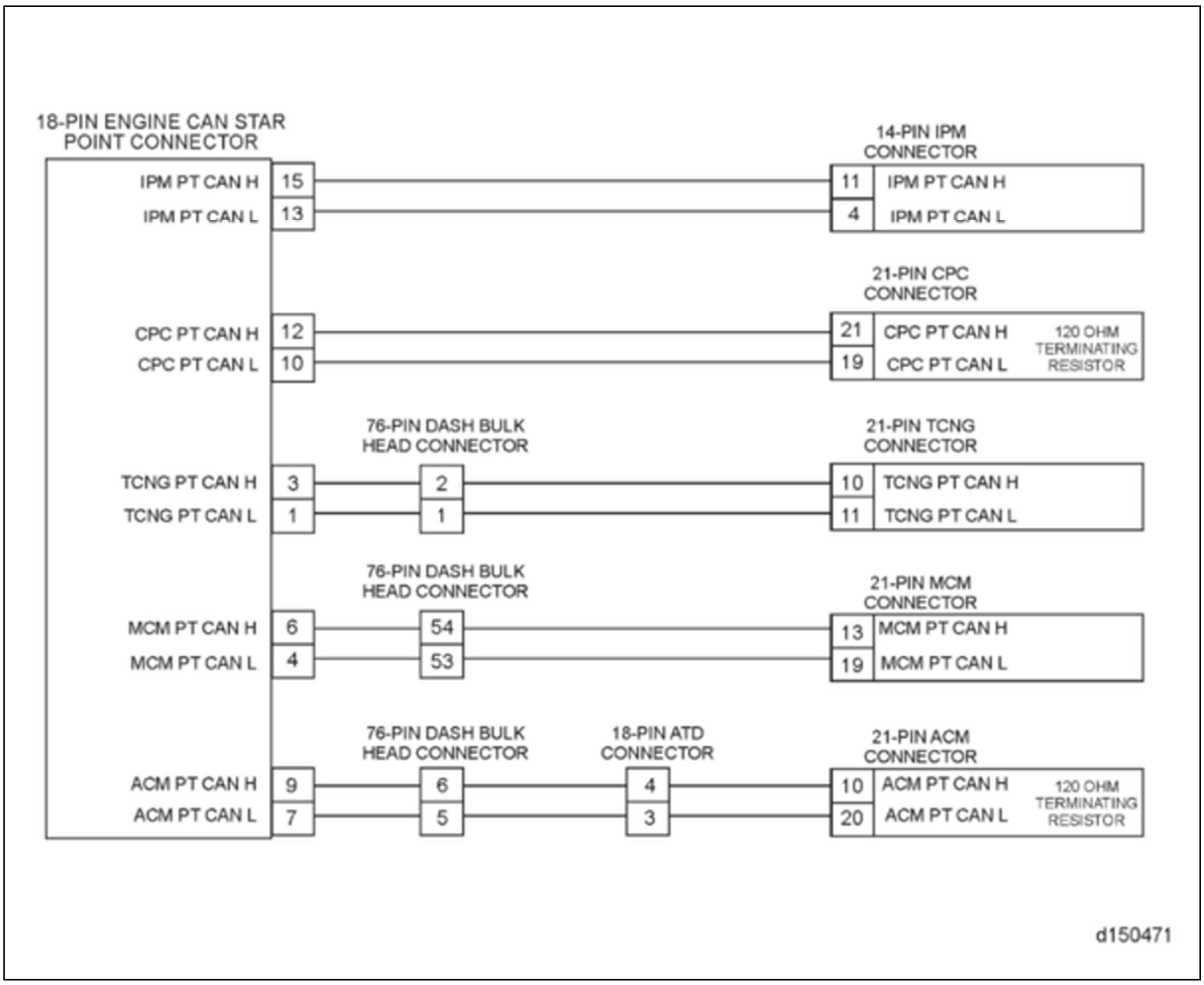
    25.a Yes; repair as necessary.

    25.b No; install a test MCM. If communication is restored (fault inactive), replace the MCM. Refer to section "Removal of the Motor Control Module" .

101.4 SPN 625/FMI 9 – GHG17

SPN 625/FMI 9	
Description	This Fault Code Sets when the Common Powertrain Controller (CPC) Stops Receiving Messages from the Aftertreatment Control Module (ACM)
Monitored Parameter	ACM Controller Area Network (CAN) Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL is Solid, CEL and AWL Flash
Engine Reaction	30 Seconds Shutdown
Verification	Turn the Ignition OFF, Wait Five Minutes, then Turn the Ignition ON





Possible causes:

- Over/under voltage supply to the module
- Fault set during a reprogram event
- Loss of ground to the ACM
- Loss of power to the ACM
- Loss of ignition switch power to the ACM
- Open in the CAN communication circuits

Check as follows:

1. Connect DiagnosticLink .
2. Check for multiple fault codes. Are fault codes SPN 168/FMI any present in any of the modules?
   2.a Yes; diagnose the other fault codes.
   2.b No; Go to step 3.
3. Has the Aftertreatment Control Module (ACM), Motor Control Module (MCM), or Common Powertrain Controller (CPC) been recently programmed?
   3.a Yes; clear the fault codes and Go to step 4.
   3.b No; Go to step 5.
4. Turn the ignition OFF, wait 5 minutes and turn the ignition back ON. Does fault code SPN 625/FMI 9 return?

4.a Yes; Go to step 5.

4.b No; the fault code was set during the reprogramming event. No further diagnostics or repairs are needed.

5. Check for MCM communication fault codes; is fault code SPN 625/FMI 9 also present in the MCM?

5.a Yes; Go to step 23.

5.b No; Go to step 6.

6. Turn the ignition OFF.

7. Disconnect and inspect the ACM 21-pin electrical connector, harness side. Is there any corrosion present?

7.a Yes; replace the ACM and the 21-pin electrical connector, harness side.

7.b No; Go to step 8.

8. Is the connector or are any of the pins damaged?

8.a Yes; Go to step 9.

8.b No; Go to step 10.

9. Inspect the 21-pin ACM electrical connector, component side. Is the connector or are any of the pins damaged?

9.a Yes; replace the ACM and repair the 21-pin electrical connector, harness side.

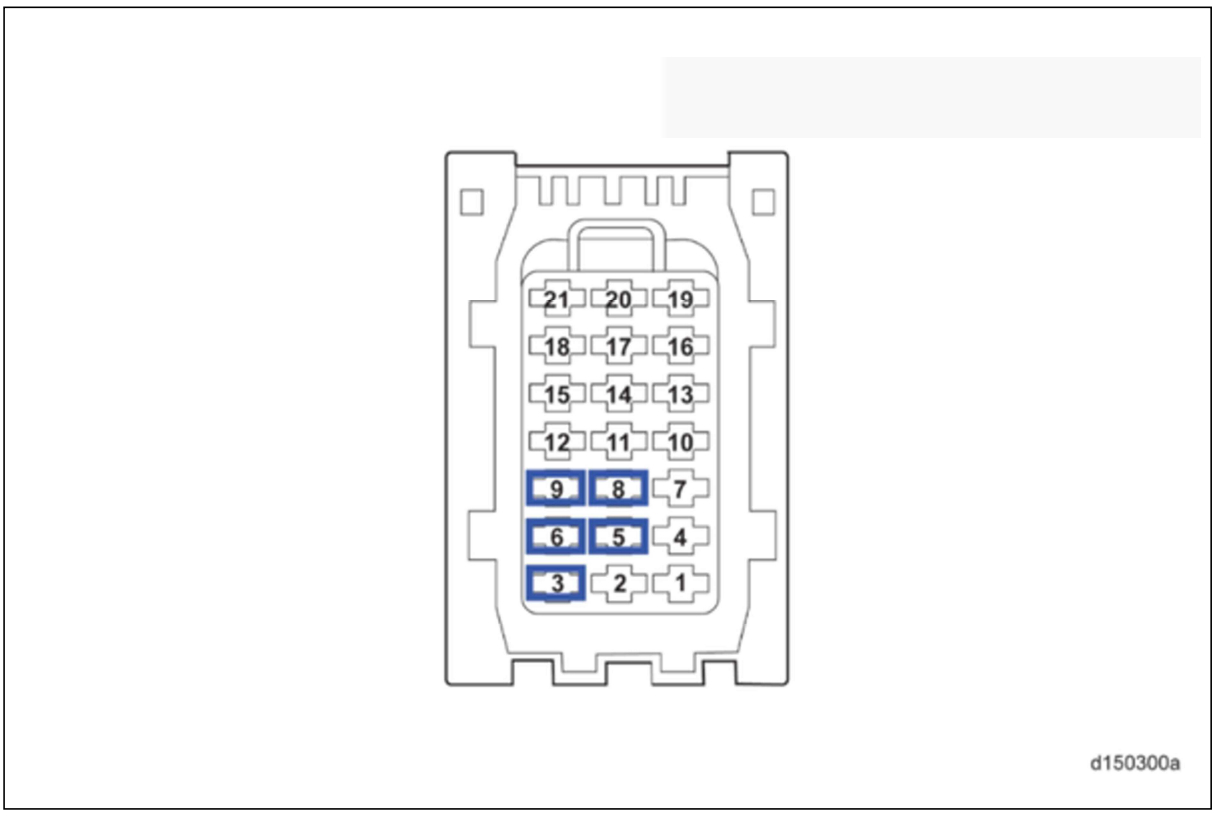
9.b No; repair the ACM 21-pin electrical connector.

10. Using the appropriate flex probe check pins 3, 5, 6, 8, 9, 10, 11, 12, 14, 15, 16, 18, and 20 in the ACM 21-pin electrical connector, harness side. Are any of the pins spread?

10.a Yes; replace the spread pins.

10.b No; Go to step 11.

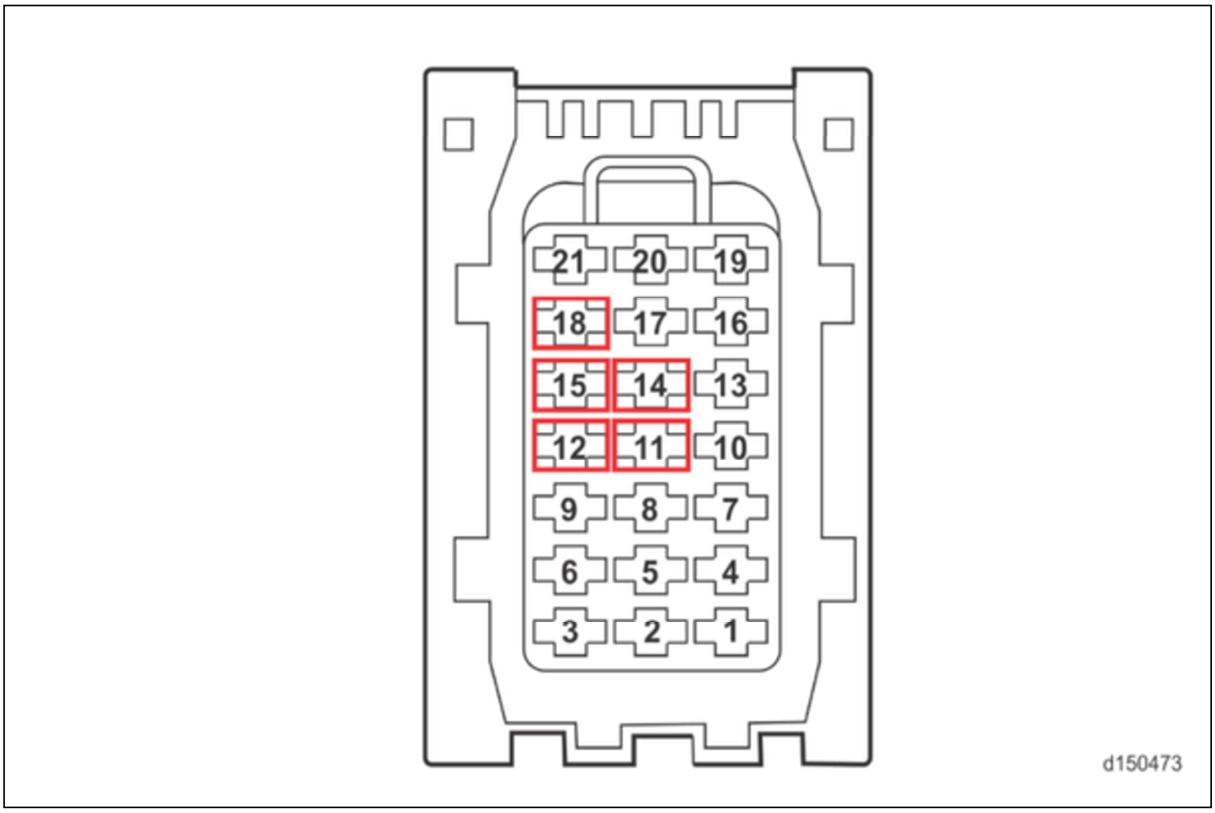
11. Measure the resistance between 3, 5, 6, 8, and 9 of the 21-pin ACM connector, harness side and ground. Are the resistances less than five ohms for each pin?



11.a Yes; Go to step 12.

11.b No; repair the circuit between pins 3, 5, 6, 8, 9 and the circuit splice.

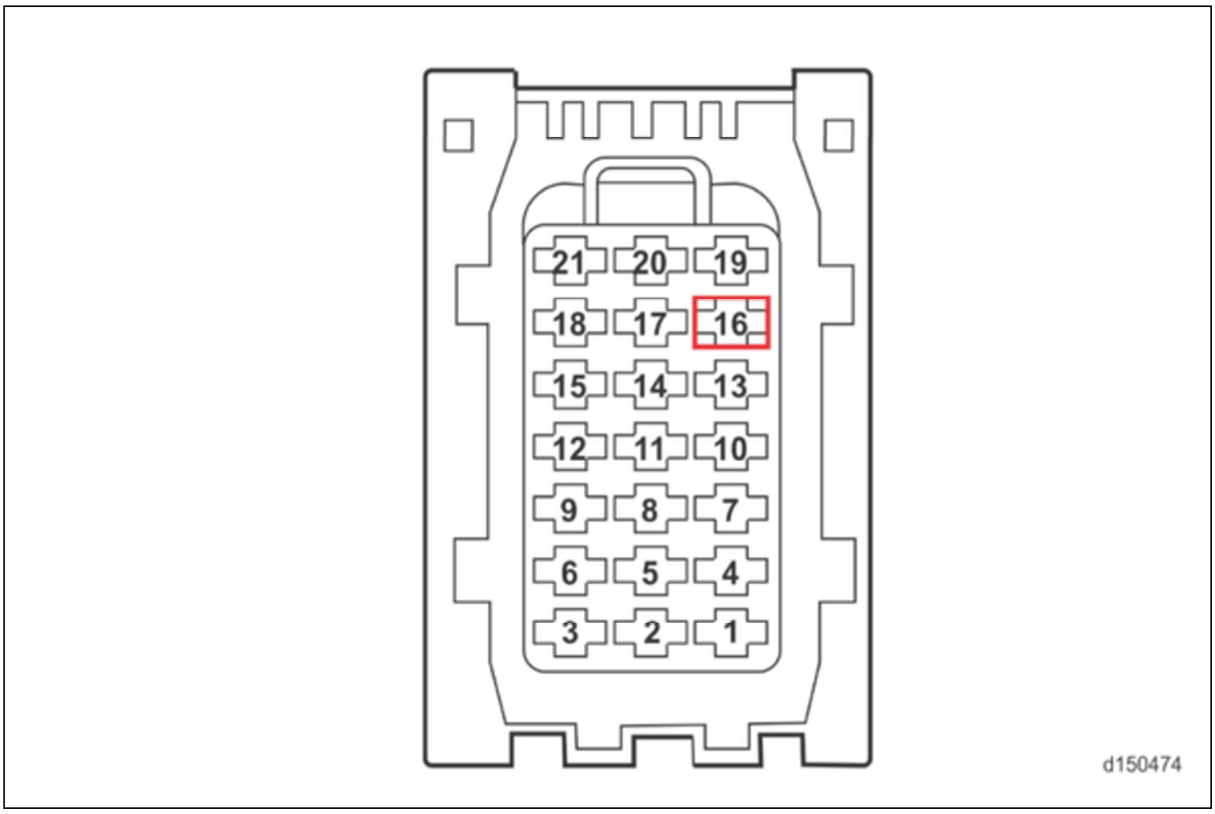
12. Measure the battery voltage directly at the batteries. Record the results.
13. Turn the ignition ON.
14. Measure the voltage on pins 7, 8, 9, 10, and 11 of the ACM 21-pin connector, harness side and ground. Is the voltage measurement on pins 7, 8, 9, 10, and 11 within one volt of the battery voltage?



14.a Yes; Go to step 15.

14.b No; repair the circuits in question.

15. Measure the voltage between pin 18 of the ACM 21-pin electrical connector, harness side and ground. Is the voltage within one volt of the battery voltage?

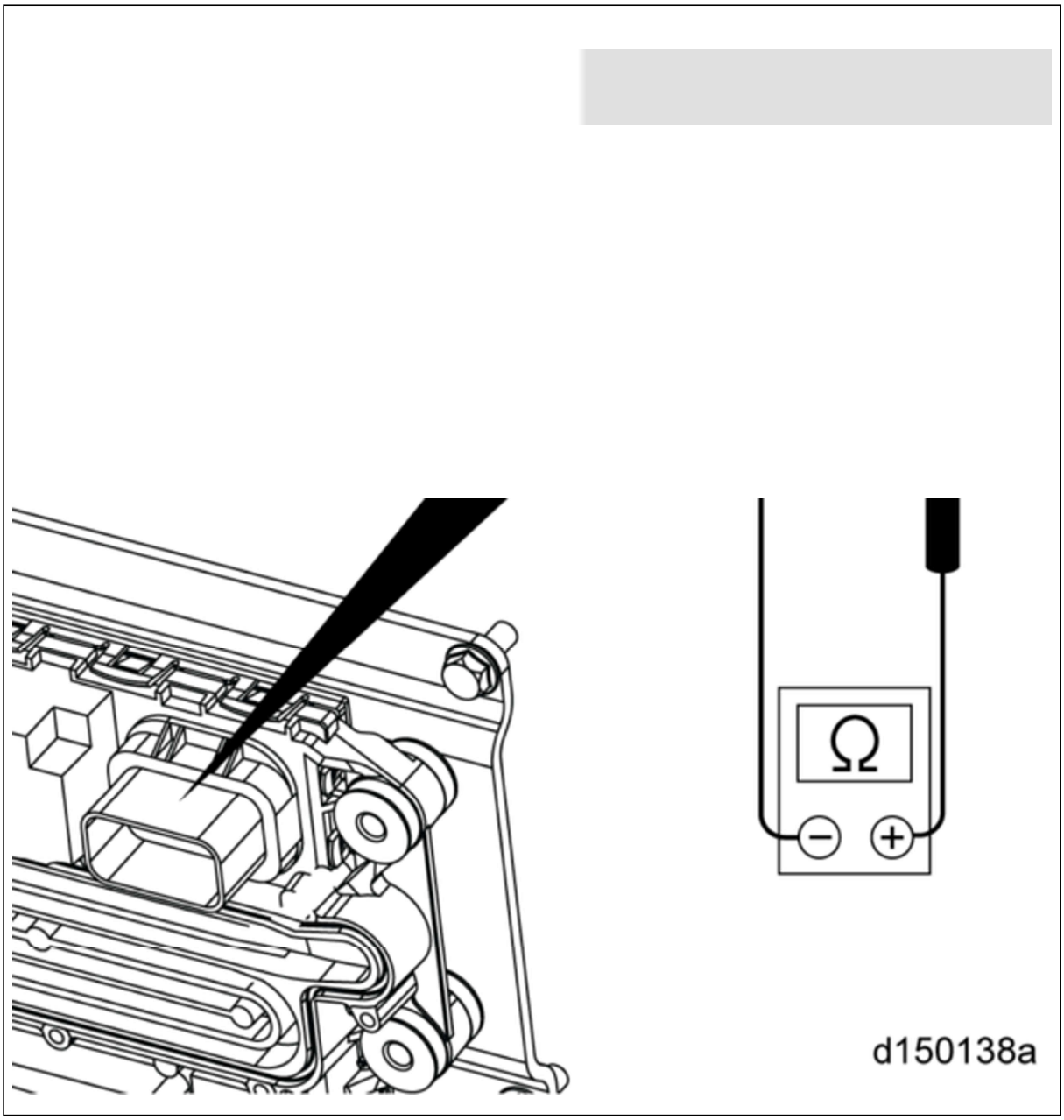


15.a Yes; Go to step 16.

15.b No; repair the ignition power circuit between pin 18 of the ACM 21-pin electrical connector, harness side, and fuse A in the Powernet Distribution Box (PNDB).

16. Turn the ignition OFF.

17. Measure resistance between pin 10 and pin 20 on the ACM connector, component side. Is the resistance between 115 and 125 ohms?



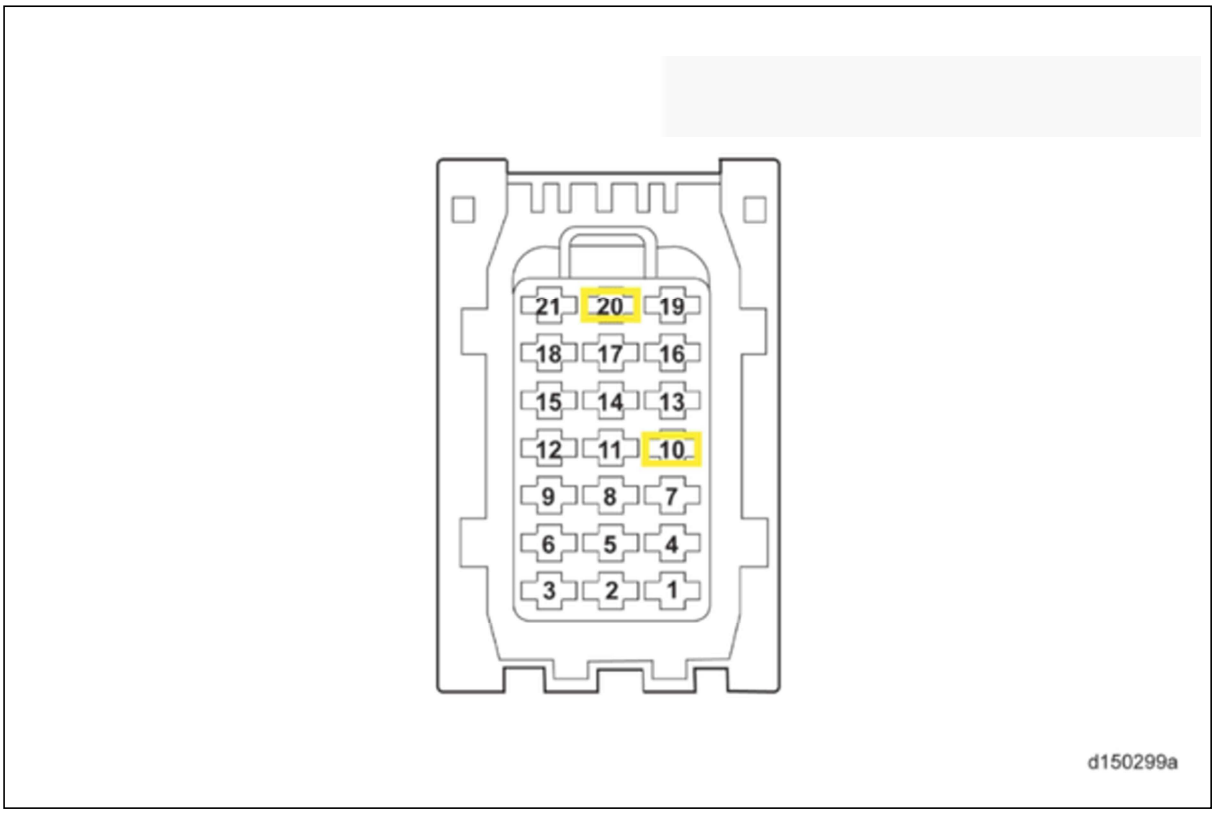
17.a Yes; Go to step 18.

17.b No; replace the ACM.

Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module"

Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module"

18. Measure resistance between pin 10 and pin 20 on the ACM connector, harness side. Is the resistance between 115 and 125 ohms?



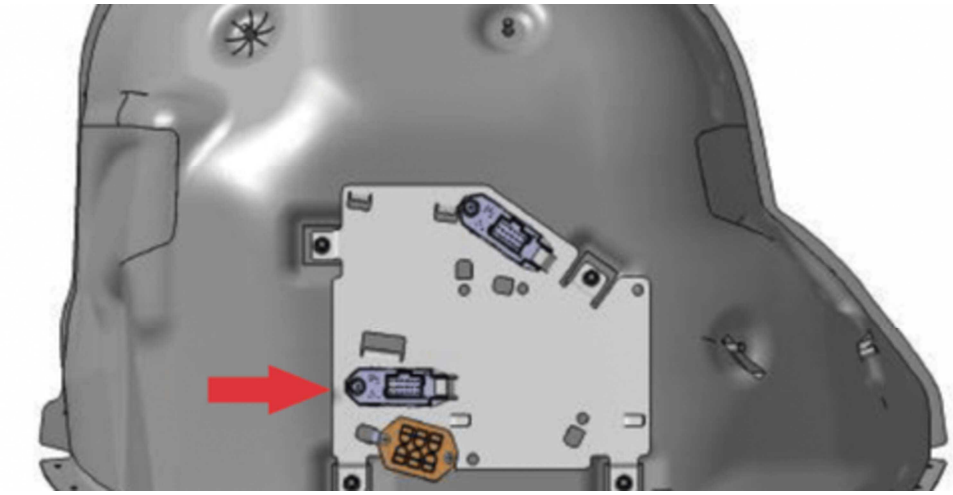
18.a Yes; replace the ACM.

Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module"

Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module"

18.b No; Go to step 19.

19. Disconnect and inspect the 18-pin star point electrical connector, harness side. Is there any corrosion present?



19.a Yes; replace the star point assembly and repair the 18-pin electrical connector, harness side.

19.b No; Go to step 20.

20. Is the connector or are pins 7 and/or 9 damaged?

20.a Yes; replace the pins.

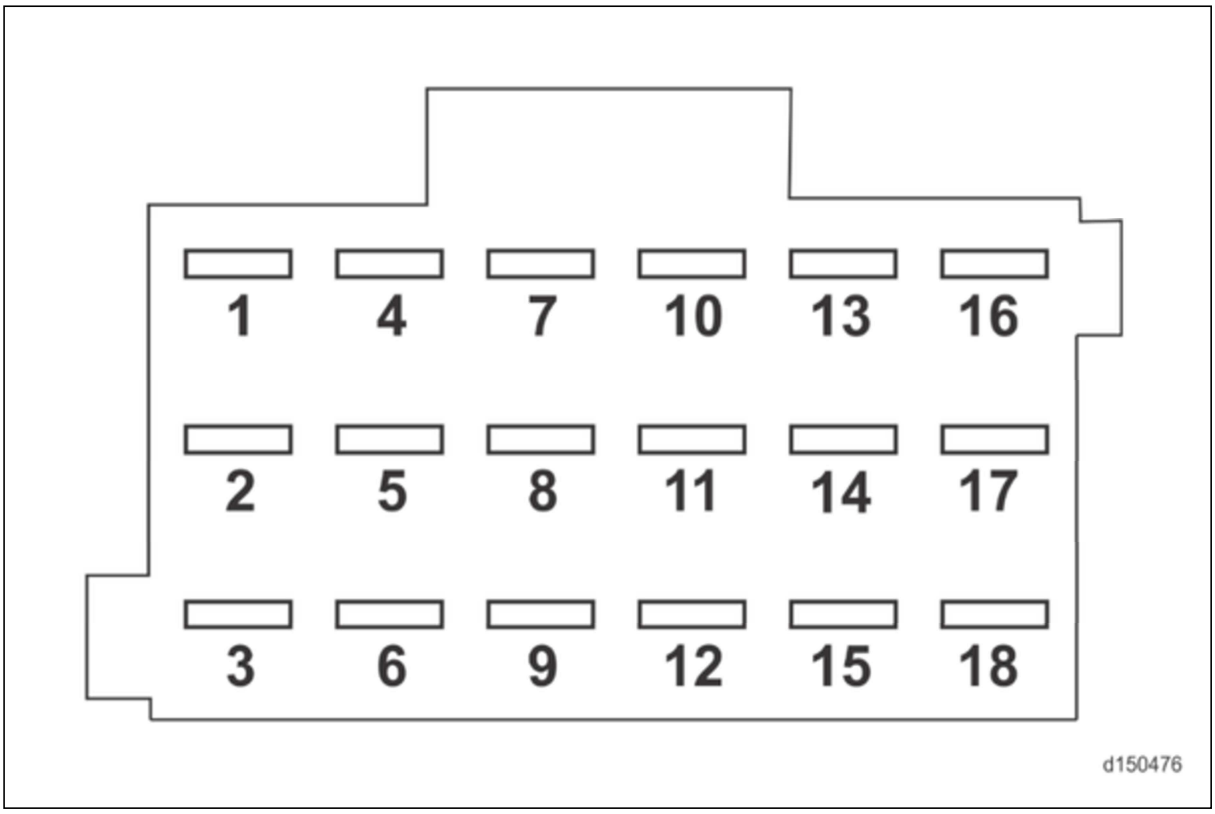
20.b No; Go to step 21.

21. Using the appropriate flex probe, check pins 3, 5, 6, 8, 10, 11, 12, 14, 15, 16, 18, and 20. Are any of the pins spread?

21.a Yes; replace the spread pin(s).

21.b No; Go to step 22.

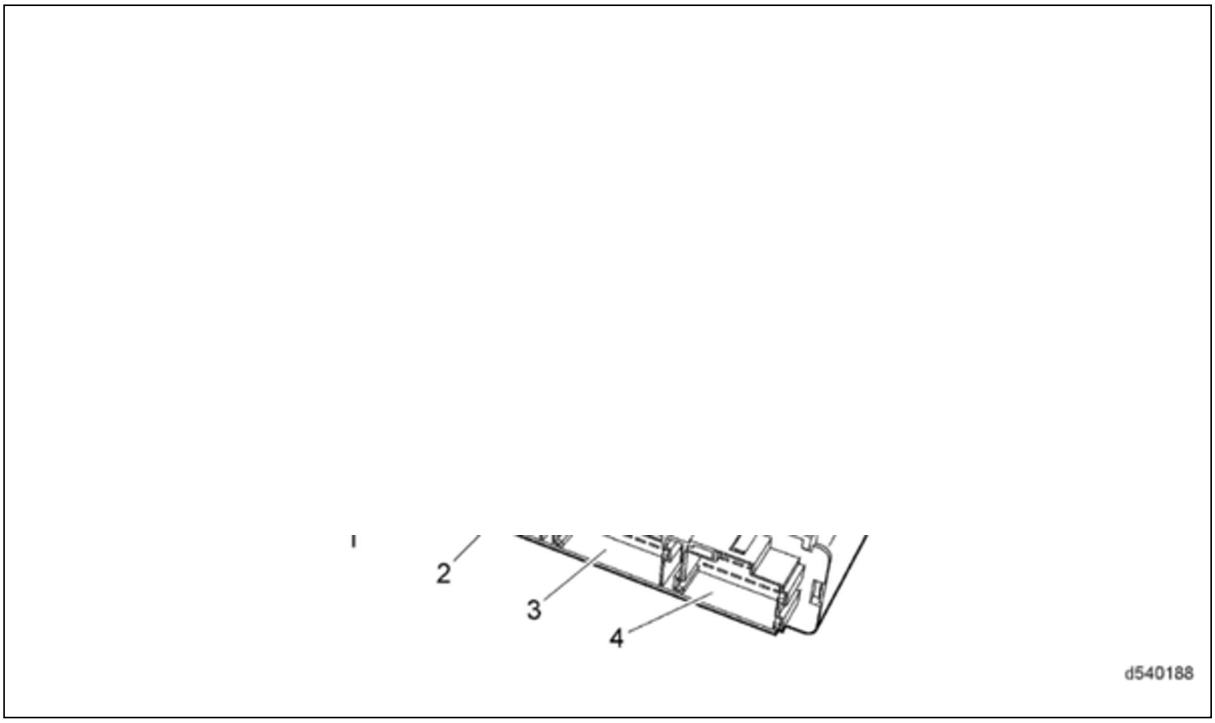
22. Measure the resistance between pin 10 of the ACM 21-pin electrical connector, harness side, and pin 9 of the 18-pin star point electrical connector, harness side. Is the resistance greater than five ohms?



22.a Yes; repair the circuit between pin 10 of the ACM 21-pin electrical connector, harness side, and pin 9 of the 18-pin star point electrical connector, harness side.

22.b No; repair the circuit between pin 20 of the ACM 21-pin electrical connector, harness side, and pin 7 of the 18-pin star point electrical connector, harness side.

23. Disconnect and inspect the CPC #3 electrical connector, harness side. Is there any corrosion present?



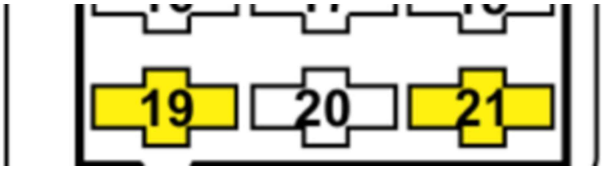
23.a Yes; replace the CPC and the electrical connector.

23.b No; Go to step 24.

24. Is the connector or are pins 19 and/or 21 damaged?

BROWN FRONT

Looking into Pins on the Harness



24.a Yes; Go to step 25.

24.b No; Go to step 26.

25. Inspect the CPC #3 electrical connector, component side. Is the connector or are any of the pins damaged?

25.a Yes; replace the CPC and repair the electrical connector, harness side.

25.b No; repair the CPC electrical connector, harness side.

26. Using the correct flex probe check pins 19 and 21. Are the pins spread?

26.a Yes; replace the pins.

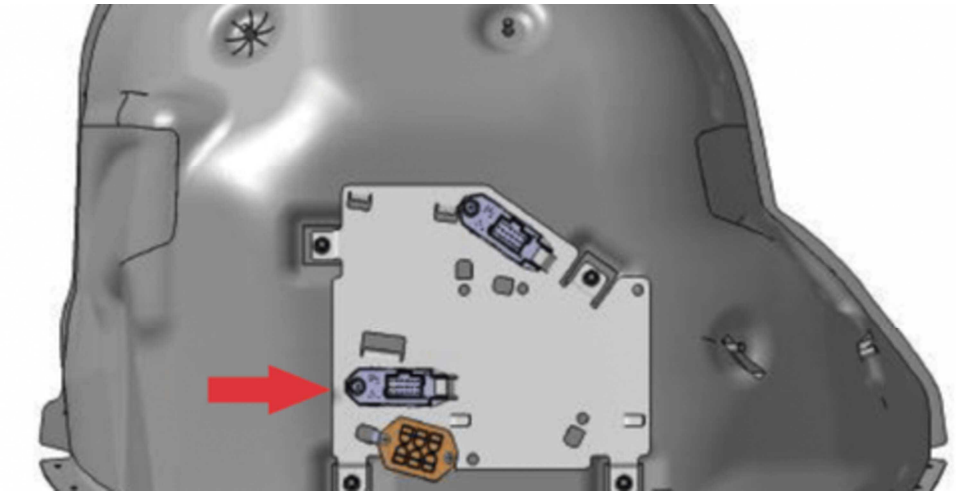
26.b No; Go to step 27.

27. Measure the resistance between pin 19 and pin 21. Is the resistance between 115 and 125 ohms?

27.a Yes; replace the CPC.

27.b No; Go to step 28.

28. Disconnect and inspect the 18-pin star point electrical connector, harness side. Is there any corrosion present?



28.a Yes; replace the star point assembly and repair the 18-pin electrical connector, harness side.

28.b No; Go to step 29.

29. Is the connector or are pins 10 and/or 12 damaged?

29.a Yes; replace the pins.

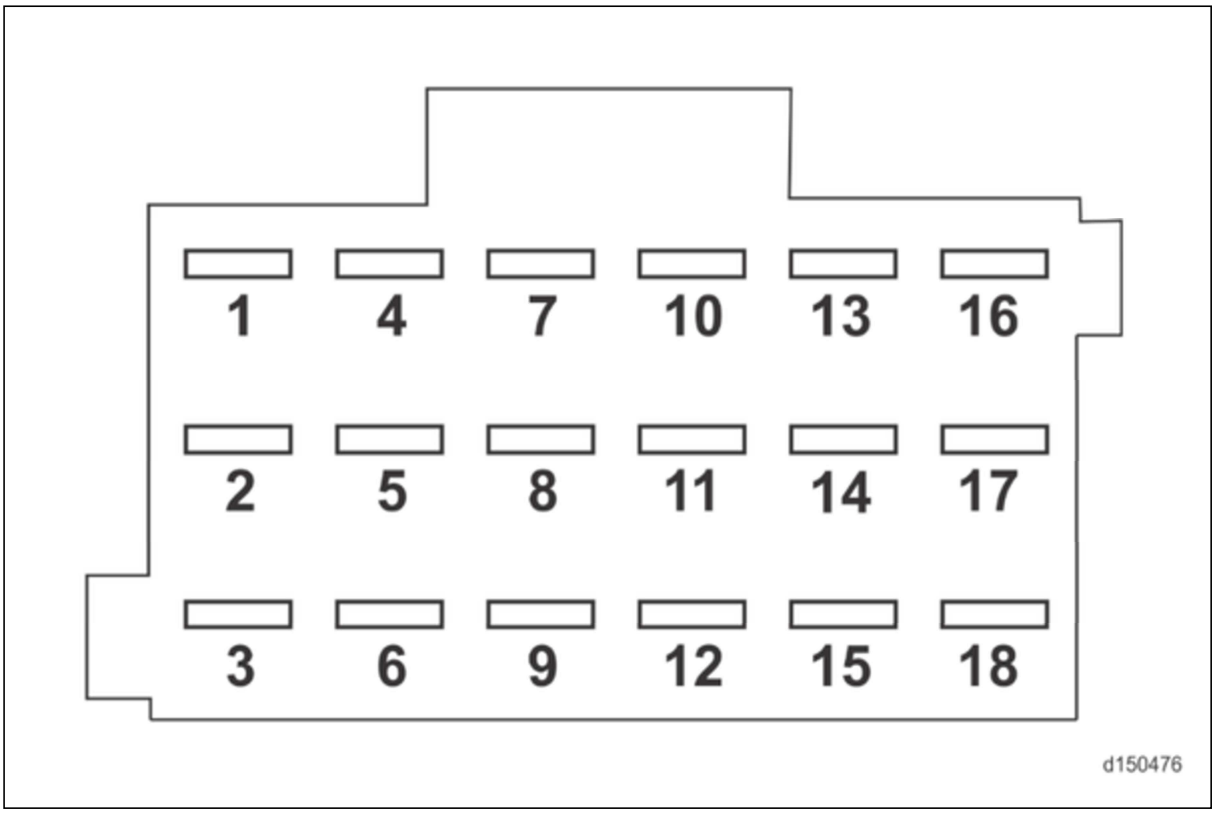
29.b No; Go to step 30.

30. Using the appropriate flex probe check pins 10 and 12. Are either of the pins spread?

30.a Yes; replace the spread pin(s).

30.b No; Go to step 31.

31. Measure the resistance between CPC #3 electrical connector pin 19, harness side and pin 10 of the 18-pin star point electrical connector, harness side. Is the resistance greater than five ohms?


1
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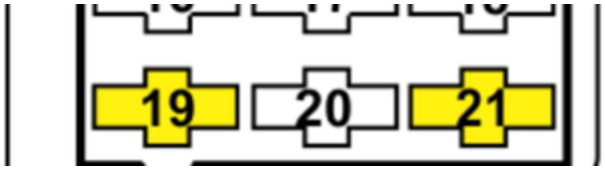
BROWN FRONT

Looking into Pins on the Harness



31.a Yes; repair the circuit between CPC #3 electrical connector pin 19, harness side, and pin 10 of the 18-pin star point electrical connector, harness side.

31.b No; repair the circuit between CPC #3 electrical connector pin 21, harness side, and pin 12 of the 18-pin star point electrical connector, harness side.

101.5 SPN 625/FMI 13 – GHG17

SPN 625/FMI 13	
Description	ECAN ID_1629 Message Not Received Or Has Stopped Arriving
Monitored Parameter	Controller Area Network (CAN) Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Verification	Engine Idle (One Minute)

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ WARNING

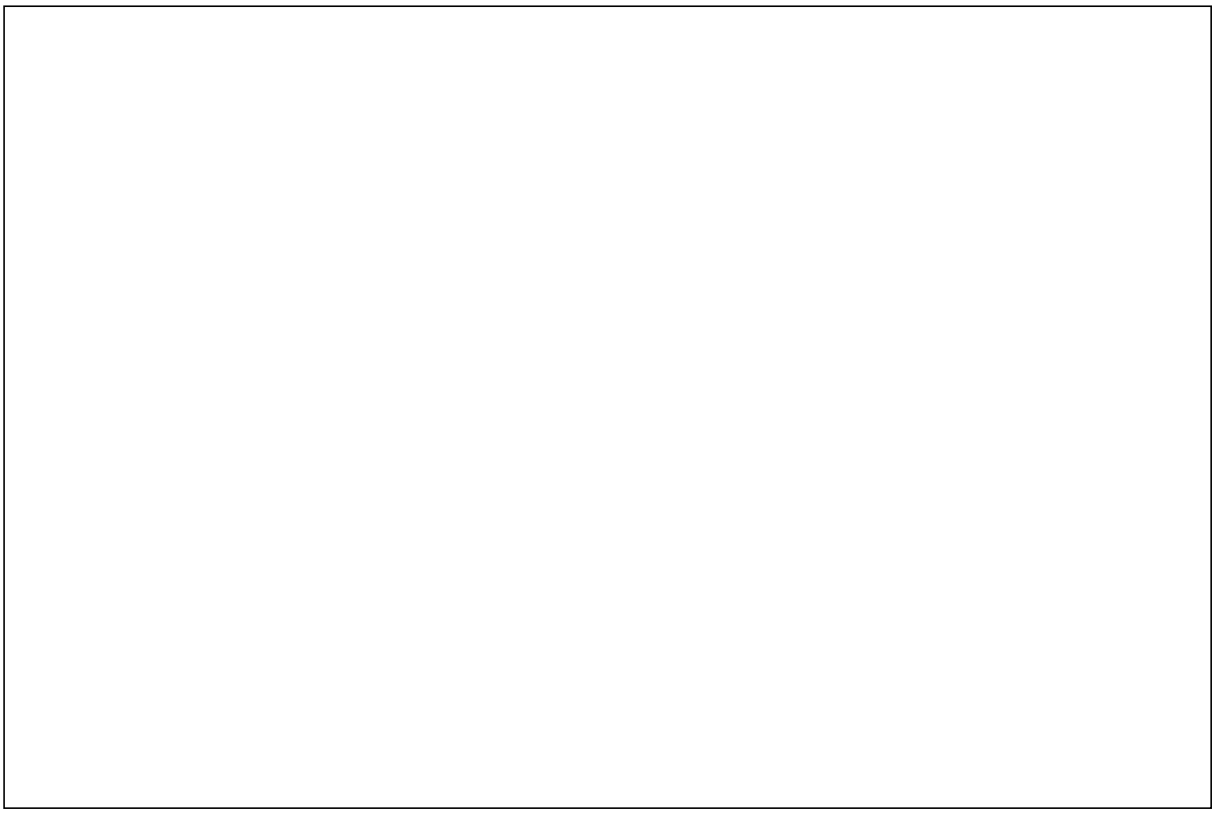
PERSONAL INJURY

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.

⚠ WARNING

ENGINE EXHAUST

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



Check as follows:

1. Are there any battery voltage faults (SPN 168/FMI any faults)?
   1.a Yes; troubleshoot battery voltage faults first.
   1.b No; Go to step 2.
2. Are there any other SPN 625/FMI codes present?
   2.a Yes; repair the other CAN communication codes first.
   2.b No; Go to step 3.
3. Turn ignition OFF and wait five minutes before proceeding.
4. Disconnect the Common Powertrain Controller (CPC) connector #3 and inspect connector for corroded, unseated (pushed out), damaged, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is contamination found?
   4.a Yes; repair as necessary.
   4.b No; Go to step 5.
5. Check CPC internal terminating resistor by measuring the resistance across pins 19 and 21 of the CPC electrical connector #3, component side. Is the resistance between 110 and 130 ohms?

5.a Yes; Go to step 7.

5.b No; replace the CPC.

6. Measure the resistance between pin 19 of the CPC connector #3, harness side and battery ground. Is the resistance greater than 10K ohms?

   6.a Yes; Go to step 8.

   6.b No; repair the wire short to ground between pin 19 of the CPC connector #3, harness side and pin 20 of the Aftertreatment Control Module (ACM) 21-pin connector, harness side.

7. Measure the resistance between pin 21 of the CPC connector #3, harness side and battery ground. Is the resistance greater than 10K ohms?

   7.a Yes; Go to step 9.

   7.b No; repair the wire short to ground between pin 21 of the CPC connector #3, harness side and pin 10 of the ACM 21-pin connector, harness side.

8. Disconnect Transmission Control Module (TCM) X1 21-pin connector and inspect connector for corroded, unseated (pushed out) or damaged pins, bent or spread pins; inspect the connector seal for damage (signs

of water or oil intrusion). Is contamination found?

8.a Yes; repair as necessary.

8.b No; Go to step 9.

9. Measure the resistance between pin 19 of the CPC connector #3, harness side and pin 10 of the TCM X1 21-pin connector. Is the resistance less than five ohms?

9.a Yes; Go to step 10.

9.b No; repair the wire between pin 19 of the CPC connector #3 and pin 10 of the TCM X1 21-pin connector.

10. Measure the resistance between pin 21 of the CPC connector #3, harness side and pin 11 of the TCM X1 21-pin connector. Is the resistance less than five ohms?

10.a Yes; Go to step 11.

10.b No; repair the wire between pin 21 of the CPC connector #3 and pin 11 of the TCM X1 21-pin connector.

11. Measure the resistance between pin 20 of the CPC connector #3, harness side and pin 7 of the TCM X1 21-pin connector. Is the resistance less than five ohms?

11.a Yes; Go to step 12.

11.b No, repair the wire between pin 20 of the CPC connector #3 and pin 7 of the TCM X1 21-pin connector.

12. Measure the resistance between pin 20 of the CPC connector #3, harness side and pin 8 of the TCM X1 21-pin connector. Is the resistance less than five ohms?

12.a Yes, install a test CPC and retest. Go to step 13.

12.b No, repair the wire between pin 20 of the CPC connector #3 and pin 8 of the TCM X1 21-pin connector.

13. Does the code return with the test CPC?

13.a Yes; Go to step 14.

13.b No; replace the CPC.

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

14. Verify repairs. Restore all connections. Idle the engine for one minute. Is fault code still active?

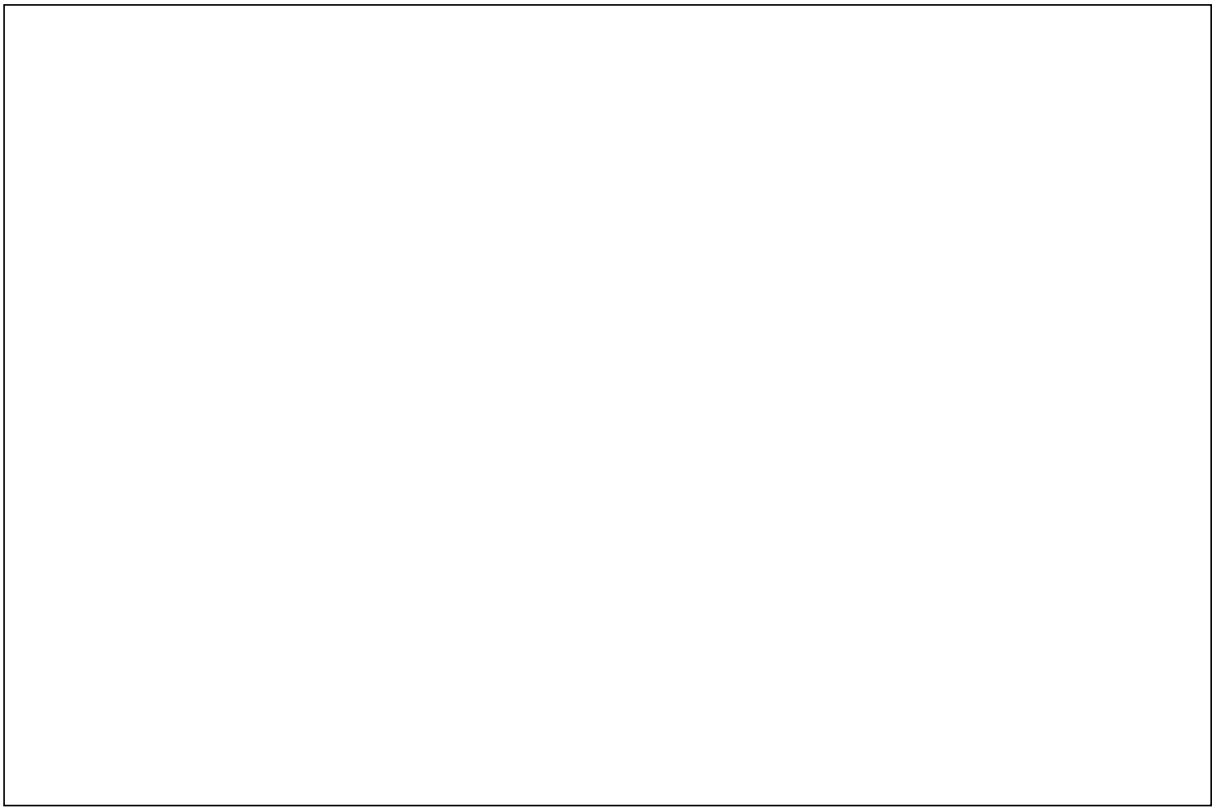
14.a Yes; replace the TCM. Refer to OEM procedures.

14.b No; if fault does not become active, clear the fault codes and release the vehicle.

101.6 SPN 625/FMI 14 - GHG17

PTCAN: MCM System ID/MCM_C01 Not Received or Stopped Arriving

SPN 625/FMI 14	
Description	MCM Message Not Received Or Has Stopped Arriving
Monitored Parameter	CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None



Check as follows:

1. Are there any battery voltage faults present (SPN 168/FMI any)?
   - 1.a Yes; troubleshoot battery voltage faults first.
   - 1.b No; Go to step 2.
2. Have the Aftertreatment Control Module (ACM), Motor Control Module (MCM) or Common Powertrain Controller (CPC) been recently programmed?
   - 2.a Yes; verify that the correct MCM, CPC and/or ACM parameter list has been installed, then clear the fault codes. If faults do not become active, release the vehicle; if faults become active, Go to step 3.
   - 2.b No, Go to step 3.
3. Turn ignition OFF and wait five minutes before proceeding. Main battery power must be left ON (the five-minute time frame allows the ACM to go completely offline).

4. Disconnect the MCM 21-pin connector.
5. Inspect the MCM 21–pin connector for corroded, unseated (pushed out) or damaged pins, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

6. Measure and record the resistance across pins 13 and 19 of the MCM 21-pin connector. Is the resistance greater than 80 ohms?

   6.a Yes; Go to step 9.

   6.b No; Go to step 7.

7. Is the resistance reading from step 6 less than five ohms?

   7.a Yes; replace the PT-CAN harness.

7.b No; Go to step 8.

8. Is the resistance from step 6 between 40 and 80 ohms?

8.a Yes; Go to step 21.

8.b No; Go to step 9.

9. Disconnect the ACM 21-pin connector.

10. Inspect the ACM 21-pin connector for corroded, unseated (pushed out) or damaged pins, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

10.a Yes; repair as necessary.

10.b No; Go to step 11.

11. Check ACM internal terminating resistor by measuring and recording the resistance across pins 10 and 20 of the ACM 21-pin connector. Is the resistance between 110 and 130 ohms?

11.a Yes; Go to step 12.

11.b No; replace the ACM.

12. Disconnect the CPC connector #3.

13. Inspect the CPC connector for corroded, unseated (pushed out) or damaged pins, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

13.a Yes; repair as necessary.

13.b No; Go to step 14.

14. Check the CPC internal terminating resistor by measuring and recording the resistance across pins 19 and 21 of the CPC connector #3. Is the resistance between 110 and 130 ohms?

14.a Yes; Go to step 15.

14.b No; replace the CPC.

15. Measure and record the resistance between pin 19 of the CPC connector #3 and pin 20 of the ACM 21-pin connector. Is resistance less than five ohms?

    15.a Yes; Go to step 16.

    15.b No; repair the wire between pin 19 of the CPC connector #3 and pin 20 of the ACM 21-pin connector.

16. Measure and record the resistance between pin 21 of the CPC connector #3 and pin 10 of the ACM 21-pin connector. Is resistance less than five ohms?

    16.a Yes; Go to step 17.

    16.b No; repair the wire between pin 21 of the CPC connector #3 and pin 10 of the ACM 21-pin connector.

17. Measure and record the resistance between pin 19 of the CPC connector #3 and pin 19 of the MCM 21-pin connector. Is resistance less than five ohms?

    17.a Yes; Go to step 18.

    17.b No; repair the wire between pin 19 of the CPC connector #3 and pin 19 of the ACM 21-pin connector.

18. Measure and record the resistance between pin 21 of the CPC connector #3 and pin 13 of the MCM 21-pin connector. Is resistance less than five ohms?

    18.a Yes; Go to step 19.

    18.b No; repair the wire between pin 21 of the CPC connector #3 and pin 13 of the MCM 21-pin connector.

19. Measure and record the resistance between pin 19 of the MCM 21-pin connector and pin 20 of the ACM 21-pin connector. Is resistance less than five ohms?

    19.a Yes; Go to step 20.

    19.b No; repair the wire between pin 19 of the MCM 21-pin connector and pin 20 of the ACM 21-pin connector.

20. Measure and record the resistance between the pin 13 of the MCM 21-pin connector and pin 10 of the ACM 21-pin connector. Is resistance less than five ohms?

    20.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" .

    20.b No; repair the wire between pin 13 of the MCM 21-pin connector and pin 10 of the ACM 21-pin connector

21. Turn the ignition ON (key ON, engine OFF).

22. Measure the voltage between pins 7, 11, 12, 14, and 15 of the MCM 21-pin connector (ignition/battery voltage) and ground. Is the voltage less than 11.5 volts?

    22.a Yes; restore voltage to pins 7, 11, 12, 14, and 15 of the MCM 21-pin connector.

    22.b No; Go to step 23.

23. Turn the ignition OFF.

24. Measure the resistance between pins 5, 6, 8 and 9 of the MCM 21-pin connector and the negative battery post. Is resistance greater than five ohms?

    24.a Yes; restore the battery ground to pins, 5, 6, 8 and 9 of the MCM 21-pin connector.

    24.b No; Go to step 25.

25. Disconnect MCM 120-pin connector and inspect connector for corrosion, or oil, fuel or water intrusion. Is contamination found?

    25.a Yes; repair as necessary.

    25.b No; install a test MCM. If communication is restored (fault inactive), replace the MCM. Refer to section "Removal of the Motor Control Module" .

SPN 625 (MCM) (GHG17)

100.1 SPN 625/FMI 8 - GHG17

SPN 625/FMI 8	
Description	DM1 Message Not Received or Has Stopped Arriving
Monitored Parameter	CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None

Check as follows:

1. Are there any battery voltage faults present (SPN 168/FMI any)?
   - 1.a Yes; troubleshoot battery voltage faults first.
   - 1.b No; Go to step 2.
2. Have the Aftertreatment Control Module (ACM), Motor Control Module (MCM) or Common Powertrain Controller (CPC) been recently programmed?
   - 2.a Yes; clear the fault codes. If faults do not become active, release the vehicle. If faults become active, Go to step 3.
   - 2.b No; Go to step 5.
3. Turn ignition OFF and wait five minutes before proceeding. Main battery power must be left ON (The five-minute timeframe allows the ACM to go completely offline).
4. Disconnect the MCM 21-pin connector.

5. Measure and record the resistance across pins 13 and 19 of the MCM 21-pin connector. Is the resistance greater than 80 ohms?
   - 5.a Yes; Go to step 8.
   - 5.b No; Go to step 6.
6. Is the resistance reading from step 5 less than 6 ohms?
   - 6.a Yes; replace the PT-CAN harness.
   - 6.b No; Go to step 7.
7. Is the resistance between 60 plus or minus 20 ohms?
   - 7.a Yes; Go to step 18.
   - 7.b No; Go to step 8.
8. Disconnect the ACM 21-pin connector.

9. Check ACM internal terminating resistor by measuring and recording the resistance across pins 10 and 20 of the ACM 21-pin connector. Is the resistance between 120 plus or minus 10 ohms?

9.a Yes; Go to step 10.

9.b No; replace the ACM.

10. Disconnect the CPC connector #3.

11. Check the CPC internal terminating resistor by measuring and recording the resistance across pins 19 and 21 of the CPC connector cavity #3. Is the resistance between 120 plus or minus 10 ohms?

11.a Yes; Go to step 12.

11.b No; replace the CPC.

12. Check for continuity between pin 19 of the CPC connector #3 and pin 20 of the ACM 21-pin connector. Is there continuity?

12.a Yes; Go to step 13.

12.b No; repair the wire between pin 19 of the CPC connector #3 and pin 20 of the ACM 21-pin connector.

13. Measure and record the resistance between pin 21 of the CPC connector #3 and pin 10 of the ACM 21-pin connector. Is there continuity?

13.a Yes; Go to step 14.

13.b No; repair the wire between pin 21 of the CPC connector #3 and pin 10 of the ACM 21-pin connector.

14. Measure and record the resistance between pin 19 of the CPC connector #3 and pin 19 of the MCM 21-pin connector. Is there continuity?

14.a Yes; Go to step 15.

14.b No; repair the wire between pin 19 of the CPC connector #3 and pin 19 of the MCM 21-pin connector.

15. Measure and record the resistance between pin 21 of the CPC connector #3 and pin 13 of the MCM 21-pin connector. Is there continuity?

15.a Yes; Go to step 16.

15.b No; repair the wire between pin 21 of the CPC connector #3 and pin 13 of the MCM 21-pin connector.

16. Measure and record the resistance between pin 19 of the MCM 21-pin connector and pin 20 of the ACM 21-pin connector. Is there continuity?

16.a Yes; Go to step 17.

16.b No; repair the wire between pin 19 of the MCM 21-pin connector and pin 20 of the ACM 21-pin connector.

17. Measure and record the resistance between pin 13 of the MCM 21-pin connector and pin 10 of the ACM 21-pin connector. Is there continuity?

17.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" .

17.b No; repair the wire between pin 13 of the MCM 21-pin connector and pin 10 of the ACM 21-pin connector.

18. Turn the ignition ON.

19. Measure the voltage between pins 7, 11, 12, 14, and 15 (ignition/battery voltage) of the MCM 21-pin connector and ground. Is the voltage less than 11.5 volts?

    19.a Yes; restore voltage to MCM 21-pin connector pins 7, 11, 12, 14, and 15.

    19.b No; Go to step 20.

20. Turn the ignition OFF.

21. Measure the resistance between pins, 5, 6, 8 and 9 of the negative battery post of the MCM 21-pin connector . Is resistance greater than three ohms?

    21.a Yes; restore the battery ground to pins, 5, 6, 8 and 9 of the MCM 21-pin connector.

    21.b No; Go to step 22.

22. Disconnect MCM 120-pin connector and inspect connector for corrosion, or oil, fuel or water intrusion. Is contamination found?

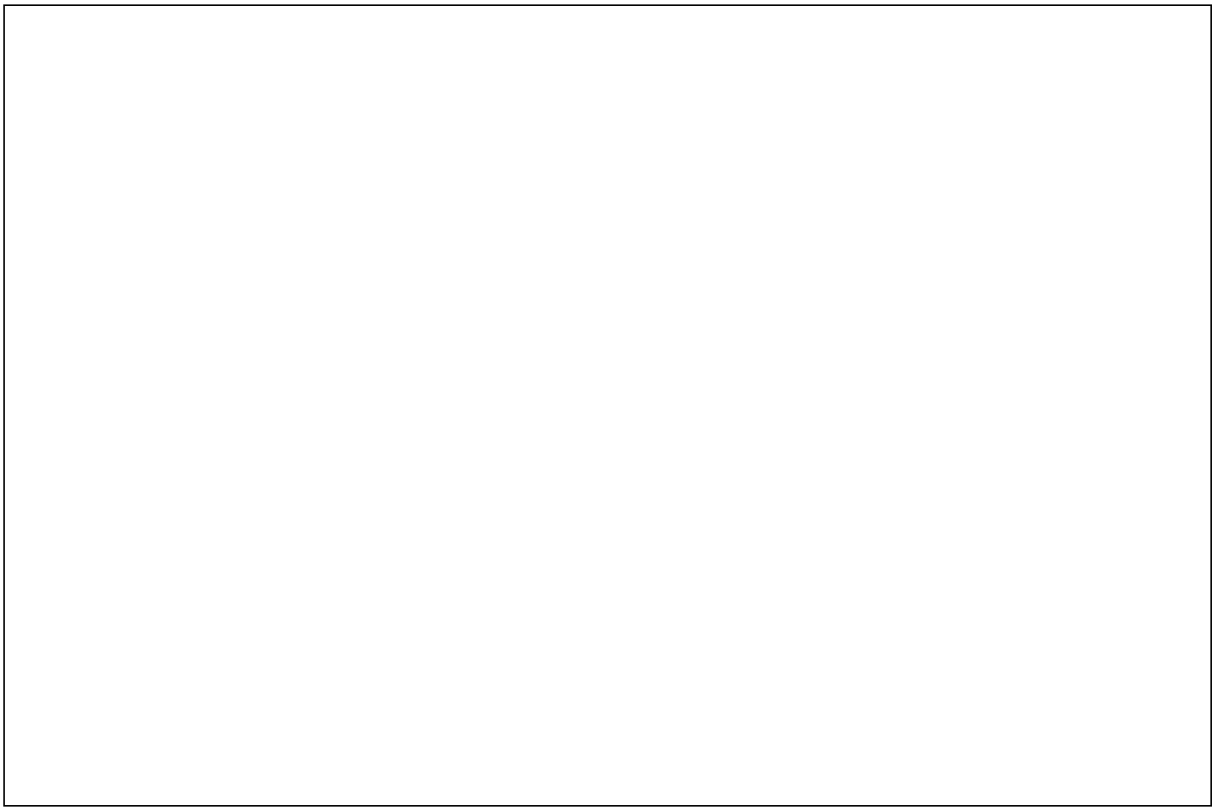
    22.a Yes; repair as necessary.

    22.b o; install a test MCM. If communication is restored (fault inactive), replace the MCM. Refer to section "Removal of the Motor Control Module" .

100.2 SPN 625/FMI 9 - GHG17

Aftertreatment Control Module PT-CAN DM1 Message Not Received or has Stopped Arriving

SPN 625/FMI 9	
Description	Aftertreatment Control Module (ACM) Message Not Received or has Stopped Arriving.
Monitored Parameter	CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Ignition On



1. Connect DiagnosticLink .
2. Check for multiple fault codes. Are fault codes SPN 168/ FMI present in any of the modules?
   - 2.a Yes; diagnose the other fault codes first.
   - 2.b No; Go to step 3.
3. Has the Aftertreament Control Module (ACM), Motor Control Module (MCM) or Common Powertrain Controller (CPC) been recently programmed?
   - 3.a Yes; clear the fault codes and cycle the ignition. If the fault code returns, Go to step 4.
   - 3.b No; Go to step 4.

4. Turn the ignition OFF.
5. Disconnect and inspect the ACM 21-pin electrical harness connector. Are there any damaged pins or corrosion present in the connector?

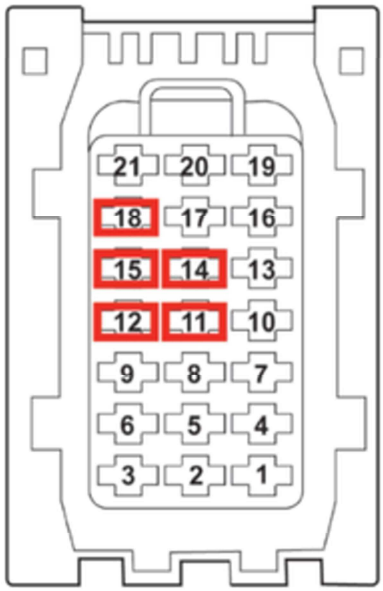
   5.a Yes; repair the connector as necessary.

   5.b No; Go to step 6.
6. Measure the battery voltage at the batteries and record the voltage.

CAUTION
ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

7. Turn the ignition ON (key ON, engine OFF).
8. Measure the voltage between pins 11, 12, 14, 15, 18 and ground of the 21-pin ACM connector, harness side. Is the voltage measurement on pins 11, 12, 14, 15, and 18 within one volt of the battery voltage?



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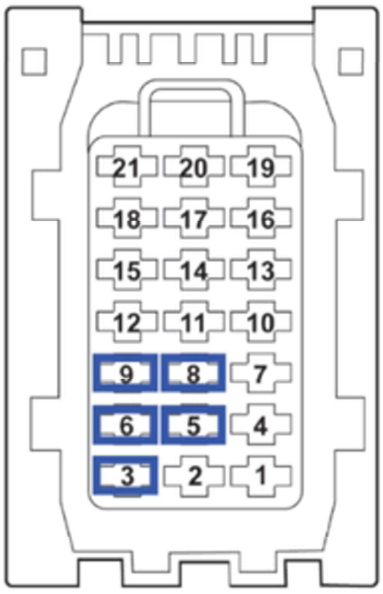
FRONT LOOKING INTO PINS ON THE HARNESS

   8.a Yes; Go to step 9.

   8.b No; repair the power circuits to pins 11, 12, 14, 15, and 18 of the 21-pin ACM connector.
9. Measure resistance between pins 3, 5, 6, 8, and 9 of the 21-pin ACM connector, harness side and ground. Are the resistances less than five ohms for each pin?



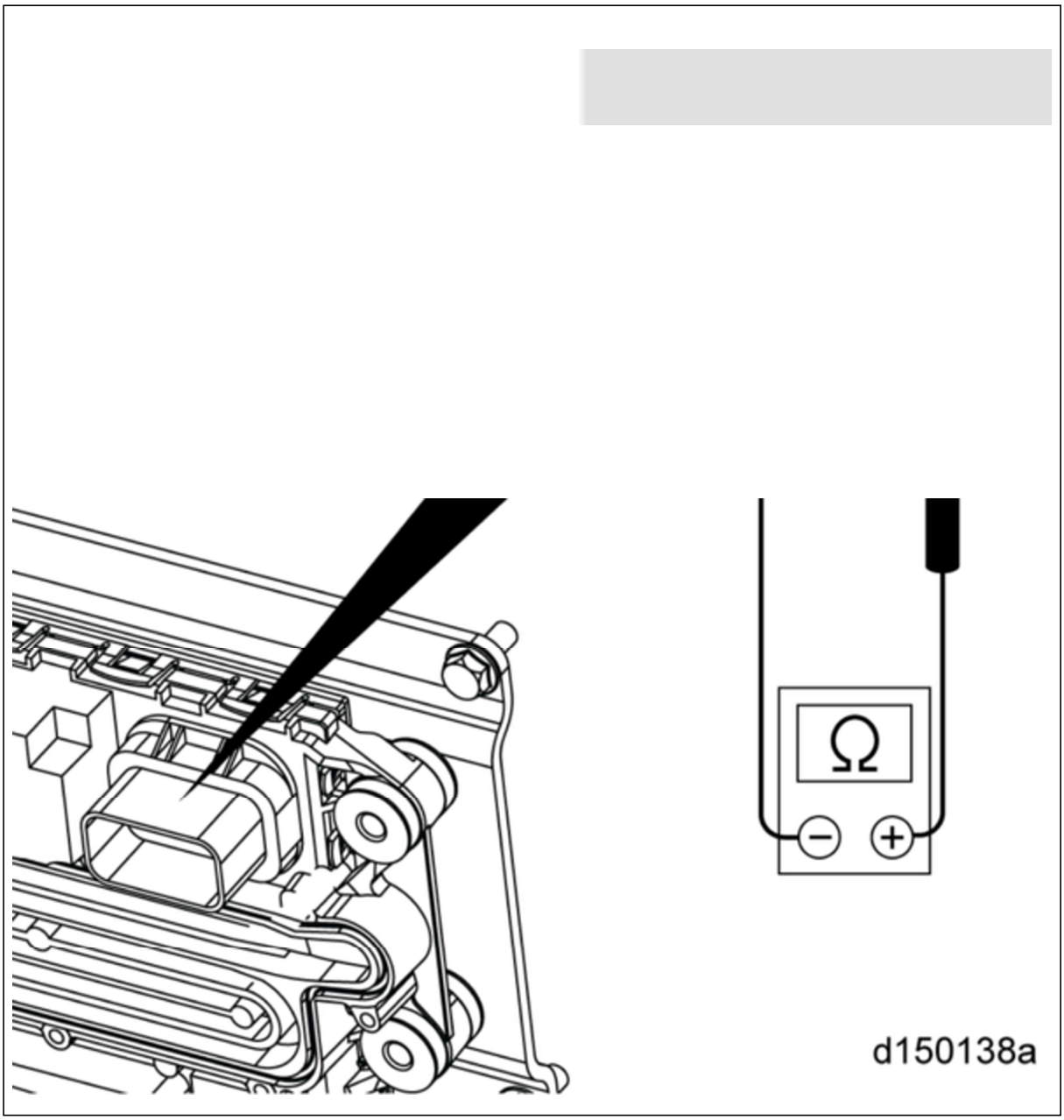
FRONT LOOKING INTO PINS ON THE HARNESS

9.a Yes; Go to step 10.

9.b No; repair the circuit in question.

10. Turn the ignition OFF.

11. Measure resistance between pin 10 and pin 20 on the ACM connector, components side. Is the resistance between 115 and 125 ohms?



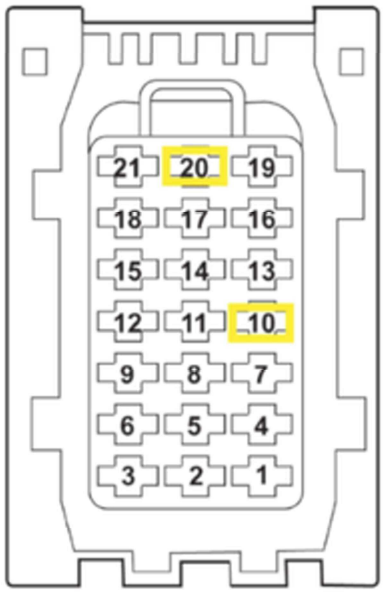
11.a Yes; Go to step 12.

11.b No; replace the ACM.

Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module"

Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module"

12. Measure resistance between pin 10 and pin 20 on the ACM connector, harness side. Is the resistance between 115 and 125 ohms?



FRONT LOOKING INTO PINS ON THE HARNESS

12.a Yes; replace the ACM.

Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module"

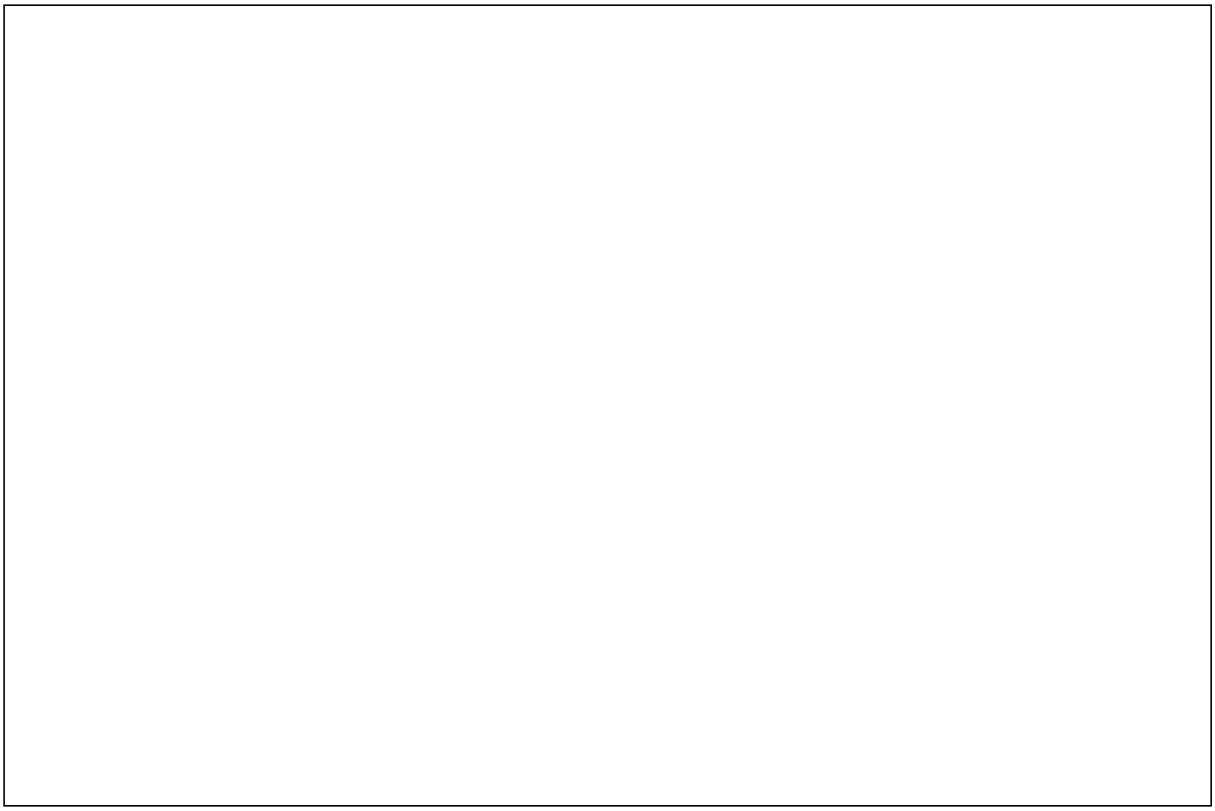
Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module"

12.b No; repair the CAN circuits to pins 10 and 20 of the ACM 21-pin connector, harness side.

100.3 SPN 625/FMI 17 - GHG17

This fault indicates an interruption in ACM/MCM communication.

SPN 625/FMI 17	
Description	Motor Control Module (MCM) Message Not Received or has Stopped Arriving
Monitored Parameter	CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Ignition On



Check as follows:

1. Are there any battery voltage faults (SPN 168/FMI any)?
   1.a Yes; troubleshoot battery voltage faults first.
   1.b No; Go to step 2.
2. Has the ACM, the Motor Control Module (MCM), or Common Powertrain Controller (CPC) been recently programmed?
   2.a Yes; clear the fault codes. Go to step 3.
   2.b No; Go to step 5.

Note : Main battery power must be left ON.

Note : The five-minute timeframe allows the ACM to go completely offline.

3. Turn ignition OFF.
4. Wait five minutes before proceeding.
5. Turn the ignition ON (key ON, engine OFF).
6. After 30 seconds, is SPN 1231/FMI 9 active?

   6.a Yes; Go to step 7.

   6.b No; release the vehicle.
7. Turn the ignition OFF.
8. Wait five minutes before proceeding.
9. Disconnect the MCM 21-pin connector.
10. Inspect the MCM 21-pin harness and module connectors for signs of damage; bent, spread, broken, corroded or unseated (pushed out) pins, signs of water, oil or fuel intrusion or damaged seals. Is damage present?

    10.a Yes; repair as necessary. Verify repairs.

    10.b No; Go to step 11.
11. Measure the resistance between pin 13 of the MCM 21-pin harness connector and battery ground. Is the resistance greater than 10K ohms?

    11.a Yes; Go to step 12.

    11.b No; repair the short to ground in the wire between pin 13 of the MCM 21-pin harness connector and pin 10 of the ACM 21-pin harness connector.
12. Measure the resistance between pin 19 of the MCM 21-pin harness connector and battery ground. Is the resistance greater than 10K ohms?

    12.a Yes; Go to step 13.

    12.b No; repair the short to ground in the wire between pin 19 of the MCM 21-pin harness connector and pin 20 of the ACM 21-pin harness connector.
13. Disconnect the ACM 21-pin harness connector.
14. Inspect the ACM 21-pin harness and module connectors for signs of damage; bent, spread, moist, broken, corroded or unseated (pushed out) pins, signs of water, oil or fuel intrusion or damaged seals. Is damage present?

    14.a Yes; repair as necessary. Verify repairs.

    14.b No; Go to step 15.
15. Check ACM internal terminating resistor by measuring the resistance across pins 10 and 20 of the ACM 21-pin module connector. Is the resistance between 110 and 120 ohms?

15.a Yes; Go to step 16.

15.b No; replace the ACM. Refer to Original Equipment Manufacturer (OEM) procedures.

16. Disconnect the CPC harness connector #3.

17. Inspect the CPC harness and module connectors for signs of damage; bent, spread, broken, corroded or unseated (pushed out) pins, signs of water, oil or fuel intrusion or damaged seals. Is damage present?

17.a Yes; repair as necessary. Verify repairs.

17.b No; Go to step 18.

18. Check CPC internal terminating resistor by measuring the resistance across pins 19 and 21 of the CPC module connector cavity #3. Is the resistance between 110 and 130 ohms?

18.a Yes; Go to step 19.

18.b No; replace the CPC. Refer to Original Equipment Manufacturer (OEM) procedures.

19. Measure the resistance between pin 19 of the CPC harness connector #3 and pin 20 of the ACM 21-pin connector. Is the resistance less than five ohms?

19.a Yes; Go to step 20.

19.b No; repair the wire between pin 19 of the CPC harness connector #3 and pin 20 of the ACM 21-pin harness connector.

20. Measure the resistance between pin 21 of the CPC harness connector #3 and pin 10 of the ACM 21-pin connector. Is the resistance less than five ohms?

20.a Yes; Go to step 21.

20.b No; repair the wire between pin 21 of the CPC harness connector #3 and pin 10 of the ACM 21-pin harness connector.

21. Measure the resistance between pin 19 of the CPC harness connector #3 and pin 19 of the MCM 21-pin connector. Is the resistance less than five ohms?

21.a Yes; Go to step 22.

21.b No; repair the wire between pin 19 of the CPC harness connector #3 and pin 19 of the MCM 21-pin harness connector.

22. Measure the resistance between pin 21 of the CPC harness connector #3 and pin 13 of the MCM 21-pin connector. Is the resistance less than five ohms?

22.a Yes; Go to step 23.

22.b No; repair the wire between pin 21 of the CPC harness connector #3 and pin 13 of the MCM 21-pin harness connector.

23. Turn the ignition ON (key ON, engine OFF).

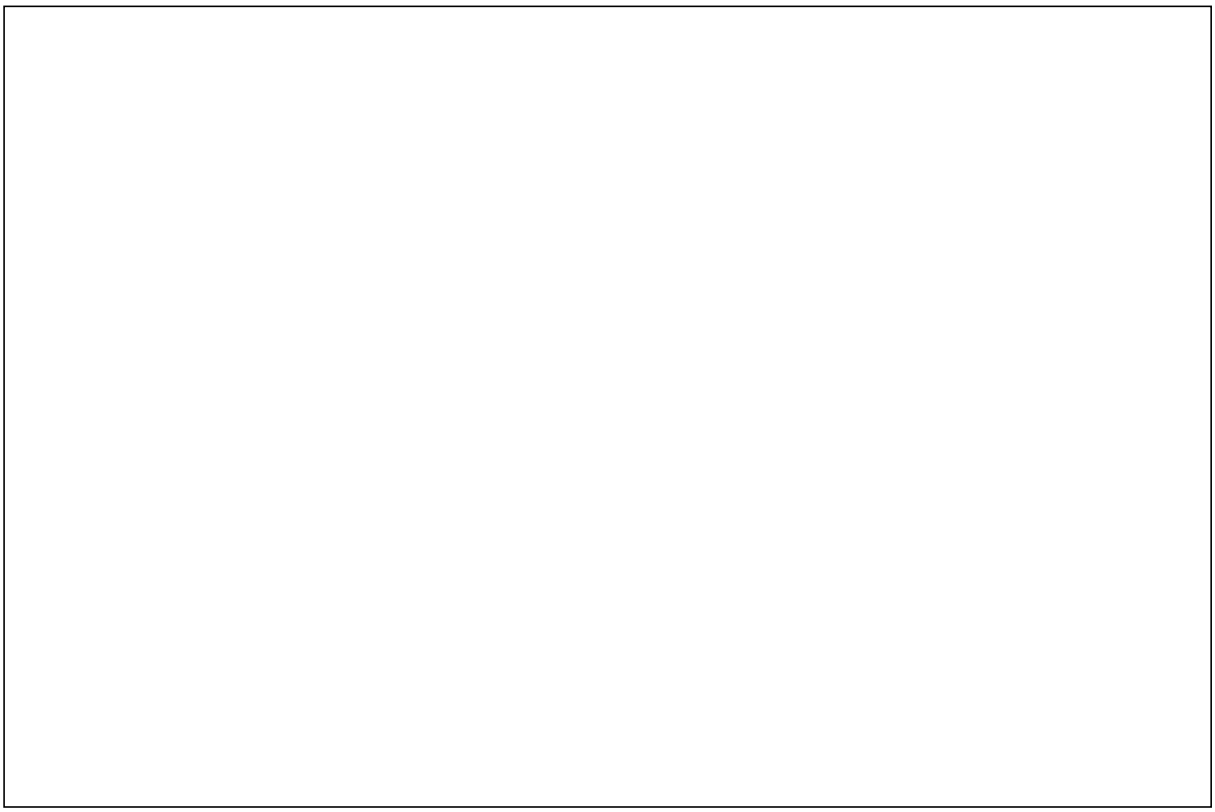
24. After 30 seconds, check for an active SPN 1231/FMI 9 fault code. Is the code active?

24.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" .

24.b No; clear codes and release the vehicle.

100.4 SPN 625/FMI 18 - GHG17

SPN 625/FMI 18	
Description	Aftertreatment Control Module (ACM) Message Not Received
Monitored Parameter	CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	Derate 25%
Engine Reaction	None
Verification	Ignition On



Check as follows:

1. Are there any battery voltage faults (SPN 168/FMI any faults)?
   1.a Yes; troubleshoot battery voltage faults first.
   1.b No; Go to step 2.
2. Has the ACM, the Motor Control Module (MCM), or Common Powertrain Controller (CPC) been recently programmed?
   2.a Yes; clear the fault codes. Go to step 3.
   2.b No; Go to step 5.

Note : Main battery power must be left ON.

Note : The five-minute timeframe allows the ACM to go completely offline.

3. Turn ignition OFF.
4. Wait five minutes before proceeding.
5. Turn the ignition ON (key ON, engine OFF).
6. After 30 seconds, is SPN 1231/FMI 9 active?
   - 6.a Yes; Go to step 7.
   - 6.b No; release the vehicle.
7. Turn the ignition OFF.
8. Wait five minutes before proceeding.
9. Disconnect the MCM 21-pin connector.
10. Inspect the MCM 21-pin harness and module connectors for signs of damage; bent, spread, broken, corroded or unseated (pushed out) pins, signs of water, oil or fuel intrusion or damaged seals. Is damage present?
    - 10.a Yes; repair as necessary. Verify repairs.
    - 10.b No; Go to step 11.
11. Measure the resistance between pin 13 of the MCM 21-pin harness connector and battery ground. Is the resistance greater than 10K ohms?
    - 11.a Yes; Go to step 12.
    - 11.b No; repair the short to ground in the wire between pin 13 of the MCM 21-pin harness connector and pin 10 of the ACM 21-pin harness connector.
12. Measure the resistance between pin 19 of the MCM 21-pin harness connector and battery ground. Is the resistance greater than 10K ohms?
    - 12.a Yes; Go to step 13.
    - 12.b No; repair the short to ground in the wire between pin 19 of the MCM 21-pin harness connector and pin 20 of the ACM 21-pin harness connector.
13. Disconnect the ACM 21-pin harness connector.
14. Inspect the ACM 21-pin harness and module connectors for signs of damage; bent, spread, moist, broken, corroded or unseated (pushed out) pins, signs of water, oil or fuel intrusion or damaged seals. Is damage present?
    - 14.a Yes; repair as necessary. Verify repairs.
    - 14.b No; Go to step 15.
15. Check ACM internal terminating resistor by measuring the resistance across pins 10 and 20 of the ACM 21-pin module connector. Is the resistance between 110 and 120 ohms?

15.a Yes; Go to step 16.

15.b No; replace the ACM. Refer to Original Equipment Manufacturer (OEM) procedures.

16. Disconnect the CPC harness connector #3.

17. Inspect the CPC harness and module connectors for signs of damage; bent, spread, broken, corroded or unseated (pushed out) pins, signs of water, oil or fuel intrusion or damaged seals. Is damage present?

17.a Yes; repair as necessary. Verify repairs.

17.b No; Go to step 18.

18. Check CPC internal terminating resistor by measuring the resistance across pins 19 and 21 of the CPC module connector cavity #3. Is the resistance between 110 and 130 ohms?

18.a Yes; Go to step 19.

18.b No; replace the CPC. Refer to Original Equipment Manufacturer (OEM) procedures.

19. Measure the resistance between pin 19 of the CPC harness connector #3 and pin 20 of the ACM 21-pin connector. Is the resistance less than five ohms?

19.a Yes; Go to step 20.

19.b No; repair the wire between pin 19 of the CPC harness connector #3 and pin 20 of the ACM 21-pin harness connector.

20. Measure the resistance between pin 21 of the CPC harness connector #3 and pin 10 of the ACM 21-pin connector. Is the resistance less than five ohms?

20.a Yes; Go to step 21.

20.b No; repair the wire between pin 21 of the CPC harness connector #3 and pin 10 of the ACM 21-pin harness connector.

21. Measure the resistance between pin 19 of the CPC harness connector #3 and pin 19 of the MCM 21-pin connector. Is the resistance less than five ohms?

21.a Yes; Go to step 22.

21.b No; repair the wire between pin 19 of the CPC harness connector #3 and pin 19 of the MCM 21-pin harness connector.

22. Measure the resistance between pin 21 of the CPC harness connector #3 and pin 13 of the MCM 21-pin connector. Is the resistance less than five ohms?

22.a Yes; Go to step 23.

22.b No; repair the wire between pin 21 of the CPC harness connector #3 and pin 13 of the MCM 21-pin harness connector.

23. Turn the ignition ON (key ON, engine OFF).

24. After 30 seconds, check for an active SPN 1231/FMI 9 fault code. Is the code active?

24.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" .

24.b No; clear codes and release the vehicle.

SPN 628 (CPC) (GHG17)

103.1 SPN 628/FMI 2 - GHG17

EEPROM Checksum Failure. Replace the Common Powertrain Controller (CPC) and reprogram with the latest software release

103.2 SPN 628/FMI 14 - GHG17

XFLASH Failure

Replace the Common Powertrain Controller (CPC) and reprogram with the latest software release.

103.3 SPN 628/FMI 17 - GHG17

Replace the Common Powertrain Controller (CPC) and reprogram with the latest software release.

SPN 629 (CPC) (GHG17)

104.1 SPN 629/FMI 2 - GHG17

SPN 629/FMI 2	
Description	This Code Logs when the CPC Hardware Does Not Match the CPC Software.
Monitored Parameter	CPC software
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On

Check as follows:

1. Was the Common Powertrain Controller (CPC) recently replaced?
   - 1.a Yes; the CPC hardware is not the correct one for the engine serial number and/or software programmed onto the CPC. Replace the CPC hardware with the correct hardware. Verify repair.
   - 1.b No; Go to step 2.
2. Was the CPC recently reprogrammed?
   - 2.a Yes; reprogram the CPC with the correct engine serial number and/or software. Verify repair.
   - 2.b No; Go to step 3.
3. Connect to DiagnosticLink .
4. Under the identification screen, make sure the CPC is programmed to the correct engine serial number and/or software. Is the correct engine serial number and/or software programmed?
   - 4.a Yes; replace the CPC and program with the latest software release. Verify repair.
   - 4.b No; reprogram the CPC with the correct software. Verify repair.

104.2 SPN 629/FMI 12 - GHG17

SPN 629/FMI 12	
Description	This Code Indicates A Flash Error.
Monitored Parameter	CPC Data Write Error
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On

Replace the Common Powertrain Controller (CPC) and program with the latest software release. Verify repair.

SPN 630 (CPC) (GHG17)

105.1 SPN 630/FMI 13 – GHG17

SPN 630/FMI 13	
Description	Selective Catalytic Reduction Number Out of Range
Monitored Parameter	EPROM Values
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On

Note : A fault may set during Common Powertrain Controller (CPC) module reprogramming. If a fault occurs while programming, clear the code and release the vehicle.

1. Connect to DiagnosticLink .
2. Check for multiple codes. Is CPC SPN 168/FMI 0/14/18 (battery voltage) present?
   - 2.a Yes; troubleshoot SPN 168/FMI 0/14/18 first.
   - 2.b No; Go to step 3.
3. Is Motor Control Module (MCM) SPN 625/FMI 9 present?
   - 3.a Yes; troubleshoot and repair the CAN line.
   - 3.b No; Go to step 4.
4. Has the CPC been recently reprogrammed?
   - 4.a Yes; check the proper configuration of the CPC. Go to step 5.
   - 4.b No; Go to step 5.
5. Clear fault code SPN 630/FMI 13 and cycle the ignition. Does SPN 630/FMI 13 return?
   - 5.a Yes; reprogram the CPC with the latest software available.
   - 5.b No; testing is completed. Release vehicle.

SPN 630 (CPC3) (GHG17)

106.1 SPN 630/FMI 2 - GHG17

Check as follows:

1. This fault indicates there is an internal EEPROM failure in the CPC3. Replace the CPC3. After replacement, reprogram module to latest server configuration.

SPN 636 (MCM) (GHG17)

107.1 SPN 636/FMI 1 - GHG17

Crankshaft Position Sensor Signal Voltage Too Low

SPN 636/FMI 1	
Description	Crankshaft Position (CKP) Sensor Signal Voltage Too Low
Monitored Parameter	Crankshaft Position Sensor Signal
Typical Enabling Conditions	Engine Idle
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	10 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (1 minute)

Note : If the sensor is removed, be sure to check the sensor tip for metal debris and clutch material and clean it if necessary.

1. If fault occurs only when cranking the engine (and engine will not start), check that the Crankshaft Position (CKP) sensor and Camshaft Position (CMP) sensors are correctly wired to the Motor Control Module (MCM).
   - 1.a If wires are not correctly wired, repair or replace wires as required.
   - 1.b If wires are correctly wired, Go to step 2.
2. If fault occurs at other times then when cranking the engine, check that the CKP sensor position is correct (the sensor is seated in all the way and the tip of the sensor is clean).
   - 2.a If fault is not active after checking CKP sensor position, repair the CKP sensor clamping sleeve.
   - 2.b If fault is still active after checking the CKP sensor position, Go to step 3.
3. Check the flywheel position through the inspection window of the timing case using turning tool. Look for timing marks and damage.
   - 3.a If the flywheel is out of position, repair or replace, as required.
   - 3.b If the flywheel is not out of position, Go to step 4.
4. Check crankshaft axial play.
   - 4.a If axial play is not within specifications, repair or replace crankshaft thrust bearings, as required.
   - 4.b If axial play is within specifications, replace the MCM.

107.2 SPN 636/FMI 2 - GHG17

SPN 636/FMI 2	
Description	This Code Will Set When There is a Camshaft and a Crankshaft Mismatch Signal
Monitored Parameter	Camshaft/Crankshaft Sensors
Typical Enabling Conditions	Engine Idle
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	10 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (One minute)

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Are there any other camshaft (SPN 723/FMI Any) or crankshaft (SPN 636/FMI 3, 8, 10, or 11) faults active?
   - 1.a Yes, repair circuit failure first. If the problem is still present after circuit repair, Go to step 2.
   - 1.b No, Go to step 2.
2. Has the engine been recently overhauled or had valve train maintenance?
   - 2.a Yes, verify proper camshaft timing and gear lash adjustment.

     Refer to section "Camshaft Timing Verification" .

     Refer to section "Checking and Adjusting Gear Lash with Camshaft Housing Removed" .
   - 2.b No, Go to step 3.
3. Remove the Camshaft Position (CMP) sensor and inspect for damage. Refer to section "Removal of the Camshaft Position Sensor" . Is there damage to the sensor?
   - 3.a Yes; Go to step 4.
   - 3.b No; replace the camshaft position sensor. Refer to section "Removal of the Camshaft Position Sensor" . After replacing the CMP sensor, verify the repair. Go to step 5.

4. Inspect the tone wheel on the intake camshaft for damage. Check gear train for excessive lash or damage. Is damage present?
   - 4.a Yes; repair as necessary, and replace the camshaft position sensor. After replacing the CMP sensor, verify the repair and Go to step 5.
   - 4.b No; replace the camshaft position sensor. Refer to section "Removal of the Camshaft Position Sensor" . After replacing the CMP sensor, verify the repair. Go to step 5.
5. Connect to DiagnosticLink® and check for codes. Is SPN 636/FMI 2 active?
   - 5.a Yes; replace the camshaft. Refer to section "Removal of the Camshafts" .
   - 5.b No; repair is complete.

107.3 SPN 636/FMI 3 - GHG17

SPN 636/FMI 3	
Description	Crankshaft Position Sensor Open Circuit
Monitored Parameter	Crankshaft Position Sensor
Typical Enabling Conditions	Engine Idle
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	10 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (One minute)

Note : If the sensor is removed, be sure to check the sensor tip for metal debris and clutch material and clean it if necessary.

Check as follows:

1. Disconnect the Crankshaft Position (CKP) sensor.
2. Measure the resistance across pins 1 and 2 of the CKP sensor. Is the resistance between 774 ohms and 946 ohms?

   2.a Yes; Go to step 3.

   2.b No; replace the CKP sensor. Refer to section "Removal of the Crankshaft Position Sensor" .
3. Disconnect the Motor Control Module (MCM) 120-pin connector.
4. Measure the resistance across pins 1 and 2 of the CKP sensor harness connector. Is the resistance greater than 10k ohms?

   4.a Yes; Go to step 5.

   4.b No; repair the short between pins 1 and 2 of the CKP sensor harness connector and pins 73 and 43 of the MCM 120-pin connector.

5. Measure the resistance between pin 1 of the CKP sensor harness connector and pin 73 of the MCM 120-pin connector. Is the resistance less than five ohms?

   5.a Yes; Go to step 6.

   5.b No; repair the open between pin 1 of the CKP sensor harness connector and pin 73 of the 120–pin MCM connector.

6. Measure the resistance between pin 2 of the CKP sensor harness connector and pin 43 of the MCM 120-pin connector. Is the resistance less than five ohms?

   6.a Yes; replace the CKP sensor. Refer to section "Removal of the Crankshaft Position Sensor" .

   6.b No; repair the open between pin 2 of the CKP sensor harness connector and pin 43 of the MCM120-pin connector.

107.4 SPN 636/FMI 8 - GHG17

SPN 636/FMI 8	
Description	Crankshaft Position Sensor Time Out
Monitored Parameter	Crankshaft Position Sensor
Typical Enabling Conditions	Engine Idle
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	10 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (One minute)

Note : If the sensor is removed, be sure to check the sensor tip for metal debris and clutch material and clean it if necessary.

Check as follows:

1. Disconnect the Crankshaft Position (CKP) sensor.
2. Measure the resistance across pins 1 and 2 of the CKP sensor. Is the resistance between 774 ohms and 946 ohms?

   2.a Yes; Go to step 3.

   2.b No; replace the CKP sensor. Refer to section "Removal of the Crankshaft Position Sensor" .
3. Disconnect the Motor Control Module (MCM) 120–pin connector.
4. Measure the resistance across pins 1 and 2 of the CKP sensor harness connector. Is the resistance greater than 10k ohms?

   4.a Yes; Go to step 5.

   4.b No; repair the short between pins 1 and 2 of the CKP sensor harness connector and pins 73 and 43 of the MCM 120-pin connector.

5. Measure the resistance between pin 1 of the CKP sensor harness connector and pin 73 of the MCM 120-pin connector. Is the resistance less than five ohms?
   - 5.a Yes; Go to step 6.
   - 5.b No; repair the open between pin 1 of the CKP sensor harness connector and pin 73 of the MCM 120-pin connector.
6. Measure the resistance between pin 2 of the CKP sensor harness connector and pin 43 of the MCM 120-pin connector. Is the resistance less than five ohms?
   - 6.a Yes; Go to step 7.
   - 6.b No; repair the open between pin 2 of the CKP sensor harness connector and pin 43 of the MCM 120-pin connector.
7. Remove the CKP sensor and ensure the sensor and tone wheel are clean and ensure the sensor is not damaged. Is damage present?
   - 7.a Yes; inspect debris and identify source (clutch material, flywheel material). Clean and repair as necessary.
   - 7.b No; replace the CKP sensor. Refer to section "Removal of the Crankshaft Position Sensor" .

107.5 SPN 636/FMI 10 - GHG17

SPN 636/FMI 10	
Description	Crankshaft Position (CKP) Sensor Signal Erratic
Monitored Parameter	Crankshaft Position Sensor Signal
Typical Enabling Conditions	Engine Idle
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL
Engine Reaction	
Verification	Engine Idle

Check as follows:

1. Disconnect the Crankshaft Position (CKP) sensor.
2. Measure the resistance across pins 1 and 2 of the CKP sensor. Is the resistance between 774 ohms and 946 ohms?
   - 2.a Yes; Go to step 3.
   - 2.b No; replace the CKP sensor. Refer to section "Removal of the Crankshaft Position Sensor" .
3. Disconnect the Motor Control Module (MCM) 120-pin connector.
4. Measure the resistance across pins 1 and 2 of the CKP sensor harness connector. Is the resistance greater than 10k ohms?
   - 4.a Yes; Go to step 5.
   - 4.b No; repair the short between pins 1 and 2 of the CKP sensor harness connector and pins 73 and 43 of the MCM 120-pin connector.
5. Measure the resistance between pin 1 of the CKP sensor harness connector and pin 73 of the MCM 120-pin connector. Is the resistance less than five ohms?
   - 5.a Yes; Go to step 6.
   - 5.b No; repair the open between pin 1 of the CKP sensor harness connector and pin 73 of the MCM 120-pin connector.
6. Measure the resistance between pin 2 of the CKP sensor harness connector and pin 43 of the MCM 120-pin connector. Is the resistance less than five ohms?
   - 6.a Yes; Go to step 7.
   - 6.b No; repair the open between pin 2 of the CKP sensor harness connector and pin 43 of the MCM 120-pin connector.
7. Remove the CKP sensor and ensure the sensor and tone wheel are clean and ensure the sensor is not damaged. Is damage present?
   - 7.a Yes; inspect debris and identify source (clutch material, flywheel material). Clean and repair as necessary.
   - 7.b No; replace the CKP sensor. Refer to section "Removal of the Crankshaft Position Sensor" .

107.6 SPN 636/FMI 11 - GHG17

Crankshaft Position Sensor - Sensor Failure

SPN 636/FMI 11	
Description	Crankshaft Position (CKP) Sensor Failure
Monitored Parameter	Crankshaft Position Sensor
Typical Enabling Conditions	Engine Idle
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Engine Idle

Check as follows:

1. Disconnect the CKP sensor.
2. Inspect the CKP sensor and harness side connector for signs of damage; bent, spread, broken, unseated (pushed out) or corroded pins, signs of moisture indicating seal damage and signs of wire damage near the connector. Is any damage found?

   2.a Yes; repair as necessary. Verify repair.

   2.b No; Go to step 3.
3. Measure the resistance across pins 1 and 2 of the CKP sensor. Is the resistance between 774 ohms and 946 ohms?

   3.a Yes; Go to step 4.

   3.b No; replace the CKP sensor. Refer to section "Removal of the Crankshaft Position Sensor" .
4. Disconnect the 120-pin MCM connector.

5. Inspect the 120-pin MCM and harness connectors for signs of damage; bent, spread, broken, unseated (pushed out) or corroded pins, signs of moisture indicating seal damage and signs of wire damage near the connector. Is any damage found?
   - 5.a Yes; repair as necessary. Verify repair.
   - 5.b No; Go to step 6.
6. Measure the resistance across pins 1 and 2 of the CKP sensor harness side connector. Is the reistance greater than 10K ohms?
   - 6.a Yes; Go to step 7.
   - 6.b No; repair the short between pins 1 and 2 of the CKP sensor harness side connector and pins 73 and 43 of the 120-pin MCM connector. Verify repair.
7. Measure the resistance between pin 1 of the CKP sensor harness connector and pin 73 of the 120-pin MCM connector. Is the resistance less than five ohms?
   - 7.a Yes; Go to step 8.
   - 7.b No; repair the wire between pin 1 of the CKP sensor harness connector and pin 73 of the 120-pin MCM connector. Verify repair.
8. Measure the resistance between pin 2 of the CKP sensor harness connector and pin 43 of the 120-pin MCM connector. Is the resistance less than five ohms?
   - 8.a Yes; Go to step 9.
   - 8.b No; repair the wire between pin 2 of the CKP sensor harness connector and pin 43 of the 120-pin MCM connector. Verify repair.
9. Remove the CKP sensor and inspect tip for debris build-up or damage. Is any damage found?
   - 9.a Yes; replace the CKP sensor. Verify repair.
   - 9.b No; Go to step 10.
10. Inspect crankshaft flywheel ring gear for wear. Is any damage found?
    - 10.a Yes; repair as needed. Refer to section "Removal of the Ring Gear" .
    - 10.b No; replace the CKP sensor. Verify repair.

107.7 SPN 636/FMI 15 - GHG17

SPN 636/FMI 15	
Description	This Code Will Set When a Mismatch Signal Between the Camshaft and the Crankshaft is Detected
Monitored Parameter	Camshaft/Crankshaft Sensors
Typical Enabling Conditions	Engine Idle
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	10 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Engine Idle (One Minute)

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Are there any other camshaft (SPN 723/FMI Any) or crankshaft (SPN 636/FMI 3, 8, 10, or 11) faults active?
   - 1.a Yes; repair circuit failure first. If the problem is still present after circuit repair, Go to step 2.
   - 1.b No; Go to step 2.
2. Has the engine been recently overhauled or had valve train maintenance?
   - 2.a Yes; verify proper camshaft timing and gear lash adjustment.

     Refer to section "Camshaft Timing Verification" .

     Refer to section "Checking and Adjusting Gear Lash with Camshaft Housing Removed" .
   - 2.b No; Go to step 3.
3. Remove the Camshaft Position (CMP) sensor and inspect for damage. Refer to section "Removal of the Camshaft Position Sensor" . Is there damage to the sensor?
   - 3.a Yes; Go to step 4.
   - 3.b No; replace the camshaft position sensor. Refer to section "Removal of the Camshaft Position Sensor" . After replacing the CMP sensor, verify the repair. Go to step 5.

4. Inspect the tone wheel on the intake camshaft for damage. Check gear train for excessive lash or damage. Is damage present?
   - 4.a Yes; repair as necessary, and replace the camshaft position sensor. After replacing the CMP sensor, verify the repair. Go to step 5.
   - 4.b No; replace the camshaft position sensor. Refer to section "Removal of the Camshaft Position Sensor" . After replacing the CMP sensor, verify the repair. Go to step 5.
5. Connect to DiagnosticLink® and check for codes. Is SPN 636/FMI 15 active?
   - 5.a Yes; replace the camshaft. Refer to section "Removal of the Camshafts" .
   - 5.b No; repair is complete.

SPN 639 (CPC) (GHG17)

108.1 SPN 639/FMI 9 - GHG17

SPN 639/FMI 9	
Description	J1939 Message Missing
Monitored Parameter	
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON

Check as follows:

1. Check for multiple codes. Are other communication codes present?
   1.a Yes; troubleshoot those faults first. This could be an indication to which communication line is missing.
   1.b No; Go to step 2.
2. Determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedure for the affected module.

108.2 SPN 639/FMI 13 - GHG17

SPN 639/FMI 13	
Description	J1939 Fan Message Missing
Monitored Parameter	
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON

Check as follows:

1. Check for multiple codes. Are other communication codes present?
   1.a Yes; troubleshoot those faults first. This could be an indication to which communication line is missing.
   1.b No; Go to step 2.
2. Check the CPC parameters to ensure they are correct for the vehicle configuration. Are the parameters correct?
   2.a a. Yes; replace and set parameters on the new CPC.
   2.b No; reset parameters on the CPC.

108.3 SPN 639/FMI 14 - GHG17

SPN 639/FMI 14	
Description	J1939 Data Link Message Missing
Monitored Parameter	
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON

Check as follows:

1. Check for multiple codes. Are other communication codes present?

   1.a Yes; troubleshoot those faults first. This could be an indication to which communication line is missing.

   1.b No; Go to step 2.

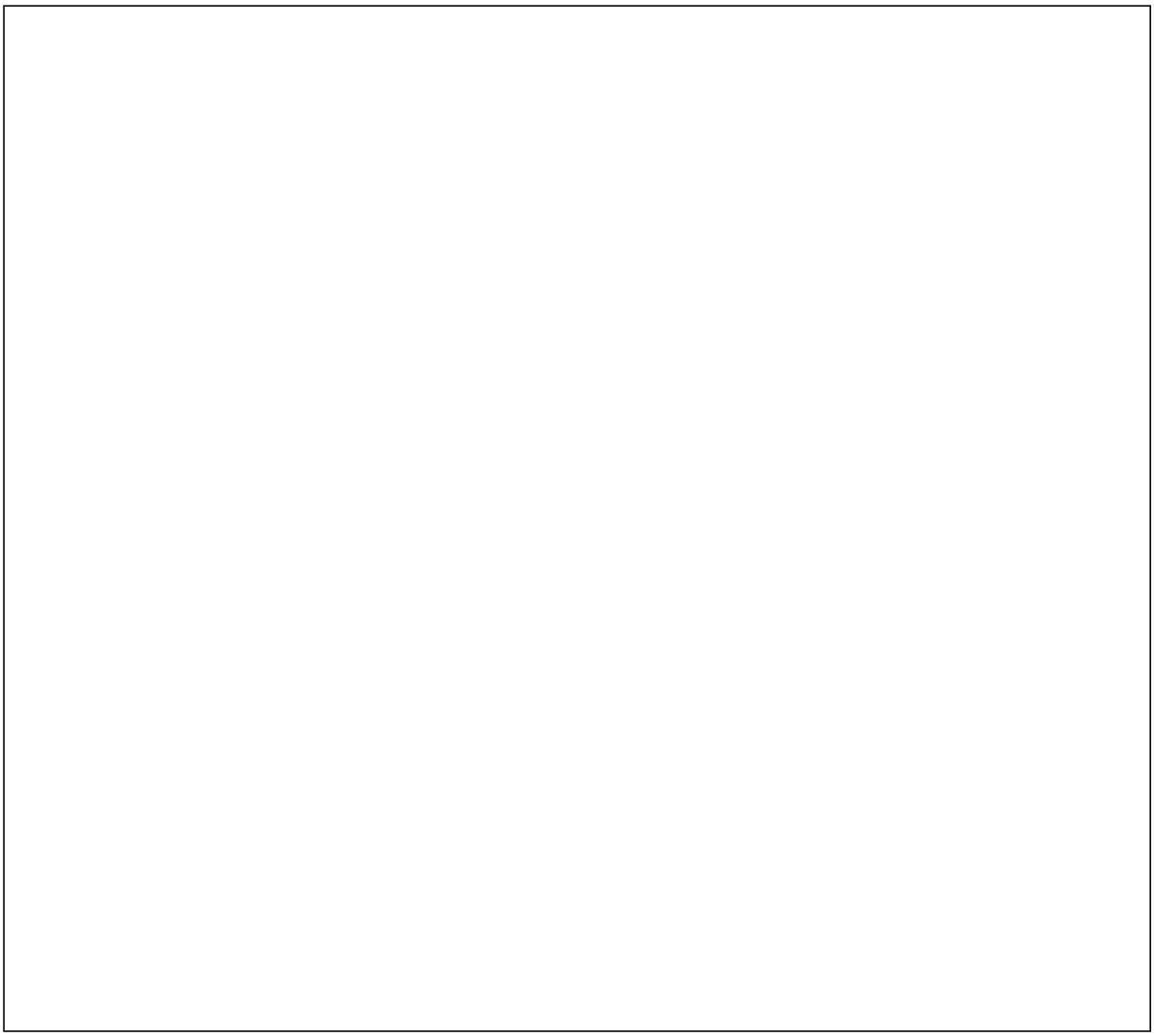
2. Determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedure for the affected module.

SPN 647 (MCM) (GHG17)

109.1 SPN 647/FMI 3 - GHG17

Fan Circuit Short to Power

SPN 647/FMI 3	
Description	Fan Stage 1 Circuit Failed High
Monitored Parameter	Fan Control Solenoid
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine Idle (one minute)



1. Turn the ignition OFF.
2. Disconnect the Original Equipment Manufacturer (OEM)10-pin harness connector.
3. Inspect the OEM 10-pin harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Are signs of damage present?
   - 3.a Yes; repair as necessary. Go to step 4.
   - 3.b No; Go to step 4.
4. Turn the ignition ON (key ON, engine OFF).
5. Connect DiagnosticLink . Clear fault codes. Does SPN 647/FMI 3 fault code become active?
   - 5.a Yes; Go to step 10.
   - 5.b No; Go to step 6.
6. Reconnect the vehicle OEM 10-pin harness connector.
7. Disconnect the fan control solenoid connector.
8. Inspect the fan control solenoid connector for corroded, unseated (pushed out) or damaged pins, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Are signs of damage present?
   - 8.a Yes; repair as necessary. Go to step 9.
   - 8.b No; Go to step 9.
9. Cycle ignition and clear fault codes. Does SPN 647/FMI 3 fault code become active?
   - 9.a Yes; repair short to power between pin 2 of OEM 10-pin chassis harness side connector and pin 1 of the fan control solenoid. Refer to OEM for wiring information. Go to step 11.
   - 9.b No; replace the fan control solenoid. Refer to OEM procedures. Go to step 11.
10. Measure the voltage between pin 2 of the 10-pin Engine Sensor Harness side and ground. Is the voltage greater than two volts?
    - 10.a Yes; repair short to power on fan control circuit pin 98 of the 120-pin connector. Go to step 11.
    - 10.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs.
11. Restore all connections. Cycle ignition and clear fault codes. Does SPN 647/FMI 3 fault code become active?
    - 11.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs.
    - 11.b No; release the vehicle.

109.2 SPN 647/FMI 4 - GHG17

Fan Circuit Short to Ground

SPN 647/FMI 4	
Description	Fan Stage 1 Circuit Failed Low
Monitored Parameter	Fan Control Solenoid
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (one minute)

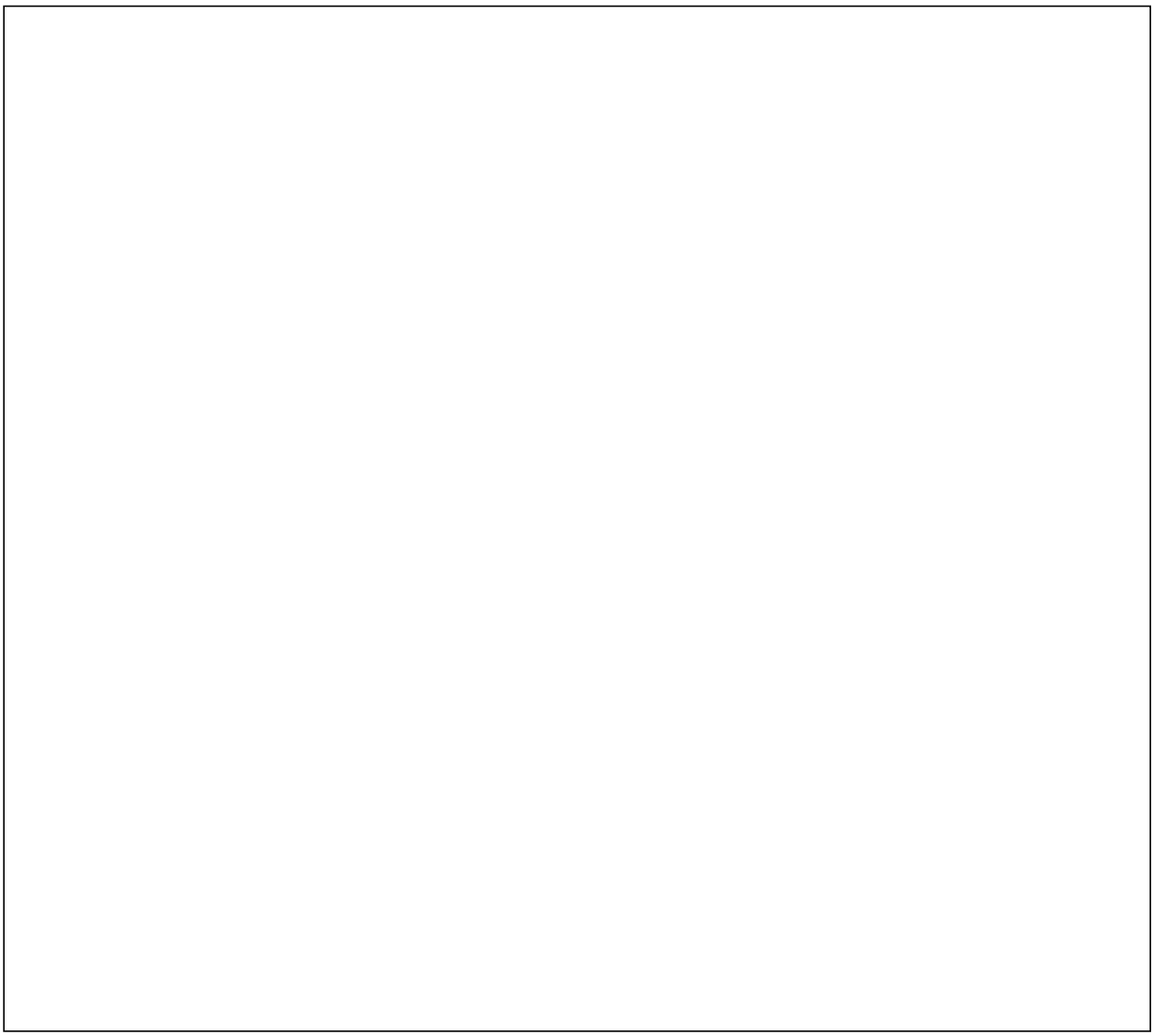
1. Turn the ignition OFF.
2. Disconnect the Original Equipment Manufacturer (OEM) 10-pin harness connector.

3. Inspect the harness OEM 10-pin harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Are signs of damage present?
   - 3.a Yes; repair as necessary. Go to step 4.
   - 3.b No; Go to step 4.
4. Turn the ignition ON (key ON, engine OFF).
5. Connect DiagnosticLink . Clear fault codes. Does SPN 647/FMI 4 fault code become active?
   - 5.a Yes; Go to step 11.
   - 5.b No; Go to step 6.
6. Turn the ignition OFF.
7. Reconnect the vehicle OEM 10-pin harness connector.
8. Disconnect the fan control solenoid connector.
9. Inspect the fan control solenoid connector for corroded, unseated (pushed out), damaged, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Are signs of damage present?
   - 9.a Yes; repair as necessary. Go to step 10.
   - 9.b No; Go to step 10.
10. Cycle ignition and clear fault codes. Does SPN 647/FMI 4 fault code become active?
    - 10.a Yes; repair a failed low circuit on pin 2 of the OEM 10-pin chassis harness side connector. Refer to OEM for wiring information. Go to step 16.
    - 10.b No; replace the fan control solenoid. Refer to OEM procedures. Go to step 16.
11. Turn the ignition OFF.
12. Disconnect the Motor Control Module (MCM) 120–pin connector.
13. Inspect the MCM 120–pin connector for corroded, unseated (pushed out), damaged, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Are signs of damage present?
    - 13.a Yes; repair as necessary. Go to step 14.
    - 13.b No; Go to step 14.
14. Turn the ignition ON (key ON, engine OFF).
15. Connect DiagnosticLink®. Clear fault codes. Does SPN 647/FMI 4 fault code become active?
    - 15.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs.
    - 15.b No; repair a failed low circuit between pin 98 of the 120-pin connector and the 10-pin connector. Go to step 16.
16. Restore all connections. Cycle ignition. Clear fault codes. Does SPN 647/FMI 3 fault code become active?
    - 16.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs.
    - 16.b No; release the vehicle.

109.3 SPN 647/FMI 5 - GHG17

Fan Open Circuit

SPN 647/FMI 5	
Description	Fan Stage 1 Circuit Failed Open
Monitored Parameter	Fan Control Solenoid
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine Idle (1 minute)



Check as follows:

1. Turn the ignition OFF.

2. Disconnect the vehicle OEM 10-pin harness connector.
3. Inspect the vehicle OEM 10-pin harness connector for corroded, unseated (pushed out), damaged, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Are signs of damage present?
   - 3.a Yes; repair as necessary. Go to step 12.
   - 3.b No; Go to step 4.
4. Disconnect the Motor Control Module (MCM) 120–pin connector.
5. Inspect the MCM 120–pin connector for corroded, unseated (pushed out), damaged, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Are signs of damage present?
   - 5.a Yes; repair as necessary. Go to step 12.
   - 5.b No; Go to step 6.
6. Measure the resistance between pin 98 of the MCM 120-pin engine harness side connector and the pin 2 of the OEM 10-pin engine harness side interface connector. Is the resistance less than five ohms?
   - 6.a Yes; Go to step 7.
   - 6.b No; repair the open circuit on fan circuit pin 98 of the MCM 120–pin engine harness side connector to pin 2 of the OEM 10-pin engine harness side interface connector. Go to step 12.
7. Disconnect the fan control solenoid connector.
8. Inspect the fan control solenoid connector for corroded, unseated (pushed out), damaged, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Are signs of damage present?
   - 8.a Yes; repair as necessary. Go to step 12.
   - 8.b No; Go to step 9.
9. Measure the resistance between pin 2 of the OEM 10-pin chassis harness side interface connector and the fan control solenoid connector pin 1. Is the resistance greater than five ohms?
   - 9.a Yes; repair the open circuit between the fan control solenoid connector and pin 2 of the OEM 10-pin chassis harness side interface connector. Refer to Original Equipment Manufacturer (OEM) procedures. Go to step 12.
   - 9.b No; Go to step 10.
10. Measure the resistance between pin 91 of the MCM 120-pin engine harness side connector and pin 1 of the OEM 10-pin engine harness side interface connector. Is the resistance less than five ohms?
    - 10.a Yes; Go to step 11.
    - 10.b No; repair the open circuit on fan circuit pin 91 of the MCM 120–pin engine harness side connector to pin 1 of the OEM 10-pin engine harness side interface connector. Go to step 12.
11. Measure the resistance between pin 1 of the OEM 10-pin chassis harness side interface connector and the fan control solenoid connector pin 2. Is the resistance greater than five ohms?
    - 11.a Yes; repair the open circuit between the fan control solenoid connector pin 2 and pin 1 of the OEM 10-pin chassis harness side interface connector. Refer to Original Equipment Manufacturer (OEM) procedures. Go to step 12.
    - 11.b No; install a new fan control solenoid. Go to step 12.
12. Restore all connections. Cycle ignition. Clear fault codes. Does SPN 647/FMI 3 fault code become active?
    - 12.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs.
    - 12.b No; release the vehicle.

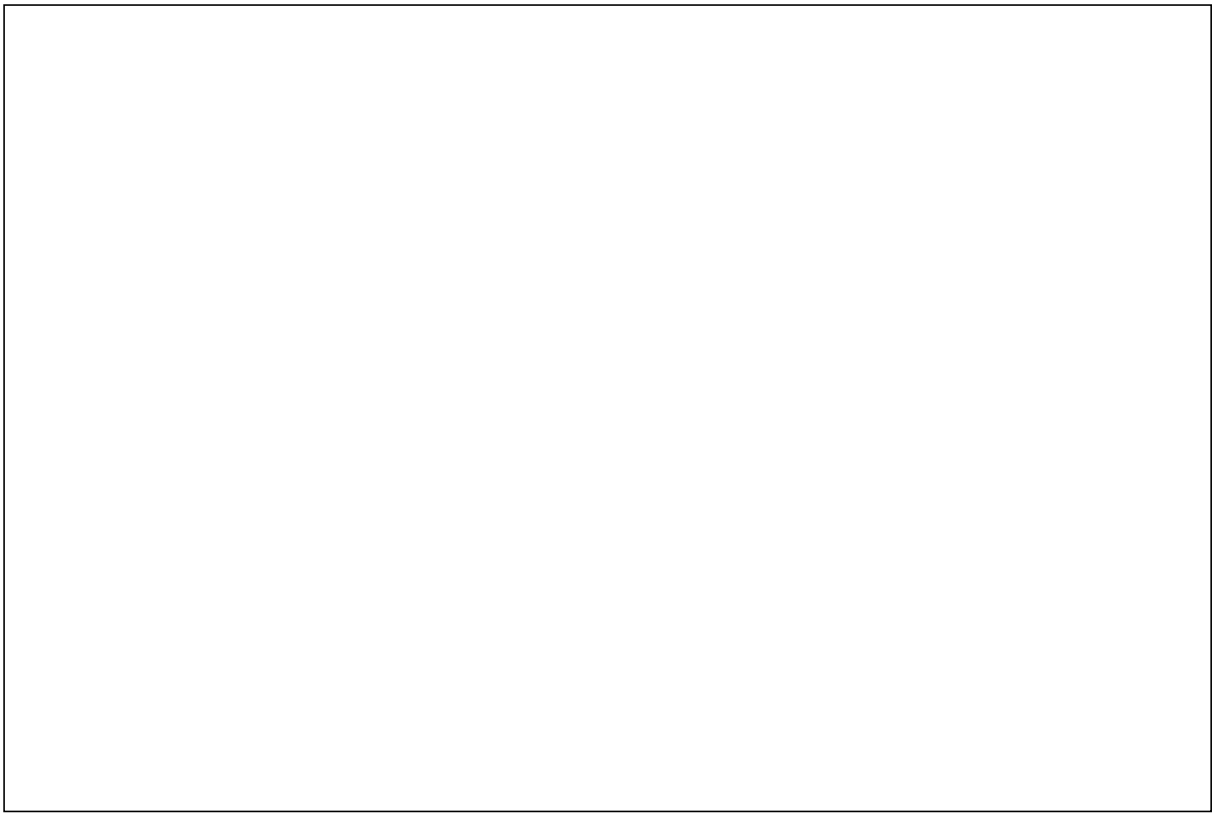
SPN 651 (MCM) (GHG17)

110.1 Electronic Diagram

Fig 110.1, Fuel Injector Electronic Diagram

110.2 SPN 651/FMI 3 - GHG17

SPN 651/FMI 3	
Description	Injector Cylinder #1 Needle Control Valve Abnormal Operation (MAX)
Monitored Parameter	Injector Cylinder #1 Needle Control Valve
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

Note : Submit completed diagnostics with warranty claim.

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

1. Check for multiple codes. Using DiagnosticLink , retain log file of active fault and clear codes (code active for one key cycle). Is SPN 168 or 723/FMI any present?

   1.a Yes; service those faults first.

   1.b No; Go to step 2.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front fuel injector harness 14-pin injector connector.
5. Inspect the front fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)					
Injector #1 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #2 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #3 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)					
Note: Ensure J-48671-10 ground strap is connected to cylinder head.					
Injector #1 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #2 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #3 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the front fuel injector harness from the engine.

   Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #1 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #2 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #3 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

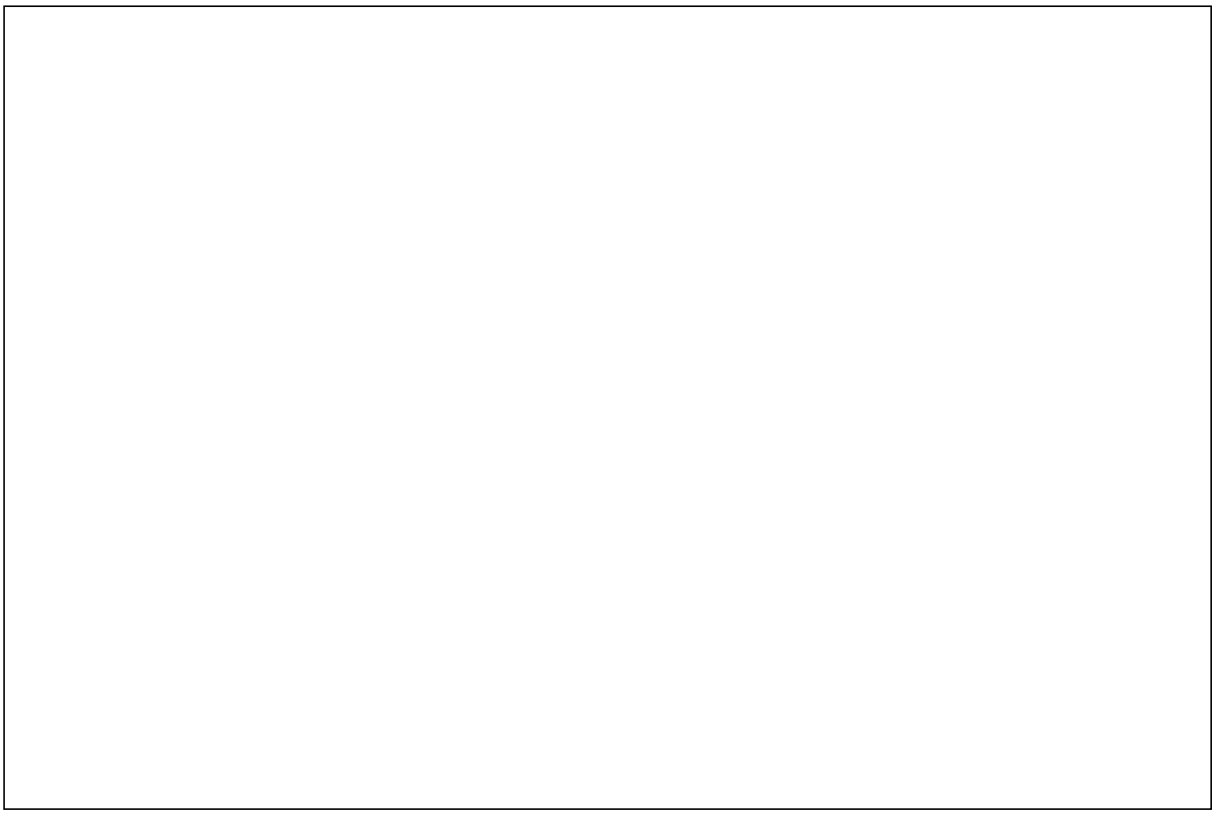
9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector Cup - Two-Filter System" .

10. Disconnect the Motor Control Module (MCM) 120-pin connector.

11. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Is damage present?

11.a Yes; verify repairs.

11.b No; Go to step 12.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

12. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

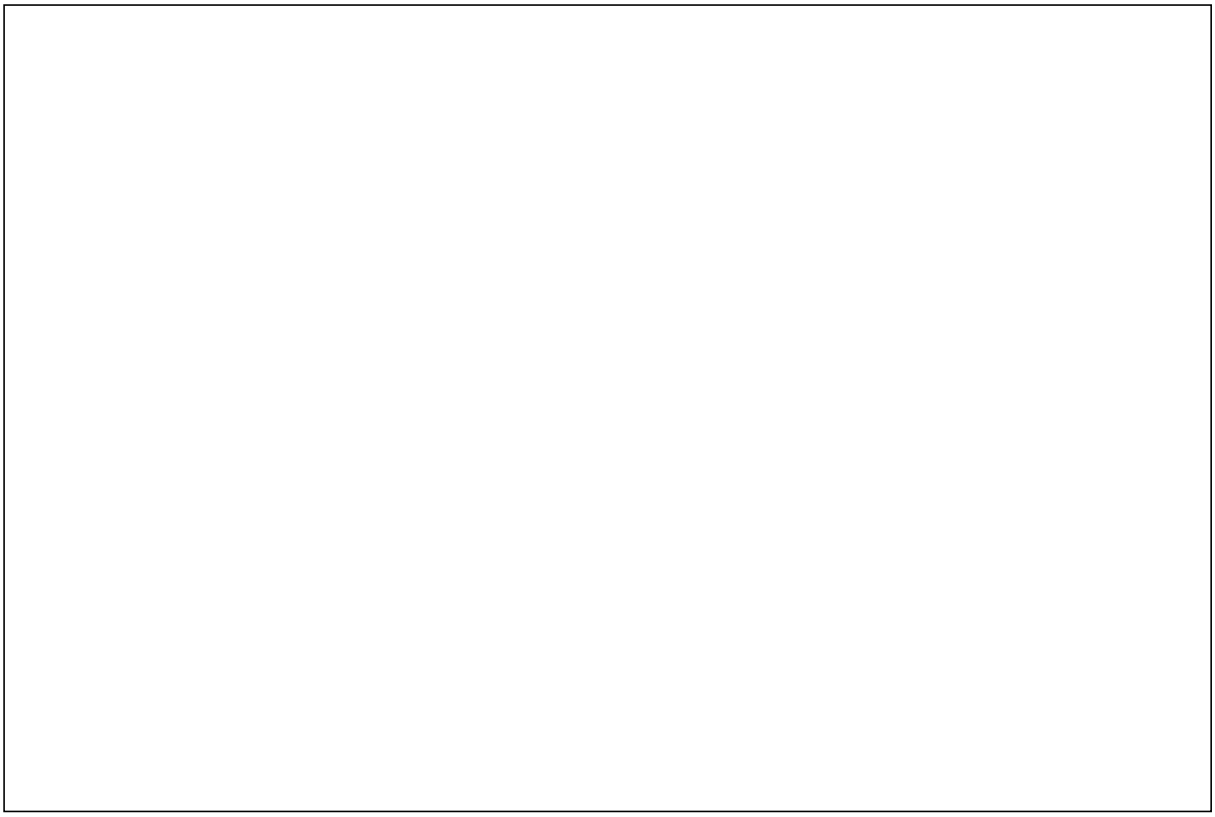
Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	25		1 and ground	
2	26		2 and ground	
3	22		3 and ground	
4	24		4 and ground	

12.a Yes; review this procedure. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the engine side harness. Verify repairs.

110.3 SPN 651/FMI 4 - GHG17

SPN 651/FMI 4	
Description	Injector Cylinder #1 Needle Control Valve Abnormal Operation (MIN)
Monitored Parameter	Injector Cylinder #1 Needle Control Valve
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

Note : Submit completed diagnostics with warranty claim.

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

1. Check for multiple codes. Using DiagnosticLink , retain log file of active fault and clear codes (code active for one key cycle). Is SPN 168 or 723/FMI any present?

   1.a Yes; service those faults first.

   1.b No; Go to step 2.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front fuel injector harness 14-pin injector connector.
5. Inspect the front fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)					
Injector #1 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #2 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #3 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)					
Note: Ensure J-48671-10 ground strap is connected to cylinder head.					
Injector #1 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #2 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #3 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the front fuel injector harness from the engine.

Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #1 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #2 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #3 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

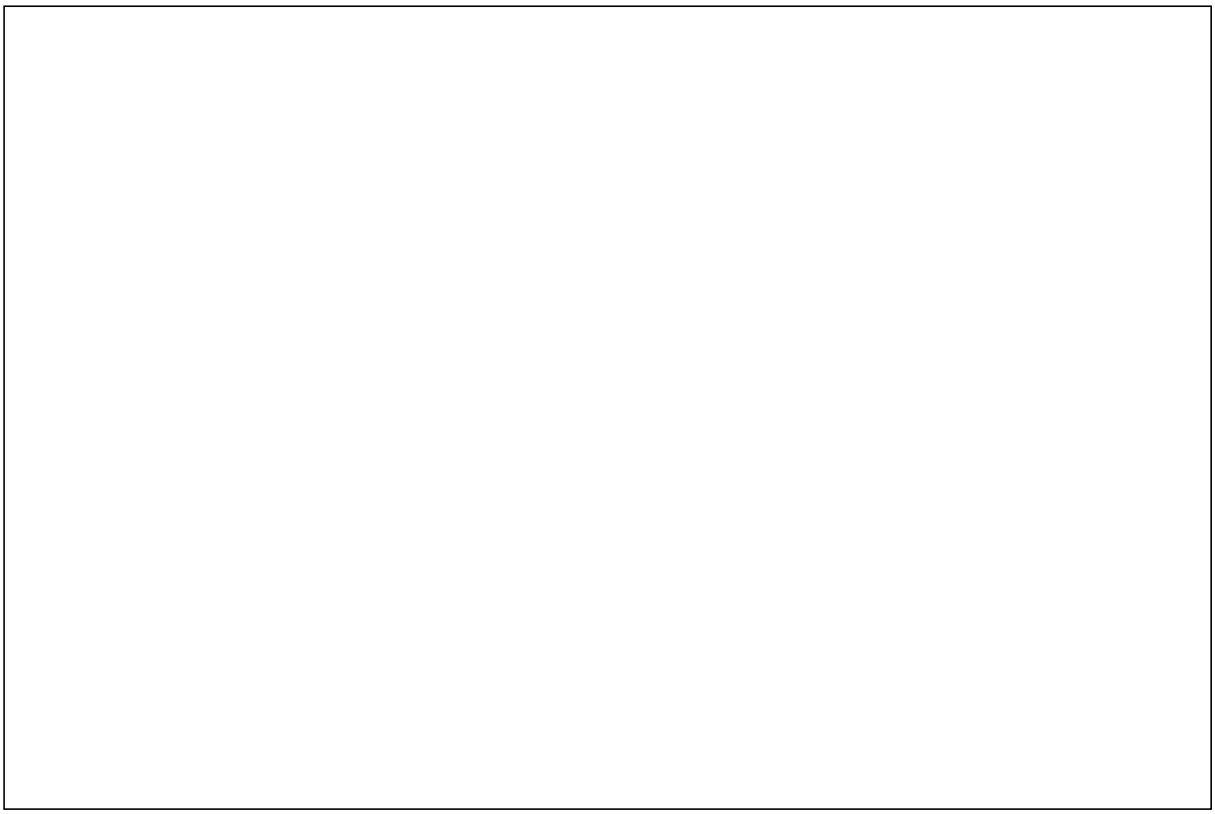
9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

10. Disconnect the Motor Control Module (MCM) 120-pin connector.

11. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Is damage present?

11.a Yes; verify repairs.

11.b No; Go to step 12.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

12. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

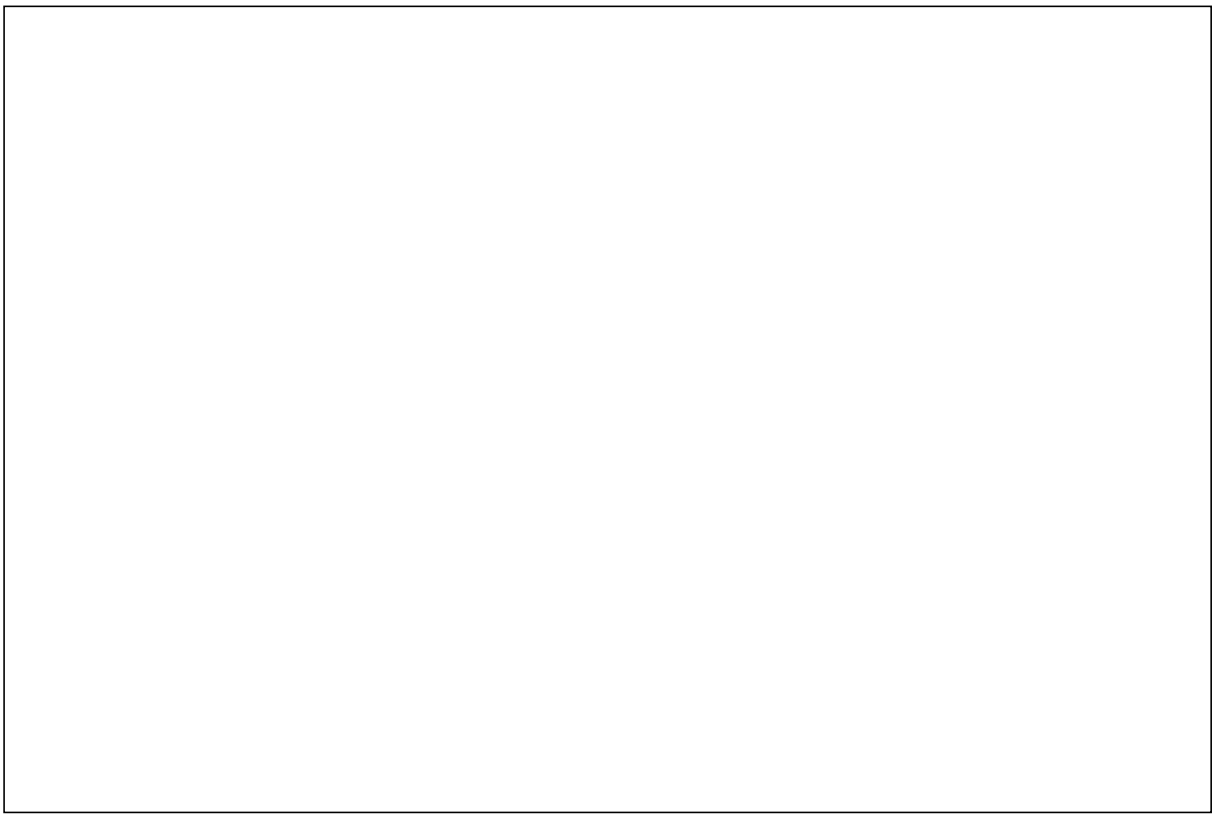
Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	25		1 and ground	
2	26		2 and ground	
3	22		3 and ground	
4	24		4 and ground	

12.a Yes; review this procedure. If the results are accurate and consistent, replace the MCM. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the engine side harness. Verify repairs.

110.4 SPN 651/FMI 5 – GHG17

SPN 651/FMI 5	
Description	Injector Cylinder #1 Needle Control Valve Circuit Open
Monitored Parameter	Injector Cylinder #1 Needle Control Valve
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

Note : Submit completed diagnostics with warranty claim.

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

1. Check for multiple codes. Using DiagnosticLink , retain log file of active fault and clear codes (code active for one key cycle). Is SPN 168 or 723/FMI any present?

   1.a Yes; service those faults first.

   1.b No; Go to step 2.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front fuel injector harness 14-pin injector connector.
5. Inspect the front fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?

Front Fuel Injector Harness 14-Pin Connector (Valve Cover Side) Resistance Chart				
Injector #1 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #2 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #3 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #2 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #3 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistance values within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #1 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #2 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #3 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

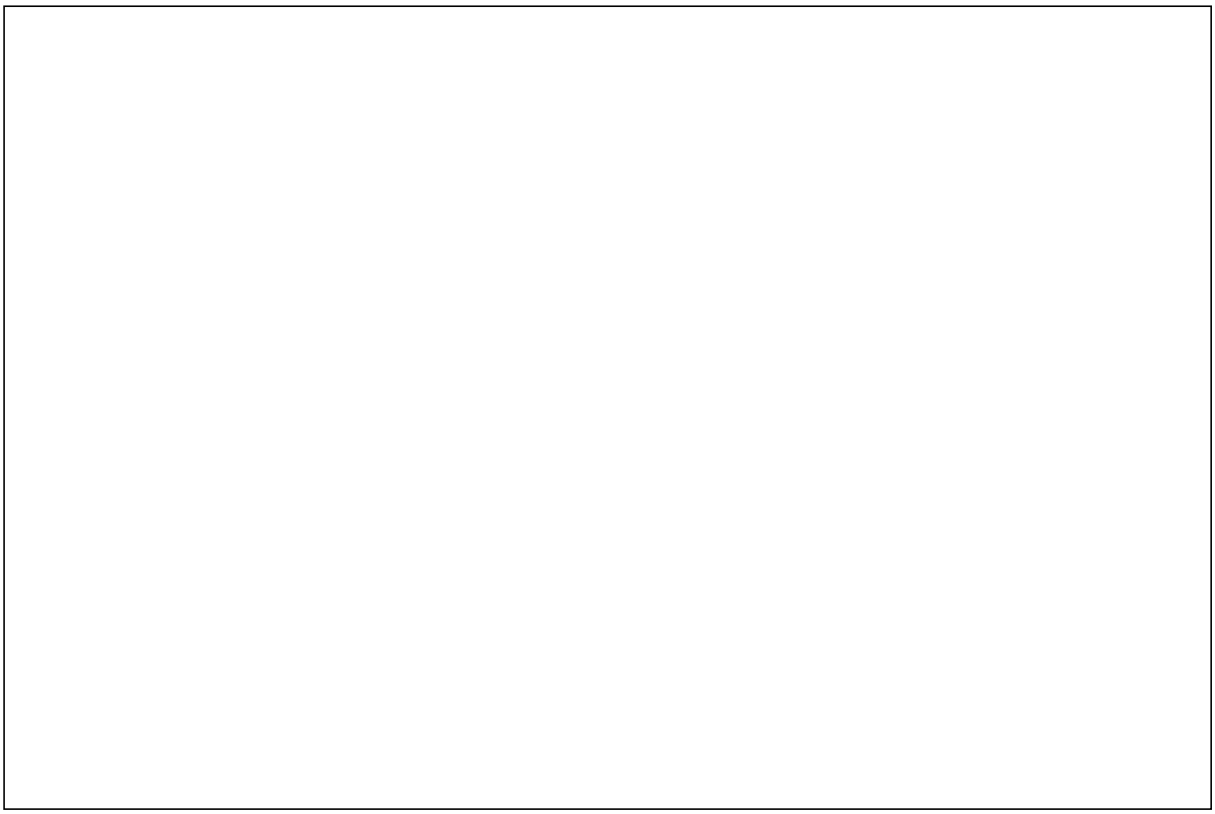
9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

10. Disconnect the Motor Control Module (MCM) 120-pin connector.

11. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Is damage present?

11.a Yes; verify repairs.

11.b No; Go to step 12.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

12. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

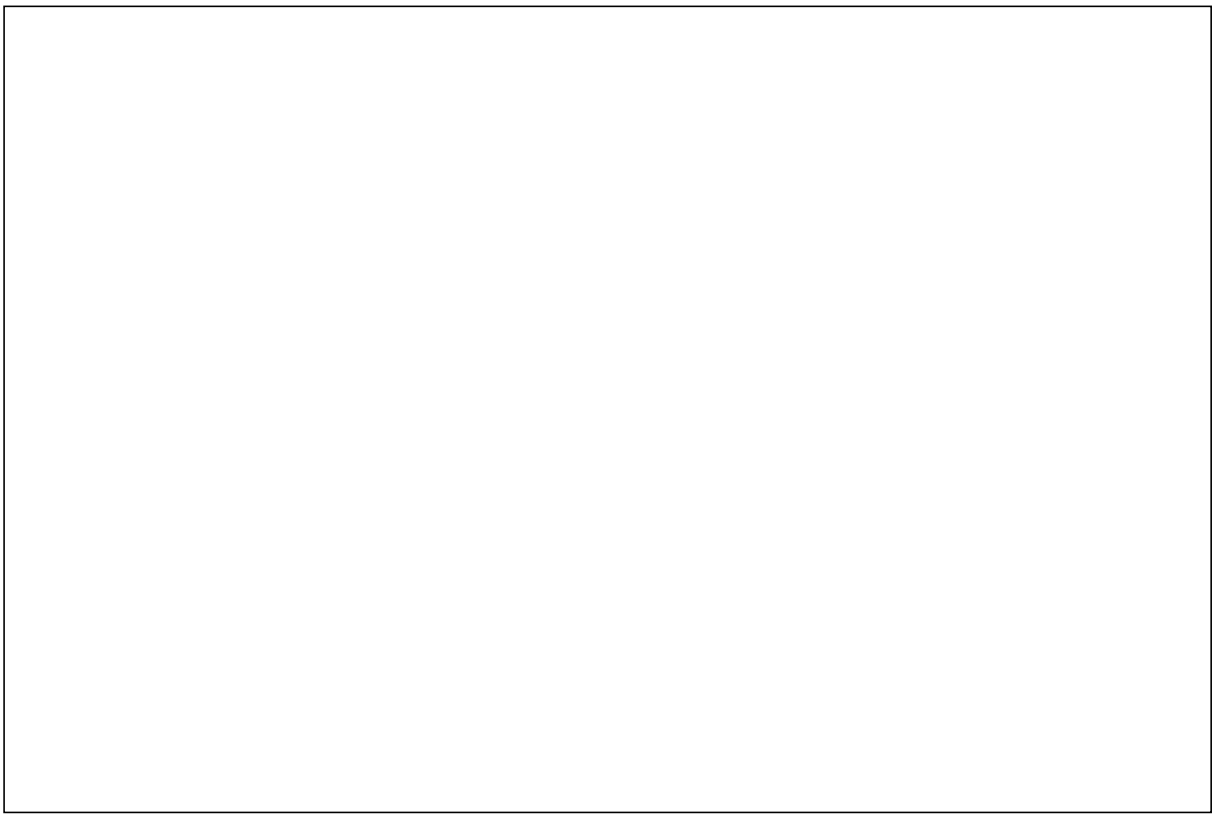
Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	25		1 and ground	
2	26		2 and ground	
3	22		3 and ground	
4	24		4 and ground	

12.a Yes; review this procedure. If the results are accurate and consistent, replace the MCM. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the engine side harness. Verify repairs.

110.5 SPN 651/FMI 6 - GHG17

SPN 651/FMI 6	
Description	Injector Cylinder #1 Needle Control Valve Shorted Circuit
Monitored Parameter	Injector Cylinder #1 Needle Control Valve
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

Note : Submit completed diagnostics with warranty claim.

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

1. Check for multiple codes. Using DiagnosticLink , retain log file of active fault and clear codes (code active for one key cycle). Is SPN 168 or 723/FMI any present?

   1.a Yes; service those faults first.

   1.b No; Go to step 2.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front fuel injector harness 14-pin connector.
5. Inspect the front fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #1 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #2 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #3 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #2 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #3 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistance values within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #1 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #2 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #3 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

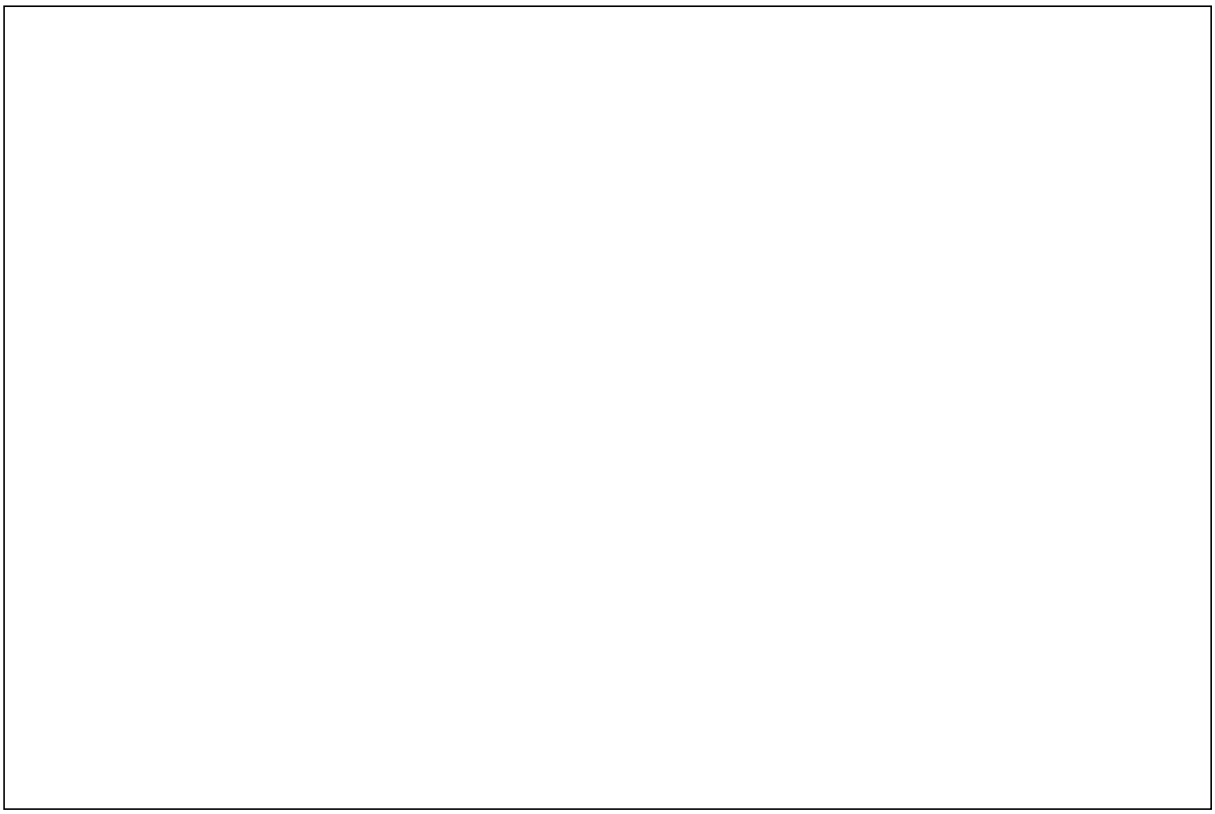
9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

10. Disconnect the Motor Control Module (MCM) 120-pin connector.

11. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

11.a Yes; verify repairs.

11.b No; Go to step 12.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

12. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	25		1 and ground	
2	26		2 and ground	
3	22		3 and ground	
4	24		4 and ground	

12.a Yes; retain log file of active fault. Replace the MCM. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the engine side harness. Verify repairs.

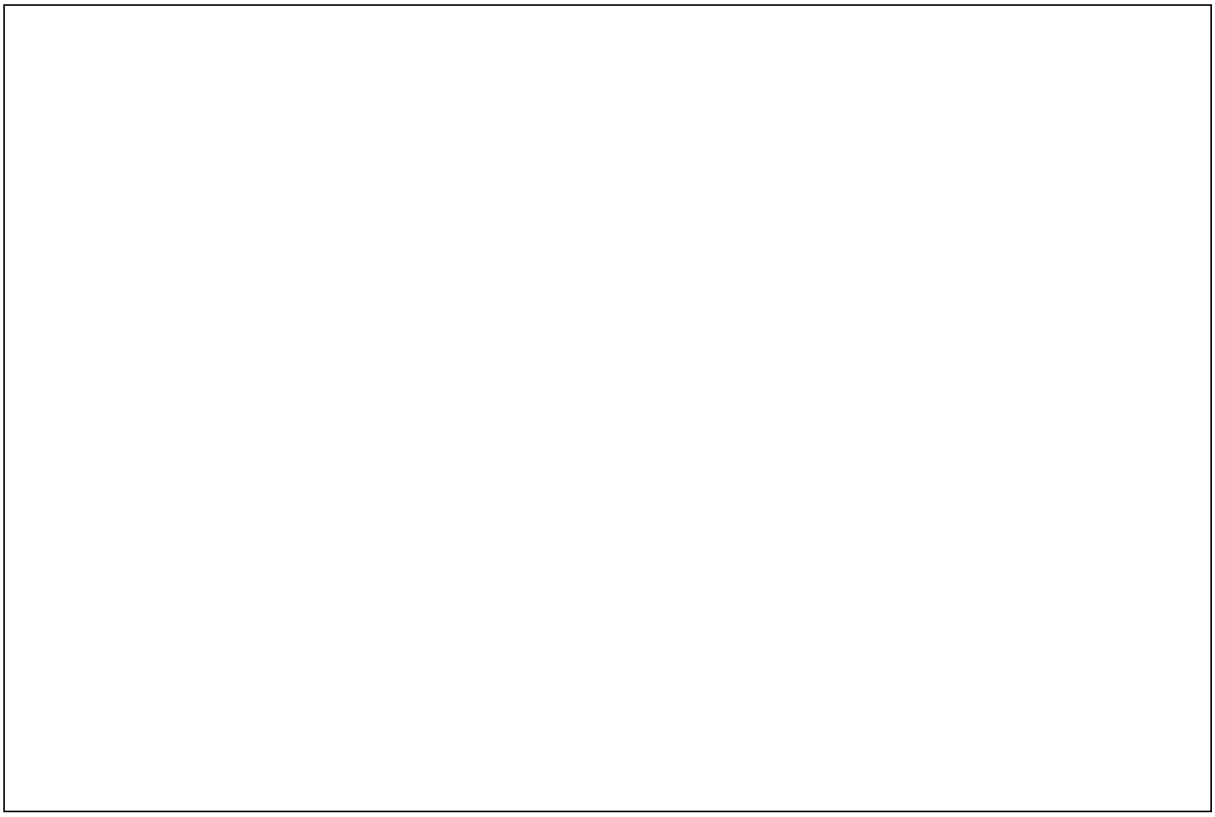
SPN 652 (MCM) (GHG17)

111.1 Electronic Diagram

Fig 111.1, Fuel Injector Electronic Diagram

111.2 SPN 652/FMI 3 - GHG17

SPN 652/FMI 3	
Description	Injector Cylinder #2 Needle Control Valve Abnormal Operation (MAX)
Monitored Parameter	Injector Cylinder #2 Needle Control Valve
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

Note : Submit completed diagnostics with warranty claim.

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

1. Check for multiple codes. Using DiagnosticLink , retain log file of active fault and clear codes (code active for one key cycle). Is SPN 168 or 723/FMI any present?

   1.a Yes; service those faults first.

   1.b No; Go to step 2.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front fuel injector harness 14-pin injector connector.
5. Inspect the front fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

Note : Do NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)					
Injector #1 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #2 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #3 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)					
Note: Ensure J-48671-10 ground strap is connected to cylinder head.					
Injector #1 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #2 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #3 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistance values within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #1 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #2 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #3 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

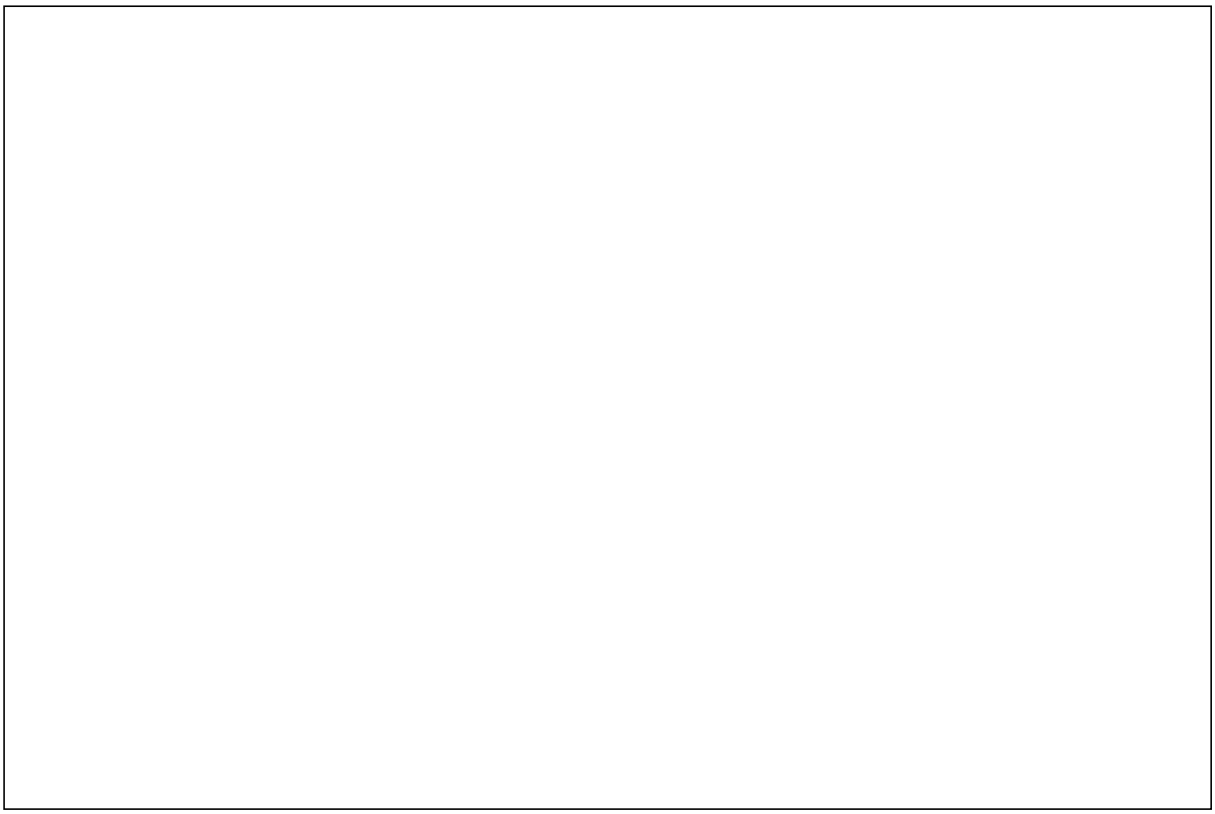
9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

10. Disconnect the Motor Control Module (MCM) 120-pin connector.

11. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Is damage present?

11.a Yes; verify repairs.

11.b No; Go to step 12.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

12. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

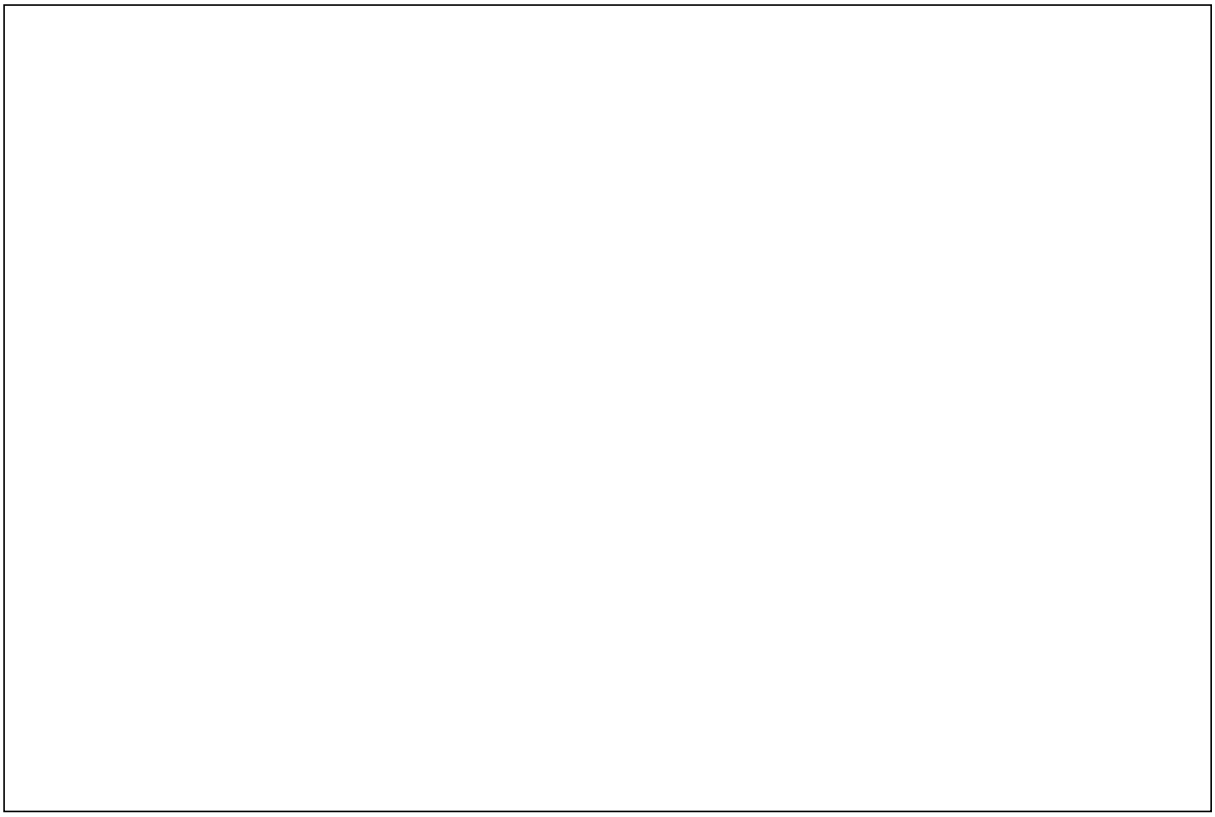
Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	25		1 and ground	
2	26		2 and ground	
3	22		3 and ground	
4	24		4 and ground	

12.a Yes; review this procedure. If the results are accurate and consistent, replace the MCM. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the engine side harness. Verify repairs.

111.3 SPN 652/FMI 4 - GHG17

SPN 652/FMI 4	
Description	Injector Cylinder #2 Needle Control Valve Abnormal Operation (MIN)
Monitored Parameter	Injector Cylinder #2 Needle Control Valve
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

Note : Submit completed diagnostics with warranty claim.

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

1. Check for multiple codes. Using DiagnosticLink , retain log file of active fault and clear codes (code active for one key cycle). Is SPN 168 or 723/FMI any present?

   1.a Yes; service those faults first.

   1.b No; Go to step 2.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front fuel injector harness 14-pin injector connector.
5. Inspect the front fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)					
Injector #1 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground	
	1.3 to 2.5*	Greater than100k*	Greater than100k*	Greater than100k*	
Injector #2 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground	
	1.3 to 2.5*	Greater than100k*	Greater than100k*	Greater than100k*	
Injector #3 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than100k*	Greater than100k*	
* = acceptable resistance					

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)					
Note: Ensure J-48671-10 ground strap is connected to cylinder head.					
Injector #1 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than100k*	Greater than100k*	Greater than100k*	
Injector #2 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than100k*	Greater than100k*	Greater than100k*	
Injector #3 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than100k*	Greater than100k*	Greater than100k*	
* = acceptable resistance					

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #1 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than100k*	Greater than100k*	
Injector #2 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than100k*	Greater than100k*	
Injector #3 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than100k*	Greater than100k*	
* = acceptable resistance					

9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

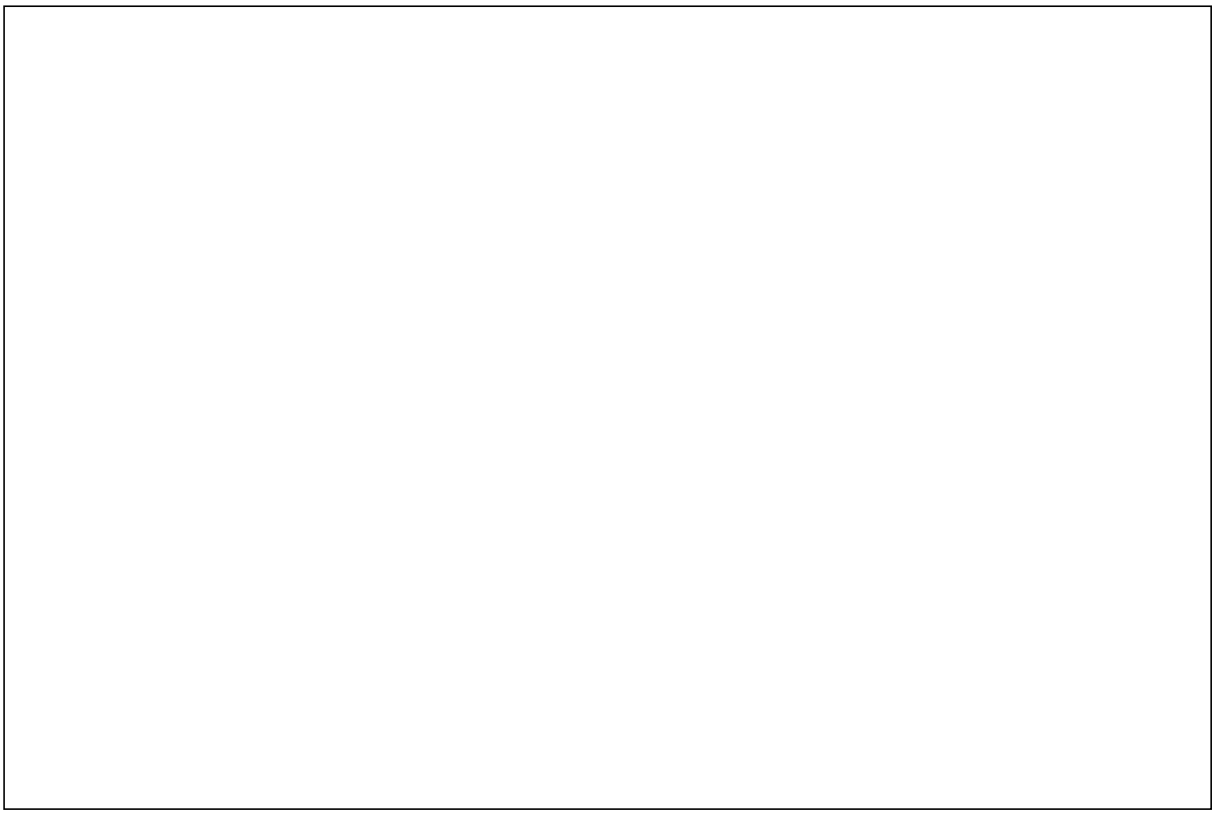
9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

10. Disconnect the Motor Control Module (MCM) 120-pin connector.

11. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Is damage present?

11.a Yes; verify repairs.

11.b No; Go to step 12.



Note : DO NOT touch the metal ohmmeter leads with your hands whilen the measurements are being taken.

12. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

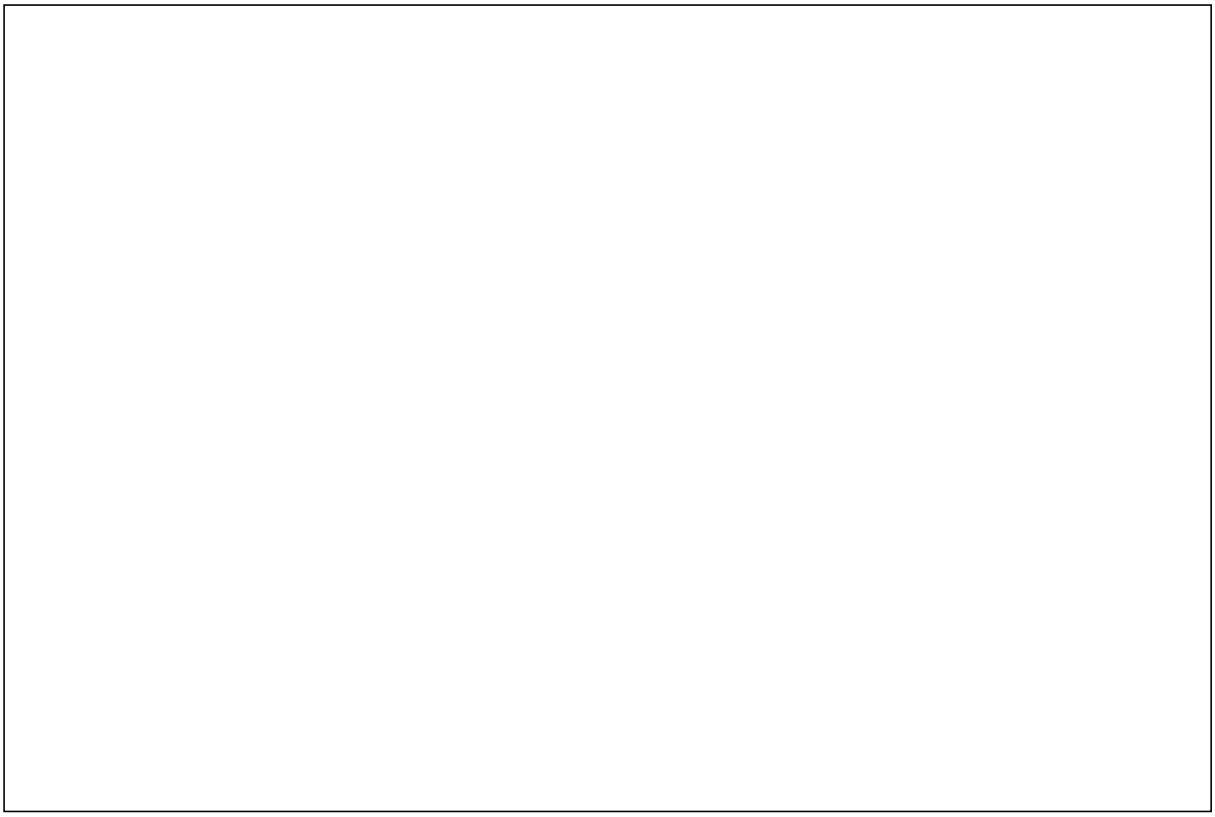
Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	25		1 and ground	
2	26		2 and ground	
3	22		3 and ground	
4	24		4 and ground	

12.a Yes; review this procedure. If the results are accurate and consistent, replace the MCM. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the engine side harness. Verify repairs.

111.4 SPN 652/FMI 5 - GHG17

SPN 652/FMI 5	
Description	Injector Cylinder #2 Needle Control Valve Abnormal Operation (MAX)
Monitored Parameter	Injector Cylinder #2 Needle Control Valve
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

Note : Submit completed diagnostics with warranty claim.

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

1. Check for multiple codes. Using DiagnosticLink , retain log file of active fault and clear codes (code active for one key cycle). Is SPN 168 or 723/FMI any present?

   1.a Yes; service those faults first.

   1.b No; Go to step 2.

WARNING

ENGINE EXHAUST

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

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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front fuel injector harness 14-pin injector connector.
5. Inspect the front fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

Note : Do NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?

Front Fuel Injector Harness 14-Pin Connector (Valve Cover Side) Resistance Chart				
Injector #1 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground
	1.3 - 2.5*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground
	1.3 - 2.5*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground
	1.3 - 2.5*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 - 2.5*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 - 2.5*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 - 2.5*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistance values within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #1 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #2 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #3 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

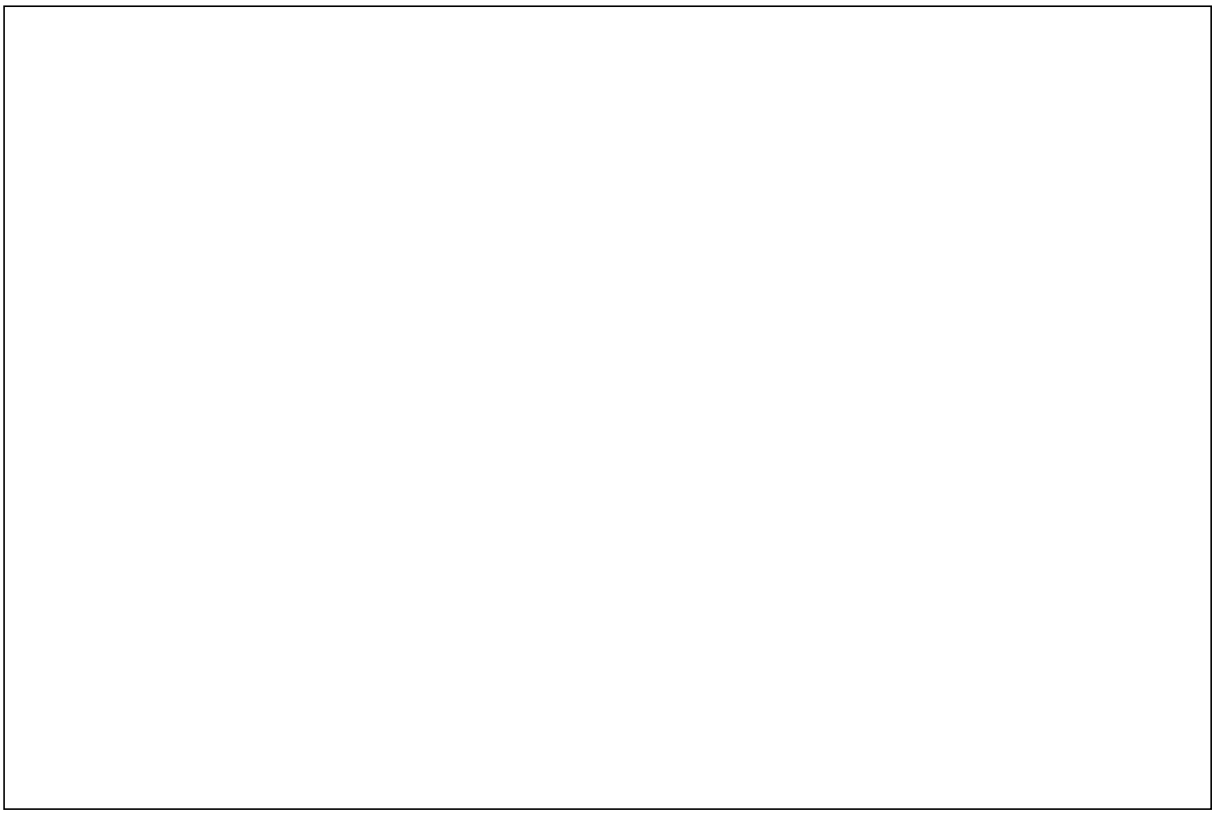
9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

10. Disconnect the Motor Control Module (MCM) 120-pin connector.

11. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Is damage present?

11.a Yes; verify repairs.

11.b No; Go to step 12.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

12. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

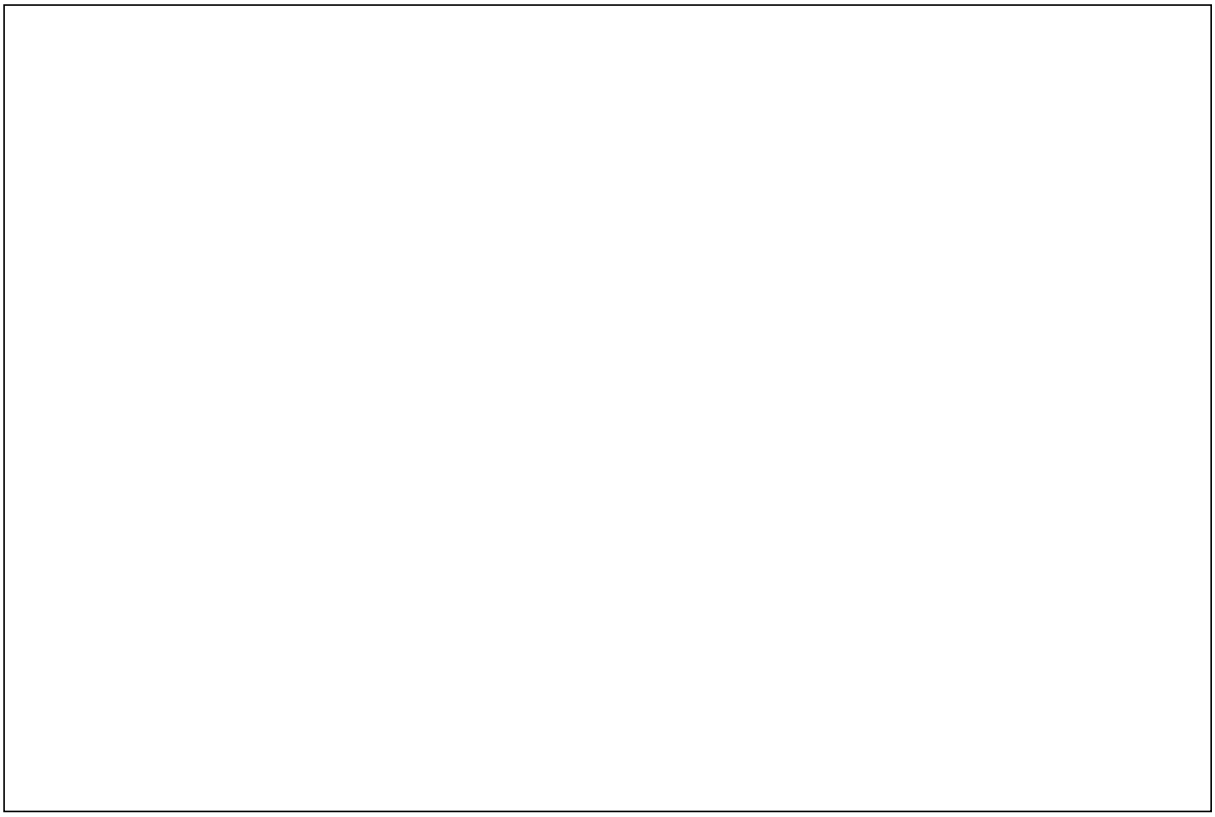
Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	MCM 120-Pin Harness Connector	Acceptable Resistance 1 or less	Front Engine Side Valve Cover 14 pin connector #	Acceptable Resistance 1K or greater
1	25		1 and ground	
2	26		2 and ground	
3	22		3 and ground	
4	24		4 and ground	

12.a Yes; review this procedure. If the results are accurate and consistent, replace the MCM. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the engine side harness. Verify repairs.

111.5 SPN 652/FMI 6 - GHG17

SPN 652/FMI 6	
Description	Injector Cylinder #2 Needle Control Valve, Valve Shorted Circuit
Monitored Parameter	Injector Cylinder #2 Needle Control Valve
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

Note : Submit completed diagnostics with warranty claim.

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

1. Check for multiple codes. Using DiagnosticLink , retain log file of active fault and clear codes (code active for one key cycle). Is SPN 168 or 723/FMI any present?

   1.a Yes; service those faults first.

   1.b No; Go to step 2.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front rocker cover 14–pin injector harness connector.
5. Inspect the front injector harness 14–pin injector connectors for bent or spread pins. Inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front injector harness listed below. Are the resistances within range?

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #1 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground
	1.3 to 2.5*	Greater than100k*	Greater than100k*	Greater than100k*
Injector #2 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground
	1.3 to 2.5*	Greater than100k*	Greater than100k*	Greater than100k*
Injector #3 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than100k*	Greater than100k*
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than100k*	Greater than100k*	Greater than100k*
Injector #2 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than100k*	Greater than100k*	Greater than100k*
Injector #3 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than100k*	Greater than100k*	Greater than100k*
* = acceptable resistance				

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #1 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than100k*	Greater than100k*	
Injector #2 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than100k*	Greater than100k*	
Injector #3 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than100k*	Greater than100k*	
* = acceptable resistance					

9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

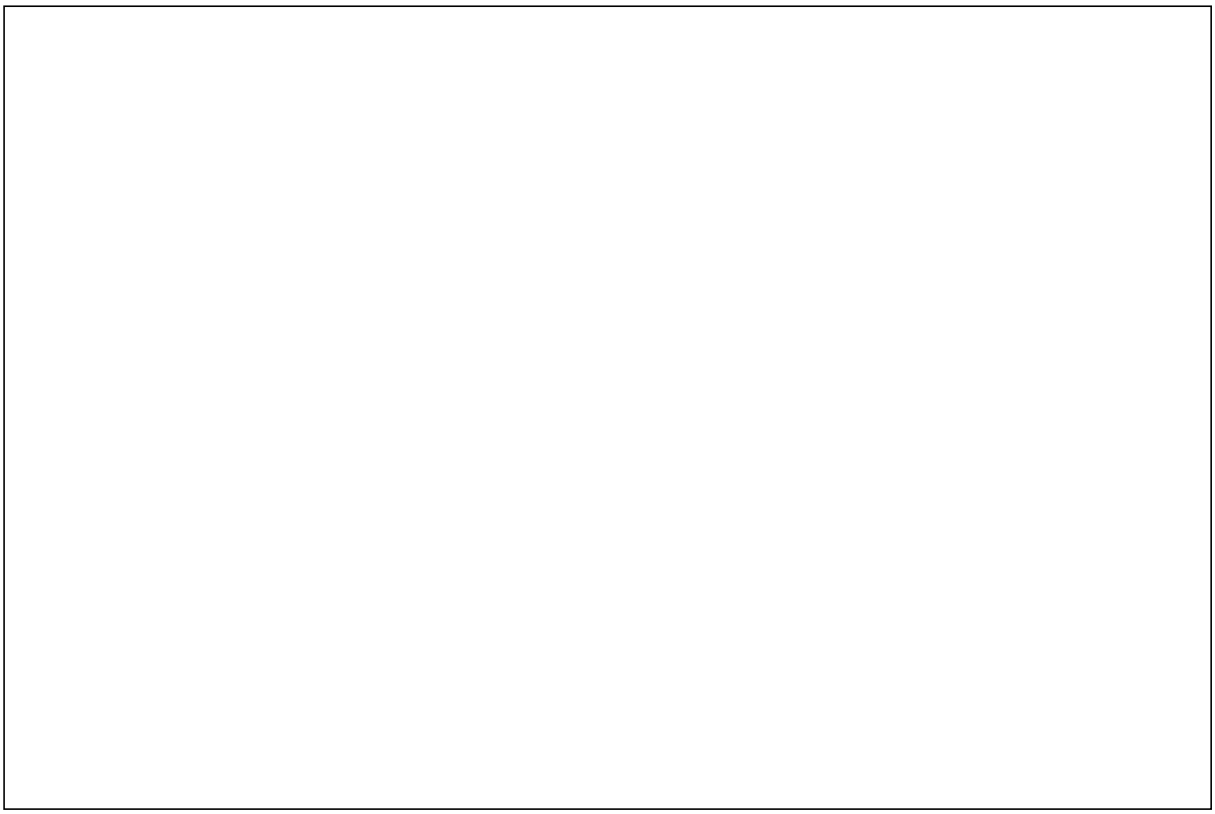
9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

10. Disconnect the Motor Control Module (MCM) 120-pin connector.

11. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Is damage present?

11.a Yes; verify repairs.

11.b No; Go to step 12.



Note : DO NOT touch the metal ohmmeter leads with your hands whilen the measurements are being taken.

12. Using the chart below, measure and record the resistance values between the engine harness side of the front valve cover 14-pin connector and the MCM 120-pin harness connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	25		1 and ground	
2	26		2 and ground	
3	22		3 and ground	
4	24		4 and ground	

12.a Yes; review this procedure. If the results are accurate and consistent, replace the MCM. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the engine side harness. Verify repairs.

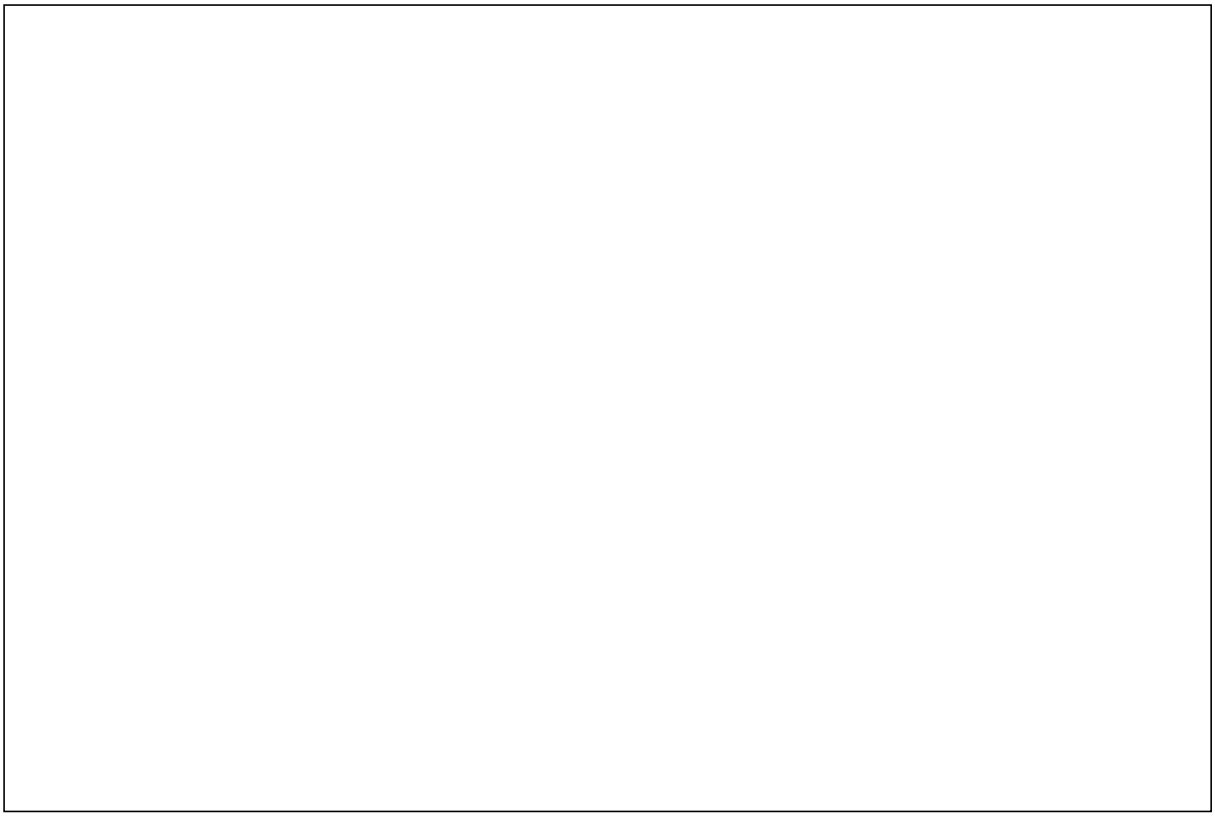
SPN 653 (MCM) (GHG17)

112.1 Electronic Diagram

Fig 112.1, Fuel Injector Electronic Diagram

112.2 SPN 653/FMI 3 -GHG17

SPN 653/FMI 3	
Description	Injector Cylinder #3 Needle Control Valve Abnormal Operation (MAX)
Monitored Parameter	Injector Cylinder #3 Needle Control Valve
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

Note : Submit completed diagnostics with warranty claim.

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

1. Check for multiple codes. Using DiagnosticLink , retain log file of active fault and clear codes (code active for one key cycle). Is SPN 168 or 723/FMI any present?

   1.a Yes; service those faults first.

   1.b No; Go to step 2.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front fuel injector harness 14-pin injector connector.
5. Inspect the front fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #1 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground
	1.3 to 2.5*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*
Injector #2 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground
	1.3 to 2.5*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*
Injector #3 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground
	1.3 to 2.5*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*
Injector #2 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*
Injector #3 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*
* = acceptable resistance				

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #1 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*	
Injector #2 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*	
Injector #3 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*	
* = acceptable resistance					

9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

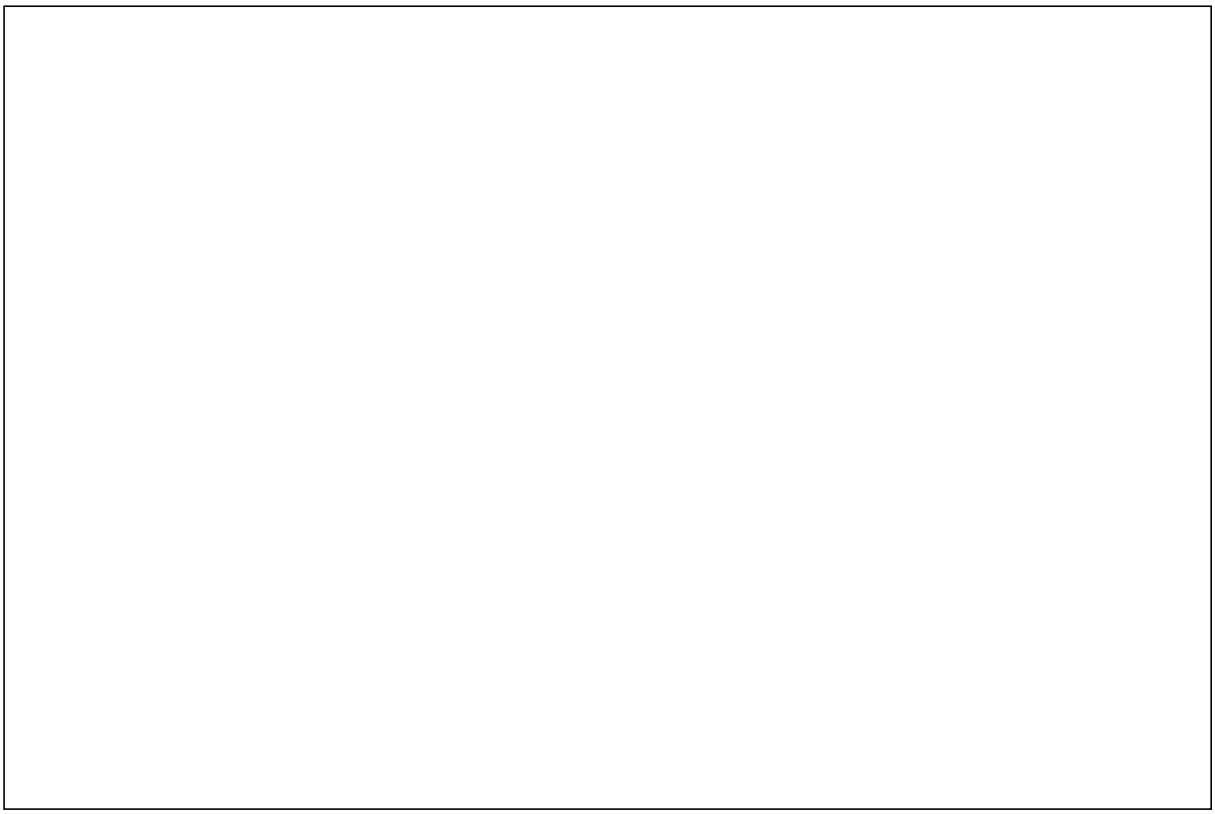
9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

10. Disconnect the Motor Control Module (MCM) 120-pin connector.

11. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Is damage present?

11.a Yes; verify repairs.

11.b No; Go to step 12.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

12. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

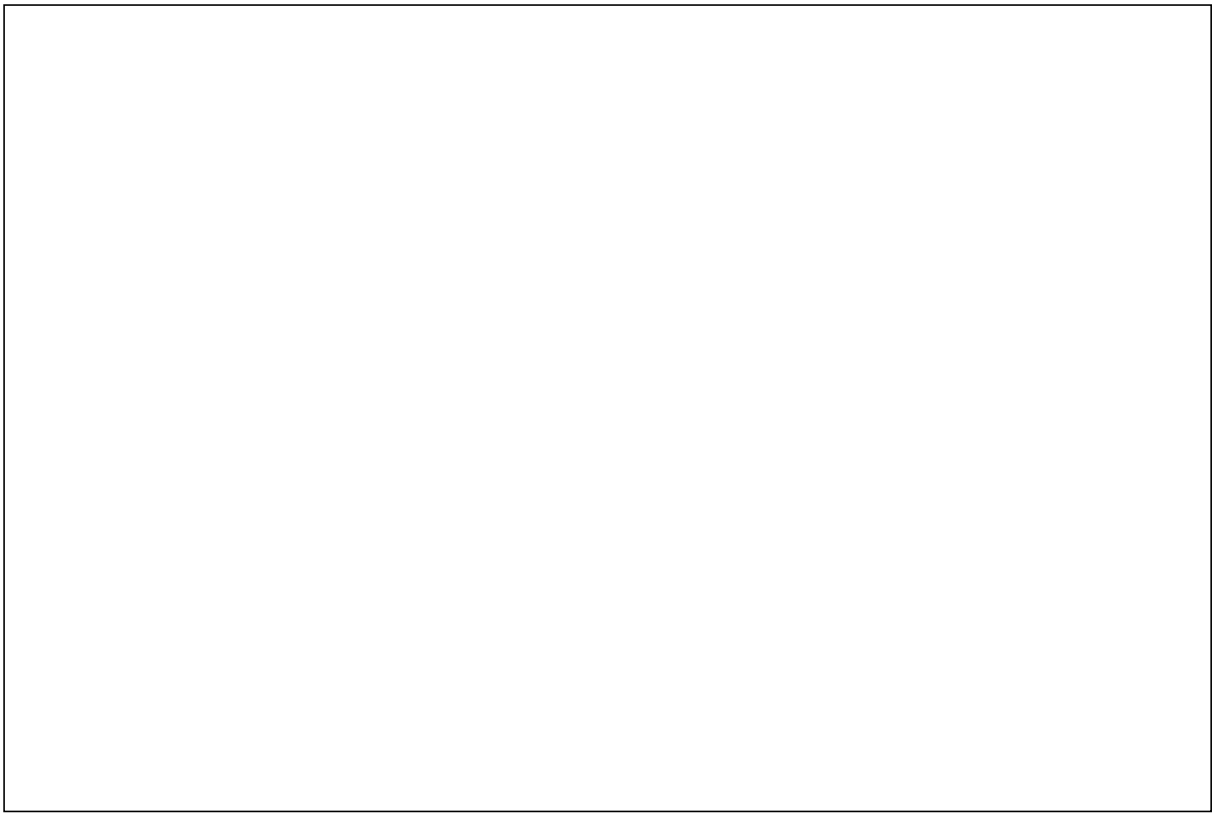
Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	25		1 and ground	
2	26		2 and ground	
3	22		3 and ground	
4	24		4 and ground	

12.a Yes; review this procedure. If the results are accurate and consistent, replace the MCM. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the engine side harness. Verify repairs.

112.3 SPN 653/FMI 4 - GHG17

SPN 653/FMI 4	
Description	Injector Cylinder #3 Needle Control Valve Abnormal Operation (MIN)
Monitored Parameter	Injector Cylinder #3 Needle Control Valve
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

Note : Submit completed diagnostics with warranty claim.

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

1. Check for multiple codes. Using DiagnosticLink , retain log file of active fault and clear codes (code active for one key cycle). Is SPN 168 or 723/FMI any present?

   1.a Yes; service those faults first.

   1.b No; Go to step 2.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front fuel injector harness 14-pin connector.
5. Inspect the front fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #1 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground
	1.3 to 2.5*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*
Injector #2 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground
	1.3 to 2.5*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*
Injector #3 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground
	1.3 to 2.5*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*
Injector #2 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*
Injector #3 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*
* = acceptable resistance				

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #1 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*	
Injector #2 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*	
Injector #3 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*	
* = acceptable resistance					

9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

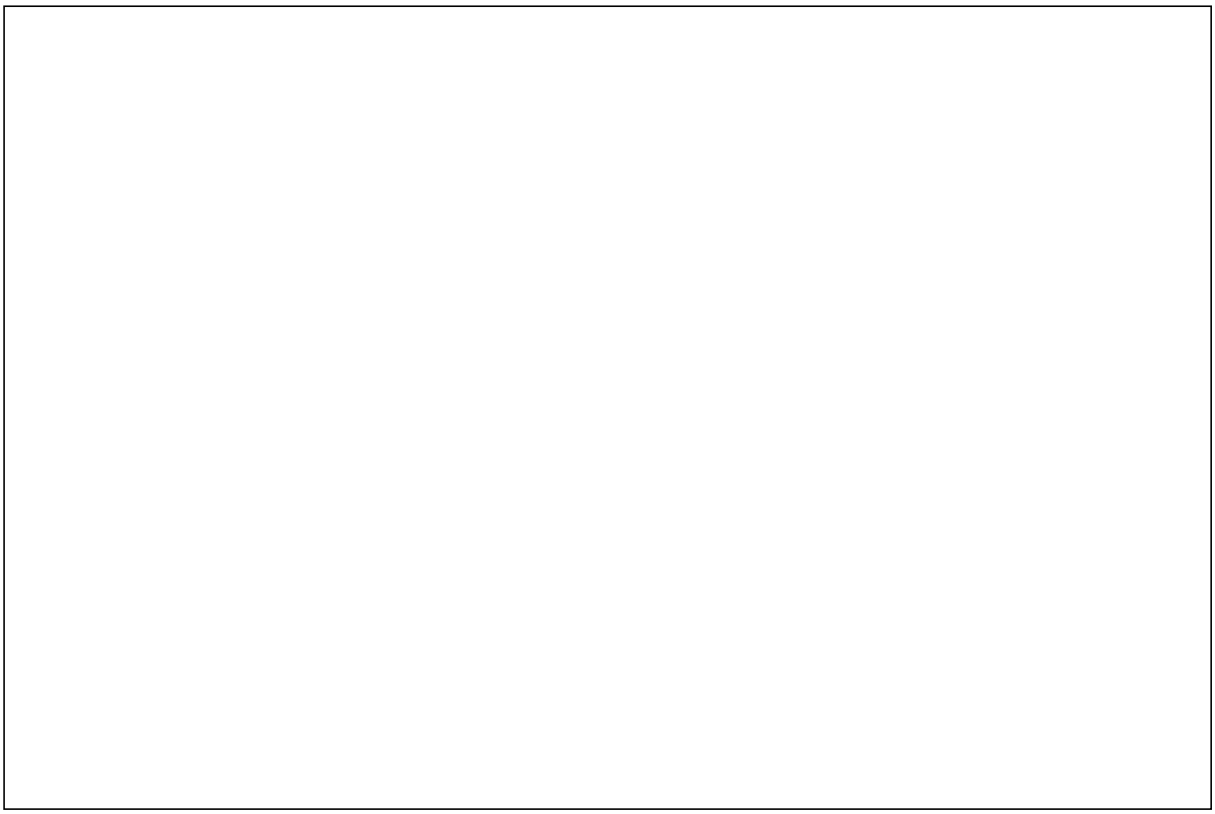
9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

10. Disconnect the Motor Control Module (MCM) 120-pin connector.

11. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Is damage present?

11.a Yes; verify repairs.

11.b No; Go to step 12.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

12. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

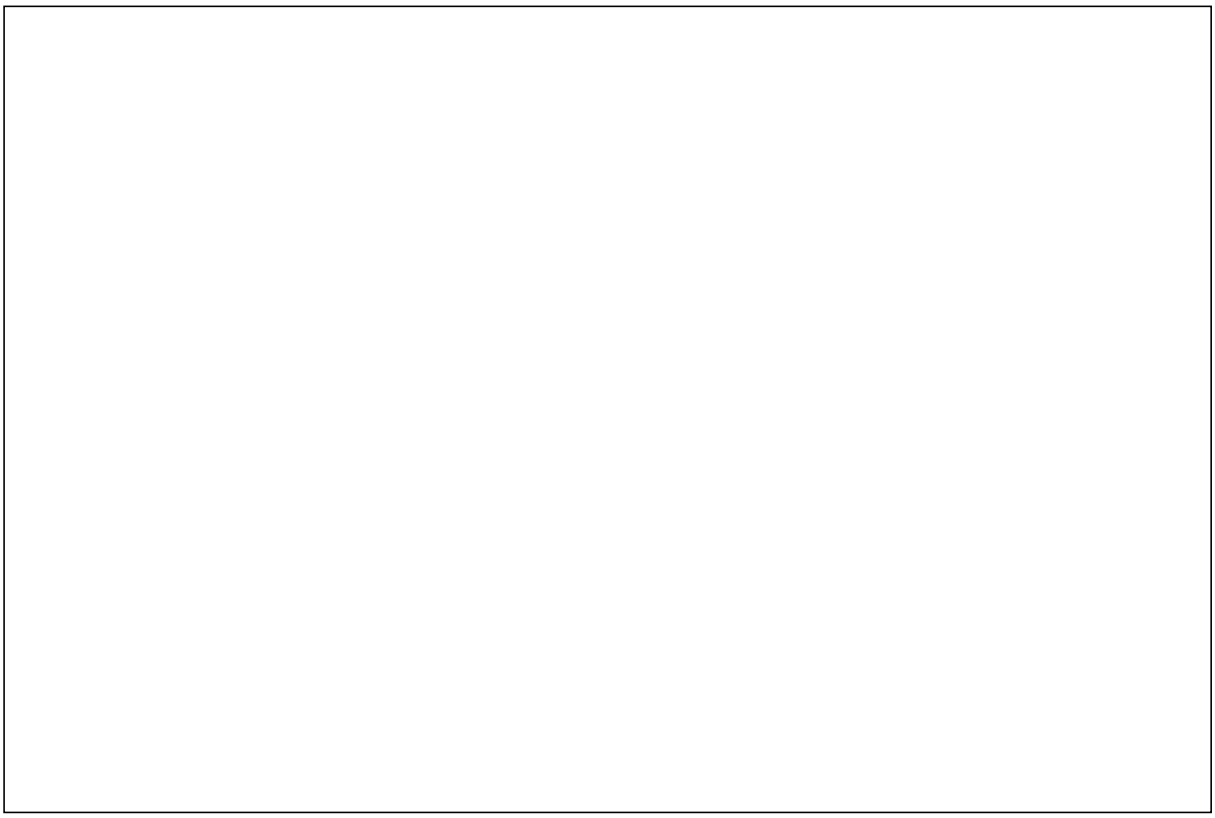
Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	25		1 and ground	
2	26		2 and ground	
3	22		3 and ground	
4	24		4 and ground	

12.a Yes; review this procedure. If the results are accurate and consistent, replace the MCM. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the engine side harness. Verify repairs.

112.4 SPN 653/FMI 5 - GHG17

SPN 653/FMI 5	
Description	Injector Cylinder #3 Needle Control Valve Circuit Open
Monitored Parameter	Injector Cylinder #3 Needle Control Valve
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

Note : Submit completed diagnostics with warranty claim.

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

1. Check for multiple codes. Using DiagnosticLink , retain log file of active fault and clear codes (code active for one key cycle). Is SPN 168 or 723/FMI any present?

   1.a Yes; service those faults first.

   1.b No; Go to step 2.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front fuel injector harness 14-pin injector connector.
5. Inspect the front fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)					
Injector #1 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground	
	1.3 to 2.5*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*	
Injector #2 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground	
	1.3 to 2.5*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*	
Injector #3 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground	
	1.3 to 2.5*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*	
* = acceptable resistance					

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)					
Note: Ensure J-48671-10 ground strap is connected to cylinder head.					
Injector #1 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*	
Injector #2 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*	
Injector #3 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*	
* = acceptable resistance					

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #1 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*	
Injector #2 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*	
Injector #3 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*	
* = acceptable resistance					

9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

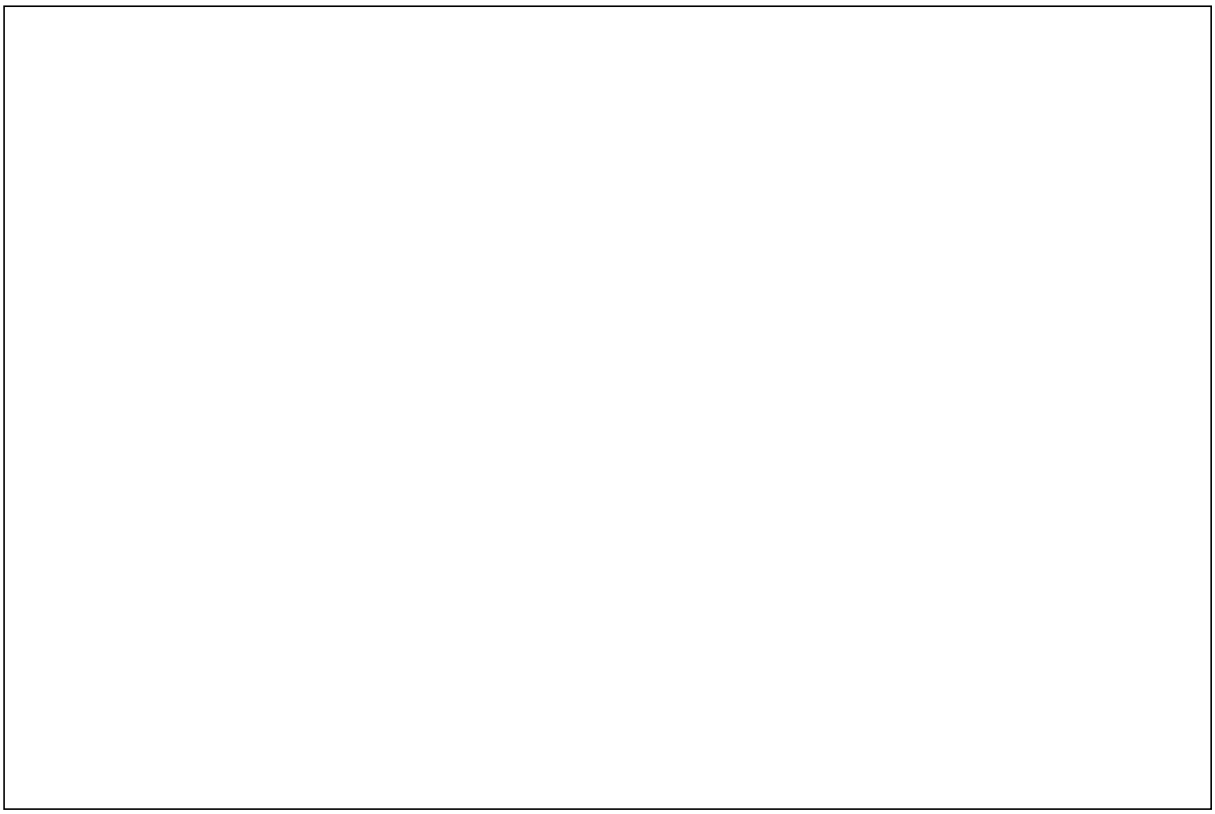
9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

10. Disconnect the Motor Control Module (MCM) 120-pin connector.

11. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Is damage present?

11.a Yes; verify repairs.

11.b No; Go to step 12.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

12. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

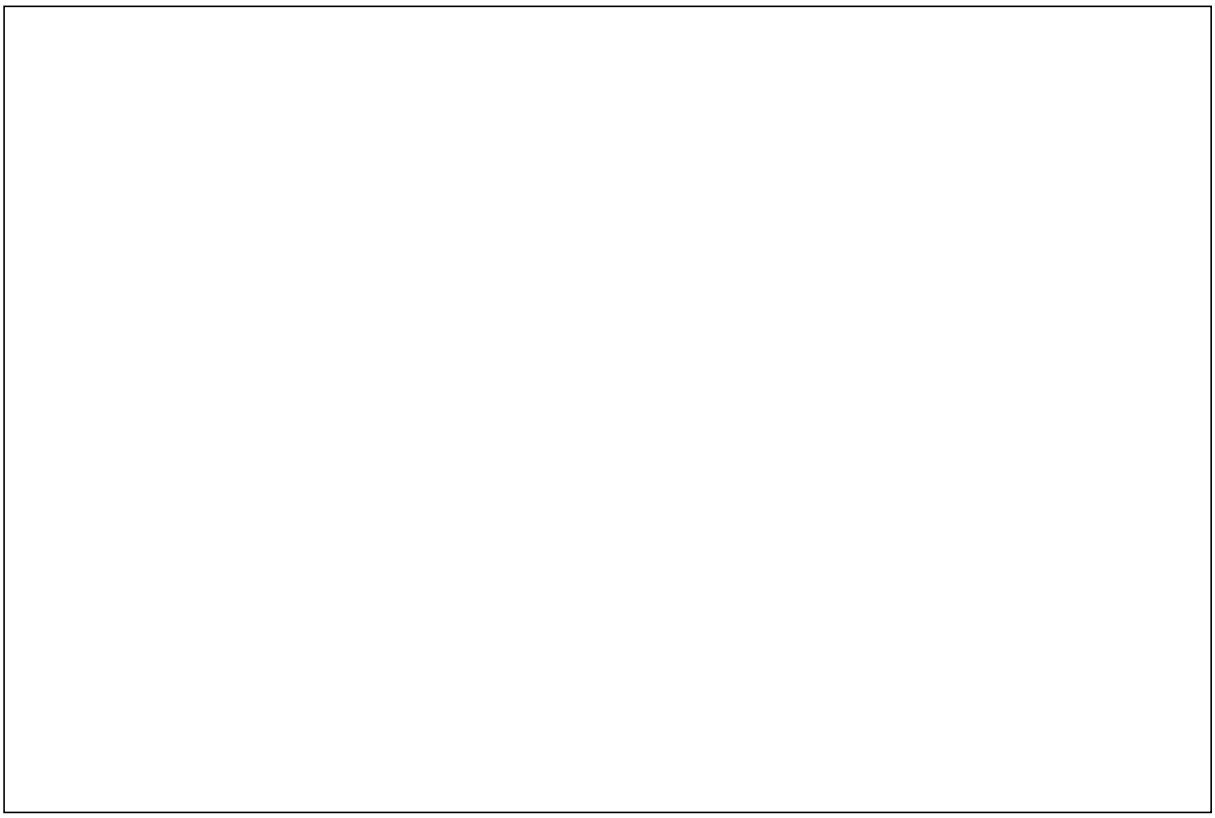
Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	25		1 and ground	
2	26		2 and ground	
3	22		3 and ground	
4	24		4 and ground	

12.a Yes; review this procedure. If the results are accurate and consistent, replace the MCM. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the engine side harness. Verify repairs.

112.5 SPN 653/FMI 6 - GHG17

SPN 653/FMI 6	
Description	Injector Cylinder #3 Needle Control Valve Shorted Circuit
Monitored Parameter	Injector Cylinder #3 Needle Control Valve
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

Note : Submit completed diagnostics with warranty claim.

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

1. Check for multiple codes. Using DiagnosticLink , retain log file of active fault and clear codes (code active for one key cycle). Is SPN 168 or 723/FMI any present?

   1.a Yes; service those faults first.

   1.b No; Go to step 2.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front rocker cover 14–pin injector harness connector.
5. Inspect the front injector harness 14–pin injector connector for bent or spread pins. Inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front injector harness listed below. Are the resistances within range?

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #1 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground
	1.3 to 2.5*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*
Injector #2 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground
	1.3 to 2.5*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*
Injector #3 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground
	1.3 to 2.5*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*
Injector #2 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*
Injector #3 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*
* = acceptable resistance				

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #1 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*	
Injector #2 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*	
Injector #3 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater Than 100k*	Greater Than 100k*	Greater Than 100k*	
* = acceptable resistance					

9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

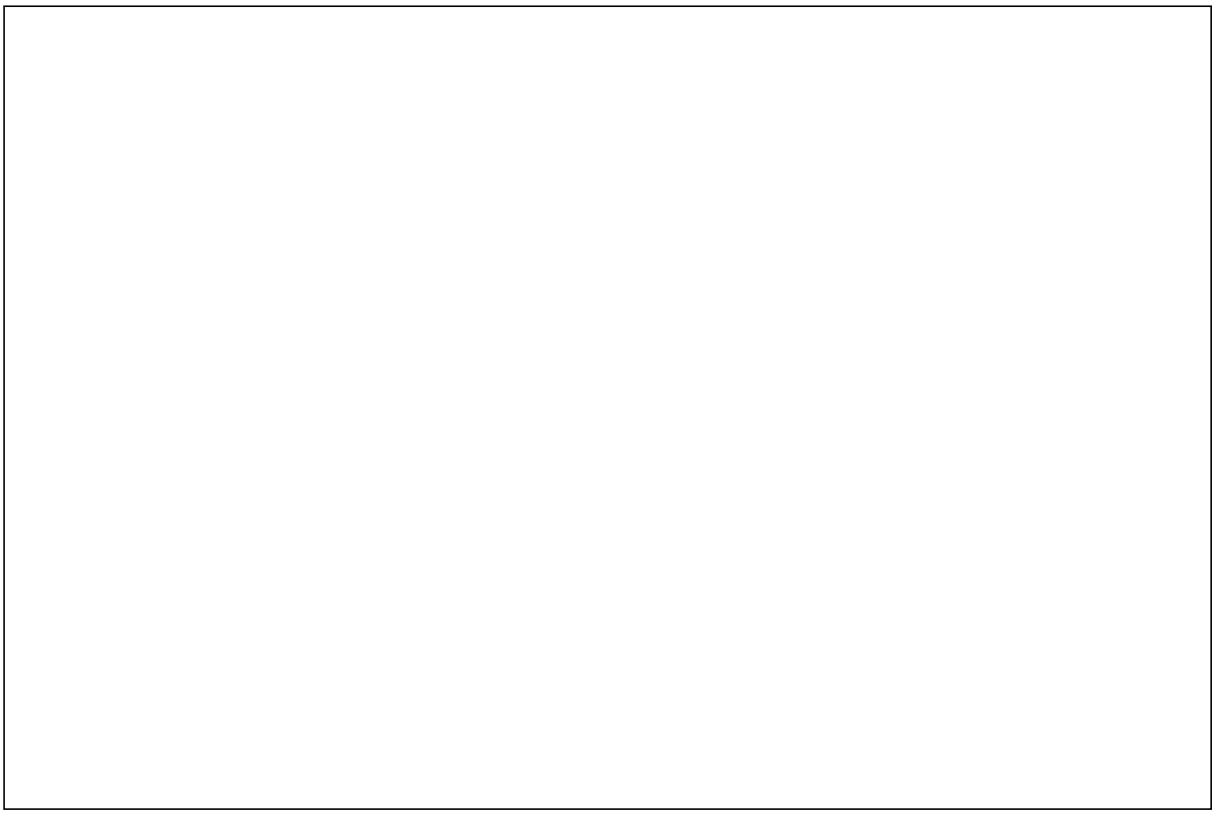
9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

10. Disconnect the Motor Control Module (MCM) 120-pin connector.

11. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Is damage present?

11.a Yes; verify repairs.

11.b No; Go to step 12.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

12. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	25		1 and ground	
2	26		2 and ground	
3	22		3 and ground	
4	24		4 and ground	

12.a Yes; review this procedure. If the results are accurate and consistent, replace the MCM. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the engine side harness. Verify repairs.

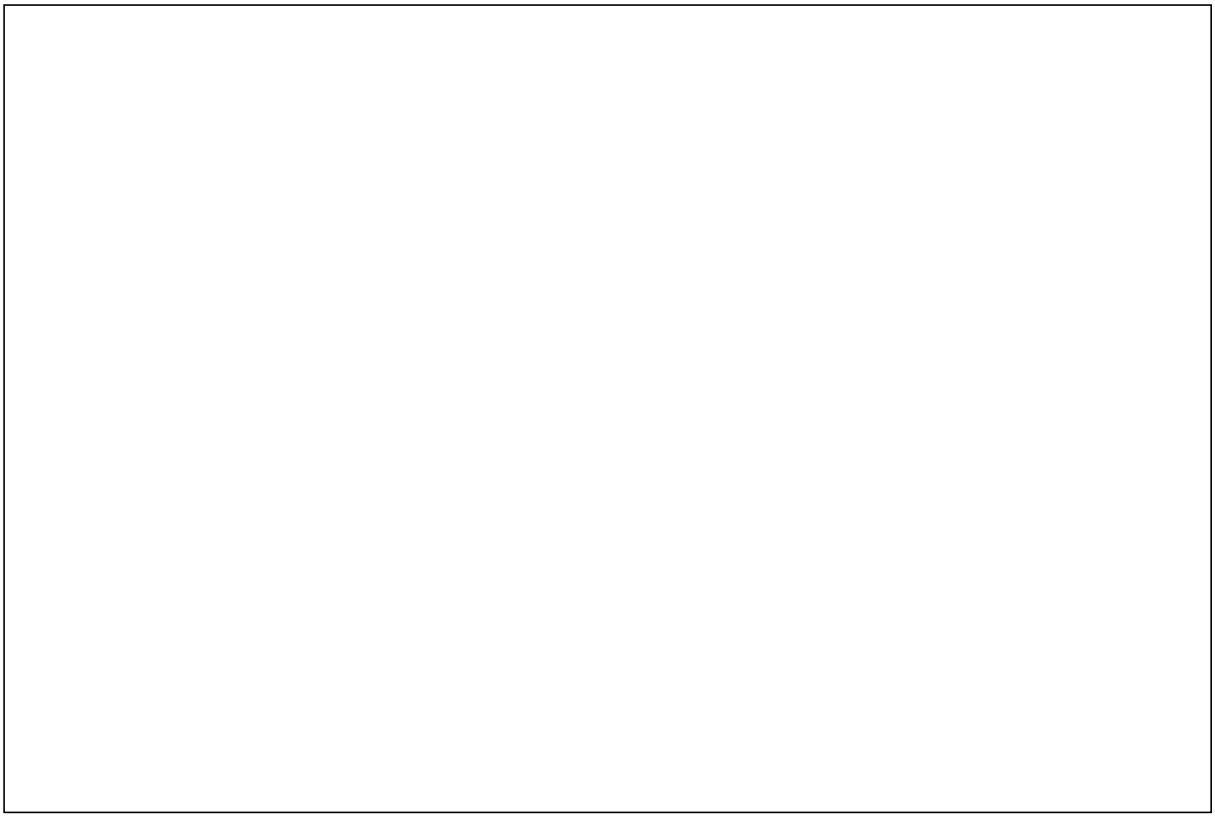
SPN 654 (MCM) (GHG17)

113.1 Electronic Diagram

Fig 113.1, Fuel Injector Electronic Diagram

113.2 SPN 654/FMI 3 - GHG17

SPN 654/FMI 3	
Description	Injector Cylinder #4 Needle Control Valve Abnormal Operation (MAX)
Monitored Parameter	Injector Cylinder #4 Needle Control Valve
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

Note : Submit completed diagnostics with warranty claim.

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

1. Check for multiple codes. Using DiagnosticLink , retain log file of active fault and clear codes (code active for one key cycle). Is SPN 168 or 723/FMI any present?

   1.a Yes; service those faults first.

   1.b No; Go to step 2.

WARNING

ENGINE EXHAUST

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

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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the rear fuel injector harness 14-pin injector connector.
5. Inspect the rear fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the resistances within range?

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #4 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #5 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #6 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the rear fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

9.a Yes; replace the rear fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

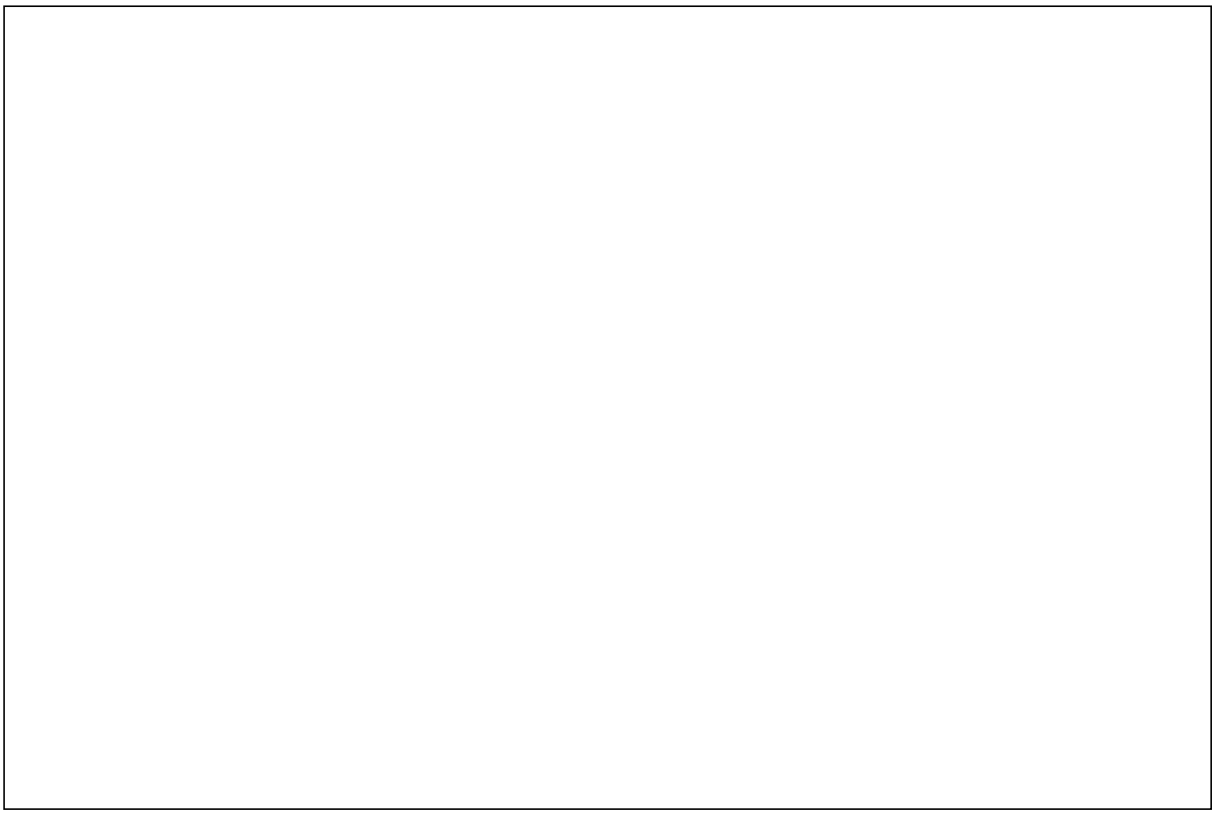
9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

10. Disconnect the Motor Control Module (MCM) 120-pin connector.

11. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Is damage present?

11.a Yes; verify repairs.

11.b No; Go to step 12.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

12. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

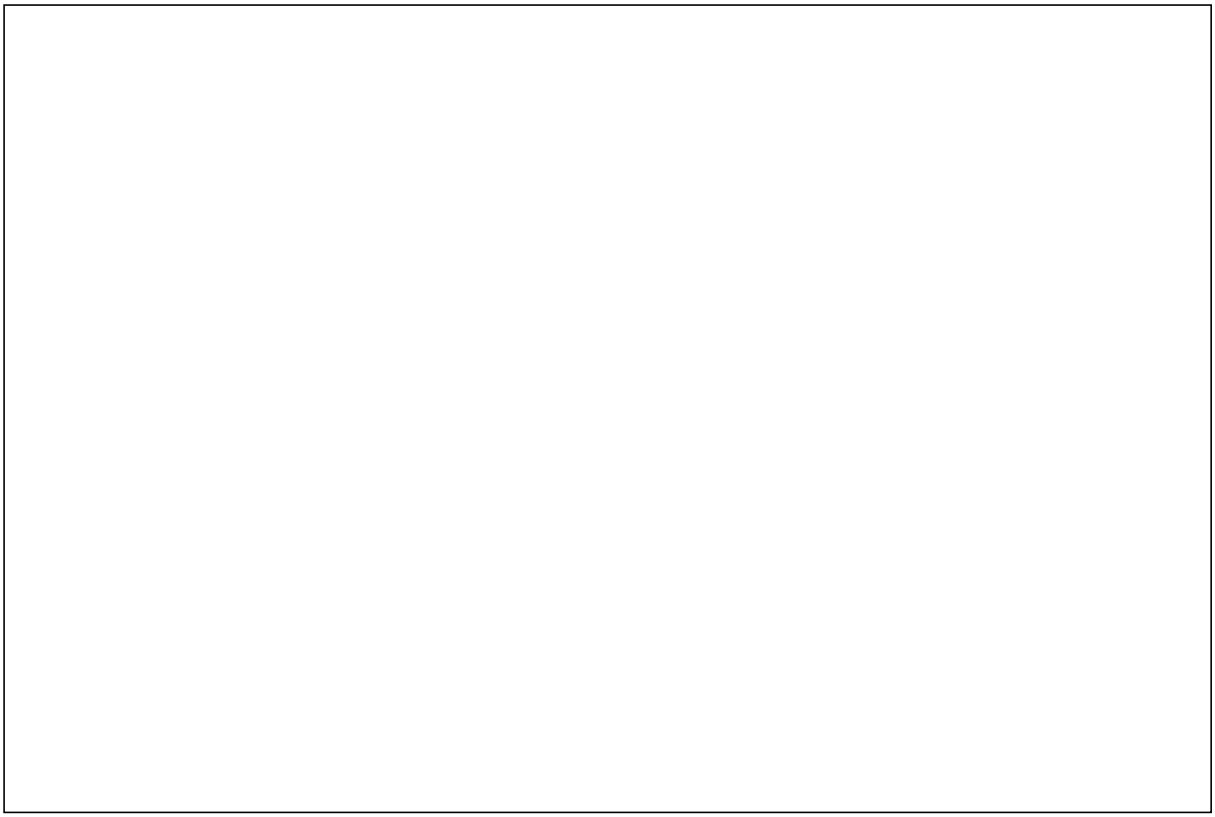
Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	19		1 and ground	
2	16		2 and ground	
3	20		3 and ground	
4	18		4 and ground	

12.a Yes; review this procedure. If the results are accurate and consistent, replace the MCM. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the engine side harness.

113.3 SPN 654/FMI 4 - GHG17

SPN 654/FMI 4	
Description	Injector Cylinder #4 Needle Control Valve Abnormal Operation (MIN)
Monitored Parameter	Injector Cylinder #4 Needle Control Valve
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

Note : Submit completed diagnostics with warranty claim.

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

1. Check for multiple codes. Using DiagnosticLink , retain log file of active fault and clear codes (code active for one key cycle). Is SPN 168 or 723/FMI any present?

   1.a Yes; service those faults first.

   1.b No; Go to step 2.

WARNING

ENGINE EXHAUST

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

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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the rear fuel injector harness 14-pin injector connector.
5. Inspect the rear fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the resistances within range?

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #4 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #5 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #6 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the rear fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

9.a Yes; replace the rear fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

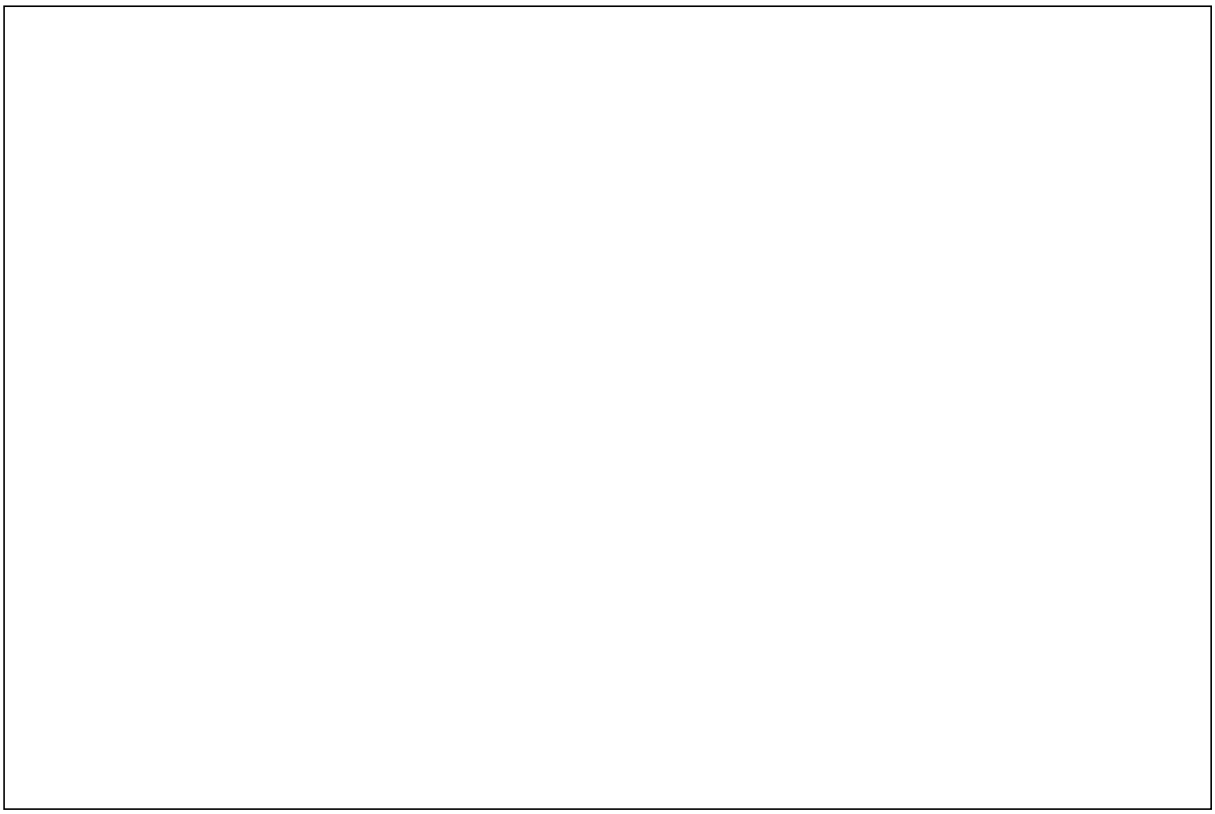
9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

10. Disconnect the Motor Control Module (MCM) 120-pin connector.

11. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage.

11.a If signs of damage are found, repair as necessary. Verify repairs.

11.b If no signs of damage, Go to step 12.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken

12. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	19		1 and ground	
2	16		2 and ground	
3	20		3 and ground	
4	18		4 and ground	

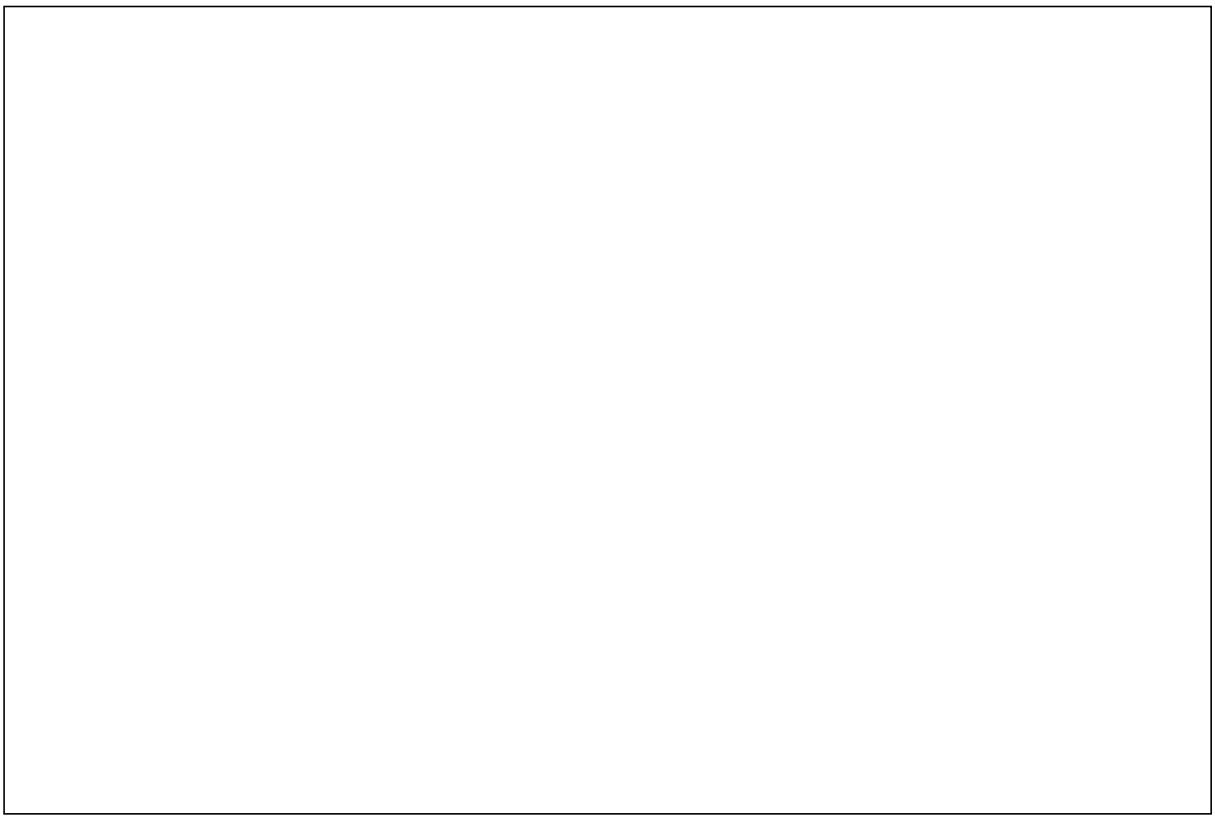
12.a Yes; review this procedure. If the results are accurate and consistent, replace the MCM. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the engine side harness.

113.4 SPN 654/FMI 5 - GHG17

Injector Cylinder #4 Needle Control Valve Circuit Open

SPN 654/FMI 5	
Description	Injector Cylinder #4 Needle Control Valve Circuit Open
Monitored Parameter	Injector Cylinder #4 Needle Control Valve
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

Note : Submit completed diagnostics with warranty claim.

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

1. Check for multiple codes. Using DiagnosticLink , retain log file of active fault and clear codes (code active for one key cycle). Is SPN 168 or 723/FMI any present?

   1.a Yes; service those faults first.

   1.b No; Go to step 2.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the rear fuel injector harness 14-pin injector connector.
5. Inspect the rear fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the resistances within range?

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #4 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #5 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #6 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the rear fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

9.a Yes; replace the rear fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

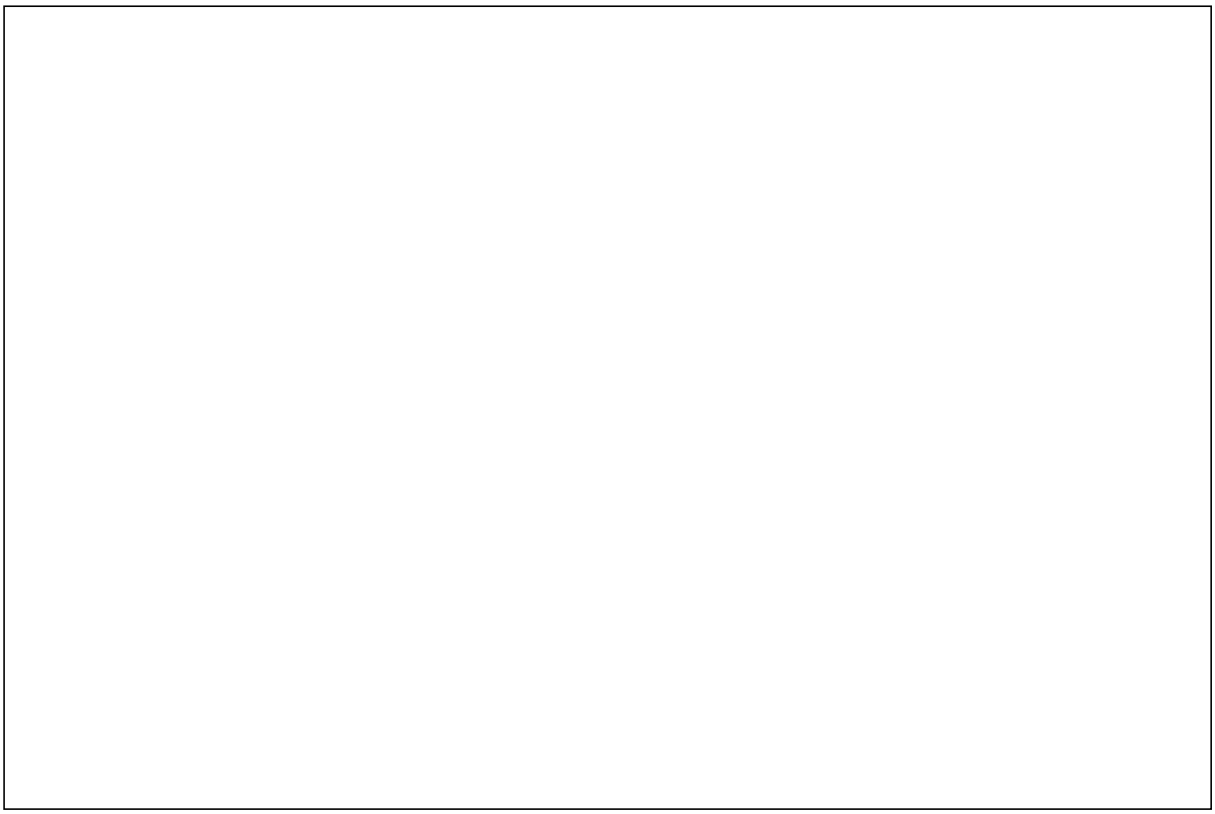
9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

10. Disconnect the Motor Control Module (MCM) 120-pin connector.

11. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Is damage present?

11.a Yes; verify repairs.

11.b No; Go to step 12.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

12. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

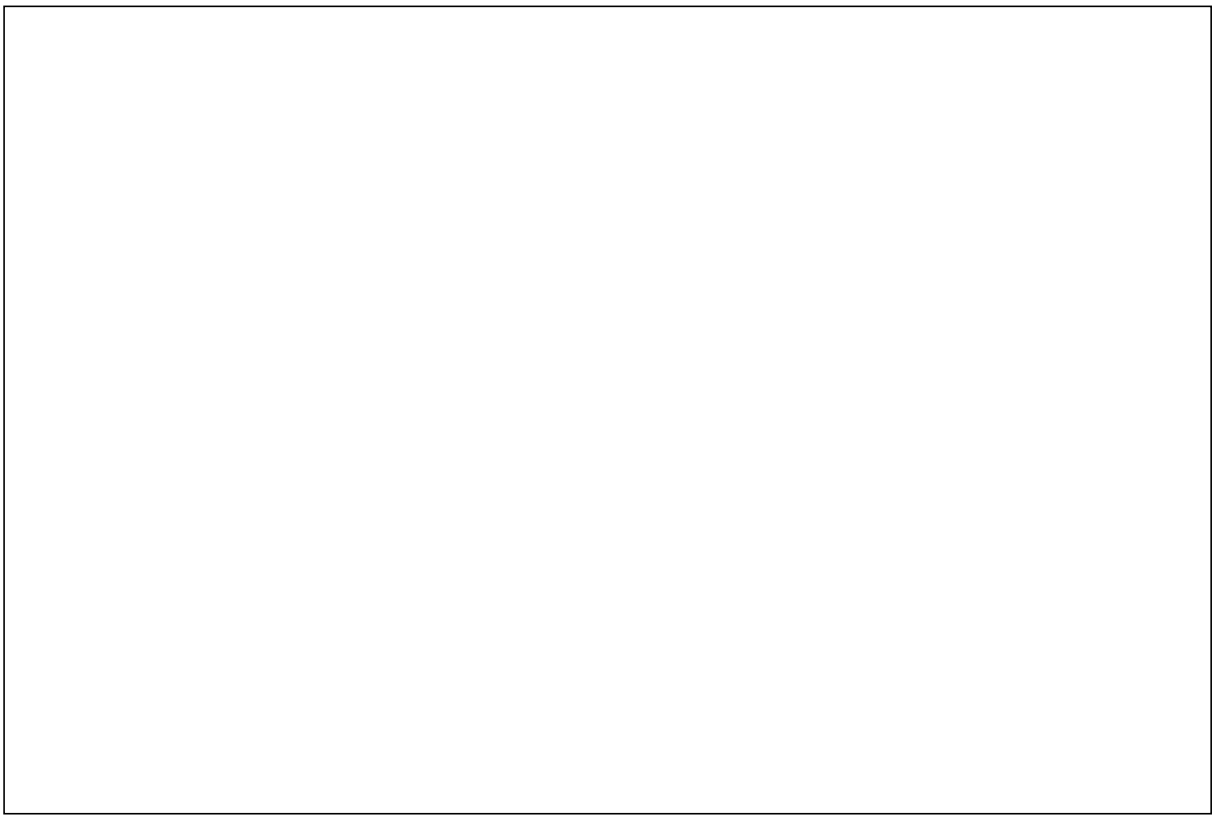
Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	19		1 and ground	
2	16		2 and ground	
3	20		3 and ground	
4	18		4 and ground	

12.a Yes; review this procedure. If the results are accurate and consistent, replace the MCM. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the engine side harness.

113.5 SPN 654/FMI 6 - GHG17

SPN 654/FMI 6	
Description	Injector Cylinder #4 Needle Control Valve Shorted Circuit
Monitored Parameter	Injector Cylinder #4 Needle Control Valve
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

Note : Submit completed diagnostics with warranty claim.

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

1. Check for multiple codes. Using DiagnosticLink , retain log file of active fault and clear codes (code active for one key cycle). Is SPN 168 or 723/FMI any present?

   1.a Yes; service those faults first.

   1.b No; Go to step 2.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the rear rocker cover 14–pin injector harness connector.
5. Inspect the rear fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the resistances within range?

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)					
Injector #4 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #5 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #6 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)					
Note: Ensure J-48671-10 ground strap is connected to cylinder head.					
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the rear fuel injector harness from the engine. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

9.a Yes; replace the rear fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

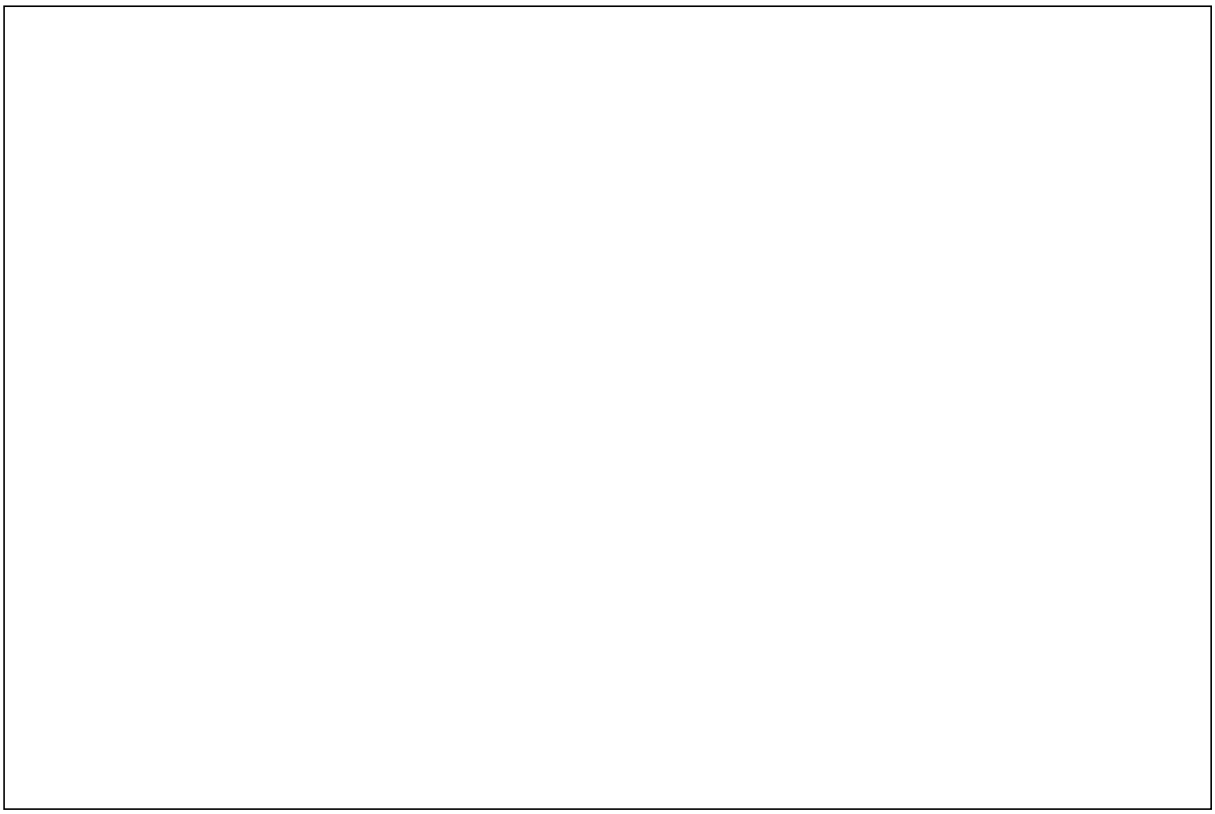
9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

10. Disconnect the Motor Control Module (MCM) 120-pin connector.

11. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Is damage present?

11.a Yes; verify repairs.

11.b No; Go to step 12.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

12. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	19		1 and ground	
2	16		2 and ground	
3	20		3 and ground	
4	18		4 and ground	

12.a Yes; review this procedure. If the results are accurate and consistent, replace the MCM. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the engine side harness. Verify repairs.

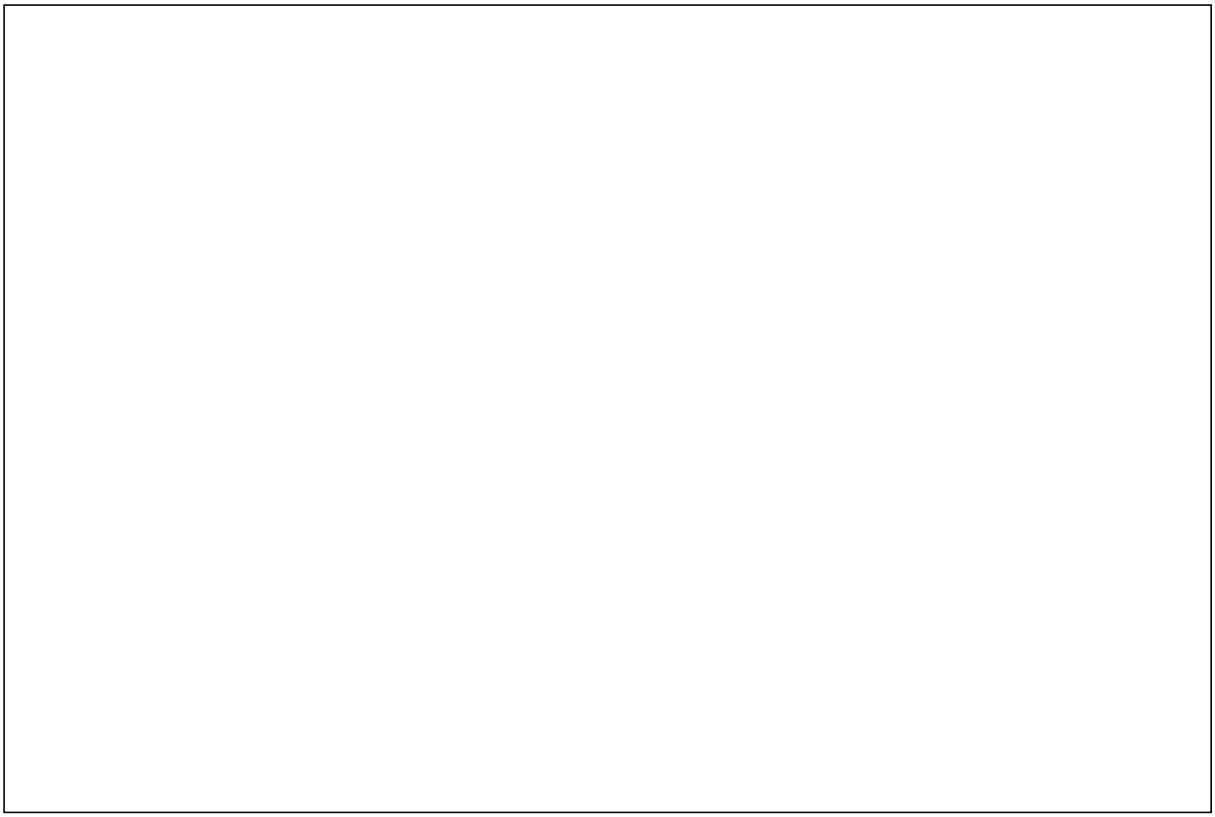
SPN 655 (MCM) (GHG17)

114.1 Electronic Diagram

Fig 114.1, Fuel Injector Electronic Diagram

114.2 SPN 655/FMI 3 - GHG17

SPN 655/FMI 3	
Description	Injector Cylinder #5 Needle Control Valve Abnormal Operation (MAX)
Monitored Parameter	Injector Cylinder #5 Needle Control Valve
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

Note : Submit completed diagnostics with warranty claim.

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

1. Check for multiple codes. Using DiagnosticLink , retain log file of active fault and clear codes (code active for one key cycle). Is SPN 168 or 723/FMI any present?

   1.a Yes; service those faults first.

   1.b No; Go to step 2.

WARNING

ENGINE EXHAUST

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

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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the rear fuel injector harness 14-pin injector connector.
5. Inspect the rear fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the resistances within range?

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #4 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #5 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #6 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the rear fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

9.a Yes; replace the rear fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

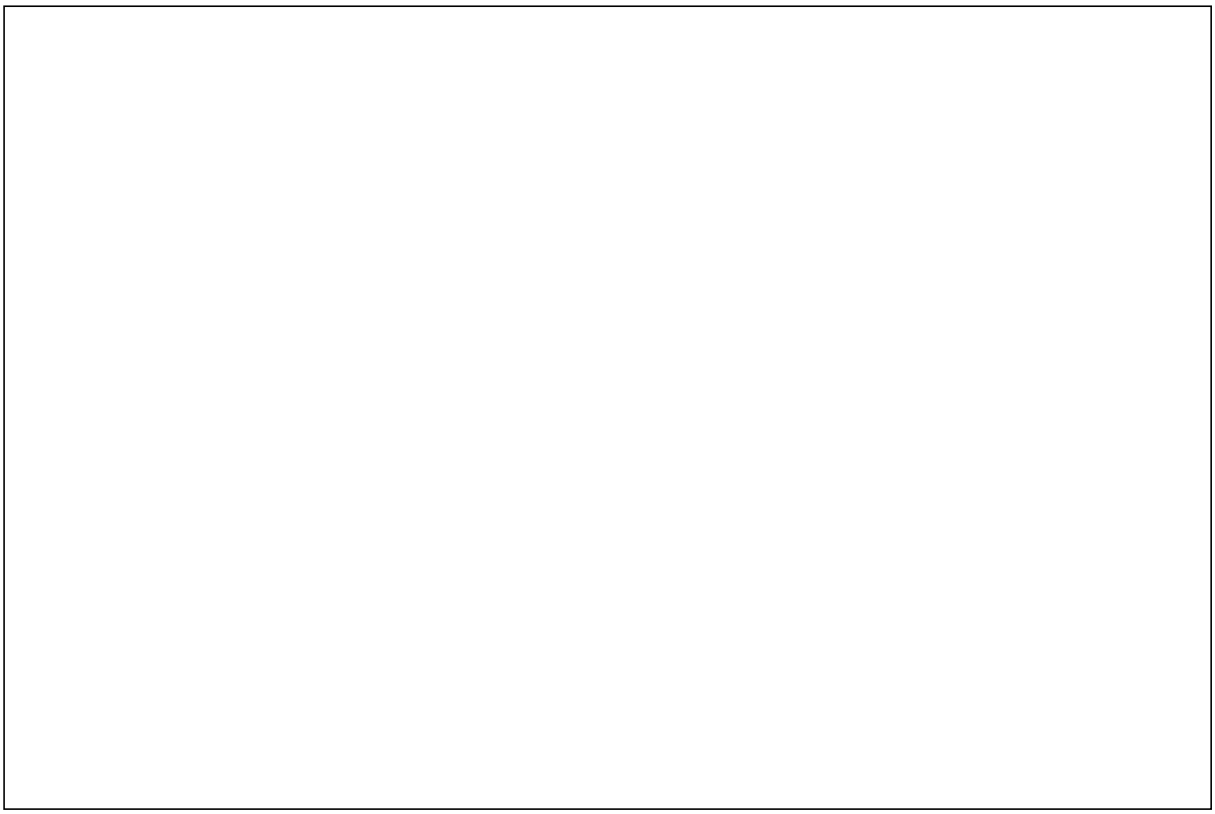
9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

10. Disconnect the Motor Control Module (MCM) 120-pin connector.

11. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Is damage present?

11.a Yes; verify repairs.

11.b No; Go to step 12.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

12. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

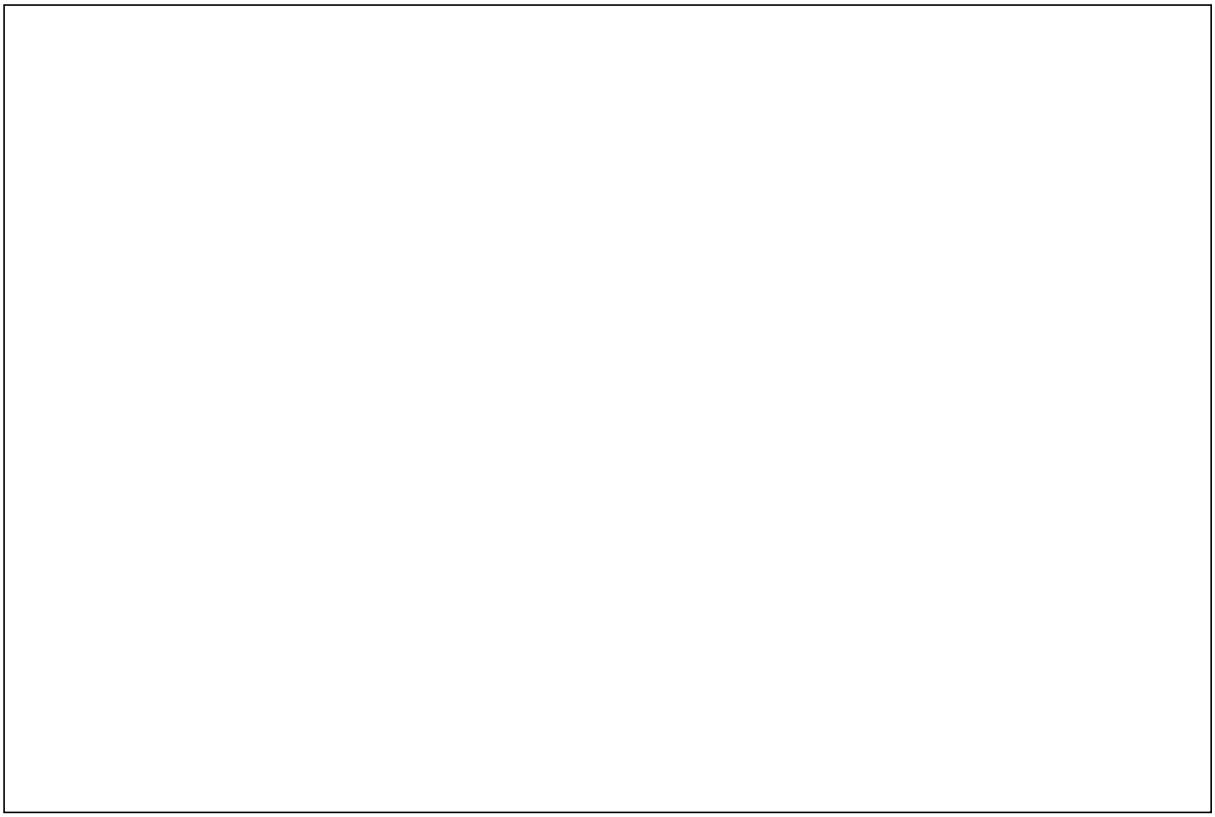
Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	19		1 and ground	
2	16		2 and ground	
3	20		3 and ground	
4	18		4 and ground	

12.a Yes; review this procedure. If the results are accurate and consistent, replace the MCM. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the engine side harness.

114.3 SPN 655/FMI 4 - GHG17

SPN 655/FMI 4	
Description	Injector Cylinder #5 Needle Control Valve Abnormal Operation (MIN)
Monitored Parameter	Injector Cylinder #5 Needle Control Valve
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

Note : Submit completed diagnostics with warranty claim.

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

1. Check for multiple codes. Using DiagnosticLink , retain log file of active fault and clear codes (code active for one key cycle). Is SPN 168 or 723/FMI any present?

   1.a Yes; service those faults first.

   1.b No; Go to step 2.

WARNING

ENGINE EXHAUST

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

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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the rear fuel injector harness 14-pin injector connector.
5. Inspect the rear fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the resistances within range?

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)					
Injector #4 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #5 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #6 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)					
Note: Ensure J-48671-10 ground strap is connected to cylinder head.					
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the rear fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

9.a Yes; replace the rear fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

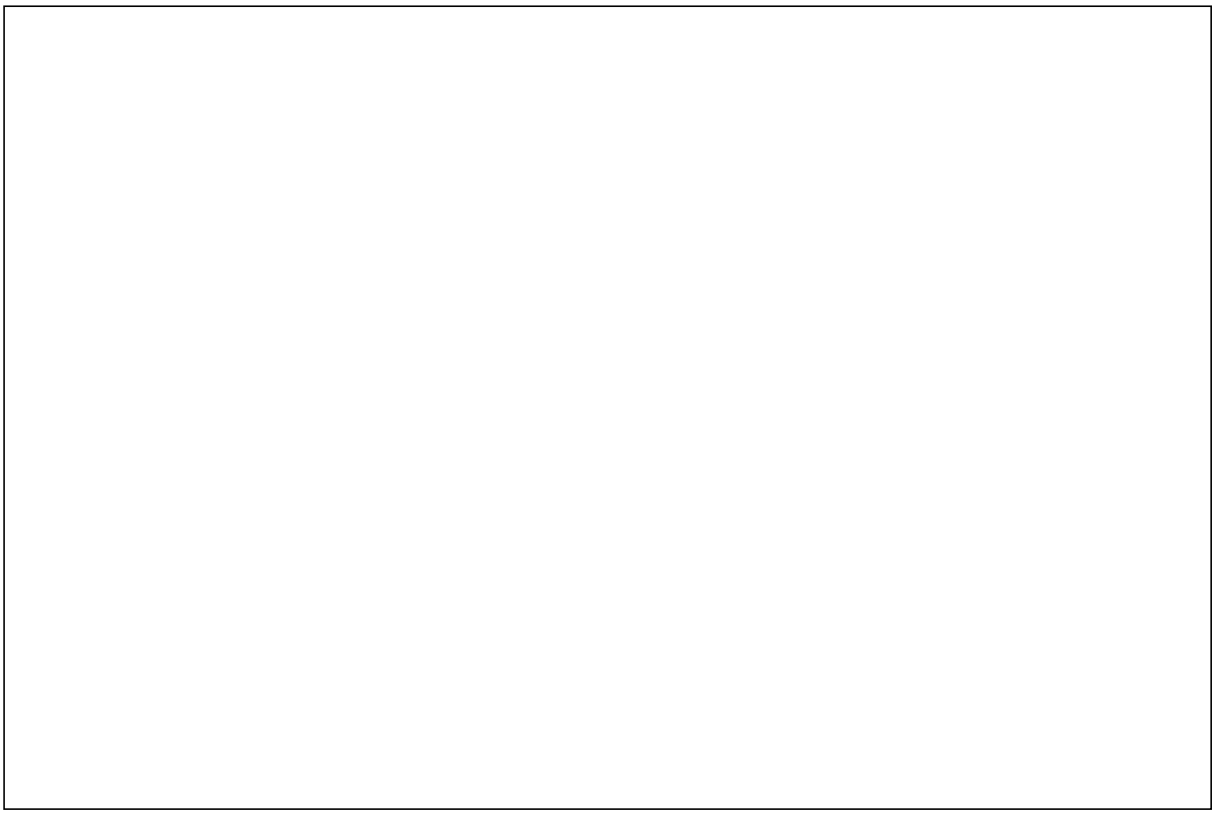
9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

10. Disconnect the Motor Control Module (MCM) 120-pin connector.

11. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Is damage present?

11.a Yes; verify repairs.

11.b No; Go to step 12.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

12. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

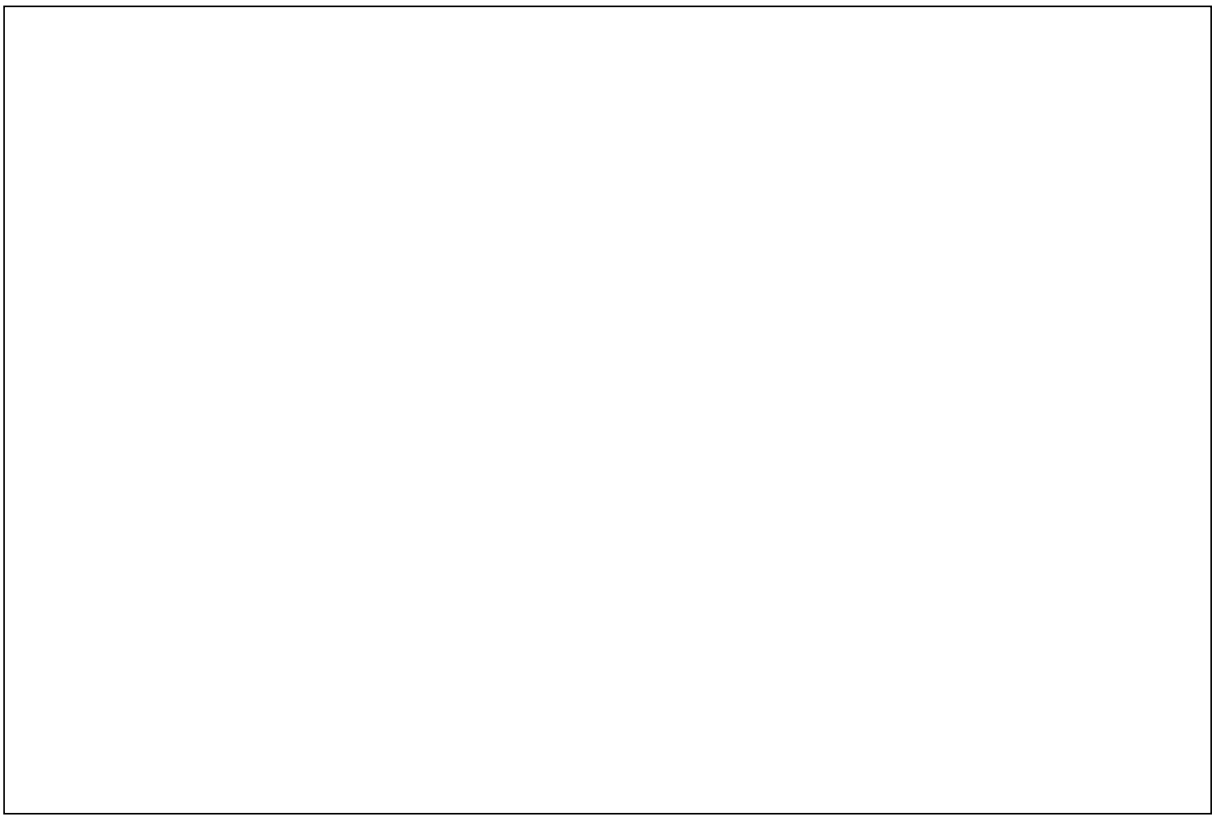
Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	19		1 and ground	
2	16		2 and ground	
3	20		3 and ground	
4	18		4 and ground	

12.a Yes; review this procedure. If the results are accurate and consistent, replace the MCM. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the engine side harness.

114.4 SPN 655/FMI 5 - GHG17

SPN 655/FMI 5	
Description	Injector Cylinder #5 Needle Control Valve Circuit Open
Monitored Parameter	Injector Cylinder #5 Needle Control
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

Note : Submit completed diagnostics with warranty claim.

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

1. Check for multiple codes. Using DiagnosticLink , retain log file of active fault and clear codes (code active for one key cycle). Is SPN 168 or 723/FMI any present?

   1.a Yes; service those faults first.

   1.b No; Go to step 2.

WARNING

ENGINE EXHAUST

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

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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the rear fuel injector harness 14-pin injector connector.
5. Inspect the rear fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the resistances within range?

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #4 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #5 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #6 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the rear fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

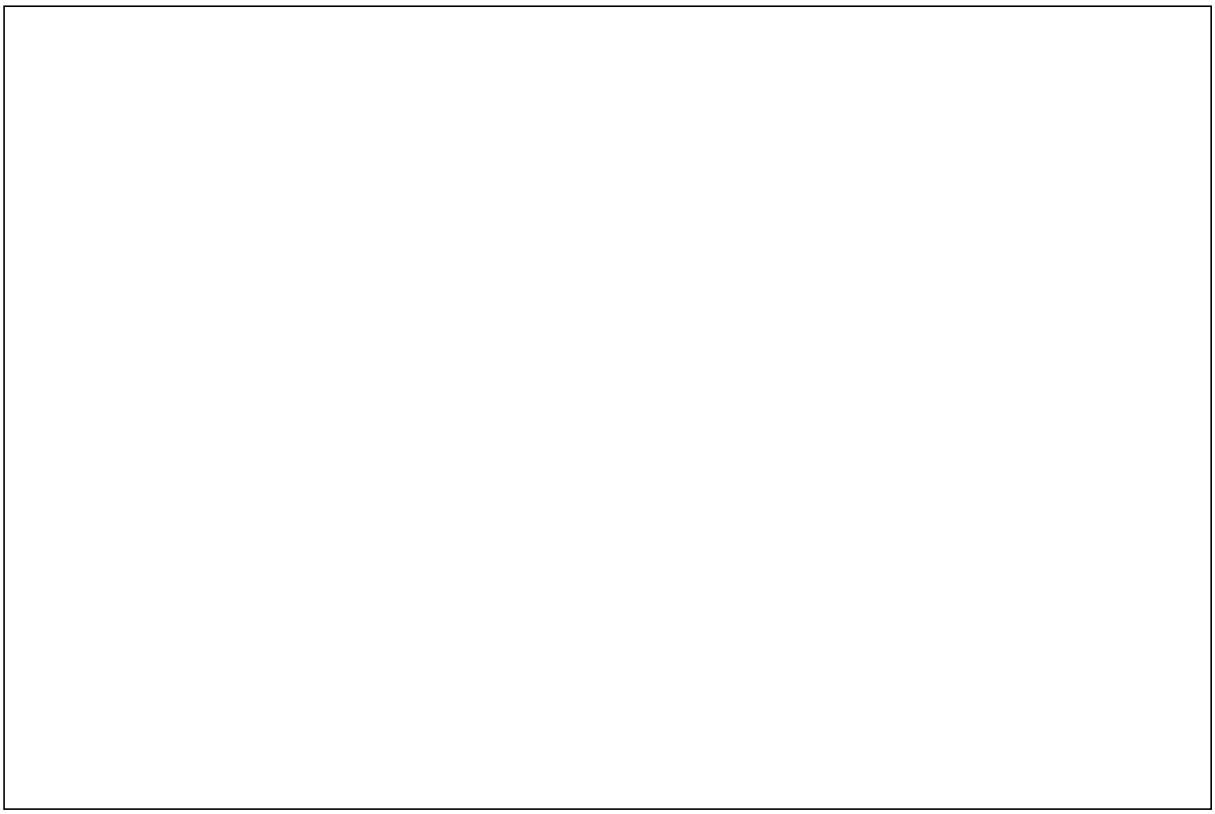
9.a Yes; replace the rear fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

10. Disconnect the Motor Control Module (MCM) 120-pin connector.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

11. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Is damage present?



11.a Yes; verify repairs.

11.b No; Go to step 12.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

12. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

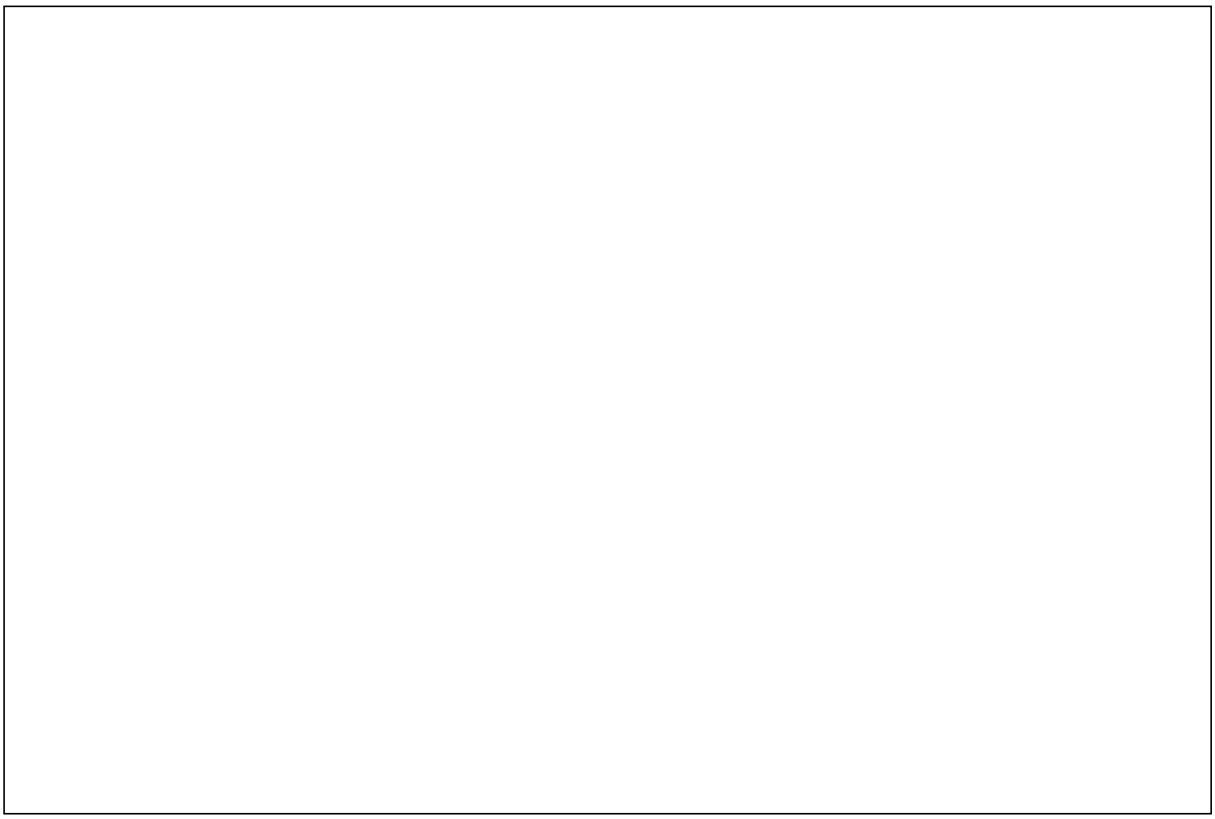
Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	19		1 and ground	
2	16		2 and ground	
3	20		3 and ground	
4	18		4 and ground	

12.a Yes; review this procedure. If the results are accurate and consistent, replace the MCM. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the engine side harness.

114.5 SPN 655/FMI 6 - GHG17

SPN 655/FMI 6	
Description	Injector Cylinder #5 Needle Control Valve Shorted Circuit
Monitored Parameter	Injector Cylinder #5 Needle Control Valve
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

Note : Submit completed diagnostics with warranty claim.

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

1. Check for multiple codes. Using DiagnosticLink , retain log file of active fault and clear codes (code active for one key cycle). Is SPN 168 or 723/FMI any present?

   1.a Yes; service those faults first.

   1.b No; Go to step 2.

WARNING

ENGINE EXHAUST

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

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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the rear rocker cover 14-pin injector harness connector.
5. Inspect the rear fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the resistances within range?

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)					
Injector #4 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #5 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #6 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)					
Note: Ensure J-48671-10 ground strap is connected to cylinder head.					
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the rear fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

9.a Yes; replace the rear fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

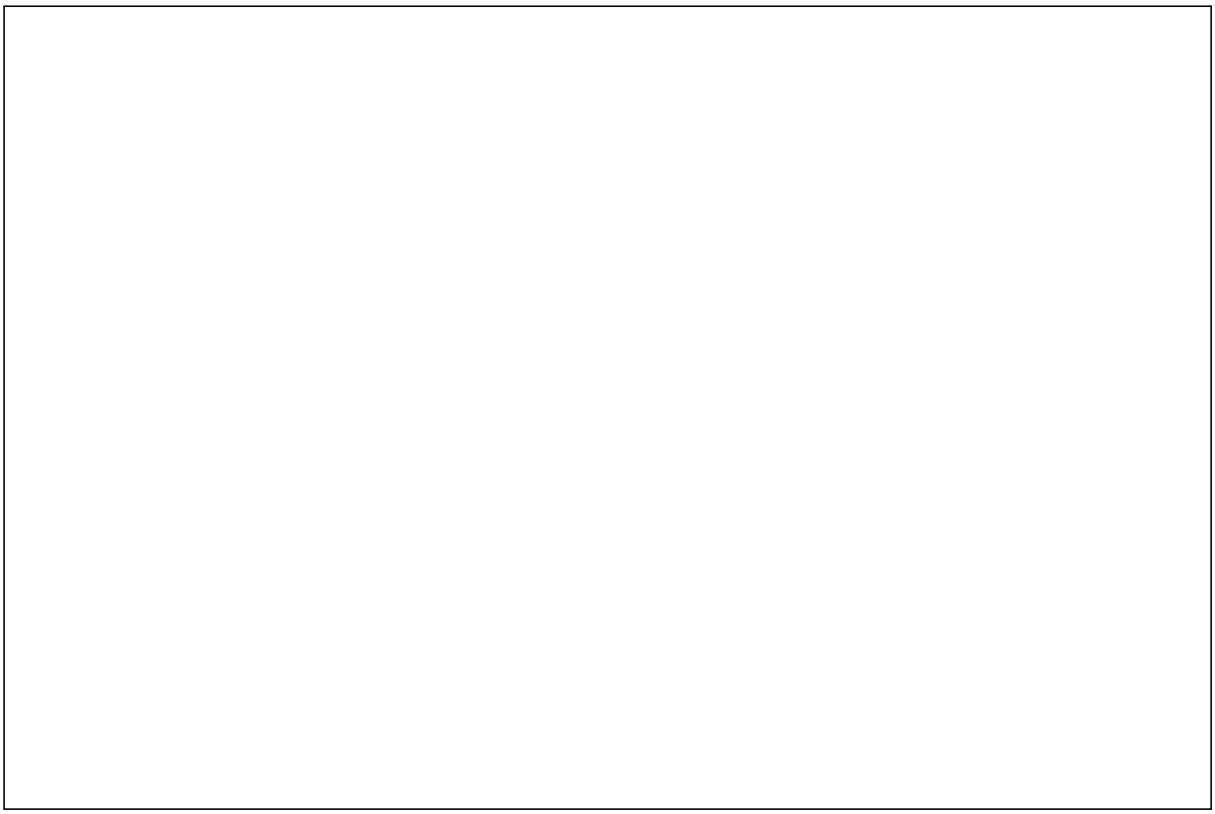
9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

10. Disconnect the Motor Control Module (MCM) 120-pin connector.

11. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Is damage present?

11.a Yes; verify repairs.

11.b No; Go to step 12.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

12. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	19		1 and ground	
2	16		2 and ground	
3	20		3 and ground	
4	18		4 and ground	

12.a Yes; review this procedure. If the results are accurate and consistent, replace the MCM. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the engine side harness.

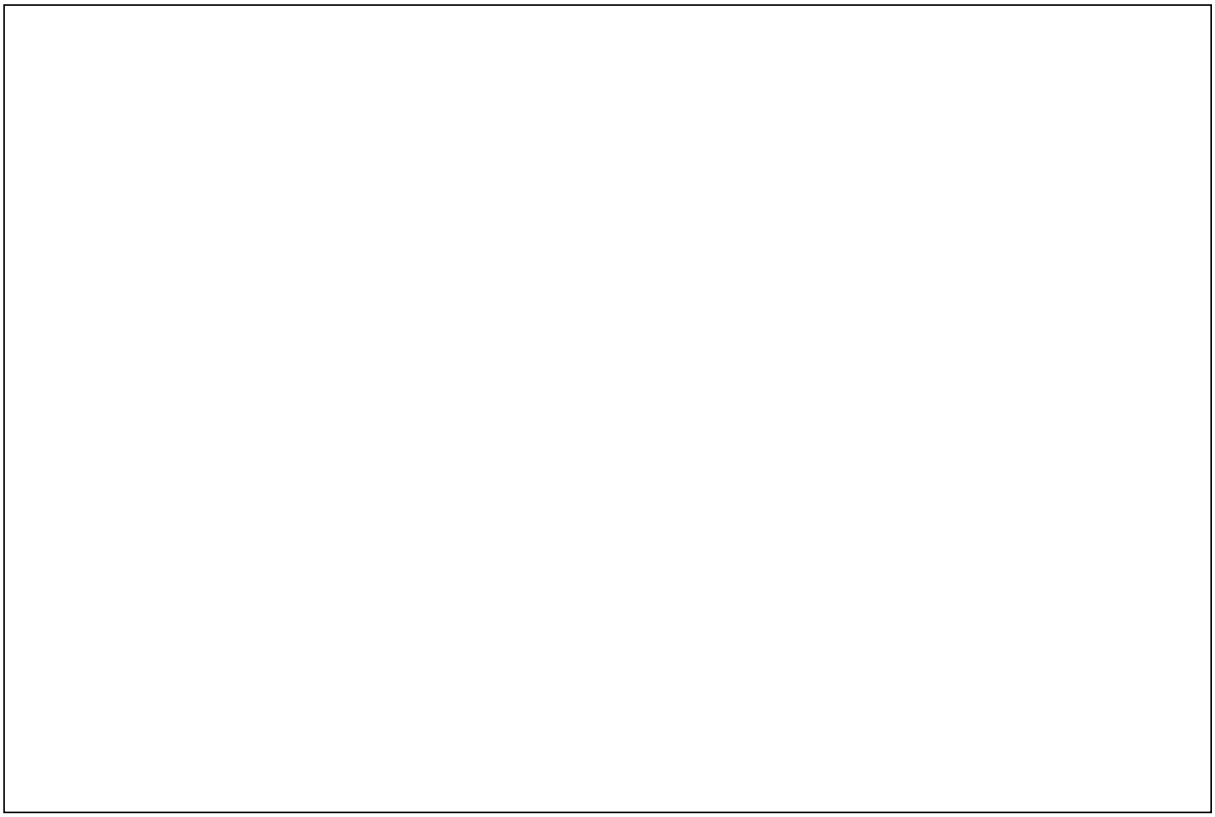
SPN 656 (MCM) (GHG17)

115.1 Electronic Diagram

Fig 115.1, Fuel Injector Electronic Diagram

115.2 SPN 656/FMI 3 - GHG17

SPN 656/FMI 3	
Description	Injector Cylinder #6 Needle Control Valve Abnormal Operation (MAX)
Monitored Parameter	Injector Cylinder #6 Needle Control Valve
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

Note : Submit completed diagnostics with warranty claim.

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

1. Check for multiple codes. Using DiagnosticLink , retain log file of active fault and clear codes (code active for one key cycle). Is SPN 168 or 723/FMI any present?

   1.a Yes; service those faults first.

   1.b No; Go to step 2.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the rear fuel injector harness 14-pin connector.
5. Inspect the rear fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the resistances within range?

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #4 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #5 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #6 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the rear fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

9.a Yes; replace the rear fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

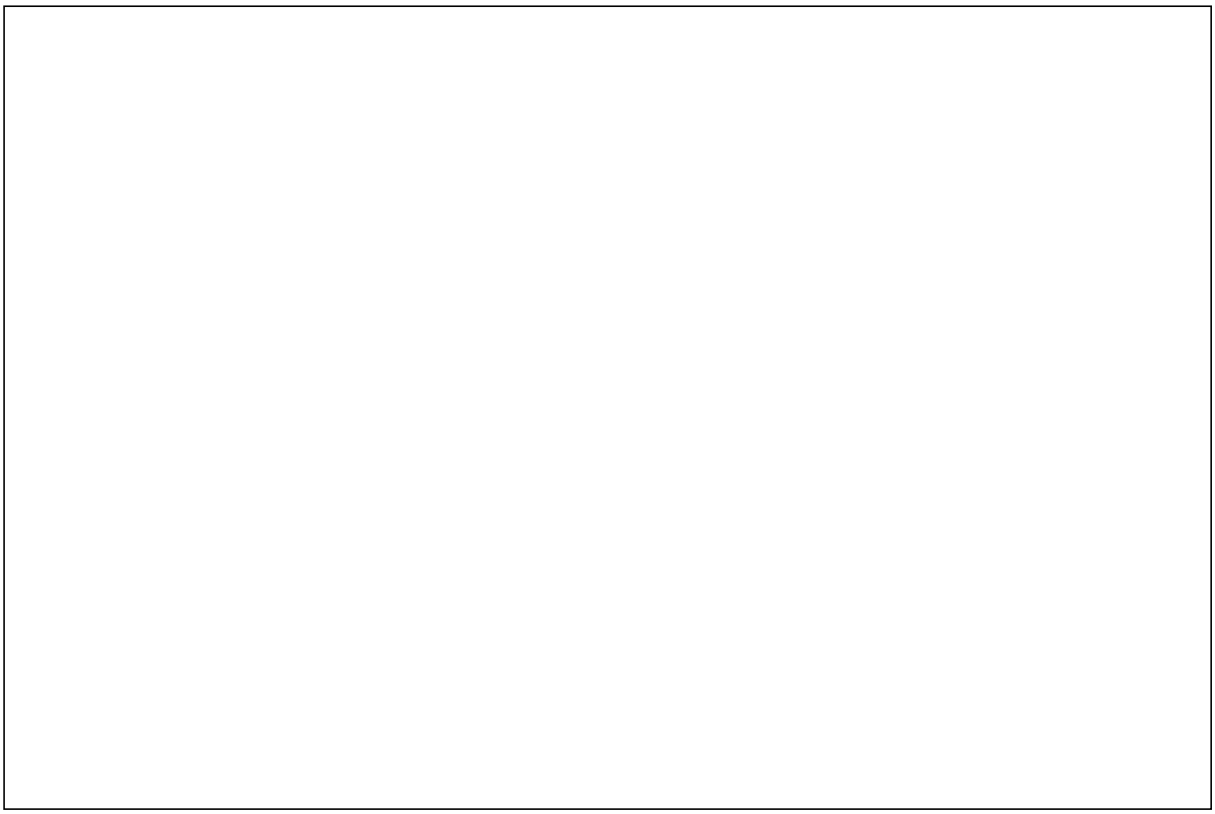
10. Disconnect the Motor Control Module (MCM) 120-pin connector.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

11. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Is damage present?

11.a Yes; verify repairs.

11.b No; Go to step 12.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

12. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

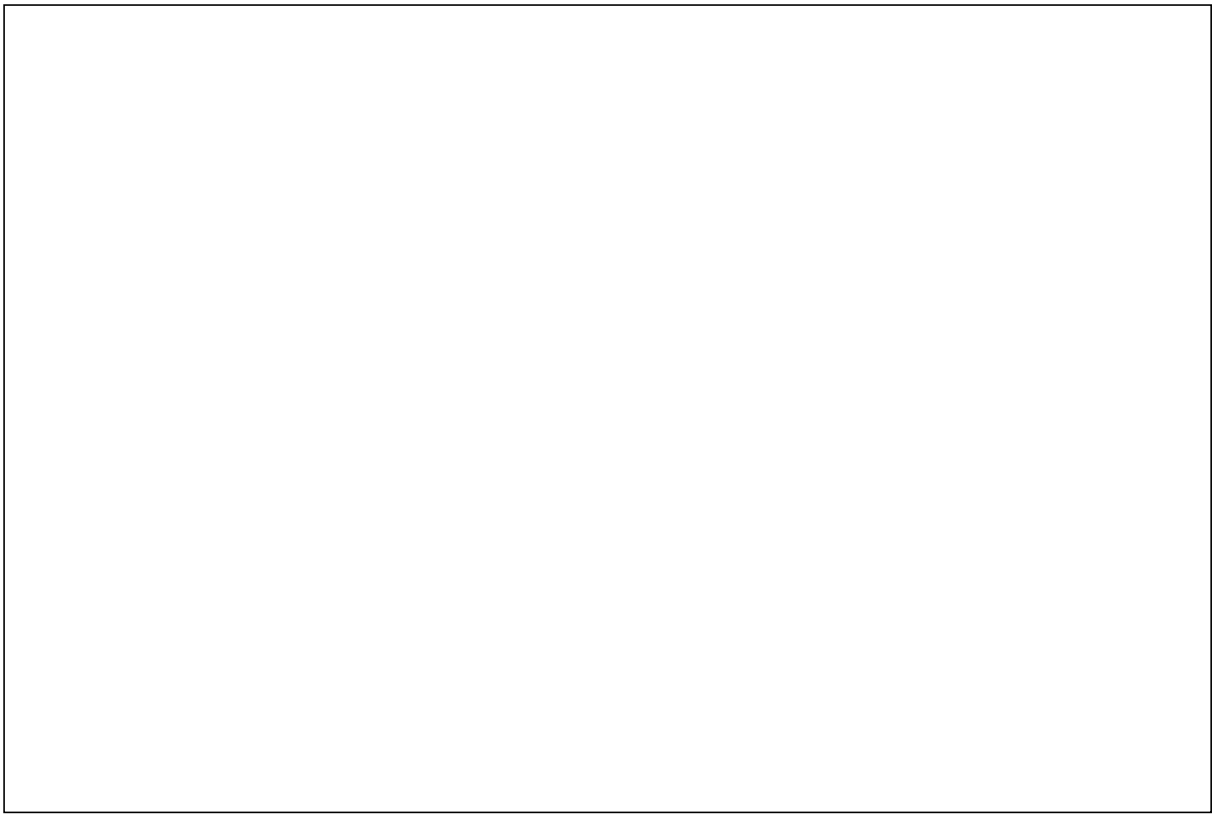
Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	19		1 and ground	
2	16		2 and ground	
3	20		3 and ground	
4	18		4 and ground	

12.a Yes; review this procedure. If the results are accurate and consistent, replace the MCM. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the engine side harness.

115.3 SPN 656/FMI 4 - GHG17

SPN 656/FMI 4	
Description	Injector Cylinder #6 Needle Control Valve Abnormal Operation (MIN)
Monitored Parameter	Injector Cylinder #6 Needle Control Valve
Typical Enabling Conditions	Engine RPM = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

Note : Submit completed diagnostics with warranty claim.

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

1. Check for multiple codes. Using DiagnosticLink , retain log file of active fault and clear codes (code active for one key cycle). Is SPN 168 or 723/FMI any present?

   1.a Yes; service those faults first.

   1.b No; Go to step 2.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the rear fuel injector harness 14-pin injector connector.
5. Inspect the rear fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the resistances within range?

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #4 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #5 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #6 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the rear fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

9.a Yes; replace the rear fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

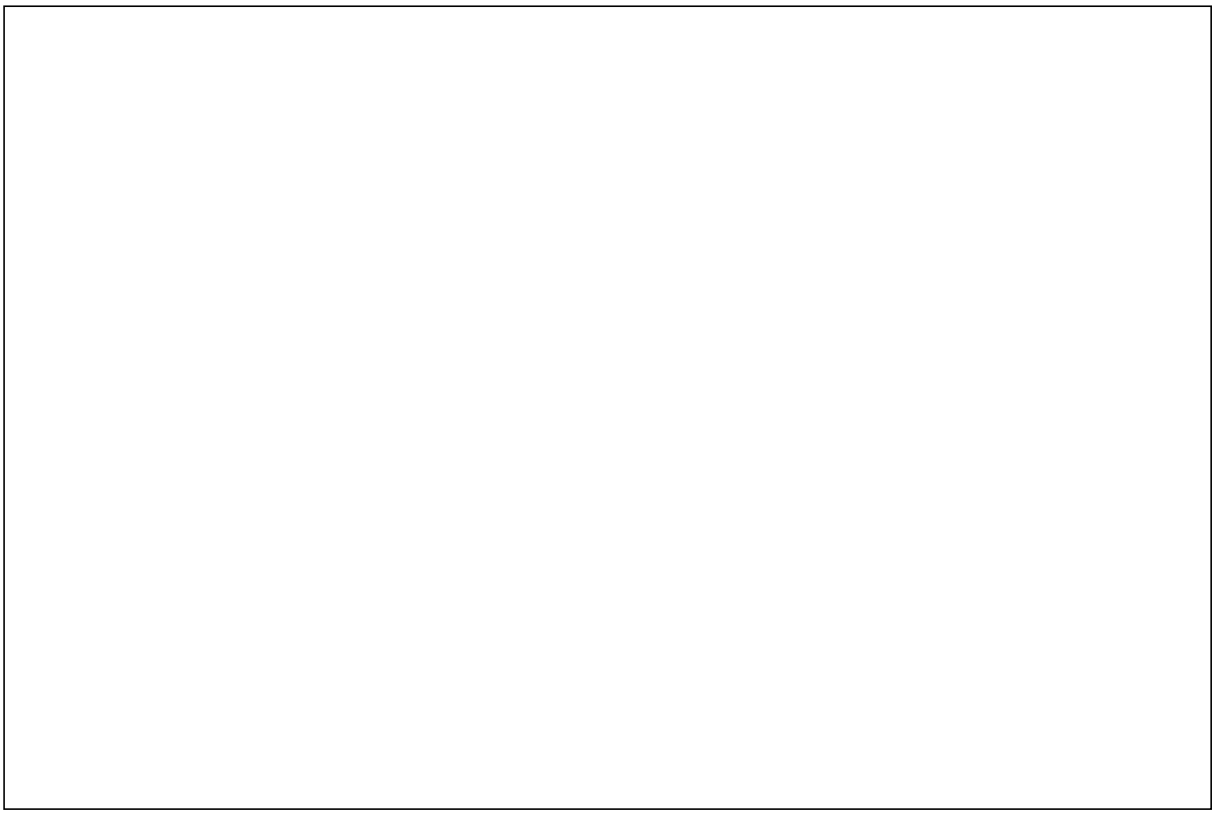
10. Disconnect the Motor Control Module (MCM) 120-pin connector.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

11. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage.

11.a Yes; verify repairs.

11.b No; Go to step 12.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

12. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

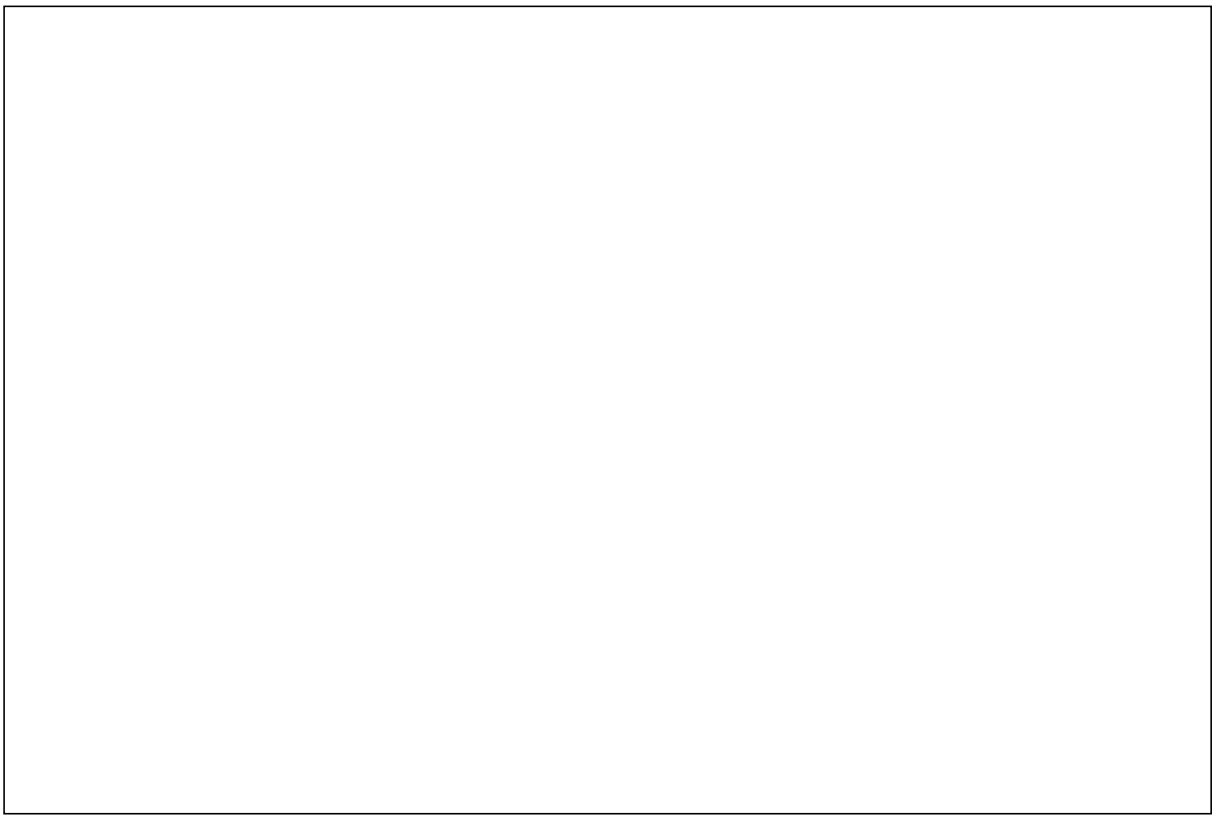
Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	19		1 and ground	
2	16		2 and ground	
3	20		3 and ground	
4	18		4 and ground	

12.a Yes; review this procedure. If the results are accurate and consistent, replace the MCM. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the engine side harness.

115.4 SPN 656/FMI 5 - GHG17

SPN 656/FMI 5	
Description	Injector Cylinder #6 Needle Control Valve Circuit Open
Monitored Parameter	Injector Cylinder #6 Needle Control Valve
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

Note : Submit completed diagnostics with warranty claim.

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

1. Check for multiple codes. Using DiagnosticLink , retain log file of active fault and clear codes (code active for one key cycle). Is SPN 168 or 723/FMI any present?

   1.a Yes; service those faults first.

   1.b No; Go to step 2.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the rear fuel injector harness 14-pin connector.
5. Inspect the rear fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the resistances within range?

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)					
Injector #4 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #5 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #6 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)					
Note: Ensure J-48671-10 ground strap is connected to cylinder head.					
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the rear fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

9.a Yes; replace the rear fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

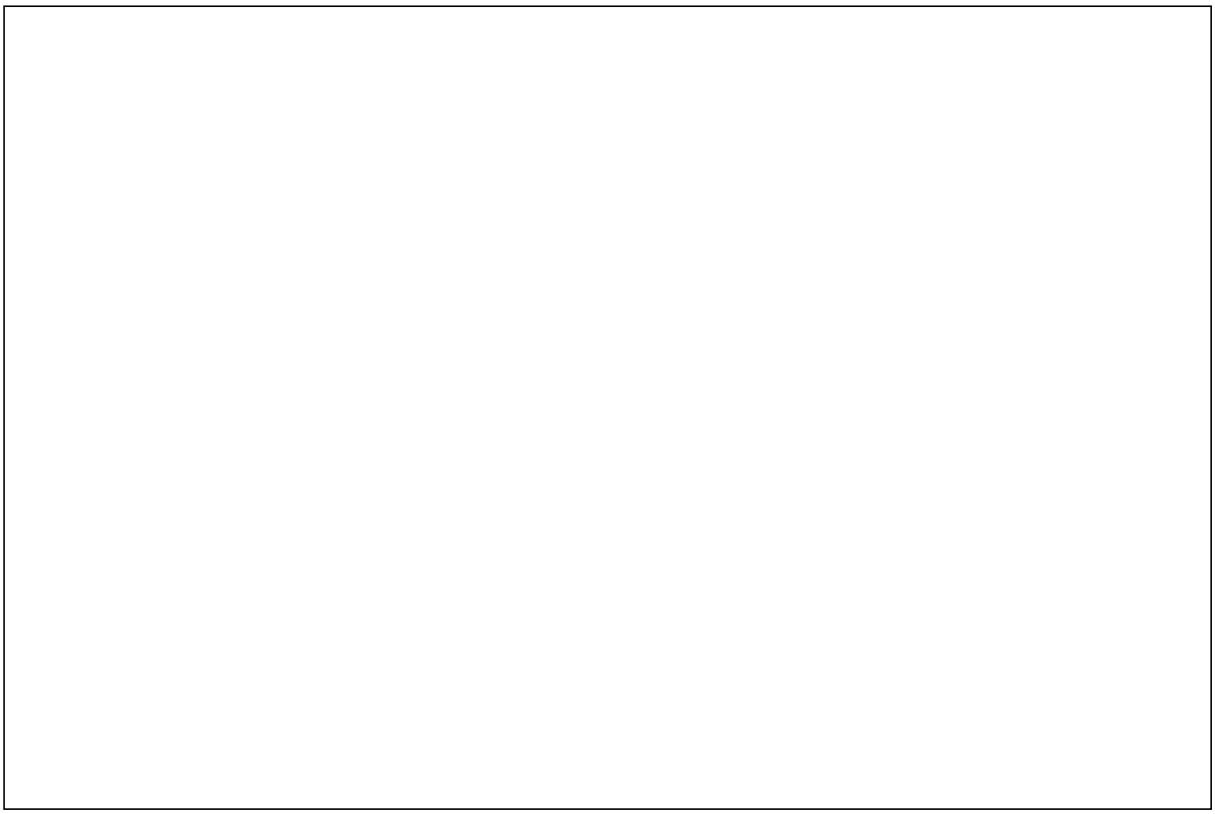
10. Disconnect the Motor Control Module (MCM) 120-pin connector.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

11. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Is damage present?

11.a Yes; verify repairs.

11.b No; Go to step 12.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

12. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

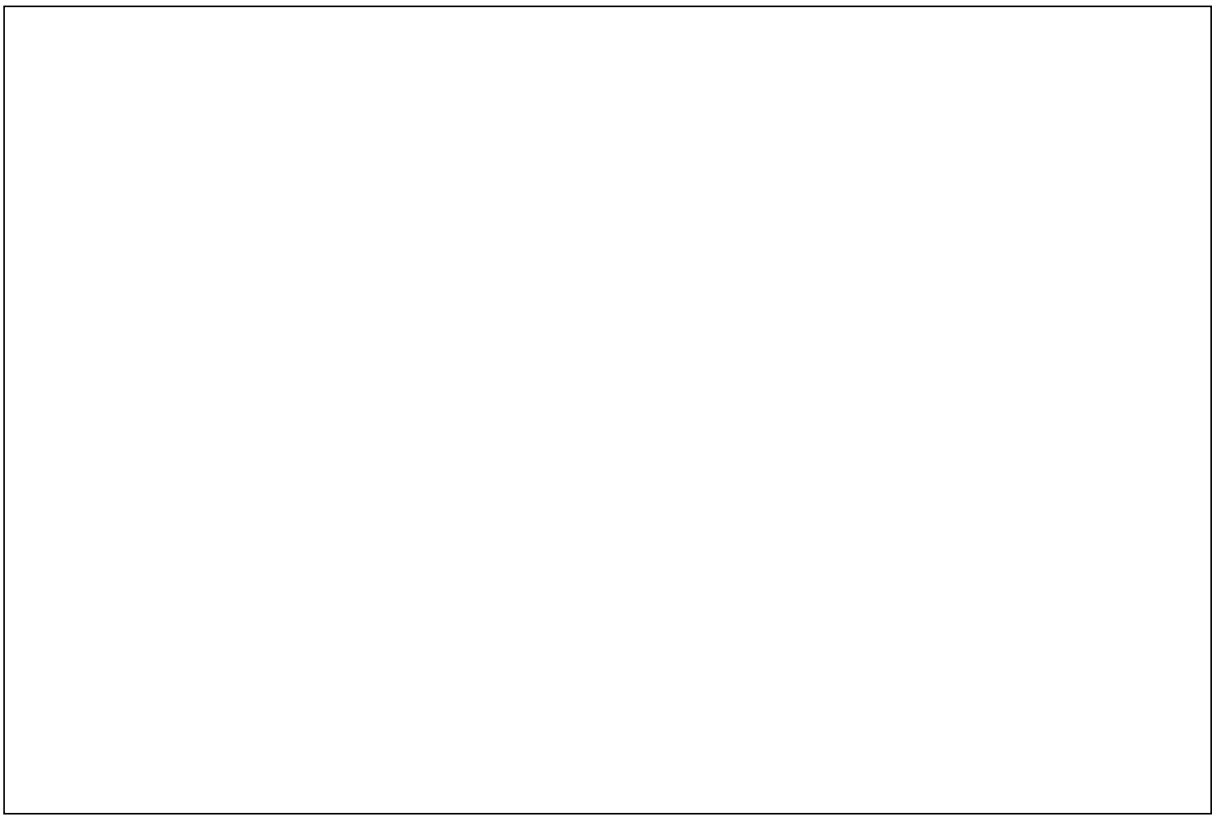
Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	19		1 and ground	
2	16		2 and ground	
3	20		3 and ground	
4	18		4 and ground	

12.a Yes; review this procedure. If the results are accurate and consistent, replace the MCM. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the engine side harness.

115.5 SPN 656/FMI 6 - GHG17

SPN 656/FMI 6	
Description	Injector Cylinder #6 Needle Control Valve Shorted Circuit
Monitored Parameter	Injector Cylinder #6 Needle Control Valve
Typical Enabling Conditions	Engine rpm = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)



Check as follows:

Note : Submit completed diagnostics with warranty claim.

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

1. Check for multiple codes. Using DiagnosticLink , retain log file of active fault and clear codes (code active for one key cycle). Is SPN 168 or 723/FMI any present?

   1.a Yes; service those faults first.

   1.b No; If SPN fault code 168 or 723/FMI any is NOT present, Go to step 2.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the rear fuel injector harness 14-pin connector.
5. Inspect the rear fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is damage present?

   5.a Yes; repair as necessary.

   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the resistances within range?

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)					
Injector #4 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #5 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #6 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)					
Note: Ensure J-48671-10 ground strap is connected to cylinder head.					
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the rear fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

9.a Yes; replace the rear fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

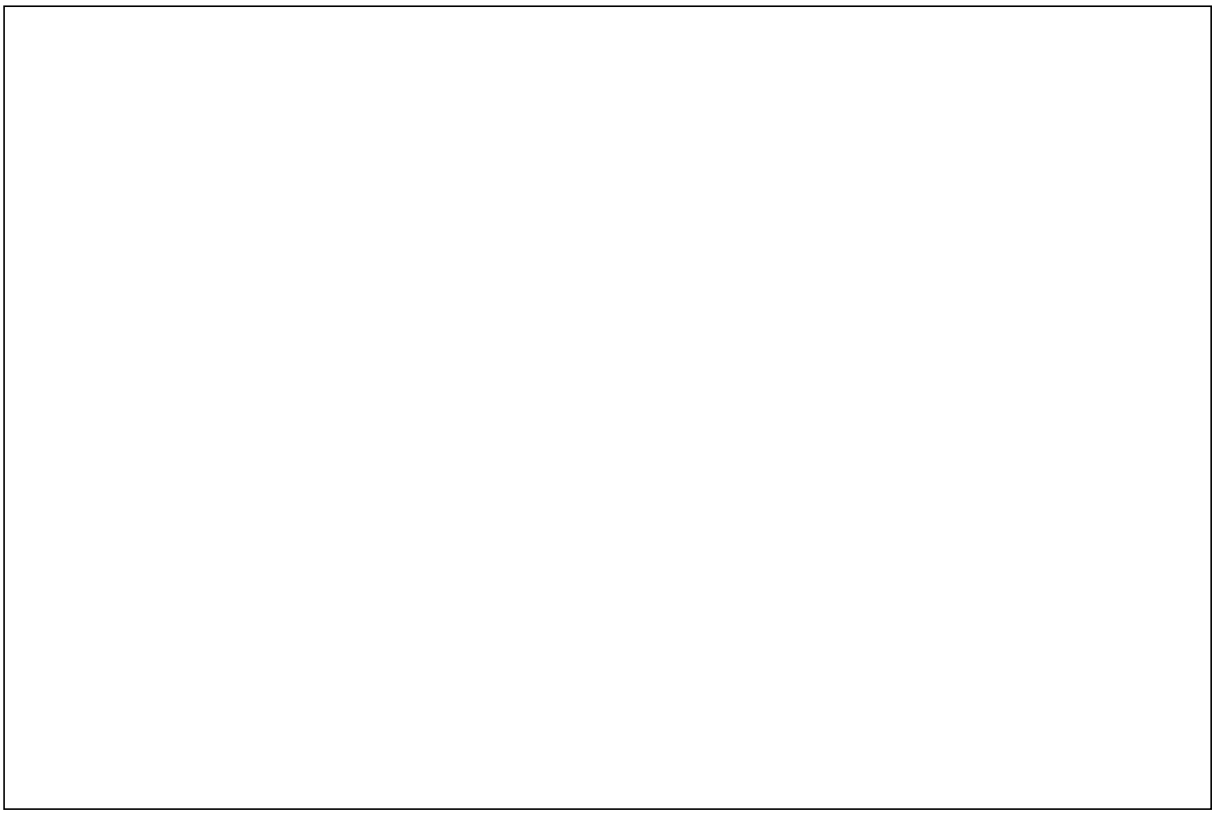
10. Disconnect the Motor Control Module (MCM) 120-pin connector.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

11. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Is damage present?

11.a Yes; verify repairs.

11.b No; Go to step 12.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

12. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	19		1 and ground	
2	16		2 and ground	
3	20		3 and ground	
4	18		4 and ground	

12.a Yes; review this procedure. If the results are accurate and consistent, replace the MCM. Refer to section "Removal of the Motor Control Module" .

12.b No; repair the engine side harness.

SPN 667 (CPC) (GHG17)

116.1 SPN 667/FMI 3 - GHG17

SPN 667/FMI 3	
Description	Short to Power on Pin 18 of the CPC Connector #1
Monitored Parameter	Run Start
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key ON, Engine ON

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

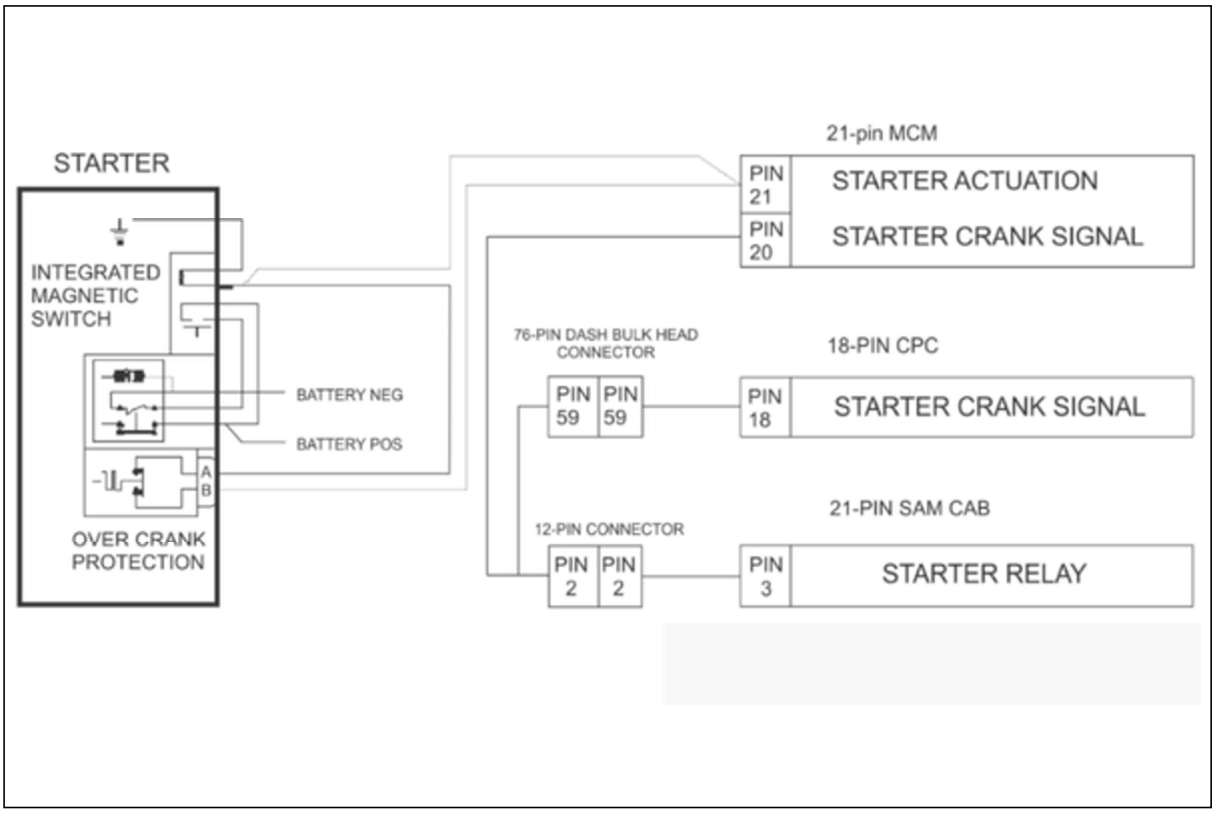
1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   - 1.a Yes; repair the battery voltage concern. Verify repair.
   - 1.b No; Go to step 2.
2. Has the Common Powertrain Controller (CPC) been recently programmed?
   - 2.a Yes; check the proper configuration of the CPC.
   - 2.b No; repair a short to Power on pin 18 of the CPC Connector #1 circuit. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

SPN 677 (MCM) (GHG17)

117.1 SPN 677/FMI 2 - GHG17

Starter Switch Inconsistent

SPN 677/FMI 2	
Description	This Fault Code Sets When the Motor Control Module (MCM) Sees that the Starter Ignition Status from the Common Powertrain Controller (CPC) and MCM Do Not Match.
Monitored Parameter	Starter Voltage Signal
Typical Enabling Conditions	Engine Start
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine Start



1. Connect DiagnosticLink .
2. Erase fault code SPN 677/FMI 2.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

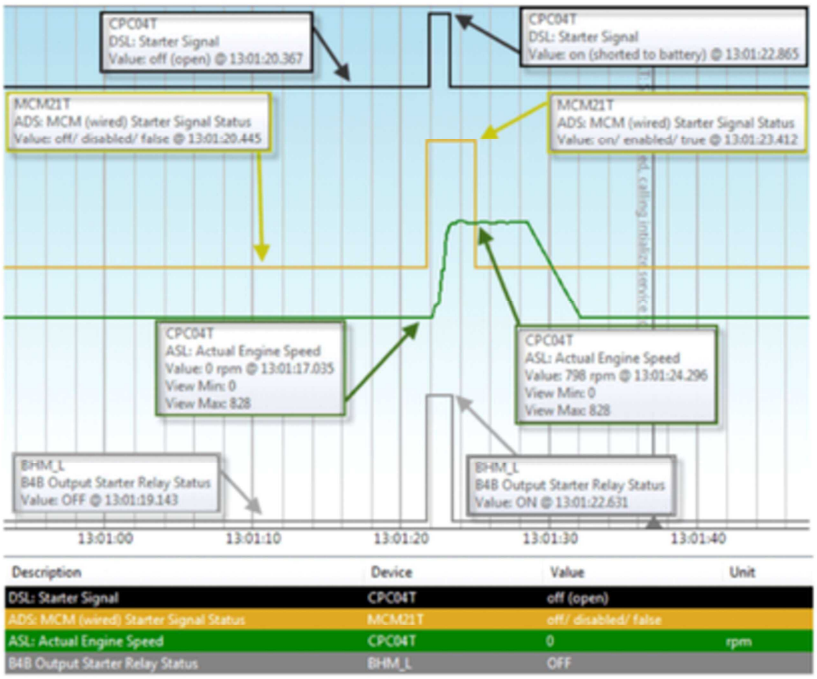
> **⚠ WARNING**
>
> PERSONAL INJURY
>
> To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

3. Start the engine.
4. Check the fault codes. Does SPN 677/FMI 2 become active?

   4.a Yes; Go to step 5.

   4.b No; the fault may have been caused by a previous low voltage concern. No further diagnostics or repairs are needed.
5. Turn the ignition OFF.
6. Turn the ignition ON (key ON, engine OFF) and reconnect DiagnosticLink.
7. In the left side menu, select Instrumentations and select chart view in the top menu. Load the following monitors:

- DSL: Starter Signal CPC
- ADS: MCM (wired) Starter Signal Status
- ASL: Actual Engine Speed
- B4B Output Starter Relay Status



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⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

8. Monitor the DSL: Starter Signal CPC and the B4B Output Starter Relay status, then start the engine. Does the DSL: Starter Signal CPC status change from "Value: off (Open)" to "Value: on (shorted to battery)" when the B4B Output Starter Relay status changes from "Value: OFF" to "Value: ON"?

   8.a Yes; Go to step 9.

   8.b No; Go to step 17.

Note : It is normal for the ADS: MCM (wired) Starter Signal Status to remain on longer than the DSL: Starter Signal CPC and B4B Output Starter Relay status.

9. Turn the ignition OFF.
10. Turn the ignition ON (key ON, engine OFF) and reconnect DiagnosticLink.

> **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.

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

11. Monitor the ADS: MCM (wired) Starter Signal Status and the B4B Output Starter Relay status, then start the engine. Does the ADS: MCM (wired) Starter Signal Status change from "Value: off/disabled/false" to "Value: on/enabled/true when the B4B Output Starter Relay status changes from "Value: OFF" to "Value: ON"?

    11.a Yes; Go to step 12.

    11.b No; Go to step 22.

12. Turn the ignition OFF.
13. Program and install a test CPC.
14. Turn the ignition ON (key ON, engine OFF) and reconnect DiagnosticLink.

> **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.

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

15. Start the engine.
16. Does fault code SPN 677/FMI 2 become active?

    16.a Yes; replace the MCM.

    16.b No; replace the CPC.

17. Disconnect and inspect the CPC #1 electrical connector harness side. Is there corrosion present?

    17.a Yes; replace the CPC and the electrical connector.

    17.b No; Go to step 18.

18. Is the connector or pin 18 damaged?

    18.a Yes; Go to step 19.

    18.b No; Go to step 20.

19. Inspect the CPC #1 electrical connector component side. Is the connector or pin 18 damaged?

    19.a Yes; replace the CPC and repair the electrical connector.

19.b No; repair/replace the CPC electrical connector and/or pin 18.

20. Using the appropriate probe tool, check pin 18 of the CPC #1 electrical connector. Is pin 18 spread?

20.a Yes; replace pin 18 in the CPC #1 electrical connector.

20.b No; Go to step 21.

21. Measure the voltage on pin 18 when the ignition is turned ON (key ON, engine OFF). Is the voltage on pin 18 greater than 10.5 volts?

21.a Yes; replace the CPC.

21.b No; repair the circuit between pin 18 of the #1 CPC electrical connector and the circuit splice.

22. Disconnect and inspect the MCM 21-pin electrical connector. Is there any corrosion present?

22.a Yes; replace the MCM and repair the 21-pin electrical connector.

22.b No; Go to step 23.

23. Are any of the pins or the connector damaged?

23.a Yes; Go to step 24.

23.b No; Go to step 25.

24. Inspect the MCM 21-pin electrical connector component side. Are any of the pins or the connector damaged?

24.a Yes; replace the MCM and the 21-pin electrical connector.

24.b No; repair the MCM 21-pin electrical connector.

25. Use the appropriate flex probe to check pin 20 in the MCM 21-pin electrical connector. Is pin 20 spread?

25.a Yes; replace pin 20 in the MCM 21-pin electrical connector harness side. Verify repair.

25.b No; Go to step 26.

26. Measure the voltage on pin 20 of the MCM 21-pin electrical connector harness side when the ignition is turned ON (key ON, engine OFF). Is the voltage on pin 20 greater than 10.5 volts?

26.a Yes; replace the MCM.

26.b No; repair the circuit between pin 20 of the MCM 21-pin electrical connector and the circuit splice.

117.2 SPN 677/FMI 3 - GHG17

Engine Starter Relay Shorted to High Source

NOTICE

Ignition must be off for at least 30 seconds before performing this test.

1. Turn ignition OFF for 30 seconds.
2. Disconnect the Motor Control Module (MCM) 21-pin connector.
3. Turn the ignition ON, (key ON, engine OFF).
4. Measure the voltage between pin 12 of the MCM 21-pin connector and ground.
   - 4.a If voltage is present, repair short to power on pin 12 of the MCM 21-pin connector; refer to Original Equipment Manufacturer (OEM) manual for wiring diagram.
   - 4.b If no voltage is present, replace the starter relay.

117.3 SPN 677/FMI 4 - GHG17

Engine Starter Relay Circuit Failed Low

1. Disconnect the Motor Control Module (MCM) 21–pin connector.
2. Remove the engine starter relay.

Note : Refer to Original Equipment Manufacturer (OEM) wiring schematic for correct pin location for the engine starter relay.

3. Measure the resistance between pin 21 of the MCM 21–pin connector and the engine starter relay.
   - 3.a If the resistance is greater than 3 ohms, repair open between pin 21 of the MCM 21–pin connector and the engine starter relay.
   - 3.b If the resistance is less than 3 ohms, replace the engine starter relay. Refer to OEM procedures.

117.4 SPN 677/FMI 7 - GHG17

Engine Starter Relay Jammed

Note : Ignition must be off for at least 30 seconds before performing this test.

1. Turn ignition OFF for 30 seconds.
2. Disconnect the MCM 21-pin connector.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 21 of the MCM 21-pin connector and ground.

   4.a If voltage is present, repair short to power on pin 21 of the MCM 21-pin connector (refer to OEM manual for wiring diagram).

   4.b If no voltage is present, replace the starter relay. Refer to OEM procedures.

SPN 701 (CPC) (GHG17)

118.1 SPN 701/FMI 3 - GHG17

SPN 701/FMI 3	
Description	Output 3/07 Circuit Short to Power
Monitored Parameter	Pin 7 of the CPC #3 Connector
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON Engine OFF

Note : The Common Powertrain Controller (CPC) digital outputs have the same SPN as some Motor Control Module (MCM) faults. DiagnosticLink® makes the distinction between the MCM and CPC when diagnosing a fault.

1. Turn the ignition ON (Key ON, engine OFF).
2. Connect to DiagnosticLink .
3. Verify parameters - go to the parameters work window.
4. Verify that the parameters in PGR035 digital outputs are set to the specific component to which this is configured (example: grid heater).
5. Are the parameters configured correctly?

   5.a Yes; Go to step 6.

   5.b No; configure the parameters properly.
6. Fix the short to power on pin 7 circuit of the CPC #3 connector. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

118.2 SPN 701/FMI 4 - GHG17

Digital Output 3/07 Circuit Failed Low

SPN 701/FMI 4	
Description	Output 3/07 Circuit Short to Ground
Monitored Parameter	Pin 7 of the CPC #3 Connector
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON Engine OFF

Note : The Common Powertrain Controller (CPC) digital outputs have the same SPN as some Motor Control Module (MCM) faults. DiagnosticLink® makes the distinction between the MCM and CPC when diagnosing a fault.

1. Turn the ignition ON (Key ON, engine OFF).
2. Connect to DiagnosticLink .
3. Verify parameters – go to the parameters work window.
4. Verify that the parameters in PGR035 digital outputs are set to the specific component to which this is configured (example: grid heater).
5. Are the parameters configured correctly?

   5.a Yes; Go to step 6.

   5.b No; configure the parameters properly.
6. Fix the short to ground on pin 7 circuit of the CPC #3 connector. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

118.3 SPN 701/FMI 5 - GHG17

SPN 701/FMI 5	
Description	Output 3/07 Open Circuit
Monitored Parameter	Pin 7 of the CPC #3 Connector
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON Engine OFF

Note : The Common Powertrain Controller (CPC) digital outputs have the same SPN as some Motor Control Module (MCM) faults. DiagnosticLink® makes the distinction between the MCM and CPC when diagnosing a fault.

1. Turn the ignition ON (Key ON, engine OFF).
2. Connect to DiagnosticLink .
3. Verify parameters – go to the parameters work window.
4. Verify that the parameters in PGR035 digital outputs are set to the specific component to which this is configured (example: grid heater).
5. Are the parameters configured correctly?
   - 5.a Yes; Go to step 6.
   - 5.b No; configure the parameters properly.
6. Fix the open circuit on pin 7 circuit of the CPC #3 connector. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

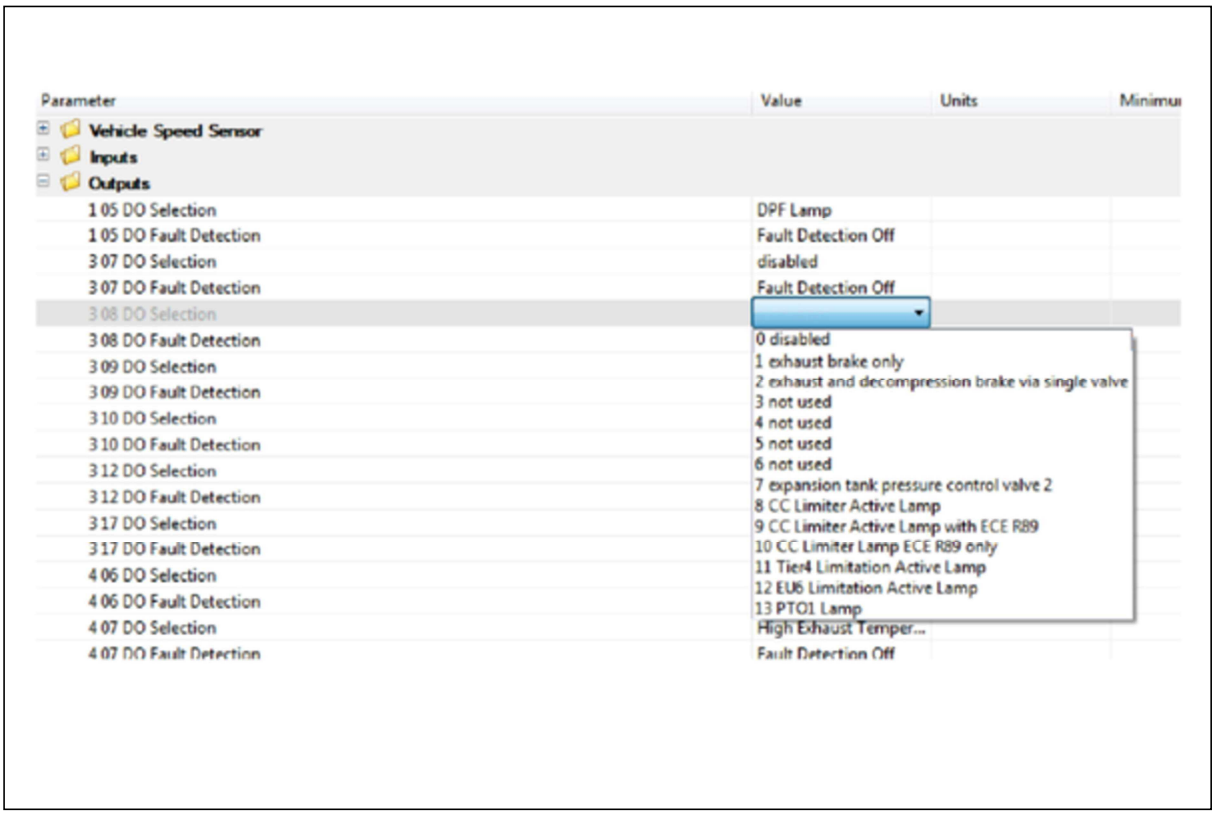
SPN 702 (CPC) (GHG17)

119.1 SPN 702/FMI 3 - GHG17

SPN 702/FMI 3	
Description	CPC Output 3 08 Short to Voltage
Monitored Parameter	CPC Output 3/8
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On With Output Activation

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .

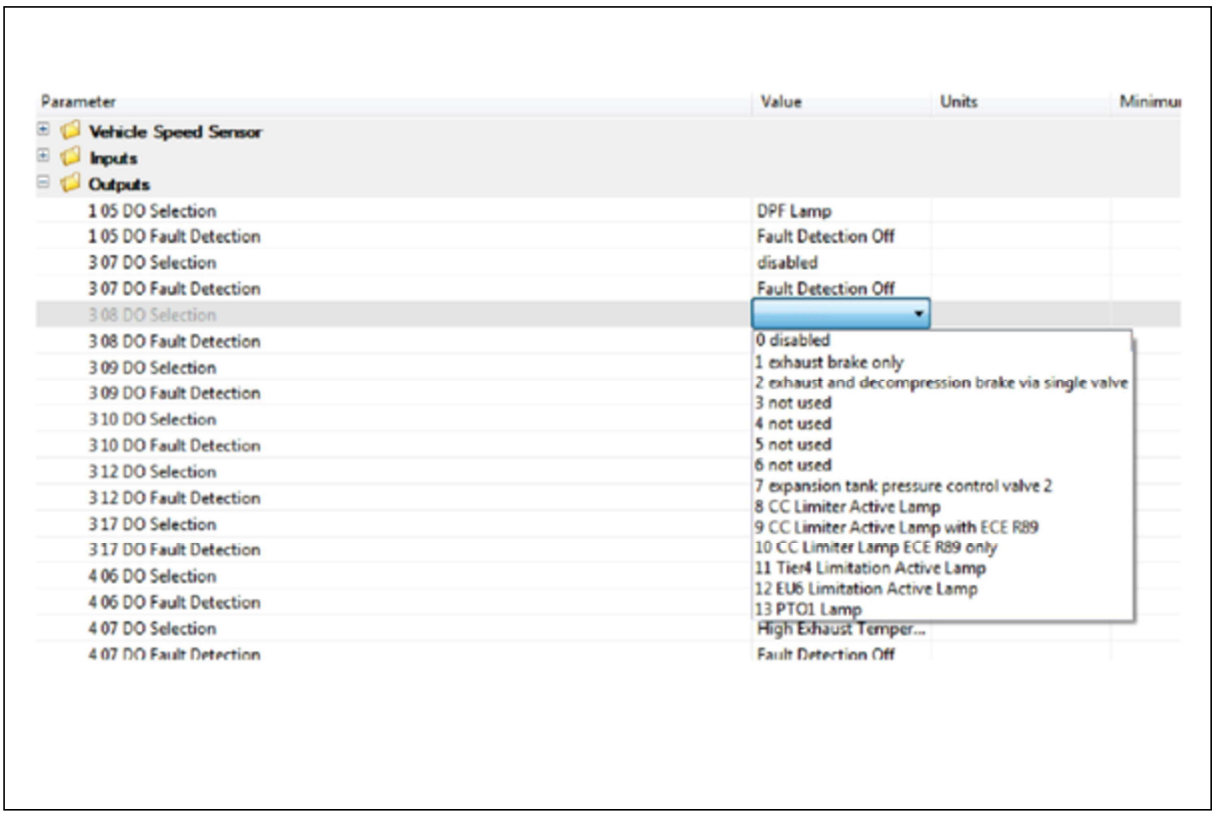


3. Under parameter, identify the parameter set to 3 08 DO Selection. Based on the parameter selected repair the short to power between pin 8 of the CPC connector #3 and the OEM component. Refer to Original Equipment Manufacturer (OEM) literature for wiring schematic information.

119.2 SPN 702/FMI 4 - GHG17

SPN 702/FMI 4	
Description	CPC Output 3 08 Short to Ground
Monitored Parameter	CPC Output 3/8
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On With Output Activation

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .

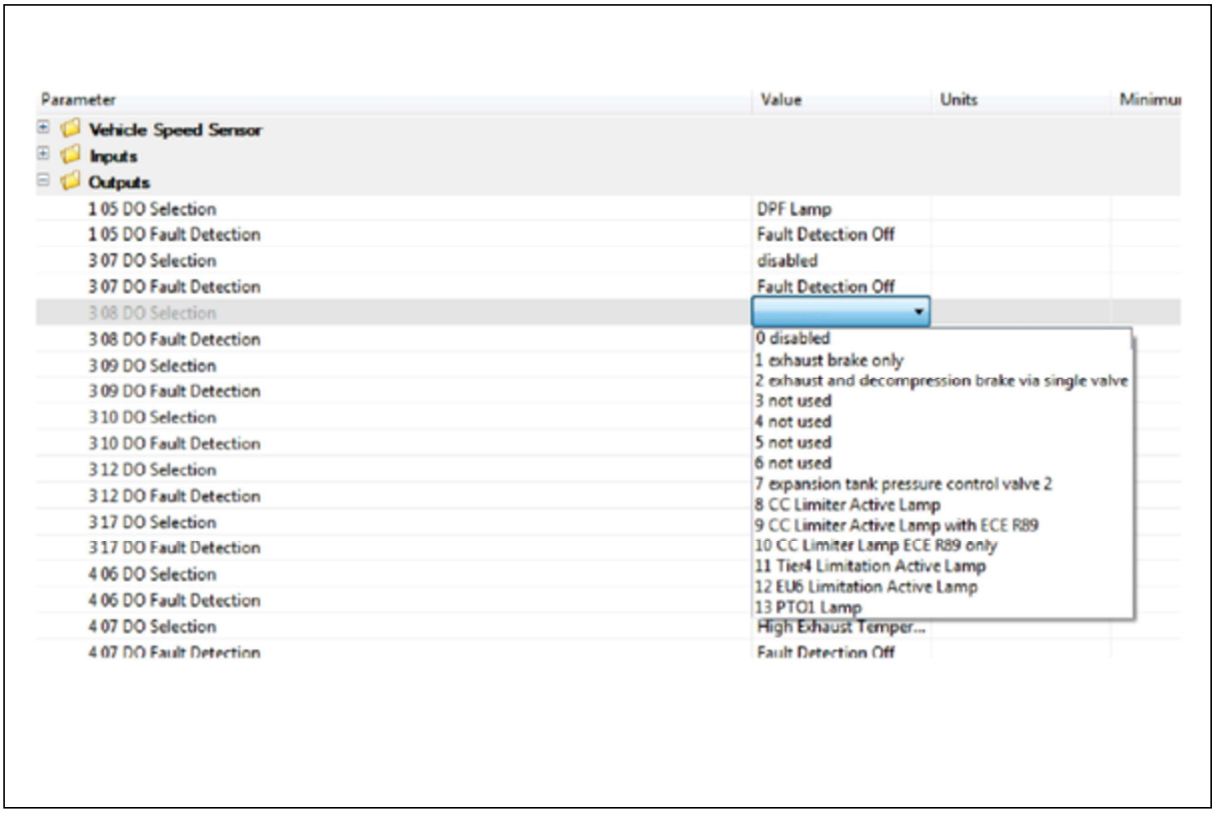


3. Under parameter, identify the parameter set to 3 08 DO Selection. Based on the parameter selected repair the short to ground between pin 8 of the CPC connector #3 and the OEM component. Refer to Original Equipment Manufacturer (OEM) literature for wiring schematic information.

119.3 SPN 702/FMI 5 - GHG17

SPN 702/FMI 5	
Description	CPC Output 3 08 Open Circuit
Monitored Parameter	CPC Output 3/8
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On With Output Activation

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Under parameter, identify the parameter set to 3 08 DO Selection. Based on the parameter selected repair the open circuit between pin 8 of the CPC connector #3 and the OEM component. Refer to Original Equipment Manufacturer (OEM) literature for wiring schematic information.

SPN 703 (CPC) (GHG17)

120.1 SPN 703/FMI 3 - GHG17

Digital Output 3 09 - Short to Power/open Circuit on Pin 9 of the Common Powertrain Controller #3 Connector

Note : The Common Powertrain Controller (CPC) digital outputs have the same SPN as some Motor Control Module (MCM) faults. DiagnosticLink® makes the distinction between the MCM and CPC when diagnosing a fault.

1. Turn the ignition ON (key ON, engine OFF).
2. Connect to DiagnosticLink.
3. Verify parameters – go to the parameters work window.
4. Verify that the parameters in PGR035 digital outputs are set to the specific component to which this is configured (example: optimized idle active lamp).
5. Are the parameters configured correctly?

   5.a Yes; Go to step 6.

   5.b No; configure the parameters properly.
6. Fix the short to power / open on pin 9 circuit of the CPC #3 connector. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

120.2 SPN 703/FMI 4 - GHG17

Digital Output 3 09 – Short to Ground on Pin 9 Circuit of the Common Powertrain Controller #3 Connector

Note : The CPC digital outputs have the same SPN as some Motor Control Module (MCM) faults. DiagnosticLink® makes the distinction between the MCM and CPC when diagnosing a fault.

1. Turn the ignition ON (key ON, engine OFF).
2. Connect DiagnosticLink.
3. Verify parameters – go to the parameters work window.
4. Verify that the parameters in PGR035 digital outputs are set to the specific component to which this is configured (example: optimized idle active lamp).
5. Are the parameters configured correctly?

   5.a Yes; Go to step 6.

   5.b No; configure the parameters properly.
6. Fix the short to ground on pin 9 circuit of the CPC #3 connector. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

120.3 SPN 703/FMI 5 - GHG17

Water-in-Fuel (WIF) Sensor Indicates an Open Circuit in the Wiring to Pin 09 of the CPC #3 Connector
For wiring schematic information refer to Original Equipment Manufacturer (OEM) literature.

NOTICE

The Common Powertrain Controller (CPC) digital outputs have the same SPN as some Motor Control Module (MCM) faults. DiagnosticLink® Standard makes the distinction between the MCM and CPC when diagnosing a fault.

SPN 704 (CPC) (GHG17)

121.1 SPN 704/FMI 3 - GHG17

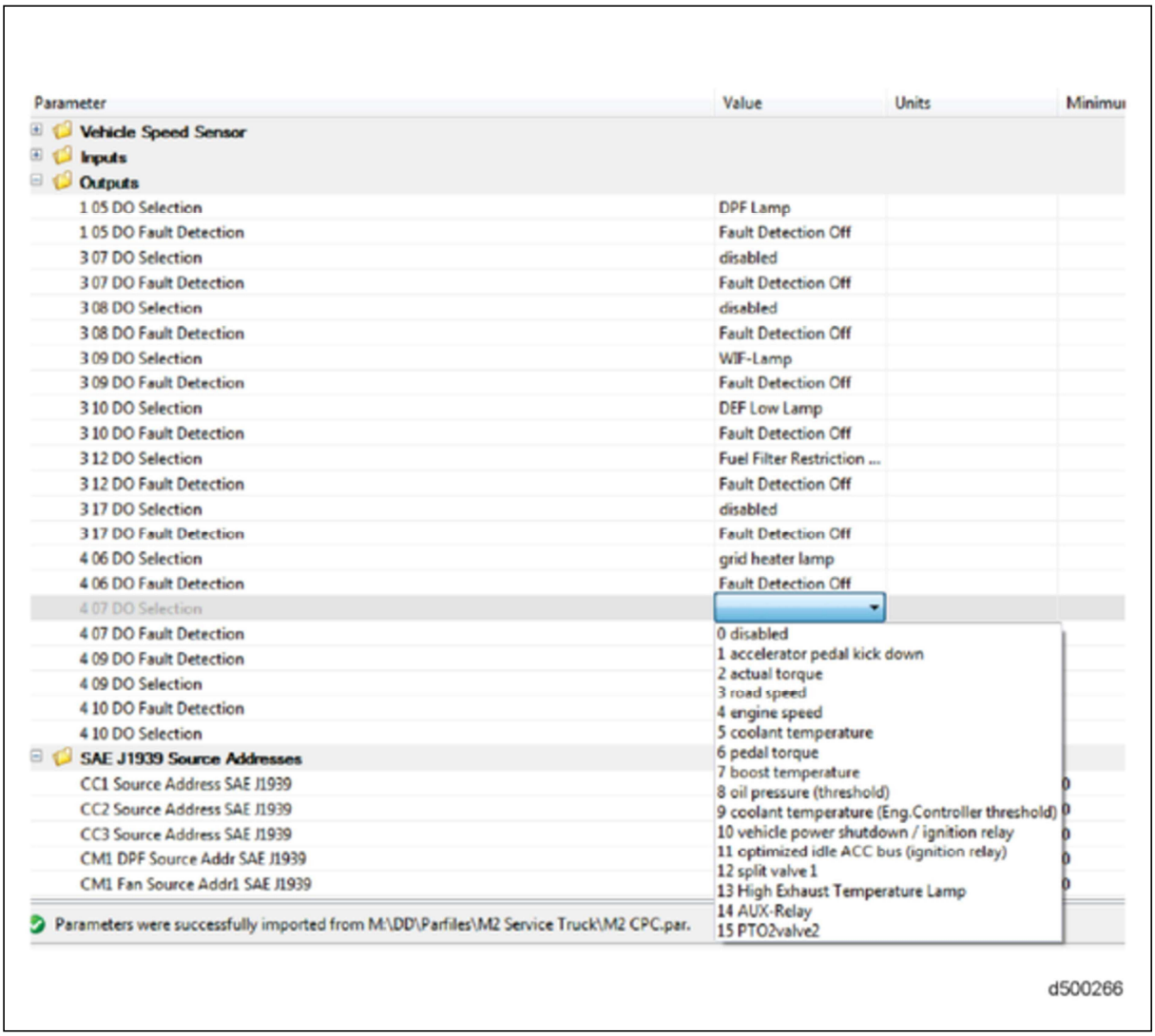
SPN 704/FMI 3	
Description	CPC Output 4 07 Short to Voltage
Monitored Parameter	CPC Output 4/7
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters by going to the parameters work window.
4. Verify that the parameter set to 4 07 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to power between pin 7 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

121.2 SPN 704/FMI 4 - GHG17

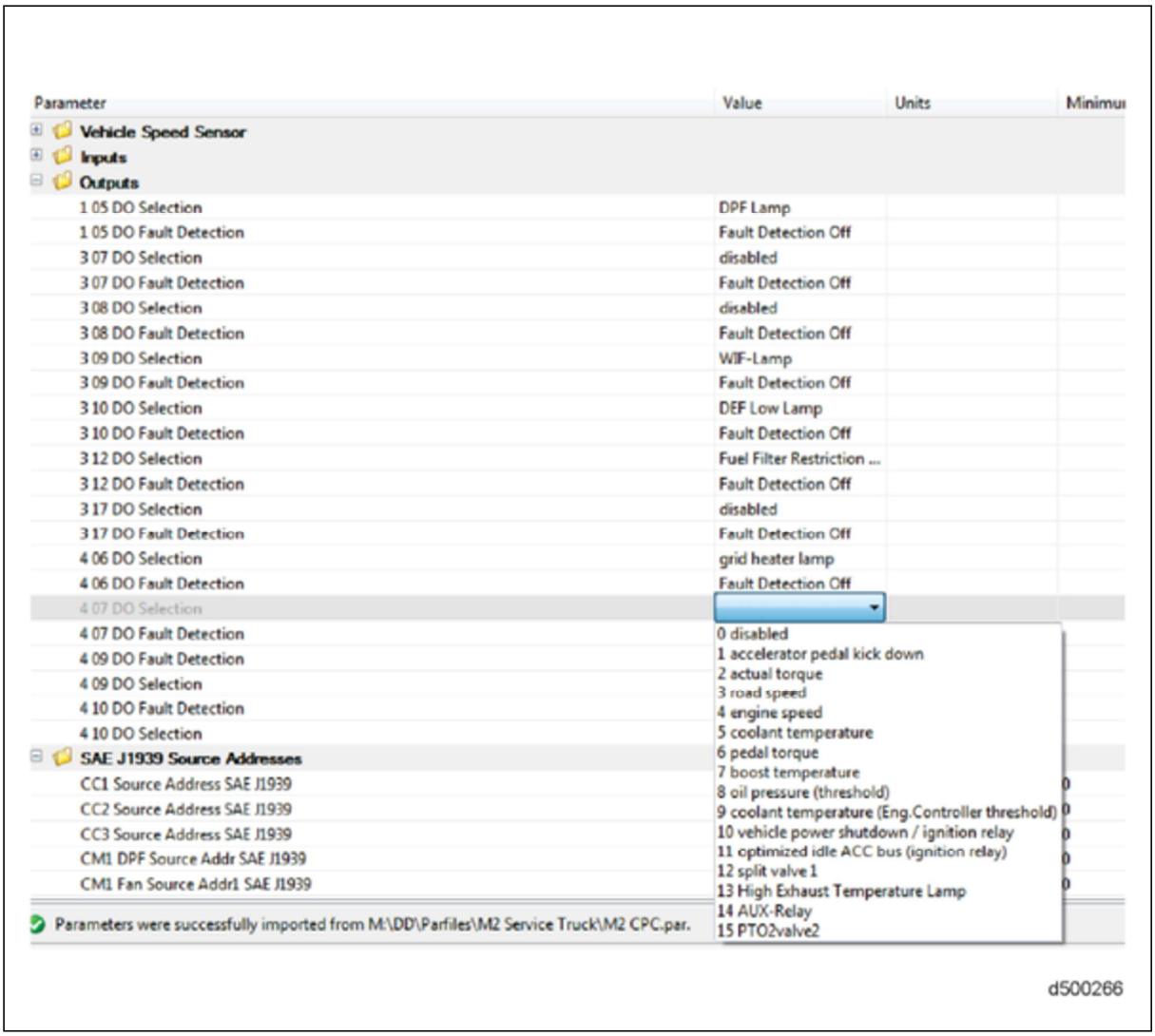
SPN 704/FMI 4	
Description	CPC Output 4 07 Short to Ground
Monitored Parameter	CPC Output 4/7
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 07 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to ground between pin 7 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

121.3 SPN 704/FMI 5 - GHG17

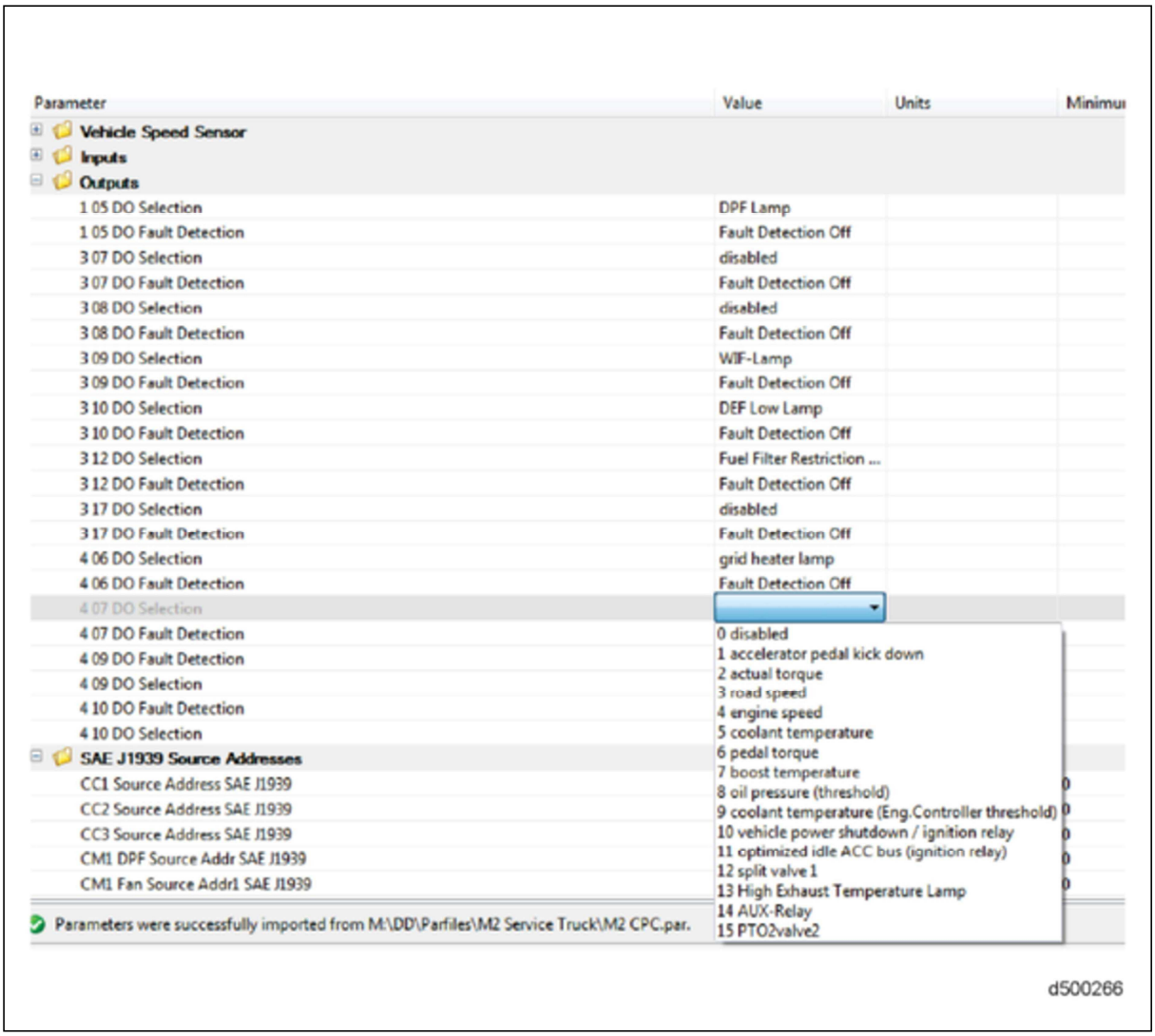
SPN 704/FMI 5	
Description	CPC Output 4 07 Open Circuit
Monitored Parameter	CPC Output 4/7
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 07 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the open circuit between pin 7 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

SPN 705 (CPC) (GHG17)

122.1 SPN 705/FMI 3 - GHG17

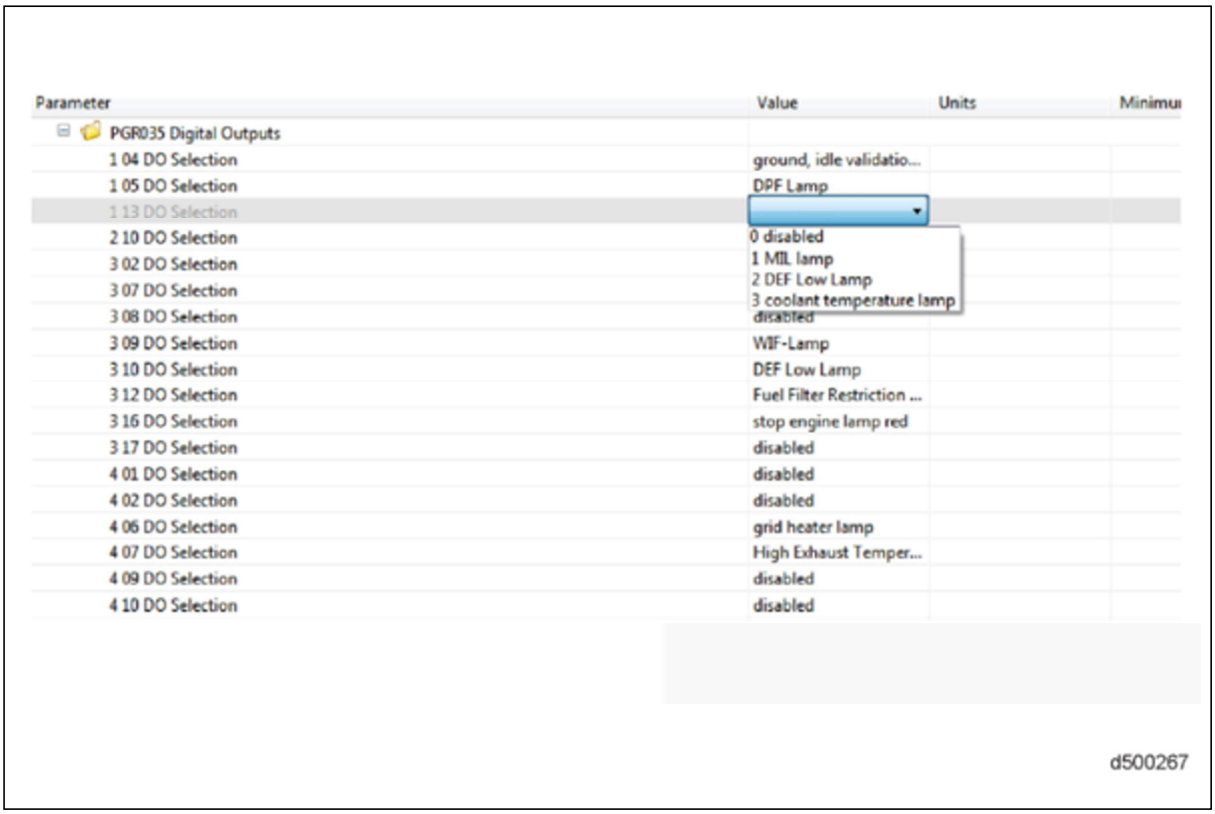
SPN 705/FMI 3	
Description	CPC Output 1 13 Short to Voltage
Monitored Parameter	CPC Output 1/13
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 1 13 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to power between pin 13 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

122.2 SPN 705/FMI 4 - GHG17

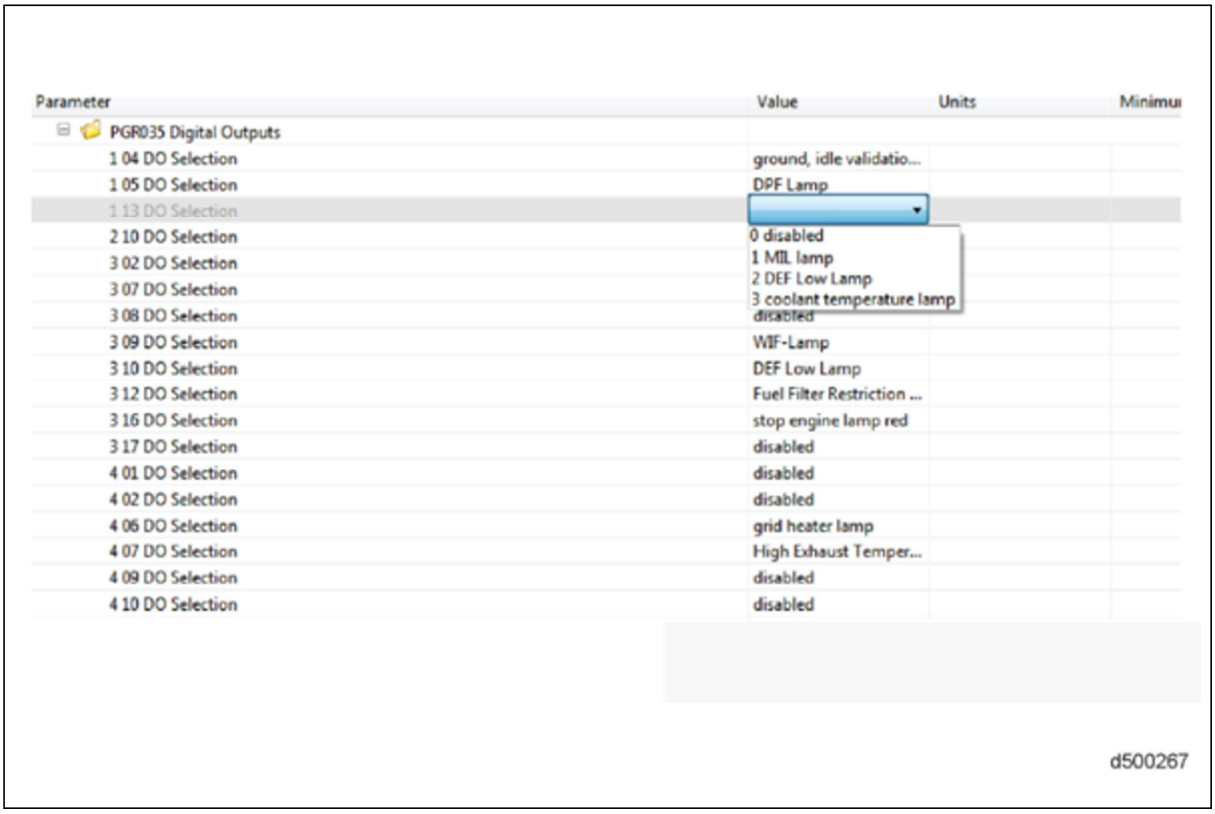
SPN 705/FMI 4	
Description	CPC Output 1 13 Short to Ground
Monitored Parameter	CPC Output 1/13
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 1 13 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to ground between pin 13 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

122.3 SPN 705/FMI 5 - GHG17

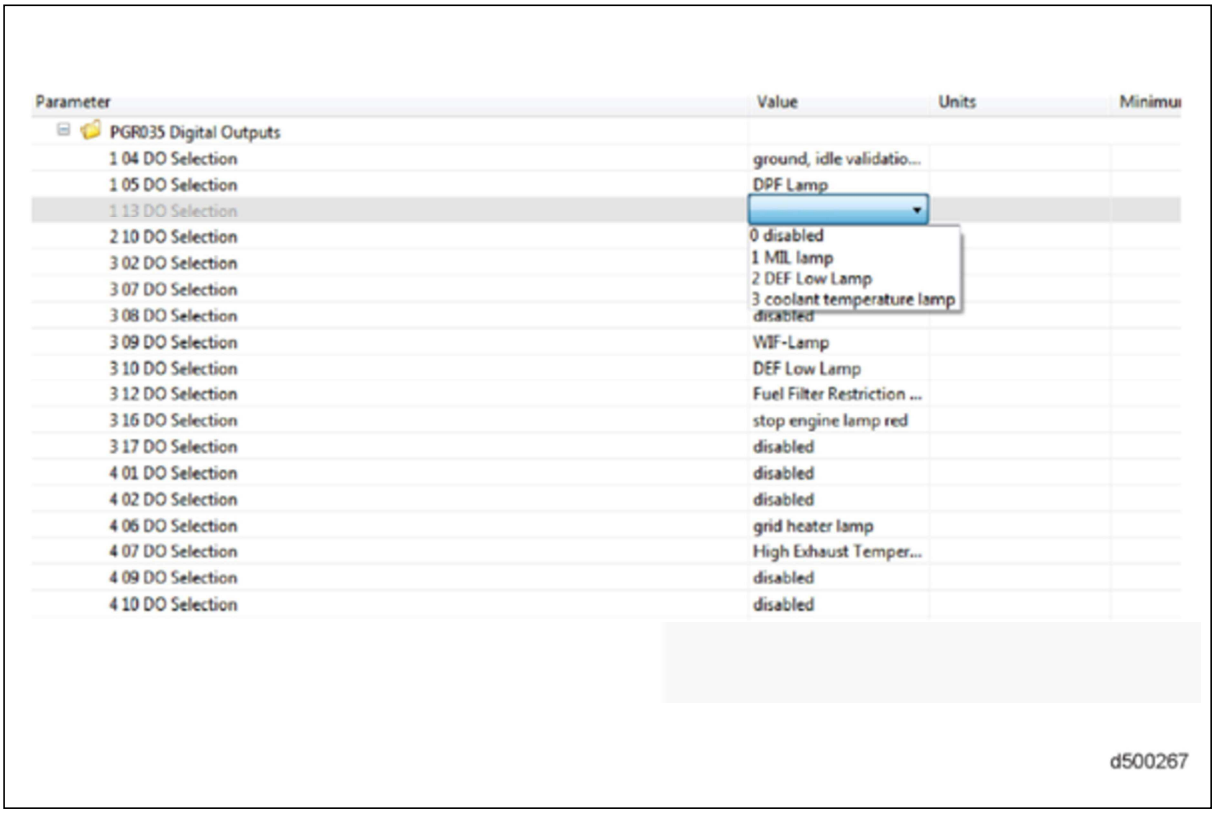
SPN 705/FMI 5	
Description	CPC Output 1 13 Open Circuit
Monitored Parameter	CPC Output 1/13
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 1 13 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the open circuit between pin 13 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

SPN 705 (MCM) (GHG17)

123.1 SPN 705/FMI 3 - GHG17

Malfunction Indicator Lamp Indicates a Short to Power/open Circuit on Pin 13 of the Common Powertrain Controller #1 Connector

For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

Note : The Common Powertrain Controller (CPC) digital outputs have the same SPN as some Motor Control Module (MCM) faults. DiagnosticLink® Standard makes the distinction between the MCM and CPC when diagnosing a fault.

SPN 706 (CPC) (GHG17)

124.1 SPN 706/FMI 3 - GHG17

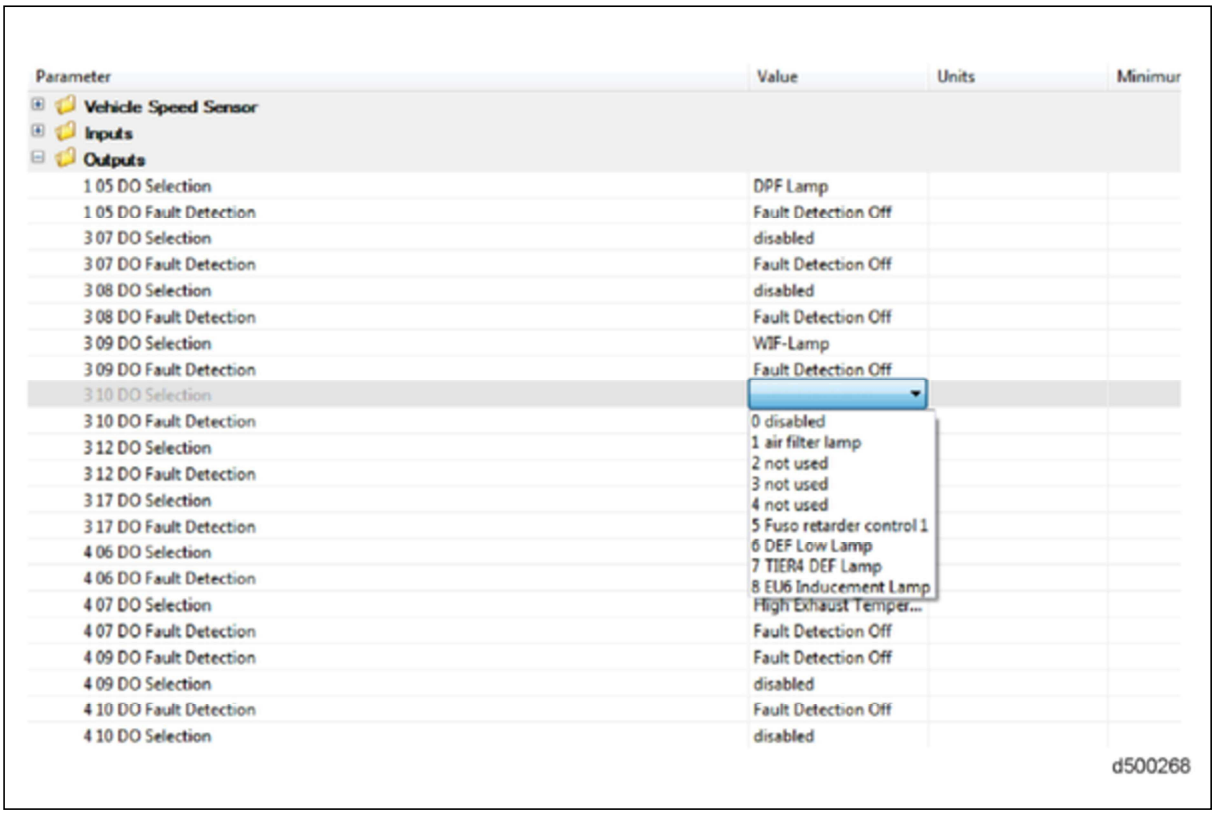
SPN 706/FMI 3	
Description	CPC Output 3 10 Short to Voltage
Monitored Parameter	CPC Output 3/10
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters by going to the parameters work window.
4. Verify that the parameter set to 3 10 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to power between pin 10 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

124.2 SPN 706/FMI 4 - GHG17

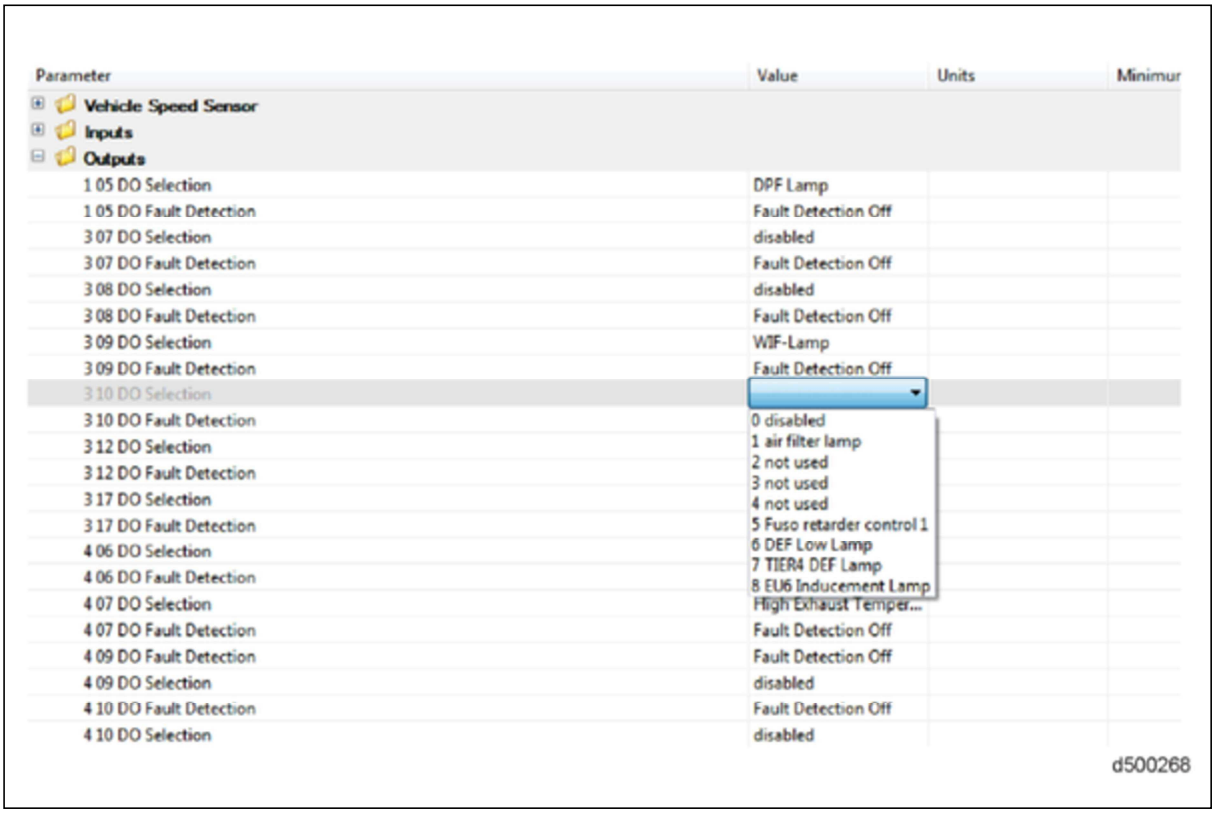
SPN 706/FMI 4	
Description	CPC Output 3 10 Short to Ground
Monitored Parameter	CPC Output 3/10
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters by going to the parameters work window.
4. Verify that the parameter set to 3 10 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to ground between pin 10 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

124.3 SPN 706/FMI 5 - GHG17

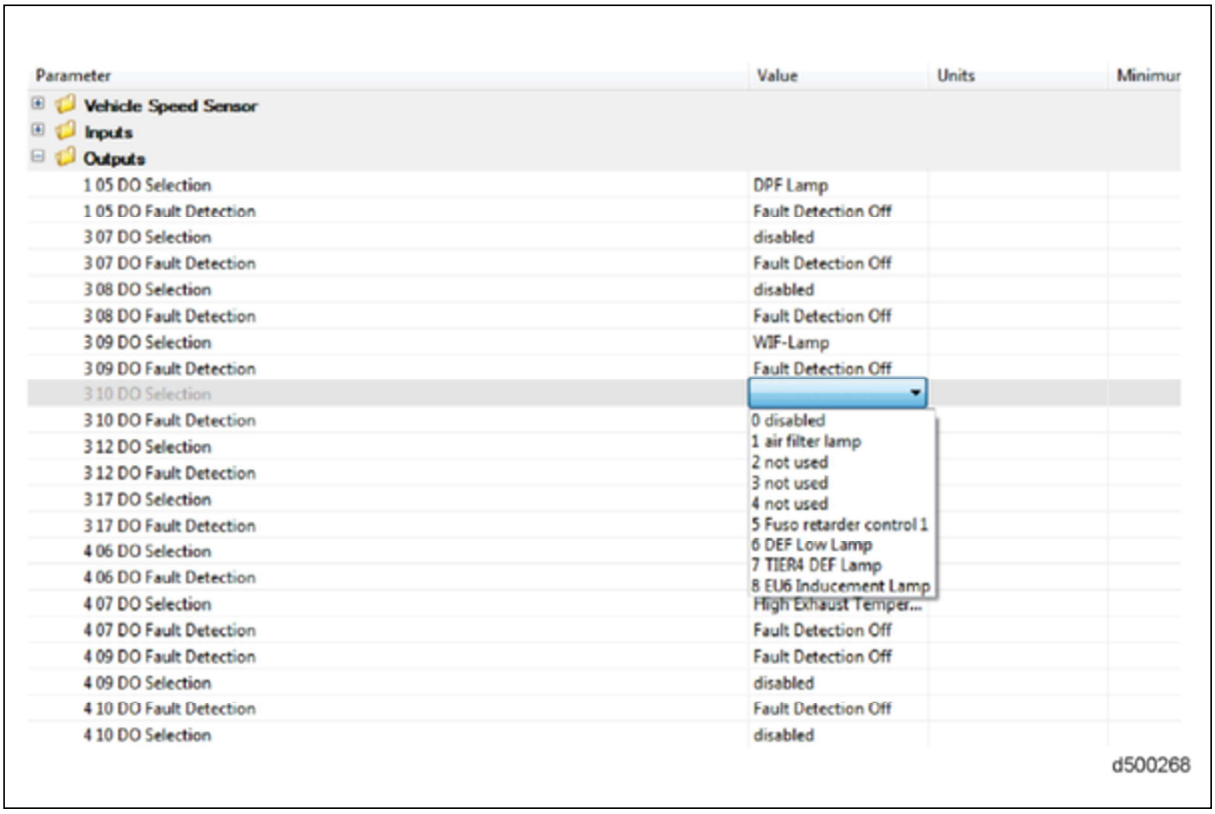
SPN 706/FMI 5	
Description	CPC Output 3 10 Open Circuit
Monitored Parameter	CPC Output 3/10
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters by going to the parameters work window.
4. Verify that the parameter set to 3 10 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the open circuit between pin 10 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

SPN 707 (CPC) (GHG17)

125.1 SPN 707/FMI 3 - GHG17

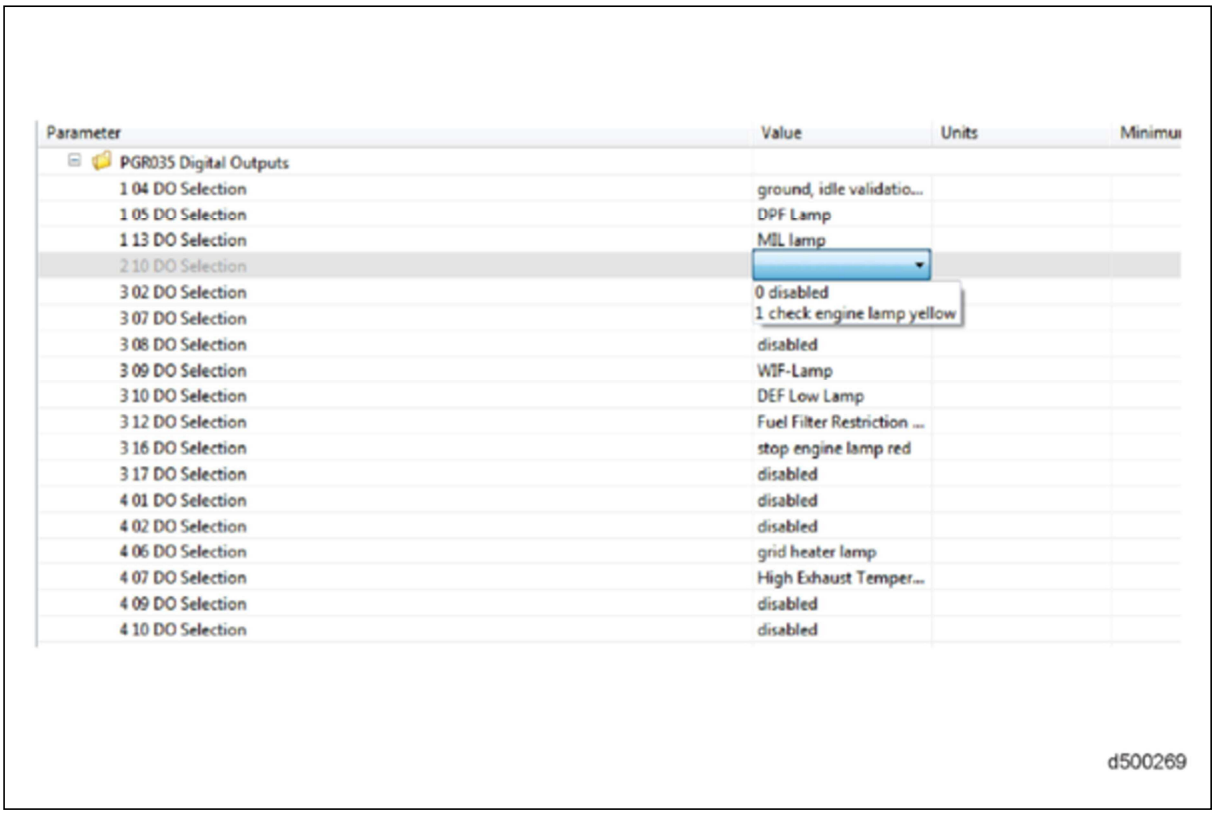
SPN 707/FMI 3	
Description	CPC Output 2 10 Short to Voltage
Monitored Parameter	CPC Output 2/10
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters by going to the parameters work window.
4. Verify that the parameter set to 2 10 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to power between pin 10 of the CPC connector #2 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

125.2 SPN 707/FMI 4 - GHG17

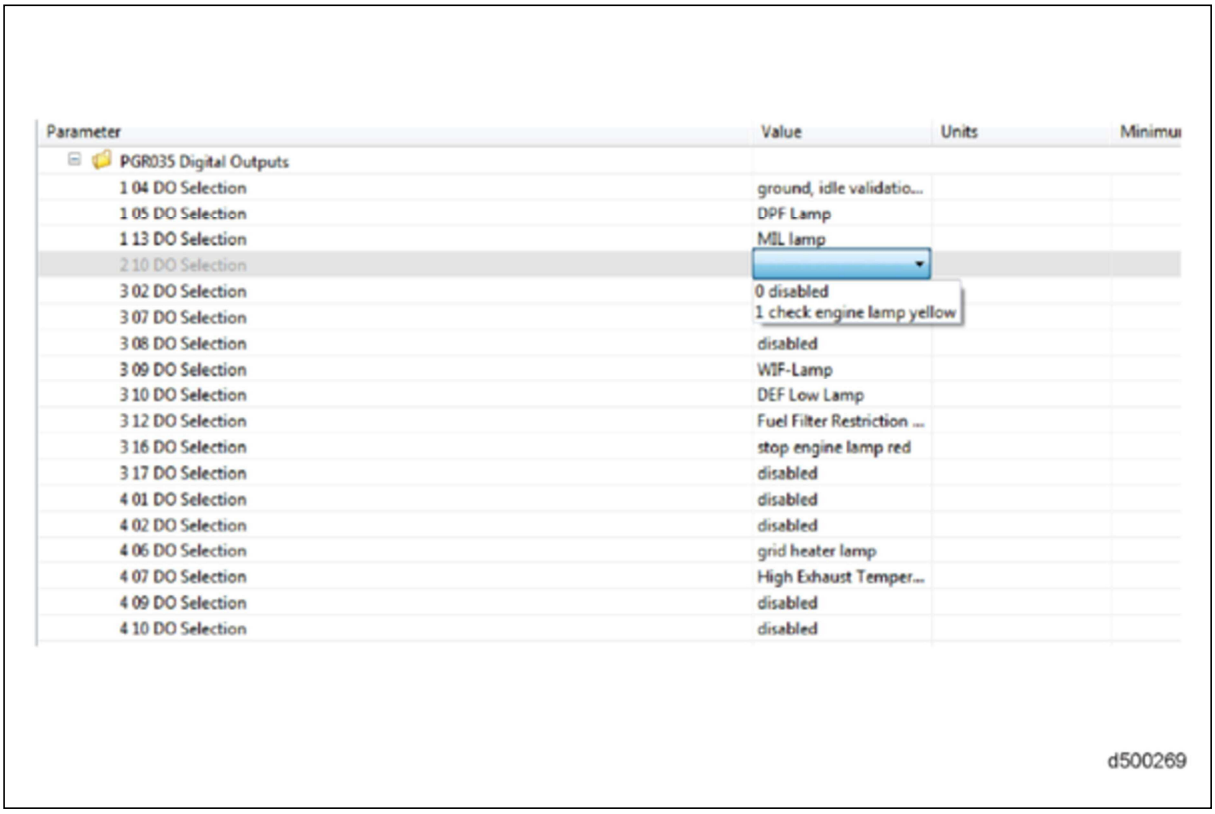
SPN 707/FMI 4	
Description	CPC Output 2 10 Short to Ground
Monitored Parameter	CPC Output 2/10
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters by going to the parameters work window.
4. Verify that the parameter set to 2 10 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to ground between pin 10 of the CPC connector #2 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

125.3 SPN 707/FMI 5 - GHG17

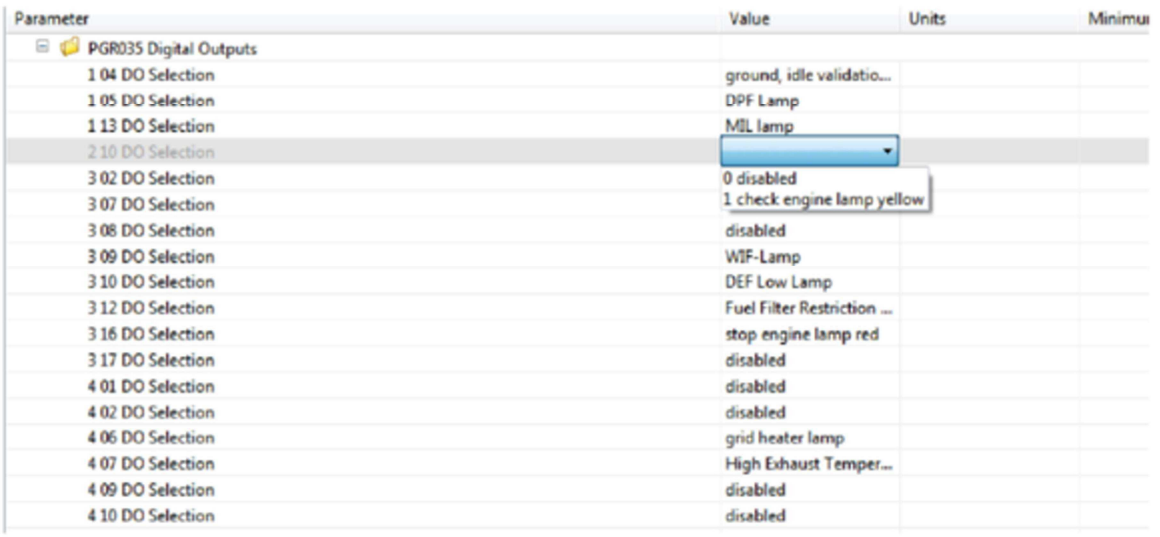
SPN 707/FMI 5	
Description	CPC Output 2 10 Open Circuit
Monitored Parameter	CPC Output 2/10
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters by going to the parameters work window.
4. Verify that the parameter set to 2 10 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the open circuit between pin 10 of the CPC connector #2 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

SPN 708 (CPC) (GHG17)

126.1 SPN 708/FMI 3 - GHG17

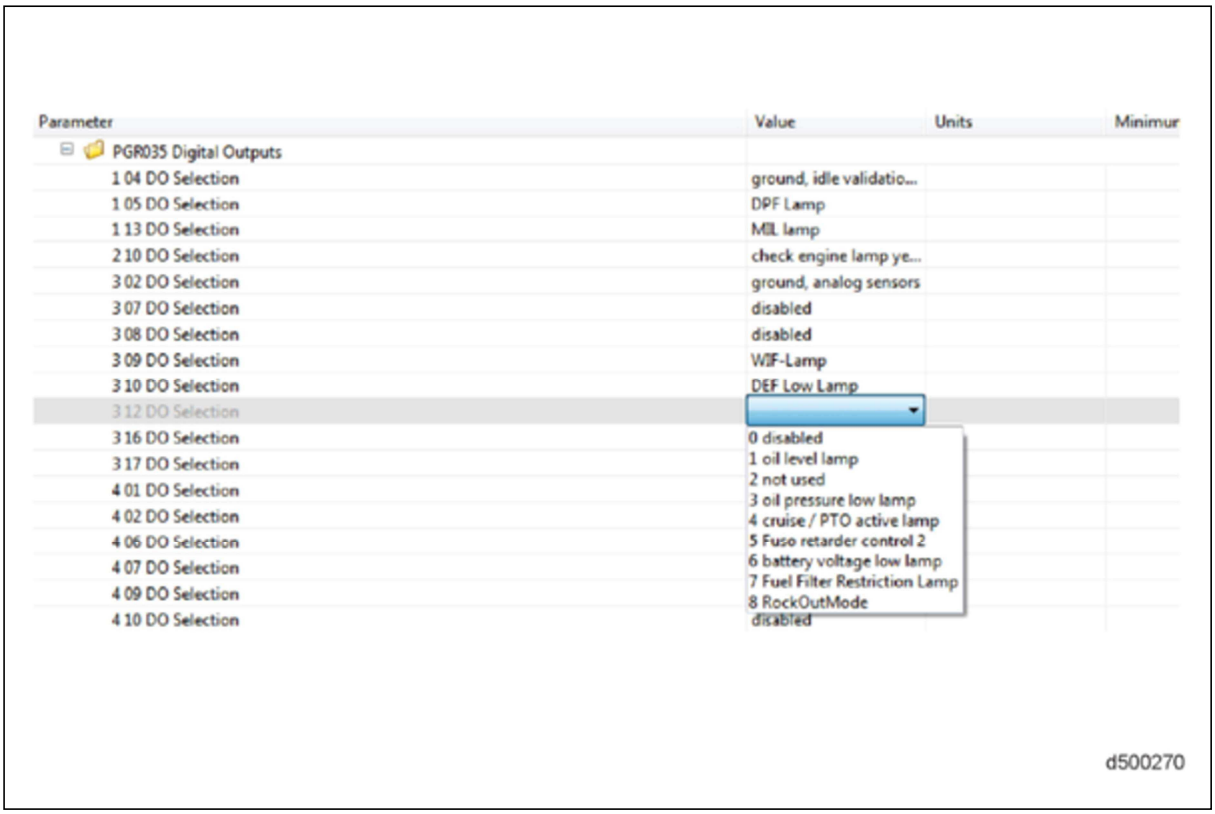
SPN 708/FMI 3	
Description	CPC Output 3 12 Short to Voltage
Monitored Parameter	CPC Output 3/12
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters by going to the parameters work window.
4. Verify that the parameter set to 3 12 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to power between pin 12 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

126.2 SPN 708/FMI 4 - GHG17

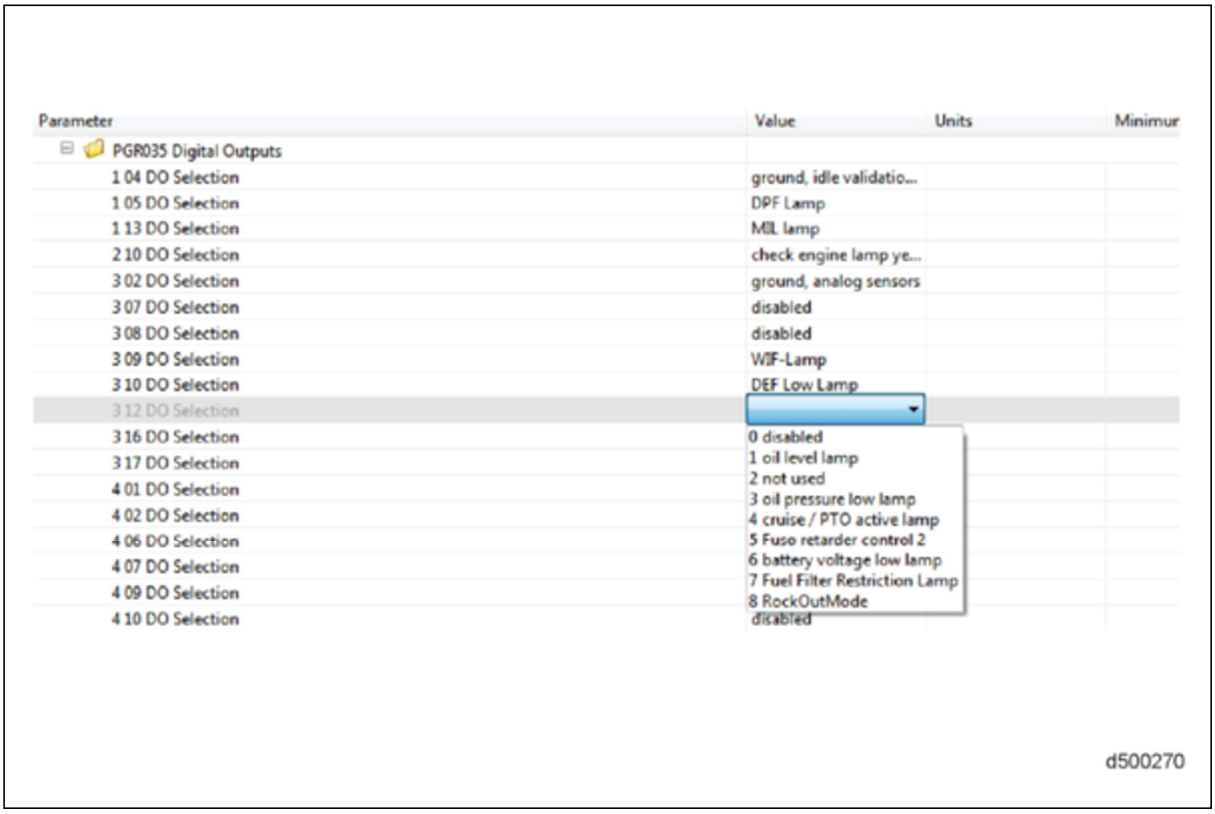
SPN 708/FMI 4	
Description	CPC Output 3 12 Short to Ground
Monitored Parameter	CPC Output 3/12
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters by going to the parameters work window.
4. Verify that the parameter set to 3 12 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to ground between pin 12 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

126.3 SPN 708/FMI 5 - GHG17

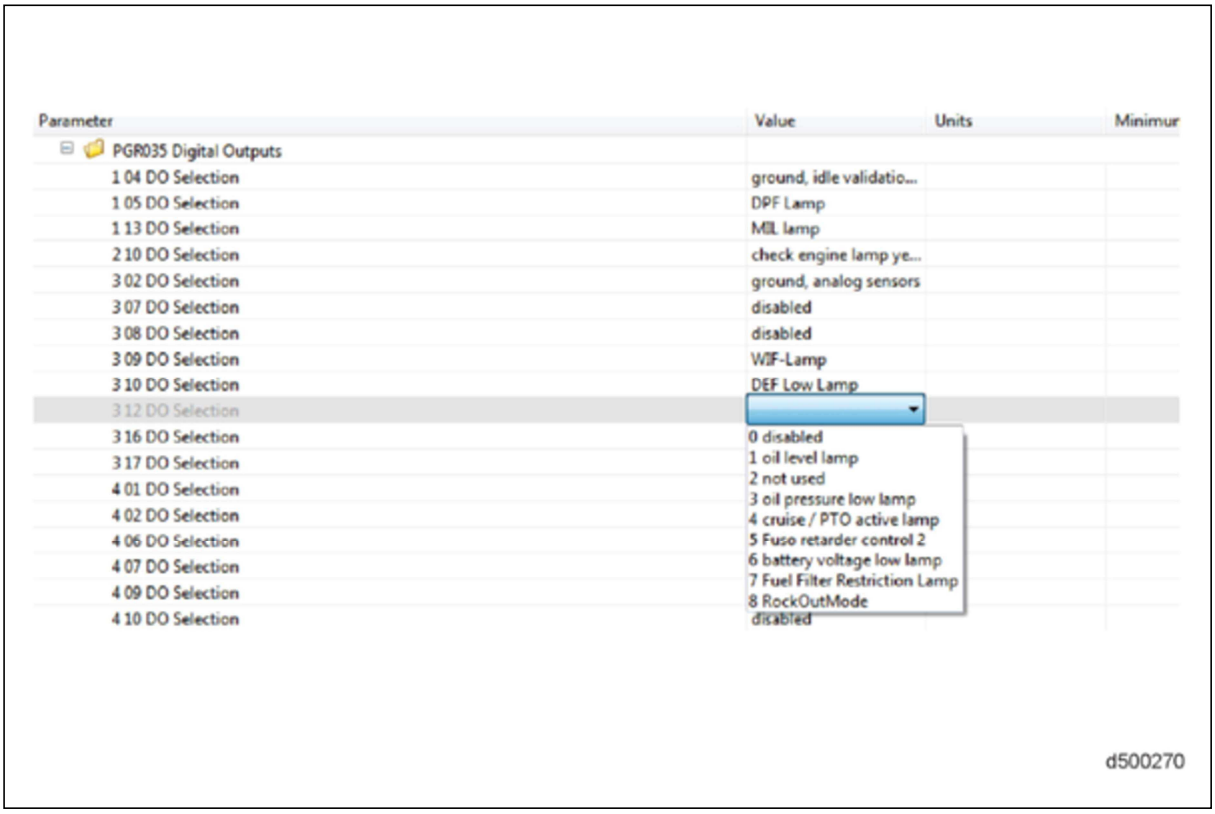
SPN 708/FMI 5	
Description	CPC Output 3 12 Open Circuit
Monitored Parameter	CPC Output 3/12
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters by going to the parameters work window.
4. Verify that the parameter set to 3 12 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the open circuit between pin 12 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

SPN 709 (CPC) (GHG17)

127.1 SPN 709/FMI 3 - GHG17

SPN 709/FMI 3	
Description	CPC Output 3 16 Short to Voltage
Monitored Parameter	CPC Output 3/16
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On With Output Activation

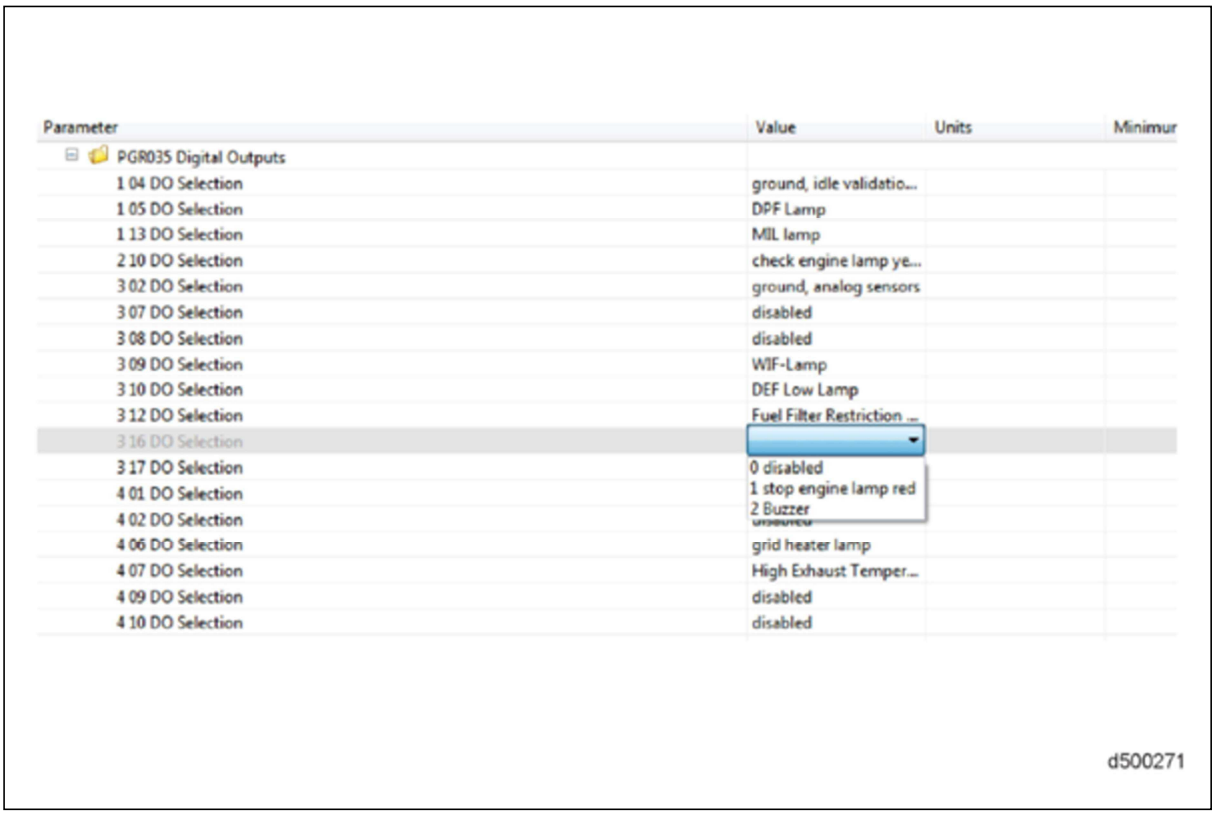
Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?

   1.a a. Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.

   1.b No; Go to step 2.

2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 3 16 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

4.a Yes; Repair the short to power between pin 16 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

4.b No; configure the parameters correctly.

127.2 SPN 709/FMI 4 - GHG17

SPN 709/FMI 4	
Description	CPC Output 3 16 Short to Ground
Monitored Parameter	CPC Output 3/16
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On With Output Activation

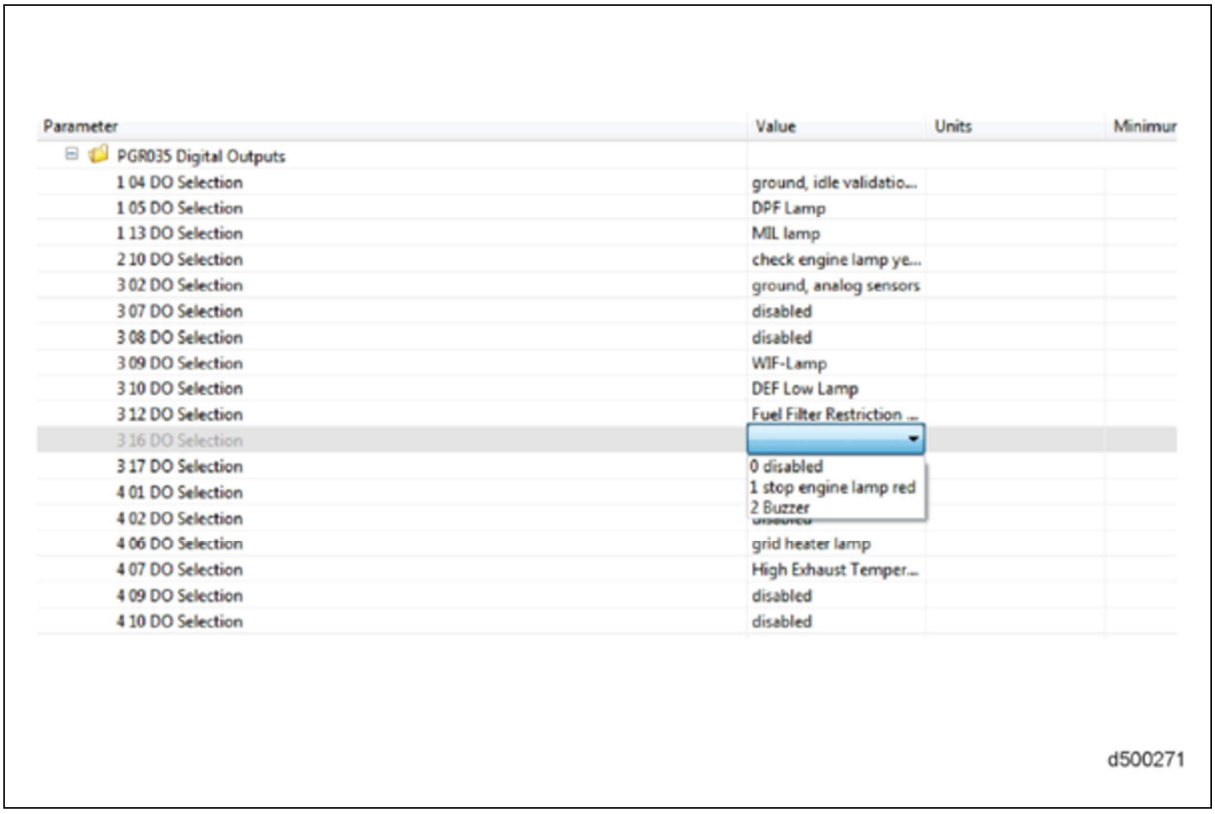
Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?

   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.

   1.b No; Go to step 2.

2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 3 16 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; Repair the short to ground between pin 16 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

4.b No; configure the parameters correctly.

127.3 SPN 709/FMI 5 - GHG17

SPN 709/FMI 5	
Description	CPC Output 3 16 Open Circuit
Monitored Parameter	CPC Output 3/16
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On With Output Activation

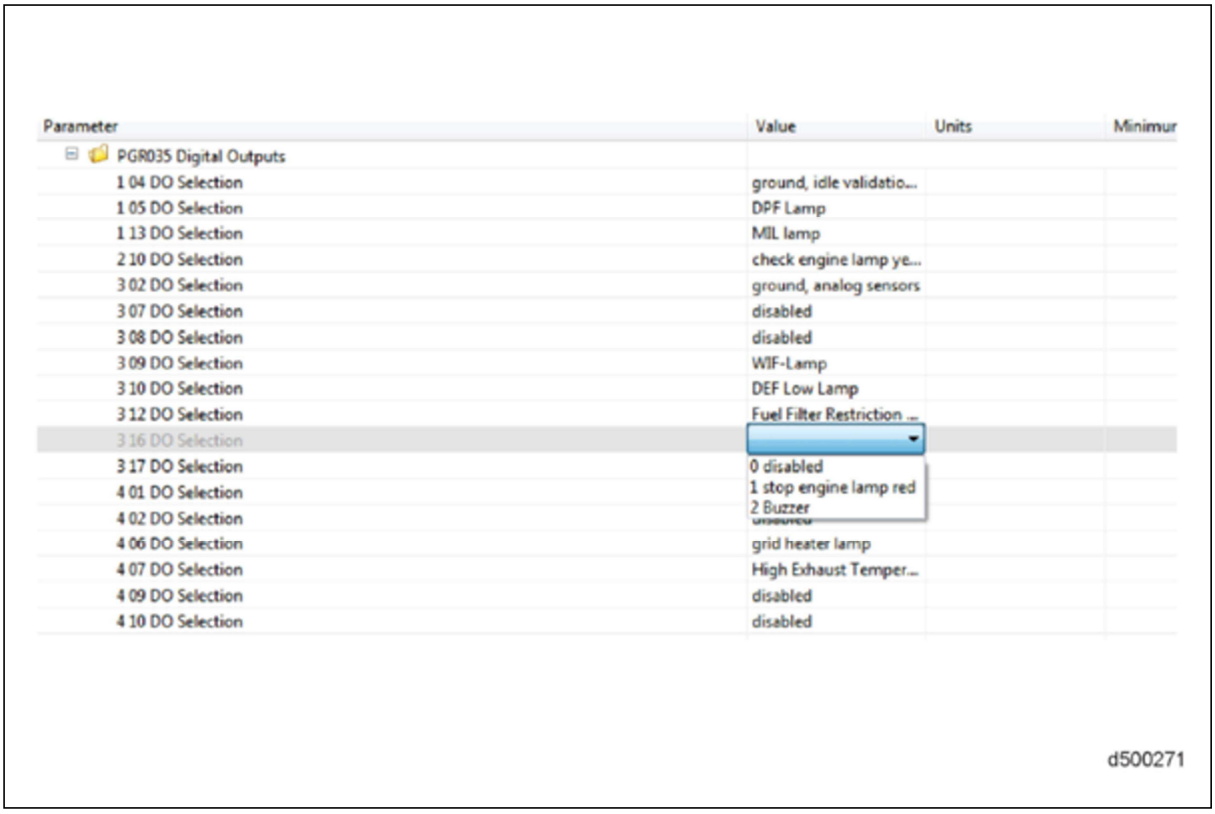
Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?

   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.

   1.b No; Go to step 2.

2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 3 16 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; Repair the open circuit between pin 16 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

4.b No; configure the parameters correctly.

SPN 710 (CPC) (GHG17)

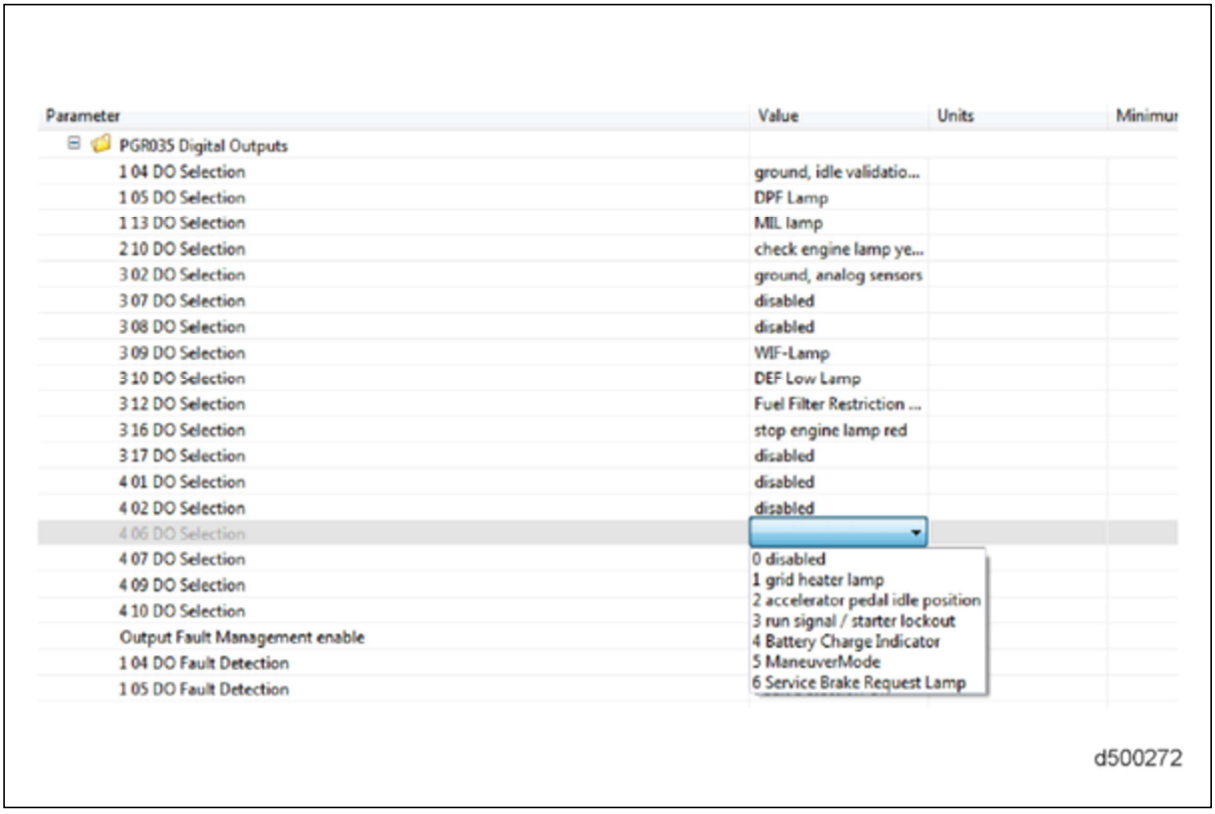
128.1 SPN 710/FMI 3 - GHG17

Digital Output 4 06 Circuit Failed High

SPN 710/FMI 3	
Description	CPC Output 4 06 Short to Voltage
Monitored Parameter	CPC Output 4/6
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On With Output Activation

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.

4. Verify that the parameter set to 4 06 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; Repair the short to power between pin 6 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

128.2 SPN 710/FMI 4 - GHG17

Digital Output 4 06 Circuit Failed Low

SPN 710/FMI 4	
Description	CPC Output 4 06 Short to Ground
Monitored Parameter	CPC Output 4/6
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On With Output Activation

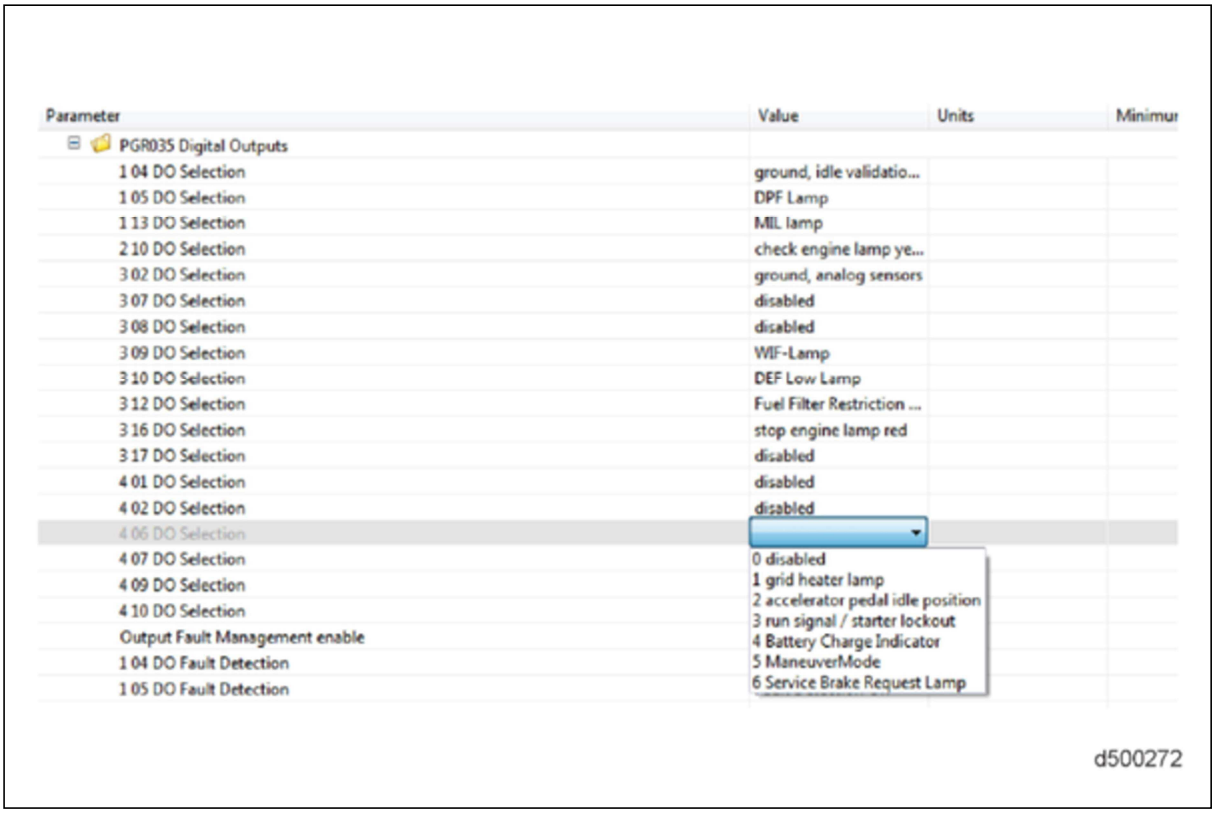
Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?

   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.

   1.b No; Go to step 2.

2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 06 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

4.a Yes; Repair the short to ground between pin 6 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

4.b No; configure the parameters correctly.

128.3 SPN 710/FMI 5 - GHG17

SPN 710/FMI 5	
Description	CPC Output 4 06 Open Circuit
Monitored Parameter	CPC Output 4/6
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On With Output Activation

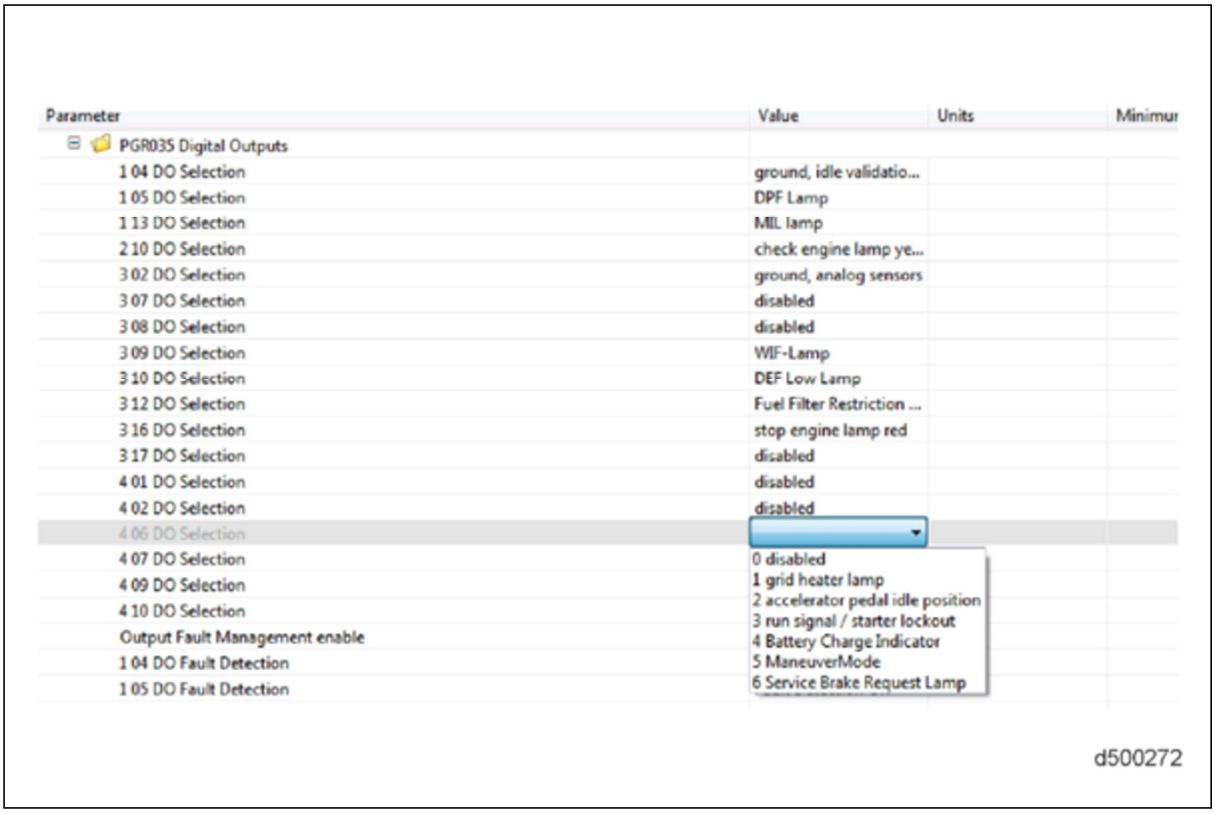
Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?

   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.

   1.b No; Go to step 2.

2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 06 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; Repair the open circuit between pin 6 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

4.b No; configure the parameters correctly.

SPN 710 (MCM) (GHG17)

129.1 SPN 710/FMI 3 - GHG17

Digital Output 4 06 Circuit Failed High

Note : The Common Powertrain Controller (CPC) digital outputs have the same SPN as some Motor Control Module (MCM) faults. DiagnosticLink® Standard makes the distinction between the MCM and CPC when diagnosing a fault.

Wait to Start (WTS) Lamp - indicates a short to power/open circuit on pin 6 of the CPC #4 connector. For wiring schematic information refer to Original Equipment Manufacturer (OEM) literature.

129.2 SPN 710/FMI 4 - GHG17

Digital Output 4 06 Circuit Failed Low

Note : The Common Powertrain Controller (CPC) digital outputs have the same SPN as some Motor Control Module (MCM) faults. DiagnosticLink® Standard makes the distinction between the MCM and CPC when diagnosing a fault.

Wait to Start (WTS) Lamp - indicates a short to power/open circuit on pin 6 of the CPC #4 connector. For wiring schematic information refer to Original Equipment Manufacturer (OEM) literature.

SPN 711 (CPC) (GHG17)

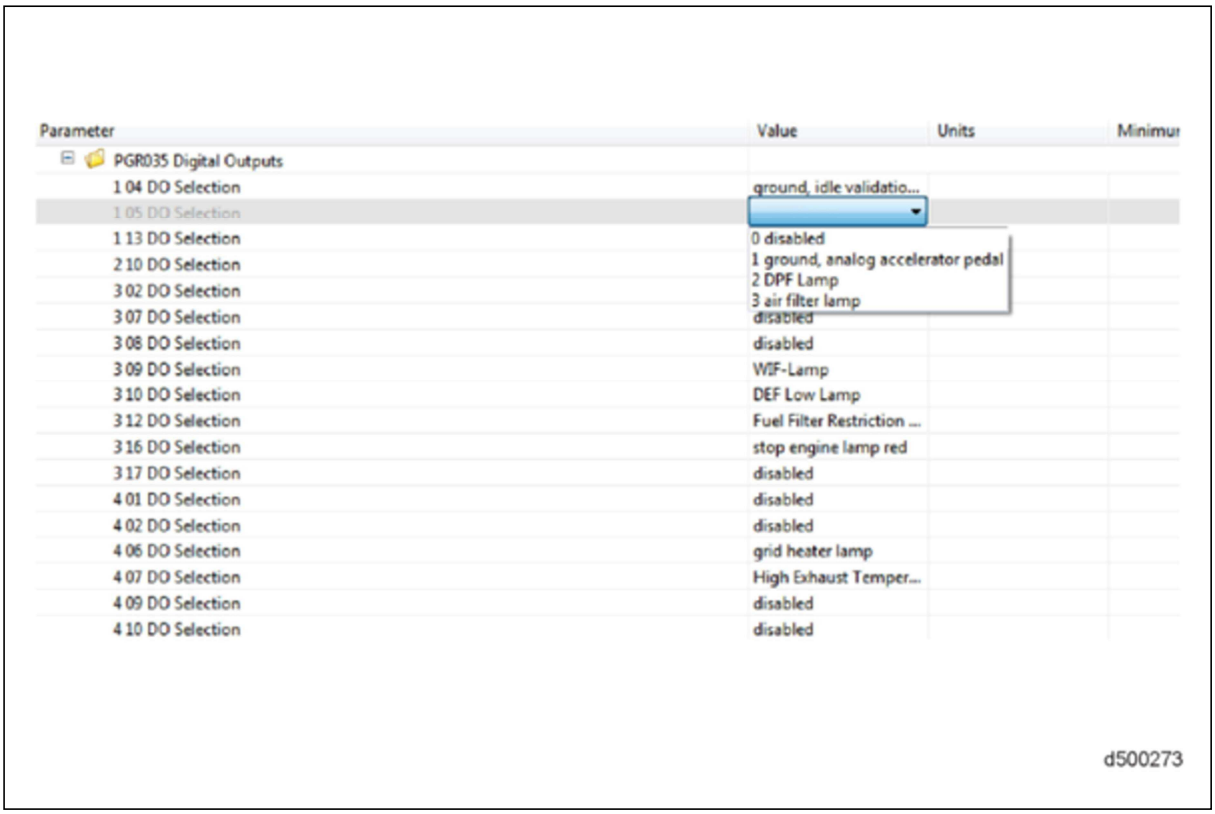
130.1 SPN 711/FMI 3 - GHG17

SPN 711/FMI 3	
Description	CPC Output 1 05 Short to Voltage
Monitored Parameter	CPC Output 1/5
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

Check as follows:

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 1 05 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; Repair the short to power between pin 5 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

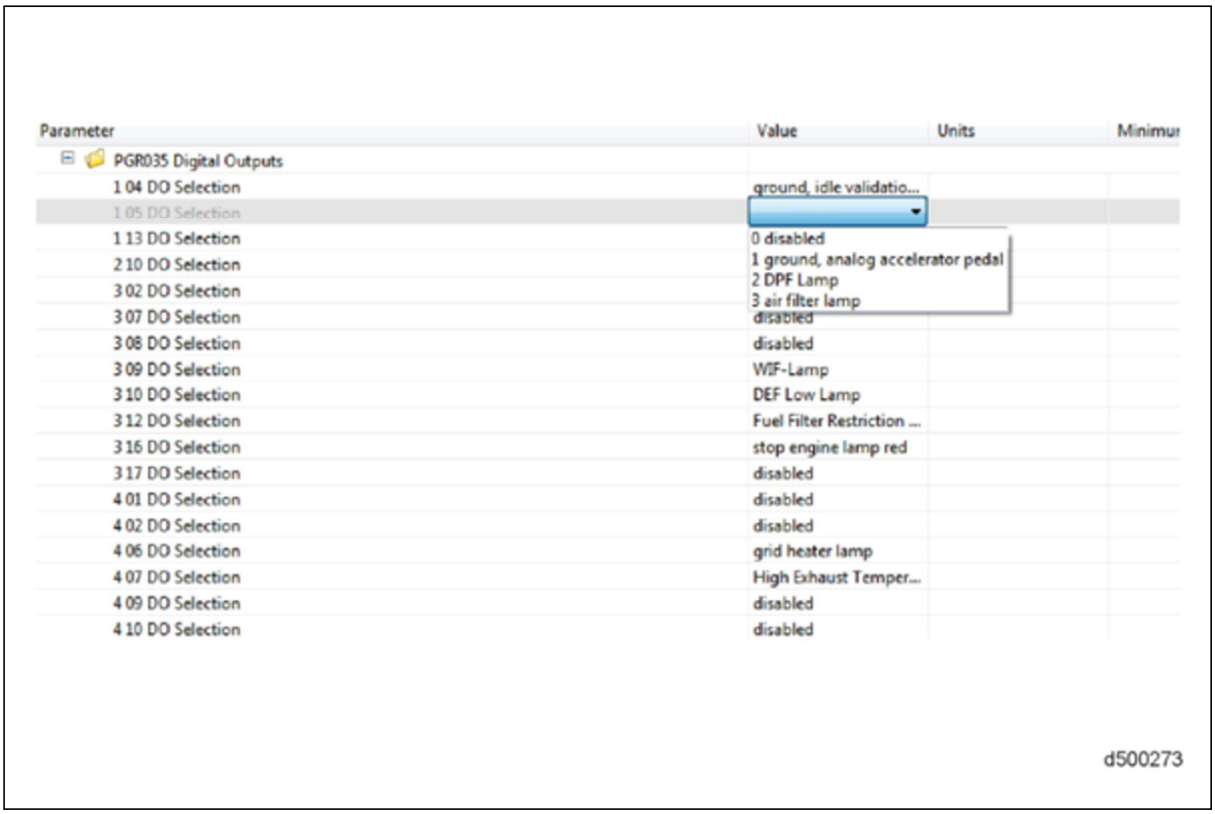
130.2 SPN 711/FMI 4 - GHG17

SPN 711/FMI 4	
Description	CPC Output 1 05 Short to Ground
Monitored Parameter	CPC Output 1/5
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

Check as follows:

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 1 05 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; Repair the short to ground between pin 5 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

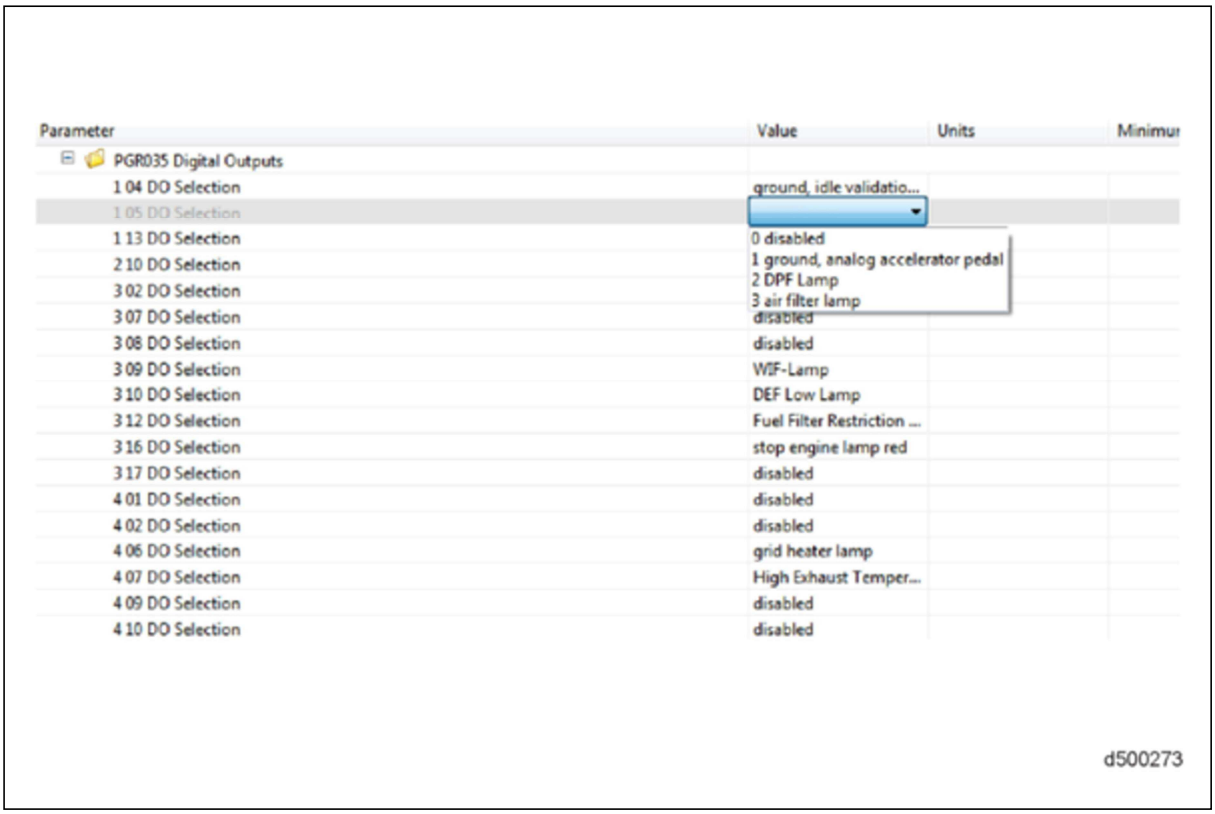
130.3 SPN 711/FMI 5 - GHG17

SPN 711/FMI 5	
Description	CPC Output 1 05 Open Circuit
Monitored Parameter	CPC Output 1/5
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

Check as follows:

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 1 05 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; Repair the open circuit between pin 5 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

SPN 712 (CPC) (GHG17)

131.1 SPN 712/FMI 3 - GHG17

SPN 712/FMI 3	
Description	CPC Output 1 04 Short to Voltage
Monitored Parameter	CPC Output 1/4
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; program the CPC to the correct settings.
   - 1.b No; repair the short to power between pin 4 of the CPC connector #1 and the idle validation switch/analog accelerator pedal. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

131.2 SPN 712/FMI 4 - GHG17

SPN 712/FMI 4	
Description	CPC Output 1 04 Short to Ground
Monitored Parameter	CPC Output 1/4
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; program the CPC to the correct settings.
   - 1.b No; repair the short to ground between pin 4 of the CPC connector #1 and the idle validation switch/analog accelerator pedal. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

131.3 SPN 712/FMI 5 - GHG17

SPN 712/FMI 5	
Description	CPC Output 1 04 Open Circuit
Monitored Parameter	CPC Output 1/4
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; program the CPC to the correct settings.
   - 1.b No; repair the short to power between pin 4 of the CPC connector #1 and the idle validation switch/analog accelerator pedal. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

SPN 713 (CPC) (GHG17)

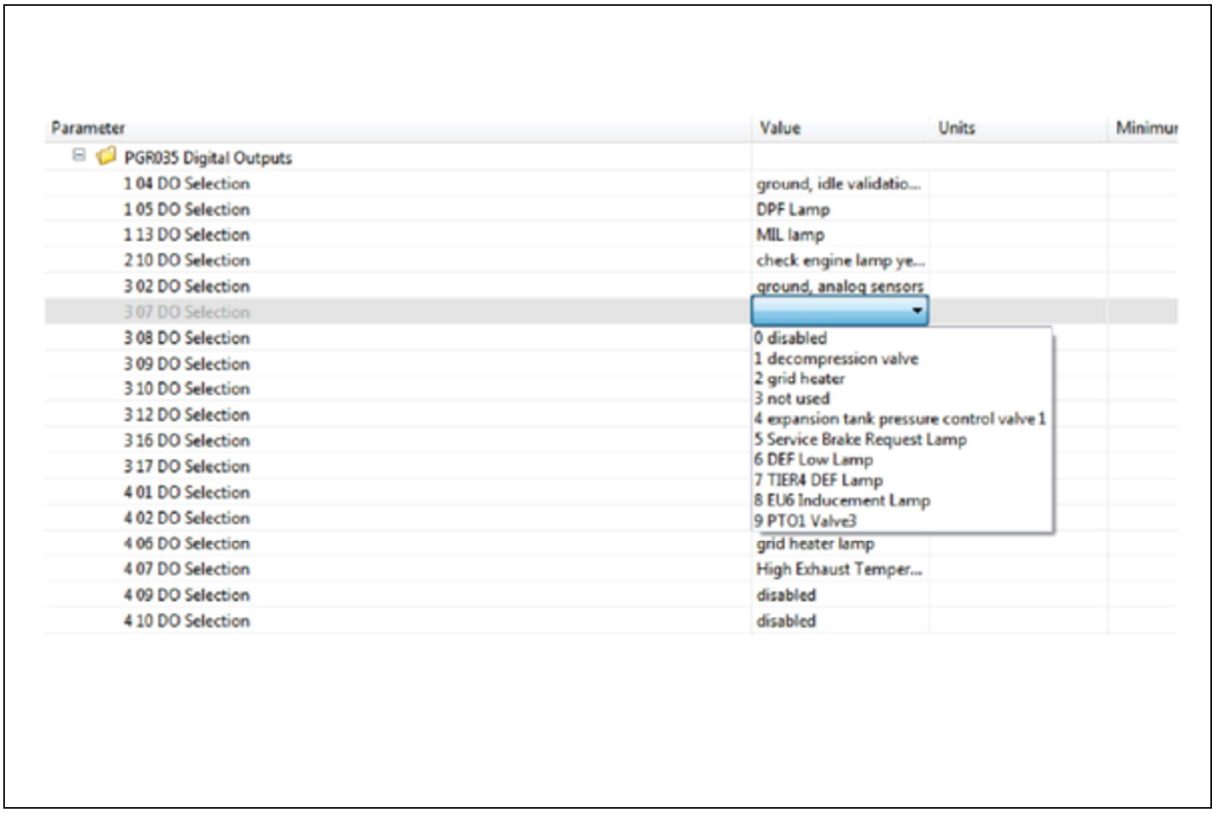
132.1 SPN 713/FMI 7 - GHG17

SPN 713/FMI 7	
Description	This Code is Used for Top2 Output Failure. If the Vehicle is Not Equipped With a Top2 Transmission, This Code Should Not Be Turned On
Monitored Parameter	CPC Output 3/7
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On, Engine OFF with Output Activation

1. Turn the ignition ON (Key ON, engine OFF).
2. Connect to DiagnosticLink .
3. Check for multiple codes. Are SPN 701/FMI any also present?

   3.a Yes; troubleshoot the other codes first.

   3.b No; Go to step 4.



4. Verify that the parameters in PGR035 digital outputs are set to the specific component to which this vehicle is configured. Are the parameters configured correctly?

4.a Yes; replace the Common Powertrain Controller (CPC) and reprogram with the latest software release.

4.b No; configure the parameters properly.

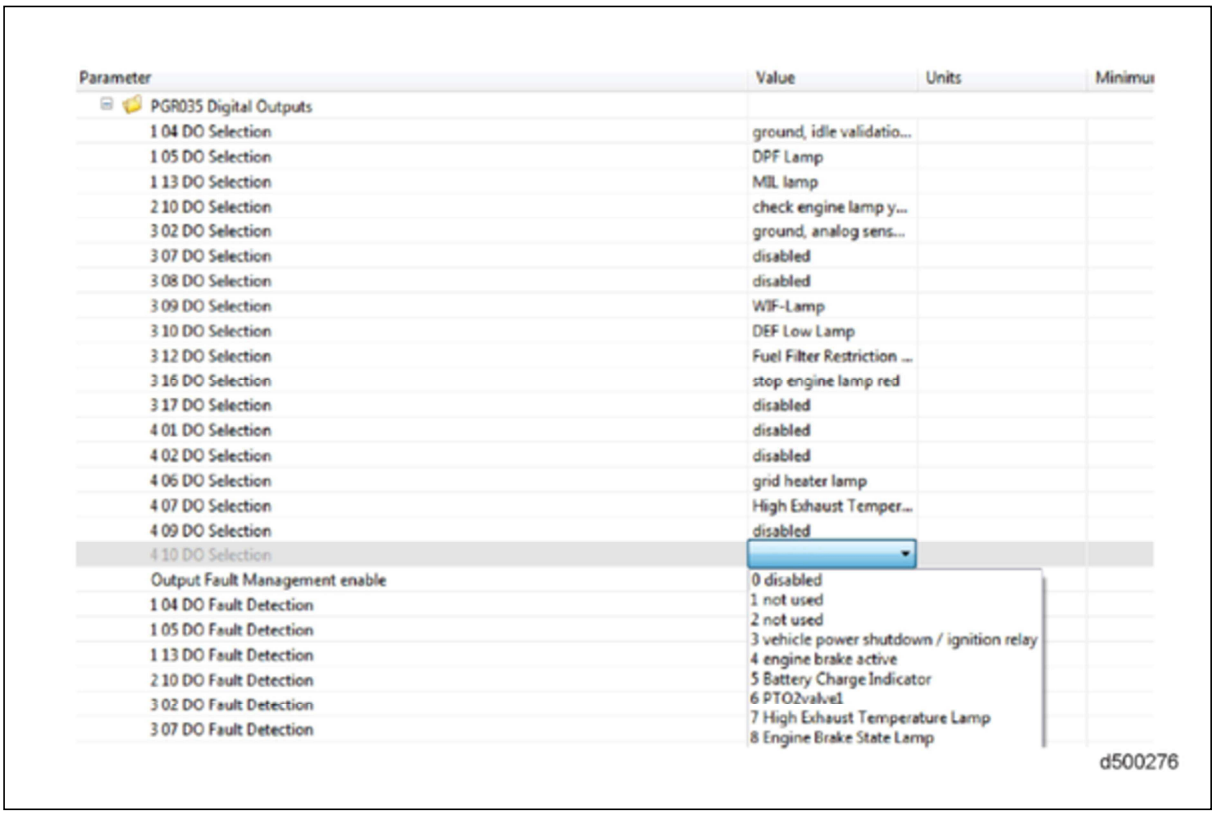
SPN 714 (CPC) (GHG17)

133.1 SPN 714/FMI 3 – GHG17

SPN 714/FMI 3	
Description	CPC Output 4 10 Short to Voltage
Monitored Parameter	CPC Output 4/10
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 10 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

4.a Yes; repair the short to power between pin 10 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

4.b No; configure the parameters correctly.

133.2 SPN 714/FMI 4 - GHG17

SPN 714/FMI 4	
Description	CPC Output 4 10 Short to Ground
Monitored Parameter	CPC Output 4/10
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

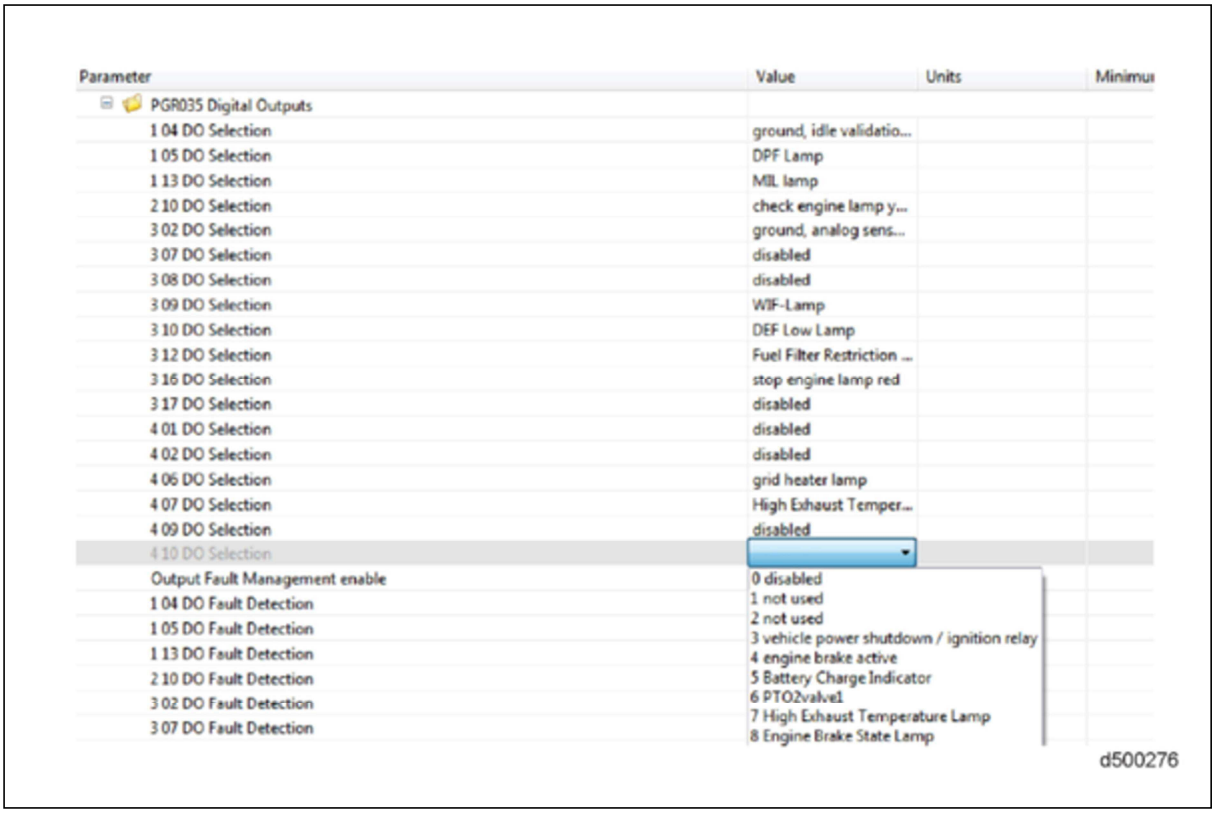
Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?

   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.

   1.b No; Go to step 2.

2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 10 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to ground between pin 10 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

4.b No; configure the parameters correctly.

133.3 SPN 714/FMI 5 - GHG17

SPN 714/FMI 5	
Description	CPC Output 4 10 Open Circuit
Monitored Parameter	CPC Output 4/10
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

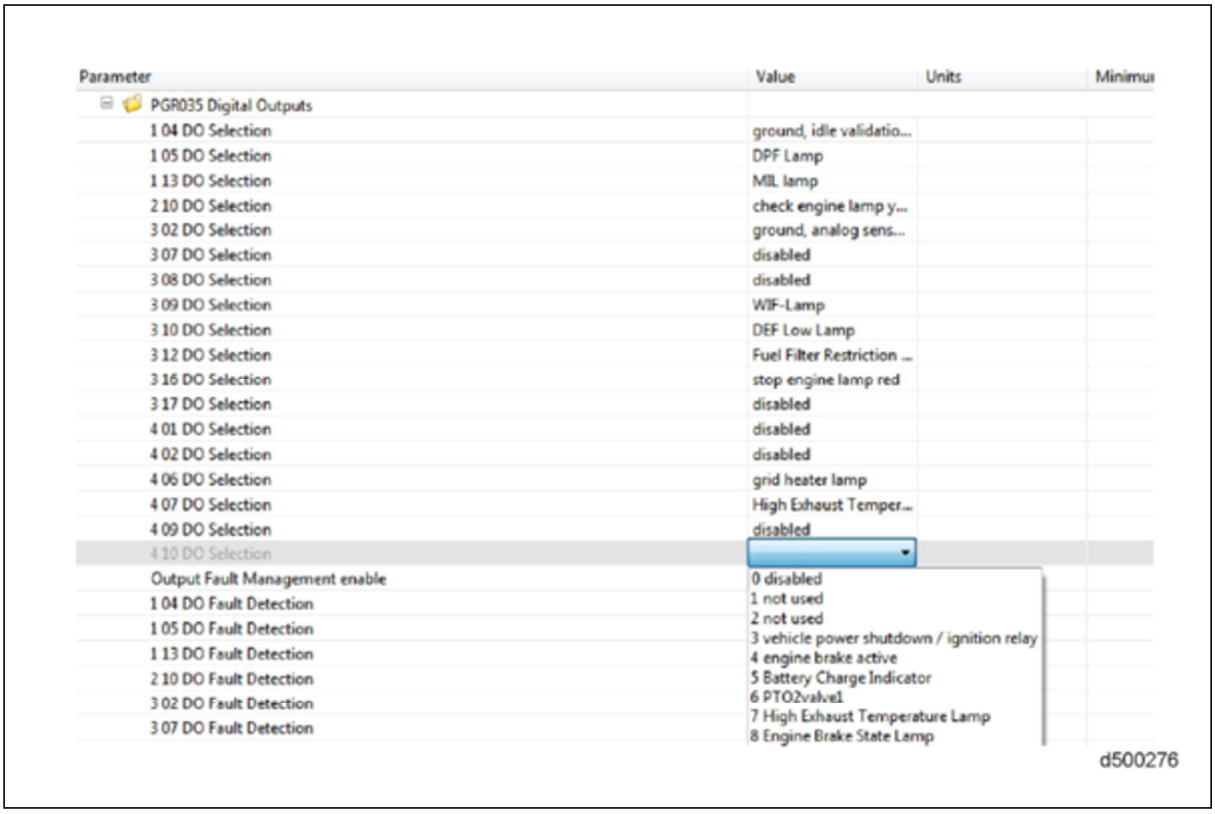
Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?

   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.

   1.b No; Go to step 2.

2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 10 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the open circuit between pin 10 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

4.b No; configure the parameters correctly.

SPN 715 (CPC) (GHG17)

134.1 SPN 715/FMI 3 - GHG17

SPN 715/FMI 3	
Description	CPC Output 4 12 Short to Voltage
Monitored Parameter	Vehicle Speed Output
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, Engine OFF

This fault indicates a short to power on the pin 12 circuit of the Common Powertrain Controller (CPC) #4 connector.

Repair the short to power between pin 12 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

134.2 SPN 715/FMI 4 - GHG17

SPN 715/FMI 4	
Description	CPC Output 4 12 Short to Ground
Monitored Parameter	Vehicle Speed Output
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, Engine OFF

This fault indicates a short to ground on the pin 12 circuit of the Common Powertrain Controller (CPC) #4 connector.

Repair the short to ground between pin 12 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

134.3 SPN 715/FMI 5 - GHG17

SPN 715/FMI 5	
Description	CPC Output 4 12 Open Circuit
Monitored Parameter	Vehicle Speed Output
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, Engine OFF

This fault indicates an open circuit on the pin 12 circuit of the Common Powertrain Controller #4 connector.

Repair the open circuit between pin 12 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

SPN 716 (CPC) (GHG17)

135.1 SPN 716/FMI 3 - GHG17

Digital Output 1 09 Circuit Failed High

SPN 716/FMI 3	
Description	CPC Output 1 09 Short to Voltage
Monitored Parameter	Tachometer
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On

WARNING

ENGINE EXHAUST

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

This fault indicates a short to power on Pin 9 circuit of the Common Powertrain Controller #1 Connector.

Repair the short to power between pin 9 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

135.2 SPN 716/FMI 4 - GHG17

Digital Output 1 09 Circuit Failed Low

SPN 716/FMI 4	
Description	CPC Output 1 09 Short to Ground
Monitored Parameter	Tachometer
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On

⚠ WARNING

ENGINE EXHAUST

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

This fault indicates a short to ground on Pin 9 circuit of the Common Powertrain Controller #1 Connector.

Repair the short to ground between pin 9 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

135.3 SPN 716/FMI 5 - GHG17

Digital Output 1 09 Circuit Open

SPN 716/FMI 5	
Description	CPC Output 1 09 Open Circuit
Monitored Parameter	Tachometer
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On

WARNING

ENGINE EXHAUST

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

This fault indicates an open circuit on Pin 9 circuit of the Common Powertrain Controller #1 Connector.

Repair the open circuit between pin 9 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

SPN 723 (MCM) (GHG17)

136.1 SPN 723/FMI 8 - GHG17

SPN 723/FMI 8	
Description	This Fault Code Sets When the Motor Control Module (MCM) Does Not Receive a Signal from the Camshaft Position Sensor
Monitored Parameter	Camshaft Position
Typical Enabling Conditions	Engine Running
Monitor Sequence	Always
Execution Frequency	None
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL, SEL
Engine Reaction	25% Derate and Engine Shutdown after 20 Seconds
Verification	Engine Running for One Minute

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ WARNING

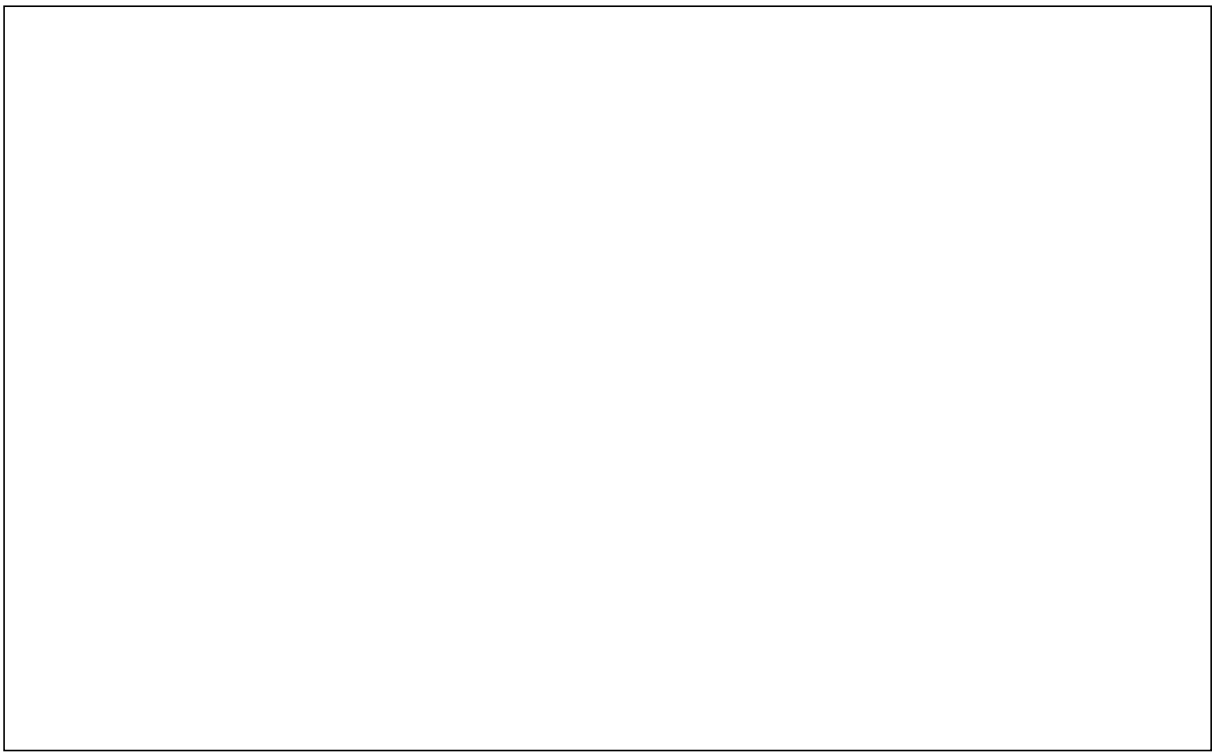
PERSONAL INJURY

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.

⚠ WARNING

ENGINE EXHAUST

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



Check as follows:

1. Use DiagnosticLink Standard to insure that cranking speed is over 150 rpm. Is cranking speed over 150 rpm?
   1.a Yes; Go to step 2.
   1.b No; determine the cause of low crank speed.
2. Turn the ignition OFF.
3. Disconnect the Camshaft Position (CMP) sensor electrical harness connector.
4. Inspect the CMP sensor and harness connector for signs of damage: bent, spread, broken, unseated (pushed out) or corroded pins, signs of moisture indicating seal damage, and signs of wire damage near the connector. Is damage present?
   4.a Yes; repair as necessary.
   4.b No; Go to step 5.
5. Turn the ignition ON (key ON, engine OFF).
6. Measure the voltage between pins 1 and 3 on the harness side of the CMP sensor. Is the voltage between 4.5 and 5.5 volts?
   6.a Yes; Go to step 8.
   6.b No; Go to step 7.
7. Measure the voltage between pin 1 of the CMP sensor harness connector and battery ground. Is the voltage between 4.5 and 5.5 volts?
   7.a Yes; repair the wire between pin 3 of the CMP harness connector and pin 48 of the Motor Control Module (MCM) 120-pin connector.
   7.b No; repair the wire between pin 1 of the CMP harness connector and pin 82 of the MCM 120-pin connector.
8. Turn the ignition OFF.
9. Disconnect the MCM 120-pin connector.
10. Inspect the MCM 120-pin module and harness connector for signs of damage: bent, spread, broken, unseated (pushed out) or corroded pins, signs of moisture indicating seal damage and signs of wire damage near the connector. Is damage present?

10.a Yes; repair as necessary.

10.b No; Go to step 11.

11. Measure the resistance between pin 2 of the CMP harness connector and pin 45 of the MCM 120-pin connector. Is resistance less than five ohms?

11.a Yes; Go to step 12.

11.b No; repair the wire between pin 2 of the CMP harness connector and pin 45 of the MCM 120-pin connector.

12. Measure the resistance between pin 2 of the CMP harness connector and battery ground. Is resistance greater than 10K ohms?

12.a Yes; Go to step 13.

12.b No; repair the shorted wire between pin 2 of the CMP harness connector and pin 45 of the MCM 120-pin connector.

13. Measure the resistance between pins 1 and 2 of the CMP harness connector. Is resistance greater than 10K ohms?

13.a Yes; Go to step 14.

13.b No; repair the shorted wire between pins 1 and 2 of the CMP harness connector and pins 82 and 45 of the MCM 120-pin connector.

14. Measure the resistance between pins 2 and 3 of the CMP harness connector. Is resistance greater than 10K ohms?

14.a Yes; Go to step 15.

14.b No; repair the shorted wire between pins 2 and 3 of the CMP harness connector and pins 45 and 48 of the MCM 120-pin connector.

15. Has the engine had any gear train, camshaft, or flywheel repairs made?

15.a Yes; verify proper gear train timing and proper flywheel installation. Refer to section "Camshaft Timing Verification" .

15.b No; Go to step 16.

16. Remove the CMP sensor and inspect for damage. Refer to section "Removal of the Camshaft Position Sensor" . Is there damage to the sensor?

16.a Yes; Go to step 17.

16.b No; replace the camshaft position sensor. Refer to section "Removal of the Camshaft Position Sensor" . After replacing the CMP sensor, verify the repair and Go to step 18.

17. Inspect the tone wheel on the intake camshaft for damage. Check gear train for excessive lash or damage. Is damage present?

17.a Yes; repair as necessary, and replace the camshaft position sensor. After replacing the CMP sensor, verify the repair and Go to step 18.

17.b No; replace the camshaft position sensor. Refer to section "Removal of the Camshaft Position Sensor" . After replacing the CMP sensor, verify the repair and Go to step 18.

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

> **⚠ 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.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

18. Connect to DiagnosticLink, start the engine and check for codes. Is SPN 723/FMI 8 active?

18.a Yes; replace the camshaft. Refer to section "Removal of the Camshafts" .

18.b No; repair is complete.

136.2 SPN 723/FMI 10 - GHG17

SPN 723/FMI 10	
Description	This Code Sets when the Camshaft Position (CMP) Sensor Signal is Erratic
Monitored Parameter	Camshaft Position Sensor Signal
Typical Enabling Conditions	Engine Idle
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Engine Idle

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

Check as follows:

1. Use DiagnosticLink to insure that cranking speed is over 150 rpm. Is cranking speed over 150 rpm?
   - 1.a Yes; Go to step 2.
   - 1.b No; determine the cause of low crank speed.
2. Disconnect the CMP sensor harness connector.
3. Turn the ignition ON (key ON, engine OFF).
4. Inspect the sensor harness for bent, spread, or corroded pins. Is damage present?
   - 4.a Yes; repair as necessary.
   - 4.b No; Go to step 5.
5. Measure the voltage between pins 1 and 3 on the harness side of the camshaft position sensor. Is the voltage greater than 4.5 volts?
   - 5.a Yes; Go to step 6.
   - 5.b No; Go to step 7.

6. Measure the voltage between pins 2 and 3 on the harness side of the CMP sensor. Is the voltage less than 4.5 volts?
   - 6.a Yes; repair the wire between pin 2 of the harness side of the CMP sensor and pin 45 of the MCM 120-pin connector.
   - 6.b No; Go to step 8.
7. Measure the voltage between pin 1 on the harness side of the CMP sensor and engine ground. Is the voltage less than 4.5 volts?
   - 7.a Yes; repair the wire between pin 1 of the harness side of the CMP sensor and pin 82 of the MCM 120-pin connector.
   - 7.b No; repair the wire between pin 2 of the harness side of the CMP sensor and pin 45 of the MCM 120-pin connector.
8. Has the engine had any gear train, camshaft, or flywheel repairs made?
   - 8.a Yes; verify proper gear train timing and proper flywheel installation. Refer to section "Camshaft Timing Verification" .
   - 8.b No; Go to step 9.
9. Remove the CMP sensor and inspect for damage. Refer to section "Removal of the Camshaft Position Sensor" . Is there damage to the sensor?
   - 9.a Yes; Go to step 10.
   - 9.b No; replace the camshaft position sensor. Refer to section "Removal of the Camshaft Position Sensor" . After replacing the CMP sensor, verify the repair. Go to step 11.
10. Inspect the tone wheel on the intake camshaft for damage. Check gear train for excessive lash or damage. Is damage present?
    - 10.a Yes; repair as necessary, and replace the camshaft position sensor. After replacing the CMP sensor, verify the repair. Go to step 11.
    - 10.b No; replace the camshaft position sensor. Refer to section "Removal of the Camshaft Position Sensor" . After replacing the CMP sensor, verify the repair. Go to step 11.
11. Connect to DiagnosticLink® and check for codes. Is SPN 723/FMI 10 active?
    - 11.a Yes; replace the camshaft. Refer to section "Removal of the Camshafts" .
    - 11.b No; repair is complete.

136.3 SPN 723/FMI 11 - GHG17

SPN 723/FMI 11	
Description	This Code Sets When the Camshaft Position (CMP) Sensor Signal is Disrupted
Monitored Parameter	Camshaft Position Sensor
Typical Enabling Conditions	Engine Idle
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Engine Idle

⚠ WARNING

PERSONAL INJURY

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⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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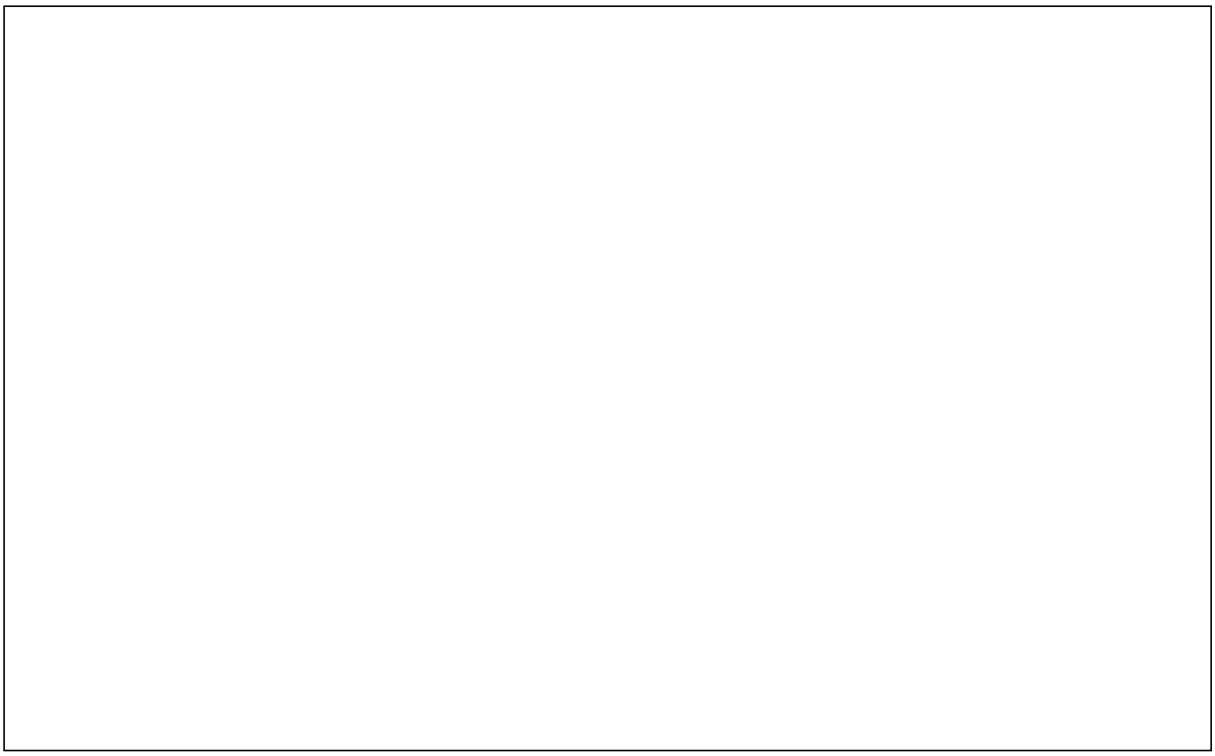


Check as follows:

1. Use DiagnosticLink to insure that cranking speed is over 150 rpm. Is cranking speed over 150 rpm?
   - 1.a Yes; Go to step 2.
   - 1.b No; determine the cause of low crank speed.
2. Turn the ignition OFF.
3. Disconnect the CMP sensor harness connector.
4. Inspect the CMP sensor and harness connectors for signs of damage: bent, spread, broken, unseated (pushed out) or corroded pins, signs of moisture indicating seal damage and signs of wire damage near the connector. Is damage present?
   - 4.a Yes; repair as necessary.
   - 4.b No; Go to step 5.
5. Turn the ignition ON (key ON, engine OFF).
6. Measure the voltage between pins 1 and 3 on the harness side of the CMP sensor. Is the voltage between 4.5 and 5.5 volts?
   - 6.a Yes; Go to step 8.
   - 6.b No; Go to step 7.
7. Measure the voltage between pin 1 of the CMP sensor harness connector and battery ground. Is the voltage between 4.5 and 5.5 volts?
   - 7.a Yes; repair the wire between pin 3 of the CMP harness connector and pin 48 of the Motor Control Module (MCM) 120-pin connector.
   - 7.b No; repair the wire between pin 1 of the CMP harness connector and pin 82 of the MCM 120-pin connector.
8. Turn the ignition OFF.
9. Disconnect the MCM 120-pin connector.
10. Inspect the MCM 120-pin module and harness connectors for signs of damage: bent, spread, broken, unseated (pushed out) or corroded pins, signs of moisture indicating seal damage and signs of wire damage near the connector. Is damage present?

10.a Yes; repair as necessary.

10.b No; Go to step 11.

11. Measure the resistance between pin 2 of the CMP harness connector and pin 45 of the MCM 120-pin connector. Is resistance less thanfiveohms?

11.a Yes; Go to step 12.

11.b No; repair the wire between pin 2 of the CMP harness connector and pin 45 of the MCM 120-pin connector.

12. Measure the resistance between pin 2 of the CMP harness connector and battery ground. Is resistance greater than 10K ohms?

12.a Yes; Go to step 13.

12.b No; repair the shorted wire between pin 2 of the CMP harness connector and pin 45 of the MCM 120-pin connector.

13. Measure the resistance between pins 1 and 2 of the CMP harness connector. Is resistance greater than 10K ohms?

13.a Yes; Go to step 14.

13.b No; repair the shorted wire between pins 1 and 2 of the CMP harness connector and pins 82 and 45 of the MCM 120-pin connector.

14. Measure the resistance between pins 2 and 3 of the CMP harness connector. Is resistance greater than 10K ohms?

14.a Yes; Go to step 15.

14.b No; repair the shorted wire between pins 2 and 3 of the CMP harness connector and pins 45 and 48 of the MCM 120-pin connector.

15. Has the engine had any gear train, camshaft, or flywheel repairs made?

15.a Yes; verify proper gear train timing and proper flywheel installation. Refer to section "Camshaft Timing Verification" .

15.b No; Go to step 16.

16. Remove the CMP sensor and inspect for damage. Refer to section "Removal of the Camshaft Position Sensor" . Is there damage to the sensor?

16.a Yes; Go to step 17.

16.b No; replace the camshaft position sensor. Refer to section "Removal of the Camshaft Position Sensor" . After replacing the CMP sensor, verify the repair. Go to step 18.

17. Inspect the tone wheel on the intake camshaft for damage. Check gear train for excessive lash or damage. Is damage present?

17.a Yes; repair as necessary, and replace the camshaft position sensor. After replacing the CMP sensor, verify the repair. Go to step 18.

17.b No; replace the camshaft position sensor. Refer to section "Removal of the Camshaft Position Sensor" . After replacing the CMP sensor, verify the repair. Go to step 18.

18. Connect to DiagnosticLink and check for codes. Is SPN 723/FMI 11 active?

18.a Yes; replace the camshaft. Refer to section "Removal of the Camshafts" .

18.b No; repair is complete.

136.4 SPN 723/FMI 31 - GHG17

This may be due to an engine temporarily running in a reverse direction. Symptoms include smoke exiting from intake manifold and a low idle speed, possibly due to a leaky injector.

SPN 723/FMI 31	
Description	This Code Sets When There is No Match of Camshaft and Crankshaft Signals
Monitored Parameter	Camshaft Reverse Direction Rising Edge Signal
Typical Enabling Conditions	Engine State and Low Idle and Camshaft Reverse Direction Error
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%, Shutdown Priority
Verification	Engine Idle

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

NOTICE

A reverse rotation of the engine will temporarily affect oil pump output. Oil pressure must be checked after engine starts. Possible bearing damage may exist.

1. Connect to DiagnosticLink . Check for other fault codes. Are there any SPN 723/FMI 8, 10, or 11 present?
   1.a Yes; troubleshoot the other codes first.
   1.b No; Go to step 2.
2. Inspect the Exhaust Gas Recirculation (EGR) hot pipe for fuel, coolant, or oil.
   For the DD13, Refer to section "Cleaning of the DD13 Exhaust Gas Recirculation System"

For the DD15, Refer to section "Cleaning of the DD15 Exhaust Gas Recirculation System"

For the DD16, Refer to section "Cleaning of the DD16 Exhaust Gas Recirculation System"

3. Is fuel present in the EGR hot pipe?
   - 3.a Yes; fuel is present. Refer to section "Test-E - Two-Filter Fuel System" .
   - 3.b No; Go to step 4.
4. Is coolant present in the EGR hot pipe?
   - 4.a Yes; coolant is present. Pressurize the cooling system according to Original Equipment Manufacturer (OEM) specifications. Repair as necessary.
   - 4.b No; Go to step 5.
5. Is oil present in the EGR hot pipe?
   - 5.a Yes; oil is present. Inspect turbocharger inlet and outlet for oil. Repair as necessary.
   - 5.b No; reinstall the EGR hot pipe with new sealing gaskets and exhaust clamps. Refer to section "Installation of the Exhaust Gas Recirculation Hot Pipe" . Go to step 6.
6. Turn the ignition ON (key ON, engine OFF).
7. Are there any Camshaft Position (CMP) sensor SPN 723/FMI Any, Crankshaft Position (CKP) sensor SPN 636/FMI Any, or oil pressure SPN 100/FMI Any faults present?
   - 7.a Yes; repair those faults first.
   - 7.b No; Go to step 8.
8. Are there any throttle pedal or idle validation switch faults present?
   - 8.a Yes; repair those faults first.
   - 8.b No; Go to step 9.
9. Perform an Idle Speed Balance (ISB) test. Are any faulty fuel injectors identified?
   - 9.a Yes; replace suspect fuel injector(s).
   - 9.b No; Go to step 10.
10. Use DiagnosticLink to insure that cranking speed is over 150 rpm. Is cranking speed over 150 rpm?
    - 10.a Yes; Go to step 11.
    - 10.b No; determine the cause of low crank speed.
11. Turn the ignition OFF.
12. Has the engine had any gear train, camshaft, or flywheel repairs made?
    - 12.a Yes; verify proper gear train timing and proper flywheel installation. Refer to section "Camshaft Timing Verification" .
    - 12.b No; Go to step 13.
13. Remove the CMP sensor and inspect for damage. Refer to section "Removal of the Camshaft Position Sensor" . Is there damage to the sensor?
    - 13.a Yes; Go to step 14.
    - 13.b No; replace the camshaft position sensor. Refer to section "Removal of the Camshaft Position Sensor" . After replacing the CMP sensor, verify the repair and Go to step 15.
14. Inspect the tone wheel on the intake camshaft for damage. Check gear train for excessive lash or damage. Is damage present?
    - 14.a Yes; repair as necessary, and replace the camshaft position sensor. After replacing the CMP sensor, verify the repair. Go to step 15.
    - 14.b No; replace the camshaft position sensor. Refer to section "Removal of the Camshaft Position Sensor" . After replacing the CMP sensor, verify the repair. Go to step 15.
15. Connect to DiagnosticLink and check for codes. Is SPN 723/FMI 31 active?
    - 15.a Yes; replace the camshaft. Refer to section "Removal of the Camshafts" .
    - 15.b No; repair is complete.

SPN 748 (CPC3) (GHG17)

137.1 SPN 748/FMI 12 - GHG17

Check as follows:

1. This fault indicates the Central Gateway is configured incorrectly. Reprogram Central Gateway to Original Equipment Manufacturer (OEM) configuration. Retarder Control Module (RCM) is not available in the NAFTA market. The CGW04T Monitor parameter ECU05 needs to be set to "RCM Not Installed".

SPN 904 (CPC) (GHG17)

138.1 SPN 904/FMI 9 - GHG17

J1939 Engine Brake Controller (EBC2) Message from the Anti-Lock Brake System (ABS) is Missing

This fault code indicates a missing message from the ABS module. Refer to Original Equipment Manufacturer (OEM) material for J1939 troubleshooting for the ABS module.

FARM & CONSTRUCTION MANUALS

138.2 SPN 904/FMI 13 - GHG17

Front Axle Speed Signal is Missing

1. Check for multiple codes:
   - 1.a If Common Powertrain Controller (CPC) SPN 168/FMI 0/14/18 (battery voltage) are present troubleshoot these first.
   - 1.b If Motor Control Module (MCM) SPN 625/FMI 9 is present, troubleshoot and repair the Controller Area Network (CAN) line.
   - 1.c If only a J1939 Error fault is present, Go to step 2.
2. Has the CPC been recently reprogrammed?
   - 2.a If yes, check the proper configuration of the CPC.
   - 2.b If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

138.3 SPN 904/FMI 19 - GHG17

Front Axle Speed Signal is Erratic

1. Check for multiple codes:
   - 1.a If Common Powertrain Controller (CPC) SPN 168/FMI 0/14/18 (battery voltage) are present troubleshoot these first.
   - 1.b If Motor Control Module (MCM) SPN 625/FMI 9 is present, troubleshoot and repair the Controller Area Network (CAN) line.
   - 1.c If only a J1939 Error fault is present, Go to step 2.
2. Has the CPC been recently reprogrammed?
   - 2.a If yes, check the proper configuration of the CPC.
   - 2.b If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

SPN 924 (CPC) (GHG17)

139.1 SPN 924/FMI 3 - GHG17

Digital Output 4 09 Circuit Failed High

SPN 924/FMI 3	
Description	CPC Output 4 09 Short to Voltage
Monitored Parameter	CPC Output 4/09
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

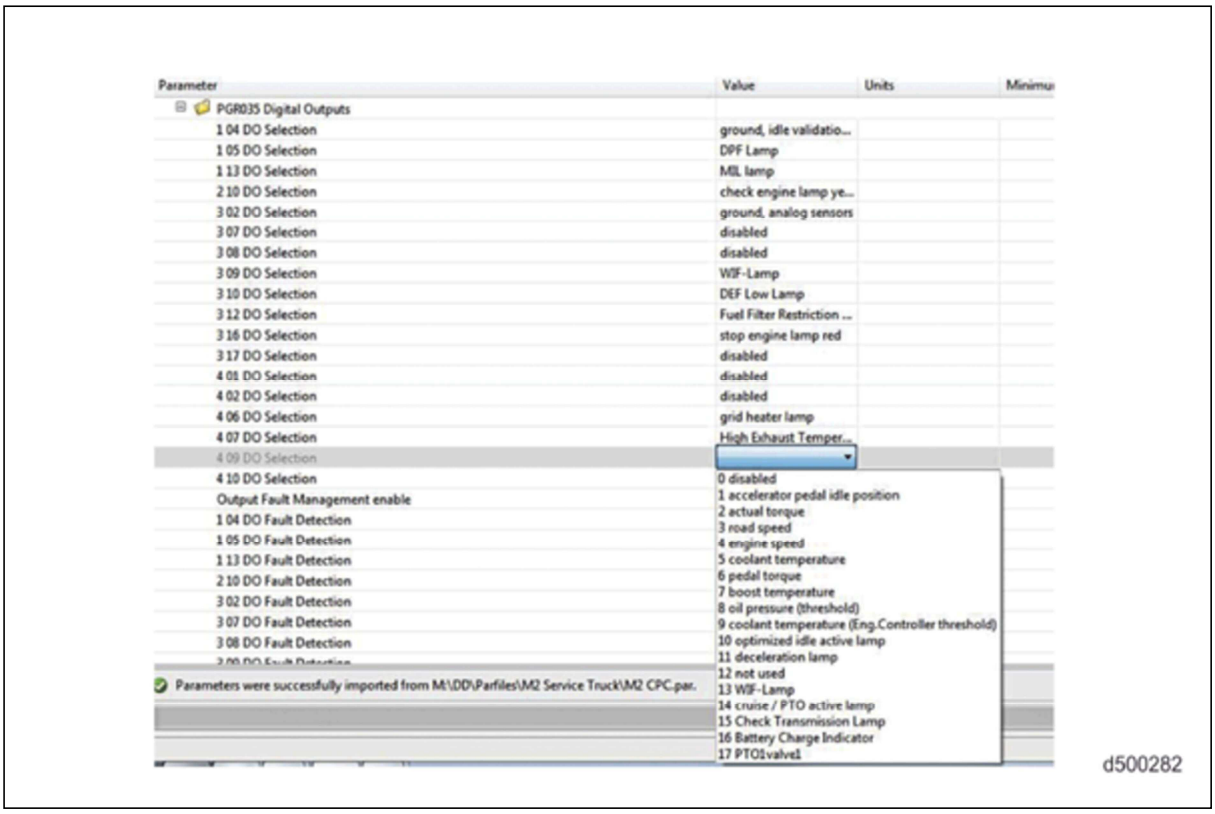
WARNING

ENGINE EXHAUST

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

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 09 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to power between pin 9 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

139.2 SPN 924/FMI 4 - GHG17

SPN 924/FMI 4	
Description	CPC Output 4 09 Short to Ground
Monitored Parameter	CPC Output 4/09
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

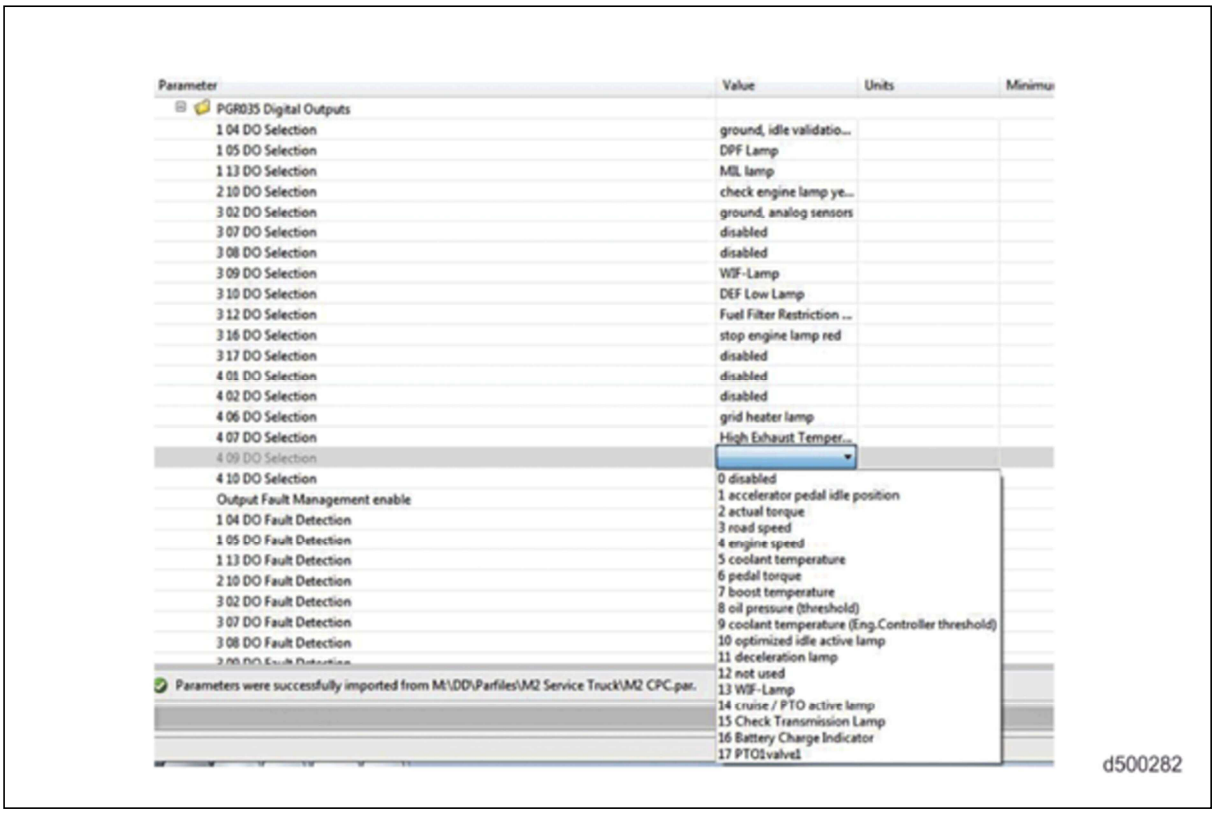
WARNING

ENGINE EXHAUST

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

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 09 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; Repair the short to ground between pin 9 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

139.3 SPN 924/FMI 5 - GHG17

Digital Output 4 09 Circuit Open

SPN 924/FMI 5	
Description	CPC Output 4 09 Open Circuit
Monitored Parameter	CPC Output 4/09
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

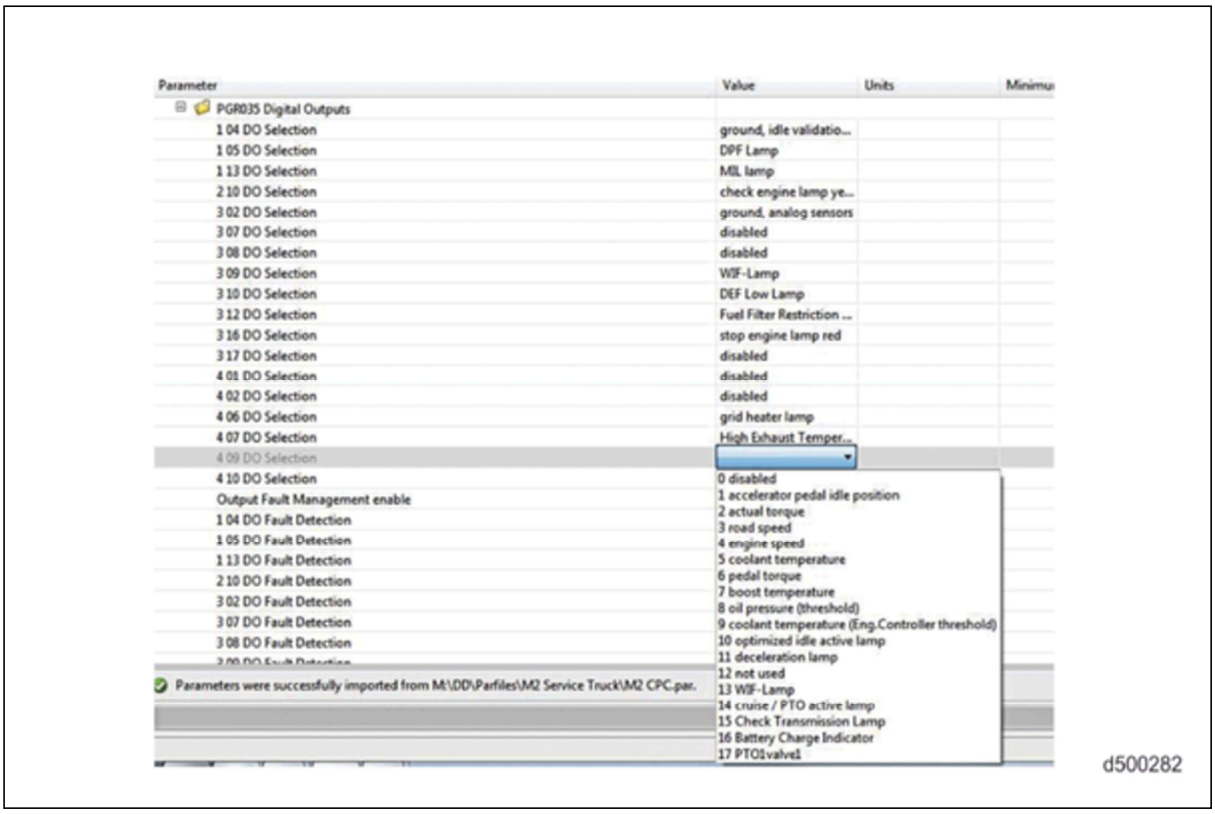
WARNING

ENGINE EXHAUST

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

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 09 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; Repair the open circuit between pin 9 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

SPN 925 (CPC) (GHG17)

140.1 SPN 925/FMI 3 – GHG17

Digital Output 3 17 Circuit Failed High

SPN 925/FMI 3	
Description	CPC Output 3 17 Short to Voltage
Monitored Parameter	CPC output 3/17
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with output activation

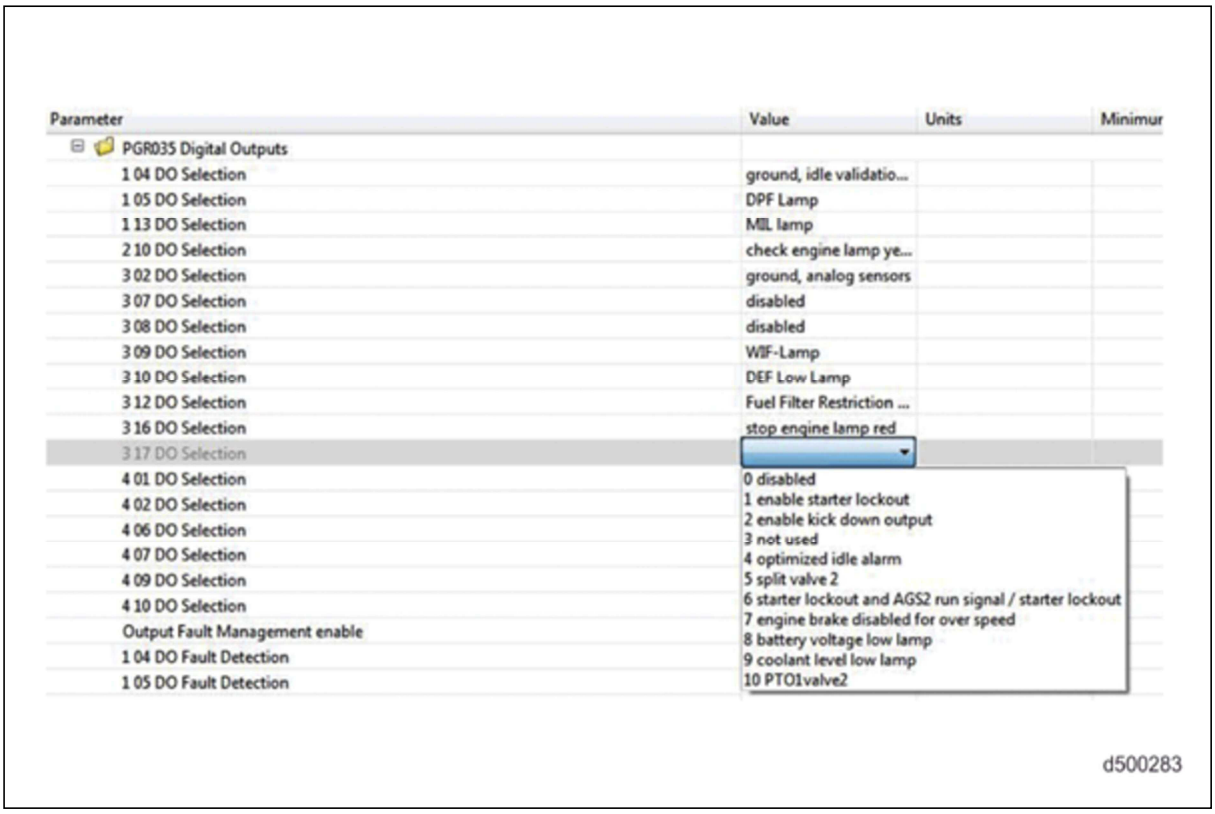
WARNING

ENGINE EXHAUST

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

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 3 17 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; Repair the short to power between pin 17 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

140.2 SPN 925/FMI 4 – GHG17

SPN 925/FMI 4	
Description	CPC Output 3 17 Short to Ground
Monitored Parameter	CPC Output 3/17
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

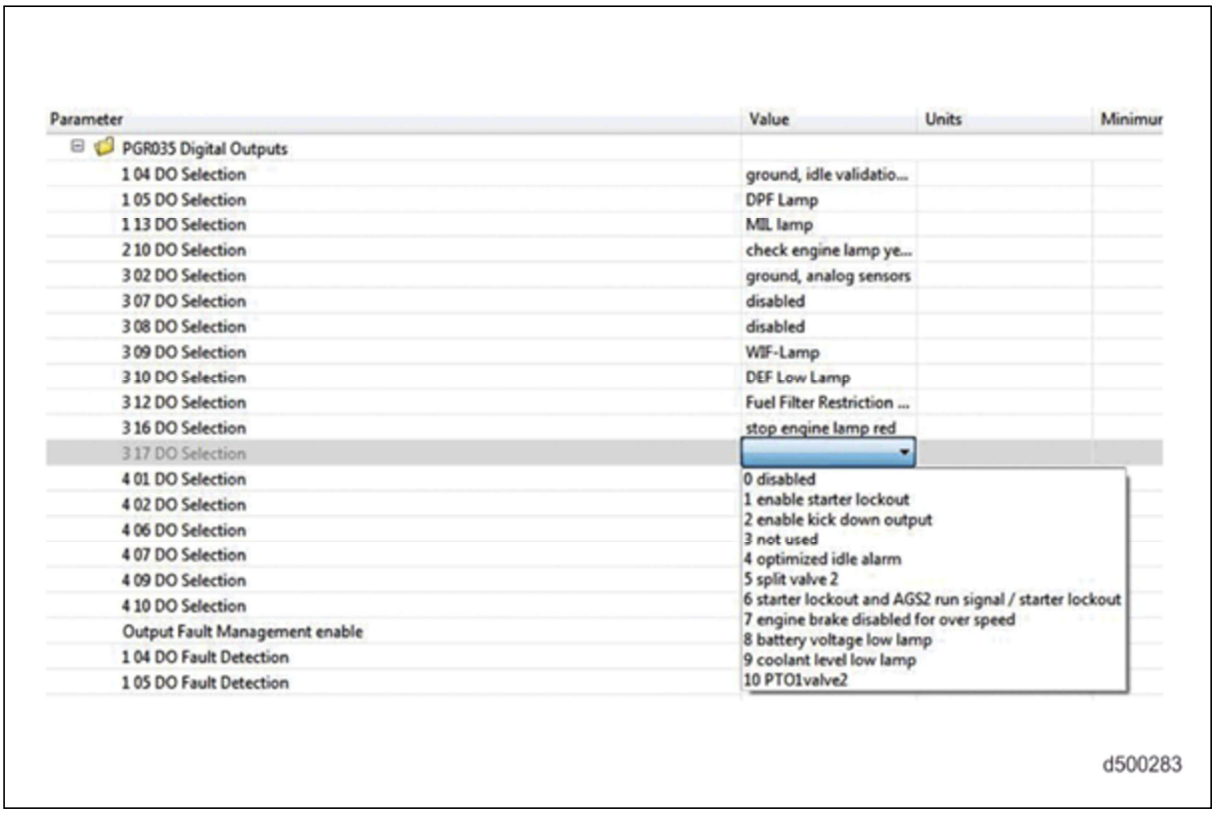
WARNING

ENGINE EXHAUST

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

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 3 17 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; Repair the short to ground between pin 17 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

140.3 SPN 925/FMI 5 – GHG17

SPN 925/FMI 5	
Description	CPC Output 3 17 Open Circuit
Monitored Parameter	CPC Output 3/17
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

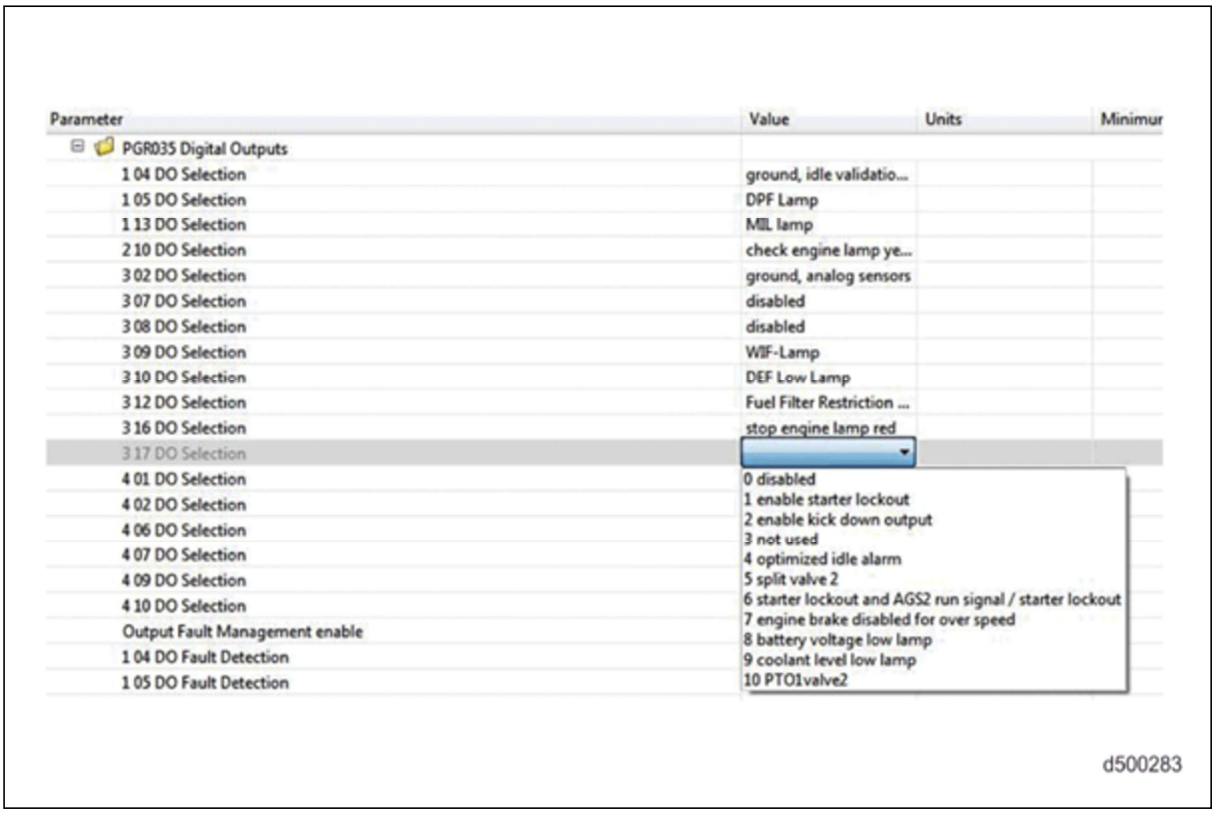
WARNING

ENGINE EXHAUST

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

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 3 17 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; Repair the open circuit between pin 17 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

SPN 926 (CPC) (GHG17)

141.1 SPN 926/FMI 3 – GHG17

SPN 926/FMI 3	
Description	CPC Output 4 01 Short to Voltage
Monitored Parameter	CPC Output 4/01
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On With Output Activation

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

WARNING

PERSONAL INJURY

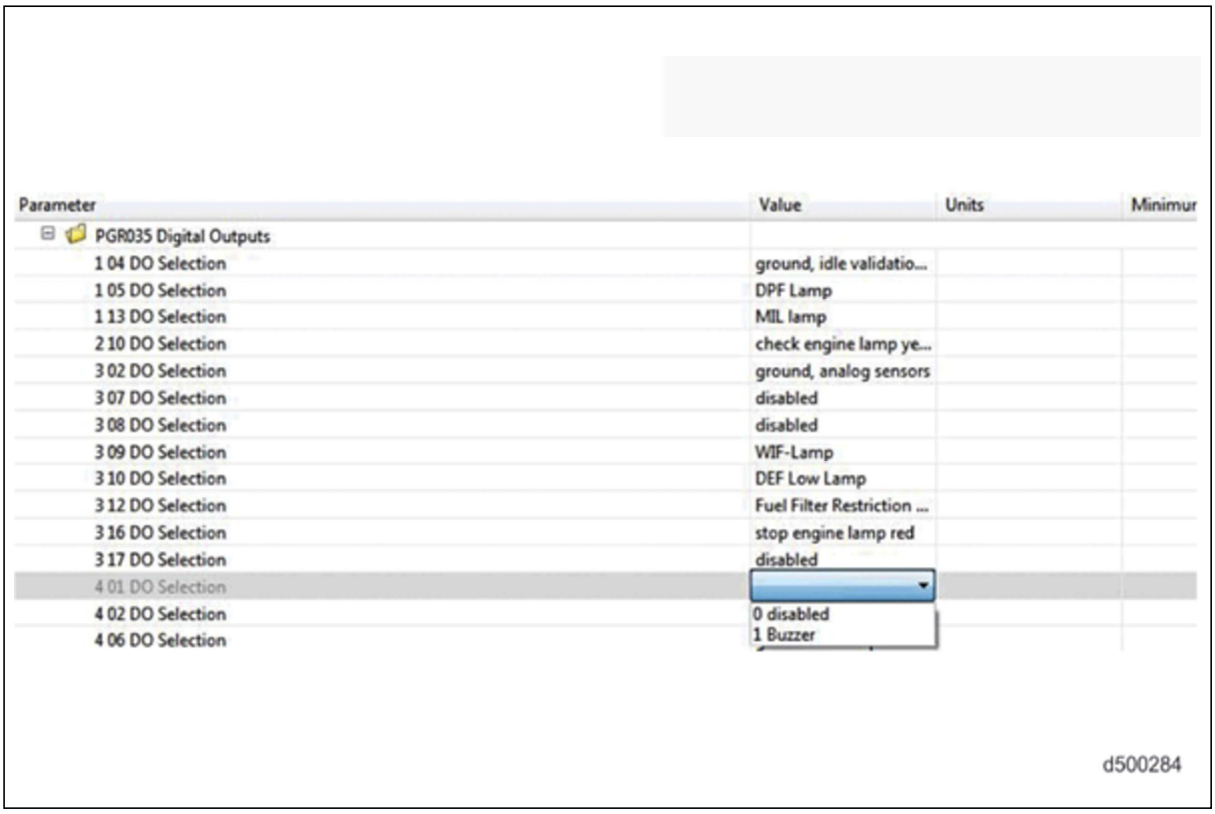
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 01 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to power between pin 1 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

141.2 SPN 926/FMI 4 – GHG17

SPN 926/FMI 4	
Description	CPC Output 4 01 Short to Ground
Monitored Parameter	CPC Output 4/01
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On With Output Activation

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ WARNING

PERSONAL INJURY

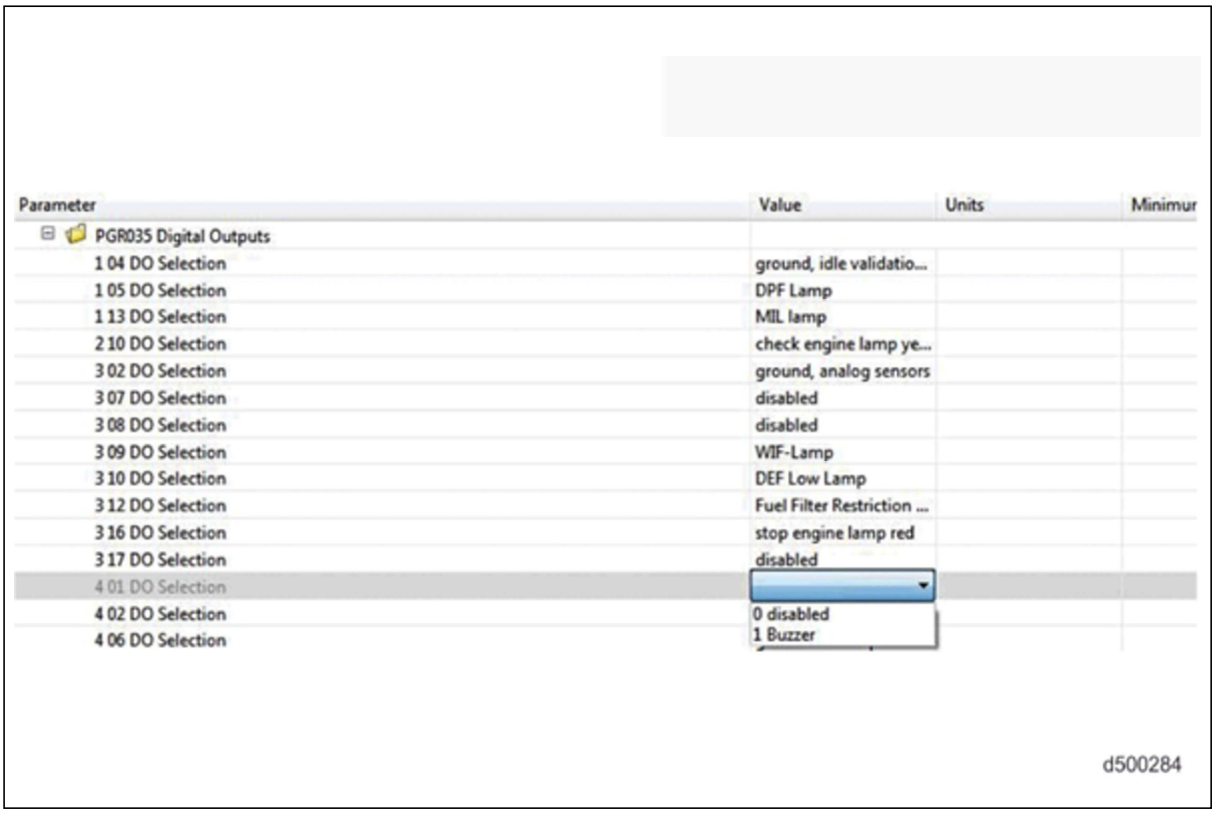
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

⚠ WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 01 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to ground between CPC connector #4 pin 01 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

141.3 SPN 926/FMI 5 – GHG17

SPN 926/FMI 5	
Description	CPC Output 4 01 Open Circuit
Monitored Parameter	CPC Output 4/01
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On With Output Activation

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

WARNING

PERSONAL INJURY

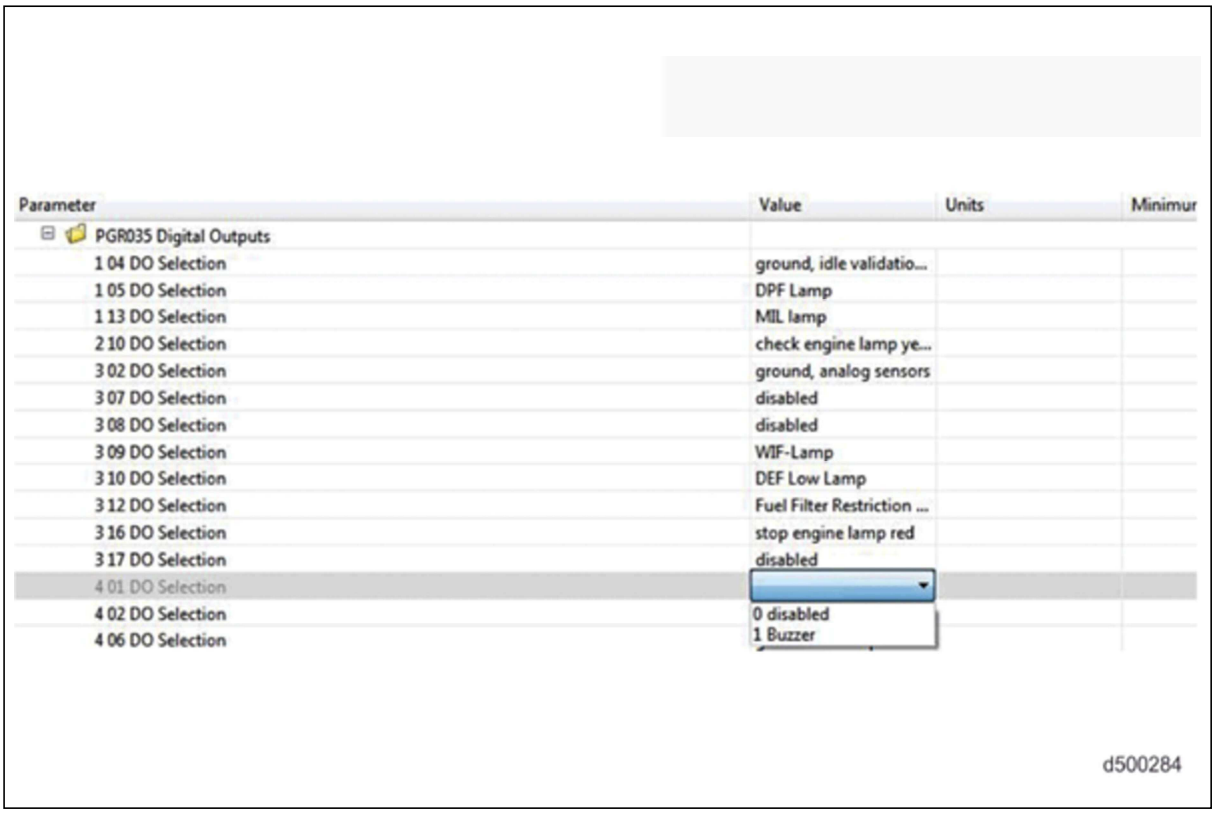
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 01 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   4.a Yes; repair the open circuit between pin 1 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   4.b No; configure the parameters correctly.

SPN 961 (MCM) (GHG17)

142.1 SPN 961/ FMI 2 - GHG17

SPN 961/FMI 2	
Description	Clock Data Invalid
Monitored Parameter	CPC Real-time Clock
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Ignition ON

Check as follows:

1. Connect to DiagnosticLink .
2. Clear code SPN 961/FMI 2 and power down for 30 seconds.
3. Reconnect to DiagnosticLink.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

4. Start and run the engine for 20 seconds.
5. Check for codes. Is SPN 961/FMI 2 active?

   5.a Yes; replace the Common Powertrain Controller (CPC) and reprogram with the latest software release.

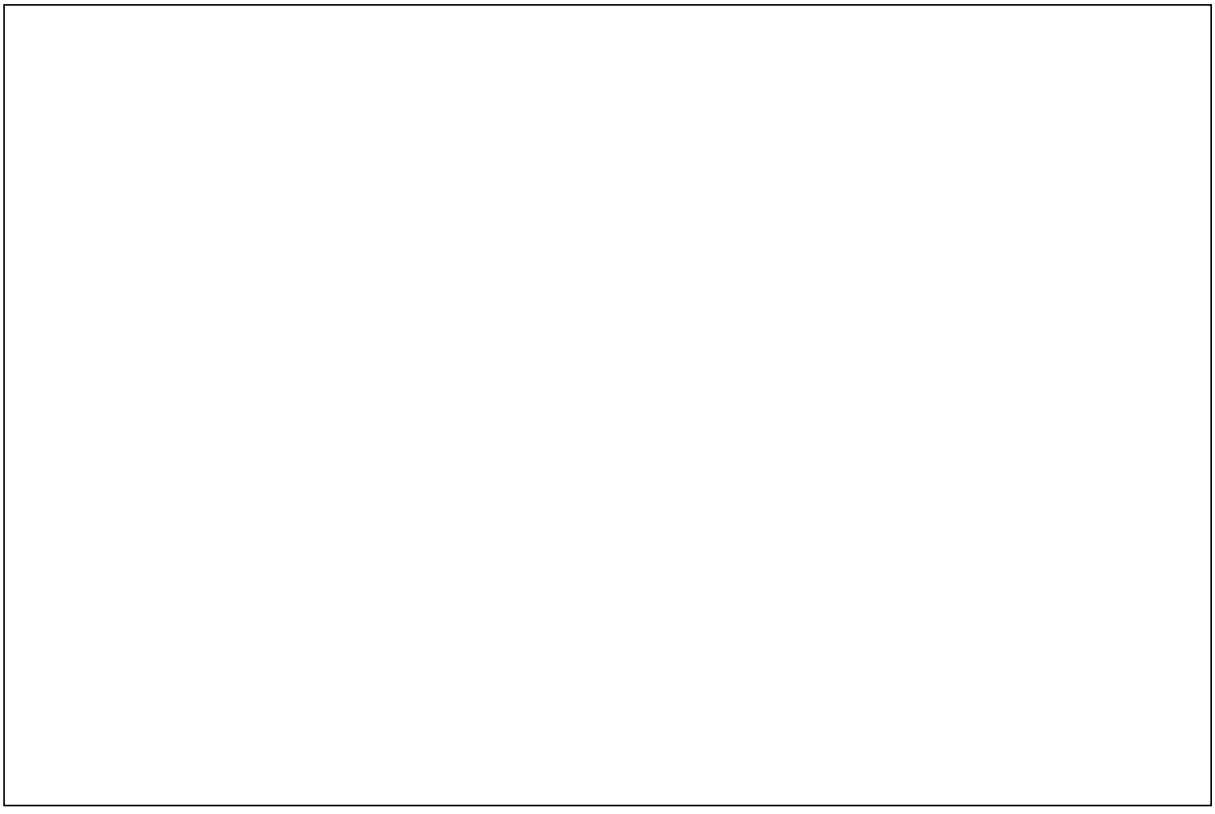
   5.b No; release the vehicle.

SPN 970 (CPC) (GHG17)

143.1 SPN 970/FMI 3 - GHG17

Engine Aux. Shutdown Input Failed High

SPN 970/FMI 3	
Description	Aux Shutdown Switch Short to Voltage or Open
Monitored Parameter	Pin 3/1 Status Bit
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	10 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key Cycle



Check as follows:

1. Turn the ignition OFF.
2. Disconnect the Aux Shutdown switch. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
3. Inspect the Aux Shutdown switch harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Are any signs of damage present?

3.a Yes; repair as necessary. Verify repairs.

3.b No; Go to step 4.

4. Turn the ignition ON (key ON, engine OFF).

5. Measure the voltage between pin C of the Aux Shutdown switch harness connector and ground. For wiring schematic information , refer to Original Equipment Manufacturer (OEM) literature. Is the voltage less than 0.5 volts?

   5.a Yes; Go to step 6.

   5.b No; repair the short to voltage between pin C of the Aux Shutdown switch harness connector and pin 2 of the CPC connector #3. Verify repairs.

6. Measure the voltage between pin A of the Aux Shutdown switch harness connector and ground. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature. Is the voltage less than 0.5 volts?

   6.a Yes; repair the open between pin A of the Aux Shutdown switch harness connector and pin 3 of the CPC connector #3 .Verify repairs.

   6.b No; Go to step 7.

7. Measure the voltage between pin B of the Aux Shutdown switch harness connector and ground. For wiring schematic information,refer to Original Equipment Manufacturer (OEM) literature. Is the voltage less than 0.5 volts?

   7.a Yes; Go to step 8.

   7.b No; repair the short to voltage between pin B of the Aux Shutdown switch harness connector and pin 1 of the CPC connector #3 . Verify repairs.

8. Disconnect the 21-pin CPC connector #3.
9. Inspect the CPC harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Are any signs of damage present?

   9.a Yes; repair as necessary. Verify repairs.

   9.b No; Go to step 10.

10. Measure the resistance between pin C of the Aux Shutdown switch harness connector and pin 2 of the CPC harness connector #3 . For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature. Is the resistance less than five ohms?

    10.a Yes; Go to step 11.

    10.b No; repair the open in the wiring harness between pin C of the Aux Shutdown switch harness side connector and pin 2 of the CPC connector #3. Verify repairs.

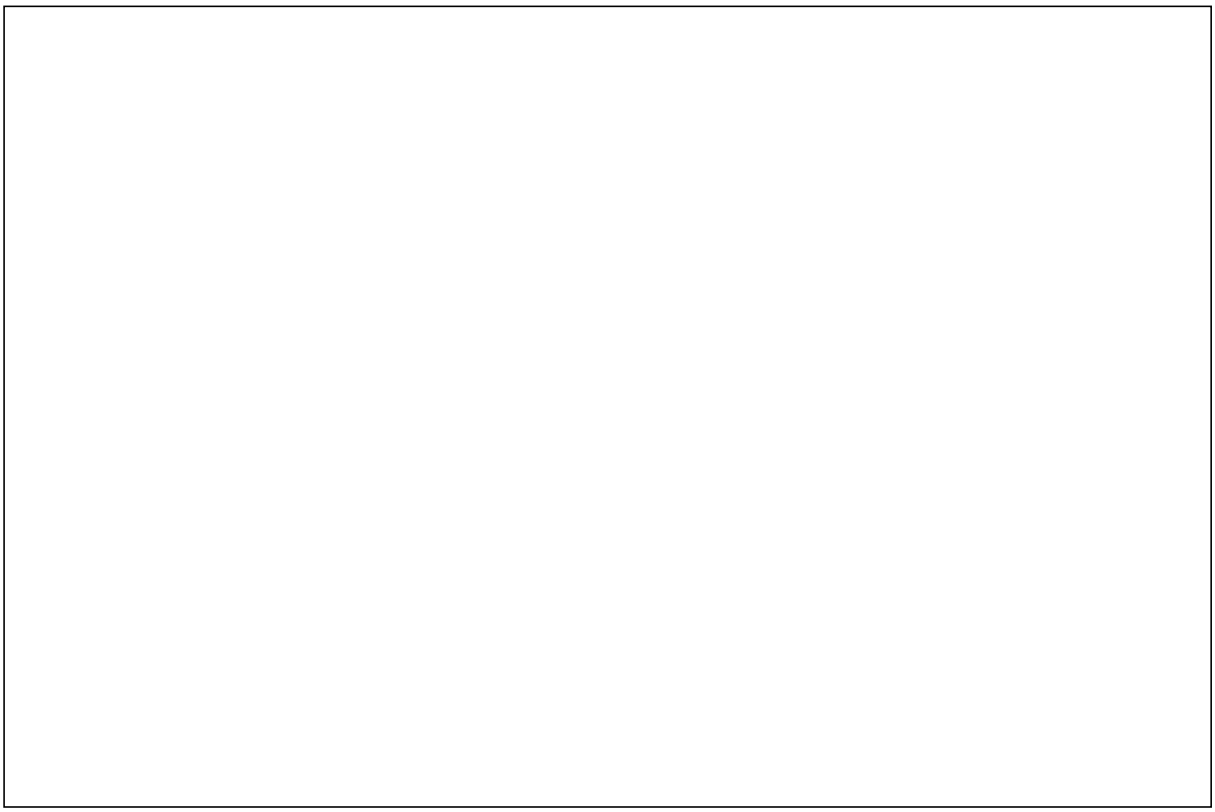
11. Measure the resistance between pin B of the Aux Shutdown switch harness connector and pin 1 of the CPC harness connector #3. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature. Is the resistance less than five ohms?

11.a Yes; replace the Aux Shutdown switch. Refer to Original Equipment Manufacturer (OEM) literature.

11.b No; repair the open in the wiring harness between pin B of the Aux Shutdown switch harness side connector and pin 1 of the CPC connector #3. Verify repairs.

143.2 SPN 970/FMI 4 - GHG17

SPN 970/FMI 4	
Description	Aux Shutdown Switch Short Ground
Monitored Parameter	Pin 3/1 Status Bit
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	10 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key Cycle



Check as follows:

1. Turn the ignition OFF.
2. Disconnect the Aux Shutdown switch. Refer to Original Equipment Manufacturer (OEM) literature for wiring schematic information.
3. Inspect the Aux Shutdown switch harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Are any signs of damage present?

   3.a Yes; repair as necessary. Verify repairs.

   3.b No; Go to step 4.
4. Measure the resistance between pin B of the Aux Shutdown switch connector harness side and ground. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature. Is the resistance greater than 10k ohms?

4.a Yes; Go to step 5.

4.b No; repair the short to ground between pin B of the Aux Shutdown switch connector harness side and pin 1 of the CPC connector #3 harness side. Verify repairs.

5. Measure the resistance between pin A of the Aux Shutdown switch connector harness side and ground. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature. Is the resistance greater than 10k ohms?

5.a Yes; Go to step 6.

5.b No; repair the short to ground between pin A of the Aux Shutdown switch connector harness side and pin 3 of the CPC connector #3 harness side. Verify repairs .

6. With the Aux Shutdown switch still disconnected , clear code SPN 970/FMI 4. Turn the ignition OFF, wait five minutes , and turn the ignition back ON. Does fault code SPN 970/FMI 4 return?

6.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature. Verify repairs.

6.b No; replace the Aux Shutdown switch. Refer to Original Equipment Manufacturer (OEM) literature.

SPN 972 (CPC) (GHG17)

144.1 SPN 972/FMI 2 - GHG17

SPN 972/FMI 2	
Description	Throttle Inhibit Switch Signal Not Plausible
Monitored Parameter	Throttle Inhibit
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On

1. Check for multiple codes. Is Common Powertrain Controller (CPC) SPN 168/FMI 0/14/18 (battery voltage) present?
   1.a Yes; troubleshoot SPN 168/FMI 0/14/18 first.
   1.b No; Go to step 2.
2. Is Motor Control Module (MCM) SPN 625/FMI 9 present?
   2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   3.a Yes; check the proper configuration of the CPC.
   3.b No; clear fault and retest. Go to step 4.
4. Turn the ignition on (key ON, engine OFF).
5. Does SPN 972/FMI 2 return?
   5.a Yes; Go to step 6.
   5.b No; testing is completed. Release vehicle.
6. Disconnect and inspect the throttle inhibit switch harness connector for bent, spread or corroded pins.
   6.a If pin damage is found, repair as necessary.
   6.b If no pin damage is found, clear fault and retest with switch disconnected. Go to step 7.
7. Does SPN 972/FMI 2 remain active?
   7.a Yes; repair short circuit on pin 17 of the CPC connector #1.
   7.b No; replace the throttle inhibit switch. Verify repairs.

SPN 973 (CPC) (GHG17)

145.1 SPN 973/FMI 2 - GHG17

Evobus 5-stage Retarder Level Position Not Plausible - Short to Power/Open Circuit on Pin 13 of the Common Powertrain Controller #2 Connector

For wiring schematic information refer to Original Equipment Manufacturer (OEM) literature.

Note : The Common Powertrain Controller (CPC) digital outputs have the same SPN as some Motor Control Module (MCM) faults. DiagnosticLink® Standard makes the distinction between the MCM and CPC when diagnosing a fault.

145.2 SPN 973/FMI 9 - GHG17

J1939 Electronic Brake Controller (EBC1) (Engine Brake Switches) is Missing

1. Check for multiple codes:
   - 1.a If Common Powertrain Controller (CPC) SPN 168/FMI 0/14/18 (battery voltage) are present troubleshoot these first.
   - 1.b If Motor Control Module (MCM) SPN 625/FMI 9 is present, troubleshoot and repair the Controller Area Network (CAN) line.
   - 1.c If only SPN 973/FMI 9 is present, Go to step 2.
2. Has the CPC been recently reprogrammed?
   - 2.a If yes, ensure the CPC Group PGR001 parameter EBC1 Source Address SAE J1939 is configured properly: 33 = non multiplex switches, 49 = multiplex switches.
   - 2.b If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

145.3 SPN 973/FMI 13 - GHG17

Engine Retarder Selection Signal is Missing

1. Check for multiple codes:
   - 1.a If Common Powertrain Controller (CPC) SPN 168/FMI 0/14/18 (battery voltage) are present troubleshoot these first.
   - 1.b If Motor Control Module (MCM) SPN 625/FMI 9 is present, troubleshoot and repair the Controller Area Network (CAN) line.
   - 1.c If only a J1939 Error fault is present, Go to step 2.
2. Has the CPC been recently reprogrammed?
   - 2.a If yes, check the proper configuration of the CPC.
   - 2.b If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

145.4 SPN 973/FMI 19 - GHG17

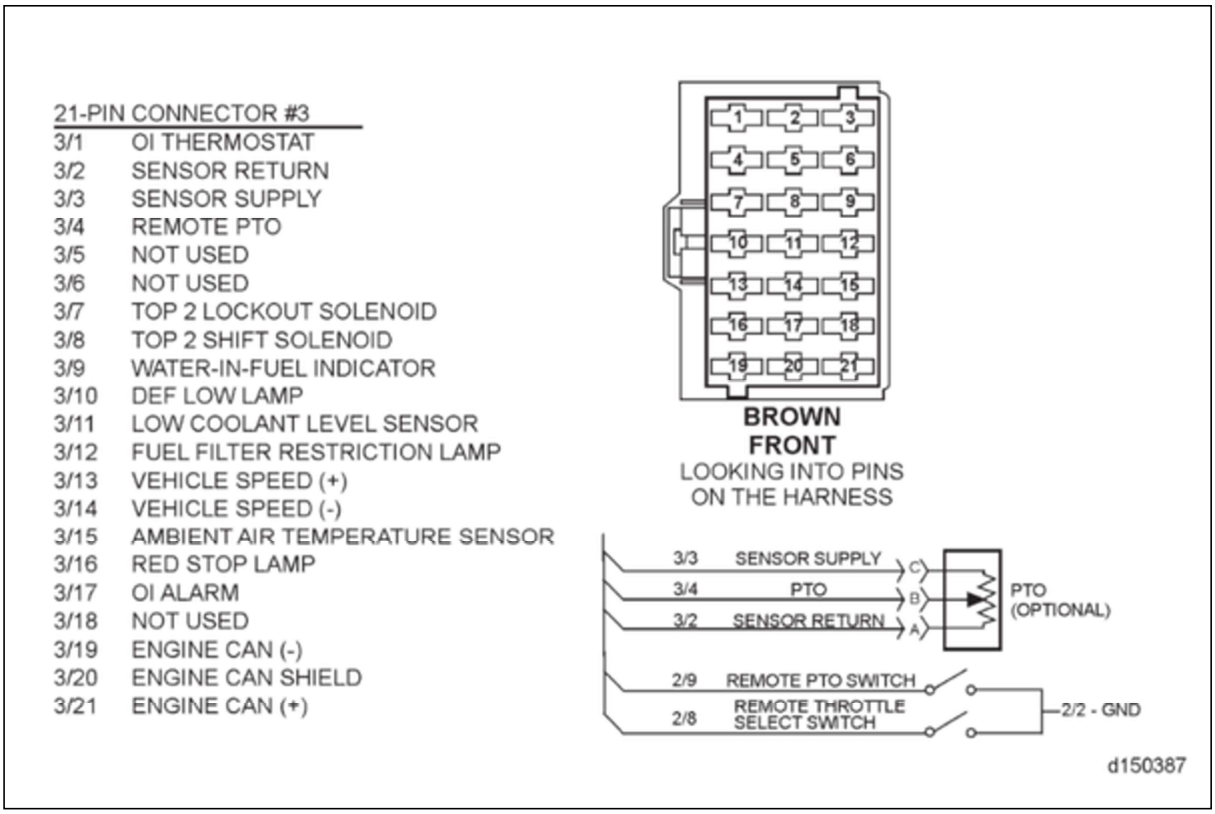
Engine Retarder Selection Signal is Erratic

1. Check for multiple codes:
   - 1.a If Common Powertrain Controller (CPC) SPN 168/FMI 0/14/18 (battery voltage) are present troubleshoot these first.
   - 1.b If Motor Control Module (MCM) SPN 625/FMI 9 is present, troubleshoot and repair the Controller Area Network (CAN) line.
   - 1.c If only a J1939 Error fault is present, Go to step 2.
2. Has the CPC been recently reprogrammed?
   - 2.a If yes, check the proper configuration of the CPC.
   - 2.b If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

SPN 974 (CPC) (GHG17)

146.1 SPN 974/FMI 2 - GHG17

SPN 974/FMI 2	
Description	This Fault May Occur if Remote Accelerator Pedal is Programmed ON and Remote Pedal Circuit is Shorted to Power or Ground
Monitored Parameter	Remote Throttle Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On Engine On



Check as follows:

1. Is the unit equipped with a remote accelerator pedal?
   1.a Yes; Go to step 2.
   1.b No; refer to the A & I manual for proper Common Powertrain Controller (CPC) configuration.
2. Disconnect the remote throttle switch.
3. Turn the ignition ON (key ON, engine OFF).

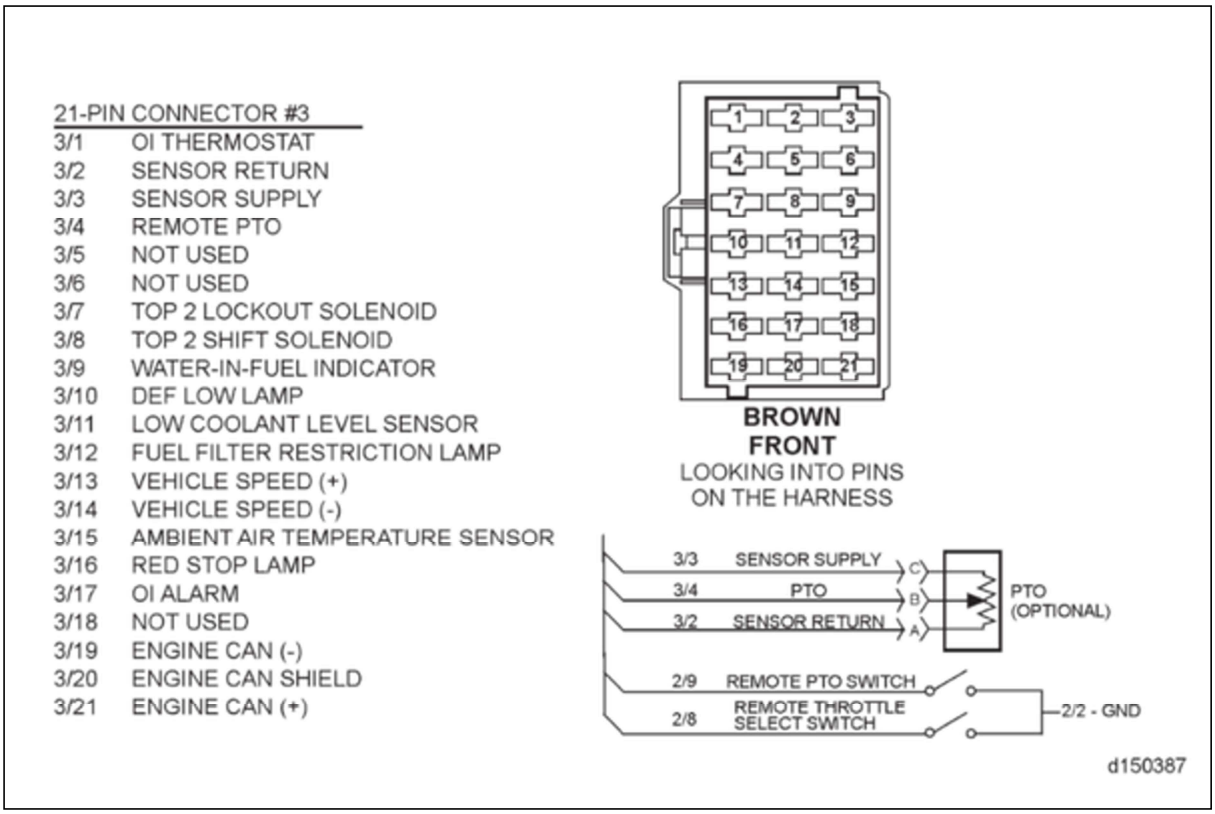
4. Measure the voltage between remote throttle switch connector (from pin 4 of the CPC connector #3) and ground. Refer to Original Equipment Manufacturer (OEM) literature for schematic information. Is voltage present?

   4.a Yes; repair the short to power between pin 4 of the CPC connector #3 and the remote throttle switch.

   4.b No; repair the short to ground between pin 4 of the CPC connector #3 and the remote throttle switch.

146.2 SPN 974/FMI 3 - GHG17

SPN 974/FMI 3	
Description	This Fault May Occur if Remote Accelerator Pedal is Programmed ON and Remote Pedal Circuit is Shorted to Power While Pin 8 of the Common Powertrain Controller (CPC) Connector #2 is Grounded
Monitored Parameter	Remote Throttle Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On Engine On with Remote Pedal Activated



Check as follows:

1. Is the unit equipped with a remote accelerator pedal?

   1.a Yes; Go to step 2.

   1.b No; refer to the Application and Installation manual for proper Common Powertrain Controller (CPC) configuration.

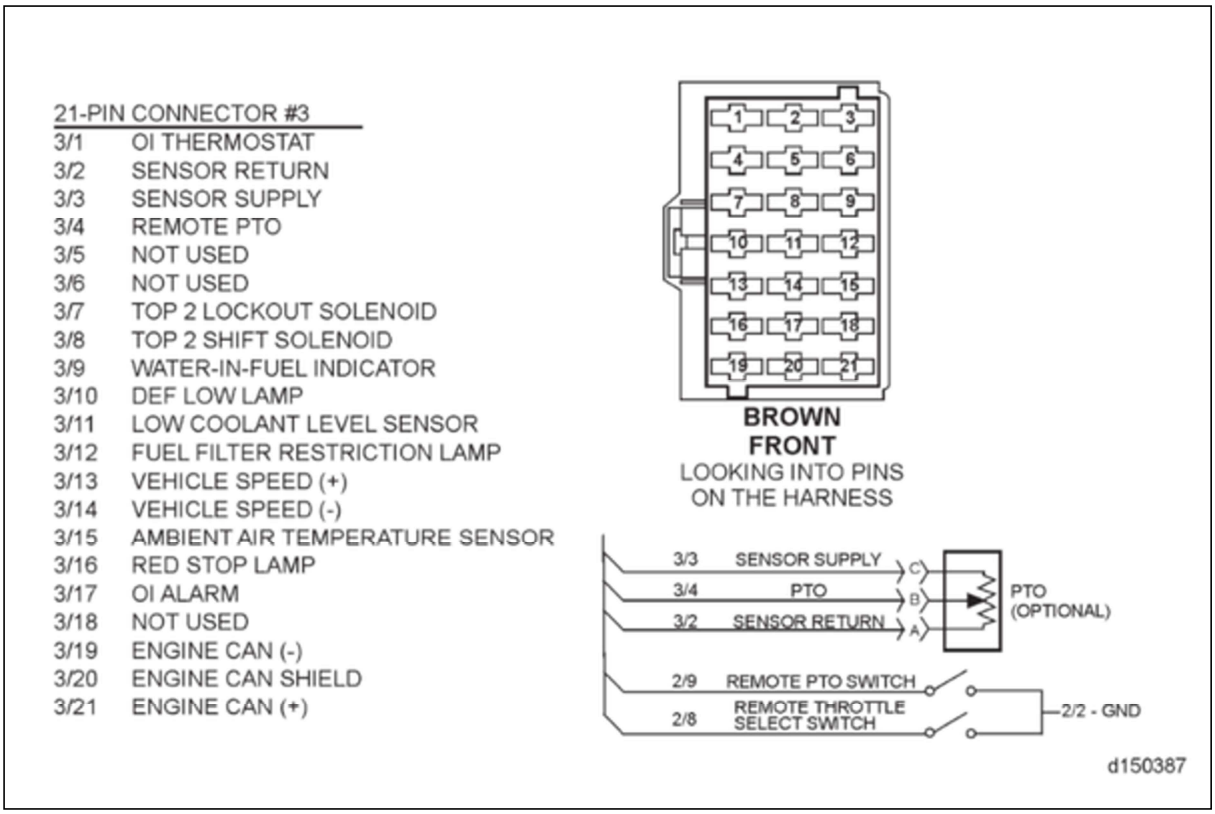
2. Disconnect the remote throttle switch.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between remote throttle switch connector (from pin 4 of the CPC connector #3) and ground. Refer to Original Equipment Manufacturer (OEM) literature for schematic information. Is voltage present?

4.a Yes; repair the short to power between pin 4 of the CPC connector #3 and the remote throttle switch.

4.b No; replace the remote throttle switch.

146.3 SPN 974/FMI 4 - GHG17

SPN 974/FMI 4	
Description	This Fault May Occur if Remote Accelerator Pedal is Programmed ON and Remote Pedal Circuit is Shorted to Ground While Pin 8 of the Common Powertrain Controller (CPC) Connector #2 is Grounded
Monitored Parameter	Remote Throttle Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On Engine On with Remote Pedal Activated



Check as follows:

1. Is the unit equipped with a remote accelerator pedal?

   1.a Yes; Go to step 2.

   1.b No; refer to the Application and Installation manual for proper Common Powertrain Controller (CPC) configuration.

2. Disconnect the remote throttle switch.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the resistance between remote throttle switch connector (from pin 4 of the CPC connector #3) and ground. Refer to Original Equipment Manufacturer (OEM) literature for schematic information. Is the resistance less than five ohms?

4.a Yes; repair the short to ground between pin 4 of the CPC connector #3 and the remote throttle switch.

4.b No; replace the remote throttle switch.

SPN 979 (CPC) (GHG17)

147.1 SPN 979/FMI 9 - GHG17

SPN 979/FMI 9	
Description	PTO Message Missing or Not Received
Monitored Parameter	PGR001/052 PTO Source Address SAE J1939
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On

1. Connect DiagnosticLink .
2. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   - 2.a Yes; repair the battery voltage concern. Verify repair.
   - 2.b No; Go to step 3.
3. Is SPN 625/FMI 9 fault code present?
   - 3.a Yes; diagnose SPN 625/FMI 9 fault code first. Verify repair.
   - 3.b No; Go to step 4.
4. Has the CPC been recently reprogrammed?
   - 4.a Yes; ensure the CPC Group PGR001 parameter PTO Source Address SAE J1939 is configured properly:

     23 = non multiplex switches

     49 = multiplex switches
   - 4.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

SPN 986 (CPC) (GHG17)

148.1 SPN 986/FMI 9 - GHG17

SPN 986/FMI 9	
Description	J1939 Message not received by Common Powertrain Controller (CPC)
Monitored Parameter	J1939 CM1 Message
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key Cycle

Check as follows:

1. Check for multiple codes. Are there multiple J1939 communication codes present?
   - 1.a Yes; troubleshoot those fault codes first.
   - 1.b No; Go to step 2.
2. Has the CPC been recently reprogrammed?
   - 2.a Yes; check the proper configuration of the CPC. Ensure CPC and MCM cooling fan type parameters match.
   - 2.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

148.2 SPN 986/FMI 13 - GHG17

NOTICE

This fault does not indicate a Common Powertrain Controller (CPC) issue; do not replace the CPC.

J1939 CM1 SPN 986 Signal from Source #1 or #2 is Missing

SPN 986/FMI 13	
Description	J1939 Message Missing
Monitored Parameter	J1939 CM1 Message
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key Cycle

This fault indicates that the CPC has received a J1939 CM1 message; however, the "SPN 986 requested fan percent speed" data signal is not available.

1. Check for multiple codes. Is CPC SPN 168/FMI 0/14/18 (battery voltage) code(s) present?
   - 1.a Yes; troubleshoot these first.
   - 1.b No; Go to step 2.
2. Is Motor Control Module (MCM) SPN 625/FMI 9 code present?
   - 2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   - 2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   - 3.a Yes; check the proper configuration of the CPC.
   - 3.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, troubleshoot the forward HVAC control module or the MSF (Modular Switch Field) modules.

148.3 SPN 986/FMI 19 - GHG17

NOTICE

This fault does not indicate a Common Powertrain Controller (CPC) issue; do not replace the CPC.

J1939 CM1 SPN986 Signal from Source #1 or #2 is Erratic

SPN 986/FMI 19	
Description	J1939 Message Erratic
Monitored Parameter	J1939 CM1 Message
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key Cycle

This fault indicates the J1939 CM1 message is received by the CPC; however the “SPN 986 requested fan percent speed ” is in error.

Check as follows:

1. Check for multiple codes. Is CPC SPN 168/FMI 0/14/18 (battery voltage) code(s) present?
   - 1.a Yes; troubleshoot these first.
   - 1.b No; Go to step 2.
2. Is Motor Control Module (MCM) SPN 625/FMI 9 code present?
   - 2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   - 2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   - 3.a Yes; check the proper configuration of the CPC.
   - 3.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

SPN 1033 (ACM) (GHG17)

149.1 SPN 1033/FMI 2 - GHG17

Aftertreatment Control Module Engine Hours Data Erratic, intermittent or Incorrect

This fault usually occurs after reprogramming the CPC or ACM. The internal clocks of the CPC or ACM do not match. After reprogramming either module, all fault codes must be cleared.

Note : The Common Powertrain Controller (CPC) digital outputs have the same SPN as some Motor Control Module (MCM) faults. DiagnosticLink® Standard makes the distinction between the MCM and CPC when diagnosing a fault.

SPN 1033 (MCM) (GHG17)

150.1 SPN 1033/FMI 15 - GHG17

SPN 1033/FMI 15	
Description	This Fault Occurs when the Internal Run Timer of the CPC or MCM Do Not Match
Monitored Parameter	Engine Run Timer
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Ignition ON

1. Connect to DiagnosticLink .
2. Clear code SPN 1033/FMI 15 and power down for 30 seconds.
3. Reconnect to DiagnosticLink.

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

4. Start and run the engine for 20 seconds.
5. Check for codes. Is SPN 1033/FMI 15 active?

5.a Yes; replace the Motor Control Module (MCM) and reprogram with the latest software release.

5.b No; release the vehicle.

150.2 SPN 1033/FMI 17 - GHG17

SPN 1033/FMI 17	
Description	This Fault Occurs when the Internal Run Timer of the CPC or MCM Do Not Match
Monitored Parameter	Engine Run Timer
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Ignition ON

1. Connect to DiagnosticLink .
2. Clear code SPN 1033/FMI 17 and power down for 30 seconds.
3. Reconnect to DiagnosticLink.

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

4. Start and run the engine for 20 seconds.
5. Check for codes. Is SPN 1033/FMI 17 active?

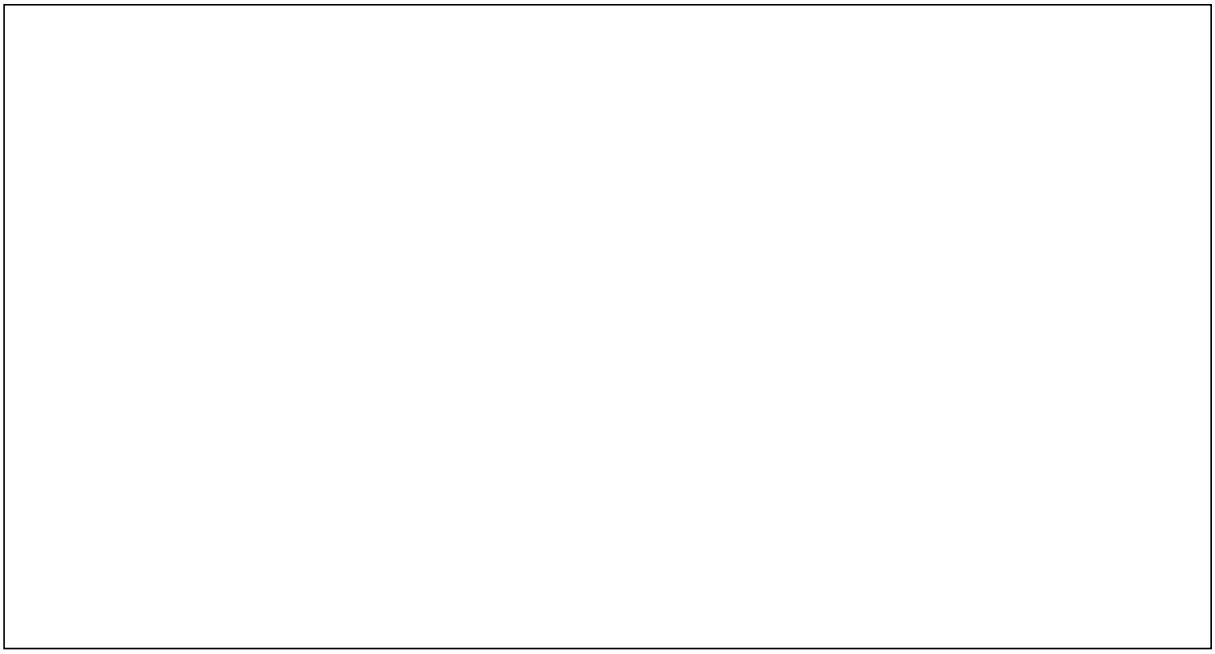
   5.a Yes; replace the Motor Control Module (MCM) and reprogram with the latest software release.

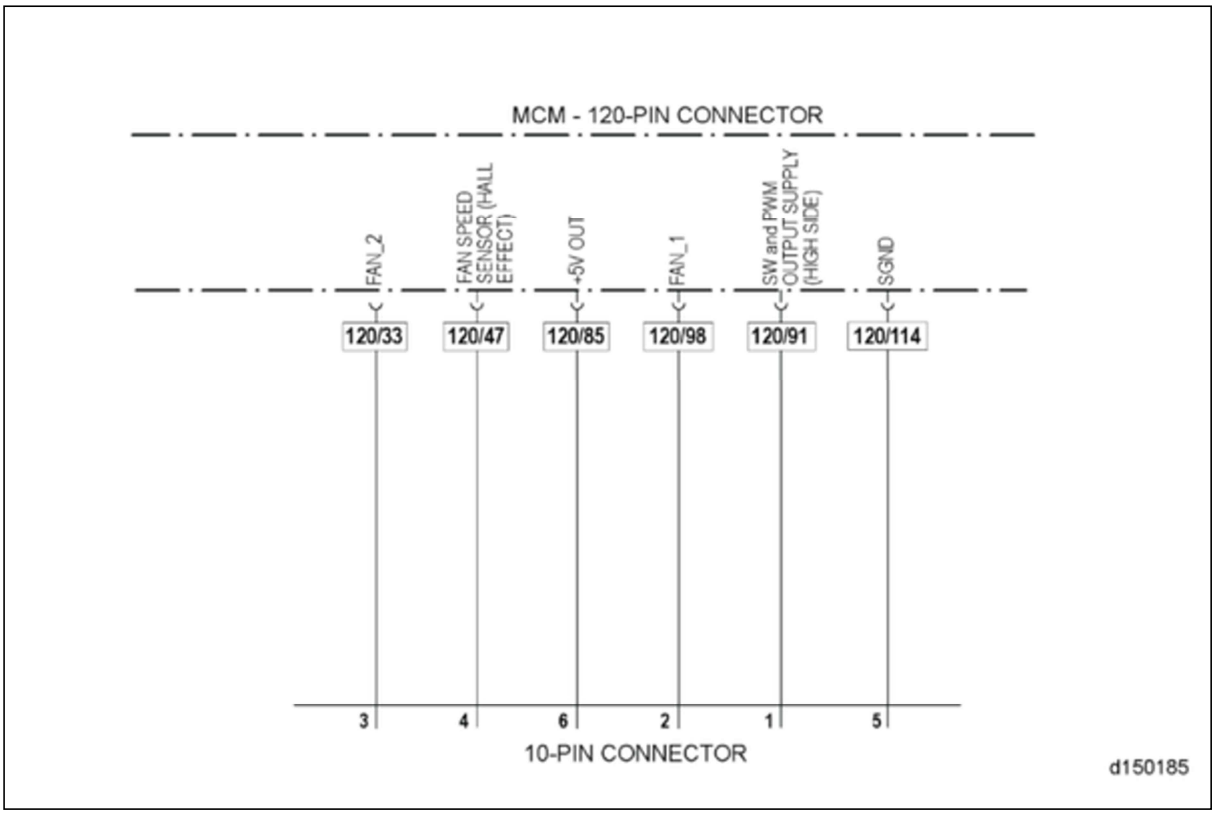
   5.b No; release the vehicle.

SPN 1071 (MCM) (GHG17)

151.1 SPN 1071/FMI 3 - GHG17

SPN 1071/FMI 3	
Description	Fan Circuit Failed High
Monitored Parameter	Fan Control Solenoid
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition cycle





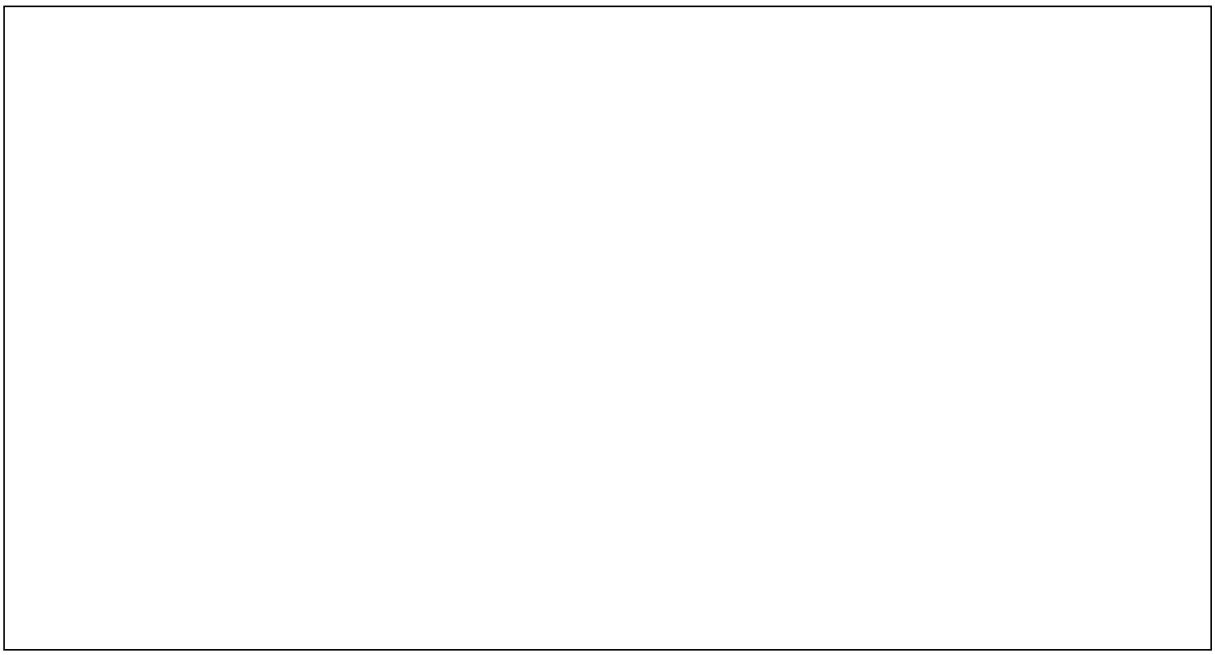
1. Turn the ignition OFF.
2. Disconnect the vehicle 10-pin interface connector.
3. Inspect the vehicle 10-pin interface connector for corroded, unseated (pushed out) or damaged pins, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion).
   3.a If water or oil intrusion, damage, bent or spread pins are found, repair as necessary. Verify repairs.
   3.b If the connector shows no signs of damage, Go to step 4.
4. Turn the ignition ON (key On, engine OFF).
5. Connect DiagnosticLink . Clear fault codes. Does the fault code become active?
   5.a Yes; Go to step 10.
   5.b No; Go to step 6.
6. Reconnect the vehicle 10-pin interface connector.
7. Disconnect the fan control solenoid connector.
8. Inspect the fan control solenoid connector for corroded, unseated (pushed out) or damaged pins, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion).
   8.a If water or oil intrusion, bent or spread pins are found, repair as necessary. Verify repairs.
   8.b If the connector shows no signs of damage, Go to step 9.
9. Cycle ignition. Clear fault codes. Does the fault code become active?
   9.a Yes; repair short to power on fan control circuit from the vehicle10-pin interface connector pin 3 to the fan control solenoid. Refer to Original Equipment Manufacturer (OEM) for wiring information.
   9.b No; replace the fan control solenoid. Refer to Original Equipment Manufacturer (OEM) procedures.
10. Turn the ignition OFF.
11. Disconnect the 120–pin Motor Control Module (MCM) connector.
12. Inspect the 120–pin MCM connector for corroded, unseated (pushed out) or damaged pins, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion).

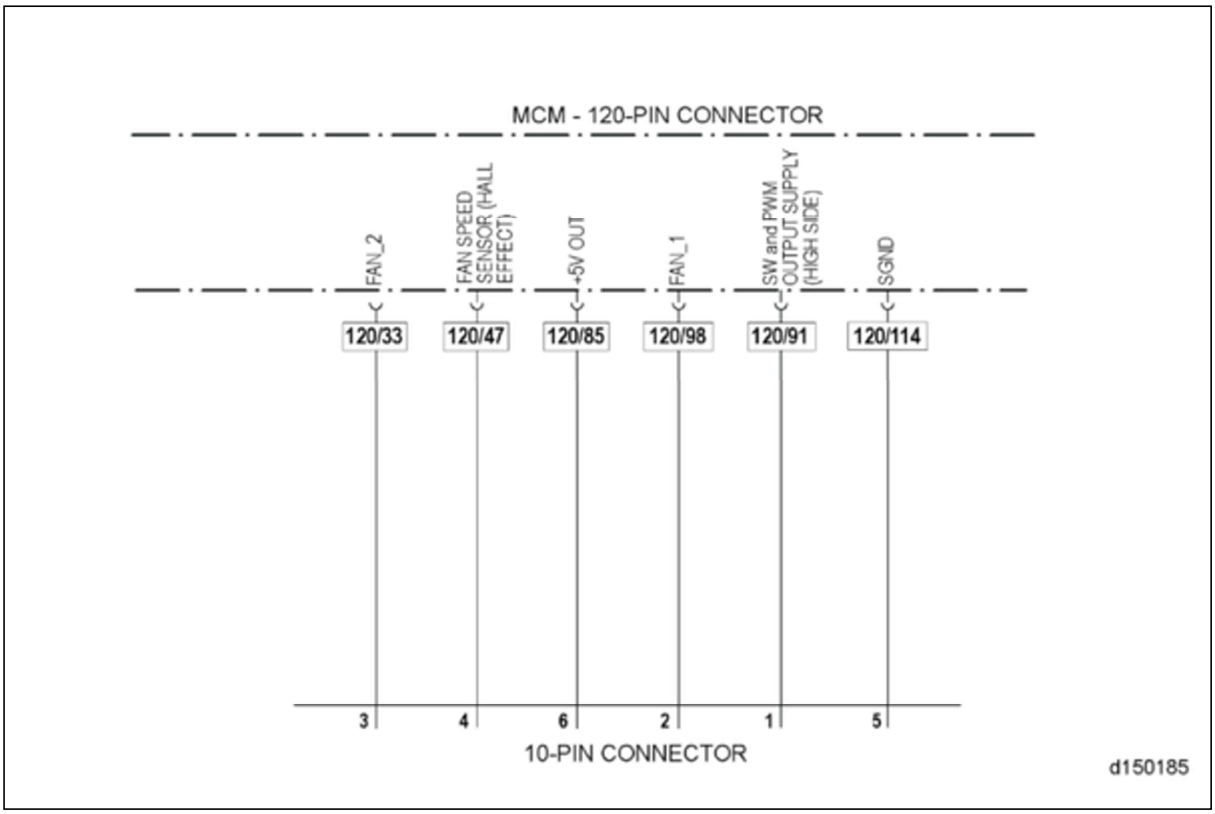
12.a If water or oil intrusion, damage, bent or spread pins are found, repair as necessary.

12.b If the connector shows no signs of damage, repair short to power on fan control circuit from MCM pin 33 to the vehicle 10-pin interface connector pin 3.

151.2 SPN 1071/FMI 4 - GHG17

SPN 1071/FMI 4	
Description	Fan Circuit Failed Low
Monitored Parameter	Fan Control Solenoid
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Ignition cycle





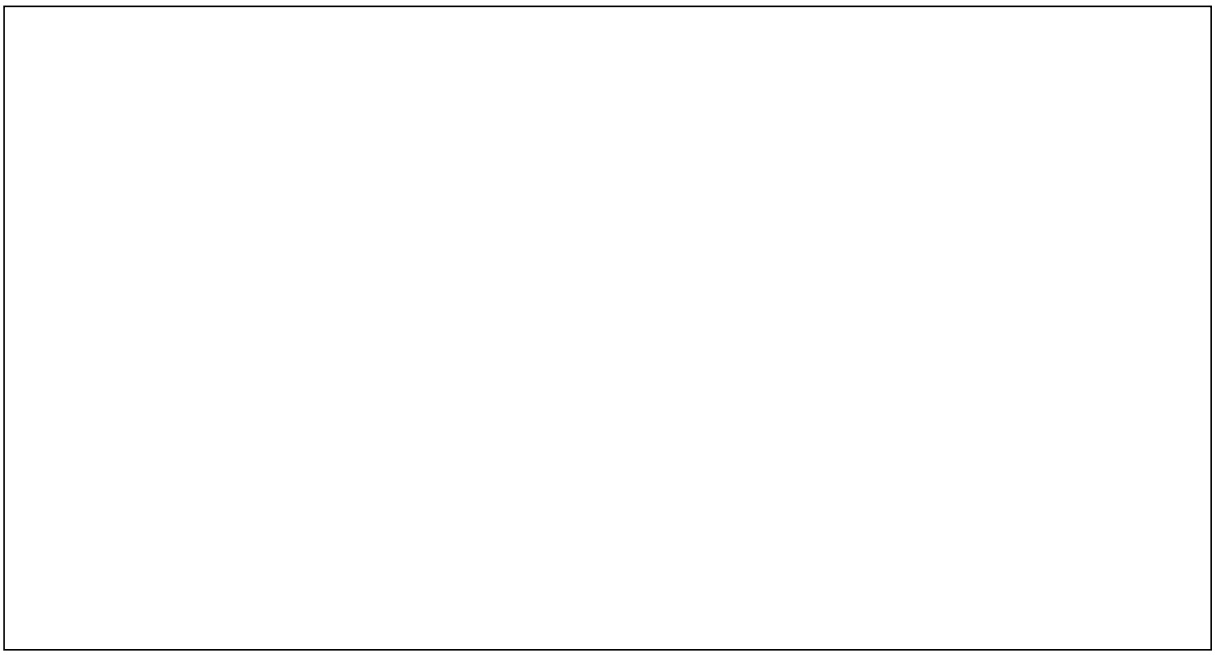
1. Turn the ignition OFF.
2. Disconnect the vehicle 10-pin interface connector.
3. Inspect the vehicle 10-pin interface connector for corroded, unseated (pushed out) or damaged pins, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion).
   3.a If water or oil intrusion, damage, bent or spread pins are found, repair as necessary.
   3.b If the connector shows no signs of damage, Go to step 4.
4. Turn the ignition ON (key ON, engine OFF).
5. Connect DiagnosticLink . Clear fault codes. Does the fault code become active?
   5.a Yes; Go to step 10.
   5.b No; Go to step 6.
6. Reconnect the vehicle 10-pin interface connector.
7. Disconnect the fan control solenoid connector.
8. Inspect the fan control solenoid connector for corroded, unseated (pushed out) or damaged pins, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion).
   8.a If water or oil intrusion, bent or spread pins are found, repair as necessary. Verify repairs.
   8.b If the connector shows no signs of damage, Go to step 9.
9. Cycle ignition. Clear fault codes. Does the fault code become active?
   9.a Yes; repair short to ground on fan control circuit from the vehicle 10-pin interface connector pin 3 to the fan control solenoid. Refer to Original Equipment Manufacturer (OEM) for wiring information.
   9.b No; replace the fan control solenoid. Refer to Original Equipment Manufacturer (OEM) procedures.
10. Turn the ignition OFF.
11. Disconnect the 120–pin Motor Control Module (MCM) connector.
12. Inspect the 120–pin Motor Control Module (MCM) connector for corroded, unseated (pushed out) or damaged pins, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion).

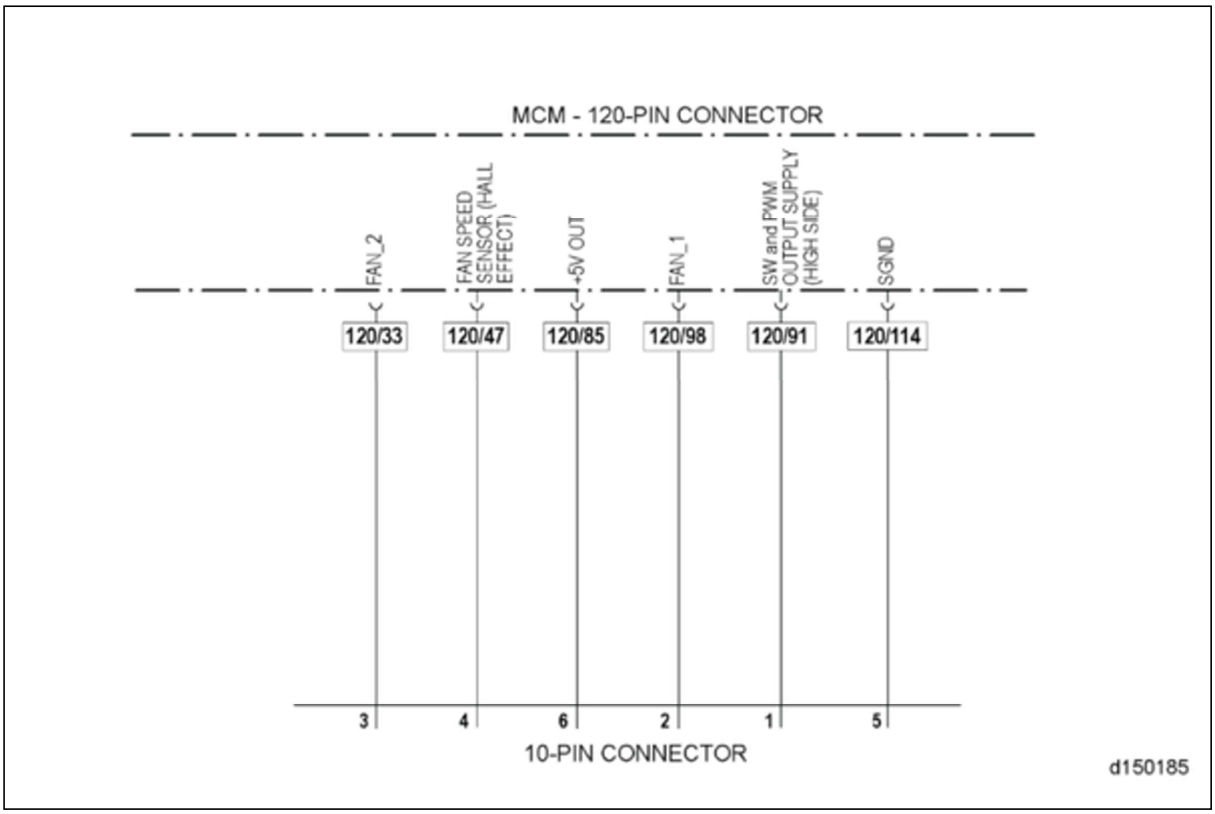
12.a If water or oil intrusion, damage, bent or spread pins are found, repair as necessary. Verify repairs.

12.b If the connector shows no signs of damage, repair short to ground on fan control circuit from MCM pin 33 to the vehicle 10-pin interface connector pin 3.

151.3 SPN 1071/FMI 5 - GHG17

SPN 1071/FMI 4	
Description	Fan Circuit Failed Open
Monitored Parameter	Fan Control Solenoid
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition cycle





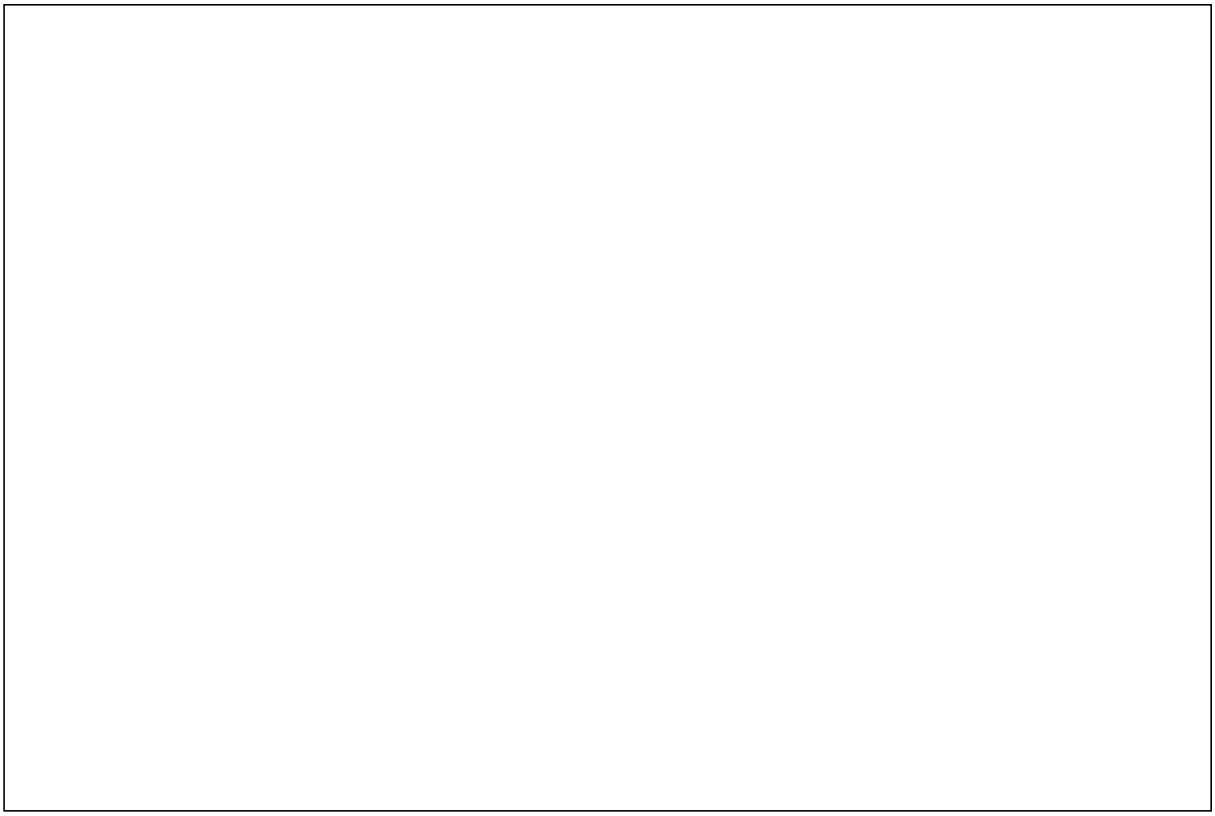
1. Check for multiple codes.
   1.a If SPN 647/FMI 5, SPN 1072/FMI 5 and SPN 1071/FMI 5 are active, repair the open in the wiring between the pin 91 of the 120–pin Motor Control Module (MCM) connector and the fan and the Jake Brake® solenoids. Verify repairs.
   1.b If only SPN 1071/FMI 5 is active, Go to step 2.
2. Turn the ignition OFF.
3. Disconnect the vehicle 10-pin interface connector.
4. Inspect the vehicle 10-pin interface connector for corroded, unseated (pushed out) or damaged pins, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion).
   4.a If water or oil intrusion, damage, bent or spread pins are found, repair as necessary.
   4.b If the connector shows no signs of damage, reconnect 10-pin connector, Go to step 5.
5. Disconnect the 120–pin Motor Control Module (MCM) connector.
6. Inspect the 120–pin MCM connector for corroded, unseated (pushed out) or damaged pins, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion).
   6.a If water or oil intrusion, bent or spread pins are found, repair as necessary. Verify repairs.
   6.b If the connector shows no signs of damage, Go to step 7.
7. Measure the resistance between MCM harness connector pin 33 and the vehicle 10-pin interface connector pin 3.
   7.a If the resistance is less than five ohms, Go to step 8.
   7.b If the resistance is greater than five ohms, repair the open circuit on fan circuit pin 33 of the 120–pin MCM connector to the vehicle 10-pin interface connector pin 3.
8. Measure the resistance between MCM harness connector pin 91 and the vehicle 10-pin interface connector pin 1.
   8.a If the resistance is less than five ohms, Go to step 9.
   8.b If the resistance is greater than five ohms, repair the open circuit on fan power circuit pin 91 of the 120–pin MCM connector to the vehicle 10-pin interface connector pin 1.

9. Disconnect the fan control solenoid connector.
10. Inspect the fan control solenoid connector for corroded, unseated (pushed out) or damaged pins, bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion).
    - 10.a If water or oil intrusion, bent or spread pins are found, repair as necessary. Verify repairs.
    - 10.b If the connector shows no signs of damage, Go to step 11.
11. Measure the resistance between the fan control solenoid pins.
    - 11.a If the resistance is less than 10K ohms, repair the open circuit(s) between the fan control solenoid connector and the vehicle 10-pin interface connector pin 3 and/or pin 1. Refer to Original Equipment Manufacturer (OEM) procedures.
    - 11.b If the resistance is greater than 10K , replace the fan control solenoid. Refer to Original Equipment Manufacturer (OEM) procedures.

SPN 1072 (MCM) (GHG17)

152.1 SPN 1072/FMI 3 - GHG17

SPN 1072/FMI 3	
Description	Jake Brake Stage 1 Short to Power
Monitored Parameter	Engine Brake
Typical Enabling Conditions	Short to Battery Power Between Pin 1 on the Engine Brake Solenoid and Pin 66 on the Motor Control Module 120-pin Connector
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (One minute)



Check as follows:

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.

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

1. Disconnect the front fuel injector valve cover harness.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pin 13 and ground on the front fuel injector valve cover harness connector (engine harness side). If you are using J-48671-10, measure either Jake Brake® pin 1 and ground. Is the voltage greater than two volts?

3.a Yes; repair the short to power between pin 13 of the front fuel injector valve cover harness connector and pin 66 of the 120-pin Motor Control Module (MCM) connector.

3.b No; Go to step 4.

4. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
5. Disconnect the front Jake Brake .
6. Inspect the engine brake solenoid connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Are signs of damage present?

6.a Yes; repair as necessary. Go to step 7.

6.b No; Go to step 7.

7. Turn the ignition ON (key ON, engine OFF).

8. Measure the voltage between pin 1 of the engine brake solenoid connector and ground. Is the voltage greater than two volts?

   8.a Yes; repair a short to power on the engine brake solenoid circuit pin 1 to pin 13 of the front fuel injector valve cover harness connector. Go to step 9.

   8.b No; Go to step 9.

> **⚠ 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.

> **⚠ WARNING**
>
> PERSONAL INJURY
>
> Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

9. Restore all connections and components. Cycle ignition and clear fault codes; idle the engine for one minute. Does SPN 1072/FMI 3 fault code become active?

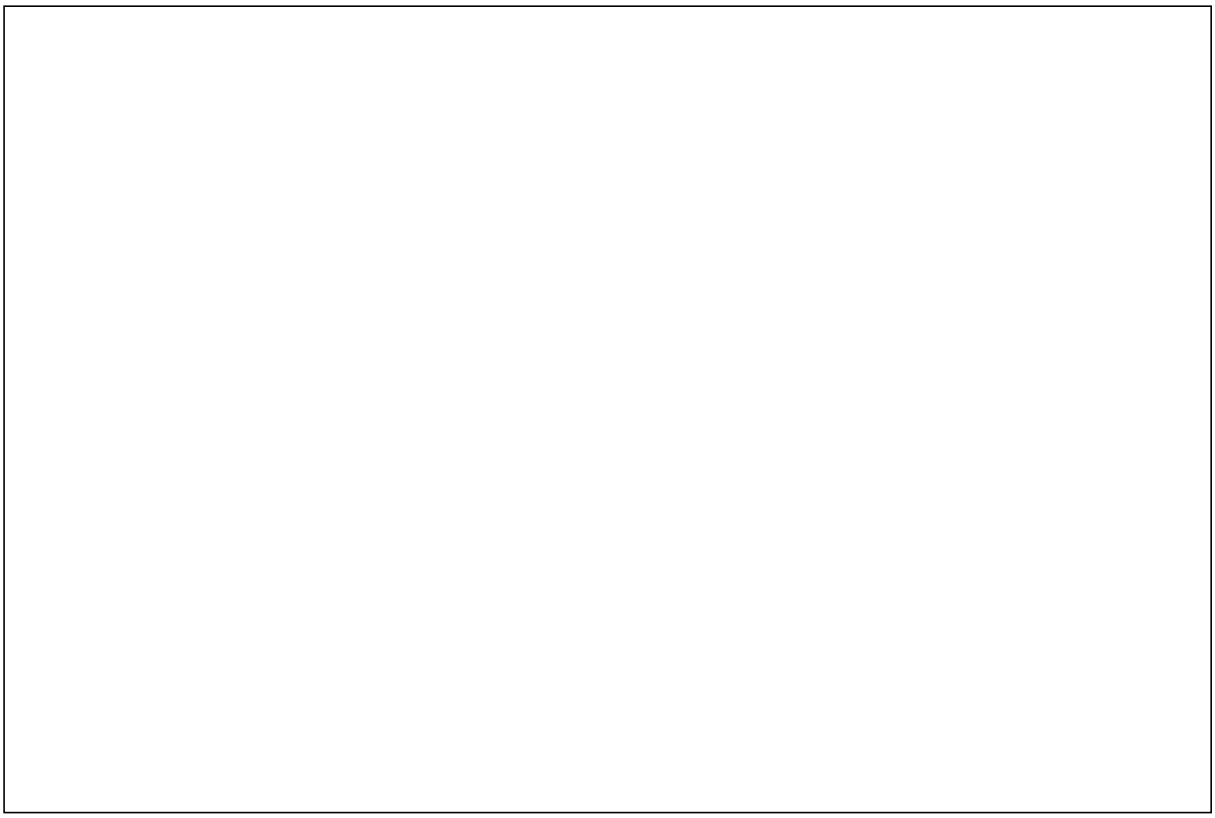
   9.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs.

   9.b No; release the vehicle.

152.2 SPN 1072/FMI 4 - GHG17

Jake Brake Stage 1 Circuit Failed Low

SPN 1072/FMI 4	
Description	Jake Brake Stage 1 Short to Ground
Monitored Parameter	Engine Brake
Typical Enabling Conditions	Short to Ground Between Pin 1 on the Jake Brake® Solenoid and Pin 66 on the Motor Control Module 120-pin Connector
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (One minute)



Check as follows:

⚠ 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.

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

1. Disconnect the front fuel injector valve cover harness.
2. Measure the resistance between pin 13 and ground on the front fuel injector valve cover harness connector (engine harness side). If you are using J-48671-10, measure either Jake Brake® pin 1 and ground. Is the resistance greater than 15 ohms?

2.a Yes; repair the short to ground between pin 13 of the front fuel injector valve cover harness connector and pin 66 of the 120-pin Motor Control Module (MCM) connector.

2.b No; Go to step 3.

3. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
4. Disconnect the engine brake solenoid electrical connection.
5. Inspect the engine brake solenoid connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Are signs of damage present?

5.a Yes; repair as necessary. Go to step 6.

5.b No; Go to step 6.

6. Turn the ignition ON (key ON, engine OFF).
7. Measure the resistance between pin 1 of the engine brake solenoid connector and ground. Is the resistance less than five ohms?

7.a Yes; repair a short to ground on the engine brake solenoid circuit pin 1 to pin 13 of the front fuel injector valve cover harness connector. Go to step 8.

7.b No; replace the engine brake solenoid. Go to step 8.

⚠ 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.

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

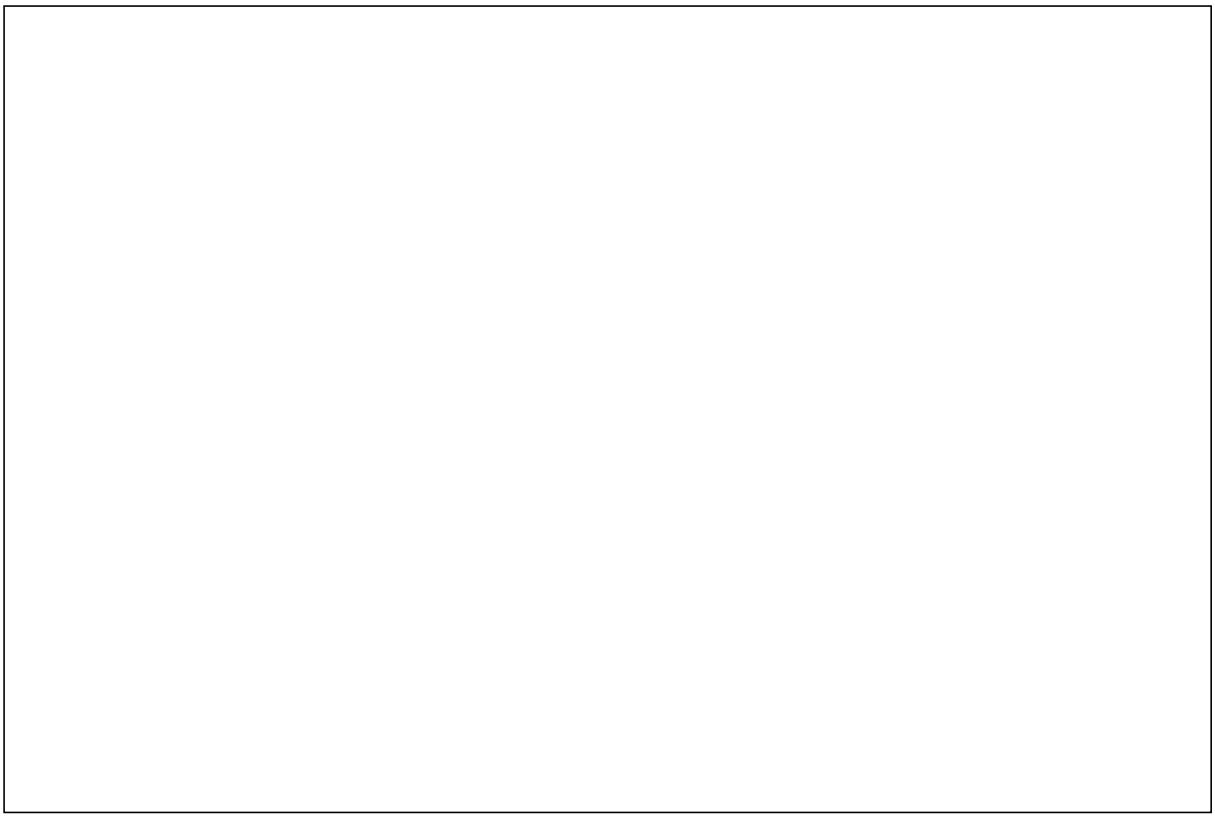
8. Restore all connections and components. Cycle ignition and clear fault codes; idle the engine for one minute. Does SPN 1072/FMI 4 fault code become active?

   8.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs.

   8.b No; release the vehicle.

152.3 SPN 1072/FMI 5 - GHG17

SPN 1072/FMI 5	
Description	Jake Brake Stage 1 Open Circuit
Monitored Parameter	Engine Brake
Typical Enabling Conditions	Open Circuit Between Pin 1 on the Jake Brake® Solenoid and Pin 32 on the Motor Control Module 120-pin Connector
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (One minute)



Check as follows:

⚠ 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.

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

1. Disconnect the front electrical harness connector of the two-piece fuel injector wiring harness.
2. Measure the resistance between pin 13 and pin 14 on the valve cover side of the front fuel injector wiring harness. If you are using J-48671-10, measure across Jake Brake® pin 1 and pin 2. Is the resistance greater than 15 ohms?

2.a Yes; Go to step 5.

2.b No; Go to step 3.

3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 14 on the engine harness side of the front fuel injector wiring harness and ground. Is the voltage less than 11.5 volts?

4.a Yes; repair the cause of low voltage between pin 91 of the MCM 120-pin connector and pin 14 of the front fuel injector wiring harness connector.

4.b No; repair the open between pin 13 of the front fuel injector wiring harness connector and pin 66 of the Motor Control Module (MCM) 120-pin connector.

5. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
6. Disconnect the engine brake solenoid electrical connection.
7. Inspect the engine brake solenoid connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Are signs of damage present?

7.a Yes; repair as necessary. Go to step 8.

7.b No; Go to step 8.

8. Turn the ignition ON (key ON, engine OFF).
9. Measure the resistance across the engine brake solenoid. Is the resistance greater than 15 ohms?

9.a Yes; replace the engine brake solenoid. Go to step 10.

9.b No; replace the front injector harness. Go to step 10.

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.

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

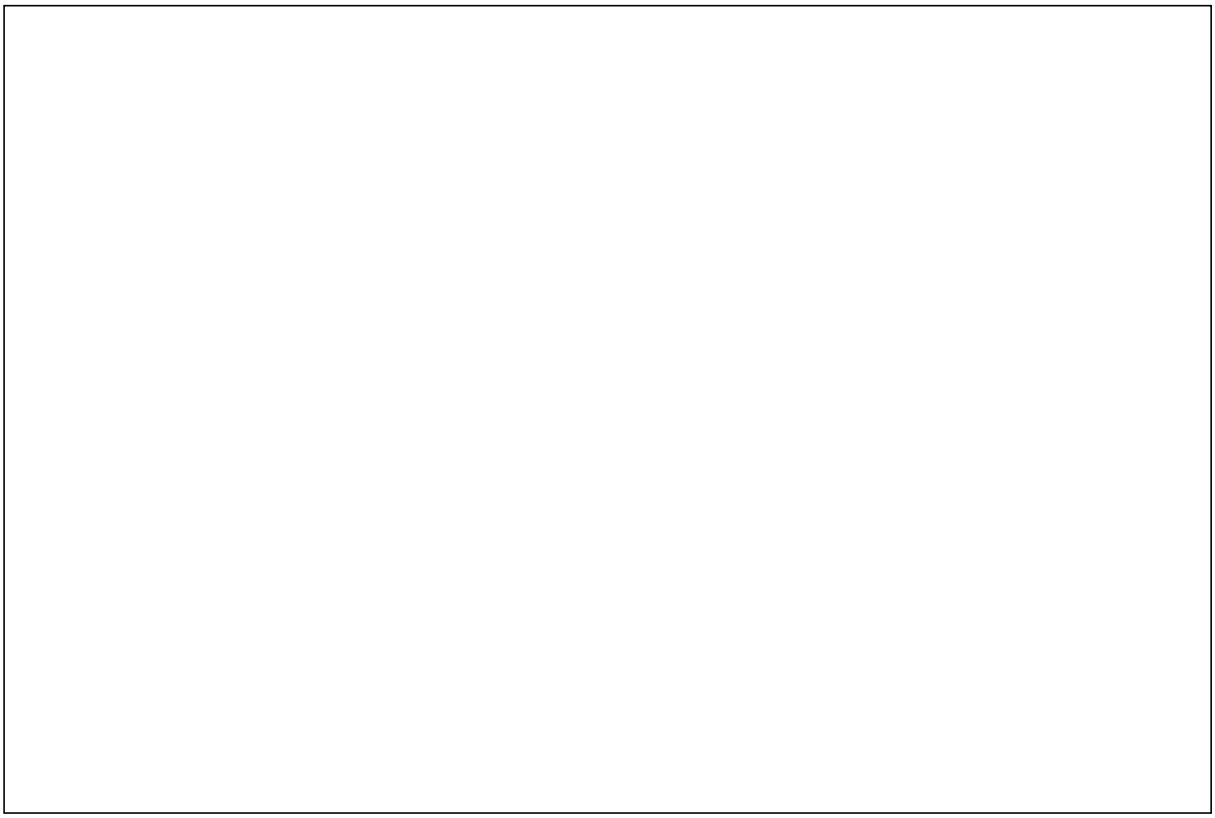
10. Restore all connections and components. Cycle ignition and clear fault codes; idle the engine for one minute. Does SPN 1072/FMI 5 fault code become active?

10.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs.

10.b No; release the vehicle.

SPN 1073 (MCM) (GHG17)

153.1 Electronic Diagram



153.2 SPN 1073/FMI 3 - GHG17

Jake Brake® stage 2 Circuit Failed High

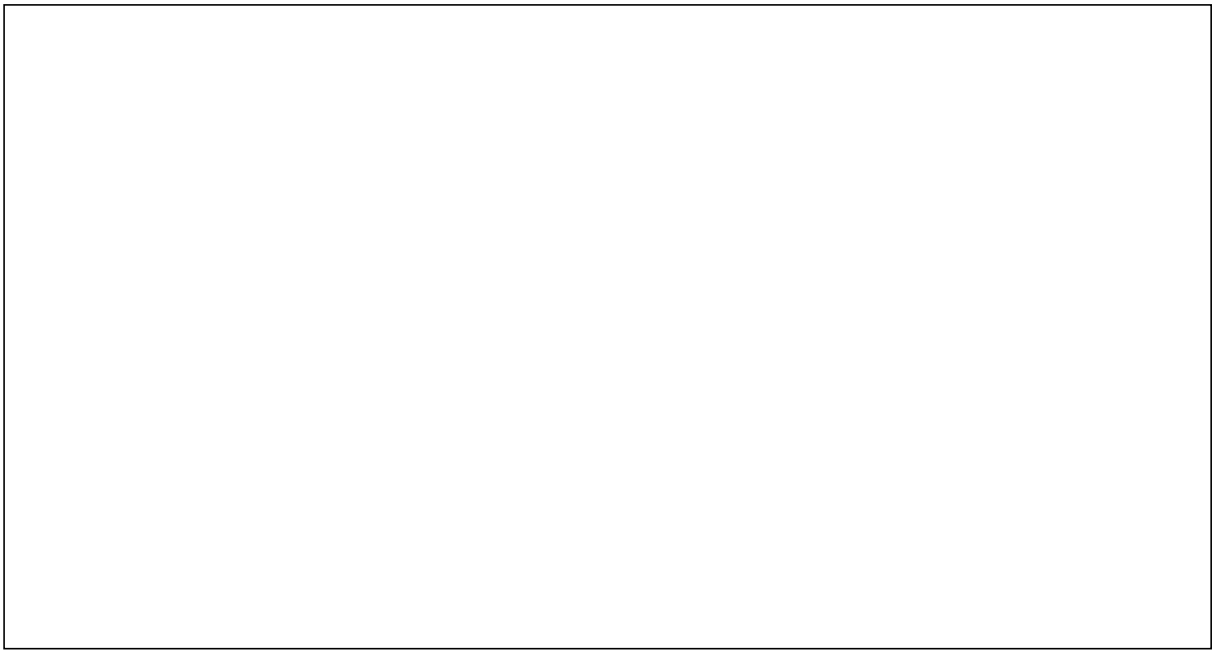
Repair the short to battery power between pin 1 on the Jake Brake® solenoid and pin 32 on the Motor Control Module (MCM) 120-pin connector.

153.3 SPN 1073/FMI 4 - GHG17

Jake Brake® Stage 2 Circuit Failed Low

SPN 1073/FMI 4	
Description	Jake Brake Stage 2 Circuit Failed Low
Monitored Parameter	Jake Solenoid
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)

1. Disconnect the rear the two-piece fuel injector wiring harness.
2. Measure resistance between pins 13 and ground on the rear two-piece fuel injector wiring harness connector. If you are using J-48671–10, measure across the Jake Brake® 2 pins.



2.a If the resistance is greater than 15 ohms, repair short to ground between pin 13 of the front two-piece fuel injector wiring harness connector and pin 32 of the 120–pin Motor Control Module (MCM) connector.

2.b If the resistance is less than 5 ohms, Go to step 3.

3. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
4. Disconnect the rear Jake Brake® electrical harness connector.
5. Measure resistance between either terminal on the Jake Brake® solenoid and ground.

5.a If the resistance is less than 5 ohms, replace the Jake Brake® solenoid.

Refer to section "Removal of the Camshafts"

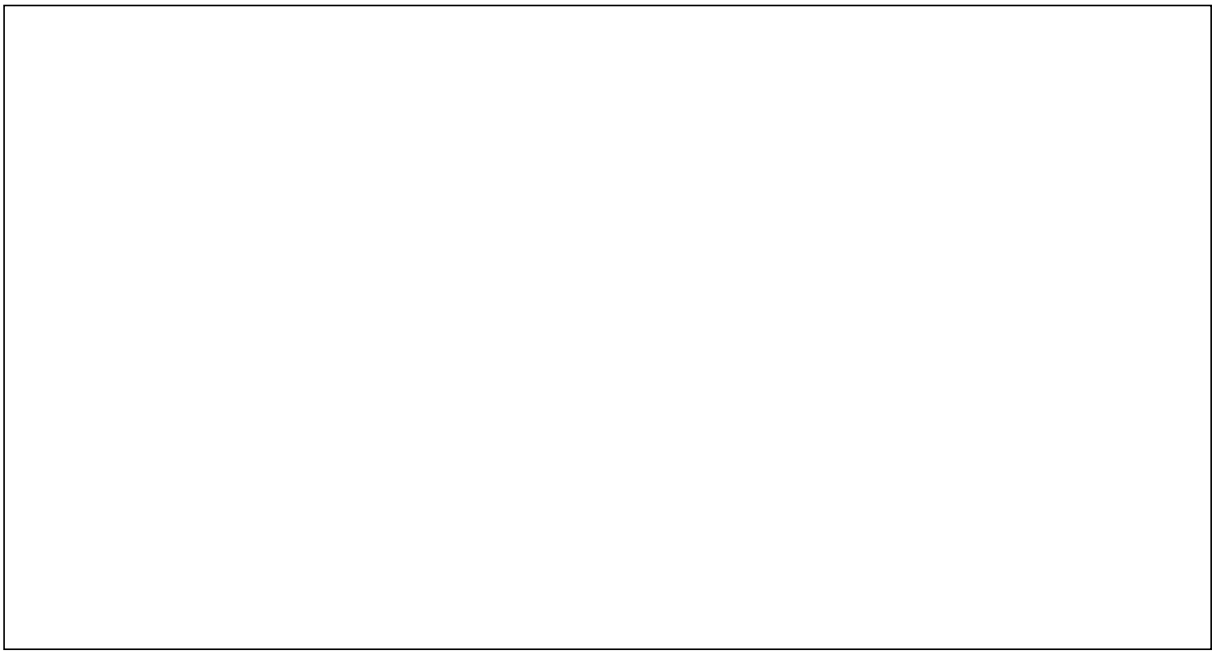
Refer to section "Removal of the Exhaust Rocker Shaft Assembly"

5.b If the resistance is greater than 5 ohms, repair the short to ground between pins 13 and 14 of the rear fuel injector valve cover harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

153.4 SPN 1073/FMI 5 - GHG17

Jake Brake® Stage 2 Circuit Failed Open

1. Disconnect the rear electrical harness connector of the two-piece fuel injector wiring harness.
2. Measure the resistance between pin 13 and 14 on the valve cover side of the rear two-piece fuel injector wiring harness . If you are using J-48671–10, measure across Jake Brake 2 pins.



2.a If the resistance is between 9 and 12 ohms, Go to step 3.

2.b If the resistance not between 9 and 12 ohms, Go to step 5.

3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 14 on the engine harness side of the valve cover harness and ground.

4.a If the voltage is less than 11.5 volts, repair the cause of low voltage between pin 62 of the Motor Control Module (MCM) 120–pin connector and pin 14 of the valve cover harness connector.

4.b If the voltage is greater than 11.5 volts, repair the open between pin 13 of the valve cover harness connector and pin 32 of the MCM 120–pin connector.

5. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
6. Disconnect the rear Jake Brake solenoid.
7. Measure the resistance across the Jake Brake solenoid.

7.a If the resistance is between 9 and 11 ohms, replace the two-piece fuel injector wiring harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

7.b If the resistance is NOT between 9 and 11 ohms, replace the Jake Brake solenoid.

Refer to section "Removal of the Camshafts"

Refer to section "Removal of the Exhaust Rocker Shaft Assembly"

SPN 1077 (MCM) (GHG17)

154.1 SPN 1077/FMI 3 – GHG17

SPN 1077/FMI 3	
Description	Quantity Control Valve (QCV) Circuit Failed High
Monitored Parameter	Quantity Control Valve (QCV) Circuit
Typical Enabling Conditions	Always on
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Parked Regen

1. Disconnect the QCV connector.
2. Inspect the harness connector for bent, spread or corroded pins.
   - 2.a If the pins are bent, spread or corroded, repair as necessary.
   - 2.b If connector shows no signs of damage, Go to step 3.
3. Disconnect the Motor Control Module (MCM) 120-pin connector.
4. Inspect the harness connector for bent, spread or corroded pins.
   - 4.a If the pins are bent, spread or corroded, repair as necessary.
   - 4.b If connector shows no signs of damage, Go to step 5.
5. Measure the resistance between pin 1 of the QCV connector and pin 1 of the MCM 120-pin connector.
   - 5.a If the resistance is greater than 5 ohms, repair the open circuit between pin 1 of the QCV connector and pin 1 of the MCM 120-pin connector. Verify repairs.
   - 5.b If the resistance is less than 5 ohms, Go to step 6.
6. Measure the resistance between pin 2 of the QCV connector and pin 2 of the MCM 120-pin connector.
   - 6.a If the resistance is greater than 5 ohms, repair the open circuit between pin 2 of the QCV connector and pin 2 of the MCM 120-pin connector. Verify repairs.
   - 6.b If the resistance is less than 5 ohms, Go to step 7.
7. Measure the resistance between pins 1 and 2 of the QCV connector.
   - 7.a If the resistance is greater than 10K ohms, replace the QCV.
   - 7.b If the resistance is less than 10K ohms, repair the short circuit between pins 1 and 2 of the QCV harness. Verify repairs.

154.2 SPN 1077/FMI 4 – GHG17

SPN 1077/FMI 4	
Description	Quantity Control Valve (QCV) Circuit Failed Low
Monitored Parameter	Quantity Control Valve (QCV) Circuit
Typical Enabling Conditions	Always on
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Parked Regen

1. Disconnect the QCV connector.
2. Inspect the harness connector for bent, spread or corroded pins.
   - 2.a If the pins are bent, spread or corroded, repair as necessary.
   - 2.b If connector shows no signs of damage, Go to step 3.
3. Disconnect the Motor Control Module (MCM) 120-pin connector.
4. Inspect the harness connector for bent, spread or corroded pins.
   - 4.a If the pins are bent, spread or corroded, repair as necessary.
   - 4.b If connector shows no signs of damage, Go to step 5.
5. Measure the resistance between pin 1 of the QCV and battery ground.
   - 5.a If the resistance is less than 10K ohms, repair the short to ground between pin 1 of the QCV harness connector and pin 1 of the MCM 120-pin connector. Verify repairs.
   - 5.b If the resistance is greater than 10K ohms, Go to step 6.
6. Measure the resistance between pin 2 of the QCV and battery ground.
   - 6.a If the resistance is less than 10K ohms, repair the short to ground between pin 2 of the QCV harness connector and pin 2 of the MCM 120-pin connector. Verify repairs.
   - 6.b If the resistance is greater than 10K ohms, replace the QCV. Verify repairs.

154.3 SPN 1077/FMI 5 - GHG17

Quantity Control Valve Current Too Low

SPN 1077/FMI 5	
Description	Quantity Control Valve (QCV) Error, Current Too Low
Monitored Parameter	Quantity Control Valve
Typical Enabling Conditions	RP Closed Loop Control
Monitor Sequence	None
Execution Frequency	Current less than 200 mA
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)

Check as follows:

1. Disconnect the quantity control valve.
2. Measure the resistance across pins 1 and 2 of the quantity control valve.
   - 2.a If the resistance is greater than 2 ohms, replace quantity control valve. Refer to section "Removal of the Quantity Control Valve - Two-Filter System" .
   - 2.b If the resistance is less than 2 ohms, Go to step 3.
3. Disconnect the MCM 120-pin connector.
4. Measure the resistance between pin 1 of the MCM 120-pin connector and pin 1 of the QCV.
   - 4.a If the resistance is less than 5 ohms, Go to step 5.
   - 4.b If the resistance is greater than 5 ohms, repair the open circuit between pin 1 of the 120 MCM connector and pin 1 of the QCV. Verify repairs. Refer to section "Verify Repairs" .
5. Measure the resistance between pin 2 of the MCM 120-pin connector and pin 2 of the QCV.

5.a If the resistance is less than 5 ohms, replace the MCM. Refer to section "Removal of the Motor Control Module" .

5.b If the resistance is greater than 5 ohms, repair the open circuit between pin 2 of the MCM 120-pin connector and pin 2 of the QCV. Verify Repairs. Refer to section "Verify Repairs" .

154.4 SPN 1077/FMI 6 - GHG17

Check as follows:

1. Disconnect the QCV.
2. Measure the resistance across pins 1 and 2 of the QCV.
   - 2.a If the resistance is greater than 2 ohms, replace the QCV. Refer to section "Removal of the Quantity Control Valve - Two-Filter System" .
   - 2.b If the resistance is less than 2 ohms, Go to step 3.
3. Disconnect the Motor Control Module (MCM) 120-pin connector.
4. Measure the resistance between pin 1 of the MCM 120-pin connector and pin 1 of the QCV.
   - 4.a If the resistance is less than 5 ohms, Go to step 5.
   - 4.b If the resistance is greater than 5 ohms, repair the open circuit between pin 1 of the 120-pin MCM connector and pin 1 of the QCV. Verify repairs. Refer to section "Verify Repairs" .
5. Measure the resistance between pin 2 of the MCM 120-pin connector and pin 2 of the QCV.
   - 5.a If the resistance is less than 5 ohms, replace the MCM. Refer to section "Removal of the Motor Control Module" .
   - 5.b If the resistance is greater than 5 ohms, repair the open circuit between pin 2 of the MCM 120-pin connector and pin 2 of the QCV. Verify repairs. Refer to section "Verify Repairs" .

154.5 SPN 1077/FMI 14 - GHG17

The Motor Control Module (MCM) monitors rail pressure during engine shut down and compares it to a stored learned value. If the bleed-down rate has changed due to leakage and it is below the learned value, this code will set.

SPN 1077/FMI 14	
Description	Leakage in High Pressure Fuel System Too High (Leak Down Test)
Monitored Parameter	Fuel Rail Pressure
Typical Enabling Conditions	Key OFF
Monitor Sequence	None
Execution Frequency	Once When Enabling Conditions Met
Typical Duration	30 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	FSIC Leak Test

Check as follows:

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

1. Start and run the engine until fuel temperature is greater than 35°C (95°F) and coolant temperature is greater than 70°C (158°F).
2. Shut the engine down.

NOTICE

The high pressure fuel rail feed lines, vibration dampers, P-clips, mounting bracket and hardware are one-time-use components and MUST be replaced any time they are removed. Refer to TS letter 16 TS-9Rev2 for the high pressure fuel line kit numbers.

3. Check for an external high pressure fuel system leak(s). Are any leaks present at the following components?

- High Pressure Fuel Pump
- High Pressure Fuel Rail Feed Lines
- High Pressure Fuel Rail
- High Pressure Fuel Injector Lines
- Fuel Rail Pressure Sensor
- Pressure Limiting Valve

3.a Yes; repair leaks. Verify repairs.

3.b No; Go to step 7.

4. Check the engine oil dipstick. Is there any fuel in the oil?

4.a Yes; Refer to section "Fuel in Oil" .

4.b No; Go to step 8.

5. Check for leakage from the Pressure Limiting Valve (PLV). Refer to section "Pressure Limiting Valve Flow Test – Two-Filter Fuel System" . Does the PLV flow test pass?

5.a Yes; Go to step 9.

5.b No; replace the PLV and verify repairs. Refer to section "Removal of the Pressure Limiting Valve - Two-Filter System" .

Note : DiagnosticLink® 8.06 or higher is necessary to complete this troubleshooting.

6. One cylinder at a time, remove the injector fuel transfer tube and cap the rail at each injector using J-48704. Run the FSIC Leak Test. Refer to *section "FSIC Leak Test." Repeat for each injector. Record results.

HP Leak Detection Test Results					
#1 Capped	#2 Capped	#3 Capped	#4 Capped	#5 Capped	#6 Capped
Leaking / Not Leaking	Leaking / Not Leaking	Leaking / Not Leaking	Leaking / Not Leaking	Leaking / Not Leaking	Leaking / Not Leaking

7. With any one injector capped off, does the FSIC Leak Test pass?

7.a Yes; replace that injector that passes the FSIC Leak Test when capped. Refer to section "Removal of the Fuel Injector - Two-Filter System" and then run the HP Leak Detection Test again to verify repair.

7.b No; Go to step 11.

8. Install all six rail caps. Crank engine for 10 seconds and then monitor rail pressure bleed down. Does rail pressure bleed down under 100 bar in less than five minutes?

8.a Yes; replace the high pressure fuel pump. Refer to section "Removal of the High Pressure Fuel Pump - Two-Filter System" .

8.b No; replace all six injectors. Refer to section "Removal of the Fuel Injector - Two-Filter System" and then run the HP Leak Detection Test again to verify repair.

9. Check for multiple codes. Are there any additional SPN 1077 codes present?

9.a Yes; service the additional fault codes first.

9.b No; Go to step 2.

10. Is the Motor Control Module (MCM) below software level 6.4.0.5?

10.a Yes; Go to step 6.

10.b No; Go to step 3.

11.a Yes; update MCM software to latest software level and Go to step 4.

11.b No; update MCM software to latest software level and release vehicle.

11. Is the Motor Control Module (MCM) at software level 6.4.0.5?

11.a Yes; Go to step 4.

11.b No: Go to step 6.

12. Is the fuel map ZGS less than 007?

12.a Yes; Go to step 5.

12.b No; Go to step 6.

13. Using DiagnosticLink , go to the fault code in the Fault Codes panel. Under section "Extended Data Record #6 DPF Data," check 'rpg_leak_div_int'. Is 'rpg_leak_div_int' greater than 2.25?

13.a Yes; update MCM software to latest software level and Go to step 6.

13.b No; update MCM software to latest software level and release vehicle.

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

14. Start and run the engine until fuel temperature is greater than 35°C (95°F) and coolant temperature is greater than 70°C (158°F).

15. Shut the engine down.

NOTICE

The high pressure fuel rail feed lines, vibration dampers, P-clips, mounting bracket and hardware are one-time-use components and MUST be replaced any time they are removed. Refer to TS letter 16 TS-9Rev2 for the high pressure fuel line kit numbers.

16. Check for an external high pressure fuel system leak(s). Are any leaks present at the following components?

- High Pressure Fuel Pump
- High Pressure Fuel Rail Feed Lines
- High Pressure Fuel Rail
- High Pressure Fuel Injector Lines
- Fuel Rail Pressure Sensor
- Pressure Limiting Valve

16.a Yes; repair leaks. Verify repairs.

16.b No; Go to step 9.

17. Check the engine oil dipstick. Is there any fuel in the oil?

17.a Yes; Refer to section "Fuel in Oil" .

17.b No; Go to step 10.

18. Check for leakage from the Pressure Limiting Valve (PLV). Refer to section "Pressure Limiting Valve Flow Test – Two-Filter Fuel System" . Does the PLV flow test pass?

18.a Yes; Go to step 11.

18.b No; replace the PLV and verify repairs. Refer to section "Removal of the Pressure Limiting Valve - Two-Filter System" .

Note : DiagnosticLink® 8.06 or higher is necessary to complete this troubleshooting.

19. One cylinder at a time, remove the injector fuel transfer tube and cap the rail at each injector using J-48704. Run the FSIC Leak Test. Refer to *section "FSIC Leak Test." Repeat for each injector. Record results.

HP Leak Detection Test Results					
#1 Capped	#2 Capped	#3 Capped	#4 Capped	#5 Capped	#6 Capped
Leaking / Not Leaking	Leaking / Not Leaking	Leaking / Not Leaking	Leaking / Not Leaking	Leaking / Not Leaking	Leaking / Not Leaking

20. With any one injector capped off, does the FSIC Leak Test pass?

20.a Yes; replace that injector that passes the FSIC Leak Test when capped. Refer to section "Removal of the Fuel Injector - Two-Filter System" and then run the FSIC Leak Detection Test again to verify repair.

20.b No; Go to step 13.

21. Install all six rail caps. Crank engine for 10 seconds and then monitor rail pressure bleed down. Does rail pressure bleed down under 100 bar in less than five minutes?

21.a Yes; replace the high pressure fuel pump. Refer to section "Removal of the High Pressure Fuel Pump - Two-Filter System" .

21.b No; replace all six injectors. Refer to section "Removal of the Fuel Injector - Two-Filter System" and then run the FSIC Leak Detection Test again to verify repair.

SPN 1089 (CPC) (GHG17)

155.1 SPN 1089/FMI 9 – GHG17

1. Connect DiagnosticLink .
2. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   2.a Yes; repair the battery voltage concern. Verify repair.
   2.b No; Go to step 3.
3. Is SPN 625/FMI 9 fault code present?
   3.a Yes; diagnose SPN 625/FMI 9 fault code first. Verify repair.
   3.b No; Go to step 4.

Note : This fault code may be set by two or more source inputs configured with the same address. Verify proper parameter settings.

4. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   4.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.
   4.b No; reprogram the CPC with the correct information as necessary. To verify repair, Go to step 5.
5. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

SPN 1121 (CPC) (GHG17)

156.1 SPN 1121/FMI 2 - GHG17

SPN 1121/FMI 2	
Description	Powertrain Message Missing
Monitored Parameter	J1939 Powertrain Message
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Idle

Check as follows:

1. Connect DiagnosticLink .
2. Are there any SPN 168 (battery voltage) fault codes present?
   - 2.a Yes; repair the battery voltage concern. Verify repair.
   - 2.b No; Go to step 3.
3. Is SPN 625/FMI 9 fault code present?
   - 3.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   - 3.b No; Go to step 4.

Note : This fault code may be set by two or more source inputs configured with the same address. Verify proper parameter settings.

4. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   - 4.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; reprogram the CPC with the correct information as necessary. To verify repair, Go to step 5.
5. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

156.2 SPN 1121/FMI 13 - GHG17

SPN 1121/FMI 13	
Description	Service Brake Signal Missing
Monitored Parameter	Service Brake Input
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Service Brake Operation

Check as follows:

1. Check for multiple codes. Is (CPC) SPN 168/FMI 0/14/18 (battery voltage) present?
   - 1.a Yes; troubleshoot these first.
   - 1.b No; Go to step 2.
2. Is Motor Control Module (MCM) SPN 625/FMI 9 present?
   - 2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   - 2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   - 3.a Yes; check the proper configuration of the CPC.
   - 3.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

156.3 SPN 1121/FMI 19 - GHG17

SPN 1121/FMI 19	
Description	Service Brake Signal Erratic
Monitored Parameter	Service Brake Input
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Service Brake Operation

Check as follows:

1. Check for multiple codes. Is (CPC) SPN 168/FMI 0/14/18 (battery voltage) present?
   - 1.a Yes; troubleshoot these first.
   - 1.b No; Go to step 2.
2. Is Motor Control Module (MCM) SPN 625/FMI 9 present?
   - 2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   - 2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   - 3.a Yes; check the proper configuration of the CPC.
   - 3.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

SPN 1136 (MCM) (GHG17)

157.1 SPN 1136/FMI 3 - GHG17

MCM Internal Injector Supply Voltage Too High

SPN 1136 /FMI 3	
Description	Internal power supply voltage high
Monitored Parameter	Internal power supply voltage
Typical Enabling Conditions	Continuous
Monitor Sequence	
Execution Frequency	Continuous When Enabling Conditions Are Met
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	

Check as follows:

1. Check for multiple codes. Are there any battery voltage faults present (SPN 168/FMI any) ?
   1.a Yes; troubleshoot these codes first.
   1.b No; Go to step 2.
2. Disconnect the MCM 21-pin connector and inspect connector for corrosion, oil, fuel or water intrusion. Is contamination found?
   2.a Yes; repair as necessary.
   2.b No; replace the MCM.

157.2 SPN 1136/FMI 4 - GHG17

MCM Internal Injector Supply Voltage Too Low

SPN 1136 /FMI 4	
Description	Internal power supply voltage low
Monitored Parameter	Internal power supply voltage
Typical Enabling Conditions	Continuous
Monitor Sequence	
Execution Frequency	Continuous When Enabling Conditions Are Met
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	

Check as follows:

1. Check for multiple codes. Are there any battery voltage faults present (SPN 168/FMI any) ?
   1.a Yes; troubleshoot these codes first.
   1.b No; Go to step 2.
2. Disconnect the MCM 21-pin connector and inspect connector for corrosion, oil, fuel or water intrusion. Is contamination found?
   2.a Yes; repair as necessary.
   2.b No; replace the MCM.

SPN 1163 (MCM) (GHG17)

158.1 SPN 1163/FMI 2 - GHG17

Motor Control Module (MCM) Temperature Sensor Signal Not Plausible

SPN 1163/FMI 2	
Description	This fault code sets when the Motor Control Module (MCM) detects that the internal MCM temperature is greater than 20°C (36°F) degrees from the expected temperature after the engine has been turned off for 8 hours.
Monitored Parameter	MCM Temperature
Typical Enabling Conditions	Key ON, engine OFF, battery voltage greater than 11 volts, engine rpm at zero, ambient temperature less than 40°C (104°F), engine OFF for no less than 8 hours.
Monitor Sequence	None
Execution Frequency	Once per cool down cycle
Typical Duration	5 seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	

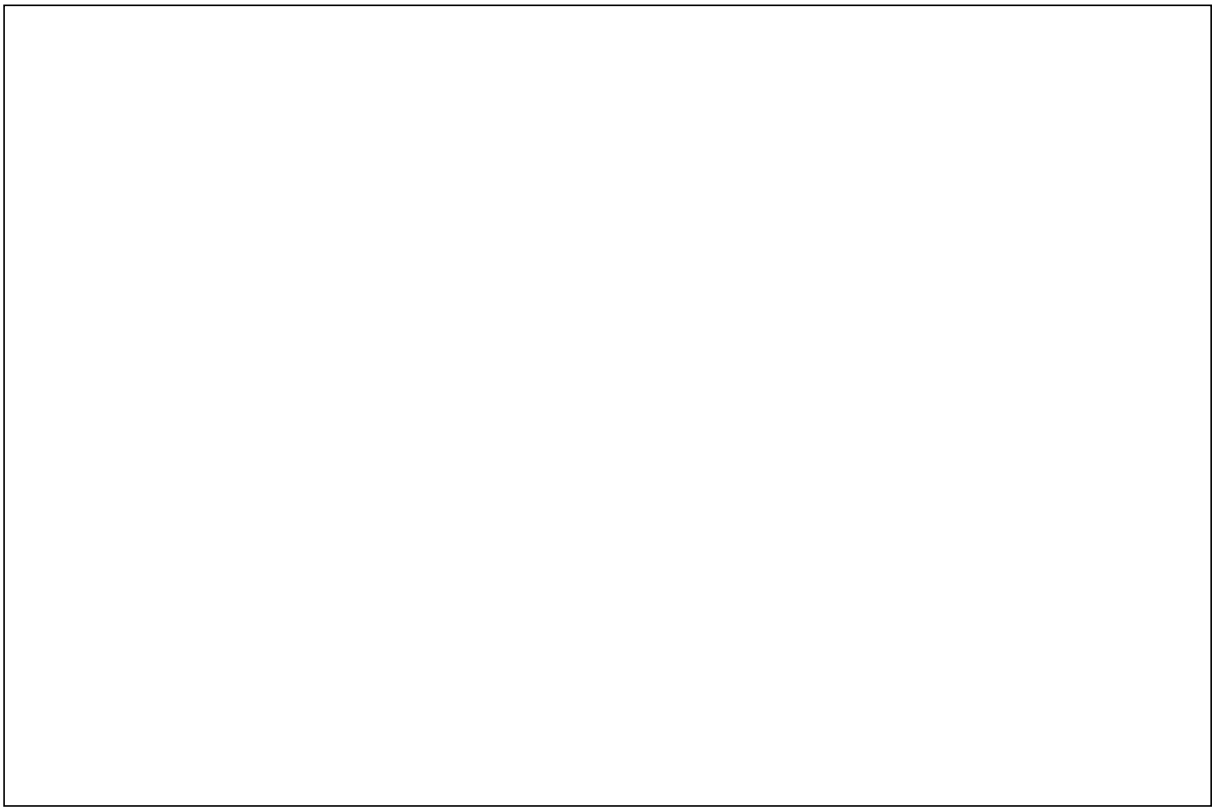
1. Has the Common Powertrain Controller (CPC) recently been reprogrammed or has the internal clock time been changed?
   1.a Yes; this fault may have been caused by the change in the CPC time.
   1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Check for multiple fault codes. Are fault codes SPN 1163//FMI 3 or 4 present?
   4.a Yes; diagnose the other fault codes first.
   4.b No; Go to step 5.
5. Disconnect and inspect the 120-pin and 21-pin MCM electrical connector. Is there damage or corrosion present?
   5.a Yes; repair as necessary. Verify repair.
   5.b No; replace the MCM. Verify repair.

SPN 1172 (MCM) (GHG17)

159.1 SPN 1172/FMI 3 - GHG17

Turbocharger Compressor Inlet Temperature Sensor or Circuit Failed High

SPN 1172/FMI 3	
Description	This Fault Code Sets When There is a Short to Power or an Open in the Turbocharger Compressor Inlet Temperature Circuit.
Monitored Parameter	Turbocharger Compressor Inlet Temperature
Typical Enabling Conditions	Ignition On
Monitor Sequence	Always
Execution Frequency	None
Typical Duration	Two Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Engine Running for One Minute



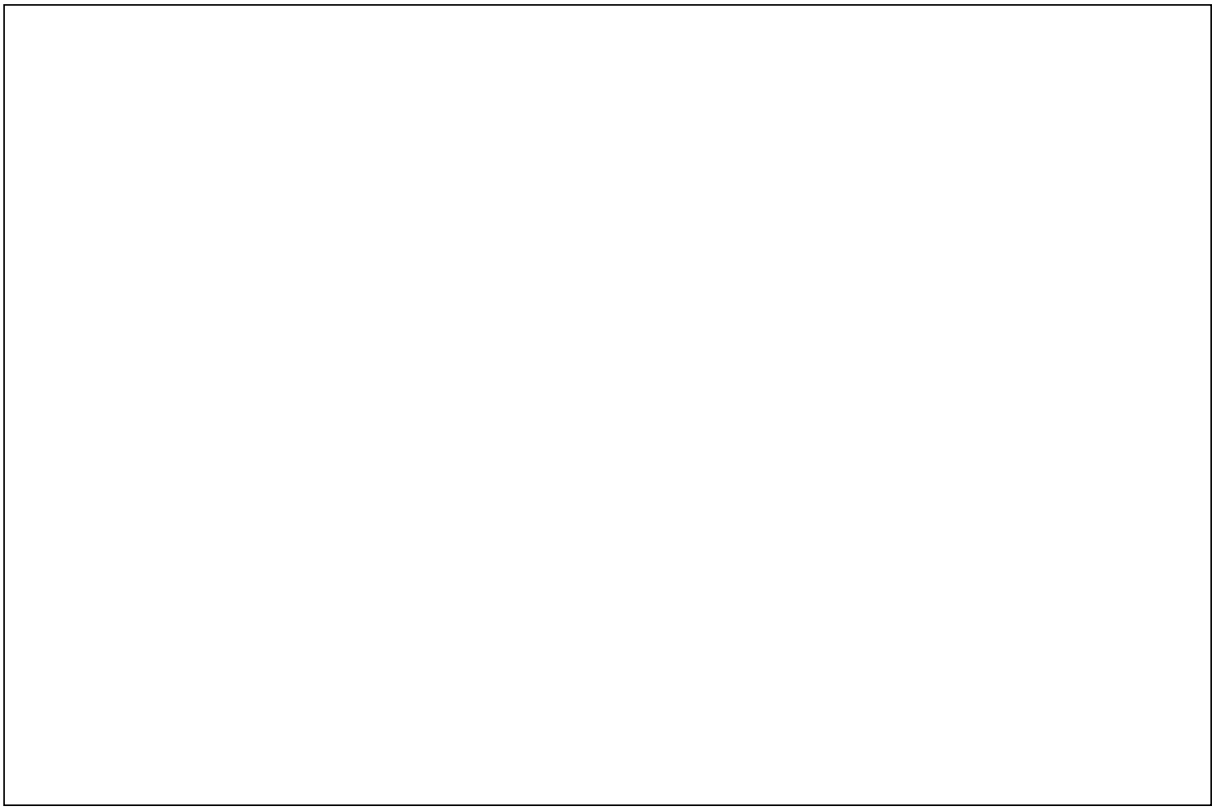
1. Disconnect and inspect the Turbocharger Compressor Inlet Temperature electrical connector harness side. Is there corrosion present?
   1.a Yes; replace the Turbocharger Compressor Inlet Temperature sensor and electrical connector. Verify repair.
   1.b No; Go to step 2.

2. Are any of the pins or the connector damaged?
   - 2.a Yes; Go to step 3.
   - 2.b No; Go to step 4.
3. Inspect the Turbocharger Compressor Inlet Temperature electrical connector component side. Are any of the pins or the connector damaged?
   - 3.a Yes; replace the Turbocharger Compressor Inlet Temperature sensor and electrical connector. Refer to section "Description and Operation of the Turbocharger Compressor Inlet Temperature Sensor" . Verify repair.
   - 3.b No; replace the Turbocharger Compressor Inlet Temperature electrical connector. Verify repair.
4. Use the appropriate flex probe and check the pins. Are there any spread pins?
   - 4.a Yes; replace the Turbocharger Compressor Inlet Temperature electrical connector. Refer to section "Description and Operation of the Turbocharger Compressor Inlet Temperature Sensor" . Verify repair.
   - 4.b No; Go to step 5.
5. Turn the ignition ON (key ON, engine OFF).
6. Measure the voltage between pins 1 and 2 of the Turbocharger Compressor Inlet Temperature electrical connector harness side. Is the voltage greater than 3.6 volts?
   - 6.a Yes; repair the short to power between pin 2 of the Turbocharger Compressor Inlet Temperature electrical connector and pin 86 of the MCM 120-pin electrical connector.
   - 6.b No; Go to step 7.
7. Measure the voltage between pins 1 and 2 of the Turbocharger Compressor Inlet Temperature electrical connector harness side. Is the voltage between 2.5 and 3.5 volts?
   - 7.a Yes; replace the Turbocharger Compressor Inlet Temperature sensor. Verify repair.
   - 7.b No; Go to step 8.
8. Measure the voltage between pin 2 of the Turbocharger Compressor Inlet Temperature electrical connector harness side and ground. Is the voltage between 2.5 and 3.5 volts?
   - 8.a Yes; repair the circuits between pin 1 of the Turbocharger Compressor Inlet Temperature electrical connector and pin 52 of the MCM 120-pin electrical connector.
   - 8.b No; repair the circuits between pin 2 of the Turbocharger Compressor Inlet Temperature electrical connector and pin 86 of the MCM 120-pin electrical connector.

159.2 SPN 1172/FMI 4 - GHG17

Turbocharger Compressor Inlet Temperature Circuit Failed Low

SPN 1172/FMI 4	
Description	This Fault Code Sets When There is a Short to Ground in the Turbocharger Compressor Inlet Temperature Circuit.
Monitored Parameter	Turbocharger Compressor Inlet Temperature
Typical Enabling Conditions	Ignition On
Monitor Sequence	Always
Execution Frequency	None
Typical Duration	Two Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Engine Running for One Minute



1. Disconnect and inspect the Turbocharger Compressor Inlet Temperature electrical connector harness side. Is there corrosion present?
   - 1.a Yes; replace the Turbocharger Compressor Inlet Temperature sensor and electrical connector. Verify repair.
   - 1.b No; Go to step 2.
2. Are any of the pins or the connector damaged?
   - 2.a Yes; Go to step 3.
   - 2.b No; Go to step 4.

3. Inspect the Turbocharger Compressor Inlet Temperature electrical connector component side. Are any of the pins or the connector damaged?
   - 3.a Yes; replace the Turbocharger Compressor Inlet Temperature sensor and electrical connector. Refer to section "Description and Operation of the Turbocharger Compressor Inlet Temperature Sensor" . Verify repair.
   - 3.b No; replace the Turbocharger Compressor Inlet Temperature electrical connector. Verify repair.
4. Turn the ignition ON (key ON, engine OFF).
5. Is fault code SPN 1172/FMI 4 now inactive and SPN 1172/FMI 3 now active?
   - 5.a Yes; replace the Turbocharger Compressor Inlet Temperature sensor. Refer to section "Description and Operation of the Turbocharger Compressor Inlet Temperature Sensor" . Verify repair.
   - 5.b No; repair the short to ground between pin 2 of the Turbocharger Compressor Inlet Temperature sensor electrical connector harness side and pin 86 of the MCM 120-pin electrical connector. Verify repair.

159.3 SPN 1172/FMI 21 - GHG17

Compressor Inlet Temperature Sensor Signal Not Plausible

SPN 1172/FMI 21	
Description	This fault code sets when the Motor Control Module (MCM) detects that the turbocharger compressor inlet temperature is greater than 20°C (36°F) degrees from the expected temperature after the engine has been turned off for 8 hours.
Monitored Parameter	Compressor inlet temperature
Typical Enabling Conditions	Key ON, engine OFF, battery voltage greater than 11 volts, engine rpm at zero, ambient temperature less than 40°C (104°F), engine OFF for no less than 8 hours.
Monitor Sequence	None
Execution Frequency	Once per cool down cycle
Typical Duration	5 seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Road test the vehicle for 30 minutes until the coolant reaches operating temperature. Then verify that the engine Compressor inlet temperature is within 10°C (18°F) of the ambient air temperature.

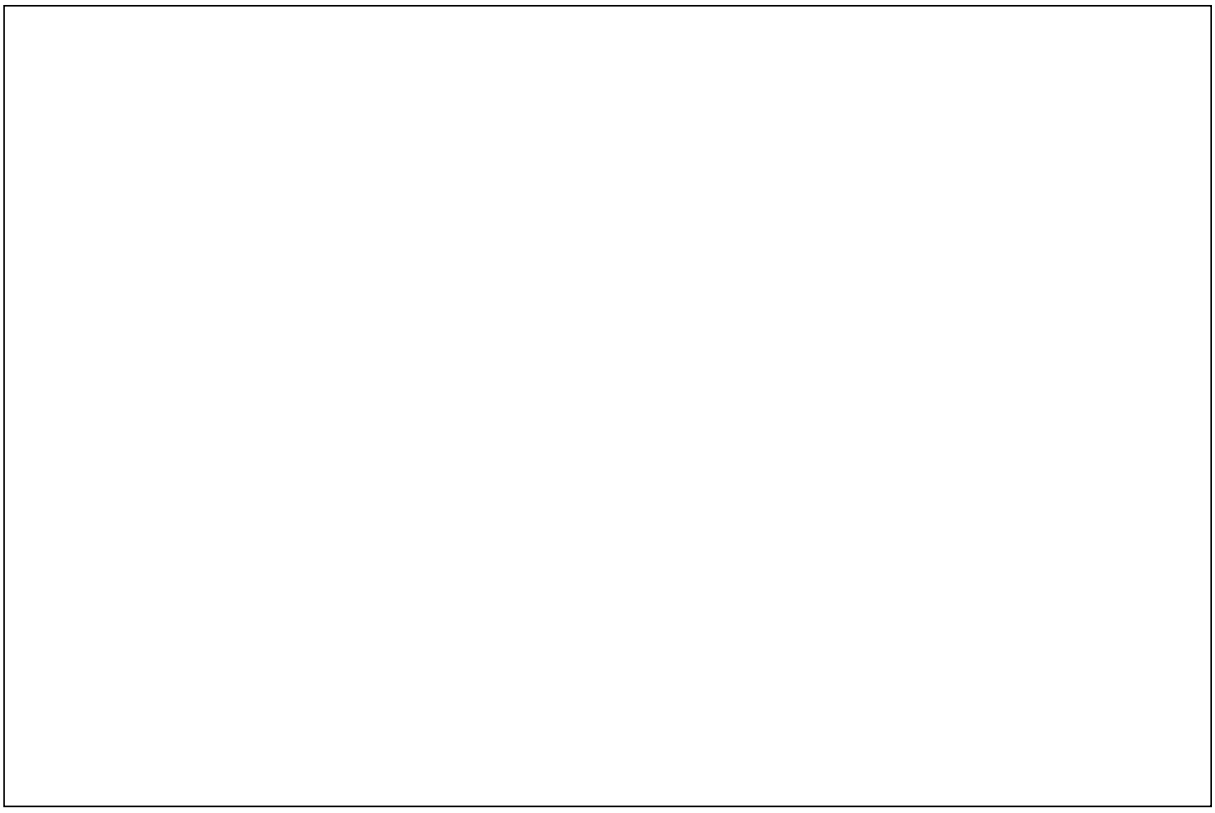
Possible causes:

1. Has the Common Powertrain Controller (CPC) recently been reprogrammed or has the internal clock time been changed?
   - 1.a Yes; this fault may have been caused by the change in the CPC time.
   - 1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Check for multiple fault codes. Are fault codes SPN 1172//FMI 3 or 4 present?
   - 4.a Yes; diagnose the other fault codes first.
   - 4.b No; Go to step 5.
5. Disconnect and inspect the compressor inlet temperature sensor electrical connector. Is there damage or corrosion present?
   - 5.a Yes; repair as necessary. Verify repair.
   - 5.b No; replace the compressor inlet temperature sensor. Verify repair.

SPN 1231 (ACM) (GHG17)

160.1 SPN 1231/FMI 9 - GHG17

SPN 1231/FMI 9	
Description	Aftertreatment Control Module (ACM) Message Not Received or has Stopped Arriving
Monitored Parameter	CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Ignition On



Check as follows:

1. Are there any battery voltage faults (SPN 168/FMI any faults)?
   1.a Yes; troubleshoot battery voltage faults first.
   1.b No; Go to step 2.
2. Has the ACM, the Motor Control Module (MCM), or Common Powertrain Controller (CPC) been recently programmed?
   2.a Yes; clear the fault codes. Go to step 3.

2.b No; Go to step 5.

Note : Main battery power must be left ON.

Note : The five minute time-frame allows the ACM to go completely offline.

3. Turn ignition OFF.
4. Wait five minutes before proceeding.
5. Turn the ignition ON (key ON, engine OFF).
6. After 30 seconds, is SPN 1231/FMI 9 active?

   6.a Yes; Go to step 7.

   6.b No; release the vehicle.
7. Turn the ignition OFF.
8. Wait five minutes before proceeding.
9. Disconnect the MCM 21-pin connector.
10. Inspect the MCM 21-pin harness and module connectors for signs of damage; bent, spread, broken, corroded or unseated (pushed out) pins, signs of water, oil or fuel intrusion or damaged seals. Is damage present?

    10.a Yes; repair as necessary. Verify repairs.

    10.b No; Go to step 11.
11. Measure the resistance between pin 13 of the MCM 21-pin harness connector and battery ground. Is the resistance greater than 10K ohms?

    11.a Yes; Go to step 12.

    11.b No; repair the short to ground in the wire between pin 13 of the MCM 21-pin harness connector and pin 10 of the ACM 21-pin harness connector.
12. Measure the resistance between pin 19 of the MCM 21-pin harness connector and battery ground. Is the resistance greater than 10K ohms?

    12.a Yes; Go to step 13.

    12.b No; repair the short to ground in the wire between pin 19 of the MCM 21-pin harness connector and pin 20 of the ACM 21-pin harness connector.
13. Disconnect the ACM 21-pin harness connector.
14. Inspect the ACM 21-pin harness and module connectors for signs of damage; bent, spread, moist, broken, corroded or unseated (pushed out) pins, signs of water, oil or fuel intrusion or damaged seals. Is damage present?

    14.a Yes; repair as necessary. Verify repairs.

    14.b No; Go to step 15.
15. Check ACM internal terminating resistor by measuring the resistance across pins 10 and 20 of the ACM 21-pin module connector. Is the resistance between 110 and 120 ohms?

15.a Yes; Go to step 16.

15.b No; replace the ACM. Refer to Original Equipment Manufacturer (OEM) procedures.

16. Disconnect the CPC harness connector #3.

17. Inspect the CPC harness and module connectors for signs of damage; bent, spread, broken, corroded or unseated (pushed out) pins, signs of water, oil or fuel intrusion or damaged seals. Is damage present?

17.a Yes; repair as necessary. Verify repairs.

17.b No; Go to step 18.

18. Check CPC internal terminating resistor by measuring the resistance across pins 19 and 21 of the CPC module connector cavity #3. Is the resistance between 110 and 130 ohms?

18.a Yes; Go to step 19.

18.b No; replace the CPC. Refer to Original Equipment Manufacturer (OEM) procedures.

19. Measure the resistance between pin 19 of the CPC harness connector #3 and pin 20 of the ACM 21-pin connector. Is the resistance less than five ohms?

19.a Yes; Go to step 20.

19.b No; repair the wire between pin 19 of the CPC harness connector #3 and pin 20 of the ACM 21-pin harness connector.

20. Measure the resistance between pin 21 of the CPC harness connector #3 and pin 10 of the ACM 21-pin connector. Is the resistance less than five ohms?

20.a Yes; Go to step 21.

20.b No; repair the wire between pin 21 of the CPC harness connector #3 and pin 10 of the ACM 21-pin harness connector.

21. Measure the resistance between pin 19 of the CPC harness connector #3 and pin 19 of the MCM 21-pin connector. Is the resistance less than five ohms?

21.a Yes; Go to step 22.

21.b No; repair the wire between pin 19 of the CPC harness connector #3 and pin 19 of the MCM 21-pin harness connector.

22. Measure the resistance between pin 21 of the CPC harness connector #3 and pin 13 of the MCM 21-pin connector. Is the resistance less than five ohms?

22.a Yes; Go to step 23.

22.b No; repair the wire between pin 21 of the CPC harness connector #3 and pin 13 of the MCM 21-pin harness connector.

23. Turn the ignition ON (key ON, engine OFF).

24. After 30 seconds, check for an active SPN 1231/FMI 9 fault code. Is the code active?

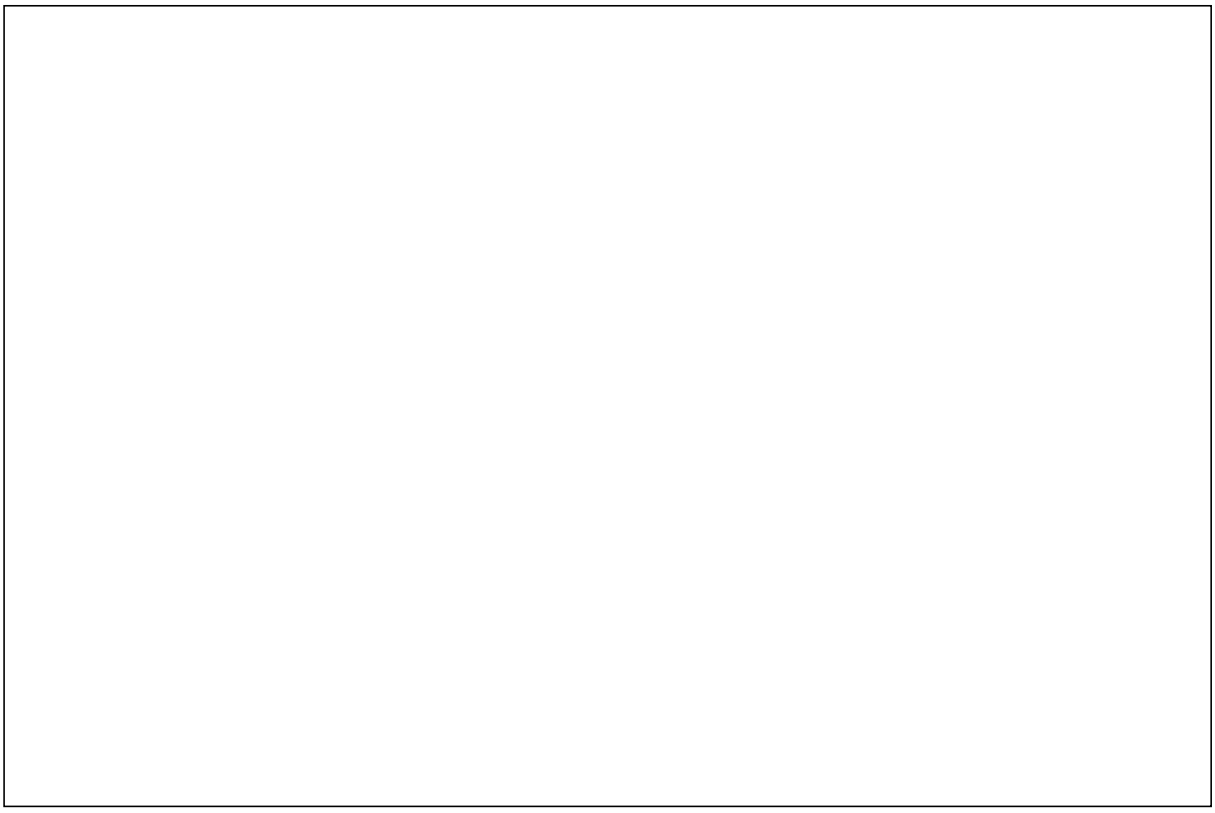
24.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" .

24.b No; clear codes and release the vehicle.

SPN 1231 (MCM) (GHG17)

161.1 SPN 1231/FMI 9 - GHG17

SPN 1231/FMI 9	
Description	Aftertreatment Control Module (ACM) Message Not Received or has Stopped Arriving
Monitored Parameter	CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Ignition On



Check as follows:

1. Are there any battery voltage faults (SPN 168/FMI any faults)?
   1.a Yes; troubleshoot battery voltage faults first.
   1.b No; Go to step 2.
2. Has the ACM, the Motor Control Module (MCM), or Common Powertrain Controller (CPC) been recently programmed?
   2.a Yes; clear the fault codes. Go to step 3.

2.b No; Go to step 5.

Note : Main battery power must be left ON.

Note : The five minute time-frame allows the ACM to go completely offline.

3. Turn ignition OFF.
4. Wait five minutes before proceeding.
5. Turn the ignition ON (key ON, engine OFF).
6. After 30 seconds, is SPN 1231/FMI 9 active?

   6.a Yes; Go to step 7.

   6.b No; release the vehicle.
7. Turn the ignition OFF.
8. Wait five minutes before proceeding.
9. Disconnect the MCM 21-pin connector.
10. Inspect the MCM 21-pin harness and module connectors for signs of damage; bent, spread, broken, corroded or unseated (pushed out) pins, signs of water, oil or fuel intrusion or damaged seals. Is damage present?

    10.a Yes; repair as necessary. Verify repairs.

    10.b No; Go to step 11.
11. Measure the resistance between pin 13 of the MCM 21-pin harness connector and battery ground. Is the resistance greater than 10K ohms?

    11.a Yes; Go to step 12.

    11.b No; repair the short to ground in the wire between pin 13 of the MCM 21-pin harness connector and pin 10 of the ACM 21-pin harness connector.
12. Measure the resistance between pin 19 of the MCM 21-pin harness connector and battery ground. Is the resistance greater than 10K ohms?

    12.a Yes; Go to step 13.

    12.b No; repair the short to ground in the wire between pin 19 of the MCM 21-pin harness connector and pin 20 of the ACM 21-pin harness connector.
13. Disconnect the ACM 21-pin harness connector.
14. Inspect the ACM 21-pin harness and module connectors for signs of damage; bent, spread, moist, broken, corroded or unseated (pushed out) pins, signs of water, oil or fuel intrusion or damaged seals. Is damage present?

    14.a Yes; repair as necessary. Verify repairs.

    14.b No; Go to step 15.
15. Check ACM internal terminating resistor by measuring the resistance across pins 10 and 20 of the ACM 21-pin module connector. Is the resistance between 110 and 120 ohms?

15.a Yes; Go to step 16.

15.b No; replace the ACM. Refer to Original Equipment Manufacturer (OEM) procedures.

16. Disconnect the CPC harness connector #3.

17. Inspect the CPC harness and module connectors for signs of damage; bent, spread, broken, corroded or unseated (pushed out) pins, signs of water, oil or fuel intrusion or damaged seals. Is damage present?

17.a Yes; repair as necessary. Verify repairs.

17.b No; Go to step 18.

18. Check CPC internal terminating resistor by measuring the resistance across pins 19 and 21 of the CPC module connector cavity #3. Is the resistance between 110 and 130 ohms?

18.a Yes; Go to step 19.

18.b No; replace the CPC. Refer to Original Equipment Manufacturer (OEM) procedures.

19. Measure the resistance between pin 19 of the CPC harness connector #3 and pin 20 of the ACM 21-pin connector. Is the resistance less than five ohms?

19.a Yes; Go to step 20.

19.b No; repair the wire between pin 19 of the CPC harness connector #3 and pin 20 of the ACM 21-pin harness connector.

20. Measure the resistance between pin 21 of the CPC harness connector #3 and pin 10 of the ACM 21-pin connector. Is the resistance less than five ohms?

20.a Yes; Go to step 21.

20.b No; repair the wire between pin 21 of the CPC harness connector #3 and pin 10 of the ACM 21-pin harness connector.

21. Measure the resistance between pin 19 of the CPC harness connector #3 and pin 19 of the MCM 21-pin connector. Is the resistance less than five ohms?

21.a Yes; Go to step 22.

21.b No; repair the wire between pin 19 of the CPC harness connector #3 and pin 19 of the MCM 21-pin harness connector.

22. Measure the resistance between pin 21 of the CPC harness connector #3 and pin 13 of the MCM 21-pin connector. Is the resistance less than five ohms?

22.a Yes; Go to step 23.

22.b No; repair the wire between pin 21 of the CPC harness connector #3 and pin 13 of the MCM 21-pin harness connector.

23. Turn the ignition ON (key ON, engine OFF).

24. After 30 seconds, check for an active SPN 1231/FMI 9 fault code. Is the code active?

24.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" .

24.b No; clear codes and release the vehicle.

SPN 1237 (CPC) (GHG17)

162.1 SPN 1237/FMI 4 - GHG17

SPN 1237/FMI 4	
Description	Input 1/15 Short To Ground
Monitored Parameter	1 15 DI Selection
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON Engine OFF

1. Has the Common Powertrain Controller (CPC) been recently reprogrammed?
   1.a Yes; check the proper configuration of the CPC.
   1.b No; clear fault and retest. Go to step 2.
2. Turn the ignition ON (key ON, engine OFF).
3. Does active fault return?
   3.a Yes; Go to step 4.
   3.b No; testing is completed. Release vehicle.
4. Disconnect CPC connector #1.
5. Measure the resistance between pin 15 of the CPC connector #1 and ground. Is the resistance more than 10k ohms?
   5.a Yes; replace the stop engine override switch.
   5.b No; repair the short to ground on the wire between pin 15 of the CPC connector #1 and the stop engine override switch.

SPN 1243 (CPC) (GHG17)

163.1 SPN 1243/FMI 14 - GHG17

SPN 1243/FMI 14	
Description	This Fault Code Indicates a Missing Message from the Antilock Brake System (ABS) Module.
Monitored Parameter	J1939 Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, Engine OFF

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   1.a Yes; repair the battery voltage concern. Verify repair.
   1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   2.b No; Go to step 3.
3. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   3.a Yes; refer to the OEM diagnostics for troubleshooting the loss of communication to the ABS module.
   3.b No; check for proper parameter configuration of the CPC against the server information.

SPN 1322 (MCM) (GHG17)

164.1 SPN 1322/FMI 10 – GHG17

SPN 1322/FMI 10	
Description	This Fault Code Sets Once the Motor Control Module (MCM) Detects a Misfire on Multiple Cylinders Within One Rotation of Crankshaft With all Conditions Met
Monitored Parameter	Injection Quantity
Typical Enabling Conditions	
Monitor Sequence	Always When Enabling Conditions Are Met
Execution Frequency	Always
Typical Duration	1000 Revolutions
Dash Lamps	MIL
Engine Reaction	None
Verification	Ensure the Ignition Has Been Off for a Minimum of Five Minutes Prior to the Last Ignition On. Meet All Enabling Conditions. 15-Minute Road Test

The entry conditions for this code are:

- Engine speed is above low idle
- All cylinders are active, no fault reactions
- Engine speed/torque is steady

This fault can occur due to the conditions listed below:

- Cylinder kit failure
- Valve train failure
- Lash adjustments
- Fuel injector
- High pressure fuel line (rail to fuel injector)
- Debris entering fuel injector (intermittent faults)
- Fuel quality

Required Service Tools		
W470589009800	DD13/15 Cam Gear Cover	

Check as follows:

1. Check and record fuel level using parameter AS044 Fuel Tank Level. Is the fuel level under ¼ tank (25%)?

1.a Yes; add fuel and road test vehicle. If code does not become active during road test, release the truck. If code becomes active during the road test with over ¼ tank of fuel, Go to step 3.

1.b No; Go to step 2.

2. Check fuel tank level in the extended fault code data. Was fuel tank level over ¼ tank (25%) when the code logged?

2.a Yes; Go to step 3.

2.b No; fuel sloshing in the tank may have caused aerated fuel and set this code. Road test vehicle. If code does not come active during road test, release the truck. If code does come active, Go to step 3.

3. Using DiagnosticLink Standard, perform the Relative Cylinder Compression Test listed under service routines. Refer to section "Relative Cylinder Compression Test" . Is low compression found and all cylinders within 10%?

3.a Yes; the issue is related to a mechanical failure/issue for that cylinder. Repair as necessary.

3.b No; Go to step 4.

WARNING

ENGINE EXHAUST

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

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.

4. Start and bring the engine up to operating temperature of 60°C (140°F).

Note : For Idle Speed Balance (ISB) values to update, the engine speed must be at idle.

5. Using DiagnosticLink Standard, read parameter ISB values under the instrumentation section. Is the value for any cylinder at its maximum limit of +100?

5.a Yes; Go to step 6.

5.b No; fault may be intermittent. Obtain information from customer on driving habits, recent repairs, number of occurrences when fault code set, or situations when the code occurred. Try to retest engine within these parameters.

6. Inspect high pressure fuel line from rail to fuel injector for damage. Is damage found?

6.a Yes; replace the high pressure fuel injector line if necessary. Go to step 7.

6.b No; replace the fuel injector for the cylinder identified. Go to step 7.

7. Verify repairs. Is misfire concern resolved?

7.a Yes; testing is completed. Clear faults and release vehicle.

7.b No; perform the Aerated Fuel Test. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" .

164.2 SPN 1322/FMI 11 – GHG17

SPN 1322/FMI 11	
Description	This Fault Will Occur Once The MCM Sees The Injection Duration Compensates More Than A Set Threshold Within Multiple Rotations Of Crankshaft With All Conditions Met
Monitored Parameter	Injection Quantity
Typical Enabling Conditions	
Monitor Sequence	Always When Enabling Conditions Are Met
Execution Frequency	Always
Typical Duration	1000 Revolutions
Dash Lamps	MIL
Engine Reaction	None
Verification	Ensure the Ignition Has Been Off for a Minimum of Five Minutes Prior to the Last Ignition On. Meet All Enabling Conditions. 15-Minute Road Test

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

The entry conditions for this code are:

- Engine speed is above low idle
- All cylinders are active, no fault reactions
- Engine speed/torque is steady

This fault can occur due to the conditions listed below:

- Cylinder kit failure
- Valve train failure
- Lash adjustments
- Fuel injector
- High pressure fuel line (rail to fuel injector)

- Debris entering fuel injector (intermittent faults)
- Fuel quality

Required Service Tools		
W470589009800	DD13/15 Cam Gear Cover	

Check as follows:

1. Check and record fuel level using parameter AS044 Fuel Tank Level. Is the fuel level under ¼ tank (25%)?
   1.a Yes; add fuel and road test vehicle. If code does not become active during road test, release the truck. If code becomes active during the road test with over ¼ tank of fuel Go to step 3.
   1.b No; Go to step 2.
2. Check fuel tank level in the extended fault code data. Was fuel tank level over ¼ tank (25%) when the code logged?
   2.a Yes; Go to step 3.
   2.b No; fuel sloshing in the tank may have caused aerated fuel and set this code. Road test vehicle. If code does not come active during road test, release the truck. If code does come active, Go to step 3.
3. Using DiagnosticLink Standard, perform the Relative Cylinder Compression Test listed under service routines. Refer to section "Relative Cylinder Compression Test" . Is low compression found and all cylinders within 10%?
   3.a Yes; the issue is related to a mechanical failure/issue for that cylinder. Repair as necessary.
   3.b No; Go to step 4.

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

4. Start and bring the engine up to operating temperature of 60°C (140°F).

Note : For Idle Speed Balance (ISB) values to update, the engine speed must be at idle.

5. Using DiagnosticLink Standard, read parameter ISB values under the instrumentation section. Is the value for any cylinder at its maximum limit of +100?
   - 5.a Yes; Go to step 6.
   - 5.b No; fault may be intermittent. Obtain information from customer on driving habits, recent repairs, number of occurrences when fault code set, or situations when the code occurred. Try to retest engine within these parameters.
6. Inspect high pressure fuel line from rail to fuel injector for damage. Is damage found?
   - 6.a Yes; replace the high pressure fuel injector line if necessary. Go to step 7.
   - 6.b No; replace the fuel injector for the cylinder identified. Go to step 7.
7. Verify repairs. Is misfire concern resolved?
   - 7.a Yes; testing is completed. Clear faults and release vehicle.
   - 7.b No; perform the Aerated Fuel Test. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" .

164.3 SPN 1322/FMI 31 - GHG17

SPN 1322/FMI 31	
Description	This Fault Code Sets when the Motor Control Module (MCM) Detects That Multiple Cylinders Have Low rpm Speed with the Injector Commanded to Max Fueling for a Count of Two with All Conditions Met
Monitored Parameter	Engine rpm
Typical Enabling Conditions	
Monitor Sequence	None
Execution Frequency	Once Per Drive Cycle When Enabling Conditions are Met
Typical Duration	Five Seconds
Dash Lamps	CEL, MIL
Engine Reaction	25% Derate
Verification	Ensure the ignition has been off for a minimum of five minutes prior to the last ignition on. Meet all enabling conditions. Let the Engine Idle for five minutes. (Fault code status will become pending with one detected failure and active with the second).

Note : DO NOT use the Idle Speed Balance (ISB) test in DiagnosticLink® for ANY misfire at idle testing.

Check as follows:

Possible causes:

- Valve Lash Out Of Adjustment
- Valve Train Damage/Failure
- Bent Valve
- Valve Face/Seat Damage
- Stuck Jake Brake
- Bearing Failure
- Bent Connecting Rod
- Cylinder Liner Damage
- Piston Ring Damage
- Failed Cylinder Head Gasket
- Failed Fuel Injector

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

CAUTION
ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

WARNING

BODILY INJURY

To avoid injury from a falling component, ensure an appropriately rated lifting device is used. Moving the component without an appropriately rated lifting device could result in the component falling, which could cause serious personal injury and component damage. Never stand beneath a suspended load.

WARNING

PERSONAL INJURY

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

1. Does the engine exhibit knocking noise while running?
   1.a Yes; Go to step 2.
   1.b No; Go to step 4.
2. Remove the Exhaust Gas Recirculation (EGR) hot pipe and check for raw fuel. Was raw fuel found?
   2.a Yes; perform the following:
   Refer to section "Cleaning of the DD13 Exhaust Gas Recirculation System"
   Refer to section "Cleaning of the DD15 Exhaust Gas Recirculation System"
   Refer to section "Cleaning of the DD16 Exhaust Gas Recirculation System"
   2.b No; reinstall EGR hot pipe and Go to step 3.
3. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was the fuel system found to be aerated?
   3.a Yes; make necessary repairs. Verify repairs.
   3.b No; Refer to section "Different Engine Noise" .

Note : Faults are listed in diagnostic priority from top to bottom.

4. Are there any of the following faults present?

- SPN 651/FMI any
- SPN 3659/FMI any
- SPN 7384/FMI any
- SPN 2797/FMI any
- SPN 4257/FMI any
- SPN 5357/FMI any
- SPN 190/FMI 0, 14, or 15
- SPN 636/FMI 2, 8, 10, or 11
- SPN 723/FMI 8, 10, or 11
- SPN 157/FMI any

- SPN 164/FMI any
- SPN 520268/FMI any

4.a Yes; repair fault with the highest priority listed above.

4.b No; Go to step 5.

5. 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 3000 rpm?

   5.a Yes; Go to step 6.

   5.b No; Go to step 7.

6. View past warranty and repair history to determine if both camshafts were replaced after the engine overspeed. Were the camshafts replaced?

   6.a Yes; Go to step 7.

   6.b No; replace both camshafts. Inspect the engine brake rocker arms for loose actuator piston retainers and loose or missing return springs. Verify repairs.

7. Connect a battery charger to the vehicle to maintain sufficient battery voltage while cranking. Use DiagnosticLink to perform the Relative Cylinder Compression test. Refer to section "Relative Cylinder Compression Test" . Is the relative compression reading for all cylinders within 10% of the highest cylinder reading?

   7.a Yes; Go to step 17.

   7.b No; Go to step 9.

8. Turn the engine OFF.
9. Disconnect the battery charger.
10. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
11. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers, or camshafts damaged?

    11.a Yes; replace the damaged components. Perform verification in fault code chart header to verify repairs.

    11.b No; Go to step 13.

12. Check the valve lash clearance for all cylinders. Refer to section "Setting the Valve and Engine Brake Lash" . Is the valve lash within specification?

    12.a Yes; Go to step 14.

    12.b No; adjust the valve lash to the correct clearance. Perform verification in fault code chart header to verify repairs.

13. Check the engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Is the engine brake lash within specification?

    13.a Yes; Go to step 16.

    13.b No; Go to step 15.

14. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?

    14.a Yes; replace the engine brake rocker arm. Perform verification in fault code chart header to verify repairs.

    Refer to section "Removal of the Camshafts"

    Refer to section "Removal of the Exhaust Rocker Shaft Assembly"

    14.b No; set the correct engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Perform verification in fault code chart header to verify repairs.

15. Connect the battery charger to maintain proper cranking speed.
16. Perform the Mechanical Cylinder Compression test. Refer to section "Mechanical Cylinder Compression Test" . Is the mechanical cylinder compression reading for any cylinder 344 kPa (50 psi) lower than any of the other cylinders?

16.a Yes; disconnect the battery charger and remove the cylinder head. Refer to section "Symptom Diagnostics - Low Engine Compression" to check for the cause of the loss of compression.

16.b No; Go to step 17.

17. Remove and inspect the engine oil filter. Refer to section "Replacement of the Oil Filter" . Is there an excessive amount of metal present in the oil filter?

17.a Yes; remove the oil pan and inspect the bearings. Repair as necessary.

17.b No; replace the fuel injectors. Refer to section "Removal of the Fuel Injector - Two-Filter System" . Perform verification in fault code chart header to verify repairs.

SPN 1323 (MCM) (GHG17)

165.1 SPN 1323/FMI 10 - GHG17

SPN 1323/FMI 10	
Description	This Fault Code Sets Once the Motor Control Module (MCM) Detects a Misfire on Cylinder #1 with all Conditions Met
Monitored Parameter	Engine rpm
Typical Enabling Conditions	
Monitor Sequence	Always When Enabling Conditions Are Met
Execution Frequency	Always
Typical Duration	1000 Revolutions
Dash Lamps	MIL
Engine Reaction	None
Verification	Ensure Ignition Has Been Off for a Minimum of Five Minutes Prior to the Last Ignition On. Meet All Enabling Conditions During a 15 Minute Road Test

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

Note : DO NOT use the Idle Speed Balance (ISB) test in DiagnosticLink® for ANY misfire testing.

Check as follows:

Possible causes:

- Valve Lash Out Of Adjustment
- Valve Train Damage/Failure
- Bent Valve
- Valve Face/Seat Damage
- Stuck Jake Brake
- Bearing Failure

- Bent Connecting Rod
- Cylinder Liner Damage
- Piston Ring Damage
- Failed Cylinder Head Gasket
- Failed Fuel Injector

⚠WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠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.

CAUTION

ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

⚠WARNING

BODILY INJURY

To avoid injury from a falling component, ensure an appropriately rated lifting device is used. Moving the component without an appropriately rated lifting device could result in the component falling, which could cause serious personal injury and component damage. Never stand beneath a suspended load.

⚠WARNING

PERSONAL INJURY

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

1. Check and record fuel level using parameter AS044 Fuel Tank Level. Is the fuel level under ¼ tank (25%)?
   - 1.a Yes; add fuel and road test vehicle. If code does not become active during road test, release the truck. If code becomes active during the road test with over ¼ tank of fuel, Go to step 3.
   - 1.b No; Go to step 2.
2. Check fuel tank level in the extended fault code data. Was fuel tank level over ¼ tank (25%) when the code logged?
   - 2.a Yes; Go to step 3.
   - 2.b No; fuel sloshing in the tank may have caused aerated fuel and set this code. Road test vehicle. If code does not come active during road test, release the truck. If code does come active, Go to step 3.

3. Does the engine exhibit knocking noise while running?

   3.a Yes; Go to step 4.

   3.b No; Go to step 6.

4. Remove the Exhaust Gas Recirculation (EGR) hot pipe and check for raw fuel. Was raw fuel found?

   4.a Yes; Refer to section "Test-E - Two-Filter Fuel System" .

   4.b No; reinstall EGR hot pipe and Go to step 5.

5. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was the fuel system found to be aerated?

   5.a Yes; make necessary repairs. Verify repairs.

   5.b No; Refer to section "Different Engine Noise" .

Note : Faults are listed in diagnostic priority from top to bottom.

6. Are there any of the following faults present?

- SPN 651/FMI any
- SPN 3659/FMI any
- SPN 7384/FMI any
- SPN 2797/FMI any
- SPN 4257/FMI any
- SPN 1322/FMI any
- SPN 5357/FMI any
- SPN 190/FMI 0, 14, or 15
- SPN 636/FMI 2, 8, 10, or 11
- SPN 723/FMI 8, 10, or 11
- SPN 157/FMI any
- SPN 164/FMI any
- SPN 520268/FMI any

   6.a Yes; repair fault with the highest priority listed above.

   6.b No; Go to step 7.

7. 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?

Peak Engine RPM	
12 Lobe Intake Camshaft	2800 rpm
6 Lobe Intake Camshaft	3000 rpm

   7.a Yes; Go to step 8.

   7.b No; Go to step 9.

8. View past warranty and repair history to determine if both camshafts were replaced after the engine overspeed. Were the camshafts replaced?

   8.a Yes; Go to step 9.

   8.b No; replace both camshafts. Inspect the engine brake rocker arms for loose actuator piston retainers and loose or missing return springs. Verify repairs.

9. Connect a battery charger to the vehicle to maintain sufficient battery voltage while cranking.

10. Use DiagnosticLink to perform the Relative Cylinder Compression test. Refer to section "Relative Cylinder Compression Test" . Is the relative compression reading for cylinder #1 within 10% of the highest cylinder reading?

10.a Yes; Go to step 20.

10.b No; Go to step 11.

11. Turn the engine OFF.
12. Disconnect the battery charger.
13. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
14. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers or camshafts damaged?

    14.a Yes; replace the damaged components. Perform verification in fault code chart header to verify repairs.

    14.b No; Go to step 15.

15. Check the valve lash clearance for cylinder #1. Refer to section "Setting the Valve and Engine Brake Lash" . Is the valve lash within specification?

    15.a Yes; Go to step 16.

    15.b No; adjust the valve lash to the correct clearance. Perform verification in fault code chart header to verify repairs.

16. Check the engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Is the engine brake lash within specification?

    16.a Yes; Go to step 18.

    16.b No; Go to step 17.

17. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?

    17.a Yes; replace the engine brake rocker arm. Refer to section "Removal of the Camshafts" and Refer to section "Removal of the Exhaust Rocker Shaft Assembly" . Perform verification in fault code chart header to verify repairs.

    17.b No; set the correct engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Perform verification in fault code chart header to verify repairs.

18. Connect the battery charger to maintain proper cranking speed.
19. Perform the Mechanical Cylinder Compression test. Refer to section "Mechanical Cylinder Compression Test" . Is the mechanical cylinder compression reading for cylinder #1 344 kPa (50 psi) lower than any of the other cylinders?

    19.a Yes; disconnect the battery charger and remove the cylinder head. Refer to section "Symptom Diagnostics - Low Engine Compression" to check for the cause of the loss of compression.

    19.b No; Go to step 20.

20. Remove and inspect the engine oil filter. Refer to section "Replacement of the Oil Filter" . Is there an excessive amount of metal present in the oil filter?

    20.a Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #1. Repair as necessary.

    20.b No; replace the fuel injector in cylinder #1. Refer to section "Removal of the Fuel Injector Cup - Two-Filter System" . Perform verification in fault code chart header to verify repairs.

165.2 SPN 1323/FMI 31 - GHG17

Idle Smoothness Control/Cylinder #1 Misfire At Idle

SPN 1323/FMI 31	
Description	This Fault Code Sets when the Motor Control Module (MCM) Detects That Cylinder #1 Has Low rpm Speed with the Injector Commanded to Max Fueling for a count of two with all conditions met.
Monitored Parameter	Engine rpm
Typical Enabling Conditions	
Monitor Sequence	None
Execution Frequency	Once per drive cycle when enabling conditions are met.
Typical Duration	Five Seconds
Dash Lamps	CEL, MIL
Engine Reaction	25% Derate
Verification	Ensure the ignition has been off for a minimum of five minutes prior to the last ignition on. Meet all enabling conditions. Let the Engine Idle for five minutes. (Fault code status will become pending with one detected failure and active with the second).

Note : DO NOT use the Idle Speed Balance (ISB) test in DiagnosticLink® for ANY misfire at idle testing.

Check as follows:

Possible causes:

- Valve Lash Out Of Adjustment
- Valve Train Damage/Failure
- Bent Valve
- Valve Face/Seat Damage
- Stuck Jake Brake
- Bearing Failure
- Bent Connecting Rod
- Cylinder Liner Damage
- Piston Ring Damage
- Failed Cylinder Head Gasket
- Failed Fuel Injector

⚠WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠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.

CAUTION
ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

WARNING

BODILY INJURY

To avoid injury from a falling component, ensure an appropriately rated lifting device is used. Moving the component without an appropriately rated lifting device could result in the component falling, which could cause serious personal injury and component damage. Never stand beneath a suspended load.

WARNING

PERSONAL INJURY

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

1. Does the engine exhibit knocking noise while running?
   1.a Yes; Go to step 2.
   1.b No; Go to step 4.
2. Remove the Exhaust Gas Recirculation (EGR) hot pipe and check for raw fuel. Was raw fuel found?
   2.a Yes; Refer to section "Test-E - Two-Filter Fuel System" .
   2.b No; reinstall EGR hot pipe and Go to step 3.
3. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was the fuel system found to be aerated?
   3.a Yes; make necessary repairs. Verify repairs.
   3.b No; Refer to section "Different Engine Noise" .

Note : Faults are listed in diagnostic priority from top to bottom.

4. Are there any of the following faults present?

- SPN 651/FMI any
- SPN 3659/FMI any
- SPN 7384/FMI any
- SPN 2797/FMI any
- SPN 4257/FMI any
- SPN 1322/FMI any
- SPN 5357/FMI any
- SPN 190/FMI 0, 14, or 15
- SPN 636/FMI 2, 8, 10, or 11
- SPN 723/FMI 8, 10, or 11
- SPN 157/FMI any
- SPN 164/FMI any
- SPN 520268/FMI any

4.a Yes; repair fault with the highest priority listed above.

4.b No; Go to step 5.

5. 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 3000 rpm?

   5.a Yes; Go to step 6.

   5.b No; Go to step 7.

6. View past warranty and repair history to determine if both camshafts were replaced after the engine overspeed. Were the camshafts replaced?

   6.a Yes; Go to step 7.

   6.b No; replace both camshafts. Inspect the engine brake rocker arms for loose actuator piston retainers and loose or missing return springs. Verify repairs.

7. Connect a battery charger to the vehicle to maintain sufficient battery voltage while cranking.

8. Use DiagnosticLink to perform the Relative Cylinder Compression test. Refer to section "Relative Cylinder Compression Test" . Is the relative compression reading for cylinder #1 within 10% of the highest cylinder reading?

   8.a Yes; Go to step 18.

   8.b No; Go to step 9.

9. Turn the engine OFF.

10. Disconnect the battery charger.

11. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

12. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers or camshafts damaged?

    12.a Yes; replace the damaged components. Perform verification in fault code chart header to verify repairs.

    12.b No; Go to step 13.

13. Check the valve lash clearance for cylinder #1. Refer to section "Setting the Valve and Engine Brake Lash" . Is the valve lash within specification?

    13.a Yes; Go to step 14.

    13.b No; adjust the valve lash to the correct clearance. Perform verification in fault code chart header to verify repairs.

14. Check the engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Is the engine brake lash within specification?

    14.a Yes; Go to step 16.

    14.b No; Go to step 15.

15. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?

    15.a Yes; replace the engine brake rocker arm. Refer to section "Removal of the Camshafts" and Refer to section "Removal of the Exhaust Rocker Shaft Assembly" . Perform verification in fault code chart header to verify repairs.

    15.b No; set the correct engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Perform verification in fault code chart header to verify repairs.

16. Connect the battery charger to maintain proper cranking speed.

17. Perform the Mechanical Cylinder Compression test. Refer to section "Mechanical Cylinder Compression Test" . Is the mechanical cylinder compression reading for cylinder #1 344 kPa (50 psi) lower than any of the other cylinders?

    17.a Yes; disconnect the battery charger and remove the cylinder head. Refer to section "Symptom Diagnostics - Low Engine Compression" to check for the cause of the loss of compression.

    17.b No; Go to step 18.

18. Remove and inspect the engine oil filter. Refer to section "Replacement of the Oil Filter" . Is there an excessive amount of metal present in the oil filter?

    18.a Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #1. Repair as necessary.

    18.b No; replace the fuel injector in cylinder #1. Refer to section "Removal of the Fuel Injector - Two-Filter System" . Perform verification in fault code chart header to verify repairs.

SPN 1324 (MCM) (GHG17)

166.1 SPN 1324/FMI 10 - GHG17

SPN 1324/FMI 10	
Description	This Fault Code Sets Once the Motor Control Module (MCM) Detects a Misfire on Cylinder #2 with All Conditions Met
Monitored Parameter	Engine rpm
Typical Enabling Conditions	
Monitor Sequence	Always When Enabling Conditions Are Met
Execution Frequency	Always
Typical Duration	1000 Revolutions
Dash Lamps	MIL
Engine Reaction	None
Verification	Ensure the Ignition has been Off for a Minimum of Five Minutes Prior to the Last Ignition On. Meet All Enabling Conditions During a 15 Minute Road Test

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

Note : DO NOT use the Idle Speed Balance (ISB) test in DiagnosticLink® for ANY misfire testing.

Check as follows:

Possible causes:

- Valve Lash Out Of Adjustment
- Valve Train Damage/Failure
- Bent Valve
- Valve Face/Seat Damage
- Stuck Jake Brake
- Bearing Failure

- Bent Connecting Rod
- Cylinder Liner Damage
- Piston Ring Damage
- Failed Cylinder Head Gasket
- Failed Fuel Injector

⚠WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠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.

CAUTION

ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

⚠WARNING

BODILY INJURY

To avoid injury from a falling component, ensure an appropriately rated lifting device is used. Moving the component without an appropriately rated lifting device could result in the component falling, which could cause serious personal injury and component damage. Never stand beneath a suspended load.

⚠WARNING

PERSONAL INJURY

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

1. Check and record fuel level using parameter AS044 Fuel Tank Level. Is the fuel level under ¼ tank (25%)?
   - 1.a Yes; add fuel and road test vehicle. If code does not become active during road test, release the truck. If code becomes active during the road test with over ¼ tank of fuel, Go to step 3.
   - 1.b No; Go to step 2.
2. Check fuel tank level in the extended fault code data. Was fuel tank level over ¼ tank (25%) when the code logged?
   - 2.a Yes; Go to step 3.
   - 2.b No; fuel sloshing in the tank may have caused aerated fuel and set this code. Road test vehicle. If code does not come active during road test, release the truck. If code does come active, Go to step 3.

3. Does the engine exhibit knocking noise while running?
   3.a Yes; Go to step 4.
   3.b No; Go to step 6.
4. Remove the Exhaust Gas Recirculation (EGR) hot pipe and check for raw fuel. Was raw fuel found?
   4.a Yes; Refer to section "Test-E - Two-Filter Fuel System" .
   4.b No; reinstall EGR hot pipe and Go to step 5.
5. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was the fuel system found to be aerated?
   5.a Yes; make necessary repairs. Verify repairs.
   5.b No; Refer to section "Different Engine Noise" .

Note : Faults are listed in diagnostic priority from top to bottom.

6. Are there any of the following faults present?

- SPN 652/FMI any
- SPN 3660/FMI any
- SPN 7385/FMI any
- SPN 2797/FMI any
- SPN 4257/FMI any
- SPN 1322/FMI any
- SPN 5357/FMI any
- SPN 190/FMI 0, 14, or 15
- SPN 636/FMI 2, 8, 10, or 11
- SPN 723/FMI 8, 10, or 11
- SPN 157/FMI any
- SPN 164/FMI any
- SPN 520268/FMI any

   6.a Yes; repair fault with the highest priority listed above.
   6.b No; Go to step 7.
7. 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?

Peak Engine RPM	
12 Lobe Intake Camshaft	2800 rpm
6 Lobe Intake Camshaft	3000 rpm

   7.a Yes; Go to step 8.
   7.b No; Go to step 9.
8. View past warranty and repair history to determine if both camshafts were replaced after the engine overspeed. Were the camshafts replaced?
   8.a Yes; Go to step 9.
   8.b No; replace both camshafts. Inspect the engine brake rocker arms for loose actuator piston retainers and loose or missing return springs. Verify repairs.
9. Connect a battery charger to the vehicle to maintain sufficient battery voltage while cranking.
10. Use DiagnosticLink to perform the Relative Cylinder Compression test. Refer to section "Relative Cylinder Compression Test" . Is the relative compression reading for cylinder #2 within 10% of the highest cylinder reading?

10.a Yes; Go to step 20.

10.b No; Go to step 11.

11. Turn the engine OFF.
12. Disconnect the battery charger.
13. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
14. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers or camshafts damaged?

    14.a Yes; replace the damaged components. Perform verification in fault code chart header to verify repairs.

    14.b No; Go to step 15.

15. Check the valve lash clearance for cylinder #2. Refer to section "Setting the Valve and Engine Brake Lash" . Is the valve lash within specification?

    15.a Yes; Go to step 16.

    15.b No; adjust the valve lash to the correct clearance. Perform verification in fault code chart header to verify repairs.

16. Check the engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Is the engine brake lash within specification?

    16.a Yes; Go to step 18.

    16.b No; Go to step 17.

17. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?

    17.a Yes; replace the engine brake rocker arm. Refer to section "Removal of the Camshafts" and Refer to section "Removal of the Exhaust Rocker Shaft Assembly" . Perform verification in fault code chart header to verify repairs.

    17.b No; set the correct engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Perform verification in fault code chart header to verify repairs.

18. Connect the battery charger to maintain proper cranking speed.
19. Perform the Mechanical Cylinder Compression test. Refer to section "Mechanical Cylinder Compression Test" . Is the mechanical cylinder compression reading for cylinder #2 344 kPa (50 psi) lower than any of the other cylinders?

    19.a Yes; disconnect the battery charger and remove the cylinder head. Refer to section "Symptom Diagnostics - Low Engine Compression" to check for the cause of the loss of compression.

    19.b No; Go to step 20.

20. Remove and inspect the engine oil filter. Refer to section "Replacement of the Oil Filter" . Is there an excessive amount of metal present in the oil filter?

    20.a Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #2. Repair as necessary.

    20.b No; replace the fuel injector in cylinder #2. Refer to section "Removal of the Fuel Injector - Two-Filter System" . Perform verification in fault code chart header to verify repairs.

166.2 SPN 1324/FMI 31 - GHG17

Idle Smoothness Control/Cylinder #2 Misfire At Idle

SPN 1324/FMI 31	
Description	This Fault Code Sets when the Motor Control Module (MCM) Detects That Cylinder #2 Has Low rpm Speed with the Injector Commanded to Max Fueling for a count of two with all conditions met.
Monitored Parameter	Engine rpm
Typical Enabling Conditions	
Monitor Sequence	None
Execution Frequency	Once per drive cycle when enabling conditions are met.
Typical Duration	Five Seconds
Dash Lamps	CEL, MIL
Engine Reaction	25% Derate
Verification	Ensure the ignition has been off for a minimum of five minutes prior to the last ignition on. Meet all enabling conditions. Let the Engine Idle for five minutes. (Fault code status will become pending with one detected failure and active with the second).

Note : DO NOT use the Idle Speed Balance (ISB) test in DiagnosticLink® for ANY misfire at idle testing.

Check as follows:

Possible causes:

- Valve Lash Out Of Adjustment
- Valve Train Damage/Failure
- Bent Valve
- Valve Face/Seat Damage
- Stuck Jake Brake
- Bearing Failure
- Bent Connecting Rod
- Cylinder Liner Damage
- Piston Ring Damage
- Failed Cylinder Head Gasket
- Failed Fuel Injector

⚠WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠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.

CAUTION
ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

WARNING

BODILY INJURY

To avoid injury from a falling component, ensure an appropriately rated lifting device is used. Moving the component without an appropriately rated lifting device could result in the component falling, which could cause serious personal injury and component damage. Never stand beneath a suspended load.

WARNING

PERSONAL INJURY

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

1. Does the engine exhibit knocking noise while running?
   1.a Yes; Go to step 2.
   1.b No; Go to step 4.
2. Remove the Exhaust Gas Recirculation (EGR) hot pipe and check for raw fuel. Was raw fuel found?
   2.a Yes; Refer to section "Test-E - Two-Filter Fuel System" .
   2.b No; reinstall EGR hot pipe and Go to step 3.
3. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was the fuel system found to be aerated?
   3.a Yes; make necessary repairs. Verify repairs.
   3.b No; Refer to section "Different Engine Noise" .

Note : Faults are listed in diagnostic priority from top to bottom.

4. Are there any of the following faults present?

- SPN 652/FMI any
- SPN 3660/FMI any
- SPN 7385/FMI any
- SPN 2797/FMI any
- SPN 4257/FMI any
- SPN 1322/FMI any
- SPN 5357/FMI any
- SPN 190/FMI 0, 14, or 15
- SPN 636/FMI 2, 8, 10, or 11
- SPN 723/FMI 8, 10, or 11
- SPN 157/FMI any
- SPN 164/FMI any
- SPN 520268/FMI any

4.a Yes; repair fault with the highest priority listed above.

4.b No; Go to step 5.

5. 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 3000 rpm?

   5.a Yes; Go to step 6.

   5.b No; Go to step 7.

6. View past warranty and repair history to determine if both camshafts were replaced after the engine overspeed. Were the camshafts replaced?

   6.a Yes; Go to step 7.

   6.b No; replace both camshafts. Inspect the engine brake rocker arms for loose actuator piston retainers and loose or missing return springs. Verify repairs.

7. Connect a battery charger to the vehicle to maintain sufficient battery voltage while cranking.

8. Use DiagnosticLink to perform the Relative Cylinder Compression test. Refer to section "Relative Cylinder Compression Test" . Is the relative compression reading for cylinder #2 within 10% of the highest cylinder reading?

   8.a Yes; Go to step 18.

   8.b No; Go to step 9.

9. Turn the engine OFF.

10. Disconnect the battery charger.

11. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

12. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers or camshafts damaged?

    12.a Yes; replace the damaged components. Perform verification in fault code chart header to verify repairs.

    12.b No; Go to step 13.

13. Check the valve lash clearance for cylinder #2. Refer to section "Setting the Valve and Engine Brake Lash" . Is the valve lash within specification?

    13.a Yes; Go to step 14.

    13.b No; adjust the valve lash to the correct clearance. Perform verification in fault code chart header to verify repairs.

14. Check the engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Is the engine brake lash within specification?

    14.a Yes; Go to step 16.

    14.b No; Go to step 15.

15. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?

    15.a Yes; replace the engine brake rocker arm. Refer to section "Removal of the Camshafts" and Refer to section "Removal of the Exhaust Rocker Shaft Assembly" . Perform verification in fault code chart header to verify repairs.

    15.b No; set the correct engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Perform verification in fault code chart header to verify repairs.

16. Connect the battery charger to maintain proper cranking speed.

17. Perform the Mechanical Cylinder Compression test. Refer to section "Mechanical Cylinder Compression Test" . Is the mechanical cylinder compression reading for cylinder #2 344 kPa (50 psi) lower than any of the other cylinders?

    17.a Yes; disconnect the battery charger and remove the cylinder head. Refer to section "Symptom Diagnostics - Low Engine Compression" to check for the cause of the loss of compression.

    17.b No; Go to step 18.

18. Remove and inspect the engine oil filter. Refer to section "Replacement of the Oil Filter" . Is there an excessive amount of metal present in the oil filter?

    18.a Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #2. Repair as necessary.

    18.b No; replace the fuel injector in cylinder #2. Refer to section "Removal of the Fuel Injector - Two-Filter System" . Perform verification in fault code chart header to verify repairs.

SPN 1325 (MCM) (GHG17)

167.1 SPN 1325/FMI 10 - GHG17

SPN 1325/FMI 10	
Description	This Fault Code Sets Once the Motor Control Module (MCM) Detects a Misfire on Cylinder #3 with All Conditions Met
Monitored Parameter	Engine rpm
Typical Enabling Conditions	
Monitor Sequence	Always When Enabling Conditions Are Met
Execution Frequency	Always
Typical Duration	1000 Revolutions
Dash Lamps	MIL
Engine Reaction	None
Verification	Ensure the Ignition Has Been Off for a Minimum of Five Minutes Prior to the Last Ignition On. Meet All Enabling Conditions During a 15 Minute Road Test

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

Note : DO NOT use the Idle Speed Balance (ISB) test in DiagnosticLink® for ANY misfire testing.

Check as follows:

Possible causes:

- Valve Lash Out Of Adjustment
- Valve Train Damage/Failure
- Bent Valve
- Valve Face/Seat Damage
- Stuck Jake Brake
- Bearing Failure

- Bent Connecting Rod
- Cylinder Liner Damage
- Piston Ring Damage
- Failed Cylinder Head Gasket
- Failed Fuel Injector

1. Check and record fuel level using parameter AS044 Fuel Tank Level. Is the fuel level under ¼ tank (25%)?
   1.a Yes; add fuel and road test vehicle. If code does not become active during road test, release the truck. If code becomes active during the road test with over ¼ tank of fuel, Go to step 3.
   1.b No; Go to step 2.
2. Check fuel tank level in the extended fault code data. Was fuel tank level over ¼ tank (25%) when the code logged?
   2.a Yes; Go to step 3.
   2.b fuel sloshing in the tank may have caused aerated fuel and set this code. Road test vehicle. If code does not come active during road test, release the truck. If code does come active, Go to step 3.
3. Does the engine exhibit knocking noise while running?
   3.a Yes; Go to step 4.
   3.b No; Go to step 6.
4. Remove the Exhaust Gas Recirculation (EGR) hot pipe and check for raw fuel. Was raw fuel found?
   4.a Yes; Refer to section "Test-E - Two-Filter Fuel System" .
   4.b No; reinstall EGR hot pipe and Go to step 5.
5. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was the fuel system found to be aerated?
   5.a Yes; make necessary repairs. Verify repairs.
   5.b No; Refer to section "Different Engine Noise" .

Note : Faults are listed in diagnostic priority from top to bottom.

6. Are there any of the following faults present?

- SPN 653/FMI any
- SPN 3661/FMI any
- SPN 7386/FMI any
- SPN 2797/FMI any
- SPN 4257/FMI any
- SPN 1322/FMI any
- SPN 5357/FMI any
- SPN 190/FMI 0, 14, or 15
- SPN 636/FMI 2, 8, 10, or 11
- SPN 723/FMI 8, 10, or 11
- SPN 157/FMI any
- SPN 164/FMI any
- SPN 520268/FMI any

   6.a Yes; repair fault with the highest priority listed above.
   6.b No; Go to step 7.

7. 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?

Peak Engine RPM	
12 Lobe Intake Camshaft	2800 rpm
6 Lobe Intake Camshaft	3000 rpm

7.a Yes; Go to step 8.

7.b No; Go to step 9.

8. View past warranty and repair history to determine if both camshafts were replaced after the engine overspeed. Were the camshafts replaced?

8.a Yes; Go to step 9.

8.b No; replace both camshafts. Inspect the engine brake rocker arms for loose actuator piston retainers and loose or missing return springs. Verify repairs.

9. Connect a battery charger to the vehicle to maintain sufficient battery voltage while cranking.

10. Use DiagnosticLink to perform the Relative Cylinder Compression test. Refer to section "Relative Cylinder Compression Test" . Is the relative compression reading for cylinder #3 within 10% of the highest cylinder reading?

10.a Yes; Go to step 20.

10.b No; Go to step 11.

11. Turn the engine OFF.

12. Disconnect the battery charger.

13. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

14. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers or camshafts damaged?

14.a Yes; replace the damaged components. Perform verification in fault code chart header to verify repairs.

14.b No; Go to step 15.

15. Check the valve lash clearance for cylinder #3. Refer to section "Setting the Valve and Engine Brake Lash" . Is the valve lash within specification?

15.a Yes; Go to step 16.

15.b No; adjust the valve lash to the correct clearance. Perform verification in fault code chart header to verify repairs.

16. Check the engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Is the engine brake lash within specification?

16.a Yes; Go to step 18.

16.b No; Go to step 17.

17. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?

17.a Yes; replace the engine brake rocker arm. Refer to section "Removal of the Camshafts" and Refer to section "Removal of the Exhaust Rocker Shaft Assembly" . Perform verification in fault code chart header to verify repairs.

17.b No; set the correct engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Perform verification in fault code chart header to verify repairs.

18. Connect the battery charger to maintain proper cranking speed.

19. Perform the Mechanical Cylinder Compression test. Refer to section "Mechanical Cylinder Compression Test" . Is the mechanical cylinder compression reading for cylinder #3 344 kPa (50 psi) lower than any of the other cylinders?

19.a Yes; disconnect the battery charger and remove the cylinder head. Refer to section "Symptom Diagnostics - Low Engine Compression" to check for the cause of the loss of compression.

19.b No; Go to step 20.

20. Remove and inspect the engine oil filter. Refer to section "Replacement of the Oil Filter" . Is there an excessive amount of metal present in the oil filter?

20.a Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #3. Repair as necessary.

20.b No; replace the fuel injector in cylinder #3. Refer to section "Removal of the Fuel Injector - Two-Filter System" . Perform verification in fault code chart header to verify repairs.

167.2 SPN 1325/FMI 31 - GHG17

Idle Smoothness Control/Cylinder #3 Misfire At Idle

SPN 1325/FMI 31	
Description	This Fault Code Sets when the Motor Control Module (MCM) Detects That Cylinder #3 Has Low rpm Speed with the Injector Commanded to Max Fueling for a count of two with all conditions met.
Monitored Parameter	Engine rpm
Typical Enabling Conditions	
Monitor Sequence	None
Execution Frequency	Once per drive cycle when enabling conditions are met.
Typical Duration	Five Seconds
Dash Lamps	CEL, MIL
Engine Reaction	25% Derate
Verification	Ensure the ignition has been off for a minimum of five minutes prior to the last ignition on. Meet all enabling conditions. Let the Engine Idle for five minutes. (Fault code status will become pending with one detected failure and active with the second).

Note : DO NOT use the Idle Speed Balance (ISB) test in DiagnosticLink® for ANY misfire at idle testing.

Check as follows:

Possible causes:

- Valve Lash Out Of Adjustment
- Valve Train Damage/Failure
- Bent Valve
- Valve Face/Seat Damage
- Stuck Jake Brake
- Bearing Failure
- Bent Connecting Rod
- Cylinder Liner Damage
- Piston Ring Damage
- Failed Cylinder Head Gasket
- Failed Fuel Injector

⚠WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠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.

CAUTION
ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

WARNING

BODILY INJURY

To avoid injury from a falling component, ensure an appropriately rated lifting device is used. Moving the component without an appropriately rated lifting device could result in the component falling, which could cause serious personal injury and component damage. Never stand beneath a suspended load.

WARNING

PERSONAL INJURY

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

1. Does the engine exhibit knocking noise while running?
   1.a Yes; Go to step 2.
   1.b No; Go to step 4.
2. Remove the Exhaust Gas Recirculation (EGR) hot pipe and check for raw fuel. Was raw fuel found?
   2.a Yes; Refer to section "Test-E - Two-Filter Fuel System" .
   2.b No; reinstall EGR hot pipe and Go to step 3.
3. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was the fuel system found to be aerated?
   3.a Yes; make necessary repairs. Verify repairs.
   3.b No; Refer to section "Different Engine Noise" .

Note : Faults are listed in diagnostic priority from top to bottom.

4. Are there any of the following faults present?

- SPN 653/FMI any
- SPN 3661/FMI any
- SPN 7386/FMI any
- SPN 2797/FMI any
- SPN 4257/FMI any
- SPN 1322/FMI any
- SPN 5357/FMI any
- SPN 190/FMI 0, 14, or 15
- SPN 636/FMI 2, 8, 10, or 11
- SPN 723/FMI 8, 10, or 11
- SPN 157/FMI any
- SPN 164/FMI any
- SPN 520268/FMI any

4.a Yes; repair fault with the highest priority listed above.

4.b No; Go to step 5.

5. 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 3000 rpm?

   5.a Yes; Go to step 6.

   5.b No; Go to step 7.

6. View past warranty and repair history to determine if both camshafts were replaced after the engine overspeed. Were the camshafts replaced?

   6.a Yes; Go to step 7.

   6.b No; replace both camshafts. Inspect the engine brake rocker arms for loose actuator piston retainers and loose or missing return springs. Verify repairs.

7. Connect a battery charger to the vehicle to maintain sufficient battery voltage while cranking.

8. Use DiagnosticLink to perform the Relative Cylinder Compression test. Refer to section "Relative Cylinder Compression Test" . Is the relative compression reading for cylinder #3 within 10% of the highest cylinder reading?

   8.a Yes; Go to step 18.

   8.b No; Go to step 9.

9. Turn the engine OFF.

10. Disconnect the battery charger.

11. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

12. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers or camshafts damaged?

    12.a Yes; replace the damaged components. Perform verification in fault code chart header to verify repairs.

    12.b No; Go to step 13.

13. Check the valve lash clearance for cylinder #3. Refer to section "Setting the Valve and Engine Brake Lash" . Is the valve lash within specification?

    13.a Yes; Go to step 14.

    13.b No; adjust the valve lash to the correct clearance. Perform verification in fault code chart header to verify repairs.

14. Check the engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Is the engine brake lash within specification?

    14.a Yes; Go to step 16.

    14.b No; Go to step 15.

15. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?

    15.a Yes; replace the engine brake rocker arm. Refer to section "Removal of the Camshafts" and Refer to section "Removal of the Exhaust Rocker Shaft Assembly" . Perform verification in fault code chart header to verify repairs.

    15.b No; set the correct engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Perform verification in fault code chart header to verify repairs.

16. Connect the battery charger to maintain proper cranking speed.

17. Perform the Mechanical Cylinder Compression test. Refer to section "Mechanical Cylinder Compression Test" . Is the mechanical cylinder compression reading for cylinder #3 344 kPa (50 psi) lower than any of the other cylinders?

    17.a Yes; disconnect the battery charger and remove the cylinder head. Refer to section "Symptom Diagnostics - Low Engine Compression" to check for the cause of the loss of compression.

    17.b No; Go to step 18.

18. Remove and inspect the engine oil filter. Refer to section "Replacement of the Oil Filter" . Is there an excessive amount of metal present in the oil filter?

    18.a Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #3. Repair as necessary.

    18.b No; replace the fuel injector in cylinder #3. Refer to section "Removal of the Fuel Injector - Two-Filter System" . Perform verification in fault code chart header to verify repairs.

SPN 1326 (MCM) (GHG17)

168.1 SPN 1326/FMI 10 - GHG17

SPN 1326/FMI 10	
Description	This Fault Code Sets Once the Motor Control Module (MCM) Detects a Misfire on Cylinder #4 with All Conditions Met
Monitored Parameter	Engine rpm
Typical Enabling Conditions	
Monitor Sequence	Always When Enabling Conditions Are Met
Execution Frequency	Always
Typical Duration	1000 Revolutions
Dash Lamps	MIL
Engine Reaction	None
Verification	Ensure the Ignition Has Been Off for a Minimum of Five Minutes Prior to the Last Ignition On. Meet All Enabling Conditions During a 15 Minute Road Test

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

Note : DO NOT use the Idle Speed Balance (ISB) test in DiagnosticLink® for ANY misfire testing.

Check as follows:

Possible causes:

- Valve Lash Out Of Adjustment
- Valve Train Damage/Failure
- Bent Valve
- Valve Face/Seat Damage
- Stuck Jake Brake
- Bearing Failure

- Bent Connecting Rod
- Cylinder Liner Damage
- Piston Ring Damage
- Failed Cylinder Head Gasket
- Failed Fuel Injector

CAUTION
ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

⚠WARNING

BODILY INJURY

To avoid injury from a falling component, ensure an appropriately rated lifting device is used. Moving the component without an appropriately rated lifting device could result in the component falling, which could cause serious personal injury and component damage. Never stand beneath a suspended load.

⚠WARNING

PERSONAL INJURY

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

1. Check and record fuel level using parameter AS044 Fuel Tank Level. Is the fuel level under ¼ tank (25%)?
   1.a Yes; add fuel and road test vehicle. If code does not become active during road test, release the truck. If code becomes active during the road test with over ¼ tank of fuel, Go to step 3.
   1.b No; Go to step 2.
2. Check fuel tank level in the extended fault code data. Was fuel tank level over ¼ tank (25%) when the code logged?
   2.a Yes; Go to step 3.
   2.b No; fuel sloshing in the tank may have caused aerated fuel and set this code. Road test vehicle. If code does not come active during road test, release the truck. If code does come active, Go to step 3.
3. Does the engine exhibit knocking noise while running?
   3.a Yes; Go to step 4.
   3.b No; Go to step 6.
4. Remove the Exhaust Gas Recirculation (EGR) hot pipe and check for raw fuel. Was raw fuel found?
   4.a Yes; Refer to section "Test-E - Two-Filter Fuel System" .
   4.b No; reinstall EGR hot pipe and Go to step 5.
5. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was the fuel system found to be aerated?
   5.a Yes; make necessary repairs. Verify repairs.
   5.b No; Refer to section "Different Engine Noise" .

Note : Faults are listed in diagnostic priority from top to bottom.

6. Are there any of the following faults present?

- SPN 654/FMI any
- SPN 3662/FMI any
- SPN 7387/FMI any
- SPN 2798/FMI any
- SPN 4258/FMI any
- SPN 1322/FMI any
- SPN 5357/FMI any
- SPN 190/FMI 0, 14, or 15
- SPN 636/FMI 2, 8, 10, or 11
- SPN 723/FMI 8, 10, or 11
- SPN 157/FMI any
- SPN 164/FMI any
- SPN 520268/FMI any

6.a Yes; repair fault with the highest priority listed above.

6.b No; Go to step 7.

7. 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?

Peak Engine RPM	
12 Lobe Intake Camshaft	2800 rpm
6 Lobe Intake Camshaft	3000 rpm

7.a Yes; Go to step 8.

7.b No; Go to step 9.

8. View past warranty and repair history to determine if both camshafts were replaced after the engine overspeed. Were the camshafts replaced?

8.a Yes; Go to step 9.

8.b No; replace both camshafts. Inspect the engine brake rocker arms for loose actuator piston retainers and loose or missing return springs. Verify repairs.

9. Connect a battery charger to the vehicle to maintain sufficient battery voltage while cranking.

10. Use DiagnosticLink to perform the Relative Cylinder Compression test. Refer to section "Relative Cylinder Compression Test" . Is the relative compression reading for cylinder #4 within 10% of the highest cylinder reading?

10.a Yes; Go to step 20.

10.b No; Go to step 11.

11. Turn the engine OFF.

12. Disconnect the battery charger.

13. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

14. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers or camshafts damaged?

14.a Yes; replace the damaged components. Perform verification in fault code chart header to verify repairs.

14.b No; Go to step 15.

15. Check the valve lash clearance for cylinder #4. Refer to section "Setting the Valve and Engine Brake Lash" . Is the valve lash within specification?

15.a Yes; Go to step 16.

15.b No; adjust the valve lash to the correct clearance. Perform verification in fault code chart header to verify repairs.

16. Check the engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Is the engine brake lash within specification?

16.a Yes; Go to step 18.

16.b No; Go to step 17.

17. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?

17.a Yes; replace the engine brake rocker arm. Refer to section "Removal of the Camshafts" and Refer to section "Removal of the Exhaust Rocker Shaft Assembly" . Perform verification in fault code chart header to verify repairs.

17.b No; set the correct engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Perform verification in fault code chart header to verify repairs.

18. Connect the battery charger to maintain proper cranking speed.

19. Perform the Mechanical Cylinder Compression test. Refer to section "Mechanical Cylinder Compression Test" . Is the mechanical cylinder compression reading for cylinder #4 344 kPa (50 psi) lower than any of the other cylinders?

19.a Yes; disconnect the battery charger and remove the cylinder head. Refer to section "Symptom Diagnostics - Low Engine Compression" to check for the cause of the loss of compression.

19.b No; Go to step 20.

20. Remove and inspect the engine oil filter. Refer to section "Replacement of the Oil Filter" . Is there an excessive amount of metal present in the oil filter?

20.a Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #4. Repair as necessary.

20.b No; replace the fuel injector in cylinder #4. Refer to section "Removal of the Fuel Injector - Two-Filter System" . Perform verification in fault code chart header to verify repairs.

168.2 SPN 1326/FMI 31 - GHG17

Idle Smoothness Control/Cylinder #4 Misfire At Idle

SPN 1326/FMI 31	
Description	This Fault Code Sets when the Motor Control Module (MCM) Detects That Cylinder #4 Has Low rpm Speed with the Injector Commanded to Max Fueling for a count of two with all conditions met.
Monitored Parameter	Engine rpm
Typical Enabling Conditions	
Monitor Sequence	None
Execution Frequency	Once per drive cycle when enabling conditions are met.
Typical Duration	Five Seconds
Dash Lamps	CEL, MIL
Engine Reaction	25% Derate
Verification	Ensure the ignition has been off for a minimum of five minutes prior to the last ignition on. Meet all enabling conditions. Let the Engine Idle for five minutes. (Fault code status will become pending with one detected failure and active with the second).

Note : DO NOT use the Idle Speed Balance (ISB) test in DiagnosticLink® for ANY misfire at idle testing.

Check as follows:

Possible causes:

- Valve Lash Out Of Adjustment
- Valve Train Damage/Failure
- Bent Valve
- Valve Face/Seat Damage
- Stuck Jake Brake
- Bearing Failure
- Bent Connecting Rod
- Cylinder Liner Damage
- Piston Ring Damage
- Failed Cylinder Head Gasket
- Failed Fuel Injector

⚠WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠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.

CAUTION
ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

⚠WARNING

BODILY INJURY

To avoid injury from a falling component, ensure an appropriately rated lifting device is used. Moving the component without an appropriately rated lifting device could result in the component falling, which could cause serious personal injury and component damage. Never stand beneath a suspended load.

⚠WARNING

PERSONAL INJURY

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

1. Does the engine exhibit knocking noise while running?
   1.a Yes; Go to step 2.
   1.b No; Go to step 4.
2. Remove the Exhaust Gas Recirculation (EGR) hot pipe and check for raw fuel. Was raw fuel found?
   2.a Yes; Refer to section "Test-E - Two-Filter Fuel System" .
   2.b No; reinstall EGR hot pipe and Go to step 3.
3. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was the fuel system found to be aerated?
   3.a Yes; make necessary repairs. Verify repairs.
   3.b No; Refer to section "Different Engine Noise" .

Note : Faults are listed in diagnostic priority from top to bottom.

4. Are there any of the following faults present?

- SPN 654/FMI any
- SPN 3662/FMI any
- SPN 7387/FMI any
- SPN 2798/FMI any
- SPN 4258/FMI any
- SPN 1322/FMI any
- SPN 5357/FMI any
- SPN 190/FMI 0, 14, or 15
- SPN 636/FMI 2, 8, 10, or 11
- SPN 723/FMI 8, 10, or 11
- SPN 157/FMI any
- SPN 164/FMI any
- SPN 520268/FMI any

4.a Yes; repair fault with the highest priority listed above.

4.b No; Go to step 5.

5. 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 3000 rpm?

   5.a Yes; Go to step 6.

   5.b No; Go to step 7.

6. View past warranty and repair history to determine if both camshafts were replaced after the engine overspeed. Were the camshafts replaced?

   6.a Yes; Go to step 7.

   6.b No; replace both camshafts. Inspect the engine brake rocker arms for loose actuator piston retainers and loose or missing return springs. Verify repairs.

7. Connect a battery charger to the vehicle to maintain sufficient battery voltage while cranking.

8. Use DiagnosticLink to perform the Relative Cylinder Compression test. Refer to section "Relative Cylinder Compression Test" . Is the relative compression reading for cylinder #4 within 10% of the highest cylinder reading?

   8.a Yes; Go to step 18.

   8.b No; Go to step 9.

9. Turn the engine OFF.

10. Disconnect the battery charger.

11. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

12. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers or camshafts damaged?

    12.a Yes; replace the damaged components. Perform verification in fault code chart header to verify repairs.

    12.b No; Go to step 13.

13. Check the valve lash clearance for cylinder #4. Refer to section "Setting the Valve and Engine Brake Lash" . Is the valve lash within specification?

    13.a Yes; Go to step 14.

    13.b No; adjust the valve lash to the correct clearance. Perform verification in fault code chart header to verify repairs.

14. Check the engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Is the engine brake lash within specification?

    14.a Yes; Go to step 16.

    14.b No; Go to step 15.

15. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?

    15.a Yes; replace the engine brake rocker arm. Refer to section "Removal of the Camshafts" and Refer to section "Removal of the Exhaust Rocker Shaft Assembly" . Perform verification in fault code chart header to verify repairs.

    15.b No; set the correct engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Perform verification in fault code chart header to verify repairs.

16. Connect the battery charger to maintain proper cranking speed.

17. Perform the Mechanical Cylinder Compression test. Refer to section "Mechanical Cylinder Compression Test" , Is the mechanical cylinder compression reading for cylinder #4 344 kPa (50 psi) lower than any of the other cylinders?

    17.a Yes; disconnect the battery charger and remove the cylinder head. Refer to section "Symptom Diagnostics - Low Engine Compression" to check for the cause of the loss of compression.

    17.b No; Go to step 18.

18. Remove and inspect the engine oil filter. Refer to section "Replacement of the Oil Filter" Is there an excessive amount of metal present in the oil filter?

    18.a Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #4. Repair as necessary.

    18.b No; replace the fuel injector in cylinder #4. Refer to section "Removal of the Fuel Injector - Two-Filter System" Perform verification in fault code chart header to verify repairs.

SPN 1327 (MCM) (GHG17)

169.1 SPN 1327/FMI 10 - GHG17

SPN 1327/FMI 10	
Description	This Fault Code Sets Once the Motor Control Module (MCM) Detects a Misfire on Cylinder #5 With All Conditions Met
Monitored Parameter	Engine rpm
Typical Enabling Conditions	
Monitor Sequence	Always When Enabling Conditions Are Met
Execution Frequency	Always
Typical Duration	1000 Revolutions
Dash Lamps	MIL
Engine Reaction	None
Verification	Ensure the Ignition has been Off for a Minimum of Five Minutes Prior to the Last Ignition On. Meet All Enabling Conditions During a 15 Minute Road Test

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

Note : DO NOT use the Idle Speed Balance (ISB) test in DiagnosticLink® for ANY misfire testing.

Check as follows:

Possible causes:

- Valve Lash Out Of Adjustment
- Valve Train Damage/Failure
- Bent Valve
- Valve Face/Seat Damage
- Stuck Jake Brake
- Bearing Failure

- Bent Connecting Rod
- Cylinder Liner Damage
- Piston Ring Damage
- Failed Cylinder Head Gasket
- Failed Fuel Injector

CAUTION
ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

⚠WARNING

BODILY INJURY

To avoid injury from a falling component, ensure an appropriately rated lifting device is used. Moving the component without an appropriately rated lifting device could result in the component falling, which could cause serious personal injury and component damage. Never stand beneath a suspended load.

⚠WARNING

PERSONAL INJURY

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

1. Check and record fuel level using parameter AS044 Fuel Tank Level. Is the fuel level under ¼ tank (25%)?
   1.a Yes; add fuel and road test vehicle. If code does not become active during road test, release the truck. If code becomes active during the road test with over ¼ tank of fuel, Go to step 3.
   1.b No; Go to step 2.
2. Check fuel tank level in the extended fault code data. Was fuel tank level over ¼ tank (25%) when the code logged?
   2.a Yes; Go to step 3.
   2.b No; fuel sloshing in the tank may have caused aerated fuel and set this code. Road test vehicle. If code does not come active during road test, release the truck. If code does come active, Go to step 3.
3. Does the engine exhibit knocking noise while running?
   3.a Yes; Go to step 4.
   3.b No; Go to step 6.
4. Remove the Exhaust Gas Recirculation (EGR) hot pipe and check for raw fuel. Was raw fuel found?
   4.a Yes; Refer to section "Test-E - Two-Filter Fuel System" .
   4.b No; reinstall EGR hot pipe and Go to step 5.
5. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was the fuel system found to be aerated?
   5.a Yes; make necessary repairs. Verify repairs.
   5.b No; Refer to section "Different Engine Noise" .

Note : Faults are listed in diagnostic priority from top to bottom.

6. Are there any of the following faults present?

- SPN 655/FMI any
- SPN 3663/FMI any
- SPN 7388/FMI any
- SPN 2798/FMI any
- SPN 4258/FMI any
- SPN 1322/FMI any
- SPN 5357/FMI any
- SPN 190/FMI 0, 14, or 15
- SPN 636/FMI 2, 8, 10, or 11
- SPN 723/FMI 8, 10, or 11
- SPN 157/FMI any
- SPN 164/FMI any
- SPN 520268/FMI any

6.a Yes; repair fault with the highest priority listed above.

6.b No; Go to step 7.

7. 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?

Peak Engine RPM	
12 Lobe Intake Camshaft	2800 rpm
6 Lobe Intake Camshaft	3000 rpm

7.a Yes; Go to step 8.

7.b No; Go to step 9.

8. View past warranty and repair history to determine if both camshafts were replaced after the engine overspeed. Were the camshafts replaced?

8.a Yes; Go to step 9.

8.b No; replace both camshafts. Inspect the engine brake rocker arms for loose actuator piston retainers and loose or missing return springs. Verify repairs.

9. Connect a battery charger to the vehicle to maintain sufficient battery voltage while cranking.

10. Use DiagnosticLink to perform the Relative Cylinder Compression test. Refer to section "Relative Cylinder Compression Test" . Is the relative compression reading for cylinder #5 within 10% of the highest cylinder reading?

10.a Yes; Go to step 20.

10.b No; Go to step 11.

11. Turn the engine OFF.

12. Disconnect the battery charger.

13. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

14. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers or camshafts damaged?

14.a Yes; replace the damaged components. Perform verification in fault code chart header to verify repairs.

14.b No; Go to step 15.

15. Check the valve lash clearance for cylinder #5. Refer to section "Setting the Valve and Engine Brake Lash" . Is the valve lash within specification?

15.a Yes; Go to step 16.

15.b No; adjust the valve lash to the correct clearance. Perform verification in fault code chart header to verify repairs.

16. Check the engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Is the engine brake lash within specification?

16.a Yes; Go to step 18.

16.b No; Go to step 17.

17. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?

17.a Yes; replace the engine brake rocker arm. Refer to section *"Removal of Camshaft and Rocker Shaft/Engine Brake Assembly"* . Perform verification in fault code chart header to verify repairs.

17.b No; set the correct engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Perform verification in fault code chart header to verify repairs.

18. Connect the battery charger to maintain proper cranking speed.

19. Perform the Mechanical Cylinder Compression test. Refer to section "Mechanical Cylinder Compression Test" . Is the mechanical cylinder compression reading for cylinder #5 344 kPa (50 psi) lower than any of the other cylinders?

19.a Yes; disconnect the battery charger and remove the cylinder head. Refer to section "Symptom Diagnostics - Low Engine Compression" to check for the cause of the loss of compression.

19.b No; Go to step 20.

20. Remove and inspect the engine oil filter. Refer to section "Replacement of the Oil Filter" . Is there an excessive amount of metal present in the oil filter?

20.a Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #5. Repair as necessary.

20.b No; replace the fuel injector in cylinder #5. Refer to section "Removal of the Fuel Injector - Two-Filter System" . Perform verification in fault code chart header to verify repairs.

169.2 SPN 1327/FMI 31 - GHG17

Idle Smoothness Control/Cylinder #5 Misfire At Idle

SPN 1327/FMI 31	
Description	This Fault Code Sets when the Motor Control Module (MCM) Detects That Cylinder #5 Has Low rpm Speed with the Injector Commanded to Max Fueling for a count of two with all conditions met.
Monitored Parameter	Engine rpm
Typical Enabling Conditions	
Monitor Sequence	None
Execution Frequency	Once per drive cycle when enabling conditions are met.
Typical Duration	Five Seconds
Dash Lamps	CEL, MIL
Engine Reaction	25% Derate
Verification	Ensure the ignition has been off for a minimum of five minutes prior to the last ignition on. Meet all enabling conditions. Let the Engine Idle for five minutes. (Fault code status will become pending with one detected failure and active with the second).

Note : DO NOT use the Idle Speed Balance (ISB) test in DiagnosticLink® for ANY misfire at idle testing.

Check as follows:

Possible causes:

- Valve Lash Out Of Adjustment
- Valve Train Damage/Failure
- Bent Valve
- Valve Face/Seat Damage
- Stuck Jake Brake
- Bearing Failure
- Bent Connecting Rod
- Cylinder Liner Damage
- Piston Ring Damage
- Failed Cylinder Head Gasket
- Failed Fuel Injector

⚠WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠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.

CAUTION
ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

⚠WARNING

BODILY INJURY

To avoid injury from a falling component, ensure an appropriately rated lifting device is used. Moving the component without an appropriately rated lifting device could result in the component falling, which could cause serious personal injury and component damage. Never stand beneath a suspended load.

⚠WARNING

PERSONAL INJURY

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

1. Does the engine exhibit knocking noise while running?
   1.a Yes; Go to step 2.
   1.b No; Go to step 4.
2. Remove the Exhaust Gas Recirculation (EGR) hot pipe and check for raw fuel. Was raw fuel found?
   2.a Yes; Refer to section "Test-E - Two-Filter Fuel System" .
   2.b No; reinstall EGR hot pipe and Go to step 3.
3. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was the fuel system found to be aerated?
   3.a Yes; make necessary repairs. Verify repairs.
   3.b No; Refer to section "Different Engine Noise" .

Note : Faults are listed in diagnostic priority from top to bottom.

4. Are there any of the following faults present?

- SPN 655/FMI any
- SPN 3663/FMI any
- SPN 7388/FMI any
- SPN 2798/FMI any
- SPN 4258/FMI any
- SPN 1322/FMI any
- SPN 5357/FMI any
- SPN 190/FMI 0, 14, or 15
- SPN 636/FMI 2, 8, 10, or 11
- SPN 723/FMI 8, 10, or 11
- SPN 157/FMI any
- SPN 164/FMI any
- SPN 520268/FMI any

4.a Yes; repair fault with the highest priority listed above.

4.b No; Go to step 5.

5. 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 3000 rpm?

   5.a Yes; Go to step 6.

   5.b No; Go to step 7.

6. View past warranty and repair history to determine if both camshafts were replaced after the engine overspeed. Were the camshafts replaced?

   6.a Yes; Go to step 7.

   6.b No; replace both camshafts. Inspect the engine brake rocker arms for loose actuator piston retainers and loose or missing return springs. Verify repairs.

7. Connect a battery charger to the vehicle to maintain sufficient battery voltage while cranking.

8. Use DiagnosticLink to perform the Relative Cylinder Compression test. Refer to section "Relative Cylinder Compression Test" . Is the relative compression reading for cylinder #5 within 10% of the highest cylinder reading?

   8.a Yes; Go to step 18.

   8.b No; Go to step 9.

9. Turn the engine OFF.

10. Disconnect the battery charger.

11. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

12. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers or camshafts damaged?

    12.a Yes; replace the damaged components. Perform verification in fault code chart header to verify repairs.

    12.b No; Go to step 13.

13. Check the valve lash clearance for cylinder #5. Refer to section "Setting the Valve and Engine Brake Lash" . Is the valve lash within specification?

    13.a Yes; Go to step 14.

    13.b No; adjust the valve lash to the correct clearance. Perform verification in fault code chart header to verify repairs.

14. Check the engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Is the engine brake lash within specification?

    14.a Yes; Go to step 16.

    14.b No; Go to step 15.

15. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?

    15.a Yes; replace the engine brake rocker arm. Refer to section *"Removal of Camshaft and Rocker Shaft/Engine Brake Assembly".* Perform verification in fault code chart header to verify repairs.

    15.b No; set the correct engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Perform verification in fault code chart header to verify repairs.

16. Connect the battery charger to maintain proper cranking speed.

17. Perform the Mechanical Cylinder Compression test. Refer to section "Mechanical Cylinder Compression Test" . Is the mechanical cylinder compression reading for cylinder #5 344 kPa (50 psi) lower than any of the other cylinders?

    17.a Yes; disconnect the battery charger and remove the cylinder head. Refer to section "Symptom Diagnostics - Low Engine Compression" to check for the cause of the loss of compression.

    17.b No; Go to step 18.

18. Remove and inspect the engine oil filter. Refer to section "Replacement of the Oil Filter" . Is there an excessive amount of metal present in the oil filter?

18.a Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #5. Repair as necessary.

18.b No; replace the fuel injector in cylinder #5. Refer to section "Removal of the Fuel Injector - Two-Filter System" . Perform verification in fault code chart header to verify repairs.

SPN 1328 (MCM) (GHG17)

170.1 SPN 1328/FMI 10 - GHG17

SPN 1328/FMI 10	
Description	This Fault Code Sets Once the Motor Control Module (MCM) Detects a Misfire On Cylinder #6 With All Conditions Met
Monitored Parameter	Engine rpm
Typical Enabling Conditions	
Monitor Sequence	Always When Enabling Conditions Are Met
Execution Frequency	Always
Typical Duration	1000 Revolutions
Dash Lamps	MIL
Engine Reaction	None
Verification	Ensure the Ignition Has Been Off for a Minimum of Five Minutes Prior to the Last Ignition On. Meet All Enabling Conditions During a 15 Minute Road Test

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

Note : DO NOT use the Idle Speed Balance (ISB) test in DiagnosticLink® for ANY misfire testing.

Check as follows:

Possible causes:

- Valve Lash Out Of Adjustment
- Valve Train Damage/Failure
- Bent Valve
- Valve Face/Seat Damage
- Stuck Jake Brake
- Bearing Failure

- Bent Connecting Rod
- Cylinder Liner Damage
- Piston Ring Damage
- Failed Cylinder Head Gasket
- Failed Fuel Injector

CAUTION
ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

⚠WARNING

BODILY INJURY

To avoid injury from a falling component, ensure an appropriately rated lifting device is used. Moving the component without an appropriately rated lifting device could result in the component falling, which could cause serious personal injury and component damage. Never stand beneath a suspended load.

⚠WARNING

PERSONAL INJURY

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

1. Check and record fuel level using parameter AS044 Fuel Tank Level. Is the fuel level under ¼ tank (25%)?
   1.a Yes; add fuel and road test vehicle. If code does not become active during road test, release the truck. If code becomes active during the road test with over ¼ tank of fuel, Go to step 3.
   1.b No; Go to step 2.
2. Check fuel tank level in the extended fault code data. Was fuel tank level over ¼ tank (25%) when the code logged?
   2.a Yes; Go to step 3.
   2.b No; fuel sloshing in the tank may have caused aerated fuel and set this code. Road test vehicle. If code does not come active during road test, release the truck. If code does come active, Go to step 3.
3. Does the engine exhibit knocking noise while running?
   3.a Yes; Go to step 4.
   3.b No; Go to step 6.
4. Remove the Exhaust Gas Recirculation (EGR) hot pipe and check for raw fuel. Was raw fuel found?
   4.a Yes; Refer to section "Test-E - Two-Filter Fuel System" .
   4.b No; reinstall EGR hot pipe and Go to step 5.
5. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was the fuel system found to be aerated?
   5.a Yes; make necessary repairs. Verify repairs.
   5.b No; Refer to section "Different Engine Noise" .

Note : Faults are listed in diagnostic priority from top to bottom.

6. Are there any of the following faults present?

- SPN 656/FMI any
- SPN 3664/FMI any
- SPN 7389/FMI any
- SPN 2798/FMI any
- SPN 4258/FMI any
- SPN 1322/FMI any
- SPN 5357/FMI any
- SPN 190/FMI 0, 14, or 15
- SPN 636/FMI 2, 8, 10, or 11
- SPN 723/FMI 8, 10, or 11
- SPN 157/FMI any
- SPN 164/FMI any
- SPN 520268/FMI any

6.a Yes; repair fault with the highest priority listed above.

6.b No; Go to step 7.

7. 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?

Peak Engine RPM	
12 Lobe Intake Camshaft	2800 rpm
6 Lobe Intake Camshaft	3000 rpm

7.a Yes; Go to step 8.

7.b No; Go to step 9.

8. View past warranty and repair history to determine if both camshafts were replaced after the engine overspeed. Were the camshafts replaced?

8.a Yes; Go to step 9.

8.b No; replace both camshafts. Inspect the engine brake rocker arms for loose actuator piston retainers and loose or missing return springs. Verify repairs.

9. Connect a battery charger to the vehicle to maintain sufficient battery voltage while cranking.

10. Use DiagnosticLink to perform the Relative Cylinder Compression test. Refer to section "Relative Cylinder Compression Test" . Is the relative compression reading for cylinder #6 within 10% of the highest cylinder reading?

10.a Yes; Go to step 20.

10.b No; Go to step 11.

11. Turn the engine OFF.

12. Disconnect the battery charger.

13. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

14. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers or camshafts damaged?

14.a Yes; replace the damaged components. Perform verification in fault code chart header to verify repairs.

14.b No; Go to step 15.

15. Check the valve lash clearance for cylinder #6. Refer to section "Setting the Valve and Engine Brake Lash" . Is the valve lash within specification?

15.a Yes; Go to step 16.

15.b No; adjust the valve lash to the correct clearance. Perform verification in fault code chart header to verify repairs.

16. Check the engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Is the engine brake lash within specification?

16.a Yes; Go to step 18.

16.b No; Go to step 17.

17. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?

17.a Yes; replace the engine brake rocker arm. Refer to section *"Removal of Camshaft and Rocker Shaft/Engine Brake Assembly"* . Perform verification in fault code chart header to verify repairs.

17.b No; set the correct engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Perform verification in fault code chart header to verify repairs.

18. Connect the battery charger to maintain proper cranking speed.

19. Perform the Mechanical Cylinder Compression test. Refer to section "Mechanical Cylinder Compression Test" . Is the mechanical cylinder compression reading for cylinder #6 344 kPa (50 psi) lower than any of the other cylinders?

19.a Yes; disconnect the battery charger and remove the cylinder head. Refer to section "Symptom Diagnostics - Low Engine Compression" to check for the cause of the loss of compression.

19.b No; Go to step 20.

20. Remove and inspect the engine oil filter. Refer to section "Replacement of the Oil Filter" . Is there an excessive amount of metal present in the oil filter?

20.a Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #6. Repair as necessary.

20.b No; replace the fuel injector in cylinder #6. Refer to section "Removal of the Fuel Injector - Two-Filter System" . Perform verification in fault code chart header to verify repairs.

170.2 SPN 1328/FMI 31 - GHG17

Idle Smoothness Control/Cylinder #6 Misfire At Idle

SPN 1328/FMI 31	
Description	This Fault Code Sets when the Motor Control Module (MCM) Detects That Cylinder #6 Has Low rpm Speed with the Injector Commanded to Max Fueling for a count of two with all conditions met.
Monitored Parameter	Engine rpm
Typical Enabling Conditions	
Monitor Sequence	None
Execution Frequency	Once per drive cycle when enabling conditions are met.
Typical Duration	Five Seconds
Dash Lamps	CEL, MIL
Engine Reaction	25% Derate
Verification	Ensure the ignition has been off for a minimum of five minutes prior to the last ignition on. Meet all enabling conditions. Let the Engine Idle for five minutes. (Fault code status will become pending with one detected failure and active with the second).

Note : DO NOT use the Idle Speed Balance (ISB) test in DiagnosticLink® for ANY misfire at idle testing.

Check as follows:

Possible causes:

- Valve Lash Out Of Adjustment
- Valve Train Damage/Failure
- Bent Valve
- Valve Face/Seat Damage
- Stuck Jake Brake
- Bearing Failure
- Bent Connecting Rod
- Cylinder Liner Damage
- Piston Ring Damage
- Failed Cylinder Head Gasket
- Failed Fuel Injector

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

CAUTION
ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

⚠WARNING

BODILY INJURY

To avoid injury from a falling component, ensure an appropriately rated lifting device is used. Moving the component without an appropriately rated lifting device could result in the component falling, which could cause serious personal injury and component damage. Never stand beneath a suspended load.

⚠WARNING

PERSONAL INJURY

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

1. Does the engine exhibit knocking noise while running?
   1.a Yes; Go to step 2.
   1.b No; Go to step 4.
2. Remove the Exhaust Gas Recirculation (EGR) hot pipe and check for raw fuel. Was raw fuel found?
   2.a Yes; Refer to section "Test-E - Two-Filter Fuel System" .
   2.b No; reinstall EGR hot pipe and Go to step 3.
3. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was the fuel system found to be aerated?
   3.a Yes; make necessary repairs. Verify repairs.
   3.b No; Refer to section "Different Engine Noise" .

Note : Faults are listed in diagnostic priority from top to bottom.

4. Are there any of the following faults present?

- SPN 656/FMI any
- SPN 3664/FMI any
- SPN 7389/FMI any
- SPN 2798/FMI any
- SPN 4258/FMI any
- SPN 1322/FMI any
- SPN 5357/FMI any
- SPN 190/FMI 0, 14, or 15
- SPN 636/FMI 2, 8, 10, or 11
- SPN 723/FMI 8, 10, or 11
- SPN 157/FMI any
- SPN 164/FMI any
- SPN 520268/FMI any

4.a Yes; repair fault with the highest priority listed above.

4.b No; Go to step 5.

5. 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 3000 rpm?

   5.a Yes; Go to step 6.

   5.b No; Go to step 7.

6. View past warranty and repair history to determine if both camshafts were replaced after the engine overspeed. Were the camshafts replaced?

   6.a Yes; Go to step 7.

   6.b No; replace both camshafts. Inspect the engine brake rocker arms for loose actuator piston retainers and loose or missing return springs. Verify repairs.

7. Connect a battery charger to the vehicle to maintain sufficient battery voltage while cranking.

8. Use DiagnosticLink to perform the Relative Cylinder Compression test. Refer to section "Relative Cylinder Compression Test" . Is the relative compression reading for cylinder #6 within 10% of the highest cylinder reading?

   8.a Yes; Go to step 18.

   8.b No; Go to step 9.

9. Turn the engine OFF.

10. Disconnect the battery charger.

11. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

12. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers or camshafts damaged?

    12.a Yes; replace the damaged components. Perform verification in fault code chart header to verify repairs.

    12.b No; Go to step 13.

13. Check the valve lash clearance for cylinder #6. Refer to section "Setting the Valve and Engine Brake Lash" . Is the valve lash within specification?

    13.a Yes; Go to step 14.

    13.b No; adjust the valve lash to the correct clearance. Perform verification in fault code chart header to verify repairs.

14. Check the engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Is the engine brake lash within specification?

    14.a Yes; Go to step 16.

    14.b No; Go to step 15.

15. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?

    15.a Yes; replace the engine brake rocker arm. Refer to section *"Removal of Camshaft and Rocker Shaft/Engine Brake Assembly"* . Perform verification in fault code chart header to verify repairs.

    15.b No; set the correct engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Perform verification in fault code chart header to verify repairs.

16. Connect the battery charger to maintain proper cranking speed.

17. Perform the Mechanical Cylinder Compression test. Refer to section "Mechanical Cylinder Compression Test" . Is the mechanical cylinder compression reading for cylinder #6 344 kPa (50 psi) lower than any of the other cylinders?

    17.a Yes; disconnect the battery charger and remove the cylinder head. Refer to section "Symptom Diagnostics - Low Engine Compression" to check for the cause of the loss of compression.

    17.b No; Go to step 18.

18. Remove and inspect the engine oil filter. Refer to section "Replacement of the Oil Filter" . Is there an excessive amount of metal present in the oil filter?

18.a Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #6. Repair as necessary.

18.b No; replace the fuel injector in cylinder #6. Refer to section "Removal of the Fuel Injector - Two-Filter System" . Perform verification in fault code chart header to verify repairs.

SPN 1482 (CPC) (GHG17)

171.1 SPN 1482/FMI 9 - GHG17

SPN 1482/FMI 9	
Description	J1939 Message is Missing
Monitored Parameter	J1939 Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key ON, Engine OFF

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   1.a Yes; repair the battery voltage concern. Verify repair.
   1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   2.b No; Go to step 3.

Note : This fault code may be set by two or more source inputs configured with the same address. Verify proper parameter settings.

3. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   3.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.
   3.b No; reprogram the CPC with the correct information, as necessary. To verify repair, Go to step 4.
4. Clear fault codes. Turn ignition OFF, and disconnect DiagnosticLink . Wait five minutes for all modules to power down. Verify repair.

SPN 1483 (CPC3) (GHG17)

172.1 SPN 1483/FMI 2 - GHG17

Check as follows:

1. Are any battery voltage faults present?
   - 1.a Yes; repair those faults first.
   - 1.b No; Go to step 2.
2. Is the MCM connected?
   - 2.a Yes; Go to step 3.
   - 2.b No; make connection to Motor Control Module (MCM) and verify fault is inactive. If fault is still active, Go to step 3.
3. Are any other MCM fault codes present?
   - 3.a Yes; repair those first.
   - 3.b No; reprogram MCM to latest settings.

SPN 1484 (CPC) (GHG17)

173.1 SPN 1484/FMI 9 - GHG17

SPN 1484/FMI 9	
Description	This Diagnostic Is Typically J1939 Message Was Lost
Monitored Parameter	J1939 Message
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Idle

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   1.a Yes; repair the battery voltage concern. Verify repair.
   1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   2.b No; Go to step 3.
3. Check for proper configuration of the Common Powertrain Controller (CPC) against the server information. Does the CPC have the proper configuration?
   3.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.
   3.b No; reprogram the CPC with the correct information as necessary. To verify repair, Go to step 4.
4. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink . Wait five minutes for all modules to power down. Verify repair.

173.2 SPN 1484/FMI 13 - GHG17

SPN 1484/FMI 13	
Description	J1939 Message Was Lost
Monitored Parameter	J1939 Message
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Idle

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   1.a Yes; repair the battery voltage concern. Verify repair.
   1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   2.b No; Go to step 3.
3. Check for proper configuration of the Common Powertrain Controller (CPC) against the server information. Does the CPC have the proper configuration?
   3.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.
   3.b No; reprogram the CPC with the correct information as necessary. To verify repair, Go to step 4.
4. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink . Wait five minutes for all modules to power down. Verify repair.

SPN 1590 (CPC) (GHG17)

174.1 SPN 1590/FMI 9 - GHG17

SPN 1590/FMI 9	
Description	Adaptive Cruise Control Message Not Received
Monitored Parameter	PGR043 Adaptive Cruise Control Enable
Typical Enabling Conditions	Key On, CPC Online, CAN Network Online, Adaptive Cruise Control System Equipped, 10 Seconds After the Engine Has Been Cranked
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two seconds
Dash Lamps	None
Engine Reaction	None
Verification	Engine Running For One Minute

WARNING

ENGINE EXHAUST

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

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Verify that the vehicle is equipped with an Adaptive Cruise Control system. Is the vehicle equipped with Adaptive Cruise?
   - 3.a Yes; Go to step 5.
   - 3.b No; Go to step 4.
4. Verify that the " Adaptive Cruise Control Enable" parameter PGR043 is disabled; refer to the Application and Installation (A&I) manual. Is parameter PGR043 disabled?
   - 4.a Yes; replace the Common Powertrain Controller (CPC). Verify repair.
   - 4.b No; change the "Adaptive Cruise Control Enable" parameter PGR043 to disabled. Verify repair.
5. Is the vehicle equipped with Detroit Assurance?
   - 5.a Yes; Go to step 6.
   - 5.b No; Go to step 7.
6. For vehicles equipped with Detroit Assurance, parameter PGR043 should be set to 0 (zero) disable. Is parameter PGR043 set to disable?
   - 6.a Yes; replace the CPC. Verify repair.
   - 6.b No; change parameter PGR043 to disable. Verify repair.

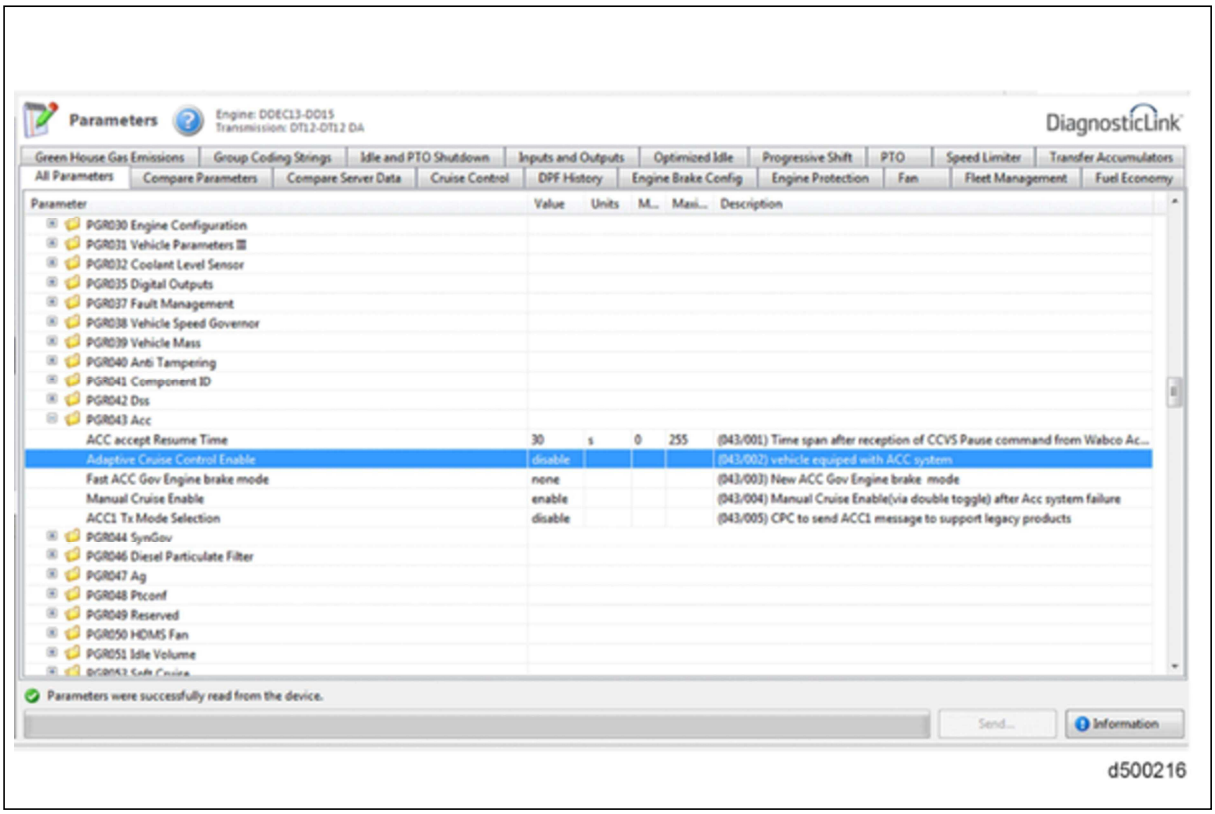


Fig 174.1, Adaptive Cruise Control

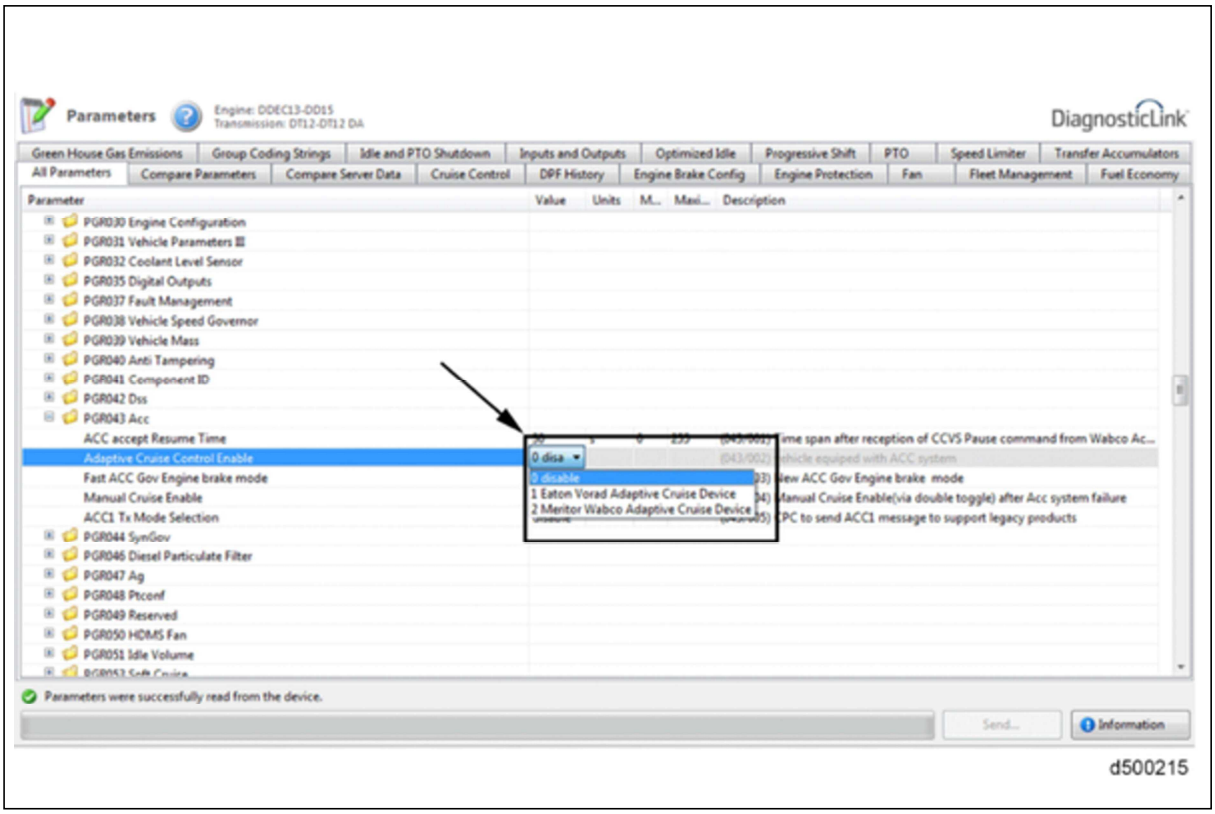


Fig 174.2, Adaptive Cruise Control Options

7. Does the display on the Adaptive Cruise Control module illuminate when the ignition is in the ON position?

   7.a Yes; refer to the Adaptive Cruise Control maintenance manual and Original Equipment Manufacturer (OEM) for further diagnostic information.

   7.b No; verify power and ground to the Adaptive Cruise Control module. Refer to Original Equipment Manufacturer (OEM) for wiring information.

174.2 SPN 1590/FMI 19 - GHG17

SPN 1590/FMI 19	
Description	Adaptive Cruise Control Message not Received or Signal Error
Monitored Parameter	Adaptive Cruise Control
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key Cycle - Ignition ON

Check as follows:

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

Note : This fault code may set if driver does not wait for gauge sweep after turning the ignition on.

1. Check for multiple codes. Is Common Powertrain Controller (CPC) SPN 168/FMI 0/14/18 (battery voltage) also present?
   - 1.a Yes; troubleshoot those faults first.
   - 1.b No; Go to step 2.
2. Verify that the vehicle is equipped with an Adaptive Cruise Control system. Is the vehicle equipped with Adaptive Cruise?
   - 2.a Yes; Go to step 4.
   - 2.b No; Go to step 3.
3. Verify that the "Adaptive Cruise Control Enable" parameter PGR043 is disabled; refer to the Application and Installation (A&I) manual. Is parameter PGR043 disabled?
   - 3.a Yes; replace the CPC. Verify repair.
   - 3.b No; change the "Adaptive Cruise Control Enable" parameter PGR043 to disabled. Verify repair.
4. Is the vehicle equipped with Detroit Assurance?
   - 4.a Yes; Go to step 5.
   - 4.b No; Go to step 6.
5. For vehicles equipped with Detroit Assurance, parameter PGR043 should be set to 0 (zero) disable. Is parameter PGR043 set to disable?
   - 5.a Yes; replace the CPC. Verify repair.
   - 5.b No; change parameter PGR043 to disable. Verify repair.

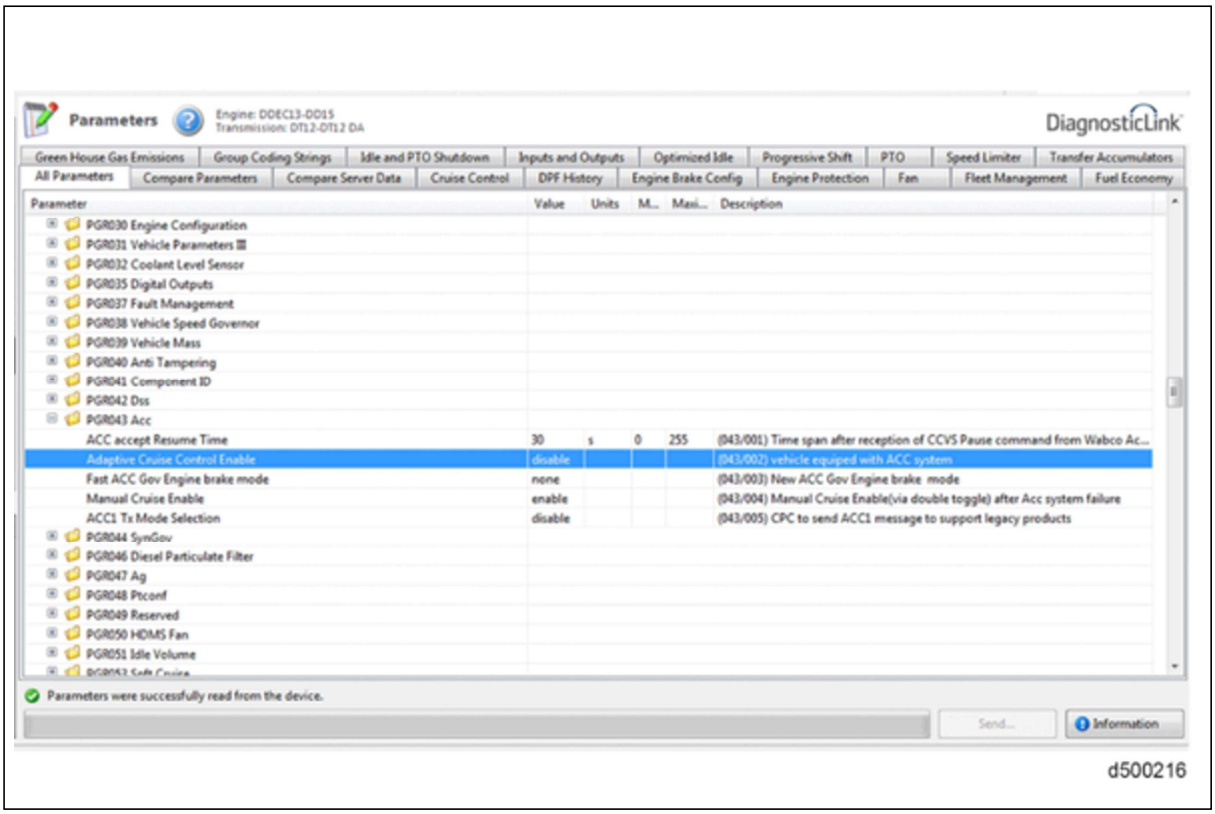


Fig 174.3, Adaptive Cruise Control

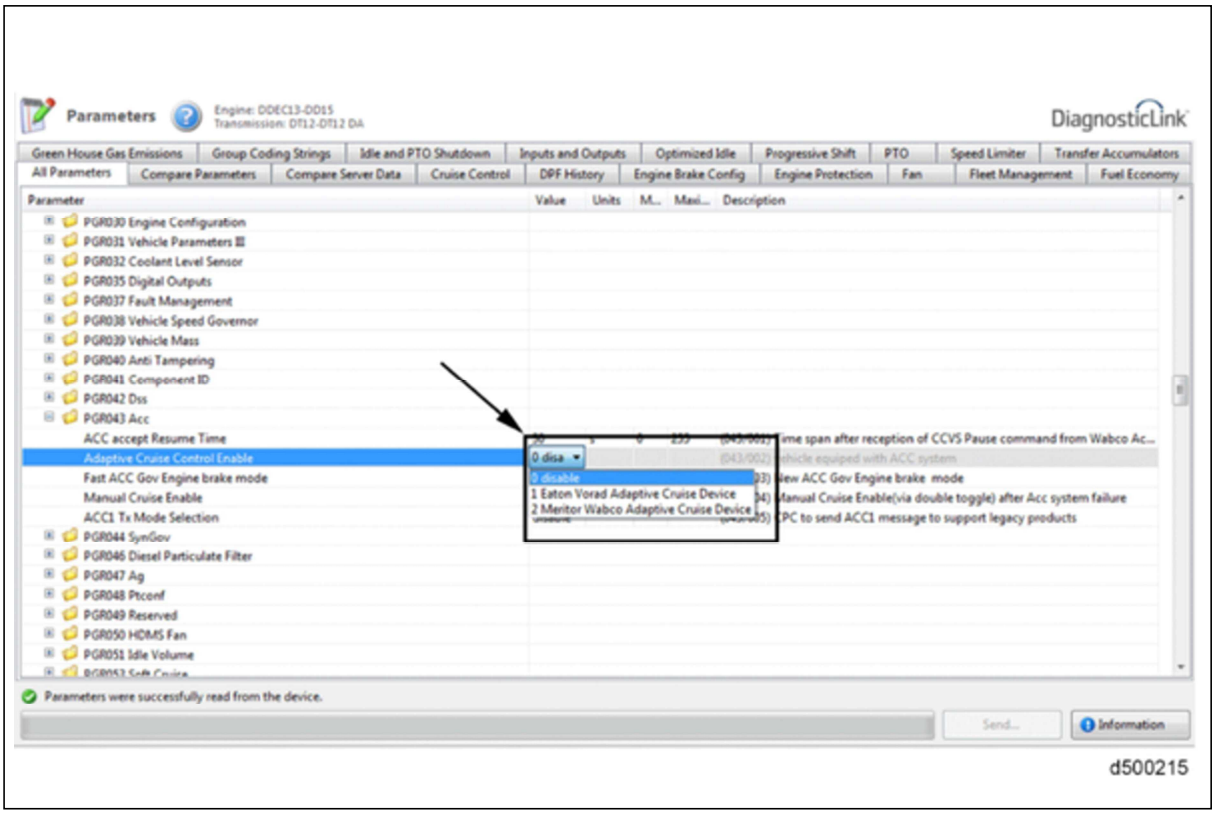


Fig 174.4, Adaptive Cruise Control Options

6. Does the display on the Adaptive Cruise Control module illuminate when the ignition is in the ON position?

   6.a Yes; refer to the Adaptive Cruise Control maintenance manual and Original Equipment Manufacturer (OEM) for further diagnostic information.

   6.b No; verify power and ground to the Adaptive Cruise Control module. Refer to Original Equipment Manufacturer (OEM) for wiring information.

SPN 1592 (CPC) (GHG17)

175.1 SPN 1592/FMI 9 – GHG17

SPN 1592/FMI 9	
Description	This Fault Code Indicates a Missing Message from the Antilock Brake System (ABS) Module.
Monitored Parameter	J1939 Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key OFF for Five Minutes, then Key ON, Engine OFF

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   1.a Yes; repair the battery voltage concern. Verify repair.
   1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   2.b No; Go to step 3.
3. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   3.a Yes; refer to the OEM diagnostics for troubleshooting the loss of communication to the ABS module.
   3.b No; check for proper parameter configuration of the CPC against the server information.

175.2 SPN 1592/FMI 13 - GHG17

SPN 1592/FMI 13	
Description	This code will Set when the J1939 Wheel Speed Signal is Not Received.
Monitored Parameter	Wheel Speed Sensor Signal
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key OFF for Five Minutes, then Key ON, Engine OFF

Check as follows:

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   1.a Yes; repair the battery voltage concern. Verify repair.
   1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   2.b No; Go to step 3.
3. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   3.a Yes; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   3.b No; make corrections to the configuration of the CPC.

175.3 SPN 1592/FMI 19 – GHG17

SPN 1592/FMI 19	
Description	This code will Set when the J1939 Wheel Speed Signal is Not Received
Monitored Parameter	Wheel Speed Sensor Signal
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key OFF for Five Minutes, then Key ON, Engine OFF

Check as follows:

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   1.a Yes; repair the battery voltage concern. Verify repair.
   1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   2.b No; Go to step 3.
3. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   3.a Yes; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   3.b No; make corrections to the configuration of the CPC.

SPN 1623 (CPC) (GHG17)

176.1 SPN 1623/FMI 9 - GHG17

SPN 1623/FMI 9	
Description	This Diagnostic is Tachograph Output Shaft Speed Signal Erratic
Monitored Parameter	J1939 Message
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Idle

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   1.a Yes; repair the battery voltage concern. Verify repair.
   1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   2.b No; Go to step 3.
3. Check for proper configuration of the Common Powertrain Controller (CPC) against the server information. Does the CPC have the proper configuration?
   3.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.
   3.b No; reprogram the CPC with the correct information as necessary. To verify repair, Go to step 4.
4. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink . Wait five minutes for all modules to power down. Verify repair.

176.2 SPN 1623/FMI 13 - GHG17

SPN 1623/FMI 13	
Description	This Diagnostic Is Tachograph Output Shaft Speed Signal Is Not Available
Monitored Parameter	J1939 Message
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Idle

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   1.a Yes; repair the battery voltage concern. Verify repair.
   1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   2.b No; Go to step 3.
3. Check for proper configuration of the Common Powertrain Controller (CPC) against the server information. Does the CPC have the proper configuration?
   3.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.
   3.b No; reprogram the CPC with the correct information as necessary. To verify repair, Go to step 4.
4. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink . Wait five minutes for all modules to power down. Verify repair.

SPN 1624 (CPC) (GHG17)

177.1 SPN 1624/FMI 9 - GHG17

SPN 1624/FMI 9	
Description	J1939 Message Not Available
Monitored Parameter	J1939 Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, Engine OFF

1. Connect DiagnosticLink .
2. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   - 2.a Yes; repair the battery voltage concern. Verify repair.
   - 2.b No; Go to step 3.
3. Is SPN 625/FMI 9 fault code present?
   - 3.a Yes; diagnose SPN 625/FMI 9 fault code first. Verify repair.
   - 3.b No; Go to step 4.
4. Has the Common Powertrain Controller (CPC) been recently reprogrammed?
   - 4.a Yes; check for proper CPC configuration.
   - 4.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

177.2 SPN 1624/FMI 13 - GHG17

SPN 1624/FMI 13	
Description	Tachograph Vehicle Speed Signal is Missing
Monitored Parameter	J1939 Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, Engine OFF

1. Connect DiagnosticLink .
2. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   - 2.a Yes; repair the battery voltage concern. Verify repair.
   - 2.b No; Go to step 3.
3. Is SPN 625/FMI 9 fault code present?
   - 3.a Yes; diagnose SPN 625/FMI 9 fault code first. Verify repair.
   - 3.b No; Go to step 4.
4. Has the Common Powertrain Controller (CPC) been recently reprogrammed?
   - 4.a Yes; check for proper CPC configuration.
   - 4.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

177.3 SPN 1624/FMI 19 - GHG17

SPN 1624/FMI 19	
Description	Tachograph Vehicle Speed Signal is Erratic
Monitored Parameter	J1939 Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, Engine OFF

1. Connect DiagnosticLink .
2. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   2.a Yes; repair the battery voltage concern. Verify repair.
   2.b No; Go to step 3.
3. Is SPN 625/FMI 9 fault code present?
   3.a Yes; diagnose SPN 625/FMI 9 fault code first. Verify repair.
   3.b No; Go to step 4.
4. Has the Common Powertrain Controller (CPC) been recently reprogrammed?
   4.a Yes; check for proper CPC configuration.
   4.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

SPN 1624 (CPC3) (GHG17)

178.1 SPN 1624/FMI 2 – GHG17

Check as follows:

1. Note that this fault only pertains to vehicles with manual transmissions.
2. Are any ABS or Vehicle Speed Sensor (VSS) faults present?
   - 2.a Yes; repair those first.
   - 2.b No; Go to step 3.
3. Disconnect the vehicle speed sensor.
4. Inspect VSS harness connector for corroded, bent, spread or damaged pins. Is pin damage found?
   - 4.a Yes; repair as necessary.
   - 4.b No; replace the vehicle speed sensor.

178.2 SPN 1624/FMI 3 – GHG17

Check as follows:

1. Note that this fault only pertains to vehicles with manual transmissions.
2. Disconnect the Vehicle Speed Sensor (VSS).
3. Inspect VSS harness connector for corroded, bent, spread or damaged pins. Is pin damage found?
   - 3.a Yes; repair as necessary.
   - 3.b No; repair open circuit between VSS sensor and pin 29 of the CPC3 connector #4. Refer to EZ Wiring module 283 for schematic details.

178.3 SPN 1624/FMI 4 – GHG17

Check as follows:

1. Note that this fault only pertains to vehicles with manual transmissions.
2. Disconnect the Vehicle Speed Sensor (VSS).
3. Inspect VSS harness connector for corroded, bent, spread or damaged pins. Is pin damage found?
   - 3.a Yes; repair as necessary.
   - 3.b No; repair short to ground between VSS sensor and pin 29 of the CPC3 connector #4. Refer to EZ Wiring module 283 for schematic details.

SPN 1636 (MCM) (GHG17)

179.1 SPN 1636/FMI 0 - GHG17

Charge Air Cooler Low Efficiency

This code sets when the Motor Control Module (MCM) detects very high charge air and air intake manifold temperatures.

SPN 1636/FMI 0	
Description	Charge Air Cooler (CAC) Low Efficiency
Monitored Parameter	Intake Manifold And Charge Air Cooler Outlet Temperature Sensors
Typical Enabling Conditions	Coolant temperature above 65°C (149°F)
Monitor Sequence	None
Execution Frequency	Always enabled.
Typical Duration	10
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	Road test the vehicle with coolant temperature above 65°C (149°F)

Note : The Intake Air Temperature and Charge Air Cooler Temperature can increase if the vehicle is driven on steep inclines in lower gears.

Possible causes:

- Low vehicle speed with high engine load
- External CAC restriction
- Internal CAC restriction
- Fluid intrusion into the CAC

Check as follows:

1. Is the vehicle equipped with a plow?
   - 1.a Yes; Go to step 2.
   - 1.b No; Go to step 3.
2. Remove the plow and test drive the vehicle. Does fault code SPN 1636/FMI 16 or SPN 1636/ FMI 0 become active?
   - 2.a Yes; Go to step 3.
   - 2.b No; the plow is restricting the air flow through the CAC. Advice the customer to operate the vehicle with the plow angled to allow air flow through the CAC.
3. Is the vehicle equipped with a winter front?
   - 3.a Yes; Go to step 4.
   - 3.b No; Go to step 5.
4. Remove the winter front and road test the vehicle. Does fault code SPN 1636/FMI 16 or SPN 1636/ FMI 0 become active?
   - 4.a Yes; Go to step 5.
   - 4.b No; the winter front is restricting the air flow through the CAC. Refer to TS letter 14TS-11 for winter front information.
5. Use a flashlight to shine through the radiator and CAC assemblies. Can the light from the flashlight be seen through the other side of the assembly?

5.a Yes; Go to step 6.

5.b No; clean the CAC assembly as necessary.

6. Remove and inspect the piping to the CAC. Are there signs of fluid intrusion?

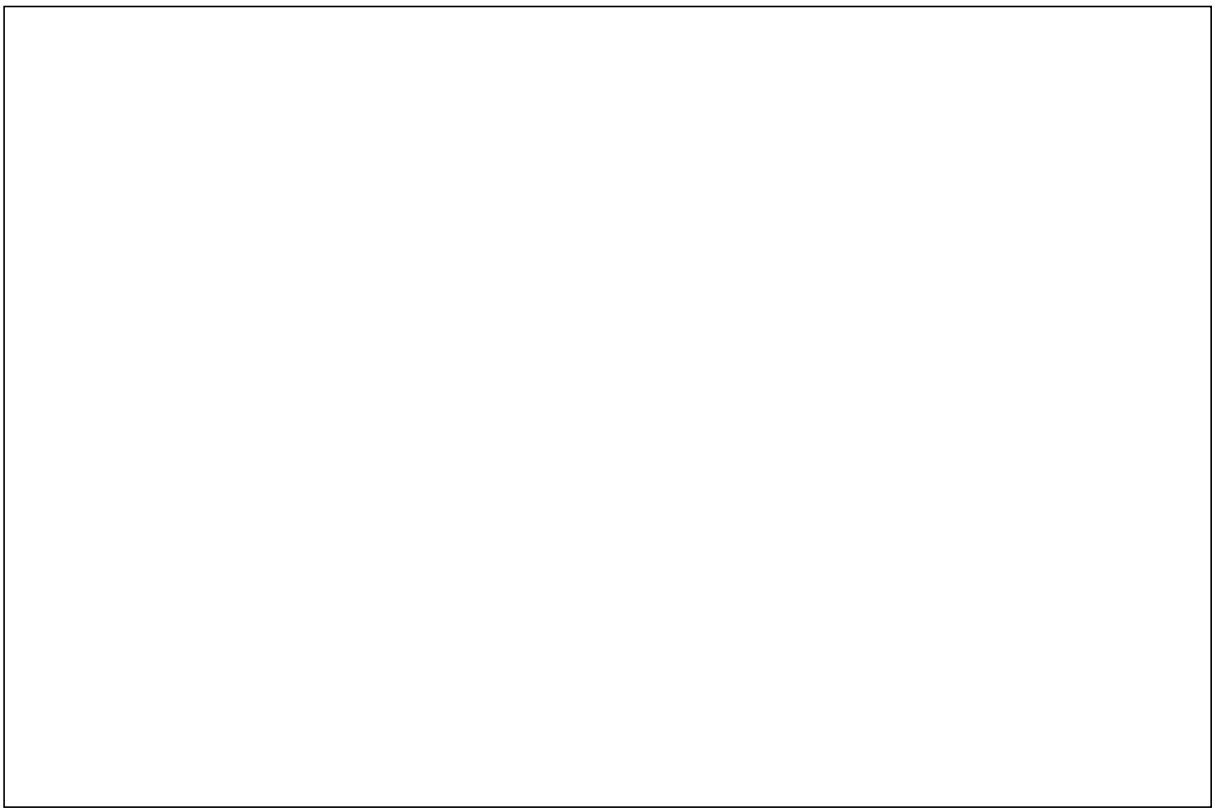
6.a Yes; diagnose and repair the cause of the fluid intrusion. Refer to OEM literature and flush the CAC. Verify repair.

6.b No; refer to OEM literature and perform the CAC restriction test. Repair as necessary. Verify repair.

179.2 SPN 1636/FMI 3 - GHG17

Intake Manifold Temperature Circuit Failed High

SPN 1636/FMI 3	
Description	Intake Manifold Temperature Circuit Failed High
Monitored Parameter	Intake Manifold Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)



Check as follows:

1. Turn the ignition OFF. Go to step 2.
2. Disconnect and inspect the Intake Manifold Temperature sensor electrical connector for signs of damaged, bent spread, broken, pushed out (unseated) or corroded pins or wire damage near the connector. Was any damaged found?
   - 2.a Yes; repair as necessary. If corrosion is present replace the sensor and the harness pig tail. Verify repair.
   - 2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF). Go to step 4.
4. Measure the voltage between pins 1 and 2 of the Intake Manifold Temperature sensor connector (harness side). Is the voltage between 2.5 and 3.5 volts?
   - 4.a Yes; replace the Intake Manifold Temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" . Verify repair.

4.b No; Go to step 5.

5. Measure the voltage between pin 2 of the Intake Manifold Temperature connector, harness side and ground. Is the voltage between 2.5 and 3.5 volts?

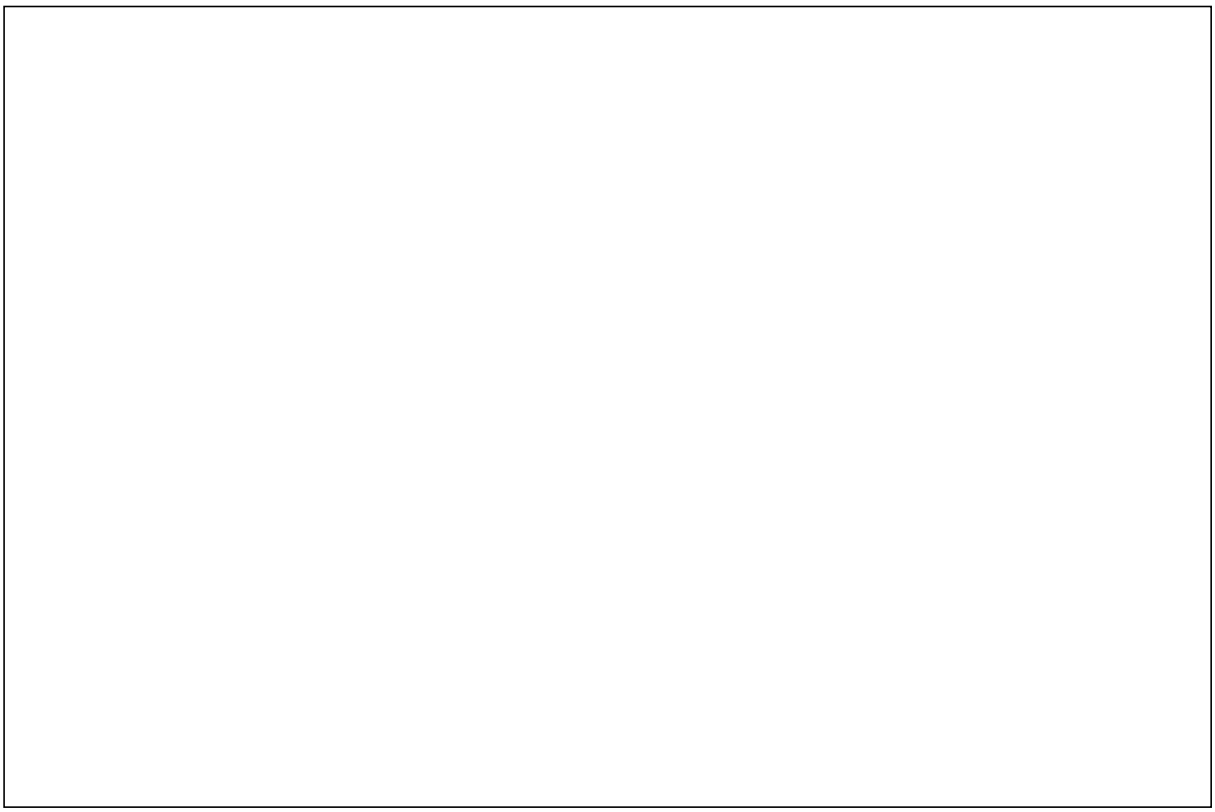
5.a Yes; repair the wire between pin 1 of the Intake Manifold Temperature Sensor connector and pin 52 of the 120-pin Motor Control Module (MCM) connector . Verify repair.

5.b No; repair the wire between pin 2 of the Intake Manifold Temperature sensor connector and pin 106 of the 120-pin MCM connector. Verify repair.

179.3 SPN 1636/FMI 4 - GHG17

Intake Manifold Temperature Circuit Failed Low

SPN 1636/FMI 4	
Description	Intake Manifold Temperature Circuit Failed Low
Monitored Parameter	Intake Manifold Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)



Check as follows:

1. Connect DiagnosticLink . Go to step 2.
2. Disconnect and inspect the Intake Manifold Temperature sensor electrical connector for signs of damaged, bent spread, broken, pushed out (unseated) or corroded pins or wire damage near the connector. Was any damaged found?
   - 2.a Yes; repair as necessary. If corrosion is present replace the sensor and the harness pig tail. Verify repair.
   - 2.b No; Go to step 3.
3. Turn the ignition on (key ON, engine OFF). Go to step 4.
4. Check the fault codes. Is fault code SPN 1636/FMI 3 now present?
   - 4.a Yes; replace the Intake Manifold Temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" . Verify repair.
   - 4.b No; Go to step 5.

5. Turn the ignition off. Go to step 6.
6. Disconnect and inspect the 120-pin Motor Control Module (MCM) connector. Go to step 7.
7. Measure the resistance between pin 2 of the Intake Manifold Temperature sensor connector, harness side and ground. Is the resistance greater than 10K ohms?

   7.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repair.

   7.b No; repair the short to ground between pin 2 of the Intake Manifold Temperature sensor connector and pin 106 of the 120-pin MCM connector. Verify repair.

179.4 SPN 1636/FMI 14 - GHG17

Intake Manifold Temperature Sensor Signal Not Plausible

SPN 1636/FMI 14	
Description	This fault code sets when the Motor Control Module (MCM) detects that the intake manifold temperature is greater than 20°C (36°F) degrees from the expected temperature after the engine has been turned off for 8 hours.
Monitored Parameter	Intake Manifold Temperature
Typical Enabling Conditions	Key ON, engine OFF, battery voltage greater than 11.08 volts, engine rpm at zero, ambient temperature less than 40°C (104°F), engine OFF for no less than 8 hours.
Monitor Sequence	None
Execution Frequency	Once per cool down cycle
Typical Duration	5 seconds
Dash Lamps	MIL
Engine Reaction	25% derate, regen disabled
Verification	Road test the vehicle for 30 minutes until the coolant reaches operating temperature. Then verify that the intake manifold temperature is within 10°C (18°F) of the Charge Air Cooler outlet temperature.

1. Has the Common Powertrain Controller (CPC) recently been reprogrammed or has the internal clock time been changed?
   1.a Yes; this fault may have been caused by the change in the CPC time.
   1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Check for multiple fault codes. Are fault codes SPN 1636//FMI 3 or 4 present?
   4.a Yes; diagnose the other fault codes first.
   4.b No; Go to step 5.
5. Disconnect and inspect the intake manifold temperature sensor electrical connector for signs of damage, bent, spread, broken, pushed out (unseated) or corroded pins or wire damage near the connector. Was any damage found?
   5.a Yes; replace the intake manifold temperature sensor and the harness pig tail. Verify repair.
   5.b No; replace the intake manifold temperature sensor. Verify repair.

179.5 SPN 1636/FMI 16 - GHG17

Charge Air Cooler Efficiency Low

SPN 1636/FMI 16	
Description	This fault code sets when the Charge Air Cooler (CAC) outlet temperature is greater than the modeled temperature.
Monitored Parameter	Charge Air Cooler outlet temperature.
Typical Enabling Conditions	Ambient temperature greater than -8°C (17.6°F), ambient air pressure greater than 755 mbar (10.9 psi), engine speed between 900 to 1650 rpm, vehicle speed greater than 45 km/hr.
Monitor Sequence	None
Execution Frequency	Always enabled
Typical Duration	10 seconds
Dash Lamps	MIL, CEL
Engine Reaction	10% derate
Verification	Road test the vehicle with the engine speed between 900 and 1650 rpm.

Check as follows:

Possible causes:

- Low vehicle speed with high engine load
- External CAC restriction (such as a plow, winter front or dirt) Refer to 14TS-11 for information on winter front usage and effect on vehicle performance
- Internal CAC restriction

1. Is the vehicle equipped with a plow?
   - 1.a Yes; Go to step 2.
   - 1.b No; Go to step 3.
2. Remove the plow and test drive the vehicle. Does fault code SPN 1636/FMI 16 become active?
   - 2.a Yes; Go to step 3.
   - 2.b No; the plow is restricting the air flow through the CAC. Advise the customer to operate the vehicle with the plow angled to allow air flow through the CAC.
3. Is the vehicle equipped with a winter front?
   - 3.a Yes; Go to step 4.
   - 3.b No; Go to step 5.
4. Remove the winter front and road test the vehicle. Does fault code SPN 1636/FMI 16 become active?
   - 4.a Yes; Go to step 5.
   - 4.b No; the winter front is restricting the air flow through the CAC. Refer to TS letter 14TS-11 for winter front information.
5. Use a flashlight to shine through the radiator and CAC assembly. Can the light from the flashlight be seen through the other side of the assembly?
   - 5.a Yes; Go to step 6.
   - 5.b No; clean the CAC assembly as necessary.
6. Remove and inspect the piping to the CAC. Are there signs of fluid intrusion?
   - 6.a Yes; diagnose and repair the cause of the fluid intrusion. Refer to OEM literature and flush the CAC. Verify repair.
   - 6.b No; refer to OEM literature and perform the CAC restriction test. Repair as necessary. Verify repair.

SPN 1637 (MCM) (GHG17)

180.1 SPN 1637/FMI 2 - GHG17

Coolant Out Temperature Signal Not Plausible

SPN 1637/FMI 2	
Description	This fault Code Sets when the Motor Control Module (MCM) Detects that the Engine Coolant Outlet Temperature is Greater than 20°C (36°F) From the Expected Temperature After the Engine has Been Turned Off for 8 Hours.
Monitored Parameter	Coolant Outlet Temperature
Typical Enabling Conditions	Key ON, engine OFF, battery voltage greater than 11 volts, Engine rpm at Zero, Ambient Temperature Less than 40°C (104°F), Engine OFF for No Less than 8 Hours.
Monitor Sequence	None
Execution Frequency	Once Per Cool Down Cycle
Typical Duration	Five seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Road Test the Vehicle for 30 Minutes Until the Coolant Reaches Operating Temperature. Then Verify that the Engine Coolant Outlet Temperature is Within 20°C (36°F) of the Engine Coolant Inlet Temperature.

Possible causes:

Note : The use of an external heating unit while the engine has been shut down for a minimum of 8 hours can cause this fault code to set erroneously.

1. Has the Common Powertrain Controller (CPC) recently been reprogrammed or has the internal clock time been changed?
   - 1.a Yes; this fault may have been caused by the change in the CPC time. Go to step 8.
   - 1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Check for multiple fault codes. Are fault codes SPN 110/FMI 3 or 4 present?
   - 4.a Yes; diagnose the other fault codes first.
   - 4.b No; Go to step 5.
5. Check the MCM software level. Is the MCM software level 6.4.0.5 ZGS 005 or greater?
   - 5.a Yes; Go to step 6.
   - 5.b No; Update the MCM using the latest server information. Perform the repair verification. If the fault returns, Go to step 6.
6. Monitor and record the engine coolant outlet temperature.

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.

WARNING

ENGINE EXHAUST

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

7. Start the engine.
8. Road test the vehicle for 30 minutes until the coolant reaches operating temperature.
9. Monitor engine coolant outlet temperature. Has the temperature increased from the previously recorded value?

   9.a Yes; Go to step 10.

   9.b No; Go to step 11.

10. Compare the engine coolant outlet temperature to the engine coolant inlet temperature. Is the difference greater than 20°C (36°F)?

    10.a Yes; Go to step 11.

    10.b No; the fault may have been caused by an external heating unit.

11. Disconnect and inspect the engine coolant outlet temperature sensor electrical connector. Is there damage or corrosion present?

    11.a Yes; repair as necessary. Verify repair.

    11.b No; replace the engine coolant outlet temperature sensor. Verify repair.

SPN 1639 (MCM) (GHG17)

181.1 SPN 1639/FMI 2 - GHG17

SPN 1639/FMI 2	
Description	This Code Sets When a Fan Speed Deviation is Detected
Monitored Parameter	Fan Speed Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine Running With Fan Engaged

1. Connect to DiagnosticLink .
2. Check for multiple codes. Are fault codes SPN 1071/FMI Any or SPN 647/FMI Any present?
   2.a Yes; diagnose the other fault codes first.
   2.b No; Go to step 3.

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

3. Start the engine.
4. Monitor fan speed. Engage fan with manual override switch or air conditioner. Does fan speed increase with engine speed?

   4.a Yes; replace the fan speed sensor. Refer to Original Equipment Manufacturer (OEM) procedures.

   4.b No; replace fan drive. Refer to OEM procedures.

SPN 1659 (MCM) (GHG17)

182.1 SPN 1659/FMI 7 - GHG17

Thermostat cool down

SPN 1659/FMI 7	
Description	This Fault Sets when the engine coolant temperature is not maintained to match a modeled temperature range.
Monitored Parameter	Inlet coolant temperature and outlet coolant temperature
Typical Enabling Conditions	Ambient temp greater than -8°C (18°F) Ambient pressure greater than 755 mbar (11 psi) Vehicle speed greater than 45 km/hr (27 mph) Engine run time after engine start greater than 5 min.
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Five seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Road test the vehicle for 40 minutes.

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are fault codes SPN 110/FMI 3, SPN 110/FMI 4, SPN 110/FMI 14, SPN 4193/FMI 2, SPN 4193/FMI 3, SPN 4193/FMI 4, or SPN 4193/FMI 17 present?
   - 3.a Yes; diagnose the other fault codes first. Verify repair.
   - 3.b No; Go to step 4.
4. Is this vehicle a bus?
   - 4.a Yes; replace the thermostat. Refer to section "Removal of the Engine Coolant Thermostat and Seal" .
   - 4.b No; Go to step 5.
5. Inspect the vehicle for any aftermarket components plumbed into the cooling system. Are there any aftermarket components plumbed into the cooling system on the vehicle?
   - 5.a Yes; isolate the components and retest. If the fault code returns, replace the thermostat. Refer to section "Removal of the Engine Coolant Thermostat and Seal" .
   - 5.b No; replace the thermostat. Refer to section "Removal of the Engine Coolant Thermostat and Seal" .

182.2 SPN 1659/FMI 17 - GHG17

Coolant temperature low pre fail

SPN 1659/FMI 17	
Description	This Fault Sets when the engine coolant temperature has not increased to match a modeled temperature range.
Monitored Parameter	Coolant temperature
Typical Enabling Conditions	Ambient temp greater than -8°C (18°F) Ambient pressure greater than 755 mbar (11 psi) Vehicle speed greater than 45 km/hr (27 mph) Engine run time after engine start greater than 5 min.
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Five seconds
Dash Lamps	None
Engine Reaction	None
Verification	None

This fault code is an informational/silent fault code. This fault code sets when the coolant temperature is not within a calibrated threshold, which starts another monitor to determine if there is a cooling system concern present.

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for other fault codes. Is fault code SPN 110/FMI 18 also present?
   - 3.a Yes; diagnose fault code SPN 110/FMI 18.
   - 3.b No; erase the fault code and release the vehicle.

182.3 SPN 1659/FMI 31- GHG17

SPN 1659/FMI 31 - GHG17	
Description	Engine coolant temperature not matched
Monitored Parameter	Outlet coolant temperature
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	None

This fault code is an informational/silent fault code. This fault code sets when the coolant temperature is not within a calibrated threshold, which starts another monitor to determine if there is a cooling system concern present.

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for other fault codes. Is fault code SPN 110/FMI Any or SPN 4193/FMI Any also present?

   3.a Yes; diagnose other fault codes first.

   3.b No; erase the fault code and release the vehicle.

SPN 1663 (CPC) (GHG17)

183.1 SPN 1663/FMI 7 - GHG17

SPN 1663/FMI 7	
Description	Optimized Idle Safety Loop Faulted
Monitored Parameter	Optimized Idle Safety Loop (Parking Brake, Hood Tilt Switch, Neutral Safety Switch and Vehicle Speed)
Typical Enabling Conditions	Fault is Set Active if a Maximum Number of Vehicle Speed Sensor Pulses During an Optimized Idle Engine Start is Exceeded or the Vehicle Speed is Above 0.25 Km/H or the Engine Torque is Above a Calibratable Threshold For 2 Seconds
Monitor Sequence	None
Execution Frequency	
Typical Duration	
Dash Lamps	CEL
Engine Reaction	None
Verification	Run an Optimized Idle Mode

Note : When creating log files for optimized idle issues using DiagnosticLink®, add the J1939 connection. This will create larger log files but the information needed will be available to reduce troubleshooting time.

Check as follows:

1. Open DiagnosticLink .
2. Go to the tools drop-down menu and select options.
3. Select the connection tab.
4. Is there a check mark in the box next to J1939ECU?

   4.a Yes; Go to step 5.

   4.b No; click on the box so the check mark will appear, then Go to step 5.

Note : If fault code SPN 1663/FMI 7 is inactive, it may indicate that the vehicle moved during optimized idle operation or that noise was detected on the Vehicle Speed Sensor (VSS).

5. Turn the ignition ON (key ON, engine OFF)
6. Connect to DiagnosticLink.

Note : The Optimized Idle Safety Loop is made up of the parking brake, hood tilt switch, neutral safety switch and vehicle speed.

7. Use DiagnosticLink to monitor the Optimized Idle Safety Loop. Cycle the switches that make up the safety loop and make sure they operate correctly. Is a failure present with the Optimized Idle Safety Loop?

   7.a Yes; repair the failed Optimized Idle Safety Loop component.

   7.b No; Go to step 8.

8. Use DiagnosticLink to monitor the following:

   Latest OI Dropout Reason t0

   Latest OI Dropout Reason t-1

   Latest OI Dropout Reason t-2

   Latest OI Dropout Reason t-3

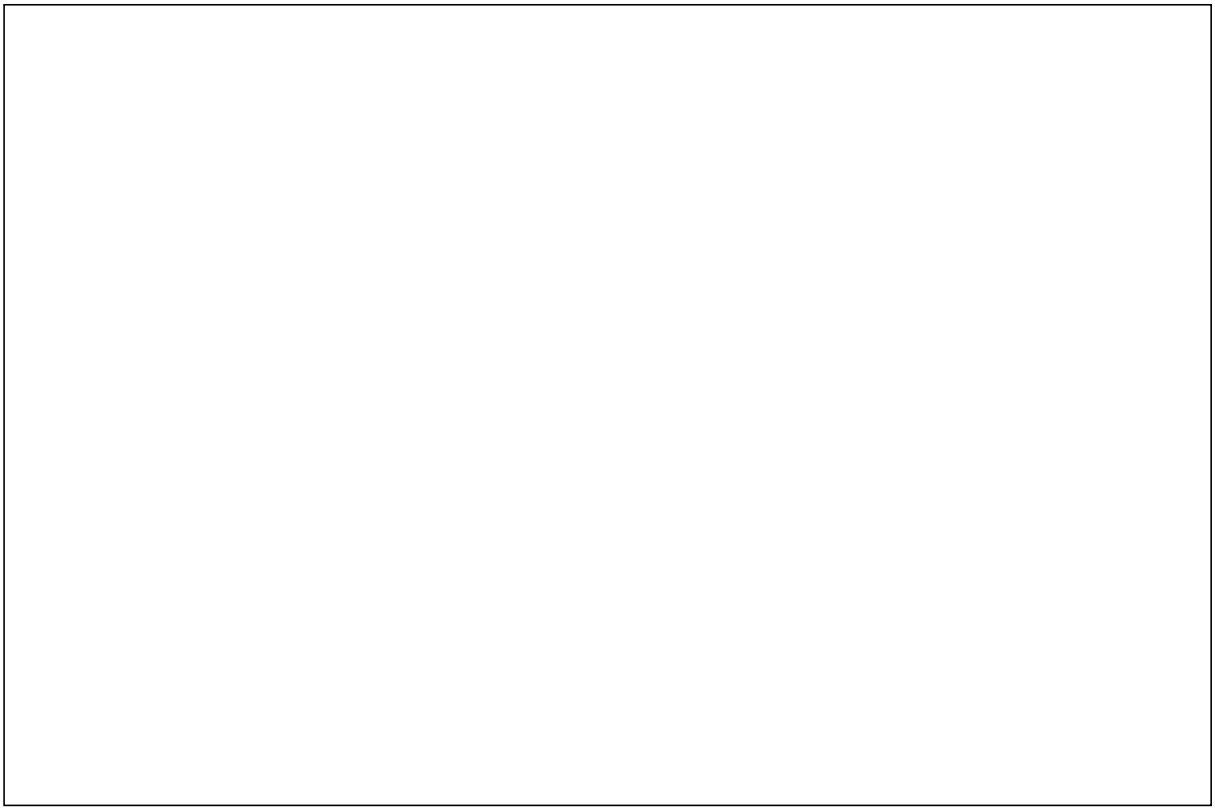
   Latest OI Dropout Reason t-4

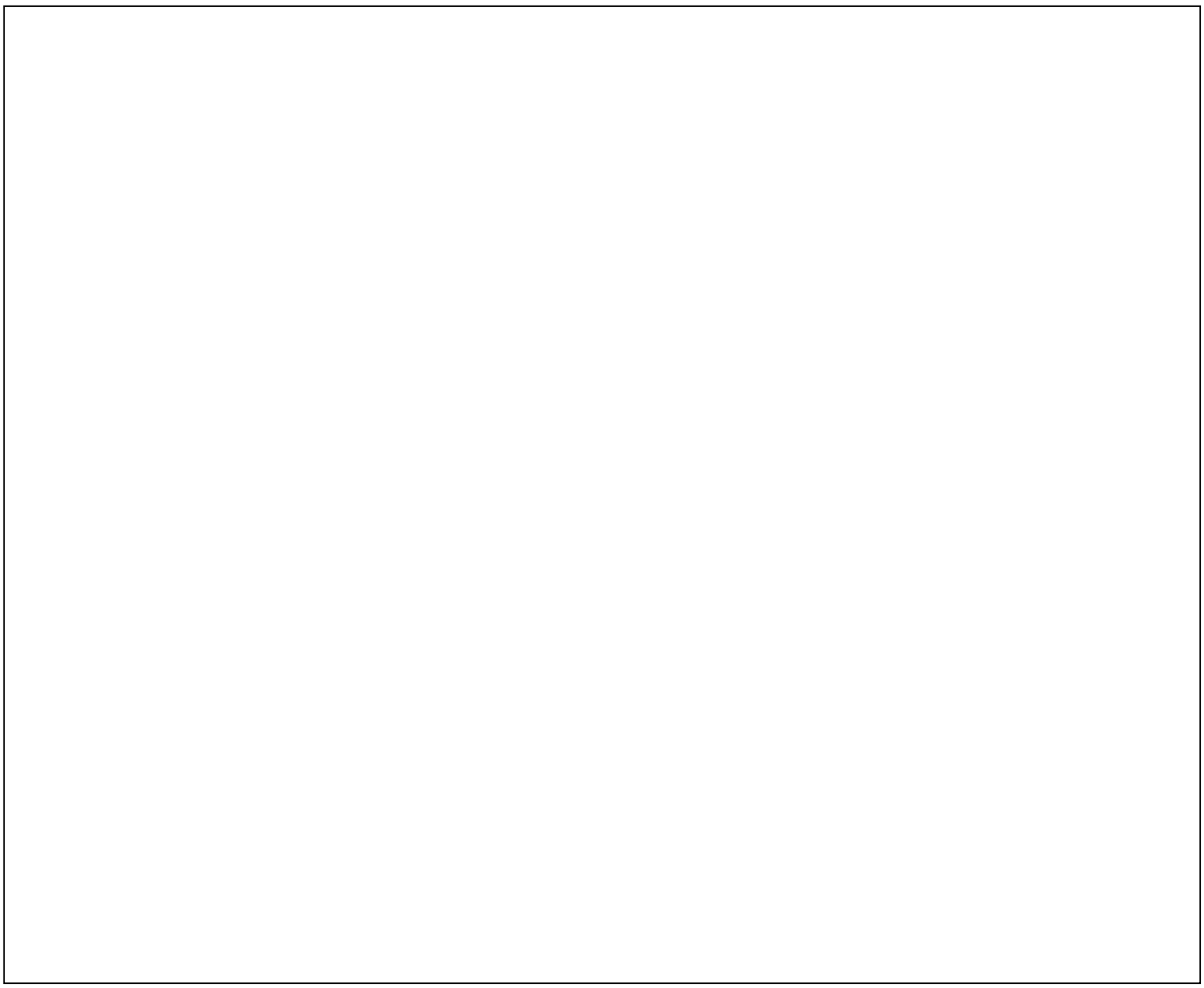
9. The value indicated by the Latest OI Dropout Reason indicates the failure causing the code to come active. "t0" indicates the most recent and "t-4" indicates the least recent. Repair the failure as indicated by the Latest OI Dropout Reason.

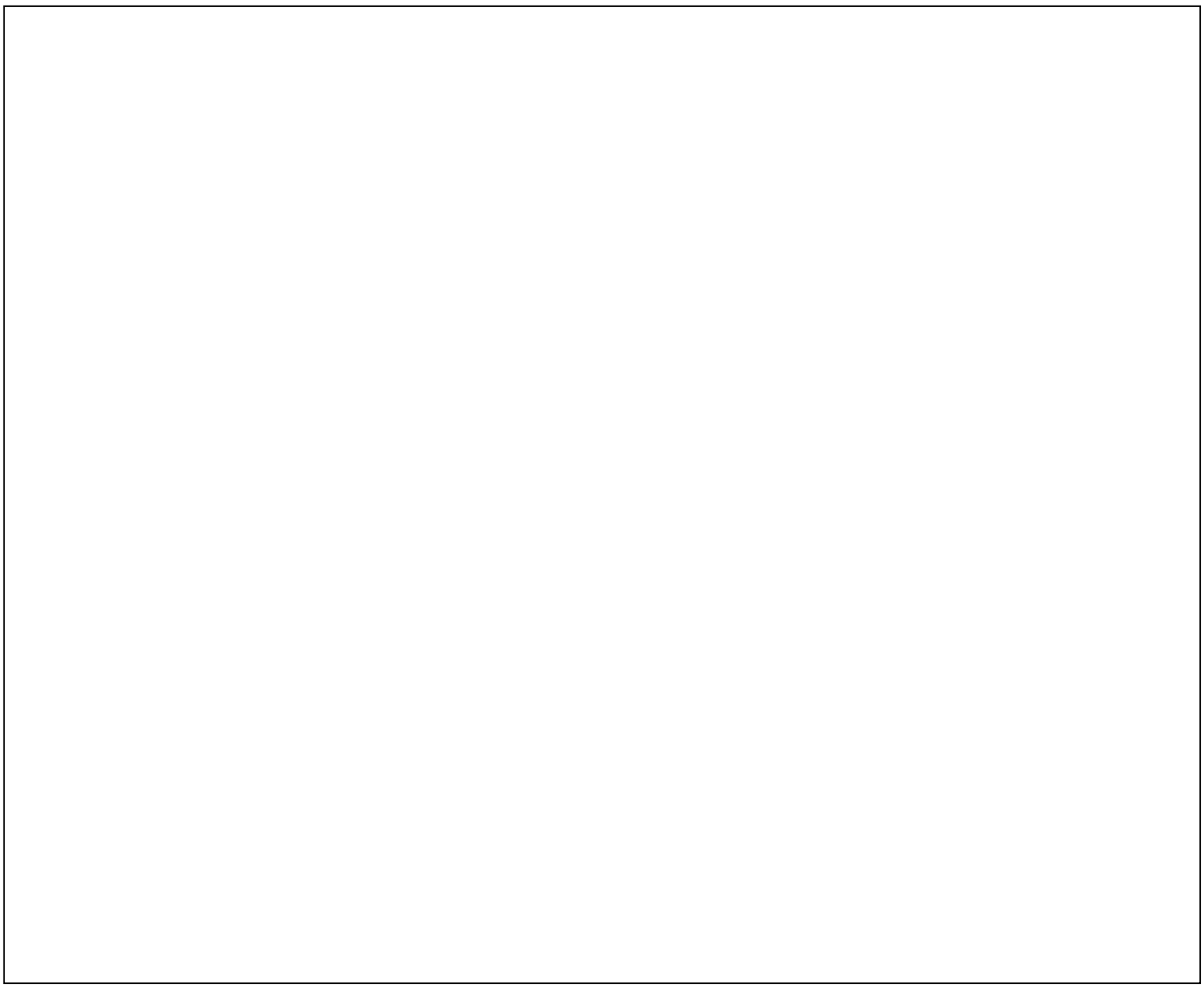
SPN 1669 (ACM) (GHG17)

184.1 SPN 1669/FMI 9 - GHG17

SPN 1669/FMI 9	
Description	ACM PT-CAN 4 High Short to Ground or CAN 4 Low Short to Power
Monitored Parameter	CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Ignition Cycle







Check as follows:

1. Are there any battery voltage faults (SPN 168/FMI any)?
   1.a Yes; troubleshoot battery voltage faults first.
   1.b No; Go to step 2.
2. Has the Aftertreatment Control Module (ACM), Motor Control Module (MCM), or Common Powertrain Controller (CPC) been recently programmed?
   2.a Yes; clear the fault codes. If faults do not become active, release the vehicle. If faults become active, Go to step 3.
   2.b No; Go to step 3.
3. Is the aftertreatment system a 1-BOX™ configuration?
   3.a Yes; Go to step 4.
   3.b No; for a Two-Box option, Go to step 6.
4. Turn the ignition OFF and disconnect the ACM 120-pin connector.
5. Measure the resistance between pins 40 and 41 on the ACM connector, component side. Is the resistance between 55 and 65 ohms?
   5.a Yes; replace the aftertreatment harness.
   5.b No; replace the ACM.
6. Turn ignition OFF and wait five minutes before proceeding.
7. Disconnect the inlet NOx sensor four-way electrical harness connector.

8. Check the resistance between pins 1 and 2 of the inlet NOx sensor electrical connector, aftertreatment harness side. Is the resistance greater than 10k ohms?

   8.a Yes; Go to step 9.

   8.b No; repair or replace the harness as necessary.

9. Check the resistance between pins 3 and 4 of the inlet NOx sensor, harness side. Is the resistance greater than 10k ohms?

   9.a Yes; Go to step 10.

   9.b No; repair or replace the harness as necessary.

10. Disconnect the outlet NOx sensor four-way electrical harness connector.

11. Check the resistance between pins 1 and 2 of the outlet NOx sensor electrical connector, aftertreatment harness side. Is the resistance greater than 10k ohms?

    11.a Yes; Go to step 12.

    11.b No; repair or replace the harness as necessary.

12. Check the resistance between pins 3 and 4 of the outlet NOx sensor electrical connector, aftertreatment harness side. Is the resistance greater than 10k ohms?

    12.a Yes; Go to step 13.

    12.b No; repair or replace the harness as necessary.

13. Disconnect the soot sensor four-way electrical harness connector.

14. Check the resistance between pins 2 and 3 of the soot sensor electrical connector, aftertreatment harness side. Is the resistance greater than 10k ohms?

    14.a Yes; Go to step 15.

    14.b No; repair or replace the harness as necessary.

15. Check the resistance between pins 1 and 4 of the soot sensor electrical connector, aftertreatment harness side. Is the resistance greater than 10k ohms?

    15.a Yes; Go to step 16.

    15.b No; repair or replace the harness as necessary.

16. Disconnect the ACM 120-pin connector.

17. Measure the resistance between pins 40 and 41 on the ACM connector, component side. Is the resistance between 55 and 65 ohms?

    17.a Yes; replace the aftertreatment harness.

    17.b No; replace the ACM.

SPN 1681 (CPC) (GHG17)

185.1 SPN 1681/FMI 9 – GHG17

SPN 1681/FMI 9	
Description	Battery Main Switch Message is Missing
Monitored Parameter	Battery Main Switch
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Idle

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   1.a Yes; repair the battery voltage concern. Verify repair.
   1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   2.b No; Go to step 3.
3. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   3.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.
   3.b No; reprogram the CPC with the correct information as necessary. To verify repair, Go to step 4.
4. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink . Wait five minutes for all modules to power down. Verify repair.

SPN 1716 (CPC) (GHG17)

186.1 SPN 1716/FMI 9 - GHG17

SPN 1716/FMI 9	
Description	J1939 Message is Missing
Monitored Parameter	This Code Will Set When the J1939 ERC1 Message is Not Received
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Idle

Note : The Common Powertrain Controller (CPC) digital outputs have the same SPN as some Motor Control Module (MCM) faults. DiagnosticLink® Standard makes the distinction between the MCM and CPC when diagnosing a fault.

Check as follows:

1. Connect DiagnosticLink .
2. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   - 2.a Yes; repair the battery voltage concern. Verify repair.
   - 2.b No; Go to step 3.
3. Is SPN 625/FMI 9 fault code present?
   - 3.a Yes; diagnose SPN 625/FMI 9 fault code first. Verify repair.
   - 3.b No; Go to step 4.
4. Has the CPC been recently reprogrammed?
   - 4.a Yes; check the proper configuration of the CPC.
   - 4.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

186.2 SPN 1716/FMI 13 – GHG17

SPN 1716/FMI 13	
Description	5-Stage Retarder Message is Missing or Not Plausible
Monitored Parameter	This code will set when the Evobus Five-Stage Retarder Signal is Not Received
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Idle

Note : The Common Powertrain Controller (CPC) digital outputs have the same SPN as some Motor Control Module (MCM) faults. DignosticLink® Standard makes the distinction between the MCM and CPC when diagnosing a fault.

Check as follows:

1. Connect DiagnosticLink .
2. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   - 2.a Yes; repair the battery voltage concern. Verify repair.
   - 2.b No; Go to step 3.
3. Is SPN 625/FMI 9 fault code present?
   - 3.a Yes; diagnose SPN 625/FMI 9 fault code first. Verify repair.
   - 3.b No; Go to step 4.
4. Has the CPC been recently reprogrammed?
   - 4.a Yes; check the proper configuration of the CPC.
   - 4.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

SPN 1761 (ACM) (GHG17)

187.1 SPN 1761/FMI 1 - GHG17

Diesel Exhaust Fluid (DEF) Tank Level 0 Condition - Empty Tank - Speed Limited

SPN 1761/FMI 1	
Description	DEF Tank Level 0 - Empty(Speed Limited)
Monitored Parameter	DEF Tank Level
Typical Enabling Conditions	DEF Tank Level less than 2.5%
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	10 Minutes
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (5 minute)

This fault indicates that the DEF tank level is empty and the warning lamps have been ignored. A 25% engine derate and 5 mph speed limit is in effect. DEF must be added to the DEF tank (minimum ¼ tank). After refill, idle engine for five minutes; if fault does not go inactive or dash lamp stays ON, refer to OEM literature for DEF level sensor diagnostics.

187.2 SPN 1761/FMI 2 – GHG17

Diesel Exhaust Fluid (DEF) Tank Level Sensor Circuit Data Erratic, Intermittent or Incorrect

1. Check for multiple codes.
   - 1.a If SPN 1761/3 and 3031/3 are present, Go to step 2.
   - 1.b If SPN 1761/3 is present, Go to step 9.
2. Disconnect the DEF tank temperature/level sensor.
3. Inspect the DEF tank temperature/level sensor connector for bent, spread or corroded pins.
   - 3.a If bent, spread or corroded pins are found, repair as necessary.
   - 3.b If no connector issues are found, Go to step 4.
4. Turn the ignition ON (key ON, engine OFF).
5. Measure the voltage between pin 2 on the harness side of the DEF tank temperature/level sensor and ground.
   - 5.a If voltage is present, repair short to power between pin 2 on the harness side of the DEF tank temperature/level sensor and pin 102 of the Aftertreatment Control Module (ACM).
   - 5.b If no voltage is present Go to step 6.
6. Turn the ignition OFF (key OFF, engine OFF).
7. Disconnect the ACM 120-pin connector.
8. Measure the resistance between pin 2 on the harness side of the DEF tank temperature/level sensor and pin 102 of the ACM.
   - 8.a If the resistance is greater than 5 ohms, repair wire between pin 2 on the harness side of the DEF tank temperature/level sensor and pin 102 of the ACM.
   - 8.b If the resistance is less than 5 ohms, refer to OEM literature for DEF tank temperature/level sensor replacement.
9. Disconnect the DEF tank temperature/level sensor.
10. Inspect the DEF tank temperature/level sender connector for bent, spread or corroded pins.
    - 10.a If bent, spread or corroded pins are found, repair as necessary.
    - 10.b If no connector issues are found, Go to step 11.
11. Turn the ignition ON (key ON, engine OFF).
12. Measure the voltage between pin 1 on the harness side of the DEF tank temperature/level sensor and ground.
    - 12.a If voltage is greater than 3.00 volts, repair short to power between pin 1 on the harness side of the DEF tank temperature/level sensor and pin 109 of the ACM.
    - 12.b If voltage is between 2.0 and 2.95, refer to OEM literature for DEF temperature/level sensor replacement.
    - 12.c If voltage is less than 2.5 volts, repair wire between pin 1 on the harness side of the DEF temperature/level sensor and pin 109 of the ACM.

187.3 SPN 1761/FMI 3 - GHG17

SPN 1761/FMI 3	
Description	Diesel Exhaust Fluid (DEF) Tank Level Sensor Circuit Failed High
Monitored Parameter	DEF Tank Level Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (One Minute)

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

Note : When there is no signal from the DEF level/temperature sensor, the vehicle will go into the low DEF level derate.

Check as follows:

1. Disconnect and inspect the DEF tank level/temperature sensor connector. Are there any bent, spread, or corroded pins?
   - 1.a Yes; repair as necessary. Verify repair.
   - 1.b No; Go to step 2.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pin 2 of the DEF tank level/temperature sensor, harness side connector and ground. Is there any voltage present?
   - 3.a Yes; repair the short to power between pin 2 of the DEF tank level/temperature connector and pin 102 of the 120-pin ACM connector. Verify repair.
   - 3.b No; Go to step 4.

4. Measure the voltage between pin 1 of the DEF tank temperature/level sensor, harness side connector and ground. Is there 3.0 volts?
   - 4.a Yes; Go to step 5.
   - 4.b No; Go to step 10.
5. Turn the ignition OFF.
6. Measure resistance between pin 2 of the DEF tank level/temperature sensor connector and ground. Is the resistance less than five ohms?
   - 6.a Yes; replace the DEF tank temperature/level sensor. Refer to section "Removal of the 13- and 23-Gallon Diesel Exhaust Fluid Tank Header Unit" . Verify repair.
   - 6.b No; Go to step 7.
7. Disconnect and inspect the 120-pin Aftertreatment Control Module (ACM), harness side, connector. Are there any bent, spread, or corroded pins?
   - 7.a Yes; repair as necessary. Verify repair.
   - 7.b No; Go to step 8.
8. Measure the resistance between pin 2 of the DEF tank level/temperature sensor, harness side connector and pin 102 of the 120-pin ACM connector. Is the resistance less than five ohms?
   - 8.a Yes; Go to step 9.
   - 8.b No; repair the wire between pin 2 of the DEF tank level/temperature sensor connector and pin 102 of the 120-pin ACM connector. Verify repair.
9. Install a test ACM. Is SPN 1761/FMI 3 still present?
   - 9.a Yes; replace the DEF tank temperature/level sensor. Refer to section "Removal of the 13- and 23-Gallon Diesel Exhaust Fluid Tank Header Unit" . Verify repair.
   - 9.b No; replace the ACM. Verify repair.
10. Disconnect and inspect the 120-pin ACM connector. Are there any bent, spread, or corroded pins?
    - 10.a Yes; repair as necessary. Verify repair.
    - 10.b No; Go to step 11.
11. Measure the resistance between pin 1 of the DEF tank level/temperature sensor, harness side, connector and pin 109 of the 120-pin ACM harness side connector. Is the resistance less than five ohms?
    - 11.a Yes; Go to step 12.
    - 11.b No; repair the wire between pin 1 of the DEF tank level/temperature sensor connector and pin 109 of the 120-pin ACM connector.
12. Install a test ACM. Is SPN 1761/FMI 3 still present?
    - 12.a Yes; replace the DEF tank temperature/level sensor. Refer to section "Removal of the 13- and 23-Gallon Diesel Exhaust Fluid Tank Header Unit" . Verify repair.
    - 12.b No; replace the ACM. Verify repair.

187.4 SPN 1761/FMI 4 - GHG17

SPN 1761/FMI 4	
Description	Diesel Exhaust Fluid (DEF) Tank Level Sensor Circuit Failed Low
Monitored Parameter	DEF Tank Level Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (One Minute)

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

Note : When there is no signal from the DEF level/temperature sensor, the vehicle will go into the low DEF level derate.

Check as follows:

1. Turn the ignition OFF.
2. Disconnect and inspect the Diesel Exhaust Fluid (DEF) tank temperature/level sensor connector. Is there any damage, corrosion, or water present?
   - 2.a Yes; repair as necessary. Verify repair.
   - 2.b No; Go to step 3.
3. Measure the resistance from pin 1 of the DEF tank temperature/level sensor harness side connector and ground. Is the resistance less than 10k ohms?
   - 3.a Yes; Go to step 4.
   - 3.b No; repair the wire between pin 1 of the DEF tank temperature/level sensor connector and pin 109 of the 120-pin ACM connector.

4. Install a test ACM. Is code SPN 1761/FMI 4 still present?

   4.a Yes; replace the DEF tank temperature/level sensor. Refer to section "Removal of the 13- and 23-Gallon Diesel Exhaust Fluid Tank Header Unit" . Verify repair.

   4.b No; replace the ACM. Verify repair.

187.5 SPN 1761/FMI 9 – GHG17

Diesel Exhaust Fluid (DEF) Tank Signal Not Available via CAN

1. Has the Aftertreatment Control Module (ACM) been recently reprogrammed?
   - 1.a Yes; clear fault codes. If they do not become active, release the vehicle. If fault returns, verify proper ACM fuel map. ACM is looking for DEF tank Controller Area Network (CAN) signal, except vehicle may be hardwired.
   - 1.b No; Go to step 2.
2. Turn the ignition OFF and disconnect DiagnosticLink . Wait five minutes for all modules to power down.
3. Turn ignition ON (key ON, engine OFF).
4. Reconnect DiagnosticLink. Are fault codes active?
   - 4.a Yes; Go to step 5.
   - 4.b No; clear faults codes and release vehicle.
5. Turn ignition OFF and wait five minutes before proceeding.
6. Disconnect the DEF tank header harness connector.
7. Inspect DEF tank header for bent, spread or corroded pins.
   - 7.a If bent, spread or corroded pins are found, repair as necessary.
   - 7.b If no connector issues are found, Go to step 8.
8. Measure the resistance across pins 1 and 2 of the DEF tank header harness connector.
   - 8.a If the resistance is between 40 and 80 ohms, Go to step 11.
   - 8.b If the resistance is not between 40 and 80 ohms, Go to step 9.
9. Disconnect the ACM 120-pin connector.
10. Check ACM internal terminating resistor by measuring and recording the resistance across pins 48 and 49 of the ACM 120-pin connector.
    - 10.a If the resistance is 50 to 70 ohms, repair the shorted DEF CAN harness.
    - 10.b If the resistance is not between 50 to 70 ohms, replace the ACM.
11. Measure and record the resistance between the ACM 120-pin connector pins 48 and 49 to engine ground.
    - 11.a If the resistance is greater than 10K ohms on both wires, replace the DEF tank header. Verify repairs.
    - 11.b If the resistance is less than 10K ohms, repair the short in the harness between ACM 120-pin connector pins 48 or 49 and ground.

187.6 SPN 1761/FMI 18 - GHG17

Diesel Exhaust Fluid (DEF) Tank Level 1 Condition - Empty Tank

SPN 1761/FMI 18	
Description	DEF Tank Level 1 - Empty
Monitored Parameter	DEF Tank Level
Typical Enabling Conditions	DEF Tank Level less than 2.5%
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	10 Minutes
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (5 minute)

This fault indicates that the DEF tank level is empty. A 25% engine derate and 55 mph speed limit is in effect. DEF must be added to the DEF tank (minimum ¼ tank). After refill, idle engine for five minutes; if fault does not go inactive or dash lamp stays on, refer to OEM literature for DEF level sensor diagnostics.

187.7 SPN 1761/FMI 31 - GHG17

Diesel Exhaust Fluid (DEF) Tank Level 3 Condition - Tank Level Very Low

This fault indicates that the DEF tank level is very low. DEF must be added to the DEF tank (minimum ¼ tank). After refill, idle engine for five minutes; if fault does not go inactive or dash lamp stays on, refer to OEM literature for DEF level sensor diagnostics.

SPN 1814 (CPC) (GHG17)

188.1 SPN 1814/FMI 9 - GHG17

VDC1 Message was Not Received or Has Stopped Arriving

SPN 1814/FMI 9	
Description	VDC1 Message Missing
Monitored Parameter	
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key OFF for Five Minutes, then Key ON, Engine OFF

Note : The Common Powertrain Controller (CPC) digital outputs have the same SPN as some Motor Control Module (MCM) faults. DiagnosticLink® Standard makes the distinction between the MCM and CPC when diagnosing a fault.

Check as follows:

1. Check for multiple codes. Are Common Powertrain Controller (CPC) SPN 168/FMI (any) (battery voltage) (Charging System) faults present?
   - 1.a Yes; troubleshoot these first.
   - 1.b No; Go to step 2.
2. Are Controller Area Network (CAN) line faults SPN 625/FMI (any) present?
   - 2.a Yes; repair the Controller Area Network (CAN) line faults.
   - 2.b No; Go to step 3.
3. Has the Common Powertrain Controller (CPC) been recently reprogrammed?
   - 3.a Yes; ensure the parameters are configured correctly for the vehicle application; refer to the Application and Installation Manual for the correct parameter configuration.
   - 3.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

SPN 1845 (CPC) (GHG17)

189.1 SPN 1845/FMI 9 - GHG17

J1939 TCFG2 Message is Missing

SPN 1845/FMI 9	
Description	J1939 TCFG2 signal is Missing
Monitored Parameter	This codes sets when the J1939 message is not received
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, Engine OFF

Check as follows:

1. Check for multiple codes. Is (CPC) SPN 168/FMI 0/14/18 (battery voltage) present?
   - 1.a Yes; troubleshoot these first.
   - 1.b No; Go to step 2.
2. Is Motor Control Module (MCM) SPN 625/FMI 9 present?
   - 2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   - 2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   - 3.a Yes; check the proper configuration of the CPC.
   - 3.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

SPN 2000 (MCM) (GHG17)

190.1 SPN 2000/FMI 9 - GHG17

Communication loss with a Common Powertrain Controller (CPC) module (CPC heartbeat message is no longer arriving)

SPN 2000/FMI 9	
Description	CPC Module has Lost Communication
Monitored Parameter	CAN Communication
Typical Enabling Conditions	
Monitor Sequence	
Execution Frequency	
Typical Duration	
Dash Lamps	
Engine Reaction	MIL, CEL
Verification	Limp mode, Shut-down condition

Check as follows:

1. Are there any battery voltage faults present (SPN 168/FMI any)?
   - 1.a Yes; troubleshoot battery voltage faults first.
   - 1.b No; Go to step 2.
2. Have the Aftertreatment Control Module (ACM), Motor Control Module (MCM) or Common Powertrain Controller (CPC) been recently programmed?
   - 2.a Yes; clear the fault codes. If faults do not become active, release the vehicle. If faults become active, Go to step 3.
   - 2.b No; Go to step 3.
3. Disconnect the CPC connector #3.

⚠ WARNING

ELECTRICAL SHOCK

To avoid injury from electrical shock, follow OEM furnished operating instructions prior to usage.

4. Check the CPC internal terminating resistor by measuring and recording the resistance across pins 19 and 21 of the CPC connector cavity #3, component side. Is the resistance 110 to 130 ohms?

4.a Yes, Go to step 5.

4.b No, replace the CPC.

5. Disconnect the MCM 21 pin connector and inspect connector for corrosion, oil, fuel or water intrusion. Is contamination found?

5.a Yes, repair as necessary.

5.b No, Go to step 6.

6. Measure and record the resistance between CPC connector #3, pin 19 and MCM 21-pin connector pin 19. Is the resistance less than 5 ohms?

6.a Yes, Go to step 7.

6.b No, repair the wire between CPC connector #3, pin 19 and MCM 21-pin connector pin 19.

7. Measure and record the resistance between CPC connector #3, pin 21 and MCM 21-pin connector pin 13. Is the resistance less than 5 ohms?

7.a Yes, Go to step 8.

7.b No, repair the wire between CPC connector #3, pin 21 and MCM 21-pin connector pin 13.

8. Turn the ignition ON (key ON, engine OFF).

9. Measure the voltage between MCM 21-pin connector pins 7, 11, 12, 14, and 15 (ignition/battery voltage) and ground. Is voltage within 1.5 volts of the battery voltage?
   - 9.a Yes, Go to step 10.
   - 9.b No, Repair the circuit in question.
10. Turn the ignition OFF.
11. Measure the resistance between MCM 21-pin connector pins, 5, 6, 8 and 9 of the negative battery post. Is resistance less than 5 ohms?
   - 11.a Yes, Go to step 12.
   - 11.b No, Repair the circuit in question.
12. Install a test MCM. Is communication restored (fault inactive)?
   - 12.a Yes. replace the MCM.
   - 12.b No, replace the CPC.

SPN 2003 (CPC) (GHG17)

191.1 SPN 2003/FMI 9 - GHG17

SPN 2003/FMI 9	
Description	J1939 Signal Missing
Monitored Parameter	This code sets when the J1939 message is not received
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, Engine OFF

Check as follows:

1. Check for multiple codes. Is (CPC) SPN 168/FMI 0/14/18 (battery voltage) present?
   - 1.a Yes; troubleshoot these first.
   - 1.b No; Go to step 2.
2. Is Motor Control Module (MCM) SPN 625/FMI 9 present?
   - 2.a Yes; troubleshoot and repair Controller Area Network (CAN) line.
   - 2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   - 3.a Yes; check the proper configuration of the CPC.
   - 3.b No; connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

SPN 2011 (CPC) (GHG17)

192.1 SPN 2011/FMI 9 - GHG17

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   1.a Yes; repair the battery voltage concern. Verify repair.
   1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   2.b No; Go to step 3.
3. Has the Common Powertrain Controller (CPC) been recently programmed? Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   3.a Yes; refer to the OEM diagnostics for troubleshooting the loss of communication to the ABS module.
   3.b No; correct the information as necessary. Verify repair.

SPN 2017 (CPC) (GHG17)

193.1 SPN 2017/FMI 9 - GHG17

SPN 2017/FMI 9	
Description	J1939 Message is Missing from Source Address 17 (dec)
Monitored Parameter	CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition Cycle

Check as follows:

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   1.a Yes; repair the battery voltage concern. Verify repair.
   1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   2.b No; Go to step 3.
3. Has the Common Powertrain Controller (CPC) been recently programmed? Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   3.a Yes; refer to the OEM diagnostics for troubleshooting the loss of communication to the ABS module.
   3.b No; correct the information as necessary. Verify repair.

SPN 2023 (CPC) (GHG17)

194.1 SPN 2023/FMI 9 - GHG17

SPN 2023/FMI 9	
Description	J1939 Message is Missing from Source Address 23 (dec)
Monitored Parameter	CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always enabled
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition Cycle

Check as follows:

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   1.a Yes; repair the battery voltage concern. Verify repair.
   1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   2.b No; Go to step 3.
3. Has the Common Powertrain Controller (CPC) been recently programmed? Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   3.a Yes; refer to the OEM diagnostics for troubleshooting the loss of communication to the ABS module.
   3.b No; correct the information as necessary. Verify repair.

SPN 2025 (CPC) (GHG17)

195.1 SPN 2025/FMI 9 - GHG17

SPN 2025/FMI 9	
Description	J1939 Message is Missing from Source Address 25 (dec)
Monitored Parameter	CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition Cycle

Check as follows:

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   - 1.a Yes; repair the battery voltage concern. Verify repair.
   - 1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   - 2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   - 2.b No; Go to step 3.
3. Has the Common Powertrain Controller (CPC) been recently programmed? Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   - 3.a Yes; refer to the OEM diagnostics for troubleshooting the loss of communication to the ABS module.
   - 3.b No; correct the information as necessary. Verify repair.

SPN 2033 (CPC) (GHG17)

196.1 SPN 2033/FMI 9 - GHG17

SPN 2033/FMI 9	
Description	J1939 Message is Missing from Source Address 33 (dec)
Monitored Parameter	CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition Cycle

Check as follows:

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   1.a Yes; repair the battery voltage concern. Verify repair.
   1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   2.b No; Go to step 3.
3. Has the Common Powertrain Controller (CPC) been recently programmed? Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   3.a Yes; refer to the OEM diagnostics for troubleshooting the loss of communication to the ABS module.
   3.b No; correct the information as necessary. Verify repair.

SPN 2042 (CPC) (GHG17)

197.1 SPN 2042/FMI 9 - GHG17

SPN 2042/FMI 9	
Description	J1939 message is Missing from Source Address 42 (dec)
Monitored Parameter	CAN communication
Typical Enabling Conditions	Always enabled
Monitor Sequence	None
Execution Frequency	Always enabled
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition cycle

Check as follows:

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   1.a Yes; repair the battery voltage concern. Verify repair.
   1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   2.b No; Go to step 3.
3. Has the Common Powertrain Controller (CPC) been recently reprogrammed? Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   3.a Yes; refer to the OEM diagnostics for troubleshooting the loss of communication to the ABS module.
   3.b No; correct the information as necessary. Verify repair.

SPN 2049 (CPC) (GHG17)

198.1 SPN 2049/FMI 9 - GHG17

SPN 2049/FMI 9	
Description	J1939 Message is Missing from Source Address 49 (dec)
Monitored Parameter	CAN communication
Typical Enabling Conditions	Always enabled
Monitor Sequence	None
Execution Frequency	Always enabled
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition cycle

Check as follows:

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   1.a Yes; repair the battery voltage concern. Verify repair.
   1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   2.b No; Go to step 3.
3. Has the Common Powertrain Controller (CPC) been recently programmed? Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   3.a Yes; refer to the OEM diagnostics for troubleshooting the loss of communication to the ABS module.
   3.b No; correct the information as necessary. Verify repair.

SPN 2596 (CPC) (GHG17)

199.1 SPN 2596/FMI 9 - GHG17

J1939 CM1 Message (Maximum Vehicle Speed Limit) is Missing or Not Available

SPN 2596/FMI 9	
Description	Maximum Vehicle Speed Limit is Missing
Monitored Parameter	J1939 Powertrain Message
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On Engine On

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Is SPN 625/FMI 9 fault code present?
   - 1.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   - 1.b No; Go to step 2.
2. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   - 2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.
   - 2.b No; reprogram the CPC with the correct information as necessary. To verify repair, Go to step 3.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink . Wait five minutes for all modules to power down. Verify repair.

SPN 2623 (CPC) (GHG17)

200.1 SPN 2623/FMI 2 - GHG17

Accelerator Pedal "In-Range" Fault

SPN 2623/FMI 2	
Description	Pedal Position Sensors Deviation Too High
Monitored Parameter	GAS1, GAS2
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key Cycle - Ignition ON

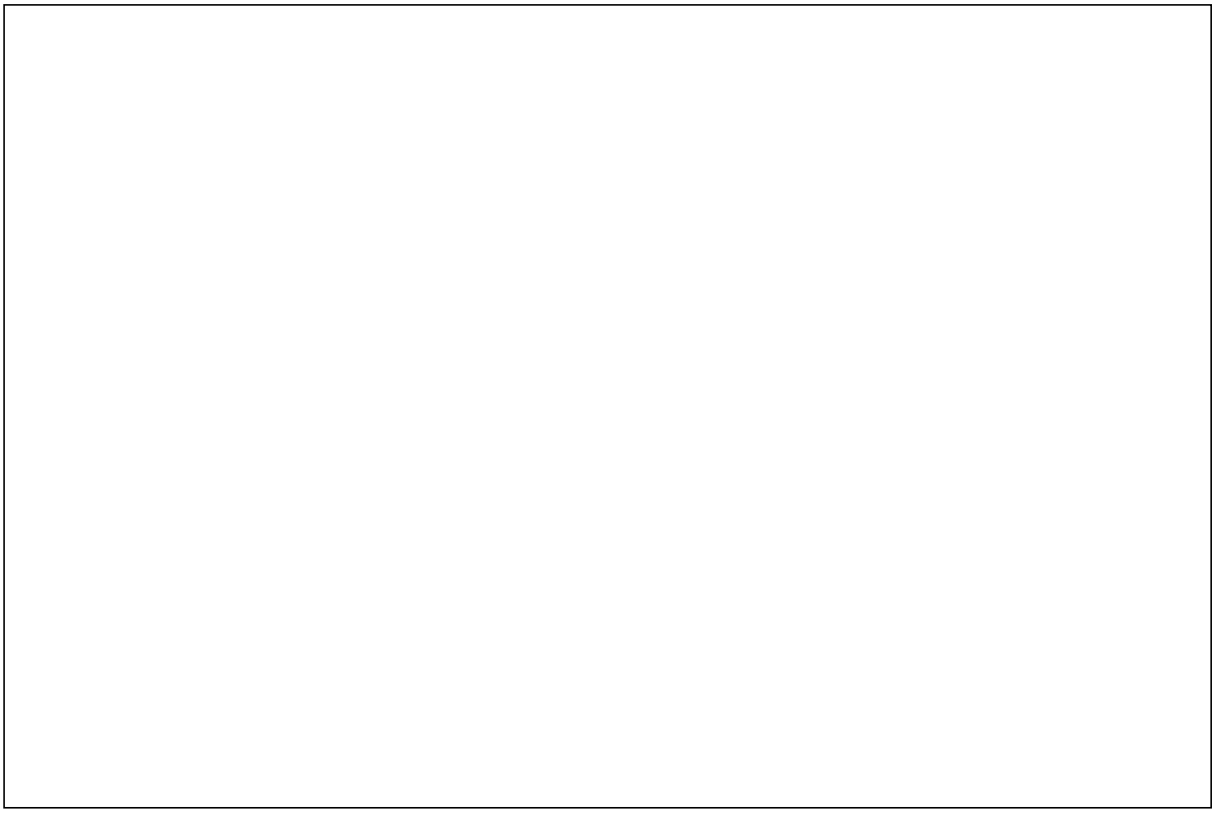


Fig 200.1, Analog Pedal Type

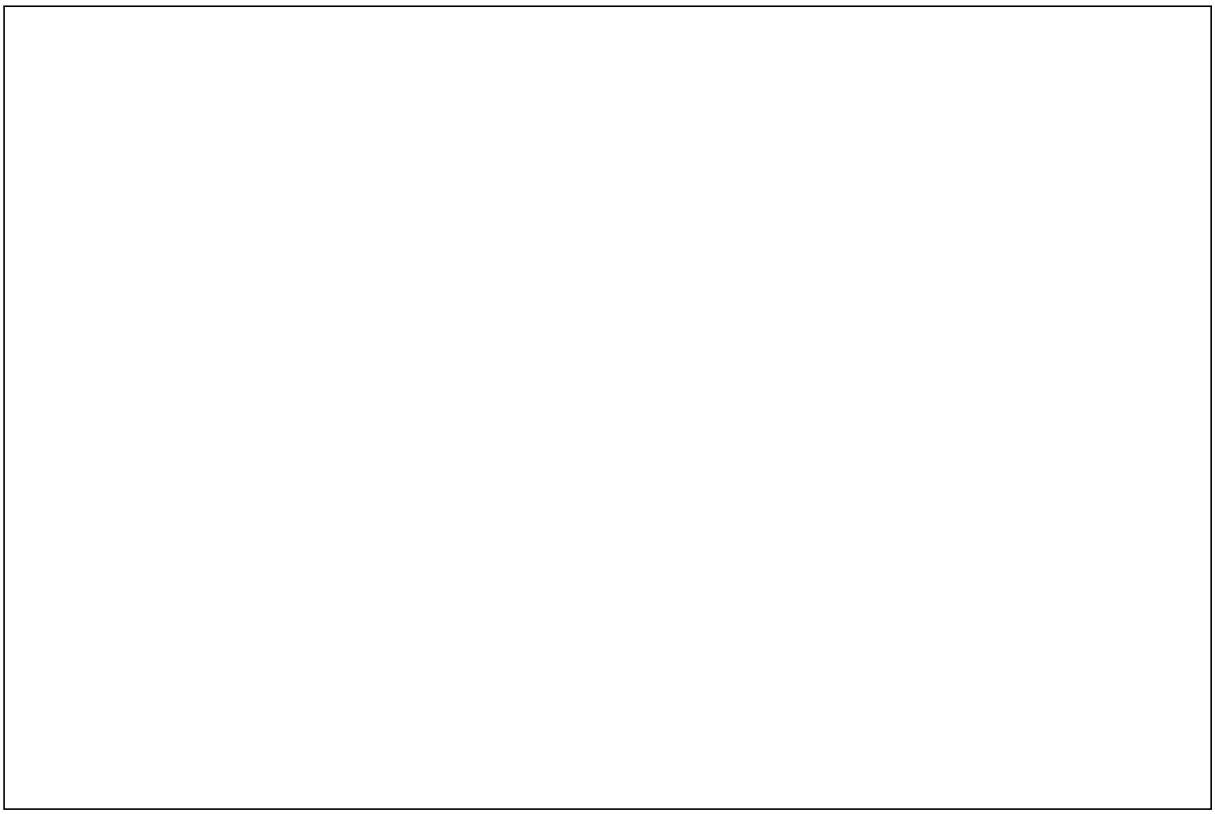


Fig 200.2, Dual-Channel Analog Pedal

Williams Dual-Channel Pedal Connector and Pinout				
Function	CPC Pinout	Connector Pinout	Comments	Connector Body
APS1	1/7	A	Sensor 1	
GND1	1/4	B	APS 1 GND	
VCC1 (+5V)	1/8	C	APS1 Power Supply	
VCC2 (+5V)	3/3	D	APS2 Power Supply	
GND2	3/2	E	APS2 GND	
APS2	4/14	F	Sensor 2	

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Connect DiagnosticLink ; are any SPN 91/FMI 0, FMI 2, FMI 4, or FMI 8 fault codes active?
   2.a Yes; troubleshoot any other faults first.
   2.b No; Go to step 3.
3. Check for proper configuration of the CPC against the server information. Does the CPC pedal type have the proper configuration?
   3.a Yes; Go to step 4.
   3.b No; reprogram the CPC with the correct information as necessary. Verify repair.
4. Disconnect the AP.
5. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

5.a Yes; repair as necessary. Verify repair.

5.b No; Go to step 6.

6. Measure the voltage between pin B of the AP harness connector and ground. Is voltage present?

6.a Yes; repair a short to power between pin B of the AP harness connector and pin 4 of the CPC #1 connector. Verify repair.

6.b No; Go to step 7.

7. Measure the voltage between pin A of the AP harness connector and ground. Is voltage present?

7.a Yes; repair a short to power between pin A of the AP harness connector and pin 7 of the CPC #1 connector. Verify repair.

7.b No; Go to step 8.

8. Is the vehicle equipped with a Williams Dual-Channel Analog Pedal?

8.a Yes; Go to step 9.

8.b No; Go to step 11.

9. Measure the voltage between pin F of the AP harness connector and ground. Is voltage present?

9.a Yes; repair a short to power between pin F of the AP harness connector and pin 14 of the CPC #4 connector. Verify repair.

9.b No; Go to step 10.

10. Measure the voltage between pin E of the AP harness connector and ground. Is voltage present?

10.a Yes; repair a short to power between pin E of the AP harness connector and pin 2 of the CPC #3 connector. Verify repair.

10.b No; Go to step 12.

11. Measure the voltage between pin F of the AP harness connector and ground. Is voltage present?

11.a Yes; repair a short to power between pin F of the AP harness connector and pin 2 of the CPC #2 connector. Verify repair.

11.b No; Go to step 12.

12. Reconnect the AP.

13. Using DiagnosticLink, monitor PWM Pedal Signal GAS1 and PWM Pedal Signal GAS2 under the Instrumentation/Chart tab.

14. Cycle Accelerator Pedal (AP) slowly several times with a full sweep from top to bottom of travel. Does voltage sweep smoothly in relation to pedal travel? Do the percentages sweep smoothly in relation to pedal travel?

14.a Yes; Go to step 15.

14.b No; replace the AP. Refer to Original Equipment Manufacturer (OEM) literature.

15. Clear codes and cycle ignition OFF.

16. Turn the ignition ON (key ON, engine OFF).

17. Does the code return?

17.a Yes; replace the AP, clear codes and verify repair. Refer to Original Equipment Manufacturer's (OEM) literature.

17.b No; Go to step 18.

18. Gently wiggle pedal and harness connector to simulate road vibration.

NOTICE

Do not tap on AP with metal object or tool as this may damage component.

NOTICE

A second technician may be required to monitor values during wiggle testing.

19. While performing wiggle test, monitor PWM Pedal Signal GAS1 and PWM Pedal Signal GAS2 under the DiagnosticLink Instrumentation/Chart tab.
20. Cycle AP slowly several times with a full sweep from top to bottom of travel. Do the percentages sweep smoothly in relation to pedal travel?
    - 20.a Yes; Go to step 21.
    - 20.b No; replace the AP, clear codes and verify repair. Refer to Original Equipment Manufacturer (OEM) literature.
21. Gently wiggle the Common Powertrain Controller (CPC) harness connectors to simulate road vibration.
22. While performing wiggle test, monitor PWM Pedal Signal GAS1 and PWM Pedal Signal GAS2 under the DiagnosticLink Instrumentation/Chart tab.
23. Cycle AP slowly several times with a full sweep from top to bottom of travel. Do the percentages sweep smoothly in relation to pedal travel?
    - 23.a Yes; Go to step 24.
    - 23.b No; isolate that section of harness and inspect for wire chaffing, corrosion, improper connections or physical damage and repair as necessary. Verify repair.
24. Disconnect the CPC #1 connector.
25. Disconnect the CPC #3 connector.
26. Disconnect the CPC #4 connector.
27. Inspect the CPC and the harness connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connectors. Is any damage found?
    - 27.a Yes; repair as necessary. Verify repair.
    - 27.b No; replace the AP, clear codes and verify repair. Refer to Original Equipment Manufacturer (OEM) literature. Verify repair.

200.2 SPN 2623/FMI 8 - GHG17

2-Channel Accelerator Pedal Signal 2 Missing

SPN 2623/FMI 8	
Description	Channel 2 Sensor Signal Failed (High Or Low)
Monitored Parameter	GAS2
Typical Enabling Conditions	Always ON
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key Cycle - Ignition ON

⚠ WARNING

ENGINE EXHAUST

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

Fig 200.3, Analog Pedal Type

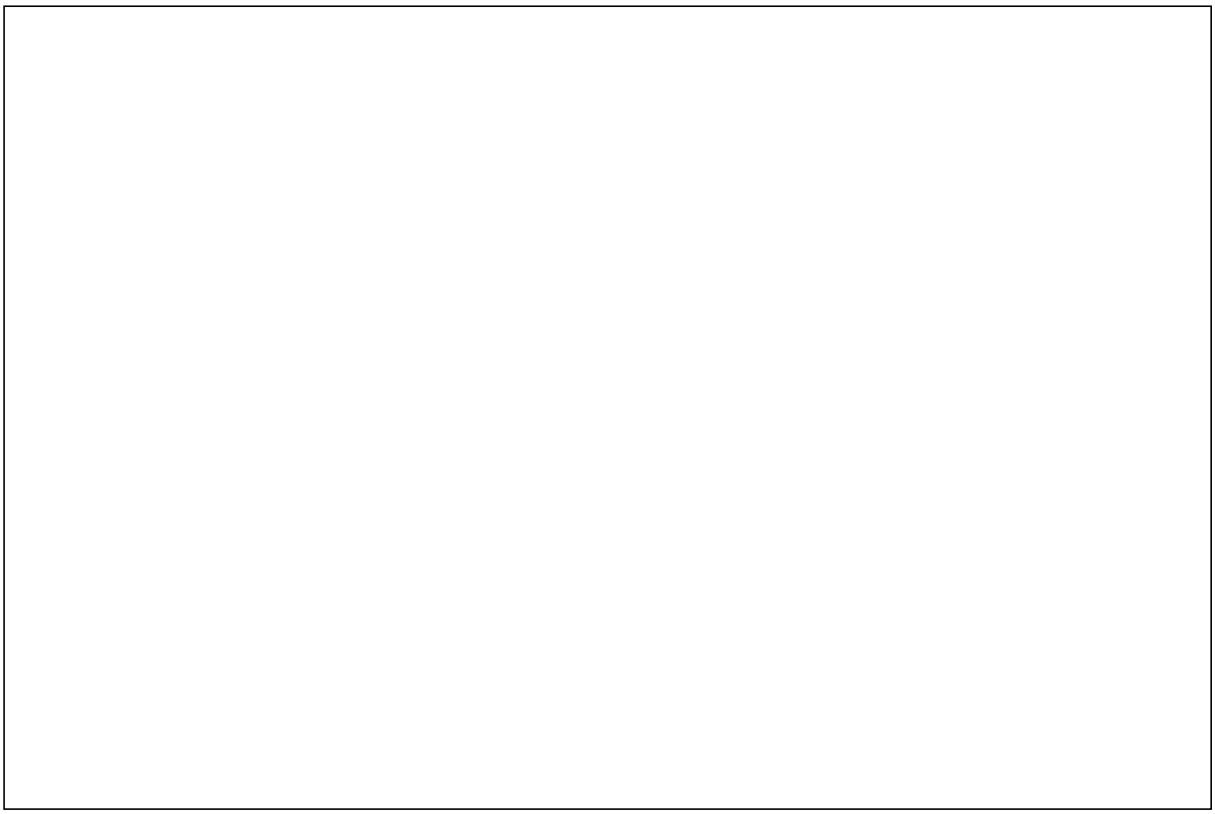


Fig 200.4, Dual-Channel Analog Pedal

Williams Dual-Channel Pedal Connector and Pinout				
Function	**CPC Pinout**	**Connector Pinout**	**Comments**	**Connector Body**
APS1	1/7	A	Sensor 1	
GND1	1/4	B	APS 1 GND	
VCC1 (+5V)	1/8	C	APS1 Power Supply	
VCC2 (+5V)	3/3	D	APS2 Power Supply	
GND2	3/2	E	APS2 GND	
APS2	4/14	F	Sensor 2	

Check as follows:

1. Disconnect the Accelerator Pedal (AP).
2. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   2.a Yes; repair as necessary. Verify repair.

   2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin B of the AP harness connector and ground. Is voltage present?

   4.a Yes; repair the short to power between pin B of the AP harness connector and pin 4 of the CPC connector #1. Verify repair.

   4.b No; Go to step 5.
5. Is the vehicle equipped with a Williams Dual-Channel Analog Pedal?

5.a Yes; Go to step 6.

5.b No; Go to step 15.

6. Disconnect the CPC connector #3.
7. Measure the resistance between pin D of the AP harness connector and pin 3 of the CPC connector #3. Is the resistance less than five ohms?

7.a Yes; reconnect the CPC connector #3. Go to step 8.

7.b No; repair the open circuit between pin D of the AP harness connector and pin 3 of the CPC connector #3. Verify repair.

8. Measure the voltage between pin D of the AP harness connector and ground. Is the voltage between 4.5 and 5.5 volts?

8.a Yes; repair the open circuit between pin E of the AP harness connector and pin 2 of the CPC connector #3. Verify repair.

8.b No; Go to step 9.

9. Measure the voltage between pin D of the AP harness connector and ground. Is voltage greater than 5.5 volts?

9.a Yes; repair the short to battery power between pin D of the AP harness connector and pin 3 of the CPC connector #3. Verify repair.

9.b No; Go to step 10.

10. Measure the voltage between pin E of the AP harness connector and ground. Is voltage present?

10.a Yes; repair the short to power between pin E of the AP harness connector and pin 2 of the CPC connector #3. Verify repair.

10.b No; Go to step 11.

11. Disconnect the CPC connector #4.
12. Measure the resistance between pin F of the AP harness connector and pin 14 of the CPC connector #4. Is the resistance less than five ohms?

12.a Yes; reconnect the CPC connector #4. Go to step 13.

12.b No; repair the open circuit between pin F of the AP harness connector and pin 14 of the CPC connector #4. Verify repair.

13. Measure the resistance between pin F of the AP harness connector and ground. Is the resistance greater than 10K ohms?

13.a Yes; Go to step 14.

13.b No; repair the short to ground circuit between pin F of the AP harness connector and pin 14 of the CPC connector #4 . Verify repair.

14. Measure the voltage between pin F of the AP harness connector and ground. Is voltage present?

14.a Yes; repair the short to power between pin F of the AP harness connector and pin 14 of the CPC connector #4. Verify repair.

14.b No; replace the AP. Refer to Original Equipment Manufacturer (OEM) literature.

15. Disconnect the CPC connector #2.
16. Measure the resistance between pin F of the AP harness connector and pin 2 of the CPC connector #2. Is the resistance less than five ohms?

16.a Yes; reconnect the CPC connector #2. Go to step 17.

16.b No; repair the open circuit between pin F and pin 2 of the CPC connector #2 . Verify repair.

17. Measure the voltage between pin F of the AP harness connector and ground. Is voltage present?

17.a Yes; repair the short to power between pin F of the AP harness connector and pin 2 of the CPC connector #2. Verify repair.

17.b No; replace the AP. Refer to Original Equipment Manufacturer (OEM) literature. Verify repair.

200.3 SPN 2623/FMI 14 - GHG17

2-Channel Accelerator Pedal GAS1 and GAS2 Signal Missing

SPN 2623/FMI 14	
Description	PWM Pedal Signal is Missing
Monitored Parameter	CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition Cycle

Check as follows:

1. Turn the ignition ON (key ON, engine OFF) .
2. Connect DiagnosticLink® and check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   - 2.a Yes; repair the battery voltage concern. Verify repair.
   - 2.b No; Go to step 3.
3. Is SPN 625/FMI 9 fault code present?
   - 3.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   - 3.b No; Go to step 4.
4. Check for proper configuration of the CPC against the server information . Does the CPC pedal type have the proper configuration?
   - 4.a Yes; refer to the OEM diagnostics for troubleshooting the loss of communication to the ABS module.
   - 4.b No; reprogram the CPC with the correct information as necessary. Verify repair.

SPN 2623 (CPC3) (GHG17)

201.1 SPN 2623/FMI 8 - GHG17

Check as follows:

1. Disconnect the Accelerator Pedal (AP).
2. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   2.a Yes; repair as necessary. Verify repair.

   2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).

Williams Dual-Channel Pedal Connector and Pinout				
Function	CPC3 Cavity	Pedal Connector Pin	Comments	Pedal Harness Connector Body
APS1	2/3	A	SENSOR 1	
GND1	2/20	B	APS1 GND	
VCC1 (+5V)	2/15	C	APS1 Power Supply	
VCC2 (+5V)	2/21	D	APS2 Power Supply	
GND2	2/14	E	APS2 GND	The image above is the front side looking into the pins on the Harness Connector.
APS2	2/4	F	SENSOR 2	Harness Connector and Seal (P/N: 12066317) Terminal Female (P/N: 12103881)

4. Measure the voltage between pins D and E of the AP harness connector. Is the voltage between 4.5 and 5.5 volts?

   4.a Yse; Go to step 6.

   4.b No; Go to step 5.

5. Measure the voltage between pin D of the AP harness connector and ground. Is the voltage between 4.5 and 5.5 volts?

5.a Yes; repair the open circuit between pin E of the AP harness connector and pin 14 of the CPC3 connector #2. Verify repair.

5.b No; repair the circuit between pin D of the AP harness connector and pin 21 of the CPC3 connector #2. Verify repair.

6. Measure the voltage between pin F of the AP harness connector and ground. Is any voltage present?

6.a Yes; repair the short to power between pin F of the AP harness connector and pin 4 of the CPC3 connector #2. Verify repair.

6.b No; Go to step 7.

7. Turn the ignition OFF.

8. Disconnect the CPC3 connector #2.

9. Inspect the CPC3 connector #2 and the harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

9.a Yes; repair as necessary. Verify repair.

9.b No; Go to step 10.

10. Measure the resistance between pin F of the AP harness connector and pin 4 of the CPC3 connector #2. Is the resistance less than five ohms?

10.a Yes; Go to step 11.

10.b No; repair the circuit between pin F of the AP harness connector and pin 4 of the CPC3 connector #2. Verify repair.

11. Measure the resistance between pin F of the AP harness connector and ground. Is the resistance greater than 10K ohms?

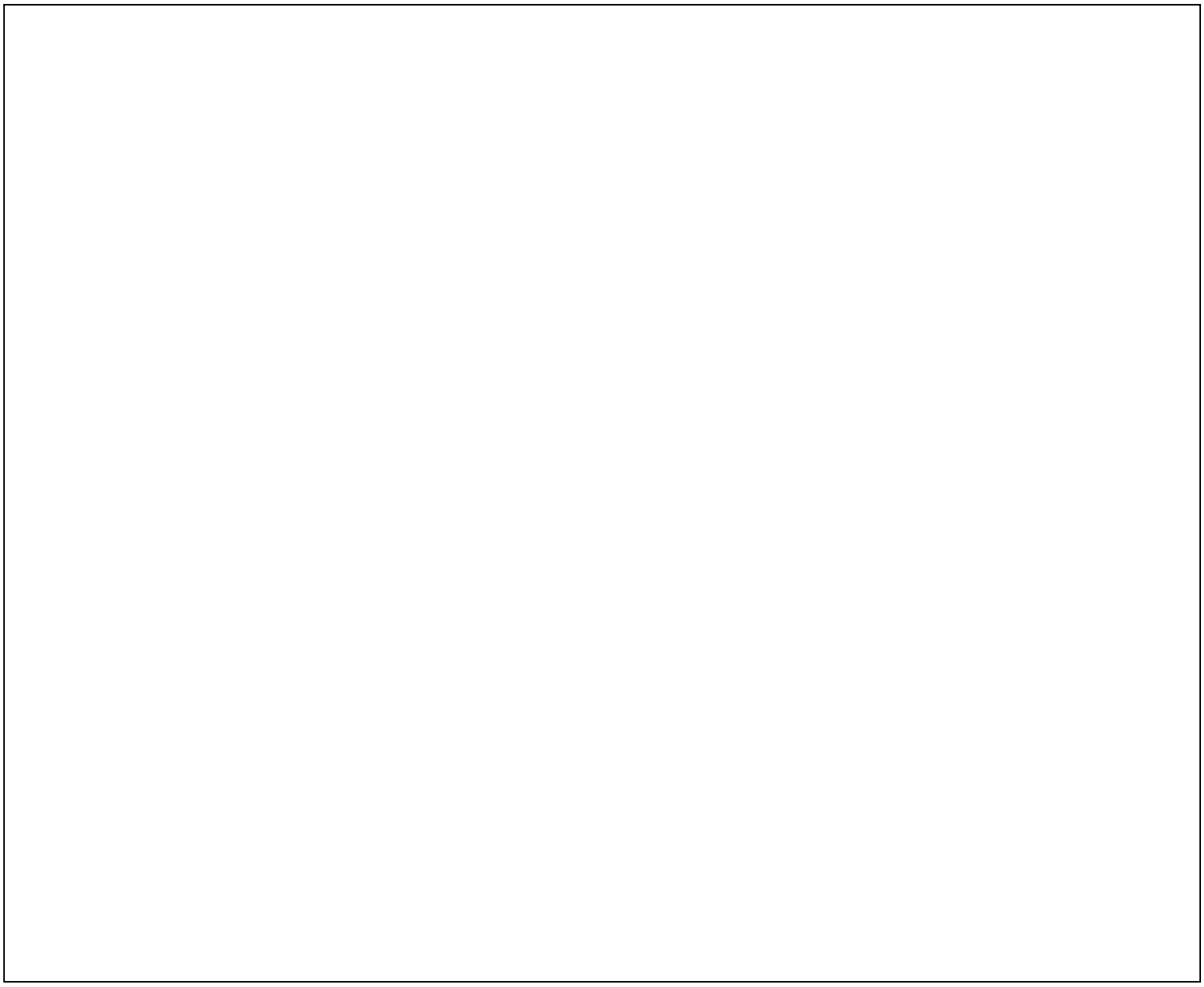
11.a Yes; replace the AP. Verify repair.

11.b No; repair the shorted circuit between pin F of the AP harness connector and pin 4 of the CPC3 connector #2.

SPN 2630 (MCM) (GHG17)

202.1 SPN 2630/FMI 3 - GHG17

SPN 2630/FMI 3	
Description	Charge Air Cooler (CAC) Short to Voltage or Open
Monitored Parameter	CAC Outlet Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine Idle (One Minute)



Note : The Charge Air Cooler (CAC) outlet temperature sensor is referred to as the intake air temperature sensor in some documentation.

> **WARNING**
>
> PERSONAL INJURY
>
> Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple codes. Are there any additional circuit failed high (FMI 3) codes for fuel rail pressure sensor and the oil separator speed sensor?
   - 3.a Yes; repair short to power or open circuit between pin 102 of the Motor Control Module (MCM) 120-pin connector and the CAC outlet temperature sensor, fuel rail pressure sensor and oil separator speed sensor.
   - 3.b No; Go to step 4.
4. Disconnect the CAC outlet temperature sensor.
5. Inspect the sensor harness for bent, spread, or corroded pins. Is damage present?
   - 5.a Yes; repair as necessary. Verify repair.
   - 5.b No; Go to step 7.
6. Measure the voltage between pin 3 of the CAC outlet temperature sensor and ground. Is the voltage less than 2.75 volts?
   - 6.a Yes; repair the open circuit between pin 3 of the CAC outlet temperature sensor harness connector and pin 119 of the MCM 120-pin connector.
   - 6.b No; Go to step 7.
7. Measure the voltage between pin 4 of the CAC outlet temperature sensor harness connector and ground. Is the voltage less than 2.75 volts?
   - 7.a Yes; Go to step 8.
   - 7.b No; repair the short to power between pin 4 of the CAC outlet temperature sensor harness connector and pin 102 of the MCM 120-pin connector.
8. Measure the resistance between pin 4 of the CAC outlet temperature sensor harness connector and ground. Is the resistance less than five ohms?
   - 8.a Yes; Go to step 9.
   - 8.b No; repair the open circuit between pin 4 of the CAC outlet temperature sensor harness connector and pin 102 of the MCM 120-pin connector.
9. Disconnect the MCM 120-pin connector and measure the resistance between pins 4 and 3 of the coolant outlet temperature sensor harness connector. Is the resistance greater than 10k ohms?
   - 9.a Yes; replace CAC Outlet Temperature Sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" .
   - 9.b No; repair the short between pins 102 and 119 of the MCM 120-pin connector.

202.2 SPN 2630/FMI 4 - GHG17

Intake air temperature circuit failed low

Repair the short to ground between pin 2 of the intake air temperature sensor harness connector and pin 119 of the Motor Control Module (MCM) 120–pin connector.

202.3 SPN 2630/FMI 14 - GHG17

Charge Air Cooler Outlet Sensor Signal Not Plausible

SPN 2630/FMI 14	
Description	This fault code sets when the Motor Control Module (MCM) detects that the charge air cooler temperature is greater than 20°C (36°F) degrees from the expected temperature after the engine has been turned off for 8 hours.
Monitored Parameter	Charge Air Cooler outlet temperature
Typical Enabling Conditions	Key ON, engine OFF, battery voltage greater than 11.08 volts, engine rpm at zero, ambient temperature less than 40°C (104°F), engine OFF for no less than 8 hours.
Monitor Sequence	None
Execution Frequency	Once per cool down cycle
Typical Duration	5 seconds
Dash Lamps	MIL
Engine Reaction	25% derate, regen disabled
Verification	Road test the vehicle for 30 minutes until the coolant reaches operating temperature. Then verify that the Charge air cooler outlet temperature is within 15°C (27°F) of the intake air temperature.

1. Has the Common Powertrain Controller (CPC) recently been reprogrammed or has the internal clock time been changed?
   1.a Yes; this fault may have been caused by the change in the CPC time.
   1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Check for multiple fault codes. Are fault codes SPN 2630//FMI 3 or 4 present?
   4.a Yes; diagnose the other fault codes first.
   4.b No; Go to step 5.
5. Disconnect and inspect the Charge Air Cooler outlet temperature sensor electrical connector. Is there damage or corrosion present?
   5.a Yes; repair as necessary. Verify repair.
   5.b No; replace the Charge Air Cooler outlet temperature sensor. Verify repair.

SPN 2631 (MCM) (GHG17)

203.1 SPN 2631/FMI 1 - GHG17

Low Air Flow

SPN 2631/FMI 1			
Description	Insufficient Air Flow		
Monitored Parameter	Smoke Mode Operation		
Typical Enabling Conditions	General Enabling Condition: Engine is in Smoke Mode		
	Specific Enabling Conditions: See Table Below		
	Engine Parameter	Min	Max
	Engine Coolant Outlet Temperature	65°C (149°F)	
	Barometric Pressure (mbar)	755	
	Ambient Temperature	-8°C (18°F)	
Monitor Sequence	None		
Execution Frequency	Continuous When Enabling Conditions Met		
Typical Duration	13 Seconds		
Dash Lamps	MIL, CEL		
Engine Reaction	Derate 25%		
Verification	Once engine is at standard operating temperature, operate engine on highway, coast for 30 seconds and then snap throttle and keep throttle at 100% for a minimum of 15 seconds.		

Check as follows:

1. Connect DiagnosticLink .
2. Are any other faults including SPN 51/FMI (any) also present?
   - 2.a Yes; repair those faults first.
   - 2.b No; Go to step 3.
3. Inspect entire air intake system including the Charge Air Cooler (CAC) for loose clamps, leaks and/or restrictions. Are any air intake system leaks or restrictions found?
   - 3.a Yes; repair as necessary.
   - 3.b No; Go to step 4.
4. Compare intake manifold pressure to ambient pressure (Baro). Is the intake manifold pressure within 0.4 ambient pressure (Baro)?
   - 4.a Yes; Go to step 7.
   - 4.b No; Go to step 5.
5. Disconnect intake manifold pressure/temperature sensor.
6. Inspect intake manifold pressure/temperature sensor connector for bent, spread or corroded pins. Is damage present?
   - 6.a Yes; repair as necessary.
   - 6.b No; replace the intake manifold pressure/temperature sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" .
7. Using DiagnosticLink, monitor Exhaust Gas Recirculation (EGR) delta p voltage (pin 109).
8. Is the EGR delta p voltage between 0.55 and 0.83 volts?
   - 8.a Yes; Go to step 11.

8.b No; Go to step 9.

9. Remove the EGR delta p sensor from the mounting pad, leave electrical harness connected.
10. Is the EGR delta p voltage between 0.55 and 0.83 volts?

10.a Yes; Go to step 11.

10.b No; replace the EGR delta p sensor. Refer to section "Removal of the Delta P Sensor" .

11. Inspect the EGR delivery pipe delta p pressure ports for blockage. Is excessive build-up or blockage found?

11.a Yes; clean the venturi pipe and reinstall the sensor.

11.b No; Go to step 12.

12. Remove the EGR cooler hot pipe, EGR crossover pipe and delivery pipe and inspect for excessive build-up or blockage. Is excessive build-up or blockage found?

Refer to section "Removal of the Exhaust Gas Recirculation Hot Pipe"

Refer to section "Removal of the Exhaust Gas Recirculation Venturi"

12.a Yes; clean piping and replace EGR cooler.

12.b No; Go to step 13.

13. Using SCR voltage service routine, monitor the Diesel Oxidation Catalyst (DOC) inlet pressure (pin 87) and Diesel Particulate Filter (DPF) outlet pressure (pin 72) voltages with key ON, engine OFF.
14. Are the DOC inlet and DPF outlet pressure sensors voltages between .44 to .56 volts?

14.a Yes; Go to step 16.

14.b No; Go to step 15.

15. Is the voltage from step 14 greater than .56 volts?

15.a Yes; replace the suspect sensor.

15.b No; inspect electrical connections between suspect sensor connector and Aftertreatment Control Module (ACM) for bent, spread, or corroded pins. Repair as necessary.

16. Inspect the DOC and DPF pressure sensor tubes and elbows for leaks, kinks, or blockage. Is damage present?

16.a Yes; repair as necessary.

16.b No; Go to step 17.

17. Disconnect the turbo inlet elbow and outlet pipe, and inspect for signs of oil residue/contamination or foreign debris. Is contamination found?

17.a Yes; determine the source of the contaminations and repair as necessary.

17.b No; Go to step 18.

> **⚠ 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. Obtain a Regeneration log file and monitor the DOC Inlet and DPF Outlet Pressures. Refer to section "Performing a Parked Regeneration - GHG17" . Does the DOC inlet pressure ever go to zero during the regeneration?

18.a Yes; replace the DOC Inlet Pressure Sensor.

18.b No; Go to step 19.

19. Does the DOC Inlet pressure decrease during the regeneration?

19.a Yes; the DOC was plugged during the time the code logged causing a restriction. Clear the code and release the vehicle.

19.b No; the DOC is plugged. Perform a DOC Face Plug Cleaning service routine. Verify repairs.

203.1 SPN 2631/FMI 1 - GHG17

Low Air Flow

SPN 2631/FMI 1			
Description	This Fault Code Sets When the Engine is in Smoke Mode Control for an Excess Amount of Time Due to Inadequate Clean Airflow into the Engine		
Monitored Parameter	Smoke Mode Operation		
Typical Enabling Conditions	General Enabling Condition: Engine is in Smoke Mode		
	Specific Enabling Conditions: See Table Below		
	Engine Parameter	Min	Max
	Engine Coolant Outlet Temperature	65°C (149°F)	
	Barometric Pressure (mbar)	755	
	Ambient Temperature	-8°C (18°F)	
Monitor Sequence	None		
Execution Frequency	Continuous When Enabling Conditions Met		
Typical Duration	13 Seconds		
Dash Lamps	MIL, CEL		
Engine Reaction	Derate 25%		
Verification	Once Engine is at Standard Operating Temperature, Operate Engine on Highway, Coast for 30 Seconds and then Snap Throttle and Keep Throttle at 100% for a Minimum of 15 Seconds.		

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Is the vehicle equipped with a DD16 engine
   - 3.a Yes; Go to step 4.
   - 3.b No; Go to step 5.
4. Check for multiple fault codes. Are there any ITV fault codes present?
   - 4.a Yes; diagnose the other fault codes first.
   - 4.b No; Go to step 5.
5. Compare the Barometric pressure reading in the MCM to the local Barometric pressure. Is the Barometric pressure reading in the MCM within 6 kPa (1 psi) of the local Barometric pressure?
   - 5.a Yes; Go to step 6.
   - 5.b No; Replace the MCM.
6. Compare the intake manifold pressure sensor reading to the barometric pressure reading. Is the intake manifold pressure sensor reading within 10.3 kPa (1.5 psi) of the barometric pressure reading?
   - 6.a Yes; Go to step 8.
   - 6.b No; Go to step 7.
7. Disconnect and inspect the intake manifold pressure sensor electrical connector. Is there any damage or corrosion present?
   - 7.a Yes; repair the connector as necessary.
   - 7.b No; replace the intake manifold pressure sensor.
8. Monitor the EGR Delta Pressure sensor voltage. Is the voltage between 0.55 and 0.83 volts?
   - 8.a Yes; Go to step 15.
   - 8.b No; Go to step 9.

9. Turn the ignition OFF.
10. Disconnect and inspect the EGR Delta Pressure sensor electrical connector. Is there any damage, corrosion or fretting present?
    - 10.a Yes; replace the EGR Delta Pressure sensor and the pigtail. Verify repair.
    - 10.b No; Go to step 11.
11. Remove EGR Delta Pressure sensor from the mounting pad.
12. Reconnect the EGR Delta Pressure sensor electrical connector while the sensor is still removed.
13. Turn the ignition ON (key ON, engine OFF).
14. Monitor the EGR Delta Pressure sensor voltage again. Is the voltage between 0.55 and 0.83 volts?
    - 14.a Yes; clean the EGR Delta Pressure ports.
    - 14.b No; replace the EGR Delta Pressure sensor.
15. Monitor the Diesel Oxidation Catalyst (DOC) inlet pressure sensor voltage. Is the voltage between 0.44 and 0.56 volts?
    - 15.a Yes; Go to step 16.
    - 15.b No; replace the DOC inlet pressure sensor.

      For 1-Box™, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" . Verify repair.

      For 2-Box (2V2), Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" .Verify repair.
16. Disconnect and inspect the turbocharger inlet elbow and outlet pipe. Are there signs of oil residue, fluid contamination or debris?
    - 16.a Yes; replace the turbocharger. If the oil has contaminated the ATD, replace the ATD.
    - 16.b No; Go to step 17.
17. Remove and inspect the EGR delivery pipe, crossover pipe and hot pipe. Are there any restrictions present?
    - 17.a Yes; clean the EGR system components and reinstall the components.
    - 17.b No; reinstall the components. Go to step 18.
18. Disconnect and inspect the DOC inlet pressure sensor hose and sensor. Are there any restrictions present?
    - 18.a Yes; clean/replace the hose sensor as necessary.
    - 18.b No; Go to step 19.

> **⚠ 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.

19. Perform a parked regeneration. Obtain a Regeneration log file and monitor the DOC Inlet and DPF Outlet Pressures. Refer to section "Performing a Parked Regeneration - GHG17" . Does the DOC inlet pressure ever go to zero during the regeneration?
    - 19.a Yes; replace the DOC Inlet Pressure Sensor.

      For 1-Box™, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" .

      For 2-Box (2V2), Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" .
    - 19.b No; Go to step 20.
20. Does the DOC Inlet pressure decrease during the regeneration?
    - 20.a Yes; the DOC was plugged during the time the code logged causing a restriction. Clear the code and release the vehicle.

20.b No; the DOC is plugged. Perform a DOC Face Plug Cleaning service routine or use the air cleaning procedure. Refer to section "GHG17 Diesel Oxidation Catalyst Face Cleaning" and Refer to section "Diesel Oxidation Catalyst Air Cleaning" . Verify repairs.

SPN 2646 (CPC) (GHG17)

204.1 SPN 2646/FMI 3 - GHG17

SPN 2646/FMI 3	
Description	CPC Output 4 02 Short to Voltage
Monitored Parameter	CPC Output 4/02
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On With Output Activation

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ WARNING

PERSONAL INJURY

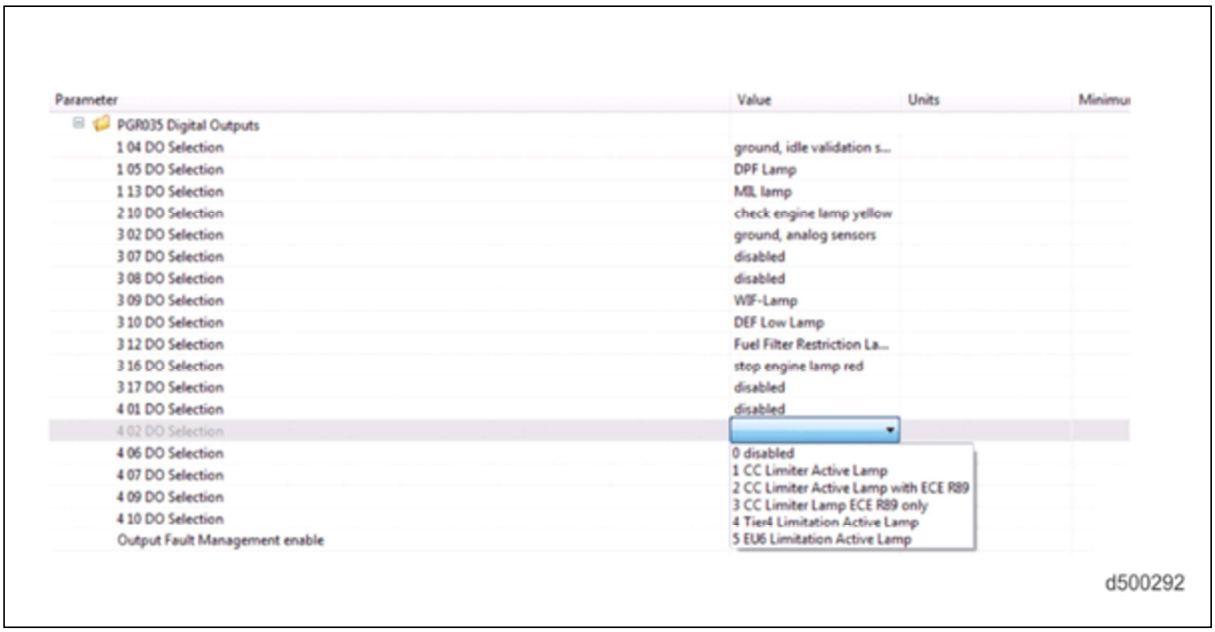
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

⚠ WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 02 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to power between pin 2 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

204.2 SPN 2646/FMI 4 - GHG17

SPN 2646/FMI 4	
Description	CPC Output 4 02 Short to Ground
Monitored Parameter	CPC Output 4/02
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On With Output Activation

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

WARNING

PERSONAL INJURY

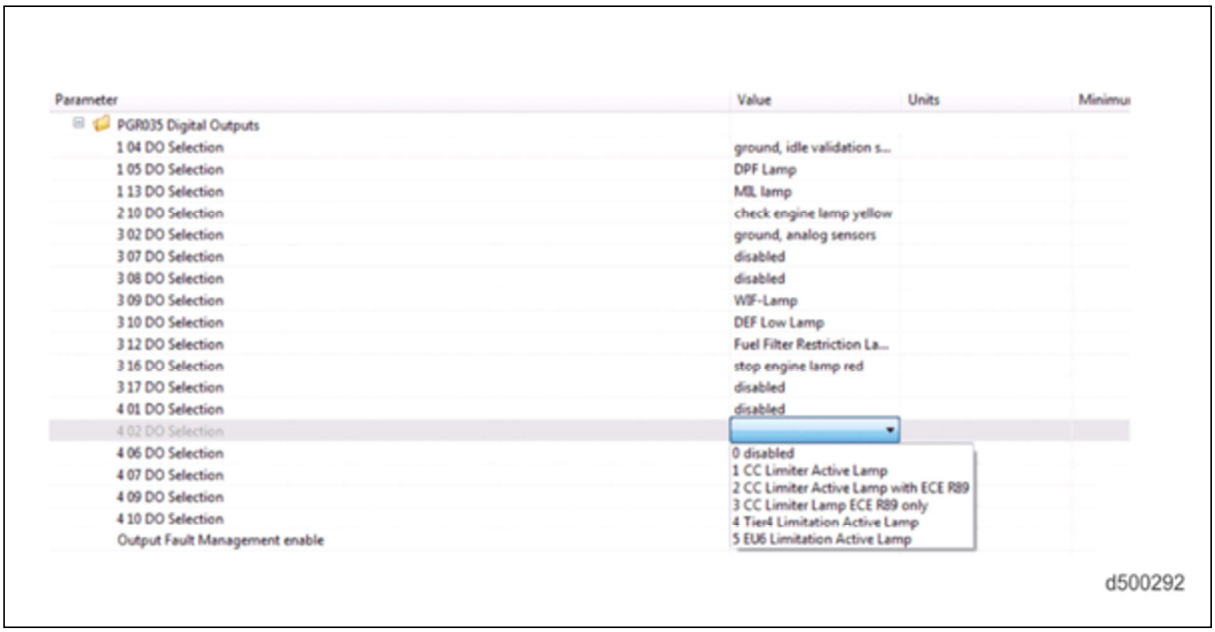
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 02 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to ground between pin 2 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

204.3 SPN 2646/FMI 5 - GHG17

SPN 2646/FMI 5	
Description	CPC Output 4 02 Open Circuit
Monitored Parameter	CPC Output 4/02
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On With Output Activation

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

WARNING

PERSONAL INJURY

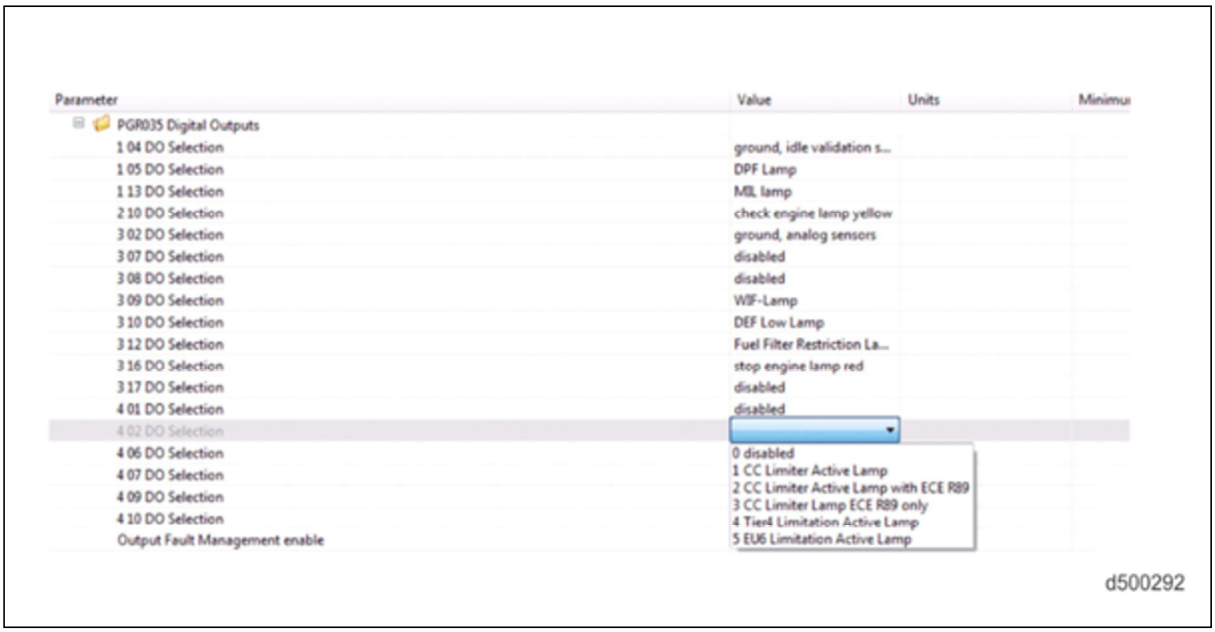
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 02 DO Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the open circuit between pin 2 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

SPN 2659 (MCM) (GHG17)

205.1 SPN 2659/FMI 0 - GHG17

Exhaust Gas Recirculation Flow Target Error Diagnostic - High Flow

SPN 2659/FMI 0	
Description	This fault code sets when the difference between the actual EGR flow and the commanded EGR flow is higher than a calibrated threshold.
Monitored Parameter	EGR Mass Flow
Typical Enabling Conditions	Desired EGR mass flow greater than .08, EGR in closed-loop control, CAC outlet temperature greater than 0°C (32°F), engine speed 1080 to 2500 rpm, engine torque 200 to 2500 N·m (148 to 1844 lb·ft), coolant temperature greater than 65°C (149°F), ambient temperature greater than -8°C (18°F) ambient, barometric pressure greater than 755 mbar (11 psi).
Monitor Sequence	None
Execution Frequency	Always Enabled.
Typical Duration	20 seconds
Dash Lamps	MIL, CEL
Engine Reaction	25% derate
Verification	Start engine, warm up such that coolant temperature greater than 65°C (149°F), ensure ambient temperature greater than -8°C (18°F) ambient and ambient barometric pressure greater than 755 mbar (11 psi).

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are any of the following fault codes present?

- SPN 411/FMI 2, FMI 3, FMI 4, FMI 13
- SPN 1636/FMI 3, FMI 4
- SPN 2791/FMI 2, FMI 7, FMI 9, FMI 11, FMI 12, FMI 13, FMI 14, FMI 16, FMI 18, FMI 31
- SPN 3563/FMI 3, FMI 4, FMI 10

3.a Yes; diagnose the other fault codes first.

3.b No; Go to step 4.

4. Check the DPF Zone; is the DPF zone zero?

4.a Yes; Go to step 5.

4.b No; perform a parked regeneration.

5. Monitor the EGR delta pressure voltage at Key ON, Engine OFF. Is the voltage between 0.55 and 0.83 volts?

5.a Yes; Go to step 12.

5.b No; Go to step 6.

6. Turn the ignition OFF.
7. Disconnect and inspect the EGR Delta Pressure sensor electrical connector. Is there damage, corrosion or fretting present?

7.a Yes; replace the Delta Pressure sensor and the pigtail. Refer to section "Removal of the Delta P Sensor" . Verify repair.

7.b No; Go to step 8.

8. Remove and inspect the EGR Delta Pressure sensor ports. Is there a restriction or contamination present?
   - 8.a Yes; clean the Delta Pressure sensor and clean the ports in the venturi pipe. Refer to section "Cleaning of the Exhaust Gas Recirculation Venturi Pipe Delta P Sensor Ports" . Verify repair.
   - 8.b No; Go to step 9.
9. Reconnect the EGR Delta Pressure sensor connector while the sensor is still removed from the venturi pipe.
10. Turn the ignition ON (key ON, engine OFF).
11. Monitor the EGR Delta Pressure voltage at Key ON, Engine OFF. Is the voltage between 0.55 and 0.83 volts?
    - 11.a Yes; clean the ports on the venturi pipe. Refer to section "Cleaning of the Exhaust Gas Recirculation Venturi Pipe Delta P Sensor Ports" . Verify repair.
    - 11.b No; replace the Delta Pressure sensor. Refer to section "Removal of the Delta P Sensor" . Verify repair.
12. Compare the barometric pressure reading to the local barometric pressure for your area. Is the barometric pressure within 69 mbar (1 psi) of the barometric pressure for your area?
    - 12.a Yes; Go to step 13.
    - 12.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repair.
13. Compare the Intake Manifold Pressure sensor reading to the Barometric pressure sensor reading. Is the Intake Manifold Pressure sensor reading within 103 mbar (1.5 psi) of the Barometric pressure reading?
    - 13.a Yes; Go to step 15.
    - 13.b No; Go to step 14.
14. Disconnect and inspect the Intake Manifold Pressure sensor electrical connector. Is there damage, corrosion or fretting present?
    - 14.a Yes; repair as necessary.
    - 14.b No; replace the Intake Manifold Pressure sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" . Verify repair.
15. Compare the intake manifold temperature to the Charge Air Cooler outlet temperature. Is the intake manifold temperature within plus or minus 10°C (18°F) of the Charge Air Cooler outlet temperature?
    - 15.a Yes; Go to step 17.
    - 15.b No; Go to step 16.
16. Disconnect and inspect the Intake Manifold Temperature sensor electrical connector. Is there any damage, corrosion or fretting present?
    - 16.a Yes; repair as necessary. Verify repair.
    - 16.b No; replace the Intake Manifold Temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .Verify repair.
17. Remove the EGR Delta Pressure sensor and inspect the ports. Is there a restriction or contamination present?
    - 17.a Yes; clean the Delta Pressure sensor and clean the ports in the venturi pipe. Refer to section "Cleaning of the Exhaust Gas Recirculation Venturi Pipe Delta P Sensor Ports" . Verify repair.
    - 17.b No; Go to step 18.
18. Remove and inspect the EGR hot pipe. Are there any restrictions present in the EGR hot pipe?
    - 18.a Yes; clean the EGR system.

      Refer to section "Cleaning of the Exhaust Gas Recirculation Venturi" .

      Then Go to step 19.
    - 18.b No; Go to step 19.
19. Move EGR pull rod back and forth while watching the EGR valve. Does the EGR flap move when the pull rod is moved back and forth?
    - 19.a Yes; replace the Delta p sensor. Refer to section "Removal of the Delta P Sensor" Verify repair.

19.b No; replace the EGR valve. Verify repair.

Refer to section "Removal of the Exhaust Gas Recirculation Hot Pipe"

Refer to section "Removal of the DD13 and DD15 Exhaust Gas Recirculation Valve"

Refer to section "Removal of the DD16 Exhaust Gas Recirculation Valve"

Refer to section "Removal of the DD13 and DD15 Exhaust Manifold" for the DD13 and DD15 engines.

205.2 SPN 2659/FMI 18 - GHG17

SPN 2659/FMI 18	
Description	This Fault Code Sets When the Difference Between the Actual Exhaust Gas Recirculation (EGR) Flow and the Commanded EGR Flow is Lower Than a Calibrated Threshold
Monitored Parameter	EGR Mass Flow
Typical Enabling Conditions	esired EGR mass flow greater than .08, EGR in closed-loop control, CAC outlet temperature greater than 0°C (32°F), engine speed 1080 to 2500 rpm, engine torque 200 to 2500 N·m (148 to 1844 lb·ft), coolant temperature greater than 65°C (149°F), ambient temperature greater than -8°C (18°F) ambient, barometric pressure greater than 755 mbar (11 psi)
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	20 seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Start engine, warm up so that coolant temperature is greater than 65°C (149°F), ensure ambient temperature greater than -8°C (18°F) ambient and ambient barometric pressure greater than 755 mbar (11 psi)

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are any of the following fault codes present?

- SPN 411/FMI 2, FMI 3, FMI 4, FMI 13
- SPN 1636/FMI 3, FMI 4
- SPN 2791/FMI 2, FMI 7, FMI 9, FMI 11, FMI 12, FMI 13, FMI 14, FMI 16, FMI 18, FMI 31
- SPN 3563/FMI 3, FMI 4, FMI 10

3.a Yes; diagnose the other fault codes first.

3.b No; Go to step 4.

4. Is the vehicle equipped with a DD13 engine?

4.a Yes; Go to step 5.

> **⚠ 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.

4.b No; performa parked regeneration.

5. Monitor the EGR delta P voltage at Key ON, Engine OFF. Is the voltage between 0.55 and 0.83 volts?

5.a Yes; Go to step 12.

5.b No; Go to step 6.

6. Turn the ignition OFF.
7. Disconnect and inspect the EGR delta P sensor electrical connector. Is there damage, corrosion or fretting present?

7.a Yes; replace the EGR delta P sensor and the pigtail. Refer to section "Removal of the Delta P Sensor" . Verify repair.

7.b No; Go to step 8.

8. Remove the EGR delta P sensor and inspect the ports. Refer to section "Removal of the Delta P Sensor" . Is there a restriction or contamination present?

8.a Yes; clean the EGR delta P sensor and clean the ports in the venturi pipe.

8.b No; Go to step 9.

9. Reconnect the EGR delta P sensor connector while the sensor is still removed from the venturi pipe.

10. Turn the ignition ON (key ON, engine OFF).

11. Monitor the EGR delta P voltage at Key ON, Engine OFF. Is the voltage between 0.55 and 0.83 volts?

11.a Yes; clean the ports on the venturi pipe.

11.b No; replace the delta P sensor. Refer to section "Removal of the Delta P Sensor" . Verify repair.

12. Compare the barometric pressure reading to the local barometric pressure for your area. Is the barometric pressure within 69 mbar (1 psi) of the barometric pressure for your area?

12.a Yes; Go to step 13.

12.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repair.

13. Compare the intake manifold pressure sensor reading to the barometric pressure sensor reading. Is the intake manifold pressure sensor reading within 103 mbar (1.5 psi) of the barometric pressure reading?

13.a Yes; Go to step 15.

13.b No; Go to step 14.

14. Disconnect and inspect the intake manifold pressure sensor electrical connector. Is there damage, corrosion or fretting present?

14.a Yes; repair as necessary.

14.b No; replace the intake manifold pressure sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" . Verify repair.

15. Compare the intake manifold temperature to the Charge Air Cooler (CAC) outlet temperature. Is the intake manifold temperature within plus or minus 10°C (18°F) of the CAC outlet temperature?

15.a Yes; Go to step 17.

15.b No; Go to step 16.

16. Disconnect and inspect the intake manifold temperature sensor electrical connector. Is there any damage, corrosion or fretting present?

16.a Yes; repair as necessary. Verify repair.

16.b No; replace the intake manifold temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" . Verify repair.

17. Remove the EGR delta P sensor and inspect the ports. Is there a restriction or contamination present.

17.a Yes; clean the delta P sensor and clean the ports in the venturi pipe. Refer to section "Cleaning of the Exhaust Gas Recirculation Venturi Pipe Delta P Sensor Ports" Verify repair.

17.b No; Go to step 18.

18. Remove and inspect the EGR hot pipe. Refer to section "Removal of the Exhaust Gas Recirculation Hot Pipe" . Are there any restrictions present in the EGR hot pipe?

18.a Yes; clean the EGR system. Verify repair.

Refer to section "Cleaning of the DD13 Exhaust Gas Recirculation System"

Refer to section "Cleaning of the DD15 Exhaust Gas Recirculation System"

Refer to section "Cleaning of the DD16 Exhaust Gas Recirculation System"

18.b No; Go to step 19.

19. Move EGR pull rod back and forth while watching the EGR valve. Does the EGR flap move when the pull rod is moved back and forth?

19.a Yes; Go to step 20.

19.b No; replace the EGR valve. Verify repair.

Refer to section "Removal of the DD13 and DD15 Exhaust Gas Recirculation Valve" .

Refer to section "Removal of the Exhaust Gas Recirculation Hot Pipe" .

Refer to section "Removal of the DD16 Exhaust Gas Recirculation Valve" .

Refer to section "Removal of the DD13 and DD15 Exhaust Manifold" .

20. Remove and inspect the EGR crossover tube, mixer pipe and venturi pipe. Are there any restrictions present?

20.a Yes; clean the EGR system. Verify repair.

Refer to section "Cleaning of the DD13 Exhaust Gas Recirculation System"

Refer to section "Cleaning of the DD15 Exhaust Gas Recirculation System"

Refer to section "Cleaning of the DD16 Exhaust Gas Recirculation System"

20.b No; Go to step 21.

21. Inspect the EGR cooler. Are there any restrictions present in the EGR cooler?

21.a Yes; clean the EGR system. Verify repair.

Refer to section "Cleaning of the DD13 Exhaust Gas Recirculation System"

Refer to section "Cleaning of the DD15 Exhaust Gas Recirculation System"

Refer to section "Cleaning of the DD16 Exhaust Gas Recirculation System"

21.b No; replace the Delta P sensor. Refer to section "Removal of the Delta P Sensor" . Verify repair.

SPN 2791 (MCM) (GHG17)

206.1 SPN 2791/FMI 2 - GHG17

EGR Valve Actuator, Position Deviation Error

SPN 2791/FMI 2	
Description	The fault code sets when the Motor Control module (MCM) detects that the Exhaust Gas Recirculation (EGR) Valve Position is Incorrect.
Monitored Parameter	EGR Position Error
Typical Enabling Conditions	Engine running
Monitor Sequence	None
Execution Frequency	Always enabled
Typical Duration	Two seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine idle

Check as follows:

1. Turn the ignition OFF.
2. Visually inspect the EGR system hardware, clamps and connections. Are there any components that will interfere with the travel of the pull rod?
   - 2.a Yes; install the components correctly, (replace any clamps that need readjustment), and perform the EGR Slow Learn routine. Verify repair.
   - 2.b No; Go to step 3.
3. Verify the orientation of the pull rod. Is the "S" stamped on the pull rod facing toward EGR actuator and the "V" stamped on the pull rod facing toward the EGR valve?
   - 3.a Yes; Go to step 4.
   - 3.b No; remove the pull rod and install the pull rod correctly. Perform the EGR Slow Learn routine. Verify repair.
4. Move the pull rod toward the rear of the engine by hand, and then release the pull rod. Does the pull rod move?
   - 4.a Yes; Go to step 5.
   - 4.b No; Go to step 7.
5. Monitor the EGR actuator while turning the ignition ON (key ON, engine OFF). Does the EGR actuator move when the ignition is first turned on?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the EGR actuator.
6. Turn the ignition OFF.
7. Disconnect and inspect the pull rod from the EGR actuator. Are the bearings or inserts in the pull rod missing?
   - 7.a Yes; replace the pull rod. Verify repair.
   - 7.b No; Go to step 8.
8. Rotate the bearings in the pull rod in the normal direction of movement when installed. Do the bearings move?
   - 8.a Yes; Go to step 9.
   - 8.b No; replace the pull rod.

9. Move the EGR valve back and forth by hand using the pull rod. Does the EGR valve move from end stop to end stop?
   - 9.a Yes; Go to step 10.
   - 9.b No; replace the EGR valve.
10. Install the pull rod back onto the EGR actuator.
11. Use DiagnosticLink to perform the EGR Slow Learn routine.
12. Does fault code SPN 2791/FMI 2 become active?
    - 12.a Yes; replace the EGR valve actuator.
    - 12.b No; the concern was corrected by performing the Slow Learn routine. No further diagnostics or repairs are needed; release the vehicle to the customer.

206.2 SPN 2791/FMI 7 - GHG17

EGR Valve Actuator, Fail Safe Mode, Motor On

SPN 2791/FMI 7	
Description	The fault code sets when the Motor Control module (MCM) detects that the Exhaust Gas Recirculation (EGR) Valve Position is Incorrect.
Monitored Parameter	EGR Position Error
Typical Enabling Conditions	Engine running
Monitor Sequence	None
Execution Frequency	Always enabled
Typical Duration	2 seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine idle

Check as follows:

1. Turn the ignition OFF.
2. Visually inspect the EGR system hardware, clamps and connections. Are there any components that will interfere with the travel of the pull rod?
   - 2.a Yes; install the components correctly, (replace any clamps that need readjustment), and perform the EGR Slow Learn routine. Verify repair.
   - 2.b No; Go to step 3.
3. Verify the orientation of the pull rod. Is the "S" stamped on the pull rod facing toward EGR actuator and the "V" stamped on the pull rod facing toward the EGR valve?
   - 3.a Yes; Go to step 4.
   - 3.b No; remove the pull rod and install the pull rod correctly. Perform the EGR Slow Learn routine. Verify repair.
4. Move the pull rod toward the rear of the engine by hand, and then release the pull rod. Does the pull rod move?
   - 4.a Yes; Go to step 5.
   - 4.b No; Go to step 7.
5. Monitor the EGR actuator while turning the ignition ON (key ON, engine OFF). Does the EGR actuator move when the ignition is first turned on?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the EGR actuator.
6. Turn the ignition OFF.
7. Disconnect and inspect the pull rod from the EGR actuator. Are the bearings or inserts in the pull rod missing?
   - 7.a Yes; replace the pull rod. Verify repair.
   - 7.b No; Go to step 8.
8. Rotate the bearings in the pull rod in the normal direction of movement when installed. Do the bearings move?
   - 8.a Yes; Go to step 9.
   - 8.b No; replace the pull rod.
9. Move the EGR valve back and forth by hand using the pull rod. Does the EGR valve move from end stop to end stop?
   - 9.a Yes; Go to step 10.

9.b No; replace the EGR valve.

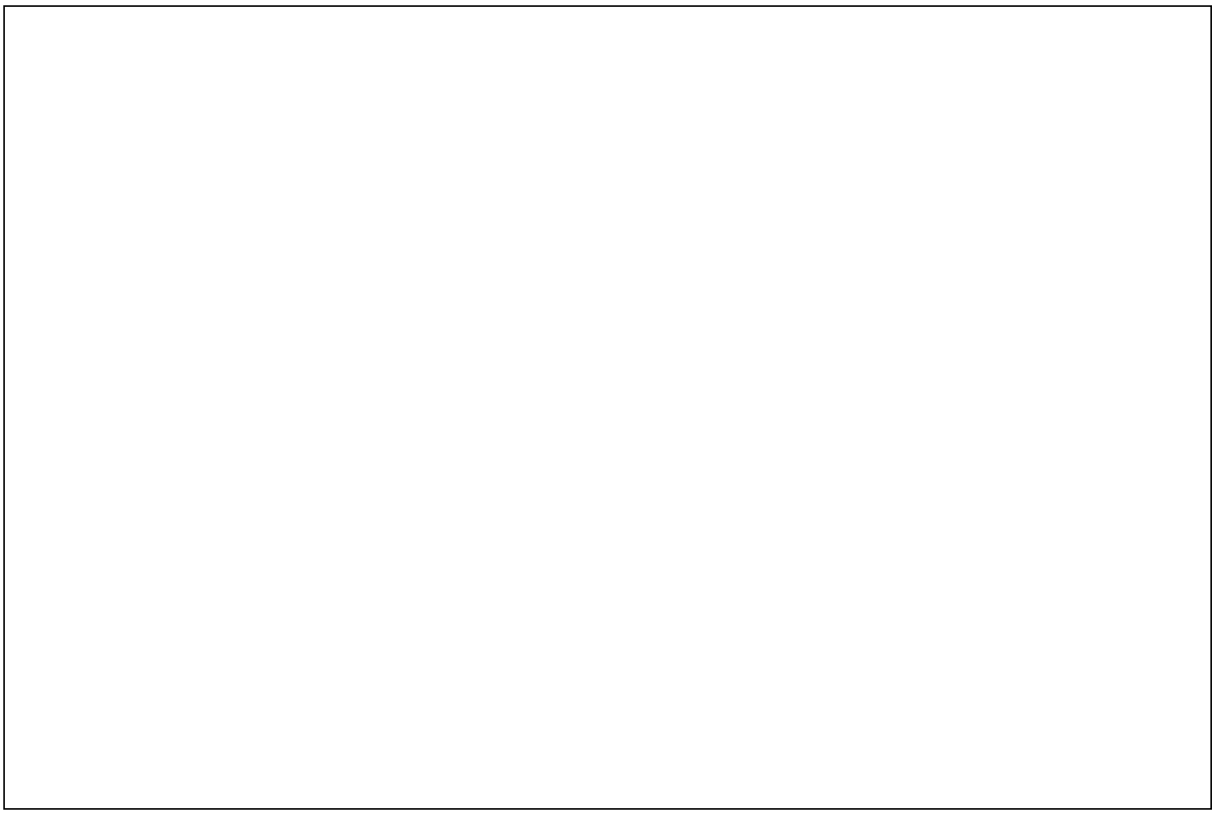
10. Install the pull rod back onto the EGR actuator.
11. Use DiagnosticLink® to perform the EGR Slow Learn routine.
12. Does fault code SPN 2791/FMI 7 become active?

12.a Yes; replace the EGR valve actuator.

12.b No; the concern was corrected by performing the Slow Learn routine. No further diagnostics or repairs are needed; release the vehicle to the customer.

206.3 SPN 2791/FMI 9 - GHG17

SPN 2791/FMI 9	
Description	The Fault Code Sets When the Motor Control Module (MCM) Does Not Receive a Message from the Exhaust Gas Recirculation (EGR) Valve Actuator
Monitored Parameter	MCM Communication From the EGR Valve Actuator
Typical Enabling Conditions	Ignition ON
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Ignition ON



Check as follows:

1. Check for low battery voltage fault codes. Is fault code 520296/FMI 3 present?
   1.a Yes; diagnose the low battery voltage fault code first.
   1.b No; Go to step 2.
2. Check for multiple EGR fault codes. Are there any other EGR valve actuator fault codes also active?
   2.a Yes; replace the EGR valve actuator.
   2.b No; Go to step 3.
3. Turn then ignition OFF.

4. Disconnect and inspect the EGR valve actuator electrical connector components side. Are there any damaged, corroded, or spread pins?
   - 4.a Yes; replace the EGR valve actuator.
   - 4.b No; Go to step 5.
5. Inspect the EGR valve actuator electrical connector harness side. Are there any damaged, corroded, or spread pins?
   - 5.a Yes; repair the connector as necessary.
   - 5.b No; Go to step 6.
6. Turn the ignition ON (key ON, engine OFF).
7. Measure the voltage between pins 1 and 2. Is the voltage greater than 11 volts?
   - 7.a Yes; Go to step 9.
   - 7.b No; Go to step 8.
8. Measure the voltage between pin 1 and ground. Is the voltage greater than 11 volts?
   - 8.a Yes; repair the ground circuit between pin 2 of the EGR valve actuator electrical connector harness side and the circuit splice.
   - 8.b No; repair the voltage circuit between pin 1 of the EGR valve actuator electrical connector harness side and the circuit splice.
9. Turn the ignition OFF.
10. Measure the resistance between pins 3 and 4 of the EGR valve actuator electrical connector harness side. Is the resistance between 55 and 65 ohms?
    - 10.a Yes: replace the EGR valve actuator.
    - 10.b No; Go to step 11.
11. Disconnect and inspect the 120-pin MCM electrical connector components side. Are there any damaged or corroded pins?
    - 11.a Yes; replace the MCM.
    - 11.b No; Go to step 12.
12. Inspect the 120-pin MCM electrical connector harness side. Are there any damaged, corroded or spread pins?
    - 12.a Yes; repair as necessary.
    - 12.b No; Go to step 13.
13. Measure the resistance between pin 3 of the EGR valve actuator electrical connector harness side and pin 74 of the 120-pin MCM electrical connector harness side. Is the resistance less than five ohms?
    - 13.a Yes; Go to step 14.
    - 13.b No; repair the communication circuit between pin 3 of the EGR valve actuator electrical connector harness side and pin 74 of the 120-pin MCM electrical connector harness side.
14. Measure the resistance between pin 4 of the EGR valve actuator electrical connector harness side and pin 75 of the 120-pin MCM electrical connector harness side. Is the resistance less than five ohms?
    - 14.a Yes; replace the MCM.
    - 14.b No; repair the communication circuit between pin 4 of the EGR valve actuator electrical connector harness side and pin 75 of the 120-pin MCM electrical connector harness side.

206.4 SPN 2791/FMI 11 - GHG17

EGR Valve Actuator Common Fault

SPN 2791/FMI 11	
Description	The Faults Code Sets when the Motor Control Module (MCM) Detects that the Exhaust Gas Recirculation (EGR) Valve Position is Incorrect or a High Coolant Temperature has Been Detected.
Monitored Parameter	EGR Position Error
Typical Enabling Conditions	Engine Running
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle and Perform Several Neutral Run Ups.

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Connect DiagnosticLink®.
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are fault codes SPN 2791/FMI 10, SPN 110/FMI 0 or SPN 110/FMI 2 present?
   - 3.a Yes; diagnose the other fault codes first.
   - 3.b No; Go to step 4.
4. Turn the ignition OFF.
5. Visually inspect the EGR system hardware, clamps and connections. Are there any components that will interfere with the travel of the pull rod?
   - 5.a Yes; install the components correctly, (replace any clamps that need readjustment), and perform the EGR Slow Learn routine. Verify repair.
   - 5.b No; Go to step 6.
6. Verify the orientation of the pull rod. Is the "S" stamped on the pull rod facing toward EGR actuator and the "V" stamped on the pull rod facing toward the EGR valve?
   - 6.a Yes; Go to step 7.
   - 6.b No; remove the pull rod and install the pull rod correctly. Perform the EGR Slow Learn routine. Verify repair.
7. Move the pull rod toward the rear of the engine by hand. Does the pull rod move?
   - 7.a Yes; Go to step 8.
   - 7.b No; Go to step 11.
8. Turn ignition ON (key ON, engine OFF).
9. Monitor the EGR actuator when the ignition is turned ON (key ON, engine OFF). Does the EGR actuator move when the ignition is first turned on?

9.a Yes; Go to step 10.

9.b No; replace the EGR actuator.

10. Turn the ignition OFF.

11. Disconnect and inspect the pull rod from the EGR actuator. Are the bearings or inserts in the pull rod missing?

11.a Yes; replace the pull rod. Verify repair.

11.b No; Go to step 12.

12. Rotate the bearings in the pull rod in the normal direction of movement when installed. Do the bearings move?

12.a Yes; Go to step 13.

12.b No; replace the pull rod.

13. Move the EGR valve back and forth by hand using the pull rod. Does the EGR valve move from end stop to end stop?

13.a Yes; Go to step 14.

13.b No; replace the EGR valve.

14. Install the pull rod back onto the EGR actuator.

15. Use DiagnosticLink® to perform the EGR Slow Learn routine.

16. Does fault code SPN 2791/FMI 11 become active?

16.a Yes; replace the EGR valve actuator.

16.b No; the concern was corrected by performing the Slow Learn routine. No further diagnostics or repairs are needed; release the vehicle to the customer.

206.5 SPN 2791/FMI 12 - GHG17

EGR Valve Actuator Frozen

SPN 2791/FMI 12	
Description	The fault code sets when the Motor Control module (MCM) detects Exhaust Gas Recirculation (EGR) Valve Position Incorrect when the ambient temperature is below 2°C (35°F).
Monitored Parameter	EGR Position Error
Typical Enabling Conditions	Engine running
Monitor Sequence	None
Execution Frequency	Always enabled
Typical Duration	2 seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine idle

Check as follows:

1. Turn the ignition OFF.
2. Visually inspect the EGR system hardware, clamps and connections. Are there any components that will interfere with the travel of the pull rod?
   - 2.a Yes; install the components correctly, (replace any clamps that need readjustment), and perform the EGR Slow Learn routine. Verify repair.
   - 2.b No; Go to step 3.
3. Verify the orientation of the pull rod. Is the "S" stamped on the pull rod facing toward EGR actuator and the "V" stamped on the pull rod facing toward the EGR valve?
   - 3.a Yes; Go to step 4.
   - 3.b No; remove the pull rod and install the pull rod correctly. Perform the EGR Slow Learn routine. Verify repair.
4. Move the pull rod toward the rear of the engine by hand, and then release the pull rod. Does the pull rod move?
   - 4.a Yes; Go to step 5.
   - 4.b No; Go to step 7.
5. Monitor the EGR actuator while turning the ignition ON (key ON, engine OFF). Does the EGR actuator move when the ignition is first turned on?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the EGR actuator.
6. Turn the ignition OFF.
7. Disconnect and inspect the pull rod from the EGR actuator. Are the bearings or inserts in the pull rod missing?
   - 7.a Yes; replace the pull rod. Verify repair.
   - 7.b No; Go to step 8.
8. Rotate the bearings in the pull rod in the normal direction of movement when installed. Do the bearings move?
   - 8.a Yes; Go to step 9.
   - 8.b No; replace the pull rod.
9. Move the EGR valve back and forth by hand using the pull rod. Does the EGR valve move from end stop to end stop?

9.a Yes; Go to step 10.

9.b No; replace the EGR valve.

10. Install the pull rod back onto the EGR actuator.
11. Use DiagnosticLink® to perform the EGR Slow Learn routine.
12. Does fault code SPN 2791/FMI 12 become active?

12.a Yes; replace the EGR valve actuator.

12.b No; the concern was corrected by performing the Slow Learn routine. No further diagnostics or repairs are needed; release the vehicle to the customer.

206.6 SPN 2791/FMI 13 - GHG17

Smart Remote Actuator 3 (EGR), Calibration Error

SPN 2791/FMI 13	
Description	This fault code becomes active when the EGR Actuator Calibration-span is out of range or when there is a learn time out.
Monitored Parameter	EGR Position
Typical Enabling Conditions	Ignition on
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Idle engine for five minutes

Check as follows:

1. Turn the ignition OFF.
2. Visually inspect the EGR system hardware, clamps and connections. Are there any components that interfere with the travel of the pull rod?
   - 2.a Yes; install the components correctly, (replace any clamps that need readjustment), and perform the EGR Slow Learn routine. Verify repair.
   - 2.b No; Go to step 3.
3. Verify the orientation of the pull rod. Is the "S" stamped on the pull rod facing toward EGR actuator and the "V" stamped on the pull rod facing toward the EGR valve?
   - 3.a Yes; Go to step 4.
   - 3.b No; remove the pull rod and install the pull rod correctly. Perform the EGR Slow Learn routine. Verify repair.
4. Move the pull rod toward the rear of the engine by hand, and then release the pull rod. Does the pull rod move?
   - 4.a Yes; Go to step 5.
   - 4.b No; Go to step 7.
5. Monitor the EGR actuator while turning the ignition ON (key ON, engine OFF). Does the EGR actuator move when the ignition is first turned on?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the EGR actuator.
6. Turn the ignition OFF.
7. Disconnect and inspect the pull rod from the EGR actuator. Are the bearings or inserts in the pull rod missing?
   - 7.a Yes; replace the pull rod. Verify repair.
   - 7.b No; Go to step 8.
8. Rotate the bearings in the pull rod in the normal direction of movement when installed. Do the bearings move?
   - 8.a Yes; Go to step 9.
   - 8.b No; replace the pull rod.
9. Move the EGR valve back and forth by hand using the pull rod. Does the EGR valve move from end stop to end stop?
   - 9.a Yes; Go to step 10.

9.b No; replace the EGR valve.

10. Install the pull rod back onto the EGR actuator.
11. Use DiagnosticLink® to perform the EGR Slow Learn routine.
12. Does fault code SPN 2791/FMI 13 become active?

12.a Yes; replace the EGR valve actuator.

12.b No; the concern was corrected by the slow learn routine. No further diagnostics or repairs are needed; release the vehicle to the customer.

206.7 SPN 2791/FMI 14 - GHG17

EGR Valve Actuator, Wrong Fail Safe Calibration

SPN 2791/FMI 14	
Description	This fault code sets when the EGR Actuator Calibration-span is out of range or when there is a learn time-out.
Monitored Parameter	EGR Position Error
Typical Enabling Conditions	Engine running
Monitor Sequence	None
Execution Frequency	Always enabled
Typical Duration	2 seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine idle

Check as follows:

1. Turn the ignition OFF.
2. Visually inspect the EGR system hardware, clamps and connections. Are there any components that will interfere with the travel of the pull rod?
   - 2.a Yes; install the components correctly, (replace any clamps that need readjustment), and perform the EGR Slow Learn routine. Verify repair.
   - 2.b No; Go to step 3.
3. Verify the orientation of the pull rod. Is the "S" stamped on the pull rod facing toward EGR actuator and the "V" stamped on the pull rod facing toward the EGR valve?
   - 3.a Yes; Go to step 4.
   - 3.b No; remove the pull rod and install the pull rod correctly. Perform the EGR Slow Learn routine. Verify repair.
4. Move the pull rod toward the rear of the engine by hand, and then release the pull rod. Does the pull rod move?
   - 4.a Yes; Go to step 5.
   - 4.b No; Go to step 7.
5. Monitor the EGR actuator while turning the ignition ON (key ON, engine OFF). Does the EGR actuator move when the ignition is first turned on?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the EGR actuator.
6. Turn the ignition OFF.
7. Disconnect and inspect the pull rod from the EGR actuator. Are the bearings or inserts in the pull rod missing?
   - 7.a Yes; replace the pull rod. Verify repair.
   - 7.b No; Go to step 8.
8. Rotate the bearings in the pull rod in the normal direction of movement when installed. Do the bearings move?
   - 8.a Yes; Go to step 9.
   - 8.b No; replace the pull rod.
9. Move the EGR valve back and forth by hand using the pull rod. Does the EGR valve move from end stop to end stop?
   - 9.a Yes; Go to step 10.

9.b No; replace the EGR valve.

10. Install the pull rod back onto the EGR actuator.
11. Use DiagnosticLink® to perform the EGR Slow Learn routine.
12. Does fault code SPN 2791/FMI 14 become active?

12.a Yes; replace the EGR valve actuator.

12.b No; the concern was corrected by performing the Slow Learn routine. No further diagnostics or repairs are needed; release the vehicle to the customer.

206.8 SPN 2791/FMI 16 - GHG17

EGR Valve Actuator Learn Cycle Too Large

SPN 2791/FMI 16	
Description	The fault code sets when the Motor Control module (MCM) detects that the Exhaust Gas Recirculation (EGR) Valve Position is Incorrect.
Monitored Parameter	EGR Position Error
Typical Enabling Conditions	Engine running
Monitor Sequence	None
Execution Frequency	Always enabled
Typical Duration	2 seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine idle

Check as follows:

1. Turn the ignition OFF.
2. Visually inspect the EGR system hardware, clamps and connections. Are there any components that will interfere with the travel of the pull rod?
   - 2.a Yes; install the components correctly, (replace any clamps that need readjustment), and perform the EGR Slow Learn routine. Verify repair.
   - 2.b No; Go to step 3.
3. Verify the orientation of the pull rod. Is the "S" stamped on the pull rod facing toward EGR actuator and the "V" stamped on the pull rod facing toward the EGR valve?
   - 3.a Yes; Go to step 4.
   - 3.b No; remove the pull rod and install the pull rod correctly. Perform the EGR Slow Learn routine. Verify repair.
4. Move the pull rod toward the rear of the engine by hand, and then release the pull rod. Does the pull rod move?
   - 4.a Yes; Go to step 5.
   - 4.b No; Go to step 7.
5. Monitor the EGR actuator while turning the ignition ON (key ON, engine OFF). Does the EGR actuator move when the ignition is first turned on?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the EGR actuator.
6. Turn the ignition OFF.
7. Disconnect and inspect the pull rod from the EGR actuator. Are the bearings or inserts in the pull rod missing?
   - 7.a Yes; replace the pull rod. Verify repair.
   - 7.b No; Go to step 8.
8. Rotate the bearings in the pull rod in the normal direction of movement when installed. Do the bearings move?
   - 8.a Yes; Go to step 9.
   - 8.b No; replace the pull rod.
9. Move the EGR valve back and forth by hand using the pull rod. Does the EGR valve move from end stop to end stop?
   - 9.a Yes; Go to step 10.

9.b No; replace the EGR valve.

10. Install the pull rod back onto the EGR actuator.
11. Use DiagnosticLink® to perform the EGR Slow Learn routine.
12. Does fault code SPN 2791/FMI 16 become active?

12.a Yes; replace the EGR valve actuator.

12.b No; the concern was corrected by performing the Slow Learn routine. No further diagnostics or repairs are needed; release the vehicle to the customer.

206.9 SPN 2791/FMI 18 - GHG17

EGR Valve Actuator Learn Cycle Too Small

SPN 2791/FMI 18	
Description	The fault code sets when the Motor Control module (MCM) detects that the Exhaust Gas Recirculation (EGR) Valve Position is Incorrect.
Monitored Parameter	EGR Position Error
Typical Enabling Conditions	Engine running
Monitor Sequence	None
Execution Frequency	Always enabled
Typical Duration	2 seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine idle

Check as follows:

1. Turn the ignition OFF.
2. Visually inspect the EGR system hardware, clamps and connections. Are there any components that will interfere with the travel of the pull rod?
   - 2.a Yes; install the components correctly, (replace any clamps that need readjustment), and perform the EGR Slow Learn routine. Verify repair.
   - 2.b No; Go to step 3.
3. Verify the orientation of the pull rod. Is the "S" stamped on the pull rod facing toward EGR actuator and the "V" stamped on the pull rod facing toward the EGR valve?
   - 3.a Yes; Go to step 4.
   - 3.b No; remove the pull rod and install the pull rod correctly. Perform the EGR Slow Learn routine. Verify repair.
4. Move the pull rod toward the rear of the engine by hand, and then release the pull rod. Does the pull rod move?
   - 4.a Yes; Go to step 5.
   - 4.b No; Go to step 7.
5. Monitor the EGR actuator while turning the ignition ON (key ON, engine OFF). Does the EGR actuator move when the ignition is first turned on?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the EGR actuator.
6. Turn the ignition OFF.
7. Disconnect and inspect the pull rod from the EGR actuator. Are the bearings or inserts in the pull rod missing?
   - 7.a Yes; replace the pull rod. Verify repair.
   - 7.b No; Go to step 8.
8. Rotate the bearings in the pull rod in the normal direction of movement when installed. Do the bearings move?
   - 8.a Yes; Go to step 9.
   - 8.b No; replace the pull rod.
9. Move the EGR valve back and forth by hand using the pull rod. Does the EGR valve move from end stop to end stop?
   - 9.a Yes; Go to step 10.

9.b No; replace the EGR valve.

10. Install the pull rod back onto the EGR actuator.
11. Use DiagnosticLink® to perform the EGR Slow Learn routine.
12. Does fault code SPN 2791/FMI 18 become active?

12.a Yes; replace the EGR valve actuator.

12.b No; the concern was corrected by performing the Slow Learn routine. No further diagnostics or repairs are needed; release the vehicle to the customer.

206.10 SPN 2791/FMI 31 - GHG17

EGR Valve Actuator Slow Response

SPN 2791/FMI 31	
Description	The fault code sets when the Motor Control module (MCM) detects that the Exhaust Gas Recirculation (EGR) Valve Position does not reach the commanded position within a calibrated time.
Monitored Parameter	EGR Position Error
Typical Enabling Conditions	Engine running
Monitor Sequence	None
Execution Frequency	Always enabled
Typical Duration	2 seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine idle

Check as follows:

1. Turn the ignition OFF.
2. Visually inspect the EGR system hardware, clamps and connections. Are there any components that will interfere with the travel of the pull rod?
   - 2.a Yes; install the components correctly, (replace any clamps that need readjustment), and perform the EGR Slow Learn routine. Verify repair.
   - 2.b No; Go to step 3.
3. Verify the orientation of the pull rod. Is the "S" stamped on the pull rod facing toward EGR actuator and the "V" stamped on the pull rod facing toward the EGR valve?
   - 3.a Yes; Go to step 4.
   - 3.b No; remove the pull rod and install the pull rod correctly. Perform the EGR Slow Learn routine. Verify repair.
4. Move the pull rod toward the rear of the engine by hand, and then release the pull rod. Does the pull rod move?
   - 4.a Yes; Go to step 5.
   - 4.b No; Go to step 7.
5. Monitor the EGR actuator while turning the ignition ON (key ON, engine OFF). Does the EGR actuator move when the ignition is first turned on?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the EGR actuator.
6. Turn the ignition OFF.
7. Disconnect and inspect the pull rod from the EGR actuator. Are the bearings or inserts in the pull rod missing?
   - 7.a Yes; replace the pull rod. Verify repair.
   - 7.b No; Go to step 8.
8. Rotate the bearings in the pull rod in the normal direction of movement when installed. Do the bearings move?
   - 8.a Yes; Go to step 9.
   - 8.b No; replace the pull rod.
9. Move the EGR valve back and forth by hand using the pull rod. Does the EGR valve move from end stop to end stop?

9.a Yes; Go to step 10.

9.b No; replace the EGR valve.

10. Install the pull rod back onto the EGR actuator.
11. Use DiagnosticLink® to perform the EGR Slow Learn routine.
12. Does fault code SPN 2791/FMI 31 become active?

12.a Yes; replace the EGR valve actuator.

12.b No; the concern was corrected by performing the Slow Learn routine. No further diagnostics or repairs are needed; release the vehicle to the customer.

SPN 2797 (MCM) (GHG17)

207.1 SPN 2797/FMI 3 - GHG17

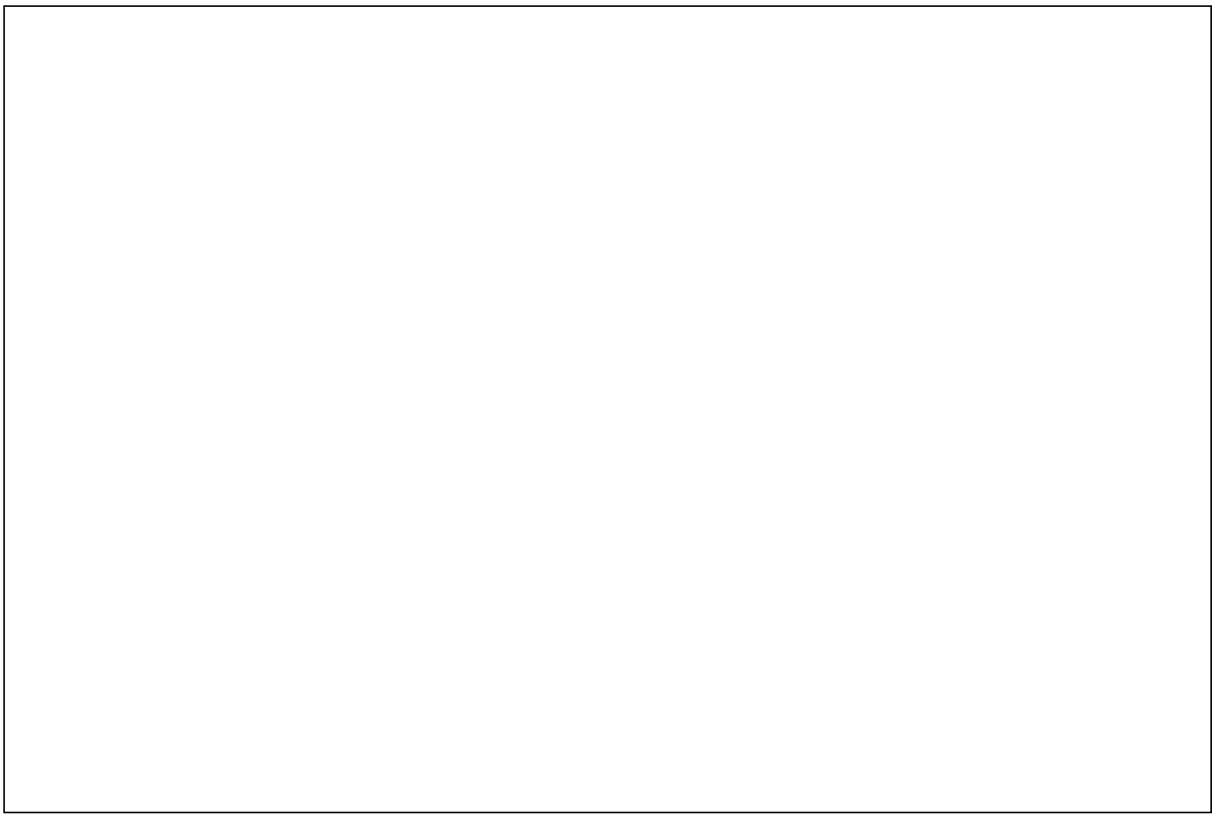
Fuel Injector Needle Control Valve for cylinder 1, 2, 3 shorted to Battery power

SPN 2797/FMI 3	
Description	Injector Needle Control Valve Cylinder 1, 2, 3 Shorted to Battery
Monitored Parameter	Injector Needle Control Valve Cylinder 1, 2, 3
Typical Enabling Conditions	Engine RPM = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)

1. Disconnect the front fuel injector harness 14–pin connector. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pin 1 on the Motor Control Module (MCM) side of the front fuel injector harness 14–pin connector and ground.
   - 3.a If there is voltage present, repair the short to power between pin 1 of the front fuel injector harness 14–pin connector and pin 25 of the 120–pin MCM connector.
   - 3.b If there is no voltage present, replace the under valve cover fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

207.2 SPN 2797/FMI 4 - GHG17

Fuel Injector Needle Control Valve Cylinder 1, 2, 3 Shorted to Ground

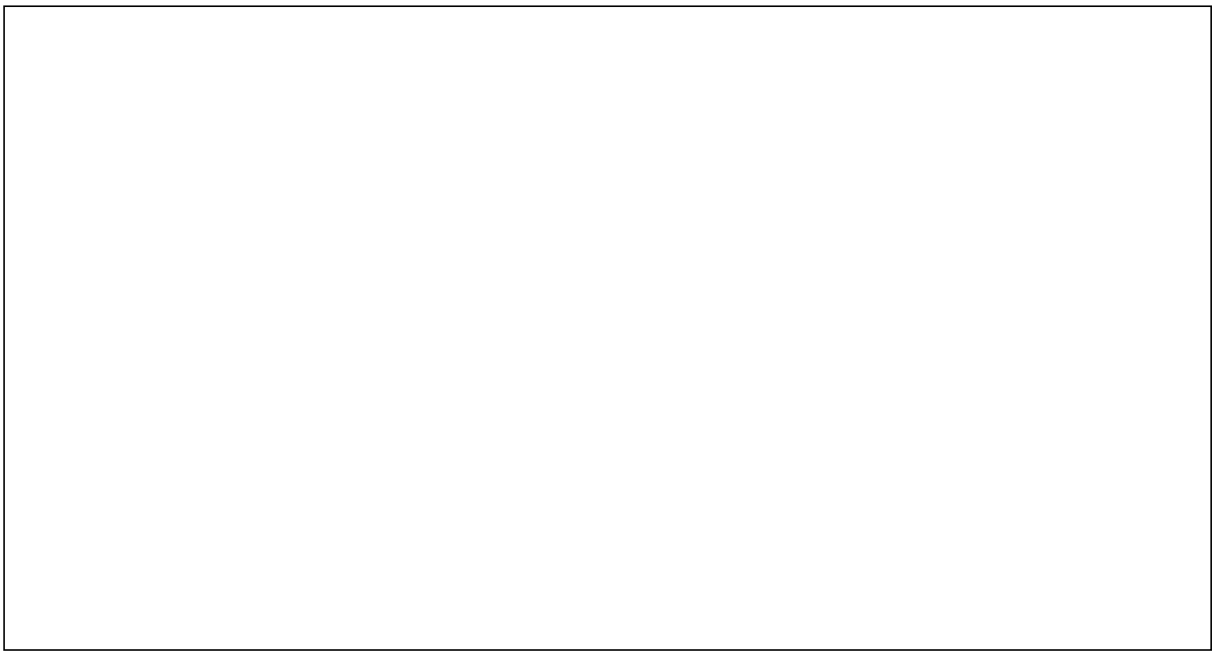


SPN 2797/FMI 4	
Description	Injector Needle Control Valve Cylinder 1, 2, 3 Shorted to Ground
Monitored Parameter	Injector Needle Control Valve Cylinder 1, 2, 3
Typical Enabling Conditions	Engine rpm = Idle or Higher
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)

1. Disconnect the front fuel injector harness 14–pin connector. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .
2. Inspect the front fuel injector harness 14–pin connector for bent or spread pins. Inspect the connector seal for damage (signs of water or oil intrusion). Is there evidence of water or oil intrusion, bent or spread pins?

   2.a Yes; repair as necessary.

   2.b No; Go to step 3.
3. Measure the resistance between pin 1 on the rocker cover side of the front fuel injector harness 14–pin connector and ground. If you are using J-48671–10, measure between pin 3 the fuel injector #1 and ground. Is resistance greater than 10k ohms?



3.a Yes; Go to step 11.

3.b No; Go to step 4.

4. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
5. Disconnect fuel injector #1.
6. Measure the resistance between pin 1 on the rocker cover side of the front fuel injector harness 14–pin connector and ground. If you are using J-48671–10, measure between pin 3 of the fuel injector #1 and ground. Is the resistance greater than 10k ohms?

   6.a Yes; replace fuel injector #1. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

   6.b No; Go to step 7.
7. Disconnect fuel injector #2.
8. Measure the resistance between pin 1 on the valve cover side of the front fuel injector harness 14–pin connector and ground. If you are using J-48671–10, measure between pin 3 of the fuel injector #2 and ground. Is resistance greater than 10k ohms?

   8.a Yes; replace fuel injector #2. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

   8.b No; Go to step 9.
9. Disconnect fuel injector #3.
10. Measure the resistance between pin 1 on the valve cover side of the front fuel injector harness 14–pin connector and ground. If you are using J-48671–10, measure between pin 3 of the fuel injector #3 and ground. Is resistance greater than 10k ohms?

    10.a Yes; replace fuel injector #3. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

    10.b No; replace the front injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .
11. Disconnect the MCM 120–pin connector.
12. Inspect the MCM 120-pin connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is there evidence of water or oil intrusion, bent or spread pins?

    12.a Yes; repair as necessary.

    12.b No; Go to step 13.
13. Measure the resistance between pin 25 on the MCM 120–pin connector and ground. If you are using J-48671–10, measure between pin 3 of the fuel injector #1 and ground. Is resistance greater than 10k ohms?

13.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module"

13.b No; repair the short to ground between pin 25 of the Motor Control Module (MCM) 120-pin connector and pin 1 of the front fuel injector harness 14-pin connector.

SPN 2798 (MCM) (GHG17)

208.1 SPN 2798/FMI 3 - GHG17

Injector Needle Control Valve Cylinder 4, 5, 6 shorted to Battery

SPN 2798/FMI 3	
Description	Injector Needle Control Valve Cylinder 4, 5, 6 shorted to Battery
Monitored Parameter	Injector Needle Control Valve Cylinder 4, 5, 6
Typical Enabling Conditions	Engine RPM = idle or higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)

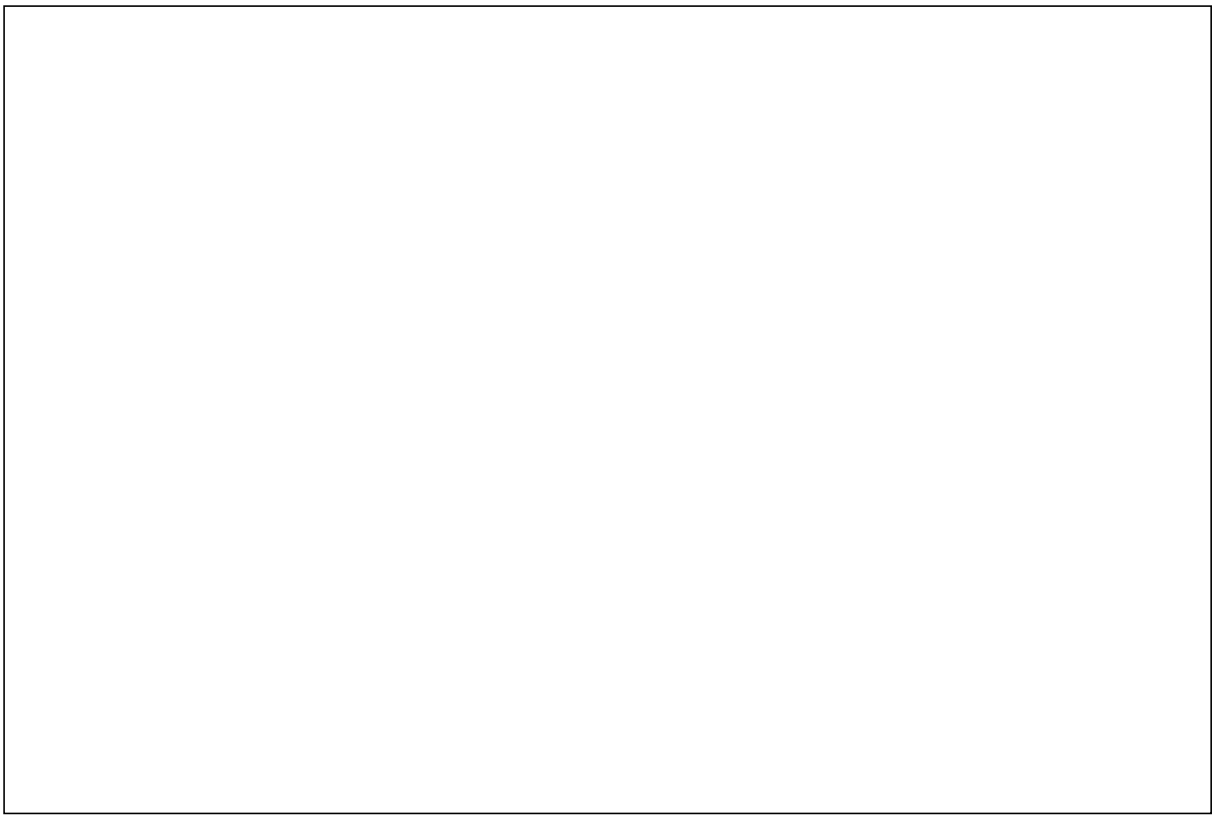
1. Disconnect the rear fuel injector harness 14-pin connector.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pin 1 on the Motor Control Module (MCM) side of the rear fuel injector harness 14–pin connector and ground.

   3.a If there is voltage present, repair the short to power between pin 1 of the rear fuel injector harness 14-pin connector and pin 19 of the 120-pin MCM connector.

   3.b If there is no voltage present, replace the under valve cover fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

208.2 SPN 2798/FMI 4 - GHG17

Injector Needle Control Valve Cylinder 4, 5, 6 Shorted to Ground



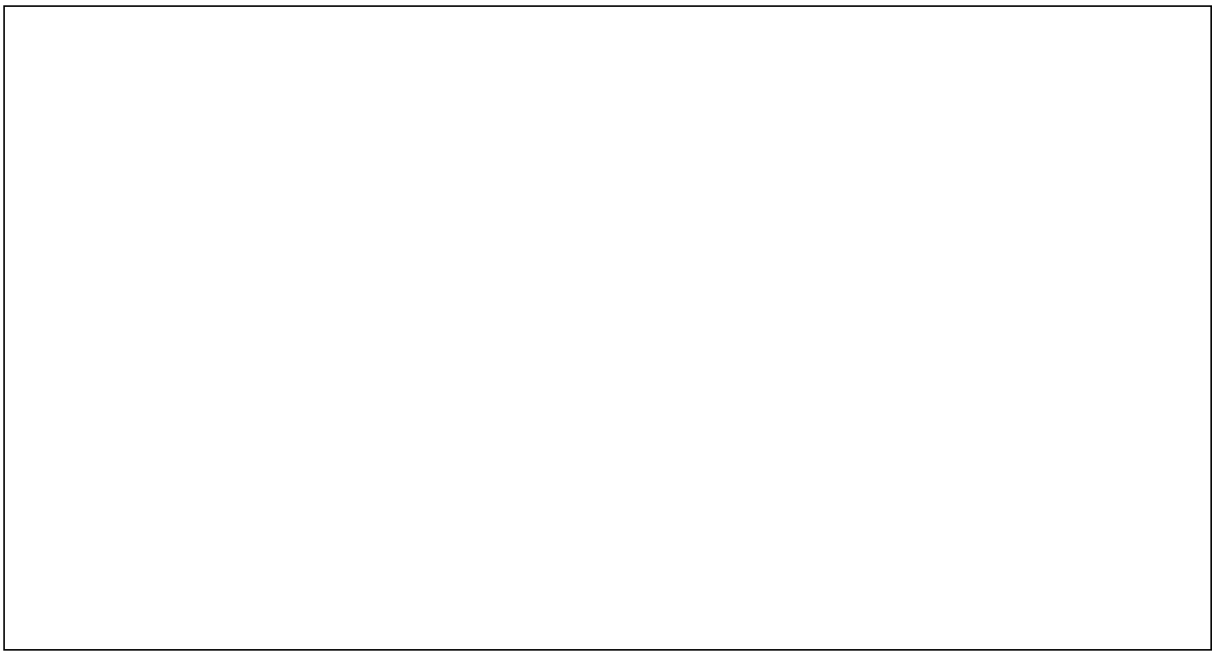
SPN 2798/FMI 4	
Description	Injector Needle Control Valve Cylinder 4, 5, 6 Shorted to Ground
Monitored Parameter	Injector Needle Control Valve Cylinder 4, 5, 6
Typical Enabling Conditions	Engine rpm = Idle or Higher
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (One minute)

1. Disconnect the rear fuel injector harness 14-pin connector.
2. Inspect the rear fuel injector harness 14-pin connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is there evidence of water or oil intrusion, bent, or spread pins?

   2.a Yes; repair as necessary.

   2.b No; Go to step 3.
3. Measure the resistance between pin 1 on the rocker cover side of the rear fuel injector harness 14-pin connector and battery ground. If you are using J-48671–10, measure between pin 3 of the fuel injector #4 and battery ground. Is the resistance greater than 10k ohms?

A	Engine Harness Side
B	Valve Cover Side



3.a Yes; Go to step 4.

3.b No; Go to step 11.

4. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
5. Disconnect fuel injector #4.
6. Measure the resistance between pin 1 on the rocker cover side of the rear fuel injector harness 14-pin connector and battery ground. If you are using J-48671–10, measure between pin 3 of the fuel injector #4 pin 3 and ground. Is the resistence greater than 10k ohms?

6.a Yes; replace fuel injector #4.

Refer to section "Removal of the Fuel Injector - Two-Filter System" .

6.b No; Go to step 7.

7. Disconnect fuel injector #5.
8. Measure the resistance between pin 1 on the rocker cover side of the rear fuel injector harness 14-pin connector and battery ground. If you are using J-48671–10, measure between pin 3 of the fuel injector #5 and battery ground. Is the resistance greater than 10k ohms?

8.a Yes, replace the #5 fuel injector.

Refer to section "Removal of the Fuel Injector - Two-Filter System" .

8.b No; Go to step 9.

9. Disconnect fuel injector #6.
10. Measure the resistance between pin 1 on the rocker cover side of the rear fuel injector harness 14-pin connector and battery ground. If you are using J-48671–10, measure between pin 3 of the fuel injector #6 and battery ground. Is the resistance greater than 10k ohms?

10.a Yes; replace fuel injector #6.

Refer to section "Removal of the Fuel Injector - Two-Filter System" .

10.b No; replace the rear injector harness.

Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

11. Disconnect the Motor Control Module (MCM) 120–pin connector.
12. Inspect the MCM 120-pin connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is there evidence of water or oil intrusion, bent or spread pins?

    12.a Yes; repair as necessary.

    12.b No; Go to step 13.

13. Measure the resistance between pin 19 on the MCM 120–pin connector and ground. If you are using J-48671–10, measure between pin 3 of the fuel injector #1 and ground. Is the resistance greater than 10k ohms?

    13.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" .

    13.b No; repair the short to ground between pin 19 of the Motor Control Module (MCM) 120-pin connector and pin 1 of the front fuel injector harness 14-pin connector.

SPN 2882 (CPC) (GHG17)

209.1 SPN 2882/FMI 13 - GHG17

SPN 2882/FMI 13	
Description	J1939 Signal is Missing
Monitored Parameter	CAN communication
Typical Enabling Conditions	Always enabled
Monitor Sequence	None
Execution Frequency	Always enabled
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition cycle

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   1.a Yes; repair the battery voltage concern. Verify repair.
   1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   2.b No; Go to step 3.
3. Has the Common Powertrain Controller (CPC) been recently programmed? Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   3.a Yes; refer to the OEM diagnostics for troubleshooting the loss of communication to the ABS module.
   3.b No; correct the information as necessary. Verify repair.

SPN 2900 (CPC) (GHG17)

210.1 SPN 2900/FMI 9 - GHG17

J1939 ETC7 Message is Missing

SPN 2900/FMI 9	
Description	J1939 Signal is Missing
Monitored Parameter	CAN communication
Typical Enabling Conditions	Always enabled
Monitor Sequence	None
Execution Frequency	Always enabled
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition cycle

Note : Fault will set during Eaton transmission module reprogramming. If fault occurs while programming, clear code and release vehicle.

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   1.a Yes; repair the battery voltage concern. Verify repair.
   1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   2.b No; Go to step 3.
3. Has the Common Powertrain Controller (CPC) been recently programmed? Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   3.a Yes; refer to the OEM diagnostics for troubleshooting the loss of communication to the ABS module.
   3.b No; correct the information as necessary. Verify repair.

SPN 3031 (ACM) (GHG17)

211.1 SPN 3031/FMI 3 - GHG17

SPN 3031/FMI 3	
Description	Diesel Exhaust Fluid (DEF) Tank Temperature Sensor Circuit Failed High
Monitored Parameter	DEF Tank Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (One Minute)

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

Note : When there is no signal from the DEF tank level/temperature sensor, the vehicle will go into the low DEF level derate.

Check as follows:

1. Disconnect and inspect the DEF tank level/temperature sensor connectors. Are there any bent, spread or corroded pins?
   - 1.a Yes; repair as necessary. Verify repair.
   - 1.b No; Go to step 2.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pin 4 of the DEF tank level/temperature sensor connector harness side and ground. Is there voltage present?
   - 3.a Yes; repair the short to power between pin 4 of the DEF tank level/temperature connector and pin 102 of the 120-pin Motor Control Module (MCM) connector. Verify repair.
   - 3.b No; Go to step 4.

4. Measure the voltage between pin 3 on the harness side of the DEF tank temperature/level sensor connector and ground. Is there 3.0 volts?
   - 4.a Yes; Go to step 5.
   - 4.b No; Go to step 10.
5. Turn the ignition OFF.
6. Measure resistance between pin 4 of the DEF tank level/temperature sensor connector, harness side, and ground. Is the resistance less than five ohms?
   - 6.a Yes; replace the DEF tank temperature/level sensor. Refer to section "Removal of the 13- and 23-Gallon Diesel Exhaust Fluid Tank Header Unit" . Verify repair.
   - 6.b No; Go to step 7.
7. Disconnect and inspect the 120-pin Aftertreatment Control Module (ACM) harness side connector. Are there any spread or damaged pins?
   - 7.a Yes; repair as necessary. Verify repair.
   - 7.b No; Go to step 8.
8. Measure the resistance between pin 4 of the DEF tank level/temperature sensor connector and pin 102 of the 120-pin ACM connector. Is the resistance less than five ohms?
   - 8.a Yes; Go to step 9.
   - 8.b No; repair the wire between pin 4 of the DEF tank level/temperature sensor connector and pin 102 of the 120-pin ACM connector. Verify repair.
9. Install a test ACM. Is SPN 3031/FMI 3 still present?
   - 9.a Yes; replace the DEF tank temperature/level sensor. Refer to section "Removal of the 13- and 23-Gallon Diesel Exhaust Fluid Tank Header Unit" . Verify repair.
   - 9.b No; replace the ACM. Verify repair.
10. Disconnect and inspect the 120-pin ACM connector. Are there any bent, spread, or corroded pins?
    - 10.a Yes; repair as necessary. Verify repair.
    - 10.b No; Go to step 11.
11. Measure the resistance between pin 3 of the DEF tank level/temperature sensor connector and pin 103 of the 120-pin ACM connector. Is the resistance less than five ohms?
    - 11.a Yes; Go to step 12.
    - 11.b No; repair the wire between pin 3 of the DEF tank level/temperature sensor connector and pin 103 of the 120-pin ACM connector.
12. Install a test ACM. Is SPN 3031/FMI 3 still present?
    - 12.a Yes; replace the DEF tank temperature/level sensor. Refer to section "Removal of the 13- and 23-Gallon Diesel Exhaust Fluid Tank Header Unit" . Verify repair.
    - 12.b No; replace the ACM. Verify repair.

211.2 SPN 3031/FMI 4 - GHG17

SPN 3031/FMI 4	
Description	Diesel Exhaust Fluid (DEF) Tank Temperature Sensor Circuit Failed Low
Monitored Parameter	DEF Tank Level Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	25 Percent Derate. After Four Hours, Engine Will be Idled After Ignition Key Cycle
Verification	Engine Idle (One Minute)

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

Note : When there is no signal from the DEF level/temperature sensor, the vehicle will go into the low DEF level derate.

Check as follows:

1. Turn the ignition OFF.
2. Disconnect and inspect the DEF tank level/temperature sensor connectors, harness side. Is there any bent, spread or corroded pins?

   2.a Yes; repair as necessary. Verify repair.

   2.b No; Go to step 3.
3. Measure the resistance from pin 3 of the DEF tank temperature/level sensor connector and ground. Is the resistance greater than 10k ohms?

   3.a Yes; Go to step 4.

   3.b No; repair the wire between pin 3 of the DEF tank temperature/level sensor connector and pin 103 of the 120-pin Aftertreatment Control Module (ACM) connector. Verify repair.

4. Install a test ACM. Is code SPN 3031/FMI 4 still present?

   4.a Yes; replace the DEF tank temperature/level sensor. Refer to section "Removal of the 13- and 23-Gallon Diesel Exhaust Fluid Tank Header Unit" . Verify repair.

   4.b No; replace the ACM. Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" . Verify repair.

211.3 SPN 3031/FMI 10 – GHG17

Diesel Exhaust Fluid Tank Temperature Erratic

1. Are there any cooling system issues or complaints?
   1.a Yes; service cooling system issues or complaints.
   1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).

Note : Perform Output Component Test, which can be run only once per key cycle.

4. Perform Output Component Test service routine. Does fault SPN 3031 FMI 3 or 4 become active during the routine?
   4.a Yes; repair those faults first, clear codes, verify repairs and release vehicle.
   4.b No; Go to step 5.
5. Using DiagnosticLink monitor parameter AS021 DEF Tank Temperature.
6. Remove the Diesel Exhaust Fluid (DEF) tank filler cap. Using an external thermometer (ex. Infrared temperature gun) to compare the actual DEF temperature (liquid) to the DiagnosticLink reported tank temperature. Is the reported AS021 DEF Tank Temperature 10°C (50°F) higher/lower than the externally measured temperature?
   6.a Yes; Go to step 7.
   6.b No; Go to step 8.
7. Disconnect the DEF Tank header temperature/level harness connector, inspect connector harness for bent, spread or corroded pins.
   7.a If pin damage is found, repair as necessary.
   7.b If no pin damage is found, replace the DEF Tank header assembly. Refer to section "Removal of the 13- and 23-Gallon Diesel Exhaust Fluid Tank Header Unit" .
8. Disconnect the DEF Tank header coolant valve harness connector, inspect connector harness for bent, spread or corroded pins.
   8.a If pin damage is found, repair as necessary.
   8.b If no pin damage is found, replace the DEF Tank header assembly. Refer to section "Removal of the 13- and 23-Gallon Diesel Exhaust Fluid Tank Header Unit" .

211.4 SPN 3031/FMI 19 – GHG17

Diesel Exhaust Fluid Tank Temperature Signal Erratic via Controller Area Network

1. Has the Aftertreatment Control Module (ACM) been recently reprogrammed?
   - 1.a Yes; clear fault codes. If they do not become active, release vehicle. If fault returns, verify proper ACM Fuelmap. ACM is looking for Diesel Exhaust Fluid (DEF) tank Controller Area Network (CAN) signal, except vehicle may be hardwired.
   - 1.b No; Go to step 2.
2. Turn the ignition OFF (key OFF, engine OFF) and disconnect DiagnosticLink , Wait five minutes for all modules to power down.
3. Turn ignition ON (key ON, engine OFF).
4. Reconnect DiagnosticLink ; are fault codes active?
   - 4.a Yes; Go to step 5.
   - 4.b No; clear faults codes and release vehicle.
5. Turn ignition OFF (key OFF, engine OFF) and wait five minutes before proceeding.
6. Disconnect the DEF tank header harness connector.
7. Measure the resistance across pins 1 and 2 of the DEF tank header harness connector.
   - 7.a If the resistance is greater than 80 ohms, Go to step 8.
   - 7.b If the resistance is between 60 +/- 20 ohms, Go to step 10.
   - 7.c If the resistance is less than 5 ohms, Go to step 8.
8. Disconnect the ACM 120-pin connector.
9. Check ACM internal terminating resistor by measuring and recording the resistance across pins 48 and 49 of the ACM 120-pin.
   - 9.a If the resistance is 60 +/- 10 ohms, repair the shorted DEF CAN harness.
   - 9.b If the resistance is not between 60 +/- 10 ohms, replace the ACM.
10. Measure and record the resistance between the ACM 120-pin connector pins 48 and 49 to engine ground.
    - 10.a If the resistance is greater than 10K ohms on both wires, replace DEF tank header. Verify repairs.
    - 10.b If the resistance is less than 10K ohms, repair the short in the harness between ACM 120-pin connector pins 48 or 49 and ground.

SPN 3056 (ACM) (GHG17)

212.1 SPN 3056/FMI 2 - GHG17

Selective Catalyst Reduction inlet NOx Sensor - Error.

SPN 3056/FMI 2	
Description	Selective Catalyst Reduction (SCR) Inlet NOx Sensor - Error
Monitored Parameter	SCR Inlet NOx
Typical Enabling Conditions	1000-1800 rpm, 35-100% load, steady cruise
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	8 Minutes
Dash Lamps	MIL
Engine Reaction	
Verification	1000-1800 rpm, 35-100% load, steady cruise, 8 minutes

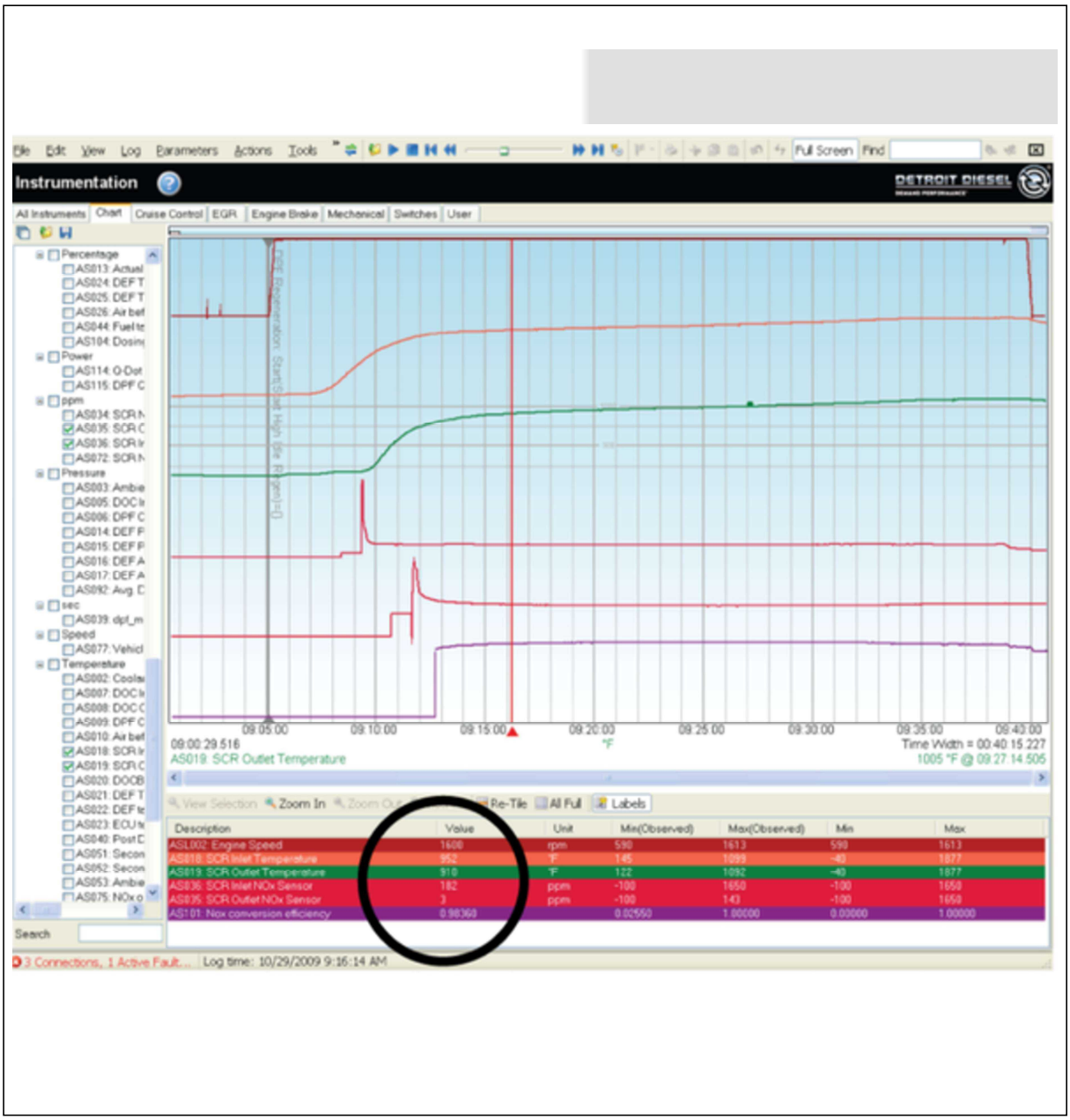
1. Connect DiagnosticLink .
2. Is SPN 5357/FMI 16 or 18 also present?
   2.a Yes; repair those fault codes first.
   2.b No; Go to step 3.
3. Monitor (chart) the following parameters:

- ASL102 engine speed
- AS018 SCR inlet temperature
- AS019 SCR outlet temperature
- AS035 SCR inlet NOx sensor
- AS036 SCR outlet NOx sensor
- AS101 NOx conversion efficiency

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

> **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.

4. Start the engine and perform a parked regeneration. Does the NOx conversion efficiency rise above 70% (0.70) during the regeneration?
   4.a Yes; clear faults and release vehicle.
   4.b No; replace the SCR inlet NOx sensor. Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .


File Edit View Log Parameters Actions Tools Full Screen Find
Instrumentation
DETROIT DIESEL
All Instruments Chart Cruise Control EGR Engine Brake Mechanical Switches User
Percentage
Power
ppm
Pressure
sec
Speed
Temperature
Search
09:05:00 09:10:00 09:15:00 09:20:00 09:25:00 09:30:00 09:35:00 09:40:00
09:00:29.516
AS019: SCR Outlet Temperature
Time Width = 00:40:15.227
1005 °F @ 09:27:14.506
Zoom In Re-Tile All Full Labels
Description Value Unit Min(Observed) Max(Observed) Min Max
ASL002: Engine Speed 1600 rpm 590 1613 590 1613
AS818: SCR Inlet Temperature 952 °F 145 1099 -40 1877
AS819: SCR Outlet Temperature 910 °F 122 1092 -40 1877
AS836: SCR Inlet NOx Sensor 182 ppm -100 1650 -100 1650
AS835: SCR Outlet NOx Sensor 3 ppm -100 143 -100 1650
AS101: Nox conversion efficiency 0.98368 0.02550 1.00000 0.00000 1.00000
3 Connections, 1 Active Fault...
Log time: 10/29/2009 9:16:14 AM

SPN 3057 (ACM) (GHG17)

213.1 SPN 3057/FMI 2 - GHG17

Selective Catalyst Reduction outlet NOx Sensor - Error.

SPN 3057/FMI 2	
Description	Selective Catalyst Reduction (SCR) Outlet NOx Sensor - Error
Monitored Parameter	SCR Outlet NOx
Typical Enabling Conditions	1000-1800 rpm, 35-100% load, steady cruise
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	8 Minutes
Dash Lamps	MIL
Engine Reaction	
Verification	1000-1800 rpm, 35-100% load, steady cruise, 8 minutes

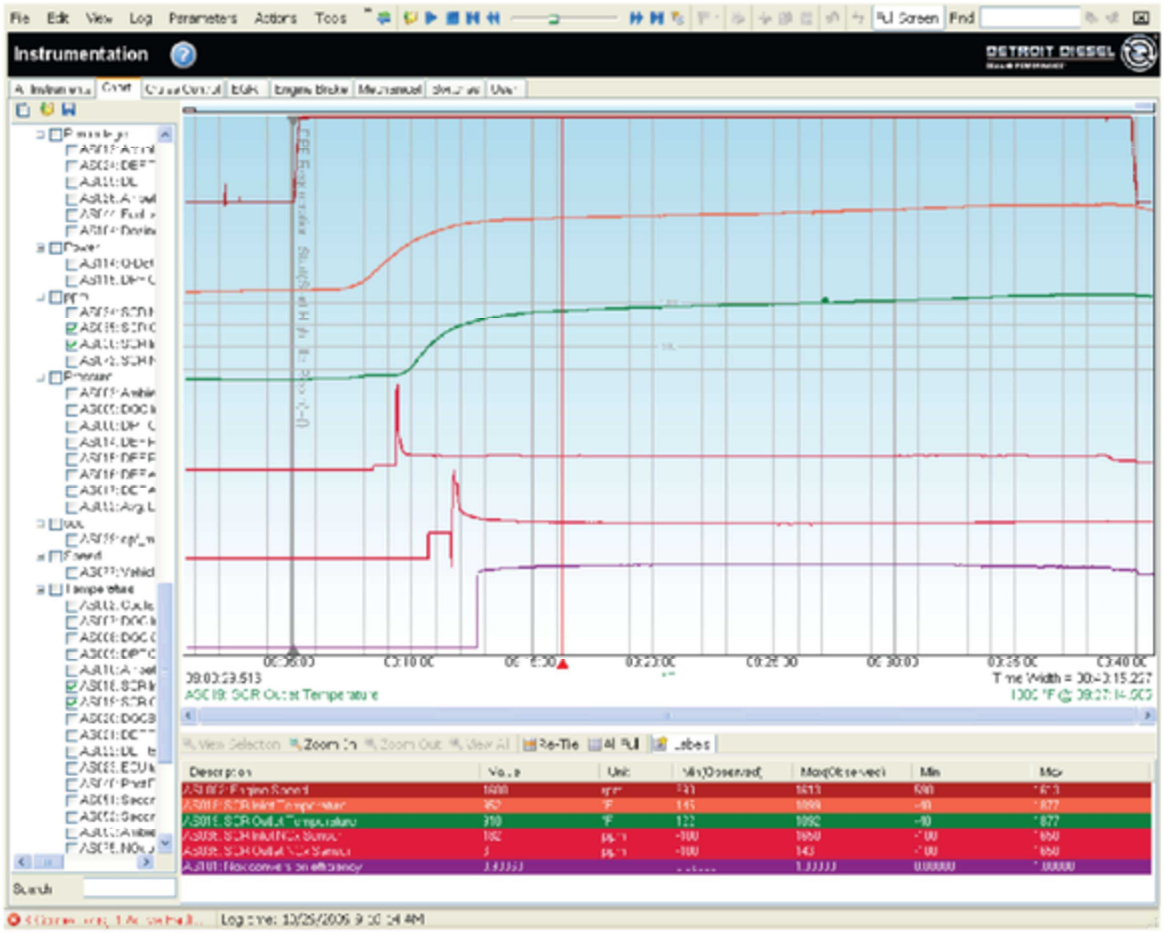
1. Connect DiagnosticLink .
2. Is SPN 5357 FMI 16 or 18 also present?
   2.a Yes; repair those fault codes first.
   2.b No; Go to step 3.
3. Monitor (chart) the following parameters.

- ASL102 engine speed
- AS018 SCR inlet temperature
- AS019 SCR outlet temperature
- AS035 SCR inlet NOx sensor
- AS036 SCR outlet NOx sensor
- AS101 NOx conversion efficiency

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

> **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.

4. Start the engine and perform a parked regeneration. Does the NOx conversion efficiency rise above 70% (0.70) during the regeneration?
   4.a Yes, clear faults and release vehicle.
   4.b No, replace the SCR outlet NOx sensor. Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .


File Edit View Log Parameters Actions Tools
Instrumentation
DETROIT DIESEL
Description
Value
Unit
Min
Max

SPN 3058 (MCM) (GHG17)

214.1 SPN 3058/FMI 9 - GHG17

Exhaust Gas Recirculation Slow Response - Low Box

SPN 3058/FMI 9	
Description	This Fault Code Sets when Actual EGR Flow vs. Desired EGR Flow is Greater than a Calibrated Threshold While the Engine rpm is Between 600 and 900 rpm.
Monitored Parameter	EGR delta P Sensor, Intake Manifold Pressure Sensor, Intake Manifold Temperature Sensor
Typical Enabling Conditions	Low Engine to High Engine Load
Monitor Sequence	One Second After Acceleration Load, Actual EGR Flow vs. Desired EGR Flow is Greater than a Calibrated Threshold
Execution Frequency	Always Enabled
Typical Duration	Five Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Road Test With a Trailer While Performing Multiple Accelerations, Engine Load Needs to Increase Above 50% During Acceleration and the Engine rpm is Between 600 and 900 rpm.

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple codes. Are any of the following codes present?

- SPN 411 / FMI 2, FMI 3, FMI 4, FMI 13
- SPN 1636 / FMI 0, FMI 3, FMI 4, FMI 14, FMI 16
- SPN 2630 / FMI 3, FMI 4, FMI 14
- SPN 2791 / FMI 2, FMI 7, FMI 9, FMI 11, FMI 12, FMI 13, FMI 14, FMI 16, FMI 18, FMI 31
- SPN 3563 / FMI 3, FMI 4, FMI 10 FMI 16, FMI 18, FMI 21
- SPN 2659 / FMI 0, FMI 18
- SPN 521018 / FMI 0
- SPN 521019 / FMI 0
- SPN 521020 / FMI 0

3.a Yes; diagnose the other fault codes first.

3.b No; Go to step 4.

4. Check the Diesel Particulate Filter (DPF) zone. Is the DPF zone greater than zero?

4.a Yes; perform a parked regeneration and Go to step 5.

4.b No; Go to step 6.

5. Road test with a trailer while performing multiple accelerations, (engine load needs to increase above 50% during acceleration). Does fault code SPN 3058 FMI 10 become active?

5.a Yes; Go to step 6.

5.b No; the back pressure in the exhaust was the cause of the concern. Release the vehicle to the customer.

6. Use DiagnosticLink to monitor the Exhaust Gas Recirculation (EGR) delta P sensor voltage. Is the voltage between 0.55 and 0.83 volts?

6.a Yes; Go to step 15.

6.b No; Go to step 7.

7. Turn the ignition OFF.

8. Disconnect and inspect the delta P sensor electrical connector harness side. Are there any bent, damaged or corroded pins?

8.a Yes; replace the EGR delta P electrical connector. Refer to technical Service letter 10 TS-8 . Verify repair.

8.b No; Go to step 9.

9. Inspect the delta P sensor electrical connector component side. Are there any bent, damaged or corroded pins?

9.a Yes; replace the delta P sensor. Refer to section "Removal of the Delta P Sensor" . Verify repair.

9.b No; Go to step 10.

10. Remove the EGR delta P sensor. Refer to section "Removal of the Delta P Sensor" .

11. Reconnect the EGR delta P electrical connector while the EGR delta P sensor is still removed.

12. Turn the ignition ON (key ON, engine OFF).

13. Monitor the EGR delta P sensor voltage again. Is the voltage between 0.55 and 0.83 volts?

13.a Yes; Go to step 14.

13.b No; replace the EGR delta P sensor. Verify repair.

14. Inspect the EGR delta P sensor ports. Are the EGR delta P sensor ports restricted?

14.a Yes; replace the EGR delta P sensor. Refer to section "Removal of the Delta P Sensor" . Verify repair.

14.b No; clean the EGR venturi ports. Refer to Service Letter 14 TS-2 and Refer to section "Cleaning of the Exhaust Gas Recirculation Venturi Pipe Delta P Sensor Ports" . Verify repair.

15. Inspect the EGR and exhaust system for leaks. Are there any leaks present?

15.a Yes; repair the EGR/exhaust leaks. Verify repair.

15.b No; Go to step 16.

16. Check for leaks between the turbocharger outlet pipe and the intake manifold. Are there any leaks present?

16.a Yes; repair the leaks. Verify repair.

16.b No; Go to step 17.

17. Check the Charge Air Cooler for leaks. Refer to Original Equipment Manufacturer (OEM) for CAC testing procedures. Does the CAC pass the leak test?

17.a Yes; Go to step 18.

17.b No; replace the CAC. Refer to OEM literature for CAC replacement procedures. Verify repair.

18. Remove and inspect the EGR delta P sensor ports. Are there any restrictions present?

18.a Yes; replace the EGR delta P sensor. Refer to section "Removal of the Delta P Sensor" . Verify repair.

18.b No; Go to step 19.

19. Inspect the EGR venturi ports. Are there any restrictions present?

19.a Yes; clean the EGR venturi ports. Refer to section "Cleaning of the Exhaust Gas Recirculation Venturi" . Verify repair.

19.b No; clean the EGR system.

For DD13 engines : Refer to section "Cleaning of the DD13 Exhaust Gas Recirculation System" .

For DD15 engines : Refer to section "Cleaning of the DD15 Exhaust Gas Recirculation System" .

For DD16 engines : Refer to section "Cleaning of the DD16 Exhaust Gas Recirculation System" .

214.2 SPN 3058/FMI 10 - GHG17

Exhaust Gas Recirculation Slow Response

SPN 3058/FMI 10	
Description	This Fault Code Sets When Actual EGR Flow vs. Desired EGR Flow is Greater than a Calibrated Threshold.
Monitored Parameter	EGR delta P Sensor, Intake Manifold Pressure Sensor, Intake Manifold Temperature Sensor
Typical Enabling Conditions	Low Engine to High Engine Load
Monitor Sequence	One Second After Acceleration Load, Actual EGR Flow vs. Desired EGR Flow is Greater than a Calibrated Threshold
Execution Frequency	Always Enabled
Typical Duration	Five Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Road Test With a Trailer While Performing Multiple Accelerations, Engine Load Needs to Increase Above 50% During Acceleration

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple codes. Are any of the following codes present?

- SPN 411 / FMI 2, FMI 3, FMI 4, FMI 13
- SPN 1636 / FMI 0, FMI 3, FMI 4, FMI 14, FMI 16
- SPN 2630 / FMI 3, FMI 4, FMI 14
- SPN 2791 / FMI 2, FMI 7, FMI 9, FMI 11, FMI 12, FMI 13, FMI 14, FMI 16, FMI 18, FMI 31
- SPN 3563 / FMI 3, FMI 4, FMI 10 FMI 16, FMI 18, FMI 21
- SPN 2659 / FMI 0, FMI 18
- SPN 521018 / FMI 0
- SPN 521019 / FMI 0
- SPN 521020 / FMI 0

3.a Yes; diagnose the other fault codes first.

3.b No; Go to step 4.

4. Check the Diesel Particulate Filter (DPF) zone. Is the DPF zone greater than zero?

4.a Yes; perform a parked regeneration and Go to step 5.

4.b No; Go to step 6.

5. Road test with a trailer while performing multiple accelerations, (engine load needs to increase above 50% during acceleration). Does fault code SPN 3058 FMI 10 become active?

5.a Yes; Go to step 6.

5.b No; the back pressure in the exhaust was the cause of the concern. Release the vehicle to the customer.

6. Use DiagnosticLink to monitor the Exhaust Gas Recirculation (EGR) delta P sensor voltage. Is the voltage between 0.55 and 0.83 volts?

6.a Yes; Go to step 15.

6.b No; Go to step 7.

7. Turn the ignition OFF.

8. Disconnect and inspect the delta P sensor electrical connector harness side. Are there any bent, damaged or corroded pins?

8.a Yes; replace the EGR delta P electrical connector. Refer to technical Service letter 10 TS-8 . Verify repair.

8.b No; Go to step 9.

9. Inspect the delta P sensor electrical connector component side. Are there any bent, damaged or corroded pins?

9.a Yes; replace the delta P sensor. Refer to section "Removal of the Delta P Sensor" . Verify repair.

9.b No; Go to step 10.

10. Remove the EGR delta P sensor. Refer to section "Removal of the Delta P Sensor" .

11. Reconnect the EGR delta P electrical connector while the EGR delta P sensor is still removed.

12. Turn the ignition ON (key ON, engine OFF).

13. Monitor the EGR delta P sensor voltage again. Is the voltage between 0.55 and 0.83 volts?

13.a Yes; Go to step 14.

13.b No; replace the EGR delta P sensor. Verify repair.

14. Inspect the EGR delta P sensor ports. Are the EGR delta P sensor ports restricted?

14.a Yes; replace the EGR delta P sensor. Refer to section "Removal of the Delta P Sensor" . Verify repair.

14.b No; clean the EGR venturi ports. Refer to Service Letter 14 TS-2 and Refer to section "Cleaning of the Exhaust Gas Recirculation Venturi Pipe Delta P Sensor Ports" . Verify repair.

15. Inspect the EGR and exhaust system for leaks. Are there any leaks present?

15.a Yes; repair the EGR/exhaust leaks. Verify repair.

15.b No; Go to step 16.

16. Check for leaks between the turbocharger outlet pipe and the intake manifold. Are there any leaks present?

16.a Yes; repair the leaks. Verify repair.

16.b No; Go to step 17.

17. Check the Charge Air Cooler for leaks. Refer to Original Equipment Manufacturer (OEM) for CAC testing procedures. Does the CAC pass the leak test?

17.a Yes; Go to step 18.

17.b No; replace the CAC. Refer to OEM literature for CAC replacement procedures. Verify repair.

18. Remove and inspect the EGR delta P sensor ports. Are there any restrictions present?

18.a Yes; replace the EGR delta P sensor. Refer to section "Removal of the Delta P Sensor" . Verify repair.

18.b No; Go to step 19.

19. Inspect the EGR venturi ports. Are there any restrictions present?

19.a Yes; clean the EGR venturi ports. Refer to section "Cleaning of the Exhaust Gas Recirculation Venturi" . Verify repair.

19.b No; clean the EGR system.

For DD13 engines : Refer to section "Cleaning of the DD13 Exhaust Gas Recirculation System" .

For DD15 engines : Refer to section "Cleaning of the DD15 Exhaust Gas Recirculation System" .

For DD16 engines : Refer to section "Cleaning of the DD16 Exhaust Gas Recirculation System" .

SPN 3061 (MCM) (GHG17)

215.1 SPN 3061/FMI 1 - GHG17

Cold start emission reduction strategy fault condition for boi main

SPN 3061/FMI 1	
Description	This fault code sets when the point of injection does not match a modeled threshold when the engine is cold.
Monitored Parameter	Injector timing
Typical Enabling Conditions	600 rpm/base idle, Coolant temperature less than 87°C (188°F)
Monitor Sequence	None
Execution Frequency	Always
Typical Duration	10 seconds
Dash Lamps	None
Engine Reaction	None
Verification	Run the engine at 600 rpm or base idle for five minutes with the coolant temperature below 87°C (188°F)

This is an informational only code.

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Diagnose the fuel system fault codes that are present.

215.2 SPN 3061/FMI 2 - GHG17

Cold start emission reduction strategy fault condition EGR position

SPN 3061/FMI 2	
Description	This fault code sets when the point of injection does not match a modeled threshold when the engine is cold.
Monitored Parameter	EGR position
Typical Enabling Conditions	600 rpm/base idle, Coolant temperature less than 87°C (188°F)
Monitor Sequence	None
Execution Frequency	Always
Typical Duration	10 seconds
Dash Lamps	None
Engine Reaction	None
Verification	Run the engine at 600 rpm or base idle for five minutes with the coolant temperature below 87°C (188°F)

This is an informational only code.

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Diagnose the Exhaust Gas Recirculation (EGR) system fault codes that are present.

SPN 3187 (CPC) (GHG17)

216.1 SPN 3187/FMI 9 – GHG17

CPC Has Lost Communication With the DT12 Shift Stalk Lever

Shift Lever Pin Number	Signal Description	CPC4 Connector Pin
1	12V Ignition	2/3 Ignition
2	LIN	2/4 LIN COM
3	GND	2/2 Main Battery Ground
4	No Connection	No Connection

1. Disconnect shift stalk lever.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure voltage between pin 1 of the shift stalk harness connector and ground. Is the voltage between 11.5 and 12 volts?
   - 3.a Yes; Go to step 4.
   - 3.b No; Go to step 9.
4. Turn the ignition OFF.
5. Disconnect CPC connector #2.
6. Inspect CPC connector #2 for bent, spread, or corroded pins. Is there any pin damage?
   - 6.a Yes; repair as necessary.
   - 6.b No; Go to step 7.
7. Measure the resistance between pin 4 of the CPC connector #2 and pin 2 of the shift stalk lever harness connector. Is the resistance less than five ohms?
   - 7.a Yes; Go to step 8.
   - 7.b No; repair wire between pin 4 of the CPC connector #2 and pin 2 of the shift stalk lever harness connector.
8. Measure the resistance between pin 2 of the CPC connector #2 and pin 3 of the shift stalk lever harness connector. Is the resistance less than five ohms?
   - 8.a Yes; replace the shift stalk lever.
   - 8.b No; repair wire between pin 2 of the CPC connector #2 and pin 3 of the shift stalk lever harness connector.
9. Turn the ignition OFF.
10. Disconnect CPC connector #2.
11. Measure the resistance between pin 4 of the CPC connector #2 and pin 2 of the shift stalk lever harness connector. Is the resistance less than five ohms?
    - 11.a Yes; refer to OEM literature for chassis side harness information on Ignition supply voltage to pin 3 of the CPC connector #2.
    - 11.b No; repair wire between pin 4 of the CPC connector #2 and pin 2 of the shift stalk lever harness connector.

SPN 3187 (CPC3) (GHG17)

217.1 SPN 3187/FMI 4 - GHG17

This fault indicates the CPC3 has lost communication with the DT12 shift stalk lever.

Shift Lever Pin Number	Signal Description	CPC3 Connector Pin
1	12V Ignition	3/21 Ignition
2	LIN	3/47 LIN COM
3	GND	3/34 Main Battery Ground
4	No Connection	No Connection

1. Turn ignition OFF.
2. Disconnect shift stalk lever.
3. Disconnect CPC3 connector #3.
4. Inspect CPC3 connector #3 for bent, spread, or corroded pins. Is pin damage present?
   - 4.a Yes; repair as necessary.
   - 4.b No; Go to step 5.
5. Measure the resistance between pin 21 of the CPC3 connector #3 and chassis ground. Is resistance less than five ohms?
   - 5.a Yes; repair short to ground between pin 21 of the CPC3 connector #3 and pin 1 of the shift stalk lever harness connector.
   - 5.b No; replace the shift stalk lever.

217.2 SPN 3187/FMI 12 - GHG17

This fault indicates the CPC3 has lost communication with the DT12 shift stalk lever.

Shift Lever Pin Number	Signal Description	CPC3 Connector Pin
1	12V Ignition	3/21 Ignition
2	LIN	3/47 LIN COM
3	GND	3/34 Main Battery Ground
4	No Connection	No Connection

1. Disconnect shift stalk lever.
2. Turn ignition ON (key ON, engine OFF).
3. Measure voltage between pin 1 of the shift stalk harness connector and ground. Is the voltage between 11.5 and 12 volts?
   - 3.a Yes; Go to step 4.
   - 3.b No; Go to step 9.
4. Turn ignition OFF.
5. Disconnect CPC3 connector #3.
6. Inspect CPC3 connector #3 for bent, spread, or corroded pins. Is pin damage present?
   - 6.a Yes; repair as necessary.
   - 6.b No; Go to step 7.
7. Measure the resistance between pin 47 of the CPC3 connector #3 and pin 2 of the shift stalk lever harness connector. Is resistance less than five ohms?
   - 7.a Yes; Go to step 8.
   - 7.b No; repair wire between pin 47 of the CPC3 connector #3 and pin 2 of the shift stalk lever harness connector.
8. Measure the resistance between pin 34 of the CPC3 connector #3 and pin 3 of the shift stalk lever harness connector. Is resistance less than five ohms?
   - 8.a Yes; replace the shift stalk lever.
   - 8.b No; repair wire between pin 34 of the CPC3 connector #3 and pin 3 of the shift stalk lever harness connector.
9. Turn the ignition OFF.
10. Disconnect CPC3 connector #3.
11. Measure the resistance between pin 21 of the CPC3 connector #3 and pin 1 of the shift stalk lever harness connector. Is resistance less than five ohms?
    - 11.a Yes; refer to OEM literature for chassis side harness information on Ignition supply voltage to pin 21 of the CPC3 connector #3.
    - 11.b No; repair wire between pin 21 of the CPC3 connector #3 and pin 1 of the shift stalk lever harness connector.

SPN 3216 (ACM) (GHG17)

218.1 SPN 3216/FMI 3 - GHG17

Selective Catalyst Reduction Inlet NOx Sensor Circuit Failed High

SPN 3216/FMI 3	
Description	This Codes Sets When There is a Short to Power on the SCR NOx Inlet Circuit Between the Sensor and the CPU
Monitored Parameter	SCR Inlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Parked Regen

Check as follows:

1. Disconnect the Selective Catalyst Reduction (SCR) inlet NOx sensor.
2. Inspect the SCR inlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?
   - 2.a Yes; repair as necessary. Verify repairs.
   - 2.b No; replace the SCR inlet NOx sensor. Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

218.2 SPN 3216/FMI 4 - GHG17

Selective Catalyst Reduction Inlet NOx Sensor Circuit Failed Low

SPN 3216/FMI 4	
Description	This Codes Sets When There is a Short to Ground on the SCR NOx Inlet Circuit Between the Sensor and the CPU
Monitored Parameter	SCR Inlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Parked Regen

1. Disconnect the Selective Catalyst Reduction (SCR) inlet NOx sensor.
2. Inspect the SCR inlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

   2.a Yes; repair as necessary. Verify repairs.

   2.b No; replace the SCR inlet NOx sensor.

   For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor"

   For 2-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor"

218.3 SPN 3216/FMI 10 – GHG17

SPN 3216/FMI 10	
Description	High NOx at Idle
Monitored Parameter	NOx
Typical Enabling Conditions	Zero vehicle speed, rpm less than 900, EGR closed
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL
Engine Reaction	None

1. Are any Exhaust Gas Recirculation (EGR) system faults also present?
   1.a Yes; repair the EGR system faults first.
   1.b No; Go to step 2.
2. Visually inspect the entire air inlet, Charge Air Cooler (CAC), and EGR piping and hose for visible signs of leaks or damage. Is any damage or leaks found?
   2.a Yes; repair as necessary.
   2.b No; Go to step 3.
3. Perform an Idle Speed Balance (ISB) test. Refer to section "Checking Idle Speed Balance" .
   3.a If a faulty fuel injector is identified, repair as necessary.
   3.b If no fuel injector issues are present, Go to step 4.
4. Check the Aftertreatment System (ATS) for visible exhaust leaks or damage. Are exhaust leaks or damage found?
   4.a Yes; repair as necessary.
   4.b No; Go to step 5.
5. Connect DiagnosticLink .

> **⚠ 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.

6. Perform a High Idle Regeneration; retain the log file and submit it to the Detroit™ Customer Support Center at 800-445-1980.

218.4 SPN 3216/FMI 13 - GHG17

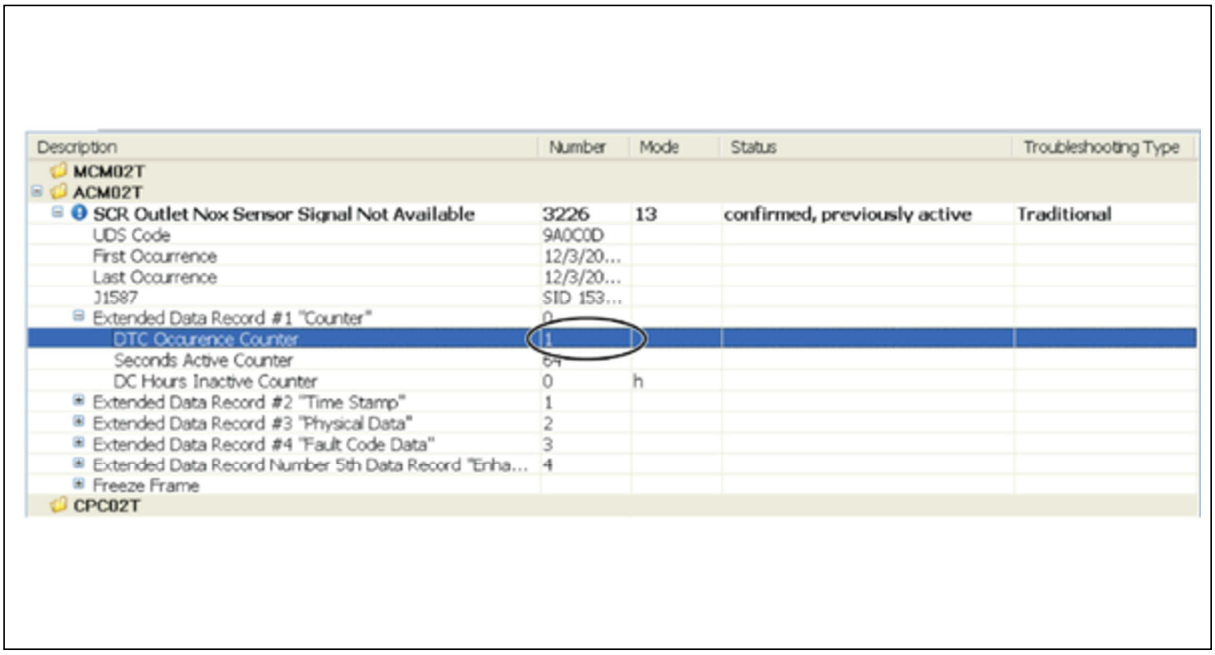
Selective Catalyst Reduction Inlet NOx Sensor Signal Not Available

SPN 3216/FMI 13	
Description	Selective Catalyst Reduction (SCR) Inlet NOx Sensor Signal Not Available
Monitored Parameter	SCR Inlet NOx Sensor Signal
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Engine Idle (1 minute)

Note : If fault occurred during high idle regeneration, clear fault and release vehicle.

Check as follows:

1. Is the SPN 3216/FMI 13 currently active?
   - 1.a Yes; Go to step 3.
   - 1.b No; Go to step 2.
2. Check the SPN 3216/FMI 13 Diagnostic Trouble Code (DTC) occurrence counter.



   - 2.a If the DTC occurrence counter is five or less, clear the fault and release the vehicle.
   - 2.b If the DTC occurrence counter is greater than five, Go to step 3.
3. Disconnect the SCR inlet NOx sensor.
4. Inspect the SCR inlet NOx sensor harness for bent, spread, or corroded pins.
   - 4.a If the pins are bent, spread, or corroded, repair as necessary.
   - 4.b If the connector shows no signs of damage, Go to step 5.

5. Turn the ignition ON (key ON, engine OFF).
6. Measure the voltage between pins 1 and 4 on the harness side of the SCR inlet NOx sensor connector.
   - 6.a If the voltage is less than 11.5 volts, Go to step 7.
   - 6.b If the voltage is greater than 11.5 volts, Go to step 8.
7. Measure the voltage between pin 1 on the harness side of the SCR inlet NOx sensor connector and engine ground.
   - 7.a If the voltage is less than 11.5 volts, repair the wire between pin 1 on the harness side of the SCR inlet NOx sensor connector and pin 50 of the Aftertreatment Control Module (ACM) 120-pin connector.
   - 7.b If the voltage is greater than 11.5 volts, repair the wire between pin 4 on the harness side of the SCR inlet NOx sensor connector and pin 51 of the ACM 120-pin connector.
8. Turn the ignition OFF.
9. Measure the resistance between pins 2 and 3 on the harness side of the SCR inlet NOx sensor connector.
   - 9.a If the resistance is between 50 and 70 ohms, replace the SCR inlet NOx sensor.

     For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

     For 2-BOX, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .
   - 9.b If the resistance is not between 50 and 70 ohms, Go to step 10.
10. Disconnect the ACM 120-pin connector.
11. Inspect the ACM 120-pin harness connector for signs of damage, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector.
    - 11.a If signs of damage are present, repair as necessary.
    - 11.b If no signs of damage are present, Go to step 12.
12. Measure the resistance between pins 2 and 3 on the harness side of the SCR inlet NOx sensor connector.
    - 12.a If the resistance is less than 10K ohms, repair the short between pins 2 and 3 on the harness side of the SCR inlet NOx sensor connector and pins 52 and 53 of the ACM 120-pin connector. Refer to section "Verify Repairs" .
    - 12.b If the resistance is greater than 10K ohms, Go to step 13.
13. Measure the resistance between pin 2 on the harness side of the SCR inlet NOx sensor connector and pin 53 of the ACM 120-pin connector.
    - 13.a If the resistance is greater than 5 ohms, repair the wire between pin 2 on the harness side of the SCR inlet NOx sensor connector and pin 53 of the ACM 120-pin connector.
    - 13.b If the resistance is less than 5 ohms, Go to step 14.
14. Measure the resistance between pin 3 on the harness side of the SCR inlet NOx sensor connector and pin 52 of the ACM 120-pin connector.
    - 14.a If the resistance is greater than 5 ohms, repair the wire between pin 3 on the harness side of the SCR inlet NOx sensor connector and pin 52 of the ACM 120-pin connector. Refer to section "Verify Repairs" .
    - 14.b If the resistance is less than 5 ohms, Go to step 15.
15. Test the ACM internal resistor; measure the resistance between pins 52 and 53 on the ACM.

15.a If the resistance is between 50 and 70 ohms, replace the SCR inlet NOx Sensor.

For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

For 2-BOX, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

15.b If the resistance is NOT between 50 and 70 ohms, replace the ACM.

218.5 SPN 3216/FMI 16 – GHG17

SPN 3216/FMI 16			
Description	NOx Sensor Plausibility Check		
Monitored Parameter	Aftertreatment Inlet NOx Sensor		
Typical Enabling Conditions (Common Subset for all Engines)	**General Enabling Condition:** Engine is not in regeneration and operating at high speed and loads		
	Specific Enabling Conditions: (see below):		
	Engine Parameter	**Min**	**Max**
	Engine Speed (rpm)	1350	1600
	Torque (N·m)	1100	1500
	Battery Voltage (Volts)	11.08	
	Engine Coolant Outlet Temperature	70°C (158°F)	
	Ambient Temperature	-8°C (17.6°F)	
	Barometric Pressure (mbar)	755 mbar (11 psi)	
	Time Since DPF regen (min.)	15	
	Beginning of Injection (BOI) - Degrees of Crankshaft Rotation	10	
	EGR Mass (Kg/min)	5	
Monitor Sequence	None		
Execution Frequency	Continuous When Enabling Conditions Met		
Typical Duration	150 Seconds (Two-Cycle)		
Dash Lamps	MIL		
Engine Reaction	None		
Verification	Parked SCR Efficiency Test		

1. Connect DiagnosticLink .
2. Are any of the following faults present SPN 3216/FMI 3,4,10,13 or SPN 2659/FMI 0, 18 or SPN 4752/FMI 0, 15?

   2.a Yes; repair those fault codes first.

   2.b No; Go to step 3.
3. Monitor (chart) the following parameters:

- ASL102 engine speed
- AS018 Selective Catalyst Reduction (SCR) inlet temperature
- AS019 SCR outlet temperature
- AS035 SCR inlet NOx sensor
- AS036 SCR outlet NOx sensor
- AS101 NOx conversion efficiency

NOTICE

Do not attempt to operate engine with the DEF lines disconnected. DEF pump runs and circulates DEF through the system at a limited rate (default) to aid in system cooling.

4. Disconnect the Diesel Exhaust Fluid (DEF) Dosing Unit electrical connector only. Leave Dosing Unit bolted to Aftertreatment and DEF lines connected.

5. Inspect the DEF dosing unit harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Are any signs of damage present?

   5.a Yes; repair as necessary. Go to step 27.

   5.b No; Go to step 6.

Note : Running the engine with a disconnected DEF Dosing Unit will induce fault codes.

> **⚠ 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.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

6. Start the engine and perform a full parked regeneration. Refer to section "Performing a Parked Regeneration - GHG17" .

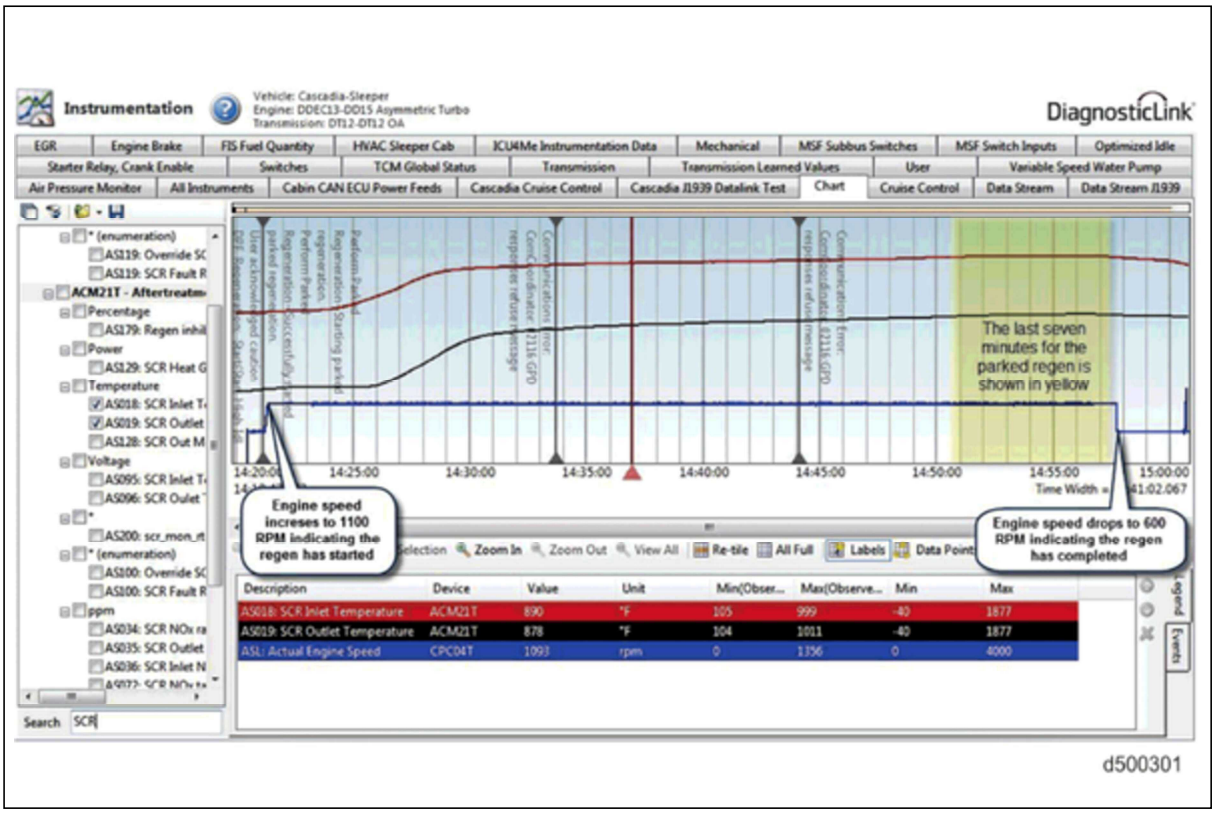
7. Monitor the inlet NOx sensor and outlet NOx sensor. During the last seven minutes of the parked regen, are the sensors reading within 50 ppm of each other?

   7.a Yes; Go to step 8.

   7.b No; replace the Inlet NOx Sensor.

   For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

   For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .



8. Turn the ignition OFF.
9. Perform Charge Air Cooler (CAC) inspection and leak test. Refer to OEM literature for procedure. Is there any damage found?
   - 9.a Yes; Go to step 26.
   - 9.b No; Go to step 10.
10. Visually inspect the entire Exhaust Gas Recirculation (EGR) and exhaust system (turbine housing, exhaust manifold, etc.) for evidence of external leakage (e.g. soot, coolant deposits at joints). Is there evidence of external leakage?
    - 10.a Yes; repair as necessary. Go to step 26.
    - 10.b No; Go to step 11.
11. Remove the delta P sensor from the mounting pad; leave the electrical harness connected.
12. Inspect the delta P sensor for moisture inside the ports. Shake moisture out if necessary; do not replace the sensor.
13. Inspect the delta P venturi ports for clogging and blockage. A layer of soot on the delta P sensor is OK. Is there any blockage found?
    - 13.a Yes; clean venturi ports. Do not replace delta P sensor. Go to step 26.
    - 13.b No; Go to step 14.
14. Turn the ignition ON (key ON, engine OFF).
15. Using DiagnosticLink, monitor delta P voltage (pin 109).
16. Is the delta P voltage between 0.55 and 0.83 volts?
    - 16.a Yes; Go to step 20.
    - 16.b No; Go to step 17.
17. Turn the ignition OFF.
18. Disconnect the delta P sensor harness connector.

19. Inspect the delta P sensor harness connector for loose, bent, spread, or corroded pins. Is there any pin damage found?
    - 19.a Yes; repair as necessary. Go to step 26.
    - 19.b No; replace delta P sensor. Refer to section "Removal of the Delta P Sensor" . Go to step 25.
20. Compare Inlet Manifold Pressure (IMP) value with the barometric pressure value. Are the values within 10.3 kPa (1.5 psi) of each other?
    - 20.a Yes; Go to step 23.
    - 20.b No; Go to step 21.
21. Disconnect the intake pressure/temperature sensor.
22. Inspect the intake pressure/temperature sensor and wiring connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is there any sign of damage present?
    - 22.a Yes; repair as necessary. Go to step 26.
    - 22.b No; replace intake pressure/temperature sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" . Go to step 26.
23. Remove EGR cooler hot pipe, EGR crossover pipe and delivery pipe and inspect for excessive build-up or blockage. Is there excessive build-up or blockage?
    - 23.a Yes; clean piping and replace EGR cooler. Refer to section "Removal of the DD13 Exhaust Gas Recirculation Cooler Water Manifold Assembly" . Go to step 25.
    - 23.b No; re-install the EGR cooler, crossover pipe and delivery pipe. Go to step 24.
24. Disconnect the inlet NOx sensor harness connector.
25. Inspect the inlet NOx sensor and wiring connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any pin damage found?
    - 25.a Yes; repair as necessary. Go to step 26.
    - 25.b No; replace the SCR inlet NOx sensor. Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" . Go to step 26.
26. Turn the ignition OFF and allow for all modules to power down, then turn the ignition back ON and start the engine. Go to step 27.
27. Verify repairs by performing a Parked SCR Efficiency Test. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

218.6 SPN 3216/FMI 18 – GHG17

SPN 3216/FMI 18			
Description	NOx Sensor Plausibility Check		
Monitored Parameter	Aftertreatment Inlet NOx Sensor		
Typical Enabling Conditions (Common Subset for all Engines)	**General Enabling Condition:** Engine is not in regen and operating at high speed and loads		
	Specific Enabling Conditions:		
	Engine Parameter	**Min**	**Max**
	Engine Speed (rpm)	1350	1600
	Torque (Nm)	1100	1500
	Battery Voltage (Volts)	11.08	
	Engine Coolant Outlet Temperature	70°C (158°F)	
	Ambient Temperature	-8°C (17.6°F)	
	Barometric Pressure (mbar)	755	
	Time Since DPF regen (min.)	15	
	Beginning of Injection (BOI) - Degrees of Crankshaft Rotation	10	
	EGR Mass (Kg/min)	5	
Monitor Sequence	None		
Execution Frequency	Continuous When Enabling Conditions Met		
Typical Duration	150 Seconds (2 Cycle)		
Dash Lamps	MIL		
Engine Reaction	None		
Verification	Warm Up Engine and Ensure Engine is Not in Regen Mode. Drive a Fully-Loaded Trailer on Highway and Maintain Above Enabling Conditions for 150 Seconds		

1. Connect DiagnosticLink .
2. Are any other faults also present?
   2.a Yes; repair those fault codes first.
   2.b No; Go to step 3.
3. Monitor (chart) the following parameters:

- ASL102 engine speed
- AS018 Selective Catalyst Reduction (SCR) inlet temperature
- AS019 SCR outlet temperature
- AS035 SCR inlet NOx sensor
- AS036 SCR outlet NOx sensor
- AS101 NOx conversion efficiency

NOTICE

Do not attempt to operate engine with the DEF lines disconnected. DEF pump runs and circulates DEF through the system at a limited rate (default) to aid in system cooling.

4. Disconnect the Diesel Exhaust Fluid (DEF) dosing unit electrical connector only. Leave dosing unit bolted to aftertreatment and DEF lines intact.

Note : SPN 3361/FMI 5 will set when the DEF dosing unit electrical connector is disconnected. The fault code can be cleared using DiagnosticLink after the DEF dosing unit electrical connector is reconnected.

5. Inspect the DEF dosing unit harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Are there any signs of damage present?

   5.a Yes; repair as necessary. Go to step 34.

   5.b No; Go to step 6.

Note : Running the engine with a disconnected DEF dosing unit will induce a fault code.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

6. Start the engine and perform a complete parked regen. Refer to section "Performing a Parked Regeneration - GHG17" .

NOTICE

It may require 30 minutes or longer for the outlet NOx sensor to turn on. Do not replace either sensor unless directed by the troubleshooting.

7. Monitor the inlet NOx sensor and outlet NOx sensor. During the last five minutes of the parked regen, are the sensors reading within 50 ppm of each other?

   7.a Yes; check for turbocharger type.

   If Asymmetrical Turbocharger (AT), Go to step 8.

   If Turbo Compound (TC), Go to step 16.

   7.b No; replace the inlet NOx sensor.

   For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor"

   For 2-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" . Verify repair.

8. Turn the ignition OFF.

9. Ensure the vehicle air supply is at least 6.0 bar (87 psi). Inspect the air line connection to the wastegate solenoid. Are there any leaks or kinks in the air line connection?

   9.a Yes; repair or replace as necessary. Go to step 35.

9.b No; Go to step 10.

10. Inspect the wastegate actuator and the plumbing to and from the actuator. Verify wastegate opens and closes. Is there any binding or damage found?

10.a Yes; repair as necessary. Go to step 35.

10.b No; Go to step 11.

11. Turn the ignition ON (key ON, engine OFF).

Note : Wastegate control does not respond at 50 percent. To cycle wastegate, use either 0 percent or 95 percent.

12. Using DiagnosticLink, activate wastegate control from Service Routines Activate Outputs Panel. Run slide control up to 95% - (Click Set). Wastegate will open with air psi available. Observe wastegate linkage movement. Does wastegate open when commanded?

12.a Yes; Go to step 13.

12.b No; Go to step 14.

13. Move slide control down to 0. Observe wastegate linkage movement. Does wastegate close when commanded?

13.a Yes; Go to step 16.

13.b No; Go to step 14.

14. Disconnect the wastegate solenoid harness connector.

15. Inspect the wastegate solenoid and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is there any damage present?

15.a Yes; repair as necessary. Go to step 35.

15.b No; replace the wastegate solenoid.

Refer to section "Removal of the DD13 Wastegate Solenoid." Go to step 35.

Refer to section "Removal of the GHG17 DD15 Asymmetrical Turbocharger Wastegate Solenoid." Go to step 35.

16. Turn the ignition OFF.

17. Perform Charge Air Cooler (CAC) inspection and leak test. Refer to OEM literature for procedure. Is there any damage found?

17.a Yes; repair as necessary. Go to step 35.

17.b No; Go to step 18.

18. Visually inspect the entire Exhaust Gas Recirculation (EGR) and exhaust system (turbine housing, exhaust manifold, etc.) for evidence of external leakage (e.g. soot, coolant deposits at joints). Is there any external leakage found?

18.a Yes; repair as necessary. Go to step 35.

18.b No; Go to step 19.

19. Remove the delta P sensor from the mounting pad; leave the electrical harness connected.

20. Inspect the delta P sensor for moisture inside the ports. Shake moisture out if necessary; do not replace the sensor.

21. Inspect the delta P venturi ports for clogging and blockage. A layer of soot on the delta P sensor is OK. Is there any blockage found?

21.a Yes; clean venturi ports. Do not replace delta P sensor. Go to step 35.

21.b No; Go to step 22.

22. Turn the ignition ON (key ON, engine OFF).

23. Using DiagnosticLink, monitor delta P voltage (pin 109).

24. Is the delta P voltage between 0.55 and 0.83 volts?

24.a Yes; Go to step 28.

24.b No; Go to step 25.

25. Turn the ignition OFF.
26. Disconnect the delta P sensor harness connector.
27. Inspect the delta P sensor harness connector for loose, bent, spread, or corroded pins. Is there any pin damage found?

    27.a Yes; repair as necessary. Go to step 35.

    27.b No; replace delta P sensor. Refer to section "Removal of the Delta P Sensor" . Go to step 35.

28. Compare Intake Manifold Pressure (IMP) value with the barometric pressure value. Are the values within 10.3 kPa (1.5 psi) of each other?

    28.a Yes; Go to step 31.

    28.b No; Go to step 29.

29. Disconnect the intake pressure/temperature sensor.
30. Inspect the intake pressure/temperature sensor and wiring connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Are there any signs of damage present?

    30.a Yes; repair as necessary. Go to step 35.

    30.b No; replace IMP sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" . Go to step 35.

31. Remove EGR cooler hot pipe, EGR crossover pipe and delivery pipe; inspect for excessive build-up or blockage of soot. Is there any excessive build-up or blockage of soot?

    31.a Yes; clean piping and replace EGR cooler. Refer to section "Removal of the DD13 Exhaust Gas Recirculation Cooler Water Manifold Assembly" . Go to step 34.

    31.b No; Go to step 32.

32. Inspect the EGR valve for physical damage (broken butterfly, etc.). Is the EGR valve damaged?

    32.a Yes; replace the center section of the exhaust manifold.

    Refer to section "Removal of the DD13 and DD15 Exhaust Manifold" . Go to step 34.

    Refer to section "Removal of the DD16 Exhaust Manifold" . Go to step 35.

    32.b No; Go to step 33.

33. Disconnect the NOx inlet sensor harness connector.
34. Inspect the inlet NOx sensor and wiring connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any pin damage found?

    34.a Yes; repair as necessary. Go to step 35.

    34.b No; refer to 15 TS-17 for additional MCM programming.

35. Verify repairs by warming up engine and ensure engine is not in regeneration mode. Drive with a fully loaded trailer on highway and maintain a steady speed and load for ten minutes.

SPN 3216 (MCM) (GHG17)

219.1 Electronic Diagram

Fig 219.1, SCR Inlet NOx Sensor Circuit

219.2 SPN 3216/FMI 16 – GHG17

Selective Catalyst Reduction Inlet NOx Sensor - Drift High

SPN 3216/FMI 16			
Description	NOx Sensor Plausibility Check		
Monitored Parameter	Aftertreatment Inlet NOx Sensor		
Typical Enabling Conditions (Common Subset for all Engines)	**General Enabling Condition:** Engine is not in regeneration and operating at high speed and loads		
	Specific Enabling Conditions: (see below):		
	Engine Parameter	**Min**	**Max**
	Engine Speed (rpm)	1100	1400
	Torque (N·m)	800	1400
	Battery Voltage (Volts)	11.08	
	Engine Coolant Outlet Temperature	70°C (158°F)	
	Ambient Temperature	-8°C (17.6°F)	
	Barometric Pressure (mbar)	755 mbar (11 psi)	
	Time Since DPF regen (min.)	15	
	Beginning of Injection (BOI) - Degrees of Crankshaft Rotation	10	
	EGR Mass (Kg/min)	5	
Monitor Sequence	None		
Execution Frequency	Continuous When Enabling Conditions Met		
Typical Duration	150 seconds (Two-Cycle)		
Dash Lamps	MIL		
Engine Reaction	None		
Verification	Parked SCR Efficiency Test		

Check as follows:

1. Connect DiagnosticLink .
2. Are any other faults also present?
   2.a Yes; repair those fault codes first.
   2.b No; Go to step 3.
3. Monitor (chart) the following parameters:

- ASL102 engine speed
- AS018 Selective Catalyst Reduction (SCR) inlet temperature
- AS019 SCR outlet temperature
- AS035 SCR inlet NOx sensor
- AS036 SCR outlet NOx sensor
- AS101 NOx conversion efficiency

NOTICE

Do not attempt to operate engine with the DEF lines disconnected. DEF pump runs and circulates DEF through the system at a limited rate (default) to aid in system cooling.

4. Disconnect the Diesel Exhaust Fluid (DEF) Dosing Unit electrical connector only. Leave Dosing Unit bolted to Aftertreatment and DEF lines connected.
5. Inspect the DEF Dosing Unit harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Are any signs of damage present?

   5.a Yes; repair as necessary. Go to step 26.

   5.b No; Go to step 6.

Note : Running the engine with a disconnected DEF Dosing Unit will induce fault codes.

> **⚠ 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.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

6. Start engine and begin a “GHG17 Perform Performance Check - Low Temp ATD.” Refer to section "GHG17 Perform Performance Check - Low Temperature ATD" . After thirty minutes, are the NOx sensor values within 50 ppm of each other?

   6.a Yes; Go to step 7.

   6.b No; replace the Selective Catalyst Reduction Inlet NOx Sensor. Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" . Verify repairs.
7. Turn the ignition OFF.
8. Perform Charge Air Cooler (CAC) inspection and leak test. Refer to OEM literature for procedure. Is there any damage found?

   8.a Yes; Go to step 26.

   8.b No; Go to step 9.
9. Visually inspect the entire Exhaust Gas Recirculation (EGR) and exhaust system (turbine housing, exhaust manifold, etc.) for evidence of external leakage (e.g. soot, coolant deposits at joints). Is there evidence of external leakage?

   9.a Yes; repair as necessary. Go to step 26.

   9.b No; Go to step 10.
10. Remove the delta P sensor from the mounting pad; leave the electrical harness connected.
11. Inspect the delta P sensor for moisture inside the ports. Shake moisture out if necessary; do not replace the sensor.
12. Inspect the delta P venturi ports for clogging and blockage. A layer of soot on the delta P sensor is OK. Is there any blockage found?

12.a Yes; clean venturi ports. Do not replace delta P sensor. Go to step 26.

12.b No; Go to step 13.

13. Turn the ignition ON (key ON, engine OFF).
14. Using DiagnosticLink, monitor delta P voltage (pin 109).
15. Is the delta P voltage between 0.55 and 0.83 volts?

15.a Yes; Go to step 19.

15.b No; Go to step 16.

16. Turn the ignition OFF.
17. Disconnect the delta P sensor harness connector.
18. Inspect the delta P sensor harness connector for loose, bent, spread or corroded pins. Is there any pin damage found?

18.a Yes; repair as necessary. Go to step 26.

18.b No; replace delta P sensor. Refer to section "Removal of the Delta P Sensor" . Go to step 26.

19. Compare Inlet Manifold Pressure (IMP) value with the barometric pressure value. Are the values within 10.3 kPa (1.5 psi) of each other?

19.a Yes; Go to step 22.

19.b No; Go to step 20.

20. Disconnect the intake pressure/temperature sensor.
21. Inspect the intake pressure/temperature sensor and wiring connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is there any sign of damage present?

21.a Yes; repair as necessary. Go to step 26.

21.b No; replace intake pressure/temperature sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" . Go to step 26.

22. Remove EGR cooler hot pipe, EGR crossover pipe and delivery pipe and inspect for excessive build-up or blockage. Is there excessive build-up or blockage?

22.a Yes; clean piping and replace EGR cooler. Refer to section "Removal of the DD13 Exhaust Gas Recirculation Cooler Water Manifold Assembly" . Go to step 26.

22.b No; Go to step 23.

23. Inspect the EGR valve for physical damage (broken butterfly, etc.). Is the EGR valve damaged?

23.a Yes; replace the center section of the exhaust manifold. Go to step 26.

Refer to section "Removal of the DD13 and DD15 Exhaust Manifold"

Refer to section "Removal of the DD16 Exhaust Manifold"

23.b No; Go to step 24.

24. Disconnect the inlet NOx sensor harness connector.
25. Inspect the inlet NOx sensor and wiring connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any pin damage found?

25.a Yes; repair as necessary. Go to step 26.

25.b No; replace the SCR inlet NOx sensor. Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" . Go to step 26.

26. Verify repairs by performing a Parked SCR Efficiency Test. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

219.3 SPN 3216/FMI 18 – GHG17

SPN 3216/FMI 18			
Description	NOx Sensor Plausibility Check		
Monitored Parameter	Aftertreatment Inlet NOx Sensor		
Typical Enabling Conditions (Common Subset for all Engines)	**General Enabling Condition:** Engine is not in regen and operating at high speed and loads		
	Specific Enabling Conditions:		
	Engine Parameter	**Min**	**Max**
	Engine Speed (rpm)	1350	1600
	Torque (Nm)	1100	1500
	Battery Voltage (Volts)	11.08	
	Engine Coolant Outlet Temperature	70°C (158°F)	
	Ambient Temperature	-8°C (17.6°F)	
	Barometric Pressure (mbar)	755	
	Time Since DPF regen (min.)	15	
	Beginning of Injection (BOI) - Degrees of Crankshaft Rotation	10	
	EGR Mass (Kg/min)	5	
Monitor Sequence	None		
Execution Frequency	Continuous When Enabling Conditions Met		
Typical Duration	150 Seconds (2 Cycle)		
Dash Lamps	MIL		
Engine Reaction	None		
Verification	Warm Up Engine and Ensure Engine is Not in Regen Mode. Drive a Fully-Loaded Trailer on Highway and Maintain Above Enabling Conditions for 150 Seconds		

1. Connect DiagnosticLink .
2. Are any other faults also present?
   2.a Yes; repair those fault codes first.
   2.b No; Go to step 3.
3. Monitor (chart) the following parameters:

- ASL102 engine speed
- AS018 Selective Catalyst Reduction (SCR) inlet temperature
- AS019 SCR outlet temperature
- AS035 SCR inlet NOx sensor
- AS036 SCR outlet NOx sensor
- AS101 NOx conversion efficiency

NOTICE

Do not attempt to operate engine with the DEF lines disconnected. DEF pump runs and circulates DEF through the system at a limited rate (default) to aid in system cooling.

4. Disconnect the Diesel Exhaust Fluid (DEF) dosing unit electrical connector only. Leave dosing unit bolted to aftertreatment and DEF lines intact.

Note : SPN 3361/FMI 5 will set when the DEF dosing unit electrical connector is disconnected. The fault code can be cleared using DiagnosticLink after the DEF dosing unit electrical connector is reconnected.

5. Inspect the DEF dosing unit harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Are there any signs of damage present?

   5.a Yes; repair as necessary. Go to step 34.

   5.b No; Go to step 6.

Note : Running the engine with a disconnected DEF dosing unit will induce a fault code.

> **⚠ 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.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

6. Start the engine and perform a complete parked regen. Refer to section "Performing a Parked Regeneration - GHG17" .

> **NOTICE**
>
> **It may require 30 minutes or longer for the outlet NOx sensor to turn on. Do not replace either sensor unless directed by the troubleshooting.**

7. Monitor the inlet NOx sensor and outlet NOx sensor. During the last five minutes of the parked regen, are the sensors reading within 50 ppm of each other?

   7.a Yes; check for turbocharger type.

   If Asymmetrical Turbocharger (AT), Go to step 8.

   If Turbo Compound (TC), Go to step 16.

   7.b No; replace the inlet NOx sensor.

   For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor"

   For 2-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" . Verify repair.

8. Turn the ignition OFF.

9. Ensure the vehicle air supply is at least 6.0 bar (87 psi). Inspect the air line connection to the wastegate solenoid. Are there any leaks or kinks in the air line connection?

   9.a Yes; repair or replace as necessary. Go to step 35.

9.b No; Go to step 10.

10. Inspect the wastegate actuator and the plumbing to and from the actuator. Verify wastegate opens and closes. Is there any binding or damage found?

10.a Yes; repair as necessary. Go to step 35.

10.b No; Go to step 11.

11. Turn the ignition ON (key ON, engine OFF).

Note : Wastegate control does not respond at 50 percent. To cycle wastegate, use either 0 percent or 95 percent.

12. Using DiagnosticLink, activate wastegate control from Service Routines Activate Outputs Panel. Run slide control up to 95% - (Click Set). Wastegate will open with air psi available. Observe wastegate linkage movement. Does wastegate open when commanded?

12.a Yes; Go to step 13.

12.b No; Go to step 14.

13. Move slide control down to 0. Observe wastegate linkage movement. Does wastegate close when commanded?

13.a Yes; Go to step 16.

13.b No; Go to step 14.

14. Disconnect the wastegate solenoid harness connector.

15. Inspect the wastegate solenoid and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is there any damage present?

15.a Yes; repair as necessary. Go to step 35.

15.b No; replace the wastegate solenoid.

Refer to section "Removal of the DD13 Wastegate Solenoid." Go to step 35.

Refer to section "Removal of the GHG17 DD15 Asymmetrical Turbocharger Wastegate Solenoid." Go to step 35.

16. Turn the ignition OFF.

17. Perform Charge Air Cooler (CAC) inspection and leak test. Refer to OEM literature for procedure. Is there any damage found?

17.a Yes; repair as necessary. Go to step 35.

17.b No; Go to step 18.

18. Visually inspect the entire Exhaust Gas Recirculation (EGR) and exhaust system (turbine housing, exhaust manifold, etc.) for evidence of external leakage (e.g. soot, coolant deposits at joints). Is there any external leakage found?

18.a Yes; repair as necessary. Go to step 35.

18.b No; Go to step 19.

19. Remove the delta P sensor from the mounting pad; leave the electrical harness connected.

20. Inspect the delta P sensor for moisture inside the ports. Shake moisture out if necessary; do not replace the sensor.

21. Inspect the delta P venturi ports for clogging and blockage. A layer of soot on the delta P sensor is OK. Is there any blockage found?

21.a Yes; clean venturi ports. Do not replace delta P sensor. Go to step 35.

21.b No; Go to step 22.

22. Turn the ignition ON (key ON, engine OFF).

23. Using DiagnosticLink, monitor delta P voltage (pin 109).

24. Is the delta P voltage between 0.55 and 0.83 volts?

24.a Yes; Go to step 28.

24.b No; Go to step 25.

25. Turn the ignition OFF.
26. Disconnect the delta P sensor harness connector.
27. Inspect the delta P sensor harness connector for loose, bent, spread, or corroded pins. Is there any pin damage found?

    27.a Yes; repair as necessary. Go to step 35.

    27.b No; replace delta P sensor. Refer to section "Removal of the Delta P Sensor" . Go to step 35.

28. Compare Intake Manifold Pressure (IMP) value with the barometric pressure value. Are the values within 10.3 kPa (1.5 psi) of each other?

    28.a Yes; Go to step 31.

    28.b No; Go to step 29.

29. Disconnect the intake pressure/temperature sensor.
30. Inspect the intake pressure/temperature sensor and wiring connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Are there any signs of damage present?

    30.a Yes; repair as necessary. Go to step 35.

    30.b No; replace IMP sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" . Go to step 35.

31. Remove EGR cooler hot pipe, EGR crossover pipe and delivery pipe; inspect for excessive build-up or blockage of soot. Is there any excessive build-up or blockage of soot?

    31.a Yes; clean piping and replace EGR cooler. Refer to section "Removal of the DD13 Exhaust Gas Recirculation Cooler Water Manifold Assembly" . Go to step 34.

    31.b No; Go to step 32.

32. Inspect the EGR valve for physical damage (broken butterfly, etc.). Is the EGR valve damaged?

    32.a Yes; replace the center section of the exhaust manifold.

    Refer to section "Removal of the DD13 and DD15 Exhaust Manifold" . Go to step 34.

    Refer to section "Removal of the DD16 Exhaust Manifold" . Go to step 35.

    32.b No; Go to step 33.

33. Disconnect the NOx inlet sensor harness connector.
34. Inspect the inlet NOx sensor and wiring connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any pin damage found?

    34.a Yes; repair as necessary. Go to step 35.

    34.b No; refer to 15 TS-17 for additional MCM programming.

35. Verify repairs by warming up engine and ensure engine is not in regeneration mode. Drive with a fully loaded trailer on highway and maintain a steady speed and load for ten minutes.

219.4 SPN 3216/FMI 21 – GHG17

Selective Catalyst Reduction (SCR) Inlet NOx Sensor - Drift (Low Box)

SPN 3216/FMI 21	
Description	Selective Catalyst Reduction (SCR) Inlet NOx Sensor - Drift (Low Box).
Monitored Parameter	Engine Out NOx
Typical Enabling Conditions	EGR Mass Flow greater than .08 kg/s, Engine Speed 1450 to 1900 rpm, Engine Torque 1400 to 2100 N·m (1.03 to 1.55 lb ft), Battery Voltage greater than 11 V, Coolant Temperature greater than 65°C (149°F), Ambient Temperature greater than -8°C (18°F) Ambient, Barometric Pressure greater than 755 mbar, Engine Not in Regeneration Mode.
Monitor Sequence	None
Execution Frequency	Always enabled
Typical Duration	1.2 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Warm Up Engine Such That Coolant Temperature greater than 65°C (149°F), Ensure Engine is not in Regeneration Mode, Ensure Ambient Temperature greater than -8°C (18°F), Barometric Pressure greater than 755 mbar.

1. Are any Exhaust Gas Recirculation (EGR) system faults also present?
   1.a Yes; repair the EGR system faults first.
   1.b No; Go to step 2.
2. Visually inspect the entire air inlet, Charge Air Cooler (CAC), and EGR piping and hose for visible signs of leaks or damage. Is damage present?
   2.a Yes; repair as necessary.
   2.b No; Go to step 3.
3. Perform an Idle Speed Balance (ISB) test. Refer to section "Checking Idle Speed Balance" . Is a faulty fuel injector identified?
   3.a Yes; repair as necessary.
   3.b No; Go to step 4.
4. Check the Aftertreatment System (ATS) for visible exhaust leaks or damage. Is damage present?
   4.a Yes; repair as necessary.
   4.b No; replace the NOx inlet sensor.
   For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .
   For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

SPN 3217 (ACM) (GHG17)

220.1 SPN 3217/ FMI 2 - GHG17

Check as follows:

> **⚠ WARNING**
>
> PERSONAL INJURY
>
> To avoid injury, never remove any engine component while the engine is running.

> **⚠ WARNING**
>
> PERSONAL INJURY
>
> To avoid injury from hot surfaces, wear protective gloves, or allow engine to cool before removing any component.

1. Connect DiagnosticLink . Are there any other fault codes?
   1.a Yes; repair other fault codes first.
   1.b No; Go to step 2.
2. Check the ACM software level and fuel maps. The ACM software should be 7.56.7.0 with fuel map ZGS002 or higher. Is the software and fuel map up to date?
   2.a Yes; Go to step 3.
   2.b No, connect to the server and update the ACM software and fuel map. Verify the repair and release the vehicle.
3. Since no other active faults are present and the software is up to date, replace the Inlet NOx sensor. Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" . Verify repair.

SPN 3217/FMI 2	
Monitor Sequence	Inlet NOx Sensor
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	10 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Road Test at Operating Temperature with Engine Above 1200 rpm, Above 40% Load, in DEF Dosing Mode. Not in Regen or EGR Mode.
Description	Goal of this Diagnostic is to Detect the Engine Out Lambda Signal Lower Than Expected in Engine No-Fueling Mode
Monitored Parameter	Inlet NOx Sensor
Typical Enabling Conditions	
Monitor Sequence	Inlet NOx Sensor
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	10 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Road Test at Operating Temperature with Engine Above 1100 rpm, Above 40% Load, while Not in Regeneration.

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are there any aftertreatment system fault codes present?
   - 3.a Yes; diagnose the other fault codes.
   - 3.b No; Go to step 4.
4. Check the Aftertreatment Control Module (ACM) software level. Is the ACM software level lower than 7.56.7.0?
   - 4.a Yes; update the ACM software to the latest available on the server.
   - 4.b No; Go to step 5.
5. Is the ACM software level 7.56.7.0?
   - 5.a Yes; Go to step 6.
   - 5.b No; clear the fault codes then update the ACM using the latest software available on the server. Verify repair.
6. Is the fuel map ZGS 002 or higher?
   - 6.a Yes; replace the SCR inlet NOx sensor. Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" . Verify repair.
   - 6.b No; clear the fault codes, then update the ACM using the latest software available on the server. Verify repair.

220.2 SPN 3217/FMI 3 - GHG17

Selective Catalyst Reduction Inlet NOx Sensor Circuit Failed High

SPN 3217/FMI 3	
Description	This Code Sets When There is a Short to Power on the SCR Inlet NOx Circuit Between the Sensor and ECU
Monitored Parameter	SCR Inlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR Inlet NOx sensor.
2. Inspect the SCR Inlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

> **⚠ WARNING**
>
> PERSONAL INJURY
>
> Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

> **⚠ 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.

2.a Yes; repair as necessary. Verify repairs.

2.b No; replace the SCR Inlet NOx sensor.

For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

For 2-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

Selective Catalyst Reduction Inlet NOx Sensor Circuit Failed High

SPN 3217/FMI 3	
Description	This Code Sets When There is a Short to Power on the SCR Inlet NOx Circuit Between the Sensor and ECU
Monitored Parameter	SCR Inlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR Inlet NOx sensor.
2. Inspect the SCR Inlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

⚠WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠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.

2.a Yes; repair as necessary. Verify repairs.

2.b No; replace the SCR Inlet NOx sensor.

For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

For 2-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

220.3 SPN 3217/FMI 5 - GHG17

Selective Catalyst Reduction Inlet NOx Sensor Circuit Failed Open

SPN 3217/FMI 5	
Description	This Codes Sets When There is an Open on the SCR NOx Inlet Circuit Between the Sensor and the ECU
Monitored Parameter	SCR Inlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR inlet NOx sensor.
2. Inspect the SCR inlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

> **⚠ WARNING**
>
> PERSONAL INJURY
>
> Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

> **⚠ 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.

2.a Yes; repair as necessary. Verify repairs.

2.b No; replace the SCR inlet NOx sensor.

For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

For 2-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

Selective Catalyst Reduction Inlet NOx Sensor Circuit Failed Open

SPN 3217/FMI 5	
Description	This Codes Sets When There is an Open on the SCR NOx Inlet Circuit Between the Sensor and the ECU
Monitored Parameter	SCR Inlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR inlet NOx sensor.
2. Inspect the SCR inlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

2.a Yes; repair as necessary. Verify repairs.

2.b No; replace the SCR inlet NOx sensor.

For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

For 2-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

220.4 SPN 3217/ FMI 7 - GHG17

SPN 3217/FMI 7	
Description	Goal of This Diagnostic is to Detect The Engine Out Lambda Signal Lower Than Expected in Engine No-Fueling Mode
Monitored Parameter	Inlet NOx Sensor
Typical Enabling Conditions	
Monitor Sequence	Inlet NOx Sensor vs. Outlet NOx Sensor
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	1.2 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Road Test at Operating Temperature With Engine Above 1200 rpm, Above 40% Load, in DEF Dosing Mode. Not in Regen or EGR Mode

Check as follows:

WARNING

PERSONAL INJURY

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

WARNING

PERSONAL INJURY

To avoid injury from hot surfaces, wear protective gloves, or allow engine to cool before removing any component.

1. Connect DiagnosticLink . Are there any other fault codes?
   1.a Yes; repair other fault codes first.
   1.b No; Go to step 2.
2. Was another emission component-related fault code repaired prior to this step?
   2.a Yes; perform a parked regeneration to verify repairs and clear fault codes.
   2.b No; Go to step 3.
3. Are any Exhaust Gas Recirculation (EGR) system faults also present?
   3.a Yes; repair the EGR system faults first.
   3.b No; Go to step 4.
4. Visually inspect the entire air inlet, Charge Air Cooler (CAC), and EGR piping and hose for visible signs of leaks or damage. Was any damage or leaks found?
   4.a Yes; repair as necessary.
   4.b No; Go to step 5.
5. Check Aftertreatment System (ATS) for visible exhaust leaks or damage. Is there any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.
6. Use DEF test strip A0005850202 to check for diesel fuel or oil contamination of the DEF fluid; Refer to section "Checking Diesel Exhaust Fluid Quality" . Do the test strips or visual inspection indicate that the DEF is contaminated?

6.a Yes; for diesel fuel or oil contamination, refer to 13 TS-17 and refer to appropriate Original Equipment Manufacturer (OEM) literature for DEF tank cleaning/flushing procedures. Refill the DEF tank with new DEF. Verify repair.

6.b No; Go to step 7.

7. Using the refractometer from DEF Test Kit W060589001900, measure the DEF urea percentage. Is DEF urea percentage between 31 and 34 percent?

7.a Yes; Go to step 8.

7.b No; clean/flush the DEF tank and the DEF system. Refer to section "Flushing of the Diesel Exhaust Fluid System" . Refill the DEF tank with new DEF. Verify repair.

8. Unbolt the DEF doser from the aftertreatment; do not disconnect the DEF lines or electrical connector.

9. Use the graduated cylinder provided in DEF test kit W060589001900, perform a DEF quantity test. Refer to section "Diesel Exhaust Fluid Quantity Test - GHG17" .

10. Monitor the amount of DEF dispensed. Is the amount of DEF dispensed between 108 and 132 mL (3.7 and 4.5 oz.)?

10.a Yes; Go to step 11.

10.b No; replace the DEF dosing unit. Refer to section "Installation of the Diesel Exhaust Fluid Dosing Unit " . Verify repair.

11. Reinstall the DEF doser. Go to step 14.

12. Disconnect the DEF doser electrical connector.

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

Note : SPN 3361/FMI 5 will set when the DEF dosing unit electrical connector is disconnected. The fault code can be cleared using DiagnosticLink after the DEF dosing unit electrical connector is reconnected.

13. Start the engine and perform a complete parked regen. Refer to section "Performing a Parked Regeneration - GHG17" .

14. Monitor the inlet NOx sensor and outlet NOx sensor. During the last five minutes of the parked regen, are the NOx sensors reading within 50 ppm of each other?

14.a Yes; Go to step 15.

14.b No; replace the SCR inlet NOx sensor and connect the DEF doser electrical connector. Verify repair.

15. Disconnect the DEF dosing unit electrical connector. Go to step 16.

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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. Start the engine and perform a parked regeneration and monitor the NOx efficiency. Is the NOx efficiency above 80%?

16.a Yes; this fault was likely caused by the DEF build-up in the exhaust which was cleared by the parked regeneration procedures. Release the vehicle.

Note : Excessive DEF build-up in the exhaust can be caused by a vehicle with a high speed, high average drive load.

16.b No; Go to step 17.

17. Perform a low temperature Aftertreatment Device (ATD) check using DiagnosticLink to check for a drifted temperature sensor. Refer to section "GHG17 Perform Performance Check - Low Temperature ATD" . Monitor the SCR inlet and SCR outlet temperatures; they should be within 25°C (45°F) during the last five minutes of this test. Replace the drifted SCR temperature sensor and verify repair.

SPN 3217/FMI 7	
Description	Goal of This Diagnostic is to Detect The Engine Out Lambda Signal Lower Than Expected in Engine No-Fueling Mode
Monitored Parameter	Inlet NOx Sensor
Typical Enabling Conditions	
Monitor Sequence	Inlet NOx Sensor vs. Outlet NOx Sensor
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	1.2 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Road Test at Operating Temperature With Engine Above 1200 rpm, Above 40% Load, in DEF Dosing Mode. Not in Regen or EGR Mode

Check as follows:

WARNING

PERSONAL INJURY

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

> **WARNING**
>
> PERSONAL INJURY
>
> To avoid injury from hot surfaces, wear protective gloves, or allow engine to cool before removing any component.

1. Connect DiagnosticLink . Are there any other fault codes?
   - 1.a Yes; repair other fault codes first.
   - 1.b No; Go to step 2.
2. Was another emission component-related fault code repaired prior to this step?
   - 2.a Yes; perform a parked regeneration to verify repairs and clear fault codes.
   - 2.b No; Go to step 3.
3. Are any Exhaust Gas Recirculation (EGR) system faults also present?
   - 3.a Yes; repair the EGR system faults first.
   - 3.b No; Go to step 4.
4. Visually inspect the entire air inlet, Charge Air Cooler (CAC), and EGR piping and hose for visible signs of leaks or damage. Was any damage or leaks found?
   - 4.a Yes; repair as necessary.
   - 4.b No; Go to step 5.
5. Check Aftertreatment System (ATS) for visible exhaust leaks or damage. Is there any damage found?
   - 5.a Yes; repair as necessary.
   - 5.b No; Go to step 6.
6. Use DEF test strip A0005850202 to check for diesel fuel or oil contamination of the DEF fluid; Refer to section "Checking Diesel Exhaust Fluid Quality" . Do the test strips or visual inspection indicate that the DEF is contaminated?
   - 6.a Yes; for diesel fuel or oil contamination, refer to 13 TS-17 and refer to appropriate Original Equipment Manufacturer (OEM) literature for DEF tank cleaning/flushing procedures. Refill the DEF tank with new DEF. Verify repair.
   - 6.b No; Go to step 7.
7. Using the refractometer from DEF Test Kit W060589001900, measure the DEF urea percentage. Is DEF urea percentage between 31 and 34 percent?
   - 7.a Yes; Go to step 8.
   - 7.b No; clean/flush the DEF tank and the DEF system. Refer to section "Flushing of the Diesel Exhaust Fluid System" . Refill the DEF tank with new DEF. Verify repair.
8. Unbolt the DEF doser from the aftertreatment; do not disconnect the DEF lines or electrical connector.
9. Use the graduated cylinder provided in DEF test kit W060589001900, perform a DEF quantity test. Refer to section "Diesel Exhaust Fluid Quantity Test - GHG17" .
10. Monitor the amount of DEF dispensed. Is the amount of DEF dispensed between 108 and 132 mL (3.7 and 4.5 oz.)?
    - 10.a Yes; Go to step 11.
    - 10.b No; replace the DEF dosing unit. Refer to section "Installation of the Diesel Exhaust Fluid Dosing Unit " . Verify repair.
11. Reinstall the DEF doser. Go to step 14.
12. Disconnect the DEF doser electrical connector.

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

Note : SPN 3361/FMI 5 will set when the DEF dosing unit electrical connector is disconnected. The fault code can be cleared using DiagnosticLink after the DEF dosing unit electrical connector is reconnected.

13. Start the engine and perform a complete parked regen. Refer to section "Performing a Parked Regeneration - GHG17" .
14. Monitor the inlet NOx sensor and outlet NOx sensor. During the last five minutes of the parked regen, are the NOx sensors reading within 50 ppm of each other?

    14.a Yes; Go to step 15.

    14.b No; replace the SCR inlet NOx sensor and connect the DEF doser electrical connector. Verify repair.
15. Disconnect the DEF dosing unit electrical connector. Go to step 16.

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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. Start the engine and perform a parked regeneration and monitor the NOx efficiency. Is the NOx efficiency above 80%?

    16.a Yes; this fault was likely caused by the DEF build-up in the exhaust which was cleared by the parked regeneration procedures. Release the vehicle.

Note : Excessive DEF build-up in the exhaust can be caused by a vehicle with a high speed, high average drive load.

    16.b No; Go to step 17.

17. Perform a low temperature Aftertreatment Device (ATD) check using DiagnosticLink to check for a drifted temperature sensor. Refer to section "GHG17 Perform Performance Check - Low Temperature ATD" . Monitor the SCR inlet and SCR outlet temperatures; they should be within 25°C (45°F) during the last five minutes of this test. Replace the drifted SCR temperature sensor and verify repair.

220.1 SPN 3217/ FMI 2 - GHG17

SPN 3217/FMI 2	
Description	Goal of this Diagnostic is to Detect the Engine Out Lambda Signal Lower Than Expected in Engine No-Fueling Mode
Monitored Parameter	Inlet NOx Sensor
Typical Enabling Conditions	
Monitor Sequence	Inlet NOx Sensor
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	10 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Road Test at Operating Temperature with Engine Above 1100 rpm, Above 40% Load, while Not in Regeneration.

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are there any aftertreatment system fault codes present?
   - 3.a Yes; diagnose the other fault codes.
   - 3.b No; Go to step 4.
4. Check the Aftertreatment Control Module (ACM) software level. Is the ACM software level lower than 7.56.7.0?
   - 4.a Yes; update the ACM software to the latest available on the server.
   - 4.b No; Go to step 5.
5. Is the ACM software level 7.56.7.0?
   - 5.a Yes; Go to step 6.
   - 5.b No; clear the fault codes then update the ACM using the latest software available on the server. Verify repair.
6. Is the fuel map ZGS 002 or higher?
   - 6.a Yes; replace the SCR inlet NOx sensor. Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" . Verify repair.
   - 6.b No; clear the fault codes, then update the ACM using the latest software available on the server. Verify repair.

220.2 SPN 3217/FMI 3 - GHG17

Selective Catalyst Reduction Inlet NOx Sensor Circuit Failed High

SPN 3217/FMI 3	
Description	This Code Sets When There is a Short to Power on the SCR Inlet NOx Circuit Between the Sensor and ECU
Monitored Parameter	SCR Inlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR Inlet NOx sensor.
2. Inspect the SCR Inlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

2.a Yes; repair as necessary. Verify repairs.

2.b No; replace the SCR Inlet NOx sensor.

For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

For 2-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

220.3 SPN 3217/FMI 5 - GHG17

Selective Catalyst Reduction Inlet NOx Sensor Circuit Failed Open

SPN 3217/FMI 5	
Description	This Codes Sets When There is an Open on the SCR NOx Inlet Circuit Between the Sensor and the ECU
Monitored Parameter	SCR Inlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR inlet NOx sensor.
2. Inspect the SCR inlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

2.a Yes; repair as necessary. Verify repairs.

2.b No; replace the SCR inlet NOx sensor.

For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

For 2-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

220.4 SPN 3217/ FMI 7 - GHG17

SPN 3217/FMI 7	
Description	Goal of This Diagnostic is to Detect The Engine Out Lambda Signal Lower Than Expected in Engine No-Fueling Mode
Monitored Parameter	Inlet NOx Sensor
Typical Enabling Conditions	
Monitor Sequence	Inlet NOx Sensor vs. Outlet NOx Sensor
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	1.2 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Road Test at Operating Temperature With Engine Above 1200 rpm, Above 40% Load, in DEF Dosing Mode. Not in Regen or EGR Mode

Check as follows:

WARNING

PERSONAL INJURY

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

WARNING

PERSONAL INJURY

To avoid injury from hot surfaces, wear protective gloves, or allow engine to cool before removing any component.

1. Connect DiagnosticLink . Are there any other fault codes?
   - 1.a Yes; repair other fault codes first.
   - 1.b No; Go to step 2.
2. Was another emission component-related fault code repaired prior to this step?
   - 2.a Yes; perform a parked regeneration to verify repairs and clear fault codes.
   - 2.b No; Go to step 3.
3. Are any Exhaust Gas Recirculation (EGR) system faults also present?
   - 3.a Yes; repair the EGR system faults first.
   - 3.b No; Go to step 4.
4. Visually inspect the entire air inlet, Charge Air Cooler (CAC), and EGR piping and hose for visible signs of leaks or damage. Was any damage or leaks found?
   - 4.a Yes; repair as necessary.
   - 4.b No; Go to step 5.
5. Check Aftertreatment System (ATS) for visible exhaust leaks or damage. Is there any damage found?
   - 5.a Yes; repair as necessary.
   - 5.b No; Go to step 6.
6. Use DEF test strip A0005850202 to check for diesel fuel or oil contamination of the DEF fluid; Refer to section "Checking Diesel Exhaust Fluid Quality" . Do the test strips or visual inspection indicate that the DEF is contaminated?

6.a Yes; for diesel fuel or oil contamination, refer to 13 TS-17 and refer to appropriate Original Equipment Manufacturer (OEM) literature for DEF tank cleaning/flushing procedures. Refill the DEF tank with new DEF. Verify repair.

6.b No; Go to step 7.

7. Using the refractometer from DEF Test Kit W060589001900, measure the DEF urea percentage. Is DEF urea percentage between 31 and 34 percent?

7.a Yes; Go to step 8.

7.b No; clean/flush the DEF tank and the DEF system. Refer to section "Flushing of the Diesel Exhaust Fluid System" . Refill the DEF tank with new DEF. Verify repair.

8. Unbolt the DEF doser from the aftertreatment; do not disconnect the DEF lines or electrical connector.

9. Use the graduated cylinder provided in DEF test kit W060589001900, perform a DEF quantity test. Refer to section "Diesel Exhaust Fluid Quantity Test - GHG17" .

10. Monitor the amount of DEF dispensed. Is the amount of DEF dispensed between 108 and 132 mL (3.7 and 4.5 oz.)?

10.a Yes; Go to step 11.

10.b No; replace the DEF dosing unit. Refer to section "Installation of the Diesel Exhaust Fluid Dosing Unit " . Verify repair.

11. Reinstall the DEF doser. Go to step 14.

12. Disconnect the DEF doser electrical connector.

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

Note : SPN 3361/FMI 5 will set when the DEF dosing unit electrical connector is disconnected. The fault code can be cleared using DiagnosticLink after the DEF dosing unit electrical connector is reconnected.

13. Start the engine and perform a complete parked regen. Refer to section "Performing a Parked Regeneration - GHG17" .

14. Monitor the inlet NOx sensor and outlet NOx sensor. During the last five minutes of the parked regen, are the NOx sensors reading within 50 ppm of each other?

14.a Yes; Go to step 15.

14.b No; replace the SCR inlet NOx sensor and connect the DEF doser electrical connector. Verify repair.

15. Disconnect the DEF dosing unit electrical connector. Go to step 16.

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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. Start the engine and perform a parked regeneration and monitor the NOx efficiency. Is the NOx efficiency above 80%?

16.a Yes; this fault was likely caused by the DEF build-up in the exhaust which was cleared by the parked regeneration procedures. Release the vehicle.

Note : Excessive DEF build-up in the exhaust can be caused by a vehicle with a high speed, high average drive load.

16.b No; Go to step 17.

17. Perform a low temperature Aftertreatment Device (ATD) check using DiagnosticLink to check for a drifted temperature sensor. Refer to section "GHG17 Perform Performance Check - Low Temperature ATD" . Monitor the SCR inlet and SCR outlet temperatures; they should be within 25°C (45°F) during the last five minutes of this test. Replace the drifted SCR temperature sensor and verify repair.

SPN 3223 (ACM) (GHG17)

221.1 SPN 3223/FMI 7 - GHG17

SPN 3223/FMI 7	
Description	NOx Inlet Sensor failure to activate
Monitored Parameter	NOx Inlet Sensor
Typical Enabling Conditions	NOx Raw count
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Always ON
Dash Lamps	MIL
Engine Reaction	None
Verification	Once engine is at standard operating temperature, drive at highway speed with loaded trailer above 1130 rpm continuously for twenty minutes.

Check as follows:

1. Connect DiagnosticLink . Are there any other fault codes?
   - 1.a Yes; repair other fault codes first.
   - 1.b No; Go to step 2.
2. Disconnect the Selective Catalytic Reduction (SCR) inlet NOx sensor harness connector.
3. Inspect the SCR inlet NOx sensor and harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins, signs of moisture in the connector or wire damage near the connector. Are any signs of damage present?
   - 3.a Yes; repair as necessary. Verify repair.
   - 3.b No; replace the SCR inlet NOx sensor.

     For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" . Go to step 4. to verify repairs.

     For 2-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" . Go to step 4. to verify repairs.
4. Using DiagnosticLink, monitor parameter *AS105: NOx Sensor Dewpoint enabled Inlet* while performing verification drive.
5. Drive vehicle for ten minutes after *AS105: NOx Sensor Dewpoint enabled Inlet* parameter changes state from zero to one and fault code goes inactive. Does *AS105: NOx Sensor Dewpoint enabled Inlet* parameter change state from zero to one and fault code stay inactive?
   - 5.a Yes; clear fault codes. Release vehicle.
   - 5.b No; replace Aftertreatment Control Module (ACM). Refer to OEM procedures. Verify repairs.

SPN 3226 (ACM) (GHG17)

222.1 SPN 3226/FMI 10 - GHG17

Outlet NOx Sensor Signal Erratic

SPN 3226/FMI 10	
Description	Outlet NOx sensor reading jumping greater than 100 Parts Per Million (ppm) per seconds.
Monitored Parameter	Selective Catalyst Reduction (SCR) Outlet NOx Sensor
Typical Enabling Conditions	Coolant Temperature greater than 65°C (149°F), Engine rpm 600-2000
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	20 seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Drive cycle with condition meet

Check as follows:

1. Disconnect the outlet NOx sensor.
2. Inspect NOx sensor harness connector for bent, spread or corroded pins. Was any damage found?
   2.a Yes; repair as necessary.
   2.b No; Go to step 3.
3. Replace the SCR outlet NOx sensor.
   For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .
   For 2-Box, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

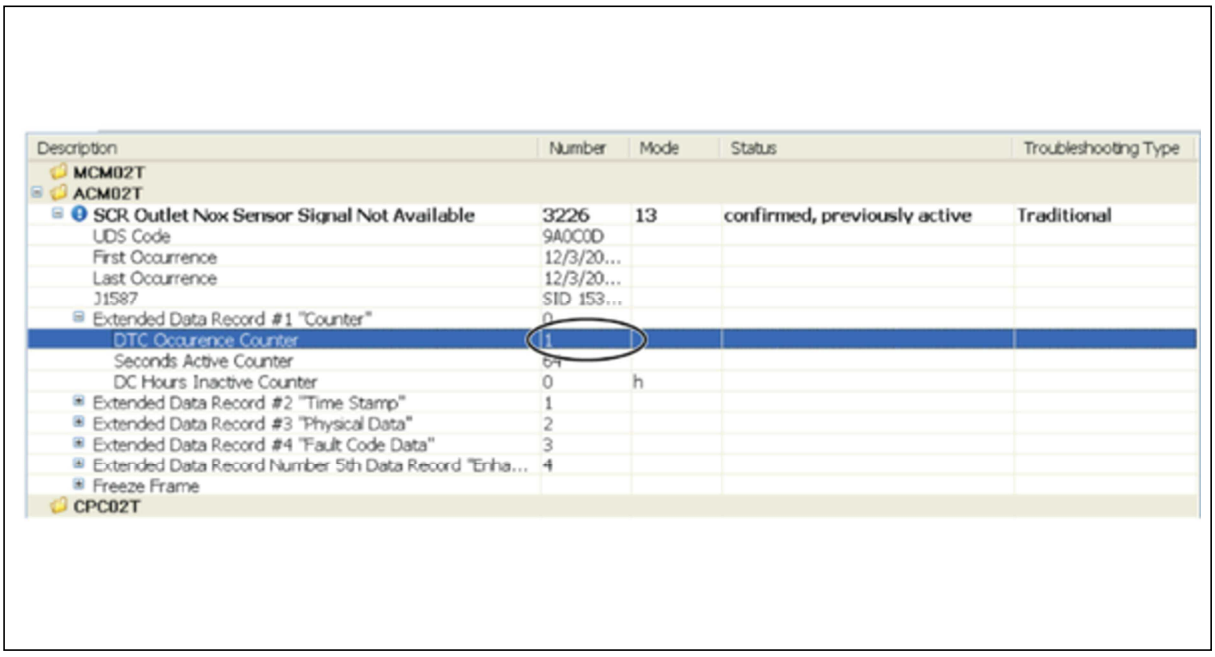
222.2 SPN 3226/FMI 13 - GHG17

SPN 3226/FMI 13	
Description	Selective Catalyst Reduction (SCR) Outlet NOx Sensor Signal Not Available
Monitored Parameter	SCR Outlet NOx Sensor Signal
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL
Engine Reaction	
Verification	Engine Idle (One minute)

Note : If fault occurred during high idle regeneration, clear fault and release vehicle.

Check as follows:

1. Is SPN 3226/FMI 13 currently active?
   1.a Yes; Go to step 3.
   1.b No; Go to step 2.
2. Check the SPN 3226/FMI 13 Diagnostic Trouble Code (DTC) occurrence counter.



   2.a If the DTC occurrence counter is five or less, clear the fault and release the vehicle.
   2.b If the DTC occurrence counter is greater than five, Go to step 3.
3. Disconnect the SCR outlet NOx sensor.
4. Inspect the sensor harness for bent, spread, or corroded pins. Are any of the pins damaged?
   4.a Yes; repair as necessary.
   4.b No; Go to step 5.

5. Turn the ignition ON (key ON, engine OFF).
6. Measure the voltage between pins 1 and 4 on the harness side of the SCR outlet NOx sensor connector. Is the voltage less than 11.5 volts?
   - 6.a Yes; Go to step 7.
   - 6.b No; Go to step 8.
7. Measure the voltage between pin 1 on the harness side of the SCR outlet NOx sensor connector and engine ground. Is the voltage less than 11.5 volts?
   - 7.a Yes; repair the wire between pin 1 on the harness side of the SCR outlet NOx sensor connector and pin 42 of the Aftertreatment Control Module (ACM) 120-pin connector.
   - 7.b No; repair the wire between pin 4 on the harness side of the SCR outlet NOx sensor connector and pin 43 of the ACM 120-pin connector.
8. Turn the ignition OFF.
9. Measure the resistance between pins 2 and 3 on the harness side of the SCR outlet NOx sensor connector. Is the resistance between 50 to 70 ohms?
   - 9.a Yes; replace the SCR outlet NOx sensor. Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .
   - 9.b No; Go to step 10.
10. Disconnect the ACM 120-pin connector.
11. Inspect the ACM 120-pin harness connector for signs of damage, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Are there signs of damage to the harness connector?
    - 11.a Yes; repair as necessary.
    - 11.b No; Go to step 12.
12. Measure the resistance between pins 2 and 3 on the harness side of the SCR outlet NOx sensor connector. Is the resistance less than 1K ohm?
    - 12.a Yes; repair short between pins 2 and 3 on the harness side of the SCR outlet NOx sensor connector and pins 40 and 41 of the ACM 120-pin connector.
    - 12.b No; Go to step 13.
13. Measure the resistance between pin 2 on the harness side of the SCR outlet NOx sensor connector and pin 41 of the ACM 120-pin connector. Is the resistance greater than five ohms?
    - 13.a Yes; repair the wire between pin 2 on the harness side of the SCR outlet NOx sensor connector and pin 41 of the ACM 120-pin connector.
    - 13.b No; Go to step 14.
14. Measure the resistance between pin 3 on the harness side of the SCR outlet NOx sensor connector and pin 40 of the ACM 120-pin connector. Is the resistance greater than five ohms?
    - 14.a Yes; repair the wire between pin 3 on the harness side of the SCR outlet NOx sensor connector and pin 40 of the ACM 120-pin connector.
    - 14.b No; Go to step 15.
15. Test ACM internal resistor; measure the resistance between pins 40 and 41 on the ACM 120-pin connector. Is the resistance between 50 to 70 ohms?

15.a Yes; replace the SCR outlet NOx Sensor. Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

15.b No; replace the ACM. Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" .

222.3 SPN 3226/FMI 20 - GHG17

SPN 3226/FMI 20	
Description	Selective Catalyst Reduction (SCR) Outlet NOx Sensor – Drift Low
Monitored Parameter	Engine Out NOx
Typical Enabling Conditions	The Following Must Be True for greater than 30s: Fuel Mass is 0, Diesel Particulate Filter (DPF) Outlet Temperature greater than 200°C (392°F), Battery Voltage greater than 10V DC, Engine Speed 500 to 2100 rpm
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Five Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Parked Regeneration

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are there any other fault codes present for the SCR outlet NOx sensor?
   3.a Yes; diagnose the other fault codes first.
   3.b No; Go to step 4.

> **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.

4. Inspect the Aftertreatment System (ATS) for exhaust leaks. Are there any leaks present?
   4.a Yes; repair the exhaust leaks. Verify repair.
   4.b No; Go to step 5.
5. Inspect the ATS for damage. Is there any damage present?
   5.a Yes; repair as necessary.
   5.b No; replace the SCR outlet NOx sensor.
   For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .Verify repair.
   For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .Verify repair.

222.4 SPN 3226/FMI 21 - GHG17

SPN 3226/FMI 21	
Description	NOx Outlet Sensor Drift High
Monitored Parameter	Selective Catalyst Reduction (SCR) Outlet NOx
Typical Enabling Conditions	Coolant Temperature greater than 70°C (158°F), Engine rpm greater than 1500 and Torque greater than 80%
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	20 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Parked Regeneration

1. Check Aftertreatment System (ATS) for visible exhaust leaks or damage. Is damage present?
   1.a Yes; repair as necessary.
   1.b No; Go to step 2.
2. Turn the ignition OFF.
3. Use DEF test strip A0005850202 to check for diesel fuel or oil contamination of the DEF fluid; Refer to section "Checking Diesel Exhaust Fluid Quality" . Do the test strips or visual inspection indicate that the DEF is contaminated?

> **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.

   3.a Yes; for diesel fuel or oil contamination, refer to 13 TS-17 and refer to appropriate Original Equipment Manufacturer (OEM) literature for DEF tank cleaning/flushing procedures. Refill the DEF tank with new DEF. Verify repair.
   3.b No; Go to step 4.
4. Using the refractometer from DEF Test Kit W060589001900, measure the DEF urea percentage. Is DEF urea percentage between 31 to 34 percent?
   4.a Yes; Go to step 5.
   4.b No; clean/flush the DEF tank and the DEF system. Refer to section "Flushing of the Diesel Exhaust Fluid System" . Refill the DEF tank with new DEF. Verify repair.

Note : Fault code SPN 3361/FMI 5 will become present when the Diesel Exhaust Fluid (DEF) doser electrical connector is disconnected. This code can be cleared using DiagnosticLink once the DEF doser electrical connector is reconnected.

5. Perform a DEF Quantity Test service routine; Refer to section "Diesel Exhaust Fluid Quantity Test - GHG17" .
6. Monitor the amount of DEF dispensed into the DEF-safe container included in DEF test kit W060589001900. Is the amount of DEF dispensed between 108 to 132 mL?
   6.a Yes; reinstall the DEF Dosing Unit using a new gasket and bolts, as these parts are one-time-use components. Refer to section "Installation of the Diesel Exhaust Fluid Dosing Unit " . Go to step 7.
   6.b No; replace the DEF Dosing Unit using a new gasket and bolts, as these parts are one-time-use components. Refer to section "Installation of the Diesel Exhaust Fluid Dosing Unit " . Verify repair.
7. Replace the SCR outlet NOx sensor.

   For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" . Verify repair.

For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" . Verify repair.

SPN 3227 (ACM) (GHG17)

223.1 SPN 3227/FMI 2 - GHG17

SPN 3227/FMI 2	
Description	Goal of this Diagnostic is to Detect the Tail Pipe Out Lambda Signal Lower Than Expected in Engine No Fueling Mode
Monitored Parameter	Outlet NOx Sensor
Typical Enabling Conditions	
Monitor Sequence	Outlet NOx Sensor
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	10 Seconds
Dash Lamp	MIL
Engine Reaction	None
Verification	Road Test at Operating Temperature with Engine Above 1200 rpm, Above 40% Load, in DEF Dosing Mode. Not in Regen or EGR Mode

Check as follows:

> **WARNING**
>
> PERSONAL INJURY
>
> To avoid injury from hot surfaces, wear protective gloves, or allow engine to cool before removing any component.

1. Connect DiagnosticLink . Are there any other fault codes?
   - 1.a Yes; repair other fault codes first.
   - 1.b No; Go to step 2.
2. Check the ACM software level and fuel maps. The ACM software should be 7.56.7.0 with fuel map ZGS002 or higher. Is the software and fuel map up to date?
   - 2.a Yes; Go to step 3.
   - 2.b No, connect to the server and update the ACM software and fuel map. Verify the repair and release the vehicle.
3. Since no other active faults are present and the software is up to date, replace the Outlet NOx sensor. Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

223.2 SPN 3227/FMI 3 - GHG17

Selective Catalyst Reduction Outlet NOx Sensor Circuit Failed High

SPN 3227/FMI 3	
Description	This Code Sets When There is a Short to Power on the SCR Outlet NOx Circuit Between the Sensor and ECU
Monitored Parameter	SCR Outlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	10% Derate
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR Outlet NOx sensor.
2. Inspect the SCR Outlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

> **⚠ WARNING**
>
> PERSONAL INJURY
>
> Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

> **⚠ 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.

2.a Yes; repair as necessary. Verify repairs.

2.b No; replace the SCR Outlet NOx sensor.

For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

For 2-Box, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

223.3 SPN 3227/FMI 5 - GHG17

Selective Catalyst Reduction Outlet NOx Sensor Circuit Failed Open

SPN 3227/FMI 5	
Description	This Code Sets When There is an Open on the SCR Outlet NOx Circuit Between the Sensor and the ECU
Monitored Parameter	SCR Outlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	10% Derate
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR Outlet NOx sensor.
2. Inspect the SCR Outlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

2.a Yes; repair as necessary. Verify repairs.

2.b No; replace the SCR Outlet NOx sensor.

For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

For 2-Box, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

SPN 3236 (ACM) (GHG17)

224.1 SPN 3236/FMI 9 – GHG17

Exhaust Mass Signal Not Available via Controller Area Network

1. Has the Aftertreatment Control Module / Motor Control Module / Common Powertrain Controller been recently reprogrammed?
   1.a Yes; clear the faults codes. If they do not become active, then release the vehicle.
   1.b No; Go to step 2.
2. Turn the ignition OFF (key OFF, engine OFF) and disconnect DiagnosticLink . Wait five minutes for all modules to power-down.
3. Turn the ignition ON (key ON, engine OFF).
4. Reconnect DiagnosticLink. Are any fault codes active?
   4.a Yes; follow the entire SPN 625/FMI 9 procedure for further PT Controller Area Network (CAN) troubleshooting.
   4.b No; clear faults codes and release vehicle.

SPN 3238 (ACM) (GHG17)

225.1 SPN 3238/FMI 2 - GHG17

Selective Catalyst Reduction Outlet NOx Sensor Failure to Activate

1. Connect DiagnosticLink .
2. Is SPN 5357 FMI 16 or 18 also present?

   2.a Yes; repair those fault codes first.

   2.b No; Go to step 3.
3. Monitor (chart) the following parameters.

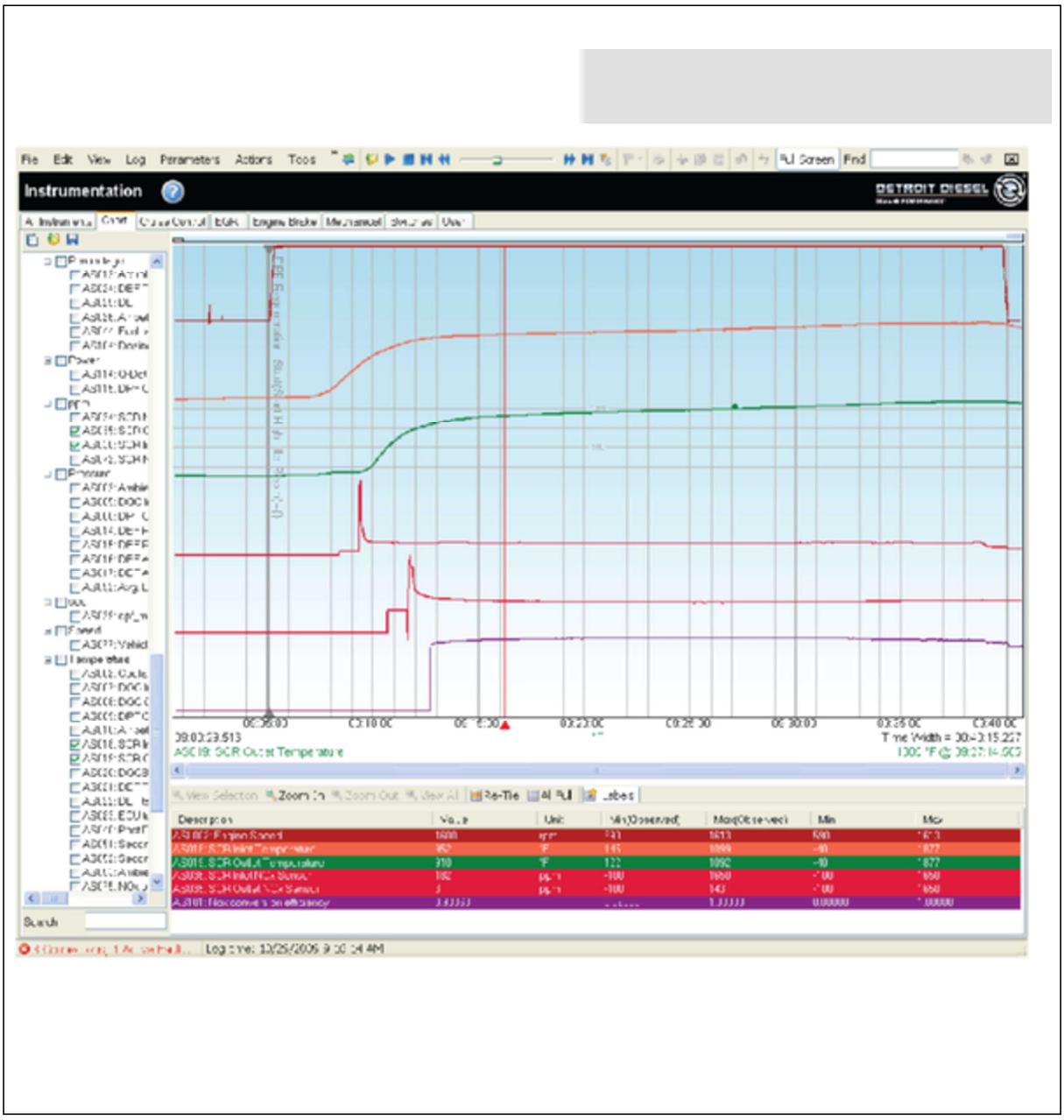
- ASL102 engine speed
- AS018 Selective Catalyst Reduction (SCR) inlet temperature
- AS019 SCR outlet temperature
- AS035 SCR inlet NOx sensor
- AS036 SCR outlet NOx sensor
- AS101 NOx conversion efficiency

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

> **⚠ 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.

4. Start the engine and perform a parked regeneration. Does the NOx conversion efficiency rise above 70% (0.70) during the regeneration?



4.a Yes; clear faults and release vehicle.

4.b No; replace the SCR outlet NOx sensor.

For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

For 2-Box, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

SPN 3242 (ACM) (GHG17)

226.1 SPN 3242/FMI 3 - GHG17

Diesel Oxidation Catalyst Inlet Temperature Sensor Circuit Failed High

1. Disconnect the Diesel Oxidation Catalyst (DOC) inlet temperature sensor connector.
2. Inspect the sensor harness for bent, spread, or corroded pins.
   2.a If the pins are bent, spread, or corroded, repair as necessary. Verify Repairs
   2.b If the connector shows no signs of damage, Go to step 3.
3. DOC inlet temperature test: measure the resistance between pin 1 and 2 of the DOC inlet temperature sensor connector.

Temp - °C	Temp -°F	Range	
		Min Resistance ()	Max Resistance ()
0	32	197.67	207.62
2	35.6	199.20	209.15
4	39.2	200.73	210.67
6	42.8	202.27	212.20
8	46.4	203.80	213.72
10	50	205.33	215.24
12	53.6	206.85	216.77
14	57.2	208.38	218.29
16	60.8	209.91	219.81
18	64.44	211.43	221.33
20	68	212.96	222.85
22	71.6	214.48	224.37
24	75.2	216.01	225.88
26	78.8	217.53	227.40
28	82.4	219.05	228.91
30	86	220.57	230.43
32	89.6	222.09	231.94
34	93.2	223.61	233.45
36	96.8	225.12	234.96
38	100.4	226.64	236.47
40	104	228.16	237.98

   3.a If the resistances are out of range, replace the DOC inlet temperature sensor.

   For 1-Box™, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Temperature Sensor" .

   For 2-Box, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Temperature Sensor" .

   3.b If the resistances are in range, Go to step 4.
4. Turn the ignition ON (key ON, engine OFF).
5. Measure the voltage between pin 2 on the harness side of the DOC inlet temperature sensor connector and ground.
   5.a If the voltage is greater than 3 volts, repair the short to power between pin 2 on the harness side of the DOC inlet temperature sensor connector and pin 107 of the Aftertreatment Control Module (ACM) 120-pin connector.
   5.b If the voltage is between 2.75 and 3 volts, Go to step 6.
   5.c If the voltage is less than 2.75 volts, repair the wire between pin 2 on the harness side of the DOC inlet temperature sensor connector and pin 107 of the ACM 120-pin connector.

6. Measure the voltage between pin 1 on the harness side of the DOC inlet temperature sensor and ground.

   6.a If voltage is present, repair the short to power between pin 1 on the harness side of the DOC inlet temperature sensor connector and pin 108 of the ACM 120-pin connector.

   6.b If no voltage is present, repair the open between pin 1 on the harness side of the DOC inlet temperature sensor connector and pin 108 of the ACM 120-pin connector.

226.2 SPN 3242/FMI 4 - GHG17

Diesel Oxidation Catalyst Inlet Temperature Sensor Failed Low

1. Turn the ignition OFF (key OFF, engine OFF).
2. Disconnect the Diesel Oxidation Catalyst (DOC) inlet temperature sensor harness connector.
3. Inspect the DOC inlet temperature sensor harness connector for bent, pushed out, spread, or corroded pins.
   - 3.a If the pins are bent, pushed out, spread, or corroded, repair as necessary. Verify repairs.
   - 3.b If the DOC inlet temperature sensor harness connector shows no signs of damage, Go to step 4.
4. Disconnect the Aftertreatment Control Module (ACM) 120-pin connector.
5. Inspect ACM 120-pin connector and harness connector for bent, pushed out, spread, or corroded pins.
   - 5.a If there are signs of bent, pushed out, spread, or corroded, repair as necessary. Verify repairs.
   - 5.b If Motor Control Module (MCM) 120-pin connector and harness show no signs of damage, Go to step 6.
6. Measure the resistance between pin 2 on the harness side of the DOC inlet temperature sensor connector and ground - (Battery Ground).
   - 6.a If the resistance is less than 1K ohms, repair the short to ground in the wire between pin 2 of the DOC inlet temperature sensor connector and pin 107 of the ACM 120-pin connector. Verify repairs.
   - 6.b If the resistance is greater than 1K ohms, Go to step 7.
7. Inspect Aftertreatment harness connectors (14-way or 47-way depending on application) and intermediate chassis wiring (OEM dependent) for bent, pushed out, spread, or corroded pins or signs of damage to the wiring.
   - 7.a If there are signs of bent, pushed out, spread, or corroded pins or harness damage, repair as necessary. Verify repairs.
   - 7.b If connectors and harness show no signs of damage, Go to step 8.
8. If problem is still unresolved, review previous steps. If issue is still not resolved, replace the DOC inlet temperature sensor.

   For 1-BOX™, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Temperature Sensor" .

   For 2- BOX, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Temperature Sensor" .

226.3 SPN 3242/FMI 8 - GHG17

Diesel Oxidation Catalyst Inlet Temperature – Signal Spike

Note : This fault indicates the Aftertreatment Control Module (ACM) has detected a sudden temperature shift on the Diesel Oxidation Catalyst (DOC) inlet temperature sensor. The most likely cause is an intermittent wiring concern (poor terminal fit, corrosion, chaffing etc.).

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check fault codes:
   - 3.a If SPN 3242/FMI 3 or 4 are active, repair those faults first.
   - 3.b If SPN 3242/FMI 3 or 4 are inactive or not present, Go to step 4.
4. Using the Selective Catalyst Reduction (SCR) and Diesel Particulate Filter (DPF) voltages service routine tab, monitor parameter DOC inlet temp (pin 107).
5. While wiggle-testing the harness, look for abnormal voltage spikes on the DOC inlet temperature signal. Once a spike is detected, isolate that section of harness and inspect for wire chaffing, corrosion, improper connections or physical damage and repair as necessary. If no voltage spikes are detected, Go to step 6.
6. DOC inlet temperature sensor test – Disconnect the DOC inlet temperature sensor, measure the resistance between pins 1 and 2 of the DOC inlet temperature sensor connector (refer to chart for resistance values).

Temp - °C	**Temp -°F**	**Range**	
		Min Resistance ()	**Max Resistance ()**
0	32	197.67	207.62
2	35.6	199.20	209.15
4	39.2	200.73	210.67
6	42.8	202.27	212.20
8	46.4	203.80	213.72
10	50	205.33	215.24
12	53.6	206.85	216.77
14	57.2	208.38	218.29
16	60.8	209.91	219.81
18	64.44	211.43	221.33
20	68	212.96	222.85
22	71.6	214.48	224.37
24	75.2	216.01	225.88
26	78.8	217.53	227.40
28	82.4	219.05	228.91
30	86	220.57	230.43
32	89.6	222.09	231.94
34	93.2	223.61	233.45
36	96.8	225.12	234.96
38	100.4	226.64	236.47
40	104	228.16	237.98

   - 6.a If the resistances are out of range, replace the DOC inlet temperature sensor.
   - 6.b If the resistances are in range, Go to step 7.
7. Using appropriate test probes from J-48476 connector test kit and terminal repair kit J-47410, drag test and inspect all harness connector terminals between the DOC inlet temperature sensor and the ACM including the chassis extension harness and Aftertreatment Device (ATD) sensor box. Repair as necessary.

226.4 SPN 3242/FMI 17 - GHG17

Diesel Oxidation Catalyst Inlet Temperature Out Of Range Low Preventing HC Dosing

Diagnose as follows:

1. Turn the ignition OFF (key OFF, engine OFF).
2. Disconnect the Diesel Oxidation Catalyst (DOC) inlet temperature sensor harness connector.
3. Inspect the DOC inlet temperature sensor harness for bent, spread, or corroded pins.
   - 3.a If the pins are bent, spread, or corroded, repair as necessary. Verify repairs.
   - 3.b If the DOC inlet temperature connector shows no signs of damage, Go to step 4.
4. Disconnect the Aftertreatment Control Module (ACM) 120-pin connector.
5. Measure the resistance between pin 2 on the harness side of the DOC inlet temperature sensor connector and ground.
   - 5.a If the resistance is less than 1K ohms, repair the wire between pin 2 of the DOC inlet temperature sensor connector and pin 107 of the ACM 120-pin connector. Verify repairs.
   - 5.b If the resistance is greater than 1K ohms, replace the DOC inlet temperature sensor.

     For 1-BOX™, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Temperature Sensor" .

     For 2-BOX, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Temperature Sensor" .

226.5 SPN 3242/FMI 20 - GHG17

Diesel Oxidation Catalyst Temperature Drift - Inlet High or Outlet Low

SPN 3242/FMI 20	
Description	70°C (126°F) Difference During Non-regeneration Mode
Monitored Parameter	Diesel Oxidation Catalyst (DOC) Inlet Temperature vs. DOC Outlet Temperature
Typical Enabling Conditions	Coolant Temperature Greater than 60°C (140°F); Regen not Active in Last Five Minutes
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	One Minute
Dash Lamps	MIL, CEL
Engine Reaction	Regen Inhibit and 10% Engine Derate
Verification	Low Temperature Regen

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Check for multiple fault codes. Are SPN 3242/FMI 3, 4, 8 or SPN 3250/FMI 3, 4, and 8 present?
   1.a Yes; repair those faults first.
   1.b No; Go to step 2.

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

2. Start the engine.
3. Run service routine Perform Performance Check - Low Temp ATD; allow the routine to run for 20 to 25 minutes.
4. Compare the Diesel Oxidation Catalyst (DOC) inlet temperature with DOC outlet temperature and Diesel Particulate Filter (DPF) outlet temperature. Are all three temperature sensors within 25°C (45°F) of each other?

   4.a Yes; DOC inlet and DOC outlet temperature sensors test good. Clear the code and release the vehicle.

   4.b No; Go to step 5.
5. Is the DOC outlet temperature sensor reading within 25°C (45°F) of the DPF outlet temperature sensor?

   5.a Yes; Go to step 8.

   5.b No; Go to step 6.
6. Shut OFF the engine.
7. Replace the DOC inlet temperature sensor.

   For 1-BOX™, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Temperature Sensor" . Verify repair.

   For Two-BOX option, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Temperature Sensor" . Verify repair.
8. Shut OFF the engine.
9. Replace the DOC outlet temperature sensor.

   For 1-BOX™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.

   For Two-BOX option, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.

SPN 3246 (ACM) (GHG17)

227.1 SPN 3246/FMI 0 - GHG17

SPN 3246/FMI 0	
Description	This Code Sets When The Diesel Particulate Filter (DPF) Outlet Temperature is Greater Than 790°C (1454°F) for More Than Two Seconds
Monitored Parameter	DPF Outlet Temperature Sensor
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Are Met
Typical Duration	Two Seconds
Dash Lamps	CEL, MIL, SEL
Engine Reaction	25% Derate, Engine Shutdown
Verification	Parked Regeneration

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

Check as follows:

Possible causes:

- Faulty DPF outlet temperature sensor
- Fluid intrusion into the exhaust
- Biased input for fuel mapping
- Incorrect or over-contributing fuel injectors
- Restricted air filter
- Incorrect camshaft timing

1. Connect DiagnosticLink .

2. Turn the ignition ON (key ON, engine OFF).
3. Check for any fuel system fault codes. Are there fuel system fault codes present?
   - 3.a Yes; diagnose the fuel system codes first.
   - 3.b No; Go to step 4.
4. Check for multiple DPF outlet temperature sensor fault codes. Is code SPN 3246/FMI 8 present?
   - 4.a Yes; diagnose code SPN 3246/FMI 8 first. Verify repair.
   - 4.b No; Go to step 5.
5. Does this vehicle have a DD15 engine?
   - 5.a Yes; Go to step 6.
   - 5.b No; Go to step 7.
6. Verify the MCM software level, is the MCM software level 6.5.0.2?
   - 6.a Yes; Go to step 7.
   - 6.b No; update the MCM to software version 6.5.0.2 (or higher) with fuel map ZGS 003 and the ACM to software 7.57.2.0 (or higher).
7. Check for multiple high exhaust temperature fault codes. Are fault codes SPN 3250/FMI 0, SPN 4360/FMI 15 or SPN 4363/FMI 0 present?
   - 7.a Yes; Go to step 8.
   - 7.b No; Go to step 10.
8. Remove and inspect the turbocharger exhaust outlet pipe. Are there signs of fluid in the exhaust?
   - 8.a Yes; determine the cause of fluid in the exhaust. Repair as necessary. Inspect the Diesel Oxidation Catalyst (DOC) and DPF.

     Refer to section "Inspection of the Diesel Oxidation Catalyst" . Verify repair.
   - 8.b No; Go to step 9.
9. Remove and inspect the Exhaust Gas Recirculation (EGR) outlet pipe. Refer to section "Removal of the Exhaust Gas Recirculation Hot Pipe" . Is there fuel present in the EGR outlet pipe?
   - 9.a Yes; Refer to section "Test-E - Two-Filter Fuel System" . Verify repair.
   - 9.b No; Go to step 10.
10. Check for any air management system fault codes. Are there any air management system fault codes present?
    - 10.a Yes; diagnose the air management system fault codes first. Verify repair.
    - 10.b No; Go to step 11.
11. Remove and inspect the air filter; refer to OEM literature for removal and inspection procedures. Is the air filter restricted?
    - 11.a Yes; replace the air filter. Verify repair.
    - 11.b No; Go to step 12.

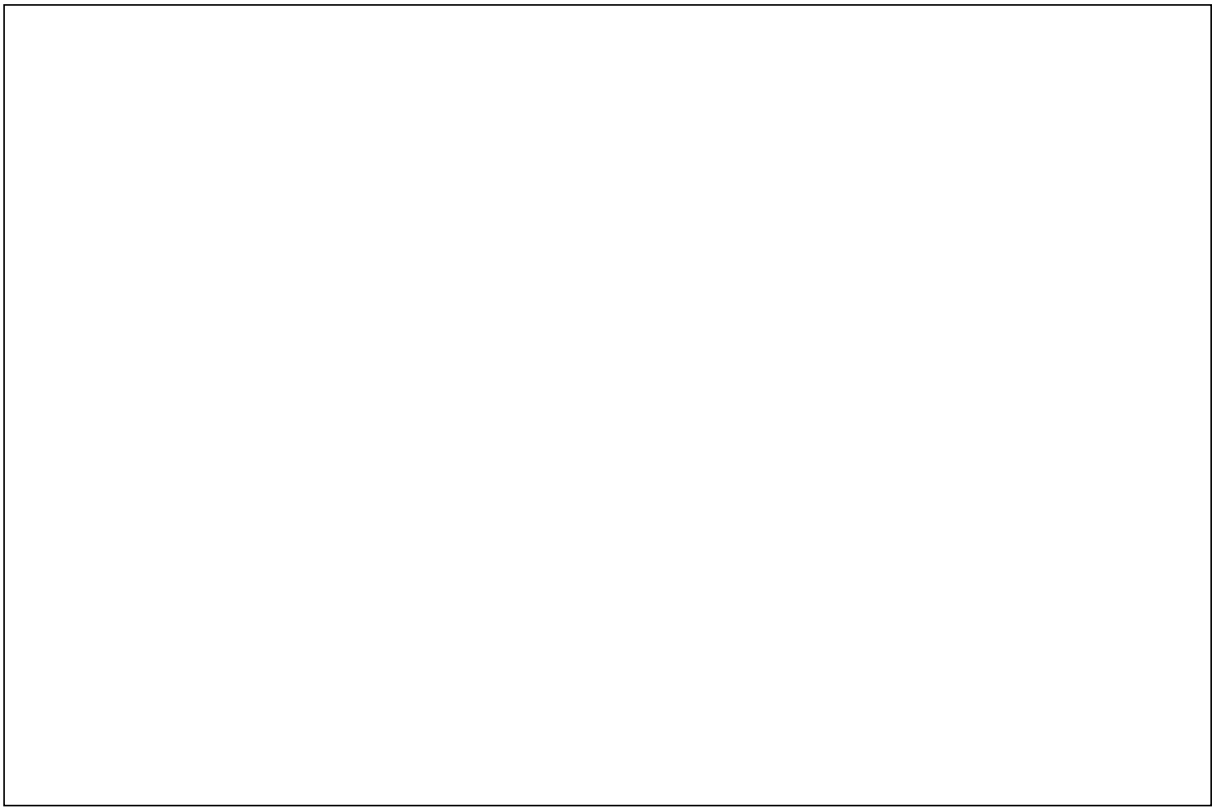
Note : A cold soak may take up to eight hours.

12. Allow the engine to cold soak so the temperature of the exhaust stabilizes with the ambient air temperature. Go to step 13.
13. Turn the ignition ON (key ON, engine OFF). Go to step 14.
14. Monitor the DPF outlet temperature sensor reading. Is the DPF outlet temperature sensor within 25°C (45°F) of the other exhaust temperature sensors?
    - 14.a Yes; Go to step 15.
    - 14.b No; replace the DPF outlet temperature sensor.

      For 1-Box™; Refer to section "Removal of the Diesel Particulate Filter Outlet Temperature Sensor" .

      For Two-Box; Refer to section "Removal of the Diesel Particulate Filter Outlet Temperature Sensor" .

15. Turn the ignition OFF.



16. Disconnect the intake temperature sensor connector, shown above.
17. Inspect the intake temperature connector and the harness connector for signs of damage, bent, spread, broken, pushed out (unseated) or corroded pins or wire damage near the connector. Was any damage found?
    17.a Yes; replace the intake temperature sensor and the harness pig tail.
    17.b No; reconnect the sensor and Go to step 18.
18. Turn the ignition ON (key ON, engine OFF).
19. Compare the barometric sensor reading to the intake manifold pressure sensor reading. Are the readings within 8.27 kPa (1.2 psi) of each other?
    19.a Yes; Go to step 20.
    19.b No; replace the intake manifold pressure sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" . Verify repair.
20. Compare the intake manifold temperature sensor reading to the charge air cooler temperature sensor reading. Are the readings within 5°C (9°F) of each other?
    20.a Yes; Go to step 21.
    20.b No; replace the intake manifold temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" . Verify repair.

WARNING

ENGINE EXHAUST

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

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.

21. Start the engine. Go to step 22.
22. Perform the Idle Speed Balance (ISB) test. Refer to section "Checking Idle Speed Balance" . Do all of the injectors pass the ISB test?
    - 22.a Yes; Go to step 23.
    - 22.b No; replace the faulty injector. Verify repair.
23. Turn the engine OFF. Go to step 24.
24. Remove and inspect the EGR cooler outlet pipe. Is there fuel present in the EGR cooler outlet pipe?
    - 24.a Yes; Refer to section "Test-E - Two-Filter Fuel System" . Verify repair.
    - 24.b No; Go to step 25.
25. Perform an Automatic Fuel System Integrity Check (FSIC) routine and monitor Actual Fuel Mass at 600 rpm. Does Actual Fuel Mass exceed 50 mg/st at 600 rpm?
    - 25.a Yes; stop FSIC routine and inspect for stuck engine brakes. Refer to section "Checking for Poor Engine Brake Performance" . Verify repair.
    - 25.b No; Go to step 26.
26. Verify the fuel injector(s) part number is correct for engine application.

    Refer to section "Removal of the Fuel Injector - Two-Filter System" . Is the fuel injector(s) part number correct for the application?

26.a Yes; verify the camshaft timing. Refer to section "Camshaft Timing Verification" . Repair as necessary. Verify repair.

26.b No; install the correct injectors.

Refer to section "Test-E - Two-Filter Fuel System" . Verify repair.

227.2 SPN 3246/FMI 2 - GHG17

DPF Outlet Temperature Not Plausible

SPN 3246/FMI 2	
Description	This fault sets if the Diesel Particulate Filter (DPF) outlet temperature is 70°C (126°F) higher compared to all other aftertreatment temperature sensors after 8 hours cold soak.
Monitored Parameter	DPF Outlet Temperature versus all other ATS temperature sensors
Typical Enabling Conditions	Engine off for more than 8 hours, Battery Voltage greater than 10.98 V, Ignition on longer than 60 seconds
Monitor Sequence	Key on; engine off for more than 60 seconds
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Ignition off/ 8 hours cold soak

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are fault codes SPN 3246/ FMI 3/4 also present?
   - 3.a Yes; diagnose the other fault codes first.
   - 3.b No; Go to step 4.
4. Disconnect and inspect the DPF outlet temperature sensor electrical connector, harness side.
5. Are there any spread pins, damaged pins, corrosion or signs of fretting present?
   - 5.a Yes; repair as necessary. Verify repair.
   - 5.b No; replace the DPF outlet temperature sensor.

     For 1-BOX™, Refer to section "Removal of the Diesel Particulate Filter Outlet Temperature Sensor"

     For 2-BOX, Refer to section "Removal of the Diesel Particulate Filter Outlet Temperature Sensor" .Verify repair.

227.3 SPN 3246/FMI 3 - GHG17

Diesel Particulate Filter Outlet Temperature Sensor Circuit Failed High

1. Disconnect the Diesel Particulate Filter (DPF) outlet temperature sensor connector.
2. Inspect the DPF outlet temperature sensor harness for bent, spread, or corroded pins.
   2.a If the pins are bent, spread, or corroded, repair as necessary.
   2.b If the connector shows no signs of damage, Go to step 3.
3. DPF outlet temperature test - measure the resistance between pin 1 and 2 of the DPF outlet temperature sensor connector (refer to chart for resistance values).

Temp - °C	Temp -°F	Range	
		Min Resistance ()	Max Resistance ()
0	32	197.67	207.62
2	35.6	199.20	209.15
4	39.2	200.73	210.67
6	42.8	202.27	212.20
8	46.4	203.80	213.72
10	50	205.33	215.24
12	53.6	206.85	216.77
14	57.2	208.38	218.29
16	60.8	209.91	219.81
18	64.44	211.43	221.33
20	68	212.96	222.85
22	71.6	214.48	224.37
24	75.2	216.01	225.88
26	78.8	217.53	227.40
28	82.4	219.05	228.91
30	86	220.57	230.43
32	89.6	222.09	231.94
34	93.2	223.61	233.45
36	96.8	225.12	234.96
38	100.4	226.64	236.47
40	104	228.16	237.98

   3.a If the resistances are out of range, replace the DPF outlet temperature sensor.

   For 1-BOX™, Refer to section "Removal of the Diesel Particulate Filter Outlet Temperature Sensor" .

   For 2-BOX, Refer to section "Removal of the Diesel Particulate Filter Outlet Temperature Sensor" .

   3.b If the resistances are in range, Go to step 4.
4. Turn the ignition ON (key ON, engine OFF).
5. Measure the voltage between pin 2 on the harness side of the DPF outlet temperature sensor connector and ground.
   5.a If the voltage is greater than 3 volts, repair the short to power between pin 2 on the harness side of the DPF Outlet Temperature sensor connector and pin 97 of the Aftertreatment Control Module (ACM) 120-pin connector.
   5.b If the voltage is between 2.75 and 3 volts, Go to step 6.
   5.c If the voltage is less than 2.75 volts, repair the wire between pin 2 on the harness side of the DPF outlet temperature sensor connector and pin 97 of the ACM 120-pin connector.
6. Measure the voltage between pin 1 on the harness side of the DPF outlet temperature sensor and ground.
   6.a If voltage is present, repair the short to power between pin 1 on the harness side of the DPF outlet temperature sensor connector and pin 98 of the ACM 120-pin connector.

6.b If no voltage is present, repair the open between pin 1 on the harness side of the DPF outlet temperature sensor connector and pin 98 of the ACM 120-pin connector.

227.4 SPN 3246/FMI 4 - GHG17

Diesel Particulate Filter Outlet Temperature Sensor Circuit Failed Low

1. Turn the ignition OFF (key OFF, engine OFF).
2. Disconnect the Diesel Particulate Filter (DPF) outlet temperature sensor harness connector.
3. Inspect the sensor harness for bent, spread, or corroded pins.
   - 3.a If the pins are bent, spread, or corroded, repair as necessary.
   - 3.b If connector shows no signs of damage, Go to step 4.
4. Disconnect the Aftertreatment Control Module (ACM) 120-pin connector.
5. Measure the resistance between pin 2 on the harness side of the DPF Outlet Temperature sensor connector and ground.
   - 5.a If the resistance is less than 1K ohms, repair the wire between pin 2 of the DPF outlet temperature sensor connector and pin 97 of the ACM 120-pin connector.
   - 5.b If the resistance is greater than 1K ohms, replace the DPF outlet temperature sensor.

     For 1-BOX™, Refer to section "Removal of the Diesel Particulate Filter Outlet Temperature Sensor"

     For 2-BOX, Refer to section "Removal of the Diesel Particulate Filter Outlet Temperature Sensor"

227.5 SPN 3246/FMI 8 - GHG17

Diesel Particulate Filter Outlet Temperature - Signal Spike

Note : This fault indicates the Aftertreatment Control Module (ACM) has detected a sudden temperature shift on the Diesel Particulate Filter (DPF) outlet temperature sensor. The most likely cause is an intermittent wiring concern (poor terminal fit, corrosion, chaffing etc.).

1. Connect DiagnosticLink .
2. Turn the ignition ON.
3. Check fault codes:

   3.a If SPN 3246/FMI 3 or 4 are active, repair those faults first.

   3.b If SPN 3246/FMI 3 or 4 are inactive or not present, Go to step 4.
4. Using the Selective Catalyst Reduction (SCR) and DPF voltages service routine tab, monitor parameter DPF outlet temp (pin 97).
5. While wiggle-testing the harness, look for abnormal voltage spikes on the DPF outlet temperature signal. Once a spike is detected, isolate that section of harness and inspect for wire chaffing, corrosion, improper connections or physical damage and repair as necessary. If no voltage spikes are detected, Go to step 6.
6. DPF outlet temperature sensor test – Disconnect the DPF outlet temperature sensor, measure the resistance between pins 1 and 2 of the DPF outlet temperature sensor connector (refer to chart for resistance values).

Temp - °C	Temp -°F	Range	
		Min Resistance ()	Max Resistance ()
0	32	197.67	207.62
2	35.6	199.20	209.15
4	39.2	200.73	210.67
6	42.8	202.27	212.20
8	46.4	203.80	213.72
10	50	205.33	215.24
12	53.6	206.85	216.77
14	57.2	208.38	218.29
16	60.8	209.91	219.81
18	64.44	211.43	221.33
20	68	212.96	222.85
22	71.6	214.48	224.37
24	75.2	216.01	225.88
26	78.8	217.53	227.40
28	82.4	219.05	228.91
30	86	220.57	230.43
32	89.6	222.09	231.94
34	93.2	223.61	233.45
36	96.8	225.12	234.96
38	100.4	226.64	236.47
40	104	228.16	237.98

   6.a If the resistances are out of range, replace the DPF outlet temperature sensor.

   6.b If the resistances are in range, Go to step 7.
7. Using appropriate test probes from J-48476 connector test kit and terminal repair kit J-47410, drag test and inspect all harness connector terminals between the DPF outlet temperature sensor and the ACM including the chassis extension harness and ATD sensor box. Repair as necessary.

227.6 SPN 3246/FMI 15 - GHG17

Diesel Particulate Filter Outlet Temperature - High

SPN 3246/FMI 15	
Description	This Code Sets When The Diesel Particulate Filter (DPF) Outlet Temperature is Greater Than 730°C (1346°F) for More Than Two Seconds
Monitored Parameter	DPF Outlet Temperature Sensor
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Are Met
Typical Duration	Two Seconds
Dash Lamps	CEL, MIL
Engine Reaction	25% Derate
Verification	Parked Regeneration

Check as follows:

Possible causes:

- Faulty DPF outlet temperature sensor
- Fluid intrusion into the exhaust
- Biased input for fuel mapping
- Incorrect or over-contributing fuel injectors
- Restricted air filter
- Incorrect camshaft timing

1. Connect DiagnosticLink®. Go to step 2.
2. Turn the ignition ON (key ON, engine OFF). Go to step 3.
3. Check for any fuel system fault codes. Are there fuel system fault codes present?
   - 3.a Yes; diagnose the fuel system codes first.
   - 3.b No; Go to step 4.
4. Check for multiple DPF outlet temperature sensor fault codes. Is code SPN 3246/FMI 8 present?
   - 4.a Yes; diagnose code SPN 3246/FMI 8 first. Verify repair.
   - 4.b No; Go to step 5.
5. Check for any SPN 190/FMI engine over-speed fault codes. Are any SPN 190/FMI fault codes active or previously active?
   - 5.a Yes; Check DDEC reports for an engine over-speed and inspect camshafts for spun cam lobes. Go to step 6.
   - 5.b No; Go to step 6.
6. Check for multiple high exhaust temperature fault codes. Are fault codes SPN 3250/FMI 0, SPN 4360/FMI 15 or SPN 4363/FMI 0 present?
   - 6.a Yes; Go to step 7.
   - 6.b No; Go to step 9.
7. Remove and inspect the turbocharger exhaust outlet pipe. Are there signs of fluid in the exhaust?
   - 7.a Yes; determine the cause of fluid in the exhaust. Repair as necessary. Inspect the Diesel Oxidation Catalyst (DOC) and Diesel Particulate Filter (DPF).

     Refer to section " *Diesel Oxidation Catalyst (DOC) Inspection - All Years* " .

     Refer to section " *Diesel Particulate Filter (DPF) Inspection - All Years* ". Verify repair.

7.b No; Go to step 8.

8. Remove and inspect the Exhaust Gas Recirculation (EGR) outlet pipe. Refer to section "Removal of the Exhaust Gas Recirculation Hot Pipe" . Is there fuel present in the EGR outlet pipe?

8.a Yes; Refer to section "Test-E - Two-Filter Fuel System" .Verify repair.

8.b No; Go to step 9.

9. Check for any air management system fault codes. Are there any air management system fault codes present?

9.a Yes; diagnose the air management system fault codes first. Verify repair.

9.b No; Go to step 10.

10. Remove and inspect the air filter; refer to OEM literature for removal and inspection procedures. Is the air filter restricted?

10.a Yes; replace the air filter. Verify repair.

10.b No; Go to step 11.

Note : A cold soak may take up to eight hours.

11. Allow the engine to cold soak so the temperature of the exhaust stabilizes with the ambient air temperature. Go to step 12.

12. Turn the ignition ON (key ON, engine OFF). Go to step 13.

13. Monitor the DPF outlet temperature sensor reading. Is the DPF outlet temperature sensor within 25°C (45°F) of the other exhaust temperature sensors?

13.a Yes; Go to step 14.

13.b No; replace the DPF outlet temperature sensor.

For 1-BOX™, Refer to section "Removal of the Diesel Particulate Filter Outlet Temperature Sensor" . Verify repair.

For 2-BOX, Refer to section "Removal of the Diesel Particulate Filter Outlet Temperature Sensor" . Verify repair.

14. Compare the barometric sensor reading to the intake manifold pressure sensor reading. Are the readings within 8.27 kPa (1.2 psi) of each other?

14.a Yes; Go to step 15.

14.b No; replace the intake manifold pressure sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" . Verify repair.

15. Compare the intake manifold temperature sensor reading to the charge air cooler temperature sensor reading. Are the readings within 5°C (9°F) of each other?

15.a Yes; Go to step 16.

15.b No; replace the intake manifold temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" . Verify repair.

WARNING

ENGINE EXHAUST

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

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.

16. Start the engine. Go to step 17.

17. Perform the Idle Speed Balance (ISB) test. Refer to section "Checking Idle Speed Balance" . Do all of the injectors pass the ISB test?

    17.a Yes; Go to step 18.

    17.b No; replace the faulty injector. Verify repair.

18. Turn the engine OFF.

19. Remove and inspect the EGR cooler outlet pipe. Is there fuel present in the EGR cooler outlet pipe?

    19.a Yes; Refer to section "Test-E - Two-Filter Fuel System" . Verify repair.

    19.b No; Go to step 20.

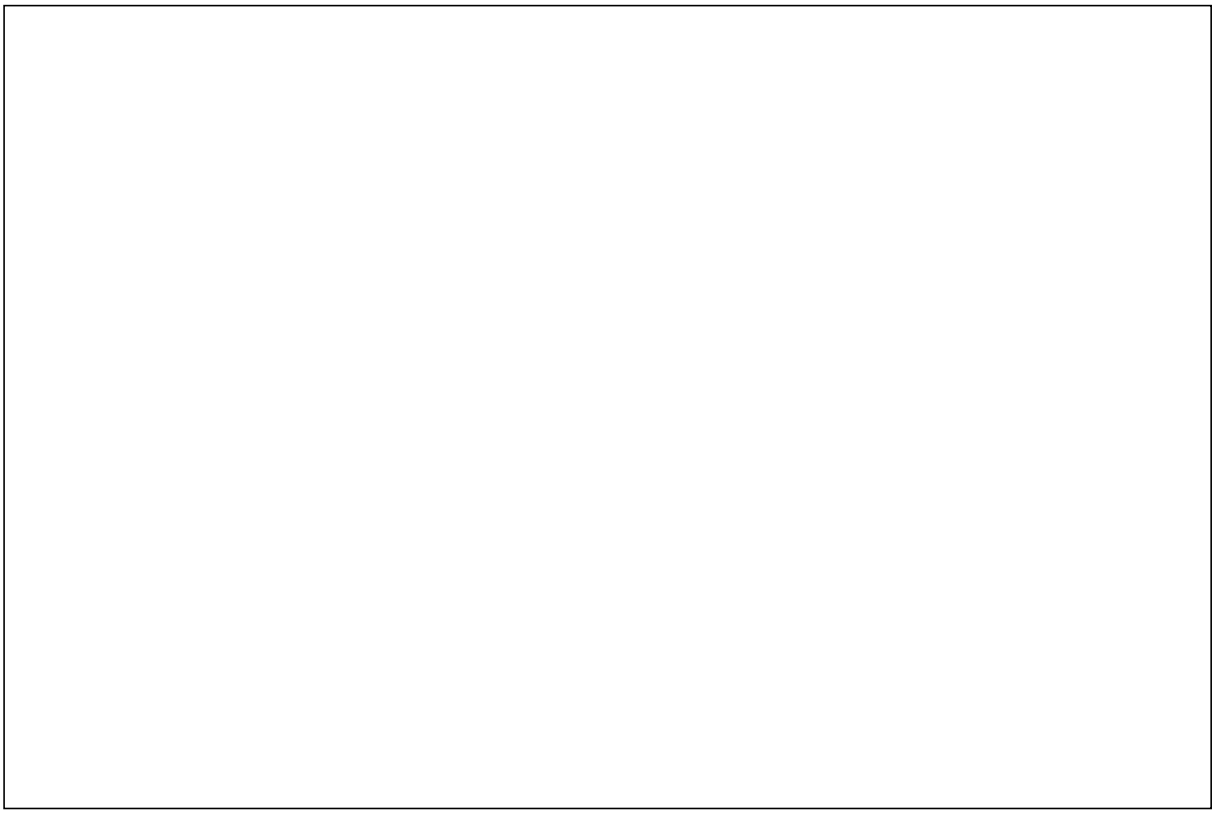
20. Perform an Automatic Fuel System Integrity Check (FSIC) routine and monitor Actual Fuel Mass at 600 rpm. Does Actual Fuel Mass exceed 50 mg/st at 600 rpm?

    20.a Yes; stop FSIC routine and inspect for stuck engine brakes. Refer to section "Checking for Poor Engine Brake Performance" . Verify repair.

    20.b No; Go to step 21.

21. Verify the fuel injector(s) part number is correct for engine application.

    Refer to section "Removal of the Fuel Injector - Two-Filter System" . Is the fuel injector(s) part number correct for the application?



    21.a Yes; verify the camshaft timing. Refer to section "Camshaft Timing Verification" . Repair as necessary. Verify repair.

    21.b No; install the correct injectors.

    Refer to section "Test-E - Two-Filter Fuel System" . Verify repair.

227.7 SPN 3246/FMI 20 - GHG17

Diesel Particulate Filter Outlet Temperature Sensor Stuck

1. Check for multiple fault codes.
   1.a If SPN 3246/FMI 3/4/8 or SPN 3250/FMI 3/4/8 is also present, repair those faults first.
   1.b If the above faults are not present, Go to step 2.
2. Turn the ignition ON (key ON, engine OFF).
3. Compare the Diesel Oxidation Catalyst (DOC) outlet temperature and Diesel Particulate Filter (DPF) outlet temperature; is the DOC outlet temperature within 7°C (45°F) of the DPF outlet temperature?
   3.a Yes; Go to step 4.
   3.b No; Go to step 7.

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

> **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.

4. Start the engine (key ON, engine ON).
5. Compare the DOC outlet temperature and DPF outlet temperature; are the DOC outlet temperature and DPF outlet temperature within 7°C (45°F) of each other?
   5.a Yes; Go to step 6.
   5.b No; Go to step 7.
6. Continue idling the engine for 10 minutes. Are the DOC outlet temperature and DPF outlet temperatures within 7°C (45°F) of each other?
   6.a Yes; clear faults and release vehicle.
   6.b No; Go to step 7.
7. Turn engine OFF.
8. Disconnect the DOC outlet temperature sensor harness.
9. Inspect the DOC outlet temperature sensor and harness connector for signs of damage, bent, spread, broken, unseated (pushed out) or corroded pins, signs of water intrusion or damaged wiring near the connector.
   9.a If signs of damage are present, repair as necessary.
   9.b If no signs of damage are present, Go to step 10.
10. Measure the resistance across the DOC outlet temperature sensor at the pigtail connector (refer to chart). Is the resistance within range?

Temp - °C	Temp -°F	Range	
		Min Resistance ()	Max Resistance ()
0	32	197.67	207.62
2	35.6	199.20	209.15
4	39.2	200.73	210.67
6	42.8	202.27	212.20
8	46.4	203.80	213.72
10	50	205.33	215.24
12	53.6	206.85	216.77
14	57.2	208.38	218.29
16	60.8	209.91	219.81
18	64.44	211.43	221.33
20	68	212.96	222.85
22	71.6	214.48	224.37
24	75.2	216.01	225.88
26	78.8	217.53	227.40
28	82.4	219.05	228.91
30	86	220.57	230.43
32	89.6	222.09	231.94
34	93.2	223.61	233.45
36	96.8	225.12	234.96
38	100.4	226.64	236.47
40	104	228.16	237.98

10.a Yes; Go to step 11.

10.b No; replace the DOC outlet temperature sensor.

For 1-BOX™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .

For 2-BOX, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .

11. Disconnect the DPF outlet temperature sensor harness.

12. Inspect the DPF outlet temperature sensor and harness connector for signs of damage, bent, spread, broken, unseated (pushed out) or corroded pins, signs of water intrusion or damaged wiring near the connector.

12.a If signs of damage are present, repair as necessary.

12.b If no signs of damage are present, Go to step 13.

13. Measure the resistance across the DPF outlet temperature sensor at pigtail connector (refer to chart above). Is the resistance within range?

13.a Yes; clear faults and release vehicle.

13.b No; replace the DPF outlet temperature sensor.

For 1-BOX™, Refer to section "Removal of the Diesel Particulate Filter Outlet Temperature Sensor" .

For 2-BOX, Refer to section "Removal of the Diesel Particulate Filter Outlet Temperature Sensor" .

227.8 SPN 3246/FMI 21 - GHG17

Diesel Particulate Filter Outlet Temperature Sensor - Not Plausible

1. Check for multiple fault codes.
   1.a If SPN 3246 FMI 3/4/8 or SPN 3250 FMI 3/4/8 is also present, repair those faults first. Verify repairs.
   1.b If the above faults are not present, Go to step 2.
2. Turn the ignition ON (key ON, engine OFF).
3. Compare Diesel Oxidation Catalyst (DOC) outlet temperature and Diesel Particulate Filter (DPF) outlet temperature. Is the DOC outlet temperature within 7°C (45°F) of the DPF outlet temperature?
   3.a Yes; Go to step 4.

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

   3.b No; Go to step 7.

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

> **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.

4. Start the engine.
5. Compare DOC outlet temperature with the DPF outlet temperature. Is the DOC outlet temperature within 7°C (45°F) of the DPF outlet temperature?
   5.a Yes; Go to step 6.
   5.b No; Go to step 7.
6. Continue idling engine for ten minutes. Is the DOC outlet temperature within 7°C (45°F) of the DPF outlet temperature?
   6.a Yes, clear faults and release vehicle.
   6.b No; Go to step 7.
7. Turn engine OFF (key OFF, engine OFF).
8. Disconnect the DOC outlet temperature sensor harness. Inspect harness for bent, spread or corroded pins.
   8.a If pin damage is found, repair as necessary. Verify repairs.
   8.b If no pin damage is found, Go to step 9.

Temp - °C	Temp -°F	Range	
		Min Resistance ()	Max Resistance ()
0	32	197.67	207.62
2	35.6	199.20	209.15
4	39.2	200.73	210.67
6	42.8	202.27	212.20
8	46.4	203.80	213.72
10	50	205.33	215.24
12	53.6	206.85	216.77
14	57.2	208.38	218.29
16	60.8	209.91	219.81
18	64.44	211.43	221.33
20	68	212.96	222.85
22	71.6	214.48	224.37
24	75.2	216.01	225.88
26	78.8	217.53	227.40
28	82.4	219.05	228.91
30	86	220.57	230.43
32	89.6	222.09	231.94
34	93.2	223.61	233.45
36	96.8	225.12	234.96
38	100.4	226.64	236.47
40	104	228.16	237.98

9. Measure the resistance across the DOC Out temperature sensor at pigtail connector (refer to chart). Is the resistance within range?

   9.a Yes; Go to step 10.

   9.b No, replace the DOC outlet temperature sensor.

   For 1-BOX™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .

   For 2-BOX, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .

10. Disconnect the DPF outlet temperature sensor harness. Inspect harness for bent, spread or corroded pins.

    10.a If pin damage is found, repair as necessary. Verify repairs.

    10.b If no pin damage is found, Go to step 11.

11. Measure the resistance across the DPF outlet temperature sensor at pigtail connector (refer to chart). Is the resistance within range?

    11.a Yes, clear faults and release vehicle.

    11.b No, replace the DPF outlet temperature sensor.

    For 1-BOX™, Refer to section "Removal of the Diesel Particulate Filter Outlet Temperature Sensor" .

    For 2-BOX, Refer to section "Removal of the Diesel Particulate Filter Outlet Temperature Sensor" .

SPN 3250 (ACM) (GHG17)

228.1 SPN 3250/FMI 0 - GHG17

SPN 3250/FMI 0	
Description	This Code Sets When the Diesel Oxidation Catalyst (DOC) Outlet Temperature is Greater Than 760°C (1400°F) For More Than Two Seconds
Monitored Parameter	Diesel Oxidation Catalyst Temperature Sensor
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate
Verification	Parked Regeneration

Possible causes:

- Faulty DOC outlet temperature sensor
- Fluid intrusion into the exhaust
- Biased input for fuel mapping
- Incorrect or over-contributing fuel injectors
- Restricted air filter
- Incorrect cam timing

Check as follows:

1. Connect Diagnostic Link . Go to step 2.
2. Turn the ignition ON (key ON, engine OFF). Go to step 3.
3. Check for any fuel system fault codes. Are there fuel system fault codes present?
   - 3.a Yes; diagnose the fuel system codes first.
   - 3.b No; Go to step 4.
4. Check for multiple DOC outlet temperature sensor fault codes. Is code SPN 3250/FMI 8 present?
   - 4.a Yes; diagnose code SPN 3250/FMI 8 first. Verify repair.
   - 4.b No; Go to step 5.
5. Check for multiple high exhaust temperature fault codes. Are fault codes SPN 3246/FMI 0, SPN 4360/FMI 15 or SPN 4363/FMI 0 present?
   - 5.a Yes; Go to step 6.
   - 5.b No; Go to step 8.
6. Remove and inspect the turbocharger exhaust outlet pipe. Are there signs of fluid in the exhaust?
   - 6.a Yes; determine and repair the cause of fluid in the exhaust. Repair as necessary. Inspect the DOC and DPF.. Refer to section "Inspection of the Diesel Oxidation Catalyst" . Verify repair.
   - 6.b No; Go to step 7.
7. Remove and inspect the Exhaust Gas Recirculation (EGR) outlet pipe. Refer to section "Removal of the Exhaust Gas Recirculation Hot Pipe" . Is there fuel present in the EGR outlet pipe?
   - 7.a Yes; Refer to section "Test-E - Two-Filter Fuel System" . Verify repair.

7.b No; Go to step 8.

8. Check for any air management system fault codes. Are there any air management system fault codes present?

8.a Yes; diagnose the air management system fault codes first. Verify repair.

8.b No; Go to step 9.

9. Remove and inspect the air filter; refer to Original Equipment Manufacturer (OEM) literature for removal and inspection procedures. Is the air filter restricted?

9.a Yes; replace the air filter. Verify repair.

9.b No; Go to step 10.

Note : A cold soak may take up to 8 hours.

10. Allow the engine to cold soak so the temperature of the exhaust stabilizes with the ambient air temperature. Go to step 11.

11. Turn the ignition ON (key ON, engine OFF). Go to step 12.

12. Monitor the DOC outlet temperature sensor reading. Is the DOC outlet temperature sensor within 25°C (45°F) of the other exhaust temperature sensors?

12.a Yes; Go to step 13.

12.b No; replace the DOC outlet temperature sensor.

For 1-Box™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.

For Two-Box, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.

13. Compare the Barometric sensor reading to the Intake Manifold Pressure sensor reading. Are the readings within 8.27 kPa (1.2 psi) of each other?

13.a Yes; Go to step 14.

13.b No; replace the intake manifold pressure sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" . Verify repair.

14. Compare the Intake Manifold Temperature sensor reading to the Charge Air Cooler Temperature sensor reading. Are the readings within 5°C (9°F) of each other?

14.a Yes; Go to step 15.

14.b No; replace the Intake Manifold Temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" . Verify repair.

⚠WARNING

ENGINE EXHAUST

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

⚠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.

15. Start the engine. Go to step 16.

16. Perform the Idle Speed Balance (ISB) test. Refer to section "Checking Idle Speed Balance" . Do all of the injectors pass the Idle Speed Balance test?

16.a Yes; Go to step 17.

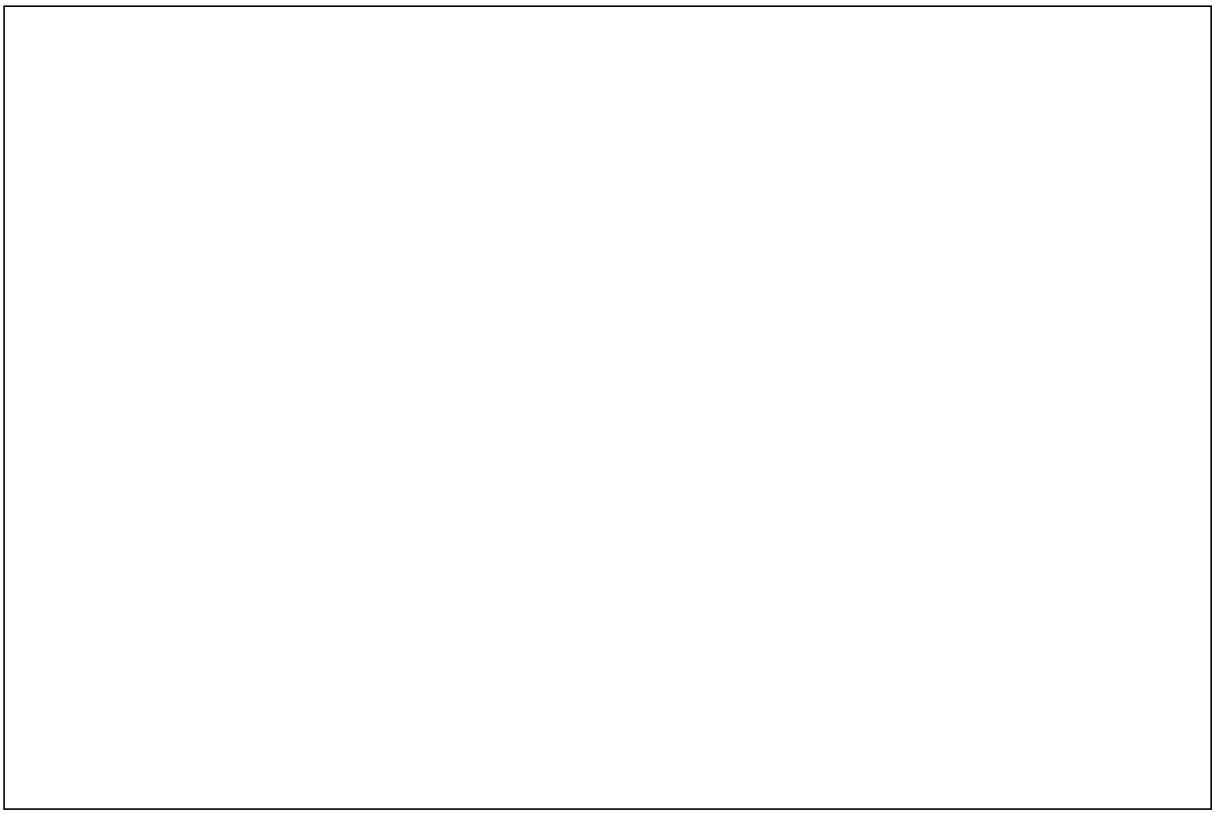
16.b No; replace the faulty injector. Verify repair.

17. Turn the engine OFF. Go to step 18.
18. Remove and inspect the EGR cooler outlet pipe. Is there fuel present in the EGR cooler outlet pipe?
    18.a Yes;

    For two filter fuel systems, Refer to section "Test-E - Two-Filter Fuel System" .Verify repair.

    18.b No; Go to step 19.
19. Perform an automatic Fuel System Integrity Check (FSIC) routine and monitor Actual Fuel Mass at 600 rpm. Does Actual Fuel Mass exceed 50 mg/st at 600 rpm?
    19.a Yes; stop FSIC routine and inspect for stuck engine brakes. Refer to section "Checking for Poor Engine Brake Performance" . Verify repair.
    19.b No; Go to step 20.
20. Verify the fuel injector(s) part number is correct for engine application.

    Refer to section "Removal of the Fuel Injector - Two-Filter System" . Is the fuel injector(s) part number correct for the application?



    20.a Yes; verify the camshaft timing. Refer to section "Camshaft Timing Verification" . Repair as necessary. Verify repair.
    20.b No; install the correct injectors. Refer to section "Test-E - Two-Filter Fuel System" . Verify repair.

228.2 SPN 3250/FMI 2 - GHG17

DOC Outlet Temperature Not Plausible

SPN 3250/FMI 2	
Description	This fault sets if the DOC outlet temperature is 70°C (126°F) higher compared to all other aftertreatment temperature sensors after 8 hours cold soak.
Monitored Parameter	Diesel Oxidation Catalyst (DOC) Outlet Temperature versus all other ATS temperature sensors
Typical Enabling Conditions	Engine off for more than 8 hours, Battery Voltage greater than 10.98 V, Ignition on longer than 60 seconds
Monitor Sequence	Key on; engine off for more than 60 seconds
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Ignition off/ 8 hours cold soak

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are fault codes SPN 3250/ FMI 3/4/8 also present?
   - 3.a Yes; diagnose the other fault codes first.
   - 3.b No; Go to step 4.
4. Disconnect and inspect the DOC outlet temperature sensor electrical connector, harness side.
5. Are there any spread pins, damaged pins, corrosion or signs of fretting present?
   - 5.a Yes; repair as necessary. Verify repair.
   - 5.b No; replace the DOC outlet temperature sensor.

     For 1-BOX™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.

     For 2-BOX, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.

228.3 SPN 3250/FMI 3 - GHG17

Diesel Oxidation Catalyst Outlet Temperature Sensor Circuit Failed High

1. Disconnect the Diesel Oxidation Catalyst (DOC) outlet temperature sensor connector.
2. Inspect the sensor harness for bent, spread, or corroded pins.
   2.a If the pins are bent, spread, or corroded, repair as necessary.
   2.b If connector shows no signs of damage, Go to step 3.
3. DOC outlet temperature test – measure the resistance between pin 1 and 2 of the DOC outlet temperature sensor connector and refer to chart for resistance values.

Resistance Values				
Temp C° (F°)	**Min. Resistance ()**	**Max. Resistance ()**	**Min. Voltage**	**Max. Voltage**
0 (32)	197.67	207.62	0.491	0.520
10 (50)	205.33	215.24	0.506	0.536
25 (77)	216.77	226.64	0.530	0.559
50 (122)	235.72	245.52	0.567	0.597
100 (212)	273.19	282.83	0.638	0.667
150 (302)	310.07	319.56	0.704	0.733
200 (392)	346.36	355.70	0.765	0.794
300 (572)	416.47	429.09	0.874	0.909
400 (752)	484.17	498.84	0.970	1.007

   3.a If the resistances are out of range, replace the DOC outlet temperature sensor.

   For 1-Box™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .

   For 2-Box, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .

   3.b If the resistances are in range, Go to step 4.
4. Turn the ignition ON (key ON, engine OFF).
5. Measure the voltage between pin 2 on the harness side of the DOC outlet temperature sensor connector and ground.
   5.a If the voltage is greater than 3 volts, repair the short to power between pin 2 on the harness side of the DOC outlet temperature sensor connector and pin 27 of the ACM 120-pin connector. Verify repairs.
   5.b If the voltage is between 2.75 and 3 volts, Go to step 6.
   5.c If the voltage is less than 2.75 volts, repair the wire between pin 2 on the harness side of the DOC outlet temperature sensor connector and pin 27 of the ACM 120-pin connector. Verify repairs.
6. Measure the voltage between pin 1 on the harness side of the DOC outlet temperature sensor and ground.
   6.a If voltage is present, repair the short to power between pin 1 on the harness side of the DOC outlet temperature sensor connector and pin 73 of the Aftertreatment Control Module (ACM) 120-pin connector. Verify repairs.
   6.b If no voltage is present, repair the open between pin 1 on the harness side of the DOC outlet temperature sensor connector and pin 73 of the ACM 120-pin connector. Verify repairs.

228.4 SPN 3250/FMI 4 - GHG17

Diesel Oxidation Catalyst Outlet Temperature Circuit Failed Low

1. Turn the ignition OFF (key OFF, engine OFF).
2. Disconnect the Diesel Oxidation Catalyst (DOC) outlet temperature sensor harness connector.
3. Inspect the sensor harness for bent, spread, or corroded pins.
   - 3.a If the pins are bent, spread, or corroded, repair as necessary.
   - 3.b If connector shows no signs of damage, Go to step 4.
4. Disconnect the Aftertreatment Control Module (ACM) 120-pin connector.
5. Measure the resistance between pin 2 on the harness side of the DOC outlet temperature sensor connector and ground.
   - 5.a If the resistance is less than 1K ohms, repair the wire between pin 2 of the DOC outlet temperature sensor connector and pin 27 of the ACM 120-pin connector.
   - 5.b If the resistance is greater than 1K ohms, replace the DOC outlet temperature sensor.

     For 1-Box™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .

     For 2-Box, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .

228.5 SPN 3250/FMI 7 – GHG17

Diesel Oxidation Catalyst Outlet Temperature Response Error

This fault code sets when the difference between the Diesel Oxidation Catalyst (DOC) outlet temperature and Ambient Air Temperature (in the ACM) is less than 35°C (95°F) after the engine has been running continuously for 40 minutes.

SPN 3250/FMI 7	
Description	DOC Outlet Temperature Response Error
Monitored Parameter	DOC Outlet Temperature, Ambient Air Temperature (ACM)
Typical Enabling Conditions	Engine Running for more than 40 minutes
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	5 seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Run the engine at idle for 40 minutes

Possible causes:

- Faulty DOC outlet temperature sensor
- No exhaust flow through the Aftertreatment System (ATS)

1. Connect DiagnosticLink . Go to step 2.
2. Turn the ignition ON (Key ON, Engine OFF). Go to step 3.
3. Check for other fault codes. Are fault codes SPN 3250/FMI 3/ 4/ or 20 present?
   - 3.a Yes; diagnose the other fault codes first. Verify repair.
   - 3.b No; Go to step 4.
4. Visually inspect the DOC outlet temperature sensor. Is the DOC outlet temperature installed correctly?
   - 4.a Yes; Go to step 5.
   - 4.b No; correctly install the DOC outlet temperature sensor.

     For 1-Box™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.

     For 2-Box, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.
5. Inspect the ATS. Is the ATS damaged or modified?
   - 5.a Yes; repair as necessary. Verify repair.
   - 5.b No; replace the DOC outlet temperature sensor.

     For 1-Box™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.

     For 2-Box, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.

228.6 SPN 3250/FMI 8 – GHG17

Diesel Oxidation Catalyst Outlet Temperature - Signal Spike

SPN 3250/FMI 8	
Description	This Fault Indicates the Aftertreatment Control Module (ACM) has Detected a Sudden Temperature Shift on the Diesel Oxidation Catalyst (DOC) Outlet Temperature Sensor
Monitored Parameter	DOC Outlet Temperature
Typical Enabling Conditions	DOC Outlet Temperature Greater Than 150°C (302°F)
Monitor Sequence	None
Execution Frequency	None
Typical Duration	10 Seconds
Dash Lamps	CEL, MIL
Engine Reaction	None
Verification	Low Temp ATD Check

Note : The most likely cause is an intermittent wiring concern (poor terminal fit, corrosion, chaffing etc.).

1. Connect DiagnosticLink®.
2. Turn the ignition ON (key ON, engine OFF).
3. Check for other fault codes. Are SPN 3250/FMI 3 or 4 present?
   - 3.a Yes; repair the other fault codes first.
   - 3.b No; Go to step 4.
4. Turn the ignition OFF.
5. Remove the DOC outlet temperature sensor.

   For 1-Box™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.

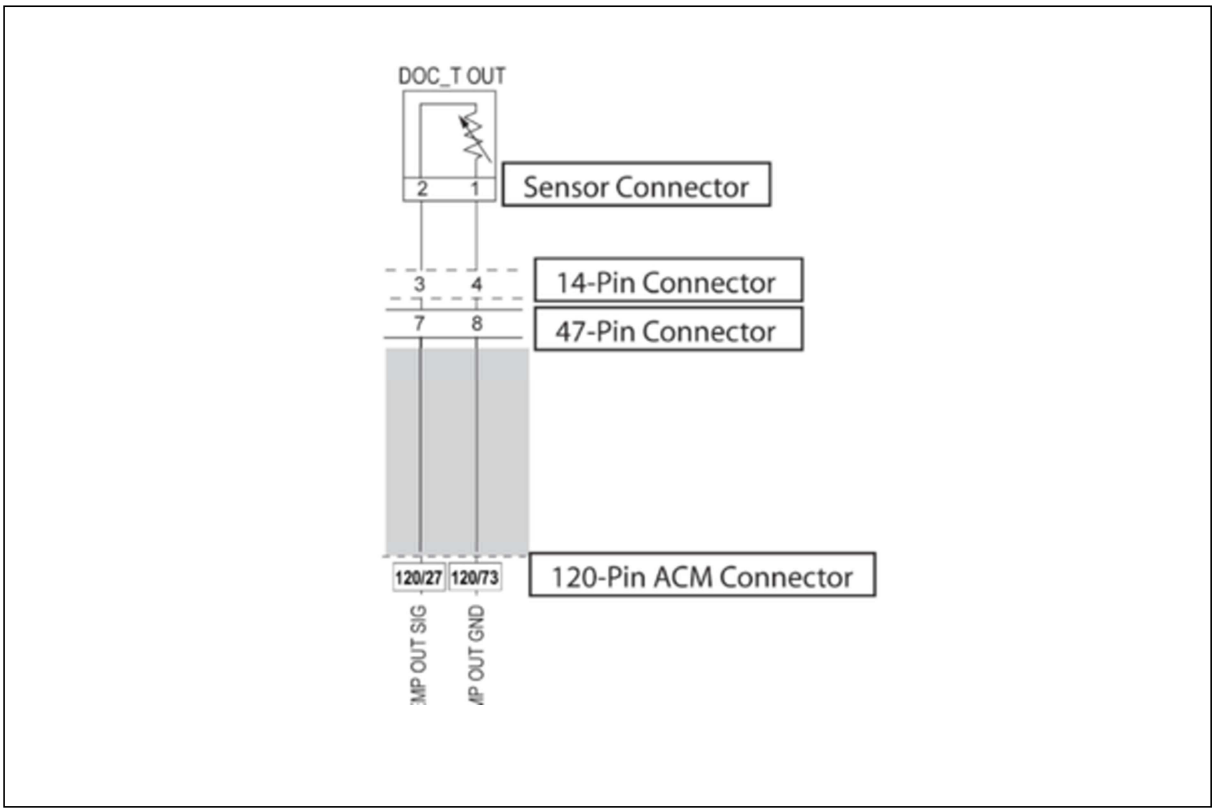
   For 2-Box, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.
6. Allow the DOC outlet temperature sensor to cold soak for several minutes until the sensor has reached ambient temperature.
7. Measure the resistance between pins 1 and 2 of the DOC outlet temperature sensor connector. Does the DOC outlet temperature sensor match the resistance specification in the chart below?
   - 7.a Yes; Go to step 8. .
   - 7.b No; replace the DOC outlet temperature sensor.

     For 1-Box™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.

     For 2-Box, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.

Temp °C (°F)	Min Resistance ()	Max Resistance ()	Min Voltage	Max Voltage
0 (32)	197.67	207.62	0.491	0.520
10 (50)	205.33	215.24	0.506	0.536
25 (77)	216.77	226.64	0.530	0.559
50 (122)	235.72	245.52	0.567	0.597
100 (212)	273.19	282.83	0.638	0.667
150 (302)	310.07	319.56	0.704	0.733
200 (392)	346.36	355.70	0.765	0.794
300 (572)	416.47	429.09	0.874	0.909
400 (752)	484.17	498.84	0.970	1.007

8. Using appropriate test probes from J-48476 connector test kit and terminal repair kit J-47410, drag test and inspect all harness connector terminals between the DOC outlet temperature sensor and the ACM including the chassis extension harness and Aftertreatment Device (ATD) sensor box. Repair as necessary.


DOC_T OUT
2
1
Sensor Connector
3
4
14-Pin Connector
7
8
47-Pin Connector
120/27
120/73
120-Pin ACM Connector
MP OUT SIG
P OUT GND

228.7 SPN 3250/FMI 15 - GHG17

Diesel Oxidation Catalyst Outlet Temperature High

SPN 3250/FMI 15	
Description	Exhaust Temperature High
Monitored Parameter	Exhaust Temperature
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Parked Regeneration

1. Shut off the engine, apply the parking brake, chock the wheels, and perform any other applicable safety steps.
2. Connect DiagnosticLink®.
3. Turn the ignition ON (key ON, engine OFF).
4. Check for multiple fault codes. Are SPN 3250 / FMI 2, 3, 4, 7, or 8 also present?

   4.a Yes; troubleshoot those first.

   4.b No; Go to step 5.

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

5. Monitor the Diesel Oxidation Catalyst (DOC) outlet temperature. Is the temperature greater than 760°C (1400°F)?

   5.a Yes; Go to step 8.

   5.b No; Go to step 6.
6. With DiagnosticLink connected, run the engine at 1200 rpm for 10 minutes.
7. Monitor the DOC inlet temperature and the DOC outlet temperature. Are the temperatures within 25°C (45°F) of each other?

   7.a Yes; Go to step 10.

   7.b No; Go to step 8.
8. Turn the ignition OFF.
9. Disconnect the DOC outlet temperature sensor and inspect the connector for damaged, bent, spread, or corroded pins. If the temperature sensor connector is OK, check the connections upstream of the Aftertreatment Control Module (ACM): pin 3 of the Aftertreatment Device (ATD) harness 14–pin connector , pin 7 of the VIH 47-pin connector , and pin 27 of the ACM 120-pin connector. Is damage present?

   9.a Yes; repair as necessary.

   9.b No; replace the DOC outlet temperature sensor.

   For 1-Box™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .

   For Two-Box, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .
10. Perform an Idle Speed Balance test using DiagnosticLink. Retain the log file. Refer to section "Checking Idle Speed Balance" .

11. Was a faulty fuel injector/cylinder identified?

    11.a Yes; repair the faulty fuel injector/cylinder, and repeat the Idle Speed Balance (ISB) test to verify the repair. Go to step 22.

    11.b No; Go to step 12.

12. Remove and inspect the EGR cooler outlet pipe. Is there fuel present in the EGR cooler outlet pipe?

    12.a Yes; Refer to section "Test-E - Two-Filter Fuel System" . Verify repair.

    12.b No; Go to step 13.

13. Perform an automatic Fuel System Integrity Check (FSIC) routine and monitor Actual Fuel Mass at 600 rpm. Does Actual Fuel Mass exceed 50 mg/st at 600 rpm?

    13.a Yes, stop FSIC routine and inspect for stuck engine brakes. Refer to section "Checking for Poor Engine Brake Performance" . Verify repair.

    13.b No, Go to step 14.

14. Remove the ATD.

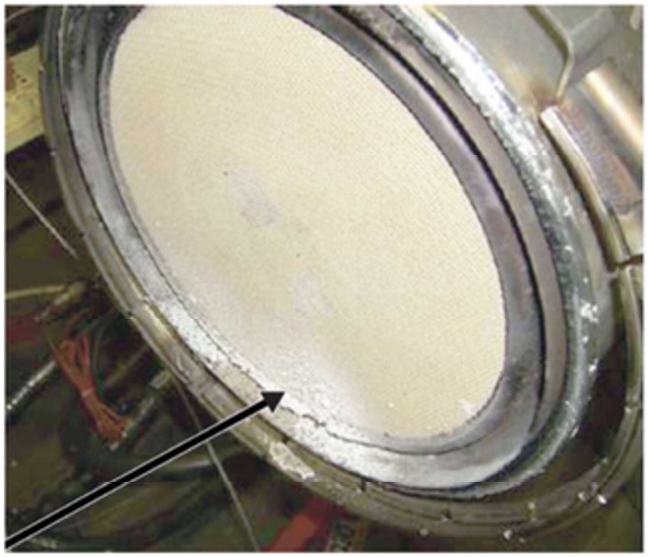
    Refer to section "Removal of the 1-BOX™ from the Vehicle" .

    Refer to section "Removal of the 2-Box (2V2) from the Vehicle" .

15. Disassemble the ATD and inspect the inlet face of the Diesel Particulate Filter (DPF) substrate for contamination. **Note:** an inlet flange washed clean indicates fuel contamination. Is contamination present?

    15.a Yes; Go to step 16.

    15.b No; Go to step 28.



16. Is coolant contamination found (white residue on inlet face of the DPF and a sweet smell from exhaust)?

    16.a Yes; Go to step 19.

    16.b No; Go to step 17.

17. Is oil contamination found (oil residue or paste on DPF Inlet face or an oil lacquer on the inlet flange)?

    17.a Yes; Go to step 22.

    17.b No; Go to step 18.

18. Inspect the ATD components for fuel contamination. If fuel contamination is found (inlet flange washed clean), repair the cause of fuel contamination and Go to step 26.

19. Question the operator about coolant usage.
20. Visually inspect the coolant reservoir for low level.
21. Repair the cause of coolant entry as necessary and Go to step 26.
22. Question the operator about excessive oil consumption.
23. Repair the cause of oil contamination and Go to step 26.
24. Inspect the ATD components for fuel contamination.
25. Repair the cause of fuel contamination and Go to step 26.

> **⚠ 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.

26. Install the ATD.

    Refer to section "Installation of the 1-BOX™ to the Vehicle" .

    Refer to section "Installation of the 2-Box (2V2) to the Vehicle" .

> **⚠ 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.

Note : The parked regeneration is successful if the DOC outlet temperature is within 100°C (212°F) of the DOC Model Delay.

27. Perform a parked regeneration, reset ash accumulators, and e-mail a log file of the successful regeneration to Detroit™ Customer Support Center. Verify repairs.

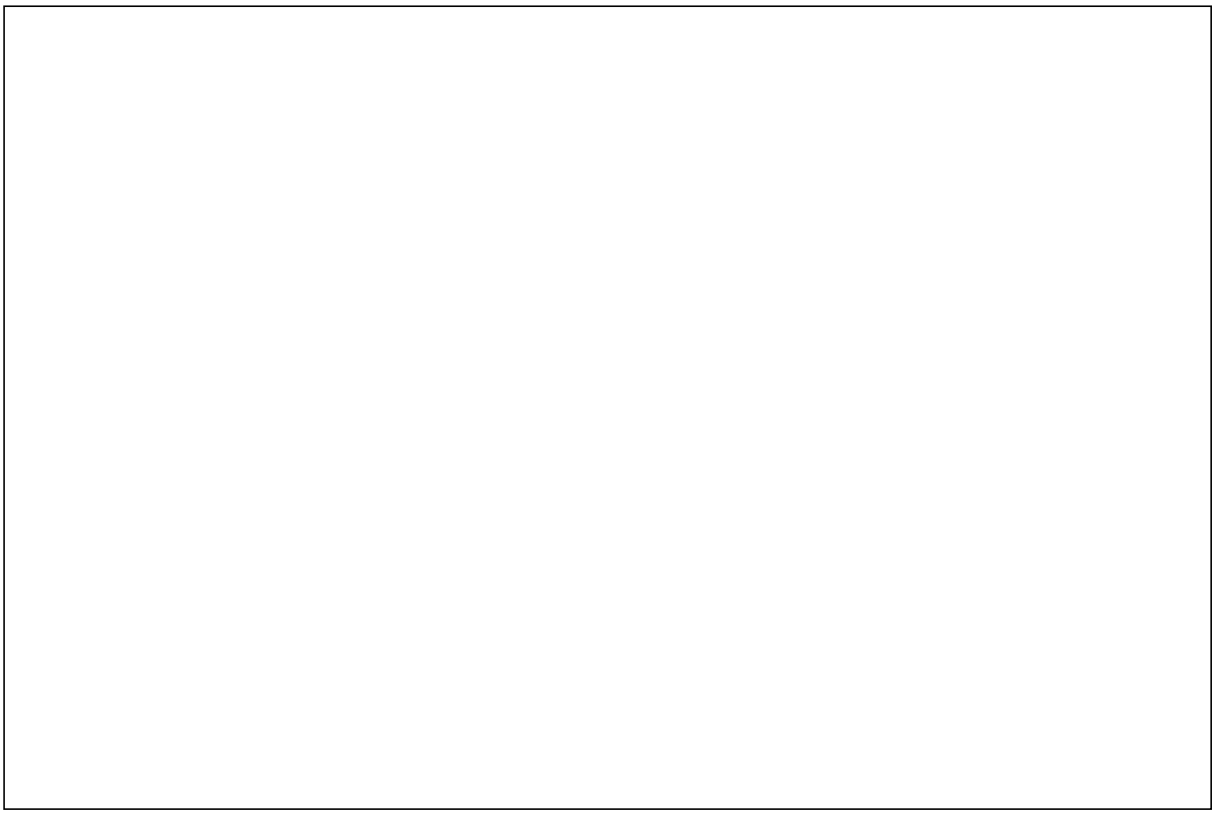
    Refer to section "Performing a Parked Regeneration - GHG17" .

    Refer to section "Resetting the Diesel Particulate Filter Ash Accumulators" . Was regeneration successful?

    27.a Yes; release vehicle.

    27.b No; Go to step 28.

28. Verify the fuel injector(s) part number is correct for engine application. Refer to section "Removal of the Fuel Injector - Two-Filter System" . Is the fuel injector(s) part number correct for the application?



28.a Yes; verify the camshaft timing. Refer to section "Camshaft Timing Verification" . Repair as necessary. Verify repair.

28.b No; install the correct injectors. Refer to section "Test-E - Two-Filter Fuel System" . Verify repair.

228.8 SPN 3250/FMI 20 - GHG17

Diesel Oxidation Catalyst Temperature Drift - Inlet Low or Outlet High

SPN 3250/FMI 20	
Description	70°C (158°F) Difference During Non-regeneration Mode
Monitored Parameter	Diesel Oxidation Catalyst (DOC) Inlet Temperature vs. DOC Outlet Temperature
Typical Enabling Conditions	Coolant Temperature Greater than 60°C (140°F), Regen not active in last five minutes
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	One Minute
Dash Lamps	CEL, MIL
Engine Reaction	Regen Inhibit and 10% Engine Derate

Check as follows:

1. Check for multiple fault codes.

   1.a If SPN 3242/FMI 3/4/8 or SPN3250/FMI 3/4/8 is also present, repair those faults first.

   Refer to section "SPN 3242/FMI 3 - GHG17" .

   Refer to section "SPN 3242/FMI 4 - GHG17" .

   Refer to section "SPN 3242/FMI 8 - GHG17" .

   Refer to section "SPN 3250/FMI 3 - GHG17" .

   Refer to section "SPN 3250/FMI 4 - GHG17" .

   Refer to section "SPN 3250/FMI 8 – GHG17" .

   1.b If the above faults are not present, Go to step 2.

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

> **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.

2. Start the engine.
3. Run service routine "Perform Performance Check - Low Temp ATD" found under the Diesel Particulate Filter (DPF) System tab. Let the test run completely to stabilize the aftertreatment temperatures.
4. Compare DOC inlet temperature and DOC outlet temperature to DPF outlet temperature.
5. Replace the DOC temperature sensor that is drifted more than 25°C (45°F) compared to the DPF outlet temperature sensor.

228.9 SPN 3250/FMI 31 - GHG17

SPN 3250/FMI 31	
Description	Abnormal Diesel Oxidation Catalyst (DOC) Temperature Rise
Monitored Parameter	DOC Temperature
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate
Verification	Parked Regen

Note : This fault indicates the Aftertreatment Control Module (ACM) has detected a sudden temperature shift on the Diesel Particulate Filter (DPF) outlet temperature sensor. The most likely cause is an intermittent wiring concern (poor terminal fit, corrosion, chaffing, etc.).

WARNING

PERSONAL INJURY

To avoid injury from hot surfaces, wear protective gloves, or allow engine to cool before removing any component.

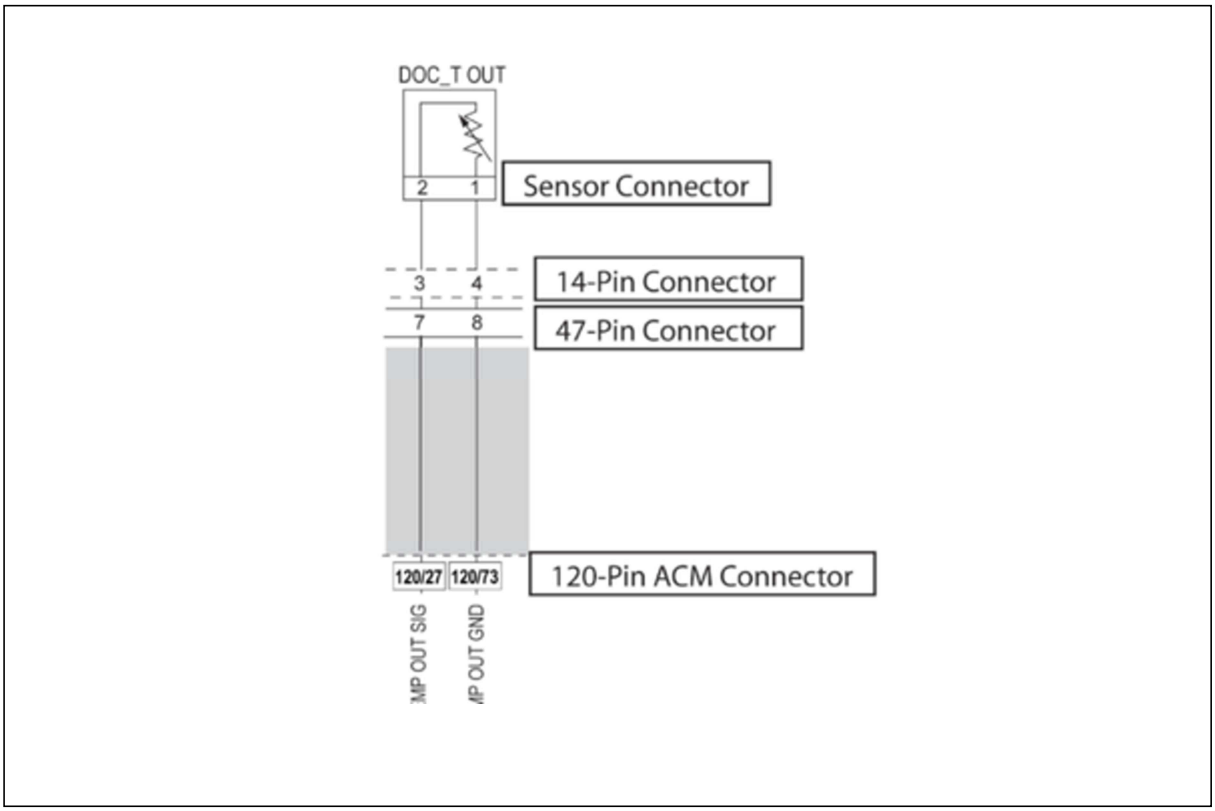
1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are other faults codes active?
   - 3.a Yes; troubleshoot those first.
   - 3.b No; Go to step 6.
4. Remove the DOC outlet temperature sensor.

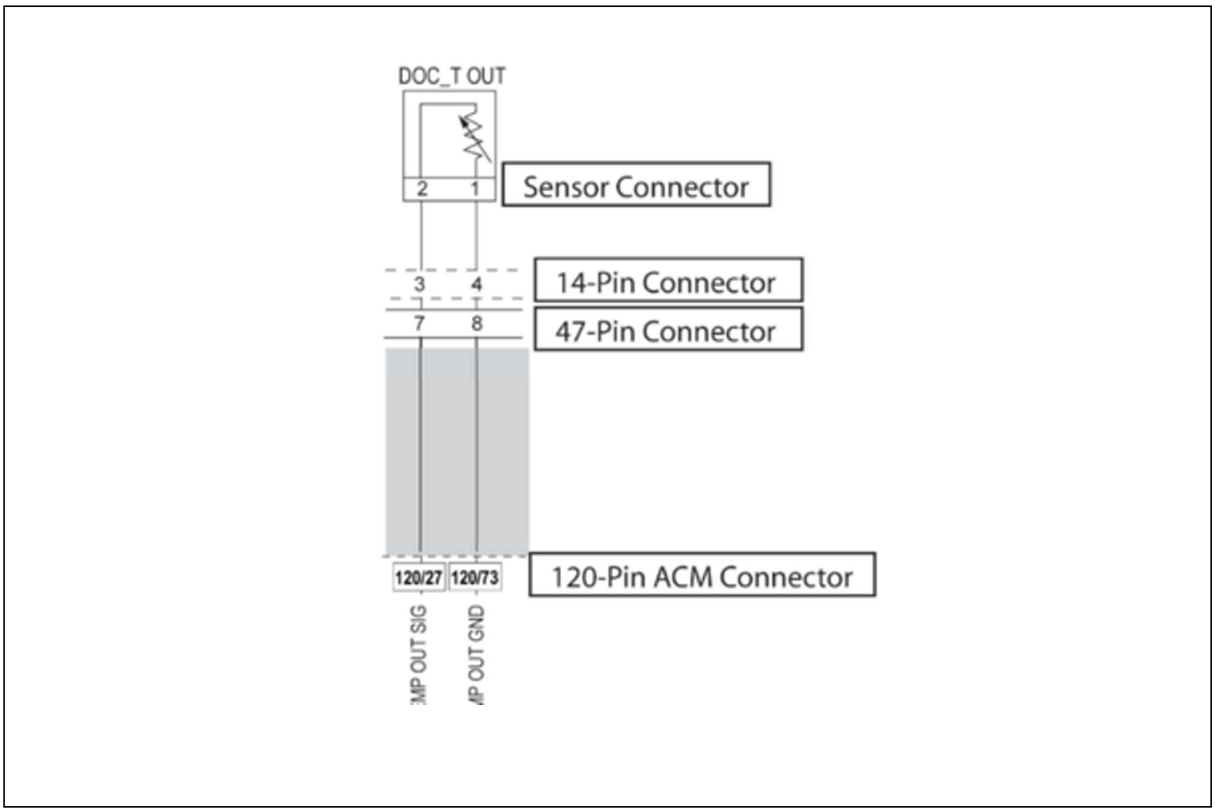
   For 1-BOX™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .

   For 2-Box, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .
5. Allow the DOC outlet temperature sensor to cold soak for several minutes until the sensor has reached ambient temperature.
6. Perform a DOC Outlet Temperature Sensor Test. Measure the resistance between pins 1 and 2 of the DOC outlet temperature sensor connector. Does the DOC outlet temperature sensor match the resistance specification in the chart below?

Temp ºC (ºF)	Min Resistance ()	Max Resistance ()	Min Voltage	Max Voltage
0 (32)	197.67	207.62	0.491	0.520
10 (50)	205.33	215.24	0.506	0.536
25 (77)	216.77	226.64	0.530	0.559
50 (122)	235.72	245.52	0.567	0.597
100 (212)	273.19	282.83	0.638	0.667
150 (302)	310.07	319.56	0.704	0.733
200 (392)	346.36	355.70	0.765	0.794
300 (572)	416.47	429.09	0.874	0.909
400 (752)	484.17	489.84	0.970	1.007

7. Using appropriate test probes from J-48476 connector test kit and J-47410 terminal repair kit , drag test and inspect all harness connector terminals between the DOC outlet temperature sensor and the ACM, including the chassis extension harness and Aftertreatment Device (ATD) sensor box. Repair as necessary to ensure a snug fit between the test probes and the female terminals.




DOC_T OUT
2
1
Sensor Connector
3
4
14-Pin Connector
7
8
47-Pin Connector
120/27
120/73
120-Pin ACM Connector
MP OUT SIG
P OUT GND

228.1 SPN 3250/FMI 0 - GHG17

SPN 3250/FMI 0	
Description	This Code Sets When the Diesel Oxidation Catalyst (DOC) Outlet Temperature is Greater Than 760°C (1400°F) For More Than Two Seconds
Monitored Parameter	Diesel Oxidation Catalyst Temperature Sensor
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate
Verification	Parked Regeneration

Possible causes:

- Faulty DOC outlet temperature sensor
- Fluid intrusion into the exhaust
- Biased input for fuel mapping
- Incorrect or over-contributing fuel injectors
- Restricted air filter
- Incorrect cam timing

Check as follows:

1. Connect Diagnostic Link . Go to step 2.
2. Turn the ignition ON (key ON, engine OFF). Go to step 3.
3. Check for any fuel system fault codes. Are there fuel system fault codes present?
   - 3.a Yes; diagnose the fuel system codes first.
   - 3.b No; Go to step 4.
4. Check for multiple DOC outlet temperature sensor fault codes. Is code SPN 3250/FMI 8 present?
   - 4.a Yes; diagnose code SPN 3250/FMI 8 first. Verify repair.
   - 4.b No; Go to step 5.
5. Check for multiple high exhaust temperature fault codes. Are fault codes SPN 3246/FMI 0, SPN 4360/FMI 15 or SPN 4363/FMI 0 present?
   - 5.a Yes; Go to step 6.
   - 5.b No; Go to step 8.
6. Remove and inspect the turbocharger exhaust outlet pipe. Are there signs of fluid in the exhaust?
   - 6.a Yes; determine and repair the cause of fluid in the exhaust. Repair as necessary. Inspect the DOC and DPF.. Refer to section "Inspection of the Diesel Oxidation Catalyst" . Verify repair.
   - 6.b No; Go to step 7.
7. Remove and inspect the Exhaust Gas Recirculation (EGR) outlet pipe. Refer to section "Removal of the Exhaust Gas Recirculation Hot Pipe" . Is there fuel present in the EGR outlet pipe?
   - 7.a Yes; Refer to section "Test-E - Two-Filter Fuel System" . Verify repair.
   - 7.b No; Go to step 8.
8. Check for any air management system fault codes. Are there any air management system fault codes present?

8.a Yes; diagnose the air management system fault codes first. Verify repair.

8.b No; Go to step 9.

9. Remove and inspect the air filter; refer to Original Equipment Manufacturer (OEM) literature for removal and inspection procedures. Is the air filter restricted?

9.a Yes; replace the air filter. Verify repair.

9.b No; Go to step 10.

Note : A cold soak may take up to 8 hours.

10. Allow the engine to cold soak so the temperature of the exhaust stabilizes with the ambient air temperature. Go to step 11.

11. Turn the ignition ON (key ON, engine OFF). Go to step 12.

12. Monitor the DOC outlet temperature sensor reading. Is the DOC outlet temperature sensor within 25°C (45°F) of the other exhaust temperature sensors?

12.a Yes; Go to step 13.

12.b No; replace the DOC outlet temperature sensor.

For 1-Box™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.

For Two-Box, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.

13. Compare the Barometric sensor reading to the Intake Manifold Pressure sensor reading. Are the readings within 8.27 kPa (1.2 psi) of each other?

13.a Yes; Go to step 14.

13.b No; replace the intake manifold pressure sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" . Verify repair.

14. Compare the Intake Manifold Temperature sensor reading to the Charge Air Cooler Temperature sensor reading. Are the readings within 5°C (9°F) of each other?

14.a Yes; Go to step 15.

14.b No; replace the Intake Manifold Temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" . Verify repair.

⚠WARNING

ENGINE EXHAUST

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

⚠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.

15. Start the engine. Go to step 16.

16. Perform the Idle Speed Balance (ISB) test. Refer to section "Checking Idle Speed Balance" . Do all of the injectors pass the Idle Speed Balance test?

16.a Yes; Go to step 17.

16.b No; replace the faulty injector. Verify repair.

17. Turn the engine OFF. Go to step 18.

18. Remove and inspect the EGR cooler outlet pipe. Is there fuel present in the EGR cooler outlet pipe?

18.a Yes;

For two filter fuel systems, Refer to section "Test-E - Two-Filter Fuel System" .Verify repair.

18.b No; Go to step 19.

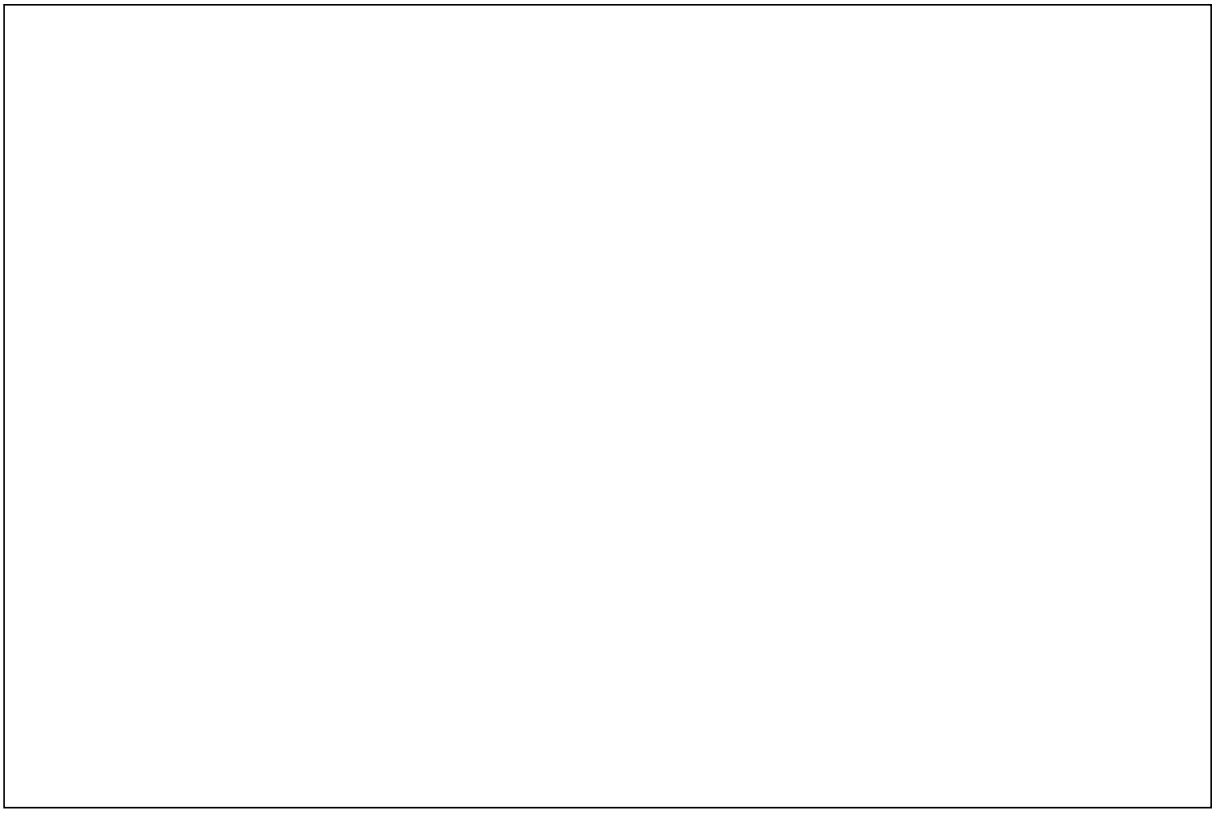
19. Perform an automatic Fuel System Integrity Check (FSIC) routine and monitor Actual Fuel Mass at 600 rpm. Does Actual Fuel Mass exceed 50 mg/st at 600 rpm?

19.a Yes; stop FSIC routine and inspect for stuck engine brakes. Refer to section "Checking for Poor Engine Brake Performance" . Verify repair.

19.b No; Go to step 20.

20. Verify the fuel injector(s) part number is correct for engine application.

Refer to section "Removal of the Fuel Injector - Two-Filter System" . Is the fuel injector(s) part number correct for the application?



20.a Yes; verify the camshaft timing. Refer to section "Camshaft Timing Verification" . Repair as necessary. Verify repair.

20.b No; install the correct injectors. Refer to section "Test-E - Two-Filter Fuel System" . Verify repair.

228.2 SPN 3250/FMI 2 - GHG17

DOC Outlet Temperature Not Plausible

SPN 3250/FMI 2	
Description	This fault sets if the DOC outlet temperature is 70°C (126°F) higher compared to all other aftertreatment temperature sensors after 8 hours cold soak.
Monitored Parameter	Diesel Oxidation Catalyst (DOC) Outlet Temperature versus all other ATS temperature sensors
Typical Enabling Conditions	Engine off for more than 8 hours, Battery Voltage greater than 10.98 V, Ignition on longer than 60 seconds
Monitor Sequence	Key on; engine off for more than 60 seconds
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Ignition off/ 8 hours cold soak

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are fault codes SPN 3250/ FMI 3/4/8 also present?
   - 3.a Yes; diagnose the other fault codes first.
   - 3.b No; Go to step 4.
4. Disconnect and inspect the DOC outlet temperature sensor electrical connector, harness side.
5. Are there any spread pins, damaged pins, corrosion or signs of fretting present?
   - 5.a Yes; repair as necessary. Verify repair.
   - 5.b No; replace the DOC outlet temperature sensor.

     For 1-BOX™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.

     For 2-BOX, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.

228.3 SPN 3250/FMI 3 - GHG17

Diesel Oxidation Catalyst Outlet Temperature Sensor Circuit Failed High

1. Disconnect the Diesel Oxidation Catalyst (DOC) outlet temperature sensor connector.
2. Inspect the sensor harness for bent, spread, or corroded pins.
   2.a If the pins are bent, spread, or corroded, repair as necessary.
   2.b If connector shows no signs of damage, Go to step 3.
3. DOC outlet temperature test – measure the resistance between pin 1 and 2 of the DOC outlet temperature sensor connector and refer to chart for resistance values.

Resistance Values				
Temp C° (F°)	**Min. Resistance ()**	**Max. Resistance ()**	**Min. Voltage**	**Max. Voltage**
0 (32)	197.67	207.62	0.491	0.520
10 (50)	205.33	215.24	0.506	0.536
25 (77)	216.77	226.64	0.530	0.559
50 (122)	235.72	245.52	0.567	0.597
100 (212)	273.19	282.83	0.638	0.667
150 (302)	310.07	319.56	0.704	0.733
200 (392)	346.36	355.70	0.765	0.794
300 (572)	416.47	429.09	0.874	0.909
400 (752)	484.17	498.84	0.970	1.007

   3.a If the resistances are out of range, replace the DOC outlet temperature sensor.

   For 1-Box™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .

   For 2-Box, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .

   3.b If the resistances are in range, Go to step 4.
4. Turn the ignition ON (key ON, engine OFF).
5. Measure the voltage between pin 2 on the harness side of the DOC outlet temperature sensor connector and ground.
   5.a If the voltage is greater than 3 volts, repair the short to power between pin 2 on the harness side of the DOC outlet temperature sensor connector and pin 27 of the ACM 120-pin connector. Verify repairs.
   5.b If the voltage is between 2.75 and 3 volts, Go to step 6.
   5.c If the voltage is less than 2.75 volts, repair the wire between pin 2 on the harness side of the DOC outlet temperature sensor connector and pin 27 of the ACM 120-pin connector. Verify repairs.
6. Measure the voltage between pin 1 on the harness side of the DOC outlet temperature sensor and ground.
   6.a If voltage is present, repair the short to power between pin 1 on the harness side of the DOC outlet temperature sensor connector and pin 73 of the Aftertreatment Control Module (ACM) 120-pin connector. Verify repairs.
   6.b If no voltage is present, repair the open between pin 1 on the harness side of the DOC outlet temperature sensor connector and pin 73 of the ACM 120-pin connector. Verify repairs.

228.4 SPN 3250/FMI 4 - GHG17

Diesel Oxidation Catalyst Outlet Temperature Circuit Failed Low

1. Turn the ignition OFF (key OFF, engine OFF).
2. Disconnect the Diesel Oxidation Catalyst (DOC) outlet temperature sensor harness connector.
3. Inspect the sensor harness for bent, spread, or corroded pins.
   3.a If the pins are bent, spread, or corroded, repair as necessary.
   3.b If connector shows no signs of damage, Go to step 4.
4. Disconnect the Aftertreatment Control Module (ACM) 120-pin connector.
5. Measure the resistance between pin 2 on the harness side of the DOC outlet temperature sensor connector and ground.
   5.a If the resistance is less than 1K ohms, repair the wire between pin 2 of the DOC outlet temperature sensor connector and pin 27 of the ACM 120-pin connector.
   5.b If the resistance is greater than 1K ohms, replace the DOC outlet temperature sensor.

   For 1-Box™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .

   For 2-Box, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .

228.5 SPN 3250/FMI 7 – GHG17

Diesel Oxidation Catalyst Outlet Temperature Response Error

This fault code sets when the difference between the Diesel Oxidation Catalyst (DOC) outlet temperature and Ambient Air Temperature (in the ACM) is less than 35°C (95°F) after the engine has been running continuously for 40 minutes.

SPN 3250/FMI 7	
Description	DOC Outlet Temperature Response Error
Monitored Parameter	DOC Outlet Temperature, Ambient Air Temperature (ACM)
Typical Enabling Conditions	Engine Running for more than 40 minutes
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	5 seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Run the engine at idle for 40 minutes

Possible causes:

- Faulty DOC outlet temperature sensor
- No exhaust flow through the Aftertreatment System (ATS)

1. Connect DiagnosticLink . Go to step 2.
2. Turn the ignition ON (Key ON, Engine OFF). Go to step 3.
3. Check for other fault codes. Are fault codes SPN 3250/FMI 3/ 4/ or 20 present?
   - 3.a Yes; diagnose the other fault codes first. Verify repair.
   - 3.b No; Go to step 4.
4. Visually inspect the DOC outlet temperature sensor. Is the DOC outlet temperature installed correctly?
   - 4.a Yes; Go to step 5.
   - 4.b No; correctly install the DOC outlet temperature sensor.
     For 1-Box™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.
     For 2-Box, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.
5. Inspect the ATS. Is the ATS damaged or modified?
   - 5.a Yes; repair as necessary. Verify repair.
   - 5.b No; replace the DOC outlet temperature sensor.
     For 1-Box™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.
     For 2-Box, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.

228.6 SPN 3250/FMI 8 – GHG17

Diesel Oxidation Catalyst Outlet Temperature - Signal Spike

SPN 3250/FMI 8	
Description	This Fault Indicates the Aftertreatment Control Module (ACM) has Detected a Sudden Temperature Shift on the Diesel Oxidation Catalyst (DOC) Outlet Temperature Sensor
Monitored Parameter	DOC Outlet Temperature
Typical Enabling Conditions	DOC Outlet Temperature Greater Than 150°C (302°F)
Monitor Sequence	None
Execution Frequency	None
Typical Duration	10 Seconds
Dash Lamps	CEL, MIL
Engine Reaction	None
Verification	Low Temp ATD Check

Note : The most likely cause is an intermittent wiring concern (poor terminal fit, corrosion, chaffing etc.).

1. Connect DiagnosticLink®.
2. Turn the ignition ON (key ON, engine OFF).
3. Check for other fault codes. Are SPN 3250/FMI 3 or 4 present?
   - 3.a Yes; repair the other fault codes first.
   - 3.b No; Go to step 4.
4. Turn the ignition OFF.
5. Remove the DOC outlet temperature sensor.

   For 1-Box™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.

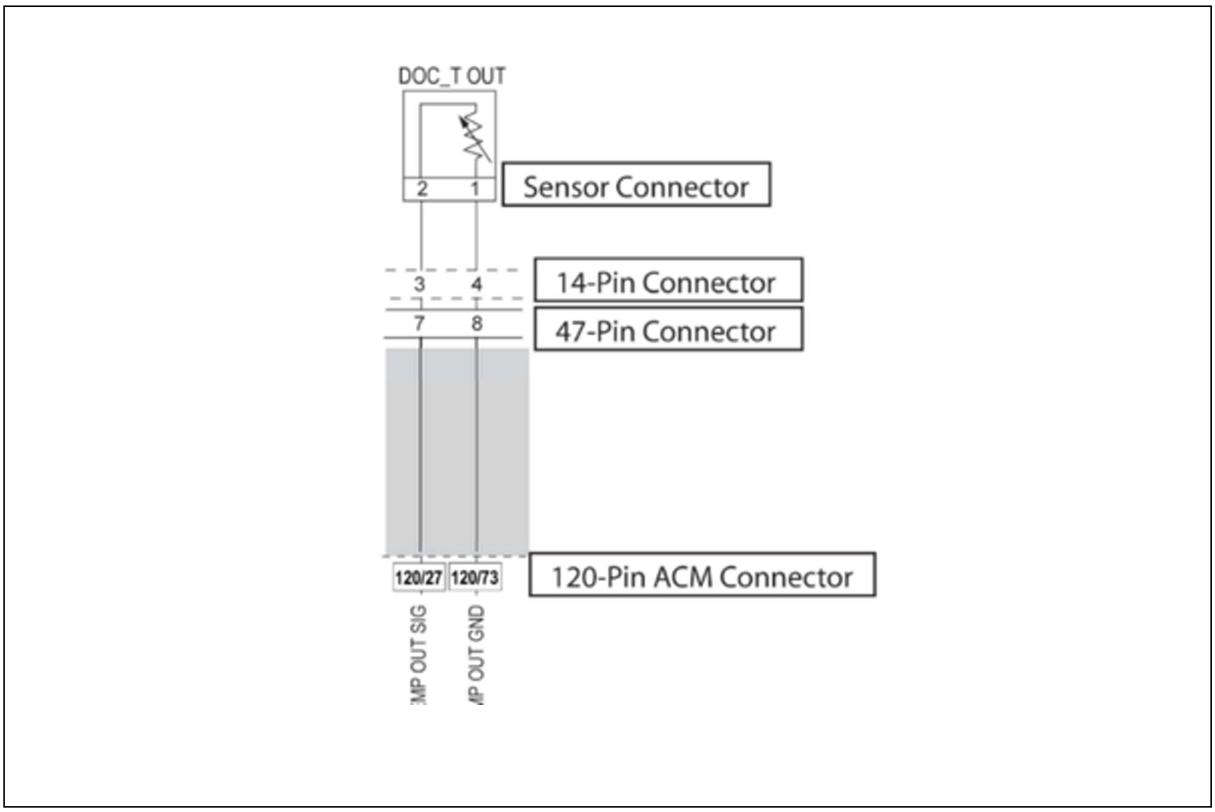
   For 2-Box, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.
6. Allow the DOC outlet temperature sensor to cold soak for several minutes until the sensor has reached ambient temperature.
7. Measure the resistance between pins 1 and 2 of the DOC outlet temperature sensor connector. Does the DOC outlet temperature sensor match the resistance specification in the chart below?
   - 7.a Yes; Go to step 8. .
   - 7.b No; replace the DOC outlet temperature sensor.

     For 1-Box™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.

     For 2-Box, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Verify repair.

Temp °C (°F)	Min Resistance ()	Max Resistance ()	Min Voltage	Max Voltage
0 (32)	197.67	207.62	0.491	0.520
10 (50)	205.33	215.24	0.506	0.536
25 (77)	216.77	226.64	0.530	0.559
50 (122)	235.72	245.52	0.567	0.597
100 (212)	273.19	282.83	0.638	0.667
150 (302)	310.07	319.56	0.704	0.733
200 (392)	346.36	355.70	0.765	0.794
300 (572)	416.47	429.09	0.874	0.909
400 (752)	484.17	498.84	0.970	1.007

8. Using appropriate test probes from J-48476 connector test kit and terminal repair kit J-47410, drag test and inspect all harness connector terminals between the DOC outlet temperature sensor and the ACM including the chassis extension harness and Aftertreatment Device (ATD) sensor box. Repair as necessary.


DOC_T OUT
2
1
Sensor Connector
3
4
14-Pin Connector
7
8
47-Pin Connector
120/27
120/73
120-Pin ACM Connector
MP OUT SIG
P OUT GND

228.7 SPN 3250/FMI 15 - GHG17

Diesel Oxidation Catalyst Outlet Temperature High

SPN 3250/FMI 15	
Description	Exhaust Temperature High
Monitored Parameter	Exhaust Temperature
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Parked Regeneration

1. Shut off the engine, apply the parking brake, chock the wheels, and perform any other applicable safety steps.
2. Connect DiagnosticLink®.
3. Turn the ignition ON (key ON, engine OFF).
4. Check for multiple fault codes. Are SPN 3250 / FMI 2, 3, 4, 7, or 8 also present?

   4.a Yes; troubleshoot those first.

   4.b No; Go to step 5.

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

5. Monitor the Diesel Oxidation Catalyst (DOC) outlet temperature. Is the temperature greater than 760°C (1400°F)?

   5.a Yes; Go to step 8.

   5.b No; Go to step 6.
6. With DiagnosticLink connected, run the engine at 1200 rpm for 10 minutes.
7. Monitor the DOC inlet temperature and the DOC outlet temperature. Are the temperatures within 25°C (45°F) of each other?

   7.a Yes; Go to step 10.

   7.b No; Go to step 8.
8. Turn the ignition OFF.
9. Disconnect the DOC outlet temperature sensor and inspect the connector for damaged, bent, spread, or corroded pins. If the temperature sensor connector is OK, check the connections upstream of the Aftertreatment Control Module (ACM): pin 3 of the Aftertreatment Device (ATD) harness 14–pin connector , pin 7 of the VIH 47-pin connector , and pin 27 of the ACM 120-pin connector. Is damage present?

   9.a Yes; repair as necessary.

   9.b No; replace the DOC outlet temperature sensor.

   For 1-Box™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .

   For Two-Box, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .
10. Perform an Idle Speed Balance test using DiagnosticLink. Retain the log file. Refer to section "Checking Idle Speed Balance" .

11. Was a faulty fuel injector/cylinder identified?

    11.a Yes; repair the faulty fuel injector/cylinder, and repeat the Idle Speed Balance (ISB) test to verify the repair. Go to step 22.

    11.b No; Go to step 12.

12. Remove and inspect the EGR cooler outlet pipe. Is there fuel present in the EGR cooler outlet pipe?

    12.a Yes; Refer to section "Test-E - Two-Filter Fuel System" . Verify repair.

    12.b No; Go to step 13.

13. Perform an automatic Fuel System Integrity Check (FSIC) routine and monitor Actual Fuel Mass at 600 rpm. Does Actual Fuel Mass exceed 50 mg/st at 600 rpm?

    13.a Yes, stop FSIC routine and inspect for stuck engine brakes. Refer to section "Checking for Poor Engine Brake Performance" . Verify repair.

    13.b No, Go to step 14.

14. Remove the ATD.

    Refer to section "Removal of the 1-BOX™ from the Vehicle" .

    Refer to section "Removal of the 2-Box (2V2) from the Vehicle" .

15. Disassemble the ATD and inspect the inlet face of the Diesel Particulate Filter (DPF) substrate for contamination. **Note:** an inlet flange washed clean indicates fuel contamination. Is contamination present?

    15.a Yes; Go to step 16.

    15.b No; Go to step 28.

16. Is coolant contamination found (white residue on inlet face of the DPF and a sweet smell from exhaust)?

    16.a Yes; Go to step 19.

    16.b No; Go to step 17.

17. Is oil contamination found (oil residue or paste on DPF Inlet face or an oil lacquer on the inlet flange)?

    17.a Yes; Go to step 22.

    17.b No; Go to step 18.

18. Inspect the ATD components for fuel contamination. If fuel contamination is found (inlet flange washed clean), repair the cause of fuel contamination and Go to step 26.

19. Question the operator about coolant usage.
20. Visually inspect the coolant reservoir for low level.
21. Repair the cause of coolant entry as necessary and Go to step 26.
22. Question the operator about excessive oil consumption.
23. Repair the cause of oil contamination and Go to step 26.
24. Inspect the ATD components for fuel contamination.
25. Repair the cause of fuel contamination and Go to step 26.

> **⚠ 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.

26. Install the ATD.

    Refer to section "Installation of the 1-BOX™ to the Vehicle" .

    Refer to section "Installation of the 2-Box (2V2) to the Vehicle" .

> **⚠ 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.

Note : The parked regeneration is successful if the DOC outlet temperature is within 100°C (212°F) of the DOC Model Delay.

27. Perform a parked regeneration, reset ash accumulators, and e-mail a log file of the successful regeneration to Detroit™ Customer Support Center. Verify repairs.

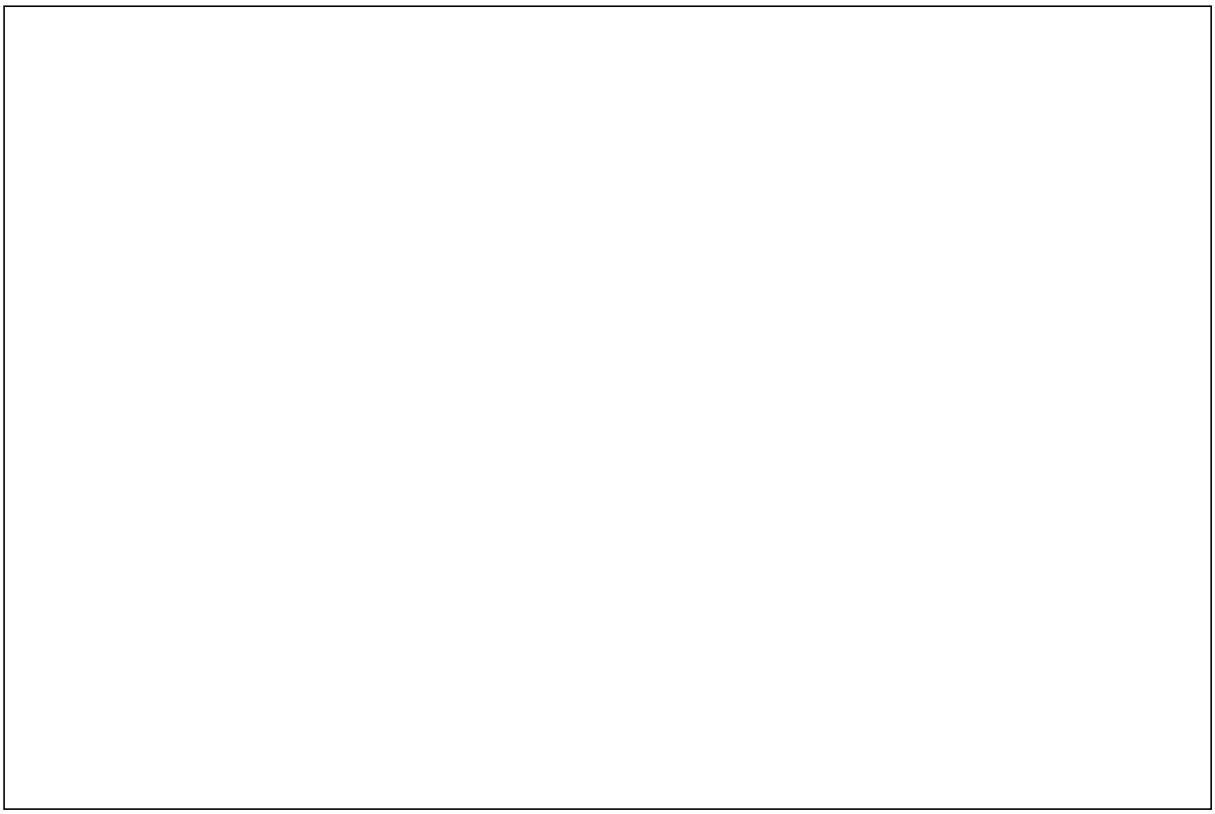
    Refer to section "Performing a Parked Regeneration - GHG17" .

    Refer to section "Resetting the Diesel Particulate Filter Ash Accumulators" . Was regeneration successful?

    27.a Yes; release vehicle.

    27.b No; Go to step 28.

28. Verify the fuel injector(s) part number is correct for engine application. Refer to section "Removal of the Fuel Injector - Two-Filter System" . Is the fuel injector(s) part number correct for the application?



28.a Yes; verify the camshaft timing. Refer to section "Camshaft Timing Verification" . Repair as necessary. Verify repair.

28.b No; install the correct injectors. Refer to section "Test-E - Two-Filter Fuel System" . Verify repair.

228.8 SPN 3250/FMI 20 - GHG17

Diesel Oxidation Catalyst Temperature Drift - Inlet Low or Outlet High

SPN 3250/FMI 20	
Description	70°C (158°F) Difference During Non-regeneration Mode
Monitored Parameter	Diesel Oxidation Catalyst (DOC) Inlet Temperature vs. DOC Outlet Temperature
Typical Enabling Conditions	Coolant Temperature Greater than 60°C (140°F), Regen not active in last five minutes
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	One Minute
Dash Lamps	CEL, MIL
Engine Reaction	Regen Inhibit and 10% Engine Derate

Check as follows:

1. Check for multiple fault codes.

   1.a If SPN 3242/FMI 3/4/8 or SPN3250/FMI 3/4/8 is also present, repair those faults first.

   Refer to section "SPN 3242/FMI 3 - GHG17" .

   Refer to section "SPN 3242/FMI 4 - GHG17" .

   Refer to section "SPN 3242/FMI 8 - GHG17" .

   Refer to section "SPN 3250/FMI 3 - GHG17" .

   Refer to section "SPN 3250/FMI 4 - GHG17" .

   Refer to section "SPN 3250/FMI 8 – GHG17" .

   1.b If the above faults are not present, Go to step 2.

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

> **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.

2. Start the engine.
3. Run service routine "Perform Performance Check - Low Temp ATD" found under the Diesel Particulate Filter (DPF) System tab. Let the test run completely to stabilize the aftertreatment temperatures.
4. Compare DOC inlet temperature and DOC outlet temperature to DPF outlet temperature.
5. Replace the DOC temperature sensor that is drifted more than 25°C (45°F) compared to the DPF outlet temperature sensor.

228.9 SPN 3250/FMI 31 - GHG17

SPN 3250/FMI 31	
Description	Abnormal Diesel Oxidation Catalyst (DOC) Temperature Rise
Monitored Parameter	DOC Temperature
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL, SEL
Engine Reaction	25% Derate, Engine Shutdown
Verification	Parked Regen

Note : This fault indicates the Aftertreatment Control Module (ACM) has detected a sudden temperature shift on the Diesel Particulate Filter (DPF) outlet temperature sensor. The most likely cause is an intermittent wiring concern (poor terminal fit, corrosion, chaffing, etc.).

> **WARNING**
>
> PERSONAL INJURY
>
> To avoid injury from hot surfaces, wear protective gloves, or allow engine to cool before removing any component.

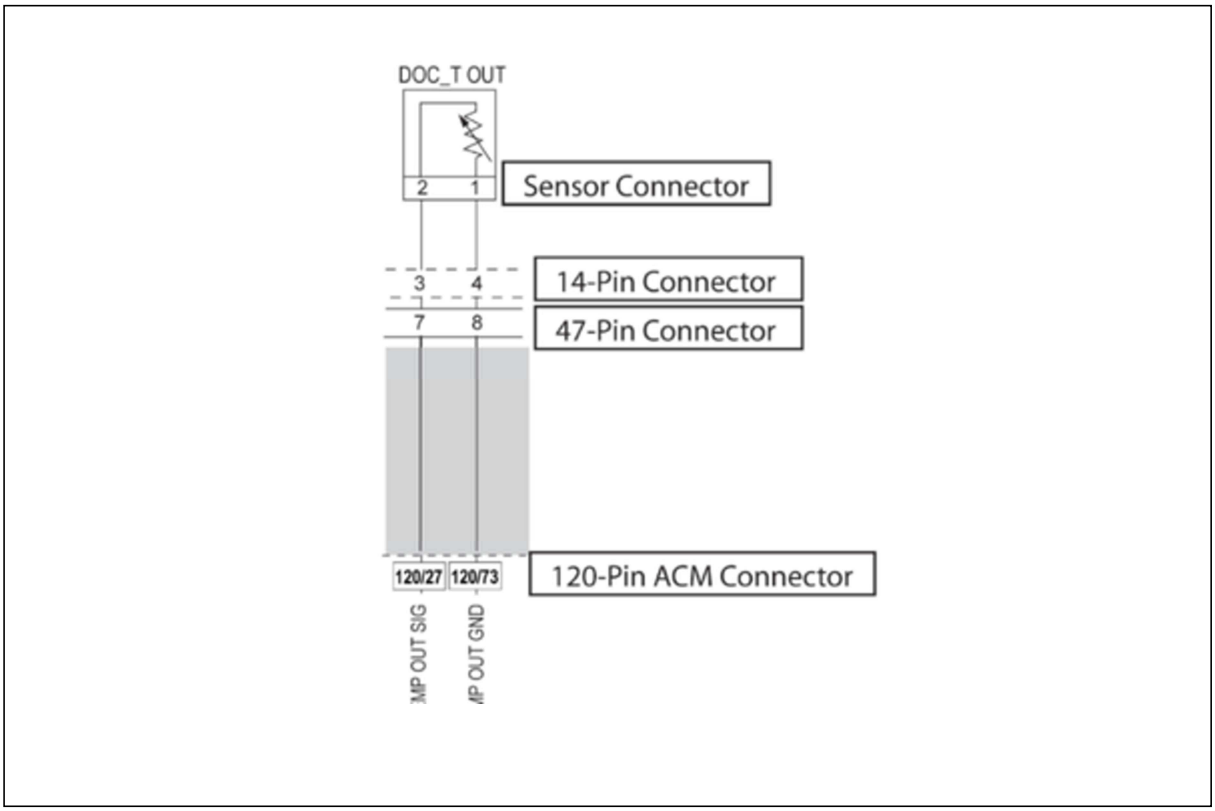
1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are other faults codes active?
   - 3.a Yes; troubleshoot those first.
   - 3.b No; Go to step 6.
4. Remove the DOC outlet temperature sensor.

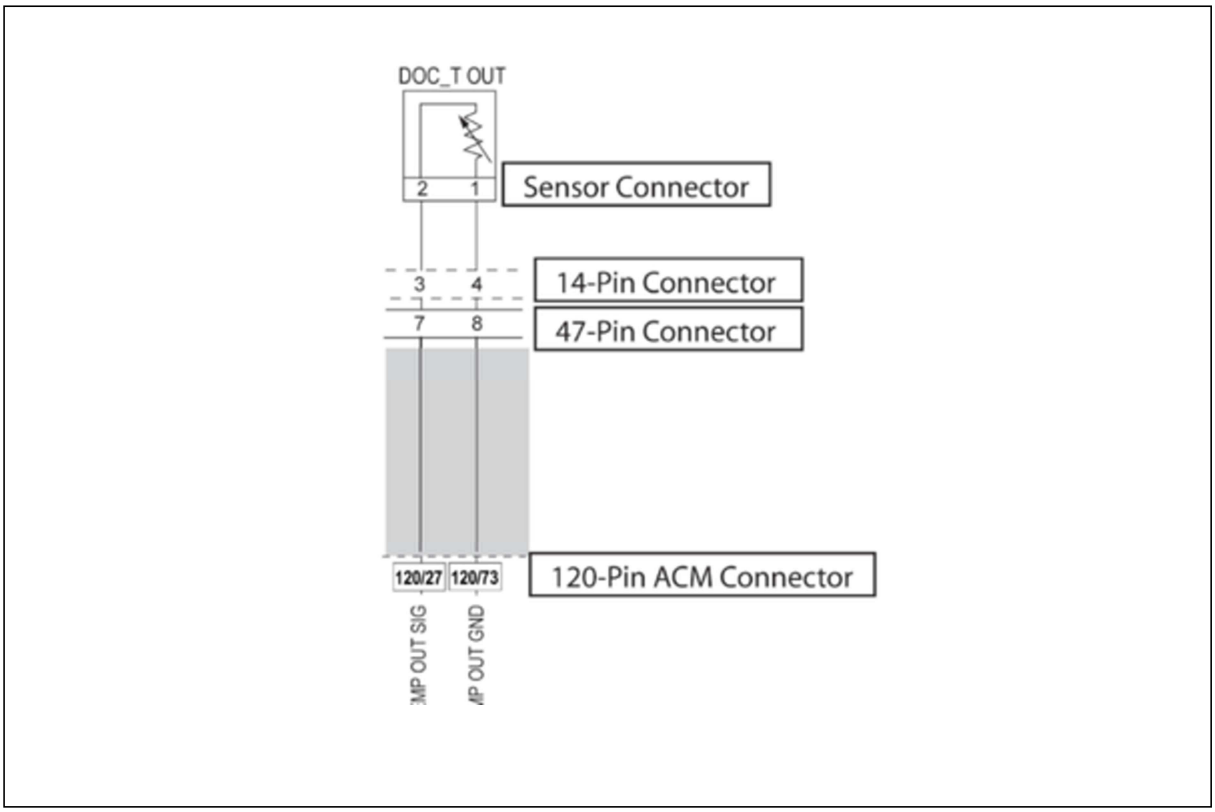
   For 1-BOX™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .

   For 2-Box, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .
5. Allow the DOC outlet temperature sensor to cold soak for several minutes until the sensor has reached ambient temperature.
6. Perform a DOC Outlet Temperature Sensor Test. Measure the resistance between pins 1 and 2 of the DOC outlet temperature sensor connector. Does the DOC outlet temperature sensor match the resistance specification in the chart below?

Temp ºC (ºF)	Min Resistance ()	Max Resistance ()	Min Voltage	Max Voltage
0 (32)	197.67	207.62	0.491	0.520
10 (50)	205.33	215.24	0.506	0.536
25 (77)	216.77	226.64	0.530	0.559
50 (122)	235.72	245.52	0.567	0.597
100 (212)	273.19	282.83	0.638	0.667
150 (302)	310.07	319.56	0.704	0.733
200 (392)	346.36	355.70	0.765	0.794
300 (572)	416.47	429.09	0.874	0.909
400 (752)	484.17	489.84	0.970	1.007

7. Using appropriate test probes from J-48476 connector test kit and J-47410 terminal repair kit , drag test and inspect all harness connector terminals between the DOC outlet temperature sensor and the ACM, including the chassis extension harness and Aftertreatment Device (ATD) sensor box. Repair as necessary to ensure a snug fit between the test probes and the female terminals.




DOC_T OUT
2
1
Sensor Connector
3
4
14-Pin Connector
7
8
47-Pin Connector
120/27
120/73
120-Pin ACM Connector
MP OUT SIG
P OUT GND

230.1 SPN 3251/FMI 0 – GHG17

SPN 3251/FMI 0	
Description	This Fault Code Sets when the Diesel Oxidation Catalyst (DOC) Inlet Pressure is 35 kPa (5 psi) Greater than the Calculated Diesel Particulate Filter (DPF) Outlet Pressure for More than 10 Seconds
Monitored Parameter	DOC Inlet Pressure Sensor
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL, SEL
Engine Reaction	Derate 25%, Shutdown
Verification	Run Engine Between 1200 to 1800 rpm With a Load Less Than 10%

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for other fault codes. Are fault codes SPN 3609/FMI 3 or FMI 4 present?
   - 3.a Yes; diagnose the other fault codes first.
   - 3.b No; Go to step 4.
4. Using DiagnosticLink, go to Service Routines > SCR and DPF voltages.
5. Monitor the DOC inlet pressure sensor voltage, pin 87. Is the voltage between 0.44 and 0.56 volts?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the DOC inlet pressure sensor. Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" . Verify repair.
6. What aftertreatment system does the vehicle have?
   - 6.a For a One-Box aftertreatment system; Go to step 9.
   - 6.b For a Two-Box aftertreatment system; Go to step 7.
7. Monitor the DPF outlet pressure sensor voltage, pin 72. Is the voltage between 0.44 and 0.56 volts?
   - 7.a Yes; Go to step 8.
   - 7.b No; replace the DPF outlet pressure sensor. Verify repair.

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

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.

8. Start the engine and run a Low temperature ATD routine. Refer to section "GHG17 Perform Performance Check - Low Temperature ATD" .
9. Monitor the DOC inlet temperature and the DOC outlet temperature readings. Does the DOC outlet temperature sensor reading follow the DOC inlet temperature sensor reading during the Low Temperature ATD routine? See Example 1.

1. Engine started
2. Low Temp Regen Started
3. DOC Inlet 116°C (241°F)
4. Engine coolant reaches (124°F) and Jake brake turned ON
5. DOC Inlet 378°C (714°F)
6. DOC Inlet 367°C (694°F)
7. As the DOC Inlet warms up, the DOC Outlet temp follows
8. DOC Outlet temp 112°C (234°F)

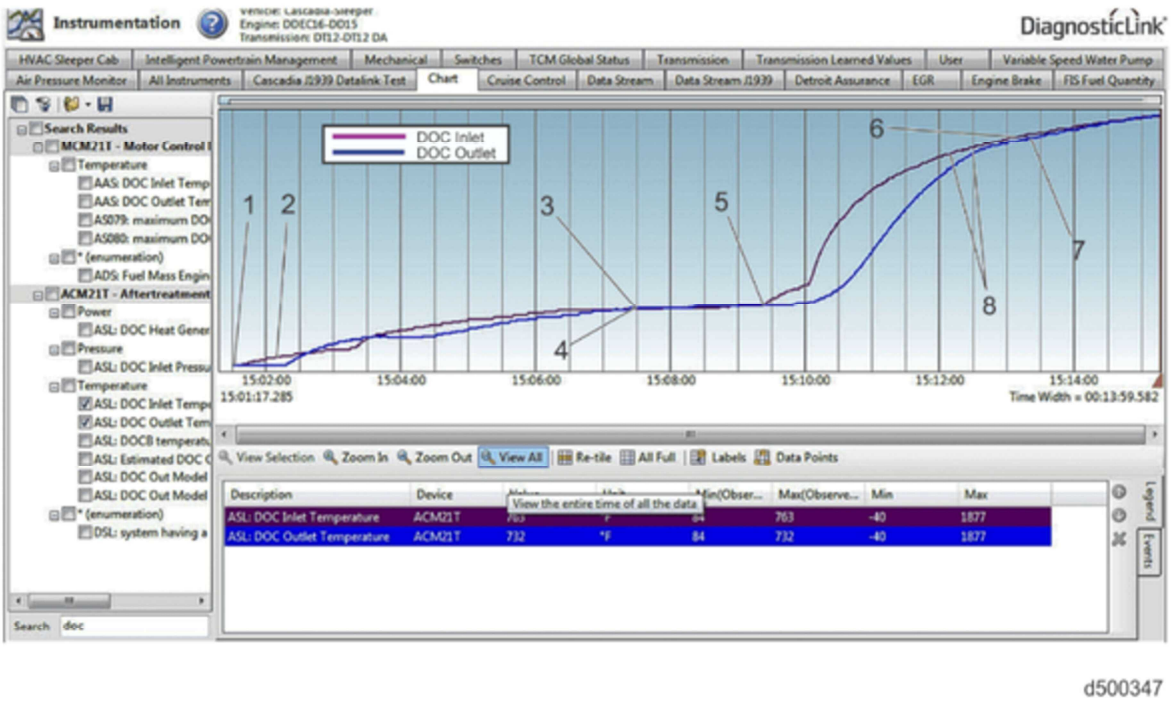


Fig 0.1, Example 1

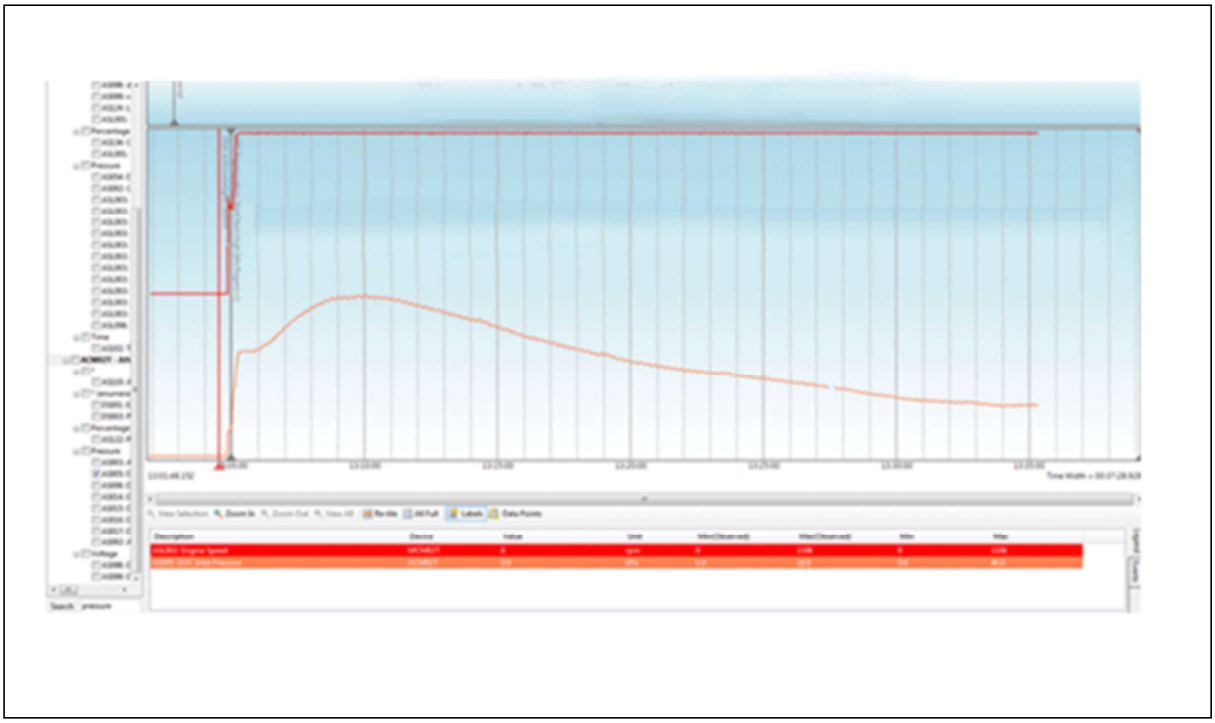
9.a Yes; replace the DPF due to a restriction. Verify repair.

9.b No; Go to step 10.

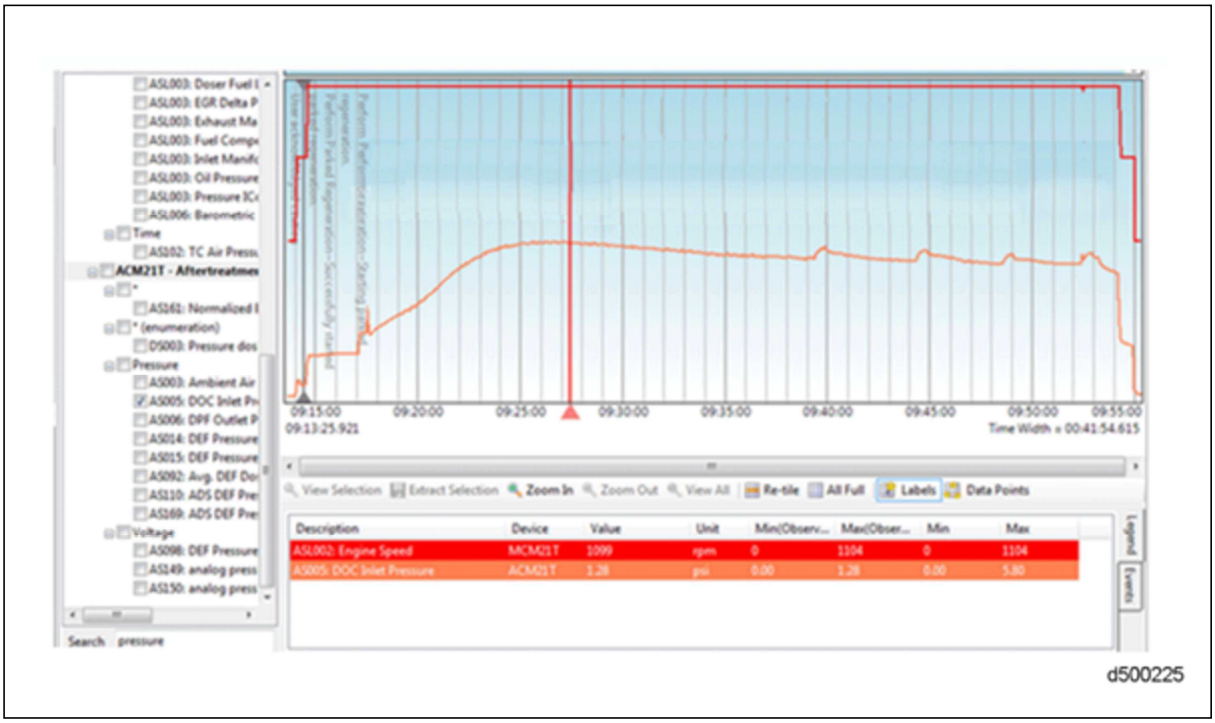
10. Stop the Perform Performance Check - Low Temperature ATD service routine.

11. Perform Parked Regeneration. Monitor DOC inlet pressure and engine speed during the regen. Compare your DOC inlet pressure reading to the screen shots and descriptions below in (a and b) to determine what step to go to next.

11.a If the DOC inlet pressure starts out high above 10 kPa (1.45 psi) and decreases during the parked regen, this indicates the DPFs were plugged and the parked regen cleared them. Go to step 12.



11.b If the DOC inlet pressure starts above 6 kPa (0.8 psi), and stays high, the DOC is considered plugged. Go to step 13.



12. The parked regen has reduced the DOC inlet pressure by reducing the soot accumulated in the DPF. Verify the fault code is gone and fill out the "ATD Checklist". Refer to section "ATD Checklist - GHG17" .
13. Is the DOC inlet pressure above 20 KPa (2.9 psi) during the regen?

    13.a Yes; Go to step 15.

    13.b No; Go to step 14.
14. Using DiagnosticLink, perform the DOC face cleaning routine. Refer to section "GHG17 Diesel Oxidation Catalyst Face Cleaning" . Verify repairs.
15. The DOCs are severely plugged. Perform the Diesel Oxidation Catalyst (DOC) air cleaning procedure. Refer to section "Diesel Oxidation Catalyst Air Cleaning" . Verify repair.

230.2 SPN 3251/FMI 20 - GHG17

SPN 3251/FMI 20	
Description	Diesel Oxidation Catalyst (DOC) Inlet Pressure Sensor - Not Plausible
Monitored Parameter	Exhaust Pressure
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Parked Regen

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ WARNING

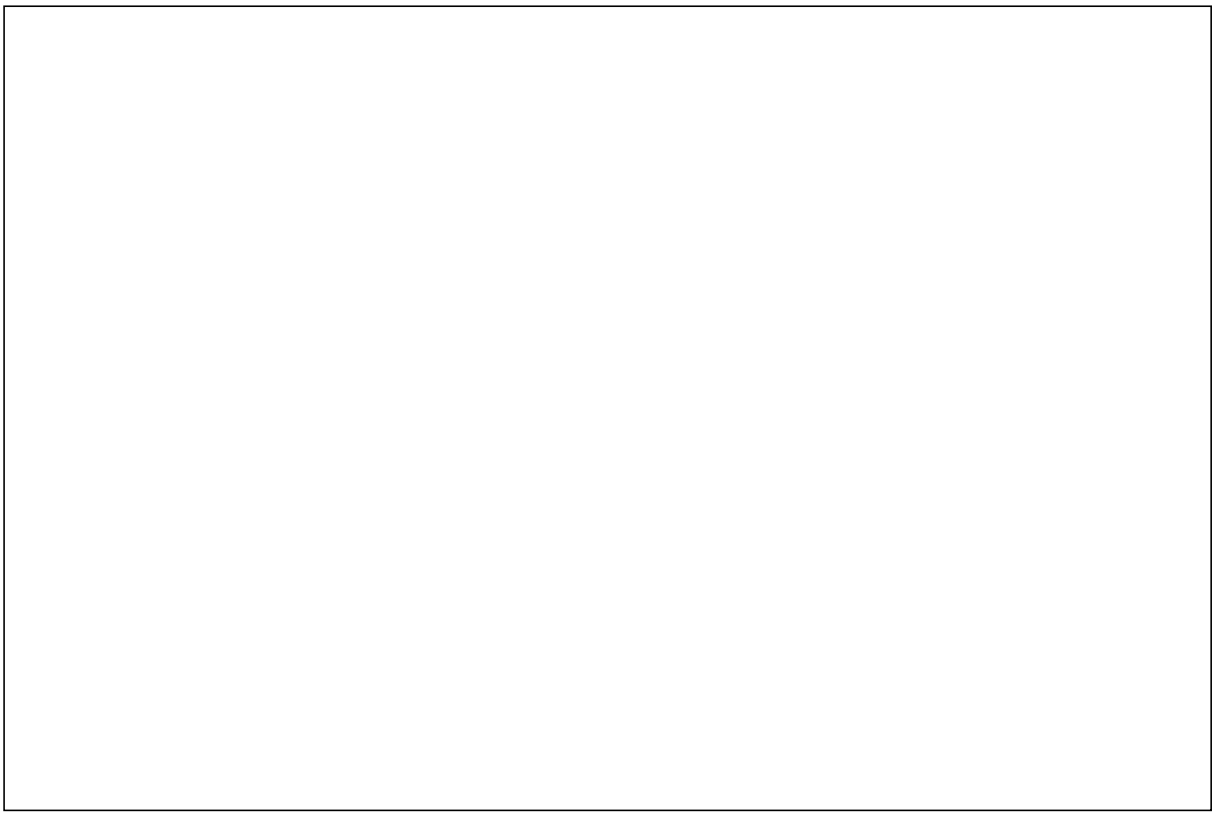
PERSONAL INJURY

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.

⚠ WARNING

ENGINE EXHAUST

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



Check as follows:

1. Visually inspect the entire exhaust system for signs of leaks or damage. Is any damage found?
   1.a Yes; repair as necessary. Verify repairs.
   1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Is the aftertreatment a 1-Box™ configuration?
   3.a Yes; Go to step 4.
   3.b No; Go to step 8.
4. Using the Selective Catalytic Reduction (SCR) voltage service routine, monitor the DOC inlet pressure sensor (pin 87) voltage with key ON and engine OFF.
5. Is the DOC inlet pressure sensor voltage between 0.44 and 0.56 volts?
   5.a Yes; inspect and repair the DOC and DPF pressure sensor tubes and elbows for leaks, kinks, or restrictions.
   5.b No; Go to step 6.
6. Disconnect the DOC inlet pressure sensor connector.
7. Inspect the DOC inlet pressure sensor connector for damaged pins, spread pins, or corrosion. Is there any damage found?
   7.a Yes; repair as necessary. Verify repairs.
   7.b No; replace the sensor. Verify repairs.
8. Using the Selective Catalytic Reduction (SCR) voltage service routine, monitor the DOC inlet pressure sensor (pin 87) and Diesel Particulate Filter (DPF) outlet pressure sensor (pin 72) voltages with key ON and engine OFF.
9. Is the DOC inlet pressure sensor voltage between 0.44 and 0.56 volts?
   9.a Yes; Go to step 13.

9.b No; Go to step 10.

10. Disconnect the DOC inlet pressure sensor connector.
11. Inspect the DOC inlet pressure sensor connector for damaged pins, spread pins, or corrosion. Is there any damage found?

    11.a Yes; repair as necessary. Verify repairs.

    11.b No; Go to step 12.

12. Measure the voltage from pin 3 of the DOC inlet pressure sensor connector to ground. Is the voltage between 4.5 and 5.5 volts?

    12.a Yes; replace the sensor. Verify repairs. For Two-BOX, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" .

    12.b No; repair the wire. Verify repairs.

13. Is the DPF outlet pressure sensor voltage between 0.44 and 0.56 volts?

    13.a Yes; inspect and repair the DOC and DPF pressure sensor tubes and elbows for leaks, kinks, or restrictions. Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor Tube" .

    13.b No; Go to step 14.

14. Disconnect the DPF outlet pressure sensor connector.
15. Inspect the DPF outlet pressure sensor connector for damaged pins, spread pins or corrosion. Is there any damage found?

    15.a Yes; repair as necessary. Verify repairs.

    15.b No; Go to step 16.

16. Measure the voltage between pin 3 of the DPF outlet pressure sensor connector and ground. Is the voltage between 4.5 and 5.5 volts?

    16.a Yes; replace the sensor. Verify repair. Refer to section "Removal of the Diesel Particulate Filter Outlet Pressure Sensor" .

    16.b No; repair the wire. Verify repair.

230.3 SPN 3251/FMI 21 - GHG17

SPN 3251/FMI 21	
Description	Diesel Oxidation Catalyst (DOC) Inlet/Outlet Pressure Not Plausible
Monitored Parameter	Exhaust Pressures
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Parked Regeneration

⚠ WARNING

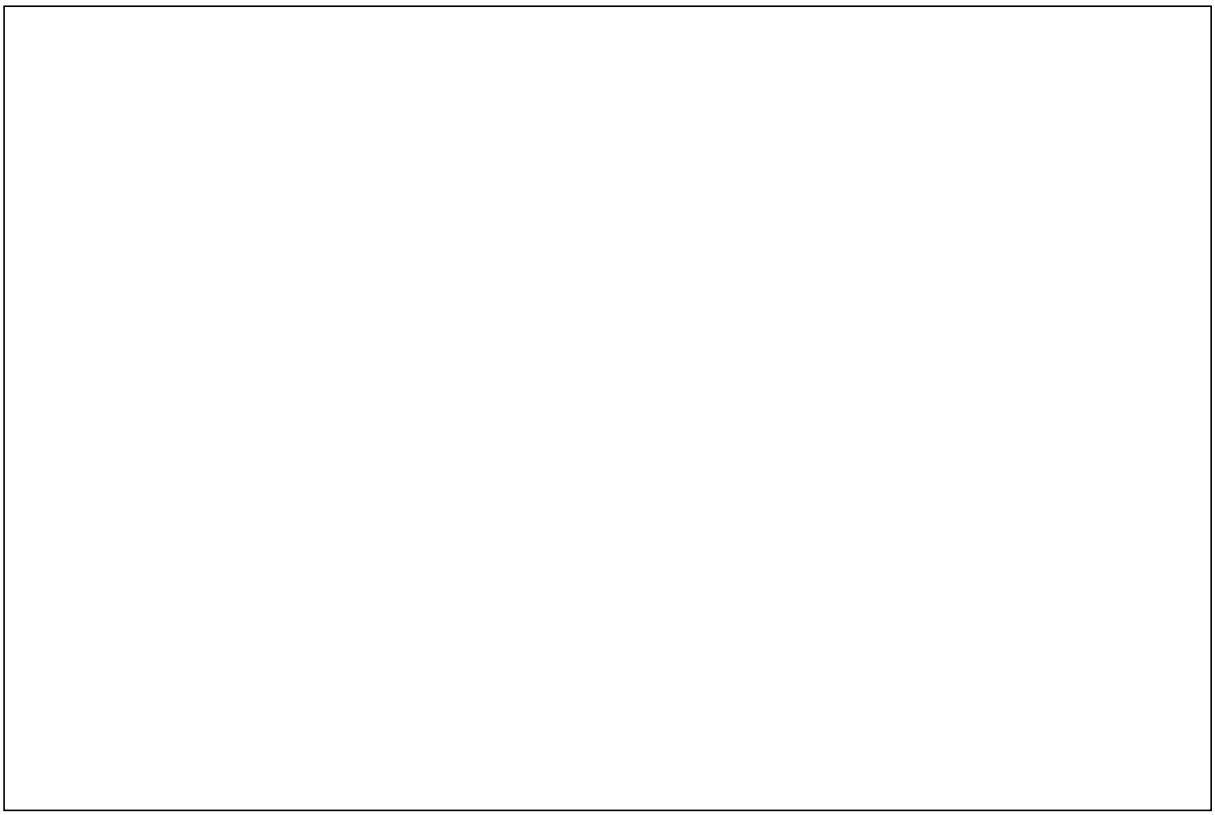
PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.



Check as follows:

1. Visually inspect the entire exhaust system for signs of leaks or damage. Is there any damage found?
   1.a Yes; repair as necessary. Verify repair.
   1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Using the Selective Catalyst Reduction (SCR) Voltage Service routine, monitor the DOC inlet pressure voltage (pin 87) with the key ON, engine OFF.
4. Is the DOC inlet pressure sensor voltage between 0.44 and 0.56 volts?
   4.a Yes; Go to step 8.
   4.b No; Go to step 5.
5. Disconnect the DOC inlet pressure sensor connector.
6. Inspect the DOC inlet pressure sensor connector for damaged pins, spread pins, or corrosion. Is there any damage found?
   6.a Yes; repair as necessary. Verify repairs.
   6.b No; Go to step 7.
7. Remove the DOC inlet pressure sensor tube. Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor Tube" .
8. Inspect the DOC inlet pressure sensor tube for any restrictions. Were restrictions found?
   8.a Yes; clear the restriction and reinstall the pressure sensor tube. Verify repair.
   8.b No; reinstall the pressure sensor tube. Go to step 9.
9. Measure the voltage from pin 3 of the DOC inlet pressure sensor connector to ground. Is the voltage between 4.5 and 5.5 volts?
   9.a Yes; the failed component could not be identified. Go to step 10.

9.b No; repair the wire between pin 3 harness side and pin 117 of the ACM. Verify repair.

10. Reconnect the DOC inlet pressure sensor.
11. Run a Parked Regen to verify the fault code is no longer active.

SPN 3251 (ACM) (GHG17)

230.1 SPN 3251/FMI 0 – GHG17

SPN 3251/FMI 0	
Description	This Fault Code Sets when the Diesel Oxidation Catalyst (DOC) Inlet Pressure is 35 kPa (5 psi) Greater than the Calculated Diesel Particulate Filter (DPF) Outlet Pressure for More than 10 Seconds
Monitored Parameter	DOC Inlet Pressure Sensor
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL, SEL
Engine Reaction	Derate 25%, Shutdown
Verification	Run Engine Between 1200 to 1800 rpm With a Load Less Than 10%

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for other fault codes. Are fault codes SPN 3609/FMI 3 or FMI 4 present?
   - 3.a Yes; diagnose the other fault codes first.
   - 3.b No; Go to step 4.
4. Using DiagnosticLink, go to Service Routines > SCR and DPF voltages.
5. Monitor the DOC inlet pressure sensor voltage, pin 87. Is the voltage between 0.44 and 0.56 volts?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the DOC inlet pressure sensor. Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" . Verify repair.
6. What aftertreatment system does the vehicle have?
   - 6.a For a One-Box aftertreatment system; Go to step 9.
   - 6.b For a Two-Box aftertreatment system; Go to step 7.
7. Monitor the DPF outlet pressure sensor voltage, pin 72. Is the voltage between 0.44 and 0.56 volts?
   - 7.a Yes; Go to step 8.
   - 7.b No; replace the DPF outlet pressure sensor. Verify repair.

> **WARNING**
>
> PERSONAL INJURY
>
> Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

> **⚠ 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.

> **⚠ 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.

8. Start the engine and run a Low temperature ATD routine. Refer to section "GHG17 Perform Performance Check - Low Temperature ATD" .
9. Monitor the DOC inlet temperature and the DOC outlet temperature readings. Does the DOC outlet temperature sensor reading follow the DOC inlet temperature sensor reading during the Low Temperature ATD routine? See Example 1.

1. Engine started
2. Low Temp Regen Started
3. DOC Inlet 116°C (241°F)
4. Engine coolant reaches (124°F) and Jake brake turned ON
5. DOC Inlet 378°C (714°F)
6. DOC Inlet 367°C (694°F)
7. As the DOC Inlet warms up, the DOC Outlet temp follows
8. DOC Outlet temp 112°C (234°F)

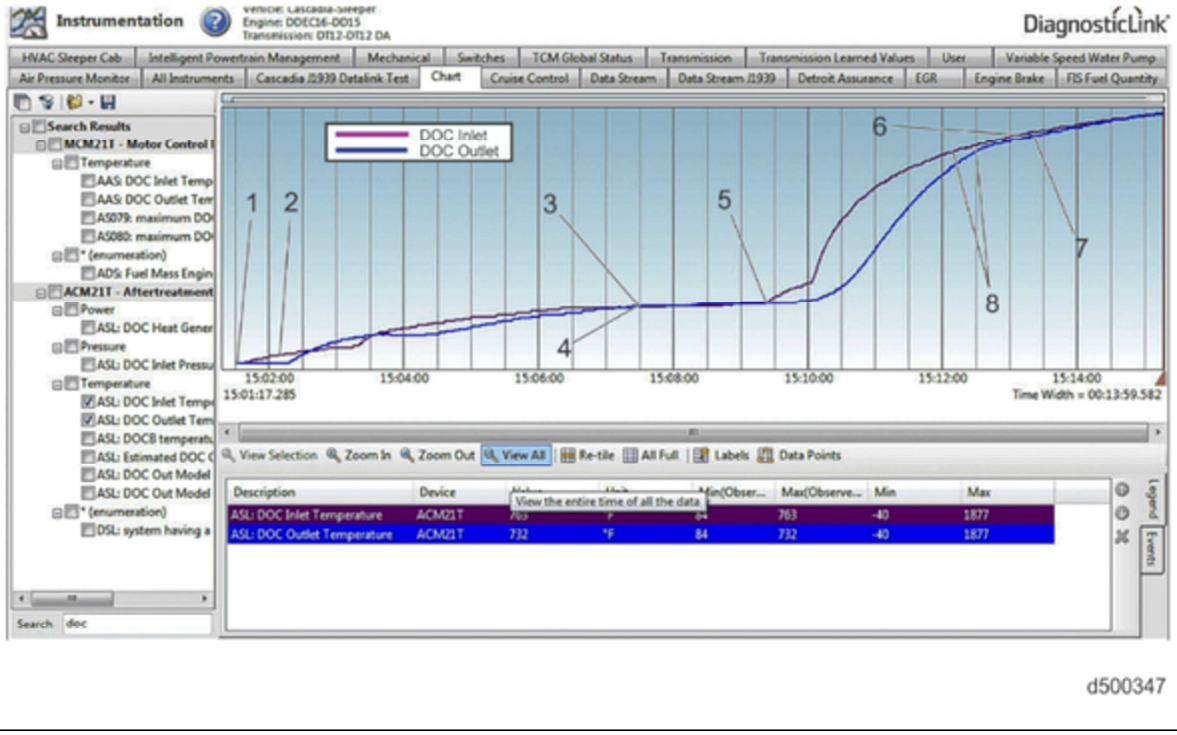


Fig 230.2, Example 1

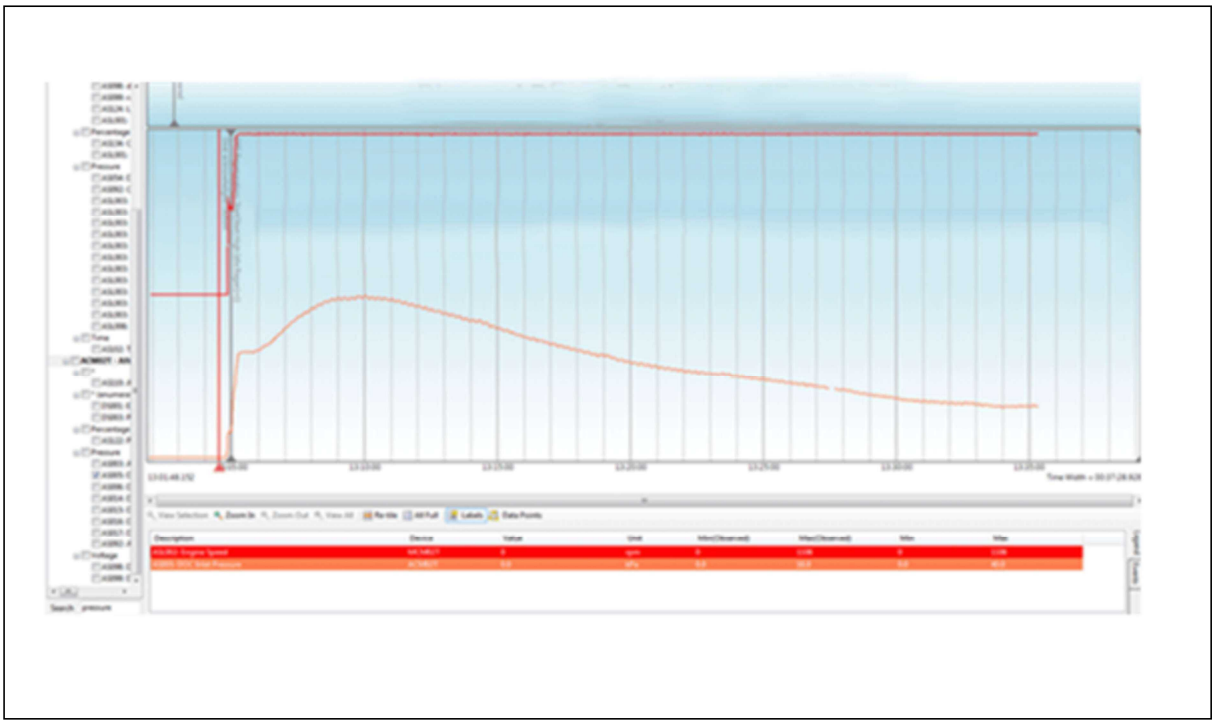
9.a Yes; replace the DPF due to a restriction. Verify repair.

9.b No; Go to step 10.

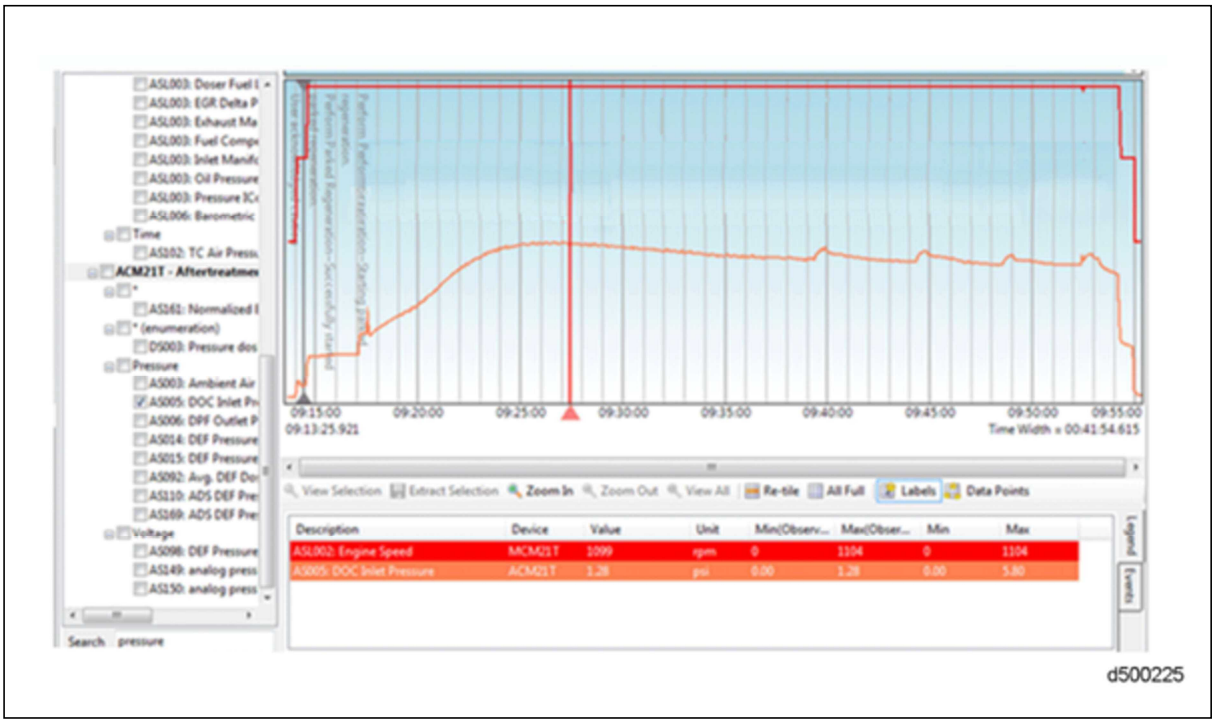
10. Stop the Perform Performance Check - Low Temperature ATD service routine.

11. Perform Parked Regeneration. Monitor DOC inlet pressure and engine speed during the regen. Compare your DOC inlet pressure reading to the screen shots and descriptions below in (a and b) to determine what step to go to next.

11.a If the DOC inlet pressure starts out high above 10 kPa (1.45 psi) and decreases during the parked regen, this indicates the DPFs were plugged and the parked regen cleared them. Go to step 12.



11.b If the DOC inlet pressure starts above 6 kPa (0.8 psi), and stays high, the DOC is considered plugged.
Go to step 13.



12. The parked regen has reduced the DOC inlet pressure by reducing the soot accumulated in the DPF. Verify the fault code is gone and fill out the "ATD Checklist". Refer to section "ATD Checklist - GHG17" .
13. Is the DOC inlet pressure above 20 KPa (2.9 psi) during the regen?

13.a Yes; Go to step 15.

13.b No; Go to step 14.

14. Using DiagnosticLink, perform the DOC face cleaning routine. Refer to section "GHG17 Diesel Oxidation Catalyst Face Cleaning" . Verify repairs.
15. The DOCs are severely plugged. Perform the Diesel Oxidation Catalyst (DOC) air cleaning procedure. Refer to section "Diesel Oxidation Catalyst Air Cleaning" . Verify repair.

230.2 SPN 3251/FMI 20 - GHG17

SPN 3251/FMI 20	
Description	Diesel Oxidation Catalyst (DOC) Inlet Pressure Sensor - Not Plausible
Monitored Parameter	Exhaust Pressure
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Parked Regen

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ WARNING

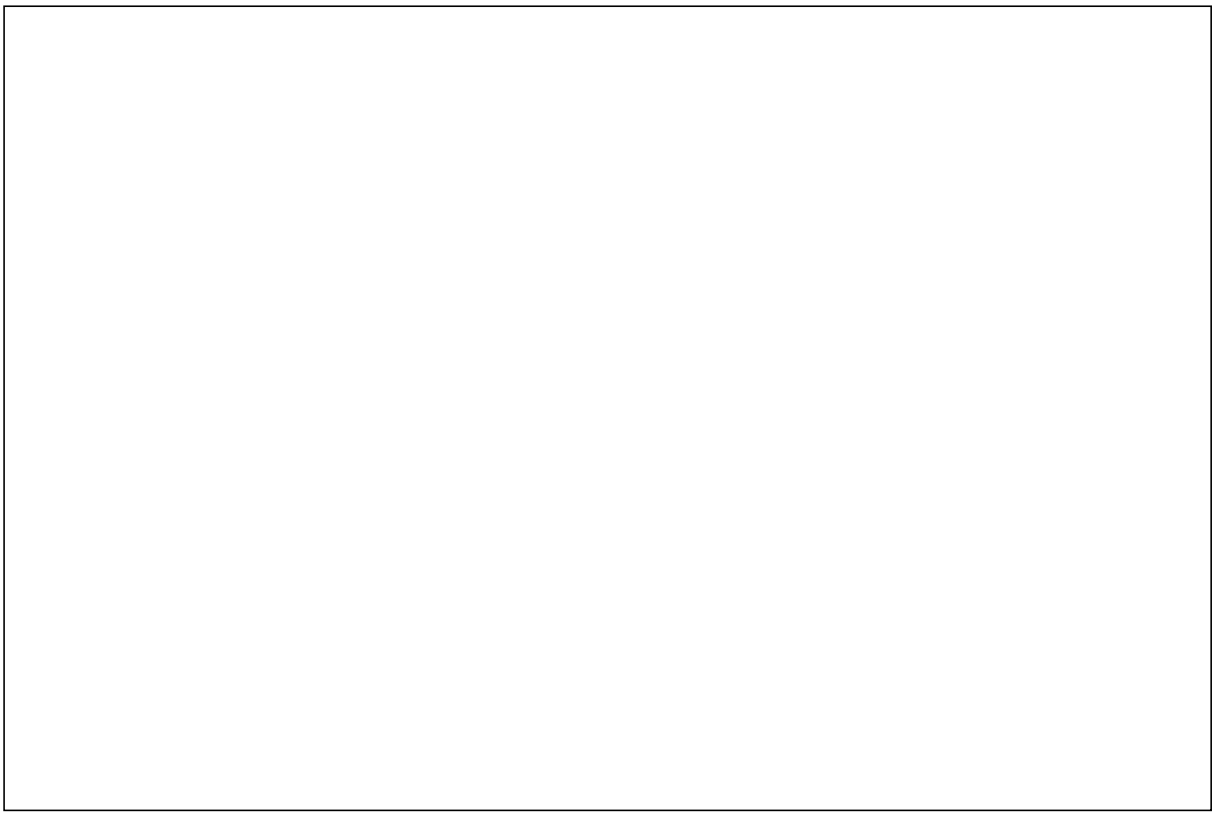
PERSONAL INJURY

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.

⚠ WARNING

ENGINE EXHAUST

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



Check as follows:

1. Visually inspect the entire exhaust system for signs of leaks or damage. Is any damage found?
   1.a Yes; repair as necessary. Verify repairs.
   1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Is the aftertreatment a 1-Box™ configuration?
   3.a Yes; Go to step 4.
   3.b No; Go to step 8.
4. Using the Selective Catalytic Reduction (SCR) voltage service routine, monitor the DOC inlet pressure sensor (pin 87) voltage with key ON and engine OFF.
5. Is the DOC inlet pressure sensor voltage between 0.44 and 0.56 volts?
   5.a Yes; inspect and repair the DOC and DPF pressure sensor tubes and elbows for leaks, kinks, or restrictions.
   5.b No; Go to step 6.
6. Disconnect the DOC inlet pressure sensor connector.
7. Inspect the DOC inlet pressure sensor connector for damaged pins, spread pins, or corrosion. Is there any damage found?
   7.a Yes; repair as necessary. Verify repairs.
   7.b No; replace the sensor. Verify repairs.
8. Using the Selective Catalytic Reduction (SCR) voltage service routine, monitor the DOC inlet pressure sensor (pin 87) and Diesel Particulate Filter (DPF) outlet pressure sensor (pin 72) voltages with key ON and engine OFF.
9. Is the DOC inlet pressure sensor voltage between 0.44 and 0.56 volts?
   9.a Yes; Go to step 13.

9.b No; Go to step 10.

10. Disconnect the DOC inlet pressure sensor connector.
11. Inspect the DOC inlet pressure sensor connector for damaged pins, spread pins, or corrosion. Is there any damage found?

11.a Yes; repair as necessary. Verify repairs.

11.b No; Go to step 12.

12. Measure the voltage from pin 3 of the DOC inlet pressure sensor connector to ground. Is the voltage between 4.5 and 5.5 volts?

12.a Yes; replace the sensor. Verify repairs. For Two-BOX, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" .

12.b No; repair the wire. Verify repairs.

13. Is the DPF outlet pressure sensor voltage between 0.44 and 0.56 volts?

13.a Yes; inspect and repair the DOC and DPF pressure sensor tubes and elbows for leaks, kinks, or restrictions. Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor Tube" .

13.b No; Go to step 14.

14. Disconnect the DPF outlet pressure sensor connector.
15. Inspect the DPF outlet pressure sensor connector for damaged pins, spread pins or corrosion. Is there any damage found?

15.a Yes; repair as necessary. Verify repairs.

15.b No; Go to step 16.

16. Measure the voltage between pin 3 of the DPF outlet pressure sensor connector and ground. Is the voltage between 4.5 and 5.5 volts?

16.a Yes; replace the sensor. Verify repair. Refer to section "Removal of the Diesel Particulate Filter Outlet Pressure Sensor" .

16.b No; repair the wire. Verify repair.

230.3 SPN 3251/FMI 21 - GHG17

SPN 3251/FMI 21	
Description	Diesel Oxidation Catalyst (DOC) Inlet/Outlet Pressure Not Plausible
Monitored Parameter	Exhaust Pressures
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Parked Regeneration

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ WARNING

HOT EXHAUST

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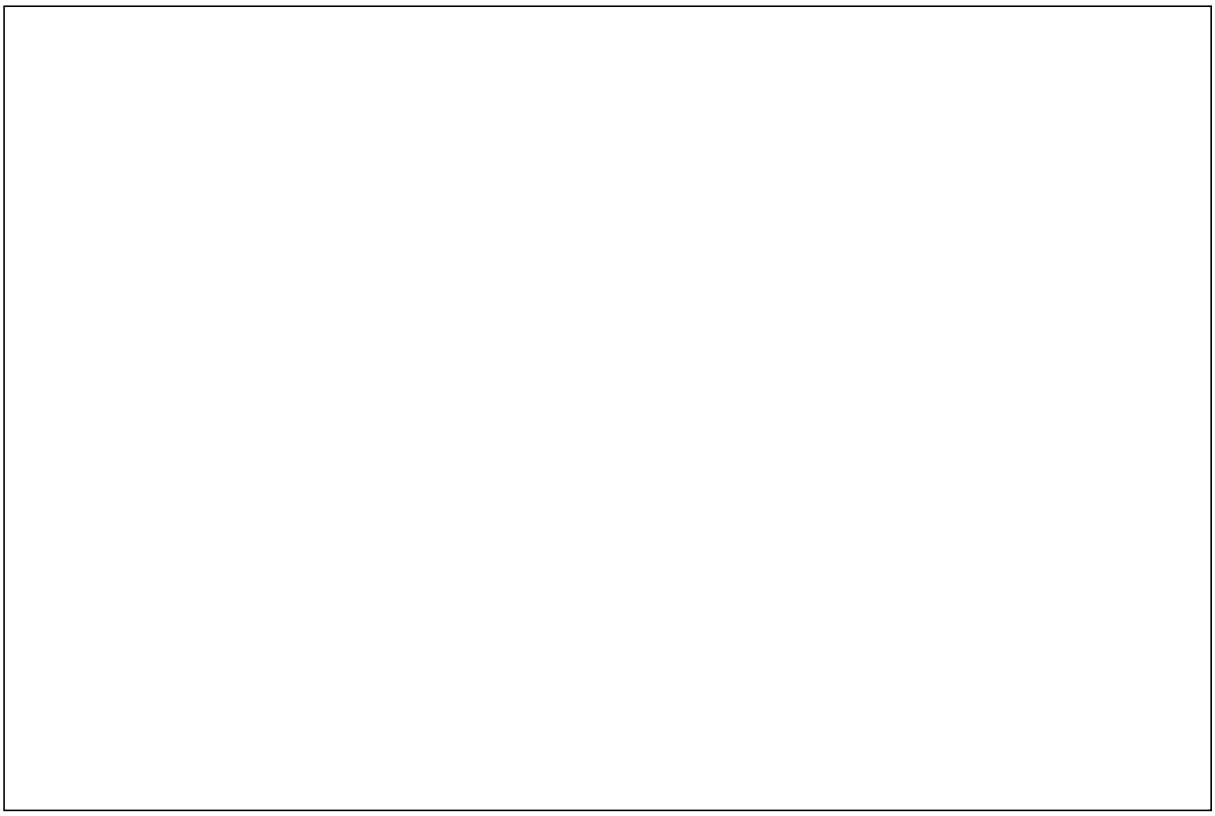


Check as follows:

1. Visually inspect the entire exhaust system for signs of leaks or damage. Is there any damage found?
   1.a Yes; repair as necessary. Verify repair.
   1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Using the Selective Catalyst Reduction (SCR) Voltage Service routine, monitor the DOC inlet pressure voltage (pin 87) with the key ON, engine OFF.
4. Is the DOC inlet pressure sensor voltage between 0.44 and 0.56 volts?
   4.a Yes; Go to step 8.
   4.b No; Go to step 5.
5. Disconnect the DOC inlet pressure sensor connector.
6. Inspect the DOC inlet pressure sensor connector for damaged pins, spread pins, or corrosion. Is there any damage found?
   6.a Yes; repair as necessary. Verify repairs.
   6.b No; Go to step 7.
7. Remove the DOC inlet pressure sensor tube. Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor Tube" .
8. Inspect the DOC inlet pressure sensor tube for any restrictions. Were restrictions found?
   8.a Yes; clear the restriction and reinstall the pressure sensor tube. Verify repair.
   8.b No; reinstall the pressure sensor tube. Go to step 9.
9. Measure the voltage from pin 3 of the DOC inlet pressure sensor connector to ground. Is the voltage between 4.5 and 5.5 volts?
   9.a Yes; the failed component could not be identified. Go to step 10.

9.b No; repair the wire between pin 3 harness side and pin 117 of the ACM. Verify repair.

10. Reconnect the DOC inlet pressure sensor.
11. Run a Parked Regen to verify the fault code is no longer active.

SPN 3353 (CPC) (GHG17)

230.1 SPN 3353/FMI 2 - GHG17

Generator (Charging System) D+ Terminal Failure

SPN 3353/FMI 2	
Description	J1939 Charging System D+ Terminal Failure
Monitored Parameter	Battery Voltage
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key OFF for Five Minutes, then Key ON, Engine OFF

Check as follows:

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   1.a Yes; repair the battery voltage concern. Verify repair.
   1.b No; Go to step 2.
2. Check for proper configuration of the Common Powertrain Controller (CPC) against the server information. Does the CPC have the proper configuration?
   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.
   2.b No; reprogram the CPC with the correct information as necessary. To verify repair. Go to step 3.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink . Wait five minutes for all modules to power down. Verify repair.

SPN 3361 (ACM) (GHG17)

232.1 SPN 3361/FMI 3 - GHG17

SPN 3361/FMI 3	
Description	Diesel Exhaust Fluid (DEF) System Circuit Voltage Above Normal, Or Shorted To High Source
Monitored Parameter	DEF Dosing Unit Voltage
Typical Enabling Conditions	DEF Dosing enabled
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 seconds
Dash Lamps	None
Engine Reaction	Derate 25%
Verification	Key OFF five minutes after repair

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the DEF dosing unit harness connector.
3. Inspect the Dosing Unit connector and the Dosing Unit harness connector for signs of damage, bent, spread, broken, pushed out (unseated) or corroded pins or wire damage near the connector. Was any damage found?

3.a Yes; repair as needed. Verify repairs.

3.b No; Go to step 4.

4. Connect to DiagnosticLink .
5. Turn the ignition ON (key ON, engine OFF).

Note : Fault will remain active until key cycle with five-minute Aftertreatment Control Module (ACM) power down.

6. Clear fault codes. Does the fault code change from SPN 3361/FMI 3 to SPN 3361/FMI 5?

6.a Yes; replace the DEF Dosing Unit. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . Verify repairs.

6.b No; Go to step 7.

7. Measure the voltage between the DEF dosing unit connector pin 1, harness side and ground. Is the voltage greater than 10 volts?

7.a Yes; repair the short to voltage between pin 1 of the DEF dosing unit connector and pin 28 of the ACM connector.

7.b No; Go to step 8.

8. Turn the ignition OFF.
9. Check intermediate connections in chassis wiring; refer to Original Equipment Manufacturer wiring diagrams for exact routing. Inspect for signs of damage, bent, spread, broken, pushed out (unseated) or corroded pins or wire damage near the connector. Was any damage found?

9.a Yes; repair as needed. Verify repairs.

9.b No; Go to step 10.

10. Disconnect the ACM 120-pin connector.
11. Inspect the ACM 120-pin connector and 120-pin harness connector for signs of damage, bent, spread, broken, pushed out (unseated) or corroded pins or wire damage near the connector. Was any damage found?

11.a Yes; repair as needed. Verify repairs.

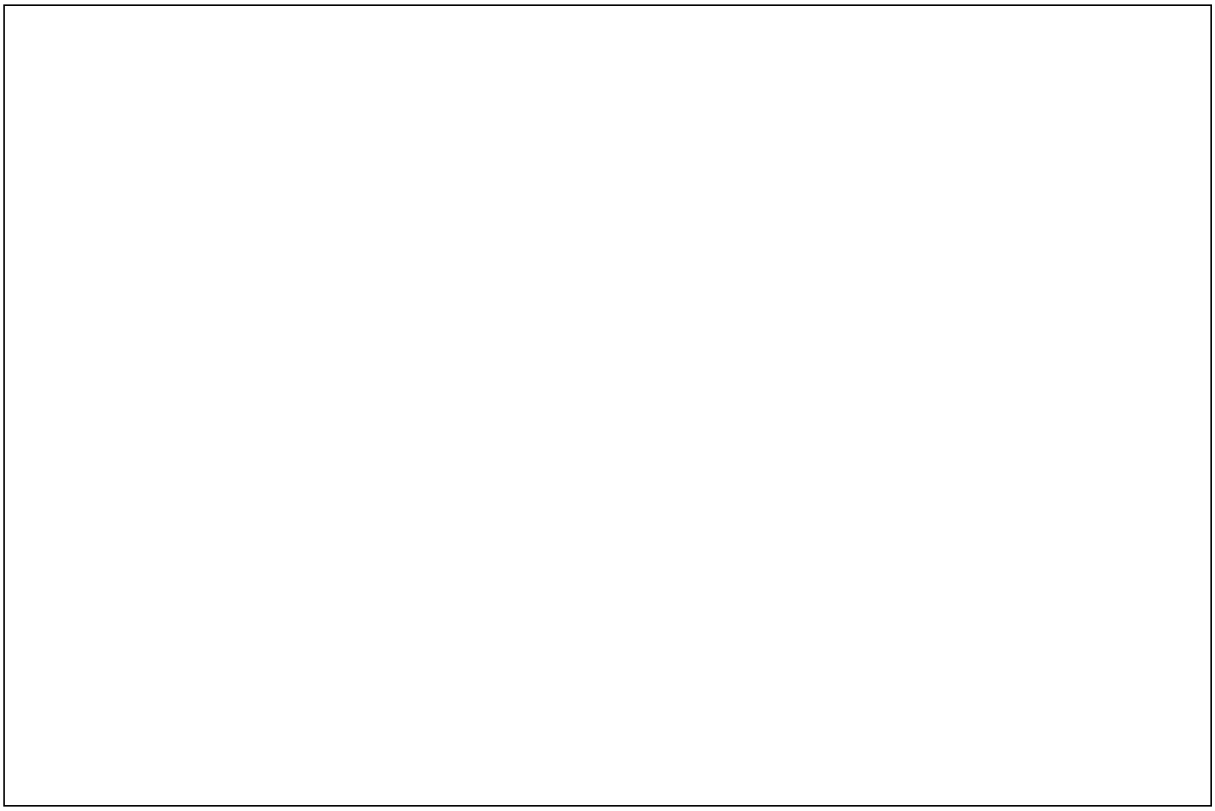
11.b No; replace ACM.

Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" . Verify repairs.

Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module" . Verify repairs.

232.2 SPN 3361/FMI 4 - GHG17

SPN 3361/FMI 4	
Description	Diesel Exhaust Fluid (DEF) System Circuit low voltage signal or short to ground
Monitored Parameter	DEF Dosing Unit Voltage
Typical Enabling Conditions	DEF Dosing enabled then disabled
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	50 seconds (max)
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Key Cycle OFF five minutes after repair



Check as follows:

1. Turn the ignition OFF.
2. Disconnect the DEF dosing unit harness connector.
3. Inspect the Dosing Unit connector and the Dosing Unit harness connector for signs of damage, bent, spread, broken, pushed out (unseated) or corroded pins or wire damage near the connector. Was any damage found?

   3.a Yes; repair as needed. Verify repairs.

   3.b No; Go to step 4.
4. Connect to DiagnosticLink .

5. Turn the ignition ON (key ON, engine OFF).

Note : Fault will remain active until key cycle with five-minute Aftertreatment Control Module (ACM) power down.

6. Clear fault codes. Does the fault code change from SPN 3361/FMI 4 to SPN 3361/FMI 5?

   6.a Yes; replace the DEF Dosing Unit. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . Verify repairs.

   6.b No; Go to step 7.

7. Turn the ignition OFF.

8-Pin	Circuit	ACM - Pin	Connector
1	Dosing Unit Low Side	28	
2	Dosing Unit High Side	33	
3	Heating Low Side	22	
4	Heating Supply	3	
5	Sensor Supply 5V	84	
6	Not Used	Not Used	
7	Sensor Ground	99	
8	DEF Pressure Signal	100	

8. Measure the resistance between the DEF dosing unit connector pin 1, harness side and ground. Is the resistance greater than 10K ohms?

   8.a Yes; Go to step 9.

   8.b No; repair the short to ground between pin 1 of the DEF dosing unit connector and pin 28 of the ACM connector. Verify repairs.

9. Check intermediate connections in chassis wiring; refer to Original Equipment Manufacturer wiring diagrams for exact routing. Inspect for signs of damage, bent, spread, broken, pushed out (unseated) or corroded pins or wire damage near the connector. Was any damage found?

   9.a Yes; repair as needed. Verify repairs.

   9.b No; Go to step 10.

10. Disconnect the ACM 120-pin connector.

11. Inspect the ACM 120-pin connector and 120-pin harness connector for signs of damage, bent, spread, broken, pushed out (unseated) or corroded pins or wire damage near the connector. Was any damage found?

    11.a Yes; repair as needed. Verify repairs.

    11.b No; Go to step 12.

12. Measure the resistance between pins 1 and 2 on the DEF dosing unit harness connector. Is the resistance greater than 10K ohms?

    12.a Yes; replace ACM.

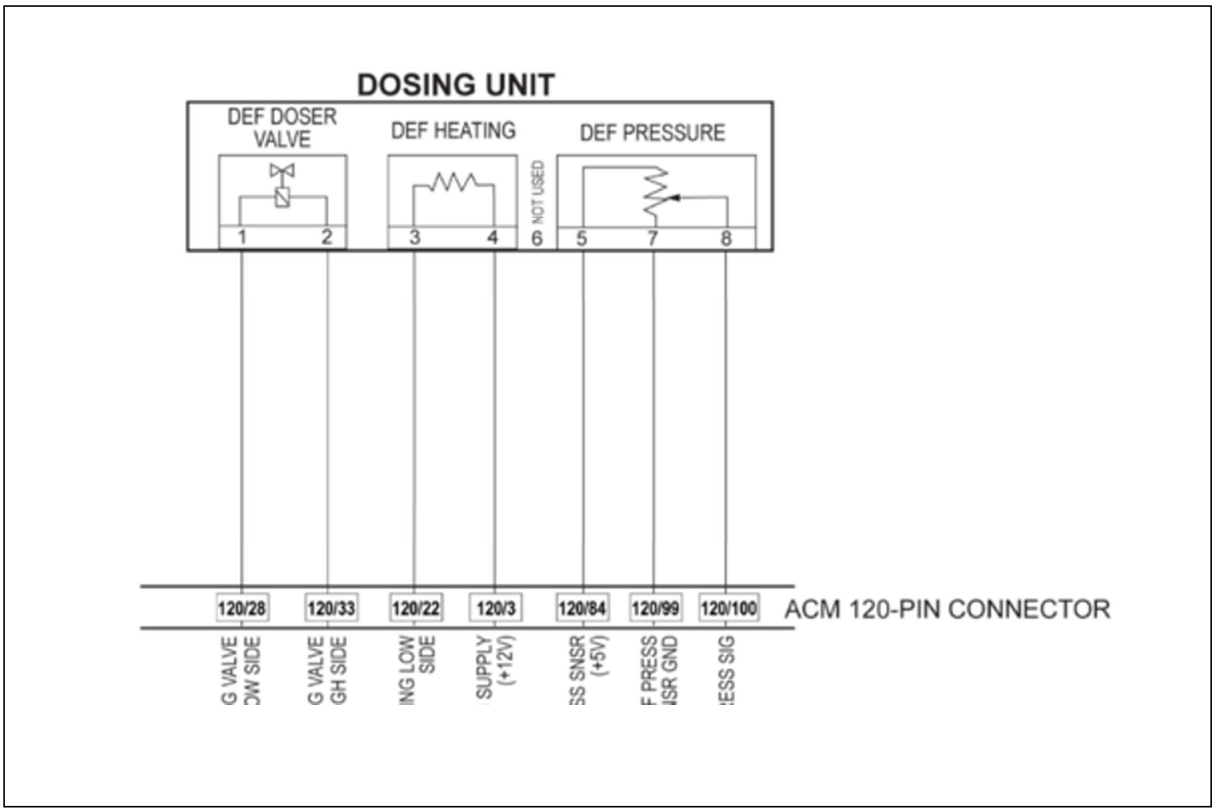
    For 1-BOX™, Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" . Verify repairs.

    For Two-Box, Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module" . Verify repairs.

    12.b No; repair the shorted wires between pins 1 and 2 of the DEF dosing unit harness and pins 28 and 33 of the ACM harness connector. Verify repairs.

232.3 SPN 3361/FMI 5 - GHG17

SPN 3361/FMI 5	
Description	This Fault Code Sets When the Aftertreatment Control Module (ACM) Detects an Open in the Diesel Exhaust Fluid DEF Doser Valve Electrical Circuit
Monitored Parameter	DEF Dosing Unit Voltage
Typical Enabling Conditions	DEF Dosing Enabled Then Disabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	50 Seconds (max)
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Key OFF Five Minutes After Repair



Check as follows:

1. Turn the ignition OFF.
2. Disconnect and inspect the DEF dosing unit electrical connector harness side. Is there corrosion present?
   - 2.a Yes; replace the DEF dosing unit and the aftertreatment harness. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . Verify repairs.
   - 2.b No; Go to step 3.
3. Are any of the pins or the connector damaged?
   - 3.a Yes; Go to step 4.
   - 3.b No; Go to step 5.

4. Inspect the DEF dosing unit electrical connector component side. Are any of the pins or the connector damaged?
   - 4.a Yes; replace the DEF dosing unit and the aftertreatment harness.

     Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit"

     Refer to section "Removal of the 1-BOX™ Aftertreatment Harness"

     Verify repairs.
   - 4.b No; replace the aftertreatment harness. Refer to section "Removal of the 1-BOX™ Aftertreatment Harness" . Verify repairs.
5. Use the appropriate flex probe and check pins 1 and 2 in the DEF dosing unit electrical connector harness side. Is either of the pins spread?
   - 5.a Yes; replace the aftertreatment harness. Refer to section "Removal of the 1-BOX™ Aftertreatment Harness" . Verify repairs.
   - 5.b No; Go to step 6.
6. Jump pin 1 to pin 2 on the DEF dosing unit electrical connector harness side.
7. Connect DiagnosticLink .
8. Turn the ignition ON (key ON, engine OFF).
9. Check the fault codes. Is fault code SPN 3361/FMI 5 now inactive and fault code SPN 3361/FMI 3 now active?
   - 9.a Yes; replace the DEF dosing unit. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . Verify repairs.
   - 9.b No; replace the aftertreatment harness.

232.4 SPN 3361/FMI 31 - GHG17

SPN 3361/FMI 31	
Description	The fault indicates that the Diesel Exhaust Fluid (DEF) Dosing Unit was switched off before completing a cycle
Monitored Parameter	DEF Pressure
Typical Enabling Conditions	When service routine is enabled and during infrequent in-use checks under non DEF dosing conditions
Monitor Sequence	None
Execution Frequency	Service tool and infrequent in-use checks during DEF dosing conditions
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Selective Catalyst Reduction (SCR) Airless Dosing System (ADS) Self-Check Routine

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple DEF system circuit failed faults; SPN (any) FMIs 3, 4, or 5; may also set SPN 3361/FMI 31. Are any other DEF system circuit-related faults also present?

   3.a Yes; repair those faults first.

   3.b No; Go to step 4.
4. Perform SCR ADS Self-Check Routine. Did the SCR ADS test pass with DEF pump speed and DEF pressure values in normal range?

- Acceptable DEF Pump Speed: greater than 750 rpm and less than 1800 rpm.
- Acceptable DEF Pressure: greater than 9000 mbar and less than 11000 mbar (130-160 psi).

   4.a Yes; Go to step 5.

   4.b No; replace the DEF Dosing Unit. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . Verify repairs by running SCR ADS Self-Check Routine.
5. Turn the ignition OFF.
6. Disconnect the DEF dosing unit harness connector.
7. Inspect the DEF dosing unit harness wiring and connector for damage, wire chafing, bent, spread or corroded pins. Is any damage found?

   7.a Yes; repair as necessary. Verify repairs by running SCR ADS Self-Check Routine.

   7.b No; Go to step 8.
8. Check all intermediate connections in chassis wiring, including Aftertreatment Control Module (ACM), for damage, wire chafing, bent, spread or corroded pins. Refer to OEM wiring diagrams for exact routing. Is any damage found?

   8.a Yes; repair as necessary. Verify repairs by running SCR ADS Self-Check Routine.

   8.b No; Go to step 9.
9. Restore all connections except the DEF dosing unit harness connector. Leave the DEF dosing unit harness connector disconnected.
10. Turn the ignition ON (key ON, engine OFF).

Note : Fault will remain active until key cycle with five-minute ACM power down.

11. Clear fault codes. Does the fault code change from SPN 3361/FMI 31 to SPN 3361/FMI 5?

    11.a Yes; replace the DEF Dosing Unit. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . Verify repairs by running SCR ADS Self-Check Routine.

11.b No; replace ACM.

Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" .Verify repairs by running SCR ADS Self-Check Routine.

Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module" .Verify repairs by running SCR ADS Self-Check Routine.

SPN 3363 (ACM) (GHG17)

233.1 SPN 3363/FMI 0 - GHG17

Diesel Exhaust Fluid Tank Temperature - High

Check as follows:

SPN 3363/FMI 0	
Description	Diesel Exhaust Fluid (DEF) Tank Temperature - High
Monitored Parameter	DEF Tank Temperature
Typical Enabling Conditions	Coolant Valve Closed greater than 1.5 hrs, Coolant Temperature greater than 158F
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	5 seconds
Dash Lamps	MIL
Engine Reaction	
Verification	Parked Regeneration

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Perform output component test service routine. Does fault SPN 3363/FMI 3, 4, or 5 become active during the routine?
   - 3.a Yes; repair those faults first; clear codes and release vehicle.

     Refer to section "SPN 3363/FMI 3 - GHG17" .

     Refer to section "SPN 3363/FMI 4 - GHG17" .

     Refer to section "SPN 3363/FMI 5 - GHG17" .
   - 3.b No; Go to step 4.
4. Using DiagnosticLink, monitor parameter AS021 DEF tank temperature.
5. Remove the DEF tank filler cap. Using an external thermometer (ex. infrared temperature gun), compare the actual DEF temperature (liquid) to the DiagnosticLink reported tank temperature. Is the AS021 DEF tank temperature 49°C (120°F) higher than the externally measured temperature?
   - 5.a Yes; Go to step 8.
   - 5.b No; Go to step 6.
6. Inspect coolant line routing from engine to DEF pump.
7. Are coolant lines routed correctly?
   - 7.a Yes; replace the DEF tank header assembly on the 13/23 gallon DEF tank or the coolant valve on 6-gallon DEF tanks and coach applications. Refer to section "Removal of the 13- and 23-Gallon Diesel Exhaust Fluid Tank Header Unit" .
   - 7.b No; correct coolant line routing.
8. Disconnect the DEF tank header harness connector. Inspect harness connector for bent, spread or corroded pins.
   - 8.a If pin damage is found, repair as necessary.
   - 8.b If no pin damage is found, replace the DEF tank header assembly. Refer to section "Removal of the 13- and 23-Gallon Diesel Exhaust Fluid Tank Header Unit" .

233.2 SPN 3363/FMI 1 - GHG17

Diesel Exhaust Fluid Tank Temperature - Low

This code sets when the Diesel Exhaust Fluid (DEF) tank temperature does not increase 0.5°C (0.9°F) within 300 seconds after the DEF tank coolant valve has been commanded on.

SPN 3363/FMI 1	
Description	DEF Tank Temperature - Low
Monitored Parameter	DEF Tank Temperature
Typical Enabling Conditions	Coolant Valve Commanded Open, Coolant Temperature Greater Than 70°C (158°F), Ambient Temperature Less Than -1°C (30°F) as measured by the ACM
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	30 Minutes
Dash Lamps	MIL
Engine Reaction	
Verification	Parked Regeneration

Possible causes:

- Coolant valve stuck closed
- Lack of coolant flow to the coolant valve
- Faulty DEF tank temperature sensor

1. Are there any cooling system issues or complaints?
   - 1.a Yes; service cooling system issues or complaints.
   - 1.b No; Go to step 2.
2. Inspect the DEF tank coolant valve supply lines for a restriction or closed shut off valves plumbed into the cooling system. Are there any restrictions present?
   - 2.a Yes; repair as necessary. Verify repair.
   - 2.b No; Go to step 3.
3. Connect DiagnosticLink . Go to step 4.
4. Turn the ignition ON (key ON, engine OFF). Go to step 5.
5. Command the DEF coolant valve on. (Service Routines > Activate Outputs > Coolant Valve Open: Start Coolant Valve Open Status). Does SPN 3363/FMI 3, 4 or 5 become active?
   - 5.a Yes; diagnose and repair the other SPN 3363 codes. Verify repair.
   - 5.b No; Go to step 6.
6. Remove the DEF tank fill cap, then use an external thermometer or infrared heat gun to measure the temperature of the DEF as close to the DEF tank temperature sensor as possible. Go to step 7.
7. Compare the externally measured DEF temperature reading to the DEF tank temperature reading in DiagnosticLink. Is the AS022 DEF tank temperature within 1 degree Celsius (2 degrees Fahrenheit) of the externally measured temperature?
   - 7.a Yes; Go to step 8.
   - 7.b No; replace the DEF tank header assembly due to a faulty DEF tank temperature sensor. Refer to section "Removal of the 13- and 23-Gallon Diesel Exhaust Fluid Tank Header Unit" or OEM literature for the 6-gallon DEF tank header unit. Verify repair.
8. Is the vehicle equipped with a 6-gallon DEF tank?
   - 8.a No; replace the DEF tank header assembly due to the coolant valve being stuck closed. Refer to section "Removal of the 13- and 23-Gallon Diesel Exhaust Fluid Tank Header Unit" .

8.b Yes; replace the DEF coolant valve. Refer to OEM literature for the 6-gallon DEF tank header unit. Verify repair.

233.3 SPN 3363/FMI 3 - GHG17

Diesel Exhaust Fluid Coolant Valve Circuit Failed High

SPN 3363/FMI 3	
Description	Diesel Exhaust Fluid (DEF) Coolant Valve Circuit Failed High
Monitored Parameter	DEF Coolant Valve
Typical Enabling Conditions	DEF Tank Temperature less than 36F and Engine coolant Temperature greater than 32F
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	Output Component Test

1. Connect to DiagnosticLink .
2. Turn ignition ON (key ON, engine OFF).
3. Perform Output Component Test.
4. Does the fault become active?
   - 4.a Yes; Go to step 6.
   - 4.b No; Go to step 5.
5. Repeat Output Component Test three times. The ignition must be cycled between each test. Does the fault become active?
   - 5.a Yes; Go to step 6.
   - 5.b No; clear the fault and release the vehicle.
6. Disconnect the DEF coolant valve harness connector.
7. Inspect the sensor harness for bent, spread, or corroded pins.
   - 7.a If the pins are bent, spread, or corroded, repair as necessary.
   - 7.b If connector shows no signs of damage, repair the short to battery (12 volts) between pin 1 of the DEF coolant valve harness connector and pin 34 of the Aftertreatment Control Module (ACM) 120-pin connector.

233.4 SPN 3363/FMI 4 - GHG17

Diesel Exhaust Fluid Valve Circuit Failed Low

SPN 3363/FMI 4	
Description	Diesel Exhaust Fluid (DEF) Valve Circuit Failed Low
Monitored Parameter	DEF Valve
Typical Enabling Conditions	DEF Tank Temperature less than 36F and Engine valve Temperature greater than 32F
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	Output Component Test

1. Ensure the ignition is OFF (key OFF, engine OFF).
2. Disconnect the DEF valve connector.
3. Inspect the sensor harness for bent, spread, or corroded pins.
   3.a If the pins are bent, spread, or corroded, repair as necessary.
   3.b If the connector shows no signs of damage, Go to step 4.
4. Disconnect the Aftertreatment Control Module (ACM) 120-pin connector.
5. Measure the resistance between pin 1 on the harness side of the DEF valve connector and ground.
   5.a If the resistance is less than 1K ohms, repair the wire between pin 1 of the DEF valve connector and pin 8 and 34 of the ACM 120-pin connector.
   5.b If the resistance is greater than 1K ohms, replace the DEF valve.

233.5 SPN 3363/FMI 5 - GHG17

Diesel Exhaust Fluid Coolant Valve Circuit Failed Open

SPN 3363/FMI 5	
Description	Diesel Exhaust Fluid (DEF) Coolant Valve Circuit Failed Open
Monitored Parameter	DEF Coolant Valve
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	Engine Idle (1 minute)

1. Disconnect the DEF coolant valve connector.
2. Inspect the sensor harness for bent, spread, or corroded pins.
   2.a If the pins are bent, spread, or corroded, repair as necessary.
   2.b If connector shows no signs of damage, Go to step 3. .
3. Turn the ignition ON (key ON, engine OFF).
4. Using the appropriate table below based on DEF tank size, measure for proper voltage as listed.
   4.a If voltage is within range, Go to step 5.
   4.b If voltage is not within range, repair wire between DEF coolant valve harness connector and the Aftertreatment Control Module (ACM).

13/23 Gallon DEF Tank	
DEF Coolant Valve Harness Connector	Voltage
Pin 4 and ground	greater than 11.5 volts
Pin 1 and ground	Approx 2.50 +/- 0.25
6 Gallon DEF Tank	
DEF Coolant Valve Harness Connector	Voltage
Pin 3 and ground	greater than 11.5 volts
Pin 1 and ground	Approx 2.50 +/- 0.25

5. Turn the ignition OFF.
6. Disconnect the ACM 120-pin connector.
7. Using the appropriate table below based on DEF tank size, measure the resistance between the DEF coolant valve harness connector and the ACM.
   7.a If resistance is within range, replace the DEF coolant valve.
   7.b If resistance is not within range, repair wire between DEF coolant valve harness connector and the ACM.

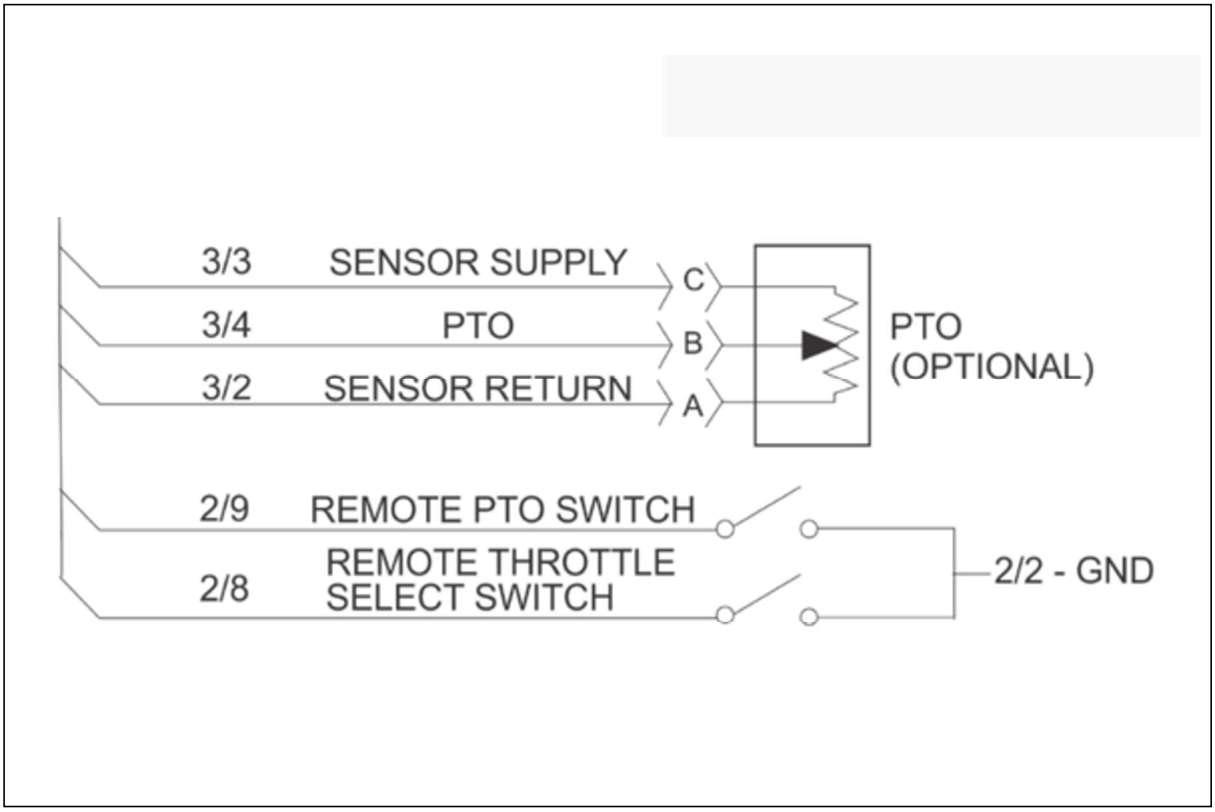
13/23 Gallon DEF Tank			
DEF Coolant Valve Harness Connector	ACM 120-Pin Connector	Acceptable Resistance	
Pin 4	Pin 19	less than 3 ohms	
Pin 1	Pin 34	less than 3 ohms	
6 Gallon DEF Tank			
DEF Coolant Valve Harness Connector	ACM 120-Pin Connector	Acceptable Resistance	
Pin 3	Pin 19	less than 3 ohms	
Pin 1	Pin 34	less than 3 ohms	

SPN 3461 (CPC) (GHG17)

234.1 SPN 3461/FMI 2 - GHG17

SPN 3461/FMI 2	
Description	This Code Sets When the Power Take Off (PTO) Input Has Been Grounded when the PTO is not Engaged.
Monitored Parameter	PGR13 PTO1 Switch Source
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink . Wait five minutes for all modules to power down.

Check as follows:



1. Is the vehicle equipped with a PTO?
   1.a Yes; Go to step 3.
   1.b No; Go to step 2.
2. Check for proper configuration of the Common Powertrain Controller (CPC) against the server information. See the *Electronic Controls Application and Installation Manual* section *Throttle Controls/Governors* for specific parameter programming information. Does the CPC have the proper configuration?

2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

2.b No; reprogram the CPC with the correct information as necessary. To verify repair.

3. Disconnect the PTO switch and measure the resistance between the PTO signal wire (B) and ground. Is the resistance less than 1000 ohms?

3.a Yes; repair a short to ground between the PTO signal wire (B) and ground.

3.b No; Go to step 4.

4. With the PTO switch still disconnected and the switch in the OFF position, measure the resistance across the PTO signal (B) and the sensor return (A). Is the resistance less than five ohms?

4.a Yes; the PTO switch is internally shorted and should be replaced.

4.b No; the PTO is stuck in the engaged position. Repair or replace the PTO.

234.2 SPN 3461/FMI 7

SPN 3461/FMI 7	
Description	This Code Sets When the Power Take Off (PTO) Drive Installation Does Not Match Up with the Programmed Parameters for that PTO, Causing a Mismatch Between the PTO Switch and Having No PTO Feedback
Monitored Parameter	PGR13 PTO1 Switch Source
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Ignition ON

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?

   1.a Yes; repair the battery voltage concern. Verify repair.

   1.b No; Go to step 2.

2. Check for proper configuration of the Common Powertrain Controller (CPC) against the server information. See the *Electronic Controls Application and Installation Manual* section *Throttle Controls/Governors* for specific parameter programming information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. To verify repair, Go to step 3.

3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink . Wait five minutes for all modules to power down. Verify repair.

SPN 3464 (MCM) (GHG17)

235.1 SPN 3464/FMI 3 - GHG17

H Bridge 1 Circuit Shorted to Battery

SPN 3464/FMI 3	
Description	H Bridge 1 Circuit Shorted to Battery
Monitored Parameter	Intake Throttle Valve
Typical Enabling Conditions	Key On & Engine Off
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	Engine OFF, then 1 minute idle

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition OFF.
3. Disconnect and inspect the Intake Throttle Valve (ITV) electrical connector. Is there damage or corrosion present?
   - 3.a Yes; repair as necessary. Verify repair.
   - 3.b No; Go to step 4.
4. Turn the ignition ON (key ON, engine OFF).
5. Is fault code SPN 3464/FMI 3 still active?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the ITV.
6. Reconnect the ITV electrical connector.
7. Turn the ignition OFF.
8. Turn the ignition ON (key ON, engine OFF).
9. Once the ITV completes its cycle, disconnect the ITV electrical connector.
10. Measure the voltage between pin 4 of the ITV electrical connector harness side and ground. Is there any voltage present?
    - 10.a Yes; repair the short to voltage on the circuit between pin 4 of the ITV electrical connector and pin 100 of the 120-pin Motor Control Module (MCM) electrical connector.
    - 10.b No; Go to step 11.
11. Measure the voltage between pin 5 of the ITV electrical connector harness side and Ground. Is there any voltage present?
    - 11.a Yes; repair the short to voltage on the circuit between pin 5 of the ITV electrical connector and pin 101 of the 120-pin MCM electrical connector.
    - 11.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

235.2 SPN 3464/FMI 4 - GHG17

H Bridge 1 Circuit Shorted to Ground

SPN 3464/FMI 4	
Description	H Bridge 1 Circuit Shorted to Ground
Monitored Parameter	Intake Throttle Valve
Typical Enabling Conditions	Key On & Engine Off
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	Engine OFF, then 1 minute idle

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition OFF.

3. Disconnect and inspect the Intake Throttle Valve (ITV) electrical connector. Is there damage or corrosion present?
   - 3.a Yes; repair as necessary. Verify repair.
   - 3.b No; Go to step 4.
4. Turn the ignition ON (key ON, engine OFF).
5. Is fault code SPN 3464/FMI 4 still active?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the ITV.
6. Turn the ignition OFF.
7. Measure the resistance between pin 4 of the ITV electrical connector harness side and ground. Is the resistance greater than 10k ohms?
   - 7.a Yes; Go to step 10.
   - 7.b No; Go to step 8.
8. Disconnect and inspect the MCM 120-pin electrical connector. Is there damage or corrosion present?
   - 8.a Yes; repair as necessary.
   - 8.b No; Go to step 9.
9. Measure the resistance between pin 4 of the ITV electrical connector harness side and ground. Is the resistance greater than 10k ohms?
   - 9.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" .
   - 9.b No; repair the short to ground on the circuit between pin 4 of the ITV electrical connector and pin 100 of the 120-pin MCM electrical connector.
10. Measure the resistance between pin 5 of the ITV electrical connector harness side and ground. Is the resistance greater than 10k ohms?
    - 10.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" .
    - 10.b No; Go to step 11.
11. Disconnect and inspect the MCM 120-pin electrical connector. Is there damage or corrosion present?
    - 11.a Yes; repair as necessary.
    - 11.b No; Go to step 12.
12. Measure the resistance between pin 5 of the ITV electrical connector harness side and ground. Is the resistance greater than 10k ohms?
    - 12.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" .
    - 12.b No; repair the short to ground on the circuit between pin 5 of the ITV electrical connector and pin 101 of the 120-pin MCM electrical connector.

235.3 SPN 3464/FMI 5 - GHG17

H Bridge 1 Circuit Open Load

SPN 3464/FMI 5	
Description	H Bridge 1 Circuit Open Load
Monitored Parameter	Intake Throttle Valve
Typical Enabling Conditions	Key On & Engine Off
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	Engine OFF, then 1 minute idle

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Turn the ignition OFF.
2. Disconnect and inspect the ITV electrical connector. Is there any damage or corrosion present?

2.a Yes; repair as necessary.

2.b No; Go to step 3.

3. Measure the resistance across pins 4 and 5 of the ITV connector components side. Is the resistance less than 3 ohms?

3.a Yes; Go to step 4.

3.b No; replace the ITV.

4. Disconnect and inspect the 120-pin MCM electrical connector. Is there any damage or corrosion present?

4.a Yes; repair as necessary.

4.b No; Go to step 5.

5. Measure the resistance between pin 4 of the ITV electrical connector harness side and pin 100 of the 120-pin MCM electrical connector harness side. Is the resistance less than 5 ohms?

5.a Yes; Go to step 6.

5.b No; repair the circuit between pin 4 of the ITV electrical connector and pin 100 of the 120-pin MCM electrical connector.

6. Measure the resistance between pin 5 of the ITV electrical connector harness side and pin 101 of the 120-pin MCM electrical connector harness side. Is the resistance less than 5 ohms?

6.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" .

6.b No; repair the circuit between pin 5 of the ITV electrical connector and pin 101 of the 120-pin MCM electrical connector.

235.4 SPN 3464/FMI 16 – GHG17

Intake Manifold Pressure Too High (Restricted Mode)

SPN 3464/FMI 16			
Description	Intake Manifold Pressure Over-boost Detected During a Regeneration		
Monitored Parameter	Intake Manifold Pressure		
Typical Enabling Conditions	General Enabling Condition: Engine is in normal mode (not regeneration), steady state operation (highway cruise operation)		
	Specific Enabling Conditions: See table below		
	Engine Parameter	Min	Max
	Engine Speed (rpm)	1130	1810
	Engine Torque N·m (lb·ft)	1100 (811)	
	Intake Air Throttle Position (%)		5
	Engine Coolant Outlet Temperature °C (°F)	65 (149)	
	Barometric Pressure (mbar)	755	
	Ambient Temperature °C (°F)	-8 (18)	
	Engine Speed Gradient (rpm/s)	-10	10
	Fuel Mass Gradient ((mg/stroke)/s)	-10	10
Monitor Sequence	None		
Execution Frequency	Continuous when enabling conditions met		
Typical Duration	15 Seconds		
Dash Lamps	MIL, CEL		
Engine Reaction	None		
Verification	Once engine is at standard operating temperature, drive at highway speed with loaded trailer above 1130 rpm continuously for five minutes.		

1. Turn the ignition ON (key ON, engine OFF).
2. Check for other codes. Are any other fault codes present?
   - 2.a Yes; repair those faults first.
   - 2.b No; Go to step 3.
3. Inspect the front grill for air blockage including winter fronts, plows, or large hose reels. Is any blockage found?
   - 3.a Yes; repair as needed.
   - 3.b No; Go to step 4.
4. Inspect hood seals. Are seals missing or damaged?
   - 4.a Yes; repair as needed.
   - 4.b No; Go to step 5.
5. Using DiagnosticLink , measure barometric pressure. Is barometric pressure above 69 kPa (10 psi) and below 110 kPa (16 psi)?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs.
6. Measure the inlet manifold pressure and the barometric pressure. Is the inlet manifold pressure within 10.3 kPa (1.5 psi) of barometric pressure?
   - 6.a Yes; Go to step 9.
   - 6.b No; Go to step 7.

7. Disconnect the inlet manifold pressure sensor harness connector.
8. Inspect the inlet manifold pressure sensor and harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage present?
   - 8.a Yes; repair as necessary.
   - 8.b No; replace the inlet manifold pressure sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" .
9. Check for engine type. Is engine equipped with an Asymmetrical Turbocharger (AT)?
   - 9.a Yes; Go to step 10.
   - 9.b No; Go to step 28.
10. Turn the ignition OFF.
11. Inspect the wastegate actuator and the plumbing to and from the actuator. Verify wastegate linkage. Is any damage found?
    - 11.a Yes; repair as necessary. Verify repair.
    - 11.b No; Go to step 12.
12. Inspect the air line connection to the wastegate solenoid for leaks. Are any air leaks found?
    - 12.a Yes; repair or replace as necessary. Verify repair.
    - 12.b No; Go to step 13.
13. Turn the ignition ON (key ON, engine OFF).

Note : Wastegate will not remain open if DiagnosticLink slide control is set above 95%.

14. Using DiagnosticLink, activate turbo control (wastegate) from the I/O Control window. Run slide control up to 95% - adjust Duration to 20 seconds- (Click Set). Wastegate will open with air psi available. Does wastegate open when commanded?
    - 14.a Yes; Go to step 15.
    - 14.b No; Go to step 16.
15. Does wastegate close when the duration timer expires?
    - 15.a Yes; Go to step 29.
    - 15.b No; Go to step 16.
16. Drain air tanks. Refer to OEM literature for details.
17. Install a suitable air pressure gauge in the inlet air pressure line to the waste gate solenoid from the vehicle.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

> **⚠ 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. Start engine to stabilize the vehicle air pressure.
19. With a suitable air pressure gauge installed, measure the inlet air pressure to the waste gate solenoid from the vehicle. Is the pressure at least 599 kPa (87 psi)?
    - 19.a Yes; restore air hose connection. Go to step 20.
    - 19.b No; refer to OEM troubleshooting for air pressure issues.
20. Turn the ignition OFF.
21. With the vehicle air pressure stabilized, use a suitable air pressure gauge to measure the outlet air pressure from the solenoid to the turbocharger wastegate.
22. Turn the ignition ON (key ON, engine OFF).
23. Is the pressure out of the wastegate solenoid less than one psi?
    - 23.a Yes; Go to step 24.
    - 23.b No; Go to step 26.
24. Using DiagnosticLink, activate turbo control (wastegate) from I/O Control window. Run slide control up to 50% - adjust Duration to 20 seconds- (Click Set). Is the pressure out of the wastegate solenoid between 117 and 158 kPa (17 and 23 psi)?
    - 24.a Yes; Go to step 25.
    - 24.b No; Go to step 26.
25. Using DiagnosticLink, activate turbo control (wastegate) from I/O Control window. Run slide control up to 95% - adjust Duration to 20 seconds- (Click Set). Is the pressure out of the wastegate solenoid between 241 and 275 kPa (35 and 40 psi)?
    - 25.a Yes; Go to step 29.
    - 25.b No; Go to step 26.
26. Turn the ignition OFF.
27. Disconnect the wastegate solenoid harness connector.
28. Inspect the wastegate solenoid and harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
    - 28.a Yes; repair as necessary. Verify repair.
    - 28.b No; replace the wastegate solenoid.
29. Turn the ignition OFF.
30. Disconnect the MCM 120-pin connector.
31. Inspect the MCM 120-pin connector and the 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Is any damage found?
    - 31.a Yes; repair as necessary. Verify repair.
    - 31.b No; Go to step 32.
32. Install a test MCM and retest with verification cycle. Does fault code return?
    - 32.a Yes; Go to step 33.
    - 32.b No; replace MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs.
33. Install original MCM. Bring to operating temperature of 71°C (160°F). Road test the vehicle. Drive at highway speed with loaded trailer above 1130 rpm continuously for five minutes. Does fault become active?

33.a Yes; replace turbocharger.

Refer to section "Removal of the DD13 and DD15 Turbocharger" .

Refer to section "Removal of the DD16 Turbocharger" .

33.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

235.5 SPN 3464/FMI 18 - GHG17

Intake Manifold Pressure Too Low (Restricted Mode)

SPN 3464/FMI 18 - GHG17			
Description	Intake Manifold Pressure Lower than Expected During a Regeneration		
Monitored Parameter	Intake Manifold Pressure		
Typical Enabling Conditions	General Enabling Condition: Engine is in normal mode (not regeneration), steady state operation (highway cruise operation)		
	Specific Enabling Conditions: See table below		
	Engine Parameter	Min	Max
	Engine Speed (rpm)	1130	1810
	Engine Torque N·m (lb·ft)	1100 (811)	
	Intake Air Throttle Position (%)		5
	Engine Coolant Outlet Temperature °C (°F)	65 (149)	
	Barometric Pressure (mbar)	755	
	Ambient Temperature °C (°F)	-8 (18)	
	Engine Speed Gradient (rpm/s)	-10	10
	Fuel Mass Gradient ((mg/stroke)/s)	-10	10
Monitor Sequence	None		
Execution Frequency	Continuous when enabling conditions met		
Typical Duration	15 Seconds		
Dash Lamps	MIL, CEL		
Engine Reaction	None		
Verification	Once engine is at standard operating temperature, drive at highway speed with loaded trailer above 1130 rpm continuously for five minutes.		

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Check for other codes. Are any other fault codes present?
   - 2.a Yes; repair those faults first.
   - 2.b No; Go to step 3.
3. Check the Motor Control Module (MCM) software level. Compare the current MCM software level to the server. Is the MCM software at the latest level?
   - 3.a Yes; Go to step 4.
   - 3.b No; update the MCM software level and perform the verification procedure in the table above. If the fault code does not return, release the vehicle. If the fault code returns, Go to step 4.
4. Inspect the front grill for air blockage including winter fronts, plows, or large hose reels. Is any blockage found?
   - 4.a Yes; repair as needed.
   - 4.b No; Go to step 5.
5. Inspect hood seals. Are seals missing or damaged?
   - 5.a Yes; repair as needed.
   - 5.b No; Go to step 6.
6. Inspect the entire air intake system, including the Charge Air Cooler (CAC), for leaks and/or restrictions. Are any air intake system leaks or restrictions found?

6.a Yes; repair as necessary. Verify repairs. Retest with verification cycle; once engine is at standard operating temperature, drive at highway speed with loaded trailer above 1130 rpm continuously for five minutes.

6.b No; Go to step 7.

7. Using DiagnosticLink , measure barometric pressure. Is barometric pressure above 69 kPa (10 psi) and below 110 kPa (16 psi)?

7.a Yes; Go to step 8.

7.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs.

8. Using DiagnosticLink, compare inlet manifold pressure to barometric pressure. Is the inlet manifold pressure within 10.3 kPa (1.5 psi) of barometric pressure?

8.a Yes; Go to step 11.

8.b No; Go to step 9.

9. Disconnect the inlet manifold pressure sensor harness connector.

10. Inspect the inlet manifold pressure sensor and harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

10.a Yes; repair as necessary. Verify repairs.

10.b No; replace the inlet manifold pressure sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" . Verify repairs.

11. Visually inspect exhaust system for leaks or damage, including manifold, gaskets, turbine housing, EGR valve, and Aftertreatment Device (ATD). Are any leaks found?

11.a Yes; repair as necessary. Verify repairs. Retest with verification cycle; once engine is at standard operating temperature, drive at highway speed with loaded trailer above 1130 rpm continuously for five minutes. If fault code returns, Go to step 12.

11.b No; Go to step 12.

12. Check for engine type. Is engine equipped with an asymmetrical turbocharger?

12.a Yes; Go to step 13.

12.b No; Go to step 30.

13. Turn the ignition OFF.

14. Inspect the wastegate actuator and the plumbing to and from the actuator. Verify wastegate linkage. Is any damage found?

14.a Yes; repair as necessary. Verify repairs.

14.b No; Go to step 15.

15. Inspect the air line connection to the wastegate solenoid for leaks. Are any air leaks found?

15.a Yes; repair or replace as necessary. Verify repairs.

15.b No; Go to step 16.

16. Turn the ignition ON (key ON, engine OFF).

Note : Wastegate will not remain open if DiagnosticLink slide control is set above 95%.

17. Using DiagnosticLink, activate turbo control (wastegate) from I/O Control window. Run slide control up to 95% - adjust Duration to 20 seconds- (Click Set). Wastegate will open with air psi available. Does wastegate open when commanded?

17.a Yes; Go to step 18.

17.b No; Go to step 19.

18. Does wastegate close when the duration timer expires?

18.a Yes; Go to step 30.

18.b No; Go to step 19.

19. Drain air tanks. Refer to OEM literature for details.

20. Install a suitable air pressure gauge in the inlet air pressure line to the waste gate solenoid from the vehicle.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

> **⚠ 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.

21. Start engine to stabilize vehicle air pressure.
22. With a suitable air pressure gauge installed, measure the inlet air pressure to the wastegate solenoid from the vehicle. Is the pressure at least 599 kPa (87psi)?

    22.a Yes; restore air hose connection. Go to step 23.

    22.b No; refer to OEM troubleshooting for air pressure issues.
23. Turn the ignition OFF.
24. With the vehicle air pressure stabilized, use a suitable air pressure gauge to measure the outlet air pressure from the solenoid to the turbocharger wastegate.
25. Turn the ignition ON (key ON, engine OFF). Is the pressure out of the wastegate solenoid less than one psi?

    25.a Yes; Go to step 26.

    25.b No; Go to step 28.
26. Using DiagnosticLink, activate turbo control (wastegate) from I/O Control window. Run slide control up to 50% - adjust Duration to 20 seconds- (Click Set). Is the pressure out of the wastegate solenoidbetween 117 and 158 kPa (17-23 psi)?

    26.a Yes; Go to step 27.

    26.b No; Go to step 28.
27. Using DiagnosticLink, activate turbo control (wastegate) from I/O Control window. Run slide control up to 95% - adjust Duration to 20 seconds- (Click Set). Is the pressure out of the wastegate solenoid between 241 and 275 kPa (35-40 psi)?

    27.a Yes; Go to step 30.

    27.b No; Go to step 28.
28. Disconnect the wastegate solenoid harness connector.
29. Inspect the wastegate solenoid and harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

    29.a Yes; repair as necessary. Verify repairs.

29.b No; replace the wastegate solenoid.

30. Turn the ignition OFF.

31. Inspect the turbocharger for damage. Is any damage present?

31.a Yes; repair as necessary. Verify repairs.

If fault returns, for AT engines, Go to step 33.

If fault returns, for Turbo-Compound (TC) engines, Go to step 32.

31.b No; for AT engines, Go to step 33.

For TC engines, Go to step 32.

32. Inspect the axial power turbine for damage. Is any damage present?

32.a Yes; repair as necessary. Clear codes and verify repairs. Retest with verification cycle; once engine is at standard operating temperature, drive at highway speed with loaded trailer above 1130 rpm continuously for five minutes.

If fault returns, Go to step 33.

32.b No; Go to step 33.

33. Turn the ignition ON (key ON, engine OFF).

34. Inspect the Diesel Oxidation Catalyst (DOC) pressure sensor tube and elbow and the Diesel Particulate Filter (DPF) pressure sensor tube and elbow for leaks, kinks, or blockages. Are any leaks, kinks, or blockages found?

34.a Yes; repair as necessary.

34.b No; Go to step 35.

⚠WARNING

ENGINE EXHAUST

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

⚠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.

⚠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.

35. Start engine, allow to warm up so coolant temperature is greater than 65°C (149°F).

Note : Normal DOC pressure is less than 10 kPa (1.5 psi) for a 1-box ATS and 13 kPa (1.9 psi) for a 2-box ATS.

36. Using DiagnosticLink, monitor DOC Inlet Pressure while performing a parked regeneration. Refer to section "Performing a Parked Regeneration - GHG17" . Does the DOC Inlet Pressure start out high and stay high?

36.a Yes; the DOC(s) are plugged. Refer to 13TS-15 for DOC inspection, cleaning, and replacement procedures.

36.b No; if DOC Inlet Pressure starts out high and then decreases, the DOCs were plugged and the parked regen cleared them. Clear any fault codes. Verify repairs. If DOC pressure reading is low or fault code returns, Go to step 37.

37. Turn the ignition OFF.
38. Disconnect the MCM 120-pin connector.
39. Inspect the MCM 120-pin connector and the 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Are any signs of damage found?
    - 39.a Yes; repair as necessary. Verify repairs.
    - 39.b No; Go to step 40.
40. Install a test MCM and retest with verification cycle. Does fault code return?
    - 40.a Yes; Go to step 41.
    - 40.b No; replace MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs.
41. Install original MCM. Bring to operating temperature of 71°C (160°F). Road test the vehicle. Drive at highway speed with loaded trailer above 1130 rpm continuously for five minutes. Does fault become active?
    - 41.a Yes; replace turbocharger.

      Refer to section "Removal of the DD13 and DD15 Turbocharger" .

      Refer to section "Removal of the DD16 Turbocharger" .
    - 41.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" Verify repairs.

235.6 SPN 3464/FMI 31 - GHG17

Intake air throttle control electrical fault

SPN 3464/FMI 31	
Description	Intake Air Throttle Control Electrical Fault
Monitored Parameter	Intake Throttle Valve
Typical Enabling Conditions	Key On & Engine Off
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	Engine OFF, then 1 minute idle

1. Is fault code active?
   - 1.a Yes; Go to step 3.
   - 1.b No; Go to step 2.
2. Cycle the ignition switch OFF, wait 15 seconds, turn ignition back ON and repeat Key ON/OFF sequence three times. Does the fault become active?
   - 2.a Yes; Go to step 3.
   - 2.b No; testing complete. Clear all faults and release vehicle.
3. Turn ignition OFF.
4. Disconnect the Intake Throttle Valve (ITV) harness connector.
5. Disconnect the Motor Control Module (MCM) 120-pin connector.
6. Measure the resistance between pin 4 of the ITV harness connector and ground.
   - 6.a If the resistance is less than 1k ohms, repair wire between pin 4 of the ITV harness connector and ground.
   - 6.b If the resistance is greater than 1k ohms, Go to step 7.
7. Measure the resistance between pin 5 of the ITV harness connector and ground.
   - 7.a If the resistance is less than 1k ohms, repair wire between pin 5 of the ITV harness connector and ground.
   - 7.b If the resistance is greater than 1k ohms, Go to step 8.
8. Measure the resistance between pin 4 of the ITV harness connector and pin 100 of the MCM 120-pin connector.
   - 8.a If the resistance is less than 3 ohms, Go to step 9.
   - 8.b If the resistance is greater than 3 ohms, repair wire between pin 4 of the ITV harness connector and pin 100 of the MCM 120-pin connector.
9. Measure the resistance between pin 5 of the ITV harness connector and pin 101 of the MCM 120-pin connector.
   - 9.a If the resistance is less than 3 ohms, replace the Intake Throttle Valve. Refer to section "Removal of the Intake Throttle Valve and Adaptor"
   - 9.b If the resistance is greater than 3 ohms, repair wire between pin 5 of the Intake Throttle Valve harness connector and pin 101 of the MCM 120-pin connector.

235.1 SPN 3464/FMI 3 - GHG17

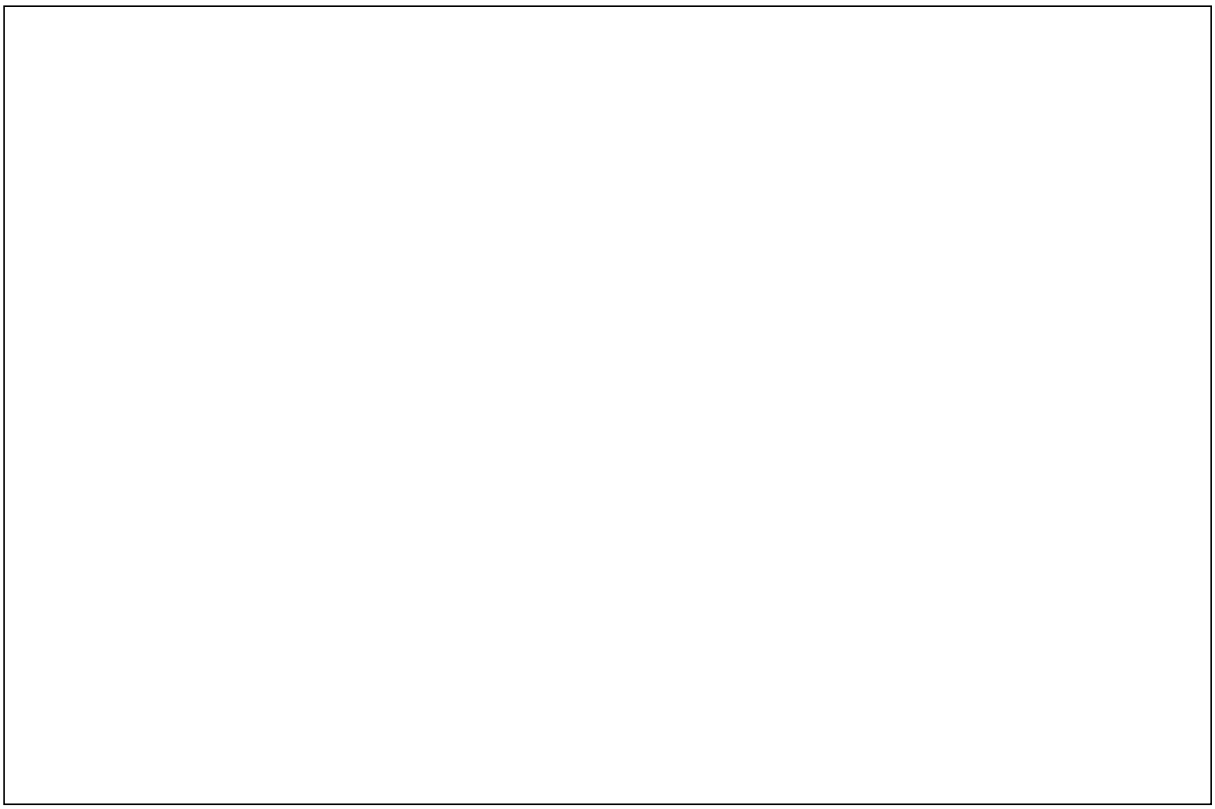
H Bridge 1 Circuit Shorted to Battery

SPN 3464/FMI 3	
Description	H Bridge 1 Circuit Shorted to Battery
Monitored Parameter	Intake Throttle Valve
Typical Enabling Conditions	Key On & Engine Off
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	Engine OFF, then 1 minute idle

WARNING

ENGINE EXHAUST

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



Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition OFF.

3. Disconnect and inspect the Intake Throttle Valve (ITV) electrical connector. Is there damage or corrosion present?
   - 3.a Yes; repair as necessary. Verify repair.
   - 3.b No; Go to step 4.
4. Turn the ignition ON (key ON, engine OFF).
5. Is fault code SPN 3464/FMI 3 still active?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the ITV.
6. Reconnect the ITV electrical connector.
7. Turn the ignition OFF.
8. Turn the ignition ON (key ON, engine OFF).
9. Once the ITV completes its cycle, disconnect the ITV electrical connector.
10. Measure the voltage between pin 4 of the ITV electrical connector harness side and ground. Is there any voltage present?
    - 10.a Yes; repair the short to voltage on the circuit between pin 4 of the ITV electrical connector and pin 100 of the 120-pin Motor Control Module (MCM) electrical connector.
    - 10.b No; Go to step 11.
11. Measure the voltage between pin 5 of the ITV electrical connector harness side and Ground. Is there any voltage present?
    - 11.a Yes; repair the short to voltage on the circuit between pin 5 of the ITV electrical connector and pin 101 of the 120-pin MCM electrical connector.
    - 11.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

235.2 SPN 3464/FMI 4 - GHG17

H Bridge 1 Circuit Shorted to Ground

SPN 3464/FMI 4	
Description	H Bridge 1 Circuit Shorted to Ground
Monitored Parameter	Intake Throttle Valve
Typical Enabling Conditions	Key On & Engine Off
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	Engine OFF, then 1 minute idle

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition OFF.

3. Disconnect and inspect the Intake Throttle Valve (ITV) electrical connector. Is there damage or corrosion present?
   - 3.a Yes; repair as necessary. Verify repair.
   - 3.b No; Go to step 4.
4. Turn the ignition ON (key ON, engine OFF).
5. Is fault code SPN 3464/FMI 4 still active?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the ITV.
6. Turn the ignition OFF.
7. Measure the resistance between pin 4 of the ITV electrical connector harness side and ground. Is the resistance greater than 10k ohms?
   - 7.a Yes; Go to step 10.
   - 7.b No; Go to step 8.
8. Disconnect and inspect the MCM 120-pin electrical connector. Is there damage or corrosion present?
   - 8.a Yes; repair as necessary.
   - 8.b No; Go to step 9.
9. Measure the resistance between pin 4 of the ITV electrical connector harness side and ground. Is the resistance greater than 10k ohms?
   - 9.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" .
   - 9.b No; repair the short to ground on the circuit between pin 4 of the ITV electrical connector and pin 100 of the 120-pin MCM electrical connector.
10. Measure the resistance between pin 5 of the ITV electrical connector harness side and ground. Is the resistance greater than 10k ohms?
    - 10.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" .
    - 10.b No; Go to step 11.
11. Disconnect and inspect the MCM 120-pin electrical connector. Is there damage or corrosion present?
    - 11.a Yes; repair as necessary.
    - 11.b No; Go to step 12.
12. Measure the resistance between pin 5 of the ITV electrical connector harness side and ground. Is the resistance greater than 10k ohms?
    - 12.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" .
    - 12.b No; repair the short to ground on the circuit between pin 5 of the ITV electrical connector and pin 101 of the 120-pin MCM electrical connector.

235.3 SPN 3464/FMI 5 - GHG17

H Bridge 1 Circuit Open Load

SPN 3464/FMI 5	
Description	H Bridge 1 Circuit Open Load
Monitored Parameter	Intake Throttle Valve
Typical Enabling Conditions	Key On & Engine Off
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	Engine OFF, then 1 minute idle

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Turn the ignition OFF.
2. Disconnect and inspect the ITV electrical connector. Is there any damage or corrosion present?

2.a Yes; repair as necessary.

2.b No; Go to step 3.

3. Measure the resistance across pins 4 and 5 of the ITV connector components side. Is the resistance less than 3 ohms?

3.a Yes; Go to step 4.

3.b No; replace the ITV.

4. Disconnect and inspect the 120-pin MCM electrical connector. Is there any damage or corrosion present?

4.a Yes; repair as necessary.

4.b No; Go to step 5.

5. Measure the resistance between pin 4 of the ITV electrical connector harness side and pin 100 of the 120-pin MCM electrical connector harness side. Is the resistance less than 5 ohms?

5.a Yes; Go to step 6.

5.b No; repair the circuit between pin 4 of the ITV electrical connector and pin 100 of the 120-pin MCM electrical connector.

6. Measure the resistance between pin 5 of the ITV electrical connector harness side and pin 101 of the 120-pin MCM electrical connector harness side. Is the resistance less than 5 ohms?

6.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" .

6.b No; repair the circuit between pin 5 of the ITV electrical connector and pin 101 of the 120-pin MCM electrical connector.

235.4 SPN 3464/FMI 16 – GHG17

Intake Manifold Pressure Too High (Restricted Mode)

SPN 3464/FMI 16			
Description	Intake Manifold Pressure Over-boost Detected During a Regeneration		
Monitored Parameter	Intake Manifold Pressure		
Typical Enabling Conditions	General Enabling Condition: Engine is in normal mode (not regeneration), steady state operation (highway cruise operation)		
	Specific Enabling Conditions: See table below		
	Engine Parameter	Min	Max
	Engine Speed (rpm)	1130	1810
	Engine Torque N·m (lb·ft)	1100 (811)	
	Intake Air Throttle Position (%)		5
	Engine Coolant Outlet Temperature °C (°F)	65 (149)	
	Barometric Pressure (mbar)	755	
	Ambient Temperature °C (°F)	-8 (18)	
	Engine Speed Gradient (rpm/s)	-10	10
	Fuel Mass Gradient ((mg/stroke)/s)	-10	10
Monitor Sequence	None		
Execution Frequency	Continuous when enabling conditions met		
Typical Duration	15 Seconds		
Dash Lamps	MIL, CEL		
Engine Reaction	None		
Verification	Once engine is at standard operating temperature, drive at highway speed with loaded trailer above 1130 rpm continuously for five minutes.		

1. Turn the ignition ON (key ON, engine OFF).
2. Check for other codes. Are any other fault codes present?
   - 2.a Yes; repair those faults first.
   - 2.b No; Go to step 3.
3. Inspect the front grill for air blockage including winter fronts, plows, or large hose reels. Is any blockage found?
   - 3.a Yes; repair as needed.
   - 3.b No; Go to step 4.
4. Inspect hood seals. Are seals missing or damaged?
   - 4.a Yes; repair as needed.
   - 4.b No; Go to step 5.
5. Using DiagnosticLink , measure barometric pressure. Is barometric pressure above 69 kPa (10 psi) and below 110 kPa (16 psi)?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs.
6. Measure the inlet manifold pressure and the barometric pressure. Is the inlet manifold pressure within 10.3 kPa (1.5 psi) of barometric pressure?
   - 6.a Yes; Go to step 9.
   - 6.b No; Go to step 7.

7. Disconnect the inlet manifold pressure sensor harness connector.
8. Inspect the inlet manifold pressure sensor and harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage present?
   - 8.a Yes; repair as necessary.
   - 8.b No; replace the inlet manifold pressure sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" .
9. Check for engine type. Is engine equipped with an Asymmetrical Turbocharger (AT)?
   - 9.a Yes; Go to step 10.
   - 9.b No; Go to step 28.
10. Turn the ignition OFF.
11. Inspect the wastegate actuator and the plumbing to and from the actuator. Verify wastegate linkage. Is any damage found?
    - 11.a Yes; repair as necessary. Verify repair.
    - 11.b No; Go to step 12.
12. Inspect the air line connection to the wastegate solenoid for leaks. Are any air leaks found?
    - 12.a Yes; repair or replace as necessary. Verify repair.
    - 12.b No; Go to step 13.
13. Turn the ignition ON (key ON, engine OFF).

Note : Wastegate will not remain open if DiagnosticLink slide control is set above 95%.

14. Using DiagnosticLink, activate turbo control (wastegate) from the I/O Control window. Run slide control up to 95% - adjust Duration to 20 seconds- (Click Set). Wastegate will open with air psi available. Does wastegate open when commanded?
    - 14.a Yes; Go to step 15.
    - 14.b No; Go to step 16.
15. Does wastegate close when the duration timer expires?
    - 15.a Yes; Go to step 29.
    - 15.b No; Go to step 16.
16. Drain air tanks. Refer to OEM literature for details.
17. Install a suitable air pressure gauge in the inlet air pressure line to the waste gate solenoid from the vehicle.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

> **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. Start engine to stabilize the vehicle air pressure.
19. With a suitable air pressure gauge installed, measure the inlet air pressure to the waste gate solenoid from the vehicle. Is the pressure at least 599 kPa (87 psi)?
    - 19.a Yes; restore air hose connection. Go to step 20.
    - 19.b No; refer to OEM troubleshooting for air pressure issues.
20. Turn the ignition OFF.
21. With the vehicle air pressure stabilized, use a suitable air pressure gauge to measure the outlet air pressure from the solenoid to the turbocharger wastegate.
22. Turn the ignition ON (key ON, engine OFF).
23. Is the pressure out of the wastegate solenoid less than one psi?
    - 23.a Yes; Go to step 24.
    - 23.b No; Go to step 26.
24. Using DiagnosticLink, activate turbo control (wastegate) from I/O Control window. Run slide control up to 50% - adjust Duration to 20 seconds- (Click Set). Is the pressure out of the wastegate solenoid between 117 and 158 kPa (17 and 23 psi)?
    - 24.a Yes; Go to step 25.
    - 24.b No; Go to step 26.
25. Using DiagnosticLink, activate turbo control (wastegate) from I/O Control window. Run slide control up to 95% - adjust Duration to 20 seconds- (Click Set). Is the pressure out of the wastegate solenoid between 241 and 275 kPa (35 and 40 psi)?
    - 25.a Yes; Go to step 29.
    - 25.b No; Go to step 26.
26. Turn the ignition OFF.
27. Disconnect the wastegate solenoid harness connector.
28. Inspect the wastegate solenoid and harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
    - 28.a Yes; repair as necessary. Verify repair.
    - 28.b No; replace the wastegate solenoid.
29. Turn the ignition OFF.
30. Disconnect the MCM 120-pin connector.
31. Inspect the MCM 120-pin connector and the 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Is any damage found?
    - 31.a Yes; repair as necessary. Verify repair.
    - 31.b No; Go to step 32.
32. Install a test MCM and retest with verification cycle. Does fault code return?
    - 32.a Yes; Go to step 33.
    - 32.b No; replace MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs.
33. Install original MCM. Bring to operating temperature of 71°C (160°F). Road test the vehicle. Drive at highway speed with loaded trailer above 1130 rpm continuously for five minutes. Does fault become active?

33.a Yes; replace turbocharger.

Refer to section "Removal of the DD13 and DD15 Turbocharger" .

Refer to section "Removal of the DD16 Turbocharger" .

33.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

235.5 SPN 3464/FMI 18 - GHG17

Intake Manifold Pressure Too Low (Restricted Mode)

SPN 3464/FMI 18 - GHG17			
Description	Intake Manifold Pressure Lower than Expected During a Regeneration		
Monitored Parameter	Intake Manifold Pressure		
Typical Enabling Conditions	General Enabling Condition: Engine is in normal mode (not regeneration), steady state operation (highway cruise operation)		
	Specific Enabling Conditions: See table below		
	Engine Parameter	Min	Max
	Engine Speed (rpm)	1130	1810
	Engine Torque N·m (lb·ft)	1100 (811)	
	Intake Air Throttle Position (%)		5
	Engine Coolant Outlet Temperature °C (°F)	65 (149)	
	Barometric Pressure (mbar)	755	
	Ambient Temperature °C (°F)	-8 (18)	
	Engine Speed Gradient (rpm/s)	-10	10
	Fuel Mass Gradient ((mg/stroke)/s)	-10	10
Monitor Sequence	None		
Execution Frequency	Continuous when enabling conditions met		
Typical Duration	15 Seconds		
Dash Lamps	MIL, CEL		
Engine Reaction	None		
Verification	Once engine is at standard operating temperature, drive at highway speed with loaded trailer above 1130 rpm continuously for five minutes.		

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Check for other codes. Are any other fault codes present?
   - 2.a Yes; repair those faults first.
   - 2.b No; Go to step 3.
3. Check the Motor Control Module (MCM) software level. Compare the current MCM software level to the server. Is the MCM software at the latest level?
   - 3.a Yes; Go to step 4.
   - 3.b No; update the MCM software level and perform the verification procedure in the table above. If the fault code does not return, release the vehicle. If the fault code returns, Go to step 4.
4. Inspect the front grill for air blockage including winter fronts, plows, or large hose reels. Is any blockage found?
   - 4.a Yes; repair as needed.
   - 4.b No; Go to step 5.
5. Inspect hood seals. Are seals missing or damaged?
   - 5.a Yes; repair as needed.
   - 5.b No; Go to step 6.
6. Inspect the entire air intake system, including the Charge Air Cooler (CAC), for leaks and/or restrictions. Are any air intake system leaks or restrictions found?

6.a Yes; repair as necessary. Verify repairs. Retest with verification cycle; once engine is at standard operating temperature, drive at highway speed with loaded trailer above 1130 rpm continuously for five minutes.

6.b No; Go to step 7.

7. Using DiagnosticLink , measure barometric pressure. Is barometric pressure above 69 kPa (10 psi) and below 110 kPa (16 psi)?

7.a Yes; Go to step 8.

7.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs.

8. Using DiagnosticLink, compare inlet manifold pressure to barometric pressure. Is the inlet manifold pressure within 10.3 kPa (1.5 psi) of barometric pressure?

8.a Yes; Go to step 11.

8.b No; Go to step 9.

9. Disconnect the inlet manifold pressure sensor harness connector.

10. Inspect the inlet manifold pressure sensor and harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

10.a Yes; repair as necessary. Verify repairs.

10.b No; replace the inlet manifold pressure sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" . Verify repairs.

11. Visually inspect exhaust system for leaks or damage, including manifold, gaskets, turbine housing, EGR valve, and Aftertreatment Device (ATD). Are any leaks found?

11.a Yes; repair as necessary. Verify repairs. Retest with verification cycle; once engine is at standard operating temperature, drive at highway speed with loaded trailer above 1130 rpm continuously for five minutes. If fault code returns, Go to step 12.

11.b No; Go to step 12.

12. Check for engine type. Is engine equipped with an asymmetrical turbocharger?

12.a Yes; Go to step 13.

12.b No; Go to step 30.

13. Turn the ignition OFF.

14. Inspect the wastegate actuator and the plumbing to and from the actuator. Verify wastegate linkage. Is any damage found?

14.a Yes; repair as necessary. Verify repairs.

14.b No; Go to step 15.

15. Inspect the air line connection to the wastegate solenoid for leaks. Are any air leaks found?

15.a Yes; repair or replace as necessary. Verify repairs.

15.b No; Go to step 16.

16. Turn the ignition ON (key ON, engine OFF).

Note : Wastegate will not remain open if DiagnosticLink slide control is set above 95%.

17. Using DiagnosticLink, activate turbo control (wastegate) from I/O Control window. Run slide control up to 95% - adjust Duration to 20 seconds- (Click Set). Wastegate will open with air psi available. Does wastegate open when commanded?

17.a Yes; Go to step 18.

17.b No; Go to step 19.

18. Does wastegate close when the duration timer expires?

18.a Yes; Go to step 30.

18.b No; Go to step 19.

19. Drain air tanks. Refer to OEM literature for details.

20. Install a suitable air pressure gauge in the inlet air pressure line to the waste gate solenoid from the vehicle.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

> **⚠ 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.

21. Start engine to stabilize vehicle air pressure.
22. With a suitable air pressure gauge installed, measure the inlet air pressure to the wastegate solenoid from the vehicle. Is the pressure at least 599 kPa (87psi)?

    22.a Yes; restore air hose connection. Go to step 23.

    22.b No; refer to OEM troubleshooting for air pressure issues.
23. Turn the ignition OFF.
24. With the vehicle air pressure stabilized, use a suitable air pressure gauge to measure the outlet air pressure from the solenoid to the turbocharger wastegate.
25. Turn the ignition ON (key ON, engine OFF). Is the pressure out of the wastegate solenoid less than one psi?

    25.a Yes; Go to step 26.

    25.b No; Go to step 28.
26. Using DiagnosticLink, activate turbo control (wastegate) from I/O Control window. Run slide control up to 50% - adjust Duration to 20 seconds- (Click Set). Is the pressure out of the wastegate solenoidbetween 117 and 158 kPa (17-23 psi)?

    26.a Yes; Go to step 27.

    26.b No; Go to step 28.
27. Using DiagnosticLink, activate turbo control (wastegate) from I/O Control window. Run slide control up to 95% - adjust Duration to 20 seconds- (Click Set). Is the pressure out of the wastegate solenoid between 241 and 275 kPa (35-40 psi)?

    27.a Yes; Go to step 30.

    27.b No; Go to step 28.
28. Disconnect the wastegate solenoid harness connector.
29. Inspect the wastegate solenoid and harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

    29.a Yes; repair as necessary. Verify repairs.

29.b No; replace the wastegate solenoid.

30. Turn the ignition OFF.

31. Inspect the turbocharger for damage. Is any damage present?

31.a Yes; repair as necessary. Verify repairs.

If fault returns, for AT engines, Go to step 33.

If fault returns, for Turbo-Compound (TC) engines, Go to step 32.

31.b No; for AT engines, Go to step 33.

For TC engines, Go to step 32.

32. Inspect the axial power turbine for damage. Is any damage present?

32.a Yes; repair as necessary. Clear codes and verify repairs. Retest with verification cycle; once engine is at standard operating temperature, drive at highway speed with loaded trailer above 1130 rpm continuously for five minutes.

If fault returns, Go to step 33.

32.b No; Go to step 33.

33. Turn the ignition ON (key ON, engine OFF).

34. Inspect the Diesel Oxidation Catalyst (DOC) pressure sensor tube and elbow and the Diesel Particulate Filter (DPF) pressure sensor tube and elbow for leaks, kinks, or blockages. Are any leaks, kinks, or blockages found?

34.a Yes; repair as necessary.

34.b No; Go to step 35.

⚠WARNING

ENGINE EXHAUST

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

⚠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.

⚠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.

35. Start engine, allow to warm up so coolant temperature is greater than 65°C (149°F).

Note : Normal DOC pressure is less than 10 kPa (1.5 psi) for a 1-box ATS and 13 kPa (1.9 psi) for a 2-box ATS.

36. Using DiagnosticLink, monitor DOC Inlet Pressure while performing a parked regeneration. Refer to section "Performing a Parked Regeneration - GHG17" . Does the DOC Inlet Pressure start out high and stay high?

36.a Yes; the DOC(s) are plugged. Refer to 13TS-15 for DOC inspection, cleaning, and replacement procedures.

36.b No; if DOC Inlet Pressure starts out high and then decreases, the DOCs were plugged and the parked regen cleared them. Clear any fault codes. Verify repairs. If DOC pressure reading is low or fault code returns, Go to step 37.

37. Turn the ignition OFF.
38. Disconnect the MCM 120-pin connector.
39. Inspect the MCM 120-pin connector and the 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Are any signs of damage found?
    - 39.a Yes; repair as necessary. Verify repairs.
    - 39.b No; Go to step 40.
40. Install a test MCM and retest with verification cycle. Does fault code return?
    - 40.a Yes; Go to step 41.
    - 40.b No; replace MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs.
41. Install original MCM. Bring to operating temperature of 71°C (160°F). Road test the vehicle. Drive at highway speed with loaded trailer above 1130 rpm continuously for five minutes. Does fault become active?
    - 41.a Yes; replace turbocharger.

      Refer to section "Removal of the DD13 and DD15 Turbocharger" .

      Refer to section "Removal of the DD16 Turbocharger" .
    - 41.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" Verify repairs.

235.6 SPN 3464/FMI 31 - GHG17

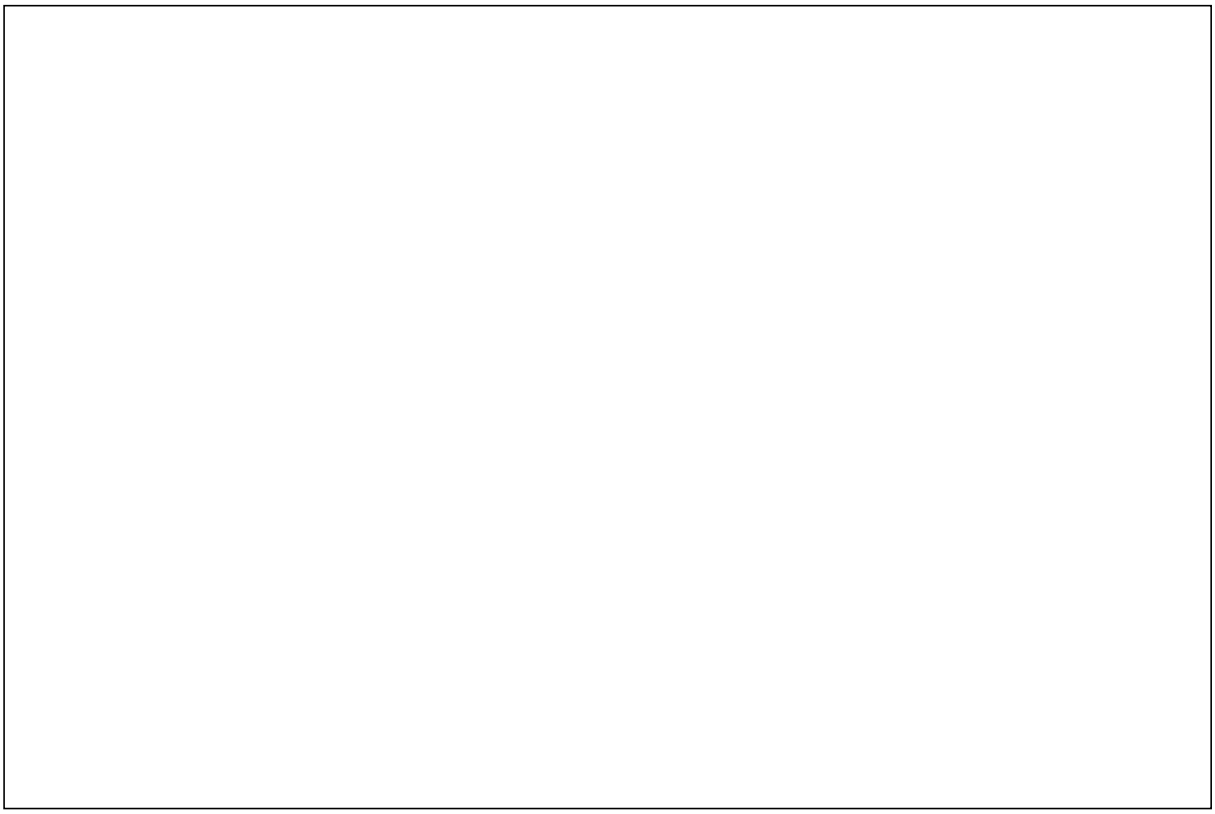
Intake air throttle control electrical fault

SPN 3464/FMI 31	
Description	Intake Air Throttle Control Electrical Fault
Monitored Parameter	Intake Throttle Valve
Typical Enabling Conditions	Key On & Engine Off
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	Engine OFF, then 1 minute idle

1. Is fault code active?
   - 1.a Yes; Go to step 3.
   - 1.b No; Go to step 2.
2. Cycle the ignition switch OFF, wait 15 seconds, turn ignition back ON and repeat Key ON/OFF sequence three times. Does the fault become active?
   - 2.a Yes; Go to step 3.
   - 2.b No; testing complete. Clear all faults and release vehicle.
3. Turn ignition OFF.
4. Disconnect the Intake Throttle Valve (ITV) harness connector.
5. Disconnect the Motor Control Module (MCM) 120-pin connector.
6. Measure the resistance between pin 4 of the ITV harness connector and ground.
   - 6.a If the resistance is less than 1k ohms, repair wire between pin 4 of the ITV harness connector and ground.
   - 6.b If the resistance is greater than 1k ohms, Go to step 7.
7. Measure the resistance between pin 5 of the ITV harness connector and ground.
   - 7.a If the resistance is less than 1k ohms, repair wire between pin 5 of the ITV harness connector and ground.
   - 7.b If the resistance is greater than 1k ohms, Go to step 8.
8. Measure the resistance between pin 4 of the ITV harness connector and pin 100 of the MCM 120-pin connector.
   - 8.a If the resistance is less than 3 ohms, Go to step 9.
   - 8.b If the resistance is greater than 3 ohms, repair wire between pin 4 of the ITV harness connector and pin 100 of the MCM 120-pin connector.
9. Measure the resistance between pin 5 of the ITV harness connector and pin 101 of the MCM 120-pin connector.
   - 9.a If the resistance is less than 3 ohms, replace the Intake Throttle Valve. Refer to section "Removal of the Intake Throttle Valve and Adaptor"
   - 9.b If the resistance is greater than 3 ohms, repair wire between pin 5 of the Intake Throttle Valve harness connector and pin 101 of the MCM 120-pin connector.

SPN 3471 (MCM) (GHG17)

236.1 Electronic Diagram



236.2 SPN 3471/FMI 3 - GHG17

SPN 3471/FMI 3	
Description	Electronic Dosing Valve (EDV) Circuit Failed High
Monitored Parameter	Electronic Dosing Valve (EDV) Circuit
Typical Enabling Conditions	Doser Enabled
Monitor Sequence	None
Execution Frequency	Doser Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	Engine Idle (1 minute)

1. Disconnect the EDV connector.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pin 1 of the EDV connector and ground (battery ground lug by starter).
   - 3.a If the voltage is greater than 4.5 volts, repair the short to power between pin 1 of the EDV connector and pin 65 of the Motor Control Module (MCM) 120-pin connector.
   - 3.b If the voltage is less than 4.5 volts, Go to step 4.
4. Turn the ignition switch to the OFF position.
5. Disconnect the MCM 120-pin connector.
6. Measure the resistance between pin 1 and pin 2 of the EDV connector.
   - 6.a If the resistance is less than 10K ohms, repair short between pins 1 and 2 of the EDV connector and pins 64 and 65 of the MCM 120-pin connector.
   - 6.b If the resistance is greater than 10K ohms, replace the Metering Unit.
7. Using DiagnosticLink , perform “Purge Hydrocarbon Doser” service routine to verify repairs.

236.3 SPN 3471/FMI 4 - GHG17

Hydrocarbon Doser Circuit Failed Low.

SPN 3471/FMI 4	
Description	Hydrocarbon (HC) Doser Circuit Failed Low
Monitored Parameter	HC Doser Circuit
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)

1. Disconnect the Electronic Dosing Valve (EDV) sensor.
2. Disconnect the Motor Control Module (MCM) 120-pin connector.
3. Measure the resistance between pin 1 of the EDV sensor harness connector and ground (battery ground lug by starter).
   - 3.a If resistance is less than 5 ohms, repair the short circuit between pin 1 of the EDV sensor harness connector and ground.
   - 3.b If resistance is greater than 5 ohms, Go to step 4. .
4. Measure the resistance between pin 2 of the EDV sensor harness connector and ground (battery ground lug by starter).
   - 4.a If resistance is less than 5 ohms, repair the short circuit between pin 2 of the EDV sensor harness connector and ground.
   - 4.b If resistance is greater than 5 ohms, replace the EDV.

236.4 SPN 3471/FMI 5 - GHG17

Hydrocarbon Doser Circuit Failed Open

SPN 3471/FMI 5	
Description	Hydrocarbon (HC) Doser Circuit Failed Open
Monitored Parameter	HC Doser Circuit
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	Engine Idle

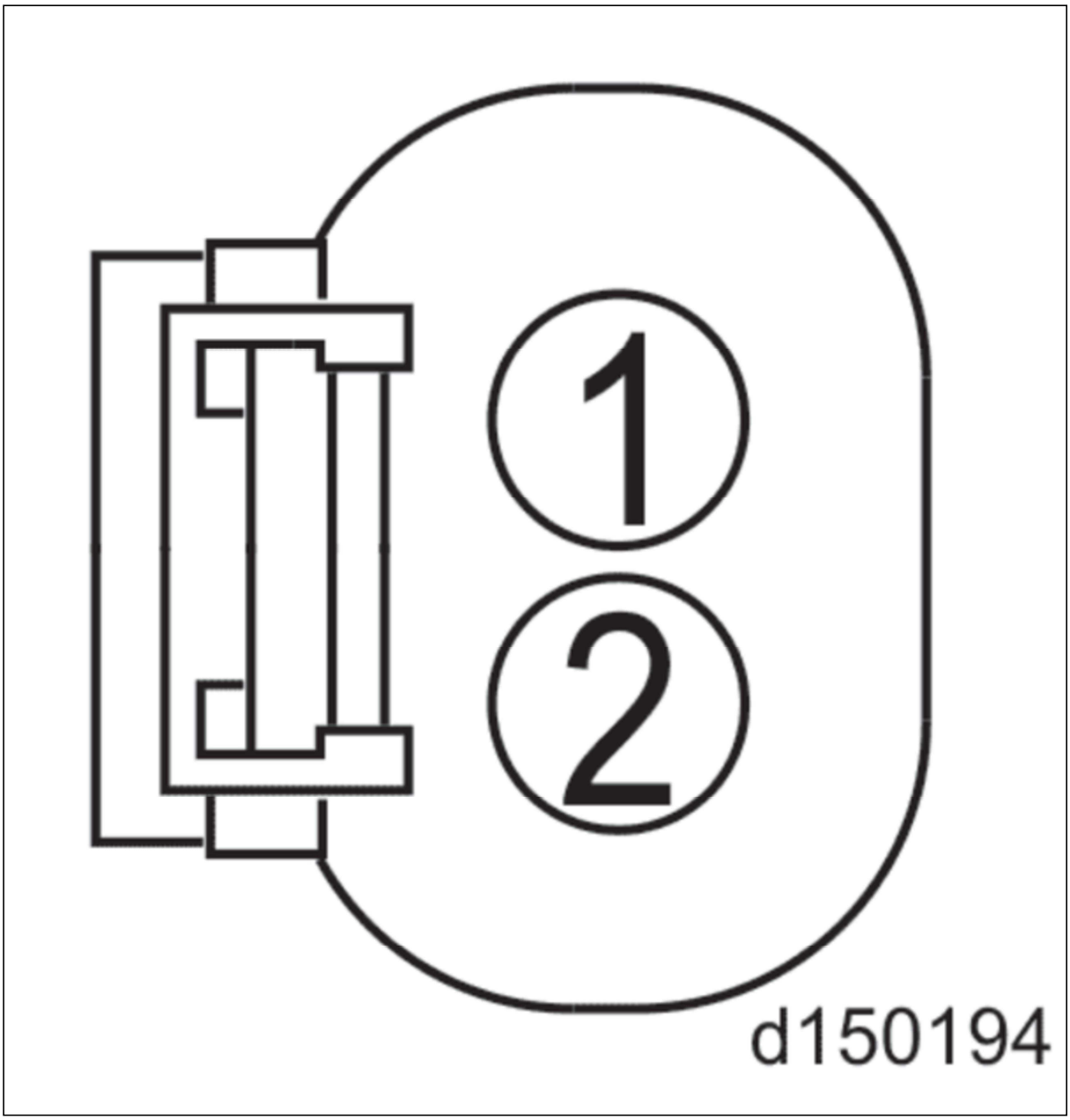
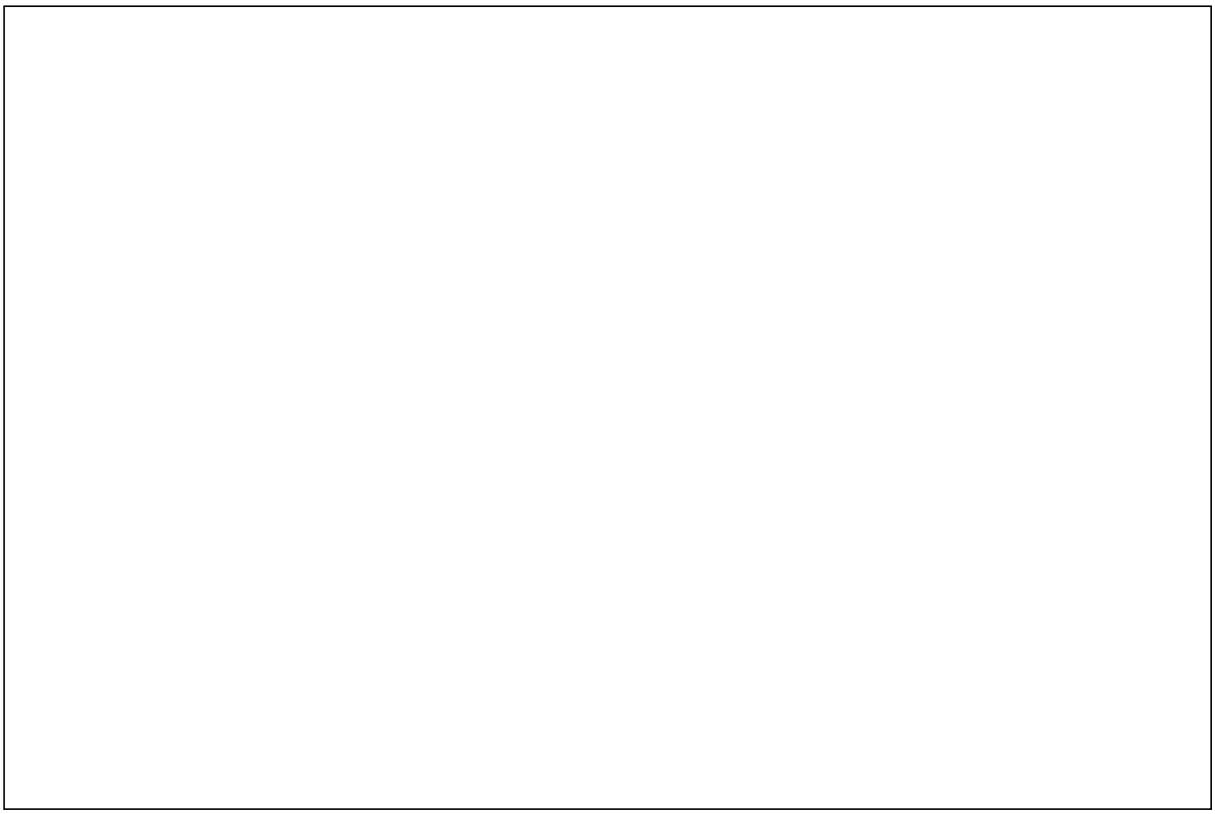


Fig 236.1, EDV Harness Connector



1. Connect Diagnostic Link . Go to step 2.
2. Turn the ignition key ON (key ON, engine OFF). Go to step 3.
3. Check for multiple codes. Is SPN 3482/FMI 5 also present?
   - 3.a Yes; repair the wire between pin 64 of the 120-pin Motor Control Module (MCM) connector and pin 2 of the Electronic Dosing Valve (EDV) / pin 2 of the Fuel Cut-Off Valve. Verify repair.
   - 3.b No; Go to step 4.
4. Turn the ignition OFF. Go to step 5.
5. Disconnect the EDV connector. Go to step 6.
6. Turn the ignition ON (key ON, engine OFF). Go to step 7.
7. Measure the voltage between pin 1 of the EDV connector, harness side and ground. Is the voltage within 1.5 volts of battery voltage?
   - 7.a Yes; Go to step 8.
   - 7.b No; Go to step 9.
8. Measure the voltage between pin 2 of the EDV connector, harness side and ground. Is the voltage between 2 and 4.5 volts?
   - 8.a Yes; replace the HC doser block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " . Verify repair.
   - 8.b No; Go to step 9.
9. Turn the ignition OFF. Go to step 10.
10. Disconnect the 120-pin MCM connector. Go to step 11.
11. Measure the resistance between pin 1 of the EDV connector, harness side and pin 65 of the 120-pin MCM connector, harness side. Is the resistance less than 5 ohms?
    - 11.a Yes; Go to step 12.
    - 11.b No; repair the wire between pin 1 of the EDV connector and pin 65 of the 120-pin MCM connector. Verify repair.

12. Measure the resistance between pin 2 of the EDV connector, harness side and pin 64 of the 120-pin MCM connector, harness side. Is the resistance less than 5 ohms?

    12.a Yes; replace the MCM, Refer to section "Removal of the Motor Control Module" . Verify repair.

    12.b No; repair the wire between pin 2 of the EDV connector and pin 64 of the 120-pin MCM connector. Verify repair.

SPN 3480 (MCM) (GHG17)

237.1 SPN 3480/FMI 0 - GHG17

Fuel Compensation Pressure High

SPN 3480/FMI 0	
Description	This Fault Will Become Active Once The Fuel Compensation Pressure Reaches and Stays Above 799 kPa (116 psi), for Longer Than 600 Seconds During a Driving Regen or 60 Seconds During a Parked Regeneration with all Conditions Met
Monitored Parameter	Doser Fuel Line Pressure
Typical Enabling Conditions	Dosing Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	One Minute
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%, DPF Inhibit Regeneration
Verification	Parked Regeneration

Required Service Tools		
Tool Number	Tool Description	Tool Graphic
J-48876	Priming Port Fuel Pressure Test Gauge	

Check as follows:

1. Shut off the engine, apply the parking brake, chock the wheels, and perform any other applicable safety steps.
2. Connect Diagnostic Link .
3. Turn the ignition ON (key ON, engine OFF).

Note : Faults are listed in diagnostic priority from top to bottom.

4. Are any fuel system faults present?

- SPN 3480/FMI 3, or 4
- SPN 3480/FMI 14
- SPN 94/FMI 3, or 4
- SPN 94/FMI 2

4.a Yes; repair fault with the highest priority listed above. Verify repairs.

4.b No; Go to step 5.

Note : KM63 GEN2 fuel filter module return lines are secured to the module with a mounting plate attached to the PLV return line.

5. Connect tool J-48876 Priming Port Fuel Pressure Test Gauge to the priming port valve. Go to step 6.

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

> **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.

6. Start the engine. Go to step 7.
7. Monitor the fuel pressure at 600 rpm and at 1800 rpm. Is the fuel pressure above 90 psi at 600 rpm or 140 psi at 1800 rpm?
   - 7.a Yes; inspect the two- stage valve.
   - 7.b Yes; replace the hydrocarbon doser block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " . Verify repairs.

237.2 SPN 3480/FMI 1 - GHG17

Doser Fuel Supply Pressure Abnormal

SPN 3480/FMI 1	
Description	This code sets when the Motor Control Module (MCM) detects that the fuel compensation pressure is lower than 358 kPa (52 psi) for 10 minutes when dosing is enabled.
Monitored Parameter	Doser Fuel Line Pressure Sensor
Typical Enabling Conditions	Dosing Enabled
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	10 minutes for parked regeneration, one minute during driving regeneration
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	Parked Regeneration

Checks as Follows:

1. Connect Diagnostic Link .
2. Turn the ignition ON (key ON, engine OFF).

Note : Faults are listed in diagnostic priority from top to bottom.

3. Are any of the following fuel system faults present?

- 3480/3, or 4
- 3480/14
- 94/3, or 4
- 94/2

3.a Yes; repair fault with the highest priority listed above. Verify repair.

3.b No; Go to step 4.

Note : When inspecting for fuel leaks, as little as one drop of fuel can cause a fuel related concern.

> **⚠ WARNING**
>
> FIRE
>
> To avoid injury from fire, contain and eliminate leaks of flammable fluids as they occur. Failure to eliminate leaks could result in fire.

4. Visually inspect the HC doser block for external fuel leaks. Are any external fuel leaks present?

4.a Yes; repair the external fuel leaks as necessary. Verify repair.

4.b No; Go to step 5.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **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.

5. Start the engine. Go to step 6.
6. Using DiagnosticLink, monitor the Low Pressure Pump Outlet (LPPO) fuel pressure at 600 rpm and at 1800 rpm. Is the LPPO fuel pressure between 482 kPa (70 psi) to 620 kPa (90 psi) at 600 rpm and between 689 kPa (100 psi) to 965 kPa (140 psi) at 1800 rpm?
   - 6.a Yes; Go to step 8.
   - 6.b No; Go to step 7.

7. Inspect the pressure relief valve. Refer to section "Inspection of the Pressure Relief Valve - Two-Filter System" . Was damage found with the pressure relief valve?
   - 7.a Yes; replace the pressure relief valve. Refer to section "Removal of the Pressure Relief Valve - Two-Filter System" . Verify repairs.
   - 7.b No; check for a restriction in the fuel supply. Verify repair.

WARNING

ENGINE EXHAUST

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

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.

8. Start the engine. Go to step 9.
9. WIth the engine at 49°C (120°F) or higher, use DiagnosticLink to perform the "Purge Hydrocarbon Doser" service routine. Go to step 10.
10. Review the log file for the "Purge Hydrocarbon Doser" service routine. Go to step 11.
11. Monitor the fuel compensation pressure when the fuel cut-off valve is commanded to 100 percent. Is the fuel compensation pressure greater than 68 kPa (10 psi)?
    - 11.a Yes; replace the high pressure fuel flange. Refer to section "Removal of the High Pressure Fuel Flange - Two-Filter System" . Go to step 12.
    - 11.b No; replace the hydrocarbon doser block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " . Verify repair.
12. With the engine at 49°C (120°F) or higher, use DiagnosticLink to perform the "Purge Hydrocarbon Doser" service routine again. Go to step 13.
13. Review the log file for the "Purge Hydrocarbon Doser" service routine. Go to step 14.
14. Monitor the fuel compensation pressure when the fuel cut-off valve is commanded to 100 percent. Is the fuel pressure greater than 448 kPa (65 psi)?
    - 14.a Yes; perform a parked regeneration. Verify repair.
    - 14.b No; replace the hydrocarbon doser block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " . Verify repair.

237.3 SPN 3480/FMI 2 - GHG17

Hydrocarbon Doser Fuel Line Pressure Low

SPN 3480/FMI 2	
Description	Hydrocarbon (HC) Doser Fuel Line Pressure Low
Monitored Parameter	HC Doser Fuel Line Pressure
Typical Enabling Conditions	Dosing Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	One Minute
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	Parked Regeneration

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check the MCM software level. Is the MCM software level 6.5.0.3 or greater?
   - 3.a Yes; Go to step 4.
   - 3.b No; Update the MCM using the latest server information. Perform the repair verification. If the fault returns, Go to step 4.

Note : Faults are listed in diagnostic priority from top to bottom.

4. Are there any fuel system faults present?
   - 4.a Yes; repair fault with the highest priority listed below. Verify repair.

     3480/3, or 4

     4077/3, or 4

     3480/1

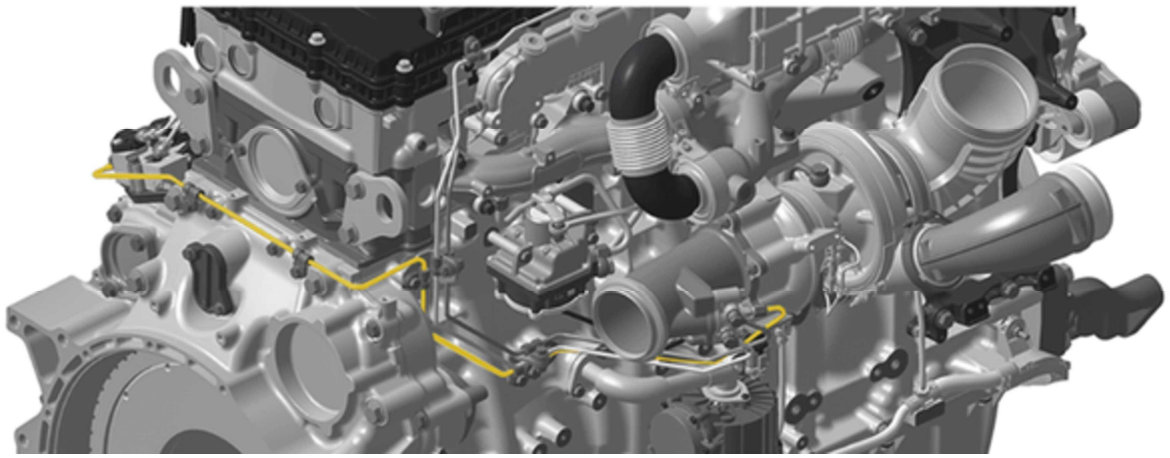
     4077/14
   - 4.b No; Go to step 5.

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

> **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.

5. Start the engine.
6. Using DiagnosticLink, perform two back-to-back "Purge Hydrocarbon Doser" service routines to help improve the chances of identifying a leak.

7. Turn the ignition OFF.



8. Visually inspect the fuel line between the HC doser block assembly and fuel doser injector valve for any sign of external fuel leaks. Are any external leaks present?
   - 8.a Yes; replace the HC doser injector valve fuel supply line. Go to step 10.
   - 8.b No; replace the HC fuel doser injector valve and fuel supply line. Go to step 9.
9. Was the truck built after 8-1-2017?
   - 9.a Yes; replace the HC fuel doser injector valve. Refer to section "Removal of the Hydrocarbon Fuel Doser Injector Valve" . Go to step 10.
   - 9.b No; replace the HC doser injector valve and fuel supply line. Refer to section "Removal of the Hydrocarbon Fuel Doser Injector Valve" . Go to step 10.

⚠WARNING

ENGINE EXHAUST

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

⚠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.

10. Turn the ignition ON and start the engine.

11. Clear fault codes.

> **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.

12. Perform a parked regeneration to verify the repair. Refer to section "Performing a Parked Regeneration - GHG17" . Did SPN 3480/FMI 2 become active during regeneration?

12.a Yes; replace doser block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " . Verify repair

12.b No; release vehicle.

237.4 SPN 3480/FMI 3 - GHG17

SPN 3480/FMI 3	
Description	Fuel Compensation Pressure (FCP) Sensor Circuit Failed High
Monitored Parameter	Fuel Compensation Pressure Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (One minute)

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple codes.
   - 3.a If SPN 100/FMI 3, SPN 4077/FMI 3, and SPN 3480/FMI 3 are present, repair short to power between pin 82 of the Motor Control Module (MCM) 120-pin connector and the engine oil pressure, fuel line, and FCP sensors.
   - 3.b If SPN 4077/FMI 3 and SPN 3480/FMI 3 are present, repair short to power between pin 104 of the MCM 120-pin connector and the fuel line psi sensors.
   - 3.c If only SPN 3480/FMI 3 is present, Go to step 4.
4. Disconnect the FCP sensor connector.
5. Inspect the FCP sensor connector for bent, spread or corroded pins. Is damage found?
   - 5.a Yes; repair as necessary.
   - 5.b No; Go to step 6.
6. Using DiagnosticLink or newer, does the code go inactive with the FCP sensor disconnected?
   - 6.a Yes; replace the Hydrocarbon Fuel Doser Block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " .
   - 6.b No; Go to step 7.
7. Turn the ignition OFF.
8. Disconnect the MCM 120-pin connector.
9. Inspect the MCM sensor connector for bent, spread, water, or corroded pins. Is damage found?
   - 9.a Yes; repair as necessary.
   - 9.b No; Go to step 10.
10. Measure the resistance across pins 1 and 2 of the FCP sensor connector. Is resistance less than 10K ohms?
    - 10.a Yes; repair the short between pins 82 and 84 of the MCM 120-pin connector.
    - 10.b No; Go to step 11.
11. Measure the resistance between pin 4 of the FCP sensor harness connector and pin 104 of the MCM 120-pin connector. Is the resistance less than five ohms?
    - 11.a Yes; Go to step 12.
    - 11.b No; repair the open wire between pin 4 of the FCP sensor harness connector and pin 104 of the MCM 120-pin connector.
12. Measure the resistance between pin 84 of the MCM 120-pin connector and pin 1 of the FCP sensor connector. Is the resistance less than five ohms?

12.a Yes; Go to step 13.

12.b No; repair the open circuit between pin 84 of the MCM 120-pin connector and pin 1 of the FCP sensor connector.

13. Reinstall MCM 120-pin connector. Do not reconnect FCP sensor.
14. Connect DiagnosticLink.
15. Turn the ignition ON (key ON, engine OFF).
16. Monitor voltage for FCP sensor. Is voltage reading greater than 4.5 volts?

16.a Yes; inspect harness for short to power due to abrasion or wire damage. Typical points of wear are sharp bends.

16.b Yes; replace the Hydrocarbon Fuel Doser Block Assembly. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " . Verify repair.

237.5 SPN 3480/FMI 4 - GHG17

SPN 3480/FMI 4	
Description	Fuel Compensation Pressure (FCP) Sensor Circuit Failed Low
Monitored Parameter	Fuel Compensation Pressure Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (One Minute)

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ WARNING

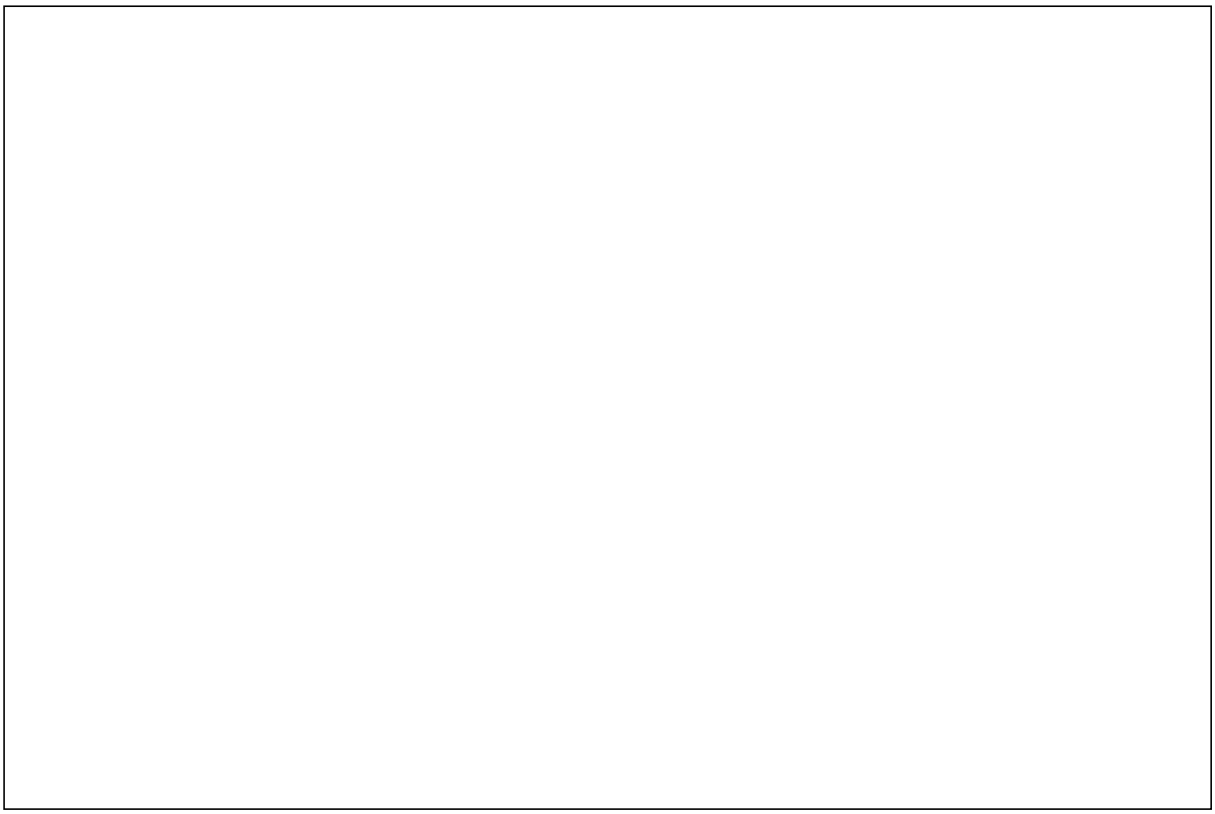
PERSONAL INJURY

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.

⚠ WARNING

ENGINE EXHAUST

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



Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple codes; is 4077/FMI 4 present, but not SPN 100/FMI 4?
   - 3.a Yes; repair short to power between pin 104 of the Motor Control Module (MCM) 120-pin connector and the fuel line pressure sensors. Clear codes. Verify repairs.
   - 3.b No; Go to step 4.
4. Are SPN 100/FMI 4 and SPN 4077/FMI 4 present?
   - 4.a Yes; Go to step 5.
   - 4.b No; Go to step 10.
5. Turn the ignition OFF.
6. Disconnect the FCP sensor.
7. Inspect the FCP sensor connector for bent, spread or corroded pins. Is any pin damage found?
   - 7.a Yes; repair as necessary.
   - 7.b No; Go to step 8.
8. Disconnect the MCM 120-pin connector.
9. Measure the resistance between 5V supply (pin 82 of the MCM 120-pin connector) and ground. Is resistance less than 10K ohms?
   - 9.a Yes; repair short to ground between pin 82 of the MCM 120-pin connector and the engine oil, fuel line, and FCP sensors.
   - 9.b No; repair open circuit between pin 82 of the MCM 120-pin connector and the engine oil, fuel line, and FCP sensors.
10. Turn the ignition OFF.

11. Disconnect the FCP sensor. Inspect the FCP sensor connector for bent, spread, or corroded pins. Is any pin damage found?
    - 11.a Yes; repair as necessary.
    - 11.b No; Go to step 12.
12. Disconnect the MCM 120-pin connector.
13. Inspect the MCM sensor connector for bent, spread, water, or corroded pins. Is any pin damage found?
    - 13.a Yes; repair as necessary.
    - 13.b No; Go to step 14.
14. Measure the resistance between signal circuit (pin 84 of the MCM 120-pin connector) and ground. Is resistance less than 10K ohms?
    - 14.a Yes; repair short to ground between pin 84 of the MCM 120-pin connector and the FCP sensor connector.
    - 14.b No; Go to step 15.
15. Measure the resistance between pin 104 of the MCM 120-pin connector and pin 84 of the MCM 120-pin connector. Is the resistance less than 10K ohms?
    - 15.a Yes; repair the short between the ground circuit pin 104 of the MCM 120-pin connector and the signal circuit pin 84 of the MCM 120-pin connector.
    - 15.b No; replace the FCP sensor. Verify repairs.

237.6 SPN 3480/FMI 14 - GHG17

Doser FLP Sensors Failed Self Test

SPN 3480/FMI 14	
Description	This fault code runs a system check that closes the fuel cutoff valve and opens the doser valve in the doser block, then compares the fuel compensation sensor to the doser line pressure sensor. If both pressure sensors are not within 48 kPa (7 psi) for a count of 4 seconds, the code becomes active.
Monitored Parameter	Doser Fuel Line Pressure
Typical Enabling Conditions	Dosing Enabled
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	1 min
Dash Lamps	MIL, CEL, DPF Inhibit Regeneration
Engine Reaction	10% Derate
Verification	Parked Regeneration

1. Shut off the engine, apply the parking brake, chock the wheels and perform any other applicable safety steps.
2. Replace the Hydrocarbon Doser Block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " . Go to step 3.

Note : It may take three purge attempts to purge all air from the lines. Do not exceed three purge attempts.

3. Using DiagnosticLink , perform Purge Hydrocarbon Doser service routine. Go to step 4.

> **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.

4. Visually inspect the HC doser block for external fuel leaks. Are any external fuel leaks present?
   - 4.a Yes; repair the external fuel leaks as necessary. Verify repair.
   - 4.b No; Go to step 5.
5. Perform parked regeneration. Refer to section "Performing a Parked Regeneration - GHG17" . Did SPN 3480/ FMI 14 become active during regeneration?
   - 5.a Yes; replace the Fuel Doser Injection Valve. Refer to section "Removal of the Hydrocarbon Fuel Doser Injector Valve" .
   - 5.b No; clear active codes and release vehicle.

237.7 SPN 3480/FMI 21 - GHG17

SPN 3480/FMI 21	
Description	Fuel Cut-off Valve Pressure Not Plausible
Monitored Parameter	Hydrocarbon (HC) Doser Fuel Compensation Pressure
Typical Enabling Conditions	Dosing Enabled
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	One Minute
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Parked Regeneration

1. Shut off the engine, apply the parking brake, chock the wheels, and perform any other applicable safety steps.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Are there any fuel system faults or SPN 3480/FMI 0, 3, 4, or 5 present?
   - 4.a Yes; repair these faults first.
   - 4.b No; Go to step 5.
5. Turn the ignition OFF.

> **WARNING**
>
> FIRE
>
> To avoid injury from fire, contain and eliminate leaks of flammable fluids as they occur. Failure to eliminate leaks could result in fire.

6. Visually inspect HC D oser B lock assembly and Fuel Doser Injector Valve fuel lines for external leaks. Are there external leaks?
   - 6.a Yes; repair as necessary. Verify repair.
   - 6.b No; replace the Hydrocarbon Fuel Doser Block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " .

237.1 SPN 3480/FMI 0 - GHG17

Fuel Compensation Pressure High

SPN 3480/FMI 0	
Description	This Fault Will Become Active Once The Fuel Compensation Pressure Reaches and Stays Above 799 kPa (116 psi), for Longer Than 600 Seconds During a Driving Regen or 60 Seconds During a Parked Regeneration with all Conditions Met
Monitored Parameter	Doser Fuel Line Pressure
Typical Enabling Conditions	Dosing Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	One Minute
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%, DPF Inhibit Regeneration
Verification	Parked Regeneration

Required Service Tools		
Tool Number	Tool Description	Tool Graphic
J-48876	Priming Port Fuel Pressure Test Gauge	

Check as follows:

1. Shut off the engine, apply the parking brake, chock the wheels, and perform any other applicable safety steps.
2. Connect Diagnostic Link .
3. Turn the ignition ON (key ON, engine OFF).

Note : Faults are listed in diagnostic priority from top to bottom.

4. Are any fuel system faults present?

- SPN 3480/FMI 3, or 4
- SPN 3480/FMI 14
- SPN 94/FMI 3, or 4
- SPN 94/FMI 2

4.a Yes; repair fault with the highest priority listed above. Verify repairs.

4.b No; Go to step 5.

Note : KM63 GEN2 fuel filter module return lines are secured to the module with a mounting plate attached to the PLV return line.

5. Connect tool J-48876 Priming Port Fuel Pressure Test Gauge to the priming port valve. Go to step 6.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

6. Start the engine. Go to step 7.
7. Monitor the fuel pressure at 600 rpm and at 1800 rpm. Is the fuel pressure above 90 psi at 600 rpm or 140 psi at 1800 rpm?
   - 7.a Yes; inspect the two- stage valve.
   - 7.b Yes; replace the hydrocarbon doser block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " . Verify repairs.

237.2 SPN 3480/FMI 1 - GHG17

Doser Fuel Supply Pressure Abnormal

SPN 3480/FMI 1	
Description	This code sets when the Motor Control Module (MCM) detects that the fuel compensation pressure is lower than 358 kPa (52 psi) for 10 minutes when dosing is enabled.
Monitored Parameter	Doser Fuel Line Pressure Sensor
Typical Enabling Conditions	Dosing Enabled
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	10 minutes for parked regeneration, one minute during driving regeneration
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	Parked Regeneration

Checks as Follows:

1. Connect Diagnostic Link .
2. Turn the ignition ON (key ON, engine OFF).

Note : Faults are listed in diagnostic priority from top to bottom.

3. Are any of the following fuel system faults present?

- 3480/3, or 4
- 3480/14
- 94/3, or 4
- 94/2

3.a Yes; repair fault with the highest priority listed above. Verify repair.

3.b No; Go to step 4.

Note : When inspecting for fuel leaks, as little as one drop of fuel can cause a fuel related concern.

> **WARNING**
>
> FIRE
>
> To avoid injury from fire, contain and eliminate leaks of flammable fluids as they occur. Failure to eliminate leaks could result in fire.

4. Visually inspect the HC doser block for external fuel leaks. Are any external fuel leaks present?

4.a Yes; repair the external fuel leaks as necessary. Verify repair.

4.b No; Go to step 5.

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

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.

5. Start the engine. Go to step 6.
6. Using DiagnosticLink, monitor the Low Pressure Pump Outlet (LPPO) fuel pressure at 600 rpm and at 1800 rpm. Is the LPPO fuel pressure between 482 kPa (70 psi) to 620 kPa (90 psi) at 600 rpm and between 689 kPa (100 psi) to 965 kPa (140 psi) at 1800 rpm?
   - 6.a Yes; Go to step 8.
   - 6.b No; Go to step 7.

7. Inspect the pressure relief valve. Refer to section "Inspection of the Pressure Relief Valve - Two-Filter System" . Was damage found with the pressure relief valve?
   - 7.a Yes; replace the pressure relief valve. Refer to section "Removal of the Pressure Relief Valve - Two-Filter System" . Verify repairs.
   - 7.b No; check for a restriction in the fuel supply. Verify repair.

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

> **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.

8. Start the engine. Go to step 9.
9. WIth the engine at 49°C (120°F) or higher, use DiagnosticLink to perform the "Purge Hydrocarbon Doser" service routine. Go to step 10.
10. Review the log file for the "Purge Hydrocarbon Doser" service routine. Go to step 11.
11. Monitor the fuel compensation pressure when the fuel cut-off valve is commanded to 100 percent. Is the fuel compensation pressure greater than 68 kPa (10 psi)?

    11.a Yes; replace the high pressure fuel flange. Refer to section "Removal of the High Pressure Fuel Flange - Two-Filter System" . Go to step 12.

    11.b No; replace the hydrocarbon doser block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " . Verify repair.
12. With the engine at 49°C (120°F) or higher, use DiagnosticLink to perform the "Purge Hydrocarbon Doser" service routine again. Go to step 13.
13. Review the log file for the "Purge Hydrocarbon Doser" service routine. Go to step 14.
14. Monitor the fuel compensation pressure when the fuel cut-off valve is commanded to 100 percent. Is the fuel pressure greater than 448 kPa (65 psi)?

    14.a Yes; perform a parked regeneration. Verify repair.

    14.b No; replace the hydrocarbon doser block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " . Verify repair.

237.3 SPN 3480/FMI 2 - GHG17

SPN 3480/FMI 2	
Description	Hydrocarbon (HC) Doser Fuel Line Pressure Low
Monitored Parameter	HC Doser Fuel Line Pressure
Typical Enabling Conditions	Dosing Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	One Minute
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	Parked Regeneration

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check the MCM software level. Is the MCM software level 6.5.0.3 or greater?
   - 3.a Yes; Go to step 4.
   - 3.b No; update the MCM using the latest server information. Perform the repair verification. If the fault returns, Go to step 4.

Note :

4. Are there any fuel system faults present?
   - 4.a Yes; repair fault with the highest priority listed below. Verify repair.

     3480/3, or 4

     4077/3, or 4

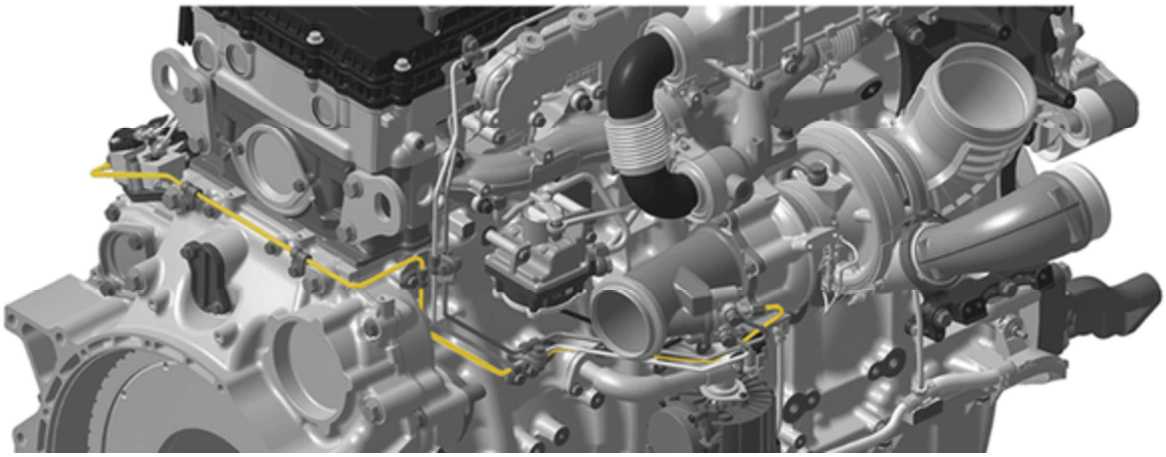
     3480/1

     4077/14
   - 4.b No; Go to step 5.

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

> **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.

5. Start the engine.
6. Using DiagnosticLink, perform two back-to-back "Purge Hydrocarbon Doser" service routines to help improve the chances of identifying a leak.
7. Turn the ignition OFF.



8. Visually inspect the fuel line between the HC doser block assembly and fuel doser injector valve for any sign of external fuel leaks. Are any external leaks present?
   - 8.a Yes; replace the HC doser injector valve fuel supply line. Go to step 10.
   - 8.b No; Go to step 9.
9. Was the truck built after 8-1-2017?
   - 9.a Yes; replace the HC fuel doser injector valve. Refer to section "Removal of the Hydrocarbon Fuel Doser Injector Valve" . Go to step 10.
   - 9.b No; replace the HC doser injector valve and fuel supply line. Refer to section "Removal of the Hydrocarbon Fuel Doser Injector Valve" . Go to step 10.

⚠WARNING

ENGINE EXHAUST

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

⚠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.

10. Turn the ignition ON and start the engine.
11. Clear fault codes.

> **⚠ 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.

12. Perform a parked regeneration to verify the repair. Refer to section "Performing a Parked Regeneration - GHG17" . Did SPN 3480/FMI 2 become active during regeneration?

12.a Yes; replace doser block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " . Verify repair

12.b No; release vehicle.

237.4 SPN 3480/FMI 3 - GHG17

SPN 3480/FMI 3	
Description	Fuel Compensation Pressure (FCP) Sensor Circuit Failed High
Monitored Parameter	Fuel Compensation Pressure Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (One minute)

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple codes.
   - 3.a If SPN 100/FMI 3, SPN 4077/FMI 3, and SPN 3480/FMI 3 are present, repair short to power between pin 82 of the Motor Control Module (MCM) 120-pin connector and the engine oil pressure, fuel line, and FCP sensors.
   - 3.b If SPN 4077/FMI 3 and SPN 3480/FMI 3 are present, repair short to power between pin 104 of the MCM 120-pin connector and the fuel line psi sensors.
   - 3.c If only SPN 3480/FMI 3 is present, Go to step 4.
4. Disconnect the FCP sensor connector.
5. Inspect the FCP sensor connector for bent, spread or corroded pins. Is damage found?
   - 5.a Yes; repair as necessary.
   - 5.b No; Go to step 6.
6. Using DiagnosticLink or newer, does the code go inactive with the FCP sensor disconnected?
   - 6.a Yes; replace the Hydrocarbon Fuel Doser Block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " .
   - 6.b No; Go to step 7.
7. Turn the ignition OFF.
8. Disconnect the MCM 120-pin connector.
9. Inspect the MCM sensor connector for bent, spread, water, or corroded pins. Is damage found?
   - 9.a Yes; repair as necessary.
   - 9.b No; Go to step 10.
10. Measure the resistance across pins 1 and 2 of the FCP sensor connector. Is resistance less than 10K ohms?
    - 10.a Yes; repair the short between pins 82 and 84 of the MCM 120-pin connector.
    - 10.b No; Go to step 11.
11. Measure the resistance between pin 4 of the FCP sensor harness connector and pin 104 of the MCM 120-pin connector. Is the resistance less than five ohms?
    - 11.a Yes; Go to step 12.
    - 11.b No; repair the open wire between pin 4 of the FCP sensor harness connector and pin 104 of the MCM 120-pin connector.
12. Measure the resistance between pin 84 of the MCM 120-pin connector and pin 1 of the FCP sensor connector. Is the resistance less than five ohms?

12.a Yes; Go to step 13.

12.b No; repair the open circuit between pin 84 of the MCM 120-pin connector and pin 1 of the FCP sensor connector.

13. Reinstall MCM 120-pin connector. Do not reconnect FCP sensor.
14. Connect DiagnosticLink.
15. Turn the ignition ON (key ON, engine OFF).
16. Monitor voltage for FCP sensor. Is voltage reading greater than 4.5 volts?

16.a Yes; inspect harness for short to power due to abrasion or wire damage. Typical points of wear are sharp bends.

16.b Yes; replace the Hydrocarbon Fuel Doser Block Assembly. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " . Verify repair.

237.5 SPN 3480/FMI 4 - GHG17

SPN 3480/FMI 4	
Description	Fuel Compensation Pressure (FCP) Sensor Circuit Failed Low
Monitored Parameter	Fuel Compensation Pressure Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (One Minute)

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

WARNING

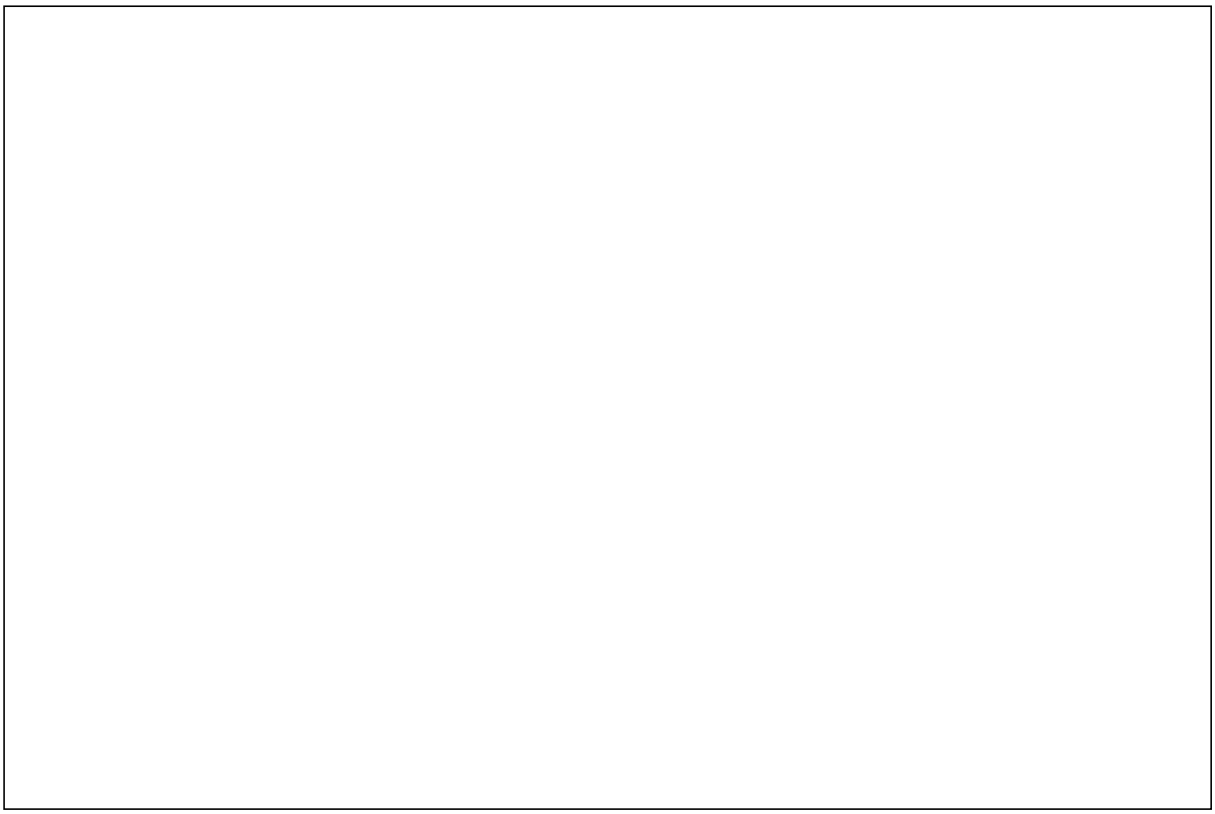
PERSONAL INJURY

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.

WARNING

ENGINE EXHAUST

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



Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple codes; is 4077/FMI 4 present, but not SPN 100/FMI 4?
   - 3.a Yes; repair short to power between pin 104 of the Motor Control Module (MCM) 120-pin connector and the fuel line pressure sensors. Clear codes. Verify repairs.
   - 3.b No; Go to step 4.
4. Are SPN 100/FMI 4 and SPN 4077/FMI 4 present?
   - 4.a Yes; Go to step 5.
   - 4.b No; Go to step 10.
5. Turn the ignition OFF.
6. Disconnect the FCP sensor.
7. Inspect the FCP sensor connector for bent, spread or corroded pins. Is any pin damage found?
   - 7.a Yes; repair as necessary.
   - 7.b No; Go to step 8.
8. Disconnect the MCM 120-pin connector.
9. Measure the resistance between 5V supply (pin 82 of the MCM 120-pin connector) and ground. Is resistance less than 10K ohms?
   - 9.a Yes; repair short to ground between pin 82 of the MCM 120-pin connector and the engine oil, fuel line, and FCP sensors.
   - 9.b No; repair open circuit between pin 82 of the MCM 120-pin connector and the engine oil, fuel line, and FCP sensors.
10. Turn the ignition OFF.

11. Disconnect the FCP sensor. Inspect the FCP sensor connector for bent, spread, or corroded pins. Is any pin damage found?
    - 11.a Yes; repair as necessary.
    - 11.b No; Go to step 12.
12. Disconnect the MCM 120-pin connector.
13. Inspect the MCM sensor connector for bent, spread, water, or corroded pins. Is any pin damage found?
    - 13.a Yes; repair as necessary.
    - 13.b No; Go to step 14.
14. Measure the resistance between signal circuit (pin 84 of the MCM 120-pin connector) and ground. Is resistance less than 10K ohms?
    - 14.a Yes; repair short to ground between pin 84 of the MCM 120-pin connector and the FCP sensor connector.
    - 14.b No; Go to step 15.
15. Measure the resistance between pin 104 of the MCM 120-pin connector and pin 84 of the MCM 120-pin connector. Is the resistance less than 10K ohms?
    - 15.a Yes; repair the short between the ground circuit pin 104 of the MCM 120-pin connector and the signal circuit pin 84 of the MCM 120-pin connector.
    - 15.b No; replace the FCP sensor. Verify repairs.

237.6 SPN 3480/FMI 14 - GHG17

Doser FLP Sensors Failed Self Test

SPN 3480/FMI 14	
Description	This fault code runs a system check that closes the fuel cutoff valve and opens the doser valve in the doser block, then compares the fuel compensation sensor to the doser line pressure sensor. If both pressure sensors are not within 48 kPa (7 psi) for a count of 4 seconds, the code becomes active.
Monitored Parameter	Doser Fuel Line Pressure
Typical Enabling Conditions	Dosing Enabled
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	1 min
Dash Lamps	MIL, CEL, DPF Inhibit Regeneration
Engine Reaction	10% Derate
Verification	Parked Regeneration

1. Shut off the engine, apply the parking brake, chock the wheels and perform any other applicable safety steps.
2. Replace the Hydrocarbon Doser Block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " . Go to step 3.

Note : It may take three purge attempts to purge all air from the lines. Do not exceed three purge attempts.

3. Using DiagnosticLink , perform Purge Hydrocarbon Doser service routine. Go to step 4.

> **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.

4. Visually inspect the HC doser block for external fuel leaks. Are any external fuel leaks present?
   - 4.a Yes; repair the external fuel leaks as necessary. Verify repair.
   - 4.b No; Go to step 5.
5. Perform parked regeneration. Refer to section "Performing a Parked Regeneration - GHG17" . Did SPN 3480/ FMI 14 become active during regeneration?
   - 5.a Yes; replace the Fuel Doser Injection Valve. Refer to section "Removal of the Hydrocarbon Fuel Doser Injector Valve" .
   - 5.b No; clear active codes and release vehicle.

237.7 SPN 3480/FMI 21 - GHG17

SPN 3480/FMI 21	
Description	Fuel Cut-off Valve Pressure Not Plausible
Monitored Parameter	Hydrocarbon (HC) Doser Fuel Compensation Pressure
Typical Enabling Conditions	Dosing Enabled
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	One Minute
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Parked Regeneration

1. Shut off the engine, apply the parking brake, chock the wheels, and perform any other applicable safety steps.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Are there any fuel system faults or SPN 3480/FMI 0, 3, 4, or 5 present?
   - 4.a Yes; repair these faults first.
   - 4.b No; Go to step 5.
5. Turn the ignition OFF.

> **WARNING**
>
> FIRE
>
> To avoid injury from fire, contain and eliminate leaks of flammable fluids as they occur. Failure to eliminate leaks could result in fire.

6. Visually inspect HC D oser B lock assembly and Fuel Doser Injector Valve fuel lines for external leaks. Are there external leaks?
   - 6.a Yes; repair as necessary. Verify repair.
   - 6.b No; replace the Hydrocarbon Fuel Doser Block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " .

SPN 3482 (MCM) (GHG17)

238.1 SPN 3482/FMI 3 - GHG17

Fuel Cut-off Valve circuit failed high

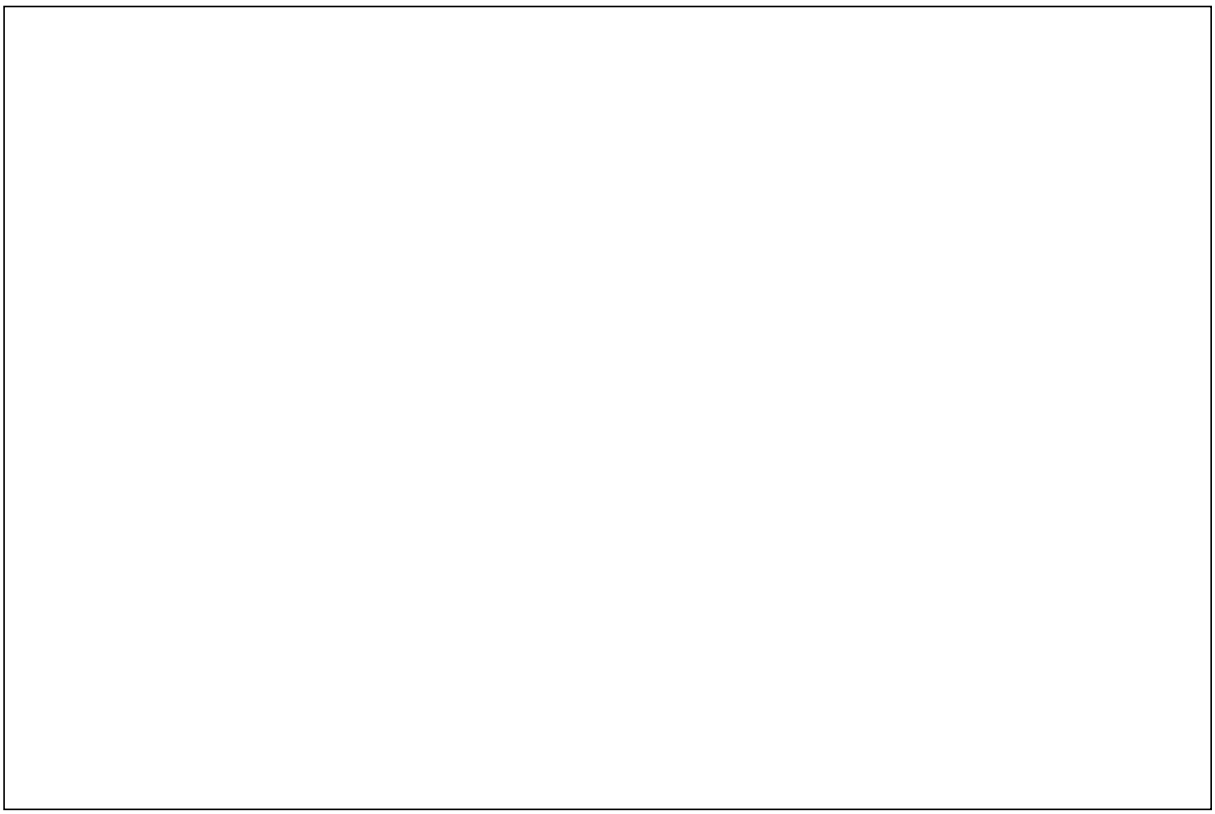
SPN 3482/FMI 3	
Description	Fuel Cut Off Valve (FCV) Circuit Failed High
Monitored Parameter	Fuel Cut Off Valve
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	Engine Idle (1 minute)

1. Disconnect the FCV connector.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pin 1 of the FCV connector and ground (battery ground lug by starter).
   - 3.a If the voltage is greater than 4.5 volts, repair short to power between pin 1 of the FCV connector and pin 69 of the MCM 120-pin connector.
   - 3.b If voltage is less than 4.5 volts, Go to step 4. .
4. Turn the ignition switch to the OFF position.
5. Disconnect the Motor Control Module (MCM) 120-pin connector.
6. Measure the resistance between pin 1 and pin 2 of the FCV connector.
   - 6.a If the resistance is less than 5 ohms, repair short between FCV connector and pins 1 and 2 and MCM 120-pin connector pins 64 and 69.
   - 6.b If the resistance is greater than 5 ohms, replace the Hydrocarbon (HC) doser block assembly. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " .

238.2 SPN 3482/FMI 4 - GHG17

Fuel Cut-off Valve circuit failed low

SPN 3482/FMI 4	
Description	Short to ground
Monitored Parameter	Fuel Cut off Valve
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Once per drive cycle
Typical Duration	20 Milliseconds
Dash Lamps	MIL, CEL
Engine Reaction	10% Derate
Verification	Key On Engine Off



1. Disconnect the Fuel Cutoff Valve (FCV) sensor.
2. Disconnect the Motor Control Module (MCM) 120-pin connector.
3. Measure the resistance between pin 1 of the FCV sensor harness connector and ground (battery ground lug by starter). Is the resistance less than 10k ohms?

   3.a Yes; repair the short circuit between pin 1 of the FCV sensor harness connector and ground.

   3.b No; replace Hydrocarbon Doser Block., Refer to section "Removal of the Hydrocarbon Fuel Doser Block " .

238.3 SPN 3482/FMI 5 - GHG17

Fuel Cut-off Valve circuit failed open.

SPN 3482/FMI 5	
Description	Fuel Cut Off Valve (FCV) Circuit Failed Open
Monitored Parameter	Fuel Cut Off Valve
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	Engine Idle

1. Turn vehicle ignition switch ON.
2. Read multiple codes.
   - 2.a If fault code SPN 3471/FMI 5 is active in addition to SPN 3482/FMI 5, repair open circuit between pin 64 of the Motor Control Module (MCM) 120-pin connector and the Electronic Dosing Valve (EDV), pin 2 and Fuel Cut-off Valve (FCV), pin 2 sensors.
   - 2.b If only fault code SPN 3482/FMI 5 is active, Go to step 4. .
3. Disconnect the FCV sensor.
4. Measure the resistance across pin 1 and pin 2 of the FCV sensor.
   - 4.a If resistance is greater than 20 ohms, replace the Hydrocarbon (HC) doser block assembly. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " .
   - 4.b If resistance is less than 20 ohms, Go to step 6. .
5. Turn the ignition ON (key ON, engine OFF).
6. Measure the voltage between pin 2 of the FCV sensor harness connector and ground (battery ground lug by starter).
   - 6.a If the voltage is between 11.5 and 12.5 volts, repair the open between pin 1 of the FCV sensor harness connector and pin 69 of the MCM 120-pin connector.
   - 6.b If the voltage is less 11.5 volts, repair open circuit between pin 2 of the FCV sensor harness connector and pin 64 of the MCM 120-pin connector.

SPN 3490 (ACM) (GHG17)

239.1 SPN 3490/FMI 3 - GHG17

Post Run Indicator Lamp - Indicates an open circuit on Pin 14 circuit of the Aftertreatment Control Module 120-pin connector.

Repair the open circuit on pin 14 circuit of the Aftertreatment Control Module (ACM) 120-pin connector. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

Note : ACM Post Run Process Lamp only applies to negative battery disconnect system.

239.2 SPN 3490/FMI 4 - GHG17

Post Run Indicator Lamp - Indicated a Short to Ground on Pin 14 circuit of the Aftertreatment Control Module 120-pin connector

Repair the short to ground on pin 14 circuit of the Aftertreatment Control Module (ACM) 120-pin connector. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

Note : ACM Post Run Process Lamp only applies to negative battery disconnect system.

239.3 SPN 3490/FMI 5 - GHG17

Post Run Indicator Lamp - Indicates a short circuit on Pin 14 circuit of the Aftertreatment Control Module 120-pin connector

Repair the short circuit on pin 14 circuit of the Aftertreatment Control Module (ACM) 120-pin connector. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

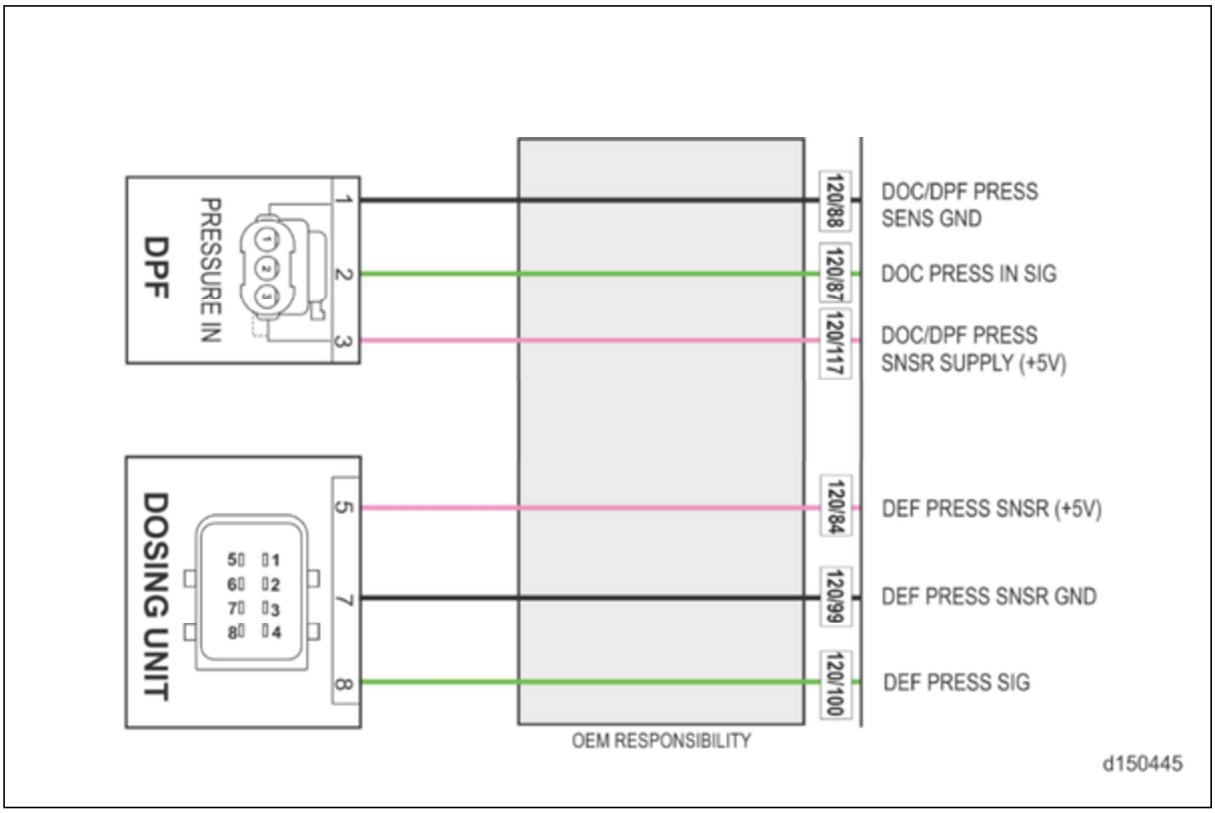
Note : ACM Post Run Process Lamp only applies to negative battery disconnect system.

SPN 3509 (ACM) (GHG17)

240.1 SPN 3509/FMI 3 - GHG17

The 5V Sensor Supply Bank 1 Circuit Failed High

SPN 3509/FMI 3	
Description	5V Sensor Supply Bank 1 Circuit Failed High
Monitored Parameter	Aftertreatment Control Module (ACM) 5V Internal Power Supply
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (One Minute)



Note : Additional faults SPN 3610/ FMI 3 Diesel Particulate Filter (DPF) Outlet Pressure Circuit Failed High and SPN 3609/FMI 3 DPF Inlet Pressure Circuit Failed High may also be present.

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Disconnect the Diesel Oxidation Catalyst (DOC) inlet pressure sensor connector.
3. Inspect the sensor harness for bent, spread, or corroded pins. Is any damage present?

3.a Yes; repair as necessary.

3.b No; Go to step 4.

4. Measure the voltage between pin 3 on the harness side of the DOC inlet pressure sensor connector and ground. Is voltage greater than 5.5 volts?

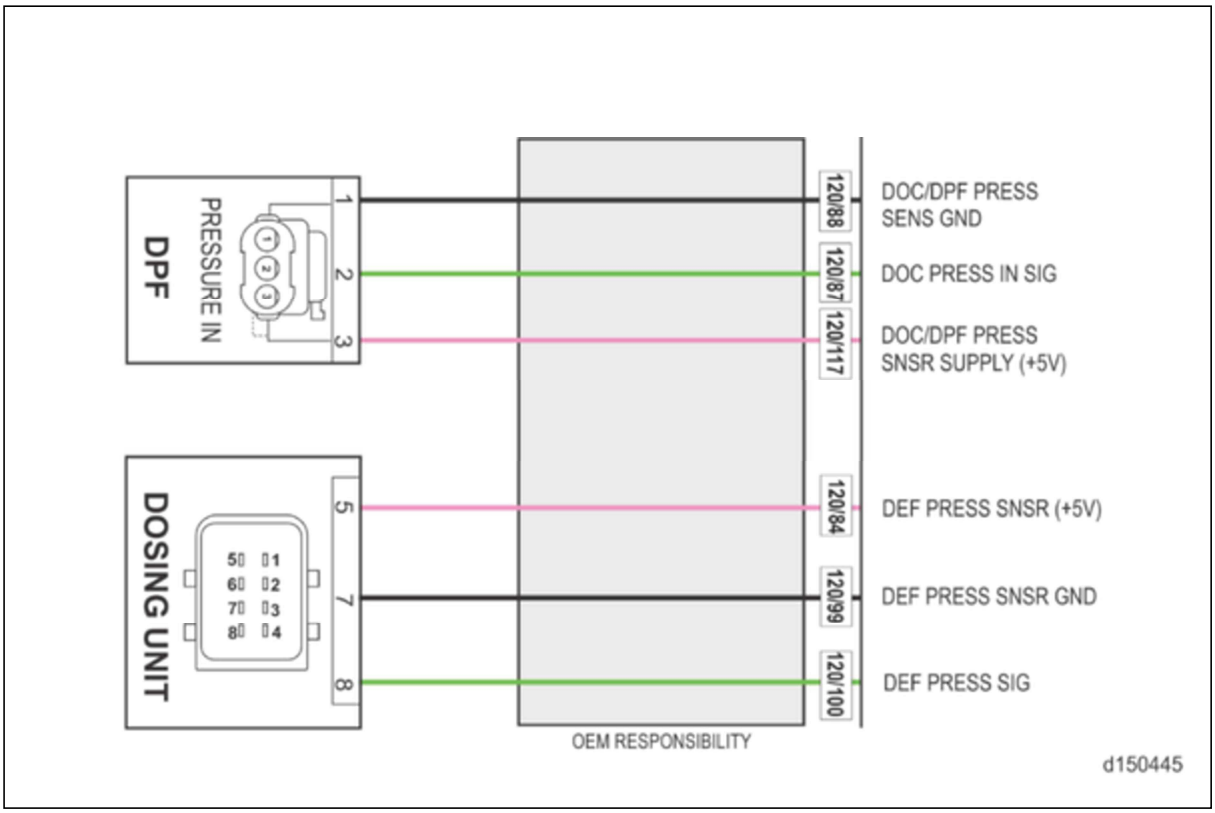
4.a Yes; repair the short to battery between pin 3 of the DOC inlet pressure sensor connector and pin 117 of the ACM 120-pin connector.

4.b No; repair the short to battery between pin 1 of the DOC inlet pressure sensor connector and pin 88 of the ACM 120-pin connector.

240.2 SPN 3509/FMI 4 - GHG17

The 5V Sensor Supply Bank 1 Circuit Failed Low

SPN 3509/FMI 4	
Description	5V Sensor Supply Bank 1 Circuit Failed Low
Monitored Parameter	Aftertreatment Control Module (ACM) 5V Internal Power Supply
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (One Minute)



Check as follows:

1. Turn the ignition OFF.
2. Disconnect the Diesel Oxidation Catalyst (DOC) inlet pressure sensor connector.
3. Inspect the sensor harness for bent, spread, or corroded pins. Is any damage present?
   - 3.a Yes; repair as necessary. Verify repairs.
   - 3.b No; Go to step 4.
4. Disconnect the ACM 120-pin connector.
5. Measure the resistance between pin 3 on the harness side of the DOC inlet pressure sensor connector and ground. Is the resistance less than 1k ohms?

5.a Yes; repair the wire between pin 3 of the DOC inlet pressure sensor connector and pin 117 of the ACM 120-pin connector. Verify repairs.

5.b No; replace the DOC inlet pressure sensor.

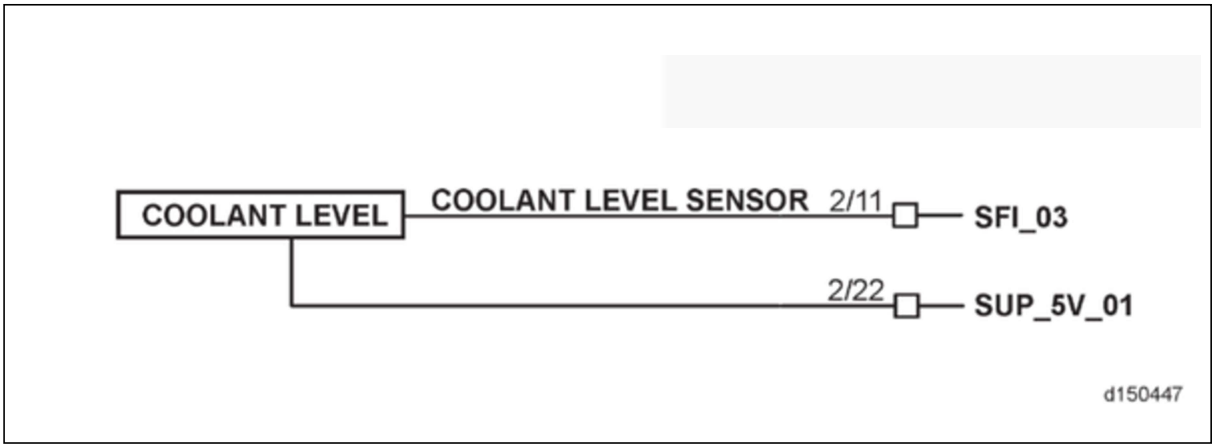
For 1-BOX™, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" . Verify repair.

For 2-BOX, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" . Verify repair.

SPN 3509 (CPC3) (GHG17)

242.1 SPN 3509/FMI 3 - GHG17

SPN 3509/FMI 3	
Description	Coolant Level Circuit Signal Failed High
Monitored Parameter	Coolant Level
Typical Enabling Conditions	Always on
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Cycle Key

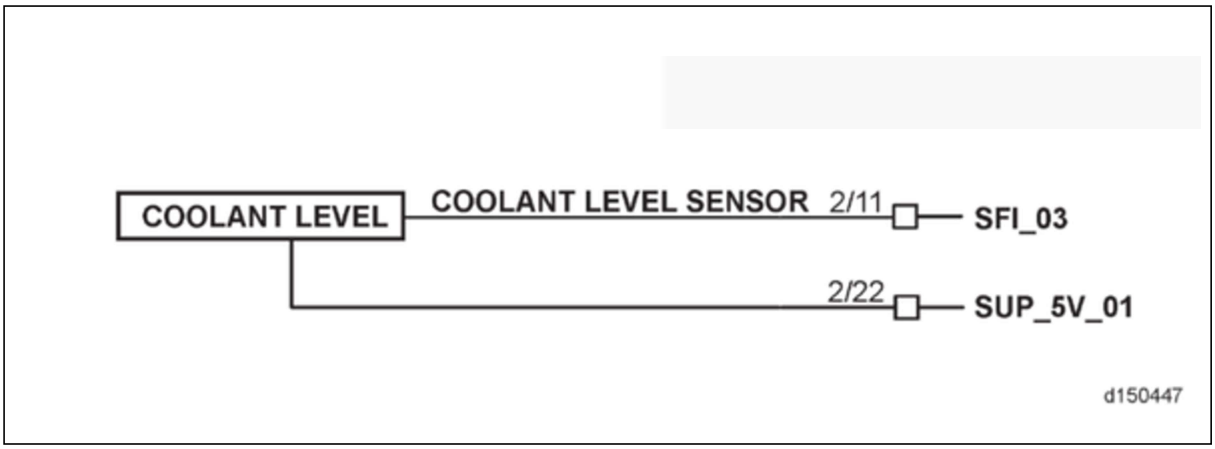


Check as follows:

1. Disconnect the coolant level sensor.
2. Inspect the coolant level sensor harness connector for bent, spread, or corroded terminals. Is pin damage present?
   - 2.a Yes; repair as necessary.
   - 2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 1 and ground. Is the voltage greater than 5.5 volts?
   - 4.a Yes; repair the short to battery power between pin 1 of the coolant level sensor harness connector and pin 22 of the CPC3 connector #2.
   - 4.b No; Go to step 5.
5. Measure the voltage between pin 2 of the coolant level sensor harness connector and ground. Is the voltage greater than 5.5 volts?
   - 5.a Yes; repair the short to battery power between pin 2 of the coolant level sensor harness connector and pin 11 of the CPC3 connector #2.
   - 5.b No; replace the coolant level sensor.

242.2 SPN 3509/FMI 4 - GHG17

SPN 3509/FMI 4	
Description	This Fault Sets when the Common Powertrain Controller (CPC3) Detects a Short to Ground on the Coolant Level Circuit
Monitored Parameter	Coolant Level
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Cycle Key



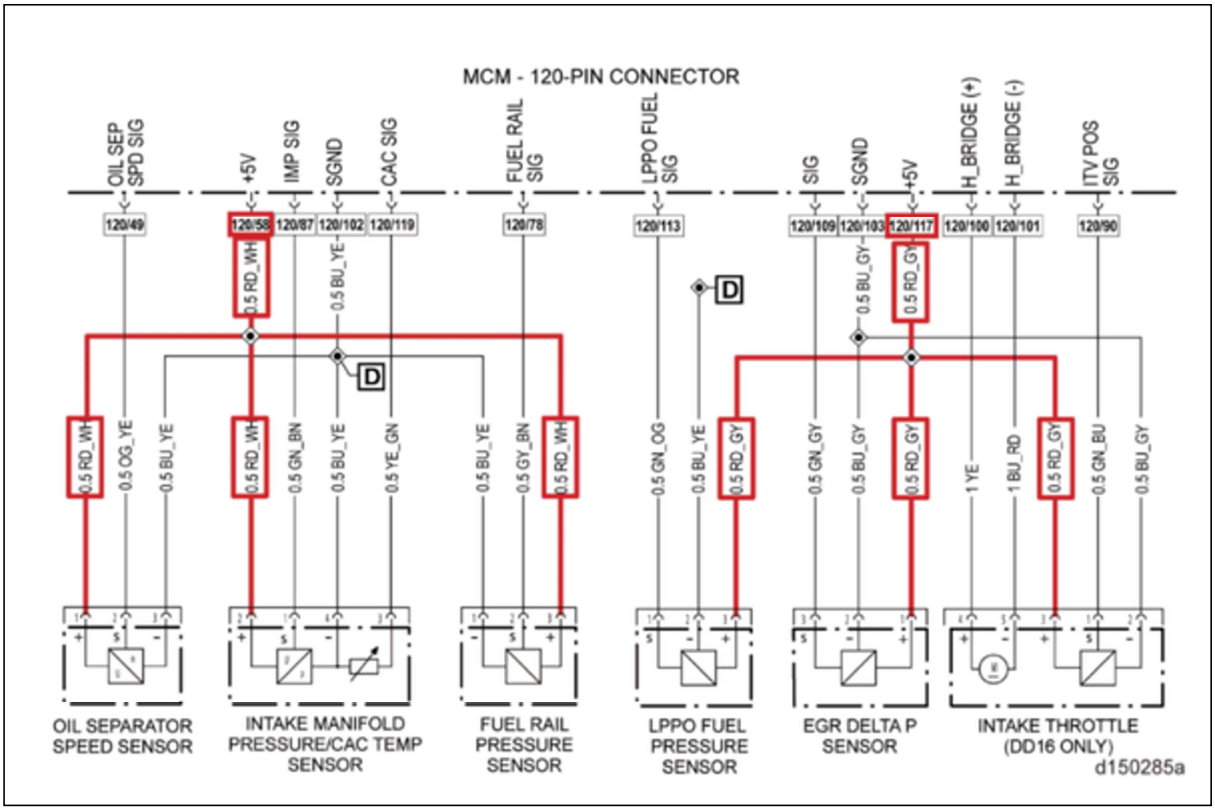
Check as follows:

1. Disconnect the coolant level sensor.
2. Inspect the coolant level sensor harness connector for bent, spread, or corroded terminals. Is pin damage present?
   - 2.a Yes; repair as necessary.
   - 2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pins 1 and 2 of the coolant level sensor harness connector. Is the voltage between 4.5 and 5.0 volts?
   - 4.a Yes; replace the coolant level sensor.
   - 4.b No; Go to step 5.
5. Measure the voltage between pin 1 of the coolant level sensor harness connector and ground. Is the voltage between 4.5 and 5.0 volts?
   - 5.a Yes; repair wire between pin 2 of the coolant level sensor harness connector and pin 11 of the CPC3 connector #2.
   - 5.b No; repair wire between pin 1 of the coolant level sensor harness connector and pin 22 of the CPC3 connector #2.

SPN 3509 (MCM) (GHG17)

241.1 SPN 3509/FMI 3 - GHG17

SPN 3509/FMI 3	
Description	This Code Sets When the Motor Control Module (MCM) Detects a Short to Voltage on Pins 58 or 117
Monitored Parameter	5V Internal Power Supply
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (one minute)



Check as follows:

1. Connect DiagnosticLink .
2. Is the vehicle equipped with a DD16 engine?
   - 2.a Yes; Go to step 3.
   - 2.b No; Go to step 6.
3. Disconnect and inspect the Intake Throttle Valve (ITV) electrical connector. Is damage or corrosion present?

3.a Yes; repair as necessary. Verify repair.

3.b No; Go to step 4.

4. Turn the ignition ON (Key ON, engine OFF).
5. Is fault code SPN 3509/FMI 4 still active?

5.a Yes; Go to step 6.

5.b No; replace the ITV. Refer to section "Removal of the Intake Throttle Valve and Adaptor" . Verify repair.

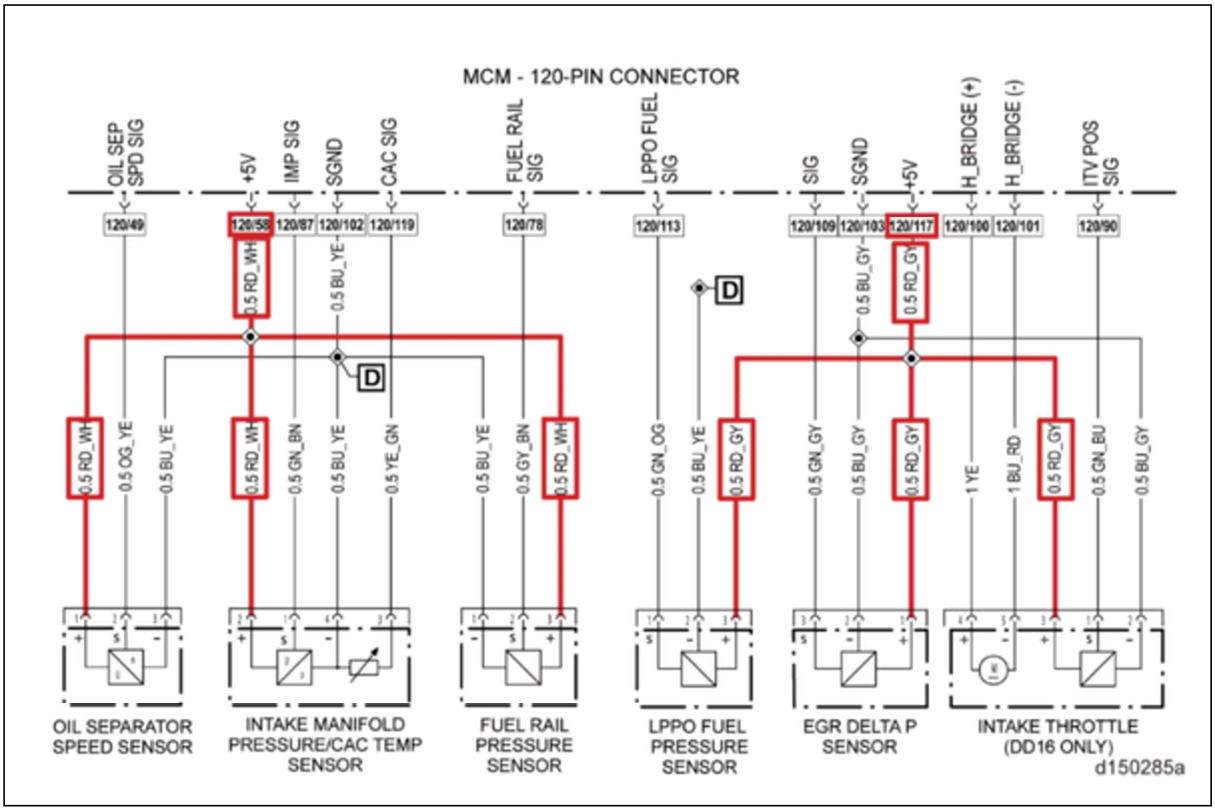
6. Turn the ignition OFF.
7. Disconnect the MCM 120-pin connector.
8. Is code SPN 3509/FMI 3 still present?

8.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repair.

8.b No; repair the short to power on the circuits for pins 58 and/or 117 of the MCM 120-pin connector. Verify repair.

241.2 SPN 3509/FMI 4 - GHG17

SPN 3509/FMI 4	
Description	This Code Sets When the Motor Control Module (MCM) Detects a Short to Ground on Pins 58 or 117
Monitored Parameter	5V Internal Power Supply
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (one minute)



Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (Key ON, engine OFF).
3. Disconnect each one of the sensors or components listed below, one at a time, while monitoring DiagnosticLink for fault code SPN 3509/FMI 4 to go inactive. Go to step 4.

- Oil Separator Speed Sensor
- Intake Manifold Pressure Sensor/Charge Air Cooler Outlet Temperature Sensor
- Fuel Rail Pressure Sensor
- EGR Delta P Sensor

- Intake Throttle Valve (DD16 only)
- LPPO Fuel Pressure Sensor

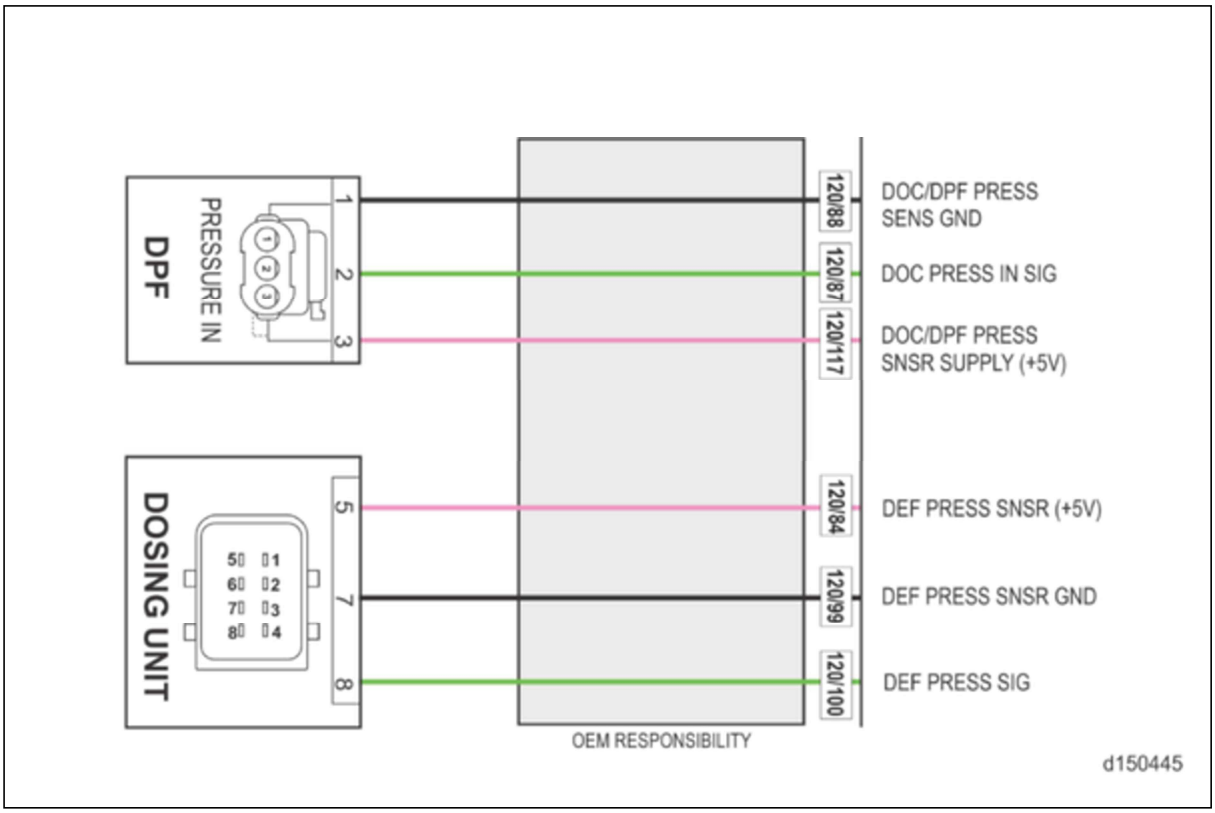
4. Does the fault code go inactive when the sensors have been disconnected?
   - 4.a Yes; replace the last sensor that was disconnected that caused the fault code SPN 3509/FMI 4 to go inactive. Verify repair.
   - 4.b No; Go to step 5.
5. Turn the ignition OFF.
6. Disconnect the MCM 120-pin connector.
7. Turn the ignition ON (key ON, engine OFF).
8. Is fault code SPN 3509/FMI 4 still present?
   - 8.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repair.
   - 8.b No; repair the short to ground on the circuits for pins 58 and/or 117 of the MCM 120-pin connector. Verify repair.

SPN 3510 (ACM) (GHG17)

244.1 SPN 3510/FMI 3 - GHG17

Aftertreatment Control Module 2 Sensor Supply 2 Short to Battery

SPN 3510/FMI 3	
Description	5V Sensor Supply Bank 2 Circuit Failed High
Monitored Parameter	Motor Control Module (MCM) 5V Internal Power Supply
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (One Minute)



Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Disconnect the Diesel Exhaust Fluid (DEF) dosing unit electrical connector.
3. Inspect the DEF dosing unit harness for bent, spread, or corroded pins. Is any damage present?

   3.a Yes; repair as necessary. Verify repairs.

   3.b No; Go to step 4.

4. Measure the voltage between pin 5 on the harness side of the DEF dosing unit connector and ground. Is the voltage greater than 5.5 volts?

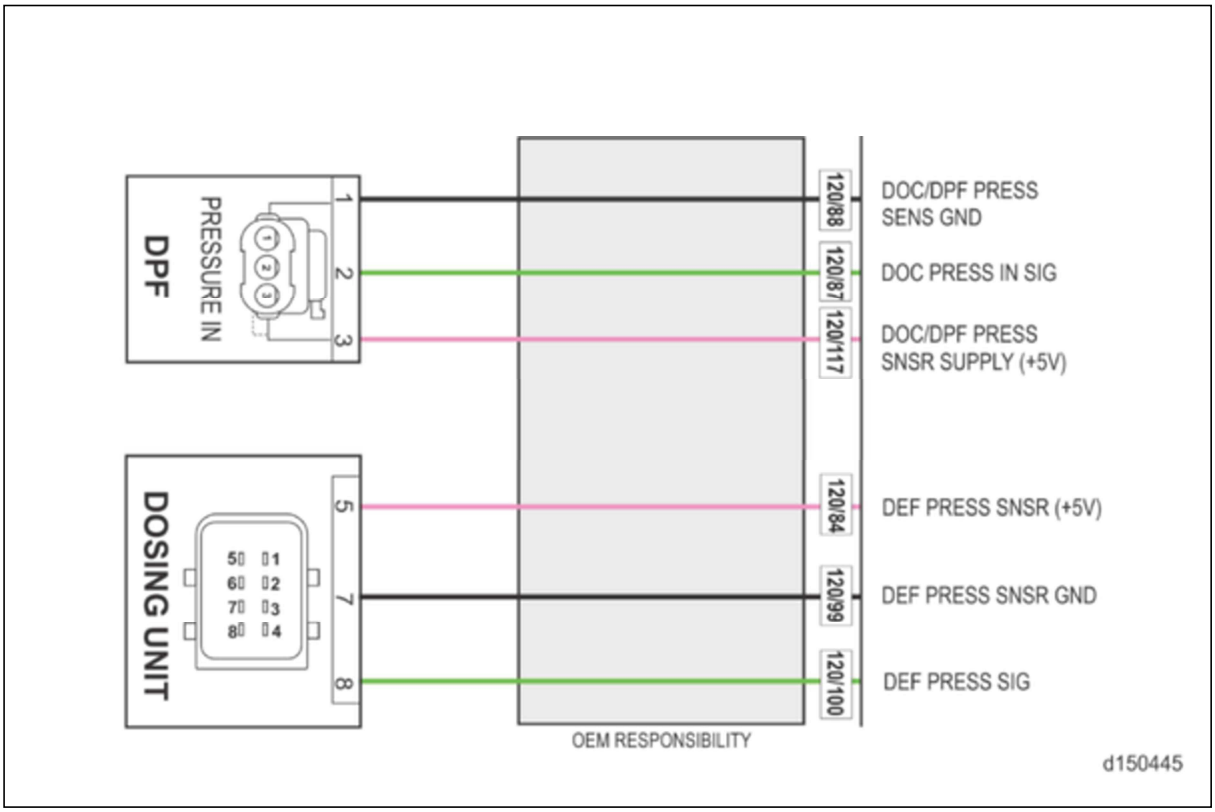
   4.a Yes; repair the short to battery between pin 5 of the DEF dosing unit connector and pin 84 of the Aftertreatment Control Module (ACM) 120-pin connector. Verify repairs.

   4.b No; repair the short between pin 7 of the DEF dosing unit connector and pin 99 of the ACM 120-pin connector. Verify repairs.

244.2 SPN 3510/FMI 4 - GHG17

Aftertreatment Control Module 2 Sensor Supply Bank 2 Short to Ground

SPN 3510/FMI 4	
Description	5V Sensor Supply Bank 2 Circuit Failed Low
Monitored Parameter	Motor Control Module (MCM) 5V Internal Power Supply
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (One Minute)



Check as follows:

1. Turn the ignition OFF.
2. Disconnect the Diesel Exhaust Fluid (DEF) dosing unit electrical connector.
3. Inspect the DEF dosing unit harness for bent, spread, or corroded pins. Is any damage present?
   3.a Yes; repair as necessary. Verify repairs.
   3.b No; Go to step 4.
4. Disconnect the Aftertreatment Control Module (ACM) 120-pin connector.
5. Measure the resistance between pin 5 on the harness side of the DEF dosing unit connector and ground. Is the resistance less than 1K ohms?

5.a Yes; repair the wire between pin 5 of the DEF dosing unit connector and pin 84 of the ACM 120-pin connector. Verify repairs.

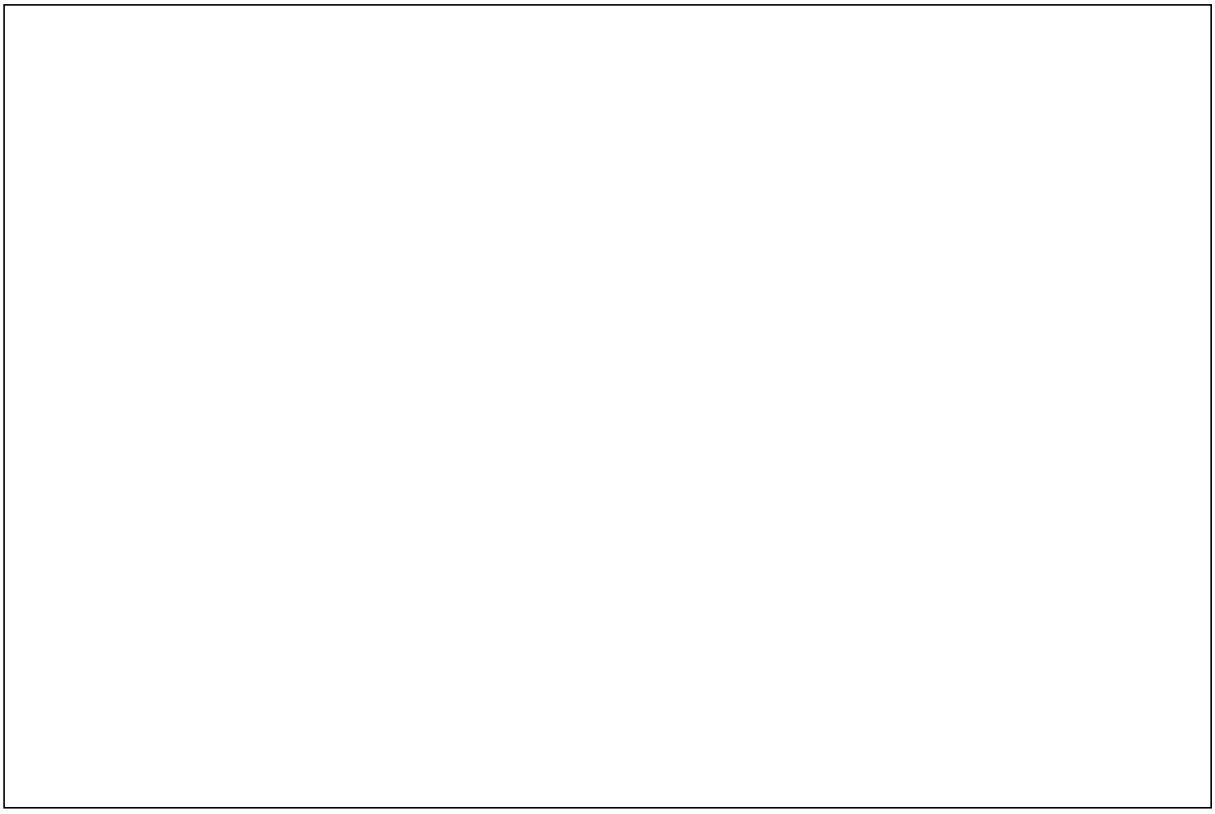
5.b No; replace the DEF doser unit.

SPN 3510 (CPC) (GHG17)

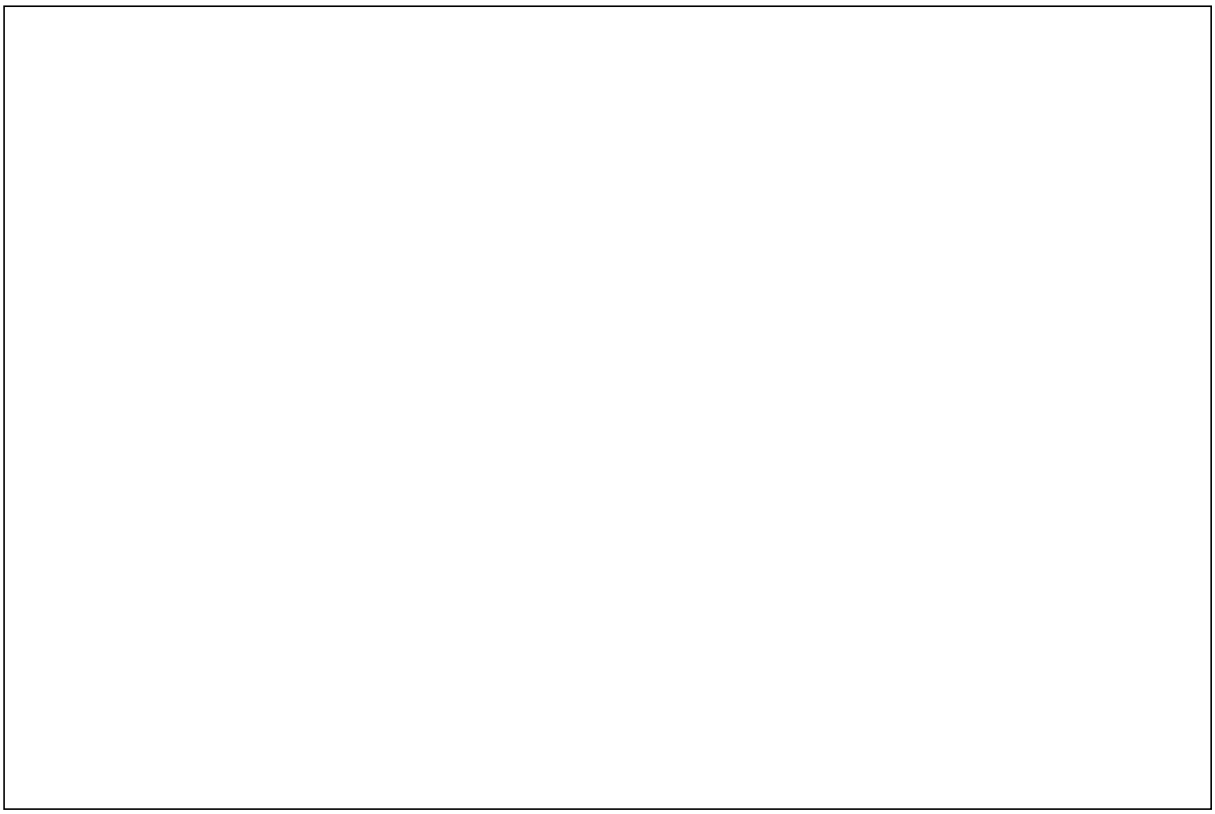
243.1 SPN 3510/FMI 4 - GHG17

SPN 3510/FMI 4	
Description	Accelerator Pedal Sensor Failed Low
Monitored Parameter	Pedal Supply Voltage
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key Cycle - Ignition ON

Analog Pedal Type



Williams Dual-Channel Analog Pedal



Williams Dual-Channel Pedal Connector and Pinout				
Function	CPC Pinout	Connector Pinout	Comments	Harness Connector Body
APS1	1/7	A	SENSOR 1	
GND1	1/4	B	APS1 GND	
VCC1 (+5V)	1/8	C	APS1 Power Supply	
VCC2 (+5V)	3/3	D	APS2 Power Supply	
GND2	3/2	E	APS2 GND	
APS2	4/14	F	SENSOR 2	Harness Connector and Seal (P/N: 12066317) Terminal Female (P/N: 12103881)

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the Accelerator Pedal (AP) connector.
3. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   3.a Yes; repair as necessary. Verify repair.

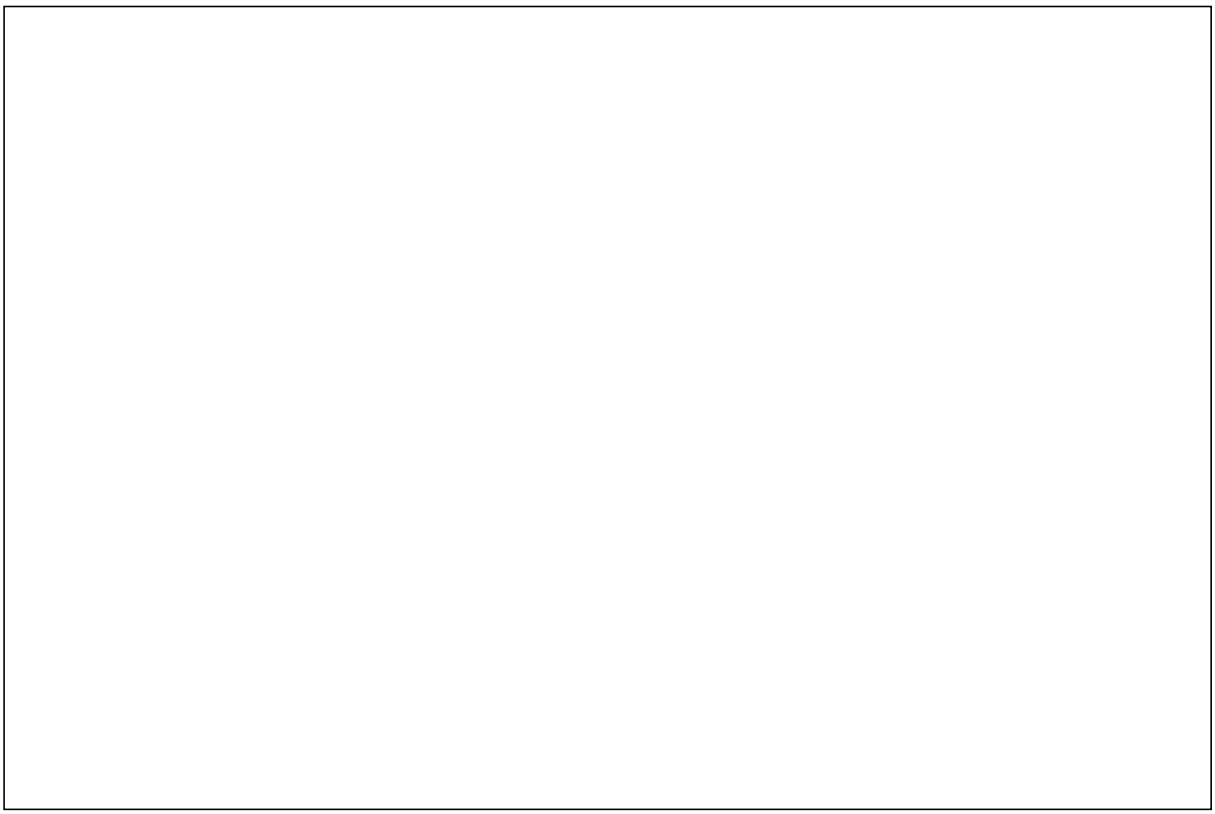
   3.b No; Go to step 4.
4. Turn the ignition ON (key ON, engine OFF).

5. Clear codes and cycle ignition.
6. Using DiagnosticLink , monitor fault code SPN 3510/FMI 4 with the AP disconnected. Does the fault code change or go inactive?
   - 6.a Yes; replace the AP, clear codes and verify repair. Refer to Original Equipment Manufacturer (OEM) literature. Verify repair.
   - 6.b No; Go to step 7.
7. Measure the voltage between pin B of the AP harness connector and ground. Is voltage present?
   - 7.a Yes; repair a short to voltage between pin B of the AP harness connector and pin 4 of the CPC#1 connector.
   - 7.b No; Go to step 8.
8. Measure the resistance between pins B and C of the AP harness connector. Is the resistance less than 10K ohms?
   - 8.a Yes; repair the short between pins B and C of the AP harness connector. Verify repair.
   - 8.b No; Go to step 9.
9. Measure the resistance between pin C of the AP harness connector and ground. Is the resistance less than 10K ohms?
   - 9.a Yes; repair the short circuit between pin C of the AP harness connector and ground. Verify repair.
   - 9.b No; Go to step 10.
10. Is the vehicle equipped with a Williams Dual-Channel Analog Pedal?
    - 10.a Yes; Go to step 11.
    - 10.b No; Go to step 14.
11. Measure the resistance between pins D and E of the AP harness connector. Is the resistance less than 10K ohms?
    - 11.a Yes; repair the short between pins D and E of the AP harness connector. Verify repair.
    - 11.b No; Go to step 12.
12. Measure the resistance between pin D of the AP harness connector and ground. Is the resistance less than 10K ohms?
    - 12.a Yes; repair the short circuit between pin D of the AP harness connector and ground. Verify repair.
    - 12.b No; Go to step 13.
13. Measure the voltage between pin E of the AP harness connector and ground. Is voltage present?
    - 13.a Yes; repair a short to voltage between pin E of the Accelerator Pedal (AP) harness connector and pin 2 of the CPC #3 connector. Verify repair.
    - 13.b No; Go to step 16.
14. Measure the voltage between pin F of the AP harness connector and ground. Is voltage present?
    - 14.a Yes; repair a short to voltage between pin F of the AP harness connector and pin 2 of the CPC #2 connector. Verify repair.
    - 14.b No; Go to step 15.
15. Measure the voltage between pin E of the AP harness connector and ground. Is voltage present?
    - 15.a Yes; repair a short to voltage between pin E of the AP harness connector and pin 6 of the CPC #1 connector. Verify repair.
    - 15.b No; Go to step 16.
16. Turn the ignition OFF.
17. Disconnect the CPC. Inspect the CPC and the harness connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
    - 17.a Yes; repair as necessary. Verify repair.
    - 17.b No; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

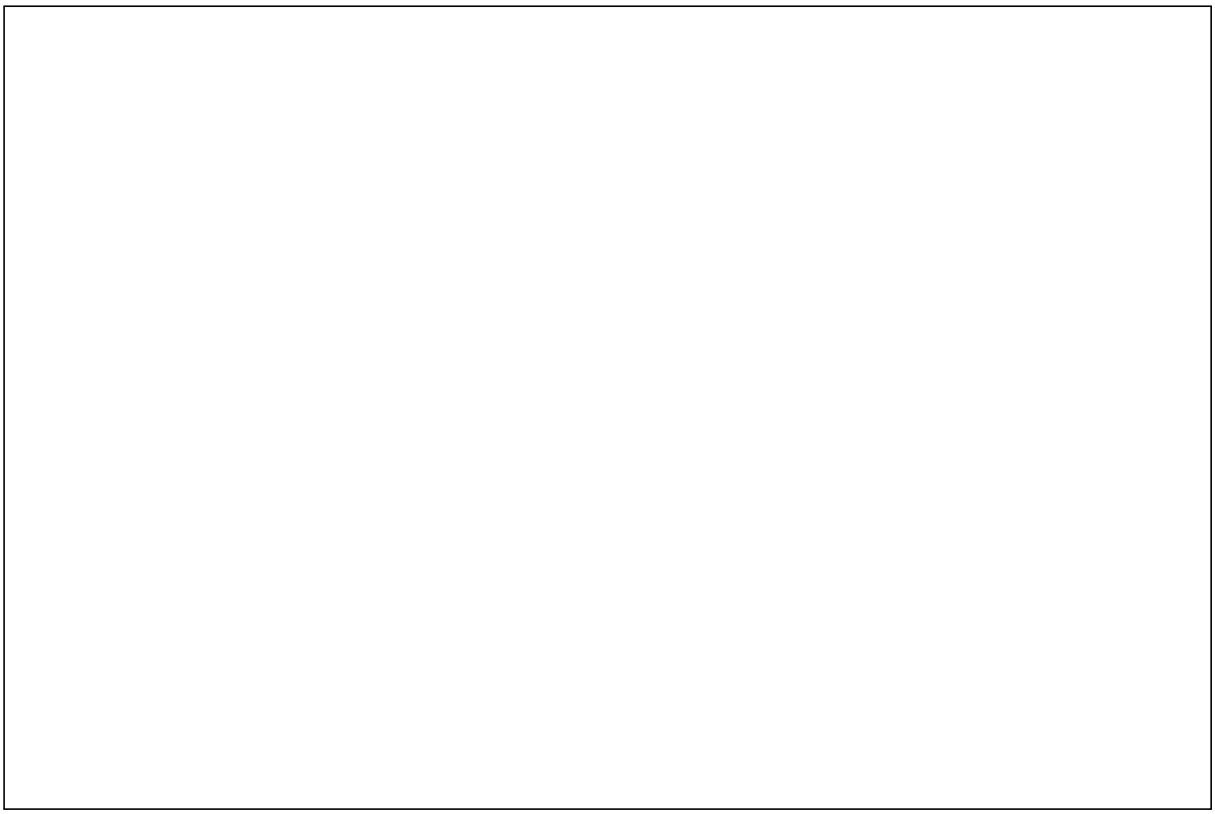
243.2 SPN 3510/FMI 7 - GHG17

SPN 3510/FMI 7	
Description	Accelerator Pedal Sensor Failed High
Monitored Parameter	Pedal Supply Voltage
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key Cycle - Ignition ON

Analog Pedal Type



Williams Dual-Channel Analog Pedal



Williams Dual-Channel Pedal Connector and Pinout				
Function	CPC Pinout	Connector Pinout	Comments	Harness Connector Body
APS1	1/7	A	SENSOR 1	
GND1	1/4	B	APS1 GND	
VCC1 (+5V)	1/8	C	APS1 Power Supply	
VCC2 (+5V)	3/3	D	APS2 Power Supply	
GND2	3/2	E	APS2 GND	
APS2	4/14	F	SENSOR 2	Harness Connector and Seal (P/N: 12066317) Terminal Female (P/N: 12103881)

Check as follows:

1. Disconnect the Accelerator Pedal (AP).
2. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   2.a Yes; repair as necessary. Verify repair.

   2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin C of the AP harness connector and ground. Is the voltage above 5.5 volts?

4.a Yes; repair short to battery power between pin C of the AP harness connector and pin 8 of the CPC #1 connector. Verify repair.

4.b No; Go to step 5.

5. Measure the voltage between pin B of the AP harness connector and ground. Is voltage present?

5.a Yes; repair short to power between pin B of the AP harness connector and pin 4 of the CPC #1 connector. Verify repair.

5.b No; Go to step 6.

6. Measure the voltage between pin A of the AP harness connector and ground. Is voltage present?

6.a Yes; repair short to power between pin A of the AP harness connector and pin 7 of the CPC #1 connector. Verify repair.

6.b No; Go to step 7.

7. Is the vehicle equipped with a Williams Dual-Channel Analog Pedal?

7.a Yes; Go to step 8.

7.b No; Go to step 10.

8. Measure the voltage between pin D of the AP harness connector and ground. Is the voltage above 5.5 volts?

8.a Yes; repair short to battery power between pin D of the AP harness connector and pin 3 of the CPC #3 connector. Verify repair.

8.b No; Go to step 9.

9. Turn the ignition OFF.

10. Disconnect the CPC. Inspect the CPC and the harness connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

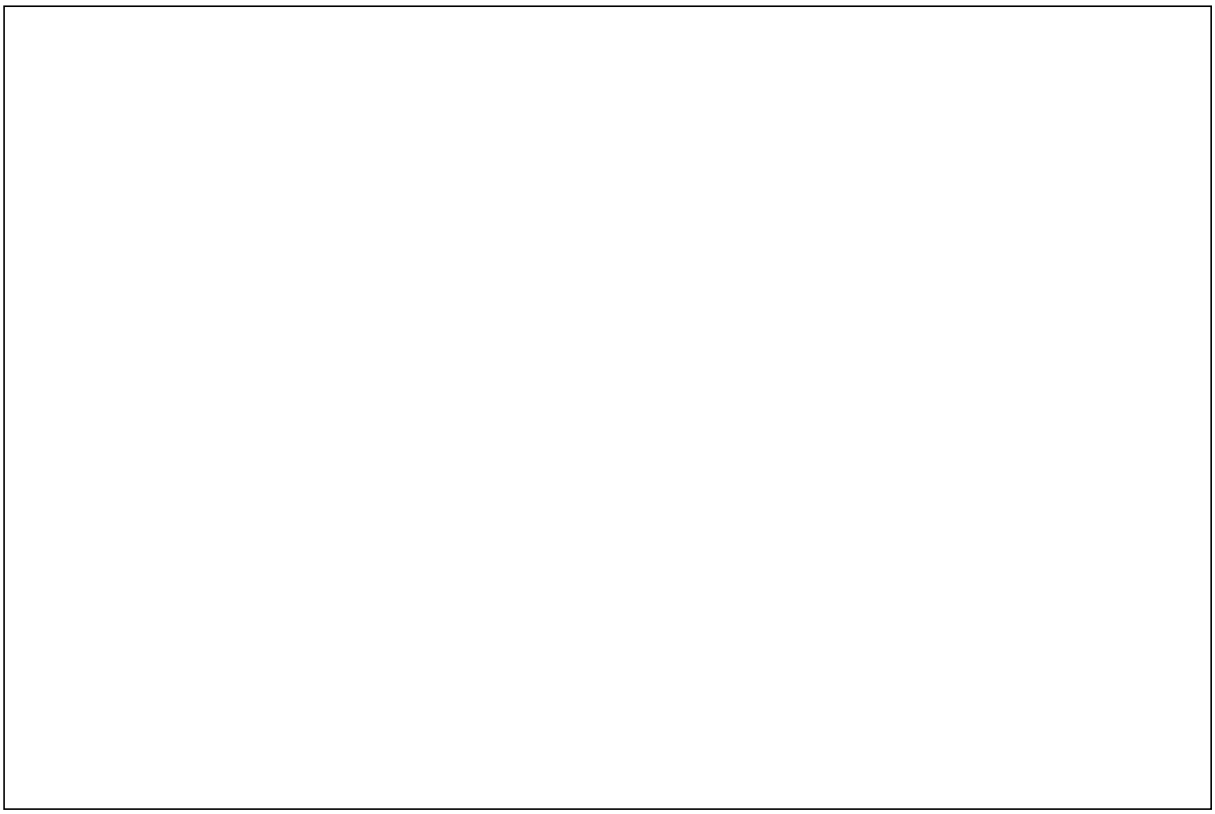
10.a Yes; repair as necessary. Verify repair.

10.b No; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

243.3 SPN 3510/FMI 8 - GHG17

SPN 3510/FMI 8	
Description	Accelerator Pedal Sensor Signal Failed
Monitored Parameter	Pedal Supply Voltage
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key Cycle - Ignition ON

Williams Dual-Channel Pedal Connector and Pinout				
Function	CPC Pinout	Connector Pinout	Comments	Harness Connector Body
APS1	1/7	A	SENSOR 1	
GND1	1/4	B	APS 1 GND	
VCC1 (+5V)	1/8	C	APS1 Power Supply	
VCC2 (+5V)	3/3	D	APS2 Power Supply	
GND2	3/2	E	APS2 GND	
APS2	4/14	F	SENSOR 2	Harness Connector and Seal (P/N: 12066317) Terminal Female (P/N: 12103881)



Check as follows:

1. Disconnect the Accelerator Pedal (AP).
2. Inspect the AP and harness side connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 2.a Yes; repair as necessary. Verify repair.
   - 2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pins B and C of the AP harness side connector. Is the voltage above 5.5 volts?
   - 4.a Yes; repair short to battery power between pin C of the AP harness side connector and pin 8 of the CPC #1 connector. Verify repair.
   - 4.b No; Go to step 5.
5. Measure the resistance between pins C and B of the AP harness side connector. Is the resistance greater than 10K ohms?
   - 5.a Yes; Go to step 6.
   - 5.b No; repair the short between pins C and B of the AP harness side connector and pins 8 and 4 of the CPC #1 connector. Verify repair.
6. Measure the resistance between pin C of the AP harness side connector and ground. Is the resistance greater than 10K ohms?
   - 6.a Yes; Go to step 7.
   - 6.b No; repair the short to ground between pin C of the AP harness side connector and pin 8 of the CPC#1 connector. Verify repair.
7. Measure the resistance between pin C of the AP harness side connector and pin 8 of the CPC #1 connector. Is the resistance less than five ohms?

7.a Yes; Go to step 8.

7.b No; repair the open circuit between pin C of the AP harness side connector and pin 8 of the CPC #1 connector.

8. Is the vehicle equipped with a Williams Dual-Channel Analog Pedal?

8.a Yes; Go to step 9.

8.b No; Go to step 12.

9. Measure the voltage between pins D of the AP harness side connector and ground. Is the voltage above 5.5 volts?

9.a Yes; repair short to battery power between pin D of the AP harness side connector and pin 3 of the CPC #3 connector. Verify repair.

9.b No; Go to step 10.

10. Measure the resistance between pin D of the AP harness side connector and ground. Is the resistance greater than 10K ohms?

10.a Yes; Go to step 11.

10.b No; repair the short circuit between pin D of the AP harness side connector and ground. Verify repair.

11. Measure the resistance between pin D of the AP harness side connector and pin 3 of the CPC #3 connector. Is the resistance greater than five ohms?

11.a Yes; repair the open circuit between pin D of the AP harness side connector and pin 3 of the CPC #3 harness side connector.

11.b No; Go to step 12.

12. Turn the ignition OFF.

13. Disconnect the CPC. Inspect the CPC and the harness connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

13.a Yes; repair as necessary. Verify repair.

13.b No; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

SPN 3510 (MCM) (GHG17)

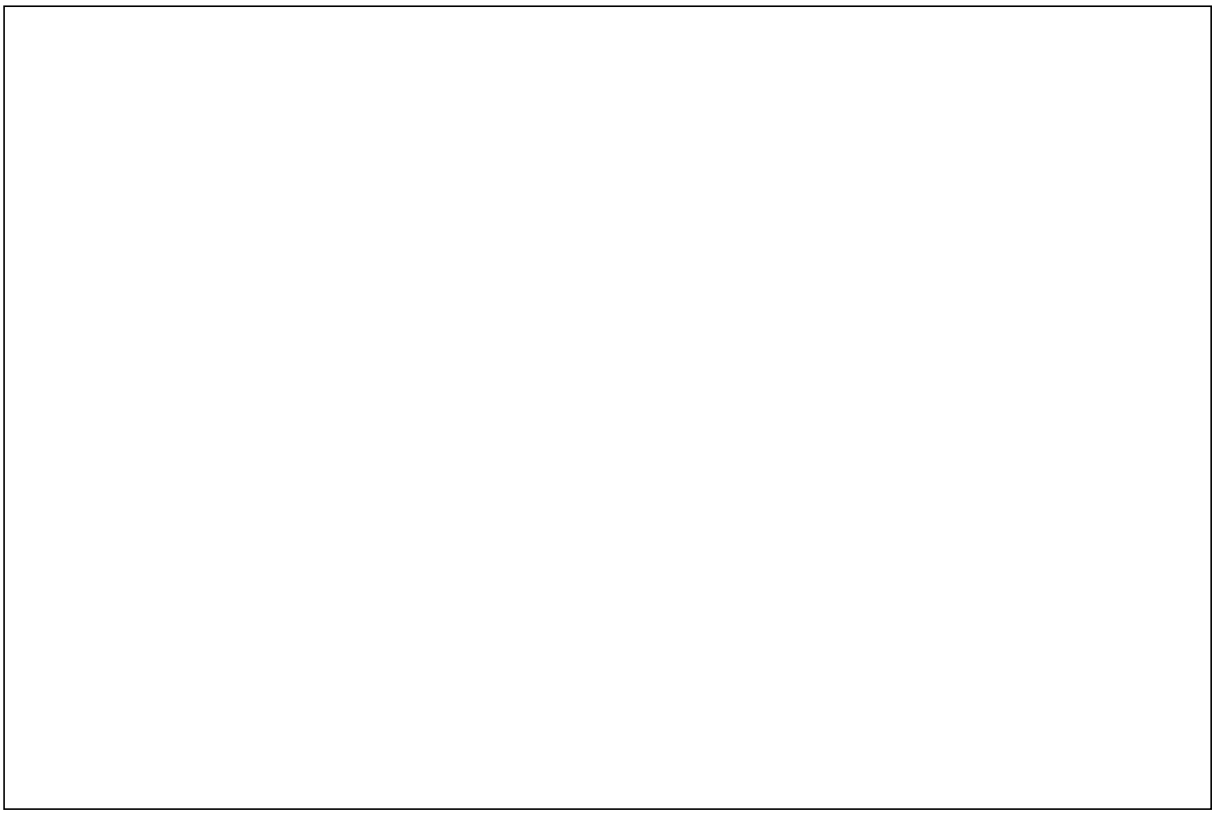
245.1 SPN 3510/FMI 3 - GHG17

5V Sensor Supply Bank 2 Circuit Failed High

SPN 3510/FMI 3	
Description	5V Sensor Supply Bank 2 Circuit Short to Power
Monitored Parameter	Motor Control Module (MCM) 5V Internal Power Supply
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON

This fault indicates the Motor Control Module (MCM) detects a short to power (voltage greater than 5.3) on any of the MCM pins, which are listed in the chart below. Inspect the harness and repair as necessary. Verify repairs.

MCM Pins for Short to Power Check	
Component	MCM Pin
Camshaft Position Sensor	82
Engine Oil Pressure Sensor	82
Fuel Compensation Pressure Sensor	82
HC Doser Fuel Pressure Sensor	82
Water Pump Speed Sensor (DD15AT / DD13 Optional)	82
Fan Speed Sensor (If equipped)	85



Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Disconnect each component listed below (if equipped) one at a time, while monitoring fault code in DiagnosticLink.

- Fuel Compensation Pressure Sensor
- HC Doser Fuel Pressure Sensor
- Camshaft Position Sensor
- Engine Oil Pressure Sensor
- Water Pump Sensor (DD15AT/DD13 Optional)
- Fan Speed Sensor (if equipped)

4. Does the fault code go inactive when a component is disconnected?

   4.a Yes; Go to step 5.

   4.b No; Go to step 6.

5. For the component in question, inspect the harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Are any signs of damage present?

   5.a Yes; repair as necessary. Verify repairs.

   5.b No; replace that component. Verify repairs.

6. Turn the ignition OFF.
7. Disconnect the engine harness 10-pin connector on the left side of engine.
8. Inspect the harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Are any signs of damage present?

8.a Yes; repair as necessary. Verify repairs.

8.b No; Go to step 9.

9. Turn the ignition ON (key ON, engine OFF).

10. Does the fault code go inactive when the engine harness 10-pin connector is disconnected?

10.a Yes; repair wiring harness between 10-pin connector and the Fan Speed Sensor (if equipped). Refer to Original Equipment Manufacturer (OEM) literature to identify chassis components wired to the 10-pin connector.

10.b No; Go to step 11.

11. Turn the ignition OFF.

12. Disconnect the MCM 120-pin connector.

13. Inspect the MCM 120-pin connector and the 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Are any signs of damage present?

13.a Yes; repair as necessary. Verify repairs.

13.b No; Go to step 14.

14. Turn the ignition ON (key ON, engine OFF).

15. Does the fault code go inactive when the MCM is disconnected?

15.a Yes; Go to step 16.

15.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs.

16. With the components still disconnected, measure the voltage between pin 82 of the MCM 120-pin connector and ground. Is any voltage present?

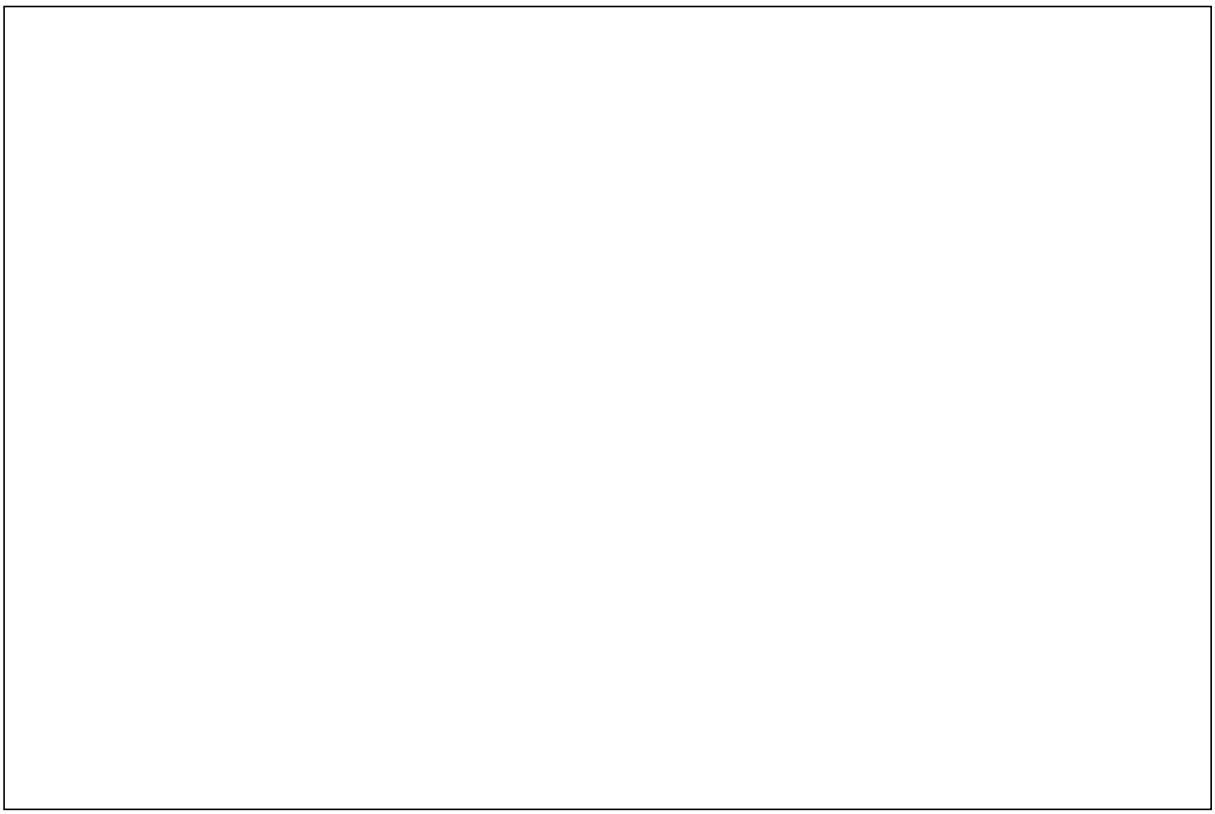
16.a Yes; repair the wire short to power on pin 82 of the MCM 120-pin connector. Verify repairs.

16.b No; repair the wire short to power on pin 85 of the MCM 120-pin connector. Verify repairs.

245.2 SPN 3510/FMI 4 - GHG17

5V Sensor Supply Bank 2 Circuit Failed Low

SPN 3510/FMI 4	
Description	5V Sensor Supply Bank 2 Circuit Failed Low
Monitored Parameter	Motor Control Module (MCM) 5V Internal Power Supply
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (1 minute)



Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Disconnect each component listed below (if equipped) one at a time, while monitoring fault code in DiagnosticLink .

- Fuel Compensation Pressure Sensor
- HC Doser Fuel Pressure Sensor
- Camshaft Position Sensor
- Engine Oil Pressure Sensor

- Water Pump Sensor (DD15AT / DD13 Optional)
- Fan Speed Sensor (If equipped)

4. Does the fault code go inactive when component is disconnected?
   - 4.a Yes; Go to step 5.
   - 4.b No; Go to step 6.
5. For the component in question,inspect the harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Are any signs of damage present?
   - 5.a Yes; repair as necessary. Verify repairs.
   - 5.b No; replace that component. Verify repairs.
6. Turn the ignition OFF.
7. Disconnect the engine harness 10-pin connector on the left side of engine.
8. Inspect the harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Are any signs of damage are present?
   - 8.a Yes; repair as necessary. Verify repairs.
   - 8.b No; Go to step 9.
9. Turn the ignition ON (key ON, engine OFF).
10. Does the fault code go inactive when the engine harness 10-pin connector is disconnected?
    - 10.a Yes; repair wiring harness between 10-pin connector and the Fan Speed Sensor (If equipped). Refer to Original Equipment Manufacturer (OEM) literature to identify chassis components wired to the 10-pin connector.
    - 10.b No; Go to step 11.
11. Turn the ignition OFF.
12. Disconnect the MCM 120-pin connector.
13. Inspect the MCM 120-pin connector and the 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Are any signs of damage present?
    - 13.a Yes; repair as necessary. Verify repairs.
    - 13.b No; Go to step 14.
14. Turn the ignition ON (key ON, engine OFF).
15. Does the fault code go inactive when the MCM is disconnected?
    - 15.a Yes; Go to step 16.
    - 15.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs.
16. Turn the ignition OFF.
17. With the components still disconnected, measure the resistance between pin 82 of the MCM 120-pin connector and ground. Is the resistance greater than 10K ohms?
    - 17.a Yes; repair the wire short to ground on pin 85 of the MCM 120-pin connector. Verify repairs.
    - 17.b No; repair the wire short to ground on pin 82 of the MCM 120-pin connector. Verify repairs.

SPN 3511 (ACM) (GHG17)

246.1 SPN 3511/FMI 3 - GHG17

SPN 3511/FMI 3	
Description	3V Sensor Supply Bank 1 Circuit Failed High
Monitored Parameter	Aftertreatment Control Module (ACM) 3V Internal Power Supply
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (One Minute)

This SPN indicates that the ACM detects a short to power (voltage is greater than 3.29) on any of the ACM pins listed in the table.

Component	ACM Pin
Diesel Oxidation Catalyst (DOC) Outlet Temperature Sensor	27
DOC Inlet Temperature Sensor	107
Diesel Particulate Filter (DPF) Outlet Temperature Sensor	97
Selective Catalyst Reduction (SRC) Outlet Temperature Sensor	78

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ WARNING

PERSONAL INJURY

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

1. Inspect the harness and repair as necessary.

246.2 SPN 3511/FMI 4 - GHG17

SPN 3511/FMI 4	
Description	3V Sensor Supply Bank 1 Circuit Failed Low
Monitored Parameter	ACM 3V Internal Power Supply
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (One Minute)

This code indicates an Aftertreatment Control Module (ACM) internal failure. Replace the ACM. Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" or Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module" Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module" .

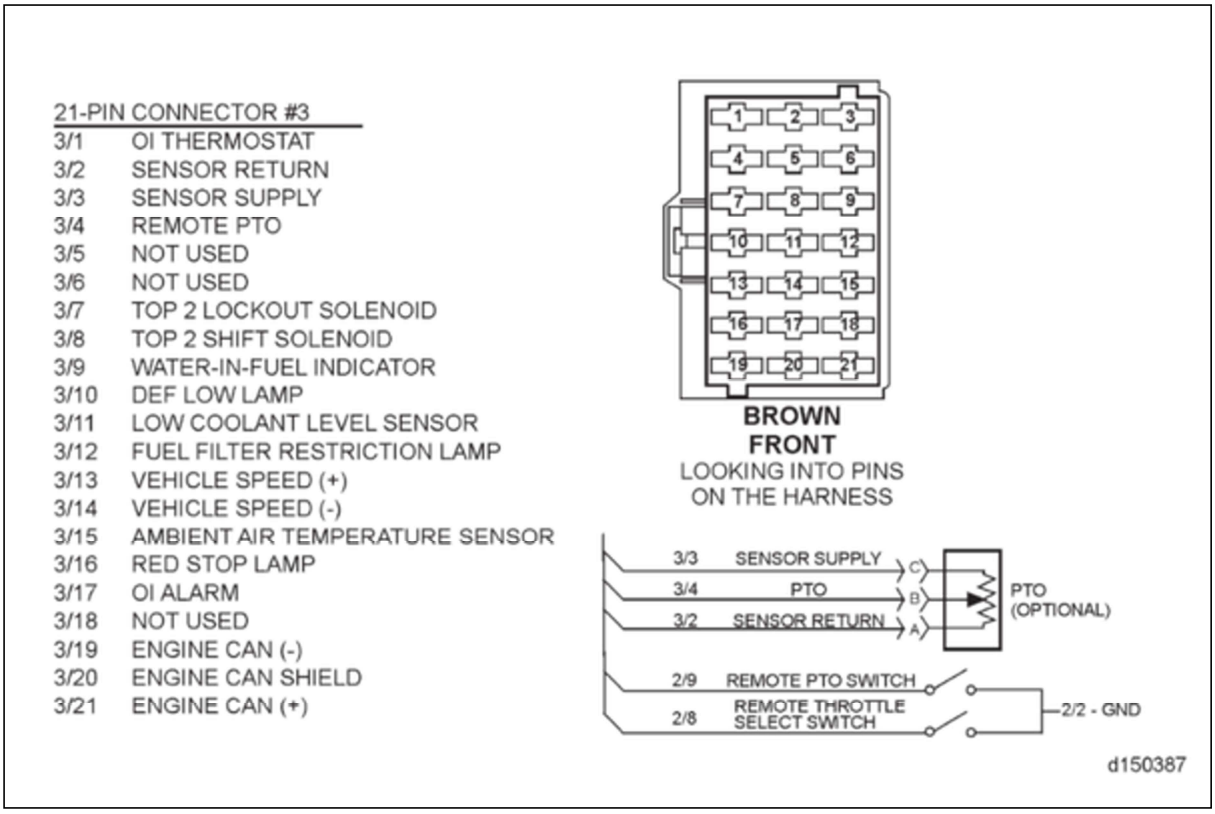
SPN 3511 (CPC) (GHG17)

248.1 SPN 3511/FMI 3 - GHG17

Remote Accelerator Pedal Supply Voltage Circuit Failed High

This code sets when the Common Powertrain Controller (CPC) detects the voltage on the sensor supply circuits is out of range.

SPN 3511/FMI 3	
Description	Remote Accelerator Pedal Supply Circuit Short to Voltage or Open
Monitored Parameter	Remote Accelerator Pedal Voltage
Typical Enabling Conditions	Always On
Monitor Sequence	Key On
Execution Frequency	None
Typical Duration	None
Dash Lamps	CEL
Engine Reaction	Idle Only
Verification	Ignition Key Cycle ON



Check as follows:

1. Is the unit equipped with a remote accelerator pedal?
   - 1.a Yes; Go to step 2.
   - 1.b No; refer to the Application and Installation manual for proper Common Powertrain Controller (CPC) configuration.

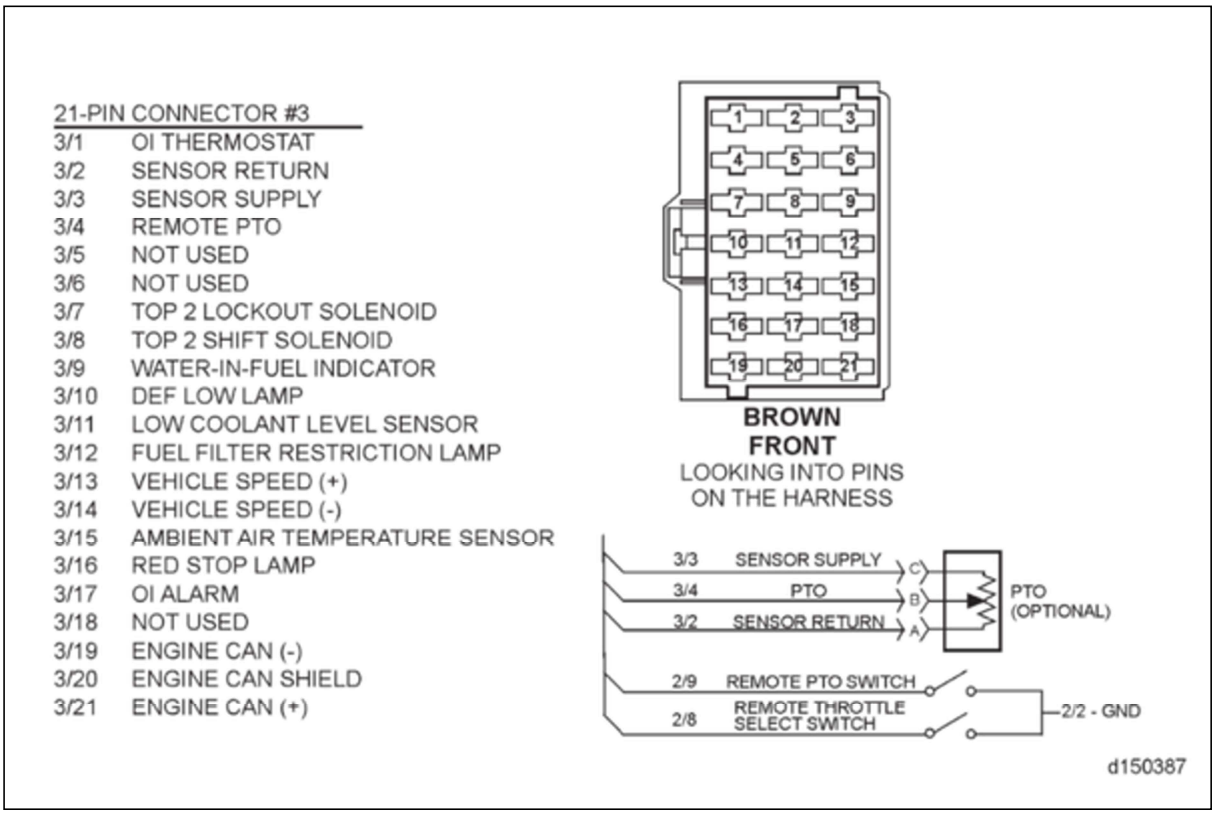
2. Disconnect the remote throttle switch.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between remote throttle sensor supply (from pin 3 of the CPC connector #3) and ground. Refer to Original Equipment Manufacturer (OEM) literature for schematic information. Is voltage present?
   - 4.a Yes; Go to step 5.
   - 4.b No; repair the open circuit between pin 3 of the CPC connector #3 and the remote throttle switch.
5. Is the voltage measured in step 4 greater than 5.5 volts?
   - 5.a Yes; repair a short to battery power between pin 3 of the CPC connector #3 and the remote throttle switch.
   - 5.b No; Go to step 6.
6. Disconnect CPC connector #3.
7. Measure the resistance between remote throttle sensor supply and pin 3 of CPC connector #3. Refer to Original Equipment Manufacturer (OEM) literature for schematic information. Is the resistance less than five ohms?
   - 7.a Yes; replace the remote throttle switch.
   - 7.b No; repair the open circuit between pin 3 of the CPC connector #3 and the remote throttle switch.

248.2 SPN 3511/FMI 4 - GHG17

Remote Accelerator Pedal Supply Voltage Circuit Failed Low

This code sets when the Common Powertrain Controller (CPC) detects the voltage on the sensor supply circuits is out of range.

SPN 3511/FMI 4	
Description	Remote Accelerator Pedal Supply Circuit Short to Ground
Monitored Parameter	Remote Accelerator Pedal Voltage
Typical Enabling Conditions	Always On
Monitor Sequence	Key On
Execution Frequency	None
Typical Duration	None
Dash Lamps	CEL
Engine Reaction	Idle Only
Verification	Ignition Key Cycle ON



Check as follows:

1. Is the vehicle equipped with a remote accelerator pedal?
   1.a Yes; Go to step 2.
   1.b No; refer to the Application and Installation manual for proper Common Powertrain Controller (CPC) configuration.
2. Disconnect the remote throttle switch.
3. Turn the ignition ON (key ON, engine OFF).

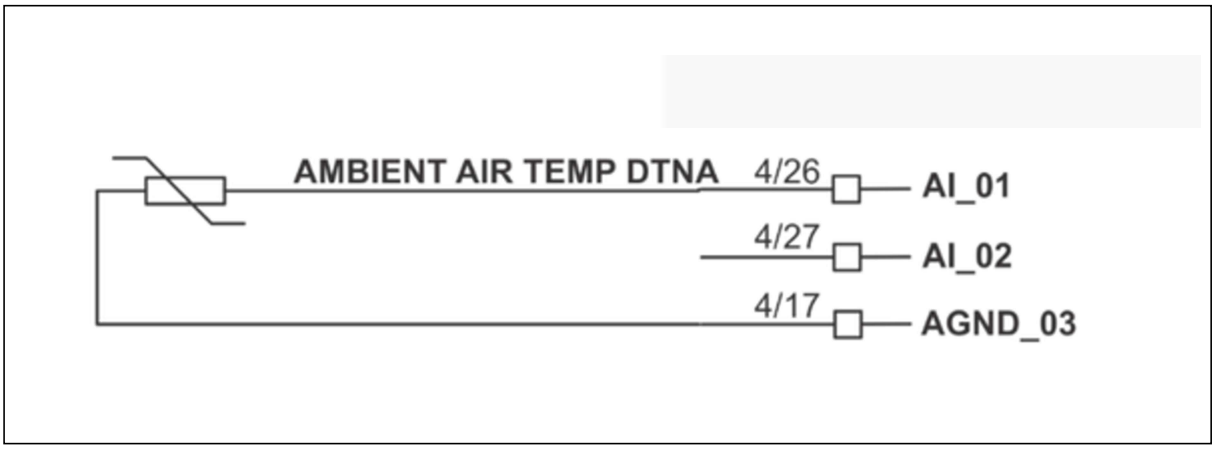
4. Measure the resistance between remote throttle switch sensor supply and ground. Refer to Original Equipment Manufacturer (OEM) literature for schematic information. Is the resistance greater than 10k ohms?

   4.a Yes; replace the remote throttle switch.

   4.b No; repair the short to ground between pin 3 of the CPC connector #3 and the remote throttle switch.

SPN 3511 (CPC3) (GHG17)

249.1 SPN 3511/FMI 3 - GHG17

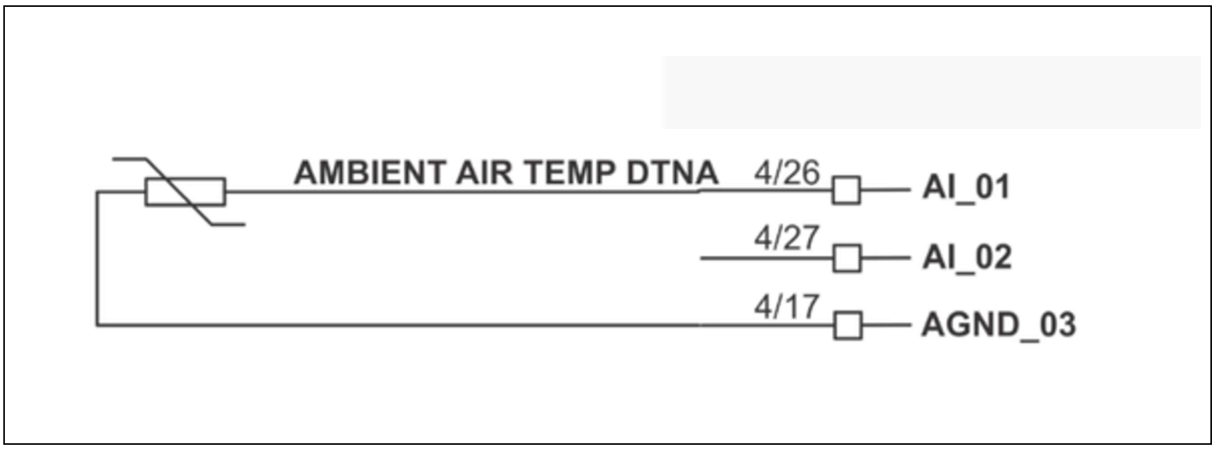


Check as follows:

1. Disconnect the ambient temperature sensor.
2. Inspect the ambient temperature sensor harness connector for bent, spread, or corroded terminals. Is pin damage present?
   - 2.a Yes; repair as necessary.
   - 2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pins 1 and 2 of the ambient temperature sensor harness connector. Is the voltage between 4.5 and 5.0 volts?
   - 4.a Yes; replace the ambient temperature sensor.
   - 4.b No; Go to step 5.
5. Measure the voltage between pin 1 of the ambient temperature sensor harness connector and ground. Is the voltage between 4.5 and 5.0 volts?
   - 5.a Yes; Go to step 6.
   - 5.b No; repair wire between pin 1 of the ambient temperature sensor harness connector and pin 26 of the CPC3 connector #4.
6. Measure the voltage between pin 2 of the ambient temperature sensor harness connector and ground. Is the voltage greater than two volts?
   - 6.a Yes; repair wire (short to power) between pin 1 of the ambient temperature sensor harness connector and pin 17 of the CPC3 connector #4.
   - 6.b No; replace the ambient temperature sensor.

249.2 SPN 3511/FMI 14 - GHG17

Ambient Air Temp Sensor Ground Wire Shorted to Chassis



Check as follows:

1. Disconnect the ambient temperature sensor.
2. Inspect the ambient temperature sensor harness connector for bent, spread, or corroded terminals. Is pin damage present?
   - 2.a Yes; repair as necessary.
   - 2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pins 1 and 2 of the ambient temperature sensor harness connector. Is the voltage between 4.5 and 5.0 volts?
   - 4.a Yes; replace the ambient temperature sensor.
   - 4.b No; Go to step 5.
5. Measure the voltage between pin 1 of the ambient temperature sensor harness connector and ground. Is the voltage between 4.5 and 5.0 volts?
   - 5.a Yes; Go to step 6.
   - 5.b No; repair wire between pin 1 of the ambient temperature sensor harness connector and pin 26 of the CPC3 connector #4.
6. Measure the voltage between pin 2 of the ambient temperature sensor harness connector and ground. Is the voltage greater than two volts?
   - 6.a Yes; repair wire (short to power) between pin 1 of the ambient temperature sensor harness connector and pin 17 of the CPC3 connector 4.
   - 6.b No; replace the ambient temperature sensor.

SPN 3511 (MCM) (GHG17)

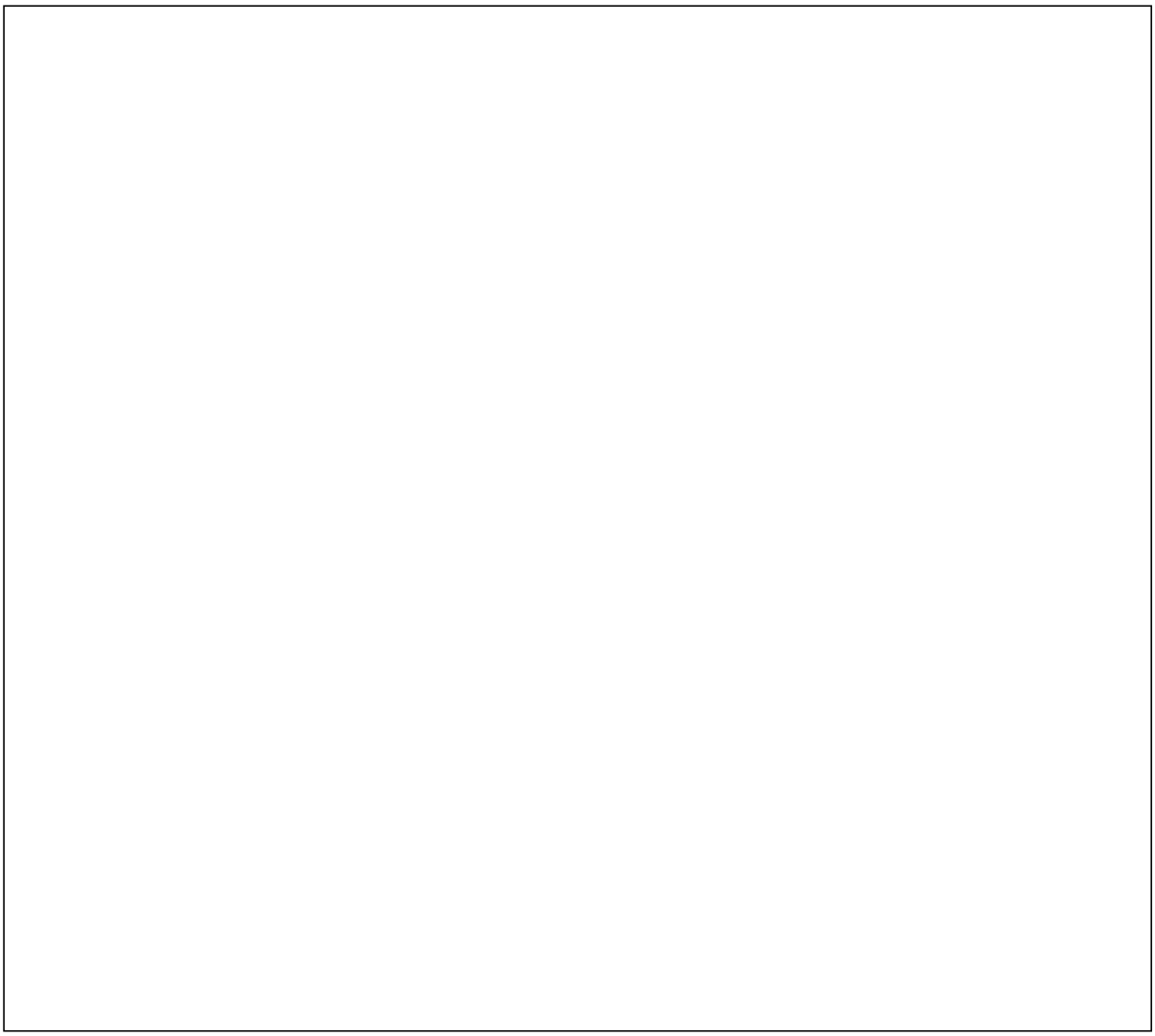
247.1 SPN 3511/FMI 3 - GHG17

3V Sensor Supply Bank 1 Circuit Failed High

SPN 3511/FMI 3	
Description	This Fault Code Sets When the Motor Control Module MCM) Detects a Voltage Greater than 3.2 Volts on 3 Volts Supply Bank
Monitored Parameter	Motor Control Module (MCM) 3V Internal Power Supply
Typical Enabling Conditions	Circuit Voltage Greater than 3.2 Volts
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (One minute)

Possible causes:

- Internally shorted Intake Manifold Pressure Sensor
- Short to power on the Fuel Temperature sensor signal circuit
- Short to power on the Coolant Inlet Temperature sensor signal circuit
- Short to power on the Intake Manifold Temperature sensor signal circuit
- Short to power on the Engine Oil Temperature sensor signal circuit
- Short to power on the Coolant Outlet Temperature sensor signal circuit
- Short to power on the Intake Manifold Pressure/ Temperature sensor signal circuit
- Short to power on the Turbocharger Compressor Inlet Temperature sensor circuit
- Internally shorted MCM



1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check the fault codes. Are any of the fault codes below also present?

- SPN 4193/FMI 3
- SPN 174/FMI 3
- SPN 175/FMI 3
- SPN 1636/FMI 3
- SPN 2630/FMI 3
- SPN 110/FMI 3
- SPN 2629/FMI 3

3.a Yes; diagnose the other fault code first.

3.b No; Go to step 4.

4. Disconnect and inspect the Intake Manifold pressure/temperature sensor electrical connector harness side. Is there corrosion, damage or spread pins?

4.a Yes; Refer to section "Electrical Connector Inspection" and repair as necessary. Verify repair.

4.b No; Go to step 5.

5. Recheck the fault code. Is fault code SPN 3511/FMI 3 still active?
   5.a Yes; Go to step 6.
   5.b No; replace the intake manifold pressure/temperature sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" . Verify Repair.
6. Turn the ignition OFF.
7. Disconnect and inspect the MCM 120-pin electrical connector. Is there corrosion, damage or bent pins?
   7.a Yes; Refer to section "Electrical Connector Inspection" and repair as necessary. Verify repair.
   7.b No; Go to step 8.
8. Turn the ignition ON (key ON, engine OFF).
9. Recheck the fault code. Is fault code SPN 3511/FMI 3 still active?
   9.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repair.
   9.b No; find and repair the short to power. Refer to the chart below.

Sensor	Sensor pin	MCM pin
Fuel Temperature Sensor	2	77
Coolant Inlet Temperature Sensor	2	80
Coolant Outlet Temperature Sensor	2	110
Intake Manifold Temperature Sensor	2	106
Engine Oil Temperature Sensor	2	108
Intake Manifold Pressure/ Temperature Sensor	3	119
Turbocharger Compressor Inlet Temperature Sensor	2	86

247.2 SPN 3511/FMI 4 - GHG17

3V sensor supply bank 1 circuit failed low

This code indicated an Motor Control Module (MCM) internal failure. Replace the MCM. Refer to section "Removal of the Motor Control Module" Refer to section "Removal of the Motor Control Module"

SPN 3511/FMI 4	
Description	3V Sensor Supply Bank 1 Circuit Failed Low
Monitored Parameter	MCM 3V Internal Power Supply
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (1 minute)

SPN 3512 (ACM) (GHG17)

250.1 SPN 3512/FMI 3 - GHG17

SPN 3512/FMI 3	
Description	3V Sensor Supply Bank 2 Circuit Failed High
Monitored Parameter	ACM 3V Internal Power Supply
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (One Minute)

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

Check as follows:

This fault indicates that the Aftertreatment Control Module (ACM) detects a short to power (voltage greater than 3.2V) on any of the ACM pins in the table below.

ACM Pins for Short to Power Check	
Component	**ACM Pin**
DEF Tank Temperature Signal	103
DEF Tank Level Signal	109
Not Used By OEM	76
Not Used By OEM	78
Not Used By OEM	63
Not Used By OEM	83
Not Used By OEM	85

Inspect the harness and repair as necessary.

250.2 SPN 3512/FMI 4 - GHG17

SPN 3512/FMI 4	
Description	3V Sensor Supply Bank 2 Circuit Failed Low
Monitored Parameter	ACM 3V Internal Power Supply
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (One Minute)

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

Check as follows:

This code indicates an Aftertreatment Control Module (ACM) internal failure. Replace the ACM. Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" .

SPN 3512 (MCM) (GHG17)

251.1 SPN 3512/FMI 3 - GHG17

3 V Sensor Supply Bank 2 Circuit Failed High

This fault indicates that the Motor Control Module (MCM) detects a short to power (voltage greater than 3.2) on any of the MCM pins in the table below.

MCM Pins for Short to Power Check	
Component	**MCM Pin**
Fuel Temperature Sensor, Engine Coolant Temperature Sensor	55
Fuel Temperature Sensor	77
Charge Air Cooler Outlet Pressure Sensor	102
Engine Oil Temperature/Pressure Sensor	108
Engine Coolant Temperature Sensor	110

Inspect the harness and repair as necessary.

251.2 SPN 3512/FMI 4 - GHG17

3V Sensor Supply Bank 2 Circuit Failed Low

This code indicates a Motor Control Module (MCM) internal failure. Replace the MCM. Refer to section "Removal of the Motor Control Module" Refer to section "Removal of the Motor Control Module" .

SPN 3512/FMI 4	
Description	3V Sensor Supply Bank 2 Circuit Failed Low
Monitored Parameter	MCM 3V Internal Power Supply
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (1 minute)

SPN 3556 (ACM) (GHG17)

252.1 SPN 3556/FMI 0 - GHG17

Regeneration Temperature - Out of Range High

SPN 3556/FMI 0	
Description	This code sets when the ACM detects that the DOC outlet temperature sensor is greater than the modeled threshold.
Monitored Parameter	Diesel Oxidation Catalyst (DOC) Temperature Outlet temperature sensor.
Typical Enabling Conditions	Aftertreatment 1 Hydrocarbon Doser Data Valid But Above Normal Operational Range - Most Severe Level
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%

Check as follows:

1. Connect DiagnosticLink . Go to step 2.
2. Turn the ignition ON (Key ON, Engine OFF). Go to step 3.
3. Check for multiple fault codes. Are fault codes SPN 3246 FMI,3, 4 or 8 and SPN 3250 FMI 3, 4, or 8 also present?
   - 3.a Yes; diagnose and repair those fault codes first. Verify repair.
   - 3.b No; Go to step 4.
4. Are there any Hydrocarbon (HC) doser low pressure fault codes present?
   - 4.a Yes; diagnose HC doser low pressure fault codes first. Verify repair.
   - 4.b No; Go to step 5.
5. Perform a low temp Aftertreatment Device (ATD) regeneration; Refer to section "GHG17 Perform Performance Check - Low Temperature ATD" . Go to step 6.
6. After the low temperature regeneration has run for at least 20 minutes, monitor the DOC outlet temperature sensor reading. Is the reading within 25°C (45°F) of the other exhaust temperature sensor readings?
   - 6.a Yes; Go to step 7.
   - 6.b No; replace the DOC outlet temperature sensor.

     For 1-BOX™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .Verify repair.

     For 2-BOX , Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .Verify repair.
7. Visually inspect the exhaust system for leaks. Are there exhaust leaks present?

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

   - 7.a Yes; repair the exhaust leaks. Verify repair.

WARNING

PERSONAL INJURY

To avoid injury from hot surfaces, wear protective gloves, or allow engine to cool before removing any component.

7.b No; replace the HC doser block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " . Verify repair.

252.2 SPN 3556/FMI 1 - GHG17

SPN 3556/FMI 1	
Description	This Code Sets when the Exhaust Temperature Does Not Increase Above the Modeled Threshold when Regeneration is Enabled
Monitored Parameter	Diesel Oxidation Catalyst (DOC) Outlet Temperature Sensor
Typical Enabling Conditions	Regeneration Enabled, 1100 to 2050 rpm, 50% to 100% Engine Load
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	20 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Parked Regeneration

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple codes. Are there DOC outlet temperature sensor drift codes, DOC outlet temperature sensor stuck fault codes, or DOC outlet temperature sensor circuit fault codes present?
   - 3.a Yes; diagnose the other fault code first.
   - 3.b No; Go to step 4.
4. Is there any Hydrocarbon (HC) doser low pressure fault codes present?
   - 4.a Yes; diagnose HC doser low pressure fault codes first.
   - 4.b No; Go to step 5.
5. Visually inspect the exhaust system for leaks; look for signs of soot trails indicating a system leak. Are there exhaust leaks present?

5.a Yes; repair the exhaust leaks. Verify repair.

5.b No; Go to step 6.

6. Remove and inspect the Hydrocarbon (HC) fuel doser injection valve. Refer to section "Removal of the Hydrocarbon Fuel Doser Injector Valve" . Is the HC fuel doser injection valve plugged?

6.a Yes; replace the Hydrocarbon (HC) doser injection valve and clean the port. Refer to section "Installation of the Hydrocarbon Fuel Doser Injector Valve" . Verify repair.

6.b No; Go to step 7.

7. Reinstall the HC doser injection valve. Refer to section "Installation of the Hydrocarbon Fuel Doser Injector Valve" .

WARNING

PERSONAL INJURY

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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.

WARNING

ENGINE EXHAUST

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

8. Start the engine.
9. Perform a GHG17 Perform Performance Check - Low Temperature ATD. Run the service routine for 20 minutes allowing for the aftertreatment temperatures to stabilize.
10. Is the DOC outlet temperature sensor reading within 25°C (45°F) of the DOC inlet temperature sensor?

10.a Yes; replace the HC doser block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " . Go to step 11.

10.b No; replace the DOC outlet temperature sensor. Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Go to step 11.

11. Turn the ignition ON (key ON, engine OFF).
12. Run service routine "DOC Lightoff Temperature Reset" under the Actions, Aftertreatment drop-down menu. Verify repair.

252.1 SPN 3556/FMI 0 - GHG17

Before starting this troubleshooting procedure, please verify if an Advanced Diagnostic (AD) version is available, and continue with that version if available. ADs provide enhanced functionality that increase the accuracy of the troubleshooting process and are preferred over traditional troubleshooting. The ADs are identified in DiagnosticLink by the magic wand icon next to the fault, and the word "Advanced" label in the "Troubleshooting Type" field.

Regeneration Temperature - Out of Range High

SPN 3556/FMI 0	
Description	This code sets when the ACM detects that the DOC outlet temperature sensor is greater than the modeled threshold.
Monitored Parameter	Diesel Oxidation Catalyst (DOC) Temperature Outlet temperature sensor.
Typical Enabling Conditions	Aftertreatment 1 Hydrocarbon Doser Data Valid But Above Normal Operational Range - Most Severe Level
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%

Check as follows:

1. Connect DiagnosticLink . Go to step 2.
2. Turn the ignition ON (Key ON, Engine OFF). Go to step 3.
3. Check for multiple fault codes. Are fault codes SPN 3246 FMI,3, 4 or 8 and SPN 3250 FMI 3, 4, or 8 also present?
   - 3.a Yes; diagnose and repair those fault codes first. Verify repair.
   - 3.b No; Go to step 4.
4. Are there any Hydrocarbon (HC) doser low pressure fault codes present?
   - 4.a Yes; diagnose HC doser low pressure fault codes first. Verify repair.
   - 4.b No; Go to step 5.
5. Perform a low temp Aftertreatment Device (ATD) regeneration; Refer to section "GHG17 Perform Performance Check - Low Temperature ATD" . Go to step 6.
6. After the low temperature regeneration has run for at least 20 minutes, monitor the DOC outlet temperature sensor reading. Is the reading within 25°C (45°F) of the other exhaust temperature sensor readings?
   - 6.a Yes; Go to step 7.
   - 6.b No; replace the DOC outlet temperature sensor.

     For 1-BOX™, Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .Verify repair.

     For 2-BOX , Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .Verify repair.
7. Visually inspect the exhaust system for leaks. Are there exhaust leaks present?

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

   - 7.a Yes; repair the exhaust leaks. Verify repair.

⚠ WARNING

PERSONAL INJURY

To avoid injury from hot surfaces, wear protective gloves, or allow engine to cool before removing any component.

7.b No; replace the HC doser block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " . Verify repair.

252.2 SPN 3556/FMI 1 - GHG17

Before starting this troubleshooting procedure, please verify if an Advanced Diagnostic (AD) version is available, and continue with that version if available. ADs provide enhanced functionality that increase the accuracy of the troubleshooting process and are preferred over traditional troubleshooting. The ADs are identified in DiagnosticLink by the magic wand icon next to the fault, and the word "Advanced" label in the "Troubleshooting Type" field.

SPN 3556/FMI 1	
Description	This Code Sets when the Exhaust Temperature Does Not Increase Above the Modeled Threshold when Regeneration is Enabled
Monitored Parameter	Diesel Oxidation Catalyst (DOC) Outlet Temperature Sensor
Typical Enabling Conditions	Regeneration Enabled, 1100 to 2050 rpm, 50% to 100% Engine Load
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	20 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Parked Regeneration

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple codes. Are there DOC outlet temperature sensor drift codes, DOC outlet temperature sensor stuck fault codes, or DOC outlet temperature sensor circuit fault codes present?

   3.a Yes; diagnose the other fault code first.

   3.b No; Go to step 4.
4. Is there any Hydrocarbon (HC) doser low pressure fault codes present?

4.a Yes; diagnose HC doser low pressure fault codes first.

4.b No; Go to step 5.

5. Visually inspect the exhaust system for leaks; look for signs of soot trails indicating a system leak. Are there exhaust leaks present?

5.a Yes; repair the exhaust leaks. Verify repair.

5.b No; Go to step 6.

6. Remove and inspect the Hydrocarbon (HC) fuel doser injection valve. Refer to section "Removal of the Hydrocarbon Fuel Doser Injector Valve" . Is the HC fuel doser injection valve plugged?

6.a Yes; replace the Hydrocarbon (HC) doser injection valve and clean the port. Refer to section "Installation of the Hydrocarbon Fuel Doser Injector Valve" . Verify repair.

6.b No; Go to step 7.

7. Reinstall the HC doser injection valve. Refer to section "Installation of the Hydrocarbon Fuel Doser Injector Valve" .

⚠WARNING

PERSONAL INJURY

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⚠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.

⚠WARNING

ENGINE EXHAUST

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

8. Start the engine.

9. Perform a GHG17 Perform Performance Check - Low Temperature ATD. Run the service routine for 20 minutes allowing for the aftertreatment temperatures to stabilize.

10. Is the DOC outlet temperature sensor reading within 25°C (45°F) of the DOC inlet temperature sensor?

10.a Yes; replace the HC doser block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " . Go to step 11.

10.b No; replace the DOC outlet temperature sensor. Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" . Go to step 11.

11. Turn the ignition ON (key ON, engine OFF).

12. Run service routine "DOC Lightoff Temperature Reset" under the Actions, Aftertreatment drop-down menu. Verify repair.

SPN 3563 (MCM) (GHG17)

253.1 SPN 3563/FMI 3 - GHG17

Intake manifold pressure circuit failed high

1. Disconnect the intake manifold pressure/temperature sensor.
2. Inspect the intake manifold pressure/temperature sensor harness for bent, spread, or corroded pins.
   2.a If the pins are bent, spread, or corroded, repair as necessary.
   2.b If the connector shows no signs of damage, Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 1 of the intake manifold pressure/temperature sensor harness connector and ground.
   4.a If the voltage is greater than 5 volts, repair the short to battery between pin 1 of the intake manifold pressure/temperature sensor harness connector and pin 87 of the Motor Control Module (MCM) 120-pin connector. Verify repairs.
   4.b If the voltage is less than 5 volts, Go to step 5.
5. Measure the voltage between pin 2 and 4 of the intake manifold pressure/temperature sensor harness connector.
   5.a If voltage is present, replace the intake manifold pressure/temperature sensor .

   Refer to section "Removal of the Intake Pressure/Temperature Sensor" .
   5.b If no voltage is present, repair the open between pin 4 of the intake manifold pressure/temperature sensor harness connector and pin 102 of the MCM 120-pin connector. Verify repairs.

253.2 SPN 3563/FMI 4 - GHG17

Intake Manifold Pressure Circuit Failed Low

SPN 3563/FMI 4	
Description	Intake Manifold Pressure Circuit Failed Low
Monitored Parameter	Intake Manifold Pressure Circuit
Typical Enabling Conditions	Always on
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Parked Regeneration

1. Disconnect the intake manifold pressure/temperature sensor harness connector.
2. Inspect the intake manifold pressure/temperature sensor harness connector for bent, spread or corroded pins.
   - 2.a If the pins are bent, spread or corroded, repair as necessary. Verify repairs.
   - 2.b If the connector shows no signs of damage, Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pins 2 and 4 of the intake manifold pressure/temperature sensor harness connector.
   - 4.a If 4.5-5.5 volts are present, Go to step 5.
   - 4.b If less than 4.5 are volts present, repair the open between pin 2 of the intake manifold pressure/temperature sensor connector and pin 58 of the Motor Control Module (MCM) 120-pin connector. Verify repairs.
5. Turn the ignition OFF (key OFF, engine OFF).
6. Disconnect the MCM 120-pin connector.
7. Measure the resistance between pin 1 on the harness side of the intake manifold pressure/temperature sensor harness connector and pin 87 of the MCM 120-pin connector.
   - 7.a If the resistance is greater than 5 ohms, repair the open between pin 1 on the harness side of the intake manifold pressure/temperature sensor harness connector and pin 87 of the MCM 120-pin connector.
   - 7.b If the resistance is less than 5 ohms, Go to step 8.
8. Measure the resistance between pin 1 on the harness side of the intake manifold pressure/temperature sensor harness connector and ground.
   - 8.a If the resistance is less than 1K ohms, repair the short-to-ground between pin 1 of the intake manifold pressure/temperature sensor harness connector and pin 87 of the MCM 120-pin connector.
   - 8.b If the resistance is greater than 1K ohms, replace the intake manifold pressure/temperature sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" .

253.3 SPN 3563/FMI 10 - GHG17

SPN 3563/FMI 10	
Description	This Fault Code Sets When the Difference Between Barometric Pressure and Intake Manifold Pressure Sensors is Larger Than a Calibrated Threshold
Monitored Parameter	Barometric Pressure and Intake Manifold Pressure
Typical Enabling Conditions	Ignition OFF for a Minimum of 30 Minutes, Then Turn the Ignition to the ON Position. Engine Speed less than 250 rpm
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	One Second
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate
Verification	Ignition OFF for 30 minutes, then Turn Ignition ON with the Engine Not Running

Check as follows:

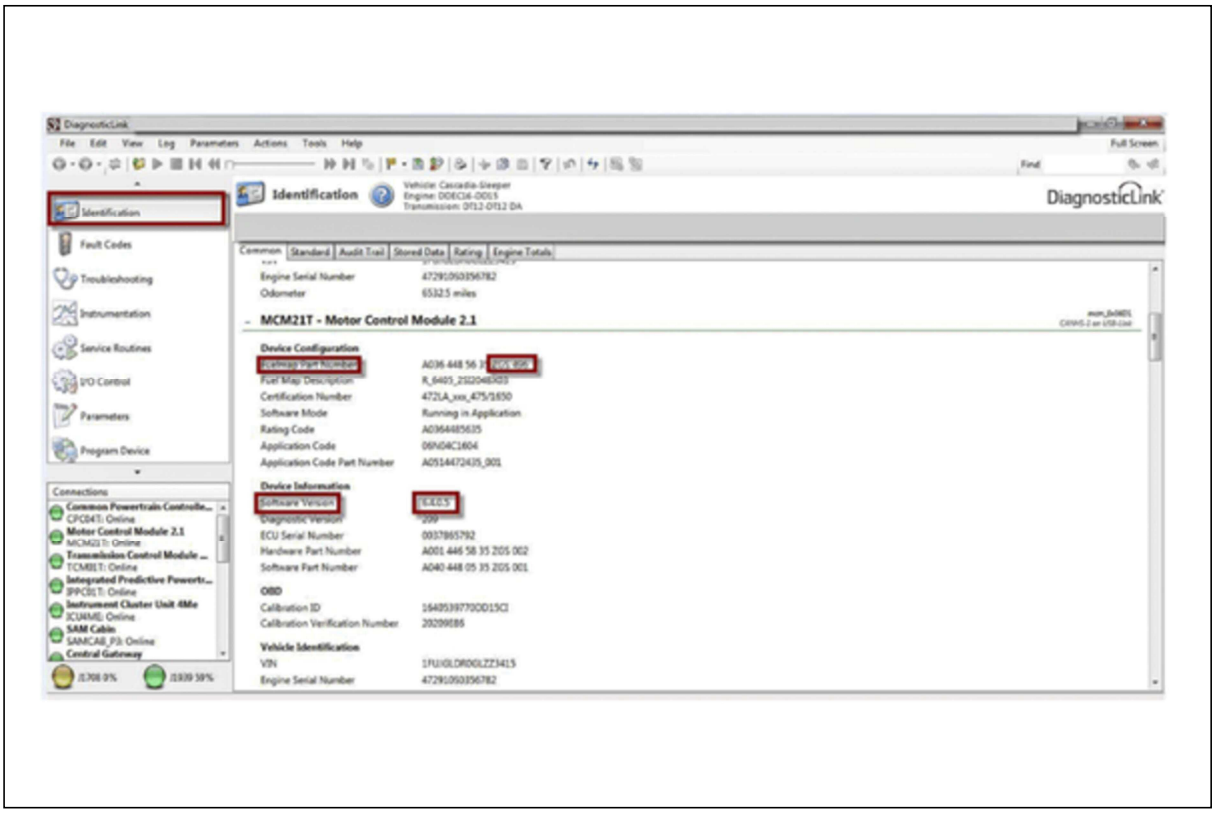
1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are fault codes also present?
   - 3.a Yes; diagnose the other fault codes.
   - 3.b No; Go to step 4.
4. Compare the barometric pressure reading in the Motor Control Module (MCM) to the local barometric pressure reading. Is the barometric pressure sensor reading in the MCM within 6.9 kPa (1 psi) of the local barometric pressure reading?
   - 4.a Yes; Go to step 5.
   - 4.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs.
5. Turn the ignition OFF.
6. Disconnect and inspect the intake manifold pressure sensor electrical connector harness side. Is there any corrosion present?
   - 6.a Yes; replace the intake manifold pressure sensor and the electrical connector on the harness. Refer to section "Removal of the Intake Pressure/Temperature Sensor" . Verify repairs.
   - 6.b No; Go to step 7.
7. Are any of the pins or the connector damaged?
   - 7.a Yes; replace the intake manifold pressure sensor and the electrical connector on the harness. Refer to section "Removal of the Intake Pressure/Temperature Sensor" . Verify repairs.
   - 7.b No; replace the intake manifold pressure sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" . Verify repairs.

253.4 SPN 3563/FMI 16 - GHG17

SPN 3563/FMI 16	
Description	This Fault Code Sets when the Motor Control Module (MCM) Detects That the Difference between the Commanded Boost Pressure and the Actual Boost Pressure Exceeds a Calibrated Threshold
Monitored Parameter	Intake Manifold Pressure
Typical Enabling Conditions	Engine Speed Between 1130 and 1650 rpm, Engine Coolant Temperature greater than 65°C (149°F)
Monitor Sequence	When The Enabling Conditions Are Met
Execution Frequency	Continuous
Typical Duration	25 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Once Engine Coolant Temperature is greater than 65°C (149°F) Drive at Highway Speed with Loaded Trailer Above 1130 rpm Continuously for Five Minutes

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).



3. Check the MCM software level. Compare the MCM software and fuel map to the chart. Is the MCM software equal or greater than specified in the chart below?

Engine	MCM Software
DD13 380 - 410HP 1450 rpm	Go to step 4.
DD13 525HP 1850 rpm	6.5.0.2 ZGS 001
DD13 - All Other	6.5.0.2 ZGS 002
DD15	6.5.0.2 ZGS 003
DD16	6.5.0.2 ZGS 002

3.a Yes; Go to step 5.

3.b No; update the MCM software and perform the repair verification. If the fault returns, Go to step 5.

4. Update the MCM software level using the latest server information. Once the MCM software has been updated, perform the repair verification. If the fault code returns, Go to step 5.
5. Compare the Barometric Pressure sensor reading in DiagnosticLink to the barometric pressure for your area. Are the readings within 6.9 kPa (1 psi) of each other?

   5.a Yes; Go to step 6.

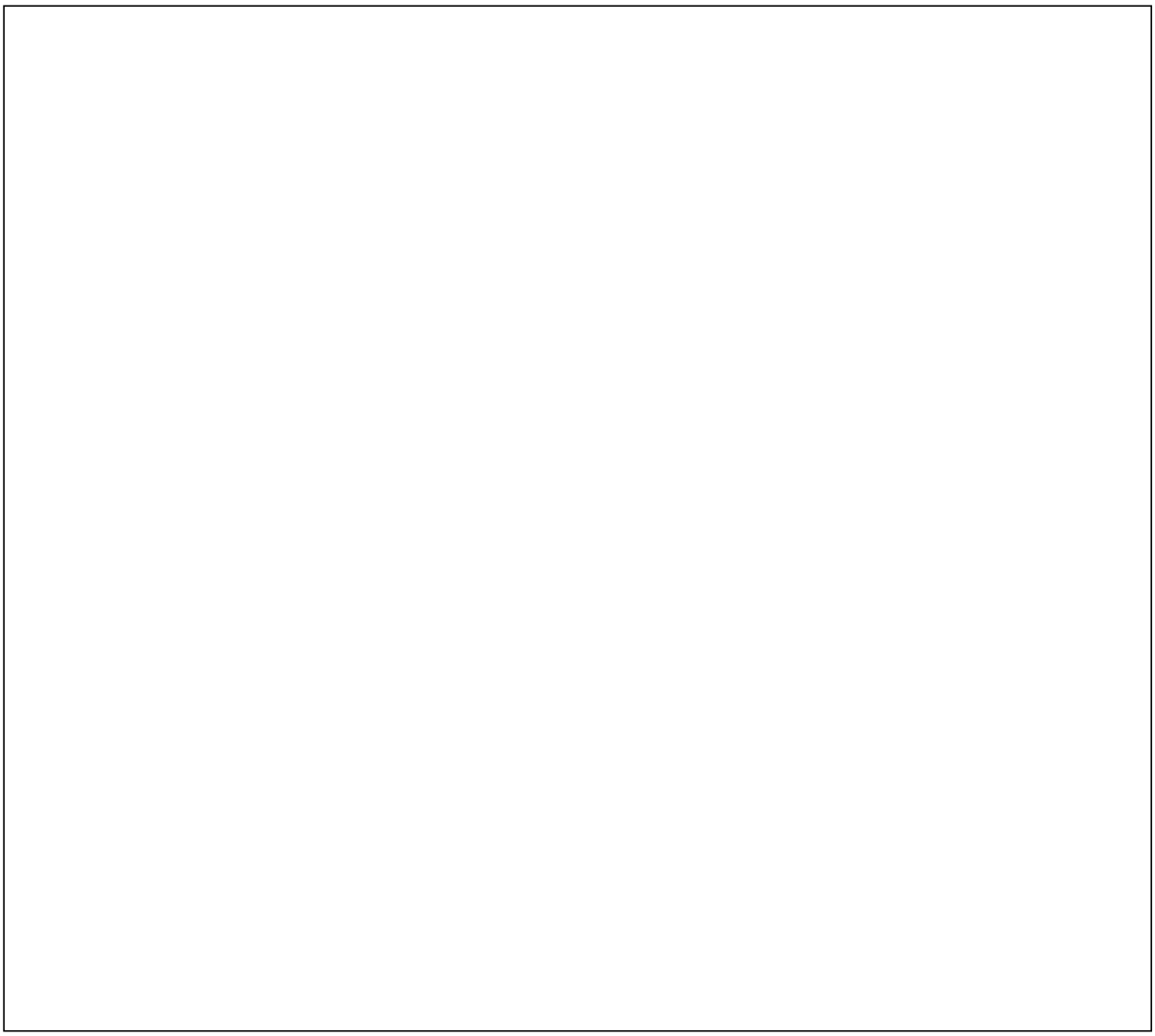
   5.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repair.
6. Compare intake manifold pressure to barometric pressure using the chart below. Tolerances will vary depending on the intake air temperature. Is the intake manifold pressure within range of barometric pressure?

Intake Air Temperature	Tolerance
-40°C to 10°C (-40°F to 50°F)	+/- 8.6 kPa (1.25 psi)
10°C to 110°C (50°F to 230°F)	+/- 5.6 kPa (0.81 psi)
110°C to 130°C (230°F to 266°F)	+/- 8.6 kPa (1.25 psi)

6.a Yes; Go to step 11.

6.b No; Go to step 7.

7. Turn the ignition OFF.
8. Disconnect and inspect the intake manifold pressure sensor (8) electrical connector harness side. Is there any corrosion present?



8.a Yes; replace the intake manifold pressure sensor and electrical connector.

8.b No; Go to step 9.

9. Are any of the pins or the connector damaged?

9.a Yes; Go to step 10.

9.b No; replace the intake manifold pressure sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" .

10. Inspect the intake manifold electrical connector sensor side. Are any of the pins or the connector damaged?

10.a Yes; replace the intake manifold pressure sensor and electrical connector. Refer to section "Removal of the Intake Pressure/Temperature Sensor" . Verify repair.

10.b No; replace the intake manifold electrical connector.

11. Monitor the DOC inlet pressure sensor voltage. Is the DOC inlet pressure sensor voltage between 0.44 and 0.56 volts?

11.a Yes; Go to step 12.

11.b No; replace the DOC inlet pressure sensor. Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" . Verify repair.

12. Monitor the DPF inlet pressure sensor voltage. Is the DPF inlet pressure sensor voltage between 0.44 and 0.56 volts?

12.a Yes; Go to step 13.

12.b No; replace the DPF inlet pressure sensor.

13. Disconnect and inspect the turbocharger inlet elbow and outlet pipe. Are there signs of oil residue, fluid contamination or debris?

13.a Yes; replace the turbocharger. If the oil has contaminated the ATD, replace the ATD.

Refer to section "Removal of the 1-BOX™ from the Vehicle"

Refer to section "Removal of the 2-Box (2V2) from the Vehicle"

For vehicles with a DD13 or DD15 engine, Refer to section "Removal of the DD13 and DD15 Turbocharger"

For vehicles equipped with a DD16 engine, Refer to section "Removal of the DD16 Turbocharger"

13.b No; reinstall the turbocharger inlet and outlet pipes, then Go to step 14.

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

14. Start and run the engine until the engine coolant temperature is greater than 65°C (149°F).

15. Using DiagnosticLink, start a parked regeneration.

16. While the parked regeneration is running, monitor the DOC inlet pressure. Is the DOC inlet pressure greater than 20 kPa (2.9 psi)?

16.a Yes; clean the face of the DOC. Refer to section "Diesel Oxidation Catalyst Air Cleaning" . Verify repair.

16.b No; Go to step 17.

17. Does the DOC inlet pressure start high and stay high?

17.a Yes; the DOC face plugging is causing back pressure in the system. Perform the DOC face plugging routine in DiagnosticLink or clean the face of the DOC.

Refer to section "GHG17 Diesel Oxidation Catalyst Face Cleaning" . Verify repair.

Refer to section "Diesel Oxidation Catalyst Air Cleaning" . Verify repair.

17.b No; replace the turbocharger. Verify repair.

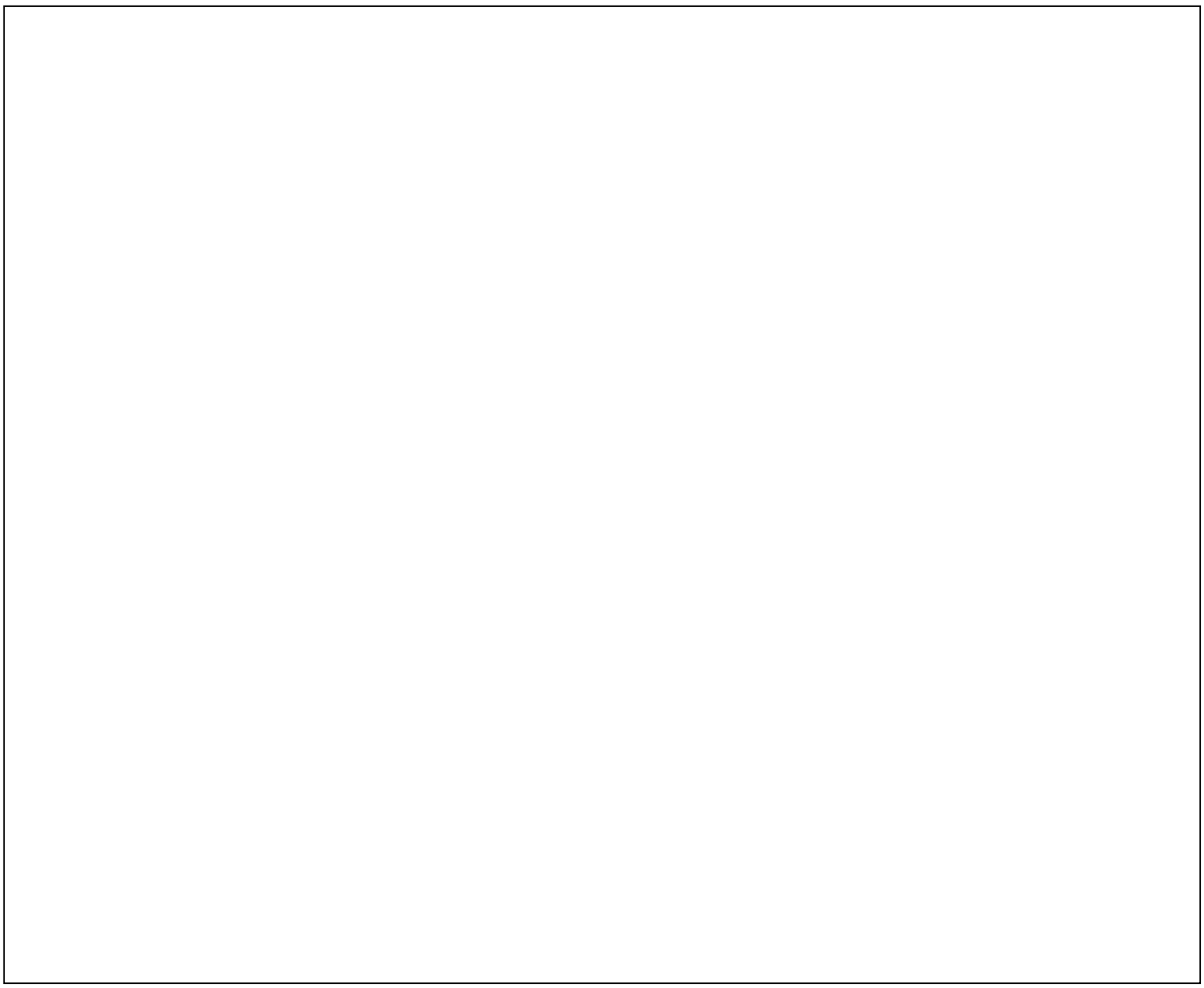
For vehicles with a DD13 or DD15 engine, Refer to section "Removal of the DD13 and DD15 Turbocharger"

For vehicles equipped with a DD16 engine, Refer to section "Removal of the DD16 Turbocharger"

253.5 SPN 3563/FMI 18 - GHG17

Inlet Manifold Pressure Low

SPN 3563/FMI 18	
Description	Compare actual to desired boost pressure. When the difference exceeds a calibrated threshold, the fault is set.
Monitored Parameter	Intake Manifold Pressure
Typical Enabling Conditions	Engine speed between 1130 rpm and 1650 rpm Torque greater than 1250 N·m (921 lb·ft) Coolant Temperature greater than 65 °C (149 °F) Barometric Pressure greater than 755 mbar (10.9 psi) Ambient Temperature greater than -8 °C (17.6 °F) Engine speed gradient between -10 rpm/sec and +10 rpm/sec Fuel mass gradient between -10 mg/st and +10 mg/st
Monitor Sequence	After enabling conditions are met, a 15 second stability time is followed by a 10s calculation of the manifold pressure error
Execution Frequency	Every 10 seconds after the stability time has been met
Typical Duration	25 seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	At operating temperature of 71 °C (160 °F). Drive at highway speed with loaded trailer above 1130 rpm continuously for five minutes



Check as follows:

1. Inspect the front grill for air blockage including winter fronts, plows, or large hose reels. Is any blockage found?
   1.a Yes; repair as necessary. Verify repairs.
   1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Compare intake manifold pressure to barometric pressure using the chart below. Tolerances will vary depending on the intake air temperature. Is the intake manifold pressure within range of barometric pressure?

Intake Air Temperature	Tolerance
-40°C to 10°C (-40°F to 50°F)	+/- 8.6 kPa (1.25 psi)
10°C to 110°C (50°F to 230°F)	+/- 5.6 kPa (0.81 psi)
110°C to 130°C (230°F to 266°F)	+/- 8.6 kPa (1.25 psi)

   4.a Yes; Go to step 5.
   4.b No; replace the intake manifold pressure/temperature sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" .
5. Disconnect the intake manifold pressure/temperature sensor.

6. Inspect intake manifold pressure/temperature sensor connector for bent, spread or corroded pins. Is any damage found?

   6.a Yes; repair the intake manifold pressure/temperature sensor connector as necessary. Verify repairs.

   6.b No; replace the intake manifold pressure/temperature sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" .

253.6 SPN 3563/FMI 21 - GHG17

SPN 3563/FMI 21			
Description	This Fault Sets When Ambient and Inlet Manifold Pressure Difference is Out of Range Under a Load		
Monitored Parameter	Inlet Manifold Pressure and Barometric Pressure		
Typical Enabling Conditions	**Engine Parameter**	**Min**	**Max**
	Engine Speed (rpm)	1350	1800
	Engine Torque (N·m)	1400	3000
	Intake Air Throttle Position (%)		5
	Engine Coolant Outlet Temperature °C (°F)	65 (149)	
Monitor Sequence	None		
Execution Frequency	Continuous When Enabling Conditions Met		
Typical Duration	40 Seconds		
Dash Lamps	SEL, CEL, MIL		
Engine Reaction	25% Derate + Engine Shutdown		
Verification	Once Engine is at Standard Operating Temperature, Drive at Highway Speed with Loaded Trailer Between 1350 To 1800 rpm Continuously for Five Minutes.		

1. Inspect the front grill for air blockage including winter fronts, plows, or large hose reels. Is any blockage found?
   - 1.a Yes; repair as needed.
   - 1.b No; Go to step 2.
2. Inspect hood seals. Are seals missing or damaged?
   - 2.a Yes; repair as needed.
   - 2.b No; Go to step 3.
3. Inspect the entire air intake system, including the Charge Air Cooler (CAC), for leaks and/or restrictions. Are any air intake system leaks or restrictions found?
   - 3.a Yes; repair as necessary. Verify repairs.
   - 3.b No; Go to step 4.
4. Using DiagnosticLink , measure barometric pressure. Is barometric pressure above 69 kPa (10 psi) and below 110 kPa (16 psi)?
   - 4.a Yes; Go to step 5.
   - 4.b No; replace the Motor Control Module (MCM). Refer to section "Removal of the Motor Control Module" . Verify repairs.
5. Using DiagnosticLink, compare inlet manifold pressure to barometric pressure. Is the inlet manifold pressure within 10.3 kPa (1.5 psi) of barometric pressure?
   - 5.a Yes; Go to step 8.
   - 5.b No; Go to step 6.
6. Disconnect the inlet manifold pressure sensor harness connector.
7. Inspect the inlet manifold pressure sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 7.a Yes; repair as necessary. Verify repairs.
   - 7.b No; replace the inlet manifold pressure sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" . Verify repairs.

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

WARNING

PERSONAL INJURY

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

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.

WARNING

PERSONAL INJURY

To avoid injury from hot surfaces, wear protective gloves, or allow engine to cool before removing any component.

8. Start the engine.
9. At idle, compare inlet manifold air pressure to barometric pressure.
10. Is the inlet manifold air pressure within 10.3 kPa (1.5 psi) of barometric pressure?
    - 10.a Yes; Go to step 11.
    - 10.b No; replace the inlet manifold pressure/temperature sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" .
11. Turn the ignition OFF.
12. Visually inspect exhaust system for leaks or damage, including manifold, gaskets, turbine housing, Exhaust Gas Recirculation (EGR) valve, and Aftertreatment Device (ATD). Are any leaks found?
    - 12.a Yes; repair as necessary. Verify repairs. If fault code returns, Go to step 13.
    - 12.b No; Go to step 13.
13. Check for engine type. Is engine equipped with an asymmetrical turbocharger?
    - 13.a Yes; Go to step 14.
    - 13.b No; Go to step 22.
14. Turn the ignition OFF.
15. Inspect the wastegate actuator and the plumbing to and from the actuator. Verify wastegate opens and closes. Is any binding or damage found?
    - 15.a Yes; repair as necessary. Verify repairs.
    - 15.b No; Go to step 16.
16. Inspect the air line connection to the wastegate solenoid for leaks. Are any air leaks found?
    - 16.a Yes; repair or replace as necessary. Verify repairs.

16.b No; Go to step 17.

17. Turn the ignition ON (key ON, engine OFF).
18. Using DiagnosticLink, activate wastegate control from Service Routines Activate Outputs Panel. Run slide control up to 95% - (Click Set). Wastegate will open with air psi available. Does wastegate open when commanded?

18.a Yes; Go to step 19.

18.b No; Go to step 20.

Note : Wastegate activates at 0% or 95%. There is no response at 50%.

19. Move slide control down to 0. Does wastegate close when commanded?

19.a Yes; Go to step 27.

19.b No; Go to step 20.

20. Disconnect the wastegate solenoid harness connector.
21. Inspect the wastegate solenoid and harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

21.a Yes; repair as necessary. Verify repairs.

21.b No; replace the wastegate solenoid.

Verify repairs. If fault code returns, Go to step 27.

22. Turn the ignition ON (key ON, engine OFF).
23. Using DiagnosticLink, monitor EGR delta P voltage (pin 109).
24. Is the EGR delta P voltage between 0.55 and 0.83 volts?

24.a Yes; Go to step 27.

24.b No; Go to step 25.

25. Remove the EGR delta P sensor from the mounting pad; leave electrical harness connected.
26. Is the EGR delta P voltage between 0.55 and 0.83 volts?

26.a Yes; Go to step 27.

26.b No; replace the EGR delta P sensor. Refer to section "Removal of the Delta P Sensor" . Verify repairs.

27. Turn the ignition OFF.
28. Inspect the EGR delivery pipe delta P pressure ports for blockage. Is any blockage found?

28.a Yes; clean the venturi pipe and reinstall the sensor. Verify repairs.

28.b No; Go to step 29.

29. Remove the EGR cooler hot pipe, EGR crossover pipe and delivery pipe and inspect for excessive build-up or blockage. Is any excessive build-up or blockage found?

Refer to section "Removal of the Exhaust Gas Recirculation Hot Pipe" .

Refer to section "Removal of the Exhaust Gas Recirculation Venturi" .

29.a Yes; clean piping and replace EGR cooler. Verify repairs.

29.b No; Go to step 30.

30. Disconnect the EGR valve actuator pull rod. Inspect the ball sockets on the pull rod for free movement. Do the sockets rotate or move freely?

30.a Yes; Go to step 31.

30.b No; replace the EGR valve actuator pull rod. Verify repairs.

For the DD13 and DD15: Refer to section "Removal of the DD13 and DD15 Exhaust Gas Recirculation Valve Actuator Pull Rod" .

For the DD16: Refer to section "Removal of the DD16 Exhaust Gas Recirculation Valve Actuator Pull Rod" .

Note : Some resistance is normal; however, the actuator should not bind in any particular spot.

31. Physically move the EGR butterfly from stop-to-stop to check for full travel (some drag is normal). Verify EGR valve moves. Does the EGR butterfly move stop-to-stop?

    31.a Yes; reconnect the EGR valve actuator pull rod to the EGR valve and EGR actuator. Clear codes and verify repairs. If fault returns, Go to step 32.

    31.b No; replace the EGR valve. Verify repairs.

    For the DD13 and DD15: Refer to section "Removal of the DD13 and DD15 Exhaust Manifold"

    For the DD16: Refer to section "Removal of the DD16 Exhaust Manifold"

    For the DD13 and DD15: Refer to section "Removal of the DD13 and DD15 Exhaust Gas Recirculation Valve"

    For the DD16: Refer to section "Removal of the DD16 Exhaust Gas Recirculation Valve"

32. Inspect the turbocharger for damage. Is any damage present?

    32.a Yes; repair as necessary. Verify repairs.

    If fault returns, for AT engines, Go to step 34.

    If fault returns, for Turbo-Compound (TC) engines, Go to step 33.

    32.b No; for AT engines, Go to step 34.

    For TC engines, Go to step 33.

33. Inspect the axial power turbine for damage. Is any damage present?

    33.a Yes; repair as necessary. Clear codes and verify repairs. If fault returns, Go to step 34.

    33.b No; Go to step 34.

34. Turn the ignition ON (key ON, engine OFF).

35. Inspect the Diesel Oxidation Catalyst (DOC) pressure sensor tube and elbow and the Diesel Particulate Filter (DPF) pressure sensor tube and elbow for leaks, kinks, or blockages. Are any leaks, kinks, or blockages found?

    35.a Yes; repair as necessary. Verify repairs.

    35.b No; Go to step 36.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

> **⚠ 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.

36. Start engine, allow to warm-up until coolant temperature is greater than 65°C (149°F).

Note : Normal DOC pressure is less than 10 kPa (1.5 psi) for a 1-Box™ emissions package and 13 kPa (1.9 psi) for a Two-Box option.

37. Using DiagnosticLink, monitor DOC inlet pressure while performing a parked regeneration. Refer to section "Performing a Parked Regeneration - GHG17" . Does the DOC inlet pressure start out high and stay high?

    37.a Yes; the DOC(s) are plugged. Perform DOC unplug routine. Refer to section "Diesel Oxidation Catalyst Face Cleaning." Verify repairs.

    37.b No; if DOC inlet pressure starts out high and then decreases, the DOC(s) were plugged and the Parked Regeneration cleared them. Clear any fault codes. Verify repairs. If DOC pressure reading is low or fault code returns, Go to step 38.

38. Turn the ignition OFF.

39. Disconnect the MCM 120-pin connector.

40. Inspect the MCM 120-pin connector and the 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Are any signs of damage found?

    40.a Yes; repair as necessary. Verify repairs.

    40.b No; replace MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs.

SPN 3597 (ACM) (GHG17)

256.1 SPN 3597/FMI 3 - GHG17

High Side Digital Output 1 Circuit Failed High

SPN 3597/FMI 3	
Description	High Side Digital Output 1 Circuit Short to Power
Monitored Parameter	High Side Digital Output 1 Circuit
Typical Enabling Conditions	Always on
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	1 second
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Ignition Key Cycle

Check as follows:

Note : This fault code sets when the Aftertreatment Control Module (ACM) detects a short to power on pin(s) 1, 3, 5, 62 or 66 of the ACM 120-pin connector.

1. Turn ignition OFF.
2. Inspect wiring harness from ACM to the Aftertreatment Devices (ATD), including Diesel Exhaust Fluid (DEF) pump, Diesel Exhaust Fluid (DEF) Dosing Unit, and DEF tank Controller Area Network (CAN) header (if equipped) for damage, wear, or heat exposure. Is any damage found?

2.a Yes; repair as necessary. Verify repair with ignition key cycle.

2.b No; Go to step 3.

3. Disconnect the ACM 120-pin harness connector.
4. Inspect the ACM 120-pin harness connector for damage, overheated or corroded pins. Was any damage found?

4.a Yes; repair as necessary. Verify repair with ignition key cycle.

4.b No; Go to step 5.

5. Turn the ignition ON (key ON, engine OFF).
6. Measure voltage between pin 1 of the 120-pin ACM connector, harness side, and battery ground. Is battery voltage present?

6.a Yes; repair the short to power between pin 1 of the 120-pin ACM connector and pin 2 of the DEF pump connector. Verify repair with ignition key cycle.

6.b No; Go to step 7.

7. Measure voltage between pin 3 of the 120-pin ACM connector, harness side, and battery ground. Is battery voltage present?

7.a Yes; repair the short to power between pin 3 of the 120-pin ACM connector and pin 4 of the DEF Dosing Unit connector. Verify repair with ignition key cycle.

7.b No; Go to step 8.

8. Measure voltage between pin 5 of the 120-pin ACM connector, harness side, and battery ground. Is battery voltage present?

8.a Yes; repair the short to power on pin 5 of the 120-pin ACM connector. Verify repair with ignition key cycle.

8.b No; Go to step 9.

9. Measure voltage between pin 62 of the 120-pin ACM connector, harness side, and battery ground. Is battery voltage present?

9.a Yes; repair the short to power between pin 62 of the 120-pin ACM connector and pin 3 of the CAN DEF tank connector (if equipped). Verify repair with ignition key cycle.

9.b No; Go to step 10.

10. Measure voltage between pin 66 of the 120-pin ACM connector, harness side, and battery ground. Is battery voltage present?

10.a Yes; repair the short to power on pin 66 of the 120-pin ACM connector. Verify repair with ignition key cycle.

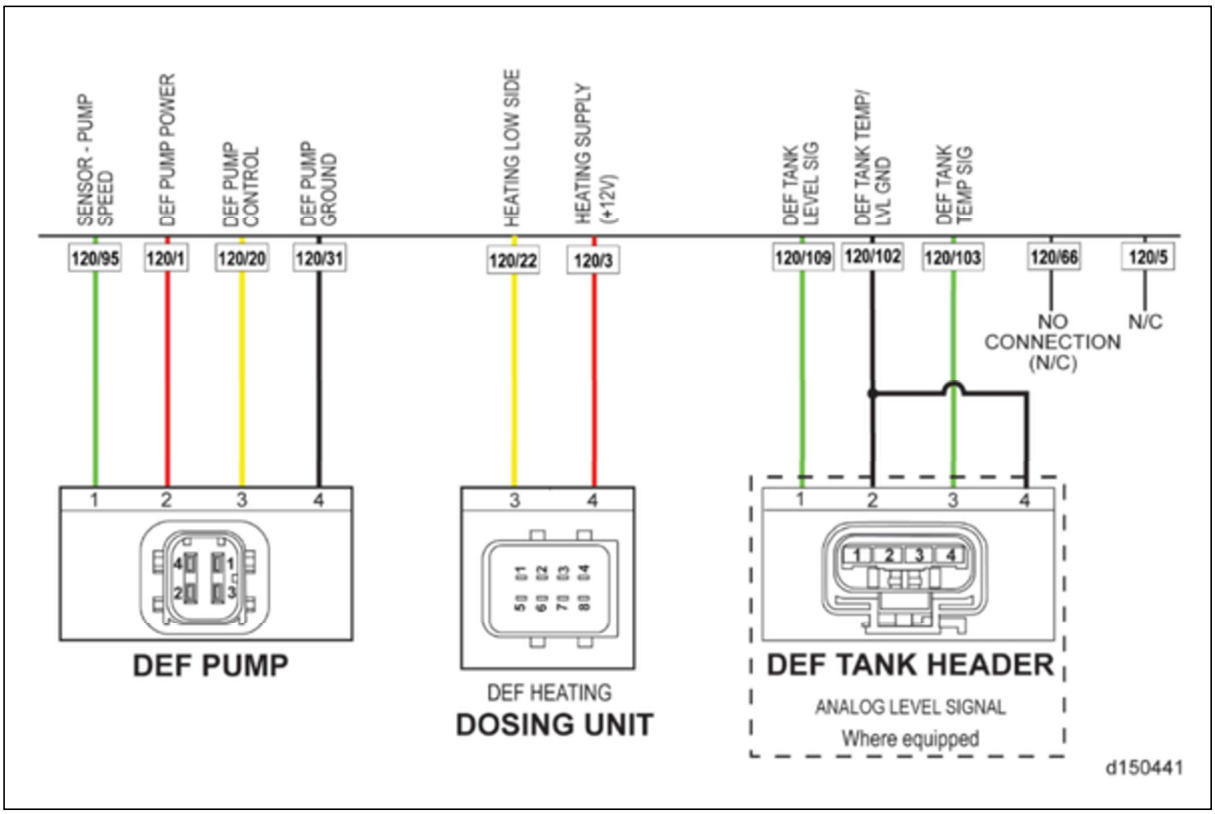
10.b No; replace ACM.

For 1-BOX™, Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" .

For 2-Box, Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module" .

256.2 SPN 3597/FMI 4 - GHG17

SPN 3597/FMI 4	
Description	High Side Digital Output 1 Circuit Short to Ground
Monitored Parameter	High Side Digital Output 1 Circuit
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Ignition Key Cycle



4-Pin	Circuit	ACM Pin	Connector
Pin 1	Pump rpm Feedback	95	
Pin 2	Pump Supply	1	
Pin 3	Pump rpm Control	20	
Pin 4	Pump GND	31	

Dosing Unit			
8-Pin	**Circuit**	**ACM Pin**	**Connector**
1	Dosing Unit Low Side	28	
2	Dosing Unit High Side	33	
3	Heating Low Side	22	
4	Heating Supply	3	
5	Sensor Supply 5V	84	
6	Not Used	Not Used	
7	Sensor Ground	99	
8	DEF Pressure Signal	100	

Analog DEF Tank	**Circuit**	**ACM Pin**	**Connector**
1	DEF TANK LEVEL SIG	109	
2	GROUND	102	
3	DEF TANK TEMP SIG	103	
4	GROUND	102	

Check as follows:

Note : This fault code sets when the Aftertreatment Control Module (ACM) detects a short to ground on pin(s) 1 or 3 of the ACM 120-pin connector.

1. Turn ignition OFF.
2. Inspect wiring harness from the ACM to the Aftertreatment Devices (ATD), including Diesel Exhaust Fluid (DEF) pump, doser unit, and DEF tank Controller Area Network (CAN) header (if equipped) for damage, wear, or chaffing. Is any damage found?
   - 2.a Yes; repair as necessary. Verify repair with ignition key cycle.
   - 2.b No; Go to step 3.
3. Disconnect the DEF dosing unit harness connector.
4. Inspect dosing unit harness connector for bent, spread, or corroded pins. Was any damage found?
   - 4.a Yes; repair as necessary. Verify repair with ignition key cycle.
   - 4.b No; turn the ignition OFF. Go to step 5.

Note : Additional open circuit fault codes will set with the DEF doser disconnected. Disregard the new fault codes at this time.

5. Turn the ignition ON (key ON, engine OFF).
6. Does the SPN 3597/FMI 4 fault code change or go inactive?
   - 6.a Yes; replace the DEF doser unit. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . Verify repair with ignition key cycle.
   - 6.b No; turn ignition OFF. Go to step 7.
7. Disconnect the DEF pump harness connector.
8. Inspect DEF pump harness connector for bent, spread, or corroded pins. Was any damage found?
   - 8.a Yes; repair as necessary. Verify repair with ignition key cycle.
   - 8.b No; Go to step 9.

Note : Additional open circuit fault codes will set with the DEF pump disconnected. Disregard the new fault codes at this time.

9. Turn the ignition ON (key ON, engine OFF).

10. Does the SPN 3597/FMI 4 fault code change or go inactive?
    - 10.a Yes; replace DEF pump. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module" .
    - 10.b No; turn the ignition OFF. Go to step 11.
11. Disconnect the DEF tank header harness connector.
12. Inspect DEF tank header harness connector for bent, spread, or corroded pins. Was any damage found?
    - 12.a Yes; repair as necessary. Verify repair with ignition key cycle.
    - 12.b No; Go to step 13.

Note : Additional open circuit fault codes will set with the DEF tank header disconnected. Disregard the new fault codes at this time.

13. Turn the ignition ON (key ON, engine OFF).
14. Does the SPN 3597/FMI 4 fault code change or go inactive?
    - 14.a Yes; replace DEF tank header. Refer to section "Removal of the 13- and 23-Gallon Diesel Exhaust Fluid Tank Header Unit" .
    - 14.b No; turn the ignition OFF. Go to step 15.
15. Disconnect the ACM 120-pin harness connector.
16. Inspect the ACM 120-pin harness connector for damaged, loose, or corroded pins. Was any damage found?
    - 16.a Yes; repair as necessary. Verify repair with ignition key cycle.
    - 16.b No; Go to step 17.
17. Measure resistance between pin 1 of the ACM 120-pin connector, harness side and battery ground. Is the resistance greater than 10k ohms?
    - 17.a Yes; Go to step 18.
    - 17.b No; repair the short to ground between pin 1 of the ACM 120-pin connector and pin 2 of the DEF pump connector. Verify repair with ignition key cycle.
18. Measure the resistance between pin 3 of the ACM 120-pin connector, harness side and battery ground. Is the resistance greater than 10k ohms?
    - 18.a Yes; replace ACM. Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" .
    - 18.b No; repair the short to ground between pin 3 of the 120-pin ACM connector and pin 4 of the DEF dosing unit. Verify repair with ignition key cycle.

SPN 3597 (CPC3) (GHG17)

254.1 SPN 3597/FMI 3 - GHG17

Shift Lever Pin Number	Signal Description	CPC3 Connector Pin
1	12V Ignition	3/21 Ignition
2	LIN	3/47 LIN COM
3	GND	3/34 Main Battery Ground
4	No Connection	No Connection

This fault indicates the CPC3 detects battery voltage on pin 21 of connector #3, with the ignition in the OFF position. Repair short to battery power between pin 21 of the CPC3 connector #3, and pin 1 of the right shift stalk lever connector.

SPN 3597 (MCM) (GHG17)

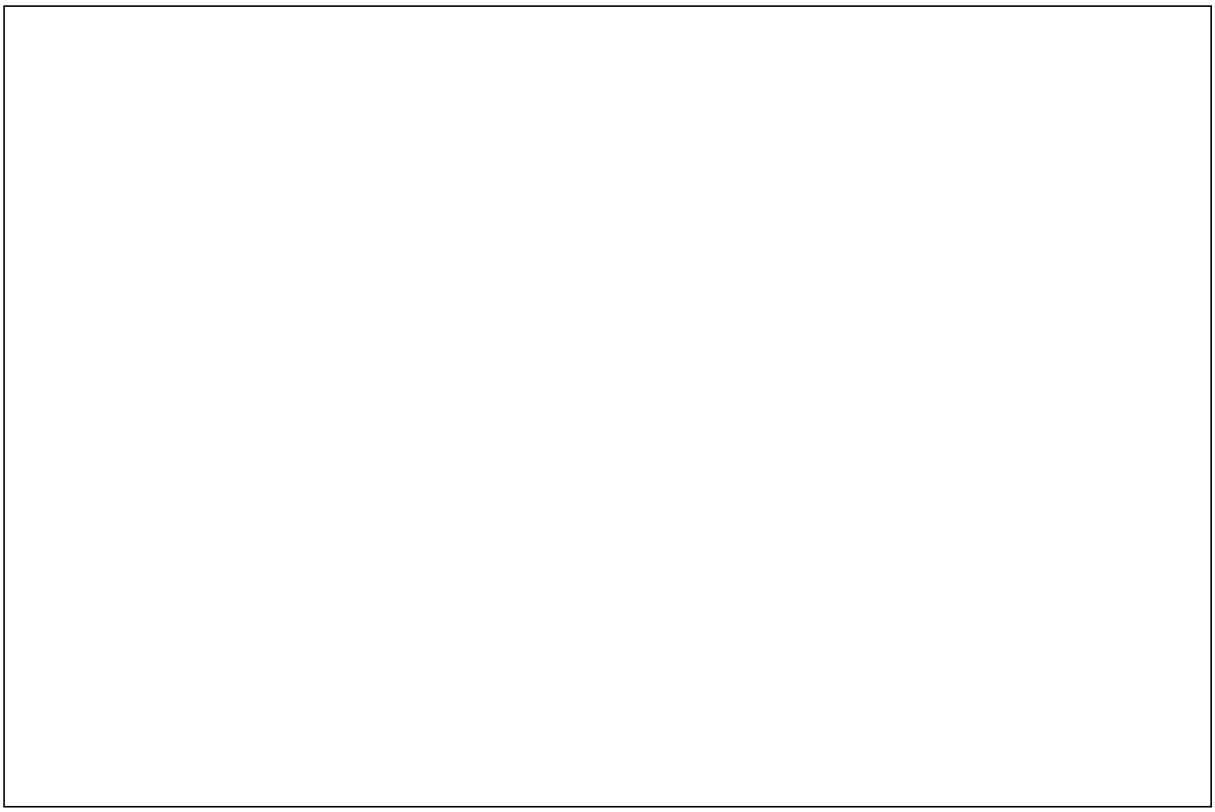
255.1 SPN 3597/FMI 3 - GHG17

SPN 3597/FMI 3	
Description	Proportional valve bank 1 circuit failed high
Monitored Parameter	Proportional valve bank 1 circuit
Typical Enabling Conditions	Always Enabled
Monitor	Sequence None
Execution Frequency	Always Enabled
Typical Duration	2 seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (1 minute)

1. Disconnect the Motor Control Module (MCM) 120-pin connector.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pin 66 of the MCM 120-pin connector and ground.
   - 3.a If the voltage is greater than 11.5 volts, repair short to power between pin 1 of the front Jake Brake® solenoid and pin 66 of the MCM 120-pin connector.
   - 3.b If no voltage is present, Go to step 4.
4. Measure the voltage between pin 91 of the MCM and ground.
   - 4.a If the voltage is greater than 11.5 volts, repair short to power between pin 2 of the Jake Brake® solenoid and pin 91 of the MCM 120-pin connector.
   - 4.b If no voltage is present, replace the MCM. Refer to section "Removal of the Motor Control Module" .

255.2 SPN 3597/FMI 4 - GHG17

Proportional Valve Bank 1 Circuit Failed Low



Check as follows:

1. Turn the ignition OFF.
2. Disconnect the front valve cover fuel injector harness connector.

   Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .
3. Inspect the harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Are any signs of damage present?

   3.a Yes; repair as necessary. Verify repairs.

   3.b No; Go to step 4.
4. Turn the ignition ON (key ON, engine OFF).
5. Using DiagnosticLink , monitor fault code SPN 3597/ FMI 4. Does the fault code change or go inactive?

   5.a Yes; Go to step 6.

   5.b No; Turn the ignition OFF. Go to step 9.
6. Turn the ignition OFF.
7. Remove the valve cover and disconnect the wires from the low engine brake solenoid.
8. Measure the resistance between pin 14 on the valve cover side of the fuel injector harness connector and ground. Is the resistance less than 10K ohms?

   8.a Yes; replace the front under valve cover fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

   8.b No; replace the engine brake solenoid. Refer to section "Removal of the Engine Brake Solenoid" . Verify repairs.

9. Disconnect the engine Original Equipment Manufacturer (OEM) 10-pin connector.
10. Inspect the harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Are any signs of damage present?
    - 10.a Yes; repair as necessary. Verify repairs.
    - 10.b No; Go to step 11.
11. Turn the ignition ON (key ON, engine OFF).
12. Using DiagnosticLink, monitor fault code SPN 3597/FMI 4. Does the fault code change or go inactive?
    - 12.a Yes; inspect fan wiring and solenoid. For wiring schematic information, refer to OEM literature.
    - 12.b No; turn the ignition OFF. Go to step 13.
13. Disconnect the Motor Control Module (MCM) 120-pin connector.
14. Inspect the MCM 120-pin and the 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage.
    - 14.a If any signs of damage are found, repair as necessary.
    - 14.b If no signs of damage, Go to step 15.
15. Turn the ignition ON (key ON, engine OFF).
16. Using DiagnosticLink, monitor fault code SPN 3597/FMI 4. Does the fault code change or go inactive?
    - 16.a Yes; Go to step 17.
    - 16.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs.
17. Measure resistance from pin 91 of the MCM 120-pin harness connector and ground. Is resistance greater than 10K ohms?
    - 17.a Yes; repair the short to ground on pin 93 of the MCM 120-pin harness connector. Verify repairs.
    - 17.b No; repair the short to ground on pin 91 of the MCM 120-pin harness connector. Verify repairs.

SPN 3598 (MCM) (GHG17)

257.1 SPN 3598/FMI 3 - GHG17

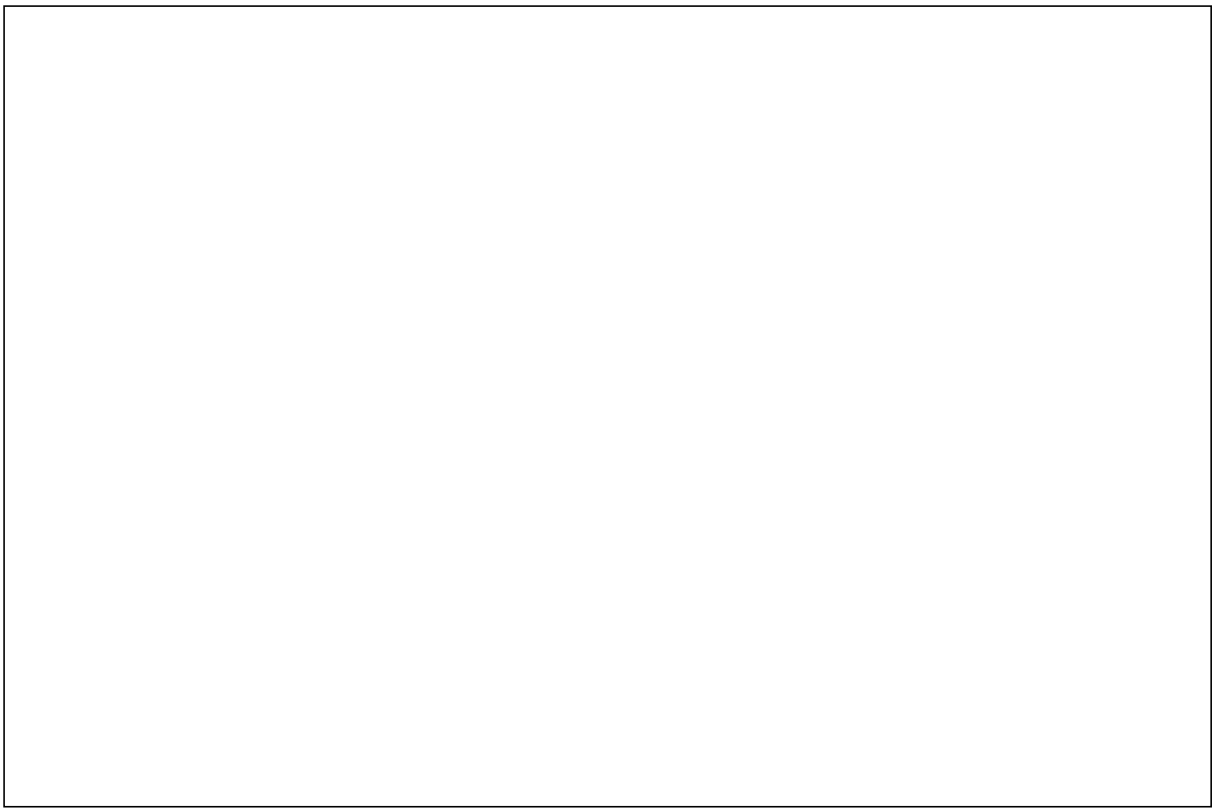
Proportional valve bank 2 circuit failed high

SPN 3598/FMI 3	
Description	Proportional Valve Bank 2 Circuit Failed High
Monitored Parameter	Motor Control Module (MCM) Bank 2 Power
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (1 minute)

1. Disconnect the MCM 120-pin connector.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pin 62 of the MCM 120-pin connector and ground.
   3.a If the voltage is greater than 11.5 volts, repair short to power between pin 2 of the rear Jake Brake® solenoid and pin 62 of the MCM 120-pin connector.
   3.b If no voltage is present, Go to step 4. .
4. Measure the voltage between pin 64 of the MCM and ground.
   4.a If the voltage is greater than 11.5 volts, repair short to power between pin 2 of the Electronic Dosing Valve (EDV) and pin 64 of the MCM 120-pin connector.
   4.b If no voltage is present, replace the MCM. Refer to section "Removal of the Motor Control Module" .

257.2 SPN 3598/FMI 4 - GHG17

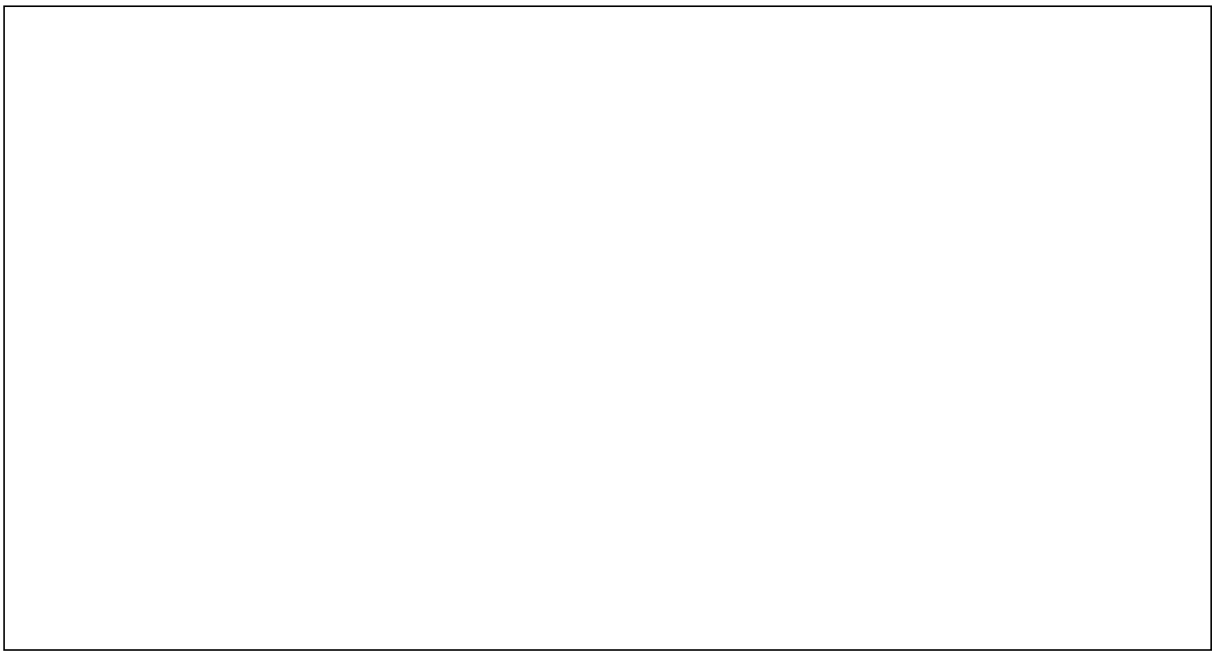
Proportional Valve Bank 2 Circuit Failed Low.



SPN 3598/FMI 4	
Description	Proportional Valve Bank 2 Circuit Failed Low
Monitored Parameter	Proportional Valve Bank 2 circuit
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate
Verification	Ignition Key Cycle

Check as follows:

Note : Other circuit low fault codes may set as a result of SPN 3598/FMI 4.



A	Engine Harness Side
B	Valve Cover Side

1. Disconnect the rear fuel injector harness 14-pin injector connector.
2. Inspect the rear fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is there any damage found?
   - 2.a Yes; repair as necessary. Verify repairs.
   - 2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).

Note : Additional fault codes will be present as a result of turning the ignition ON while there are disconnected components. Disregard these new fault codes at this time.

4. Using DiagnosticLink , does SPN 3598/FMI 4 fault code become inactive with the rear fuel injector harness disconnected?
   - 4.a Yes; Go to step 5.
   - 4.b No; Go to step 8.
5. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
6. Disconnect the rear Jake Brake® electrical harness connector.
7. Measure resistance between either terminal on the Jake Brake® solenoid and ground. Is the resistance greater than 10k ohms?
   - 7.a Yes; install a new rear fuel injector valve cover harness.

     Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .
   - 7.b No; replace the Jake Brake® solenoid.

     Refer to section "Removal of the Camshafts" .

     Refer to section "Removal of the Exhaust Rocker Shaft Assembly" . Verify repairs.
8. Disconnect the fuel cutoff valve connector.
9. Inspect the harness connector and valve for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is there any damage found?

9.a Yes; repair as necessary. Verify repairs.

9.b No; Go to step 10.

10. Using DiagnosticLink, does SPN 3598/FMI 4 become inactive with the fuel cutoff valve disconnected?

10.a Yes; replace the HC doser block assembly. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " . Verify repairs.

10.b No; Go to step 11.

11. Disconnect the electronic dosing valve connector.

12. Inspect the harness connector and valve for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is there any damage found?

12.a Yes; repair as necessary. Verify repairs.

12.b No; Go to step 13.

13. Using DiagnosticLink, does SPN 3598/FMI 4 become inactive with the electronic dosing valve disconnected?

13.a Yes; replace the Hydrocarbon (HC) doser block assembly. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " . Verify repairs.

13.b No; Go to step 14.

14. Disconnect the Exhaust Gas Recirculation (EGR) valve actuator connector.

15. Inspect the harness connector and valve for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is there any damage present?

15.a Yes; repair as necessary. Verify repairs.

15.b No; Go to step 16.

16. Using DiagnosticLink, does SPN 3598/FMI 4 become inactive with the EGR valve disconnected?

16.a Yes; replace the EGR valve.

For DD13 and DD15: Refer to section "Removal of the DD13 and DD15 Exhaust Gas Recirculation Valve Actuator" .

For DD16: Refer to section "Removal of the DD16 Exhaust Gas Recirculation Valve Actuator" . Verify repairs.

16.b No; Go to step 17.

17. Is vehicle equipped with variable speed water pump?

17.a Yes; Go to step 18.

17.b No; Go to step 21.

18. Disconnect the variable speed water pump connector.

19. Inspect the harness connector and water pump for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is there any damage found?

19.a Yes; repair as necessary. Verify repairs.

19.b No; Go to step 20.

20. Using DiagnosticLink, does SPN 3598/FMI 4 become inactive with the variable speed water pump disconnected?

20.a Yes; replace the variable speed water pump. Refer to section "Removal of the Variable Speed Water Pump" . Verify repairs.

20.b No; Go to step 21.

21. While monitoring fault code, wiggle-test the harness. Does SPN 3598/FMI 4 change or become inactive?

21.a Yes; isolate that section of harness and inspect for wire chaffing, corrosion, improper connections or physical damage and repair as necessary. Verify repairs.

21.b No; Go to step 22.

22. Turn the ignition OFF.

23. Disconnect the Motor Control Module (MCM) 120-pin connector.

24. Inspect the 120-pin connector and MCM for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is there any damage found?

24.a Yes; repair as necessary. Verify repairs.

24.b No; Go to step 25.

25. Measure the resistance between pin 62 on the 120-pin MCM harness side connector and battery ground. Is the resistance greater than 10K ohms?

25.a Yes; Go to step 26.

25.b No; repair the short to ground on pin 62 of the MCM 120-pin connector. Verify repairs.

26. Measure the resistance between pin 64 of the 120-pin MCM harness side connector and battery ground. Is the resistance greater than 10K ohms?

26.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repairs.

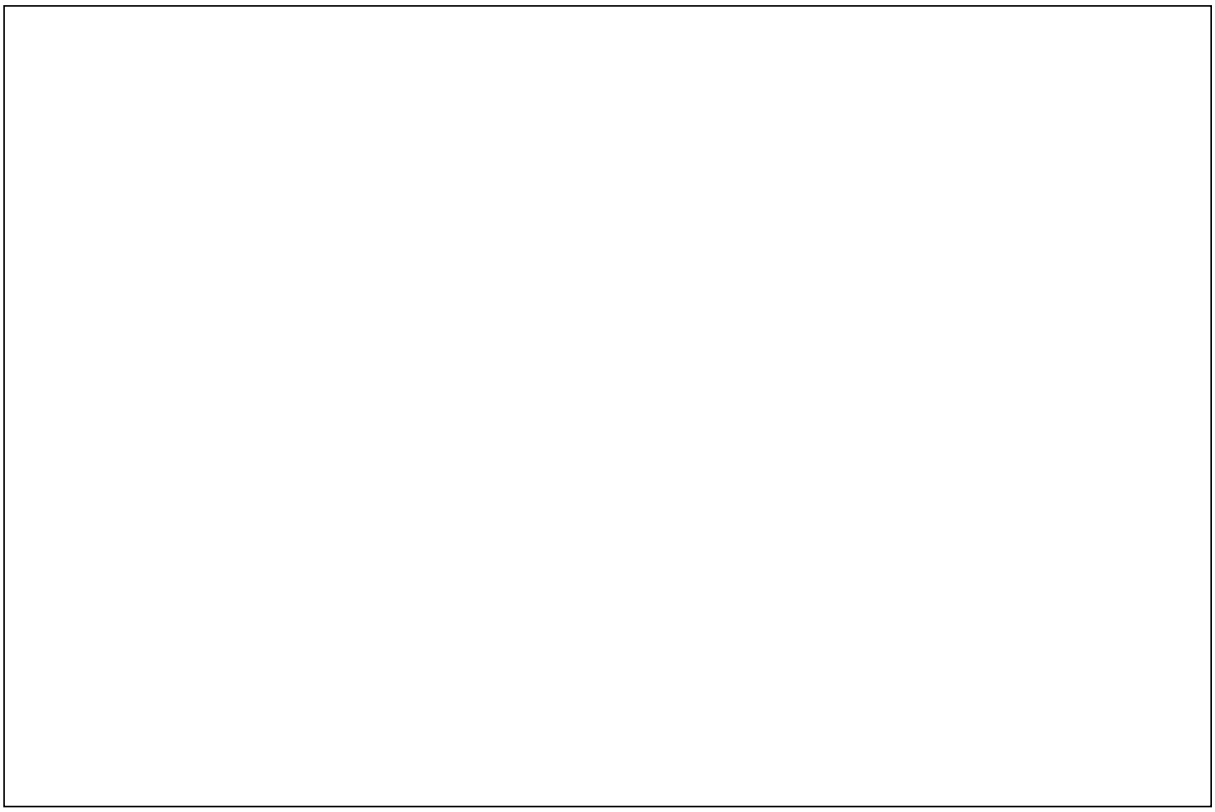
26.b No; repair the short to ground on pin 64 of the MCM 120-pin connector. Verify repairs.

SPN 3599 (ACM) (GHG17)

257.1 SPN 3599/FMI 3 - GHG17

High Side Digital Output 3 Circuit Failed High

SPN 3599/FMI 3	
Description	This Code Sets When the Aftertreatment Control Module (ACM) Detects a Short to Power on Pins 9, 15, or 39 within One Second After the Ignition has Been Turned On.
Monitored Parameter	High Side Digital Output 3 Circuit
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	One Second After the Ignition is Cycled On
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Cycle the Ignition Key from the Off Position to the On Position.



Check as follows:

1. Disconnect the 120-pin ACM connector. Go to step 2.
2. Connect DiagnosticLink . Go to step 3.
3. Turn the ignition ON (key ON, engine OFF). Go to step 4.
4. Does code SPN 3599/FMI 3 still set?

4.a Yes; replace the ACM .

For 1-BOX™, Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" .Verify repair.

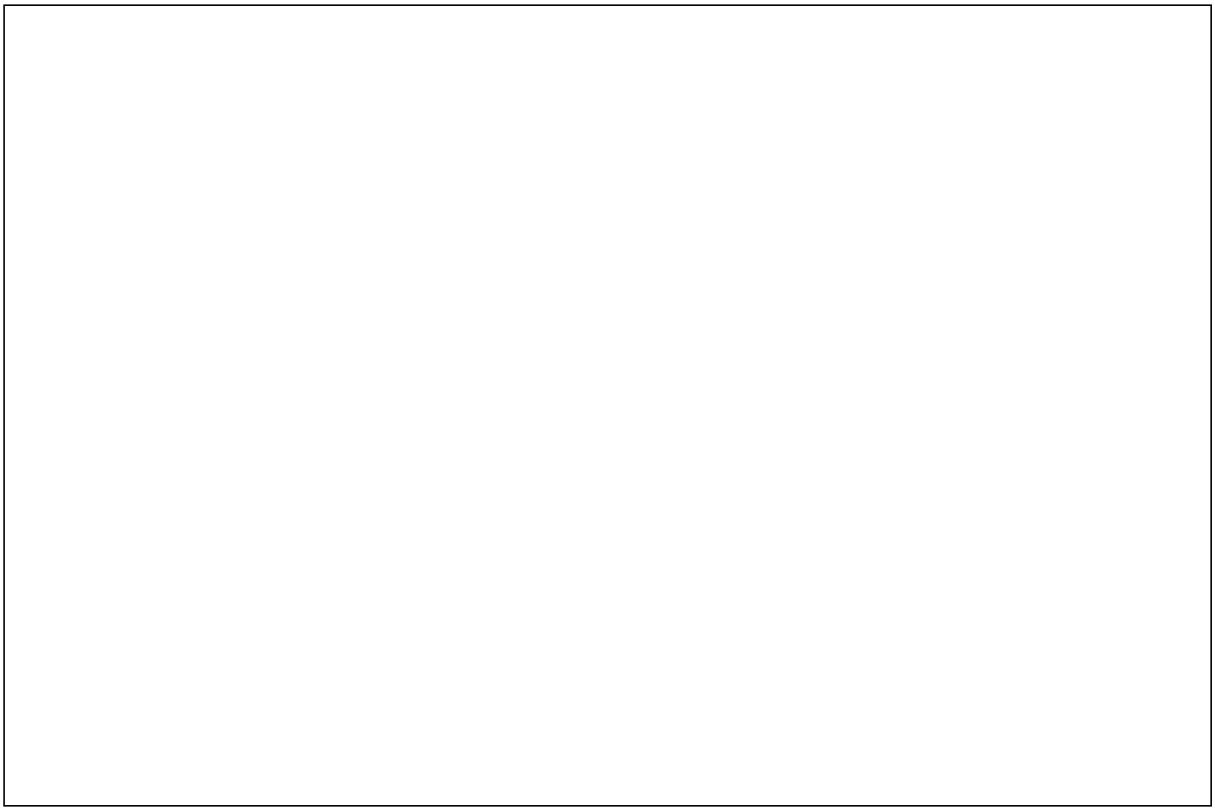
For Two-BOX, Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module" .Verify repair.

4.b No; turn the ignition OFF. Refer to Original Equipment Manufacturer (OEM) literature and repair the wire between the ACM and the line heaters. Verify repair.

257.2 SPN 3599/FMI 4 - GHG17

High Side Digital Output 3 Circuit Failed Low

SPN 3599/FMI 4	
Description	This Code Sets When the Aftertreatment Control Module (ACM) Detects a Short to Ground on pins 9, 15, or 39.
Monitored Parameter	High Side Digital Output 3 Circuit
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Cycle the Ignition Key from the Off Position to the On Position.



Check as follows:

1. Disconnect the 120-pin ACM connector. Go to step 2.
2. Connect DiagnosticLink . Go to step 3.
3. Turn the ignition ON (key ON, engine OFF). Go to step 4.
4. Does code SPN 3599/ FMI 4 still set?

   4.a Yes; replace the ACM.

   For 1-BOX™, Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" .Verify repair.

   For Two-BOX, Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module" .Verify repair.

4.b No; turn the ignition OFF. Refer to Original Equipment Manufacturer (OEM) literature and repair the wire between the ACM and the line heaters. Verify repair.

SPN 3599 (MCM) (GHG17)

259.1 SPN 3599/FMI 3 - GHG17

SPN 3599/FMI 3	
Description	Motor Control Module (MCM) Internal Injector Power Supply Failed High
Monitored Parameter	MCM Internal Injector Power Supply
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)

1. Replace the MCM.

259.2 SPN 3599/FMI 4 - GHG17

SPN 3599/FMI 4	
Description	Motor Control Module (MCM) Internal Fuel Injector Power Supply Failed Low
Monitored Parameter	MCM Internal Fuel Injector Power Supply
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)

1. Replace the MCM.

SPN 3606 (CPC) (GHG17)

260.1 SPN 3606/FMI 9 - GHG17

J1939 ESS Message is Missing

1. Check for multiple codes:
   - 1.a If CPC SPN 168/FMI 0 or SPN 168/FMI 14 (Battery Voltage) are present, troubleshoot these first.

     Refer to section "SPN 168/FMI 0 - GHG17 " .
   - 1.b If CPC SPN 625/FMI 9 is present, troubleshoot and repair the Controller Area Network (CAN) line.
   - 1.c If only a 'J1939 Error' fault is present, Go to step 2.
2. Has the Common Powertrain Controller (CPC) been recently reprogrammed?
   - 2.a Yes; check the proper configuration of the CPC.
   - 2.b No; connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

SPN 3609 (ACM) (GHG17)

261.1 SPN 3609/FMI 3 - GHG17

Diesel Oxidation Catalyst inlet pressure sensor circuit failed high

1. Check for multiple codes.
   1.a If SPN 3609/FMI 3, SPN 3610/FMI 3 and SPN 3509/FMI 3 are present, repair short to power between pin 1 of the Diesel Oxidation Catalyst (DOC) filter inlet pressure sensor and pin 88 of the Aftertreatment Control Module (ACM).
   1.b If SPN 3609/FMI 3 and SPN 3610/FMI 3 are present, repair open between pin 1 of the DOC inlet pressure sensor and pin 88 of the ACM.
   1.c If only SPN 3609/FMI 3 is present, Go to step 2.
2. Disconnect the DOC inlet pressure sensor.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 2 of the DOC inlet pressure sensor and ground.
   4.a If voltage is present, repair short to power between pin 2 of the DOC inlet pressure sensor and pin 87 of the ACM.
   4.b If no voltage is present, Go to step 5.
5. Turn the ignition OFF (key OFF, engine OFF).
6. Disconnect the ACM 120-pin connector.
7. Measure the resistance between pin 2 of the DOC inlet pressure sensor and pin 87 of the ACM.
   7.a If the resistance is greater than 5 ohms repair the wire between pin 2 of the DOC inlet pressure sensor and pin 87 of the ACM.
   7.b If the resistance is less than 5 ohms, replace the DOC inlet pressure sensor.

   For 1-BOX™, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" . Verify repair.

   For 2-BOX, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" . Verify repair.

261.2 SPN 3609/FMI 4 - GHG17

Diesel Oxidation Catalyst Inlet Pressure sensor circuit failed low

1. Check for multiple codes.
   - 1.a If SPN 3609/FMI 4 and SPN 3610/FMI 4 are present, repair open between Aftertreatment Control Module (ACM) pin 117 and Diesel Oxidation Catalyst (DOC)/Diesel Particulate Filter (DPF) pressure sensors pin 3.
   - 1.b If only SPN 3609/FMI 4 is present, Go to step 2.
2. Turn the ignition OFF (key OFF, engine OFF).
3. Disconnect the DOC inlet pressure sensor.
4. Inspect the DOC inlet pressure sensor harness for bent, spread, or corroded pins.
   - 4.a If the pins are bent, spread, or corroded, repair as necessary.
   - 4.b If the connector shows no signs of damage, Go to step 5.
5. Disconnect the ACM 120-pin connector.
6. Measure the resistance between pin 2 of the DOC inlet pressure sensor and ground.
   - 6.a If the resistance is less than 1k ohms, repair short to ground between pin 2 of the DOC inlet pressure sensor and pin 87 of the ACM 120-pin connector.
   - 6.b If the resistance is greater than 1K ohms, Go to step 7.
7. Measure the resistance between pin 2 of the DOC inlet pressure sensor and pin 87 of the ACM 120-pin connector.
   - 7.a If the resistance is greater than 3 ohms repair wire between pin 2 of the DOC inlet pressure sensor and pin 87 of the ACM 120-pin connector.
   - 7.b If the resistance is less than 3 ohms, replace the DOC inlet pressure sensor.

     For 1-BOX™, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" . Verify repair.

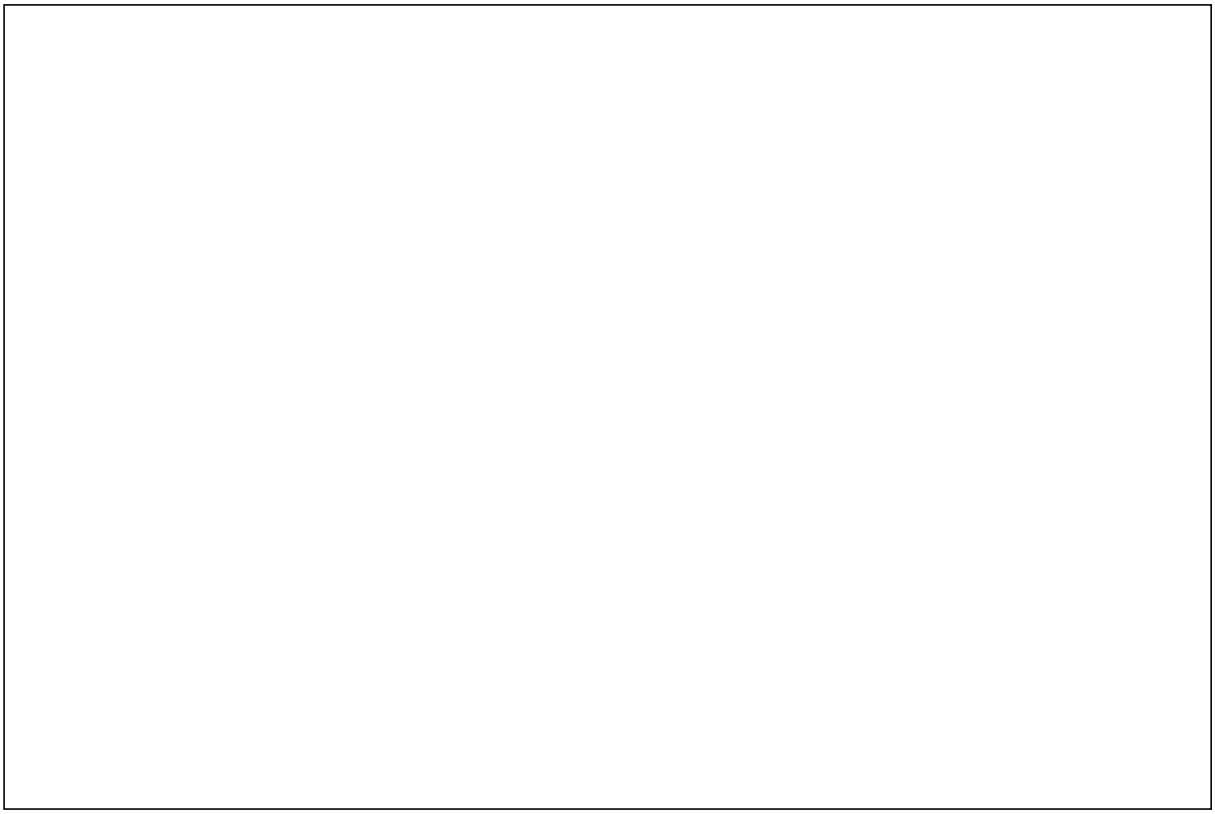
     For 2-BOX, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" . Verify repair.

SPN 3610 (ACM) (GHG17)

262.1 SPN 3610/FMI 2 - GHG17

Diesel Oxidation Catalyst Inlet Pressure - Not Plausible

SPN 3610/FMI 2	
Description	Diesel Oxidation Catalyst (DOC) Inlet Pressure Not Plausible
Monitored Parameter	Exhaust Pressures
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Parked Regeneration



⚠ WARNING

ENGINE EXHAUST

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

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.

1. Start the engine and visually inspect the entire exhaust system for signs of leaks or damage. Are there any leaks or damage present?
   - 1.a Yes; repair as necessary. Verify repair.
   - 1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Using the Selective Catalyst Reduction (SCR) voltage service routine, monitor the Diesel Oxidation Catalyst (DOC) filter inlet pressure (pin 87) and the DPF outlet pressure (pin 72) voltages with the ignition ON (key ON, engine OFF). Is the DOC inlet pressure sensor voltage between 0.44 and 0.56 volts?
   - 3.a Yes; Go to step 7.
   - 3.b No; Go to step 4.
4. Disconnect the DOC inlet pressure sensor connector. Go to step 5.
5. Inspect the connectors for damaged pins, spread pins or corrosion. Is there any damage present?
   - 5.a Yes; repair as necessary. Verify repairs.
   - 5.b No; Go to step 6.
6. Measure the voltage from pin 3 of the DOC inlet pressure sensor connector to ground. Is the voltage between 4.5 and 5.5 volts?
   - 6.a Yes; replace the sensor. Verify repair.

     For 1-BOX™, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" .

     For 2-BOX, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" .
   - 6.b No; repair the wire. Verify repair.
7. Measure the DPF outlet sensor voltage. Is the voltage between 0.44 and 0.56 volts?
   - 7.a Yes; repair restricted/damaged DOC or DPF pressure sensor tubes. Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor Tube" . Verify repair.
   - 7.b No; Go to step 8.
8. Disconnect the DOC inlet pressure sensor connector. Go to step 9.
9. Inspect the connectors for damaged pins, spread pins or corrosion. Is there any damage present?
   - 9.a Yes; repair as necessary. Verify repairs.
   - 9.b No; Go to step 10.
10. Measure the voltage between pin 3 of the DOC inlet pressure sensor connector and ground. Is the voltage between 4.5 and 5.5 volts?
    - 10.a Yes; replace the sensor.

      For 1-BOX™, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" . Verify repair.

      For 2-BOX, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" . Verify repair.
    - 10.b No; repair the circuit. Verify repair.

262.2 SPN 3610/FMI 3 - GHG17

This is for DD13 2-Box only.

1. Check for multiple codes.
   - 1.a If SPN 3610/FMI 3, SPN 3609/FMI 3 and SPN 3509/FMI 3 are present, repair short to power between pin 1 of the Diesel Particulate Filter (DPF) outlet pressure sensor and pin 88 of the Aftertreatment Control Module (ACM).
   - 1.b If SPN 3610/FMI 3 and FMI 3609/FMI 3 are present, repair open between pin 1 of the DPF outlet pressure sensor and pin 88 of the ACM.
   - 1.c If only SPN 3610/FMI 3 is present, Go to step 2.
2. Disconnect the DPF outlet pressure sensor.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 2 of the DPF outlet pressure sensor and ground. Is voltage present?
   - 4.a Yes; repair short to power between pin 2 of the DPF outlet pressure sensor and pin 72 of the ACM.
   - 4.b No; Go to step 5.
5. Turn the ignition OFF (key OFF, engine OFF).
6. Disconnect the ACM 120-pin connector.
7. Measure the resistance between pin 2 of the DPF outlet pressure sensor and pin 72 of the ACM. Is the resistance greater than five ohms?
   - 7.a Yes; repair the wire between pin 2 of the DPF outlet pressure sensor and pin 72 of the ACM.
   - 7.b No; replace the DPF outlet pressure sensor . Refer to section "Removal of the GHG17 Diesel Particulate Filter Outlet Pressure Sensor.

262.3 SPN 3610/FMI 4 - GHG17

Diesel Particulate Filter Outlet Pressure Sensor Circuit Failed Low

1. Check for multiple codes.
   1.a If SPN 3610/FMI 4 and SPN 3609/FMI 4 are present, repair open between Aftertreatment Control Module (ACM) pin 117 and Diesel Oxidation Catalyst (DOC)/Diesel Particulate Filter (DPF) pressure sensors pin 3.
   1.b If only SPN 3610/FMI 4 is present, Go to step 2.
2. Turn the ignition OFF.
3. Disconnect the DPF outlet pressure sensor.
4. Inspect the DPF outlet pressure sensor harness for bent, spread, or corroded pins. Are any of the pins damaged?
   4.a Yes; repair as necessary.
   4.b No; Go to step 5.
5. Disconnect the ACM 120-pin connector.
6. Measure the resistance between pin 2 of the DPF outlet pressure sensor and ground. Is the resistance less than 1k ohm?
   6.a Yes; repair short to ground between pin 2 of the DPF outlet pressure sensor and pin 72 of the ACM 120-pin connector.
   6.b No; Go to step 7.
7. Measure the resistance between pin 2 of the DPF outlet pressure sensor and pin 72 of the ACM 120-pin connector. Is the resistance greater than three ohms?
   7.a Yes; repair wire between pin 2 of the DPF outlet pressure sensor and pin 72 of the ACM 120-pin connector.
   7.b No; replace the DPF outlet pressure sensor. Refer to section "Removal of the GHG17 Diesel Particulate Filter Outlet Pressure Sensor".

SPN 3645 (CPC) (GHG17)

263.1 SPN 3645/FMI 9 - GHG17

J1939 TCI Message (Transfer Case Information) is Missing

SPN 3645/FMI 9	
Description	Transfer Case Information is Missing
Monitored Parameter	J1939 Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Idle

WARNING

ENGINE EXHAUST

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

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.

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   1.a Yes; repair the battery voltage concern. Verify repair.
   1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   2.b No; Go to step 3.
3. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   3.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.
   3.b No; reprogram the CPC with the correct information as necessary. To verify repair, Go to step 4.
4. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink . Wait five minutes for all modules to power down. Verify repair.

SPN 3659 (MCM) (GHG17)

263.1 Electronic Diagram

Fig 263.1, Fuel Injector Electronic Diagram

263.2 SPN 3659/FMI 3 - GHG17

Injector Cylinder #1 Amplifier Control Valve Abnormal Operation (MAX)

SPN 3659/FMI 3	
Description	Injector Cylinder #1 Amplifier Control Valve Abnormal Operation (MAX)
Monitored Parameter	Injector Cylinder #1 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723 / FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front fuel injector harness 14-pin connector.
5. Inspect the front fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #1 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

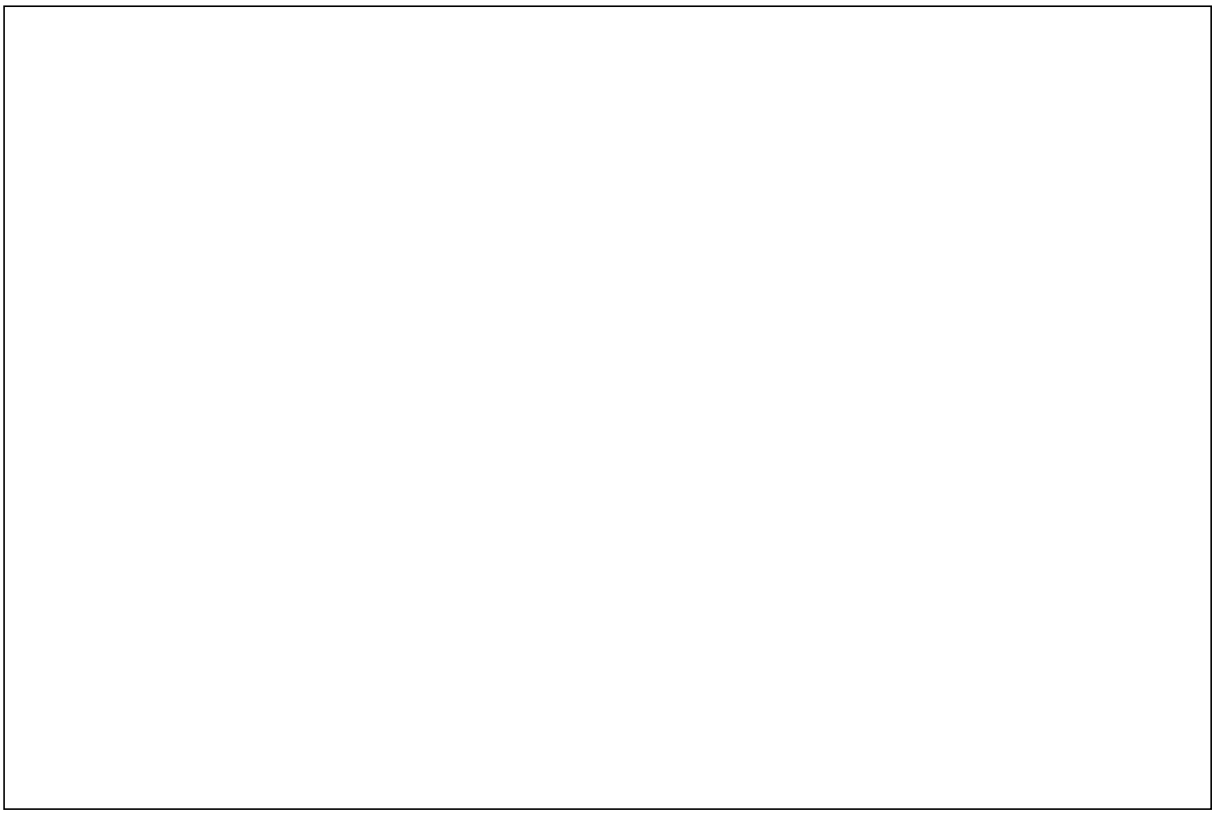
7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the values within range?
   - 9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .
   - 9.b No; replace the fuel injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

11. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

    11.a Yes; Go to step 12.

    11.b No; repair the engine side harness.

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	13		5 and ground	
8	14		8 and ground	
9	10		9 and ground	
12	12		12 and ground	

Note : The use of extension harness J-49120 will ease installation of test MCM.

12. Install a test MCM.
13. Reconnect all connections and start engine. Bring to operating temperature of 71°C (160°F). Did the fault become active?

    13.a Yes; replace injector listed in code description. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

    13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

263.3 SPN 3659/FMI 4 - GHG17

Injector Cylinder #1 Amplifier Control Valve Abnormal Operation (MIN)

SPN 3659/FMI 4	
Description	Injector Cylinder #1 Amplifier Control Valve Abnormal Operation (MIN)
Monitored Parameter	Injector Cylinder #1 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723/FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front fuel injector harness 14-pin connector.
5. Inspect the front fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #1 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

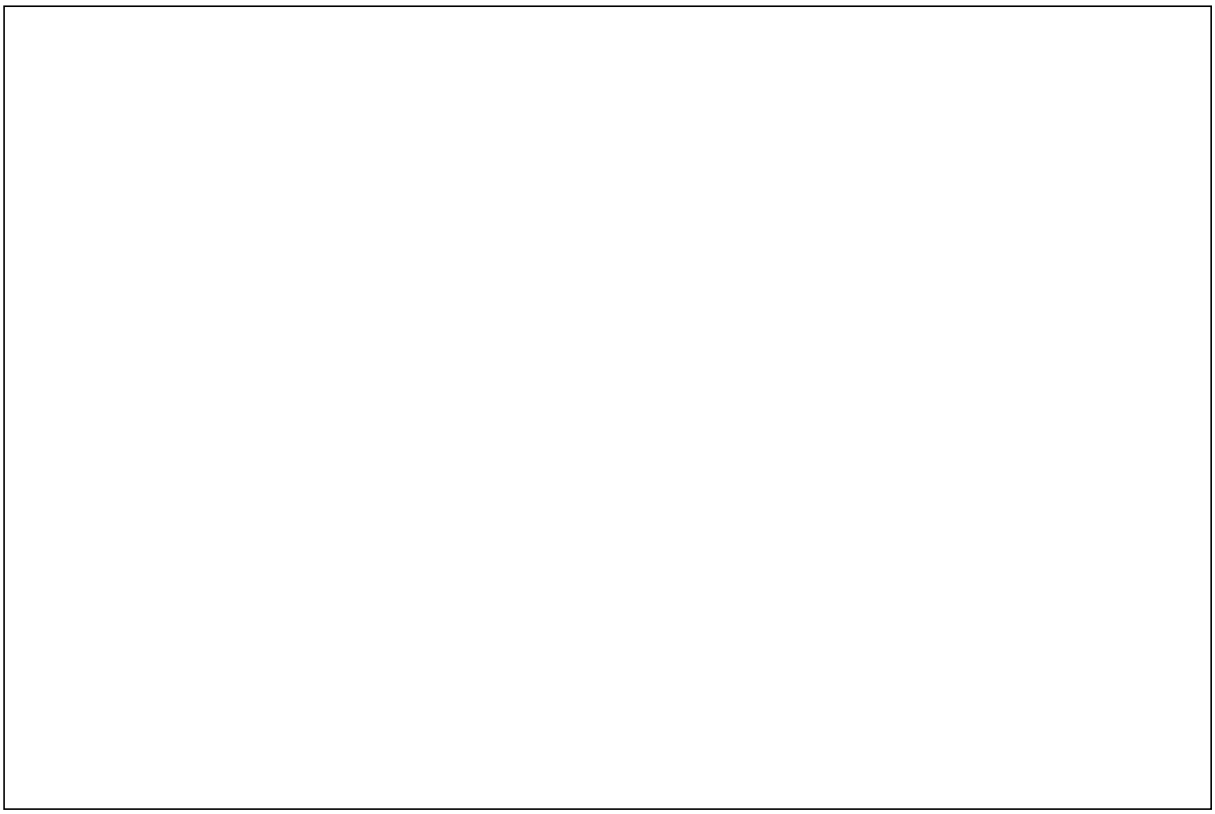
9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

   9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

   9.b No; replace the fuel injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

11. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

    11.a Yes; Go to step 12.

    11.b No; repair the engine side harness.

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	13		5 and ground	
8	14		8 and ground	
9	10		9 and ground	
12	12		12 and ground	

Note : The use of extension harness J-49120 will ease installation of test MCM.

12. Install a test MCM.

WARNING

ENGINE EXHAUST

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

> **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.

13. Reconnect all connections and start engine. Bring to operating temperature of 71°C (160°F). Does fault become active?

13.a Yes; replace injector listed in code description. Refer to section "Removal of the Fuel Injector - Two-Filter System"

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

263.4 SPN 3659/FMI 5 - GHG17

Injector Cylinder #1 Amplifier Control Valve Abnormal Operation (OPEN)

SPN 3659/FMI 5	
Description	Injector Cylinder #1 Amplifier Control Valve Abnormal Operation (OPEN)
Monitored Parameter	Injector Cylinder #1 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723/FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF (key OFF, engine OFF).
4. Disconnect the front fuel injector harness 14-pin connector.
5. Inspect the front fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)					
Injector #1 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #2 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #3 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)					
Note: Ensure J-48671-10 ground strap is connected to cylinder head.					
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

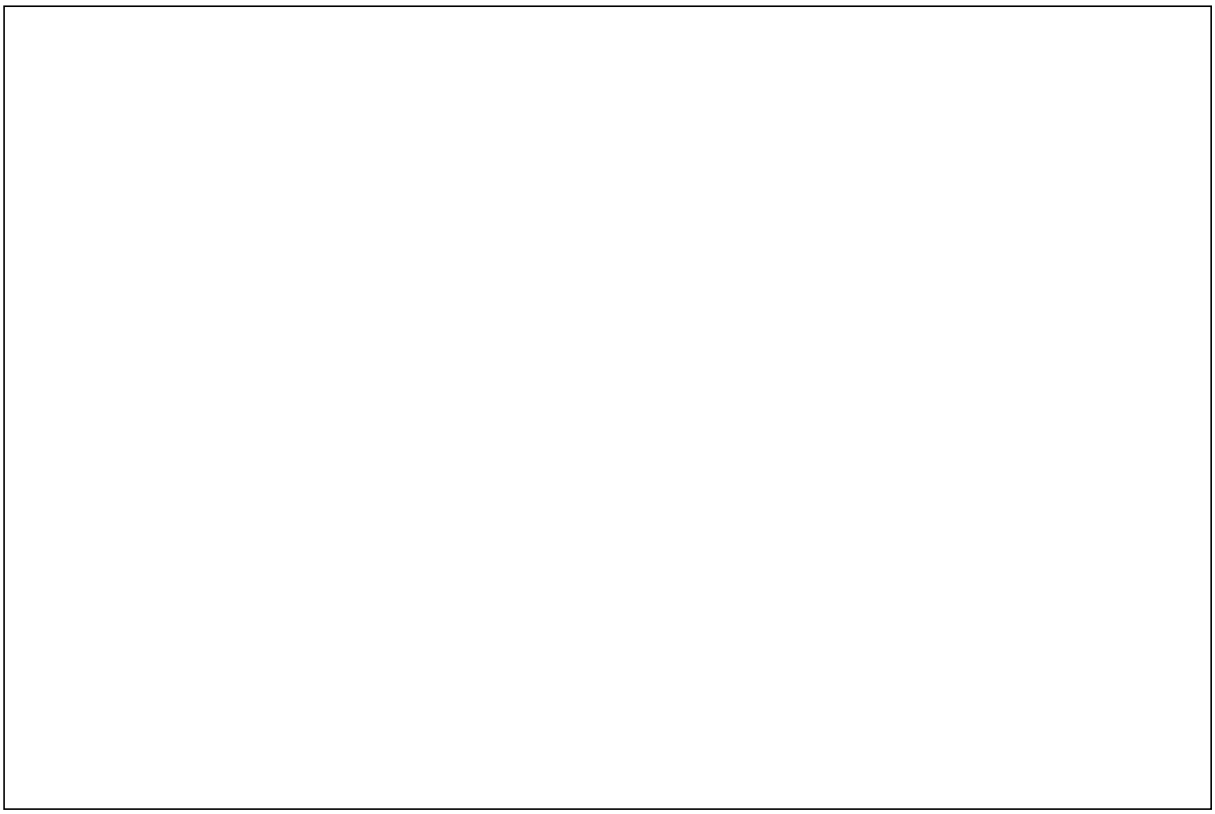
9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

   9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

   9.b No; replace the fuel injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)					
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

11. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

    11.a Yes; Go to step 12.

    11.b No; repair the engine side harness.

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	13		5 and ground	
8	14		8 and ground	
9	10		9 and ground	
12	12		12 and ground	

Note : The use of extension harness J-49120 will ease installation of test MCM.

12. Install a test MCM.

WARNING

ENGINE EXHAUST

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

> **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.

13. Reconnect all connections and start engine. Bring to operating temperature of 71°C (160°F). Does fault become active?

13.a Yes; replace injector listed in code description. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

263.5 SPN 3659/FMI 6 - GHG17

Injector Cylinder #1 Amplifier Control Valve – Valve Shorted Circuit

SPN 3659/FMI 6	
Description	Injector Cylinder #1 Amplifier Control Valve, Valve Shorted Circuit
Monitored Parameter	Injector Cylinder #1 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723 / FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front rocker cover 14–pin injector harness connector.
5. Inspect the front injector harness 14–pin injector connectors for bent or spread pins. Inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : Do NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front injector harness listed below. Are the resistances within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #1 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the front injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : Do NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

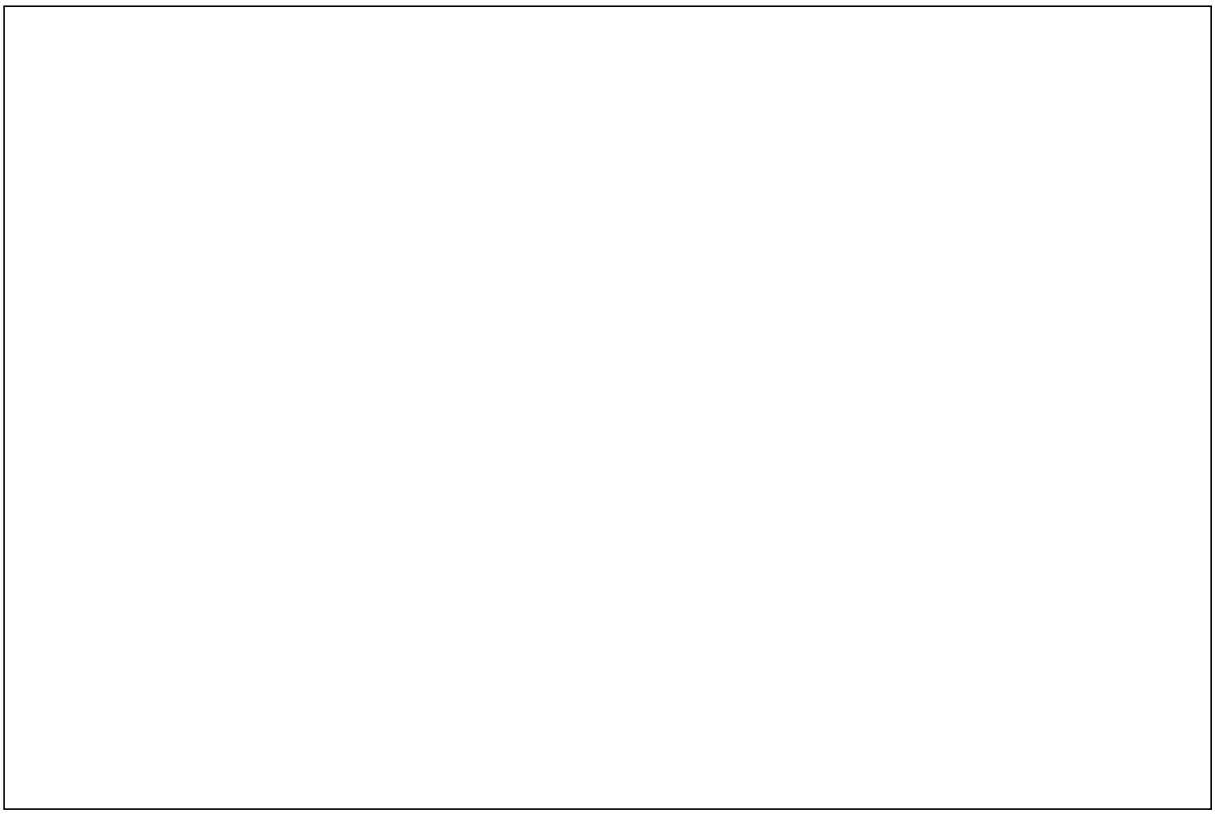
9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

   9.a Yes; replace the front injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

   9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

11. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

    11.a Yes; Go to step 12.

    11.b No; repair the engine side harness.

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	13		5 and ground	
8	14		8 and ground	
9	10		9 and ground	
12	12		12 and ground	

Note : The use of extension harness J-49120 will ease installation of test MCM.

12. Install a test MCM.
13. Reconnect all connections and start engine, bring to operating temperature 71º C (160º F). Does fault become active?

    13.a Yes; replace injector listed in code description. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

    13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

263.1 Electronic Diagram

Fig 263.2, Fuel Injector Electronic Diagram

263.2 SPN 3659/FMI 3 - GHG17

Injector Cylinder #1 Amplifier Control Valve Abnormal Operation (MAX)

SPN 3659/FMI 3	
Description	Injector Cylinder #1 Amplifier Control Valve Abnormal Operation (MAX)
Monitored Parameter	Injector Cylinder #1 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723 / FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front fuel injector harness 14-pin connector.
5. Inspect the front fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)					
Injector #1 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #2 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #3 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)					
Note: Ensure J-48671-10 ground strap is connected to cylinder head.					
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

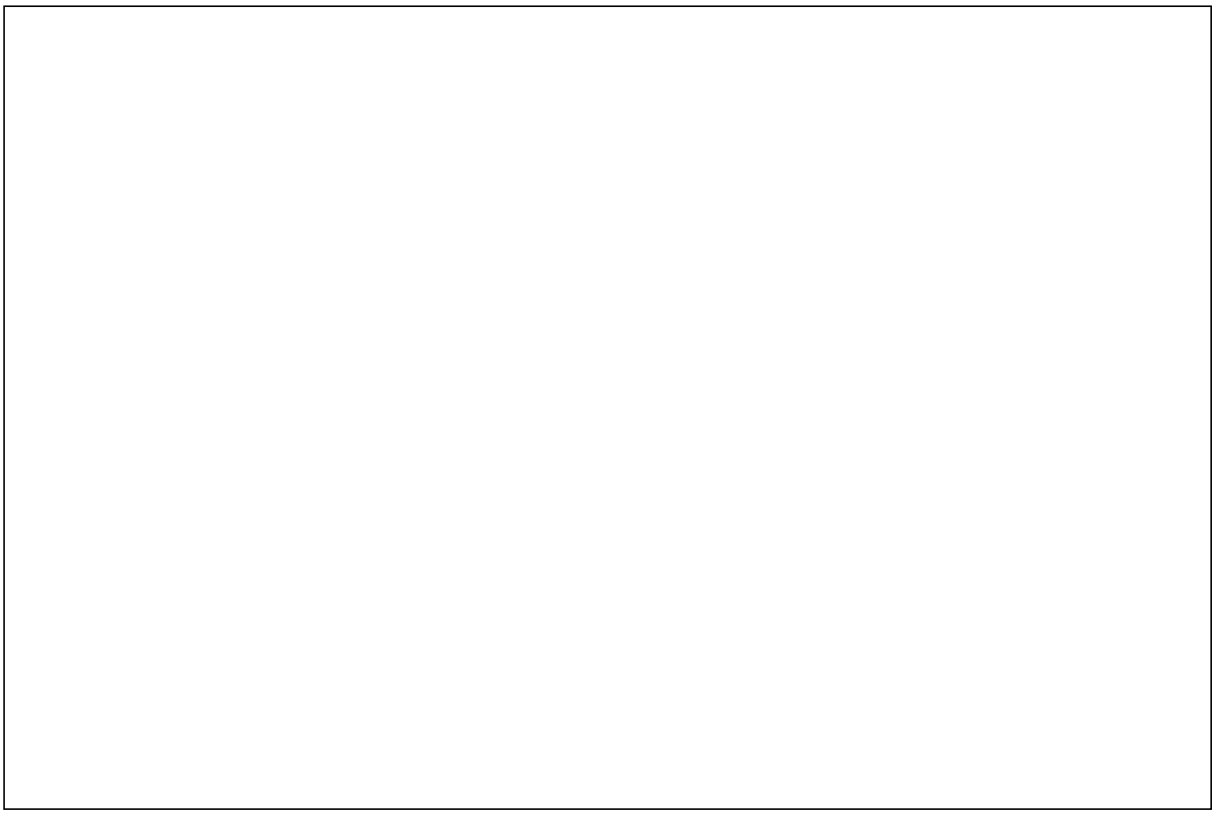
7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the values within range?
   - 9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .
   - 9.b No; replace the fuel injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)					
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

11. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	13		5 and ground	
8	14		8 and ground	
9	10		9 and ground	
12	12		12 and ground	

11.a Yes; Go to step 12.

11.b No; repair the engine side harness. Verify repairs.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

13.a Yes; repair as necessary.

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

263.3 SPN 3659/FMI 4 - GHG17

Injector Cylinder #1 Amplifier Control Valve Abnormal Operation (MIN)

SPN 3659/FMI 4	
Description	Injector Cylinder #1 Amplifier Control Valve Abnormal Operation (MIN)
Monitored Parameter	Injector Cylinder #1 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723/FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front fuel injector harness 14-pin connector.
5. Inspect the front fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)					
Injector #1 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #2 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #3 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)					
Note: Ensure J-48671-10 ground strap is connected to cylinder head.					
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

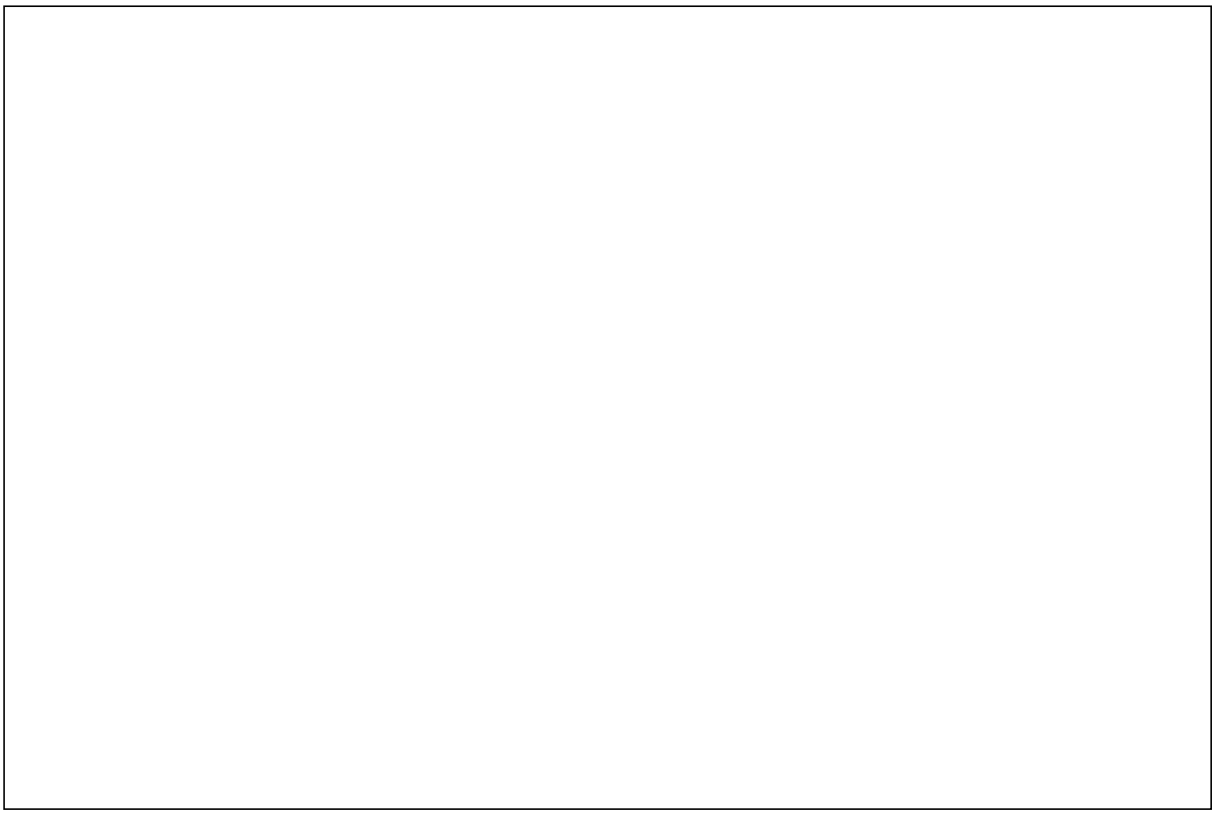
7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?
   - 9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .
   - 9.b No; replace the fuel injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)					
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

11. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	13		5 and ground	
8	14		8 and ground	
9	10		9 and ground	
12	12		12 and ground	

11.a Yes; Go to step 12.

11.b No; repair the engine side harness. Verify repairs.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

13.a Yes; repair as necessary.

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

263.4 SPN 3659/FMI 5 - GHG17

Injector Cylinder #1 Amplifier Control Valve Abnormal Operation (OPEN)

SPN 3659/FMI 5	
Description	Injector Cylinder #1 Amplifier Control Valve Abnormal Operation (OPEN)
Monitored Parameter	Injector Cylinder #1 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723/FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF (key OFF, engine OFF).
4. Disconnect the front fuel injector harness 14-pin connector.
5. Inspect the front fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #1 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

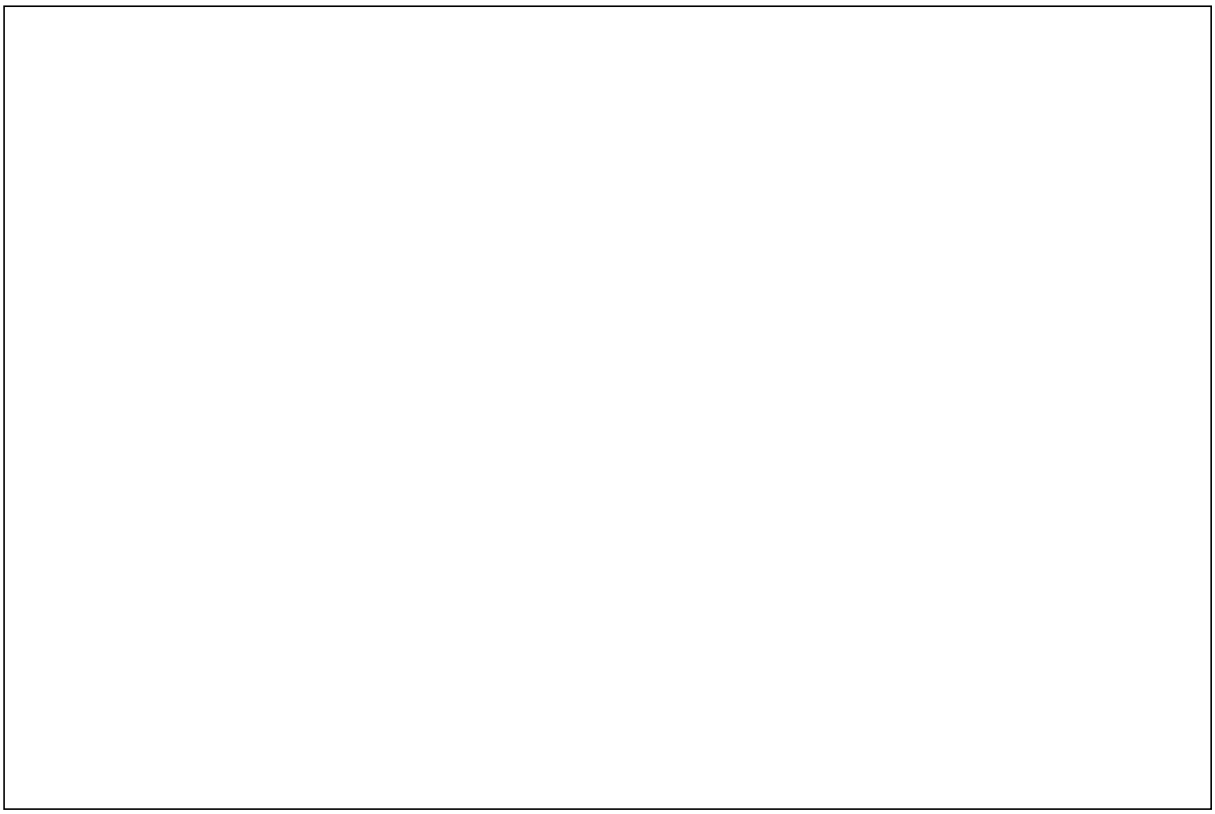
9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

   9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

   9.b No; replace the fuel injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

11. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	13		5 and ground	
8	14		8 and ground	
9	10		9 and ground	
12	12		12 and ground	

11.a Yes; Go to step 12.

11.b No; repair the engine side harness. Verify repairs.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

13.a Yes; repair as necessary.

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

263.5 SPN 3659/FMI 6 - GHG17

Injector Cylinder #1 Amplifier Control Valve – Valve Shorted Circuit

SPN 3659/FMI 6	
Description	Injector Cylinder #1 Amplifier Control Valve, Valve Shorted Circuit
Monitored Parameter	Injector Cylinder #1 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723 / FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front rocker cover 14–pin injector harness connector.
5. Inspect the front injector harness 14–pin injector connectors for bent or spread pins. Inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : Do NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front injector harness listed below. Are the resistances within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #1 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the front injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : Do NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

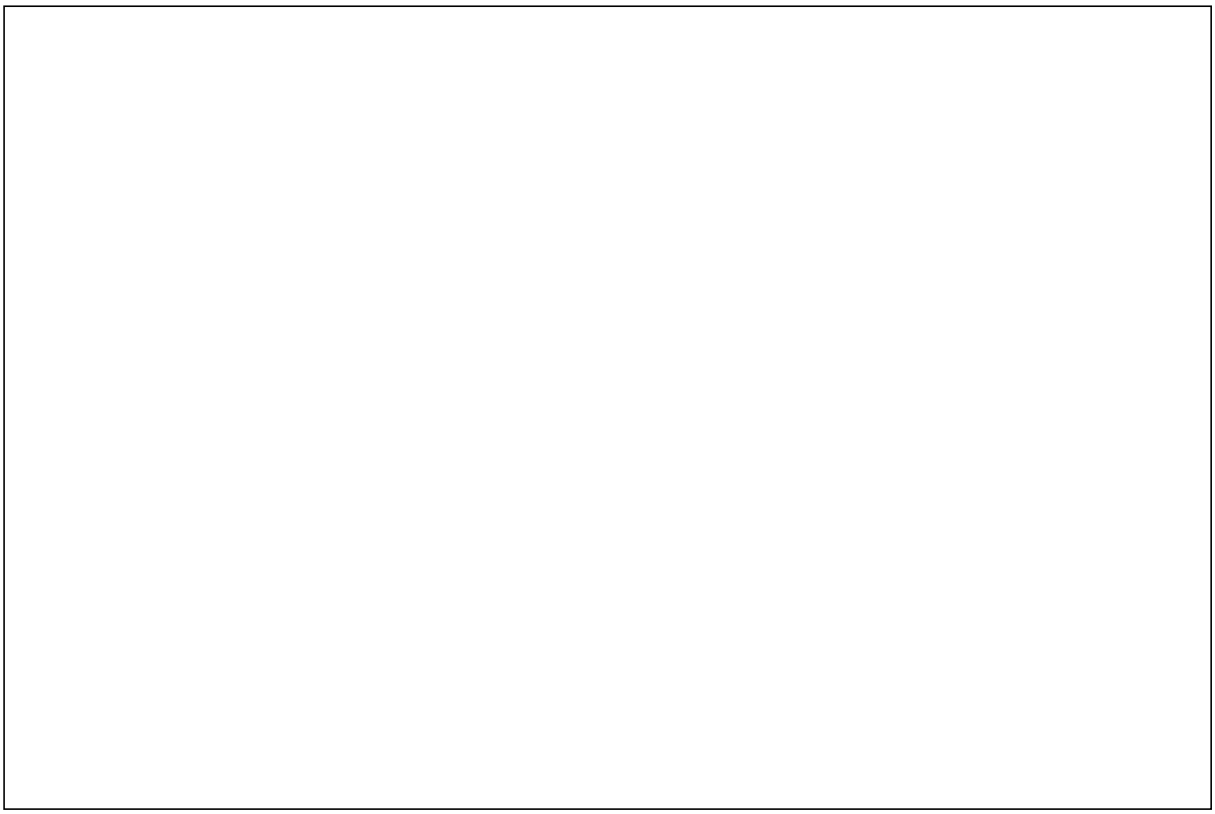
9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

   9.a Yes; replace the front injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

   9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

11. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	13		5 and ground	
8	14		8 and ground	
9	10		9 and ground	
12	12		12 and ground	

11.a Yes; Go to step 12.

11.b No; repair the engine side harness. Verify repairs.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

13.a Yes; repair as necessary.

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

SPN 3660 (MCM) (GHG17)

265.1 Electronic Diagram

Fig 265.1, Fuel Injector Electronic Diagram

265.2 SPN 3660/FMI 3 - GHG17

SPN 3660/FMI 3	
Description	Injector Cylinder #2 Amplifier Control Valve Abnormal Operation (MAX)
Monitored Parameter	Injector Cylinder #2 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 to 1500 (One Minute)

1. Check for multiple codes. Is SPN fault code 168 or 723/FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front fuel injector harness 14-pin connector.
5. Inspect the front fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the values within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #1 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground
	0.5 – 2.0 ohms*	greater than 100k ohms*	greater than 100k ohms*	greater than 100k ohms*
	ohms	ohms	ohms	ohms
Injector #2 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground
	0.5 – 2.0 ohms*	greater than 100k ohms*	greater than 100k ohms*	greater than 100k ohms*
	ohms	ohms	ohms	ohms
Injector #3 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground
	0.5 – 2.0 ohms*	greater than 100k ohms*	greater than 100k ohms*	greater than 100k ohms*
	ohms	ohms	ohms	ohms
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Test:	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
Specifications:	0.5 – 2.0 ohms*	greater than 100k ohms*	greater than 100k ohms*	greater than 100k ohms*
Injector #1 Amplifier	ohms	ohms	ohms	ohms
Injector #2 Amplifier	ohms	ohms	ohms	ohms
Injector #3 Amplifier	ohms	ohms	ohms	ohms
* = acceptable resistance				

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

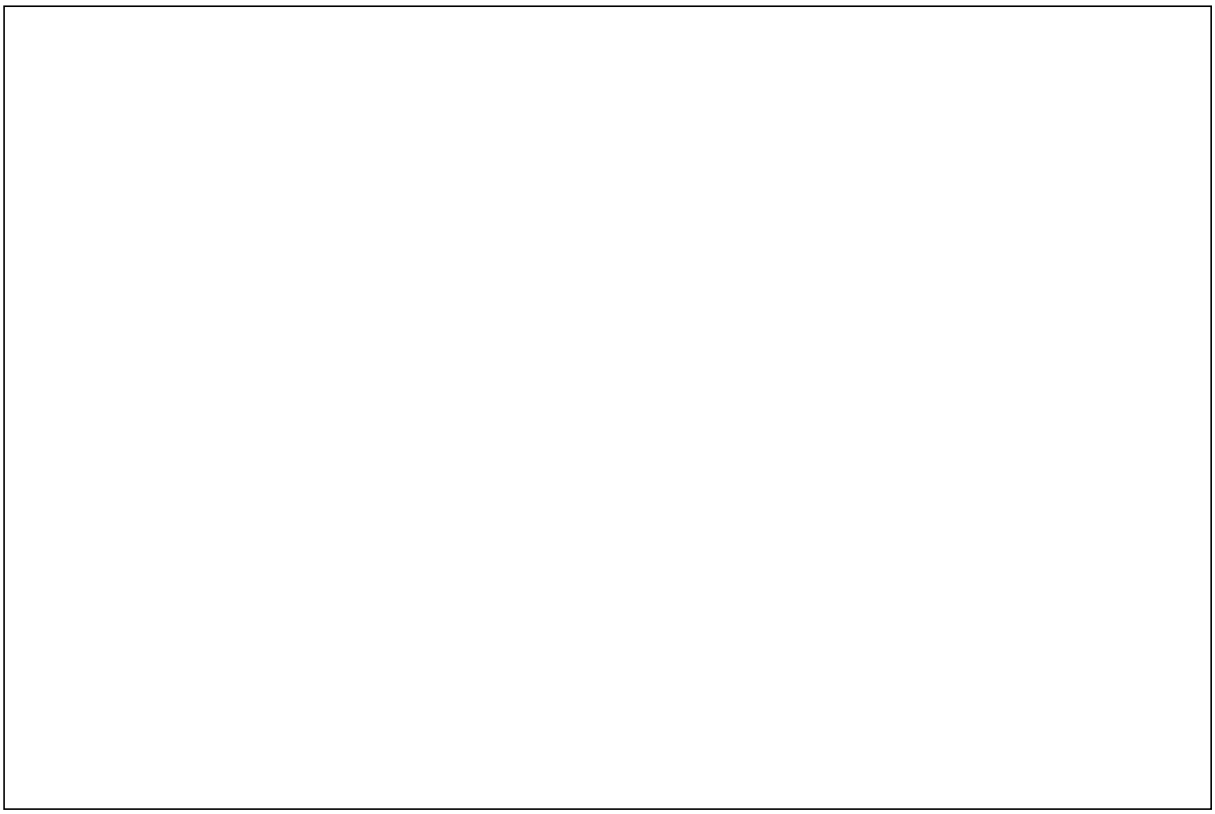
9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

   9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Repair complete. Verify repairs.

   9.b No; replace the fuel injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" . Repair complete. Verify repairs.

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)				
Test:	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
Specification:	2.0 ohms or less*	greater than 20k ohms*	greater than 100k ohms*	greater than 100k ohms*
Injector #1 Amplifier	ohms	ohms	ohms	ohms
Injector #2 Amplifier	ohms	ohms	ohms	ohms
Injector #3 Amplifier	ohms	ohms	ohms	ohms
* = acceptable resistance				

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

11. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the values within range?

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 ohms or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K ohms or greater**
5	13	ohms	5 and ground	ohms
8	14	ohms	8 and ground	ohms
9	10	ohms	9 and ground	ohms
12	12	ohms	12 and ground	ohms

11.a Yes; Go to step 12.

11.b No; repair the engine side harness. Verify repairs.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover"

13. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

13.a Yes; repair as necessary.

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

265.3 SPN 3660/FMI 4 - GHG17

Injector Cylinder #2 Amplifier Control Valve Abnormal Operation (MIN)

SPN 3660/FMI 4	
Description	Injector Cylinder #2 Amplifier Control Valve Abnormal Operation (MIN)
Monitored Parameter	Injector Cylinder #2 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723 / FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front fuel injector harness 14-pin connector.
5. Inspect the front fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #1 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

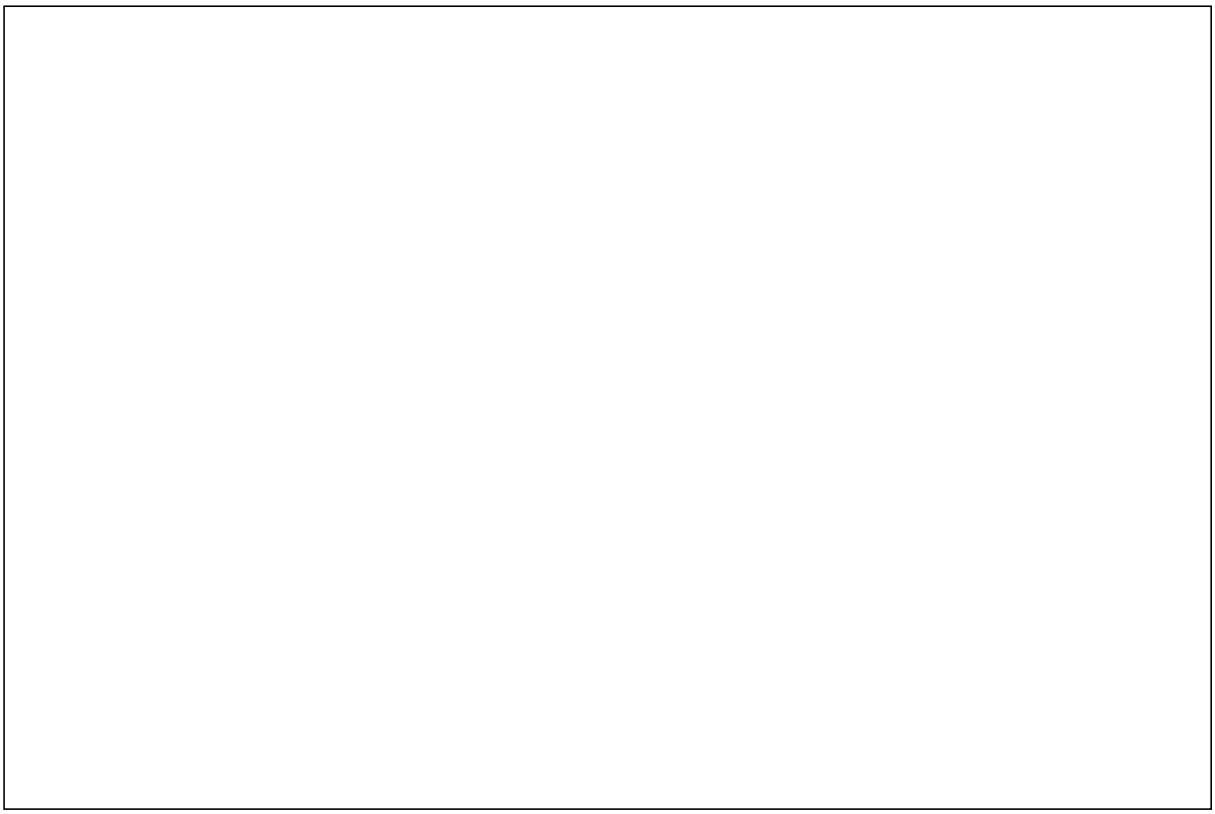
9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

   9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Repair complete. Verify repairs.

   9.b No; replace the fuel injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" . Repair complete. Verify repairs.

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

11. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	13		5 and ground	
8	14		8 and ground	
9	10		9 and ground	
12	12		12 and ground	

11.a Yes; Go to step 12.

11.b No; repair the engine side harness. Verify repairs.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover"

13. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

13.a Yes; repair as necessary.

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

265.4 SPN 3660/FMI 5 - GHG17

Injector Cylinder #2 Amplifier Control Valve Abnormal Operation OPEN

SPN 3660/FMI 5	
Description	Injector Cylinder #2 Amplifier Control Valve Abnormal Operation Open
Monitored Parameter	Injector Cylinder #2 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723/FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front fuel injector harness 14-pin connector.
5. Inspect the front fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)					
Injector #1 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #2 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #3 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)					
Note: Ensure J-48671-10 ground strap is connected to cylinder head.					
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

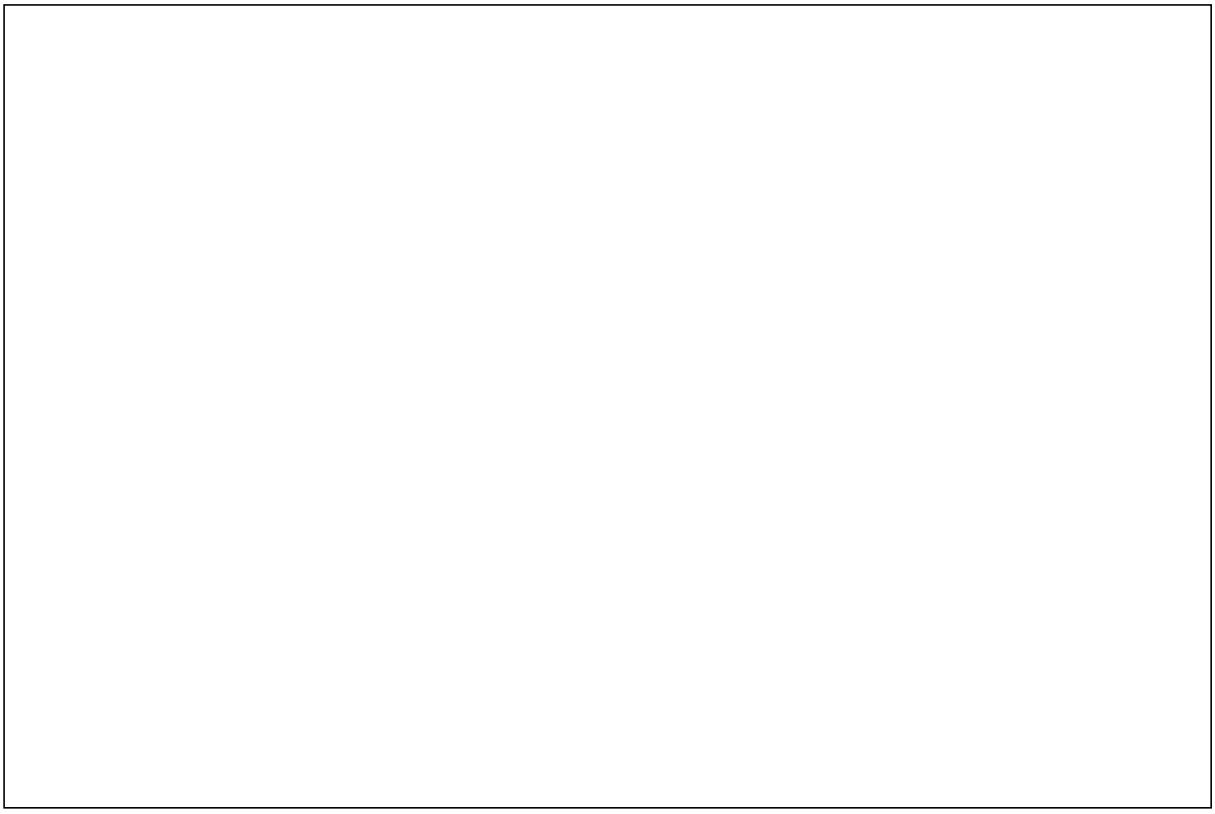
9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)					
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

9.b No; replace the fuel injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

11. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	13		5 and ground	
8	14		8 and ground	
9	10		9 and ground	
12	12		12 and ground	

11.a Yes; Go to step 12.

11.b No; repair the engine side harness. Verify repairs.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

13.a Yes; repair as necessary.

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

265.5 SPN 3660/FMI 6 - GHG17

Injector Cylinder #2 Amplifier Control Valve – Valve Shorted Circuit

SPN 3660/FMI 6	
Description	Injector Cylinder #2 Amplifier Control Valve, Valve Shorted Circuit
Monitored Parameter	Injector Cylinder #2 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723 / FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front rocker cover 14-pin injector harness connector.
5. Inspect the front injector harness 14–pin injector connectors for bent or spread pins. Inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : Do NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front injector harness listed below. Are the resistances within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Front Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Front Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the front injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : Do NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

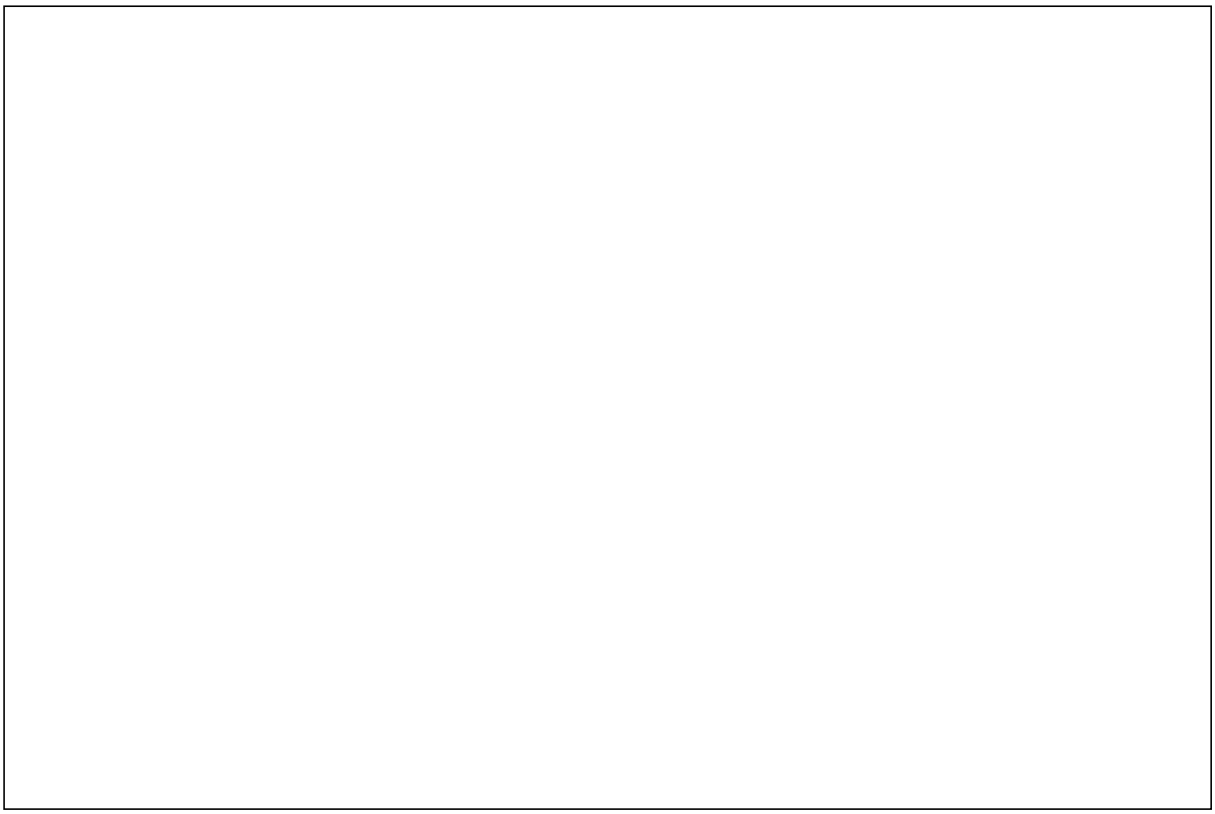
9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

   9.a Yes; replace the front injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

   9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

11. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	13		5 and ground	
8	14		8 and ground	
9	10		9 and ground	
12	12		12 and ground	

11.a Yes; Go to step 12.

11.b No; repair the engine side harness. Verify repairs.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

13.a Yes; repair as necessary.

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

SPN 3661 (MCM) (GHG17)

265.1 Electronic Diagram

Fig 265.1, Fuel Injector Electronic Diagram

265.2 SPN 3661/FMI 3 - GHG17

Injector Cylinder #3 Amplifier Control Valve Abnormal Operation (MAX)

SPN 3661/FMI 3	
Description	Injector Cylinder #3 Amplifier Control Valve Abnormal Operation (MAX)
Monitored Parameter	Injector Cylinder #3 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723 / FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front fuel injector harness 14-pin connector.
5. Inspect the front fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the values within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #1 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

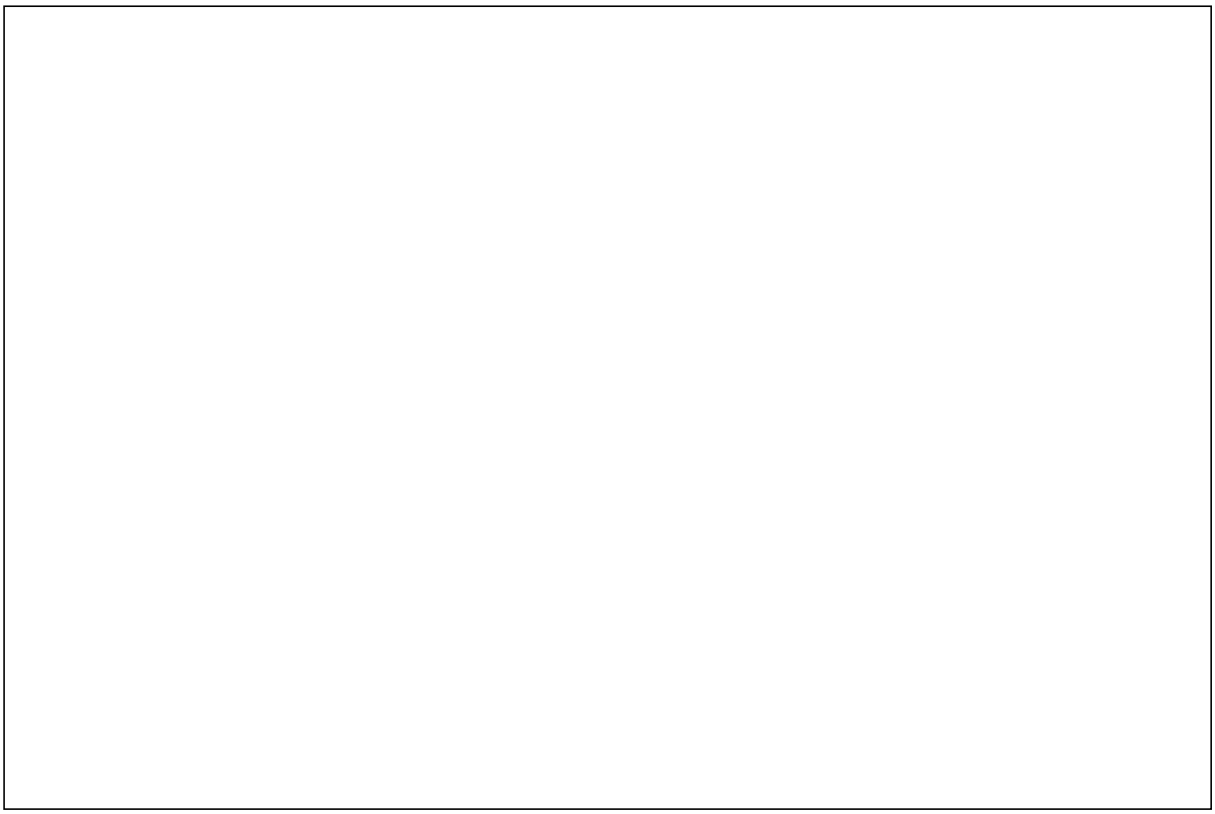
9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

   9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

   9.b No; replace the fuel injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

11. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

    11.a Yes; Go to step 12.

    11.b No; repair the engine side harness.

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	7		5 and ground	
8	4		8 and ground	
9	8		9 and ground	
12	6		12 and ground	

Note : The use of extension harness J49120 will ease installation of test MCM.

12. Install a test MCM.
13. Reconnect all connections and start engine. Bring to operating temperature of 71°C (160°F). Does the fault become active?

    13.a Yes; replace injector listed in code description. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

    13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

265.3 SPN 3661/FMI 4 - GHG17

Injector Cylinder #3 Amplifier Control Valve Abnormal Operation (MIN)

SPN 3661/FMI 4	
Description	Injector Cylinder #3 Amplifier Control Valve Abnormal Operation (MIN)
Monitored Parameter	Injector Cylinder #3 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723 / FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front fuel injector harness 14-pin connector.
5. Inspect the front fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)					
Injector #1 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #2 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #3 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)					
Note: Ensure J-48671-10 ground strap is connected to cylinder head.					
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

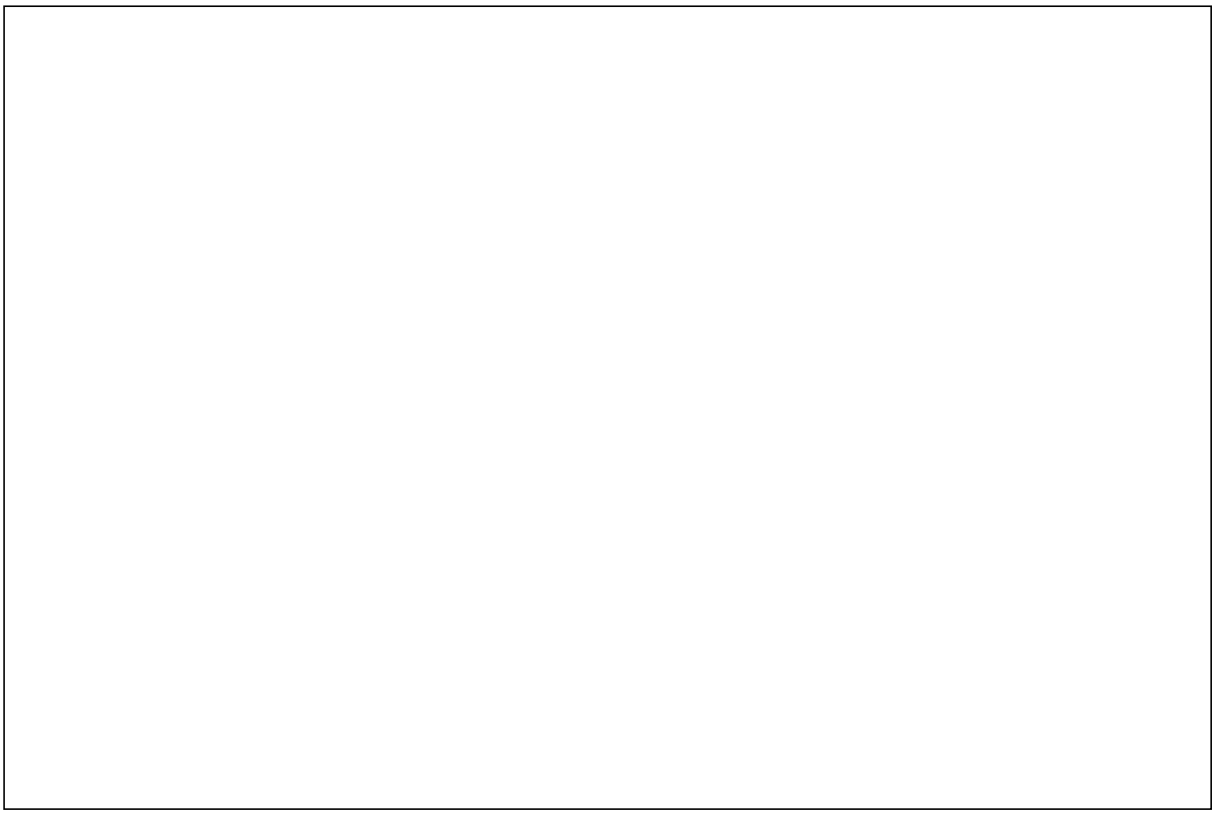
7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?
   - 9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .
   - 9.b No; replace the fuel injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)					
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

11. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

    11.a Yes; Go to step 12.

    11.b No; repair the engine side harness.

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	13		5 and ground	
8	14		8 and ground	
9	10		9 and ground	
12	12		12 and ground	

Note : The use of extension harness J-49120 will ease installation of test MCM.

12. Install a test MCM.
13. Reconnect all connections and start engine. Bring to operating temperature of 71°C (160°F). Does fault become active?

    13.a Yes; replace injector listed in code description. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

    13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

265.4 SPN 3661/FMI 5 - GHG17

Injector Cylinder #3 Amplifier Control Valve Abnormal Operation (Open)

SPN 3661/FMI 5	
Description	Injector Cylinder #3 Amplifier Control Valve Abnormal Operation (Open)
Monitored Parameter	Injector Cylinder #3 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723/FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front fuel injector harness 14-pin connector.
5. Inspect the front fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #1 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

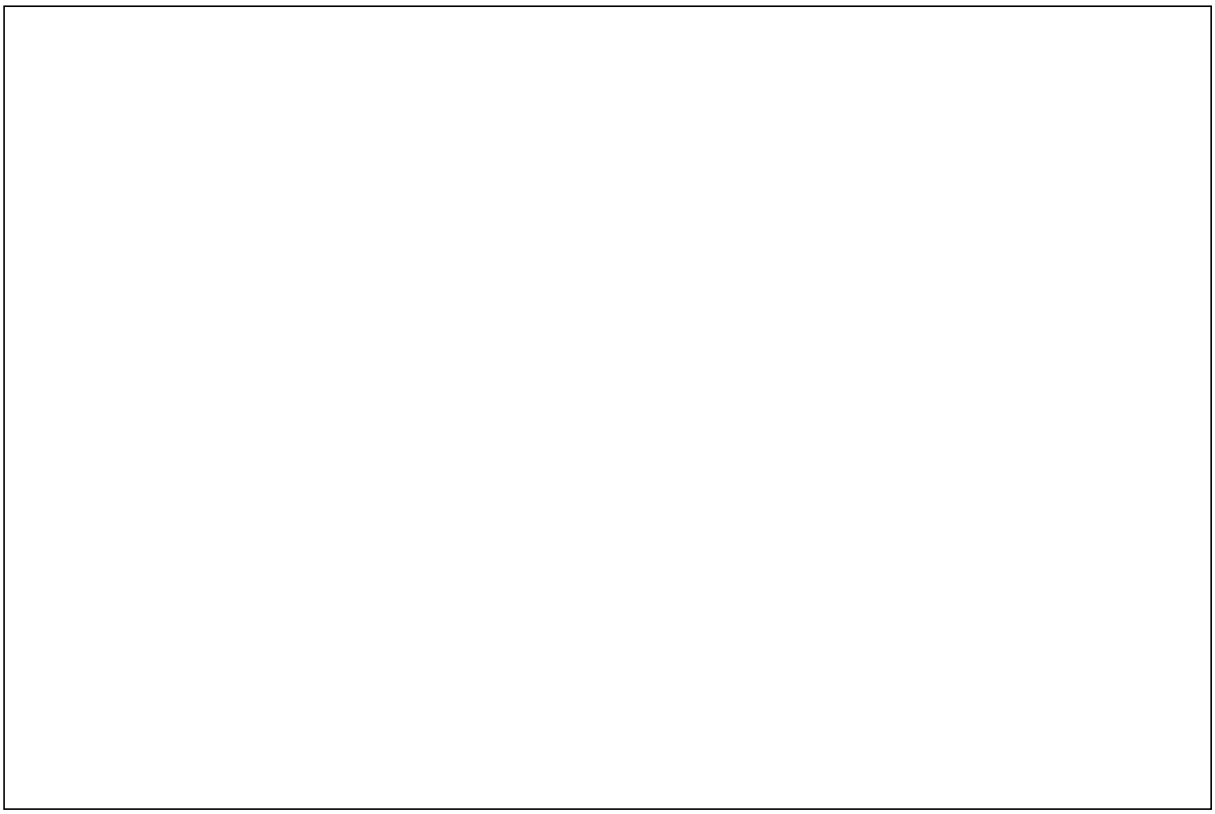
9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

   9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

   9.b No; replace the fuel injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

11. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

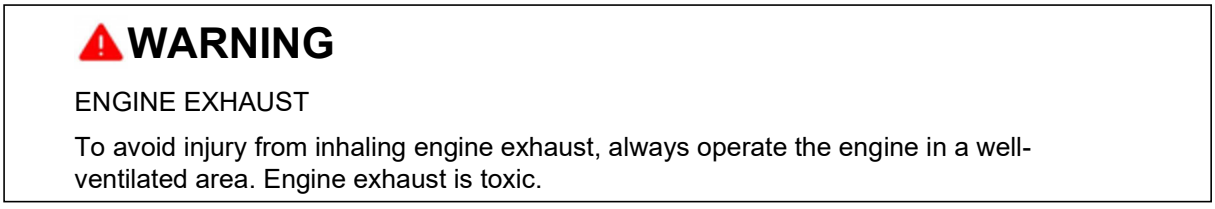
    11.a Yes; Go to step 12.

    11.b No; repair the engine side harness.

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	13		5 and ground	
8	14		8 and ground	
9	10		9 and ground	
12	12		12 and ground	

Note : The use of extension harness J-49120 will ease installation of test MCM.

12. Install a test MCM.



> **⚠ 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.

13. Reconnect all connections and start engine. Bring to operating temperature of 71°C (160°F). Does fault become active?

13.a Yes; replace injector listed in code description. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

265.5 SPN 3661/FMI 6 - GHG17

Injector Cylinder #3 Amplifier Control Valve, Valve Shorted Circuit

SPN 3661/FMI 6	
Description	Injector Cylinder #3 Amplifier Control Valve, Valve Shorted Circuit
Monitored Parameter	Injector Cylinder #3 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 to 1500 (One minute)

1. Check for multiple codes. Is fault code SPN 168 or 723 / FMI any present?
   1.a Yes; service those faults first. Verify repair.
   1.b No; Go to step 2.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect and inspect the front rocker 14-pin injector harness connector.
5. Inspect the front injector harness 14-pin injector connector for bent or spread pins. Inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : Do NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure the resistance values between the corresponding pins on the valve cover side of the front injector harness as listed below. Are the resistances in range?

Front Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the front injector harness from the engine.

   Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" ,

Note : Do NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

   9.a Yes; replace the front injector harness.

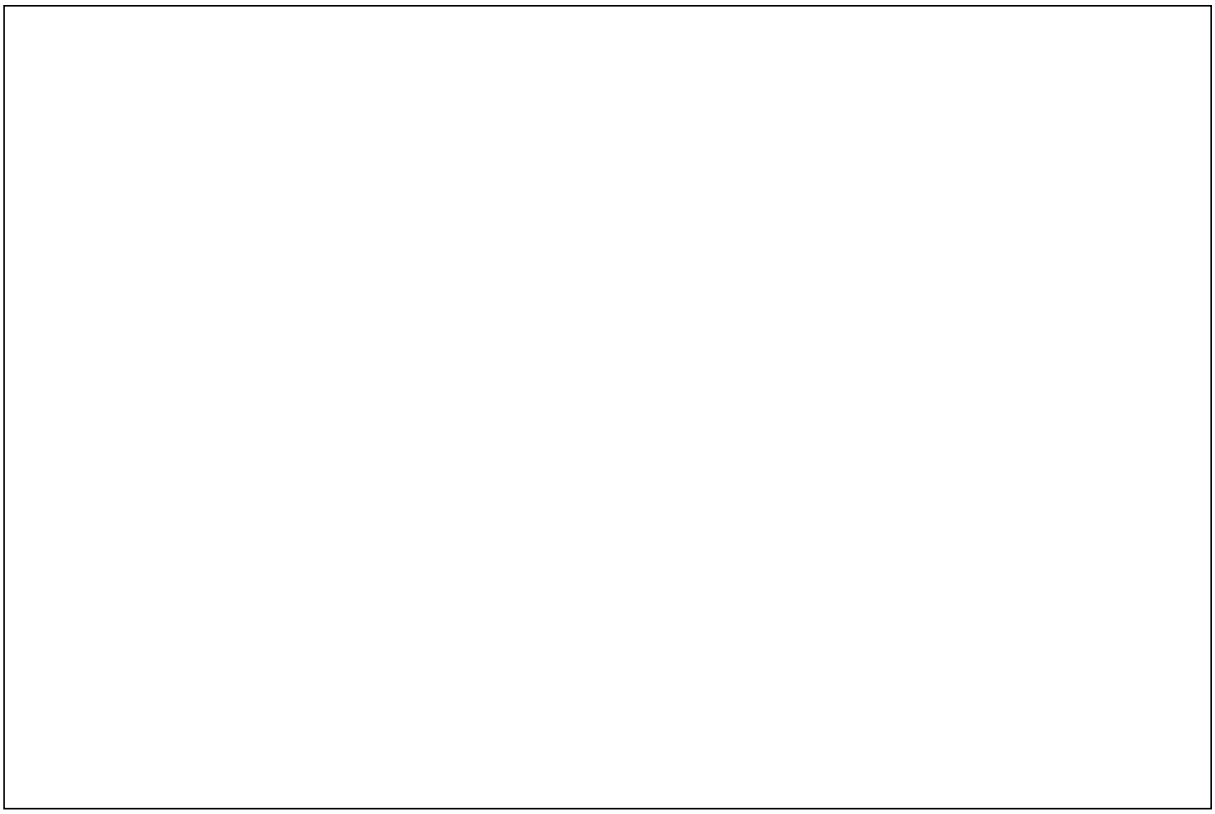
   Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

   9.b No; replace the injector with the out-of-range resistance.

   Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

11. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range.

    11.a Yes; Go to step 12.

    11.b No; repair the engine side harness.

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	13		5 and ground	
8	14		8 and ground	
9	10		9 and ground	
12	12		12 and ground	

Note : The use of extension harness J49120 will ease installation of test MCM.

12. Install a test MCM.
13. Reconnect all connectors and start the engine. Bring the engine up to operating temperature of 71°C (160°F). Does fault become active?

13.a Yes; replace injector listed in code description. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

265.1 Electronic Diagram

Fig 265.2, Fuel Injector Electronic Diagram

265.2 SPN 3661/FMI 3 - GHG17

Injector Cylinder #3 Amplifier Control Valve Abnormal Operation (MAX)

SPN 3661/FMI 3	
Description	Injector Cylinder #3 Amplifier Control Valve Abnormal Operation (MAX)
Monitored Parameter	Injector Cylinder #3 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723 / FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front fuel injector harness 14-pin connector.
5. Inspect the front fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the values within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #1 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

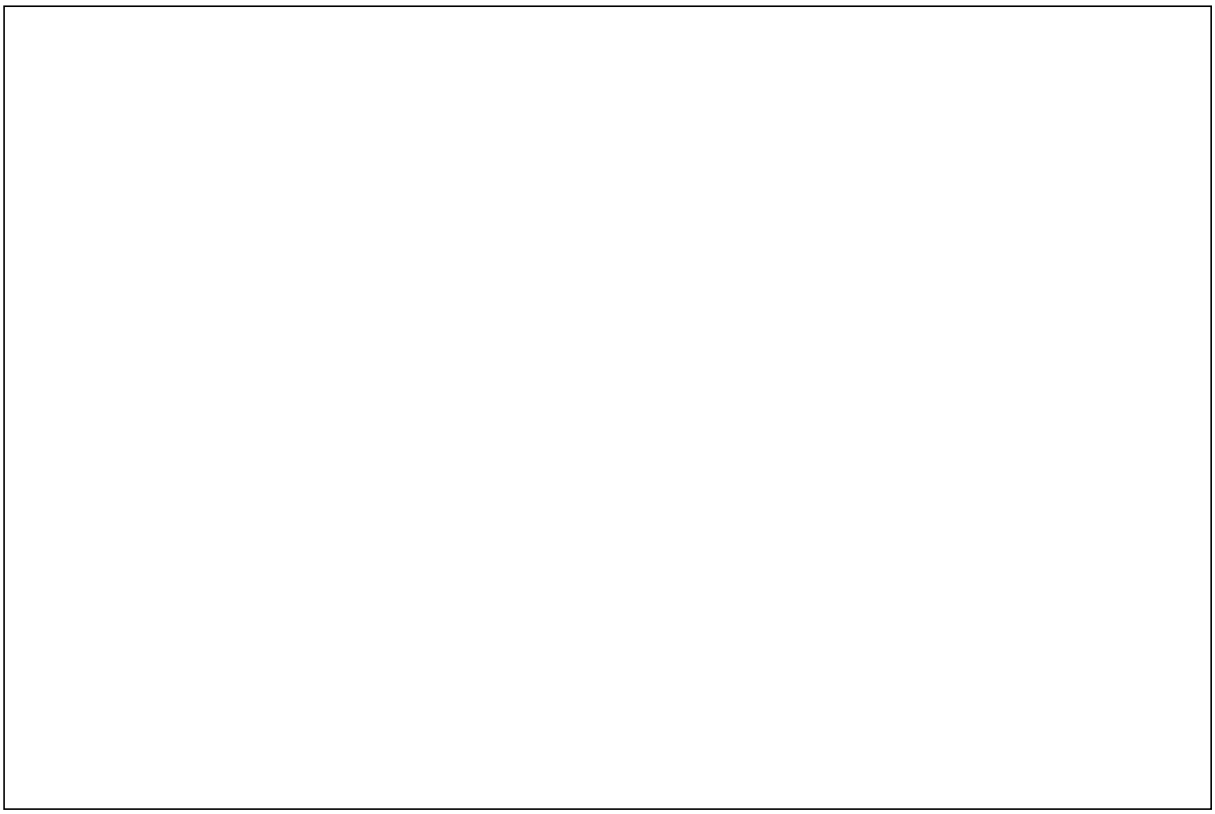
9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

   9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

   9.b No; replace the fuel injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

11. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	7		5 and ground	
8	4		8 and ground	
9	8		9 and ground	
12	6		12 and ground	

11.a Yes; Go to step 12.

11.b No; repair the engine side harness. Verify repairs.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

13.a Yes; repair as necessary.

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

265.3 SPN 3661/FMI 4 - GHG17

Injector Cylinder #3 Amplifier Control Valve Abnormal Operation (MIN)

SPN 3661/FMI 4	
Description	Injector Cylinder #3 Amplifier Control Valve Abnormal Operation (MIN)
Monitored Parameter	Injector Cylinder #3 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723 / FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front fuel injector harness 14-pin connector.
5. Inspect the front fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #1 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

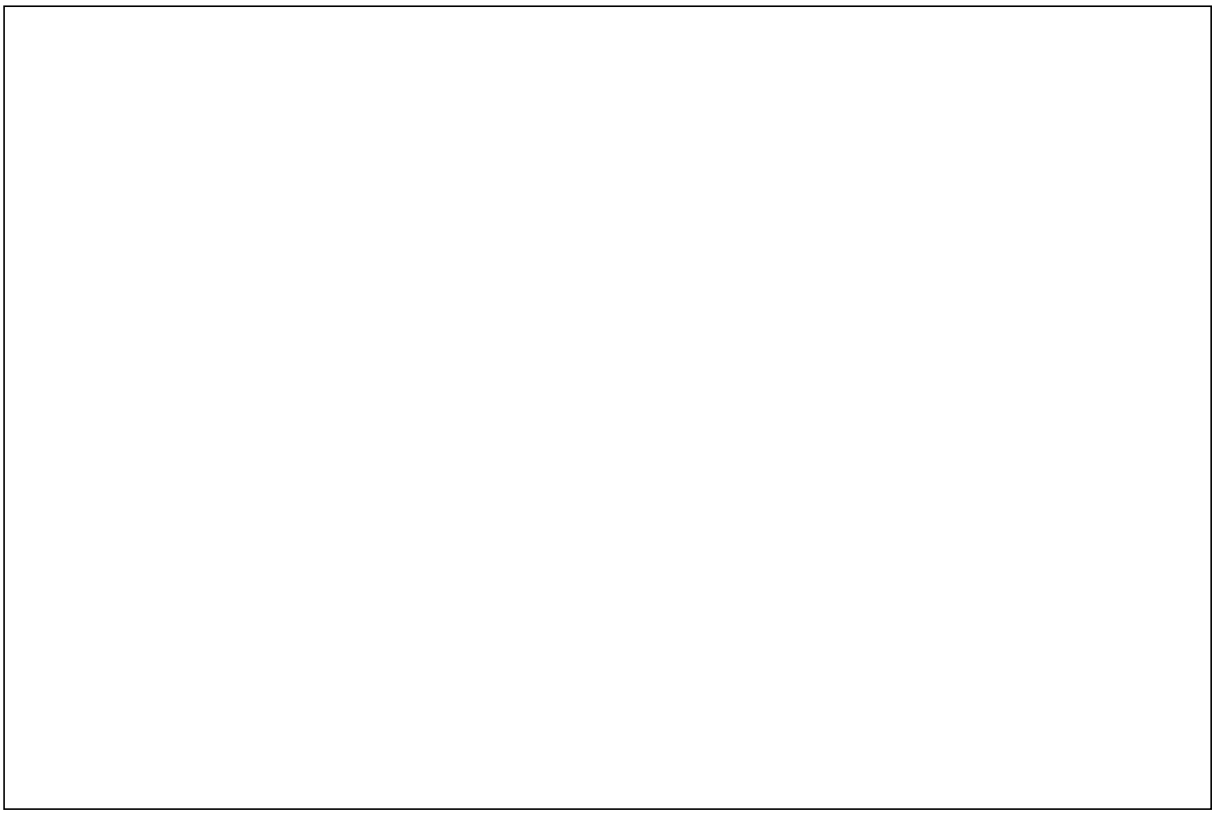
7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?
   - 9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .
   - 9.b No; replace the fuel injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

11. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	13		5 and ground	
8	14		8 and ground	
9	10		9 and ground	
12	12		12 and ground	

11.a Yes; Go to step 12.

11.b No; repair the engine side harness. Verify repairs.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

13.a Yes; repair as necessary.

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

265.4 SPN 3661/FMI 5 - GHG17

Injector Cylinder #3 Amplifier Control Valve Abnormal Operation (Open)

SPN 3661/FMI 5	
Description	Injector Cylinder #3 Amplifier Control Valve Abnormal Operation (Open)
Monitored Parameter	Injector Cylinder #3 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723/FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front fuel injector harness 14-pin connector.
5. Inspect the front fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)					
Injector #1 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #2 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #3 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)					
Note: Ensure J-48671-10 ground strap is connected to cylinder head.					
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the front fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

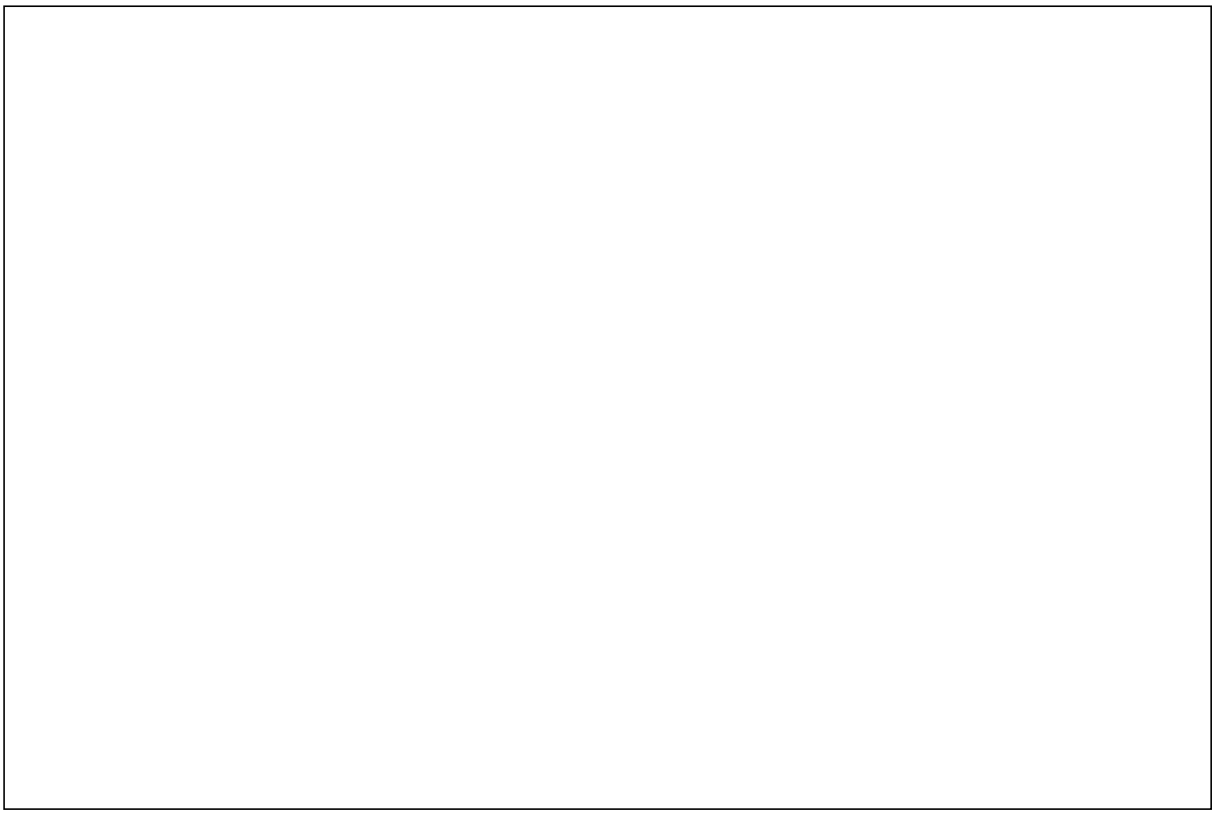
9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

   9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

   9.b No; replace the fuel injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)					
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

11. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	13		5 and ground	
8	14		8 and ground	
9	10		9 and ground	
12	12		12 and ground	

11.a Yes; Go to step 12.

11.b No; repair the engine side harness. Verify repairs.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

13.a Yes; repair as necessary.

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

265.5 SPN 3661/FMI 6 - GHG17

Injector Cylinder #3 Amplifier Control Valve, Valve Shorted Circuit

SPN 3661/FMI 6	
Description	Injector Cylinder #3 Amplifier Control Valve, Valve Shorted Circuit
Monitored Parameter	Injector Cylinder #3 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 to 1500 (One minute)

1. Check for multiple codes. Is fault code SPN 168 or 723 / FMI any present?
   1.a Yes; service those faults first. Verify repair.
   1.b No; Go to step 2.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect and inspect the front rocker 14-pin injector harness connector.
5. Inspect the front injector harness 14-pin injector connector for bent or spread pins. Inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : Do NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure the resistance values between the corresponding pins on the valve cover side of the front injector harness as listed below. Are the resistances in range?

Front Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Injector #1 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #2 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #3 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the front injector harness from the engine.

   Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" ,

Note : Do NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

   9.a Yes; replace the front injector harness.

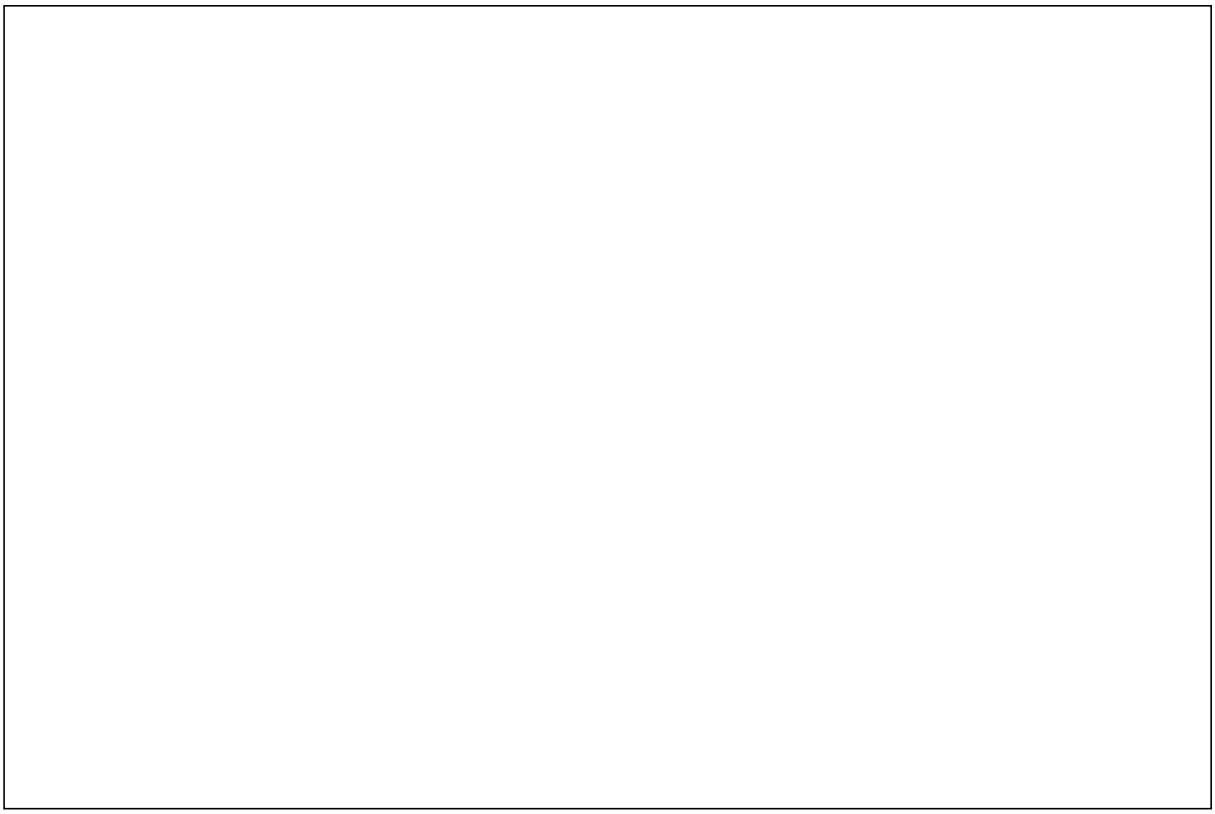
   Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

   9.b No; replace the injector with the out-of-range resistance.

   Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)				
	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
Injector #1 Amplifier	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
Injector #2 Amplifier	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
Injector #3 Amplifier	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

11. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range.

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	13		5 and ground	
8	14		8 and ground	
9	10		9 and ground	
12	12		12 and ground	

11.a Yes; Go to step 12.

11.b No; repair the engine side harness. Verify repairs.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

13.a Yes; repair as necessary.

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

SPN 3662 (MCM) (GHG17)

267.1 Electronic Diagram

Fig 267.1, Fuel Injector Electronic Diagram

267.2 SPN 3662/FMI 3 - GHG17

Injector Cylinder #4 Amplifier Control Valve Abnormal Operation (MAX)

SPN 3662/FMI 3	
Description	Injector Cylinder #4 Amplifier Control Valve Abnormal Operation (MAX)
Monitored Parameter	Injector Cylinder #4 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. SPN fault code 168 or 723 / FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the rear fuel injector harness 14-pin connector.
5. Inspect the rear fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : Do NOT touch the metal ohmmeter leads with your hands while taking the measurements.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the values within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)					
Injector #4 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #5 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #6 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)					
Note: Ensure J-48671-10 ground strap is connected to cylinder head.					
Injector #4 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #5 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #6 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the rear fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

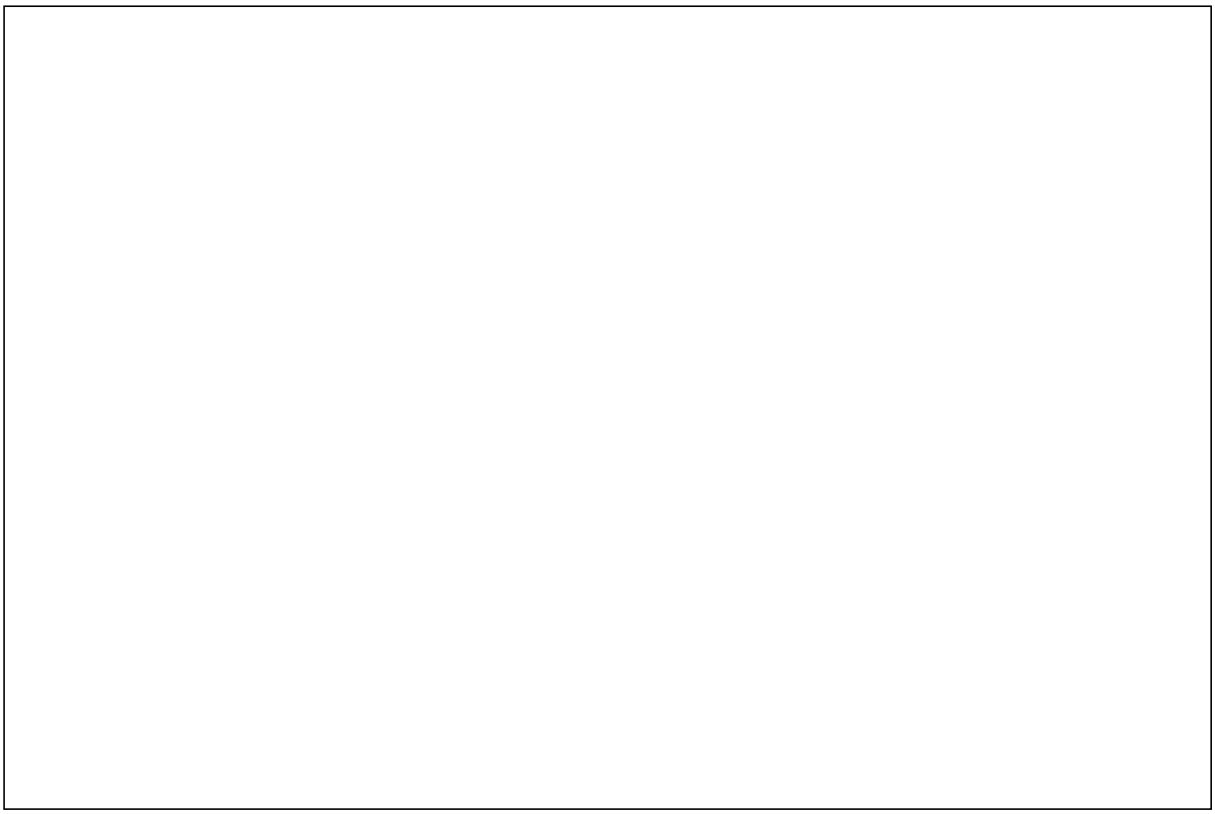
9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the values within range?

   9.a Yes; replace the rear fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

   9.b No; replace the fuel injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)					
Injector #4 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #5 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #6 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

11. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	7		5 and ground	
8	4		8 and ground	
9	8		9 and ground	
12	6		12 and ground	

11.a Yes; Go to step 12.

11.b No; repair the engine side harness. Verify repairs.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

13.a Yes; repair as necessary.

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

267.3 SPN 3662/FMI 4 - GHG17

Injector Cylinder #4 Amplifier Control Valve Abnormal Operation (MIN)

SPN 3662/FMI 4	
Description	Injector Cylinder #4 Amplifier Control Valve Abnormal Operation (MIN)
Monitored Parameter	Injector Cylinder #4 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723/FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the rear fuel injector harness 14-pin connector.
5. Inspect the rear fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands while the measurements are taken.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the resistances within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)					
Injector #4 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #5 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #6 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)					
Note: Ensure J-48671-10 ground strap is connected to cylinder head.					
Injector #4 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #5 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #6 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the rear fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

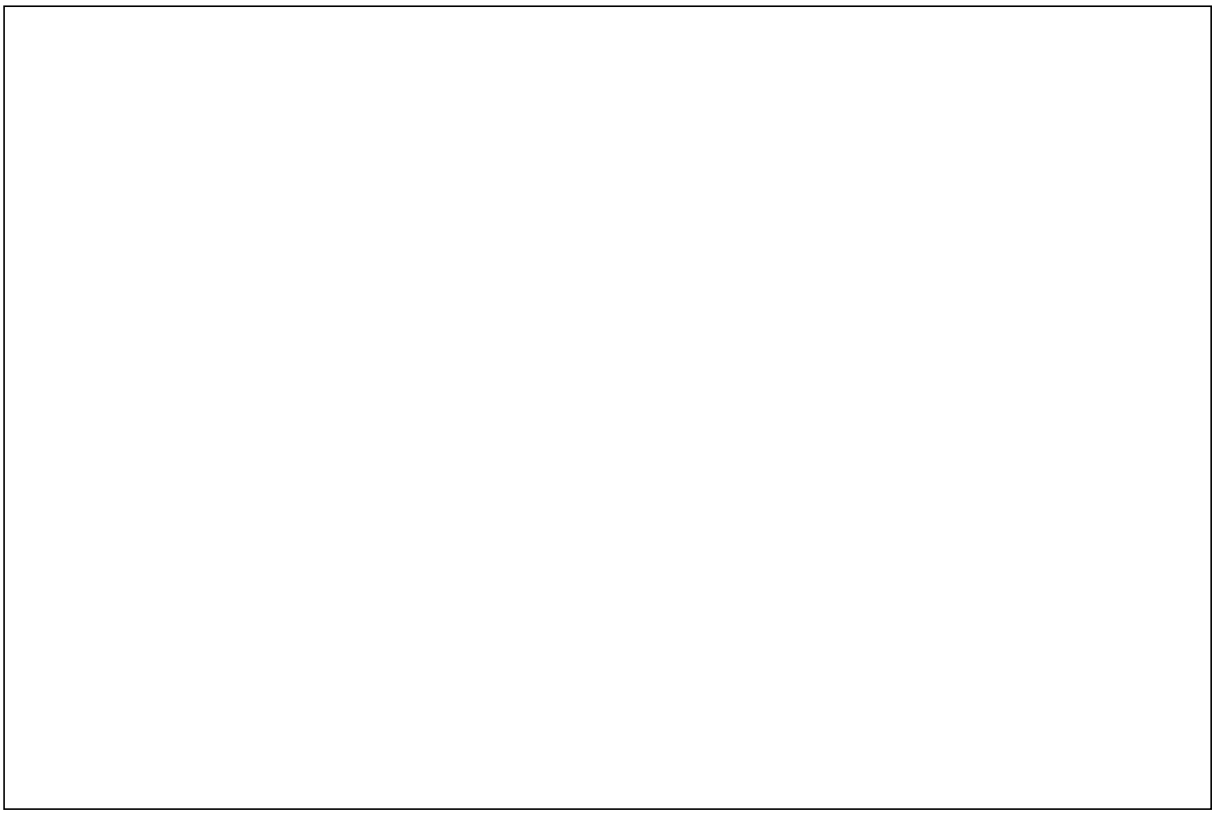
9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

   9.a Yes; replace the rear fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

   9.b No; replace the fuel injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)					
Injector #4 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #5 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #6 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands while taking the measurements.

11. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	7		5 and ground	
8	4		8 and ground	
9	8		9 and ground	
12	6		12 and ground	

11.a Yes; Go to step 12.

11.b No; repair the engine side harness. Verify repairs.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

13.a Yes; repair as necessary.

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

267.4 SPN 3662/FMI 5 - GHG17

Injector Cylinder #4 Amplifier Control Valve Abnormal Operation (OPEN)

SPN 3662/FMI 5	
Description	Injector Cylinder #4 Amplifier Control Valve Abnormal Operation (OPEN)
Monitored Parameter	Injector Cylinder #4 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723/FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the front fuel injector harness 14-pin connector.
5. Inspect the front fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)					
Injector #4 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #5 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #6 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)					
Note: Ensure J-48671-10 ground strap is connected to cylinder head.					
Injector #4 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #5 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #6 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

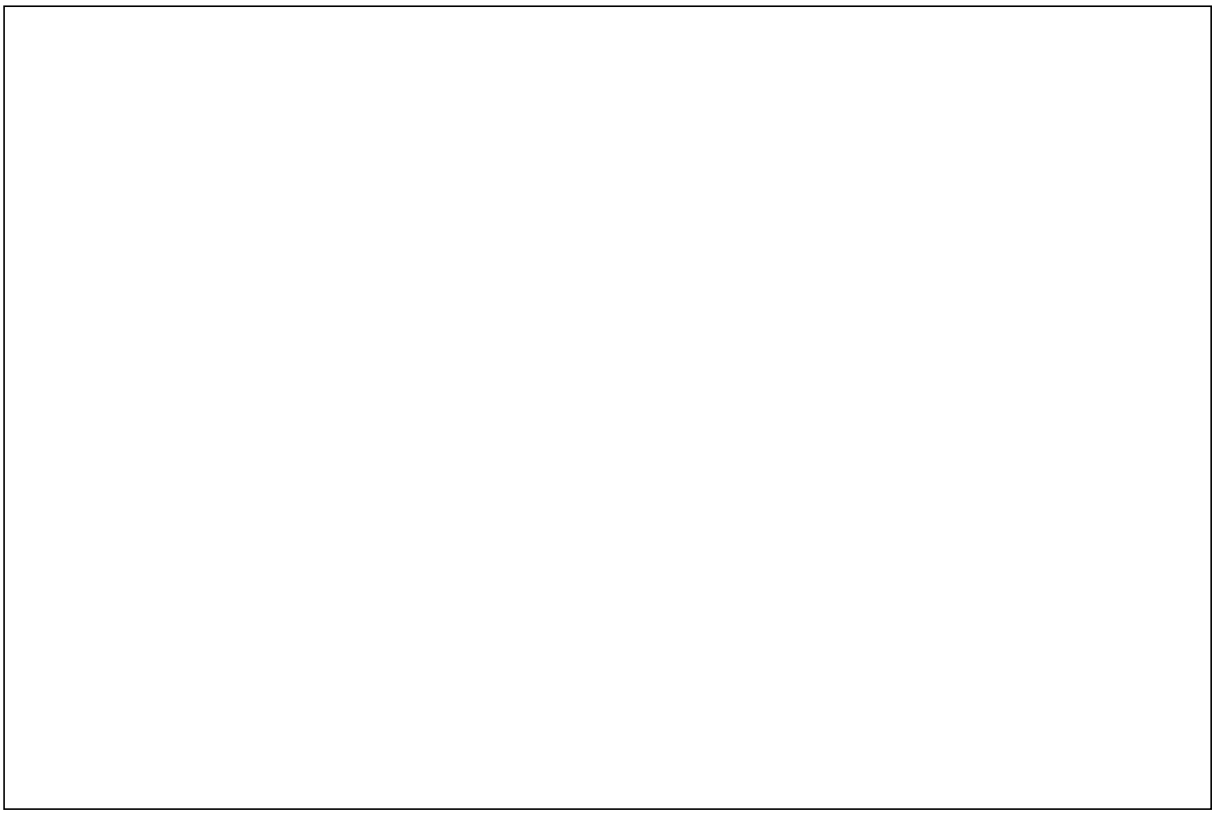
7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the rear fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?
   - 9.a Yes; replace the front fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .
   - 9.b No; replace the fuel injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)					
Injector #4 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #5 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #6 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

11. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	7		5 and ground	
8	4		8 and ground	
9	8		9 and ground	
12	6		12 and ground	

11.a Yes; Go to step 12.

11.b No; repair the engine side harness. Verify repairs.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

13.a Yes; repair as necessary.

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

267.5 SPN 3662/FMI 6 - GHG17

Injector Cylinder #4 Amplifier Control Valve – Valve Shorted Circuit

SPN 3662/FMI 6	
Description	Injector Cylinder #4 Amplifier Control Valve, Valve Shorted Circuit
Monitored Parameter	Injector Cylinder #4 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723 / FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the rear rocker cover 14-pin injector harness connector.
5. Inspect the rear injector harness 14–pin injector connector for bent or spread pins. Inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : Do NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear injector harness listed below. Are the resistances within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Rear Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #4 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #5 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #6 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Rear Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #4 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than20k*	greater than100k*	greater than100k*
Injector #5 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than20k*	greater than100k*	greater than100k*
Injector #6 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than20k*	greater than100k*	greater than100k*
* = acceptable resistance				

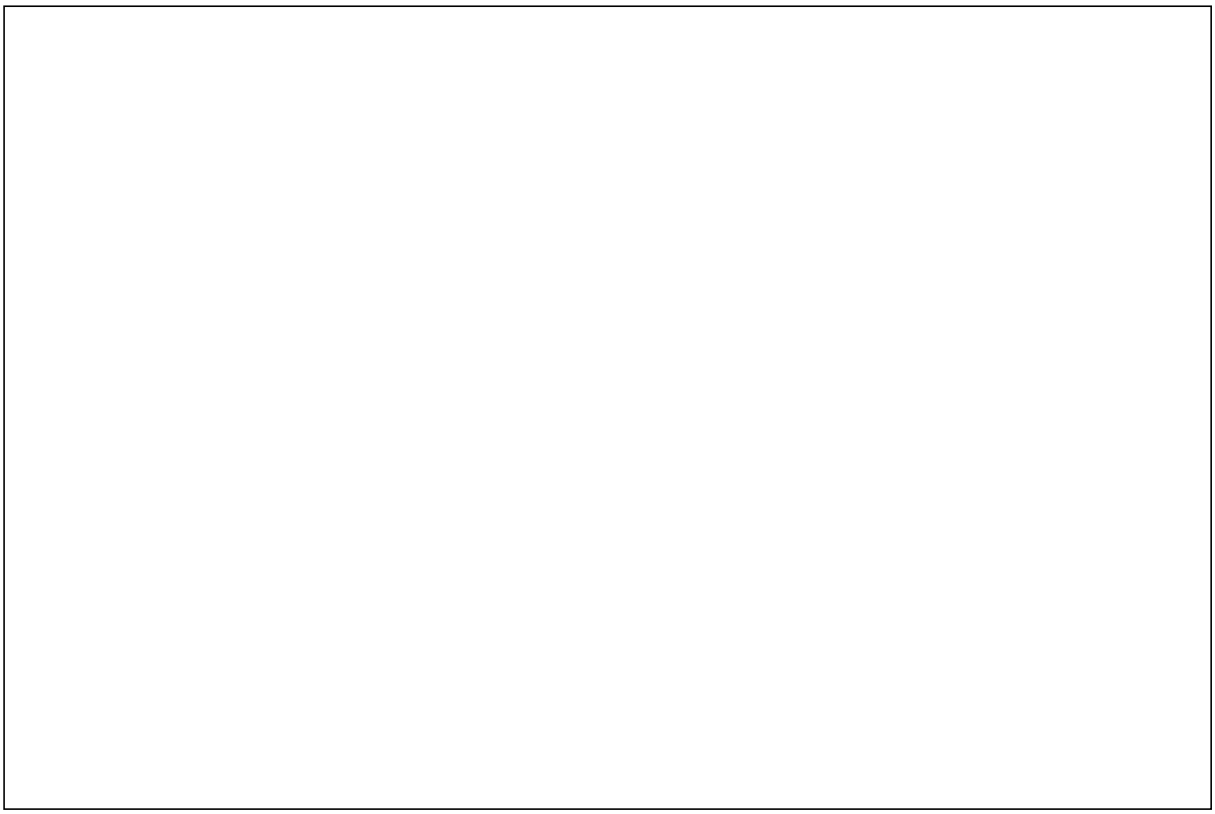
7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the rear injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?
   - 9.a Yes; replace the rear injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .
   - 9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)				
Injector #4 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #5 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #6 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

10. Disconnect the MCM 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands while taking the measurements.

11. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	7		5 and ground	
8	4		8 and ground	
9	8		9 and ground	
12	6		12 and ground	

11.a Yes; Go to step 12.

11.b No; repair the engine side harness. Verify repairs.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

13.a Yes; repair as necessary.

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

SPN 3663 (MCM) (GHG17)

268.1 Electronic Diagram

Fig 268.1, Fuel Injector Electronic Diagram

268.2 SPN 3663/FMI 3 - GHG17

Injector Cylinder #5 Amplifier Control Valve Abnormal Operation (MAX)

SPN 3663/FMI 3	
Description	Injector Cylinder #5 Amplifier Control Valve Abnormal Operation (MAX)
Monitored Parameter	Injector Cylinder #5 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723 / FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the rear fuel injector harness 14-pin connector.
5. Inspect the rear fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the values within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #4 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #5 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #6 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to the cylinder head.				
Injector #4 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #5 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #6 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the rear fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

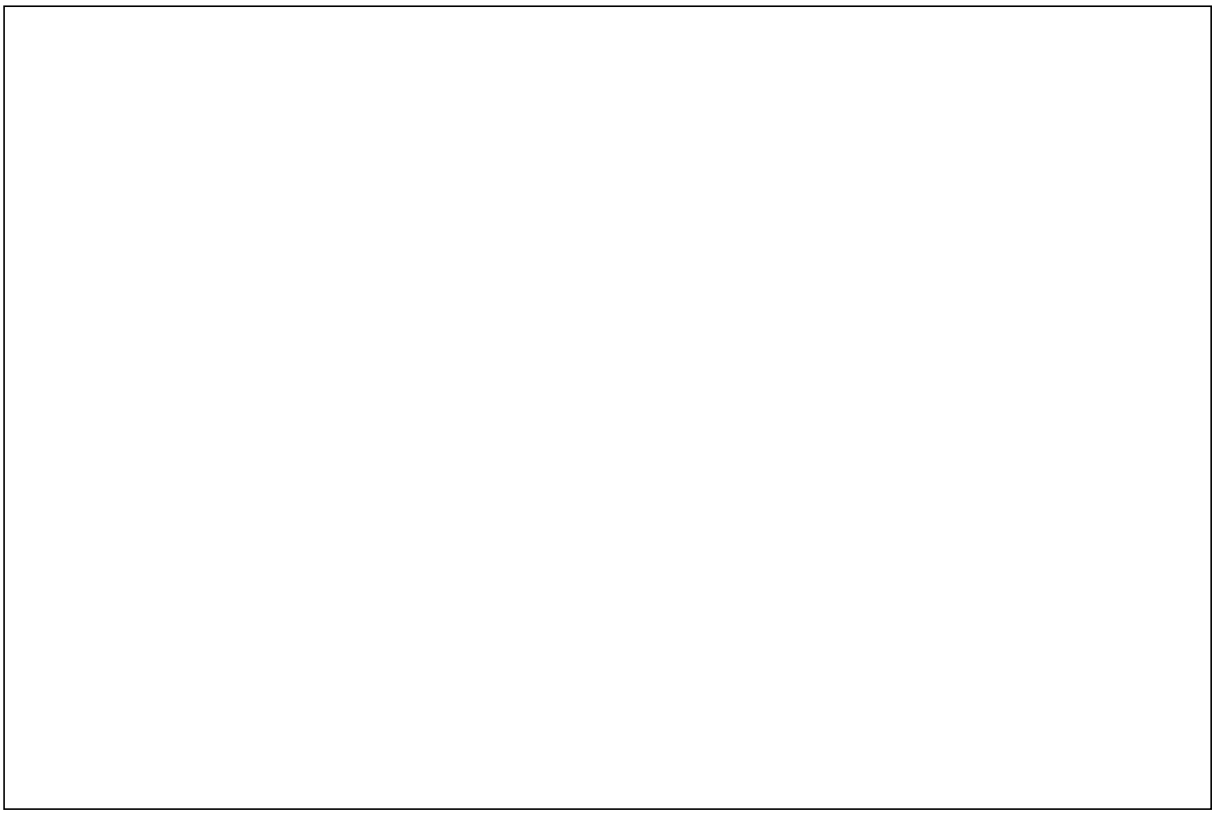
9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the values within range?

   9.a Yes; replace the rear fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

   9.b No; replace the fuel injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)				
Injector #4 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #5 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #6 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

11. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the values within range?

Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	7		5 and ground	
8	4		8 and ground	
9	8		9 and ground	
12	6		12 and ground	

11.a Yes; Go to step 12.

11.b No; repair the engine side harness. Verify repairs.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

13.a Yes; repair as necessary.

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

268.3 SPN 3663/FMI 4 - GHG17

Injector Cylinder #5 Amplifier Control Valve Abnormal Operation (MIN)

SPN 3663/FMI 4	
Description	Injector Cylinder #5 Amplifier Control Valve Abnormal Operation (MIN)
Monitored Parameter	Injector Cylinder #5 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723/FMI any present?
   1.a Yes; service those faults first.
   1.b No: Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the rear fuel injector harness 14-pin connector.
5. Inspect the rear fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the resistances within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #4 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #5 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #6 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to the cylinder head.				
Injector #4 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #5 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #6 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the rear fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

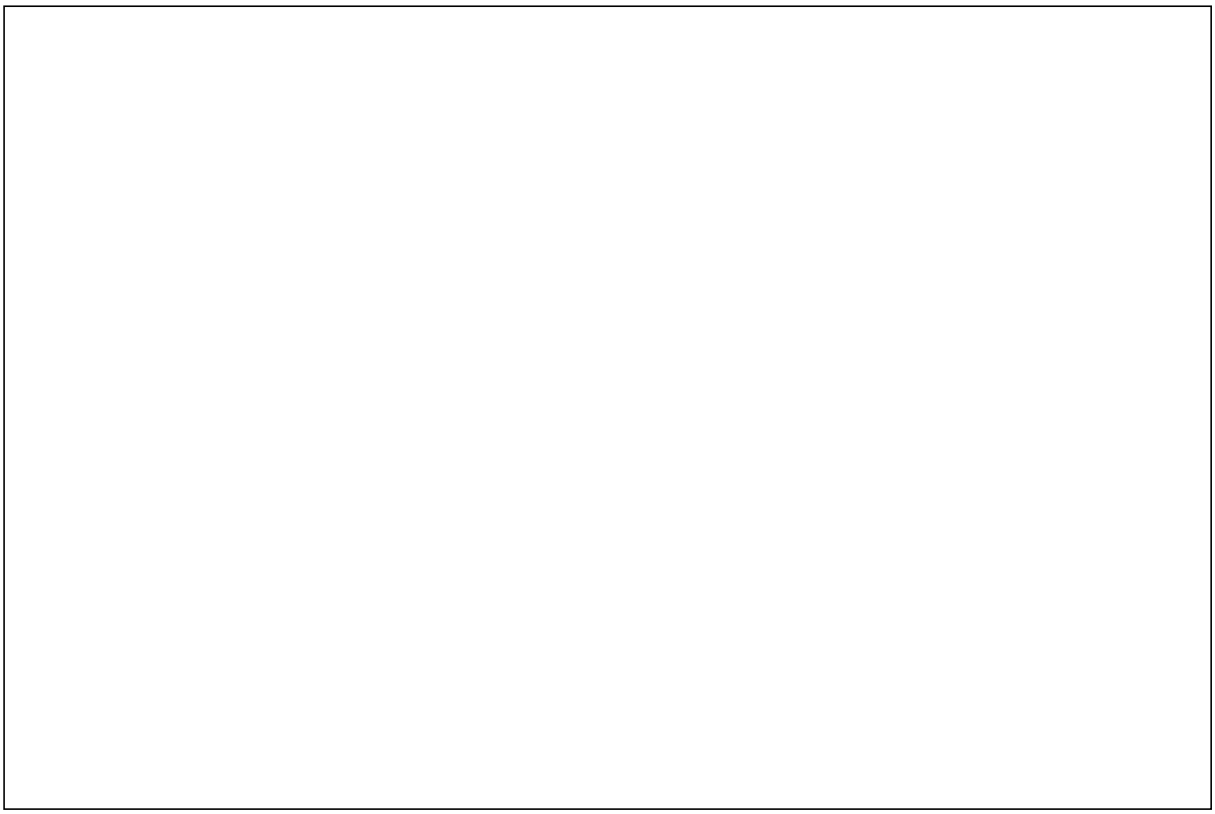
9. Using the chart below, measure and record the resistance resistances between the injector pins listed below. Are the values within range?

   9.a Yes; replace the rear fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

   9.b No; replace the fuel injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)				
Injector #4 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #5 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #6 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

11. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	7		5 and ground	
8	4		8 and ground	
9	8		9 and ground	
12	6		12 and ground	

11.a Yes; Go to step 12.

11.b No; repair the engine side harness. Verify repairs.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

13.a Yes; repair as necessary.

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

268.4 SPN 3663/FMI 5 - GHG17

Injector Cylinder #5 Amplifier Control Valve Abnormal Operation (OPEN)

SPN 3663/FMI 5	
Description	Injector Cylinder #5 Amplifier Control Valve Abnormal Operation (OPEN)
Monitored Parameter	Injector Cylinder #5 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723 / FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the rear fuel injector harness 14-pin connector.
5. Inspect the rear fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the resistances within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #4 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #5 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #6 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to the cylinder head.				
Injector #4 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #5 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #6 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

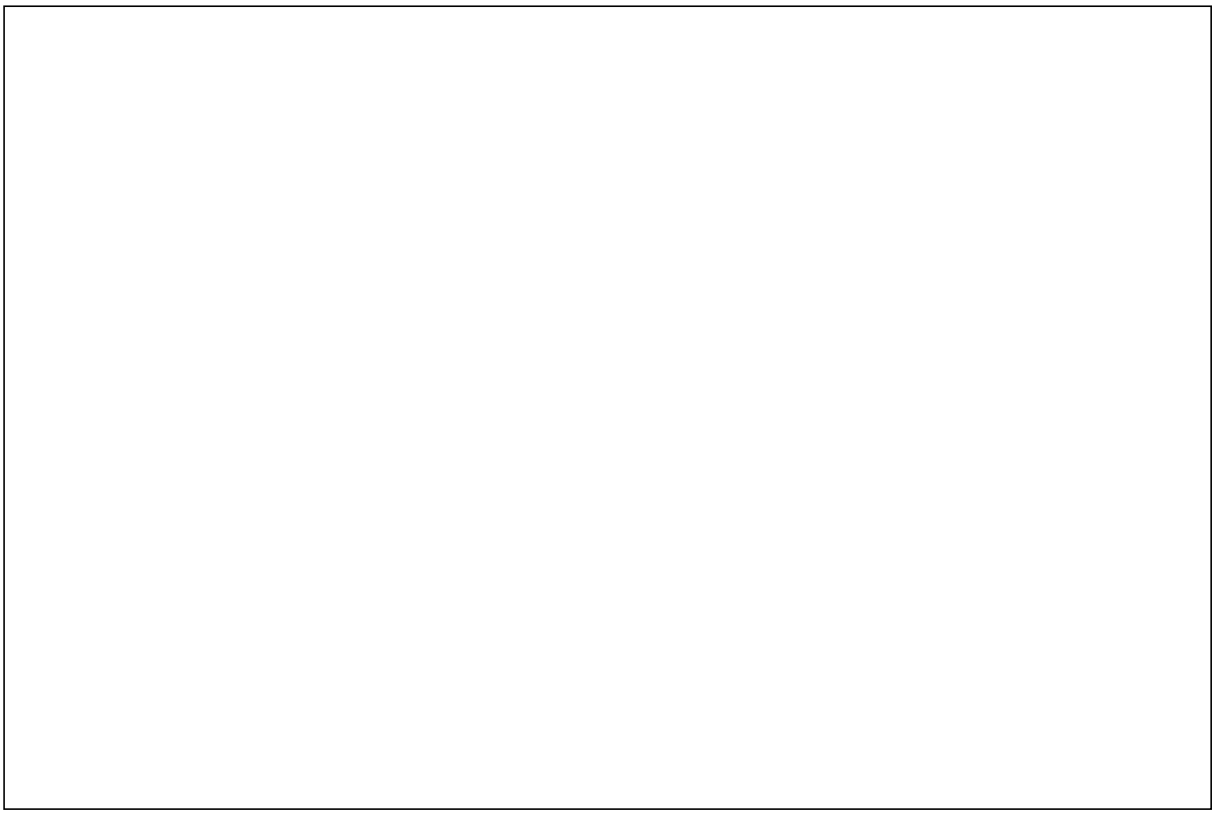
7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the rear fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

9. Using the chart below, measure and record the resistance between the injector pins listed below. Are the values within range?
   - 9.a Yes; replace the rear fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .
   - 9.b No; replace the fuel injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)				
Injector #4 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #5 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #6 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

11. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	7		5 and ground	
8	4		8 and ground	
9	8		9 and ground	
12	6		12 and ground	

11.a Yes; Go to step 12.

11.b No; repair the engine side harness. Verify repairs.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

13.a Yes; repair as necessary.

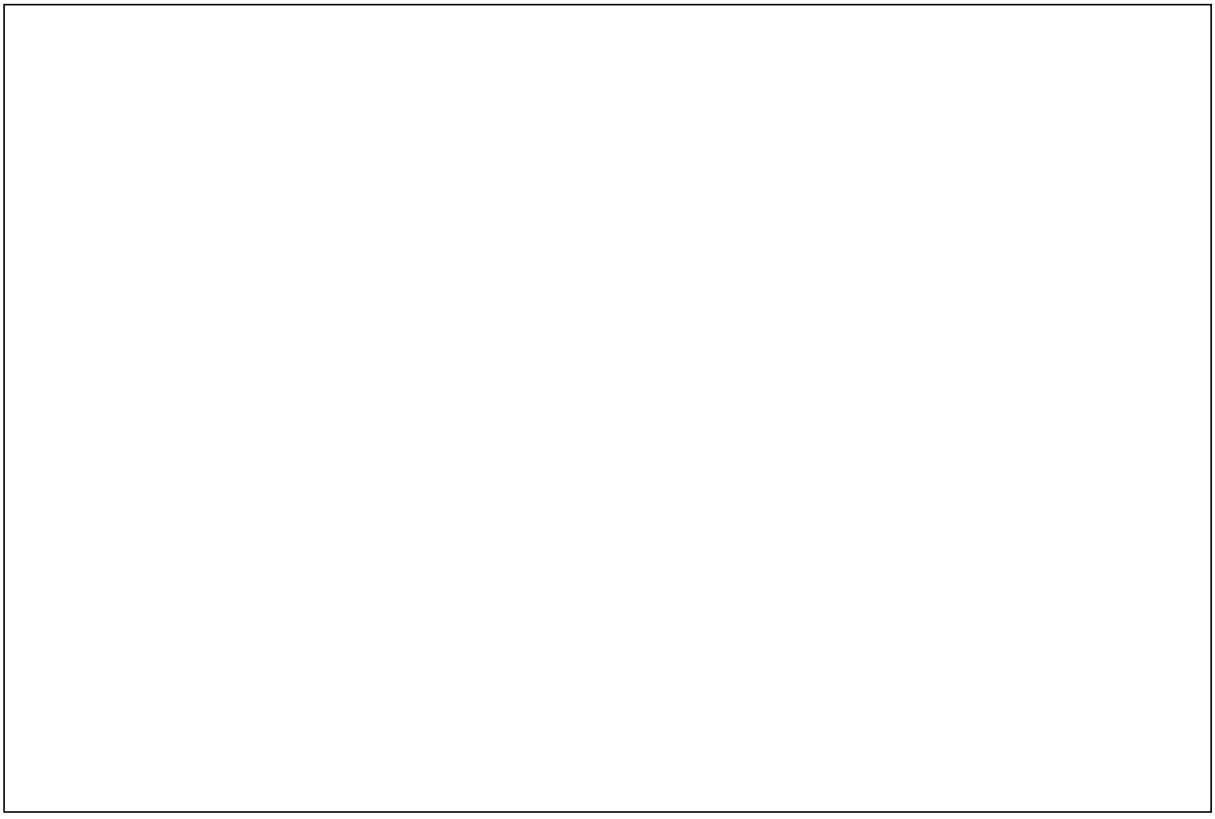
13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

268.5 SPN 3663/FMI 6 - GHG17

Injector Cylinder #5 Spill Control Valve - Valve Shorted Circuit

Check as follows:

SPN 3663/FMI 6	
Description	Injector Cylinder #5 Spill Control Valve, Valve Shorted Circuit
Monitored Parameter	Injector Cylinder #5 Spill Control Valve
Typical Enabling Conditions	Injector open greater than threshold
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)



1. Check for multiple codes. Is SPN fault code 168 or 723/FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

WARNING

ENGINE EXHAUST

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

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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the rear rocker cover 14-pin injector harness connector.
5. Inspect the rear injector harness 14–pin injector connector for bent or spread pins. Inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?

   5.a Yes; repair as necessary. Verify repairs.

   5.b No; Go to step 6.

Note : Do NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear injector harness listed below. Are the resistances within range?

Rear Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #4 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground
	0.5 to 2.0*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #5 Amplifier	Pins 5 and 9	Pins 5 and 2	Pin 3 and ground	Pin 9 and ground
	0.5 to 2.0*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #6 Amplifier	Pins 5 and 12	Pins 5 and 2	Pin 4 and ground	Pin 12 and ground
	0.5 to 2.0*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

Rear Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to the cylinder head.				
Injector #4 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 to 2.0*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #5 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 to 2.0*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #6 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 to 2.0*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

6.a Yes; Go to step 10.

6.b No; Go to step 7.

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

8. Remove the rear injector harness from the engine.

   Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : Do NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)					
Injector #4 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #5 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	Greter than 100k*	Greater than 100k*	Greater than 100k*	
Injector #6 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

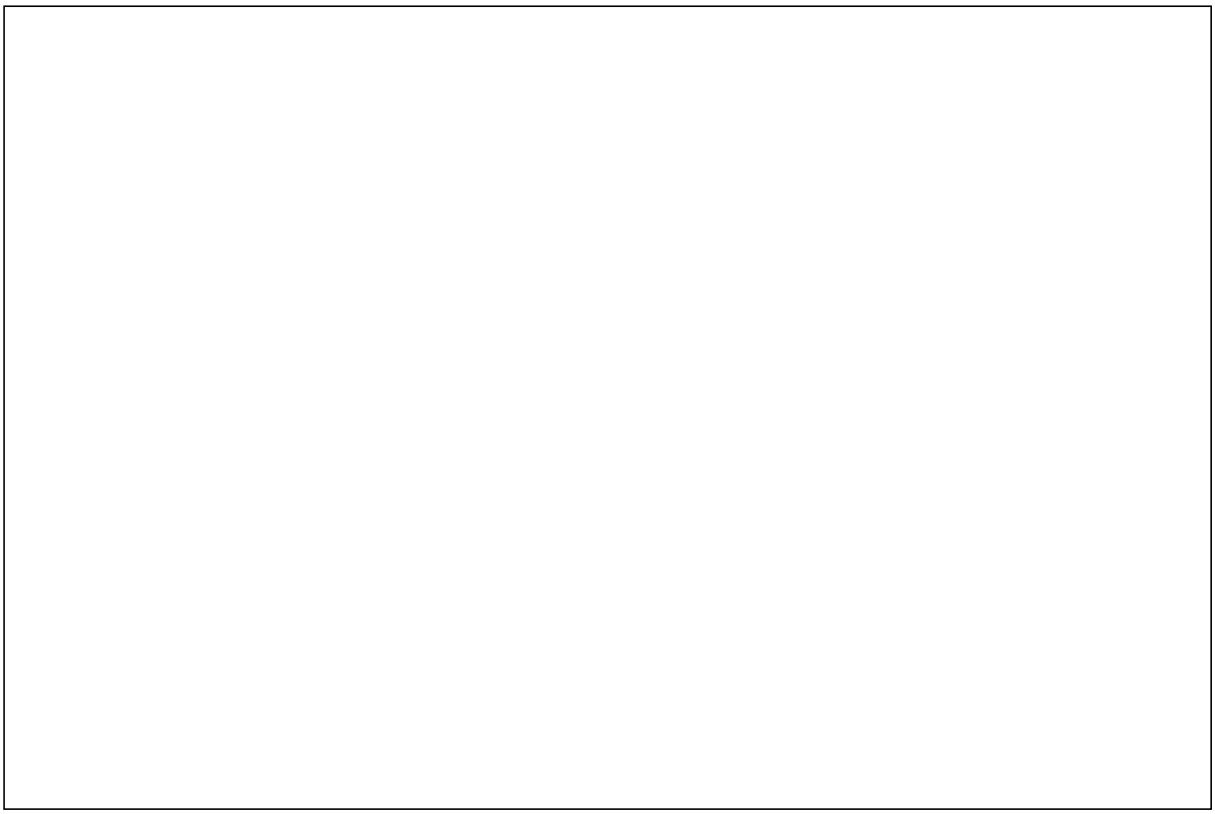
9.a Yes; replace the rear injector harness.

Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System"

9.b No; replace the injector with the out-of-range resistance.

Refer to section "Removal of the Fuel Injector - Two-Filter System" .

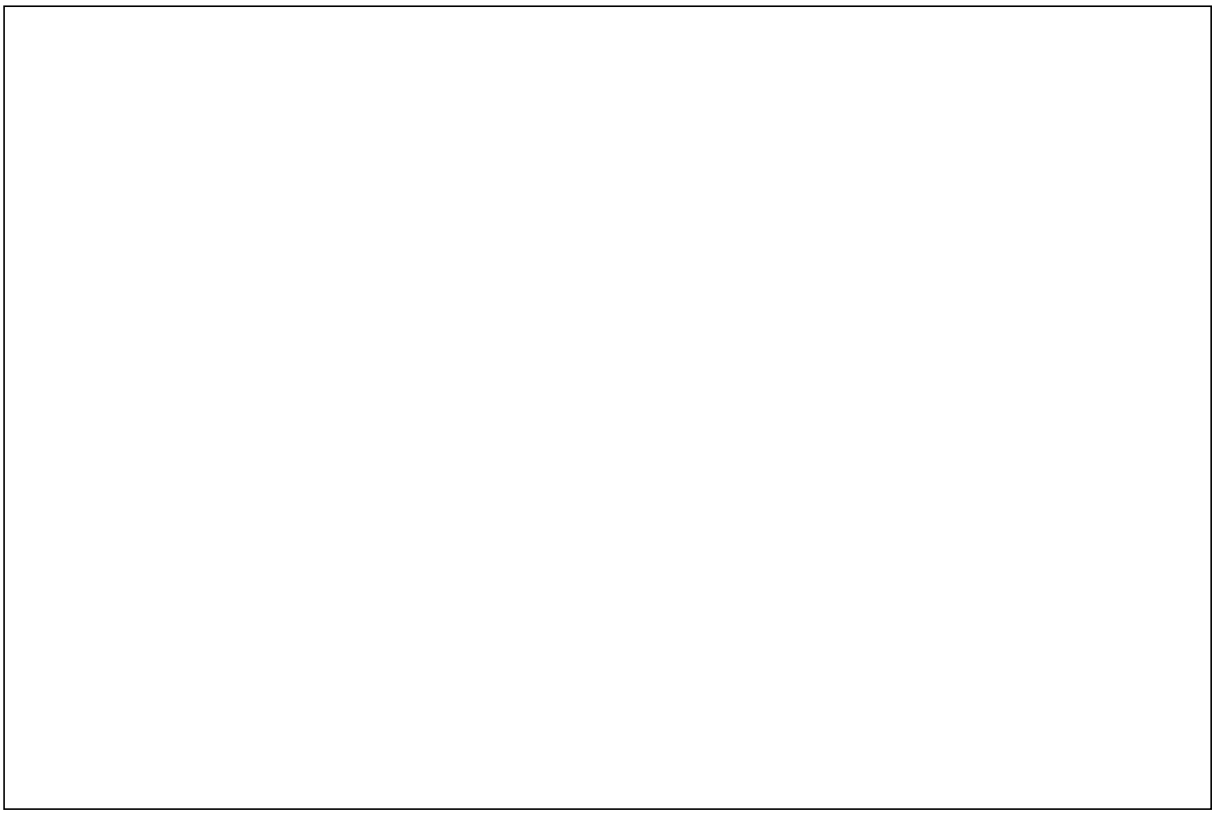
10. Disconnect the Motor Control Module (MCM) 120-pin connector.



11. Inspect the MCM 120-pin connector and the 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Is any damage found?

    11.a Yes; repair as necessary. Verify repairs.

    11.b No; Go to step 12.



Note : Do NOT touch the metal ohmmeter leads with your hands when the measurements are made.

12. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	7		5 and ground	
8	4		8 and ground	
9	8		9 and ground	
12	6		12 and ground	

12.a Yes, Go to step 13.

12.b No; repair the engine side harness. Verify repairs.

13. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

14. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

14.a Yes; repair as necessary.

14.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

SPN 3664 (MCM) (GHG17)

269.1 Electronic Diagram

Fig 269.1, Fuel Injector Electronic Diagram

269.2 SPN 3664/FMI 3 - GHG17

Injector Cylinder #6 Amplifier Control Valve Abnormal Operation (MAX)

SPN 3664/FMI 3	
Description	Injector Cylinder #6 Amplifier Control Valve Abnormal Operation (MAX)
Monitored Parameter	Injector Cylinder #6 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723 / FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the rear fuel injector harness 14-pin connector.
5. Inspect the rear fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the resistances within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)					
Injector #4 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #5 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #6 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)					
Note: Ensure J-48671-10 ground strap is connected to cylinder head.					
Injector #4 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #5 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #6 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the rear fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

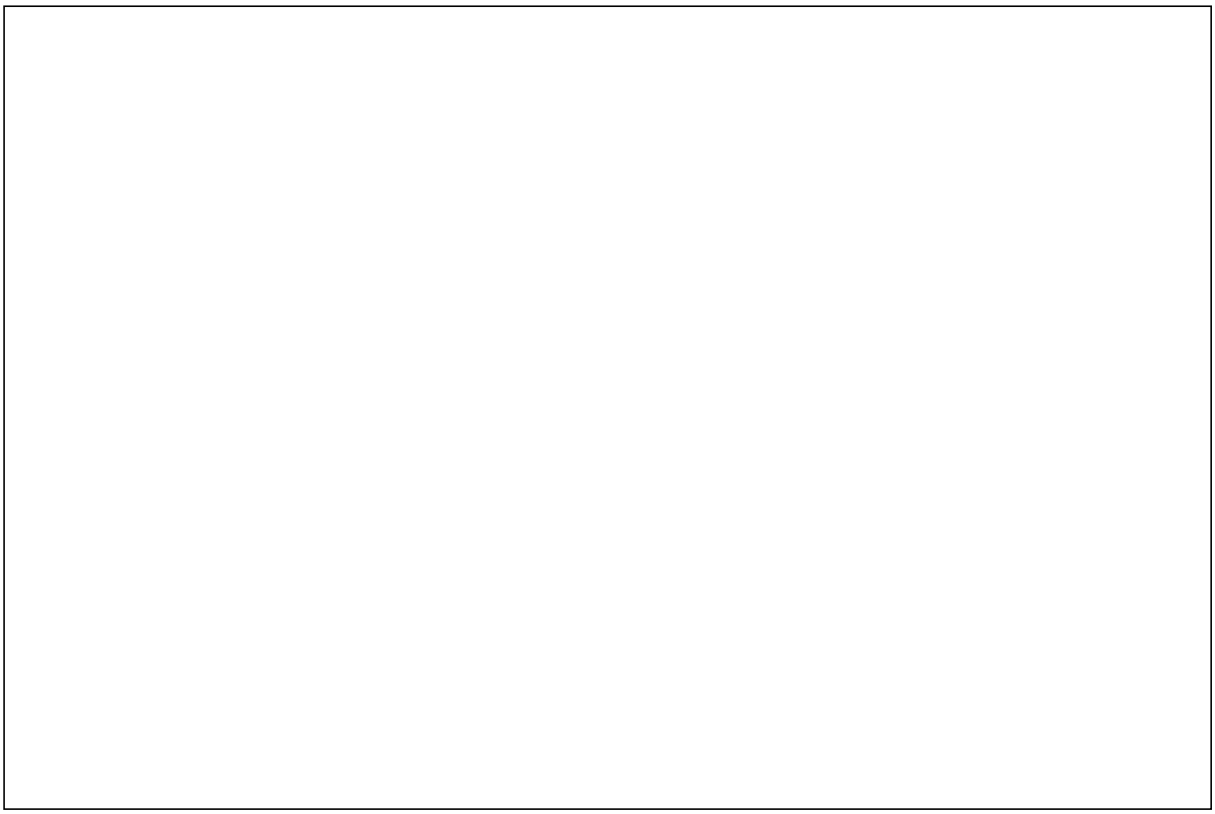
9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the values within range?

   9.a Yes; replace the rear fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

   9.b No; replace the fuel injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)					
Injector #4 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #5 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #6 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

11. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	7		5 and ground	
8	4		8 and ground	
9	8		9 and ground	
12	6		12 and ground	

11.a Yes; Go to step 12.

11.b No; repair the engine side harness. Verify repairs.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

13.a Yes; repair as necessary.

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

269.3 SPN 3664/FMI 4 - GHG17

Injector Cylinder #6 Amplifier Control Valve Abnormal Operation (MIN)

SPN 3664/FMI 4	
Description	Injector Cylinder #6 Amplifier Control Valve Abnormal Operation (MIN)
Monitored Parameter	Injector Cylinder #6 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723/FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the rear fuel injector harness 14-pin connector.
5. Inspect the rear fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the resistances within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #4 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #5 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #6 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #4 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #5 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #6 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the rear fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

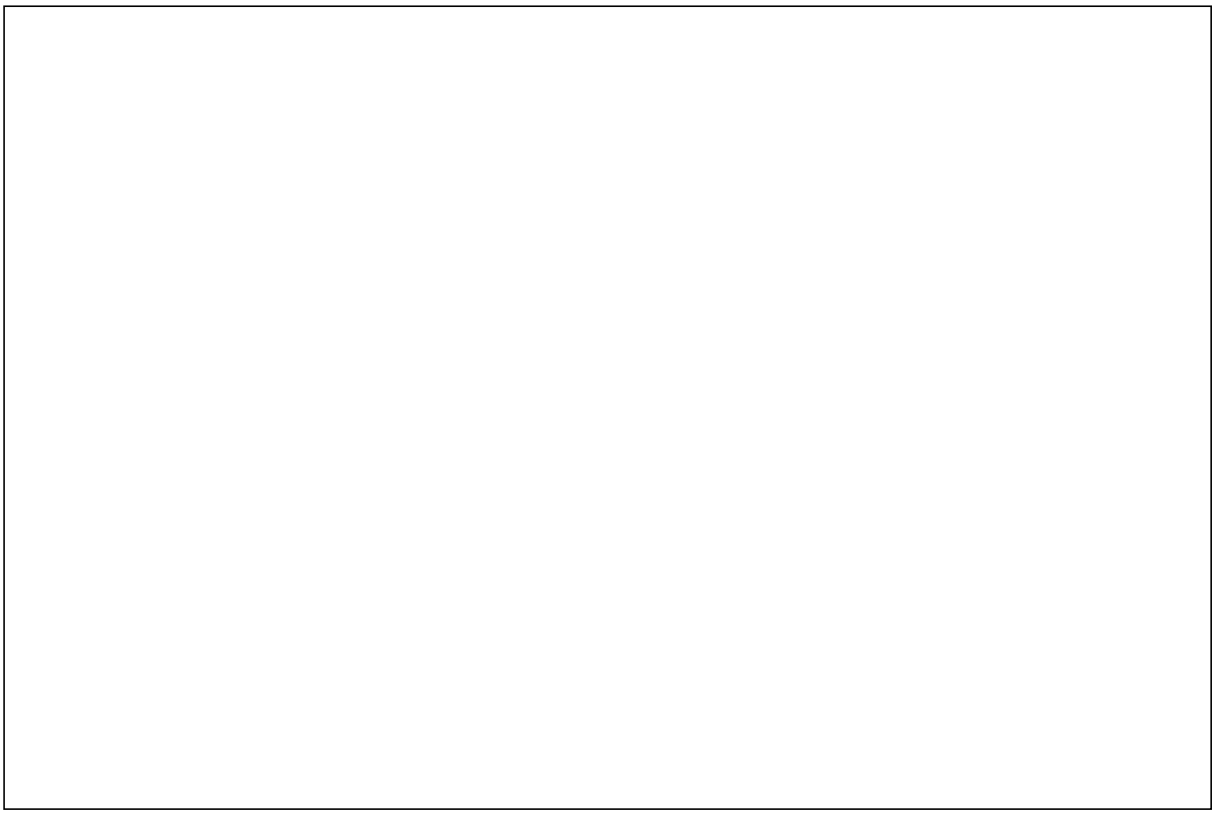
9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

   9.a Yes; replace the rear fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

   9.b No; replace the fuel injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)				
Injector #4 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #5 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #6 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

11. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	7		5 and ground	
8	4		8 and ground	
9	8		9 and ground	
12	6		12 and ground	

11.a Yes; Go to step 12.

11.b No; repair the engine side harness. Verify repairs.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

13.a Yes; repair as necessary.

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

269.4 SPN 3664/FMI 5 - GHG17

Injector Cylinder #6 Amplifier Control Valve Abnormal Operation (Open)

SPN 3664/FMI 5	
Description	Injector Cylinder #6 Amplifier Control Valve Abnormal Operation (OPEN)
Monitored Parameter	Injector Cylinder #6 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes.
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the rear fuel injector harness 14-pin connector.
5. Inspect the rear fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the resistances within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)					
Injector #4 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #5 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #6 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)					
Note: Ensure J-48671-10 ground strap is connected to cylinder head.					
Injector #4 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #5 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
Injector #6 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the rear fuel injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are taken.

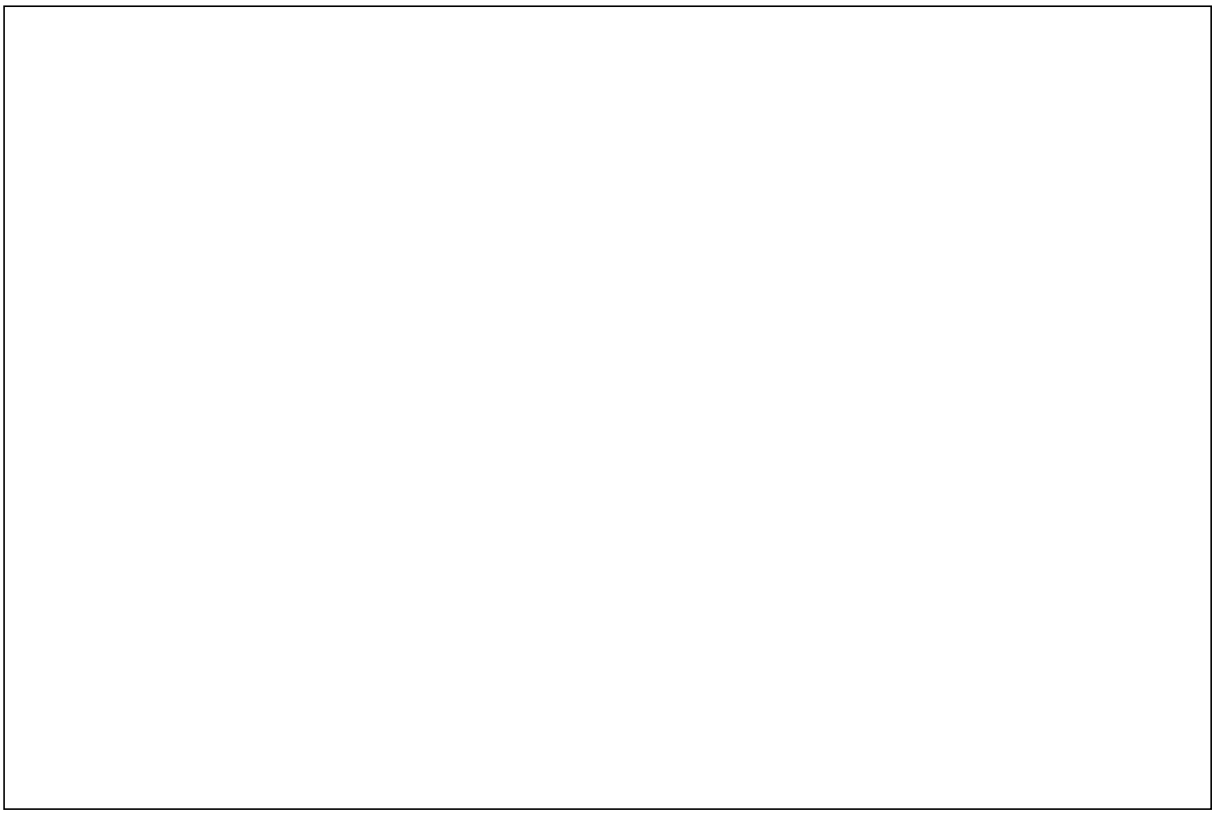
9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

   9.a Yes; replace the rear fuel injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

   9.b No; replace the fuel injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)					
Injector #4 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #5 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #6 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

10. Disconnect the Motor Control Module (MCM) 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

11. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	7		5 and ground	
8	4		8 and ground	
9	8		9 and ground	
12	6		12 and ground	

11.a Yes; Go to step 12.

11.b No; repair the engine side harness. Verify repairs.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

13.a Yes; repair as necessary.

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

269.5 SPN 3664/FMI 6 - GHG17

Injector Cylinder #6 Amplifier Control Valve – Valve Shorted Circuit

SPN 3664/FMI 6	
Description	Injector Cylinder #6 Amplifier Control Valve, Valve Shorted Circuit
Monitored Parameter	Injector Cylinder #6 Amplifier Control Valve
Typical Enabling Conditions	fis_nop_act greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (One minute)

1. Check for multiple codes. Is SPN fault code 168 or 723/FMI any present?
   1.a Yes; service those faults first.
   1.b No; Go to step 2.

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

> **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.

2. Start and warm the engine until the coolant temperature is above 71°C (160°F).
3. Turn the engine OFF.
4. Disconnect the rear rocker cover 14-pin injector harness connector.
5. Inspect the rear injector harness 14–pin injector connector for bent or spread pins. Inspect the connector seal for damage (signs of water or oil intrusion). Is any damage found?
   5.a Yes; repair as necessary.
   5.b No; Go to step 6.

Note : Do NOT touch the metal ohmmeter leads with your hands when the measurements are made.

6. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear injector harness listed below. Are the resistances within range?
   6.a Yes; Go to step 10.
   6.b No; Go to step 7.

Rear Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #4 Amplifier	Pins 5 and 8	Pins 5 and 2	Pin 2 and ground	Pin 8 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #5 Amplifier	Pins 5 and 9	Pins 5 and 3	Pin 3 and ground	Pin 9 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
Injector #6 Amplifier	Pins 5 and 12	Pins 5 and 4	Pin 4 and ground	Pin 12 and ground
	0.5 – 2.0*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Rear Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #4 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than20k*	greater than100k*	greater than100k*
Injector #5 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than20k*	greater than100k*	greater than100k*
Injector #6 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	0.5 – 2.0*	greater than20k*	greater than100k*	greater than100k*
* = acceptable resistance				

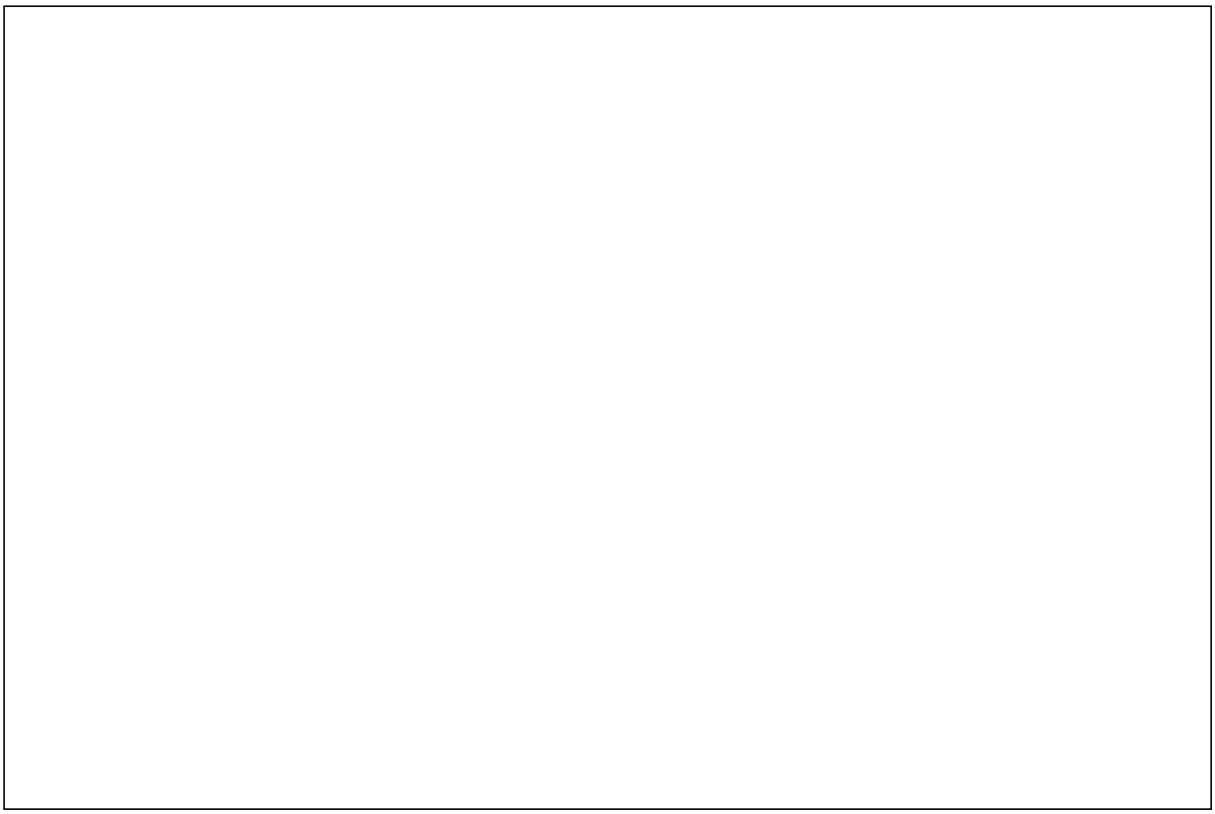
7. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
8. Remove the rear injector harness from the engine. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : Do NOT touch the metal ohmmeter leads with your hands when the measurements are made.

9. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?
   - 9.a Yes; replace the rear injector harness. Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .
   - 9.b No; replace the injector with the out-of-range resistance. Refer to section "Removal of the Fuel Injector - Two-Filter System" .

Injector Amplifier Resistance Chart (Injector Harness must be removed from engine)				
Injector #4 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #5 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
Injector #6 Amplifier	Pins 1 and 2	Pins 2 and 3	Pin 1 and ground	Pin 3 and ground
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

10. Disconnect the MCM 120-pin connector.



Note : DO NOT touch the metal ohmmeter leads with your hands when the measurements are made.

11. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
5	7		5 and ground	
8	4		8 and ground	
9	8		9 and ground	
12	6		12 and ground	

11.a Yes; Go to step 12.

11.b No; repair the engine side harness. Verify repairs.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

13.a Yes; repair as necessary.

13.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

SPN 3695 (CPC) (GHG17)

270.1 SPN 3695/FMI 9 - GHG17

SPN 3695/FMI 9	
Description	This fault code sets when the Common Powertrain Controller (CPC) does not see the Diesel Particulate Filter (DPF) Inhibit Switch over the J-1939 CAN.
Monitored Parameter	Diesel Particulate Filter (DPF) Inhibit Switch
Typical Enabling Conditions	Key ON, Engine OFF
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Cycle the Key to Power Down, then Cycle the Key Back On

Note : This fault code only sets when the CPC is parameterized to receive the Diesel Particulate Filter (DPF) Inhibit Switch from another module over the J1939 CAN.

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Connect DiagnosticLink .
3. Has the CPC been reprogrammed recently?
   - 3.a Yes; Reprogram the CPC using the latest software and the correct VIN. If the fault returns Go to step 4.
   - 3.b No; Go to step 4.
4. Check for other fault codes. Are there any communication fault codes present in the other modules?
   - 4.a Yes; diagnose the other fault codes.
   - 4.b No; replace the CPC.

270.2 SPN 3695/FMI 13 - GHG17

SPN 3695/FMI 13	
Description	Signal Not Available on the CPC DPF Inhibit Switch
Monitored Parameter	Diesel Particulate Filter (DPF) Inhibit Switch
Typical Enabling Conditions	Key ON, Engine OFF
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Cycle the Key to Power Down, then Cycle the Key Back On

Check as follows:

1. Check for multiple codes. Is (CPC) SPN 168/FMI 0/14/18 or (MCM) SPN 625/FMI 9 present?
   - 1.a Yes; troubleshoot and repair these first.
   - 1.b No; Go to step 2.
2. Measure resistance between the DPF inhibit switch connector, harness side and ground. Is the resistance greater than 10k ohms?
   - 2.a Yes; Go to step 3.
   - 2.b No; repair a short to ground on the DPF inhibit switch circuit from pin 13 of the CPC connector #4 to the DPF inhibit switch.
3. Has the Common Powertrain Controller (CPC) been recently reprogrammed?
   - 3.a Yes; Go to step 4.
   - 3.b No; check the other vehicle modules for communication faults. Follow the appropriate troubleshooting for the fault. If no other faults are found, Go to step 4.
4. Cycle the key to power down, then cycle the key back on. Did SPN 3695/FMI 13 return active?
   - 4.a Yes; check the proper configuration of the CPC. Go to step 5.
   - 4.b No; release the vehicle.
5. Cycle the key to power down, then cycle the key back on. Did SPN 3695/FMI 13 return active?
   - 5.a Yes; replace the CPC.
   - 5.b No; release the vehicle.

270.3 SPN 3695/FMI 14 - GHG17

SPN 3695/FMI 14	
Description	Loss of Communication Occurred on the CPC DPF Inhibit Switch
Monitored Parameter	Diesel Particulate Filter (DPF) Inhibit Switch
Typical Enabling Conditions	Key ON, Engine OFF
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Cycle the Key to Power Down, then Cycle the Key Back On

Check as follows:

1. Check for multiple codes. Is (CPC) SPN 168/FMI 0/14/18 or (MCM) SPN 625/FMI 9 present?
   - 1.a Yes; troubleshoot and repair these first.
   - 1.b No; Go to step 2.
2. Has the Common Powertrain Controller (CPC) been recently reprogrammed?
   - 2.a Yes; Go to step 3.
   - 2.b No; check the other vehicle modules for communication faults. Follow the appropriate troubleshooting for the fault. If no other faults are found, Go to step 3.
3. Cycle the key to power down, then cycle the key back on. Did SPN 3695/FMI 14 return active?
   - 3.a Yes; check the proper configuration of the CPC. Go to step 4.
   - 3.b No; release the vehicle.
4. Cycle the key to power down, then cycle the key back on. Did SPN 3695/FMI 14 return active?
   - 4.a Yes; replace the CPC.
   - 4.b No; release the vehicle.

270.4 SPN 3695/FMI 19 - GHG17

SPN 3695/FMI 19	
Description	A Communication Error Occurred on the CPC DPF Inhibit Switch
Monitored Parameter	Diesel Particulate Filter (DPF) Inhibit Switch
Typical Enabling Conditions	Key ON, Engine OFF
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Cycle the Key to Power Down, then Cycle the Key Back On

Check as follows:

1. Check for multiple codes. Is (CPC) SPN 168/FMI 0/14/18 or (MCM) SPN 625/FMI 9 present?
   - 1.a Yes; troubleshoot and repair these first.
   - 1.b No; Go to step 2.
2. Has the Common Powertrain Controller (CPC) been recently reprogrammed?
   - 2.a Yes; Go to step 3.
   - 2.b No; check the other vehicle modules for communication faults. Follow the appropriate troubleshooting for the fault. If no other faults are found, Go to step 3.
3. Cycle the key to power down, then cycle the key back on. Did SPN 3695/FMI 19 return active?
   - 3.a Yes; check the proper configuration of the CPC. Go to step 4.
   - 3.b No; release the vehicle.
4. Cycle the key to power down, then cycle the key back on. Did SPN 3695/FMI 19 return active?
   - 4.a Yes; replace the CPC.
   - 4.b No; release the vehicle.

SPN 3696 (CPC) (GHG17)

271.1 SPN 3696/FMI 4 - GHG17

SPN 3696/FMI 4	
Description	DPF Regeneration Switch is shorted to ground
Monitored Parameter	4/17 Regen switch
Typical Enabling Conditions	Key ON and engine OFF
Monitor Sequence	
Execution Frequency	Continuous when enabling conditions met
Typical Duration	
Dash Lamps	
Engine Reaction	
Verification	Cycle the key to power down, then cycle the key back on

1. Check for multiple codes. Is (CPC) SPN 168/FMI 0/14/18 or (MCM) SPN 625/FMI 9 present?
   1.a Yes; troubleshoot and repair these first.
   1.b No; Go to step 2.
2. Measure resistance at the DPF Regen Switch connector, harness side. Is the resistance greater than 10k ohms?
   2.a Yes; repair a short to ground on the DPF regen switch circuit from CPC connector 4, pin 17 (4/17) to the DPF Regen Switch.
   2.b No; Go to step 3.
3. Has the CPC been recently reprogrammed?
   3.a Yes; Go to step 4.
   3.b No; Check the other vehicle modules for communication faults. Follow the appropriate troubleshooting for the fault. If no other faults are found, Go to step 4.
4. Is the vehicle either a Cascadia or M2 Chassis?
   4.a Yes; Go to step 5.
   4.b No; the vehicle is neither a Cascadia nor an M2 Chassis, Go to step 7.
5. Is the vehicle an M2 Chassis?

5.a Yes; Verify CPC parameter PGR001/007, CM1 DPF Source Addr SAE J1939 is set to 33. Go to step 6.

5.b No; Verify CPC parameter PGR001/007, CM1 DPF Source Addr SAE J1939 is set to 49. Go to step 6.

6. Cycle the key to power down, then cycle the key back on. Did SPN 3696/FMI 4 return active?

6.a Yes; Go to step 7.

6.b No; Release the vehicle.

7. Using DiagnosticLink , go to the Program Device screen. Add the Engine Serial Number (ESN) and connect to server.

8. Using DiagnosticLink Compare Parameter feature, compare the parameters on the CPC to the ones under Server Data. Set CPC parameter PGR001/007, CM1 DPF Source Addr SAE J1939 on the CPC the same as on the server. Go to step 9.

9. Cycle the key to power down, then cycle the key back on. Did SPN 3696/FMI 4 return active?

9.a Yes; Contact the chassis OEM for appropriate parameter settings.

9.b No; Release the vehicle.

271.2 SPN 3696/FMI 9 - GHG17

SPN 3696/FMI 9	
Description	Loss of communication occurred on the CPC DPF switch source address
Monitored Parameter	CM1 DPF Source Addr SAE J1939
Typical Enabling Conditions	Key ON and engine OFF
Monitor Sequence	
Execution Frequency	Continuous when enabling conditions met
Typical Duration	
Dash Lamps	
Engine Reaction	None
Verification	Cycle the key to power down, then cycle the key back on

1. Check for multiple codes. Is either (CPC) SPN 168/FMI 0/14/18 or (MCM) SPN 625/FMI 9 present?
   1.a Yes; troubleshoot and repair these first.
   1.b No; Go to step 2.
2. Has the CPC been recently reprogrammed?
   2.a Yes; Go to step 3.
   2.b No; Check the other vehicle modules for communication faults. Follow the appropriate troubleshooting for the fault. If no other faults are found, Go to step 3.
3. Is the vehicle either a Cascadia or M2 Chassis?
   3.a Yes; Go to step 4.
   3.b No; the vehicle is neither a Cascadia nor an M2 Chassis, Go to step 6.
4. Is the vehicle an M2 Chassis?
   4.a Yes; Verify CPC parameter PGR001/007, CM1 DPF Source Addr SAE J1939 is set to 33. Go to step 5.
   4.b No; Verify CPC parameter PGR001/007, CM1 DPF Source Addr SAE J1939 is set to 49. Go to step 5.
5. Cycle the key to power down, then cycle the key back on. Did SPN 3696/FMI 9 return active?
   5.a Yes; Go to step 6.
   5.b No; Release the vehicle.
6. Using DiagnosticLink , go to the Program Device screen. Add the Engine Serial Number (ESN) and connect to server.
7. Using DiagnosticLink Compare Parameter feature, compare the parameters on the CPC to the ones under Server Data. Set CPC parameter PGR001/007, CM1 DPF Source Addr SAE J1939 on the CPC the same as on the server. Go to step 8.
8. Cycle the key to power down, then cycle the key back on. Did SPN 3696/FMI 9 return active?
   8.a Yes; Contact the chassis OEM for appropriate parameter settings.
   8.b No; Release the vehicle.

271.3 SPN 3696/ FMI 13 - GHG17

Diesel Particulate Filter Regen Force MUX Switch Message Contains SNV Indicator

SPN 3696/FMI 13	
Description	Signal not available on the CPC DPF switch source address
Monitored Parameter	CM1 DPF Source Addr SAE J1939
Typical Enabling Conditions	Key ON and engine OFF
Monitor Sequence	
Execution Frequency	Continuous when enabling conditions met
Typical Duration	
Dash Lamps	
Engine Reaction	None
Verification	Cycle the key to power down, then cycle the key back on

1. Is the vehicle either a Cascadia or M2 Chassis?
   1.a Yes; Go to step 2.
   1.b No; the vehicle is neither a Cascadia nor an M2 Chassis, Go to step 4.
2. Is the vehicle an M2 Chassis?
   2.a Yes; Verify CPC parameter PGR001/007, CM1 DPF Source Addr SAE J1939 is set to 33. Go to step 3.
   2.b No; Verify CPC parameter PGR001/007, CM1 DPF Source Addr SAE J1939 is set to 49. Go to step 3.
3. Cycle the key to power down, then cycle the key back on. Did SPN 3696/FMI 13 return active?
   3.a Yes; Go to step 4.
   3.b No; Release the vehicle.
4. Using DiagnosticLink , go to the Program Device screen. Add the Engine Serial Number (ESN) and connect to server.
5. Using DiagnosticLink Compare Parameter feature, compare the parameters on the CPC to the ones under Server Data. Set CPC parameter PGR001/007, CM1 DPF Source Addr SAE J1939 on the CPC the same as on the server. Go to step 6.
6. Cycle the key to power down, then cycle the key back on. Did SPN 3696/FMI 13 return active?
   6.a Yes; Contact the chassis OEM for appropriate parameter settings.
   6.b No; Release the vehicle.

271.4 SPN 3696/FMI 14 - GHG17

SPN 3696/FMI 14	
Description	Loss of communication occurred on the CPC DPF switch source address
Monitored Parameter	CM1 DPF Source Addr SAE J1939
Typical Enabling Conditions	Key ON and engine OFF
Monitor Sequence	
Execution Frequency	Continuous when enabling conditions met
Typical Duration	
Dash Lamps	
Engine Reaction	None
Verification	Cycle the key to power down, then cycle the key back on

1. Check for multiple codes. Is either (CPC) SPN 168/FMI 0/14/18 or (MCM) SPN 625/FMI 9 present?
   1.a Yes; troubleshoot and repair these first.
   1.b No; Go to step 2.
2. Has the CPC been recently reprogrammed?
   2.a Yes; Go to step 3.
   2.b No; Check the other vehicle modules for communication faults. Follow the appropriate troubleshooting for the fault. If no other faults are found, Go to step 3.
3. Is the vehicle either a Cascadia or M2 Chassis?
   3.a Yes; Go to step 4.
   3.b No; the vehicle is neither a Cascadia nor an M2 Chassis, Go to step 6.
4. Is the vehicle an M2 Chassis?
   4.a Yes; Verify CPC parameter PGR001/007, CM1 DPF Source Addr SAE J1939 is set to 33. Go to step 5.
   4.b No; Verify CPC parameter PGR001/007, CM1 DPF Source Addr SAE J1939 is set to 49. Go to step 5.
5. Cycle the key to power down, then cycle the key back on. Did SPN 3696/FMI 14 return active?
   5.a Yes; Go to step 6.
   5.b No; Release the vehicle.
6. Using DiagnosticLink , go to the Program Device screen. Add the Engine Serial Number (ESN) and connect to server.
7. Using DiagnosticLink Compare Parameter feature, compare the parameters on the CPC to the parameters under Server Data. Set CPC parameter PGR001/007, CM1 DPF Source Addr SAE J1939 on the CPC the same as on the server. Go to step 8.
8. Cycle the key to power down, then cycle the key back on. Did SPN 3696/FMI 14 return active?
   8.a Yes; Contact the chassis OEM for appropriate parameter settings.
   8.b No; Release the vehicle.

271.5 SPN 3696/FMI 19 - GHG17

SPN 3696/FMI 19	
Description	A communication error occurred on the CPC DPF switch source address
Monitored Parameter	CM1 DPF Source Addr SAE J1939
Typical Enabling Conditions	Key ON and engine OFF
Monitor Sequence	
Execution Frequency	Continuous when enabling conditions met
Typical Duration	
Dash Lamps	
Engine Reaction	None
Verification	Cycle the key to power down, then cycle the key back on

1. Check for multiple codes. Is either (CPC) SPN 168/FMI 0/14/18 or (MCM) SPN 625/FMI 9 present?
   1.a Yes; troubleshoot and repair these first.
   1.b No; Go to step 2.
2. Has the CPC been recently reprogrammed?
   2.a Yes; Go to step 3.
   2.b No; Check the other vehicle modules for communication faults. Follow the appropriate troubleshooting for the fault. If no other faults are found, Go to step 3.
3. Is the vehicle either a Cascadia or M2 Chassis?
   3.a Yes; Go to step 4.
   3.b No; the vehicle is neither a Cascadia nor an M2 Chassis, Go to step 6.
4. Is the vehicle an M2 Chassis?
   4.a Yes; Verify CPC parameter PGR001/007, CM1 DPF Source Addr SAE J1939 is set to 33. Go to step 5.
   4.b No; Verify CPC parameter PGR001/007, CM1 DPF Source Addr SAE J1939 is set to 49. Go to step 5.
5. Cycle the key to power down, then cycle the key back on. Did SPN 3696/FMI 19 return active?
   5.a Yes; Go to step 6.
   5.b No; Release the vehicle.
6. Using DiagnosticLink , go to the Program Device screen. Add the Engine Serial Number (ESN) and connect to server.
7. Using DiagnosticLink Compare Parameter feature, compare the parameters on the CPC to the parameters under Server Data. Set CPC parameter PGR001/007, CM1 DPF Source Addr SAE J1939 on the CPC the same as on the server. Go to step 8.
8. Cycle the key to power down, then cycle the key back on. Did SPN 3696/FMI 19 return active?
   8.a Yes; Contact the chassis OEM for appropriate parameter settings.
   8.b No; Release the vehicle.

SPN 3711 (MCM;ACM) (GHG17)

272.1 SPN 3711/FMI 31 - GHG17

High Idle Regeneration (Aborted) – Low Exhaust Temperature

The fault indicates that the High Idle Regeneration (HIR) was aborted due to the Diesel Oxidation Catalyst (DOC) inlet temperature not reaching the minimum of 270°C (518°F) to initiate dosing during an HIR. The CEL and MIL lamps will remain ON until the fault is resolved or a successful regeneration is completed.

1. Connect DiagnosticLink .
2. Check fault codes; are SPN 3242/FMI 8 or SPN 3242/FMI 20 active or previously active?
   - 2.a Yes; troubleshoot these codes first.
   - 2.b No; Go to step 3.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

3. Start the engine.
4. Monitor the Diesel Oxidation Catalyst (DOC) inlet temperature sensor and DOC outlet temperature sensor. Continue idling for 10 minutes. Is the DOC inlet temperature within 13.89°C (25°F) of the DOC outlet temperature?
   - 4.a Yes; replace the DOC inlet temperature sensor and perform an HIR.
   - 4.b No; For a DD16 engine, Go to step 5. For a DD13 or a DD15, Go to step 6.
5. Using DiagnosticLink, perform an Intake Throttle Service Routine. Is the commanded position achieved?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the Intake Throttle Valve (ITV).
6. Inspect the exhaust system for leaks. Are any leaks found?
   - 6.a Yes; repair as necessary.
   - 6.b No; Go to step 7.
7. Pressurize the intake tract and inspect for leaks. Are any leaks found?
   - 7.a Yes; repair as necessary.
   - 7.b No; Go to step 8.

> **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.

8. Perform a Parked Regen. View the Jake Brake® -1 (PWM 13). Is the MCM commanding Jake Brake 1 on?
   - 8.a Yes; Go to step 9.
   - 8.b No; the oil temperature may be too cold. The oil temperature needs to be above 50ºC (122°F) for the Jake Brakes to turn on.
9. Using DiagnosticLink during the regen, view AS087 Actual Fuel Mass. Is the fuel mass above 100 mg/st?
   - 9.a Yes; send in the log file to the Detroit™ Customer Support Center at CSC@daimler.com. Call 800-445-1980 for further analysis and instruction.
   - 9.b No; Go to step 10.
10. Install a test MCM using the extension harness and perform a regen. Is the fuel mass above 100 mg/st?
    - 10.a Yes; replace the MCM.
    - 10.b No; Go to step 11.

> **WARNING**
>
> PERSONAL INJURY
>
> To avoid injury, never remove any engine component while the engine is running.

11. Remove the valve cover. Inspect the front top of the exhaust rocker arm shaft. It should state "TOP FRONT". Refer to section "Checking for Poor Engine Brake Performance" .
    - 11.a If the rocker arm does NOT state "TOP FRONT" then remove and inspect it for correct installation and part.
    - 11.b If the rocker arm does state "TOP FRONT", Go to step 12.
12. Using DiagnosticLink, Service Routines, Cylinder Cut-Out, cut out cylinders one, two, and three. On the Jake Brake solenoid there is a button to push called the Jake Brake Override. Push and hold the Jake Brake override button. Does the engine quit running?
    - 12.a Yes; replace the exhaust rocker arm shaft. The plug in the rocker arm shaft is missing (cannot be seen), causing oil to activate the rear Jake Brakes.
    - 12.b No; Go to step 13.
13. When the Jake override button is pushed down, do you see all the Jake Brake rocker arm pistons come out of the Jake Brake rocker arms for cylinders one, two, and three?
    - 13.a Yes; replace the solenoid and assemble the engine to perform a regen.
    - 13.b No; Go to step 14.
14. Remove the front (Bank 1) engine brake solenoid from the cam frame. This will require the removal of the front injector harness. Make sure both injector harnesses (front and rear) are unplugged. Crank the engine; is there oil coming out of the port in the cam frame housing?
    - 14.a Yes; replace the solenoid. Go to step 15.
    - 14.b No; replace the cam frame housing.
15. Push on the Jake Brake override button again. Do the Jake Brake pistons activate for cylinders one, two and three?
    - 15.a Yes; assemble the engine and try a regen.

⚠ WARNING

EYE INJURY

To avoid injury from flying debris when using compressed air, wear adequate eye protection (face shield or safety goggles) and do not exceed 276 kPa (40 psi) air pressure.

15.b No; remove the Jake Brake solenoid and the exhaust rocker arm shaft. Blow compressed shop air through the cam frame to the solenoid gallery, inspecting for a blockage. Remove the rockers for cylinders one, two and three. Blow compressed shop air through the rocker arm inspecting for blockage. If no blockage is found, replace the Jake Brake rockers that **did not** have the pistons activate.

SPN 3713 (ACM) (GHG17)

273.1 SPN 3713/FMI 31 - GHG17

High Idle Regeneration Aborted - Low Regeneration Temperature

The fault indicates that the High Idle Regeneration (HIR) was aborted due to the Diesel Oxidation Catalyst (DOC) outlet temperature not reaching the expected target temperature to complete a HIR. If there are any other regeneration or fuel system related faults address those first. The CEL and MIL lamp will remain ON until a fault is resolved or a successful regeneration is completed. Retain log file if customer assistance is required.

SPN 3716 (MCM) (GHG17)

274.1 SPN 3716/FMI 31- GHG17

SPN 3716/FMI 31	
Description	This Fault Logs when the Coolant Temperature Fails to Reach 60°C (140°F) During High Idle Regeneration Initiation
Monitored Parameter	Engine Coolant Temperature
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Parked Regeneration

WARNING

ENGINE EXHAUST

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

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.

1. Connect DiagnosticLink .
2. Check for multiple fault codes. Are fault codes SPN 110/FMI 3, FMI 4 or FMI 10 present?
   - 2.a Yes; diagnose the other fault codes first.
   - 2.b No; Go to step 3.
3. Using DiagnosticLink, compare engine coolant temperature and engine oil temperature. Are the temperatures within 12°C (21.6°F) of each other?
   - 3.a Yes; Go to step 4.
   - 3.b No; replace the coolant temperature sensor. Verify repair. Refer to section "Removal of the Engine Coolant Outlet Temperature Sensor" .
4. Check for proper operation of the engine cooling fan. Is the fan running longer than desired?
   - 4.a Yes; repair as necessary. Verify repair.
   - 4.b No; Go to step 5.
5. Check coolant thermostat operation. Refer to section "Low Engine Coolant Temperature" . Does the thermostat operate correctly?
   - 5.a Yes; replace the coolant temperature sensor. Refer to section "Removal of the Engine Coolant Outlet Temperature Sensor" . Verify repair.
   - 5.b No; replace the engine coolant thermostat. Refer to section "Removal of the Engine Coolant Thermostat and Seal" . Verify repair.

SPN 3719 (ACM) (GHG17)

275.1 SPN 3719/FMI 0 - GHG17

Check as follows:

Note : When this code is detected, the operator has two minutes to initiate regeneration request.

⚠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.

⚠WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠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.

⚠WARNING

ENGINE EXHAUST

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

1. Perform a parked regeneration.

Note : Do not interrupt regeneration once it has been initiated.

2. Clear all codes following the completion of the parked regeneration.

275.2 SPN 3719/FMI 15 - GHG17

Diesel Particulate Filter Zone 3 Condition

Silent Code that Logs when the Diesel Particulate Filter Regeneration Lamp is Flashing in "Regen Zone 3"

Note : This code is informational only and used by service to help understand which dash lights illuminated during normal service. A stationary regeneration is required if the fault code is active. No action is required for an inactive fault code.

275.3 SPN 3719/FMI 16 - GHG17

Check as follows:

Note : When this code is detected, the operator has two minutes to initiate regeneration request.

> **⚠ 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.

> **⚠ WARNING**
>
> PERSONAL INJURY
>
> Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

> **⚠ 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.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

1. Perform a parked regeneration.

Note : Do not interrupt regeneration once it has been initiated.

2. Clear all codes following the completion of the parked regeneration.

275.4 SPN 3719/FMI 31 - GHG17

Note : This code is informational only and used by service to help understand which dash lights illuminated during normal service. A stationary regeneration is required if the fault code is active. No action is required for an inactive fault code.

SPN 3719 (CPC) (GHG17)

276.1 SPN 3719/FMI 0 - GHG17

DPF Filter Soot Level is Very High

SPN 3719/ FMI 0	
Description	Diesel Particular Filter (DPF) is at a Very High Soot Level
Monitored Parameter	DPF Zone
Typical Enabling Conditions	Soot Sensor Enabled
Monitor Sequence	Continuously
Execution Frequency	Always Enabled
Typical Duration	
Dash Lamps	SEL
Engine Reaction	None
Verification	Parked Regeneration

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple codes. Are any Aftertreatment Control Module (ACM) fault codes also present, including ACM code SPN 3719/FMI 0?

   3.a Yes; troubleshoot the other faults first.

   3.b No; Go to step 4.
4. Check for proper configuration of the Common Powertrain Controller (CPC) against the server information. Does the CPC have the proper configuration?

   4.a Yes; Go to step 5.

   4.b No; reprogram the CPC with the correct information as necessary. Go to step 5.

> **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.

5. Clear fault codes and verify repair by performing a Parked Regeneration.

276.2 SPN 3719/FMI 16 - GHG17

DPF Filter Soot Level is High

SPN 3719/FMI 16	
Description	Diesel Particulate Filter is at a high soot level
Monitored Parameter	DPF Zone
Typical Enabling Conditions	Soot Sensor Enabled
Monitor Sequence	Continuously
Execution Frequency	Always Enabled
Typical Duration	
Dash Lamps	CEL
Engine Reaction	None
Verification	Parked Regeneration

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple codes. Are any ACM fault codes also present, including ACM code SPN 3719/FMI 16?
   - 3.a Yes; troubleshoot the other faults first.
   - 3.b No; Go to step 4.
4. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   - 4.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; reprogram the CPC with the correct information as necessary. Go to step 5.
5. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair by performing a Parked Regeneration.

276.3 SPN 3719/FMI 31 - GHG17

Silent Code that Logs when the Diesel Particulate Filter Regeneration Lamp is Flashing in "Regen Zone 2"

Note : This code is informational only and used by service to help understand which dash lights illuminated during normal service. A stationary regeneration is required if the fault code is active. No action is required for an inactive fault code.

SPN 3720 (ACM) (GHG17)

277.1 SPN 3720/FMI 15 - GHG17

Diesel Particulate Filter Has Reached the End of its Service Life

Replace DPF and perform the Ash Accumulator reset using DiagnosticLink .

The DPF lamp will illuminate and code 3720/15 will log when the truck reaches the appropriate mileage interval. This fault indicates that the DPF needs to be replaced and the DPF Ash Accumulator Routine in DiagnosticLink must be completed. This routine can be found in the Actions drop-down menu and must be completed after the DPF has been replaced.

Cleaning accumulated ash from the DPF is a necessary part of vehicle maintenance and is a customer charge. The recommended service is to remove the DPF and replace with a reliabilt® Clean DPF. The reliabilt® Clean DPF has a parts warranty and the same cleaning interval as the original 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 Diesel Oxidation Catalyst (DOC) or DPF assemblies as a result of alternate cleaning methods.

Refer to section "Resetting the Diesel Particulate Filter Ash Accumulators" Refer to section "Resetting the Diesel Particulate Filter Ash Accumulators"

SPN 3720 (MCM) (GHG17)

278.1 SPN 3720/FMI 14 - GHG17

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Select Diesel Particulate Filter (DPF) ash accumulator from the actions drop-down menu.
4. Choose Aftertreatment Control Module (ACM) replacement option, then select set ash volume button.
5. Verify that the ACM value has changed in the DPF ash accumulator window and that the 3720/14 MCM fault is no longer active. ACM will change to a value that should be within 5% of the MCM displayed volume within 5-10 seconds of executing the routine. Clear all faults and release vehicle.

SPN 3840 (CPC) (GHG17)

278.1 SPN 3840/FMI 3 – GHG17

SPN 3840/FMI 3	
Description	CPC Output 4 15 Short to Voltage
Monitored Parameter	CPC Output 4/15
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .
3. Verify parameters - go to the parameters work window
4. Verify that the parameter in PGR009 frequency outputs are set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to power between pin 15 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

278.2 SPN 3840/FMI 4 - GHG17

SPN 3840/FMI 4	
Description	CPC Output 4 15 Short to Ground
Monitored Parameter	CPC Output 4/15
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .
3. Verify parameters - go to the parameters work window.
4. Verify that the parameter in PGR009 frequency outputs are set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to ground between pin 15 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

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278.3 SPN 3840/FMI 5 - GHG17

SPN 3840/FMI 5	
Description	CPC Output 4 15 Open Circuit
Monitored Parameter	CPC Output 4/15
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .
3. Verify parameters - go to the parameters work window.
4. Verify that the parameter in PGR009 frequency outputs are set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the open circuit between pin 15 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

SPN 3841 (CPC) (GHG17)

279.1 SPN 3841/FMI 3 – GHG17

SPN 3841/FMI 3	
Description	CPC Output 4 11 Short to Voltage
Monitored Parameter	CPC Output 4/11
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .
3. Verify parameters - go to the parameters work window.
4. Verify that the parameter in PGR009 frequency outputs are set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to power between pin 11 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

279.2 SPN 3841/FMI 4 - GHG17

SPN 3841/FMI 4	
Description	CPC Output 4 11 Short to Ground
Monitored Parameter	CPC Output 4/11
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .
3. Verify parameters - go to the parameters work window.
4. Verify that the parameter in PGR009 frequency outputs are set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to ground between pin 11 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

279.3 SPN 3841/FMI 5 - GHG17

SPN 3841/FMI 5	
Description	CPC Output 4 11 Open Circuit
Monitored Parameter	CPC Output 4/11
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .
3. Verify parameters - go to the parameters work window.
4. Verify that the parameter in PGR009 frequency outputs are set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the open circuit between pin 11 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

SPN 3842 (CPC) (GHG17)

281.1 SPN 3842/FMI 3 - GHG17

SPN 3842/FMI 3	
Description	CPC Output 3 02 Short to Voltage
Monitored Parameter	CPC Output 3/02
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On

Repair the short to power between pin 2 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

281.2 SPN 3842/FMI 4 - GHG17

SPN 3842/FMI 4	
Description	CPC Output 3 02 Short to Ground
Monitored Parameter	CPC Output 3/02
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On

Repair the short to ground between pin 2 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

281.3 SPN 3842/FMI 5 - GHG17

SPN 3842/FMI 5	
Description	CPC Output 3 02 Open Circuit
Monitored Parameter	CPC Output 3/02
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On

Repair the open circuit between pin 2 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

SPN 3843 (CPC) (GHG17)

281.1 SPN 3843/FMI 3 - GHG17

SPN 3843/FMI 3	
Description	CPC Input 1 01 Short to Voltage
Monitored Parameter	CPC Input 1/01
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .

3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 1 01 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to power between pin 1 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

281.2 SPN 3843/FMI 4 - GHG17

SPN 3843/FMI 4	
Description	CPC Input 1 01 Short to Ground
Monitored Parameter	CPC Input 1/01
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .

3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 1 01 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to ground between pin 1 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

SPN 3844 (CPC) (GHG17)

282.1 SPN 3844/FMI 3 - GHG17

SPN 3844/FMI 3	
Description	CPC Input 1 02 Short to Voltage
Monitored Parameter	CPC Input 1/02
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .

3. Verify parameters – go to the parameters work window.
4. Verify that the parameter set to 1 02 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to power between pin 2 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

4.b No; configure the parameters correctly.

282.2 SPN 3844/FMI 4 - GHG17

SPN 3844/FMI 4	
Description	CPC Input 1 02 Short to Ground
Monitored Parameter	CPC Input 1/02
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .

3. Verify parameters – go to the parameters work window.
4. Verify that the parameter set to 1 02 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to ground between pin 2 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

SPN 3845 (CPC) (GHG17)

283.1 SPN 3845/FMI 3 - GHG17

SPN 3845/FMI 3	
Description	CPC Input 1 12 Short to Voltage
Monitored Parameter	CPC Input 1/12
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

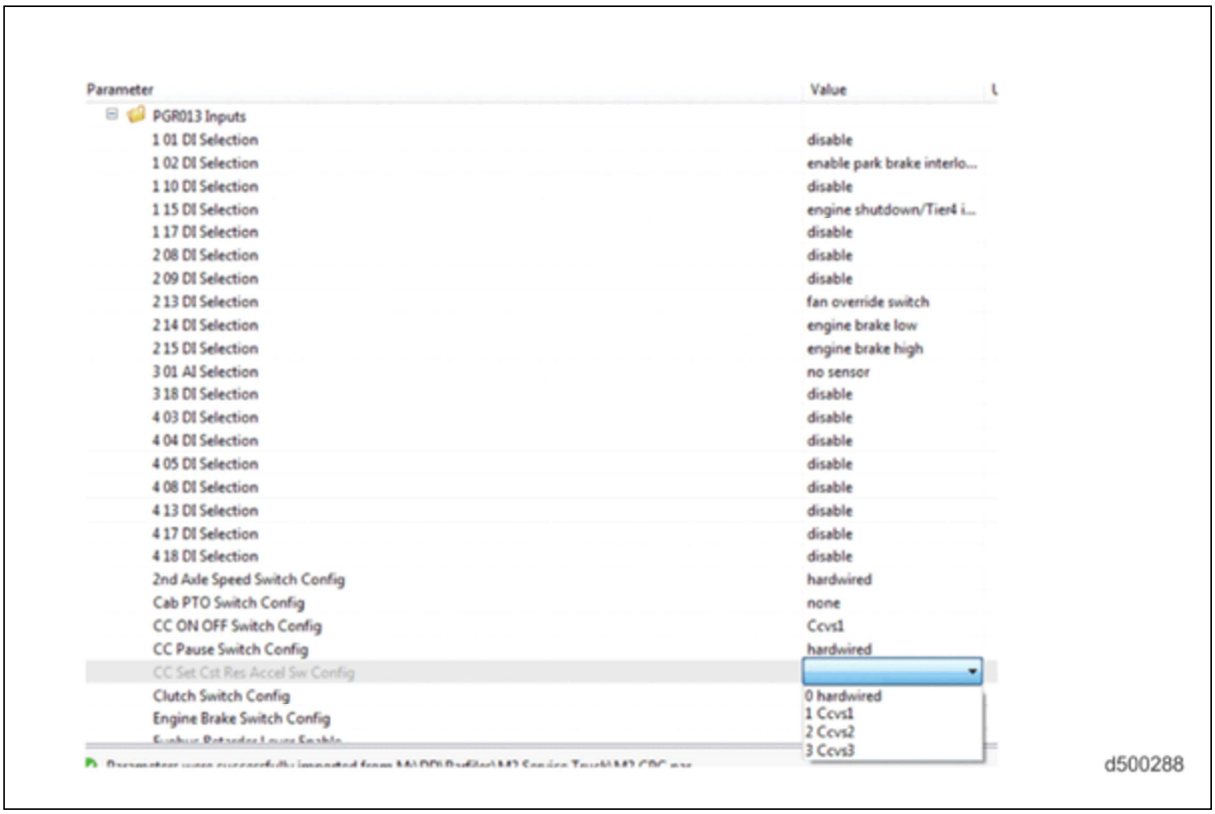
WARNING

ENGINE EXHAUST

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

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 1 12 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to power between pin 12 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

283.2 SPN 3845/FMI 4 - GHG17

SPN 3845/FMI 4	
Description	CPC Input 1 12 Short to Ground
Monitored Parameter	CPC Input 1/12
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

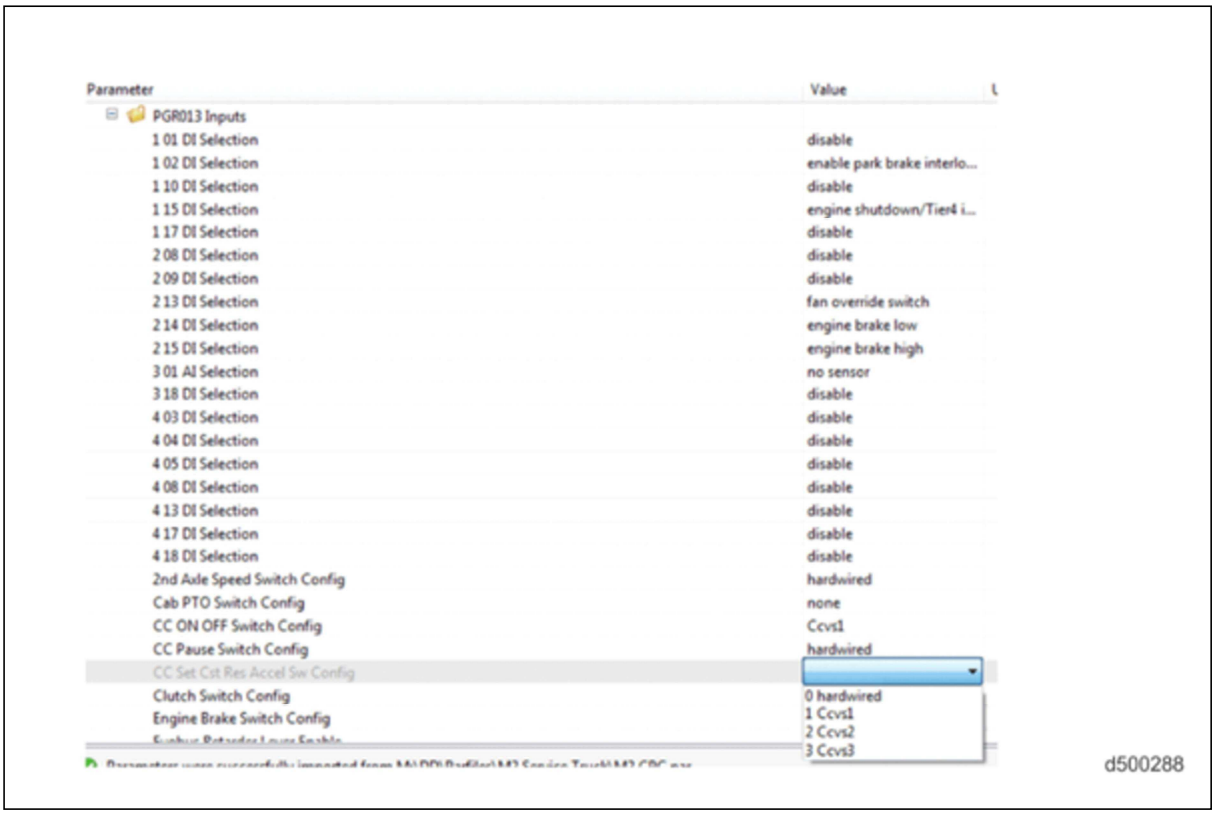
WARNING

ENGINE EXHAUST

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

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 1 12 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to ground between pin 12 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

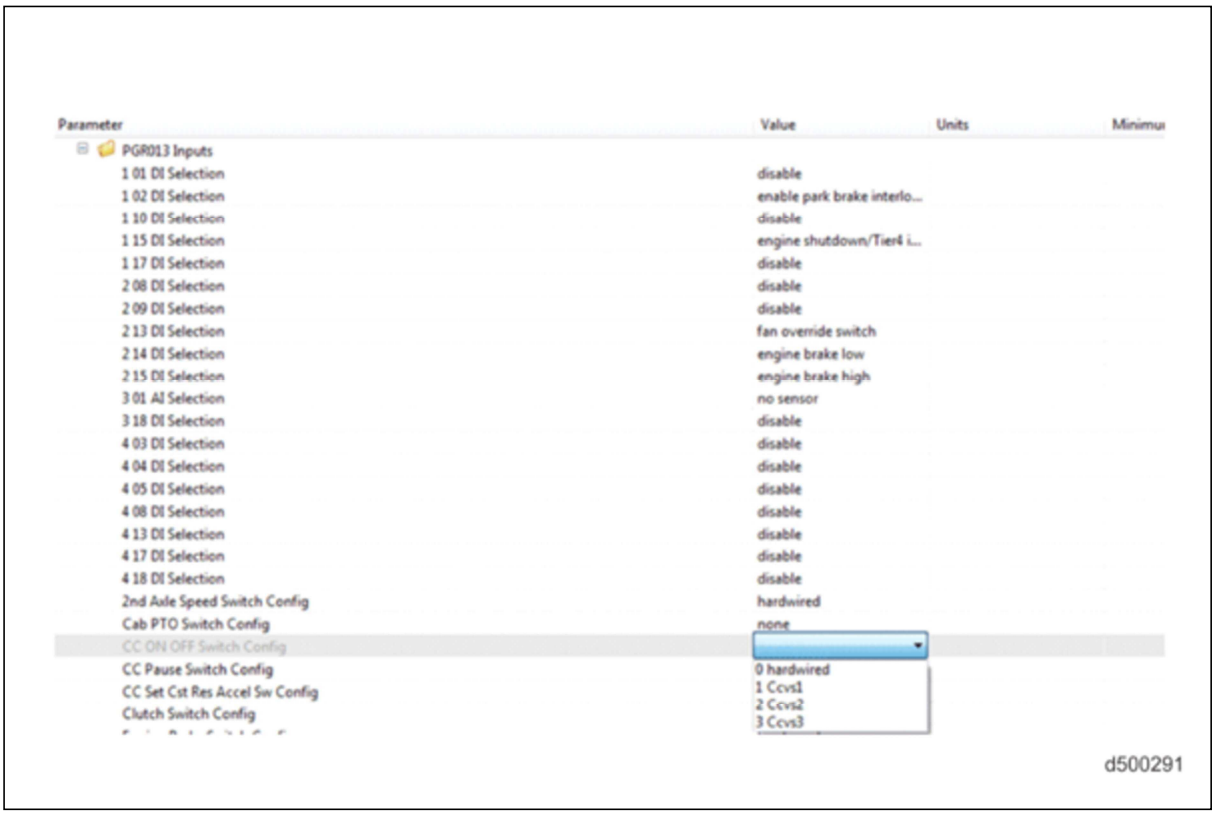
SPN 3846 (CPC) (GHG17)

284.1 SPN 3846/FMI 3 - GHG17

SPN 3846/FMI 3	
Description	CPC Input 1 14 Short to Voltage
Monitored Parameter	CPC Input 1/14
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameters for Cruise Control Enable are configured correctly. Are the parameters configured correctly?

4.a Yes; repair the short to power between pin 14 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

4.b No; configure the parameter correctly.

284.2 SPN 3846/FMI 4 - GHG17

SPN 3846/FMI 4	
Description	CPC Input 1 14 Short to Ground
Monitored Parameter	CPC Input 1/14
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

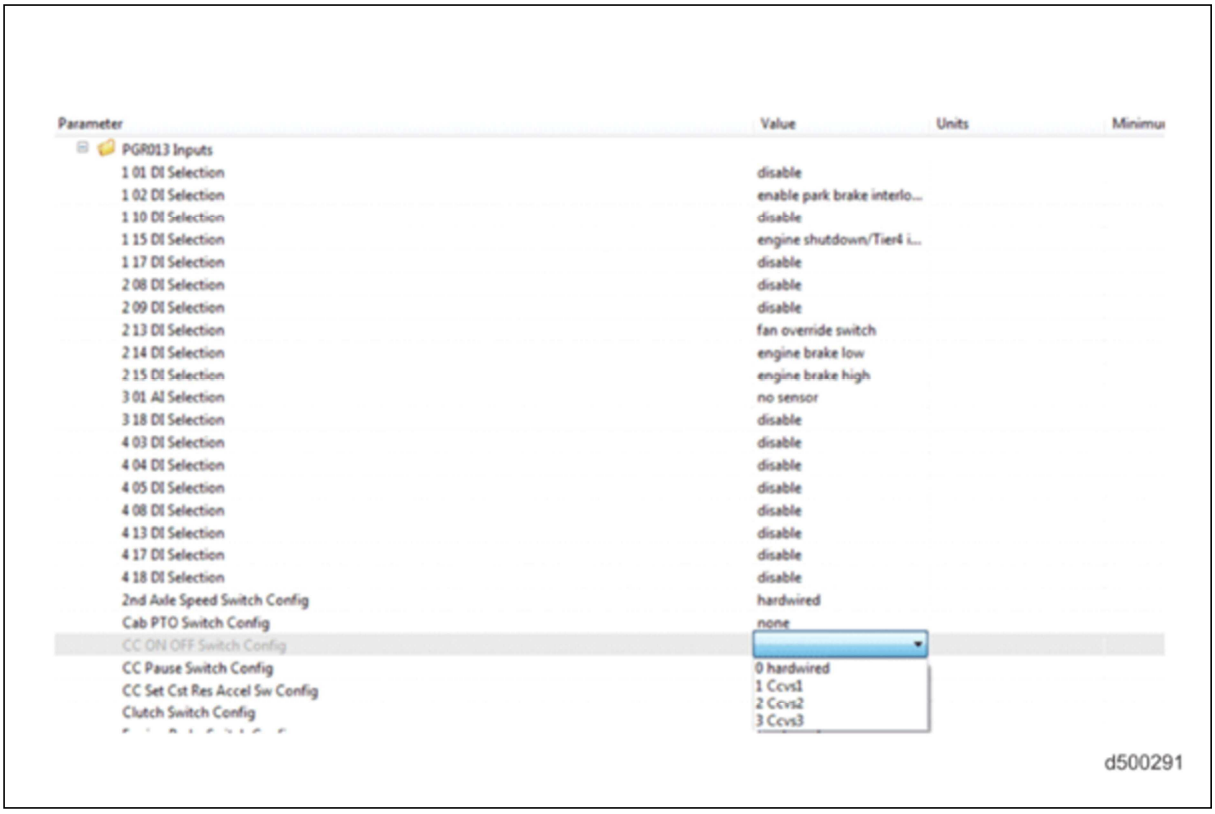
Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?

   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.

   1.b No; Go to step 2.

2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter for Cruise Control Enable is configured correctly. Is the parameter configured correctly?

   4.a Yes; repair the short to ground between pin 14 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

4.b No; configure the parameter correctly.

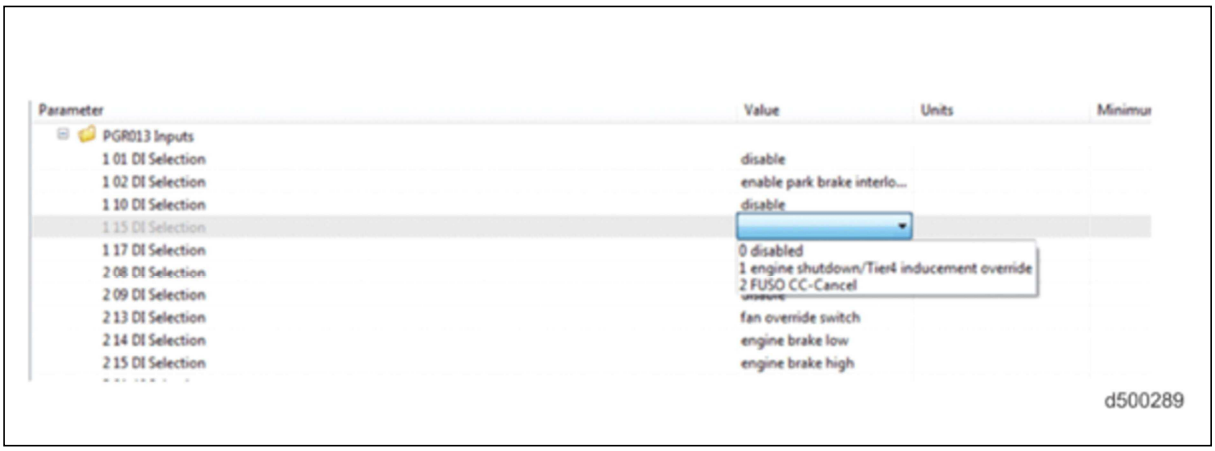
SPN 3847 (CPC) (GHG17)

285.1 SPN 3847/FMI 3 - GHG17

SPN 3847/FMI 3	
Description	CPC Input 1 15 Short to Voltage
Monitored Parameter	CPC Input 1/15
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 1 15 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   4.a Yes; repair the short to power between pin 15 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   4.b No; configure the parameters correctly.

285.2 SPN 3847/FMI 4 - GHG17

SPN 3847/FMI 4	
Description	CPC Input 1 15 Short to Ground
Monitored Parameter	CPC Input 1/15
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

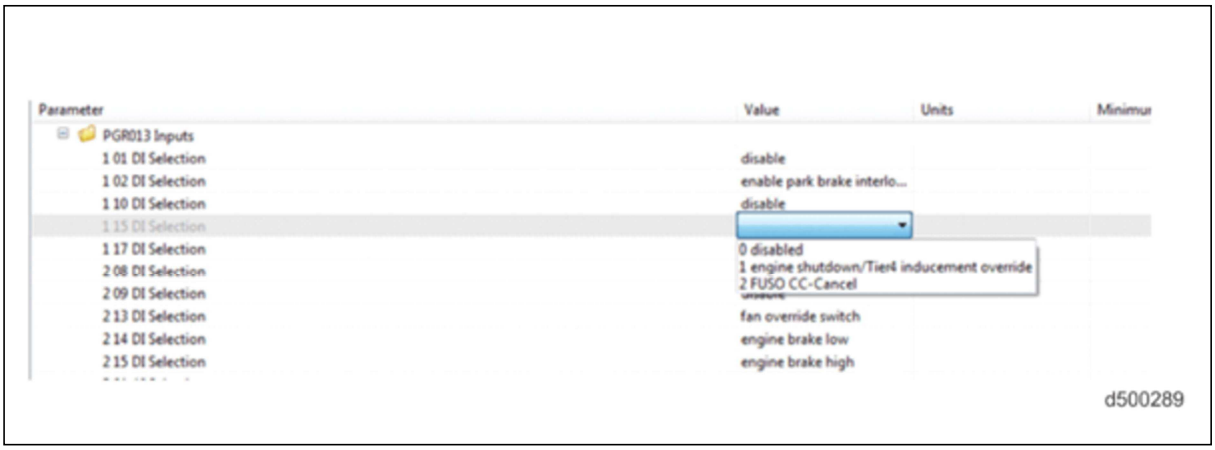
WARNING

ENGINE EXHAUST

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

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 1 15 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to ground between pin 15 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

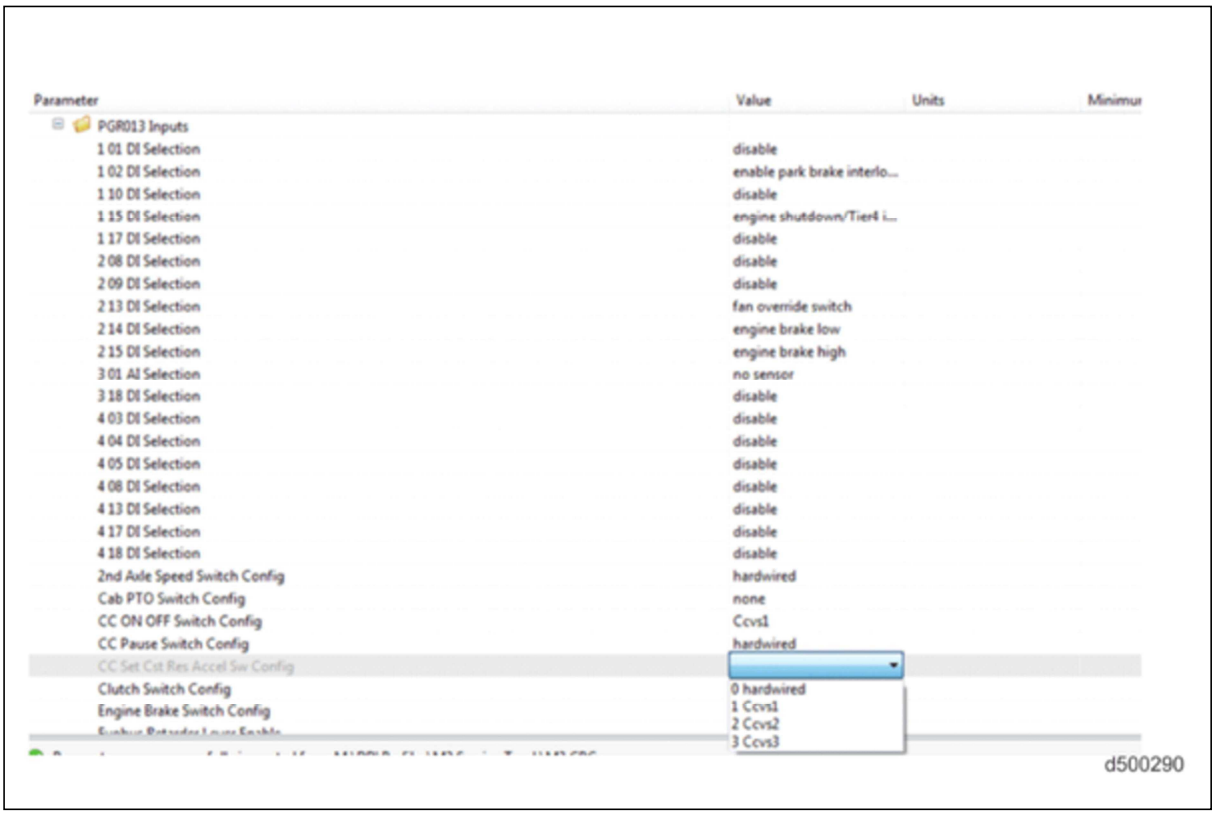
SPN 3848 (CPC) (GHG17)

287.1 SPN 3848/FMI 3 - GHG17

SPN 3848/FMI 3	
Description	CPC Input 1 16 Short to Voltage
Monitored Parameter	CPC Input 1/16
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to Resume/Accel Enable is configured correctly. Is the parameter configured correctly?

4.a Yes; repair the short to power between pin 16 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

4.b No; configure the parameter correctly.

287.2 SPN 3848/FMI 4 - GHG17

SPN 3848/FMI 4	
Description	CPC Input 1 16 Short to Ground
Monitored Parameter	CPC Input 1/16
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

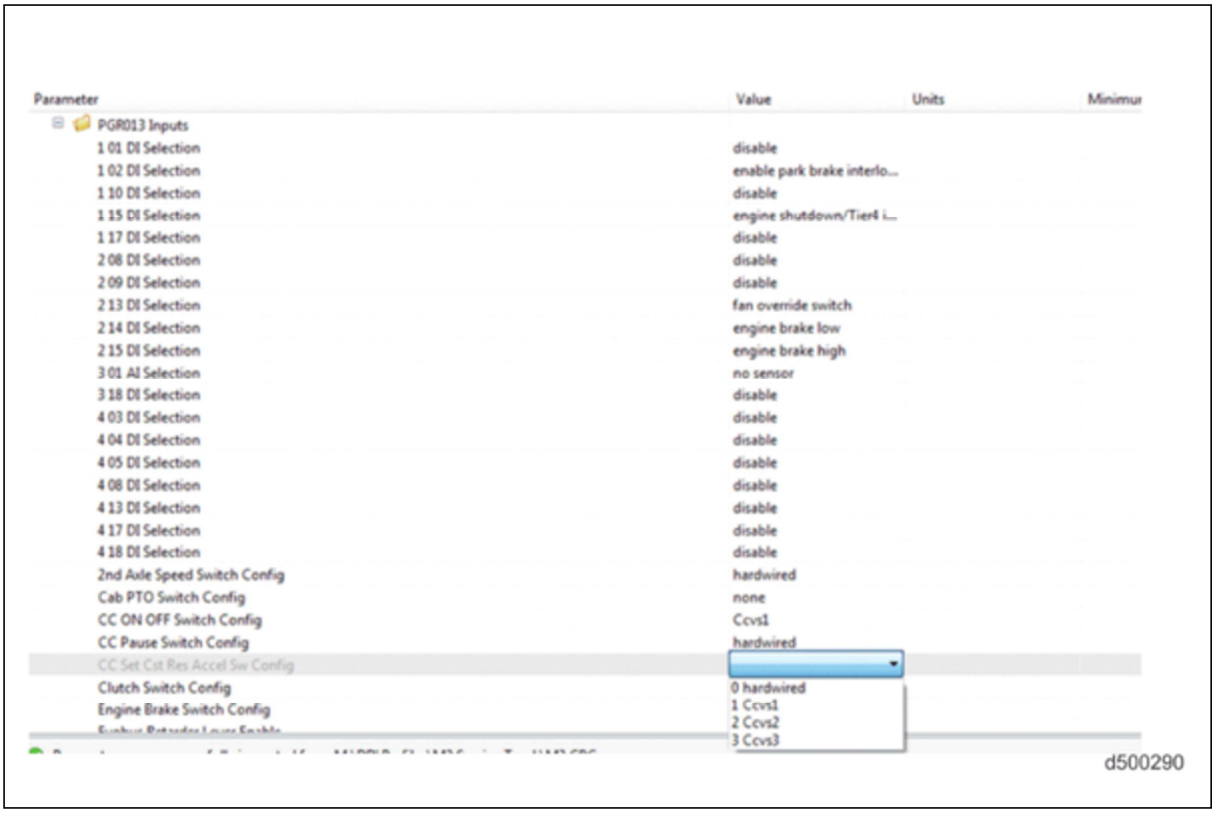
Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?

   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.

   1.b No; Go to step 2.

2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to Resume/Accel Enable is configured correctly. Is the parameter configured correctly?

   4.a Yes; repair the short to ground between pin 16 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

4.b No; configure the parameter correctly.

SPN 3849 (CPC) (GHG17)

288.1 SPN 3849/FMI 3 - GHG17

SPN 3849/FMI 3	
Description	CPC Input 1 17 Short to Voltage
Monitored Parameter	CPC Input 1/17
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On With Output Activation

WARNING

ENGINE EXHAUST

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

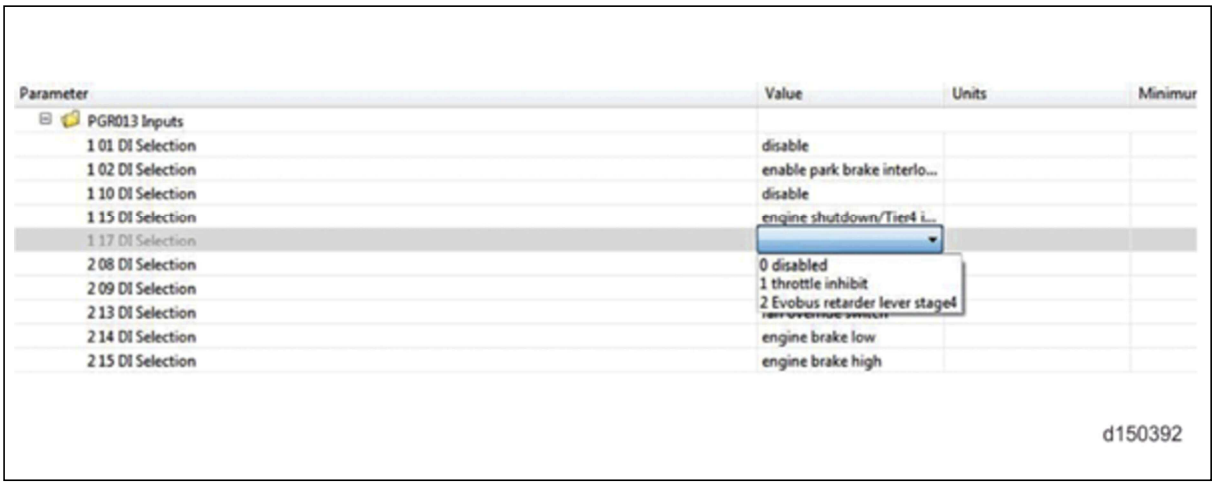
Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?

   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.

   1.b No; Go to step 2.

2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 1 17 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to power between pin 17 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

4.b No; configure the parameters correctly.

288.2 SPN 3849/FMI 4 - GHG17

SPN 3849/FMI 4	
Description	CPC Input 1 17 Short to Ground
Monitored Parameter	CPC Input 1/17
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

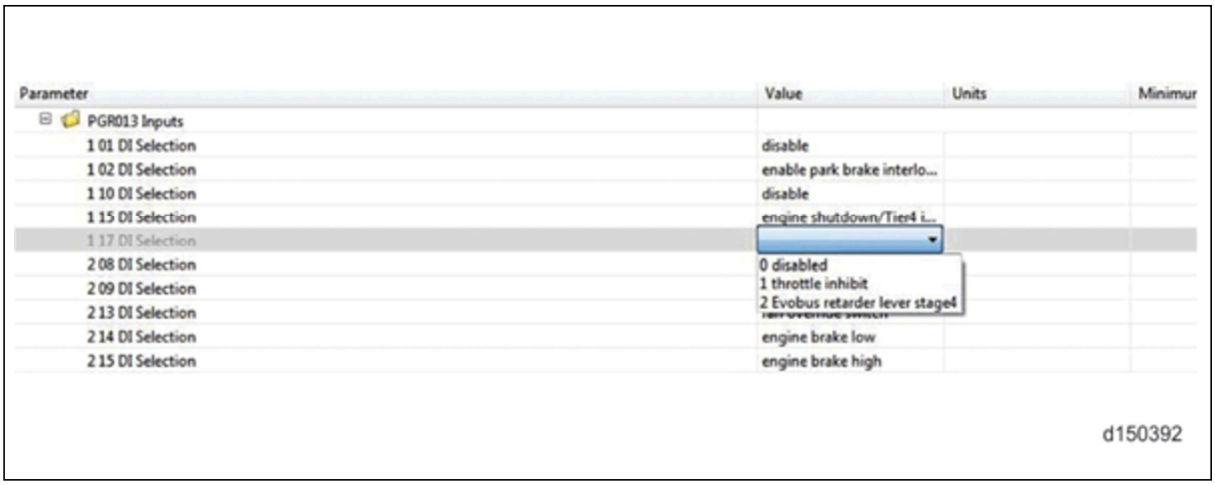
WARNING

ENGINE EXHAUST

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

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 1 17 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   4.a Yes; repair the short to ground between pin 17 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   4.b No; configure the parameters correctly.

SPN 3850 (CPC) (GHG17)

288.1 SPN 3850/FMI 3 - GHG17

SPN 3850/FMI 3	
Description	CPC Input 1 11 Short to Voltage
Monitored Parameter	CPC Input 1/11
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

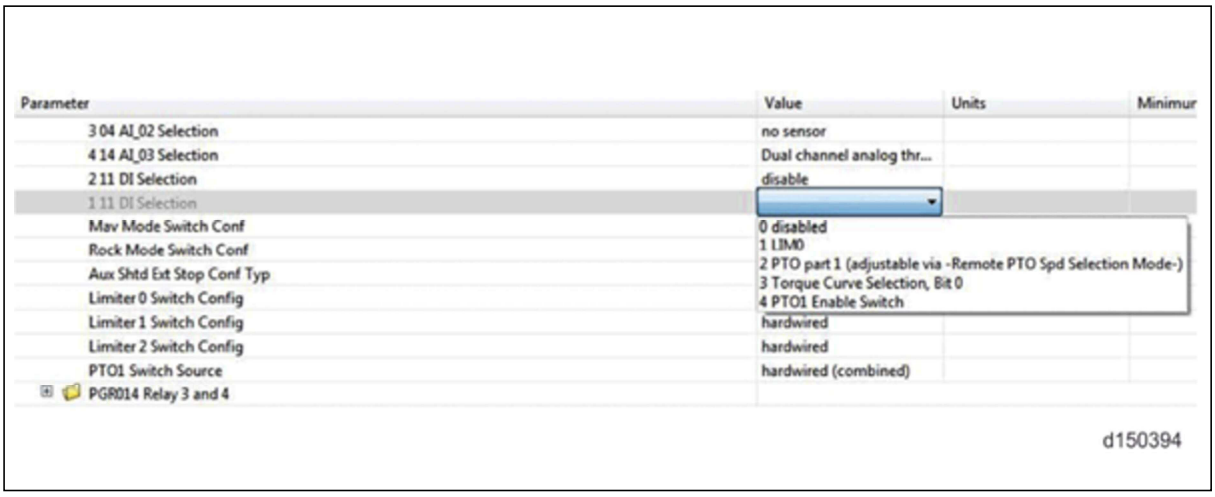
Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?

   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.

   1.b No; Go to step 2.

2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 1 11 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to power between pin 11 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

4.b No; configure the parameters correctly.

288.2 SPN 3850/FMI 4 - GHG17

SPN 3850/FMI 4	
Description	CPC Input 1 11 Short to Ground
Monitored Parameter	CPC Input 1/11
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

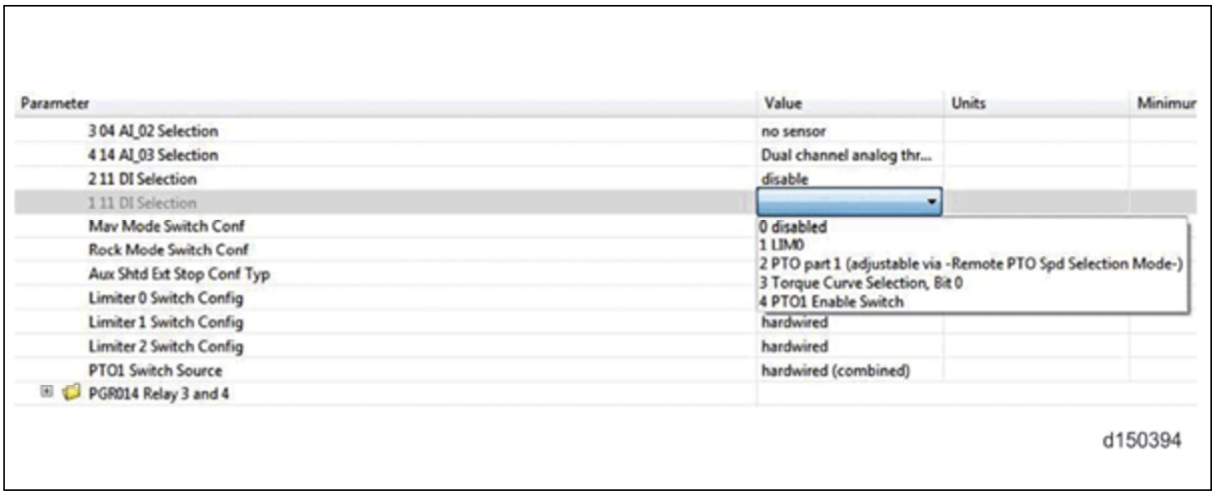
WARNING

ENGINE EXHAUST

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

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 1 11 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to ground between pin 11 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

SPN 3851 (CPC) (GHG17)

289.1 SPN 3851/FMI 3 - GHG17

SPN 3851/FMI 3	
Description	CPC Input 2 09 Short to Voltage
Monitored Parameter	CPC Input 2/09
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

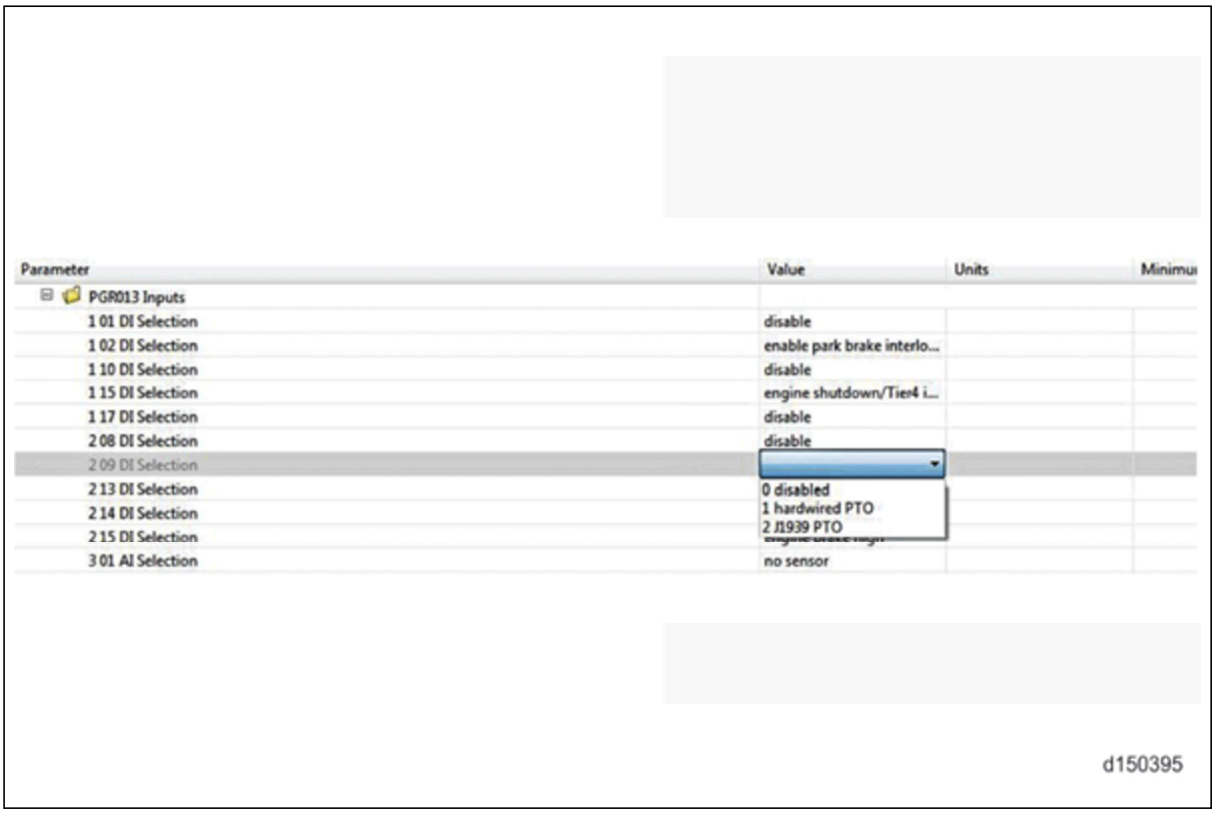
WARNING

ENGINE EXHAUST

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

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 2 09 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to power between pin 9 of the CPC connector #2 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

289.2 SPN 3851/FMI 4 - GHG17

SPN 3851/FMI 4	
Description	CPC Input 2 09 Short to Ground
Monitored Parameter	CPC Input 2/09
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

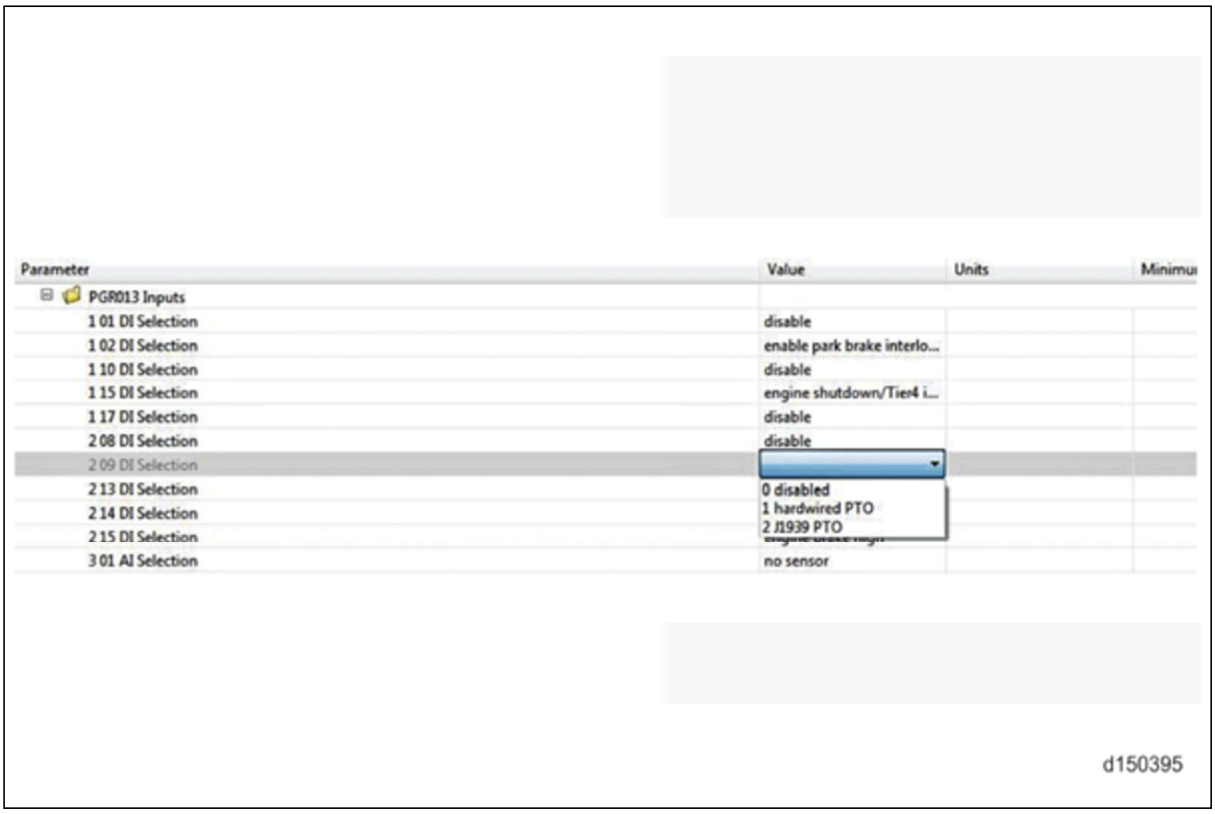
WARNING

ENGINE EXHAUST

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

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 2 09 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to ground between pin 9 of the CPC connector #2 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

SPN 3852 (CPC) (GHG17)

291.1 SPN 3852/FMI 3 - GHG17

SPN 3852/FMI 3	
Description	CPC Input 2 11 Short to Voltage
Monitored Parameter	CPC Input 2/11
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

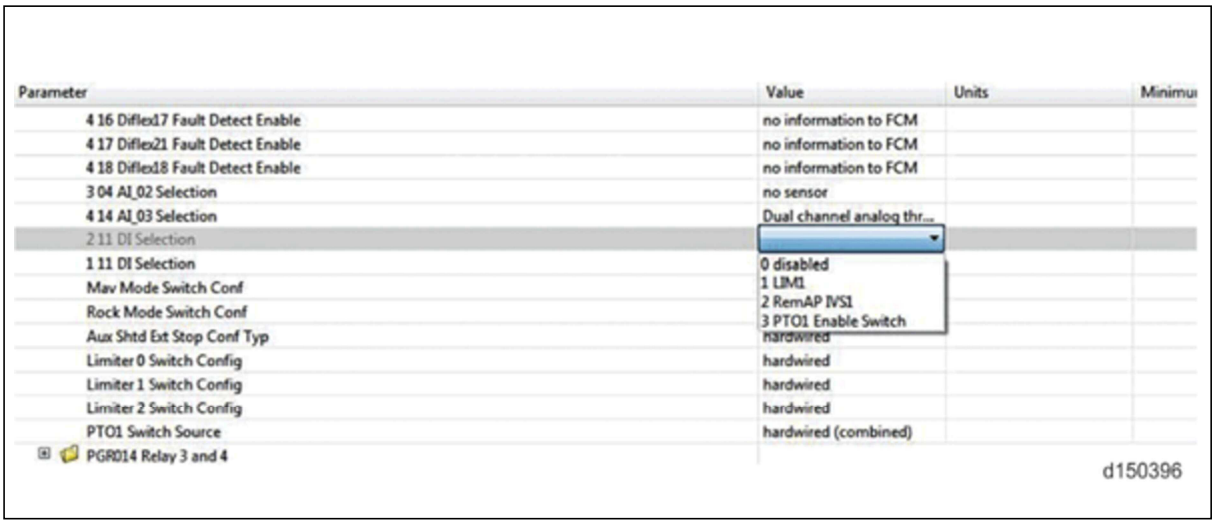
Check as follows:

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?

   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.

   1.b No; Go to step 2.

2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 2 11 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

4.a Yes; repair the short to power between pin 11 of the CPC connector #2 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

4.b No; configure the parameters correctly.

291.2 SPN 3852/FMI 4 - GHG17

SPN 3852/FMI 4	
Description	CPC Input 2 11 Short to Ground
Monitored Parameter	CPC Input 2/11
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

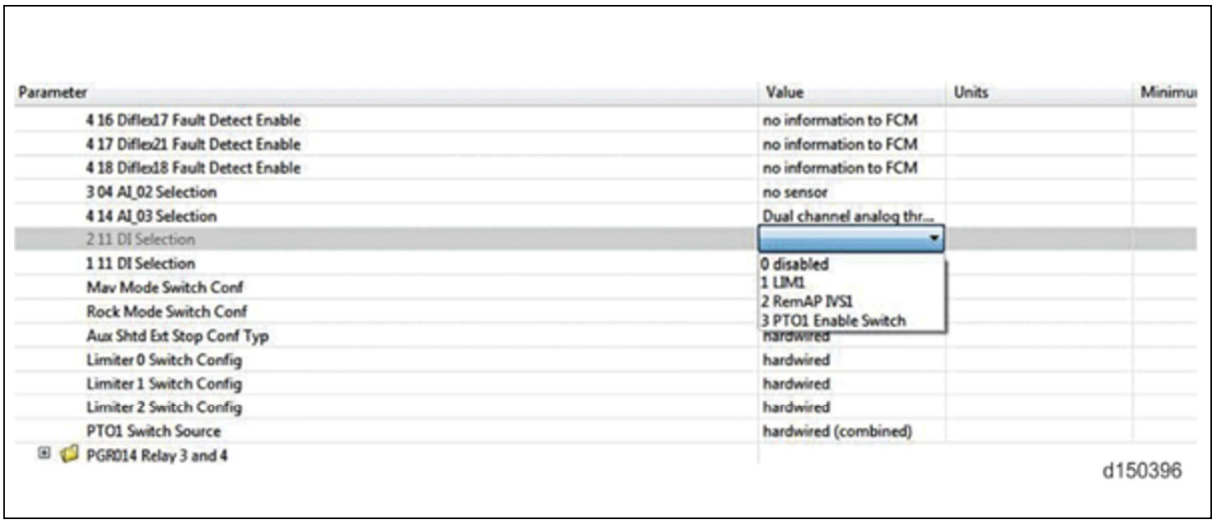
WARNING

ENGINE EXHAUST

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

Check as follows:

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 2 11 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to ground between pin 11 of the CPC connector #2 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

SPN 3853 (CPC) (GHG17)

292.1 SPN 3853/FMI 3 - GHG17

SPN 3853/FMI 3	
Description	CPC Input 2 12 Short to Voltage
Monitored Parameter	CPC Input 2/12
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

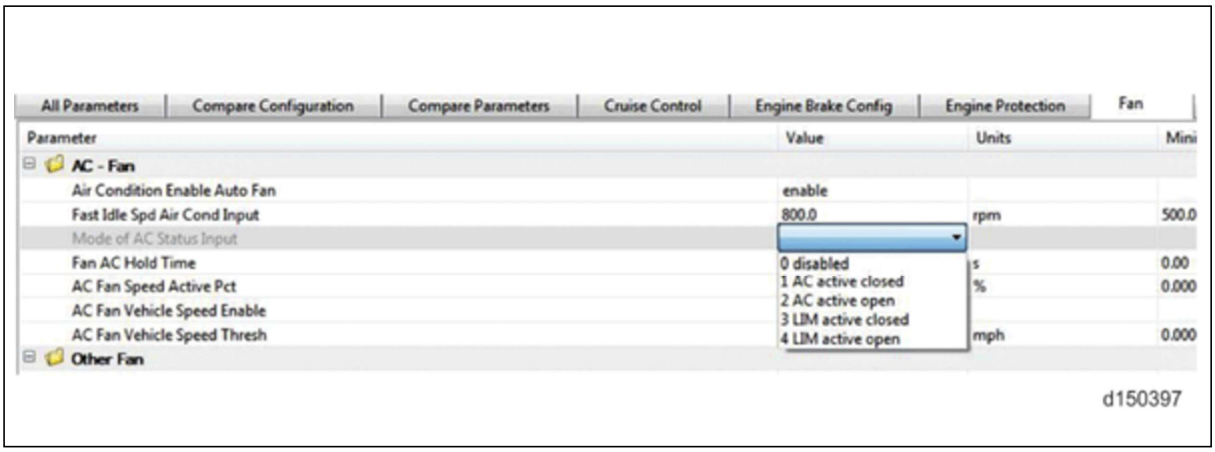
WARNING

ENGINE EXHAUST

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

Check as follows:

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to Mode of AC Status Input is configured correctly. Is the parameter configured correctly?
   - 4.a Yes; repair the short to power between pin 12 of the CPC connector #2 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

4.b No; configure the parameters correctly.

292.2 SPN 3853/FMI 4 - GHG17

SPN 3853/FMI 4	
Description	CPC Input 2 12 Short to Ground
Monitored Parameter	CPC Input 2/12
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

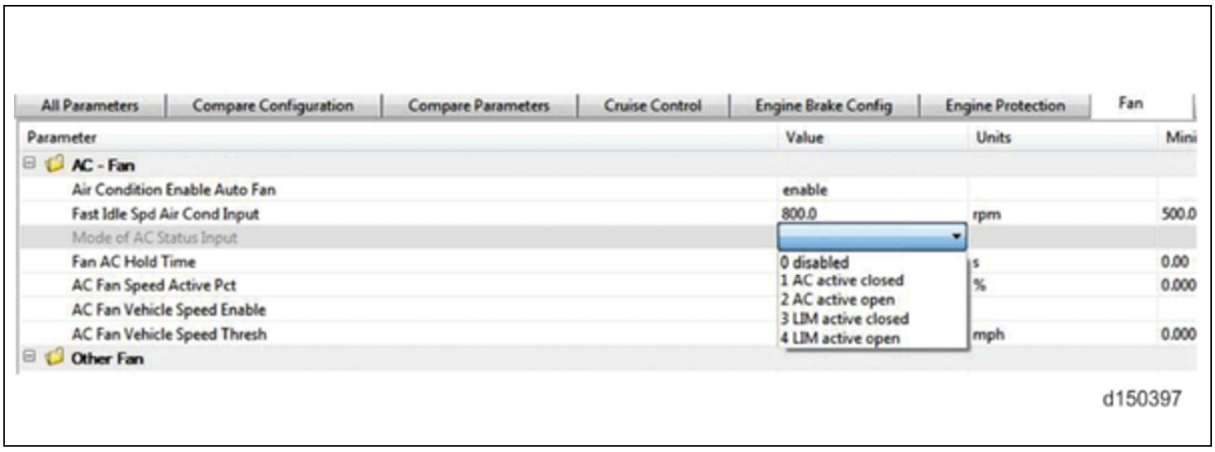
WARNING

ENGINE EXHAUST

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

Check as follows:

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to Mode of AC Status Input is configured correctly. Is the parameter configured correctly?
   - 4.a Yes; repair the short to ground between pin 12 of the CPC connector #2 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

SPN 3854 (CPC) (GHG17)

292.1 SPN 3854/FMI 3 - GHG17

SPN 3854/FMI 3	
Description	CPC Input 2 13 Short to Voltage
Monitored Parameter	CPC Input 2/13
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

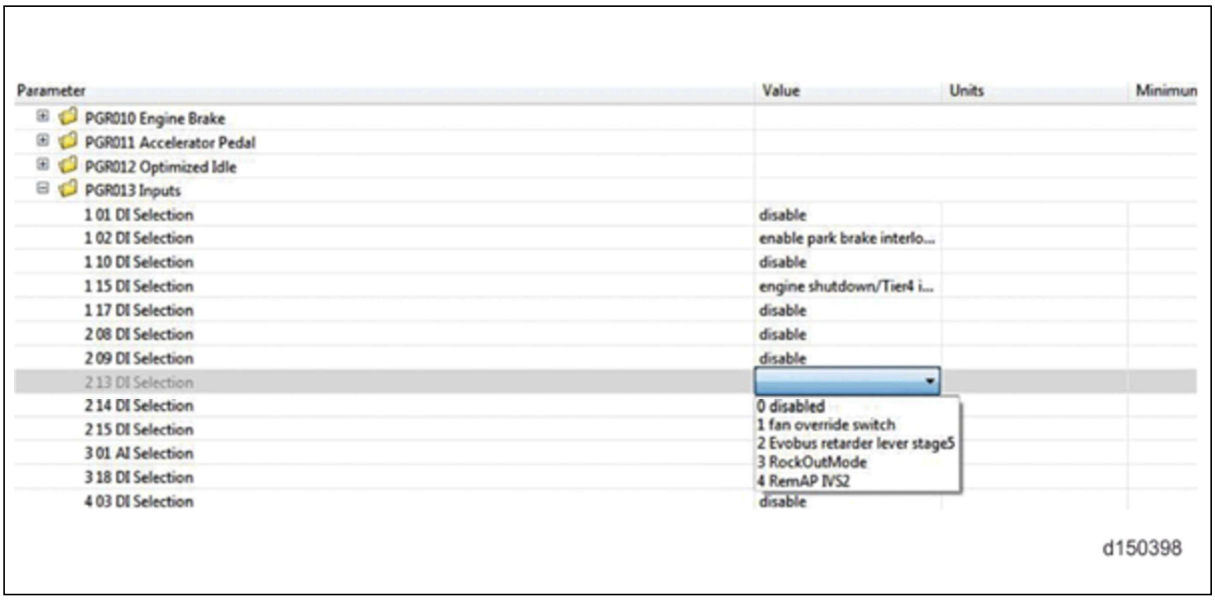
Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?

   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.

   1.b No; Go to step 2.

2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.

4. Verify that the parameter set to 2 13 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to power between pin 13 of the CPC connector #2 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

292.2 SPN 3854/FMI 4 - GHG17

SPN 3854/FMI 4	
Description	CPC Input 2 13 Short to Ground
Monitored Parameter	CPC Input 2/13
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

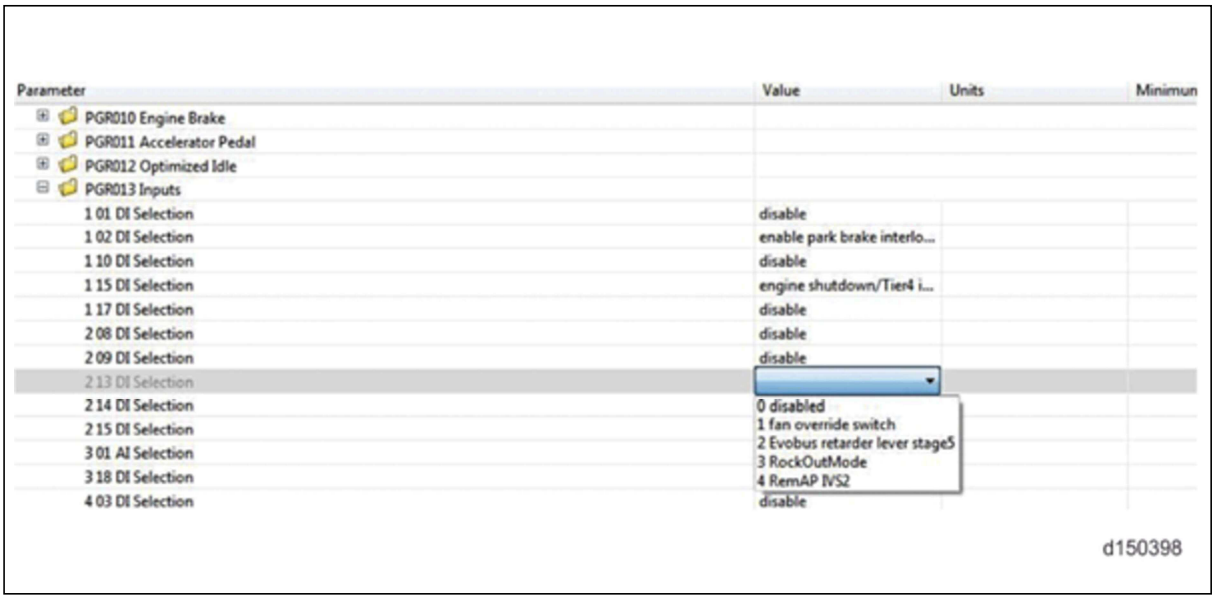
WARNING

ENGINE EXHAUST

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

Check as follows:

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 2 13 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

4.a Yes; repair the short to ground between pin 13 of the CPC connector #2 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

4.b No; configure the parameters correctly.

SPN 3855 (CPC) (GHG17)

293.1 SPN 3855/FMI 3 - GHG17

SPN 3855/FMI 3	
Description	CPC Input 2 14 Short to Voltage
Monitored Parameter	CPC Input 2/14
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

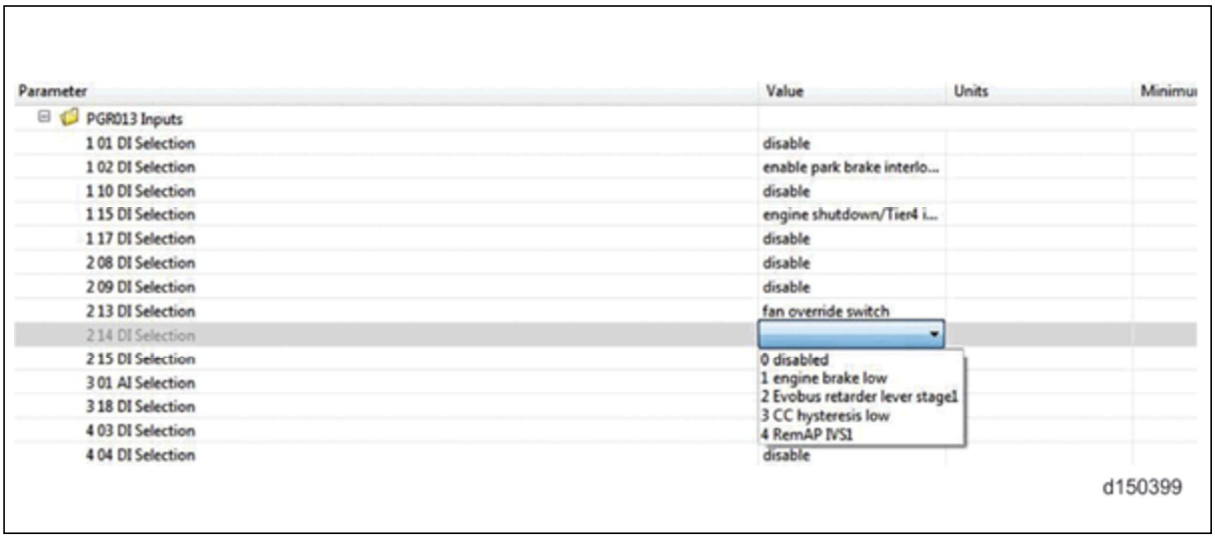
To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?

   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.

   1.b No; Go to step 2.

2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 2 14 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to power between pin 14 of the CPC connector #2 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

4.b No; configure the parameters correctly.

293.2 SPN 3855/FMI 4 - GHG17

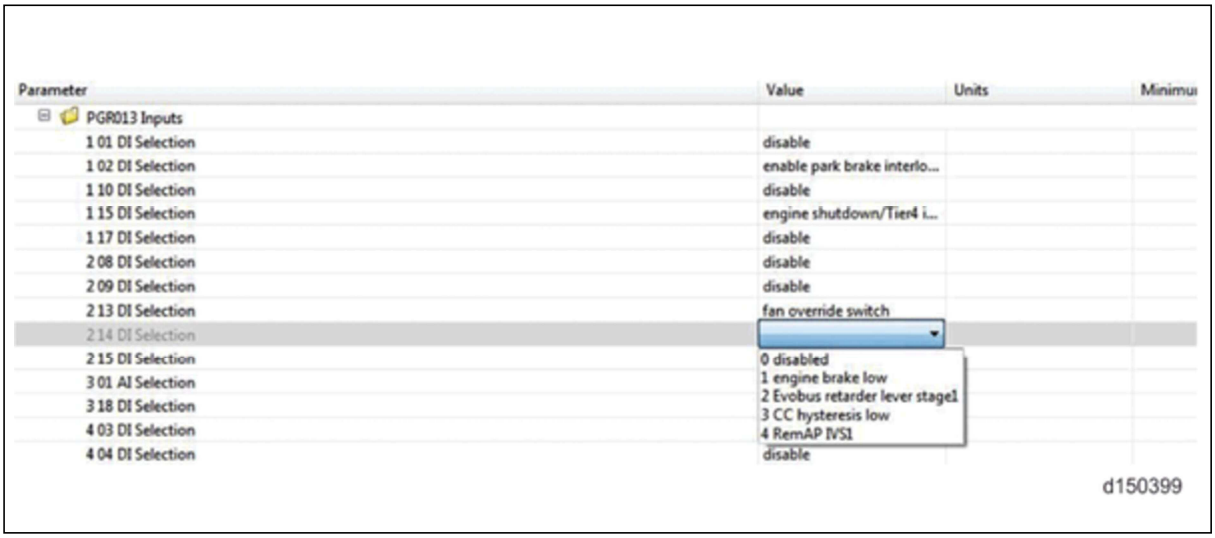
SPN 3855/FMI 4	
Description	CPC Input 2 14 Short to Ground
Monitored Parameter	CPC Input 2/14
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 2 14 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to ground between pin 14 of the CPC connector #2 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

SPN 3856 (CPC) (GHG17)

295.1 SPN 3856/FMI 3 - GHG17

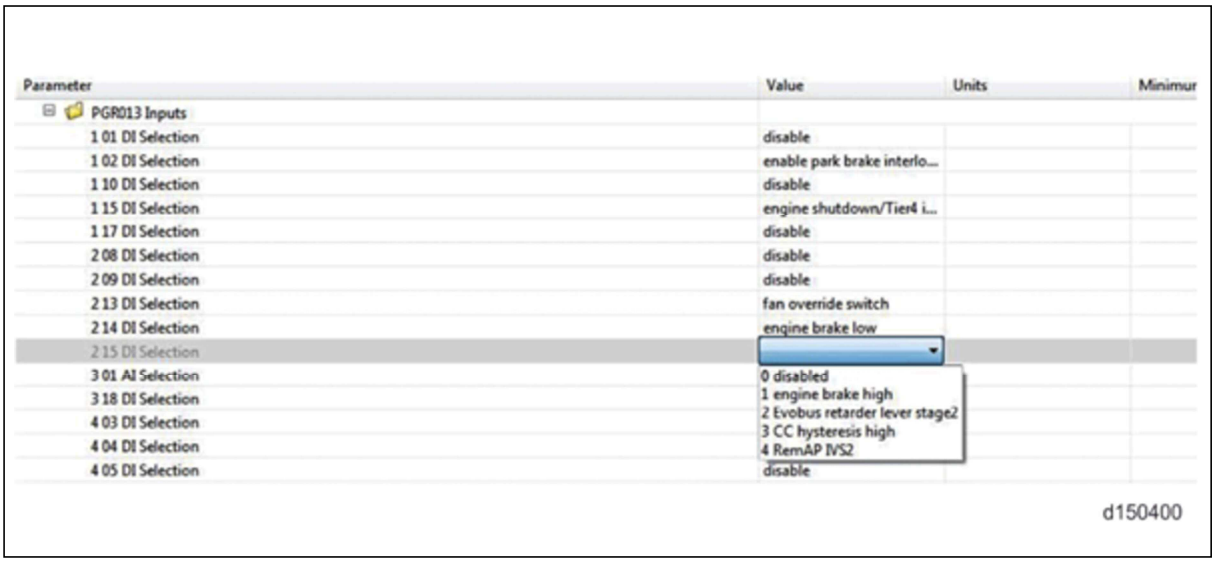
SPN 3856/FMI 3	
Description	CPC Input 2 15 Short to Voltage
Monitored Parameter	CPC Input 2/15
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 2 15 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

4.a Yes; repair the short to power between pin 15 of the CPC connector #2 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

4.b No; configure the parameters correctly.

295.2 SPN 3856/FMI 4 - GHG17

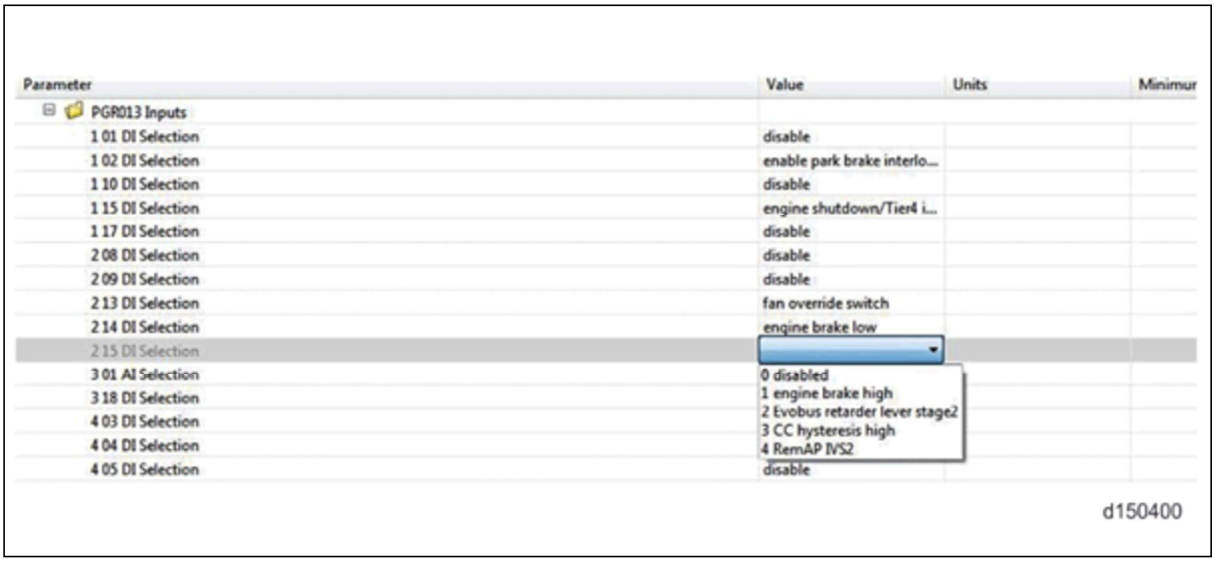
SPN 3856/FMI 4	
Description	CPC Input 2 15 Short to Ground
Monitored Parameter	CPC Input 2/15
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 2 15 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to ground between pin 15 of the CPC connector #2 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

SPN 3857 (CPC) (GHG17)

296.1 SPN 3857/FMI 3 - GHG17

SPN 3857/FMI 3	
Description	CPC Input 2 07 Short to Voltage
Monitored Parameter	CPC Input 2/07
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

WARNING

PERSONAL INJURY

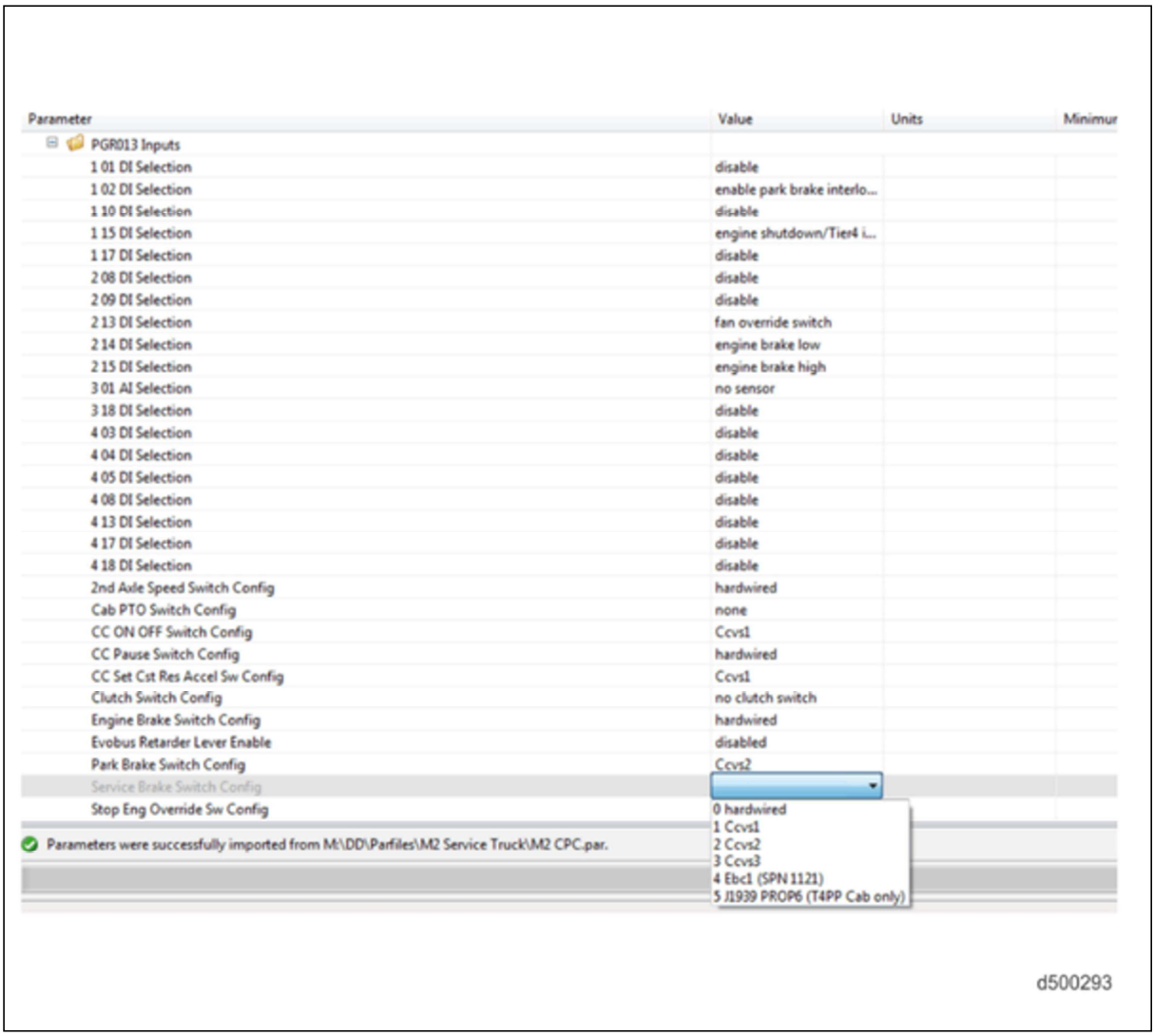
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to Service Brake Switch Config is configured correctly. Is the parameter configured correctly?

   4.a Yes; repair the short to power between pin 7 of the CPC connector #2 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

296.2 SPN 3857/FMI 4 - GHG17

SPN 3857/FMI 4	
Description	CPC Input 2 07 Short to Ground
Monitored Parameter	CPC Input 2/07
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

WARNING

PERSONAL INJURY

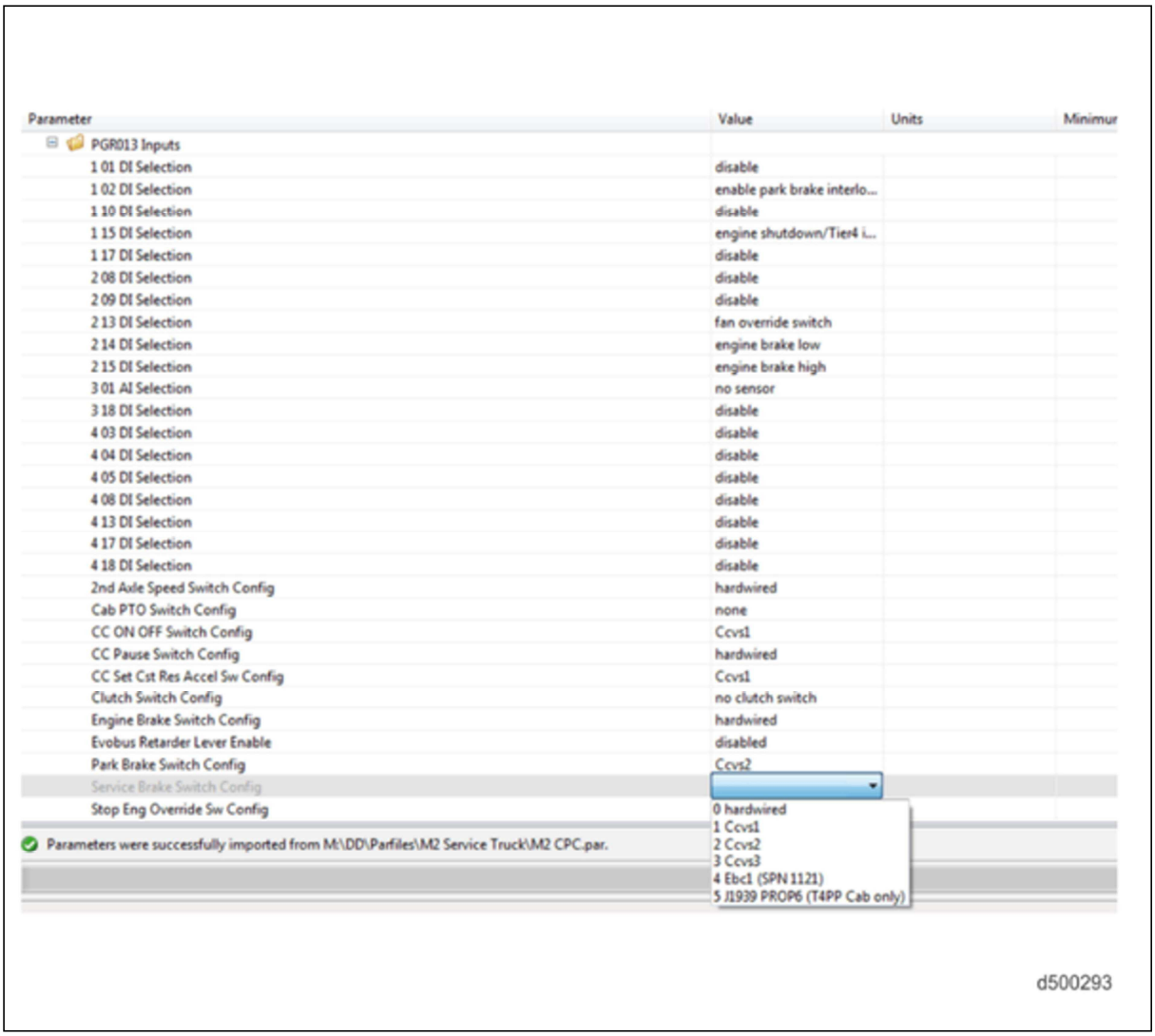
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to Service Brake Switch Config is configured correctly. Is the parameter configured correctly?

   4.a Yes; repair the short to ground between pin 7 of the CPC connector #2 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

SPN 3858 (CPC) (GHG17)

297.1 SPN 3858/FMI 3 - GHG17

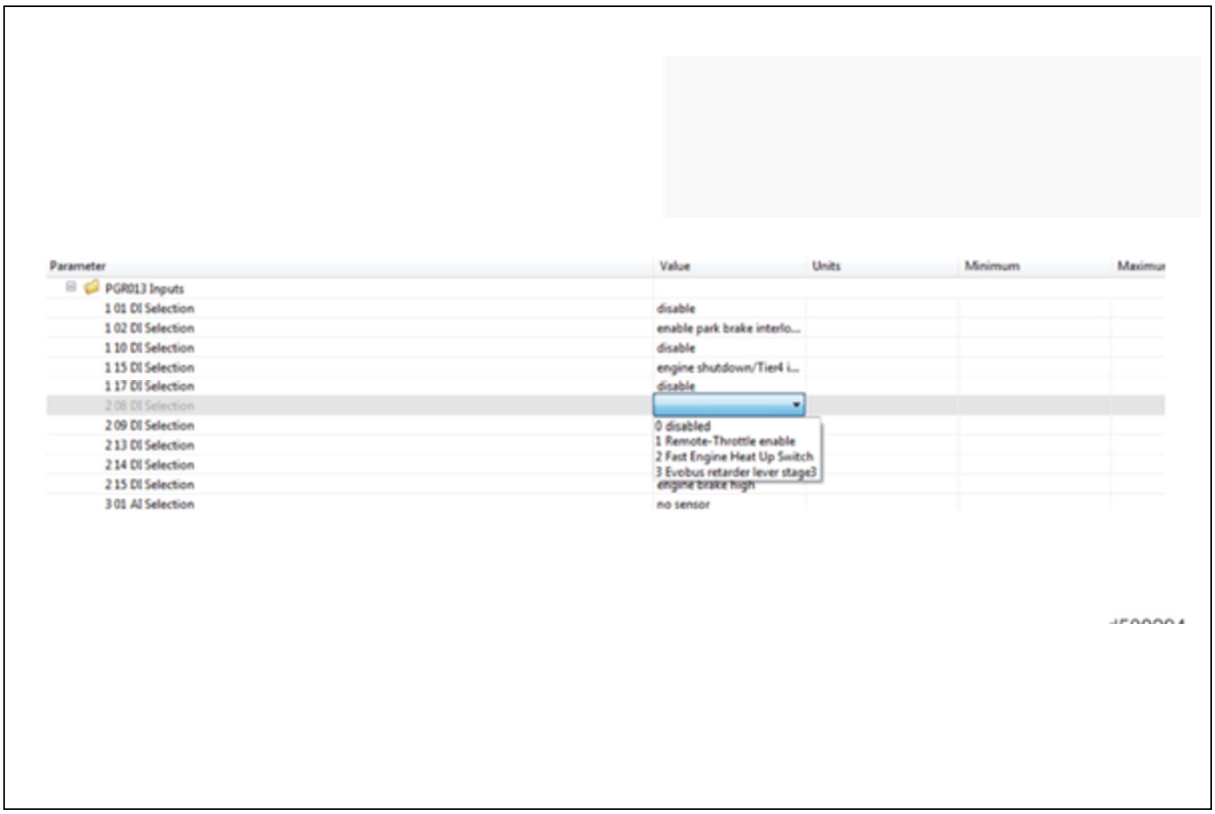
SPN 3858/FMI 3	
Description	CPC Input 2 08 Short to Voltage
Monitored Parameter	CPC Input 2/08
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 2 08 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to power between pin 8 of the CPC connector #2 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

297.2 SPN 3858/FMI 4 - GHG17

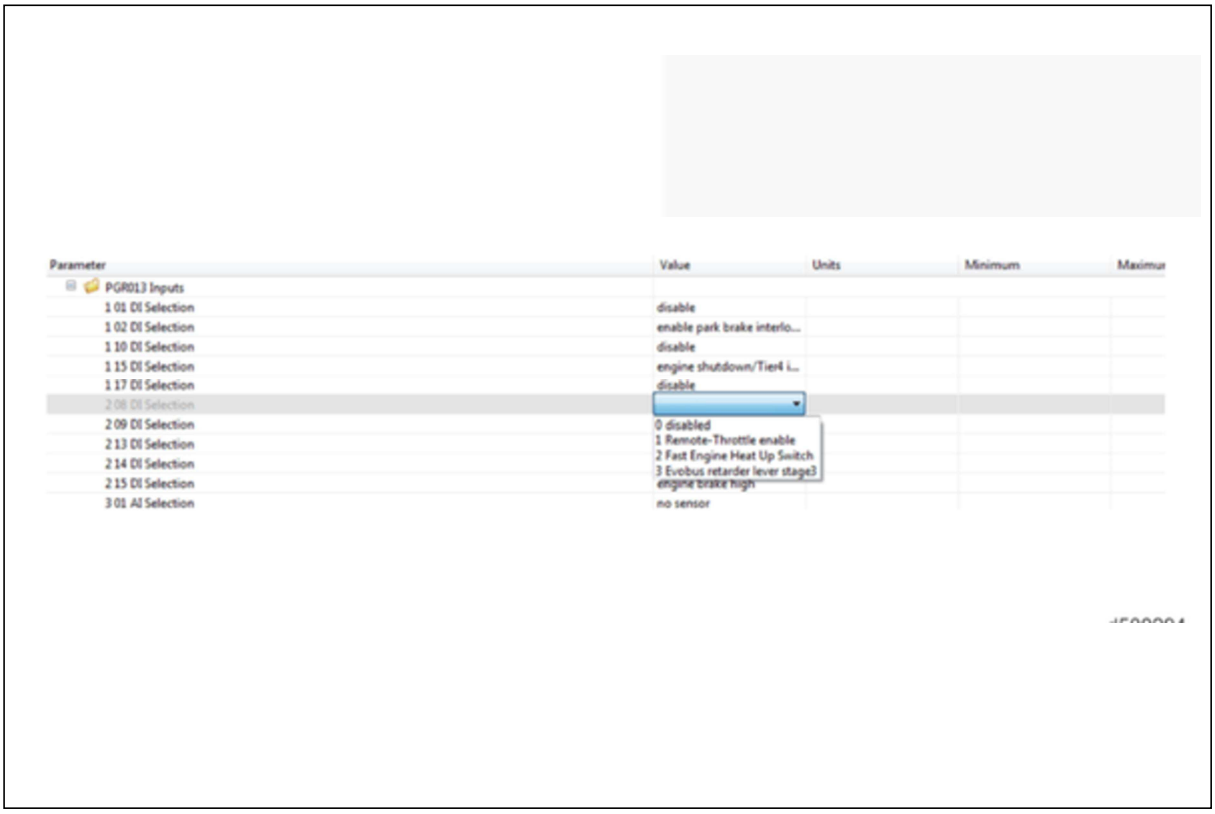
SPN 3858/FMI 4	
Description	CPC Input 2 08 Short to Ground
Monitored Parameter	CPC Input 2/08
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 2 08 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to ground between pin 8 of the CPC connector #2 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

SPN 3859 (CPC) (GHG17)

297.1 SPN 3859/FMI 3 - GHG17

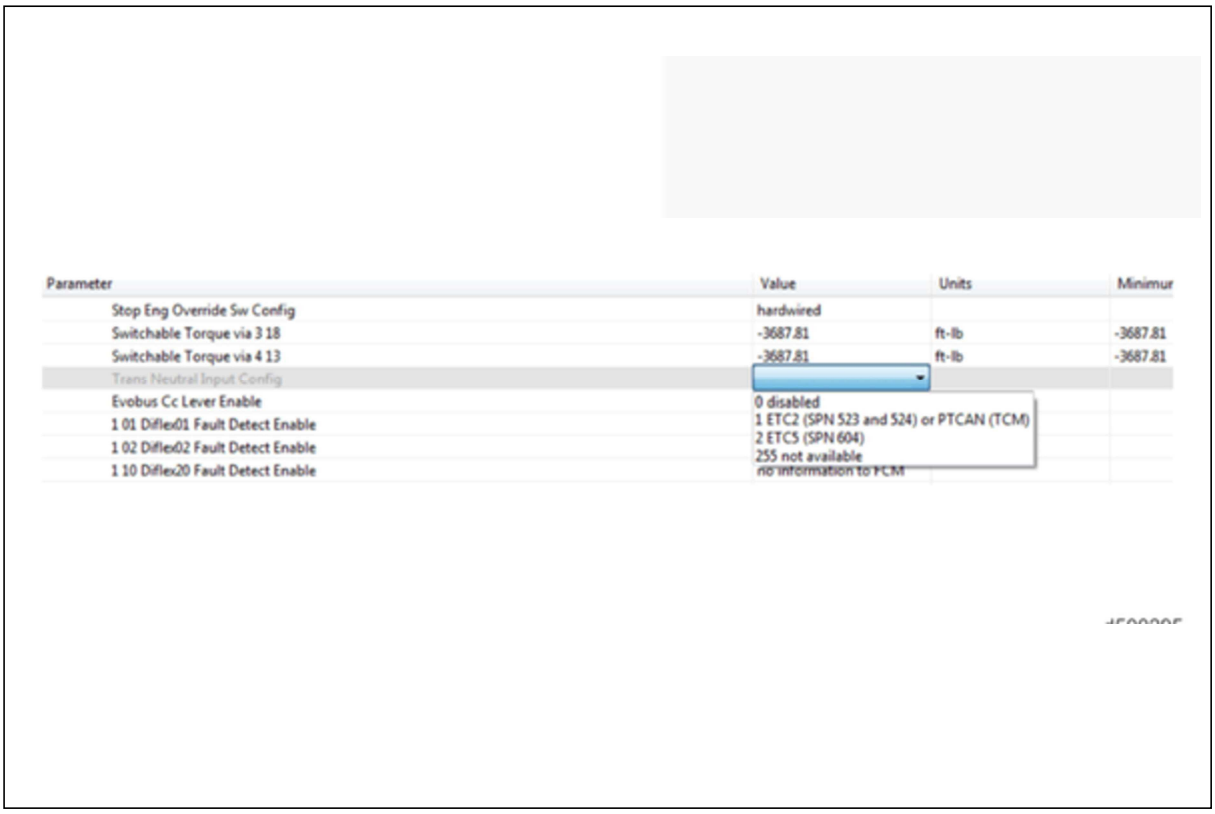
SPN 3859/FMI 3	
Description	CPC Input 4 16 Short to Voltage
Monitored Parameter	CPC Input 4/16
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to Trans Neutral Input Config is configured correctly. Is the parameter configured correctly?
   - 4.a Yes; repair the short to power between pin 16 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

297.2 SPN 3859/FMI 4 - GHG17

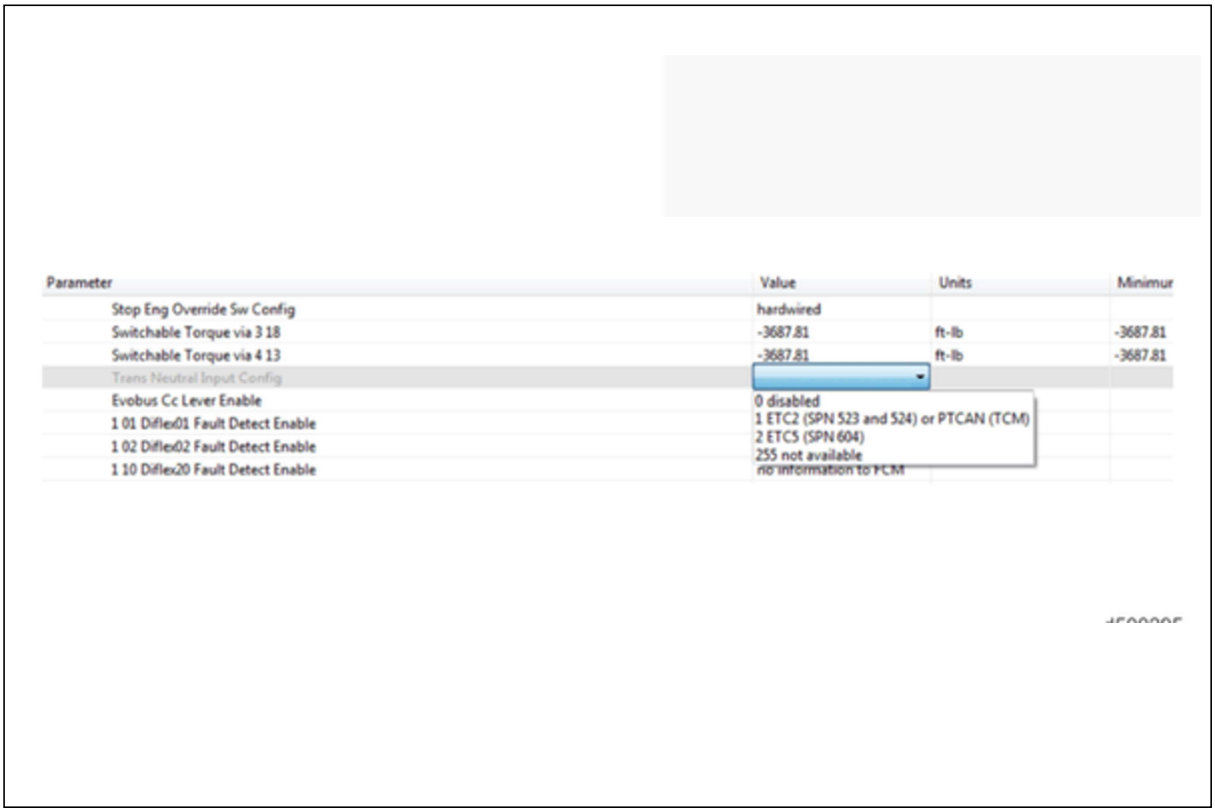
SPN 3859/FMI 4	
Description	CPC Input 4 16 Short to Ground
Monitored Parameter	CPC Input 4/16
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to Trans Neutral Input Config is configured correctly. Is the parameter configured correctly?

   4.a Yes; repair the short to ground between pin 16 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

SPN 3860 (CPC) (GHG17)

298.1 SPN 3860/FMI 3 - GHG17

SPN 3860/FMI 3	
Description	CPC Input 4 18 Short to Voltage
Monitored Parameter	CPC Input 4/18
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

WARNING

PERSONAL INJURY

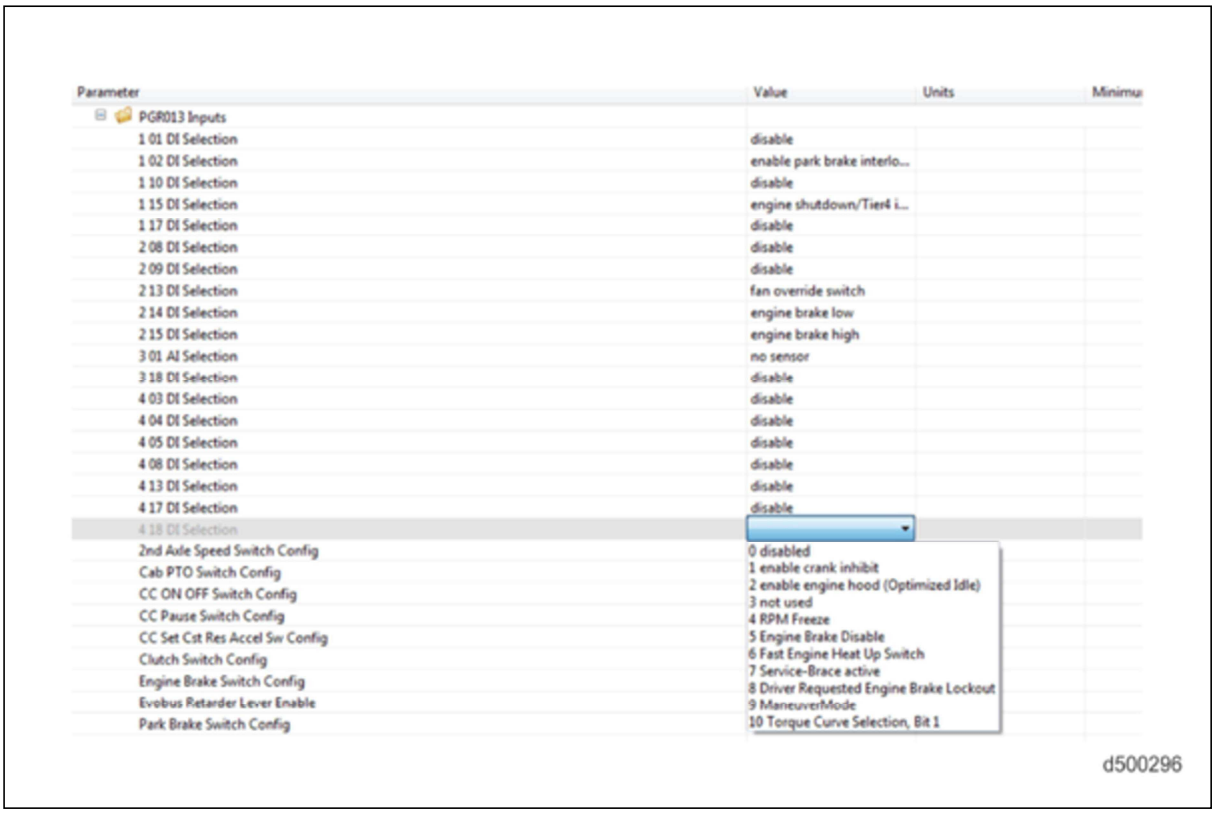
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 18 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to power between pin 18 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

298.2 SPN 3860/FMI 4 - GHG17

SPN 3860/FMI 4	
Description	CPC Input 4 18 Short to Ground
Monitored Parameter	CPC Input 4/18
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

WARNING

PERSONAL INJURY

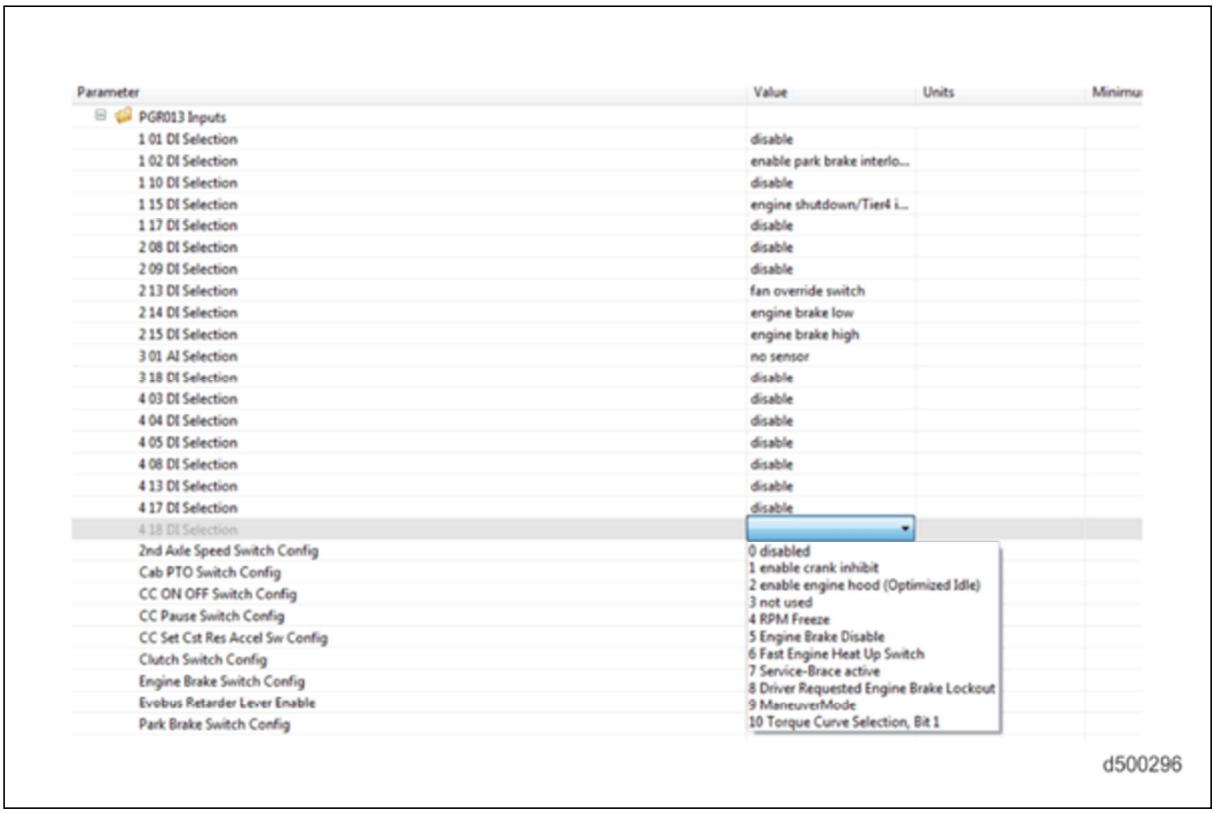
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 18 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to ground between pin 18 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

SPN 3861 (CPC) (GHG17)

300.1 SPN 3861/FMI 3 - GHG17

SPN 3861/FMI 3	
Description	CPC Input 4 13 Short to Voltage
Monitored Parameter	CPC Input 4/13
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

WARNING

PERSONAL INJURY

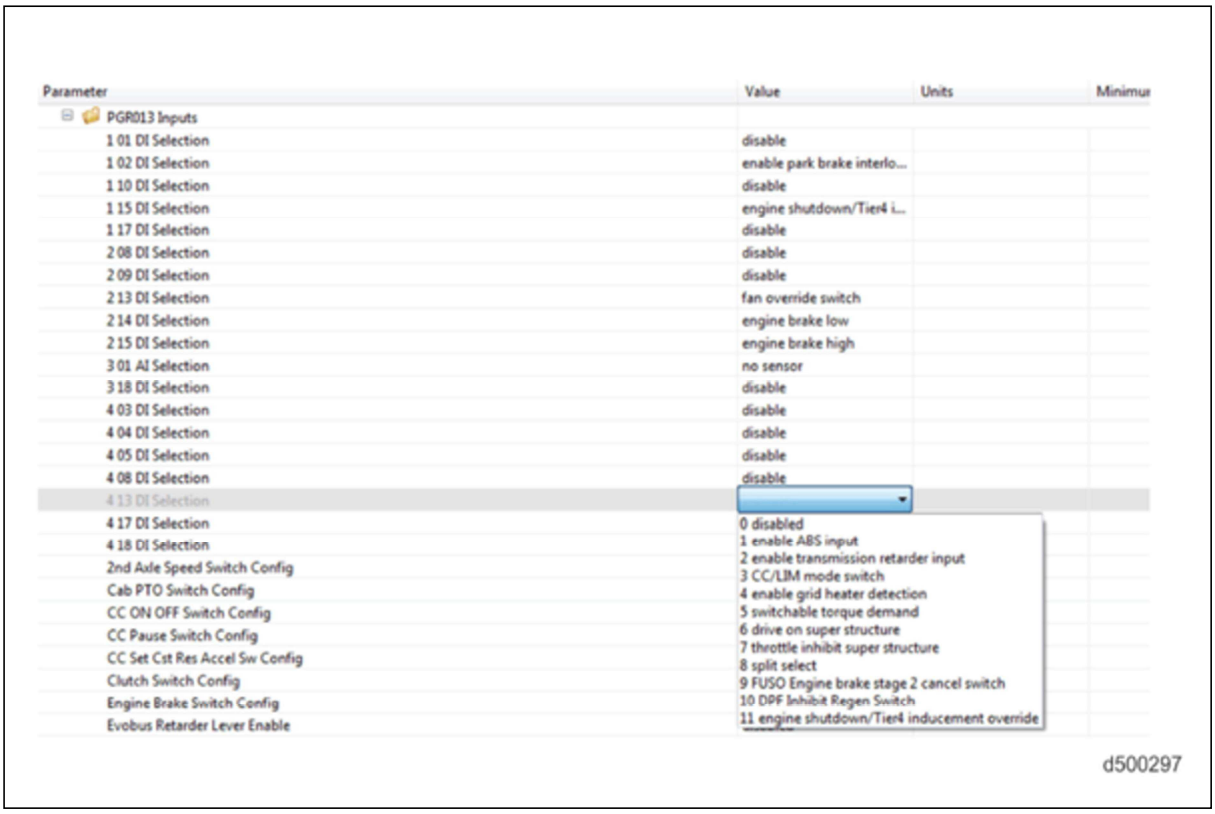
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 13 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to power between pin 13 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

300.2 SPN 3861/FMI 4 - GHG17

SPN 3861/FMI 4	
Description	CPC Input 4 13 Short to Ground
Monitored Parameter	CPC Input 4/13
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

PERSONAL INJURY

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WARNING

PERSONAL INJURY

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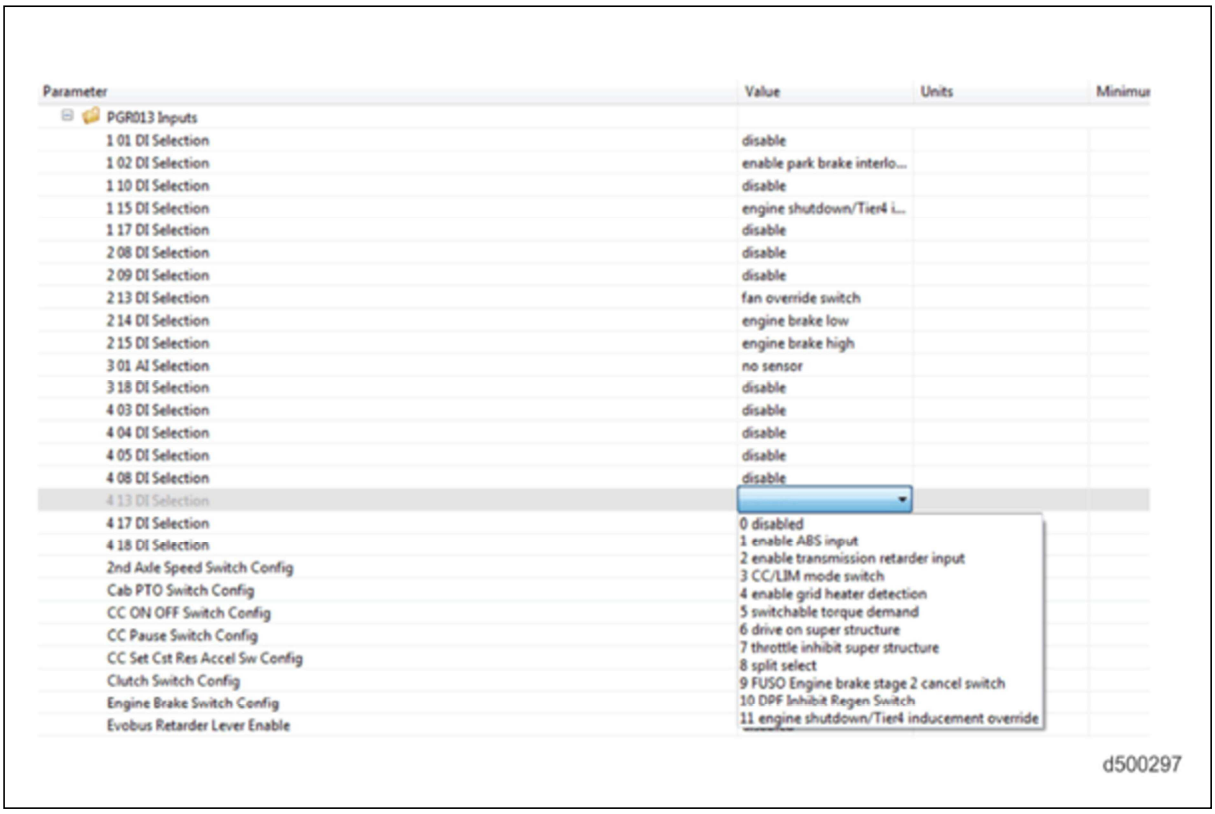
WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 13 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to ground between pin 13 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

SPN 3862 (CPC) (GHG17)

301.1 SPN 3862/FMI 3 - GHG17

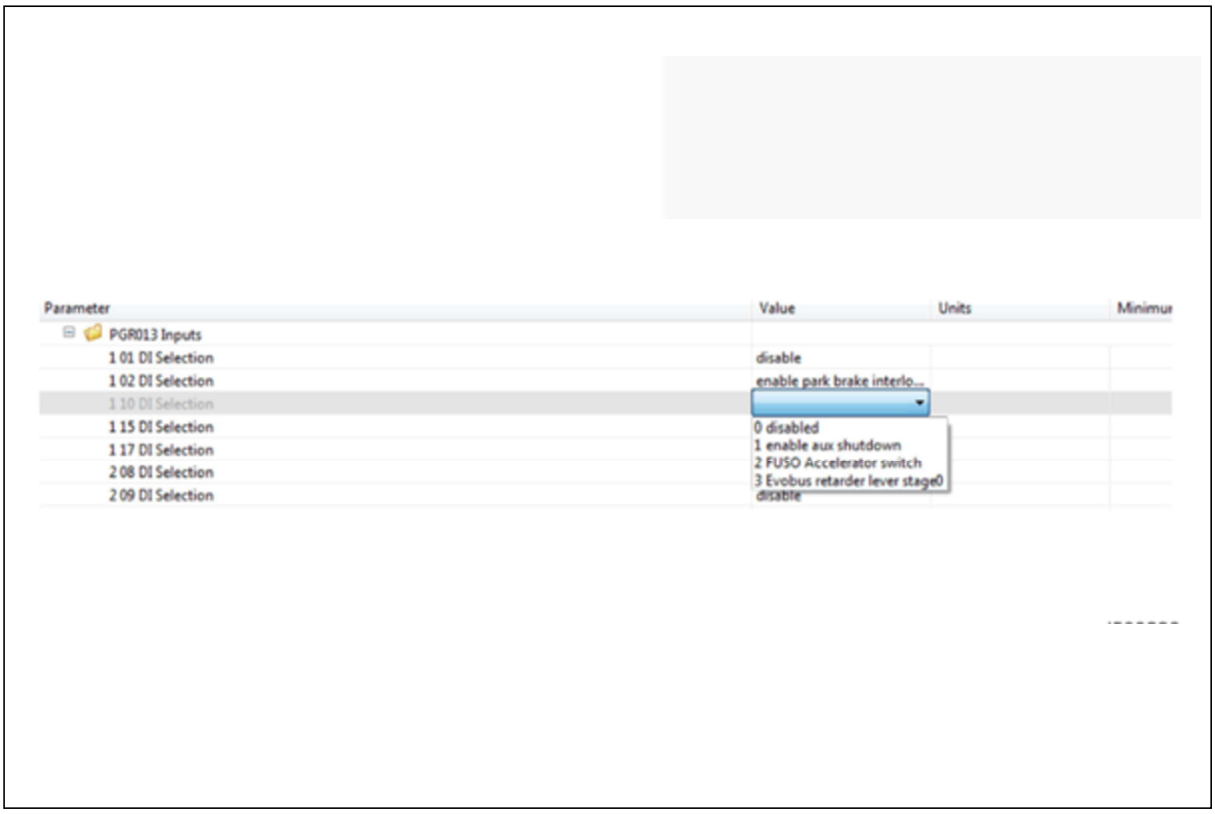
SPN 3862/FMI 3	
Description	CPC Input 1 10 Short to Voltage
Monitored Parameter	CPC Input 1/10
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 1 10 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to power between pin 10 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

301.2 SPN 3862/FMI 4 - GHG17

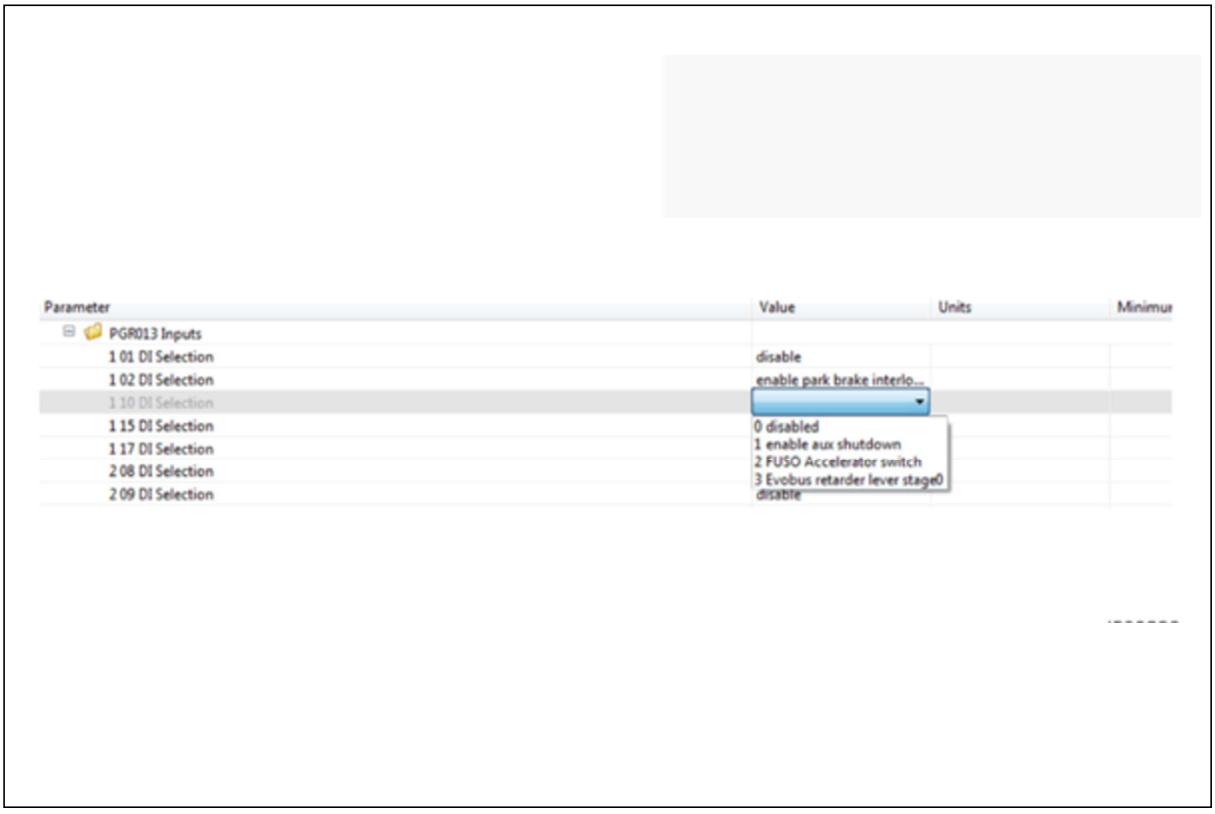
SPN 3862/FMI 4	
Description	CPC Input 1 10 Short to Ground
Monitored Parameter	CPC Input 1/10
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 1 10 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to ground between pin 10 of the CPC connector #1 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

SPN 3863 (CPC) (GHG17)

301.1 SPN 3863/FMI 3 - GHG17

SPN 3863/FMI 3	
Description	CPC Input 4 17 Short to Voltage
Monitored Parameter	CPC Input 4/17
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

WARNING

PERSONAL INJURY

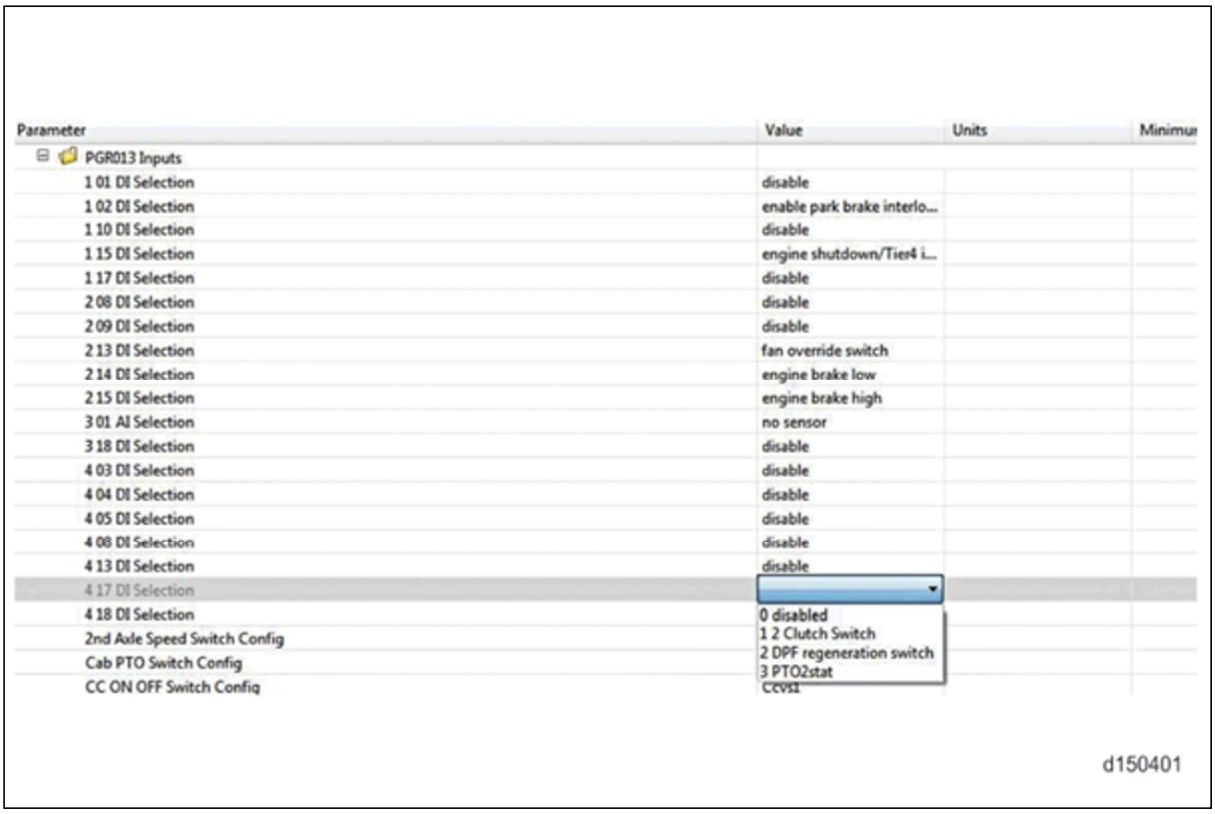
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 17 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to power between pin 17 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

301.2 SPN 3863/FMI 4 - GHG17

SPN 3863/FMI 4	
Description	CPC Input 4 17 Short to Ground
Monitored Parameter	CPC Input 4/17
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

PERSONAL INJURY

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WARNING

PERSONAL INJURY

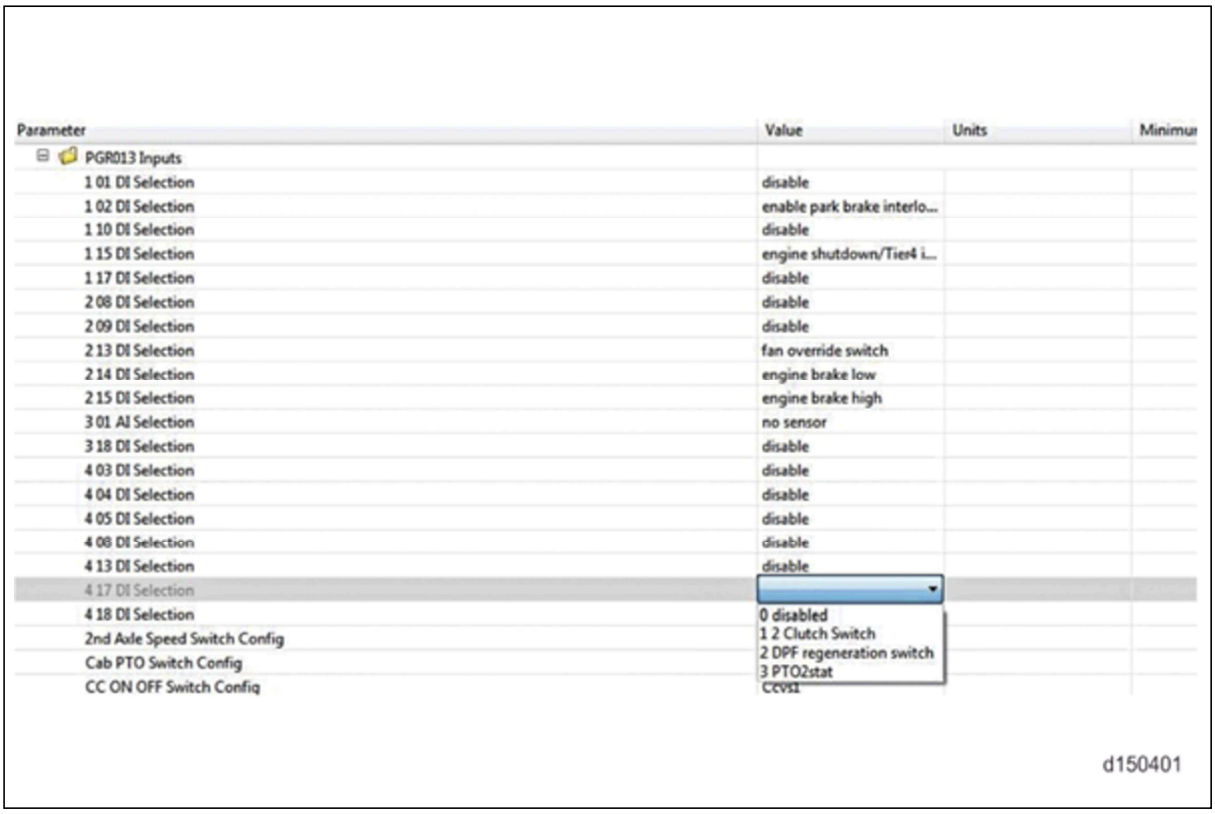
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 17 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to ground between pin 17 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

SPN 3864 (CPC) (GHG17)

302.1 SPN 3864/FMI 3 – GHG17

SPN 3864/FMI 3	
Description	CPC Input 3 18 Short to Voltage
Monitored Parameter	CPC Input 3/18
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ WARNING

PERSONAL INJURY

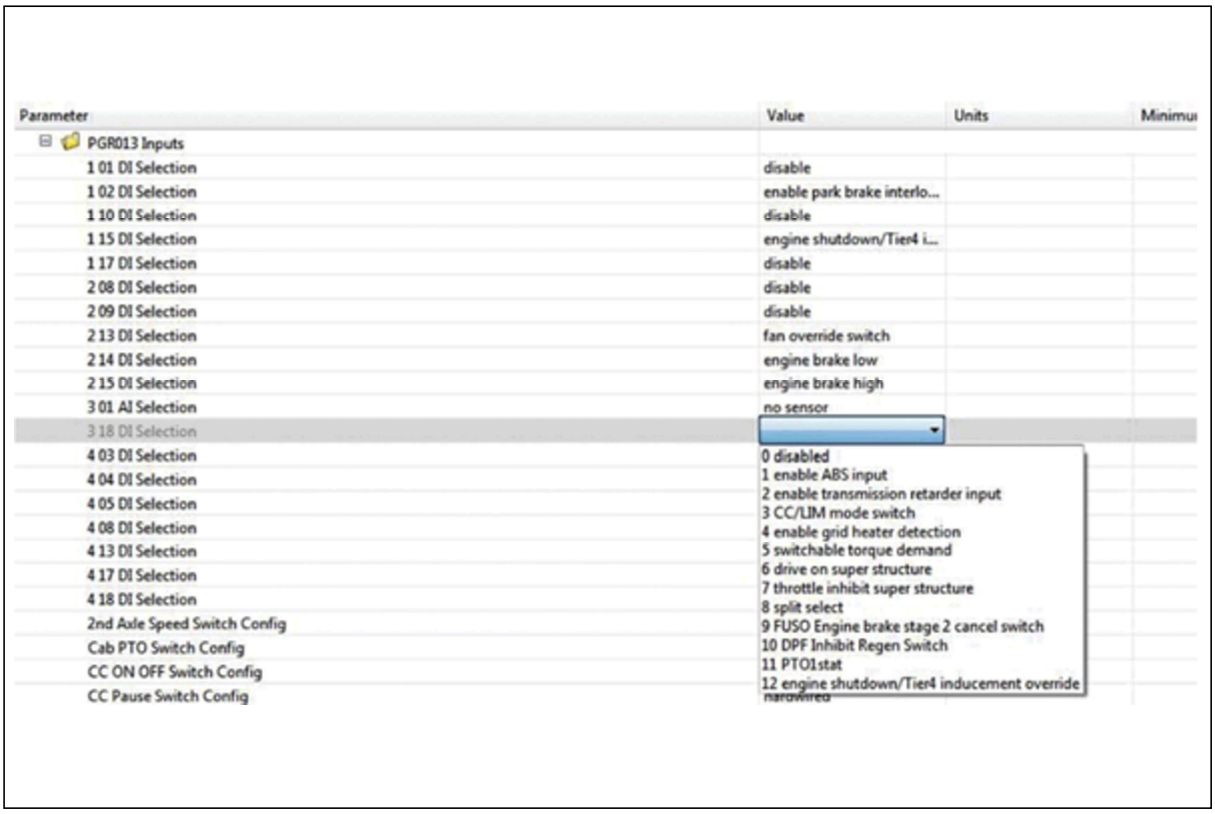
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

⚠ WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 3 18 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to power between pin 18 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

302.2 SPN 3864/FMI 4 - GHG17

SPN 3864/FMI 4	
Description	CPC Input 3 18 Short to Ground
Monitored Parameter	CPC Input 3/18
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

WARNING

PERSONAL INJURY

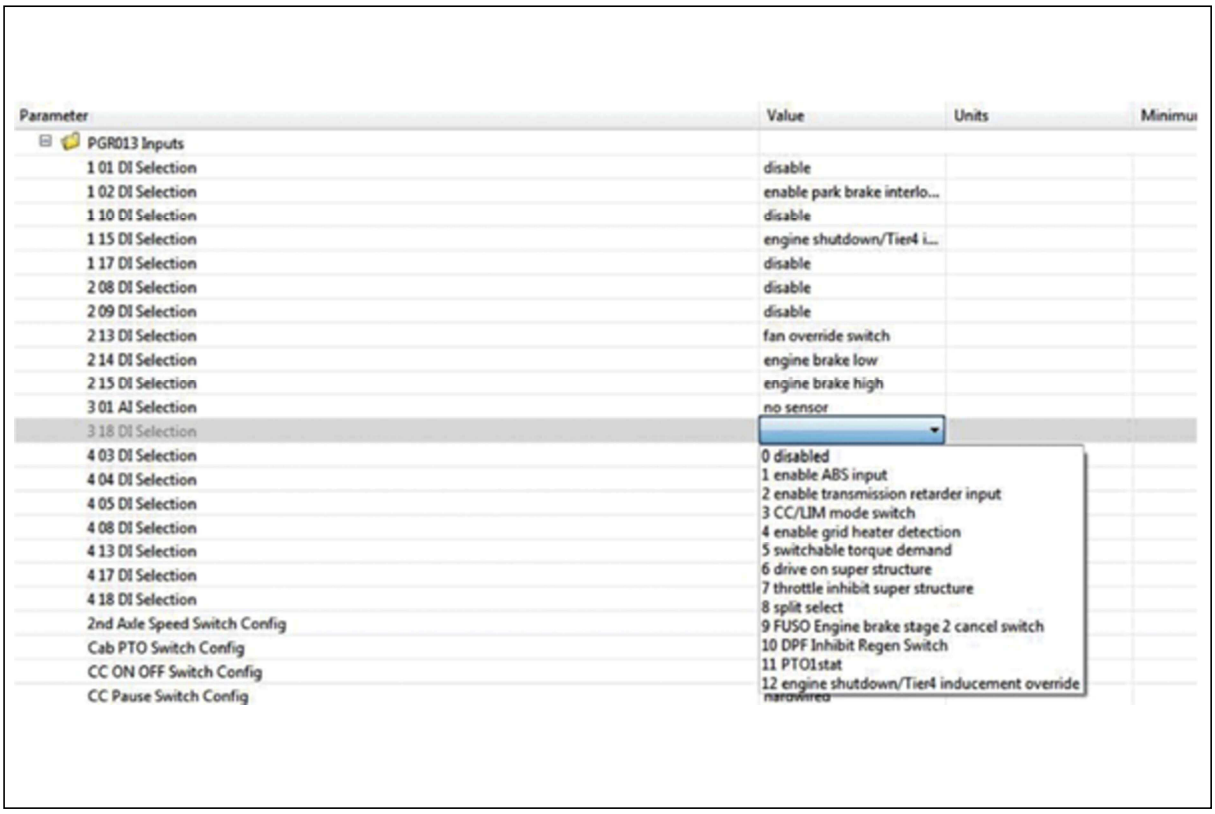
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters – go to the parameters work window.
4. Verify that the parameter set to 3 18 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   4.a Yes; repair the short to ground between pin 18 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   4.b No; configure the parameters correctly.

SPN 3865 (CPC) (GHG17)

303.1 SPN 3865/FMI 3 - GHG17

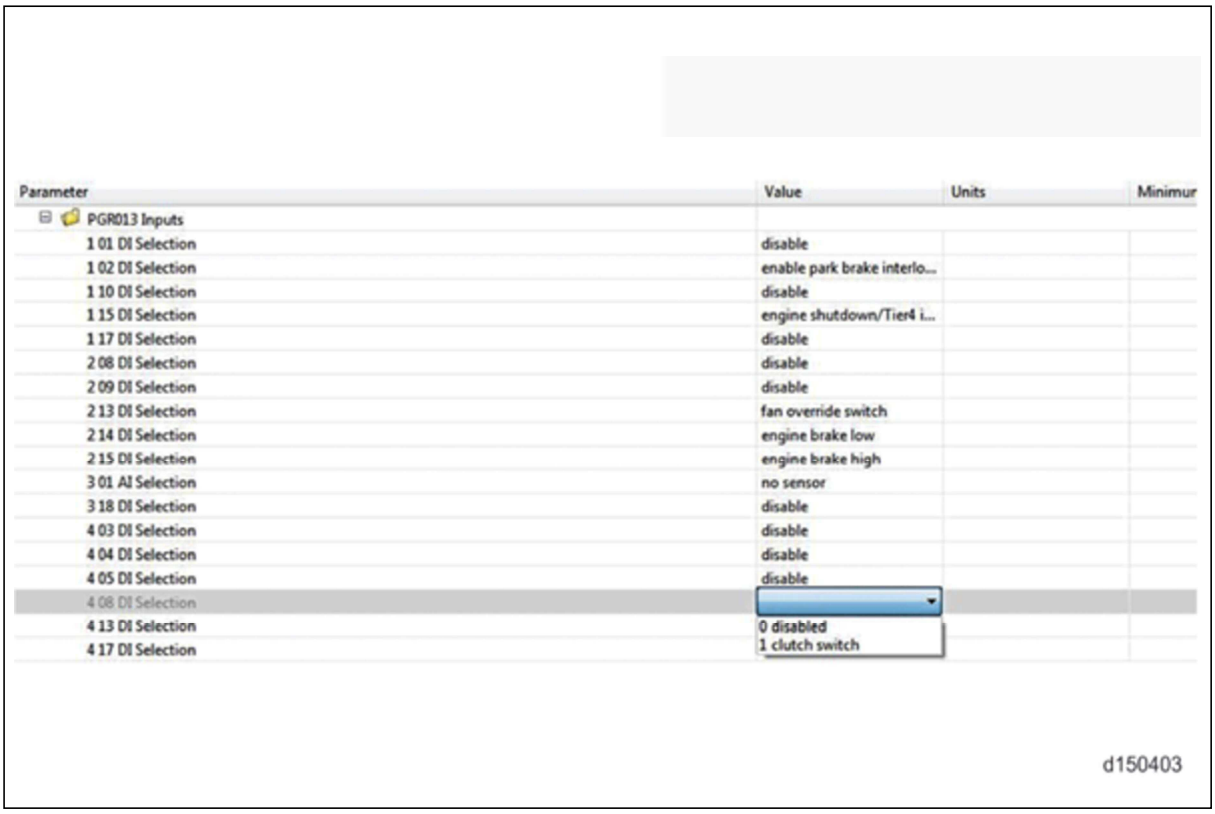
SPN 3865/FMI 3	
Description	CPC Input 4 08 Short to Voltage
Monitored Parameter	CPC Input 4/08
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .

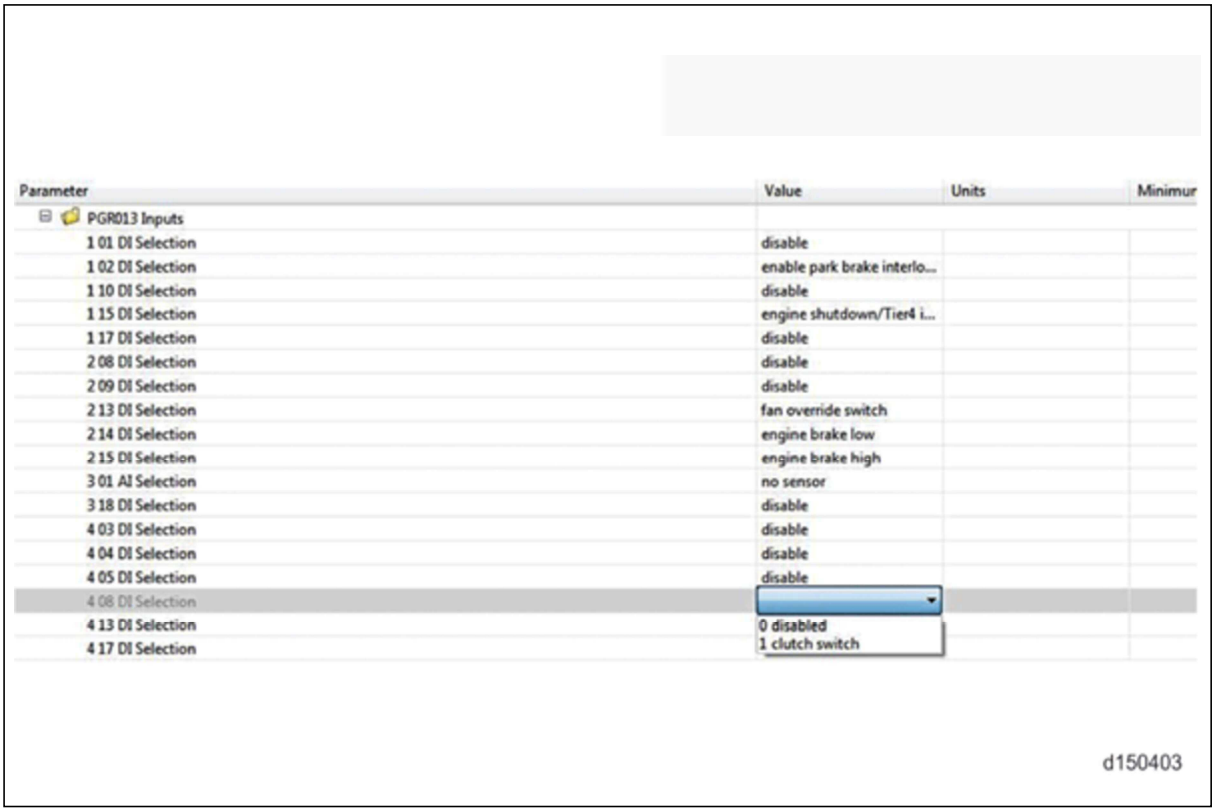


3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 08 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to power between pin 8 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

303.2 SPN 3865/FMI 4 - GHG17

SPN 3865/FMI 4	
Description	CPC Input 4 08 Short to Ground
Monitored Parameter	CPC Input 4/08
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 08 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   4.a Yes; repair the short to ground between pin 8 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   4.b No; configure the parameters correctly.

SPN 3866 (CPC) (GHG17)

304.1 SPN 3866/FMI 3 – GHG17

SPN 3866/FMI 3	
Description	CPC Input 4 04 Short to Voltage
Monitored Parameter	CPC Input 4/04
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .
3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 04 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to power between pin 4 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

304.2 SPN 3866/FMI 4 - GHG17

SPN 3866/FMI 4	
Description	CPC Input 4 04 Short to Ground
Monitored Parameter	CPC Input 4/04
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .
3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 04 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to ground between pin 4 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

SPN 3867 (CPC) (GHG17)

305.1 SPN 3867/FMI 3 – GHG17

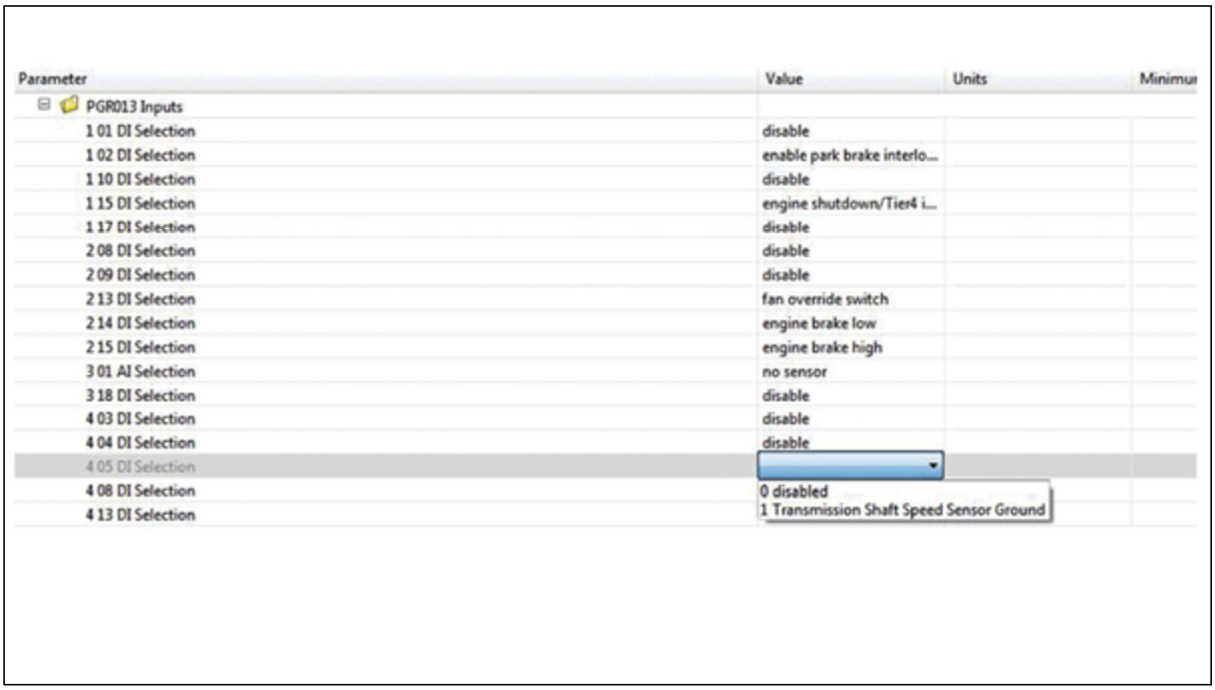
SPN 3867/FMI 3	
Description	CPC Input 4 05 Short to Voltage
Monitored Parameter	CPC Input 4/05
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 05 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to power between pin 5 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

305.2 SPN 3867/FMI 4 - GHG17

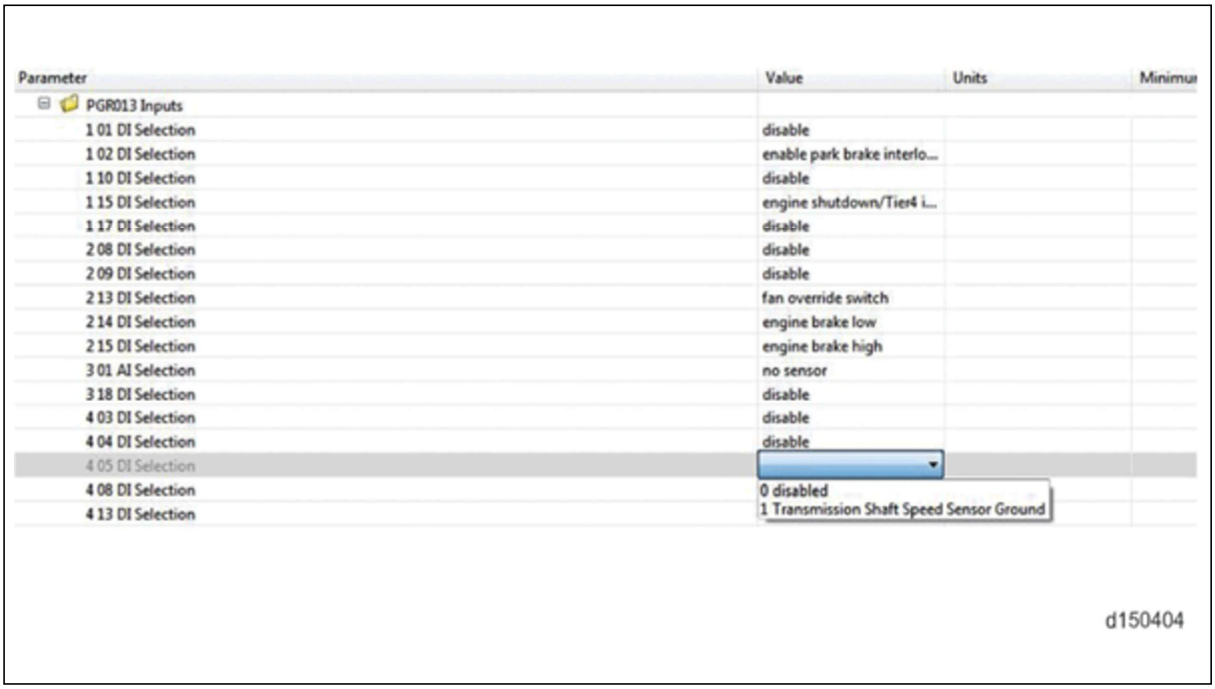
SPN 3867/FMI 4	
Description	CPC Input 4 05 Short to Ground
Monitored Parameter	CPC Input 4/05
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 05 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

4.a Yes; repair the short to ground between pin 5 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

4.b No; configure the parameters correctly.

SPN 3868 (CPC) (GHG17)

306.1 SPN 3868/FMI 3 – GHG17

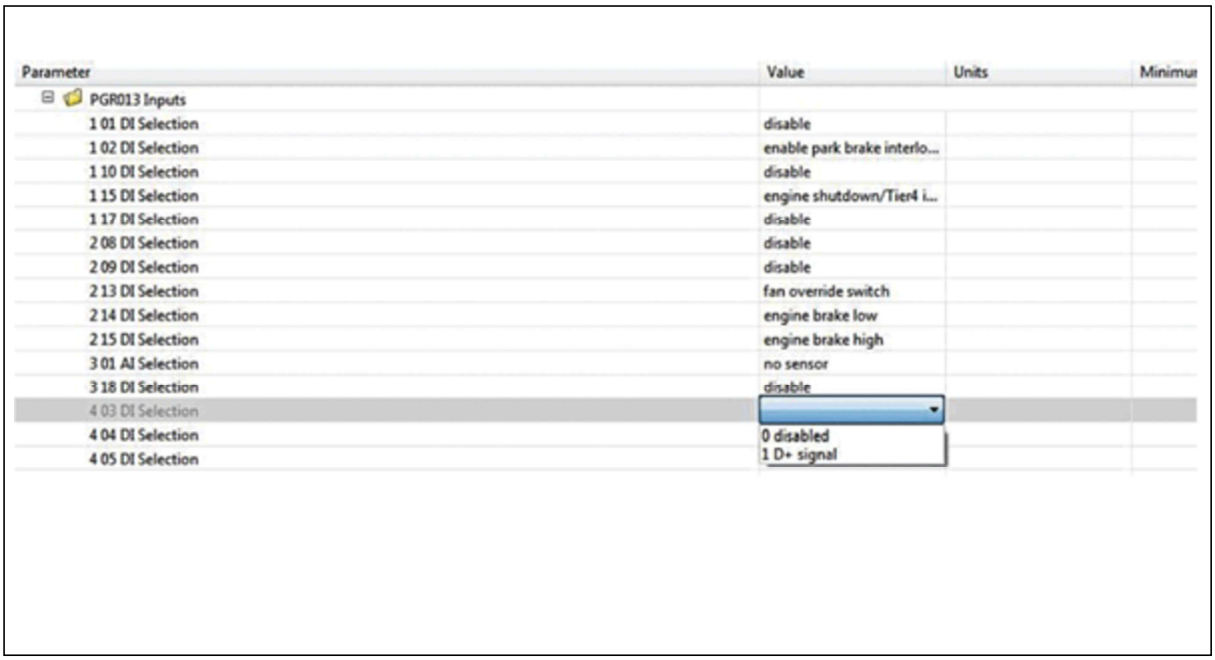
SPN 3868/FMI 3	
Description	CPC Input 4 03 Short to Voltage
Monitored Parameter	CPC Input 4/03
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 03 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to power between pin 3 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

306.2 SPN 3868/FMI 4 - GHG17

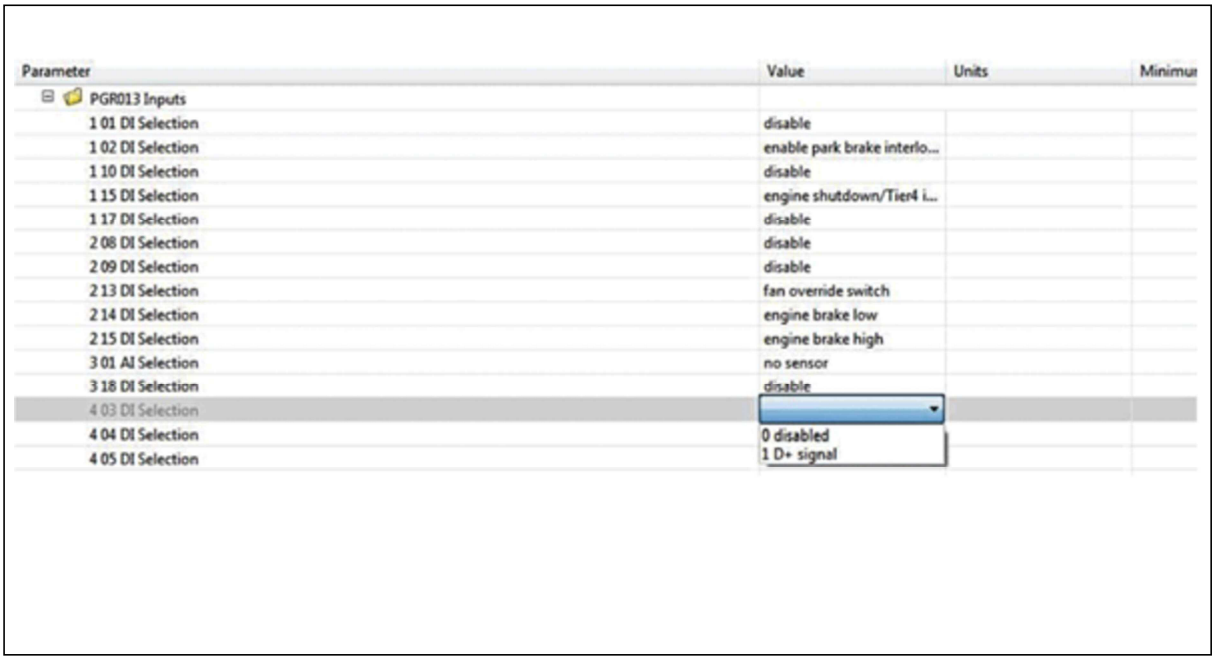
SPN 3868/FMI 4	
Description	CPC Input 4 03 Short to Ground
Monitored Parameter	CPC Input 4/03
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) recently been changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 4 03 DI Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

4.a Yes; repair the short to ground between pin 3 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

4.b No; configure the parameters correctly.

SPN 3869 (CPC) (GHG17)

307.1 SPN 3869/FMI 3 - GHG17

SPN 3869/FMI 3	
Description	CPC Input 4 01 Short to Voltage
Monitored Parameter	CPC Input 4/01
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .
3. Verify parameters - go to the parameters work window.
4. Verify that the parameters in PGR013 are set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to power between pin 1 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

307.2 SPN 3869/FMI 4 - GHG17

SPN 3869/FMI 4	
Description	CPC Input 4 01 Short to Ground
Monitored Parameter	CPC Input 4/01
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .
3. Verify parameters - go to the parameters work window.
4. Verify that the parameters in PGR013 are set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to ground between pin 1 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

SPN 3870 (CPC) (GHG17)

309.1 SPN 3870/FMI 3 – GHG17

SPN 3870/FMI 3	
Description	CPC Input 4 02 Short to Voltage
Monitored Parameter	CPC Input 4/02
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .
3. Verify parameters - go to the parameters work window.
4. Verify that the parameters in PGR013 are set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to power between pin 2 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

309.2 SPN 3870/FMI 4 - GHG17

SPN 3870/FMI 4	
Description	CPC Input 4 02 Short to Ground
Monitored Parameter	CPC Input 4/02
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .
3. Verify parameters - go to the parameters work window.
4. Verify that the parameters in PGR013 are set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to ground between pin 2 of the CPC connector #4 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

SPN 3871 (CPC) (GHG17)

310.1 SPN 3871/FMI 2 - GHG17

Transmission Speed Failure

1. Has the Common Powertrain Controller (CPC) been recently reprogrammed?
   - 1.a Yes; insure the Transmission Speed Sensor (TSS) parameters are configured correctly for the vehicle application. If the fault returns, Go to step 2.
   - 1.b No, Go to step 2.
2. Is the TSS hardwired or transmitted via J1939?
   - 2.a Hardwired; Go to step 3.
   - 2.b J1939; refer to the Application and Installation manual for the correct parameter configuration. If the configuration is correct, refer to the Original Equipment Manufacturer (OEM) material for J1939 troubleshooting.
3. Disconnect the TSS harness connector; refer to OEM literature for location.
4. Inspect the TSS harness connector for bent, spread, or corroded pins.
   - 4.a If pin damage is found, repair as necessary.
   - 4.b If no pin damage is found, Go to step 5.
5. Disconnect the CPC connector #3 or 4. Refer to OEM literature for TSS connector pin out.
6. Measure the resistance between CPC connector #3 pins 13 and 14 or connector #4 pins 4 and 5.
   - 6.a If the resistance is less than 10K ohms, repair the short between CPC connector #3 pins 13 and 14 or connector #4 pins 4 and 5 and the TSS connector.
   - 6.b If the resistance is greater than 10K ohms, Go to step 7.
7. Measure the resistance between CPC connector #3 pin 13 or connector #4 pin 4 and battery ground.
   - 7.a If the resistance is less than 10K ohms, repair the wire between CPC connector #3 pin 13 or connector #4 pin 4 and the TSS+ harness connection.
   - 7.b If the resistance is greater than 10K ohms, Go to step 8.
8. Measure the resistance between CPC connector #3 pin 13 or connector #4 pin 4 and the TSS+ harness connection.
   - 8.a If the resistance is greater than 5 ohms, repair the wire between CPC connector #3 pin 13 or connector #4 pin 4 and the TSS+ harness connection.
   - 8.b If the resistance is less than 5 ohms, Go to step 9.
9. Measure the resistance between CPC connector #3 pin14 or connector #4 pin 5 and the VSS- harness connector.
   - 9.a If resistance is greater than 5 ohms, repair the wire between CPC connector #3 pin 14 or connector #4 pin 5 and the TSS- harness connection.
   - 9.b If the resistance is less than 5 ohms, refer to OEM literature for TSS sensor diagnostics.

310.2 SPN 3871/FMI 3 - GHG17

Transmission Speed Sensor 4 04 or 3 13 Circuit Failed High

1. Has the Common Powertrain Controller (CPC) been recently reprogrammed?
   - 1.a Yes; insure the Transmission Speed Sensor (TSS) parameters are configured correctly for the vehicle application. If fault returns, Go to step 2.
   - 1.b No, Go to step 2.
2. Is the TSS hardwired or transmitted via J1939?
   - 2.a Hardwired; Go to step 3.
   - 2.b J1939; refer to the Application and Installation manual for the correct parameter configuration. If the configuration is correct, refer to the Original Equipment Manufacturer (OEM) material for J1939 troubleshooting.
3. Disconnect the TSS harness connector; refer to OEM literature for location.
4. Inspect the TSS harness connector for bent, spread, or corroded pins.
   - 4.a If pin damage is found, repair as necessary.
   - 4.b If no pin damage is found, Go to step 5.
5. Disconnect CPC connector #3 or 4. Refer to OEM literature for TSS connector pinout.
6. Measure the resistance between CPC connector #3 pin 13 or connector #4 pin 4 and the TSS+ harness connector.
   - 6.a If the resistance is greater than 5 ohms, repair the wire between CPC connector#3 pin 13 or connector #4 pin 4 and the TSS+ harness connection.
   - 6.b If the resistance is less than 5 ohms, Go to step 7.
7. Measure the resistance between CPC connector #3 pin14 or connector #4 pin 5 and the VSS- harness connector.
   - 7.a If resistance is greater than 5 ohms, repair the wire between CPC connector #3 pin 14 or connector #4 pin 5 and the TSS- harness connection.
   - 7.b If the resistance is less than 5 ohms, refer to OEM literature for TSS sensor diagnostics.

310.3 SPN 3871/FMI 4 - GHG17

Transmission Speed Sensor 4 04 or 3 13 Circuit Failed Low

1. Has the Common Powertrain Controller (CPC) been recently reprogrammed?
   - 1.a Yes; insure the Transmission Speed Sensor (TSS) parameters are configured correctly for the vehicle application. If fault returns, Go to step 2.
   - 1.b No, Go to step 2.
2. Is the TSS hardwired or transmitted via J1939?
   - 2.a Hardwired; Go to step 3.
   - 2.b J1939; refer to the Application and Installation manual for the correct parameter configuration. If configuration is correct, refer to the Original Equipment Manufacturer (OEM) material for J1939 troubleshooting.
3. Disconnect the TSS harness connector; refer to OEM literature for location.
4. Inspect the TSS harness connector for bent, spread, or corroded pins.
   - 4.a If pin damage is found, repair as necessary.
   - 4.b If no pin damage is found, Go to step 5.
5. Disconnect CPC connector #3 or 4. Refer to OEM literature for TSS connector pinout.
6. Measure the resistance between CPC connector #3 pin 13 or connector #4 pin 4 and battery ground.
   - 6.a If the resistance is less than 10K ohms, repair the wire between CPC connector #3 pin13 or connector #4 pin 4 and the TSS+ harness connection.
   - 6.b If the resistance is greater than 10K ohms, Go to step 7.
7. Measure the resistance between CPC connector #3 pins 13 and 14 or connector #4 pins 4 and 5.
   - 7.a If the resistance is less than 10K ohms, repair the short between CPC connector #3 pins 13 and 14 or connector #4 pins 4 and 5 and the TSS connector.
   - 7.b If the resistance is greater than 10K ohms, refer to OEM literature for TSS sensor diagnostics.

310.4 SPN 3871/FMI 5 - GHG17

Transmission Speed Sensor 4 04 or 3 13 Circuit Failed Open

1. Has the Common Powertrain Controller (CPC) been recently reprogrammed?
   - 1.a Yes; insure the Transmission Speed Sensor (TSS) parameters are configured correctly for the vehicle application. If the fault returns, Go to step 2.
   - 1.b No, Go to step 2.
2. Is the TSS hardwired or transmitted via J1939?
   - 2.a Hardwired; Go to step 3.
   - 2.b J1939; refer to the Application and Installation manual for the correct parameter configuration. If configuration is correct, refer to the Original Equipment Manufacturer (OEM) material for J1939 troubleshooting.
3. Disconnect the TSS harness connector; refer to OEM literature for location.
4. Inspect the TSS harness connector for bent, spread, or corroded pins.
   - 4.a If pin damage is found, repair as necessary.
   - 4.b If no pin damage is found, Go to step 5.
5. Disconnect CPC connector #3 or 4. Refer to OEM literature for TSS connector pin out.
6. Measure the resistance between CPC connector #3 pin 13 or connector #4 pin 4 and the TSS+ harness connector.
   - 6.a If the resistance is greater than 5 ohms, repair the wire between CPC connector #3 pin 13 or connector #4 pin 4 and the TSS+ harness connection.
   - 6.b If the resistance is less than 5 ohms, Go to step 7.
7. Measure the resistance between CPC connector #3 pin14 or connector #4 pin 5 and the VSS- harness connector.
   - 7.a If resistance is greater than 5 ohms, repair the wire between CPC connector #3 pin14 or connector #4 pin 5 and the TSS- harness connection.
   - 7.b If the resistance is less than 5 ohms, refer to OEM literature for TSS sensor diagnostics.

SPN 3872 (CPC) (GHG17)

311.1 SPN 3872/FMI 3 – GHG17

SPN 3872/FMI 3	
Description	CPC Input 3 05 Short to Voltage
Monitored Parameter	CPC Input 3/05
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ WARNING

PERSONAL INJURY

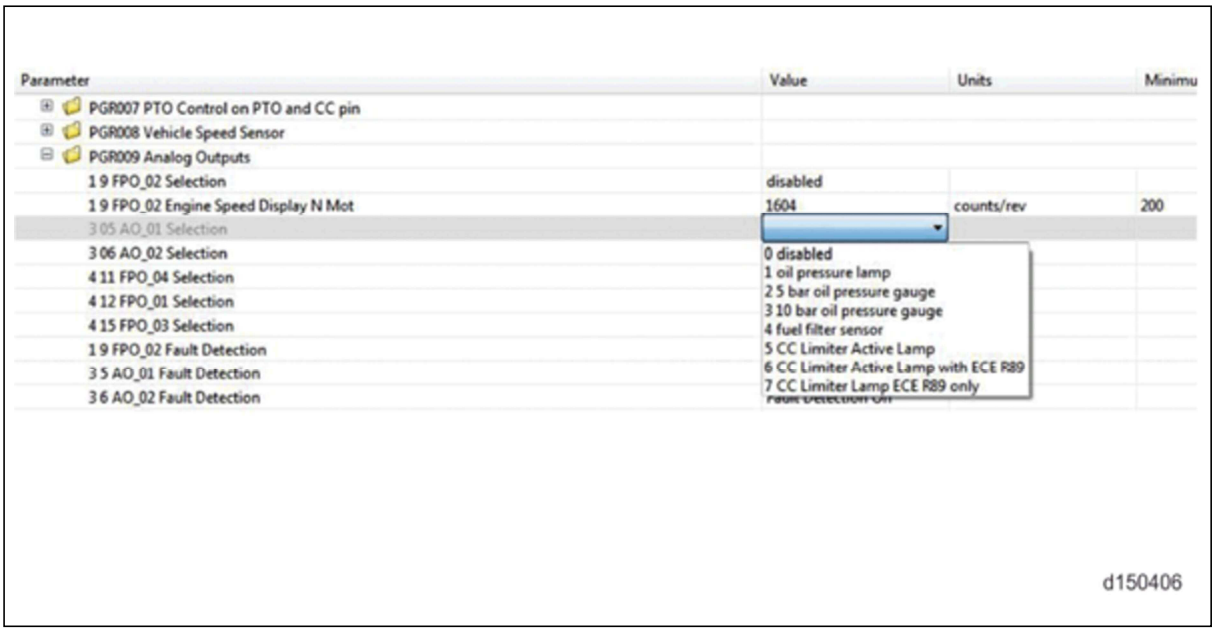
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

⚠ WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 3 05 AO_01 Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; repair the short to power between pin 5 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   4.b No; configure the parameters correctly.

311.2 SPN 3872/FMI 4 - GHG17

SPN 3872/FMI 4	
Description	CPC Input 3 05 Short to Ground
Monitored Parameter	CPC Input 3/05
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

WARNING

PERSONAL INJURY

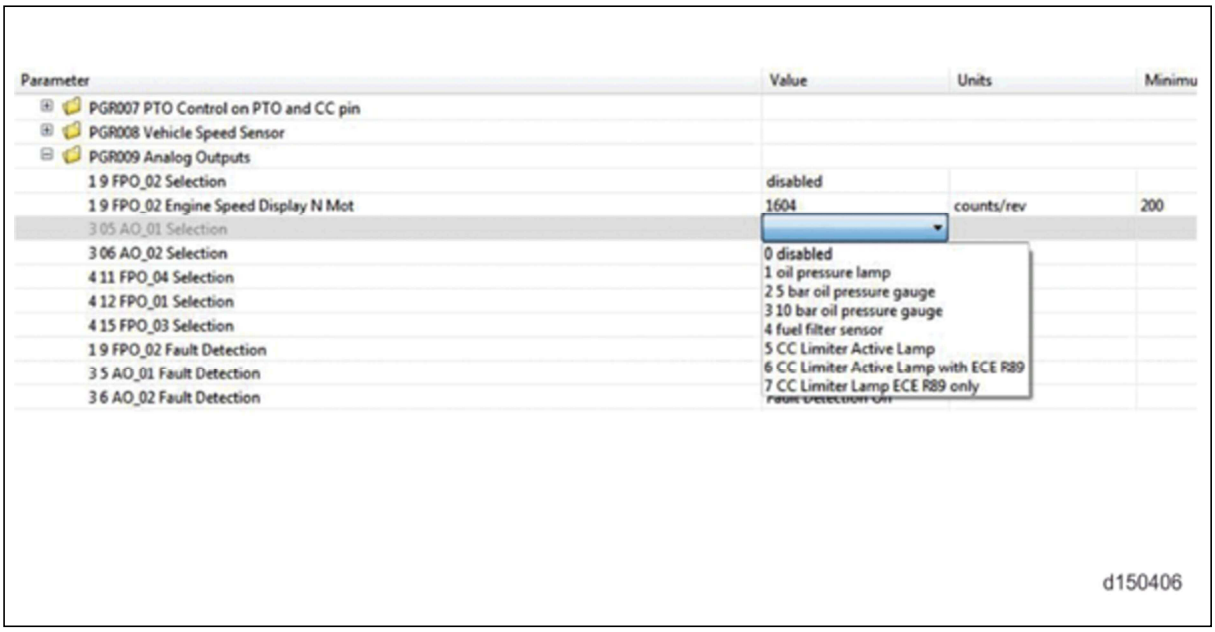
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 3 05 AO_01 Selection is set to the specific component to which this is configured. Are the parameters configured correctly?

   4.a Yes; Go to step 5.

   4.b No; configure the parameters correctly.

5. Measure the resistance between pin 5 of the CPC connector #3 and ground. Is the resistance less than five ohms?

   5.a Yes; repair the short to ground between pin 5 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

   5.b No; repair an open circuit ground between pin 5 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

312.1 SPN 3873/FMI 3 – GHG17

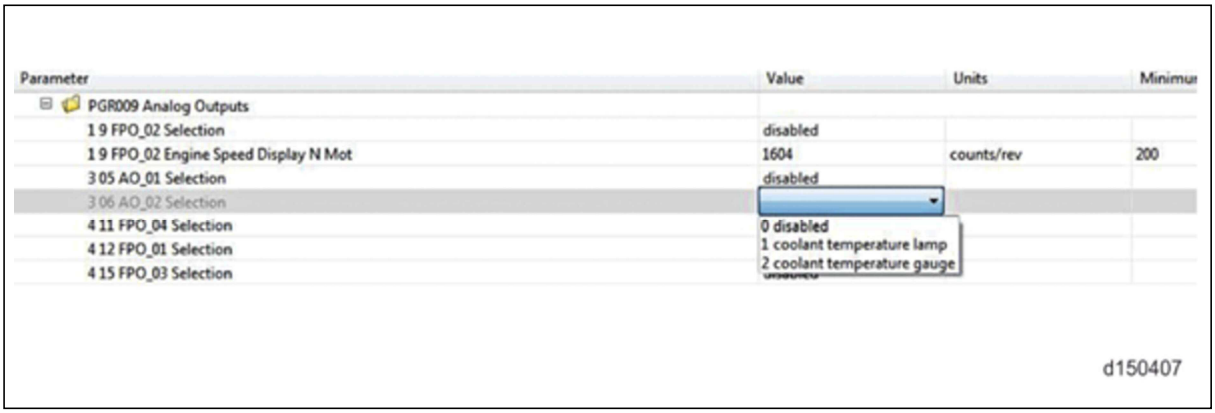
SPN 3873/FMI 3	
Description	CPC Input 3 06 Short to Voltage
Monitored Parameter	CPC Input 3/06
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 3 06 AO_02 Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; repair the short to power between pin 6 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; configure the parameters correctly.

312.2 SPN 3873/FMI 4 - GHG17

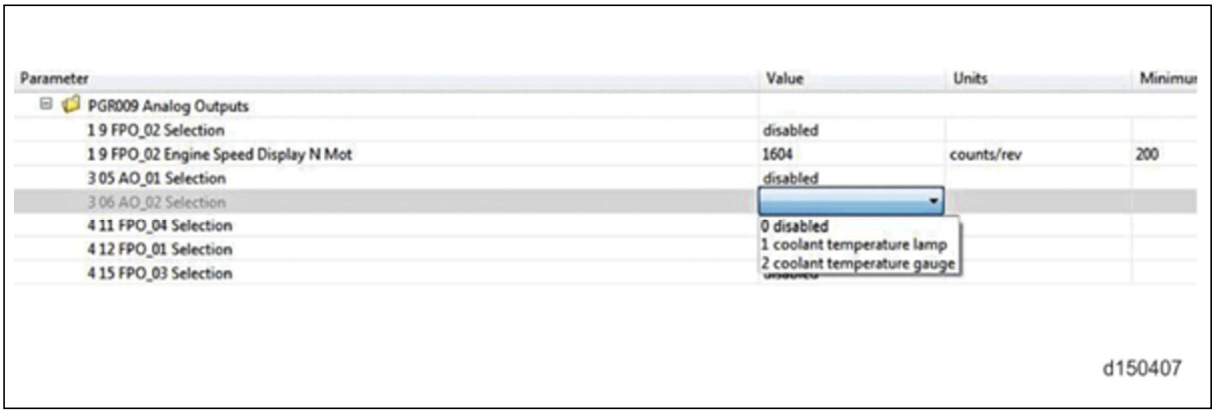
SPN 3873/FMI 4	
Description	CPC Input 3 06 Short to Ground
Monitored Parameter	CPC Input 3/06
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 3 06 AO_02 Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; Go to step 5.
   - 4.b No; configure the parameters correctly.
5. Measure the resistance between pin 6 of the CPC connector #3 and ground. Is the resistance less than five ohms?
   - 5.a Yes; repair the short to ground between pin 6 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 5.b No; repair an open circuit ground between pin 6 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

SPN 3873 (CPC) (GHG17)

312.1 SPN 3873/FMI 3 – GHG17

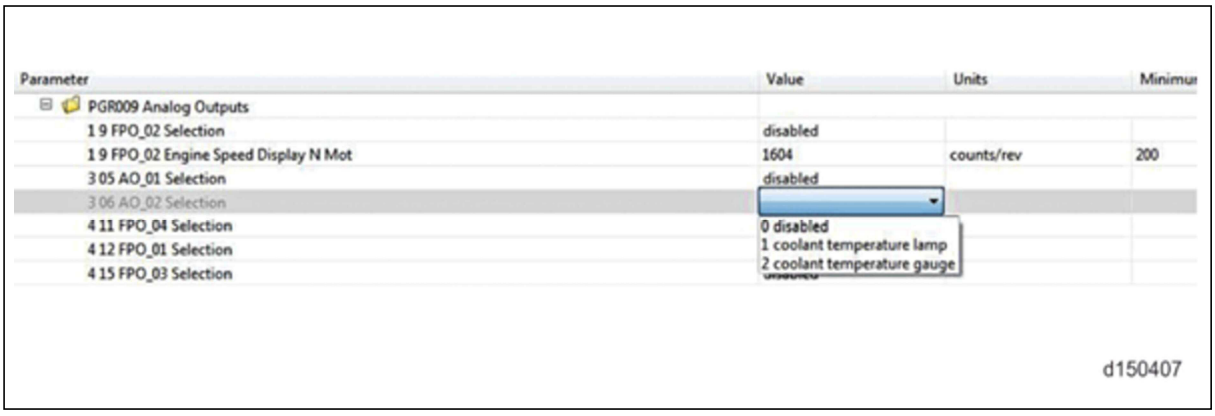
SPN 3873/FMI 3	
Description	CPC Input 3 06 Short to Voltage
Monitored Parameter	CPC Input 3/06
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 3 06 AO_02 Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   4.a Yes; repair the short to power between pin 6 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   4.b No; configure the parameters correctly.

312.2 SPN 3873/FMI 4 - GHG17

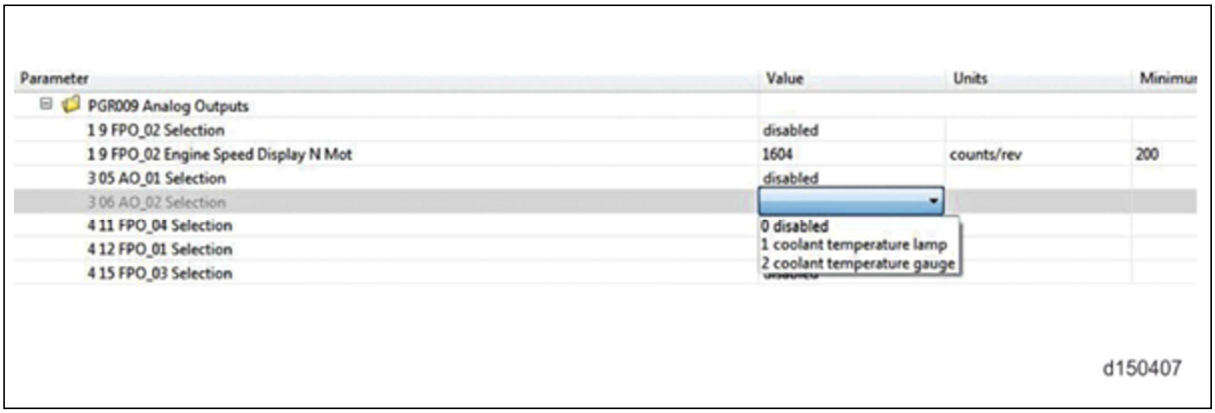
SPN 3873/FMI 4	
Description	CPC Input 3 06 Short to Ground
Monitored Parameter	CPC Input 3/06
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine On with Output Activation

WARNING

ENGINE EXHAUST

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

1. Has the Common Powertrain Controller (CPC) been recently changed or reprogrammed?
   - 1.a Yes; verify that the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, then Go to step 2.
   - 1.b No; Go to step 2.
2. Connect to DiagnosticLink .



3. Verify parameters - go to the parameters work window.
4. Verify that the parameter set to 3 06 AO_02 Selection is set to the specific component to which this is configured. Are the parameters configured correctly?
   - 4.a Yes; Go to step 5.
   - 4.b No; configure the parameters correctly.
5. Measure the resistance between pin 6 of the CPC connector #3 and ground. Is the resistance less than five ohms?
   - 5.a Yes; repair the short to ground between pin 6 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 5.b No; repair an open circuit ground between pin 6 of the CPC connector #3 and the wired component. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

313.1 SPN 3936/FMI 18 - GHG17

Diesel Particulate Filter (DPF) Pressure - Out of Range Low

SPN 3936/FMI 18	
Description	This Fault Code Sets when the Diesel Oxidation Catalyst (DOC) Inlet Pressure Delta is Below Normal Operating Range for More Than 10 Seconds
Monitored Parameter	DOC Inlet Pressure Sensor
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL, SEL
Engine Reaction	Derate 25%
Verification	Run Engine Between 1200 to 1800 rpm With a Load Less Than 10%

Check as follows:

1. Visually inspect entire exhaust system for signs of leaks or damage. Are there any leaking or damaged exhaust components?

   1.a Yes; repair as necessary.

   1.b No; Go to step 2.

2. Connect DiagnosticLink .
3. Using the Selective Catalytic Reduction (SCR) voltage service routine, monitor the Diesel Oxidation Catalyst (DOC) inlet pressure (pin 87) voltages with the key ON, engine OFF.
4. Is the DOC inlet pressure sensor voltage between .44 to .56 volts?

   4.a Yes; Go to step 6.

   4.b No; Go to step 5.

5. Inspect electrical connector between DOC inlet pressure sensor connector and harness for bent, spread, or corroded pins. Is there any damage found?

   5.a Yes; repair as necessary.

   5.b No; replace the DOC inlet pressure sensor.

   For 1-BOX™, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" . Verify repair.

   For 2-BOX, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" . Verify repair.

6. Inspect the DOC pressure sensor tubes and elbows for leaks, kinks, or blockages. Were any leaks, kinks or blockages found?

   6.a Yes; repair as necessary.

   6.b No; Go to step 7.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

⚠ 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.

⚠ 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.

7. Perform a parked regeneration; during the regeneration, monitor (ASL: DOC Inlet Pressure).
8. During the parked regeneration, does either the DOC inlet pressure sensor drop to 0.0 psi at any time?
   - 8.a Yes; replace the failed sensor.
   - 8.b No; clear fault and release unit. The code likely occurred after extended idle and soot buildup has cleared.

313.1 SPN 3936/FMI 18 - GHG17

Before starting this troubleshooting procedure, please verify if an Advanced Diagnostic (AD) version is available, and continue with that version if available. ADs provide enhanced functionality that increase the accuracy of the troubleshooting process and are preferred over traditional troubleshooting. The ADs are identified in DiagnosticLink by the magic wand icon next to the fault, and the word "Advanced" label in the "Troubleshooting Type" field.

Diesel Particulate Filter (DPF) Pressure - Out of Range Low

SPN 3936/FMI 18	
Description	This Fault Code Sets when the Diesel Oxidation Catalyst (DOC) Inlet Pressure Delta is Below Normal Operating Range for More Than 10 Seconds
Monitored Parameter	DOC Inlet Pressure Sensor
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL, SEL
Engine Reaction	Derate 25%
Verification	Run Engine Between 1200 to 1800 rpm With a Load Less Than 10%

Check as follows:

1. Visually inspect entire exhaust system for signs of leaks or damage. Are there any leaking or damaged exhaust components?
   - 1.a Yes; repair as necessary.
   - 1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Using the Selective Catalytic Reduction (SCR) voltage service routine, monitor the Diesel Oxidation Catalyst (DOC) inlet pressure (pin 87) voltages with the key ON, engine OFF.
4. Is the DOC inlet pressure sensor voltage between .44 to .56 volts?
   - 4.a Yes; Go to step 6.
   - 4.b No; Go to step 5.
5. Inspect electrical connector between DOC inlet pressure sensor connector and harness for bent, spread, or corroded pins. Is there any damage found?
   - 5.a Yes; repair as necessary.
   - 5.b No; replace the DOC inlet pressure sensor.

     For 1-BOX™, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" . Verify repair.

     For 2-BOX, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" . Verify repair.
6. Inspect the DOC pressure sensor tubes and elbows for leaks, kinks, or blockages. Were any leaks, kinks or blockages found?
   - 6.a Yes; repair as necessary.
   - 6.b No; Go to step 7.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

> **⚠ 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.

7. Perform a parked regeneration; during the regeneration, monitor (ASL: DOC Inlet Pressure).
8. During the parked regeneration, does either the DOC inlet pressure sensor drop to 0.0 psi at any time?
   - 8.a Yes; replace the failed sensor.
   - 8.b No; clear fault and release unit. The code likely occurred after extended idle and soot buildup has cleared.

SPN 3936 (ACM) (GHG17)

314.1 SPN 3948/FMI 9 – GHG17

SPN 3948/FMI 9	
Description	J1939 Message is Missing
Monitored Parameter	J1939 Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key ON, Engine OFF

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   1.a Yes; repair the battery voltage concern. Verify repair.
   1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   2.b No; Go to step 3.

Note : This fault code may be set by two or more source inputs configured with the same address. Verify proper parameter settings.

3. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   3.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.
   3.b No; reprogram the CPC with the correct information, as necessary. To verify repair, Go to step 4.
4. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink . Wait five minutes for all modules to power down. Verify repair.

SPN 3948 (CPC) (GHG17)

314.1 SPN 3948/FMI 9 – GHG17

SPN 3948/FMI 9	
Description	J1939 Message is Missing
Monitored Parameter	J1939 Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key ON, Engine OFF

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   1.a Yes; repair the battery voltage concern. Verify repair.
   1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   2.b No; Go to step 3.

Note : This fault code may be set by two or more source inputs configured with the same address. Verify proper parameter settings.

3. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   3.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.
   3.b No; reprogram the CPC with the correct information, as necessary. To verify repair, Go to step 4.
4. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink . Wait five minutes for all modules to power down. Verify repair.

315.1 SPN 4041/FMI 0 - GHG17

Common Powertrain Controller Internal Failure

1. Connect to DiagnosticLink .
2. Clear faults and retest. Does fault become active?
   2.a Yes; replace the Common Powertrain Controller (CPC) and reprogram with the latest software release.
   2.b No; release vehicle.

315.2 SPN 4041/FMI 9 - GHG17

Common Powertrain Controller Internal Failure

1. Connect to DiagnosticLink .
2. Clear faults and retest. Does fault become active?
   2.a Yes; replace the Common Powertrain Controller (CPC) and reprogram with the latest software release.
   2.b No; release vehicle.

315.3 SPN 4041/FMI 16 - GHG17

Common Powertrain Controller Internal Failure

1. Connect to DiagnosticLink .
2. Clear faults and retest. Does fault become active?

   2.a Yes; replace the Common Powertrain Controller (CPC) and reprogram with the latest software release.

   2.b No; release vehicle.

SPN 4041 (CPC) (GHG17)

315.1 SPN 4041/FMI 0 - GHG17

Common Powertrain Controller Internal Failure

1. Connect to DiagnosticLink .
2. Clear faults and retest. Does fault become active?
   2.a Yes; replace the Common Powertrain Controller (CPC) and reprogram with the latest software release.
   2.b No; release vehicle.

315.2 SPN 4041/FMI 9 - GHG17

Common Powertrain Controller Internal Failure

1. Connect to DiagnosticLink .
2. Clear faults and retest. Does fault become active?
   2.a Yes; replace the Common Powertrain Controller (CPC) and reprogram with the latest software release.
   2.b No; release vehicle.

315.3 SPN 4041/FMI 16 - GHG17

Common Powertrain Controller Internal Failure

1. Connect to DiagnosticLink .
2. Clear faults and retest. Does fault become active?
   2.a Yes; replace the Common Powertrain Controller (CPC) and reprogram with the latest software release.
   2.b No; release vehicle.

316.1 SPN 4077/FMI 0 - GHG17

High Doser Fuel Line Pressure

SPN 4077/FMI 0	
Description	Hydrocarbon (HC) Doser Fuel Line Pressure High
Monitored Parameter	Hydrocarbon (HC) Doser Fuel Line Pressure
Typical Enabling Conditions	Dosing Enabled
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	1 Minute
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	Parked Regeneration

1. Shut off the engine, apply the parking brake, chock the wheels, and perform any other applicable safety steps.
2. Replace the Fuel Doser Injector Valve and clean the cavity in the flanged manifold/S-pipe. Refer to section "Removal of the Hydrocarbon Fuel Doser Injector Valve" .
3. Connect DiagnosticLink Standard.

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

> **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.

4. Start the engine.

Note : Purge routine may have to be performed three times to remove all air. Do not exceed three purge attempts.

> **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.

5. Using DiagnosticLink Standard, perform Purge Hydrocarbon Doser Service Routine.
6. Using DiagnosticLink Standard, initiate a Parked Regeneration. Does regen complete?

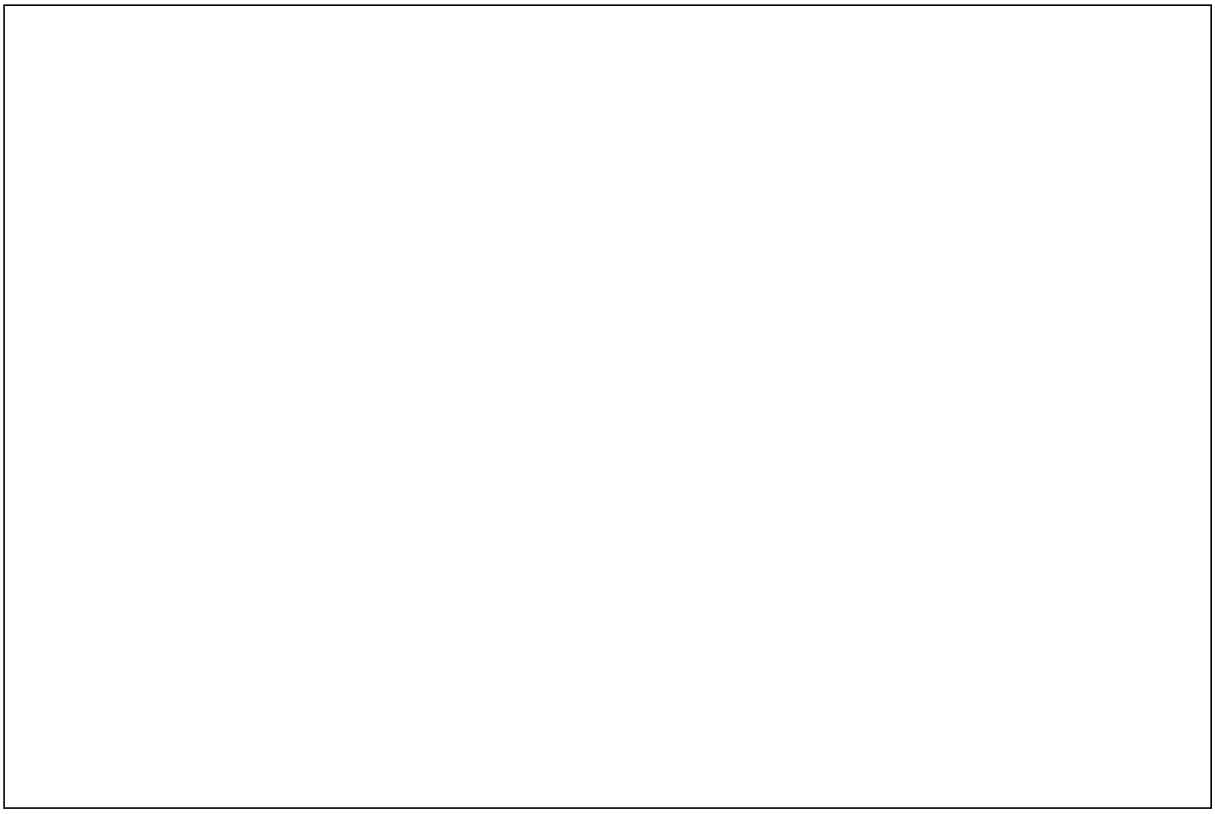
   6.a Yes; clear faults and release vehicle.

   6.b No; replace Hydrocarbon Fuel Doser Block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " . Verify repairs.

316.2 SPN 4077/FMI 3 - GHG17

Doser Fuel Line Pressure Sensor Circuit Failed High

SPN 4077/FMI 3	
Description	This fault code sets when the Motor Control Module (MCM) detects that the Hydrocarbon (HC) Doser Fuel Line Pressure (FLP) Sensor Circuit is failed high.
Monitored Parameter	Hydrocarbon (HC) Doser Fuel Line Pressure Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (1 minute)



Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Is the engine equipped with a DD15 AT engine?
   - 3.a Yes; Go to step 11.
   - 3.b No; Go to step 4.
4. Check for multiple fault codes. Is fault code SPN 3480/FMI 3 also present?

4.a Yes; repair the circuit between pin 104 of the 120-pin Motor Control Module (MCM) and pin 2 of the Fuel Doser Line Pressure sensor electrical connector/pin 2 of the Fuel Compensation Pressure sensor. Verify repair.

4.b No; Go to step 5.

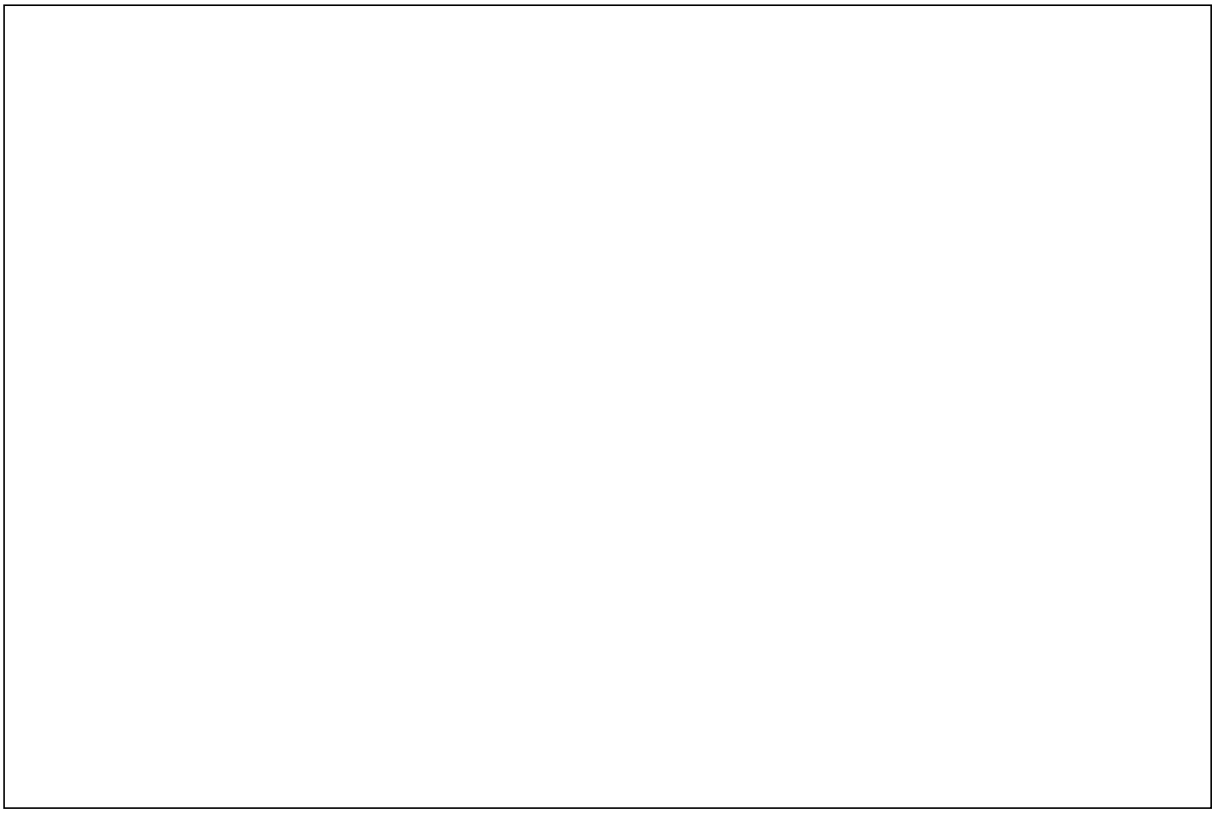
5. Is fault code SPN 3510/FMI 3 also present?

5.a Yes; diagnose SPN 3510/FMI 3 first; Refer to section "SPN 3510/FMI 3 - GHG17" .

5.b No; Go to step 6.

6. Turn the ignition OFF.

7. Disconnect the hydrocarbon doser fuel line pressure sensor (1).



8. Disconnect the 120-pin Motor Control Module (MCM) connector.

9. Measure the resistance from pin 111 of the 120-pin MCM connector harness side and pin 1 of the hydrocarbon doser fuel line pressure sensor electrical connector harness side. Is the resistance less than 5 ohms?

9.a Yes; Go to step 10.

9.b No; repair the circuit between pin 111 of the 120-pin MCM connector and pin 1 of the hydrocarbon doser fuel line pressure sensor electrical connector. Verify repair.

10. Measure the resistance from pin 104 of the 120-pin MCM connector harness side and pin 4 of the hydrocarbon doser fuel line pressure sensor electrical connector harness side. Is the resistance less than 5 ohms?

10.a Yes; replace the Motor Control Module (MCM), Refer to section "Removal of the Motor Control Module" . Verify repair.

10.b No; repair the circuit between pin 2 of the hydrocarbon doser fuel line pressure sensor and the circuit splice. Verify repair.

11. Check for multiple fault codes. Is fault code SPN 3480/FMI 3 also present?

11.a Yes; repair the circuit between pin 104 of the 120-pin Motor Control Module (MCM) and pin 2 of the Fuel Line Pressure sensor electrical connector/ pin 4 of the Fuel Compensation Pressure sensor electrical connector. Verify repair.

11.b No; Go to step 12.

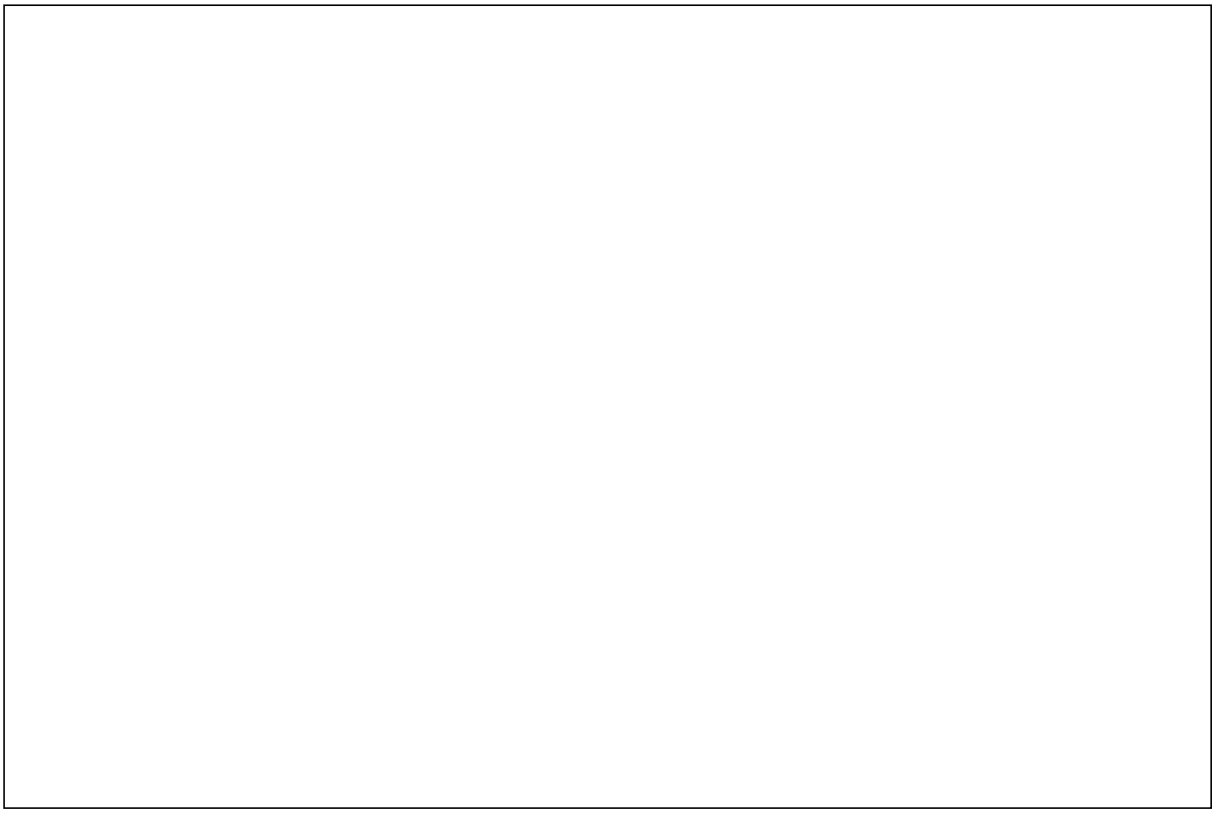
12. Is fault code SPN 3510/FMI 3 also present?

12.a Yes; diagnose fault code SPN 3510/FMI 3 first, Refer to section "SPN 3510/FMI 3 - GHG17".

12.b No; Go to step 13.

13. Turn the ignition OFF. Go to step 14.

14. Disconnect the hydrocarbon doser fuel line pressure sensor (1).



15. Disconnect the 120-pin Motor Control Module (MCM) connector.

16. Measure the resistance from pin 111 of the 120-pin MCM connector harness side and pin 4 of the hydrocarbon doser fuel line pressure sensor electrical connector harness side. Is the resistance less than 5 ohms?

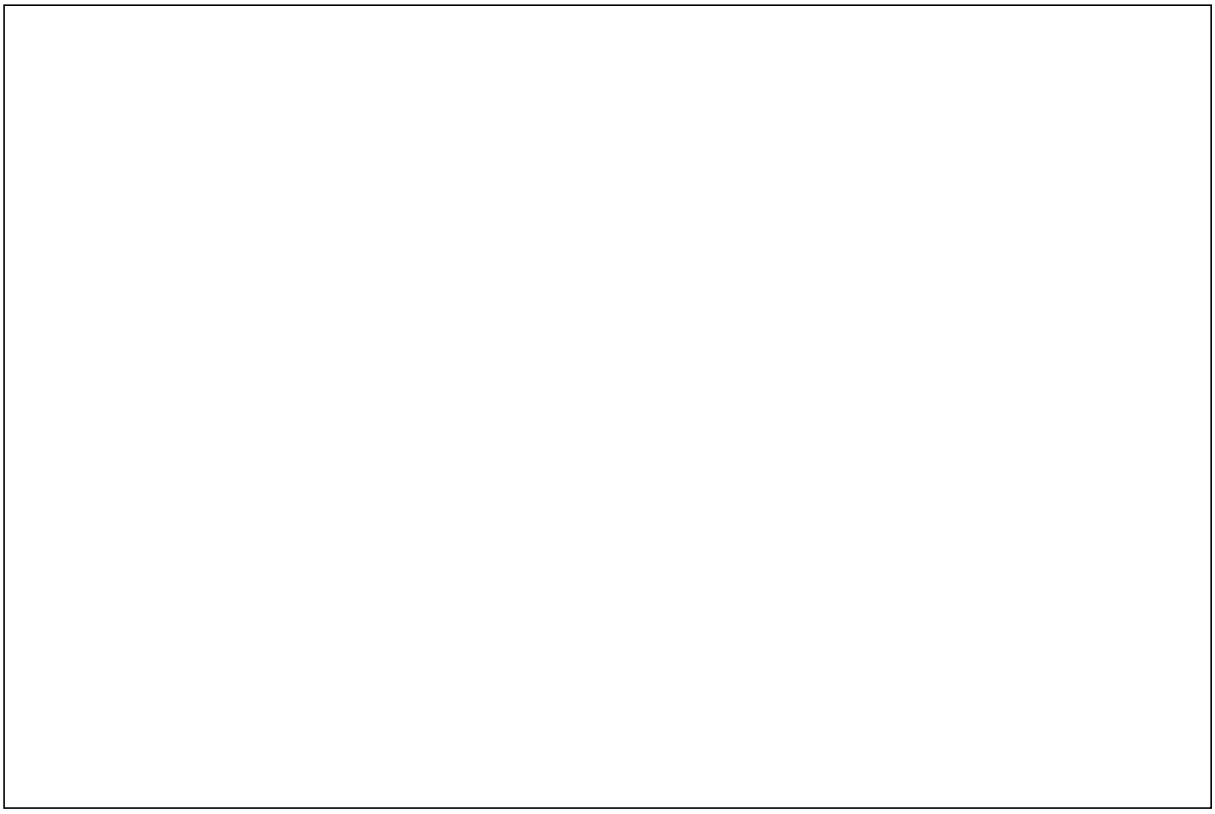
16.a Yes; replace the MCM, Refer to section "Removal of the Motor Control Module" . Verify repair.

16.b No; repair the circuit between pin 111 of the 120-pin MCM connector and pin 4 of the hydrocarbon doser fuel line pressure sensor electrical connector. Verify repair.

316.3 SPN 4077/FMI 4 - GHG17

Doser Fuel Line Pressure Sensor Circuit Failed Low

SPN 4077/FMI 4	
Description	This fault code sets when the Motor Control Module (MCM) detects that the Hydrocarbon (HC) Doser Fuel Line Pressure (FLP) Sensor Circuit is failed low.
Monitored Parameter	Hydrocarbon (HC) Doser Fuel Line Pressure Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (1 minute)



Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Is fault code SPN 3510/FMI 4 also present?
   3.a Yes; diagnose SPN 3510/FMI 4; Refer to section "SPN 3510/FMI 4 - GHG17" .
   3.b No; Go to step 4.
4. Is this vehicle equipped with a DD15 AT engine?

4.a Yes; Go to step 6.

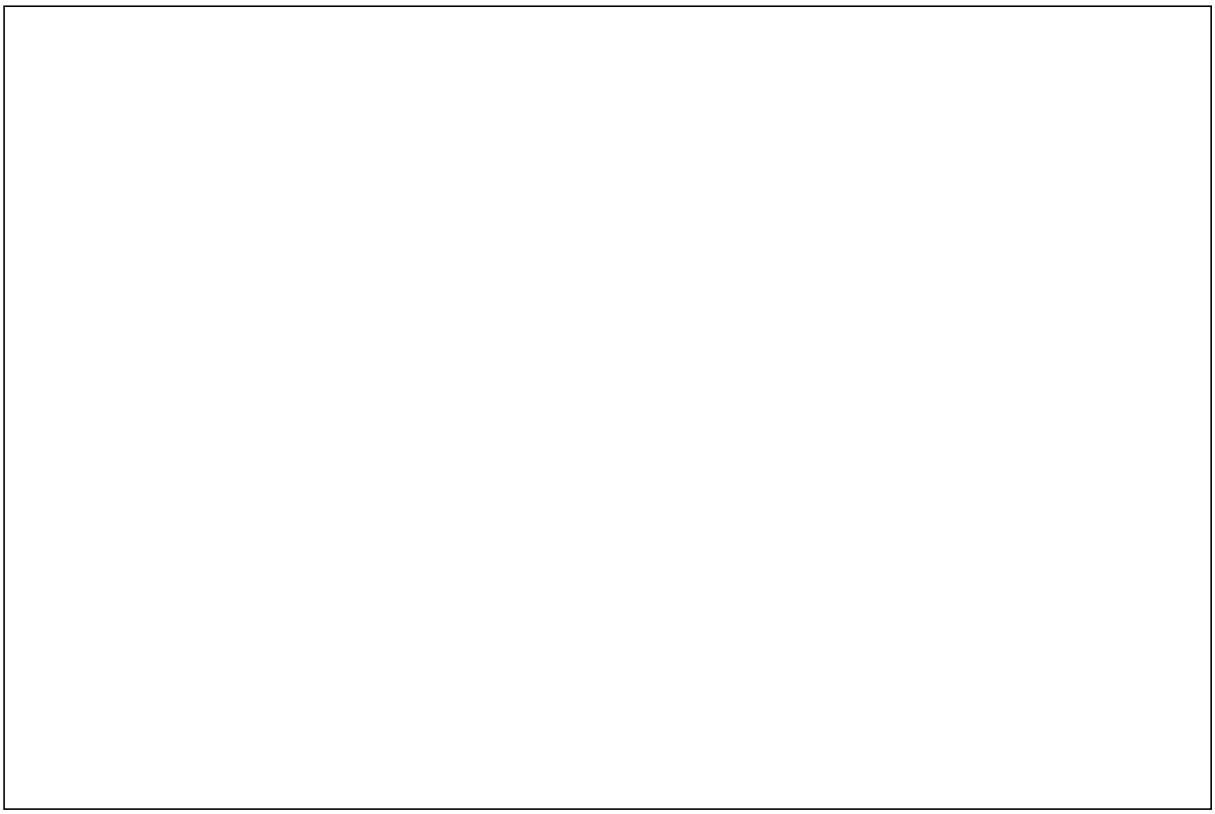
4.b No; Go to step 5.

5. Disconnect the Hydrocarbon doser fuel line pressure sensor (1). Is fault code SPN 4077/FMI 4 still present?

5.a Yes; repair the circuit between pin 111 of the 120-pin MCM connector and pin 1 of the hydrocarbon doser fuel line pressure sensor connector. Verify repair.

5.b No; replace the hydrocarbon doser block; Refer to section "Removal of the Hydrocarbon Doser Block " . Verify repair.

6. Disconnect the Hydrocarbon doser fuel line pressure sensor (1). Is fault code SPN 4077/FMI 4 still present?



6.a Yes; repair the circuit between pin 111 of the 120-pin MCM connector and pin 4 of the hydrocarbon doser fuel line pressure sensor electrical connector. Verify repair.

6.b No; replace the hydrocarbon doser block; Refer to section "Removal of the Hydrocarbon Doser Block " . Verify repair.

316.4 SPN 4077/FMI 14 - GHG17

Doser Fuel Line Pressure Failed Self-Test

SPN 4077/FMI 14	
Description	This fault will set when the Doser Line Pressure is less than 20.6 kPa (3 psi), once all conditions are met.
Monitored Parameter	Doser Fuel Line Pressure
Typical Enabling Conditions	
Monitor Sequence	None
Execution Frequency	Once per drive cycle
Typical Duration	Seven seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%, Diesel Particulate Filter (DPF) Inhibit Regeneration
Verification	Parked Regeneration

Check as follows:

Note : This fault code may have been caused by an exceeded temperature threshold due to a small capacity single fuel tank and extended PTO mode operation.

1. Shut off the engine, apply the parking brake, chock the wheels, and perform any other applicable safety steps.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Are there any fuel system faults present?

- Faults are listed in diagnostic priority from top to bottom:
- SPN 3480/FMI 3 or 4
- SPN 4077/FMI 3 or 4
- SPN 3480/FMI 1

4.a Yes; repair these faults first.

4.b No; Go to step 5.

Note : Any trace of fuel visible on the Hydrocarbon (HC) doser block, dosing fuel line, or fuel doser injector valve is an indication of a fuel leak that can cause this fault.

5. Visually inspect HC doser block assembly, dosing fuel line and fuel doser injector valve for external leaks. Are any external leaks are present?

5.a Yes; repair as necessary. Go to step 6.

5.b No; replace the Hydrocarbon Doser Fuel Injector Valve and clean the cavity in the flanged manifold/S-pipe. Refer to section "Removal of the Hydrocarbon Fuel Doser Injector Valve" . Go to step 6.

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

> **⚠ 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.

> **⚠ 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.

6. Start the engine.
7. Perform two consecutive HC Doser Purge routines.

> **⚠ 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.

8. Perform a parked regeneration to confirm the repair. Refer to section "Performing a Parked Regeneration - GHG17" .
9. Is SPN 4077 FMI 14 still active?
   - 9.a Yes; replace the HC doser block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " then Go to step 10.
   - 9.b No; repair is complete.
10. Perform two consecutive HC Doser Purge routines and verify repairs.

SPN 4077 (MCM) (GHG17)

316.1 SPN 4077/FMI 0 - GHG17

High Doser Fuel Line Pressure

SPN 4077/FMI 0	
Description	Hydrocarbon (HC) Doser Fuel Line Pressure High
Monitored Parameter	Hydrocarbon (HC) Doser Fuel Line Pressure
Typical Enabling Conditions	Dosing Enabled
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	1 Minute
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	Parked Regeneration

1. Shut off the engine, apply the parking brake, chock the wheels, and perform any other applicable safety steps.
2. Replace the Fuel Doser Injector Valve and clean the cavity in the flanged manifold/S-pipe. Refer to section "Removal of the Hydrocarbon Fuel Doser Injector Valve" .
3. Connect DiagnosticLink Standard.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

4. Start the engine.

Note : Purge routine may have to be performed three times to remove all air. Do not exceed three purge attempts.

> **⚠ 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.

5. Using DiagnosticLink Standard, perform Purge Hydrocarbon Doser Service Routine.
6. Using DiagnosticLink Standard, initiate a Parked Regeneration. Does regen complete?

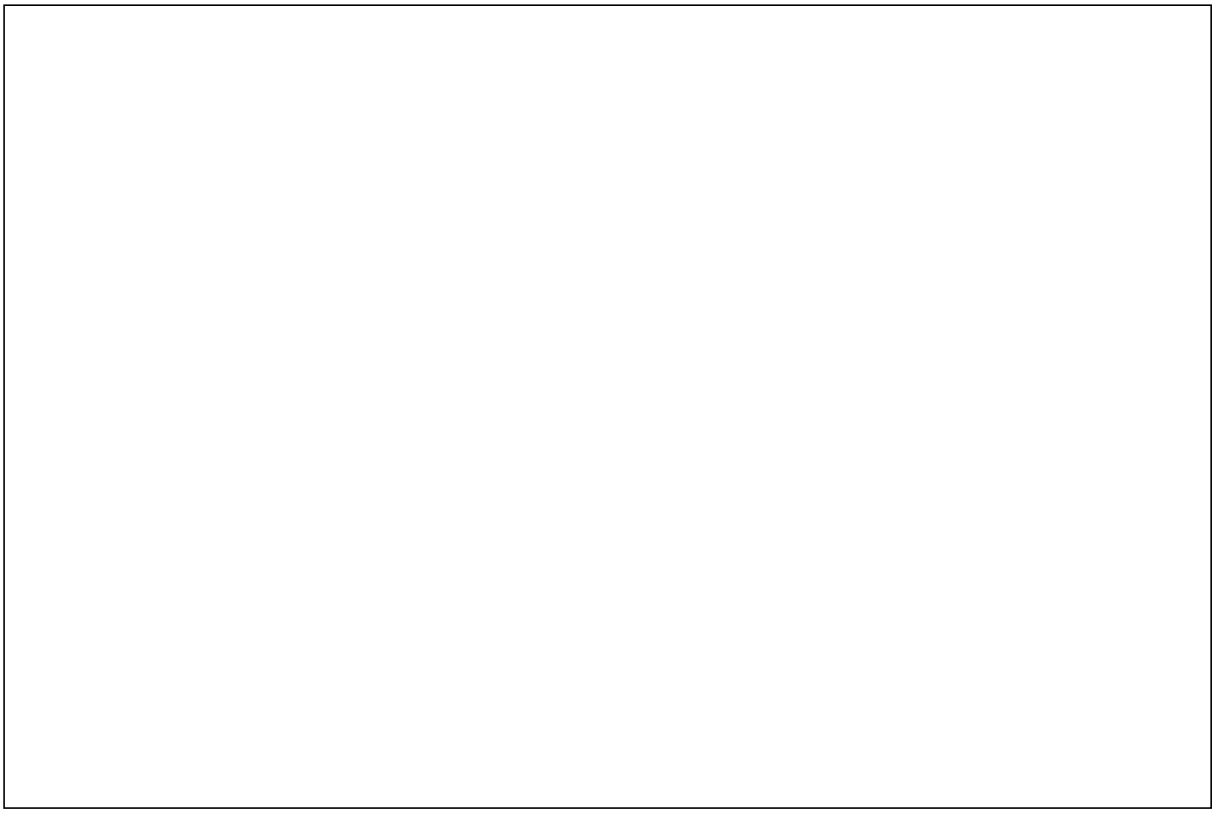
6.a Yes; clear faults and release vehicle.

6.b No; replace Hydrocarbon Fuel Doser Block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " . Verify repairs.

316.2 SPN 4077/FMI 3 - GHG17

Doser Fuel Line Pressure Sensor Circuit Failed High

SPN 4077/FMI 3	
Description	This fault code sets when the Motor Control Module (MCM) detects that the Hydrocarbon (HC) Doser Fuel Line Pressure (FLP) Sensor Circuit is failed high.
Monitored Parameter	Hydrocarbon (HC) Doser Fuel Line Pressure Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (1 minute)



Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Is the engine equipped with a DD15 AT engine?
   - 3.a Yes; Go to step 11.
   - 3.b No; Go to step 4.
4. Check for multiple fault codes. Is fault code SPN 3480/FMI 3 also present?

4.a Yes; repair the circuit between pin 104 of the 120-pin Motor Control Module (MCM) and pin 2 of the Fuel Doser Line Pressure sensor electrical connector/pin 2 of the Fuel Compensation Pressure sensor. Verify repair.

4.b No; Go to step 5.

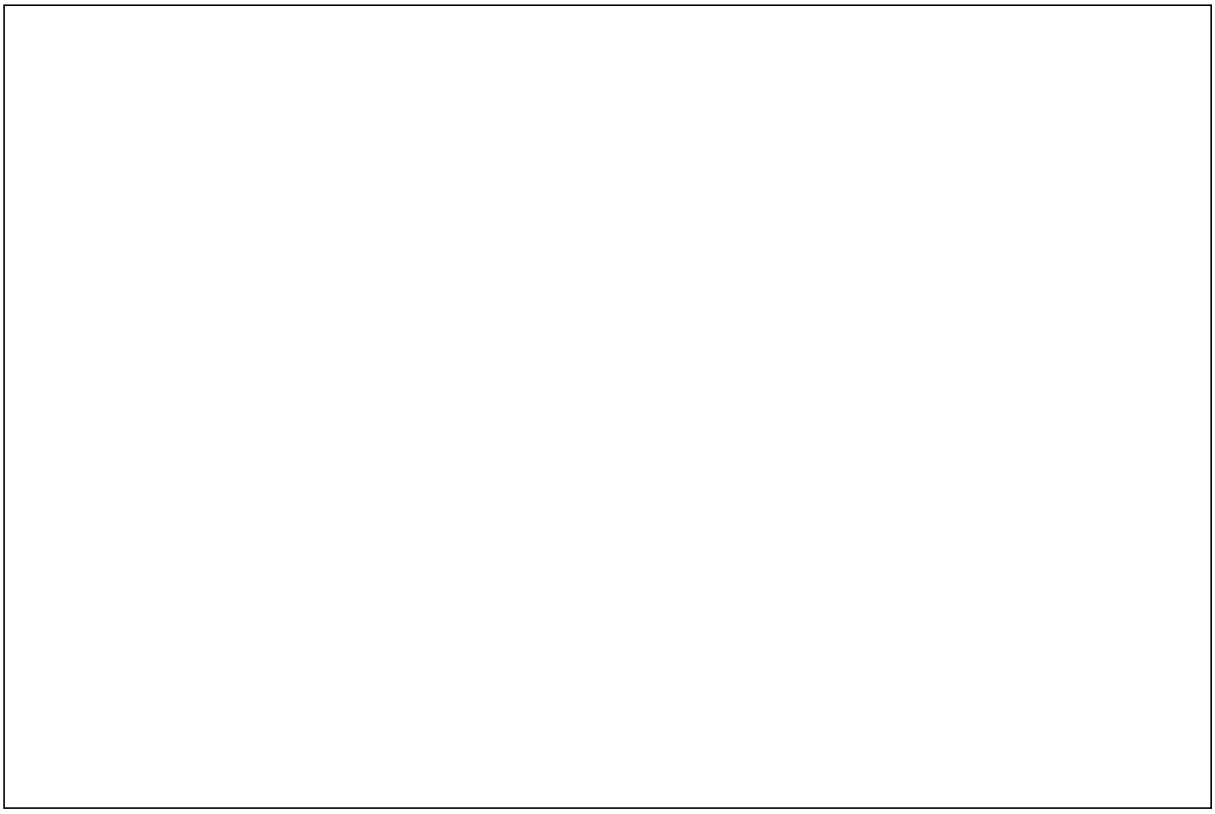
5. Is fault code SPN 3510/FMI 3 also present?

5.a Yes; diagnose SPN 3510/FMI 3 first; Refer to section "SPN 3510/FMI 3 - GHG17" .

5.b No; Go to step 6.

6. Turn the ignition OFF.

7. Disconnect the hydrocarbon doser fuel line pressure sensor (1).



8. Disconnect the 120-pin Motor Control Module (MCM) connector.

9. Measure the resistance from pin 111 of the 120-pin MCM connector harness side and pin 1 of the hydrocarbon doser fuel line pressure sensor electrical connector harness side. Is the resistance less than 5 ohms?

9.a Yes; Go to step 10.

9.b No; repair the circuit between pin 111 of the 120-pin MCM connector and pin 1 of the hydrocarbon doser fuel line pressure sensor electrical connector. Verify repair.

10. Measure the resistance from pin 104 of the 120-pin MCM connector harness side and pin 4 of the hydrocarbon doser fuel line pressure sensor electrical connector harness side. Is the resistance less than 5 ohms?

10.a Yes; replace the Motor Control Module (MCM), Refer to section "Removal of the Motor Control Module" . Verify repair.

10.b No; repair the circuit between pin 2 of the hydrocarbon doser fuel line pressure sensor and the circuit splice. Verify repair.

11. Check for multiple fault codes. Is fault code SPN 3480/FMI 3 also present?

11.a Yes; repair the circuit between pin 104 of the 120-pin Motor Control Module (MCM) and pin 2 of the Fuel Line Pressure sensor electrical connector/ pin 4 of the Fuel Compensation Pressure sensor electrical connector. Verify repair.

11.b No; Go to step 12.

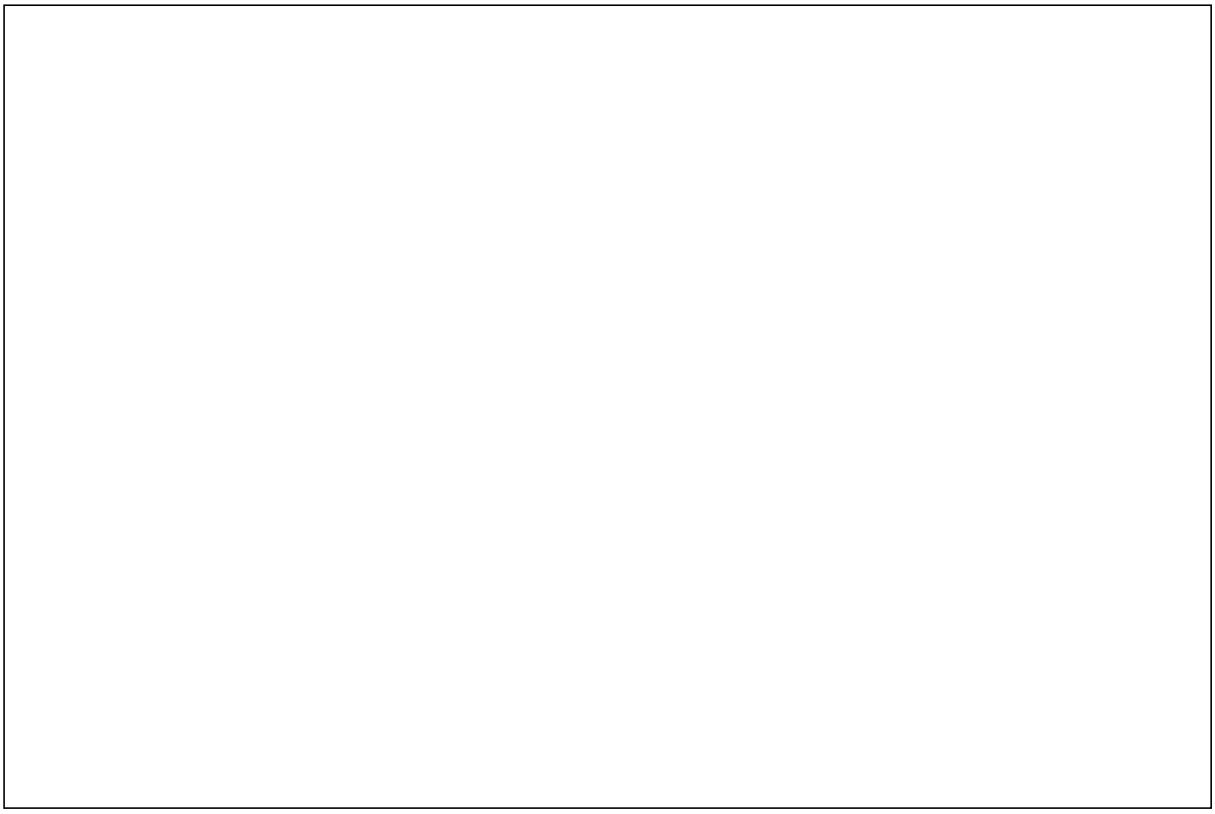
12. Is fault code SPN 3510/FMI 3 also present?

12.a Yes; diagnose fault code SPN 3510/FMI 3 first, Refer to section "SPN 3510/FMI 3 - GHG17".

12.b No; Go to step 13.

13. Turn the ignition OFF. Go to step 14.

14. Disconnect the hydrocarbon doser fuel line pressure sensor (1).



15. Disconnect the 120-pin Motor Control Module (MCM) connector.

16. Measure the resistance from pin 111 of the 120-pin MCM connector harness side and pin 4 of the hydrocarbon doser fuel line pressure sensor electrical connector harness side. Is the resistance less than 5 ohms?

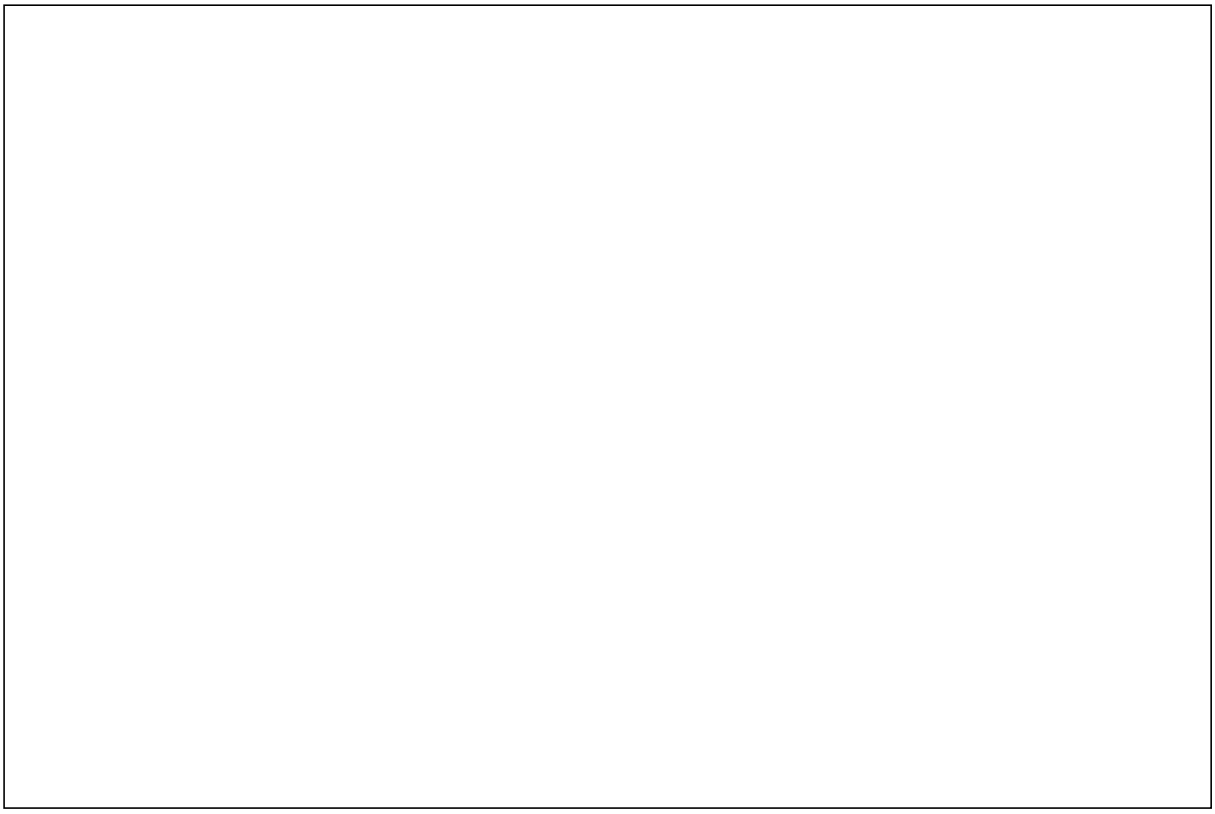
16.a Yes; replace the MCM, Refer to section "Removal of the Motor Control Module" . Verify repair.

16.b No; repair the circuit between pin 111 of the 120-pin MCM connector and pin 4 of the hydrocarbon doser fuel line pressure sensor electrical connector. Verify repair.

316.3 SPN 4077/FMI 4 - GHG17

Doser Fuel Line Pressure Sensor Circuit Failed Low

SPN 4077/FMI 4	
Description	This fault code sets when the Motor Control Module (MCM) detects that the Hydrocarbon (HC) Doser Fuel Line Pressure (FLP) Sensor Circuit is failed low.
Monitored Parameter	Hydrocarbon (HC) Doser Fuel Line Pressure Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (1 minute)



Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Is fault code SPN 3510/FMI 4 also present?
   3.a Yes; diagnose SPN 3510/FMI 4; Refer to section "SPN 3510/FMI 4 - GHG17" .
   3.b No; Go to step 4.
4. Is this vehicle equipped with a DD15 AT engine?

4.a Yes; Go to step 6.

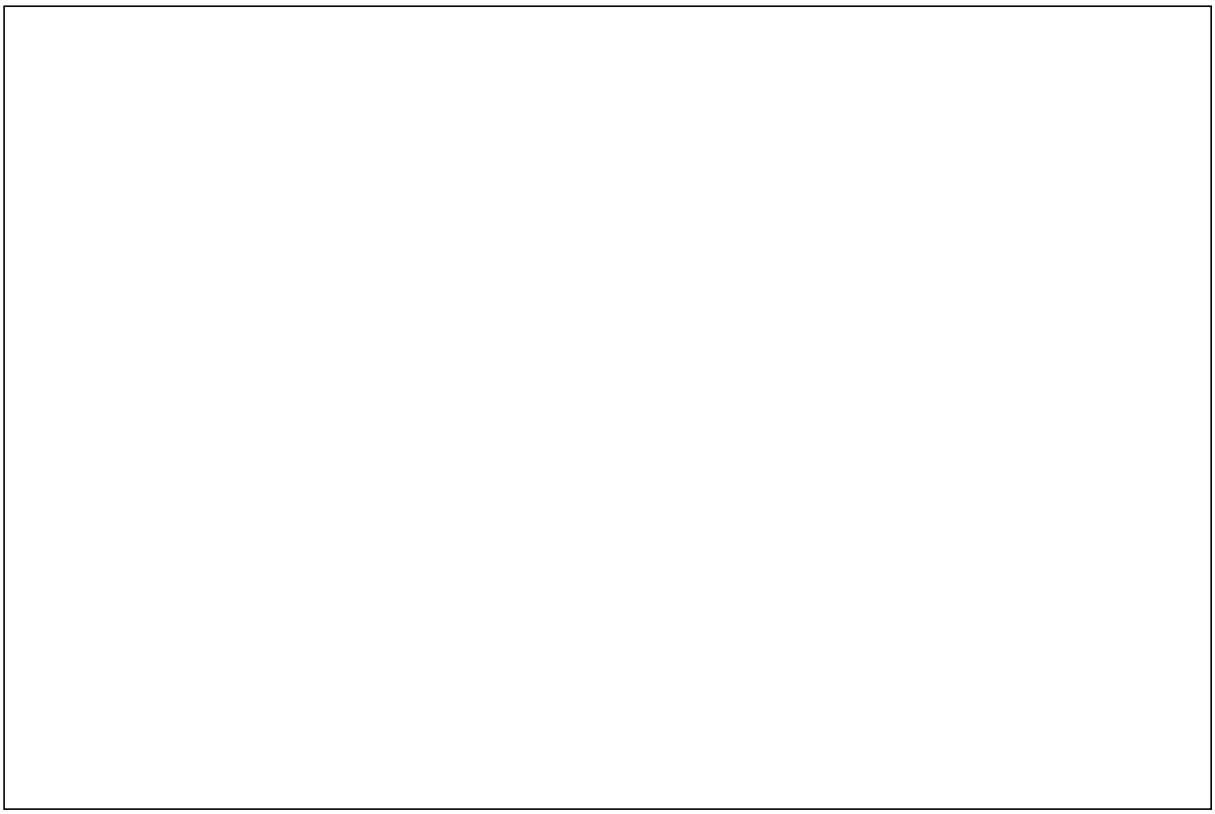
4.b No; Go to step 5.

5. Disconnect the Hydrocarbon doser fuel line pressure sensor (1). Is fault code SPN 4077/FMI 4 still present?

5.a Yes; repair the circuit between pin 111 of the 120-pin MCM connector and pin 1 of the hydrocarbon doser fuel line pressure sensor connector. Verify repair.

5.b No; replace the hydrocarbon doser block; Refer to section "Removal of the Hydrocarbon Doser Block " . Verify repair.

6. Disconnect the Hydrocarbon doser fuel line pressure sensor (1). Is fault code SPN 4077/FMI 4 still present?



6.a Yes; repair the circuit between pin 111 of the 120-pin MCM connector and pin 4 of the hydrocarbon doser fuel line pressure sensor electrical connector. Verify repair.

6.b No; replace the hydrocarbon doser block; Refer to section "Removal of the Hydrocarbon Doser Block " . Verify repair.

316.4 SPN 4077/FMI 14 - GHG17

Doser Fuel Line Pressure Failed Self-Test

SPN 4077/FMI 14	
Description	This fault will set when the Doser Line Pressure is less than 20.6 kPa (3 psi), once all conditions are met.
Monitored Parameter	Doser Fuel Line Pressure
Typical Enabling Conditions	
Monitor Sequence	None
Execution Frequency	Once per drive cycle
Typical Duration	Seven seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%, Diesel Particulate Filter (DPF) Inhibit Regeneration
Verification	Parked Regeneration

Check as follows:

Note : This fault code may have been caused by an exceeded temperature threshold due to a small capacity single fuel tank and extended PTO mode operation.

1. Shut off the engine, apply the parking brake, chock the wheels, and perform any other applicable safety steps.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Are there any fuel system faults present?

- Faults are listed in diagnostic priority from top to bottom:
- SPN 3480/FMI 3 or 4
- SPN 4077/FMI 3 or 4
- SPN 3480/FMI 1

4.a Yes; repair these faults first.

4.b No; Go to step 5.

Note : Any trace of fuel visible on the Hydrocarbon (HC) doser block, dosing fuel line, or fuel doser injector valve is an indication of a fuel leak that can cause this fault.

5. Visually inspect HC doser block assembly, dosing fuel line and fuel doser injector valve for external leaks. Are any external leaks are present?

5.a Yes; repair as necessary. Go to step 6.

5.b No; replace the Hydrocarbon Doser Fuel Injector Valve and clean the cavity in the flanged manifold/S-pipe. Refer to section "Removal of the Hydrocarbon Fuel Doser Injector Valve" . Go to step 6.

WARNING

ENGINE EXHAUST

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

> **⚠ 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.

> **⚠ 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.

6. Start the engine.
7. Perform two consecutive HC Doser Purge routines.

> **⚠ 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.

8. Perform a parked regeneration to confirm the repair. Refer to section "Performing a Parked Regeneration - GHG17" .
9. Is SPN 4077 FMI 14 still active?
   - 9.a Yes; replace the HC doser block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " then Go to step 10.
   - 9.b No; repair is complete.
10. Perform two consecutive HC Doser Purge routines and verify repairs.

317.1 SPN 4193/FMI 3 - GHG17

Engine Coolant Inlet Temperature Circuit Failed High

SPN 4193/FMI 3	
Description	Engine Coolant Inlet Temperature Circuit Failed High
Monitored Parameter	Engine Coolant Inlet Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (1 minute)

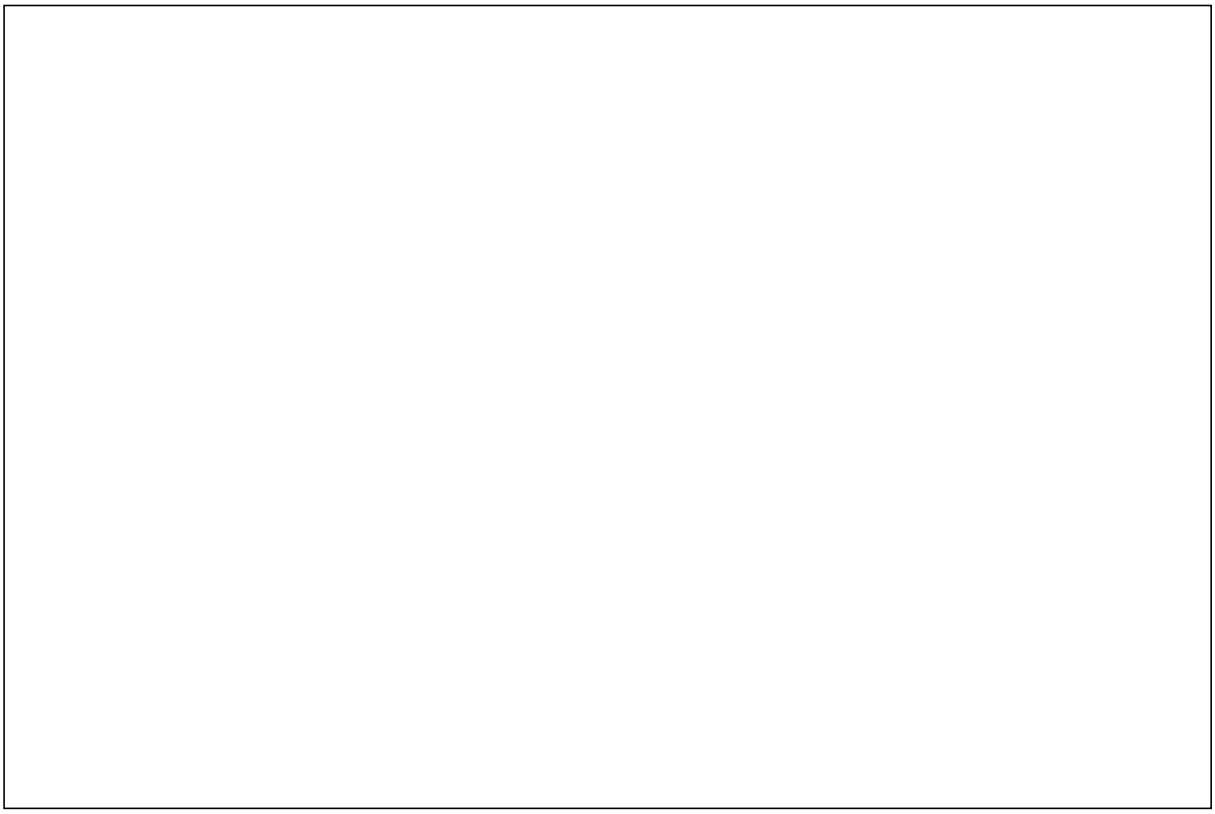


Fig 0.1, Engine Coolant Inlet Temperature Circuit

1. Disconnect the engine coolant inlet temperature sensor.
2. Turn the ignition ON (key ON, engine OFF).
3. Inspect the sensor harness for bent, spread, or corroded pins.
   - 3.a If damage is found, repair as necessary.
   - 3.b If no damage is found, Go to step 4.
4. Measure the voltage between pins 1 and 2 of the engine coolant inlet temperature sensor harness connector.
   - 4.a If the voltage is between 2.8 and 3 volts, replace the engine coolant inlet temperature sensor. Refer to section "Removal of the Engine Coolant Inlet Temperature Sensor" .

4.b If the voltage is less than 2.8 volts, Go to step 5.

5. Measure voltage between pin 2 of the engine coolant inlet temperature sensor and ground.

5.a If the voltage is between 2.8 and 3 volts, repair the wire between pin 1 of the engine coolant inlet temperature sensor connector and pin 55 of the MCM 120-pin connector.

5.b If the voltage is less than 2.8 volts, repair the wire between pin 2 of the engine coolant inlet temperature sensor connector and pin 80 of the MCM 120-pin connector.

6. Measure the voltage between pins 1 and 2 of the engine coolant inlet temperature sensor harness connector.

6.a If the voltage is greater than 3 volts, repair the short to power on one of the following MCM pins: 77, 80, 108 or 110.

6.b If no voltage is present, repair the open between pin 55 of the MCM 120-pin connector and the engine coolant outlet temperature, engine coolant inlet temperature, engine oil temperature and the supply fuel temperature sensors.

317.2 SPN 4193/FMI 4 - GHG17

Engine Coolant Inlet Temperature Circuit Failed Low

SPN 4193/FMI 4	
Description	Engine Coolant Inlet Temperature Circuit Failed Low
Monitored Parameter	Engine Coolant Inlet Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (1 minute)

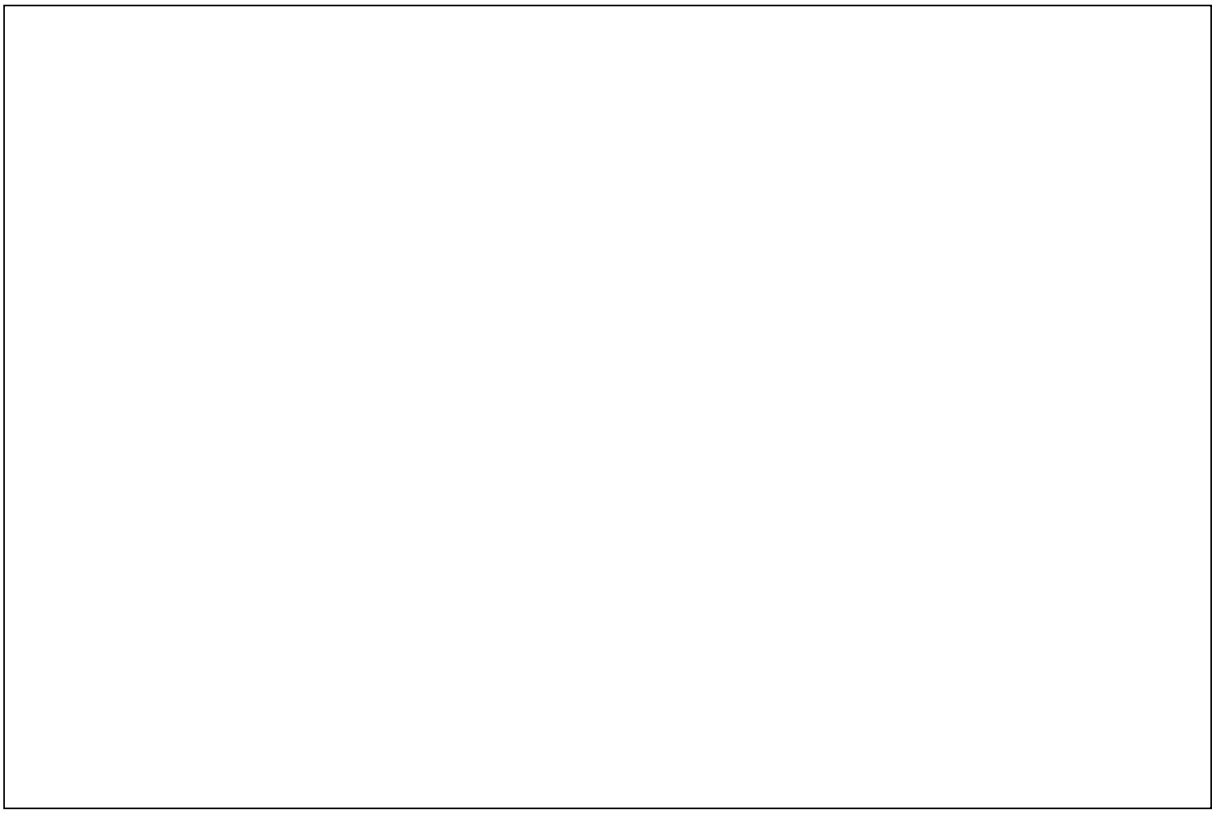


Fig 0.2, Engine Coolant Inlet Temperature Circuit

1. Disconnect the engine coolant inlet temperature sensor connector.
2. Inspect the sensor harness for bent, spread, or corroded pins.
   2.a If damage is found, repair as necessary.
   2.b If no damage is found, Go to step 3.
3. Disconnect the MCM 120-pin connector.
4. Measure the resistance between pins 1 and 2 on the coolant inlet temperature sensor connector.
   4.a If the resistance is less than 1k ohms, repair the short to ground between pin 2 of the engine coolant inlet sensor harness connector and pin 80 of the MCM 120-pin connector.

4.b If the resistance is greater than 1k ohms, replace the engine coolant inlet temperature sensor. Refer to section "Removal of the Engine Coolant Inlet Temperature Sensor" .

317.3 SPN 4193/FMI 20 - GHG17

Coolant Inlet Temperature Signal Not Plausible

SPN 4193/FMI 20	
Description	This fault code sets when the Motor Control Module (MCM) detects that the engine coolant inlet temperature is greater than 20°C (36°F) degrees from the expected temperature after the engine has been turned off for 8 hours.
Monitored Parameter	Coolant inlet temperature
Typical Enabling Conditions	Key ON, engine OFF, battery voltage greater than 11 volts, engine rpm at zero, ambient temperature less than 40°C (104°F), engine OFF for no less than 8 hours.
Monitor Sequence	None
Execution Frequency	Once per cool down cycle
Typical Duration	5 seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Road test the vehicle for 30 minutes until the coolant reaches operating temperature. Then verify that the engine coolant inlet temperature is within 20°C (36°F) of the engine coolant outlet temperature.

Possible causes:

Note : The use of an external heating unit while the engine has been shut down for a minimum of 8 hours can cause this fault code to set erroneously.

1. Has the Common Powertrain Controller (CPC) recently been reprogrammed or has the internal clock time been changed?
   1.a Yes; this fault may have been caused by the change in the CPC time.
   1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Check for multiple fault codes. Are fault codes SPN 4193//FMI 3 or 4 present?
   4.a Yes; diagnose the other fault codes first.
   4.b No; Go to step 5.
5. Monitor and record the engine coolant inlet temperature.

> **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.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

6. Start the engine.
7. Road test the vehicle for 30 minutes until the coolant reaches operating temperature.
8. Monitor engine coolant inlet temperature. Has the temperature increased from the previously recorded value?
   - 8.a Yes; Go to step 9.
   - 8.b No; Go to step 10.
9. Compare the engine coolant inlet temperature to the engine coolant outlet temperature. Is the difference greater than 20°C (36°F)?
   - 9.a Yes; Go to step 10.
   - 9.b No; the fault may have been caused by an external heating unit.
10. Disconnect and inspect the engine coolant inlet temperature sensor electrical connector. Is there damage or corrosion present?
    - 10.a Yes; repair as necessary. Verify repair.
    - 10.b No; replace the engine coolant inlet temperature sensor. Verify repair.

SPN 4193 (MCM) (GHG17)

317.1 SPN 4193/FMI 3 - GHG17

Engine Coolant Inlet Temperature Circuit Failed High

SPN 4193/FMI 3	
Description	Engine Coolant Inlet Temperature Circuit Failed High
Monitored Parameter	Engine Coolant Inlet Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (1 minute)

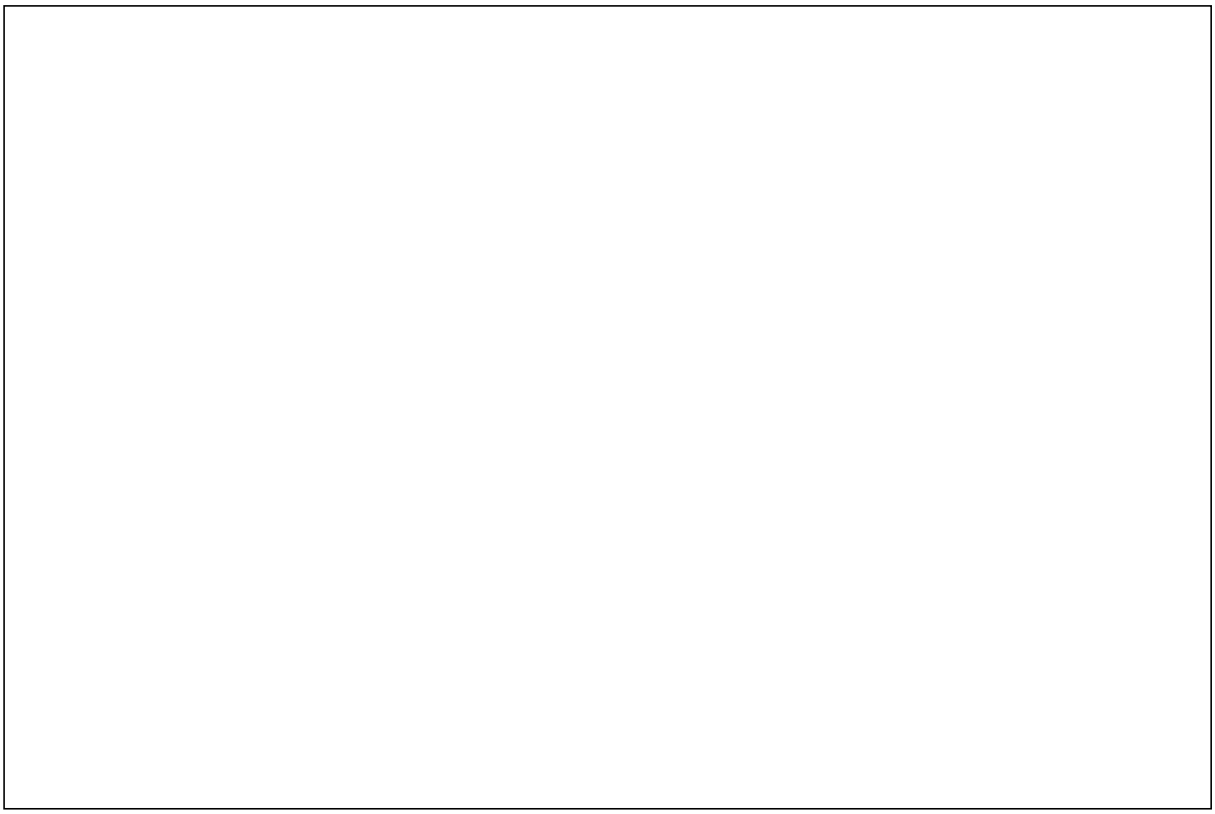


Fig 317.3, Engine Coolant Inlet Temperature Circuit

1. Disconnect the engine coolant inlet temperature sensor.
2. Turn the ignition ON (key ON, engine OFF).
3. Inspect the sensor harness for bent, spread, or corroded pins.
   3.a If damage is found, repair as necessary.
   3.b If no damage is found, Go to step 4.

4. Measure the voltage between pins 1 and 2 of the engine coolant inlet temperature sensor harness connector.
   - 4.a If the voltage is between 2.8 and 3 volts, replace the engine coolant inlet temperature sensor. Refer to section "Removal of the Engine Coolant Inlet Temperature Sensor" .
   - 4.b If the voltage is less than 2.8 volts, Go to step 5.
5. Measure voltage between pin 2 of the engine coolant inlet temperature sensor and ground.
   - 5.a If the voltage is between 2.8 and 3 volts, repair the wire between pin 1 of the engine coolant inlet temperature sensor connector and pin 55 of the MCM 120-pin connector.
   - 5.b If the voltage is less than 2.8 volts, repair the wire between pin 2 of the engine coolant inlet temperature sensor connector and pin 80 of the MCM 120-pin connector.
6. Measure the voltage between pins 1 and 2 of the engine coolant inlet temperature sensor harness connector.
   - 6.a If the voltage is greater than 3 volts, repair the short to power on one of the following MCM pins: 77, 80, 108 or 110.
   - 6.b If no voltage is present, repair the open between pin 55 of the MCM 120-pin connector and the engine coolant outlet temperature, engine coolant inlet temperature, engine oil temperature and the supply fuel temperature sensors.

317.2 SPN 4193/FMI 4 - GHG17

Engine Coolant Inlet Temperature Circuit Failed Low

SPN 4193/FMI 4	
Description	Engine Coolant Inlet Temperature Circuit Failed Low
Monitored Parameter	Engine Coolant Inlet Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	Engine Idle (1 minute)

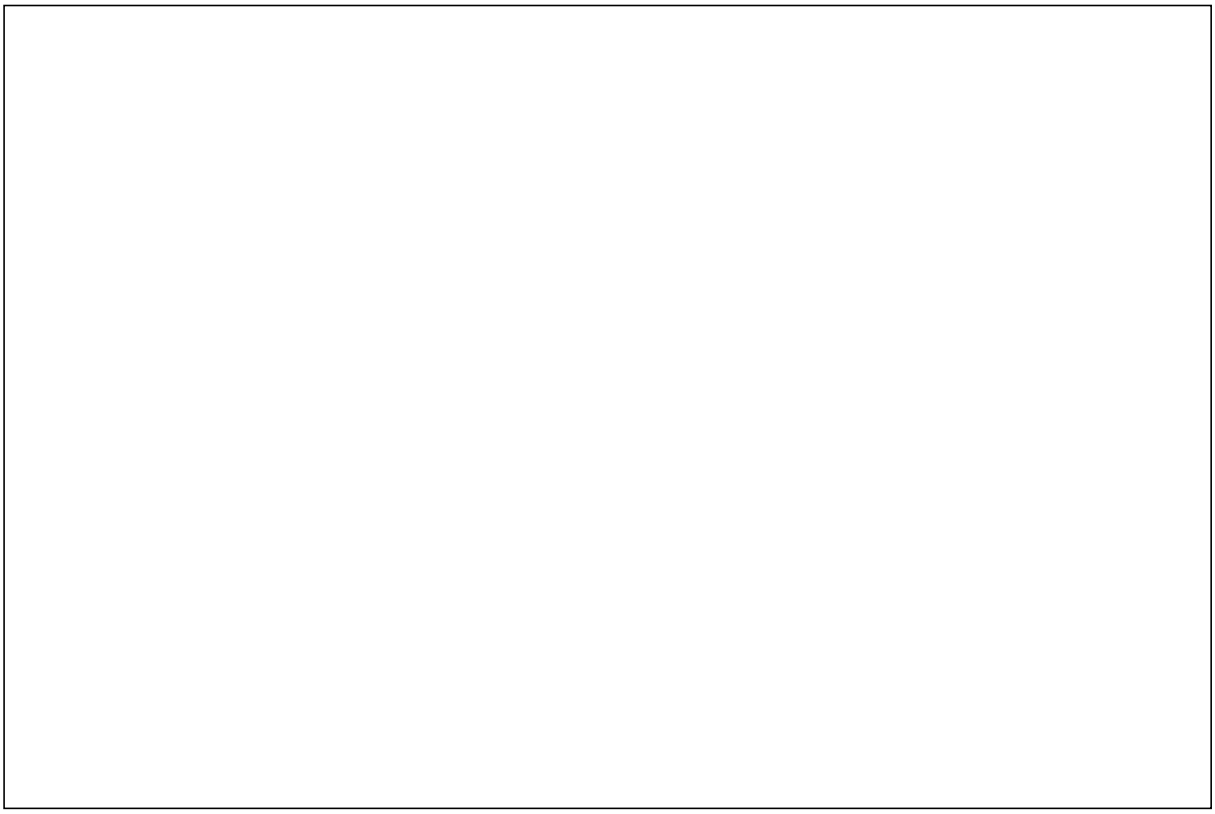


Fig 317.4, Engine Coolant Inlet Temperature Circuit

1. Disconnect the engine coolant inlet temperature sensor connector.
2. Inspect the sensor harness for bent, spread, or corroded pins.
   2.a If damage is found, repair as necessary.
   2.b If no damage is found, Go to step 3.
3. Disconnect the MCM 120-pin connector.
4. Measure the resistance between pins 1 and 2 on the coolant inlet temperature sensor connector.
   4.a If the resistance is less than 1k ohms, repair the short to ground between pin 2 of the engine coolant inlet sensor harness connector and pin 80 of the MCM 120-pin connector.

4.b If the resistance is greater than 1k ohms, replace the engine coolant inlet temperature sensor. Refer to section "Removal of the Engine Coolant Inlet Temperature Sensor" .

317.3 SPN 4193/FMI 20 - EuroV

Coolant Inlet Temperature Signal Not Plausible

SPN 4193/FMI 20	
Description	This fault code sets when the Motor Control Module (MCM) detects that the engine coolant inlet temperature is greater than 20°C (36°F) from the expected temperature after the engine has been turned off for eight hours.
Monitored Parameter	Coolant inlet temperature
Typical Enabling Conditions	Key ON, engine OFF, battery voltage greater than 11 volts, engine rpm at zero, ambient temperature less than 40°C (104°F), engine OFF for no less than eight hours.
Monitor Sequence	None
Execution Frequency	Once per cool down cycle
Typical Duration	Five seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Road test the vehicle for 30 minutes until the coolant reaches operating temperature. Then verify that the engine coolant inlet temperature is within 20°C (36°F) of the engine coolant outlet temperature.

Possible causes:

Note : The use of an external heating unit while the engine has been shut down for a minimum of eight hours can cause this fault code to set erroneously.

1. Has the Common Powertrain Controller (CPC) recently been reprogrammed or has the internal clock time been changed?
   1.a Yes; this fault may have been caused by the change in the CPC time.
   1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Check for multiple fault codes. Are fault codes SPN 4193/FMI 3 or 4 present?
   4.a Yes; diagnose the other fault codes first.
   4.b No; Go to step 5.
5. Monitor and record the engine coolant inlet temperature.

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

6. Start the engine.
7. Road test the vehicle for 30 minutes until the coolant reaches operating temperature.
8. Monitor engine coolant inlet temperature. Has the temperature increased from the previously recorded value?

   8.a Yes; Go to step 9.

   8.b No; Go to step 10.
9. Compare the engine coolant inlet temperature to the engine coolant outlet temperature. Is the difference greater than 20°C (36°F)?

   9.a Yes; Go to step 10.

   9.b No; the fault may have been caused by an external heating unit.
10. Disconnect and inspect the engine coolant inlet temperature sensor electrical connector. Is there damage or corrosion present?

    10.a Yes; repair as necessary. Verify repair.

    10.b No; replace the engine coolant inlet temperature sensor. Verify repair.

SPN 4206 (CPC) (GHG17)

318.1 SPN 4206/FMI 2 - GHG17

Common Powertrain Controller Internal Failure

1. Connect to DiagnosticLink .
2. Clear faults and retest. Does fault become active?
   - 2.a Yes; Replace the Common Powertrain Controller (CPC) and reprogram with the latest software release.
   - 2.b No; release vehicle.

319.1 SPN 4207/FMI 2 - GHG17

Common Powertrain Controller Internal Failure

1. Connect to DiagnosticLink .
2. Clear faults and retest. Does fault become active?

   2.a Yes; replace the Common Powertrain Controller (CPC) and reprogram with the latest software release.

   2.b No; release vehicle.

SPN 4207 (CPC) (GHG17)

319.1 SPN 4207/FMI 2 - GHG17

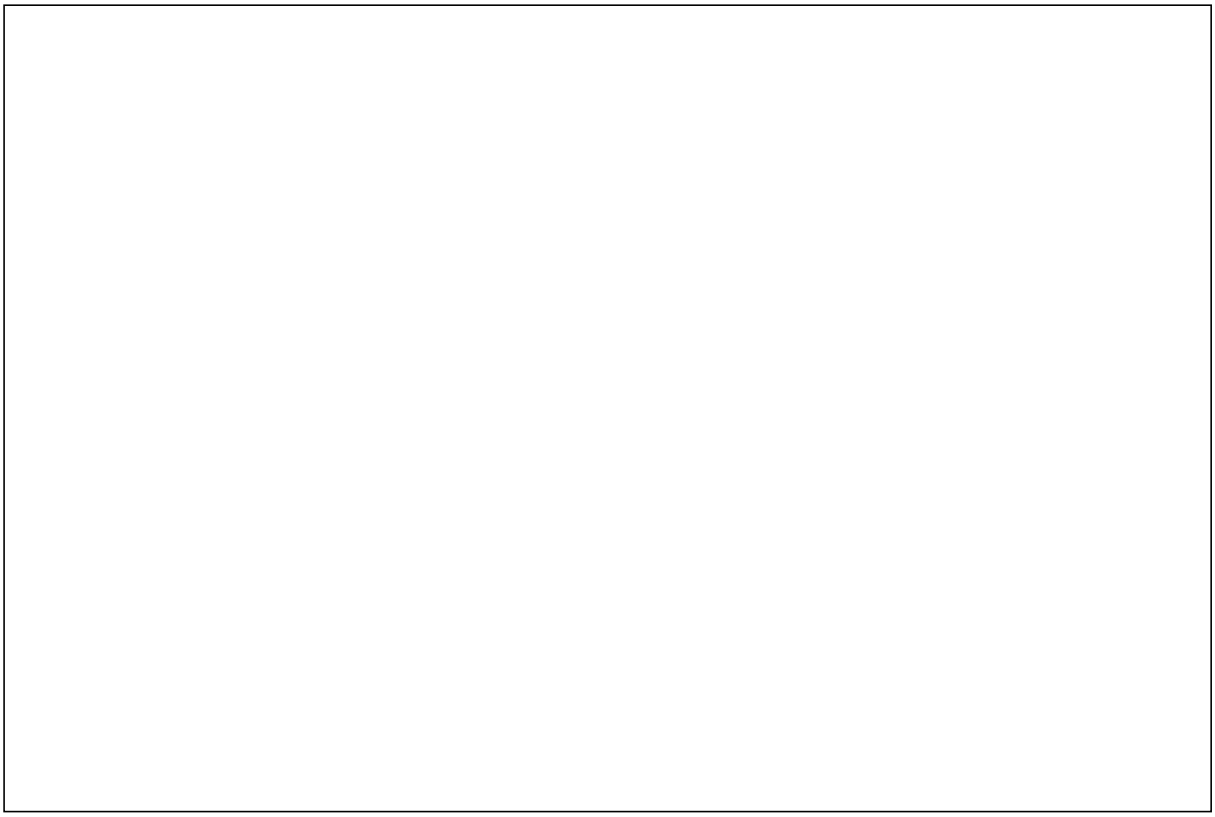
Common Powertrain Controller Internal Failure

1. Connect to DiagnosticLink .
2. Clear faults and retest. Does fault become active?
   2.a Yes; replace the Common Powertrain Controller (CPC) and reprogram with the latest software release.
   2.b No; release vehicle.

320.1 SPN 4257/FMI 3 - GHG17

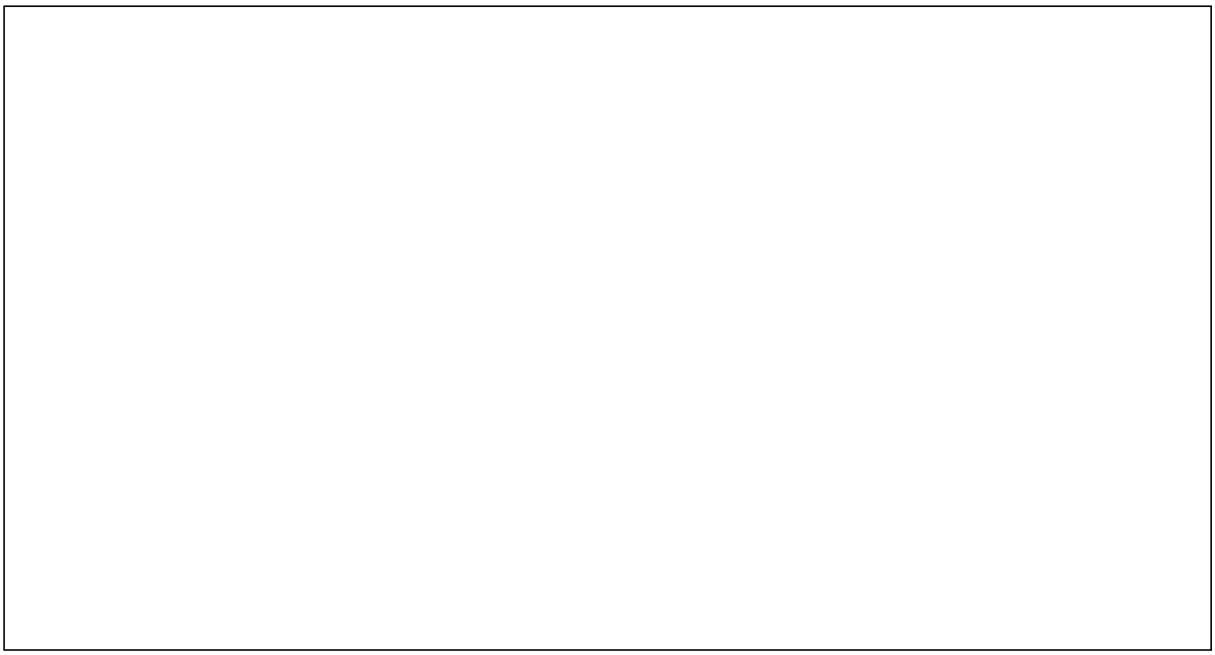
Injector Amplifier Control Valve Cylinder 1, 2, 3 Shorted to Battery

SPN 4257/FMI 3	
Description	Injector Amplifier Control Valve Cylinder 1, 2, 3 Shorted to Battery
Monitored Parameter	Injector Amplifier Control Valve Cylinder 1, 2, 3
Typical Enabling Conditions	fis_nop_act is greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (1 minute)



Check as follows:

1. Disconnect the front fuel injector harness 14-pin connector.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pin 5 on the Motor Control Module (MCM) engine harness side of the front fuel injector harness 14-pin connector and battery ground.



3.a If there is voltage present, repair the short to power between pin 5 of the engine harness side front fuel injector harness 14-pin connector and pin 13 of the MCM 120-pin connector.

3.b If there is no voltage present, Go to step 4.

4. Measure the voltage between pin 12 on the MCM side of the engine harness side front fuel injector harness 14-pin connector and ground.

4.a If there is voltage present, repair the short to power between pin 12 of the engine harness side front fuel injector harness connector and pin 12 of the MCM 120-pin connector.

4.b If there is no voltage present, Go to step 5.

5. Measure the voltage between pin 9 on the MCM side of the front fuel injector harness 14-pin connector and ground.

5.a If there is voltage present, repair the short to power between pin 9 of the front fuel injector harness connector and pin 10 of the MCM 120-pin connector.

5.b If there is no voltage present, repair the short to power between pin 8 of the front fuel injector harness connector and pin 14 of the MCM 120-pin connector.

320.2 SPN 4257/FMI 4 - GHG17

Injector Amplifier Control Valve Cylinder 1, 2, 3 Shorted to Ground

SPN 4257/FMI 4	
Description	This code sets when the MCM detects that there is a short to ground on the circuits for the injector amplifier control valve on cylinders 1, 2 and or 3.
Monitored Parameter	Injector Amplifier Control Valve Cylinder 1, 2, 3
Typical Enabling Conditions	Fuel injector system nozzle opening pressure reading greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (1 minute)

Fig 0.1, Tool J-48671-10 Injector Breakout Box

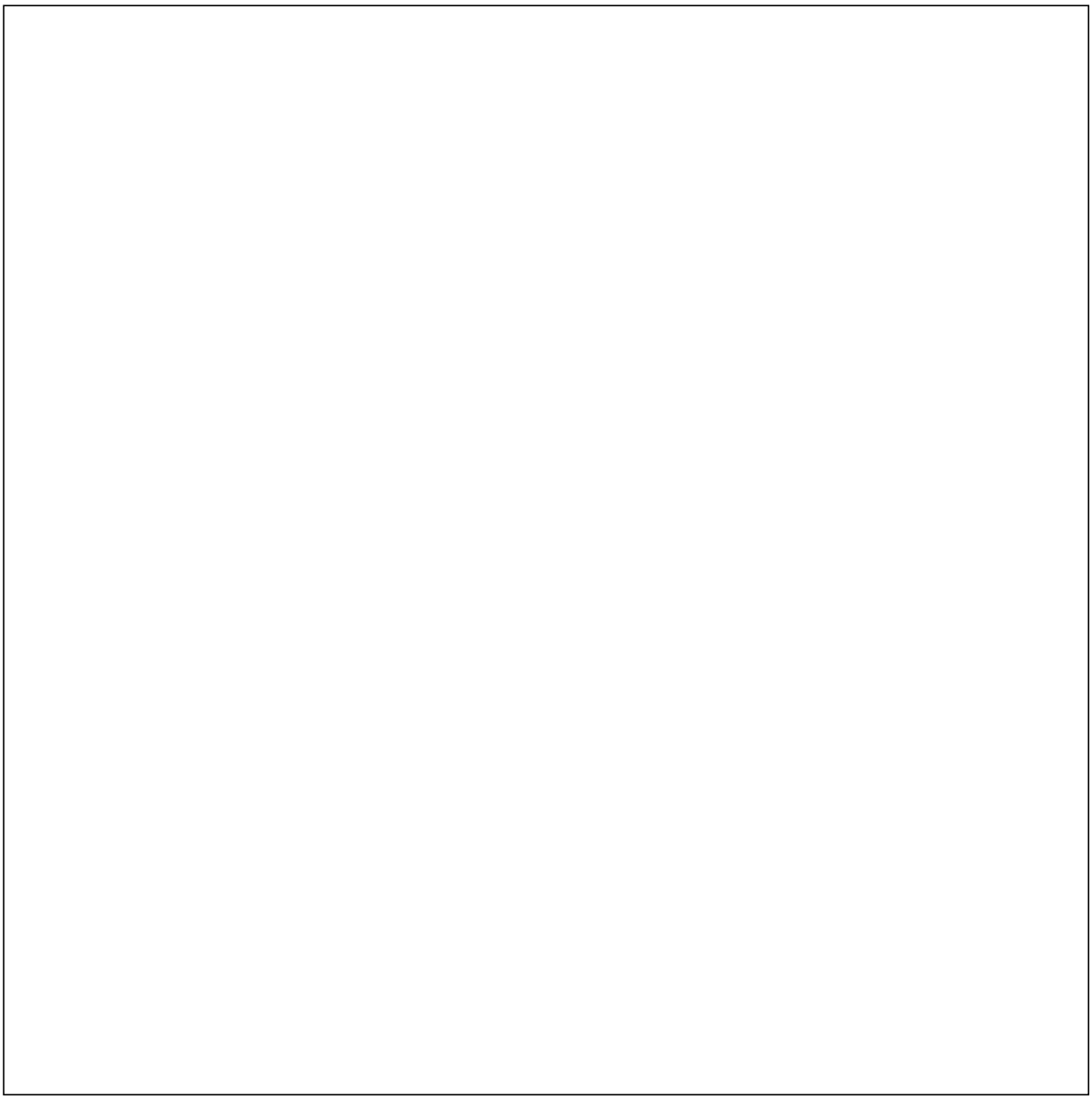
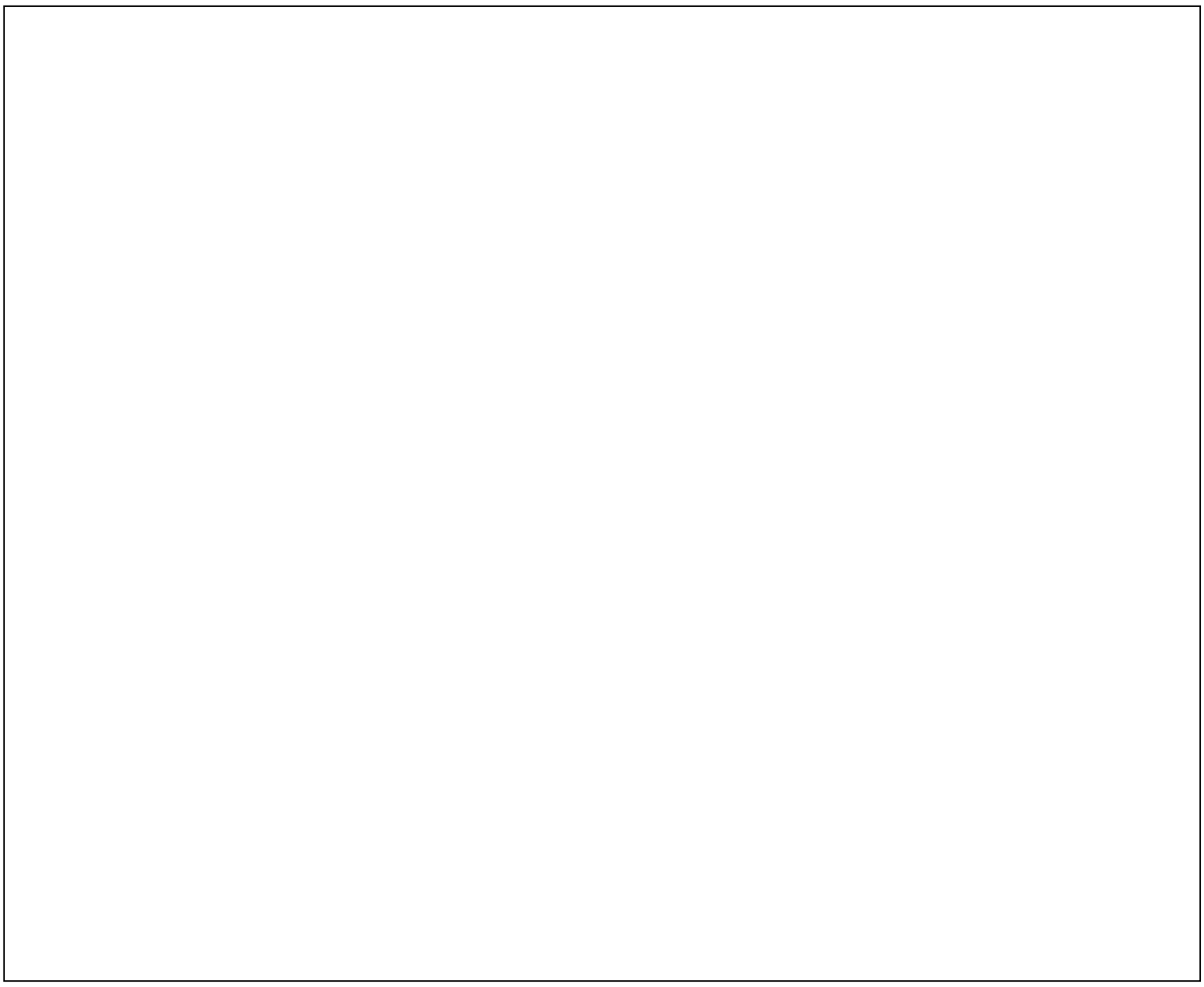
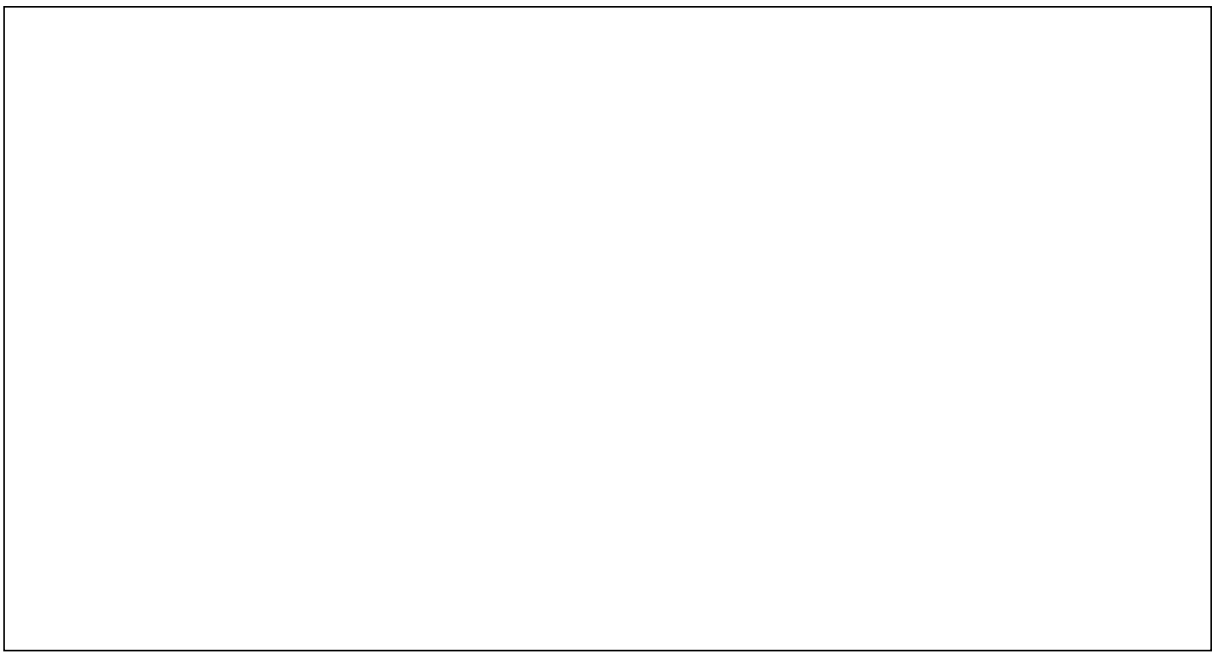


Fig 0.2, Tool J-48671-HDE DD13/15 Injector Breakout Box Harness Adaptor





Check as follows:

1. Disconnect the front fuel injector harness 14-pin connector. Go to step 2.
2. Inspect both sides of the front fuel injector harness 14-pin connectors for oil intrusion. Is there any oil present in the connectors?
   - 2.a Yes; replace the under valve cover harness and clean the engine side harness connector.
     Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Verify repair.
   - 2.b No; Go to step 3.
3. Inspect the front fuel injector harness 14-pin connectors for spread or damaged pins. Are there any spread or damaged pins?
   - 3.a Yes; repair as necessary. Verify repair.
   - 3.b No; Go to step 4.
4. Measure the resistance between pin 5 on the value cover side of the front fuel injector harness 14-pin connector and ground. If you are using tools J-48671-10 and J-48671-HDE, measure between fuel injector #4 pin 1 and ground. Is the resistance less than 5 ohms?
   - 4.a Yes; Go to step 5.
   - 4.b No; Go to step 12.
5. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" . Go to step 6.
6. Disconnect the electrical harness connecter on fuel injector #1. Go to step 7.
7. Measure the resistance between pin 5 on the valve cover side of the front fuel injector harness 14-pin connector and ground. If you are using tools J-48671-10 and J-48671-HDE, measure between fuel injector #1 pin 1 and ground. Is the resistance greater than 5 ohms?
   - 7.a Yes; replace fuel injector #1.
     Refer to section "Removal of the Fuel Injector - Two-Filter System" . Verify repair.
   - 7.b No; Go to step 8.
8. Disconnect the electrical harness connecter on fuel injector #2. Go to step 9.
9. Measure the resistance between pin 5 on the valve cover side of the front fuel injector harness 14-pin connector and ground. If you are using tools J-48671-10 and J-48671-HDE, measure between fuel injector #2 pin 1 and ground. Is the resistance greater than five ohms?
   - 9.a Yes; replace injector #2.
     Refer to section "Removal of the Fuel Injector - Two-Filter System" . Verify repair.
   - 9.b No; Go to step 10.
10. Disconnect the electrical harness connecter on fuel injector #3. Go to step 11.
11. Measure the resistance between pin 5 on the valve cover side of the front fuel injector harness 14-pin connector and ground. If you are using tools J-48671-10 and J-48671-HDE, measure between fuel injector #3 pin 1 and ground. Is the resistance greater than five ohms?
    - 11.a Yes; replace fuel injector #6.
      Refer to section "Removal of the Fuel Injector - Two-Filter System" . Verify repair.
    - 11.b No; replace the under valve cover harness.
      Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Verify repair.
12. Disconnect the 120-pin MCM connector. Go to step 13.
13. Measure the resistance between pin 5 of the engine harness side of the front fuel injector harness 14-pin connector and ground. Is the resistance greater than 5 ohms?
    - 13.a Yes; Go to step 14.
    - 13.b No; repair the short to ground between pin 13 of the MCM 120-pin connector and pin 5 of the front fuel injector harness 14-pin connector. Verify repair.
14. Measure the resistance between pin 8 of the engine harness side of the front fuel injector harness 14-pin connector and ground. Is the resistance greater than 5 ohms?
    - 14.a Yes; Go to step 15.

14.b No; repair the short to ground between pin 14 of the MCM 120-pin connector and pin 8 of the front fuel injector harness 14-pin connector. Verify repair.

15. Measure the resistance between pin 9 of the engine harness side of the front fuel injector harness 14-pin connector and ground. Is the resistance greater than 5 ohms?

15.a Yes; Go to step 16.

15.b No; repair the short to ground between pin 10 of the MCM 120-pin connector and pin 9 of the front fuel injector harness 14-pin connector. Verify repair.

16. Measure the resistance between pin 12 of the engine harness side of the front fuel injector harness 14-pin connector and ground. Is the resistance greater than 5 ohms?

16.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repair.

16.b No; repair the short between pin 12 of the MCM 120-pin connector and pin 12 of the front fuel injector harness 14-pin connector. Verify repair.

SPN 4257 (MCM) (GHG17)

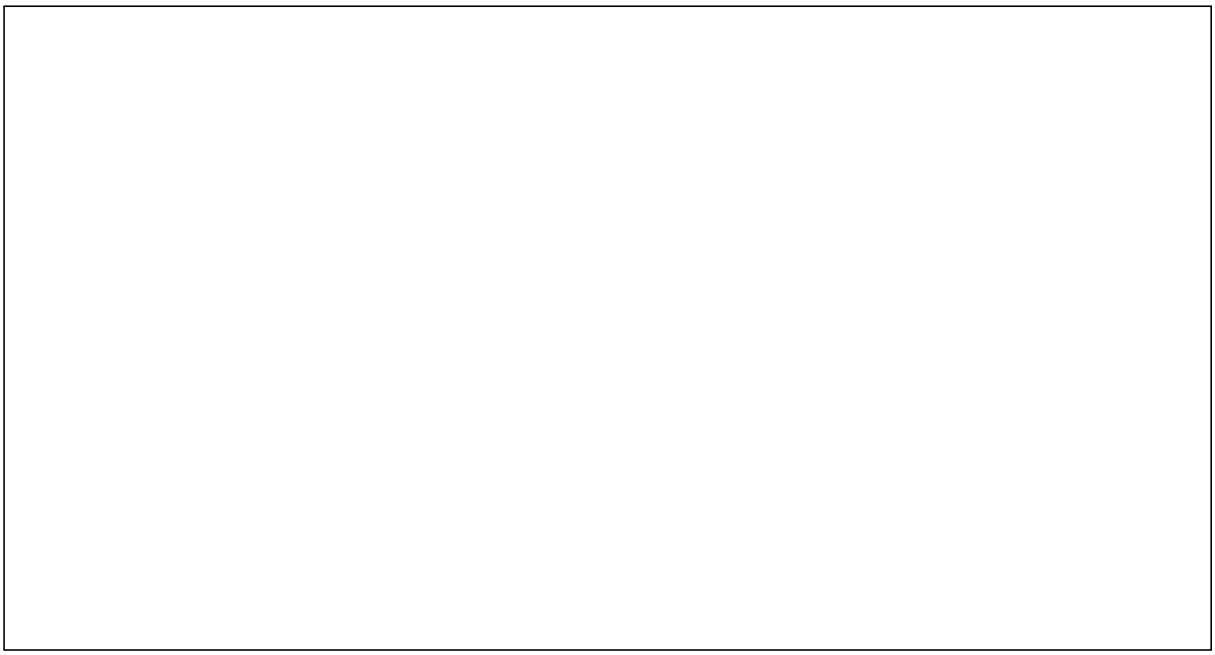
320.1 SPN 4257/FMI 3 - GHG17

Injector Amplifier Control Valve Cylinder 1, 2, 3 Shorted to Battery

SPN 4257/FMI 3	
Description	Injector Amplifier Control Valve Cylinder 1, 2, 3 Shorted to Battery
Monitored Parameter	Injector Amplifier Control Valve Cylinder 1, 2, 3
Typical Enabling Conditions	fis_nop_act is greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (1 minute)

Check as follows:

1. Disconnect the front fuel injector harness 14-pin connector.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pin 5 on the Motor Control Module (MCM) engine harness side of the front fuel injector harness 14-pin connector and battery ground.



3.a If there is voltage present, repair the short to power between pin 5 of the engine harness side front fuel injector harness 14-pin connector and pin 13 of the MCM 120-pin connector.

3.b If there is no voltage present, Go to step 4.

4. Measure the voltage between pin 12 on the MCM side of the engine harness side front fuel injector harness 14-pin connector and ground.

4.a If there is voltage present, repair the short to power between pin 12 of the engine harness side front fuel injector harness connector and pin 12 of the MCM 120-pin connector.

4.b If there is no voltage present, Go to step 5.

5. Measure the voltage between pin 9 on the MCM side of the front fuel injector harness 14-pin connector and ground.

5.a If there is voltage present, repair the short to power between pin 9 of the front fuel injector harness connector and pin 10 of the MCM 120-pin connector.

5.b If there is no voltage present, repair the short to power between pin 8 of the front fuel injector harness connector and pin 14 of the MCM 120-pin connector.

320.2 SPN 4257/FMI 4 - GHG17

Injector Amplifier Control Valve Cylinder 1, 2, 3 Shorted to Ground

SPN 4257/FMI 4	
Description	This code sets when the MCM detects that there is a short to ground on the circuits for the injector amplifier control valve on cylinders 1, 2 and or 3.
Monitored Parameter	Injector Amplifier Control Valve Cylinder 1, 2, 3
Typical Enabling Conditions	Fuel injector system nozzle opening pressure reading greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (1 minute)

Fig 320.3, Tool J-48671-10 Injector Breakout Box

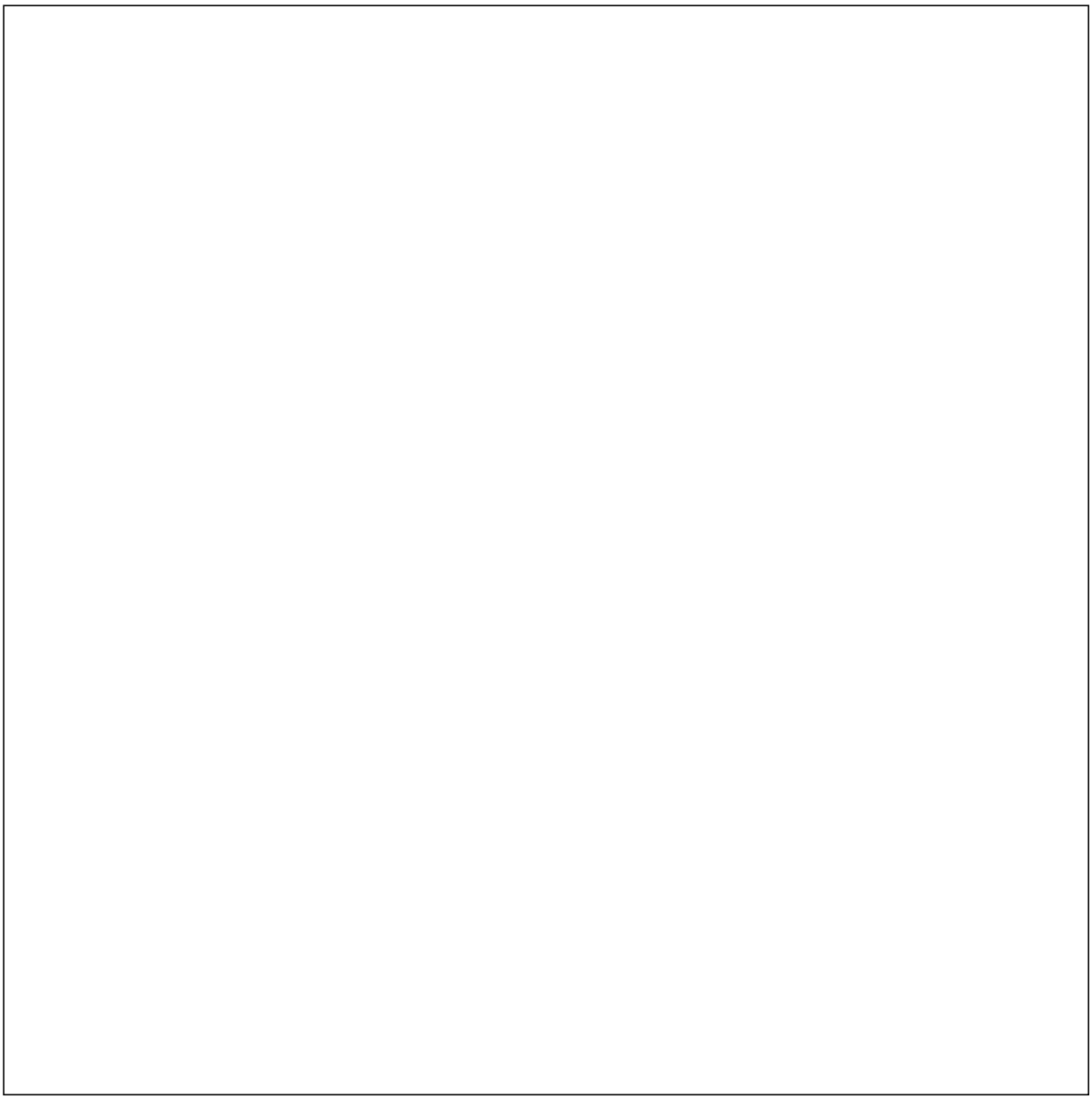
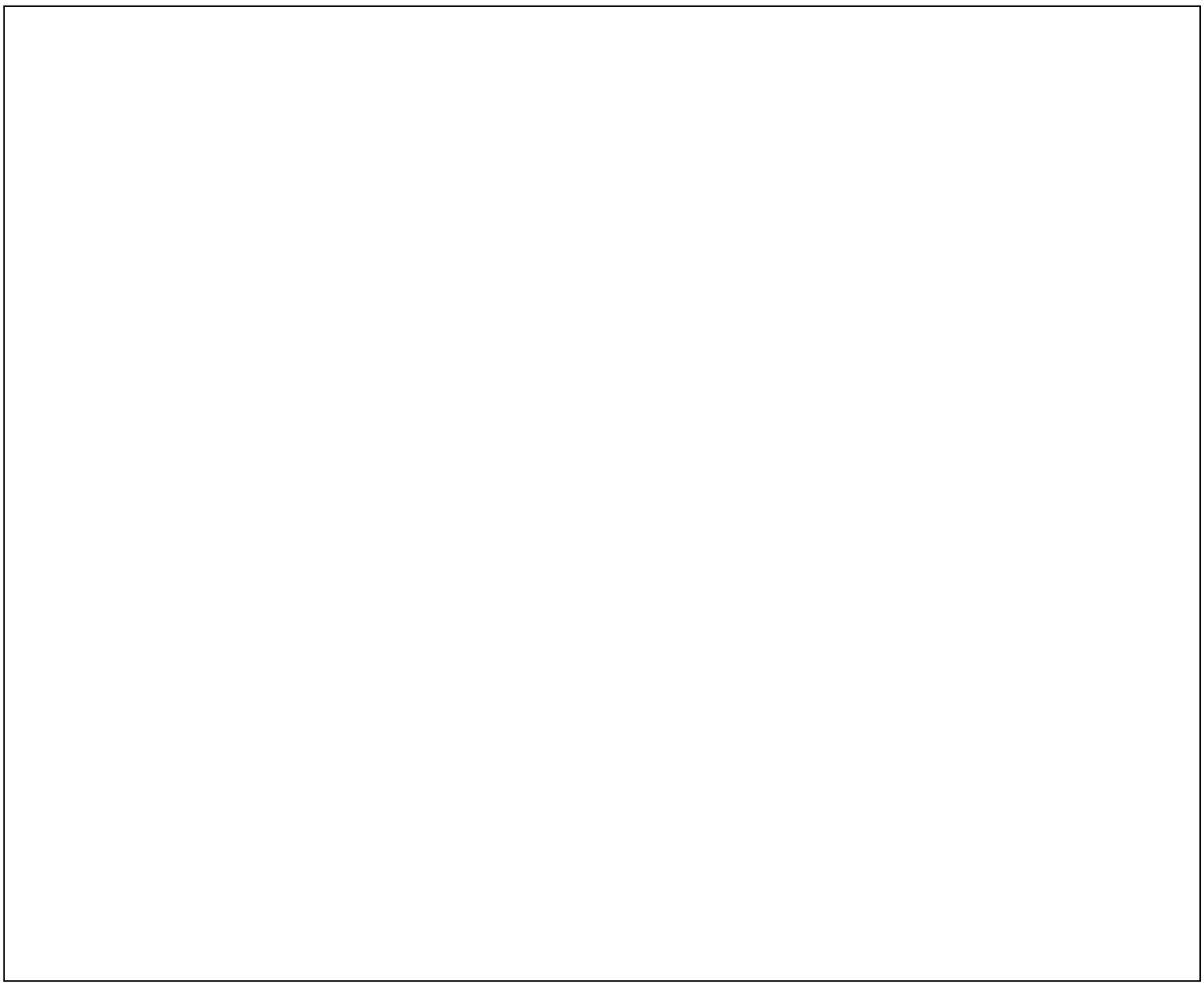
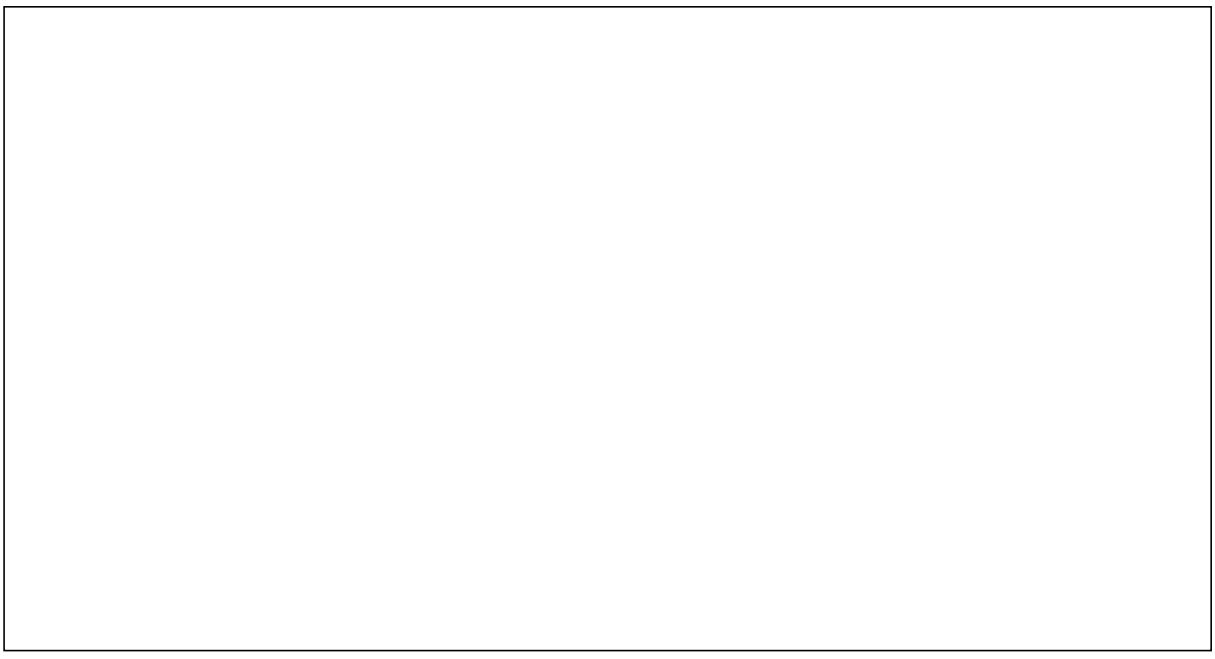


Fig 320.4, Tool J-48671-HDE DD13/15 Injector Breakout Box Harness Adaptor





Check as follows:

1. Disconnect the front fuel injector harness 14-pin connector. Go to step 2.
2. Inspect both sides of the front fuel injector harness 14-pin connectors for oil intrusion. Is there any oil present in the connectors?
   - 2.a Yes; replace the under valve cover harness and clean the engine side harness connector.
     Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Verify repair.
   - 2.b No; Go to step 3.
3. Inspect the front fuel injector harness 14-pin connectors for spread or damaged pins. Are there any spread or damaged pins?
   - 3.a Yes; repair as necessary. Verify repair.
   - 3.b No; Go to step 4.
4. Measure the resistance between pin 5 on the value cover side of the front fuel injector harness 14-pin connector and ground. If you are using tools J-48671-10 and J-48671-HDE, measure between fuel injector #4 pin 1 and ground. Is the resistance less than 5 ohms?
   - 4.a Yes; Go to step 5.
   - 4.b No; Go to step 12.
5. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" . Go to step 6.
6. Disconnect the electrical harness connecter on fuel injector #1. Go to step 7.
7. Measure the resistance between pin 5 on the valve cover side of the front fuel injector harness 14-pin connector and ground. If you are using tools J-48671-10 and J-48671-HDE, measure between fuel injector #1 pin 1 and ground. Is the resistance greater than 5 ohms?
   - 7.a Yes; replace fuel injector #1.
     Refer to section "Removal of the Fuel Injector - Two-Filter System" . Verify repair.
   - 7.b No; Go to step 8.
8. Disconnect the electrical harness connecter on fuel injector #2. Go to step 9.
9. Measure the resistance between pin 5 on the valve cover side of the front fuel injector harness 14-pin connector and ground. If you are using tools J-48671-10 and J-48671-HDE, measure between fuel injector #2 pin 1 and ground. Is the resistance greater than five ohms?
   - 9.a Yes; replace injector #2.
     Refer to section "Removal of the Fuel Injector - Two-Filter System" . Verify repair.
   - 9.b No; Go to step 10.
10. Disconnect the electrical harness connecter on fuel injector #3. Go to step 11.
11. Measure the resistance between pin 5 on the valve cover side of the front fuel injector harness 14-pin connector and ground. If you are using tools J-48671-10 and J-48671-HDE, measure between fuel injector #3 pin 1 and ground. Is the resistance greater than five ohms?
    - 11.a Yes; replace fuel injector #6.
      Refer to section "Removal of the Fuel Injector - Two-Filter System" . Verify repair.
    - 11.b No; replace the under valve cover harness.
      Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Verify repair.
12. Disconnect the 120-pin MCM connector. Go to step 13.
13. Measure the resistance between pin 5 of the engine harness side of the front fuel injector harness 14-pin connector and ground. Is the resistance greater than 5 ohms?
    - 13.a Yes; Go to step 14.
    - 13.b No; repair the short to ground between pin 13 of the MCM 120-pin connector and pin 5 of the front fuel injector harness 14-pin connector. Verify repair.
14. Measure the resistance between pin 8 of the engine harness side of the front fuel injector harness 14-pin connector and ground. Is the resistance greater than 5 ohms?
    - 14.a Yes; Go to step 15.

14.b No; repair the short to ground between pin 14 of the MCM 120-pin connector and pin 8 of the front fuel injector harness 14-pin connector. Verify repair.

15. Measure the resistance between pin 9 of the engine harness side of the front fuel injector harness 14-pin connector and ground. Is the resistance greater than 5 ohms?

15.a Yes; Go to step 16.

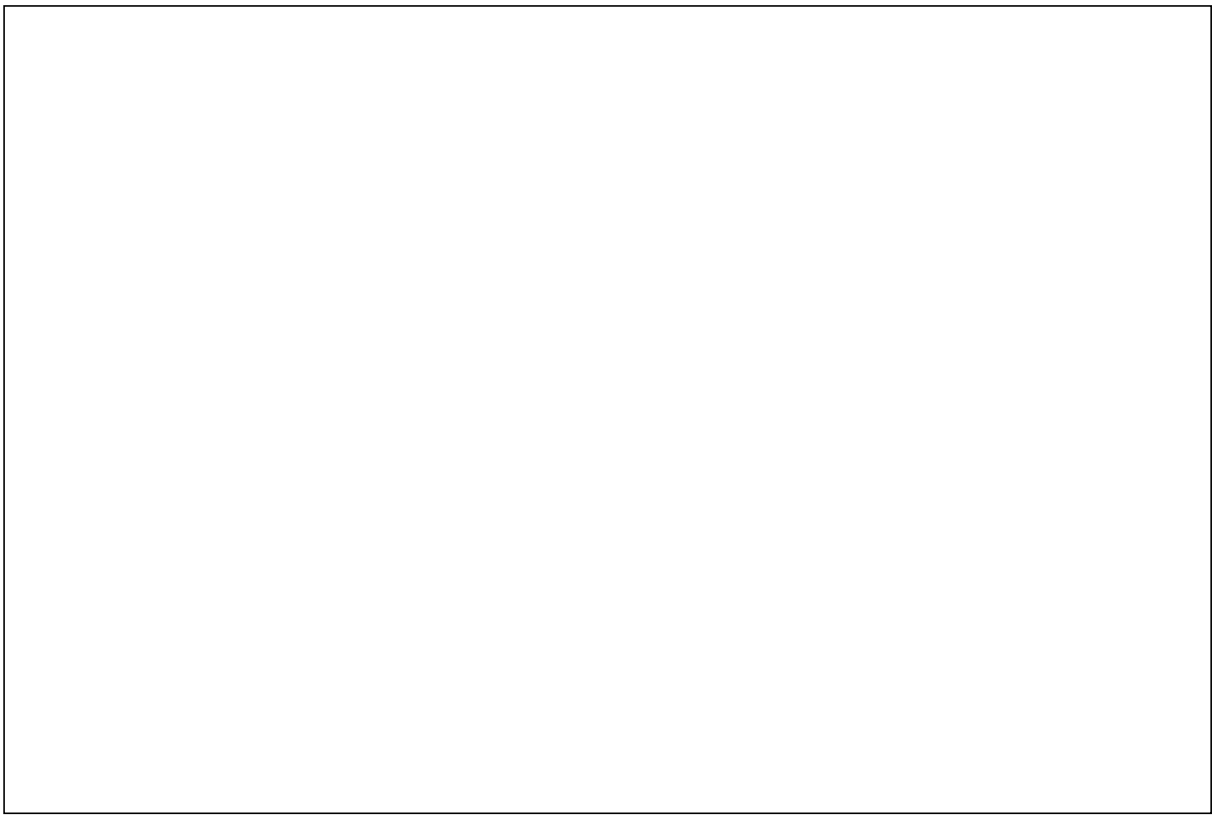
15.b No; repair the short to ground between pin 10 of the MCM 120-pin connector and pin 9 of the front fuel injector harness 14-pin connector. Verify repair.

16. Measure the resistance between pin 12 of the engine harness side of the front fuel injector harness 14-pin connector and ground. Is the resistance greater than 5 ohms?

16.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repair.

16.b No; repair the short between pin 12 of the MCM 120-pin connector and pin 12 of the front fuel injector harness 14-pin connector. Verify repair.

321.1 Electronic Diagram



321.2 SPN 4258/FMI 3 - GHG17

Injector Amplifier Control Valve Cylinder 4, 5, 6 Shorted to Battery

SPN 4258/FMI 3	
Description	Injector Amplifier Control Valve Cylinder 4, 5, 6 Shorted to Battery
Monitored Parameter	Injector Amplifier Control Valve Cylinder 4, 5, 6
Typical Enabling Conditions	fis_nop_act is greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (1 minute)

1. Disconnect the rear fuel injector harness 14-pin connector.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pin 1 on the Motor Control Module (MCM) side of the rear fuel injector harness 14-pin connector and ground.
   - 3.a If there is voltage present, repair the short to power between pin 1 of the Rear fuel injector Harness 14-pin connector and pin 4 of the 120-pin MCM connector.
   - 3.b If there is no voltage present, Go to step 4.

4. Measure the voltage between pin 8 on the MCM side of the rear fuel injector harness 14-pin connector and ground.
   - 4.a If there is voltage present, repair the short to power between pin 8 of the rear fuel injector harness connector and pin 8 of the 120-pin MCM connector.
   - 4.b If there is no voltage present, repair the short to power between pin 12 of the rear fuel injector harness connector and pin 6 of the 120-pin MCM connector.

321.3 SPN 4258/FMI 4 - GHG17

Injector Amplifier Control Valve Cylinder 4, 5, 6 Shorted to Ground

SPN 4258/FMI 4	
Description	This code sets when the MCM detects that there is a short to ground on the circuits for the injector amplifier control valve on cylinders 4, 5 and/or 6.
Monitored Parameter	Injector Amplifier Control Valve Cylinder 4, 5, 6
Typical Enabling Conditions	Fuel injector system nozzle opening pressure greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (1 minute)

Fig 0.1, Tool J-48671-10 Injector Breakout Box

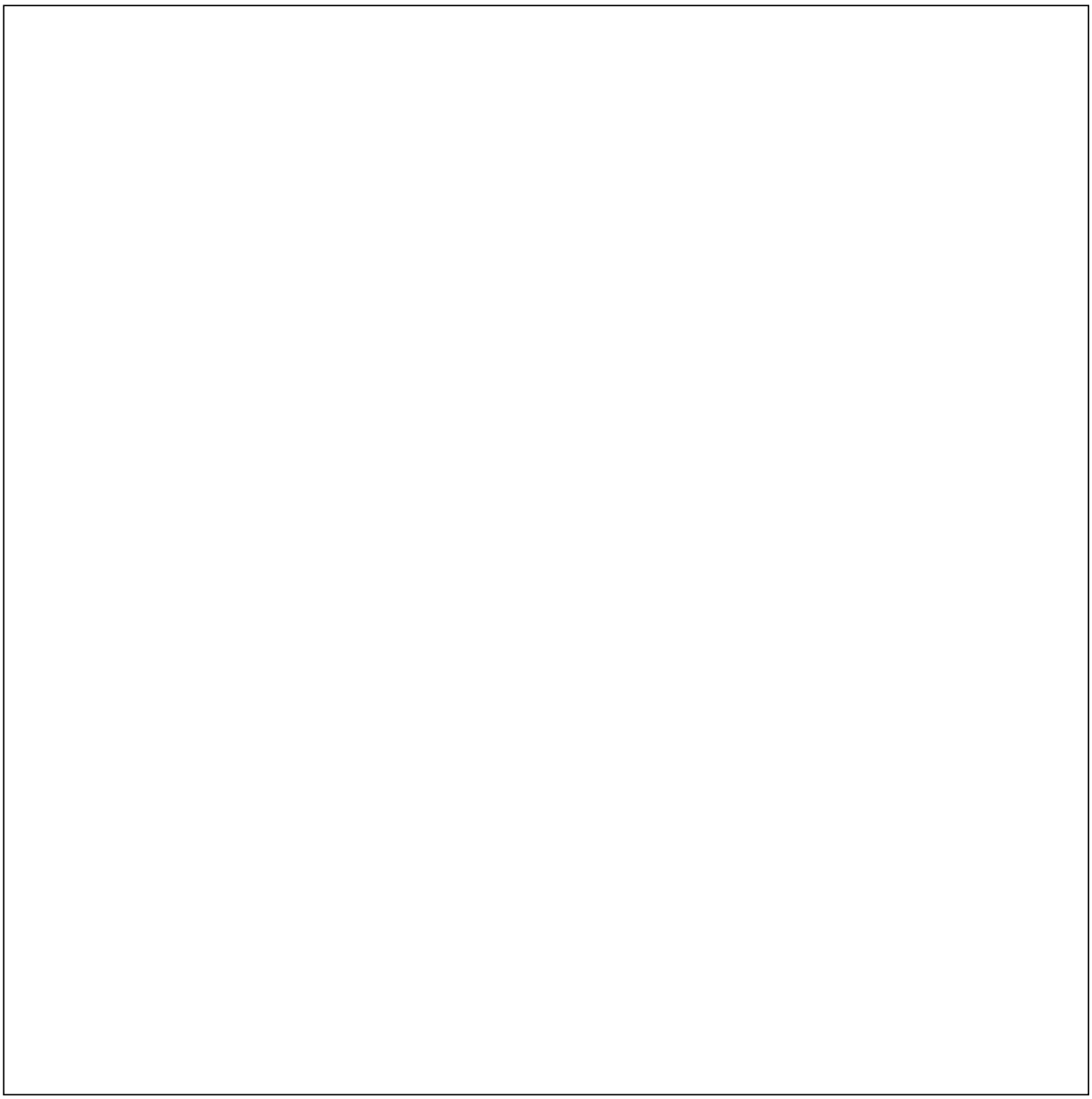
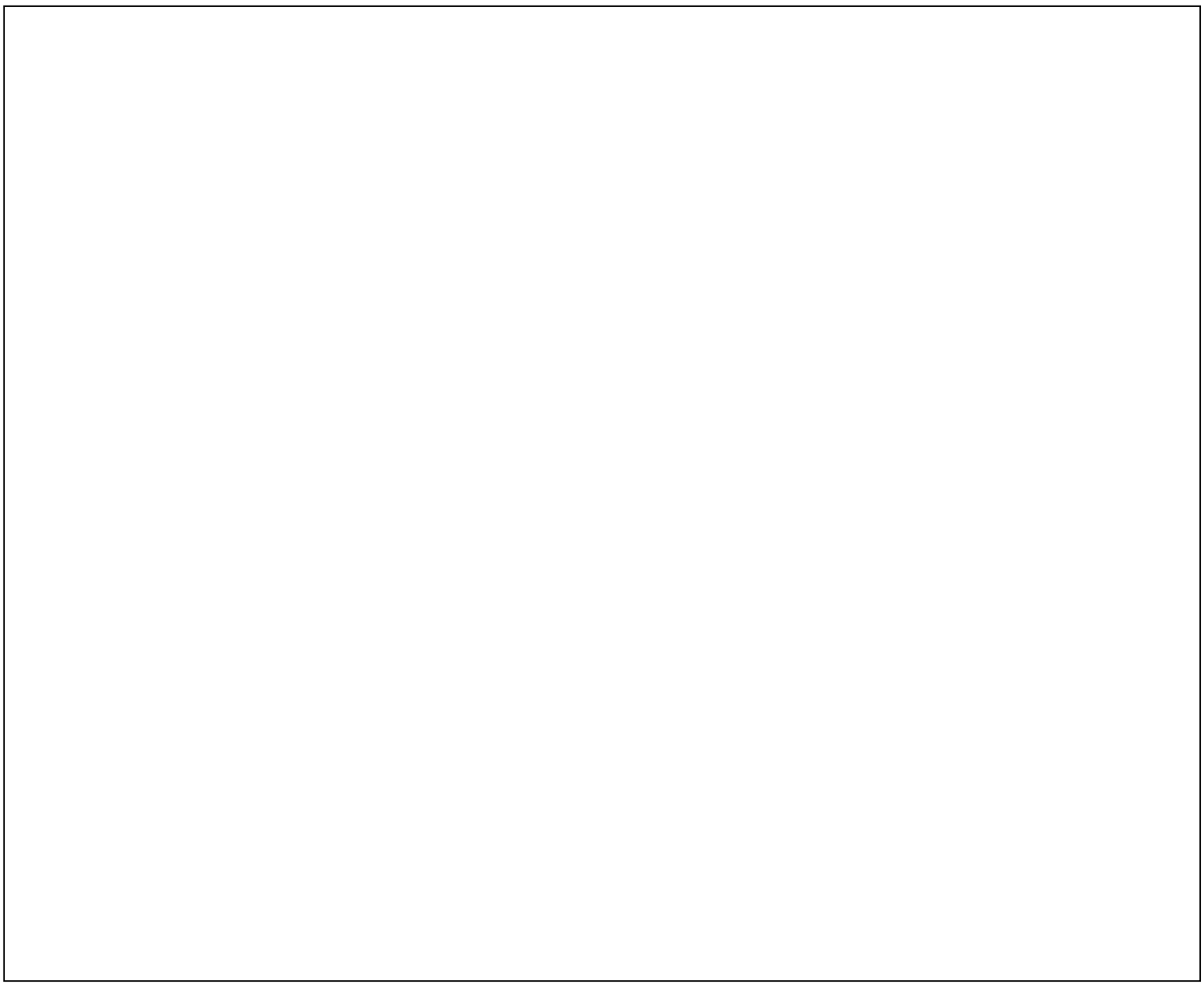
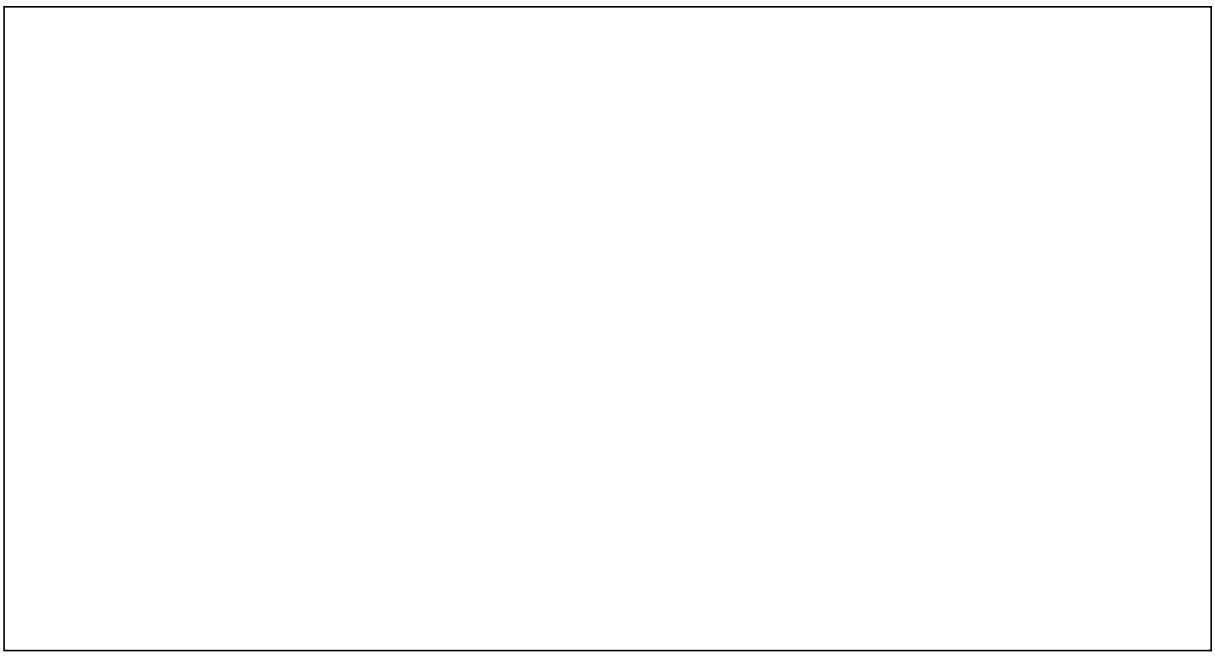


Fig 0.2, Tool J-48671-HDE DD13/15 Injector Breakout Box Harness Adaptor





Check as follows:

1. Disconnect the rear fuel injector Harness 14-pin connector. Go to step 2.
2. Inspect both sides of the rear fuel injector harness 14-pin connector for oil intrusion. Is there any oil present in the connectors?
   - 2.a Yes; replace the under valve cover harness and clean the engine side harness connector.
     Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Verify repair.
   - 2.b No; Go to step 3.
3. Inspect the rear fuel injector harness 14-pin connectors for spread or damaged pins. Are there any spread or damaged pins?
   - 3.a Yes; repair as necessary. Verify repair.
   - 3.b No; Go to step 4.
4. Measure the resistance between pin 5 on the valve cover side of the rear fuel injector harness 14-pin connector and ground. If you are using tools J-48671-10 and J-48671-HDE, measure between pin 1 of fuel injector #4 pin 1 and ground. Is the resistance less than 5 ohms?
   - 4.a Yes; Go to step 5.
   - 4.b No; Go to step 12.
5. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" . Go to step 6.
6. Disconnect the electrical harness connecter on fuel injector #4. Go to step 7.
7. Measure the resistance between pin 5 on the valve cover side of the rear fuel injector harness 14-pin connector and ground. If you are using tools J-48671-10 and J-48671-HDE, measure between pin 1 of fuel injector #4 pin 1 and ground. Is the resistance greater than 5 ohms?
   - 7.a Yes; replace fuel injector #4.
     Refer to section "Removal of the Fuel Injector - Two-Filter System" .Verify repair.
   - 7.b No; Go to step 8.
8. Disconnect the electrical harness connecter on fuel injector #5. Go to step 9.
9. Measure the resistance between pin 5 on the valve cover side of the rear fuel injector harness 14-pin connector and ground. If you are using tools J-48671-10 and J-48671-HDE, measure between pin 1 of fuel injector #5 pin 1 and ground. Is the resistance greater than 5 ohms?
   - 9.a Yes; replace injector #5.
     Refer to section "Removal of the Fuel Injector - Two-Filter System" .Verify repair.
   - 9.b No; Go to step 10.
10. Disconnect the electrical harness connecter on fuel injector #6. Go to step 16.
11. Measure the resistance between pin 5 on the valve cover side of the rear fuel injector harness 14-pin connector and ground. If you are using tools J-48671-10 and J-48671-HDE, measure between pin 1 of fuel injector #6 pin 1 and ground. Is the resistance greater than 5 ohms?
    - 11.a Yes; replace fuel injector #6.
      Refer to section "Removal of the Fuel Injector - Two-Filter System" . Verify repair.
    - 11.b No; replace the under valve cover harness.
      Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Verify repair.
12. Disconnect the 120-pin MCM connector. Go to step 13.
13. Measure the resistance between pin 5 of the engine harness side of the rear fuel injector harness 14-pin connector and ground. Is the resistance greater than 5 ohms?
    - 13.a Yes; Go to step 14.
    - 13.b No; repair the short to ground between pin 7 of the MCM 120-pin connector and pin 5 of the rear fuel injector harness 14-pin connector. Verify repair.
14. Measure the resistance between pin 8 of the engine harness side of the rear fuel injector harness 14-pin connector and ground. Is the resistance greater than 5 ohms?
    - 14.a Yes; Go to step 15.

14.b No; repair the short to ground between pin 4 of the MCM 120-pin connector and pin 8 of the rear fuel injector harness 14-pin connector. Verify repair.

15. Measure the resistance between pin 9 of the engine harness side of the rear fuel injector harness 14-pin connector and ground. Is the resistance greater than 5 ohms?

15.a Yes; Go to step 16.

15.b No; repair the short to ground between pin 8 of the MCM 120-pin connector and pin 9 of the rear fuel injector harness 14-pin connector. Verify repair.

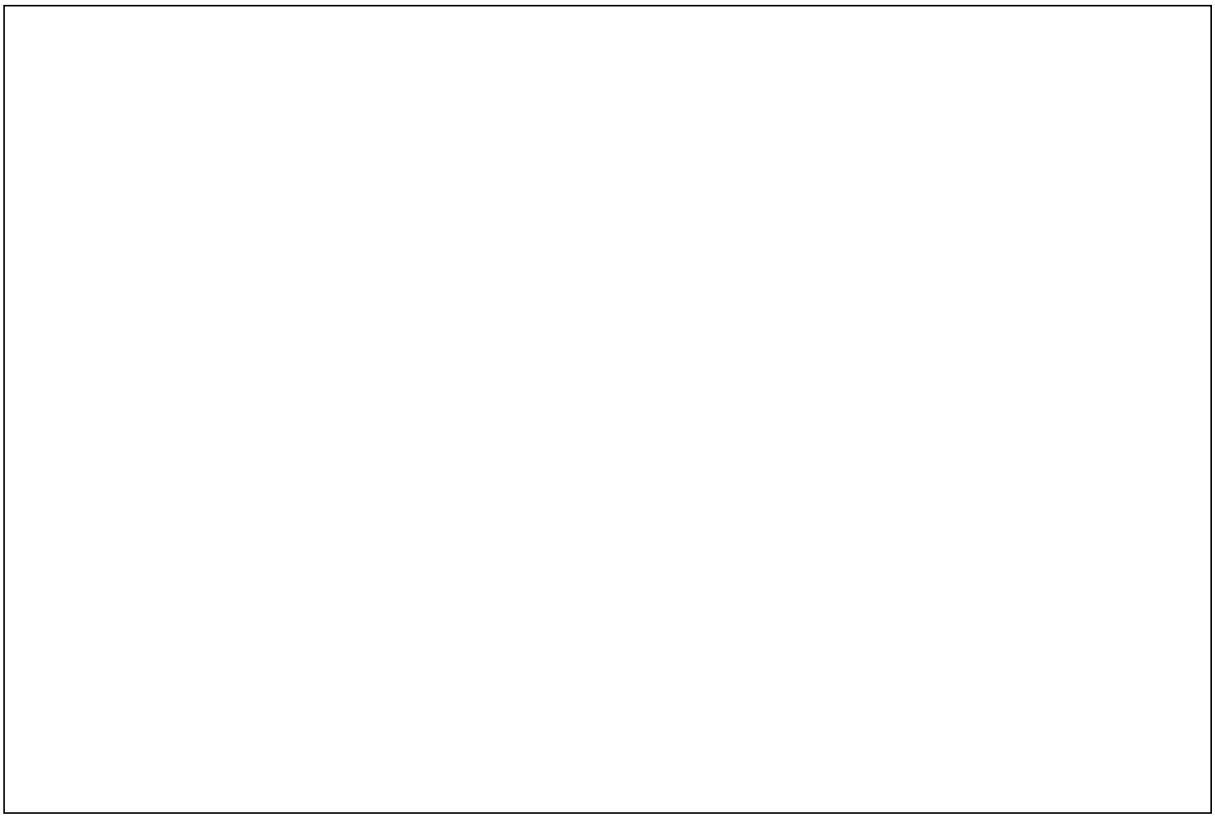
16. Measure the resistance between pin 12 of the engine harness side of the rear fuel injector harness 14-pin connector and ground. Is the resistance greater than 5 ohms?

16.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repair.

16.b No; repair the short between pin 6 of the MCM 120-pin connector and pin 12 of the rear fuel injector harness 14-pin connector. Verify repair.

SPN 4258 (MCM) (GHG17)

321.1 Electronic Diagram



321.2 SPN 4258/FMI 3 - GHG17

Injector Amplifier Control Valve Cylinder 4, 5, 6 Shorted to Battery

SPN 4258/FMI 3	
Description	Injector Amplifier Control Valve Cylinder 4, 5, 6 Shorted to Battery
Monitored Parameter	Injector Amplifier Control Valve Cylinder 4, 5, 6
Typical Enabling Conditions	fis_nop_act is greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (1 minute)

1. Disconnect the rear fuel injector harness 14-pin connector.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pin 1 on the Motor Control Module (MCM) side of the rear fuel injector harness 14-pin connector and ground.
   - 3.a If there is voltage present, repair the short to power between pin 1 of the Rear fuel injector Harness 14-pin connector and pin 4 of the 120-pin MCM connector.
   - 3.b If there is no voltage present, Go to step 4.

4. Measure the voltage between pin 8 on the MCM side of the rear fuel injector harness 14-pin connector and ground.
   - 4.a If there is voltage present, repair the short to power between pin 8 of the rear fuel injector harness connector and pin 8 of the 120-pin MCM connector.
   - 4.b If there is no voltage present, repair the short to power between pin 12 of the rear fuel injector harness connector and pin 6 of the 120-pin MCM connector.

321.3 SPN 4258/FMI 4 - GHG17

Injector Amplifier Control Valve Cylinder 4, 5, 6 Shorted to Ground

SPN 4258/FMI 4	
Description	This code sets when the MCM detects that there is a short to ground on the circuits for the injector amplifier control valve on cylinders 4, 5 and/or 6.
Monitored Parameter	Injector Amplifier Control Valve Cylinder 4, 5, 6
Typical Enabling Conditions	Fuel injector system nozzle opening pressure greater than 1.85
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine rpm 1400 - 1500 (1 minute)

Fig 321.3, Tool J-48671-10 Injector Breakout Box

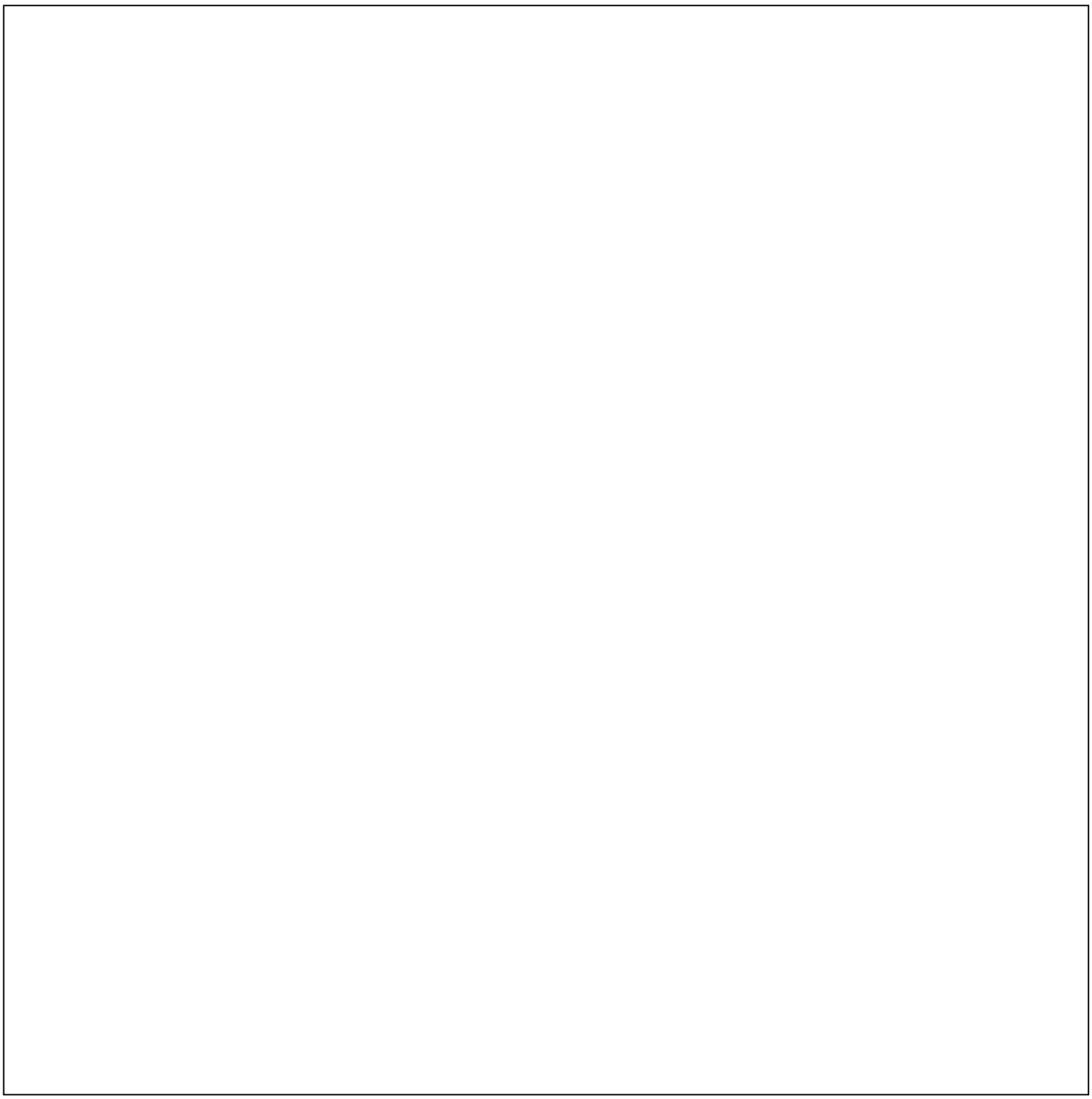
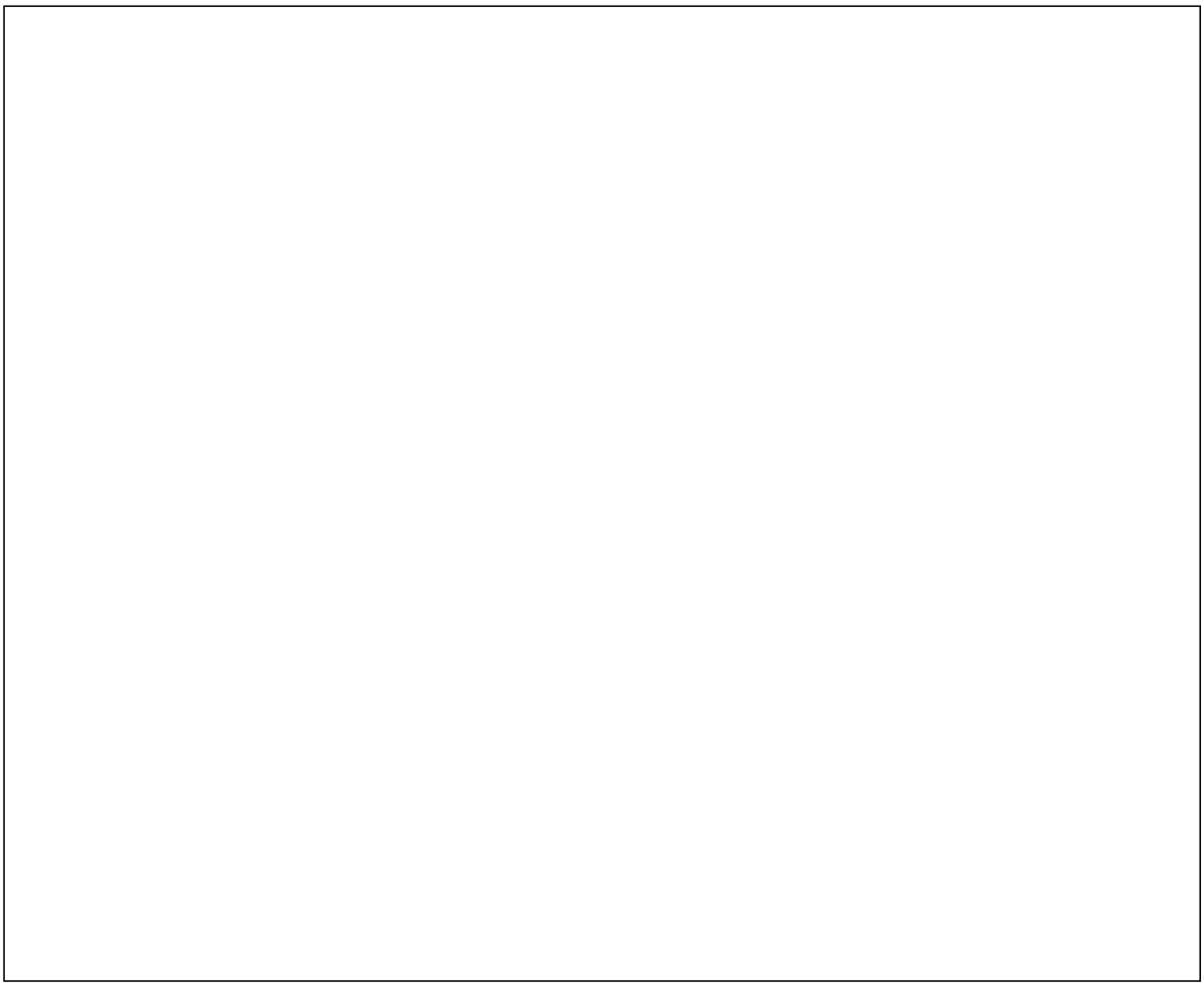
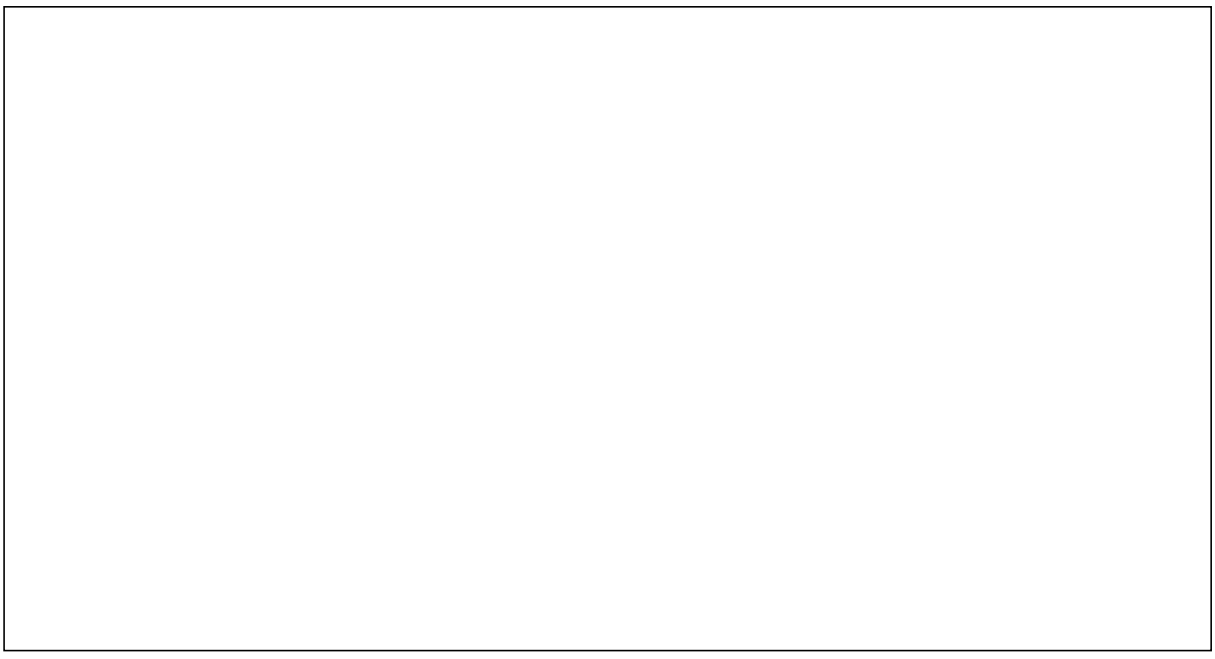


Fig 321.4, Tool J-48671-HDE DD13/15 Injector Breakout Box Harness Adaptor





Check as follows:

1. Disconnect the rear fuel injector Harness 14-pin connector. Go to step 2.
2. Inspect both sides of the rear fuel injector harness 14-pin connector for oil intrusion. Is there any oil present in the connectors?
   - 2.a Yes; replace the under valve cover harness and clean the engine side harness connector.
     Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Verify repair.
   - 2.b No; Go to step 3.
3. Inspect the rear fuel injector harness 14-pin connectors for spread or damaged pins. Are there any spread or damaged pins?
   - 3.a Yes; repair as necessary. Verify repair.
   - 3.b No; Go to step 4.
4. Measure the resistance between pin 5 on the valve cover side of the rear fuel injector harness 14-pin connector and ground. If you are using tools J-48671-10 and J-48671-HDE, measure between pin 1 of fuel injector #4 pin 1 and ground. Is the resistance less than 5 ohms?
   - 4.a Yes; Go to step 5.
   - 4.b No; Go to step 12.
5. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" . Go to step 6.
6. Disconnect the electrical harness connecter on fuel injector #4. Go to step 7.
7. Measure the resistance between pin 5 on the valve cover side of the rear fuel injector harness 14-pin connector and ground. If you are using tools J-48671-10 and J-48671-HDE, measure between pin 1 of fuel injector #4 pin 1 and ground. Is the resistance greater than 5 ohms?
   - 7.a Yes; replace fuel injector #4.
     Refer to section "Removal of the Fuel Injector - Two-Filter System" .Verify repair.
   - 7.b No; Go to step 8.
8. Disconnect the electrical harness connecter on fuel injector #5. Go to step 9.
9. Measure the resistance between pin 5 on the valve cover side of the rear fuel injector harness 14-pin connector and ground. If you are using tools J-48671-10 and J-48671-HDE, measure between pin 1 of fuel injector #5 pin 1 and ground. Is the resistance greater than 5 ohms?
   - 9.a Yes; replace injector #5.
     Refer to section "Removal of the Fuel Injector - Two-Filter System" .Verify repair.
   - 9.b No; Go to step 10.
10. Disconnect the electrical harness connecter on fuel injector #6. Go to step 16.
11. Measure the resistance between pin 5 on the valve cover side of the rear fuel injector harness 14-pin connector and ground. If you are using tools J-48671-10 and J-48671-HDE, measure between pin 1 of fuel injector #6 pin 1 and ground. Is the resistance greater than 5 ohms?
    - 11.a Yes; replace fuel injector #6.
      Refer to section "Removal of the Fuel Injector - Two-Filter System" . Verify repair.
    - 11.b No; replace the under valve cover harness.
      Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Verify repair.
12. Disconnect the 120-pin MCM connector. Go to step 13.
13. Measure the resistance between pin 5 of the engine harness side of the rear fuel injector harness 14-pin connector and ground. Is the resistance greater than 5 ohms?
    - 13.a Yes; Go to step 14.
    - 13.b No; repair the short to ground between pin 7 of the MCM 120-pin connector and pin 5 of the rear fuel injector harness 14-pin connector. Verify repair.
14. Measure the resistance between pin 8 of the engine harness side of the rear fuel injector harness 14-pin connector and ground. Is the resistance greater than 5 ohms?
    - 14.a Yes; Go to step 15.

14.b No; repair the short to ground between pin 4 of the MCM 120-pin connector and pin 8 of the rear fuel injector harness 14-pin connector. Verify repair.

15. Measure the resistance between pin 9 of the engine harness side of the rear fuel injector harness 14-pin connector and ground. Is the resistance greater than 5 ohms?

15.a Yes; Go to step 16.

15.b No; repair the short to ground between pin 8 of the MCM 120-pin connector and pin 9 of the rear fuel injector harness 14-pin connector. Verify repair.

16. Measure the resistance between pin 12 of the engine harness side of the rear fuel injector harness 14-pin connector and ground. Is the resistance greater than 5 ohms?

16.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repair.

16.b No; repair the short between pin 6 of the MCM 120-pin connector and pin 12 of the rear fuel injector harness 14-pin connector. Verify repair.

322.1 SPN 4331/FMI 15 - GHG17

DEF Dosing Quantity Low

SPN 4331/FMI 15	
Description	The Fault Indicates Low DEF Delivery
Monitored Parameter	NOx Conversion Efficiency
Typical Enabling Conditions	Closed Loop DEF Dosing
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Parked SCR Efficiency Test Followed By a Full Parked Regeneration

Check as follows:

1. Connect DiagnosticLink .
2. Visually check all DEF supply lines for physical damage (kinks, cracks, leaks, disconnects). Is any damage found?
   - 2.a Yes; repair as necessary; Go to step 3.
   - 2.b No; Go to step 3.
3. Using a refractometer from the DEF Test Kit W060589001900, measure the DEF percentage. Is DEF percentage between 31 and 34%?
   - 3.a Yes; Go to step 4.
   - 3.b No; Clean/flush the DEF tank. Go to step 4. Refer to section "Flushing of the Diesel Exhaust Fluid System" .
4. Unbolt DEF Dosing Unit from aftertreatment. Do not disconnect DEF hoses or electrical connector. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" .

Note : Monitor and record the DEF Pump Speed and DEF Pump Pressure values during DEF quantity test. The values will be used in the next step.

5. Perform DEF Quantity Test service routine and record the amount of DEF dispensed, pump speed and DEF pressure. Is the dispensed DEF fluid level between 108 and 132 mL?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the DEF dosing unit. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . To verify repairs, Go to step 8.

Note : Normal values for DEF pump speed and pressure are as follows:Normal DEF Pump Speed: Greater than 750 rpm, less than 1800 rpm.Normal DEF Pump Pressure: Greater than 9 bar, less than 11 bar.

6. Did the DEF Quantity Test service routine DEF pump speed and DEF pressure values match normal values?
   - 6.a Yes; replace the DEF dosing unit. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . To verify repairs, Go to step 8.
   - 6.b No; Go to step 7.
7. Inspect the DEF pump harness connector for bent, spread or corroded pins. Is any damage found?
   - 7.a Yes; repair as necessary. To verify repairs, Go to step 8.
   - 7.b No; replace DEF pump. To verify repairs, Go to step 8. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module" .

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.

WARNING

ENGINE EXHAUST

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

8. Start the engine and perform a Parked SCR Efficiency test to clear fault and verify repairs. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

SPN 4331 (ACM) (GHG17)

322.1 SPN 4331/FMI 15 - GHG17

DEF Dosing Quantity Low

SPN 4331/FMI 15	
Description	The Fault Indicates Low DEF Delivery
Monitored Parameter	NOx Conversion Efficiency
Typical Enabling Conditions	Closed Loop DEF Dosing
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Parked SCR Efficiency Test Followed By a Full Parked Regeneration

Check as follows:

1. Connect DiagnosticLink .
2. Visually check all DEF supply lines for physical damage (kinks, cracks, leaks, disconnects). Is any damage found?
   - 2.a Yes; repair as necessary; Go to step 3.
   - 2.b No; Go to step 3.
3. Using a refractometer from the DEF Test Kit W060589001900, measure the DEF percentage. Is DEF percentage between 31 and 34%?
   - 3.a Yes; Go to step 4.
   - 3.b No; Clean/flush the DEF tank. Go to step 4. Refer to section "Flushing of the Diesel Exhaust Fluid System" .
4. Unbolt DEF Dosing Unit from aftertreatment. Do not disconnect DEF hoses or electrical connector. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" .

Note : Monitor and record the DEF Pump Speed and DEF Pump Pressure values during DEF quantity test. The values will be used in the next step.

5. Perform DEF Quantity Test service routine and record the amount of DEF dispensed, pump speed and DEF pressure. Is the dispensed DEF fluid level between 108 and 132 mL?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the DEF dosing unit. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . To verify repairs, Go to step 8.

Note :

6. Did the DEF Quantity Test service routine DEF pump speed and DEF pressure values match normal values?
   - 6.a Yes; replace the DEF dosing unit. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . To verify repairs, Go to step 8.
   - 6.b No; Go to step 7.
7. Inspect the DEF pump harness connector for bent, spread or corroded pins. Is any damage found?
   - 7.a Yes; repair as necessary. To verify repairs, Go to step 8.
   - 7.b No; replace DEF pump. To verify repairs, Go to step 8. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module" .

> **⚠ 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.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

8. Start the engine and perform a Parked SCR Efficiency test to clear fault and verify repairs. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

SPN 4332 (ACM) (GHG17)

323.1 SPN 4332/FMI 31 – GHG17

The fault indicates the High Idle Regeneration (HIR) was aborted due to Diesel Oxidation Catalyst (DOC) inlet temperature not reaching the minimum of 270°C (518°F) to initiate dosing during an HIR. The Malfunction Indicator Lamp (MIL) will remain ON until the fault is resolved or a successful regeneration is complete.

SPN 4332/FMI 31	
Description	DOC Inlet Temperature Out of Range Low
Monitored Parameter	DOC temperature
Typical Enabling Conditions	Regeneration
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Parked Regen

Note : Retain log file if customer assistance is required.

1. Connect DiagnosticLink .
2. Check fault codes. Are SPN 3242/FMI 8 or SPN 3242/FMI 20 active or previously active?
   - 2.a Yes; troubleshoot these codes first.
   - 2.b No; Go to step 3.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

3. Start the engine.
4. Monitor the DOC inlet temperature sensor and the DOC outlet temperature sensor. Continue idling for 10 minutes. Is the DOC inlet temperature drifted low?
   - 4.a Yes; replace the DOC inlet temperature sensor and perform a Parked Regen.
   - 4.b No; Go to step 5.
5. If equipped with an Intake Throttle valve, use DiagnosticLink to perform an Intake Throttle Service Routine. Is the commanded position achieved?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the Intake Throttle Valve (ITV).
6. Inspect the exhaust system for leaks. Are any leaks found?

6.a Yes; repair as necessary.

6.b No; Go to step 7.

7. Pressurize the intake tract and inspect for leaks. Are any leaks found?

7.a Yes; repair as necessary.

7.b No; Go to step 8.

> **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.

8. Perform a Parked Regeneration. Refer to section "Performing a Parked Regeneration - GHG17" . Does the regen complete?

8.a Yes; clear faults and release vehicle.

8.b No; check engine brakes for proper operation. Repair as necessary.

324.1 SPN 4334/FMI 3 - GHG17

Diesel Exhaust Fluid Pressure Sensor Circuit Failed High

SPN 4334/FMI 3	
Description	Diesel Exhaust Fluid (DEF) Pressure Sensor Circuit Voltage Above Normal, or Shorted to High Source
Monitored Parameter	Diesel Exhaust Fluid (DEF) Pressure Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)

8-Pin	Circuit	ACM-Pin	Connector
1	Metering Valve Low Side	28	
2	Metering Valve High Side	33	
3	Heating Low Side	22	
4	Heating Supply	3	
5	Sensor Supply 5V	84	
6	Not Used	Not Used	
7	Sensor Ground	99	
8	DEF Pressure Signal	100	

Check as follows:

1. Check for multiple codes.
   - 1.a If SPN 4334/FMI 3 and SPN 3510/FMI 3 are present, repair short to voltage (greater than 5.0V) between pin 8 of the DEF pressure sensor and pin 100 of the Aftertreatment Control Module (ACM) 120-pin connector.
   - 1.b If only SPN 4334/FMI 3 is present, Go to step 2.
2. Turn the ignition OFF.
3. Disconnect the DEF dosing unit harness connector.
4. Inspect the dosing unit connector and the dosing unit harness connector for signs of damage, bent, spread, broken, pushed out (unseated) or corroded pins or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as needed. Verify repairs.
   - 4.b No; Go to step 5.
5. Turn the ignition ON (key ON, engine OFF).
6. Using DiagnosticLink , does the SPN 4334/FMI 3 change to SPN 3361/FMI 5 with the DEF dosing unit disconnected?
   - 6.a Yes; replace the DEF dosing unit. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . Verify repairs.
   - 6.b No; Go to step 7.
7. Measure the voltage between pin 8 of the DEF dosing unit connector harness side and ground. Is the voltage greater than 0.5V?
   - 7.a Yes; repair short to supply voltage between pin 8 of the DEF dosing unit and pin 100 of the ACM.
   - 7.b No; Go to step 8.

8. Turn the ignition OFF.
9. Disconnect the ACM 120-pin connector.
10. Inspect the ACM 120-pin connector and 120-pin harness connector for signs of damage, bent, spread, broken, pushed out (unseated) or corroded pins or wire damage near the connector. Is any damage found?

    10.a Yes; repair as needed. Verify repairs.

    10.b No; Go to step 11.

11. Measure the resistance between pin 7 of the DEF dosing unit connector, harness side and pin 99 of the ACM 120-pin connector, harness side. Is the resistance less than 5 ohms?

    11.a Yes; replace ACM.

    For 1-BOX™, Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" . Verify repairs.

    For Two-BOX, Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module" . Verify repairs.

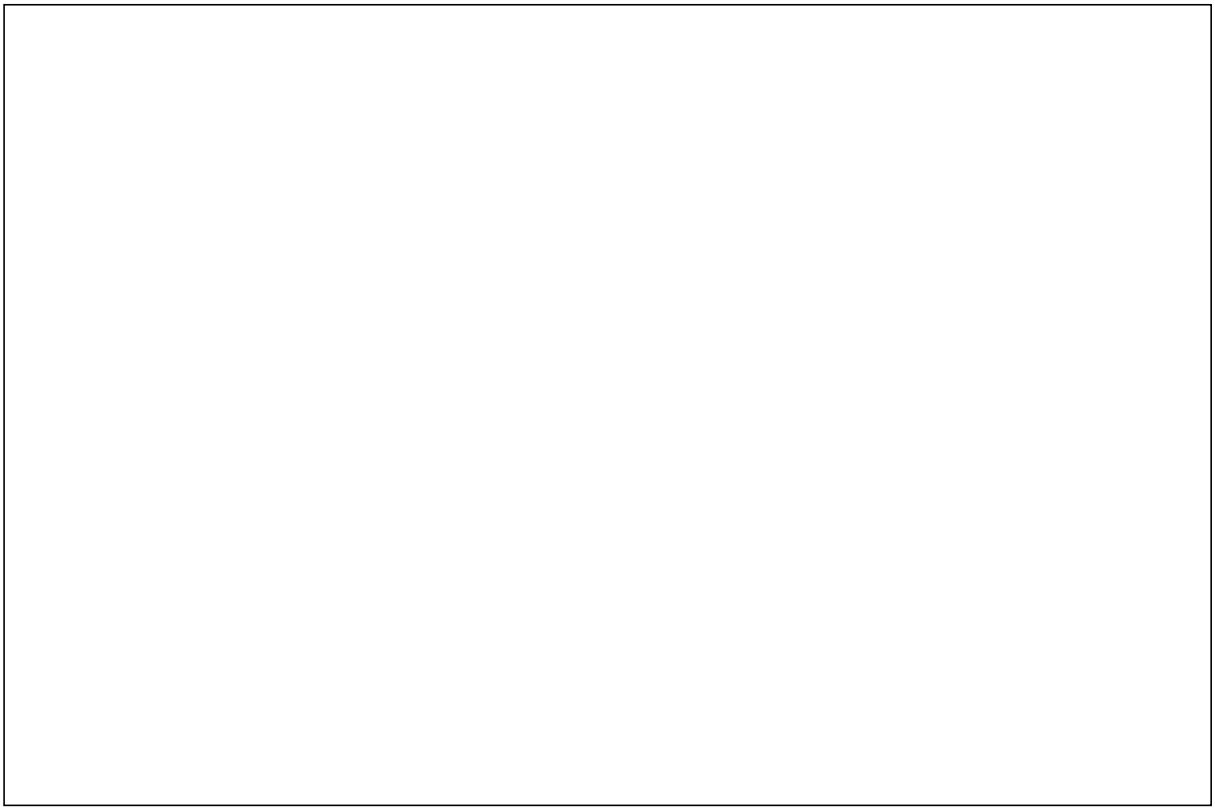
    11.b No; repair the open wire between pin 7 of the DEF dosing unit and pin 99 of the ACM 120-pin connector. Inspect all intermediate connections in chassis wiring. Refer to OEM wiring diagrams for exact routing.

324.2 SPN 4334/FMI 4 - GHG17

Diesel Exhaust Fluid Pressure Sensor Circuit Failed Low

SPN 4334/FMI 4	
Description	Diesel Exhaust Fluid (DEF) Pressure Sensor Circuit Voltage Below Normal, or Shorted to Low Source
Monitored Parameter	Diesel Exhaust Fluid (DEF) Pressure Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)

8-Pin	Circuit	ACM-Pin	Connector
1	Metering Valve Low Side	28	
2	Metering Valve High Side	33	
3	Heating Low Side	22	
4	Heating Supply	3	
5	Sensor Supply 5V	84	
6	Not Used	Not Used	
7	Sensor Ground	99	
8	DEF Pressure Signal	100	



Check as follows:

1. Check for multiple codes.
   1.a If SPN 4334/FMI 4, and SPN 3510/FMI 4 are present, repair short to ground between pin 5 of the DEF dosing unit and pin 84 of the Aftertreatment Control Module (ACM).
   1.b If only SPN 4334/FMI 4 is present, Go to step 2.
2. Turn the ignition OFF.
3. Disconnect the DEF dosing unit harness connector.
4. Inspect the DEF dosing unit connector and the DEF dosing unit harness side connector for signs of damage, bent, spread, broken, pushed out (unseated) or corroded pins or wire damage near the connector. Is any damage found?
   4.a Yes; repair as needed. Verify repairs.
   4.b No; Go to step 5.
5. Disconnect the ACM 120-pin connector.
6. Inspect the ACM 120-pin connector and 120-pin harness connector for signs of damage, bent, spread, broken, pushed out (unseated) or corroded pins or wire damage near the connector. Is any damage found?
   6.a Yes; repair as needed. Verify repairs.
   6.b No; Go to step 7.
7. Measure the resistance between pin 7 and pin 8 on the DEF dosing unit connector, harness side. Is the resistance greater than 10K ohms?
   7.a Yes; Go to step 8.
   7.b No; repair the short in the wire harness between pin 7 and pin 8 of the DEF dosing unit. Check intermediate connections in chassis wiring; refer to OEM wiring diagrams for exact routing. Verify repairs.
8. Measure the resistance between pin 8 on the DEF dosing unit connector, harness side, and chassis ground. Is the resistance greater than 10K ohms?
   8.a Yes; Go to step 9.
   8.b No; repair the short in the wire harness between pin 8 of the DEF dosing unit and ground. Check intermediate connections in chassis wiring; refer to OEM wiring diagrams for exact routing. Verify repairs.
9. Measure the resistance between pin 8 of the DEF dosing unit connector, harness side, and pin 100 of the ACM 120-pin connector, harness side. Is the resistance less than five ohms?
   9.a Yes; Go to step 10.
   9.b No; repair the open wire between pin 8 of the DEF dosing unit connector and pin 100 of the ACM 120-pin connector. Check intermediate connections in chassis wiring; refer to OEM wiring diagrams for exact routing. Verify repairs.
10. Measure the resistance between pin 5 of the DEF dosing unit connector, harness side, and pin 84 of the ACM 120-pin connector, harness side. Is the resistance less than five ohms?
    10.a Yes; Go to step 11.
    10.b No; repair the open wire between pin 5 of the DEF dosing unit connector and pin 84 of the ACM 120-pin connector. Check intermediate connections in chassis wiring; refer to OEM wiring diagrams for exact routing. Verify repairs.
11. Turn the ignition ON (key ON, engine OFF).

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

12. Measure the voltage between pin 84 of the ACM 120-pin connector, component side, and ground. Is the voltage between 4.5 and 5.5 volts?

    12.a Yes; replace the DEF dosing unit. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . Verify repairs.

    12.b No; replace ACM. Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" . Verify repairs.

SPN 4334 (ACM) (GHG17)

324.1 SPN 4334/FMI 3 - GHG17

Diesel Exhaust Fluid Pressure Sensor Circuit Failed High

SPN 4334/FMI 3	
Description	Diesel Exhaust Fluid (DEF) Pressure Sensor Circuit Voltage Above Normal, or Shorted to High Source
Monitored Parameter	Diesel Exhaust Fluid (DEF) Pressure Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)

8-Pin	Circuit	ACM-Pin	Connector
1	Metering Valve Low Side	28	
2	Metering Valve High Side	33	
3	Heating Low Side	22	
4	Heating Supply	3	
5	Sensor Supply 5V	84	
6	Not Used	Not Used	
7	Sensor Ground	99	
8	DEF Pressure Signal	100	

Check as follows:

1. Check for multiple codes.
   - 1.a If SPN 4334/FMI 3 and SPN 3510/FMI 3 are present, repair short to voltage (greater than 5.0V) between pin 8 of the DEF pressure sensor and pin 100 of the Aftertreatment Control Module (ACM) 120-pin connector.
   - 1.b If only SPN 4334/FMI 3 is present, Go to step 2.
2. Turn the ignition OFF.
3. Disconnect the DEF dosing unit harness connector.
4. Inspect the dosing unit connector and the dosing unit harness connector for signs of damage, bent, spread, broken, pushed out (unseated) or corroded pins or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as needed. Verify repairs.
   - 4.b No; Go to step 5.
5. Turn the ignition ON (key ON, engine OFF).
6. Using DiagnosticLink , does the SPN 4334/FMI 3 change to SPN 3361/FMI 5 with the DEF dosing unit disconnected?
   - 6.a Yes; replace the DEF dosing unit. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . Verify repairs.
   - 6.b No; Go to step 7.
7. Measure the voltage between pin 8 of the DEF dosing unit connector harness side and ground. Is the voltage greater than 0.5V?

7.a Yes; repair short to supply voltage between pin 8 of the DEF dosing unit and pin 100 of the ACM.

7.b No; Go to step 8.

8. Turn the ignition OFF.
9. Disconnect the ACM 120-pin connector.
10. Inspect the ACM 120-pin connector and 120-pin harness connector for signs of damage, bent, spread, broken, pushed out (unseated) or corroded pins or wire damage near the connector. Is any damage found?

10.a Yes; repair as needed. Verify repairs.

10.b No; Go to step 11.

11. Measure the resistance between pin 7 of the DEF dosing unit connector, harness side and pin 99 of the ACM 120-pin connector, harness side. Is the resistance less than 5 ohms?

11.a Yes; replace ACM.

For 1-BOX™, Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" . Verify repairs.

For Two-BOX, Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module" . Verify repairs.

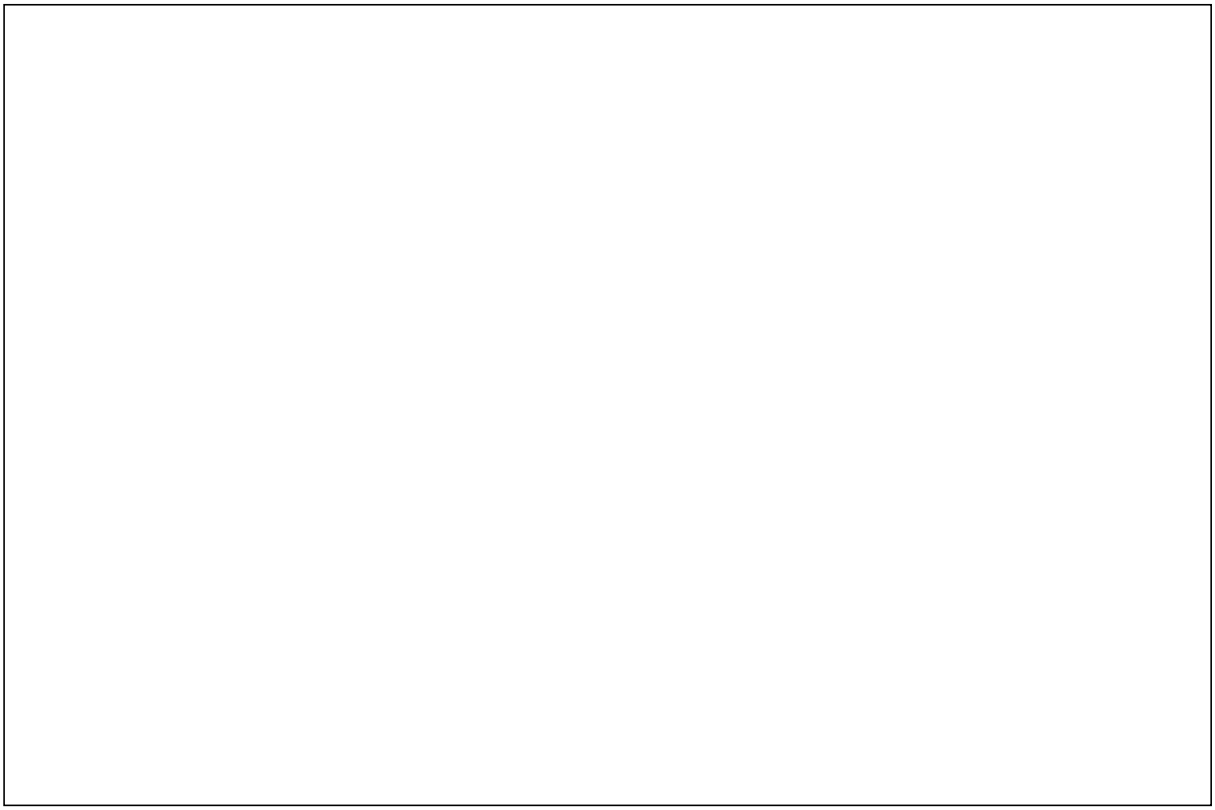
11.b No; repair the open wire between pin 7 of the DEF dosing unit and pin 99 of the ACM 120-pin connector. Inspect all intermediate connections in chassis wiring. Refer to OEM wiring diagrams for exact routing.

324.2 SPN 4334/FMI 4 - GHG17

Diesel Exhaust Fluid Pressure Sensor Circuit Failed Low

SPN 4334/FMI 4	
Description	Diesel Exhaust Fluid (DEF) Pressure Sensor Circuit Voltage Below Normal, or Shorted to Low Source
Monitored Parameter	Diesel Exhaust Fluid (DEF) Pressure Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)

8-Pin	Circuit	ACM-Pin	Connector
1	Metering Valve Low Side	28	
2	Metering Valve High Side	33	
3	Heating Low Side	22	
4	Heating Supply	3	
5	Sensor Supply 5V	84	
6	Not Used	Not Used	
7	Sensor Ground	99	
8	DEF Pressure Signal	100	



Check as follows:

1. Check for multiple codes.
   1.a If SPN 4334/FMI 4, and SPN 3510/FMI 4 are present, repair short to ground between pin 5 of the DEF dosing unit and pin 84 of the Aftertreatment Control Module (ACM).
   1.b If only SPN 4334/FMI 4 is present, Go to step 2.
2. Turn the ignition OFF.
3. Disconnect the DEF dosing unit harness connector.
4. Inspect the DEF dosing unit connector and the DEF dosing unit harness side connector for signs of damage, bent, spread, broken, pushed out (unseated) or corroded pins or wire damage near the connector. Is any damage found?
   4.a Yes; repair as needed. Verify repairs.
   4.b No; Go to step 5.
5. Disconnect the ACM 120-pin connector.
6. Inspect the ACM 120-pin connector and 120-pin harness connector for signs of damage, bent, spread, broken, pushed out (unseated) or corroded pins or wire damage near the connector. Is any damage found?
   6.a Yes; repair as needed. Verify repairs.
   6.b No; Go to step 7.
7. Measure the resistance between pin 7 and pin 8 on the DEF dosing unit connector, harness side. Is the resistance greater than 10K ohms?
   7.a Yes; Go to step 8.
   7.b No; repair the short in the wire harness between pin 7 and pin 8 of the DEF dosing unit. Check intermediate connections in chassis wiring; refer to OEM wiring diagrams for exact routing. Verify repairs.
8. Measure the resistance between pin 8 on the DEF dosing unit connector, harness side, and chassis ground. Is the resistance greater than 10K ohms?
   8.a Yes; Go to step 9.
   8.b No; repair the short in the wire harness between pin 8 of the DEF dosing unit and ground. Check intermediate connections in chassis wiring; refer to OEM wiring diagrams for exact routing. Verify repairs.
9. Measure the resistance between pin 8 of the DEF dosing unit connector, harness side, and pin 100 of the ACM 120-pin connector, harness side. Is the resistance less than five ohms?
   9.a Yes; Go to step 10.
   9.b No; repair the open wire between pin 8 of the DEF dosing unit connector and pin 100 of the ACM 120-pin connector. Check intermediate connections in chassis wiring; refer to OEM wiring diagrams for exact routing. Verify repairs.
10. Measure the resistance between pin 5 of the DEF dosing unit connector, harness side, and pin 84 of the ACM 120-pin connector, harness side. Is the resistance less than five ohms?
    10.a Yes; Go to step 11.
    10.b No; repair the open wire between pin 5 of the DEF dosing unit connector and pin 84 of the ACM 120-pin connector. Check intermediate connections in chassis wiring; refer to OEM wiring diagrams for exact routing. Verify repairs.
11. Turn the ignition ON (key ON, engine OFF).

⚠ WARNING

ENGINE EXHAUST

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

12. Measure the voltage between pin 84 of the ACM 120-pin connector, component side, and ground. Is the voltage between 4.5 and 5.5 volts?

    12.a Yes; replace the DEF dosing unit. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . Verify repairs.

    12.b No; replace ACM. Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" . Verify repairs.

325.1 SPN 4354/FMI 3 - GHG17

Line Heater #1 Circuit Failed High

1. Connect to DiagnosticLink .
2. Turn ignition ON (key ON, engine OFF).
3. Perform Output Component Test.
4. Does the fault become active?
   - 4.a Yes; Go to step 6.
   - 4.b No; Go to step 5.
5. Repeat Output Component Test three times. The ignition must be cycled between each test. Does the fault become active?
   - 5.a Yes; Go to step 6.
   - 5.b No; clear the fault and release the vehicle.
6. Disconnect the line heater #1 harness connector.
7. Inspect the sensor harness for bent, spread, or corroded pins.
   - 7.a If the pins are bent, spread, or corroded, repair as necessary.
   - 7.b If connector shows no signs of damage, repair the short to battery (12 volts) between pin 1 of the line heater #1 harness connector and pin 6 of the ACM 120-pin connector.

325.2 SPN 4354/FMI 4 - GHG17

Line Heater #1 Circuit Failed Low

1. Turn the ignition OFF.
2. Disconnect the line heater #1 connector.
3. Inspect the sensor harness for bent, spread, or corroded pins.
   3.a If the pins are bent, spread, or corroded, repair as necessary.
   3.b If the connector shows no signs of damage, Go to step 4.
4. Disconnect the ACM 120-pin connector.
5. Measure the resistance between pin 1 on the harness side of the line heater #1 connector and ground.
   5.a If the resistance is less than 1k ohms, repair the wire between pin 1 of the line heater #1 connector and pin 6 of the ACM 120-pin connector.
   5.b If the resistance is greater than 1k ohms, replace the line heater #1. Refer to OEM procedures.

325.3 SPN 4354/FMI 5 - GHG17

Line Heater 1 Open Circuit

1. Check for multiple codes.
   1.a If SPN 4354/FMI 5 and SPN 4356/FMI 5 are present, repair open between pin 9 of the ACM 120-pin connector and pin 2 of line heaters 1 and 3.
   1.b If only SPN 4354/FMI 5 is present, Go to step 2.
2. Disconnect line heater 1.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 2 on the harness side of line heater 1 connector and ground.
   4.a If the voltage is greater than 11.75, Go to step 5.
   4.b If the voltage is less than 11.75, repair wire between pin 2 on the harness side of line heater 1 connector and pin 9 of the ACM.
5. Measure the voltage between pin 1 on the harness side of line heater 1 connector and ground.
   5.a If the voltage is between 2.25 and 2.50, Go to step 6.
   5.b If the voltage is not between 2.25 and 2.50, repair wire between pin 1 on the harness side of line heater 1 connector and pin 6 of the ACM.
6. Measure the resistance on the heating element side of line heater 1. If resistance is not within this range, replace the line heating element. Refer to table below for proper resistance values.

Diesel Exhaust Fluid Line Heater Resistance Chart				
Length (mm)	**Length (inches)**	**Nominal Resistance (ohms)**	**Min Resistance (ohms)**	**Max Resistance (ohms)**
500	19.6	16	12.8	19.2
1000	39.3	9.8	7.84	11.76
1200	47.2	8.6	6.88	10.32
1400	55.1	7.8	6.24	9.36
1600	62.9	7	5.6	8.4
1800	70.8	6.1	4.88	7.32
2000	78.7	5.6	4.48	6.72
2200	86.6	5.2	4.16	6.24
2400	94.4	4.9	3.92	5.88
2600	102.3	4.6	3.68	5.52

SPN 4354 (ACM) (GHG17)

325.1 SPN 4354/FMI 3 - GHG17

Line Heater #1 Circuit Failed High

1. Connect to DiagnosticLink .
2. Turn ignition ON (key ON, engine OFF).
3. Perform Output Component Test.
4. Does the fault become active?
   - 4.a Yes; Go to step 6.
   - 4.b No; Go to step 5.
5. Repeat Output Component Test three times. The ignition must be cycled between each test. Does the fault become active?
   - 5.a Yes; Go to step 6.
   - 5.b No; clear the fault and release the vehicle.
6. Disconnect the line heater #1 harness connector.
7. Inspect the sensor harness for bent, spread, or corroded pins.
   - 7.a If the pins are bent, spread, or corroded, repair as necessary.
   - 7.b If connector shows no signs of damage, repair the short to battery (12 volts) between pin 1 of the line heater #1 harness connector and pin 6 of the ACM 120-pin connector.

325.2 SPN 4354/FMI 4 - GHG17

Line Heater #1 Circuit Failed Low

1. Turn the ignition OFF.
2. Disconnect the line heater #1 connector.
3. Inspect the sensor harness for bent, spread, or corroded pins.
   3.a If the pins are bent, spread, or corroded, repair as necessary.
   3.b If the connector shows no signs of damage, Go to step 4.
4. Disconnect the ACM 120-pin connector.
5. Measure the resistance between pin 1 on the harness side of the line heater #1 connector and ground.
   5.a If the resistance is less than 1k ohms, repair the wire between pin 1 of the line heater #1 connector and pin 6 of the ACM 120-pin connector.
   5.b If the resistance is greater than 1k ohms, replace the line heater #1. Refer to OEM procedures.

325.3 SPN 4354/FMI 5 - GHG17

Line Heater 1 Open Circuit

1. Check for multiple codes.
   1.a If SPN 4354/FMI 5 and SPN 4356/FMI 5 are present, repair open between pin 9 of the ACM 120-pin connector and pin 2 of line heaters 1 and 3.
   1.b If only SPN 4354/FMI 5 is present, Go to step 2.
2. Disconnect line heater 1.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 2 on the harness side of line heater 1 connector and ground.
   4.a If the voltage is greater than 11.75, Go to step 5.
   4.b If the voltage is less than 11.75, repair wire between pin 2 on the harness side of line heater 1 connector and pin 9 of the ACM.
5. Measure the voltage between pin 1 on the harness side of line heater 1 connector and ground.
   5.a If the voltage is between 2.25 and 2.50, Go to step 6.
   5.b If the voltage is not between 2.25 and 2.50, repair wire between pin 1 on the harness side of line heater 1 connector and pin 6 of the ACM.
6. Measure the resistance on the heating element side of line heater 1. If resistance is not within this range, replace the line heating element. Refer to table below for proper resistance values.

Diesel Exhaust Fluid Line Heater Resistance Chart				
Length (mm)	**Length (inches)**	**Nominal Resistance (ohms)**	**Min Resistance (ohms)**	**Max Resistance (ohms)**
500	19.6	16	12.8	19.2
1000	39.3	9.8	7.84	11.76
1200	47.2	8.6	6.88	10.32
1400	55.1	7.8	6.24	9.36
1600	62.9	7	5.6	8.4
1800	70.8	6.1	4.88	7.32
2000	78.7	5.6	4.48	6.72
2200	86.6	5.2	4.16	6.24
2400	94.4	4.9	3.92	5.88
2600	102.3	4.6	3.68	5.52

SPN 4355 (ACM) (GHG17)

326.1 SPN 4355/FMI 3 - GHG17

Line Heater #2 Circuit Failed High

1. Connect to DiagnosticLink .
2. Turn ignition ON (key ON, engine OFF).
3. Perform Output Component Test.
4. Does the fault become active?
   - 4.a Yes; Go to step 6.
   - 4.b No; Go to step 5.
5. Repeat Output Component Test three times. The ignition must be cycled between each test. Does the fault become active?
   - 5.a Yes; Go to step 6.
   - 5.b No; clear the fault and release the vehicle.
6. Disconnect the line heater #2 harness connector.
7. Inspect the sensor harness for bent, spread, or corroded pins.
   - 7.a If the pins are bent, spread, or corroded, repair as necessary.
   - 7.b If connector shows no signs of damage, repair the short to battery (12 volts) between pin 1 of the line heater #2 harness connector and pin 24 of the ACM 120-pin connector.

326.2 SPN 4355/FMI 4 - GHG17

Line Heater #2 Circuit Failed Low

1. Turn the ignition OFF.
2. Disconnect the line heater #2 connector.
3. Inspect the sensor harness for bent, spread, or corroded pins.
   3.a If the pins are bent, spread, or corroded, repair as necessary.
   3.b If the connector shows no signs of damage, Go to step 4.
4. Disconnect the ACM 120-pin connector.
5. Measure the resistance between pin 1 on the harness side of the line heater #2 connector and ground.
   5.a If the resistance is less than 1k ohms, repair the wire between pin 1 of the line heater #2 connector and pin 24 of the ACM 120-pin connector.
   5.b If the resistance is greater than 1k ohms, replace the line heater #2.

326.3 SPN 4355/FMI 5 - GHG17

Line Heater 2 Open Circuit

1. Check for multiple codes.
   1.a If SPN 4355/FMI 5 and SPN 4357/FMI 5 are present, repair open between pin 15 of the ACM 120-pin connector and pin 2 of line heaters 2 and 4.
   1.b If only SPN 4355/FMI 5 is present, Go to step 2.
2. Disconnect line heater 2.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 2 on the harness side of line heater 2 connector and ground.
   4.a If the voltage is greater than 11.75, Go to step 5.
   4.b If the voltage is less than 11.75, repair wire between pin 2 on the harness side of line heater 2 connector and pin 15 of the ACM.
5. Measure the voltage between pin 1 on the harness side of line heater 2 connector and ground.
   5.a If the voltage is between 2.25 and 2.50, Go to step 6.
   5.b If the voltage is not between 2.25 and 2.50, repair wire between pin 1 on the harness side of line heater 2 connector and pin 24 of the ACM.
6. Measure the resistance on the heating element side of line heater 2. If resistance is not within this range, replace the line heating element. Refer to table below for proper resistance values.

Diesel Exhaust Fluid Line Heater Resistance Chart				
Length (mm)	**Length (inches)**	**Nominal Resistance (ohms)**	**Min Resistance (ohms)**	**Max Resistance (ohms)**
500	19.6	16	12.8	19.2
1000	39.3	9.8	7.84	11.76
1200	47.2	8.6	6.88	10.32
1400	55.1	7.8	6.24	9.36
1600	62.9	7	5.6	8.4
1800	70.8	6.1	4.88	7.32
2000	78.7	5.6	4.48	6.72
2200	86.6	5.2	4.16	6.24
2400	94.4	4.9	3.92	5.88
2600	102.3	4.6	3.68	5.52

SPN 4356 (ACM) (GHG17)

327.1 SPN 4356/FMI 3 - GHG17

Line Heater #3 Circuit Failed High

1. Connect to DiagnosticLink .
2. Turn ignition ON (key ON, engine OFF).
3. Perform Output Component Test.
4. Does the fault become active?
   - 4.a Yes; Go to step 6.
   - 4.b No; Go to step 5.
5. Repeat Output Component Test three times. The ignition must be cycled between each test. Does the fault become active?
   - 5.a Yes; Go to step 6.
   - 5.b No; clear the fault and release the vehicle.
6. Disconnect the Line Heater #3 harness connector.
7. Inspect the sensor harness for bent, spread, or corroded pins.
   - 7.a If the pins are bent, spread, or corroded, repair as necessary.
   - 7.b If connector shows no signs of damage, repair the short to battery (12 volts) between pin 1 of the Line Heater #3 harness connector and pin 18 of the ACM 120-pin connector.

327.2 SPN 4356/FMI 4 - GHG17

Line Heater #3 Circuit Failed Low

1. Turn the ignition OFF.
2. Disconnect the line heater #3 connector.
3. Inspect the sensor harness for bent, spread, or corroded pins.
   3.a If the pins are bent, spread, or corroded, repair as necessary.
   3.b If the connector shows no signs of damage, Go to step 4.
4. Disconnect the ACM 120-pin connector.
5. Measure the resistance between pin 1 on the harness side of the line heater #3 connector and ground.
   5.a If the resistance is less than 1k ohms, repair the wire between pin 1 of the line heater #3 connector and pin 18 of the ACM 120-pin connector.
   5.b If the resistance is greater than 1k ohms, replace the line heater #3.

327.3 SPN 4356/FMI 5 - GHG17

Line Heater 3 Open Circuit

1. Check for multiple codes.
   1.a If SPN 4356/FMI 5 and SPN 4354/FMI 5 are present, repair open between pin 9 of the ACM 120-pin connector and pin 2 of line heaters 3 and 1.
   1.b If only SPN 4356/FMI 5 is present, Go to step 2.
2. Disconnect line heater 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 2 on the harness side of line heater 3 connector and ground.
   4.a If the voltage is greater than 11.75, Go to step 5.
   4.b If the voltage is less than 11.75, repair wire between pin 2 on the harness side of line heater 3 connector and pin 9 of the ACM.
5. Measure the voltage between pin 1 on the harness side of line heater 3 connector and ground.
   5.a If the voltage is between 2.25 and 2.50, Go to step 6.
   5.b If the voltage is not between 2.25 and 2.50, repair wire between pin 1 on the harness side of line heater 3 connector and pin 18 of the ACM.
6. Measure the resistance on the heating element side of line heater 3. If resistance is not within this range, replace the line heating element. Refer to table below for proper resistance values.

Diesel Exhaust Fluid Line Heater Resistance Chart				
Length (mm)	**Length (inches)**	**Nominal Resistance (ohms)**	**Min Resistance (ohms)**	**Max Resistance (ohms)**
500	19.6	16	12.8	19.2
1000	39.3	9.8	7.84	11.76
1200	47.2	8.6	6.88	10.32
1400	55.1	7.8	6.24	9.36
1600	62.9	7	5.6	8.4
1800	70.8	6.1	4.88	7.32
2000	78.7	5.6	4.48	6.72
2200	86.6	5.2	4.16	6.24
2400	94.4	4.9	3.92	5.88
2600	102.3	4.6	3.68	5.52

328.1 SPN 4357/FMI 3 - GHG17

Line Heater #4 Circuit Failed High

1. Connect to DiagnosticLink .
2. Turn ignition ON (key ON, engine OFF).
3. Perform the Output Component Test.
4. Does the fault become active?
   - 4.a Yes; Go to step 6.
   - 4.b No; Go to step 5.

Note : The ignition must be cycled between each Output Component Test.

5. Repeat Output Component Test three times. Does the fault become active?
   - 5.a Yes; Go to step 6.
   - 5.b No; clear the fault and release the vehicle.
6. Disconnect the line heater #4 harness connector.
7. Inspect the sensor harness for bent, spread, or corroded pins.
   - 7.a If the pins are bent, spread, or corroded, repair as necessary.
   - 7.b If connector shows no signs of damage, repair the short to battery (12 volts) between pin 1 of the line heater #4 harness connector and pin 32 of the ACM 120-pin connector.

328.2 SPN 4357/FMI 4 - GHG17

Line Heater #4 Circuit Failed Low

1. Turn the ignition OFF.
2. Disconnect the line heater #4 connector.
3. Inspect the sensor harness for bent, spread, or corroded pins.
   3.a If the pins are bent, spread, or corroded, repair as necessary.
   3.b If the connector shows no signs of damage, Go to step 4.
4. Disconnect the ACM 120-pin connector.
5. Measure the resistance between pin 1 on the harness side of the line heater #4 connector and ground.
   5.a If the resistance is less than 1K ohms, repair the wire between pin 1 of the line heater #4 connector and pin 32 of the ACM 120-pin connector.
   5.b If the resistance is greater than 1k ohms, replace the line heater #4.

328.3 SPN 4357/FMI 5 - GHG17

Line Heater 4 Open Circuit

1. Check for multiple codes.
   1.a If SPN 4355/FMI 5 and SPN 4357/FMI 5 are present, repair open between pin 15 of the ACM 120-pin connector and pin 2 of line heaters 2 and 4.
   1.b If only SPN 4357/FMI 5 is present, Go to step 2.
2. Disconnect line heater 4.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 2 on the harness side of line heater 4 connector and ground.
   4.a If the voltage is greater than 11.75, Go to step 5.
   4.b If the voltage is less than 11.75, repair wire between pin 2 on the harness side of line heater 4 connector and pin 15 of the ACM.
5. Measure the voltage between pin 1 on the harness side of line heater 4 connector and ground.
   5.a If the voltage is between 2.25 and 2.50, Go to step 6.
   5.b If the voltage is not between 2.25 and 2.50, repair wire between pin 1 on the harness side of line heater 4 connector and pin 32 of the ACM.
6. Measure the resistance on the heating element side of line heater 4. If resistance is not within this range, replace the line heating element. Refer to table below for proper resistance values.

Diesel Exhaust Fluid Line Heater Resistance Chart				
Length (mm)	**Length (inches)**	**Nominal Resistance (ohms)**	**Min Resistance (ohms)**	**Max Resistance (ohms)**
500	19.6	16	12.8	19.2
1000	39.3	9.8	7.84	11.76
1200	47.2	8.6	6.88	10.32
1400	55.1	7.8	6.24	9.36
1600	62.9	7	5.6	8.4
1800	70.8	6.1	4.88	7.32
2000	78.7	5.6	4.48	6.72
2200	86.6	5.2	4.16	6.24
2400	94.4	4.9	3.92	5.88
2600	102.3	4.6	3.68	5.52

SPN 4357 (ACM) (GHG17)

328.1 SPN 4357/FMI 3 - GHG17

Line Heater #4 Circuit Failed High

1. Connect to DiagnosticLink .
2. Turn ignition ON (key ON, engine OFF).
3. Perform the Output Component Test.
4. Does the fault become active?
   - 4.a Yes; Go to step 6.
   - 4.b No; Go to step 5.

Note : The ignition must be cycled between each Output Component Test.

5. Repeat Output Component Test three times. Does the fault become active?
   - 5.a Yes; Go to step 6.
   - 5.b No; clear the fault and release the vehicle.
6. Disconnect the line heater #4 harness connector.
7. Inspect the sensor harness for bent, spread, or corroded pins.
   - 7.a If the pins are bent, spread, or corroded, repair as necessary.
   - 7.b If connector shows no signs of damage, repair the short to battery (12 volts) between pin 1 of the line heater #4 harness connector and pin 32 of the ACM 120-pin connector.

328.2 SPN 4357/FMI 4 - GHG17

Line Heater #4 Circuit Failed Low

1. Turn the ignition OFF.
2. Disconnect the line heater #4 connector.
3. Inspect the sensor harness for bent, spread, or corroded pins.
   3.a If the pins are bent, spread, or corroded, repair as necessary.
   3.b If the connector shows no signs of damage, Go to step 4.
4. Disconnect the ACM 120-pin connector.
5. Measure the resistance between pin 1 on the harness side of the line heater #4 connector and ground.
   5.a If the resistance is less than 1K ohms, repair the wire between pin 1 of the line heater #4 connector and pin 32 of the ACM 120-pin connector.
   5.b If the resistance is greater than 1k ohms, replace the line heater #4.

328.3 SPN 4357/FMI 5 - GHG17

Line Heater 4 Open Circuit

1. Check for multiple codes.
   1.a If SPN 4355/FMI 5 and SPN 4357/FMI 5 are present, repair open between pin 15 of the ACM 120-pin connector and pin 2 of line heaters 2 and 4.
   1.b If only SPN 4357/FMI 5 is present, Go to step 2.
2. Disconnect line heater 4.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 2 on the harness side of line heater 4 connector and ground.
   4.a If the voltage is greater than 11.75, Go to step 5.
   4.b If the voltage is less than 11.75, repair wire between pin 2 on the harness side of line heater 4 connector and pin 15 of the ACM.
5. Measure the voltage between pin 1 on the harness side of line heater 4 connector and ground.
   5.a If the voltage is between 2.25 and 2.50, Go to step 6.
   5.b If the voltage is not between 2.25 and 2.50, repair wire between pin 1 on the harness side of line heater 4 connector and pin 32 of the ACM.
6. Measure the resistance on the heating element side of line heater 4. If resistance is not within this range, replace the line heating element. Refer to table below for proper resistance values.

Diesel Exhaust Fluid Line Heater Resistance Chart				
Length (mm)	**Length (inches)**	**Nominal Resistance (ohms)**	**Min Resistance (ohms)**	**Max Resistance (ohms)**
500	19.6	16	12.8	19.2
1000	39.3	9.8	7.84	11.76
1200	47.2	8.6	6.88	10.32
1400	55.1	7.8	6.24	9.36
1600	62.9	7	5.6	8.4
1800	70.8	6.1	4.88	7.32
2000	78.7	5.6	4.48	6.72
2200	86.6	5.2	4.16	6.24
2400	94.4	4.9	3.92	5.88
2600	102.3	4.6	3.68	5.52

329.1 SPN 4360/FMI 2 - GHG17

Selective Catalyst Reduction Inlet Temperature - Not Plausible

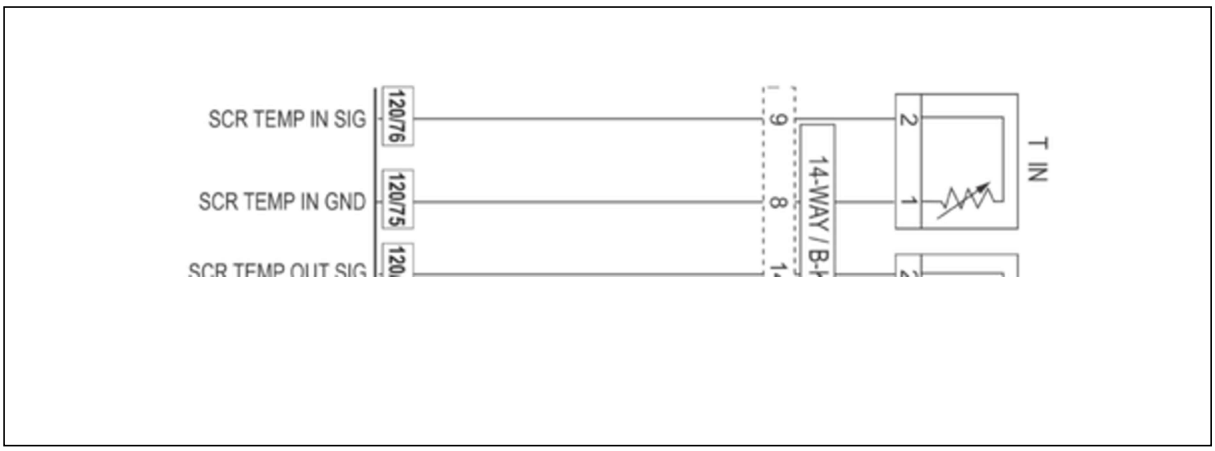
SPN 4360/FMI 2	
Description	This fault sets if SCR Inlet temperature is 70°C (126°F) higher compared to all other aftertreatment temperature sensors after 8-hour cold soak.
Monitored Parameter	Selective Catalyst Reduction (SCR) Inlet Temperature versus all other ATS temperature sensors.
Typical Enabling Conditions	Engine off for more than 8 hours, Battery Voltage greater than 10.98 V, Ignition on longer than 60 seconds
Monitor Sequence	Key on; engine off for more than 60 seconds
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Ignition off / 8-hour cold soak

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are fault codes SPN 4360/ FMI 3/4 also present?
   - 3.a Yes; diagnose the other fault codes first.
   - 3.b No; Go to step 4.
4. Disconnect and inspect the SCR inlet temperature sensor electrical connector, harness side.
5. Are there any spread pins, damaged pins, corrosion or signs of fretting present?
   - 5.a Yes; repair as necessary. Verify repair.
   - 5.b No; replace the SCR inlet temperature sensor. Refer to section "Removal of the Selective Catalytic Reduction Inlet Temperature Sensor" . Verify repair.

329.2 SPN 4360/FMI 3 - GHG17

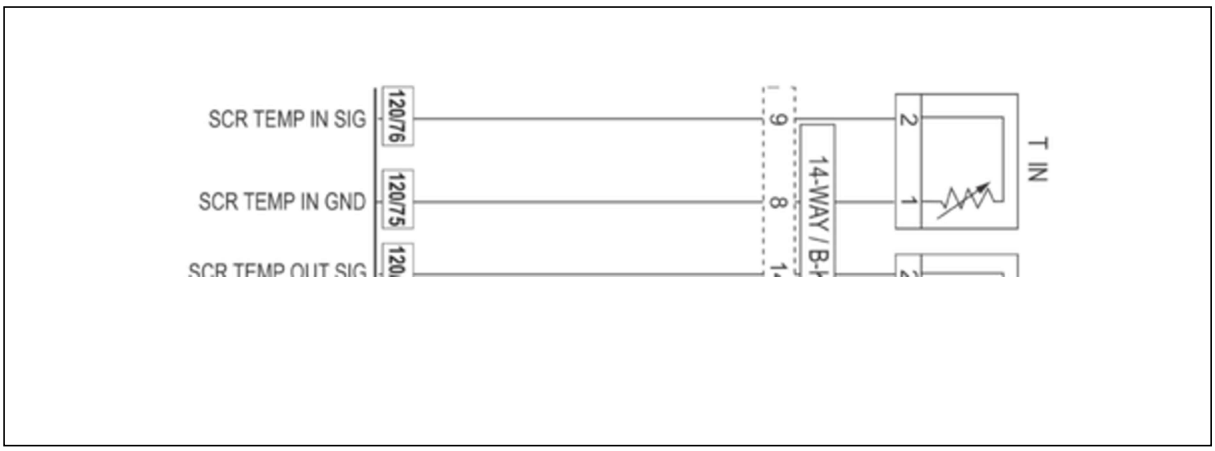
SPN 4360/FMI 3	
Description	Selective Catalyst Reduction (SCR) Inlet Temperature Sensor Circuit Failed High
Monitored Parameter	SCR Inlet Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate
Verification	Engine Idle (One Minute)



1. Disconnect the Selective Catalyst Reduction (SCR) inlet temperature sensor connector.
2. Inspect the sensor harness for bent, spread, or corroded pins. Is any damage found?
   - 2.a Yes; repair as necessary.
   - 2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pins 1 and 2 of the SCR inlet temperature sensor connector (harness side). Is the voltage between 2.5 and 3.5 volts?
   - 4.a Yes; replace the SCR inlet temperature sensor. Refer to section "Removal of the Selective Catalytic Reduction Inlet Temperature Sensor" . Verify repair.
   - 4.b No; Go to step 5.
5. Measure the voltage between pin 2 on the harness side of the SCR inlet temperature sensor connector and ground. Is the voltage between 2.5 and 3.5 volts?
   - 5.a Yes; repair the circuit between pin 1 on the harness side of the SCR inlet temperature sensor connector and pin 75 of the ACM 120-pin connector.
   - 5.b No; repair the circuit between pin 2 on the harness side of the SCR inlet temperature sensor connector and pin 76 of the ACM 120-pin connector.

329.3 SPN 4360/FMI 4 - GHG17

SPN 4360/FMI 4	
Description	Selective Catalyst Reduction (SCR) Inlet Temperature Sensor Circuit Failed Low
Monitored Parameter	SCR Inlet Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate
Verification	Engine Idle (One Minute)



1. Turn the ignition OFF.
2. Disconnect the Selective Catalyst Reduction (SCR) inlet temperature sensor harness connector.
3. Inspect the sensor harness electrical connector for signs of damage, bent, spread, broken, pushed out (unseated) or corroded pins or damaged near the connector. Was any damage found?
   - 3.a Yes; repair as necessary. If corrosion is present replace the sensor and the harness pig tail. Verify repair.
   - 3.b No; Go to step 4.
4. Turn the ignition ON (key ON, engine OFF).
5. Check the fault codes. Is fault code SPN 4360/ FMI 3 now active?
   - 5.a Yes; replace the SCR Inlet Temperature Sensor. Refer to section "Removal of the Selective Catalytic Reduction Inlet Temperature Sensor" . Verify repair.
   - 5.b No; Go to step 6.
6. Turn the ignition OFF.
7. Disconnect the ACM 120-pin connector.
8. Measure the resistance between pin 2 of the SCR inlet temperature sensor connector, harness side and ground. Is the resistance greater than 10K ohm?
   - 8.a Yes; replace the SCR inlet temperature sensor. Refer to section "Removal of the Selective Catalytic Reduction Inlet Temperature Sensor" . Verify repair.
   - 8.b No; this indicated a short to ground. Repair the wire between pin 2 of the SCR inlet temperature sensor connector and pin 76 of the ACM 120-pin connector. Verify repair.

329.4 SPN 4360/FMI 8 - GHG17

SPN 4360/FMI 8	
Description	This Fault Code Sets when the Aftertreatment Control Module (ACM) Detects a Momentary Abnormal Selective Catalyst Reduction (SCR) Inlet Temperature Reading
Monitored Parameter	Selective Catalyst Reduction Inlet Temperature Sensor
Typical Enabling Conditions	Non-Regen Mode
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	SCR Efficiency Test

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are fault codes SPN 4360/FMI 3 or 4 present?
   - 3.a Yes; diagnose the fault codes SPN 4360/FMI 3 and/or 4 first.
   - 3.b No; Go to step 4.
4. Move the SCR inlet temperature sensor harness around while watching the SCR sensor voltage using DiagnosticLink. Does the voltage fluctuate when the harness is shaken?
   - 4.a Yes; replace the harness. Verify repair.
   - 4.b No; Go to step 5.
5. Disconnect the SCR inlet temperature sensor electrical connector.
6. Inspect the SCR inlet temperature sensor and harness connector for signs of damage, bent, spread, broken, unseated (pushed out) or corroded pins, signs of water intrusion or damaged wires near the connector. Was any damage found?

6.a Yes; repair the harness as necessary. Verify repair.

6.b No; replace the SCR inlet temperature sensor. Refer to section "Removal of the Selective Catalytic Reduction Inlet Temperature Sensor" . Verify repair.

329.5 SPN 4360/FMI 15 – GHG17

Selective Catalyst Reduction Inlet Temperature High

SPN 4360/FMI 15	
Description	Selective Catalyst Reduction (SCR) Inlet Temperature High
Monitored Parameter	SCR Inlet Temperature
Typical Enabling Conditions	Non-Regen Mode
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%

1. Connect DiagnosticLink .
2. Is SPN 3246/FMI 15 (Diesel Particulate Filter (DPF) outlet over temperature) also present?
   - 2.a Yes; refer to SPN 3246/FMI 15 for diagnostics.
   - 2.b No; Go to step 3.
3. Monitor parameter AS095 SCR Inlet Temperature Voltage, while flexing (wiggle testing) the harness. Are any sudden voltage changes detected?
   - 3.a Yes; repair harness as necessary.
   - 3.b No; Go to step 4.
4. Disconnect the SCR inlet temperature sensor.
5. Inspect the SCR inlet temperature sensor harness connector for bent, spread or corroded pins.
   - 5.a If pin damage is found, repair as necessary.
   - 5.b If no pin damage is found, replace the SCR inlet temperature sensor.

329.6 SPN 4360/FMI 20 - GHG17

SPN 4360/FMI 20	
Description	Selective Catalyst Reduction (SCR) Inlet Temperature Sensor Drift High in Range
Monitored Parameter	SCR Inlet Temperature
Typical Enabling Conditions	Coolant is greater than 60°C (140°F), exhaust mass flow greater than 600kg/h
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	60 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate
Verification	Parked Regeneration

Check as follows:

1. Check for multiple fault codes. Are fault codes SPN 3246/ FMI 2, 8, 15, 20, 21 or FMI 4363/ FMI 8, 10 also present?

   1.a Yes; diagnose the other fault codes first.

   1.b No; Go to step 2.

2. Visually inspect the exhaust system from the turbocharger outlet to the aftertreatment inlet. Are there any visible signs of damage or soot trails indicating a leak in the exhaust?

   2.a Yes; repair the exhaust leak and verify the repair.

   2.b No; Go to step 3.

3. Disconnect the Diesel Particulate Filter (DPF) outlet temperature sensor.

4. Inspect the DPF outlet temperature sensor and harness connector for signs of damage, bent, spread, broken, unseated (pushed out) or corroded pins, signs of water intrusion or damaged wires near the connector.

   4.a If signs of damage is found, repair as necessary. Verify Repair.

   4.b If no signs of damage is found, Go to step 5.

5. Remove the DPF outlet temperature sensor from the aftertreatment.

   For 1-Box™ : Refer to section "Removal of the Diesel Particulate Filter Outlet Temperature Sensor" .

   For 2-Box: Refer to section "Removal of the Diesel Particulate Filter Outlet Temperature Sensor" .

6. Measure the resistance across the DPF outlet temperature sensor at the pigtail connector (refer to chart), compare to current ambient temperature. Is the resistance within range?

Temp - °C	Temp -°F	Range	
		Min Resistance ()	Max Resistance ()
0	32	197.67	207.62
2	35.6	199.20	209.15
4	39.2	200.73	210.67
6	42.8	202.27	212.20
8	46.4	203.80	213.72
10	50	205.33	215.24
12	53.6	206.85	216.77
14	57.2	208.38	218.29
16	60.8	209.91	219.81
18	64.44	211.43	221.33
20	68	212.96	222.85
22	71.6	214.48	224.37
24	75.2	216.01	225.88
26	78.8	217.53	227.40
28	82.4	219.05	228.91
30	86	220.57	230.43
32	89.6	222.09	231.94
34	93.2	223.61	233.45
36	96.8	225.12	234.96
38	100.4	226.64	236.47
40	104	228.16	237.98

6.a Yes; re-install the DPF outlet temperature sensor.

For 1-Box™: Refer to section "Installation of the Diesel Particulate Filter Outlet Temperature Sensor" . Go to step 7.

For 2-Box: Refer to section "Installation of the Diesel Particulate Filter Outlet Temperature Sensor" . Go to step 7.

6.b No; replace the DPF outlet temperature sensor. Verify repair.

For 1-Box™: Refer to section "Installation of the Diesel Particulate Filter Outlet Temperature Sensor" . Verify repair.

For 2-Box: Refer to section "Installation of the Diesel Particulate Filter Outlet Temperature Sensor" . Verify repair.

7. Disconnect and inspect the SCR outlet temperature sensor electrical connector, harness side. Are there any spread pins, damaged pins, corrosion or signs of fretting present?

7.a Yes; repair as necessary. Verify repair.

7.b No; replace the SCR outlet temperature sensor.

For 1-Box™: Refer to section "Removal of the Selective Catalyst Reduction Outlet Temperature Sensor" . Verify repair.

For 2-Box: Refer to section "Removal of the Selective Catalytic Reduction Outlet Temperature Sensor" . Verify repair.

329.7 SPN 4360/FMI 31 - GHG17

SPN 4360/FMI 31	
Description	Selective Catalyst Reduction (SCR) Inlet Temperature Low
Monitored Parameter	DPF Outlet and SCR Outlet Temperature Sensors
Typical Enabling Conditions	Non-Regen Mode
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	SCR Efficiency Test

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Connect DiagnosticLink .
2. Check for multiple fault codes. Are any of the following faults active: SPN 4363/FMI 3 or 4, SPN 3246/FMI 3, 4, or 21?
   - 2.a Yes; Refer to section "SPN 3246/FMI 15 - GHG17" for diagnostics.
   - 2.b No; Go to step 3.
3. Visually inspect the exhaust system from the turbocharger outlet to the aftertreatment inlet. Are there any visible signs of damage or soot trails indicating a leak in the exhaust?
   - 3.a Yes; repair the exhaust leak and verify the repair.
   - 3.b No; Go to step 4.
4. Disconnect the DPF outlet temperature sensor harness. Inspect harness for bent, spread, corroded pins or damages wires. Was any damage found?
   - 4.a Yes, repair as necessary. Verify repairs.
   - 4.b No; reconnect the DPF outlet temperature sensor. Go to step 5.

5. Disconnect the SCR outlet temperature sensor harness. Inspect harness for bent, spread, corroded pins or damaged wires. Was any damage found?
   5.a Yes, repair as necessary. Verify repairs.
   5.b No; reconnect the SCR inlet temperature sensor. Go to step 6.

> **⚠ WARNING**
>
> PERSONAL INJURY
>
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> **⚠ 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.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

6. Start the engine.
7. Perform a low temperature Aftertreatment Device (ATD) check using DiagnosticLink to check for a drifted temperature sensor.
8. After the routine has run for 25 minutes monitor the DOC inlet, DOC outlet, DPF outlet and SCR outlet temperature sensors. Are all the temperature sensors reading within 25°C (45°F) of each other?
   8.a Yes; perform a parked SCR efficiency test to verify the fault.
   8.b No; replace the temperature sensor that is drifted more than 25°C (45°F) from the others. Verify repair.

SPN 4360 (ACM) (GHG17)

329.1 SPN 4360/FMI 2 - GHG17

Selective Catalyst Reduction Inlet Temperature - Not Plausible

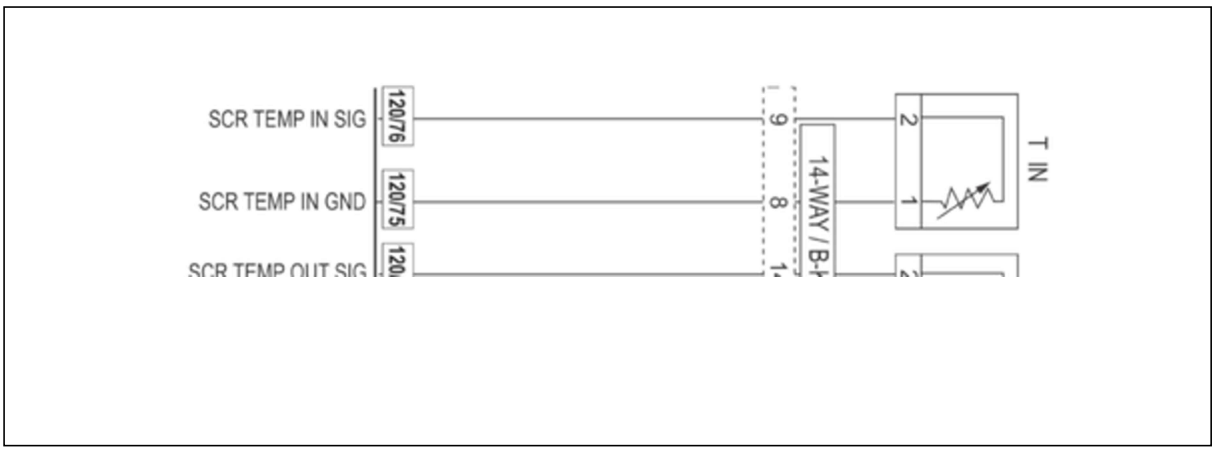
SPN 4360/FMI 2	
Description	This fault sets if SCR Inlet temperature is 70°C (126°F) higher compared to all other aftertreatment temperature sensors after 8-hour cold soak.
Monitored Parameter	Selective Catalyst Reduction (SCR) Inlet Temperature versus all other ATS temperature sensors.
Typical Enabling Conditions	Engine off for more than 8 hours, Battery Voltage greater than 10.98 V, Ignition on longer than 60 seconds
Monitor Sequence	Key on; engine off for more than 60 seconds
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Ignition off / 8-hour cold soak

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are fault codes SPN 4360/ FMI 3/4 also present?
   - 3.a Yes; diagnose the other fault codes first.
   - 3.b No; Go to step 4.
4. Disconnect and inspect the SCR inlet temperature sensor electrical connector, harness side.
5. Are there any spread pins, damaged pins, corrosion or signs of fretting present?
   - 5.a Yes; repair as necessary. Verify repair.
   - 5.b No; replace the SCR inlet temperature sensor. Refer to section "Removal of the Selective Catalytic Reduction Inlet Temperature Sensor" . Verify repair.

329.2 SPN 4360/FMI 3 - GHG17

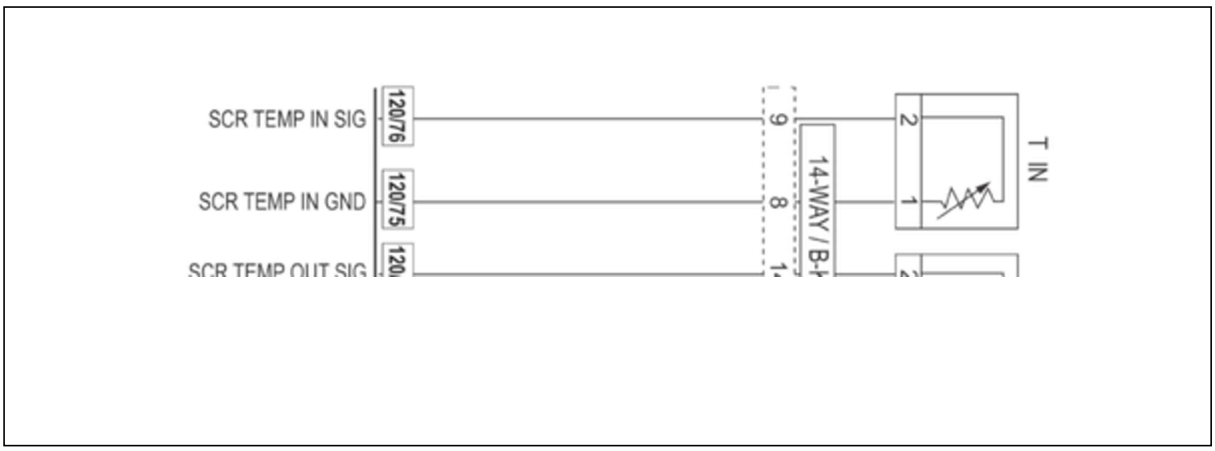
SPN 4360/FMI 3	
Description	Selective Catalyst Reduction (SCR) Inlet Temperature Sensor Circuit Failed High
Monitored Parameter	SCR Inlet Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate
Verification	Engine Idle (One Minute)



1. Disconnect the Selective Catalyst Reduction (SCR) inlet temperature sensor connector.
2. Inspect the sensor harness for bent, spread, or corroded pins. Is any damage found?
   - 2.a Yes; repair as necessary.
   - 2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pins 1 and 2 of the SCR inlet temperature sensor connector (harness side). Is the voltage between 2.5 and 3.5 volts?
   - 4.a Yes; replace the SCR inlet temperature sensor. Refer to section "Removal of the Selective Catalytic Reduction Inlet Temperature Sensor" . Verify repair.
   - 4.b No; Go to step 5.
5. Measure the voltage between pin 2 on the harness side of the SCR inlet temperature sensor connector and ground. Is the voltage between 2.5 and 3.5 volts?
   - 5.a Yes; repair the circuit between pin 1 on the harness side of the SCR inlet temperature sensor connector and pin 75 of the ACM 120-pin connector.
   - 5.b No; repair the circuit between pin 2 on the harness side of the SCR inlet temperature sensor connector and pin 76 of the ACM 120-pin connector.

329.3 SPN 4360/FMI 4 - GHG17

SPN 4360/FMI 4	
Description	Selective Catalyst Reduction (SCR) Inlet Temperature Sensor Circuit Failed Low
Monitored Parameter	SCR Inlet Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate
Verification	Engine Idle (One Minute)



1. Turn the ignition OFF.
2. Disconnect the Selective Catalyst Reduction (SCR) inlet temperature sensor harness connector.
3. Inspect the sensor harness electrical connector for signs of damage, bent, spread, broken, pushed out (unseated) or corroded pins or damaged near the connector. Was any damage found?
   - 3.a Yes; repair as necessary. If corrosion is present replace the sensor and the harness pig tail. Verify repair.
   - 3.b No; Go to step 4.
4. Turn the ignition ON (key ON, engine OFF).
5. Check the fault codes. Is fault code SPN 4360/ FMI 3 now active?
   - 5.a Yes; replace the SCR Inlet Temperature Sensor. Refer to section "Removal of the Selective Catalytic Reduction Inlet Temperature Sensor" . Verify repair.
   - 5.b No; Go to step 6.
6. Turn the ignition OFF.
7. Disconnect the ACM 120-pin connector.
8. Measure the resistance between pin 2 of the SCR inlet temperature sensor connector, harness side and ground. Is the resistance greater than 10K ohm?
   - 8.a Yes; replace the SCR inlet temperature sensor. Refer to section "Removal of the Selective Catalytic Reduction Inlet Temperature Sensor" . Verify repair.
   - 8.b No; this indicated a short to ground. Repair the wire between pin 2 of the SCR inlet temperature sensor connector and pin 76 of the ACM 120-pin connector. Verify repair.

329.4 SPN 4360/FMI 8 - GHG17

SPN 4360/FMI 8	
Description	This Fault Code Sets when the Aftertreatment Control Module (ACM) Detects a Momentary Abnormal Selective Catalyst Reduction (SCR) Inlet Temperature Reading
Monitored Parameter	Selective Catalyst Reduction Inlet Temperature Sensor
Typical Enabling Conditions	Non-Regen Mode
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	SCR Efficiency Test

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are fault codes SPN 4360/FMI 3 or 4 present?
   - 3.a Yes; diagnose the fault codes SPN 4360/FMI 3 and/or 4 first.
   - 3.b No; Go to step 4.
4. Move the SCR inlet temperature sensor harness around while watching the SCR sensor voltage using DiagnosticLink. Does the voltage fluctuate when the harness is shaken?
   - 4.a Yes; replace the harness. Verify repair.
   - 4.b No; Go to step 5.
5. Disconnect the SCR inlet temperature sensor electrical connector.
6. Inspect the SCR inlet temperature sensor and harness connector for signs of damage, bent, spread, broken, unseated (pushed out) or corroded pins, signs of water intrusion or damaged wires near the connector. Was any damage found?

6.a Yes; repair the harness as necessary. Verify repair.

6.b No; replace the SCR inlet temperature sensor. Refer to section "Removal of the Selective Catalytic Reduction Inlet Temperature Sensor" . Verify repair.

329.5 SPN 4360/FMI 15 – GHG17

Selective Catalyst Reduction Inlet Temperature High

SPN 4360/FMI 15	
Description	Selective Catalyst Reduction (SCR) Inlet Temperature High
Monitored Parameter	SCR Inlet Temperature
Typical Enabling Conditions	Non-Regen Mode
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%

1. Connect DiagnosticLink .
2. Is SPN 3246/FMI 15 (Diesel Particulate Filter (DPF) outlet over temperature) also present?
   2.a Yes; refer to SPN 3246/FMI 15 for diagnostics.
   2.b No; Go to step 3.
3. Monitor parameter AS095 SCR Inlet Temperature Voltage, while flexing (wiggle testing) the harness. Are any sudden voltage changes detected?
   3.a Yes; repair harness as necessary.
   3.b No; Go to step 4.
4. Disconnect the SCR inlet temperature sensor.
5. Inspect the SCR inlet temperature sensor harness connector for bent, spread or corroded pins.
   5.a If pin damage is found, repair as necessary.
   5.b If no pin damage is found, replace the SCR inlet temperature sensor.

329.6 SPN 4360/FMI 20 - GHG17

SPN 4360/FMI 20	
Description	Selective Catalyst Reduction (SCR) Inlet Temperature Sensor Drift High in Range
Monitored Parameter	SCR Inlet Temperature
Typical Enabling Conditions	Coolant is greater than 60°C (140°F), exhaust mass flow greater than 600kg/h
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	60 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate
Verification	Parked Regeneration

Check as follows:

1. Check for multiple fault codes. Are fault codes SPN 3246/ FMI 2, 8, 15, 20, 21 or FMI 4363/ FMI 8, 10 also present?

   1.a Yes; diagnose the other fault codes first.

   1.b No; Go to step 2.

2. Visually inspect the exhaust system from the turbocharger outlet to the aftertreatment inlet. Are there any visible signs of damage or soot trails indicating a leak in the exhaust?

   2.a Yes; repair the exhaust leak and verify the repair.

   2.b No; Go to step 3.

3. Disconnect the Diesel Particulate Filter (DPF) outlet temperature sensor.

4. Inspect the DPF outlet temperature sensor and harness connector for signs of damage, bent, spread, broken, unseated (pushed out) or corroded pins, signs of water intrusion or damaged wires near the connector.

   4.a If signs of damage is found, repair as necessary. Verify Repair.

   4.b If no signs of damage is found, Go to step 5.

5. Remove the DPF outlet temperature sensor from the aftertreatment.

   For 1-Box™ : Refer to section "Removal of the Diesel Particulate Filter Outlet Temperature Sensor" .

   For 2-Box: Refer to section "Removal of the Diesel Particulate Filter Outlet Temperature Sensor" .

6. Measure the resistance across the DPF outlet temperature sensor at the pigtail connector (refer to chart), compare to current ambient temperature. Is the resistance within range?

Temp - °C	Temp -°F	Range	
		Min Resistance ()	Max Resistance ()
0	32	197.67	207.62
2	35.6	199.20	209.15
4	39.2	200.73	210.67
6	42.8	202.27	212.20
8	46.4	203.80	213.72
10	50	205.33	215.24
12	53.6	206.85	216.77
14	57.2	208.38	218.29
16	60.8	209.91	219.81
18	64.44	211.43	221.33
20	68	212.96	222.85
22	71.6	214.48	224.37
24	75.2	216.01	225.88
26	78.8	217.53	227.40
28	82.4	219.05	228.91
30	86	220.57	230.43
32	89.6	222.09	231.94
34	93.2	223.61	233.45
36	96.8	225.12	234.96
38	100.4	226.64	236.47
40	104	228.16	237.98

6.a Yes; re-install the DPF outlet temperature sensor.

For 1-Box™: Refer to section "Installation of the Diesel Particulate Filter Outlet Temperature Sensor" . Go to step 7.

For 2-Box: Refer to section "Installation of the Diesel Particulate Filter Outlet Temperature Sensor" . Go to step 7.

6.b No; replace the DPF outlet temperature sensor. Verify repair.

For 1-Box™: Refer to section "Installation of the Diesel Particulate Filter Outlet Temperature Sensor" . Verify repair.

For 2-Box: Refer to section "Installation of the Diesel Particulate Filter Outlet Temperature Sensor" . Verify repair.

7. Disconnect and inspect the SCR outlet temperature sensor electrical connector, harness side. Are there any spread pins, damaged pins, corrosion or signs of fretting present?

7.a Yes; repair as necessary. Verify repair.

7.b No; replace the SCR outlet temperature sensor.

For 1-Box™: Refer to section "Removal of the Selective Catalyst Reduction Outlet Temperature Sensor" . Verify repair.

For 2-Box: Refer to section "Removal of the Selective Catalytic Reduction Outlet Temperature Sensor" . Verify repair.

329.7 SPN 4360/FMI 31 - GHG17

SPN 4360/FMI 31	
Description	Selective Catalyst Reduction (SCR) Inlet Temperature Low
Monitored Parameter	DPF Outlet and SCR Outlet Temperature Sensors
Typical Enabling Conditions	Non-Regen Mode
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	SCR Efficiency Test

WARNING

PERSONAL INJURY

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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.

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Connect DiagnosticLink .
2. Check for multiple fault codes. Are any of the following faults active: SPN 4363/FMI 3 or 4, SPN 3246/FMI 3, 4, or 21?
   - 2.a Yes; Refer to section "SPN 3246/FMI 15 - GHG17" for diagnostics.
   - 2.b No; Go to step 3.
3. Visually inspect the exhaust system from the turbocharger outlet to the aftertreatment inlet. Are there any visible signs of damage or soot trails indicating a leak in the exhaust?
   - 3.a Yes; repair the exhaust leak and verify the repair.
   - 3.b No; Go to step 4.
4. Disconnect the DPF outlet temperature sensor harness. Inspect harness for bent, spread, corroded pins or damages wires. Was any damage found?
   - 4.a Yes, repair as necessary. Verify repairs.
   - 4.b No; reconnect the DPF outlet temperature sensor. Go to step 5.

5. Disconnect the SCR outlet temperature sensor harness. Inspect harness for bent, spread, corroded pins or damaged wires. Was any damage found?
   5.a Yes, repair as necessary. Verify repairs.
   5.b No; reconnect the SCR inlet temperature sensor. Go to step 6.

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>
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> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

6. Start the engine.
7. Perform a low temperature Aftertreatment Device (ATD) check using DiagnosticLink to check for a drifted temperature sensor.
8. After the routine has run for 25 minutes monitor the DOC inlet, DOC outlet, DPF outlet and SCR outlet temperature sensors. Are all the temperature sensors reading within 25°C (45°F) of each other?
   8.a Yes; perform a parked SCR efficiency test to verify the fault.
   8.b No; replace the temperature sensor that is drifted more than 25°C (45°F) from the others. Verify repair.

330.1 SPN 4363/FMI 0 - GHG17

SCR Outlet Temperature High

SPN 4363/FMI 0	
Description	Selective Catalyst Reduction (SCR) Outlet Temperature High
Monitored Parameter	SCR Outlet Temperature
Typical Enabling Conditions	Non-Regen Mode
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25% , 30 seconds shut down.
Verification	SCR Efficiency Test

Check as follows:

1. Connect DiagnosticLink .
2. Is SPN 3246/FMI 15 (Diesel Particulate Filter (DPF) outlet over temperature) also present?
   - 2.a Yes; Refer to section "SPN 3246/FMI 15 - GHG17" .
   - 2.b No; Go to step 3.
3. Check the Motor Control Module (MCM), Aftertreatment Control Module (ACM), Common Powertrain Controller (CPC) and Transmission Control Module (TCM) software levels. Compare the current software levels to the server. Are the MCM, ACM, CPC and TCM software at the latest levels?
   - 3.a Yes; Go to step 4.
   - 3.b No; update the software levels and verify repair. If the fault code does not return, release the vehicle. If the fault code returns, Go to step 4.
4. Disconnect the SCR outlet temperature sensor.
5. Inspect the SCR outlet temperature sensor and harness connector for bent, spread or corroded pins. Is any damage found?
   - 5.a Yes; repair as necessary.
   - 5.b No; Go to step 6.
6. Remove the SCR temperature sensor and let the sensor adjust to ambient room temperature. Go to step 7. Refer to section "Removal of the Selective Catalytic Reduction Outlet Temperature Sensor" .
7. SCR temperature sensor Test - Measure the resistance between pin 1 and 2 of the SCR Temperature sensor connectors (Refer to chart for resistance values).
   - 7.a If the resistance is out of range, replace the suspect temperature sensor.
   - 7.b If the resistance is in range, reinstall the sensors and Go to step 8.

Temp - °C	Temp -°F	Range	
		Min Resistance ()	Max Resistance ()
0	32	197.67	207.62
2	35.6	199.20	209.15
4	39.2	200.73	210.67
6	42.8	202.27	212.20
8	46.4	203.80	213.72
10	50	205.33	215.24
12	53.6	206.85	216.77
14	57.2	208.38	218.29
16	60.8	209.91	219.81
18	64.44	211.43	221.33
20	68	212.96	222.85
22	71.6	214.48	224.37
24	75.2	216.01	225.88
26	78.8	217.53	227.40
28	82.4	219.05	228.91
30	86	220.57	230.43
32	89.6	222.09	231.94
34	93.2	223.61	233.45
36	96.8	225.12	234.96
38	100.4	226.64	236.47
40	104	228.16	237.98

⚠ 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.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

8. Start the engine and run a Parked Regen. During the last 10% of the parked regen period, is the Selective Catalyst Reduction (SCR) inlet temperature more than 38° C (68.4° F) lower than SCR outlet temperature?

   8.a Yes; Go to step 9.

   8.b No; Clear fault and release unit. Code likely occurred after extended idle and was caused by hydrocarbon burn off.

9. Perform a low temperature Aftertreatment Device (ATD) check using DiagnosticLink to check for a drifted temperature sensor. Refer to section "GHG17 Perform Performance Check - Low Temperature ATD" . Are the SCR inlet

and SCR outlet temperatures within 25° C (45° F) during the last five minutes of this test?

9.a Yes; replace the DOC/SCR module. This indicates an internal failure of the DOC/SCR module.

9.b No; replace the drifted SCR temperature sensor and verify repair.

330.2 SPN 4363/FMI 2 - GHG17

Selective Catalyst Reduction Outlet Temperature - Not Plausible

SPN 4363/FMI 2	
Description	This fault sets if the SCR outlet temperature is 70°C (126°F) higher compared to all other aftertreatment temperature sensors after 8-hour cold soak.
Monitored Parameter	Selective Catalyst Reduction (SCR) Outlet Temperature vs. all other ATS temperature sensors
Typical Enabling Conditions	Engine off more than 8 hours, Battery Voltage greater than 10.98 V, Ignition on longer than 60 seconds
Monitor Sequence	Key ON, engine OFF for more than 60 seconds
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Ignition off/ 8-hour cold soak

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are fault codes SPN 4363/ FMI 3/4 also present?
   - 3.a Yes; diagnose the other fault codes first.
   - 3.b No; Go to step 4.
4. Disconnect and inspect the SCR outlet temperature sensor electrical connector, harness side.
5. Are there any spread pins, damaged pins, corrosion or signs of fretting present?
   - 5.a Yes; repair as necessary. Verify repair.
   - 5.b No; replace the SCR outlet temperature sensor. Refer to section "Removal of the Selective Catalytic Reduction Outlet Temperature Sensor" . Verify repair.

330.3 SPN 4363/FMI 3 - GHG17

Selective Catalyst Reduction Outlet Temperature Sensor Circuit Failed High

SPN 4363/FMI 3	
Description	Selective Catalyst Reduction (SCR) Outlet Temperature Sensor Circuit Failed High
Monitored Parameter	SCR Outlet Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)

1. Disconnect the Selective Catalyst Reduction (SCR) outlet temperature sensor connector.
2. Inspect the sensor harness for bent, spread, or corroded pins.
   2.a If the pins are bent, spread, or corroded, repair as necessary.
   2.b If connector shows no signs of damage, Go to step 3.
3. SCR Outlet Temperature Test - Measure the resistance between pin 1 and 2 of the SCR outlet temperature sensor connector (refer to chart for resistance values).
   3.a If the resistance are out of range, replace the SCR outlet temperature sensor.
   3.b If the resistance are in range, Go to step 4.

Temp - °C	Temp -°F	Range	
		Min Resistance ()	Max Resistance ()
0	32	197.67	207.62
2	35.6	199.20	209.15
4	39.2	200.73	210.67
6	42.8	202.27	212.20
8	46.4	203.80	213.72
10	50	205.33	215.24
12	53.6	206.85	216.77
14	57.2	208.38	218.29
16	60.8	209.91	219.81
18	64.44	211.43	221.33
20	68	212.96	222.85
22	71.6	214.48	224.37
24	75.2	216.01	225.88
26	78.8	217.53	227.40
28	82.4	219.05	228.91
30	86	220.57	230.43
32	89.6	222.09	231.94
34	93.2	223.61	233.45
36	96.8	225.12	234.96
38	100.4	226.64	236.47
40	104	228.16	237.98

4. Turn the ignition ON (key ON, engine OFF).

5. Measure the voltage between pin 2 on the harness side of the SCR outlet temperature sensor connector and ground.
   - 5.a If the voltage is greater than 3 volts, repair the short to power between pin 2 on the harness side of the SCR outlet temperature sensor connector and pin 78 of the ACM 120-pin connector.
   - 5.b If the voltage is less than 2.75 volts, repair the wire between pin 2 on the harness side of the SCR outlet temperature sensor connector and pin 78 of the ACM 120-pin connector.
   - 5.c If the voltage is between 2.75 and 3 volts, Go to step 6.
6. Measure the voltage between pin 1 on the harness side of the SCR outlet temperature sensor and ground.
   - 6.a If voltage is present, repair the short to power between pin 1 on the harness side of the SCR outlet temperature sensor connector and pin 77 of the ACM 120-pin connector.
   - 6.b If no voltage is present, repair the open between pin 1 on the harness side of the SCR outlet temperature sensor connector and pin 77 of the ACM 120-pin connector.

330.4 SPN 4363/FMI 4 - GHG17

Selective Catalyst Reduction Outlet Temperature Sensor Circuit Failed Low

SPN 4363/FMI 4	
Description	Selective Catalyst Reduction (SCR) Outlet Temperature Sensor Circuit Failed Low
Monitored Parameter	SCR Outlet Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)

1. Ensure the ignition is OFF.
2. Disconnect the Selective Catalyst Reduction (SCR) outlet temperature sensor harness connector.
3. Inspect the sensor harness for bent, spread, or corroded pins.
   3.a If the pins are bent, spread, or corroded, repair as necessary.
   3.b If connector shows no signs of damage, Go to step 4.
4. Disconnect the ACM 120-pin connector.
5. Measure the resistance between pin 2 on the harness side of the SCR outlet temperature sensor connector and ground.
   5.a If the resistance is less than 1K ohms, repair the wire between pin 2 of the SCR outlet temperature sensor connector and pin 78 of the ACM 120-pin connector.
   5.b If the resistance is greater than 1K ohms, replace the SCR outlet temperature sensor.

330.5 SPN 4363/FMI 8 - GHG17

SCR Outlet Temperature Signal Spike

SPN 4363 /FMI 8	
Description	This fault code sets when the Aftertreatment Control Module (ACM) detects a momentary abnormal Selective Catalyst Reduction (SCR) outlet temperature reading.
Monitored Parameter	Selective Catalyst Reduction Outlet Temperature sensor
Typical Enabling Conditions	Non-Regen Mode
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	SCR efficiency test

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are fault codes SPN 4363/FMI 3 or 4 present?
   - 3.a Yes; diagnose the other fault codes first.
   - 3.b No; Go to step 4.
4. Shake the SCR outlet temperature sensor harness while watching the SCR sensor voltage using DiagnosticLink. Does the voltage fluctuate when the harness is shaken?
   - 4.a Yes; replace the harness. Verify repair.
   - 4.b No; Go to step 5.
5. Disconnect and inspect the SCR outlet temperature sensor electrical connector. Are there any spread pins, damaged pins, corrosion or signs of fretting present?
   - 5.a Yes; repair the harness as necessary. Verify repair.
   - 5.b No; replace the SCR outlet temperature sensor. Refer to section "Removal of the Selective Catalytic Reduction Outlet Temperature Sensor" . Verify repair.

330.6 SPN 4363/FMI 20 - GHG17

SCR Temperature Drift - Inlet Low/Outlet High

SPN 4363/FMI 20	
Description	This fault code sets when the Aftertreatment Control Module (ACM) detects that the Selective Catalyst Reduction (SCR) outlet temperature sensor reading and SCR outlet model temperature is greater than 70°C (158°F).
Monitored Parameter	SCR Outlet Temperature
Typical Enabling Conditions	Exhaust flow greater than 600 Kg/hr, coolant temperature greater than 60°C (140°F). Non-regen mode.
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL
Engine Reaction	Derate 25%
Verification	SCR Efficiency Test

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are fault codes SPN 4363/FMI 3 or 4 also present?
   - 3.a Yes; diagnose the other fault codes first.
   - 3.b No; Go to step 4.
4. Disconnect and inspect the SCR outlet temperature sensor electrical connector, harness side. For 1-BOX™, Refer to section "1-BOX™ Aftertreatment Device Sensor Locations" or for Two-BOX, Refer to section "2-BOX (2V2) Aftertreatment Device Sensor Locations" . Are there any spread pins, damaged pins, corrosion or signs of fretting present?
   - 4.a Yes; repair as necessary. Verify repair.
   - 4.b No; replace the SCR outlet temperature sensor. Refer to section "Removal of the Selective Catalytic Reduction Outlet Temperature Sensor" . Verify repair.

SPN 4363 (ACM) (GHG17)

330.1 SPN 4363/FMI 0 - GHG17

SCR Outlet Temperature High

SPN 4363/FMI 0	
Description	Selective Catalyst Reduction (SCR) Outlet Temperature High
Monitored Parameter	SCR Outlet Temperature
Typical Enabling Conditions	Non-Regen Mode
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25% , 30 seconds shut down.
Verification	SCR Efficiency Test

Check as follows:

1. Connect DiagnosticLink .
2. Is SPN 3246/FMI 15 (Diesel Particulate Filter (DPF) outlet over temperature) also present?
   - 2.a Yes; Refer to section "SPN 3246/FMI 15 - GHG17" .
   - 2.b No; Go to step 3.
3. Check the Motor Control Module (MCM), Aftertreatment Control Module (ACM), Common Powertrain Controller (CPC) and Transmission Control Module (TCM) software levels. Compare the current software levels to the server. Are the MCM, ACM, CPC and TCM software at the latest levels?
   - 3.a Yes; Go to step 4.
   - 3.b No; update the software levels and verify repair. If the fault code does not return, release the vehicle. If the fault code returns, Go to step 4.
4. Disconnect the SCR outlet temperature sensor.
5. Inspect the SCR outlet temperature sensor and harness connector for bent, spread or corroded pins. Is any damage found?
   - 5.a Yes; repair as necessary.
   - 5.b No; Go to step 6.
6. Remove the SCR temperature sensor and let the sensor adjust to ambient room temperature. Go to step 7. Refer to section "Removal of the Selective Catalytic Reduction Outlet Temperature Sensor" .
7. SCR temperature sensor Test - Measure the resistance between pin 1 and 2 of the SCR Temperature sensor connectors (Refer to chart for resistance values).
   - 7.a If the resistance is out of range, replace the suspect temperature sensor.
   - 7.b If the resistance is in range, reinstall the sensors and Go to step 8.

Temp - °C	Temp -°F	Range	
		Min Resistance ()	Max Resistance ()
0	32	197.67	207.62
2	35.6	199.20	209.15
4	39.2	200.73	210.67
6	42.8	202.27	212.20
8	46.4	203.80	213.72
10	50	205.33	215.24
12	53.6	206.85	216.77
14	57.2	208.38	218.29
16	60.8	209.91	219.81
18	64.44	211.43	221.33
20	68	212.96	222.85
22	71.6	214.48	224.37
24	75.2	216.01	225.88
26	78.8	217.53	227.40
28	82.4	219.05	228.91
30	86	220.57	230.43
32	89.6	222.09	231.94
34	93.2	223.61	233.45
36	96.8	225.12	234.96
38	100.4	226.64	236.47
40	104	228.16	237.98

⚠ 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.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

8. Start the engine and run a Parked Regen. During the last 10% of the parked regen period, is the Selective Catalyst Reduction (SCR) inlet temperature more than 38° C (68.4° F) lower than SCR outlet temperature?

   8.a Yes; Go to step 9.

   8.b No; Clear fault and release unit. Code likely occurred after extended idle and was caused by hydrocarbon burn off.

9. Perform a low temperature Aftertreatment Device (ATD) check using DiagnosticLink to check for a drifted temperature sensor. Refer to section "GHG17 Perform Performance Check - Low Temperature ATD" . Are the SCR inlet

and SCR outlet temperatures within 25° C (45° F) during the last five minutes of this test?

9.a Yes; replace the DOC/SCR module. This indicates an internal failure of the DOC/SCR module.

9.b No; replace the drifted SCR temperature sensor and verify repair.

330.2 SPN 4363/FMI 2 - GHG17

Selective Catalyst Reduction Outlet Temperature - Not Plausible

SPN 4363/FMI 2	
Description	This fault sets if the SCR outlet temperature is 70°C (126°F) higher compared to all other aftertreatment temperature sensors after 8-hour cold soak.
Monitored Parameter	Selective Catalyst Reduction (SCR) Outlet Temperature vs. all other ATS temperature sensors
Typical Enabling Conditions	Engine off more than 8 hours, Battery Voltage greater than 10.98 V, Ignition on longer than 60 seconds
Monitor Sequence	Key ON, engine OFF for more than 60 seconds
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Ignition off/ 8-hour cold soak

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are fault codes SPN 4363/ FMI 3/4 also present?
   - 3.a Yes; diagnose the other fault codes first.
   - 3.b No; Go to step 4.
4. Disconnect and inspect the SCR outlet temperature sensor electrical connector, harness side.
5. Are there any spread pins, damaged pins, corrosion or signs of fretting present?
   - 5.a Yes; repair as necessary. Verify repair.
   - 5.b No; replace the SCR outlet temperature sensor. Refer to section "Removal of the Selective Catalytic Reduction Outlet Temperature Sensor" . Verify repair.

330.3 SPN 4363/FMI 3 - GHG17

Selective Catalyst Reduction Outlet Temperature Sensor Circuit Failed High

SPN 4363/FMI 3	
Description	Selective Catalyst Reduction (SCR) Outlet Temperature Sensor Circuit Failed High
Monitored Parameter	SCR Outlet Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)

1. Disconnect the Selective Catalyst Reduction (SCR) outlet temperature sensor connector.
2. Inspect the sensor harness for bent, spread, or corroded pins.
   2.a If the pins are bent, spread, or corroded, repair as necessary.
   2.b If connector shows no signs of damage, Go to step 3.
3. SCR Outlet Temperature Test - Measure the resistance between pin 1 and 2 of the SCR outlet temperature sensor connector (refer to chart for resistance values).
   3.a If the resistance are out of range, replace the SCR outlet temperature sensor.
   3.b If the resistance are in range, Go to step 4.

Temp - °C	Temp -°F	Range	
		Min Resistance ()	Max Resistance ()
0	32	197.67	207.62
2	35.6	199.20	209.15
4	39.2	200.73	210.67
6	42.8	202.27	212.20
8	46.4	203.80	213.72
10	50	205.33	215.24
12	53.6	206.85	216.77
14	57.2	208.38	218.29
16	60.8	209.91	219.81
18	64.44	211.43	221.33
20	68	212.96	222.85
22	71.6	214.48	224.37
24	75.2	216.01	225.88
26	78.8	217.53	227.40
28	82.4	219.05	228.91
30	86	220.57	230.43
32	89.6	222.09	231.94
34	93.2	223.61	233.45
36	96.8	225.12	234.96
38	100.4	226.64	236.47
40	104	228.16	237.98

4. Turn the ignition ON (key ON, engine OFF).

5. Measure the voltage between pin 2 on the harness side of the SCR outlet temperature sensor connector and ground.
   - 5.a If the voltage is greater than 3 volts, repair the short to power between pin 2 on the harness side of the SCR outlet temperature sensor connector and pin 78 of the ACM 120-pin connector.
   - 5.b If the voltage is less than 2.75 volts, repair the wire between pin 2 on the harness side of the SCR outlet temperature sensor connector and pin 78 of the ACM 120-pin connector.
   - 5.c If the voltage is between 2.75 and 3 volts, Go to step 6.
6. Measure the voltage between pin 1 on the harness side of the SCR outlet temperature sensor and ground.
   - 6.a If voltage is present, repair the short to power between pin 1 on the harness side of the SCR outlet temperature sensor connector and pin 77 of the ACM 120-pin connector.
   - 6.b If no voltage is present, repair the open between pin 1 on the harness side of the SCR outlet temperature sensor connector and pin 77 of the ACM 120-pin connector.

330.4 SPN 4363/FMI 4 - GHG17

Selective Catalyst Reduction Outlet Temperature Sensor Circuit Failed Low

SPN 4363/FMI 4	
Description	Selective Catalyst Reduction (SCR) Outlet Temperature Sensor Circuit Failed Low
Monitored Parameter	SCR Outlet Temperature Sensor
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)

1. Ensure the ignition is OFF.
2. Disconnect the Selective Catalyst Reduction (SCR) outlet temperature sensor harness connector.
3. Inspect the sensor harness for bent, spread, or corroded pins.
   3.a If the pins are bent, spread, or corroded, repair as necessary.
   3.b If connector shows no signs of damage, Go to step 4.
4. Disconnect the ACM 120-pin connector.
5. Measure the resistance between pin 2 on the harness side of the SCR outlet temperature sensor connector and ground.
   5.a If the resistance is less than 1K ohms, repair the wire between pin 2 of the SCR outlet temperature sensor connector and pin 78 of the ACM 120-pin connector.
   5.b If the resistance is greater than 1K ohms, replace the SCR outlet temperature sensor.

330.5 SPN 4363/FMI 8 - GHG17

SCR Outlet Temperature Signal Spike

SPN 4363 /FMI 8	
Description	This fault code sets when the Aftertreatment Control Module (ACM) detects a momentary abnormal Selective Catalyst Reduction (SCR) outlet temperature reading.
Monitored Parameter	Selective Catalyst Reduction Outlet Temperature sensor
Typical Enabling Conditions	Non-Regen Mode
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	SCR efficiency test

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are fault codes SPN 4363/FMI 3 or 4 present?
   - 3.a Yes; diagnose the other fault codes first.
   - 3.b No; Go to step 4.
4. Shake the SCR outlet temperature sensor harness while watching the SCR sensor voltage using DiagnosticLink. Does the voltage fluctuate when the harness is shaken?
   - 4.a Yes; replace the harness. Verify repair.
   - 4.b No; Go to step 5.
5. Disconnect and inspect the SCR outlet temperature sensor electrical connector. Are there any spread pins, damaged pins, corrosion or signs of fretting present?
   - 5.a Yes; repair the harness as necessary. Verify repair.
   - 5.b No; replace the SCR outlet temperature sensor. Refer to section "Removal of the Selective Catalytic Reduction Outlet Temperature Sensor" . Verify repair.

330.6 SPN 4363/FMI 20 - GHG17

SCR Temperature Drift - Inlet Low/Outlet High

SPN 4363/FMI 20	
Description	This fault code sets when the Aftertreatment Control Module (ACM) detects that the Selective Catalyst Reduction (SCR) outlet temperature sensor reading and SCR outlet model temperature is greater than 70°C (158°F).
Monitored Parameter	SCR Outlet Temperature
Typical Enabling Conditions	Exhaust flow greater than 600 Kg/hr, coolant temperature greater than 60°C (140°F). Non-regen mode.
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL
Engine Reaction	Derate 25%
Verification	SCR Efficiency Test

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are fault codes SPN 4363/FMI 3 or 4 also present?
   - 3.a Yes; diagnose the other fault codes first.
   - 3.b No; Go to step 4.
4. Disconnect and inspect the SCR outlet temperature sensor electrical connector, harness side. For 1-BOX™, Refer to section "1-BOX™ Aftertreatment Device Sensor Locations" or for Two-BOX, Refer to section "2-BOX (2V2) Aftertreatment Device Sensor Locations" . Are there any spread pins, damaged pins, corrosion or signs of fretting present?
   - 4.a Yes; repair as necessary. Verify repair.
   - 4.b No; replace the SCR outlet temperature sensor. Refer to section "Removal of the Selective Catalytic Reduction Outlet Temperature Sensor" . Verify repair.

331.1 SPN 4364/FMI 1 - GHG17

SPN 4364/FMI 1	
Description	This Code Sets When the Aftertreatment Control Module (ACM) Detects Poor Selective Catalyst Reduction (SCR) NOx Conversion Efficiency.
Monitored Parameter	SCR Inlet NOx Sensor and SCR Outlet NOx Sensor
Typical Enabling Conditions	Diesel Exhaust Fluid (DEF) Dosing Enabled, 1000 to 2100 rpm, 15 to 100% Load
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	30 Minutes
Dash Lamps	MIL
Engine Reaction	25% Derate
Verification	Parked SCR Efficiency Test

1. Refer to section "SPN 4364/FMI 17 - GHG17" and follow the diagnostic procedure.

331.2 SPN 4364/FMI 17 - GHG17

SPN 4364/FMI 17	
Description	This Code Sets When the Aftertreatment Control Module (ACM) Detects Poor Selective Catalyst Reduction (SCR) NOx Conversion Efficiency
Monitored Parameter	SCR Inlet NOx Sensor and SCR Outlet NOx Sensor
Typical Enabling Conditions	Diesel Exhaust Fluid (DEF) Dosing Enabled, 1000 to 2100 rpm, 15 to 100% Load
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	30 Minutes
Dash Lamps	MIL
Engine Reaction	25% Derate
Verification	Parked SCR Efficiency Test

Possible causes:

- Contaminated DEF
- Incorrect concentration of urea in the DEF
- Biased NOx sensor
- Excessive DEF build-up in the exhaust
- Improper DPF maintenance
- Over temp aftertreatment

NOTICE

DEF crystallization inside the SCR mixing chamber or around the dosing unit does not indicate a failed/leaking DEF doser. Do not replace the DEF dosing unit unless directed.

NOTICE

It may require 30 minutes or longer for the outlet NOx sensor to turn on. Do not replace either sensor unless directed to within the troubleshooting.

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for other fault codes. Are there any air management system fault codes present, such as Intake Throttle Valve (ITV), Intake Manifold Pressure (IMP), Intake Air Temperature (IAT), or turbocharger?
   - 3.a Yes; diagnose the air management system fault codes first.
   - 3.b No; Go to step 4.
4. Are there any Exhaust Gas Recirculation (EGR) system fault codes present?
   - 4.a Yes; repair the EGR system fault codes first.
   - 4.b No; Go to step 5.
5. Are there any fuel system fault codes present?
   - 5.a Yes; diagnose the fuel system fault codes first.

5.b No; Go to step 6.

6. Are there any other NOx sensor fault codes present?

6.a Yes; diagnose the other NOx sensor fault codes first.

6.b No; Go to step 7.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

> **⚠ 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.

7. Was another emission component-related fault code repaired prior to this step?

7.a Yes; warm up the engine and perform a Parked SCR Efficiency Test to verify repairs and clear fault codes. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

7.b No; Go to step 8.

8. Are there any ACM temperature or pressure fault codes present?

8.a Yes; diagnose the fault first.

8.b No; Go to step 9.

9. Turn the ignition OFF.

10. Use DEF test strip A0005850202 to check for diesel fuel or oil contamination of the DEF fluid. Refer to section "Checking Diesel Exhaust Fluid Quality" . Do the test strips or visual inspection indicate that the DEF is contaminated?

10.a Yes; for diesel fuel or oil contamination, refer to the following table for a list of parts that must be replaced. Refill the new DEF tank with new DEF. Verify repair; perform a Parked SCR Efficiency Test to clear the regulatory fault. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

10.b No; Go to step 11.

Parts to be replaced for diesel fuel or oil in the DEF system. Refer to the GHG17 DD Platform Workshop Manual (DDC-SVC-MAN-0190) for proper repair procedures.	
Part Description	Comment
DEF Tank	Chassis OEM Part
DEF Tank Header	Chassis OEM Part
DEF Supply Line From DEF Tank To DEF Pump	Chassis OEM Part
DEF Line From DEF Pump To DEF Dosing Unit	Chassis OEM Part
DEF Return Line From DEF Dosing Unit To Tank	Chassis OEM Part
DEF Pump	Detroit Diesel Part
DEF Dosing Unit	Detroit Diesel Part

11. Using the refractometer from DEF Test Kit W060589001900, measure the DEF urea percentage. Is DEF urea percentage between 31 and 34 percent?

    11.a Yes; Go to step 12.

    11.b No; drain and flush the DEF tank and the DEF system with water. Refill the DEF tank with new DEF. Verify repair; perform a Parked SCR Efficiency Test to clear the regulatory fault. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

12. Turn the ignition ON (key ON, engine OFF).

13. Inspect the area around the DEF dosing unit gasket for DEF crystallization. Is there any DEF crystallization build-up present?

    13.a Yes; this indicates the gasket has failed, NOT the DEF dosing unit. Replace the gasket after completing the DEF quantity test in the next step. Go to step 14.

    13.b No; Go to step 14.

14. Unbolt the DEF doser from the aftertreatment; do not disconnect the DEF lines or electrical connector.

Fig 0.1, Normal DEF Crystallization in the DEF Doser Port Hole

15. Find the graduated cylinder provided in DEF test kit W060589001900, which is used in DEF quantity tests; Refer to section "Diesel Exhaust Fluid Quantity Test - GHG17" .
16. Perform a DEF Quantity Test service routine.
17. Monitor the amount of DEF dispensed. Is the amount of DEF dispensed between 108 and 132 mL?
    - 17.a Yes; reinstall the DEF dosing unit. Use a new gasket and bolts, as they are one-time use. Refer to section "Installation of the Diesel Exhaust Fluid Dosing Unit " . Go to step 18.
    - 17.b No; replace the DEF dosing unit. Use a new gasket and bolts, as they are one-time use. Refer to section "Installation of the Diesel Exhaust Fluid Dosing Unit " . Verify repair; perform a Parked SCR Efficiency Test to clear the regulatory fault. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .
18. Disconnect the DEF dosing unit electrical connector.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

> **⚠ 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.

Note : SPN 3361/FMI 5 will set when the DEF dosing unit electrical connector is disconnected. The fault code can be cleared using DiagnosticLink after the DEF dosing unit electrical connector is reconnected.

19. Start the engine and perform a complete parked regeneration. Refer to section "Performing a Parked Regeneration - GHG17" . The regen will burn off any DEF deposits in the aftertreatment before checking the NOx sensors.

> **NOTICE**
>
> **It may require 30 minutes or longer for the outlet NOx sensor to turn on. Do not replace either sensor unless directed by the troubleshooting.**

20. Monitor the inlet NOx sensor and outlet NOx sensor. During the last five minutes of the parked regen, are the sensor readings within 50 parts per million (ppm) of each other?
    - 20.a Yes; Go to step 22.
    - 20.b No; replace the inlet NOx sensor. Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" . Go to step 21.
21. Start the engine and perform a complete parked regen. Refer to section "Performing a Parked Regeneration - GHG17" . Monitor the inlet NOx sensor and outlet NOx sensor. During the last five minutes of the parked regen, are the sensors reading within 50 ppm of each other?
    - 21.a Yes; Go to step 22.

21.b No; replace the outlet NOx sensor. Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" . Go to step 22.

22. Reconnect the DEF dosing unit electrical connector.

WARNING

ENGINE EXHAUST

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

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.

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.

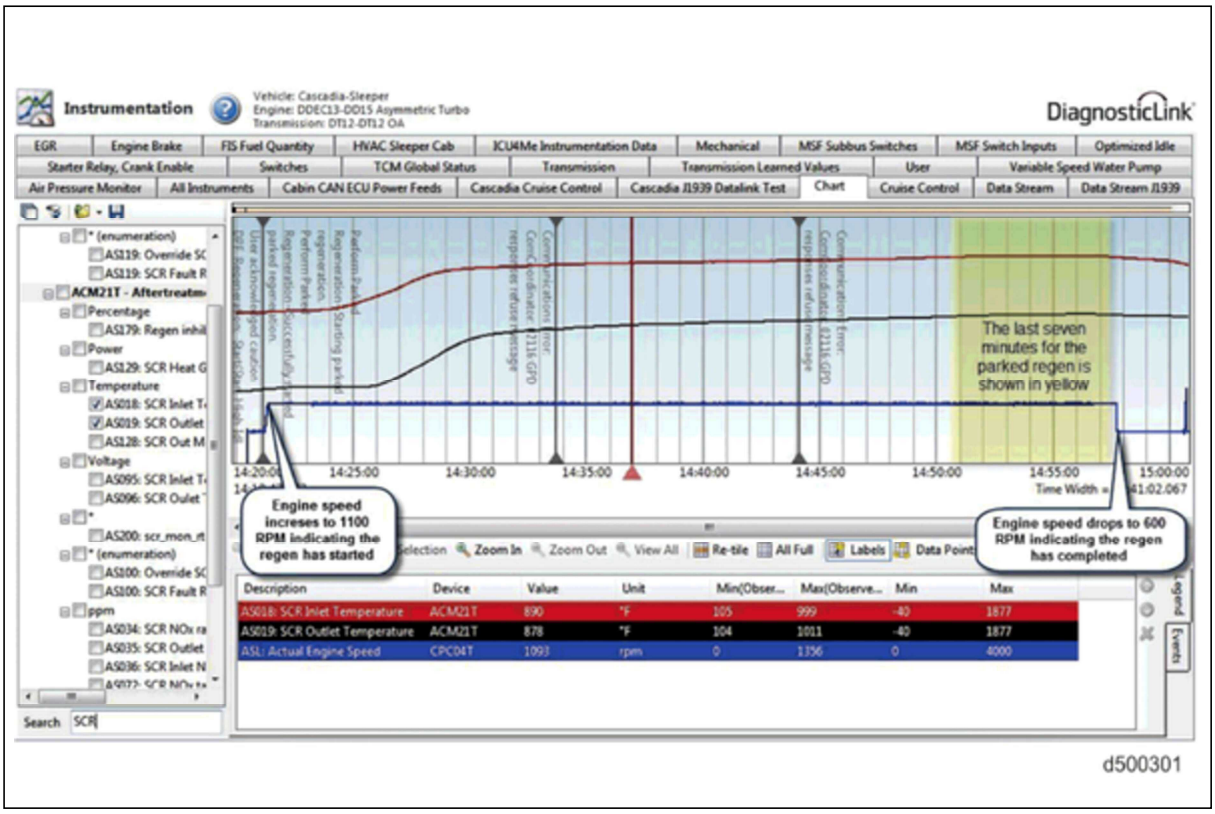
23. Start the engine and perform a parked regeneration. Monitor the NOx conversion efficiency. Is the NOx conversion efficiency above 85%?

23.a Yes; this fault was likely caused by the DEF build-up in the exhaust which was cleared by the parked regeneration procedures. Perform a Parked SCR Efficiency Test to clear the regulatory fault. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

Note : Excessive DEF build-up in the exhaust can be caused by a vehicle with a high speed, high average drive load.

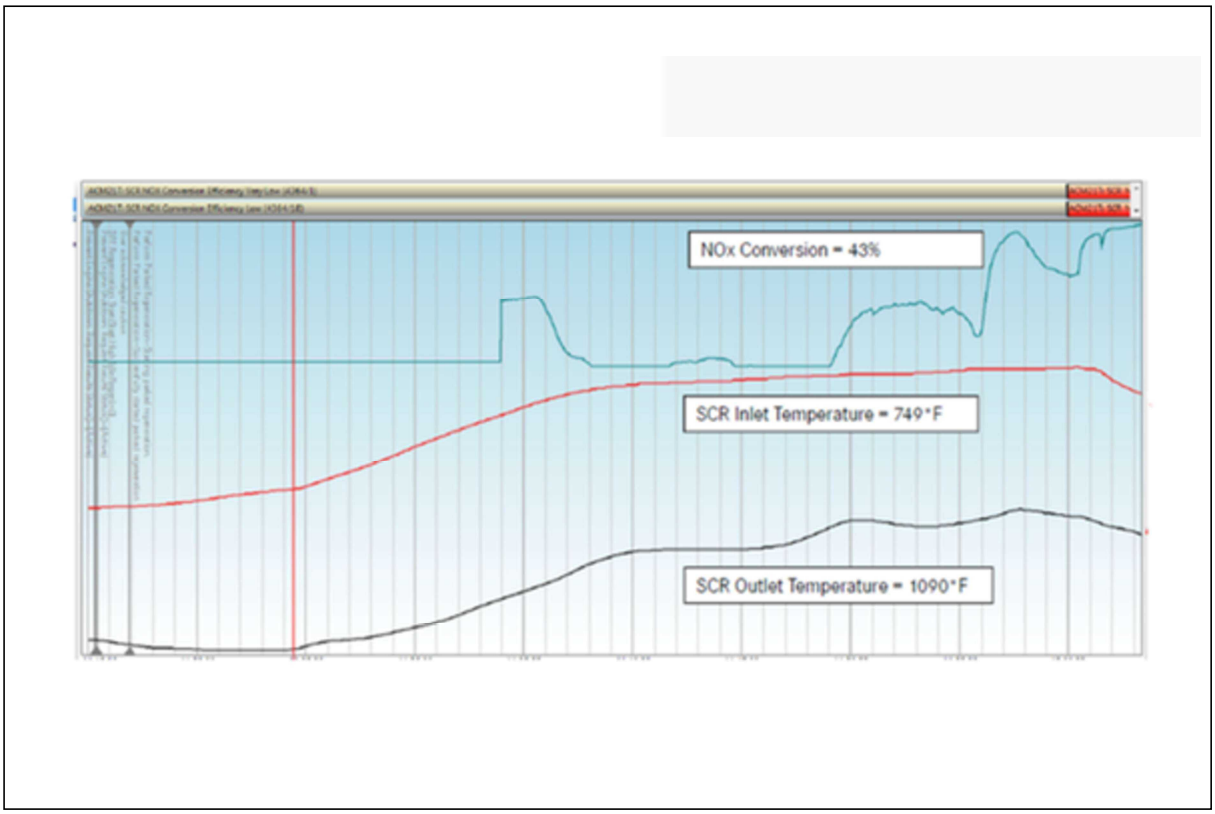
23.b No; Go to step 24.

24. Review the last seven minutes of the parked regeneration log data from step 23. The illustration below identifies the last seven minutes of the parked regen.



25. Is the Selective Catalyst Reduction (SCR) inlet temperature lower than SCR outlet temperature by more than 38°C (68.4°F)?

    Example: SCR outlet temperature is 588°C (1090°F) - SCR Inlet Temp 398°C (748°F) = 171°C (340°F). Difference between inlet and outlet is 171°C (341°F), which is greater than 38°C (68.4°F)?



25.a Yes; Go to step 27.

25.b No; for a 1-Box™ system, replace the DOC/SCR module. For a Two-Box system, replace the SCR module. Complete the ATD checklist to identify cause of failure. Go to step 26.

26. Perform a Parked SCR Efficiency Test to clear the regulatory fault. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

27. Review the data from the "Perform the GHG17 Perform Performance Check - Low Temperature ATD" check in step 20. Are the calculated SCR inlet temperature and SCR outlet temperatures sensor readings within 25°C (45°F) at the end of the low temp regen?

27.a Yes; this indicates internal structural damage for a 1-Box. Replace the DOC/SCR module. The ATD checklist is **NOT** required since the ATD is the primary failed part. This image below illustrates the possible internal damage to the aftertreatment. Go to step 28.

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27.b No; replace the drifted temperature sensor and verify repair. Go to step 28.

28. Perform a Parked SCR Efficiency Test to clear the fault. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

SPN 4364 (ACM) (GHG17)

331.1 SPN 4364/FMI 1 - GHG17

Before starting this troubleshooting procedure, please verify if an Advanced Diagnostic (AD) version is available, and continue with that version if available. ADs provide enhanced functionality that increase the accuracy of the troubleshooting process and are preferred over traditional troubleshooting. The ADs are identified in DiagnosticLink by the magic wand icon next to the fault, and the word "Advanced" label in the "Troubleshooting Type" field.

SPN 4364/FMI 1	
Description	This Code Sets When the Aftertreatment Control Module (ACM) Detects Poor Selective Catalyst Reduction (SCR) NOx Conversion Efficiency.
Monitored Parameter	SCR Inlet NOx Sensor and SCR Outlet NOx Sensor
Typical Enabling Conditions	Diesel Exhaust Fluid (DEF) Dosing Enabled, 1000 to 2100 rpm, 15 to 100% Load
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	30 Minutes
Dash Lamps	MIL
Engine Reaction	25% Derate
Verification	Parked SCR Efficiency Test

1. Refer to section "SPN 4364/FMI 17 - GHG17" and follow the diagnostic procedure.

331.2 SPN 4364/FMI 17 - GHG17

Before starting this troubleshooting procedure, please verify if an Advanced Diagnostic (AD) version is available, and continue with that version if available. ADs provide enhanced functionality that increase the accuracy of the troubleshooting process and are preferred over traditional troubleshooting. The ADs are identified in DiagnosticLink by the magic wand icon next to the fault, and the word "Advanced" label in the "Troubleshooting Type" field.

SPN 4364/FMI 17	
Description	This Code Sets When the Aftertreatment Control Module (ACM) Detects Poor Selective Catalyst Reduction (SCR) NOx Conversion Efficiency
Monitored Parameter	SCR Inlet NOx Sensor and SCR Outlet NOx Sensor
Typical Enabling Conditions	Diesel Exhaust Fluid (DEF) Dosing Enabled, 1000 to 2100 rpm, 15 to 100% Load
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	30 Minutes
Dash Lamps	MIL
Engine Reaction	25% Derate
Verification	Parked SCR Efficiency Test

Possible causes:

- Contaminated DEF
- Incorrect concentration of urea in the DEF
- Biased NOx sensor
- Excessive DEF build-up in the exhaust
- Improper DPF maintenance
- Over temp aftertreatment

NOTICE

DEF crystallization inside the SCR mixing chamber or around the dosing unit does not indicate a failed/leaking DEF doser. Do not replace the DEF dosing unit unless directed.

NOTICE

It may require 30 minutes or longer for the outlet NOx sensor to turn on. Do not replace either sensor unless directed to within the troubleshooting.

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for other fault codes. Are there any air management system fault codes present, such as Intake Throttle Valve (ITV), Intake Manifold Pressure (IMP), Intake Air Temperature (IAT), or turbocharger?

   3.a Yes; diagnose the air management system fault codes first.

   3.b No; Go to step 4.
4. Are there any Exhaust Gas Recirculation (EGR) system fault codes present?

4.a Yes; repair the EGR system fault codes first.

4.b No; Go to step 5.

5. Are there any fuel system fault codes present?

5.a Yes; diagnose the fuel system fault codes first.

5.b No; Go to step 6.

6. Are there any other NOx sensor fault codes present?

6.a Yes; diagnose the other NOx sensor fault codes first.

6.b No; Go to step 7.

WARNING

ENGINE EXHAUST

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

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.

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.

7. Was another emission component-related fault code repaired prior to this step?

7.a Yes; warm up the engine and perform a Parked SCR Efficiency Test to verify repairs and clear fault codes. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

7.b No; Go to step 8.

8. Are there any ACM temperature or pressure fault codes present?

8.a Yes; diagnose the fault first.

8.b No; Go to step 9.

9. Turn the ignition OFF.

10. Use DEF test strip A0005850202 to check for diesel fuel or oil contamination of the DEF fluid. Refer to section "Checking Diesel Exhaust Fluid Quality" . Do the test strips or visual inspection indicate that the DEF is contaminated?

10.a Yes; for diesel fuel or oil contamination, refer to the following table for a list of parts that must be replaced. Refill the new DEF tank with new DEF. Verify repair; perform a Parked SCR Efficiency Test to clear the regulatory fault. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

10.b No; Go to step 11.

Parts to be replaced for diesel fuel or oil in the DEF system. Refer to the GHG17 DD Platform Workshop Manual (DDC-SVC-MAN-0190) for proper repair procedures.	
Part Description	Comment
DEF Tank	Chassis OEM Part
DEF Tank Header	Chassis OEM Part
DEF Supply Line From DEF Tank To DEF Pump	Chassis OEM Part
DEF Line From DEF Pump To DEF Dosing Unit	Chassis OEM Part
DEF Return Line From DEF Dosing Unit To Tank	Chassis OEM Part
DEF Pump	Detroit Diesel Part
DEF Dosing Unit	Detroit Diesel Part

11. Using the refractometer from DEF Test Kit W060589001900, measure the DEF urea percentage. Is DEF urea percentage between 31 and 34 percent?

    11.a Yes; Go to step 12.

    11.b No; drain and flush the DEF tank and the DEF system with water. Refill the DEF tank with new DEF. Verify repair; perform a Parked SCR Efficiency Test to clear the regulatory fault. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

12. Turn the ignition ON (key ON, engine OFF).

13. Inspect the area around the DEF dosing unit gasket for DEF crystallization. Is there any DEF crystallization build-up present?

    13.a Yes; this indicates the gasket has failed, NOT the DEF dosing unit. Replace the gasket after completing the DEF quantity test in the next step. Go to step 14.

    13.b No; Go to step 14.

14. Unbolt the DEF doser from the aftertreatment; do not disconnect the DEF lines or electrical connector.

Fig 331.2, Normal DEF Crystallization in the DEF Doser Port Hole

15. Find the graduated cylinder provided in DEF test kit W060589001900, which is used in DEF quantity tests; Refer to section "Diesel Exhaust Fluid Quantity Test - GHG17" .
16. Perform a DEF Quantity Test service routine.
17. Monitor the amount of DEF dispensed. Is the amount of DEF dispensed between 108 and 132 mL?
    - 17.a Yes; reinstall the DEF dosing unit. Use a new gasket and bolts, as they are one-time use. Refer to section "Installation of the Diesel Exhaust Fluid Dosing Unit " . Go to step 18.
    - 17.b No; replace the DEF dosing unit. Use a new gasket and bolts, as they are one-time use. Refer to section "Installation of the Diesel Exhaust Fluid Dosing Unit " . Verify repair; perform a Parked SCR Efficiency Test to clear the regulatory fault. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .
18. Disconnect the DEF dosing unit electrical connector.

WARNING

ENGINE EXHAUST

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

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.

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.

Note : SPN 3361/FMI 5 will set when the DEF dosing unit electrical connector is disconnected. The fault code can be cleared using DiagnosticLink after the DEF dosing unit electrical connector is reconnected.

19. Start the engine and perform a complete parked regeneration. Refer to section "Performing a Parked Regeneration - GHG17" . The regen will burn off any DEF deposits in the aftertreatment before checking the NOx sensors.

NOTICE

It may require 30 minutes or longer for the outlet NOx sensor to turn on. Do not replace either sensor unless directed by the troubleshooting.

20. Monitor the inlet NOx sensor and outlet NOx sensor. During the last five minutes of the parked regen, are the sensor readings within 50 parts per million (ppm) of each other?
    - 20.a Yes; Go to step 22.
    - 20.b No; replace the inlet NOx sensor. Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" . Go to step 21.
21. Start the engine and perform a complete parked regen. Refer to section "Performing a Parked Regeneration - GHG17" . Monitor the inlet NOx sensor and outlet NOx sensor. During the last five minutes of the parked regen, are the sensors reading within 50 ppm of each other?
    - 21.a Yes; Go to step 22.

21.b No; replace the outlet NOx sensor. Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" . Go to step 22.

22. Reconnect the DEF dosing unit electrical connector.

WARNING

ENGINE EXHAUST

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

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.

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.

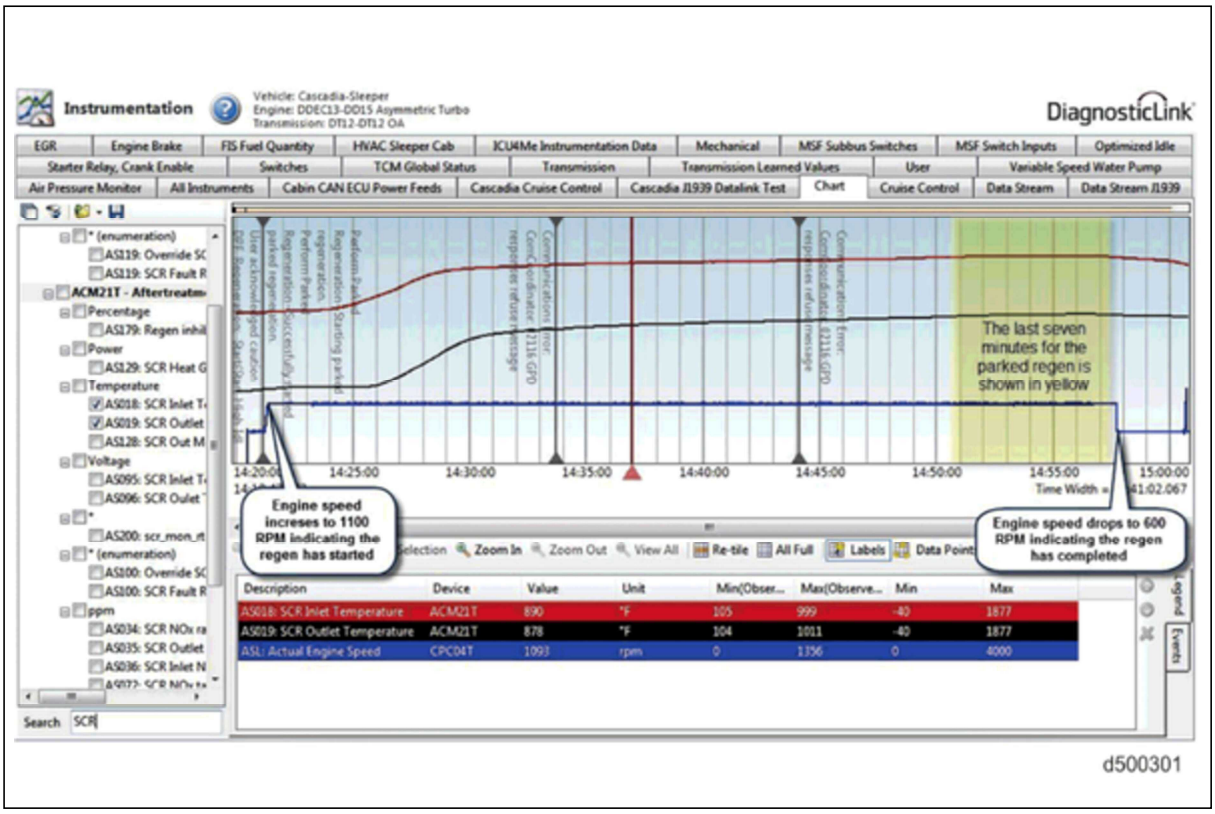
23. Start the engine and perform a parked regeneration. Monitor the NOx conversion efficiency. Is the NOx conversion efficiency above 85%?

23.a Yes; this fault was likely caused by the DEF build-up in the exhaust which was cleared by the parked regeneration procedures. Perform a Parked SCR Efficiency Test to clear the regulatory fault. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

Note : Excessive DEF build-up in the exhaust can be caused by a vehicle with a high speed, high average drive load.

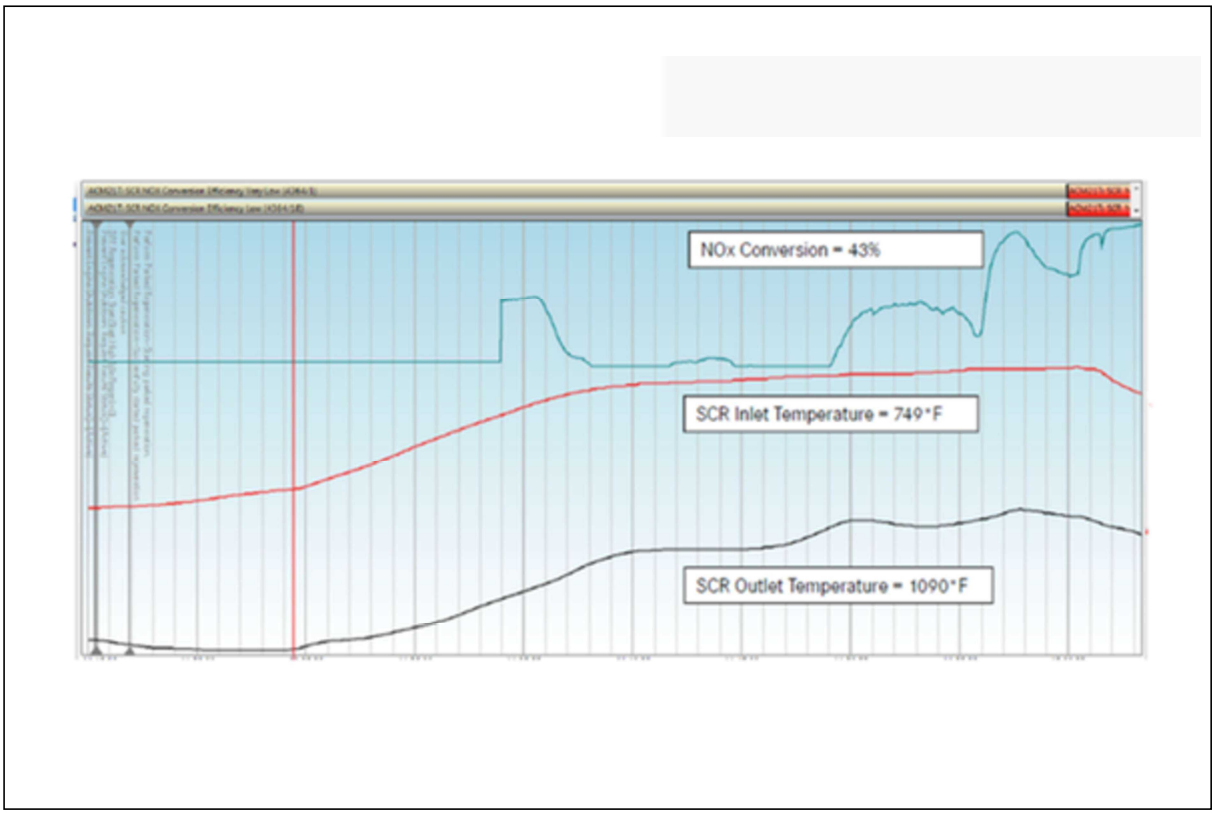
23.b No; Go to step 24.

24. Review the last seven minutes of the parked regeneration log data from step 23. The illustration below identifies the last seven minutes of the parked regen.



25. Is the Selective Catalyst Reduction (SCR) inlet temperature lower than SCR outlet temperature by more than 38°C (68.4°F)?

    Example: SCR outlet temperature is 588°C (1090°F) - SCR Inlet Temp 398°C (748°F) = 171°C (340°F). Difference between inlet and outlet is 171°C (341°F), which is greater than 38°C (68.4°F)?



25.a Yes; Go to step 27.

25.b No; for a 1-Box™ system, replace the DOC/SCR module. For a Two-Box system, replace the SCR module. Complete the ATD checklist to identify cause of failure. Go to step 26.

26. Perform a Parked SCR Efficiency Test to clear the regulatory fault. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

27. Review the data from the "Perform the GHG17 Perform Performance Check - Low Temperature ATD" check in step 20. Are the calculated SCR inlet temperature and SCR outlet temperatures sensor readings within 25°C (45°F) at the end of the low temp regen?

27.a Yes; this indicates internal structural damage for a 1-Box. Replace the DOC/SCR module. The ATD checklist is **NOT** required since the ATD is the primary failed part. This image below illustrates the possible internal damage to the aftertreatment. Go to step 28.

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27.b No; replace the drifted temperature sensor and verify repair. Go to step 28.

28. Perform a Parked SCR Efficiency Test to clear the fault. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

332.1 SPN 4374/FMI 0 – GHG17

SPN 4374/FMI 0	
Description	This Code Sets When the Diesel Exhaust Fluid (DEF) Pump Speed is Higher than Normal For a Given DEF Pressure
Monitored Parameter	DEF Pump Speed, DEF Pressure
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Continuous Until Resolved
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	SCR ADS Self-Check

Possible causes:

- Restriction in the DEF line between the DEF tank and the DEF pump
- Restriction in the DEF line between the DEF pump and the DEF dosing unit
- Air in the DEF line between the DEF tank and the DEF pump
- Restriction in the DEF pump
- Failed DEF pump

Check as follows:

> **NOTICE**
>
> **Customers in colder climates where winter ambient air temperatures generally stay below -11° C (12°F) need to verify that the DEF is not frozen before troubleshooting this fault code.**

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple codes. Are codes SPN 4334/FMI 3, 4, SPN 4375/FMI 3, 4, or SPN 3361/FMI 3, 4, 5 also present?
   - 3.a Yes; diagnose and repair the other fault codes first. Verify repair.
   - 3.b No; Go to step 4.
4. Turn the ignition OFF.
5. Inspect the DEF tank vent tube. Is there any blockage or restriction?
   - 5.a Yes; clear the restricted vent tube. Go to step 6.
   - 5.b No; Go to step 6.
6. Using DEF test strip A0005850202, check for diesel fuel or oil contamination of the DEF fluid. Does the test strip indicate contamination?
   - 6.a Yes; replace the following components and refill the system with new DEF:

- DEF tank
- DEF tank header
- DEF supply line from the DEF tank to the DEF pump
- DEF line from the DEF pump to the DEF dosing unit
- DEF return line from the DEF dosing unit to the DEF tank
- DEF pump

- DEF dosing unit

6.b No; Go to step 7.

> **⚠ WARNING**
>
> EYE INJURY
>
> To avoid injury from flying debris when using compressed air, wear adequate eye protection (face shield or safety goggles) and do not exceed 276 kPa (40 psi) air pressure.

7. Inspect the DEF line that runs from the DEF pump to the DEF dosing unit. Is the DEF line damaged, pinched, or kinked?

   7.a Yes; replace the DEF line from the DEF pump to the DEF dosing unit.

   7.b No; Go to step 8.

8. Inspect the DEF line that runs from the DEF tank to the DEF pump. Is the DEF line damaged, pinched, or kinked?

   8.a Yes; replace the DEF line from the DEF tank to the DEF pump.

   8.b No; Go to step 9.

9. Disconnect the DEF supply line at the dosing unit. Fill the graduated cylinder supplied in DEF test kit (P/N: W060589001900) with water. Place the end of the DEF line into the graduated cylinder as far as possible.

Note : Place the graduated cylinder in a secondary container to catch over flowing DEF fluid, making sure you still have clear sight of the end of the DEF line.

10. Using DiagnosticLink, perform the Selective Catalyst Reduction Airless Dosing System (SCR ADS) Self-Check routine. When the service routine is running, visually inspect the DEF line for continuous air bubbles coming from the line and DEF flow.
11. Were any bubbles coming from the DEF pump supply line indicating a crack in the DEF pump feed line?

    11.a Yes; replace the DEF supply line from the DEF tank to the DEF pump. Verify repair.

    11.b No; Go to step 12.

12. Remove the DEF tank header.
13. Inspect inside the DEF tank for debris that may be floating around or stuck to the DEF tank header pick up screen. Was any debris found?

    13.a Yes; flush out the DEF tank and clean the DEF tank header filter screen. Go to step 14.

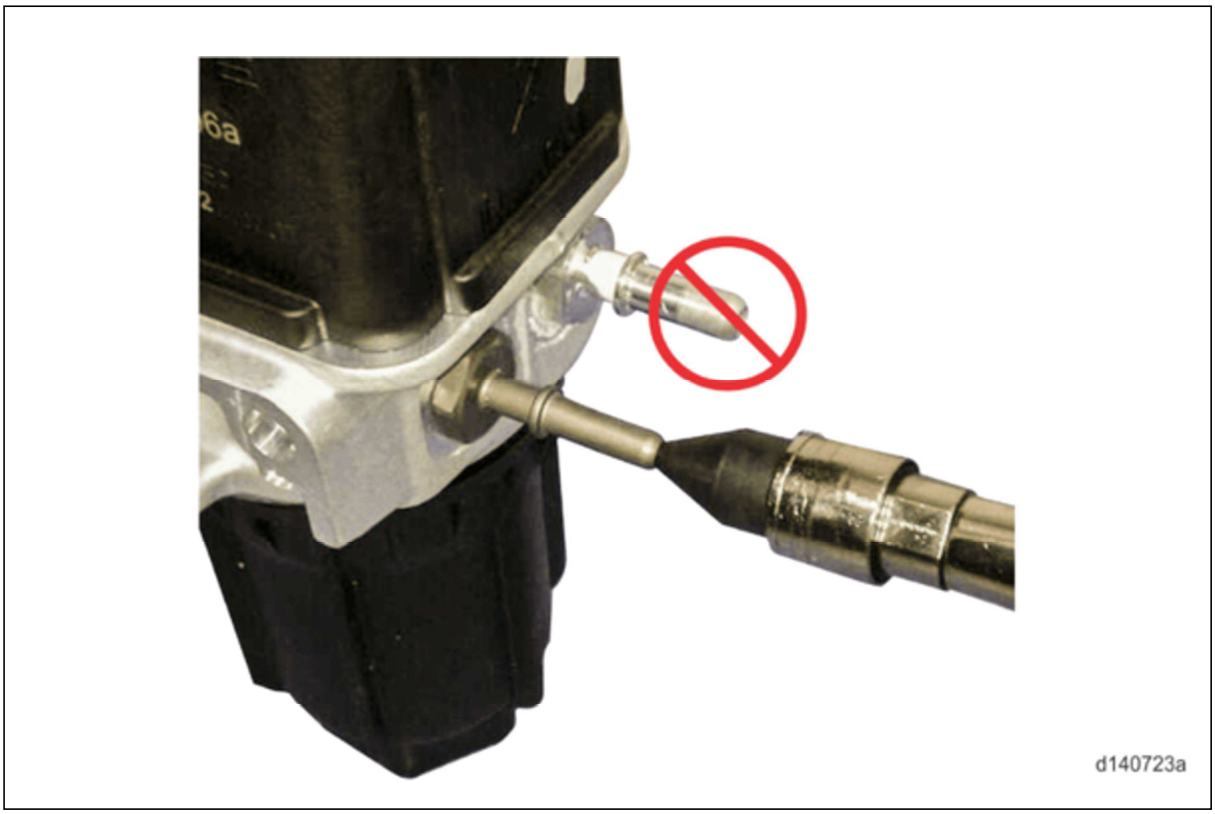
    13.b No; Go to step 14.

> **NOTICE**
>
> **The RS SUPPLY KIT contains all the necessary parts for steps 14-17.**

14. Using the DEF/Doser Kit (RS SUPPLY KIT - available through eParts catalog), replace the DEF pump module filter. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module Filter" . Go to step 15.
15. Replace the DEF pump inlet screen. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module Inlet Screen" . Go to step 16.
16. Replace DEF Pressure Relief Valve (PRV). Refer to section "Removal of the Diesel Exhaust Fluid Pump Pressure Relief Valve" . Go to step 17.
17. Replace DEF dosing unit inlet screen. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit Inlet Screen" . Go to step 18.

Note : If air pressure is greater than 827 kPa (120 psi), use a pressure regulator.

18. Prime pump with shop air. Using a rubber tipped air gun to seal around the DEF pump inlet fitting, apply clean regulated shop air to the DEF pump inlet fitting for three to five seconds.



19. Connect all DEF lines and electrical connections. Go to step 20.
20. Perform Selective Catalytic Reduction Airless Dosing System (SCR ADS) Self-Check Routine. Did the SCR ADS test pass?
    - 20.a Yes; clear the codes and release the vehicle.
    - 20.b No; replace the DEF pump. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module" .

332.2 SPN 4374/FMI 1 – GHG17

SPN 4374/FMI 1	
Description	Over Pressurized Diesel Exhaust Fluid (DEF) System
Monitored Parameter	DEF Pump Speed vs. DEF Pressure
Typical Enabling Conditions	DEF Pump Enabled OR On-Off-Cycle Request
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	2 Minutes
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	ADS Self-check

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple codes. Are any other faults active in addition to SPN 4374/FMI 1?
   - 3.a Yes; Diagnose and repair the other faults first. Verify repair.
   - 3.b No; Go to step 4.
4. Turn the ignition OFF.
5. Disconnect the DEF dosing unit electrical harness connector.
6. Inspect the DEF dosing unit electrical harness wiring and connector for signs of damage, bent, spread, corroded or unseated (pushed out) pins, moisture in the connector or wire damage near the connector. Is any damage found?
   - 6.a Yes; repair as necessary. Perform Selective Catalytic Reduction Airless Dosing System (SCR ADS) Self-Check Routine to verify repairs.
   - 6.b No; Reconnect harness connector. Go to step 7.
7. Disconnect the DEF return line from the DEF dosing unit. Refer to section "Removal of the Diesel Exhaust Fluid Lines" . Connect a temporary drain hose from the DEF dosing unit return fitting into a DEF-safe container.
8. Clear fault codes.
9. Perform SCR ADS Self-Check Routine. Did the SCR ADS test pass with flow from dosing unit return line into the DEF-safe container?
   - 9.a Yes; Replace DEF return line. Go to step 10.
   - 9.b No; replace DEF dosing unit. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . Verify repair.
10. Reconnect all DEF lines and connectors. Perform SCR ADS Self-Check Routine to prime the system. Did the SCR ADS Self-Check Routine complete successfully?
    - 10.a Yes; release vehicle.
    - 10.b No; replace DEF dosing unit. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . Verify repairs.

332.3 SPN 4374/FMI 3 – GHG17

SPN 4374/FMI 3	
Description	DEF pump speed signal above measurement range
Monitored Parameter	DEF pump speed frequency
Typical Enabling Conditions	DEF pump enabled OR on-off-cycle request
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 minutes
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	SCR ADS Self-check

Note : Retain a log file if Detroit™ Customer Assistance is required.

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF). Are other codes present?
   - 2.a Yes; repair other codes first.
   - 2.b No; Go to step 3.
3. Turn the ignition OFF.
4. Inspect the DEF pump harness wiring and connector for damage, wire chafing, bent, spread or corroded pins.
   - 4.a If damage is found, repair as necessary. Go to step 7.
   - 4.b If no pin damage is found, Go to step 5.

DEF Pump Connector			
4-Pin	Circuit	ACM - Pin	Connector
1	RPM Pump Feedback	95	
2	Pump Supply	1	
3	Pump RPM Control	20	
4	Pump GND	31	

5. Perform Selective Catalytic Reduction Airless Dosing System (SCR ADS) Self-Check Routine. Did the SCR ADS test pass with DEF pump speed and DEF pressure values in normal range?
   - 5.a Yes; clear codes and release vehicle.
   - 5.b No; replace the DEF pump. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module" . Go to step 6.
6. Turn ignition ON (key ON, engine OFF).
7. Verify repairs by running Selective Catalytic Reduction Airless Dosing System – SCR ADS Self-Check Routine. Does ADS Self-Check Routine pass?
   - 7.a Yes; clear codes and release vehicle.
   - 7.b No; turn OFF ignition. Install a test ACM. Go to step 8.
8. Rerun ADS Self-Check Routine to verify repairs. Does test pass with no codes?
   - 8.a Yes; replace ACM. Verify repairs by running SCR ADS Self-Check Routine.
   - 8.b No; Check the ATS harness connectors for corroded or spread pins. Repair as necessary.

332.4 SPN 4374/FMI 4 - GHG17

SPN 4374/FMI 4	
Description	DEF pump speed signal below measurement range
Monitored Parameter	DEF pump speed vs. DEF Pressure
Typical Enabling Conditions	DEF pump enabled OR on-off-cycle request
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 minutes
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	SCR ADS Self-check

Note : Retain a log file if Detroit™ Customer Assistance is required.

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF). Are other codes present?
   - 2.a Yes; Repair other codes first.
   - 2.b No; Go to step 3.
3. Turn the ignition OFF.
4. Inspect DEF pump harness wiring and connector for damage, wire chafing, bent, spread or corroded pins.
   - 4.a If damage is found, repair as necessary. Go to step 11.
   - 4.b If no damage is found, Go to step 5.
5. Disconnect ACM 120-pin connector.
6. Check resistance between DEF pump connector pin 1 and ACM connector pin 95. Is resistance less than five ohms?

DEF Pump Connector			
4-Pin	Circuit	ACM - Pin	Connector
1	RPM Pump Feedback	95	
2	Pump Supply	1	
3	Pump RPM Control	20	
4	Pump GND	31	

   - 6.a Yes; Go to step 7.
   - 6.b No; repair open in wire between DEF pump connector pin 1 and ACM connector pin 95. Go to step 11.
7. Check resistance between DEF pump connector pin 1 and battery ground. Is resistance greater than 10K ohms?
   - 7.a Yes; Go to step 8.
   - 7.b No; repair short in wire between DEF pump connector pin 1 and chassis ground. Go to step 11.
8. Check resistance between DEF pump connector pins 1 and 2. Is the resistance greater than 10K ohms?
   - 8.a Yes; Go to step 9.
   - 8.b No; repair short in wire between DEF pump connector pins 1 and pin 2. Go to step 11.
9. Check resistance between DEF pump connector pins 1 and 3. Is the resistance greater than 10K ohms?
   - 9.a Yes; Go to step 10.
   - 9.b No; repair short in wire between DEF pump connector pins 1 and pin 3. Go to step 11.
10. Check resistance between DEF pump connector pins 1 and 4. Is the resistance greater than 10K ohms?

10.a Yes; install a test ACM. Go to step 11.

10.b No; repair short in wire between DEF pump connector pins 1 and pin 4. Go to step 11.

11. Reconnect ACM and DEF pump electrical connectors.

12. Turn the ignition ON (key ON, engine OFF). Does fault return?

12.a Yes; replace the DEF Pump. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module" . Verify repairs by running Selective Catalytic Reduction Airless Dosing System – SCR ADS Self-Check Routine.

12.b No; turn OFF ignition. Replace ACM.

332.5 SPN 4374/FMI 19 - GHG17

Diesel Exhaust Fluid System is Not Being Controlled as Expected

SPN 4374/FMI 19	
Description	DEF system is not being controlled as expected
Monitored Parameter	DEF Pump Speed and Pump Duty Cycle
Typical Enabling Conditions	DEF pump operation is above or below defined thresholds
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	SCR ADS Self-check

Note : Retain a log file if Detroit™ Customer Assistance is required.

1. Connect DiagnosticLink Standard.
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple codes:
   - 3.a If other faults are active, troubleshoot the other faults first.
   - 3.b If only SPN 4374/FMI 19 is present, Go to step 4.
4. Inspect the DEF pump harness wiring and connector for damage, wire chafing, bent, spread or corroded pins.
   - 4.a If damage is found, repair as necessary. Go to step 6.
   - 4.b If no pin damage is found, Go to step 5.
5. Perform Selective Catalytic Reduction Airless Dosing System (SCR ADS) Self Check Routine. Did the SCR ADS test pass with DEF pump speed and DEF pressure values in normal range?

Acceptable DEF Pump Speed: greater than 750 rpm, DEF Pump Speed less than 1800 rpm.
Acceptable DEF Pressure: greater than 9000 mbar, DEF Pressure less than 11000 mbar (130 to 160 psi).

   - 5.a Yes; Go to step 6.
   - 5.b No; replace DEF pump. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module" . Go to step 6.
6. Clear codes, cycle ignition and start engine. Idle for five minutes. Does the fault return?
   - 6.a Yes; install test ACM and repeat test. Repair as necessary.
   - 6.b No; verify repairs and release.

332.5 SPN 4374/FMI 19 - GHG17

Diesel Exhaust Fluid System is Not Being Controlled as Expected

SPN 4374/FMI 19	
Description	DEF system is not being controlled as expected
Monitored Parameter	DEF Pump Speed and Pump Duty Cycle
Typical Enabling Conditions	DEF pump operation is above or below defined thresholds
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	SCR ADS Self-check

Note : Retain a log file if Detroit™ Customer Assistance is required.

1. Connect DiagnosticLink Standard.
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple codes:
   - 3.a If other faults are active, troubleshoot the other faults first.
   - 3.b If only SPN 4374/FMI 19 is present, Go to step 4.
4. Inspect the DEF pump harness wiring and connector for damage, wire chafing, bent, spread or corroded pins.
   - 4.a If damage is found, repair as necessary. Go to step 6.
   - 4.b If no pin damage is found, Go to step 5.
5. Perform Selective Catalytic Reduction Airless Dosing System (SCR ADS) Self Check Routine. Did the SCR ADS test pass with DEF pump speed and DEF pressure values in normal range?

Acceptable DEF Pump Speed: greater than 750 rpm, DEF Pump Speed less than 1800 rpm.
Acceptable DEF Pressure: greater than 9000 mbar, DEF Pressure less than 11000 mbar (130 to 160 psi).

   - 5.a Yes; Go to step 6.
   - 5.b No; replace DEF pump. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module" . Go to step 6.
6. Clear codes, cycle ignition and start engine. Idle for five minutes. Does the fault return?
   - 6.a Yes; install test ACM and repeat test. Repair as necessary.
   - 6.b No; verify repairs and release.

SPN 4374 (ACM) (GHG17)

332.1 SPN 4374/FMI 0 – GHG17

Before starting this troubleshooting procedure, please verify if an Advanced Diagnostic (AD) version is available, and continue with that version if available. ADs provide enhanced functionality that increase the accuracy of the troubleshooting process and are preferred over traditional troubleshooting. The ADs are identified in DiagnosticLink by the magic wand icon next to the fault, and the word "Advanced" label in the "Troubleshooting Type" field.

SPN 4374/FMI 0	
Description	This Code Sets When the Diesel Exhaust Fluid (DEF) Pump Speed is Higher than Normal For a Given DEF Pressure
Monitored Parameter	DEF Pump Speed, DEF Pressure
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Continuous Until Resolved
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	SCR ADS Self-Check

Possible causes:

- Restriction in the DEF line between the DEF tank and the DEF pump
- Restriction in the DEF line between the DEF pump and the DEF dosing unit
- Air in the DEF line between the DEF tank and the DEF pump
- Restriction in the DEF pump
- Failed DEF pump

Check as follows:

NOTICE

Customers in colder climates where winter ambient air temperatures generally stay below -11° C (12°F) need to verify that the DEF is not frozen before troubleshooting this fault code.

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple codes. Are codes SPN 4334/FMI 3, 4, SPN 4375/FMI 3, 4, or SPN 3361/FMI 3, 4, 5 also present?
   - 3.a Yes; diagnose and repair the other fault codes first. Verify repair.
   - 3.b No; Go to step 4.
4. Turn the ignition OFF.
5. Inspect the DEF tank vent tube. Is there any blockage or restriction?
   - 5.a Yes; clear the restricted vent tube. Go to step 6.
   - 5.b No; Go to step 6.
6. Using DEF test strip A0005850202, check for diesel fuel or oil contamination of the DEF fluid. Does the test strip indicate contamination?

6.a Yes; replace the following components and refill the system with new DEF:

- DEF tank
- DEF tank header
- DEF supply line from the DEF tank to the DEF pump
- DEF line from the DEF pump to the DEF dosing unit
- DEF return line from the DEF dosing unit to the DEF tank
- DEF pump
- DEF dosing unit

6.b No; Go to step 7.

WARNING

EYE INJURY

To avoid injury from flying debris when using compressed air, wear adequate eye protection (face shield or safety goggles) and do not exceed 276 kPa (40 psi) air pressure.

7. Inspect the DEF line that runs from the DEF pump to the DEF dosing unit. Is the DEF line damaged, pinched, or kinked?

   7.a Yes; replace the DEF line from the DEF pump to the DEF dosing unit.

   7.b No; Go to step 8.

8. Inspect the DEF line that runs from the DEF tank to the DEF pump. Is the DEF line damaged, pinched, or kinked?

   8.a Yes; replace the DEF line from the DEF tank to the DEF pump.

   8.b No; Go to step 9.

9. Disconnect the DEF supply line at the dosing unit. Fill the graduated cylinder supplied in DEF test kit (P/N: W060589001900) with water. Place the end of the DEF line into the graduated cylinder as far as possible.

Note : Place the graduated cylinder in a secondary container to catch over flowing DEF fluid, making sure you still have clear sight of the end of the DEF line.

10. Using DiagnosticLink, perform the Selective Catalyst Reduction Airless Dosing System (SCR ADS) Self-Check routine. When the service routine is running, visually inspect the DEF line for continuous air bubbles coming from the line and DEF flow.
11. Were any bubbles coming from the DEF pump supply line indicating a crack in the DEF pump feed line?

    11.a Yes; replace the DEF supply line from the DEF tank to the DEF pump. Verify repair.

    11.b No; Go to step 12.

12. Remove the DEF tank header.
13. Inspect inside the DEF tank for debris that may be floating around or stuck to the DEF tank header pick up screen. Was any debris found?

    13.a Yes; flush out the DEF tank and clean the DEF tank header filter screen. Go to step 14.

    13.b No; Go to step 14.

NOTICE

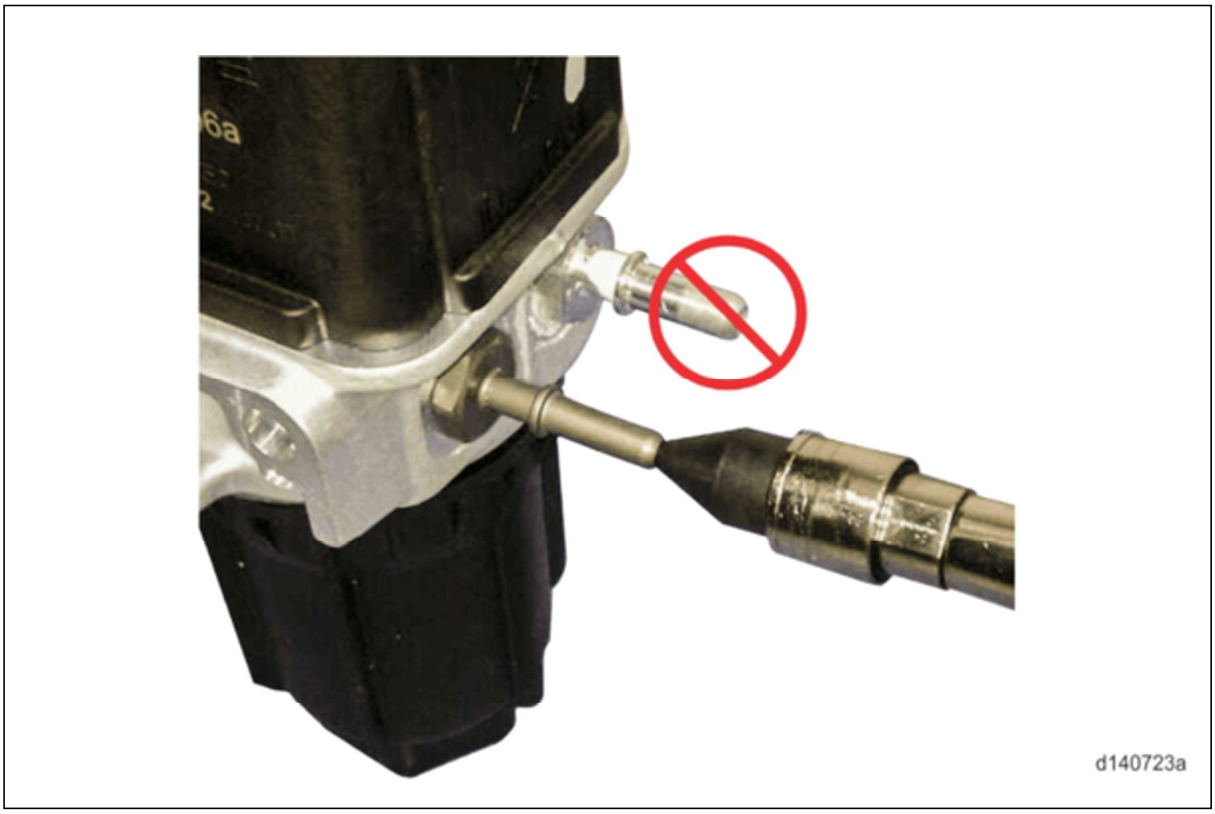
The RS SUPPLY KIT contains all the necessary parts for steps 14-17.

14. Using the DEF/Doser Kit (RS SUPPLY KIT - available through eParts catalog), replace the DEF pump module filter. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module Filter" . Go to step 15.
15. Replace the DEF pump inlet screen. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module Inlet Screen" . Go to step 16.

16. Replace DEF Pressure Relief Valve (PRV). Refer to section "Removal of the Diesel Exhaust Fluid Pump Pressure Relief Valve" . Go to step 17.
17. Replace DEF dosing unit inlet screen. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit Inlet Screen" . Go to step 18.

Note : If air pressure is greater than 827 kPa (120 psi), use a pressure regulator.

18. Prime pump with shop air. Using a rubber tipped air gun to seal around the DEF pump inlet fitting, apply clean regulated shop air to the DEF pump inlet fitting for three to five seconds.



19. Connect all DEF lines and electrical connections. Go to step 20.
20. Perform Selective Catalytic Reduction Airless Dosing System (SCR ADS) Self-Check Routine two times to further prime the system. Ignore the results of these two tests and Go to step 21.
21. Perform Selective Catalytic Reduction Airless Dosing System (SCR ADS) Self-Check Routine. Did the SCR ADS test pass?

    21.a Yes; clear the codes and release the vehicle.

    21.b No; replace the DEF pump. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module" .

332.2 SPN 4374/FMI 1 – GHG17

SPN 4374/FMI 1	
Description	Over Pressurized Diesel Exhaust Fluid (DEF) System
Monitored Parameter	DEF Pump Speed vs. DEF Pressure
Typical Enabling Conditions	DEF Pump Enabled OR On-Off-Cycle Request
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	2 Minutes
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	ADS Self-check

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple codes. Are any other faults active in addition to SPN 4374/FMI 1?
   - 3.a Yes; Diagnose and repair the other faults first. Verify repair.
   - 3.b No; Go to step 4.
4. Turn the ignition OFF.
5. Disconnect the DEF dosing unit electrical harness connector.
6. Inspect the DEF dosing unit electrical harness wiring and connector for signs of damage, bent, spread, corroded or unseated (pushed out) pins, moisture in the connector or wire damage near the connector. Is any damage found?
   - 6.a Yes; repair as necessary. Perform Selective Catalytic Reduction Airless Dosing System (SCR ADS) Self-Check Routine to verify repairs.
   - 6.b No; Reconnect harness connector. Go to step 7.
7. Disconnect the DEF return line from the DEF dosing unit. Refer to section "Removal of the Diesel Exhaust Fluid Lines" . Connect a temporary drain hose from the DEF dosing unit return fitting into a DEF-safe container.
8. Clear fault codes.
9. Perform SCR ADS Self-Check Routine. Did the SCR ADS test pass with flow from dosing unit return line into the DEF-safe container?
   - 9.a Yes; Replace DEF return line. Go to step 10.
   - 9.b No; replace DEF dosing unit. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . Verify repair.
10. Reconnect all DEF lines and connectors. Perform SCR ADS Self-Check Routine to prime the system. Did the SCR ADS Self-Check Routine complete successfully?
    - 10.a Yes; release vehicle.
    - 10.b No; replace DEF dosing unit. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . Verify repairs.

332.3 SPN 4374/FMI 3 – GHG17

SPN 4374/FMI 3	
Description	DEF pump speed signal above measurement range
Monitored Parameter	DEF pump speed frequency
Typical Enabling Conditions	DEF pump enabled OR on-off-cycle request
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 minutes
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	SCR ADS Self-check

Note : Retain a log file if Detroit™ Customer Assistance is required.

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF). Are other codes present?
   - 2.a Yes; repair other codes first.
   - 2.b No; Go to step 3.
3. Turn the ignition OFF.
4. Inspect the DEF pump harness wiring and connector for damage, wire chafing, bent, spread or corroded pins.
   - 4.a If damage is found, repair as necessary. Go to step 7.
   - 4.b If no pin damage is found, Go to step 5.

DEF Pump Connector			
4-Pin	Circuit	ACM - Pin	Connector
1	RPM Pump Feedback	95	
2	Pump Supply	1	
3	Pump RPM Control	20	
4	Pump GND	31	

5. Perform Selective Catalytic Reduction Airless Dosing System (SCR ADS) Self-Check Routine. Did the SCR ADS test pass with DEF pump speed and DEF pressure values in normal range?
   - 5.a Yes; clear codes and release vehicle.
   - 5.b No; replace the DEF pump. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module" . Go to step 6.
6. Turn ignition ON (key ON, engine OFF).
7. Verify repairs by running Selective Catalytic Reduction Airless Dosing System – SCR ADS Self-Check Routine. Does ADS Self-Check Routine pass?
   - 7.a Yes; clear codes and release vehicle.
   - 7.b No; turn OFF ignition. Install a test ACM. Go to step 8.
8. Rerun ADS Self-Check Routine to verify repairs. Does test pass with no codes?
   - 8.a Yes; replace ACM. Verify repairs by running SCR ADS Self-Check Routine.
   - 8.b No; Check the ATS harness connectors for corroded or spread pins. Repair as necessary.

332.4 SPN 4374/FMI 4 - GHG17

SPN 4374/FMI 4	
Description	DEF pump speed signal below measurement range
Monitored Parameter	DEF pump speed vs. DEF Pressure
Typical Enabling Conditions	DEF pump enabled OR on-off-cycle request
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 minutes
Dash Lamps	MIL, CEL
Engine Reaction	Derate 10%
Verification	SCR ADS Self-check

Note : Retain a log file if Detroit™ Customer Assistance is required.

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF). Are other codes present?
   - 2.a Yes; Repair other codes first.
   - 2.b No; Go to step 3.
3. Turn the ignition OFF.
4. Inspect DEF pump harness wiring and connector for damage, wire chafing, bent, spread or corroded pins.
   - 4.a If damage is found, repair as necessary. Go to step 11.
   - 4.b If no damage is found, Go to step 5.
5. Disconnect ACM 120-pin connector.
6. Check resistance between DEF pump connector pin 1 and ACM connector pin 95. Is resistance less than five ohms?

DEF Pump Connector			
4-Pin	Circuit	ACM - Pin	Connector
1	RPM Pump Feedback	95	
2	Pump Supply	1	
3	Pump RPM Control	20	
4	Pump GND	31	

   - 6.a Yes; Go to step 7.
   - 6.b No; repair open in wire between DEF pump connector pin 1 and ACM connector pin 95. Go to step 11.
7. Check resistance between DEF pump connector pin 1 and battery ground. Is resistance greater than 10K ohms?
   - 7.a Yes; Go to step 8.
   - 7.b No; repair short in wire between DEF pump connector pin 1 and chassis ground. Go to step 11.
8. Check resistance between DEF pump connector pins 1 and 2. Is the resistance greater than 10K ohms?
   - 8.a Yes; Go to step 9.
   - 8.b No; repair short in wire between DEF pump connector pins 1 and pin 2. Go to step 11.
9. Check resistance between DEF pump connector pins 1 and 3. Is the resistance greater than 10K ohms?
   - 9.a Yes; Go to step 10.
   - 9.b No; repair short in wire between DEF pump connector pins 1 and pin 3. Go to step 11.
10. Check resistance between DEF pump connector pins 1 and 4. Is the resistance greater than 10K ohms?

10.a Yes; install a test ACM. Go to step 11.

10.b No; repair short in wire between DEF pump connector pins 1 and pin 4. Go to step 11.

11. Reconnect ACM and DEF pump electrical connectors.

12. Turn the ignition ON (key ON, engine OFF). Does fault return?

12.a Yes; replace the DEF Pump. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module" . Verify repairs by running Selective Catalytic Reduction Airless Dosing System – SCR ADS Self-Check Routine.

12.b No; turn OFF ignition. Replace ACM.

332.5 SPN 4374/FMI 11 – GHG17

SPN 4374/FMI 11	
Description	This Code Sets When the Diesel Exhaust Fluid (DEF) Pump Speed is Lower than Normal for a Given DEF Pressure
Monitored Parameter	DEF Pump Speed vs. DEF Pressure
Typical Enabling Conditions	DEF Pump Enabled OR On-Off-Cycle Request
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Minutes
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	ADS Self-Check

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple codes. Are any other faults active in addition to SPN 4374/FMI 11?
   - 3.a Yes; diagnose and repair the other fault codes first. Verify repair.
   - 3.b No; Go to step 4.
4. Turn the ignition OFF.
5. Disconnect the DEF dosing unit electrical harness connector.
6. Inspect the DEF dosing unit electrical harness wiring and connector for signs of damage, bent, spread, corroded or unseated (pushed out) pins, moisture in the connector or wire damage near the connector. Is any damage found?
   - 6.a Yes; repair as necessary. Perform Selective Catalytic Reduction Airless Dosing System (SCR ADS) Self-Check Routine to verify repairs.
   - 6.b No; reconnect harness connector. Go to step 7.
7. Disconnect the DEF return line from the DEF dosing unit. Refer to section "Removal of the Diesel Exhaust Fluid Lines" . Connect a temporary drain hose from the DEF dosing unit return fitting into a DEF-safe container.
8. Clear fault codes.
9. Perform SCR ADS Self-Check Routine. Did the SCR ADS test pass with flow from dosing unit return line into the DEF-safe container?
   - 9.a Yes; replace DEF return line. Go to step 10.
   - 9.b No; replace DEF dosing unit. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . Verify repair.
10. Reconnect all DEF lines and connectors. Perform SCR ADS Self-Check Routine to prime the system. Did the SCR ADS Self-Check Routine complete successfully?
    - 10.a Yes; release vehicle.
    - 10.b No; replace DEF dosing unit. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . Verify repairs.

332.6 SPN 4374/FMI 14 – GHG17

SPN 4374/FMI 14	
Description	This Code Sets When the Diesel Exhaust Fluid (DEF) Pump Speed is Higher than Normal for a Given DEF Pressure
Monitored Parameter	DEF Pump Speed, DEF Pressure
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Continuous Until Resolved
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	SCR ADS Self-Check

Possible causes:

- Restriction in the DEF line between the DEF tank and the DEF pump
- Restriction in the DEF line between the DEF pump and the DEF dosing unit
- Air in the DEF line between the DEF tank and the DEF pump
- Restriction in the DEF pump
- Failed DEF pump

Check as follows:

> **NOTICE**
>
> **Customers in colder climates where winter ambient air temperatures generally stay below -11° C (12°F) need to verify that the DEF is not frozen before troubleshooting this fault code.**

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple codes. Are codes SPN 4334/FMI 3, 4, SPN 4375/FMI 3, 4, or SPN 3361/FMI 3, 4, 5 also present?

   3.a Yes; diagnose and repair the other fault codes first. Verify repair.

   3.b No; Go to step 4.
4. Turn the ignition OFF.
5. Inspect the DEF tank vent tube. Is there any blockage or restriction?

   5.a Yes; clear the restricted vent tube. Go to step 6.

   5.b No; Go to step 6.
6. Using DEF test strip A0005850202, check for diesel fuel or oil contamination of the DEF fluid. Does the test strip indicate contamination?

   6.a Yes; replace the following components and refill the system with new DEF:

- DEF tank
- DEF tank header
- DEF supply line from the DEF tank to the DEF pump
- DEF line from the DEF pump to the DEF dosing unit
- DEF return line from the DEF dosing unit to the DEF tank
- DEF pump

- DEF dosing unit

6.b No; Go to step 7.

> **⚠ WARNING**
>
> EYE INJURY
>
> To avoid injury from flying debris when using compressed air, wear adequate eye protection (face shield or safety goggles) and do not exceed 276 kPa (40 psi) air pressure.

7. Inspect the DEF line that runs from the DEF pump to the DEF dosing unit. Is the DEF line damaged, pinched, or kinked?

   7.a Yes; replace the DEF line from the DEF pump to the DEF dosing unit.

   7.b No; Go to step 8.

8. Inspect the DEF line that runs from the DEF tank to the DEF pump. Is the DEF line damaged, pinched, or kinked?

   8.a Yes; replace the DEF line from the DEF tank to the DEF pump.

   8.b No; Go to step 9.

9. Disconnect the DEF supply line at the dosing unit. Fill the graduated cylinder supplied in DEF test kit (P/N: W060589001900) with water. Place the end of the DEF line into the graduated cylinder as far as possible.

Note : Place the graduated cylinder in a secondary container to catch over flowing DEF fluid, making sure you still have clear sight of the end of the DEF line.

10. Using DiagnosticLink, perform the Selective Catalyst Reduction Airless Dosing System (SCR ADS) Self-Check routine. When the service routine is running, visually inspect the DEF line for continuous air bubbles coming from the line and DEF flow.
11. Were any bubbles coming from the DEF pump supply line indicating a crack in the DEF pump feed line?

    11.a Yes; replace the DEF supply line from the DEF tank to the DEF pump. Verify repair.

    11.b No; Go to step 12.

12. Remove the DEF tank header.
13. Inspect inside the DEF tank for debris that may be floating around or stuck to the DEF tank header pick up screen. Was any debris found?

    13.a Yes; flush out the DEF tank and clean the DEF tank header filter screen. Go to step 14.

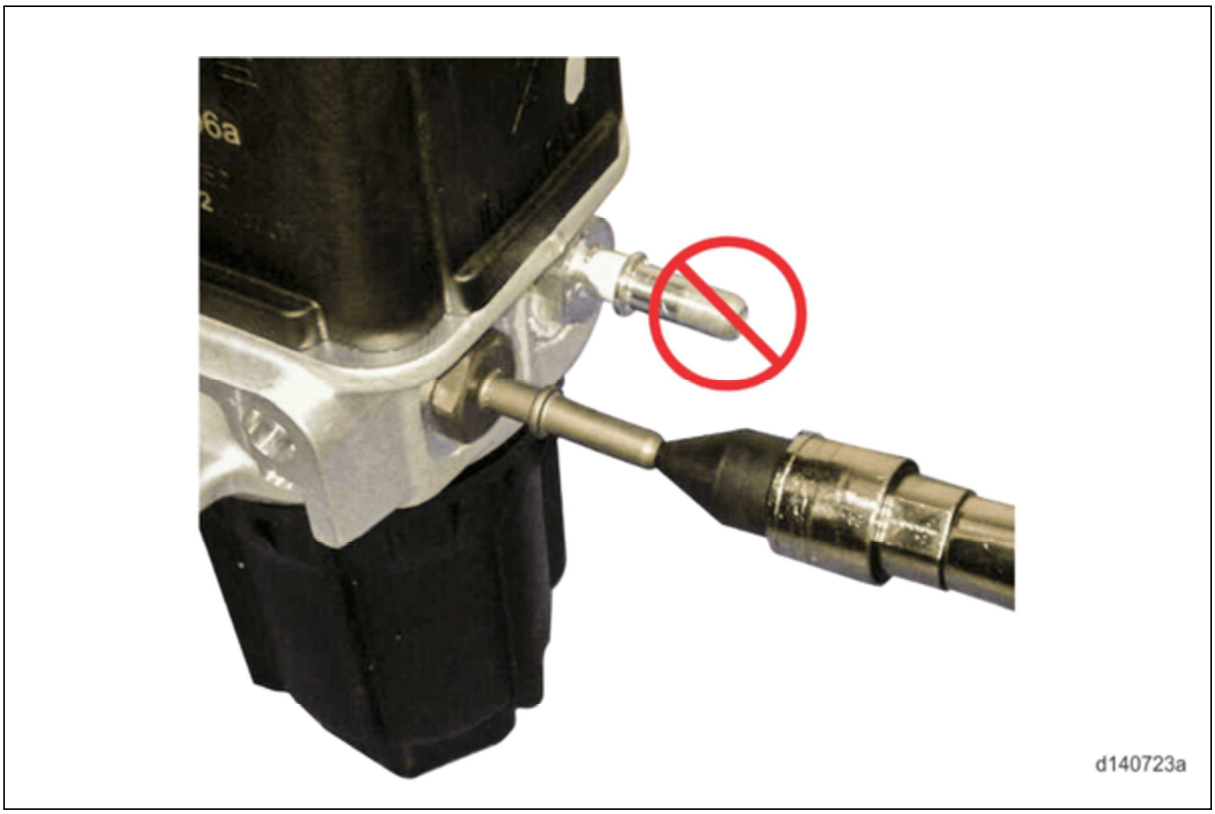
    13.b No; Go to step 14.

> **NOTICE**
>
> **The RS SUPPLY KIT contains all the necessary parts for steps 14-17.**

14. Using the DEF/Doser Kit (RS SUPPLY KIT - available through eParts catalog), replace the DEF pump module filter. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module Filter" . Go to step 15.
15. Replace the DEF pump inlet screen. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module Inlet Screen" . Go to step 16.
16. Replace DEF Pressure Relief Valve (PRV). Refer to section "Removal of the Diesel Exhaust Fluid Pump Pressure Relief Valve" . Go to step 17.
17. Replace DEF dosing unit inlet screen. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit Inlet Screen" . Go to step 18.

Note : If air pressure is greater than 827 kPa (120 psi), use a pressure regulator.

18. Prime pump with shop air. Using a rubber tipped air gun to seal around the DEF pump inlet fitting, apply clean regulated shop air to the DEF pump inlet fitting for three to five seconds.



19. Connect all DEF lines and electrical connections. Go to step 20.
20. Perform Selective Catalytic Reduction Airless Dosing System (SCR ADS) Self-Check Routine. Did the SCR ADS test pass?
    - 20.a Yes; clear the codes and release the vehicle.
    - 20.b No; replace the DEF pump. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module" .

332.7 SPN 4374/FMI 19 - GHG17

Diesel Exhaust Fluid System is Not Being Controlled as Expected

SPN 4374/FMI 19	
Description	DEF system is not being controlled as expected
Monitored Parameter	DEF Pump Speed and Pump Duty Cycle
Typical Enabling Conditions	DEF pump operation is above or below defined thresholds
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	SCR ADS Self-check

Note : Retain a log file if Detroit™ Customer Assistance is required.

1. Connect DiagnosticLink Standard.
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple codes:
   - 3.a If other faults are active, troubleshoot the other faults first.
   - 3.b If only SPN 4374/FMI 19 is present, Go to step 4.
4. Inspect the DEF pump harness wiring and connector for damage, wire chafing, bent, spread or corroded pins.
   - 4.a If damage is found, repair as necessary. Go to step 6.
   - 4.b If no pin damage is found, Go to step 5.
5. Perform Selective Catalytic Reduction Airless Dosing System (SCR ADS) Self Check Routine. Did the SCR ADS test pass with DEF pump speed and DEF pressure values in normal range?

Acceptable DEF Pump Speed: greater than 750 rpm, DEF Pump Speed less than 1800 rpm.
Acceptable DEF Pressure: greater than 9000 mbar, DEF Pressure less than 11000 mbar (130 to 160 psi).

   - 5.a Yes; Go to step 6.
   - 5.b No; replace DEF pump. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module" . Go to step 6.
6. Clear codes, cycle ignition and start engine. Idle for five minutes. Does the fault return?
   - 6.a Yes; install test ACM and repeat test. Repair as necessary.
   - 6.b No; verify repairs and release.

333.1 SPN 4375/FMI 3 - GHG17

Diesel Exhaust Fluid Pump Circuit Failed High

SPN 4375/FMI 3	
Description	Diesel Exhaust Fluid (DEF) Pump Circuit Failed High
Monitored Parameter	DEF Pump
Typical Enabling Conditions	DEF Pump On
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	SCR ADS Self Check

1. Connect to DiagnosticLink .
2. Turn ignition ON (key ON, engine OFF).
3. Perform a Selective Catalytic Reduction Airless Dosing System (SCR ADS) Self-Check Routine.
4. Does the fault become active?
   - 4.a Yes; Go to step 5.
   - 4.b No; clear the fault code and release the vehicle.
5. Disconnect the DEF pump harness connector.
6. Inspect the sensor harness for bent, spread or corroded pins.
   - 6.a If the pins are bent, spread or corroded, repair as necessary.
   - 6.b If connector shows no sign of damage, repair the short-to-battery (12 volts) between pin 3 of the DEF Pump harness connector and pin 20 of the ACM 120-pin connector.

4-Pin	Circuit	ACM-Pin	Connector
Pin 1	Pump rpm Feedback	95	
Pin 2	Pump Supply	1	
Pin 3	Pump rpm Control	20	
Pin 4	Pump GND	31	

333.2 SPN 4375/FMI 4 - GHG17

Diesel Exhaust Fluid Pump Circuit Failed Low

SPN 4375/FMI 4	
Description	Diesel Exhaust Fluid (DEF) Pump Circuit Failed Low
Monitored Parameter	DEF Pump
Typical Enabling Conditions	Ignition On
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	SCR ADS Self Check

1. Disconnect the DEF pump harness connector.
2. Inspect the sensor harness for bent, spread, or corroded pins.
   2.a If the pins are bent, spread or corroded, repair as necessary. Go to step 8.
   2.b If connector shows no signs of damage, Go to step 3.
3. Turn ignition ON (key ON, engine OFF).
4. Clear codes.
5. Using DiagnosticLink , recheck for codes.
6. Is SPN 4375/FMI 4 active with DEF pump disconnected?
   6.a Yes, Go to step 7.
   6.b No, Replace DEF pump. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module" . Verify repairs by running Selective Catalytic Reduction Airless Dosing System – SCR ADS Self-Check Routine.

4-Pin	Circuit	ACM-Pin	Connector
Pin 1	Pump rpm Feedback	95	
Pin 2	Pump Supply	1	
Pin 3	Pump rpm Control	20	
Pin 4	Pump GND	31	

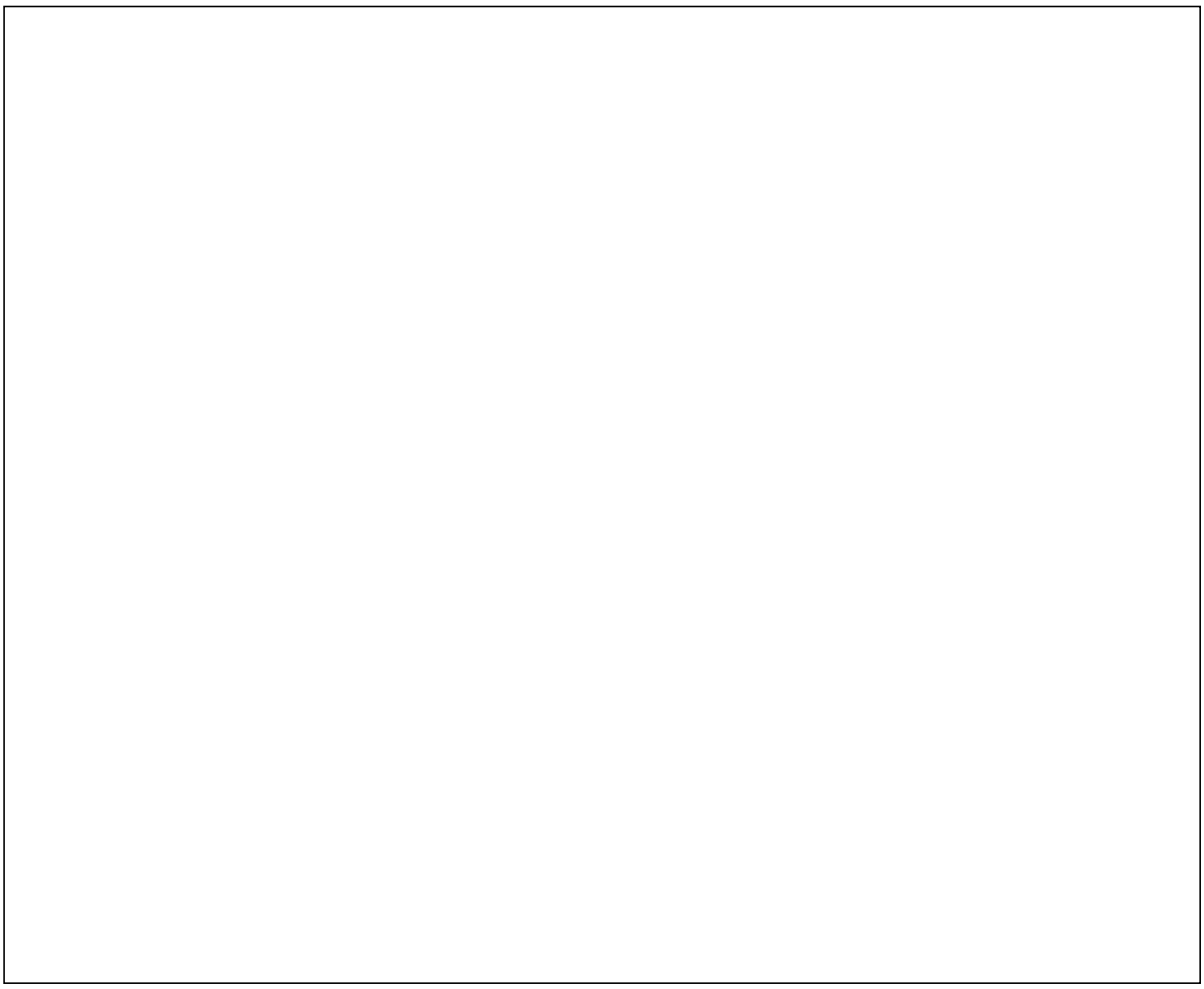
Note : SPN 3475/FMI 5 may occur with DEF pump disconnected.

7. Conduct a wiggle test on ACM 120-Pin connector, DEF pump harness connector. Does fault code go inactive?
   7.a Yes; Repair the short-to-ground between pin 3 of the DEF pump harness connector and pin 20 of the ACM 120-pin connector. Go to step 8.
   7.b No; Check the ATS harness connectors for corroded or spread pins. Repair as necessary.
8. Run ADS Self-Check to verify repairs. Does test pass with no codes?
   8.a Yes; release vehicle.
   8.b No; Check the ATS harness connectors for corroded or spread pins. Repair as necessary.

333.3 SPN 4375/FMI 5 - GHG17

Diesel Exhaust Fluid Pump Circuit Failed Open

SPN 4375/FMI 5	
Description	Diesel Exhaust Fluid (DEF) Pump Circuit Failed Open
Monitored Parameter	DEF Pump
Typical Enabling Conditions	Ignition On
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	SCR ADS Self-Check



1. Turn ignition OFF.
2. Disconnect the DEF pump harness connector.
3. Inspect the sensor harness for bent, spread or corroded pins.

   3.a If the pins are bent, spread or corroded, repair as necessary. Go to step 9.

3.b If connector shows no signs of damage, Go to step 4.

4-Pin	Circuit	ACM-Pin	Connector
Pin 1	Pump rpm Feedback	95	
Pin 2	Pump Supply	1	
Pin 3	Pump rpm Control	20	
Pin 4	Pump GND	31	

4. Measure resistance between DEF pump pins 2 and 3. Is resistance greater than 6K ohms?
   - 4.a Yes, Replace DEF pump. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module" . Verify repairs by running Selective Catalytic Reduction Airless Dosing System – SCR ADS Self-Check Routine.
   - 4.b No, Go to step 5.
5. Check resistance between pin 3 of the DEF pump connector and pin 20 of the ACM 120-pin connector. Is resistance less than five ohms?
   - 5.a Yes, Go to step 6.
   - 5.b No, Repair open in wire between pin 3 of the DEF pump connector and pin 20 of the ACM 120-pin connector. Go to step 9.
6. Check resistance between pin 2 of the DEF pump connector and pin 1 of the ACM 120-pin connector. Is resistance less than five ohms?
   - 6.a Yes, Go to step 7.
   - 6.b No, Repair open in wire between pin 2 of the DEF pump connector and pin 1 of the ACM 120-pin connector. Go to step 9.
7. Install a test ACM.
8. Turn ignition ON (key ON, engine OFF). Using DiagnosticLink, does fault return?
   - 8.a Yes, Check the ATS harness connectors for corroded or spread pins. Repair as necessary. Go to step 9.
   - 8.b No, Turn the ignition OFF. Replace ACM. Go to step 9.
9. Rerun SCR ADS Self-Check to verify repairs. Does test pass with no codes?
   - 9.a Yes, release vehicle.
   - 9.b No, Check the ATS harness connectors for corroded or spread pins. Repair as necessary. Run the SCR ADS Self-Check to verify the repairs.

SPN 4375 (ACM) (GHG17)

333.1 SPN 4375/FMI 3 - GHG17

Diesel Exhaust Fluid Pump Circuit Failed High

SPN 4375/FMI 3	
Description	Diesel Exhaust Fluid (DEF) Pump Circuit Failed High
Monitored Parameter	DEF Pump
Typical Enabling Conditions	DEF Pump On
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	SCR ADS Self Check

1. Connect to DiagnosticLink .
2. Turn ignition ON (key ON, engine OFF).
3. Perform a Selective Catalytic Reduction Airless Dosing System (SCR ADS) Self-Check Routine.
4. Does the fault become active?
   - 4.a Yes; Go to step 5.
   - 4.b No; clear the fault code and release the vehicle.
5. Disconnect the DEF pump harness connector.
6. Inspect the sensor harness for bent, spread or corroded pins.
   - 6.a If the pins are bent, spread or corroded, repair as necessary.
   - 6.b If connector shows no sign of damage, repair the short-to-battery (12 volts) between pin 3 of the DEF Pump harness connector and pin 20 of the ACM 120-pin connector.

4-Pin	Circuit	ACM-Pin	Connector
Pin 1	Pump rpm Feedback	95	
Pin 2	Pump Supply	1	
Pin 3	Pump rpm Control	20	
Pin 4	Pump GND	31	

333.2 SPN 4375/FMI 4 - GHG17

Diesel Exhaust Fluid Pump Circuit Failed Low

SPN 4375/FMI 4	
Description	Diesel Exhaust Fluid (DEF) Pump Circuit Failed Low
Monitored Parameter	DEF Pump
Typical Enabling Conditions	Ignition On
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	SCR ADS Self Check

1. Disconnect the DEF pump harness connector.
2. Inspect the sensor harness for bent, spread, or corroded pins.
   2.a If the pins are bent, spread or corroded, repair as necessary. Go to step 8.
   2.b If connector shows no signs of damage, Go to step 3.
3. Turn ignition ON (key ON, engine OFF).
4. Clear codes.
5. Using DiagnosticLink , recheck for codes.
6. Is SPN 4375/FMI 4 active with DEF pump disconnected?
   6.a Yes, Go to step 7.
   6.b No, Replace DEF pump. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module" . Verify repairs by running Selective Catalytic Reduction Airless Dosing System – SCR ADS Self-Check Routine.

4-Pin	Circuit	ACM-Pin	Connector
Pin 1	Pump rpm Feedback	95	
Pin 2	Pump Supply	1	
Pin 3	Pump rpm Control	20	
Pin 4	Pump GND	31	

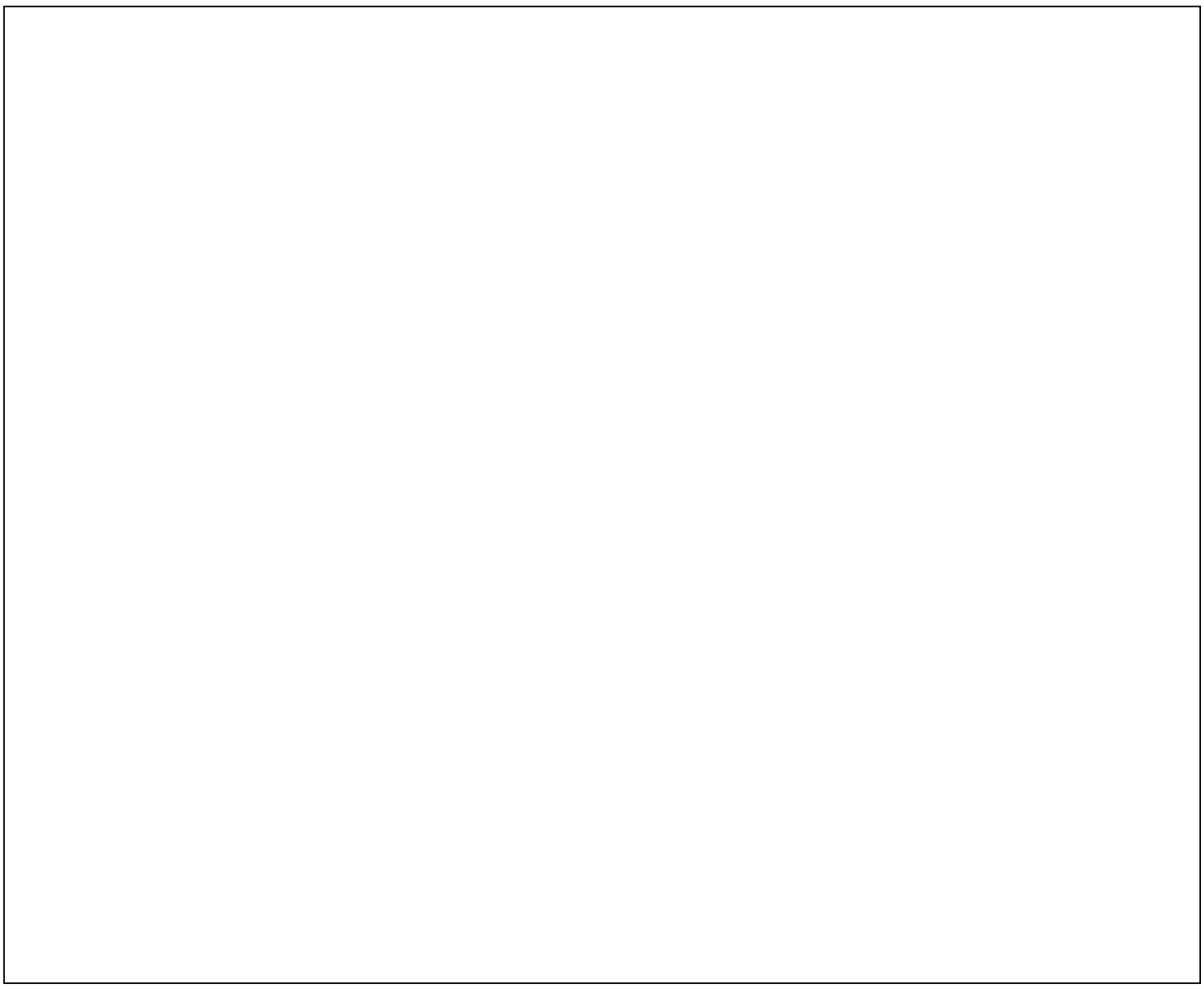
Note : SPN 3475/FMI 5 may occur with DEF pump disconnected.

7. Conduct a wiggle test on ACM 120-Pin connector, DEF pump harness connector. Does fault code go inactive?
   7.a Yes; Repair the short-to-ground between pin 3 of the DEF pump harness connector and pin 20 of the ACM 120-pin connector. Go to step 8.
   7.b No; Check the ATS harness connectors for corroded or spread pins. Repair as necessary.
8. Run ADS Self-Check to verify repairs. Does test pass with no codes?
   8.a Yes; release vehicle.
   8.b No; Check the ATS harness connectors for corroded or spread pins. Repair as necessary.

333.3 SPN 4375/FMI 5 - GHG17

Diesel Exhaust Fluid Pump Circuit Failed Open

SPN 4375/FMI 5	
Description	Diesel Exhaust Fluid (DEF) Pump Circuit Failed Open
Monitored Parameter	DEF Pump
Typical Enabling Conditions	Ignition On
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	SCR ADS Self-Check



1. Turn ignition OFF.
2. Disconnect the DEF pump harness connector.
3. Inspect the sensor harness for bent, spread or corroded pins.
   3.a If the pins are bent, spread or corroded, repair as necessary. Go to step 9.

3.b If connector shows no signs of damage, Go to step 4.

4-Pin	Circuit	ACM-Pin	Connector
Pin 1	Pump rpm Feedback	95	
Pin 2	Pump Supply	1	
Pin 3	Pump rpm Control	20	
Pin 4	Pump GND	31	

4. Measure resistance between DEF pump pins 2 and 3. Is resistance greater than 6K ohms?
   - 4.a Yes, Replace DEF pump. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module" . Verify repairs by running Selective Catalytic Reduction Airless Dosing System – SCR ADS Self-Check Routine.
   - 4.b No, Go to step 5.
5. Check resistance between pin 3 of the DEF pump connector and pin 20 of the ACM 120-pin connector. Is resistance less than five ohms?
   - 5.a Yes, Go to step 6.
   - 5.b No, Repair open in wire between pin 3 of the DEF pump connector and pin 20 of the ACM 120-pin connector. Go to step 9.
6. Check resistance between pin 2 of the DEF pump connector and pin 1 of the ACM 120-pin connector. Is resistance less than five ohms?
   - 6.a Yes, Go to step 7.
   - 6.b No, Repair open in wire between pin 2 of the DEF pump connector and pin 1 of the ACM 120-pin connector. Go to step 9.
7. Install a test ACM.
8. Turn ignition ON (key ON, engine OFF). Using DiagnosticLink, does fault return?
   - 8.a Yes, Check the ATS harness connectors for corroded or spread pins. Repair as necessary. Go to step 9.
   - 8.b No, Turn the ignition OFF. Replace ACM. Go to step 9.
9. Rerun SCR ADS Self-Check to verify repairs. Does test pass with no codes?
   - 9.a Yes, release vehicle.
   - 9.b No, Check the ATS harness connectors for corroded or spread pins. Repair as necessary. Run the SCR ADS Self-Check to verify the repairs.

334.1 SPN 4752/FMI 0 - GHG17

Exhaust Gas Recirculation Cooler Performance Monitor

SPN 4752/FMI 0	
Description	Exhaust Gas Recirculation (EGR) Cooler Performance Monitor
Monitored Parameter	Intake manifold temperature sensor
Typical Enabling Conditions	Engine running greater than 5 minutes, EGR mass flow greater than .08, intake manifold temperature less than 125°C (257°F), engine speed 1200 to 2500 rpm, engine torque 500 to 2500 N·m (368.6 to 1844 lb·ft), coolant temperature greater than 65°C (149°F), ambient temperature less than 45°C (113°F) ambient, coolant temperature greater than 65°C (149°F), ambient temperature greater than -8°C (17.6°F) ambient, barometric pressure greater than 755 mbar (10.95 psi).
Monitor Sequence	None
Execution Frequency	Always enabled.
Typical Duration	30 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	When ambient temperature less than 45°C (113°F), start engine, warm up so coolant temperature greater than 65°C (149°F), ambient barometric pressure greater than 755 mbar (10.95 psi)

1. Are there any cooling system or fan operation concerns?
   1.a Yes, repair those failures, clear codes and release vehicle.
   1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Monitor the intake manifold air temperature; is the intake manifold air temperature reading greater than 93°C (200°F)?
   4.a Yes, replace the intake manifold air temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .
   4.b No; Go to step 5.
5. Turn the ignition OFF.
6. Disconnect the intake manifold air temperature sensor harness connector.
7. Inspect the intake manifold air temperature sensor harness connector for bent, spread or corroded pins.
   7.a If pin damage is found, replace the intake manifold temperature sensor harness connector and intake manifold temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .
   7.b If no pin damage is found, Go to step 8.
8. Visually inspect the entire EGR system for evidence of external leakage (e.g. soot, coolant deposits at joints).
   8.a If external leakage is found, repair as necessary.
   8.b If no external leakage is found, Go to step 9.
9. Remove the following components:

   Refer to section "Removal of the Exhaust Gas Recirculation Hot Pipe" .

   Refer to section "Removal of the Exhaust Gas Recirculation Venturi" .

   Refer to section "Removal of the Mixer Pipe" .

9.a If excessive build up or blockage is found, clean piping and replace EGR cooler.

Refer to section "Removal of the DD13 Exhaust Gas Recirculation Cooler Water Manifold Assembly" .

Refer to section "Removal of the DD15 and DD16 Exhaust Gas Recirculation Cooler" .

9.b If there is no excessive buildup or blockage, replace the intake manifold air temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .

334.2 SPN 4752/FMI 15 - GHG17

Exhaust Gas Recirculation Cooler Performance Monitor

SPN 4752/FMI 15	
Description	Exhaust Gas Recirculation (EGR) Cooler Performance Monitor
Monitored Parameter	Intake Manifold Temperature Sensor
Typical Enabling Conditions	Engine running greater than 5 minutes, EGR mass flow greater than .08, intake manifold temperature less than 125°C (257°F), engine speed 1200 to 2500 RPM, engine torque 500 to 2500 N·m, coolant temperature greater than 65°C (149°F), ambient temperature less than 45°C (113°F) ambient, coolant temperature greater than 65°C (149°F), ambient temperature greater than -8°C (17.6°F) ambient, barometric pressure greater than 755 mbar (10.95 psi).
Monitor Sequence	None
Execution Frequency	Always enabled
Typical Duration	30 Seconds
Dash Lamps	MIL
Engine Reaction	
Verification	When ambient temperature less than 45°C (113°F), start engine, warm up such that coolant temperature greater than 65°C (149°F), insure ambient barometric pressure greater than 755 mbar (10.95 psi)

Check as follows:

1. Is there any cooling system or fan operation concerns?
   - 1.a Yes, repair those failures; clear codes and release vehicle.
   - 1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Monitor the intake manifold air temperature; is the intake manifold air temperature reading greater than 93°C (200°F)?
   - 4.a Yes, replace the intake manifold air temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .
   - 4.b No; Go to step 5.
5. Turn the ignition OFF.
6. Disconnect the intake manifold air temperature sensor harness connector.
7. Inspect the intake manifold air temperature sensor harness connector for bent, spread, or corroded pins.
   - 7.a If pin damage is found, replace the intake manifold temperature sensor harness connector and intake manifold temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .
   - 7.b If no pin damage is found, Go to step 8.
8. Visually inspect the entire EGR system for evidence of external leakage (e.g. soot, coolant deposits at joints).
   - 8.a If external leakage is found, repair as necessary.
   - 8.b If no external leakage is found Go to step 9.
9. Remove the following components:

   Refer to section "Removal of the Exhaust Gas Recirculation Hot Pipe" .

   Refer to section "Removal of the Exhaust Gas Recirculation Venturi" .

   Refer to section "Removal of the Mixer Pipe" .

9.a If excessive build up or blockage is found, clean piping and replace EGR cooler.

Refer to section "Removal of the DD13 Exhaust Gas Recirculation Cooler Water Manifold Assembly" .

Refer to section "Removal of the DD15 and DD16 Exhaust Gas Recirculation Cooler" .

9.b If there is no excessive buildup or blockage, replace the intake manifold air temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .

SPN 4752 (MCM) (GHG17)

334.1 SPN 4752/FMI 0 - GHG17

Exhaust Gas Recirculation Cooler Performance Monitor

SPN 4752/FMI 0	
Description	Exhaust Gas Recirculation (EGR) Cooler Performance Monitor
Monitored Parameter	Intake manifold temperature sensor
Typical Enabling Conditions	Engine running greater than 5 minutes, EGR mass flow greater than .08, intake manifold temperature less than 125°C (257°F), engine speed 1200 to 2500 rpm, engine torque 500 to 2500 N·m (368.6 to 1844 lb·ft), coolant temperature greater than 65°C (149°F), ambient temperature less than 45°C (113°F) ambient, coolant temperature greater than 65°C (149°F), ambient temperature greater than -8°C (17.6°F) ambient, barometric pressure greater than 755 mbar (10.95 psi).
Monitor Sequence	None
Execution Frequency	Always enabled.
Typical Duration	30 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	
Verification	When ambient temperature less than 45°C (113°F), start engine, warm up so coolant temperature greater than 65°C (149°F), ambient barometric pressure greater than 755 mbar (10.95 psi)

1. Are there any cooling system or fan operation concerns?
   1.a Yes, repair those failures, clear codes and release vehicle.
   1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Monitor the intake manifold air temperature; is the intake manifold air temperature reading greater than 93°C (200°F)?
   4.a Yes, replace the intake manifold air temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .
   4.b No; Go to step 5.
5. Turn the ignition OFF.
6. Disconnect the intake manifold air temperature sensor harness connector.
7. Inspect the intake manifold air temperature sensor harness connector for bent, spread or corroded pins.
   7.a If pin damage is found, replace the intake manifold temperature sensor harness connector and intake manifold temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .
   7.b If no pin damage is found, Go to step 8.
8. Visually inspect the entire EGR system for evidence of external leakage (e.g. soot, coolant deposits at joints).
   8.a If external leakage is found, repair as necessary.
   8.b If no external leakage is found, Go to step 9.
9. Remove the following components:

   Refer to section "Removal of the Exhaust Gas Recirculation Hot Pipe" .

Refer to section "Removal of the Exhaust Gas Recirculation Venturi" .

Refer to section "Removal of the Mixer Pipe" .

9.a If excessive build up or blockage is found, clean piping and replace EGR cooler.

Refer to section "Removal of the DD13 Exhaust Gas Recirculation Cooler Water Manifold Assembly" .

Refer to section "Removal of the DD15 and DD16 Exhaust Gas Recirculation Cooler" .

9.b If there is no excessive buildup or blockage, replace the intake manifold air temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .

334.2 SPN 4752/FMI 15 - GHG17

Exhaust Gas Recirculation Cooler Performance Monitor

SPN 4752/FMI 15	
Description	Exhaust Gas Recirculation (EGR) Cooler Performance Monitor
Monitored Parameter	Intake Manifold Temperature Sensor
Typical Enabling Conditions	Engine running greater than 5 minutes, EGR mass flow greater than .08, intake manifold temperature less than 125°C (257°F), engine speed 1200 to 2500 RPM, engine torque 500 to 2500 N·m, coolant temperature greater than 65°C (149°F), ambient temperature less than 45°C (113°F) ambient, coolant temperature greater than 65°C (149°F), ambient temperature greater than -8°C (17.6°F) ambient, barometric pressure greater than 755 mbar (10.95 psi).
Monitor Sequence	None
Execution Frequency	Always enabled
Typical Duration	30 Seconds
Dash Lamps	MIL
Engine Reaction	
Verification	When ambient temperature less than 45°C (113°F), start engine, warm up such that coolant temperature greater than 65°C (149°F), insure ambient barometric pressure greater than 755 mbar (10.95 psi)

Check as follows:

1. Is there any cooling system or fan operation concerns?
   - 1.a Yes, repair those failures; clear codes and release vehicle.
   - 1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Monitor the intake manifold air temperature; is the intake manifold air temperature reading greater than 93°C (200°F)?
   - 4.a Yes, replace the intake manifold air temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .
   - 4.b No; Go to step 5.
5. Turn the ignition OFF.
6. Disconnect the intake manifold air temperature sensor harness connector.
7. Inspect the intake manifold air temperature sensor harness connector for bent, spread, or corroded pins.
   - 7.a If pin damage is found, replace the intake manifold temperature sensor harness connector and intake manifold temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .
   - 7.b If no pin damage is found, Go to step 8.
8. Visually inspect the entire EGR system for evidence of external leakage (e.g. soot, coolant deposits at joints).
   - 8.a If external leakage is found, repair as necessary.
   - 8.b If no external leakage is found Go to step 9.
9. Remove the following components:

   Refer to section "Removal of the Exhaust Gas Recirculation Hot Pipe" .

   Refer to section "Removal of the Exhaust Gas Recirculation Venturi" .

   Refer to section "Removal of the Mixer Pipe" .

9.a If excessive build up or blockage is found, clean piping and replace EGR cooler.

Refer to section "Removal of the DD13 Exhaust Gas Recirculation Cooler Water Manifold Assembly" .

Refer to section "Removal of the DD15 and DD16 Exhaust Gas Recirculation Cooler" .

9.b If there is no excessive buildup or blockage, replace the intake manifold air temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .

335.1 SPN 4765/FMI 0 - GHG17

SPN 4765/FMI 0	
Description	Exhaust Temperature High
Monitored Parameter	Exhaust Temperature
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	Derate 25%

Check as follows:

1. Shut off the engine, apply the parking brake, chock the wheels, and perform any other applicable safety steps.
2. Connect DiagnosticLink Standard.
3. Turn the ignition ON (key ON, engine OFF).
4. Check for multiple fault codes. Are codes other than SPN 4765/FMI 0 active?
   - 4.a Yes; troubleshoot those first.
   - 4.b No; if only SPN 4765/FMI 0 and related codes are present, Go to step 5.
5. Monitor the Diesel Oxidation Catalyst (DOC) outlet temperature. Is the temperature greater than 760°C (1400°F)?
   - 5.a Yes; Go to step 8.
   - 5.b No; Go to step 6.

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

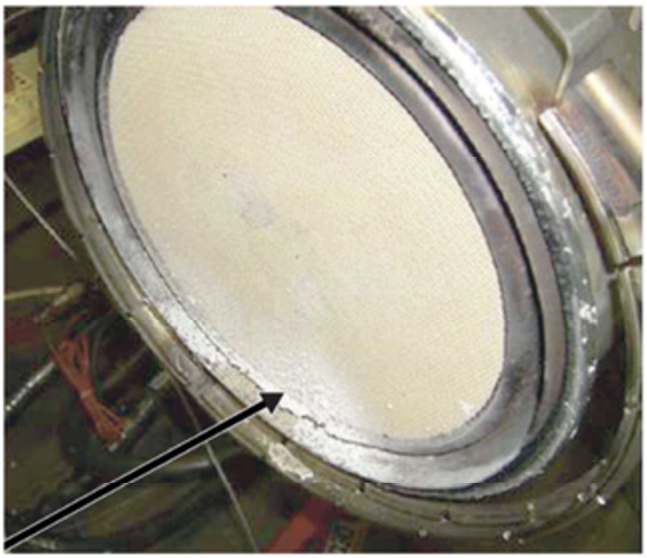
6. With DiagnosticLink connected, run the engine at 1200 rpm for 10 minutes.
7. Monitor the DOC inlet temperature and the DOC outlet temperature. Are the temperatures within 25°C (45°F) of each other?
   - 7.a Yes; Go to step 10.
   - 7.b No; Go to step 8.
8. Turn the ignition OFF.
9. Disconnect the DOC outlet temperature sensor and inspect the connector for damaged, bent, spread, or corroded pins. If the temperature sensor connector is OK, check wiring from the Aftertreatment Control Module (ACM), ACM 120-pin connector pin 27. Was any damage found?
   - 9.a Yes; repair as necessary.
   - 9.b No; replace the DOC outlet temperature sensor. Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .
10. Perform an Idle Speed Balance test using DiagnosticLink. Retain the log file. Refer to section "Checking Idle Speed Balance" .
11. Was a faulty fuel injector/cylinder identified?
    - 11.a Yes; repair the faulty fuel injector/cylinder, and repeat the idle speed balance test to verify the repair. Go to step 21.

11.b No; Go to step 12.

12. Remove the Aftertreatment Device (ATD). Refer to section "Removal of the 1-BOX™ from the Vehicle" .
13. Disassemble the ATD and inspect the inlet face of the DPF substrate for contamination.
14. Was coolant contamination found (white residue on inlet face of the DPF and a sweet smell from exhaust)?

14.a Yes; Go to step 17.

14.b No; Go to step 15.



15. Was oil contamination found (oil residue or paste on DPF Inlet face or an oil lacquer on the inlet flange)?

15.a Yes; Go to step 20.

15.b No; Go to step 16.

16. Was fuel contamination found (inlet flange washed clean)?

16.a Yes; Go to step 22.

16.b No; Go to step 23.

17. Question the operator about coolant usage.
18. Visually inspect the coolant reservoir for low level.
19. Repair the cause of coolant entry as necessary and Go to step 23.
20. Question the operator about excessive oil consumption. Possible causes of excessive oil consumption are:

- Excessive idle time
- Defective turbine wheel seal
- Turbocharger bearing failure
- Worn exhaust valve seals
- Defective crankcase breather system
- Stuck rings

21. Repair the cause of oil contamination and Go to step 23.
22. Repair the cause of fuel contamination and Go to step 23.
23. Install the ATD. Refer to section "Installation of the 1-BOX™ Aftertreatment Control Module" .

WARNING

ENGINE EXHAUST

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

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.

Note : The parked regeneration is successful if the DOC outlet temperature is within 100C (212F) of the DOC Model Delay.

24. Perform a parked regeneration. Verify repairs.

    Refer to section "Performing a Parked Regeneration - GHG17"

    Refer to section "Resetting the Diesel Particulate Filter Ash Accumulators"

SPN 4765 (MCM) (GHG17)

335.1 SPN 4765/FMI 0 - GHG17

SPN 4765/FMI 0	
Description	Exhaust Temperature High
Monitored Parameter	Exhaust Temperature
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	Derate 25%

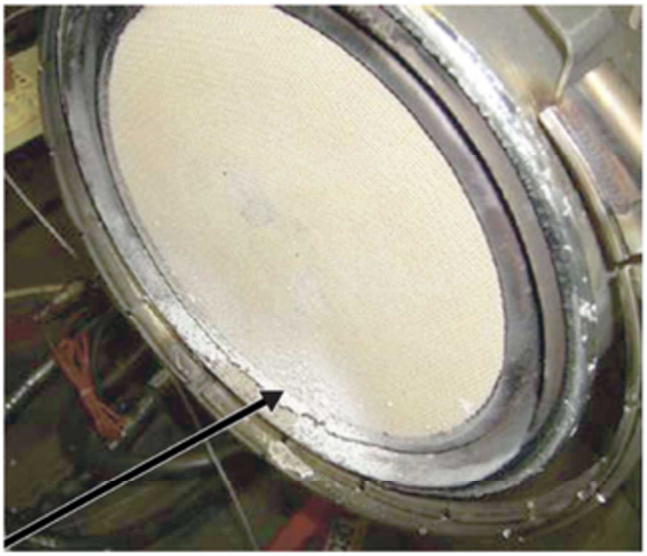
Check as follows:

1. Shut off the engine, apply the parking brake, chock the wheels, and perform any other applicable safety steps.
2. Connect DiagnosticLink Standard.
3. Turn the ignition ON (key ON, engine OFF).
4. Check for multiple fault codes. Are codes other than SPN 4765/FMI 0 active?
   - 4.a Yes; troubleshoot those first.
   - 4.b No; if only SPN 4765/FMI 0 and related codes are present, Go to step 5.
5. Monitor the Diesel Oxidation Catalyst (DOC) outlet temperature. Is the temperature greater than 760°C (1400°F)?
   - 5.a Yes; Go to step 8.
   - 5.b No; Go to step 6.

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

6. With DiagnosticLink connected, run the engine at 1200 rpm for 10 minutes.
7. Monitor the DOC inlet temperature and the DOC outlet temperature. Are the temperatures within 25°C (45°F) of each other?
   - 7.a Yes; Go to step 10.
   - 7.b No; Go to step 8.
8. Turn the ignition OFF.
9. Disconnect the DOC outlet temperature sensor and inspect the connector for damaged, bent, spread, or corroded pins. If the temperature sensor connector is OK, check wiring from the Aftertreatment Control Module (ACM), ACM 120-pin connector pin 27. Was any damage found?
   - 9.a Yes; repair as necessary.
   - 9.b No; replace the DOC outlet temperature sensor. Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor" .
10. Perform an Idle Speed Balance test using DiagnosticLink. Retain the log file. Refer to section "Checking Idle Speed Balance" .

11. Was a faulty fuel injector/cylinder identified?
    11.a Yes; repair the faulty fuel injector/cylinder, and repeat the idle speed balance test to verify the repair. Go to step 21.
    11.b No; Go to step 12.
12. Remove the Aftertreatment Device (ATD). Refer to section "Removal of the 1-BOX™ from the Vehicle" .
13. Disassemble the ATD and inspect the inlet face of the DPF substrate for contamination.
14. Was coolant contamination found (white residue on inlet face of the DPF and a sweet smell from exhaust)?
    14.a Yes; Go to step 17.
    14.b No; Go to step 15.



15. Was oil contamination found (oil residue or paste on DPF Inlet face or an oil lacquer on the inlet flange)?
    15.a Yes; Go to step 20.
    15.b No; Go to step 16.
16. Was fuel contamination found (inlet flange washed clean)?
    16.a Yes; Go to step 22.
    16.b No; Go to step 23.
17. Question the operator about coolant usage.
18. Visually inspect the coolant reservoir for low level.
19. Repair the cause of coolant entry as necessary and Go to step 23.
20. Question the operator about excessive oil consumption. Possible causes of excessive oil consumption are:

- Excessive idle time
- Defective turbine wheel seal
- Turbocharger bearing failure
- Worn exhaust valve seals
- Defective crankcase breather system
- Stuck rings

21. Repair the cause of oil contamination and Go to step 23.
22. Repair the cause of fuel contamination and Go to step 23.
23. Install the ATD. Refer to section "Installation of the 1-BOX™ Aftertreatment Control Module" .

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

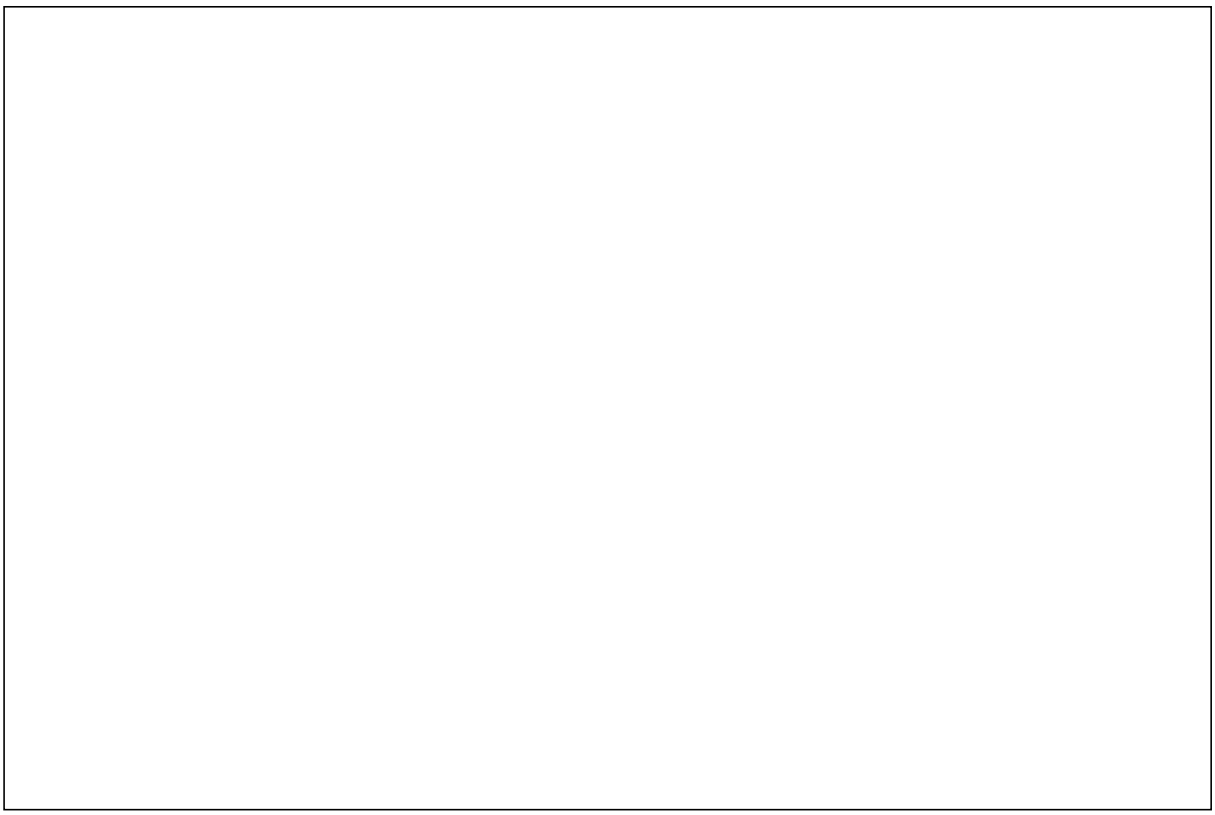
Note : The parked regeneration is successful if the DOC outlet temperature is within 100C (212F) of the DOC Model Delay.

24. Perform a parked regeneration. Verify repairs.
    Refer to section "Performing a Parked Regeneration - GHG17"
    Refer to section "Resetting the Diesel Particulate Filter Ash Accumulators"

336.1 SPN 4814/FMI 3 - GHG17

Water Pump Circuit Failed High

SPN 4814/FMI 3	
Description	Water pump circuit short to battery
Monitored Parameter	Water pump solenoid PWM11
Typical Enabling Conditions	Enabled when engine coolant above 71°C (160°F)
Monitor Sequence	Continuous
Execution Frequency	Continuous
Typical Duration	
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine running, coolant above 71°C (160°F)



1. Disconnect the water pump solenoid harness connector.
2. Inspect the water pump solenoid harness connector for bent, spread, or corroded pins. Is damage found?
   2.a Yes; repair as necessary.
   2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 1 of the water pump solenoid connector, harness side and ground. Is the voltage greater than 0.5 volts?
   4.a Yes; repair a shorted circuit between pin 1 of the water pump solenoid connector and pin 37 of the 120-pin MCM connector.

4.b No; install a new MCM. Refer to section "Removal of the Motor Control Module" .

336.2 SPN 4814/FMI 4 - GHG17

Water Pump Circuit Failed Low

SPN 4814/FMI 4	
Description	Water pump circuit short to ground
Monitored Parameter	Water pump solenoid PWM11
Typical Enabling Conditions	Enabled when engine coolant above 71°C (160°F)
Monitor Sequence	Continuous
Execution Frequency	Continuous
Typical Duration	
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine running, coolant above 71°C (160°F)

1. Disconnect the water pump harness connector.
2. Connect DiagnosticLink .

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

3. Start the engine.
4. Run the engine until inlet coolant temperature sensor reading is greater than 71°C (160°F). Does **SPN 4814/FMI 4 remain active?**

   4.a Yes; Go to step 5.

   4.b No; install a new variable speed water pump. Refer to section "Removal of the Variable Speed Water Pump" .
5. Disconnect the 120-pin MCM connector.
6. Measure the resistance between pin 1 of the water pump solenoid connector, harness side and ground. Is the resistance greater than 10k ohms?

   6.a Yes; Install a new MCM. Refer to section "Removal of the Motor Control Module" .

   6.b No; repair the circuit between pin 1 of the water pump solenoid connector and pin 37 of the 120-pin MCM connector for a short to ground.

336.3 SPN 4814/FMI 5 - GHG17

Water Pump Circuit Failed Open

SPN 4814/FMI 5	
Description	Water pump circuit open
Monitored Parameter	Water pump solenoid PWM11
Typical Enabling Conditions	Enabled when engine coolant above 71°C (160°F)
Monitor Sequence	Continuous
Execution Frequency	Continuous
Typical Duration	
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine running, coolant above 71°C (160°F)

1. Turn the ignition OFF.
2. Disconnect the 120-pin MCM connector.
3. Disconnect the water pump solenoid connector.
4. Measure the resistance between pin 1 of the water pump solenoid connector, harness side and pin 37 of the 120-pin MCM connector . Is the resistance less than five ohms?
   - 4.a Yes; Go to step 5.
   - 4.b No; repair the open circuit between pin 1 of the water pump solenoid connector and pin 37 of the 120-pin MCM connector.
5. Measure the resistance between pin 2 of the water pump solenoid connector, harness side and pin 62 of the 120-pin MCM connector . Is the resistance less than five ohms?

5.a Yes; Go to step 6.

5.b No; repair the open circuit between pin 2 of the water pump solenoid connector and pin 62 of the 120-pin MCM connector.

6. Measure the resistance between pin 1 and pin 2 of the water pump solenoid connector, component side ? Is the resistance less than 5 ohms?

6.a Yes; install a new MCM. Refer to section "Removal of the Motor Control Module" .

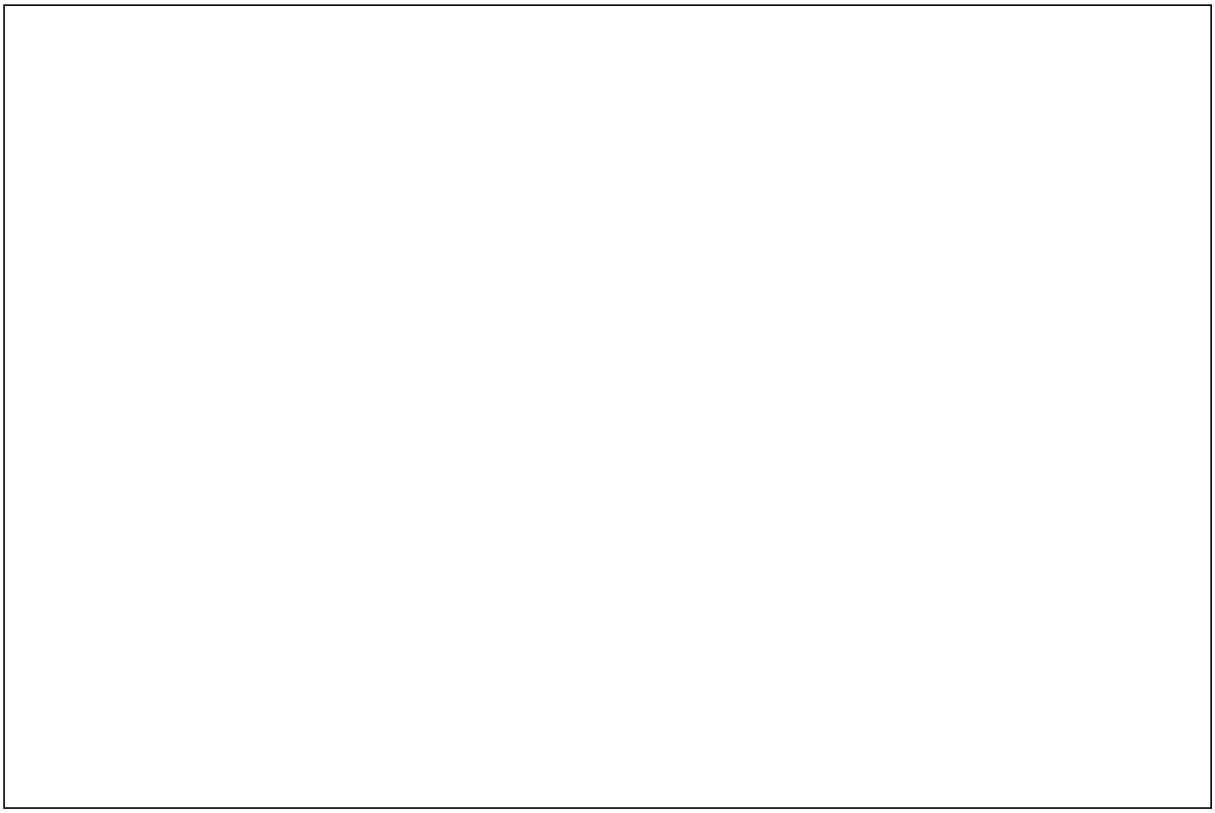
6.b No; install a new variable speed water pump. Refer to section "Removal of the Variable Speed Water Pump" .

SPN 4814 (MCM) (GHG17)

336.1 SPN 4814/FMI 3 - EuroV

Water Pump Circuit Failed High

SPN 4814/FMI 3	
Description	Water pump circuit short to battery
Monitored Parameter	Water pump solenoid PWM11
Typical Enabling Conditions	Enabled when engine coolant above 71°C (160°F)
Monitor Sequence	Continuous
Execution Frequency	Continuous
Typical Duration	
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine running, coolant above 71°C (160°F)



1. Disconnect the water pump solenoid harness connector.
2. Inspect the water pump solenoid harness connector for bent, spread, or corroded pins. Is damage found?
   2.a Yes; repair as necessary.
   2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 1 of the water pump solenoid connector, harness side and ground. Is the voltage greater than 0.5 volts?

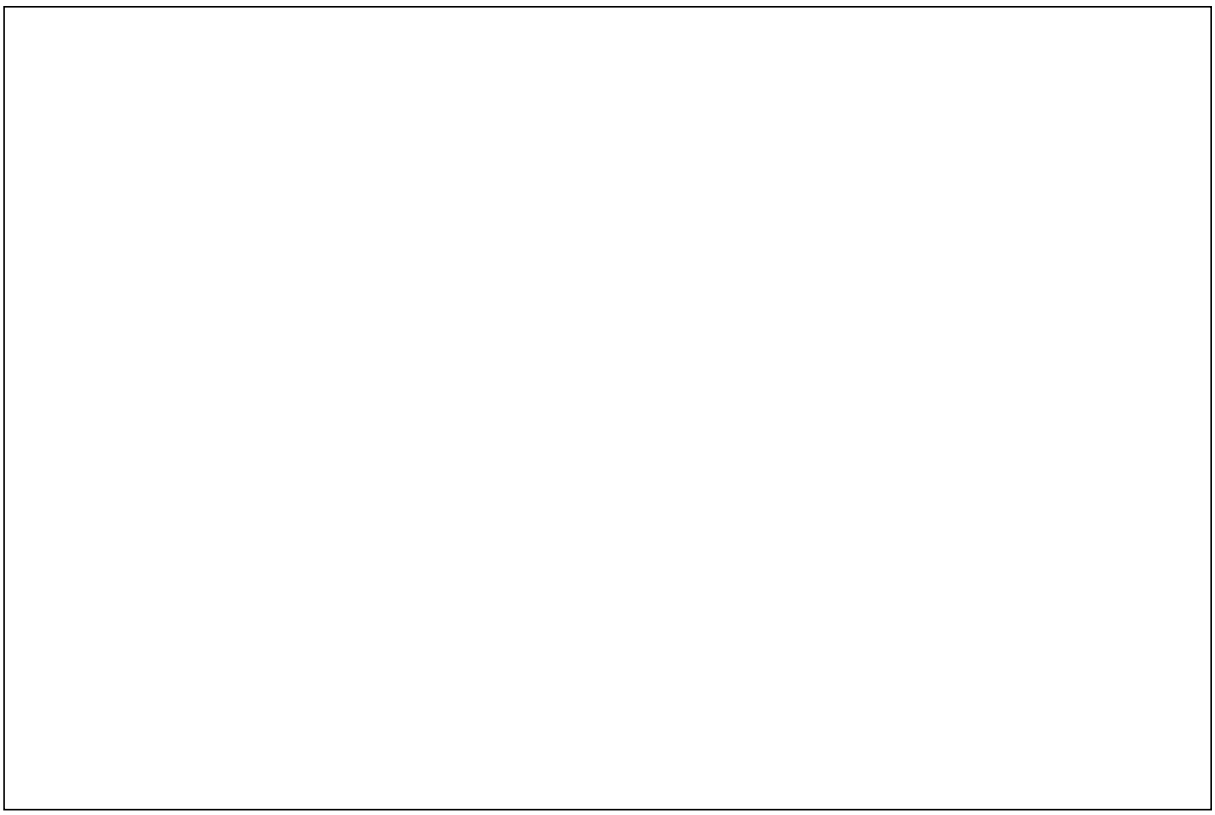
4.a Yes; repair a shorted circuit between pin 1 of the water pump solenoid connector and pin 37 of the 120-pin MCM connector.

4.b No; install a new MCM. Refer to section "Removal of the Motor Control Module" .

336.2 SPN 4814/FMI 4 - EuroV

Water Pump Circuit Failed Low

SPN 4814/FMI 4	
Description	Water pump circuit short to ground
Monitored Parameter	Water pump solenoid PWM11
Typical Enabling Conditions	Enabled when engine coolant above 71°C (160°F)
Monitor Sequence	Continuous
Execution Frequency	Continuous
Typical Duration	
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine running, coolant above 71°C (160°F)



1. Disconnect the water pump harness connector.
2. Connect DiagnosticLink .

⚠ 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.

WARNING

ENGINE EXHAUST

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

WARNING

HOT EXHAUST

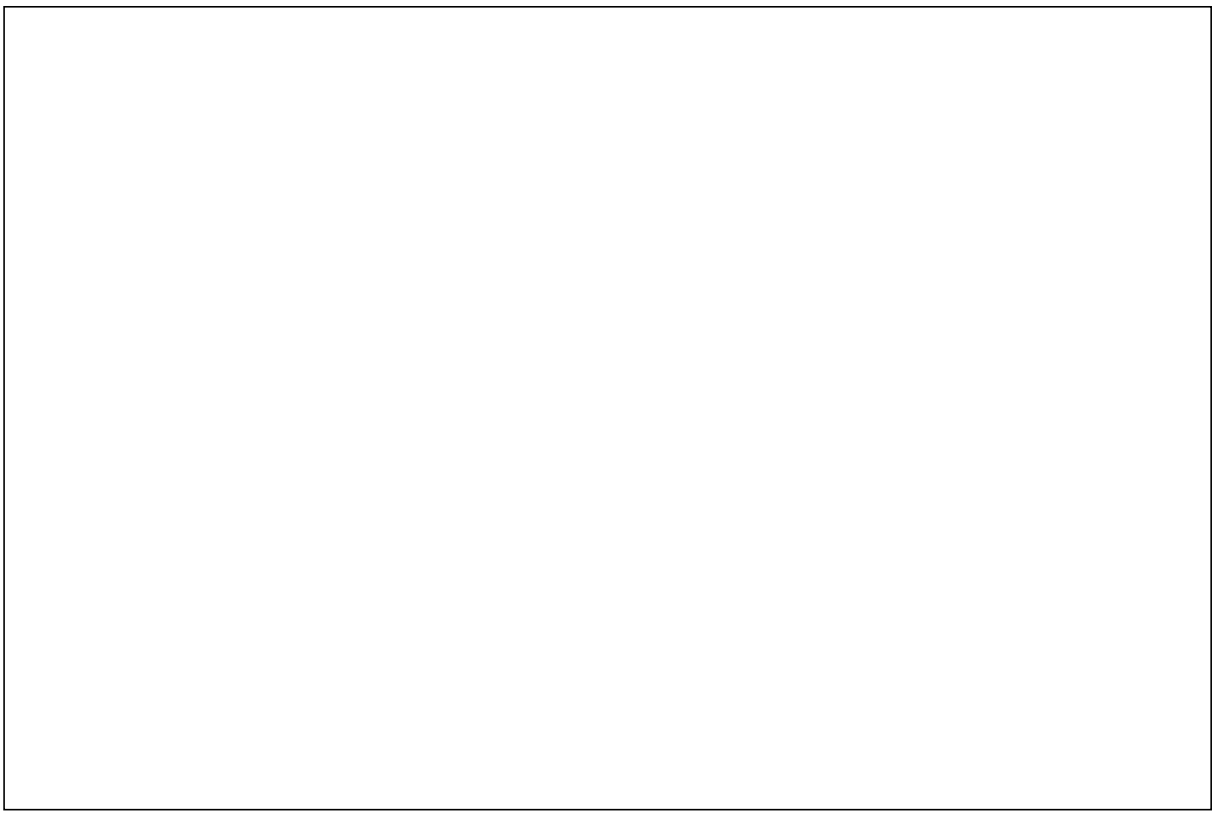
During parked regeneration the exhaust gases will be extremely HOT and could cause a fire if directed at combustible materials. The vehicle must be parked outside.

3. Start the engine.
4. Run the engine until inlet coolant temperature sensor reading is greater than 71°C (160°F). Does **SPN 4814/FMI 4 remain active?**
   - 4.a Yes; Go to step 5.
   - 4.b No; install a new variable speed water pump. Refer to section "Removal of the Variable Speed Water Pump" .
5. Disconnect the 120-pin MCM connector.
6. Measure the resistance between pin 1 of the water pump solenoid connector, harness side and ground. Is the resistance greater than 10k ohms?
   - 6.a Yes; Install a new MCM. Refer to section "Removal of the Motor Control Module" .
   - 6.b No; repair the circuit between pin 1 of the water pump solenoid connector and pin 37 of the 120-pin MCM connector for a short to ground.

336.3 SPN 4814/FMI 5 - EuroV

Water Pump Circuit Failed Open

SPN 4814/FMI 5	
Description	Water pump circuit open
Monitored Parameter	Water pump solenoid PWM11
Typical Enabling Conditions	Enabled when engine coolant above 71°C (160°F)
Monitor Sequence	Continuous
Execution Frequency	Continuous
Typical Duration	
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine running, coolant above 71°C (160°F)



1. Turn the ignition OFF.
2. Disconnect the 120-pin MCM connector.
3. Disconnect the water pump solenoid connector.
4. Measure the resistance between pin 1 of the water pump solenoid connector, harness side and pin 37 of the 120-pin MCM connector . Is the resistance less than five ohms?
   - 4.a Yes; Go to step 5.
   - 4.b No; repair the open circuit between pin 1 of the water pump solenoid connector and pin 37 of the 120-pin MCM connector.
5. Measure the resistance between pin 2 of the water pump solenoid connector, harness side and pin 62 of the 120-pin MCM connector . Is the resistance less than five ohms?

5.a Yes; Go to step 6.

5.b No; repair the open circuit between pin 2 of the water pump solenoid connector and pin 62 of the 120-pin MCM connector.

6. Measure the resistance between pin 1 and pin 2 of the water pump solenoid connector, component side ? Is the resistance less than 5 ohms?

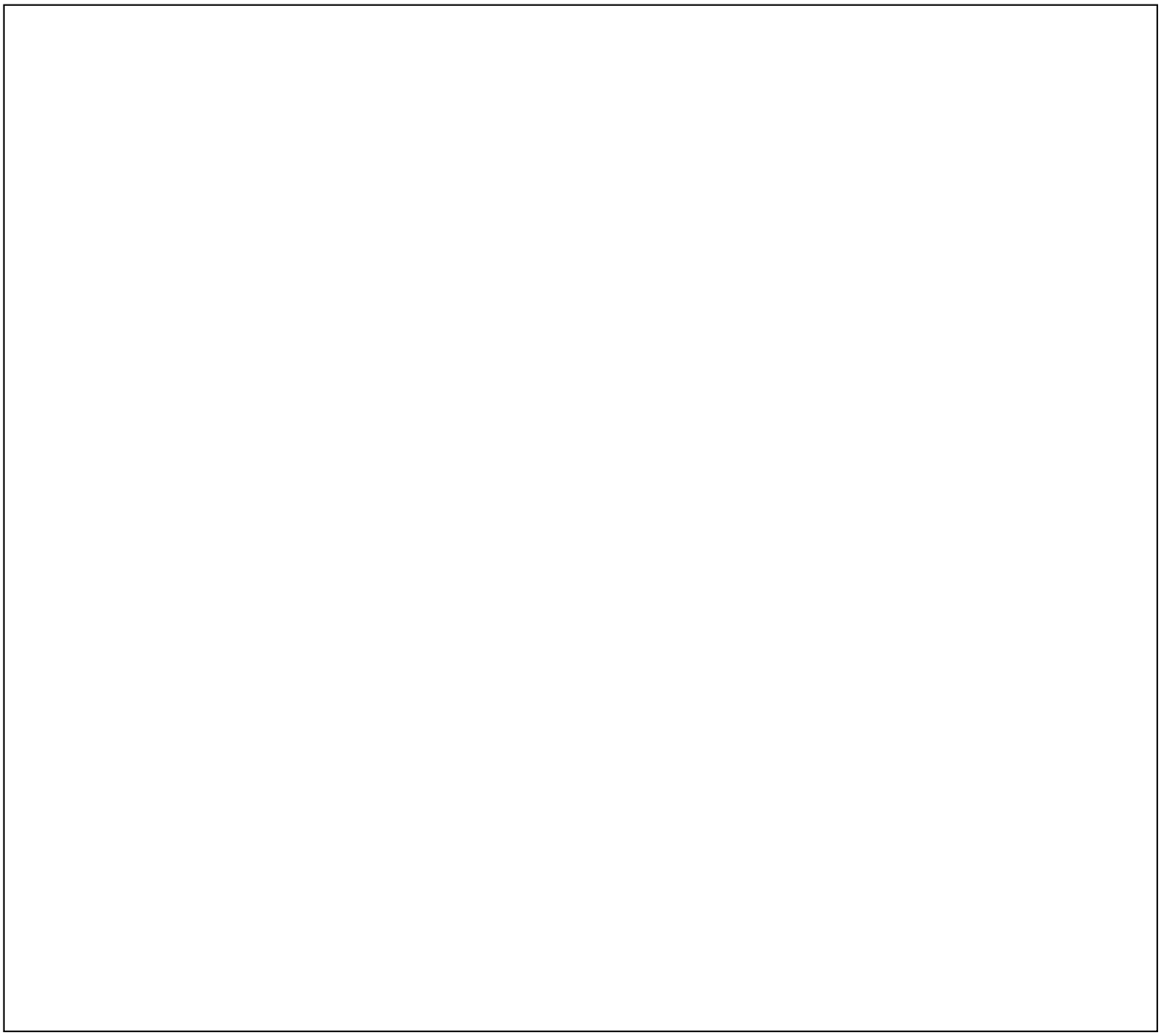
6.a Yes; install a new MCM. Refer to section "Removal of the Motor Control Module" .

6.b No; install a new variable speed water pump. Refer to section "Removal of the Variable Speed Water Pump" .

337.1 SPN 5016/FMI 3 - GHG17

SPN 5016/FMI 3	
Description	High Side Digital Output Circuit Shorted to Power
Monitored Parameter	High Side Digital Output
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Key Cycle

Note : The supply voltage circuit is networked internal of the Aftertreatment Control Module (ACM). This circuit supplies voltage to the coolant valve, Diesel Exhaust Fluid (DEF) post run indicator (if equipped), and the inlet NOx sensor. A short-to-power on any one of those circuits will set this fault code.



Signal	ACM Pin	Component
SCR Supply 12V	106	DEF Post Run Indicator Supply (if equipped)
SCR Supply 12V	110	N/C
SCR Supply 12V	19	CAN DEF Tank 6-5 Tank Heat Coolant Valve 2-2
SCR Supply 12V	50	Deutsch 47-14 then NOx1 in 4-1

Check as follows:

1. Check for multiple codes. Is fault code SPN 3216/FMI 13 or SPN 3490/FMI (any) present along with SPN 5016/FMI 3?
   - 1.a Yes; repair the other fault code first.
   - 1.b No; Go to step 2.
2. Turn the ignition OFF.
3. Disconnect the Aftertreatment Control Module (ACM) 120-pin connector.
4. Inspect the ACM 120-pin harness connector for bent, spread, or corroded pins. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repair.
   - 4.b No; Go to step 5.

Note : Multiple fault codes will set with ACM 120-pin connector disconnected. Disregard other fault codes at this time.

5. Turn the ignition ON (key ON, engine OFF) and clear fault codes. Does SPN 5016/FMI 3 become active?
   - 5.a Yes; replace the ACM. Refer to Original Equipment Manufacturer (OEM) procedures. Verify repair.
   - 5.b No; Go to step 6.
6. With the key ON, engine OFF, measure the voltage between pin 19 of the ACM 120-pin connector, harness side, and battery ground. Is any voltage present?
   - 6.a Yes; repair the short to power between pin 19 of the ACM 120-pin connector and pins 3 and 4 of the DEF coolant valve connector. Verify repair.
   - 6.b No; Go to step 7.
7. With the key ON, engine OFF, measure the voltage between pin 50 of the ACM 120-pin connector, harness side, and battery ground. Is any voltage present?
   - 7.a Yes; repair the short to power between pin 50 of the ACM 120-pin connector and pin 1 of the NOx inlet sensor connector. Verify repair.
   - 7.b No; Go to step 8.
8. Is the vehicle equipped with a DEF Post Run indicator?
   - 8.a Yes; Go to step 9.
   - 8.b No; Go to step 11.
9. With the key ON, engine OFF, measure the voltage between pin 106 of the ACM 120-pin connector, harness side, and battery ground. Is any voltage present?
   - 9.a Yes; repair the short to power between pin 106 of the ACM 120-pin connector and pin 2 of the DEF Post Run indicator. Verify repair.
   - 9.b No; Go to step 10.
10. Inspect connector cavity 106 of the ACM 120-pin connector, harness side. Is a wire populated in cavity 106?
    - 10.a Yes; repair the short to power on pin 106 of the ACM 120-pin connector. Repair connector as needed. Verify repair.
    - 10.b No; Go to step 11.

Note : ACM pin 110 is not populated from the factory. The ACM 120-pin connector should be equipped with a cavity plug in cavity 110 of the 120-pin connector.

11. Inspect connector cavity 110 of the ACM 120-pin connector, harness side. Is a wire populated in cavity 110?

    11.a Yes; repair the short to power on pin 110 of the ACM 120-pin connector. Repair connector as needed. Verify repair.

    11.b No; replace the ACM.

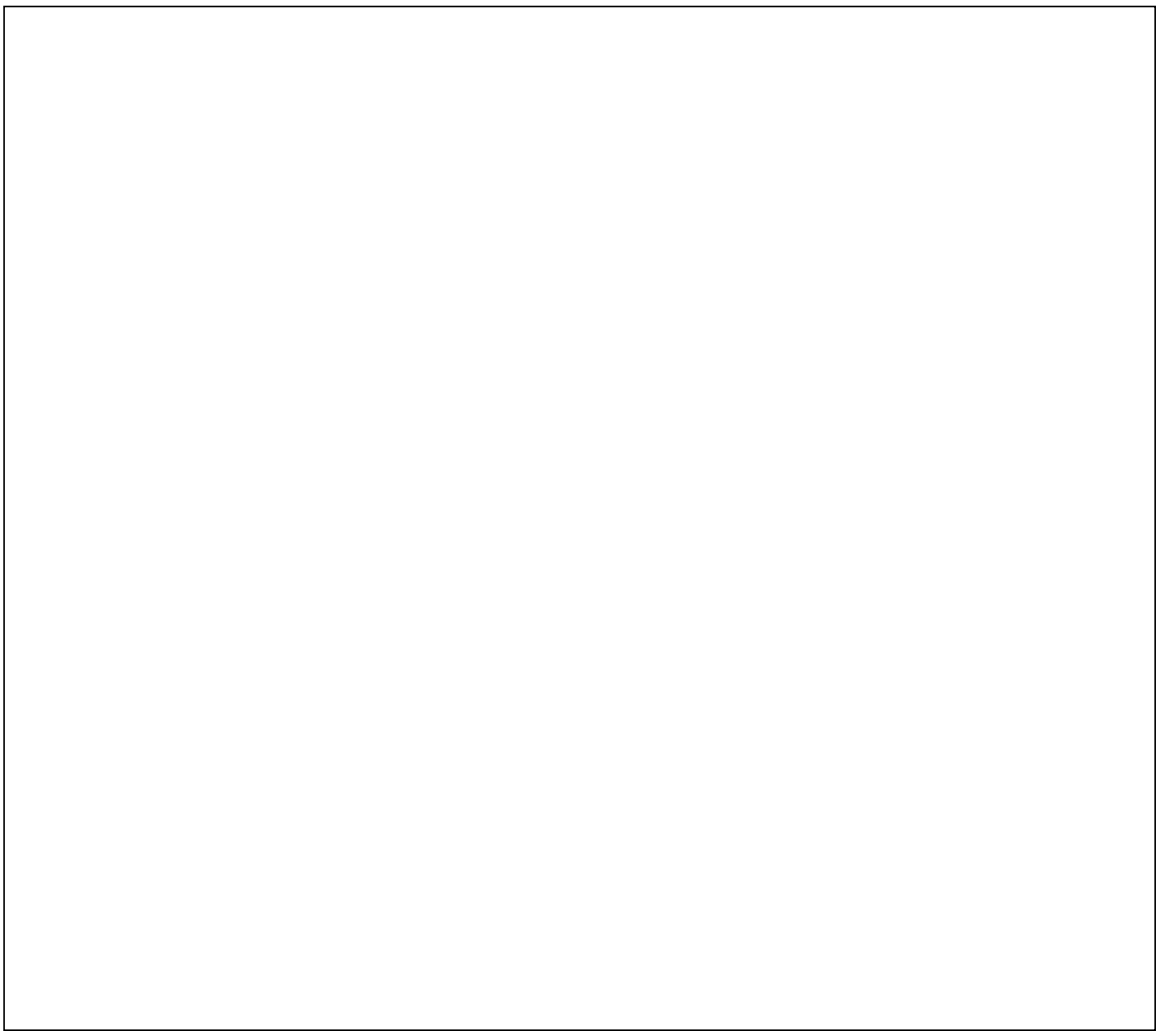
    For 1-BOX™, Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" . Repair the connector as needed. Verify repair.

    For 2-BOX, Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module" . Repair the connector as needed. Verify repair.

337.2 SPN 5016/FMI 4 - GHG17

High Side Digital Output 4 Circuit Failed Low

SPN 5016/FMI 4	
Description	High Side Digital Output Circuit Shorted Low
Monitored Parameter	High Side Digital Output
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Key Cycle



Signal	ACM Pin	Component
SCR Supply 12V	106	DEF Post Run Indicator Supply (if equipped)
SCR Supply 12V	110	N/C
SCR Supply 12V	19	CAN DEF Tank 6-5 Tank Heat Coolant Valve 2-2
SCR Supply 12V	50	Deutsch 47-14 then NOx1 in 4-1

Note : The supply voltage circuit is networked internal of the Aftertreatment Control Module (ACM). This circuit supplies voltage to the Coolant Valve, DEF Post Run indicator (if equipped), and the Inlet NOx sensor. A short on any one of those circuits will set this fault code.

Check as follows:

1. Check for multiple codes. Is fault code SPN 3216/FMI 13 or SPN 3490/FMI (any) present along with SPN 5016/FMI 4?
   - 1.a Yes; repair the other fault code first.
   - 1.b No; Go to step 2.
2. Turn the ignition OFF.
3. Disconnect the Diesel Exhaust Fluid (DEF) coolant valve. Refer to OEM procedures.
4. Inspect the DEF coolant valve and harness connector for bent, spread or corroded pins. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repair.
   - 4.b No; Go to step 5.

Note : Disregard the additional faults set with components disconnected.

5. Turn the ignition ON (key ON, engine OFF) and clear fault codes. Does the fault become active?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the DEF tank coolant valve. Refer to OEM procedures. Verify repair.
6. Turn the ignition OFF.
7. Disconnect the inlet NOx sensor.
8. Inspect the inlet NOx sensor and harness connector for bent, spread or corroded pins. Is any damage found?
   - 8.a Yes; repair as necessary. Verify repair.
   - 8.b No; Go to step 9.

Note : Disregard the additional faults set with components disconnected.

9. Turn the ignition ON (key ON, engine OFF) and clear fault codes. Does the fault become active?
   - 9.a Yes; Go to step 10.
   - 9.b No; replace the inlet NOx sensor.

     For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" . Verify repair.

     For 2-BOX, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" . Verify repair.
10. Turn the ignition OFF.
11. Is the vehicle equipped with a DEF Post Run indicator?
    - 11.a Yes; Go to step 12.
    - 11.b No; Go to step 15.
12. Disconnect the DEF Post Run indicator. Refer to Original Equipment Manufacturer (OEM) procedures.
13. Inspect the DEF Post Run indicator and harness connector for bent, spread or corroded pins. Is any damage found?
    - 13.a Yes; repair as necessary. Verify repair.

13.b No; Go to step 14.

Note : Disregard the additional faults set with components disconnected.

14. Turn the ignition ON (key ON, engine OFF) and clear fault codes. Does the fault become active?

    14.a Yes; Go to step 15.

    14.b No; replace the DEF Post Run indicator. Refer to OEM procedures. Verify repair.

15. Turn the ignition OFF.

16. Disconnect the Aftertreatment Control Module (ACM) 120-pin connector.

17. Inspect the ACM 120-pin and harness connector for bent, spread or corroded pins. Is any damage found?

    17.a Yes; repair as necessary. Verify repair.

    17.b No; Go to step 18.

18. Turn the ignition ON (key ON, engine OFF) and clear fault codes. Does the fault become active?

    18.a Yes; replace the ACM. Refer to OEM procedures. Verify repair.

    18.b No; Go to step 19.

19. Turn the ignition OFF.

20. Measure resistance between pin 19 of the 120-pin ACM connector, harness side, and battery ground. Is the resistance greater than 10K ohms?

    20.a Yes; Go to step 21.

    20.b No; repair the short to ground between pin 19 of the 120-pin ACM connector and pin 2 of the DEF coolant valve connector. Verify repair.

21. Measure resistance between pin 50 of the 120-pin ACM connector, harness side, and battery ground. Is the resistance greater than 10K ohms?

    21.a Yes; Go to step 22.

    21.b No; repair the short to ground between pin 50 of the 120-pin ACM connector and pin 1 of the NOx inlet sensor connector. Verify repair.

Note : ACM pin 106 is not populated from the factory if not equipped with a DEF Post Run indicator lamp. The 120-pin ACM connector should be equipped with a cavity plug in the 120-pin connector cavity 106.

22. Measure resistance between pin 106 of the 120-pin ACM connector, harness side, and battery ground. Is the resistance greater than 10K ohms?

    22.a Yes; Go to step 23.

    22.b No; repair the short to ground on pin 106 of the 120-pin ACM connector. Verify repair.

Note : ACM Pin 110 is not populated from the factory. The 120-pin ACM connector should be equipped with a cavity plug in the 120-pin connector cavity 110.

23. Inspect connector cavity #110 of the 120-pin ACM connector, harness side. Is a wire populated in cavity 110?

    23.a Yes; repair the short to ground on pin 110 of the 120-pin ACM connector. Repair connector as needed. Verify repair.

    23.b No; replace the ACM.

    For 1-BOX™, Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" . Verify repair.

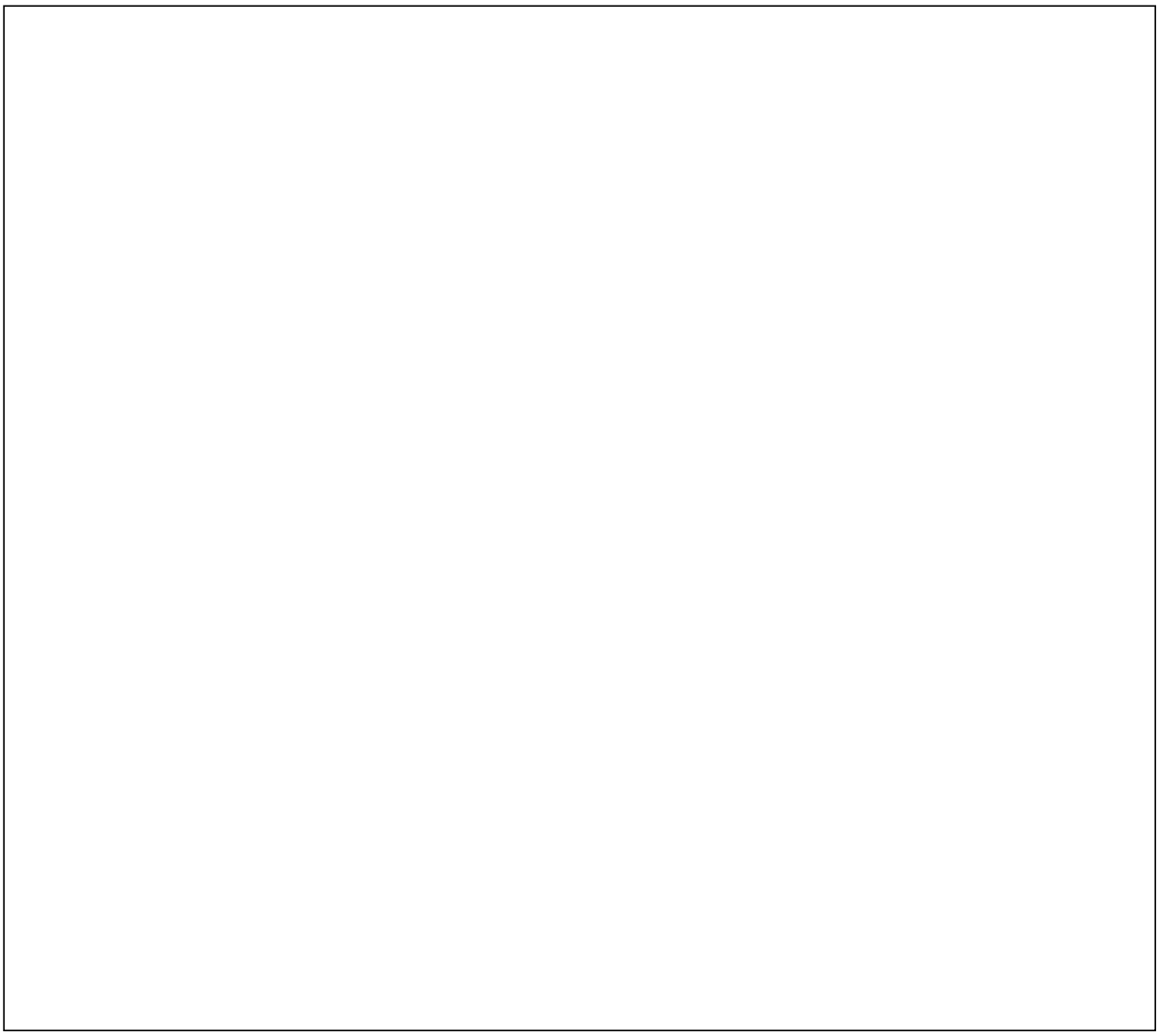
    For 2-BOX, Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module" . Verify repair.

SPN 5016 (ACM) (GHG17)

337.1 SPN 5016/FMI 3 - GHG17

SPN 5016/FMI 3	
Description	High Side Digital Output Circuit Shorted to Power
Monitored Parameter	High Side Digital Output
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Key Cycle

Note : The supply voltage circuit is networked internal of the Aftertreatment Control Module (ACM). This circuit supplies voltage to the coolant valve, Diesel Exhaust Fluid (DEF) post run indicator (if equipped), and the inlet NOx sensor. A short-to-power on any one of those circuits will set this fault code.



Signal	ACM Pin	Component
SCR Supply 12V	106	DEF Post Run Indicator Supply (if equipped)
SCR Supply 12V	110	N/C
SCR Supply 12V	19	CAN DEF Tank 6-5 Tank Heat Coolant Valve 2-2
SCR Supply 12V	50	Deutsch 47-14 then NOx1 in 4-1

Check as follows:

1. Check for multiple codes. Is fault code SPN 3216/FMI 13 or SPN 3490/FMI (any) present along with SPN 5016/FMI 3?
   1.a Yes; repair the other fault code first.
   1.b No; Go to step 2.
2. Turn the ignition OFF.
3. Disconnect the Aftertreatment Control Module (ACM) 120-pin connector.
4. Inspect the ACM 120-pin harness connector for bent, spread, or corroded pins. Is any damage found?
   4.a Yes; repair as necessary. Verify repair.

4.b No; Go to step 5.

Note : Multiple fault codes will set with ACM 120-pin connector disconnected. Disregard other fault codes at this time.

5. Turn the ignition ON (key ON, engine OFF) and clear fault codes. Does SPN 5016/FMI 3 become active?
   - 5.a Yes; replace the ACM. Refer to Original Equipment Manufacturer (OEM) procedures. Verify repair.
   - 5.b No; Go to step 6.
6. With the key ON, engine OFF, measure the voltage between pin 19 of the ACM 120-pin connector, harness side, and battery ground. Is any voltage present?
   - 6.a Yes; repair the short to power between pin 19 of the ACM 120-pin connector and pins 3 and 4 of the DEF coolant valve connector. Verify repair.
   - 6.b No; Go to step 7.
7. With the key ON, engine OFF, measure the voltage between pin 50 of the ACM 120-pin connector, harness side, and battery ground. Is any voltage present?
   - 7.a Yes; repair the short to power between pin 50 of the ACM 120-pin connector and pin 1 of the NOx inlet sensor connector. Verify repair.
   - 7.b No; Go to step 8.
8. Is the vehicle equipped with a DEF Post Run indicator?
   - 8.a Yes; Go to step 9.
   - 8.b No; Go to step 11.
9. With the key ON, engine OFF, measure the voltage between pin 106 of the ACM 120-pin connector, harness side, and battery ground. Is any voltage present?
   - 9.a Yes; repair the short to power between pin 106 of the ACM 120-pin connector and pin 2 of the DEF Post Run indicator. Verify repair.
   - 9.b No; Go to step 10.
10. Inspect connector cavity 106 of the ACM 120-pin connector, harness side. Is a wire populated in cavity 106?
    - 10.a Yes; repair the short to power on pin 106 of the ACM 120-pin connector. Repair connector as needed. Verify repair.
    - 10.b No; Go to step 11.

Note : ACM pin 110 is not populated from the factory. The ACM 120-pin connector should be equipped with a cavity plug in cavity 110 of the 120-pin connector.

11. Inspect connector cavity 110 of the ACM 120-pin connector, harness side. Is a wire populated in cavity 110?
    - 11.a Yes; repair the short to power on pin 110 of the ACM 120-pin connector. Repair connector as needed. Verify repair.
    - 11.b No; replace the ACM.

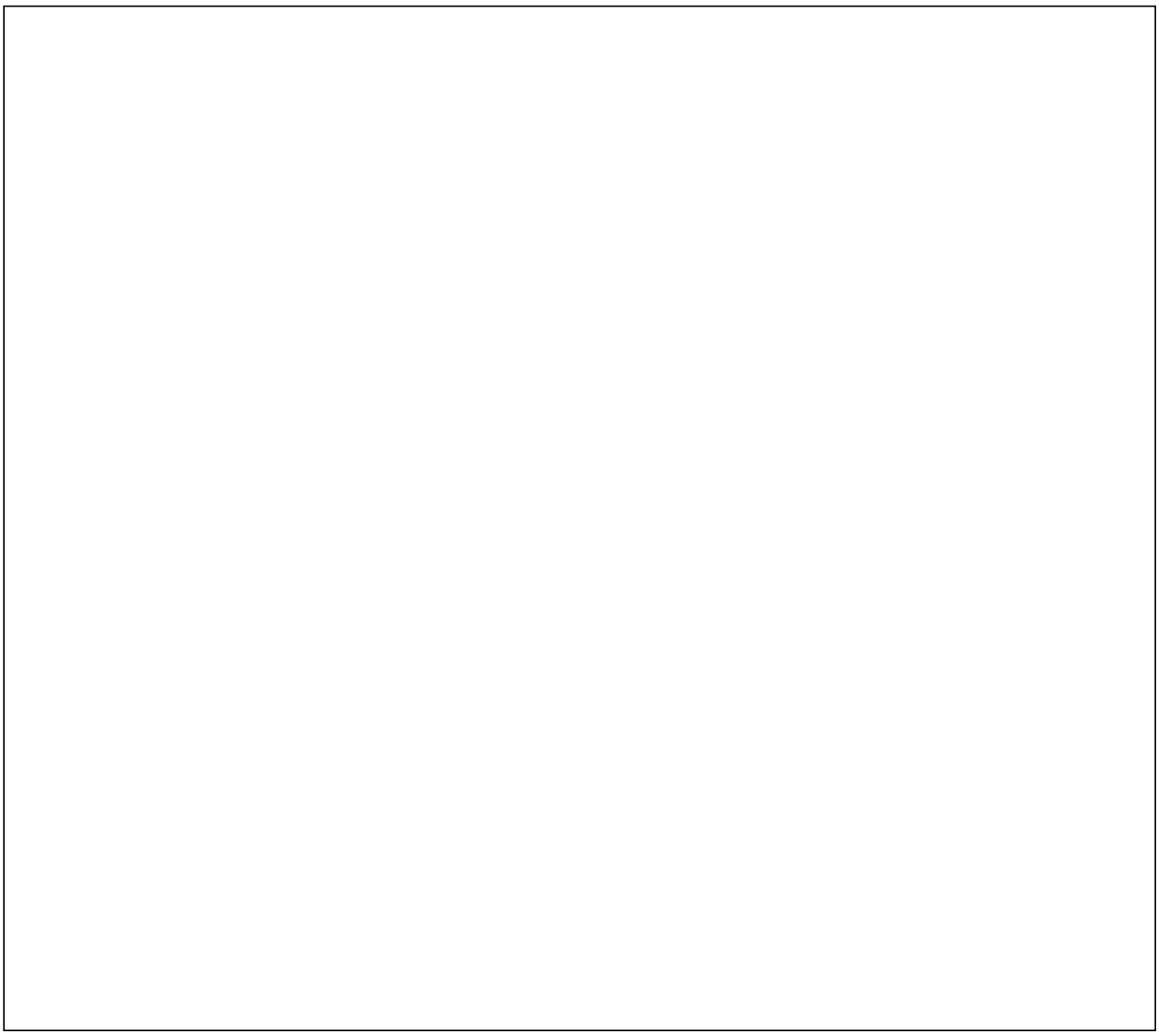
      For 1-BOX™, Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" . Repair the connector as needed. Verify repair.

      For 2-BOX, Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module" . Repair the connector as needed. Verify repair.

337.2 SPN 5016/FMI 4 - GHG17

High Side Digital Output 4 Circuit Failed Low

SPN 5016/FMI 4	
Description	High Side Digital Output Circuit Shorted Low
Monitored Parameter	High Side Digital Output
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Key Cycle



Signal	ACM Pin	Component
SCR Supply 12V	106	DEF Post Run Indicator Supply (if equipped)
SCR Supply 12V	110	N/C
SCR Supply 12V	19	CAN DEF Tank 6-5 Tank Heat Coolant Valve 2-2
SCR Supply 12V	50	Deutsch 47-14 then NOx1 in 4-1

Note : The supply voltage circuit is networked internal of the Aftertreatment Control Module (ACM). This circuit supplies voltage to the Coolant Valve, DEF Post Run indicator (if equipped), and the Inlet NOx sensor. A short on any one of those circuits will set this fault code.

Check as follows:

1. Check for multiple codes. Is fault code SPN 3216/FMI 13 or SPN 3490/FMI (any) present along with SPN 5016/FMI 4?
   - 1.a Yes; repair the other fault code first.
   - 1.b No; Go to step 2.
2. Turn the ignition OFF.
3. Disconnect the Diesel Exhaust Fluid (DEF) coolant valve. Refer to OEM procedures.
4. Inspect the DEF coolant valve and harness connector for bent, spread or corroded pins. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repair.
   - 4.b No; Go to step 5.

Note : Disregard the additional faults set with components disconnected.

5. Turn the ignition ON (key ON, engine OFF) and clear fault codes. Does the fault become active?
   - 5.a Yes; Go to step 6.
   - 5.b No; replace the DEF tank coolant valve. Refer to OEM procedures. Verify repair.
6. Turn the ignition OFF.
7. Disconnect the inlet NOx sensor.
8. Inspect the inlet NOx sensor and harness connector for bent, spread or corroded pins. Is any damage found?
   - 8.a Yes; repair as necessary. Verify repair.
   - 8.b No; Go to step 9.

Note : Disregard the additional faults set with components disconnected.

9. Turn the ignition ON (key ON, engine OFF) and clear fault codes. Does the fault become active?
   - 9.a Yes; Go to step 10.
   - 9.b No; replace the inlet NOx sensor.

     For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" . Verify repair.

     For 2-BOX, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" . Verify repair.
10. Turn the ignition OFF.
11. Is the vehicle equipped with a DEF Post Run indicator?
    - 11.a Yes; Go to step 12.
    - 11.b No; Go to step 15.
12. Disconnect the DEF Post Run indicator. Refer to Original Equipment Manufacturer (OEM) procedures.
13. Inspect the DEF Post Run indicator and harness connector for bent, spread or corroded pins. Is any damage found?
    - 13.a Yes; repair as necessary. Verify repair.

13.b No; Go to step 14.

Note : Disregard the additional faults set with components disconnected.

14. Turn the ignition ON (key ON, engine OFF) and clear fault codes. Does the fault become active?

    14.a Yes; Go to step 15.

    14.b No; replace the DEF Post Run indicator. Refer to OEM procedures. Verify repair.

15. Turn the ignition OFF.

16. Disconnect the Aftertreatment Control Module (ACM) 120-pin connector.

17. Inspect the ACM 120-pin and harness connector for bent, spread or corroded pins. Is any damage found?

    17.a Yes; repair as necessary. Verify repair.

    17.b No; Go to step 18.

18. Turn the ignition ON (key ON, engine OFF) and clear fault codes. Does the fault become active?

    18.a Yes; replace the ACM. Refer to OEM procedures. Verify repair.

    18.b No; Go to step 19.

19. Turn the ignition OFF.

20. Measure resistance between pin 19 of the 120-pin ACM connector, harness side, and battery ground. Is the resistance greater than 10K ohms?

    20.a Yes; Go to step 21.

    20.b No; repair the short to ground between pin 19 of the 120-pin ACM connector and pin 2 of the DEF coolant valve connector. Verify repair.

21. Measure resistance between pin 50 of the 120-pin ACM connector, harness side, and battery ground. Is the resistance greater than 10K ohms?

    21.a Yes; Go to step 22.

    21.b No; repair the short to ground between pin 50 of the 120-pin ACM connector and pin 1 of the NOx inlet sensor connector. Verify repair.

Note : ACM pin 106 is not populated from the factory if not equipped with a DEF Post Run indicator lamp. The 120-pin ACM connector should be equipped with a cavity plug in the 120-pin connector cavity 106.

22. Measure resistance between pin 106 of the 120-pin ACM connector, harness side, and battery ground. Is the resistance greater than 10K ohms?

    22.a Yes; Go to step 23.

    22.b No; repair the short to ground on pin 106 of the 120-pin ACM connector. Verify repair.

Note : ACM Pin 110 is not populated from the factory. The 120-pin ACM connector should be equipped with a cavity plug in the 120-pin connector cavity 110.

23. Inspect connector cavity #110 of the 120-pin ACM connector, harness side. Is a wire populated in cavity 110?

    23.a Yes; repair the short to ground on pin 110 of the 120-pin ACM connector. Repair connector as needed. Verify repair.

    23.b No; replace the ACM.

    For 1-BOX™, Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" . Verify repair.

    For 2-BOX, Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module" . Verify repair.

338.1 SPN 5017/FMI 3 - GHG17

NOx Sensor Digital Output 5 Circuit Signal Failed High

Check as follows:

1. Disconnect the Selective Catalyst Reduction (SCR) outlet NOx sensor.
2. Inspect the sensor harness for bent, spread, or corroded pins.
   - 2.a If the pins are bent, spread, or corroded, repair as necessary.
   - 2.b If connector shows no signs of damage, Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 1 and 4 on the harness side of the SCR outlet NOx sensor connector.
   - 4.a If the voltage is less than 11.5 volts, Go to step 5.
   - 4.b If the voltage is greater than 11.5 volts, Go to step 6.
5. Measure the voltage between pin 1 on the harness side of the SCR outlet NOx sensor connector and engine ground.
   - 5.a If the voltage is less than 11.5 volts, repair the wire between pin 1 on the harness side of the SCR outlet NOx sensor connector and pin 42 of the Aftertreatment Control Module (ACM) 120-pin connector.
   - 5.b If the voltage is greater than 11.5 volts, repair the wire between pin 4 on the harness side of the SCR outlet NOx sensor connector and pin 43 of the ACM 120-pin connector.
6. Turn the ignition OFF (key OFF, engine OFF).
7. Measure the resistance between pin 2 and 3 on the harness side of the SCR outlet NOx sensor connector.
   - 7.a If the resistance is between 50 and 70 ohms, replace the SCR outlet NOx sensor.

     For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

     For 2-BOX, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .
   - 7.b If the resistance is not between 50 and 70 ohms, Go to step 8.
8. Disconnect the ACM 120-pin connector.
9. Measure the resistance between pin 2 and 3 on the harness side of the SCR outlet NOx sensor connector.
   - 9.a If the resistance is less than 1K ohms, repair the short between pins 2 and 3 on the harness side of the SCR outlet NOx sensor connector and pins 40 and 41 of the ACM 120-pin connector.
   - 9.b If the resistance is greater than 1K ohms, Go to step 10.
10. Measure the resistance between pin 2 on the harness side of the SCR outlet NOx sensor connector and pin 41 of the ACM 120-pin connector.
    - 10.a If the resistance is greater than 5 ohms, repair the wire between pin 2 on the harness side of the SCR outlet NOx sensor connector and pin 41 of the ACM 120-pin connector.
    - 10.b If the resistance is less than 5 ohms, Go to step 11.
11. Measure the resistance between pin 3 on the harness side of the SCR outlet NOx sensor connector and pin 40 of the ACM 120-pin connector.
    - 11.a If the resistance is greater than 5 ohms, repair the wire between pin 3 on the harness side of the SCR outlet NOx sensor connector and pin 40 of the ACM 120-pin connector.
    - 11.b If the resistance is less than 5 ohms, Go to step 12.
12. Test ACM internal resistor; measure the resistance between pins 40 and 41 on the ACM.
    - 12.a If the resistance is between 50 and 70 ohms, replace the SCR outlet NOx sensor.

      For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

      For 2-BOX, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .
    - 12.b If the resistance is NOT between 50 and 70 ohms, replace the ACM.

338.2 SPN 5017/FMI 4 - GHG17

NOx Sensor Digital Output 5 Circuit Signal Failed Low

Check as follows:

1. Disconnect the Selective Catalyst Reduction (SCR) outlet NOx sensor.
2. Inspect the sensor harness for bent, spread, or corroded pins.
   - 2.a If the pins are bent, spread, or corroded, repair as necessary.
   - 2.b If connector shows no signs of damage, Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 1 and 4 on the harness side of the SCR outlet NOx sensor connector.
   - 4.a If the voltage is less than 11.5 volts, Go to step 5.
   - 4.b If the voltage is greater than 11.5 volts, Go to step 6.
5. Measure the voltage between pin 1 on the harness side of the SCR outlet NOx sensor connector and engine ground.
   - 5.a If the voltage is less than 11.5 volts, repair the wire between pin 1 on the harness side of the SCR outlet NOx sensor connector and pin 42 of the Aftertreatment Control Module (ACM) 120-pin connector.
   - 5.b If the voltage is greater than 11.5 volts, repair the wire between pin 4 on the harness side of the SCR outlet NOx sensor connector and pin 43 of the ACM 120-pin connector.
6. Turn the ignition OFF.
7. Measure the resistance between pin 2 and 3 on the harness side of the SCR outlet NOx sensor connector.
   - 7.a If the resistance is between 50 and 70 ohms, replace the SCR outlet NOx sensor.

     For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

     For 2-BOX, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .
   - 7.b If the resistance is not between 50 and 70 ohms, Go to step 8.
8. Disconnect the ACM 120-pin connector.
9. Measure the resistance between pin 2 and 3 on the harness side of the SCR outlet NOx sensor connector.
   - 9.a If the resistance is less than 1K ohms, repair short between pins 2 and 3 on the harness side of the SCR outlet NOx sensor connector and pins 40 and 41 of the ACM 120-pin connector.
   - 9.b If the resistance is greater than 1K ohms, Go to step 10.
10. Measure the resistance between pin 2 on the harness side of the SCR outlet NOx sensor connector and pin 41 of the ACM 120-pin connector.
    - 10.a If the resistance is greater than 5 ohms, repair the wire between pin 2 on the harness side of the SCR outlet NOx sensor connector and pin 41 of the ACM 120-pin connector.
    - 10.b If the resistance is less than 5 ohms, Go to step 11.
11. Measure the resistance between pin 3 on the harness side of the SCR outlet NOx sensor connector and pin 40 of the ACM 120-pin connector.
    - 11.a If the resistance is greater than 5 ohms, repair the wire between pin 3 on the harness side of the SCR outlet NOx sensor connector and pin 40 of the ACM 120-pin connector.
    - 11.b If the resistance is less than 5 ohms, Go to step 12.
12. Test ACM internal resistor; measure the resistance between pins 40 and 41 on the ACM.
    - 12.a If the resistance is between 50 and 70 ohms, replace the SCR outlet NOx Sensor.

      For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

      For 2-BOX, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .
    - 12.b If the resistance is not between 50 and 70 ohms, replace the ACM.

SPN 5017 (ACM) (GHG17)

338.1 SPN 5017/FMI 3 - GHG17

NOx Sensor Digital Output 5 Circuit Signal Failed High

Check as follows:

1. Disconnect the Selective Catalyst Reduction (SCR) outlet NOx sensor.
2. Inspect the sensor harness for bent, spread, or corroded pins.
   - 2.a If the pins are bent, spread, or corroded, repair as necessary.
   - 2.b If connector shows no signs of damage, Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 1 and 4 on the harness side of the SCR outlet NOx sensor connector.
   - 4.a If the voltage is less than 11.5 volts, Go to step 5.
   - 4.b If the voltage is greater than 11.5 volts, Go to step 6.
5. Measure the voltage between pin 1 on the harness side of the SCR outlet NOx sensor connector and engine ground.
   - 5.a If the voltage is less than 11.5 volts, repair the wire between pin 1 on the harness side of the SCR outlet NOx sensor connector and pin 42 of the Aftertreatment Control Module (ACM) 120-pin connector.
   - 5.b If the voltage is greater than 11.5 volts, repair the wire between pin 4 on the harness side of the SCR outlet NOx sensor connector and pin 43 of the ACM 120-pin connector.
6. Turn the ignition OFF (key OFF, engine OFF).
7. Measure the resistance between pin 2 and 3 on the harness side of the SCR outlet NOx sensor connector.
   - 7.a If the resistance is between 50 and 70 ohms, replace the SCR outlet NOx sensor.

     For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

     For 2-BOX, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .
   - 7.b If the resistance is not between 50 and 70 ohms, Go to step 8.
8. Disconnect the ACM 120-pin connector.
9. Measure the resistance between pin 2 and 3 on the harness side of the SCR outlet NOx sensor connector.
   - 9.a If the resistance is less than 1K ohms, repair the short between pins 2 and 3 on the harness side of the SCR outlet NOx sensor connector and pins 40 and 41 of the ACM 120-pin connector.
   - 9.b If the resistance is greater than 1K ohms, Go to step 10.
10. Measure the resistance between pin 2 on the harness side of the SCR outlet NOx sensor connector and pin 41 of the ACM 120-pin connector.
    - 10.a If the resistance is greater than 5 ohms, repair the wire between pin 2 on the harness side of the SCR outlet NOx sensor connector and pin 41 of the ACM 120-pin connector.
    - 10.b If the resistance is less than 5 ohms, Go to step 11.
11. Measure the resistance between pin 3 on the harness side of the SCR outlet NOx sensor connector and pin 40 of the ACM 120-pin connector.
    - 11.a If the resistance is greater than 5 ohms, repair the wire between pin 3 on the harness side of the SCR outlet NOx sensor connector and pin 40 of the ACM 120-pin connector.
    - 11.b If the resistance is less than 5 ohms, Go to step 12.
12. Test ACM internal resistor; measure the resistance between pins 40 and 41 on the ACM.
    - 12.a If the resistance is between 50 and 70 ohms, replace the SCR outlet NOx sensor.

      For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

      For 2-BOX, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

12.b If the resistance is NOT between 50 and 70 ohms, replace the ACM.

338.2 SPN 5017/FMI 4 - GHG17

NOx Sensor Digital Output 5 Circuit Signal Failed Low

Check as follows:

1. Disconnect the Selective Catalyst Reduction (SCR) outlet NOx sensor.
2. Inspect the sensor harness for bent, spread, or corroded pins.
   - 2.a If the pins are bent, spread, or corroded, repair as necessary.
   - 2.b If connector shows no signs of damage, Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 1 and 4 on the harness side of the SCR outlet NOx sensor connector.
   - 4.a If the voltage is less than 11.5 volts, Go to step 5.
   - 4.b If the voltage is greater than 11.5 volts, Go to step 6.
5. Measure the voltage between pin 1 on the harness side of the SCR outlet NOx sensor connector and engine ground.
   - 5.a If the voltage is less than 11.5 volts, repair the wire between pin 1 on the harness side of the SCR outlet NOx sensor connector and pin 42 of the Aftertreatment Control Module (ACM) 120-pin connector.
   - 5.b If the voltage is greater than 11.5 volts, repair the wire between pin 4 on the harness side of the SCR outlet NOx sensor connector and pin 43 of the ACM 120-pin connector.
6. Turn the ignition OFF.
7. Measure the resistance between pin 2 and 3 on the harness side of the SCR outlet NOx sensor connector.
   - 7.a If the resistance is between 50 and 70 ohms, replace the SCR outlet NOx sensor.

     For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

     For 2-BOX, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .
   - 7.b If the resistance is not between 50 and 70 ohms, Go to step 8.
8. Disconnect the ACM 120-pin connector.
9. Measure the resistance between pin 2 and 3 on the harness side of the SCR outlet NOx sensor connector.
   - 9.a If the resistance is less than 1K ohms, repair short between pins 2 and 3 on the harness side of the SCR outlet NOx sensor connector and pins 40 and 41 of the ACM 120-pin connector.
   - 9.b If the resistance is greater than 1K ohms, Go to step 10.
10. Measure the resistance between pin 2 on the harness side of the SCR outlet NOx sensor connector and pin 41 of the ACM 120-pin connector.
    - 10.a If the resistance is greater than 5 ohms, repair the wire between pin 2 on the harness side of the SCR outlet NOx sensor connector and pin 41 of the ACM 120-pin connector.
    - 10.b If the resistance is less than 5 ohms, Go to step 11.
11. Measure the resistance between pin 3 on the harness side of the SCR outlet NOx sensor connector and pin 40 of the ACM 120-pin connector.
    - 11.a If the resistance is greater than 5 ohms, repair the wire between pin 3 on the harness side of the SCR outlet NOx sensor connector and pin 40 of the ACM 120-pin connector.
    - 11.b If the resistance is less than 5 ohms, Go to step 12.
12. Test ACM internal resistor; measure the resistance between pins 40 and 41 on the ACM.
    - 12.a If the resistance is between 50 and 70 ohms, replace the SCR outlet NOx Sensor.

      For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

      For 2-BOX, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .
    - 12.b If the resistance is not between 50 and 70 ohms, replace the ACM.

339.1 SPN 5018/FMI 18 - GHG17

SPN 5018/FMI 18	
Description	Diesel Oxidation Catalyst (DOC) Efficiency Fault
Monitored Parameter	Exhaust Temperature
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Parked Regen

NOTICE

If a High Idle Regen is started, then aborted within the first 12 minutes, more than two times without shutting down the engine, the Aftertreatment Control Module (ACM) could falsely set SPN 5018/FMI 18; in this case the code can be ignored.

Check as follows:

1. Connect DiagnosticLink Standard.
2. Turn the ignition ON (key ON, engine OFF).
3. Check for active DOC or DPF temperature sensor faults. Are there any DOC or Diesel Particulate Filter (DPF) temperature faults active?
   - 3.a Yes; troubleshoot those faults first.
   - 3.b No; Go to step 4.
4. Inspect the exhaust system for leaks. Are there any leaks found?
   - 4.a Yes; repair as necessary.
   - 4.b No; Go to step 5.

⚠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.

⚠WARNING

ENGINE EXHAUST

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

5. Start the engine.
6. Run service routine "Perform Performance Check-Low Temp ATD".
7. Monitor the Diesel Oxidation Catalyst (DOC) inlet temperature sensor, the DOC outlet temperature sensor, and the Diesel Particulate Filter (DPF) outlet temperature sensor for 20 minutes.

8. After 20 minutes, are the DOC inlet and DOC outlet temperature sensors readings within 42°C (76°F) of the DPF outlet temperature sensor?
   - 8.a Yes; Go to step 12.
   - 8.b No; Go to step 9.
9. Continue running the routine for 5 minutes. Are the temperatures now within 42°C (76°F) of each other?
   - 9.a Yes; Go to step 12.
   - 9.b No; Go to step 10.
10. Stop the "Perform Performance Check-Low Temp ATD" service routine. Shut off the engine.
11. Replace the drifted DOC temperature sensor.

    Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Temperature Sensor"

    Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor"

    Verify repair.
12. Stop the "Perform Performance Check-Low Temp ATD" service routine. Shut off the engine, then turn the ignition to the ON position.
13. Monitor the DOC inlet pressure sensor voltage. Is the voltage 0.44 to 0.56 volt?
    - 13.a Yes; Go to step 15.
    - 13.b No; Go to step 14.
14. Inspect the DOC inlet pressure sensor electrical connector for corrosion and spread pins. Is there any corrosion or spread pins on electrical connector?
    - 14.a Yes; repair as necessary. Verify repairs.
    - 14.b No; replace the DOC inlet pressure sensor.

      For 1-BOX™, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" . Verify repair.

      For 2-BOX, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" . Verify repair.

> **⚠ 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.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

15. Start the engine.
16. Perform a parked regeneration and monitor DOC outlet temperature and DOC out model delay. Review the last 15 minutes of the regen log file.

17. Is the DOC outlet temperature reading within 117°C (211°F) of the DOC out model delay?

17.a Yes; diagnostics are completed.

17.b No; replace the HC doser block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " . Verify repair.

SPN 5018 (ACM) (GHG17)

339.1 SPN 5018/FMI 18 - GHG17

SPN 5018/FMI 18	
Description	Diesel Oxidation Catalyst (DOC) Efficiency Fault
Monitored Parameter	Exhaust Temperature
Typical Enabling Conditions	Always On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Parked Regen

NOTICE

If a High Idle Regen is started, then aborted within the first 12 minutes, more than two times without shutting down the engine, the Aftertreatment Control Module (ACM) could falsely set SPN 5018/FMI 18; in this case the code can be ignored.

Check as follows:

1. Connect DiagnosticLink Standard.
2. Turn the ignition ON (key ON, engine OFF).
3. Check for active DOC or DPF temperature sensor faults. Are there any DOC or Diesel Particulate Filter (DPF) temperature faults active?
   - 3.a Yes; troubleshoot those faults first.
   - 3.b No; Go to step 4.
4. Inspect the exhaust system for leaks. Are there any leaks found?
   - 4.a Yes; repair as necessary.
   - 4.b No; Go to step 5.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

5. Start the engine.

6. Run service routine "Perform Performance Check-Low Temp ATD".
7. Monitor the Diesel Oxidation Catalyst (DOC) inlet temperature sensor, the DOC outlet temperature sensor, and the Diesel Particulate Filter (DPF) outlet temperature sensor for 20 minutes.
8. After 20 minutes, are the DOC inlet and DOC outlet temperature sensors readings within 42°C (76°F) of the DPF outlet temperature sensor?
   - 8.a Yes; Go to step 12.
   - 8.b No; Go to step 9.
9. Continue running the routine for 5 minutes. Are the temperatures now within 42°C (76°F) of each other?
   - 9.a Yes; Go to step 12.
   - 9.b No; Go to step 10.
10. Stop the "Perform Performance Check-Low Temp ATD" service routine. Shut off the engine.
11. Replace the drifted DOC temperature sensor.

    Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Temperature Sensor"

    Refer to section "Removal of the Diesel Oxidation Catalyst Outlet Temperature Sensor"

    Verify repair.
12. Stop the "Perform Performance Check-Low Temp ATD" service routine. Shut off the engine, then turn the ignition to the ON position.
13. Monitor the DOC inlet pressure sensor voltage. Is the voltage 0.44 to 0.56 volt?
    - 13.a Yes; Go to step 15.
    - 13.b No; Go to step 14.
14. Inspect the DOC inlet pressure sensor electrical connector for corrosion and spread pins. Is there any corrosion or spread pins on electrical connector?
    - 14.a Yes; repair as necessary. Verify repairs.
    - 14.b No; replace the DOC inlet pressure sensor.

      For 1-BOX™, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" . Verify repair.

      For 2-BOX, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Pressure Sensor" . Verify repair.

⚠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.

⚠WARNING

ENGINE EXHAUST

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

⚠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.

15. Start the engine.
16. Perform a parked regeneration and monitor DOC outlet temperature and DOC out model delay. Review the last 15 minutes of the regen log file.
17. Is the DOC outlet temperature reading within 117°C (211°F) of the DOC out model delay?

    17.a Yes; diagnostics are completed.

    17.b No; replace the HC doser block. Refer to section "Removal of the Hydrocarbon Fuel Doser Block " . Verify repair.

340.1 SPN 5298/FMI 14 - GHG17

SPN 5298/FMI 14	
Description	Selective Catalytic Reduction (SCR) Abnormal Temperature Rise
Monitored Parameter	Diesel Particulate Filter (DPF) Outlet Temperature, SCR Outlet Temperature
Typical Enabling Conditions	
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	10 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Parked Regeneration

1. Connect DiagnosticLink .
2. Disconnect the SCR outlet and DPF outlet temperature sensor connectors.
3. Inspect the SCR outlet and DPF outlet temperature sensor harnesses. Are there any signs of bent, spread, or corroded pin(s)?

   3.a Yes; repair as necessary.

   3.b No; Go to step 4.

> **WARNING**
>
> PERSONAL INJURY
>
> To avoid injury from hot surfaces, wear protective gloves, or allow engine to cool before removing any component.

4. Remove the DPF outlet temperature sensor and let the sensor adjust to ambient room temperature. Go to step 5.
5. DPF Temperature Sensor Test - Measure the resistance between pins 1 and 2 of the DPF temperature sensor connectors (refer to chart for resistance values). Is the resistance out of range?

   5.a Yes; replace the sensor.

   5.b No; re-install the sensors. Go to step 6.
6. Remove the SCR outlet temperature sensor and let the sensor adjust to ambient room temperature. Go to step 7.
7. SCR Outlet Sensor Test - Measure the resistance between pins 1 and 2 of the SCR Temperature sensor connectors (refer to chart for resistance values). Is the resistance out of range?

   7.a Yes; replace the sensor.

   7.b No; re-install the sensors. Go to step 8.

Temp - °C	Temp -°F	Range	
		Min Resistance ()	Max Resistance ()
0	32	197.67	207.62
2	35.6	199.20	209.15
4	39.2	200.73	210.67
6	42.8	202.27	212.20
8	46.4	203.80	213.72
10	50	205.33	215.24
12	53.6	206.85	216.77
14	57.2	208.38	218.29
16	60.8	209.91	219.81
18	64.44	211.43	221.33
20	68	212.96	222.85
22	71.6	214.48	224.37
24	75.2	216.01	225.88
26	78.8	217.53	227.40
28	82.4	219.05	228.91
30	86	220.57	230.43
32	89.6	222.09	231.94
34	93.2	223.61	233.45
36	96.8	225.12	234.96
38	100.4	226.64	236.47
40	104	228.16	237.98

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

⚠ 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.

Note : Submit regen log file (if run during diagnostics) with Warranty claim.

8. Start the engine and perform a low temperature Aftertreatment Device (ATD) check using DiagnosticLink to check for a drifted temperature sensor. Refer to section "GHG17 Perform Performance Check - Low Temperature ATD" .
9. Are the DPF outlet and SCR outlet temperatures sensors within 25°C (45°F) during the last five minutes of the routine?

   9.a Yes; clear the fault and release the vehicle. The fault most likely set from built up hydrocarbons in the SCR catalyst burning off after extended idling.

9.b No; replace the drifted SCR temperature sensor and verify repair.

SPN 5298 (ACM) (GHG17)

340.1 SPN 5298/FMI 14 - GHG17

SPN 5298/FMI 14	
Description	Selective Catalytic Reduction (SCR) Abnormal Temperature Rise
Monitored Parameter	Diesel Particulate Filter (DPF) Outlet Temperature, SCR Outlet Temperature
Typical Enabling Conditions	
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	10 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Parked Regeneration

1. Connect DiagnosticLink .
2. Disconnect the SCR outlet and DPF outlet temperature sensor connectors.
3. Inspect the SCR outlet and DPF outlet temperature sensor harnesses. Are there any signs of bent, spread, or corroded pin(s)?

   3.a Yes; repair as necessary.

   3.b No; Go to step 4.

> **WARNING**
>
> PERSONAL INJURY
>
> To avoid injury from hot surfaces, wear protective gloves, or allow engine to cool before removing any component.

4. Remove the DPF outlet temperature sensor and let the sensor adjust to ambient room temperature. Go to step 5.
5. DPF Temperature Sensor Test - Measure the resistance between pins 1 and 2 of the DPF temperature sensor connectors (refer to chart for resistance values). Is the resistance out of range?

   5.a Yes; replace the sensor.

   5.b No; re-install the sensors. Go to step 6.
6. Remove the SCR outlet temperature sensor and let the sensor adjust to ambient room temperature. Go to step 7.
7. SCR Outlet Sensor Test - Measure the resistance between pins 1 and 2 of the SCR Temperature sensor connectors (refer to chart for resistance values). Is the resistance out of range?

   7.a Yes; replace the sensor.

   7.b No; re-install the sensors. Go to step 8.

Temp - °C	Temp -°F	Range	
		Min Resistance ()	Max Resistance ()
0	32	197.67	207.62
2	35.6	199.20	209.15
4	39.2	200.73	210.67
6	42.8	202.27	212.20
8	46.4	203.80	213.72
10	50	205.33	215.24
12	53.6	206.85	216.77
14	57.2	208.38	218.29
16	60.8	209.91	219.81
18	64.44	211.43	221.33
20	68	212.96	222.85
22	71.6	214.48	224.37
24	75.2	216.01	225.88
26	78.8	217.53	227.40
28	82.4	219.05	228.91
30	86	220.57	230.43
32	89.6	222.09	231.94
34	93.2	223.61	233.45
36	96.8	225.12	234.96
38	100.4	226.64	236.47
40	104	228.16	237.98

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

⚠ 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.

Note : Submit regen log file (if run during diagnostics) with Warranty claim.

8. Start the engine and perform a low temperature Aftertreatment Device (ATD) check using DiagnosticLink to check for a drifted temperature sensor. Refer to section "GHG17 Perform Performance Check - Low Temperature ATD" .
9. Are the DPF outlet and SCR outlet temperatures sensors within 25°C (45°F) during the last five minutes of the routine?

   9.a Yes; clear the fault and release the vehicle. The fault most likely set from built up hydrocarbons in the SCR catalyst burning off after extended idling.

9.b No; replace the drifted SCR temperature sensor and verify repair.

341.1 SPN 5319/FMI 14 - GHG17

SPN 5319/FMI 14	
Description	Soot Sensor Fails to Successfully Regenerate and Clear Accumulated Ash
Monitored Parameter	Soot Sensor Heater
Typical Enabling Conditions	Soot Sensor Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Five Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify Repairs by using DiagnosticLink Soot Sensor Panel Inspection Routine

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

Note : When the engine starts, the soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink , check for any communication or voltage fault codes. Are any other fault codes present?

   2.a Yes; repair those fault codes first.

   2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

4.a Yes; repair as necessary. Verify repairs.

4.b No; reconnect the soot sensor. Go to step 5.

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

5. Start the engine.
6. Use the soot sensor panel in DiagnosticLink to check the sensor. Start the service routine and wait until the service routine completes. Did the service routine complete successfully?

6.a Yes; clear the fault and release the vehicle.

6.b No; replace the soot sensor.

Refer to section "Removal of the Soot Sensor"

2V2/2HH Soot Sensor: Refer to section "Removal of the Soot Sensor"

Verify repairs.

SPN 5319 (ACM) (GHG17)

341.1 SPN 5319/FMI 14 - GHG17

SPN 5319/FMI 14	
Description	Soot Sensor Fails to Successfully Regenerate and Clear Accumulated Ash
Monitored Parameter	Soot Sensor Heater
Typical Enabling Conditions	Soot Sensor Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Five Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify Repairs by using DiagnosticLink Soot Sensor Panel Inspection Routine

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

Note : When the engine starts, the soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink , check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.

4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   4.a Yes; repair as necessary. Verify repairs.

   4.b No; reconnect the soot sensor. Go to step 5.

> **⚠ WARNING**
>
> PERSONAL INJURY
>
> Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

> **⚠ 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.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

5. Start the engine.
6. Use the soot sensor panel in DiagnosticLink to check the sensor. Start the service routine and wait until the service routine completes. Did the service routine complete successfully?

   6.a Yes; clear the fault and release the vehicle.

   6.b No; replace the soot sensor.

   Refer to section "Removal of the Soot Sensor"

   2V2/2HH Soot Sensor: Refer to section "Removal of the Soot Sensor"

   Verify repairs.

342.1 SPN 5323/FMI 13 - GHG17

SPN 5323/FMI 13	
Description	Excessive Time to Enter Closed Loop Fuel Pressure Control
Monitored Parameter	Fuel Rail Pressure
Typical Enabling Conditions	Rail Pressure Governor was Previously Operating in Closed Loop Mode
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	15 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle

The Motor Control Module (MCM) monitors the fuel rail pressure. When fuel rail pressure is less than 200 bar, the MCM sets the code. This fault can occur due to the conditions listed below:

- External Fuel Leakage Between the High Pressure Pump and Fuel Injectors
- Pressure Limiting Valve Leakage (Internal)
- Fuel Filter Integrity (Loose Caps, Plugged Filters)
- Fuel Supply Issues (Fuel Level, Fuel Aeration, Leaking Fuel Lines, Fuel Restrictions)
- Intermittent Loss of Engine Speed Signal
- High Pressure Pump Internal Failure
- Fuel Injector (Amplifier or Needle) Leakage
- Fuel Contamination
- Rail Pressure Sensor
- Motor Control Module (MCM)

Service Tools Used in the Procedure	
Tool Number	Description
J-48876	Test Gauge, Primer Port, HDE
J-48704	Caps, HP Fuel Rail, HDE
DiagnosticLink Standard	

Note : It is important to obtain information from the customer on when the Check Engine lamp occurs and if there were any performance concerns or exhaust smoke.

Check as follows:

1. Did SPN 157/FMI 16, SPN 5323/FMI 13, or SPN 520268/FMI 18 appear after the fuel system was repaired or fuel filter maintenance was performed?

   1.a Yes; the code may be set due to air in the fuel system. Clear codes and road test to verify complaint. If code does not set, release the vehicle. If code sets, Go to step 2.

   1.b No; Go to step 2.

2. Turn the ignition ON (key ON, engine OFF).
3. Check and record fuel level using parameter AS044 Fuel Tank Level. Is the fuel level under ¼ tank (25%)?

   3.a Yes; add fuel and road test vehicle. If code does not become active during road test, release the truck. If the code becomes active during the road test with over ¼ tank (25%) of fuel, Go to step 5.

   3.b No; Go to step 4.

4. Check fuel tank level in extended fault code data. Was fuel tank level over ¼ tank (25%) when the code logged?

   4.a Yes; Go to step 5.

   4.b No; fuel sloshing in the tank may have caused aerated fuel and set this code. Road test vehicle; if code does not come active during road test, release the truck. If code does come active, Go to step 5.

5. Check for fuel contamination, including Diesel Exhaust Fluid (DEF), water, gasoline, kerosene, coolant. Is any contamination found?

   5.a Yes; refer to the "Contaminated Fluids" section of this manual.

   5.b No; Go to step 6.

6. Visually inspect for external fuel leaks on the engine and on the chassis. Are any leaks found?

   6.a Yes; repair leak(s). Verify repairs.

   6.b No; Go to step 7.

7. Using DiagnosticLink 8.03 or higher, check for other active codes. Are any of the following codes active?

   7.a Yes; perform the associated diagnostics first:

- SPN 94/FMI 15 Fuel Filter Plugged
- SPN 94/FMI 16 Fuel Filter Plugged
- SPN 97/FMI 15 Water in the Fuel
- SPN 157/FMI 1 Rail Pressure Too High
- SPN 164/FMI (All) Rail Pressure Sensor Faults
- SPN 174/FMI 0 Fuel Temperature Too High
- SPN 679/FMI 7 PLV Stuck Open
- SPN 723/FMI (All) Cam Sensor Codes
- SPN 636/FMI (All) Crank Sensor Codes
- SPN 1077/FMI 5, 6 or 14

   7.b No; only SPN 1077/FMI 7, 157/FMI 16 or 1077/FMI 31 is present. Go to step 8.

Note : Do not reset this counter unless the PLV is being replaced.

8. Using DiagnosticLink 8.03 or higher, check the value of Pressure Limiting Valve (PLV) openings. With key ON, engine OFF, select the Actions tab in the top tool bar. Select Fuel System, then Pressure Limiting Valve (PLV). Change or view (RPG_CTR_PLV_OPEN) under "Extended Data Record #5" list. View and record the PLV open counts. Is the counter greater than 50?

   8.a Yes; replace the PLV. Refer to section "Removal of the Pressure Limiting Valve - Two-Filter System" . Verify repairs.

   8.b No; Go to step 9.

9. Perform Automatic Fuel System Integrity Check (FSIC) routine using DiagnosticLink 8.03 or higher. With key ON, Engine OFF, start the Automatic FSIC. The software/tool will ask to start the engine when required. Once the engine is running, the software will have the engine enter and exit several engine operating conditions. Once the engine shuts down, leave the key on for five minutes. Disconnect DiagnosticLink and open the log file. The next steps of the troubleshooting will require reviewing the FSIC log file.

10. Monitor rail pressure bleed-off time. Is bleed off time below 35 seconds?

    10.a Yes; Refer to section "High Pressure Fuel System - Leak Test - Two-Filter System" .

    10.b No; Go to step 11.

11. In the previous step, was bleed off time greater than two minutes and 30 seconds?

    11.a Yes; Refer to section "Idle Speed Balance Test" .

    11.b No; Go to step 12.

12. Does Kw/Nw show/stay "ON / Enabled / True" while the engine is running during the Automatic FSIC routine?

    12.a Yes; Go to step 13.

12.b No; Refer to section "SPN 723/FMI 10 - GHG17" .

13. Was the fuel temperature rise greater than 5.56 °C (10°F) degrees?

13.a Yes; Go to step 15.

13.b No; Go to step 14.

14. At 600 rpm, is ASL003 Fuel Compensation Pressure between 586 kPa (85 psi) and 689 kPa (100 psi)?

14.a Yes; Go to step 16.

14.b No; Go to step 15.

15. Monitor AS124 LPPO sensor. Is the fuel pressure between 496 kPa (72 psi) and 551 kPa (80 psi) at 600 rpm and 689 kPa (100 psi) to 869 kPa (126 psi) at 1800 rpm?

15.a Yes; Go to step 16.

15.b No; repair cause of incorrect fuel pressure.

16. Monitor AS124 LPPO (if equipped) and ASL003 Fuel Compensation Pressure at all engine speeds; are pressures stable with no oscillations? Unstable pressures will have oscillations greater than 10.3 kPa (1.5 psi) at stable engine speed.

16.a Yes; Go to step 17.

16.b No; Refer to section "Aerated Fuel Test – Two-Filter Fuel System" .

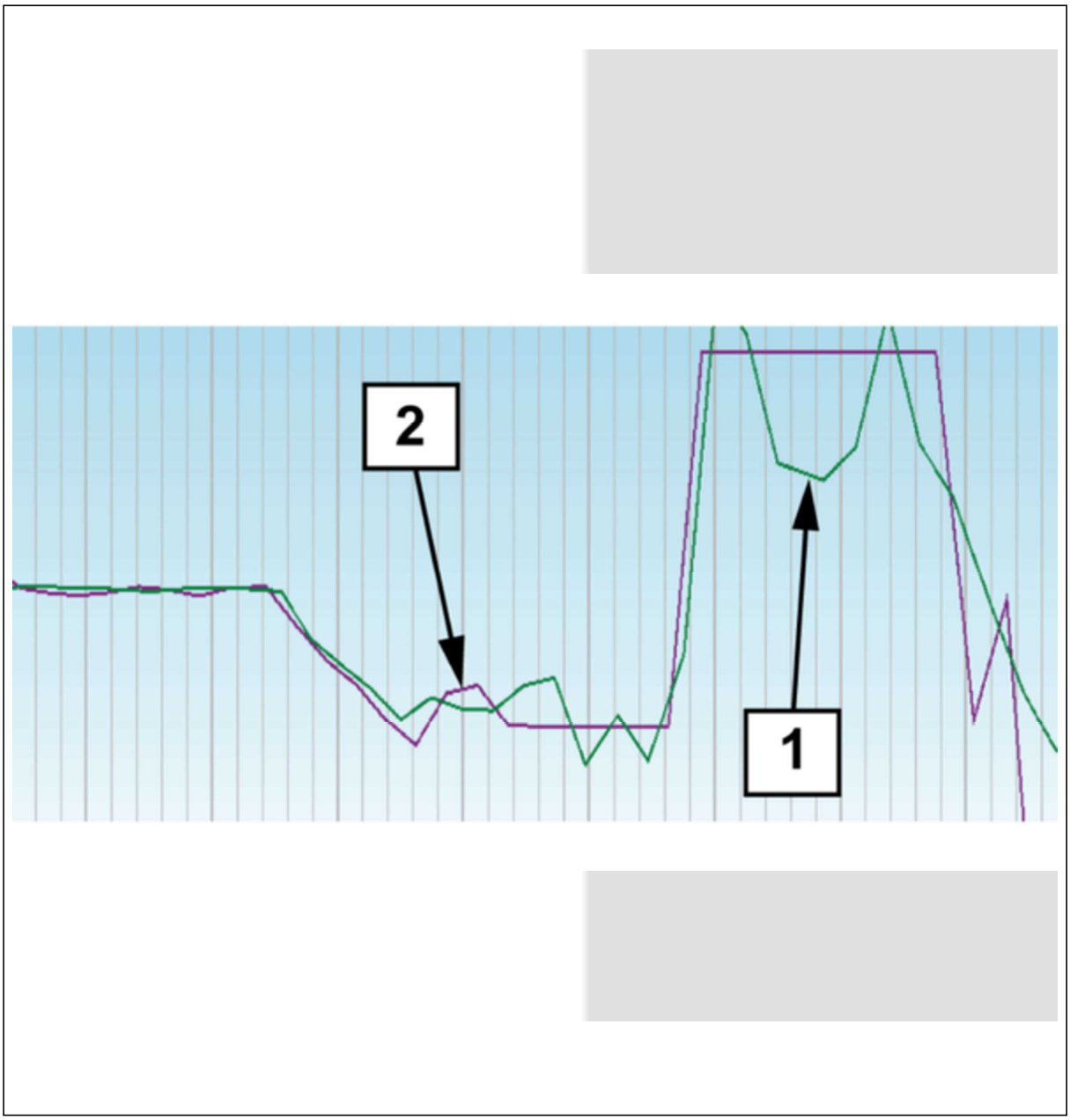
17. Check the Idle Speed Balance (ISB) Values. Refer to section "Idle Speed Balance Test" . Are there any cylinders above 70% or below -70%?

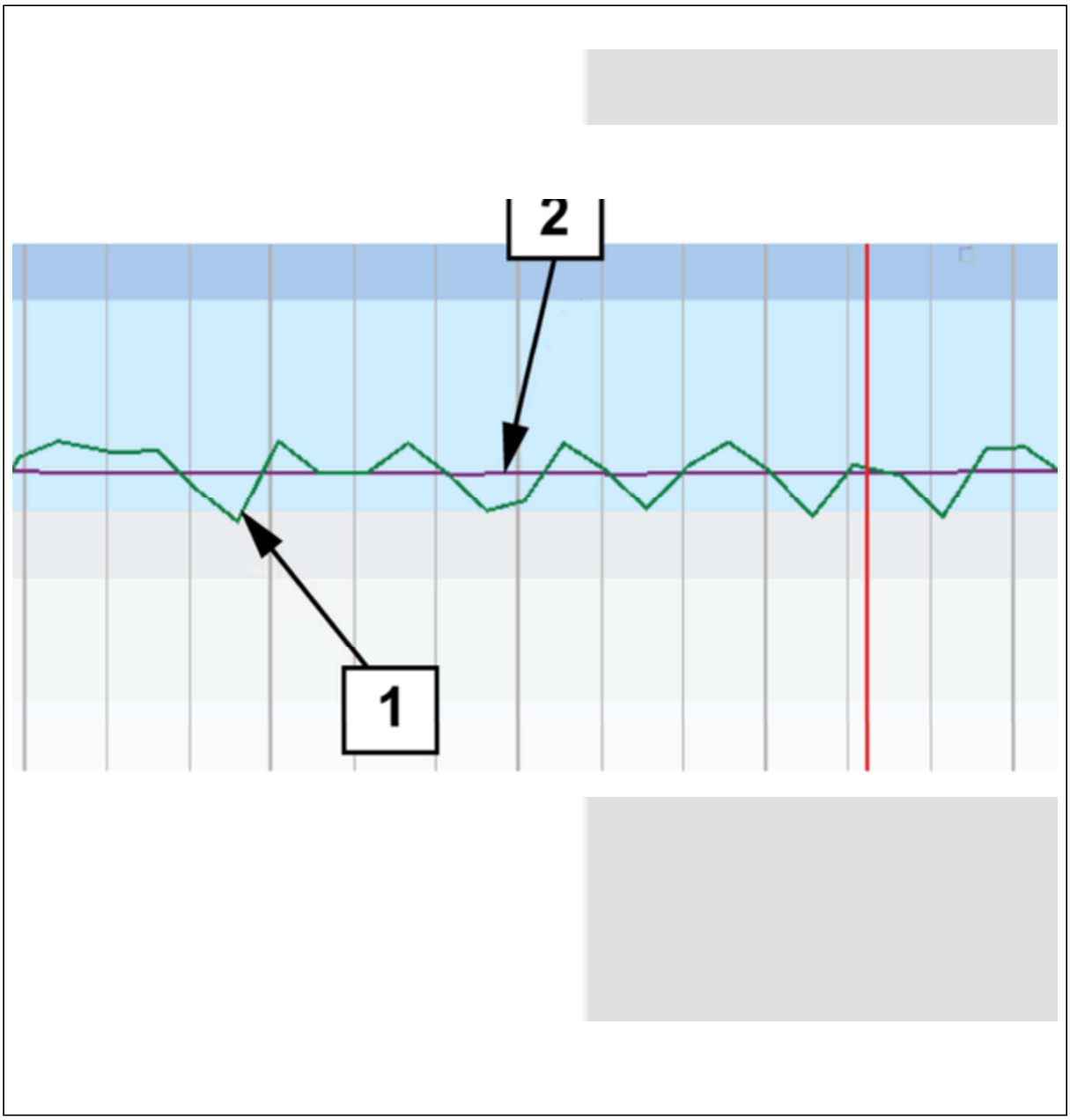
17.a Yes; follow repair procedures in " Idle Speed Balance (ISB) Test" and verify repairs. Refer to section "Verify Repairs" .

17.b No; Go to step 18.

Note : See examples of erratic pressure showing (1) ASL001 Rail pressure and (2) AS098 Desired rail pressure.

18. Is ASL001 Rail Pressure erratic or does it have a saw-tooth pattern?


2
1



18.a Yes; Go to step 19.

18.b No; Go to step 20.

19. Perform the aerated fuel test. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was fuel aerated?

19.a Yes; repair cause of aerated fuel. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" .

19.b No; replace the Quantity Control Valve. Refer to section "Removal of the Quantity Control Valve - Two-Filter System" .

20. Perform Pressure Limiting Valve (PLV) flow test. Refer to section "Pressure Limiting Valve Flow Test – Two-Filter Fuel System" . Did the PLV flow test pass?

20.a Yes; Go to step 21.

20.b No; replace the PLV. Refer to section "Removal of the Pressure Limiting Valve - Two-Filter System" .

21. Inspect the low pressure fuel system for leaks. Refer to section "FIS Low Pressure Leak Test" . Did the low pressure leak test pass?

21.a Yes; Go to step 22.

NOTICE

Prime fuel system prior to going to next step. Refer to section "Priming the Fuel System - KM63 GEN2 - Two-Filter System".

21.b No; repair as necessary. Refer to section "FIS Low Pressure Leak Test" .

22. Cap the rail at all six injector feed connections using J-48704 injector rail caps and crank the engine for 10 seconds. Does the ASL001 rail pressure reach AS098 desired rail pressure?

22.a Yes; Go to step 23.

22.b No; replace high pressure pump. Refer to section "Removal of the High Pressure Fuel Pump - Two-Filter System" .

23. With the injectors still capped after cranking engine for 10 seconds, does the rail pressure bleed down under 100 bar in less than five minutes?

23.a Yes; replace the high pressure fuel pump.

23.b No; Go to step 24.

24. Using DiagnosticLink 8.03 or higher, navigate to Service Routines and Fuel System Integrity Check test and select Manual FSIC. Road test the truck. Does the code set?

24.a Yes; Go to step 25.

24.b No; replace fuel filters and release unit to customer.

25. Remove the MCM 120-pin connector. Inspect for damage including fuel, water corrosion or bent terminals. Is damage found?

25.a Yes; repair as needed.

25.b No; Go to step 26.

26. Install a test MCM using the extension harness and test drive the truck. Does the code come active?

26.a Yes; install original MCM. Go to step 27.

26.b No; replace MCM and verify repair.

27. Inspect chassis fuel system for restrictions or debris. Refer to OEM Procedures. Is there a chassis fuel system issue?

27.a Yes; identify source of issue and repair as necessary.

27.b No; replace fuel filters and release to customer.

SPN 5323 (MCM) (GHG17)

342.1 SPN 5323/FMI 13 - GHG17

SPN 5323/FMI 13	
Description	Excessive Time to Enter Closed Loop Fuel Pressure Control
Monitored Parameter	Fuel Rail Pressure
Typical Enabling Conditions	Rail Pressure Governor was Previously Operating in Closed Loop Mode
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	15 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle

The Motor Control Module (MCM) monitors the fuel rail pressure. When fuel rail pressure is less than 200 bar, the MCM sets the code. This fault can occur due to the conditions listed below:

- External Fuel Leakage Between the High Pressure Pump and Fuel Injectors
- Pressure Limiting Valve Leakage (Internal)
- Fuel Filter Integrity (Loose Caps, Plugged Filters)
- Fuel Supply Issues (Fuel Level, Fuel Aeration, Leaking Fuel Lines, Fuel Restrictions)
- Intermittent Loss of Engine Speed Signal
- High Pressure Pump Internal Failure
- Fuel Injector (Amplifier or Needle) Leakage
- Fuel Contamination
- Rail Pressure Sensor
- Motor Control Module (MCM)

Service Tools Used in the Procedure	
Tool Number	Description
J-48876	Test Gauge, Primer Port, HDE
J-48704	Caps, HP Fuel Rail, HDE
DiagnosticLink Standard	

Note : It is important to obtain information from the customer on when the Check Engine lamp occurs and if there were any performance concerns or exhaust smoke.

Check as follows:

1. Did SPN 157/FMI 16, SPN 5323/FMI 13, or SPN 520268/FMI 18 appear after the fuel system was repaired or fuel filter maintenance was performed?

   1.a Yes; the code may be set due to air in the fuel system. Clear codes and road test to verify complaint. If code does not set, release the vehicle. If code sets, Go to step 2.

   1.b No; Go to step 2.

2. Turn the ignition ON (key ON, engine OFF).
3. Check and record fuel level using parameter AS044 Fuel Tank Level. Is the fuel level under ¼ tank (25%)?

   3.a Yes; add fuel and road test vehicle. If code does not become active during road test, release the truck. If the code becomes active during the road test with over ¼ tank (25%) of fuel, Go to step 5.

3.b No; Go to step 4.

4. Check fuel tank level in extended fault code data. Was fuel tank level over ¼ tank (25%) when the code logged?

   4.a Yes; Go to step 5.

   4.b No; fuel sloshing in the tank may have caused aerated fuel and set this code. Road test vehicle; if code does not come active during road test, release the truck. If code does come active, Go to step 5.

5. Check for fuel contamination, including Diesel Exhaust Fluid (DEF), water, gasoline, kerosene, coolant. Is any contamination found?

   5.a Yes; refer to the "Contaminated Fluids" section of this manual.

   5.b No; Go to step 6.

6. Visually inspect for external fuel leaks on the engine and on the chassis. Are any leaks found?

   6.a Yes; repair leak(s). Verify repairs.

   6.b No; Go to step 7.

7. Using DiagnosticLink 8.03 or higher, check for other active codes. Are any of the following codes active?

   7.a Yes; perform the associated diagnostics first:

- SPN 94/FMI 15 Fuel Filter Plugged
- SPN 94/FMI 16 Fuel Filter Plugged
- SPN 97/FMI 15 Water in the Fuel
- SPN 157/FMI 1 Rail Pressure Too High
- SPN 164/FMI (All) Rail Pressure Sensor Faults
- SPN 174/FMI 0 Fuel Temperature Too High
- SPN 679/FMI 7 PLV Stuck Open
- SPN 723/FMI (All) Cam Sensor Codes
- SPN 636/FMI (All) Crank Sensor Codes
- SPN 1077/FMI 5, 6 or 14

   7.b No; only SPN 1077/FMI 7, 157/FMI 16 or 1077/FMI 31 is present. Go to step 8.

Note : Do not reset this counter unless the PLV is being replaced.

8. Using DiagnosticLink 8.03 or higher, check the value of Pressure Limiting Valve (PLV) openings. With key ON, engine OFF, select the Actions tab in the top tool bar. Select Fuel System, then Pressure Limiting Valve (PLV). Change or view (RPG_CTR_PLV_OPEN) under "Extended Data Record #5" list. View and record the PLV open counts. Is the counter greater than 50?

   8.a Yes; replace the PLV. Refer to section "Removal of the Pressure Limiting Valve - Two-Filter System" . Verify repairs.

   8.b No; Go to step 9.

9. Perform Automatic Fuel System Integrity Check (FSIC) routine using DiagnosticLink 8.03 or higher. With key ON, Engine OFF, start the Automatic FSIC. The software/tool will ask to start the engine when required. Once the engine is running, the software will have the engine enter and exit several engine operating conditions. Once the engine shuts down, leave the key on for five minutes. Disconnect DiagnosticLink and open the log file. The next steps of the troubleshooting will require reviewing the FSIC log file.

10. Monitor rail pressure bleed-off time. Is bleed off time below 35 seconds?

    10.a Yes; Refer to section "High Pressure Fuel System - Leak Test - Two-Filter System" .

    10.b No; Go to step 11.

11. In the previous step, was bleed off time greater than two minutes and 30 seconds?

    11.a Yes; Refer to section "Idle Speed Balance Test" .

    11.b No; Go to step 12.

12. Does Kw/Nw show/stay "ON / Enabled / True" while the engine is running during the Automatic FSIC routine?

12.a Yes; Go to step 13.

12.b No; Refer to section "SPN 723/FMI 10 - GHG17" .

13. Was the fuel temperature rise greater than 5.56 °C (10°F) degrees?

13.a Yes; Go to step 15.

13.b No; Go to step 14.

14. At 600 rpm, is ASL003 Fuel Compensation Pressure between 586 kPa (85 psi) and 689 kPa (100 psi)?

14.a Yes; Go to step 16.

14.b No; Go to step 15.

15. Monitor AS124 LPPO sensor. Is the fuel pressure between 496 kPa (72 psi) and 551 kPa (80 psi) at 600 rpm and 689 kPa (100 psi) to 869 kPa (126 psi) at 1800 rpm?

15.a Yes; Go to step 16.

15.b No; repair cause of incorrect fuel pressure.

16. Monitor AS124 LPPO (if equipped) and ASL003 Fuel Compensation Pressure at all engine speeds; are pressures stable with no oscillations? Unstable pressures will have oscillations greater than 10.3 kPa (1.5 psi) at stable engine speed.

16.a Yes; Go to step 17.

16.b No; Refer to section "Aerated Fuel Test – Two-Filter Fuel System" .

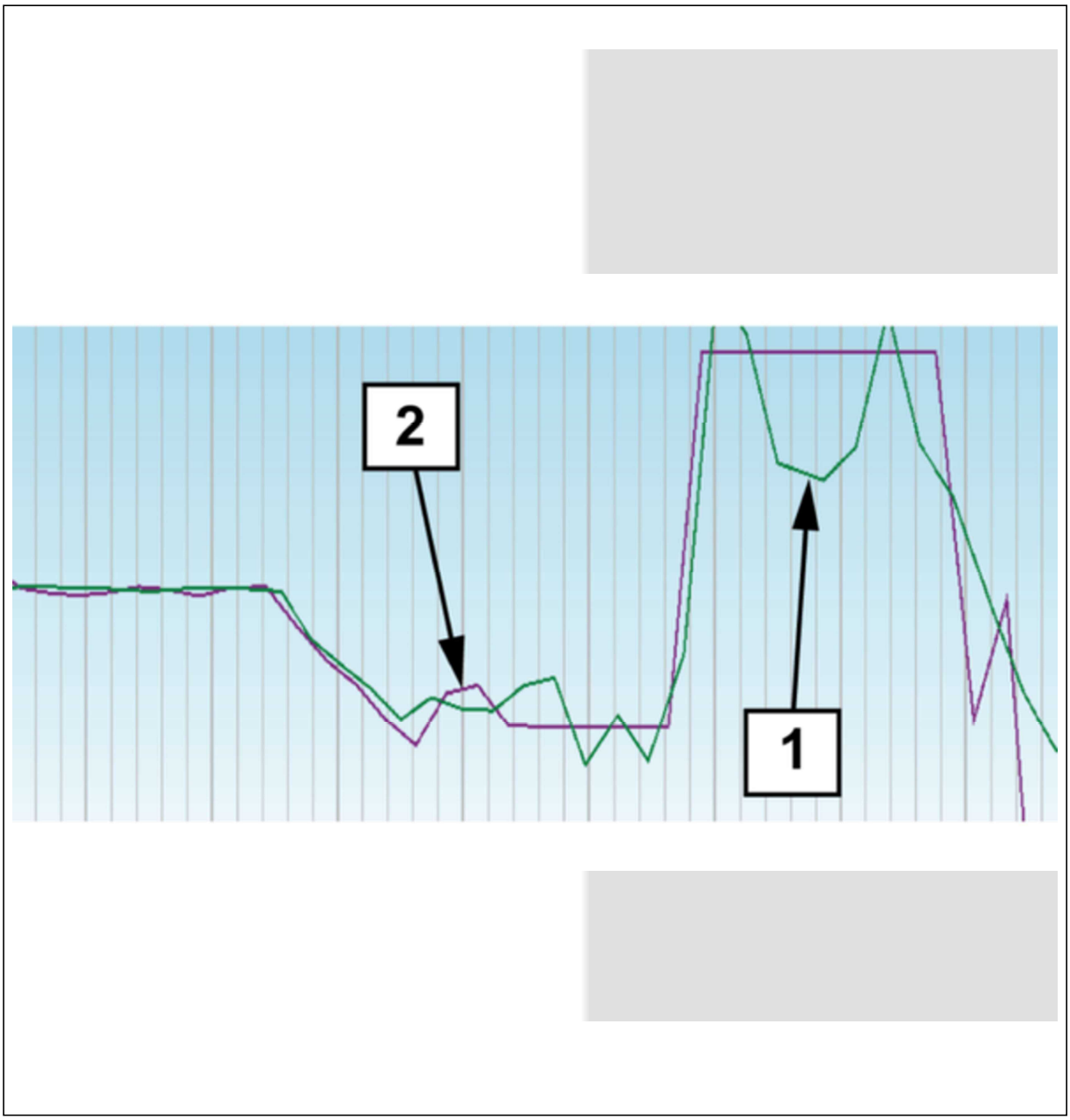
17. Check the Idle Speed Balance (ISB) Values. Refer to section "Idle Speed Balance Test" . Are there any cylinders above 70% or below -70%?

17.a Yes; follow repair procedures in " Idle Speed Balance (ISB) Test" and verify repairs. Refer to section "Verify Repairs" .

17.b No; Go to step 18.

Note : See examples of erratic pressure showing (1) ASL001 Rail pressure and (2) AS098 Desired rail pressure.

18. Is ASL001 Rail Pressure erratic or does it have a saw-tooth pattern?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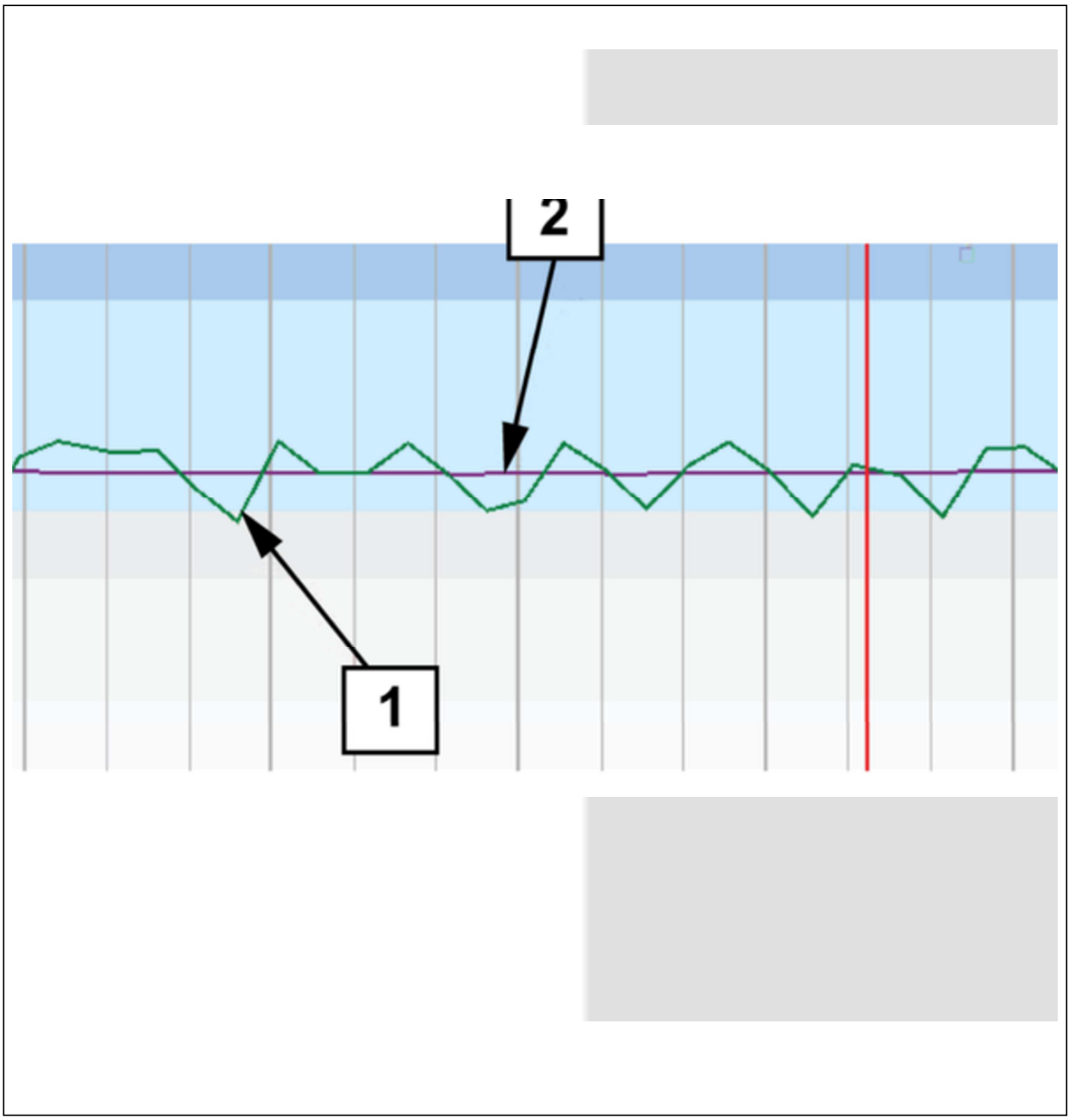


18.a Yes; Go to step 19.

18.b No; Go to step 20.

19. Perform the aerated fuel test. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was fuel aerated?

19.a Yes; repair cause of aerated fuel. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" .

19.b No; replace the Quantity Control Valve. Refer to section "Removal of the Quantity Control Valve - Two-Filter System" .

20. Perform Pressure Limiting Valve (PLV) flow test. Refer to section "Pressure Limiting Valve Flow Test – Two-Filter Fuel System" . Did the PLV flow test pass?

20.a Yes; Go to step 21.

20.b No; replace the PLV. Refer to section "Removal of the Pressure Limiting Valve - Two-Filter System" .

21. Inspect the low pressure fuel system for leaks. Refer to section "FIS Low Pressure Leak Test" . Did the low pressure leak test pass?

21.a Yes; Go to step 22.

NOTICE

Prime fuel system prior to going to next step. Refer to section "Priming the Fuel System - KM63 GEN2 - Two-Filter System".

21.b No; repair as necessary. Refer to section "FIS Low Pressure Leak Test" .

22. Cap the rail at all six injector feed connections using J-48704 injector rail caps and crank the engine for 10 seconds. Does the ASL001 rail pressure reach AS098 desired rail pressure?

22.a Yes; Go to step 23.

22.b No; replace high pressure pump. Refer to section "Removal of the High Pressure Fuel Pump - Two-Filter System" .

23. With the injectors still capped after cranking engine for 10 seconds, does the rail pressure bleed down under 100 bar in less than five minutes?

23.a Yes; replace the high pressure fuel pump.

23.b No; Go to step 24.

24. Using DiagnosticLink 8.03 or higher, navigate to Service Routines and Fuel System Integrity Check test and select Manual FSIC. Road test the truck. Does the code set?

24.a Yes; Go to step 25.

24.b No; replace fuel filters and release unit to customer.

25. Remove the MCM 120-pin connector. Inspect for damage including fuel, water corrosion or bent terminals. Is damage found?

25.a Yes; repair as needed.

25.b No; Go to step 26.

26. Install a test MCM using the extension harness and test drive the truck. Does the code come active?

26.a Yes; install original MCM. Go to step 27.

26.b No; replace MCM and verify repair.

27. Inspect chassis fuel system for restrictions or debris. Refer to OEM Procedures. Is there a chassis fuel system issue?

27.a Yes; identify source of issue and repair as necessary.

27.b No; replace fuel filters and release to customer.

343.1 SPN 5357/FMI 16 - GHG17

SPN 5357/FMI 16	
Description	Fuel Quantity High Detected
Monitored Parameter	Injector Quantity
Typical Enabling Conditions	Steady State Drive and No Regen
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Minutes
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Steady Engine rpm 1400 to 1500 (Two Minute)

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Are any other fault codes present?
   - 3.a Yes; repair other faults first.
   - 3.b No; Go to step 4.
4. Monitor the intake manifold temperature; is the intake manifold temperature reading greater than 65°C (150°F)?
   - 4.a Yes; replace the intake manifold temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .
   - 4.b No; Go to step 5.
5. Disconnect the intake manifold temperature sensor harness.
6. Inspect the intake manifold temperature sensor harness connector for bent, spread or corroded pins. Is damage found?
   - 6.a Yes; replace the intake manifold temperature sensor harness connector and intake manifold temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .
   - 6.b No; Go to step 7.
7. Compare intake manifold pressure to atmospheric (Baro) pressure. Is the intake manifold pressure within 0.4 psi of Baro pressure?
   - 7.a Yes; Go to step 8.
   - 7.b No; replace the intake manifold pressure sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" .
8. Monitor the Exhaust Gas Recirculation (EGR) delta P voltage (pin 109). Is the EGR delta P voltage between 0.55 and 0.83 volts?
   - 8.a Yes; Go to step 11.
   - 8.b No; Go to step 9.
9. Remove the EGR delta P sensor from the mounting pad; leave electrical harness connected. Refer to section "Removal of the Delta P Sensor" .
10. Is the EGR delta P voltage between 0.55 and 0.83 volts?
    - 10.a Yes; Go to step 11.
    - 10.b No; replace the EGR delta P sensor. Refer to section "Removal of the Delta P Sensor" .
11. Visually inspect the entire EGR system for evidence of external leakage (e.g. soot, coolant deposits at joints). Is external leakage found?
    - 11.a Yes; repair as necessary.
    - 11.b No; Go to step 12.

12. Remove the EGR cooler hot pipe, EGR crossover pipe and delivery pipe and inspect for excessive build up or blockage. Is excessive build up or blockage found?

    Refer to section "Removal of the Exhaust Gas Recirculation Hot Pipe" .

    Refer to section "Removal of the Exhaust Gas Recirculation Crossover Tube.

    12.a Yes; clean piping and replace the EGR cooler.

    For the DD13: Refer to section "Removal of the DD13 Exhaust Gas Recirculation Cooler Water Manifold Assembly" .

    For the DD15 and DD16: Refer to section "Removal of the DD15 and DD16 Exhaust Gas Recirculation Cooler" .

    12.b No; Go to step 13.

13. Visually inspect the entire exhaust system for leaks, specifically between the turbocharger outlet and the Aftertreatment Device (ATD) inlet for leaks or damage. Are and leaks or damage found?

    13.a Yes; repair as necessary.

    13.b No; Go to step 14.

14. Inspect the entire air intake system (including clamps) for signs of leaks or damage. Are and leaks or damage found?

    14.a Yes; repair as necessary.

    14.b No; Go to step 15.

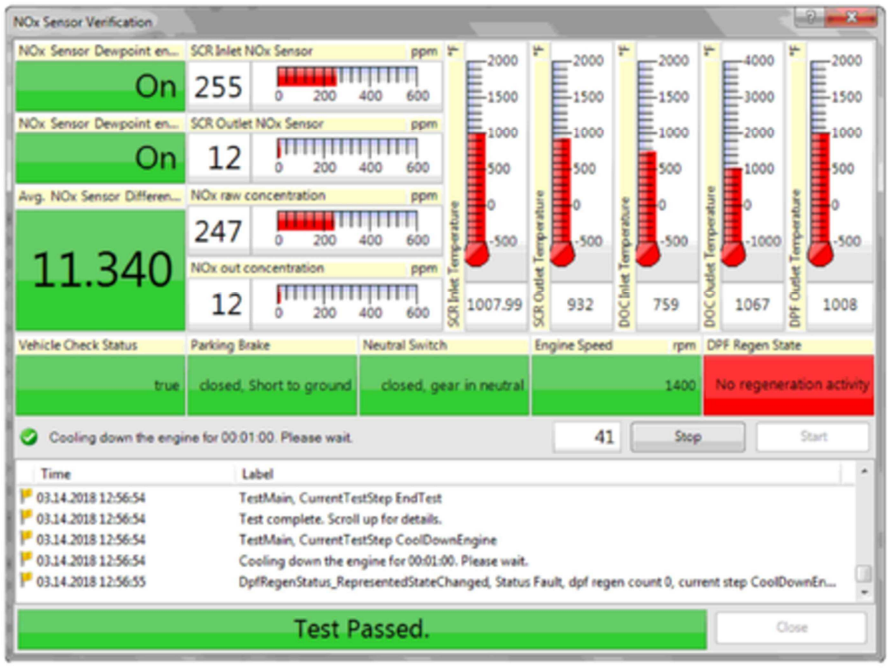
15. Leak check the Charge Air Cooler (CAC); refer to OEM literature for procedure. Does check pass?

    15.a Yes; repair as necessary.

    15.b No; Go to step 16.

> **⚠ 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. Start engine, using Diagnostic Link run the NOx Sensor Verification test located in the drop down menu under Actions / Aftertreatment.



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17. If the NOx Sensor Verification Panel test fails, replace the Inlet NOx sensor.
    For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .
    For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

343.2 SPN 5357/FMI 18 - GHG17

SPN 5357/FMI 18	
Description	Fuel Quantity Low Detected
Monitored Parameter	Injector Quantity
Typical Enabling Conditions	Steady State Drive and No Regen
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Minutes
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Steady Engine rpm 1400 to 1500 (Two Minutes)

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Are any other fault codes present?
   - 3.a Yes; repair other faults first.
   - 3.b No; Go to step 4.
4. Monitor the intake manifold temperature; is the intake manifold temperature reading greater than 65°C (150°F)?
   - 4.a Yes; replace the intake manifold temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .
   - 4.b No; Go to step 5.
5. Disconnect the intake manifold temperature sensor harness.
6. Inspect the intake manifold temperature sensor harness connector for bent, spread or corroded pins. Is pin damage found?
   - 6.a Yes; replace the intake manifold temperature sensor harness connector and intake manifold temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .
   - 6.b No; Go to step 7.
7. Compare intake manifold pressure to atmospheric (Baro) pressure. Is the intake manifold pressure within 0.4 psi of Baro pressure?
   - 7.a Yes; Go to step 8.
   - 7.b No; replace the intake manifold pressure sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" .
8. Monitor the Exhaust Gas Recirculation (EGR) delta P voltage (pin 109). Is the EGR delta P voltage between 0.55 and 0.83 volts?
   - 8.a Yes; Go to step 11.
   - 8.b No; Go to step 9.
9. Remove the EGR delta P sensor from the mounting pad; leave electrical harness connected. Refer to section "Removal of the Delta P Sensor" .
10. Is the EGR delta P voltage between 0.55 and 0.83 volts?
    - 10.a Yes; Go to step 11.
    - 10.b No; replace the EGR delta P sensor. Refer to section "Removal of the Delta P Sensor" .
11. Visually inspect the entire EGR system for evidence of external leakage (e.g. soot, coolant deposits at joints). Is external leakage found?
    - 11.a Yes; repair as necessary.

11.b No; Go to step 12.

12. Remove the EGR cooler hot pipe, EGR crossover pipe and delivery pipe and inspect for excessive build up or blockage. Is excessive build up or blockage found?

    Refer to section "Removal of the Exhaust Gas Recirculation Hot Pipe" .

    Refer to section "Removal of the Exhaust Gas Recirculation Crossover Tube."

    12.a Yes; clean piping and replace the EGR cooler.

        For the DD13: Refer to section "Removal of the DD13 Exhaust Gas Recirculation Cooler Water Manifold Assembly" .

        For the DD15 and DD16: Refer to section "Removal of the DD15 and DD16 Exhaust Gas Recirculation Cooler" .

    12.b No; Go to step 13.

13. Visually inspect the entire exhaust system for leaks, specifically between the turbocharger outlet and the Aftertreatment Device (ATD) inlet for leaks or damage. Are any leaks or damage found?

    13.a Yes; repair as necessary.

    13.b No; Go to step 14.

14. Inspect the entire air intake system (including clamps) for signs of leaks or damage. Are any leaks or damage found?

    14.a Yes; repair as necessary.

    14.b No; Go to step 15.

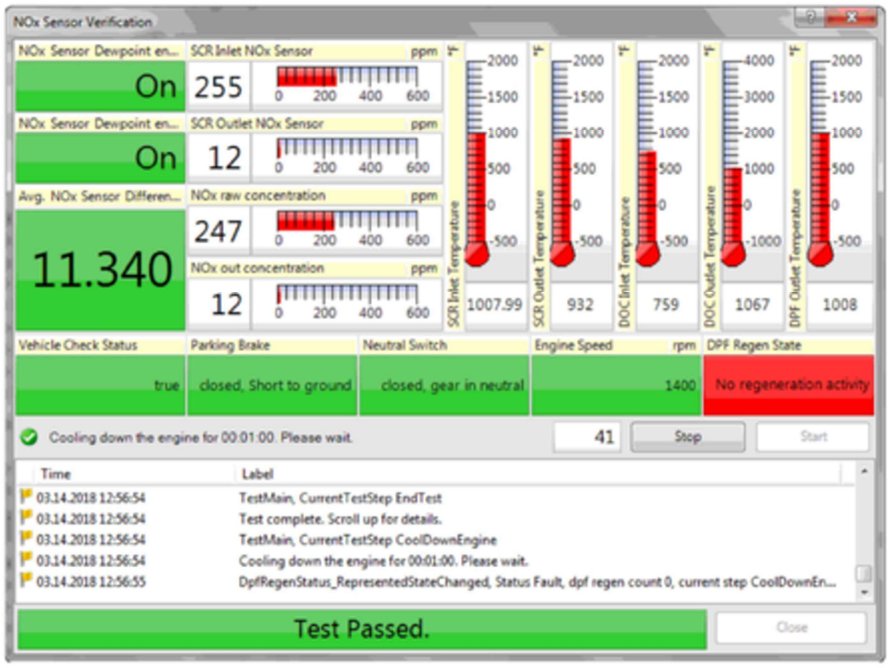
15. Leak check the Charge Air Cooler (CAC); refer to OEM literature for procedure. Does check pass?

    15.a Yes; repair as necessary.

    15.b No; Go to step 16.

> **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. Start engine, using Diagnostic Link run the NOx Sensor Verification test located in the drop down menu under Actions / Aftertreatment.



17. If the NOx Sensor Verification test fails, replace the Inlet NOx sensor.
    For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .
    For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

343.1 SPN 5357/FMI 16 - GHG17

SPN 5357/FMI 16	
Description	Fuel Quantity High Detected
Monitored Parameter	Injector Quantity
Typical Enabling Conditions	Steady State Drive and No Regen
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Minutes
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Steady Engine rpm 1400 to 1500 (Two Minute)

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Are any other fault codes present?
   - 3.a Yes; repair other faults first.
   - 3.b No; Go to step 4.
4. Monitor the intake manifold temperature; is the intake manifold temperature reading greater than 65°C (150°F)?
   - 4.a Yes; replace the intake manifold temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .
   - 4.b No; Go to step 5.
5. Disconnect the intake manifold temperature sensor harness.
6. Inspect the intake manifold temperature sensor harness connector for bent, spread or corroded pins. Is damage found?
   - 6.a Yes; replace the intake manifold temperature sensor harness connector and intake manifold temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .
   - 6.b No; Go to step 7.
7. Compare intake manifold pressure to atmospheric (Baro) pressure. Is the intake manifold pressure within 0.4 psi of Baro pressure?
   - 7.a Yes; Go to step 8.
   - 7.b No; replace the intake manifold pressure sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" .
8. Monitor the Exhaust Gas Recirculation (EGR) delta P voltage (pin 109). Is the EGR delta P voltage between 0.55 and 0.83 volts?
   - 8.a Yes; Go to step 11.
   - 8.b No; Go to step 9.
9. Remove the EGR delta P sensor from the mounting pad; leave electrical harness connected. Refer to section "Removal of the Delta P Sensor" .
10. Is the EGR delta P voltage between 0.55 and 0.83 volts?
    - 10.a Yes; Go to step 11.
    - 10.b No; replace the EGR delta P sensor. Refer to section "Removal of the Delta P Sensor" .
11. Visually inspect the entire EGR system for evidence of external leakage (e.g. soot, coolant deposits at joints). Is external leakage found?
    - 11.a Yes; repair as necessary.
    - 11.b No; Go to step 12.

12. Remove the EGR cooler hot pipe, EGR crossover pipe and delivery pipe and inspect for excessive build up or blockage. Is excessive build up or blockage found?

    Refer to section "Removal of the Exhaust Gas Recirculation Hot Pipe" .

    Refer to section "Removal of the Exhaust Gas Recirculation Crossover Tube.

    12.a Yes; clean piping and replace the EGR cooler.

    For the DD13: Refer to section "Removal of the DD13 Exhaust Gas Recirculation Cooler Water Manifold Assembly" .

    For the DD15 and DD16: Refer to section "Removal of the DD15 and DD16 Exhaust Gas Recirculation Cooler" .

    12.b No; Go to step 13.

13. Visually inspect the entire exhaust system for leaks, specifically between the turbocharger outlet and the Aftertreatment Device (ATD) inlet for leaks or damage. Are and leaks or damage found?

    13.a Yes; repair as necessary.

    13.b No; Go to step 14.

14. Inspect the entire air intake system (including clamps) for signs of leaks or damage. Are and leaks or damage found?

    14.a Yes; repair as necessary.

    14.b No; Go to step 15.

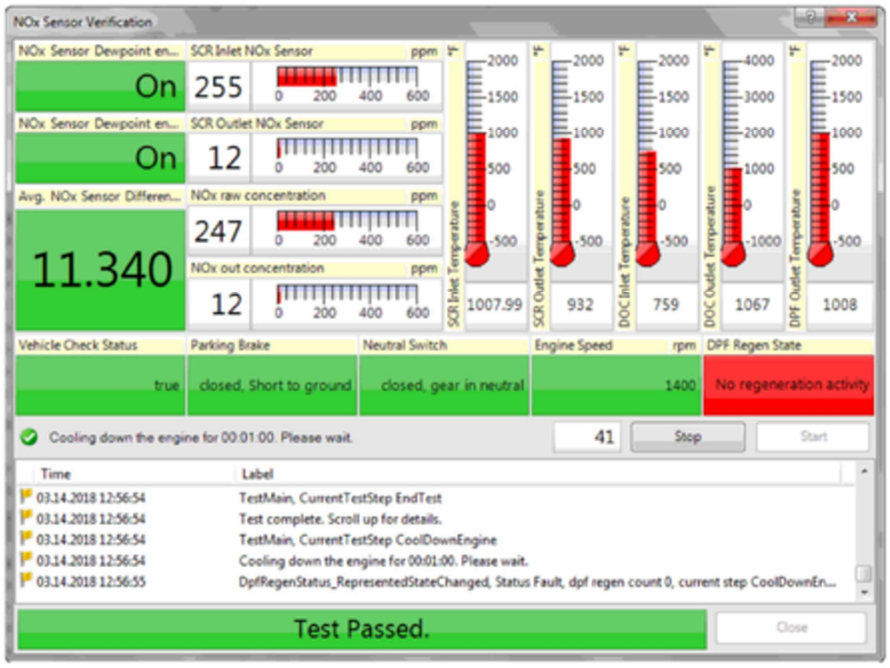
15. Leak check the Charge Air Cooler (CAC); refer to OEM literature for procedure. Does check pass?

    15.a Yes; repair as necessary.

    15.b No; Go to step 16.

> **⚠ 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. Start engine, using Diagnostic Link run the NOx Sensor Verification test located in the drop down menu under Actions / Aftertreatment.



17. If the NOx Sensor Verification Panel test fails, replace the Inlet NOx sensor.
    For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .
    For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

343.2 SPN 5357/FMI 18 - GHG17

SPN 5357/FMI 18	
Description	Fuel Quantity Low Detected
Monitored Parameter	Injector Quantity
Typical Enabling Conditions	Steady State Drive and No Regen
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Minutes
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Steady Engine rpm 1400 to 1500 (Two Minutes)

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Are any other fault codes present?
   - 3.a Yes; repair other faults first.
   - 3.b No; Go to step 4.
4. Monitor the intake manifold temperature; is the intake manifold temperature reading greater than 65°C (150°F)?
   - 4.a Yes; replace the intake manifold temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .
   - 4.b No; Go to step 5.
5. Disconnect the intake manifold temperature sensor harness.
6. Inspect the intake manifold temperature sensor harness connector for bent, spread or corroded pins. Is pin damage found?
   - 6.a Yes; replace the intake manifold temperature sensor harness connector and intake manifold temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .
   - 6.b No; Go to step 7.
7. Compare intake manifold pressure to atmospheric (Baro) pressure. Is the intake manifold pressure within 0.4 psi of Baro pressure?
   - 7.a Yes; Go to step 8.
   - 7.b No; replace the intake manifold pressure sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" .
8. Monitor the Exhaust Gas Recirculation (EGR) delta P voltage (pin 109). Is the EGR delta P voltage between 0.55 and 0.83 volts?
   - 8.a Yes; Go to step 11.
   - 8.b No; Go to step 9.
9. Remove the EGR delta P sensor from the mounting pad; leave electrical harness connected. Refer to section "Removal of the Delta P Sensor" .
10. Is the EGR delta P voltage between 0.55 and 0.83 volts?
    - 10.a Yes; Go to step 11.
    - 10.b No; replace the EGR delta P sensor. Refer to section "Removal of the Delta P Sensor" .
11. Visually inspect the entire EGR system for evidence of external leakage (e.g. soot, coolant deposits at joints). Is external leakage found?
    - 11.a Yes; repair as necessary.

11.b No; Go to step 12.

12. Remove the EGR cooler hot pipe, EGR crossover pipe and delivery pipe and inspect for excessive build up or blockage. Is excessive build up or blockage found?

    Refer to section "Removal of the Exhaust Gas Recirculation Hot Pipe" .

    Refer to section "Removal of the Exhaust Gas Recirculation Crossover Tube."

    12.a Yes; clean piping and replace the EGR cooler.

        For the DD13: Refer to section "Removal of the DD13 Exhaust Gas Recirculation Cooler Water Manifold Assembly" .

        For the DD15 and DD16: Refer to section "Removal of the DD15 and DD16 Exhaust Gas Recirculation Cooler" .

    12.b No; Go to step 13.

13. Visually inspect the entire exhaust system for leaks, specifically between the turbocharger outlet and the Aftertreatment Device (ATD) inlet for leaks or damage. Are any leaks or damage found?

    13.a Yes; repair as necessary.

    13.b No; Go to step 14.

14. Inspect the entire air intake system (including clamps) for signs of leaks or damage. Are any leaks or damage found?

    14.a Yes; repair as necessary.

    14.b No; Go to step 15.

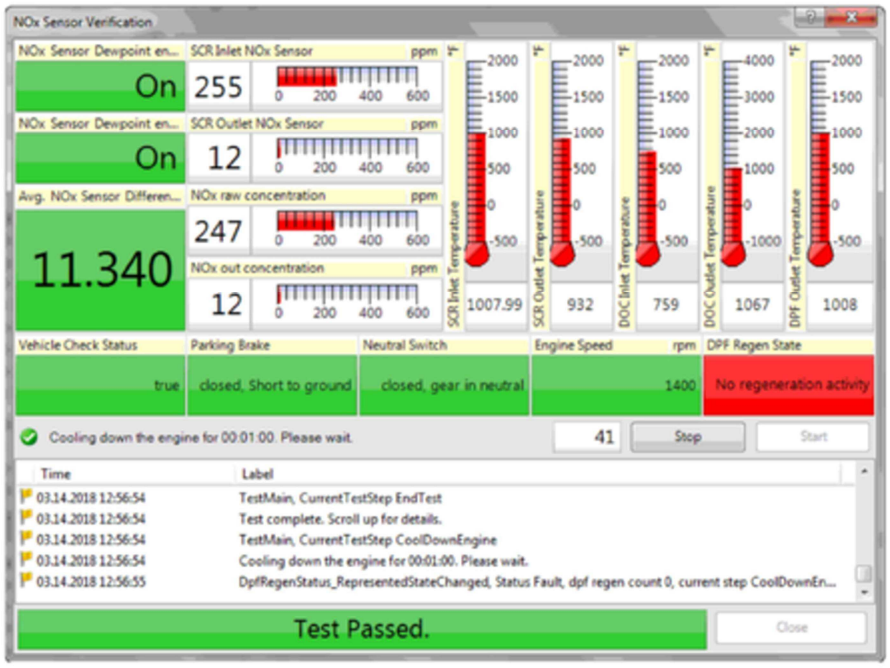
15. Leak check the Charge Air Cooler (CAC); refer to OEM literature for procedure. Does check pass?

    15.a Yes; repair as necessary.

    15.b No; Go to step 16.

> **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. Start engine, using Diagnostic Link run the NOx Sensor Verification test located in the drop down menu under Actions / Aftertreatment.



17. If the NOx Sensor Verification test fails, replace the Inlet NOx sensor.
    For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .
    For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

SPN 5357 (MCM) (GHG17)

343.1 SPN 5357/FMI 16 - GHG17

SPN 5357/FMI 16	
Description	Fuel Quantity High Detected
Monitored Parameter	Injector Quantity
Typical Enabling Conditions	Steady State Drive and No Regen
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Minutes
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Steady Engine rpm 1400 to 1500 (Two Minute)

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Are any other fault codes present?
   - 3.a Yes; repair other faults first.
   - 3.b No; Go to step 4.
4. Monitor the intake manifold temperature; is the intake manifold temperature reading greater than 65°C (150°F)?
   - 4.a Yes; replace the intake manifold temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .
   - 4.b No; Go to step 5.
5. Disconnect the intake manifold temperature sensor harness.
6. Inspect the intake manifold temperature sensor harness connector for bent, spread or corroded pins. Is damage found?
   - 6.a Yes; replace the intake manifold temperature sensor harness connector and intake manifold temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .
   - 6.b No; Go to step 7.
7. Compare intake manifold pressure to atmospheric (Baro) pressure. Is the intake manifold pressure within 0.4 psi of Baro pressure?
   - 7.a Yes; Go to step 8.
   - 7.b No; replace the intake manifold pressure sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" .
8. Monitor the Exhaust Gas Recirculation (EGR) delta P voltage (pin 109). Is the EGR delta P voltage between 0.55 and 0.83 volts?
   - 8.a Yes; Go to step 11.
   - 8.b No; Go to step 9.
9. Remove the EGR delta P sensor from the mounting pad; leave electrical harness connected. Refer to section "Removal of the Delta P Sensor" .
10. Is the EGR delta P voltage between 0.55 and 0.83 volts?
    - 10.a Yes; Go to step 11.
    - 10.b No; replace the EGR delta P sensor. Refer to section "Removal of the Delta P Sensor" .
11. Visually inspect the entire EGR system for evidence of external leakage (e.g. soot, coolant deposits at joints). Is external leakage found?

11.a Yes; repair as necessary.

11.b No; Go to step 12.

12. Remove the EGR cooler hot pipe, EGR crossover pipe and delivery pipe and inspect for excessive build up or blockage. Is excessive build up or blockage found?

Refer to section "Removal of the Exhaust Gas Recirculation Hot Pipe" .

Refer to section "Removal of the Exhaust Gas Recirculation Crossover Tube.

12.a Yes; clean piping and replace the EGR cooler.

For the DD13: Refer to section "Removal of the DD13 Exhaust Gas Recirculation Cooler Water Manifold Assembly" .

For the DD15 and DD16: Refer to section "Removal of the DD15 and DD16 Exhaust Gas Recirculation Cooler" .

12.b No; Go to step 13.

13. Visually inspect the entire exhaust system for leaks, specifically between the turbocharger outlet and the Aftertreatment Device (ATD) inlet for leaks or damage. Are and leaks or damage found?

13.a Yes; repair as necessary.

13.b No; Go to step 14.

14. Inspect the entire air intake system (including clamps) for signs of leaks or damage. Are and leaks or damage found?

14.a Yes; repair as necessary.

14.b No; Go to step 15.

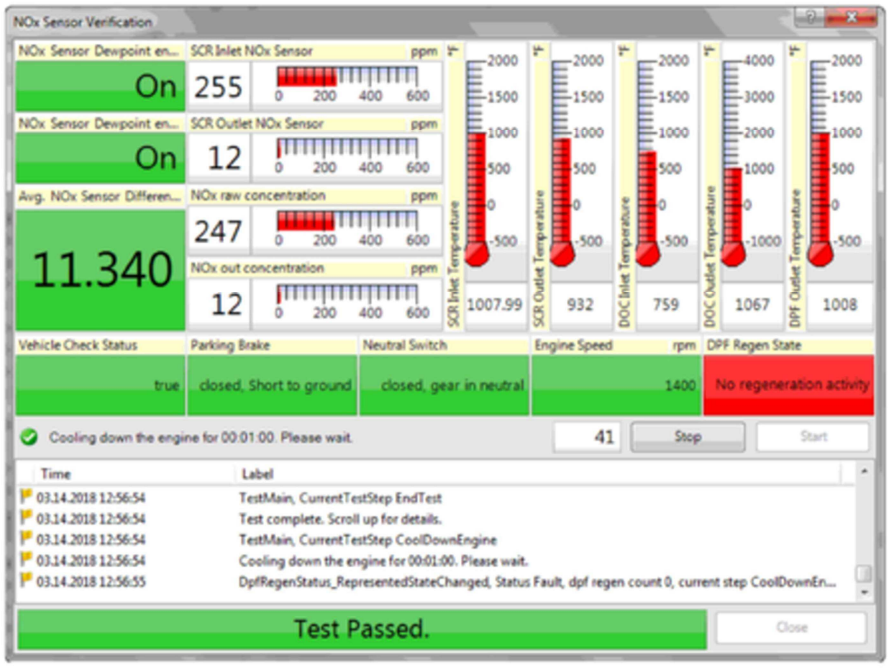
15. Leak check the Charge Air Cooler (CAC); refer to OEM literature for procedure. Does check pass?

15.a Yes; repair as necessary.

15.b No; Go to step 16.

> **⚠ 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. Start engine, using Diagnostic Link run the NOx Sensor Verification test located in the drop down menu under Actions / Aftertreatment.



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17. If the NOx Sensor Verification Panel test fails, replace the Inlet NOx sensor.
    For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .
    For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

343.2 SPN 5357/FMI 18 - GHG17

SPN 5357/FMI 18	
Description	Fuel Quantity Low Detected
Monitored Parameter	Injector Quantity
Typical Enabling Conditions	Steady State Drive and No Regen
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two Minutes
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Steady Engine rpm 1400 to 1500 (Two Minutes)

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Are any other fault codes present?
   - 3.a Yes; repair other faults first.
   - 3.b No; Go to step 4.
4. Monitor the intake manifold temperature; is the intake manifold temperature reading greater than 65°C (150°F)?
   - 4.a Yes; replace the intake manifold temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .
   - 4.b No; Go to step 5.
5. Disconnect the intake manifold temperature sensor harness.
6. Inspect the intake manifold temperature sensor harness connector for bent, spread or corroded pins. Is pin damage found?
   - 6.a Yes; replace the intake manifold temperature sensor harness connector and intake manifold temperature sensor. Refer to section "Removal of the Intake Manifold Air Temperature Sensor" .
   - 6.b No; Go to step 7.
7. Compare intake manifold pressure to atmospheric (Baro) pressure. Is the intake manifold pressure within 0.4 psi of Baro pressure?
   - 7.a Yes; Go to step 8.
   - 7.b No; replace the intake manifold pressure sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" .
8. Monitor the Exhaust Gas Recirculation (EGR) delta P voltage (pin 109). Is the EGR delta P voltage between 0.55 and 0.83 volts?
   - 8.a Yes; Go to step 11.
   - 8.b No; Go to step 9.
9. Remove the EGR delta P sensor from the mounting pad; leave electrical harness connected. Refer to section "Removal of the Delta P Sensor" .
10. Is the EGR delta P voltage between 0.55 and 0.83 volts?
    - 10.a Yes; Go to step 11.
    - 10.b No; replace the EGR delta P sensor. Refer to section "Removal of the Delta P Sensor" .
11. Visually inspect the entire EGR system for evidence of external leakage (e.g. soot, coolant deposits at joints). Is external leakage found?
    - 11.a Yes; repair as necessary.

11.b No; Go to step 12.

12. Remove the EGR cooler hot pipe, EGR crossover pipe and delivery pipe and inspect for excessive build up or blockage. Is excessive build up or blockage found?

    Refer to section "Removal of the Exhaust Gas Recirculation Hot Pipe" .

    Refer to section "Removal of the Exhaust Gas Recirculation Crossover Tube."

    12.a Yes; clean piping and replace the EGR cooler.

        For the DD13: Refer to section "Removal of the DD13 Exhaust Gas Recirculation Cooler Water Manifold Assembly" .

        For the DD15 and DD16: Refer to section "Removal of the DD15 and DD16 Exhaust Gas Recirculation Cooler" .

    12.b No; Go to step 13.

13. Visually inspect the entire exhaust system for leaks, specifically between the turbocharger outlet and the Aftertreatment Device (ATD) inlet for leaks or damage. Are any leaks or damage found?

    13.a Yes; repair as necessary.

    13.b No; Go to step 14.

14. Inspect the entire air intake system (including clamps) for signs of leaks or damage. Are any leaks or damage found?

    14.a Yes; repair as necessary.

    14.b No; Go to step 15.

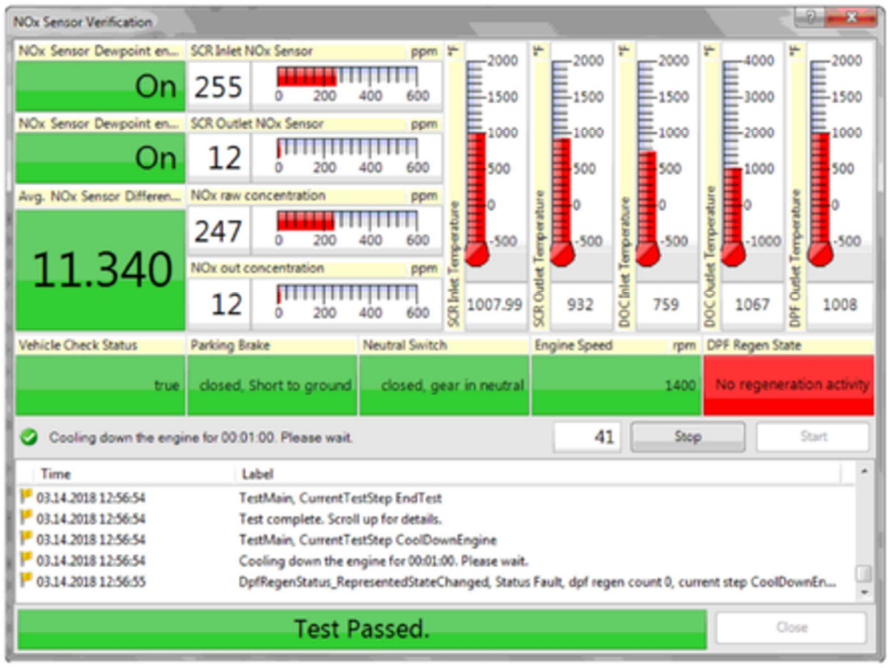
15. Leak check the Charge Air Cooler (CAC); refer to OEM literature for procedure. Does check pass?

    15.a Yes; repair as necessary.

    15.b No; Go to step 16.

> **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. Start engine, using Diagnostic Link run the NOx Sensor Verification test located in the drop down menu under Actions / Aftertreatment.



17. If the NOx Sensor Verification test fails, replace the Inlet NOx sensor.
    For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .
    For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

SPN 5358 (MCM) (GHG17)

344.1 SPN 5358/FMI 16 - GHG17

SPN 5358/FMI 16	
Description	This Fault Code Sets When the Motor Control Module (MCM) Detects that Cylinder #1 Has Low rpm Speed With The Injector Commanded To Maximum Fueling With All Conditions Met
Monitored Parameter	Engine rpm
Typical Enabling Conditions	Engine Speed Between 1100 rpm to 1400 rpm Actual Torque Load 40 to 80% Actual Torque greater than 800 N·m (560 lb·ft) for DD13/DD15 Actual Torque greater than 1000 N·m (738 lb·ft) (between 1100 to 1300 rpm) or 1330 N·m (981 lb·ft) (between 1300 to 1400 rpm) for DD16 No Fuel System Faults No Circuit Faults No Air System Faults Engine Coolant Temperature Greater Than 65°C (149°F) Engine Fuel Temperature Greater Than 0°C (32°F)
Monitor Sequence	None
Execution Frequency	Once Per Drive Cycle
Typical Duration	20 Seconds
Dash Lamps	MIL
Engine Reaction	25% Derate
Verification	Key-Off For 5 Minutes Followed By A Road Test With All Conditions Met

Possible causes:

- Drivetrain Vibrations
- Valve Lash Out Of Adjustment
- Valve Train Damage/Failure
- Bent Valve
- Valve Face/Seat Damage
- Stuck Jake Brake
- Bearing Failure
- Bent Connecting Rod
- Cylinder Liner Damage
- Piston Ring Damage
- Failed Cylinder Head Gasket
- Failed Fuel Injector

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

CAUTION

ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

⚠ WARNING

BODILY INJURY

To avoid injury from a falling component, ensure an appropriately rated lifting device is used. Moving the component without an appropriately rated lifting device could result in the component falling, which could cause serious personal injury and component damage. Never stand beneath a suspended load.

⚠ WARNING

PERSONAL INJURY

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

1. Does the engine exhibit knocking noise while running?
   1.a Yes; Go to step 2.
   1.b No; Go to step 4.
2. Remove the Exhaust Gas Recirculation (EGR) hot pipe and check for raw fuel. Was raw fuel found?
   2.a Yes; Refer to section "Test-E - Two-Filter Fuel System" .
   2.b No; reinstall EGR hot pipe and Go to step 3.
3. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was the fuel system found to be aerated?
   3.a Yes; make necessary repairs, verify repairs.
   3.b No; Refer to section "Different Engine Noise" .

Note : Faults are listed in diagnostic priority from top to bottom.

4. Test drive vehicle to check for drivetrain vibration under heavy load. Are any vibrations found?
   4.a Yes; repair cause of vibration.
   4.b No; Go to step 5.
5. Are there any of the following faults present?

- SPN 651/FMI any
- SPN 3659/FMI any
- SPN 7384/FMI any
- SPN 2797/FMI any
- SPN 4257/FMI any

- SPN 1322/FMI any
- SPN 5357/FMI any
- SPN 190/FMI 0, 14, or 15
- SPN 636/FMI 2, 8, 10, or 11
- SPN 723/FMI 8, 10, or 11
- SPN 157/FMI any
- SPN 164/FMI any
- SPN 520268/FMI any

5.a Yes; repair fault with the highest priority listed above.

5.b No; Go to step 6.

6. 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?

Peak Engine RPM	
12 Lobe Intake Camshaft	2800 rpm
6 Lobe Intake Camshaft	3000 rpm

6.a Yes; Go to step 7.

6.b No; Go to step 8.

7. View past warranty and repair history to determine if both camshafts were replaced after the engine overspeed. Were the camshafts replaced?

7.a Yes; Go to step 8.

7.b No; replace both camshafts. Inspect the engine brake rocker arms for loose actuator piston retainers and loose or missing return springs. Verify repairs.

8. Connect a battery charger to the vehicle to maintain sufficient battery voltage while cranking.

9. Use DiagnosticLink® to perform the relative compression test. Refer to section "Relative Cylinder Compression Test" . Is the relative compression reading for cylinder #1 within 10% of the highest cylinder reading?

9.a Yes; Go to step 19.

9.b No; Go to step 10.

10. Turn the engine OFF.

11. Disconnect the battery charger.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers or camshafts damaged?

13.a Yes; replace the damaged components. Perform verification in fault code chart header to verify repairs.

13.b No; Go to step 14.

14. Check the valve lash clearance for cylinder #1. Refer to section "Setting the Valve and Engine Brake Lash" . Is the valve lash within specification?

14.a Yes; Go to step 15.

14.b No; adjust the valve lash to the correct clearance. Perform verification in fault code chart header to verify repairs.

15. Check the engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Is the engine brake lash within specification?

15.a Yes; Go to step 17.

15.b No; Go to step 16.

16. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?

    16.a Yes; replace the engine brake rocker arm. Refer to section "Removal of the Camshafts" and Refer to section "Removal of the Exhaust Rocker Shaft Assembly" . Perform verification in fault code chart header to verify repairs.

    16.b No; set the correct engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Perform verification in fault code chart header to verify repairs.

17. Connect the battery charger to maintain proper cranking speed.

18. Perform the mechanical cylinder compression test. Refer to section "Mechanical Cylinder Compression Test" . Is the mechanical cylinder compression reading for cylinder #1 344 kPa (50 psi) lower than any of the other cylinders?

    18.a Yes; disconnect the battery charger and remove the cylinder head. Refer to section "Symptom Diagnostics - Low Engine Compression" to check for the cause of the loss of compression.

    18.b No; Go to step 19.

19. Remove and inspect the engine oil filter. Refer to section "Replacement of the Oil Filter" . Is there an excessive amount of metal present in the oil filter?

    19.a Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #1. Repair as necessary.

    19.b No; replace the fuel injector in cylinder #1. Refer to section "Removal of the Fuel Injector - Two-Filter System" . Perform verification in fault code chart header to verify repairs.

344.2 SPN 5358/FMI 18 - GHG17

SPN 5358/FMI 18	
Description	This Fault Code Sets When the Motor Control Module (MCM) Detects That Cylinder #1 Has High rpm Speed With The Injector Commanded To Maximum Fueling With All Conditions Met
Monitored Parameter	Engine rpm
Typical Enabling Conditions	Engine Speed Between 1100 rpm to 1400 rpm Actual Torque Load 40 to 80% Actual Torque greater than 800 N·m (560 lb·ft) for DD13/DD15 Actual Torque greater than 1000 N·m (738 lb·ft) (between 1100 to 1300 rpm) or 1330 N·m (981 lb·ft) (between 1300 to 1400 rpm) for DD16 No Fuel System Faults No Circuit Faults No Air System Faults Engine Coolant Temperature Greater Than 65°C (149°F) Engine Fuel Temperature Greater Than 0°C (32°F)
Monitor Sequence	None
Execution Frequency	Once Per Drive Cycle
Typical Duration	20 Seconds
Dash Lamps	MIL
Engine Reaction	25% Derate
Verification	Key-Off For 5 Minutes Followed By A Road Test With All Conditions Met

Follow troubleshooting procedure for SPN 5358/FMI 16. .

SPN 5359 (MCM) (GHG17)

345.1 SPN 5359/FMI 16 - GHG17

SPN 5359/FMI 16	
Description	This Fault Code Sets When the Motor Control Module (MCM) Detects that Cylinder #2 Has Low rpm Speed With The Injector Commanded To Maximum Fueling With All Conditions Met
Monitored Parameter	Engine rpm
Typical Enabling Conditions	Engine Speed Between 1100 rpm to 1400 rpm Actual Torque Load 40 to 80% Actual Torque greater than 800 N·m (560 lb·ft) for DD13/DD15 Actual Torque greater than 1000 N·m (738 lb·ft) (between 1100 to 1300 rpm) or 1330 N·m (981 lb·ft) (between 1300 to 1400 rpm) for DD16 No Fuel System Faults No Circuit Faults No Air System Faults Engine Coolant Temperature Greater Than 65°C (149°F) Engine Fuel Temperature Greater Than 0°C (32°F)
Monitor Sequence	None
Execution Frequency	Once Per Drive Cycle
Typical Duration	20 Seconds
Dash Lamps	MIL
Engine Reaction	25% Derate
Verification	Key-Off For 5 Minutes Followed By A Road Test With All Conditions Met

Possible causes:

- Drivetrain Vibrations
- Valve Lash Out Of Adjustment
- Valve Train Damage/Failure
- Bent Valve
- Valve Face/Seat Damage
- Stuck Jake Brake
- Bearing Failure
- Bent Connecting Rod
- Cylinder Liner Damage
- Piston Ring Damage
- Failed Cylinder Head Gasket
- Failed Fuel Injector

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠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.

CAUTION

ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

⚠WARNING

BODILY INJURY

To avoid injury from a falling component, ensure an appropriately rated lifting device is used. Moving the component without an appropriately rated lifting device could result in the component falling, which could cause serious personal injury and component damage. Never stand beneath a suspended load.

⚠WARNING

PERSONAL INJURY

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

1. Does the engine exhibit knocking noise while running?
   1.a Yes; Go to step 2.
   1.b No; Go to step 4.
2. Remove the Exhaust Gas Recirculation (EGR) hot pipe and check for raw fuel. Was raw fuel found?
   2.a Yes; Refer to section "Test-E - Two-Filter Fuel System" .
   2.b No; reinstall EGR hot pipe and Go to step 3.
3. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was the fuel system found to be aerated?
   3.a Yes; make necessary repairs, verify repairs.
   3.b No; Refer to section "Different Engine Noise" .

Note : Faults are listed in diagnostic priority from top to bottom.

4. Test drive vehicle to check for drivetrain vibration under heavy load. Are any vibrations found?
   4.a Yes; repair cause of vibration.
   4.b No; Go to step 5.
5. Are there any of the following faults present?

- SPN 652/FMI any
- SPN 3660/FMI any
- SPN 7385/FMI any
- SPN 2797/FMI any
- SPN 4257/FMI any

- SPN 1322/FMI any
- SPN 5357/FMI any
- SPN 190/FMI 0, 14, or 15
- SPN 636/FMI 2, 8, 10, or 11
- SPN 723/FMI 8, 10, or 11
- SPN 157/FMI any
- SPN 164/FMI any
- SPN 520268/FMI any

5.a Yes; repair fault with the highest priority listed above.

5.b No; Go to step 6.

6. 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?

Peak Engine RPM	
12 Lobe Intake Camshaft	2800 rpm
6 Lobe Intake Camshaft	3000 rpm

6.a Yes; Go to step 7.

6.b No; Go to step 8.

7. View past warranty and repair history to determine if both camshafts were replaced after the engine overspeed. Were the camshafts replaced?

7.a Yes; Go to step 8.

7.b No; replace both camshafts. Inspect the engine brake rocker arms for loose actuator piston retainers and loose or missing return springs. Verify repairs.

8. Connect a battery charger to the vehicle to maintain sufficient battery voltage while cranking.

9. Use DiagnosticLink® to perform the relative compression test. Refer to section "Relative Cylinder Compression Test" . Is the relative compression reading for cylinder #2 within 10% of the highest cylinder reading?

9.a Yes; Go to step 19.

9.b No; Go to step 10.

10. Turn the engine OFF.

11. Disconnect the battery charger.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers or camshafts damaged?

13.a Yes; replace the damaged components. Perform verification in fault code chart header to verify repairs.

13.b No; Go to step 14.

14. Check the valve lash clearance for cylinder #2. Refer to section "Setting the Valve and Engine Brake Lash" . Is the valve lash within specification?

14.a Yes; Go to step 15.

14.b No; adjust the valve lash to the correct clearance. Perform verification in fault code chart header to verify repairs.

15. Check the engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Is the engine brake lash within specification?

15.a Yes; Go to step 17.

15.b No; Go to step 16.

16. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?

    16.a Yes; replace the engine brake rocker arm. Refer to section "Removal of the Camshafts" and Refer to section "Removal of the Exhaust Rocker Shaft Assembly" . Perform verification in fault code chart header to verify repairs.

    16.b No; set the correct engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Perform verification in fault code chart header to verify repairs.

17. Connect the battery charger to maintain proper cranking speed.

18. Perform the mechanical cylinder compression test. Refer to section "Mechanical Cylinder Compression Test" . Is the mechanical cylinder compression reading for cylinder #2 344 kPa (50 psi) lower than any of the other cylinders?

    18.a Yes; disconnect the battery charger and remove the cylinder head. Refer to section "Symptom Diagnostics - Low Engine Compression" to check for the cause of the loss of compression.

    18.b No; Go to step 19.

19. Remove and inspect the engine oil filter. Refer to section "Replacement of the Oil Filter" . Is there an excessive amount of metal present in the oil filter?

    19.a Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #2. Repair as necessary.

    19.b No; replace the fuel injector in cylinder #2. Refer to section "Removal of the Fuel Injector - Two-Filter System" . Perform verification in fault code chart header to verify repairs.

345.2 SPN 5359/FMI 18 - GHG17

SPN 5359/FMI 18	
Description	This Fault Code Sets When The Motor Control Module (MCM) Detects That Cylinder #2 Has High rpm Speed With The Injector Commanded To Maximum Fueling With All Conditions Met
Monitored Parameter	Engine rpm
Typical Enabling Conditions	Engine Speed Between 1100 rpm to 1400 rpm Actual Torque Load 40 to 80% Actual Torque greater than 800 N·m (560 lb·ft) for DD13/DD15 Actual Torque greater than 1000 N·m (738 lb·ft) (between 1100 to 1300 rpm) or 1330 N·m (981 lb·ft) (between 1300 to 1400 rpm) for DD16 No Fuel System Faults No Circuit Faults No Air System Faults Engine Coolant Temperature Greater Than 65°C (149°F) Engine Fuel Temperature Greater Than 0°C (32°F)
Monitor Sequence	None
Execution Frequency	Once Per Drive Cycle
Typical Duration	20 Seconds
Dash Lamps	MIL
Engine Reaction	25% Derate
Verification	Key-Off For 5 Minutes Followed By A Road Test With All Conditions Met

Follow troubleshooting procedure for SPN 5359/FMI 16. .

SPN 5360 (MCM) (GHG17)

346.1 SPN 5360/FMI 16 - GHG17

SPN 5360/FMI 16	
Description	This Fault Code Sets When the Motor Control Module (MCM) Detects that Cylinder #3 Has Low rpm Speed With The Injector Commanded To Maximum Fueling With All Conditions Met
Monitored Parameter	Engine rpm
Typical Enabling Conditions	Engine Speed Between 1100 rpm to 1400 rpm Actual Torque Load 40 to 80% Actual Torque greater than 800 N·m (560 lb·ft) for DD13/DD15 Actual Torque greater than 1000 N·m (738 lb·ft) (between 1100 to 1300 rpm) or 1330 N·m (981 lb·ft) (between 1300 to 1400 rpm) for DD16 No Fuel System Faults No Circuit Faults No Air System Faults Engine Coolant Temperature Greater Than 65°C (149°F) Engine Fuel Temperature Greater Than 0°C (32°F)
Monitor Sequence	None
Execution Frequency	Once Per Drive Cycle
Typical Duration	20 Seconds
Dash Lamps	MIL
Engine Reaction	25% Derate
Verification	Key-Off For 5 Minutes Followed By A Road Test With All Conditions Met

Possible causes:

- Drivetrain Vibration
- Valve Lash Out Of Adjustment
- Valve Train Damage/Failure
- Bent Valve
- Valve Face/Seat Damage
- Stuck Jake Brake
- Bearing Failure
- Bent Connecting Rod
- Cylinder Liner Damage
- Piston Ring Damage
- Failed Cylinder Head Gasket
- Failed Fuel Injector

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

CAUTION

ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

⚠ WARNING

BODILY INJURY

To avoid injury from a falling component, ensure an appropriately rated lifting device is used. Moving the component without an appropriately rated lifting device could result in the component falling, which could cause serious personal injury and component damage. Never stand beneath a suspended load.

⚠ WARNING

PERSONAL INJURY

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

1. Does the engine exhibit knocking noise while running?
   1.a Yes; Go to step 2.
   1.b No; Go to step 4.
2. Remove the Exhaust Gas Recirculation (EGR) hot pipe and check for raw fuel. Was raw fuel found?
   2.a Yes; Refer to section "Test-E - Two-Filter Fuel System" .
   2.b No; reinstall EGR hot pipe and Go to step 3.
3. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was the fuel system found to be aerated?
   3.a Yes; make necessary repairs, verify repairs.
   3.b No; Refer to section "Different Engine Noise" .

Note : Faults are listed in diagnostic priority from top to bottom.

4. Test drive vehicle to check for drivetrain vibration under heavy load. Are any vibrations found?
   4.a Yes; repair cause of vibration.
   4.b No; Go to step 5.
5. Are there any of the following faults present?

- SPN 653/FMI any
- SPN 3661/FMI any
- SPN 7386/FMI any
- SPN 2797/FMI any
- SPN 4257/FMI any

- SPN 1322/FMI any
- SPN 5357/FMI any
- SPN 190/FMI 0, 14, or 15
- SPN 636/FMI 2, 8, 10, or 11
- SPN 723/FMI 8, 10, or 11
- SPN 157/FMI any
- SPN 164/FMI any
- SPN 520268/FMI any

5.a Yes; repair fault with the highest priority listed above.

5.b No; Go to step 6.

6. 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?

Peak Engine RPM	
12 Lobe Intake Camshaft	2800 rpm
6 Lobe Intake Camshaft	3000 rpm

6.a Yes; Go to step 7.

6.b No; Go to step 8.

7. View past warranty and repair history to determine if both camshafts were replaced after the engine overspeed. Were the camshafts replaced?

7.a Yes; Go to step 8.

7.b No; replace both camshafts. Inspect the engine brake rocker arms for loose actuator piston retainers and loose or missing return springs. Verify repairs.

8. Connect a battery charger to the vehicle to maintain sufficient battery voltage while cranking.

9. Use DiagnosticLink® to perform the relative compression test. Refer to section "Relative Cylinder Compression Test" . Is the relative compression reading for cylinder #3 within 10% of the highest cylinder reading?

9.a Yes; Go to step 19.

9.b No; Go to step 10.

10. Turn the engine OFF.

11. Disconnect the battery charger.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers or camshafts damaged?

13.a Yes; replace the damaged components. Perform verification in fault code chart header to verify repairs.

13.b No; Go to step 14.

14. Check the valve lash clearance for cylinder #3. Refer to section "Setting the Valve and Engine Brake Lash" . Is the valve lash within specification?

14.a Yes; Go to step 15.

14.b No; adjust the valve lash to the correct clearance. Perform verification in fault code chart header to verify repairs.

15. Check the engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Is the engine brake lash within specification?

15.a Yes; Go to step 17.

15.b No; Go to step 16.

16. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?

    16.a Yes; replace the engine brake rocker arm. Refer to section "Removal of the Camshafts" and Refer to section "Removal of the Exhaust Rocker Shaft Assembly" . Perform verification in fault code chart header to verify repairs.

    16.b No; set the correct engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Perform verification in fault code chart header to verify repairs.

17. Connect the battery charger to maintain proper cranking speed.

18. Perform the mechanical cylinder compression test. Refer to section "Mechanical Cylinder Compression Test" . Is the mechanical cylinder compression reading for cylinder #3 344 kPa (50 psi) lower than any of the other cylinders?

    18.a Yes; disconnect the battery charger and remove the cylinder head. Refer to section "Symptom Diagnostics - Low Engine Compression" to check for the cause of the loss of compression.

    18.b No; Go to step 19.

19. Remove and inspect the engine oil filter. Refer to section "Replacement of the Oil Filter" . Is there an excessive amount of metal present in the oil filter?

    19.a Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #3. Repair as necessary.

    19.b No; replace the fuel injector in cylinder #3. Refer to section "Removal of the Fuel Injector - Two-Filter System" . Perform verification in fault code chart header to verify repairs.

346.2 SPN 5360/FMI 18 - GHG17

SPN 5360/FMI 18	
Description	This Fault Code Sets When the Motor Control Module (MCM) Detects That Cylinder #3 Has High rpm Speed With The Injector Commanded To Maximum Fueling With All Conditions Met
Monitored Parameter	Engine rpm
Typical Enabling Conditions	Engine Speed Between 1100 rpm to 1400 rpm Actual Torque Load 40 to 80% Actual Torque greater than 800 N·m (560 lb·ft) for DD13/DD15 Actual Torque greater than 1000 N·m (738 lb·ft) (between 1100 to 1300 rpm) or 1330 N·m (981 lb·ft) (between 1300 to 1400 rpm) for DD16 No Fuel System Faults No Circuit Faults No Air System Faults Engine Coolant Temperature Greater Than 65°C (149°F) Engine Fuel Temperature Greater Than 0°C (32°F)
Monitor Sequence	None
Execution Frequency	Once Per Drive Cycle
Typical Duration	20 Seconds
Dash Lamps	MIL
Engine Reaction	25% Derate
Verification	Key-Off For 5 Minutes Followed By A Road Test With All Conditions Met

Follow troubleshooting procedure for SPN 5360/FMI 16. .

SPN 5361 (MCM) (GHG17)

347.1 SPN 5361/FMI 16 - GHG17

SPN 5361/FMI 16	
Description	This Fault Code Sets When the Motor Control Module (MCM) Detects that Cylinder #4 Has Low rpm Speed With The Injector Commanded To Maximum Fueling With All Conditions Met
Monitored Parameter	Engine rpm
Typical Enabling Conditions	Engine Speed Between 1100 rpm to 1400 rpm Actual Torque Load 40 to 80% Actual Torque greater than 800 N·m (560 lb·ft) for DD13/DD15 Actual Torque greater than 1000 N·m (738 lb·ft) (between 1100 to 1300 rpm) or 1330 N·m (981 lb·ft) (between 1300 to 1400 rpm) for DD16 No Fuel System Faults No Circuit Faults No Air System Faults Engine Coolant Temperature Greater Than 65°C (149°F) Engine Fuel Temperature Greater Than 0°C (32°F)
Monitor Sequence	None
Execution Frequency	Once Per Drive Cycle
Typical Duration	20 Seconds
Dash Lamps	MIL
Engine Reaction	25% Derate
Verification	Key-Off For 5 Minutes Followed By A Road Test With All Conditions Met

Possible causes:

- Drivetrain Vibrations
- Valve Lash Out Of Adjustment
- Valve Train Damage/Failure
- Bent Valve
- Valve Face/Seat Damage
- Stuck Jake Brake
- Bearing Failure
- Bent Connecting Rod
- Cylinder Liner Damage
- Piston Ring Damage
- Failed Cylinder Head Gasket
- Failed Fuel Injector

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

CAUTION

ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

⚠ WARNING

BODILY INJURY

To avoid injury from a falling component, ensure an appropriately rated lifting device is used. Moving the component without an appropriately rated lifting device could result in the component falling, which could cause serious personal injury and component damage. Never stand beneath a suspended load.

⚠ WARNING

PERSONAL INJURY

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

1. Does the engine exhibit knocking noise while running?
   1.a Yes; Go to step 2.
   1.b No; Go to step 4.
2. Remove the Exhaust Gas Recirculation (EGR) hot pipe and check for raw fuel. Was raw fuel found?
   2.a Yes; Refer to section "Test-E - Two-Filter Fuel System" .
   2.b No; reinstall EGR hot pipe and Go to step 3.
3. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was the fuel system found to be aerated?
   3.a Yes; make necessary repairs, verify repairs.
   3.b No; Refer to section "Different Engine Noise" .

Note : Faults are listed in diagnostic priority from top to bottom.

4. Test drive vehicle to check for drivetrain vibration under heavy load. Are any vibrations found?
   4.a Yes; repair cause of vibration.
   4.b No; Go to step 5.
5. Are there any of the following faults present?

- SPN 654/FMI any
- SPN 3662/FMI any
- SPN 7387/FMI any
- SPN 2798/FMI any
- SPN 4258/FMI any

- SPN 1322/FMI any
- SPN 5357/FMI any
- SPN 190/FMI 0, 14, or 15
- SPN 636/FMI 2, 8, 10, or 11
- SPN 723/FMI 8, 10, or 11
- SPN 157/FMI any
- SPN 164/FMI any
- SPN 520268/FMI any

5.a Yes; repair fault with the highest priority listed above.

5.b No; Go to step 6.

6. 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?

Peak Engine RPM	
12 Lobe Intake Camshaft	2800 rpm
6 Lobe Intake Camshaft	3000 rpm

6.a Yes; Go to step 7.

6.b No; Go to step 8.

7. View past warranty and repair history to determine if both camshafts were replaced after the engine overspeed. Were the camshafts replaced?

7.a Yes; Go to step 8.

7.b No; replace both camshafts. Inspect the engine brake rocker arms for loose actuator piston retainers and loose or missing return springs. Verify repairs.

8. Connect a battery charger to the vehicle to maintain sufficient battery voltage while cranking.

9. Use DiagnosticLink® to perform the relative compression test. Refer to section "Relative Cylinder Compression Test" . Is the relative compression reading for cylinder #4 within 10% of the highest cylinder reading?

9.a Yes; Go to step 19.

9.b No; Go to step 10.

10. Turn the engine OFF.

11. Disconnect the battery charger.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers or camshafts damaged?

13.a Yes; replace the damaged components. Perform verification in fault code chart header to verify repairs.

13.b No; Go to step 14.

14. Check the valve lash clearance for cylinder #4. Refer to section "Setting the Valve and Engine Brake Lash" . Is the valve lash within specification?

14.a Yes; Go to step 15.

14.b No; adjust the valve lash to the correct clearance. Perform verification in fault code chart header to verify repairs.

15. Check the engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Is the engine brake lash within specification?

15.a Yes; Go to step 17.

15.b No; Go to step 16.

16. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?

    16.a Yes; replace the engine brake rocker arm. Refer to section "Removal of the Camshafts" and Refer to section "Removal of the Exhaust Rocker Shaft Assembly" . Perform verification in fault code chart header to verify repairs.

    16.b No; set the correct engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Perform verification in fault code chart header to verify repairs.

17. Connect the battery charger to maintain proper cranking speed.

18. Perform the mechanical cylinder compression test. Refer to section "Mechanical Cylinder Compression Test" . Is the mechanical cylinder compression reading for cylinder #4 344 kPa (50 psi) lower than any of the other cylinders?

    18.a Yes; disconnect the battery charger and remove the cylinder head. Refer to section "Symptom Diagnostics - Low Engine Compression" to check for the cause of the loss of compression.

    18.b No; Go to step 19.

19. Remove and inspect the engine oil filter. Refer to section "Replacement of the Oil Filter" . Is there an excessive amount of metal present in the oil filter?

    19.a Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #4. Repair as necessary.

    19.b No; replace the fuel injector in cylinder #4. Refer to section "Removal of the Fuel Injector - Two-Filter System" . Perform verification in fault code chart header to verify repairs.

347.2 SPN 5361/FMI 18 - GHG17

SPN 5361/FMI 18	
Description	This Fault Code Sets When The Motor Control Module (MCM) Detects That Cylinder #4 Has High rpm Speed With The Injector Commanded To Maximum Fueling With All Conditions Met
Monitored Parameter	Engine rpm
Typical Enabling Conditions	Engine Speed Between 1100 rpm to 1400 rpm Actual Torque Load 40 to 80% Actual Torque greater than 800 N·m (560 lb·ft) for DD13/DD15 Actual Torque greater than 1000 N·m (738 lb·ft) (between 1100 to 1300 rpm) or 1330 N·m (981 lb·ft) (between 1300 to 1400 rpm) for DD16 No Fuel System Faults No Circuit Faults No Air System Faults Engine Coolant Temperature Greater Than 65°C (149°F) Engine Fuel Temperature Greater Than 0°C (32°F)
Monitor Sequence	None
Execution Frequency	Once Per Drive Cycle
Typical Duration	20 Seconds
Dash Lamps	MIL
Engine Reaction	25% Derate
Verification	Key-Off For 5 Minutes Followed By A Road Test With All Conditions Met

Follow troubleshooting procedure for SPN 5361/FMI 16. .

SPN 5362 (MCM) (GHG17)

348.1 SPN 5362/FMI 16 - GHG17

SPN 5362/FMI 16	
Description	This Fault Code Sets When the Motor Control Module (MCM) Detects that Cylinder #5 Has Low rpm Speed With The Injector Commanded To Maximum Fueling With All Conditions Met
Monitored Parameter	Engine rpm
Typical Enabling Conditions	Engine Speed Between 1100 rpm to 1400 rpm Actual Torque Load 40 to 80% Actual Torque greater than 800 N·m (560 lb·ft) for DD13/DD15 Actual Torque greater than 1000 N·m (738 lb·ft) (between 1100 to 1300 rpm) or 1330 N·m (981 lb·ft) (between 1300 to 1400 rpm) for DD16 No Fuel System Faults No Circuit Faults No Air System Faults Engine Coolant Temperature Greater Than 65°C (149°F) Engine Fuel Temperature Greater Than 0°C (32°F)
Monitor Sequence	None
Execution Frequency	Once Per Drive Cycle
Typical Duration	20 Seconds
Dash Lamps	MIL
Engine Reaction	25% Derate
Verification	Key-Off For 5 Minutes Followed By A Road Test With All Conditions Met

Possible causes:

- Drivetrain Vibrations
- Valve Lash Out Of Adjustment
- Valve Train Damage/Failure
- Bent Valve
- Valve Face/Seat Damage
- Stuck Jake Brake
- Bearing Failure
- Bent Connecting Rod
- Cylinder Liner Damage
- Piston Ring Damage
- Failed Cylinder Head Gasket
- Failed Fuel Injector

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

CAUTION

ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

⚠ WARNING

BODILY INJURY

To avoid injury from a falling component, ensure an appropriately rated lifting device is used. Moving the component without an appropriately rated lifting device could result in the component falling, which could cause serious personal injury and component damage. Never stand beneath a suspended load.

⚠ WARNING

PERSONAL INJURY

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

1. Does the engine exhibit knocking noise while running?
   - 1.a Yes; Go to step 2.
   - 1.b No; Go to step 4.
2. Remove the Exhaust Gas Recirculation (EGR) hot pipe and check for raw fuel. Was raw fuel found?
   - 2.a Yes; Refer to section "Test-E - Two-Filter Fuel System" .
   - 2.b No; reinstall EGR hot pipe and Go to step 3.
3. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was the fuel system found to be aerated?
   - 3.a Yes; make necessary repairs, verify repairs.
   - 3.b No; Refer to section "Different Engine Noise" .

Note : Faults are listed in diagnostic priority from top to bottom.

4. Test drive vehicle to check for drivetrain vibration under heavy load. Are any vibrations found?
   - 4.a Yes; repair cause of vibration.
   - 4.b No; Go to step 5.
5. Are there any of the following faults present?

- SPN 655/FMI any
- SPN 3663/FMI any
- SPN 7388/FMI any
- SPN 2798/FMI any
- SPN 4258/FMI any

- SPN 1322/FMI any
- SPN 5357/FMI any
- SPN 190/FMI 0, 14, or 15
- SPN 636/FMI 2, 8, 10, or 11
- SPN 723/FMI 8, 10, or 11
- SPN 157/FMI any
- SPN 164/FMI any
- SPN 520268/FMI any

5.a Yes; repair fault with the highest priority listed above.

5.b No; Go to step 6.

6. 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?

Peak Engine RPM	
12 Lobe Intake Camshaft	2800 rpm
6 Lobe Intake Camshaft	3000 rpm

6.a Yes; Go to step 7.

6.b No; Go to step 8.

7. View past warranty and repair history to determine if both camshafts were replaced after the engine overspeed. Were the camshafts replaced?

7.a Yes; Go to step 8.

7.b No; replace both camshafts. Inspect the engine brake rocker arms for loose actuator piston retainers and loose or missing return springs. Verify repairs.

8. Connect a battery charger to the vehicle to maintain sufficient battery voltage while cranking.

9. Use DiagnosticLink® to perform the relative compression test. Refer to section "Relative Cylinder Compression Test" . Is the relative compression reading for cylinder #5 within 10% of the highest cylinder reading?

9.a Yes; Go to step 19.

9.b No; Go to step 10.

10. Turn the engine OFF.

11. Disconnect the battery charger.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers or camshafts damaged?

13.a Yes; replace the damaged components. Perform verification in fault code chart header to verify repairs.

13.b No; Go to step 14.

14. Check the valve lash clearance for cylinder #5. Refer to section "Setting the Valve and Engine Brake Lash" . Is the valve lash within specification?

14.a Yes; Go to step 15.

14.b No; adjust the valve lash to the correct clearance. Perform verification in fault code chart header to verify repairs.

15. Check the engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Is the engine brake lash within specification?

15.a Yes; Go to step 17.

15.b No; Go to step 16.

16. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?

    16.a Yes; replace the engine brake rocker arm. Refer to section "Removal of the Camshafts" and Refer to section "Removal of the Exhaust Rocker Shaft Assembly" . Perform verification in fault code chart header to verify repairs.

    16.b No; set the correct engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Perform verification in fault code chart header to verify repairs.

17. Connect the battery charger to maintain proper cranking speed.

18. Perform the mechanical cylinder compression test. Refer to section "Mechanical Cylinder Compression Test" . Is the mechanical cylinder compression reading for cylinder #5 344 kPa (50 psi) lower than any of the other cylinders?

    18.a Yes; disconnect the battery charger and remove the cylinder head. Refer to section "Symptom Diagnostics - Low Engine Compression" to check for the cause of the loss of compression.

    18.b No; Go to step 19.

19. Remove and inspect the engine oil filter. Refer to section "Replacement of the Oil Filter" . Is there an excessive amount of metal present in the oil filter?

    19.a Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #5. Repair as necessary.

    19.b No; replace the fuel injector in cylinder #5. Refer to section "Removal of the Fuel Injector - Two-Filter System" . Perform verification in fault code chart header to verify repairs.

348.2 SPN 5362/FMI 18 - GHG17

SPN 5362/FMI 18	
Description	This Fault Code Sets When The Motor Control Module (MCM) Detects That Cylinder #5 Has High rpm Speed With The Injector Commanded To Maximum Fueling With All Conditions Met
Monitored Parameter	Engine rpm
Typical Enabling Conditions	Engine Speed Between 1100 rpm to 1400 rpm Actual Torque Load 40 to 80% Actual Torque greater than 800 N·m (560 lb·ft) for DD13/DD15 Actual Torque greater than 1000 N·m (738 lb·ft) (between 1100 to 1300 rpm) or 1330 N·m (981 lb·ft) (between 1300 to 1400 rpm) for DD16 No Fuel System Faults No Circuit Faults No Air System Faults Engine Coolant Temperature Greater Than 65°C (149°F) Engine Fuel Temperature Greater Than 0°C (32°F)
Monitor Sequence	None
Execution Frequency	Once Per Drive Cycle
Typical Duration	20 Seconds
Dash Lamps	MIL
Engine Reaction	25% Derate
Verification	Key-Off For 5 Minutes Followed By A Road Test With All Conditions Met

Follow troubleshooting procedure for SPN 5362/FMI 16. .

349.1 SPN 5363/FMI 16 - GHG17

SPN 5363/FMI 16	
Description	This Fault Code Sets When the Motor Control Module (MCM) Detects that Cylinder #6 Has Low rpm Speed With The Injector Commanded To Maximum Fueling With All Conditions Met
Monitored Parameter	Engine rpm
Typical Enabling Conditions	Engine Speed Between 1100 rpm to 1400 rpm Actual Torque Load 40 to 80% Actual Torque greater than 800 N·m (560 lb·ft) for DD13/DD15 Actual Torque greater than 1000 N·m (738 lb·ft) (between 1100 to 1300 rpm) or 1330 N·m (981 lb·ft) (between 1300 to 1400 rpm) for DD16 No Fuel System Faults No Circuit Faults No Air System Faults Engine Coolant Temperature Greater Than 65°C (149°F) Engine Fuel Temperature Greater Than 0°C (32°F)
Monitor Sequence	None
Execution Frequency	Once Per Drive Cycle
Typical Duration	20 Seconds
Dash Lamps	MIL
Engine Reaction	25% Derate
Verification	Key-Off For 5 Minutes Followed By A Road Test With All Conditions Met

Possible causes:

- Drivetrain Vibrations
- Valve Lash Out Of Adjustment
- Valve Train Damage/Failure
- Bent Valve
- Valve Face/Seat Damage
- Stuck Jake Brake
- Bearing Failure
- Bent Connecting Rod
- Cylinder Liner Damage
- Piston Ring Damage
- Failed Cylinder Head Gasket
- Failed Fuel Injector

> **⚠ WARNING**
>
> PERSONAL INJURY
>
> Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

CAUTION

ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

⚠ WARNING

BODILY INJURY

To avoid injury from a falling component, ensure an appropriately rated lifting device is used. Moving the component without an appropriately rated lifting device could result in the component falling, which could cause serious personal injury and component damage. Never stand beneath a suspended load.

⚠ WARNING

PERSONAL INJURY

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

1. Does the engine exhibit knocking noise while running?
   1.a Yes; Go to step 2.
   1.b No; Go to step 4.
2. Remove the Exhaust Gas Recirculation (EGR) hot pipe and check for raw fuel. Was raw fuel found?
   2.a Yes; Refer to section "Test-E - Two-Filter Fuel System" .
   2.b No; reinstall EGR hot pipe and Go to step 3.
3. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was the fuel system found to be aerated?
   3.a Yes; make necessary repairs, verify repairs.
   3.b No; Refer to section "Different Engine Noise" .

Note : Faults are listed in diagnostic priority from top to bottom.

4. Test drive vehicle to check for drivetrain vibration under heavy load. Are any vibrations found?
   4.a Yes; repair cause of vibration.
   4.b No; Go to step 5.
5. Are there any of the following faults present?

- SPN 656/FMI any
- SPN 3664/FMI any
- SPN 7389/FMI any
- SPN 2798/FMI any
- SPN 4258/FMI any

- SPN 1322/FMI any
- SPN 5357/FMI any
- SPN 190/FMI 0, 14, or 15
- SPN 636/FMI 2, 8, 10, or 11
- SPN 723/FMI 8, 10, or 11
- SPN 157/FMI any
- SPN 164/FMI any
- SPN 520268/FMI any

5.a Yes; repair fault with the highest priority listed above.

5.b No; Go to step 6.

6. 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?

Peak Engine RPM	
12 Lobe Intake Camshaft	2800 rpm
6 Lobe Intake Camshaft	3000 rpm

6.a Yes; Go to step 7.

6.b No; Go to step 8.

7. View past warranty and repair history to determine if both camshafts were replaced after the engine overspeed. Were the camshafts replaced?

7.a Yes; Go to step 8.

7.b No; replace both camshafts. Inspect the engine brake rocker arms for loose actuator piston retainers and loose or missing return springs. Verify repairs.

8. Connect a battery charger to the vehicle to maintain sufficient battery voltage while cranking.

9. Use DiagnosticLink® to perform the relative compression test. Refer to section "Relative Cylinder Compression Test" . Is the relative compression reading for cylinder #6 within 10% of the highest cylinder reading?

9.a Yes; Go to step 19.

9.b No; Go to step 10.

10. Turn the engine OFF.

11. Disconnect the battery charger.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers or camshafts damaged?

13.a Yes; replace the damaged components. Perform verification in fault code chart header to verify repairs.

13.b No; Go to step 14.

14. Check the valve lash clearance for cylinder #6. Refer to section "Setting the Valve and Engine Brake Lash" . Is the valve lash within specification?

14.a Yes; Go to step 15.

14.b No; adjust the valve lash to the correct clearance. Perform verification in fault code chart header to verify repairs.

15. Check the engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Is the engine brake lash within specification?

15.a Yes; Go to step 17.

15.b No; Go to step 16.

16. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?

    16.a Yes; replace the engine brake rocker arm. Refer to section "Removal of the Camshafts" and Refer to section "Removal of the Exhaust Rocker Shaft Assembly" . Perform verification in fault code chart header to verify repairs.

    16.b No; set the correct engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Perform verification in fault code chart header to verify repairs.

17. Connect the battery charger to maintain proper cranking speed.

18. Perform the mechanical cylinder compression test. Refer to section "Mechanical Cylinder Compression Test" . Is the mechanical cylinder compression reading for cylinder #6 344 kPa (50 psi) lower than any of the other cylinders?

    18.a Yes; disconnect the battery charger and remove the cylinder head. Refer to section "Symptom Diagnostics - Low Engine Compression" to check for the cause of the loss of compression.

    18.b No; Go to step 19.

19. Remove and inspect the engine oil filter. Refer to section "Replacement of the Oil Filter" . Is there an excessive amount of metal present in the oil filter?

    19.a Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #6. Repair as necessary.

    19.b No; replace the fuel injector in cylinder #6. Refer to section "Removal of the Fuel Injector - Two-Filter System" . Perform verification in fault code chart header to verify repairs.

349.2 SPN 5363/FMI 18 - GHG17

SPN 5363/FMI 18	
Description	This Fault Code Sets When The Motor Control Module (MCM) Detects That Cylinder #6 Has High rpm Speed With The Injector Commanded To Maximum Fueling With All Conditions Met
Monitored Parameter	Engine rpm
Typical Enabling Conditions	Engine Speed Between 1100 rpm to 1400 rpm Actual Torque Load 40 to 80% Actual Torque greater than 800 N·m (560 lb·ft) for DD13/DD15 Actual Torque greater than 1000 N·m (738 lb·ft) (between 1100 to 1300 rpm) or 1330 N·m (981 lb·ft) (between 1300 to 1400 rpm) for DD16 No Fuel System Faults No Circuit Faults No Air System Faults Engine Coolant Temperature Greater Than 65°C (149°F) Engine Fuel Temperature Greater Than 0°C (32°F)
Monitor Sequence	None
Execution Frequency	Once Per Drive Cycle
Typical Duration	20 Seconds
Dash Lamps	MIL
Engine Reaction	25% Derate
Verification	Key-Off For 5 Minutes Followed By A Road Test With All Conditions Met

Follow troubleshooting procedure for SPN 5363/FMI 16. Refer to section "SPN 5363/FMI 16 - GHG17" Refer to section "SPN 5363/FMI 16 - GHG17" .

SPN 5363 (MCM) (GHG17)

349.1 SPN 5363/FMI 16 - GHG17

SPN 5363/FMI 16	
Description	This Fault Code Sets When the Motor Control Module (MCM) Detects that Cylinder #6 Has Low rpm Speed With The Injector Commanded To Maximum Fueling With All Conditions Met
Monitored Parameter	Engine rpm
Typical Enabling Conditions	Engine Speed Between 1100 rpm to 1400 rpm Actual Torque Load 40 to 80% Actual Torque greater than 800 N·m (560 lb·ft) for DD13/DD15 Actual Torque greater than 1000 N·m (738 lb·ft) (between 1100 to 1300 rpm) or 1330 N·m (981 lb·ft) (between 1300 to 1400 rpm) for DD16 No Fuel System Faults No Circuit Faults No Air System Faults Engine Coolant Temperature Greater Than 65°C (149°F) Engine Fuel Temperature Greater Than 0°C (32°F)
Monitor Sequence	None
Execution Frequency	Once Per Drive Cycle
Typical Duration	20 Seconds
Dash Lamps	MIL
Engine Reaction	25% Derate
Verification	Key-Off For 5 Minutes Followed By A Road Test With All Conditions Met

Possible causes:

- Drivetrain Vibrations
- Valve Lash Out Of Adjustment
- Valve Train Damage/Failure
- Bent Valve
- Valve Face/Seat Damage
- Stuck Jake Brake
- Bearing Failure
- Bent Connecting Rod
- Cylinder Liner Damage
- Piston Ring Damage
- Failed Cylinder Head Gasket
- Failed Fuel Injector

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

CAUTION

ELECTRICAL SHOCK

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

⚠ WARNING

BODILY INJURY

To avoid injury from a falling component, ensure an appropriately rated lifting device is used. Moving the component without an appropriately rated lifting device could result in the component falling, which could cause serious personal injury and component damage. Never stand beneath a suspended load.

⚠ WARNING

PERSONAL INJURY

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

1. Does the engine exhibit knocking noise while running?
   1.a Yes; Go to step 2.
   1.b No; Go to step 4.
2. Remove the Exhaust Gas Recirculation (EGR) hot pipe and check for raw fuel. Was raw fuel found?
   2.a Yes; Refer to section "Test-E - Two-Filter Fuel System" .
   2.b No; reinstall EGR hot pipe and Go to step 3.
3. Refer to section "Aerated Fuel Test – Two-Filter Fuel System" . Was the fuel system found to be aerated?
   3.a Yes; make necessary repairs, verify repairs.
   3.b No; Refer to section "Different Engine Noise" .

Note : Faults are listed in diagnostic priority from top to bottom.

4. Test drive vehicle to check for drivetrain vibration under heavy load. Are any vibrations found?
   4.a Yes; repair cause of vibration.
   4.b No; Go to step 5.
5. Are there any of the following faults present?

- SPN 656/FMI any
- SPN 3664/FMI any
- SPN 7389/FMI any
- SPN 2798/FMI any
- SPN 4258/FMI any

- SPN 1322/FMI any
- SPN 5357/FMI any
- SPN 190/FMI 0, 14, or 15
- SPN 636/FMI 2, 8, 10, or 11
- SPN 723/FMI 8, 10, or 11
- SPN 157/FMI any
- SPN 164/FMI any
- SPN 520268/FMI any

5.a Yes; repair fault with the highest priority listed above.

5.b No; Go to step 6.

6. 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?

Peak Engine RPM	
12 Lobe Intake Camshaft	2800 rpm
6 Lobe Intake Camshaft	3000 rpm

6.a Yes; Go to step 7.

6.b No; Go to step 8.

7. View past warranty and repair history to determine if both camshafts were replaced after the engine overspeed. Were the camshafts replaced?

7.a Yes; Go to step 8.

7.b No; replace both camshafts. Inspect the engine brake rocker arms for loose actuator piston retainers and loose or missing return springs. Verify repairs.

8. Connect a battery charger to the vehicle to maintain sufficient battery voltage while cranking.

9. Use DiagnosticLink® to perform the relative compression test. Refer to section "Relative Cylinder Compression Test" . Is the relative compression reading for cylinder #6 within 10% of the highest cylinder reading?

9.a Yes; Go to step 19.

9.b No; Go to step 10.

10. Turn the engine OFF.

11. Disconnect the battery charger.

12. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

13. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers or camshafts damaged?

13.a Yes; replace the damaged components. Perform verification in fault code chart header to verify repairs.

13.b No; Go to step 14.

14. Check the valve lash clearance for cylinder #6. Refer to section "Setting the Valve and Engine Brake Lash" . Is the valve lash within specification?

14.a Yes; Go to step 15.

14.b No; adjust the valve lash to the correct clearance. Perform verification in fault code chart header to verify repairs.

15. Check the engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Is the engine brake lash within specification?

15.a Yes; Go to step 17.

15.b No; Go to step 16.

16. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?

    16.a Yes; replace the engine brake rocker arm. Refer to section "Removal of the Camshafts" and Refer to section "Removal of the Exhaust Rocker Shaft Assembly" . Perform verification in fault code chart header to verify repairs.

    16.b No; set the correct engine brake lash. Refer to section "Setting the Valve and Engine Brake Lash" . Perform verification in fault code chart header to verify repairs.

17. Connect the battery charger to maintain proper cranking speed.

18. Perform the mechanical cylinder compression test. Refer to section "Mechanical Cylinder Compression Test" . Is the mechanical cylinder compression reading for cylinder #6 344 kPa (50 psi) lower than any of the other cylinders?

    18.a Yes; disconnect the battery charger and remove the cylinder head. Refer to section "Symptom Diagnostics - Low Engine Compression" to check for the cause of the loss of compression.

    18.b No; Go to step 19.

19. Remove and inspect the engine oil filter. Refer to section "Replacement of the Oil Filter" . Is there an excessive amount of metal present in the oil filter?

    19.a Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #6. Repair as necessary.

    19.b No; replace the fuel injector in cylinder #6. Refer to section "Removal of the Fuel Injector - Two-Filter System" . Perform verification in fault code chart header to verify repairs.

349.2 SPN 5363/FMI 18 - GHG17

SPN 5363/FMI 18	
Description	This Fault Code Sets When The Motor Control Module (MCM) Detects That Cylinder #6 Has High rpm Speed With The Injector Commanded To Maximum Fueling With All Conditions Met
Monitored Parameter	Engine rpm
Typical Enabling Conditions	Engine Speed Between 1100 rpm to 1400 rpm Actual Torque Load 40 to 80% Actual Torque greater than 800 N·m (560 lb·ft) for DD13/DD15 Actual Torque greater than 1000 N·m (738 lb·ft) (between 1100 to 1300 rpm) or 1330 N·m (981 lb·ft) (between 1300 to 1400 rpm) for DD16 No Fuel System Faults No Circuit Faults No Air System Faults Engine Coolant Temperature Greater Than 65°C (149°F) Engine Fuel Temperature Greater Than 0°C (32°F)
Monitor Sequence	None
Execution Frequency	Once Per Drive Cycle
Typical Duration	20 Seconds
Dash Lamps	MIL
Engine Reaction	25% Derate
Verification	Key-Off For 5 Minutes Followed By A Road Test With All Conditions Met

Follow troubleshooting procedure for SPN 5363/FMI 16. .

350.1 SPN 5395/FMI 15 - GHG17

Idle Fuel Quantity Out of Range

SPN 5395/FMI 15	
Description	Fuel Quantity Above Normal Operating Range at Idle
Monitored Parameter	Injector Quantity
Typical Enabling Conditions	Engine Idle and no vehicle speed
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two minutes
Dash Lamps	MIL
Engine Reaction	No Derate
Verification	Steady Engine Idle (Two minute)

Check as follows:

Note : This fault code will set with excessive load at idle such as running with engine loaded through FEPTO equipment without putting the truck in PTO mode.

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Are any other fault codes present?
   - 3.a Yes; repair other faults first.
   - 3.b No; Go to step 4.
4. Does this unit run PTO at idle or on start up?
   - 4.a Yes; disable PTO at idle or start up. Verify set up with customer.
   - 4.b No; an issue exists with the adjustment of the equipment/PTO putting additional load on the engine. Repair as needed. Verify repairs.

SPN 5395 (MCM) (GHG17)

350.1 SPN 5395/FMI 15 - GHG17

Idle Fuel Quantity Out of Range

SPN 5395/FMI 15	
Description	Fuel Quantity Above Normal Operating Range at Idle
Monitored Parameter	Injector Quantity
Typical Enabling Conditions	Engine Idle and no vehicle speed
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	Two minutes
Dash Lamps	MIL
Engine Reaction	No Derate
Verification	Steady Engine Idle (Two minute)

Check as follows:

Note : This fault code will set with excessive load at idle such as running with engine loaded through FEPTO equipment without putting the truck in PTO mode.

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Are any other fault codes present?
   - 3.a Yes; repair other faults first.
   - 3.b No; Go to step 4.
4. Does this unit run PTO at idle or on start up?
   - 4.a Yes; disable PTO at idle or start up. Verify set up with customer.
   - 4.b No; an issue exists with the adjustment of the equipment/PTO putting additional load on the engine. Repair as needed. Verify repairs.

351.1 SPN 5397/FMI 31 - GHG17

Regen Frequency Error

Note : Regeneration must be completed with DiagnosticLink®, dash switch initiated regen will not clear this fault.

1. Connect DiagnosticLink.
2. Verify the ACM software level is up to date. ACM software 7.57.2.0 with fuel map ZGS 002 has improvements for this fault code. Is your current ACM software up to date?

   2.a Yes; Go to step 3.

   2.b No; Update the ACM software and release the vehicle.

> **⚠ 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.

3. Perform a Parked Regeneration, clear faults, and release vehicle. Refer to section " *Performing a Parked Regeneration Using DiagnosticLink®"* .

SPN 5397 (ACM) (GHG17)

351.1 SPN 5397/FMI 31 - GHG17

Regen Frequency Error

Note : Regeneration must be completed with DiagnosticLink , dash switch initiated regen will not clear this fault.

1. Connect DiagnosticLink.
2. Verify the ACM software level is up to date. ACM software 7.57.2.0 with fuel map ZGS 002 has improvements for this fault code. Is your current ACM software up to date?

   2.a Yes; Go to step 3.

   2.b No; Update the ACM software and release the vehicle.

> **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.

3. Perform a Parked Regeneration, clear faults, and release vehicle. Refer to section " *Performing a Parked Regeneration Using DiagnosticLink®"* .

352.1 SPN 5418/FMI 3 - GHG17

Quantity Control Valve High Side Error

SPN 5418 FMI 3	
Description	Quantity Control Valve (High Side) Error
Monitored Parameter	Quantity Control Valve
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 seconds
Dash Lamp	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)

This condition can occur when:

- MCM pin 1 circuit is shorted to ground
- Internal short of the quantity control valve

1. Check for multiple codes.
   - 1.a If SPN 5418/FMI 4 is stored along with SPN 5418/FMI 3, service SPN 5418/FMI 4 first.
   - 1.b If only SPN 5418/FMI 3 is active, Go to step 2.
2. Disconnect the quantity control valve harness connector.
3. Ensure the multi meter or Digital Voltage Ohm Meter (DVOM) resistance is set to zero.
   - 3.a If meter can auto-zero, perform this function before making a resistance measurement.
   - 3.b If meter can not auto-zero, note the resistance of the leads and subtract it from the measurement taken in step 4.
4. Measure the resistance across pins 1 and 2 of the quantity control valve.
   - 4.a If the resistance is less than 1.3 ohms, replace quantity control valve. Refer to section "Removal of the Quantity Control Valve - Two-Filter System" .
   - 4.b If the resistance is between 1.3 ohms and 1.4 ohms, Go to step 5.
5. Disconnect the 120-pin MCM connector and check for corroded, bent or broken pins. Insure both the MCM and harness connector pins are checked. Repair or replace if needed.
6. Measure the resistance between pin 1 of the quantity control valve harness connector and ground.
   - 6.a If the resistance is greater than 10K ohms, replace quantity control valve. Refer to section "Removal of the Quantity Control Valve - Two-Filter System" .
   - 6.b If the resistance is less than 10K ohms, repair the short circuit between pin 1 of the quantity control valve and ground.

352.2 SPN 5418/FMI 4 - GHG17

Quantity Control Valve Low Side Error

SPN 5418 FMI 4	
Description	Quantity Control Valve (Low Side) Error
Monitored Parameter	Quantity Control Valve
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)

This condition can occur when:

- MCM pin 2 circuit is shorted to power
- Internal short of the quantity control valve

1. Disconnect the quantity control valve harness connector.
2. Ensure the multi meter or Digital Voltage Ohm Meter (DVOM) resistance is set to zero.
   2.a If meter can auto-zero, perform this function before making a resistance measurement.
   2.b If meter can not auto-zero, note the resistance of the leads and subtract it from the measurement taken in step 3.
3. Measure the resistance across pins 1 and 2 of the quantity control valve.
   3.a If the resistance is less than 1.3 ohms, replace quantity control valve. Refer to section "Removal of the Quantity Control Valve - Two-Filter System" .
   3.b If the resistance is between 1.3 ohms and 1.4 ohms, Go to step 4.
4. Disconnect the 120-pin Motor Control Module (MCM) connector and check for corroded, bent or broken pins. Ensure both the MCM and harness connector pins are checked. Repair or replace if needed
5. Turn the ignition ON (key ON, engine OFF).

6. Measure the voltage at pin 2 of the quantity control valve harness connector.

   6.a If the voltage is 0, replace the MCM. Refer to section "Removal of the Motor Control Module" .

   6.b If the voltage is greater than 0, repair the short circuit between pin 2 of the quantity control valve harness connector and battery.

SPN 5418 (MCM) (GHG17)

352.1 SPN 5418/FMI 3 - GHG17

Quantity Control Valve High Side Error

SPN 5418 FMI 3	
Description	Quantity Control Valve (High Side) Error
Monitored Parameter	Quantity Control Valve
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 seconds
Dash Lamp	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)

This condition can occur when:

- MCM pin 1 circuit is shorted to ground
- Internal short of the quantity control valve

1. Check for multiple codes.
   1.a If SPN 5418/FMI 4 is stored along with SPN 5418/FMI 3, service SPN 5418/FMI 4 first.
   1.b If only SPN 5418/FMI 3 is active, Go to step 2.
2. Disconnect the quantity control valve harness connector.
3. Ensure the multi meter or Digital Voltage Ohm Meter (DVOM) resistance is set to zero.
   3.a If meter can auto-zero, perform this function before making a resistance measurement.
   3.b If meter can not auto-zero, note the resistance of the leads and subtract it from the measurement taken in step 4.
4. Measure the resistance across pins 1 and 2 of the quantity control valve.
   4.a If the resistance is less than 1.3 ohms, replace quantity control valve. Refer to section "Removal of the Quantity Control Valve - Two-Filter System" .
   4.b If the resistance is between 1.3 ohms and 1.4 ohms, Go to step 5.
5. Disconnect the 120-pin MCM connector and check for corroded, bent or broken pins. Insure both the MCM and harness connector pins are checked. Repair or replace if needed.
6. Measure the resistance between pin 1 of the quantity control valve harness connector and ground.
   6.a If the resistance is greater than 10K ohms, replace quantity control valve. Refer to section "Removal of the Quantity Control Valve - Two-Filter System" .
   6.b If the resistance is less than 10K ohms, repair the short circuit between pin 1 of the quantity control valve and ground.

352.2 SPN 5418/FMI 4 - GHG17

Quantity Control Valve Low Side Error

SPN 5418 FMI 4	
Description	Quantity Control Valve (Low Side) Error
Monitored Parameter	Quantity Control Valve
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)

This condition can occur when:

- MCM pin 2 circuit is shorted to power
- Internal short of the quantity control valve

1. Disconnect the quantity control valve harness connector.
2. Ensure the multi meter or Digital Voltage Ohm Meter (DVOM) resistance is set to zero.
   2.a If meter can auto-zero, perform this function before making a resistance measurement.
   2.b If meter can not auto-zero, note the resistance of the leads and subtract it from the measurement taken in step 3.
3. Measure the resistance across pins 1 and 2 of the quantity control valve.
   3.a If the resistance is less than 1.3 ohms, replace quantity control valve. Refer to section "Removal of the Quantity Control Valve - Two-Filter System" .
   3.b If the resistance is between 1.3 ohms and 1.4 ohms, Go to step 4.
4. Disconnect the 120-pin Motor Control Module (MCM) connector and check for corroded, bent or broken pins. Ensure both the MCM and harness connector pins are checked. Repair or replace if needed
5. Turn the ignition ON (key ON, engine OFF).

6. Measure the voltage at pin 2 of the quantity control valve harness connector.

   6.a If the voltage is 0, replace the MCM. Refer to section "Removal of the Motor Control Module" .

   6.b If the voltage is greater than 0, repair the short circuit between pin 2 of the quantity control valve harness connector and battery.

353.1 SPN 5435/FMI 7 – GHG17

Non Diesel Exhaust Fluid Flow Situation

This code sets when the Aftertreatment Control Module (ACM) detects that the Diesel Exhaust Fluid (DEF) pump speed is too low when activated.

SPN 5435 FMI 7	
Description	Non DEF Flow Situation
Monitored Parameter	DEF Pump Speed
Typical Enabling Conditions	DEF Pump Enabled and Cannot Operate Above a DEF Pump Speed Threshold
Monitor Sequence	DEF pump Is Enabled
Execution Frequency	Service Tool and Infrequent In-use Checks During On DEF Dosing Conditions
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Selective Catalyst Reduction Airless Dosing System (SCR ADS) Self-check

Note : Retain a log file if Detroit™ Customer Assistance is required.

1. Connect DiagnosticLink and check for other fault codes. Are fault codes SPN 4374/FMI 3 or 4 present?
   1.a Yes; diagnose and repair the other fault codes first. Verify repair.
   1.b No: replace the DEF pump. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module" . Verify repair.

SPN 5435 (ACM) (GHG17)

353.1 SPN 5435/FMI 7 – GHG17

Non Diesel Exhaust Fluid Flow Situation

This code sets when the Aftertreatment Control Module (ACM) detects that the Diesel Exhaust Fluid (DEF) pump speed is too low when activated.

SPN 5435 FMI 7	
Description	Non DEF Flow Situation
Monitored Parameter	DEF Pump Speed
Typical Enabling Conditions	DEF Pump Enabled and Cannot Operate Above a DEF Pump Speed Threshold
Monitor Sequence	DEF pump Is Enabled
Execution Frequency	Service Tool and Infrequent In-use Checks During On DEF Dosing Conditions
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Selective Catalyst Reduction Airless Dosing System (SCR ADS) Self-check

Note : Retain a log file if Detroit™ Customer Assistance is required.

1. Connect DiagnosticLink and check for other fault codes. Are fault codes SPN 4374/FMI 3 or 4 present?
   1.a Yes; diagnose and repair the other fault codes first. Verify repair.
   1.b No: replace the DEF pump. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module" . Verify repair.

353.2 SPN 5435/FMI 11 - GHG17

SPN 5435 FMI 11	
Description	This Code Sets when the Aftertreatment Control Module (ACM) Detects that the Diesel Exhaust Fluid (DEF) Pump Speed Is Too Low When Activated
Monitored Parameter	DEF Pump Speed
Typical Enabling Conditions	DEF Pump Enabled and Cannot Operate Above a DEF Pump Speed Threshold
Monitor Sequence	DEF Pump Is Enabled
Execution Frequency	Service Tool and Infrequent In-use Checks During On DEF Dosing Conditions
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate
Verification	Use DiagnosticLink to Perform the Selective Catalyst Reduction Airless Dosing System (SCR ADS) Self-check

1. Connect DiagnosticLink and check for other fault codes. Are fault codes SPN 4374/FMI 3 or 4 present?
   1.a Yes; diagnose and repair the other fault codes first. Verify repair.
   1.b No: replace the DEF pump. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module" . Verify repair.

354.1 SPN 5443/FMI 0 – GHG17

SPN 5443/FMI 0	
Description	High Hydrocarbon Absorption in the Diesel Particulate Filter (DPF)
Monitored Parameter	Diesel Oxidation Catalyst (DOC) Temperature In
Typical Enabling Conditions	High Idle Times
Monitor Sequence	Always Enabled
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	SEL
Engine Reaction	None
Verification	Parked Regeneration

Check as follows:

1. Connect DiagnosticLink .
2. Use the chart below to verify the Aftertreatment Control Module (ACM) software level is up to date. Is the current ACM software and fuel map at or greater than the chart below?

   2.a Yes; Go to step 3.

   2.b No; update to the latest ACM software configuration on the server. Go to step 3.

   ACM 7.56.6.0 software with fuel map ZGS Version

Model	ATS Configuration	Software Version	ACM Fuel Map Version
DD15, DD16,DD13	1-Box	7.56.6.0	ZGS 005
DD13	Two-Box 2HV / 2HH	7.56.6.0	ZGS 004
DD13	Two-Box 2V2	7.56.6.0	ZGS 004
DD13	1-Box FCCC, Terex Crane	7.56.6.0	ZGS 005
DD13	1-Box non-DTNA	7.56.6.0	ZGS 004
DD13	Two-Box 2V2 non-DTNA	7.56.6.0	ZGS 003
DD13	EvoBus	7.56.6.0	ZGS 005

3. Are any other faults also present?

   3.a Yes; repair those faults first.

   3.b No; Go to step 4.

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

⚠ 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.

⚠ 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.

4. Start the engine.
5. Using DiagnosticLink, perform a parked regeneration. Refer to section "Performing a Parked Regeneration - GHG17" .
6. When regeneration is complete, clear all fault codes. Verify repairs.

354.2 SPN 5443/FMI 15 - GHG17

SPN 5443/FMI 15	
Description	High Hydrocarbon Absorption in the Diesel Particulate Filter (DPF)
Monitored Parameter	Diesel Oxidation Catalyst (DOC) Temperature In
Typical Enabling Conditions	High Idle Times
Monitor Sequence	Always Enabled
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Parked Regeneration

Check as follows:

1. Connect DiagnosticLink .
2. Use the chart below to verify the Aftertreatment Control Module (ACM) software level is up to date. Is the current ACM software and fuel map at or greater than the chart below?

   2.a Yes; Go to step 3.

   2.b No; update to the latest ACM software configuration on the server. Go to step 3.

   ACM 7.56.6.0 software with fuel map ZGS Version

Model	ATS Configuration	Software Version	ACM Fuel Map Version
DD15, DD16,DD13	1-Box	7.56.6.0	ZGS 005
DD13	Two-Box 2HV / 2HH	7.56.6.0	ZGS 004
DD13	Two-Box 2V2	7.56.6.0	ZGS 004
DD13	1-Box FCCC, Terex Crane	7.56.6.0	ZGS 005
DD13	1-Box non-DTNA	7.56.6.0	ZGS 004
DD13	Two-Box 2V2 non-DTNA	7.56.6.0	ZGS 003
DD13	EvoBus	7.56.6.0	ZGS 005

3. Are any other faults also present?

   3.a Yes; repair those faults first.

   3.b No; Go to step 4.

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

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.

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.

4. Start the engine.
5. Using DiagnosticLink, perform a parked regeneration. Refer to section "Performing a Parked Regeneration - GHG17" .
6. Clear fault codes after completion of regeneration.

354.3 SPN 5443/FMI 16 - GHG17

SPN 5443/FMI 16	
Description	High Hydrocarbon Absorption in the Diesel Particulate Filter
Monitored Parameter	Diesel Oxidation Catalyst (DOC) Temperature In
Typical Enabling Conditions	High Idle Times
Monitor Sequence	Always Enabled
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Parked Regeneration

Check as follows:

1. Connect DiagnosticLink .
2. Use the chart below to verify the Aftertreatment Control Module (ACM) software level is up to date. Is the current ACM software and fuel map at or greater than the chart below?

   2.a Yes; Go to step 3.

   2.b No; update to the latest ACM software configuration on the server. Go to step 3.

   ACM 7.56.6.0 software with fuel map ZGS Version

Model	ATS Configuration	Software Version	ACM Fuel Map Version
DD15, DD16,DD13	1-Box	7.56.6.0	ZGS 005
DD13	Two-Box 2HV / 2HH	7.56.6.0	ZGS 004
DD13	Two-Box 2V2	7.56.6.0	ZGS 004
DD13	1-Box FCCC, Terex Crane	7.56.6.0	ZGS 005
DD13	1-Box non-DTNA	7.56.6.0	ZGS 004
DD13	Two-Box 2V2 non-DTNA	7.56.6.0	ZGS 003
DD13	EvoBus	7.56.6.0	ZGS 005

3. Are any other faults also present?

   3.a Yes; repair those faults first.

   3.b No; Go to step 4.

WARNING

ENGINE EXHAUST

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

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.

> **⚠ 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.

4. Start the engine.
5. Using DiagnosticLink, perform a parked regeneration. Refer to section "Performing a Parked Regeneration - GHG17" .
6. When regeneration is complete, clear all fault codes.

SPN 5443 (ACM) (GHG17)

354.1 SPN 5443/FMI 0 – GHG17

SPN 5443/FMI 0	
Description	High Hydrocarbon Absorption in the Diesel Particulate Filter (DPF)
Monitored Parameter	Diesel Oxidation Catalyst (DOC) Temperature In
Typical Enabling Conditions	High Idle Times
Monitor Sequence	Always Enabled
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	SEL
Engine Reaction	None
Verification	Parked Regeneration

Check as follows:

1. Connect DiagnosticLink .
2. Use the chart below to verify the Aftertreatment Control Module (ACM) software level is up to date. Is the current ACM software and fuel map at or greater than the chart below?

   2.a Yes; Go to step 3.

   2.b No; update to the latest ACM software configuration on the server. Go to step 3.

   ACM 7.56.6.0 software with fuel map ZGS Version

Model	ATS Configuration	Software Version	ACM Fuel Map Version
DD15, DD16,DD13	1-Box	7.56.6.0	ZGS 005
DD13	Two-Box 2HV / 2HH	7.56.6.0	ZGS 004
DD13	Two-Box 2V2	7.56.6.0	ZGS 004
DD13	1-Box FCCC, Terex Crane	7.56.6.0	ZGS 005
DD13	1-Box non-DTNA	7.56.6.0	ZGS 004
DD13	Two-Box 2V2 non-DTNA	7.56.6.0	ZGS 003
DD13	EvoBus	7.56.6.0	ZGS 005

3. Are any other faults also present?

   3.a Yes; repair those faults first.

   3.b No; Go to step 4.

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

⚠ 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.

⚠ 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.

4. Start the engine.
5. Using DiagnosticLink, perform a parked regeneration. Refer to section "Performing a Parked Regeneration - GHG17" .
6. When regeneration is complete, clear all fault codes. Verify repairs.

354.2 SPN 5443/FMI 15 - GHG17

SPN 5443/FMI 15	
Description	High Hydrocarbon Absorption in the Diesel Particulate Filter (DPF)
Monitored Parameter	Diesel Oxidation Catalyst (DOC) Temperature In
Typical Enabling Conditions	High Idle Times
Monitor Sequence	Always Enabled
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Parked Regeneration

Check as follows:

1. Connect DiagnosticLink .
2. Use the chart below to verify the Aftertreatment Control Module (ACM) software level is up to date. Is the current ACM software and fuel map at or greater than the chart below?

   2.a Yes; Go to step 3.

   2.b No; update to the latest ACM software configuration on the server. Go to step 3.

   ACM 7.56.6.0 software with fuel map ZGS Version

Model	ATS Configuration	Software Version	ACM Fuel Map Version
DD15, DD16,DD13	1-Box	7.56.6.0	ZGS 005
DD13	Two-Box 2HV / 2HH	7.56.6.0	ZGS 004
DD13	Two-Box 2V2	7.56.6.0	ZGS 004
DD13	1-Box FCCC, Terex Crane	7.56.6.0	ZGS 005
DD13	1-Box non-DTNA	7.56.6.0	ZGS 004
DD13	Two-Box 2V2 non-DTNA	7.56.6.0	ZGS 003
DD13	EvoBus	7.56.6.0	ZGS 005

3. Are any other faults also present?

   3.a Yes; repair those faults first.

   3.b No; Go to step 4.

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

> **⚠ 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.

> **⚠ 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.

4. Start the engine.
5. Using DiagnosticLink, perform a parked regeneration. Refer to section "Performing a Parked Regeneration - GHG17" .
6. Clear fault codes after completion of regeneration.

354.3 SPN 5443/FMI 16 - GHG17

SPN 5443/FMI 16	
Description	High Hydrocarbon Absorption in the Diesel Particulate Filter
Monitored Parameter	Diesel Oxidation Catalyst (DOC) Temperature In
Typical Enabling Conditions	High Idle Times
Monitor Sequence	Always Enabled
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Parked Regeneration

Check as follows:

1. Connect DiagnosticLink .
2. Use the chart below to verify the Aftertreatment Control Module (ACM) software level is up to date. Is the current ACM software and fuel map at or greater than the chart below?

   2.a Yes; Go to step 3.

   2.b No; update to the latest ACM software configuration on the server. Go to step 3.

   ACM 7.56.6.0 software with fuel map ZGS Version

Model	ATS Configuration	Software Version	ACM Fuel Map Version
DD15, DD16,DD13	1-Box	7.56.6.0	ZGS 005
DD13	Two-Box 2HV / 2HH	7.56.6.0	ZGS 004
DD13	Two-Box 2V2	7.56.6.0	ZGS 004
DD13	1-Box FCCC, Terex Crane	7.56.6.0	ZGS 005
DD13	1-Box non-DTNA	7.56.6.0	ZGS 004
DD13	Two-Box 2V2 non-DTNA	7.56.6.0	ZGS 003
DD13	EvoBus	7.56.6.0	ZGS 005

3. Are any other faults also present?

   3.a Yes; repair those faults first.

   3.b No; Go to step 4.

WARNING

ENGINE EXHAUST

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

WARNING

PERSONAL INJURY

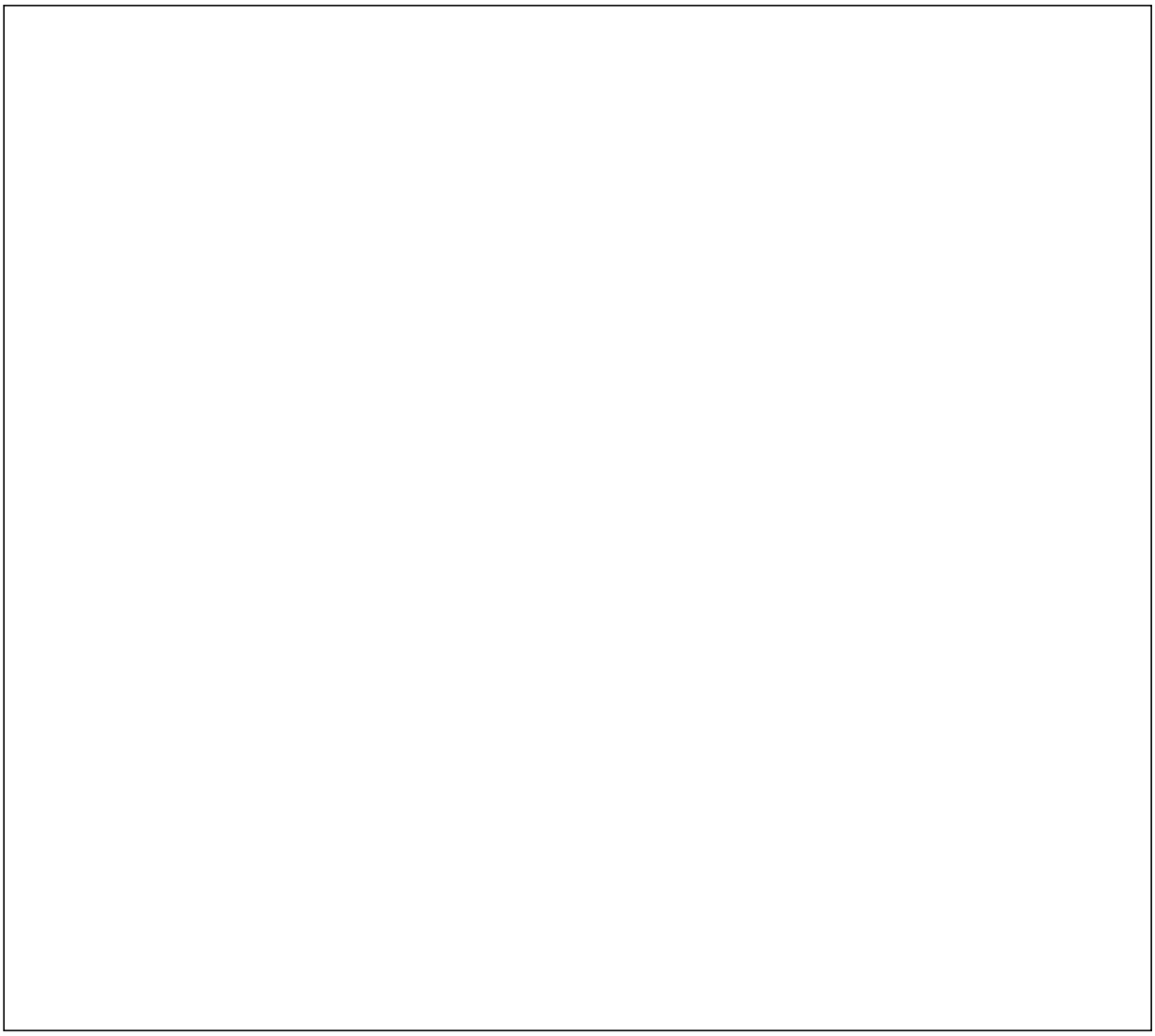
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

> **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.

4. Start the engine.
5. Using DiagnosticLink, perform a parked regeneration. Refer to section "Performing a Parked Regeneration - GHG17" .
6. When regeneration is complete, clear all fault codes.

355.1 SPN 5444/FMI 1 - GHG17

SPN 5444/FMI 1	
Description	Fault Code Sets When the Engine Oil Separator Speed is less than 3,000 rpm for 45 Seconds
Monitored Parameter	Crankcase Ventilator Oil Separator Speed
Typical Enabling Conditions	Engine Coolant Temperature Greater than 65°C (149°F), Engine Oil Temperature Greater than 65°C (149°F), Engine rpm Greater than 900 rpm, Ambient Temperature Greater than -8°C (17.6°F), Barometric Pressure Greater than 10.9 psi (755 mbar)
Monitor Sequence	None
Execution Frequency	None
Typical Duration	45 seconds
Dash Lamps	None
Engine Reaction	None
Verification	Engine Running for Greater than One Minute with the Typical Enabling Conditions Met



Check as follows:

1. Connect DiagnosticLink .

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

> **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.

2. Start and run the engine at idle.
3. Monitor the crankcase ventilator oil separator speed. Is the crankcase ventilator oil separator speed zero rpm?
   - 3.a Yes; Go to step 5.
   - 3.b No; Go to step 4.
4. Monitor the crankcase ventilator oil separator speed. Is the crankcase ventilator oil separator speed less than 3,000 rpm?
   - 4.a Yes; replace the crankcase breather. Refer to section "Removal of the Crankcase Breather Assembly" .
   - 4.b No; replace the engine crankcase breather oil separator speed sensor and the pigtail.
5. Turn the engine OFF.
6. Disconnect and inspect the engine crankcase breather oil separator speed sensor electrical connector. Is there damage or corrosion present?
   - 6.a Yes; replace the engine crankcase breather oil separator speed sensor and the pigtail.
   - 6.b No; Go to step 7.
7. Turn the ignition ON (key ON, engine OFF).
8. Measure the voltage between pins 1 and 3 of the engine crankcase breather oil separator speed sensor electrical connector harness side. Is the voltage between 4.5 to 5.5 volts?
   - 8.a Yes; Go to step 10.
   - 8.b No; Go to step 9.
9. Measure the voltage between pin 1 of the engine crankcase breather oil separator speed sensor electrical connector harness side and ground. Is the voltage between 4.5 to 5.5 volts?
   - 9.a Yes; repair the circuit between pin 3 of the engine crankcase breather oil separator speed sensor electrical connector harness side and the circuit splice.
   - 9.b No; repair the circuit between pin 1 of the engine crankcase breather oil separator speed sensor electrical connector harness side and the circuit splice.
10. Turn the ignition OFF.
11. Measure the resistance between pins 2 and 3 of the engine crankcase breather oil separator speed sensor electrical connector harness side. Is the resistance more than five ohms?
    - 11.a Yes; repair the circuit between pin 2 of the engine crankcase breather oil separator speed sensor electrical connector harness side and pin 49 of the MCM 120-pin electrical connector.
    - 11.b No; replace the engine crankcase breather oil separator speed sensor and the pigtail.

SPN 5444 (MCM) (GHG17)

355.1 SPN 5444/FMI 1 - GHG17

SPN 5444/FMI 1	
Description	Fault Code Sets When the Engine Oil Separator Speed is less than 3,000 rpm for 45 Seconds
Monitored Parameter	Crankcase Ventilator Oil Separator Speed
Typical Enabling Conditions	Engine Coolant Temperature Greater than 65°C (149°F), Engine Oil Temperature Greater than 65°C (149°F), Engine rpm Greater than 900 rpm, Ambient Temperature Greater than -8°C (17.6°F), Barometric Pressure Greater than 10.9 psi (755 mbar)
Monitor Sequence	None
Execution Frequency	None
Typical Duration	45 seconds
Dash Lamps	None
Engine Reaction	None
Verification	Engine Running for Greater than One Minute with the Typical Enabling Conditions Met

Check as follows:

1. Connect DiagnosticLink .

WARNING

ENGINE EXHAUST

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

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.

2. Start and run the engine at idle.
3. Monitor the crankcase ventilator oil separator speed. Is the crankcase ventilator oil separator speed zero rpm?

3.a Yes; Go to step 5.

3.b No; Go to step 4.

4. Monitor the crankcase ventilator oil separator speed. Is the crankcase ventilator oil separator speed less than 3,000 rpm?

4.a Yes; replace the crankcase breather. Refer to section "Removal of the Crankcase Breather Assembly" .

4.b No; replace the engine crankcase breather oil separator speed sensor and the pigtail.

5. Turn the engine OFF.

6. Disconnect and inspect the engine crankcase breather oil separator speed sensor electrical connector. Is there damage or corrosion present?

6.a Yes; replace the engine crankcase breather oil separator speed sensor and the pigtail.

6.b No; Go to step 7.

7. Turn the ignition ON (key ON, engine OFF).

8. Measure the voltage between pins 1 and 3 of the engine crankcase breather oil separator speed sensor electrical connector harness side. Is the voltage between 4.5 to 5.5 volts?

8.a Yes; Go to step 10.

8.b No; Go to step 9.

9. Measure the voltage between pin 1 of the engine crankcase breather oil separator speed sensor electrical connector harness side and ground. Is the voltage between 4.5 to 5.5 volts?

9.a Yes; repair the circuit between pin 3 of the engine crankcase breather oil separator speed sensor electrical connector harness side and the circuit splice.

9.b No; repair the circuit between pin 1 of the engine crankcase breather oil separator speed sensor electrical connector harness side and the circuit splice.

10. Turn the ignition OFF.

11. Measure the resistance between pins 2 and 3 of the engine crankcase breather oil separator speed sensor electrical connector harness side. Is the resistance more than five ohms?

11.a Yes; repair the circuit between pin 2 of the engine crankcase breather oil separator speed sensor electrical connector harness side and pin 49 of the MCM 120-pin electrical connector.

11.b No; replace the engine crankcase breather oil separator speed sensor and the pigtail.

356.1 SPN 5488/FMI 3 – GHG17

Diesel Exhaust Fluid Line Heater 5 Circuit Failed High

SPN 5488/FMI 3	
Description	Line Heater 5 Circuit Failed High
Monitored Parameter	Line Heater 5 Circuit
Typical Enabling Conditions	Always on
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Output Component Test

1. Connect to DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Perform Output Component Test.
4. Does the fault become active?
   - 4.a Yes; Go to step 6.
   - 4.b No; Go to step 5.
5. Repeat Output Component Test. The ignition must be cycled between each test. Does the fault become active?
   - 5.a Yes; Go to step 6.
   - 5.b No, clear the fault and release the vehicle.
6. Disconnect the line heater / Dosing Unit harness connector.
7. Inspect the sensor harness for bent, spread or corroded pins.
   - 7.a If the pins are bent, spread or corroded, repair as necessary.
   - 7.b If connector shows no signs of damage, repair the short to battery (12 volts) between pin 3 of the line heater 8-pin harness connector and pin 22 of the ACM 120-pin connector.

Dosing Unit			
8-Pin	**Circuit**	**ACM-Pin**	**Connector**
1	Dosing Unit Low side	28	
2	Dosing Unit High side	33	
3	Heating Low side	22	
4	Heating Supply	3	
5	Sensor Supply 5V	84	
6	Not Used	Not Used	
7	Sensor Ground	99	
8	DEF Pressure Signal	100	

356.2 SPN 5488/FMI 4 – GHG17

Diesel Exhaust Fluid Line Heater 5 Circuit Failed Low

SPN 5488/FMI 4	
Description	Line Heater 5 Circuit Failed Low
Monitored Parameter	Line Heater 5 Circuit
Typical Enabling Conditions	Always on
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Output Component Test

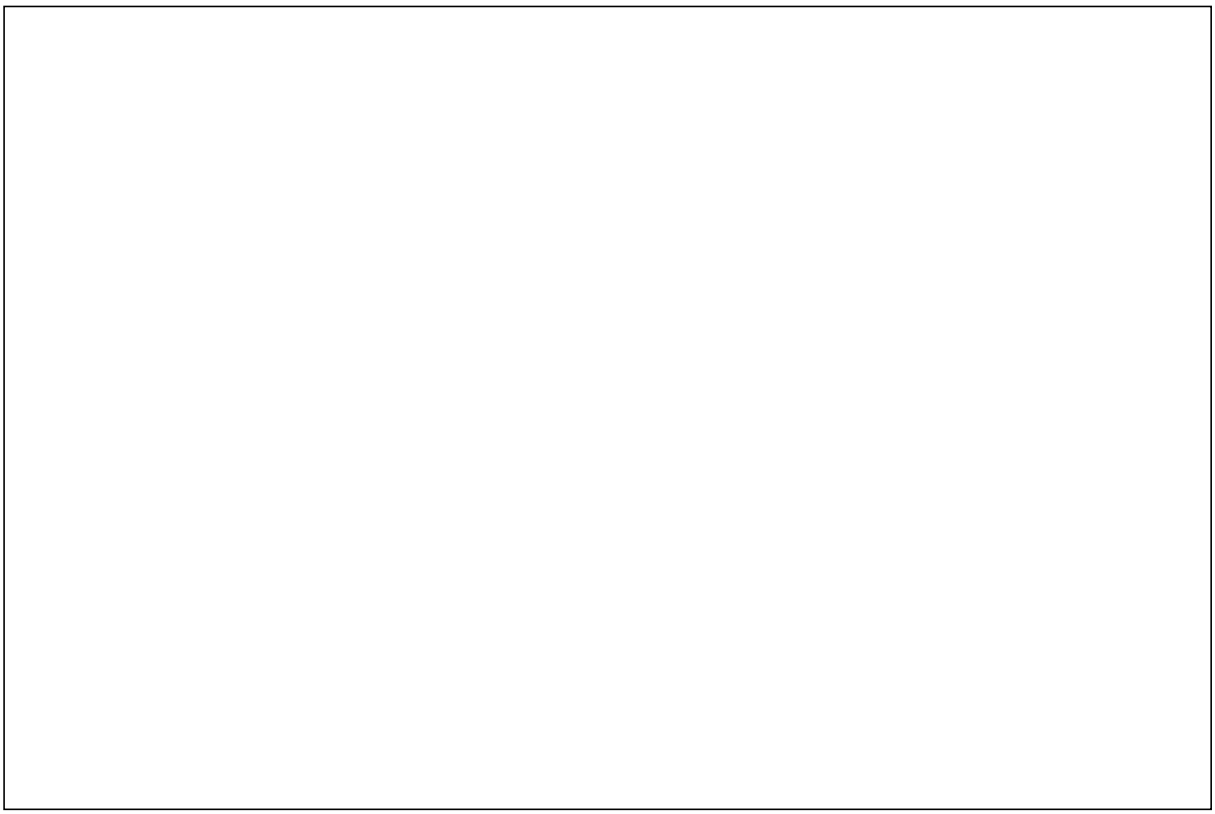
1. Turn the ignition OFF.
2. Disconnect the line heater/Dosing Unit 8-pin connector.
3. Inspect the sensor harness for bent, spread or corroded pins.
   - 3.a If the pins are bent, spread or corroded, repair as necessary.
   - 3.b If the connector shows no signs of damage, Go to step 4.
4. Disconnect the ACM 120-pin connector.
5. Measure the resistance between pin 3 on the harness side of the line heater 8-pin connector and ground.
   - 5.a If the resistance is less than 10K ohms, repair the wire between pin 3 of the line heater 8-pin connector and pin 22 of the ACM 120-pin connector.
   - 5.b If the resistance is greater than 10K ohms, replace the Dosing Unit.

Dosing Unit			
8-Pin	**Circuit**	**ACM-Pin**	**Connector**
1	Dosing Unit Low side	28	
2	Dosing Unit High side	33	
3	Heating Low side	22	
4	Heating Supply	3	
5	Sensor Supply 5V	84	
6	Not Used	Not Used	
7	Sensor Ground	99	
8	DEF Pressure Signal	100	

356.3 SPN 5488/FMI 5 – GHG17

Selective Catalyst Reduction Line Heater 5 Circuit Failed Open

SPN 5488/FMI 5	
Description	Selective Catalyst Reduction (SCR) Line Heater 5 Circuit Failed Open
Monitored Parameter	SCR Line Heater 5 Circuit
Typical Enabling Conditions	Always on
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Output Component Test



Note : Diesel Exhaust Fluid (DEF) line heaters are internal of the DEF lines. The heater electrical connectors are located near the DEF line couplings.

Line Heater 1	Doser To Tank DEF Line (Long-Line Extension Only)
Line Heater 2	Tank To Pump DEF Line
Line Heater 3	Pump To Doser DEF Line (Long-Line Extension Only)
Line Heater 4	Pump To Doser DEF Line
Line Heater 5	Doser To Tank DEF Line

Check as follows:

1. Disconnect line heater 5 harness connector. Refer to Original Equipment Manufacturer (OEM) literature for schematic information.
2. Inspect the harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector.
   - 2.a If signs of damage are present, repair as necessary. Using DiagnosticLink , perform Output Component Test to verify repairs.
   - 2.b If no signs of damage are present, Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 2 on the line heater 5 harness side connector and battery ground.
   - 4.a If the voltage is greater than 11.5V, Go to step 5.
   - 4.b If the voltage is less than 11.5V, repair the wire between pin 2 on the harness side of the DEF line heater connector and pin 39 of the Aftertreatment Control Module (ACM) 120-pin connector. Using DiagnosticLink, perform Output Component Test to verify repairs.
5. Turn the ignition OFF.
6. Disconnect the ACM 120-pin connector.
7. Inspect the harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector.
   - 7.a If signs of damage are present, repair as necessary. Using DiagnosticLink, perform Output Component Test to verify repairs.
   - 7.b If no signs of damage are present, Go to step 8.
8. Measure the resistance between pin 1 on the line heater 5 harness side connector and pin 16 of the ACM 120-pin harness side connector.
   - 8.a If the resistance is greater than 5 ohms, repair the open wire between pin 1 on the line heater 5 harness side connector and pin 16 of the ACM 120-pin harness side connector. Refer to Original Equipment Manufacturer (OEM) literature for schematic information.
   - 8.b If the resistance is less than 5 ohms, replace line heater 5. Refer to section "Removal of the Diesel Exhaust Fluid Lines" .

SPN 5488 (ACM) (GHG17)

356.1 SPN 5488/FMI 3 – GHG17

Diesel Exhaust Fluid Line Heater 5 Circuit Failed High

SPN 5488/FMI 3	
Description	Line Heater 5 Circuit Failed High
Monitored Parameter	Line Heater 5 Circuit
Typical Enabling Conditions	Always on
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Output Component Test

1. Connect to DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Perform Output Component Test.
4. Does the fault become active?
   - 4.a Yes; Go to step 6.
   - 4.b No; Go to step 5.
5. Repeat Output Component Test. The ignition must be cycled between each test. Does the fault become active?
   - 5.a Yes; Go to step 6.
   - 5.b No, clear the fault and release the vehicle.
6. Disconnect the line heater / Dosing Unit harness connector.
7. Inspect the sensor harness for bent, spread or corroded pins.
   - 7.a If the pins are bent, spread or corroded, repair as necessary.
   - 7.b If connector shows no signs of damage, repair the short to battery (12 volts) between pin 3 of the line heater 8-pin harness connector and pin 22 of the ACM 120-pin connector.

Dosing Unit			
8-Pin	**Circuit**	**ACM-Pin**	**Connector**
1	Dosing Unit Low side	28	
2	Dosing Unit High side	33	
3	Heating Low side	22	
4	Heating Supply	3	
5	Sensor Supply 5V	84	
6	Not Used	Not Used	
7	Sensor Ground	99	
8	DEF Pressure Signal	100	

356.2 SPN 5488/FMI 4 – GHG17

Diesel Exhaust Fluid Line Heater 5 Circuit Failed Low

SPN 5488/FMI 4	
Description	Line Heater 5 Circuit Failed Low
Monitored Parameter	Line Heater 5 Circuit
Typical Enabling Conditions	Always on
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Output Component Test

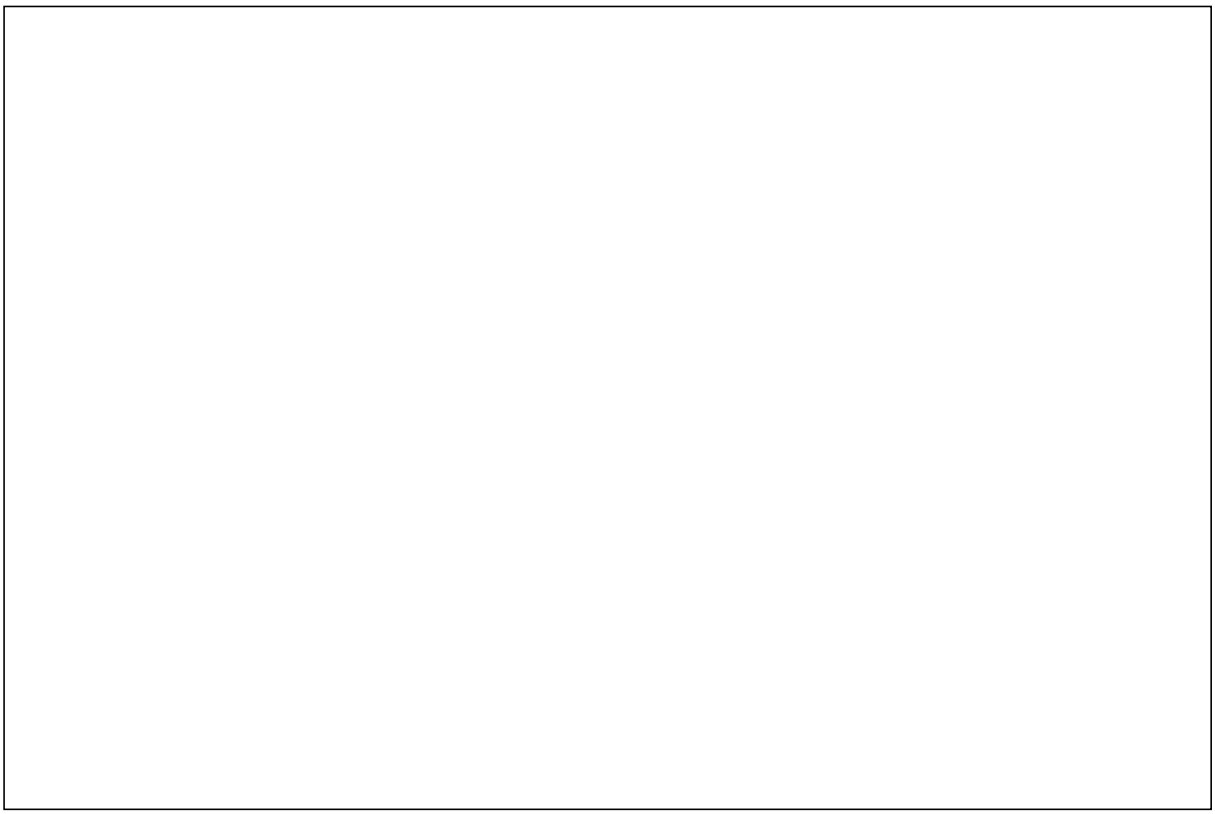
1. Turn the ignition OFF.
2. Disconnect the line heater/Dosing Unit 8-pin connector.
3. Inspect the sensor harness for bent, spread or corroded pins.
   - 3.a If the pins are bent, spread or corroded, repair as necessary.
   - 3.b If the connector shows no signs of damage, Go to step 4.
4. Disconnect the ACM 120-pin connector.
5. Measure the resistance between pin 3 on the harness side of the line heater 8-pin connector and ground.
   - 5.a If the resistance is less than 10K ohms, repair the wire between pin 3 of the line heater 8-pin connector and pin 22 of the ACM 120-pin connector.
   - 5.b If the resistance is greater than 10K ohms, replace the Dosing Unit.

Dosing Unit			
8-Pin	**Circuit**	**ACM-Pin**	**Connector**
1	Dosing Unit Low side	28	
2	Dosing Unit High side	33	
3	Heating Low side	22	
4	Heating Supply	3	
5	Sensor Supply 5V	84	
6	Not Used	Not Used	
7	Sensor Ground	99	
8	DEF Pressure Signal	100	

356.3 SPN 5488/FMI 5 – GHG17

Selective Catalyst Reduction Line Heater 5 Circuit Failed Open

SPN 5488/FMI 5	
Description	Selective Catalyst Reduction (SCR) Line Heater 5 Circuit Failed Open
Monitored Parameter	SCR Line Heater 5 Circuit
Typical Enabling Conditions	Always on
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Output Component Test



Note : Diesel Exhaust Fluid (DEF) line heaters are internal of the DEF lines. The heater electrical connectors are located near the DEF line couplings.

Line Heater 1	Doser To Tank DEF Line (Long-Line Extension Only)
Line Heater 2	Tank To Pump DEF Line
Line Heater 3	Pump To Doser DEF Line (Long-Line Extension Only)
Line Heater 4	Pump To Doser DEF Line
Line Heater 5	Doser To Tank DEF Line

Check as follows:

1. Disconnect line heater 5 harness connector. Refer to Original Equipment Manufacturer (OEM) literature for schematic information.
2. Inspect the harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector.
   - 2.a If signs of damage are present, repair as necessary. Using DiagnosticLink , perform Output Component Test to verify repairs.
   - 2.b If no signs of damage are present, Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 2 on the line heater 5 harness side connector and battery ground.
   - 4.a If the voltage is greater than 11.5V, Go to step 5.
   - 4.b If the voltage is less than 11.5V, repair the wire between pin 2 on the harness side of the DEF line heater connector and pin 39 of the Aftertreatment Control Module (ACM) 120-pin connector. Using DiagnosticLink, perform Output Component Test to verify repairs.
5. Turn the ignition OFF.
6. Disconnect the ACM 120-pin connector.
7. Inspect the harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector.
   - 7.a If signs of damage are present, repair as necessary. Using DiagnosticLink, perform Output Component Test to verify repairs.
   - 7.b If no signs of damage are present, Go to step 8.
8. Measure the resistance between pin 1 on the line heater 5 harness side connector and pin 16 of the ACM 120-pin harness side connector.
   - 8.a If the resistance is greater than 5 ohms, repair the open wire between pin 1 on the line heater 5 harness side connector and pin 16 of the ACM 120-pin harness side connector. Refer to Original Equipment Manufacturer (OEM) literature for schematic information.
   - 8.b If the resistance is less than 5 ohms, replace line heater 5. Refer to section "Removal of the Diesel Exhaust Fluid Lines" .

357.1 SPN 5540/FMI 2 - GHG17

Fuel Temperature Signal Not Plausible

SPN 5540 /FMI 2	
Description	This fault code sets when the Motor Control Module (MCM) detects that the fuel temperature is more than plus or minus 20°C (36°F) from the expected temperature after the engine has been turned off for eight hours.
Monitored Parameter	Fuel Temperature
Typical Enabling Conditions	Key ON, Engine OFF, battery voltage greater than 11 volts, engine rpm zero, ambient temperature less than 40°C (104 °F) ,ignition off for no less than eight hours.
Monitor Sequence	None
Execution Frequency	Once per cold soak cycle
Typical Duration	5 seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Road test the vehicle for 30 minutes until the coolant reaches operating temperature.

Possible causes:

- Reprogramming or time change to the CPC
- Usage of an external or aftermarket heating unit
- Damaged or corroded sensor connectors
- Failed sensor

Check as follows:

Note : The use of an external heating unit while the engine has been shut down for a minimum of eight hours can cause this fault code to set erroneously.

1. Has the Common Powertrain Controller (CPC) recently been reprogrammed or has the internal clock time been changed?
   1.a Yes; this fault may have been caused by the change in the CPC time. Go to step 8.
   1.b No; Go to step 2.
2. Connect DiagnosticLink®.
3. Turn the ignition ON (key ON, engine OFF).
4. Check for multiple fault codes. Are fault codes SPN 174/FMI 0, FMI 3, FMI 4 or FMI 17 present?
   4.a Yes; diagnose the other fault codes first.
   4.b No; Go to step 5.
5. Monitor and record the fuel temperature.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **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.

6. Start the engine.
7. Road test the vehicle for 30 minutes until the coolant reaches operating temperature.
8. Monitor the fuel temperature. Has the temperature increased from the previously recorded value?
   - 8.a Yes; Go to step 11.
   - 8.b No; Go to step 9.
9. Turn the ignition OFF.
10. Disconnect and inspect the fuel temperature electrical connector. Is there damage or corrosion present?
    - 10.a Yes; repair as necessary. Verify repair.
    - 10.b No; replace the fuel temperature sensor. Verify repair.
11. Turn the ignition OFF.
12. Disconnect and inspect the fuel temperature electrical connector. Is there damage or corrosion present?
    - 12.a Yes; repair as necessary. Verify repair.
    - 12.b No; Go to step 13.
13. Put a suitable drain pan under the vehicle below the fuel temperature sensor.
14. Remove the fuel temperature sensor.
15. Let the fuel temperature sensor sit out for 20 minutes.
16. Reconnect the fuel temperature electrical connector while the fuel temperature sensor is still removed.
17. Turn the ignition ON (key ON, engine OFF).
18. Compare the fuel temperature sensor reading to the ambient air temperature reading. Is the fuel temperature within 10°C (18°F) of the ambient air temperature?
    - 18.a Yes; the fault code may be caused by an external fuel heater. Go to step 19.
    - 18.b No; replace the fuel temperature sensor. Go to step 19.
19. Turn the ignition OFF.
20. Reinstall the fuel temperature sensor.
21. Prime the fuel system.

SPN 5540 (MCM) (GHG17)

357.1 SPN 5540/FMI 2 - GHG17

Fuel Temperature Signal Not Plausible

SPN 5540 /FMI 2	
Description	This fault code sets when the Motor Control Module (MCM) detects that the fuel temperature is more than plus or minus 20°C (36°F) from the expected temperature after the engine has been turned off for eight hours.
Monitored Parameter	Fuel Temperature
Typical Enabling Conditions	Key ON, Engine OFF, battery voltage greater than 11 volts, engine rpm zero, ambient temperature less than 40°C (104 °F) ,ignition off for no less than eight hours.
Monitor Sequence	None
Execution Frequency	Once per cold soak cycle
Typical Duration	5 seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Road test the vehicle for 30 minutes until the coolant reaches operating temperature.

Possible causes:

- Reprogramming or time change to the CPC
- Usage of an external or aftermarket heating unit
- Damaged or corroded sensor connectors
- Failed sensor

Check as follows:

Note : The use of an external heating unit while the engine has been shut down for a minimum of eight hours can cause this fault code to set erroneously.

1. Has the Common Powertrain Controller (CPC) recently been reprogrammed or has the internal clock time been changed?
   1.a Yes; this fault may have been caused by the change in the CPC time. Go to step 8.
   1.b No; Go to step 2.
2. Connect DiagnosticLink®.
3. Turn the ignition ON (key ON, engine OFF).
4. Check for multiple fault codes. Are fault codes SPN 174/FMI 0, FMI 3, FMI 4 or FMI 17 present?
   4.a Yes; diagnose the other fault codes first.
   4.b No; Go to step 5.
5. Monitor and record the fuel temperature.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **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.

6. Start the engine.
7. Road test the vehicle for 30 minutes until the coolant reaches operating temperature.
8. Monitor the fuel temperature. Has the temperature increased from the previously recorded value?
   - 8.a Yes; Go to step 11.
   - 8.b No; Go to step 9.
9. Turn the ignition OFF.
10. Disconnect and inspect the fuel temperature electrical connector. Is there damage or corrosion present?
    - 10.a Yes; repair as necessary. Verify repair.
    - 10.b No; replace the fuel temperature sensor. Verify repair.
11. Turn the ignition OFF.
12. Disconnect and inspect the fuel temperature electrical connector. Is there damage or corrosion present?
    - 12.a Yes; repair as necessary. Verify repair.
    - 12.b No; Go to step 13.
13. Put a suitable drain pan under the vehicle below the fuel temperature sensor.
14. Remove the fuel temperature sensor.
15. Let the fuel temperature sensor sit out for 20 minutes.
16. Reconnect the fuel temperature electrical connector while the fuel temperature sensor is still removed.
17. Turn the ignition ON (key ON, engine OFF).
18. Compare the fuel temperature sensor reading to the ambient air temperature reading. Is the fuel temperature within 10°C (18°F) of the ambient air temperature?
    - 18.a Yes; the fault code may be caused by an external fuel heater. Go to step 19.
    - 18.b No; replace the fuel temperature sensor. Go to step 19.
19. Turn the ignition OFF.
20. Reinstall the fuel temperature sensor.
21. Prime the fuel system.

358.1 SPN 5569/FMI 3 - GHG17

Soot Sensor Printed Circuit Board Temperature 1 Signal Range High

SPN 5569/FMI 3	
Description	Soot Sensor detects an over-temperature
Monitored Parameter	Soot Sensor Temperature
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink , check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

358.2 SPN 5569/FMI 4 - GHG17

Soot Sensor Printed Circuit Board Temperature 1 Signal Range Low

SPN 5569/FMI 4	
Description	Soot Sensor printed circuit board temperature low
Monitored Parameter	Soot Sensor circuit board temperature
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink , check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

SPN 5569 (ACM) (GHG17)

358.1 SPN 5569/FMI 3 - GHG17

Soot Sensor Printed Circuit Board Temperature 1 Signal Range High

SPN 5569/FMI 3	
Description	Soot Sensor detects an over-temperature
Monitored Parameter	Soot Sensor Temperature
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink , check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

358.2 SPN 5569/FMI 4 - GHG17

Soot Sensor Printed Circuit Board Temperature 1 Signal Range Low

SPN 5569/FMI 4	
Description	Soot Sensor printed circuit board temperature low
Monitored Parameter	Soot Sensor circuit board temperature
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink , check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

359.1 SPN 5571/FMI 7 - GHG17

Pressure Limiting Valve Staying Open

The pressure limiting valve will open when rail pressure is above 1150 bar. The Motor Control Module (MCM) will command a lower rail pressure, trying to force the pressure limiting valve closed. If the pressure limiting valve does not close, a fault code is generated. The condition that caused the Pressure Limiting Valve (PLV) to open must be addressed.

SPN 5571/FMI 7	
Description	Pressure Limiting Valve, Failed to Close
Monitored Parameter	Pressure Limiting Valve
Typical Enabling Conditions	RP Closed Loop Control & RPM Greater than 0
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	10 Seconds
Dash Lamps	MIL,CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)

Check as follows:

1. Check for multiple codes.
   1.a If additional fault codes are present with SPN 5571/FMI 7, service the additional fault codes first.
   1.b If only SPN 5571/FMI 7 is present, Go to step 2.

> **⚠ 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.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ WARNING**
>
> PERSONAL INJURY
>
> Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

2. Start the engine.

> **WARNING**
>
> PRESSURIZED FUEL
>
> To avoid injury to eye or face, wear a face shield or goggles when conducting a pressure test.

3. Using DiagnosticLink Standard, monitor fuel rail pressure at idle.
   - 3.a If the fuel rail pressure is above 900 bar, check for a damaged needle return line and a damaged line (fuel rail to fuel injector). Repair as necessary.
   - 3.b If rail pressure is below 900 bar, Go to step 4.

> **WARNING**
>
> PERSONAL INJURY
>
> To prevent the escape of high pressure fuel that can penetrate skin, ensure the engine has been shut down for a minimum of 10 minutes before servicing any component within the high pressure circuit. Residual high fuel pressure may be present within the circuit.

4. Increase engine speed to 1800 rpm and check the fuel rail pressure.
   - 4.a If rail pressure is above 900 bar, check for a damaged needle return line, a damaged amplifier return line and a damaged line (fuel rail to fuel injector). Repair as necessary.
   - 4.b If rail pressure is below 900 bar, replace the PLV. Refer to section "Removal of the Pressure Limiting Valve - Two-Filter System" .

SPN 5571 (MCM) (GHG17)

359.1 SPN 5571/FMI 7 - GHG17

Pressure Limiting Valve Staying Open

The pressure limiting valve will open when rail pressure is above 1150 bar. The Motor Control Module (MCM) will command a lower rail pressure, trying to force the pressure limiting valve closed. If the pressure limiting valve does not close, a fault code is generated. The condition that caused the Pressure Limiting Valve (PLV) to open must be addressed.

SPN 5571/FMI 7	
Description	Pressure Limiting Valve, Failed to Close
Monitored Parameter	Pressure Limiting Valve
Typical Enabling Conditions	RP Closed Loop Control & RPM Greater than 0
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	10 Seconds
Dash Lamps	MIL,CEL
Engine Reaction	Derate 25%
Verification	Engine Idle (1 minute)

Check as follows:

1. Check for multiple codes.
   1.a If additional fault codes are present with SPN 5571/FMI 7, service the additional fault codes first.
   1.b If only SPN 5571/FMI 7 is present, Go to step 2.

> **⚠ 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.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ WARNING**
>
> PERSONAL INJURY
>
> Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

2. Start the engine.

> **WARNING**
>
> PRESSURIZED FUEL
>
> To avoid injury to eye or face, wear a face shield or goggles when conducting a pressure test.

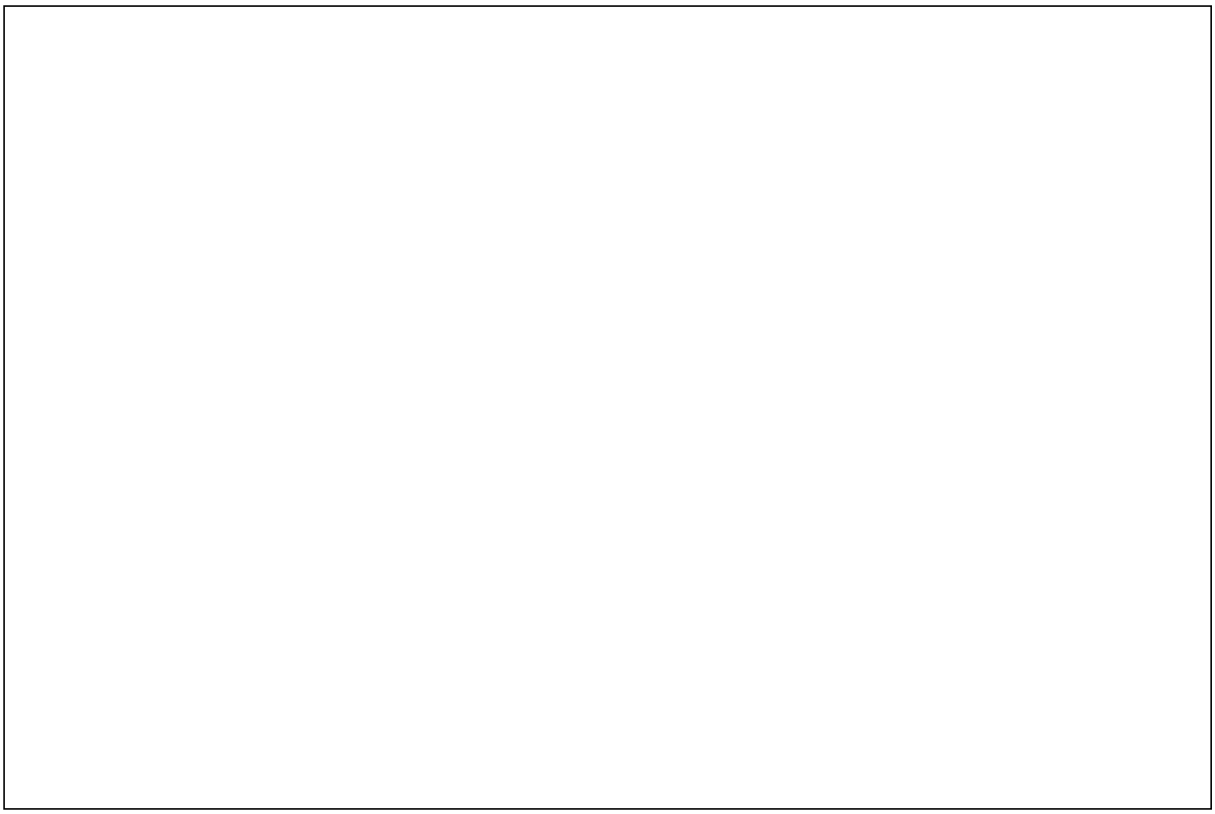
3. Using DiagnosticLink Standard, monitor fuel rail pressure at idle.
   - 3.a If the fuel rail pressure is above 900 bar, check for a damaged needle return line and a damaged line (fuel rail to fuel injector). Repair as necessary.
   - 3.b If rail pressure is below 900 bar, Go to step 4.

> **WARNING**
>
> PERSONAL INJURY
>
> To prevent the escape of high pressure fuel that can penetrate skin, ensure the engine has been shut down for a minimum of 10 minutes before servicing any component within the high pressure circuit. Residual high fuel pressure may be present within the circuit.

4. Increase engine speed to 1800 rpm and check the fuel rail pressure.
   - 4.a If rail pressure is above 900 bar, check for a damaged needle return line, a damaged amplifier return line and a damaged line (fuel rail to fuel injector). Repair as necessary.
   - 4.b If rail pressure is below 900 bar, replace the PLV. Refer to section "Removal of the Pressure Limiting Valve - Two-Filter System" .

360.1 SPN 5588/FMI 9 - GHG17

SPN 5588/FMI 9	
Description	The Fault Code Sets when the Motor Control Module (MCM) Does Not Receive a Message from the Exhaust Gas Recirculation (EGR) Valve Actuator
Monitored Parameter	MCM Communication from the EGR Valve Actuator
Typical Enabling Conditions	Ignition ON
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Ignition ON



Check as follows:

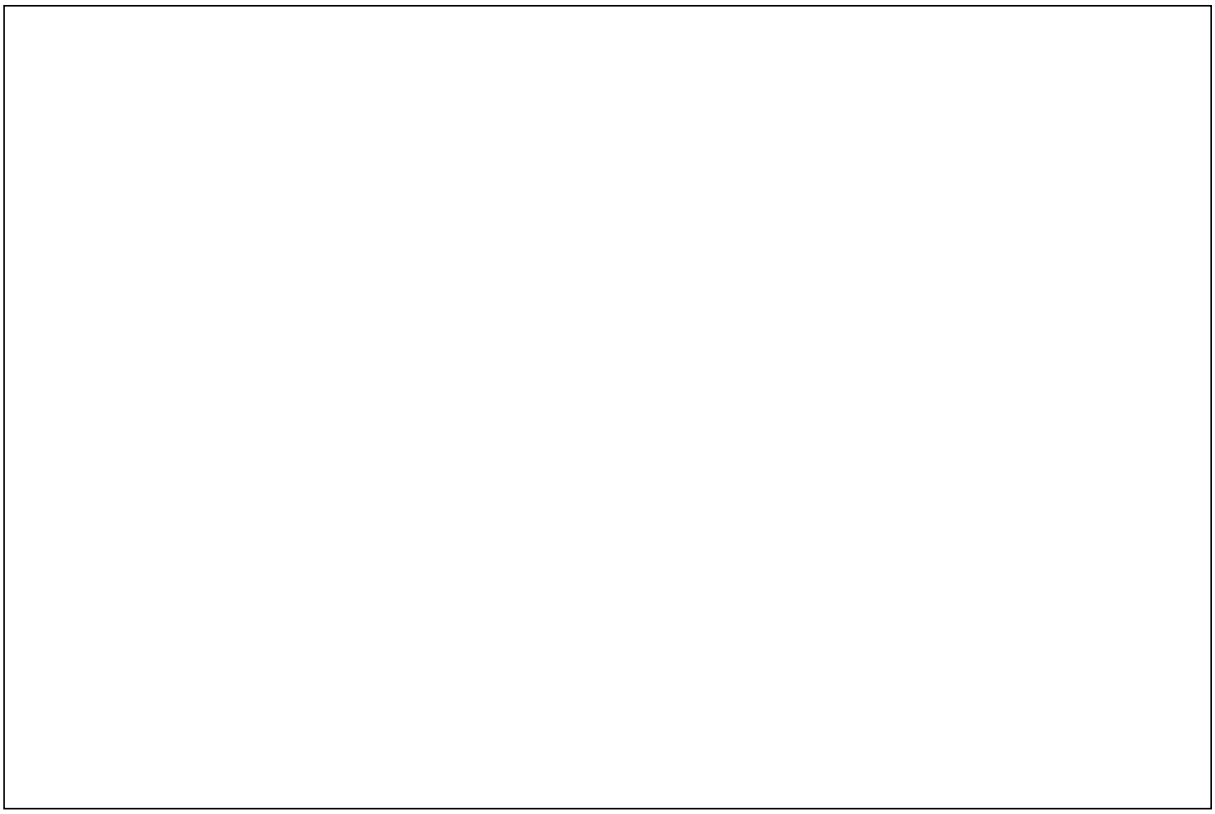
1. Check for low battery voltage fault codes. Is fault code SPN 520296/FMI 3 present?
   1.a Yes; diagnose the low battery voltage fault code first.
   1.b No; Go to step 2.
2. Check for multiple EGR fault codes. Are there any other EGR valve actuator fault codes also active?
   2.a Yes; replace the EGR valve actuator.
   2.b No; Go to step 3.
3. Turn the ignition OFF.

4. Disconnect and inspect the EGR valve actuator electrical connector components side. Are there any damaged, corroded or spread pins?
   - 4.a Yes; replace the EGR valve actuator.
   - 4.b No; Go to step 5.
5. Inspect the EGR valve actuator electrical connector harness side. Are there any damaged, corroded or spread pins?
   - 5.a Yes; repair the connector as necessary.
   - 5.b No; Go to step 6.
6. Turn the ignition ON (key ON, engine OFF).
7. Measure the voltage between pins 1 and 2. Is the voltage greater than 11 volts?
   - 7.a Yes; Go to step 9.
   - 7.b No; Go to step 8.
8. Measure the voltage between pin 1 and ground. Is the voltage greater than 11 volts?
   - 8.a Yes; repair the ground circuit between pin 2 of the EGR valve actuator electrical connector harness side and the circuit splice.
   - 8.b No; repair the voltage circuit between pin 1 of the EGR valve actuator electrical connector harness side and the circuit splice.
9. Turn the ignition OFF.
10. Measure the resistance between pins 3 and 4 of the EGR valve actuator electrical connector harness side. Is the resistance between 55 and 65 ohms?
    - 10.a Yes: replace the EGR valve actuator.
    - 10.b No, Go to step 11.
11. Disconnect and inspect the 120-pin MCM electrical connector components side. Are there any damaged or corroded pins?
    - 11.a Yes; replace the MCM.
    - 11.b No; Go to step 12.
12. Inspect the 120-pin MCM electrical connector harness side. Are there any damaged, corroded, or spread pins?
    - 12.a Yes; repair as necessary.
    - 12.b No; Go to step 13.
13. Measure the resistance between pin 3 of the EGR valve actuator electrical connector harness side and pin 74 of the 120-pin MCM electrical connector harness side. Is the resistance less than five ohms?
    - 13.a Yes; Go to step 14.
    - 13.b No; repair the communication circuit between pin 3 of the EGR valve actuator electrical connector harness side and pin 74 of the 120-pin MCM electrical connector harness side.
14. Measure the resistance between pin 4 of the EGR valve actuator electrical connector harness side and pin 75 of the 120-pin MCM electrical connector harness side. Is the resistance less than five ohms?
    - 14.a Yes; replace the MCM.
    - 14.b No; repair the communication circuit between pin 4 of the EGR valve actuator electrical connector harness side and pin 75 of the 120-pin MCM electrical connector harness side.

SPN 5588 (MCM) (GHG17)

360.1 SPN 5588/FMI 9 - GHG17

SPN 5588/FMI 9	
Description	The Fault Code Sets when the Motor Control Module (MCM) Does Not Receive a Message from the Exhaust Gas Recirculation (EGR) Valve Actuator
Monitored Parameter	MCM Communication from the EGR Valve Actuator
Typical Enabling Conditions	Ignition ON
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Ignition ON



Check as follows:

1. Check for low battery voltage fault codes. Is fault code SPN 520296/FMI 3 present?
   1.a Yes; diagnose the low battery voltage fault code first.
   1.b No; Go to step 2.
2. Check for multiple EGR fault codes. Are there any other EGR valve actuator fault codes also active?
   2.a Yes; replace the EGR valve actuator.

2.b No; Go to step 3.

3. Turn the ignition OFF.
4. Disconnect and inspect the EGR valve actuator electrical connector components side. Are there any damaged, corroded or spread pins?

   4.a Yes; replace the EGR valve actuator.

   4.b No; Go to step 5.

5. Inspect the EGR valve actuator electrical connector harness side. Are there any damaged, corroded or spread pins?

   5.a Yes; repair the connector as necessary.

   5.b No; Go to step 6.

6. Turn the ignition ON (key ON, engine OFF).
7. Measure the voltage between pins 1 and 2. Is the voltage greater than 11 volts?

   7.a Yes; Go to step 9.

   7.b No; Go to step 8.

8. Measure the voltage between pin 1 and ground. Is the voltage greater than 11 volts?

   8.a Yes; repair the ground circuit between pin 2 of the EGR valve actuator electrical connector harness side and the circuit splice.

   8.b No; repair the voltage circuit between pin 1 of the EGR valve actuator electrical connector harness side and the circuit splice.

9. Turn the ignition OFF.
10. Measure the resistance between pins 3 and 4 of the EGR valve actuator electrical connector harness side. Is the resistance between 55 and 65 ohms?

    10.a Yes: replace the EGR valve actuator.

    10.b No, Go to step 11.

11. Disconnect and inspect the 120-pin MCM electrical connector components side. Are there any damaged or corroded pins?

    11.a Yes; replace the MCM.

    11.b No; Go to step 12.

12. Inspect the 120-pin MCM electrical connector harness side. Are there any damaged, corroded, or spread pins?

    12.a Yes; repair as necessary.

    12.b No; Go to step 13.

13. Measure the resistance between pin 3 of the EGR valve actuator electrical connector harness side and pin 74 of the 120-pin MCM electrical connector harness side. Is the resistance less than five ohms?

    13.a Yes; Go to step 14.

    13.b No; repair the communication circuit between pin 3 of the EGR valve actuator electrical connector harness side and pin 74 of the 120-pin MCM electrical connector harness side.

14. Measure the resistance between pin 4 of the EGR valve actuator electrical connector harness side and pin 75 of the 120-pin MCM electrical connector harness side. Is the resistance less than five ohms?

    14.a Yes; replace the MCM.

    14.b No; repair the communication circuit between pin 4 of the EGR valve actuator electrical connector harness side and pin 75 of the 120-pin MCM electrical connector harness side.

361.1 SPN 5741/FMI 4 - GHG17

Soot Sensor Inter-Digital Electrode Short Circuit

SPN 5741 / FMI 4	
Description	Soot Sensor Heater High Current Flow
Monitored Parameter	Soot Sensor Temperature
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

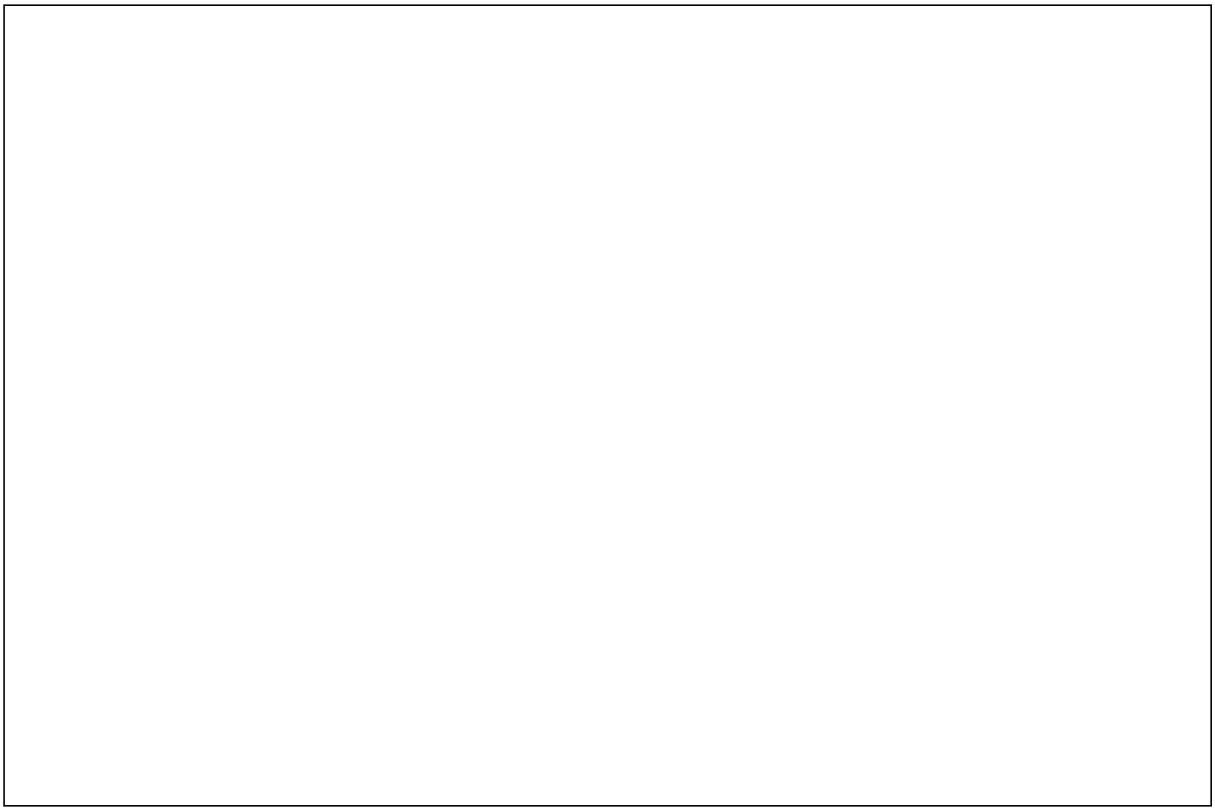
Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 200°C (392°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect soot sensor harness connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

361.2 SPN 5741/FMI 9 - GHG17

Soot Sensor Communication Error

SPN 5741/FMI 9	
Description	This fault code sets when the soot sensor feedback Controller Area Network (CAN) signal fails.
Monitored Parameter	Soot Sensor CAN Communication
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	Continuously
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Key Cycle



Check as follows:

1. Turn the ignition OFF.
2. Disconnect the soot sensor electrical connector.
3. Inspect the harness and connector for signs of damage, bent, spread, corroded or unseated (pushed out) pins. Is any damage found?
   - 3.a Yes; repair as necessary. Verify repairs.
   - 3.b No; Go to step 4.
4. Inspect the soot sensor wiring between the sensor probe and the sensor control unit. Is any damage found?
   - 4.a Yes; Replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.
   - 4.b No; Go to step 5.

5. Inspect the harness and connectors between the soot sensor and the Aftertreatment Control Module (ACM) for signs of damage, chaffing, overheating, or corrosion. Is any damage found?
   - 5.a Yes; repair as necessary. Verify repairs.
   - 5.b No; Go to step 6.
6. Disconnect the ACM 120-pin connector.
7. Inspect the ACM 120-pin harness connector for signs of damage, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 7.a Yes; repair as necessary. Verify repairs.
   - 7.b No; Go to step 8.
8. Measure the resistance between pin 3 of the soot sensor connector, harness side and pin 44 of the ACM 120-pin connector, harness side. Is the resistance less than 5 ohms?
   - 8.a Yes; Go to step 9.
   - 8.b No; repair the wire between pin 3 on the harness side of the soot sensor connector and pin 44 of the ACM 120-pin connector. Verify repairs.
9. Measure the resistance between pin 4 of the soot sensor connector, harness side and pin 61 of the ACM 120-pin connector, harness side. Is the resistance less than 5 ohms?
   - 9.a Yes; Go to step 10.
   - 9.b No; repair the wire between pin 4 on the harness side of the soot sensor connector and pin 61 of the ACM 120-pin connector.
10. Measure the resistance between pin 3 of the soot sensor connector, harness side, and battery ground. Is the resistance greater than 10K ohms?
    - 10.a Yes; Go to step 11.
    - 10.b No; repair the shorted wire between pin 3 on the harness side of the soot sensor connector and ground. Verify repairs.
11. Measure the resistance between pin 4 of the soot sensor connector, harness side and battery ground. Is the resistance greater than 10K ohms?
    - 11.a Yes; Go to step 12.
    - 11.b No; repair the shorted wire between pin 4 on the harness side of the soot sensor connector and ground. Verify repairs.
12. Measure the resistance between pins 44 and 61 on the ACM 120-pin connector, component side. Is the resistance between 50 and 70 ohms?
    - 12.a Yes; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor. Verify repairs.
    - 12.b No; replace the ACM.

      For 1-BOX™, Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" . Verify repairs.

      For 2-BOX, Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module" . Verify repairs.

361.3 SPN 5741/FMI 12 - GHG17

Soot Sensor Inter-Digital Electrode Self-Diagnostic

SPN 5741/ FMI 12	
Description	Soot Sensor Heater Current Flow
Monitored Parameter	Soot Sensor Heater Temperature
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink® Soot Sensor Panel inspection routine.

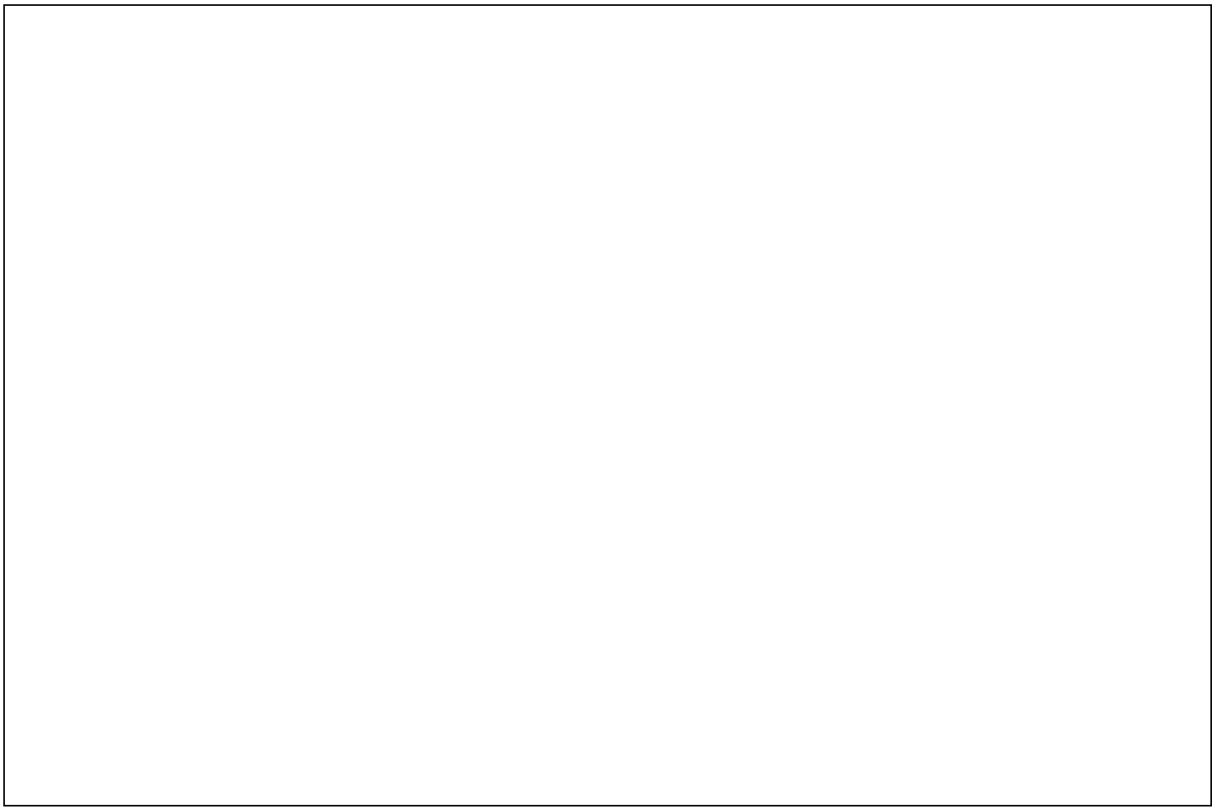
Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 200°C (392°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink , check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect soot sensor harness connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

361.4 SPN 5741/FMI 13 - GHG17

SPN 5741/FMI 13	
Description	Soot Sensor Controller Area Network (CAN) Feedback Signal Failure
Monitored Parameter	Soot Sensor CAN Communication
Typical Enabling Conditions	Soot Sensor Enabled
Monitor Sequence	Continuously
Execution Frequency	Always Enabled
Typical Duration	Five Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Soot Sensor Inspection Routine



Check as follows:

1. Check the Aftertreatment Control Module (ACM) software level. Is the software level e7.57.5.0 or higher?
   1.a Yes; Go to step 2.
   1.b No; connect to the server and update the ACM to the latest available on the server. Verify repairs.
2. Turn the ignition OFF.
3. Disconnect the soot sensor harness connector.
4. Inspect the harness and connector for signs of damage, bent, spread, corroded or unseated (pushed out) pins. Is any damage found?
   4.a Yes; repair as necessary. Verify repairs.
   4.b No; Go to step 5.
5. Inspect soot sensor wiring between the sensor probe and the sensor control unit. Is any damage found?
   5.a Yes; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor" . Verify repairs.

5.b No; Go to step 6.

6. Inspect the harness and connectors between soot sensor and the Aftertreatment Control Module (ACM) for signs of damage, chaffing, overheating, or corrosion. Is any damage found?

   6.a Yes; repair as necessary. Verify repairs.

   6.b No; Go to step 7.

7. Turn the ignition ON (key ON, engine OFF).

8. Measure the voltage between pins 1 and 2 of the soot sensor harness connector, harness side. Is the voltage reading within .5 volts of battery voltage?

   8.a Yes; Go to step 10.

   8.b No; Go to step 9.

9. Measure the voltage between pin 1 of the soot sensor connector harness side and ground. Is the voltage within .5 volts of battery voltage?

   9.a Yes; repair the open circuit between pin 2 of the soot sensor connector and pin 96 of the ACM 120-pin connector.

   9.b No; repair the open circuit between pin 1 of the soot sensor connector and pin 66 of the ACM 120-pin connector.

10. Turn the ignition OFF.

11. Measure the resistance between pins 3 and 4 of the soot sensor connector harness side. Is the resistance between 55 and 65 ohms?

    11.a Yes; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor" . Verify repairs.

    11.b No; Go to step 12.

12. Measure the resistance between pin 3 of the soot sensor connector harness side and ground. Is the resistance greater than 10K ohms?

    12.a Yes; Go to step 13.

    12.b No; repair the short to ground between pin 3 of the soot sensor connector and pin 44 of the ACM 120-pin connector. Verify repair.

13. Measure the resistance between pin 4 of the soot sensor connector harness side and ground. Is the resistance greater than 10K ohms?

    13.a Yes; Go to step 14.

    13.b No; repair the short to ground between pin 4 of the soot sensor connector and pin 61 of the ACM 120-pin connector.

14. Disconnect the ACM 120-pin connector.

15. Inspect the ACM 120-pin harness connector for signs of damage, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

    15.a Yes; repair as necessary. Verify repairs.

    15.b No; Go to step 16.

16. Measure the resistance between pins 44 and 61 on the ACM 120-pin connector, component side. Is the resistance between 55 to 65 ohms?

    16.a Yes; replace the aftertreatment harness. Refer to section "Removal of the 1-BOX™ Aftertreatment Harness" . Verify repairs.

    16.b No; replace the ACM.

    Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" . Verify repairs.

    Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module" . Verify repairs.

361.5 SPN 5741/FMI 16 - GHG17

Soot Sensor Data Valid But Above Normal Operating Range - Moderately Severe Level

SPN 5741/ FMI 16	
Description	Soot Sensor data is above normal range
Monitored Parameter	Soot Sensor Inter-Digital Electrode (IDE)
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	Continuously
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 200°C (392°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink , check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect soot sensor harness connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section *"Removal of the 2V2/2HH Soot Sensor".* Verify repairs.

361.6 SPN 5741/FMI 18 - GHG17

Soot Sensor Data Valid But Below Normal Operating Range - Moderately Severe Level

SPN 5741/ FMI 18	
Description	Soot Sensor data is below normal range
Monitored Parameter	Soot Sensor Inter-Digital Electrode (IDE)
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	Continuously
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink® Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 200°C (392°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink , check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect soot sensor harness connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

SPN 5741 (ACM) (GHG17)

361.1 SPN 5741/FMI 4 - GHG17

Soot Sensor Inter-Digital Electrode Short Circuit

SPN 5741 / FMI 4	
Description	Soot Sensor Heater High Current Flow
Monitored Parameter	Soot Sensor Temperature
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

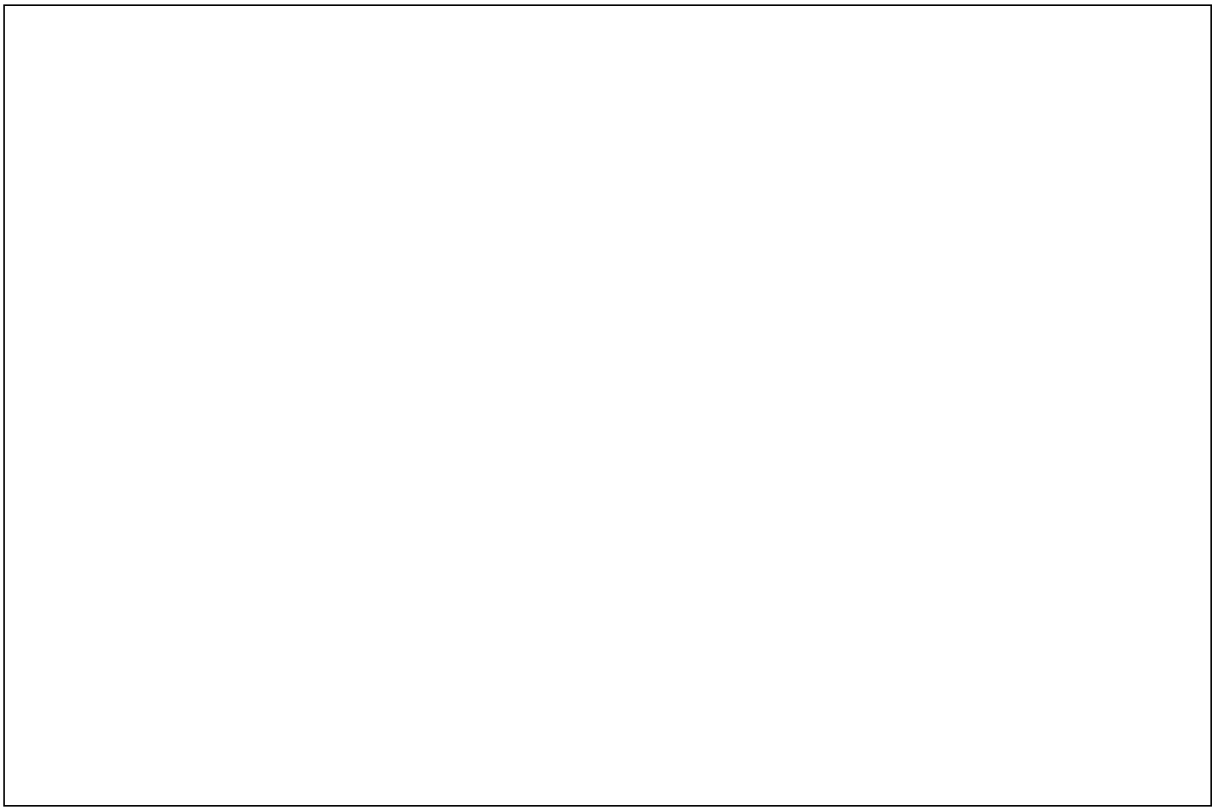
Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 200°C (392°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect soot sensor harness connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

361.2 SPN 5741/FMI 9 - GHG17

Soot Sensor Communication Error

SPN 5741/FMI 9	
Description	This fault code sets when the soot sensor feedback Controller Area Network (CAN) signal fails.
Monitored Parameter	Soot Sensor CAN Communication
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	Continuously
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Key Cycle



Check as follows:

1. Turn the ignition OFF.
2. Disconnect the soot sensor electrical connector.
3. Inspect the harness and connector for signs of damage, bent, spread, corroded or unseated (pushed out) pins. Is any damage found?
   - 3.a Yes; repair as necessary. Verify repairs.
   - 3.b No; Go to step 4.
4. Inspect the soot sensor wiring between the sensor probe and the sensor control unit. Is any damage found?
   - 4.a Yes; Replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.
   - 4.b No; Go to step 5.

5. Inspect the harness and connectors between the soot sensor and the Aftertreatment Control Module (ACM) for signs of damage, chaffing, overheating, or corrosion. Is any damage found?
   - 5.a Yes; repair as necessary. Verify repairs.
   - 5.b No; Go to step 6.
6. Disconnect the ACM 120-pin connector.
7. Inspect the ACM 120-pin harness connector for signs of damage, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 7.a Yes; repair as necessary. Verify repairs.
   - 7.b No; Go to step 8.
8. Measure the resistance between pin 3 of the soot sensor connector, harness side and pin 44 of the ACM 120-pin connector, harness side. Is the resistance less than 5 ohms?
   - 8.a Yes; Go to step 9.
   - 8.b No; repair the wire between pin 3 on the harness side of the soot sensor connector and pin 44 of the ACM 120-pin connector. Verify repairs.
9. Measure the resistance between pin 4 of the soot sensor connector, harness side and pin 61 of the ACM 120-pin connector, harness side. Is the resistance less than 5 ohms?
   - 9.a Yes; Go to step 10.
   - 9.b No; repair the wire between pin 4 on the harness side of the soot sensor connector and pin 61 of the ACM 120-pin connector.
10. Measure the resistance between pin 3 of the soot sensor connector, harness side, and battery ground. Is the resistance greater than 10K ohms?
    - 10.a Yes; Go to step 11.
    - 10.b No; repair the shorted wire between pin 3 on the harness side of the soot sensor connector and ground. Verify repairs.
11. Measure the resistance between pin 4 of the soot sensor connector, harness side and battery ground. Is the resistance greater than 10K ohms?
    - 11.a Yes; Go to step 12.
    - 11.b No; repair the shorted wire between pin 4 on the harness side of the soot sensor connector and ground. Verify repairs.
12. Measure the resistance between pins 44 and 61 on the ACM 120-pin connector, component side. Is the resistance between 50 and 70 ohms?
    - 12.a Yes; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor. Verify repairs.
    - 12.b No; replace the ACM.

      For 1-BOX™, Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" . Verify repairs.

      For 2-BOX, Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module" . Verify repairs.

361.3 SPN 5741/FMI 12 - GHG17

Soot Sensor Inter-Digital Electrode Self-Diagnostic

SPN 5741/ FMI 12	
Description	Soot Sensor Heater Current Flow
Monitored Parameter	Soot Sensor Heater Temperature
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink® Soot Sensor Panel inspection routine.

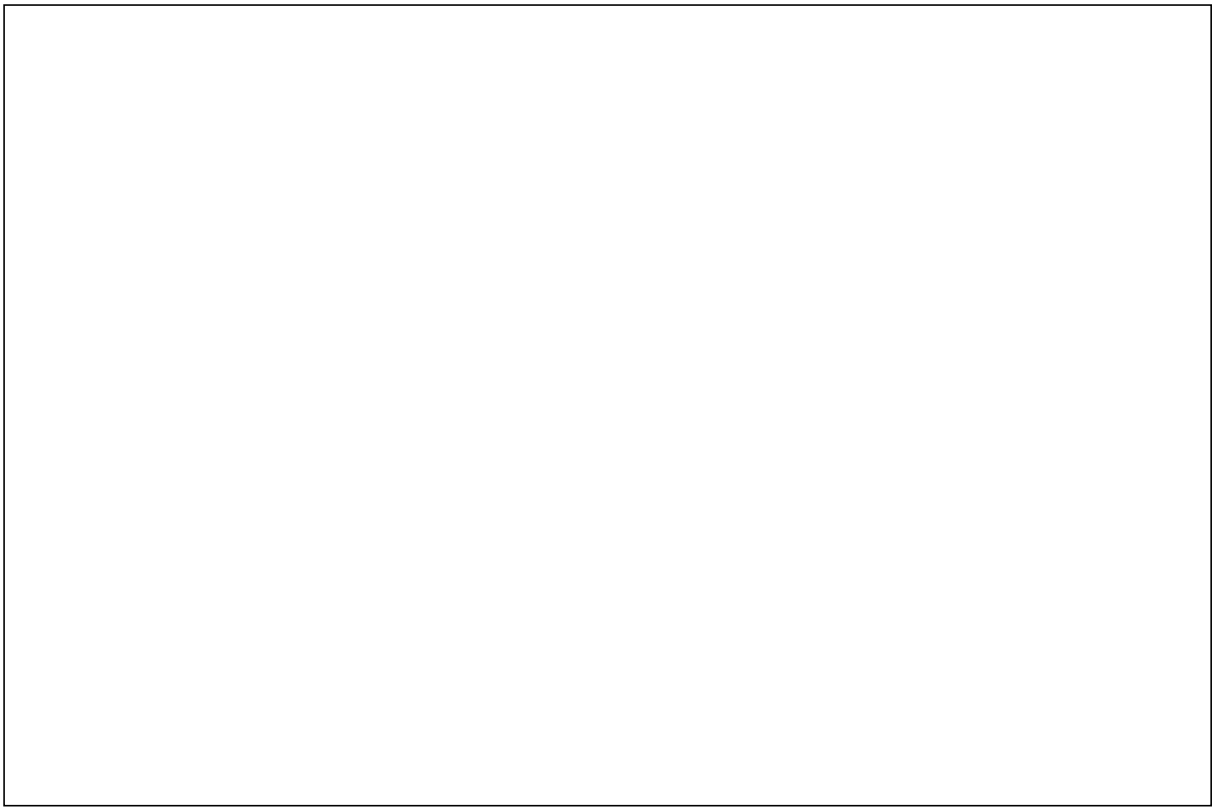
Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 200°C (392°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink , check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect soot sensor harness connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

361.4 SPN 5741/FMI 13 - GHG17

SPN 5741/FMI 13	
Description	Soot Sensor Controller Area Network (CAN) Feedback Signal Failure
Monitored Parameter	Soot Sensor CAN Communication
Typical Enabling Conditions	Soot Sensor Enabled
Monitor Sequence	Continuously
Execution Frequency	Always Enabled
Typical Duration	Five Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Soot Sensor Inspection Routine



Check as follows:

1. Check the Aftertreatment Control Module (ACM) software level. Is the software level e7.57.5.0 or higher?
   1.a Yes; Go to step 2.
   1.b No; connect to the server and update the ACM to the latest available on the server. Verify repairs.
2. Turn the ignition OFF.
3. Disconnect the soot sensor harness connector.
4. Inspect the harness and connector for signs of damage, bent, spread, corroded or unseated (pushed out) pins. Is any damage found?
   4.a Yes; repair as necessary. Verify repairs.
   4.b No; Go to step 5.
5. Inspect soot sensor wiring between the sensor probe and the sensor control unit. Is any damage found?
   5.a Yes; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor" . Verify repairs.

5.b No; Go to step 6.

6. Inspect the harness and connectors between soot sensor and the Aftertreatment Control Module (ACM) for signs of damage, chaffing, overheating, or corrosion. Is any damage found?

   6.a Yes; repair as necessary. Verify repairs.

   6.b No; Go to step 7.

7. Turn the ignition ON (key ON, engine OFF).

8. Measure the voltage between pins 1 and 2 of the soot sensor harness connector, harness side. Is the voltage reading within .5 volts of battery voltage?

   8.a Yes; Go to step 10.

   8.b No; Go to step 9.

9. Measure the voltage between pin 1 of the soot sensor connector harness side and ground. Is the voltage within .5 volts of battery voltage?

   9.a Yes; repair the open circuit between pin 2 of the soot sensor connector and pin 96 of the ACM 120-pin connector.

   9.b No; repair the open circuit between pin 1 of the soot sensor connector and pin 66 of the ACM 120-pin connector.

10. Turn the ignition OFF.

11. Measure the resistance between pins 3 and 4 of the soot sensor connector harness side. Is the resistance between 55 and 65 ohms?

    11.a Yes; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor" . Verify repairs.

    11.b No; Go to step 12.

12. Measure the resistance between pin 3 of the soot sensor connector harness side and ground. Is the resistance greater than 10K ohms?

    12.a Yes; Go to step 13.

    12.b No; repair the short to ground between pin 3 of the soot sensor connector and pin 44 of the ACM 120-pin connector. Verify repair.

13. Measure the resistance between pin 4 of the soot sensor connector harness side and ground. Is the resistance greater than 10K ohms?

    13.a Yes; Go to step 14.

    13.b No; repair the short to ground between pin 4 of the soot sensor connector and pin 61 of the ACM 120-pin connector.

14. Disconnect the ACM 120-pin connector.

15. Inspect the ACM 120-pin harness connector for signs of damage, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

    15.a Yes; repair as necessary. Verify repairs.

    15.b No; Go to step 16.

16. Measure the resistance between pins 44 and 61 on the ACM 120-pin connector, component side. Is the resistance between 55 to 65 ohms?

    16.a Yes; replace the aftertreatment harness. Refer to section "Removal of the 1-BOX™ Aftertreatment Harness" . Verify repairs.

    16.b No; replace the ACM.

    Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" . Verify repairs.

    Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module" . Verify repairs.

361.5 SPN 5741/FMI 16 - GHG17

Soot Sensor Data Valid But Above Normal Operating Range - Moderately Severe Level

SPN 5741/ FMI 16	
Description	Soot Sensor data is above normal range
Monitored Parameter	Soot Sensor Inter-Digital Electrode (IDE)
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	Continuously
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 200°C (392°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink , check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect soot sensor harness connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section *"Removal of the 2V2/2HH Soot Sensor".* Verify repairs.

361.6 SPN 5741/FMI 18 - GHG17

Soot Sensor Data Valid But Below Normal Operating Range - Moderately Severe Level

SPN 5741/ FMI 18	
Description	Soot Sensor data is below normal range
Monitored Parameter	Soot Sensor Inter-Digital Electrode (IDE)
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	Continuously
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink® Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 200°C (392°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink , check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect soot sensor harness connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

362.1 SPN 5747/FMI 12 - GHG17

Soot Sensor Heater Fault

SPN 5747/FMI 12	
Description	Soot Sensor heater temperature or voltage is out of range
Monitored Parameter	Soot Sensor heater temperature or voltage
Typical Enabling Conditions	Soot Sensor heater enabled
Monitor Sequence	Continuously
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink™ Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, the soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition ON (Key ON, Engine OFF).
2. Using DiagnosticLink , check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

SPN 5747 (ACM) (GHG17)

362.1 SPN 5747/FMI 12 - GHG17

Soot Sensor Heater Fault

SPN 5747/FMI 12	
Description	Soot Sensor heater temperature or voltage is out of range
Monitored Parameter	Soot Sensor heater temperature or voltage
Typical Enabling Conditions	Soot Sensor heater enabled
Monitor Sequence	Continuously
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink™ Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, the soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition ON (Key ON, Engine OFF).
2. Using DiagnosticLink , check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

363.1 SPN 5765/FMI 0 - GHG17

EGR temperature alert

SPN 5765/FMI 0	
Description	This fault code sets when the EGR actuator temperature is greater than 134°C (275°F)
Monitored Parameter	EGR temperature
Typical Enabling Conditions	Engine running
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine running

Check as follows:

> **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.

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

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are any of the following fault codes present?

- SPN 110/FMI 0
- SPN 110/FMI 16
- SPN 110/FMI 18

3.a Yes; diagnose the other fault codes first.

3.b No; Go to step 4.

4. Inspect the EGR actuator coolant supply and return metal lines. Are the coolant lines pinched or kinked?

4.a Yes; replace the EGR coolant line.

4.b No; Go to step 5.

5. Check for coolant leaks at the EGR actuator. Are there any leaks present?

5.a Yes; replace the EGR valve actuator.

5.b No; Go to step 6.

6. Drain the coolant. Refer to Original Equipment Manufacturer (OEM) literature for coolant draining procedures.
7. Remove the EGR actuator coolant lines.

> **WARNING**
>
> EYE INJURY
>
> To avoid injury from flying debris when using compressed air, wear adequate eye protection (face shield or safety goggles) and do not exceed 276 kPa (40 psi) air pressure.

8. Use shop air to blow through the coolant fittings on the EGR actuator. Are there any restrictions present?
   - 8.a Yes; clean the EGR coolant passage and flush the cooling system. Refer to OEM literature for cooling system flushing procedures. Verify repair.
   - 8.b No; Go to step 9.
9. Use shop air to blow through the EGR actuator inlet coolant line. Are there any restrictions present?
   - 9.a Yes; clean the EGR actuator inlet coolant line and flush the cooling system. Refer to OEM literature for cooling system flushing procedures. Verify repair.
   - 9.b No; Go to step 10.
10. Use shop air to blow through the EGR actuator outlet coolant line. Are there any restrictions present?
    - 10.a Yes; clean the EGR actuator outlet coolant line and flush the cooling system. Refer to OEM literature for cooling system flushing procedures. Verify repair.
    - 10.b No; replace the EGR actuator.

SPN 5765 (MCM) (GHG17)

363.1 SPN 5765/FMI 0 - GHG17

EGR temperature alert

SPN 5765/FMI 0	
Description	This fault code sets when the EGR actuator temperature is greater than 134°C (275°F)
Monitored Parameter	EGR temperature
Typical Enabling Conditions	Engine running
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Engine running

Check as follows:

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.

WARNING

ENGINE EXHAUST

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

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are any of the following fault codes present?

- SPN 110/FMI 0
- SPN 110/FMI 16
- SPN 110/FMI 18

3.a Yes; diagnose the other fault codes first.

3.b No; Go to step 4.

4. Inspect the EGR actuator coolant supply and return metal lines. Are the coolant lines pinched or kinked?

4.a Yes; replace the EGR coolant line.

4.b No; Go to step 5.

5. Check for coolant leaks at the EGR actuator. Are there any leaks present?

5.a Yes; replace the EGR valve actuator.

5.b No; Go to step 6.

6. Drain the coolant. Refer to Original Equipment Manufacturer (OEM) literature for coolant draining procedures.
7. Remove the EGR actuator coolant lines.

> **WARNING**
>
> EYE INJURY
>
> To avoid injury from flying debris when using compressed air, wear adequate eye protection (face shield or safety goggles) and do not exceed 276 kPa (40 psi) air pressure.

8. Use shop air to blow through the coolant fittings on the EGR actuator. Are there any restrictions present?
   - 8.a Yes; clean the EGR coolant passage and flush the cooling system. Refer to OEM literature for cooling system flushing procedures. Verify repair.
   - 8.b No; Go to step 9.
9. Use shop air to blow through the EGR actuator inlet coolant line. Are there any restrictions present?
   - 9.a Yes; clean the EGR actuator inlet coolant line and flush the cooling system. Refer to OEM literature for cooling system flushing procedures. Verify repair.
   - 9.b No; Go to step 10.
10. Use shop air to blow through the EGR actuator outlet coolant line. Are there any restrictions present?
    - 10.a Yes; clean the EGR actuator outlet coolant line and flush the cooling system. Refer to OEM literature for cooling system flushing procedures. Verify repair.
    - 10.b No; replace the EGR actuator.

364.1 SPN 5841/FMI 14 - GHG17

Diesel Exhaust Fluid Quality Low

SPN 5841/FMI 14	
Description	Diesel Exhaust Fluid (DEF) Quality Low
Monitored Parameter	DEF Quality
Typical Enabling Conditions	Closed loop DEF dosing
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two hours
Dash Lamps	None
Engine Reaction	None
Verification	Parked SCR Efficiency Test

Check as follows:

Note : Retain a log file if Detroit™ Customer Assistance is required.

1. Connect DiagnosticLink .
2. Using a refractometer from the DEF Test Kit W060589001900, measure the DEF percentage. Is DEF percentage between 31 to 34%?
   - 2.a Yes; Go to step 3.
   - 2.b No; clean/flush the DEF tank, then Go to step 6. Refer to section "Flushing of the Diesel Exhaust Fluid System" .
3. Turn ignition ON (key ON, engine OFF).
4. Unbolt the DEF Dosing Unit from the aftertreatment. Do not disconnect DEF hoses or electrical connector. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" .
5. Perform a DEF Quantity Test service routine and record the amount of DEF fluid level dispensed. Is the dispensed DEF fluid level between 108 to 132 mL?
   - 5.a Yes; reinstall DEF Dosing Unit. Go to step 6.
   - 5.b No; replace DEF Dosing Unit. To verify repairs, Go to step 6.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

> **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.

6. Start the engine and perform a full parked regeneration. Refer to section "Performing a Parked Regeneration - GHG17" . After the regen has completed, Go to step 7.
7. Turn the ignition OFF and allow for all modules to power down, then turn the ignition back ON and start the engine. Go to step 8.
8. Perform an SCR Efficiency Test to clear fault. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

SPN 5841 (ACM) (GHG17)

364.1 SPN 5841/FMI 14 - GHG17

Diesel Exhaust Fluid Quality Low

SPN 5841/FMI 14	
Description	Diesel Exhaust Fluid (DEF) Quality Low
Monitored Parameter	DEF Quality
Typical Enabling Conditions	Closed loop DEF dosing
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two hours
Dash Lamps	None
Engine Reaction	None
Verification	Parked SCR Efficiency Test

Check as follows:

Note : Retain a log file if Detroit™ Customer Assistance is required.

1. Connect DiagnosticLink .
2. Using a refractometer from the DEF Test Kit W060589001900, measure the DEF percentage. Is DEF percentage between 31 to 34%?
   - 2.a Yes; Go to step 3.
   - 2.b No; clean/flush the DEF tank, then Go to step 6. Refer to section "Flushing of the Diesel Exhaust Fluid System" .
3. Turn ignition ON (key ON, engine OFF).
4. Unbolt the DEF Dosing Unit from the aftertreatment. Do not disconnect DEF hoses or electrical connector. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" .
5. Perform a DEF Quantity Test service routine and record the amount of DEF fluid level dispensed. Is the dispensed DEF fluid level between 108 to 132 mL?
   - 5.a Yes; reinstall DEF Dosing Unit. Go to step 6.
   - 5.b No; replace DEF Dosing Unit. To verify repairs, Go to step 6.

⚠WARNING

ENGINE EXHAUST

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

⚠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.

> **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.

6. Start the engine and perform a full parked regeneration. Refer to section "Performing a Parked Regeneration - GHG17" . After the regen has completed, Go to step 7.
7. Turn the ignition OFF and allow for all modules to power down, then turn the ignition back ON and start the engine. Go to step 8.
8. Perform an SCR Efficiency Test to clear fault. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

365.1 SPN 5927/FMI 2 - GHG17

Water Pump Limp Home Mode

This fault can be caused by:

- Coolant temperature in high
- Coolant temperature out
- Intake temperature high
- Engine protection mode

1. Check for multiple codes.
   1.a If fault codes SPN 110/FMI (any) or SPN 1636/FMI (any) are also present, repair those faults first.
   1.b If fault codes SPN 110/FMI (any) or SPN 1636/FMI (any) are not present, Go to step 2.
2. With engine cold, compare coolant inlet and coolant outlet temperatures. Are the temperatures within 15° C (25° F) of each other?
   2.a Yes; Go to step 3.
   2.b No; check coolant sensor resistance. Refer to chart for specifications, then replace sensor which is out of range.
3. Check for coolant loss. Is coolant loss present?
   3.a Yes; repair cause of coolant loss.
   3.b No; Go to step 4.
4. Check thermostat operation. Is the thermostat operating properly?
   4.a Yes; Go to step 5.
   4.b No; replace thermostat and verify repair.
5. Check for blockage in radiator and charge air cooler. Was a blockage found in the radiator and/or charge air cooler?
   5.a Yes; repair cause of blockage and verify repair.
   5.b No; Go to step 6.
6. Check fan belt condition (slippage). Is the fan belt in good condition and not slipping?
   6.a Yes; Go to step 7.
   6.b No; replace fan belt and verify repair.
7. Check for proper location of fan shroud. Is the fan shroud in the proper location?
   7.a Yes; Go to step 8.
   7.b No; repair fan shroud and verify repair.
8. Check for proper radiator hose condition (no collapsed hoses). Are radiator hoses in proper working condition?
   8.a Yes; Go to step 9.
   8.b No; replace hoses as needed and verify repair.
9. Check for proper viscous fan operation. Is the fan operating properly?
   9.a Yes; Go to step 10.
   9.b No; repair fan as necessary and verify repair.

WARNING

ENGINE EXHAUST

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

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.

10. Start engine and bring to operating temperature 85°C (185°F).
11. Does engine reach operating temperature 85°C (185°F)?
    - 11.a Yes, Go to step 12.
    - 11.b No, service the engine cooling system thermostat. Refer to section "Removal of the Engine Coolant Thermostat and Seal" .
12. Shut engine OFF (key OFF, engine OFF).
13. Disconnect inlet and outlet coolant sensors.
14. Inspect inlet and outlet coolant sensors harness connectors for bent, spread or corroded pins. Is damage found?
    - 14.a Yes; repair as necessary.
    - 14.b No; Go to step 15.
15. Check coolant sensor resistance, refer to chart for specifications, replace sensor which is out of range.

Coolant Sensor Resistance Chart							
Temp (°C)	**Temp (°F)**	**Resistance ( ) Nominal**	**Resistance ( ) Low**	**Resistance () High**	**Nominal Voltage (V)**	**Voltage Low (V)**	**Voltage High (V)**
0	32	5872.8	5496.4	6249.2	2.56	2.51	2.61
10	50	3769	3640.3	3897.7	2.37	2.33	2.41
20	68	2480.7	2260.0	2701.4	2.14	2.05	2.22
30	86	1693.2	1613.4	1773.0	1.89	1.83	1.95
35	95	1401.1	1338.4	1463.8	1.75	1.69	1.81
40	104	1166.8	1117.5	1216.1	1.62	1.56	1.67
50	122	829.5	798.2	860.8	1.36	1.30	1.41
60	140	593.8	574.5	613.1	1.12	1.07	1.17
70	158	435.4	423.1	447.7	0.91	0.86	0.95

16. Clear faults and verify repairs.

365.2 SPN 5927/FMI 7 - GHG17

SPN 5927/FMI 7	
Description	This Code Logs When an Error Has Been Detected on the Speed and Flow of the Cooling System
Monitored Parameter	Water Pump Speed
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	25% Derate
Verification	Engine Running

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

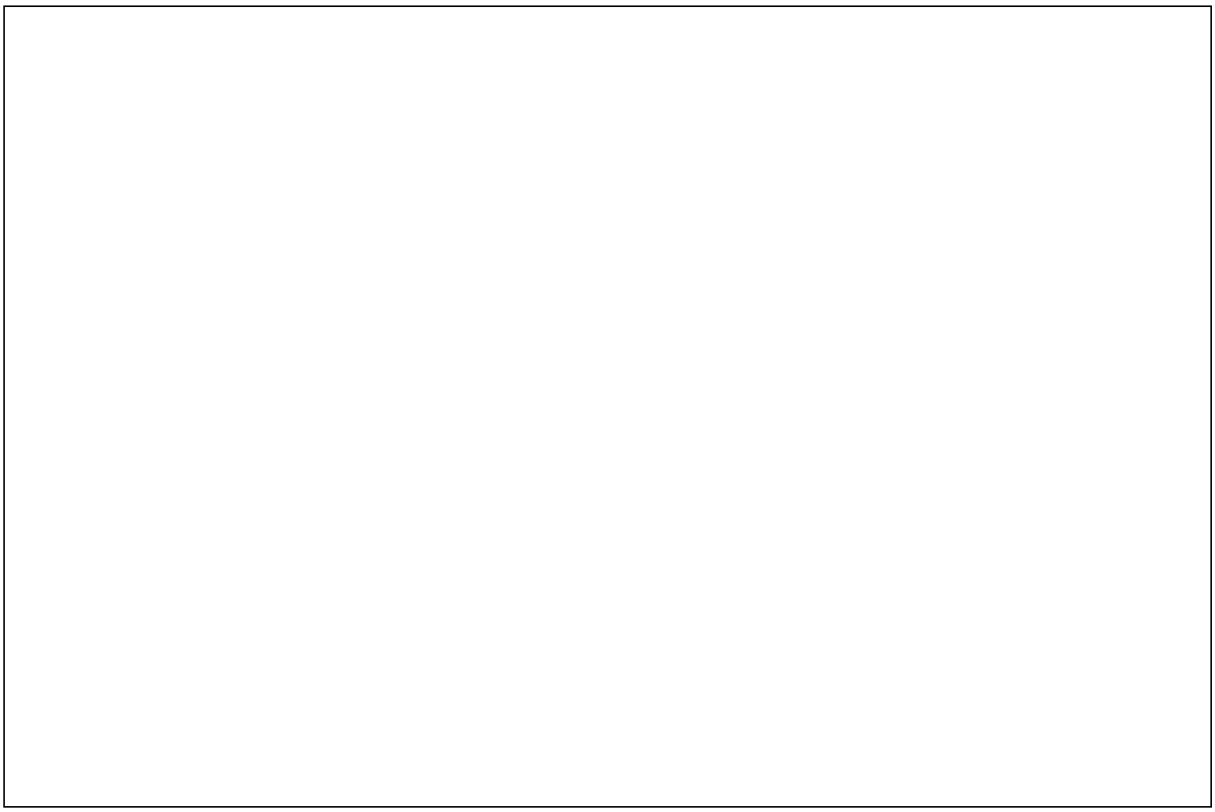
⚠ WARNING

ENGINE EXHAUST

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

This fault can be caused by:

- Water Pump Speed Less Than Commanded Threshold
- Coolant Temperature In High
- Coolant Temperature Out High
- Intake Temperature High
- Engine Protection Mode



Check as follows:

1. Check for multiple codes. Are there any other active cooling system faults?
   1.a Yes; repair cooling system faults first.
   1.b No; Go to step 2.
2. With engine cold, compare coolant inlet and coolant outlet temperatures. Are the temperatures within 14°C (25°F) of each other?
   2.a Yes; Go to step 3.
   2.b No; check coolant sensor resistance. Refer to chart for specifications; replace sensor which is out of range.

Coolant Sensor Resistance Chart

Temp (°C)	Temp (°F)	Resistance Nominal (ohms)	Resistance Low (ohms)	Resistance High (ohms)	Nominal Voltage (V)	Voltage Low (V)	Voltage High (V)
0	32	5872.8	5496.4	6249.2	2.56	2.51	2.61
10	50	3769	3640.3	3897.7	2.37	2.33	2.41
20	68	2480.7	2260.0	2701.4	2.14	2.05	2.22
30	86	1693.2	1613.4	1773.0	1.89	1.83	1.95
35	95	1401.1	1338.4	1463.8	1.75	1.69	1.81
40	104	1166.8	1117.5	1216.1	1.62	1.56	1.67
50	122	829.5	798.2	860.8	1.36	1.30	1.41
60	140	593.8	574.5	613.1	1.12	1.07	1.17
70	158	435.4	423.1	447.7	0.91	0.86	0.95

3. Connect to DiagnosticLink .

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

4. Start engine and bring to operating temperature of 85°C (185°F).
5. Does engine reach operating temperature of 85°C (185°F)?
   - 5.a Yes; Go to step 6.
   - 5.b No; service the engine cooling system thermostat. Refer to section "Removal of the Engine Coolant Thermostat and Seal" .
6. Turn the ignition OFF.
7. Disconnect the water pump harness connector.
8. Disconnect the MCM 120-pin connector.
9. Measure the resistance between pins 1 and 2 of the water pump speed sensor harness connector (engine harness side). Is the resistance greater than 10K ohms?
   - 9.a Yes; Go to step 10.
   - 9.b No; repair the short between pins 1 and 2 of the water pump harness connector and pins 107 and 50 of the MCM 120-pin connector.
10. Measure the resistance between pin 2 of the water pump speed sensor harness connector and pin 107 of the MCM 120-pin connector. Is the resistance less than five ohms?
    - 10.a Yes; Go to step 11.
    - 10.b No; repair the wire between pin 2 of the water pump speed sensor harness connector and pin 107 of the MCM 120-pin connector.
11. Measure the resistance between pin 1 of the water pump speed sensor harness connector and pin 50 of the MCM 120-pin connector. Is the resistance less than five ohms?
    - 11.a Yes; Go to step 12.
    - 11.b No; repair the wire between pin 1 of the water pump speed sensor harness connector and pin 50 of the MCM 120-pin connector.
12. Connect the MCM 120-pin connector.
13. Turn the ignition ON (key ON, engine OFF).
14. Measure the voltage between pin 3 on the harness side of the water pump speed sensor harness connector and ground. Is the voltage less than five volts?
    - 14.a Yes; repair the open wire between pin 3 of the water pump speed sensor harness connector and pin 82 of the Motor Control Module (MCM) 120-pin connector.

14.b No; Go to step 15.

15. Measure the resistance between pin 3 of the water pump speed sensor harness connector and pin 82 of the MCM 120-pin connector. Is the resistance less than five ohms?

15.a Yes; replace the water pump.

15.b No; repair the wire between pin 3 of the water pump speed sensor harness connector and pin 82 of the MCM 120-pin connector.

SPN 5927 (MCM) (GHG17)

365.1 SPN 5927/FMI 2 - GHG17

Water Pump Limp Home Mode

This fault can be caused by:

- Coolant temperature in high
- Coolant temperature out
- Intake temperature high
- Engine protection mode

1. Check for multiple codes.
   1.a If fault codes SPN 110/FMI (any) or SPN 1636/FMI (any) are also present, repair those faults first.
   1.b If fault codes SPN 110/FMI (any) or SPN 1636/FMI (any) are not present, Go to step 2.
2. With engine cold, compare coolant inlet and coolant outlet temperatures. Are the temperatures within 15° C (25° F) of each other?
   2.a Yes; Go to step 3.
   2.b No; check coolant sensor resistance. Refer to chart for specifications, then replace sensor which is out of range.
3. Check for coolant loss. Is coolant loss present?
   3.a Yes; repair cause of coolant loss.
   3.b No; Go to step 4.
4. Check thermostat operation. Is the thermostat operating properly?
   4.a Yes; Go to step 5.
   4.b No; replace thermostat and verify repair.
5. Check for blockage in radiator and charge air cooler. Was a blockage found in the radiator and/or charge air cooler?
   5.a Yes; repair cause of blockage and verify repair.
   5.b No; Go to step 6.
6. Check fan belt condition (slippage). Is the fan belt in good condition and not slipping?
   6.a Yes; Go to step 7.
   6.b No; replace fan belt and verify repair.
7. Check for proper location of fan shroud. Is the fan shroud in the proper location?
   7.a Yes; Go to step 8.
   7.b No; repair fan shroud and verify repair.
8. Check for proper radiator hose condition (no collapsed hoses). Are radiator hoses in proper working condition?
   8.a Yes; Go to step 9.
   8.b No; replace hoses as needed and verify repair.
9. Check for proper viscous fan operation. Is the fan operating properly?
   9.a Yes; Go to step 10.
   9.b No; repair fan as necessary and verify repair.

WARNING

ENGINE EXHAUST

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

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.

10. Start engine and bring to operating temperature 85°C (185°F).
11. Does engine reach operating temperature 85°C (185°F)?
    - 11.a Yes, Go to step 12.
    - 11.b No, service the engine cooling system thermostat. Refer to section "Removal of the Engine Coolant Thermostat and Seal" .
12. Shut engine OFF (key OFF, engine OFF).
13. Disconnect inlet and outlet coolant sensors.
14. Inspect inlet and outlet coolant sensors harness connectors for bent, spread or corroded pins. Is damage found?
    - 14.a Yes; repair as necessary.
    - 14.b No; Go to step 15.
15. Check coolant sensor resistance, refer to chart for specifications, replace sensor which is out of range.

Coolant Sensor Resistance Chart							
Temp (°C)	**Temp (°F)**	**Resistance ( ) Nominal**	**Resistance ( ) Low**	**Resistance () High**	**Nominal Voltage (V)**	**Voltage Low (V)**	**Voltage High (V)**
0	32	5872.8	5496.4	6249.2	2.56	2.51	2.61
10	50	3769	3640.3	3897.7	2.37	2.33	2.41
20	68	2480.7	2260.0	2701.4	2.14	2.05	2.22
30	86	1693.2	1613.4	1773.0	1.89	1.83	1.95
35	95	1401.1	1338.4	1463.8	1.75	1.69	1.81
40	104	1166.8	1117.5	1216.1	1.62	1.56	1.67
50	122	829.5	798.2	860.8	1.36	1.30	1.41
60	140	593.8	574.5	613.1	1.12	1.07	1.17
70	158	435.4	423.1	447.7	0.91	0.86	0.95

16. Clear faults and verify repairs.

365.2 SPN 5927/FMI 7 - EuroV

SPN 5927/FMI 7	
Description	This Code Logs When an Error Has Been Detected on the Speed and Flow of the Cooling System
Monitored Parameter	Water Pump Speed
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	25% Derate
Verification	Engine Running

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

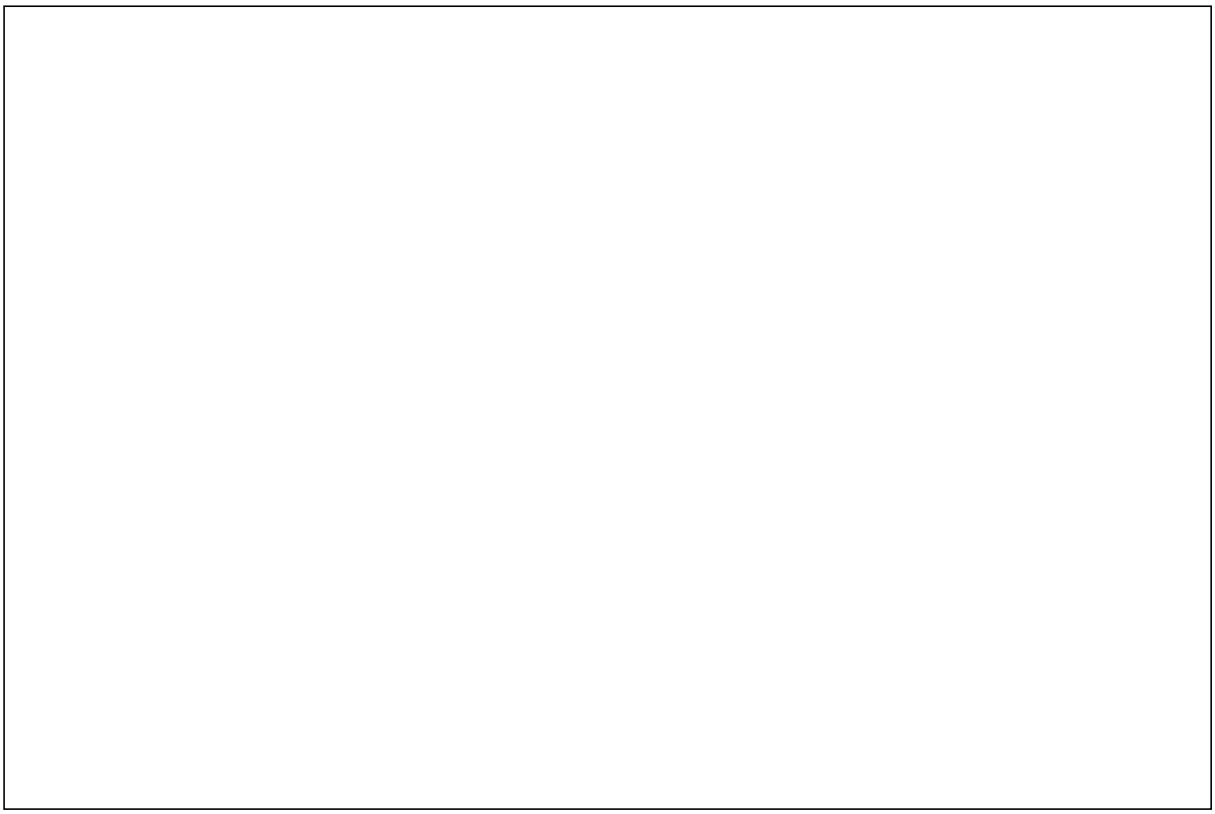
⚠ WARNING

ENGINE EXHAUST

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

This fault can be caused by:

- Water Pump Speed Less Than Commanded Threshold
- Coolant Temperature In High
- Coolant Temperature Out High
- Intake Temperature High
- Engine Protection Mode



Check as follows:

1. Check for multiple codes. Are there any other active cooling system faults?
   1.a Yes; repair cooling system faults first.
   1.b No; Go to step 2.
2. With engine cold, compare coolant inlet and coolant outlet temperatures. Are the temperatures within 14°C (25°F) of each other?
   2.a Yes; Go to step 3.
   2.b No; check coolant sensor resistance. Refer to chart for specifications; replace sensor which is out of range.

Coolant Sensor Resistance Chart

Temp (°C)	Temp (°F)	Resistance Nominal (ohms)	Resistance Low (ohms)	Resistance High (ohms)	Nominal Voltage (V)	Voltage Low (V)	Voltage High (V)
0	32	5872.8	5496.4	6249.2	2.56	2.51	2.61
10	50	3769	3640.3	3897.7	2.37	2.33	2.41
20	68	2480.7	2260.0	2701.4	2.14	2.05	2.22
30	86	1693.2	1613.4	1773.0	1.89	1.83	1.95
35	95	1401.1	1338.4	1463.8	1.75	1.69	1.81
40	104	1166.8	1117.5	1216.1	1.62	1.56	1.67
50	122	829.5	798.2	860.8	1.36	1.30	1.41
60	140	593.8	574.5	613.1	1.12	1.07	1.17
70	158	435.4	423.1	447.7	0.91	0.86	0.95

3. Connect to DiagnosticLink .

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

4. Start engine and bring to operating temperature of 85°C (185°F).
5. Does engine reach operating temperature of 85°C (185°F)?
   - 5.a Yes; Go to step 6.
   - 5.b No; service the engine cooling system thermostat. Refer to section "Removal of the Engine Coolant Thermostat and Seal" .
6. Turn the ignition OFF.
7. Disconnect the water pump harness connector.
8. Disconnect the MCM 120-pin connector.
9. Measure the resistance between pins 1 and 2 of the water pump speed sensor harness connector (engine harness side). Is the resistance greater than 10K ohms?
   - 9.a Yes; Go to step 10.
   - 9.b No; repair the short between pins 1 and 2 of the water pump harness connector and pins 107 and 50 of the MCM 120-pin connector.
10. Measure the resistance between pin 2 of the water pump speed sensor harness connector and pin 107 of the MCM 120-pin connector. Is the resistance less than five ohms?
    - 10.a Yes; Go to step 11.
    - 10.b No; repair the wire between pin 2 of the water pump speed sensor harness connector and pin 107 of the MCM 120-pin connector.
11. Measure the resistance between pin 1 of the water pump speed sensor harness connector and pin 50 of the MCM 120-pin connector. Is the resistance less than five ohms?
    - 11.a Yes; Go to step 12.
    - 11.b No; repair the wire between pin 1 of the water pump speed sensor harness connector and pin 50 of the MCM 120-pin connector.
12. Connect the MCM 120-pin connector.
13. Turn the ignition ON (key ON, engine OFF).
14. Measure the voltage between pin 3 on the harness side of the water pump speed sensor harness connector and ground. Is the voltage less than five volts?
    - 14.a Yes; repair the open wire between pin 3 of the water pump speed sensor harness connector and pin 82 of the Motor Control Module (MCM) 120-pin connector.

14.b No; Go to step 15.

15. Measure the resistance between pin 3 of the water pump speed sensor harness connector and pin 82 of the MCM 120-pin connector. Is the resistance less than five ohms?

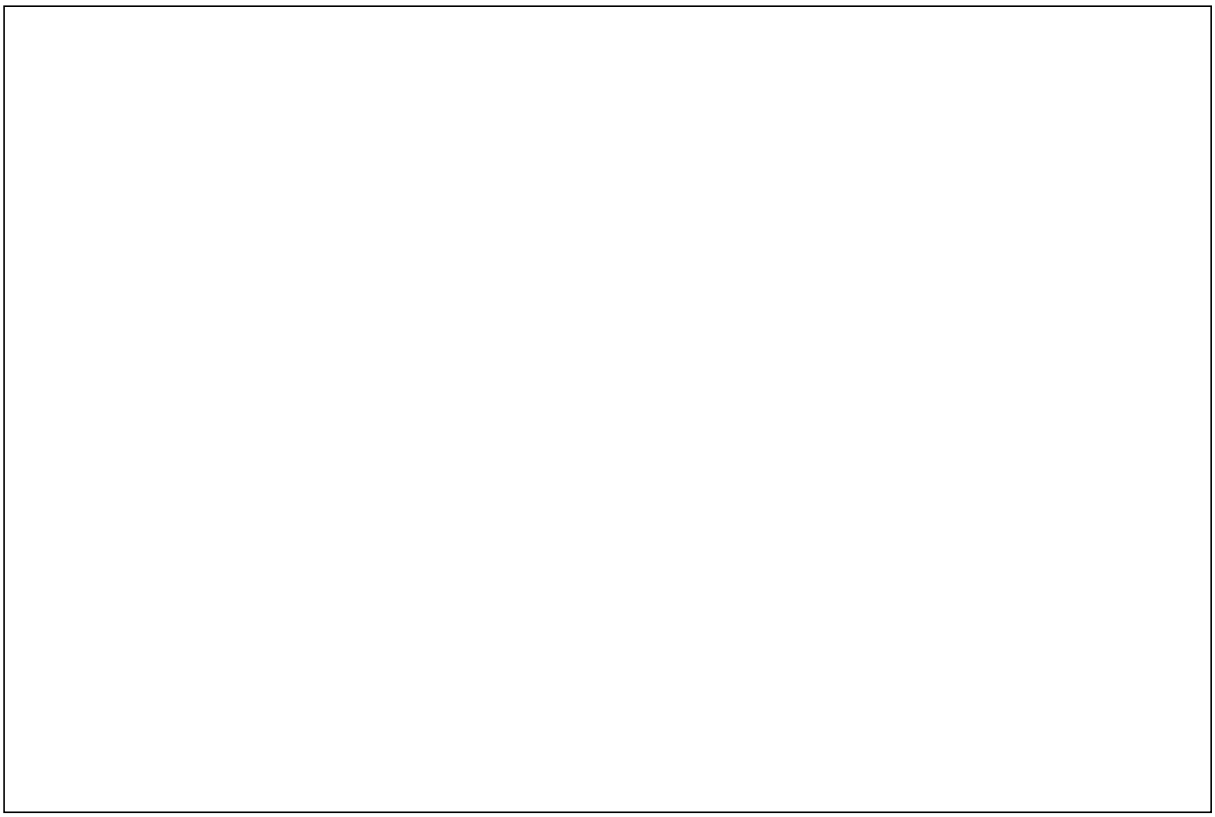
15.a Yes; replace the water pump.

15.b No; repair the wire between pin 3 of the water pump speed sensor harness connector and pin 82 of the MCM 120-pin connector.

366.1 SPN 7384/FMI 3 - GHG17

Injector Cylinder #1 Needle Control Valve, Abnormal Operation (MAX) Cold

SPN 7384/FMI 3	
Description	This code will set when the Needle solenoid current response time does not meet requirement.
Monitored Parameter	Injector Cylinder #1 Needle Control Valve Current
Typical Enabling Conditions	This mode cannot be seen through DiagnosticLink. This mode is activated from a calculated value that includes a table value (Charge Air Cooler Out vs. Coolant temperatures). Verification will ensure all conditions are met.
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	5 sec
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate, DPF Inhibit Regeneration
Verification	Let the engine cold soak to room temperature. Start engine and warm up to operating temperature (or 65°C (149°F))



Check as follows:

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

Note : Faults are listed in diagnostic priority from top to bottom.

1. Are there any of the following faults present?

- SPN 168/FMI any

- SPN 723/FMI any

1.a Yes, repair fault with the highest priority listed above. Verify repairs.

1.b No; Go to step 2.

2. Disconnect the front fuel injector harness 14-pin injector connector.
3. Inspect the front fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Was water or oil intrusion, bent or spread pins found?

3.a Yes; repair as necessary.

3.b No; Go to step 4.

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

4. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)					
Injector #1 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #2 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #3 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)					
Note: Ensure J-48671-10 ground strap is connected to cylinder head.					
Injector #1 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #2 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #3 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground	
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

4.a Yes; Go to step 8.

4.b No; Go to step 5.

5. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
6. Remove the front fuel injector harness from the engine.

Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

7. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #1 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #2 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #3 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

7.a Yes; replace the front fuel injector harness.

Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

7.b No; replace the injector with the out-of-range resistance.

Refer to section "Removal of the Fuel Injector - Two-Filter System" .

8. Disconnect the Motor Control Module (MCM) 120-pin connector.
9. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Were signs of damage are found?

9.a Yes; repair as necessary. Verify repairs.

9.b No; Go to step 10.

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

10. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	25		1 and ground	
2	26		2 and ground	
3	22		3 and ground	
4	24		4 and ground	

10.a Yes; Go to step 11.

10.b No; repair the engine side harness. Verify repairs.

11. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

12. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

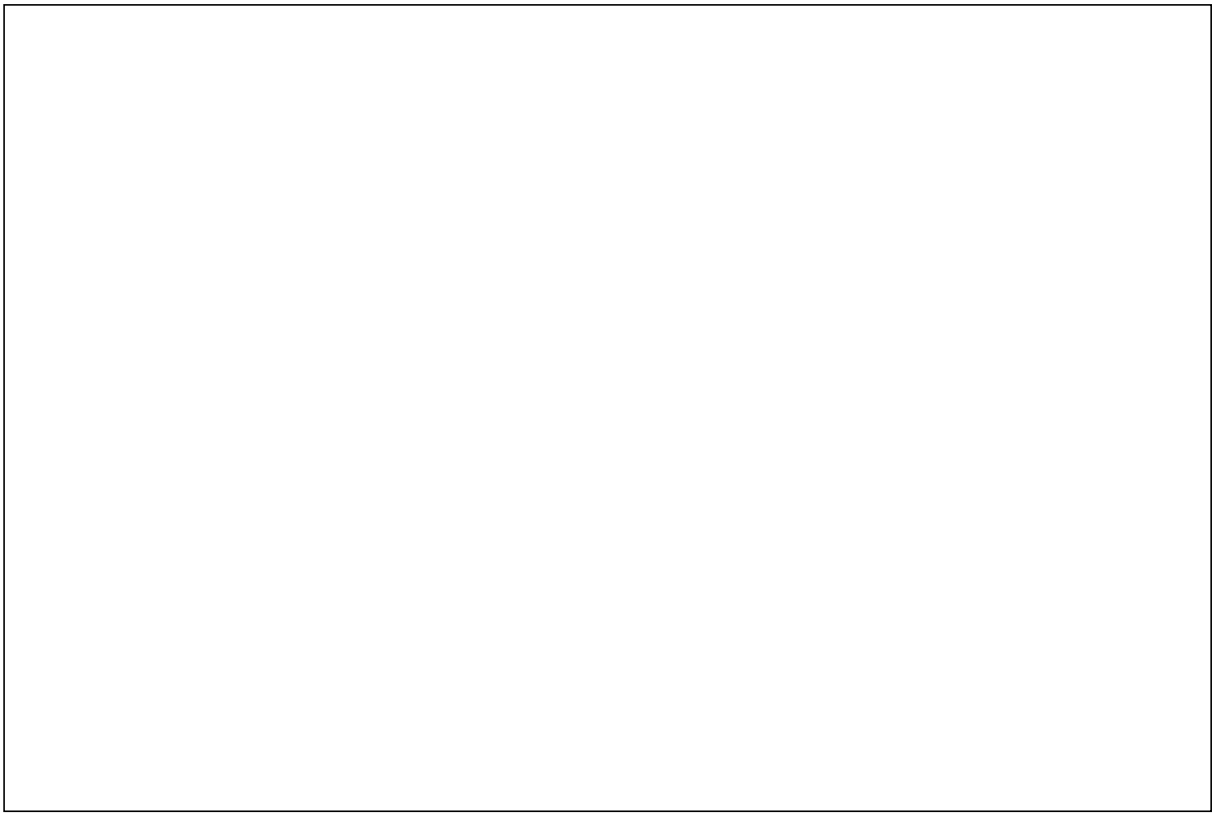
12.a Yes; repair as necessary.

12.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

366.2 SPN 7384/FMI 4 - GHG17

Injector Cylinder #1 Needle Control Valve, Abnormal Operation (MIN) Cold

SPN 7384/FMI 4	
Description	This code will set when the Needle solenoid current response time does not meet requirement.
Monitored Parameter	Injector Cylinder #1 Needle Control Valve Current
Typical Enabling Conditions	Engine is running in cold mode. This mode cannot be seen through DiagnosticLink. This mode is activated from a calculated value that includes a table value (Charge Air Cooler Out vs. Coolant temperatures). Verification will ensure all conditions are met.
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	5 sec
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate, DPF Inhibit Regeneration
Verification	Let the engine cold soak to room temperature. Start engine and warm up to operating temperature (or 65°C (149°F))



Check as follows:

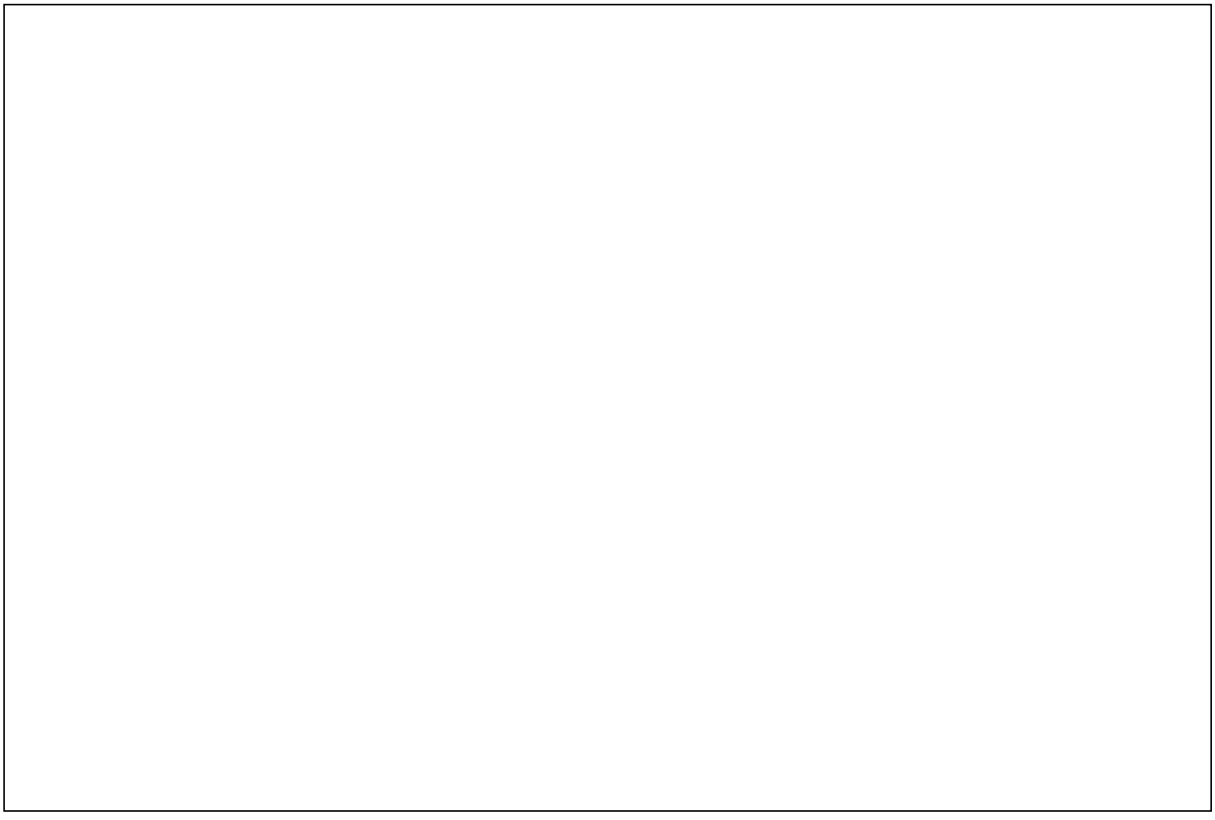
1. Follow troubleshooting procedure for SPN 7384/FMI 3. Refer to section "SPN 7384/FMI 3 - GHG17" .

SPN 7384 (MCM) (GHG17)

366.1 SPN 7384/FMI 3 - GHG17

Injector Cylinder #1 Needle Control Valve, Abnormal Operation (MAX) Cold

SPN 7384/FMI 3	
Description	This code will set when the Needle solenoid current response time does not meet requirement.
Monitored Parameter	Injector Cylinder #1 Needle Control Valve Current
Typical Enabling Conditions	This mode cannot be seen through DiagnosticLink. This mode is activated from a calculated value that includes a table value (Charge Air Cooler Out vs. Coolant temperatures). Verification will ensure all conditions are met.
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	5 sec
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate, DPF Inhibit Regeneration
Verification	Let the engine cold soak to room temperature. Start engine and warm up to operating temperature (or 65°C (149°F))



Check as follows:

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

Note : Faults are listed in diagnostic priority from top to bottom.

1. Are there any of the following faults present?

- SPN 168/FMI any
- SPN 723/FMI any

1.a Yes, repair fault with the highest priority listed above. Verify repairs.

1.b No; Go to step 2.

2. Disconnect the front fuel injector harness 14-pin injector connector.
3. Inspect the front fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Was water or oil intrusion, bent or spread pins found?

3.a Yes; repair as necessary.

3.b No; Go to step 4.

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

4. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #1 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #2 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #3 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #2 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #3 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

4.a Yes; Go to step 8.

4.b No; Go to step 5.

5. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
6. Remove the front fuel injector harness from the engine.

Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

7. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #1 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #2 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #3 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

7.a Yes; replace the front fuel injector harness.

Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

7.b No; replace the injector with the out-of-range resistance.

Refer to section "Removal of the Fuel Injector - Two-Filter System" .

8. Disconnect the Motor Control Module (MCM) 120-pin connector.
9. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Were signs of damage are found?

9.a Yes; repair as necessary. Verify repairs.

9.b No; Go to step 10.

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

10. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	25		1 and ground	
2	26		2 and ground	
3	22		3 and ground	
4	24		4 and ground	

10.a Yes; Go to step 11.

10.b No; repair the engine side harness. Verify repairs.

11. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

12. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

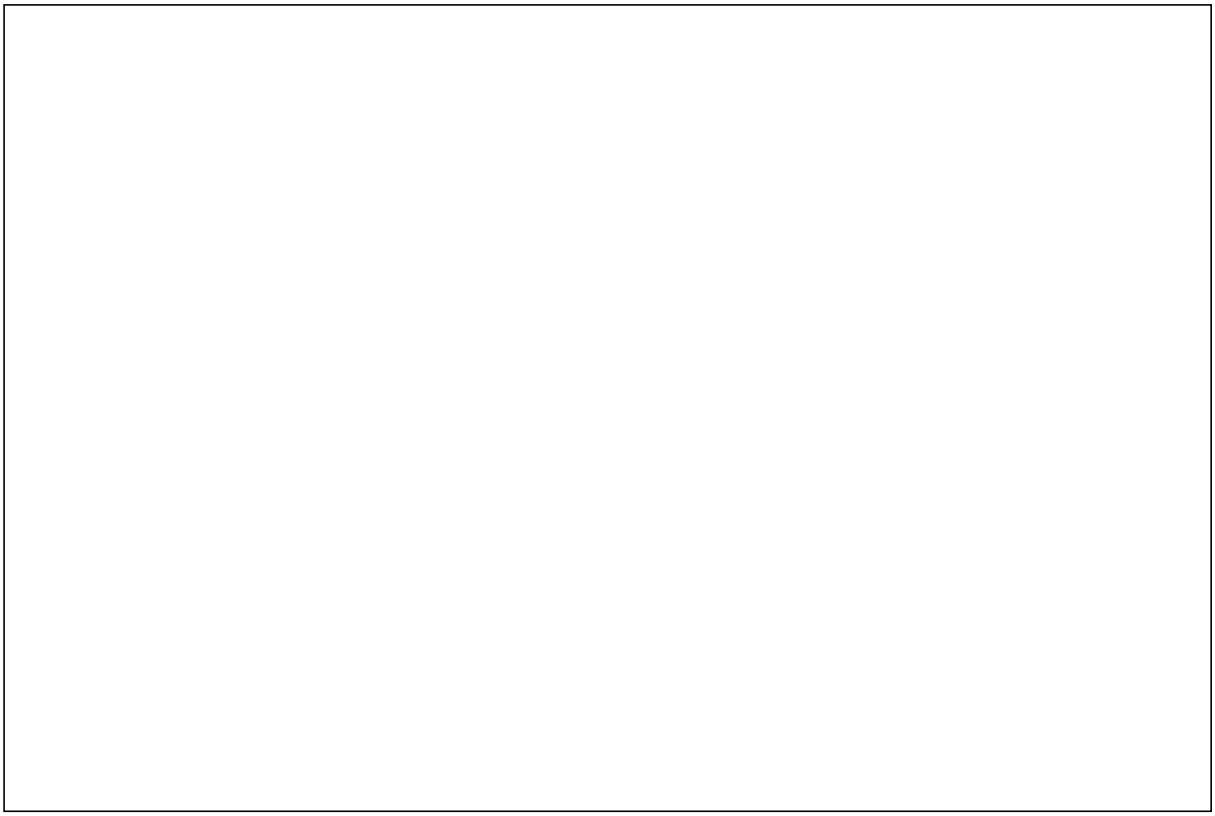
12.a Yes; repair as necessary.

12.b No; replace the MCM. Refer to section "Removal of the Motor Control Module" .

366.2 SPN 7384/FMI 4 - GHG17

Injector Cylinder #1 Needle Control Valve, Abnormal Operation (MIN) Cold

SPN 7384/FMI 4	
Description	This code will set when the Needle solenoid current response time does not meet requirement.
Monitored Parameter	Injector Cylinder #1 Needle Control Valve Current
Typical Enabling Conditions	Engine is running in cold mode. This mode cannot be seen through DiagnosticLink. This mode is activated from a calculated value that includes a table value (Charge Air Cooler Out vs. Coolant temperatures). Verification will ensure all conditions are met.
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	5 sec
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate, DPF Inhibit Regeneration
Verification	Let the engine cold soak to room temperature. Start engine and warm up to operating temperature (or 65°C (149°F))



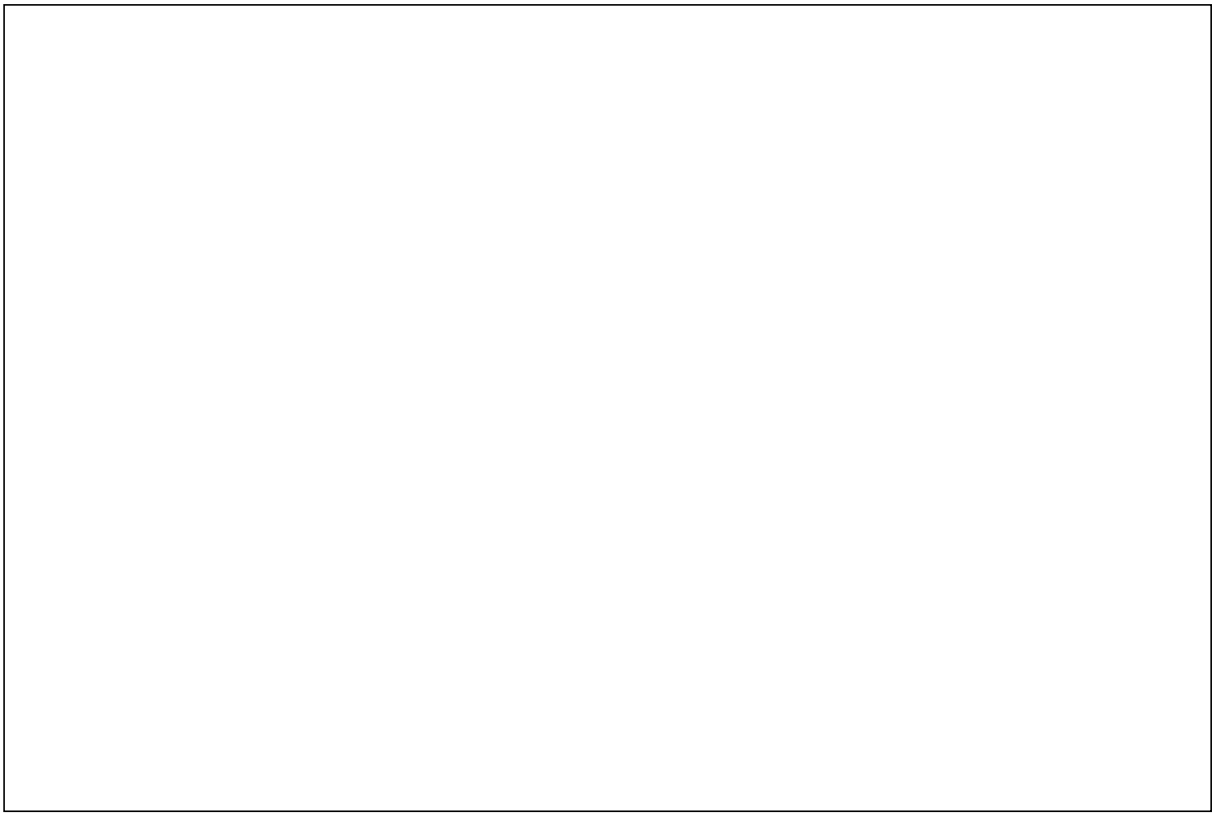
Check as follows:

1. Follow troubleshooting procedure for SPN 7384/FMI 3. Refer to section "SPN 7384/FMI 3 - GHG17" .

367.1 SPN 7385/FMI 3 - GHG17

Injector Cylinder #2 Needle Control Valve, Abnormal Operation (MAX) Cold

SPN 7385/FMI 3	
Description	This code will set when the Needle solenoid current response time does not meet requirement.
Monitored Parameter	Injector Cylinder #2 Needle Control Valve Current
Typical Enabling Conditions	Engine is running in cold mode. This mode cannot be seen through DiagnosticLink. This mode is activated from a calculated value that includes a table value (Charge Air Cooler Out vs. Coolant temperatures). Verification will ensure all conditions are met.
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	5 sec
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate, DPF Inhibit Regeneration
Verification	Let the engine cold soak to room temperature. Start engine and warm up to operating temperature (or 65°C (149°F))



Check as follows:

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

Note : Faults are listed in diagnostic priority from top to bottom.

1. Are any of the following faults present?

- SPN 168/FMI any
- SPN 723/FMI any

1.a Yes, repair fault with the highest priority listed above. Verify repairs.

1.b No; Go to step 2.

2. Disconnect the front fuel injector harness 14-pin injector connector.
3. Inspect the front fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Was water or oil intrusion, bent or spread pins found?

3.a Yes; repair as necessary.

3.b No; Go to step 4.

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

4. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #1 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #2 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #3 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #2 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #3 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

4.a Yes; Go to step 8.

4.b No; Go to step 5.

5. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
6. Remove the front fuel injector harness from the engine.

Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

7. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #1 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #2 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #3 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

7.a Yes; replace the front fuel injector harness.

Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

7.b No; replace the injector with the out-of-range resistance.

Refer to section "Removal of the Fuel Injector - Two-Filter System" .

8. Disconnect the Motor Control Module (MCM) 120-pin connector.
9. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Were signs of damage found?

9.a Yes; repair as necessary. Verify repairs.

9.b No; Go to step 10.

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

10. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	25		1 and ground	
2	26		2 and ground	
3	22		3 and ground	
4	24		4 and ground	

10.a Yes; Go to step 11.

10.b No; repair the engine side harness. Verify repairs.

11. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

12. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

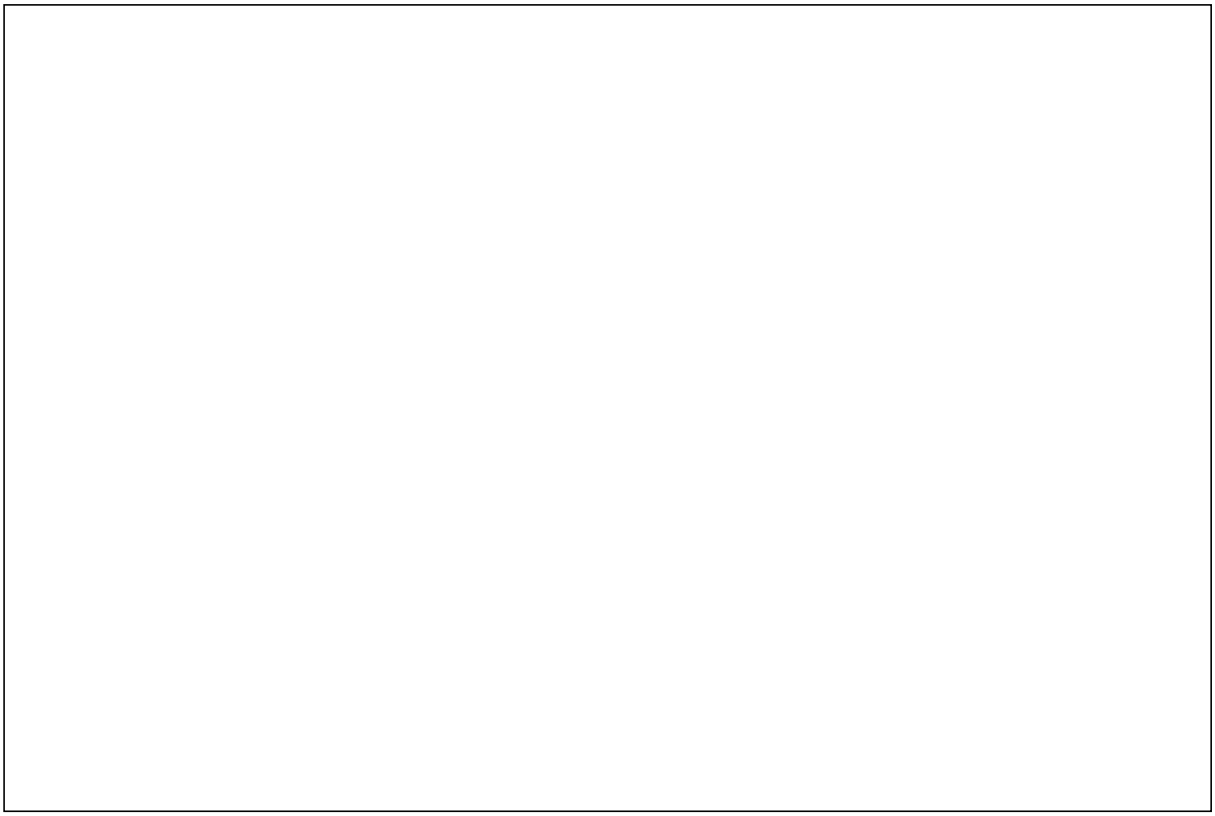
12.a Yes; repair as necessary.

12.b No; Refer to section "Removal of the Motor Control Module" .

367.2 SPN 7385/FMI 4 - GHG17

Injector Cylinder #2 Needle Control Valve, Abnormal Operation (MIN) Cold

SPN 7385/FMI 4	
Description	This code will set when the Needle solenoid current response time does not meet requirement.
Monitored Parameter	Injector Cylinder #2 Needle Control Valve Current
Typical Enabling Conditions	Engine is running in cold mode. This mode cannot be seen through DiagnosticLink. This mode is activated from a calculated value that includes a table value (Charge Air Cooler Out vs. Coolant temperatures). Verification will ensure all conditions are met.
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	5 sec
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate, DPF Inhibit Regeneration
Verification	Let the engine cold soak to room temperature. Start engine and warm up to operating temperature (or 65°C (149°F))



Check as follows:

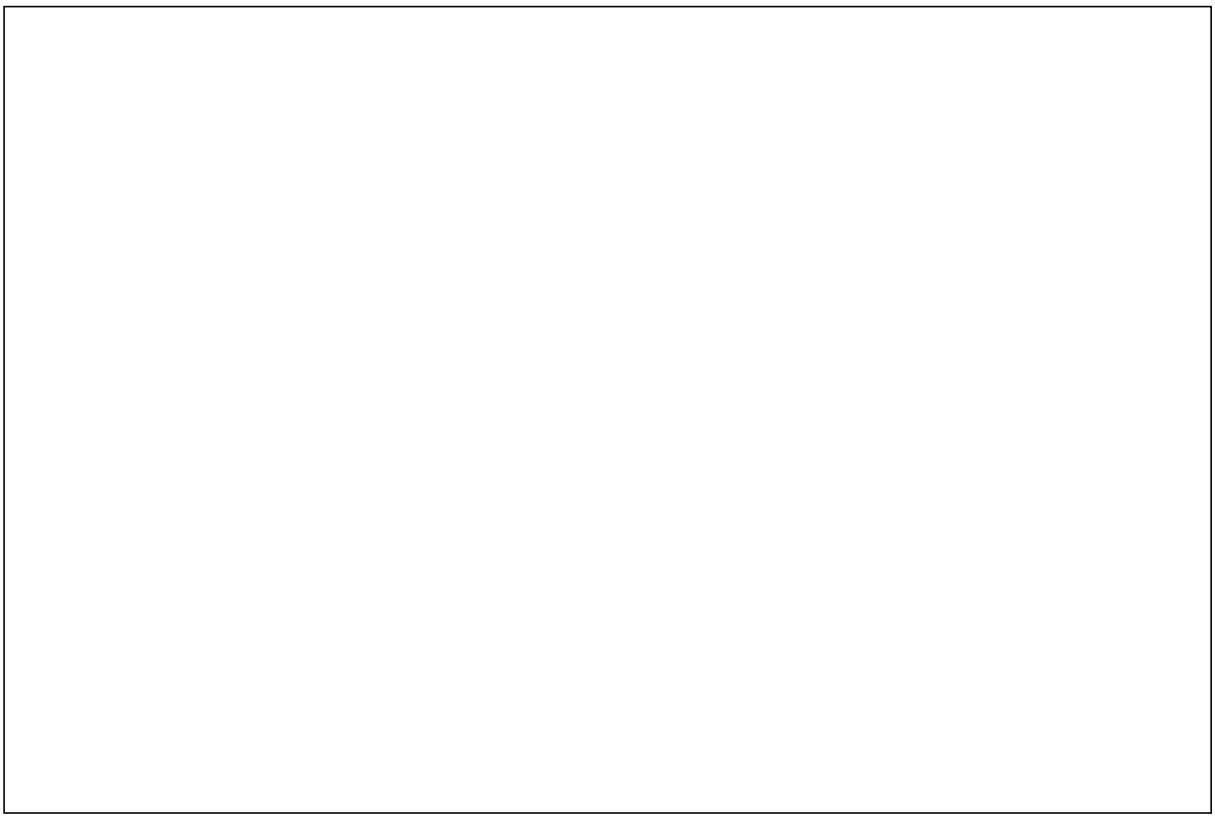
1. Follow troubleshooting procedure for SPN 7385/FMI 3. Refer to section "SPN 7385/FMI 3 - GHG17" .

SPN 7385 (MCM) (GHG17)

367.1 SPN 7385/FMI 3 - GHG17

Injector Cylinder #2 Needle Control Valve, Abnormal Operation (MAX) Cold

SPN 7385/FMI 3	
Description	This code will set when the Needle solenoid current response time does not meet requirement.
Monitored Parameter	Injector Cylinder #2 Needle Control Valve Current
Typical Enabling Conditions	Engine is running in cold mode. This mode cannot be seen through DiagnosticLink. This mode is activated from a calculated value that includes a table value (Charge Air Cooler Out vs. Coolant temperatures). Verification will ensure all conditions are met.
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	5 sec
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate, DPF Inhibit Regeneration
Verification	Let the engine cold soak to room temperature. Start engine and warm up to operating temperature (or 65°C (149°F))



Check as follows:

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

Note : Faults are listed in diagnostic priority from top to bottom.

1. Are any of the following faults present?

- SPN 168/FMI any
- SPN 723/FMI any

1.a Yes, repair fault with the highest priority listed above. Verify repairs.

1.b No; Go to step 2.

2. Disconnect the front fuel injector harness 14-pin injector connector.
3. Inspect the front fuel injector harness 14-pin injector connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Was water or oil intrusion, bent or spread pins found?

3.a Yes; repair as necessary.

3.b No; Go to step 4.

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

4. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #1 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #2 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #3 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #2 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #3 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

4.a Yes; Go to step 8.

4.b No; Go to step 5.

5. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
6. Remove the front fuel injector harness from the engine.

Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

7. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #1 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #2 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #3 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

7.a Yes; replace the front fuel injector harness.

Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

7.b No; replace the injector with the out-of-range resistance.

Refer to section "Removal of the Fuel Injector - Two-Filter System" .

8. Disconnect the Motor Control Module (MCM) 120-pin connector.

9. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Were signs of damage found?

9.a Yes; repair as necessary. Verify repairs.

9.b No; Go to step 10.

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

10. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	25		1 and ground	
2	26		2 and ground	
3	22		3 and ground	
4	24		4 and ground	

10.a Yes; Go to step 11.

10.b No; repair the engine side harness. Verify repairs.

11. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

12. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

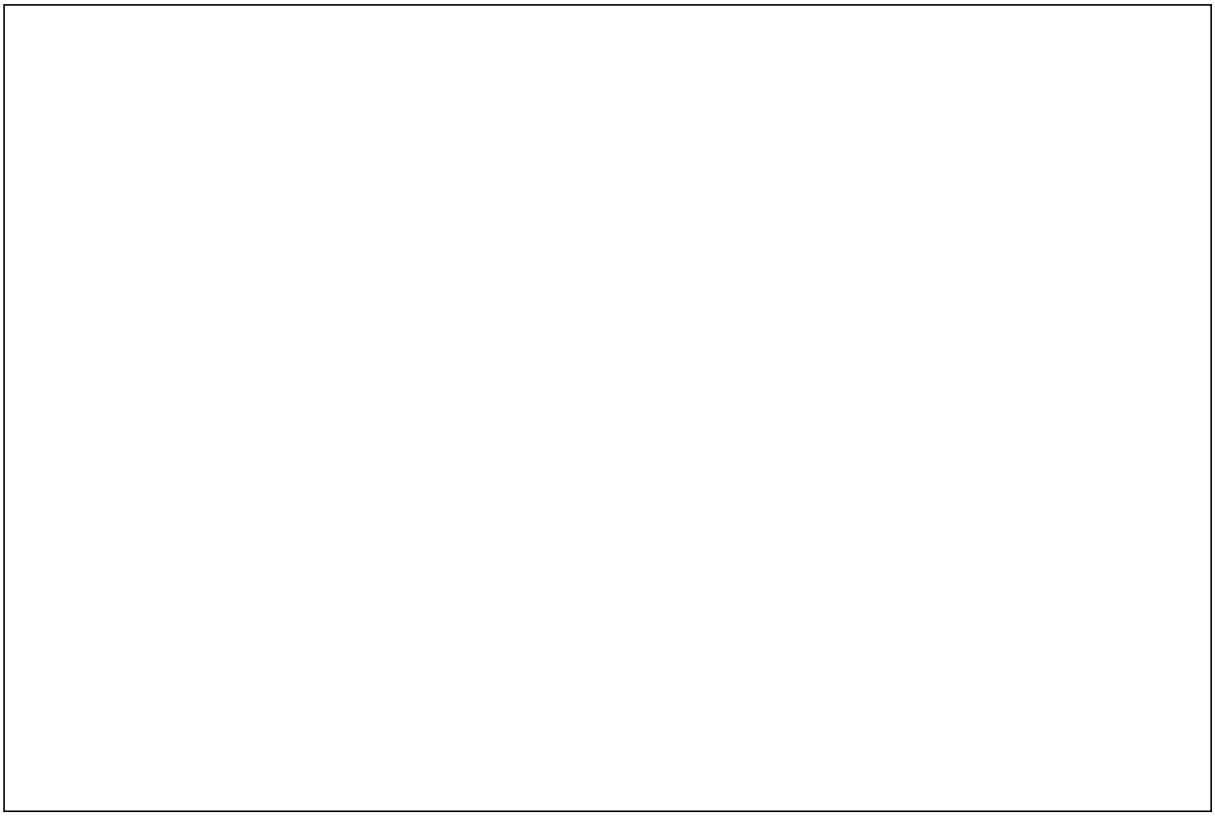
12.a Yes; repair as necessary.

12.b No; Refer to section "Removal of the Motor Control Module" .

367.2 SPN 7385/FMI 4 - GHG17

Injector Cylinder #2 Needle Control Valve, Abnormal Operation (MIN) Cold

SPN 7385/FMI 4	
Description	This code will set when the Needle solenoid current response time does not meet requirement.
Monitored Parameter	Injector Cylinder #2 Needle Control Valve Current
Typical Enabling Conditions	Engine is running in cold mode. This mode cannot be seen through DiagnosticLink. This mode is activated from a calculated value that includes a table value (Charge Air Cooler Out vs. Coolant temperatures). Verification will ensure all conditions are met.
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	5 sec
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate, DPF Inhibit Regeneration
Verification	Let the engine cold soak to room temperature. Start engine and warm up to operating temperature (or 65°C (149°F))



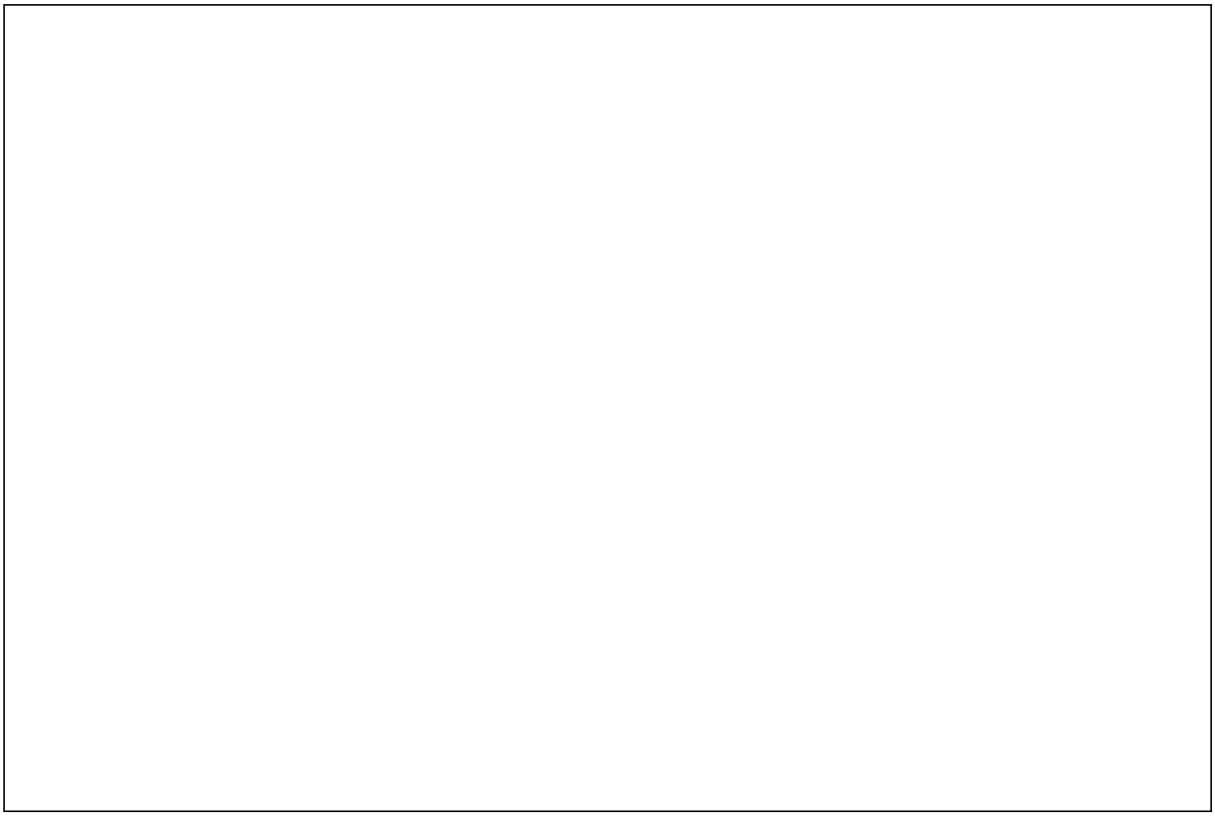
Check as follows:

1. Follow troubleshooting procedure for SPN 7385/FMI 3. Refer to section "SPN 7385/FMI 3 - GHG17" .

368.1 SPN 7386/FMI 3 - GHG17

Injector Cylinder #3 Needle Control Valve, Abnormal Operation (MAX) Cold

SPN 7386/FMI 3	
Description	This code will set when the Needle solenoid current response time does not meet requirement.
Monitored Parameter	Injector Cylinder #3 Needle Control Valve Current
Typical Enabling Conditions	Engine is running in cold mode. This mode cannot be seen through DiagnosticLink. This mode is activated from a calculated value that includes a table value (Charge Air Cooler Out vs. Coolant temperatures). Verification will ensure all conditions are met.
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	5 sec
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate, DPF Inhibit Regeneration
Verification	Let the engine cold soak to room temperature. Start engine and warm up to operating temperature (or 65°C (149°F))



Check as follows:

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

Note : Faults are listed in diagnostic priority from top to bottom.

1. Are any of the following faults present?

- SPN 168/FMI any
- SPN 723/FMI any

1.a Yes, repair fault with the highest priority listed above. Verify repairs.

1.b No; Go to step 2.

2. Disconnect the front fuel injector harness 14-pin injector connector.
3. Inspect the front fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Was water or oil intrusion, bent or spread pins found?

3.a Yes; repair as necessary.

3.b No; Go to step 4.

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

4. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #1 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #2 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #3 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #2 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #3 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

4.a Yes; Go to step 8.

4.b No; Go to step 5.

5. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
6. Remove the front fuel injector harness from the engine.

Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

7. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #1 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #2 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #3 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

7.a Yes; replace the front fuel injector harness.

Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

7.b No; replace the injector with the out-of-range resistance.

Refer to section "Removal of the Fuel Injector - Two-Filter System" .

8. Disconnect the Motor Control Module (MCM) 120-pin connector.
9. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Were signs of damage found?

9.a Yes; repair as necessary. Verify repairs.

9.b No; Go to step 10.

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

10. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	25		1 and ground	
2	26		2 and ground	
3	22		3 and ground	
4	24		4 and ground	

10.a Yes; Go to step 11.

10.b No; repair the engine side harness. Verify repairs.

11. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

12. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

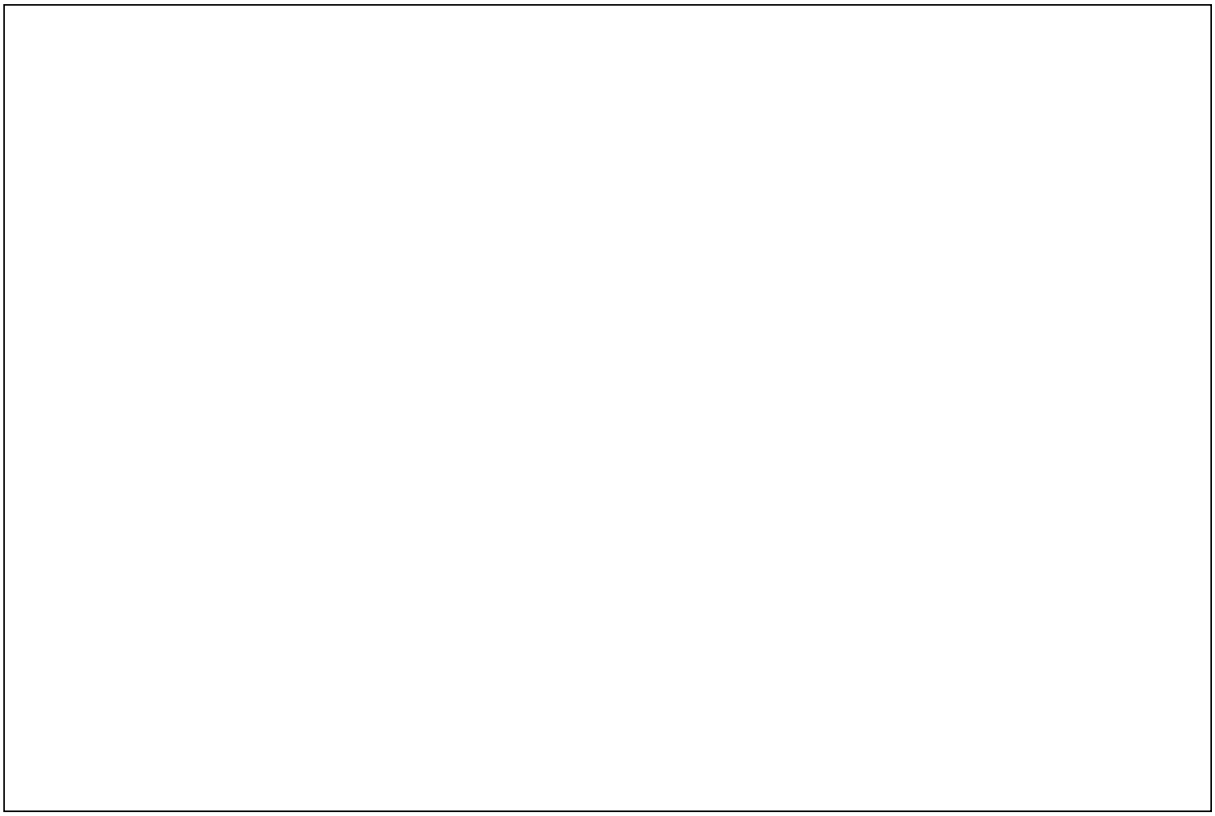
12.a Yes; repair as necessary.

12.b No; Refer to section "Removal of the Motor Control Module" .

368.2 SPN 7386/FMI 4 - GHG17

Injector Cylinder #3 Needle Control Valve, Abnormal Operation (MIN) Cold

SPN 7386/FMI 4	
Description	This code will set when the Needle solenoid current response time does not meet requirement.
Monitored Parameter	Injector Cylinder #3 Needle Control Valve Current
Typical Enabling Conditions	Engine is running in cold mode. This mode cannot be seen through DiagnosticLink. This mode is activated from a calculated value that includes a table value (Charge Air Cooler Out vs. Coolant temperatures). Verification will ensure all conditions are met.
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	5 sec
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate, DPF Inhibit Regeneration
Verification	Let the engine cold soak to room temperature. Start engine and warm up to operating temperature (or 65°C (149°F))



Check as follows:

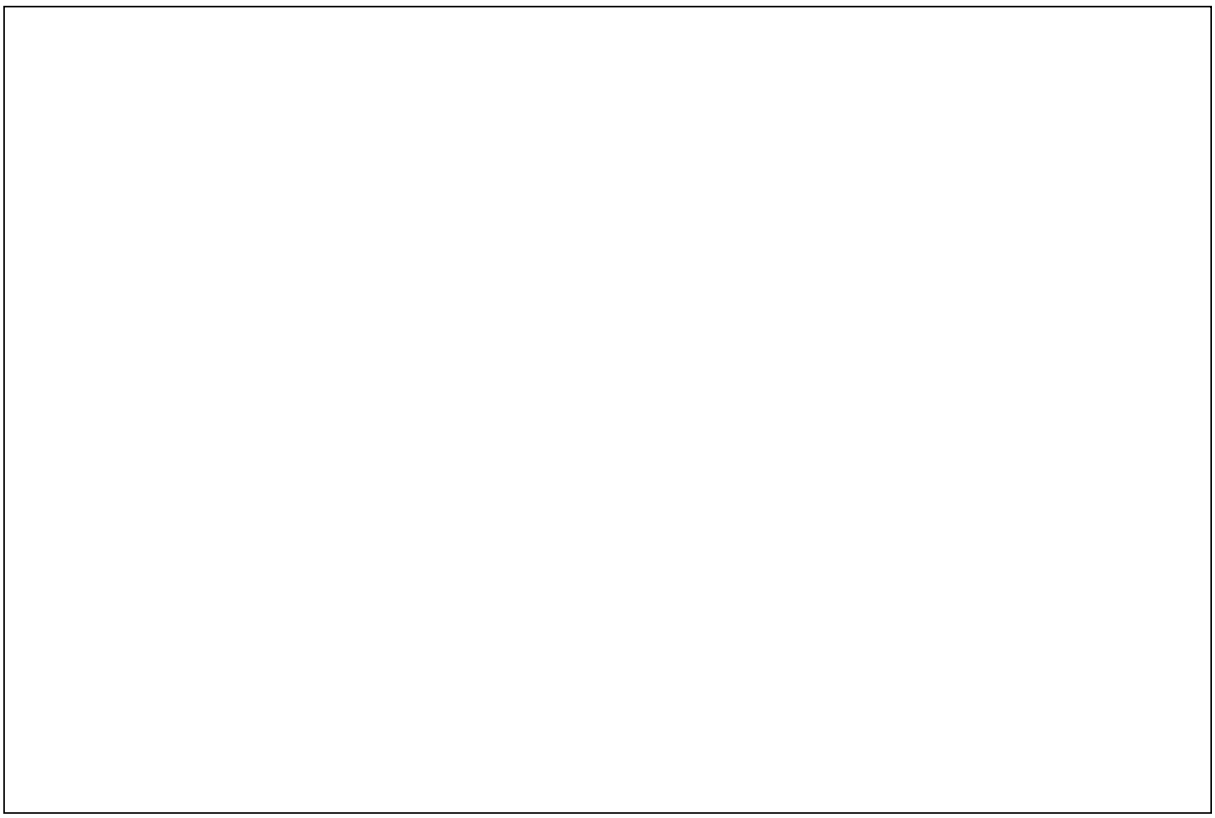
1. Follow troubleshooting procedure for SPN 7386/FMI 3. Refer to section "SPN 7386/FMI 3 - GHG17" .

SPN 7386 (MCM) (GHG17)

368.1 SPN 7386/FMI 3 - GHG17

Injector Cylinder #3 Needle Control Valve, Abnormal Operation (MAX) Cold

SPN 7386/FMI 3	
Description	This code will set when the Needle solenoid current response time does not meet requirement.
Monitored Parameter	Injector Cylinder #3 Needle Control Valve Current
Typical Enabling Conditions	Engine is running in cold mode. This mode cannot be seen through DiagnosticLink. This mode is activated from a calculated value that includes a table value (Charge Air Cooler Out vs. Coolant temperatures). Verification will ensure all conditions are met.
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	5 sec
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate, DPF Inhibit Regeneration
Verification	Let the engine cold soak to room temperature. Start engine and warm up to operating temperature (or 65°C (149°F))



Check as follows:

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

Note : Faults are listed in diagnostic priority from top to bottom.

1. Are any of the following faults present?

- SPN 168/FMI any
- SPN 723/FMI any

1.a Yes, repair fault with the highest priority listed above. Verify repairs.

1.b No; Go to step 2.

2. Disconnect the front fuel injector harness 14-pin injector connector.
3. Inspect the front fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Was water or oil intrusion, bent or spread pins found?

3.a Yes; repair as necessary.

3.b No; Go to step 4.

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

4. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the front fuel injector harness listed below. Are the resistances within range?

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #1 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #2 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #3 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

Front Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #1 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #2 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
Injector #3 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 to 2.5*	Greater than 100k*	Greater than 100k*	Greater than 100k*
* = acceptable resistance				

4.a Yes; Go to step 8.

4.b No; Go to step 5.

5. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
6. Remove the front fuel injector harness from the engine.

Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

7. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #1 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #2 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
Injector #3 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	Greater than 100k*	Greater than 100k*	Greater than 100k*	
* = acceptable resistance					

7.a Yes; replace the front fuel injector harness.

Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

7.b No; replace the injector with the out-of-range resistance.

Refer to section "Removal of the Fuel Injector - Two-Filter System" .

8. Disconnect the Motor Control Module (MCM) 120-pin connector.

9. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Were signs of damage found?

9.a Yes; repair as necessary. Verify repairs.

9.b No; Go to step 10.

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

10. Using the chart below, measure and record the resistance values between the engine side of the front valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	25		1 and ground	
2	26		2 and ground	
3	22		3 and ground	
4	24		4 and ground	

10.a Yes; Go to step 11.

10.b No; repair the engine side harness. Verify repairs.

11. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

12. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

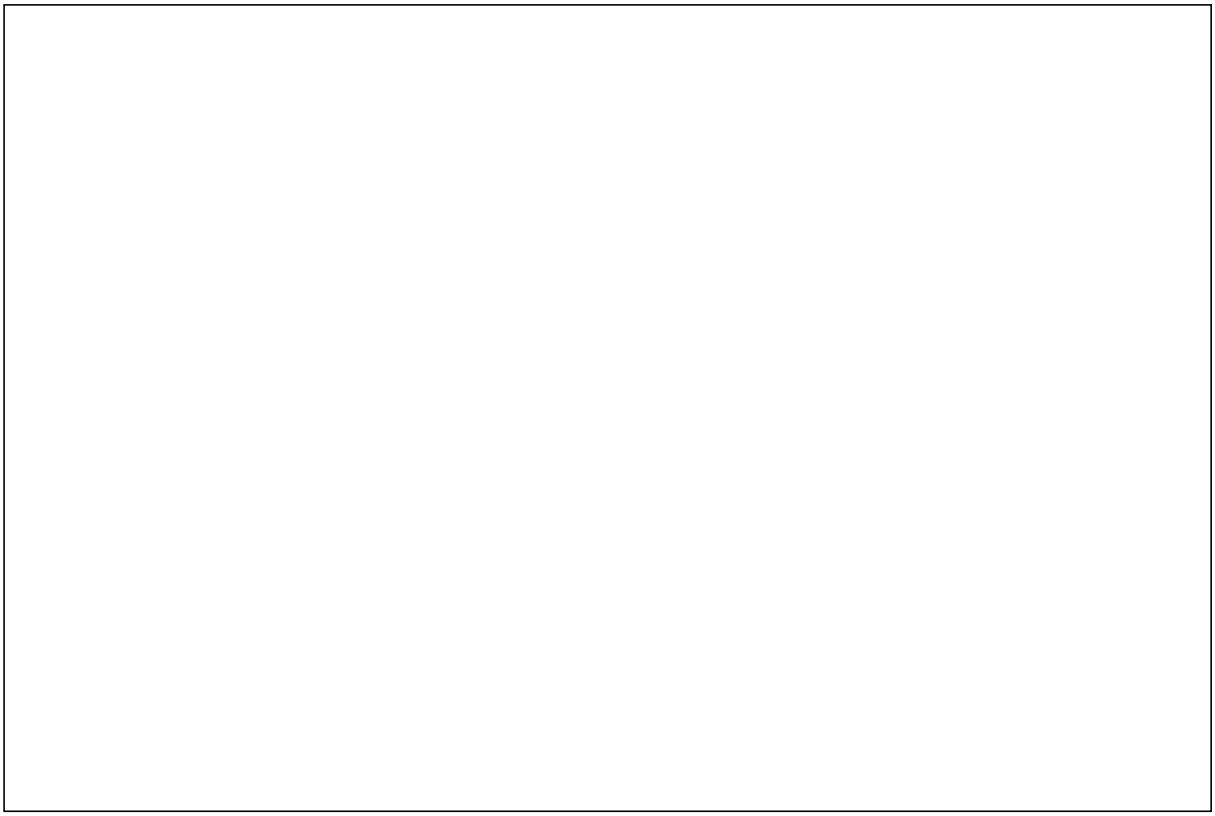
12.a Yes; repair as necessary.

12.b No; Refer to section "Removal of the Motor Control Module" .

368.2 SPN 7386/FMI 4 - GHG17

Injector Cylinder #3 Needle Control Valve, Abnormal Operation (MIN) Cold

SPN 7386/FMI 4	
Description	This code will set when the Needle solenoid current response time does not meet requirement.
Monitored Parameter	Injector Cylinder #3 Needle Control Valve Current
Typical Enabling Conditions	Engine is running in cold mode. This mode cannot be seen through DiagnosticLink. This mode is activated from a calculated value that includes a table value (Charge Air Cooler Out vs. Coolant temperatures). Verification will ensure all conditions are met.
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	5 sec
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate, DPF Inhibit Regeneration
Verification	Let the engine cold soak to room temperature. Start engine and warm up to operating temperature (or 65°C (149°F))



Check as follows:

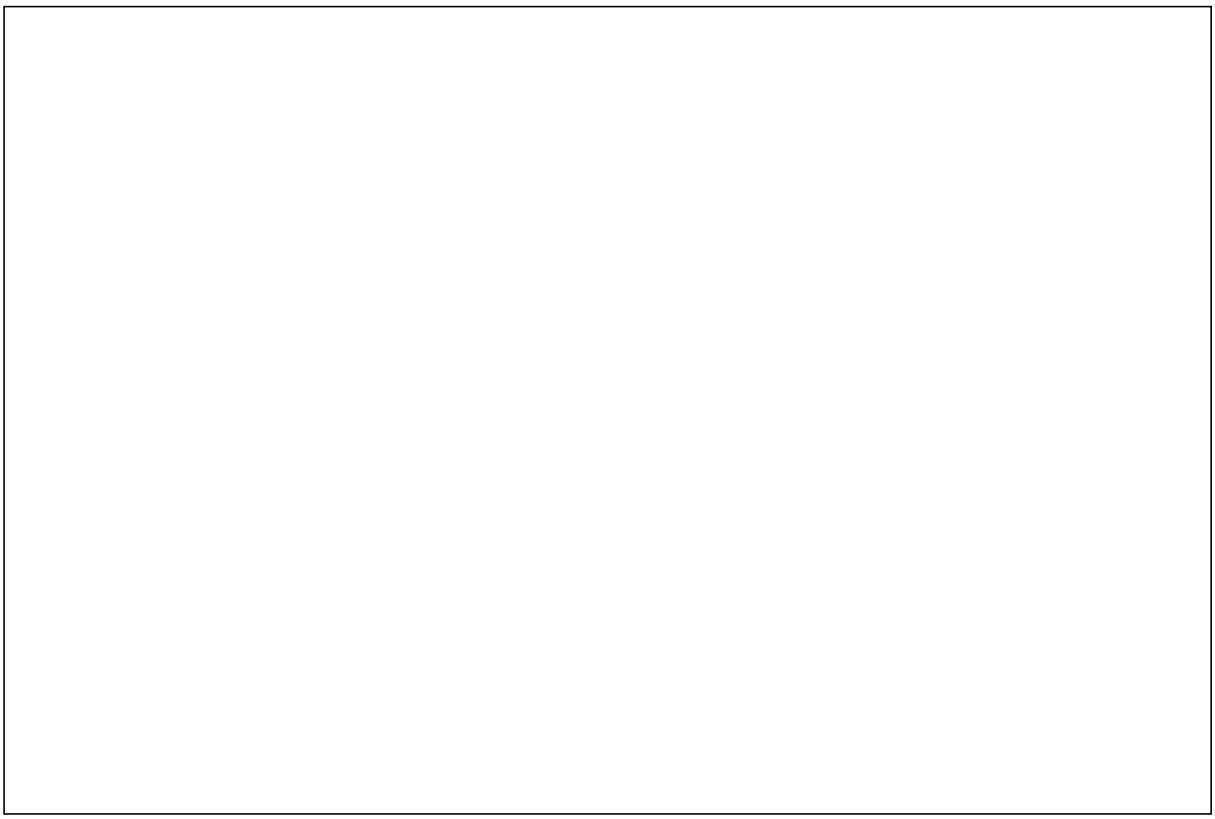
1. Follow troubleshooting procedure for SPN 7386/FMI 3. Refer to section "SPN 7386/FMI 3 - GHG17" .

SPN 7387 (MCM) (GHG17)

369.1 SPN 7387/FMI 3 - GHG17

Injector Cylinder #4 Needle Control Valve, Abnormal Operation (MAX) Cold

SPN 7387/FMI 3	
Description	This code will set when the Needle solenoid current response time does not meet requirement.
Monitored Parameter	Injector Cylinder #4 Needle Control Valve Current
Typical Enabling Conditions	Engine is running in cold mode. This mode cannot be seen through DiagnosticLink. This mode is activated from a calculated value that includes a table value (Charge Air Cooler Out vs. Coolant temperatures). Verification will ensure all conditions are met.
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	5 sec
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate, DPF Inhibit Regeneration
Verification	Let the engine cold soak to room temperature. Start engine and warm up to operating temperature (or 65°C (149°F))



Check as follows:

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

Note : Faults are listed in diagnostic priority from top to bottom.

1. Are any of the following faults present?

- SPN 168/FMI any
- SPN 723/FMI any

1.a Yes, repair fault with the highest priority listed above. Verify repairs.

1.b No; Go to step 2.

2. Disconnect the rear fuel injector harness 14-pin injector connector.
3. Inspect the rear fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Was water or oil intrusion, bent or spread pins found?

3.a Yes; repair as necessary.

3.b No; Go to step 4.

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

4. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the resistances within range?

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #4 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground
	1.3 - 2.5*	greater than100k*	greater than100k*	greater than100k*
Injector #5 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground
	1.3 - 2.5*	greater than100k*	greater than100k*	greater than100k*
Injector #6 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground
	1.3 - 2.5*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 - 2.5*	greater than 100k*	greater than100k*	greater than100k*
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 - 2.5*	greater than 100k*	greater than100k*	greater than100k*
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 - 2.5*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

4.a Yes; Go to step 8.

4.b No; Go to step 5.

5. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
6. Remove the rear fuel injector harness from the engine.

Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

7. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #4 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	greater than 100k*	greater than100k*	greater than100k*	
Injector #5 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #6 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

7.a Yes; replace the rear fuel injector harness.

Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

7.b No; replace the injector with the out-of-range resistance.

Refer to section "Removal of the Fuel Injector - Two-Filter System" .

8. Disconnect the Motor Control Module (MCM) 120-pin connector.
9. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Were signs of damage found?

9.a Yes; repair as necessary. Verify repairs

9.b No; Go to step 10.

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

10. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Rear Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Rear Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	19		1 and ground	
2	16		2 and ground	
3	20		3 and ground	
4	18		4 and ground	

10.a Yes; Go to step 11.

10.b No; repair the engine side harness. Verify repairs.

11. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

12. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

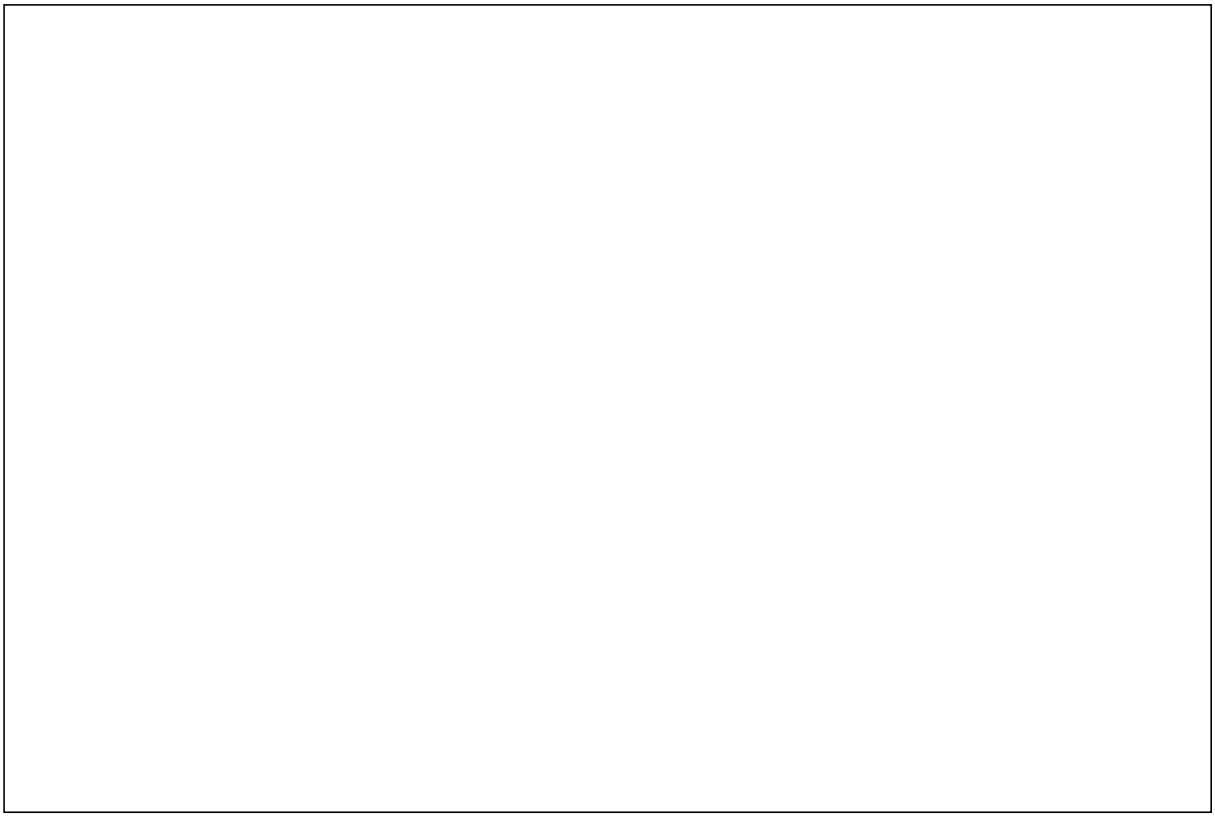
12.a Yes; repair as necessary.

12.b No; Refer to section "Removal of the Motor Control Module" .

369.2 SPN 7387/FMI 4 - GHG17

Injector Cylinder #4 Needle Control Valve, Abnormal Operation (MIN) Cold

SPN 7387/FMI 4	
Description	This code will set when the Needle solenoid current response time does not meet requirement.
Monitored Parameter	Injector Cylinder #4 Needle Control Valve Current
Typical Enabling Conditions	Engine is running in cold mode. This mode cannot be seen through DiagnosticLink. This mode is activated from a calculated value that includes a table value (Charge Air Cooler Out vs. Coolant temperatures). Verification will ensure all conditions are met.
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	5 sec
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate, DPF Inhibit Regeneration
Verification	Let the engine cold soak to room temperature. Start engine and warm up to operating temperature (or 65°C (149°F))



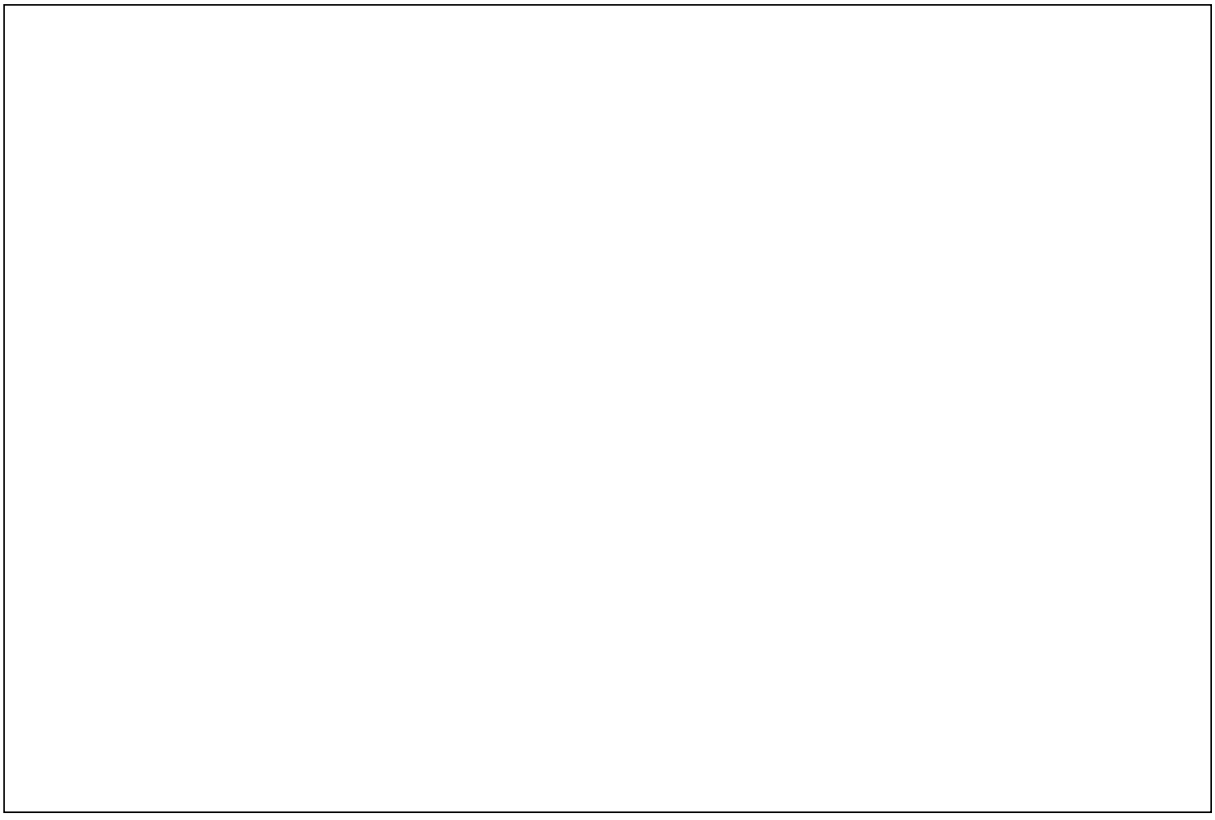
Check as follows:

1. Follow troubleshooting procedure for SPN 7387/FMI 3. Refer to section "SPN 7387/FMI 3 - GHG17" .

370.1 SPN 7388/FMI 3 - GHG17

Injector Cylinder #5 Needle Control Valve, Abnormal Operation (MAX) Cold

SPN 7388/FMI 3	
Description	This code will set when the Needle solenoid current response time does not meet requirement.
Monitored Parameter	Injector Cylinder #5 Needle Control Valve Current
Typical Enabling Conditions	Engine is running in cold mode. This mode cannot be seen through DiagnosticLink. This mode is activated from a calculated value that includes a table value (Charge Air Cooler Out vs. Coolant temperatures). Verification will ensure all conditions are met.
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	5 sec
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate, DPF Inhibit Regeneration
Verification	Let the engine cold soak to room temperature. Start engine and warm up to operating temperature (or 65°C (149°F))



Check as follows:

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

Note : Faults are listed in diagnostic priority from top to bottom.

1. Are any of the following faults present?

- SPN 168/FMI any
- SPN 723/FMI any

1.a Yes, repair fault with the highest priority listed above. Verify repairs.

1.b No; Go to step 2.

2. Disconnect the rear fuel injector harness 14-pin injector connector.
3. Inspect the rear fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Was water or oil intrusion, bent or spread pins found?

3.a Yes; repair as necessary.

3.b No; Go to step 4.

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

4. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the resistances within range?

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #4 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground
	1.3 - 2.5*	greater than100k*	greater than100k*	greater than100k*
Injector #5 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground
	1.3 - 2.5*	greater than100k*	greater than100k*	greater than100k*
Injector #6 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground
	1.3 - 2.5*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 - 2.5*	greater than 100k*	greater than100k*	greater than100k*
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 - 2.5*	greater than 100k*	greater than100k*	greater than100k*
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 - 2.5*	greater than 100k*	greater than100k*	greater than100k*
* = acceptable resistance				

4.a Yes; Go to step 8.

4.b No; Go to step 5.

5. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
6. Remove the rear fuel injector harness from the engine.

   Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

7. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #4 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #5 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #6 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

7.a Yes; replace the rear fuel injector harness.

Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

7.b No; replace the injector with the out-of-range resistance.

Refer to section "Removal of the Fuel Injector - Two-Filter System" .

8. Disconnect the Motor Control Module (MCM) 120-pin connector.
9. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Were signs of damage found?

9.a Yes; repair as necessary. Verify repairs.

9.b No; Go to step 10.

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

10. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	19		1 and ground	
2	16		2 and ground	
3	20		3 and ground	
4	18		4 and ground	

10.a Yes; Go to step 11.

10.b No; repair the engine side harness. Verify repairs.

11. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

12. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

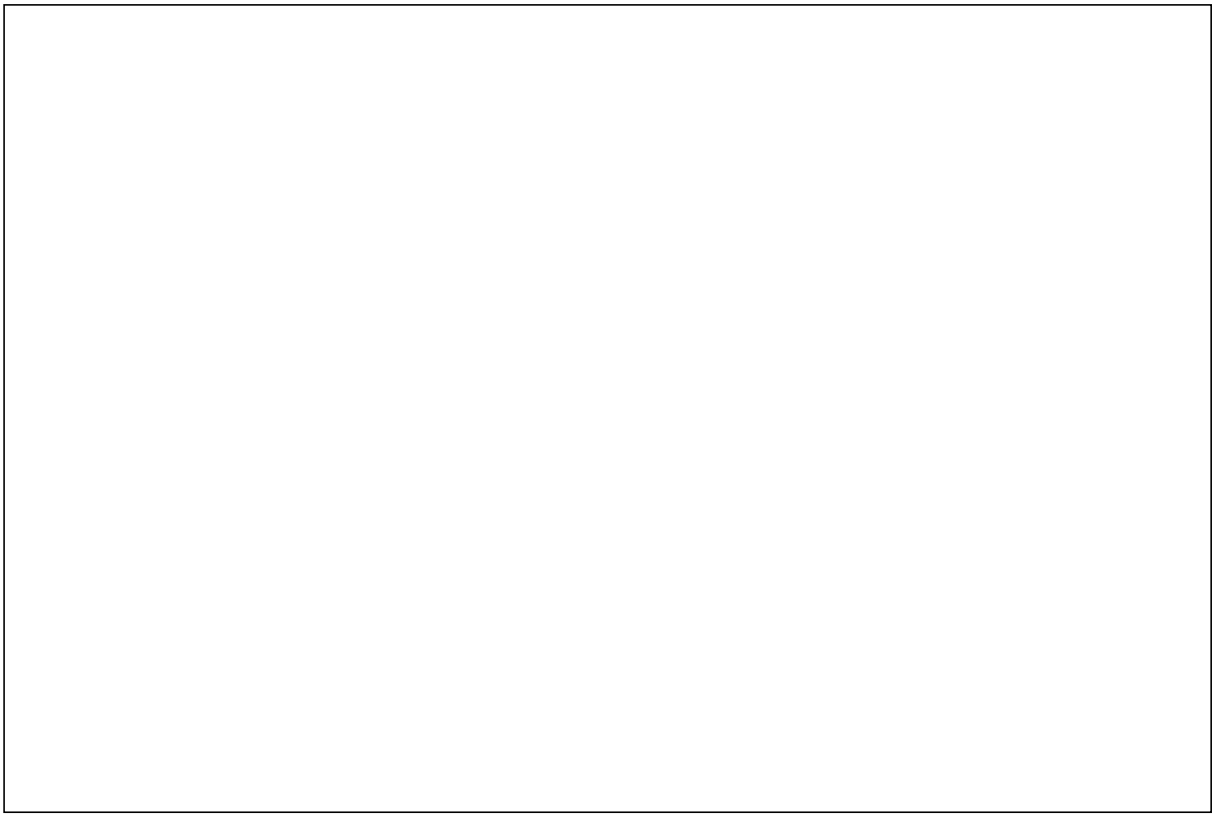
12.a Yes; repair as necessary.

12.b No; Refer to section "Removal of the Motor Control Module" .

370.2 SPN 7388/FMI 4 - GHG17

Injector Cylinder #5 Needle Control Valve, Abnormal Operation (MIN) Cold

SPN 7388/FMI 4	
Description	This code will set when the Needle solenoid current response time does not meet requirement.
Monitored Parameter	Injector Cylinder #5 Needle Control Valve Current
Typical Enabling Conditions	Engine is running in cold mode. This mode cannot be seen through DiagnosticLink. This mode is activated from a calculated value that includes a table value (Charge Air Cooler Out vs. Coolant temperatures). Verification will ensure all conditions are met.
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	5 sec
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate, DPF Inhibit Regeneration
Verification	Let the engine cold soak to room temperature. Start engine and warm up to operating temperature (or 65°C (149°F))



Check as follows:

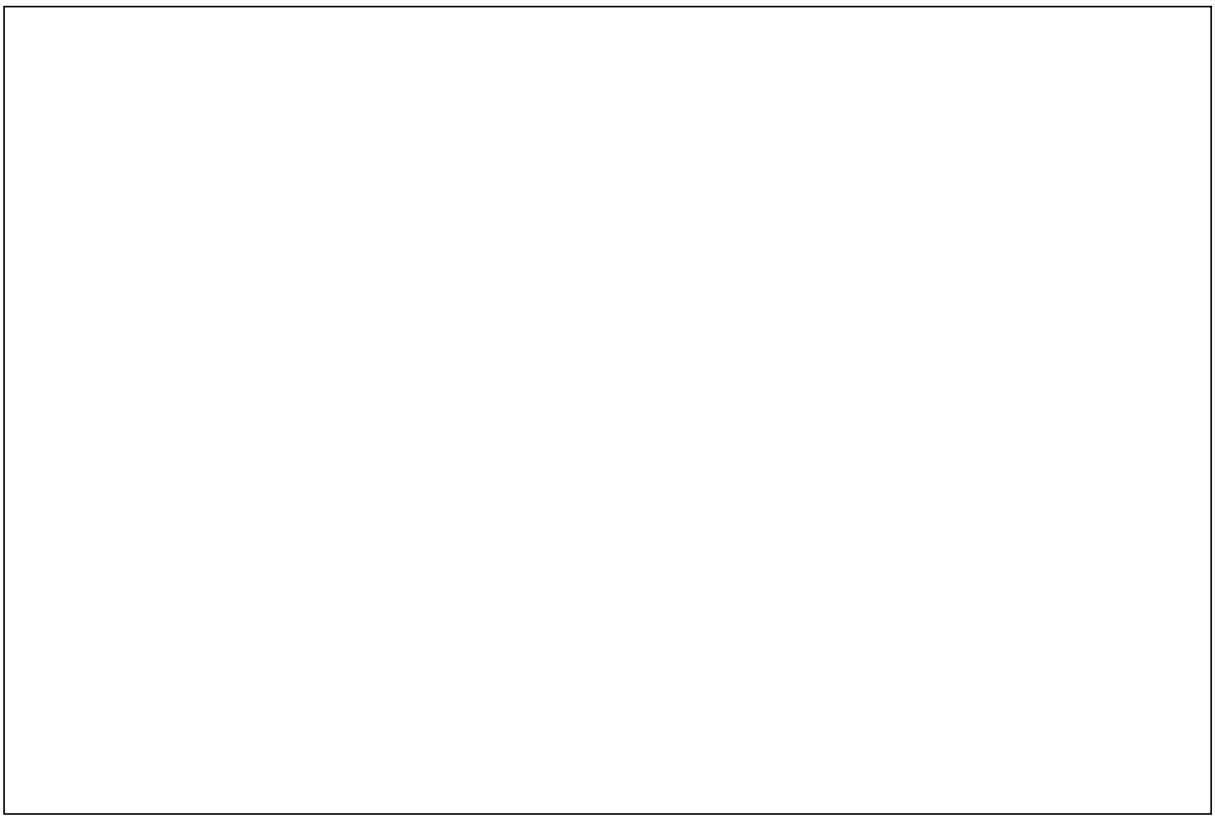
1. Follow troubleshooting procedure for SPN 7388/FMI 3. Refer to section "SPN 7388/FMI 3 - GHG17" .

SPN 7388 (MCM) (GHG17)

370.1 SPN 7388/FMI 3 - GHG17

Injector Cylinder #5 Needle Control Valve, Abnormal Operation (MAX) Cold

SPN 7388/FMI 3	
Description	This code will set when the Needle solenoid current response time does not meet requirement.
Monitored Parameter	Injector Cylinder #5 Needle Control Valve Current
Typical Enabling Conditions	Engine is running in cold mode. This mode cannot be seen through DiagnosticLink. This mode is activated from a calculated value that includes a table value (Charge Air Cooler Out vs. Coolant temperatures). Verification will ensure all conditions are met.
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	5 sec
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate, DPF Inhibit Regeneration
Verification	Let the engine cold soak to room temperature. Start engine and warm up to operating temperature (or 65°C (149°F))



Check as follows:

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

Note : Faults are listed in diagnostic priority from top to bottom.

1. Are any of the following faults present?

- SPN 168/FMI any
- SPN 723/FMI any

1.a Yes, repair fault with the highest priority listed above. Verify repairs.

1.b No; Go to step 2.

2. Disconnect the rear fuel injector harness 14-pin injector connector.
3. Inspect the rear fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Was water or oil intrusion, bent or spread pins found?

3.a Yes; repair as necessary.

3.b No; Go to step 4.

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

4. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the resistances within range?

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #4 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground
	1.3 - 2.5*	greater than100k*	greater than100k*	greater than100k*
Injector #5 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground
	1.3 - 2.5*	greater than100k*	greater than100k*	greater than100k*
Injector #6 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground
	1.3 - 2.5*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 - 2.5*	greater than 100k*	greater than100k*	greater than100k*
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 - 2.5*	greater than 100k*	greater than100k*	greater than100k*
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 - 2.5*	greater than 100k*	greater than100k*	greater than100k*
* = acceptable resistance				

4.a Yes; Go to step 8.

4.b No; Go to step 5.

5. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
6. Remove the rear fuel injector harness from the engine.

Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

7. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #4 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #5 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #6 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

7.a Yes; replace the rear fuel injector harness.

Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

7.b No; replace the injector with the out-of-range resistance.

Refer to section "Removal of the Fuel Injector - Two-Filter System" .

8. Disconnect the Motor Control Module (MCM) 120-pin connector.

9. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Were signs of damage found?

9.a Yes; repair as necessary. Verify repairs.

9.b No; Go to step 10.

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

10. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	19		1 and ground	
2	16		2 and ground	
3	20		3 and ground	
4	18		4 and ground	

10.a Yes; Go to step 11.

10.b No; repair the engine side harness. Verify repairs.

11. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

12. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

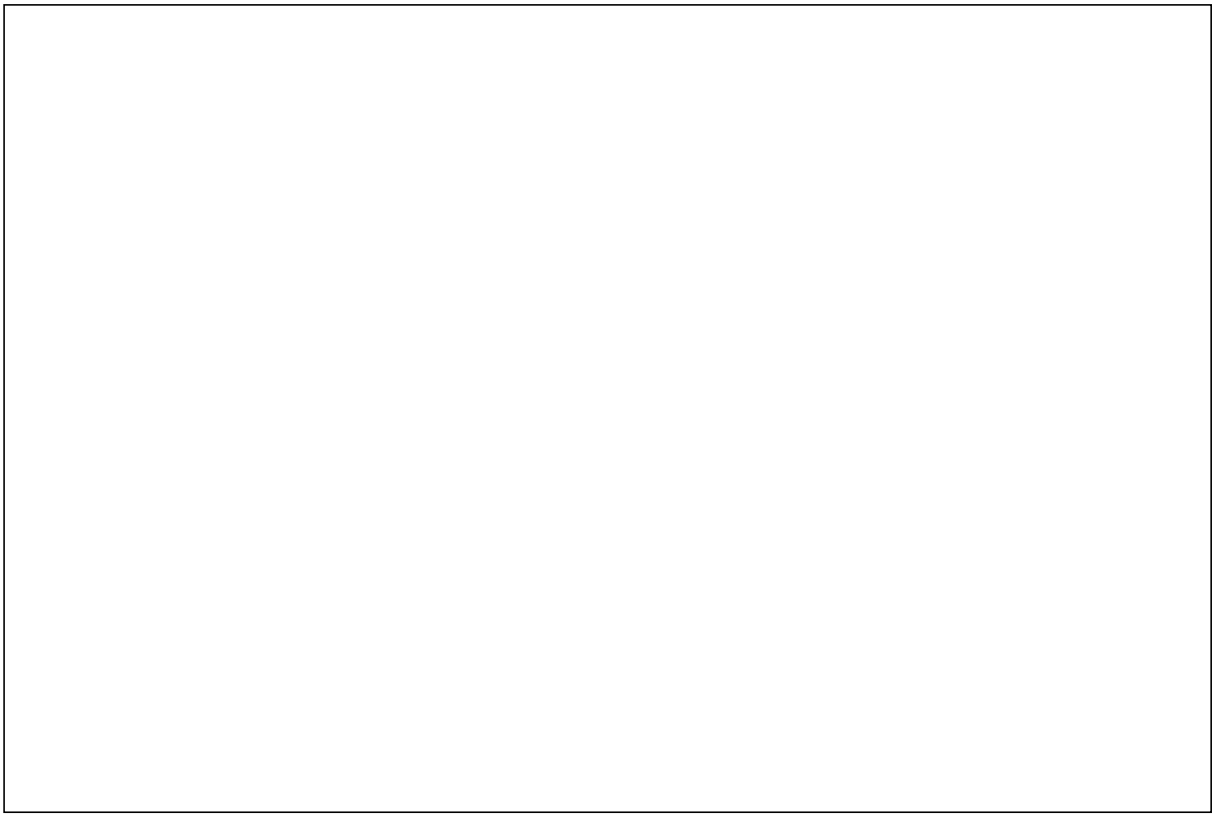
12.a Yes; repair as necessary.

12.b No; Refer to section "Removal of the Motor Control Module" .

370.2 SPN 7388/FMI 4 - GHG17

Injector Cylinder #5 Needle Control Valve, Abnormal Operation (MIN) Cold

SPN 7388/FMI 4	
Description	This code will set when the Needle solenoid current response time does not meet requirement.
Monitored Parameter	Injector Cylinder #5 Needle Control Valve Current
Typical Enabling Conditions	Engine is running in cold mode. This mode cannot be seen through DiagnosticLink. This mode is activated from a calculated value that includes a table value (Charge Air Cooler Out vs. Coolant temperatures). Verification will ensure all conditions are met.
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	5 sec
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate, DPF Inhibit Regeneration
Verification	Let the engine cold soak to room temperature. Start engine and warm up to operating temperature (or 65°C (149°F))



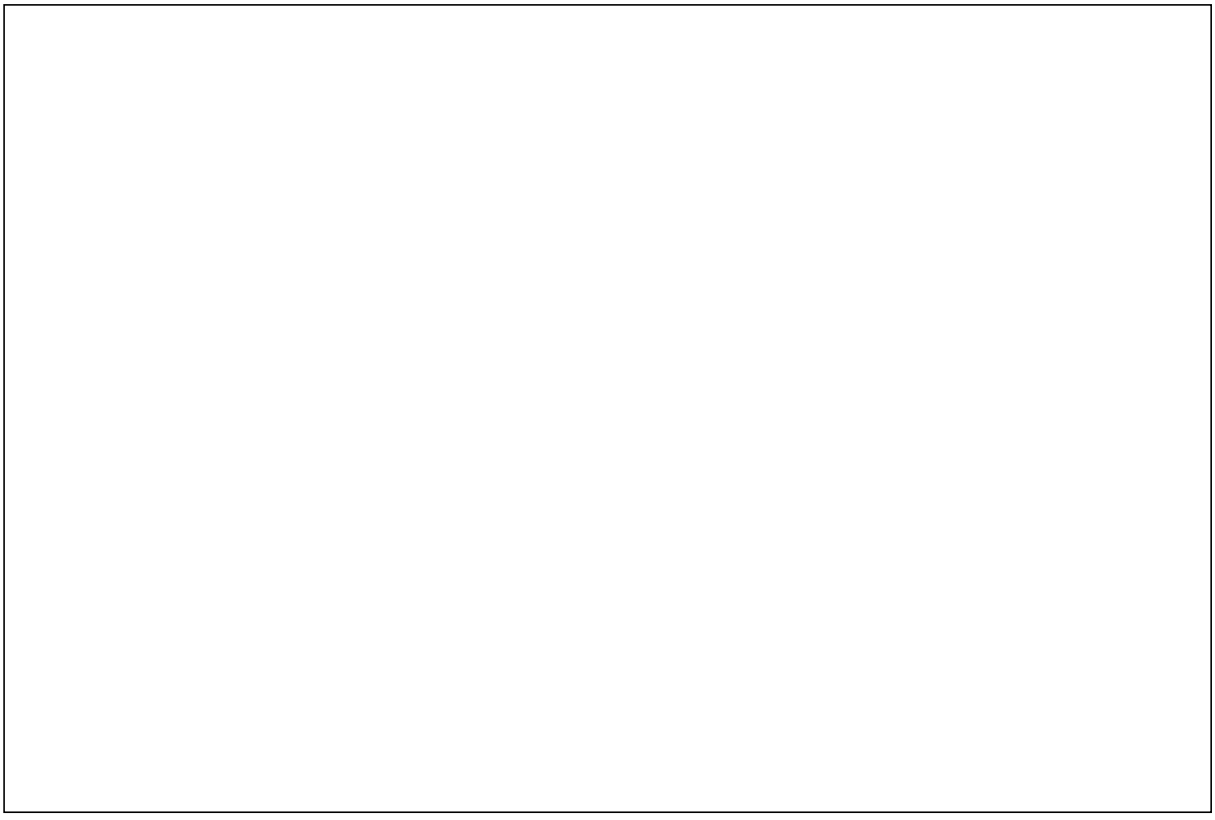
Check as follows:

1. Follow troubleshooting procedure for SPN 7388/FMI 3. Refer to section "SPN 7388/FMI 3 - GHG17" .

371.1 SPN 7389/FMI 3 - GHG17

Injector Cylinder #6 Needle Control Valve, Abnormal Operation (MAX) Cold

SPN 7389/FMI 3	
Description	This code will set when the Needle solenoid current response time does not meet requirement.
Monitored Parameter	Injector Cylinder #6 Needle Control Valve Current
Typical Enabling Conditions	Engine is running in cold mode. This mode cannot be seen through DiagnosticLink. This mode is activated from a calculated value that includes a table value (Charge Air Cooler Out vs. Coolant temperatures). Verification will ensure all conditions are met.
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	5 sec
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate, DPF Inhibit Regeneration
Verification	Let the engine cold soak to room temperature. Start engine and warm up to operating temperature (or 65°C (149°F))



Check as follows:

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

Note : Faults are listed in diagnostic priority from top to bottom.

1. Are any of the following faults present?

- SPN 168/FMI any
- SPN 723/FMI any

1.a Yes, repair fault with the highest priority listed above. Verify repairs.

1.b No; Go to step 2.

2. Disconnect the rear fuel injector harness 14-pin injector connector.
3. Inspect the rear fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Was water or oil intrusion, bent or spread pins found?

3.a Yes; repair as necessary.

3.b No; Go to step 4.

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

4. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the resistances within range?

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #4 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground
	1.3 - 2.5*	greater than100k*	greater than100k*	greater than100k*
Injector #5 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground
	1.3 - 2.5*	greater than100k*	greater than100k*	greater than100k*
Injector #6 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground
	1.3 - 2.5*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 - 2.5*	greater than 100k*	greater than100k*	greater than100k*
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 - 2.5*	greater than 100k*	greater than100k*	greater than100k*
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 - 2.5*	greater than 100k*	greater than100k*	greater than100k*
* = acceptable resistance				

4.a Yes; Go to step 8.

4.b No; Go to step 5.

5. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
6. Remove the rear fuel injector harness from the engine.

   Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

7. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #4 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #5 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #6 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

7.a Yes; replace the rear fuel injector harness.

Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

7.b No; replace the injector with the out-of-range resistance.

Refer to section "Removal of the Fuel Injector - Two-Filter System" .

8. Disconnect the Motor Control Module (MCM) 120-pin connector.
9. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Were signs of damage found?

9.a Yes; repair as necessary. Verify repairs.

9.b No; Go to step 10.

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

10. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	19		1 and ground	
2	16		2 and ground	
3	20		3 and ground	
4	18		4 and ground	

10.a Yes; Go to step 11.

10.b No; repair the engine side harness. Verify repairs.

11. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

12. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

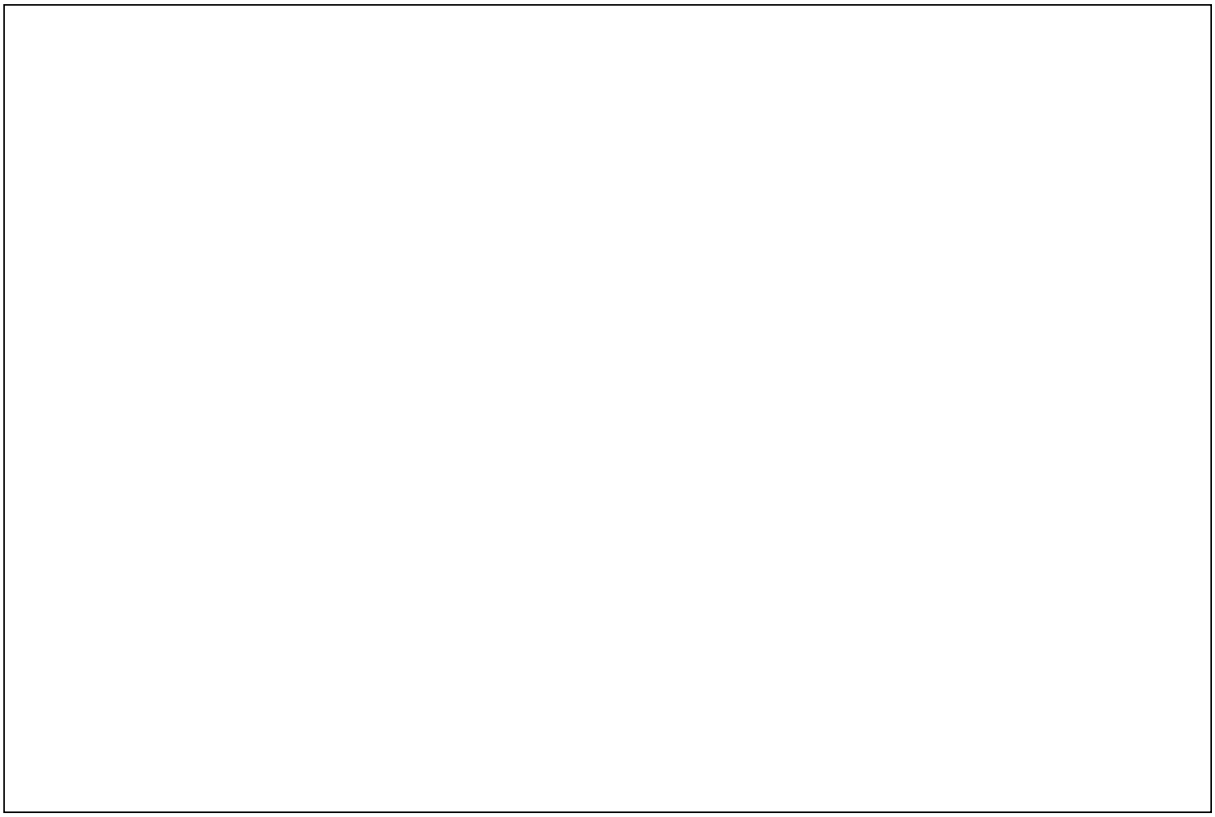
12.a Yes; repair as necessary.

12.b No; Refer to section "Removal of the Motor Control Module" .

371.2 SPN 7389/FMI 4 - GHG17

Injector Cylinder #6 Needle Control Valve, Abnormal Operation (MIN) Cold

SPN 7389/FMI 4	
Description	This code will set when the Needle solenoid current response time does not meet requirement.
Monitored Parameter	Injector Cylinder #6 Needle Control Valve Current
Typical Enabling Conditions	Engine is running in cold mode. This mode cannot be seen through DiagnosticLink. This mode is activated from a calculated value that includes a table value (Charge Air Cooler Out vs. Coolant temperatures). Verification will ensure all conditions are met.
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	5 sec
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate, DPF Inhibit Regeneration, EGR Valve Shut, Limit DEF Dosing
Verification	Let the engine cold soak to room temperature. Start engine and warm up to operating temperature (or 65°C (149°F))



Check as follows:

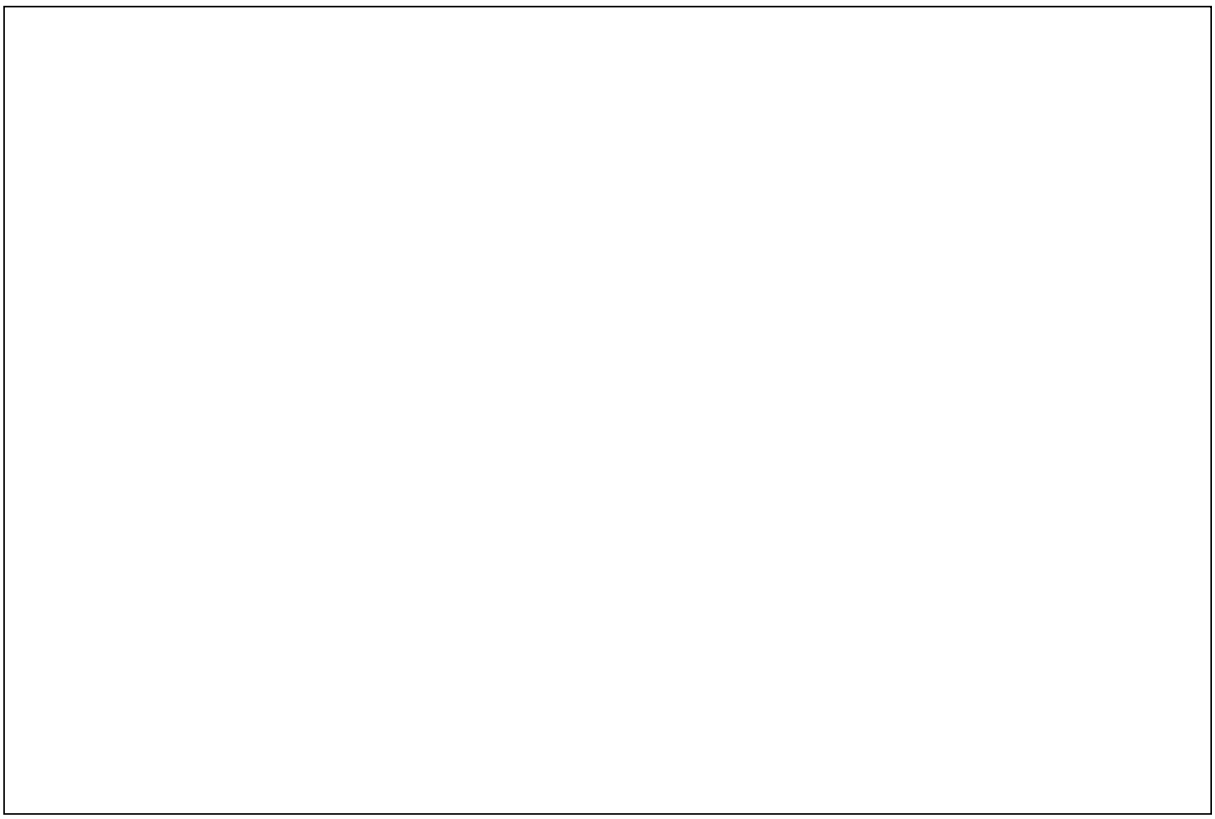
1. Follow troubleshooting procedure for SPN 7389/FMI 3. Refer to section "SPN 7389/FMI 3 - GHG17 " .

SPN 7389 (MCM) (GHG17)

371.1 SPN 7389/FMI 3 - GHG17

Injector Cylinder #6 Needle Control Valve, Abnormal Operation (MAX) Cold

SPN 7389/FMI 3	
Description	This code will set when the Needle solenoid current response time does not meet requirement.
Monitored Parameter	Injector Cylinder #6 Needle Control Valve Current
Typical Enabling Conditions	Engine is running in cold mode. This mode cannot be seen through DiagnosticLink. This mode is activated from a calculated value that includes a table value (Charge Air Cooler Out vs. Coolant temperatures). Verification will ensure all conditions are met.
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	5 sec
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate, DPF Inhibit Regeneration
Verification	Let the engine cold soak to room temperature. Start engine and warm up to operating temperature (or 65°C (149°F))



Check as follows:

Note : Injector chart PDF available on DDCSN/SUPPORT/SPECIALIZED SERVICE.

Note : Faults are listed in diagnostic priority from top to bottom.

1. Are any of the following faults present?

- SPN 168/FMI any
- SPN 723/FMI any

1.a Yes, repair fault with the highest priority listed above. Verify repairs.

1.b No; Go to step 2.

2. Disconnect the rear fuel injector harness 14-pin injector connector.
3. Inspect the rear fuel injector harness 14-pin injector connectors for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Was water or oil intrusion, bent or spread pins found?

3.a Yes; repair as necessary.

3.b No; Go to step 4.

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

4. Using the appropriate chart below, measure and record the resistance values between the corresponding pins on the valve cover side of the rear fuel injector harness listed below. Are the resistances within range?

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Valve Cover Side)				
Injector #4 Needle	Pins 1 and 2	Pins 1 and 8	Pin 2 and ground	Pin 8 and ground
	1.3 - 2.5*	greater than100k*	greater than100k*	greater than100k*
Injector #5 Needle	Pins 1 and 3	Pins 1 and 9	Pin 3 and ground	Pin 9 and ground
	1.3 - 2.5*	greater than100k*	greater than100k*	greater than100k*
Injector #6 Needle	Pins 1 and 4	Pins 1 and 12	Pin 4 and ground	Pin 12 and ground
	1.3 - 2.5*	greater than100k*	greater than100k*	greater than100k*
* = acceptable resistance				

Rear Fuel Injector Harness 14-Pin Connector Resistance Chart (Using J-48671-10 Injector Breakout Box)				
Note: Ensure J-48671-10 ground strap is connected to cylinder head.				
Injector #4 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 - 2.5*	greater than 100k*	greater than100k*	greater than100k*
Injector #5 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 - 2.5*	greater than 100k*	greater than100k*	greater than100k*
Injector #6 Needle	Pins 3 and 4	Pins 2 and 3	Pin 2 and ground	Pin 3 and ground
	1.3 - 2.5*	greater than 100k*	greater than100k*	greater than100k*
* = acceptable resistance				

4.a Yes; Go to step 8.

4.b No; Go to step 5.

5. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .
6. Remove the rear fuel injector harness from the engine.

Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

7. Using the chart below, measure and record the resistance values between the injector pins listed below. Are the resistances within range?

Injector Needle Resistance Chart (Injector Harness must be removed from engine)					
Injector #4 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #5 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
Injector #6 Needle	Pins 3 and 4	Pins 3 and 2	Pin 2 and ground	Pin 3 and ground	
	2.0 or less*	greater than100k*	greater than100k*	greater than100k*	
* = acceptable resistance					

7.a Yes; replace the rear fuel injector harness.

Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" .

7.b No; replace the injector with the out-of-range resistance.

Refer to section "Removal of the Fuel Injector - Two-Filter System" .

8. Disconnect the Motor Control Module (MCM) 120-pin connector.

9. Inspect the MCM 120-pin connector and 120-pin harness connector for signs of corrosion, spread, unseated (pushed out) or damaged pins, connector seal for damage (signs of water or oil intrusion) or signs of wire damage. Were signs of damage found?

9.a Yes; repair as necessary. Verify repairs.

9.b No; Go to step 10.

Note : DO NOT touch the metal ohmmeter leads with your hands when taking measurements.

10. Using the chart below, measure and record the resistance values between the engine side of the rear valve cover 14-pin connector and the MCM 120-pin connector. Are the resistances within range?

Engine Harness Injector Circuit Resistance Table				
Front Engine Side Valve Cover 14-pin connector #	**MCM 120-Pin Harness Connector**	**Acceptable Resistance 1 or less**	**Front Engine Side Valve Cover 14 pin connector #**	**Acceptable Resistance 1K or greater**
1	19		1 and ground	
2	16		2 and ground	
3	20		3 and ground	
4	18		4 and ground	

10.a Yes; Go to step 11.

10.b No; repair the engine side harness. Verify repairs.

11. Remove the rocker cover. Refer to section "Removal of the Rocker Cover" .

12. Inspect all injector terminals for loose of cross-threaded nuts. Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System" . Are any injector nuts loose or cross-threaded?

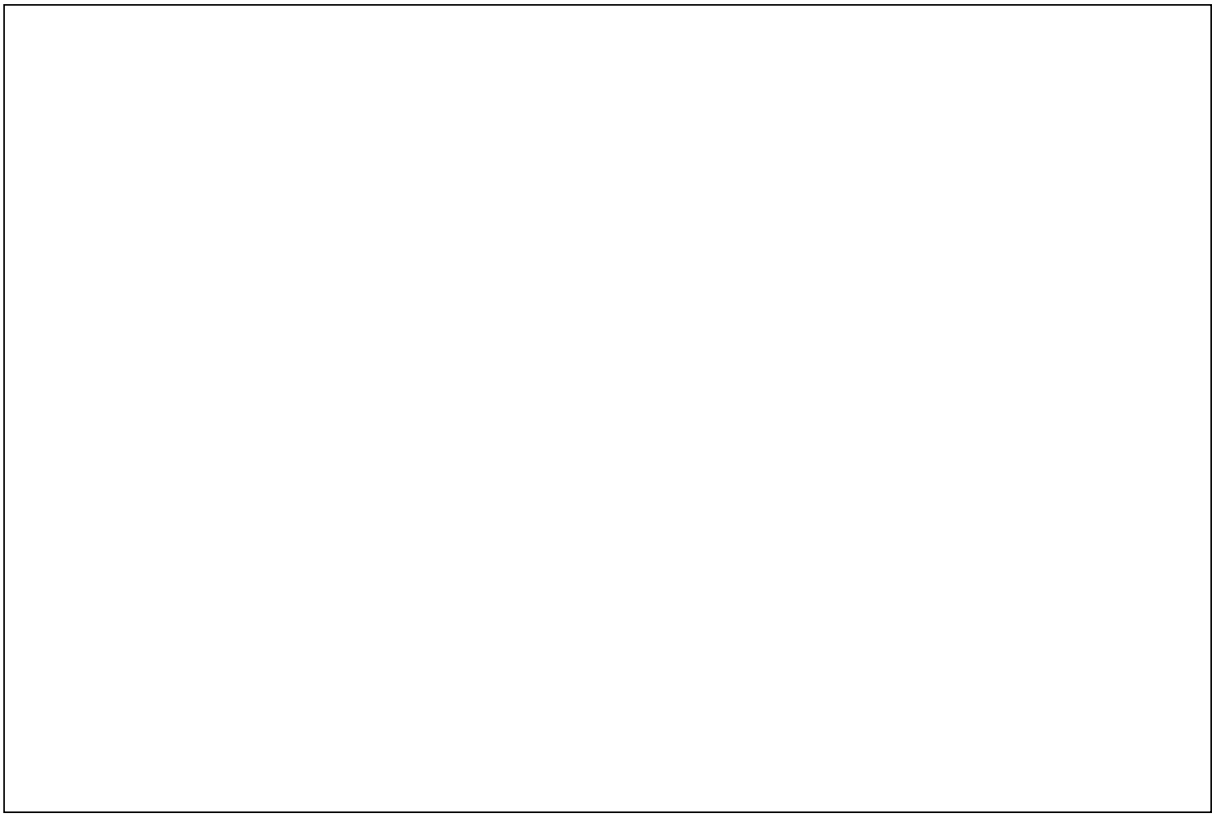
12.a Yes; repair as necessary.

12.b No; Refer to section "Removal of the Motor Control Module" .

371.2 SPN 7389/FMI 4 - GHG17

Injector Cylinder #6 Needle Control Valve, Abnormal Operation (MIN) Cold

SPN 7389/FMI 4	
Description	This code will set when the Needle solenoid current response time does not meet requirement.
Monitored Parameter	Injector Cylinder #6 Needle Control Valve Current
Typical Enabling Conditions	Engine is running in cold mode. This mode cannot be seen through DiagnosticLink. This mode is activated from a calculated value that includes a table value (Charge Air Cooler Out vs. Coolant temperatures). Verification will ensure all conditions are met.
Monitor Sequence	None
Execution Frequency	Continuous
Typical Duration	5 sec
Dash Lamps	MIL, CEL
Engine Reaction	25% Derate, DPF Inhibit Regeneration, EGR Valve Shut, Limit DEF Dosing
Verification	Let the engine cold soak to room temperature. Start engine and warm up to operating temperature (or 65°C (149°F))



Check as follows:

1. Follow troubleshooting procedure for SPN 7389/FMI 3. Refer to section "SPN 7389/FMI 3 - GHG17 " .

SPN 520199 (IPPC) (GHG17)

372.1 SPN 520199/FMI 19 - GHG17

Gyroscope Network Data Error

SPN 520199/FMI 19	
Description	This Code Sets When the Integrated Predictive Powertrain Control (IPPC) Module Receives Invalid Network Data from the Gyroscope
Monitored Parameter	Gyroscope
Typical Enabling Conditions	Always Enabled
Monitor Sequence	Continuous
Execution Frequency	2 Seconds
Typical Duration	10 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition On

Check as follows:

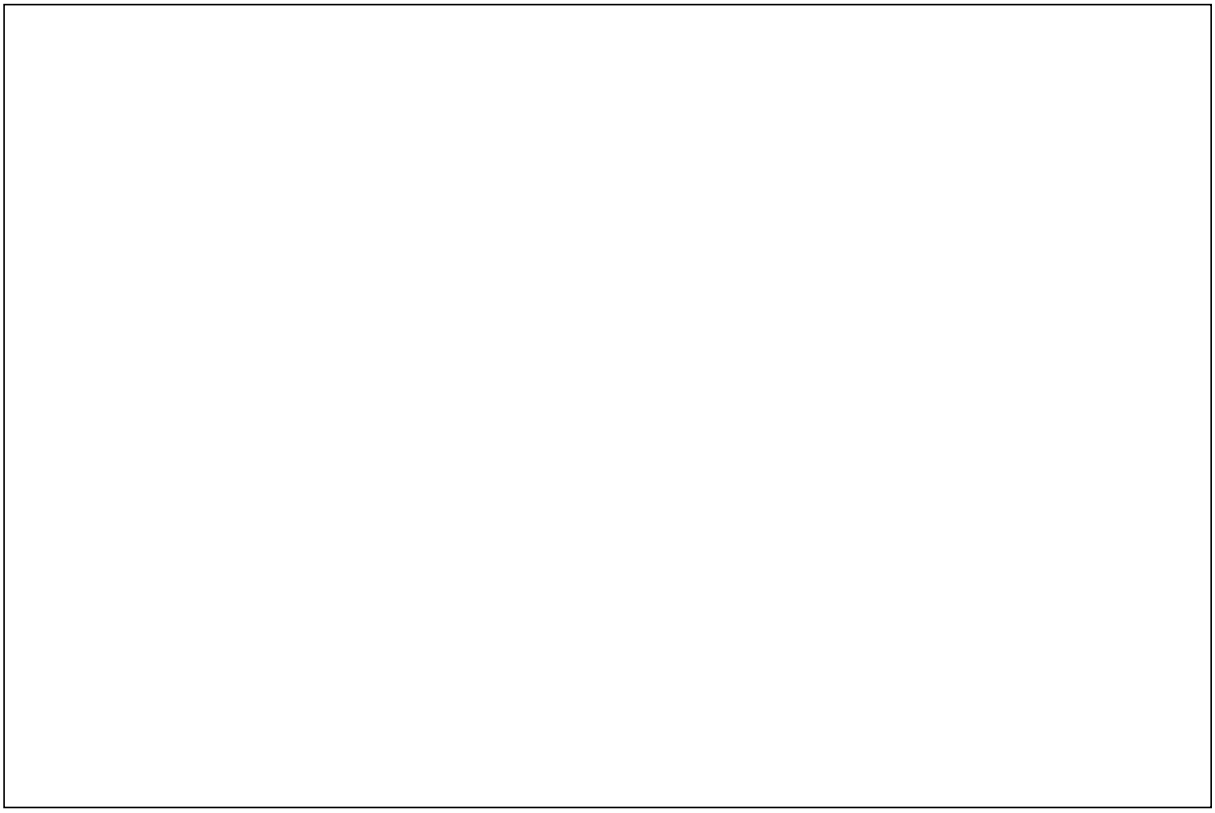
1. Replace the Integrated Predictive Powertrain Control (IPPC) module. Refer to OEM literature. Verify repair.

SPN 520200 (IPPC) (GHG17)

373.1 SPN 520200/FMI 6 - GHG17

Powertrain Controller Area Network Common Circuit Error

SPN 520200/FMI 6	
Description	This Fault Code Sets when the Integrated Predictive Powertrain Control (IPPC) Module Detects that the Powertrain Controller Area Network (PT-CAN) Circuit is Shorted to Power or Ground
Monitored Parameter	PT-CAN
Typical Enabling Conditions	Always Enabled
Monitor Sequence	Continuous
Execution Frequency	2 Seconds
Typical Duration	10 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition On



Check as follows:

1. Turn the ignition OFF.
2. Remove and inspect the IPPC electrical connector. Are there any spread or damaged pins?
   - 2.a Yes; repair the pins as necessary. Verify repair.
   - 2.b No; Go to step 3.
3. Measure the resistance between pins 13 and 15 of the IPPC electrical connector. Is the resistance between 55 and 65 ohms?
   - 3.a Yes; refer to OEM literature and replace the IPPC module.
   - 3.b No; repair the PT CAN circuit. Verify repair.

SPN 520203 (CPC3) (GHG17)

375.1 SPN 520203/FMI 3 - GHG17

Accelerator Pedal Sensor 1 Supply Short to Battery

Check as follows:

1. Disconnect the Accelerator Pedal (AP).
2. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   2.a Yes; repair as necessary. Verify repair.

   2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).

Williams Dual-Channel Pedal Connector and Pinout				
Function	CPC3 Cavity	Pedal Connector Pin	Comments	Pedal Harness Connector Body
APS1	2/3	A	SENSOR 1	
GND1	2/20	B	APS1 GND	
VCC1 (+5V)	2/15	C	APS1 Power Supply	
VCC2 (+5V)	2/21	D	APS2 Power Supply	
GND2	2/14	E	APS2 GND	
APS2	2/4	F	SENSOR 2	

4. Measure the voltage between pin C of the AP harness connector and ground. Is the voltage greater than 5.5 volts?

   4.a Yes; repair the short to battery power between pin C of the accelerator pedal sensor harness connector and pin 15 of the CPC3 connector #2.

   4.b No; replace the accelerator pedal.

375.2 SPN 520203/FMI 4 - GHG17

Accelerator Pedal Sensor 1 Supply Short to Ground

Check as follows:

1. Disconnect the Accelerator Pedal (AP).
2. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   2.a Yes; repair as necessary. Verify repair.

   2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).

Williams Dual-Channel Pedal Connector and Pinout				
Function	CPC3 Cavity	Pedal Connector Pin	Comments	Pedal Harness Connector Body
APS1	2/3	A	SENSOR 1	
GND1	2/20	B	APS1 GND	
VCC1 (+5V)	2/15	C	APS1 Power Supply	
VCC2 (+5V)	2/21	D	APS2 Power Supply	
GND2	2/14	E	APS2 GND	
APS2	2/4	F	SENSOR 2	

4. Measure the voltage between pin C of the AP harness connector and ground. Is the voltage between 4.5 and 5.5 volts?

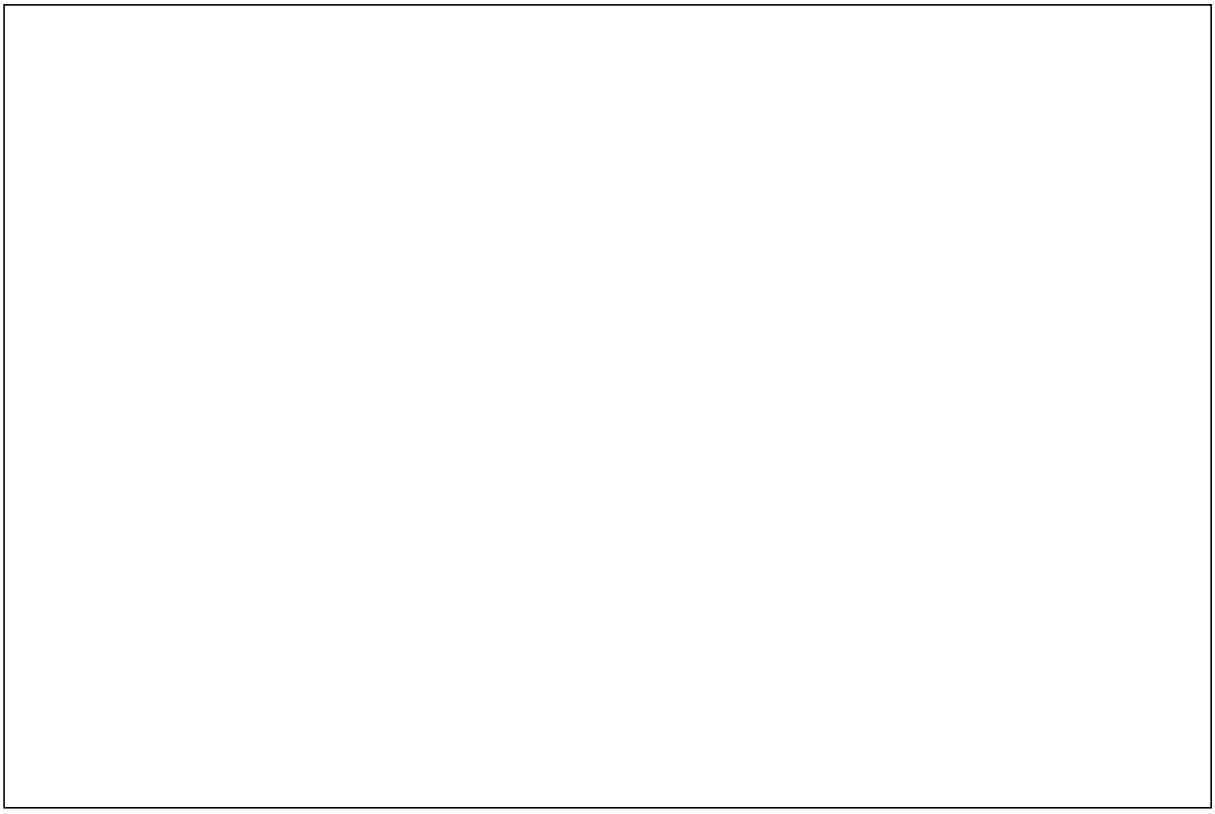
   4.a Yes; replace the accelerator pedal.

   4.b No; repair the circuit between pin C of the accelerator pedal sensor harness connector and pin 15 of the CPC3 connector #2.

374.1 SPN 520203/FMI 6 - GHG17

Measurement-Controller Area Network Common Circuit Error

SPN 520203/FMI 6	
Description	This Fault Code Sets when the Integrated Predictive Powertrain Control (IPPC) Module Detects that the Measurement Controller Area Network (CAN) Circuit is Shorted to Power or Ground. Note: The Measurement CAN is Used for Engineering Purposes
Monitored Parameter	Measurement CAN
Typical Enabling Conditions	Always Enabled
Monitor Sequence	Continuous
Execution Frequency	2 Seconds
Typical Duration	10 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key ON, Engine OFF



Check as follows:

1. Remove and inspect the 15 pin Integrated Predictive Powertrain Control (IPPC) module electrical connector. Are there spread or damaged pins?
   1.a Yes; repair as necessary. Verify repair.
   1.b No; Go to step 2.
2. Are wires present in cavities 10, 11, and 12?
   2.a Yes; remove the circuits from the connector cavities. Verify repair.

2.b No; replace the IPPC module. Refer to OEM literature. Verify repair.

SPN 520203 (IPPC) (GHG17)

374.1 SPN 520203/FMI 6 - GHG17

Measurement-Controller Area Network Common Circuit Error

SPN 520203/FMI 6	
Description	This Fault Code Sets when the Integrated Predictive Powertrain Control (IPPC) Module Detects that the Measurement Controller Area Network (CAN) Circuit is Shorted to Power or Ground. Note: The Measurement CAN is Used for Engineering Purposes
Monitored Parameter	Measurement CAN
Typical Enabling Conditions	Always Enabled
Monitor Sequence	Continuous
Execution Frequency	2 Seconds
Typical Duration	10 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key ON, Engine OFF

Check as follows:

1. Remove and inspect the 15 pin Integrated Predictive Powertrain Control (IPPC) module electrical connector. Are there spread or damaged pins?

   1.a Yes; repair as necessary. Verify repair.

1.b No; Go to step 2.

2. Are wires present in cavities 10, 11, and 12?

2.a Yes; remove the circuits from the connector cavities. Verify repair.

2.b No; replace the IPPC module. Refer to OEM literature. Verify repair.

376.1 SPN 520204/FMI 5 - GHG17

SPN 520204/FMI 5	
Description	Common Powertrain Controller (CPC3) Ground Circuit Open, Connector 5, Pin 6
Monitored Parameter	CPC3 Battery Ground
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	10 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine Running

This fault indicates an open circuit to pin 6 of the CPC3 connector #5.

1. Connect DiagnosticLink® 8.08 or higher.
2. Turn the ignition ON (key ON, engine OFF). Is SPN 520204/FMI 5 active?
   - 2.a Yes; Go to step 3.
   - 2.b No; clear all faults. If fault remains inactive, release vehicle. If fault becomes active, Go to step 3.
3. Turn the ignition OFF.
4. Disconnect CPC3evo connector #5.
5. Inspect the harness connector for bent, spread or corroded pins. Is there any pin damage?
   - 5.a Yes; repair as necessary.
   - 5.b No; Go to step 6.
6. Measure the resistance between pin 6 of the CPC3 connector #5 and ground. Is the resistance less than three ohms?
   - 6.a Yes; replace the CPC3 connector.
   - 6.b No; restore ground to pin 6 of the CPC3 connector #5. Refer to EZWiring/Vehicle Sub-System/GROUND) section for detailed schematic information.

376.1 SPN 520204/FMI 5 - GHG17

SPN 520204/FMI 5	
Description	Common Powertrain Controller (CPC3) Ground Circuit Open, Connector 5, Pin 6
Monitored Parameter	CPC3 Battery Ground
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	10 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine Running

This fault indicates an open circuit to pin 6 of the CPC3 connector #5.

1. Connect DiagnosticLink® 8.08 or higher.
2. Turn the ignition ON (key ON, engine OFF). Is SPN 520204/FMI 5 active?
   - 2.a Yes; Go to step 3.
   - 2.b No; clear all faults. If fault remains inactive, release vehicle. If fault becomes active, Go to step 3.
3. Turn the ignition OFF.
4. Disconnect CPC3evo connector #5.
5. Inspect the harness connector for bent, spread or corroded pins. Is there any pin damage?
   - 5.a Yes; repair as necessary.
   - 5.b No; Go to step 6.
6. Measure the resistance between pin 6 of the CPC3 connector #5 and ground. Is the resistance less than three ohms?
   - 6.a Yes; replace the CPC3 connector.
   - 6.b No; restore ground to pin 6 of the CPC3 connector #5. Refer to EZWiring/Vehicle Sub-System/GROUND) section for detailed schematic information.

SPN 520204 (CPC3) (GHG17)

376.1 SPN 520204/FMI 5 - GHG17

SPN 520204/FMI 5	
Description	Common Powertrain Controller (CPC3) Ground Circuit Open, Connector 5, Pin 6
Monitored Parameter	CPC3 Battery Ground
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	10 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Engine Running

This fault indicates an open circuit to pin 6 of the CPC3 connector #5.

1. Connect DiagnosticLink® 8.08 or higher.
2. Turn the ignition ON (key ON, engine OFF). Is SPN 520204/FMI 5 active?
   - 2.a Yes; Go to step 3.
   - 2.b No; clear all faults. If fault remains inactive, release vehicle. If fault becomes active, Go to step 3.
3. Turn the ignition OFF.
4. Disconnect CPC3evo connector #5.
5. Inspect the harness connector for bent, spread or corroded pins. Is there any pin damage?
   - 5.a Yes; repair as necessary.
   - 5.b No; Go to step 6.
6. Measure the resistance between pin 6 of the CPC3 connector #5 and ground. Is the resistance less than three ohms?
   - 6.a Yes; replace the CPC3 connector.
   - 6.b No; restore ground to pin 6 of the CPC3 connector #5. Refer to EZWiring/Vehicle Sub-System/GROUND) section for detailed schematic information.

377.1 SPN 520205/FMI 3 - GHG17

Check as follows:

1. Disconnect the Accelerator Pedal (AP).
2. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   2.a Yes; repair as necessary. Verify repair.

   2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).

Williams Dual-Channel Pedal Connector and Pinout				
Function	CPC3 Cavity	Pedal Connector Pin	Comments	Pedal Harness Connector Body
APS1	2/3	A	SENSOR 1	
GND1	2/20	B	APS1 GND	
VCC1 (+5V)	2/15	C	APS1 Power Supply	
VCC2 (+5V)	2/21	D	APS2 Power Supply	
GND2	2/14	E	APS2 GND	
APS2	2/4	F	SENSOR 2	

4. Measure the voltage between pin D of the AP harness connector and ground. Is the voltage greater than 5.5 volts?

   4.a Yes; repair the short to battery power between pin D of the accelerator pedal sensor harness connector and pin 21 of the CPC3 connector #2.

   4.b No; replace the accelerator pedal.

377.2 SPN 520205/FMI 4 - GHG17

Accelerator Pedal Sensor 2 Supply Short to Ground

1. Disconnect the Accelerator Pedal (AP).
2. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   2.a Yes; repair as necessary. Verify repair.

   2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).

Williams Dual-Channel Pedal Connector and Pinout				
Function	CPC3 Cavity	Pedal Connector Pin	Comments	Pedal Harness Connector Body
APS1	2/3	A	SENSOR 1	
GND1	2/20	B	APS1 GND	
VCC1 (+5V)	2/15	C	APS1 Power Supply	
VCC2 (+5V)	2/21	D	APS2 Power Supply	
GND2	2/14	E	APS2 GND	
APS2	2/4	F	SENSOR 2	

4. Measure the voltage between pin D of the AP harness connector and ground. Is the voltage between 4.5 and 5.5 volts?

   4.a Yes; replace the accelerator pedal.

   4.b No; repair the circuit between pin D of the accelerator pedal sensor harness connector and pin 21 of the CPC3 connector #2.

SPN 520205 (CPC3) (GHG17)

377.1 SPN 520205/FMI 3 - GHG17

Check as follows:

1. Disconnect the Accelerator Pedal (AP).
2. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   2.a Yes; repair as necessary. Verify repair.

   2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).

Williams Dual-Channel Pedal Connector and Pinout				
Function	CPC3 Cavity	Pedal Connector Pin	Comments	Pedal Harness Connector Body
APS1	2/3	A	SENSOR 1	
GND1	2/20	B	APS1 GND	
VCC1 (+5V)	2/15	C	APS1 Power Supply	
VCC2 (+5V)	2/21	D	APS2 Power Supply	
GND2	2/14	E	APS2 GND	
APS2	2/4	F	SENSOR 2	

4. Measure the voltage between pin D of the AP harness connector and ground. Is the voltage greater than 5.5 volts?

   4.a Yes; repair the short to battery power between pin D of the accelerator pedal sensor harness connector and pin 21 of the CPC3 connector #2.

   4.b No; replace the accelerator pedal.

377.2 SPN 520205/FMI 4 - GHG17

Accelerator Pedal Sensor 2 Supply Short to Ground

1. Disconnect the Accelerator Pedal (AP).
2. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   2.a Yes; repair as necessary. Verify repair.

   2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).

Williams Dual-Channel Pedal Connector and Pinout				
Function	CPC3 Cavity	Pedal Connector Pin	Comments	Pedal Harness Connector Body
APS1	2/3	A	SENSOR 1	
GND1	2/20	B	APS1 GND	
VCC1 (+5V)	2/15	C	APS1 Power Supply	
VCC2 (+5V)	2/21	D	APS2 Power Supply	
GND2	2/14	E	APS2 GND	
APS2	2/4	F	SENSOR 2	

4. Measure the voltage between pin D of the AP harness connector and ground. Is the voltage between 4.5 and 5.5 volts?

   4.a Yes; replace the accelerator pedal.

   4.b No; repair the circuit between pin D of the accelerator pedal sensor harness connector and pin 21 of the CPC3 connector #2.

378.1 SPN 520208/FMI 19 - GHG17

PID General Checksum Error

SPN 520208/FMI 19	
Description	PID general checksum error
Monitored Parameter	Internal Integrated Predictive Powertrain Control (IPPC) Software
Typical Enabling Conditions	Ignition on
Monitor Sequence	Always
Execution Frequency	Always
Typical Duration	2 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition on

Check as follows:

1. Connect DiagnosticLink .
2. Reprogram the IPPC. Does the fault return?
   2.a Yes; replace the IPPC module. Refer to the Original Equipment Manufacturer (OEM) literature.
   2.b No; release the vehicle.

SPN 520208 (IPPC) (GHG17)

378.1 SPN 520208/FMI 19 - GHG17

PID General Checksum Error

SPN 520208/FMI 19	
Description	PID general checksum error
Monitored Parameter	Internal Integrated Predictive Powertrain Control (IPPC) Software
Typical Enabling Conditions	Ignition on
Monitor Sequence	Always
Execution Frequency	Always
Typical Duration	2 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition on

Check as follows:

1. Connect DiagnosticLink .
2. Reprogram the IPPC. Does the fault return?
   2.a Yes; replace the IPPC module. Refer to the Original Equipment Manufacturer (OEM) literature.
   2.b No; release the vehicle.

SPN 520210 (IPPC) (GHG17)

379.1 SPN 520210/FMI 19 - GHG17

Check Map Failed

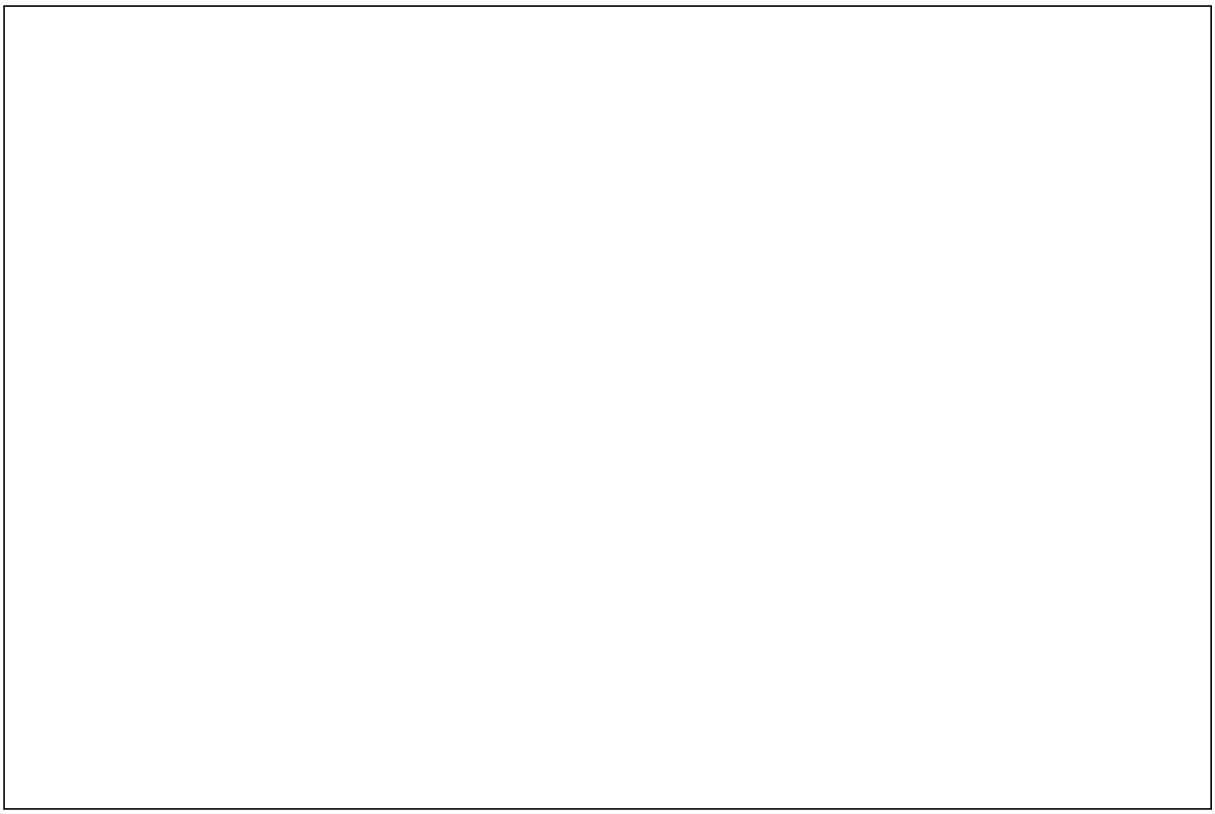
SPN 520210/FMI 19	
Description	This Fault Code Sets When The Internal Integrated Predictive Powertrain Control (IPPC) Module Is Unable To Read The Map Software
Monitored Parameter	Internal Integrated Predictive Powertrain Control (IPPC) Software
Typical Enabling Conditions	Ignition On
Monitor Sequence	Always
Execution Frequency	Always
Typical Duration	2 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key ON, Engine OFF

Check as follows:

1. Replace the Integrated Predictive Powertrain Control (IPPC) module. Refer to OEM literature. Verify repair.

380.1 SPN 520211/FMI 2 - GHG17

SPN 520211/FMI 2	
Description	This Fault Code Sets When the Integrated Predictive Powertrain Control (IPPC) Module Receives Erratic, Incorrect, or Intermittent Data From the Common Powertrain Control (CPC) Module During Initial Activation
Monitored Parameters	PT-CAN
Typical Enabling Conditions	Always Enabled
Monitor Sequence	Continuous
Execution Frequency	Two Seconds
Typical Duration	10 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition ON



Check as follows:

1. Check other modules for fault codes. Are there Powertrain Controller Area Network (PT- CAN) communication fault codes present in any other modules?

   1.a Yes; repair the powertrain PT-CAN communication faults first.

   1.b No; Go to step 2.

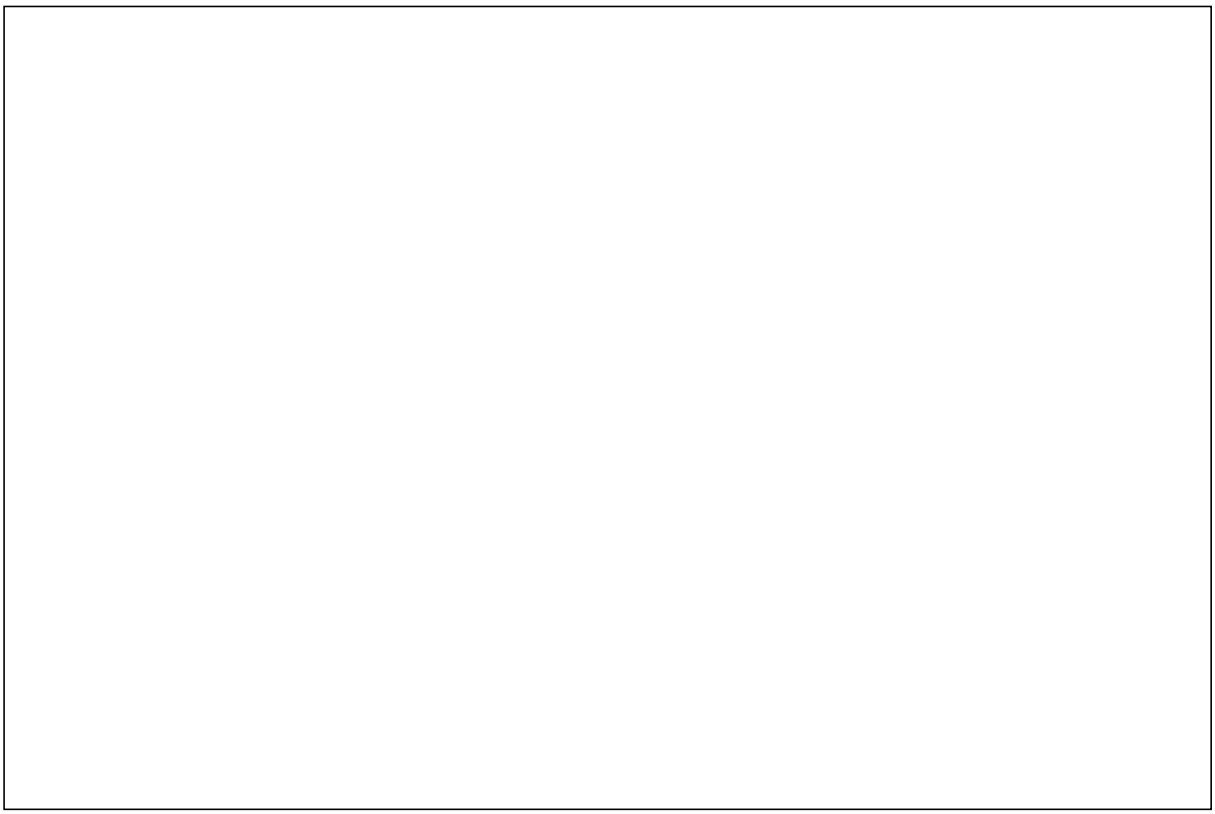
2. Use DiagnosticLink to reprogram the CPC using the latest server information.
3. Clear the fault codes.
4. Close DiagnosticLink and disconnect the PC to vehicle interface/communication device from the 9-pin connector.

5. Cycle the ignition in the following sequence:
   - Ignition OFF for 60 seconds
   - Ignition ON for 60 seconds
   - Ignition OFF for 60 seconds
   - Ignition ON for 60 seconds
   - Ignition OFF for 60 seconds
6. Reconnect the PC to vehicle interface/communication device to the 9-pin connector and open DiagnosticLink.
7. Turn the ignition ON (key ON, engine OFF) and wait 10 seconds.
8. Is fault code SPN 520211/FMI 2 active?
   - 8.a Yes; replace the IPPC module. Refer to OEM literature. Verify repair.
   - 8.b No; release the vehicle.

SPN 520211 (IPPC) (GHG17)

380.1 SPN 520211/FMI 2 - GHG17

SPN 520211/FMI 2	
Description	This Fault Code Sets When the Integrated Predictive Powertrain Control (IPPC) Module Receives Erratic, Incorrect, or Intermittent Data From the Common Powertrain Control (CPC) Module During Initial Activation
Monitored Parameters	PT-CAN
Typical Enabling Conditions	Always Enabled
Monitor Sequence	Continuous
Execution Frequency	Two Seconds
Typical Duration	10 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition ON



Check as follows:

1. Check other modules for fault codes. Are there Powertrain Controller Area Network (PT- CAN) communication fault codes present in any other modules?

   1.a Yes; repair the powertrain PT-CAN communication faults first.

   1.b No; Go to step 2.

2. Use DiagnosticLink to reprogram the CPC using the latest server information.

3. Clear the fault codes.
4. Close DiagnosticLink and disconnect the PC to vehicle interface/communication device from the 9-pin connector.
5. Cycle the ignition in the following sequence:

- Ignition OFF for 60 seconds
- Ignition ON for 60 seconds
- Ignition OFF for 60 seconds
- Ignition ON for 60 seconds
- Ignition OFF for 60 seconds

6. Reconnect the PC to vehicle interface/communication device to the 9-pin connector and open DiagnosticLink.
7. Turn the ignition ON (key ON, engine OFF) and wait 10 seconds.
8. Is fault code SPN 520211/FMI 2 active?

8.a Yes; replace the IPPC module. Refer to OEM literature. Verify repair.

8.b No; release the vehicle.

381.1 SPN 520212/FMI 11 - GHG17

SW Watchdog Error

SPN 520212/FMI 11	
Description	This Fault Code Sets When There is an Internal Error with the Integrated Predictive Powertrain Control (IPPC) Software
Monitored Parameter	IPPC Software
Typical Enabling Conditions	Ignition ON
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	2 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key ON, Engine OFF

1. Replace the Integrated Predictive Powertrain Control (IPPC) module. Refer to OEM literature. Verify repair.

SPN 520212 (IPPC) (GHG17)

381.1 SPN 520212/FMI 11 - GHG17

SW Watchdog Error

SPN 520212/FMI 11	
Description	This Fault Code Sets When There is an Internal Error with the Integrated Predictive Powertrain Control (IPPC) Software
Monitored Parameter	IPPC Software
Typical Enabling Conditions	Ignition ON
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	2 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key ON, Engine OFF

1. Replace the Integrated Predictive Powertrain Control (IPPC) module. Refer to OEM literature. Verify repair.

SPN 520213 (IPPC) (GHG17)

382.1 SPN 520213/FMI 11 - GHG17

Hardware Watchdog Error

SPN 520213/FMI 11	
Description	This Fault Code Sets When There is an Internal Error with the Integrated Predictive Powertrain Control (IPPC) Hardware
Monitored Parameter	IPPC Hardware
Typical Enabling Conditions	Ignition ON
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	2 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key ON, Engine OFF

1. Replace the Integrated Predictive Powertrain Control (IPPC) module. Refer to OEM literature. Verify repair.

383.1 SPN 520215/FMI 4 - GHG17

Global Positioning System Antenna Main Line Short To Battery Plus

SPN 520215/FMI 4	
Description	This Fault Code Sets when the Integrated Predictive Powertrain Control (IPPC) Module Detects that the Global Positioning System (GPS) Antenna Circuit is Shorted to Power
Monitored Parameters	GPS Antenna
Typical Enabling Conditions	Ignition On
Monitor Sequence	Always
Execution Frequency	Always
Typical Duration	2 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key ON, Engine OFF

Check as follows:

1. Turn the ignition OFF.
2. Connect DiagnosticLink .

Note : When the GPS antenna wire is disconnected, fault code 520215/FMI 5 will set. This fault code can be erased using DiagnosticLink after the GPS antenna has been reinstalled.

3. Disconnect the GPS antenna from the Integrated Predictive Powertrain Control (IPPC) module.
4. Turn the ignition ON (key ON, engine OFF).

5. Is fault code SPN 520215/FMI 4 still present?
   5.a Yes; replace the IPPC module. Refer to the Original Equipment Manufacturer (OEM) service literature.
   5.b No; Go to step 6.
6. Turn the ignition OFF.
7. Reconnect the GPS antenna harness back to the IPPC module.
8. Disconnect the GPS antenna harness from the GPS antenna pigtail.
9. Turn the ignition ON (key ON, engine OFF).
10. Is fault code SPN 520215/FMI 4 still present?
    10.a Yes; replace the GPS antenna harness. Refer to OEM service literature.
    10.b No; replace the GPS antenna. Refer to OEM service literature.

383.2 SPN 520215/FMI 5 - GHG17

Global Positioning System Antenna Main Line Open

SPN 520215/FMI 5	
Description	This Fault Code Sets when the Integrated Predictive Powertrain Control (IPPC) Module Detects that there is an Open Circuit in the Global Positioning System (GPS) Antenna Circuit
Monitored Parameters	GPS Antenna Circuit
Typical Enabling Conditions	Ignition ON
Monitor Sequence	Always
Execution Frequency	Always
Typical Duration	2 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key ON, Engine OFF

Check as follows:

1. Connect DiagnosticLink .
2. Inspect the GPS antenna harness connector at the IPPC module. Is the GPS antenna harness connector properly connected to the IPPC connector?

   2.a Yes; Go to step 3.

   2.b No; repair as necessary. Verify repair.
3. Inspect the GPS antenna harness connector at the GPS antenna pigtail. Is the GPS antenna harness connector properly connected to the GPS antenna pigtail connector?

3.a Yes; Go to step 4.

3.b No; repair as necessary. Verify repair.

4. Remove the GPS antenna from the vehicle.
5. Connect the GPS antenna pigtail into the IPPC GPS antenna port.
6. Turn the ignition ON (key ON, engine OFF).
7. Is fault code SPN 520215/FMI 5 still present?

7.a Yes; replace the GPS antenna. Refer to Original Equipment Manufacturer (OEM) service literature.

7.b No; replace the GPS antenna harness. Refer to OEM service literature.

383.3 SPN 520215/FMI 6 - GHG17

Global Positioning System Antenna Main Line Short To Ground

SPN 520215/FMI 6	
Description	This Fault Code Sets when the Integrated Predictive Powertrain Control (IPPC) Module Detects that the Global Positioning System (GPS) Antenna Circuit is Shorted to Ground
Monitored Parameters	GPS Antenna Circuit
Typical Enabling Conditions	Ignition ON
Monitor Sequence	Always
Execution Frequency	Always
Typical Duration	2 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key ON, Engine OFF

Check as follows:

1. Turn the ignition OFF.
2. Connect DiagnosticLink .

Note : When the GPS antenna wire is disconnected, fault code SPN 520215/FMI 5 will set. This fault code can be erased using DiagnosticLink after the GPS antenna has been reinstalled.

3. Disconnect the GPS antenna from the Integrated Predictive Powertrain Control (IPPC) module.
4. Turn the ignition ON (key ON, engine OFF).

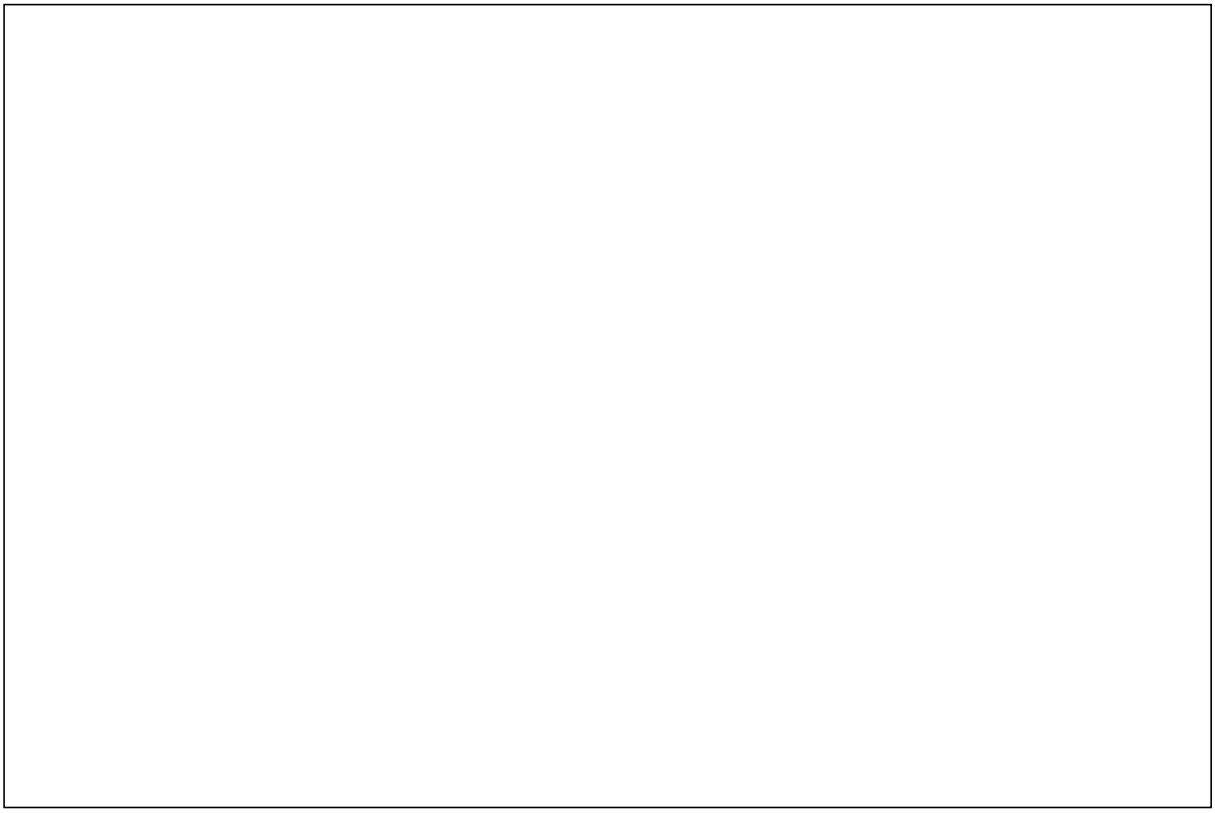
5. Is fault code SPN 520215/FMI 6 still present?
   5.a Yes; replace the IPPC module. Refer to Original Equipment Manufacturer (OEM) service literature.
   5.b No; Go to step 6.
6. Turn the ignition OFF.
7. Disconnect the GPS antenna harness from the GPS antenna pigtail.
8. Turn the ignition ON (key ON, engine OFF).
9. Is fault code SPN 520215/FMI 6 still present?
   9.a Yes; replace the GPS antenna harness. Refer to the OEM service literature.
   9.b No; replace the GPS antenna. Refer to the OEM service literature.

SPN 520215 (IPPC) (GHG17)

383.1 SPN 520215/FMI 4 - GHG17

Global Positioning System Antenna Main Line Short To Battery Plus

SPN 520215/FMI 4	
Description	This Fault Code Sets when the Integrated Predictive Powertrain Control (IPPC) Module Detects that the Global Positioning System (GPS) Antenna Circuit is Shorted to Power
Monitored Parameters	GPS Antenna
Typical Enabling Conditions	Ignition On
Monitor Sequence	Always
Execution Frequency	Always
Typical Duration	2 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key ON, Engine OFF



Check as follows:

1. Turn the ignition OFF.
2. Connect DiagnosticLink .

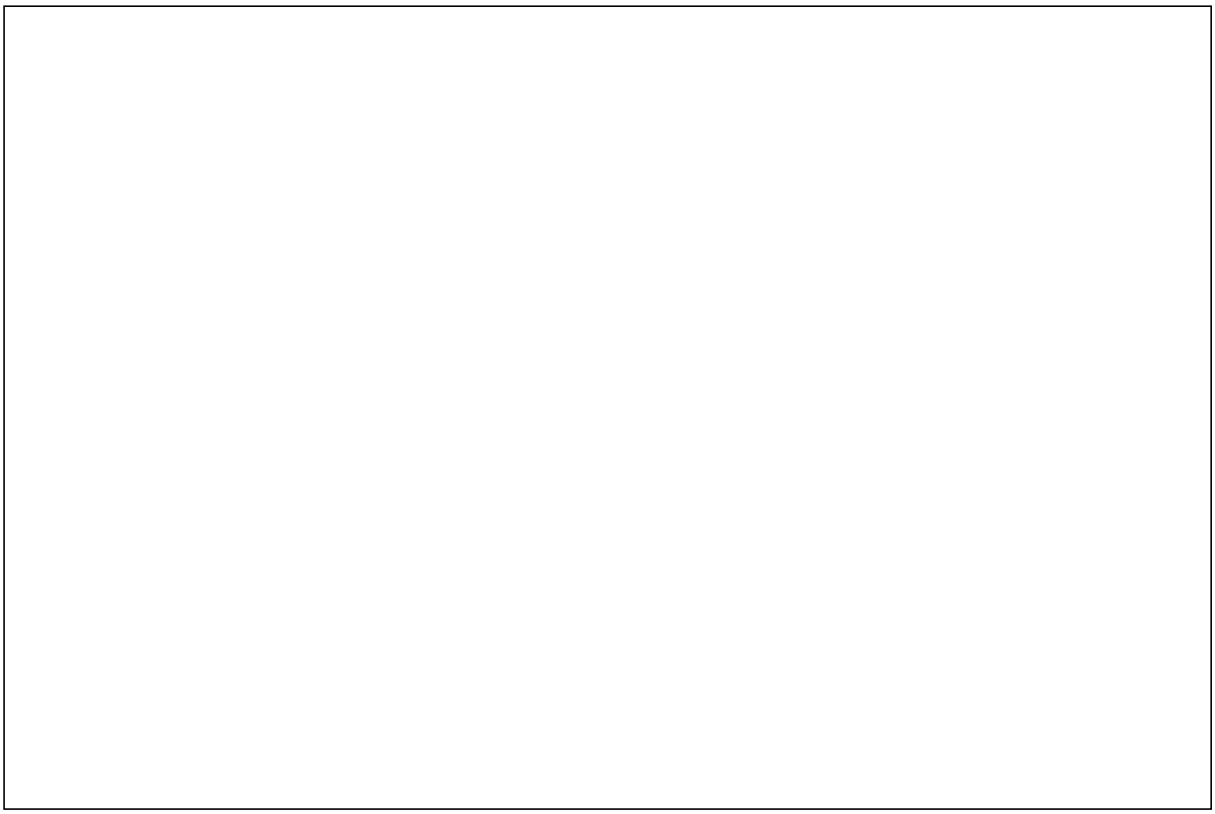
Note : When the GPS antenna wire is disconnected, fault code 520215/FMI 5 will set. This fault code can be erased using DiagnosticLink after the GPS antenna has been reinstalled.

3. Disconnect the GPS antenna from the Integrated Predictive Powertrain Control (IPPC) module.
4. Turn the ignition ON (key ON, engine OFF).
5. Is fault code SPN 520215/FMI 4 still present?
   - 5.a Yes; replace the IPPC module. Refer to the Original Equipment Manufacturer (OEM) service literature.
   - 5.b No; Go to step 6.
6. Turn the ignition OFF.
7. Reconnect the GPS antenna harness back to the IPPC module.
8. Disconnect the GPS antenna harness from the GPS antenna pigtail.
9. Turn the ignition ON (key ON, engine OFF).
10. Is fault code SPN 520215/FMI 4 still present?
    - 10.a Yes; replace the GPS antenna harness. Refer to OEM service literature.
    - 10.b No; replace the GPS antenna. Refer to OEM service literature.

383.2 SPN 520215/FMI 5 - GHG17

Global Positioning System Antenna Main Line Open

SPN 520215/FMI 5	
Description	This Fault Code Sets when the Integrated Predictive Powertrain Control (IPPC) Module Detects that there is an Open Circuit in the Global Positioning System (GPS) Antenna Circuit
Monitored Parameters	GPS Antenna Circuit
Typical Enabling Conditions	Ignition ON
Monitor Sequence	Always
Execution Frequency	Always
Typical Duration	2 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key ON, Engine OFF



Check as follows:

1. Connect DiagnosticLink .
2. Inspect the GPS antenna harness connector at the IPPC module. Is the GPS antenna harness connector properly connected to the IPPC connector?

   2.a Yes; Go to step 3.

   2.b No; repair as necessary. Verify repair.
3. Inspect the GPS antenna harness connector at the GPS antenna pigtail. Is the GPS antenna harness connector properly connected to the GPS antenna pigtail connector?

3.a Yes; Go to step 4.

3.b No; repair as necessary. Verify repair.

4. Remove the GPS antenna from the vehicle.
5. Connect the GPS antenna pigtail into the IPPC GPS antenna port.
6. Turn the ignition ON (key ON, engine OFF).
7. Is fault code SPN 520215/FMI 5 still present?

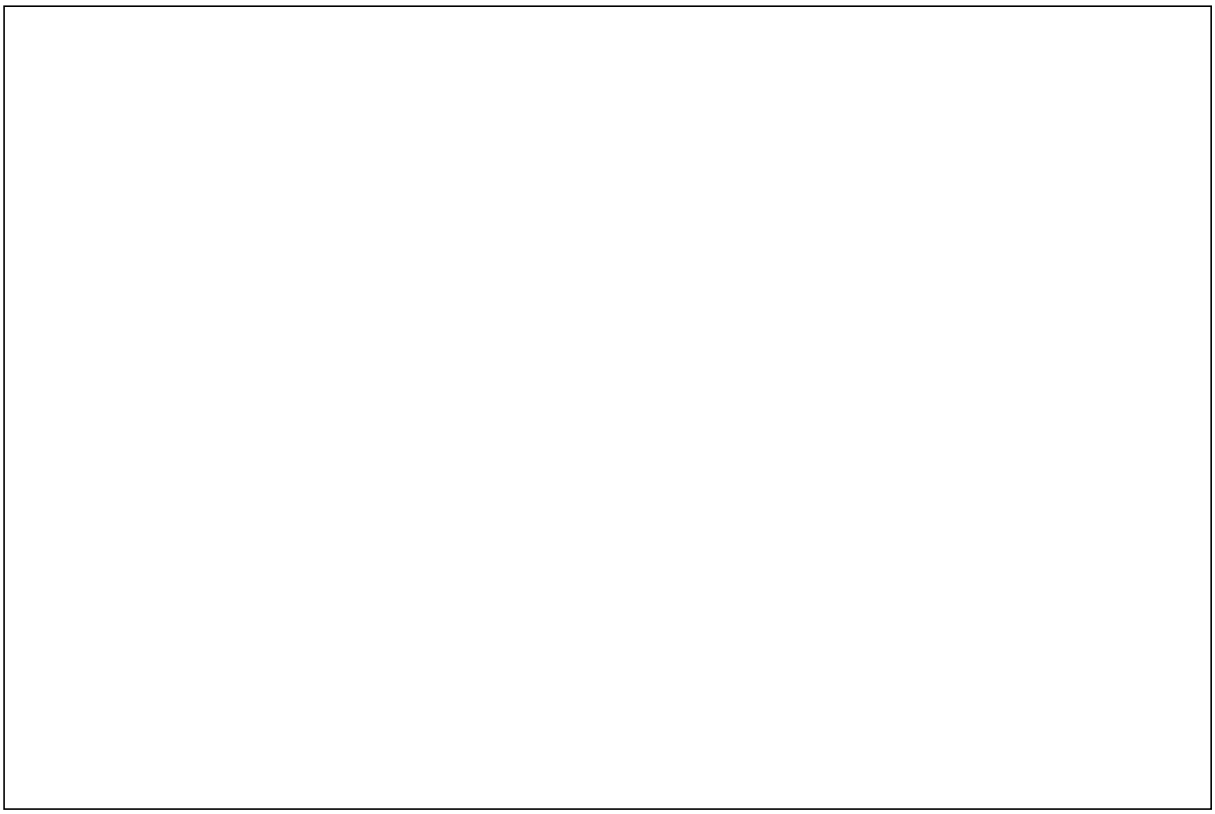
7.a Yes; replace the GPS antenna. Refer to Original Equipment Manufacturer (OEM) service literature.

7.b No; replace the GPS antenna harness. Refer to OEM service literature.

383.3 SPN 520215/FMI 6 - GHG17

Global Positioning System Antenna Main Line Short To Ground

SPN 520215/FMI 6	
Description	This Fault Code Sets when the Integrated Predictive Powertrain Control (IPPC) Module Detects that the Global Positioning System (GPS) Antenna Circuit is Shorted to Ground
Monitored Parameters	GPS Antenna Circuit
Typical Enabling Conditions	Ignition ON
Monitor Sequence	Always
Execution Frequency	Always
Typical Duration	2 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key ON, Engine OFF



Check as follows:

1. Turn the ignition OFF.
2. Connect DiagnosticLink .

Note : When the GPS antenna wire is disconnected, fault code SPN 520215/FMI 5 will set. This fault code can be erased using DiagnosticLink after the GPS antenna has been reinstalled.

3. Disconnect the GPS antenna from the Integrated Predictive Powertrain Control (IPPC) module.
4. Turn the ignition ON (key ON, engine OFF).

5. Is fault code SPN 520215/FMI 6 still present?
   5.a Yes; replace the IPPC module. Refer to Original Equipment Manufacturer (OEM) service literature.
   5.b No; Go to step 6.
6. Turn the ignition OFF.
7. Disconnect the GPS antenna harness from the GPS antenna pigtail.
8. Turn the ignition ON (key ON, engine OFF).
9. Is fault code SPN 520215/FMI 6 still present?
   9.a Yes; replace the GPS antenna harness. Refer to the OEM service literature.
   9.b No; replace the GPS antenna. Refer to the OEM service literature.

384.1 SPN 520217/FMI 11 - GHG17

Application Error

SPN 520217/FMI 11	
Description	This Fault Code Sets when There is an Internal Application Error in the Integrated Predictive Powertrain Control (IPPC) Module Software
Monitored Parameters	Internal IPPC Application
Typical Enabling Conditions	Ignition ON
Monitor Sequence	Always
Execution Frequency	Always
Typical Duration	2 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition ON

Check as follows:

1. Replace the Integrated Predictive Powertrain Control (IPPC) module. Refer to OEM literature. Verify repair.

SPN 520217 (IPPC) (GHG17)

384.1 SPN 520217/FMI 11 - GHG17

Application Error

SPN 520217/FMI 11	
Description	This Fault Code Sets when There is an Internal Application Error in the Integrated Predictive Powertrain Control (IPPC) Module Software
Monitored Parameters	Internal IPPC Application
Typical Enabling Conditions	Ignition ON
Monitor Sequence	Always
Execution Frequency	Always
Typical Duration	2 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition ON

Check as follows:

1. Replace the Integrated Predictive Powertrain Control (IPPC) module. Refer to OEM literature. Verify repair.

SPN 520219 (IPPC) (GHG17)

385.1 SPN 520219/FMI 13 - GHG17

Driving Mode in the Common Powertrain Controller and Integrated Predictive Powertrain Control Not Plausible

SPN 520219/FMI 13	
Description	This Fault Code Sets when the Driving/Transmission Mode in the Integrated Predictive Powertrain Control (IPPC) Module Does Not Match the Driving/Transmission Mode in the Common Powertrain Control (CPC) Module
Monitored Parameter	Transmission Mode
Typical Enabling Conditions	Cruise Control Enabled
Monitor Sequence	Always
Execution Frequency	Always
Typical Duration	2 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Road Test With Cruise Control Enabled

Note : When a new IPPC module is installed, this fault code will be active until the parameter is set correctly in the CPC.

1. Connect DiagnosticLink .
2. Refer to the Application and Installation (A&I) manual and verify that the parameters are set correctly in the Common Powertrain Controller (CPC), refer to “DDC-SVC-MAN-0127”. Are the parameters set correctly?

   2.a Yes; refer to Original Equipment Manufacturer (OEM) literature and replace the IPPC module. Verify repair.

   2.b No; change the CPC parameters as necessary and road test the vehicle.

SPN 520228 (CPC3) (GHG17)

386.1 SPN 520228/FMI 3 - GHG17

Accelerator Pedal Sensor 1 Supply Pin 2/15 - Short to Battery

1. Disconnect the Accelerator Pedal (AP).
2. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   2.a Yes; repair as necessary. Verify repair.

   2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).

Williams Dual-Channel Pedal Connector and Pinout				
Function	CPC3 Cavity	Pedal Connector Pin	Comments	Pedal Harness Connector Body
APS1	2/3	A	SENSOR 1	
GND1	2/20	B	APS1 GND	
VCC1 (+5V)	2/15	C	APS1 Power Supply	
VCC2 (+5V)	2/21	D	APS2 Power Supply	
GND2	2/14	E	APS2 GND	
APS2	2/4	F	SENSOR 2	

4. Measure the voltage between pin C of the AP harness connector and ground. Is the voltage greater than 5.5 volts?

   4.a Yes; repair the short to battery power between pin C of the accelerator pedal sensor harness connector and pin 15 of the CPC3 connector #2.

   4.b No; replace the accelerator pedal.

386.2 SPN 520228/FMI 4 - GHG17

Accelerator Pedal Sensor 1 Supply Pin 2-20 Short to Ground

1. Disconnect the Accelerator Pedal (AP).
2. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   2.a Yes; repair as necessary. Verify repair.

   2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).

Williams Dual-Channel Pedal Connector and Pinout				
Function	CPC3 Cavity	Pedal Connector Pin	Comments	Pedal Harness Connector Body
APS1	2/3	A	SENSOR 1	
GND1	2/20	B	APS1 GND	
VCC1 (+5V)	2/15	C	APS1 Power Supply	
VCC2 (+5V)	2/21	D	APS2 Power Supply	
GND2	2/14	E	APS2 GND	
APS2	2/4	F	SENSOR 2	

4. Measure the voltage between pin C of the AP harness connector and ground. Is the voltage between 4.5 and 5.5 volts?

   4.a Yes; replace the accelerator pedal.

   4.b No; repair the circuit between pin C of the accelerator pedal sensor harness connector and pin 15 of the CPC3 connector #2.

388.1 SPN 520229/FMI 3 - GHG17

Accelerator Pedal Sensor 2 Supply Pin 2-21 Short to Battery

Check as follows:

1. Disconnect the Accelerator Pedal (AP).
2. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   2.a Yes; repair as necessary. Verify repair.

   2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).

Williams Dual-Channel Pedal Connector and Pinout				
Function	CPC3 Cavity	Pedal Connector Pin	Comments	Pedal Harness Connector Body
APS1	2/3	A	SENSOR 1	
GND1	2/20	B	APS1 GND	
VCC1 (+5V)	2/15	C	APS1 Power Supply	
VCC2 (+5V)	2/21	D	APS2 Power Supply	
GND2	2/14	E	APS2 GND	
APS2	2/4	F	SENSOR 2	

4. Measure the voltage between pin D of the AP harness connector and ground. Is the voltage greater than 5.5 volts?

   4.a Yes; repair the short to battery power between pin D of the accelerator pedal sensor harness connector and pin 21 of the CPC3 connector #2.

   4.b No; replace the accelerator pedal.

388.2 SPN 520229/FMI 4 - GHG17

Check as follows:

1. Disconnect the Accelerator Pedal (AP).
2. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   2.a Yes; repair as necessary. Verify repair.

   2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).

Williams Dual-Channel Pedal Connector and Pinout				
Function	CPC3 Cavity	Pedal Connector Pin	Comments	Pedal Harness Connector Body
APS1	2/3	A	SENSOR 1	
GND1	2/20	B	APS1 GND	
VCC1 (+5V)	2/15	C	APS1 Power Supply	
VCC2 (+5V)	2/21	D	APS2 Power Supply	
GND2	2/14	E	APS2 GND	
APS2	2/4	F	SENSOR 2	

4. Measure the voltage between pin D of the AP harness connector and ground. Is the voltage between 4.5 and 5.5 volts?

   4.a Yes; replace the accelerator pedal.

   4.b No; repair the circuit between pin D of the accelerator pedal sensor harness connector and pin 21 of the CPC3 connector #2.

SPN 520229 (CPC3) (GHG17)

388.1 SPN 520229/FMI 3 - GHG17

Accelerator Pedal Sensor 2 Supply Pin 2-21 Short to Battery

Check as follows:

1. Disconnect the Accelerator Pedal (AP).
2. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   2.a Yes; repair as necessary. Verify repair.

   2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).

Williams Dual-Channel Pedal Connector and Pinout				
Function	CPC3 Cavity	Pedal Connector Pin	Comments	Pedal Harness Connector Body
APS1	2/3	A	SENSOR 1	
GND1	2/20	B	APS1 GND	
VCC1 (+5V)	2/15	C	APS1 Power Supply	
VCC2 (+5V)	2/21	D	APS2 Power Supply	
GND2	2/14	E	APS2 GND	
APS2	2/4	F	SENSOR 2	

4. Measure the voltage between pin D of the AP harness connector and ground. Is the voltage greater than 5.5 volts?

   4.a Yes; repair the short to battery power between pin D of the accelerator pedal sensor harness connector and pin 21 of the CPC3 connector #2.

   4.b No; replace the accelerator pedal.

388.2 SPN 520229/FMI 4 - GHG17

Check as follows:

1. Disconnect the Accelerator Pedal (AP).
2. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   2.a Yes; repair as necessary. Verify repair.

   2.b No; Go to step 3.
3. Turn the ignition ON (key ON, engine OFF).

Williams Dual-Channel Pedal Connector and Pinout				
Function	CPC3 Cavity	Pedal Connector Pin	Comments	Pedal Harness Connector Body
APS1	2/3	A	SENSOR 1	
GND1	2/20	B	APS1 GND	
VCC1 (+5V)	2/15	C	APS1 Power Supply	
VCC2 (+5V)	2/21	D	APS2 Power Supply	
GND2	2/14	E	APS2 GND	
APS2	2/4	F	SENSOR 2	

4. Measure the voltage between pin D of the AP harness connector and ground. Is the voltage between 4.5 and 5.5 volts?

   4.a Yes; replace the accelerator pedal.

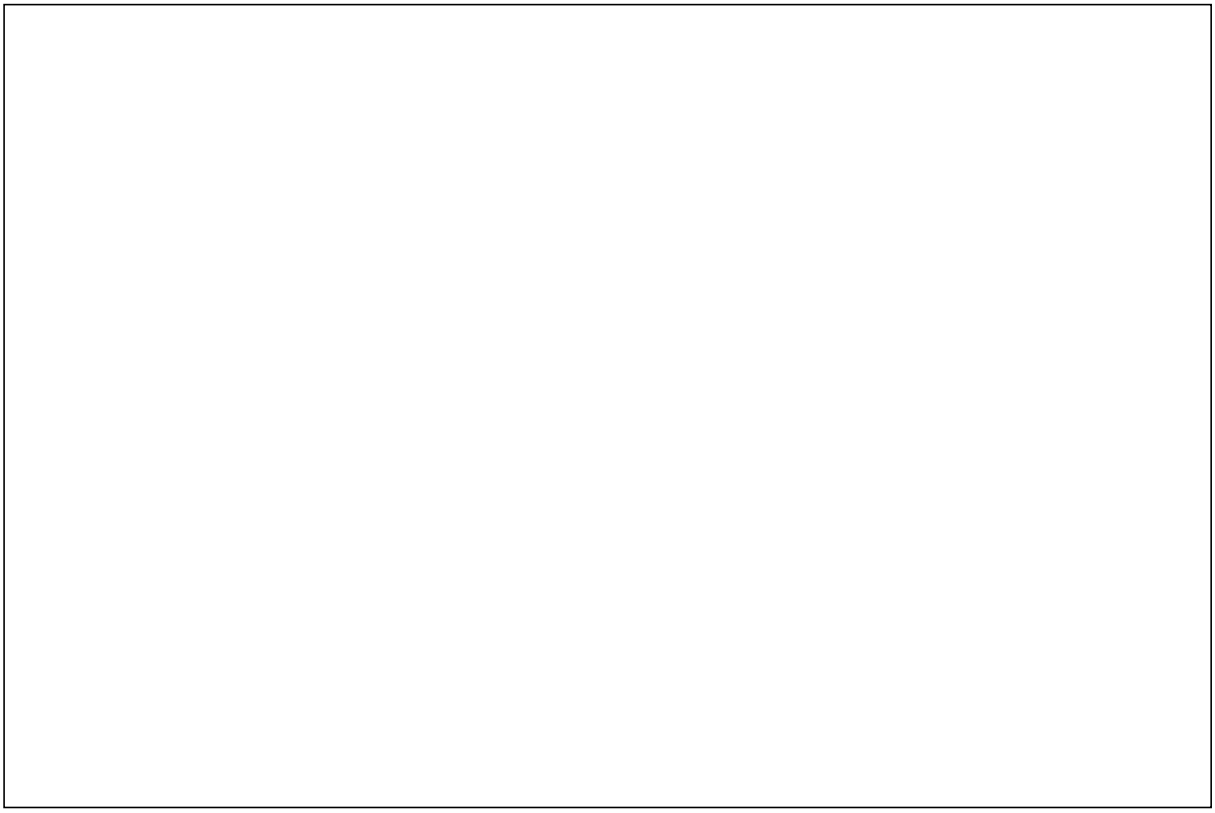
   4.b No; repair the circuit between pin D of the accelerator pedal sensor harness connector and pin 21 of the CPC3 connector #2.

SPN 520229 (IPPC) (GHG17)

387.1 SPN 520229/FMI 3 - GHG17

Ignition Status Not Plausible

SPN 520229/FMI 3	
Description	This Fault Code Sets when the Ignition Power to the Integrated Predictive Powertrain Control (IPPC) Module Does Not Match the Ignition Status in the Common Powertrain Controller (CPC)
Monitored Parameter	Ignition Power
Typical Enabling Conditions	Ignition ON
Monitor Sequence	Always
Execution Frequency	Always
Typical Duration	2 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key ON, Engine OFF



Check as follows:

1. Disconnect the Integrated Predictive Powertrain Control (IPPC) electrical connector.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pin 2 of the IPPC 15-pin connector, harness side, and ground. Is the voltage between 10.5 volts and 12.5 volts?

   3.a Yes; replace the IPPC module. Refer to Original Equipment Manufacturer (OEM) literature. Verify repair.

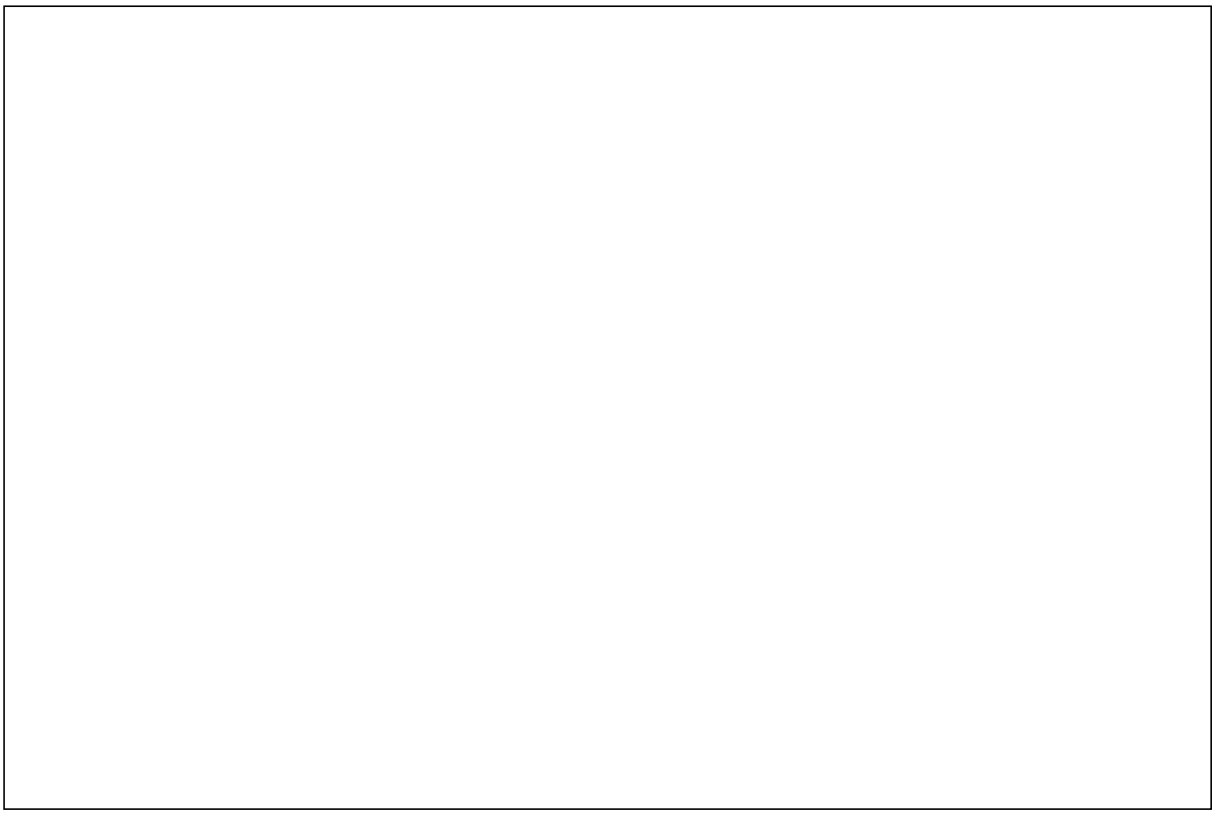
   3.b No; repair the ignition power circuit. Refer to the OEM literature for the IPPC wiring diagrams.

389.1 SPN 520230/FMI 5 - GHG17

Powertrain - Controller Area Network Open

SPN 520230/FMI 5	
Description	This Fault Code Sets when the Integrated Predictive Powertrain Control (IPPC) Module Detects that there is an Open in the Powertrain Controller Area Network (CAN) Circuit
Monitored Parameter	PT CAN
Typical Enabling Conditions	Ignition ON
Monitor Sequence	Always
Execution Frequency	Always
Typical Duration	2 seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition ON

Front Looking into the Pins on the Harness



Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON, (key ON, engine OFF).

3. Check for fault codes in the other modules. Are there any powertrain CAN fault codes also present in the other modules?
   3.a Yes; diagnose the other fault codes first. Refer to section "SPN 625/FMI 9 – GHG17" .
   3.b No; Go to step 4.
4. Turn the ignition OFF.
5. Disconnect and inspect the IPPC 15-pin connector. Are there any spread or damaged pins?
   5.a Yes; repair as necessary. Verify repair.
   5.b No; Go to step 6.
6. Measure the resistance between pin 13 and pin 15 of the IPPC electrical connector, harness side. Is the resistance between 55 and 65 ohms?
   6.a Yes; refer to Original Equipment Manufacturer (OEM) literature and replace the IPPC module.
   6.b No; repair the Powertrain CAN circuit. Verify repair.

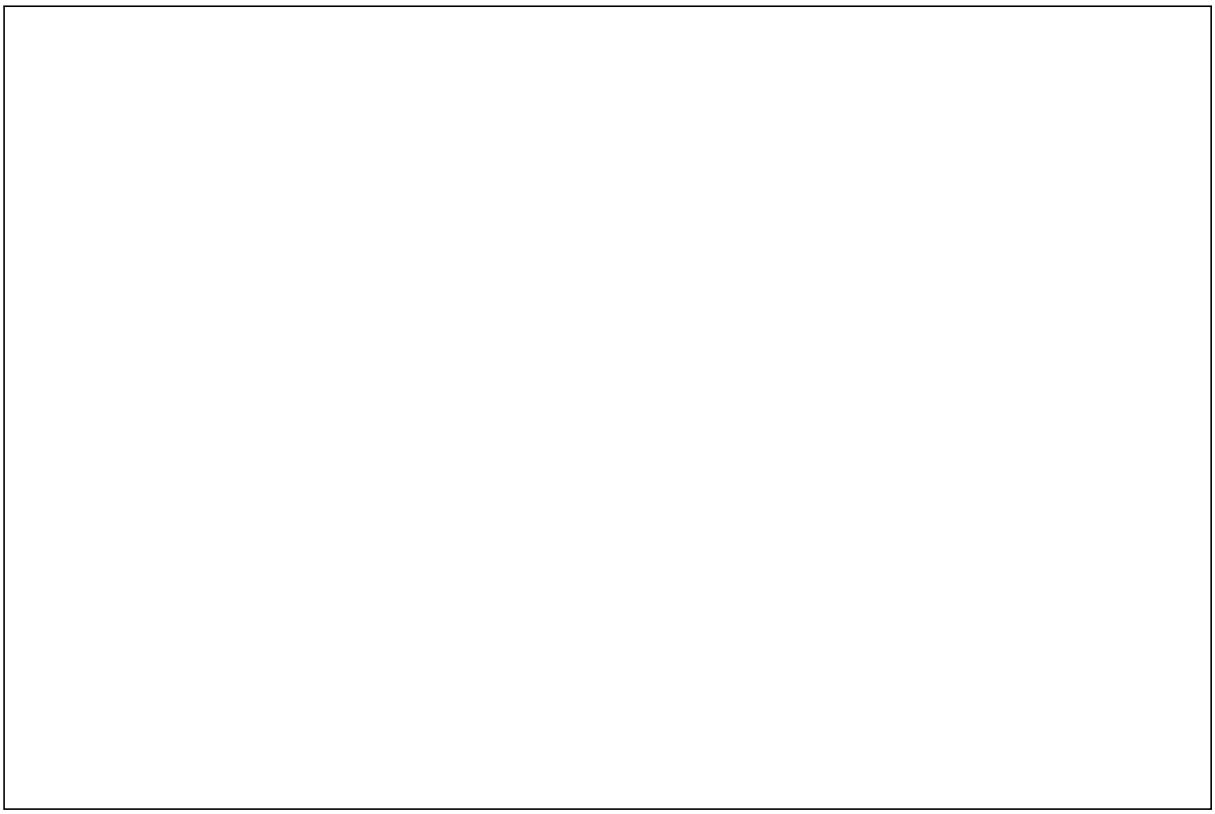
SPN 520230 (IPPC) (GHG17)

389.1 SPN 520230/FMI 5 - GHG17

Powertrain - Controller Area Network Open

SPN 520230/FMI 5	
Description	This Fault Code Sets when the Integrated Predictive Powertrain Control (IPPC) Module Detects that there is an Open in the Powertrain Controller Area Network (CAN) Circuit
Monitored Parameter	PT CAN
Typical Enabling Conditions	Ignition ON
Monitor Sequence	Always
Execution Frequency	Always
Typical Duration	2 seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition ON

Front Looking into the Pins on the Harness



Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON, (key ON, engine OFF).

3. Check for fault codes in the other modules. Are there any powertrain CAN fault codes also present in the other modules?
   3.a Yes; diagnose the other fault codes first. Refer to section "SPN 625/FMI 9 – GHG17" .
   3.b No; Go to step 4.
4. Turn the ignition OFF.
5. Disconnect and inspect the IPPC 15-pin connector. Are there any spread or damaged pins?
   5.a Yes; repair as necessary. Verify repair.
   5.b No; Go to step 6.
6. Measure the resistance between pin 13 and pin 15 of the IPPC electrical connector, harness side. Is the resistance between 55 and 65 ohms?
   6.a Yes; refer to Original Equipment Manufacturer (OEM) literature and replace the IPPC module.
   6.b No; repair the Powertrain CAN circuit. Verify repair.

390.1 SPN 520232/FMI 9 - GHG17

NOx Mass Signal Not Available via Controller Area Network

1. Has the Aftertreatment Control Module (ACM)/Motor Control Module (MCM)/Common Powertrain Controller (CPC) been recently reprogrammed?
   - 1.a Yes; clear fault codes if they do not become active, release vehicle.
   - 1.b No; Go to step 2.
2. Turn the ignition OFF (key OFF, engine OFF) and disconnect DiagnosticLink . Wait five minutes for all modules to power down.
3. Turn ignition ON (key ON, engine OFF).
4. Reconnect DiagnosticLink. Are fault codes active?
   - 4.a Yes; follow entire SPN 625/FMI 9 procedure for further PT Controller Area Network (CAN) troubleshooting. Refer to section "SPN 625/FMI 9 – GHG17" .
   - 4.b No; clear faults codes and release vehicle.

SPN 520232 (ACM) (GHG17)

390.1 SPN 520232/FMI 9 - GHG17

NOx Mass Signal Not Available via Controller Area Network

1. Has the Aftertreatment Control Module (ACM)/Motor Control Module (MCM)/Common Powertrain Controller (CPC) been recently reprogrammed?

   1.a Yes; clear fault codes if they do not become active, release vehicle.

   1.b No; Go to step 2.

2. Turn the ignition OFF (key OFF, engine OFF) and disconnect DiagnosticLink . Wait five minutes for all modules to power down.
3. Turn ignition ON (key ON, engine OFF).
4. Reconnect DiagnosticLink. Are fault codes active?

   4.a Yes; follow entire SPN 625/FMI 9 procedure for further PT Controller Area Network (CAN) troubleshooting. Refer to section "SPN 625/FMI 9 – GHG17" .

   4.b No; clear faults codes and release vehicle.

391.1 SPN 520253/FMI 14 - GHG17

Software Reset Detected Due to an Error in Engine Speed Plausibility

This fault may be caused by an external fuel source or torque out-of-bounds. Check injectors, alternative fuel sources or add-on devices that may be requesting torque modifications.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

Note : For Idle Speed Balance (ISB) values to update, the engine speed must be at idle.

1. Start and bring the engine up to operating temperature of 60°C (140°F).
2. Using DiagnosticLink .
3. Check the ISB Values. Refer to section "Idle Speed Balance Test" . Are there any cylinders above 70% or below -70%?
   - 3.a Yes; Follow repair procedures and Refer to section "Idle Speed Balance Test" and verify repairs. Refer to section "Verify Repairs" .
   - 3.b If any value is less than +70, the fault may be intermittent. Obtain information from customer on driving habits, recent repairs, number of occurrences when fault code set, or situations when the code occurred. Try to retest engine within these parameters. If no problem found, Go to step 4.
4. Clear faults and reevaluate the vehicle. Does the fault return?
   - 4.a Yes; Reprogram Motor Control Module (MCM) with the latest software release.
   - 4.b No; Release the vehicle.

391.2 SPN 520253/FMI 31 - GHG17

Software Reset Due to Internal Monitoring. Reprogram MCM with the latest software release.

SPN 520253 (MCM) (GHG17)

391.1 SPN 520253/FMI 14 - GHG17

Software Reset Detected Due to an Error in Engine Speed Plausibility

This fault may be caused by an external fuel source or torque out-of-bounds. Check injectors, alternative fuel sources or add-on devices that may be requesting torque modifications.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

Note : For Idle Speed Balance (ISB) values to update, the engine speed must be at idle.

1. Start and bring the engine up to operating temperature of 60°C (140°F).
2. Using DiagnosticLink .
3. Check the ISB Values. Refer to section "Idle Speed Balance Test" . Are there any cylinders above 70% or below -70%?
   - 3.a Yes; Follow repair procedures and Refer to section "Idle Speed Balance Test" and verify repairs. Refer to section "Verify Repairs" .
   - 3.b If any value is less than +70, the fault may be intermittent. Obtain information from customer on driving habits, recent repairs, number of occurrences when fault code set, or situations when the code occurred. Try to retest engine within these parameters. If no problem found, Go to step 4.
4. Clear faults and reevaluate the vehicle. Does the fault return?
   - 4.a Yes; Reprogram Motor Control Module (MCM) with the latest software release.
   - 4.b No; Release the vehicle.

391.2 SPN 520253/FMI 31 - GHG17

Software Reset Due to Internal Monitoring. Reprogram MCM with the latest software release.

392.1 SPN 520261/FMI 31 – GHG17

Speed Limitation Fault

SPN 520261/FMI 31	
Description	Speed Limitation Fault Due to Powertrain Monitoring Control
Monitored Parameter	Engine Speed
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Zero Seconds
Dash Lamps	None
Engine Reaction	Engine idle speed limited to 950 rpm
Verification	Engine at idle, raise the engine speed above 950 rpm

Check as follows:

1. Connect DiagnosticLink .
2. Is communication to the Motor Control Module (MCM) possible?
   - 2.a Yes; reprogram the MCM with the latest software release. Go to step 3.
   - 2.b No; replace the MCM.

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

> **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.

3. Start the engine and raise the idle speed above 950 rpm . Is SPN 520261/FMI 31 active?
   - 3.a Yes; replace the MCM.
   - 3.b No; testing is complete . Release the vehicle.

SPN 520261 (MCM) (GHG17)

392.1 SPN 520261/FMI 31 – GHG17

Speed Limitation Fault

SPN 520261/FMI 31	
Description	Speed Limitation Fault Due to Powertrain Monitoring Control
Monitored Parameter	Engine Speed
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Zero Seconds
Dash Lamps	None
Engine Reaction	Engine idle speed limited to 950 rpm
Verification	Engine at idle, raise the engine speed above 950 rpm

Check as follows:

1. Connect DiagnosticLink .
2. Is communication to the Motor Control Module (MCM) possible?
   - 2.a Yes; reprogram the MCM with the latest software release. Go to step 3.
   - 2.b No; replace the MCM.

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

> **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.

3. Start the engine and raise the idle speed above 950 rpm . Is SPN 520261/FMI 31 active?
   - 3.a Yes; replace the MCM.
   - 3.b No; testing is complete . Release the vehicle.

393.1 SPN 520268/FMI 16 - GHG17

SPN 520268/FMI 16	
Description	Fuel Rail Pressure Low
Monitored Parameter	Fuel Rail Pressure
Typical Enabling Conditions	Closed Loop & Actual Rail pressure 200 bar (2900 psi) Lower Than Desired Rail Pressure
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Eight Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Steady Engine rpm 1400 to 1500 (Two Minutes)

Complete the troubleshooting for SPN 157/FMI 16. Refer to section "SPN 157/FMI 16 - GHG17" Refer to section "SPN 157/FMI 16 - GHG17" .

393.2 SPN 520268/FMI 18 - GHG17

SPN 520268/FMI 18	
Description	Fuel Rail Pressure High
Monitored Parameter	Fuel Rail Pressure
Typical Enabling Conditions	Closed Loop & Actual Rail Pressure 200 Bar (2900 psi) Higher than Desired Rail Pressure
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Eight Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Steady Engine rpm 1400 to 1500 (Two Minutes)

Complete the troubleshooting for SPN 157/FMI 18. Refer to section "SPN 157/FMI 18 - GHG17" Refer to section "SPN 157/FMI 18 - GHG17" .

393.1 SPN 520268/FMI 16 - GHG17

SPN 520268/FMI 16	
Description	Fuel Rail Pressure Low
Monitored Parameter	Fuel Rail Pressure
Typical Enabling Conditions	Torque Within 20% of the Torque and Within 375 rpm of Initial 157/16 Fault
Monitor Sequence	This Monitor Sets Simultaneously with 157/16, and Remains Active Until Monitor Passes In Similar Operating Conditions to the Initial 157/16 Fault
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	One Second
Dash Lamps	MIL
Engine Reaction	None
Verification	Use Freeze-Frame Data to Determine the Speed and Load Conditions when the Original 157/16 Code Set. Road Test Vehicle and Operate in Similar Speed and Load Conditions. Verify that 157/16 and 520268/16 Codes are No Longer Active

Complete the troubleshooting for SPN 157/FMI 16. .

393.2 SPN 520268/FMI 18 - GHG17

SPN 520268/FMI 18	
Description	Fuel Rail Pressure High
Monitored Parameter	Fuel Rail Pressure
Typical Enabling Conditions	Torque Within 20% of the Torque and Within 375 rpm of Initial 157/18 Fault
Monitor Sequence	This Monitor Sets Simultaneously with 157/18, and Remains Active Until Monitor Passes In Similar Operating Conditions to the Initial 157/18 Fault
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	One Second
Dash Lamps	MIL
Engine Reaction	None
Verification	Use Freeze-Frame Data to Determine the Speed and Load Conditions when the Original 157/18 Code Set. Road Test Vehicle and Operate in Similar Speed and Load Conditions. Verify that 157/18 and 520268/18 Codes are No Longer Active

Complete the troubleshooting for SPN 157/FMI 18. .

SPN 520268 (MCM) (GHG17)

393.1 SPN 520268/FMI 16 - GHG17

SPN 520268/FMI 16	
Description	Fuel Rail Pressure Low
Monitored Parameter	Fuel Rail Pressure
Typical Enabling Conditions	Torque Within 20% of the Torque and Within 375 rpm of Initial 157/16 Fault
Monitor Sequence	This Monitor Sets Simultaneously with 157/16, and Remains Active Until Monitor Passes In Similar Operating Conditions to the Initial 157/16 Fault
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	One Second
Dash Lamps	MIL
Engine Reaction	None
Verification	Use Freeze-Frame Data to Determine the Speed and Load Conditions when the Original 157/16 Code Set. Road Test Vehicle and Operate in Similar Speed and Load Conditions. Verify that 157/16 and 520268/16 Codes are No Longer Active

Complete the troubleshooting for SPN 157/FMI 16. .

393.2 SPN 520268/FMI 18 - GHG17

SPN 520268/FMI 18	
Description	Fuel Rail Pressure High
Monitored Parameter	Fuel Rail Pressure
Typical Enabling Conditions	Torque Within 20% of the Torque and Within 375 rpm of Initial 157/18 Fault
Monitor Sequence	This Monitor Sets Simultaneously with 157/18, and Remains Active Until Monitor Passes In Similar Operating Conditions to the Initial 157/18 Fault
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	One Second
Dash Lamps	MIL
Engine Reaction	None
Verification	Use Freeze-Frame Data to Determine the Speed and Load Conditions when the Original 157/18 Code Set. Road Test Vehicle and Operate in Similar Speed and Load Conditions. Verify that 157/18 and 520268/18 Codes are No Longer Active

Complete the troubleshooting for SPN 157/FMI 18. .

394.1 SPN 520280/FMI 7 - GHG17

Mismatch in Jake Brake Request Controller Area Network Matrix Between Motor Control Module and Common Powertrain Controller

Reprogram Motor Control Module (MCM) and Common Powertrain Controller (CPC) with the latest software release.

SPN 520280 (MCM) (GHG17)

394.1 SPN 520280/FMI 7 - GHG17

Mismatch in Jake Brake Request Controller Area Network Matrix Between Motor Control Module and Common Powertrain Controller

Reprogram Motor Control Module (MCM) and Common Powertrain Controller (CPC) with the latest software release.

395.1 SPN 520281/FMI 7 – GHG17

Mismatch in Controller Area Network matrix between MCM and CPC. Reprogram MCM and CPC with the latest software release.

SPN 520281 (MCM) (GHG17)

395.1 SPN 520281/FMI 7 – GHG17

Mismatch in Controller Area Network matrix between MCM and CPC. Reprogram MCM and CPC with the latest software release.

396.1 SPN 520282/FMI 7 - GHG17

Mismatch in Jake Brake® Solenoid Request Controller Area Network Matrix between Motor Control Module and Common Powertrain Controller

Reprogram Motor Control Module (MCM) and Common Powertrain Controller (CPC) with the latest software release.

SPN 520282 (MCM) (GHG17)

396.1 SPN 520282/FMI 7 - GHG17

Mismatch in Jake Brake® Solenoid Request Controller Area Network Matrix between Motor Control Module and Common Powertrain Controller

Reprogram Motor Control Module (MCM) and Common Powertrain Controller (CPC) with the latest software release.

397.1 SPN 520286/FMI 31 - GHG17

Software Reset Detected, Case A

SPN 520286/FMI 31	
Description	This Code Logs Due to a Software Reset Caused by Internal Monitoring
Monitored Parameter	MCM
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	None Seconds
Dash Lamps	None
Engine Reaction	Engine Speed Limited to Idle Speed
Verification	Engine At Idle, Raise the Engine Speed Above 1150 rpm

1. Connect DiagnosticLink .
2. Is communication to the Motor Control Module (MCM) possible?
   2.a Yes; reprogram the MCM with the latest software release. Go to step 3.
   2.b No; replace the MCM.

> **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.

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

3. Start the engine and raise the idle speed above 1150 rpm. Is SPN 520286/FMI 31 active?
   3.a Yes; replace the MCM.
   3.b No; testing is complete. Release the vehicle.

SPN 520286 (MCM) (GHG17)

397.1 SPN 520286/FMI 31 - GHG17

Software Reset Detected, Case A

SPN 520286/FMI 31	
Description	This Code Logs Due to a Software Reset Caused by Internal Monitoring
Monitored Parameter	MCM
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	None Seconds
Dash Lamps	None
Engine Reaction	Engine Speed Limited to Idle Speed
Verification	Engine At Idle, Raise the Engine Speed Above 1150 rpm

1. Connect DiagnosticLink .
2. Is communication to the Motor Control Module (MCM) possible?
   2.a Yes; reprogram the MCM with the latest software release. Go to step 3.
   2.b No; replace the MCM.

> **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.

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

3. Start the engine and raise the idle speed above 1150 rpm. Is SPN 520286/FMI 31 active?
   3.a Yes; replace the MCM.
   3.b No; testing is complete. Release the vehicle.

398.1 SPN 520287/FMI 7 - GHG17

MCM Hardware Reset

SPN 520287/FMI 7	
Description	Software Reset due to Hardware Issue in the Motor Control Module (MCM)
Monitored Parameter	MCM
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Zero Seconds
Dash Lamps	None
Engine Reaction	Intermittent Loss Of Communication
Verification	Key ON Engine OFF

Check as follows:

1. Connect DiagnosticLink .
2. Check the extended fault data for SPN 520287/FMI 7. Does SPN 520287/FMI 7 have more than one occurrence?

   2.a Yes; replace the MCM.

   2.b No; reprogram the MCM with the latest software release.

398.2 SPN 520287/FMI 13 - GHG17

SPN 520287/FMI 13	
Description	Software Reset due to Internal Monitoring
Monitored Parameter	MCM
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Zero Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key ON Engine OFF

Check as follows:

1. Connect DiagnosticLink .
2. Is communication to the Motor Control Module (MCM) possible?
   - 2.a Yes; reprogram the MCM with the latest software release. Go to step 3.
   - 2.b No; replace the MCM.
3. Turn the key to the ON position, engine OFF. Is SPN 520287/FMI 13 active?
   - 3.a Yes; replace the MCM.
   - 3.b No; testing is complete. Release the vehicle.

398.3 SPN 520287/FMI 14 - GHG17

SPN 520287/FMI 14	
Description	This Fault Usually Occurs After Reprogramming the Motor Control Module (MCM). After Reprogramming, All Fault Codes Must be Cleared.
Monitored Parameter	MCM
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Zero Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key ON Engine OFF

Use DiagnosticLink Professional to set Engine Serial Number/Vehicle Identification Number (ESN/VIN) command. This command changes the ESN/VIN in the electronic control modules when they are replaced, or when the engine is exchanged.

SPN 520287 (MCM) (GHG17)

398.1 SPN 520287/FMI 7 - GHG17

MCM Hardware Reset

SPN 520287/FMI 7	
Description	Software Reset due to Hardware Issue in the Motor Control Module (MCM)
Monitored Parameter	MCM
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Zero Seconds
Dash Lamps	None
Engine Reaction	Intermittent Loss Of Communication
Verification	Key ON Engine OFF

Check as follows:

1. Connect DiagnosticLink .
2. Check the extended fault data for SPN 520287/FMI 7. Does SPN 520287/FMI 7 have more than one occurrence?

   2.a Yes; replace the MCM.

   2.b No; reprogram the MCM with the latest software release.

398.2 SPN 520287/FMI 13 - GHG17

SPN 520287/FMI 13	
Description	Software Reset due to Internal Monitoring
Monitored Parameter	MCM
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Zero Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key ON Engine OFF

Check as follows:

1. Connect DiagnosticLink .
2. Is communication to the Motor Control Module (MCM) possible?
   - 2.a Yes; reprogram the MCM with the latest software release. Go to step 3.
   - 2.b No; replace the MCM.
3. Turn the key to the ON position, engine OFF. Is SPN 520287/FMI 13 active?
   - 3.a Yes; replace the MCM.
   - 3.b No; testing is complete. Release the vehicle.

398.3 SPN 520287/FMI 14 - GHG17

SPN 520287/FMI 14	
Description	This Fault Usually Occurs After Reprogramming the Motor Control Module (MCM). After Reprogramming, All Fault Codes Must be Cleared.
Monitored Parameter	MCM
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Zero Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Key ON Engine OFF

Use DiagnosticLink Professional to set Engine Serial Number/Vehicle Identification Number (ESN/VIN) command. This command changes the ESN/VIN in the electronic control modules when they are replaced, or when the engine is exchanged.

399.1 SPN 520296/FMI 3 - GHG17

Exhaust Gas Recirculation Valve Actuator, Low Supply Voltage

SPN 520296/FMI 3	
Description	Exhaust Gas Recirculation (EGR) Valve Actuator, Low Supply Voltage
Monitored Parameter	EGR Valve Actuator Voltage
Typical Enabling Conditions	EGR Valve Actuator internal self test at start up.
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None

1. Check for multiple codes.
   1.a If SPN 3510/FMI 4 is also present, troubleshoot SPN 3510/FMI 4 first.
   1.b If only SPN 520296/FMI 3 is present, Go to step 2.
2. Disconnect the EGR valve connector.
3. Turn the Ignition ON (key ON, engine OFF).
4. Measure the voltage between pins 1 and 2 of the EGR valve actuator connector (engine harness side).
   4.a If the voltage is greater than 11 volts, Go to step 6.
   4.b If the voltage is less than 11 volts, Go to step 5.
5. Measure the voltage between pin 1 of the EGR valve actuator connector and ground (engine harness side).
   5.a If the voltage is less than 11 volts, repair wire between pin 1 of the EGR valve actuator connector harness and pin 62 of the Motor Control Module (MCM) 120-pin connector.
   5.b If the voltage is greater than 11 volts, repair wire between pin 2 of the EGR valve actuator connector (engine harness side) and pin 67 of the MCM 120-pin connector.
6. Check Charging System and Starting System for proper operation. Refer to OEM procedures for testing.
   6.a If problem is present, repair as necessary. Verify repairs.
   6.b If no problems are present, Go to step 7.
7. Clear codes, cycle the ignition ON and monitor SRA3 status using DiagnosticLink .
   7.a If SRA3 status is "0" or "OK", clear the codes and release the vehicle.
   7.b If SRA3 status is not "0" or "OK", contact the Detroit™ Customer Support Center at 800-445-1980.

399.2 SPN 520296/FMI 31 - GHG17

SPN 520296/FMI 31	
Description	The Fault Code Sets When the Motor Control Module (MCM) Detects that the Exhaust Gas Recirculation (EGR) Valve Position Does Not Reach the Commanded Position Within a Calibrated Time.
Monitored Parameter	EGR Position Error
Typical Enabling Conditions	Engine Running
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle

Check as follows:

1. Turn the ignition OFF.
2. Visually inspect the EGR system hardware, clamps and connections. Are there any components that will interfere with the travel of the pull rod?

   2.a Yes; Go to step 3.

   2.b No; install the components correctly (replace any clamps that need readjustment), and use DiagnosticLink to perform the EGR Slow Learn routine. Verify repair.
3. Verify the orientation of the pull rod. Is the "S" stamped on the pull rod facing toward the EGR actuator and the "V" stamped on the pull rod facing toward the EGR valve?

   3.a Yes; Go to step 4.

   3.b No; remove the pull rod and install the pull rod correctly. Perform the EGR Slow Learn routine. Verify repair.
4. Move the pull rod toward the rear of the engine by hand, and then release the pull rod. Does the pull rod move?

   4.a Yes; Go to step 5.

   4.b No; Go to step 7.
5. Monitor the EGR actuator while turning the ignition ON (key ON, engine OFF). Does the EGR actuator move when the ignition is first turned on?

   5.a Yes; Go to step 6.

   5.b No; replace the EGR actuator.
6. Turn the ignition OFF.
7. Disconnect and inspect the pull rod from the EGR actuator. Are the bearings or inserts in the pull rod missing?

   7.a Yes; replace the pull rod. Verify repair.

   7.b No; Go to step 8.
8. Rotate the bearings in the pull rod in the normal direction of movement when installed. Do the bearings move?

   8.a Yes; Go to step 9.

   8.b No; replace the pull rod.
9. Move the EGR valve back and forth by hand using the pull rod. Does the EGR valve move from end stop to end stop?

   9.a Yes; Go to step 10.

9.b No; replace the EGR valve.

10. Install the pull rod back onto the EGR actuator.
11. Use DiagnosticLink® to perform the EGR Slow Learn routine.
12. Does fault code SPN 2791/FMI 31 become active?

12.a Yes; replace the EGR valve actuator.

12.b No; the concern was corrected by performing the Slow Learn routine. No further diagnostics or repairs are needed; release the vehicle to the customer.

SPN 520296 (MCM) (GHG17)

399.1 SPN 520296/FMI 3 - GHG17

Exhaust Gas Recirculation Valve Actuator, Low Supply Voltage

SPN 520296/FMI 3	
Description	Exhaust Gas Recirculation (EGR) Valve Actuator, Low Supply Voltage
Monitored Parameter	EGR Valve Actuator Voltage
Typical Enabling Conditions	EGR Valve Actuator internal self test at start up.
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None

1. Check for multiple codes.
   1.a If SPN 3510/FMI 4 is also present, troubleshoot SPN 3510/FMI 4 first.
   1.b If only SPN 520296/FMI 3 is present, Go to step 2.
2. Disconnect the EGR valve connector.
3. Turn the Ignition ON (key ON, engine OFF).
4. Measure the voltage between pins 1 and 2 of the EGR valve actuator connector (engine harness side).
   4.a If the voltage is greater than 11 volts, Go to step 6.
   4.b If the voltage is less than 11 volts, Go to step 5.
5. Measure the voltage between pin 1 of the EGR valve actuator connector and ground (engine harness side).
   5.a If the voltage is less than 11 volts, repair wire between pin 1 of the EGR valve actuator connector harness and pin 62 of the Motor Control Module (MCM) 120-pin connector.
   5.b If the voltage is greater than 11 volts, repair wire between pin 2 of the EGR valve actuator connector (engine harness side) and pin 67 of the MCM 120-pin connector.
6. Check Charging System and Starting System for proper operation. Refer to OEM procedures for testing.
   6.a If problem is present, repair as necessary. Verify repairs.
   6.b If no problems are present, Go to step 7.
7. Clear codes, cycle the ignition ON and monitor SRA3 status using DiagnosticLink .
   7.a If SRA3 status is "0" or "OK", clear the codes and release the vehicle.
   7.b If SRA3 status is not "0" or "OK", contact the Detroit™ Customer Support Center at 800-445-1980.

399.2 SPN 520296/FMI 31 - GHG17

SPN 520296/FMI 31	
Description	The Fault Code Sets When the Motor Control Module (MCM) Detects that the Exhaust Gas Recirculation (EGR) Valve Position Does Not Reach the Commanded Position Within a Calibrated Time.
Monitored Parameter	EGR Position Error
Typical Enabling Conditions	Engine Running
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle

Check as follows:

1. Turn the ignition OFF.
2. Visually inspect the EGR system hardware, clamps and connections. Are there any components that will interfere with the travel of the pull rod?

   2.a Yes; Go to step 3.

   2.b No; install the components correctly (replace any clamps that need readjustment), and use DiagnosticLink to perform the EGR Slow Learn routine. Verify repair.
3. Verify the orientation of the pull rod. Is the "S" stamped on the pull rod facing toward the EGR actuator and the "V" stamped on the pull rod facing toward the EGR valve?

   3.a Yes; Go to step 4.

   3.b No; remove the pull rod and install the pull rod correctly. Perform the EGR Slow Learn routine. Verify repair.
4. Move the pull rod toward the rear of the engine by hand, and then release the pull rod. Does the pull rod move?

   4.a Yes; Go to step 5.

   4.b No; Go to step 7.
5. Monitor the EGR actuator while turning the ignition ON (key ON, engine OFF). Does the EGR actuator move when the ignition is first turned on?

   5.a Yes; Go to step 6.

   5.b No; replace the EGR actuator.
6. Turn the ignition OFF.
7. Disconnect and inspect the pull rod from the EGR actuator. Are the bearings or inserts in the pull rod missing?

   7.a Yes; replace the pull rod. Verify repair.

   7.b No; Go to step 8.
8. Rotate the bearings in the pull rod in the normal direction of movement when installed. Do the bearings move?

   8.a Yes; Go to step 9.

   8.b No; replace the pull rod.
9. Move the EGR valve back and forth by hand using the pull rod. Does the EGR valve move from end stop to end stop?

   9.a Yes; Go to step 10.

9.b No; replace the EGR valve.

10. Install the pull rod back onto the EGR actuator.
11. Use DiagnosticLink® to perform the EGR Slow Learn routine.
12. Does fault code SPN 2791/FMI 31 become active?

12.a Yes; replace the EGR valve actuator.

12.b No; the concern was corrected by performing the Slow Learn routine. No further diagnostics or repairs are needed; release the vehicle to the customer.

400.1 SPN 520321/FMI 31- GHG17

Internal MCM Error

SPN 520321/FMI 31	
Description	Internal MCM Error Detected
Monitored Parameter	MCM
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On

1. Connect DiagnosticLink .
2. Is communication to the Motor Control Module (MCM) possible?
   - 2.a Yes; reprogram the MCM with the latest software release. Go to step 3.
   - 2.b No; replace the MCM.
3. Is SPN 520321/FMI 31 still active?
   - 3.a Yes; replace the MCM.
   - 3.b No; testing is complete. Release the vehicle.

SPN 520321 (MCM) (GHG17)

400.1 SPN 520321/FMI 31- GHG17

Internal MCM Error

SPN 520321/FMI 31	
Description	Internal MCM Error Detected
Monitored Parameter	MCM
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On

1. Connect DiagnosticLink .
2. Is communication to the Motor Control Module (MCM) possible?
   - 2.a Yes; reprogram the MCM with the latest software release. Go to step 3.
   - 2.b No; replace the MCM.
3. Is SPN 520321/FMI 31 still active?
   - 3.a Yes; replace the MCM.
   - 3.b No; testing is complete. Release the vehicle.

401.1 SPN 520322/FMI 31 - GHG17

No Match of Camshaft and Crankshaft Signals - engine cold

SPN 520322/FMI 31	
Description	This fault code sets when the Camshaft signal is 6 degrees different from the crankshaft signal for 50 counts.
Monitored Parameter	Camshaft/Crankshaft Sensors
Typical Enabling Conditions	Engine Idle Engine coolant temperature less than (87°C)188 °F
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	10 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (1 minute)

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON(key ON, engine OFF).
3. Check for multiple fault codes. Are fault codes SPN 723 FMI 3, FMI 4, SPN 636 FMI 3 or FMI 4 also present?
   - 3.a Yes; diagnose the other fault codes first.
   - 3.b No; Go to step 4.
4. Has the camshafts recently been removed from the engine?
   - 4.a Yes; Go to step 5.
   - 4.b No; Go to step 6.
5. Verify the camshaft timing. Is the camshaft timing correct?
   - 5.a Yes; Go to step 6.
   - 5.b No; correct the camshaft timing. Verify repair.
6. Disconnect and inspect the camshaft position sensor connector. Is there damage, corrosion or fretting present?
   - 6.a Yes; repair as necessary.
   - 6.b No; Go to step 7.
7. Remove and inspect the camshaft position sensor. Is the camshaft position sensor damaged?
   - 7.a Yes; replace the camshaft position sensor.
   - 7.b No; Go to step 8.
8. Check the cam gear tone wheel for damage. Is the cam gear tone wheel damaged?
   - 8.a Yes; replace the camshaft.
   - 8.b No; replace the camshaft position sensor. Verify repair.

SPN 520322 (MCM) (GHG17)

401.1 SPN 520322/FMI 31 - GHG17

No Match of Camshaft and Crankshaft Signals - engine cold

SPN 520322/FMI 31	
Description	This fault code sets when the Camshaft signal is 6 degrees different from the crankshaft signal for 50 counts.
Monitored Parameter	Camshaft/Crankshaft Sensors
Typical Enabling Conditions	Engine Idle Engine coolant temperature less than (87°C)188 °F
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	10 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Engine Idle (1 minute)

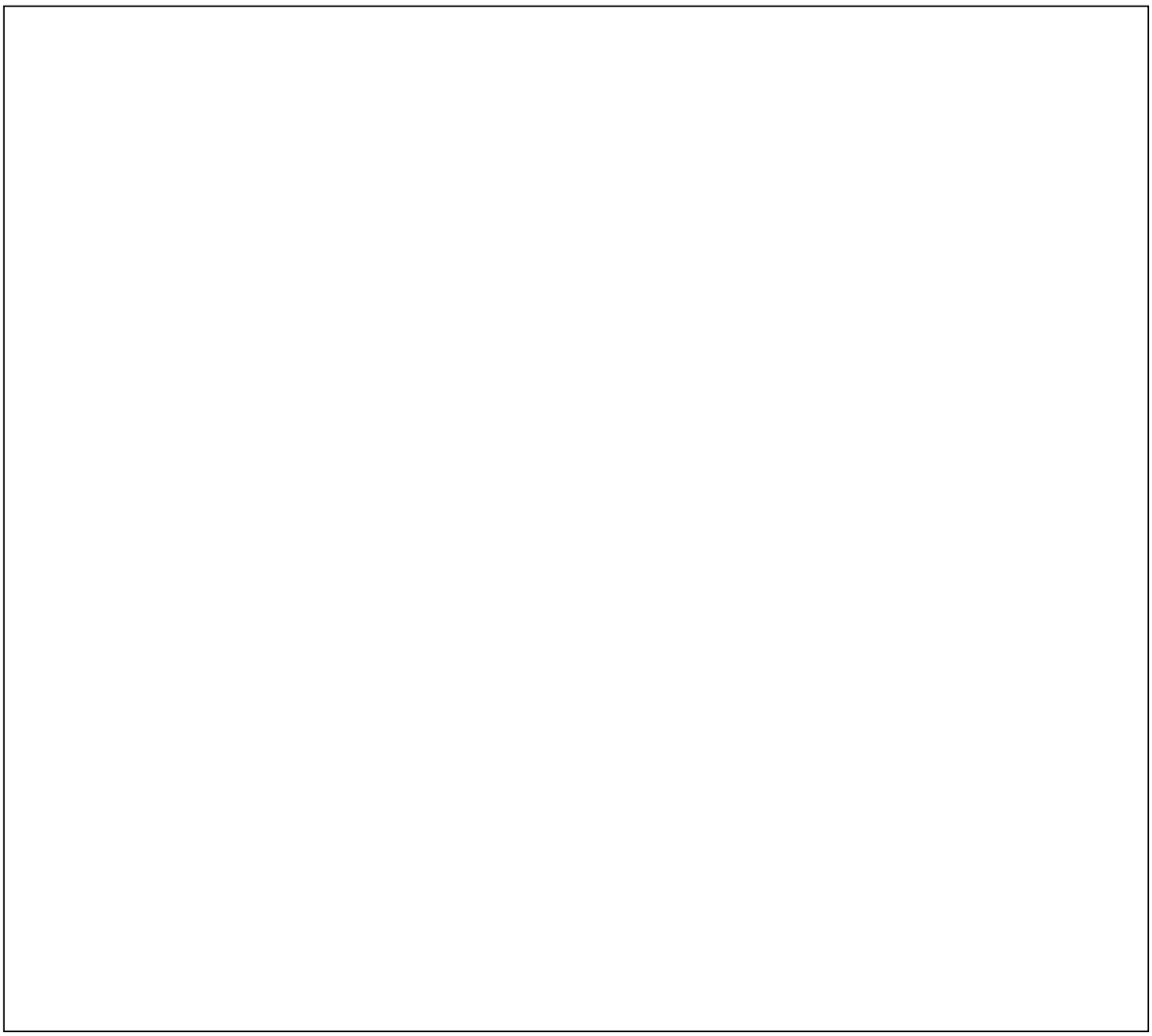
Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON(key ON, engine OFF).
3. Check for multiple fault codes. Are fault codes SPN 723 FMI 3, FMI 4, SPN 636 FMI 3 or FMI 4 also present?
   - 3.a Yes; diagnose the other fault codes first.
   - 3.b No; Go to step 4.
4. Has the camshafts recently been removed from the engine?
   - 4.a Yes; Go to step 5.
   - 4.b No; Go to step 6.
5. Verify the camshaft timing. Is the camshaft timing correct?
   - 5.a Yes; Go to step 6.
   - 5.b No; correct the camshaft timing. Verify repair.
6. Disconnect and inspect the camshaft position sensor connector. Is there damage, corrosion or fretting present?
   - 6.a Yes; repair as necessary.
   - 6.b No; Go to step 7.
7. Remove and inspect the camshaft position sensor. Is the camshaft position sensor damaged?
   - 7.a Yes; replace the camshaft position sensor.
   - 7.b No; Go to step 8.
8. Check the cam gear tone wheel for damage. Is the cam gear tone wheel damaged?
   - 8.a Yes; replace the camshaft.
   - 8.b No; replace the camshaft position sensor. Verify repair.

402.1 SPN 520323/FMI 3 - GHG17

High Side Digital Output Supply Voltage Circuit Failed High

SPN 520323/FMI 3	
Description	High Side Digital Output Supply Voltage Circuit Failed High
Monitored Parameter	DEF Dosing Unit Voltage
Typical Enabling Conditions	DEF Dosing enabled
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	5 seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Parked Regen



1. Turn the ignition OFF.
2. Disconnect the Diesel Exhaust Fluid (DEF) Dosing Unit harness connector.

3. Inspect Dosing Unit harness connector for bent, spread or corroded pins. Was any damage found?
   3.a Yes; repair as necessary.
   3.b No; Go to step 4.
4. Turn the ignition ON (key ON, engine OFF).

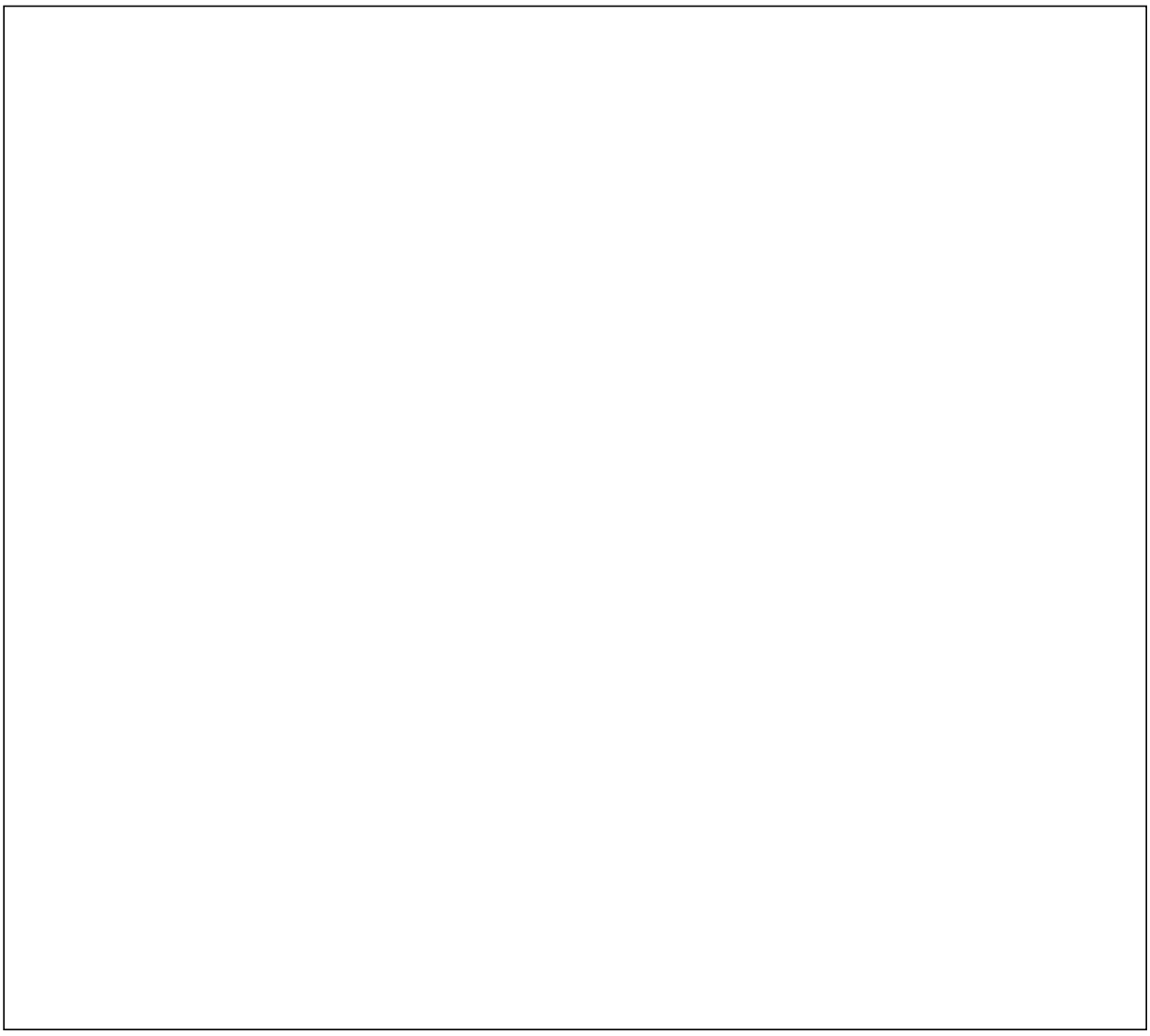
Dosing Unit			
8-Pin	Circuit	ACM-Pin	Connector
1	Dosing Unit Low side	28	
2	Dosing Unit High side	33	
3	Heating Low side	22	
4	Heating Supply	3	
5	Sensor Supply 5V	84	
6	Not Used	Not Used	
7	Sensor Ground	99	
8	DEF Pressure Signal	100	

5. Measure the voltage between pins 2 and 7 on the harness side of the DEF dosing unit connector. Is the voltage less than 11.5 volts?
   5.a Yes; Go to step 6.
   5.b No; repair the short to battery voltage between pin 2 on the harness side of the DEF Dosing Unit harness connector and pin 33 of the ACM 120-pin connector.
6. Measure the voltage between pin 2 on the harness side of the DEF dosing unit harness connector and engine ground.
   6.a If voltage is less than 11.5 volts, repair the wire between pin 1 on the harness side of the DEF Dosing Unit harness connector and pin 28 of the ACM 120-pin connector.
   6.b If voltage is greater than 11.5 volts, repair the short to battery voltage between pin 2 on the harness side of the DEF Dosing Unit harness connector and pin 33 of the ACM 120-pin connector.

402.2 SPN 520323/FMI 4 - GHG17

High Side Digital Output Supply Voltage Circuit Failed Low

SPN 520323/FMI 4	
Description	High Side Digital Output Supply Voltage Circuit Failed Low
Monitored Parameter	DEF Dosing Unit Voltage
Typical Enabling Conditions	DEF Dosing enabled
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	5 seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Parked Regen



1. Turn the ignition OFF.
2. Disconnect the Diesel Exhaust Fluid (DEF) Dosing Unit harness connector.

3. Inspect Dosing Unit harness connector for bent, spread or corroded pins. Was any damage found?
   3.a Yes; repair as necessary.
   3.b No; Go to step 4.
4. Disconnect the ACM 120-pin connector.

Dosing Unit			
8-Pin	Circuit	ACM-Pin	Connector
1	Dosing Unit Low side	28	
2	Dosing Unit High side	33	
3	Heating Low side	22	
4	Heating Supply	3	
5	Sensor Supply 5V	84	
6	Not Used	Not Used	
7	Sensor Ground	99	
8	DEF Pressure Signal	100	

5. Measure the resistance between pins 2 and 7 on the harness side of the DEF Dosing Unit harness connector. Is the resistance greater than 10k ohms?
   5.a Yes; Go to step 6.
   5.b No; repair the short between pins 2 and 7 on the harness side of the DEF Dosing Unit.
6. Measure the resistance between pin 2 on the harness side of the DEF Dosing Unit harness connector and engine ground. Is the resistance greater than 10k ohms?
   6.a Yes; repair the short to ground between pin 1 on the harness side of the DEF Dosing Unit harness connector and pin 28 of the ACM 120-pin connector.
   6.b No; repair the short to ground between pin 2 on the harness side of the DEF Dosing Unit and pin 33 of the ACM 120-pin connector.

SPN 520323 (ACM) (GHG17)

402.1 SPN 520323/FMI 3 - GHG17

High Side Digital Output Supply Voltage Circuit Failed High

SPN 520323/FMI 3	
Description	High Side Digital Output Supply Voltage Circuit Failed High
Monitored Parameter	DEF Dosing Unit Voltage
Typical Enabling Conditions	DEF Dosing enabled
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	5 seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Parked Regen

1. Turn the ignition OFF.
2. Disconnect the Diesel Exhaust Fluid (DEF) Dosing Unit harness connector.
3. Inspect Dosing Unit harness connector for bent, spread or corroded pins. Was any damage found?
   3.a Yes; repair as necessary.
   3.b No; Go to step 4.
4. Turn the ignition ON (key ON, engine OFF).

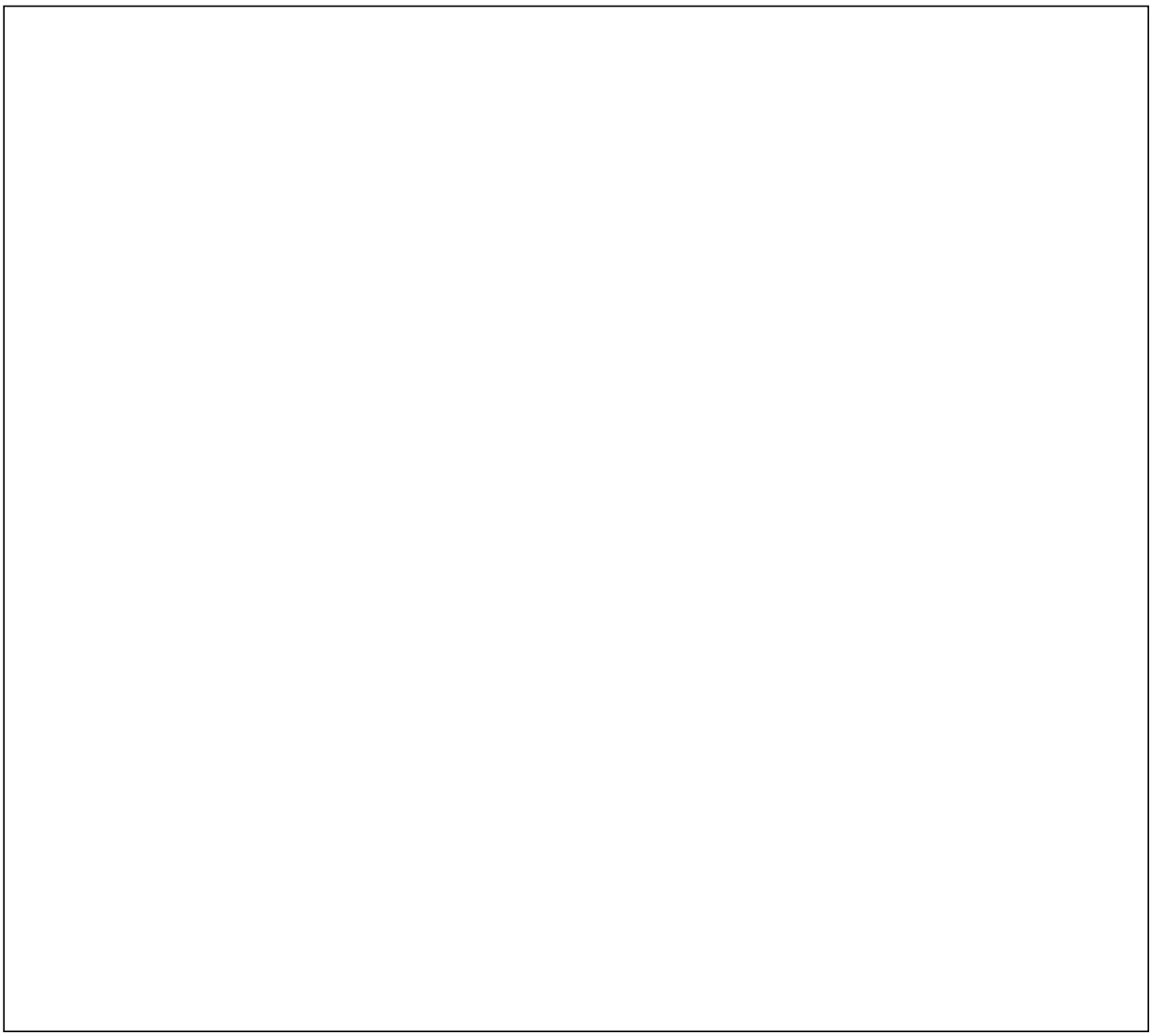
Dosing Unit			
8-Pin	Circuit	ACM-Pin	Connector
1	Dosing Unit Low side	28	
2	Dosing Unit High side	33	
3	Heating Low side	22	
4	Heating Supply	3	
5	Sensor Supply 5V	84	
6	Not Used	Not Used	
7	Sensor Ground	99	
8	DEF Pressure Signal	100	

5. Measure the voltage between pins 2 and 7 on the harness side of the DEF dosing unit connector. Is the voltage less than 11.5 volts?
   5.a Yes; Go to step 6.
   5.b No; repair the short to battery voltage between pin 2 on the harness side of the DEF Dosing Unit harness connector and pin 33 of the ACM 120-pin connector.
6. Measure the voltage between pin 2 on the harness side of the DEF dosing unit harness connector and engine ground.
   6.a If voltage is less than 11.5 volts, repair the wire between pin 1 on the harness side of the DEF Dosing Unit harness connector and pin 28 of the ACM 120-pin connector.
   6.b If voltage is greater than 11.5 volts, repair the short to battery voltage between pin 2 on the harness side of the DEF Dosing Unit harness connector and pin 33 of the ACM 120-pin connector.

402.2 SPN 520323/FMI 4 - GHG17

High Side Digital Output Supply Voltage Circuit Failed Low

SPN 520323/FMI 4	
Description	High Side Digital Output Supply Voltage Circuit Failed Low
Monitored Parameter	DEF Dosing Unit Voltage
Typical Enabling Conditions	DEF Dosing enabled
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	5 seconds
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Parked Regen



1. Turn the ignition OFF.
2. Disconnect the Diesel Exhaust Fluid (DEF) Dosing Unit harness connector.

3. Inspect Dosing Unit harness connector for bent, spread or corroded pins. Was any damage found?
   3.a Yes; repair as necessary.
   3.b No; Go to step 4.
4. Disconnect the ACM 120-pin connector.

Dosing Unit			
8-Pin	Circuit	ACM-Pin	Connector
1	Dosing Unit Low side	28	
2	Dosing Unit High side	33	
3	Heating Low side	22	
4	Heating Supply	3	
5	Sensor Supply 5V	84	
6	Not Used	Not Used	
7	Sensor Ground	99	
8	DEF Pressure Signal	100	

5. Measure the resistance between pins 2 and 7 on the harness side of the DEF Dosing Unit harness connector. Is the resistance greater than 10k ohms?
   5.a Yes; Go to step 6.
   5.b No; repair the short between pins 2 and 7 on the harness side of the DEF Dosing Unit.
6. Measure the resistance between pin 2 on the harness side of the DEF Dosing Unit harness connector and engine ground. Is the resistance greater than 10k ohms?
   6.a Yes; repair the short to ground between pin 1 on the harness side of the DEF Dosing Unit harness connector and pin 28 of the ACM 120-pin connector.
   6.b No; repair the short to ground between pin 2 on the harness side of the DEF Dosing Unit and pin 33 of the ACM 120-pin connector.

SPN 520328 (ACM) (GHG17)

403.1 SPN 520328/FMI 7 – GHG17

Diesel Exhaust Fluid System has Been Over-pressurized

SPN 520328/FMI 7	
Description	Diesel Exhaust Fluid (DEF) Pressure Relief Valve Stuck Closed
Monitored Parameter	DEF Pressure
Typical Enabling Conditions	When Service Routine Is Enabled and During In-Use Checks under Non-DEF Dosing Conditions
Monitor Sequence	None
Execution Frequency	Service Tool and During In-Use Checks under Non-DEF Dosing Conditions
Typical Duration	2 Seconds
Dash Lamps	None
Engine Reaction	None
Verification	SCR ADS Self-check

Note : Retain a log file if Detroit™ Customer Assistance is required.

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes.
   3.a If other fault codes are active, in addition to SPN 520328/FMI 7, troubleshoot the other faults first.
   3.b If only SPN 520328/FMI 7 is present, Go to step 4.
4. Replace Pressure Relief Valve (PRV). Refer to section "Removal of the Diesel Exhaust Fluid Pump Pressure Relief Valve" . Perform Selective Catalytic Reduction Airless Dosing System (SCR ADS) Self-Check Routine to prime the system and verify repairs.

SPN 520329 (ACM) (GHG17)

404.1 SPN 520329/FMI 31 - GHG17

DEF flow quantity below normal

SPN 520329/FMI 31	
Description	Diesel Exhaust Fluid (DEF) pump speed low
Monitored Parameter	DEF pump speed
Typical Enabling Conditions	DEF pump enabled and cannot operate above a DEF pump speed threshold
Monitor Sequence	DEF pump is enabled
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Selective Catalyst Reduction Airless Dosing System (SCR ADS) Self-check

Note : Retain a log file if Detroit™ Customer Assistance is required.

Check as follows:

1. Connect DiagnosticLink and check for other fault codes. Are fault codes SPN 4374/FMI 3 or 4 present?
   1.a Yes; diagnose and repair the other fault codes first. Verify repair.
   1.b No; replace the DEF pump. Refer to section "Removal of the Diesel Exhaust Fluid Pump Module" . Verify repair.

405.1 SPN 520332/FMI 17 – GHG17

Diesel Oxidation Catalyst Inlet Temperature Out of Range Low Preventing HC Dosing

The fault indicates that the High Idle Regen (HIR) was aborted due to the Diesel Oxidation Catalyst (DOC) inlet temperature not reaching the minimum of 270°C (518°F) to initiate dosing during an HIR .

SPN 520332/FMI 17	
Description	DOC Inlet Temperature Out of Range Low
Monitored Parameter	Exhaust temperature
Typical Enabling Conditions	Always on
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Parked Regen

Note : Retain a log file if Detroit™ Customer Assistance is required.

1. Are any other faults present?
   1.a Yes; troubleshoot and repair them first.
   1.b No; Go to step 2.
2. Inspect the following areas for possible issues:

- Intake Throttle Valve – perform intake throttle service routine to see if commanded position can be achieved
- Exhaust leaks
- Intake manifold leaks
- Charge Air Cooler (CAC) leaks
- Jake Brake® operation
- Thermostat

3. Compare Diesel Oxidation Filter (DOC) inlet temperature to the DOC outlet temperature and the Diesel Particulate Filter (DPF) outlet temperature sensors with the key ON, engine OFF. Both sensors should read within 25°C (77°F) . Is any problem found?
   3.a Yes; perform repairs as needed.
   3.b No; Go to step 4.
4. Disconnect the DOC inlet temperature sensor.
5. Inspect the DOC inlet temperature sensor harness connector for bent, spread or corroded pins.
   5.a If pin damage is found, repair as necessary.
   5.b If no pin damage is found, replace the DOC inlet temperature sensor.

SPN 520332 (ACM) (GHG17)

405.1 SPN 520332/FMI 17 – GHG17

Diesel Oxidation Catalyst Inlet Temperature Out of Range Low Preventing HC Dosing

The fault indicates that the High Idle Regen (HIR) was aborted due to the Diesel Oxidation Catalyst (DOC) inlet temperature not reaching the minimum of 270°C (518°F) to initiate dosing during an HIR .

SPN 520332/FMI 17	
Description	DOC Inlet Temperature Out of Range Low
Monitored Parameter	Exhaust temperature
Typical Enabling Conditions	Always on
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Parked Regen

Note : Retain a log file if Detroit™ Customer Assistance is required.

1. Are any other faults present?
   1.a Yes; troubleshoot and repair them first.
   1.b No; Go to step 2.
2. Inspect the following areas for possible issues:

- Intake Throttle Valve – perform intake throttle service routine to see if commanded position can be achieved
- Exhaust leaks
- Intake manifold leaks
- Charge Air Cooler (CAC) leaks
- Jake Brake® operation
- Thermostat

3. Compare Diesel Oxidation Filter (DOC) inlet temperature to the DOC outlet temperature and the Diesel Particulate Filter (DPF) outlet temperature sensors with the key ON, engine OFF. Both sensors should read within 25°C (77°F) . Is any problem found?
   3.a Yes; perform repairs as needed.
   3.b No; Go to step 4.
4. Disconnect the DOC inlet temperature sensor.
5. Inspect the DOC inlet temperature sensor harness connector for bent, spread or corroded pins.
   5.a If pin damage is found, repair as necessary.
   5.b If no pin damage is found, replace the DOC inlet temperature sensor.

SPN 520348 (ACM) (GHG17)

406.1 SPN 520348/FMI 14 - GHG17

Soot Sensor Tube Clogged / Defect

SPN 520348/FMI 14	
Description	Soot Sensor blockage or tampering.
Monitored Parameter	Soot Sensor Protection Tube Temperature
Typical Enabling Conditions	Always on
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	5 seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Verify repairs by road test with loaded trailer for 30 minutes.

Check as follows:

Note : When the engine starts, Soot Sensor will cycle through three modes: protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, heater active regeneration 800°C (1472°F) to clean soot, and measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink , check for multiple fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Turn the ignition OFF.
4. Inspect soot sensor for tampering, damage and proper mounting. Is soot sensor damaged or loose?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; Go to step 5.
5. Remove Soot Sensor. Refer to section "Removal of the 2V2/2HH Soot Sensor".

> **WARNING**
>
> EYE INJURY
>
> To avoid injury from flying debris when using compressed air, wear adequate eye protection (face shield or safety goggles) and do not exceed 276 kPa (40 psi) air pressure.

6. Inspect the soot sensor for deposits restricting the exhaust gas flow through its protection tube. Is the protection tube plugged or excessive soot found?
   - 6.a Yes; diagnose and repair the source of soot. Clean soot sensor protection tube using compressed air. Go to step 7.
   - 6.b No; replace Soot Sensor. Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.
7. Road test to verify cleaning procedure. Does the fault code return?
   - 7.a Yes; replace Soot Sensor. Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.
   - 7.b No; release vehicle.

SPN 520349 (ACM) (GHG17)

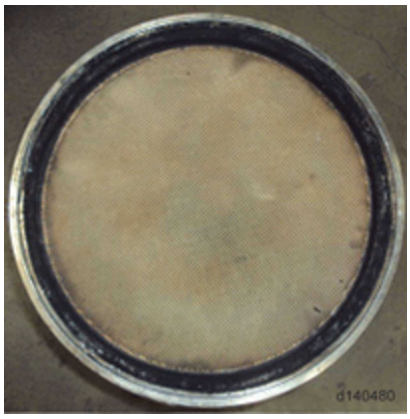
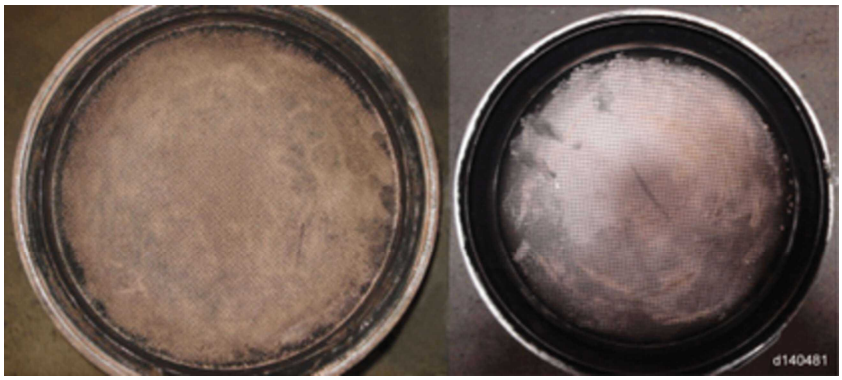
407.1 SPN 520349/FMI 14 - GHG17

SPN 520349/FMI 14	
Description	Soot Sensor Detects Elevated Soot Accumulation
Monitored Parameter	Soot Sensor Current Measurement
Typical Enabling Conditions	Soot Sensor Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Five Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify Repairs Using DiagnosticLink Soot Sensor Panel inspection Routine

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, heater active regeneration 800°C (1472°F) to clean soot, and measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink , check for multiple fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first. Other fault codes may result in excessive soot build-up.
   - 2.b If only SPN 520349/FMI 14 is present, Go to step 3.
3. Remove the soot sensor. Refer to section "Removal of the Soot Sensor" .
4. Inspect soot sensor for excessive soot. Soot evidence can be a slight existence of black film in the tip and around the edges and can be identified by wiping with a light colored cloth. Is excessive soot present?
   - 4.a Yes; wipe clean the soot sensor's protection tube and reinstall the soot sensor. Refer to section "Installation of the Soot Sensor" . Go to step 5.
   - 4.b No; Go to step 7.
5. This fault has set due to a failed DPF. Replace the DPF. Refer to section "Removal of the 1-BOX™ Diesel Particulate Filter" . Clean all remaining soot. Go to step 6.
6. Reset the ash accumulation. Verify repair.
7. Remove the DPF and inspect the outlet face of the DPF substrate for contamination. Refer to section "Removal of the 1-BOX™ Diesel Particulate Filter" . Is soot present on the outlet face of the DPF?

	
Clean DPF	Excessive Soot Presence

7.a Yes; replace the DPF. Clean all remaining soot. Reset the ash accumulation. Go to step 8.

7.b No; clean all remaining soot and replace soot sensor. Refer to section "Installation of the Soot Sensor" . Verify repairs.

WARNING

ENGINE EXHAUST

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

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.

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.

8. Reinstall the soot sensor. Refer to section "Installation of the Soot Sensor" .
9. Clear fault codes. Perform a parked regeneration; reset the ash accumulators. Refer to section "Performing a Parked Regeneration - GHG17" .
10. Using DiagnosticLink, perform soot sensor inspection routine to verify repairs. Does the routine pass?

10.a Yes; release vehicle.

10.b No; replace soot sensor. Refer to section "Removal of the Soot Sensor" . Verify repairs.

SPN 520349 (ACM) (GHG17)

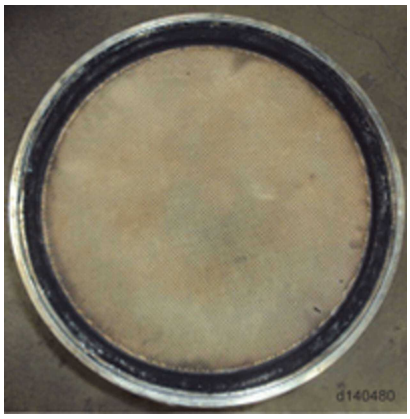
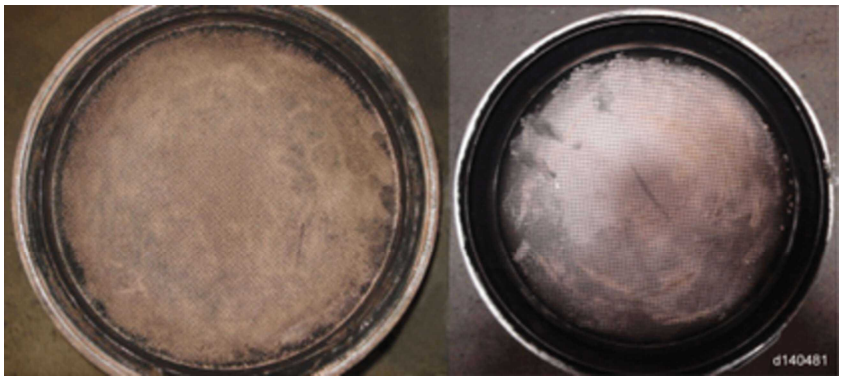
407.1 SPN 520349/FMI 14 - GHG17

SPN 520349/FMI 14	
Description	Soot Sensor Detects Elevated Soot Accumulation
Monitored Parameter	Soot Sensor Current Measurement
Typical Enabling Conditions	Soot Sensor Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Five Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify Repairs Using DiagnosticLink Soot Sensor Panel inspection Routine

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, heater active regeneration 800°C (1472°F) to clean soot, and measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink , check for multiple fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first. Other fault codes may result in excessive soot build-up.
   - 2.b If only SPN 520349/FMI 14 is present, Go to step 3.
3. Remove the soot sensor. Refer to section "Removal of the Soot Sensor" .
4. Inspect soot sensor for excessive soot. Soot evidence can be a slight existence of black film in the tip and around the edges and can be identified by wiping with a light colored cloth. Is excessive soot present?
   - 4.a Yes; wipe clean the soot sensor's protection tube and reinstall the soot sensor. Refer to section "Installation of the Soot Sensor" . Go to step 5.
   - 4.b No; Go to step 7.
5. This fault has set due to a failed DPF. Replace the DPF. Refer to section "Removal of the 1-BOX™ Diesel Particulate Filter" . Clean all remaining soot. Go to step 6.
6. Reset the ash accumulation. Verify repair.
7. Remove the DPF and inspect the outlet face of the DPF substrate for contamination. Refer to section "Removal of the 1-BOX™ Diesel Particulate Filter" . Is soot present on the outlet face of the DPF?

	
Clean DPF	Excessive Soot Presence

7.a Yes; replace the DPF. Clean all remaining soot. Reset the ash accumulation. Go to step 8.

7.b No; clean all remaining soot and replace soot sensor. Refer to section "Installation of the Soot Sensor" . Verify repairs.

WARNING

ENGINE EXHAUST

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

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.

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.

8. Reinstall the soot sensor. Refer to section "Installation of the Soot Sensor" .
9. Clear fault codes. Perform a parked regeneration; reset the ash accumulators. Refer to section "Performing a Parked Regeneration - GHG17" .
10. Using DiagnosticLink, perform soot sensor inspection routine to verify repairs. Does the routine pass?

10.a Yes; release vehicle.

10.b No; replace soot sensor. Refer to section "Removal of the Soot Sensor" . Verify repairs.

SPN 520352 (ACM) (GHG17)

408.1 SPN 520352/FMI 3 - GHG17

Supply Voltage Difference Between ACM and Soot Sensor

SPN 520352 / FMI 3	
Description	Supply Voltage Signals not equal between ACM and soot sensor when heater is on
Monitored Parameter	Soot Sensor voltage supply
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	Continuously
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Key Cycle - Engine Idle two minutes.

Check as follows:

1. Turn the ignition key ON (key ON, engine OFF).
2. Using DiagnosticLink , check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Turn the ignition OFF.
4. Disconnect the soot sensor harness connector.
5. Inspect the harness and connector for signs of damage, bent, spread, corroded or unseated (pushed out) pins. Is any damage found?
   - 5.a Yes; repair as necessary. Verify repairs.
   - 5.b No; Go to step 6.

6. Inspect soot sensor wiring from Soot Sensor Control Unit (SCU) to sensor probe. Is any damage found?
   - 6.a Yes; replace soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.
   - 6.b No; Go to step 7.
7. Turn the ignition ON (key ON, engine OFF).
8. Measure the voltage between soot sensor connector pins 1 and 2, harness side. Is the voltage within 0.5 V of the battery voltage?
   - 8.a Yes; replace soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.
   - 8.b No; Go to step 9.
9. Measure the voltage between soot sensor connector pin 1, harness side and battery ground. Is the voltage within 0.5 V of the battery voltage?
   - 9.a Yes; repair the open wire between pin 2 on the harness side of the soot sensor connector and pin 96 of the ACM 120-pin connector. Verify repairs.
   - 9.b No; Go to step 10.
10. Turn the ignition OFF.
11. Disconnect the ACM 120-pin connector.
12. Inspect the ACM 120-pin harness connector for signs of damage, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
    - 12.a Yes; repair as necessary. Verify repairs.
    - 12.b No; Go to step 13.
13. Measure the resistance between pin 1 of the soot sensor connector, harness side and pin 66 of the ACM 120-pin connector, harness side. Is the resistance less than 5 ohms?
    - 13.a Yes; Go to step 14.
    - 13.b No; repair the open wire between pin 1 on the harness side of the soot sensor connector and pin 66 of the ACM 120-pin connector. Verify repairs.
14. Measure the resistance between pin 1 of the soot sensor connector, harness side and battery ground. Is the resistance greater than 10K ohms?
    - 14.a Yes; Go to step 15.
    - 14.b No; repair the shorted wire between pin 1 on the harness side of the soot sensor connector and ground. Verify repairs.
15. Measure the resistance between pin 2 on the harness side of the soot sensor connector and pin 96 of the ACM 120-pin connector. Is the resistance less than 5 ohms?
    - 15.a Yes; Go to step 16.
    - 15.b No; repair the open wire between pin 2 on the harness side of the soot sensor connector and pin 96 of the ACM 120-pin connector. Verify repairs.
16. Turn the ignition ON (key ON, engine OFF).
17. Measure the voltage between pins 66 and 96 of the ACM 120-pin connector . Is the voltage within 0.5 V of the battery voltage?
    - 17.a Yes; replace soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section"Removal of the 2V2/2HH Soot Sensor". Verify repairs.
    - 17.b No; replace the ACM.

      For 1-BOX™, Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" . Verify repairs.

      For Two-Box, Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module" .Verify repairs.

SPN 520352 (ACM) (GHG17)

408.1 SPN 520352/FMI 3 - GHG17

Supply Voltage Difference Between ACM and Soot Sensor

SPN 520352 / FMI 3	
Description	Supply Voltage Signals not equal between ACM and soot sensor when heater is on
Monitored Parameter	Soot Sensor voltage supply
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	Continuously
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Key Cycle - Engine Idle two minutes.

Check as follows:

1. Turn the ignition key ON (key ON, engine OFF).
2. Using DiagnosticLink , check for any communication or voltage fault codes. Are any other fault codes present?
   2.a Yes; repair those fault codes first.
   2.b No; Go to step 3.
3. Turn the ignition OFF.
4. Disconnect the soot sensor harness connector.
5. Inspect the harness and connector for signs of damage, bent, spread, corroded or unseated (pushed out) pins. Is any damage found?
   5.a Yes; repair as necessary. Verify repairs.
   5.b No; Go to step 6.

6. Inspect soot sensor wiring from Soot Sensor Control Unit (SCU) to sensor probe. Is any damage found?
   - 6.a Yes; replace soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.
   - 6.b No; Go to step 7.
7. Turn the ignition ON (key ON, engine OFF).
8. Measure the voltage between soot sensor connector pins 1 and 2, harness side. Is the voltage within 0.5 V of the battery voltage?
   - 8.a Yes; replace soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.
   - 8.b No; Go to step 9.
9. Measure the voltage between soot sensor connector pin 1, harness side and battery ground. Is the voltage within 0.5 V of the battery voltage?
   - 9.a Yes; repair the open wire between pin 2 on the harness side of the soot sensor connector and pin 96 of the ACM 120-pin connector. Verify repairs.
   - 9.b No; Go to step 10.
10. Turn the ignition OFF.
11. Disconnect the ACM 120-pin connector.
12. Inspect the ACM 120-pin harness connector for signs of damage, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
    - 12.a Yes; repair as necessary. Verify repairs.
    - 12.b No; Go to step 13.
13. Measure the resistance between pin 1 of the soot sensor connector, harness side and pin 66 of the ACM 120-pin connector, harness side. Is the resistance less than 5 ohms?
    - 13.a Yes; Go to step 14.
    - 13.b No; repair the open wire between pin 1 on the harness side of the soot sensor connector and pin 66 of the ACM 120-pin connector. Verify repairs.
14. Measure the resistance between pin 1 of the soot sensor connector, harness side and battery ground. Is the resistance greater than 10K ohms?
    - 14.a Yes; Go to step 15.
    - 14.b No; repair the shorted wire between pin 1 on the harness side of the soot sensor connector and ground. Verify repairs.
15. Measure the resistance between pin 2 on the harness side of the soot sensor connector and pin 96 of the ACM 120-pin connector. Is the resistance less than 5 ohms?
    - 15.a Yes; Go to step 16.
    - 15.b No; repair the open wire between pin 2 on the harness side of the soot sensor connector and pin 96 of the ACM 120-pin connector. Verify repairs.
16. Turn the ignition ON (key ON, engine OFF).
17. Measure the voltage between pins 66 and 96 of the ACM 120-pin connector . Is the voltage within 0.5 V of the battery voltage?
    - 17.a Yes; replace soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section"Removal of the 2V2/2HH Soot Sensor". Verify repairs.
    - 17.b No; replace the ACM.

      For 1-BOX™, Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" . Verify repairs.

      For Two-Box, Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module" .Verify repairs.

409.1 SPN 520353/FMI 17 - GHG17

Soot Sensor Temperature Rationality Failure - Cold Start

SPN 520353/FMI 17	
Description	Soot sensor temperature and select catalyst reduction temperature sensors do not match when cold
Monitored Parameter	Soot Sensor Temperature, SCR Outlet Temperature
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Key cycle; perform DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, heater active regeneration 800°C (1472°F) to clean soot, and measurement mode for duration of key cycle.

1. Turn the ignition key ON (Key ON, Engine OFF).
2. Using DiagnosticLink , check for multiple fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect soot sensor harness connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; reconnect soot sensor. Go to step 5.
5. Using DiagnosticLink, monitor the listed Aftertreatment Device (ATD) temperatures:

- Diesel Particulate Filter (DPF) Outlet
- Selective Catalyst Reduction (SCR) Inlet
- SCR Outlet
- Soot temperature

6. Is the SCR outlet temperature sensor reading similar to temperature values of the others? For example: if the other temperature readings are approx 25°C (77°F) and SCR outlet temperature reading is 0°C (32°F) or 50°C (122°F), that would be the suspect sensor.
   - 6.a Yes; replace soot sensor. Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.
   - 6.b No; replace the SCR outlet temperature sensor. Refer to section "Removal of the Selective Catalytic Reduction Outlet Temperature Sensor" .

SPN 520353 (ACM) (GHG17)

409.1 SPN 520353/FMI 17 - GHG17

Soot Sensor Temperature Rationality Failure - Cold Start

SPN 520353/FMI 17	
Description	Soot sensor temperature and select catalyst reduction temperature sensors do not match when cold
Monitored Parameter	Soot Sensor Temperature, SCR Outlet Temperature
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Key cycle; perform DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, heater active regeneration 800°C (1472°F) to clean soot, and measurement mode for duration of key cycle.

1. Turn the ignition key ON (Key ON, Engine OFF).
2. Using DiagnosticLink , check for multiple fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect soot sensor harness connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; reconnect soot sensor. Go to step 5.
5. Using DiagnosticLink, monitor the listed Aftertreatment Device (ATD) temperatures:

- Diesel Particulate Filter (DPF) Outlet
- Selective Catalyst Reduction (SCR) Inlet
- SCR Outlet
- Soot temperature

6. Is the SCR outlet temperature sensor reading similar to temperature values of the others? For example: if the other temperature readings are approx 25°C (77°F) and SCR outlet temperature reading is 0°C (32°F) or 50°C (122°F), that would be the suspect sensor.
   - 6.a Yes; replace soot sensor. Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.
   - 6.b No; replace the SCR outlet temperature sensor. Refer to section "Removal of the Selective Catalytic Reduction Outlet Temperature Sensor" .

410.1 SPN 520357/FMI 2 - GHG17

Soot Sensor Printed Circuit Board Temperature Rationality Fault

SPN 520357/FMI 2	
Description	This Fault Code Sets when Soot Sensor Control Unit Detects an Over-temperature
Monitored Parameter	Soot Sensor Temperature
Typical Enabling Conditions	Soot Sensor Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify Repairs By Using DiagnosticLink Soot Sensor Panel Inspection Routine

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate; 2) Heater active regeneration 800°C (1472°F) to clean soot; and 3) Measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

410.2 SPN 520357/FMI 15 - GHG17

Soot Sensor Printed Circuit Board Temperature High

SPN 520357/FMI 15	
Description	Soot Sensor Detects A Circuit Board Over-Temperature
Monitored Parameter	Soot Sensor Temperature
Typical Enabling Conditions	Soot Sensor Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify Repairs By Using DiagnosticLink Soot Sensor Panel Inspection Routine

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate; 2) Heater active regeneration 800°C (1472°F) to clean soot; and 3) Measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

SPN 520357 (ACM) (GHG17)

410.1 SPN 520357/FMI 2 - GHG17

Soot Sensor Printed Circuit Board Temperature Rationality Fault

SPN 520357/FMI 2	
Description	This Fault Code Sets when Soot Sensor Control Unit Detects an Over-temperature
Monitored Parameter	Soot Sensor Temperature
Typical Enabling Conditions	Soot Sensor Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify Repairs By Using DiagnosticLink Soot Sensor Panel Inspection Routine

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate; 2) Heater active regeneration 800°C (1472°F) to clean soot; and 3) Measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

410.2 SPN 520357/FMI 15 - GHG17

Soot Sensor Printed Circuit Board Temperature High

SPN 520357/FMI 15	
Description	Soot Sensor Detects A Circuit Board Over-Temperature
Monitored Parameter	Soot Sensor Temperature
Typical Enabling Conditions	Soot Sensor Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify Repairs By Using DiagnosticLink Soot Sensor Panel Inspection Routine

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate; 2) Heater active regeneration 800°C (1472°F) to clean soot; and 3) Measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

411.1 SPN 520358/FMI 3 - GHG17

Soot Sensor Printed Circuit Board Temperature 2 Signal Range High

SPN 520358 / FMI 3	
Description	Soot Sensor printed circuit board temperature high
Monitored Parameter	Soot Sensor circuit board temperature
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition key ON (key ON, engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

411.2 SPN 520358/FMI 4 - GHG17

Soot Sensor Printed Circuit Board Temperature 2 Signal Range Low

SPN 520358 / FMI 4	
Description	Soot Sensor printed circuit board temperature low
Monitored Parameter	Soot Sensor circuit board temperature
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) measurement mode for duration of key cycle.

1. Turn the ignition key ON (key ON, engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

SPN 520358 (ACM) (GHG17)

411.1 SPN 520358/FMI 3 - GHG17

Soot Sensor Printed Circuit Board Temperature 2 Signal Range High

SPN 520358 / FMI 3	
Description	Soot Sensor printed circuit board temperature high
Monitored Parameter	Soot Sensor circuit board temperature
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition key ON (key ON, engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

411.2 SPN 520358/FMI 4 - GHG17

Soot Sensor Printed Circuit Board Temperature 2 Signal Range Low

SPN 520358 / FMI 4	
Description	Soot Sensor printed circuit board temperature low
Monitored Parameter	Soot Sensor circuit board temperature
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) measurement mode for duration of key cycle.

1. Turn the ignition key ON (key ON, engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

412.1 SPN 520359/FMI 3 - GHG17

Soot Sensor Heater Short Circuit to Battery

SPN 520359 / FMI 3	
Description	Higher than expected heater circuit voltage
Monitored Parameter	Soot Sensor heater
Typical Enabling Conditions	Soot Sensor heater enabled
Monitor Sequence	Continuously
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

412.2 SPN 520359/FMI 4 - GHG17

Soot Sensor Heater Short Circuit to Ground

SPN 520359 / FMI 4	
Description	Lower than expected heater circuit voltage
Monitored Parameter	Soot Sensor heater
Typical Enabling Conditions	Soot Sensor heater enabled
Monitor Sequence	Continuously
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

412.3 SPN 520359/FMI 5 - GHG17

Soot Sensor Heater Open Load

SPN 520359/FMI 5	
Description	Lower than expected heater current
Monitored Parameter	Soot Sensor heater
Typical Enabling Conditions	Soot Sensor heater enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

412.4 SPN 520359/FMI 12 - GHG17

Soot Sensor Heater Printed Circuit Board Component Failure

SPN 520359 / FMI 12	
Description	Lower than expected heater current
Monitored Parameter	Soot Sensor heater
Typical Enabling Conditions	Soot Sensor heater enabled
Monitor Sequence	Continuously
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

SPN 520359 (ACM) (GHG17)

412.1 SPN 520359/FMI 3 - GHG17

Soot Sensor Heater Short Circuit to Battery

SPN 520359 / FMI 3	
Description	Higher than expected heater circuit voltage
Monitored Parameter	Soot Sensor heater
Typical Enabling Conditions	Soot Sensor heater enabled
Monitor Sequence	Continuously
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

412.2 SPN 520359/FMI 4 - GHG17

Soot Sensor Heater Short Circuit to Ground

SPN 520359 / FMI 4	
Description	Lower than expected heater circuit voltage
Monitored Parameter	Soot Sensor heater
Typical Enabling Conditions	Soot Sensor heater enabled
Monitor Sequence	Continuously
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

412.3 SPN 520359/FMI 5 - GHG17

Soot Sensor Heater Open Load

SPN 520359/FMI 5	
Description	Lower than expected heater current
Monitored Parameter	Soot Sensor heater
Typical Enabling Conditions	Soot Sensor heater enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

412.4 SPN 520359/FMI 12 - GHG17

Soot Sensor Heater Printed Circuit Board Component Failure

SPN 520359 / FMI 12	
Description	Lower than expected heater current
Monitored Parameter	Soot Sensor heater
Typical Enabling Conditions	Soot Sensor heater enabled
Monitor Sequence	Continuously
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

413.1 SPN 520360/FMI 3 - GHG17

Soot Sensor Inter-Digital Electrode Positive Short Circuit to Battery Diagnostic

SPN 520360 / FMI 3	
Description	Soot Sensor inter-digital electrode (IDE) overvoltage
Monitored Parameter	Soot Sensor IDE current
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

413.2 SPN 520360/FMI 4 - GHG17

Soot Sensor Inter-Digital Electrode Positive Short Circuit to Ground Diagnostic

SPN 520360/FMI 4	
Description	Soot Sensor inter-digital electrode (IDE) short to ground
Monitored Parameter	Soot Sensor IDE current
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, heater active regeneration 800°C (1472°F) to clean soot, and measurement mode for duration of key cycle.

1. Turn the ignition key ON (key ON, engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

413.3 SPN 520360/FMI 15 - GHG17

Soot Sensor Inter-Digital Electrode Positive Signal Range High Diagnostic

SPN 520360 / FMI 15	
Description	Soot Sensor inter-digital electrode (IDE) detects an overvoltage
Monitored Parameter	Soot Sensor IDE current
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition key ON (key ON, engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

SPN 520360 (ACM) (GHG17)

413.1 SPN 520360/FMI 3 - GHG17

Soot Sensor Inter-Digital Electrode Positive Short Circuit to Battery Diagnostic

SPN 520360 / FMI 3	
Description	Soot Sensor inter-digital electrode (IDE) overvoltage
Monitored Parameter	Soot Sensor IDE current
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

413.2 SPN 520360/FMI 4 - GHG17

Soot Sensor Inter-Digital Electrode Positive Short Circuit to Ground Diagnostic

SPN 520360/FMI 4	
Description	Soot Sensor inter-digital electrode (IDE) short to ground
Monitored Parameter	Soot Sensor IDE current
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, heater active regeneration 800°C (1472°F) to clean soot, and measurement mode for duration of key cycle.

1. Turn the ignition key ON (key ON, engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

413.3 SPN 520360/FMI 15 - GHG17

Soot Sensor Inter-Digital Electrode Positive Signal Range High Diagnostic

SPN 520360 / FMI 15	
Description	Soot Sensor inter-digital electrode (IDE) detects an overvoltage
Monitored Parameter	Soot Sensor IDE current
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition key ON (key ON, engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

414.1 SPN 520361/FMI 2 - GHG17

Soot Sensor Temperature Rationality Signal Range Low

SPN 520361/FMI 2	
Description	Soot Sensor Temperature out of range Low
Monitored Parameter	Soot Sensor Temperature
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, Soot Sensor will cycle through three modes: protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, heater active regeneration 800°C (1472°F) to clean soot, and measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink®, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect soot sensor harness connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; Replace soot sensor. Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

414.2 SPN 520361/FMI 16 - GHG17

Soot Sensor Temperature High

SPN 520361/FMI 16	
Description	Higher Than Expected Heater Current For Soot Sensor Temperature
Monitored Parameter	Soot Sensor Heater Current and Temperature Signals
Typical Enabling Conditions	Soot Sensor Heater Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink™ Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, the soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate; 2) Heater active regeneration 800°C (1472°F) to clean soot; and 3) Measurement mode for the duration of the key cycle.

1. Turn the ignition key ON (key ON, engine OFF).
2. Using DiagnosticLink , check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

414.3 SPN 520361/FMI 18 - GHG17

Soot Sensor Temperature Low

SPN 520361/FMI 18	
Description	Lower than expected Soot Sensor temperature
Monitored Parameter	Soot Sensor temperature signal
Typical Enabling Conditions	Soot Sensor heater enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, the soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition key ON (Key ON, Engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

SPN 520361 (ACM) (GHG17)

414.1 SPN 520361/FMI 2 - GHG17

Soot Sensor Temperature Rationality Signal Range Low

SPN 520361/FMI 2	
Description	Soot Sensor Temperature out of range Low
Monitored Parameter	Soot Sensor Temperature
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, Soot Sensor will cycle through three modes: protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, heater active regeneration 800°C (1472°F) to clean soot, and measurement mode for duration of key cycle.

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink®, check for any communication or voltage fault codes. Are any other fault codes present?

   2.a Yes; repair those fault codes first.

   2.b No; Go to step 3.
3. Disconnect soot sensor harness connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   4.a Yes; repair as necessary. Verify repairs.

   4.b No; Replace soot sensor. Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

414.2 SPN 520361/FMI 16 - GHG17

Soot Sensor Temperature High

SPN 520361/FMI 16	
Description	Higher Than Expected Heater Current For Soot Sensor Temperature
Monitored Parameter	Soot Sensor Heater Current and Temperature Signals
Typical Enabling Conditions	Soot Sensor Heater Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink™ Soot Sensor Panel inspection routine.

Check as follows:

Note : When the engine starts, the soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate; 2) Heater active regeneration 800°C (1472°F) to clean soot; and 3) Measurement mode for the duration of the key cycle.

1. Turn the ignition key ON (key ON, engine OFF).
2. Using DiagnosticLink , check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

414.3 SPN 520361/FMI 18 - GHG17

Soot Sensor Temperature Low

SPN 520361/FMI 18	
Description	Lower than expected Soot Sensor temperature
Monitored Parameter	Soot Sensor temperature signal
Typical Enabling Conditions	Soot Sensor heater enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Verify repairs by using DiagnosticLink Soot Sensor Panel inspection routine.

Check as follows:

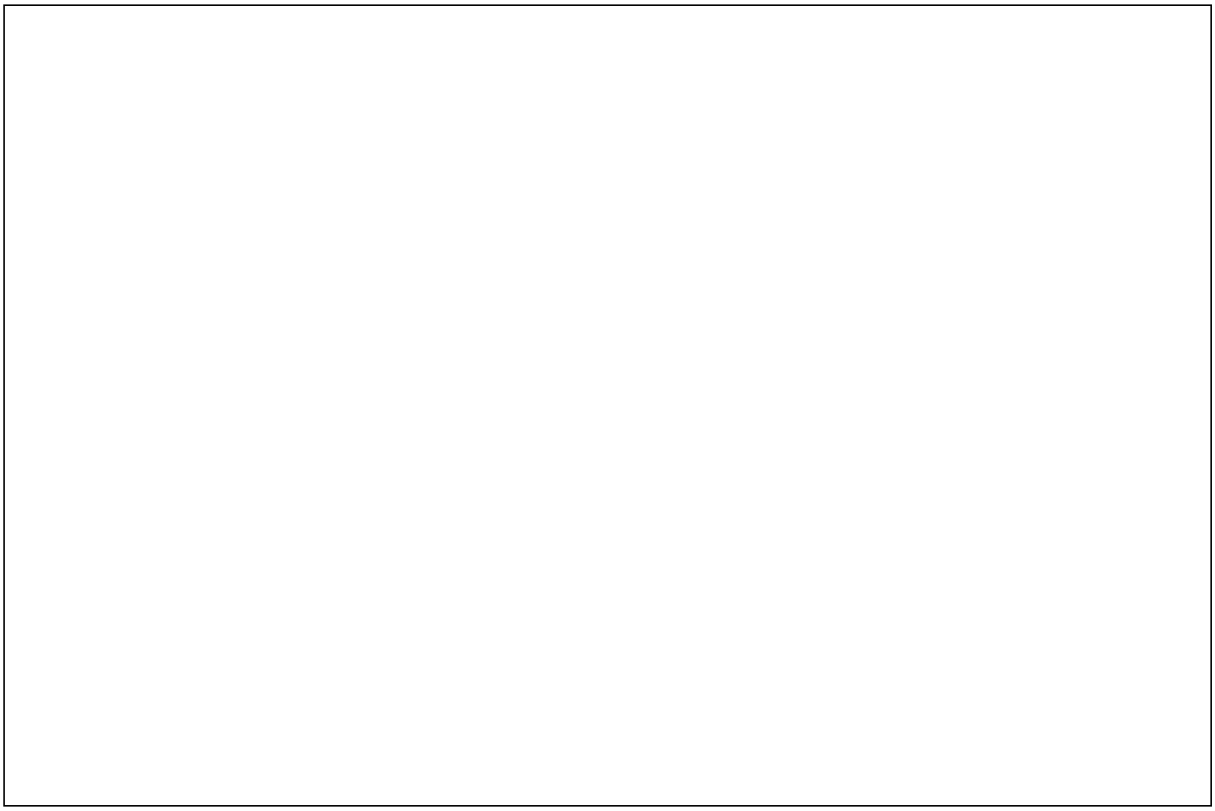
Note : When the engine starts, the soot sensor will cycle through three modes: 1) Protective heating of exhaust temperature dew point 210°C (410°F) to allow moisture to evaporate, 2) Heater active regeneration 800°C (1472°F) to clean soot, and 3) Measurement mode for duration of key cycle.

1. Turn the ignition key ON (Key ON, Engine OFF).
2. Using DiagnosticLink, check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Disconnect the soot sensor electrical connector.
4. Inspect the soot sensor and harness connector for signs of damaged, bent, spread, corroded, or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
   - 4.a Yes; repair as necessary. Verify repairs.
   - 4.b No; replace the soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

415.1 SPN 520362/FMI 3 - GHG17

Soot Sensor Supply Line Voltage Above Normal, Or Shorted To High Source

SPN 520362 / FMI 3	
Description	This Fault sets when Supply Voltage is Above Normal with the ignition ON Or Shorted To voltage with ignition OFF.
Monitored Parameter	Soot Sensor voltage supply
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	Continuously
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Key Cycle - Engine Idle two minutes



Check as follows:

1. Turn the ignition key ON (key ON, engine OFF).
2. Using DiagnosticLink , check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Turn the ignition OFF.
4. Disconnect the soot sensor harness connector.
5. Inspect the harness and connector for signs of damage, bent, spread, corroded or unseated (pushed out) pins. Is any damage found?
   - 5.a Yes; repair as necessary. Verify repairs.
   - 5.b No; Go to step 6.

Note : No voltage should be present at soot sensor with ignition key off.

6. Measure the voltage between soot sensor harness connector pins 1 and 2. Is there any voltage present?
   - 6.a Yes; repair the short to power wire between pin 1 on the harness side of the soot sensor connector and pin 66 on the ACM. Verify repairs.
   - 6.b No; Go to step 7.

> **⚠ 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.

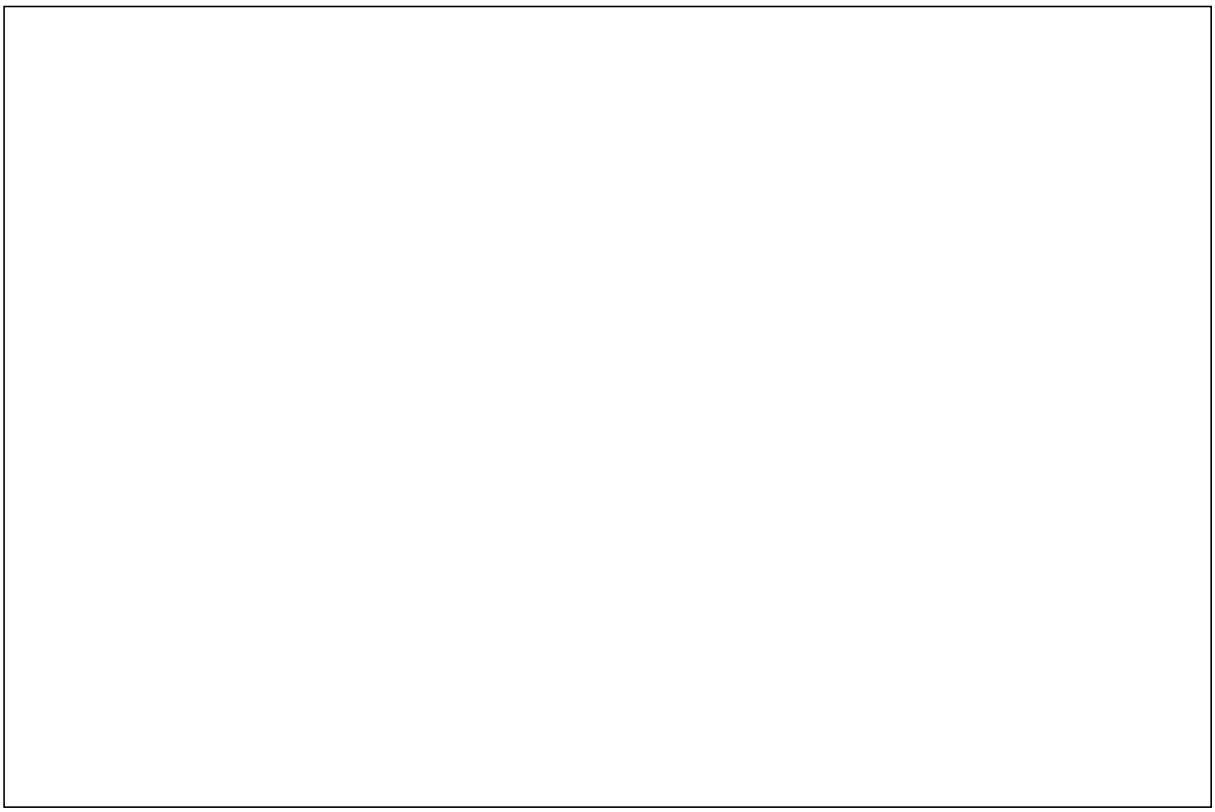
> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

7. Start the engine and run at 900 rpm.
8. Measure the voltage between soot sensor harness connector pins 1and 2. Is the voltage greater than 15.5V?
   - 8.a Yes; inspect and repair charging system. Refer to the Original Equipment Manufacturer (OEM) service literature.
   - 8.b No; replace soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

415.2 SPN 520362/FMI 4 - GHG17

Soot Sensor Supply Line Signal Range Low

SPN 520362/FMI 4	
Description	Soot senor supply voltage below normal
Monitored Parameter	soot sensor voltage supply
Typical Enabling Conditions	soot sensor enabled
Monitor Sequence	Continuously
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Key Cycle - Engine Idle two minutes.



Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink , check for any communication or voltage fault codes. Are any other fault codes present?
   2.a Yes; repair those fault codes first.
   2.b No; Go to step 3.
3. Turn the ignition OFF.
4. Disconnect the soot sensor harness connector.
5. Inspect the harness and connector for signs of damage, bent, spread, corroded or unseated (pushed out) pins. Is any damage found?
   5.a Yes; repair as necessary. Verify repairs.
   5.b No; Go to step 6.

6. Is this a Two-box aftertreatment system?
   - 6.a Yes; Go to step 7.
   - 6.b No; Go to step 9.
7. Disconnect the harness between the ACM and Soot sensor. For a 2V2 disconnect the 47-way and for a 2HH disconnect the 14-way. Inspect the harness connectors for signs of damage, bent, spread, corroded or unseated (pushed out) pins. Was any damage found?
   - 7.a Yes; repair as necessary. Verify repairs.
   - 7.b No; Go to step 8.
8. Reconnect the harness between the soot sensor and ACM.
9. Turn the ignition ON (key ON, engine OFF).
10. Measure the voltage between soot sensor harness connector pins 1 and 2. Is the voltage within 0.5V of the battery voltage?
    - 10.a Yes; replace soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.
    - 10.b No; Go to step 11.
11. Measure the voltage between soot sensor harness connector pin 1 and battery ground. Is the voltage within 0.5V of the battery voltage?
    - 11.a Yes; repair the open wire between pin 2 on the harness side of the Soot Sensor connector and pin 96 of the ACM 120-pin connector. Verify repairs.
    - 11.b No; Go to step 12.
12. Turn the ignition OFF.
13. Disconnect the ACM 120-pin connector.
14. Inspect the ACM 120-pin harness connector for signs of damage, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
    - 14.a Yes; repair as necessary. Verify repairs.
    - 14.b No; Go to step 15.
15. Measure the resistance between pin 1 on the harness side of the soot sensor connector and pin 66 of the ACM 120-pin connector. Is the resistance less than 5 ohms?
    - 15.a Yes; Go to step 16.
    - 15.b No; repair the open wire between pin 1 on the harness side of the soot sensor connector and pin 66 of the ACM 120-pin connector. Verify repairs.
16. Measure the resistance between pin 1 on the harness side of the soot sensor connector and battery ground. Is the resistance greater than 10K ohms?
    - 16.a Yes; Go to step 17.
    - 16.b No; repair the shorted wire between pin 1 on the harness side of the soot sensor connector and ground. Verify repairs.
17. Turn the ignition ON (key ON, engine OFF).
18. Measure the voltage between pins 66 and 96 of the ACM 120-pin connector. Is the voltage within 0.5V of the battery voltage?
    - 18.a Yes; replace soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.
    - 18.b No; replace the ACM.

      For 1-BOX™, Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" . Verify repairs.

      For Two-Box, Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module" Verify repairs.

SPN 520362 (ACM) (GHG17)

415.1 SPN 520362/FMI 3 - GHG17

Soot Sensor Supply Line Voltage Above Normal, Or Shorted To High Source

SPN 520362 / FMI 3	
Description	This Fault sets when Supply Voltage is Above Normal with the ignition ON Or Shorted To voltage with ignition OFF.
Monitored Parameter	Soot Sensor voltage supply
Typical Enabling Conditions	Soot Sensor enabled
Monitor Sequence	Continuously
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Key Cycle - Engine Idle two minutes

Check as follows:

1. Turn the ignition key ON (key ON, engine OFF).
2. Using DiagnosticLink , check for any communication or voltage fault codes. Are any other fault codes present?
   - 2.a Yes; repair those fault codes first.
   - 2.b No; Go to step 3.
3. Turn the ignition OFF.
4. Disconnect the soot sensor harness connector.
5. Inspect the harness and connector for signs of damage, bent, spread, corroded or unseated (pushed out) pins. Is any damage found?
   - 5.a Yes; repair as necessary. Verify repairs.
   - 5.b No; Go to step 6.

Note : No voltage should be present at soot sensor with ignition key off.

6. Measure the voltage between soot sensor harness connector pins 1 and 2. Is there any voltage present?

   6.a Yes; repair the short to power wire between pin 1 on the harness side of the soot sensor connector and pin 66 on the ACM. Verify repairs.

   6.b No; Go to step 7.

> **⚠ 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.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

7. Start the engine and run at 900 rpm.
8. Measure the voltage between soot sensor harness connector pins 1and 2. Is the voltage greater than 15.5V?

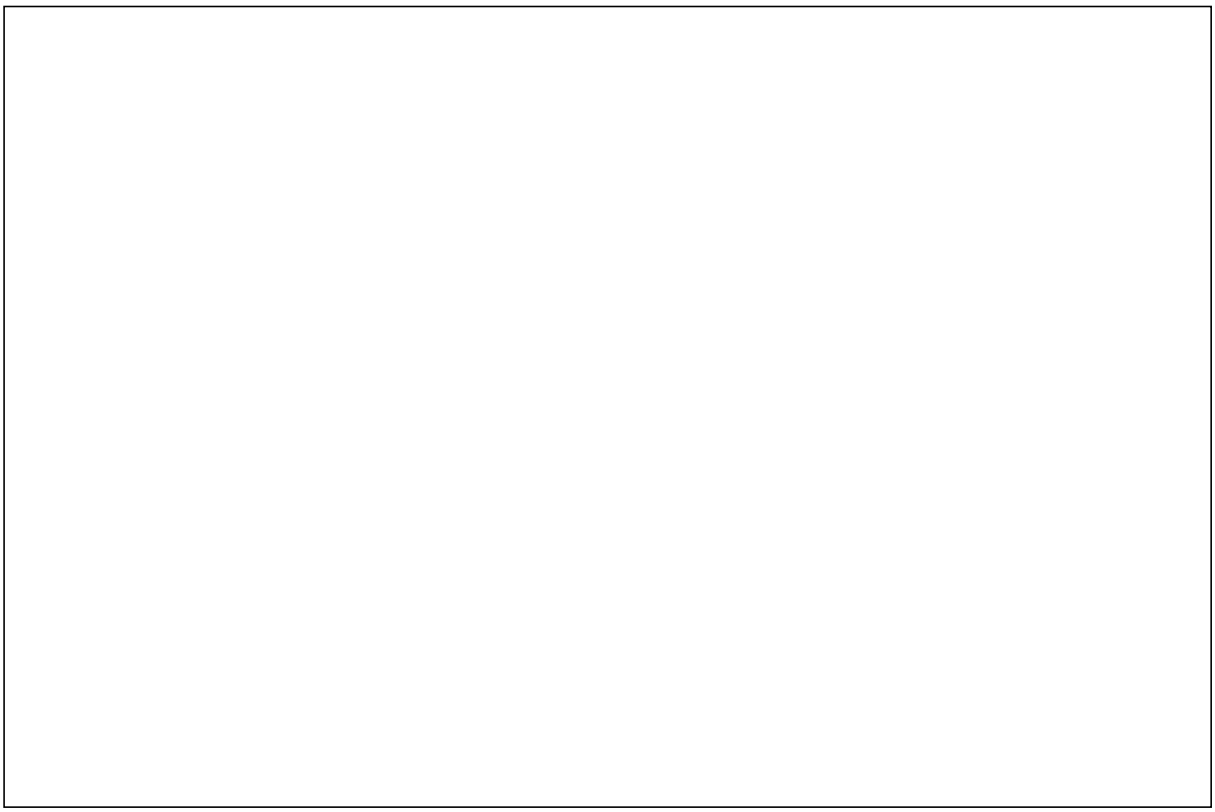
   8.a Yes; inspect and repair charging system. Refer to the Original Equipment Manufacturer (OEM) service literature.

   8.b No; replace soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.

415.2 SPN 520362/FMI 4 - GHG17

Soot Sensor Supply Line Signal Range Low

SPN 520362/FMI 4	
Description	Soot senor supply voltage below normal
Monitored Parameter	soot sensor voltage supply
Typical Enabling Conditions	soot sensor enabled
Monitor Sequence	Continuously
Execution Frequency	Always Enabled
Typical Duration	5 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Key Cycle - Engine Idle two minutes.



Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Using DiagnosticLink , check for any communication or voltage fault codes. Are any other fault codes present?
   2.a Yes; repair those fault codes first.
   2.b No; Go to step 3.
3. Turn the ignition OFF.
4. Disconnect the soot sensor harness connector.
5. Inspect the harness and connector for signs of damage, bent, spread, corroded or unseated (pushed out) pins. Is any damage found?
   5.a Yes; repair as necessary. Verify repairs.
   5.b No; Go to step 6.

6. Is this a Two-box aftertreatment system?
   - 6.a Yes; Go to step 7.
   - 6.b No; Go to step 9.
7. Disconnect the harness between the ACM and Soot sensor. For a 2V2 disconnect the 47-way and for a 2HH disconnect the 14-way. Inspect the harness connectors for signs of damage, bent, spread, corroded or unseated (pushed out) pins. Was any damage found?
   - 7.a Yes; repair as necessary. Verify repairs.
   - 7.b No; Go to step 8.
8. Reconnect the harness between the soot sensor and ACM.
9. Turn the ignition ON (key ON, engine OFF).
10. Measure the voltage between soot sensor harness connector pins 1 and 2. Is the voltage within 0.5V of the battery voltage?
    - 10.a Yes; replace soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.
    - 10.b No; Go to step 11.
11. Measure the voltage between soot sensor harness connector pin 1 and battery ground. Is the voltage within 0.5V of the battery voltage?
    - 11.a Yes; repair the open wire between pin 2 on the harness side of the Soot Sensor connector and pin 96 of the ACM 120-pin connector. Verify repairs.
    - 11.b No; Go to step 12.
12. Turn the ignition OFF.
13. Disconnect the ACM 120-pin connector.
14. Inspect the ACM 120-pin harness connector for signs of damage, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?
    - 14.a Yes; repair as necessary. Verify repairs.
    - 14.b No; Go to step 15.
15. Measure the resistance between pin 1 on the harness side of the soot sensor connector and pin 66 of the ACM 120-pin connector. Is the resistance less than 5 ohms?
    - 15.a Yes; Go to step 16.
    - 15.b No; repair the open wire between pin 1 on the harness side of the soot sensor connector and pin 66 of the ACM 120-pin connector. Verify repairs.
16. Measure the resistance between pin 1 on the harness side of the soot sensor connector and battery ground. Is the resistance greater than 10K ohms?
    - 16.a Yes; Go to step 17.
    - 16.b No; repair the shorted wire between pin 1 on the harness side of the soot sensor connector and ground. Verify repairs.
17. Turn the ignition ON (key ON, engine OFF).
18. Measure the voltage between pins 66 and 96 of the ACM 120-pin connector. Is the voltage within 0.5V of the battery voltage?
    - 18.a Yes; replace soot sensor. Refer to section "Removal of the Soot Sensor" or Refer to section "Removal of the 2V2/2HH Soot Sensor". Verify repairs.
    - 18.b No; replace the ACM.

      For 1-BOX™, Refer to section "Removal of the 1-BOX™ Aftertreatment Control Module" . Verify repairs.

      For Two-Box, Refer to section "Removal of the Two-BOX (2V2) Aftertreatment Control Module" Verify repairs.

416.1 SPN 520363/FMI 3 - GHG17

Selective Catalyst Reduction Inlet NOx Sensor Circuit Failed High

SPN 520363/FMI 5	
Description	This Code Sets When There is a Short to Power on the SCR Inlet NOx Circuit Between the Sensor and ECU
Monitored Parameter	SCR Inlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR Inlet NOx sensor.
2. Inspect the SCR Inlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

   2.a Yes; repair as necessary. Verify repairs.

   2.b No; replace the SCR Inlet NOx sensor.

   For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

   For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

416.2 SPN 520363/FMI 5 - GHG17

Selective Catalyst Reduction Inlet NOx Sensor Circuit Failed Open

SPN 520363/FMI 5	
Description	This Codes Sets When There is an Open on the SCR Inlet NOx Circuit Between the Sensor and the ECU
Monitored Parameter	SCR Inlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR inlet NOx sensor.
2. Inspect the SCR inlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

   2.a Yes; repair as necessary. Verify repairs.

   2.b No; replace the SCR inlet NOx sensor.

   For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

   For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

SPN 520363 (ACM) (GHG17)

416.1 SPN 520363/FMI 3 - GHG17

Selective Catalyst Reduction Inlet NOx Sensor Circuit Failed High

SPN 520363/FMI 5	
Description	This Code Sets When There is a Short to Power on the SCR Inlet NOx Circuit Between the Sensor and ECU
Monitored Parameter	SCR Inlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR Inlet NOx sensor.
2. Inspect the SCR Inlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

   2.a Yes; repair as necessary. Verify repairs.

   2.b No; replace the SCR Inlet NOx sensor.

   For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

   For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

416.2 SPN 520363/FMI 5 - GHG17

Selective Catalyst Reduction Inlet NOx Sensor Circuit Failed Open

SPN 520363/FMI 5	
Description	This Codes Sets When There is an Open on the SCR Inlet NOx Circuit Between the Sensor and the ECU
Monitored Parameter	SCR Inlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR inlet NOx sensor.
2. Inspect the SCR inlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

   2.a Yes; repair as necessary. Verify repairs.

   2.b No; replace the SCR inlet NOx sensor.

   For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

   For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

417.1 SPN 520364/FMI 3 - GHG17

Selective Catalyst Reduction Inlet NOx Sensor Circuit Failed High

SPN 520364/FMI 3	
Description	This Code Sets When There is a Short to Power on the SCR Inlet NOx Circuit Between the Sensor and the ECU
Monitored Parameter	SCR Inlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR inlet NOx sensor.
2. Inspect the SCR inlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

   2.a Yes; repair as necessary. Verify repairs.

   2.b No; replace the SCR inlet NOx sensor.

   For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

   For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

SPN 520364 (ACM) (GHG17)

417.1 SPN 520364/FMI 3 - GHG17

Selective Catalyst Reduction Inlet NOx Sensor Circuit Failed High

SPN 520364/FMI 3	
Description	This Code Sets When There is a Short to Power on the SCR Inlet NOx Circuit Between the Sensor and the ECU
Monitored Parameter	SCR Inlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR inlet NOx sensor.
2. Inspect the SCR inlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

   2.a Yes; repair as necessary. Verify repairs.

   2.b No; replace the SCR inlet NOx sensor.

   For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

   For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

SPN 520365 (ACM) (GHG17)

418.1 SPN 520365/FMI 3 - GHG17

Selective Catalyst Reduction Outlet NOx Sensor Circuit Failed High

SPN 520365/FMI 3	
Description	This Code Sets When There is a Short to Power on the SCR Outlet NOx Circuit Between the Sensor and ECU
Monitored Parameter	SCR Outlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	10% Derate
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR Outlet NOx sensor.
2. Inspect the SCR Outlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

   2.a Yes; repair as necessary. Verify repairs.

   2.b No; replace the SCR Outlet NOx sensor.

   For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

   For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

418.2 SPN 520365/FMI 5 - GHG17

Selective Catalyst Reduction Outlet NOx Sensor Circuit Failed Open

SPN 520365/FMI 5	
Description	This Codes Sets When There is an Open on the SCR NOx Outlet Circuit Between the Sensor and the ECU
Monitored Parameter	SCR Outlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	10% Derate
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR Outlet NOx sensor.
2. Inspect the SCR Outlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

   2.a Yes; repair as necessary. Verify repairs.

   2.b No; replace the SCR Outlet NOx sensor.

   For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

   For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

SPN 520366 (ACM) (GHG17)

419.1 SPN 520366/FMI 3 - GHG17

Selective Catalyst Reduction Outlet NOx Sensor Circuit Failed High

SPN 520366/FMI 3	
Description	This Code Sets When There is a Short to Power on the SCR Outlet NOx Circuit Between the Sensor and ECU
Monitored Parameter	SCR Outlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	10% Derate
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR Outlet NOx sensor.
2. Inspect the SCR Outlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

2.a Yes; repair as necessary. Verify repairs.

> **⚠ 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.

2.b No; replace the SCR Outlet NOx sensor.

For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

419.2 SPN 520366/FMI 5 - GHG17

Selective Catalyst Reduction Outlet NOx Sensor Circuit Failed Open

SPN 520366/FMI 5	
Description	This Code Sets When There is an Open on the SCR Outlet NOx Circuit Between the Sensor and the ECU
Monitored Parameter	SCR Outlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	10% Derate
Verification	Parked Regen

1. Disconnect the SCR Outlet NOx sensor.
2. Inspect the SCR Outlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

2.a Yes; repair as necessary. Verify repairs.

> **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.

2.b No; replace the SCR Outlet NOx sensor.

For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

420.1 SPN 520367/FMI 3 - GHG17

Selective Catalyst Reduction Inlet NOx Sensor Circuit Failed High

SPN 520367/FMI 3	
Description	This Code Sets When There is a Short to Power on the SCR Inlet NOx Circuit Between the Sensor and ECU
Monitored Parameter	SCR Inlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR Inlet NOx sensor.
2. Inspect the SCR Inlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

2.a Yes; repair as necessary. Verify repairs.

> **⚠ 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.

2.b No; replace the SCR Inlet NOx sensor.

For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

For Two-BOX, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

420.2 SPN 520367/FMI 5 - GHG17

Selective Catalyst Reduction Inlet NOx Sensor Circuit Failed Open

SPN 520367/FMI 5	
Description	This Code Sets When There is an Open on the SCR NOx Inlet Circuit Between the Sensor and the ECU
Monitored Parameter	SCR Inlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR inlet NOx sensor.
2. Inspect the SCR inlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

2.a Yes; repair as necessary. Verify repairs.

> **⚠ 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.

2.b No; replace the SCR inlet NOx sensor.

For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

For Two-BOX, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

SPN 520367 (ACM) (GHG17)

420.1 SPN 520367/FMI 3 - GHG17

Selective Catalyst Reduction Inlet NOx Sensor Circuit Failed High

SPN 520367/FMI 3	
Description	This Code Sets When There is a Short to Power on the SCR Inlet NOx Circuit Between the Sensor and ECU
Monitored Parameter	SCR Inlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR Inlet NOx sensor.
2. Inspect the SCR Inlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

   2.a Yes; repair as necessary. Verify repairs.

> **⚠ 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.

   2.b No; replace the SCR Inlet NOx sensor.

   For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

   For Two-BOX, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

420.2 SPN 520367/FMI 5 - GHG17

Selective Catalyst Reduction Inlet NOx Sensor Circuit Failed Open

SPN 520367/FMI 5	
Description	This Code Sets When There is an Open on the SCR NOx Inlet Circuit Between the Sensor and the ECU
Monitored Parameter	SCR Inlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR inlet NOx sensor.
2. Inspect the SCR inlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

2.a Yes; repair as necessary. Verify repairs.

> **⚠ 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.

2.b No; replace the SCR inlet NOx sensor.

For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

For Two-BOX, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

421.1 SPN 520368/FMI 14 - GHG17

Selective Catalyst Reduction Outlet NOx Sensor Circuit Failed Open

SPN 520368/FMI 14	
Description	This Codes Sets When There is an Open on the SCR NOx Outlet Circuit Between the Sensor and the ECU
Monitored Parameter	SCR Outlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	10% Derate
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR Outlet NOx sensor.
2. Inspect the SCR Outlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

   2.a Yes; repair as necessary. Verify repairs.

> **⚠ 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.

3. No; replace the SCR Outlet NOx sensor.

   For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

   For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

421.2 SPN 520368/FMI 31 - GHG17

Selective Catalyst Reduction Outlet NOx Sensor Circuit Failed High

SPN 520368/FMI 31	
Description	This Code Sets When There is a Short to Power on the SCR Outlet NOx Circuit Between the Sensor and ECU
Monitored Parameter	SCR Outlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	10 % Derate
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR Outlet NOx sensor.
2. Inspect the SCR Outlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

2.a Yes; repair as necessary. Verify repairs.

> **⚠ 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.

2.b No; replace the SCR Outlet NOx sensor.

For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

SPN 520368 (ACM) (GHG17)

421.1 SPN 520368/FMI 14 - GHG17

Selective Catalyst Reduction Outlet NOx Sensor Circuit Failed Open

SPN 520368/FMI 14	
Description	This Codes Sets When There is an Open on the SCR NOx Outlet Circuit Between the Sensor and the ECU
Monitored Parameter	SCR Outlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	10% Derate
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR Outlet NOx sensor.
2. Inspect the SCR Outlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

   2.a Yes; repair as necessary. Verify repairs.

> **⚠ 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.

3. No; replace the SCR Outlet NOx sensor.

   For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

   For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

421.2 SPN 520368/FMI 31 - GHG17

Selective Catalyst Reduction Outlet NOx Sensor Circuit Failed High

SPN 520368/FMI 31	
Description	This Code Sets When There is a Short to Power on the SCR Outlet NOx Circuit Between the Sensor and ECU
Monitored Parameter	SCR Outlet NOx Sensor
Typical Enabling Conditions	Dewpoint Enabled
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	3 Seconds
Dash Lamps	MIL, CEL
Engine Reaction	10 % Derate
Verification	Parked Regen

Check as follows:

1. Disconnect the SCR Outlet NOx sensor.
2. Inspect the SCR Outlet NOx sensor and harness side connector for bent, spread, or corroded pins. Is any damage found?

2.a Yes; repair as necessary. Verify repairs.

> **⚠ 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.

2.b No; replace the SCR Outlet NOx sensor.

For 1-BOX™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" .

422.1 SPN 520371/FMI 16 - GHG17

SPN 520371/FMI 16	
Description	The Fault Indicates High Diesel Exhaust Fluid (DEF) Delivery
Monitored Parameter	NOx Conversion Efficiency
Typical Enabling Conditions	Closed Loop DEF Dosing
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Parked SCR Efficiency Test

Check as follows:

1. Connect DiagnosticLink .
2. Using a refractometer from the DEF Test Kit W060589001900, measure the DEF percentage. Is DEF percentage between 31 and 34%?
   - 2.a Yes; Go to step 3.
   - 2.b No; clean/flush the DEF tank. Go to step 4. Refer to section "Flushing of the Diesel Exhaust Fluid System" .
3. Unbolt DEF dosing unit from aftertreatment. Do not disconnect DEF hoses or electrical connector. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" .
4. Perform DEF Quantity Test service routine and record the amount of DEF dispensed. Is the dispensed DEF fluid level between 108 and 132 mL?
   - 4.a Yes; Go to step 5.
   - 4.b No; replace the DEF dosing unit. To verify repairs, Go to step 8. Refer to section "Installation of the Diesel Exhaust Fluid Dosing Unit " .
5. Reinstall the DEF dosing unit to the aftertreatment, using a new gasket and bolts. Refer to section "Installation of the Diesel Exhaust Fluid Dosing Unit " . Go to step 6.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

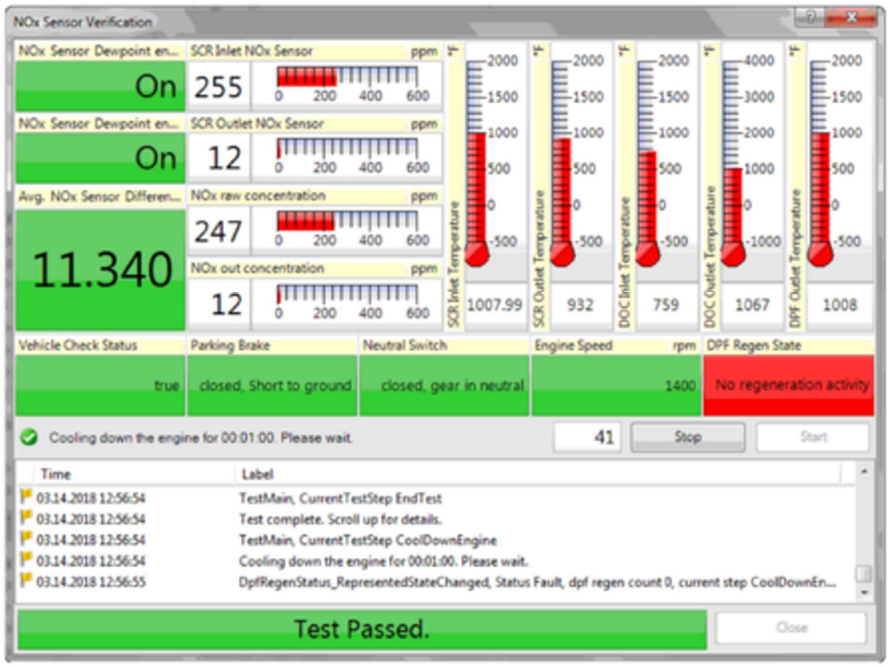
To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

⚠ 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.

6. Start the engine. Using DiagnosticLink, run the NOx Sensor Verification test located in the drop-down menu under Actions / Aftertreatment.



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7. Did the NOx Sensor Verification test pass?
   7.a Yes; Go to step 8.
   7.b No; replace the Inlet NOx sensor. Go to step 8.
   For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .
   For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .
8. Turn the ignition OFF and allow for all modules to power down, then turn the ignition back ON. Go to step 9.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

> **⚠ 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.

9. Start the engine and perform a Parked SCR Efficiency test to clear the fault code. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

422.1 SPN 520371/FMI 16 - GHG17

SPN 520371/FMI 16	
Description	The Fault Indicates High Diesel Exhaust Fluid (DEF) Delivery
Monitored Parameter	NOx Conversion Efficiency
Typical Enabling Conditions	Closed Loop DEF Dosing
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Parked SCR Efficiency Test

Check as follows:

1. Connect DiagnosticLink .
2. Using a refractometer from the DEF Test Kit W060589001900, measure the DEF percentage. Is DEF percentage between 31 and 34%?
   - 2.a Yes; Go to step 3.
   - 2.b No; clean/flush the DEF tank. Go to step 4. Refer to section "Flushing of the Diesel Exhaust Fluid System" .
3. Unbolt DEF dosing unit from aftertreatment. Do not disconnect DEF hoses or electrical connector. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" .
4. Perform DEF Quantity Test service routine and record the amount of DEF dispensed. Is the dispensed DEF fluid level between 108 and 132 mL?
   - 4.a Yes; Go to step 5.
   - 4.b No; replace the DEF dosing unit. To verify repairs, Go to step 8. Refer to section "Installation of the Diesel Exhaust Fluid Dosing Unit " .
5. Reinstall the DEF dosing unit to the aftertreatment, using a new gasket and bolts. Refer to section "Installation of the Diesel Exhaust Fluid Dosing Unit " . Go to step 6.

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.

WARNING

ENGINE EXHAUST

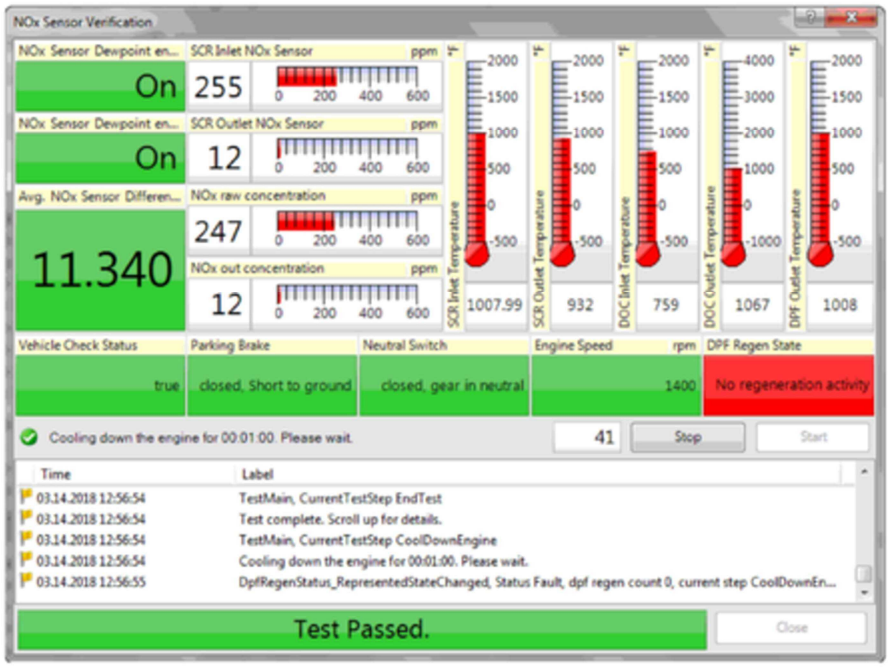
To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

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.

6. Start the engine. Using DiagnosticLink, run the NOx Sensor Verification test located in the drop-down menu under Actions / Aftertreatment.



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7. Did the NOx Sensor Verification test pass?
   - 7.a Yes; Go to step 8.
   - 7.b No; replace the Inlet NOx sensor. Go to step 8.

     For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

     For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .
8. Turn the ignition OFF and allow for all modules to power down, then turn the ignition back ON. Go to step 9.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

> **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.

9. Start the engine and perform a Parked SCR Efficiency test to clear the fault code. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

SPN 520371 (ACM) (GHG17)

422.1 SPN 520371/FMI 16 - GHG17

SPN 520371/FMI 16	
Description	The Fault Indicates High Diesel Exhaust Fluid (DEF) Delivery
Monitored Parameter	NOx Conversion Efficiency
Typical Enabling Conditions	Closed Loop DEF Dosing
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Parked SCR Efficiency Test

Check as follows:

1. Connect DiagnosticLink .
2. Using a refractometer from the DEF Test Kit W060589001900, measure the DEF percentage. Is DEF percentage between 31 and 34%?
   - 2.a Yes; Go to step 3.
   - 2.b No; clean/flush the DEF tank. Go to step 4. Refer to section "Flushing of the Diesel Exhaust Fluid System" .
3. Unbolt DEF dosing unit from aftertreatment. Do not disconnect DEF hoses or electrical connector. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" .
4. Perform DEF Quantity Test service routine and record the amount of DEF dispensed. Is the dispensed DEF fluid level between 108 and 132 mL?
   - 4.a Yes; Go to step 5.
   - 4.b No; replace the DEF dosing unit. To verify repairs, Go to step 8. Refer to section "Installation of the Diesel Exhaust Fluid Dosing Unit " .
5. Reinstall the DEF dosing unit to the aftertreatment, using a new gasket and bolts. Refer to section "Installation of the Diesel Exhaust Fluid Dosing Unit " . Go to step 6.

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.

WARNING

ENGINE EXHAUST

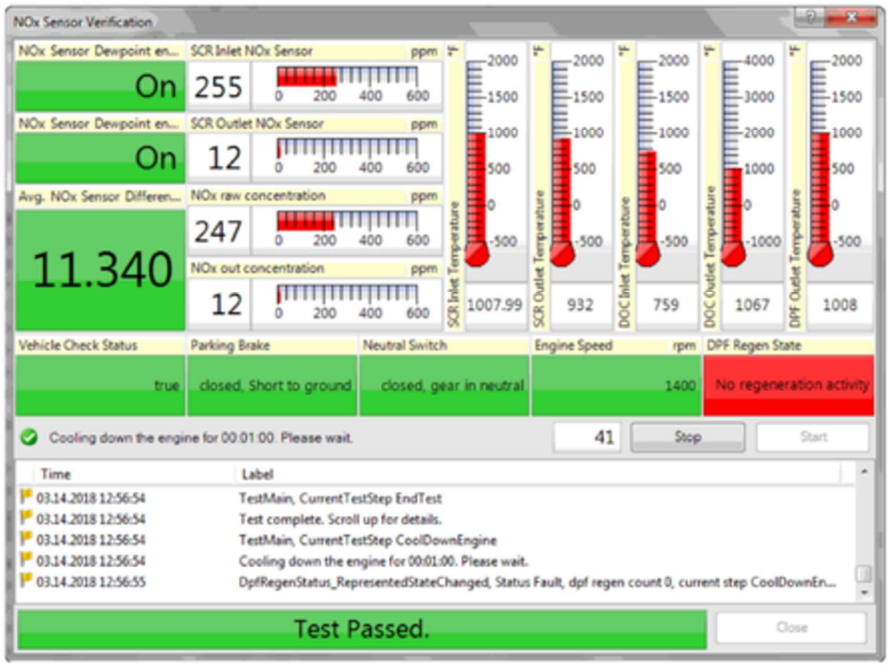
To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

⚠ 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.

6. Start the engine. Using DiagnosticLink, run the NOx Sensor Verification test located in the drop-down menu under Actions / Aftertreatment.



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7. Did the NOx Sensor Verification test pass?

   7.a Yes; Go to step 8.

   7.b No; replace the Inlet NOx sensor. Go to step 8.

   For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

   For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" .

8. Turn the ignition OFF and allow for all modules to power down, then turn the ignition back ON. Go to step 9.

⚠ 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.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

9. Start the engine and perform a Parked SCR Efficiency test to clear the fault code. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

423.1 SPN 520372/FMI 14 - GHG17

SPN 520372/FMI 14	
Description	The Fault Indicates Low Diesel Exhaust Fluid (DEF) Delivery
Monitored Parameter	NOx Conversion Efficiency
Typical Enabling Conditions	Closed Loop DEF Dosing
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Parked SCR Efficiency Test

Check as follows:

1. Connect DiagnosticLink .
2. Using a refractometer from the DEF Test Kit W060589001900, measure the DEF percentage. Is DEF percentage between 31 and 34%?
   - 2.a Yes; Go to step 3.
   - 2.b No; clean/flush the DEF tank. Go to step 4. Refer to section "Flushing of the Diesel Exhaust Fluid System" . Verify repair.
3. Remove the DEF dosing unit. Do not disconnect the DEF lines or electrical connector. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" .
4. Perform DEF Quantity Test service routine and record the amount of DEF dispensed. Is the dispensed DEF fluid level between 108 and 132 mL?
   - 4.a Yes; Go to step 5.
   - 4.b No; replace the DEF dosing unit. To verify repairs, Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . Go to step 10.
5. Install the DEF dosing unit. Refer to section "Installation of the Diesel Exhaust Fluid Dosing Unit " . Go to step 6.

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.

WARNING

ENGINE EXHAUST

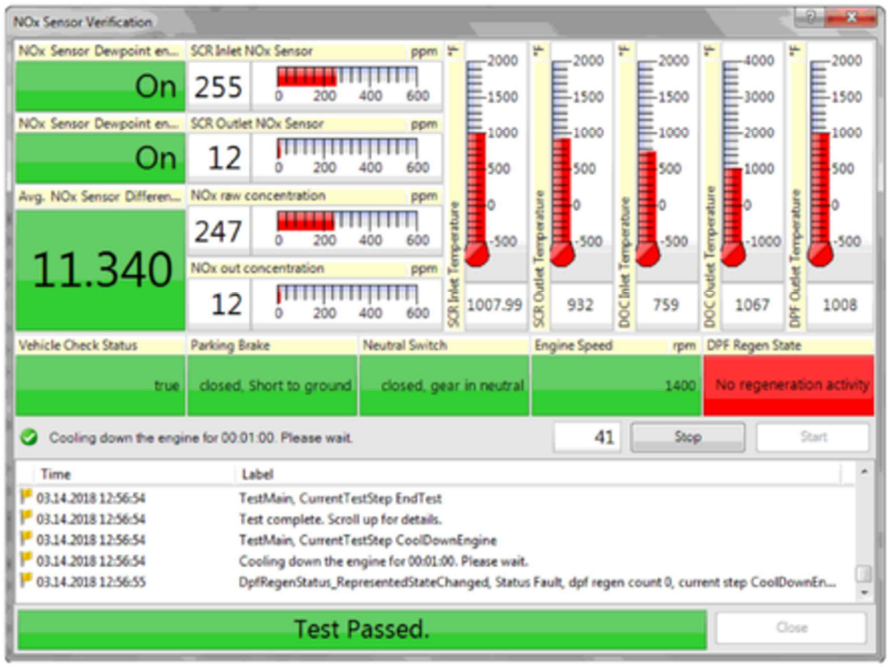
To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

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.

6. Start the engine. Using DiagnosticLink, run the NOx Sensor Verification test located in the drop-down menu under Actions / Aftertreatment. .



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7. Did the NOx Sensor Verification test pass?
   7.a Yes; Go to step 10.
   7.b No; replace the inlet NOx sensor.
   For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" . Go to step 8.
   For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" . Go to step 8.
8. Start the engine. Run the NOx Sensor Verification panel a second time to verify both sensors are now reading correctly.
9. Did the NOx Sensor Verification test pass?
   9.a Yes; Go to step 10.
   9.b No; replace the outlet NOx sensor.
   For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" . Go to step 10.
   For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" . Go to step 10.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

10. Turn the ignition OFF and allow for all modules to power down, then turn the ignition back ON and start the engine. Go to step 11.
11. Perform a Parked SCR Efficiency test to clear fault and verify repairs. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

423.2 SPN 520372/FMI 16 - GHG17

Selective Catalyst Reduction Closed Loop Control at Maximum Limit

SPN 520372/FMI 16	
Description	The Fault Indicates High DEF Delivery
Monitored Parameter	NOx Conversion Efficiency
Typical Enabling Conditions	Closed Loop DEF Dosing
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Parked SCR Efficiency Test

Check as follows:

1. Connect DiagnosticLink .
2. Use the chart below to verify the Aftertreatment Control Module (ACM) software level is up to date. Is the current ACM software and fuel map at or greater than the chart below?

   2.a Yes; Go to step 3.

   2.b No; update to the latest ACM software configuration on the server. Go to step 3.

   ACM 7.56.6.0 software with fuel map ZGS Version

Model	ATS Configuration	Software Version	ACM Fuel Map Version
DD15, DD16,DD13	1-Box	7.56.6.0	ZGS 005
DD13	Two-Box 2HV / 2HH	7.56.6.0	ZGS 004
DD13	Two-Box 2V2	7.56.6.0	ZGS 004
DD13	1-Box FCCC, Terex Crane	7.56.6.0	ZGS 005
DD13	1-Box non-DTNA	7.56.6.0	ZGS 004
DD13	Two-Box 2V2 non-DTNA	7.56.6.0	ZGS 003
DD13	EvoBus	7.56.6.0	ZGS 005

3. Check for multiple fault codes. Are any of the following faults present: SPN 4331/FMI 15, SPN 3216/FMI 16, SPN 520372/FMI 14 or SPN 5841/FMI 14?

   3.a Yes; diagnose the other fault code first.

   3.b No; Go to step 4.

4. Using a refractometer from the DEF Test Kit W060589001900, measure the DEF percentage. Is DEF percentage between 31 and 34%?

   4.a Yes; Go to step 5.

   4.b No; clean/flush the DEF tank. Go to step 5. Refer to section "Flushing of the Diesel Exhaust Fluid System" .

5. Unbolt the DEF Dosing Unit from the aftertreatment device. Do not disconnect DEF lines or electrical connector. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" .
6. Perform DEF Quantity Test service routine and record the amount of DEF dispensed. Is the dispensed DEF fluid level between 108 and 132 mL?

   6.a Yes; Go to step 7.

   6.b No; replace the DEF Dosing Unit. To verify repairs, Go to step 10. Refer to section "Installation of the Diesel Exhaust Fluid Dosing Unit " .

7. Install the DEF Dosing Unit. Refer to section "Installation of the Diesel Exhaust Fluid Dosing Unit " .

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

8. Start the engine and perform a full parked regeneration. Refer to section "Performing a Parked Regeneration - GHG17" . After the regen has completed, Go to step 9.
9. Turn the ignition OFF and allow for all modules to power down, then turn the ignition back ON and start the engine. Go to step 10.
10. Perform a Parked SCR Efficiency test to clear fault. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

423.1 SPN 520372/FMI 14 - GHG17

SPN 520372/FMI 14	
Description	The Fault Indicates Low Diesel Exhaust Fluid (DEF) Delivery
Monitored Parameter	NOx Conversion Efficiency
Typical Enabling Conditions	Closed Loop DEF Dosing
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Parked SCR Efficiency Test

Check as follows:

1. Connect DiagnosticLink .
2. Using a refractometer from the DEF Test Kit W060589001900, measure the DEF percentage. Is DEF percentage between 31 and 34%?
   - 2.a Yes; Go to step 3.
   - 2.b No; clean/flush the DEF tank. Go to step 4. Refer to section "Flushing of the Diesel Exhaust Fluid System" . Verify repair.
3. Remove the DEF dosing unit. Do not disconnect the DEF lines or electrical connector. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" .
4. Perform DEF Quantity Test service routine and record the amount of DEF dispensed. Is the dispensed DEF fluid level between 108 and 132 mL?
   - 4.a Yes; Go to step 5.
   - 4.b No; replace the DEF dosing unit. To verify repairs, Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . Go to step 10.
5. Install the DEF dosing unit. Refer to section "Installation of the Diesel Exhaust Fluid Dosing Unit " . Go to step 6.

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.

WARNING

ENGINE EXHAUST

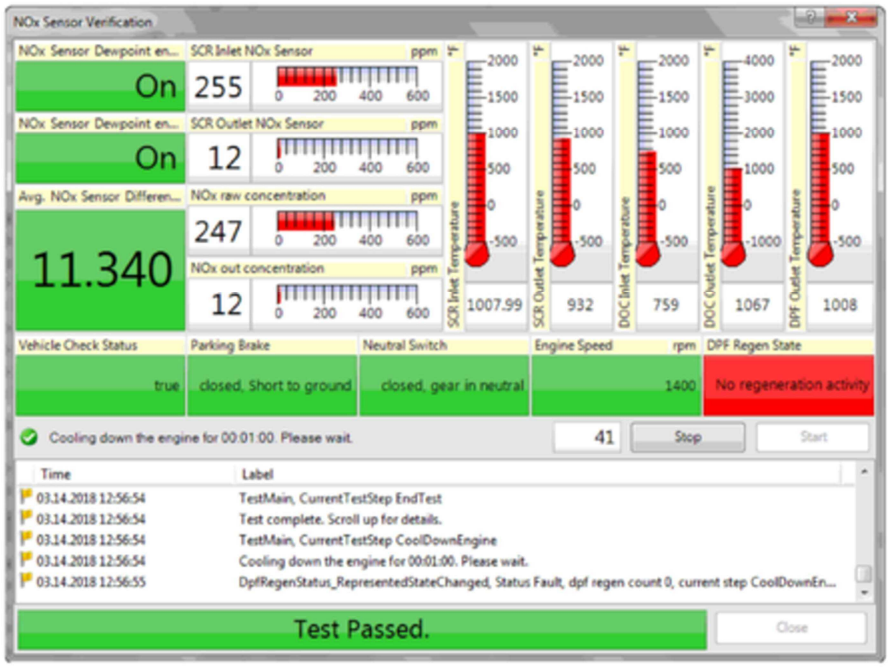
To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

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.

6. Start the engine. Using DiagnosticLink, run the NOx Sensor Verification test located in the drop-down menu under Actions / Aftertreatment. .



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7. Did the NOx Sensor Verification test pass?
   7.a Yes; Go to step 10.
   7.b No; replace the inlet NOx sensor.
      For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" . Go to step 8.
      For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" . Go to step 8.
8. Start the engine. Run the NOx Sensor Verification panel a second time to verify both sensors are now reading correctly.
9. Did the NOx Sensor Verification test pass?
   9.a Yes; Go to step 10.
   9.b No; replace the outlet NOx sensor.
      For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" . Go to step 10.
      For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" . Go to step 10.

⚠ 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.

WARNING

ENGINE EXHAUST

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

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.

10. Turn the ignition OFF and allow for all modules to power down, then turn the ignition back ON and start the engine. Go to step 11.
11. Perform a Parked SCR Efficiency test to clear fault and verify repairs. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

423.2 SPN 520372/FMI 16 - GHG17

Selective Catalyst Reduction Closed Loop Control at Maximum Limit

SPN 520372/FMI 16	
Description	The Fault Indicates High DEF Delivery
Monitored Parameter	NOx Conversion Efficiency
Typical Enabling Conditions	Closed Loop DEF Dosing
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Parked SCR Efficiency Test

Check as follows:

1. Connect DiagnosticLink .
2. Use the chart below to verify the Aftertreatment Control Module (ACM) software level is up to date. Is the current ACM software and fuel map at or greater than the chart below?

   2.a Yes; Go to step 3.

   2.b No; update to the latest ACM software configuration on the server. Go to step 3.

   ACM 7.56.6.0 software with fuel map ZGS Version

Model	ATS Configuration	Software Version	ACM Fuel Map Version
DD15, DD16,DD13	1-Box	7.56.6.0	ZGS 005
DD13	Two-Box 2HV / 2HH	7.56.6.0	ZGS 004
DD13	Two-Box 2V2	7.56.6.0	ZGS 004
DD13	1-Box FCCC, Terex Crane	7.56.6.0	ZGS 005
DD13	1-Box non-DTNA	7.56.6.0	ZGS 004
DD13	Two-Box 2V2 non-DTNA	7.56.6.0	ZGS 003
DD13	EvoBus	7.56.6.0	ZGS 005

3. Check for multiple fault codes. Are any of the following faults present: SPN 4331/FMI 15, SPN 3216/FMI 16, SPN 520372/FMI 14 or SPN 5841/FMI 14?

   3.a Yes; diagnose the other fault code first.

   3.b No; Go to step 4.

4. Using a refractometer from the DEF Test Kit W060589001900, measure the DEF percentage. Is DEF percentage between 31 and 34%?

   4.a Yes; Go to step 5.

   4.b No; clean/flush the DEF tank. Go to step 5. Refer to section "Flushing of the Diesel Exhaust Fluid System" .

5. Unbolt the DEF Dosing Unit from the aftertreatment device. Do not disconnect DEF lines or electrical connector. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" .
6. Perform DEF Quantity Test service routine and record the amount of DEF dispensed. Is the dispensed DEF fluid level between 108 and 132 mL?

   6.a Yes; Go to step 7.

   6.b No; replace the DEF Dosing Unit. To verify repairs, Go to step 10. Refer to section "Installation of the Diesel Exhaust Fluid Dosing Unit " .

7. Install the DEF Dosing Unit. Refer to section "Installation of the Diesel Exhaust Fluid Dosing Unit " .

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

8. Start the engine and perform a full parked regeneration. Refer to section "Performing a Parked Regeneration - GHG17" . After the regen has completed, Go to step 9.
9. Turn the ignition OFF and allow for all modules to power down, then turn the ignition back ON and start the engine. Go to step 10.
10. Perform a Parked SCR Efficiency test to clear fault. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

423.1 SPN 520372/FMI 14 - GHG17

SPN 520372/FMI 14	
Description	The Fault Indicates Low Diesel Exhaust Fluid (DEF) Delivery
Monitored Parameter	NOx Conversion Efficiency
Typical Enabling Conditions	Closed Loop DEF Dosing
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Parked SCR Efficiency Test

Check as follows:

1. Connect DiagnosticLink .
2. Using a refractometer from the DEF Test Kit W060589001900, measure the DEF percentage. Is DEF percentage between 31 and 34%?
   - 2.a Yes; Go to step 3.
   - 2.b No; clean/flush the DEF tank. Go to step 4. Refer to section "Flushing of the Diesel Exhaust Fluid System" . Verify repair.
3. Remove the DEF dosing unit. Do not disconnect the DEF lines or electrical connector. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" .
4. Perform DEF Quantity Test service routine and record the amount of DEF dispensed. Is the dispensed DEF fluid level between 108 and 132 mL?
   - 4.a Yes; Go to step 5.
   - 4.b No; replace the DEF dosing unit. To verify repairs, Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . Go to step 10.
5. Install the DEF dosing unit. Refer to section "Installation of the Diesel Exhaust Fluid Dosing Unit " . Go to step 6.

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.

WARNING

ENGINE EXHAUST

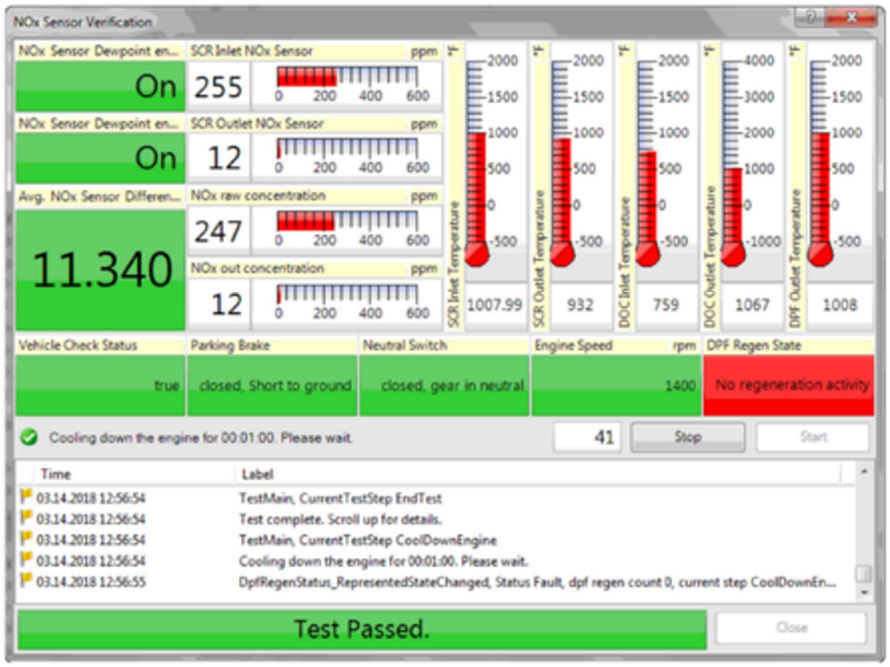
To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

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.

6. Start the engine. Using DiagnosticLink, run the NOx Sensor Verification test located in the drop-down menu under Actions / Aftertreatment. .



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7. Did the NOx Sensor Verification test pass?
   7.a Yes; Go to step 10.
   7.b No; replace the inlet NOx sensor.
   For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" . Go to step 8.
   For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" . Go to step 8.
8. Start the engine. Run the NOx Sensor Verification panel a second time to verify both sensors are now reading correctly.
9. Did the NOx Sensor Verification test pass?
   9.a Yes; Go to step 10.
   9.b No; replace the outlet NOx sensor.
   For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" . Go to step 10.
   For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" . Go to step 10.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

10. Turn the ignition OFF and allow for all modules to power down, then turn the ignition back ON and start the engine. Go to step 11.
11. Perform a Parked SCR Efficiency test to clear fault and verify repairs. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

423.2 SPN 520372/FMI 16 - GHG17

Selective Catalyst Reduction Closed Loop Control at Maximum Limit

SPN 520372/FMI 16	
Description	This fault code sets when the Aftertreatment Control Module (ACM) detects that there is a DEF dosing fault. An additional fault code should set identifying the dosing system fault.
Monitored Parameter	NOx Conversion Efficiency, DEF dosing, DEF pump revolutions.
Typical Enabling Conditions	Closed Loop DEF Dosing
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Perform a parked regeneration, turn the ignition off for five minutes, then perform a parked SCR Efficiency Test.

Check as follows:

WARNING

ENGINE EXHAUST

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

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.

Note : If another dosing system fault code is not present with this fault code, the vehicle will need to run until the fault monitor can run to identify the fault.

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check the ACM software level. Is ACM software level 7.57.4 or higher?
   - 3.a Yes; Go to step 4.
   - 3.b No; update the ACM using the latest server information and Go to step 4.
4. Is the ACM fuel map ZGS 002 or higher?
   - 4.a Yes; Go to step 5.
   - 4.b No; update the ACM using the latest server information and Go to step 5.
5. Check for fault codes. Are there any other DEF dosing, fuel system or engine air management fault codes present?
   - 5.a Yes; diagnose the other fault code(s).

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

5.b No; perform a parked regeneration. Refer to section "Performing a Parked Regeneration - GHG17" . Once the parked regeneration has completed, turn the ignition OFF for five minutes to allow the modules to disconnect. Turn the ignition ON, start the engine and run the SCR Efficiency Test. Refer to section "GHG17 Perform Parked SCR Efficiency Test" . Diagnose the DEF dosing system fault code that sets.

SPN 520372 (ACM) (GHG17)

423.1 SPN 520372/FMI 14 - GHG17

SPN 520372/FMI 14	
Description	The Fault Indicates Low Diesel Exhaust Fluid (DEF) Delivery
Monitored Parameter	NOx Conversion Efficiency
Typical Enabling Conditions	Closed Loop DEF Dosing
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Parked SCR Efficiency Test

Check as follows:

1. Connect DiagnosticLink .
2. Using a refractometer from the DEF Test Kit W060589001900, measure the DEF percentage. Is DEF percentage between 31 and 34%?
   - 2.a Yes; Go to step 3.
   - 2.b No; clean/flush the DEF tank. Go to step 4. Refer to section "Flushing of the Diesel Exhaust Fluid System" . Verify repair.
3. Remove the DEF dosing unit. Do not disconnect the DEF lines or electrical connector. Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" .
4. Perform DEF Quantity Test service routine and record the amount of DEF dispensed. Is the dispensed DEF fluid level between 108 and 132 mL?
   - 4.a Yes; Go to step 5.
   - 4.b No; replace the DEF dosing unit. To verify repairs, Refer to section "Removal of the Diesel Exhaust Fluid Dosing Unit" . Go to step 10.
5. Install the DEF dosing unit. Refer to section "Installation of the Diesel Exhaust Fluid Dosing Unit " . Go to step 6.

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.

WARNING

ENGINE EXHAUST

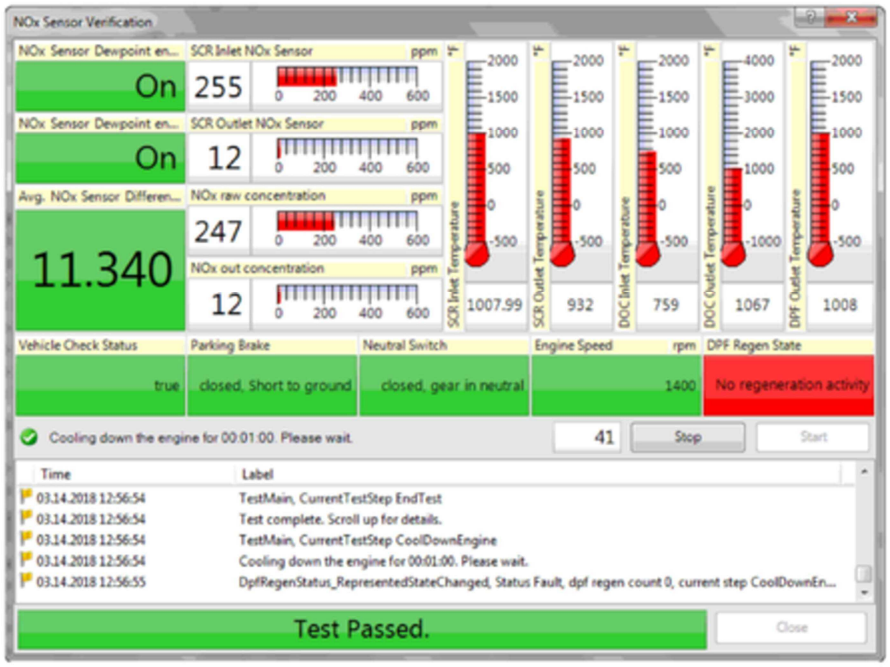
To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

⚠ 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.

6. Start the engine. Using DiagnosticLink, run the NOx Sensor Verification test located in the drop-down menu under Actions / Aftertreatment. .



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7. Did the NOx Sensor Verification test pass?
   7.a Yes; Go to step 10.
   7.b No; replace the inlet NOx sensor.
      For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" . Go to step 8.
      For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Inlet NOx Sensor" . Go to step 8.
8. Start the engine. Run the NOx Sensor Verification panel a second time to verify both sensors are now reading correctly.
9. Did the NOx Sensor Verification test pass?
   9.a Yes; Go to step 10.
   9.b No; replace the outlet NOx sensor.
      For 1-Box™, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" . Go to step 10.
      For Two-Box, Refer to section "Removal of the Selective Catalytic Reduction Outlet NOx Sensor" . Go to step 10.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

10. Turn the ignition OFF and allow for all modules to power down, then turn the ignition back ON and start the engine. Go to step 11.
11. Perform a Parked SCR Efficiency test to clear fault and verify repairs. Refer to section "GHG17 Perform Parked SCR Efficiency Test" .

423.2 SPN 520372/FMI 16 - GHG17

Selective Catalyst Reduction Closed Loop Control at Maximum Limit

SPN 520372/FMI 16	
Description	This fault code sets when the Aftertreatment Control Module (ACM) detects that there is a DEF dosing fault. An additional fault code should set identifying the dosing system fault.
Monitored Parameter	NOx Conversion Efficiency, DEF dosing, DEF pump revolutions.
Typical Enabling Conditions	Closed Loop DEF Dosing
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Perform a parked regeneration, turn the ignition off for five minutes, then perform a parked SCR Efficiency Test.

Check as follows:

WARNING

ENGINE EXHAUST

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

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.

Note : If another dosing system fault code is not present with this fault code, the vehicle will need to run until the fault monitor can run to identify the fault.

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check the ACM software level. Is ACM software level 7.57.4 or higher?
   - 3.a Yes; Go to step 4.
   - 3.b No; update the ACM using the latest server information and Go to step 4.
4. Is the ACM fuel map ZGS 002 or higher?
   - 4.a Yes; Go to step 5.
   - 4.b No; update the ACM using the latest server information and Go to step 5.
5. Check for fault codes. Are there any other DEF dosing, fuel system or engine air management fault codes present?
   - 5.a Yes; diagnose the other fault code(s).

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

5.b No; perform a parked regeneration. Refer to section "Performing a Parked Regeneration - GHG17" . Once the parked regeneration has completed, turn the ignition OFF for five minutes to allow the modules to disconnect. Turn the ignition ON, start the engine and run the SCR Efficiency Test. Refer to section "GHG17 Perform Parked SCR Efficiency Test" . Diagnose the DEF dosing system fault code that sets.

424.1 SPN 520378/FMI 0 - GHG17

Aftertreatment Temperature not plausible

SPN 520378/FMI 0	
Description	This fault sets when more than one aftertreatment temperature sensor drifts greater than 70°C (126°F).
Monitored Parameter	Diesel Oxidation Catalyst (DOC) Inlet/Outlet Temperature vs. Diesel Particulate Filter (DPF) outlet vs. Selective Catalyst Reduction (SCR) Outlet Temperature
Typical Enabling Conditions	Ignition off 8-Hour then cycled on for 60 seconds, Battery voltage above 10.98 V
Execution Frequency	Once Per 8-Hour Cold Soak
Typical Duration	60 seconds
Dash Lamps	MIL, AWL
Engine Reaction	None
Verification	Ignition off/ 8-hour cold soak

Check as follows:

1. Check for multiple fault codes.
   1.a If SPN 3242/FMI 3/4, SPN 3250/FMI 3/4, SPN 3246/FMI 3/4 or SPN4363/FMI 3/4 is also present, repair those faults first.
   1.b If the above faults are not present, Go to step 2.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

2. Start the engine.
3. Run service routine "Perform Performance Check - Low Temp ATD" found under the Diesel Particulate Filter (DPF) System tab. Let the test run completely to stabilize the aftertreatment temperatures.
4. Compare DOC inlet/outlet temperature, DPF outlet temperature and SCR outlet temperature.
5. Replace the two temperature sensors that are drifted more than 25°C (45°F) compared to the other aftertreatment temperature sensor.

SPN 520378 (ACM) (GHG17)

424.1 SPN 520378/FMI 0 - GHG17

Aftertreatment Temperature not plausible

SPN 520378/FMI 0	
Description	This fault sets when more than one aftertreatment temperature sensor drifts greater than 70°C (126°F).
Monitored Parameter	Diesel Oxidation Catalyst (DOC) Inlet/Outlet Temperature vs. Diesel Particulate Filter (DPF) outlet vs. Selective Catalyst Reduction (SCR) Outlet Temperature
Typical Enabling Conditions	Ignition off 8-Hour then cycled on for 60 seconds, Battery voltage above 10.98 V
Execution Frequency	Once Per 8-Hour Cold Soak
Typical Duration	60 seconds
Dash Lamps	MIL, AWL
Engine Reaction	None
Verification	Ignition off/ 8-hour cold soak

Check as follows:

1. Check for multiple fault codes.
   1.a If SPN 3242/FMI 3/4, SPN 3250/FMI 3/4, SPN 3246/FMI 3/4 or SPN4363/FMI 3/4 is also present, repair those faults first.
   1.b If the above faults are not present, Go to step 2.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

2. Start the engine.
3. Run service routine "Perform Performance Check - Low Temp ATD" found under the Diesel Particulate Filter (DPF) System tab. Let the test run completely to stabilize the aftertreatment temperatures.
4. Compare DOC inlet/outlet temperature, DPF outlet temperature and SCR outlet temperature.
5. Replace the two temperature sensors that are drifted more than 25°C (45°F) compared to the other aftertreatment temperature sensor.

425.1 SPN 520381/FMI 2 - GHG17

DOC Inlet Temperature Not Plausible

SPN 520381/FMI 2	
Description	This fault sets if DOC inlet temperature is 70°C (126°F) higher compared to all other aftertreatment temperature sensors after 8-hour cold soak.
Monitored Parameter	Diesel Oxidation Catalyst (DOC) Inlet Temperature versus all other ATS temperature sensors
Typical Enabling Conditions	Engine off for more than 8 hours, Battery Voltage greater than 10.98 V, Ignition on longer than 60 seconds
Monitor Sequence	Key on; engine off for more than 60 seconds
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Ignition off / 8-hour cold soak

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are fault codes SPN 3242/ FMI 3/4 also present?
   - 3.a Yes; diagnose the other fault codes first.
   - 3.b No; Go to step 4.
4. Disconnect and inspect the DOC inlet temperature sensor electrical connector, harness side.
5. Are there any spread pins, damaged pins, corrosion or signs of fretting present?
   - 5.a Yes; repair as necessary. Verify repair.
   - 5.b No; replace the DOC inlet temperature sensor.

     For 1-BOX™, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Temperature Sensor" .Verify repair.

     For Two-Box, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Temperature Sensor" . Verify repair.

SPN 520381 (ACM) (GHG17)

425.1 SPN 520381/FMI 2 - GHG17

DOC Inlet Temperature Not Plausible

SPN 520381/FMI 2	
Description	This fault sets if DOC inlet temperature is 70°C (126°F) higher compared to all other aftertreatment temperature sensors after 8-hour cold soak.
Monitored Parameter	Diesel Oxidation Catalyst (DOC) Inlet Temperature versus all other ATS temperature sensors
Typical Enabling Conditions	Engine off for more than 8 hours, Battery Voltage greater than 10.98 V, Ignition on longer than 60 seconds
Monitor Sequence	Key on; engine off for more than 60 seconds
Execution Frequency	Continuous when enabling conditions met
Typical Duration	2 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Ignition off / 8-hour cold soak

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are fault codes SPN 3242/ FMI 3/4 also present?
   - 3.a Yes; diagnose the other fault codes first.
   - 3.b No; Go to step 4.
4. Disconnect and inspect the DOC inlet temperature sensor electrical connector, harness side.
5. Are there any spread pins, damaged pins, corrosion or signs of fretting present?
   - 5.a Yes; repair as necessary. Verify repair.
   - 5.b No; replace the DOC inlet temperature sensor.

     For 1-BOX™, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Temperature Sensor" .Verify repair.

     For Two-Box, Refer to section "Removal of the Diesel Oxidation Catalyst Inlet Temperature Sensor" . Verify repair.

426.1 SPN 521001/FMI 14

Check as follows:

1. Has the vehicle's Transmission Control Module (TCM), Aftertreatment Control Module (ACM), Motor Control Module (MCM), or Common Powertrain Controller (CPC) been recently programmed?
   - 1.a Yes; verify correct software levels are present.
   - 1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Are there any other active transmission-related faults also present other than SPN 521001/FMI 14 or SPN 521002/FMI 14?
   - 4.a Yes; repair other transmission faults first.
   - 4.b No; Go to step 5.
5. Are there any chassis-side Anti-lock Brake System (ABS) faults present?
   - 5.a Yes; refer to OEM literature for ABS diagnostics.
   - 5.b No; Go to step 6.
6. Are there any CAN/J1939 communication faults present?
   - 6.a Yes; repair those faults first.
   - 6.b No; Go to step 7.
7. Is the vehicle experiencing any drivability complaints related to Transmission Symptom Diagnostics?
   - 7.a Yes; complete the appropriate Symptom Diagnostic section
   - 7.b No; Go to step 8.
8. Under instrumentation "Transmission" tab, does the clutch and transmission learned values display "learned values available"?
   - 8.a Yes; Go to step 9.
   - 8.b No; under the Actions drop-down menu "Transmission Selection," perform the "Transmission Learn Procedure."
9. In DiagnosticLink, ensure auto-connect to J1708 and J1939 devices is enabled. If the unit can be driven, obtain a driving log file. If the unit cannot be driven, attempt to duplicate the complaint or complete an Engine Idle Gear/Split/Range test going through all gears. Obtain DDEC Reports, and contact Software Support at the Detroit™ Customer Support Center at 855-253-0428 for further transmission assistance.

SPN 521001 (CPC3) (GHG17)

426.1 SPN 521001/FMI 14

Check as follows:

1. Has the vehicle's Transmission Control Module (TCM), Aftertreatment Control Module (ACM), Motor Control Module (MCM), or Common Powertrain Controller (CPC) been recently programmed?
   - 1.a Yes; verify correct software levels are present.
   - 1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Are there any other active transmission-related faults also present other than SPN 521001/FMI 14 or SPN 521002/FMI 14?
   - 4.a Yes; repair other transmission faults first.
   - 4.b No; Go to step 5.
5. Are there any chassis-side Anti-lock Brake System (ABS) faults present?
   - 5.a Yes; refer to OEM literature for ABS diagnostics.
   - 5.b No; Go to step 6.
6. Are there any CAN/J1939 communication faults present?
   - 6.a Yes; repair those faults first.
   - 6.b No; Go to step 7.
7. Is the vehicle experiencing any drivability complaints related to Transmission Symptom Diagnostics?
   - 7.a Yes; complete the appropriate Symptom Diagnostic section
   - 7.b No; Go to step 8.
8. Under instrumentation "Transmission" tab, does the clutch and transmission learned values display "learned values available"?
   - 8.a Yes; Go to step 9.
   - 8.b No; under the Actions drop-down menu "Transmission Selection," perform the "Transmission Learn Procedure."
9. In DiagnosticLink, ensure auto-connect to J1708 and J1939 devices is enabled. If the unit can be driven, obtain a driving log file. If the unit cannot be driven, attempt to duplicate the complaint or complete an Engine Idle Gear/Split/Range test going through all gears. Obtain DDEC Reports, and contact Software Support at the Detroit™ Customer Support Center at 855-253-0428 for further transmission assistance.

427.1 SPN 521002/FMI 14

DT12 Automatic Mode not Available

1. Has the vehicle's Transmission Control Module (TCM), Aftertreatment Control Module (ACM), Motor Control Module (MCM), or Common Powertrain Controller (CPC) been recently programmed?
   - 1.a Yes; verify correct software levels are present.
   - 1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Are there any other active transmission related faults also present other than SPN 521002/FMI 14 or SPN 521001/FMI 14?
   - 4.a Yes; repair other transmission faults first.
   - 4.b No; Go to step 5.
5. Are there any chassis-side Anti-lock Brake System (ABS) faults present?
   - 5.a Yes; refer to OEM literature for ABS diagnostics.
   - 5.b No; Go to step 6.
6. Are there any CAN/J1939 communication faults present?
   - 6.a Yes; repair those faults first.
   - 6.b No; Go to step 7.
7. Is the vehicle experiencing any drivability complaints related to Transmission Symptom Diagnostics?
   - 7.a Yes; complete the appropriate Symptom Diagnostic section.
   - 7.b No; Go to step 8.
8. Under instrumentation "transmission" tab, does the clutch and transmission learned values display "learned values available"?
   - 8.a Yes; Go to step 9.
   - 8.b No; under the Actions dropdown menu "Transmission Selection," perform the "Transmission Learn Procedure."
9. In DiagnosticLink, ensure auto-connect to J1708 and J1939 devices is enabled. If the unit can be driven, obtain a driving log file. If the unit cannot be driven, attempt to duplicate the complaint or complete an engine idle Gear/Split/Range test going through all gears, obtain DDEC Reports, and contact the Detroit™ Customer Support Center at 855-253-0428 for further transmission assistance.

SPN 521002 (CPC3) (GHG17)

427.1 SPN 521002/FMI 14

DT12 Automatic Mode not Available

1. Has the vehicle's Transmission Control Module (TCM), Aftertreatment Control Module (ACM), Motor Control Module (MCM), or Common Powertrain Controller (CPC) been recently programmed?
   - 1.a Yes; verify correct software levels are present.
   - 1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Are there any other active transmission related faults also present other than SPN 521002/FMI 14 or SPN 521001/FMI 14?
   - 4.a Yes; repair other transmission faults first.
   - 4.b No; Go to step 5.
5. Are there any chassis-side Anti-lock Brake System (ABS) faults present?
   - 5.a Yes; refer to OEM literature for ABS diagnostics.
   - 5.b No; Go to step 6.
6. Are there any CAN/J1939 communication faults present?
   - 6.a Yes; repair those faults first.
   - 6.b No; Go to step 7.
7. Is the vehicle experiencing any drivability complaints related to Transmission Symptom Diagnostics?
   - 7.a Yes; complete the appropriate Symptom Diagnostic section.
   - 7.b No; Go to step 8.
8. Under instrumentation "transmission" tab, does the clutch and transmission learned values display "learned values available"?
   - 8.a Yes; Go to step 9.
   - 8.b No; under the Actions dropdown menu "Transmission Selection," perform the "Transmission Learn Procedure."
9. In DiagnosticLink, ensure auto-connect to J1708 and J1939 devices is enabled. If the unit can be driven, obtain a driving log file. If the unit cannot be driven, attempt to duplicate the complaint or complete an engine idle Gear/Split/Range test going through all gears, obtain DDEC Reports, and contact the Detroit™ Customer Support Center at 855-253-0428 for further transmission assistance.

428.1 SPN 521003/FMI 14 - GHG17

This fault indicates the CPC3 has detected inconsistent ABS input signals and has disabled eCoast during this condition.

1. Connect DiagnosticLink 8.0 or higher to all Powertrain and Chassis modules on the vehicle. Are there any ABS speed sensor or communication faults present on any modules (active/inactive)?

   1.a Yes; repair those faults first.

   1.b No; road test the vehicle. If fault does not become active, release the truck. If fault becomes active, repeat step 1.

428.1 SPN 521003/FMI 14 - GHG17

This fault indicates the CPC3 has detected inconsistent ABS input signals and has disabled eCoast during this condition.

1. Connect DiagnosticLink 8.0 or higher to all Powertrain and Chassis modules on the vehicle. Are there any ABS speed sensor or communication faults present on any modules (active/inactive)?

   1.a Yes; repair those faults first.

   1.b No; road test the vehicle. If fault does not become active, release the truck. If fault becomes active, repeat step 1.

SPN 521003 (CPC3) (GHG17)

428.1 SPN 521003/FMI 14 - GHG17

This fault indicates the CPC3 has detected inconsistent ABS input signals and has disabled eCoast during this condition.

1. Connect DiagnosticLink 8.0 or higher to all Powertrain and Chassis modules on the vehicle. Are there any ABS speed sensor or communication faults present on any modules (active/inactive)?

   1.a Yes; repair those faults first.

   1.b No; road test the vehicle. If fault does not become active, release the truck. If fault becomes active, repeat step 1.

429.1 SPN 521004/FMI 14

This Fault Indicates CPC3 Has Detected an Incompatible or Missing Dataset

1. Connect DiagnosticLink® 8.07 SP2 or higher.
2. Turn ignition ON (key ON, engine OFF).
3. Under the "Identification" heading, "Common" tab, verify a shift map part number is present in the CPC3. Is a shift map part number present?

   3.a Yes; Go to step 4.

   3.a No; program the CPC3 to the latest server setting.
4. Under the "Identification" heading, "Common" tab, verify the correct transmission type is set under the TCM heading, based on the metal identification plate on the lower left rear of the transmission. Is the transmission type set correctly?

   4.a Yes; Go to step 5.

   4.a No; under the "Actions" tab, "Transmission" heading, select "TCM replacement" and reset the transmission type accordingly. After reset, perform a Transmission/Clutch Relearn.
5. Reprogram the CPC3/MCM/ACM/TCM to the latest server configuration.

429.1 SPN 521004/FMI 14

This Fault Indicates CPC3 Has Detected an Incompatible or Missing Dataset

1. Connect DiagnosticLink® 8.07 SP2 or higher.
2. Turn ignition ON (key ON, engine OFF).
3. Under the "Identification" heading, "Common" tab, verify a shift map part number is present in the CPC3. Is a shift map part number present?

   3.a Yes; Go to step 4.

   3.a No; program the CPC3 to the latest server setting.
4. Under the "Identification" heading, "Common" tab, verify the correct transmission type is set under the TCM heading, based on the metal identification plate on the lower left rear of the transmission. Is the transmission type set correctly?

   4.a Yes; Go to step 5.

   4.a No; under the "Actions" tab, "Transmission" heading, select "TCM replacement" and reset the transmission type accordingly. After reset, perform a Transmission/Clutch Relearn.
5. Reprogram the CPC3/MCM/ACM/TCM to the latest server configuration.

SPN 521004 (CPC3) (GHG17)

429.1 SPN 521004/FMI 14

This Fault Indicates CPC3 Has Detected an Incompatible or Missing Dataset

1. Connect DiagnosticLink® 8.07 SP2 or higher.
2. Turn ignition ON (key ON, engine OFF).
3. Under the "Identification" heading, "Common" tab, verify a shift map part number is present in the CPC3. Is a shift map part number present?

   3.a Yes; Go to step 4.

   3.a No; program the CPC3 to the latest server setting.
4. Under the "Identification" heading, "Common" tab, verify the correct transmission type is set under the TCM heading, based on the metal identification plate on the lower left rear of the transmission. Is the transmission type set correctly?

   4.a Yes; Go to step 5.

   4.a No; under the "Actions" tab, "Transmission" heading, select "TCM replacement" and reset the transmission type accordingly. After reset, perform a Transmission/Clutch Relearn.
5. Reprogram the CPC3/MCM/ACM/TCM to the latest server configuration.

430.1 SPN 521005/FMI 14 - GHG17

Check as follows:

1. Compare CPC3 parameters to OEM settings and adjust as necessary.

SPN 521005 (CPC3) (GHG17)

430.1 SPN 521005/FMI 14 - GHG17

Check as follows:

1. Compare CPC3 parameters to OEM settings and adjust as necessary.

431.1 SPN 521005/FMI 3 - GHG17

SPN 521005/FMI 3	
Description	Internal Power Supply Voltage Failed High
Monitored Parameter	Internal Power Supply Voltage
Typical Enabling Conditions	Continuous
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Are Met
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition ON

Check as follows:

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

1. Check for multiple codes. Are there any battery voltage faults present (SPN 168/FMI any) ?
   - 1.a Yes; troubleshoot these codes first.
   - 1.b No; Go to step 2.
2. Disconnect the MCM 21-pin connector and inspect connector for corrosion, oil, fuel or water intrusion. Is contamination found?
   - 2.a Yes; repair as necessary.
   - 2.b No; Go to step 3.
3. Is fault code SPN 521005/FMI 3 active?
   - 3.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repair.
   - 3.b No; this fault may have set due to a low MCM voltage while cranking or when the ignition has been left on. No further diagnostics or repairs are necessary. Erase the fault code and release the vehicle.

431.2 SPN 521005/FMI 4 - GHG17

SPN 521005/FMI 4	
Description	Internal Power Supply Voltage Failed Low
Monitored Parameter	Internal Power Supply Voltage
Typical Enabling Conditions	Continuous
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Are Met
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition ON

Check as follows:

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

1. Check for multiple codes. Are there any battery voltage faults present (SPN 168/FMI any) ?
   - 1.a Yes; troubleshoot these codes first.
   - 1.b No; Go to step 2.
2. Disconnect the MCM 21-pin connector and inspect connector for corrosion, oil, fuel or water intrusion. Is contamination found?
   - 2.a Yes; repair as necessary.
   - 2.b No; Go to step 3.
3. 3. Is fault code SPN 521005/FMI 4 active?
   - 3.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repair.
   - 3.b No; this fault may have set due to a low MCM voltage while cranking or when the ignition has been left on. No further diagnostics or repairs are necessary. Erase the fault code and release the vehicle.

SPN 521005 (MCM) (GHG17)

431.1 SPN 521005/FMI 3 - GHG17

SPN 521005/FMI 3	
Description	Internal Power Supply Voltage Failed High
Monitored Parameter	Internal Power Supply Voltage
Typical Enabling Conditions	Continuous
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Are Met
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition ON

Check as follows:

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

1. Check for multiple codes. Are there any battery voltage faults present (SPN 168/FMI any) ?
   - 1.a Yes; troubleshoot these codes first.
   - 1.b No; Go to step 2.
2. Disconnect the MCM 21-pin connector and inspect connector for corrosion, oil, fuel or water intrusion. Is contamination found?
   - 2.a Yes; repair as necessary.
   - 2.b No; Go to step 3.
3. Is fault code SPN 521005/FMI 3 active?
   - 3.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repair.
   - 3.b No; this fault may have set due to a low MCM voltage while cranking or when the ignition has been left on. No further diagnostics or repairs are necessary. Erase the fault code and release the vehicle.

431.2 SPN 521005/FMI 4 - GHG17

SPN 521005/FMI 4	
Description	Internal Power Supply Voltage Failed Low
Monitored Parameter	Internal Power Supply Voltage
Typical Enabling Conditions	Continuous
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Are Met
Typical Duration	Two Seconds
Dash Lamps	None
Engine Reaction	None
Verification	Ignition ON

Check as follows:

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

1. Check for multiple codes. Are there any battery voltage faults present (SPN 168/FMI any) ?
   - 1.a Yes; troubleshoot these codes first.
   - 1.b No; Go to step 2.
2. Disconnect the MCM 21-pin connector and inspect connector for corrosion, oil, fuel or water intrusion. Is contamination found?
   - 2.a Yes; repair as necessary.
   - 2.b No; Go to step 3.
3. 3. Is fault code SPN 521005/FMI 4 active?
   - 3.a Yes; replace the MCM. Refer to section "Removal of the Motor Control Module" . Verify repair.
   - 3.b No; this fault may have set due to a low MCM voltage while cranking or when the ignition has been left on. No further diagnostics or repairs are necessary. Erase the fault code and release the vehicle.

432.1 SPN 521006/FMI 14 - GHG17

Check as follows:

This fault indicates an internal failure of the DT12 shift stalk lever. Replace the shift stalk lever.

SPN 521006 (CPC3) (GHG17)

432.1 SPN 521006/FMI 14 - GHG17

Check as follows:

This fault indicates an internal failure of the DT12 shift stalk lever. Replace the shift stalk lever.

433.1 SPN 521007/FMI 14 - GHG17

This fault indicates an internal failure of the DT12 shift stalk lever. Replace the shift stalk lever.

SPN 521007 (CPC3) (GHG17)

433.1 SPN 521007/FMI 14 - GHG17

This fault indicates an internal failure of the DT12 shift stalk lever. Replace the shift stalk lever.

434.1 SPN 521008/FMI 14 - GHG17

This fault indicates the DT12 shift stalk lever is incorrectly configured. Reprogram CPC3 to OEM settings.

SPN 521008 (CPC3) (GHG17)

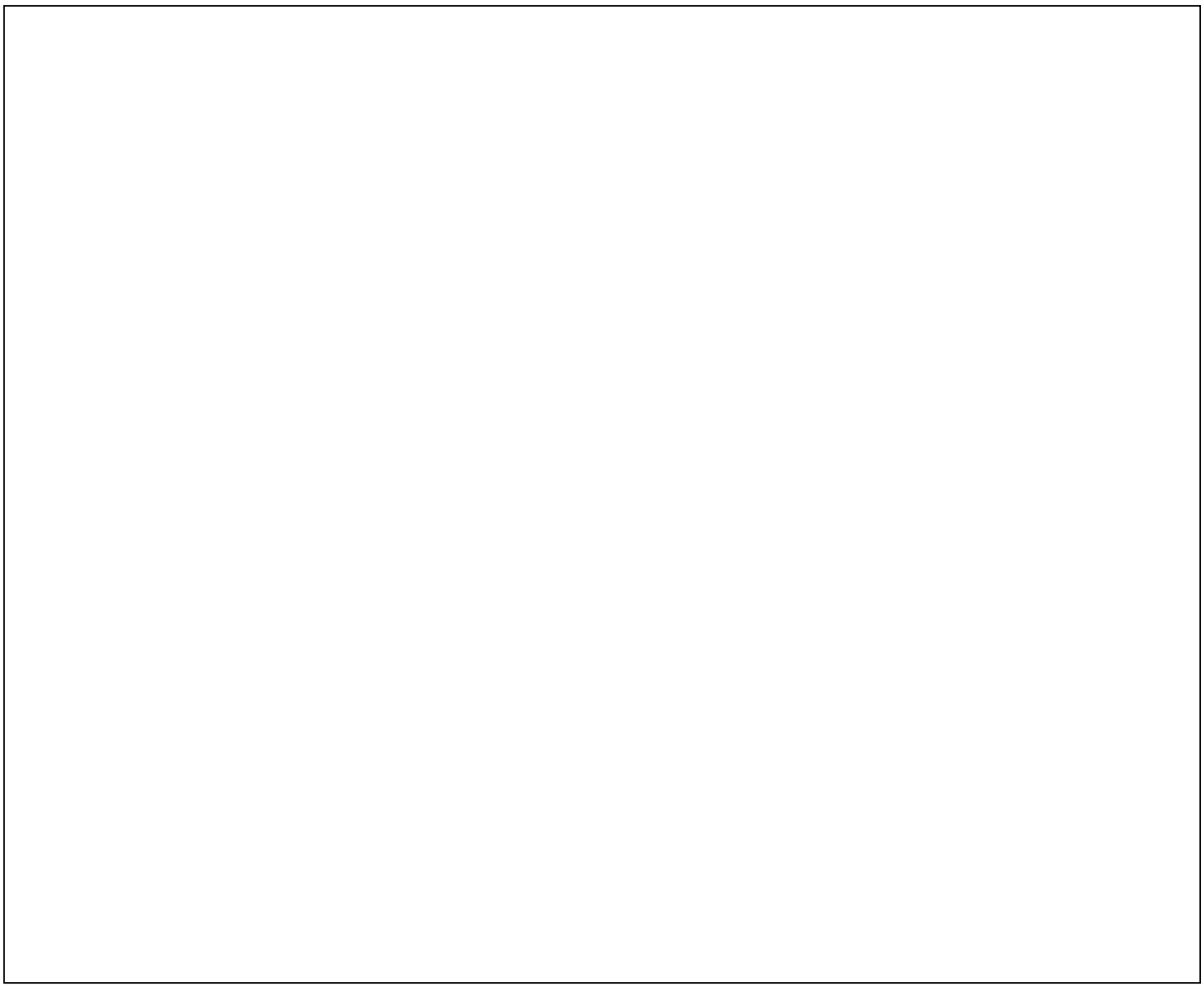
434.1 SPN 521008/FMI 14 - GHG17

This fault indicates the DT12 shift stalk lever is incorrectly configured. Reprogram CPC3 to OEM settings.

435.1 SPN 521012/FMI 1 - GHG17

Intake Deviation Low

SPN 521012/FMI 1	
Description	Intake Manifold Pressure Too Low
Monitored Parameter	
Typical Enabling Conditions	
Monitor Sequence	
Execution Frequency	
Typical Duration	
Dash Lamps	MIL
Engine Reaction	25% Derate
Verification	At operating temperature of 71°C (160°F). Drive at highway speed with loaded trailer above 1130 rpm continuously for five minutes.



Check as follows:

1. Inspect the entire air intake system, including the Charge Air Cooler (CAC), for leaks and/or restrictions.

1.a If the air intake system leaks or restrictions are found, repair as necessary. Verify repairs.

1.b If no air intake system leaks are found, Go to step 2.

2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Compare intake manifold pressure to barometric pressure using the chart below. Tolerances will vary depending on the intake air temperature. Is the intake manifold pressure within the tolerance range of barometric pressure indicated below?

Intake Air Temperature	**Tolerance**
-40°C to 10°C (-40°F to 50°F)	+/- 8.6 kPa (1.25 psi)
10°C to 110°C (50°F to 230°F)	+/- 5.6 kPa (0.81 psi)
110°C to 130°C (230°F to 266°F)	+/- 8.6 kPa (1.25 psi)

4.a Yes; Go to step 5.

4.b No; replace the intake manifold pressure/temperature sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" .

5. Disconnect the intake manifold pressure/temperature sensor.
6. Inspect intake manifold pressure/temperature sensor connector for bent, spread or corroded pins.

6.a If damage is found, repair the intake manifold pressure/temperature sensor connector as necessary. Verify repairs.

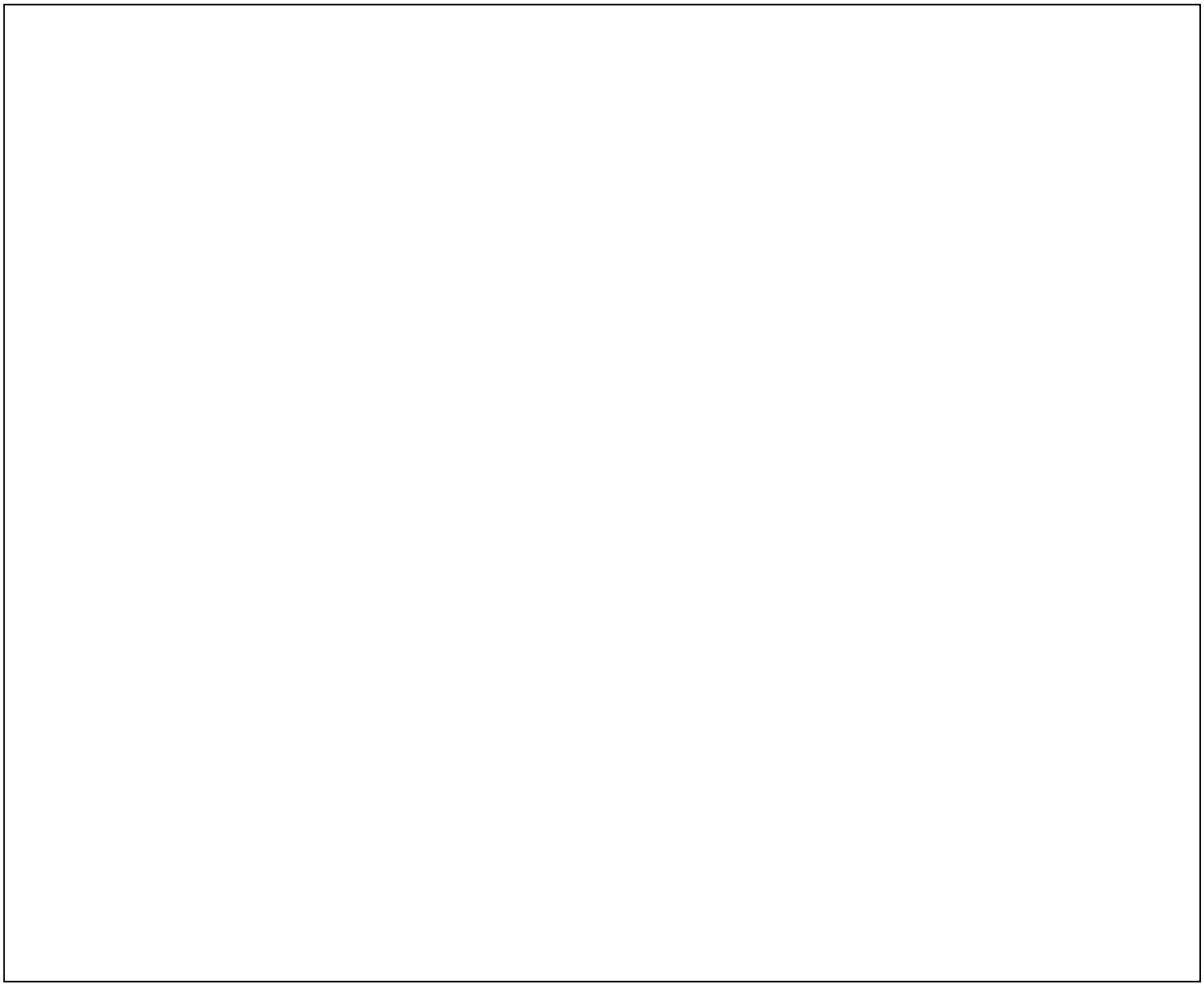
6.b If no damage is found, replace the intake manifold pressure/temperature sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" .

SPN 521012 (MCM) (GHG17)

435.1 SPN 521012/FMI 1 - GHG17

Intake Deviation Low

SPN 521012/FMI 1	
Description	Intake Manifold Pressure Too Low
Monitored Parameter	
Typical Enabling Conditions	
Monitor Sequence	
Execution Frequency	
Typical Duration	
Dash Lamps	MIL
Engine Reaction	25% Derate
Verification	At operating temperature of 71°C (160°F). Drive at highway speed with loaded trailer above 1130 rpm continuously for five minutes.



Check as follows:

1. Inspect the entire air intake system, including the Charge Air Cooler (CAC), for leaks and/or restrictions.
   1.a If the air intake system leaks or restrictions are found, repair as necessary. Verify repairs.
   1.b If no air intake system leaks are found, Go to step 2.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Compare intake manifold pressure to barometric pressure using the chart below. Tolerances will vary depending on the intake air temperature. Is the intake manifold pressure within the tolerance range of barometric pressure indicated below?

Intake Air Temperature	**Tolerance**
-40°C to 10°C (-40°F to 50°F)	+/- 8.6 kPa (1.25 psi)
10°C to 110°C (50°F to 230°F)	+/- 5.6 kPa (0.81 psi)
110°C to 130°C (230°F to 266°F)	+/- 8.6 kPa (1.25 psi)

   4.a Yes; Go to step 5.
   4.b No; replace the intake manifold pressure/temperature sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" .
5. Disconnect the intake manifold pressure/temperature sensor.
6. Inspect intake manifold pressure/temperature sensor connector for bent, spread or corroded pins.
   6.a If damage is found, repair the intake manifold pressure/temperature sensor connector as necessary. Verify repairs.
   6.b If no damage is found, replace the intake manifold pressure/temperature sensor. Refer to section "Removal of the Intake Pressure/Temperature Sensor" .

436.1 SPN 521013/FMI 31 - GHG17

SPN 521013/FMI 31	
Description	Symmetric Injection Mode Expected
Monitored Parameter	Injector Duration Ratio
Typical Enabling Conditions	Injector Duration Ratio greater than 0.5
Monitor Sequence	Engine Load greater than 20% and less than 100%, Engine Speed Gradient less than or equal to 200 rpm
Execution Frequency	Five Seconds, Two Times in one Drive Cycle
Typical Duration	
Dash Lamps	MIL
Engine Reaction	None
Verification	

1. Are any of the following faults present?

- SPN 651/FMI any
- SPN 652/FMI any
- SPN 653/FMI any
- SPN 654/FMI any
- SPN 655/FMI any
- SPN 656/FMI any
- SPN 2797/FMI any
- SPN 2798/FMI any
- SPN 1072/FMI any
- SPN 1073/FMI any

1.a Yes; troubleshoot that fault code first.

1.b No; Go to step 2.

2. Disconnect both injector harness 14-pin connectors. Inspect the fuel injector harness 14-pin connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Was an issue found?

2.a Yes; repair as needed. Clear fault and release to customer.

2.b No; clear fault and release to customer.

SPN 521013 (MCM) (GHG17)

436.1 SPN 521013/FMI 31 - GHG17

SPN 521013/FMI 31	
Description	Symmetric Injection Mode Expected
Monitored Parameter	Injector Duration Ratio
Typical Enabling Conditions	Injector Duration Ratio greater than 0.5
Monitor Sequence	Engine Load greater than 20% and less than 100%, Engine Speed Gradient less than or equal to 200 rpm
Execution Frequency	Five Seconds, Two Times in one Drive Cycle
Typical Duration	
Dash Lamps	MIL
Engine Reaction	None
Verification	

1. Are any of the following faults present?

- SPN 651/FMI any
- SPN 652/FMI any
- SPN 653/FMI any
- SPN 654/FMI any
- SPN 655/FMI any
- SPN 656/FMI any
- SPN 2797/FMI any
- SPN 2798/FMI any
- SPN 1072/FMI any
- SPN 1073/FMI any

1.a Yes; troubleshoot that fault code first.

1.b No; Go to step 2.

2. Disconnect both injector harness 14-pin connectors. Inspect the fuel injector harness 14-pin connector for bent or spread pins; inspect the connector seal for damage (signs of water or oil intrusion). Was an issue found?

2.a Yes; repair as needed. Clear fault and release to customer.

2.b No; clear fault and release to customer.

437.1 SPN 521014/FMI 19 - GHG17

This fault indicates the CPC3 has lost communication with the DT12 shift stalk lever.

Shift Lever Pin Number	Signal Description	CPC3 Connector Pin
1	12V Ignition	3/21 Ignition
2	LIN	3/47 LIN COM
3	GND	3/34 Main Battery Ground
4	No Connection	No Connection

Check as follows:

1. Shut off the engine, apply the parking brake, chock the wheels, and perform any other applicable safety steps.
2. Disconnect shift stalk lever.
3. Turn ignition ON (key ON, engine OFF).
4. Measure voltage between pin 1 of the shift stalk harness connector and ground. Is the voltage between 11.5 and 12 volts?
   - 4.a Yes; Go to step 5.
   - 4.b No; Go to step 9.
5. Turn ignition OFF.
6. Disconnect CPC3 connector #3.
7. Inspect CPC3 connector #3 for bent, spread, or corroded pins. Is pin damage present?
   - 7.a Yes; repair as necessary.
   - 7.b No; Go to step 8.
8. Measure the resistance between pin 47 of the CPC3 connector #3 and pin 2 of the shift stalk lever harness connector. Is the resistance less than five ohms?
   - 8.a Yes; Go to step 9.
   - 8.b No; repair wire between pin 47 of the CPC3 connector #3 and pin 2 of the shift stalk lever harness connector.
9. Measure the resistance between pin 34 of the CPC3 connector #3 and pin 3 of the shift stalk lever harness connector. Is the resistance less than five ohms?
   - 9.a Yes; replace the shift stalk lever.
   - 9.b No; repair wire between pin 34 of the CPC3 connector #3 and pin 3 of the shift stalk lever harness connector.
10. Turn the ignition OFF.
11. Disconnect CPC3 connector #3.
12. Measure the resistance between pin 21 of the CPC3 connector #3 and pin 1 of the shift stalk lever harness connector. Is the resistance less than five ohms?
    - 12.a Yes; refer to OEM literature for chassis side harness information on Ignition supply voltage to pin 21 of the CPC3 connector #3.
    - 12.b No; repair wire between pin 21 of the CPC3 connector #3 and pin 1 of the shift stalk lever harness connector.

SPN 521014 (CPC3) (GHG17)

437.1 SPN 521014/FMI 19 - GHG17

This fault indicates the CPC3 has lost communication with the DT12 shift stalk lever.

Shift Lever Pin Number	Signal Description	CPC3 Connector Pin
1	12V Ignition	3/21 Ignition
2	LIN	3/47 LIN COM
3	GND	3/34 Main Battery Ground
4	No Connection	No Connection

Check as follows:

1. Shut off the engine, apply the parking brake, chock the wheels, and perform any other applicable safety steps.
2. Disconnect shift stalk lever.
3. Turn ignition ON (key ON, engine OFF).
4. Measure voltage between pin 1 of the shift stalk harness connector and ground. Is the voltage between 11.5 and 12 volts?
   - 4.a Yes; Go to step 5.
   - 4.b No; Go to step 9.
5. Turn ignition OFF.
6. Disconnect CPC3 connector #3.
7. Inspect CPC3 connector #3 for bent, spread, or corroded pins. Is pin damage present?
   - 7.a Yes; repair as necessary.
   - 7.b No; Go to step 8.
8. Measure the resistance between pin 47 of the CPC3 connector #3 and pin 2 of the shift stalk lever harness connector. Is the resistance less than five ohms?
   - 8.a Yes; Go to step 9.
   - 8.b No; repair wire between pin 47 of the CPC3 connector #3 and pin 2 of the shift stalk lever harness connector.
9. Measure the resistance between pin 34 of the CPC3 connector #3 and pin 3 of the shift stalk lever harness connector. Is the resistance less than five ohms?
   - 9.a Yes; replace the shift stalk lever.
   - 9.b No; repair wire between pin 34 of the CPC3 connector #3 and pin 3 of the shift stalk lever harness connector.
10. Turn the ignition OFF.
11. Disconnect CPC3 connector #3.
12. Measure the resistance between pin 21 of the CPC3 connector #3 and pin 1 of the shift stalk lever harness connector. Is the resistance less than five ohms?
    - 12.a Yes; refer to OEM literature for chassis side harness information on Ignition supply voltage to pin 21 of the CPC3 connector #3.
    - 12.b No; repair wire between pin 21 of the CPC3 connector #3 and pin 1 of the shift stalk lever harness connector.

438.1 SPN 521015/FMI 12 - GHG17

This fault indicates and internal failure of the DT12 shift stalk lever. Replace the shift stalk lever.

SPN 521015 (CPC3) (GHG17)

438.1 SPN 521015/FMI 12 - GHG17

This fault indicates and internal failure of the DT12 shift stalk lever. Replace the shift stalk lever.

439.1 SPN 521018/FMI 0 - GHG17

Group 1 Sensors Not Plausible

SPN 521018/FMI 0	
Description	This Fault Code Sets when One or More Sensors from Group 2 and One or More Sensors from Group 3 are Not Within an Expected Range After an 8 Hour Cold Soak.
Monitored Parameter	Fuel Temp Engine Oil temp Coolant In Coolant Out Compressor Inlet Charge Air Cooler Outlet Intake Temp Ambient Air Temp
Typical Enabling Conditions	Key ON, Engine OFF, Battery Voltage Greater than 11 Volts, Engine rpm at Zero, Ambient Temperature Less than 40°C (104°F), Ignition Off for No Less than 8 Hours.
Monitor Sequence	None
Execution Frequency	Once Per Cold Cycle
Typical Duration	Five seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Road Test the Vehicle for 30 Minutes Until the Coolant Reaches Operating Temperature. Then Verify that the Engine Oil Temperature is Within 20°C (36°F) of the Engine Coolant Outlet Temperature.

Possible causes:

Note : The use of an external heating unit while the engine has been shut down for a minimum of 8 hours can cause this fault code to set erroneously.

1. Has the Common Powertrain Controller (CPC) recently been reprogrammed or has the internal clock time been changed?
   - 1.a Yes; this fault may have been caused by the change in the CPC time. Go to step 8.
   - 1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Check the MCM software level. Is the MCM software level 6.4.0.5 ZGS 005 or greater?
   - 4.a Yes; Go to step 5.
   - 4.b No; Update the MCM software using the latest server information. Perform the repair verification. If the fault code returns, Go to step 5.
5. Check for multiple fault codes. Are any of the following fault codes present?

- SPN 100/FMI 3 or FMI 4
- SPN 110/FMI 3 or FMI 4
- SPN 171/FMI 3 or FMI 4
- SPN 174/FMI 3 or FMI 4
- SPN 1172/FMI 3 or FMI 4
- SPN 1636/FMI 3 or FMI 4
- SPN 2630/FMI 3 or FMI 4

- SPN 3511/FMI 3 or FMI 4
- SPN 3512/FMI 3 or FMI 4
- SPN 4193/FMI 3 or FMI 4

5.a Yes; diagnose the other fault codes first.

5.b No; Go to step 6.

6. Monitor and record the following readings:

- engine oil temperature
- fuel temperature
- compressor inlet temperature
- intake air temperature
- coolant inlet temperature
- coolant outlet temperature
- charge air cooler outlet temperature

> **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.

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

7. Start the engine.
8. Road test the vehicle for 30 minutes until the coolant reaches operating temperature.
9. Monitor and record the following readings again:

- engine oil temperature
- fuel temperature
- compressor inlet temperature
- intake air temperature
- coolant inlet temperature
- coolant outlet temperature
- charge air cooler outlet temperature

10. Have the values increased from the recorded values in step 5?

10.a Yes; Go to step 12.

10.b No; Go to step 11.

11. Compare the sensor readings in the chart below. Are any of the sensors out of the allowable range?

Sensor	Range	Sensor
Oil temperature	greater than 20°C (36°F)	Coolant outlet temperature
Ambient Air Temperature	greater than 10°C (18°F)	Compressor inlet temperature
Compressor inlet temperature	greater than 10°C (18°F)	Ambient air temperature
Intake temperature	greater than 15°C (27°F)	Intercooler outlet temperature
Coolant inlet temp	greater than 15°C (27°F)	Coolant outlet temperature
Coolant outlet temp	greater than 15°C (27°F)	Coolant inlet temperature
CAC outlet temp	greater than 15°C (27°F)	Intercooler inlet temperature

11.a Yes; Go to step 12.

11.b No; the fault code may have been set due to an external heating unit.

12. Disconnect and inspect the sensor electrical connector of the faulty sensors. Is there damage, corrosion or fretting present?

12.a Yes; repair as necessary. Verify repair.

12.b No; replace the sensors that are out of range. Verify repair.

SPN 521018 (MCM) (GHG17)

439.1 SPN 521018/FMI 0 - GHG17

Group 1 Sensors Not Plausible

SPN 521018/FMI 0	
Description	This Fault Code Sets when One or More Sensors from Group 2 and One or More Sensors from Group 3 are Not Within an Expected Range After an 8 Hour Cold Soak.
Monitored Parameter	Fuel Temp Engine Oil temp Coolant In Coolant Out Compressor Inlet Charge Air Cooler Outlet Intake Temp Ambient Air Temp
Typical Enabling Conditions	Key ON, Engine OFF, Battery Voltage Greater than 11 Volts, Engine rpm at Zero, Ambient Temperature Less than 40°C (104°F), Ignition Off for No Less than 8 Hours.
Monitor Sequence	None
Execution Frequency	Once Per Cold Cycle
Typical Duration	Five seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	Road Test the Vehicle for 30 Minutes Until the Coolant Reaches Operating Temperature. Then Verify that the Engine Oil Temperature is Within 20°C (36°F) of the Engine Coolant Outlet Temperature.

Possible causes:

Note : The use of an external heating unit while the engine has been shut down for a minimum of 8 hours can cause this fault code to set erroneously.

1. Has the Common Powertrain Controller (CPC) recently been reprogrammed or has the internal clock time been changed?

   1.a Yes; this fault may have been caused by the change in the CPC time. Go to step 8.

   1.b No; Go to step 2.

2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Check the MCM software level. Is the MCM software level 6.4.0.5 ZGS 005 or greater?

   4.a Yes; Go to step 5.

   4.b No; Update the MCM software using the latest server information. Perform the repair verification. If the fault code returns, Go to step 5.

5. Check for multiple fault codes. Are any of the following fault codes present?

- SPN 100/FMI 3 or FMI 4
- SPN 110/FMI 3 or FMI 4
- SPN 171/FMI 3 or FMI 4
- SPN 174/FMI 3 or FMI 4

- SPN 1172/FMI 3 or FMI 4
- SPN 1636/FMI 3 or FMI 4
- SPN 2630/FMI 3 or FMI 4
- SPN 3511/FMI 3 or FMI 4
- SPN 3512/FMI 3 or FMI 4
- SPN 4193/FMI 3 or FMI 4

5.a Yes; diagnose the other fault codes first.

5.b No; Go to step 6.

6. Monitor and record the following readings:

- engine oil temperature
- fuel temperature
- compressor inlet temperature
- intake air temperature
- coolant inlet temperature
- coolant outlet temperature
- charge air cooler outlet temperature

> **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.

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

7. Start the engine.
8. Road test the vehicle for 30 minutes until the coolant reaches operating temperature.
9. Monitor and record the following readings again:

- engine oil temperature
- fuel temperature
- compressor inlet temperature
- intake air temperature
- coolant inlet temperature
- coolant outlet temperature
- charge air cooler outlet temperature

10. Have the values increased from the recorded values in step 5?

10.a Yes; Go to step 12.

10.b No; Go to step 11.

11. Compare the sensor readings in the chart below. Are any of the sensors out of the allowable range?

Sensor	Range	Sensor
Oil temperature	greater than 20°C (36°F)	Coolant outlet temperature
Ambient Air Temperature	greater than 10°C (18°F)	Compressor inlet temperature
Compressor inlet temperature	greater than 10°C (18°F)	Ambient air temperature
Intake temperature	greater than 15°C (27°F)	Intercooler outlet temperature
Coolant inlet temp	greater than 15°C (27°F)	Coolant outlet temperature
Coolant outlet temp	greater than 15°C (27°F)	Coolant inlet temperature
CAC outlet temp	greater than 15°C (27°F)	Intercooler inlet temperature

11.a Yes; Go to step 12.

11.b No; the fault code may have been set due to an external heating unit.

12. Disconnect and inspect the sensor electrical connector of the faulty sensors. Is there damage, corrosion or fretting present?

12.a Yes; repair as necessary. Verify repair.

12.b No; replace the sensors that are out of range. Verify repair.

440.1 SPN 521019/FMI 0 - GHG17

Group 2 Sensors Not Plausible

SPN 521019/FMI 0	
Description	This fault code sets when 2 or more sensors from group 2 are not within an expected range after an 8 hour cold soak.
Monitored Parameter	Coolant In Coolant Out Intake Temp Engine Oil Temp
Typical Enabling Conditions	Key ON, engine OFF, battery voltage greater than 11 volts, engine rpm at zero, ambient temperature less than 40°C (104°F), ignition off for no less than 8 hours.
Monitor Sequence	None
Execution Frequency	Once per cold cycle
Typical Duration	5 seconds
Dash Lamps	MIL
Engine Reaction	25% derate, regen disabled
Verification	Road test the vehicle for 30 minutes until the coolant reaches operating temperature. Then verify that the engine oil temperature is within 20°C (36°F) of the engine coolant outlet temperature.

Possible causes:

Note : The use of an external heating unit while the engine has been shut down for a minimum of 8 hours can cause this fault code to set erroneously.

1. Has the Common Powertrain Controller (CPC) recently been reprogrammed or has the internal clock time been changed?

   1.a Yes; this fault may have been caused by the change in the CPC time. Go to step 8.

   1.b No; Go to step 2.

2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Check for multiple fault codes. Are any of the following fault codes present?

- SPN 100/FMI 3 or FMI 4
- SPN 110/FMI 3 or FMI 4
- SPN 1636/FMI 3 or FMI 4
- SPN 3512/FMI 3 or FMI 4
- SPN 4193/FMI 3 or FMI 4

   4.a Yes; diagnose the other fault codes first.

   4.b No; Go to step 5.

5. Monitor and record the following readings:

- engine oil temperature
- coolant inlet temperature
- coolant outlet temperature
- intake air temperature

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.

WARNING

ENGINE EXHAUST

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

6. Start the engine.
7. Road test the vehicle for 30 minutes until the coolant reaches operating temperature.
8. Monitor and record the following readings again:
   - engine oil temperature
   - coolant inlet temperature
   - coolant outlet temperature
   - intake air temperature
9. Have the values increased from the recorded values in step 5?
   - 9.a Yes; Go to step 11.
   - 9.b No; Go to step 10.
10. Compare the sensor readings in the chart below. Are any of the sensors out of the allowable range?

Sensor	Range	Sensor
Coolant inlet temperature	greater than 15°C (27°F)	Coolant outlet temperature
Coolant outlet temp	greater than 15°C (27°F)	Coolant inlet temp
Oil temp	greater than 20°C (36°F)	Coolant outlet temp
Intake air temperature	greater than 15°C (27°F)	CAC outlet temp

   - 10.a Yes; Go to step 11.
   - 10.b No; the fault code may have been set due to an external heating unit.
11. Disconnect and inspect the sensor electrical connector of the faulty sensors. Is there damage, corrosion or fretting present?
   - 11.a Yes; repair as necessary. Verify repair.
   - 11.b No; replace the sensors that are out of range. Verify repair.

SPN 521019 (MCM) (GHG17)

440.1 SPN 521019/FMI 0 - GHG17

Group 2 Sensors Not Plausible

SPN 521019/FMI 0	
Description	This fault code sets when 2 or more sensors from group 2 are not within an expected range after an 8 hour cold soak.
Monitored Parameter	Coolant In Coolant Out Intake Temp Engine Oil Temp
Typical Enabling Conditions	Key ON, engine OFF, battery voltage greater than 11 volts, engine rpm at zero, ambient temperature less than 40°C (104°F), ignition off for no less than 8 hours.
Monitor Sequence	None
Execution Frequency	Once per cold cycle
Typical Duration	5 seconds
Dash Lamps	MIL
Engine Reaction	25% derate, regen disabled
Verification	Road test the vehicle for 30 minutes until the coolant reaches operating temperature. Then verify that the engine oil temperature is within 20°C (36°F) of the engine coolant outlet temperature.

Possible causes:

Note : The use of an external heating unit while the engine has been shut down for a minimum of 8 hours can cause this fault code to set erroneously.

1. Has the Common Powertrain Controller (CPC) recently been reprogrammed or has the internal clock time been changed?

   1.a Yes; this fault may have been caused by the change in the CPC time. Go to step 8.

   1.b No; Go to step 2.

2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Check for multiple fault codes. Are any of the following fault codes present?

- SPN 100/FMI 3 or FMI 4
- SPN 110/FMI 3 or FMI 4
- SPN 1636/FMI 3 or FMI 4
- SPN 3512/FMI 3 or FMI 4
- SPN 4193/FMI 3 or FMI 4

   4.a Yes; diagnose the other fault codes first.

   4.b No; Go to step 5.

5. Monitor and record the following readings:

- engine oil temperature
- coolant inlet temperature
- coolant outlet temperature

- intake air temperature

> **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.

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

6. Start the engine.
7. Road test the vehicle for 30 minutes until the coolant reaches operating temperature.
8. Monitor and record the following readings again:
   - engine oil temperature
   - coolant inlet temperature
   - coolant outlet temperature
   - intake air temperature
9. Have the values increased from the recorded values in step 5?
   - 9.a Yes; Go to step 11.
   - 9.b No; Go to step 10.
10. Compare the sensor readings in the chart below. Are any of the sensors out of the allowable range?

Sensor	Range	Sensor
Coolant inlet temperature	greater than 15°C (27°F)	Coolant outlet temperature
Coolant outlet temp	greater than 15°C (27°F)	Coolant inlet temp
Oil temp	greater than 20°C (36°F)	Coolant outlet temp
Intake air temperature	greater than 15°C (27°F)	CAC outlet temp

   - 10.a Yes; Go to step 11.
   - 10.b No; the fault code may have been set due to an external heating unit.
11. Disconnect and inspect the sensor electrical connector of the faulty sensors. Is there damage, corrosion or fretting present?
   - 11.a Yes; repair as necessary. Verify repair.
   - 11.b No; replace the sensors that are out of range. Verify repair.

441.1 SPN 521020/FMI 0 - GHG17

Group 3 Sensors Not Plausible

SPN 521020/FMI 0	
Description	This fault code sets when 2 or more sensors from group 3 are not within an expected range after an 8 hour cold soak.
Monitored Parameter	Fuel Temp Compressor Inlet Charge Air Cooler Outlet Ambient Air Temp
Typical Enabling Conditions	Key ON, engine OFF, battery voltage greater than 11 volts, engine rpm at zero, ambient temperature less than 40°C (104°F), ignition off for no less than 8 hours.
Monitor Sequence	None
Execution Frequency	Once per cold cycle
Typical Duration	5 seconds
Dash Lamps	MIL
Engine Reaction	25% derate, regen disabled, EGR valve shut and SCR dosing is disabled
Verification	Road test the vehicle for 30 minutes until the coolant reaches operating temperature. Then verify that the engine oil temperature is within 20°C (36°F) of the engine coolant outlet temperature.

Possible causes:

Note : The use of an external heating unit while the engine has been shut down for a minimum of 8 hours can cause this fault code to set erroneously.

1. Has the Common Powertrain Controller (CPC) recently been reprogrammed or has the internal clock time been changed?

   1.a Yes; this fault may have been caused by the change in the CPC time. Go to step 8.

   1.b No; Go to step 2.

2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Check for multiple fault codes. Are any of the following fault codes present?

- SPN 171/FMI 3 or FMI 4
- SPN 174/FMI 3 or FMI 4
- SPN 1172/FMI 3 or FMI 4
- SPN 2630/FMI 3 or FMI 4
- SPN 3511/FMI 3 or FMI 4
- SPN 3512/FMI 3 or FMI 4

   4.a Yes; diagnose the other fault codes first.

   4.b No; Go to step 5.

5. Monitor and record the following readings:

- Fuel temperature
- Compressor inlet temperature
- CAC outlet temperature

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.

WARNING

ENGINE EXHAUST

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

6. Start the engine.
7. Road test the vehicle for 30 minutes until the coolant reaches operating temperature.
8. Monitor and record the following readings again:
   - Fuel temperature
   - Compressor inlet temperature
   - CAC outlet temperature
9. Have the values increased from the recorded values in step 5?
   - 9.a Yes; Go to step 11.
   - 9.b No; Go to step 10.
10. Compare the sensor readings in the chart below. Then, Go to step 11.

Sensor	Range	Sensor
Fuel temperature	greater than 10°C (18°F)	Compare to ambient temperature after the fuel temp sensor has been removed for 20 minutes.
Compressor inlet temp	greater than 10°C (18°F)	Ambient air temp
CAC outlet temp	greater than 15°C (27°F)	Intake air temp
Ambient air temperature	greater than 10°C (18°F)	Intercooler air temperature

11. Disconnect and inspect the sensor electrical connector of the faulty sensors. Is there damage, corrosion or fretting present?
    - 11.a Yes; repair as necessary. Verify repair.
    - 11.b No; replace the sensors that are out of range. Verify repair.

SPN 521020 (MCM) (GHG17)

441.1 SPN 521020/FMI 0 - GHG17

Group 3 Sensors Not Plausible

SPN 521020/FMI 0	
Description	This fault code sets when 2 or more sensors from group 3 are not within an expected range after an 8 hour cold soak.
Monitored Parameter	Fuel Temp Compressor Inlet Charge Air Cooler Outlet Ambient Air Temp
Typical Enabling Conditions	Key ON, engine OFF, battery voltage greater than 11 volts, engine rpm at zero, ambient temperature less than 40°C (104°F), ignition off for no less than 8 hours.
Monitor Sequence	None
Execution Frequency	Once per cold cycle
Typical Duration	5 seconds
Dash Lamps	MIL
Engine Reaction	25% derate, regen disabled, EGR valve shut and SCR dosing is disabled
Verification	Road test the vehicle for 30 minutes until the coolant reaches operating temperature. Then verify that the engine oil temperature is within 20°C (36°F) of the engine coolant outlet temperature.

Possible causes:

Note : The use of an external heating unit while the engine has been shut down for a minimum of 8 hours can cause this fault code to set erroneously.

1. Has the Common Powertrain Controller (CPC) recently been reprogrammed or has the internal clock time been changed?

   1.a Yes; this fault may have been caused by the change in the CPC time. Go to step 8.

   1.b No; Go to step 2.

2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Check for multiple fault codes. Are any of the following fault codes present?

- SPN 171/FMI 3 or FMI 4
- SPN 174/FMI 3 or FMI 4
- SPN 1172/FMI 3 or FMI 4
- SPN 2630/FMI 3 or FMI 4
- SPN 3511/FMI 3 or FMI 4
- SPN 3512/FMI 3 or FMI 4

   4.a Yes; diagnose the other fault codes first.

   4.b No; Go to step 5.

5. Monitor and record the following readings:

- Fuel temperature
- Compressor inlet temperature
- CAC outlet temperature

> **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.

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

6. Start the engine.
7. Road test the vehicle for 30 minutes until the coolant reaches operating temperature.
8. Monitor and record the following readings again:

- Fuel temperature
- Compressor inlet temperature
- CAC outlet temperature

9. Have the values increased from the recorded values in step 5?

9.a Yes; Go to step 11.

9.b No; Go to step 10.

10. Compare the sensor readings in the chart below. Then, Go to step 11.

Sensor	Range	Sensor
Fuel temperature	greater than 10°C (18°F)	Compare to ambient temperature after the fuel temp sensor has been removed for 20 minutes.
Compressor inlet temp	greater than 10°C (18°F)	Ambient air temp
CAC outlet temp	greater than 15°C (27°F)	Intake air temp
Ambient air temperature	greater than 10°C (18°F)	Intercooler air temperature

11. Disconnect and inspect the sensor electrical connector of the faulty sensors. Is there damage, corrosion or fretting present?

11.a Yes; repair as necessary. Verify repair.

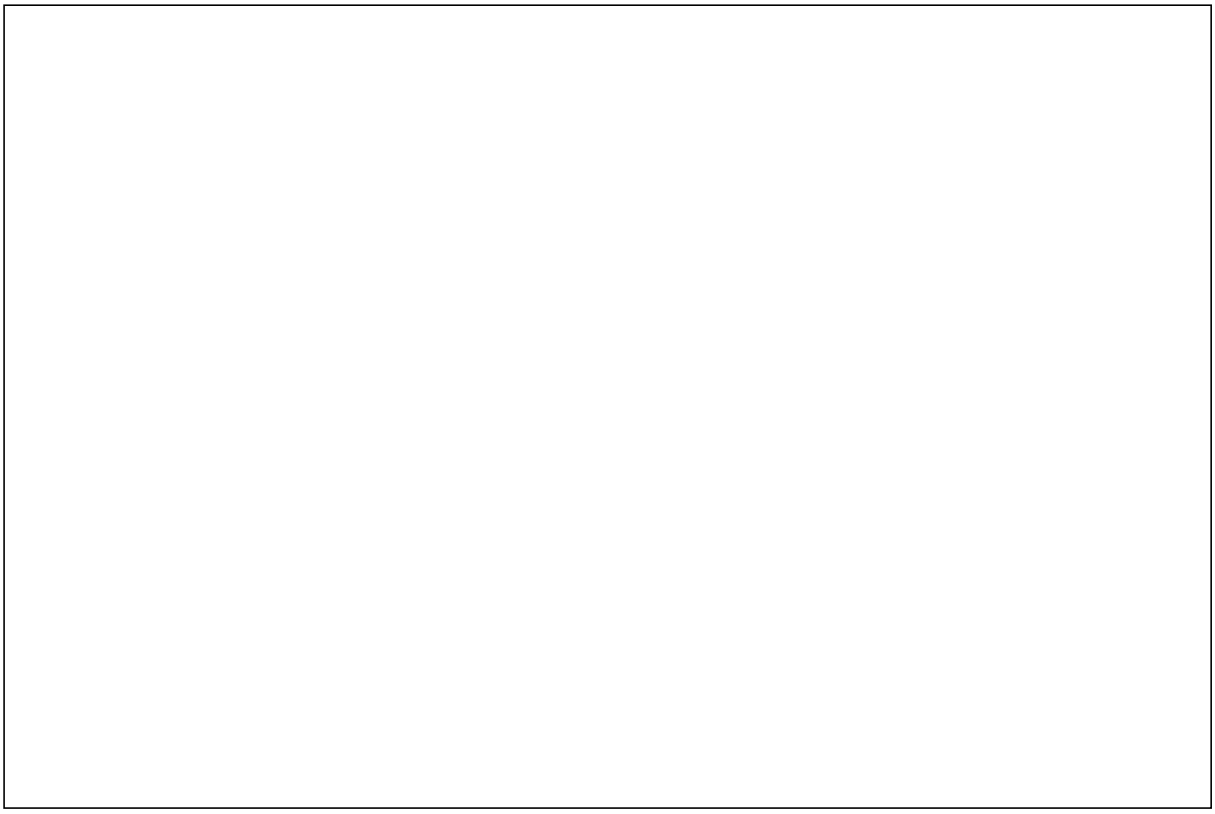
11.b No; replace the sensors that are out of range. Verify repair.

SPN 521027 (MCM) (GHG17)

442.1 SPN 521027/FMI 9 - GHG17

EGR Valve Actuator No Longer Communicating On MCM CAN3

SPN 521027 /FMI 9	
Description	Lost Communication With Exhaust Gas Recirculation Control Module, CAN Bus is Ok
Monitored Parameter	EGR Valve Actuator
Typical Enabling Conditions	Ignition On
Monitor Sequence	None
Execution Frequency	Continuous When Enabling Conditions Met
Typical Duration	Two Seconds
Dash Lamps	MIL, CEL
Engine Reaction	None
Verification	Turn the Ignition OFF, Wait Five Minutes, Turn the Ignition ON and Recheck for the Fault.



Check as follows:

1. Check for low battery voltage fault codes. Are there any battery voltage fault codes present?
   1.a Yes; diagnose the low battery voltage fault code first.
   1.b No; Go to step 2.
2. Check for multiple EGR fault codes. Are there any other EGR valve actuator fault codes also active?

2.a Yes; replace the EGR valve actuator.

2.b No; Go to step 3.

3. Turn the ignition OFF.
4. Disconnect and inspect the EGR valve actuator electrical connector components side. Are there any damaged, corroded or spread pins?

4.a Yes; replace the EGR valve actuator.

4.b No; Go to step 5.

5. Inspect the EGR valve actuator electrical connector harness side. Are there any damaged, corroded or spread pins?

5.a Yes; repair the connector as necessary.

5.b No; Go to step 6.

6. Turn the ignition ON (key ON, engine OFF).
7. Measure the voltage between pins 1 and 2. Is the voltage greater than 11 volts?

7.a Yes; Go to step 9.

7.b No; Go to step 8.

8. Measure the voltage between pin 1 and ground. Is the voltage greater than 11 volts?

8.a Yes; repair the ground circuit between pin 2 of the EGR valve actuator electrical connector harness side and the circuit splice.

8.b No; repair the voltage circuit between pin 1 of the EGR valve actuator electrical connector harness side and the circuit splice.

9. Turn the ignition OFF.
10. Measure the resistance between pins 3 and 4 of the EGR valve actuator electrical connector harness side. Is the resistance between 55 and 65 ohms?

10.a Yes: replace the EGR valve actuator.

10.b No; Go to step 11.

11. Disconnect and inspect the MCM 120-pin electrical connector components side. Are there any damaged or corroded pins?

11.a Yes; replace the MCM.

11.b No; Go to step 12.

12. Inspect the MCM 120-pin electrical connector harness side. Are there any damaged, corroded, or spread pins?

12.a Yes; repair as necessary.

12.b No; Go to step 13.

13. Measure the resistance between pin 3 of the EGR valve actuator electrical connector harness side and pin 74 of the MCM 120-pin electrical connector harness side. Is the resistance less than five ohms?

13.a Yes; Go to step 14.

13.b No; repair the communication circuit between pin 3 of the EGR valve actuator electrical connector harness side and pin 74 of the MCM 120-pin electrical connector harness side.

14. Measure the resistance between pin 4 of the EGR valve actuator electrical connector harness side and pin 75 of the MCM 120-pin electrical connector harness side. Is the resistance less than five ohms?

14.a Yes; replace the MCM.

14.b No; repair the communication circuit between pin 4 of the EGR valve actuator electrical connector harness side and pin 75 of the MCM 120-pin electrical connector harness side.

443.1 SPN 521039/FMI 16 - GHG17

EGR Controller Effort Exceeds Limits Low - High EGR flow

SPN 521039/FMI 16	
Description	This fault code sets when the difference between the actual Exhaust Gas Recirculation (EGR) flow and the commanded EGR flow is higher than a calibrated threshold.
Monitored Parameter	EGR Mass Flow
Typical Enabling Conditions	Desired EGR Mass Flow Greater Than .08, EGR In Closed-Loop Control, CAC Outlet Temperature Greater Than 0°C (32°F), Engine Speed 1080 to 2500 rpm, Engine Torque 200 to 2500 N·M (148 to 1894 lb·ft), Coolant Temperature Greater Than 65°C (149°F), Ambient Temperature Greater Than -8°C (17.6°F) Ambient, Barometric Pressure Greater Than 755 mbar (11 psi).
Monitor Sequence	none
Execution Frequency	Always Enabled
Typical Duration	20
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Start engine, warm up such that coolant temperature greater than 65°C (149°F) ensure ambient temperature greater than -8°C (17.6°F) ambient and ambient barometric pressure greater than 755 mbar (11 psi). Desired EGR mass flow greater than .08, EGR in closed-loop control, CAC outlet temperature greater than 0°C (32°F), engine speed 1080 to 2500 rpm, engine torque 200 to 2500 N·m (148 to 1894 lb·ft)

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are any of the following fault codes present?

- SPN 411/FMI 2
- SPN 411/FMI 3
- SPN 411/FMI 4
- SPN 411/FMI 13
- SPN 1636/FMI 3
- SPN 1636/FMI 4
- SPN 1636/FMI 14
- SPN 2791/FMI 2
- SPN 2791/FMI 7
- SPN 2791/FMI 9
- SPN 2791/FMI 11
- SPN 2791/FMI 12
- SPN 2791/FMI 13
- SPN 2791/FMI 14
- SPN 2791/FMI 16
- SPN 2791/FMI 18
- SPN 2791/FMI 31
- SPN 3563/FMI 3

- SPN 3563/FMI 4
- SPN 3563/FMI 10

3.a Yes; diagnose the other fault codes first.

3.b No; Go to step 4.

4. Check the Diesel Particulate Filter (DPF) Zone; is the DPF zone zero?

4.a Yes; Go to step 5.

4.b No; perform a parked regeneration . Recheck for the fault code, if fault code SPN 521039 FMI 18 returns Go to step 5.

5. Monitor the EGR delta pressure voltage with the ignition ON (key ON, engine OFF). Is the voltage between 0.55 and 0.83 volts?

5.a Yes; Go to step 12.

5.b No; Go to step 6.

6. Turn the ignition OFF.

7. Disconnect and inspect the EGR delta pressure sensor electrical connector. Is there damage, corrosion or fretting present?

7.a Yes; replace the delta pressure sensor and the pigtail.

7.b No; Go to step 8.

8. Remove and inspect the EGR delta pressure sensor ports. Is there a restriction or contamination present?

8.a Yes; clean the delta pressure sensor and clean the ports in the venturi pipe.

8.b No; Go to step 9.

9. Reconnect the EGR delta pressure sensor connector while the sensor is still removed from the venturi pipe.

10. Turn the ignition ON (key ON, engine OFF).

11. Monitor the EGR delta pressure voltage with the ignition ON (key ON, engine OFF). Is the voltage between 0.55 and 0.83 volts?

11.a Yes; clean the ports on the venturi pipe.

11.b No; replace the delta pressure sensor.

12. Compare the barometric pressure reading to the local barometric pressure for your area. Is the barometric pressure within 68.9 mbar (1 psi) of the barometric pressure for your area?

12.a Yes; Go to step 13.

12.b No; replace the MCM.

13. Compare the Intake Manifold Pressure sensor reading to the Barometric pressure sensor reading. Is the Intake Manifold Pressure sensor reading within 103.4 mbar (1.5 psi) of the barometric pressure reading?

13.a Yes; Go to step 15.

13.b No; Go to step 14.

14. Disconnect and inspect the Intake Manifold Pressure sensor electrical connector. Is there damage, corrosion or fretting present?

14.a Yes; repair as necessary.

14.b No; replace the intake manifold pressure sensor.

15. Compare the intake manifold temperature to the Charge Air Cooler outlet temperature. Is the intake manifold temperature within plus or minus 10°C (18°F) of the Charge Air Cooler outlet temperature?

15.a Yes; Go to step 17.

15.b No; Go to step 16.

16. Disconnect and inspect the intake manifold temperature sensor electrical connector. Is there any damage, corrosion or fretting present?

16.a Yes; repair as necessary. Verify repair.

16.b No; replace the intake manifold temperature sensor.

17. Remove the EGR delta pressure sensor and inspect the ports. Is there a restriction or contamination present?

    17.a Yes; clean the delta pressure sensor and clean the ports in the venturi pipe.

    17.b No; Go to step 18.

18. Remove and inspect the EGR hot pipe. Are there any restrictions present in the EGR hot pipe?

    18.a Yes; clean the EGR system. Verify repair.

    18.b No; Go to step 19.

19. Move EGR pull rod back and forth while watching the EGR valve. Does the EGR flap move when the pull rod is moved back and forth?

    19.a Yes; replace the delta P sensor.

    19.b No; replace the EGR valve.

443.2 SPN 521039/FMI 18 - GHG17

EGR Controller Effort Exceeds Limits High - Low EGR flow

SPN 521039/FMI 18	
Description	This fault code sets when the difference between the actual Exhaust Gas Recirculation (EGR) flow and the commanded EGR flow is lower than a calibrated threshold.
Monitored Parameter	EGR Mass Flow
Typical Enabling Conditions	Desired EGR Mass Flow Greater Than .08, EGR In Closed-Loop Control, CAC Outlet Temperature Greater Than 0°C (32°F), Engine Speed 1080 to 2500 rpm, Engine Torque 200 to 2500 N·M (148 to 1894 lb·ft), Coolant Temperature Greater Than 65°C (149°F), Ambient Temperature Greater Than -8°C (17.6°F) Ambient, Barometric Pressure Greater Than 755 mbar (11 psi).
Monitor Sequence	none
Execution Frequency	Always Enabled
Typical Duration	20
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Start engine, warm up such that coolant temperature greater than 65°C (149°F) ensure ambient temperature greater than -8°C (17.6°F) ambient and ambient barometric pressure greater than 755 mbar (11 psi). Desired EGR mass flow greater than .08, EGR in closed-loop control, CAC outlet temperature greater than 0°C (32°F), engine speed 1080 to 2500 rpm, engine torque 200 to 2500 N·m (148 to 1894 lb·ft)

Check as follows:

1. Connect DiagnosticLink®.
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are any of the following fault codes present?

- SPN 411/FMI 2
- SPN 411/FMI 3
- SPN 411/FMI 4
- SPN 411/FMI 13
- SPN 1636/FMI 3
- SPN 1636/FMI 4
- SPN 1636/FMI 14
- SPN 2791/FMI 2
- SPN 2791/FMI 7
- SPN 2791/FMI 9
- SPN 2791/FMI 11
- SPN 2791/FMI 12
- SPN 2791/FMI 13
- SPN 2791/FMI 14
- SPN 2791/FMI 16
- SPN 2791/FMI 18
- SPN 2791/FMI 31
- SPN 3563/FMI 3

- SPN 3563/FMI 4
- SPN 3563/FMI 10

3.a Yes; diagnose the other fault codes first.

3.b No; Go to step 4.

4. Check the Diesel Particulate Filter (DPF) Zone; is the DPF zone zero?

4.a Yes; Go to step 5.

4.b No; perform a parked regeneration. Recheck for the fault code, if fault code SPN 521039/FMI 18 returns Go to step 5.

5. Monitor the EGR delta pressure voltage with the ignition ON (key ON, engine OFF). Is the voltage between 0.55 and 0.83 volts?

5.a Yes; Go to step 12.

5.b No; Go to step 6.

6. Turn the ignition OFF.

> **WARNING**
>
> ELECTRICAL SHOCK
>
> To avoid injury from electrical shock, follow OEM furnished operating instructions prior to usage.

7. Disconnect and inspect the EGR delta pressure sensor electrical connector. Is there damage, corrosion or fretting present?

7.a Yes; replace the delta pressure sensor and the pigtail.

7.b No; Go to step 8.

8. Remove the EGR delta pressure sensor and inspect the ports. Is there a restriction or contamination present?

8.a Yes; clean the delta pressure sensor and clean the ports in the venturi pipe.

8.b No; Go to step 9.

9. Reconnect the EGR delta pressure sensor connector while the sensor is still removed from the venturi pipe.
10. Turn the ignition ON (key ON, engine OFF).
11. Monitor the EGR delta pressure voltage with the ignition ON (key ON, engine OFF). Is the voltage between 0.55 and 0.83 volts?

11.a Yes; clean the ports on the venturi pipe.

11.b No; replace the delta pressure sensor.

12. Compare the barometric pressure reading to the local barometric pressure for your area. Is the barometric pressure within 68.9 mbar (1 psi) of the barometric pressure for your area?

12.a Yes; Go to step 13.

12.b No; replace the MCM.

13. Compare the Intake Manifold Pressure sensor reading to the Barometric pressure sensor reading. Is the Intake Manifold Pressure sensor reading within 103.4 mbar (1.5 psi) of the barometric pressure reading?

13.a Yes; Go to step 15.

13.b No; Go to step 14.

14. Disconnect and inspect the Intake Manifold Pressure sensor electrical connector. Is there damage, corrosion or fretting present?

> **WARNING**
>
> ELECTRICAL SHOCK
>
> To avoid injury from electrical shock, follow OEM furnished operating instructions prior to usage.

14.a Yes repair as necessary.

14.b No; replace the intake manifold pressure sensor.

15. Compare the intake manifold temperature to the Charge Air Cooler outlet temperature. Is the intake manifold temperature within plus or minus 10°C (18°F) of the Charge Air Cooler outlet temperature?

15.a Yes; Go to step 17.

15.b No; Go to step 16.

16. Disconnect and inspect the intake manifold temperature sensor electrical connector. Is there any damage, corrosion or fretting present?

> **WARNING**
>
> ELECTRICAL SHOCK
>
> To avoid injury from electrical shock, follow OEM furnished operating instructions prior to usage.

16.a Yes; repair as necessary. Verify repair.

16.b No; replace the intake manifold temperature sensor.

17. Remove the EGR delta pressure sensor and inspect the ports. Is there a restriction or contamination present?

17.a Yes; clean the delta pressure sensor and clean the ports in the venturi pipe.

17.b No; Go to step 18.

18. Remove and inspect the EGR hot pipe. Are there any restrictions present in the EGR hot pipe?

> **WARNING**
>
> ELECTRICAL SHOCK
>
> To avoid injury from electrical shock, follow OEM furnished operating instructions prior to usage.

18.a Yes; clean the EGR system.

18.b No; replace the delta P sensor.

SPN 521039 (MCM) (GHG17)

443.1 SPN 521039/FMI 16 - GHG17

EGR Controller Effort Exceeds Limits Low - High EGR flow

SPN 521039/FMI 16	
Description	This fault code sets when the difference between the actual Exhaust Gas Recirculation (EGR) flow and the commanded EGR flow is higher than a calibrated threshold.
Monitored Parameter	EGR Mass Flow
Typical Enabling Conditions	Desired EGR Mass Flow Greater Than .08, EGR In Closed-Loop Control, CAC Outlet Temperature Greater Than 0°C (32°F), Engine Speed 1080 to 2500 rpm, Engine Torque 200 to 2500 N·M (148 to 1894 lb·ft), Coolant Temperature Greater Than 65°C (149°F), Ambient Temperature Greater Than -8°C (17.6°F) Ambient, Barometric Pressure Greater Than 755 mbar (11 psi).
Monitor Sequence	none
Execution Frequency	Always Enabled
Typical Duration	20
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Start engine, warm up such that coolant temperature greater than 65°C (149°F) ensure ambient temperature greater than -8°C (17.6°F) ambient and ambient barometric pressure greater than 755 mbar (11 psi). Desired EGR mass flow greater than .08, EGR in closed-loop control, CAC outlet temperature greater than 0°C (32°F), engine speed 1080 to 2500 rpm, engine torque 200 to 2500 N·m (148 to 1894 lb·ft)

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are any of the following fault codes present?

- SPN 411/FMI 2
- SPN 411/FMI 3
- SPN 411/FMI 4
- SPN 411/FMI 13
- SPN 1636/FMI 3
- SPN 1636/FMI 4
- SPN 1636/FMI 14
- SPN 2791/FMI 2
- SPN 2791/FMI 7
- SPN 2791/FMI 9
- SPN 2791/FMI 11
- SPN 2791/FMI 12
- SPN 2791/FMI 13
- SPN 2791/FMI 14
- SPN 2791/FMI 16

- SPN 2791/FMI 18
- SPN 2791/FMI 31
- SPN 3563/FMI 3
- SPN 3563/FMI 4
- SPN 3563/FMI 10

3.a Yes; diagnose the other fault codes first.

3.b No; Go to step 4.

4. Check the Diesel Particulate Filter (DPF) Zone; is the DPF zone zero?

4.a Yes; Go to step 5.

4.b No; perform a parked regeneration . Recheck for the fault code, if fault code SPN 521039 FMI 18 returns Go to step 5.

5. Monitor the EGR delta pressure voltage with the ignition ON (key ON, engine OFF). Is the voltage between 0.55 and 0.83 volts?

5.a Yes; Go to step 12.

5.b No; Go to step 6.

6. Turn the ignition OFF.
7. Disconnect and inspect the EGR delta pressure sensor electrical connector. Is there damage, corrosion or fretting present?

7.a Yes; replace the delta pressure sensor and the pigtail.

7.b No; Go to step 8.

8. Remove and inspect the EGR delta pressure sensor ports. Is there a restriction or contamination present?

8.a Yes; clean the delta pressure sensor and clean the ports in the venturi pipe.

8.b No; Go to step 9.

9. Reconnect the EGR delta pressure sensor connector while the sensor is still removed from the venturi pipe.
10. Turn the ignition ON (key ON, engine OFF).
11. Monitor the EGR delta pressure voltage with the ignition ON (key ON, engine OFF). Is the voltage between 0.55 and 0.83 volts?

11.a Yes; clean the ports on the venturi pipe.

11.b No; replace the delta pressure sensor.

12. Compare the barometric pressure reading to the local barometric pressure for your area. Is the barometric pressure within 68.9 mbar (1 psi) of the barometric pressure for your area?

12.a Yes; Go to step 13.

12.b No; replace the MCM.

13. Compare the Intake Manifold Pressure sensor reading to the Barometric pressure sensor reading. Is the Intake Manifold Pressure sensor reading within 103.4 mbar (1.5 psi) of the barometric pressure reading?

13.a Yes; Go to step 15.

13.b No; Go to step 14.

14. Disconnect and inspect the Intake Manifold Pressure sensor electrical connector. Is there damage, corrosion or fretting present?

14.a Yes; repair as necessary.

14.b No; replace the intake manifold pressure sensor.

15. Compare the intake manifold temperature to the Charge Air Cooler outlet temperature. Is the intake manifold temperature within plus or minus 10°C (18°F) of the Charge Air Cooler outlet temperature?

15.a Yes; Go to step 17.

15.b No; Go to step 16.

16. Disconnect and inspect the intake manifold temperature sensor electrical connector. Is there any damage, corrosion or fretting present?
    16.a Yes; repair as necessary. Verify repair.
    16.b No; replace the intake manifold temperature sensor.
17. Remove the EGR delta pressure sensor and inspect the ports. Is there a restriction or contamination present?
    17.a Yes; clean the delta pressure sensor and clean the ports in the venturi pipe.
    17.b No; Go to step 18.
18. Remove and inspect the EGR hot pipe. Are there any restrictions present in the EGR hot pipe?
    18.a Yes; clean the EGR system. Verify repair.
    18.b No; Go to step 19.
19. Move EGR pull rod back and forth while watching the EGR valve. Does the EGR flap move when the pull rod is moved back and forth?
    19.a Yes; replace the delta P sensor.
    19.b No; replace the EGR valve.

443.2 SPN 521039/FMI 18 - GHG17

EGR Controller Effort Exceeds Limits High - Low EGR flow

SPN 521039/FMI 18	
Description	This fault code sets when the difference between the actual Exhaust Gas Recirculation (EGR) flow and the commanded EGR flow is lower than a calibrated threshold.
Monitored Parameter	EGR Mass Flow
Typical Enabling Conditions	Desired EGR Mass Flow Greater Than .08, EGR In Closed-Loop Control, CAC Outlet Temperature Greater Than 0°C (32°F), Engine Speed 1080 to 2500 rpm, Engine Torque 200 to 2500 N·M (148 to 1894 lb·ft), Coolant Temperature Greater Than 65°C (149°F), Ambient Temperature Greater Than -8°C (17.6°F) Ambient, Barometric Pressure Greater Than 755 mbar (11 psi).
Monitor Sequence	none
Execution Frequency	Always Enabled
Typical Duration	20
Dash Lamps	MIL, CEL
Engine Reaction	Derate 25%
Verification	Start engine, warm up such that coolant temperature greater than 65°C (149°F) ensure ambient temperature greater than -8°C (17.6°F) ambient and ambient barometric pressure greater than 755 mbar (11 psi). Desired EGR mass flow greater than .08, EGR in closed-loop control, CAC outlet temperature greater than 0°C (32°F), engine speed 1080 to 2500 rpm, engine torque 200 to 2500 N·m (148 to 1894 lb·ft)

Check as follows:

1. Connect DiagnosticLink®.
2. Turn the ignition ON (key ON, engine OFF).
3. Check for multiple fault codes. Are any of the following fault codes present?

- SPN 411/FMI 2
- SPN 411/FMI 3
- SPN 411/FMI 4
- SPN 411/FMI 13
- SPN 1636/FMI 3
- SPN 1636/FMI 4
- SPN 1636/FMI 14
- SPN 2791/FMI 2
- SPN 2791/FMI 7
- SPN 2791/FMI 9
- SPN 2791/FMI 11
- SPN 2791/FMI 12
- SPN 2791/FMI 13
- SPN 2791/FMI 14
- SPN 2791/FMI 16
- SPN 2791/FMI 18
- SPN 2791/FMI 31
- SPN 3563/FMI 3

- SPN 3563/FMI 4
- SPN 3563/FMI 10

3.a Yes; diagnose the other fault codes first.

3.b No; Go to step 4.

4. Check the Diesel Particulate Filter (DPF) Zone; is the DPF zone zero?

4.a Yes; Go to step 5.

4.b No; perform a parked regeneration. Recheck for the fault code, if fault code SPN 521039/FMI 18 returns Go to step 5.

5. Monitor the EGR delta pressure voltage with the ignition ON (key ON, engine OFF). Is the voltage between 0.55 and 0.83 volts?

5.a Yes; Go to step 12.

5.b No; Go to step 6.

6. Turn the ignition OFF.

> **WARNING**
>
> ELECTRICAL SHOCK
>
> To avoid injury from electrical shock, follow OEM furnished operating instructions prior to usage.

7. Disconnect and inspect the EGR delta pressure sensor electrical connector. Is there damage, corrosion or fretting present?

7.a Yes; replace the delta pressure sensor and the pigtail.

7.b No; Go to step 8.

8. Remove the EGR delta pressure sensor and inspect the ports. Is there a restriction or contamination present?

8.a Yes; clean the delta pressure sensor and clean the ports in the venturi pipe.

8.b No; Go to step 9.

9. Reconnect the EGR delta pressure sensor connector while the sensor is still removed from the venturi pipe.
10. Turn the ignition ON (key ON, engine OFF).
11. Monitor the EGR delta pressure voltage with the ignition ON (key ON, engine OFF). Is the voltage between 0.55 and 0.83 volts?

11.a Yes; clean the ports on the venturi pipe.

11.b No; replace the delta pressure sensor.

12. Compare the barometric pressure reading to the local barometric pressure for your area. Is the barometric pressure within 68.9 mbar (1 psi) of the barometric pressure for your area?

12.a Yes; Go to step 13.

12.b No; replace the MCM.

13. Compare the Intake Manifold Pressure sensor reading to the Barometric pressure sensor reading. Is the Intake Manifold Pressure sensor reading within 103.4 mbar (1.5 psi) of the barometric pressure reading?

13.a Yes; Go to step 15.

13.b No; Go to step 14.

14. Disconnect and inspect the Intake Manifold Pressure sensor electrical connector. Is there damage, corrosion or fretting present?

> **WARNING**
>
> ELECTRICAL SHOCK
>
> To avoid injury from electrical shock, follow OEM furnished operating instructions prior to usage.

14.a Yes repair as necessary.

14.b No; replace the intake manifold pressure sensor.

15. Compare the intake manifold temperature to the Charge Air Cooler outlet temperature. Is the intake manifold temperature within plus or minus 10°C (18°F) of the Charge Air Cooler outlet temperature?

15.a Yes; Go to step 17.

15.b No; Go to step 16.

16. Disconnect and inspect the intake manifold temperature sensor electrical connector. Is there any damage, corrosion or fretting present?

> **WARNING**
>
> ELECTRICAL SHOCK
>
> To avoid injury from electrical shock, follow OEM furnished operating instructions prior to usage.

16.a Yes; repair as necessary. Verify repair.

16.b No; replace the intake manifold temperature sensor.

17. Remove the EGR delta pressure sensor and inspect the ports. Is there a restriction or contamination present?

17.a Yes; clean the delta pressure sensor and clean the ports in the venturi pipe.

17.b No; Go to step 18.

18. Remove and inspect the EGR hot pipe. Are there any restrictions present in the EGR hot pipe?

> **WARNING**
>
> ELECTRICAL SHOCK
>
> To avoid injury from electrical shock, follow OEM furnished operating instructions prior to usage.

18.a Yes; clean the EGR system.

18.b No; replace the delta P sensor.

444.1 SPN 521049/FMI 31 - GHG17

SPN 521049/FMI 31	
Description	This Code Sets When There is a Code Present for the Diesel Exhaust Fluid (DEF) Tank Level, DEF Dosing Unit, DEF Pump, NOx Sensors, Blocked DEF Line, DEF Quality, NOx Efficiency, Selective Catalyst Reduction (SCR) Harness and/or SCR Sensor.
Monitored Parameter	SCR and Diesel Particulate Filter (DPF) Sensors
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	DEF Lamp
Engine Reaction	25% Derate
Verification	High Idle Regeneration followed by a Parked SCR Efficiency Test

Check as follows:

1. Connect DiagnosticLink
2. Turn the ignition ON (key ON, engine OFF).

> **⚠ WARNING**
>
> PERSONAL INJURY
>
> Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

> **⚠ 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.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

3. Check for other emission-related fault codes. Are there any Selective Catalyst Reduction (SCR) or Diesel Particulate Filter (DPF) related fault codes present?

3.a Yes; diagnose and repair the emission-related fault codes first. Verify repair.

3.b No; perform a high idle regeneration. When the engine returns to idle, turn the ignition OFF and wait for all the modules to power down (usually about one minute). Turn the ignition ON (key ON, engine OFF) and wait one minute, then start the engine and run a Parked SCR efficiency test. Use DiagnosticLink to clear the code.

SPN 521049 (MCM) (GHG17)

444.1 SPN 521049/FMI 31 - GHG17

SPN 521049/FMI 31	
Description	This Code Sets When There is a Code Present for the Diesel Exhaust Fluid (DEF) Tank Level, DEF Dosing Unit, DEF Pump, NOx Sensors, Blocked DEF Line, DEF Quality, NOx Efficiency, Selective Catalyst Reduction (SCR) Harness and/or SCR Sensor.
Monitored Parameter	SCR and Diesel Particulate Filter (DPF) Sensors
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	DEF Lamp
Engine Reaction	25% Derate
Verification	High Idle Regeneration followed by a Parked SCR Efficiency Test

Check as follows:

1. Connect DiagnosticLink
2. Turn the ignition ON (key ON, engine OFF).

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

> **⚠ 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.

3. Check for other emission-related fault codes. Are there any Selective Catalyst Reduction (SCR) or Diesel Particulate Filter (DPF) related fault codes present?

   3.a Yes; diagnose and repair the emission-related fault codes first. Verify repair.

   3.b No; perform a high idle regeneration. When the engine returns to idle, turn the ignition OFF and wait for all the modules to power down (usually about one minute). Turn the ignition ON (key ON, engine OFF) and wait one minute, then start the engine and run a Parked SCR efficiency test. Use DiagnosticLink to clear the code.

445.1 SPN 521050/FMI 14 - GHG17

Check as follows:

1. Disconnect DiagnosticLink from the 9-pin connector. **If tool is connected, the fault will not clear.** Turn the ignition OFF; wait until ICUC display goes blank (this ensures all modules have gone offline and may take a few minutes).
2. Turn ignition ON (key ON, engine OFF). Wait one minute and then connect DiagnosticLink. Verify fault is no longer active.

SPN 521050 (CPC3) (GHG17)

445.1 SPN 521050/FMI 14 - GHG17

Check as follows:

1. Disconnect DiagnosticLink from the 9-pin connector. **If tool is connected, the fault will not clear.** Turn the ignition OFF; wait until ICUC display goes blank (this ensures all modules have gone offline and may take a few minutes).
2. Turn ignition ON (key ON, engine OFF). Wait one minute and then connect DiagnosticLink. Verify fault is no longer active.

446.1 SPN 521050/FMI 31 - GHG17

SPN 521050/FMI 31	
Description	This Code Sets After SPN 521049/FMI 31 is Present and the Speed Limit has Been Reduced to 55 mph.
Monitored Parameter	SCR and Diesel Particulate Filter (DPF) Sensors
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	SEL Lamp
Engine Reaction	40% Derate, Vehicle Speed Limited to Five mph
Verification	High Idle Regeneration followed by a Parked SCR Efficiency Test

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).

⚠ WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ 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.

⚠ WARNING

ENGINE EXHAUST

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

⚠ 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.

3. Check for other emission-related fault codes. Are there any Selective Catalyst Reduction (SCR) or Diesel Particulate Filter (DPF) related fault codes present?

   3.a Yes; diagnose and repair the emission-related fault codes first. Verify repair.

3.b No; perform a high idle regeneration. When the engine returns to idle, turn the ignition OFF and wait for all the modules to power down (usually about one minute). Turn the ignition ON (key ON, engine OFF) and wait one minutes, then start the engine and run a Parked SCR efficiency test. Use DiagnosticLink to clear the code.

SPN 521050 (MCM) (GHG17)

446.1 SPN 521050/FMI 31 - GHG17

SPN 521050/FMI 31	
Description	This Code Sets After SPN 521049/FMI 31 is Present and the Speed Limit has Been Reduced to 55 mph.
Monitored Parameter	SCR and Diesel Particulate Filter (DPF) Sensors
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	SEL Lamp
Engine Reaction	40% Derate, Vehicle Speed Limited to Five mph
Verification	High Idle Regeneration followed by a Parked SCR Efficiency Test

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).

⚠WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠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.

⚠WARNING

ENGINE EXHAUST

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

⚠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.

3. Check for other emission-related fault codes. Are there any Selective Catalyst Reduction (SCR) or Diesel Particulate Filter (DPF) related fault codes present?

3.a Yes; diagnose and repair the emission-related fault codes first. Verify repair.

3.b No; perform a high idle regeneration. When the engine returns to idle, turn the ignition OFF and wait for all the modules to power down (usually about one minute). Turn the ignition ON (key ON, engine OFF) and wait one minutes, then start the engine and run a Parked SCR efficiency test. Use DiagnosticLink to clear the code.

447.1 SPN 521052/FMI 31 - GHG17

SPN 521052/FMI 31	
Description	This Code Sets When SPN 521050/FMI 31 has Been Present for One Hour of Idle Time, the Vehicle has Been Restarted or Six Gallons of Fuel has Been Used.
Monitored Parameter	SCR and Diesel Particulate Filter (DPF) Sensors
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL Lamp
Engine Reaction	55 mph Speed Limit, Progressive Derate From 25% to 40%
Verification	High Idle Regeneration followed by a Parked SCR Efficiency Test

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).

> **⚠ WARNING**
>
> PERSONAL INJURY
>
> Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

> **⚠ 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.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

3. Check for other emission-related fault codes. Are there any Selective Catalyst Reduction (SCR) or Diesel Particulate Filter (DPF) related fault codes present?

   3.a Yes; diagnose and repair the emission-related fault codes first. Verify repair.

3.b No; perform a high idle regeneration. When the engine returns to idle, turn the ignition OFF and wait for all the modules to power down (usually about one minute). Turn the ignition ON (key ON, engine OFF) and wait one minute, then start the engine and run a Parked SCR efficiency test. Use DiagnosticLink to clear the code.

SPN 521052 (MCM) (GHG17)

447.1 SPN 521052/FMI 31 - GHG17

SPN 521052/FMI 31	
Description	This Code Sets When SPN 521050/FMI 31 has Been Present for One Hour of Idle Time, the Vehicle has Been Restarted or Six Gallons of Fuel has Been Used.
Monitored Parameter	SCR and Diesel Particulate Filter (DPF) Sensors
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL Lamp
Engine Reaction	55 mph Speed Limit, Progressive Derate From 25% to 40%
Verification	High Idle Regeneration followed by a Parked SCR Efficiency Test

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON (key ON, engine OFF).

⚠WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠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.

⚠WARNING

ENGINE EXHAUST

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

⚠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.

3. Check for other emission-related fault codes. Are there any Selective Catalyst Reduction (SCR) or Diesel Particulate Filter (DPF) related fault codes present?

   3.a Yes; diagnose and repair the emission-related fault codes first. Verify repair.

   3.b No; perform a high idle regeneration. When the engine returns to idle, turn the ignition OFF and wait for all the modules to power down (usually about one minute). Turn the ignition ON (key ON, engine OFF) and wait one minute, then start the engine and run a Parked SCR efficiency test. Use DiagnosticLink to clear the code.

448.1 SPN 521054/FMI 14 - GHG17

Check as follows:

1. Disconnect DiagnosticLink from the 9-pin connector **(if tool is connected, fault will not clear)** . Turn the ignition OFF and wait until ICUC display goes blank (this ensures all modules have gone offline and may take a few minutes).
2. Turn ignition ON (key ON, engine OFF), wait one minute, and then connect DiagnosticLink. Verify fault is no longer active.
3. Are any other MCM fault codes present?

   3.a Yes; repair those first.

   3.b No; Go to step 4.
4. If fault is active after above steps, reprogram MCM to latest settings.

SPN 521054 (CPC3) (GHG17)

448.1 SPN 521054/FMI 14 - GHG17

Check as follows:

1. Disconnect DiagnosticLink from the 9-pin connector **(if tool is connected, fault will not clear)** . Turn the ignition OFF and wait until ICUC display goes blank (this ensures all modules have gone offline and may take a few minutes).
2. Turn ignition ON (key ON, engine OFF), wait one minute, and then connect DiagnosticLink. Verify fault is no longer active.
3. Are any other MCM fault codes present?

   3.a Yes; repair those first.

   3.b No; Go to step 4.
4. If fault is active after above steps, reprogram MCM to latest settings.

449.1 SPN 521058/FMI 13 - GHG17

Vehicle Speed outside the Allowable range

SPN 521058/FMI 13	
Description	This fault code sets when the vehicle speed is not transmitted from the CPC to the MCM.
Monitored Parameter	Vehicle Speed Sensor (VSS)
Typical Enabling Conditions	rpm greater than 1500, Torque Demand On
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	10 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	rpm greater than 1500, Torque Demand On

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON(key ON, engine OFF).
3. Check for multiple fault codes. Are any of the following fault codes present in the CPC?

- SPN 84/FMI 3
- SPN 84/FMI 4
- SPN 84/FMI 5
- SPN 84/FMI 9
- SPN 84/FMI 10
- SPN 84/FMI 11
- SPN 84/FMI 13
- SPN 84/FMI 14
- SPN 84/FMI 19
- SPN 84/FMI 20
- SPN 84/FMI 21
- SPN 625/FMI 9

3.a Yes; diagnose the other fault codes first.

3.b No; Go to step 4.

4. Verify the VSS parameters are configured correctly for the vehicle application.

4.a Yes; Go to step 5.

4.b No; configure the parameter correctly.

5. Install a test CPC. Does fault code SPN 521058/FMI 13 become active?

5.a Yes; replace the MCM.

5.b No; replace the CPC.

449.2 SPN 521058/FMI 14 - GHG17

Check as follows:

1. Compare the below CPC3 parameters to OEM settings and adjust as necessary.

- Grp 227 Single (1) or Dual (2) Wheel on Drive Axle
- Grp 50 PTO Mode Governor Type
- Grp 233 Rear Axle Ratio
- Grp 228 Engine Torque/Power Selection

SPN 521058 (MCM) (GHG17)

449.1 SPN 521058/FMI 13 - GHG17

Vehicle Speed outside the Allowable range

SPN 521058/FMI 13	
Description	This fault code sets when the vehicle speed is not transmitted from the CPC to the MCM.
Monitored Parameter	Vehicle Speed Sensor (VSS)
Typical Enabling Conditions	rpm greater than 1500, Torque Demand On
Monitor Sequence	None
Execution Frequency	Continuous when enabling conditions met
Typical Duration	10 Seconds
Dash Lamps	MIL
Engine Reaction	None
Verification	rpm greater than 1500, Torque Demand On

Check as follows:

1. Connect DiagnosticLink .
2. Turn the ignition ON(key ON, engine OFF).
3. Check for multiple fault codes. Are any of the following fault codes present in the CPC?

- SPN 84/FMI 3
- SPN 84/FMI 4
- SPN 84/FMI 5
- SPN 84/FMI 9
- SPN 84/FMI 10
- SPN 84/FMI 11
- SPN 84/FMI 13
- SPN 84/FMI 14
- SPN 84/FMI 19
- SPN 84/FMI 20
- SPN 84/FMI 21
- SPN 625/FMI 9

3.a Yes; diagnose the other fault codes first.

3.b No; Go to step 4.

4. Verify the VSS parameters are configured correctly for the vehicle application.

4.a Yes; Go to step 5.

4.b No; configure the parameter correctly.

5. Install a test CPC. Does fault code SPN 521058/FMI 13 become active?

5.a Yes; replace the MCM.

5.b No; replace the CPC.

449.2 SPN 521058/FMI 14 - GHG17

Check as follows:

1. Compare the below CPC3 parameters to OEM settings and adjust as necessary.

- Grp 227 Single (1) or Dual (2) Wheel on Drive Axle
- Grp 50 PTO Mode Governor Type
- Grp 233 Rear Axle Ratio
- Grp 228 Engine Torque/Power Selection

SPN 522204 (CPC3) (GHG17)

450.1 SPN 522204/FMI 14 - GHG17

Check as follows:

1. Reprogram CPC3 to latest software level. Does the fault go inactive?
   1.a Yes; release vehicle.
   1.b No; replace CPC3 and then reprogram to latest software level.

451.1 SPN 522222/FMI 2 - GHG17

CPC Internal - EEPROM Checksum Error

This fault indicates the CPC3evo has detected an internal EEPROM checksum error. This fault generally occurs after a programming event. Using DiagnosticLink 8.08 or higher reprogram the CPC3evo module to latest settings.

451.2 SPN 522222/FMI 13 - GHG17

Check as follows:

1. This fault indicates the CPC3evo has detected an internal EEPROM Data verification. This fault generally occurs after a programming event. Using DiagnosticLink® 8.08 or higher reprogram the CPC3evo module to latest settings.

SPN 522222 (CPC3) (GHG17)

451.1 SPN 522222/FMI 2 - GHG17

CPC Internal - EEPROM Checksum Error

This fault indicates the CPC3evo has detected an internal EEPROM checksum error. This fault generally occurs after a programming event. Using DiagnosticLink 8.08 or higher reprogram the CPC3evo module to latest settings.

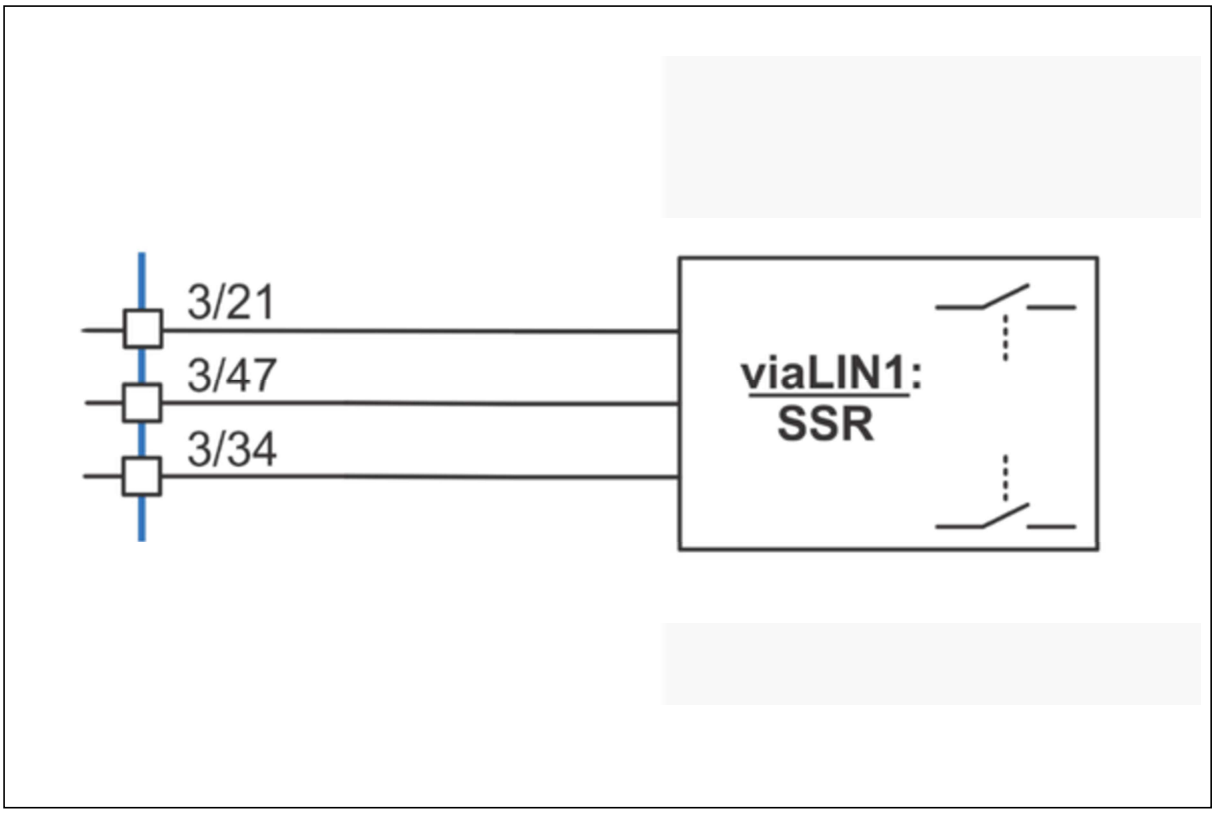
451.2 SPN 522222/FMI 13 - GHG17

Check as follows:

1. This fault indicates the CPC3evo has detected an internal EEPROM Data verification. This fault generally occurs after a programming event. Using DiagnosticLink® 8.08 or higher reprogram the CPC3evo module to latest settings.

452.1 SPN 523597/FMI 3 - GHG17

Shift Stalk Pin 3-34 Short to Battery

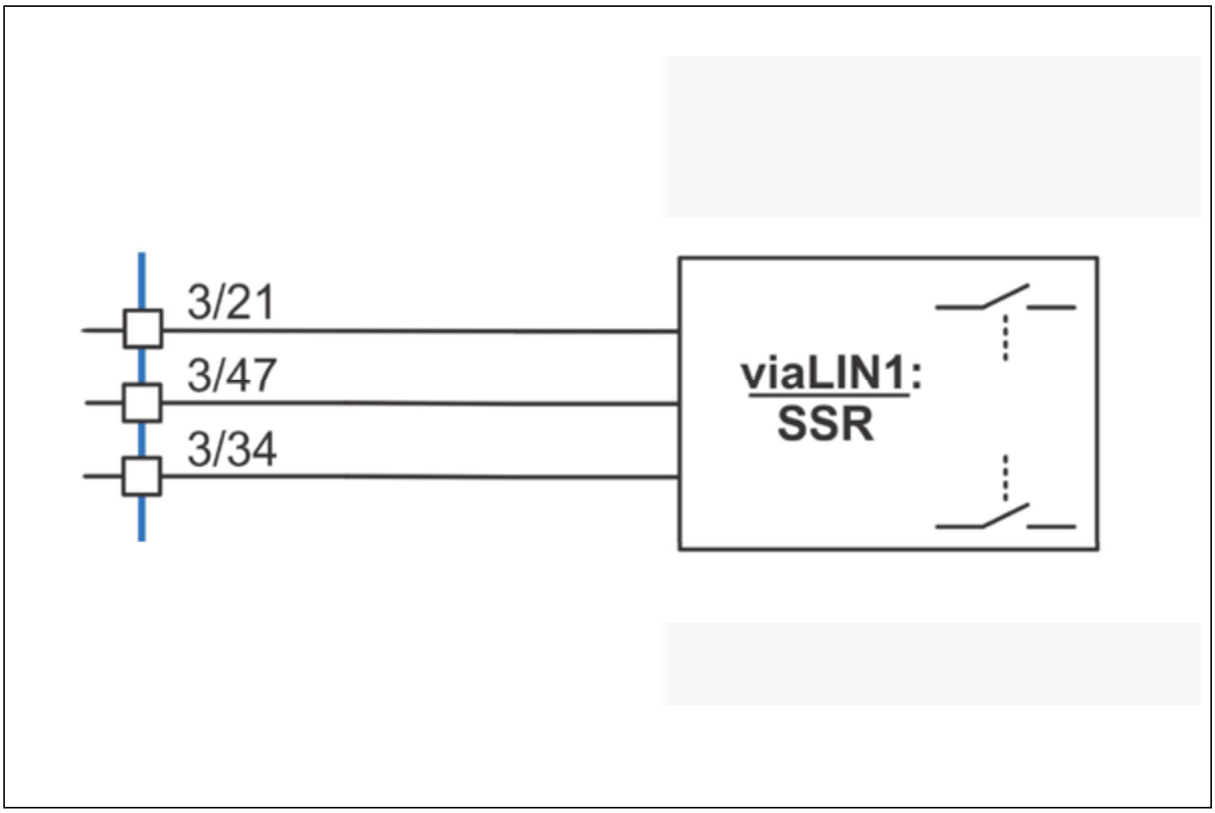


Check as follows:

1. Disconnect right shift stalk connector.
2. Inspect harness connector for bent, spread, or corroded pins. Is pin damage present?
   - 2.a Yes; repair harness between shift stalk and CPC3 connector #3.
   - 2.b No; repair short to battery power between right shift stalk connector and pin 34 of the CPC3 connector #3. Refer to Original Equipment Manufacturer (OEM) wiring schematics for harness layout.

452.2 SPN 523597/FMI 4 - GHG17

Shift Stalk Pin 3-34 Short to Ground



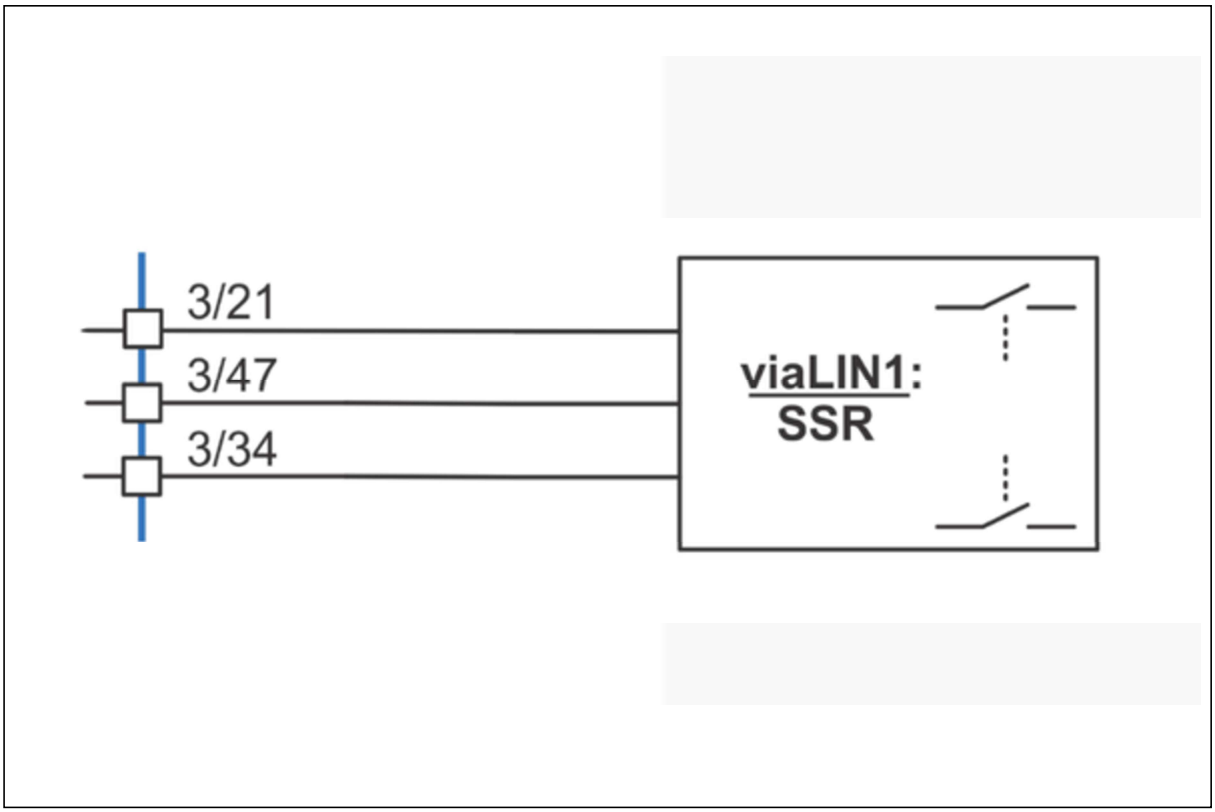
Check as follows:

1. Disconnect right shift stalk connector.
2. Inspect harness connector for bent, spread, or corroded pins. Is pin damage present?
   - 2.a Yes; repair harness between shift stalk and CPC3 connector #3.
   - 2.b No, repair short to ground between right shift stalk connector and pin 34 of the CPC3 connector #3. Refer to Original Equipment Manufacturer (OEM) wiring schematics for harness layout.

SPN 523597 (CPC3) (GHG17)

452.1 SPN 523597/FMI 3 - GHG17

Shift Stalk Pin 3-34 Short to Battery

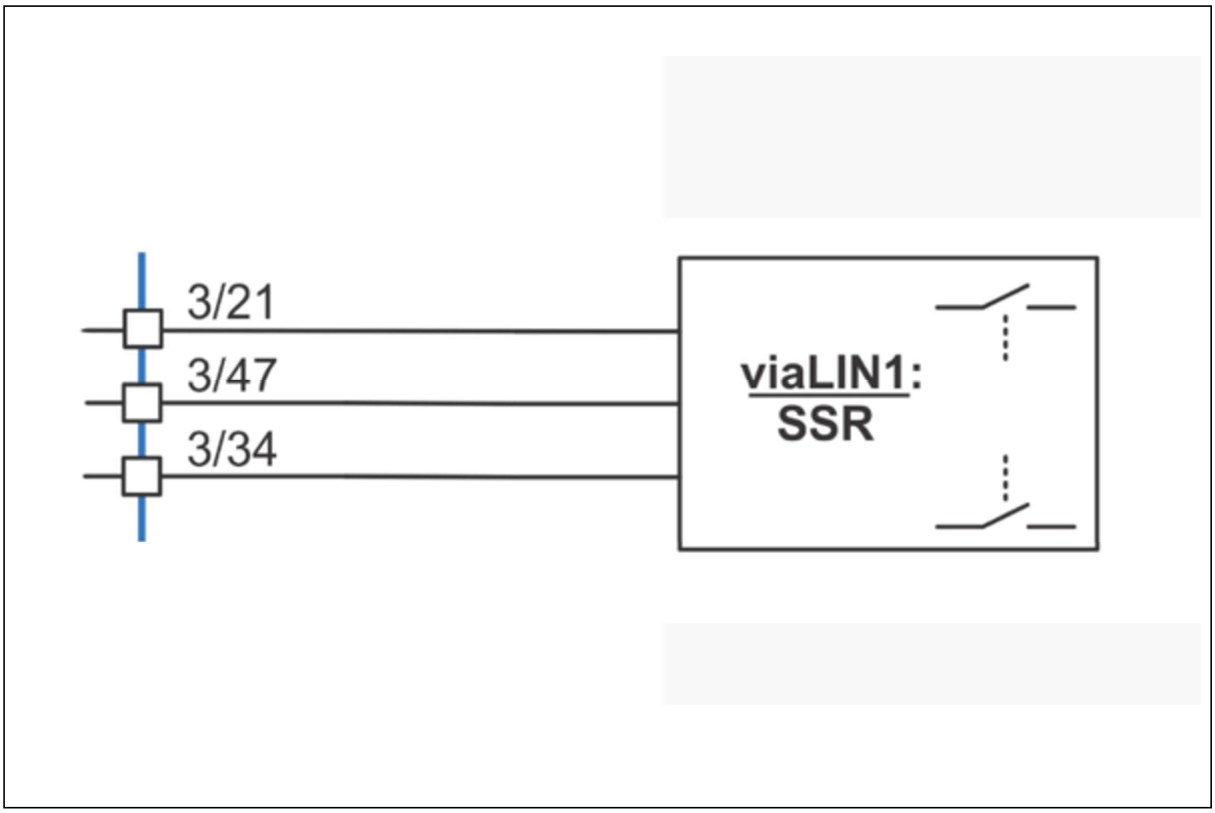


Check as follows:

1. Disconnect right shift stalk connector.
2. Inspect harness connector for bent, spread, or corroded pins. Is pin damage present?
   - 2.a Yes; repair harness between shift stalk and CPC3 connector #3.
   - 2.b No; repair short to battery power between right shift stalk connector and pin 34 of the CPC3 connector #3. Refer to Original Equipment Manufacturer (OEM) wiring schematics for harness layout.

452.2 SPN 523597/FMI 4 - GHG17

Shift Stalk Pin 3-34 Short to Ground



Check as follows:

1. Disconnect right shift stalk connector.
2. Inspect harness connector for bent, spread, or corroded pins. Is pin damage present?
   - 2.a Yes; repair harness between shift stalk and CPC3 connector #3.
   - 2.b No, repair short to ground between right shift stalk connector and pin 34 of the CPC3 connector #3. Refer to Original Equipment Manufacturer (OEM) wiring schematics for harness layout.

453.1 SPN 524200/FMI 3 - GHG17

This fault indicates there is an internal error failure in the CPC3. Replace the CPC3. After replacement, reprogram the module to latest server configuration.

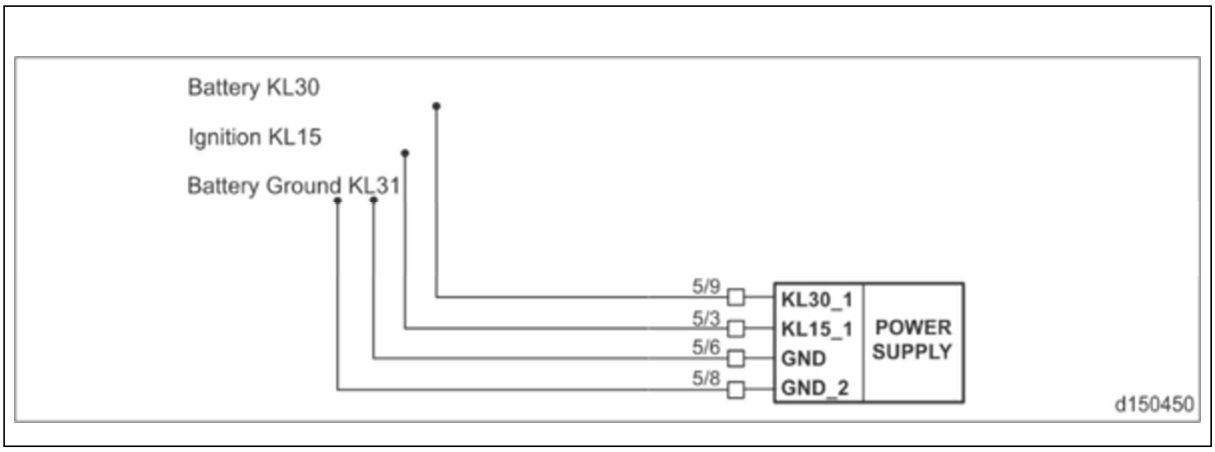
SPN 524200 (CPC3) (GHG17)

453.1 SPN 524200/FMI 3 - GHG17

This fault indicates there is an internal error failure in the CPC3. Replace the CPC3. After replacement, reprogram the module to latest server configuration.

454.1 SPN 524204/FMI 5 - GHG17

CPC3 Ground Circuit Pin 5/6 Open



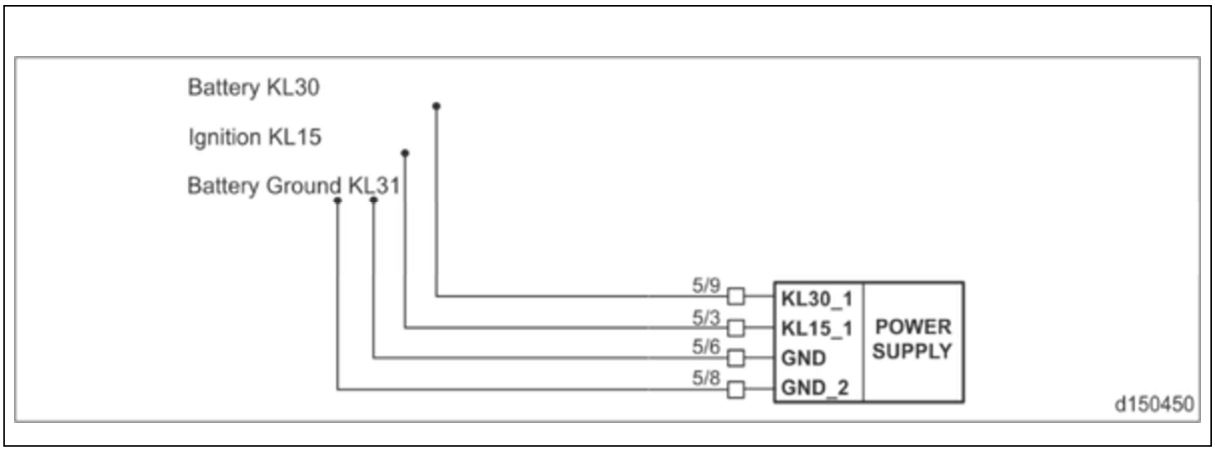
Check as follows:

1. Disconnect CPC3 connector #5.
2. Inspect harness connector for bent, spread, or corroded pins. Is pin damage present?
   - 2.a Yes; repair as necessary.
   - 2.b No; restore ground connection to pin 6 of connector #5. Refer to EZ Wiring module 283 for harness layout.

SPN 524204 (CPC3) (GHG17)

454.1 SPN 524204/FMI 5 - GHG17

CPC3 Ground Circuit Pin 5/6 Open



Check as follows:

1. Disconnect CPC3 connector #5.
2. Inspect harness connector for bent, spread, or corroded pins. Is pin damage present?
   - 2.a Yes; repair as necessary.
   - 2.b No; restore ground connection to pin 6 of connector #5. Refer to EZ Wiring module 283 for harness layout.

455.1 SPN 524205/FMI 14 - GHG17

This fault indicates there is an internal PMC error failure in the CPC3. Replace the CPC3. After replacement, reprogram the module to latest server configuration.

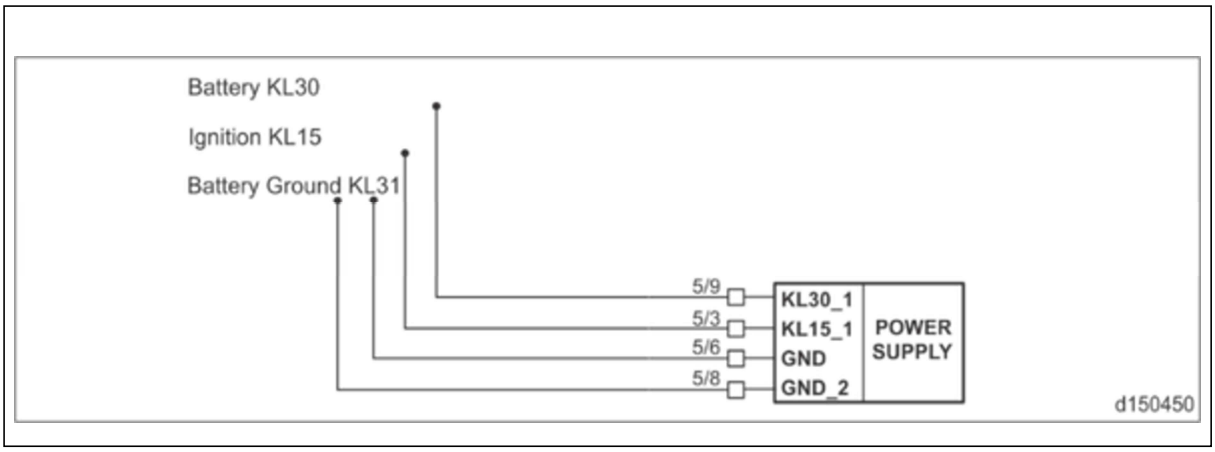
SPN 524205 (CPC3) (GHG17)

455.1 SPN 524205/FMI 14 - GHG17

This fault indicates there is an internal PMC error failure in the CPC3. Replace the CPC3. After replacement, reprogram the module to latest server configuration.

456.1 SPN 524206/FMI 5 - GHG17

CPC3 Ground Circuit Pin 5/8 Open



Check as follows:

1. Disconnect CPC3 connector #5.
2. Inspect harness connector for bent, spread, or corroded pins. Is pin damage present?
   - 2.a Yes; repair as necessary.
   - 2.b No; restore ground connection to pin 8 of connector #5. Refer to Original Equipment Manufacturer (OEM) wiring schematics for harness layout.

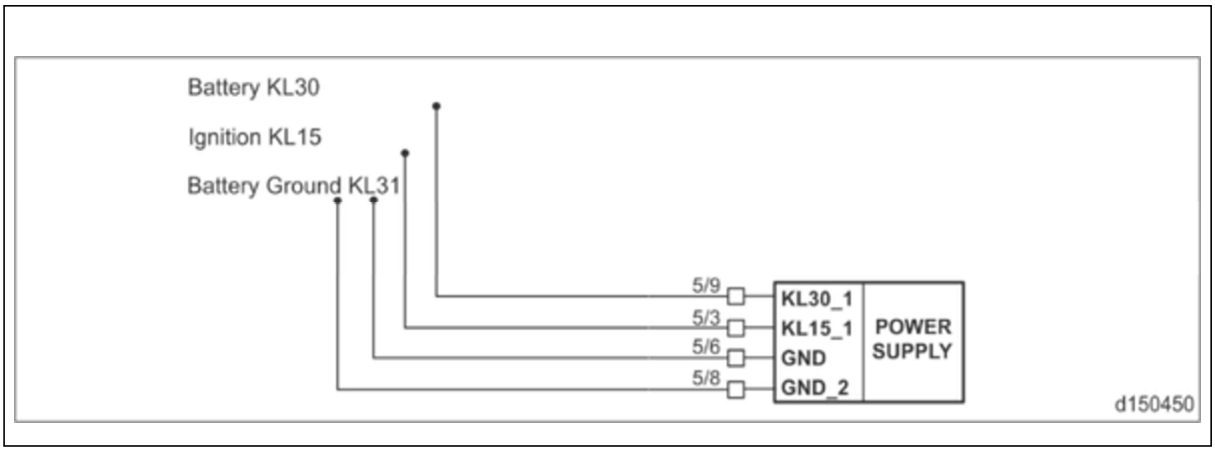
456.2 SPN 524206/FMI 12 - GHG17

This fault indicates internal temperature error failure in the CPC3. Replace the CPC3. After replacement, reprogram the module to the latest server configuration.

SPN 524206 (CPC3) (GHG17)

456.1 SPN 524206/FMI 5 - GHG17

CPC3 Ground Circuit Pin 5/8 Open



Check as follows:

1. Disconnect CPC3 connector #5.
2. Inspect harness connector for bent, spread, or corroded pins. Is pin damage present?
   - 2.a Yes; repair as necessary.
   - 2.b No; restore ground connection to pin 8 of connector #5. Refer to Original Equipment Manufacturer (OEM) wiring schematics for harness layout.

456.2 SPN 524206/FMI 12 - GHG17

This fault indicates internal temperature error failure in the CPC3. Replace the CPC3. After replacement, reprogram the module to the latest server configuration.

457.1 SPN 524207/FMI 12 - GHG17

Check as follows:

1. Shut off the engine, apply the parking brake, chock the wheels, and perform any other applicable safety steps.
2. Disconnect the Accelerator Pedal (AP).
3. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   3.a Yes; repair as necessary. Verify repair.

   3.b No; Go to step 4.
4. Turn the ignition ON (key ON, engine OFF).

Williams Dual-Channel Pedal Connector and Pinout				
Function	CPC3 Cavity	Pedal Connector Pin	Comments	Pedal Harness Connector Body
APS1	2/3	A	SENSOR 1	
GND1	2/20	B	APS1 GND	
VCC1 (+5V)	2/15	C	APS1 Power Supply	
VCC2 (+5V)	2/21	D	APS2 Power Supply	
GND2	2/14	E	APS2 GND	The image above is the front side looking into the pins on the Harness Connector.
APS2	2/4	F	SENSOR 2	Harness Connector and Seal (P/N: 12066317) Terminal Female (P/N: 12103881)

5. Measure the voltage between pin F of the AP harness connector and ground. Is any voltage present?

   5.a Yes; repair the short to power between pin F of the AP harness connector and pin 4 of the CPC3 connector #2. Verify repair.

   5.b No; Go to step 6.
6. Measure the voltage between pin A of the AP harness connector and ground. Is any voltage present?

   6.a Yes; repair the short to power between pin A of the AP harness connector and pin 3 of the CPC3 connector #2. Verify repair.

   6.b No; Go to step 7.
7. Turn the ignition OFF.
8. Disconnect the CPC3 connector #2.
9. Inspect the CPC3 connector #2 and the harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage present?

   9.a Yes; repair as necessary. Verify repair.

9.b No; Go to step 10.

10. Measure the resistance between pin F of the AP harness connector and pin 4 of the CPC3 connector #2. Is the resistance less than five ohms?

10.a Yes; Go to step 11.

10.b No; repair the circuit between pin F of the AP harness connector and pin 4 of the CPC3 connector #2. Verify repair.

11. Measure the resistance between pin F of the AP harness connector and ground. Is the resistance greater than 10K ohms?

11.a Yes; Go to step 12.

11.b No; repair the shorted circuit between pin F of the AP harness connector and pin 4 of the CPC3 connector #2.

12. Measure the resistance between pin A of the AP harness connector and pin 3 of the CPC3 connector #2. Is the resistance less than five ohms?

12.a Yes; Go to step 13.

12.b No; repair the circuit between pin A of the AP harness connector and pin 3 of the CPC3 connector#2. Verify repair.

13. Measure the resistance between pin F of the AP harness connector and ground. Is the resistance greater than 10K ohms?

13.a Yes; replace the accelerator pedal.

13.b No; repair the shorted circuit between pin A of the AP harness connector and pin 3 of the CPC3 connector #2.

SPN 524207 (CPC3) (GHG17)

457.1 SPN 524207/FMI 12 - GHG17

Check as follows:

1. Shut off the engine, apply the parking brake, chock the wheels, and perform any other applicable safety steps.
2. Disconnect the Accelerator Pedal (AP).
3. Inspect the AP and harness side connectors for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage found?

   3.a Yes; repair as necessary. Verify repair.

   3.b No; Go to step 4.
4. Turn the ignition ON (key ON, engine OFF).

Williams Dual-Channel Pedal Connector and Pinout				
Function	CPC3 Cavity	Pedal Connector Pin	Comments	Pedal Harness Connector Body
APS1	2/3	A	SENSOR 1	
GND1	2/20	B	APS1 GND	
VCC1 (+5V)	2/15	C	APS1 Power Supply	
VCC2 (+5V)	2/21	D	APS2 Power Supply	
GND2	2/14	E	APS2 GND	The image above is the front side looking into the pins on the Harness Connector.
APS2	2/4	F	SENSOR 2	Harness Connector and Seal (P/N: 12066317) Terminal Female (P/N: 12103881)

5. Measure the voltage between pin F of the AP harness connector and ground. Is any voltage present?

   5.a Yes; repair the short to power between pin F of the AP harness connector and pin 4 of the CPC3 connector #2. Verify repair.

   5.b No; Go to step 6.
6. Measure the voltage between pin A of the AP harness connector and ground. Is any voltage present?

   6.a Yes; repair the short to power between pin A of the AP harness connector and pin 3 of the CPC3 connector #2. Verify repair.

   6.b No; Go to step 7.
7. Turn the ignition OFF.
8. Disconnect the CPC3 connector #2.
9. Inspect the CPC3 connector #2 and the harness connector for signs of damaged, bent, spread, corroded or unseated (pushed out) pins and signs of moisture in the connector or wire damage near the connector. Is any damage present?

9.a Yes; repair as necessary. Verify repair.

9.b No; Go to step 10.

10. Measure the resistance between pin F of the AP harness connector and pin 4 of the CPC3 connector #2. Is the resistance less than five ohms?

10.a Yes; Go to step 11.

10.b No; repair the circuit between pin F of the AP harness connector and pin 4 of the CPC3 connector #2. Verify repair.

11. Measure the resistance between pin F of the AP harness connector and ground. Is the resistance greater than 10K ohms?

11.a Yes; Go to step 12.

11.b No; repair the shorted circuit between pin F of the AP harness connector and pin 4 of the CPC3 connector #2.

12. Measure the resistance between pin A of the AP harness connector and pin 3 of the CPC3 connector #2. Is the resistance less than five ohms?

12.a Yes; Go to step 13.

12.b No; repair the circuit between pin A of the AP harness connector and pin 3 of the CPC3 connector#2. Verify repair.

13. Measure the resistance between pin F of the AP harness connector and ground. Is the resistance greater than 10K ohms?

13.a Yes; replace the accelerator pedal.

13.b No; repair the shorted circuit between pin A of the AP harness connector and pin 3 of the CPC3 connector #2.

SPN 524208 (CPC3) (GHG17)

458.1 SPN 524208/FMI 14 - GHG17

Accelerator Pedal - Idle Position Not Detected

This is an information-only fault code; a silent fault code that displays a message in the instrument cluster indicating that the accelerator pedal was pressed at the time of engine start. No action is required: this is information only.

459.1 SPN 524213/FMI 14 - GHG17

This is an information-only fault which means the transmission has been placed in dyno mode. Connect DiagnosticLink® 8.04 SP2, or higher, and under the Actions/Transmission tab, deactivate dyno mode.

SPN 524213 (CPC3) (GHG17)

459.1 SPN 524213/FMI 14 - GHG17

This is an information-only fault which means the transmission has been placed in dyno mode. Connect DiagnosticLink® 8.04 SP2, or higher, and under the Actions/Transmission tab, deactivate dyno mode.

460.1 SPN 524275/FMI 19 - GHG17

RCM Message Not Received or Stopped Arriving

SPN 524275/FMI 19	
Description	Retarder Control Module (RCM) messages are missing
Monitored Parameter	CPC 001/091 RCM Diagnosis Source Address
Typical Enabling Conditions	
Monitor Sequence	
Execution Frequency	
Typical Duration	
Dash Lamps	
Engine Reaction	None
Verification	CPC 001/091 should not be configured.

Check as follows:

Note : This fault code is not calibrated for NAFTA Market. If this fault code is active, the Common Powertrain Controller (CPC) parameter set is wrong.

1. Connect DiagnosticLink .
2. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. Go to step 3. to verify repair.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

SPN 524275 (CPC) (GHG17)

460.1 SPN 524275/FMI 19 - GHG17

RCM Message Not Received or Stopped Arriving

SPN 524275/FMI 19	
Description	Retarder Control Module (RCM) messages are missing
Monitored Parameter	CPC 001/091 RCM Diagnosis Source Address
Typical Enabling Conditions	
Monitor Sequence	
Execution Frequency	
Typical Duration	
Dash Lamps	
Engine Reaction	None
Verification	CPC 001/091 should not be configured.

Check as follows:

Note : This fault code is not calibrated for NAFTA Market. If this fault code is active, the Common Powertrain Controller (CPC) parameter set is wrong.

1. Connect DiagnosticLink .
2. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. Go to step 3. to verify repair.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

461.1 SPN 524276/FMI 13 - GHG17

SPN 524276/FMI 13	
Description	Common Powertrain Controller (CPC) Configuration Mismatched
Monitored Parameter	CPC PGR002/024 GVC Emission Standard Conf
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	None
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON Engine OFF

1. Connect to DiagnosticLink .
2. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct the information as necessary. To verify repair, Go to step 3.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

SPN 524276 (CPC) (GHG17)

461.1 SPN 524276/FMI 13 - GHG17

SPN 524276/FMI 13	
Description	Common Powertrain Controller (CPC) Configuration Mismatched
Monitored Parameter	CPC PGR002/024 GVC Emission Standard Conf
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	None
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON Engine OFF

1. Connect to DiagnosticLink .
2. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct the information as necessary. To verify repair, Go to step 3.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

462.1 SPN 524277/FMI 13 - GHG17

SPN 524277/FMI 13	
Description	This Code is not Configured for NAFTA Applications; if this Code is Active, CPC Configuration is Incorrect
Monitored Parameter	CPC PGR042
Typical Enabling Conditions	Not Enabled
Monitor Sequence	None
Execution Frequency	Nonet
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON Engine OFF

1. Connect DiagnosticLink .
2. Check for proper configuration of the Common Powertrain Controller (CPC) against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. To verify repair, Go to step 3.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

462.2 SPN 524277/FMI 14 - GHG17

SPN 524277/FMI 14	
Description	This Code is not Configured for NAFTA Applications; if this Code is Active, CPC Configuration is Incorrect
Monitored Parameter	CPC PGR042
Typical Enabling Conditions	Not Enabled
Monitor Sequence	None
Execution Frequency	None
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON Engine OFF

1. Connect DiagnosticLink .
2. Check for proper configuration of the Common Powertrain Controller (CPC) against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. To verify repair, Go to step 3.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

462.3 SPN 524277/FMI 19 - GHG17

SPN 524277/FMI 19	
Description	This Code is not Configured for NAFTA Applications; if This Code is Active, CPC Configuration is Incorrect
Monitored Parameter	CPC PGR042
Typical Enabling Conditions	Not Enabled
Monitor Sequence	None
Execution Frequency	None
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON Engine OFF

1. Connect DiagnosticLink .
2. Check for proper configuration of the Common Powertrain Controller (CPC) against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. To verify repair, Go to step 3.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

SPN 524277 (CPC) (GHG17)

462.1 SPN 524277/FMI 13 - GHG17

SPN 524277/FMI 13	
Description	This Code is not Configured for NAFTA Applications; if this Code is Active, CPC Configuration is Incorrect
Monitored Parameter	CPC PGR042
Typical Enabling Conditions	Not Enabled
Monitor Sequence	None
Execution Frequency	Nonet
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON Engine OFF

1. Connect DiagnosticLink .
2. Check for proper configuration of the Common Powertrain Controller (CPC) against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. To verify repair, Go to step 3.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

462.2 SPN 524277/FMI 14 - GHG17

SPN 524277/FMI 14	
Description	This Code is not Configured for NAFTA Applications; if this Code is Active, CPC Configuration is Incorrect
Monitored Parameter	CPC PGR042
Typical Enabling Conditions	Not Enabled
Monitor Sequence	None
Execution Frequency	None
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON Engine OFF

1. Connect DiagnosticLink .
2. Check for proper configuration of the Common Powertrain Controller (CPC) against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. To verify repair, Go to step 3.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

462.3 SPN 524277/FMI 19 - GHG17

SPN 524277/FMI 19	
Description	This Code is not Configured for NAFTA Applications; if This Code is Active, CPC Configuration is Incorrect
Monitored Parameter	CPC PGR042
Typical Enabling Conditions	Not Enabled
Monitor Sequence	None
Execution Frequency	None
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON Engine OFF

1. Connect DiagnosticLink .
2. Check for proper configuration of the Common Powertrain Controller (CPC) against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. To verify repair, Go to step 3.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

463.1 SPN 524278/FMI 13 - GHG17

SPN 524278/FMI 13	
Description	Accelerator Pedal Signal Missing
Monitored Parameter	Accelerator Pedal
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On Engine On

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Connect DiagnosticLink .
2. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. Go to step 3. to verify repair.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

463.2 SPN 524278/FMI 14 - GHG17

SPN 524278/FMI 14	
Description	Accelerator Pedal Signal Missing
Monitored Parameter	Accelerator Pedal
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On Engine On

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Connect DiagnosticLink .
2. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. Go to step 3. to verify repair.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

463.3 SPN 524278/FMI 15 - GHG17

SPN 524278/FMI 15	
Description	Accelerator Pedal Signal Error
Monitored Parameter	Accelerator Pedal
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On Engine On

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Connect DiagnosticLink .
2. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. Go to step 3. to verify repair.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

SPN 524278 (CPC) (GHG17)

463.1 SPN 524278/FMI 13 - GHG17

SPN 524278/FMI 13	
Description	Accelerator Pedal Signal Missing
Monitored Parameter	Accelerator Pedal
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On Engine On

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Connect DiagnosticLink .
2. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. Go to step 3. to verify repair.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

463.2 SPN 524278/FMI 14 - GHG17

SPN 524278/FMI 14	
Description	Accelerator Pedal Signal Missing
Monitored Parameter	Accelerator Pedal
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On Engine On

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Connect DiagnosticLink .
2. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. Go to step 3. to verify repair.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

463.3 SPN 524278/FMI 15 - GHG17

SPN 524278/FMI 15	
Description	Accelerator Pedal Signal Error
Monitored Parameter	Accelerator Pedal
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On Engine On

WARNING

ENGINE EXHAUST

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

Check as follows:

1. Connect DiagnosticLink .
2. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. Go to step 3. to verify repair.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

464.1 SPN 524279/FMI 2 - GHG17

SPN 524279/FMI 2	
Description	This Code is not Configured for NAFTA Applications. If This Code is Active, Common Powertrain Controller (CPC) Configuration is Incorrect
Monitored Parameter	CPC PGR063
Typical Enabling Conditions	Not Enabled
Monitor Sequence	None
Execution Frequency	None
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, Engine OFF

Check as follows:

1. Connect DiagnosticLink .
2. Check for proper configuration of the Common Powertrain Controller (CPC) against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. Go to step 3.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

464.2 SPN 524279/FMI 3 - GHG17

SPN 524279/FMI 3	
Description	This Code is Not Configured for NAFTA Applications; If this Code is Active, Common Powertrain Controller (CPC) Configuration is Incorrect
Monitored Parameter	CPC PGR063
Typical Enabling Conditions	Not Enabled
Monitor Sequence	None
Execution Frequency	None
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, Engine OFF

Check as follows:

1. Connect DiagnosticLink .
2. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. Go to step 3.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

464.3 SPN 524279/FMI 4 - GHG17

SPN 524279/FMI 4	
Description	This Code is not Configured For NAFTA Applications. If This Code is Active, Common Powertrain Controller (CPC) Configuration is Incorrect
Monitored Parameter	CPC PGR063
Typical Enabling Conditions	Not Enabled
Monitor Sequence	None
Execution Frequency	None
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, Engine OFF

Check as follows:

1. Connect DiagnosticLink .
2. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. Go to step 3.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

464.4 SPN 524279/FMI 11 - GHG17

SPN 524279/FMI 11	
Description	This Code is not Configured for NAFTA Applications. If this Code is Active, Common Powertrain Controller (CPC) Configuration is Incorrect
Monitored Parameter	CPC PGR063
Typical Enabling Conditions	Not Enabled
Monitor Sequence	None
Execution Frequency	None
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, Engine OFF

Check as follows:

1. Connect DiagnosticLink .
2. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. Go to step 3.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

464.5 SPN 524279/FMI 18 - GHG17

SPN 524279/FMI 18	
Description	This Code is not Configured for NAFTA Applications. If this Code is Active, Common Powertrain Controller (CPC) Configuration is Incorrect
Monitored Parameter	CPC PGR063
Typical Enabling Conditions	Not Enabled
Monitor Sequence	None
Execution Frequency	None
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, Engine OFF

Check as follows:

1. Connect DiagnosticLink .
2. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. Go to step 3.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

SPN 524279 (CPC) (GHG17)

464.1 SPN 524279/FMI 2 - GHG17

SPN 524279/FMI 2	
Description	This Code is not Configured for NAFTA Applications. If This Code is Active, Common Powertrain Controller (CPC) Configuration is Incorrect
Monitored Parameter	CPC PGR063
Typical Enabling Conditions	Not Enabled
Monitor Sequence	None
Execution Frequency	None
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, Engine OFF

Check as follows:

1. Connect DiagnosticLink .
2. Check for proper configuration of the Common Powertrain Controller (CPC) against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. Go to step 3.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

464.2 SPN 524279/FMI 3 - GHG17

SPN 524279/FMI 3	
Description	This Code is Not Configured for NAFTA Applications; If this Code is Active, Common Powertrain Controller (CPC) Configuration is Incorrect
Monitored Parameter	CPC PGR063
Typical Enabling Conditions	Not Enabled
Monitor Sequence	None
Execution Frequency	None
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, Engine OFF

Check as follows:

1. Connect DiagnosticLink .
2. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. Go to step 3.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

464.3 SPN 524279/FMI 4 - GHG17

SPN 524279/FMI 4	
Description	This Code is not Configured For NAFTA Applications. If This Code is Active, Common Powertrain Controller (CPC) Configuration is Incorrect
Monitored Parameter	CPC PGR063
Typical Enabling Conditions	Not Enabled
Monitor Sequence	None
Execution Frequency	None
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, Engine OFF

Check as follows:

1. Connect DiagnosticLink .
2. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. Go to step 3.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

464.4 SPN 524279/FMI 11 - GHG17

SPN 524279/FMI 11	
Description	This Code is not Configured for NAFTA Applications. If this Code is Active, Common Powertrain Controller (CPC) Configuration is Incorrect
Monitored Parameter	CPC PGR063
Typical Enabling Conditions	Not Enabled
Monitor Sequence	None
Execution Frequency	None
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, Engine OFF

Check as follows:

1. Connect DiagnosticLink .
2. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. Go to step 3.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

464.5 SPN 524279/FMI 18 - GHG17

SPN 524279/FMI 18	
Description	This Code is not Configured for NAFTA Applications. If this Code is Active, Common Powertrain Controller (CPC) Configuration is Incorrect
Monitored Parameter	CPC PGR063
Typical Enabling Conditions	Not Enabled
Monitor Sequence	None
Execution Frequency	None
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON, Engine OFF

Check as follows:

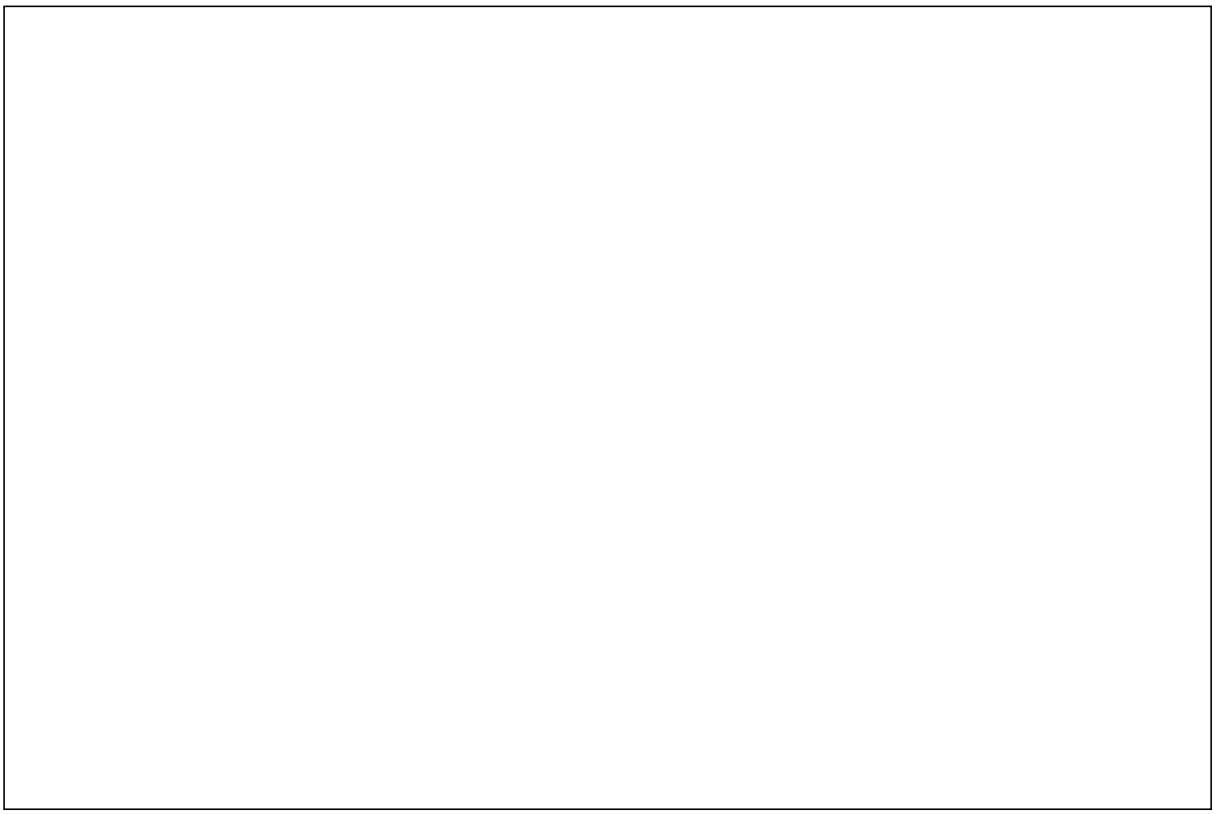
1. Connect DiagnosticLink .
2. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?

   2.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.

   2.b No; reprogram the CPC with the correct information as necessary. Go to step 3.
3. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

465.1 SPN 524280/FMI 2 - GHG17

SPN 524280/FMI 2	
Description	Idle Validation Switch Inputs Reversed
Monitored Parameter	Idle Validation Switch Input
Typical Enabling Conditions	Always On
Monitor Sequence	Key On
Execution Frequency	None
Typical Duration	None
Dash Lamps	MIL
Engine Reaction	Idle Only
Verification	Ignition Key Cycled On



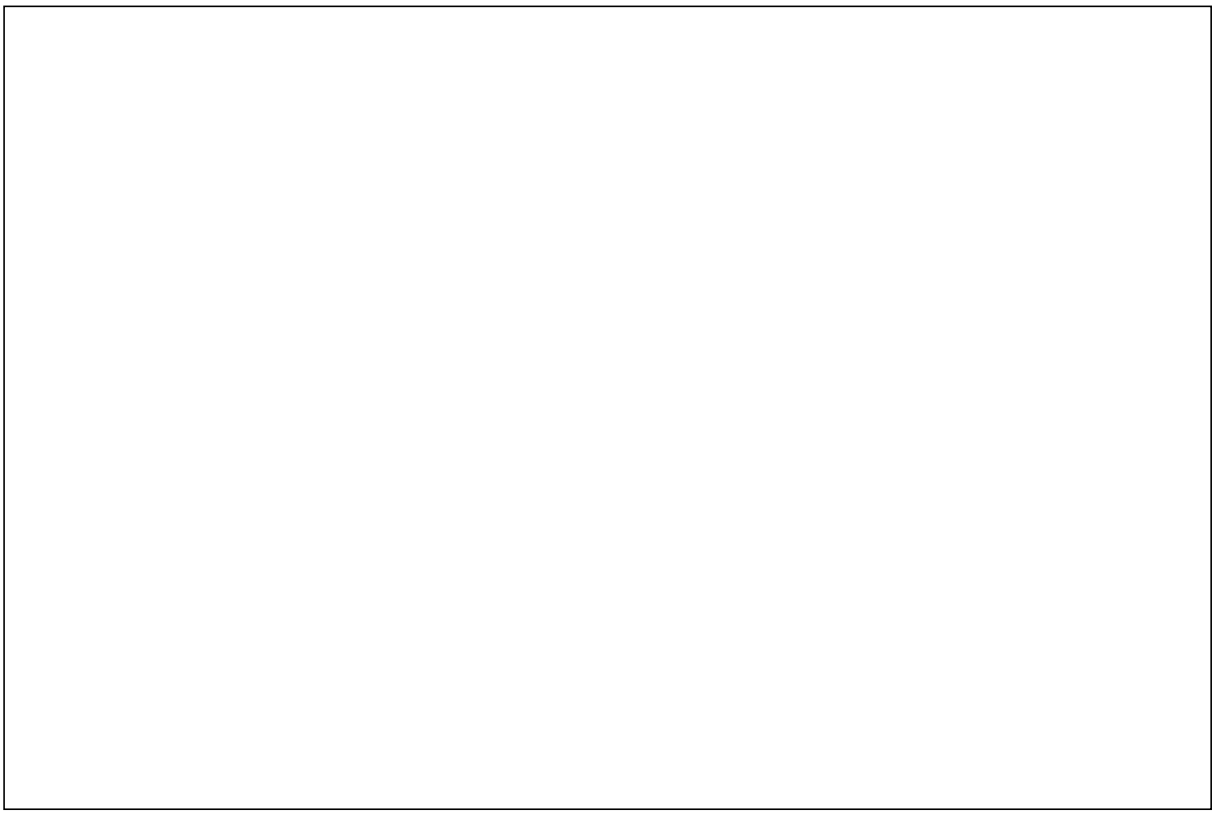
1. Verify that the vehicle is equipped with an Idle Validation Switch. Is the vehicle equipped with a remote accelerator pedal?
   1.a Yes; Go to step 4.
   1.b No; Go to step 2.
2. Has the Common Powertrain Controller (CPC) been reprogrammed recently?
   2.a Yes; verify the configuration of the CPC against the server information or the Application and Installation Manual. Correct the information as necessary. Verify repair.
   2.b No; Go to step 3.
3. Reprogram the CPC using the information from the server. Is SPN 524280/FMI 2 still present?
   3.a Yes; replace the CPC. Verify repair.

3.b No; release the vehicle.

4. Disconnect the Idle Validation Switch. Go to step 5.
5. Is SPN 524280/FMI 2 still present?
   5.a Yes; Go to step 6.
   5.b No; refer to OEM procedures to diagnose either a short in the Idle Validation Switch or incorrect wiring.
6. Reprogram the CPC. Is SPN 524280/FMI 2 still present?
   6.a Yes; replace the CPC. Verify repair.
   6.b No; release the vehicle.

465.2 SPN 524280/FMI 3 - GHG17

SPN 524280/FMI 3	
Description	Idle Validation Switch 1 Open Circuit
Monitored Parameter	VCC1
Typical Enabling Conditions	Always On
Monitor Sequence	Key On
Execution Frequency	None
Typical Duration	None
Dash Lamps	MIL
Engine Reaction	Idle Only
Verification	Ignition Key Cycled On



1. Verify that the vehicle is equipped with an Idle Validation Switch. Is the vehicle equipped with a remote accelerator pedal?
   1.a Yes; Go to step 4.
   1.b No; Go to step 2.
2. Has the Common Powertrain Controller (CPC) been reprogrammed recently?
   2.a Yes; verify the configuration of the CPC against the server information or the Application and Installation Manual. Correct the information as necessary. Verify repair.
   2.b No; Go to step 3.
3. Reprogram the CPC using the information from the server. Is SPN 524280/FMI 3 still present?
   3.a Yes; replace the CPC. Verify repair.

3.b No; release the vehicle.

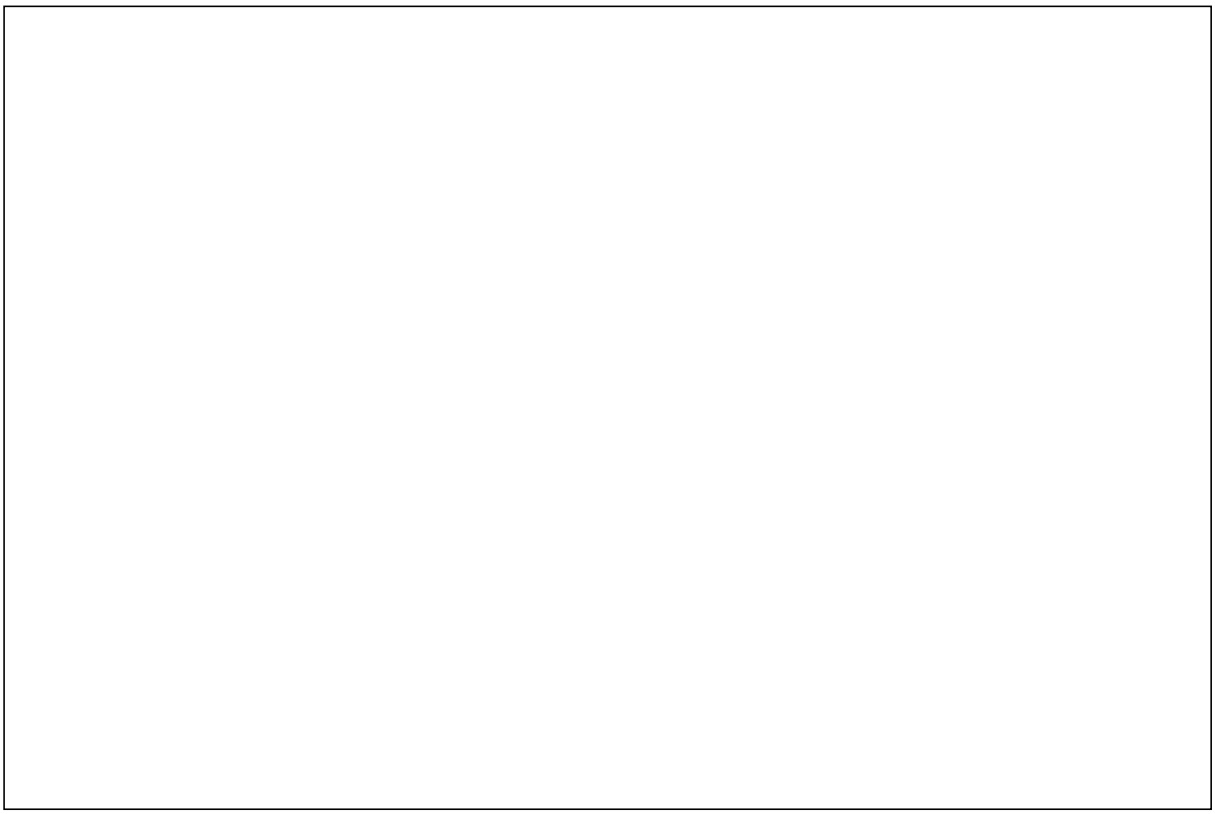
4. Measure the resistance between pin 8 of the CPC connector #1 and the Idle Validation Switch. Is the resistance less than five ohms?

4.a Yes; refer to OEM procedures to diagnose the open in the Idle Validation Switch.

4.b No; repair the open between pin 8 of the CPC connector #1 and the Idle Validation Switch.

465.3 SPN 524280/FMI 4 - GHG17

SPN 524280/FMI 4	
Description	Idle Validation Switch 1 Short to Ground
Monitored Parameter	VCC1
Typical Enabling Conditions	Always On
Monitor Sequence	Key On
Execution Frequency	None
Typical Duration	None
Dash Lamps	MIL
Engine Reaction	Idle Only
Verification	Ignition Key Cycled On



1. Verify that the vehicle is equipped with an Idle Validation Switch. Is the vehicle equipped with a remote accelerator pedal?
   1.a Yes; Go to step 4.
   1.b No; Go to step 2.
2. Has the Common Powertrain Controller (CPC) been reprogrammed recently?
   2.a Yes; verify the configuration of the CPC against the server information or the Application and Installation Manual. Correct the information as necessary. Verify repair.
   2.b No; Go to step 3.
3. Reprogram the CPC using the information from the server. Is SPN 524280/FMI 4 still present?
   3.a Yes; replace the CPC. Verify repair.

3.b No; release the vehicle.

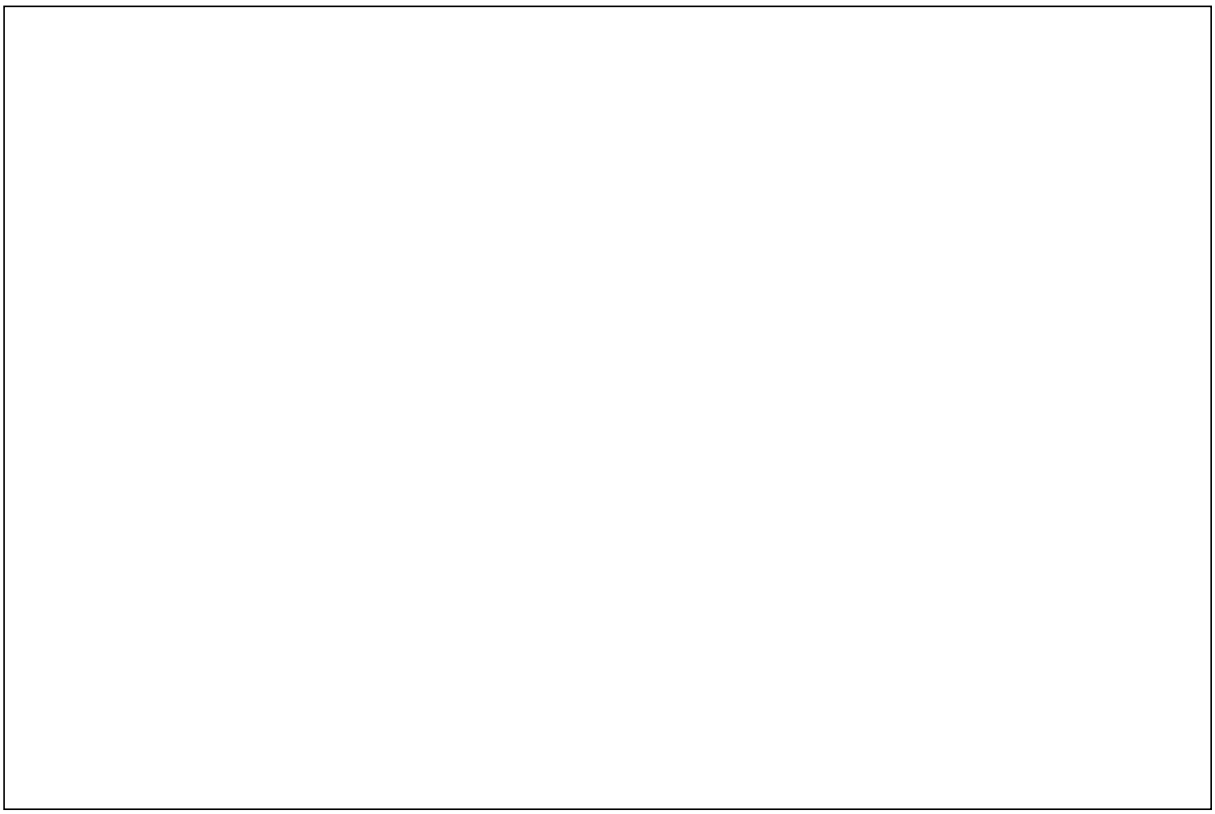
4. Measure the resistance between the Idle Validation Switch VCC1 connector (harness side) and ground. Is the resistance less than five ohms?

4.a Yes; repair the short to ground between Idle Validation Switch VCC1 connector (harness side) and ground.

4.b No; refer to OEM procedures to diagnose a short in the Idle Validation Switch.

465.4 SPN 524280/FMI 5 - GHG17

SPN 524280/FMI 5	
Description	Idle Validation Switch 2 Short to Ground
Monitored Parameter	VCC2
Typical Enabling Conditions	Always On
Monitor Sequence	Key On
Execution Frequency	None
Typical Duration	None
Dash Lamps	MIL
Engine Reaction	Idle Only
Verification	Ignition Key Cycled On



1. Verify that the vehicle is equipped with an Idle Validation Switch. Is the vehicle equipped with a remote accelerator pedal?
   - 1.a Yes; Go to step 4.
   - 1.b No; Go to step 2.
2. Has the Common Powertrain Controller (CPC) been reprogrammed recently?
   - 2.a Yes; verify the configuration of the CPC against the server information or the Application and Installation Manual. Correct the information as necessary. Verify repair.
   - 2.b No; Go to step 3.
3. Reprogram the CPC using the information from the server. Is SPN 524280/FMI 5 still present?
   - 3.a Yes; replace the CPC. Verify repair.

3.b No; release the vehicle.

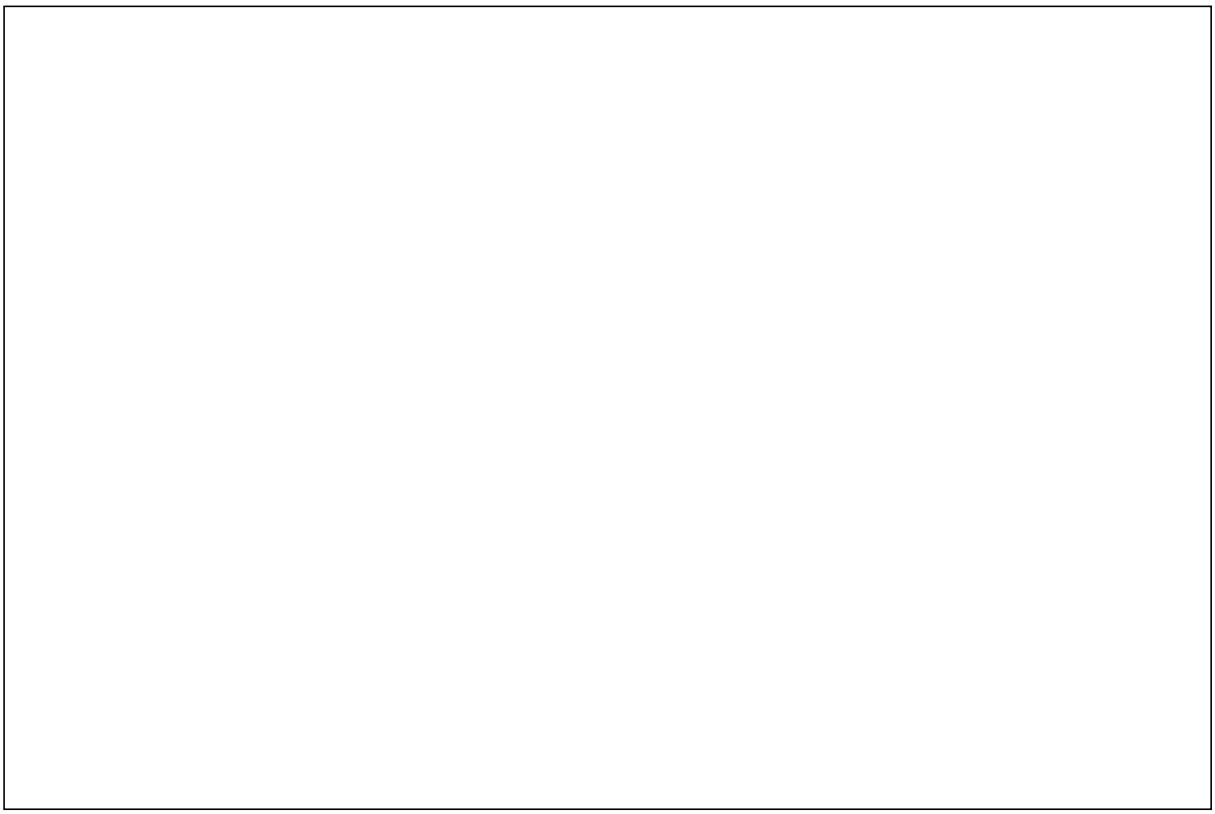
4. Measure the resistance between the Idle Validation Switch VCC2 connector (harness side) and ground. Is the resistance less than five ohms?

4.a Yes; repair the short to ground between Idle Validation Switch VCC2 connector (harness side) and ground.

4.b No; refer to OEM procedures to diagnose a short in the Idle Validation Switch.

465.5 SPN 524280/FMI 6 - GHG17

SPN 524280/FMI 6	
Description	Idle Validation Switch 2 Open Circuit
Monitored Parameter	VCC2
Typical Enabling Conditions	Always On
Monitor Sequence	Key On
Execution Frequency	None
Typical Duration	None
Dash Lamps	MIL
Engine Reaction	Idle Only
Verification	Ignition Key Cycled On



1. Verify that the vehicle is equipped with an Idle Validation Switch. Is the vehicle equipped with a remote accelerator pedal?
   - 1.a Yes; Go to step 4.
   - 1.b No; Go to step 2.
2. Has the Common Powertrain Controller (CPC) been reprogrammed recently?
   - 2.a Yes; verify the configuration of the CPC against the server information or the Application and Installation Manual. Correct the information as necessary. Verify repair.
   - 2.b No; Go to step 3.
3. Reprogram the CPC using the information from the server. Is SPN 524280/FMI 6 still present?
   - 3.a Yes; replace the CPC. Verify repair.

3.b No; release the vehicle.

4. Measure the resistance between pin 3 of the CPC connector #3 and the Idle Validation Switch. Is the resistance less than five ohms?

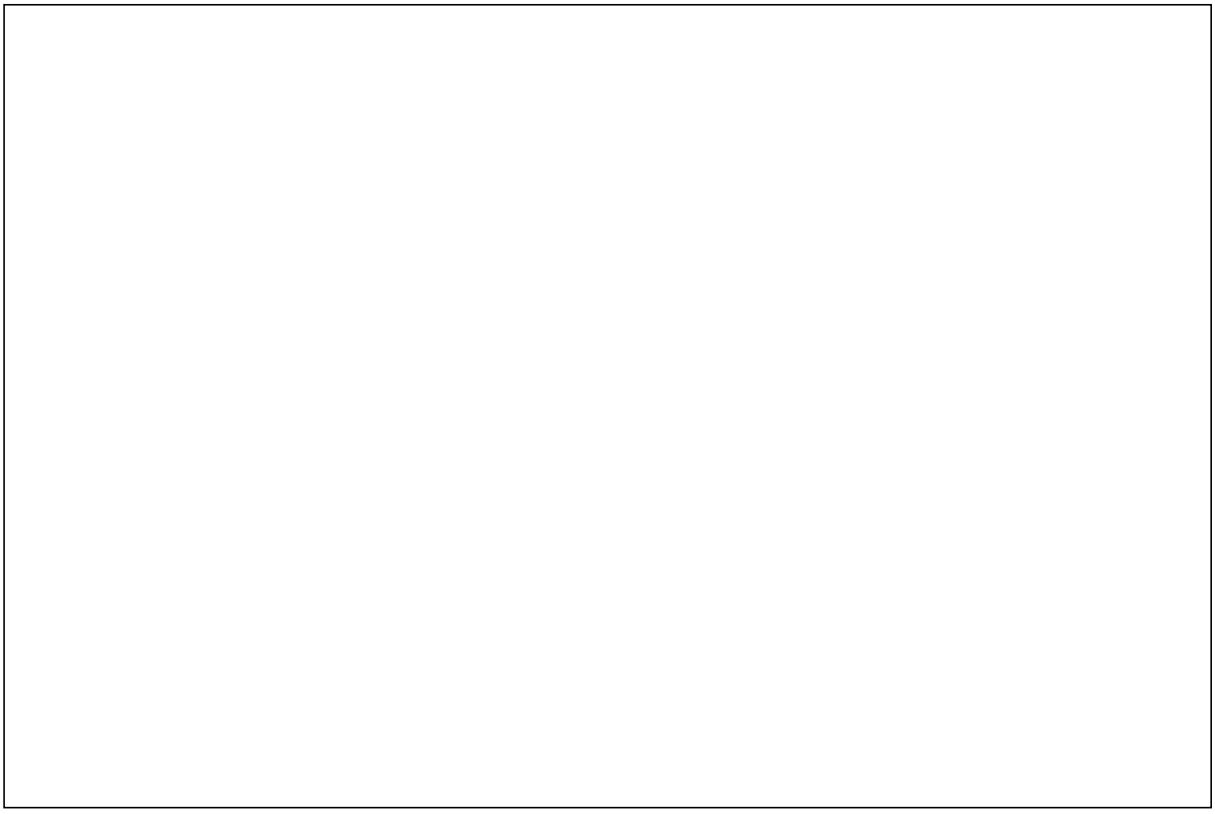
4.a Yes; refer to OEM procedures to diagnose the open in the Idle Validation Switch.

4.b No; repair the open between pin 3 of the CPC connector #3 and the Idle Validation Switch.

SPN 524280 (CPC) (GHG17)

465.1 SPN 524280/FMI 2 - GHG17

SPN 524280/FMI 2	
Description	Idle Validation Switch Inputs Reversed
Monitored Parameter	Idle Validation Switch Input
Typical Enabling Conditions	Always On
Monitor Sequence	Key On
Execution Frequency	None
Typical Duration	None
Dash Lamps	MIL
Engine Reaction	Idle Only
Verification	Ignition Key Cycled On

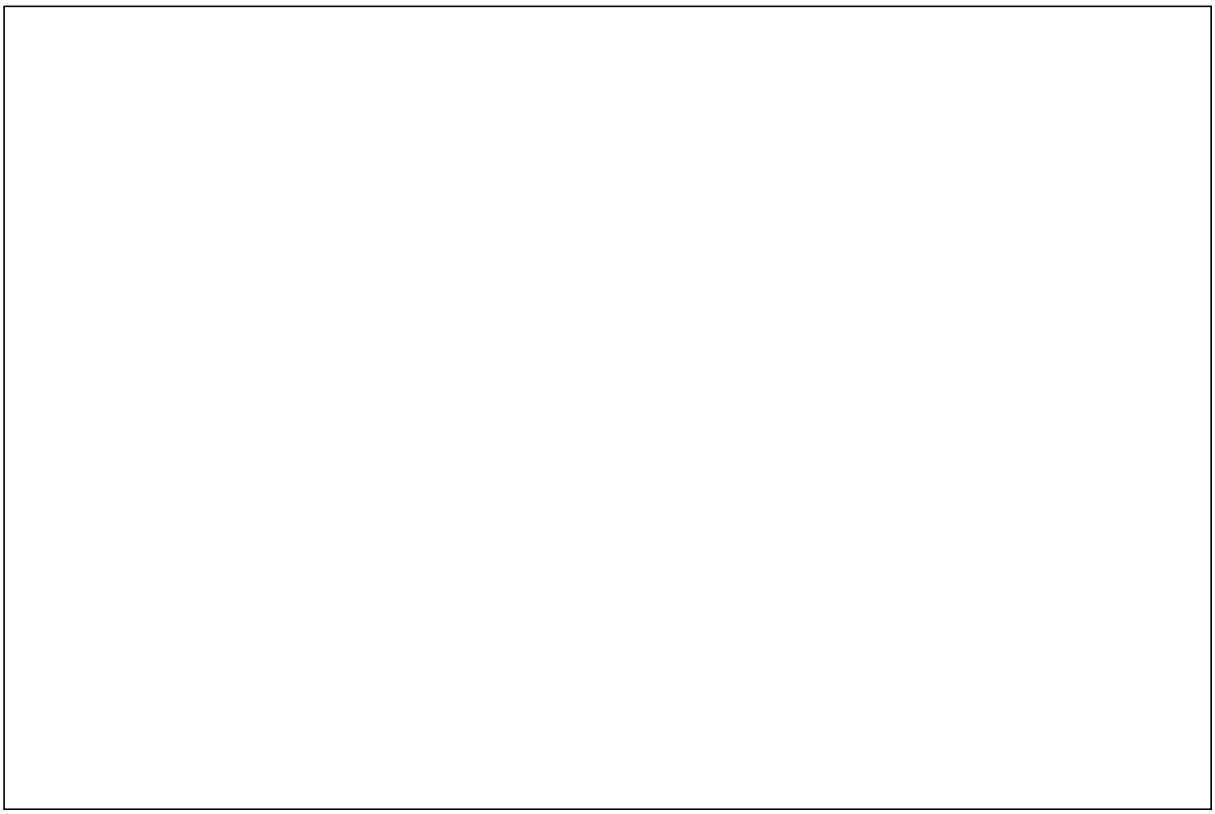


1. Verify that the vehicle is equipped with an Idle Validation Switch. Is the vehicle equipped with a remote accelerator pedal?
   1.a Yes; Go to step 4.
   1.b No; Go to step 2.
2. Has the Common Powertrain Controller (CPC) been reprogrammed recently?
   2.a Yes; verify the configuration of the CPC against the server information or the Application and Installation Manual. Correct the information as necessary. Verify repair.
   2.b No; Go to step 3.

3. Reprogram the CPC using the information from the server. Is SPN 524280/FMI 2 still present?
   3.a Yes; replace the CPC. Verify repair.
   3.b No; release the vehicle.
4. Disconnect the Idle Validation Switch. Go to step 5.
5. Is SPN 524280/FMI 2 still present?
   5.a Yes; Go to step 6.
   5.b No; refer to OEM procedures to diagnose either a short in the Idle Validation Switch or incorrect wiring.
6. Reprogram the CPC. Is SPN 524280/FMI 2 still present?
   6.a Yes; replace the CPC. Verify repair.
   6.b No; release the vehicle.

465.2 SPN 524280/FMI 3 - GHG17

SPN 524280/FMI 3	
Description	Idle Validation Switch 1 Open Circuit
Monitored Parameter	VCC1
Typical Enabling Conditions	Always On
Monitor Sequence	Key On
Execution Frequency	None
Typical Duration	None
Dash Lamps	MIL
Engine Reaction	Idle Only
Verification	Ignition Key Cycled On



1. Verify that the vehicle is equipped with an Idle Validation Switch. Is the vehicle equipped with a remote accelerator pedal?
   1.a Yes; Go to step 4.
   1.b No; Go to step 2.
2. Has the Common Powertrain Controller (CPC) been reprogrammed recently?
   2.a Yes; verify the configuration of the CPC against the server information or the Application and Installation Manual. Correct the information as necessary. Verify repair.
   2.b No; Go to step 3.
3. Reprogram the CPC using the information from the server. Is SPN 524280/FMI 3 still present?
   3.a Yes; replace the CPC. Verify repair.

3.b No; release the vehicle.

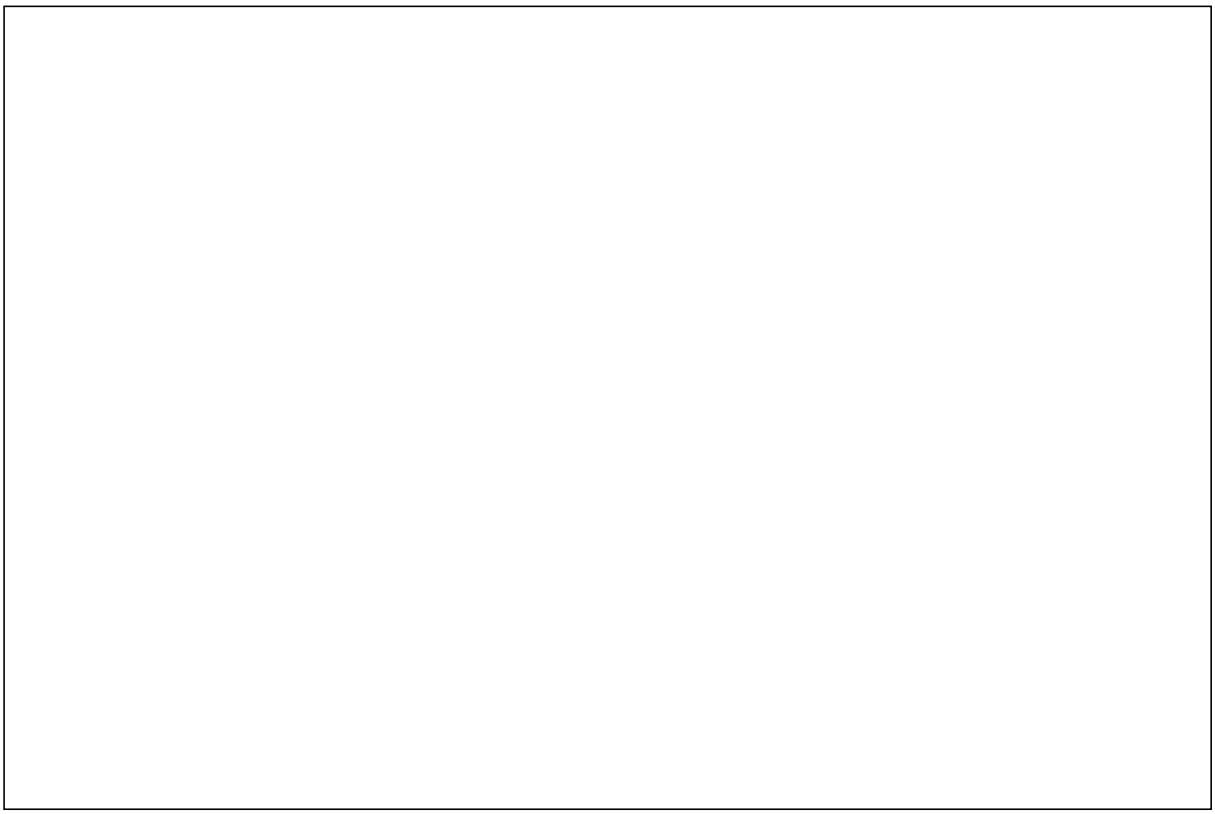
4. Measure the resistance between pin 8 of the CPC connector #1 and the Idle Validation Switch. Is the resistance less than five ohms?

4.a Yes; refer to OEM procedures to diagnose the open in the Idle Validation Switch.

4.b No; repair the open between pin 8 of the CPC connector #1 and the Idle Validation Switch.

465.3 SPN 524280/FMI 4 - GHG17

SPN 524280/FMI 4	
Description	Idle Validation Switch 1 Short to Ground
Monitored Parameter	VCC1
Typical Enabling Conditions	Always On
Monitor Sequence	Key On
Execution Frequency	None
Typical Duration	None
Dash Lamps	MIL
Engine Reaction	Idle Only
Verification	Ignition Key Cycled On



1. Verify that the vehicle is equipped with an Idle Validation Switch. Is the vehicle equipped with a remote accelerator pedal?
   1.a Yes; Go to step 4.
   1.b No; Go to step 2.
2. Has the Common Powertrain Controller (CPC) been reprogrammed recently?
   2.a Yes; verify the configuration of the CPC against the server information or the Application and Installation Manual. Correct the information as necessary. Verify repair.
   2.b No; Go to step 3.
3. Reprogram the CPC using the information from the server. Is SPN 524280/FMI 4 still present?
   3.a Yes; replace the CPC. Verify repair.

3.b No; release the vehicle.

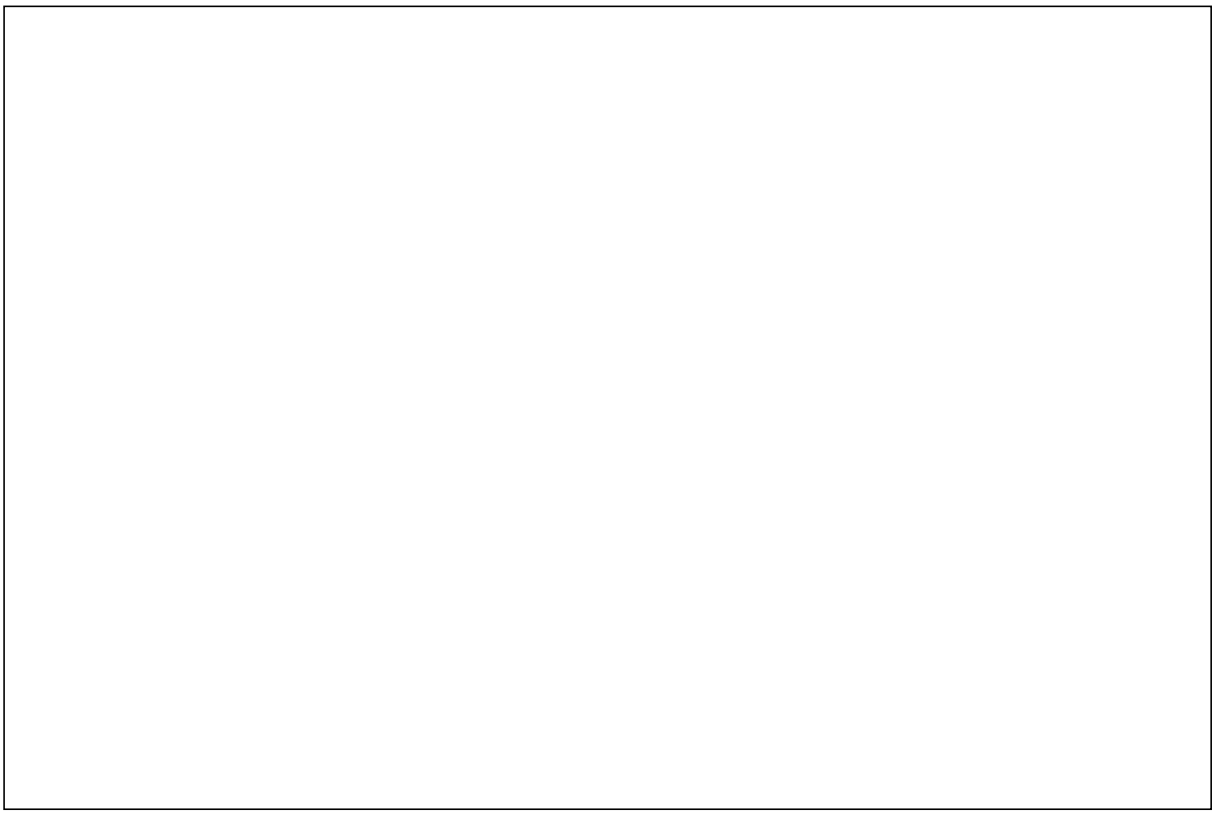
4. Measure the resistance between the Idle Validation Switch VCC1 connector (harness side) and ground. Is the resistance less than five ohms?

4.a Yes; repair the short to ground between Idle Validation Switch VCC1 connector (harness side) and ground.

4.b No; refer to OEM procedures to diagnose a short in the Idle Validation Switch.

465.4 SPN 524280/FMI 5 - GHG17

SPN 524280/FMI 5	
Description	Idle Validation Switch 2 Short to Ground
Monitored Parameter	VCC2
Typical Enabling Conditions	Always On
Monitor Sequence	Key On
Execution Frequency	None
Typical Duration	None
Dash Lamps	MIL
Engine Reaction	Idle Only
Verification	Ignition Key Cycled On



1. Verify that the vehicle is equipped with an Idle Validation Switch. Is the vehicle equipped with a remote accelerator pedal?
   1.a Yes; Go to step 4.
   1.b No; Go to step 2.
2. Has the Common Powertrain Controller (CPC) been reprogrammed recently?
   2.a Yes; verify the configuration of the CPC against the server information or the Application and Installation Manual. Correct the information as necessary. Verify repair.
   2.b No; Go to step 3.
3. Reprogram the CPC using the information from the server. Is SPN 524280/FMI 5 still present?
   3.a Yes; replace the CPC. Verify repair.

3.b No; release the vehicle.

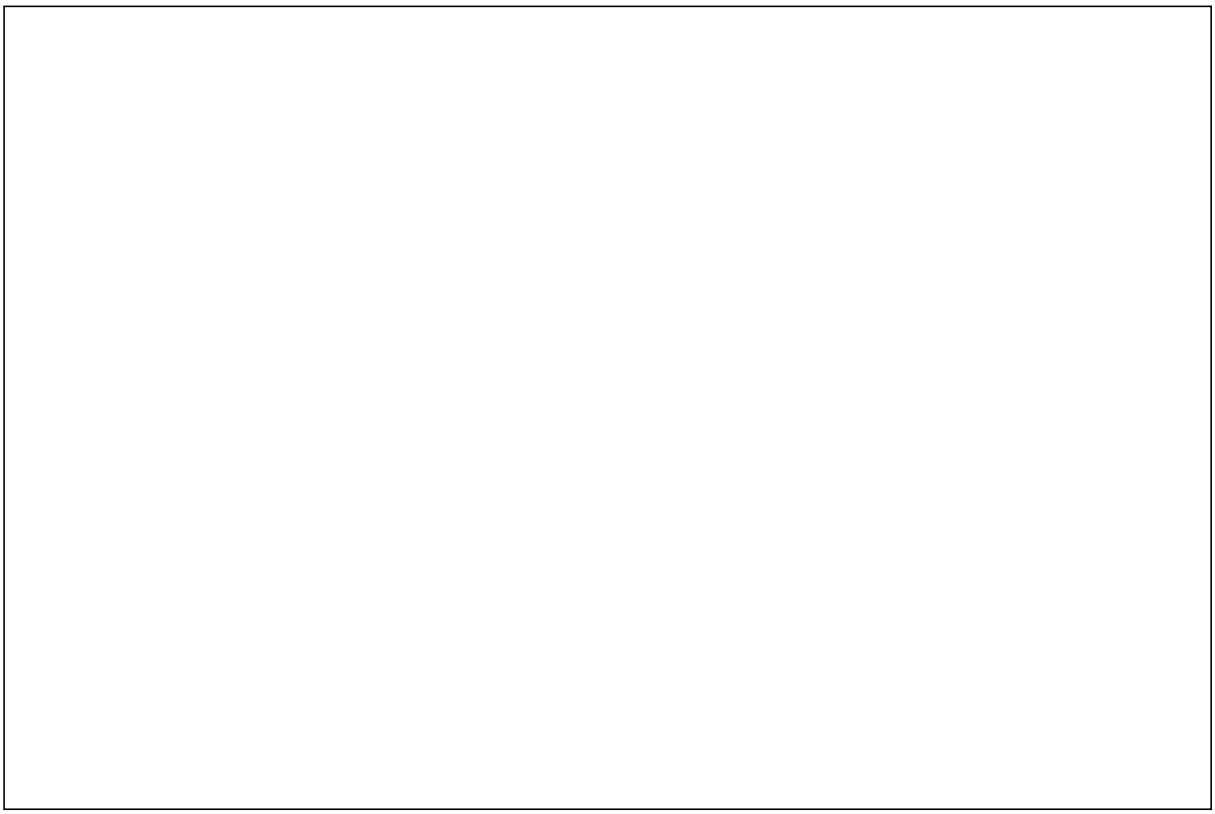
4. Measure the resistance between the Idle Validation Switch VCC2 connector (harness side) and ground. Is the resistance less than five ohms?

4.a Yes; repair the short to ground between Idle Validation Switch VCC2 connector (harness side) and ground.

4.b No; refer to OEM procedures to diagnose a short in the Idle Validation Switch.

465.5 SPN 524280/FMI 6 - GHG17

SPN 524280/FMI 6	
Description	Idle Validation Switch 2 Open Circuit
Monitored Parameter	VCC2
Typical Enabling Conditions	Always On
Monitor Sequence	Key On
Execution Frequency	None
Typical Duration	None
Dash Lamps	MIL
Engine Reaction	Idle Only
Verification	Ignition Key Cycled On



1. Verify that the vehicle is equipped with an Idle Validation Switch. Is the vehicle equipped with a remote accelerator pedal?
   1.a Yes; Go to step 4.
   1.b No; Go to step 2.
2. Has the Common Powertrain Controller (CPC) been reprogrammed recently?
   2.a Yes; verify the configuration of the CPC against the server information or the Application and Installation Manual. Correct the information as necessary. Verify repair.
   2.b No; Go to step 3.
3. Reprogram the CPC using the information from the server. Is SPN 524280/FMI 6 still present?
   3.a Yes; replace the CPC. Verify repair.

3.b No; release the vehicle.

4. Measure the resistance between pin 3 of the CPC connector #3 and the Idle Validation Switch. Is the resistance less than five ohms?

4.a Yes; refer to OEM procedures to diagnose the open in the Idle Validation Switch.

4.b No; repair the open between pin 3 of the CPC connector #3 and the Idle Validation Switch.

466.1 SPN 524283/FMI 2 - GHG17

Check as follows:

1. Connect DiagnosticLink .
2. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   2.a Yes; repair the battery voltage concern. Verify repair.
   2.b No; Go to step 3.
3. Is SPN 625/FMI 9 fault code present?
   3.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   3.b No; Go to step 4.

Note : This fault code may be set by two or more source inputs configured with the same address. Verify proper parameter settings.

4. Check for proper configuration of the Common Powertrain Controller (CPC) against the server information. Does the CPC have the proper configuration?
   4.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.
   4.b No; reprogram the CPC with the correct information as necessary. Go to step 5. to verify repair.
5. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

466.2 SPN 524283/FMI 14 - GHG17

Check as follows:

1. Connect DiagnosticLink .
2. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   2.a Yes; repair the battery voltage concern. Verify repair.
   2.b No; Go to step 3.
3. Is SPN 625/FMI 9 fault code present?
   3.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   3.b No; Go to step 4.

Note : This fault code may be set by two or more source inputs configured with the same address. Verify proper parameter settings.

4. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   4.a Yes; replace the Common Powertrain Controller (CPC). Refer to Original Equipment Manufacturer (OEM) literature.
   4.b No; reprogram the CPC with the correct information as necessary. Go to step 5. to verify repair.
5. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

SPN 524283 (CPC) (GHG17)

466.1 SPN 524283/FMI 2 - GHG17

Check as follows:

1. Connect DiagnosticLink .
2. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   2.a Yes; repair the battery voltage concern. Verify repair.
   2.b No; Go to step 3.
3. Is SPN 625/FMI 9 fault code present?
   3.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   3.b No; Go to step 4.

Note : This fault code may be set by two or more source inputs configured with the same address. Verify proper parameter settings.

4. Check for proper configuration of the Common Powertrain Controller (CPC) against the server information. Does the CPC have the proper configuration?
   4.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.
   4.b No; reprogram the CPC with the correct information as necessary. Go to step 5. to verify repair.
5. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

466.2 SPN 524283/FMI 14 - GHG17

Check as follows:

1. Connect DiagnosticLink .
2. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   - 2.a Yes; repair the battery voltage concern. Verify repair.
   - 2.b No; Go to step 3.
3. Is SPN 625/FMI 9 fault code present?
   - 3.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   - 3.b No; Go to step 4.

Note : This fault code may be set by two or more source inputs configured with the same address. Verify proper parameter settings.

4. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   - 4.a Yes; replace the Common Powertrain Controller (CPC). Refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; reprogram the CPC with the correct information as necessary. Go to step 5. to verify repair.
5. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink. Wait five minutes for all modules to power down. Verify repair.

467.1 SPN 524284/FMI 14 - GHG17

SPN 524284/FMI 14	
Description	Powertrain Monitor Control (PMC) is a Safety Feature that Protects the Truck. In this Case PMC Plausibility Calculation Detected a Mismatch and PMC Has Turned Off
Monitored Parameter	Powertrain Monitor Control
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Idle

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   1.a Yes; repair the battery voltage concern. Verify repair.
   1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   2.b No; Go to step 3.
3. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   3.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.
   3.b No; reprogram the CPC with the correct information as necessary. To verify repair, Go to step 4.
4. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink . Wait five minutes for all modules to power down. Verify repair.

467.2 SPN 524284/FMI 19 - GHG17

SPN 524284/FMI 19	
Description	Powertrain Monitor Control (PMC) is a Safety Feature that Protects the Truck. In this Case an Implausible Signal was Received Via PT-CAN From MCM2 or TCM
Monitored Parameter	Powertrain Monitor Control
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Idle

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   - 1.a Yes; repair the battery voltage concern. Verify repair.
   - 1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   - 2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   - 2.b No; Go to step 3.
3. Has the Common Powertrain Controller (CPC) been recently programmed? Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   - 3.a Yes; check the proper configuration of the CPC.
   - 3.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

SPN 524284 (CPC) (GHG17)

467.1 SPN 524284/FMI 14 - GHG17

SPN 524284/FMI 14	
Description	Powertrain Monitor Control (PMC) is a Safety Feature that Protects the Truck. In this Case PMC Plausibility Calculation Detected a Mismatch and PMC Has Turned Off
Monitored Parameter	Powertrain Monitor Control
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Idle

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   - 1.a Yes; repair the battery voltage concern. Verify repair.
   - 1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   - 2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   - 2.b No; Go to step 3.
3. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   - 3.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature.
   - 3.b No; reprogram the CPC with the correct information as necessary. To verify repair, Go to step 4.

4. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink . Wait five minutes for all modules to power down. Verify repair.

467.2 SPN 524284/FMI 19 - GHG17

SPN 524284/FMI 19	
Description	Powertrain Monitor Control (PMC) is a Safety Feature that Protects the Truck. In this Case an Implausible Signal was Received Via PT-CAN From MCM2 or TCM
Monitored Parameter	Powertrain Monitor Control
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Idle

WARNING

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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.

WARNING

ENGINE EXHAUST

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

1. Check for multiple codes. Are there any SPN 168 (battery voltage) fault codes present?
   - 1.a Yes; repair the battery voltage concern. Verify repair.
   - 1.b No; Go to step 2.
2. Is SPN 625/FMI 9 fault code present?
   - 2.a Yes; repair the Controller Area Network (CAN) line. Verify repair.
   - 2.b No; Go to step 3.
3. Has the Common Powertrain Controller (CPC) been recently programmed? Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   - 3.a Yes; check the proper configuration of the CPC.
   - 3.b No; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

468.1 SPN 524285/FMI 4 - GHG17

SPN 524285/FMI 4	
Description	J1939 DPF Regeneration Switch Failed Low
Monitored Parameter	DPF Regeneration Switch
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON Engine OFF

1. Check for multiple codes. Is Common Powertrain Controller (CPC) SPN 168/FMI 0/14/18 (battery voltage) code present?
   - 1.a Yes; troubleshoot these first.
   - 1.b No; Go to step 2.
2. Is Motor Control Module (MCM) SPN 625/FMI 9 code present?
   - 2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   - 2.b No; Go to step 3.
3. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   - 3.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature. Go to step 4.
   - 3.b No; reprogram the CPC with the correct information as necessary. To verify repair, Go to step 4.
4. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink . Wait five minutes for all modules to power down. Did the code return?
   - 4.a Yes; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; testing is complete. Release the vehicle.

SPN 524285 (CPC) (GHG17)

468.1 SPN 524285/FMI 4 - GHG17

SPN 524285/FMI 4	
Description	J1939 DPF Regeneration Switch Failed Low
Monitored Parameter	DPF Regeneration Switch
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key ON Engine OFF

1. Check for multiple codes. Is Common Powertrain Controller (CPC) SPN 168/FMI 0/14/18 (battery voltage) code present?
   - 1.a Yes; troubleshoot these first.
   - 1.b No; Go to step 2.
2. Is Motor Control Module (MCM) SPN 625/FMI 9 code present?
   - 2.a Yes; troubleshoot and repair the Controller Area Network (CAN) line.
   - 2.b No; Go to step 3.
3. Check for proper configuration of the CPC against the server information. Does the CPC have the proper configuration?
   - 3.a Yes; replace the CPC. Refer to Original Equipment Manufacturer (OEM) literature. Go to step 4.
   - 3.b No; reprogram the CPC with the correct information as necessary. To verify repair, Go to step 4.
4. Clear fault codes. Turn ignition OFF and disconnect DiagnosticLink . Wait five minutes for all modules to power down. Did the code return?
   - 4.a Yes; determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module. For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.
   - 4.b No; testing is complete. Release the vehicle.

469.1 SPN 524286/FMI 1 - GHG17

Automatic Gear Selection - Automatic Mode Not Available

Check as follows:

1. Connect DiagnosticLink .
2. Check the Motor Control Module (MCM), Aftertreatment Control Module (ACM), Common Powertrain Controller (CPC) and Transmission Control Module (TCM) software levels. Compare the current software levels to the server. Are the MCM, ACM, CPC and TCM software at the latest levels?
   - 2.a Yes; Go to step 3.
   - 2.b No; update the software levels and verify repair. If the fault code does not return, release the vehicle. If the fault code returns, Go to step 3.
3. Are there any other active transmission-related faults also present, other than SPN 524286/FMI 4 or SPN 524286/FMI 1?
   - 3.a Yes; repair other transmission faults first.
   - 3.b No; Go to step 4.
4. Are there any chassis-side Anti-lock Brake System (ABS) faults present?
   - 4.a Yes; refer to OEM literature for ABS diagnostics.
   - 4.b No; Go to step 5.
5. Under instrumentation “transmission" tab, verify the clutch and transmission learned values display “learned values available.”
   - 5.a If learned values display “no learned values available” under the Actions dropdown menu "Transmission Selection," perform the “Transmission Learn Procedure.”
   - 5.b If learned values display correctly, Go to step 6.
6. In DiagnosticLink®, ensure auto-connect to J1708 and J1939 devices is enabled. Obtain a two-minute key ON, engine OFF log file and contact the Detroit™ Customer Support Center at 855-253-0428 for further transmission assistance.

469.2 SPN 524286/FMI 2

This fault indicates CPC4 has detected an incompatible or missing dataset.

1. Connect DiagnosticLink 8 8.05 SP2 or higher.
2. Turn ignition ON.
3. Under the "Identification" heading "Common" tab, verify a shift map part number is present in the CPC. Is a shift map part number present?

   3.a Yes; Go to step 4.

   3.b No; program CPC to latest server setting.
4. Under the "Identification" heading "Common" tab, verify the correct transmission type is set under the TCM heading, based off of the metal identification plate on the lower left rear of the transmission. Is the transmission type set correctly?

   4.a Yes; Go to step 5.

   4.b No; under the "Actions" tab, "Transmission Heading," select "TCM replacement" and reset the transmission type accordingly. After reset, perform a "Transmission/Clutch Relearn."
5. Reprogram the CPC/MCM/ACM/TCM to latest server configuration.

469.3 SPN 524286/FMI 4 - GHG17

Automatic Gear Selection: Gear Shift Not Plausible

Check as follows:

1. Has the vehicle’s Transmission Control Module (TCM), Aftertreatment Control Module (ACM), Motor Control Module (MCM), or Common Powertrain Controller (CPC) been recently programmed?
   - 1.a Yes; verify correct software levels are present.
   - 1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Are there any other active transmission related faults also present other than SPN 524286/FMI 4 or SPN 524286/FMI 1?
   - 4.a Yes; repair other transmission faults first.
   - 4.b No; Go to step 5.
5. Are there any chassis-side Anti-lock Brake System (ABS) faults present?
   - 5.a Yes; refer to OEM literature for ABS diagnostics.
   - 5.b No; Go to step 6.
6. Are there any CAN/J1939 communication faults present?
   - 6.a Yes; repair those faults first.
   - 6.b No; Go to step 7.
7. Is the vehicle experiencing any drivability complaints related to Transmission Symptom Diagnostics?
   - 7.a Yes; complete the appropriate Symptom Diagnostic section.
   - 7.b If learned values display correctly, Go to step 8.
8. Under instrumentation "transmission" tab, does the clutch and transmission learned values display "learned values available"?
   - 8.a Yes; Go to step 9.
   - 8.b No; under the Actions dropdown menu "Transmission Selection," perform the "Transmission Learn Procedure."
9. In DiagnosticLink, ensure auto-connect to J1708 and J1939 devices is enabled. If the unit can be driven obtain a driving log file, if the unit cannot be driven complete an engine idle Gear/Split/Range test going through all gears, obtain DDEC Reports, and contact the Detroit™ Customer Support Center at 855-253-0428 for further transmission assistance.

469.4 SPN 524286/FMI 6 - GHG17

Check as follows:

This fault indicates CPC is incorrectly parameterized. Reprogram the CPC with the latest server configuration.

469.5 SPN 524286/FMI 7 - GHG17

This fault indicates the Common Powertrain Controller (CPC) has detected inconsistent driveline speed inputs based on current parameter setting. Usually, the tire size and/or axle ratio is incorrectly set.

1. Did fault occur after a recent CPC reprogramming?
   - 1.a Yes; reset CPC to original configuration.
   - 1.b No; Go to step 2.
2. Did fault occur after ABS brake module replacement or update?
   - 2.a Yes; refer to module manufacturer for programming set up.
   - 2.b No; Go to step 3.
3. Connect DiagnosticLink and extract CPC parameters in group PGR008 Vehicle Speed Sensor. Verify/program axle ratio per component installed on truck. Verify or program tire revolution (revs) for front and rear tires to components currently installed on vehicle. Tire revolutions per mile can be obtained from tire manufacturers' website.

SPN 524286 (CPC) (GHG17)

469.1 SPN 524286/FMI 1 - GHG17

Automatic Gear Selection - Automatic Mode Not Available

Check as follows:

1. Connect DiagnosticLink .
2. Check the Motor Control Module (MCM), Aftertreatment Control Module (ACM), Common Powertrain Controller (CPC) and Transmission Control Module (TCM) software levels. Compare the current software levels to the server. Are the MCM, ACM, CPC and TCM software at the latest levels?

   2.a Yes; Go to step 3.

   2.b No; update the software levels and verify repair. If the fault code does not return, release the vehicle. If the fault code returns, Go to step 3.
3. Are there any other active transmission-related faults also present, other than SPN 524286/FMI 4 or SPN 524286/FMI 1?

   3.a Yes; repair other transmission faults first.

   3.b No; Go to step 4.
4. Are there any chassis-side Anti-lock Brake System (ABS) faults present?

   4.a Yes; refer to OEM literature for ABS diagnostics.

   4.b No; Go to step 5.
5. Under instrumentation “transmission" tab, verify the clutch and transmission learned values display “learned values available.”

   5.a If learned values display “no learned values available” under the Actions dropdown menu "Transmission Selection," perform the “Transmission Learn Procedure.”

   5.b If learned values display correctly, Go to step 6.
6. In DiagnosticLink®, ensure auto-connect to J1708 and J1939 devices is enabled. Obtain a two-minute key ON, engine OFF log file and contact the Detroit™ Customer Support Center at 855-253-0428 for further transmission assistance.

469.2 SPN 524286/FMI 2

This fault indicates CPC4 has detected an incompatible or missing dataset.

1. Connect DiagnosticLink 8 8.05 SP2 or higher.
2. Turn ignition ON.
3. Under the "Identification" heading "Common" tab, verify a shift map part number is present in the CPC. Is a shift map part number present?

   3.a Yes; Go to step 4.

   3.b No; program CPC to latest server setting.
4. Under the "Identification" heading "Common" tab, verify the correct transmission type is set under the TCM heading, based off of the metal identification plate on the lower left rear of the transmission. Is the transmission type set correctly?

   4.a Yes; Go to step 5.

   4.b No; under the "Actions" tab, "Transmission Heading," select "TCM replacement" and reset the transmission type accordingly. After reset, perform a "Transmission/Clutch Relearn."
5. Reprogram the CPC/MCM/ACM/TCM to latest server configuration.

469.3 SPN 524286/FMI 4 - GHG17

Automatic Gear Selection: Gear Shift Not Plausible

Check as follows:

1. Has the vehicle’s Transmission Control Module (TCM), Aftertreatment Control Module (ACM), Motor Control Module (MCM), or Common Powertrain Controller (CPC) been recently programmed?
   - 1.a Yes; verify correct software levels are present.
   - 1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Are there any other active transmission related faults also present other than SPN 524286/FMI 4 or SPN 524286/FMI 1?
   - 4.a Yes; repair other transmission faults first.
   - 4.b No; Go to step 5.
5. Are there any chassis-side Anti-lock Brake System (ABS) faults present?
   - 5.a Yes; refer to OEM literature for ABS diagnostics.
   - 5.b No; Go to step 6.
6. Are there any CAN/J1939 communication faults present?
   - 6.a Yes; repair those faults first.
   - 6.b No; Go to step 7.
7. Is the vehicle experiencing any drivability complaints related to Transmission Symptom Diagnostics?
   - 7.a Yes; complete the appropriate Symptom Diagnostic section.
   - 7.b If learned values display correctly, Go to step 8.
8. Under instrumentation "transmission" tab, does the clutch and transmission learned values display "learned values available"?
   - 8.a Yes; Go to step 9.
   - 8.b No; under the Actions dropdown menu "Transmission Selection," perform the "Transmission Learn Procedure."
9. In DiagnosticLink, ensure auto-connect to J1708 and J1939 devices is enabled. If the unit can be driven obtain a driving log file, if the unit cannot be driven complete an engine idle Gear/Split/Range test going through all gears, obtain DDEC Reports, and contact the Detroit™ Customer Support Center at 855-253-0428 for further transmission assistance.

469.4 SPN 524286/FMI 6 - GHG17

Check as follows:

This fault indicates CPC is incorrectly parameterized. Reprogram the CPC with the latest server configuration.

469.5 SPN 524286/FMI 7 - GHG17

This fault indicates the Common Powertrain Controller (CPC) has detected inconsistent driveline speed inputs based on current parameter setting. Usually, the tire size and/or axle ratio is incorrectly set.

1. Did fault occur after a recent CPC reprogramming?
   1.a Yes; reset CPC to original configuration.
   1.b No; Go to step 2.
2. Did fault occur after ABS brake module replacement or update?
   2.a Yes; refer to module manufacturer for programming set up.
   2.b No; Go to step 3.
3. Connect DiagnosticLink and extract CPC parameters in group PGR008 Vehicle Speed Sensor. Verify/program axle ratio per component installed on truck. Verify or program tire revolution (revs) for front and rear tires to components currently installed on vehicle. Tire revolutions per mile can be obtained from tire manufacturers' website.

SPN 524286 (CPC4) (GHG17)

465.1 SPN 524286/FMI 4 - GHG17

Automatic Gear Selection: Gear Shift Not Plausible

Check as follows:

1. Has the vehicle’s Transmission Control Module (TCM), Aftertreatment Control Module (ACM), Motor Control Module (MCM), or Common Powertrain Controller (CPC) been recently programmed?
   - 1.a Yes; verify correct software levels are present.
   - 1.b No; Go to step 2.
2. Connect DiagnosticLink .
3. Turn the ignition ON (key ON, engine OFF).
4. Are there any other active transmission related faults also present other than SPN 524286/FMI 4 or SPN 524286/FMI 1?
   - 4.a Yes; repair other transmission faults first.
   - 4.b No; Go to step 5.
5. Are there any chassis-side Anti-lock Brake System (ABS) faults present?
   - 5.a Yes; refer to OEM literature for ABS diagnostics.
   - 5.b No; Go to step 6.
6. Are there any CAN/J1939 communication faults present?
   - 6.a Yes; repair those faults first.
   - 6.b No; Go to step 7.
7. Is the vehicle experiencing any drivability complaints related to Transmission Symptom Diagnostics?
   - 7.a Yes; complete the appropriate Symptom Diagnostic section.
   - 7.b If learned values display correctly, Go to step 8.
8. Under instrumentation "transmission" tab, does the clutch and transmission learned values display "learned values available"?
   - 8.a Yes; Go to step 9.
   - 8.b No; under the Actions dropdown menu "Transmission Selection," perform the "Transmission Learn Procedure."
9. In DiagnosticLink, ensure auto-connect to J1708 and J1939 devices is enabled. If the unit can be driven obtain a driving log file, if the unit cannot be driven complete an engine idle Gear/Split/Range test going through all gears, obtain DDEC Reports, and contact the Detroit™ Customer Support Center at 855-253-0428 for further transmission assistance.

470.1 SPN 524287/FMI 1 - GHG17

SPN 524287/FMI 1	
Description	Evobus Cruise Control Lever Position Not Plausible or Out of Range
Monitored Parameter	Cruise Control Lever Position
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On

Evobus cruise control lever position signal indicates not plausible (out of range). For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

470.2 SPN 524287/FMI 9 - GHG17

SPN 524287/FMI 9	
Description	This Fault Code Sets When the Common Powertrain Controller (CPC) has Received a Message From the Predictive Cruise Control Module.
Monitored Parameter	Predictive Cruise Control CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Turn the Ignition OFF, Wait Five Minutes, Turn the Ignition ON and Recheck for the Fault Code.

1. Turn the ignition ON (key ON, engine OFF).
2. Connect DiagnosticLink .
3. Has the CPC been reprogrammed recently?
   - 3.a Yes; reprogram the CPC using the latest software and the correct VIN. If the fault returns, Go to step 4.
   - 3.b No; Go to step 4.
4. Check for battery voltage fault codes. Are there any battery voltage fault codes present?
   - 4.a Yes; diagnose the battery voltage fault codes. If the fault code returns, Go to step 5.
   - 4.b No; Go to step 5.
5. Check for other fault codes. Are there any communication fault codes present in the other modules?
   - 5.a Yes; diagnose the other fault codes.
   - 5.b No; replace the CPC.

470.3 SPN 524287/FMI 19 - GHG17

SPN 524287/FMI 19	
Description	This fault Code Sets When the Common Powertrain Controller (CPC) has Received an Error Message From the Predictive Cruise Module.
Monitored Parameter	Predictive Cruise Control CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Turn the Ignition OFF, Wait Five Minutes, Turn the Ignition ON and Recheck for the Fault Code.

1. Turn the ignition ON (key ON, engine OFF).
2. Connect DiagnosticLink .
3. Has the CPC been reprogrammed recently?
   - 3.a Yes; reprogram the CPC using the latest software and the correct VIN. If the fault returns, Go to step 4.
   - 3.b No; Go to step 4.
4. Check for battery voltage fault codes. Are there any battery voltage fault codes present?
   - 4.a Yes; diagnose the battery voltage fault codes. If the fault code returns, Go to step 5.
   - 4.b No; Go to step 5.
5. Check for other fault codes. Are there any communication fault codes present in the other modules?
   - 5.a Yes; diagnose the other fault codes.
   - 5.b No; replace the CPC.

SPN 524287 (CPC) (GHG17)

470.1 SPN 524287/FMI 1 - GHG17

SPN 524287/FMI 1	
Description	Evobus Cruise Control Lever Position Not Plausible or Out of Range
Monitored Parameter	Cruise Control Lever Position
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Key On

Evobus cruise control lever position signal indicates not plausible (out of range). For wiring schematic information, refer to Original Equipment Manufacturer (OEM) literature.

470.2 SPN 524287/FMI 9 - GHG17

SPN 524287/FMI 9	
Description	This Fault Code Sets When the Common Powertrain Controller (CPC) has Received a Message From the Predictive Cruise Control Module.
Monitored Parameter	Predictive Cruise Control CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Turn the Ignition OFF, Wait Five Minutes, Turn the Ignition ON and Recheck for the Fault Code.

1. Turn the ignition ON (key ON, engine OFF).
2. Connect DiagnosticLink .
3. Has the CPC been reprogrammed recently?
   - 3.a Yes; reprogram the CPC using the latest software and the correct VIN. If the fault returns, Go to step 4.
   - 3.b No; Go to step 4.
4. Check for battery voltage fault codes. Are there any battery voltage fault codes present?
   - 4.a Yes; diagnose the battery voltage fault codes. If the fault code returns, Go to step 5.
   - 4.b No; Go to step 5.
5. Check for other fault codes. Are there any communication fault codes present in the other modules?
   - 5.a Yes; diagnose the other fault codes.
   - 5.b No; replace the CPC.

470.3 SPN 524287/FMI 19 - GHG17

SPN 524287/FMI 19	
Description	This fault Code Sets When the Common Powertrain Controller (CPC) has Received an Error Message From the Predictive Cruise Module.
Monitored Parameter	Predictive Cruise Control CAN Communication
Typical Enabling Conditions	Always Enabled
Monitor Sequence	None
Execution Frequency	Always Enabled
Typical Duration	Two Seconds
Dash Lamps	CEL
Engine Reaction	None
Verification	Turn the Ignition OFF, Wait Five Minutes, Turn the Ignition ON and Recheck for the Fault Code.

1. Turn the ignition ON (key ON, engine OFF).
2. Connect DiagnosticLink .
3. Has the CPC been reprogrammed recently?
   - 3.a Yes; reprogram the CPC using the latest software and the correct VIN. If the fault returns, Go to step 4.
   - 3.b No; Go to step 4.
4. Check for battery voltage fault codes. Are there any battery voltage fault codes present?
   - 4.a Yes; diagnose the battery voltage fault codes. If the fault code returns, Go to step 5.
   - 4.b No; Go to step 5.
5. Check for other fault codes. Are there any communication fault codes present in the other modules?
   - 5.a Yes; diagnose the other fault codes.
   - 5.b No; replace the CPC.

471.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF (key OFF, engine OFF).
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DiagnosticLink®.

> **⚠ WARNING**
>
> ENGINE EXHAUST
>
> To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

> **⚠ 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.

4. Start and bring engine up to operating temperature (coolant temperature over 60°C (140°F).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit™ Customer Support Center at 800-445-1980.

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5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit™ Customer Support Center at 800-445-1980.

472.1 Acronyms

Following is a list of acronyms which are commonly used in the Troubleshooting Manuals.

Acronym	Acronym Meaning
1US	DOC/SCR module emission package
2V2/2HH	Two Vertical / Two Horizontal (exhaust configuration - vertical or horizontal)
AAT	Ambient Air Temperature
ABS	Anti-Lock Braking System
A/C	Air Conditioning
ACM	Aftertreatment Control Module
APU	Auxiliary Power Unit
ATD	Aftertreatment Device
ATS	Aftertreatment System
AWL	Amber Warning Lamp (check engine)
BAR	Metric measurement unit of pressure
BARO	Barometric Pressure
CAC	Charge Air Cooler
CAN	Controller Area Network
CARB	California Air Resources Board
CBF	Caesar Binary File
CC	Cruise Control
CEL	Check Engine Lamp
CGW	Central Gateway
CKP	Crankshaft Position (Sensor)
CMP	Camshaft Position (Sensor)
CPC	Common Powertrain Controller
CSC	Customer Support Center
DDC	Detroit Diesel Corporation
DDEC	Detroit Diesel Electronic Controls
DEF	Diesel Exhaust Fluid
DI	Digital Input
DL	DiagnosticLink®
DO	Digital Output
DOC	Diesel Oxidation Catalyst
DPF	Diesel Particulate Filter
DTC	Diagnostic Trouble Code
DTNA	Daimler Trucks North America
ECAN	Engine Controller Area Network
ECM	Engine Control Module
ECU	Electronic Control Unit or ECM (Electronic Control Module)
EGR	Exhaust Gas Recirculation
EGRA	Exhaust Gas Recirculation Actuator
EGRC	Exhaust Gas Recirculation Cooler
EGRV	Exhaust Gas Recirculation Valve
EOP	Engine Oil Pressure
EOT	Engine Oil Temperature
EPA	Environmental Protection Agency
ESH	Engine Sensor Harness
ESN	Engine Serial Number
FIS	Fuel Injection System
FLLC	Freightliner Limited Liability Company
FMI	Failure Model Identifier
FSIC	Fuel System Integrity Check
FTL	Freightliner
GHG	Green House Gas

GHG17	Green House Gas 2017 Emissions Level
GND	Ground
GPS	Global Positioning System
HC	Hydrocarbon
HCD	HC Doser
HDMS	Hydraulic Drive Modulated Speed (Variable speed fan)
HEST	High Exhaust System Temperature
HG	Inches of Mercury (measurement of pressure)
HIR	High Idle Regeneration
IMAT	Intake Manifold Air Temperature
IMT	Intake Manifold Temperature
IMP	Intake Manifold Pressure
ISB	Idle Speed Balance
ITV	Intake Throttle Valve
J1939	Vehicle Network (SAE J1939) for communication and diagnostics
kPa	Kilopascal - measurement of pressure
lb·ft	Pound-Foot (foot pounds torque)
LED	Light Emitting Diode
LIM	Limiter
LPPI	Low Pressure Pump Inlet
LPPO	Low Pressure Pump Outlet
MCM	Motor Control Module
MIL	Malfunction Indicator Lamp
mpg	miles per gallon
MSF	Modular Switch Field
n/a	Not applicable
n/c	Not connected
n.p.	Not populated
NAFTA	North American Free Trade Agreement
N·m	Newton Meter (torque)
OBD	On-Board Diagnostics
OEM	Original Equipment Manufacturer
OI	Optimized Idle
OL	Open Load
PAR	Parameter file extension - .par
PCC	Predictive Cruise Control
PCV	Pressure Control Valve
PLU	Pressure Limiting Unit
PLV	Pressure Limiting Valve
P/N	Part Number
PSI	Pounds per Square Inch
PTO	Power Take-off
PWM	Pulse Width Modulated
QCV	Quantity Control Valve
RPBO	Rail Pressure Bleed-Off
rpm	revolutions per minute
RSL	Red Stop (engine) Lamp
SA	Source Address
SAE	Society of Automotive Engineers, Professional standards organization
SAM	Signal-detection and Actuation Module
SCR	Selective Catalytic Reduction
SGND	Signal Ground

SPN	Suspect Parameter Number
SW	Software
TCM	Transmission Control Module
TPS	Throttle Position Sensor
TSS	Turbocharger Speed Sensor
ULSD	Ultra Low Sulfur Diesel
VCP	Variable Cam Phaser
VEPS	Vehicle Electronics Parameterizing System
VIH	Vehicle Interface Harness
VIN	Vehicle Identification Number
VIM	Vehicle Interface Module
VSS	Vehicle Speed Sensor
VT	Virtual Technician
WIF	Water In Fuel sensor
WST	Western Star
ZGS	DTNA 3-digit fuel map number designation

Acronyms

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ABS	Anti-Lock Braking System
A/C	Air Conditioning
ACM	Aftertreatment Control Module
APU	Auxiliary Power Unit
ATD	Aftertreatment Device
ATS	Aftertreatment System
AWL	Amber Warning Lamp (check engine)
BAR	Metric measurement unit of pressure
BARO	Barometric Pressure
CAC	Charge Air Cooler
CAN	Controller Area Network
CARB	California Air Resources Board
CBF	Caesar Binary File
CC	Cruise Control
CEL	Check Engine Lamp
CGW	Central Gateway
CKP	Crankshaft Position (Sensor)
CMP	Camshaft Position (Sensor)
CPC	Common Powertrain Controller
CSC	Customer Support Center
DDC	Detroit Diesel Corporation
DDEC	Detroit Diesel Electronic Controls
DEF	Diesel Exhaust Fluid
DI	Digital Input
DL	DiagnosticLink®
DO	Digital Output
DOC	Diesel Oxidation Catalyst
DPF	Diesel Particulate Filter
DTC	Diagnostic Trouble Code
DTNA	Daimler Trucks North America
ECAN	Engine Controller Area Network
ECM	Engine Control Module
ECU	Electronic Control Unit or ECM (Electronic Control Module)
EGR	Exhaust Gas Recirculation
EGRA	Exhaust Gas Recirculation Actuator
EGRC	Exhaust Gas Recirculation Cooler
EGRV	Exhaust Gas Recirculation Valve
EOP	Engine Oil Pressure
EOT	Engine Oil Temperature
EPA	Environmental Protection Agency
ESH	Engine Sensor Harness
ESN	Engine Serial Number
FIS	Fuel Injection System
FLLC	Freightliner Limited Liability Company
FMI	Failure Model Identifier
FSIC	Fuel System Integrity Check
FTL	Freightliner
GHG	Green House Gas

GHG17	Green House Gas 2017 Emissions Level
GND	Ground
GPS	Global Positioning System
HC	Hydrocarbon
HCD	HC Doser
HDMS	Hydraulic Drive Modulated Speed (Variable speed fan)
HEST	High Exhaust System Temperature
HG	Inches of Mercury (measurement of pressure)
HIR	High Idle Regeneration
IMAT	Intake Manifold Air Temperature
IMT	Intake Manifold Temperature
IMP	Intake Manifold Pressure
ISB	Idle Speed Balance
ITV	Intake Throttle Valve
J1939	Vehicle Network (SAE J1939) for communication and diagnostics
kPa	Kilopascal - measurement of pressure
lb·ft	Pound-Foot (foot pounds torque)
LED	Light Emitting Diode
LIM	Limiter
LPPI	Low Pressure Pump Inlet
LPPO	Low Pressure Pump Outlet
MCM	Motor Control Module
MIL	Malfunction Indicator Lamp
mpg	miles per gallon
MSF	Modular Switch Field
n/a	Not applicable
n/c	Not connected
n.p.	Not populated
NAFTA	North American Free Trade Agreement
N·m	Newton Meter (torque)
OBD	On-Board Diagnostics
OEM	Original Equipment Manufacturer
OI	Optimized Idle
OL	Open Load
PAR	Parameter file extension - .par
PCC	Predictive Cruise Control
PCV	Pressure Control Valve
PLU	Pressure Limiting Unit
PLV	Pressure Limiting Valve
P/N	Part Number
PSI	Pounds per Square Inch
PTO	Power Take-off
PWM	Pulse Width Modulated
QCV	Quantity Control Valve
RPBO	Rail Pressure Bleed-Off
rpm	revolutions per minute
RSL	Red Stop (engine) Lamp
SA	Source Address
SAE	Society of Automotive Engineers, Professional standards organization
SAM	Signal-detection and Actuation Module
SCR	Selective Catalytic Reduction
SGND	Signal Ground

SPN	Suspect Parameter Number
SW	Software
TCM	Transmission Control Module
TPS	Throttle Position Sensor
TSS	Turbocharger Speed Sensor
ULSD	Ultra Low Sulfur Diesel
VCP	Variable Cam Phaser
VEPS	Vehicle Electronics Parameterizing System
VIH	Vehicle Interface Harness
VIN	Vehicle Identification Number
VIM	Vehicle Interface Module
VSS	Vehicle Speed Sensor
VT	Virtual Technician
WIF	Water In Fuel sensor
WST	Western Star
ZGS	DTNA 3-digit fuel map number designation

FARM & CONSTRUCTION MANUALS