

Engine Performance Troubleshooting Tree - CM554 Electronic Control System with CAPS Fuel System

This troubleshooting procedure should be followed for the following symptoms:

- Engine Acceleration or Response Poor
- Cranking Fuel Pressure is Low
- Engine Operating Fuel Pressure is Low
- Engine Decelerates Slowly
- Engine Difficult to Start or Will Not Start (Exhaust Smoke)
- Engine Difficult to Start or Will Not Start (No Exhaust Smoke)
- Engine Power Output Low
- Engine Runs Rough at Idle
- Engine Runs Rough or Misfires
- Engine Speed Surges at Low or High Idle
- Engine Speed Surges Under Load or in Operating Range
- Engine Shuts Off or Dies Unexpectedly or Dies During Deceleration
- Engine Starts but Will Not Keep Running
- Engine Will Not Reach Rated Speed (RPM)
- Intake Manifold Pressure (Boost) is Below Normal

How to Use This Troubleshooting Procedure:

This symptom tree can be used to troubleshoot all performance based symptoms listed above. Start by performing Step 1 troubleshooting. Step 2 will ask a series of questions and will provide a list of troubleshooting steps to perform depending on the symptom. Perform the list of troubleshooting in the sequence shown in the Specifications/Repair section of the tree.

Shop Talk:

Driveability is a term that in general describes vehicle performance on the road. Driveability problems for an engine can be caused by several different factors. Some of the factors are engine-related and some are **not**. Before troubleshooting it is important to determine the exact complaint and whether the engine has a real driveability problem or if it simply does **not** meet driver expectations.

Low power is a term that is used in the field to describe many different performance problems. Low power is defined as the inability of the engine to produce the power necessary to move the vehicle at a speed that can be reasonably expected under the given conditions of load, grade, wind, and so on.

Poor acceleration or response is described as the inability of the vehicle to accelerate satisfactorily from a stop or from the bottom of a grade. It can also be the lag in acceleration during an attempt to pass or overtake another vehicle at conditions less than rated speed and load. Poor acceleration or response is difficult to troubleshoot since it can be caused by several factors.

TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Perform basic troubleshooting procedures.		
STEP 1A: Check for active fault codes or high counts of inactive fault codes.	Active fault codes or high counts of inactive fault codes?	
STEP 1B: Perform basic troubleshooting checks.	All steps have been verified to be correct?	
STEP 2: Determination of engine symptom.		
STEP 2A: Low power, poor acceleration, or poor response.	Is the engine symptom low power, poor acceleration, or poor response?	
STEP 2B: Engine misfire, engine speed surge, or engine speed unstable.	Is the engine symptom engine misfire, engine speed surge, or engine speed unstable?	
STEP 2C: Excessive white or black smoke.	Is the engine symptom excessive white or black smoke?	
STEP 2D: Low intake manifold pressure.	Is the engine symptom low boost pressure?	
STEP 2E: Engine will not start or difficult to start, or engine shuts off unexpectedly.	Is the symptom engine will not start or difficult to start, or engine shuts off unexpectedly?	
STEP 3: No-start troubleshooting procedures.		
STEP 3A: Check the ECM keyswitch voltage.	Is the keyswitch voltage equal to battery voltage?	
STEP 3B: Check the ECM battery supply voltage.	Is the ECM battery supply voltage equal to the battery voltage?	
STEP 3C: Verify the operation of cold weather starting aids.	If equipped, are cold weather starting aids operating correctly?	
STEP 3D: Check the fuel lift pump pressure.	Is the fuel lift pump pressure greater than the specifications outlined in Procedure 005-045 in Section 5 in the ISC, ISCe, QSC8.3, ISL and QSL9 Engines Troubleshooting and Repair Manual, Bulletin 4021418?	
STEP 3E: Verify fuel pressure sensor accuracy.	Is the accumulator pressure value less than 34.5 bar [500 psi]?	
STEP 3F: Check the accumulator pressure.	Is accumulator pressure greater than 293 bar [4250 psi] while cranking?	
STEP 3G: Use INSITE™ electronic service tool to check the CPS crank state.	Does CPS state read Valid Sync while cranking?	
STEP 3G-1: Check and adjust speed/position sensor air gap.	Are the sensor(s) depth measurements within specification?	

<u>STEP 3H:</u>	Measure gear pump pressure.	Is the fuel gear pump pressure greater than the specifications outlined in Procedure 005-089 in Section 5 in the ISC, ISCe, QSC8.3, ISL and QSL9 Engines Troubleshooting and Repair Manual, Bulletin 4021418?
<u>STEP 3I:</u>	Perform the injection control valve (IVC) click test.	Does the injection control valve pass the click test?
<u>STEP 3J:</u>	Perform the pumping control valve (PCV) click test.	Do the pumping control valves pass the click test?
<u>STEP 3K:</u>	Check the distributor rotor timing.	Distributor rotor timing is correct as outlined in Procedure 005-072 in Section 5 in the ISC, ISCe, QSC8.3, ISL and QSL9 Engines Troubleshooting and Repair Manual, Bulletin 4021418?
<u>STEP 3L:</u>	Inspect the gear pump coupling for wear.	Is the gear pump drive shaft or coupling worn?
<u>STEP 4:</u>	Fuel system troubleshooting procedures.	
<u>STEP 4A:</u>	Check for fault codes.	Are fuel system fault codes active?
<u>STEP 4B:</u>	Check the CAPS fuel pump wiring.	All fuel pump wiring is undamaged and is properly connected?
<u>STEP 4C:</u>	Check transorb diode.	Does the rough running, black smoke, or surge complaint continue?
<u>STEP 4D:</u>	Check for air in the high-pressure pump fuel supply.	Is air present in the fuel supply?
<u>STEP 4E:</u>	Measure the fuel inlet restriction.	Is the fuel inlet restriction less than the specifications outlined in Procedure 006-020 (Fuel Inlet Restriction) in the ISC, ISCe, QSC8.3, ISL and QSL9 Engines Troubleshooting and Repair Manual, Bulletin 4021418?
<u>STEP 4F:</u>	Measure the fuel gear pump pressure.	Is the fuel gear pump pressure greater than the specifications outlined in Procedure 005-089 (Fuel Pump Gear Pump Module) in the ISC, ISCe, QSC8.3, ISL and QSL9 Engines Troubleshooting and Repair Manual, Bulletin 4021418?
<u>STEP 4G:</u>	Perform the injection control valve click test.	Does the injection control valve pass the click test?
<u>STEP 4H:</u>	Perform the pumping control valve click test.	Do the pumping control valves pass the click test?
<u>STEP 4I:</u>	Measure fuel drain line restriction.	Is the drain line restriction less than specification?
<u>STEP 4J:</u>	Perform the single cylinder cutout test.	Can the miss or excessive smoke be attributed to a single cylinder?

<u>STEP 4K:</u>	Verify the fuel temperature sensor is within specification.	Is the fuel temperature sensor within specification?
<u>STEP 4L:</u>	Check for excessive injector drain leakage.	Are only a few drops of fuel per minute draining from the back of the cylinder head?
<u>STEP 4M:</u>	Pop test the injectors.	The injector spray pattern is correct and the injectors pop between 275 and 300 bar [3989 and 4351 psi]?
<u>STEP 4N:</u>	Inspect the gear pump coupling for wear.	Is the gear pump drive shaft or coupling worn?
<u>STEP 5:</u>	Air handling troubleshooting procedures.	
<u>STEP 5A:</u>	Inspect the turbocharger blades for damage.	Damage found on turbocharger blades?
<u>STEP 5B:</u>	Check the turbocharger axial and radial clearances.	Are the turbocharger axial and radial bearing clearances within specification?
<u>STEP 5C:</u>	Inspect the wastegate actuator rod for travel.	Does the wastegate actuator rod move?
<u>STEP 5C-1:</u>	Inspect the wastegate actuator rod for travel.	Does the wastegate actuator rod move?
<u>STEP 6:</u>	Electronic feature troubleshooting procedures.	
<u>STEP 6A:</u>	Verify throttle pedal travel.	Does the throttle position read zero when the throttle is released and 100 percent when the throttle is depressed?
<u>STEP 6B:</u>	Check ambient air pressure sensor accuracy (if equipped).	Is the reading within 50.8 mm-Hg [2 in-Hg] of local barometric pressure?
<u>STEP 6C:</u>	Check intake manifold pressure sensor accuracy.	Is the intake manifold pressure reading less than 102 mm-Hg [4 in-Hg]?
<u>STEP 6D:</u>	Verify electronic feature settings are correct.	Are the electronic features set correctly?
<u>STEP 7:</u>	Base engine troubleshooting procedures.	
<u>STEP 7A:</u>	Verify overhead adjustments are correct.	Are the overhead settings within the reset limits?
<u>STEP 7B:</u>	Verify engine brake adjustment (if equipped).	Are the engine brake settings within the reset limits?
<u>STEP 7C:</u>	Inspect the charge air cooler.	Is the charge air cooler free of cracks, holes, or other damage?
<u>STEP 7D:</u>	Check air intake restriction.	Is air intake restriction greater than 635 mm-H 2O [25 in-H 2O]?
<u>STEP 7E:</u>	Check exhaust restriction.	Is exhaust back pressure less than 72 mm-Hg [3 in-Hg]?
<u>STEP 7F:</u>	Check engine blowby.	Are the engine blowby measurements within specification?
<u>STEP 7F-1:</u>	Verify turbocharger contribution to engine blowby.	Has the total engine blowby dropped more than 30 percent of the total?

TROUBLESHOOTING STEP

STEP 1: Perform basic troubleshooting procedures.

STEP 1A: Check for active fault codes or high counts of inactive fault codes.

Condition: <ul style="list-style-type: none"> • Turn keyswitch ON. • Connect INSITE™ electronic service tool. 		
Action	Specification/Repair	Next Step
Check for active fault codes. <ul style="list-style-type: none"> • Use INSITE™ electronic service tool to read the fault codes. 	Active fault codes or high counts of inactive fault codes? YES	Go to appropriate fault code troubleshooting procedures.
	Active fault codes or high counts of inactive fault codes? NO	1B

STEP 1B: Perform basic troubleshooting checks.

Condition: None.		
Action	Specification/Repair	Next Step
The following items must be checked or verified before continuing: <ul style="list-style-type: none"> • Verify the fuel level in the tanks, regardless of what the gauge reads. • Verify there have not been any changes to CPL components on the engine. • Verify fuel grade is correct for the application. • Verify the engine is operating within the recommended altitude. • Verify engine oil is at the correct level. • Verify engine parasitics have not changed. • Verify engine duty cycle has not changed. • Verify engine cranking speed is greater than 150 rpm. • Verify battery voltage is adequate. 	All steps have been verified to be correct? YES	2A
		All steps have been verified to be correct? NO Repair: Correct the failure and verify complaint is no longer present after repair.

STEP 2: Determination of engine symptoms.

STEP 2A: Low power, poor acceleration, or poor response.

Condition: None.		
Action	Specification/Repair	Next Step
Interview driver and verify the complaint.	Is the engine symptom low power, poor acceleration, or poor response? YES Repair: Perform the troubleshooting steps in the recommended order listed below: <ul style="list-style-type: none"> • Step 4 - Fuel system checks • Step 5 - Air handling checks • Step 6 - Electronics checks • Step 7 - Base engine checks. 	Perform the troubleshooting steps suggested in the repair procedure
	Is the engine symptom low power, poor acceleration, or poor response? NO	2B

STEP 2B: Engine misfire, engine speed surge, or engine speed unstable.

Condition: None.		
Action	Specification/Repair	Next Step
Interview driver and verify the complaint.	Is the engine symptom engine misfire, engine speed surge, or engine speed unstable? YES Repair: Perform the troubleshooting steps in the recommended order listed below: <ul style="list-style-type: none"> • Step 4 - Fuel system checks • Step 5 - Air handling checks • Step 6 - Electronics checks • Step 7 - Base engine checks. 	Perform the troubleshooting steps suggested in the repair procedure.
	Is the engine symptom engine misfire, engine speed surge, or engine speed unstable? NO	2C

STEP 2C: Excessive white or black smoke.

Condition: None.		
Action	Specification/Repair	Next Step
Interview the driver and verify the complaint.	Is the engine symptom excessive white or black smoke? YES Repair: Perform the troubleshooting steps in the recommended order listed below: <ul style="list-style-type: none"> • Step 5 - Air Handling Checks • Step 4 - Fuel System Checks • Step 7 - Base Engine Checks. 	Perform the troubleshooting steps suggested in the repair procedure
	Is the engine symptom excessive white or black smoke? NO	2D

STEP 2D: Low intake manifold pressure.

Condition: None.		
Action	Specification/Repair	Next Step
Interview driver and verify the complaint.	Is the engine symptom Low Boost Pressure? YES Repair: Perform the troubleshooting steps in the recommended order listed below: <ul style="list-style-type: none"> • Step 5 - Air Handling Checks • Step 4 - Fuel System Checks • Step 7 - Base Engine Checks. 	Perform the troubleshooting steps suggested in the repair procedure
	Is the engine symptom Low Boost Pressure? NO	2E

STEP 2E: Engine will not start or difficult to start, engine shuts off unexpectedly.

Condition: None.		
Action	Specification/Repair	Next Step
Interview driver and verify the complaint.	Is the symptom engine will not start or difficult to start, or engine shuts off unexpectedly? YES Repair: Perform the troubleshooting steps in the recommended order listed below: <ul style="list-style-type: none"> • Step 3 - No Start Checks • Step 4 - Fuel System • Checks Step 7 - Base Engine • Checks Step 5 - Air Handling • Checks Step 6 - Electronics Checks. 	Perform the troubleshooting steps suggested in the repair procedure
	Is the symptom engine will not start or difficult to start, or engine shuts off unexpectedly? NO	Return to correct symptom tree.

STEP 3: No-start troubleshooting procedures.

STEP 3A: Check the ECM keyswitch voltage.

Condition: <ul style="list-style-type: none"> • Disconnect the OEM harness from the ECM. • Turn keyswitch ON 		
Action	Specification/Repair	Next Step
Measure the signal voltage from the keyswitch input SIGNAL wire of the OEM harness to the engine block ground. Measure the keyswitch voltage with the keyswitch in the ON position and also with the keyswitch in the START position. Reference the wiring diagram for connector pin identification.	Is the keyswitch voltage equal to battery voltage? YES	3B
	Is the keyswitch voltage equal to battery voltage? NO Repair: Repair or replace the OEM power harness or keyswitch, or check the battery connections.	Repair complete

STEP 3B: Check the ECM battery supply voltage.

Condition: <ul style="list-style-type: none"> • Turn the keyswitch ON. • Disconnect connector 2 from the ECM 		
Action	Specification/Repair	Next Step
Measure the voltage from the ECM battery supply (+) to the ECM battery supply (-) pins in the OEM harness connector. <ul style="list-style-type: none"> • Reference the wiring diagram for connector pin identification. 	Is the ECM battery supply voltage equal to the battery voltage? YES	3C
	Is the ECM battery supply voltage equal to the battery voltage? NO Repair: Repair or replace the ECM power harness. Check the battery connections and fuse terminals.	Repair complete

STEP 3C: Verify the operation of cold weather starting aids.

Condition: None.		
Action	Specification/Repair	Next Step
Make sure the intake air heater and other cold starting aids are operational, if equipped. Refer to Procedure 008-011 in Section 8, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 010-029 in Section 10, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.	If equipped, are cold weather starting aids operating correctly? YES	3D
	If equipped, are cold weather starting aids operating correctly? NO Repair: Repair cold weather starting aids. Refer to Procedure 010-029 in Section 10, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.	Repair complete

STEP 3D: Check the fuel lift pump pressure.

<p>Condition:</p> <ul style="list-style-type: none"> Refer to Procedure 005-045 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. 		
Action	Specification/Repair	Next Step
<p>Measure the fuel lift pump output pressure. Refer to Procedure 005-045 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	<p>Is the fuel lift pump pressure greater than the specifications outlined? YES</p>	3E
	<p>Is the fuel lift pump pressure greater than the specifications outlined? NO Repair: Find and repair the cause of low lift pump pressure. Refer to Procedure 005-045 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	Repair complete

STEP 3E: Verify fuel pressure sensor accuracy.

<p>Condition:</p> <ul style="list-style-type: none"> Turn keyswitch ON. Connect INSITE™ electronic service tool. 		
Action	Specification/Repair	Next Step
<p>Use INSITE™ electronic service tool to monitor accumulator pressure. The engine speed must be zero for at least 1 minute before performing this test.</p>	<p>Is the accumulator pressure value less than 34.5 bar [500 psi]? YES</p>	3F
	<p>Is the accumulator pressure value less than 34.5 bar [500 psi]? NO Repair: Replace the fuel pressure sensor. Reference Service Bulletin, CAPS Fuel Pressure Sensor Kit, 4021293 or 4021294.</p>	Repair complete

STEP 3F: Check the accumulator pressure.

Condition: <ul style="list-style-type: none"> • Turn keyswitch ON. • Connect INSITE™ electronic service tool. 		
Action	Specification/Repair	Next Step
Use INSITE™ electronic service tool to read accumulator pressure while cranking the engine.	Is accumulator pressure greater than 293 bar [4250 psi] while cranking? YES	3L
	Is accumulator pressure greater than 293 bar [4250 psi] while cranking? NO	3G

STEP 3G: Use INSITE™ electronic service tool to check the CPS crank state.

Condition: <ul style="list-style-type: none"> • Connect INSITE™ electronic service tool. • Turn keyswitch ON. 		
Action	Specification/Repair	Next Step
Check ignition coils. Use INSITE™ electronic service tool to monitor CPS state while cranking the engine.	Does CPS state read Valid Sync while cranking? YES	3H
	Does CPS state read Valid Sync while cranking? NO Repair: Troubleshoot the engine speed sensor circuit. See Fault Codes 115 and 121.	3G-1

STEP 3G-1: Check and adjust the speed/position sensor air gap.

Condition: <ul style="list-style-type: none"> Install the sensors. 		
Action	Specification/Repair	Next Step
Check and adjust the speed/position sensor air gap. <ul style="list-style-type: none"> Check the air gap between the ESS/EPS and the camshaft ring gear. Since the EPS and ESS are mounted on the same boss, the air gap can be measured using the outside sensor bore. This measurement can usually be taken without removing the air compressor. Bar the engine over 2 full revolutions (clockwise facing the front of the engine). Use a depth micrometer and measure the distance from the face of the gear housing boss to the face of the camshaft ring gear. Record this measurement "A". Measure the gap in 45 degree camshaft rotation increments. If the measurements "A" varies by more than 0.051 mm [0.002 in] the tone wheel is warped, or the camshaft gear is walking. Next measure the sensor. Use a depth micrometer to measure the distance from the bottom of the sensor mounting flange to the tip of the threaded end of the sensor. Record this as measurement "B". The air gap can be calculated by subtracting B from A (air gap measurement equals A minus B). If the air gap is less than 0.406 mm [0.016 in] add a 0.508 mm [0.020 in] shim to sensor. Minimum Air Gap: 0.406 mm [0.016 in] Maximum Air Gap: 1.020 mm [0.040 in] 	Are the sensor(s) depth measurements within specification? YES	3H
	Are the sensor(s) depth measurements within specification? NO Repair: Replace the engine speed/position sensor(s). Refer to Procedure 019-042 in Section 19, ISC, QSC8.3, and ISL Electronic Control System, Troubleshooting and Repair Manual, Bulletin 3666271.	Repair complete

STEP 3H: Measure gear pump pressure.

<p>Condition:</p> <ul style="list-style-type: none"> Connect a fuel pressure gauge to the Compuchek™ fitting on the cam housing. 		
Action	Specification/Repair	Next Step
<p>Measure the gear pump pressure while cranking the engine.</p> <p>Refer to Procedure 005-089 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	<p>Is the fuel gear pump pressure greater than the specifications. Refer to Procedure 005-089 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418?</p> <p>YES</p> <p>Repair:</p> <p>Use the following procedure in the C8.3G, C Gas Plus, and L Gas Plus Engines Troubleshooting and Repair Manual, Bulletin 3666206. Refer to Procedure 013-016 in Section 13.</p>	3I
	<p>Is the fuel gear pump pressure greater than the specifications. Refer to Procedure 005-089 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418?</p> <p>NO</p>	3K

STEP 3I: Perform the injection control valve (ICV) click test.

<p>Condition:</p> <ul style="list-style-type: none"> Connect INSITE™ electronic service tool. Turn the keyswitch ON 		
Action	Specification/Repair	Next Step
<p>Use INSITE™ electronic service tool to perform the ICV click test.</p> <p>Refer to Procedure 005-078 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	<p>Does the injection control valve pass the click test?</p> <p>YES</p> <p>Repair:</p> <p>Follow the electronic fault code trees for the appropriate troubleshooting procedure.</p>	3J
	<p>Does the injection control valve pass the click test?</p> <p>NO</p> <p>Repair:</p> <p>Replace the injection control valve stator. Refer to Procedure 019-430 in Section 19, in the Electronic Control System ISC, QSC8.3, and ISL Troubleshooting and Repair Manual, Bulletin 3666271.</p>	Repair complete

STEP 3J: Perform the pumping control valve (PCV) click test.

<p>Condition:</p> <ul style="list-style-type: none"> • Connect INSITE™ electronic service tool. • Turn keyswitch ON. 		
Action	Specification/Repair	Next Step
<p>Use INSITE™ electronic service tool to perform the front and rear PCV test.</p> <p>Refer to Procedure 005-079 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	<p>Do the pumping control valves pass the click test?</p> <p>YES</p> <p>Repair:</p> <p>Replace the injection control valve module. Refer to Procedure 005-086 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	<p>Repair complete</p>
	<p>Do the pumping control valves pass the click test?</p> <p>NO</p> <p>Repair:</p> <p>Replace the accumulator module. Refer to Procedure 005-085 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	<p>Repair complete</p>

STEP 3K: Check the distributor rotor timing.

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch OFF. 		
Action	Specification/Repair	Next Step
<p>Inspect the distributor rotor timing and check for a seized rotor.</p> <p>Refer to Procedure 005-072 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	<p>Distributor rotor timing is correct as outlined. Refer to Procedure 005-072 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418?</p> <p>YES</p>	<p>3L</p>
	<p>Distributor rotor timing is correct as outlined. Refer to Procedure 005-072 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418?</p> <p>NO</p> <p>Repair:</p> <p>Replace the fuel injection pump. Refer to Procedure 005-229 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	<p>Repair complete</p>

STEP 3L: Inspect the gear pump coupling for wear.

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch OFF. • Remove the gear pump module. 		
Action	Specification/Repair	Next Step
<p>Inspect the gear pump drive shaft coupling and shaft for wear.</p> <p>Refer to Procedure 005-089 in Section 5 in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	<p>Is the gear pump drive shaft or coupling worn?</p> <p>YES</p> <p>Repair:</p> <p>Replace the gear pump module. Refer to Procedure 005-089 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	<p>Repair complete</p>
	<p>Is the gear pump drive shaft or coupling worn?</p> <p>NO</p> <p>Repair:</p> <p>Replace the injection control valve. Refer to Procedure 005-086 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	<p>Repair complete</p>

STEP 4: Fuel system troubleshooting procedures.

STEP 4A: Check for fault codes.

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch ON • Connect INSITE™ electronic service tool. 		
Action	Specification/Repair	Next Step
<p>Measure the fuel pressure while cranking the engine.</p> <ul style="list-style-type: none"> • Use INSITE™ electronic service tool to read the fault code information. <p>Check for active fuel system fault codes related to the complaint.</p>	<p>Are fuel system fault codes active?</p> <p>YES</p> <p>Repair:</p> <p>Follow the appropriate troubleshooting tree.</p>	<p>Repair complete</p>
	<p>Are fuel system fault codes active?</p> <p>NO</p>	<p>4B</p>

STEP 4B: Check the CAPS fuel pump wiring.

Condition: None.		
Action	Specification/Repair	Next Step
Check the injection control valve, pressure control valve, fuel pressure sensor, and fuel temperature sensor wiring for damage, cuts, and loose connections.	All fuel pump wiring is undamaged and is properly connected? YES	4C
	All fuel pump wiring is undamaged and is properly connected? NO Repair: Replace the malfunctioning fuel system component.	Repair complete

STEP 4C: Check the transorb diode.

Condition: <ul style="list-style-type: none"> • Unplug the fuel pressure sensor. 		
Action	Specification/Repair	Next Step
Unplug the fuel pressure sensor.	Does the rough running, black smoke, or surge complaint continue? YES	4D
	Does the rough running, black smoke, or surge complaint continue? NO Repair: Replace the transorb diode. Refer to Procedure 019-184 in Section 19, in the Electronic Control System ISC, QSC8.3, and ISL Troubleshooting and Repair Manual, Bulletin 3666271.	Repair complete

STEP 4D: Check for air in the high-pressure pump fuel supply.

<p>Condition:</p> <ul style="list-style-type: none"> Refer to Procedure 006-003 in Section 6, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. 		
Action	Specification/Repair	Next Step
<p>Check for air in the fuel.</p> <p>Refer to Procedure 006-003 in Section 6, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	<p>Is air present in the fuel supply?</p> <p>YES</p> <p>Repair:</p> <p>Locate and correct the cause of air ingestion in the fuel supply system. Sources of air ingestion include loose fuel filters, loose fuel line fittings, loose or cracked fuel tank stand-pipes, and severe restrictions in the fuel supply lines and filters.</p>	<p>Repair complete</p>
	<p>Is air present in the fuel supply?</p> <p>NO</p>	<p>4E</p>

STEP 4E: Measure the fuel inlet restriction.

<p>Condition:</p> <ul style="list-style-type: none"> Perform this check during the complaint. 		
Action	Specification/Repair	Next Step
<p>Measure the fuel inlet restriction.</p> <p>Refer to Procedure 006-020 in Section 6, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	<p>Refer to Procedure 006-020 in Section 6, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 402141?</p> <p>YES</p>	<p>4F</p>
	<p>Refer to Procedure 006-020 in Section 6, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418?</p> <p>NO</p> <p>Repair:</p> <p>Locate the cause of the high inlet restriction. Check the OEM fuel inlet plumbing, fuel filters, and lift pump check valve.</p>	<p>Repair complete.</p>

STEP 4F: Measure the fuel gear pump pressure.

<p>Condition:</p> <ul style="list-style-type: none"> Connect a fuel pressure gauge to the Compuchek™ fitting on the cam housing. 		
Action	Specification/Repair	Next Step
<p>Measure the gear pump pressure while the engine is at the rated condition.</p> <p>Refer to Procedure 005-089 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	<p>Is the fuel gear pump pressure greater than the specifications outlined. Refer to Procedure 005-089 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418?</p> <p>YES</p>	4G
	<p>Is the fuel gear pump pressure greater than the specifications outlined. Refer to Procedure 005-089 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418?</p> <p>NO</p> <p>Repair:</p> <p>Replace the fuel gear pump module. Refer to Procedure 005-089 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	Repair complete

STEP 4G: Perform the injection control valve (ICV) click test.

<p>Condition:</p> <ul style="list-style-type: none"> Connect INSITE™ electronic service tool. Turn keyswitch ON. 		
Action	Specification/Repair	Next Step
<p>Use INSITE™ electronic service tool to perform the ICV click test.</p> <p>Refer to Procedure 005-078 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	<p>Does the injection control valve pass the click test?</p> <p>YES</p>	4H
	<p>Does the injection control valve pass the click test?</p> <p>NO</p> <p>Repair:</p> <p>Replace the injection control valve stator.</p> <p>Refer to Procedure 019-430 in Section 19, in the Electronic Control System ISC, QSC8.3, and ISL Troubleshooting and Repair Manual, Bulletin 3666271.</p>	Repair complete

STEP 4H: Perform the pumping control valve (PCV) click test.

<p>Condition:</p> <ul style="list-style-type: none"> • Connect INSITE™ electronic service tool. • Turn keyswitch ON. 		
Action	Specification/Repair	Next Step
<p>Use INSITE™ electronic service tool to perform the front and rear PCV click test.</p> <p>Refer to Procedure 005-079 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	<p>Do the pumping control valves pass the click test?</p> <p>YES</p>	4I
	<p>Do the pumping control valves pass the click test?</p> <p>NO</p> <p>Repair:</p> <p>Replace the accumulator module.</p> <p>Refer to Procedure 005-085 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	Repair complete

STEP 4I: Measure fuel drain line restriction.

<p>Condition:</p> <ul style="list-style-type: none"> • Refer to Procedure 006-012 in Section 6, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. • Perform this check during the complaint. 		
Action	Specification/Repair	Next Step
<p>Check the fuel drain line restriction.</p> <p>Refer to Procedure 006-012 in Section 6, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	<p>Is the drain line restriction less than specification?</p> <p>YES</p>	4J
	<p>Is the drain line restriction less than specification?</p> <p>NO</p> <p>Repair:</p> <p>Look for causes of high drain line restriction, such as kinked or blocked fuel lines.</p>	Repair complete

STEP 4J: Perform the single cylinder cutout test.

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch ON. • Engine running at low idle. • Connect INSITE™ electronic service tool. 		
Action	Specification/Repair	Next Step
<p>Operate the engine at loaded conditions.</p> <ul style="list-style-type: none"> • Use INSITE™ electronic service tool to perform the single cylinder cutout test to disable individual injectors. 	<p>Can the miss or excessive smoke be attributed to a single cylinder?</p> <p>YES</p> <p>Repair:</p> <p>Replace the fuel injector in the cylinder that was identified using the single cylinder cutout test.</p> <p>Refer to Procedure 006-026 in Section 6, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	Repair complete
	<p>Can the miss or excessive smoke be attributed to a single cylinder?</p> <p>NO</p>	4K

STEP 4K: Verify the fuel temperature sensor is within specification.

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the engine harness from the fuel temperature sensor. • Install the fuel pressure/temperature sensor breakout cable, Part Number 3162982 		
Action	Specification/Repair	Next Step
<p>Check the resistance of the fuel temperature sensor.</p> <ul style="list-style-type: none"> • Measure the resistance from pin B to pin D of the fuel temperature sensor. <p>Refer to Procedure 019-119 in Section 19, in the Electronic Control System ISC, QSC8.3, and ISL Troubleshooting and Repair Manual, Bulletin 3666271.</p>	<p>Is the fuel temperature sensor within specification?</p> <p>YES</p>	4L
	<p>Is the fuel temperature sensor within specification?</p> <p>NO</p> <p>Repair:</p> <p>Replace the fuel temperature sensor.</p> <p>Refer to Procedure 019-119 in Section 19, in the Electronic Control System ISC, QSC8.3, and ISL Troubleshooting and Repair Manual, Bulletin 3666271.</p>	Repair complete

STEP 4L: Check for excessive injector drain leakage.

<p>Condition:</p> <ul style="list-style-type: none"> Remove the fuel injector drain banjo fitting from the back of the cylinder head. 		
Action	Specification/Repair	Next Step
<p>Run the engine at low idle while monitoring the amount of fuel draining from the back of the cylinder head.</p>	<p>Are only a few drops of fuel per minute draining from the back of the cylinder head?</p> <p>YES</p>	4M
	<p>Are only a few drops of fuel per minute draining from the back of the cylinder head?</p> <p>NO</p> <p>Repair:</p> <p>A damaged connection between the high-pressure connector and an injector has been detected.</p> <p>Remove all high-pressure connectors and check for burrs or deformation around the tip of the injector.</p> <p>Refer to Procedure 006-052 in Section 6, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	Repair complete

STEP 4M: Pop test the injectors.

<p>Condition:</p> <ul style="list-style-type: none"> Remove the injectors. Refer to Procedure 006-026 in Section 6, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. 		
Action	Specification/Repair	Next Step
<p>Pop test the injectors and check for proper spray pattern.</p> <p>Refer to Procedure 006-026 in Section 6, the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	<p>The injector spray pattern is correct and the injectors pop between 275 and 300 bar [3989 and 4351 psi]?</p> <p>YES</p>	4N
	<p>The injector spray pattern is correct and the injectors pop between 275 and 300 bar [3989 and 4351 psi]?</p> <p>NO</p> <p>Repair:</p> <p>Replace the malfunctioning injector. Refer to Procedure 006-026 in Section 6, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	Repair complete

STEP 4N: Inspect the gear pump coupling for wear.

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch OFF. • Remove the gear pump module. 		
Action	Specification/Repair	Next Step
Inspect the gear pump drive shaft coupling and shaft for wear.	<p>Is the gear pump drive shaft or coupling worn?</p> <p>YES</p> <p>Repair:</p> <p>Replace the gear pump module. Refer to Procedure 005-089 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	Repair complete
	<p>Is the gear pump drive shaft or coupling worn?</p> <p>NO</p> <p>Repair:</p> <p>Replace the injection control valve. Refer to Procedure 005-086 in Section 5, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	Repair complete

STEP 5: Air handling troubleshooting procedures.

STEP 5A: Inspect the turbocharger blades for damage.

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch OFF. • Remove the intake and exhaust pipes from the turbocharger. 		
Action	Specification/Repair	Next Step
<p>Inspect the compressor and turbine blades for damage or wear.</p> <ul style="list-style-type: none"> • Use the following procedure in the B5.9G, B5.9LPG, B Gas Plus, B LPG Plus, B Gas International, and G5.9 Engines Troubleshooting and Repair Manual, Bulletin 3666164. Refer to Procedure 010-033 in Section 10. 	<p>Damage found on turbocharger blades?</p> <p>YES</p> <p>Repair:</p> <p>Replace the turbocharger assembly. Refer to Procedure 010-033 in Section 10, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	Repair complete
	<p>Damage found on turbocharger blades?</p> <p>NO</p>	5B

STEP 5B: Check the turbocharger axial and radial clearances.

Condition: • Turn keyswitch OFF.		
Action	Specification/Repair	Next Step
Check the turbocharger for correct axial and radial clearance. Refer to Procedure 010-033 in Section 10, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.	Are the turbocharger axial and radial bearing clearances within specification? YES	5C
	Are the turbocharger axial and radial bearing clearances within specification? NO Repair: Replace the turbocharger assembly. Refer to Procedure 010-033 in Section 10, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.	Repair complete

STEP 5C: Inspect the wastegate actuator rod for travel..

Condition: • Turn keyswitch OFF. • Remove the integral boost line from the wastegate actuator.		
Action	Specification/Repair	Next Step
Apply a regulated air supply of 138 kPa [20 psi] to the actuator and check for actuator movement.	Does the wastegate actuator rod move? YES	Repair complete
	Does the wastegate actuator rod move? NO	5C-1

STEP 5C-1: Inspect the wastegate actuator rod for travel.

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch OFF. • Remove the e-clip from the wastegate pin and disconnect the actuator rod. 		
Action	Specification/Repair	Next Step
<p>Apply a regulated air supply of 138 kPa [20 psi] to the actuator and check for actuator movement.</p>	<p>Does the wastegate actuator rod move? YES</p> <p>Repair: Move the wastegate lever on the turbocharger back and forth to check for smooth operation. Replace the turbocharger assembly if the wastegate is seized.</p> <p>Refer to Procedure 010-033 in Section 10, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	<p>Repair complete</p>
	<p>Does the wastegate actuator rod move? NO</p> <p>Repair: Replace the wastegate actuator.</p> <p>Refer to Procedure 010-050 in Section 10, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	<p>Repair complete</p>

STEP 6: Electronic feature troubleshooting procedures.

STEP 6A: Verify throttle pedal travel.

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch ON. • Connect INSITE™ electronic service tool. 		
Action	Specification/Repair	Next Step
<p>Use INSITE™ electronic service tool to monitor the throttle position while fully depressing and releasing the throttle pedal.</p>	<p>Does the throttle position read zero when the throttle is released and 100 percent when the throttle is depressed? YES</p>	<p>6B</p>
	<p>Does the throttle position read zero when the throttle is released and 100 percent when the throttle is depressed? NO</p> <p>Repair: Determine and correct the cause of the throttle pedal restriction.</p>	<p>Repair complete</p>

STEP 6B: Check ambient air pressure sensor accuracy (if equipped).

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch ON. • Connect INSITE™ electronic service tool. 		
Action	Specification/Repair	Next Step
<p>Start INSITE™ Data Monitor/Logger and compare INSITE™ reading for Barometric Air Pressure to the local barometric pressure using the table below.</p> <p>Refer to Procedure 018-028 in Section V.</p>	<p>Is the reading within 50.8 mm-Hg [2 in-Hg] of local barometric pressure?</p> <p>YES</p>	6C
	<p>Is the reading within 50.8 mm-Hg [2 in-Hg] of local barometric pressure?</p> <p>NO</p> <p>Repair:</p> <p>Replace the barometric pressure sensor. Refer to Procedure 019-004 in Section 19, in the Electronic Control System ISC, QSC8.3, and ISL Troubleshooting and Repair Manual, Bulletin 3666271.</p>	Repair Complete

STEP 6C: Check intake manifold pressure sensor accuracy.

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch ON. • Connect INSITE™ electronic service tool. 		
Action	Specification/Repair	Next Step
<p>Start INSITE™ electronic service tool Data/Monitor/Logger and read the value of intake manifold pressure.</p>	<p>Is the intake manifold pressure reading less than 102 mm-Hg [4 in-Hg]?</p> <p>YES</p>	6D
	<p>Is the intake manifold pressure reading less than 102 mm-Hg [4 in-Hg]?</p> <p>NO</p> <p>Repair:</p> <p>Replace the intake manifold pressure sensor. Refer to Procedure 019-061 in Section 19, in the Electronic Control System ISC, QSC8.3, and ISL Troubleshooting and Repair Manual, Bulletin 3666271.</p>	Repair complete

STEP 6D: Verify electronic feature settings are correct.

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch ON. • Connect INSITE™ electronic service tool. 		
Action	Specification/Repair	Next Step
<p>Use INSITE™ electronic service tool to verify the following adjustable parameters are set correctly:</p> <ul style="list-style-type: none"> • Maximum Vehicle Speed • Powertrain Protection • Rear Axle Ratio • Tailshaft Teeth • Tire Revolutions per Mile • Gear-Down Protection • Cruise Control Droop Settings • Cruise Control Maximum Vehicle Speed. 	<p>Are the electronic features set correctly? YES</p>	2A
	<p>Are the electronic features set correctly? NO</p> <p>Repair: Use INSITE™ electronic service tool to correct programmable features.</p>	Repair complete

STEP 7: Base engine troubleshooting procedures.

STEP 7A: Verify overhead adjustments are correct.

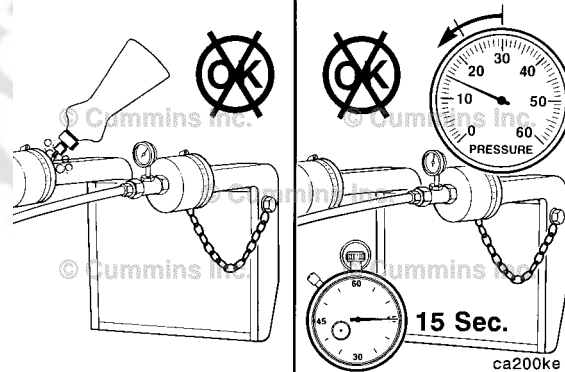
<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch OFF. • Remove the rocker lever cover. Refer to Procedure 003-011 Section 3 in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. 		
Action	Specification/Repair	Next Step
<p>Measure the overhead setting.</p> <ul style="list-style-type: none"> • Refer to Procedure 003-004 in Section 3. 	<p>Are the overhead settings within the reset limits? YES</p>	7B
	<p>Are the overhead settings within the reset limits? NO</p> <p>Repair: Adjust the overhead settings. Refer to Procedure 003-004 in Section 3, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	Repair complete

STEP 7B: Verify engine brake adjustment (if equipped).

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch OFF. • Remove the rocker lever cover. Refer to Procedure 003-011 in Section 3, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. 		
Action	Specification/Repair	Next Step
<p>Verify the engine brakes are operating correctly.</p> <ul style="list-style-type: none"> • Measure the engine brake settings. Refer to Procedure 020-004 in Section 20, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. 	<p>Are the engine brake settings within the reset limits?</p> <p>YES</p>	7C
	<p>Are the engine brake settings within the reset limits?</p> <p>NO</p> <p>Repair:</p> <p>Adjust the engine brake settings. Refer to Procedure 020-004 in Section 20, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p>	Repair complete

STEP 7C: Inspect the charge air cooler.

<p>Condition:</p> <ul style="list-style-type: none"> • Refer to Procedure 010-027 in Section 10. 		
Action	Specification/Repair	Next Step
<p>Inspect the charge air cooler.</p> <p>Inspect the charge air cooler for cracks, holes, or damage.</p> <p>Refer to Procedure 010-027 in Section 10.</p>	<p>Is the charge air cooler free of cracks, holes, or other damage?</p> <p>YES</p>	7D
	<p>Is the charge air cooler free of cracks, holes, or other damage?</p> <p>NO</p> <p>Repair:</p> <p>Repair the charge air cooler assembly.</p>	Repair complete

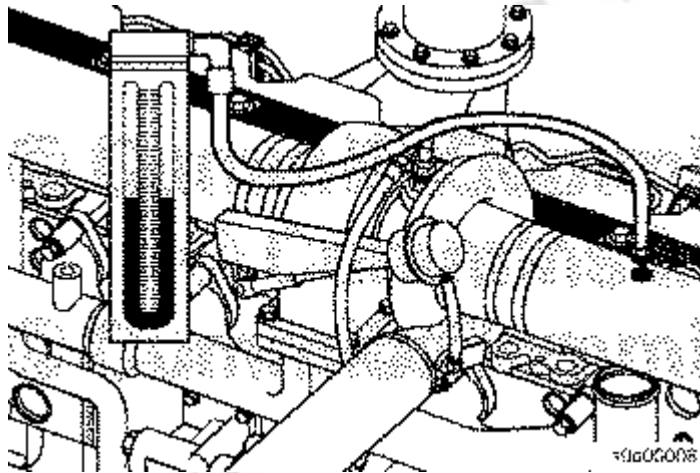


STEP 7D: Check air intake restriction.

Condition:

- Refer to Procedure 010-031 in Section 10.

Action	Specification/Repair	Next Step
Check the intake system restriction by installing a vacuum gauge into the air intake system. <ul style="list-style-type: none"> • Refer to Procedure 010-031 in Section 10. 	Is air intake restriction greater than 635 mm H ₂ O [25 in H ₂ O]? YES Repair: Correct the cause of high intake air restriction. Check for plugged air filter or restricted air intake piping.	Repair complete
	Is air intake restriction greater than 635 mm H ₂ O [25 in H ₂ O]? NO	7E

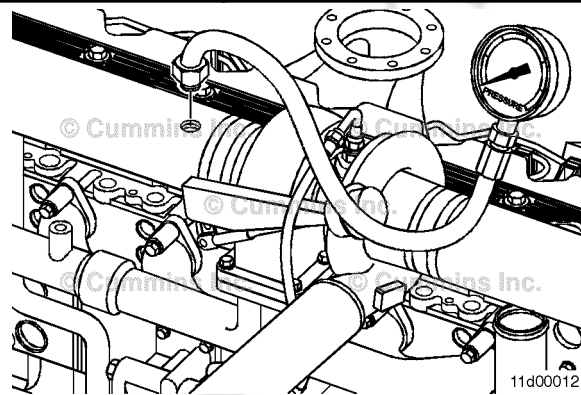


STEP 7E: Check exhaust restriction.

Condition:

- Use the following procedure in the B5.9G, B5.9LPG, B Gas Plus, B LPG Plus, B Gas International, and G5.9 Engines Troubleshooting and Repair Manual, Bulletin 3666164. Refer to Procedure 011-009 in Section 11.

Action	Specification/Repair	Next Step
Check the exhaust system back pressure. Check the exhaust system back pressure by installing a pressure gauge into the exhaust system just past the turbocharger outlet. Use the following procedure in the B5.9G, B5.9LPG, B Gas Plus, B LPG Plus, B Gas International, and G5.9 Engines Troubleshooting and Repair Manual, Bulletin 3666164. Refer to Procedure 011-009 in Section 11.	Exhaust back pressure within 61 to 127 mm-Hg [2.4 to 5.0 in-Hg]? YES	7F
	Exhaust back pressure within 61 to 127 mm-Hg [2.4 to 5.0 in-Hg]? NO Repair: Inspect exhaust system for source of high restriction. Use the following procedure in the B5.9G, B5.9LPG, B Gas Plus, B LPG Plus, B Gas International, and G5.9 Engines Troubleshooting and Repair Manual, Bulletin 3666164. Refer to Procedure 011-009 in Section 11.	Repair complete



STEP 7E: Check exhaust restriction.

Condition:

- Refer to Procedure 011-009 in Section 11, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.

Action	Specification/Repair	Next Step
Check the exhaust system back pressure by installing a pressure gauge into the exhaust system just past the turbocharger outlet. • Refer to Procedure 011-009 in Section 11, in the ISC, ISCe, QSC8.3, ISL and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.	Is exhaust back pressure less than 72 mm-Hg [3 in-Hg]? YES	7F
	Is exhaust back pressure less than 72 mm-Hg [3 in-Hg]? NO Repair: Inspect the exhaust system for the source of high restriction.	Repair complete.

STEP 7F: Check engine blowby.

<p>Condition:</p> <ul style="list-style-type: none"> Refer to Procedure 014-005 in Section 14. in the B5.9G, B5.9LPG, B Gas Plus, B LPG Plus, B Gas International, and G5.9 Engines Troubleshooting and Repair Manual, Bulletin 3666164. 		
Action	Specification/Repair	Next Step
<p>Measure the engine blowby.</p> <ul style="list-style-type: none"> Measure the engine blowby. Refer to Procedure 014-005 in Section 14 in the B5.9G, B5.9LPG, B Gas Plus, B LPG Plus, B Gas International, and G5.9 Engines Troubleshooting and Repair Manual, Bulletin 3666164 	<p>Are the engine blowby measurements within specification?</p> <p>YES</p>	<p>Return to Step 2 or contact a Cummins Inc. service representative for further diagnostic and troubleshooting instructions. 7G</p>
	<p>Are the engine blowby measurements within specification?</p> <p>NO</p>	<p>7F-1</p>

STEP 7F-1: Verify turbocharger contribution to engine blowby.

<p>Condition:</p> <ul style="list-style-type: none"> Turn keyswitch OFF. Connect the appropriate orifice to the end of the blowby draft tube. Remove the turbocharger oil drain line from the block and drain into a bucket. Start the engine. 		
Action	Specification/Repair	Next Step
<p>Load engine to rated rpm on a chassis dynamometer.</p> <ul style="list-style-type: none"> Measure the engine blowby. Refer to Procedure 014-005 in Section 14 in the B5.9G, B5.9LPG, B Gas Plus, B LPG Plus, B Gas International, and G5.9 Engines Troubleshooting and Repair Manual, Bulletin 3666164 	<p>Has the total engine blowby dropped more than 30 percent of the total?</p> <p>YES</p> <p>Repair:</p> <p>Replace the turbocharger assembly. Refer to Procedure 010-033 in Section 10. in the B5.9G, B5.9LPG, B Gas Plus, B LPG Plus, B Gas International, and G5.9 Engines Troubleshooting and Repair Manual, Bulletin 3666164.</p>	<p>Repair complete</p>
	<p>Has the total engine blowby dropped more than 30 percent of the total?</p> <p>NO</p> <p>Repair:</p> <p>The engine may need to be rebuilt. See the engine rebuild specifications.</p>	<p>Repair complete</p>

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