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EGES-265-1

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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## Sensor Identification



**WARNING:** To avoid serious personal injury, possible death, or damage to the engine or vehicle, read all safety instructions in the "Safety Information" section of this manual.



**WARNING:** To avoid serious personal injury, possible death, or damage to the engine or vehicle, make sure the transmission is in neutral, parking brake is set, and wheels are blocked before doing diagnostic or service procedures on engine or vehicle.

**NOTE:** For information regarding the removal or installation of adjacent components, refer to the following service procedures located in other sections of this manual:

- Valve cover

This section should be used for sensor identification and location. For a more detailed description of the electrical sensors, see the Engine and Vehicle Sensors in the "Introduction" in this manual, or the corresponding diagnostic manual.



H09007

**Figure 402 Camshaft Position (CMP) sensor**

The CMP sensor is a magnetic type sensor. It responds to a rotating actuator positioned on the camshaft gear. The CMP sensor is installed in the front cover, above and to the right of the water pump pulley.

When ordering this sensor for replacement, make sure that the sensor you receive is the same one pictured. This sensor is used in different International Truck and Engine Corporation applications to sense crankshaft position.

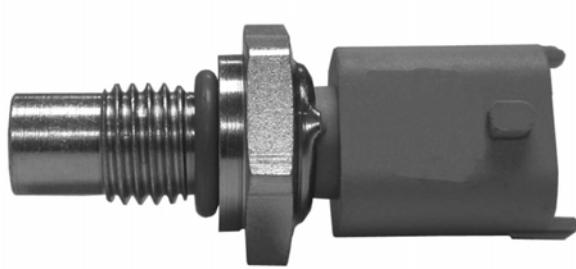


H09004

**Figure 403 Crankshaft Position (CKP) sensor**

The CKP sensor is a magnetic pickup sensor. The CKP sensor is installed on the top left of the flywheel housing.

When ordering this sensor for replacement, make sure that the sensor you receive is the same one pictured. This sensor is used in different International Truck and Engine Corporation applications to sense camshaft position.

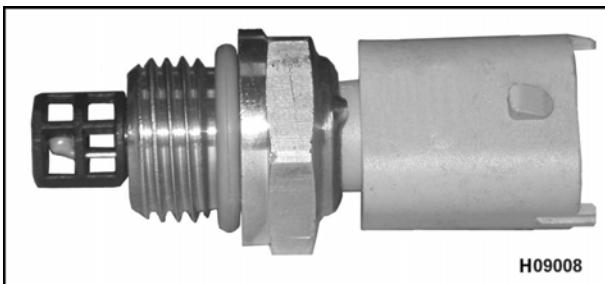


H09005

**Figure 404 Engine Oil Temperature (EOT) sensor and Engine Coolant Temperature (ECT) sensor**

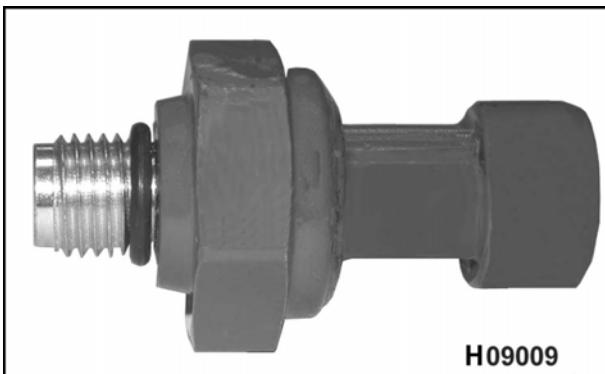
The EOT sensor is a thermistor type sensor. The EOT sensor is installed in the rear of the front cover, left of the high-pressure oil pump assembly.

The ECT sensor is a thermistor type sensor. The ECT sensor is installed in the water supply housing (Freon® compressor bracket), left of the flat idler pulley assembly.



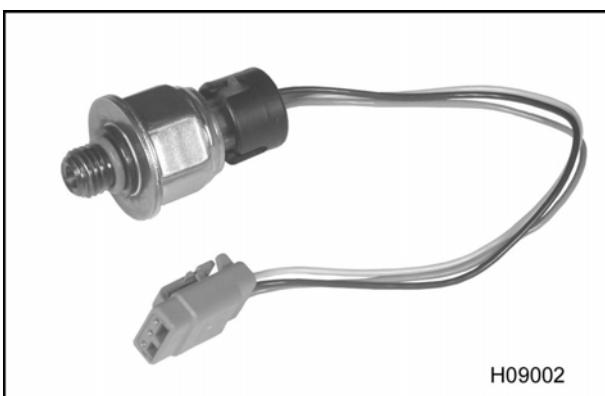
**Figure 405 Manifold Absolute Temperature (MAT) sensor**

The MAT sensor is a thermistor type sensor. The MAT sensor is installed to the right of the MAP sensor in the intake manifold.



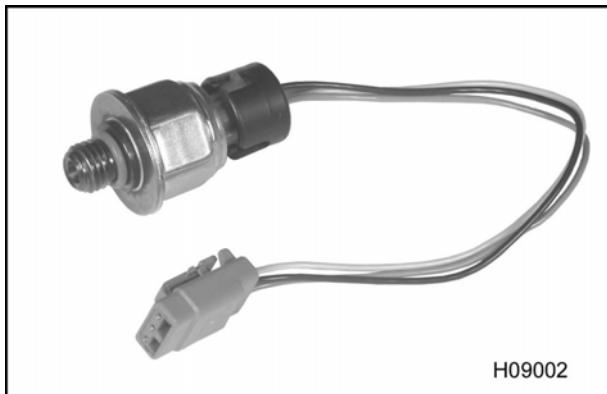
**Figure 406 Engine Oil Pressure (EOP) sensor**

The EOP sensor is a variable capacitance sensor. The EOP sensor is installed on the left of the crankcase below and left of the fuel filter housing.



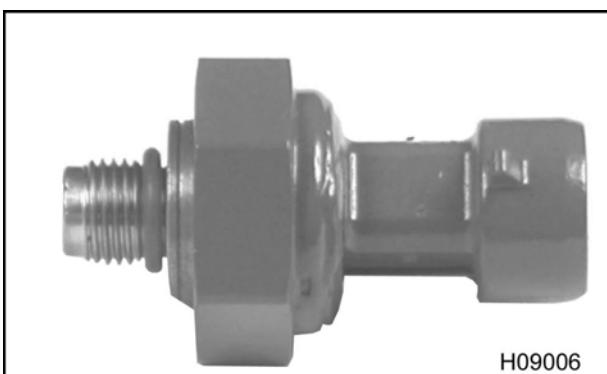
**Figure 407 Injection Control Pressure (ICP) sensor**

The ICP sensor is a variable capacitance sensor. The ICP sensor is installed left of the engine Brake shutoff valve in the high-pressure rail.



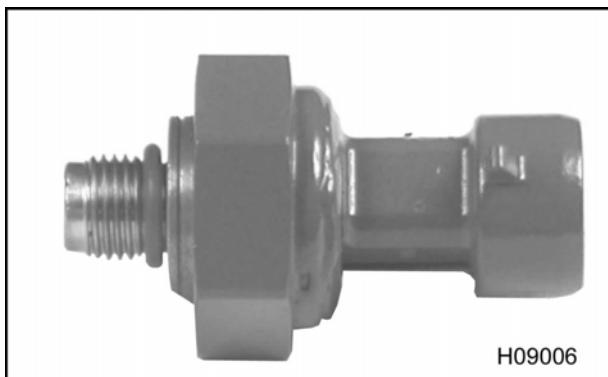
**Figure 408 Brake Control Pressure (BCP) sensor**

The BCP sensor is a variable capacitance sensor. The BCP sensor is installed forward of the engine Brake shutoff valve in the high-pressure rail.



**Figure 409 Engine Fuel Pressure (EFP) sensor**

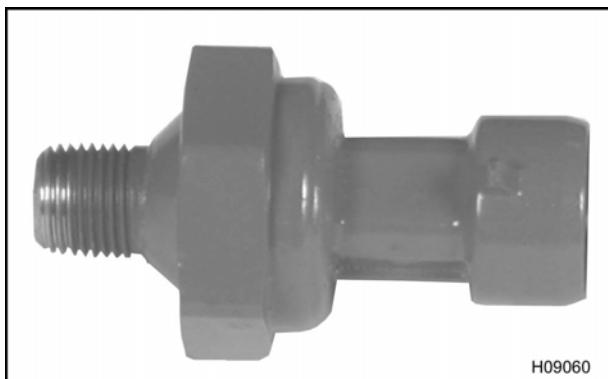
The EFP sensor is a variable capacitance sensor. The EFP sensor is installed in the rear of the fuel filter assembly (crankcase side).



H09006

**Figure 410 Manifold Absolute Pressure (MAP) sensor**

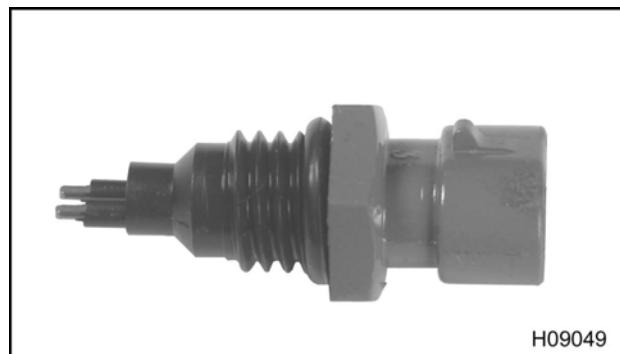
The MAP sensor is a variable capacitance sensor. The MAP sensor is installed left of the MAT sensor in the intake manifold.



H09060

**Figure 411 Exhaust Back Pressure (EBP) sensor**

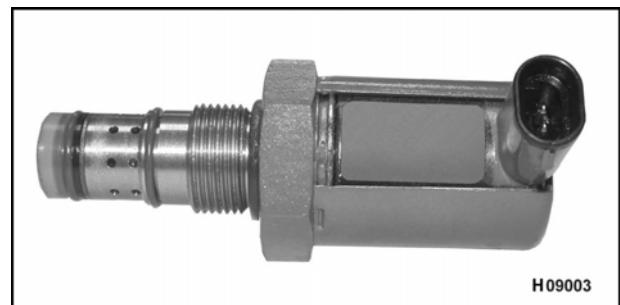
The EBP sensor is a variable capacitance sensor. The EBP sensor is installed in a bracket mounted on the water supply housing (Freon® compressor bracket).



H09049

**Figure 412 Water In Fuel (WIF) sensor**

The Water In Fuel sensor detects water in the fuel. The WIF sensor is installed at the base of the fuel filter housing.



H09003

**Figure 413 Injection Pressure Regulator (IPR) valve**

The IPR valve is a pulse width modulated valve that regulates the injection control pressure. The valve is located on the rear of the high-pressure oil pump.

## Removal

### Sensor Wiring Harness



**WARNING:** To avoid serious personal injury, possible death, or damage to the engine or vehicle, disconnect the main negative battery terminal before removing or installing any electrical components.

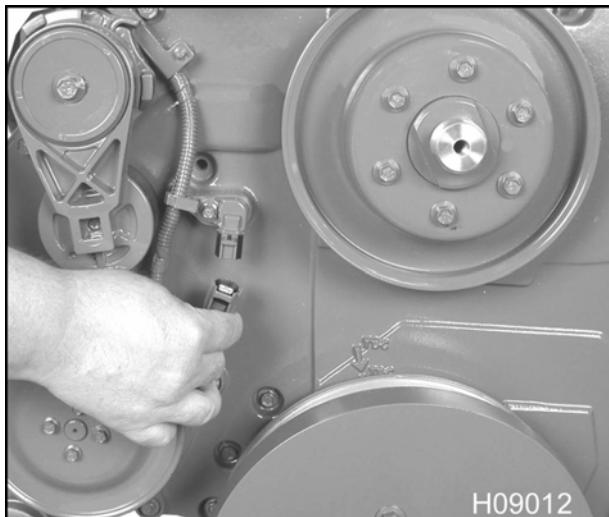
**CAUTION:** To avoid engine damage, make sure the key is in the OFF position before unplugging the connector or relay for the ECM, IDM, and EGR drive module. Failure to turn the key to the OFF position will cause a voltage spike and damage the electrical components.

**CAUTION:** To avoid engine damage, do not tug on any wiring harnesses while trying to remove them. If resistance is felt, find the source of resistance and free up any connectors or clips that are caught before proceeding.



Figure 414 Disconnecting the VGT harness

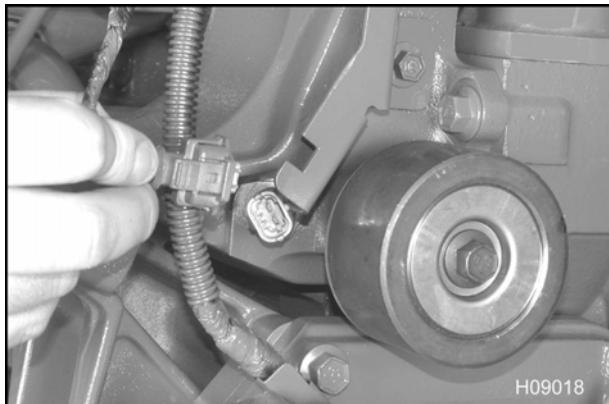
1. Disconnect the wiring harness from the VGT actuator.



H09012

Figure 415 Disconnecting the CMP sensor

2. Disconnect the wiring harness connector from the CMP sensor.



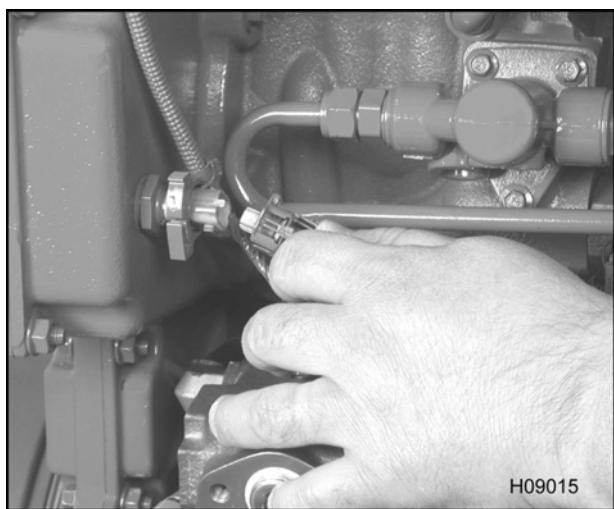
H09018

Figure 416 Disconnecting the ECT sensor

3. Disconnect the wiring harness connector from the ECT sensor.

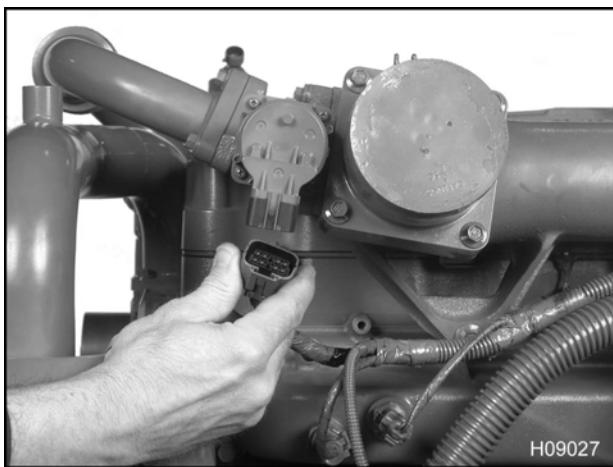


**Figure 417** Disconnecting the EBP sensor



**Figure 419** Disconnecting the EOT sensor

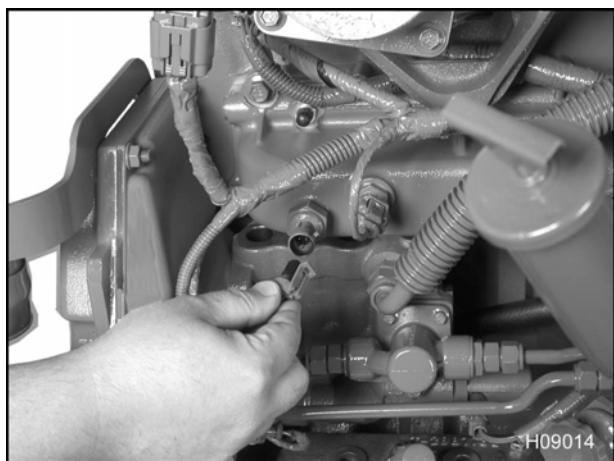
4. Disconnect the wiring harness connector from the EBP sensor.



**Figure 418** Disconnecting the EGR control valve connector

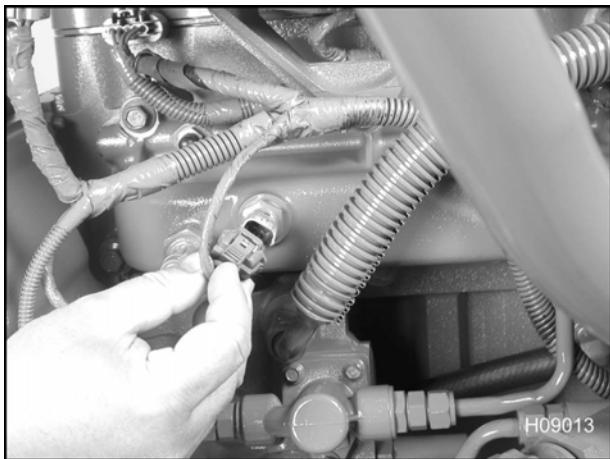
5. Disconnect the wiring harness connector from the EGR control valve.

6. Disconnect the wiring harness connector from the EOT sensor.



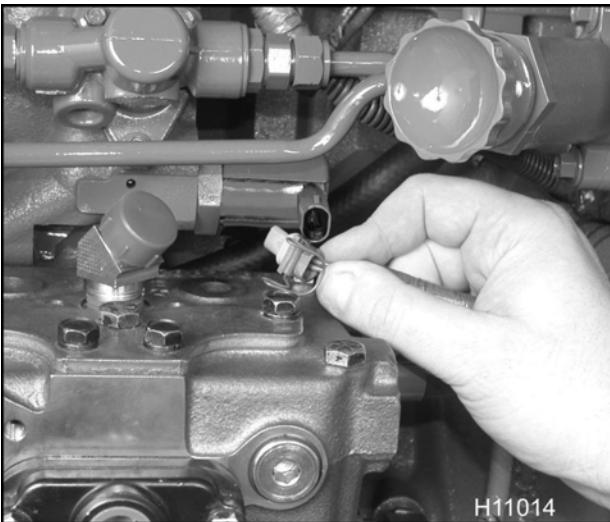
**Figure 420** Disconnecting the MAP sensor

7. Disconnect the wiring harness connector from the MAP sensor.



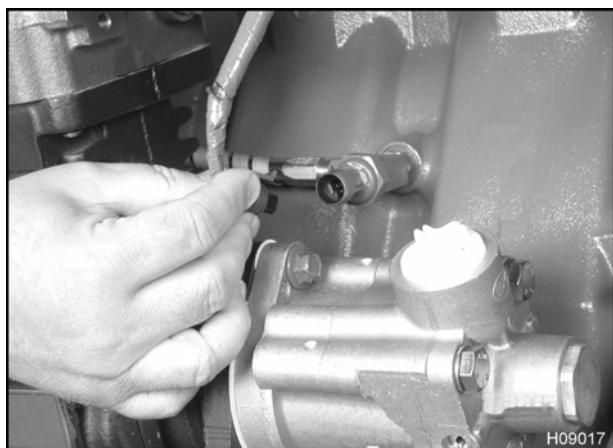
**Figure 421** Disconnecting the MAT sensor

8. Disconnect the wiring harness connector from the MAT sensor.



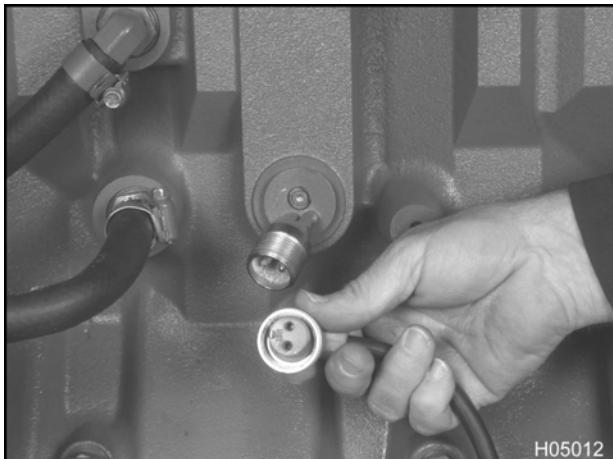
**Figure 422** Disconnecting the IPR valve connector

9. Disconnect wiring harness connector from the IPR valve.



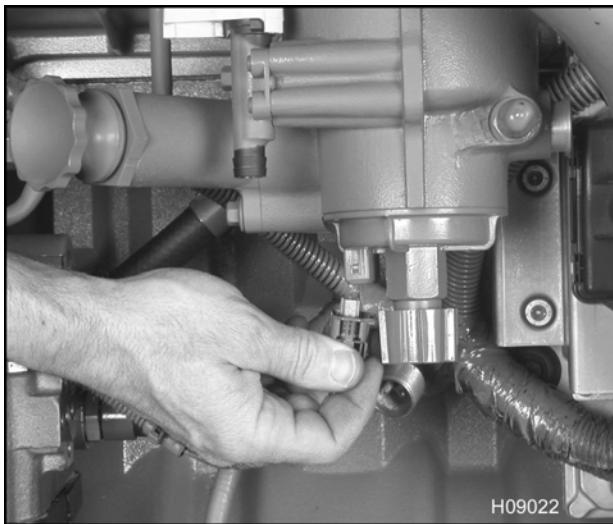
**Figure 423** Disconnecting the EOP sensor

10. Disconnect the wiring harness connector from the EOP sensor.



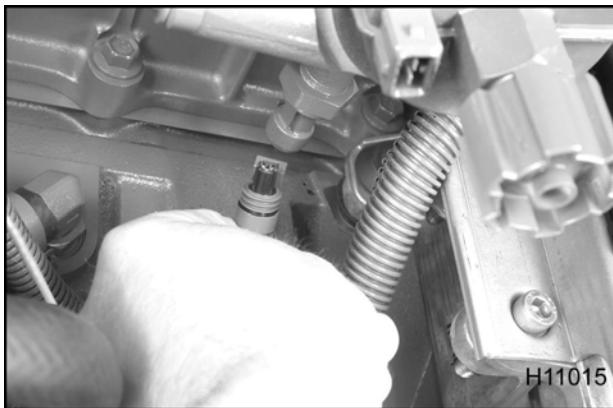
**Figure 424** Disconnecting the block heater

11. Disconnect the block heater cable (optional).



**Figure 425** Disconnecting the fuel heater connector

12. Disconnect the wiring harness connector from the fuel heater (optional).



**Figure 426** Disconnecting the fuel pressure sensor

13. Disconnect the wiring harness connector from the fuel pressure sensor (optional).



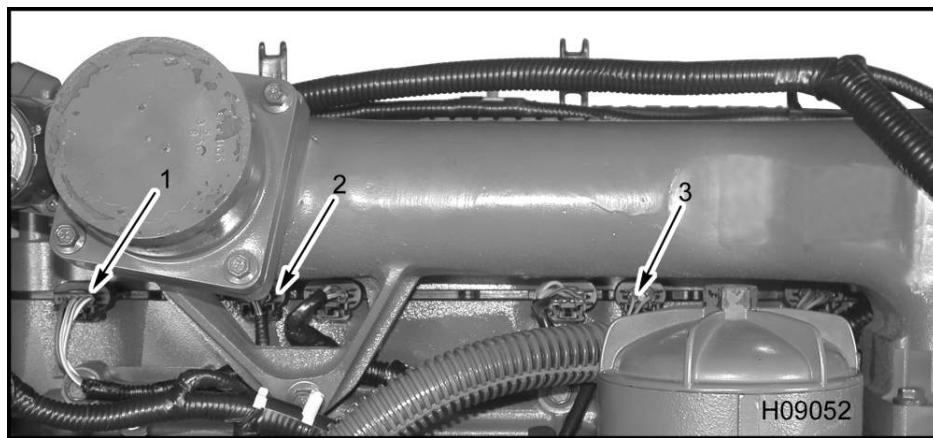
**Figure 427** Disconnecting the WIF sensor

14. Disconnect the wiring harness connector from the WIF sensor.



**Figure 428** Disconnecting the CKP sensor

15. Disconnect the wiring harness connector from the CKP sensor.
16. Disconnect two additional, three wire connectors for the BCP sensor connector and brake shutoff valve connector to the valve cover gasket (optional).



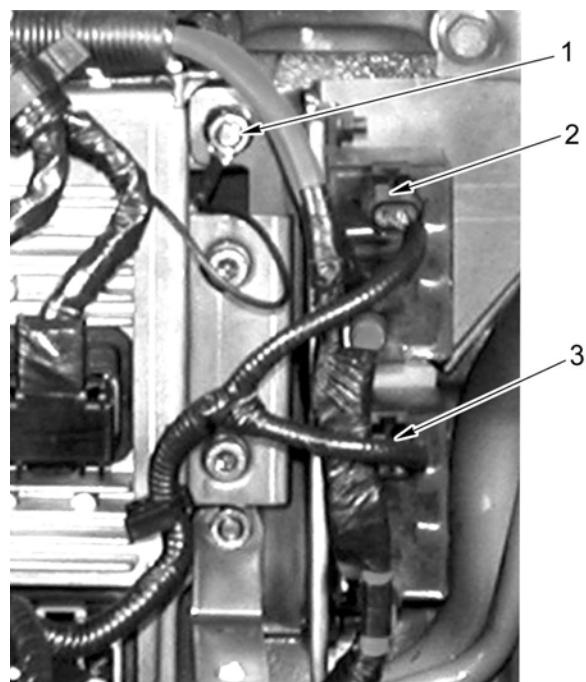
**Figure 429 BCP, Brake shutoff valve, and injector locations**

- |                                    |  |
|------------------------------------|--|
| 1. Injector connector (6)          | 3. Brake shutoff connector<br>(optional) |
| 2. BCP sensor connector (optional) |  |
17. Disconnect one, three wire ICP connector from valve cover gasket.
18. Disconnect wiring harness at EGR drive module.
19. Disconnect one IDM connector. This is the one of three IDM connectors in the most forward position on the IDM.
20. Disconnect two ECM engine connectors. These are the two connectors towards the rear of the ECM.



**Figure 430 12 wire engine connector**

21. Disconnect one, 12 wire engine connector.



**Figure 431 Intake air heater relay connectors (2)**

1. Injector shield ground nut
2. Top relay connector
3. Bottom relay connector

22. Disconnect two intake air heater relay connectors.

23. Remove injector shield ground nut.

24. Remove the sensor harness by disconnecting harness at the various tie down locations.

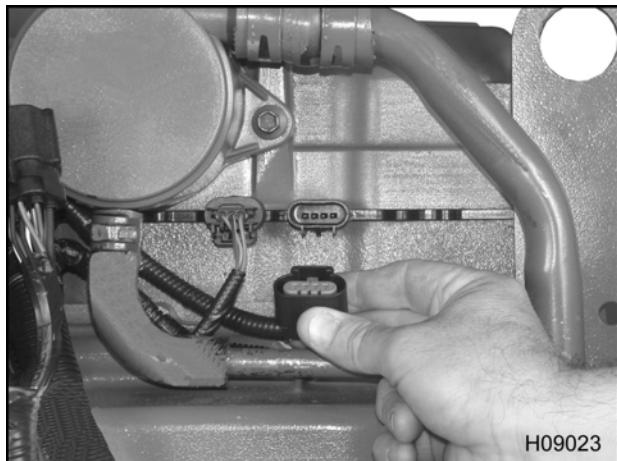
- If removing complete harness; sensor and injector harnesses, continue with injector harness removal before attempting to remove the sensor harness.

**Injector Wiring Harness**

**WARNING:** To avoid serious personal injury, possible death, or damage to the engine or vehicle, disconnect the main negative battery terminal before removing or installing any electrical components.

**CAUTION:** To avoid engine damage, make sure the key is in the OFF position before unplugging the connector or relay for the ECM, IDM, and EGR drive module. Failure to turn the key to the OFF position will cause a voltage spike and damage the electrical components.

**CAUTION:** To avoid engine damage, do not tug on any wiring harnesses while trying to remove them. If resistance is felt, find the source of resistance and free up any connectors or clips that are caught before proceeding. If necessary, remove the valve cover to gain clearance for injector harness.



**Figure 432** Disconnecting the No. 6 fuel injector connector

1. Disconnect six, four wire injector connectors from valve cover gasket.
- If only removing the injector harness, separate it from the sensor harness and remove from various tie down locations.
- If removing both the sensor and injector harnesses together, it is assumed the sensor harness removal procedure was followed by removing both harnesses at the various tie down locations.

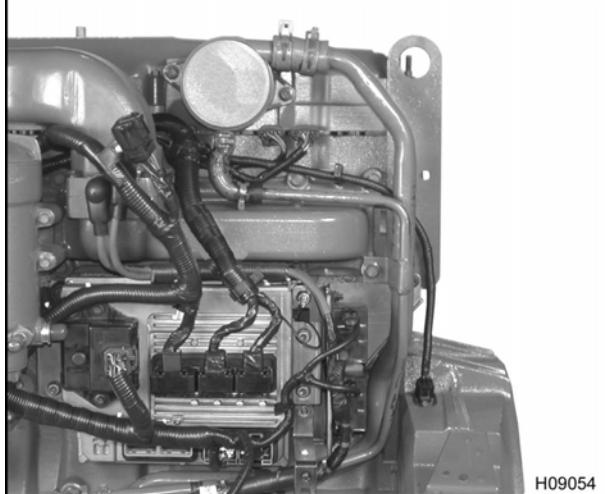
### ECM, IDM, EGR Drive Module, and Intake Air Heater



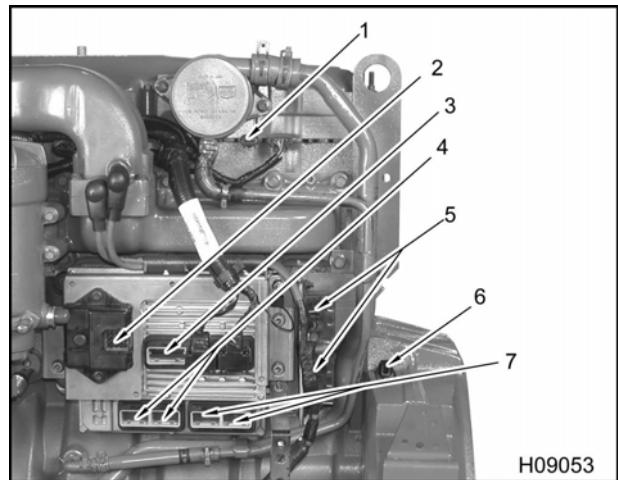
**WARNING:** To avoid serious personal injury, possible death, or damage to the engine or vehicle, disconnect the main negative battery terminal before removing or installing any electrical components.

**CAUTION:** To avoid engine damage, make sure the key is in the OFF position before unplugging the connector or relay for the ECM, IDM, and EGR drive module. Failure to turn the key to the OFF position will cause a voltage spike and damage the electrical components.

**CAUTION:** To avoid engine damage, do not tug on any wiring harnesses while trying to remove them. If resistance is felt, find the source of resistance and free up any connectors or clips that are caught before proceeding.



**Figure 433** ECM, IDM, EGR drive module, and tube assembly overview



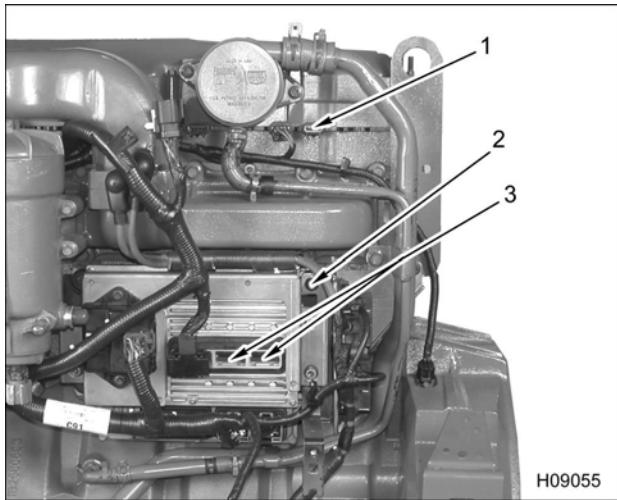
**Figure 434** ECM and sensor harness locations

1. ICP sensor connector
2. EGR drive module
3. IDM connector
4. ECM chassis connectors (2)
5. Intake air heater relay connections (2)
6. CKP sensor
7. ECM engine connectors (2)

#### Disconnecting the sensor wiring harness at the drive modules.

1. Disconnect the ICP connector from the valve cover connection.
2. Disconnect the EGR drive module.
3. Disconnect the IDM connector.
4. Disconnect two ECM chassis connectors.
5. Disconnect two intake air heater relay connectors.
6. Disconnect the CKP sensor.
7. Disconnect two ECM engine connectors.

### Injector wiring harness at ECM and IDM drive modules

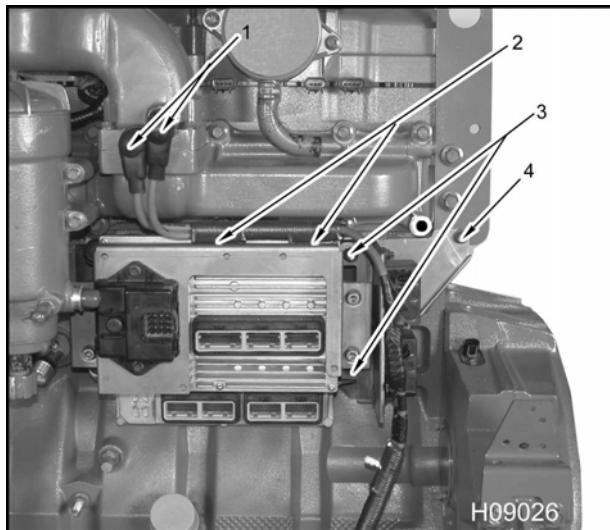


**Figure 435 Injector harness locations**

1. Injector connectors (6)
2. Injector shield ground stud connection
3. IDM connectors (2)
  
8. Disconnect six injector connectors from the valve cover gasket.
9. Disconnect the injector shield ground stud connection.
10. Disconnect two IDM connectors.
11. Disconnect two ECM engine connectors.
12. Disconnect two ECM chassis connectors.

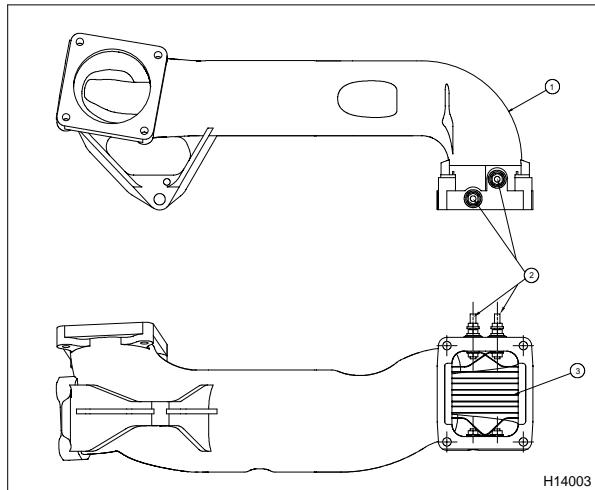
### Intake Air Heater Wiring Harness Assembly

13. Disconnect intake air heater cable at starter solenoid.



**Figure 436 Intake air heater and relay wiring harness**

1. Intake air heater mounting nuts (2)
2. Intake air heater wiring harness tie downs
3. Intake air heater mounting nut stud bolts (2)
4. Intake air heater and relay bracket mounting bolt

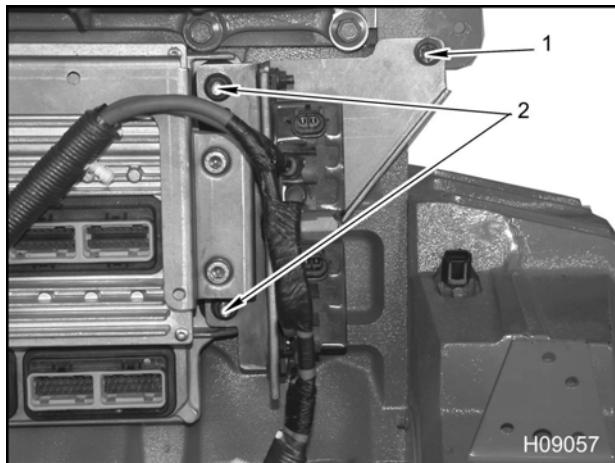


**Figure 437 Intake air heater cable locations**

1. Inlet and EGR mixer
2. Intake air heater cable locations
3. Intake air heater element

14. Remove two intake air heater mounting nuts under boot protectors.

15. Pull up on intake air heater wiring harness to disengage two tie down locations from ECM / IDM bracket.

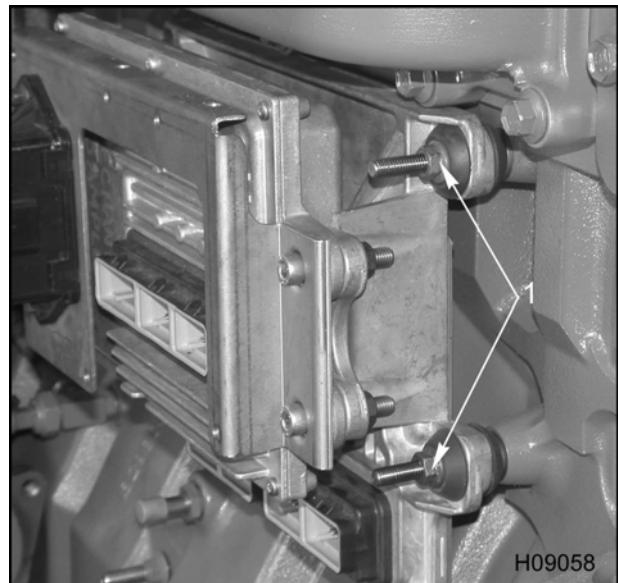


**Figure 438 Intake air heater relay bracket**

1. Heater relay bracket bolt, M6 x 20 and nut, M6
2. Heater relay bracket nuts, M8 (2)

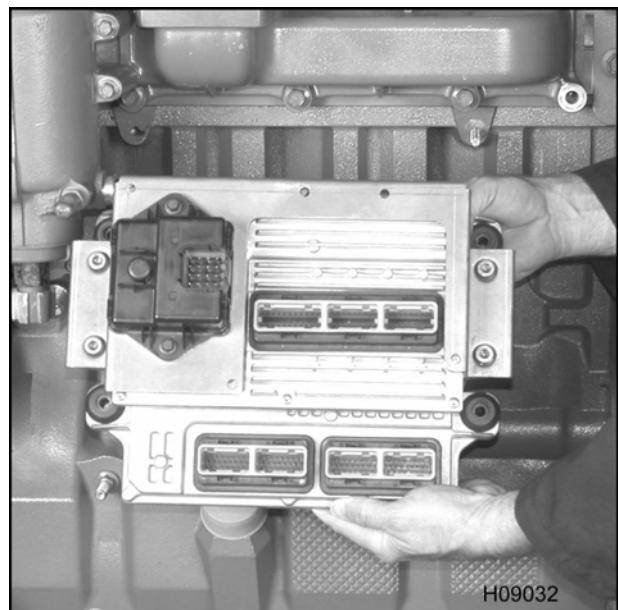
16. Remove two intake air heater mounting nuts (M6) and heater relay bracket bolt (M6 x 20) and nut (M6).
17. Remove intake air heater bracket with harness assembly.

**NOTE:** Heater relay bracket and heater wiring harness are removed as an assembly. There is no need to disconnect the air heater wiring harness connectors from the air heater relays.



**Figure 439 ECM, IDM, and EGR drive module assembly (side view)**

1. Module assembly mounting stud bolts
18. Remove two module assembly to engine mounting stud bolts on right side (M8 x 45/19).
19. Remove two module assembly mounting bolts on left side (M8 x 45).



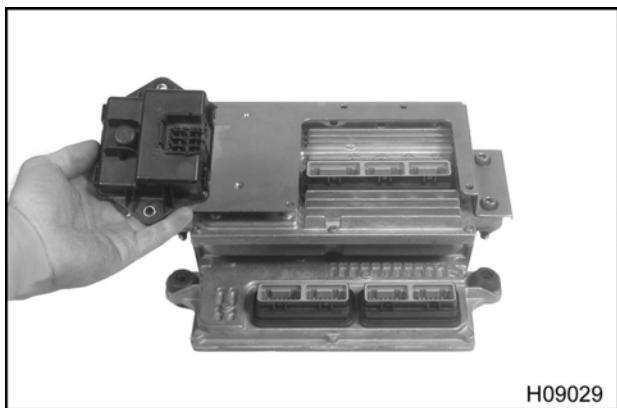
**Figure 440 ECM, IDM, and EGR drive module assembly**

20. Remove module assembly.

**NOTE:** The ECM, IDM, and EGR drive module can be removed as a single unit and disassembled on a workbench, or they can be replaced individually on the engine. It will be disassembled on a workbench for illustrative purposes.

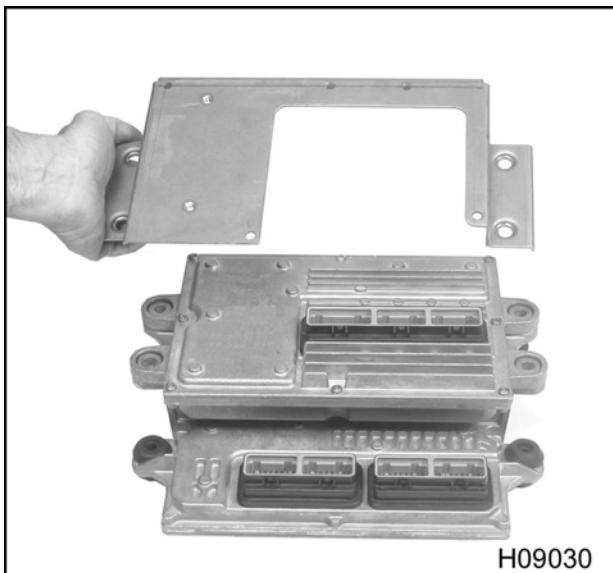


**Figure 441 EGR drive module, IDM, and ECM assembly**



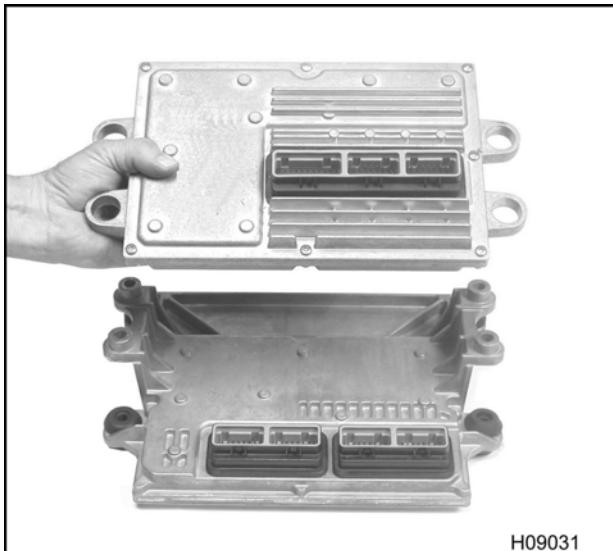
**Figure 442 EGR drive module**

21. Remove two bolts (M6 x 16) securing EGR drive module to the ECM / IDM bracket and lift off.



**Figure 443 ECM / IDM bracket**

22. Remove four bolts (M8 x 40) securing the ECM / IDM bracket to both modules then remove bracket.



**Figure 444 Removing IDM from ECM**

23. Both IDM and ECM modules can now be separated.

### Valve Cover Gasket with Pass-Through Connectors



**WARNING:** To avoid serious personal injury, possible death, or damage to the engine or vehicle, disconnect the main negative battery terminal before removing or installing any electrical components.

**CAUTION:** To avoid engine damage, make sure the key is in the OFF position before unplugging the connector or relay for the ECM, IDM, and EGR drive module. Failure to turn the key to the OFF position will cause a voltage spike and damage the electrical components.

**CAUTION:** To avoid engine damage, do not tug on any wiring harnesses while trying to remove them. If resistance is felt, find the source of resistance and free up any connectors or clips that are caught before proceeding.

**NOTE:** When removing, disconnecting, or installing the brake shutoff valve, ICP and BCP sensors, the valve cover must be removed.

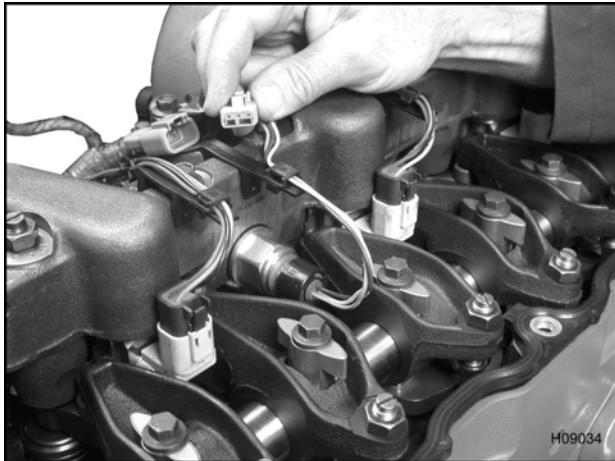


Figure 445 Disconnecting the ICP sensor

1. Disconnect the wiring harness connector from the ICP sensor.



Figure 446 Disconnecting the BCP sensor

2. Disconnect the wiring harness connector from the BCP sensor (optional).

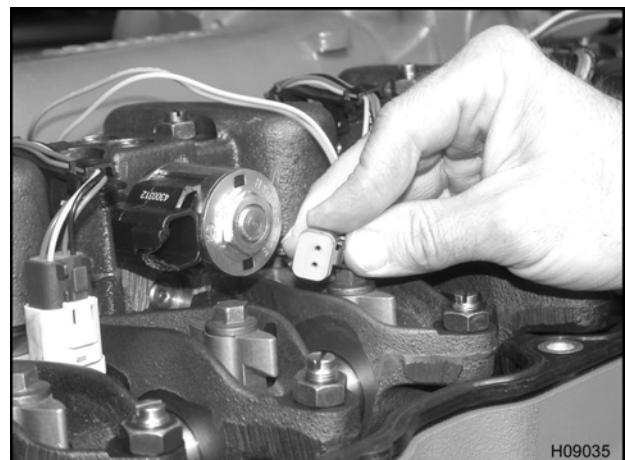
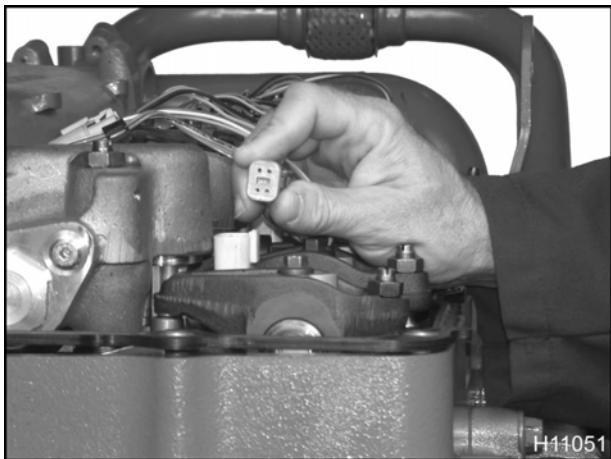


Figure 447 Brake shutoff valve connector

3. Disconnect the wiring harness connector from the Brake shutoff valve (optional).



4. Disconnect the wiring harness connector from each of the six injectors.
5. Disconnect from the valve cover gasket.
6. Release valve cover harness by unclipping from the high-pressure oil manifold.

**Figure 448 Injector connector**

## Cleaning and Inspection

### Checking Wiring Harness and Electrical Connectors

1. Check the connector pins on all electrical components. If any pins are bent, replace component.
2. Check each wiring harness for worn flexible conduit, and heat damage to wiring. Repair or replace each wiring harness as necessary.
3. Check each wiring harness connector for corrosion (green or gray and white deposits on the terminals), female connector sleeves that are spread open, and terminals that are pushed back relative to the other terminals in the same connector. Replace damaged connectors and terminals as necessary.