EMISSION CONTROL SYSTEM

ON-BOARD DIAGNOSTICS

INDEX

GENERAL INFORMATION

SYSTEM DESCRIPTION

Two different modules are used for powertrain control with the diesel engine. The Powertrain Control Module (PCM) is used primarily for charging system, transmission, and speed control functions. The Engine Control Module (ECM) is used to control the fuel system. The PCM is located in the right/rear of engine compartment (Fig. 1). The ECM is bolted to the left side of the engine cylinder block (Fig. 2). Refer to either Powertrain Control Module (PCM), or Engine Control Module (ECM) in Group 14, Fuel System for a list of inputs and outputs for each module.

The PCM and ECM monitor many different circuits in the powertrain system. If the ECM or PCM senses a problem with a monitored circuit often enough to indicate an actual problem, it stores a Diagnostic Trouble Code (DTC) in the ECM's or PCM's memory. With certain DTC's, if the problem is repaired or ceases to exist, the ECM or PCM cancels the code after 40 warm-up cycles. Certain other DTC's may be cancelled after 1 or 2 good "trips". Refer to Trip Definition. DTC's that affect vehicle emissions illuminate the Malfunction Indicator Lamp (CHECK ENGINE lamp). Refer to Malfunction Indicator Lamp.

Certain DTC's will set a "companion DTC" in the opposite control module. This means that after repair, the DTC must be erased from **both** modules.

Certain criteria must be met before the ECM or PCM will store a DTC in memory. The criteria may be a specific range of engine RPM, throttle opening, engine temperature or input voltage.

The ECM or PCM might not store a DTC for a monitored circuit even though a malfunction has occurred. This may happen because one of the DTC criteria for the circuit has not been met. **For example,** assume the DTC criteria requires the ECM to monitor the circuit only when the engine operates between 750 and 2000 RPM. Suppose the sensor's output circuit shorts to ground when engine operates above 2400 RPM (resulting in 0 volt input to the ECM). Because the condition happens at an engine speed above the maximum threshold (2000 rpm), the ECM will not store a DTC.

There are several operating conditions for which the ECM and PCM monitors and sets DTC's. Refer to Monitored Systems, Components, and Non-Monitored Circuits in this section.

Technicians must retrieve stored DTC's by connecting the DRB scan tool (or an equivalent scan tool) to the 16–way data link connector (Fig. 3). Refer to the Diagnostic Trouble Code chart (list). **Remember that DTC's are the results of a system or circuit failure, but do not directly identify the failed component or components.**

GENERAL INFORMATION (Continued)

Various diagnostic procedures may actually cause a diagnostic monitor to set a DTC. For instance, disconnecting a relay or removing an electrical connector while the engine is running. When a repair is completed and verified, connect the DRB scan tool to the 16–way data link connector to erase all ECM and PCM DTC's and extinguish the MIL (CHECK ENGINE lamp).

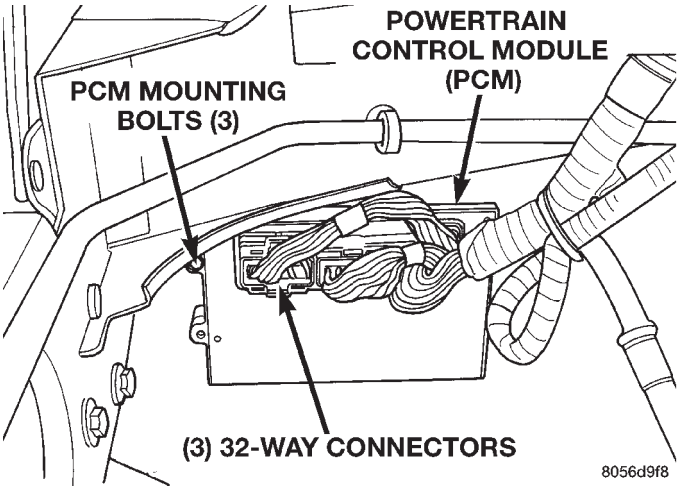

Fig. 1 Powertrain Control Module (PCM)

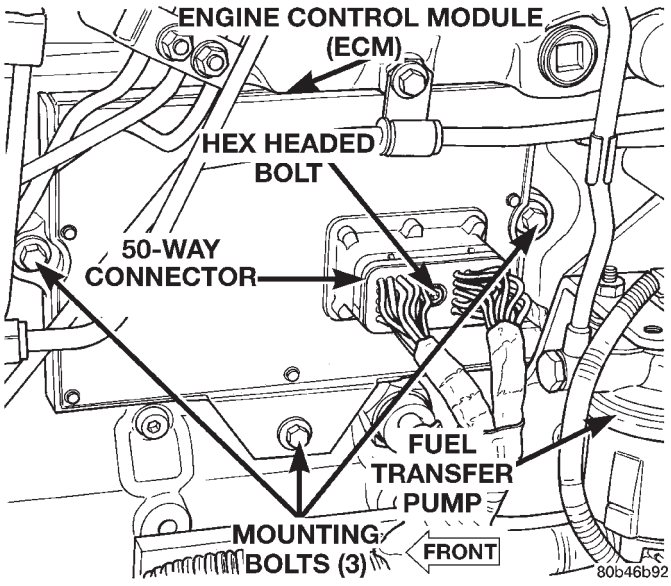

Fig. 2 Engine Control Module (ECM)

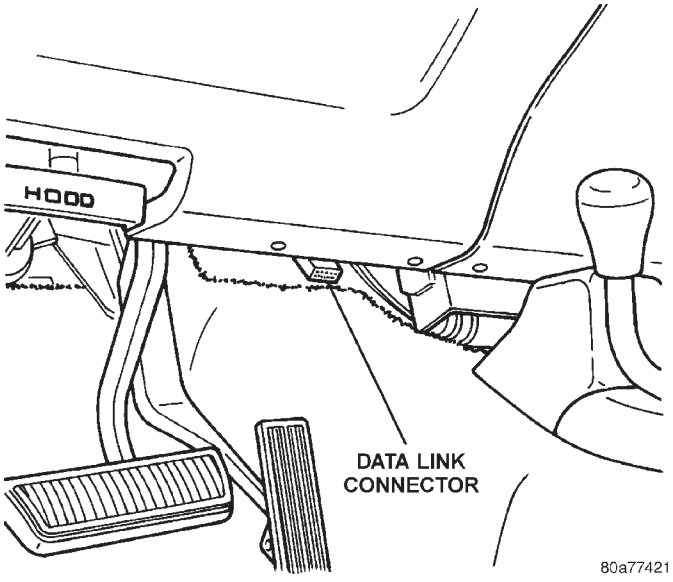

Fig. 3 16–Way Data Link (Diagnostic) Connector Location

DESCRIPTION AND OPERATION

MALFUNCTION INDICATOR LAMP (MIL)

Whenever the Engine Control Module (ECM), or the Powertrain Control Module (PCM) sets a Diagnostic Trouble Code (DTC) for an emission related item, it illuminates the Malfunction Indicator Lamp (MIL). The MIL is displayed on the instrument panel as the CHECK ENGINE lamp. The MIL will only be illuminated for DTC's that affect vehicle emissions.

There are some monitors that may take two consecutive "trips" to illuminate the MIL if a DTC has been detected. Refer to Trip Definition for additional information. The MIL will stay on continuously (if key is ON) when the ECM or PCM has entered a "Limp-In" mode or has identified a failed emission component.

The MIL either flashes or illuminates continuously when the PCM detects active engine misfire. Refer to Misfire Monitoring.

Additionally, the ECM or PCM may reset (turn off) the MIL if a previous malfunction (DTC) has not been re-detected after 2 consecutive "trips" have occurred.

The MIL will illuminate at key-on and will stay lit for approximately 2 seconds if the engine has not been cranked over. This is done as a bulb check (bulb test).

Refer to the Diagnostic Trouble Code charts for a list of emission related and non-emission related DTC's.

DESCRIPTION AND OPERATION (Continued)

DIAGNOSTIC TROUBLE CODES

A Diagnostic Trouble Code (DTC) indicates that either the Powertrain Control Module (PCM), or the Engine Control Module (ECM) has recognized an abnormal condition in the system. Certain DTC's will set a "Companion DTC", meaning the same code will be set in the opposite module (ECM or PCM).

DTC's are the results of a system or circuit failure, but do not directly identify the failed component or components.

Technicians must retrieve stored DTC's by connecting the DRB III scan tool (or an equivalent scan tool) to the 16–way data link connector (Fig. 3).

NOTE: For a list of DTC's, refer to the following charts.

OBTAINING DTC's

WARNING: APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING ANY TEST ON AN OPERATING ENGINE.

(1) Connect the DRB scan tool to data link (diagnostic) connector.

(2) Turn the ignition switch on, access Read Fault Screen. Record all the DTC's shown on the DRB scan tool.

(3) To erase DTC's, use the Erase Trouble Code data screen on the DRB scan tool.

(4) Certain DTC's are stored as "Companion DTC's". They must be erased from both the ECM and PCM.

(a) CHECK ENGINE lamp (Malfunction Indicator Lamp or MIL) illuminated during engine operation if this DTC was recorded (CARB and/or EPA requirements).

(b) CHECK ENGINE lamp (Malfunction Indicator Lamp or MIL) illuminated during engine operation if this DTC was recorded (CARB requirements only).

(c) ECM may derate engine power, degrade engine performance or put fuel system into "Limp-In" mode if this DTC was recorded.

(d) CHECK GAUGES lamp illuminated during engine operation if this DTC was recorded.

(e) Companion DTC recorded (DTC recorded in both ECM and PCM).

(f) Water-In-Fuel warning lamp illuminated if this DTC was recorded.

(g) CHECK ENGINE lamp (Malfunction Indicator Lamp or MIL) **not illuminated** during engine operation if this DTC was recorded.

DIAGNOSTIC TROUBLE CODE (DTC) DESCRIPTIONS

Generic Scan Tool P-Code	DRB Scan Tool Display	Description of Diagnostic Trouble Code
P0112 (b), (c)	Intake Air Temperature (IAT) Sensor Voltage Low	Intake manifold air temperature sensor voltage input below the minimum acceptable voltage.
P0113 (b), (c)	Intake Air Temperature (IAT) Sensor Voltage High	Intake manifold air temperature sensor voltage input above the maximum acceptable voltage.
P0117 (b), (c)	Engine Coolant Temperature (ECT) Sensor Voltage Too Low	Engine coolant temperature sensor voltage input below minimum acceptable voltage.
P0118 (b), (c)	Engine Coolant Temperature (ECT) Sensor Voltage Too High	Engine coolant temperature sensor voltage input above maximum acceptable voltage.
P0121 (a), (c)	Accel. Position Sensor Volts Do Not Agree w/idle Validation Sig.	Problem detected in APPS idle validation circuit
P0122 (a), (c)	Accelerator Position Sensor (APPS) Signal Voltage Too Low	APPS voltage input below the minimum acceptable voltage
P0123 (a), (c)	Accelerator Position Sensor (APPS) Signal Voltage Too High	APPS voltage input above the maximum acceptable voltage.
P0125 (b)	Engine is Cold Too Long	Engine does not reach operating temperature.
P0168 (c), (g)	Decreased Engine Performance Due To High Injection Pump Fuel Temp	Fuel temperature is above the engine protection limit. Engine power will be derated.
P0177 (f), (g)	Water In Fuel	Excess water found in fuel by water-in-fuel sensor

DESCRIPTION AND OPERATION (Continued)

Generic Scan Tool P-Code	DRB Scan Tool Display	Description of Diagnostic Trouble Code
P0178 (g)	Water In Fuel Sensor Voltage Too Low	Loss of water-in-fuel circuit or sensor.
P0181 (c), (g)	Fuel Injection Pump Failure	Low power, engine derated, or engine stops.
P0215 (g)	Fuel Injection Pump Control Circuit	Failure in fuel pump relay control circuit.
P0216 (b), (c)	Fuel Injection Pump Timing Failure	High fuel supply restriction, low fuel pressure or possible wrong or incorrectly installed pump keyway.
P0217 (c), (d)	Decreased Engine Performance Due To Engine Overheat Condition	Engine overheating. ECM will derate engine performance.
P0219 (c), (g)	Crankshaft Position Sensor Overspeed Signal	Engine has exceeded rpm limits.
P0222 (a)	Idle Validation Signals Both Low	Problem detected with idle validation circuits within APPS.
P0223 (a), (c)	Idle Validation Signals Both High (Above 5 Volts)	Problem detected with idle validation circuits within APPS.
P0230 (c), (g)	Transfer Pump (Lift Pump) Circuit Out of Range	Problem detected in fuel transfer pump circuits.
P0232 (g)	Fuel Shutoff Signal Voltage Too High	Fuel shut-off signal voltage too high from ECM to fuel injection pump.
P0234 (b), (c)	Turbo Boost Limit Exceeded	Problem detected in turbocharger wastegate.
P0236 (b)	Map Sensor Too High Too Long	Problem detected in turbocharger wastegate.
P0237 (b), (c)	Map Sensor Voltage Too Low	MAP sensor voltage input below the minimum acceptable voltage.
P0238 (b), (c)	Map Sensor Voltage Too High	MAP sensor voltage input above the maximum acceptable voltage.
P0251 (a), (c)	Fuel Inj. Pump Mech. Failure Fuel Valve Feedback Circuit	Problem sensed with fuel circuit internal to fuel injection pump.
P0253 (b), (c)	Fuel Injection Pump Fuel Valve Open Circuit	Problem sensed with fuel circuit internal to fuel injection pump.
P0254 (c), (g)	Fuel Injection Pump Fuel Valve Current Too High	Problem caused by internal fuel injection pump failure.
P0300 (b), (c)	Multiple Cylinder Mis-fire	Misfire detected in multiple cylinders.
P0301 (b), (c)	Cylinder #1 Mis-fire	Misfire detected in cylinder #1.
P0302 (b), (c)	Cylinder #2 Mis-fire	Misfire detected in cylinder #2.
P0303 (b), (c)	Cylinder #3 Mis-fire	Misfire detected in cylinder #3.
P0304 (b), (c)	Cylinder #4 Mis-fire	Misfire detected in cylinder #4.
P0305 (b), (c)	Cylinder #5 Mis-fire	Misfire detected in cylinder #5.
P0306 (b), (c)	Cylinder #6 Mis-fire	Misfire detected in cylinder #6.
P0320 (b)	No RPM Signal to PCM (Crankshaft Position Sensor Signal to JTEC)	A CKP signal has not been detected at the PCM.
P0336 (b), (c)	Crankshaft Position (CKP) Sensor Signal	Problem with voltage signal from CKP.
P0341 (b)	Camshaft Position (CMP) Sensor Signal	Problem with voltage signal from CMP.

DESCRIPTION AND OPERATION (Continued)

Generic Scan Tool P-Code	DRB Scan Tool Display	Description of Diagnostic Trouble Code
P0370 (c), (g)	Fuel Injection Pump Speed/ Position Sensor Sig Lost	Problem caused by internal fuel injection pump failure.
P0380 (b)	Intake Air Heater Relay #1 Control Circuit	Problem detected in #1 air heater solenoid/relay circuit (not heater element)
P0381 (b)	Wait To Start Lamp Inoperative	Problem detected in wait-to-start bulb circuit.
P0382 (b)	Intake Air Heater Relay #2 Control Circuit	Problem detected in #2 air heater solenoid/relay circuit (not heater element)
P0387 (c), (g)	Crankshaft Position Sensor Supply Voltage Too Low	CKP sensor voltage input below the minimum acceptable voltage.
P0388 (c), (g)	Crankshaft Position Sensor Supply Voltage Too High	CKP sensor voltage input above the maximum acceptable voltage.
P0460 (g)	Fuel Level Unit No Change Over Miles	Fuel level sending unit voltage does not change for more than 40 miles.
P0462 (b)	Fuel Level Sending Unit Volts Too Low	Open circuit between PCM and fuel gauge sending unit.
P0463 (b)	Fuel Level Sending Unit Volts Too High	Circuit shorted to voltage between PCM and fuel gauge sending unit.
P0500 (b)	No Vehicle Speed Sensor Signal	A vehicle speed signal was not detected.
P0522 (c), (g)	Oil Pressure Voltage Too Low	Oil pressure sending unit (sensor) voltage input below the minimum acceptable voltage.
P0523 (c), (g)	Oil Pressure Voltage Too High	Oil pressure sending unit (sensor) voltage input above the maximum acceptable voltage.
P0524 (c), (d), (g)	Oil Pressure Too Low	Engine oil pressure is low. Engine power derated.
P0545 (g)	A/C Clutch Relay Circuit	Problem detected in air conditioning clutch relay control circuit.
P0562 (d), (g)	Charging System Voltage Too Low	Supply voltage sensed at ECM too low.
P0563 (d), (g)	Charging System Voltage Too High	Supply voltage sensed at ECM too high.
P0601 (b)	Internal Controller Failure	PCM Internal fault condition detected.
P0602 (b), (c)	ECM Fueling Calibration Error	ECM Internal fault condition detected.
P0606 (b)	ECM Failure	ECM Internal fault condition detected.
P0622 (d), (g)	Generator Field Not Switching Properly	An open or shorted condition detected in the generator field control circuit.
P0712 (b)	Trans Temp Sensor Voltage Too Low	Voltage less than 1.55 volts (4-speed auto. trans. only).
P0713 (b)	Trans Temp Sensor Voltage Too High	Voltage greater than 3.76 volts (4-speed auto. trans. only).
P0720 (b)	Low Output Spd Sensor RPM Above 15 mph	Output shaft speed is less than 60 rpm with vehicle speed above 15 mph (4-speed auto. trans. only).
P0743 (b)	Torque Converter Clutch Solenoid/Trans Relay Circuits	An open or shorted condition detected in the torque converter part throttle unlock solenoid control circuit (3 or 4-speed auto. trans. only).
P0748 (b)	Governor Pressure Sol Control/Trans Relay Circuits	An open or shorted condition detected in the governor pressure solenoid or relay circuits (4-speed auto. trans. only).

DESCRIPTION AND OPERATION (Continued)

Generic Scan Tool P-Code	DRB Scan Tool Display	Description of Diagnostic Trouble Code
P0751 (b)	O/D Switch Pressed (LO) More Than 5 Min	Overdrive Off switch input too low for more than 5 minutes (4-speed auto. trans. only).
P0753 (b)	Trans 3-4 Shift Sol/Trans Relay Circuits	An open or shorted condition detected in the transmission 2-4 shift solenoid circuit (4-speed auto. trans. only).
P1110 (c), (g)	Decrease Engine Performance Due To High Intake Air Temperature	Intake manifold air temperature is above the engine protection limit. Engine power will be derated.
P1180 (c), (g)	Decreased Engine Performance Due To High Injection Pump Fuel Temp	Fuel temperature is above the engine protection limit. Engine power will be derated.
P1283 (g)	Idle Select Signal Invalid	ECM or fuel injection pump module internal fault condition detected.
P1284 (b), (c)	Fuel Injection Pump Battery Voltage Out-Of-Range	Fuel injection pump module internal fault condition detected. Engine power will be derated.
P1285 (b), (c)	Fuel Injection Pump Controller Always On	Fuel injection pump module relay circuit failure detected. Engine power will be derated.
P1286 (c), (g)	Accelerator Position Sensor (APPS) Supply Voltage Too High	High voltage detected at APPS.
P1287 (c), (g)	Fuel Injection Pump Controller Supply Voltage Low	ECM or fuel injection pump module internal fault condition detected. Engine power will be derated.
P1291 (b)	No Temperature Rise Seen From Intake Air Heaters	Problem detected in intake manifold air heating system.
P1295 (c), (g)	Accelerator Position Sensor (APPS) Supply Voltage Too Low	APPS supply voltage input below the minimum acceptable voltage.
P1388 (g)	Auto Shutdown Relay Control Circuit	An open or shorted condition detected in the auto shutdown relay circuit.
P1389 (g)	No ASD Relay Output Voltage at PCM	An open condition detected In the ASD relay output circuit.
P1399 (g)	Wait To Start Lamp Circuit	Problem detected in wait-to-start lamp circuit
P01475 (g)	Aux 5 Volt Supply Voltage High	Sensor supply voltage for ECM sensors is too high.
P1488 (g)	5 Volt Supply Voltage Low	Sensor supply voltage for ECM sensors is too low.
P1492 (b), (d)	Ambient/Batt Temp Sensor Volts Too High	Battery temperature sensor input voltage above an acceptable range.
P1493 (b), (d)	Ambient/Batt Temp Sen Volts Too Low	Battery temperature sensor input voltage below an acceptable range.
P1594 (g)	Charging System Voltage Too High	Battery voltage sense input above target charging voltage during engine operation.
P1595 (g)	Speed Control Solenoid Circuits	An open or shorted condition detected in the speed control vacuum or vent solenoid circuits.
P1597 (g)	Speed Control Switch Always Low	Speed control switch input below the minimum acceptable voltage.
P1598 (g)	A/C Sensor Input Hi	Problem detected in air conditioning electrical circuit.
P1599 (g)	A/C Sensor Input Lo	Problem detected in air conditioning electrical circuit.
P1682 (d), (g)	Charging System Voltage Too Low	Charging system output voltage low.

DESCRIPTION AND OPERATION (Continued)

Generic Scan Tool P-Code	DRB Scan Tool Display	Description of Diagnostic Trouble Code
P1683 (g)	Spd ctrl pwr rly, or s/c 12v driver circuit	An open or shorted condition detected in the speed control servo power control circuit.
P1688 (a), (c)	Internal Fuel Injection Pump Controller Failure	Internal problem within the fuel injection pump. Low power, engine derated, or engine stops.
P1689 (a), (c)	No Communication Between ECM and Injection Pump Module	Data link circuit failure between ECM and fuel injection pump. Low power, engine derated, or engine stops.
P1690 (b), (c)	Fuel Injection Pump CKP Sensor Does Not Agree With ECM CKP Sensor	Problem in fuel sync signal. Possible injection pump timing problem. Low power, engine derated, or engine stops.
P1691 (c), (g)	Fuel Injection Pump Controller Calibration Error	Internal fuel injection pump failure. Low power, engine derated, or engine stops.
P1692 (e), (g)	DTC Set In ECM	A ″Companion DTC″ was set in both the ECM and PCM.
P1693 (e), (g)	DTC Detected in PCM/ECM or DTC Detected in ECM	A ″Companion DTC″ was set in both the ECM and PCM.
P1694 (b), (e)	No CCD Messages received from ECM	Bus communication failure to PCM.
P1698 (e), (g)	No CCD Messages received from PCM	Bus communication failure to PCM. A ″Companion DTC″ was set in both the ECM and PCM.
P1740 (b)	TCC OR O/D Solenoid Performance	Problem detected in transmission convertor clutch and/or overdrive circuits (diesel engine with 4-speed auto. trans. only).
P1756 (b)	Governor Pressure Not Equal to Target @ 15-20 PSI	Governor sensor input not between 10 and 25 psi when requested (4-speed auto. trans. only).
P1757 (b)	Governor Pressure Above 3 PSI In Gear With 0 MPH	Governor pressure greater than 3 psi when requested to be 0 psi (4-speed auto. trans. only).
P1762 (b)	Governor Press Sen Offset Volts Too Low or High	Sensor input greater or less than calibration for 3 consecutive Neutral/Park occurrences (4-speed auto. trans. only).
P1763 (b)	Governor Pressure Sensor Volts Too HI	Voltage greater than 4.89 volts (4-speed auto. trans. only).
P1764 (b)	Governor Pressure Sensor Volts Too Low	Voltage less than .10 volts (4-speed auto. trans. only).
P1765 (b)	Trans 12 Volt Supply Relay Ctrl Circuit	Current state of solenoid output port is different than expected (4-speed auto. trans. only).
P1899 (b)	P/N Switch Stuck in Park or in Gear	Incorrect input state detected for the Park/Neutral switch (3 or 4-speed auto. trans. only).

COMPONENT MONITORS

There are several electrical components that will affect vehicle emissions if they malfunction. If one of these components is malfunctioning, a Diagnostic Trouble Code (DTC) will be set by either the Powertrain Control Module (PCM) or the Engine Control Module (ECM). The Malfunction Indicator Lamp (MIL) will then be illuminated when the engine is running (the MIL is displayed on the instrument panel as the CHECK ENGINE lamp).

These electrically operated components have input (rationality) and output (functionality) checks. A check is done by one or more components to check the operation of another component.

Example: The Intake Manifold Air Temperature (IAT) sensor is used to monitor intake manifold air temperature over a period of time after a cold start. If the temperature has not risen to a certain specification during a specified time, a Diagnostic Trouble Code (DTC) will be set for a problem in the manifold air heater system.

All open/short circuit checks, or any component that has an associated limp-in will set a DTC and trigger the MIL after 1 trip with the malfunction

DESCRIPTION AND OPERATION (Continued)

present. Components without an associated limp-in will take two trips to illuminate the MIL.

NON-MONITORED CIRCUITS

The PCM and/or the ECM will not monitor certain malfunctioning circuits or components that could cause driveability problems. Also, a Diagnostic Trouble Code (DTC) might not be stored for these malfunctions. However, problems with these circuits or components may cause the PCM/ECM to store DTC's for other circuits or components.**EXAMPLES:** A cylinder with low compression will not set a DTC directly, but may cause an engine misfire. This in turn may cause the ECM to set a DTC for an engine misfire. Or, a dirty or plugged air filter will not set a DTC directly, but may cause lack of turbocharger boost. This in turn may cause the ECM to set a DTC for a boost pressure malfunction.

FUEL PRESSURE

Primary fuel pressure from the fuel tank to the fuel injection pump is supplied by the low-pressure fuel transfer pump. High-pressure to the fuel injectors is supplied by the fuel injection pump. The ECM cannot detect actual fuel pressure, a clogged fuel filter, clogged fuel screen, or a pinched fuel supply or return line. However, a DTC may be set due to an engine misfire.

CYLINDER COMPRESSION

The ECM cannot detect uneven, low, or high engine cylinder compression. However, these could result in a possible misfire which may set a DTC.

EXHAUST SYSTEM

The ECM cannot detect a plugged, restricted or leaking exhaust system. However, DTC's may be set for engine misfire, high intake manifold temperature, high engine coolant temperature, turbocharger overboost or turbocharger underboost.

FUEL INJECTOR MECHANICAL MALFUNCTIONS

The ECM cannot determine if a fuel injector is clogged, the needle is sticking or if the wrong injector is installed. However, these could result in a possible misfire which may set a DTC.

EXCESSIVE OIL CONSUMPTION

The ECM cannot determine excessive oil consumption. However, if excess oil consumption is high enough, it could result in a possible engine misfire which may set a DTC.

AIR FLOW

The ECM cannot detect a clogged, restricted or dirty air filter element, or a restriction in the air inlet system. However, these could result in a possible misfire which may set a DTC.

AIR PRESSURE LEAKS

The ECM cannot detect leaks or restrictions in the air intake system. However, these could cause the ECM to store a Manifold Air Pressure (MAP) sensor DTC (boost pressure problem detected).

PCM/ECM SYSTEM GROUNDS

The PCM/ECM cannot directly determine poor system grounds. However, one or more DTC's may be generated as a result of poor grounds.

PCM/ECM CONNECTOR ENGAGEMENT

The PCM/ECM may not be able to determine spread, damaged or corroded connector pins. However, it might store DTC's as a result of spread connector pins (circuits that are open).

HIGH AND LOW LIMITS

Both the Powertrain Control Module (PCM) and the Engine Control Module (ECM) compare input signal voltages from each input device with established high and low limits for the device. If the input voltage is not within limits, and other criteria are met, the PCM/ECM will store a Diagnostic Trouble Code (DTC) in memory. Other DTC criteria might include engine RPM limits, or input voltages from other sensors or switches that must be present before verifying a DTC condition.

ROLLOVER VALVE

One rollover valve is used. The valve is used only to vent the fuel tank to the atmosphere. A check valve is located within the rollover valve to prevent fuel flow from fuel tank in the event of an accidental vehicle rollover. The rollover valve is located on top of the fuel tank module (Fig. 4). The valve may be serviced separately. If replacement is necessary, refer to Rollover Valve Removal/Installation.

REMOVAL AND INSTALLATION

ROLLOVER VALVE

REMOVAL

One rollover valve is used. The valve is located on top of fuel tank module (Fig. 4) and may be serviced separately.

(1) Disconnect both negative battery cables at both batteries.

(2) Remove fuel filler cap and drain fuel tank. Refer to Fuel Tank Removal/Installation in Group 14, Fuel System.

REMOVAL AND INSTALLATION (Continued)

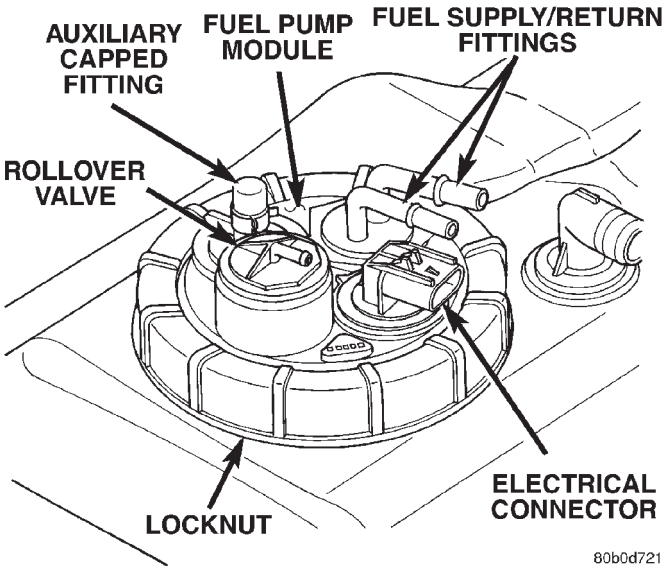

Fig. 4 Rollover Valve Location—Diesel Powered

(3) Remove fuel tank. Refer to Fuel Tank Removal/Installation in Group 14, Fuel System.

(4) The rollover valve is seated into a rubber grommet. Remove valve by prying one side upward and then roll valve out of grommet.

(5) Discard old grommet.

INSTALLATION

(1) Install new grommet into fuel tank module.

(2) Using finger pressure only, press valve into place.

(3) Install fuel tank. Refer to Fuel Tank Removal/Installation.

(4) Fill fuel tank. Install fuel tank filler cap.

(5) Connect both negative battery cables.

(6) Start vehicle and check for leaks.