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## Service Information Bulletin

SUBJECT	DATE
SPN 1323 through 1328 (MCM) (GHG14)	January 2015

### Additions, Revisions, or Updates

Publication Number / Title	Platform	Section Title	Change
DDC-SVC-MAN-0084	GHG14 DD Platform	SPN 1323/FMI 31 - GHG14	The diagnostic procedures have been revised to include more in depth inspection.
		SPN 1324/FMI 31 - GHG14	
		SPN 1325/FMI 31 - GHG14	
		SPN 1326/FMI 31 - GHG14	
		SPN 3127/FMI 31 - GHG14	
		SPN 1328/FMI 31 - GHG14	



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## 2 SPN 1323/FMI 31 - GHG14

Idle Smoothness Control/Cylinder #1 Misfire At Idle

**Table 1.**

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
Monitored Parameter	Engine rpm
Typical Enabling Conditions	Engine Speed Between 600 and 960 rpm, Engine Coolant Temperature Greater Than 70°C (158°F), Engine Fuel Temperature Greater Than 10°C (50°F)
Monitor Sequence	None
Execution Frequency	When Enabling Conditions Are Met
Typical Duration	30 Seconds
Dash Lamps	CEL, MIL
Engine Reaction	25% Derate, EGR is Shut Off
Verification	Start and Run the Engine Until Engine Coolant Temperature is Greater than 70°C (158°F), Along with Engine Fuel Temperature Greater Than 10°C (50°F). Then Let the Engine Idle for 10 minutes

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.

- Always start and operate an engine in a well ventilated area.
- If operating an engine in an enclosed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system or emission control system.



**WARNING: PERSONAL INJURY**

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

**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. Connect DiagnosticLink<sup>®</sup>.
2. Turn the ignition ON (key ON, engine OFF).
3. Check for injector circuit fault codes. Are fault codes SPN 1323/FMI 3 or FMI 4 present?
  - a. Yes; diagnose the circuit fault codes first. Verify repair.
  - b. No; Go to step 4.
4. Check for engine over speed fault codes. Are fault codes SPN 190/FMI 0, FMI 14 or FMI 15 present?
  - a. Yes; diagnose the other faults first.
  - b. No; Go to step 5.
5. Check the max camshaft speed. Is the max camshaft speed above 3000 rpm?
  - a. Yes; replace the camshafts.
  - b. No; Go to step 6.
6. Check for cam sensor or crank sensor fault codes. Are fault codes SPN 636/FMI 2, FMI 8, FMI 10, FMI 11, SPN 723/FMI 8, FMI 10, or FMI 11 also present?
  - a. Yes; diagnose the other fault codes first.
  - b. No; Go to step 7.
7. Does the engine exhibit knocking noise while running?
  - a. Yes; determine the cause of the noise. Repair as necessary.
  - b. No; Go to step 8.
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 lower by more than 10% as compared to the highest cylinder reading?
  - a. Yes; Go to step 13.
  - b. No; Go to step 10.
10. Disconnect the battery charger.

**WARNING: PERSONAL INJURY**

To avoid injury 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 and run the engine until the coolant temperature is greater than 70°C (158°F) and the fuel temperature is greater than 10°C (50°F).
12. Use DiagnosticLink to check the cylinder Idle Speed Balance (ISB) readings. Refer to section "Checking Idle Speed Balance". Does cylinder #1 pass the ISB test?
  - a. Yes; refer to Technical Service letter 15 TS-1 for further instructions.
  - b. No; Go to step 23.
13. Turn the engine OFF.
14. Remove the rocker cover. Refer to section "Removal of the Rocker Cover".
15. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers or camshafts damaged?
  - a. Yes; replace the damaged components.
  - b. No; Go to step 16.
16. Check the valve lash clearance for cylinder #1. Refer to section "Valve Lash Adjustments". Is the valve lash within specification?
  - a. Yes; Go to step 17.
  - b. No; adjust the valve lash to the correct clearance. Verify repair.
17. Check the engine brake lash. Refer to section "Setting the Engine Brake Lash". Is the engine brake lash within specification?
  - a. Yes; Go to step 18.
  - b. No; Go to step 19.
18. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?
  - a. Yes; replace the engine brake rocker arm. Refer to section "Removal of Camshaft and Rocker Shaft/Engine Brake Assembly". Verify repair.
  - b. No; Go to step 21.
19. Turn the engine brake adjuster screw out to back off the actuator piston from the rocker arm.
20. Set the correct engine brake lash. Refer to section "Setting the Engine Brake Lash". Does the engine brake actuator piston stick when adjusting the actuator?
  - a. Yes; replace the engine brake rocker arm. Refer to section "Removal of Camshaft and Rocker Shaft/Engine Brake Assembly".
  - b. No; adjust the engine brake valve lash to the correct specification. Refer to section "Setting the Engine Brake Lash". Verify repair.
21. Connect the battery charger to maintain proper cranking speed.
22. 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?
  - 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.
  - b. No; remove the oil pan and inspect the bearings starting with the bearings near cylinder #1. Repair as necessary.
23. Turn the engine OFF.
24. 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?
  - a. Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #1. Repair as necessary.
  - b. No; replace the fuel injector in cylinder #1. Refer to section "Removal of the Fuel Injector - Two-Filter System". Verify repair.

### 3 SPN 1324/FMI 31 - GHG14

Idle Smoothness Control/ Cylinder #2 Misfire At Idle

**Table 2.**

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 Comanded To Max Fueling
Monitored Parameter	Engine rpm
Typical Enabling Conditions	Engine Speed Between 600 And 960 rpm, Engine Coolant Temperature Greater Than 70°C (158°F), Engine Fuel Temperature Greater Than 10°C (50°F)
Monitor Sequence	None
Execution Frequency	When Enabling Conditions Are Met
Typical Duration	30 Seconds
Dash Lamps	CEL, MIL
Engine Reaction	25% Derate, EGR is Shut Off
Verification	Start and Run the Engine Until Engine Coolant Temperature is Greater than 70°C (158°F), Along with Engine Fuel Temperature Greater Than 10°C (50°F). Then Let the Engine Idle for 10 minutes

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.

- Always start and operate an engine in a well ventilated area.
- If operating an engine in an enclosed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system or emission control system.



#### **WARNING: PERSONAL INJURY**

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

**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. Connect DiagnosticLink®.
2. Turn the ignition ON (key ON, engine OFF).
3. Check for injector circuit fault codes. Are fault codes SPN 1324/FMI 3 or FMI 4 present?
  - a. Yes; diagnose the circuit fault codes first. Verify repair.
  - b. No; Go to step 4.
4. Check for engine over speed fault codes SPN 190/FMI 0, FMI 14 or FMI 15 present.
  - a. Yes; diagnose the other faults first.
  - b. No; Go to step 5.
5. Check the max camshaft speed. Is the max camshaft speed above 3000 rpm?
  - a. Yes; replace the camshafts.
  - b. No; Go to step 6.
6. Check for cam sensor or crank sensor fault codes. Are fault codes SPN 636/FMI 2, FMI 8, FMI 10 FMI 11, SPN 723/FMI 8, FMI 10, or FMI 11 also present?
  - a. Yes; diagnose the other fault codes first.
  - b. No; Go to step 7.
7. Does the engine exhibit knocking noise while running?
  - a. Yes; determine the cause of the noise. Repair as necessary.
  - b. No; Go to step 8.
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 lower by more than 10% as compared to the highest cylinder reading?
  - a. Yes; Go to step 13.
  - b. No; Go to step 10.
10. Disconnect the battery charger.

**WARNING: PERSONAL INJURY**

To avoid injury 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 and run the engine until the coolant temperature is greater than 70°C (158°F) and the fuel temperature is greater than 10°C (50°F).
12. Use DiagnosticLink to check the cylinder Idle Speed Balance (ISB) readings. Refer to section "Checking Idle Speed Balance". Does cylinder #2 pass the ISB test?
  - a. Yes; refer to Technical Service letter 15 TS-1 for further instructions.
  - b. No; Go to step 23.
13. Turn the engine OFF.
14. Remove the rocker cover. Refer to section "Removal of the Rocker Cover".
15. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the cam shafts. Are the rocker arms, rollers or camshafts damaged?
  - a. Yes; replace the damaged components.
  - b. No; Go to step 16.
16. Check the valve lash clearance for cylinder #2. Refer to section "Valve Lash Adjustments". Is the valve lash within specification?
  - a. Yes; Go to step 17.
  - b. No; adjust the valve lash to the correct clearance. Verify repair.
17. Check the engine brake lash. Refer to section "Setting the Engine Brake Lash". Is the engine brake lash within specification?
  - a. Yes; Go to step 18.
  - b. No; Go to step 19.
18. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?
  - a. Yes; replace the engine brake rocker arm. Refer to section "Removal of Camshaft and Rocker Shaft/Engine Brake Assembly". Verify repair.
  - b. No; Go to step 21.
19. Turn the engine brake adjuster screw out to back off the actuator piston from the rocker arm.
20. Set the correct engine brake lash. Refer to section "Setting the Engine Brake Lash". Does the engine brake actuator piston stick when adjusting the actuator?
  - a. Yes; replace the engine brake rocker arm. Refer to section "Removal of Camshaft and Rocker Shaft/Engine Brake Assembly".
  - b. No; adjust the engine brake valve lash to the correct specification. Refer to section "Setting the Engine Brake Lash". Verify repair.
21. Connect the battery charger to maintain proper cranking speed.
22. 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?
  - 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.
  - b. No; remove the oil pan and inspect the bearings starting with the bearings near cylinder #2. Repair as necessary.
23. Turn the engine OFF.
24. 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?
  - a. Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #2. Repair as necessary.
  - b. No; replace the fuel injector in cylinder #2. Refer to section "Removal of the Fuel Injector - Two-Filter System". Verify repair.

## 4 SPN 1325/FMI 31 - GHG14

Idle Smoothness Control/ Cylinder #3 Misfire At Idle

**Table 3.**

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
Monitored Parameter	Engine rpm
Typical Enabling Conditions	Engine Speed Between 600 and 960 rpm, Engine Coolant Temperature Greater Than 70°C (158°F), Engine Fuel Temperature Greater Than 10°C (50°F)
Monitor Sequence	None
Execution Frequency	When Enabling Conditions Are Met
Typical Duration	30 Seconds
Dash Lamps	CEL, MIL
Engine Reaction	25% Derate, EGR is Shut Off
Verification	Start and Run the Engine Until Engine Coolant Temperature is Greater than 70°C (158°F), Along with Engine Fuel Temperature Greater Than 10°C (50°F). Then Let the Engine Idle for 10 minutes

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.

- Always start and operate an engine in a well ventilated area.
- If operating an engine in an enclosed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system or emission control system.



### WARNING: PERSONAL INJURY

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

**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. Connect DiagnosticLink<sup>®</sup>.
2. Turn the ignition ON (key ON, engine OFF).
3. Check for injector circuit fault codes. Are fault codes SPN 1325/FMI 3 or FMI 4 present?
  - a. Yes; diagnose the circuit fault codes first. Verify repair.
  - b. No; Go to step 4.
4. Check for engine over speed fault codes SPN 190/FMI 0, FMI 14 or FMI 15 present?
  - a. Yes; diagnose the other faults first.
  - b. No; Go to step 5.
5. Check the max camshaft speed. Is the max camshaft speed above 3000 rpm?
  - a. Yes; replace the camshafts.
  - b. No; Go to step 6.
6. Check for cam sensor or crank sensor fault codes. Are fault codes, SPN 636/FMI 2, FMI 8, FMI 10 FMI 11, SPN 723/FMI 8, FMI 10, or FMI 11 also present?
  - a. Yes; diagnose the other fault codes first.
  - b. No; Go to step 7.
7. Does the engine exhibit knocking noise while running?
  - a. Yes; determine the cause of the noise. Repair as necessary.
  - b. No; Go to step 8.
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 lower by more than 10% as compared to the highest cylinder reading?
  - a. Yes; Go to step 13.
  - b. No; Go to step 10.
10. Disconnect the battery charger.

**WARNING: PERSONAL INJURY**

To avoid injury 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 and run the engine until the coolant temperature is greater than 70°C (158°F) and the fuel temperature is greater than 10°C (50°F).
12. Use DiagnosticLink to check the cylinder Idle Speed Balance (ISB) readings. Refer to section "Checking Idle Speed Balance". Does cylinder #3 pass the ISB test?
  - a. Yes; refer to Technical Service letter 15 TS-1 for further instructions.
  - b. No; Go to step 23.
13. Turn the engine OFF.
14. Remove the rocker cover. Refer to section "Removal of the Rocker Cover".
15. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers or camshafts damaged?
  - a. Yes; replace the damaged components.
  - b. No; Go to step 16.
16. Check the valve lash clearance for cylinder #3. Refer to section "Valve Lash Adjustments". Is the valve lash within specification?
  - a. Yes; Go to step 17.
  - b. No; adjust the valve lash to the correct clearance. Verify repair.
17. Check the engine brake lash. Refer to section "Setting the Engine Brake Lash". Is the engine brake lash within specification?
  - a. Yes; Go to step 18.
  - b. No; Go to step 19.
18. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?
  - a. Yes; replace the engine brake rocker arm. Refer to section "Removal of Camshaft and Rocker Shaft/Engine Brake Assembly". Verify repair.
  - b. No; Go to step 21.
19. Turn the engine brake adjuster screw out to back off the actuator piston from the rocker arm.
20. Set the correct engine brake lash. Refer to section "Setting the Engine Brake Lash". Does the engine brake actuator piston stick when adjusting the actuator?
  - a. Yes; replace the engine brake rocker arm. Refer to section "Removal of Camshaft and Rocker Shaft/Engine Brake Assembly".
  - b. No; adjust the engine brake valve lash to the correct specification. Refer to section "Setting the Engine Brake Lash". Verify repair.
21. Connect the battery charger to maintain proper cranking speed.
22. 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?
  - 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.
  - b. No; remove the oil pan and inspect the bearings starting with the bearings near cylinder #3. Repair as necessary.
23. Turn the engine OFF.
24. 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?
  - a. Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #3. Repair as necessary.
  - b. No; replace the fuel injector in cylinder #3. Refer to section "Removal of the Fuel Injector - Two-Filter System". Verify repair.

## 5 SPN 1326/FMI 31 - GHG14

Idle Smoothness Control/Cylinder #4 Misfire At Idle

**Table 4.**

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
Monitored Parameter	Engine rpm
Typical Enabling Conditions	Engine Speed Between 600 and 960 rpm, Engine Coolant Temperature Greater Than 70°C (158°F), Engine Fuel Temperature Greater Than 10°C (50°F)
Monitor Sequence	None
Execution Frequency	When Enabling Conditions Are Met
Typical Duration	30 Seconds
Dash Lamps	CEL, MIL
Engine Reaction	25% Derate, EGR is Shut Off
Verification	Start and Run the Engine Until Engine Coolant Temperature is Greater than 70°C (158°F), Along with Engine Fuel Temperature Greater Than 10°C (50°F). Then Let the Engine Idle for 10 minutes

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

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- Always start and operate an engine in a well ventilated area.
- If operating an engine in an enclosed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system or emission control system.



### WARNING: PERSONAL INJURY

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

**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. Connect DiagnosticLink®.
2. Turn the ignition ON (key ON, engine OFF).
3. Check for injector circuit fault codes. Are fault codes SPN 1326/FMI 3 or FMI 4 present?
  - a. Yes; diagnose the circuit fault codes first. Verify repair.
  - b. No; Go to step 4.
4. Check for engine over speed fault codes SPN 190/FMI 0, FMI 14 or FMI 15 present?
  - a. Yes; diagnose the other faults first.
  - b. No; Go to step 5.
5. Check the max camshaft speed. Is the max camshaft speed above 3000 rpm?
  - a. Yes; replace the camshafts.
  - b. No; Go to step 6.
6. Check for cam sensor or crank sensor fault codes. Are fault codes, SPN 636/FMI 2, FMI 8, FMI 10 FMI 11, SPN 723/FMI 8, FMI 10, or FMI 11 also present?
  - a. Yes; diagnose the other fault codes first.
  - b. No; Go to step 7.
7. Does the engine exhibit knocking noise while running?
  - a. Yes; determine the cause of the noise. Repair as necessary.
  - b. No; Go to step 8.
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 lower by more than 10% as compared to the highest cylinder reading?
  - a. Yes; Go to step 13.
  - b. No; Go to step 10.
10. Disconnect the battery charger.

**WARNING: PERSONAL INJURY**

To avoid injury 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 and run the engine until the coolant temperature is greater than 70°C (158°F) and the fuel temperature is greater than 10°C (50°F).
12. Use DiagnosticLink to check the cylinder Idle Speed Balance (ISB) readings. Refer to section "Checking Idle Speed Balance". Does cylinder #4 pass the ISB test?
  - a. Yes; refer to Technical Service letter 15 TS-1 for further instructions.
  - b. No; Go to step 23.
13. Turn the engine OFF (key ON, engine OFF).
14. Remove the rocker cover. Refer to section "Removal of the Rocker Cover".
15. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers or camshafts damaged?
  - a. Yes; replace the damaged components.
  - b. No; Go to step 16.
16. Check the valve lash clearance for cylinder #4. Refer to section "Valve Lash Adjustments". Is the valve lash within specification?
  - a. Yes; Go to step 17.
  - b. No; adjust the valve lash to the correct clearance. Verify repair.
17. Check the engine brake lash. Refer to section "Setting the Engine Brake Lash". Is the engine brake lash within specification?
  - a. Yes; Go to step 18.
  - b. No; Go to step 19.
18. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?
  - a. Yes; replace the engine brake rocker arm. Refer to section "Removal of Camshaft and Rocker Shaft/Engine Brake Assembly". Verify repair.
  - b. No; Go to step 21.
19. Turn the engine brake adjuster screw out to back off the actuator piston from the rocker arm.
20. Set the correct engine brake lash. Refer to section "Setting the Engine Brake Lash". Does the engine brake actuator piston stick when adjusting the actuator?
  - a. Yes; replace the engine brake rocker arm. Refer to section "Removal of Camshaft and Rocker Shaft/Engine Brake Assembly".
  - b. No; adjust the engine brake valve lash to the correct specification. Refer to section "Setting the Engine Brake Lash". Verify repair.
21. Connect the battery charger to maintain proper cranking speed.
22. 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?
  - 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.
  - b. No; remove the oil pan and inspect the bearings starting with the bearings near cylinder #4. Repair as necessary.
23. Turn the engine OFF.
24. 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?
  - a. Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #4. Repair as necessary.
  - b. No; replace the fuel injector in cylinder #4. Refer to section "Removal of the Fuel Injector - Two-Filter System". Verify repair.

## 6 SPN 1327/FMI 31 - GHG14

Idle Smoothness Control/Cylinder #5 Misfire At Idle

**Table 5.**

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
Monitored Parameter	Engine rpm
Typical Enabling Conditions	Engine Speed Between 600 and 960 rpm, Engine Coolant Temperature Greater Than 70°C (158°F), Engine Fuel Temperature Greater Than 10°C (50°F)
Monitor Sequence	None
Execution Frequency	When Enabling Conditions Are Met
Typical Duration	30 Seconds
Dash Lamps	CEL, MIL
Engine Reaction	25% Derate, EGR is Shut Off
Verification	Start and Run the Engine Until Engine Coolant Temperature is Greater than 70°C (158°F), Along with Engine Fuel Temperature Greater Than 10°C (50°F). Then Let the Engine Idle for 10 minutes

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.

- Always start and operate an engine in a well ventilated area.
- If operating an engine in an enclosed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system or emission control system.



### WARNING: PERSONAL INJURY

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

**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. Connect DiagnosticLink<sup>®</sup>.
2. Turn the ignition ON (key ON, engine OFF).
3. Check for injector circuit fault codes. Are fault codes SPN 1327/FMI 3 or FMI 4 present?
  - a. Yes; diagnose the circuit fault codes first. Verify repair.
  - b. No; Go to step 4.
4. Check for engine over speed fault codes SPN 190/FMI 0, FMI 14 or FMI 15 present?
  - a. Yes; diagnose the other faults first.
  - b. No; Go to step 5.
5. Check the max camshaft speed. Is the max camshaft speed above 3000 rpm?
  - a. Yes; replace the camshafts.
  - b. No; Go to step 6.
6. Check for cam sensor or crank sensor fault codes. Are fault codes, SPN 636/FMI 2, FMI 8, FMI 10 FMI 11, SPN 723/FMI 8, FMI 10, or FMI 11 also present?
  - a. Yes; diagnose the other fault codes first.
  - b. No; Go to step 7.
7. Does the engine exhibit knocking noise while running?
  - a. Yes; determine the cause of the noise. Repair as necessary.
  - b. No; Go to step 8.
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 lower by more than 10% as compared to the highest cylinder reading?
  - a. Yes; Go to step 13.
  - b. No; Go to step 10.
10. Disconnect the battery charger.

**WARNING: PERSONAL INJURY**

To avoid injury 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 and run the engine until the coolant temperature is greater than 70°C (158°F) and the fuel temperature is greater than 10°C (50°F).
12. Use DiagnosticLink to check the cylinder Idle Speed Balance (ISB) readings. Refer to section "Checking Idle Speed Balance". Does cylinder #5 pass the ISB test?
  - a. Yes; refer to Technical Service letter 15 TS-1 for further instructions.
  - b. No; Go to step 23.
13. Turn the engine OFF.
14. Remove the rocker cover. Refer to section "Removal of the Rocker Cover".
15. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers or camshafts damaged?
  - a. Yes; replace the damaged components.
  - b. No; Go to step 16.
16. Check the valve lash clearance for cylinder #5. Refer to section "Valve Lash Adjustments". Is the valve lash within specification?
  - a. Yes; Go to step 17.
  - b. No; adjust the valve lash to the correct clearance. Verify repair.
17. Check the engine brake lash. Refer to section "Setting the Engine Brake Lash". Is the engine brake lash within specification?
  - a. Yes; Go to step 18.
  - b. No; Go to step 19.
18. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?
  - a. Yes; replace the engine brake rocker arm. Refer to section "Removal of Camshaft and Rocker Shaft/Engine Brake Assembly". Verify repair.
  - b. No; Go to step 21.
19. Turn the engine brake adjuster screw out to back off the actuator piston from the rocker arm.
20. Set the correct engine brake lash. Refer to section "Setting the Engine Brake Lash". Does the engine brake actuator piston stick when adjusting the actuator?
  - a. Yes; replace the engine brake rocker arm. Refer to section "Removal of Camshaft and Rocker Shaft/Engine Brake Assembly".
  - b. No; adjust the engine brake valve lash to the correct specification. Refer to section "Setting the Engine Brake Lash". Verify repair.
21. Connect the battery charger to maintain proper cranking speed.
22. 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?
  - 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.
  - b. No; remove the oil pan and inspect the bearings starting with the bearings near cylinder #5. Repair as necessary.
23. Turn the engine OFF.
24. 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?
  - a. Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #5. Repair as necessary.
  - b. No; replace the fuel injector in cylinder #5. Refer to section "Removal of the Fuel Injector - Two-Filter System". Verify repair.

## 7 SPN 1328/FMI 31 - GHG14

Idle Smoothness Control/Cylinder #6 Misfire At Idle

**Table 6.**

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
Monitored Parameter	Engine rpm
Typical Enabling Conditions	Engine Speed Between 600 and 960 rpm, Engine Coolant Temperature Greater Than 70°C (158°F), Engine Fuel Temperature Greater Than 10°C (50°F)
Monitor Sequence	None
Execution Frequency	When Enabling Conditions Are Met
Typical Duration	30 Seconds
Dash Lamps	CEL, MIL
Engine Reaction	25% Derate, EGR is Shut Off
Verification	Start and Run the Engine Until Engine Coolant Temperature is Greater than 70°C (158°F), Along with Engine Fuel Temperature Greater Than 10°C (50°F). Then Let the Engine Idle for 10 minutes

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.

- Always start and operate an engine in a well ventilated area.
- If operating an engine in an enclosed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system or emission control system.



### WARNING: PERSONAL INJURY

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

**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. Connect DiagnosticLink<sup>®</sup>.
2. Turn the ignition ON (key ON, engine OFF).
3. Check for injector circuit fault codes. Are fault codes SPN 1328/FMI 3 or FMI 4 present?
  - a. Yes; diagnose the circuit fault codes first. Verify repair.
  - b. No; Go to step 4.
4. Check for engine over speed fault codes SPN 190/FMI 0, FMI 14 or FMI 15 present?
  - a. Yes; diagnose the other faults first.
  - b. No; Go to step 5.
5. Check the max camshaft speed. Is the max camshaft speed above 3000 rpm?
  - a. Yes; replace the camshafts.
  - b. No; Go to step 6.
6. Check for cam sensor or crank sensor fault codes. Are fault codes, SPN 636/FMI 2, FMI 8, FMI 10 FMI 11, SPN 723/FMI 8, FMI 10, or FMI 11 also present?
  - a. Yes; diagnose the other fault codes first.
  - b. No; Go to step 7.
7. Does the engine exhibit knocking noise while running?
  - a. Yes; determine the cause of the noise. Repair as necessary.
  - b. No; Go to step 8.
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 lower by more than 10% as compared to the highest cylinder reading?
  - a. Yes; Go to step 13.
  - b. No; Go to step 10.
10. Disconnect the battery charger.

**WARNING: PERSONAL INJURY**

To avoid injury 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 and run the engine until the coolant temperature is greater than 70°C (158°F) and the fuel temperature is greater than 10°C (50°F).
12. Use DiagnosticLink to check the cylinder Idle Speed Balance (ISB) readings. Refer to section "Checking Idle Speed Balance". Does cylinder #6 pass the ISB test?
  - a. Yes; refer to Technical Service letter 15 TS-1 for further instructions.
  - b. No; Go to step 23.
13. Turn the engine OFF.
14. Remove the rocker cover. Refer to section "Removal of the Rocker Cover".
15. Visually inspect the rocker arms, rollers on the rocker shafts and the lobes on the camshafts. Are the rocker arms, rollers or camshafts damaged?
  - a. Yes; replace the damaged components.
  - b. No; Go to step 16.
16. Check the valve lash clearance for cylinder #6. Refer to section "Valve Lash Adjustments". Is the valve lash within specification?
  - a. Yes; Go to step 17.
  - b. No; adjust the valve lash to the correct clearance. Verify repair.
17. Check the engine brake lash. Refer to section "Setting the Engine Brake Lash". Is the engine brake lash within specification?
  - a. Yes; Go to step 18.
  - b. No; Go to step 19.
18. Inspect the engine brake piston actuator. Is the engine brake piston actuator constantly engaged or stuck in the extended position?
  - a. Yes; replace the engine brake rocker arm. Refer to section "Removal of Camshaft and Rocker Shaft/Engine Brake Assembly". Verify repair.
  - b. No; Go to step 21.
19. Turn the engine brake adjuster screw out to back off the actuator piston from the rocker arm.
20. Set the correct engine brake lash. Refer to section "Setting the Engine Brake Lash". Does the engine brake actuator piston stick when adjusting the actuator?
  - a. Yes; replace the engine brake rocker arm. Refer to section "Removal of Camshaft and Rocker Shaft/Engine Brake Assembly".
  - b. No; adjust the engine brake valve lash to the correct specification. Refer to section "Setting the Engine Brake Lash". Verify repair.
21. Connect the battery charger to maintain proper cranking speed.
22. 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?
  - 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.
  - b. No; remove the oil pan and inspect the bearings starting with the bearings near cylinder #6. Repair as necessary.
23. Turn the engine OFF.
24. 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?
  - a. Yes; remove the oil pan and inspect the bearings starting with the bearings near cylinder #6. Repair as necessary.
  - b. No; replace the fuel injector in cylinder #6. Refer to section "Removal of the Fuel Injector - Two-Filter System". Verify repair.