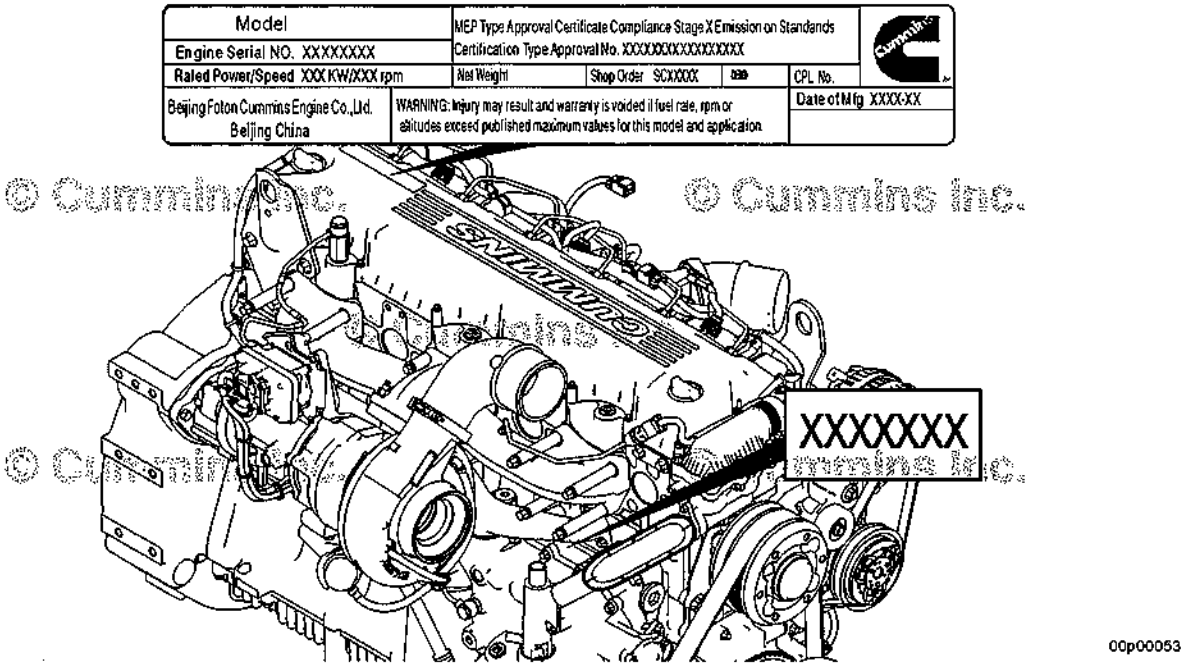
Engine Identification

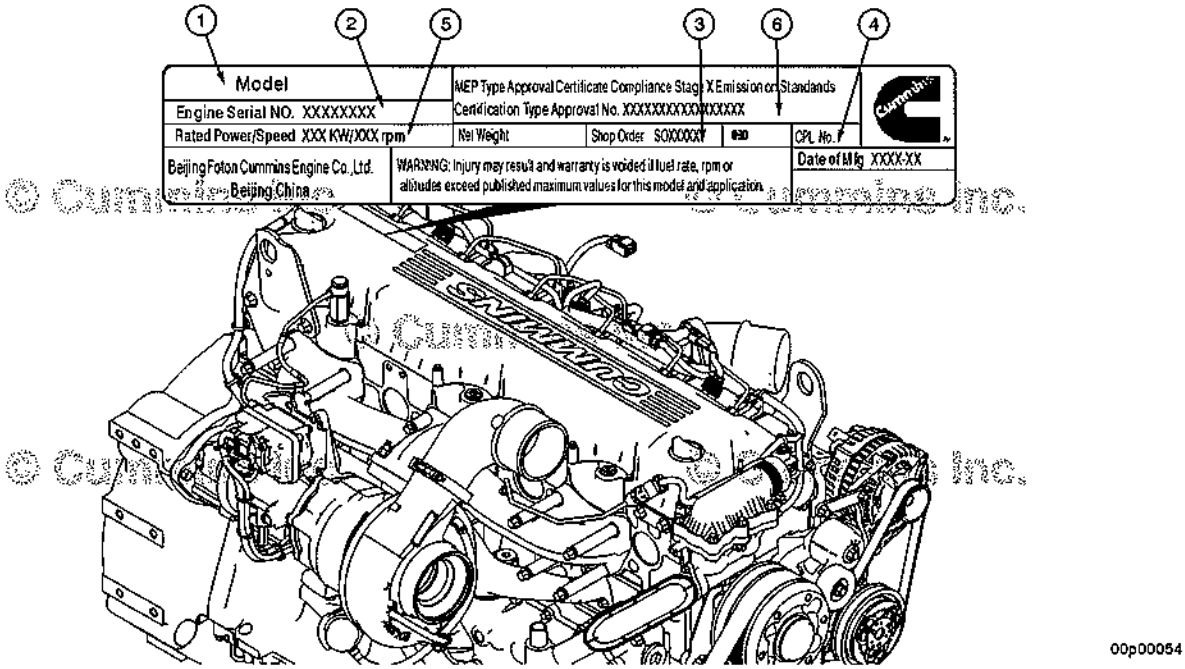
Engine Dataplate



00p00053

The engine dataplate provides important facts about the engine. The dataplate is typically located on the engine rocker lever cover, but may also be located on the side of the gear housing. The engine serial number (ESN) and control parts list (CPL) provide data for ordering parts and service. The engine dataplate **must not** be changed unless approved by Cummins Inc.

Have the following engine data available when communicating with a Cummins® Authorized Repair Location. The information on the dataplate is mandatory when sourcing service parts.

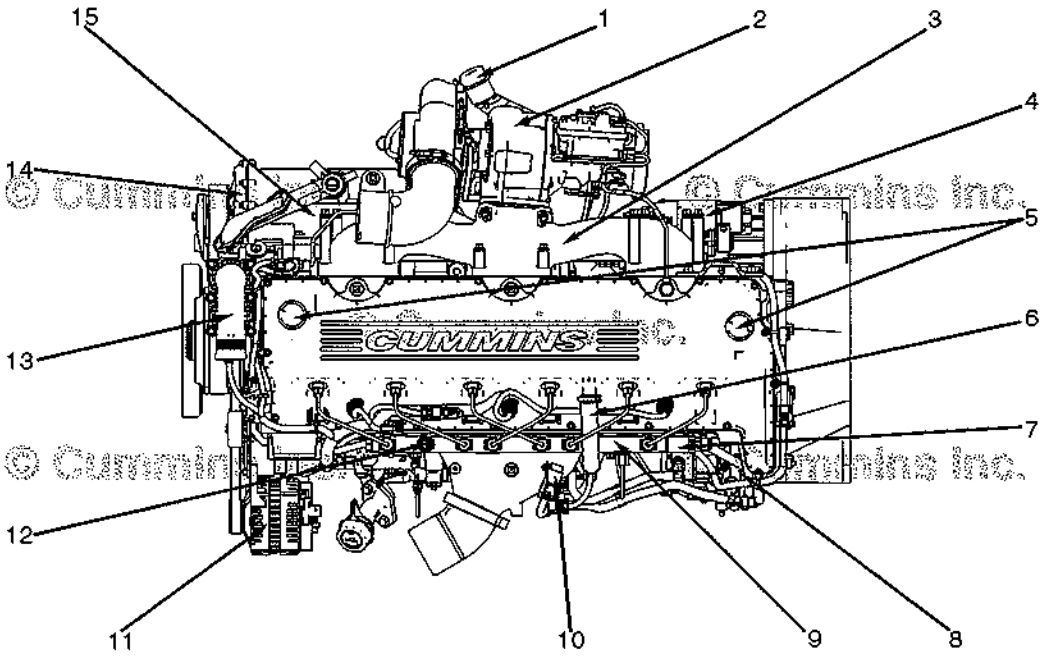


00p00054

1 Engine model information
2 Engine serial number (ESN)
3 Shop Order (SO)
4 Control parts list (CPL)

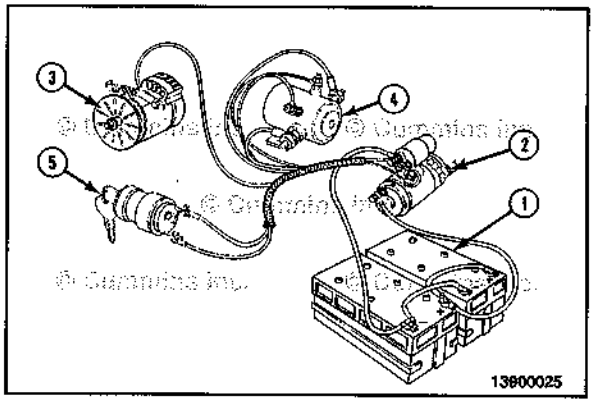
Engine Diagrams

Engine Views



Top

1 Turbocharger wastegate control valve
2 Turbocharger
3 Exhaust manifold
4 Starter
5 Oil fill cap
6 Crankcase breather tube
7 Fuel rail pressure relief valve
8 Hydraulic drive adaptor
9 Fuel rail
10 Intake manifold pressure/temperature sensor
11 Alternator
12 Fuel rail pressure sensor
13 Dual thermostat housing
14 Water pump
15 Lubricating oil cooler module.



Electrical Equipment - Overview (013-999)

General Information

⚠WARNING⚠
Batteries can emit explosive gases. To reduce the possibility of personal injury, always ventilate the compartment before servicing the batteries. To reduce the possibility of arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.

⚠WARNING⚠
To reduce the possibility of personal injury, keep hands, long hair, jewelry, and loose-fitting or torn clothing away from fans and other moving parts.

The basic electrical system consists of:

1 Batteries

2 Starter motor

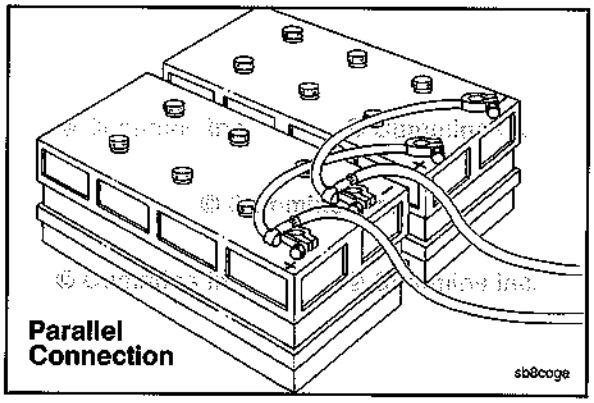
3 Alternator

4 Magnetic switch

5 Keyswitch

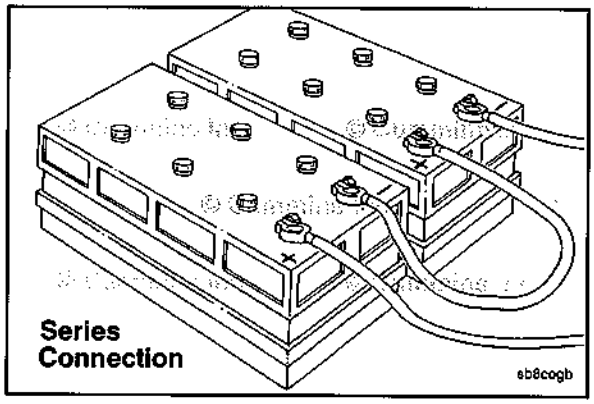
6 All necessary wiring.

All components **must** be carefully matched.



The accompanying illustrations show typical parallel and series battery connections:

- Parallel connection.

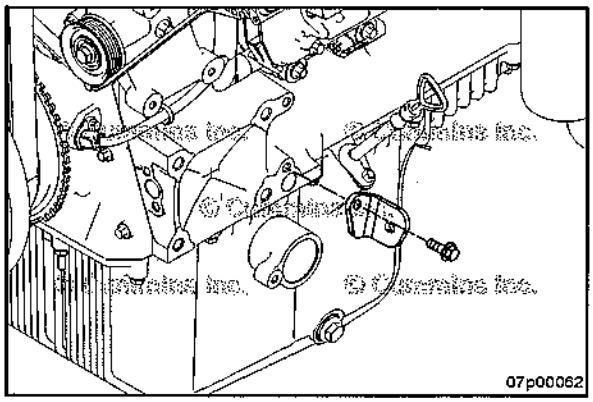


- Series connection.

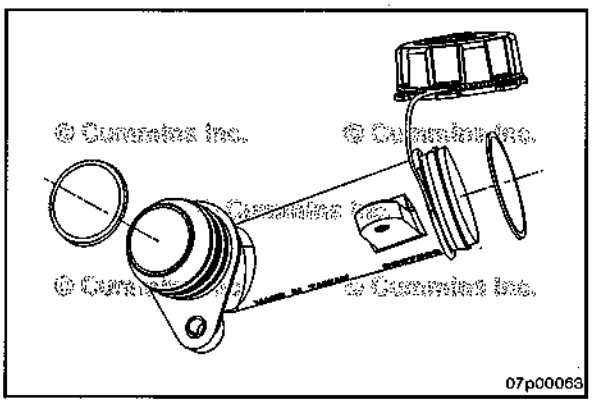
Lubricating Oil Consumption Excessive

This is symptom tree t102

Cause	Correction
STEP 1 Verify the oil consumption rate	Check the amount of oil added versus the mileage.
OK Go To Next Step	
STEP 2 Lubricating oil leak (external)	Inspect the engine for external oil leaks. Tighten the capscrews, pipe plugs, and fittings. Replace gaskets, if necessary. Refer to Procedure 007-024 in Section 7.
OK Go To Next Step	
STEP 3 Crankcase ventilation system is plugged	Check and clean the crankcase breather and vent tube. Refer to Procedure 003-002 in Section 3.
OK Go To Next Step	
STEP 4 Air compressor is pumping lubricating oil into the air system	Check the air lines for carbon buildup and lubricating oil. Refer to the Air Compressor Pumping Excess Lubricating Oil into the Air System troubleshooting symptom tree.
OK Go To Next Step	
STEP 5 Lubricating oil dipstick calibration is **not** correct	Check the dipstick calibration. Refer to Procedure 007-009 in Section 7.
OK Go To Next Step	
STEP 6 Lubricating oil drain interval is excessive	Verify the correct lubricating oil drain interval. Refer to Procedure 102-002 in Section 2 in QSG12 CM2350 G110 Operation and Maintenance Manual, Bulletin 4367322.
OK Go To Next Step	
STEP 7 Lubricating oil does **not** meet specifications for operating conditions	Change the oil and filter(s). Refer to the Cummins® Engine Oil and Oil Analysis Recommendations, Bulletin 3810340 for lubricating oil specifications. Also, refer to Procedure 007-037 and Procedure 007-013 in Section 7. Use the oil type recommended in Section V.
OK Go To Next Step	
STEP 8 Turbocharger oil seal is leaking	Check the turbocharger compressor and turbine seals. Refer to Procedure 010-033 in Section 10.
OK Go To Next Step	



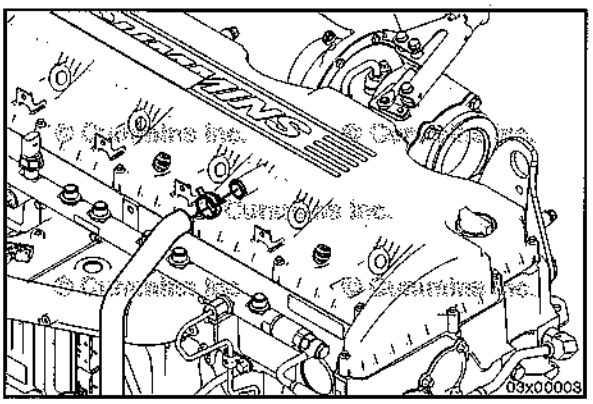
Remove the tube brace and capscrew from the block.



Remove the ring seals from the oil fill tube and the oil fill tube cap.

Discard the ring seals.

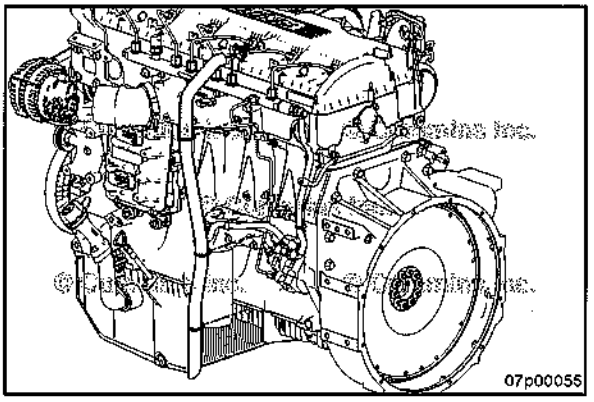
- Oil fill tube o-ring
- Oil fill cap seal



Crankcase Breather Tube (003-018)

Remove

Disconnect the crankcase breather vent tube from the rocker lever cover.



Remove the three fir tree clips securing the crankcase breather tube to the intake connection, cylinder block, and oil pan.

Remove the crankcase breather vent tube.

⚠WARNING⚠
Use caution while handling and cleaning the cylinder block. The cylinder block may contain sharp edges that can cause personal injury.

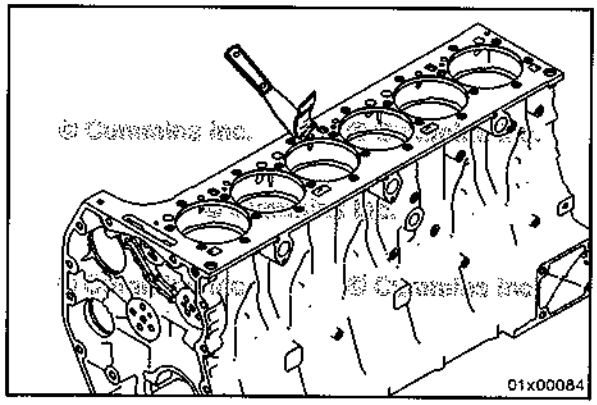
⚠WARNING⚠
When using solvents, acids, or alkaline materials for cleaning, follow the manufacturer's recommendations for use. Wear goggles and protective clothing to reduce the possibility of personal injury.

△CAUTION△
Use care not to damage the machined gasket surfaces.

Use a gasket scraper to clean the cylinder block deck surface.

Use Scotch-Brite™ 7747 abrasive pad, Part Number 3823258, or equivalent, and solvent to remove any residual gasket material from the cylinder block deck surface.

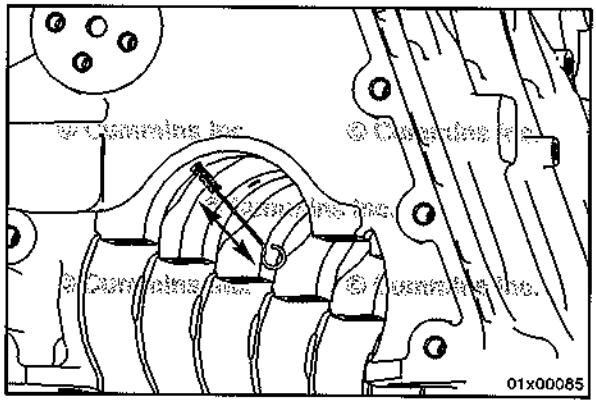
Remove any remaining adhesive sealant from other cylinder block sealing surfaces.



⚠WARNING⚠
Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury.

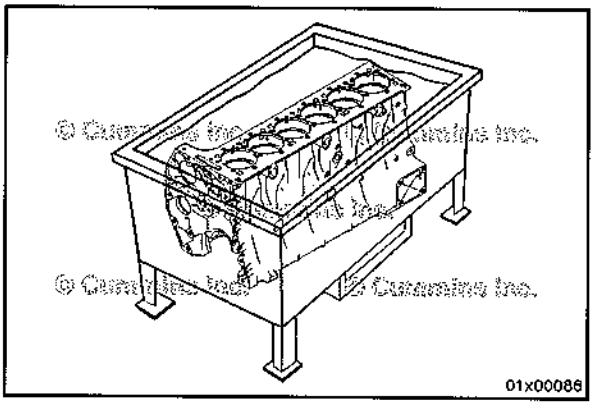
Use clean solvent and a non-metallic brush to clean the block oil drillings.

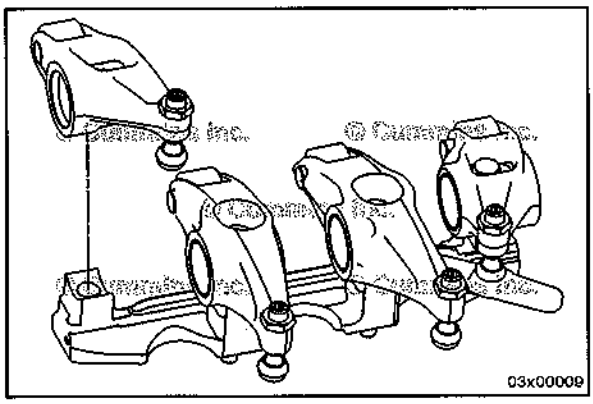
Dry with compressed air.



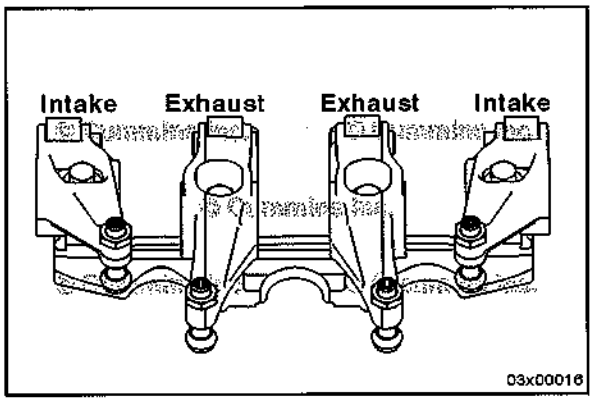
NOTE: Cummins Inc. does **not** recommend any specific cleaning solution.

Remove the block from the engine stand and place the block in a cleaning tank.

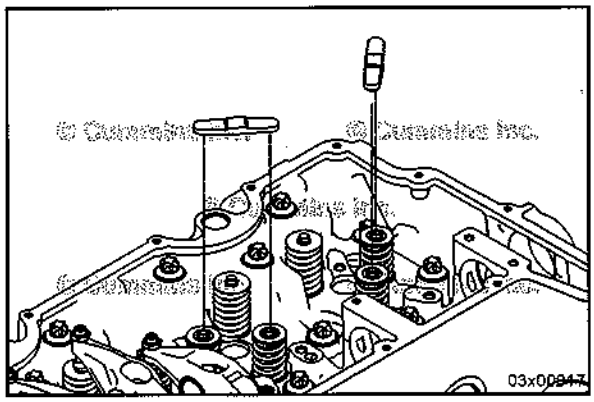




Position the rocker levers on the rocker pedestal.

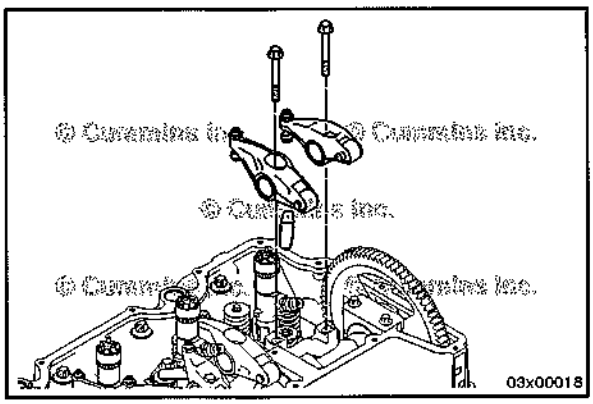


⚠CAUTION⚠
Make sure to assemble the intake and exhaust rocker levers in the correct location. Failure to do so may result in engine damage.



Install

Install the crossheads in their original location and position.



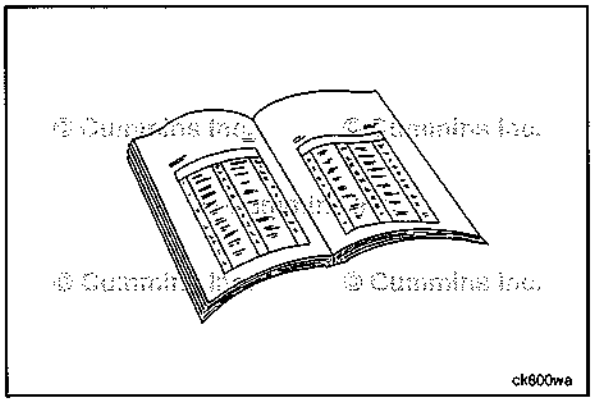
Install the rocker lever assemblies and pedestals in their original position.

Lubricate the mounting capscrews with clean engine oil.

Install the pedestal mounting capscrews.

MPa	Megapascal
mph	Miles Per Hour
mpq	Miles Per Quart
N•m	Newton-meter
NOx	Nitrogen Oxides
NG	Natural Gas
O2	Oxygen
OAT	Organic Acid Technology
OBD	On-Board Diagnostics
OEM	Original Equipment Manufacturer
OSHA	Occupational Safety and Health Administration
PID	Parameter Identification Descriptions
PPE	Personal Protective Equipment
ppm	Parts Per Million
psi	Pounds Per Square Inch
PTO	Power Takeoff
QSOL	QuickServe® Online
REPTO	Rear Engine Power Takeoff
RGT	Rear Gear Train
rpm	Revolutions Per Minute
SAE	Society of Automotive Engineers
SCA	Supplemental Coolant Additive
SCR	Selective Catalytic Reduction
STC	Step Timing Control
SID	Subsystem Identification Descriptions
TDC	Top Dead Center
TSB	Technical Service Bulletin
ULSD	Ultra Low Sulfur Diesel
VDC	Volts of Direct Current
VGT	Variable Geometry Turbocharger
VS	Variable Speed
VSS	Vehicle Speed Sensor

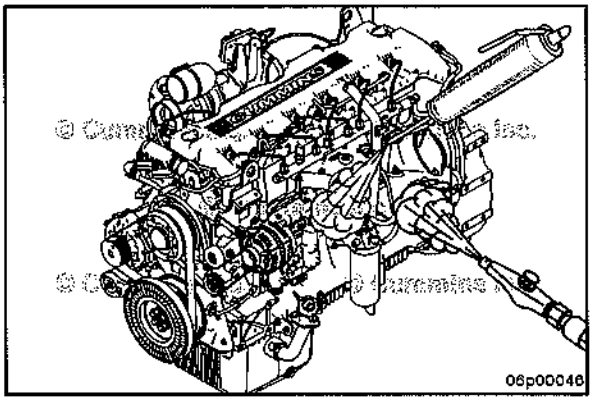
Use the following procedure for details on testing the fuel pressure relief valve for excessive leakage. Refer to Procedure 005-236 in Section 5.



Preparatory Steps

⚠CAUTION⚠
Clean all fittings before disassembly. Dirt or contaminants can damage the fuel system.

Before servicing any fuel system components, (such as fuel lines, fuel pump, injectors, etc.) which would expose the fuel system or internal engine component to potential contaminants prior to disassembly, clean the fittings, mounting hardware, and the area around the component to be removed. Dirt or contaminants can be introduced into the fuel system and engine if the surrounding areas are **not** cleaned, resulting in damage to the fuel system and engine.



Clean the fuel pressure relief valve and surrounding area with contact cleaner, Part Number 3824510 or equivalent.

To prevent damage from debris and contamination, cover, cap, or plug any openings as soon as possible when servicing the fuel system. Caps and plugs can be found in Clean Care Kit, Part Number 4919073.

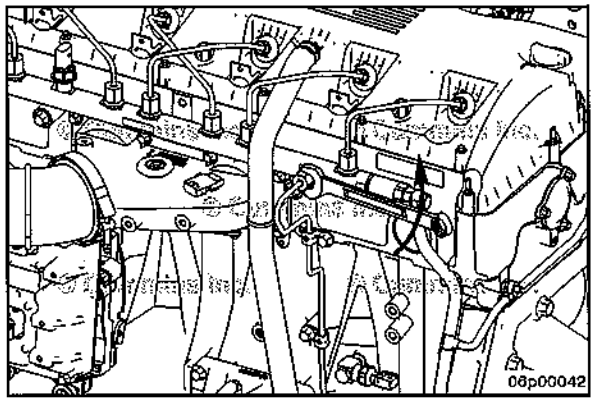
⚠WARNING⚠
Normal engine operation creates highly pressurized fuel in the fuel line which will remain in the fuel line after engine shutdown. Never open the fuel system when the engine is operating. Before servicing the fuel system, always loosen the pump to rail fuel line at the rail to vent the pressure. Keep hands clear of the line when loosening. High-pressure fuel spray can penetrate the skin, resulting in serious personal injury or death.

- Before servicing the fuel system, loosen the pump to rail line at the rail to vent the pressure.
- Keep hands clear of the line when loosening.
- Tighten pump to rail line nut.

Torque Value: 25 N•m [221 in-lb]

NOTE: A machined slot in this fitting directs the fuel spray toward the cylinder block.

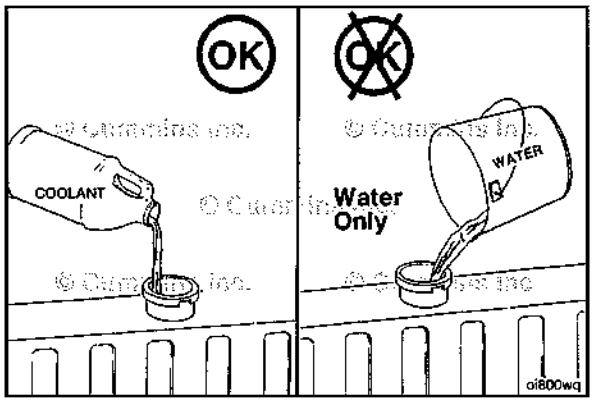
- Remove the fuel drain line from the fuel rail pressure relief valve. Refer to Procedure 006-013 in Section 6.



Combustion Gas Leak

Use combustion gas tester, Part Number 3822985, or equivalent, to test for combustion gases in the cooling system.

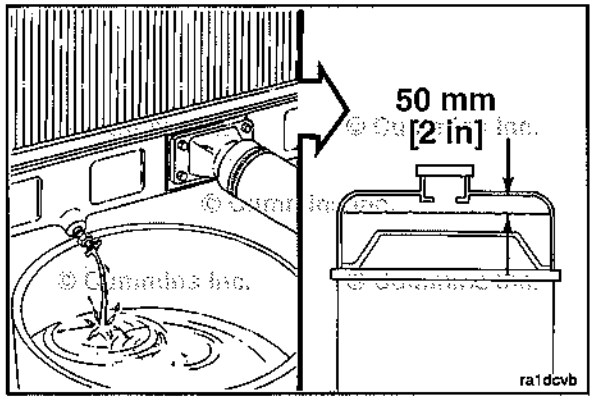
A 50-percent antifreeze and 50-percent water mixture **must** be used in the cooling system when performing the combustion gas leak test.



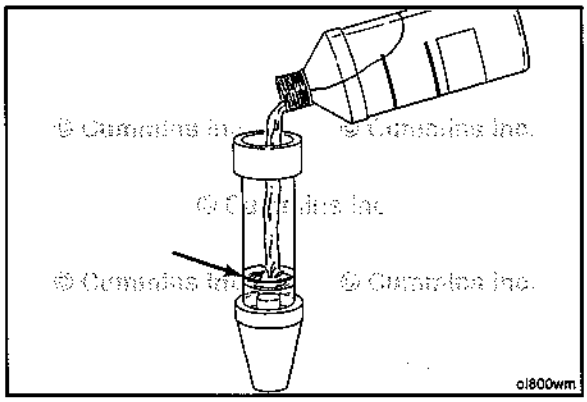
⚠WARNING⚠
Coolant is toxic. Keep away from children and pets. If not reused, dispose of in accordance with local environmental regulations.

NOTE: Coolant that gets into the combustion analyzer will stop the color change and render the test ineffective.

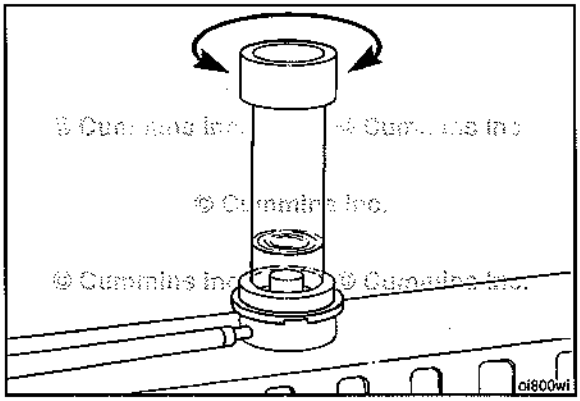
Drain the coolant level down approximately 75 mm [3 in] below the radiator cap seal ledge in the radiator fill neck.



Pour the test fluid into the combustion gas leak test instrument until it is up to the yellow fill line on the instrument.



Insert the rubber tip of the combustion gas leak test instrument into the radiator fill neck. Hold the instrument down firmly and turn back and forth to make sure that an airtight seal is formed between the tester and the radiator fill neck.

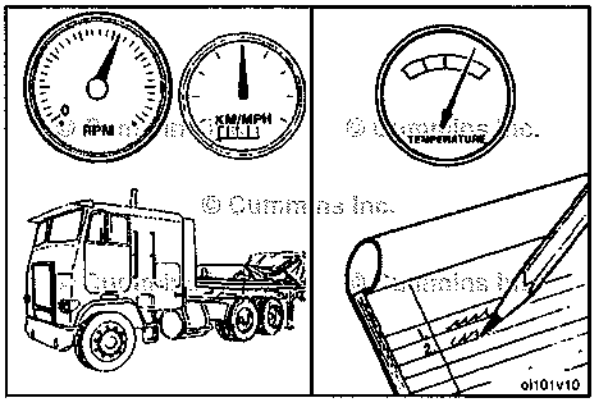


Operate the engine at rated rpm and full load.

NOTE: If a road test is performed two people should perform the test. One to drive the unit, the other to monitor the temperatures.

Compare the value to the specifications given in the engine performance data sheets.

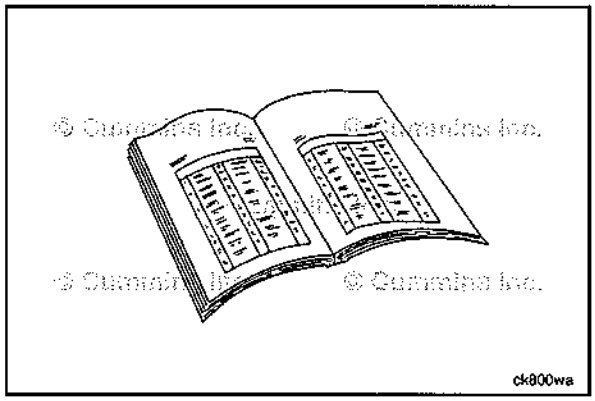
NOTE: Stall speed is **not** full power.



Finishing Steps

⚠CAUTION⚠
The testing boot must be removed after testing. Failure to remove the testing boot could result in air leaks.

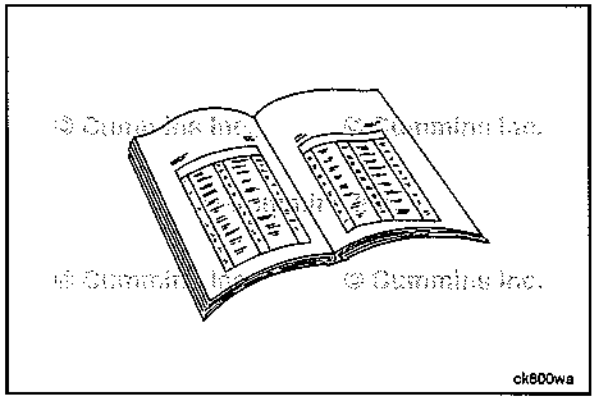
- Remove all testing equipment.
- Install the original charge air cooler boot onto the intake air connection. See equipment manufacturer service information.
- Operate engine and check for leaks.



Air Intake Connection (010-080)

Preparatory Steps

- Disconnect the air intake connection adapter.
- Disconnect the intake manifold air pressure/ temperature sensor from the engine harness. Refer to Procedure 019-159 in Section 19.
- Disconnect the wire harness attachments from the air intake connection.
- If applicable, disconnect the cold start aid wiring. Refer to Procedure 010-029 in Section 10.
- Disconnect the air compressor supply line from the air intake manifold. Refer to Procedure 012-024 in Section 12.



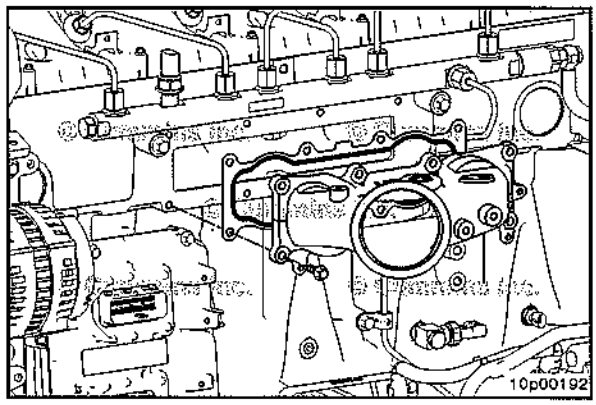
Remove

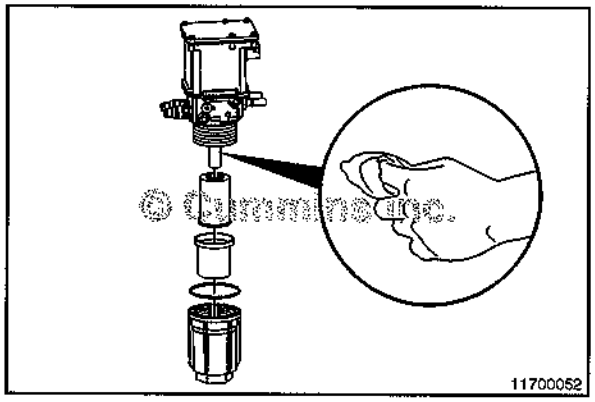
Remove the fir tree that holds the crankcase breather to the air intake connection.

Remove the eight capscrews holding the air intake connection to the cylinder head.

Remove and discard the air intake connection gasket.

Use protective caps and heavy tape from the Air Handling Clean Care Kit, Part Number 4919588, to cover open points on the plumbing and engine.





Remove

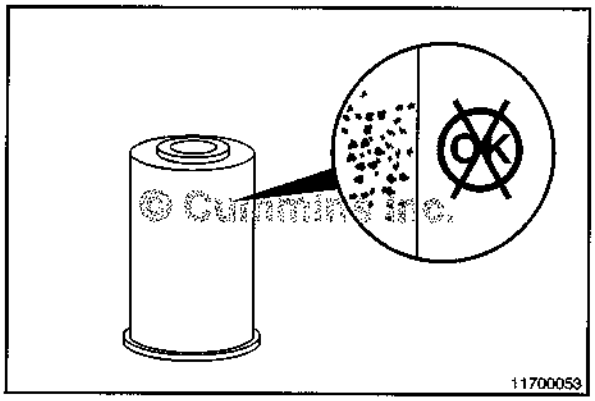
⚠CAUTION⚠
A small amount of dirt and debris can be very harmful to the DEF dosing system. Dirt or other foreign objects must not get into the DEF dosing unit.

NOTE: There may be residual DEF in the filter housing. A collection container placed below the DEF filter housing is recommended.

- Use a 46 mm socket to remove the DEF filter housing.
- Remove and discard the o-ring.

NOTE: In the next step, the frost protection membrane will be removed. A small amount of DEF could leak.

- Remove the frost protection membrane and inspect. A small amount of DEF could leak out of it.
- Remove the filter element from the unit by twisting, while pulling. Absorb the dripping DEF with a dry clean lint-free cloth and dry the unit.
- Discard the o-ring, frost protection membrane, and filter element.



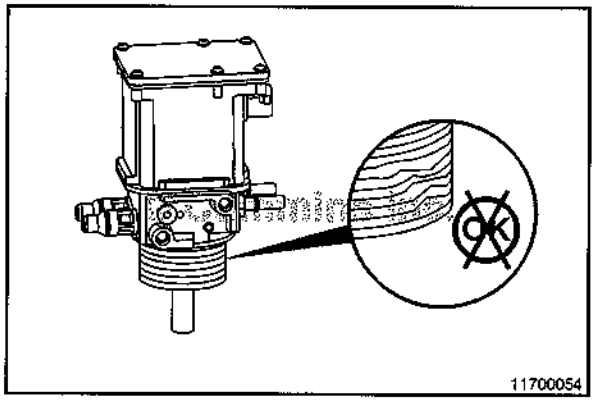
If there is the possibility that contaminated DEF has gone through the DEF dosing system, check the DEF filter prior to discarding it.

Check the diesel exhaust filter for evidence of contaminated DEF. Use visual and aroma characteristics of the filter to determine if contaminated fluid has passed through the dosing system.

Use the following procedure for further information on contaminated DEF. Refer to Procedure 011-056 in Section 11.

Inspect the DEF filter for debris. If debris is evident, also check:

- DEF tank filter. See equipment manufacturer service information.
- The aftertreatment DEF dosing unit inlet connector. Refer to Procedure 011-058 in Section 11.



Clean and Inspect for Reuse

Inspect the aftertreatment DEF dosing unit threads. This is especially important if the aftertreatment DEF dosing unit cap was damaged.

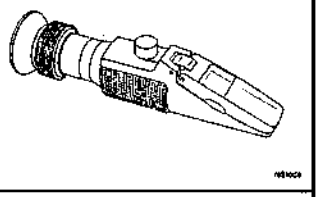
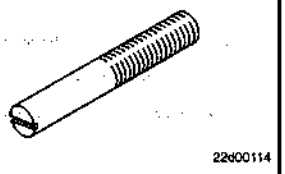
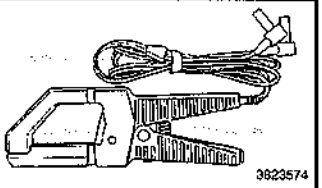
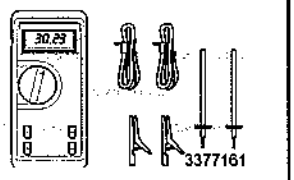
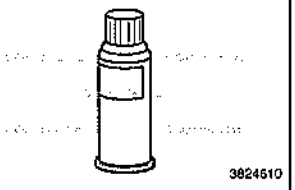
If the aftertreatment DEF dosing unit threads are damaged, replace the entire aftertreatment DEF dosing unit.

Be sure the frost protection membrane groove is clean and free of debris. Clean using a clean damp cloth, warm water, and a mild detergent.

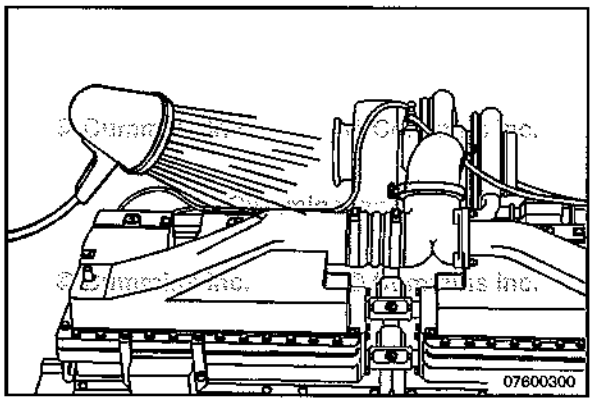
Service Tools

Electrical Equipment

The following special tools are recommended to perform procedures in this section. The use of these tools is shown in the appropriate procedure. These tools can be purchased from a local Cummins® Authorized Repair Location.

Tool No.	Tool Description	Tool Illustration
CC-2800	**Refractometer** This tool is used to check the charge condition of a conventional battery.	
3163934	**Guide Pin** Used to help align the components during installation.	
3164490	**Clamp-On Current Probe** This tool is used to measure AC and DC currents. This unit **must** be used with digital multimeter, Part Number 3400162.	
3400162	**Digital Multimeter Kit** This tool is used to test various electrical circuits. Includes deluxe multimeter 3164489, pressure adapter 3164491, and immersion probe 3164492.	
3824510	**QD Contact Cleaner** Used when cleaning electrical connections.	

Test



⚠WARNING⚠
To reduce the possibility of personal injury, avoid direct contact of hot oil with your skin.

⚠WARNING⚠
To reduce the possibility of personal injury, keep hands, long hair, jewelry, and loose-fitting or torn clothing away from fans and other moving parts.

NOTE: The lubricating oil contamination test is not effective on a cold engine, less than 21°C [70°F] coolant temperature, or with a loose overhead setting.

Use the black light from the Leak Test Kit, Part Number 2892320, to inspect for the presence of fluorescent tracer dye.

Operation of the engine may be necessary during the inspection process to determine the location of the origin of the fluorescent tracer dye.

Always start at the bottom of the engine or component being inspected and work toward the top. Liquids will flow to the lowest point before forming droplets. Follow the fluorescent tracer dye trail upward to determine the origin of the leak.

Fluorescent tracer dye may collect and distribute around areas like the lubricating oil pan rail, head gasket area, or the rocker lever cover rail before dripping or flowing downward. If a leak is suspected in these locations, make certain the fluorescent tracer dye trail does **not** originate from a location above.

Components like the cooling fan may create turbulence that will distribute the fluorescent tracer dye in a horizontal direction. In these cases, follow the fluorescent tracer dye in the opposite direction of flow to find the origin of the leak.

Components, like the flywheel or vibration damper, will distribute fluorescent tracer dye in a circular pattern. For this situation, determine if the fluorescent tracer dye is being dripped on the component from above and being redistributed, or if the leak originates at the seal near the center of the component.

Repair or replace the component or components that the fluorescent tracer dye originates from.

If the origin of the fluorescent tracer dye can **not** be found, consider cleaning the engine or component and test again.

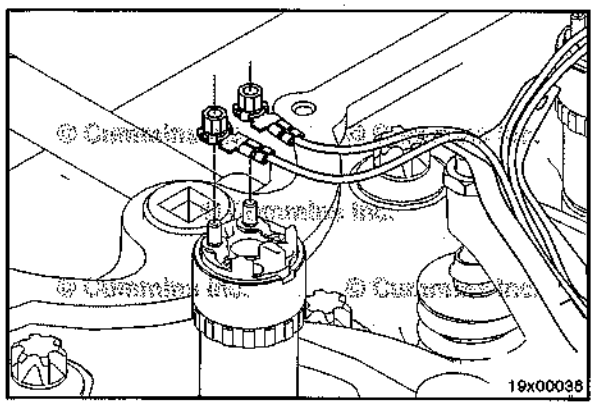
If fluorescent tracer dye is **not** found during the inspection, no leak is present.

Finishing Steps

Install any components that were removed for access during the test.

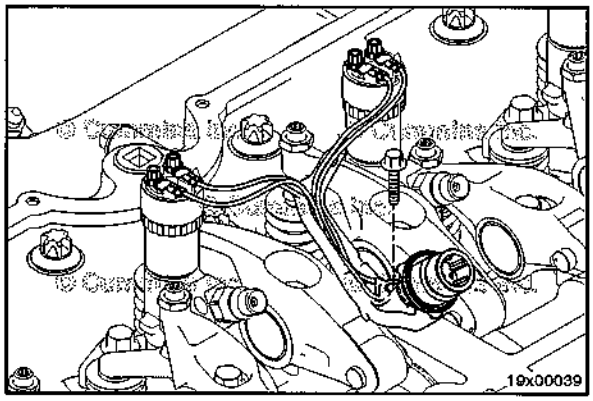
To verify the repair, operate the engine or system in the same manner used to generate the leak.

Repeat the test to verify the leak has been repaired.

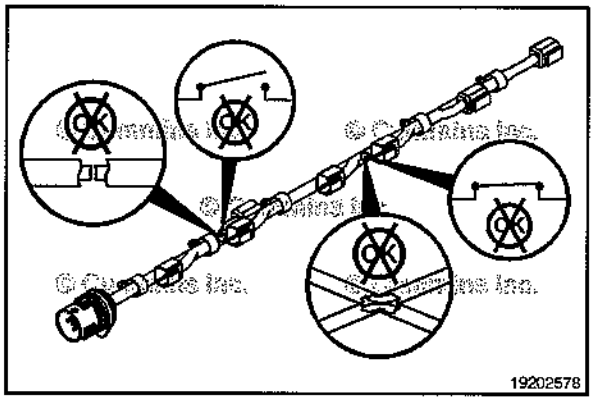


Remove

Disconnect the actuator harness from each of the two injector solenoids.

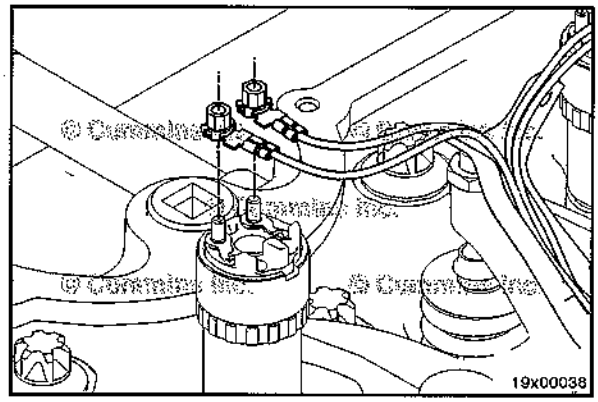


Remove the capscrews securing the actuator harness to the cylinder head.



Inspect for Reuse

Replace or repair the internal actuator harness if there is an open circuit or a short circuit found under the protective covering of the harness body.



Install

Connect the actuator harness to each of the injector solenoids.

Torque Value: 2 N•m [18 in-lb]

NOTE: Install the injector wires so they will **not** interfere with a rocker lever. If the rocker lever is able to come into contact with the injector harness, it will rub through the wire insulation and cause injector circuit fault codes.

Torque Value: 2 N•m [18 in-lb]