

## SYMPTOM DIAGNOSIS

### IMPORTANT PRELIMINARY CHECKS

**Important:** Several symptom procedures call for a careful visual/physical inspection. Always perform the visual/physical test first. Visual inspections may lead to

correcting a problem without further checks and can save valuable time.

Step	Action	Value(s)	Yes	No
1	Perform the On-Board Diagnostic (EOBD) System Check. Are any Diagnostic Trouble Code(s) (DTCs) stored in the Engine Control Module (ECM) memory?	-	Go to Appropriate DTC Table	Go to <i>Step 2</i>
2	1. Inspect all of the ECM ground connections. 2. Inspect all of the vacuum hoses for splits, kinks, and proper connections. 3. Check for air leaks at all of the mounting areas of the intake manifold sealing surfaces. 4. Inspect the ignition wires for cracking, hardness, proper routing, and carbon tracking. 5. Inspect the wiring for proper connections, pinches, and cuts. Are all checks complete?	-	Go to Appropriate Symptom Table	-

## INTERMITTENT

Definition: The problem may or may not illuminate the Malfunction Indicator Lamp (MIL) or store a Diagnostic Trouble Code (DTC).

present in order to locate the problem. If a fault is intermittent, use of Diagnostic Trouble Code tables may result in the replacement of good parts.

**Important:** Do not use the Diagnostic Trouble Code (DTC) tables for intermittent problems. A fault must be

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	-	Go to <i>Step 2</i>	Go to "Important Preliminary Checks"
2	<ol style="list-style-type: none"> <li>1. Perform a careful inspection of any suspect circuits.</li> <li>2. Inspect for poor mating of the connector halves, or terminals not fully seated into the connector body.</li> <li>3. Inspect for improperly formed or damaged terminals.</li> <li>4. Inspect for poor terminal-to-wire connections. This requires removing the terminal from the connector body to inspect it.</li> </ol> Are any problems present?	-	Go to <i>Step 3</i>	Go to <i>Step 4</i>
3	Repair the electrical connections as needed. Is the repair complete?	-	System OK	-
4	Road test the vehicle with a voltmeter connected to a suspected circuit or a scan tool connected to the Data Link Connector (DLC). Did the voltmeter or the scan tool indicate an abnormal voltage or scan reading?	-	Go to <i>Step 5</i>	Go to <i>Step 6</i>
5	Replace the sensor in the affected circuit, if a Diagnostic Trouble Code (DTC) was stored for this circuit (except for the DTCs P0171 and P0172). Is the repair complete?	-	System OK	-
6	Does an intermittent Malfunction Indicator Lamp (MIL) or DTC occur?	-	Go to <i>Step 7</i>	Go to <i>Step 8</i>
7	<ol style="list-style-type: none"> <li>1. Check for a faulty relay, Engine Control Module (ECM) driven solenoid, or switch.</li> <li>2. Check for improper installation of electrical devices, such as lights, two-way radios, electric motors, etc.</li> <li>3. Inspect the ignition control wires for proper routing (away from ignition wires, ignition system components, and the generator).</li> <li>4. Check for a short-to-ground in the MIL circuit or the DLC "test" terminal.</li> <li>5. Inspect the ECM ground connections.</li> <li>6. Correct or repair the affected circuits as needed.</li> </ol> Is the repair complete?	-	System OK	-
8	<ol style="list-style-type: none"> <li>1. Check for a loss of DTC memory.</li> <li>2. Disconnect the throttle position (TP) sensor.</li> <li>3. Run the engine at idle until the MIL comes on.</li> <li>4. Turn the ignition OFF.</li> </ol> Is DTC P0122 stored in memory?	-	Go to <i>Step 10</i>	Go to <i>Step 9</i>

## Intermittent (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	System OK	–
10	Does the vehicle stall while driving?	–	Go to <i>Step 11</i>	Go to <i>Step 12</i>
11	Monitor the oxygen sensor and the injector base pulse width with the scan tool. Does the scan tool display a steady low voltage (about 0 millivolts) for the oxygen sensor with the control module commanding an injector base pulse width of the value specified?	8 ms	Go to <i>Step 9</i>	Go to <i>Step 12</i>
12	1. Check for an open diode across the A/C clutch and for other open diodes. 2. Repair or replace any components as needed. Is the repair complete?	–	System OK	–

## HARD START

**Definition:** The engine cranks OK, but does not start for a long time. The engine eventually runs or may start and immediately die.

**Important:** Ensure that the driver is using the correct starting procedure. Before diagnosing, check service bulletins for updates.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	-	Go to <i>Step 2</i>	Go to "Important Preliminary Checks"
2	<ol style="list-style-type: none"> <li>1. Connect the scan tool to the Data Link Connector (DLC).</li> <li>2. Check the Engine Coolant Temperature (ECT) sensor and the Intake Air Temperature (IAT) sensor using the scan tool.</li> <li>3. Compare the coolant temperature and the IAT with the ambient temperature when the engine is cold.</li> </ol> Do the ECT and the IAT readings differ from the ambient temperature by more than the value specified?	3°C (5°F)	Go to <i>Step 3</i>	Go to <i>Step 4</i>
3	<ol style="list-style-type: none"> <li>1. Measure the resistance of the ECT sensor and the IAT sensor.</li> <li>2. Compare the resistance value to specifications using the Temperature Vs. Resistance tables for DTCs P0118 and P0113.</li> <li>3. If the resistance is not the same, replace the faulty sensor.</li> </ol> Is the repair complete?	-	System OK	-
4	<ol style="list-style-type: none"> <li>1. Check for a sticking throttle shaft or a binding linkage that may cause a high Throttle Position (TP) sensor voltage. Repair or replace as needed.</li> <li>2. Check the TP sensor voltage reading with the throttle closed.</li> </ol> Does the voltage measure within the value specified?	0.4–0.8 V	Go to <i>Step 5</i>	Go to <i>Step 26</i>
5	<ol style="list-style-type: none"> <li>1. Check the Manifold Absolute Pressure (MAP) sensor response and accuracy.</li> <li>2. Replace the MAP sensor as needed.</li> </ol> Is the repair complete?	-	System OK	Go to <i>Step 6</i>
6	Check the fuel pump operation. Does the fuel pump operate for the specified time when the ignition switch is turned ON?	2 sec	Go to <i>Step 7</i>	Go to "Fuel Pump Relay Circuit Check"
7	Check the fuel system pressure. Is the fuel pressure within the specifications?	380 kPa (55 psi)	Go to <i>Step 8</i>	Go to <i>Step 27</i>
8	Check for water contamination in the fuel. Is fuel contaminated?	-	Go to <i>Step 9</i>	Go to <i>Step 10</i>
9	Replace the contaminated fuel. Is the repair complete?	-	System OK	-

## Hard Start (Cont'd)

Step	Action	Value(s)	Yes	No
10	<ol style="list-style-type: none"> <li>1. Check the fuel injector driver circuit.</li> <li>2. Disconnect all of the fuel injector harness connectors at the fuel injectors.</li> <li>3. Connect an injector test light between the harness terminals of each fuel injector connector.</li> <li>4. Note the test light while cranking the engine.</li> </ol> Does the test light blink at all connectors?	–	Go to Step 13	Go to Step 11
11	Check the fuel injector driver wiring harness, the connectors, and the connector terminals for the proper connections. Is the problem found?	–	Go to Step 12	Go to Step 28
12	Repair the wiring harness, the connector, or the connector terminal as needed. Is the repair complete?	–	System OK	–
13	Measure the resistance of each fuel injector. Is the fuel injector resistance within the value specified at 20°C (68°F) <b>Note:</b> The resistance will increase slightly at higher temperatures)?	11.6–12.4 Ω	Go to Step 15	Go to Step 14
14	Replace any fuel injector with a resistance that is out of specifications. Is the repair complete?	–	System OK	–
15	Perform an injector diagnosis. Is the problem found?	–	Go to Step 16	Go to Step 17
16	Replace any restricted or leaking fuel injectors as needed. Is the repair complete?	–	System OK	–
17	<ol style="list-style-type: none"> <li>1. Check for the proper ignition voltage output for each cylinder with a spark tester.</li> <li>2. Inspect the spark plugs for cracks, wear, improper gap, burned electrodes, or heavy deposits.</li> <li>3. Inspect the ignition wires for short conditions.</li> <li>4. Inspect all of the ignition grounds for loose connections.</li> <li>5. Inspect the Engine Control Module (ECM) for the proper operation.</li> </ol> Is the problem found?	–	Go to Step 18	Go to Step 19
18	Correct or replace any faulty ignition components. Is the repair complete?	–	System OK	–
19	Does the engine misfire or cut out under load or at idle?	–	Go to "Ignition System Check"	Go to Step 20
20	Does the engine start, but then immediately stall?	–	Go to Step 21	Go to Step 23
21	<ol style="list-style-type: none"> <li>1. Remove the Crankshaft Position (CKP) sensor.</li> <li>2. Inspect for faulty connections and repair as needed.</li> </ol> Is the problem found?	–	Go to Step 22	Go to Step 25
22	Repair the faulty connections as needed. Is the repair complete?	–	System OK	–

## Hard Start (Cont'd)

Step	Action	Value(s)	Yes	No
23	1. Check for the proper valve timing. 2. Check the cylinder compression. 3. Inspect the pushrods, the rocker arms, the valve springs, and the camshaft lobes for excessive wear. 4. Inspect the intake manifold and the exhaust manifold passages for casting flash. Is the problem found?	–	Go to <i>Step 24</i>	Go to <i>Step 25</i>
24	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
25	Check the idle air control valve operation. Repair or replace components as needed. Is the repair complete?	–	System OK	–
26	Check the throttle position sensor circuit for proper operation. Repair or replace components as needed. Is the repair complete?	–	System OK	–
27	Repair the fuel system as needed. Is the repair complete?	–	System OK	–
28	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	System OK	–

## SURGES OR CHUGGLES

Definition: Engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and slows down with no change in the accelerator pedal position.

**Important:** Make sure the driver understands A/C compressor operation as described in the owner's manual.

The speedometer reading and the speed reading on the scan tool should be equal.

Before diagnosing the symptom, check service bulletins for updates.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to <i>Step 2</i>	Go to "Important Preliminary Checks"
2	Connect the scan tool to the Data Link Connector (DLC). Does the oxygen sensor (O2S) respond quickly to different throttle positions?	–	Go to <i>Step 4</i>	Go to <i>Step 3</i>
3	1. Check the O2S for silicone or other contaminants from fuel or use of improper Room Temperature Vulcanizing (RTV) sealant. 2. Replace the contaminated O2S. Is the repair complete?	–	System OK	–
4	1. Drive the vehicle at the speed of the complaint. 2. Monitor the long term fuel trim reading using the scan tool. Is the long term fuel trim reading within the value specified?	–20–25%	Go to <i>Step 7</i>	Go to <i>Step 5</i>
5	Is the long term fuel trim reading below the value specified?	–20%	Go to "Diagnostic Aids for DTC P0172"	Go to <i>Step 6</i>
6	Is the long term fuel trim reading above the value specified?	25%	Go to "Diagnostic Aids for DTC P0171"	–
7	Check the fuel system pressure while the condition exists. Is the fuel system pressure within specifications?	380 kPa (55 psi)	Go to <i>Step 8</i>	Go to <i>Step 17</i>
8	Check the in-line fuel filter. Is the filter dirty or plugged?	–	Go to <i>Step 18</i>	Go to <i>Step 9</i>
9	Perform an injector diagnosis. Did the injector diagnosis pinpoint the problem?	–	Go to <i>Step 19</i>	Go to <i>Step 10</i>
10	1. Check for proper ignition voltage output using a spark tester. 2. Inspect the spark plugs for cracks, wear, improper gap, burned electrodes, or heavy deposits. Is the problem found?	–	Go to <i>Step 11</i>	Go to <i>Step 12</i>
11	Repair or replace any ignition system components as needed. Is the repair complete?	–	System OK	–
12	1. Inspect the ECM grounds for being clean, tight, and in their proper locations. 2. Inspect the vacuum lines for kinks or leaks. Is the problem found?	–	Go to <i>Step 13</i>	Go to <i>Step 14</i>

## Surges or Chuggles (Cont'd)

Step	Action	Value(s)	Yes	No
13	Repair the electrical connections or the vacuum lines as needed. Is the repair complete?	–	System OK	–
14	Check the generator output voltage. Is the generator voltage within the value specified?	12–16 V	Go to <i>Step 16</i>	Go to <i>Step 15</i>
15	Repair the generator. Is the repair complete?	–	System OK	–
16	1. Check for intermittent Electric Exhaust Gas Recirculation (EEGR) valve operation. 2. Repair or replace any components as needed. Is the repair complete?	–	System OK	–
17	Repair the fuel system as needed. Is the repair complete?	–	System OK	–
18	Replace the fuel filter. Is the repair complete?	–	System OK	–
19	Replace the leaking or restricted fuel injectors. Is the repair complete?	–	System OK	–



## LACK OF POWER, SLUGGISHNESS, OR SPONGINESS

Definition: The engine delivers less than expected power. There is little or no increase in speed when the accelerator pedal is partially applied.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to <i>Step 2</i>	Go to “Important Preliminary Checks”
2	1. Verify the customer’s complaint. 2. Compare the performance of the customer’s vehicle with a similar unit. Does the problem exist?	–	Go to <i>Step 3</i>	System OK
3	1. Inspect the air filter for excessive contamination. 2. Replace the air filter as needed. 3. Check the transaxle shift pattern and down shift operation. Does the transaxle operate properly?	–	Go to <i>Step 4</i>	Go to <i>Step 5</i>
4	Check the fuel system pressure. Is the fuel system pressure within specifications?	380 kPa (55 psi)	Go to <i>Step 7</i>	Go to <i>Step 6</i>
5	Repair the transaxle as needed. Is the repair complete?	–	System OK	–
6	Repair the fuel system as needed. Is the repair complete?	–	System OK	–
7	Check for a restricted fuel filter or contaminated fuel. Is the problem found?	–	Go to <i>Step 8</i>	Go to <i>Step 9</i>
8	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
9	1. Check the ignition system output for all of the cylinders using a spark tester. 2. Check for proper ignition control operation. Is the ignition system operating properly?	–	Go to <i>Step 10</i>	Go to <i>Step 11</i>
10	1. With the engine at normal operating temperature, connect a vacuum gauge to a vacuum port on the intake manifold. 2. Operate the engine at 1000 rpm. 3. Record the vacuum reading. 4. Increase the engine speed to 2500 rpm. 5. Note the vacuum reading at a steady 2500 rpm. Does the vacuum decrease more than the value specified?	10 kPa (3 in Hg)	Go to <i>Step 12</i>	Go to <i>Step 15</i>
11	Repair or replace any ignition system components as needed. Is the repair complete?	–	System OK	–
12	Inspect the exhaust system for restrictions and damaged or collapsed pipes. Is the problem found?	–	Go to <i>Step 13</i>	Go to <i>Step 14</i>
13	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
14	1. Check the cylinder compression and valve timing. 2. Inspect the camshaft for excessive wear. Is the problem found?	–	Go to <i>Step 15</i>	Go to <i>Step 16</i>

**Lack of Power, Sluggishness, or Sponginess (Cont'd)**

<b>Step</b>	<b>Action</b>	<b>Value(s)</b>	<b>Yes</b>	<b>No</b>
15	Repair or replace any engine components as needed. Is the repair complete?	-	System OK	-
16	1. Check the Engine Control Module (ECM) grounds for being clean, tight, and in their proper location. 2. Check the exhaust recirculation valve for being open or partially open all the time. 3. Check the torque converter clutch operation. 4. Check the A/C system operation. 5. Check the generator output. 6. Repair the generator if the output is not within the specified range. Are all checks and repairs complete?	12-16 V	System OK	-

## DETONATION/SPARK KNOCK

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	-	Go to <i>Step 2</i>	Go to "Important Preliminary Checks"
2	1. Fill the fuel tank with a known good grade of gasoline that has the octane rating of the value specified. 2. Reevaluate the vehicle's performance. Does the detonation problem still exist?	91 octane	Go to <i>Step 3</i>	System OK
3	1. Inspect for low engine coolant level. 2. Check for restricted airflow to the radiator or restricted coolant flow. 3. Check for a faulty thermostat. 4. Check for an incorrect coolant solution. Is the problem found?	-	Go to <i>Step 4</i>	Go to <i>Step 5</i>
4	Repair or replace any cooling system components as needed. Is the repair complete?	-	System OK	-
5	1. Check the engine coolant temperature using the scan tool. 2. Replace the Engine Coolant Temperature (ECT) sensor if the resistance is not within specifications as listed in the Diagnostic Aids for diagnostic trouble code P0118. Is the problem found?	-	Go to <i>Step 6</i>	Go to <i>Step 7</i>
6	Replace the ECT sensor or repair the circuit as needed. Is the repair complete?	-	System OK	-
7	1. Check the ignition system output with a spark tester. 2. Inspect the spark plugs for the proper heat range and gap. 3. Check for the proper operation of the ignition controls. Is the ignition system operating properly?	-	Go to <i>Step 9</i>	Go to <i>Step 8</i>
8	Repair or replace the ignition system components as needed. Is the repair complete?	-	System Ok	-
9	1. Connect the scan tool to the Data Link Connector (DLC). 2. Road test the vehicle at the speed of the complaint. 3. Monitor the long term fuel trim reading from the scanner data stream. Is the long term fuel trim reading above the value specified?	25%	Go to "Diagnostic Aids for DTC P0171"	Go to <i>Step 10</i>
10	Check the fuel system pressure. Is the problem found?	380 kPa (55 psi)	Go to <i>Step 11</i>	Go to <i>Step 12</i>
11	Repair or replace the fuel system components as needed. Is the repair complete?	-	System OK	-

**Detonation/Spark Knock (Cont'd)**

<b>Step</b>	<b>Action</b>	<b>Value(s)</b>	<b>Yes</b>	<b>No</b>
12	<ol style="list-style-type: none"> <li>1. Inspect for carbon buildup inside the engine.</li> <li>2. Remove the carbon with a top engine cleaner. Follow the instructions supplied with the product.</li> <li>3. Check the basic engine parts such as the camshaft, the cylinder head, the pistons, etc. for excessive wear.</li> <li>4. Replace any excessively worn parts.</li> </ol> Is the procedure complete?	-	Go to <i>Step 13</i>	-
13	<ol style="list-style-type: none"> <li>1. Check the exhaust gas recirculation valve for proper operation.</li> <li>2. Check the air intake system for proper operation.</li> <li>3. Check the torque converter clutch operation and transaxle shift points.</li> <li>4. Check the service bulletins for Programmable Read Only Memory (PROM) updates.</li> <li>5. Check the cylinder compression.</li> <li>6. Repair or replace any faulty components.</li> </ol> Are all checks and repairs complete?	-	System OK	-

## HESITATION, SAG, STUMBLE

Definition: Momentary lack of response as the accelerator is pushed down. This can occur at any vehicle speed. It is usually the most severe when first trying to make the vehicle move, as from a stop. Hesitation, sag, or stumble may cause the engine to stall if severe enough.

**Important:** Before diagnosing this condition, check service bulletins for PROM updates.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to <i>Step 2</i>	Go to “Important Preliminary Checks”
2	1. Check the fuel system pressure. If the pressure is not within the value specified, service the fuel system as needed. 2. Inspect the Throttle Position (TP) sensor for binding or sticking. The TP sensor voltage should increase at a steady rate as the throttle is moved toward Wide Open Throttle (WOT). Is the problem found?	380 kPa (55 psi)	Go to <i>Step 3</i>	Go to <i>Step 4</i>
3	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
4	1. Check the Manifold Absolute Pressure (MAP) sensor response and accuracy. 2. Inspect the fuel for water contamination. 3. Check the Evaporative Emission (EVAP) Canister Purge System for proper operation. Is the problem found?	–	Go to <i>Step 5</i>	Go to <i>Step 6</i>
5	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
6	1. Disconnect all of the fuel injector harness connectors. 2. Connect an injector test light between the harness terminals of each fuel injector. 3. Note the test light while cranking the engine. Does the test light blink on all connectors?	–	Go to <i>Step 8</i>	Go to <i>Step 7</i>
7	1. Repair or replace the faulty fuel injector drive harness, the connector, or the connector terminal. 2. If the connections and the harnesses are good, replace the Engine Control Module (ECM). Is the repair complete?	–	System OK	–
8	Measure the resistance of each fuel injector. Is the fuel injector resistance within the value specified (the resistance will increase slightly at higher temperatures)?	11.6–12.4 $\Omega$	Go to <i>Step 10</i>	Go to <i>Step 9</i>
9	Replace any of the fuel injectors with a resistance that is out of specifications. Is the repair complete?	–	System OK	–
10	Perform an injector diagnosis. Is the problem found?	–	Go to <i>Step 11</i>	Go to <i>Step 12</i>
11	Replace any restricted or leaking fuel injectors. Is the repair complete?	–	System OK	–
12	Check the fuel system pressure after a cold start or during moderate or full throttle acceleration. Is the fuel pressure within specifications?	380 kPa (55 psi)	Go to <i>Step 14</i>	Go to <i>Step 13</i>

**Hesitation, Sag, Stumble (Cont'd)**

<b>Step</b>	<b>Action</b>	<b>Value(s)</b>	<b>Yes</b>	<b>No</b>
13	Repair the restriction in the fuel system or replace the faulty fuel pump. Is the repair complete?	–	System OK	–
14	1. Check for faulty ignition wires. 2. Inspect for fouled spark plugs. 3. Check the ignition system output on each cylinder with a spark tester. Is the problem found?	–	Go to <i>Step 15</i>	Go to <i>Step 16</i>
15	Repair or replace any ignition components as needed. Is the repair complete?	–	System OK	–
16	1. Check the generator output voltage. 2. Repair or replace the generator if the generator output is less than the value specified. 3. Check the Electric Exhaust Gas Recirculation (EEGR) valve operation. Are all checks and needed repairs complete?	–	System OK	–

## CUTS OUT, MISSES

Definition: Steady pulsation or jerking that follows engine speed, usually more pronounced as engine load in-

creases. The exhaust has a steady spitting sound at idle or low speed.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to <i>Step 2</i>	Go to “Important Preliminary Checks”
2	Check the ignition system voltage output for all of the cylinders using a spark tester. Is spark present on all of the cylinders?	–	Go to <i>Step 3</i>	Go to “Ignition System Check”
3	1. Inspect the spark plugs for excessive wear, insulation cracks, improper gap, or heavy deposits. 2. Check the resistance of the ignition wires. Replace any ignition wires that have a resistance greater than the value specified. Is the problem found?	30000 Ω	Go to <i>Step 4</i>	Go to <i>Step 5</i>
4	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
5	With the engine running, spray the ignition wires with a fine water mist to check for arcing and shorting to ground. Is the problem found?	–	Go to <i>Step 6</i>	Go to <i>Step 7</i>
6	Replace the ignition wires. Is the repair complete?	–	System OK	–
7	1. Perform a cylinder compression test. 2. If the compression is low, repair the engine as needed. 3. Inspect for proper valve timing, bent pushrods, worn rocker arms, broken or weak valve springs, and worn camshaft lobes. 4. Inspect the intake manifold and the exhaust manifold passages for casting flash. Is the problem found?	–	Go to <i>Step 8</i>	Go to <i>Step 9</i>
8	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
9	1. Check the fuel system for a plugged in-line fuel filter. 2. Check the fuel system for low fuel pressure. If the fuel pressure is below the value specified, service the fuel system as needed. 3. Inspect for contaminated fuel. Is the problem found?	380 kPa (55 psi)	Go to <i>Step 10</i>	Go to <i>Step 11</i>
10	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
11	1. Disconnect all of the fuel injector harness connectors at the fuel injectors. 2. Connect an injector test light to the harness terminals of each fuel injector connector. 3. Note the test light while cranking the engine for each fuel injector. Does the test light blink for all of the fuel injectors?	–	Go to <i>Step 13</i>	Go to <i>Step 12</i>

**Cuts Out, Misses (Cont'd)**

<b>Step</b>	<b>Action</b>	<b>Value(s)</b>	<b>Yes</b>	<b>No</b>
12	1. Repair or replace the faulty injector drive circuit harness, the connector, or the connector terminal. 2. If the connections and the harnesses are good, replace the Engine Control Module (ECM). Is the repair complete?	–	System OK	–
13	Measure the resistance of each fuel injector. Is the injector resistance within the value specified (the resistance will increase slightly at higher temperatures)?	11.6–12.4 $\Omega$	Go to <i>Step 15</i>	Go to <i>Step 14</i>
14	Replace any fuel injectors with a resistance that is out of specifications. Is the repair complete?	–	System OK	–
15	Perform an injector diagnosis. Is the problem found?	–	Go to <i>Step 16</i>	Go to <i>Step 17</i>
16	Replace any restricted or leaking fuel injectors. Is the repair complete?	–	System OK	–
17	1. Check for electromagnetic interference. 2. Monitor the engine rpm with a scan tool. Does the scan tool rpm change greatly with little change in actual engine rpm?	–	Go to <i>Step 18</i>	–
18	1. Inspect the routing of the ignition wires. 2. Inspect all of the ignition system grounds. 3. Correct the routing or repair the ground connections as needed. Are all checks and needed repairs complete?	–	System OK	–



### POOR FUEL ECONOMY

Definition: Fuel economy, as measured by an actual road test, is noticeably lower than expected. Also, fuel economy is noticeably lower than it was on this vehicle at one time, as previously shown by an actual road test.

**Important:** Driving habits affect fuel economy. Check the owner's driving habits by asking the following questions:

1. Is the A/C system (i.e. defroster mode) turned on all the time?
2. Are the tires at the correct air pressure?
3. Have excessively heavy loads been carried?
4. Does the driver accelerate too much and too often?  
Suggest the driver read the section in the owner's manual about fuel economy.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to <i>Step 2</i>	Go to "Important Preliminary Checks"
2	1. Inspect the air filter for excessive contamination. 2. Inspect for fuel system leaks. Are all needed checks complete?	–	Go to <i>Step 3</i>	–
3	1. Inspect the spark plugs for excessive wear, insulation cracks, improper gap, or heavy deposits. 2. Replace any faulty spark plugs. 3. Inspect the ignition wires for cracking, hardness, and proper connections. Are all needed checks and repairs complete?	–	Go to <i>Step 4</i>	–
4	1. Inspect the engine coolant level. 2. Check the thermostat for being always open or for an incorrect heat range. 3. Replace the thermostat as needed. Are all needed checks and repairs complete?	–	Go to <i>Step 4</i>	–
5	1. Check the transaxle shift pattern. Ensure all transaxle gears are functioning. 2. Check for proper calibration of the speedometer. 3. Check the brakes for dragging. 4. Check the cylinder compression. 5. Repair, replace, or adjust any components as needed. Are all checks and needed repairs complete?	–	System OK	–

## ROUGH, UNSTABLE, OR INCORRECT IDLE, STALLING

Definition: The engine runs unevenly at idle. If the condition is bad enough, the vehicle may shake. Also, the idle varies in rpm (called "hunting"). Either condition may be severe enough to cause stalling. The engine idles at incorrect idle speed.

**Important:** Before diagnosing the symptom, check service bulletins for updates.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to Step 2	Go to "Important Preliminary Checks"
2	1. Connect the scan tool to the Data Link Connector (DLC). 2. Monitor the oxygen sensor (O2S) reading at different throttle positions. Does the O2S change quickly from rich to lean at the different throttle positions?	–	Go to Step 5	Go to Step 3
3	Check the O2S for contamination from fuel or improper use of room temperature vulcanizing sealant. Is the O2S contaminated?	–	Go to Step 4	Go to Step 5
4	Replace the contaminated O2S as needed. Is the repair complete?	–	System OK	–
5	1. Check for a sticking throttle shaft or binding throttle linkage that may cause incorrect Throttle Position (TP) sensor voltage. 2. Check the TP sensor voltage reading with the throttle closed. Is the TP sensor voltage within the value specified?	0.4–0.8 V	Go to Step 6	Go to "Diagnostic Aids for DTC P0123"
6	1. Check the Engine Coolant Temperature (ECT) sensor voltage reading using the scan tool. 2. Compare the ECT sensor reading with the ambient temperature when the engine is cold. Does the ECT sensor temperature reading differ from the ambient temperature by more than the value specified?	3°C (5°F)	Go to Step 7	Go to Step 9
7	Check for high resistance in the ECT sensor circuit or the sensor itself. Is the problem found?	–	Go to Step 8	Go to Step 9
8	Replace the ECT sensor or repair the circuit as needed. Is the repair complete?	–	System OK	–
9	Check the Manifold Absolute Pressure (MAP) sensor for response and accuracy. Is the problem found?	–	Go to Step 10	Go to Step 11
10	Replace the MAP sensor or repair the MAP sensor circuit as needed. Is the repair complete?	–	System OK	–
11	1. Road test the vehicle at the speed of the complaint. 2. Monitor the long term fuel trim reading using the scan tool. Is the long term fuel trim reading within the value specified?	–20–25%	Go to Step 14	Go to Step 12

### Rough, Unstable, or Incorrect Idle, Stalling (Cont'd)

Step	Action	Value(s)	Yes	No
12	Is the long term fuel trim reading below the value specified?	-20%	Go to "Diagnostic Aids for DTC P0172"	Go to Step 13
13	Is the long term fuel trim reading above the value specified?	25%	Go to "Diagnostic Aids for DTC P0171"	-
14	<ol style="list-style-type: none"> <li>1. Disconnect all of the fuel injector harness connectors at the fuel injectors.</li> <li>2. Connect an injector test light between the harness terminals of each fuel injector connector.</li> <li>3. Note the test light while cranking the engine.</li> </ol> Does the test light blink for all of the fuel injectors?	-	Go to Step 16	Go to Step 15
15	<ol style="list-style-type: none"> <li>1. Repair or replace the faulty injector drive circuit harness, the connector, or the connector terminals as needed.</li> <li>2. If the harness, the connectors, and the terminals are OK, replace the Engine Control Module (ECM).</li> </ol> Is the repair complete?	-	System OK	-
16	Measure the resistance of each of the fuel injectors. Is the resistance within the value specified (the resistance will increase slightly at higher temperatures)?	11.6-12.4 $\Omega$	Go to Step 18	Go to Step 17
17	Replace any fuel injectors with a resistance that is out of specifications. Is the repair complete?	-	System OK	-
18	Perform an injector diagnosis. Is the problem found?	-	Go to Step 19	Go to Step 20
19	Replace any leaking or restricted fuel injectors. Is the repair complete?	-	System OK	-
20	<ol style="list-style-type: none"> <li>1. With the engine OFF, disconnect the fuel pressure regulator vacuum hose.</li> <li>2. Thoroughly inspect the fuel pressure regulator vacuum port and the fuel pressure regulator vacuum hose for the presence of fuel.</li> </ol> Is the problem found?	-	Go to Step 21	Go to Step 22
21	Replace the fuel pressure regulator as needed. Is the repair complete?	-	System OK	-
22	<ol style="list-style-type: none"> <li>1. Check the ignition system output voltage for all of the cylinders using a spark tester.</li> <li>2. Inspect the spark plugs for excessive wear, insulation cracks, improper gap, or heavy deposits.</li> <li>3. Inspect the ignition wires for cracking, hardness, or improper connections.</li> <li>4. Replace any ignition wires with a resistance over the value specified.</li> </ol> Is the problem found?	30000 $\Omega$	Go to Step 23	Go to Step 24
23	Repair or replace any ignition system components as needed. Is the repair complete?	-	System OK	-

**Rough, Unstable, or Incorrect Idle, Stalling (Cont'd)**

<b>Step</b>	<b>Action</b>	<b>Value(s)</b>	<b>Yes</b>	<b>No</b>
24	1. Inspect for vacuum leaks. 2. Check for proper Positive Crankcase Ventilation (PCV) operation. 3. Check the Idle Air Control (IAC) valve operation. 4. Inspect the ECM ground connections. Is the problem found?	–	Go to <i>Step 25</i>	Go to <i>Step 26</i>
25	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
26	1. Check the Electric Exhaust Gas Recirculation (EGR) valve for proper operation. 2. Inspect the battery cables and the ground straps for proper connections. 3. Check the generator voltage output. Repair or replace the generator if the voltage output is not within the value specified. Is the problem found?	12–16 V	Go to <i>Step 27</i>	Go to <i>Step 28</i>
27	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
28	1. Inspect for broken engine mounts. 2. Check for proper valve timing. 3. Perform a cylinder compression test. 4. Inspect for bent pushrods, worn rocker arms, broken or weak valve springs, and a worn camshaft. 5. Perform repairs as needed. Are all of the checks and needed repairs complete?	–	System OK	–

**EXCESSIVE EXHAUST EMISSIONS OR ODORS**

Definition: A vehicle fails an emission test. The vehicle has an excessive rotten egg smell. Excessive odors do not necessarily indicate excessive emissions.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to <i>Step 2</i>	Go to “Important Preliminary Checks”
2	1. Run the engine until it reaches operating temperature. 2. Perform an emission test. Did the vehicle pass the emission test?	–	System OK	Go to <i>Step 3</i>
3	1. Connect the scan tool to the Data Link Connector (DLC). 2. Road test the vehicle. 3. Monitor the long term fuel trim memory. Is the long term fuel trim memory within the value specified?	–20 – 25 %	Go to <i>Step 6</i>	Go to <i>Step 4</i>
4	Is the long term fuel trim memory below the value specified?	–20 %	Go to “Diagnostic Aids for DTC P0172”	Go to <i>Step 5</i>
5	Is the long term fuel trim memory above the value specified?	25 %	Go to “Diagnostic Aids for DTC P0171”	–
6	1. Check for a properly installed fuel cap. 2. Check the fuel system pressure. 3. Perform an injector diagnosis. Is the problem found?	–	Go to <i>Step 7</i>	Go to <i>Step 8</i>
7	1. Repair or replace any fuel system components as needed. 2. Perform an emission test. Did the vehicle pass the emission test?	–	System OK	–
8	1. Check the ignition system for proper operation. 2. Inspect the spark plugs for excessive wear, insulation cracks, improper gap, or heavy deposits. 3. Check the ignition wires for cracking, hardness, or improper connections. Is the problem found?	–	Go to <i>Step 9</i>	Go to <i>Step 10</i>
9	1. Repair or replace any ignition system components as needed. 2. Perform an emission test. Did the vehicle pass the emission test?	–	System OK	–

**Excessive Exhaust Emissions or Odors (Cont'd)**

Step	Action	Value(s)	Yes	No
10	1. Inspect for vacuum leaks. 2. Inspect the catalytic converter for contamination. 3. Inspect for carbon buildup on the throttle body and the throttle plate and inside the engine. Remove with a top engine cleaner. 4. Check the Electric Exhaust Gas Recirculation (EEGR) valve for not opening. 5. Check for proper Positive Crankcase Ventilation (PCV) operation. Are all checks and needed repairs complete?	-	System OK	-

**DIESELING, RUN-ON**

Definition: An engine continues to run after the ignition switch is turned OFF.

<b>Step</b>	<b>Action</b>	<b>Value(s)</b>	<b>Yes</b>	<b>No</b>
1	Were the Important Preliminary Checks performed?	–	Go to <i>Step 2</i>	Go to “Important Preliminary Checks”
2	Does the engine run smoothly after the ignition switch is turned OFF?	–	Go to <i>Step 3</i>	Go to <i>Step 4</i>
3	1. Check the ignition switch and the ignition switch adjustment. 2. Replace the ignition switch if needed. Is the repair complete?	–	System OK	–
4	1. Check the evaporative emission system. 2. Check for leaking fuel injectors. 3. Check the Idle Air Control (IAC) valve operation. 4. Inspect for vacuum leaks. 5. Check for the proper base idle setting. Are all checks and repairs complete?	–	System OK	–

**BACKFIRE**

Definition: Fuel ignites in the intake manifold, or in the exhaust system, making a loud popping noise.

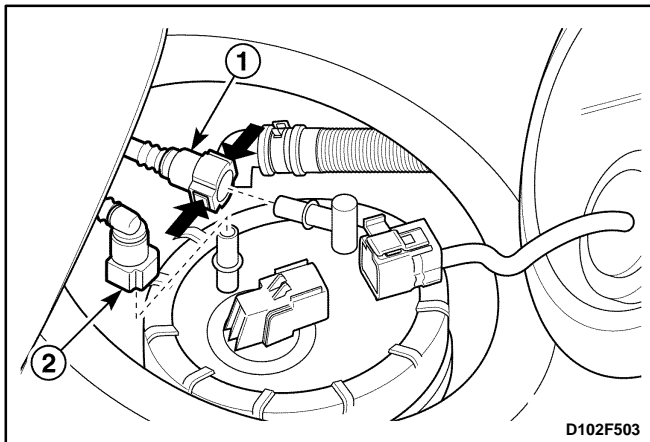
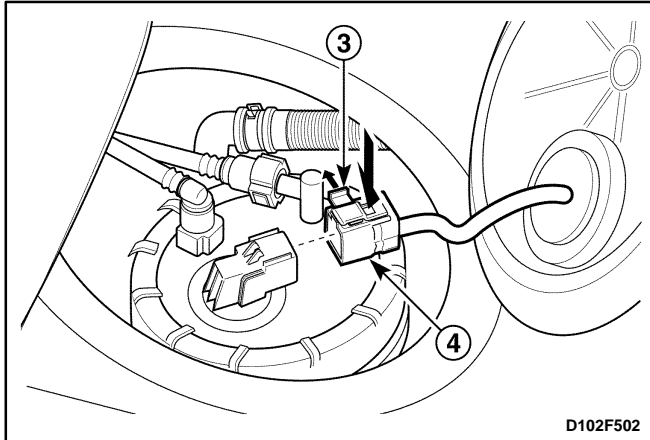
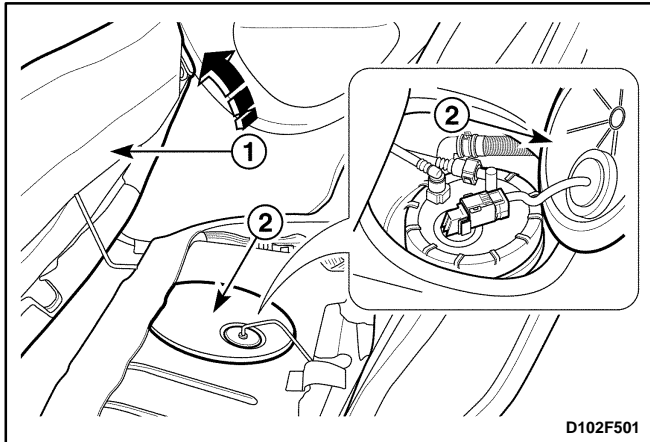
Important: Before diagnosing the symptom, check service bulletins for updates.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to <i>Step 2</i>	Go to “Important Preliminary Checks”
2	1. Inspect for crossed or crossfiring ignition wires. 2. Check the ignition system output voltage for all cylinders using a spark tester. 3. Inspect the spark plugs for excessive wear, burned electrodes, improper gap, or heavy deposits. Is the problem found?	–	Go to <i>Step 3</i>	Go to <i>Step 4</i>
3	Repair or replace any ignition system components as needed. Is the repair complete?	–	System OK	–
4	1. Check the fuel system operation. 2. Check the fuel injectors by performing an injector diagnosis. Is the problem found?	–	Go to <i>Step 5</i>	Go to <i>Step 6</i>
5	Repair or replace any fuel system components as needed. Is the repair complete?	–	System OK	–
6	1. Inspect the Electric Exhaust Gas Recirculation (EGR) gasket for a leak or a loose fit. 2. Check the EGR valve for proper operation. 3. Inspect the intake manifold and the exhaust manifold for a casting flash. Is the problem found?	–	Go to <i>Step 7</i>	Go to <i>Step 8</i>
7	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
8	1. Inspect the timing belt for proper installation and tension. 2. Check the engine compression. 3. Inspect the intake manifold gasket and the exhaust manifold gasket for leaks. 4. Check for sticking or leaking valves. 5. Repair or replace any components as needed. Are all checks and corrections complete?	–	System OK	–



# REPAIR INSTRUCTIONS

## ON-VEHICLE SERVICE



### FUEL PUMP

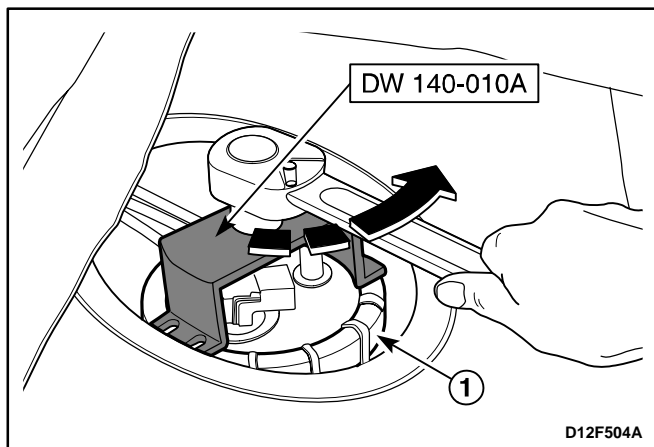
#### Tools Required

DW 140-010A Fuel Pump Lock Ring Remover/Installer.

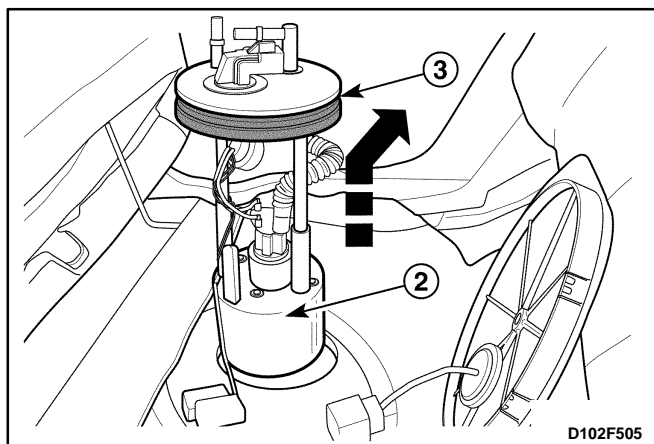
#### Removal Procedure

**Caution:** *The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.*

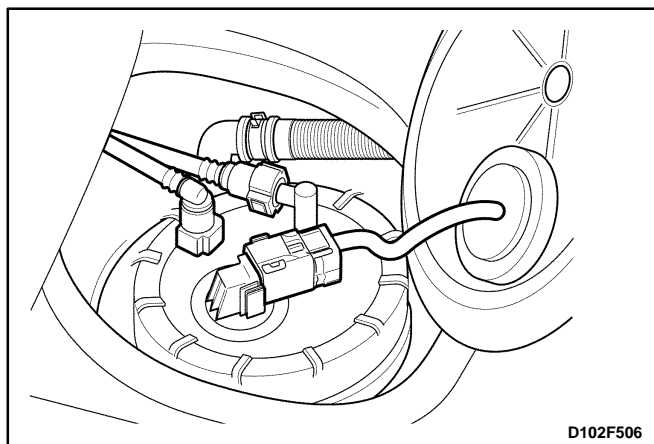
1. Relieve the fuel system pressure.
  - Start the engine and remove the rear seat cushion (1).
  - Remove the fuel pump access cover (2).
  - Disconnect the fuel pump assembly electrical connector lock pin (3).
  - Disconnect the fuel pump assembly electrical connector (4).
  - Crank the engine for an additional 10 seconds.
  
2. Disconnect the fuel lines from the fuel pump.
  - Disconnect the fuel outlet line (1).
  - Disconnect the fuel tank return line (2).



3. Remove the fuel pump assembly from the tank.
  - Install the fuel pump lock ring remover/installer DW 140-010A.
  - Turn the fuel tank lock ring counterclockwise (1).

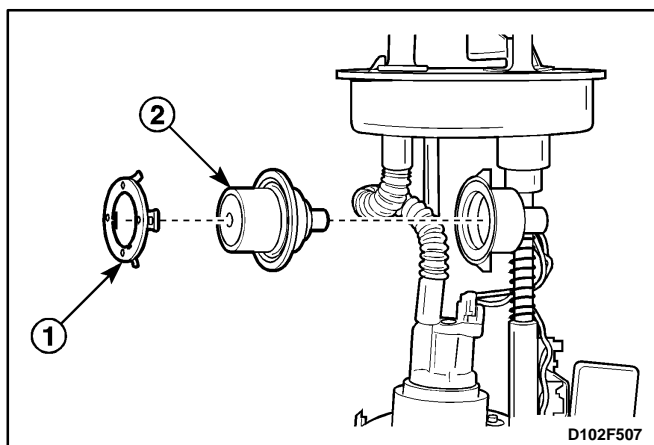


- Remove the fuel pump assembly (2).
- Remove the fuel pump gasket (3).



### Installation Procedure

1. Install in the reverse order of removal.
2. Perform an operational check of the fuel pump.
  - Perform an operational check of the ignition switch ON the 2 seconds fuel pump operation.

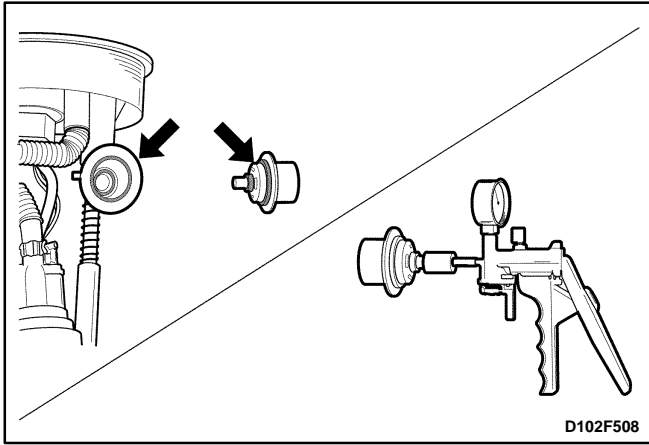


### FUEL PRESSURE REGULATOR

#### Removal Procedure

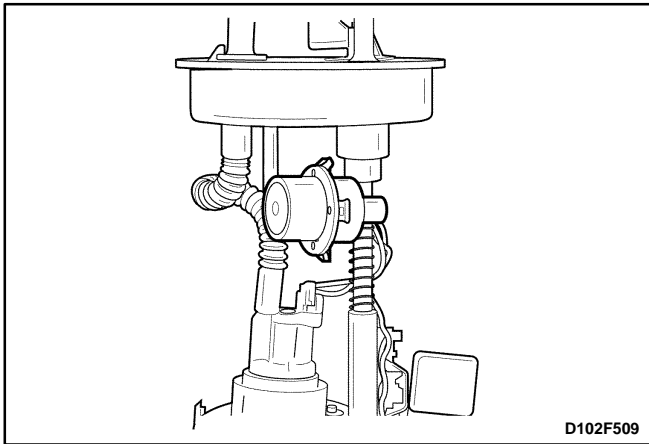
**Caution:** The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

1. Relieve the fuel system pressure after remove the fuel pump assembly. Refer to "Fuel Pump" in this section.



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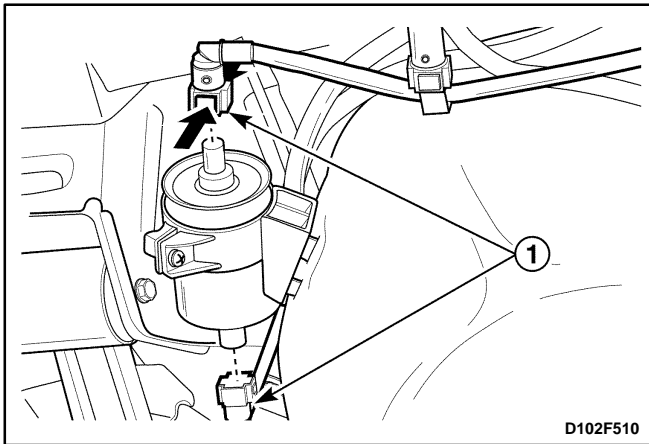
2. Remove the fuel pressure regulator from the fuel pump.
  - Remove the retainer from the fuel pump assembly (1).
  - Remove the fuel pressure regulator (2).
  - Check the O-ring seals for the damage or the rip.
  - Use a vacuum gauge to check the diaphragm for damage and the spring for operation.



D102F509

### Installation Procedure

1. Install in the reverse order of removal.
  - Do not reuse the removed O-ring seals. Replace the removed O-ring seals with the new ones.



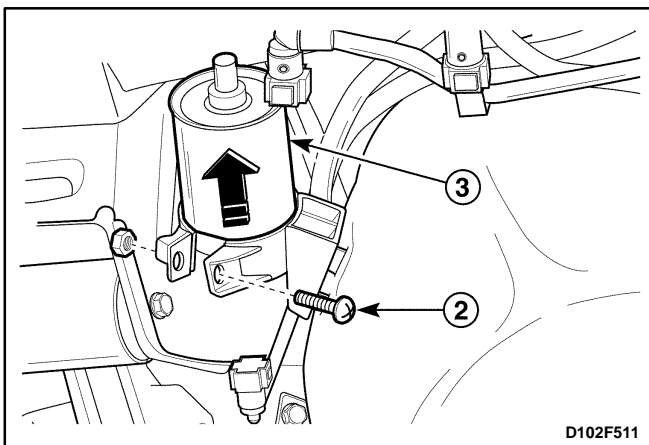
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## FUEL FILTER

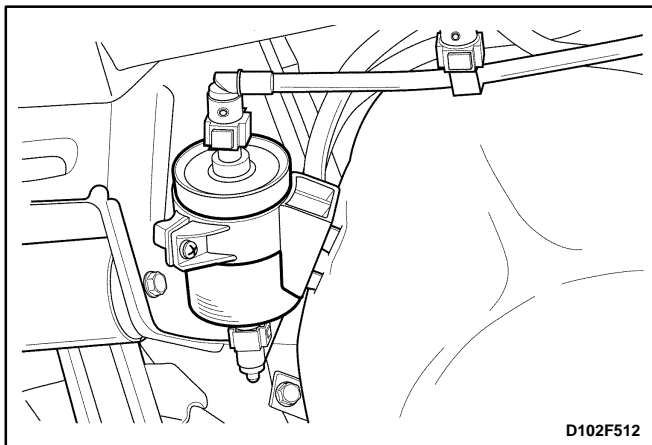
### Removal Procedure

**Caution:** The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

1. Relieve the fuel system pressure.  
Refer to "Fuel Pump" in this section.
2. Remove the fuel filter from the fuel tank.
  - Disconnect the inlet/outlet fuel lines by pushing the line connector lock and pulling off the hose of the fuel filter tube (1).
  - Remove the screw from the retaining clamp (2).
  - Remove the fuel filter (3).



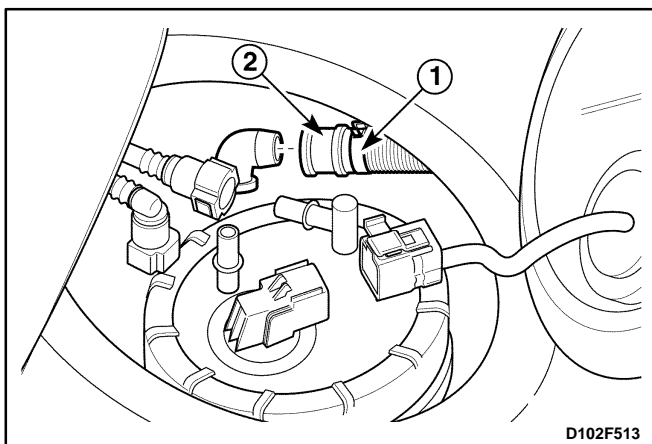
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D102F512

## Installation Procedure

1. Install in the reverse order of removal.
  - Install the new fuel filter into the retaining clamp. Note the flow direction.
  - Connect the inlet/outlet lines. Secure the lines with the connector lock.
  - Perform a leak test of the fuel filter.



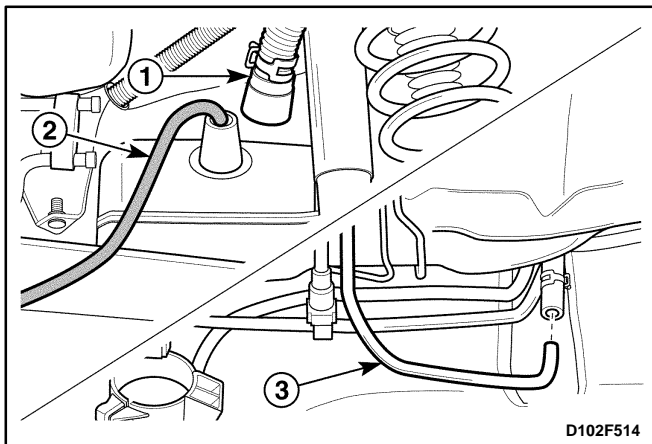
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## FUEL TANK

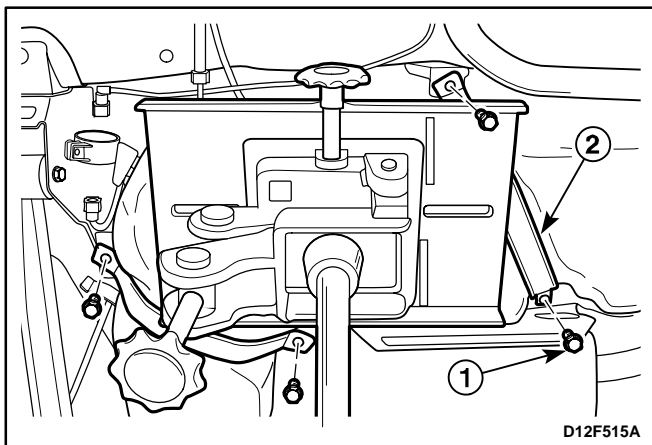
### Removal Procedure

**Caution:** The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

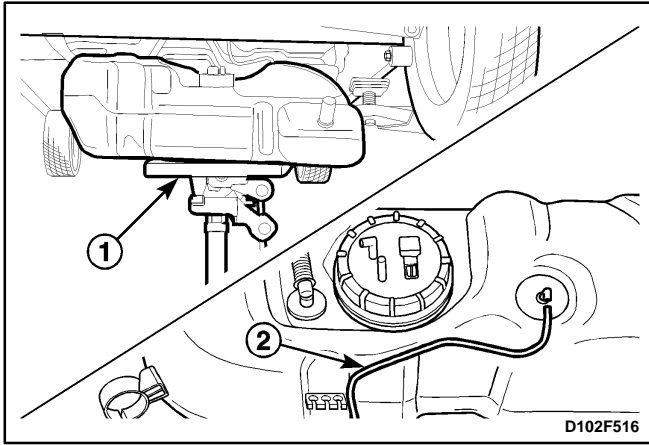
1. Relieve the fuel system pressure. Refer to "Fuel Pump" in this section.
2. Disconnect the fuel tank ventilation tube.
  - Disconnect the clamp (1).
  - Disconnect the ventilation tube (2).
3. Drain the fuel tank.
  - Place a pan below the fuel tank to catch the draining fuel.
  - Disconnect the fuel tank filter tube (1).
  - Drain the fuel from the fuel tank using the ventilation tube joint port (2).
  - Disconnect the evaporative emission canister line (3).
4. Remove the fuel filter. Refer to "Fuel Filter" in this section.
5. Install the jack to remove the fuel tank.
  - Install the jack on the center of the fuel tank.
  - Remove the strap bolts (1).
  - Remove the straps (2).



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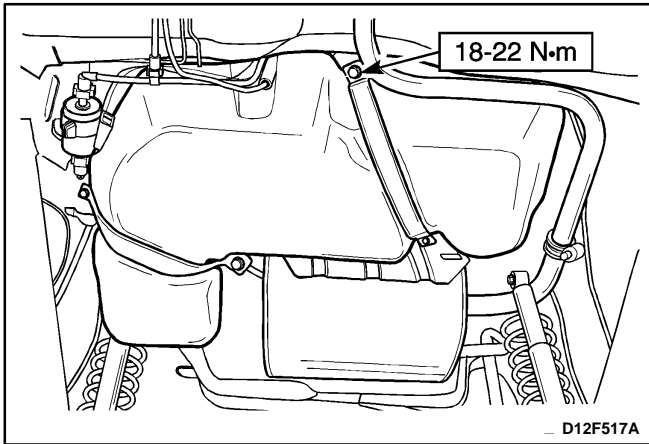


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6. Remove the fuel tank.

- Lower slowly the jack to remove the fuel tank easily (1).
- Disconnect the canister hose which is connected to the roll over valve from the fuel tank removed (2).
- Inspect the fuel tank for clacks, damages, and contaminations.
- Inspect the fuel lines for cracks and damages.



**Installation Procedure**

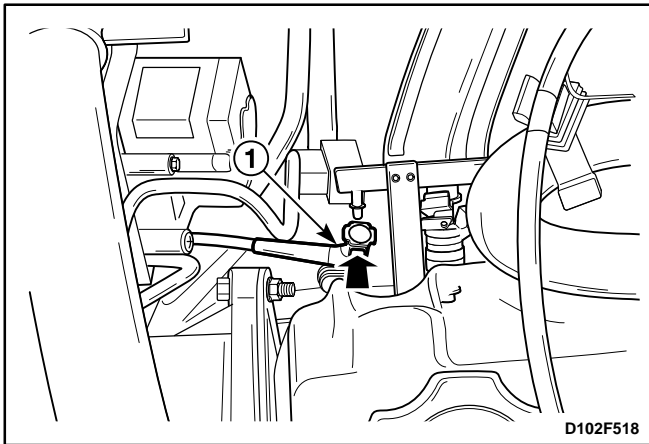
1. Install in the reverse order of removal.

- After the installation is complete, start the engine to prevent the vapor lock and check the hoses for leaks.

2. Install the fuel tank strap bolts.

**Tighten**

Tighten the fuel tank strap bolts to 18–22 N•m (13–16 lb-ft).



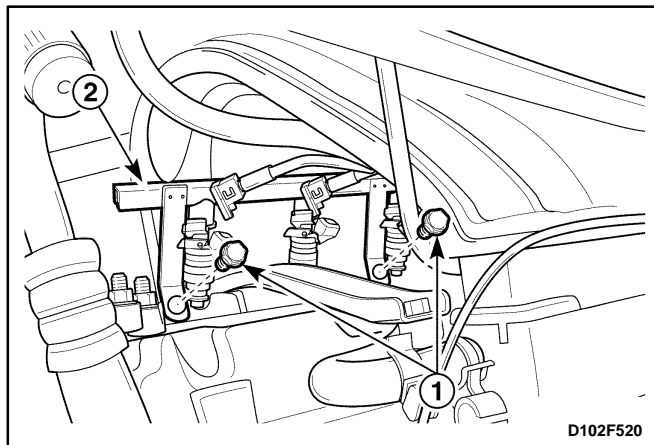
**FUEL RAIL AND INJECTORS**

**Removal Procedure**

**Caution:** The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

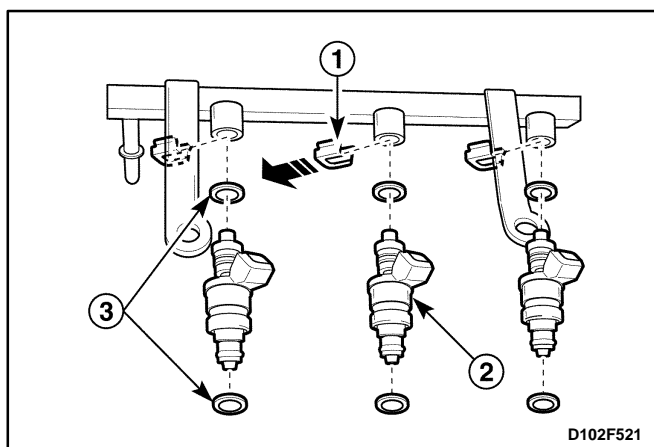
1. Relieve the fuel system pressure.  
Refer to “Fuel Pump” in this section.
2. Remove the canister from the engine room. Refer to “Evaporative Emission Canister” in this section.
3. Disconnect the fuel inlet line (1).
4. Disconnect the fuel injector harness connectors (2).





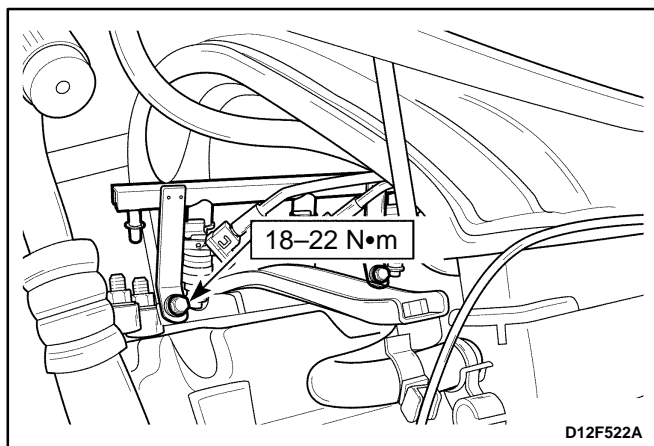
5. Remove the fuel rail with the fuel injectors attached.
  - Remove the bolts (1).
  - Remove the fuel rail with the fuel injectors attached (2).

**Notice:** Before removal, the fuel rail assembly may be cleaned with a spray-type cleaner, following package instructions. Do not immerse the fuel rails in liquid cleaning solvent. Use care in removing the fuel rail assembly to prevent damage to the electrical connectors and the injector spray tips. Prevent dirt and other contaminants from entering open lines and passages. Fittings should be capped and holes plugged during service.



6. Remove the injectors from the fuel rail.
  - Remove the fuel injector retainer clips (1).
  - Remove the fuel injectors by pulling them down and out (2).
  - Discard the fuel injector O-rings (3).

**Important:** Different fuel injectors are calibrated for different flow rates. When ordering new fuel injectors, be certain to order the identical part number that is inscribed on the old fuel injector.



### Installation Procedure

1. Install in the reverse order of removal.
 

**Important:** If a fuel injector becomes separated from the fuel rail and remains in the cylinder head, replace the fuel injector O-ring seals and the retaining clip.

  - Lubricate the new fuel injector O-rings with engine oil. Install the new O-rings on the fuel injectors.
2. Install the fuel rail retaining bolts.

### Tighten

Tighten the fuel rail retaining bolts to 18–22 N•m (13–16 lb-ft).

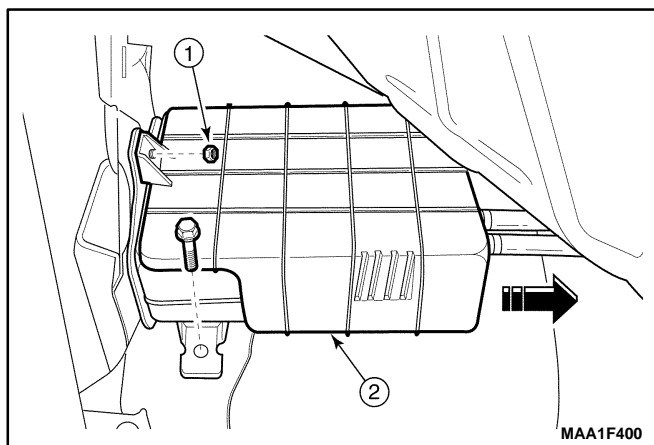
3. Perform a leak check of the fuel rail and the fuel injectors.

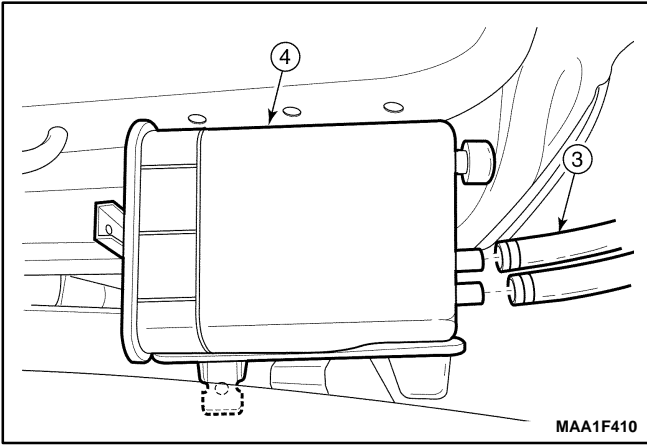
## EVAPORATIVE EMISSION CANISTER

### Removal Procedure

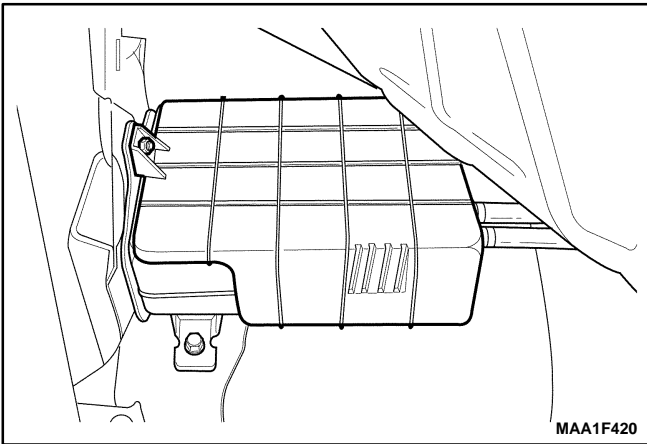
**Caution:** Canister and vacuum hoses contain fuel vapors. Do not smoke in the area or permit an open flame.

1. Disconnect the negative battery cable.
2. Remove the canister.
  - Remove the bolt (1).
  - Remove the nut, then remove the cover (2).



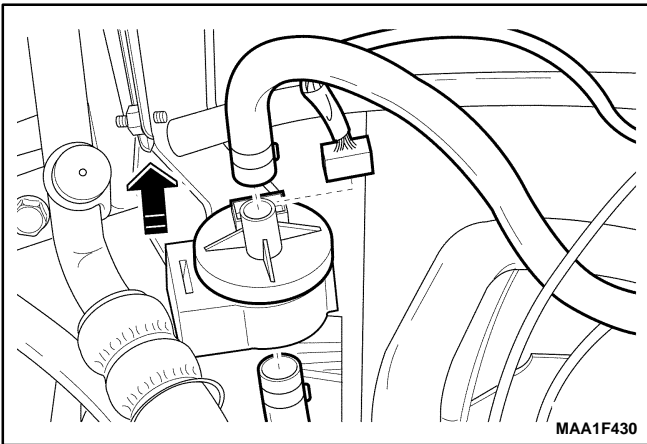


- Disconnect the canister hoses (3).
- Remove the evaporative emission canister (4).



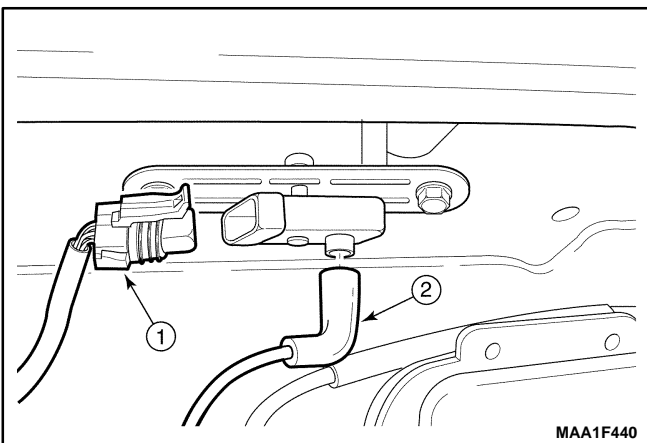
### Installation Procedure

1. Install in the reverse order of removal.



### EVAPORATIVE EMISSION CANISTER PURGE SOLENOID

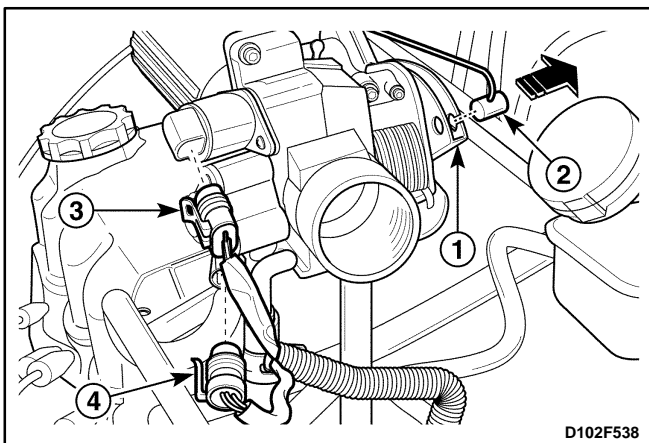
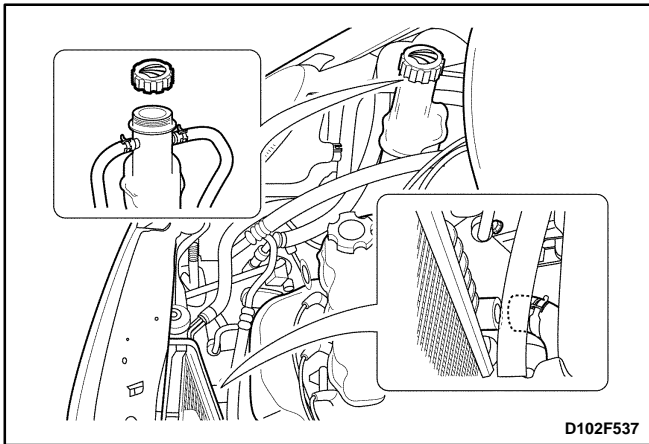
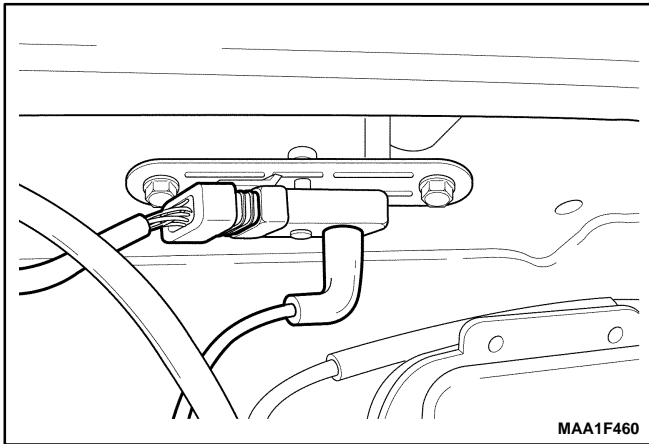
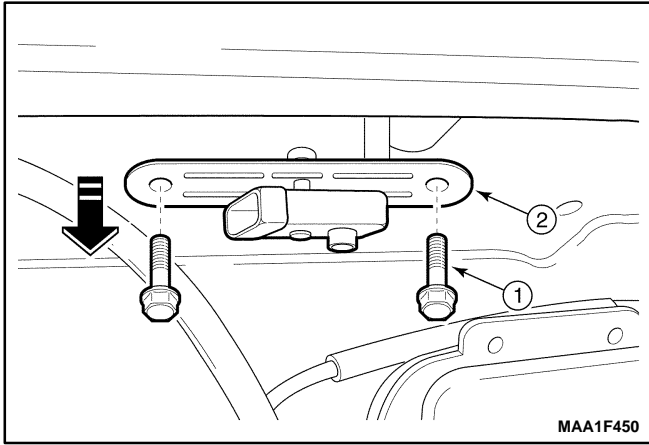
1. Disconnect the negative battery cable.
2. Disconnect the evaporative (EVAP) emission canister purge solenoid connector.
3. Disconnect the vacuum hoses from the EVAP canister purge solenoid.
4. Unclip the EVAP emission canister purge solenoid from the mounting bracket.
5. Installation should follow the removal procedure in the reverse order.



### MANIFOLD ABSOLUTE PRESSURE SENSOR

#### Removal Procedure

1. Disconnect the manifold absolute pressure (MAP) sensor connector and vacuum hose.
  - Disconnect the MAP connector (1).
  - Disconnect the vacuum hose from the MAP sensor (2).



2. Remove the MAP sensor.
  - Remove the bolts (1).
  - Remove the MAP sensor with bracket (2).

### Installatin Procedure

1. Install in the reverse order of removal.
  - Inspect the MAP sensor vacuum hose for the tear and damages.
2. Install the MAP sensor with the bolts and nuts.

### Tighten

Tighten the MAP sensor bolts/nuts to 8–12 N•m (71–106 lb-in).

Tighten the MAP sensor bracket bolt to 8–12 N•m (71–106 lb-in).

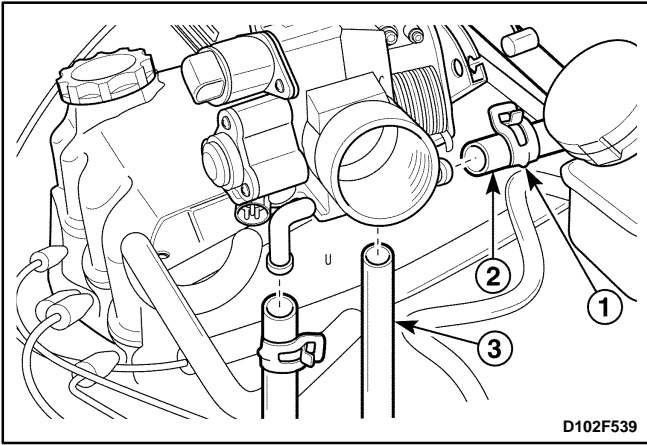
## THROTTLE BODY

### Removal Procedure

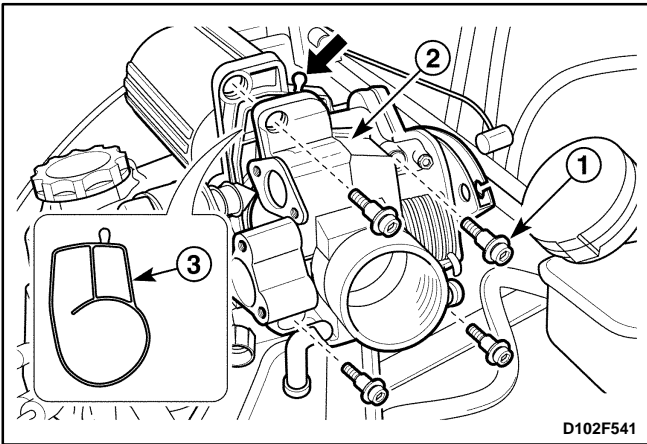
1. Remove the air cleaner/resonator assembly and air intake tube. Refer to *Section 1B, SOHC Engine Mechanical*.
2. Drain the engine coolant. Refer to *Section 1D, Engine Cooling*.

3. Disconnect the throttle cable, the throttle position sensor and the idle air control valve connectors.
  - Open the throttle valve (1).
  - Disconnect the throttle cable (2).
  - Disconnect the idle air control valve connector (3).
  - Disconnect the throttle position sensor connector (4).

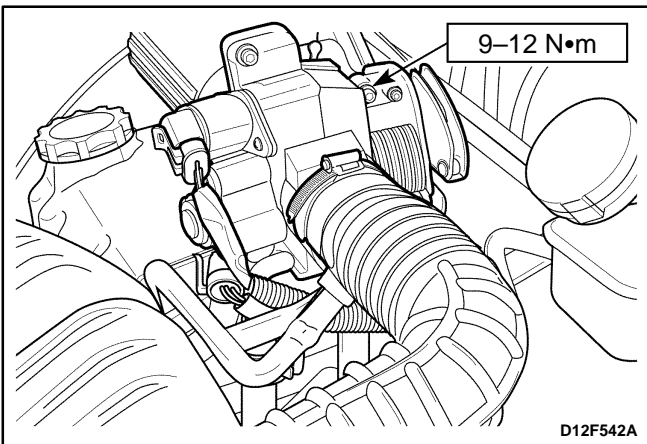




4. Disconnect the coolant hoses and vacuum hoses from the throttle body.
  - Loosen the clamps from the coolant hoses (1).
  - Disconnect the coolant hoses from the throttle body (2).
  - Disconnect the vacuum hoses (3).



5. Remove the throttle body from the intake manifold.
  - Remove the throttle body bolts (1).
  - Remove the throttle body (2).
  - Discard the throttle body gasket (3).
  - Inspect the throttle body gasket for the deformation and the damages.



### Installation Procedure

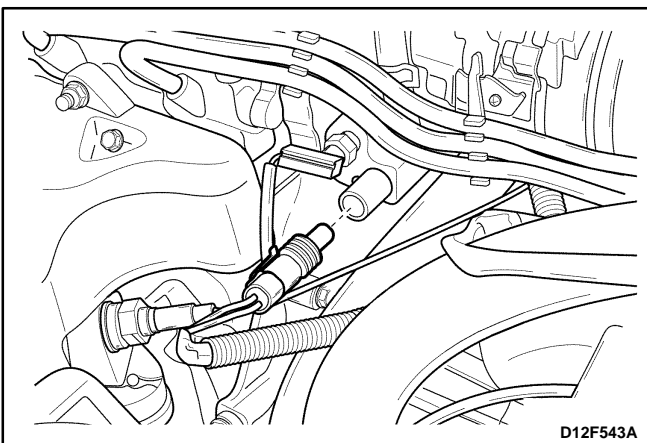
1. Install in the reverse order of removal.

**Important:** Make sure the throttle control cable do not hold the throttle open. With the engine OFF, check to see that the accelerator pedal is free.

2. Install the throttle body with the bolts.

### Tighten

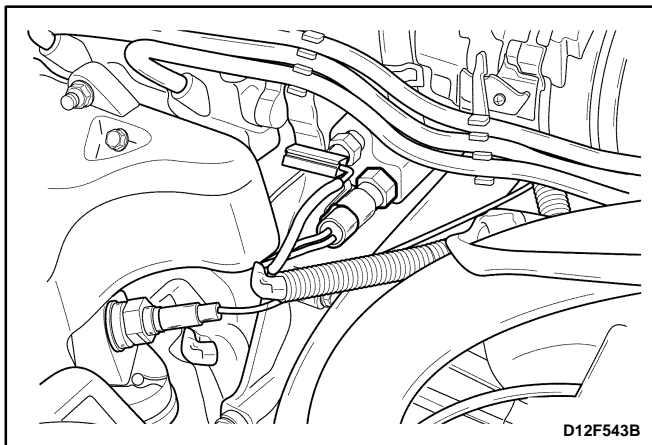
Tighten the throttle body bolts to 9-12 N•m (80-106 lb-in).



## ENGINE COOLANT TEMPERATURE (ECT) SENSOR

### Removal Procedure

1. Remove the engine coolant temperature (ECT) sensor. Refer to *Section 1D, Engine Coolings*.

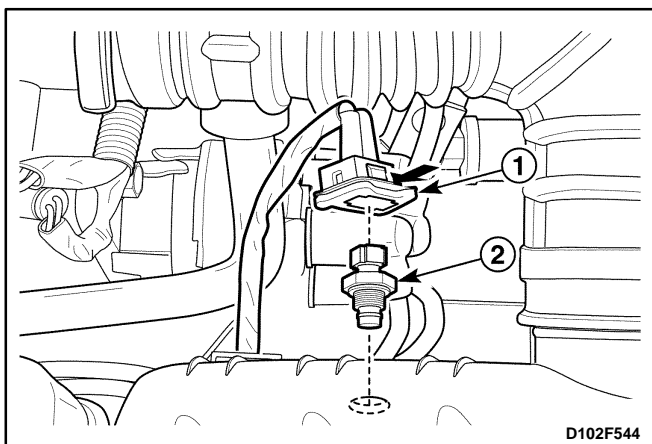


### Installation Procedure

1. Install the engine coolant temperature sensor.

#### Tighten

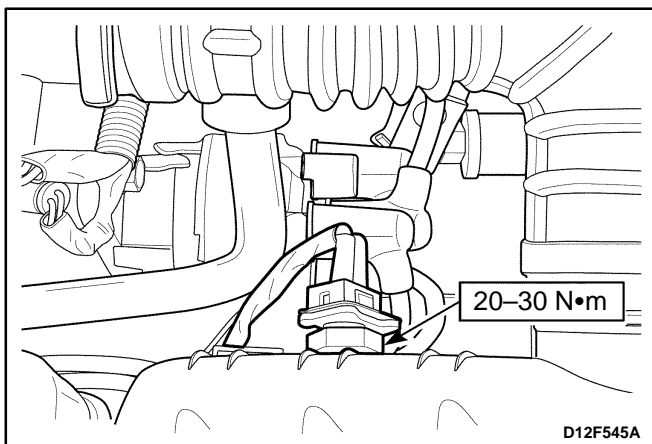
Tighten the engine coolant temperature sensor to 8–12 N•m (71–106 lb-ft).



### INTAKE AIR TEMPERATURE (IAT) SENSOR

#### Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the intake air temperature (IAT) sensor.
  - Disconnect the IAT sensor connector (1)
  - Disconnect the IAT sensor.

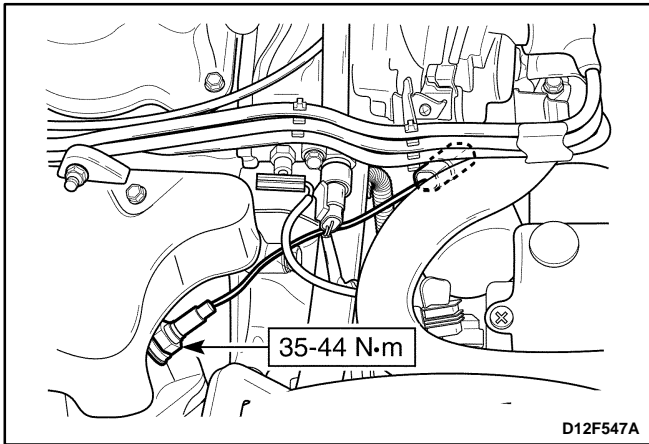
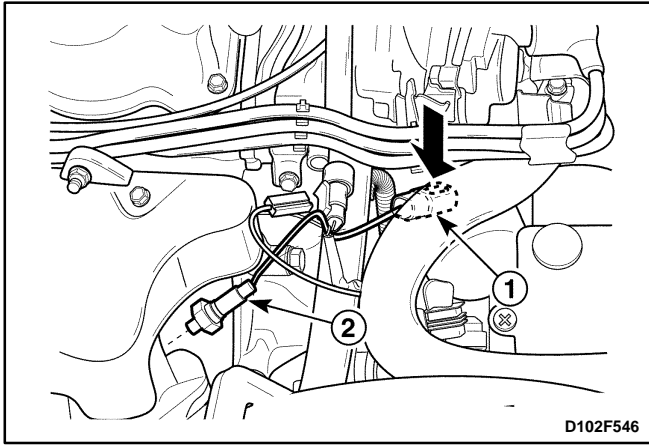


#### Installation Procedure

1. Install in the reverse order of removal.
2. Install the IAT sensor.

#### Tighten

Tighten the IAT sensor to 20–30 N•m (15–22 lb-ft).



## OXYGEN SENSOR (O2S1)

### Removal Procedure

1. Remove the air cleaner/resonator assembly. Refer to *Section 1B, SOHC Engine Mechanical*.
2. Remove the oxygen sensor.
  - Disconnect the oxygen sensor connector (1).
  - Remove the oxygen sensor (2).

**Notice:** The oxygen sensor uses a permanently attached pigtail and connector. This pigtail should not be removed from the oxygen sensor. Damage or removal of the pigtail or the connector could affect proper operation of the oxygen sensor. Take care when handling the oxygen sensor. Do not drop the oxygen sensor.

### Installation Procedure

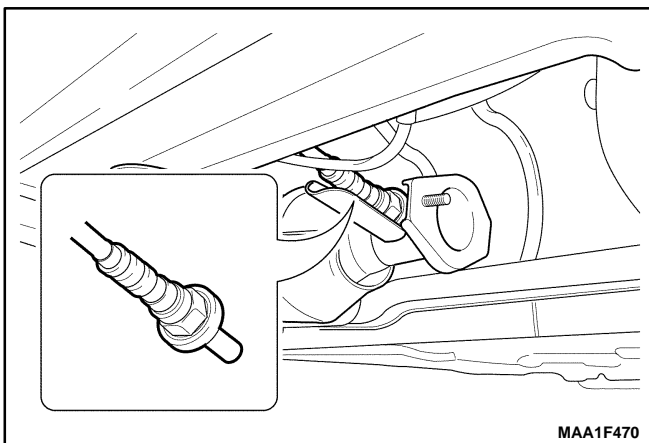
1. Install in the reverse order of removal.

**Important:** A special anti-seize compound is used on the oxygen sensor threads. This compound consists of a liquid graphite and glass beads. The graphite will burn away, but the glass beads will remain, making the sensor easier to remove. New or service sensors will already have the compound applied to the threads. If a sensor is removed from any engine and if for any reason it is to be reinstalled, the threads must have anti-seize compound applied before reinstallation.

2. Install the oxygen sensor.

### Tighten

Tighten the oxygen sensor to 35~44 N•m (26~33 lb-ft).



## HEATED OXYGEN SENSOR (HO2S2)

### Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the front center console.
3. Disconnect the HO2S2 connector.
4. Remove the front exhaust pipe. Refer to *Section 1G, Engine Exhaust*.
5. Remove the HO2S2 from the front exhaust pipe.

### Installation Procedure

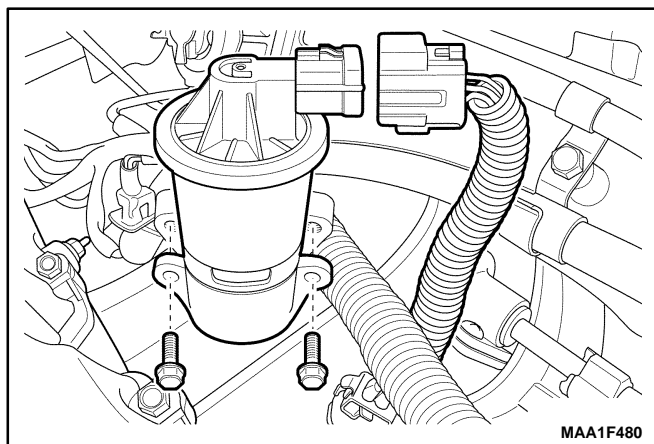
1. Install in the reverse order of removal.

**Important:** A special anti-seize compound is used on the oxygen sensor threads. This compound consists of a liquid graphite and glass beads. The graphite will burn away, but the glass beads will remain, making the sensor easier to remove. New or service sensors will already have the compound applied to the threads. If a sensor is removed from any engine and if for any reason it is to be reinstalled, the threads must have anti-seize compound applied before reinstallation.

2. Install the oxygen sensor.

### Tighten

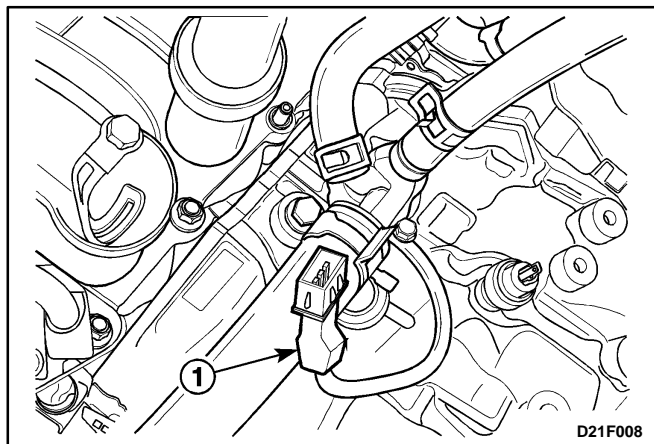
Tighten the oxygen sensor to 35~44 N•m (26~33 lb-ft).



## EXHAUST GAS RECIRCULATION VALVE

### Removal Procedure

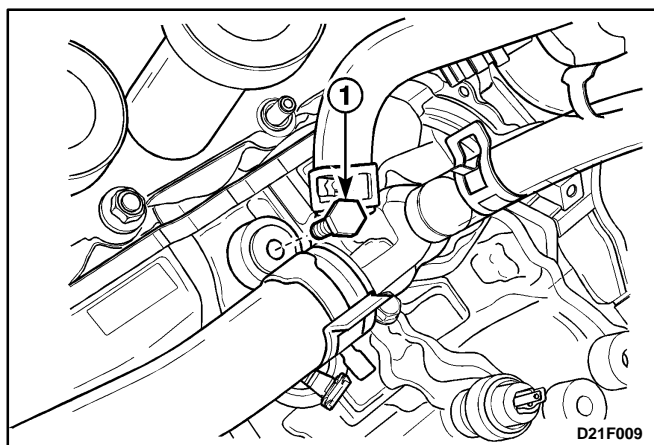
1. Disconnect the negative battery cable.
2. Remove the air cleaner assembly.
3. Disconnect the electric exhaust gas recirculation (EGR) valve connector.

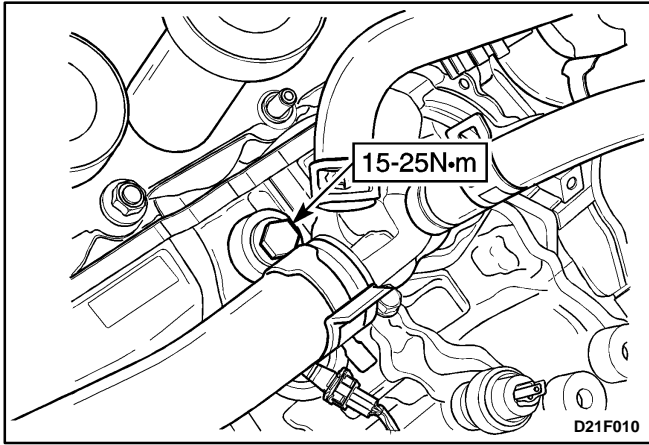


## KNOCK SENSOR

### Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the starter. Refer to *Section 1E, Engine Electrical*.
3. Disconnect the electrical connector at the knock sensor (1).
4. Remove the knock sensor.
  - Remove the knock sensor retaining bolt (1).
  - Remove the knock sensor.





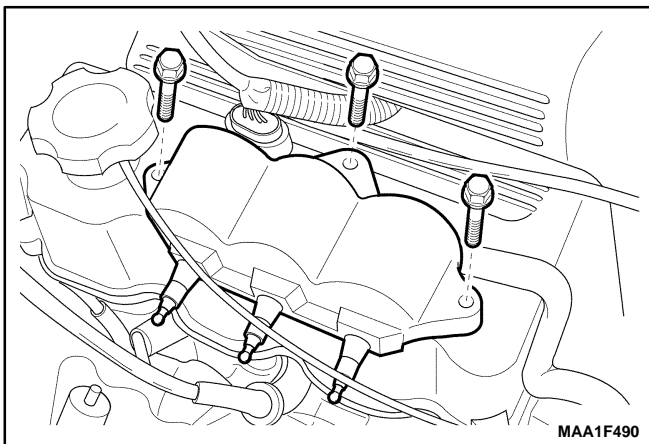
### Installation Procedure

1. Install the knock sensor with the bolt.

#### Tighten

Tighten the knock sensor retaining bolt to 15–25 N•m (11–18 lb-ft).

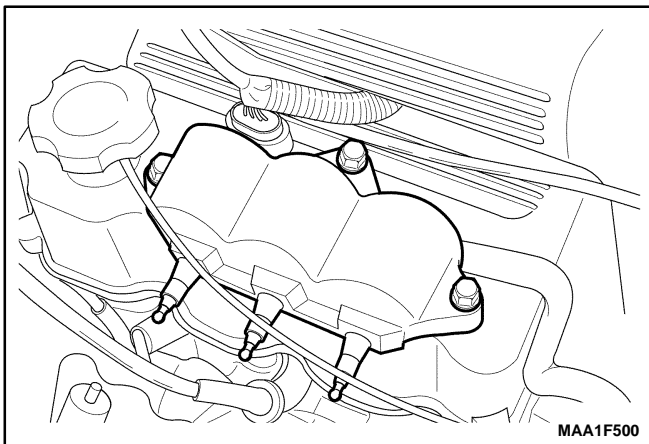
2. Connect the electrical connector to the knock sensor.
3. Install the starter. Refer to *Section 1E, Engine Electrical*.
4. Connect the negative battery cable.



### ELECTRONIC IGNITION (EI) SYSTEM IGNITION COIL

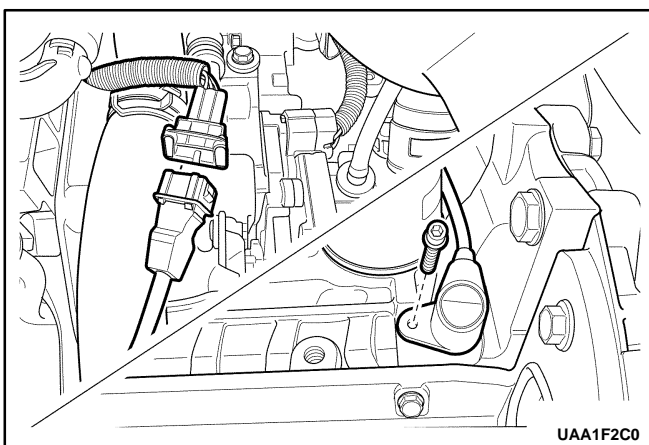
#### Removal Procedure

1. Disconnect the negative battery cable.
2. Note the ignition wire location and disconnect the ignition wires from the EI system ignition coil.
3. Disconnect the EI system ignition coil connector.
4. Remove the EI system ignition coil retaining bolts.
5. Remove the EI system ignition coil.



#### Installation Procedure

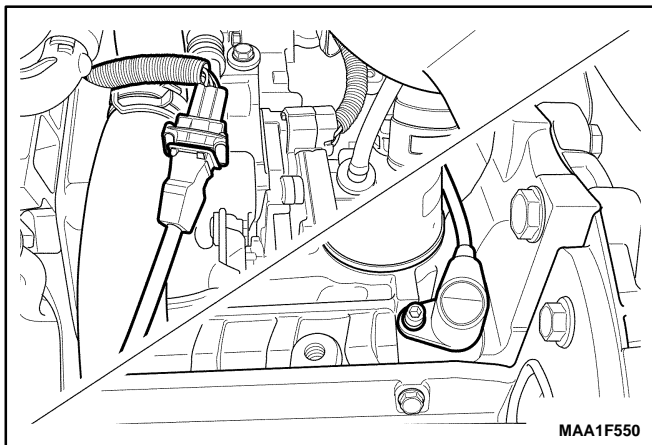
1. Install the EI system ignition coil.
2. Tighten the EI system ignition coil to 8–12 N•m (71–106 lb-in).



### CRANKSHAFT POSITION (CKP) SENSOR

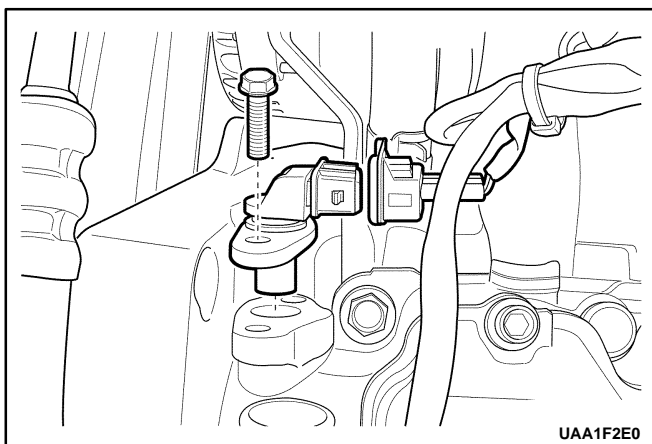
#### Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the air cleaner assembly.
3. Disconnect the crankshaft position (CKP) sensor connector.
4. Remove the CKP sensor retaining bolt.



### Installation Procedure

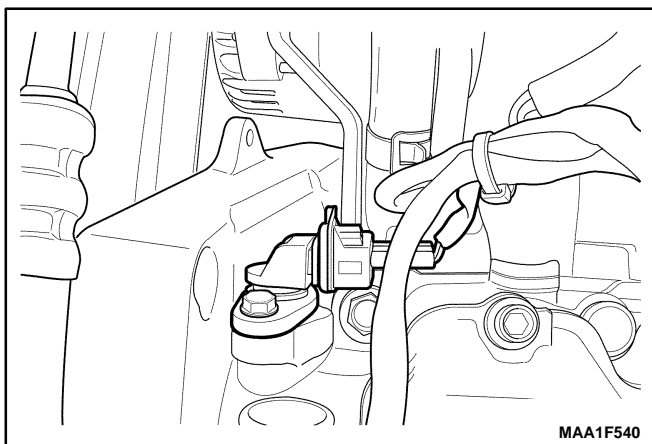
1. Install the CKP sensor.
2. Tighten the CKP sensor retaining bolt to 5–8 N•m (44–71 lb-in).



### CAMSHAFT POSITION (CMP) SENSOR

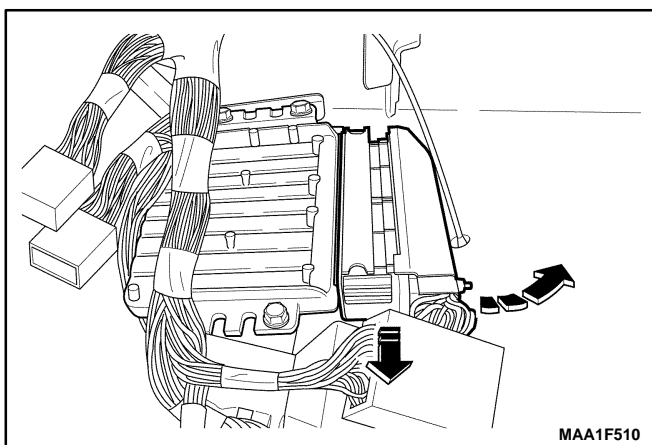
#### Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the camshaft position (CMP) sensor connector.
3. Remove the CMP sensor retaining bolt.
4. Remove the CMP sensor.



#### Installation Procedure

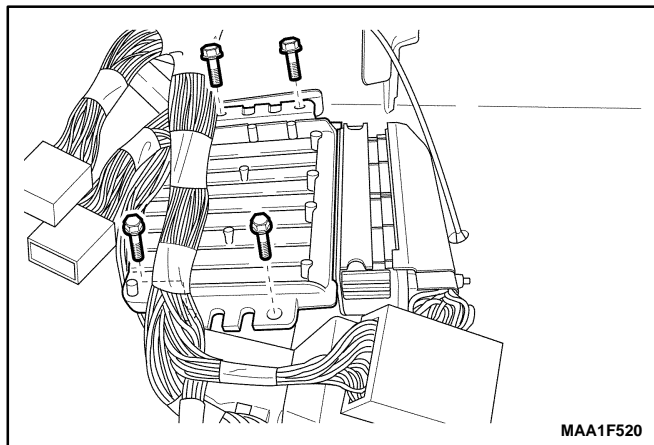
1. Install the CMP sensor.
2. Tighten the CMP sensor retaining bolt to 10–14 N•m (89–124 lb-in).



### ENGINE CONTROL MODULE (ECM)

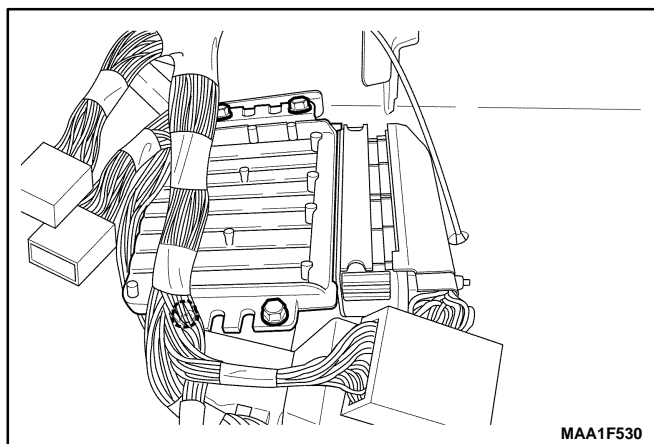
#### Removal Procedure

1. Disconnect the ECM connector.



2. Remove the ECM.

- Remove the bolts.
- Remove the ECM.



## Installation Procedure

1. Install in the reverse order of removal.

**Notice:** If disconnecting the battery cable to the ECM, the IAC valve resetting should be proceeded.

2. install the ECM with the bolts.

### Tighten

Tighten the ECM mounting bolts to 6–8 N•m (53–71 lb-in).

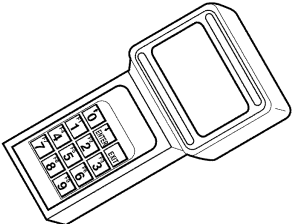
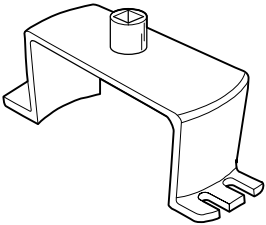
# SPECIFICATIONS

## FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Camshaft Position Sensor Bolts	10-14	-	89-124
Engine Coolant Temperature (ECT) Sensor	8-12	-	71-106
Crankshaft Position (CKP) Sensor Retaining Bolt	5-8	-	44-71
Electronic Ignition (EI) System Ignition Coil Retaining Bolts	8-12	-	71-106
Evaporative Emission Canister Protective Cover	8	-	71
Electric Exhaust Gas Recirculation (EEGR) Valve Retaining Bolts	20-30	15-22	-
Fuel Rail Retaining Bolts	18-22	13-16	-
Fuel Tank Strap Retaining Nuts	18-22	13-16	-
Knock Sensor Bolt	15-25	11-18	-
Intake Air Temperature (IAT) Sensor	20-30	15-22	-
Manifold Absolute Pressure (MAP) Sensor Retaining Bolt	8-12	-	71-106
Oxygen Sensor	35-44	26-33	-
Heated Oxygen Sensor	35-44	26-33	-
Throttle Body Retaining Bolt	9-12	-	80-106
ECM Mounting Bolts	6-8	-	53-71

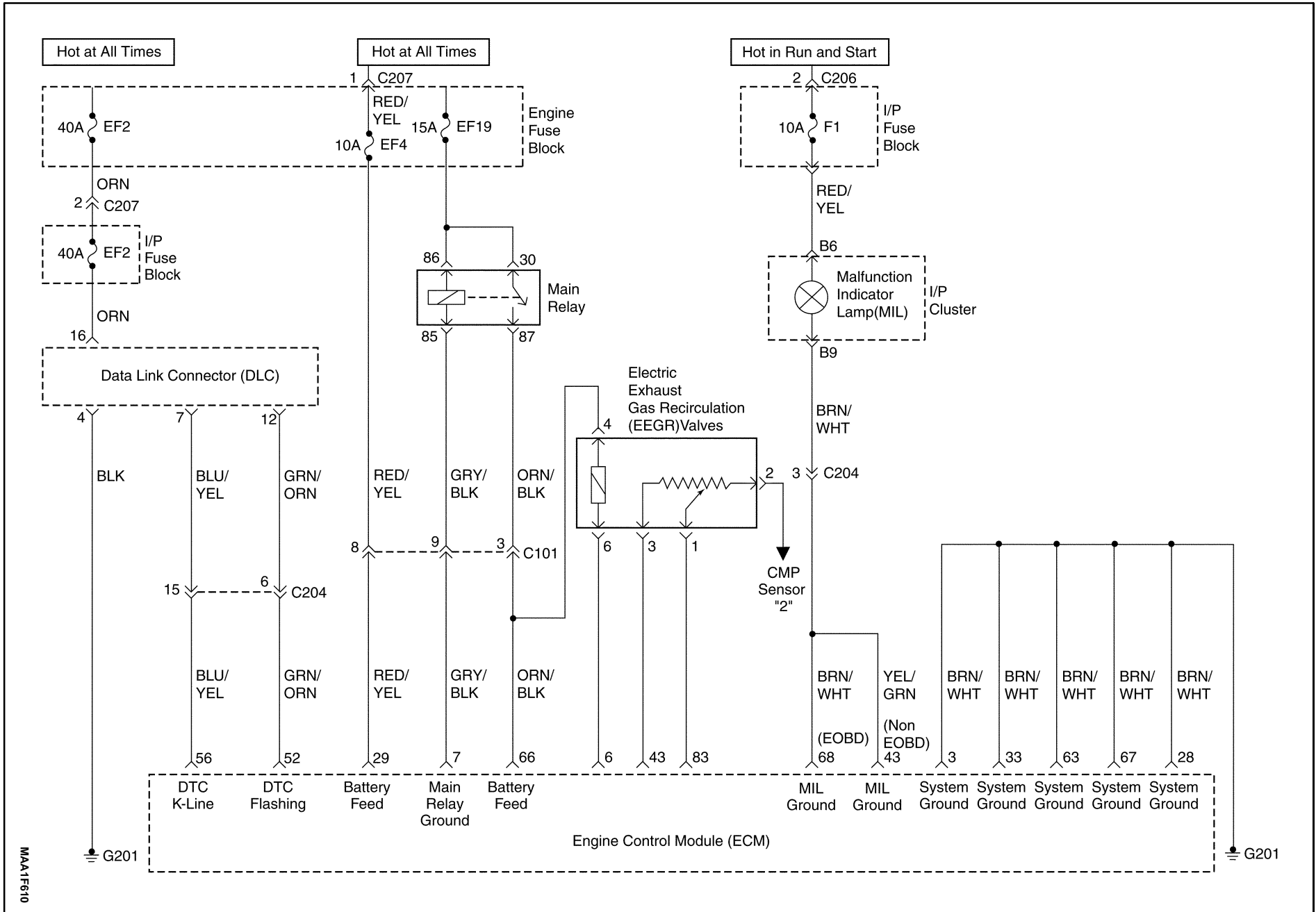
## SPECIAL TOOLS

### SPECIAL TOOLS TABLE

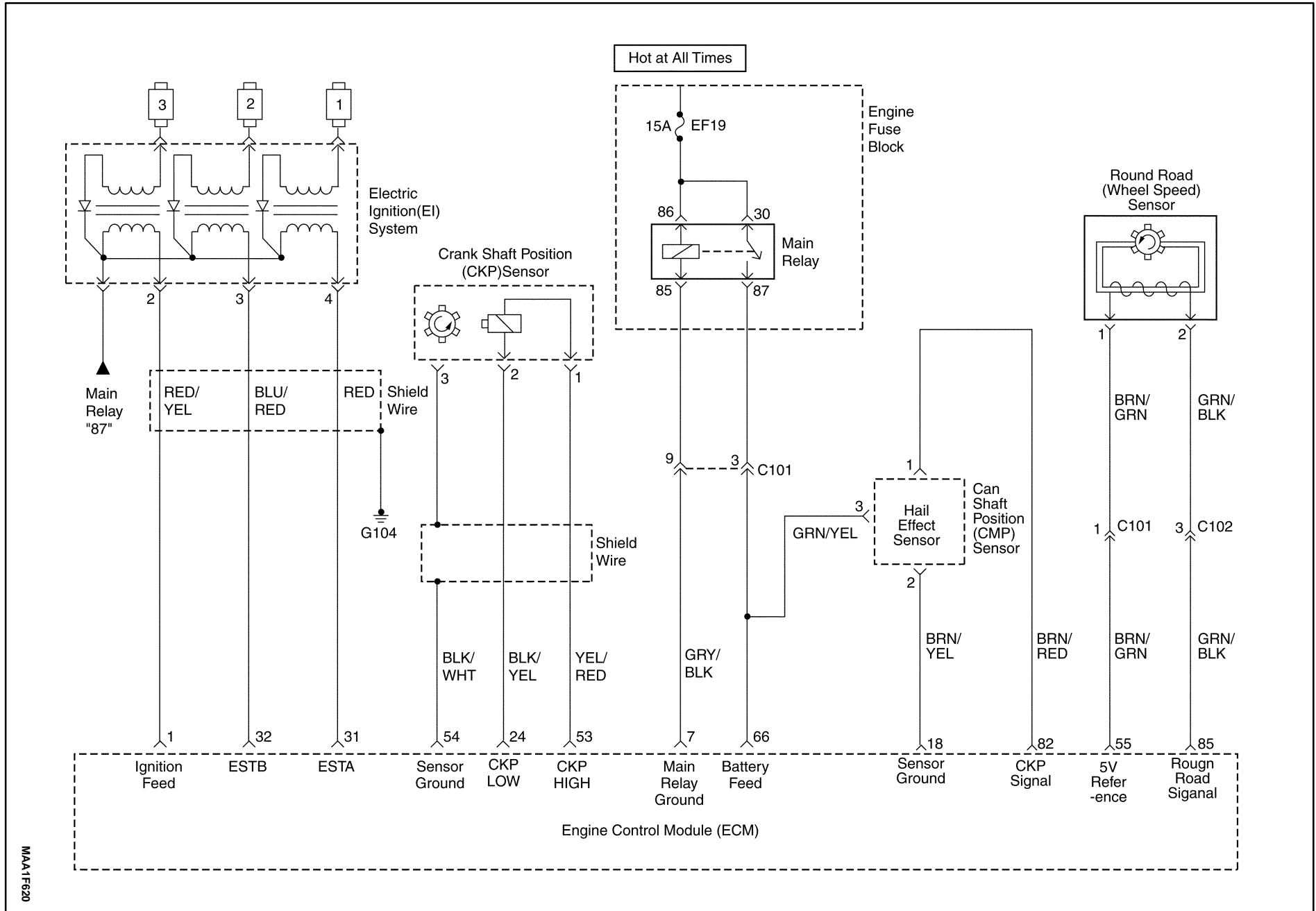
 <p>D102F101</p>	<p>Scan Tool</p>	 <p>D12F102A</p>	<p>DW-140-010A Fuel Pump Lock Ring Remover/Installer</p>
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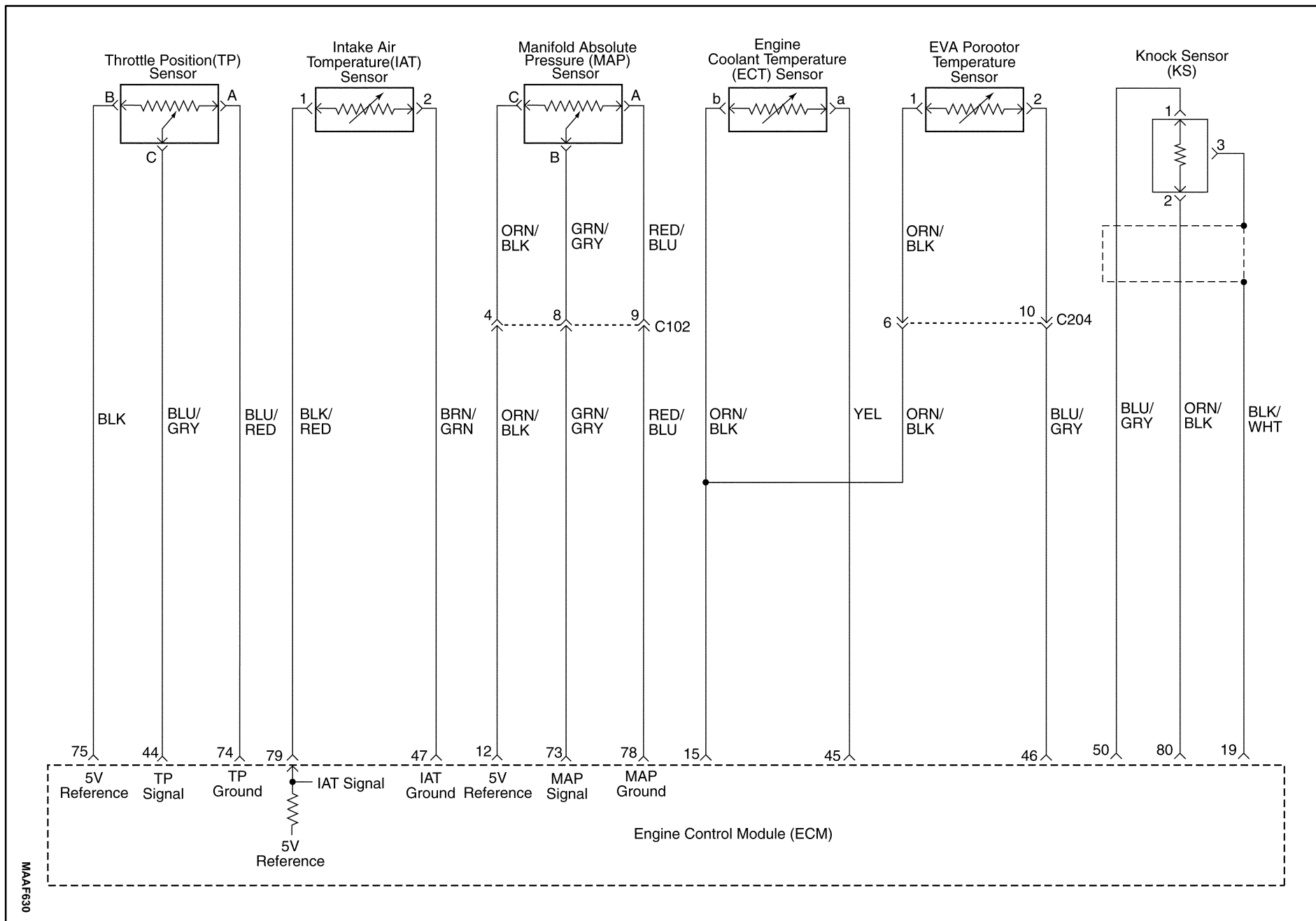
# ECM WIRING DIAGRAM (SIRIUS D3 – 1 OF 5)



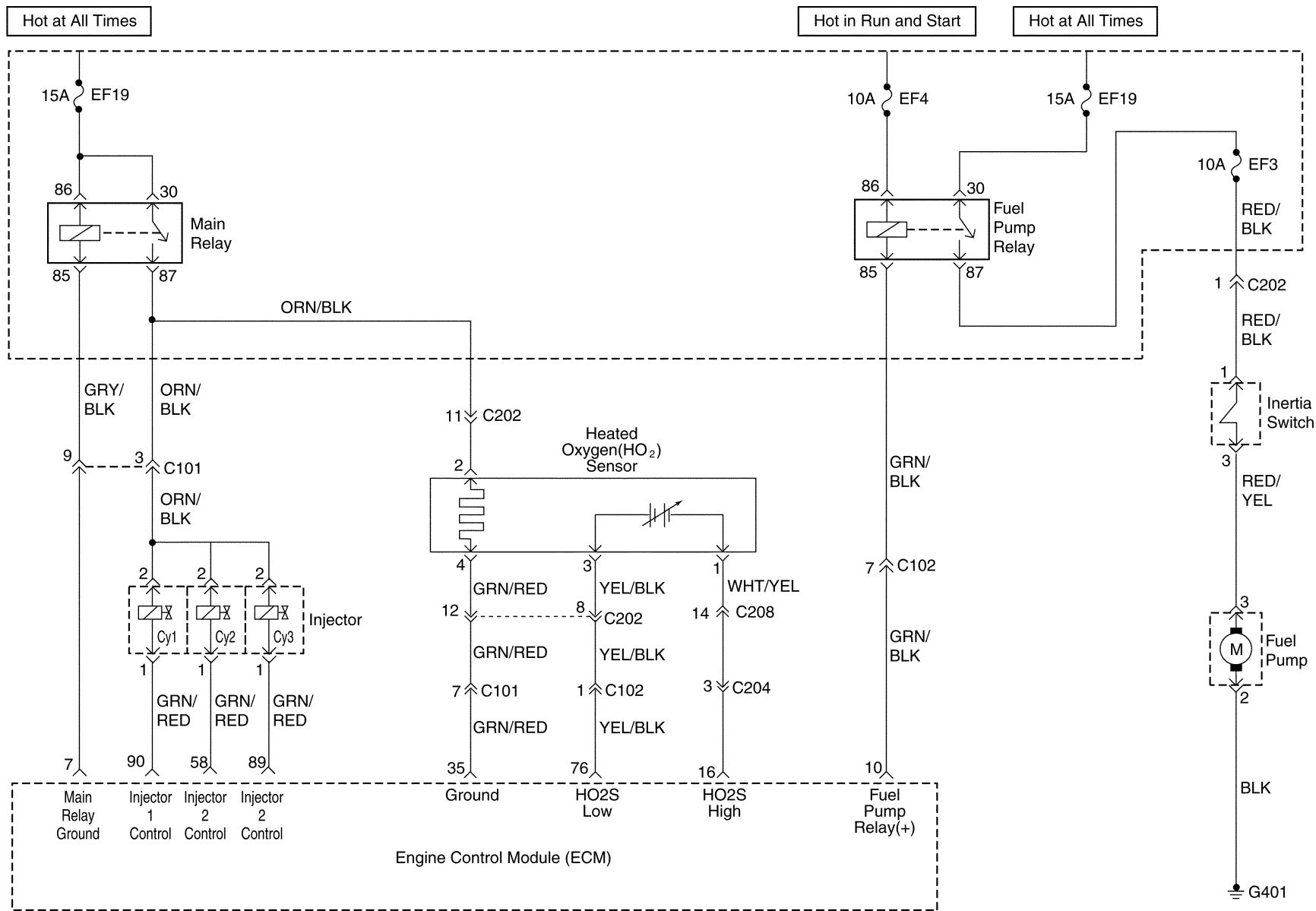
# ECM WIRING DIAGRAM (SIRIUS D3 – 2 OF 5)



# ECM WIRING DIAGRAM (SIRIUS D3 – 3 OF 5)



# ECM WIRING DIAGRAM (SIRIUS D3 – 4 OF 5)



# ECM WIRING DIAGRAM (SIRIUS D3 – 5 OF 5)

