EMISSION CONTROL SYSTEM

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GENERAL INFORMATION

SYSTEM DESCRIPTION—2.5L DIESEL ENGINE

The 2.5L diesel Powertrain Control Module (PCM) monitors and controls many different circuits in the fuel injection pump and engine systems. If the PCM senses a problem with a monitored circuit that indicates an actual problem, a Diagnostic Trouble Code (DTC) will be stored in the PCM's memory, and eventually will illuminate the Diesel Glow Plug lamp constantly while the key is on. If the problem is repaired, or is intermittent, the PCM will erase the DTC after 40 warm-up cycles. A warm-up cycle consists of starting the vehicle when the engine is cold, then the engine to warms up to a certain temperature, and finally, the engine temperature falls to a normal operating temperature, then the key is turned off.

Certain criteria must be met for a DTC to be entered into PCM memory. The criteria may be a specific range of engine rpm, engine or fuel temperature and/or input voltage to the PCM. A DTC indicates that the PCM has identified an abnormal signal in a circuit or the system. A DTC may indicate the result of a failure, but never identify the failed component directly.

There are several operating conditions that the PCM does not monitor and set a DTC for. Refer to the following Monitored Circuits and Non–Monitored Circuits in this section.

MONITORED CIRCUITS

The PCM can detect certain problems in the electrical system.

Open or Shorted Circuit – The PCM can determine if sensor output (which is the input to PCM) is within proper range. It also determines if the circuit is open or shorted.

Output Device Current Flow – The PCM senses whether the output devices are electrically connected.

If there is a problem with the circuit, the PCM senses whether the circuit is open, shorted to ground (–), or shorted to (+) voltage.

NON–MONITORED CIRCUITS

The PCM does not monitor the following circuits, systems or conditions that could have malfunctions that result in driveability problems. A DTC will not be displayed for these conditions.

Fuel Pressure: Fuel pressure is controlled by the fuel injection pump. The PCM cannot detect problems in this component.

Cylinder Compression: The PCM cannot detect uneven, low, or high engine cylinder compression.

Exhaust System: The PCM cannot detect a plugged, restricted or leaking exhaust system.

Fuel Injector Malfunctions: The PCM cannot determine if the fuel injector is clogged, or the wrong injector is installed. The fuel injectors on the diesel engine are **not controlled** by the PCM, although a

defective fuel injector sensor **is monitored** by the PCM.

Vacuum Assist: Leaks or restrictions in the vacuum circuits of vacuum assisted engine control system devices are not monitored by the PCM.

PCM System Ground: The PCM cannot determine a poor system ground. However, a DTC may be generated as a result of this condition.

PCM Connector Engagement: The PCM cannot determine spread or damaged connector pins. However, a DTC may be generated as a result of this condition.

HIGH AND LOW LIMITS

The PCM compares input signal voltages from each input device. It will establish high and low limits that are programmed into it for that device. If the input voltage is not within specifications and other DTC criteria are met, a DTC will be stored in memory. Other DTC criteria might include engine rpm limits or input voltages from other sensors or switches. The other inputs might have to be sensed by the PCM when it senses a high or low input voltage from the control system device in question.

DESCRIPTION AND OPERATION

DIAGNOSTIC TROUBLE CODES

On the following pages, a list of DTC's is provided for the 2.5L diesel engine. A DTC indicates that the PCM has recognized an abnormal signal in a circuit or the system. A DTC may indicate the result of a failure, but most likely will not identify the failed component directly.

ACCESSING DIAGNOSTIC TROUBLE CODES

A stored DTC can be displayed through the use of the DRB III scan tool. The DRB III connects to the data link connector. The data link connector is located under the instrument panel near bottom of the steering column (Fig. 1).

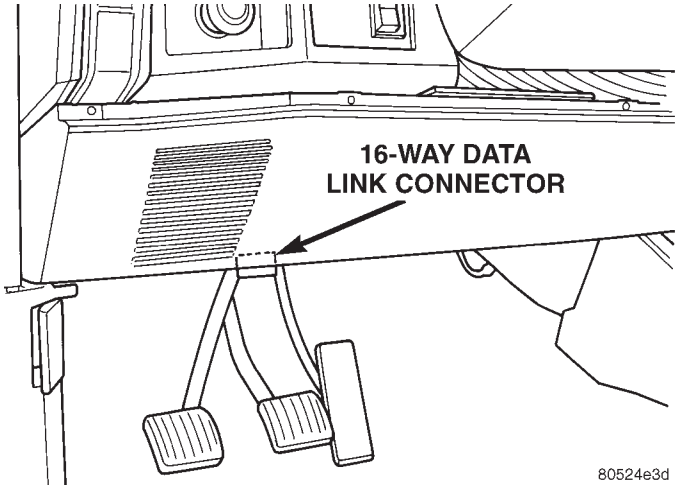

Fig. 1 Data Link Connector Location—Typical

ERASING TROUBLE CODES

After the problem has been repaired, use the DRB III scan tool to erase a DTC.

Generic Scan Tool Code	DRB III Scan Tool Display
P1112	Boost Pressure Sensor Signal High Boost Pressure Sensor Signal Low Boost Pressure Sensor Supply High Boost Pressure Sensor Supply Low Boost Pressure Sensor Plausibility
P0110	Intake Air Temperature Sensor Signal High Intake Air Temperature Sensor Signal Low
P1685	Immobilizer Signal Lost Invalid SKIM Message
P0115	Temperature of Engine Coolant SRC High Exceeded Temperature of Engine Coolant SRC Low Exceeded
P0180	Fuel Temperature Sensor SRC High Exceeded Fuel Temperature Sensor SRC Low Exceeded
P0400	EGR Open Circuit EGR Short Circuit
P0500	Vehicle Speed Sensor PEC Frequency Too High Vehicle Speed Sensor Signal SRC High Exceeded

DESCRIPTION AND OPERATION (Continued)

Generic Scan Tool Code	DRB III Scan Tool Display
P0725	Engine Speed Sensor Dynamic Plausibility Engine Speed Sensor Over Speed Recognition Engine Speed Sensor Static Plausibilty
P1105	Atmospheric Pressure Sensor SRC High Exceeded Atmospheric Pressure Sensor SRC Low Exceeded
P1201	Needle Movement Sensor SRC High Exceeded Needle Movement Sensor SRC Low Exceeded
P1220	Fuel Quantity Actuator Neg. Gov. Deviation Cold Fuel Quantity Actuator Neg. Gov. Deviation Warm Fuel Quantity Actuator Pos. Gov. Deviation Cold Fuel Quantity Actuator Pos. Gov. Deviation Warm
P1225	Control Sleeve Sensor Signal High Exceeded Control Sleeve Sensor Start End Pos. Not Attained Control Sleeve Sensor Stop End Pos. Not Attained
P1230	Timing Governing Negative Governor Deviation Timing Governing Positive Governor Deviation
P1515	Accelerator Pedal Sensor Signal High Exceeded Accelerator Pedal Sensor Signal Low Exceeded Accelerator Pedal Sensor Signal PWG Plaus With Low Idle Switch Accelerator Pedal Sensor Signal PWG Plaus With Potentiometer
P1600	Battery Voltage SRC High Exceeded
P1605	Terminal #15 Plausibility After Startup
P1610	Regulator Lower Regulator Limit Regulator Upper Regulator Limit
P1615	Microcontroller Gate-Array Monitoring Microcontroller Gate-Array Watchdog Microcontroller Prepare Fuel Quantity Stop Microcontroller Recovery Was Occurred Microcontrller Redundant Overrun Monitoring
P1630	Timing Solenoid Valve Controller Open Circuit Timing Solenoid Valve Controller Short Circuit
P1635	Glow Relay Controller Open Circuit Glow Relay Controller Short Circuit
P1650	Diagnostic Lamp Open Circuit Diagnostic Lamp Short Circuit
P1655	A/C Control Short Circuit A/C Control Open Circuit
P1660	Redundant Emer. Stop Plausibility In After-Run Redundant Emer Stop Powerstage Defective
P1665	Cruise Status Indicator Lamp Short Circuit
P1680	EEPROM Plausibility Checksum Error for Adj. EEPROM Plausibility Checksum Error in CC212 EEPROM Plausibility Communication With EEPROM EEPROM Plausibility Func. Switch Wrong or Missing

DESCRIPTION AND OPERATION (Continued)

Generic Scan Tool Code	DRB III Scan Tool Display
	EEPROM Plausibility Ver Number Not Corresponding
P1685	Vehicle Theft Alarm Code Line Breakdown
P1690	Fan Control Open Circuit Fan #1 Fan Control Open Circuit Fan #2 Fan Control Short Circuit Fan #1 Fan Control Short Circuit Fan #2
P1695	A/C System Pressure Sensor Signal High Exceeded A/C System Pressure Sensor Signal Low Exceeded A/C System Pressure Supply Signal High Exceeded A/C System Pressure Supply Signal Low Exceeded
P1703	Brake Signal Plaus With Redundant Contact
P1740	Clutch Signal Plausibilty
P1725	Inductive Aux. Speed Sensor Dynamic Plausibilty Inductive Aux. Speed Sensor Overspeed Recognition Inductive Aux Speed Sensor Plausibilty Inductive Aux. Speed Sensor Static Plausibilty

EXHAUST EMISSION CONTROLS—2.5L DIESEL ENGINE

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DESCRIPTION AND OPERATION

VACUUM HOSE ROUTING SCHEMATIC

Vacuum for the EGR system is supplied by the internal engine mounted vacuum pump. Refer to EGR System Operation for vacuum pump information. Vacuum harness routing for emission related components is displayed in (Fig. 1).

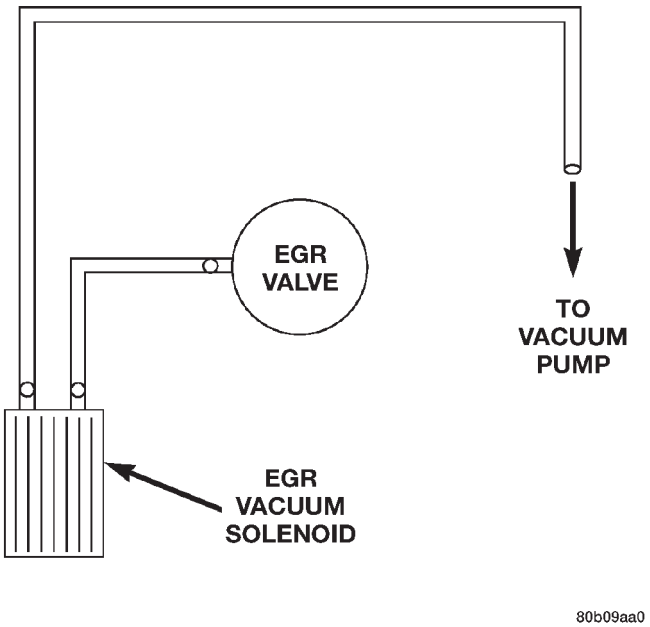

Fig. 1 Typical Hose Routing

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

GENERAL INFORMATION

The EGR system reduces oxides of nitrogen (NOx) in the engine exhaust. This is accomplished by allowing a predetermined amount of hot exhaust gas to recirculate and dilute the incoming fuel/air mixture.

A malfunctioning EGR system can cause engine stumble, sags or hesitation, rough idle, engine stalling and poor driveability.

EGR SYSTEM OPERATION

The system consists of:

- An EGR valve assembly. The valve is located behind the intake manifold (Fig. 2).

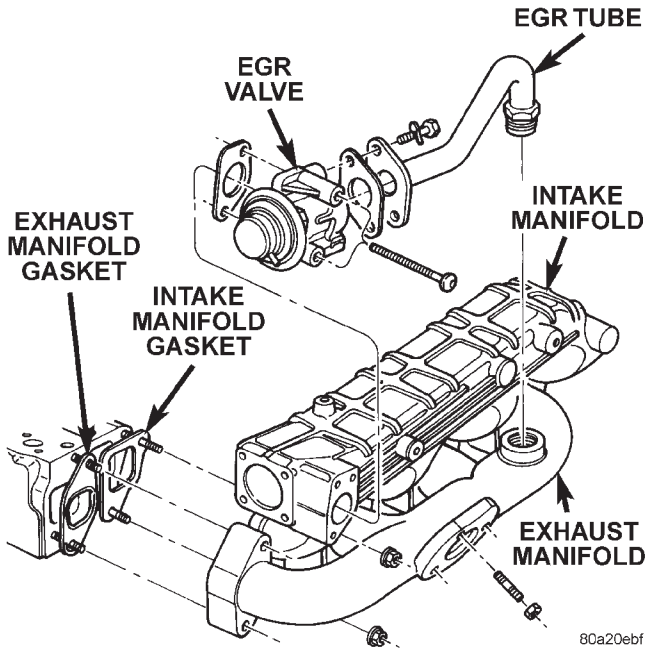

Fig. 2 EGR Valve and Tube Location

DESCRIPTION AND OPERATION (Continued)

• An EGR Solenoid. The EGR solenoid is located in the engine compartment next to the PDC (Fig. 3). The EGR solenoid opens and closes the vaccum supply that opens and closes the EGR valve. The amount of time the EGR solenoid is held open is controlled by the PCM. This is referred to as the "on time" of the EGR valve.

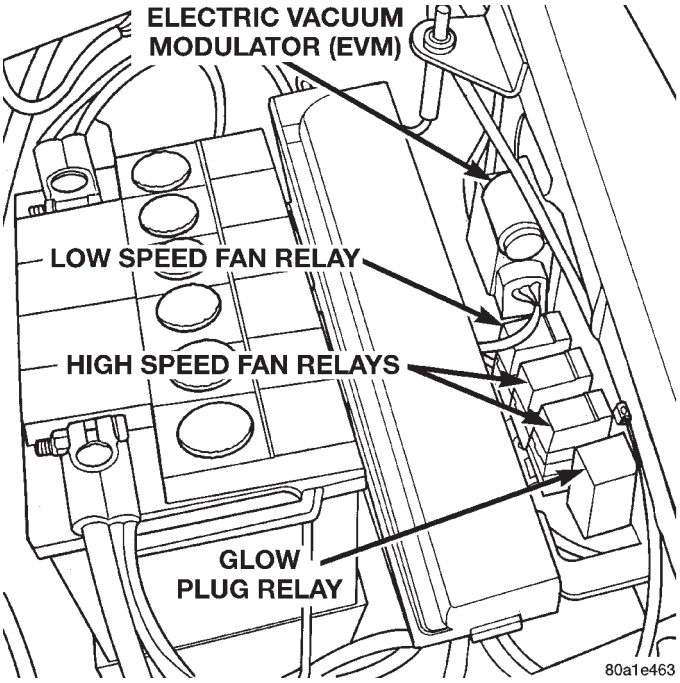

Fig. 3 EGR Solenoid

• An EGR tube (Fig. 2) connecting a passage in the EGR valve to the rear of the exhaust manifold.

• The vacuum pump, which supplies vacuum for the EGR Solenoid valve. This pump also supplies vacuum for operation of the power brake booster. The pump is located internally in the front of the engine block (Fig. 4) and is driven by the crankshaft gear.

• Vacuum lines and hoses to connect the various components.

When the PCM supplies a "on" or "off" signal to the EGR Solenoid by grounding the circuit, EGR system operation starts to occur. The PCM will monitor various engine conditions and determine when to supply and remove this ground signal. Some of the engine conditions that are monitored are the engine coolant temperature, throttle position and engine speed sensors.

When the ground signal is supplied to the EGR Solenoid, vacuum from the vacuum pump will be allowed to pass to the EGR valve via a connecting hose.

Exhaust gas recirculation will begin in this order when:

• The PCM determines that EGR system operation is necessary.

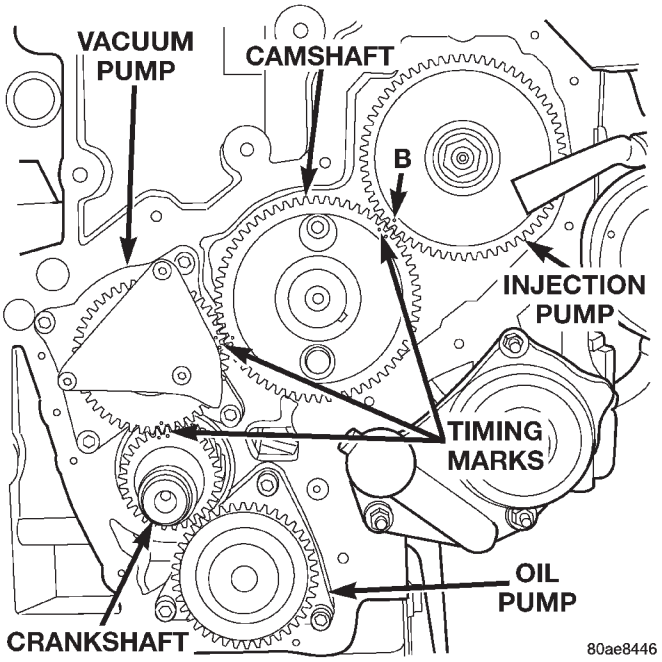

Fig. 4 Internal Vacuum Pump

• The engine is running to operate the vacuum pump.

• A ground signal is supplied to the EVM.

• Vacuum passes to the EGR valve.

• The inlet seat (poppet valve) at the bottom of the EGR valve opens to dilute and recirculate exhaust gas back into the intake manifold.

The EGR system will be shut down by the PCM after 60 seconds of continuous engine idling to improve idle quality.

DIAGNOSIS AND TESTING

EGR GAS FLOW TEST

Use the following test procedure to determine if exhaust gas is flowing through the EGR valve. It can also be used to determine if the EGR tube is plugged, or the system passages in the intake or exhaust manifolds are plugged.

This is not to be used as a complete test of the EGR system.

The engine must be started, running and warmed to operating temperature for this test.

(1) All EGR valves are equipped with a vacuum supply fitting located on the EGR valve vacuum motor (Fig. 2).

(2) Disconnect the rubber hose from the vacuum supply fitting (Fig. 2).

(3) Connect a hand–held vacuum pump to this fitting.

(4) Start the engine.

DIAGNOSIS AND TESTING (Continued)

(5) Slowly apply 10 inches of vacuum to the fitting on the EGR valve motor. Vacuum should hold steady at 10 inches. If not, replace the EGR valve. If vacuum holds steady at 10 inches, proceed to next step.

(6) While applying vacuum, and with the engine running at idle speed, the idle speed should drop, a rough idle may occur, or the engine may even stall. This is indicating that exhaust gas is flowing through the EGR tube between the intake and exhaust manifolds.

(7) If the engine speed did not change, the EGR valve may be defective, the EGR tube may be plugged with carbon, or the passages in the intake and exhaust manifolds may be plugged with carbon.

(a) Remove EGR valve from engine. Refer to EGR Valve Removal in this group.

(b) Apply vacuum to the vacuum motor fitting and observe the stem on the EGR valve. If the stem is moving, it can be assumed that the EGR valve is functioning correctly. The problem is in either a plugged EGR tube or plugged passages at the intake or exhaust manifolds. Refer to step (c). If the stem will not move, replace the EGR valve.

(c) Remove the EGR tube between the intake and exhaust manifolds. Check and clean the EGR tube and its related openings on the manifolds. Refer to EGR Tube in this group for procedures.

Do not attempt to clean the EGR valve. If the valve shows evidence of heavy carbon build–up near the base, replace it.

ELECTRIC VACUUM MODULATOR (EVM) TEST

VACUUM TEST

With the engine running, disconnect the vacuum supply line at the fitting on the EVM. Minimum vacuum should be no less than 20 inches. If vacuum is lower, check for leaks in vacuum supply line. If leaks cannot be found, check for low vacuum at vacuum pump. Refer to Group 5, Brake System for procedures.

REMOVAL AND INSTALLATION

EGR VALVE

REMOVAL

(1) Remove the rubber hose from turbocharger to metal tube.

(2) Disconnect vacuum line at EGR valve vacuum supply fitting (Fig. 2).

(3) Loosen the tube fitting at exhaust manifold end of EGR tube (Fig. 2).

(4) Remove the two bolts retaining the EGR tube to the side of EGR valve (Fig. 2).

(5) Remove the two EGR valve mounting bolts (Fig. 2) and remove EGR valve.

(6) Discard both of the old EGR mounting gaskets.

INSTALLATION

(1) Clean the intake manifold of any old gasket material.

(2) Clean the end of EGR tube of any old gasket material.

(3) Position the EGR valve and new gasket to the intake manifold.

(4) Install two EGR valve mounting bolts. Do not tighten bolts at this time.

(5) Position new gasket between EGR valve and EGR tube.

(6) Install two EGR tube bolts. Tighten all four mounting bolts to 23 N·m (204 in. lbs.).

(7) Tighten EGR tube fitting at exhaust manifold.

(8) Connect vacuum line to EGR valve.

(9) Install the rubber hose from turbocharger to metal tube.

EGR TUBE

The EGR tube connects the EGR valve to the rear of the exhaust manifold (Fig. 2).

REMOVAL

(1) Remove rubber hose from turbocharger to metal tube.

(2) Remove two EGR tube mounting bolts at EGR valve end of tube (Fig. 2).

(3) Loosen fitting at exhaust manifold end of tube (Fig. 2).

(4) Remove EGR tube and discard old gasket.

(5) Clean gasket mating surfaces and EGR tube flange gasket surfaces.

(6) Check for signs of leakage or cracked surfaces at both ends of tube, exhaust manifold and EGR valve.

INSTALLATION

(1) Install a new gasket to EGR valve end of EGR tube.

(2) Position EGR tube to engine.

(3) Loosely tighten fitting at exhaust manifold end of tube.

(4) Install 2 mounting bolts at EGR valve end of tube. Tighten bolts to 23 N·m (204 in. lbs.) torque.

(5) Tighten fitting at exhaust manifold end of tube.

(6) Install hose from turbocharger to metal tube.

ELECTRIC VACUUM MODULATOR (EVM)

The EVM (EGR Duty Cycle Purge Solenoid) is mounted to the side of the PDC (Fig. 6).

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Disconnect both cables from battery, negative cable first.

(2) Remove 2 screws holding PDC to bracket, swing out of way.

(3) Remove nut and clamp holding battery to battery tray (Fig. 5).

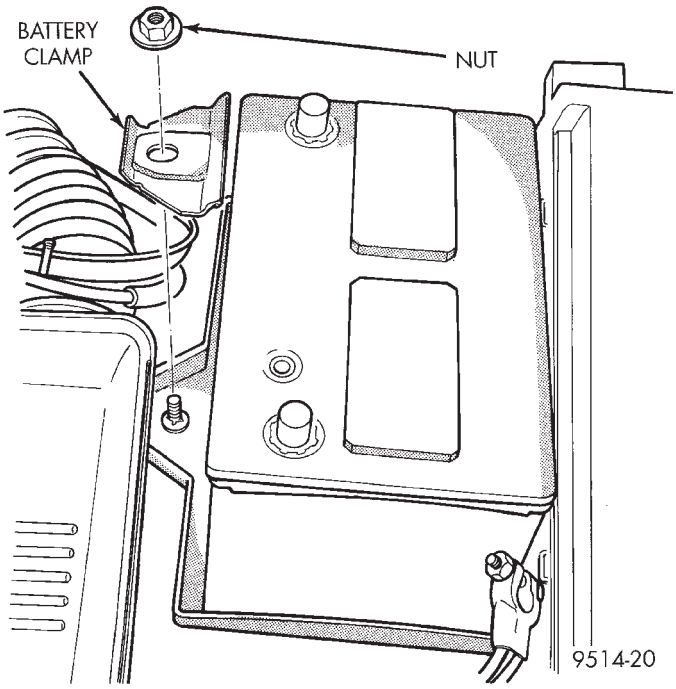

Fig. 5 Battery Clamp

(4) Remove battery from vehicle.

(5) Disconnect two vacuum hoses at EVM (Fig. 6).

(6) Remove mounting screws of EVM.

(7) Remove the EVM to gain access to the EVM electrical connector.

(8) Remove electrical connector at EVM.

INSTALLATION

(1) Install electrical connector to EVM.

(2) Install EVM and tighten mounting screws.

(3) Connect vacuum hoses.

(4) Install PDC to bracket and tighten mounting screws.

(5) Install battery.

(6) Connect battery cables positive first.

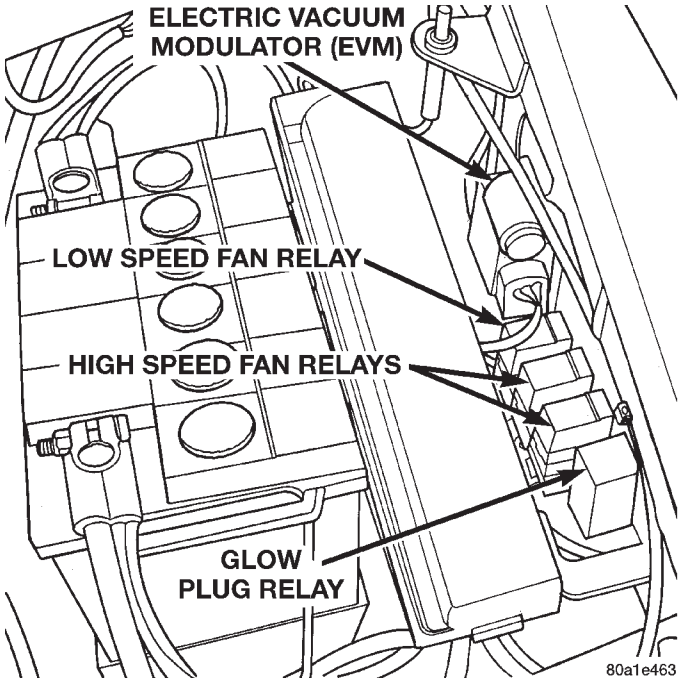

Fig. 6 EVM Location

SPECIFICATIONS

TORQUE CHART—2.5L DIESEL

Description	Torque
EGR Valve Mounting Bolts	23 N·m (204 in. lbs.)
EGR Tube Mounting Bolts	23 N·m (204 in. lbs.)
EVM (Electric Vacuum Modulator) Mounting Bolt	2 N·m (20 in. lbs.)

EMISSION CONTROL SYSTEM—2.0L ENGINE

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GENERAL INFORMATION

GENERAL INFORMATION

The emission control system for the 2.0L engine functions the same as the systems for the 2.4/3.0/3.3/3.8L engines. Refer to group 25 for more information about Diagnostic Trouble Codes and other system features.

POSITIVE CRANKCASE VENTILATION SYSTEM (PCV) SYSTEM—2.0L ENGINE

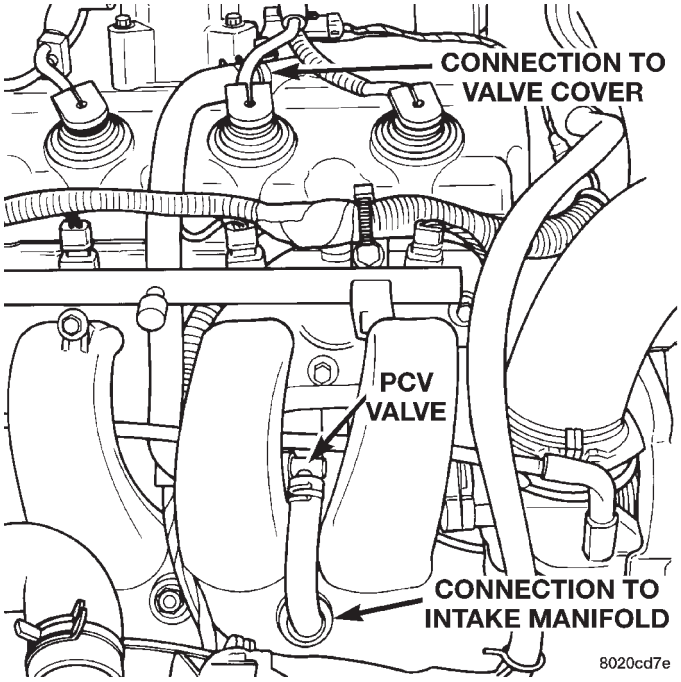

Fig. 1 PCV System—2.0L

The PCV System for 2.0L engines function the same as PCV systems for 2.4/3.0/3.3/3.8L engines. Refer to group 25 for more information.

REMOVAL AND INSTALLATION

EGR VALVE

If the EGR system operates incorrectly, replace the entire EGR valve and transducer together. The EGR valve and electrical transducer (EET) are calibrated together.

REMOVAL

The EGR valve attaches to the rear of the cylinder head (Fig. 2). EGR transducer is attached to the air inlet duct.

(1) Remove EGR transducer from air inlet duct.
(2) Disconnect vacuum supply tube from EGR transducer solenoid.
(3) Disconnect electrical connector from solenoid.
(4) Remove air inlet duct.
(5) Remove EGR tube to EGR valve screws.
(6) Remove EGR valve mounting screws. Remove EGR valve and transducer.
(7) Clean gasket surfaces. Discard old gaskets. If necessary, clean EGR passages.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Loosely install EGR valve with new gaskets.
(2) Finger tighten EGR tube fasteners.
(3) Tighten EGR tube fasteners to 11 N·m (95 in. lbs.) torque.
(4) Tightening EGR valve mounting screws to 22 N·m (200 in. lbs.) torque.
(5) Install air inlet duct.
(6) Connect vacuum supply tube to solenoid.
(7) Attach electrical connector to solenoid.
(8) Install EGR transducer onto air inlet duct.

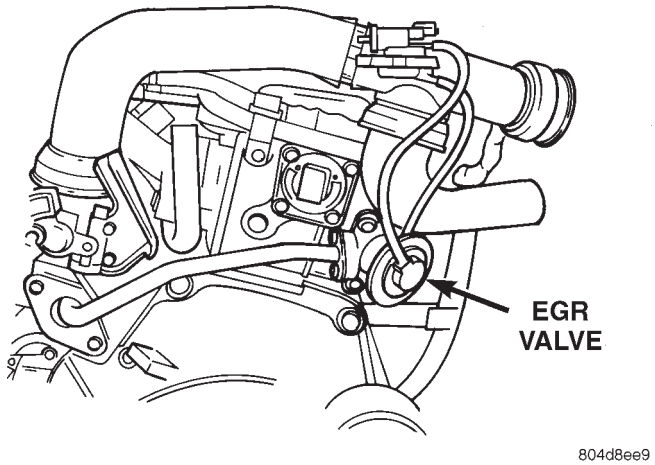

Fig. 2 EGR System

EGR TUBE

The EGR tube attaches to the intake manifold plenum below the throttle body and EGR valve.

REMOVAL

(1) Remove screws attaching EGR tube to intake manifold (Fig. 3).
(2) Remove EGR tube to EGR valve screws.
(3) Remove EGR tube. Clean gasket surface on the EGR valve. Wipe clean the grommet on the intake manifold.

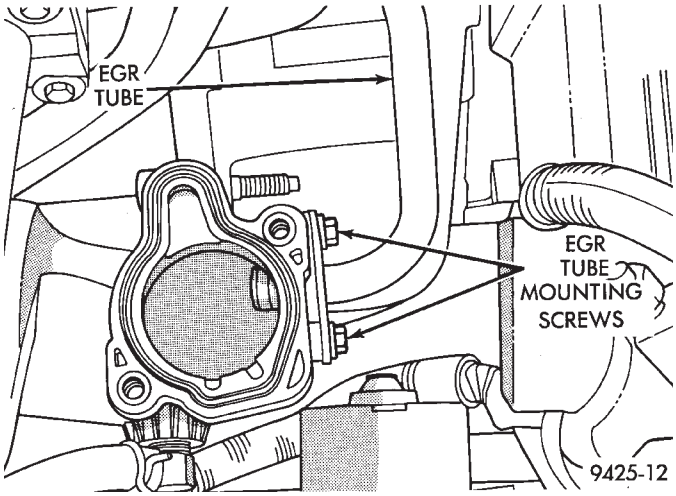

Fig. 3 EGR Tube Stud Bolts

INSTALLATION

The rubber grommet that seals the EGR tube to intake manifold connection is reusable.
(1) Loosely install the EGR tube and fasteners.
(2) Tighten the EGR tube to intake manifold plenum screws to 11 N·m (95 in. lbs) torque.
(3) Tighten the EGR tube to EGR valve screws to 11 N·m (95 in. lbs.) torque.

TORQUE

Description	Torque
EGR valve to cyl. head	22 N·m (200 in. lbs.)
EGR tube to EGR valve	11 (95 in. lbs.)
EGR tube to intake manifold	11 N·m (95 in. lbs.)