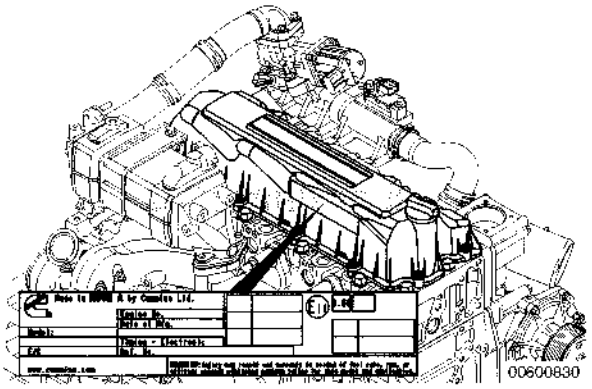
Engine Identification

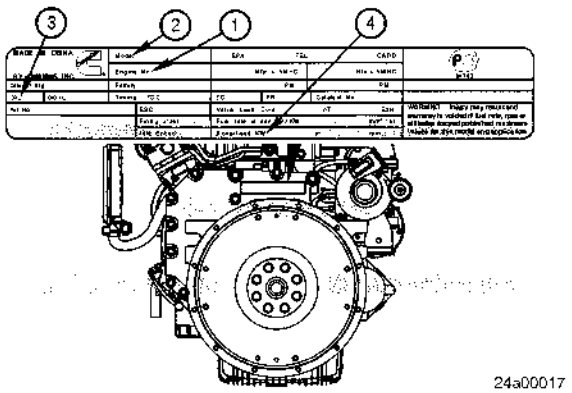
General Information



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.

NOTE: The dataplates used on engines can differ in appearance and location of information. The following illustrations show examples of common dataplates used and the information contained on these dataplates.

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



There are four possible dataplates that can be found on the engine rocker lever cover, but can also be located on the side of the gear housing. They contain the following information:

1 Engine serial number

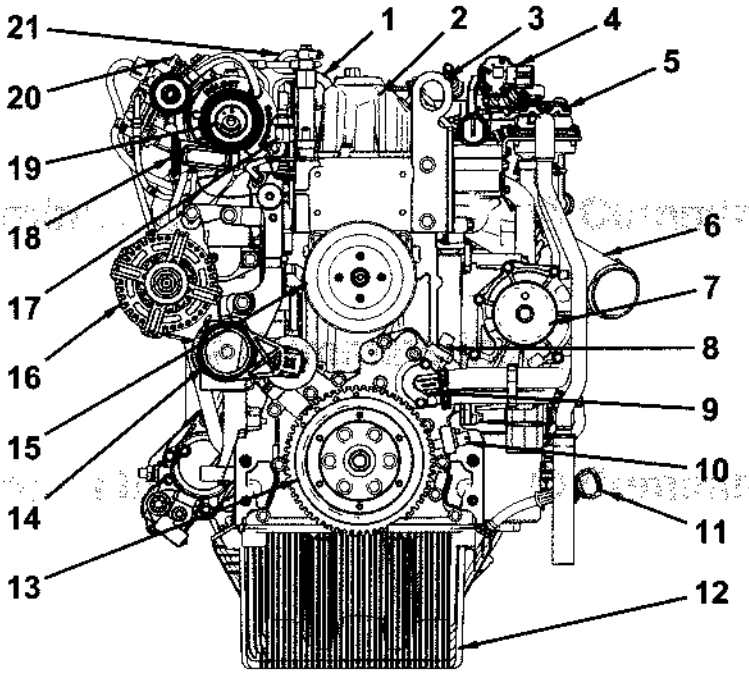
2 Engine model information

3 Control parts list

4 Horsepower and rpm rating.

Engine Diagrams

General Information



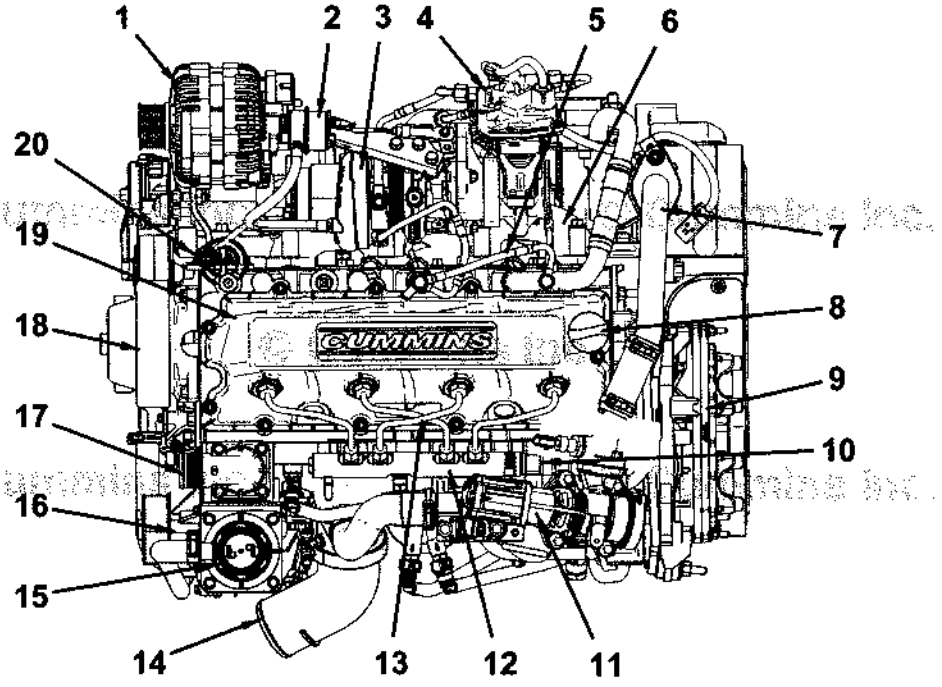
00r00015

Front View

1 Rear engine lifting bracket
2 Rocker lever cover
3 Front engine lifting bracket
4 Exhaust gas recirculation (EGR) valve
5 Open crankcase ventilation valve
6 Air intake connection
7 Water pump pulley
8 Camshaft speed/position sensor
9 Crankcase breather adapter
10 Crankshaft speed/position sensor
11 Lubricating oil dipstick tube
12 Lubricating oil pan
13 Crankshaft pulley
14 Automatic belt tensioner
15 Fan drive pulley
16 Alternator
17 Exhaust pressure sensor
18 Wastegate turbocharger compressor outlet
19 Wastegate turbocharger compressor inlet
20 Exhaust pressure regulator
21 EGR coolant vent tube.

Engine Diagrams

General Information



Top View

1 Alternator
2 Turbocharger wastegate actuator
3 Wastegate turbocharger
4 Exhaust pressure regulator
5 EGR coolant vent tube
6 Exhaust manifold
7 EGR crossover tube
8 Lubricating oil fill cap
9 ECM
10 Fuel rail pressure sensor
11 EGR valve
12 Common rail fuel manifold
13 Injector supply lines
14 Intake air connection
15 Open crankcase ventilation valve
16 Water pump
17 Water outlet connection (thermostat is underneath)
18 Fan hub
19 Rocker lever cover
20 Exhaust temperature sensor.

STEP 1B: Duplicate the complaint based on the customer description.

Condition:
- None.

Action	Specification/Repair	Next Step
Operate the equipment based on the description from the customer to duplicate the complaint. N/A	Customer's complaint be duplicated? **YES**	1C
	Customer's complaint be duplicated? **NO**	Repair complete

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

Condition:
- Turn keyswitch ON.
- Connect INSITE™ electronic service tool.

Action	Specification/Repair	Next Step
Check the fault codes. • Use INSITE™ electronic service tool to read the fault codes.	Active fault codes or high counts of inactive fault codes? **YES** **Repair:** See the corresponding Electronic Control System Troubleshooting and Repair manual for the engine being serviced.	Repair complete
	Active fault codes or high counts of inactive fault codes? **NO**	1D

STEP 1D: Perform the basic troubleshooting checks.

Condition:
- As required.

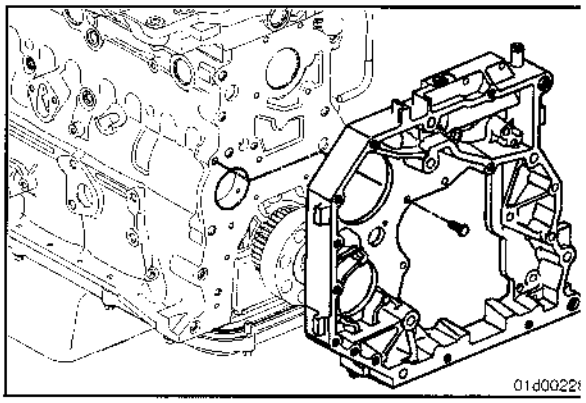
Action	Specification/Repair	Next Step
Check or verify the following items before continuing. • Battery voltage is low (engine running) • Lubricating oil level is above specification • External fuel leak • Engine idle speed is set too low • Engine idle speed is set too high • Throttle lever or pedal, return spring, or air throttle damaged or improperly adjusted (use INSITE™ electronic service tool for electronic engines) • Air in the fuel • Fuel pressure • Inlet restriction.	All steps verified to be correct? **YES**	1E
	All steps verified to be correct? **NO**	Repair complete

Gear Housing, Rear (001-034)

Remove

NOTE: The rear gear housing is mounted to the engine with three different length and size of capscrews. Note the location and size of the capscrews when they are removed to be sure they are installed in the same locations.

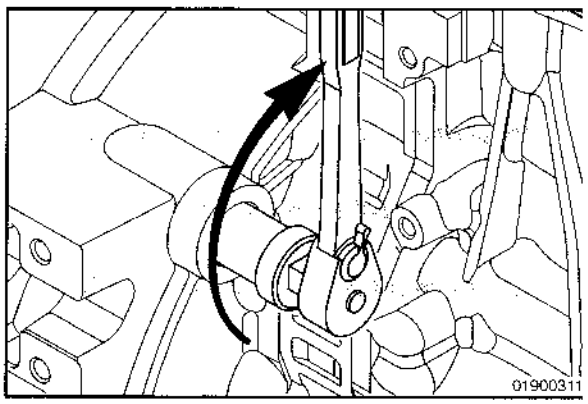
Remove the rear gear housing capscrews and housing.



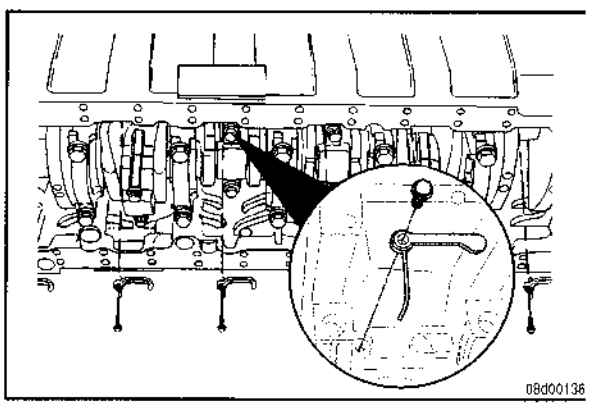
Piston Cooling Nozzle (001-046)

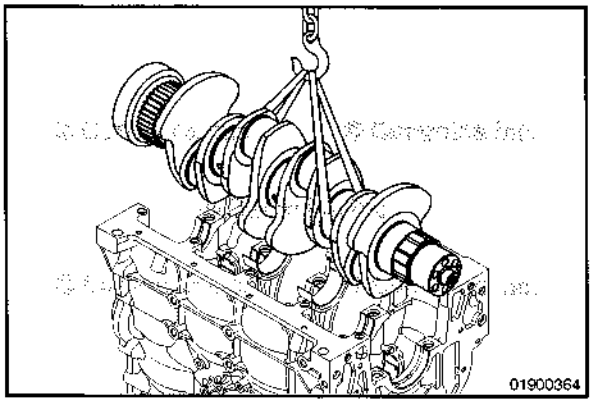
Remove

Use the engine barring tool, Cummins® Part Number 3824591, to rotate the crankshaft to various positions to access each piston cooling nozzle and/or capscrew.



Remove the piston cooling nozzles and/or capscrews.

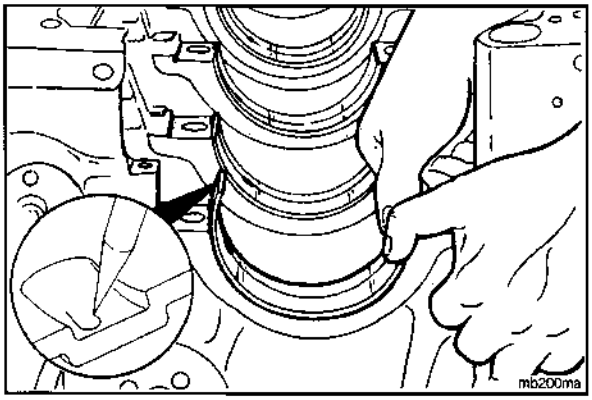




Remove

⚠WARNING⚠
This component or assembly weighs greater than 23 kg [50 lb]. To prevent serious personal injury, be sure to have assistance or use appropriate lifting equipment to lift this component or assembly.

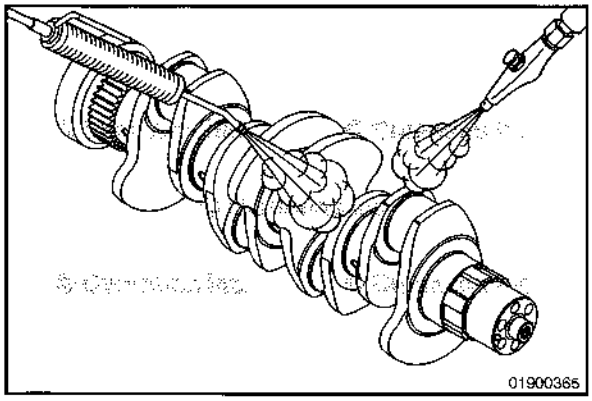
Remove the crankshaft.



Remove the upper main bearings.

Use an awl to mark the bearing's position in the tang area.

NOTE: Marking the bearing's position is for future identification or possible failure analysis.



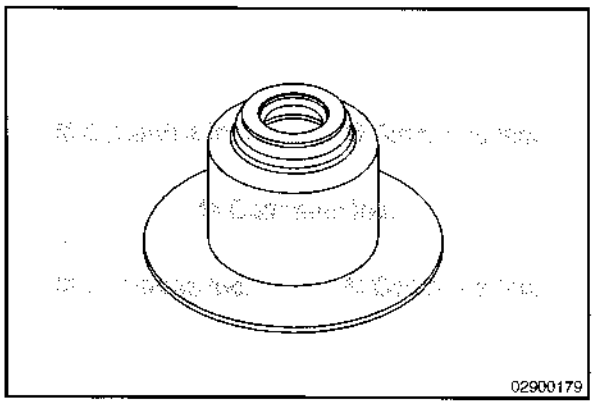
Clean

⚠WARNING⚠
When using a steam cleaner, wear safety glasses or a face shield, as well as protective clothing. Hot steam can cause serious personal injury.

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

Steam-clean or use hot, soapy water to clean the crankshaft and gear(s).

Use a non-metallic bristle brush to clean the oil drillings. Dry with compressed air. Make sure to blow out the threaded holes on each end of the crankshaft and the oil drillings.

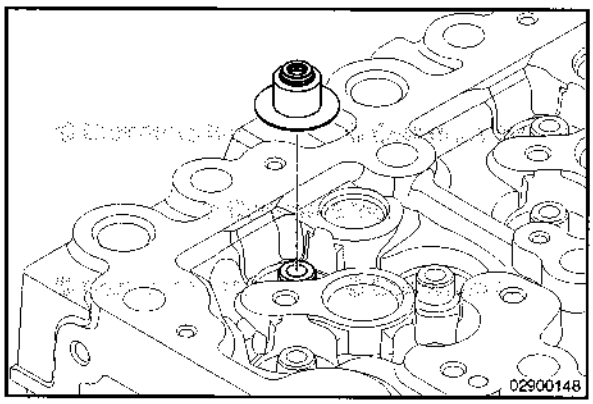


NOTE: Prior to removing the valve stem seals, note the type and color of the valve stem seal installed at each valve location. The same type and color valve stem seal **must** be installed when assembling the cylinder head.

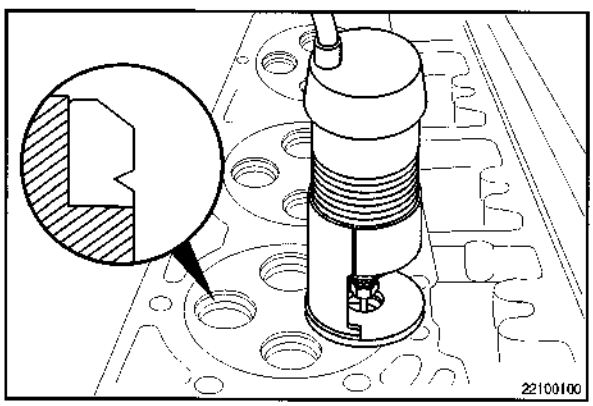
"Top-Hat" Seal

Colors Used:

- Green (Used for exhaust valves)
- Yellow (Used for intake and exhaust valves)
- Brown (Used for intake and exhaust valves)



Use boot pliers, Cummins® Part Number 3163293, to remove the valve stem seals.



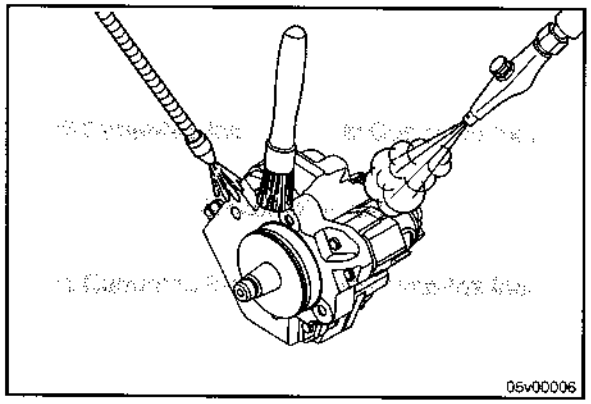
NOTE: Prior to removing the valve seat inserts, see the Inspect for Reuse and Clean and Inspect for Reuse steps in this procedure. The condition of the valve, the amount of recess, and the sealing of the valve on the seat insert all help determine whether or **not** a seat insert needs to be replaced.

1 If required, remove the valve seat inserts.

2 Inspect the valve-insert-to-cylinder-head contact area. A sufficient groove for the remover **must** exist.

3 If there is sufficient valve insert groove area, proceed to the next step.

4 If the valve insert groove area is **not** sufficient, use the valve seat insert cutting kit, Cummins® Part Number 3376405, to create a sufficient groove.



Clean and Inspect for Reuse

⚠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.

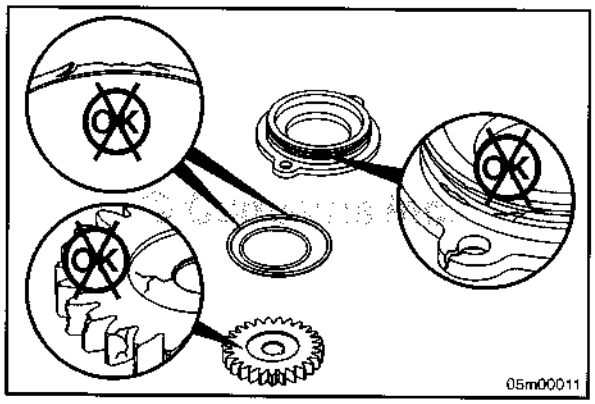
⚠WARNING⚠
Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury.

△CAUTION△
Use solvent or cleaner that will not harm aluminum.

△CAUTION△
Do not allow the cleaner to enter the fuel fittings. Dirt and debris can damage the fuel system.

Clean the fuel pump with solvent.

Dry with compressed air.

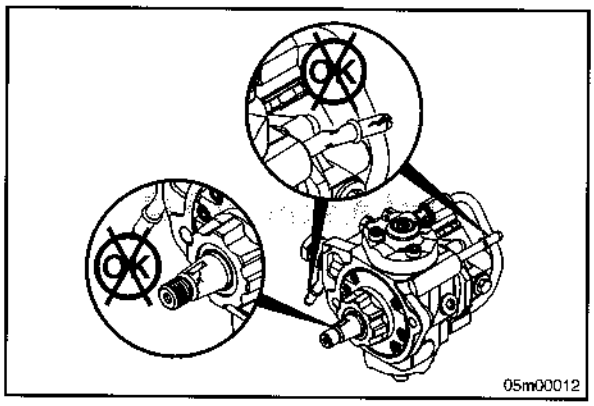


Inspect the drive gear for damage. Replace if damage is found.

Inspect the o-ring seal for damage. Replace if damage is found.

Inspect the o-ring seal area for damage. Clean and repair any burred surfaces.

Inspect the adapter for damage. Replace if any damages is found.



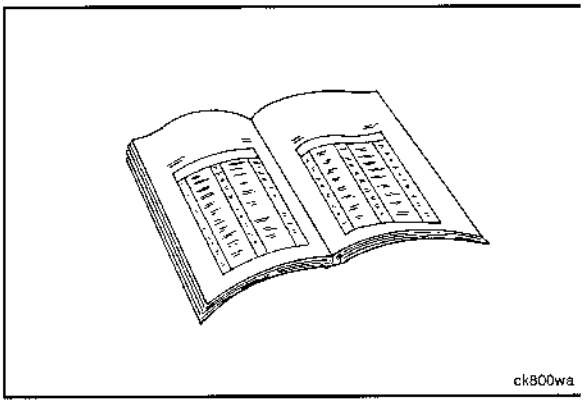
Inspect the driveshaft for damage.

Replace the fuel pump if damage is found.

Inspect the quick connect fittings for cracks, wear, or pinched areas.

Replace the fuel pump assembly, if damage is found.

Finishing Steps

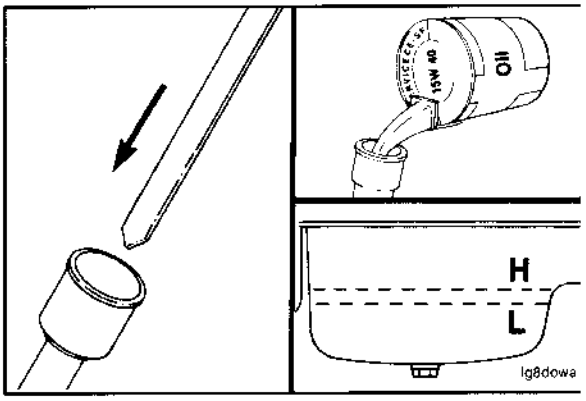


⚠WARNING⚠
Coolant is toxic. Keep away from pets and children. If not reused, dispose of in accordance with local environmental regulations.

- Install the coolant bypass tube. Refer to Procedure 008-005 in Section 8.
- Install the coolant inlet hose to the water pump. See equipment manufacturer service information.
- Install the fan drive belt. Refer to Procedure 008-002 in Section 8.
- Fill the engine the coolant. Refer to Procedure 008-018 in Section 8.
- Operate the engine and check for leaks.

Lubricating Oil Dipstick (007-009)

Calibrate



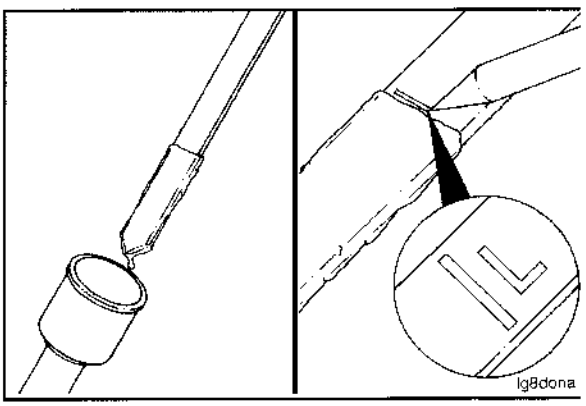
⚠WARNING⚠
Some state and federal agencies have determined that used engine oil can be carcinogenic and can cause reproductive toxicity. Avoid inhalation of vapors, ingestion, and prolonged contact with used engine oil.

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

Drain the lubricating oil. Refer to Procedure 007-037 in Section 7.

Wipe off the dipstick and install it in the dipstick tube housing.

Use clean 15W-40 oil to fill the oil pan to the specified low oil level. Use the following procedure for lubricating oil system specifications in the QSF3.8 CM2350 F107 Operation and Maintenance Manual, Bulletin 4367317. Refer to Procedure 018-003 in Section V.The low oil level can be found by looking up the oil pan option for the engine serial number on QuickServe™ Online.



△CAUTION△
Use care when marking the dipstick, or the dipstick will break if the scribe mark is too deep.

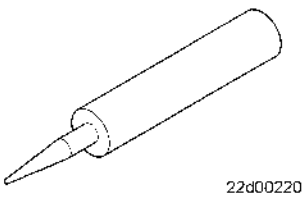
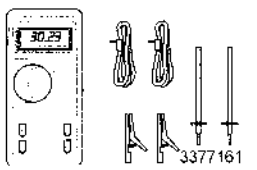
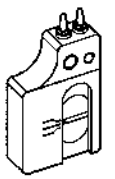
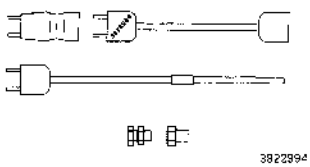
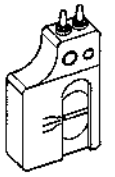
Remove the dipstick, and scribe a mark across the stick at the oil level. Label the mark with an L to indicate the low oil level.

NOTE: If a new, blank dipstick is being used, cut the dipstick off approximately 38 mm [1.5 in] below the low oil level mark.

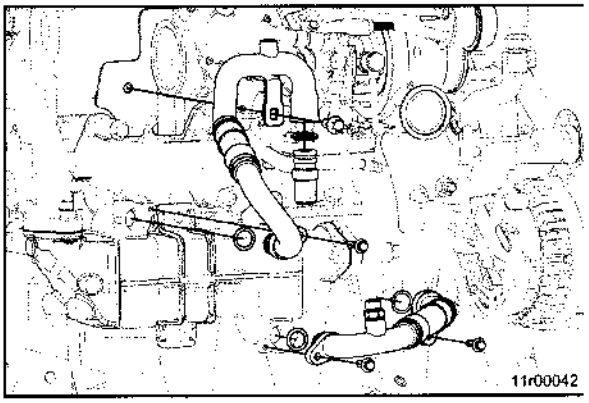
Service Tools

Air Intake System

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
2892320	**Leak Test Kit** Used to detect leaks in all engine fluid systems (lubricating oil, coolant, and fuel) using a cordless "True UV" light that will detect the presence of fluorescent dye additive.	
3164070	**RTV Sealant** Used to seal rear gear housing to block, front cover to block, and intake manifold to cylinder head joints.	
3164489	**Digital Multimeter** Used to measure electrical circuits: Voltage (volts), resistance (ohms), and current (amps). 3164489 - with built in temperature adapter and tachometer.	
3164492	**Immersion Probe Thermocouple** Used for checking charge-air cooler and piping. Use with digital multimeter, Part Number 3164488.	
3164498	**Bead Probe** Used with digital thermometer, Part Number 3164499.	
3164499	**Digital Thermometer** Used to measure ambient air temperature. Use with digital multimeter, Part Number 3164488.	

Remove

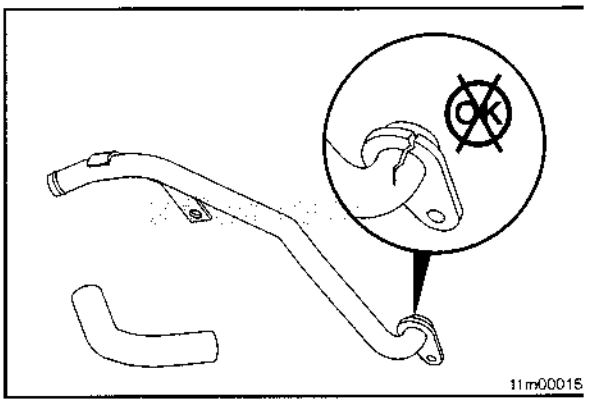


Remove the capscrew holding the coolant return tube to the exhaust gas recirculation (EGR) cooler.

Remove the coolant tube.

Remove the capscrews holding the coolant supply tube to the cylinder block and EGR cooler.

Clean and Inspect for Reuse

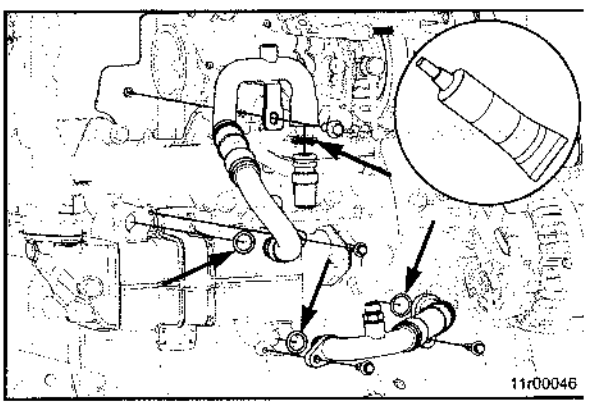


Inspect the hoses and tubes for cracks, plugging, restrictions, and pinched areas. Replace if damaged.

Inspect the hose clamps for cracking. Replace if damaged.

Inspect the sealing ring for cracks. Inspect the o-ring groove for burrs or nicks that can cut the o-ring. Replace if damaged.

Install



Lubricate all coolant tube o-rings with P80 lubricant before installation.

Install the o-rings on the end of the coolant return tube.

Install the coolant return tube.

Align the coolant tube to the securing position on the cylinder head and EGR cooler.

Install the support capscrew into the EGR cooler.

Torque Value: 9.5 N•m [84 in-lb]

Install capscrew to support bracket attached to rocker cover heat shield.

Torque Value: 24 N•m [212 in-lb]

Install the coolant supply tube.

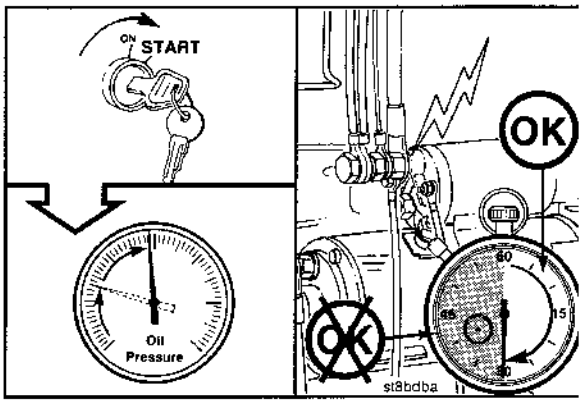
Align the coolant supply tube to the securing position on the cylinder block and EGR cooler.

Install the capscrews holding the coolant supply tube to the cylinder block and EGR cooler.

Torque Value: 9.5 N•m [84 in-lb]

⚠CAUTION⚠
Do not crank the engine for more than 30 seconds. Excessive heat will damage the starter motor.

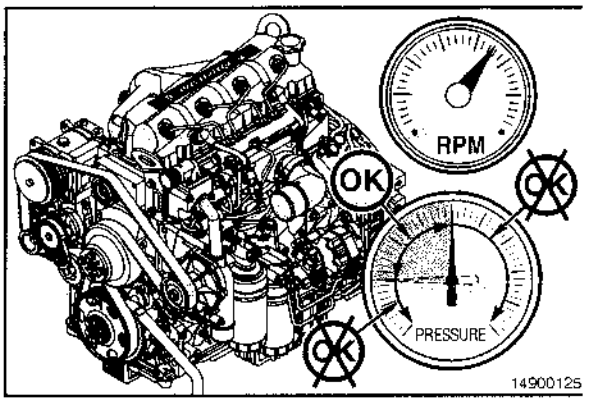
Crank the engine and observe the lubricating oil pressure when the engine starts. If the engine fails to start within 30 seconds, allow the starter motor to cool for 2 minutes before cranking the engine again.



⚠CAUTION⚠
If the lubricating oil pressure is not within specifications, shut off the engine immediately. Low lubricating oil pressure will cause engine damage.

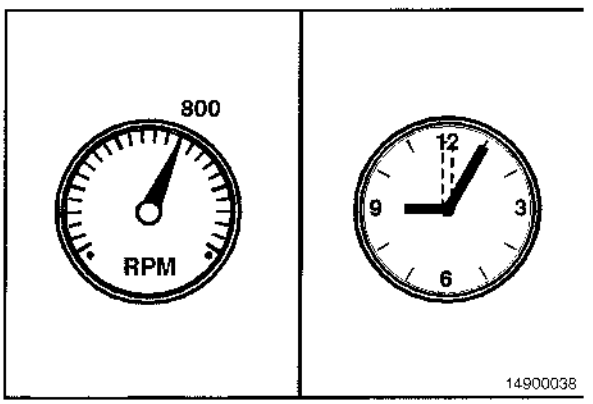
Engine lubricating oil pressure **must** be at least 69 kPa [10 psi] at 700 rpm.

Correct the problem if the lubricating oil pressure is **not** within specifications.



⚠CAUTION⚠
Do not operate the engine at idle speed longer than specified during engine run-in. Excessive carbon formation will cause damage to the engine.

Operate the engine at approximately 800 rpm for 3 to 5 minutes.

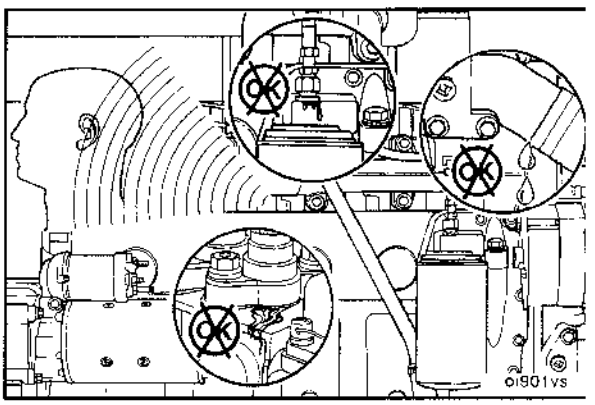


NOTE: Repair all leaks or component problems before continuing the engine run-in.

Listen for unusual noises.

Watch for coolant, fuel, and lubricating oil leaks.

Check for correct engine operation in general.



Engine Control Module Calibration Code (019-032)

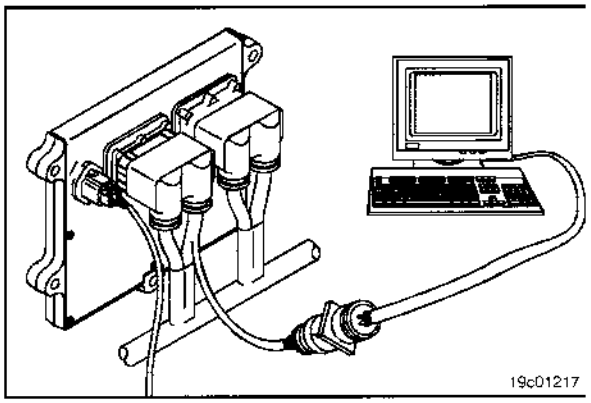
General Information

NOTE: Due to the number of various engine control module (ECM) configurations, this procedure has been written to be common. **Not** all illustrations within this procedure will represent the application that is being worked on.

ECM calibrations can be performed by INSITE™ electronic service tool.

After an ECM is replaced or calibrated, the actual engine hours / distance **must** be entered correctly into the ECM.

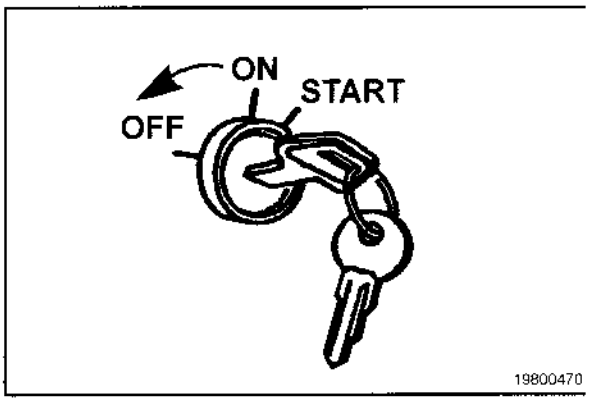
Record the values of ECM Distance Offset, ECM Time Offset, Engine Distance Offset, and Engine Time Offset prior to replacement or calibration of the ECM. These parameters can be found in the Trip Information section of Features and Parameters.



Initial Check

NOTE: If the tool will **not** communicate with the keyswitch in the ON position, cycle the keyswitch and try again.

The ECM calibration process occurs with the keyswitch turned ON. **Always** follow the instructions on the service tool screens.



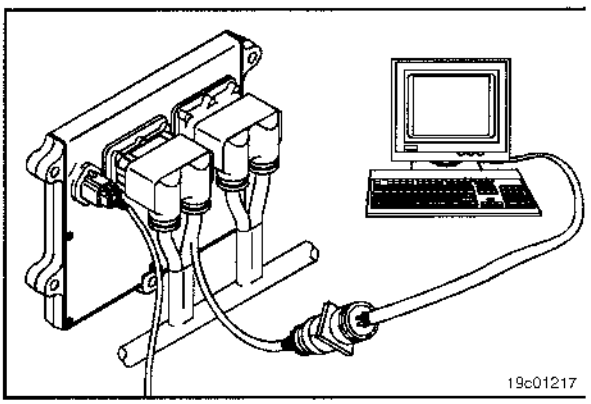
Preparatory Steps

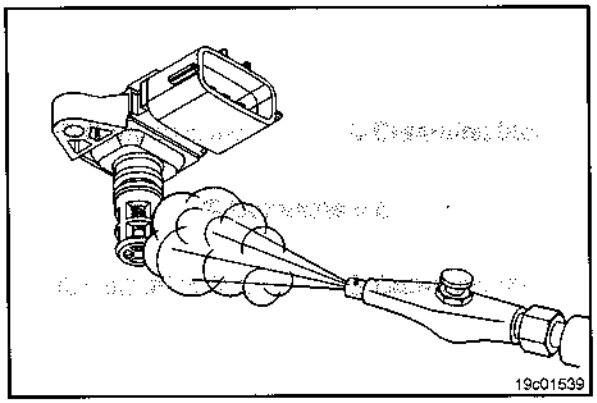
Connect INSITE™ electronic service tool to the service tool data link, which is located on the engine or in the cab.

See the help section within INSITE™ electronic service tool for detailed ECM calibration procedures.

After an ECM is replaced or calibrated, the actual engine hours / distance **must** be entered correctly into the ECM.

Input the values of ECM Distance Offset, ECM Time Offset, Engine Distance Offset, and Engine Time Offset prior to replacement or calibration of the ECM. These parameters can be found in the Trip Information section of Features and Parameters.



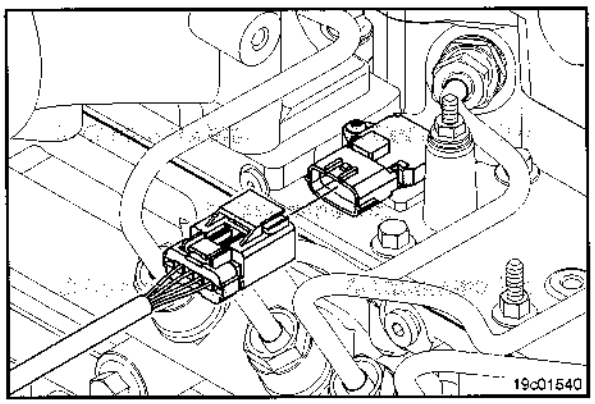


⚠WARNING⚠
Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury.

Inspect the tip of the sensor for soot and carbon buildup.

Use compressed air to remove the soot from the sensor, if necessary.

Do **not** replace the sensor for soot in the sensor.



Install

Make sure the new sensor has an o-ring.

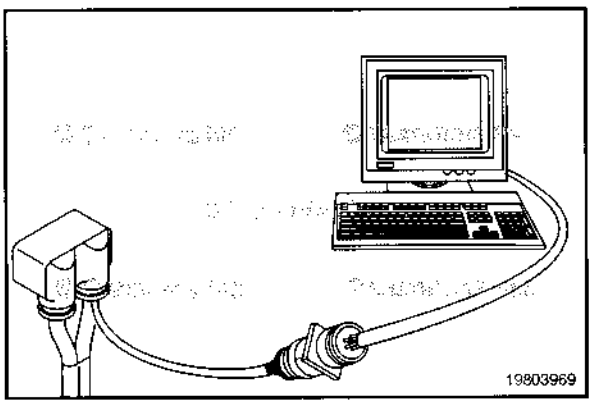
Lubricate the o-ring with 15W-40 lubricating oil.

Install the new sensor into the engine.

Tighten the capscrew.

Torque Value: 3 N•m [27 in-lb]

Push the connectors together until they lock. An audible click will be heard as the connectors lock in place.



Data Link Circuit, SAE J1939 (019-165)

General Information

The OEM J1939 datalink circuit is located in the OEM wiring harness.

The purpose of this datalink is to allow communication with vehicle control-operated systems such as transmission controllers, traction control system, etc.

The traditional OEM J1939 datalink circuit is described as a shielded twisted pair and includes the wires connected to the J1939 datalink positive (+) pin, the J1939 datalink negative (-) pin, and the J1939 (shield) pin in the OEM harness.

On newer vehicles and equipment, OEM's can utilize an OEM J1939 datalink circuit that is described as an unshielded twisted pair (UTP). The unshielded twisted pair (UTP) J1939 datalink does **not** include the J1939 (shield) pin and **only** includes the J1939 datalink positive (+) pin and the J1939 datalink negative (-) pin in the OEM harness.

With the keyswitch in the ON position, public datalink messages will be broadcast on the OEM J1939 datalink. The broadcast will stop when the keyswitch is turned to the OFF position.

How to Find the Internal Resistance of the Meter

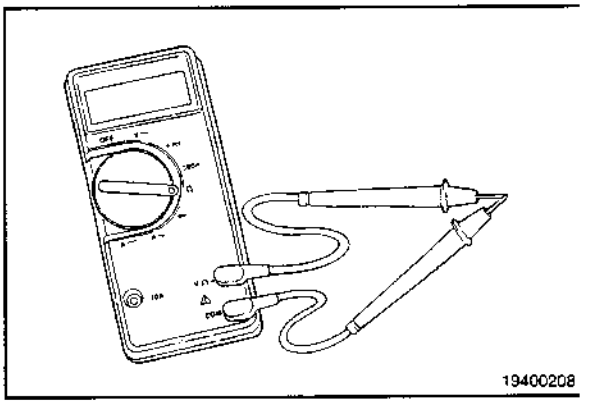
It is important to know the internal resistance of the meter when measuring small resistances. To measure small resistances accurately, the internal resistance of the meter **must** be subtracted from the measured resistance.

Turn the meter ON.

Set the meter to the lowest ohm scale.

Measure the resistance of the meter by touching the test probes together and reading the resistance value (including special test leads, if they are being used).

ZERO the meter or subtract this value when taking measurements.



How to Test for Continuity

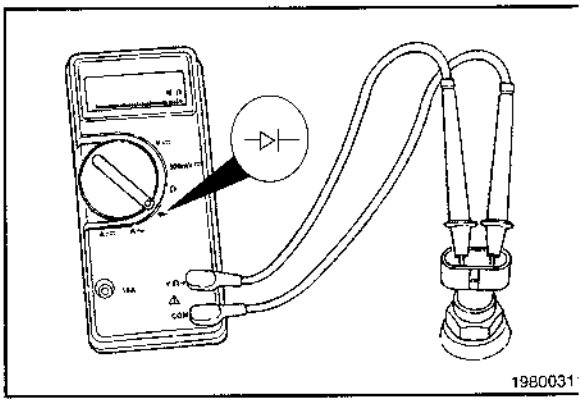
Select the continuity function on the meter (usually marked with a diode symbol).

Make sure there is no power to the component being measured.

Disconnect both ends of the circuit or component to be measured. Touch one probe to one end of the circuit or component terminal. Touch the other probe to the other end of the circuit or the other component terminal.

Read the displayed measurement.

The meter will beep if the resistance is less than about 150 ohms. If there is an open circuit, the meter does **not** beep.

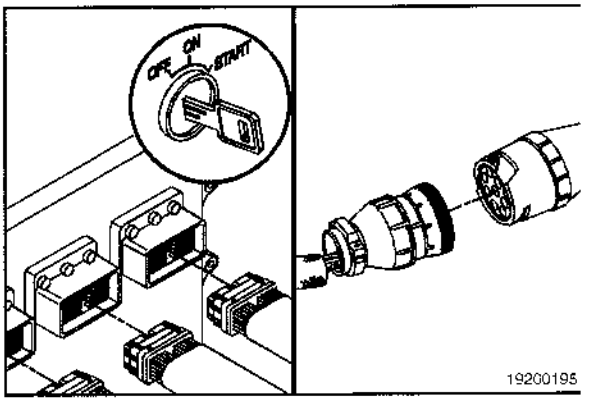


Short Circuit to Ground - Check

Short circuit to ground is a condition where a connection from a circuit to ground exists when it is **not** intended.

The procedure for checking for a short circuit to ground is as follows:

- Turn keyswitch OFF.
- Disconnect the connectors that are to be tested.



When testing a sensor, **only** the sensor connection is required to be disconnected.

When testing a harness, the harness connector at the electronic control unit and the connector at the sensor or multiple sensors should be disconnected.

Identify the pins that need to be tested.

Inspect the connector pins. 019-361.

Adjust the multimeter to measure resistance.