



FUEL SYSTEMS

CONTENTS

	page		page
ACCELERATOR PEDAL AND THROTTLE CABLE ..	18	ON-BOARD DIAGNOSTICS	47
FUEL DELIVERY	2	SEQUENTIAL MULTI-PORT FUEL INJECTION—	
FUEL TANKS	15	SERVICE PROCEDURES	55
SEQUENTIAL MULTI-PORT FUEL INJECTION—		SEQUENTIAL MULTI-PORT FUEL INJECTION—	
GENERAL DIAGNOSIS	35	SYSTEM OPERATION	20
SEQUENTIAL MULTI-PORT FUEL INJECTION—		SPECIFICATIONS	72

GENERAL INFORMATION

Throughout this group, references may be made to a particular vehicle by letter or number designation. The Introduction Section at the front of this manual explains the different designations.

This Group contains several different sections. Each section has an Index of the systems and components it addresses.

Group 25 describes the function of the Evaporation Control and Exhaust Gas Recirculation systems. Refer to Group 25, Emissions.

FUEL REQUIREMENTS

3.3L ENGINE

The vehicle is designed to meet all emission regulations and provide excellent fuel economy when using high quality unleaded gasoline having a minimum octane rating of 87.

3.5L ENGINE

The vehicle will operate satisfactorily on fuels ranging from regular unleaded gasoline having a minimum octane rating of 87 to premium unleaded with a minimum rating of 91. However, midgrade unleaded fuel with a minimum octane rating of 89 is recommended. The use of premium unleaded gasoline will further improve performance.

Light spark knock at low engine speeds is not harmful to your engine. However, continued heavy spark knock at high speeds can cause damage and should be reported to your dealer immediately. Engine damage resulting from operating with a heavy spark knock may not be covered by the new vehicle warranty.

In addition to using unleaded gasoline with the proper octane rating, gasolines that contain detergents, corrosion and stability additives are recommended. Using gasolines that have these additives will help improve fuel economy, reduce emissions, and maintain vehicle performance. Generally, premium unleaded gasolines contain more additive than regular unleaded.

Poor quality gasoline can cause problems such as hard starting, stalling, and stumble. If you experience these problems, try another brand of gasoline before considering service for the vehicle.

GASOLINE/OXYGENATE BLENDS

Some fuel suppliers blend gasoline with materials that contain oxygen such as alcohol, MTBE and ETBE. The type and amount of oxygenate used in the blend is important.

The following are generally used in gasoline blends:

Ethanol - (Ethyl or Grain Alcohol) properly blended, is used as a mixture of 10 percent ethanol and 90 percent gasoline. Gasoline blended with ethanol may be used in your vehicle.

Methanol - (Methyl or Wood Alcohol) is used in a variety of concentrations when blended with unleaded gasoline. You may find fuels containing 3 percent or more methanol along with other alcohols called cosolvents.

Do not use gasolines containing Methanol.

Use of methanol/gasoline blends may result in starting and driveability problems and damage to critical fuel system components.

Problems that are the result of using methanol/gasoline blends are not the responsibility of Chrysler Corporation and may not be covered by the new vehicle warranty.

MTBE/ETBE - Gasoline and MTBE (Methyl Tertiary Butyl Ether) blends are a mixture of unleaded gasoline blended and up to 15 percent MTBE. Gasoline and ETBE (Ethyl Tertiary Butyl Ether) are blends of gasoline and up to 17 percent ETBE. Gasoline blended with MTBE or ETBE may be used in your vehicle.

Clean Air Gasoline

Many gasolines are now being blended that contribute to cleaner air, especially in those areas of the country where pollution levels are high. These new blends provide a cleaner burning fuel and some are referred to as reformulated gasoline.



In areas of the country where carbon monoxide levels are high, gasolines are being treated with oxygenated materials such as ETBE, MTBE and Ethanol. The use of gasoline blended with these materials also contributes to cleaner air.

Chrysler Motors supports these efforts toward cleaner air and recommends that you use these gasolines as they become available.

Materials Added to Fuel

Indiscriminate use of fuel system cleaning agents should be avoided. Many of these materials intended for gum and varnish removal may contain active solvents of similar ingredients that can be harmful to fuel system gasket and diaphragm materials.

FUEL DELIVERY

INDEX

	page		page
Chassis Fuel Tubes	13	Fuel Pump Strainer	5
Fuel Filter	13	Fuel System Pressure Release Procedure	2
Fuel Level Sensor	4	Fuel System Pressure Specifications	10
Fuel Pressure Regulator	7	Fuel Tank Pressure Relief/Rollover Valve	6
Fuel Pump Module	3	Fuel Tubes and Quick-Connect Fittings	11
Fuel Pump Pressure Test	10	General Information	2

GENERAL INFORMATION

The fuel delivery system consists of the fuel pump module, in-line fuel filter, fuel lines and fuel hoses. The fuel pump module contains the fuel pump, inlet strainer, level sensor, and fuel reservoir. The level sensor pressure relief/rollover valve and inlet strainer are the only serviceable parts of the module.

Relieve fuel system pressure before servicing fuel system components. Refer to the Fuel System Pressure Release Procedure and follow all Cautions and Warnings. Most fuel system components attach to the fuel lines with quick connect fittings. Refer to Quick Connect Fittings in this section.

FUEL SYSTEM PRESSURE RELEASE PROCEDURE

- (1) Disconnect negative cable from battery.
- (2) Remove fuel filler cap.
- (3) Remove the protective cap from the fuel pressure test port on the fuel rail (Fig. 1 or Fig. 2).

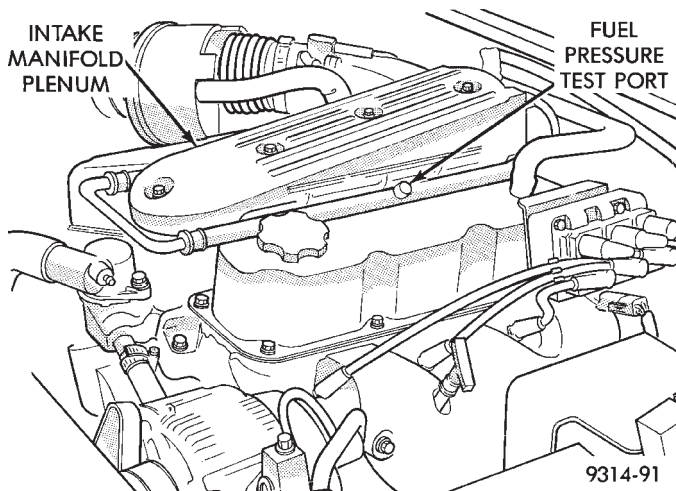


Fig. 1 Fuel Pressure Test Port—3.3L Engine

- (4) Place the open end of fuel pressure release hose, tool number C-4799-1, into an approved gaso-

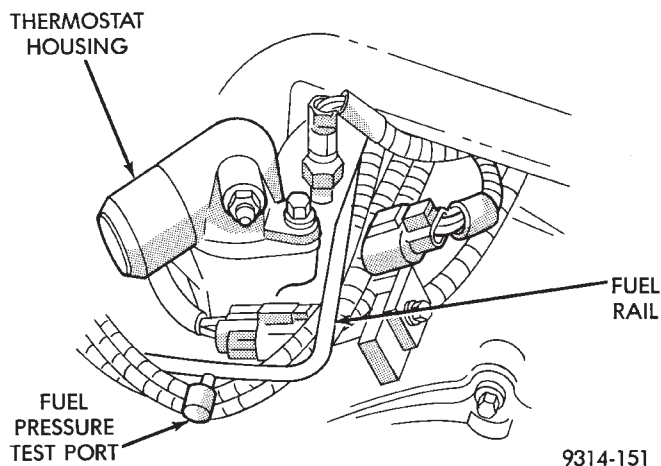


Fig. 2 Fuel Pressure Test Port—3.5L Engine

line container. Connect the other end of hose C-4799-1 to the fuel pressure test port (Fig. 3). Fuel pressure will bleed off through the hose into the gasoline container. Fuel gauge C-4799-A contains hose C-4799-1.

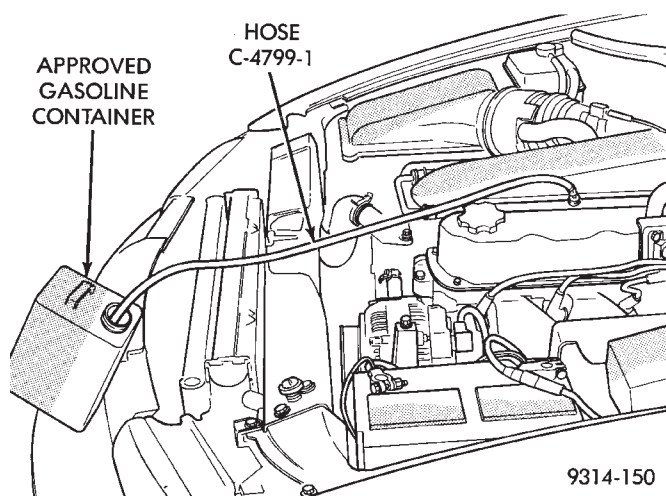


Fig. 3 Releasing Fuel Pressure—Typical



FUEL PUMP MODULE

The fuel pump module contains the fuel pump, fuel reservoir, level sensor, inlet strainer, and pressure relief/rollover valve (Fig. 4). The inlet strainer, level sensor and pressure relief/rollover valve are the only serviceable items. If the fuel pump requires service, replace the fuel pump module.

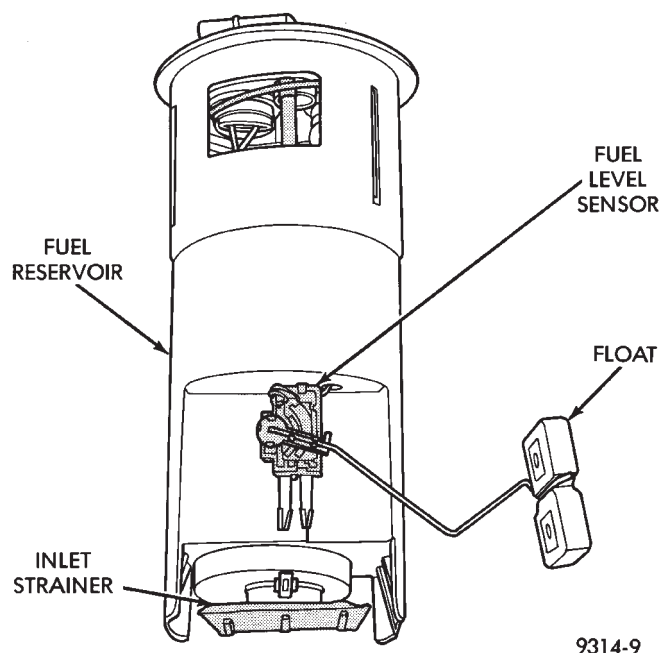


Fig. 4 Fuel Pump Module

The fuel system uses a positive displacement, gerotor gear, immersible pump with a permanent magnet electric motor. The pump draws fuel through a strainer and pushes it through the motor to the outlet. The pump module contains three check valves. One valve relieves internal fuel pump pressure and regulates maximum pump output. Another valve, inside the pump module assembly in the fuel return circuit, prevents fuel tank leakage if the line is damaged during an accident. The third valve, in the pump outlet, maintains pump pressure during engine off conditions. The fuel pump relay provides voltage to the fuel pump.

The fuel pump has a maximum unregulated pressure output of approximately 871 kPa (125 psi). Without vacuum applied to the fuel pressure regulator, the regulator adjusts fuel system pressure to approximately 379 kPa (55 psi) on 3.3L engines and 331 kPa (48 psi) on 3.5L engines. Fuel system pressure varies with different amounts of manifold vacuum.

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING THE FUEL TANK, FUEL PUMP, FUEL LINES, FUEL FILTER, OR PARTS OF THE FUEL RAIL. FOLLOW THE FUEL SYSTEM PRESSURE RELEASE PROCEDURE TO RELIEVE FUEL SYSTEM PRESSURE.

REMOVAL

The trunk has an access cover in the floor panel for servicing the fuel pump module (Fig. 5).

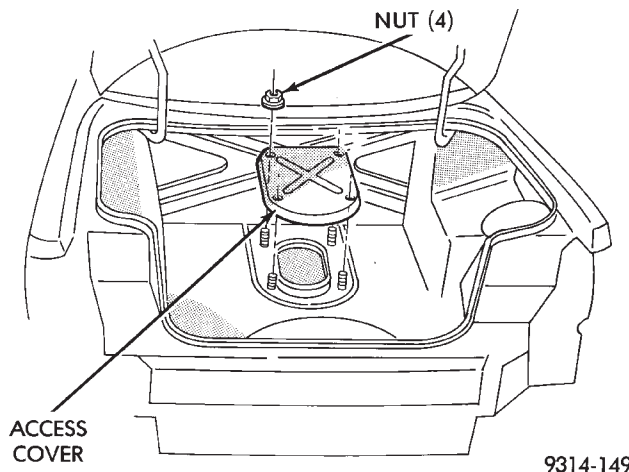


Fig. 5 Fuel Pump Access Panel

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE REMOVING THE FUEL PUMP MODULE. REFER TO THE FUEL PRESSURE RELEASE PROCEDURE.

- (1) Release fuel system pressure. Refer to Fuel Pressure Release Procedure.
- (2) Disconnect negative cable from battery.
- (3) Remove trunk liner.
- (4) Remove access panel fasteners.
- (5) Remove access panel and gasket (Fig. 6). Inspect gasket for damage. If necessary, replace gasket.
- (6) Disconnect electrical connector from top of

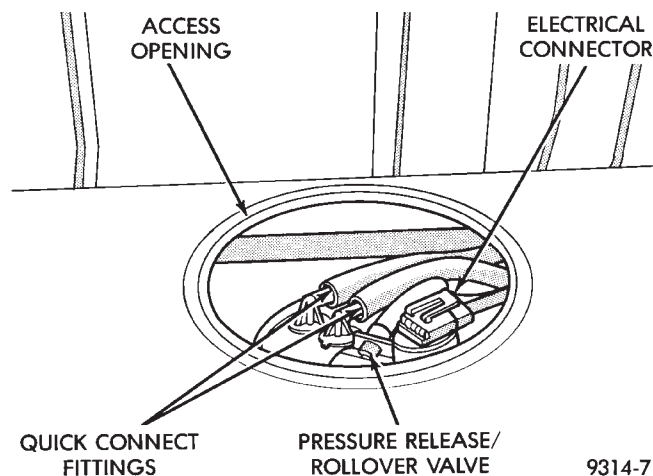


Fig. 6 Access Opening in Trunk

pump module.

(7) Disconnect fuel supply and return tubes from fuel pump module. Refer to Quick-Connect Fittings in this section.

(8) Disconnect hose from pressure relief/rollover valve.



A band clamp fastens the fuel pump module to the tank. The module rises up from the tank after loosening the clamp.

(9) Loosen band clamp until fuel pump module rises up from tank.

WARNING: THE FUEL PUMP RESERVOIR MAY CONTAIN FUEL. DO NOT SPILL FUEL WHILE REMOVING THE MODULE.

(10) To absorb possible fuel spillage, place shop towels around access opening. Without removing the module, tip it backwards to allow fuel in the reservoir to run down the side and back into the fuel tank.

The float arm of the level sensor catches on the inside of the tank while removing the module. Tilt the module to one side when removing from tank.

(11) Remove fuel pump module and gasket from tank.

(12) Drain remainder of fuel from reservoir before servicing the pump module.

INSTALLATION

The fuel pump module and fuel tank have alignment marks. The tank has two molded lines at the ten o'clock position. The fuel pump module has a triangular alignment mark (Fig. 7). Align the marks to correctly position the pump module.

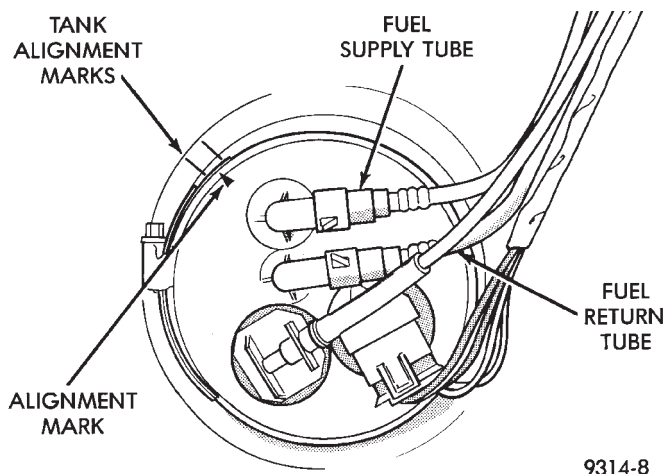


Fig. 7 Fuel Pump Module Alignment Mark

(1) With a new gasket, insert the module straight into the tank to set float on bottom. Align marks on module and tank.

(2) Seat module to tank by pushing the top down. Make sure the gasket does not slip over the outside or inside edge of the fuel tank lip. While holding module in seated position, place band clamp over lip of tank and edge of fuel pump module. Tighten band clamp to 4 N•m (31 in. lbs) torque. **Do not over tighten the fuel pump band clamp.**

(3) Install fuel tubes over fuel return and supply nipples on the module. Refer to Fuel Tubes and Quick Connect Fittings in this section.

(4) Connect vent line to pressure relief/rollover valve.

(5) Attach electrical connector to fuel pump module.

(6) Use DRBII scan tool to pressurize fuel system. Check for leaks.

(7) Install access cover and gasket. Tighten fasteners.

(8) Install trunk liner.

FUEL LEVEL SENSOR

The fuel level sensor attaches to the side of the fuel pump module. Remove the fuel pump module to replace the fuel level sensor. Refer to Fuel Pump Module Removal in this section.

DIAGNOSIS

This procedure test the resistance of the level sensor itself. It does not test the level sensor circuit. Refer to Group 8W, Wiring Diagrams for circuit identification.

The level sensor is a variable resistor. Its resistance changes with the amount of fuel in the tank. The float arm attached to the sensor moves as the fuel level changes. To test the level sensor, connect an ohmmeter across the sensor signal and sensor ground terminals of the fuel pump module connector (Fig. 8). Move the float lever to the positions shown in the resistance chart (Fig. 8). Record the resistance at each point. Replace the level sensor if the resistance is not within specifications.

REMOVAL

Remove fuel pump module. Refer to Fuel Pump Module in this section.

(1) Depress the retaining tab and remove the fuel pump/level sensor connector from the bottom of the fuel pump module electrical connector (Fig. 9).

(2) Remove wire terminal retaining clip from connector (Fig. 10). Note the location of terminals for the level sensor wires (Fig. 11).

(3) Push level sensor signal and ground terminals up out of the connector (Fig. 12).

(4) Insert a screwdriver between the fuel pump module and the top of the level sensor housing (Fig. 13). Push level sensor down slightly.

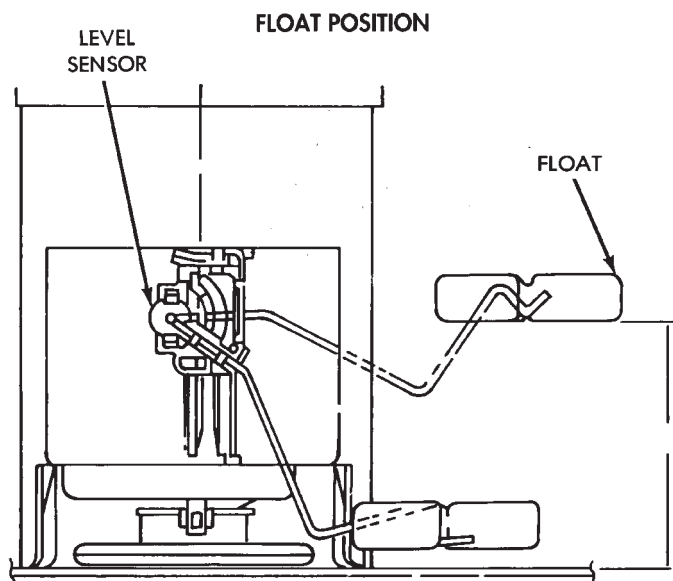
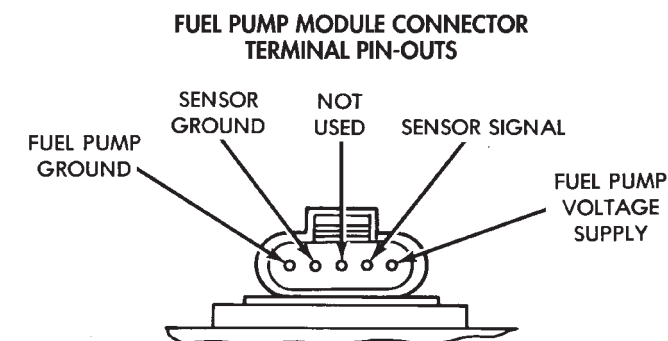
(5) Slide level sensor wires through standpipe inside fuel pump module (Fig. 14).

(6) Slide level sensor out of installation channel (Fig. 13).

INSTALLATION

(1) Insert level sensor wires in bottom of standpipe.

(2) Wrap wires into groove in back of level sensor (Fig. 15).



FLOAT POSITION (HEIGHT)	RESISTANCE
187.9 mm (Sensor Full Stop)	20 ± 40 Ohms
179.3 mm (Stop on Gauge)	80 ± 15 Ohms
135.3 mm (3/4 position)	290 ± 30 Ohms
99.1 mm (1/2 position)	500 ± 30 Ohms
61.1 mm (1/4 position)	710 ± 30 Ohms
13.4 mm (Empty on Gauge)	920 ± 30 Ohms
2.5 mm (Sensor Empty Stop)	1000 ± 20 Ohms

9314-17

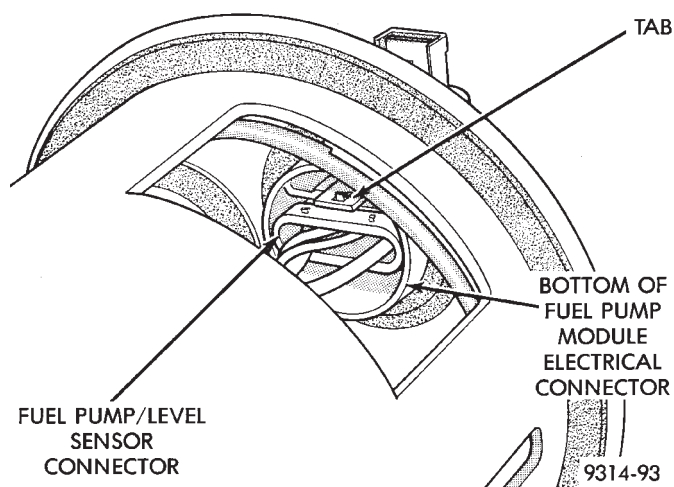
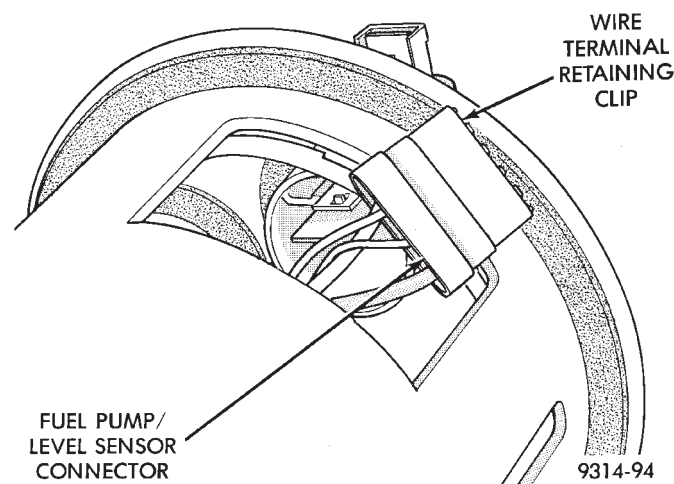
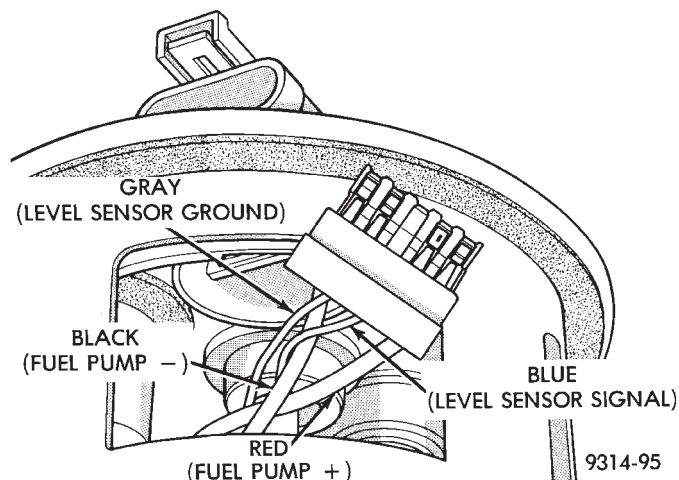
Fig. 8 Level Sensor Diagnosis

(3) While feeding wires into standpipe, slide level sensor up into installation channel until it snaps into place. Ensure tab at bottom of sensor locks in place.

(4) Install level sensor wires in connector. Push the wires up through the connector and then pull them down until they lock in place. Ensure signal and ground wires are installed in the correct position (Fig. 11).

(5) Install retaining clip on connector.

(6) Push fuel pump/level sensor connector up into bottom of fuel pump module electrical connector.

**Fig. 9 Fuel Pump/Level Sensor Connector****Fig. 10 Wire Terminal Retaining Clip****Fig. 11 Wire Terminal Identification**

(7) Install fuel pump module. Refer to Fuel Pump Module in this section.

FUEL PUMP STRAINER

Remove fuel pump module. Refer to Fuel Pump Module in this section.

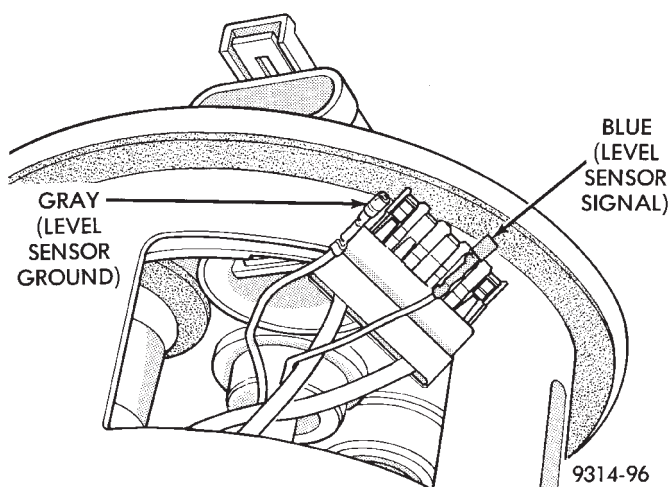


Fig. 12 Level Sensor Signal and Ground Wires

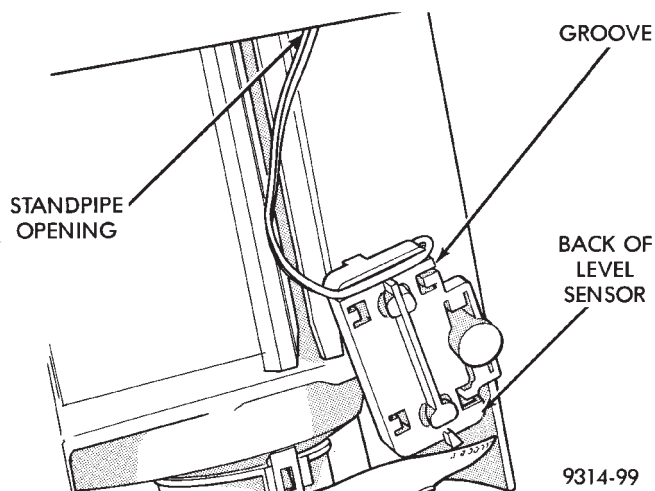


Fig. 15 Level Sensor Installation

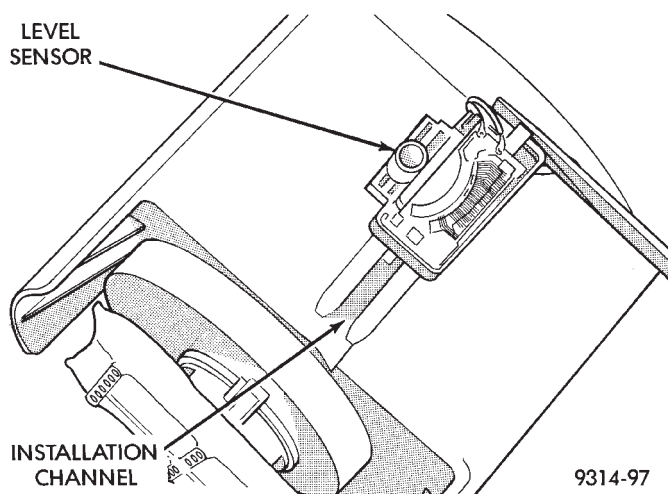


Fig. 13 Fuel Level Sensor Removal

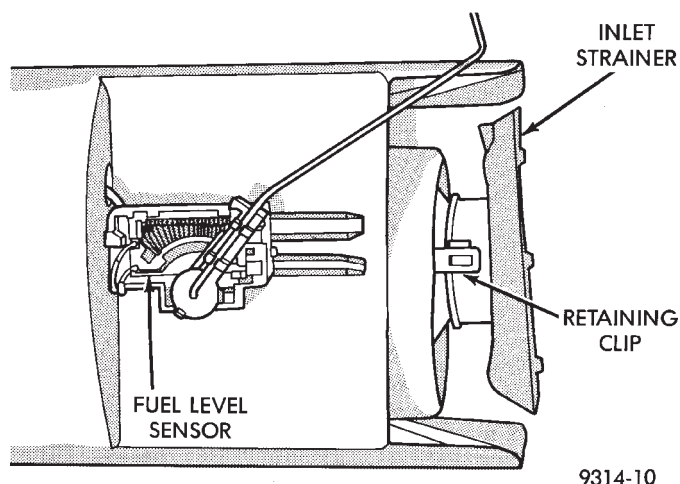


Fig. 16 Inlet Strainer

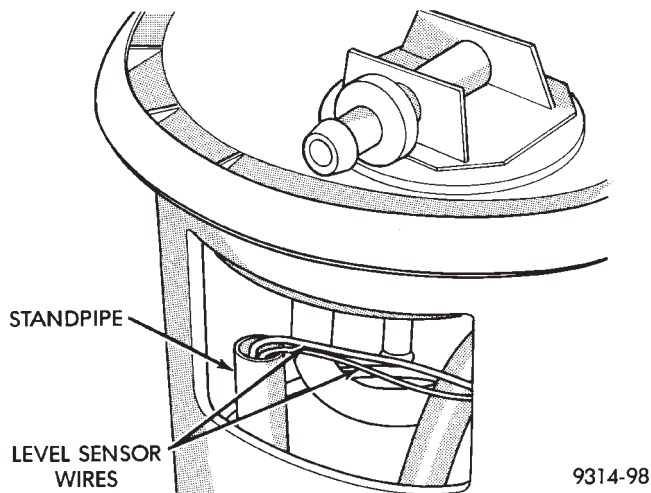


Fig. 14 Standpipe Inside Module

- (1) Spread retaining clips and remove strainer (Fig. 16).
- (2) Replace strainer O-ring.
- (3) Install new strainer into retaining clips. Strainer should snap into place.

FUEL TANK PRESSURE RELIEF/ROLLOVER VALVE

The fuel pump module houses the pressure relief/rollover valve (Fig. 17). The dual function valve relieves fuel tank pressure and prevents fuel flow through the fuel tank vent hoses in the event of vehicle rollover. All vehicles pass a full 360° rollover without fuel leakage.

REMOVAL

- (1) Remove fuel pump module. Refer to Fuel Pump Module in this section.
- (2) Wedge the blade of a straight screwdriver between the rubber grommet and the fuel pump module. **To prevent damage to the valve, do not pry between the valve and the grommet.**
- (3) Use a second screwdriver as a support to pry the valve and grommet assembly from the module.
- (4) To remove the grommet, place the valve upright on a flat surface. Push down on the grommet and peel it off the valve.

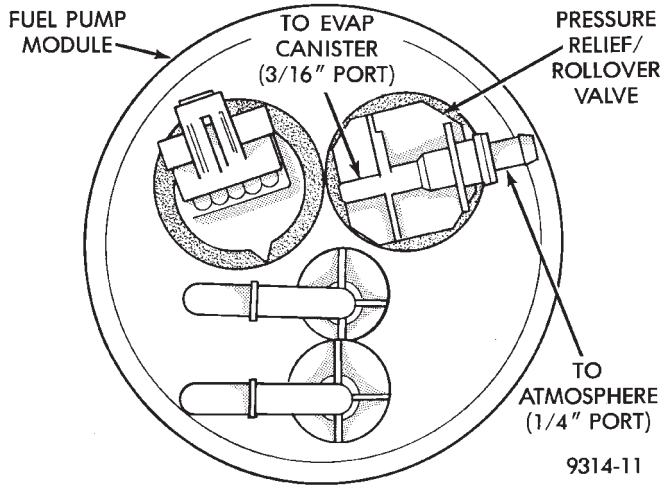


Fig. 17 Pressure Relief/Rollover Valve

INSTALLATION

- (1) Install the rubber grommet in the fuel pump module.
- (2) Lubricate the grommet with a light coating of **Power Steering Fluid**. Push the valve downward into the grommet. Twist valve until the ports are properly positioned (Fig. 17).
- (3) Install fuel pump module. Refer to Fuel Pump Module Installation in this section.

FUEL PRESSURE REGULATOR

The fuel system uses a vacuum balanced, non-adjustable fuel pressure regulator. The powertrain control module (PCM) does not operate the regulator. On 3.3L engines, the pressure regulator sits in the fuel rail (Fig. 18). On 3.5L engines the regulator attaches to the fuel return tube at the rear of the engine below the intake manifold plenum (Fig. 19).

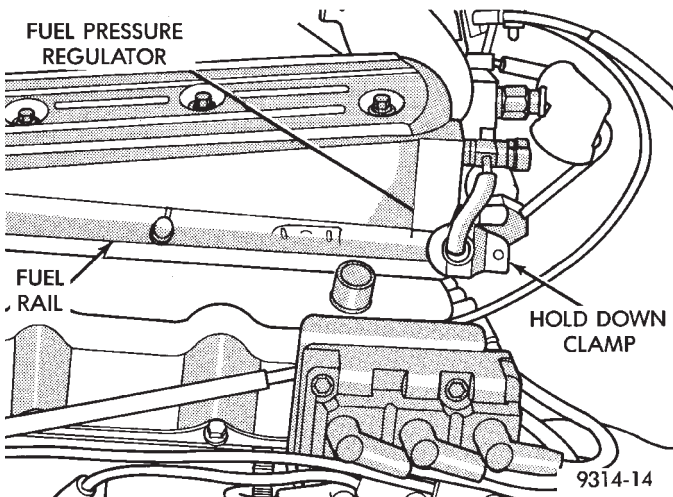


Fig. 18 Fuel Pressure Regulator—3.3L Engine

On 3.3L engines, the regulator maintains fuel system pressure at approximately 317 kPa (46 psi) with manifold vacuum applied to it and the engine idling.

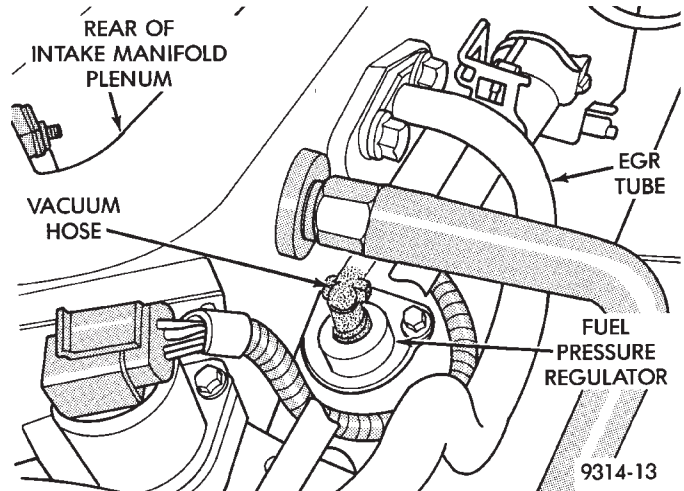


Fig. 19 Fuel Pressure Regulator—3.5L Engine

Without vacuum applied, the 3.3L regulator maintains pressure at approximately 379 kPa (55 psi).

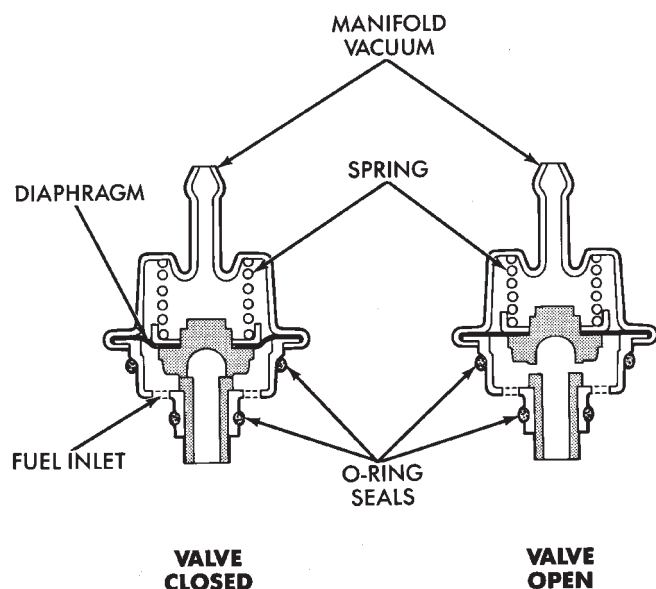
On 3.5L engines, the regulator maintains fuel system pressure at approximately 317 kPa (39 psi) with manifold vacuum applied to it and the engine idling. Without vacuum applied, the 3.5L regulator maintains pressure at approximately 379 kPa (48 psi).

A leaking vacuum supply hose can change fuel system pressure. To determine if the regulator operates correctly, check fuel system without vacuum applied to the regulator.

The pressure regulator contains a diaphragm, calibrated spring and a fuel return valve (Fig. 20). The spring pushes down on the diaphragm and closes off the fuel return port. Manifold vacuum applied to the top of the diaphragm acts against the spring pressure while fuel pressure pushes on the bottom of the diaphragm. The combination of fuel pressure and intake manifold open the return port. The more intake manifold vacuum applied to the regulator, the less fuel pressure required to open the return port. System fuel pressure reflects the amount of fuel pressure required to open the return port. System pressure varies with different amounts of intake manifold vacuum.

With low vacuum, such as during wide open throttle conditions, minimal vacuum assistance is available and full spring pressure is exerted to seal the fuel outlet causing. This causes system pressure to increase. With high vacuum, such as during idle, fuel pressure on the bottom of the diaphragm is balanced by intake manifold pressure on the spring side. This results in lower system fuel pressure.

For fuel pressure regulator service, refer to the Service Procedures section in this group.

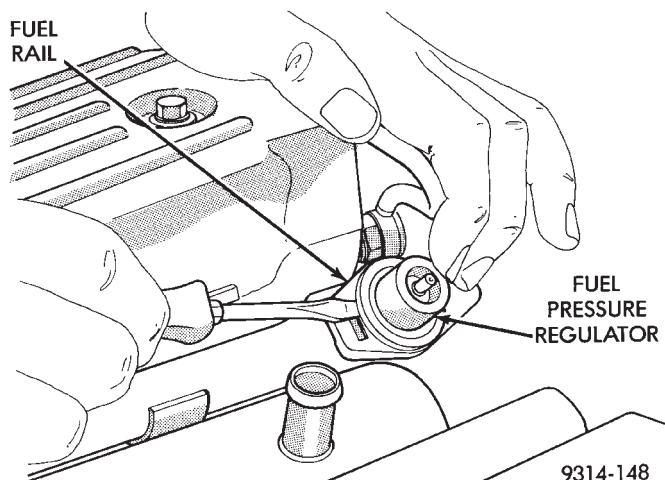


J9114-138

Fig. 20 Fuel Pressure Regulator Operation**REMOVAL—3.3L ENGINE**

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE REMOVING THE FUEL PRESSURE REGULATOR. REFER TO THE FUEL PRESSURE RELEASE PROCEDURE.

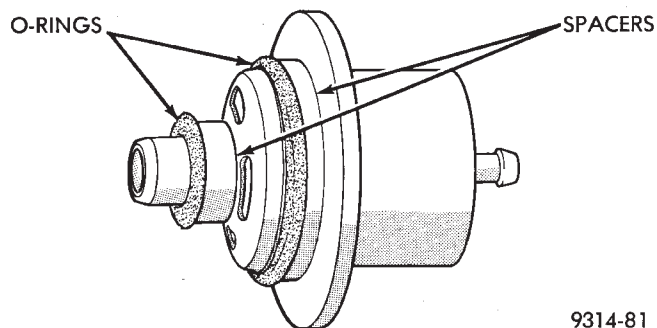
- (1) Disconnect negative cable from battery.
- (2) Release fuel system pressure. Refer to Fuel System Pressure Release Procedure in this section.
- (3) Disconnect vacuum hose from regulator.
- (4) Remove holddown clamp screw (Fig. 18). Remove clamp.
- (5) Using a thin flat screwdriver, pry the fuel pressure regulator out of the fuel rail (Fig. 21).



9314-148

Fig. 21 Fuel Pressure Regulator Removal—3.3L Engine

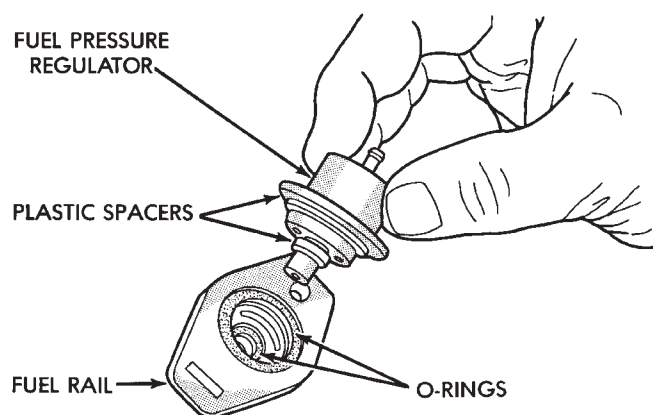
- (6) Ensure the upper O-ring, upper spacer, lower O-ring, and lower spacer were removed with the regulator. If not, remove them from the well in fuel rail (Fig. 22).



9314-81

Fig. 22 Fuel Pressure Regulator—Typical**INSTALLATION—3.3L ENGINE**

- (1) Ensure the plastic spacers are on the pressure regulator (Fig. 22).
- (2) To aid installation, apply a light coating of clean engine oil to the O-rings. Install O-rings into fuel rail cavity (Fig. 23).



9314-16

Fig. 23 Fuel Pressure Regulator Installation

- (3) Insert regulator into fuel rail cavity.
- (4) Install holddown clamp. Tighten screw to 7 N•m (60 in. lbs.) torque.
- (5) Connect vacuum supply hose to regulator.

CAUTION: When using the ASD Fuel System Test, the Auto Shutdown (ASD) Relay remains energized for either 7 minutes, until the test is stopped, or until the ignition switch is turned to the Off position.

- (6) Use the DRB II ASD Fuel System Test to pressurize the fuel system. Check for leaks.

REMOVAL—3.5L ENGINE

The intake manifold plenum must be removed to service the fuel pressure regulator. Refer to 3.5L In-



take Manifold Plenum in Multi-Port Fuel Injection—Service Procedures section of this group.

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE REMOVING THE FUEL PRESSURE REGULATOR. REFER TO THE FUEL PRESSURE RELEASE PROCEDURE.

(1) Release fuel system pressure. Refer to Fuel System Pressure Release Procedure in this section.

Tag the injector connectors with their cylinder number.

(2) Remove electrical connector from injectors.

(3) Remove the vacuum tube from the fuel pressure regulator (Fig. 24).

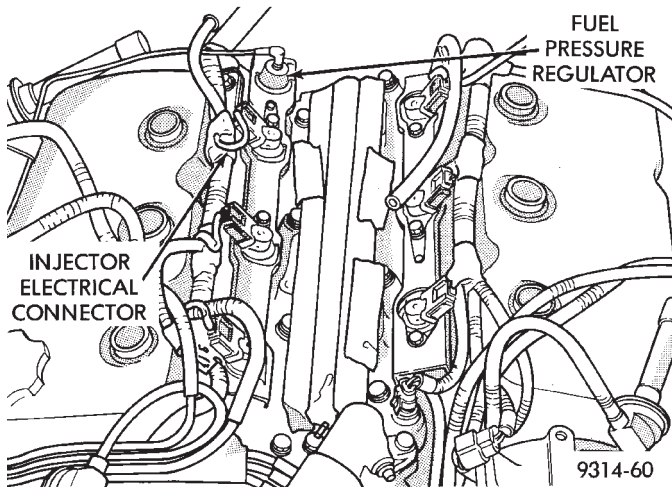


Fig. 24 Fuel Pressure Regulator

(4) Remove fuel rail mounting bolts (Fig. 25).

(5) Remove injector clamp screw (Fig. 25).

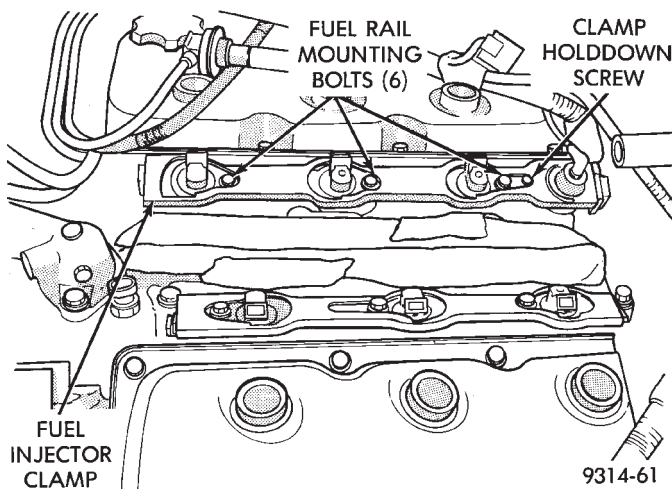


Fig. 25 Fuel Injector Clamp

(6) Slide the injector clamp toward the rear of the engine, then lift the clamp off of the rail (Fig. 26).

(7) Install fuel rail mounting bolts finger tight.

(8) Using a thin flat screwdriver, pry the fuel pressure regulator out of the fuel rail (Fig. 27).

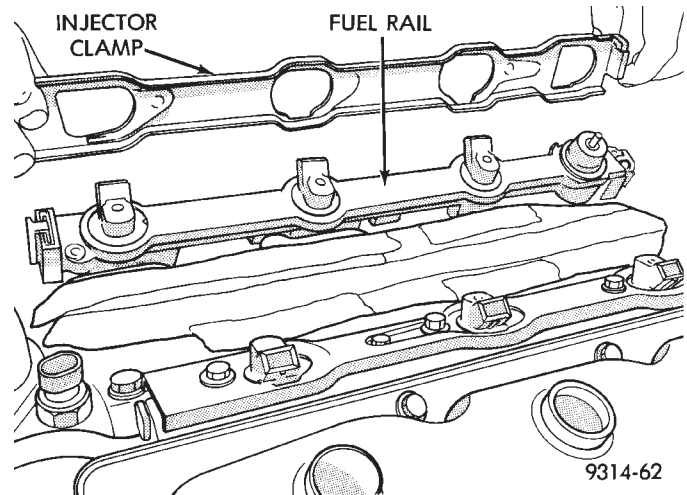


Fig. 26 Injector Clamp Removal/Installation

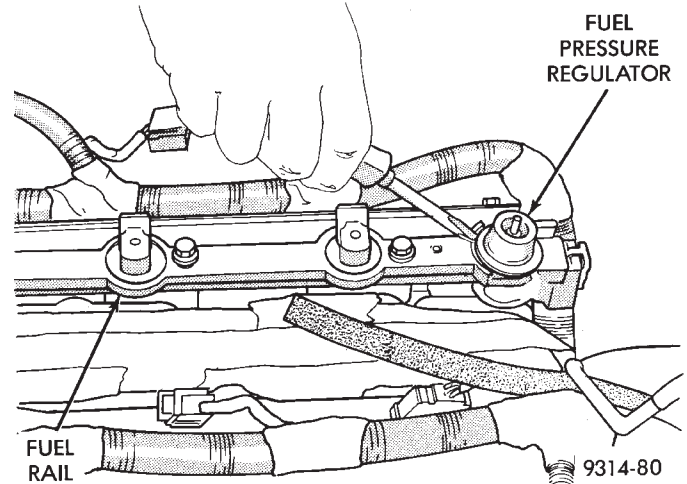


Fig. 27 Fuel Pressure Regulator Removal

(9) Ensure the upper O-ring, upper spacer, lower O-ring, and lower spacer were removed with the regulator. If not, remove them from the well in fuel rail (Fig. 22).

INSTALLATION—3.5L ENGINE

(1) Lightly lubricate the O-rings with a couple drops of clean engine oil.

(2) Install fuel pressure regulator flush with fuel rail.

(3) Remove fuel rail mounting bolts.

(4) Install fuel injector clamps.

(5) Tighten fuel rail mounting bolts to 11 N•m (100 in. lbs.) torque.

(6) Install fuel injector clamp screw.

(7) Attach electrical connectors to fuel injectors.

(8) Install intake manifold plenum and new gasket. Refer to Intake Manifold Plenum—3.5L Engine in this section.



FUEL SYSTEM PRESSURE SPECIFICATIONS

3.3L ENGINE

Without vacuum applied to the regulator, the 3.3L fuel system operates at 379 kPa (55 PSI). With the engine idling and manifold vacuum applied to the regulator, the system operates at approximately 317 kPa (46 PSI). Fuel system pressure varies with different amounts of manifold vacuum applied to the regulator.

3.5L ENGINE

Without vacuum applied to the regulator, the 3.5L fuel system operates at 331 kPa (48 PSI). With the engine idling and manifold vacuum applied to the regulator, the system operates at approximately 269 kPa (39 PSI). Fuel system pressure varies with different amounts of manifold vacuum applied to the regulator.

FUEL SYSTEM PRESSURE—WITHOUT VACUUM APPLIED TO PRESSURE REGULATOR

SYSTEM	PRESSURE
3.3L	379 kPa (55 PSI)
3.5L	331 kPa (48 PSI)

9314-1

FUEL PUMP PRESSURE TEST

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE TESTING, REMOVING OR DISCONNECTING A FUEL SYSTEM HOSE OR COMPONENT.

The 3.3L and 3.5L fuel systems operate at different pressures. Refer Fuel System Specifications for correct system pressure.

- (1) Release fuel system pressure before disconnecting a fuel hose. Perform fuel system pressure release.
- (2) Remove protective cover from service valve on the fuel rail.
- (3) Connect Fuel Pressure Gauge C-4799B to fuel rail service valve. (Fig. 28 or Fig. 29).

CAUTION: When using the ASD Fuel System Test, the ASD relay and fuel pump relay remain energized for 7 minutes or until the test is stopped, or until the ignition switch is turned to the Off position.

- (4) Place the ignition key in the ON position. Using the DRBII tester, access ASD Fuel System Test. The ASD Fuel System Test will activate the fuel pump and pressurize the system.

If the gauge reading equals the specification listed in the Fuel System Pressure chart, further testing is not required. If pressure is not correct, record the pressure and remove gauge.

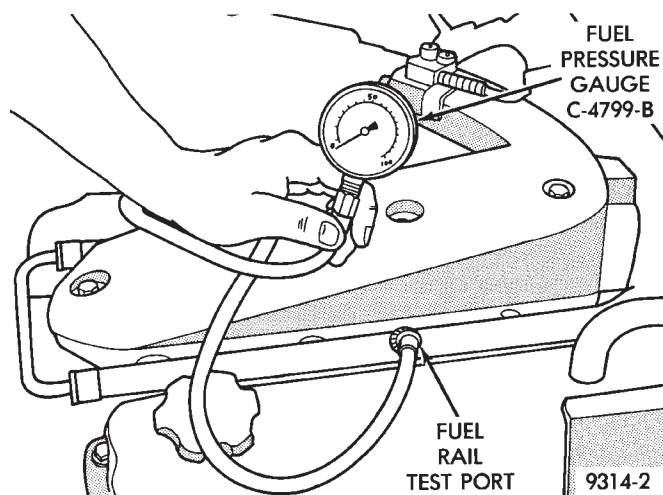


Fig. 28 Checking Fuel Pressure at Fuel Rail—3.3L Engine

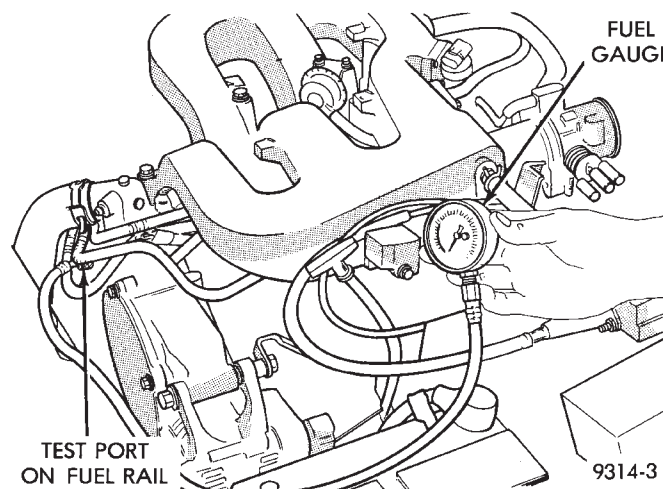


Fig. 29 Checking Fuel Pressure at Fuel Rail—3.5L Engine

Ensure fuel does not leak from the fuel rail service valve. Install protective cover onto fuel rail service valve.

If pressure is below specifications, proceed to Fuel System Pressure Below Specifications. If pressure is above specifications, proceed to Fuel System Pressure Above Specifications.

Fuel System Pressure Below Specifications

If the fuel pressure reading in step (4) was below specifications, test the system according to the following procedure.

WARNING: FUEL SYSTEM PRESSURE MUST BE RELEASED BEFORE A FUEL SYSTEM HOSE OR COMPONENT IS DISCONNECTED.

- (a) Perform Fuel Pressure Release procedure.
- (b) Install Fuel Pressure Gauge C-4799 and Fuel Pressure Adapter 6631 in the fuel supply line between the fuel tank and fuel filter (Fig. 30).
- (c) Using the DRB II, with the ignition key in

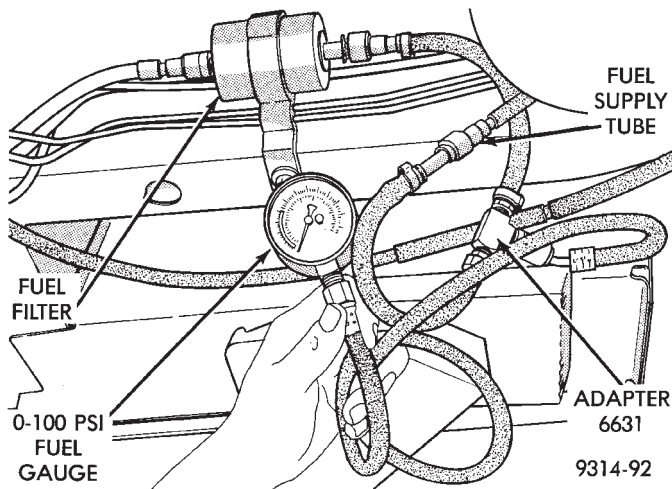


Fig. 30 Checking Fuel Pressure Between Pump and Filter

the ON position, repeat the ASD Fuel System Test.

- If pressure is at least 5 psi higher than reading recorded in step (4), replace fuel filter.
- If no change is observed, gently squeeze return hose. If pressure increases, replace pressure regulator. If the gauge reading does not change when the return hose is squeezed, the problem is either a plugged inlet strainer or defective fuel pump.

Fuel System Pressure Above Specifications

If the fuel pressure reading in step (4) was above specifications test the system according to the following procedure.

WARNING: FUEL SYSTEM PRESSURE MUST BE RELEASED BEFORE A FUEL SYSTEM HOSE OR COMPONENT IS DISCONNECTED.

- (a) Perform Fuel Pressure Release procedure.
- (b) Install Fuel Pressure Gauge C-4799 and Fuel Pressure Adapter 6631 in the fuel supply line (Fig. 16) between the fuel tank and fuel filter.
- (c) Remove the fuel return line hose from the fuel pump at fuel tank. Connect Fuel Pressure Test Adapter 6668 to the return line. Place the other end of adapter 6668 into an approved gasoline container (minimum 2 gallon size). All return fuel will flow into container.
- (d) Using the DRB II, with the ignition key in the ON position, repeat the ASD Fuel System Test.
 - If pressure is now correct, replace fuel pump assembly.
 - If pressure is still above specifications, remove fuel return hose from chassis fuel tubes (at engine). Attach Fuel Pressure Test Connect Adapter 6668 to the fuel return tube and place other end of hose in clean container (Fig. 31). Repeat test. If pressure is now correct, check for restricted fuel return line. If no change is observed, replace fuel pressure regulator.

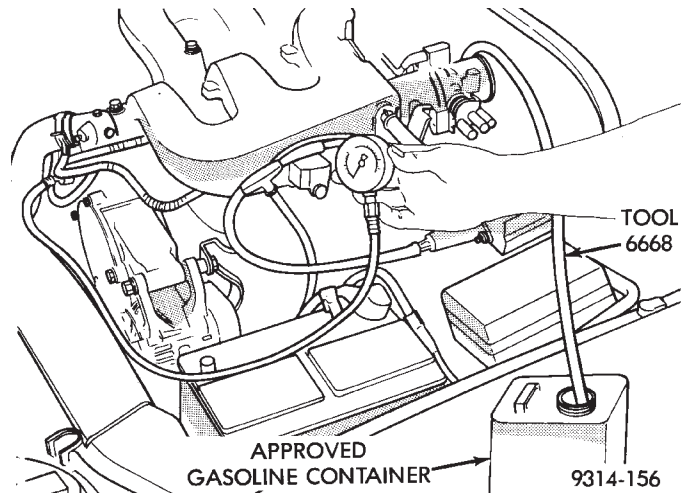


Fig. 31 Fuel Return Line Adapter

FUEL TUBES AND QUICK-CONNECT FITTINGS

The LH fuel system uses two different types of quick-connect fittings. The fittings have different removal and installation procedures. The fuel pump module uses plastic quick-connect fittings. The fuel filter and fuel rail connections use metal quick-connect fittings.

PLASTIC QUICK-CONNECT FITTINGS

The nylon fuel tubes connect to the pump module with plastic quick-connect fuel fittings. The fitting contains non-serviceable sealed O-rings (Fig. 32).

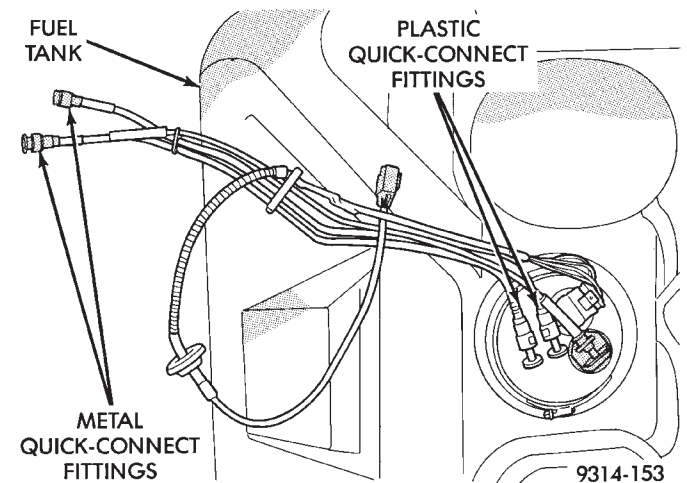


Fig. 32 Plastic Quick-Connect Fittings

CAUTION: Quick-connect fittings are not serviced separately. Do not attempt to repair damaged quick-connect fittings or fuel tubes. Replace the complete fuel tube/quick-connect fitting assembly.

The quick-connect fitting consists of the O-rings, retainer and casing (Fig. 33). When the fuel tube enters the fitting, the retainer locks the shoulder of the nipple in place and the O-rings seal the tube.

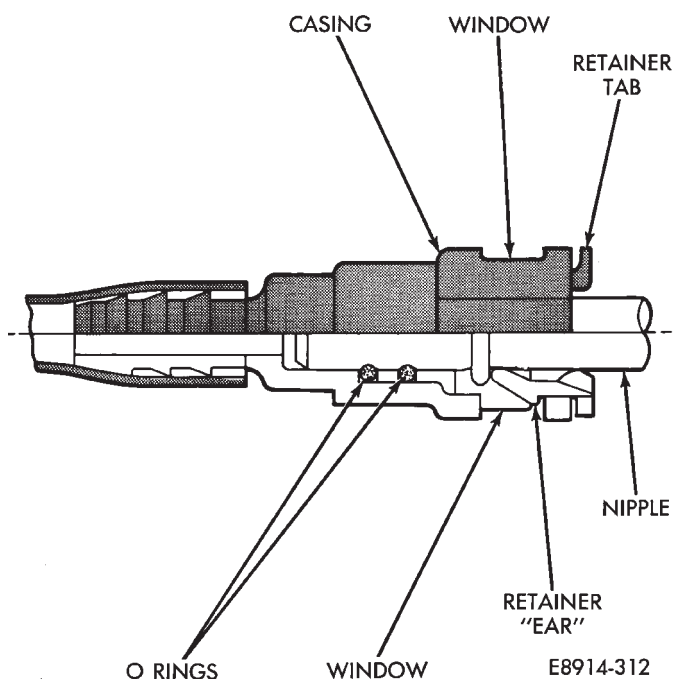


Fig. 33 Plastic Quick-Connect Fitting

REMOVAL

When disconnecting a quick-connect fitting, the retainer will remain on the fuel tube nipple.

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE DISCONNECTING A QUICK-CONNECT FITTINGS. REFER TO THE FUEL PRESSURE RELEASE PROCEDURE

- (1) Disconnect negative cable from the battery.
- (2) Perform the Fuel Pressure Release Procedure. Refer to the Fuel Pressure Release Procedure in this section.
- (3) Squeeze retainer tabs together and pull fuel tube/quick-connect fitting assembly off of the fuel tube nipple. The retainer will remain on the fuel tube.

INSTALLATION

- (1) Using a clean lint free cloth, clean the fuel tube nipple and retainer.
 - (2) Prior to connecting the fitting to the fuel tube, coat the fuel tube nipple with clean 30 weight engine oil.
- Never install a quick-connect fitting without the retainer being either on the fuel tube or already in the quick-connect fitting. In either case, **ensure the retainer locks securely into the quick-connect fitting.**

- (3) Push the quick-connect fitting over the fuel tube until the **retainer seats and a click is heard.**

The quick-connect fitting has windows in the sides of the casing. When the fitting completely attaches to the fuel tube, the retainer locking ears and the fuel tube

shoulder are visible in the windows. If they are not visible, the retainer was not properly installed (Fig. 34).

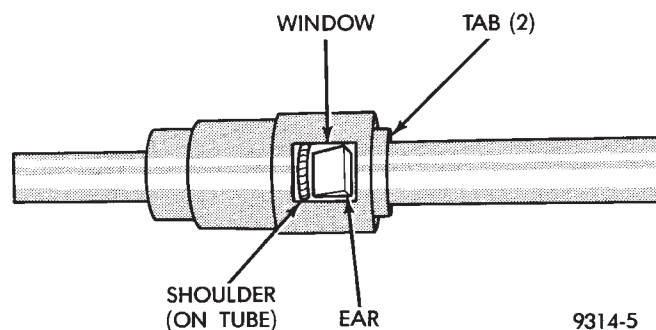


Fig. 34 Plastic Quick-Connect Fitting/Fuel Tube Connection

- (4) Ensure the locking ears on the retainer and the shoulder (stop bead) on the fuel tube are completely visible in the quick-connect fitting windows. Do not rely upon the audible click to confirm a secure connection.

- (5) Verify the connection by pulling on the lines. If the fitting locks in place, the connection is secure.

CAUTION: When using the ASD Fuel System Test, the Auto Shutdown (ASD) Relay remains energized for either 7 minutes, until the test is stopped, or until the ignition switch is turned to the Off position.

- (6) Use the DRB II ASD Fuel System Test to pressurize the fuel system. Check for leaks.

METAL QUICK CONNECT FITTINGS

The fuel filter and fuel rail use steel quick-connect fittings. The fitting contains non-serviceable sealed O-rings. The fittings contain a plastic disconnect tool.

The quick-connect fitting consists of the O-rings, casing, disconnect tool and a retainer (Fig. 35). When the fuel tube enters the fitting, the retainer locks the shoulder of the nipple in place and the O-rings seal the tube.

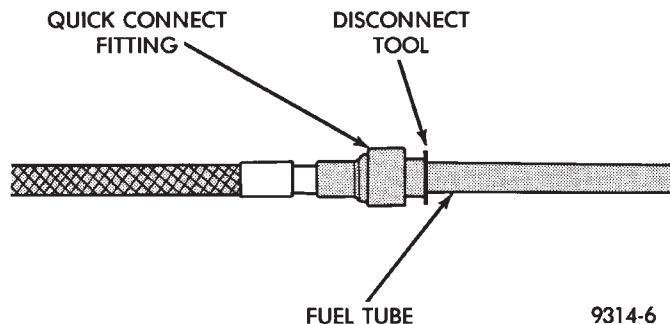


Fig. 35 Metal Quick-Connect Fittings

CAUTION: Quick-connect fittings are not serviced separately. Do not attempt to repair damaged quick-connect fittings or fuel tubes. Replace the complete fuel tube/quick-connect fitting assembly.



When installing fuel tubes, route them in the holders along the frame rail, fuel tank and the rear of the engine.

REMOVAL

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE DISCONNECTING A QUICK-CONNECT FITTINGS. REFER TO THE FUEL PRESSURE RELEASE PROCEDURE

- (1) Disconnect negative cable from the battery.
- (2) Perform the Fuel Pressure Release Procedure. Refer to the Fuel Pressure Release Procedure in this section.
- (3) Remove any loose dirt from quick connect fittings.

WARNING: WRAP SHOP TOWELS AROUND HOSES TO CATCH ANY GASOLINE SPILLAGE.

- (4) Push the quick connect fitting toward the fuel tube while depressing the built-in release tool. Then slightly twist the fitting and pull it off the fuel tube (Fig. 35).
- (5) Cover the fitting to prevent contamination.

TUBE/FITTING ASSEMBLY

(1) Ensure the black plastic release ring is in the **OUT** position. If the locking retainer is stuck in the **RELEASE** position due to mushrooming of the release ring or dirt accumulation, replace the fitting and tube assembly.

(2) Lubricate the fuel tube nipple with clean 30 weight engine oil.

(3) Insert fuel tube nipple into quick connector fitting. When the fuel tube nipple enters the quick-connect fitting, the locking retainer holds the fuel nipple shoulder in place and the O-rings seal the tube.

(4) Check for a tight connection by pulling back on the quick connect fitting. The tube should lock in place. If the connection is not complete, make sure the black plastic ring is not causing the locking retainer to jam in the release position.

CAUTION: When using the ASD Fuel System Test, the ASD relay and fuel pump relay remain energized for 7 minutes or until the test is stopped, or until the ignition switch is turned to the Off position.

- (5) Use the DRBII scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

FUEL FILTER

The fuel filter mounts to the frame rail in front of the fuel tank (Fig. 36). The inlet and outlet ends of the filter are marked for correct installation.

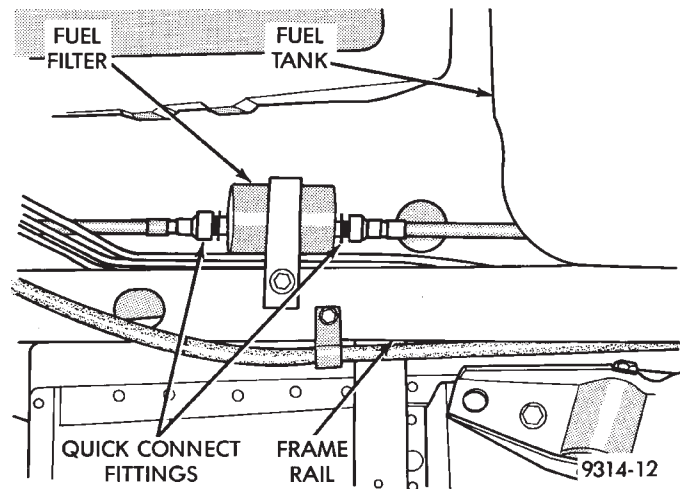


Fig. 36 Fuel Filter

REMOVAL

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE DISCONNECTING A QUICK-CONNECT FITTINGS AT FUEL FILTER. REFER TO THE FUEL PRESSURE RELEASE PROCEDURE

- (1) Release fuel system pressure. Refer to Fuel Pressure Release Procedure in this section.
- (2) Disconnect quick-connect fittings from fuel filter. Refer to Fuel Tubes and Quick-Fittings in this section.
- (3) Remove fuel filter mounting bracket. Remove filter.

INSTALLATION

(1) The inlet and outlet sides of the filter are marked. Install the filter with the inlet side to the fuel tank.

(2) Place fuel filter into bracket. Place bracket against frame rail. Tighten mounting screw to 12 N•m (110 in. lbs.) torque.

(3) Apply a light coating of clean 30 weight engine oil to the fuel filter nipples. Install fuel tubes. Refer to Fuel Tubes and Quick-Connect Fittings in this section.

CHASSIS FUEL TUBES

The fuel tubes route from the fuel tank, along the frame rail to the fuel rail (Fig. 37). Plastic fuel tubes connect to the fuel pump module. Metal quick-connect fittings and braided tubes attach the fuel filter and fuel return circuit to the fuel rail. Quick-Connect fittings attach the fuel tubes. When servicing fuel tubes or components near the tube, ensure the tubes do not contact or rub against other parts of the vehicle. Refer to Fuel Tubes and Quick-Connect Fittings in this section.



9314-154

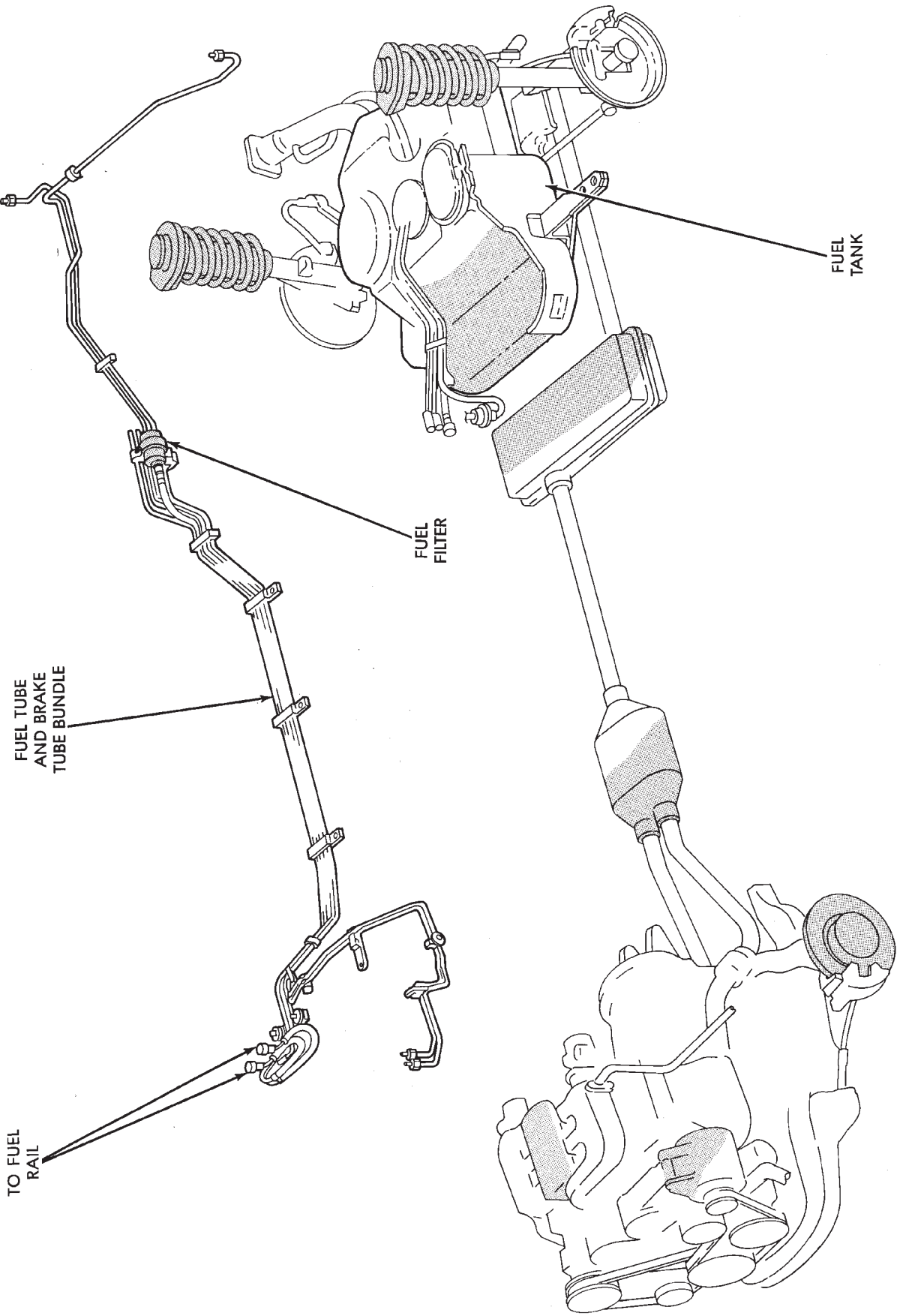


Fig. 37 Chassis Fuel Tubes



FUEL TANKS

INDEX

	page		page
Fuel Level Sensor	17	Fuel Tank Pressure Relief/Rollover Valve	17
Fuel Pump Module	17	General Information	15
Fuel System Pressure Release Procedure	15	Pressure-Vacuum Filler Cap	15
Fuel Tank	16		

GENERAL INFORMATION

The LH fuel tank has fuel and vapor controls that allow the vehicle to pass a full 360° rollover without fuel leakage.

The fuel pump module contains a pressure relief/rollover valve. The valve is mounted the top of the fuel pump module on all LH vehicles. With the vehicle upright, the valve functions as a pressure relief valve. The valve also contains a check valve that prevents fuel from escaping the fuel tank if the vehicle rolls over.

The fuel filler cap also acts as a pressure/vacuum valve. When air pressure inside the fuel tank gets too high or too low, the fuel filler cap opens to relieve the difference in pressure.

An evaporation control system restricts fuel evaporation into the atmosphere and reduces unburned hydrocarbons. Vapors from the fuel tank are collected in a charcoal filled canister. The vapors are held in the canister until the engine operates. Engine vacuum draws the vapors through the intake manifold into the combustion chambers.

PRESSURE-VACUUM FILLER CAP

The fuel filler cap incorporates a two-way relief valve that is closed to atmosphere during normal operating conditions. The relief valve is calibrated to open when a pressure of 10 kPa (1.5 psi) or vacuum of 6 kPa (1.8 in. Hg) occurs in the fuel tank. When the pressure or vacuum is relieved, the valve returns to the normally closed position.

CAUTION: Remove the fuel filler cap to release fuel tank pressure before disconnecting any fuel system component.

FUEL TANK CAPACITY

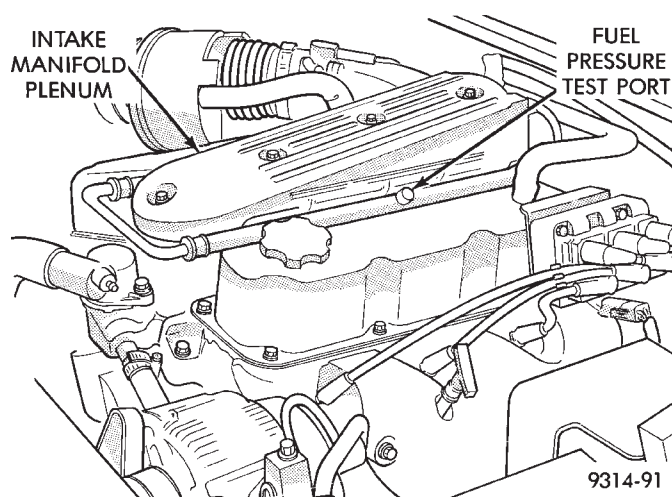
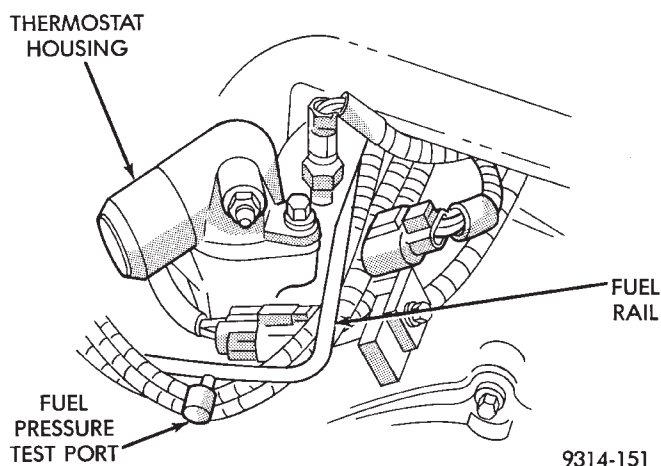
VEHICLE	LITERS	U.S. GALLONS
LH	68.0	18.0

Nominal refill capacities are shown. A variation may be observed from vehicle to vehicle due to manufacturing tolerance and refill procedure.

9314-158

FUEL SYSTEM PRESSURE RELEASE PROCEDURE

- (1) Disconnect negative cable from battery.
- (2) Remove fuel filler cap.
- (3) Remove the protective cap from the fuel pressure test port on the fuel rail (Fig. 1 or Fig. 2).

**Fig. 1 Fuel Pressure Test Port—3.3L Engine****Fig. 2 Fuel Pressure Test Port—3.5L Engine**

- (4) Place the open end of fuel pressure release hose, tool number C-4799-1, into an approved gasoline container. Connect the other end of hose C-4799-1 to the fuel pressure test port (Fig. 3). Fuel



pressure will bleed off through the hose into the gasoline container. Fuel gauge C-4799-A contains hose C-4799-1.

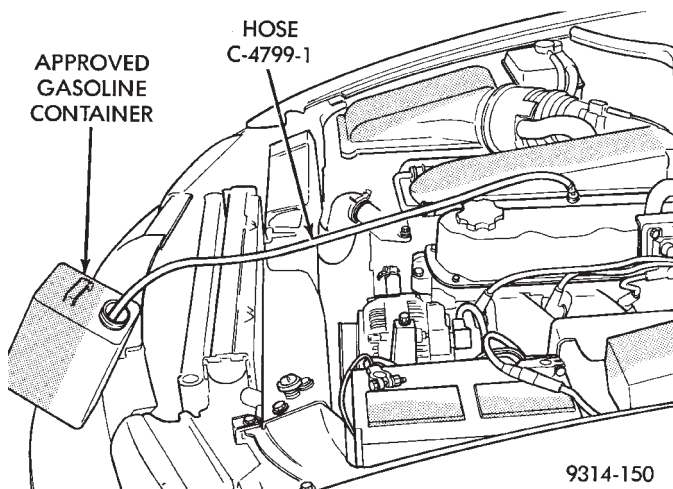


Fig. 3 Releasing Fuel Pressure—Typical

FUEL TANK

DRAINING FUEL TANK

If the fuel pump operates, energize the pump and drain the fuel into a portable fuel siphoning tank. Use the DRB II ASD Fuel System test to energize the fuel pump.

If the pump does not operate, remove the fuel pump module through the access panel in the trunk floor. Drain the tank into a portable fuel siphoning tank through the opening for the fuel pump module. Refer to Fuel Pump Module in the Fuel Delivery section of this group.

FUEL TANK REMOVAL

(1) Release fuel system pressure. Refer to the Fuel System Pressure Release Procedure.

(2) Drain the fuel tank. Refer to Draining Fuel Tank in this section.

(3) Disconnect negative cable from battery.

(4) Remove rear tires.

(5) Pull exhaust pipe hangers rubber insulators off of mounting studs on frame rail at the rear of the vehicle and in front of the fuel tank.

(6) Using a grease pencil, place alignment marks on the fuel filler hose and filler tube. Also mark the vent hose and vent tube. Remove splash shield from passenger side rear wheel well.

(7) Remove the fuel filler and vent hose clamps. Remove the vent hose from the vent tube. Remove the filler hose from the filler tube (Fig. 4).

(8) Disconnect fuel supply tube from inlet side of fuel filter. Disconnect fuel return tube and vent tube near fuel filter. Refer to Quick Connect Fittings in the Fuel Delivery section of this group.

(9) Disconnect both ends of the sway bar from the stabilizer links (Fig. 5).

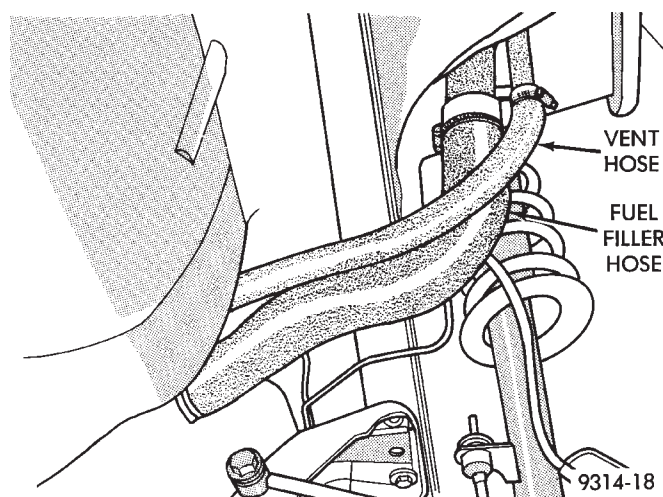


Fig. 4 Fuel Filler and Vent Hoses

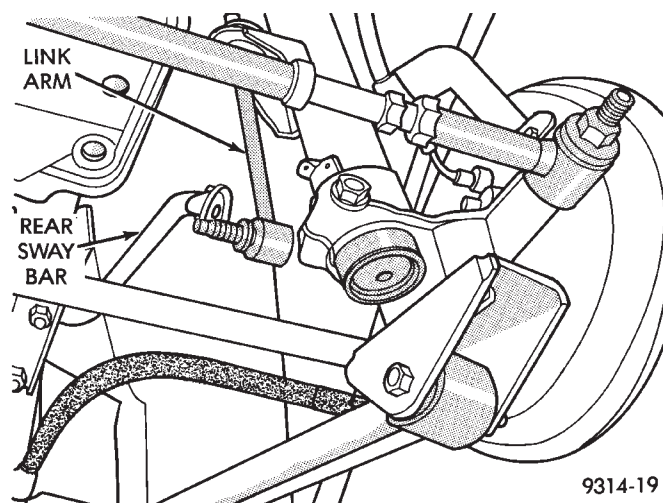


Fig. 5 Disconnecting Sway Bar Ends

(10) Use a grease pencil or marker to outline the position of the crossmember ends on the frame rail.

(11) Remove crossmember mounting bolts (Fig. 6).

(12) Pull crossmember down until it stops.

(13) Place a transmission jack under fuel tank.

CAUTION: The sway bar bracket bolts must be replaced after loosening or removing them. Only use original equipment bolts as replacements.

(14) Remove sway bar mounting brackets, heat shield, and fuel tank strap (Fig. 6).

(15) To prevent sway bar from falling down, install sway bar mounting brackets with bolts finger tight (Fig. 7).

(16) Center transmission jack. Lower jack enough to provide access to the fuel line and electrical connections on the fuel pump module at the top of the tank.

(17) Disconnect electrical connector from fuel pump module.

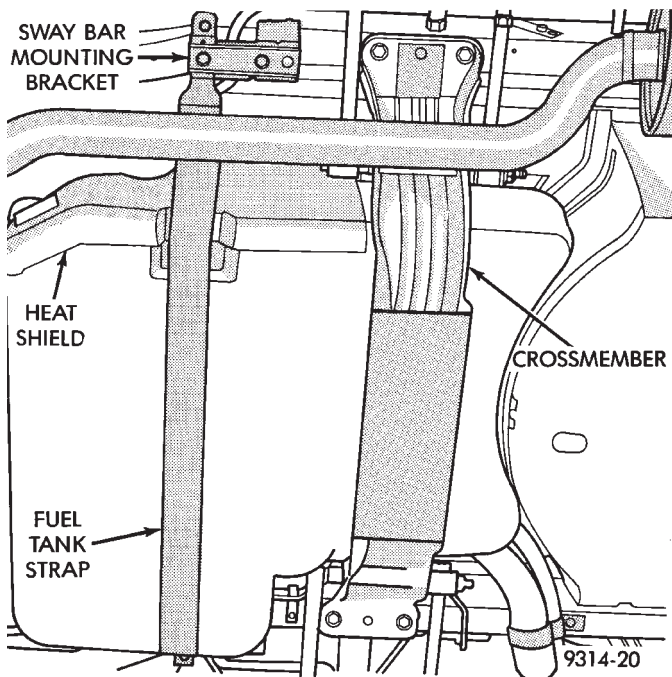


Fig. 6 Crossmember Bolts

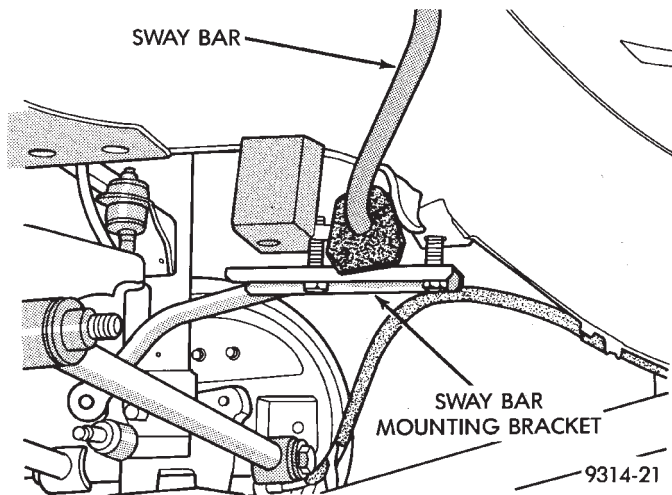


Fig. 7 Holding Sway Bar In Place

(18) Slightly lower the front of the tank. Slide tank away from crossmember while pushing filler vent and fill tube over the crossmember.

(19) Lower fuel tank.

FUEL TANK INSTALLATION

(1) Position tank on transmission jack with shield and tank strap in place.

(2) Raise and position tank over crossmember.

(3) Raise tank enough to connect fuel pump module electrical connector.

(4) Push vent and filler tube over the crossmember.

(5) Rotate sway bar into position. Remove sway bar mounting brackets.

(6) Raise tank into place. Position sway bar mounting brackets and fuel tank straps in place. Install and tighten bolts to 60 N•m (44 ft. lbs.) torque.

(7) Raise crossmember into position. Align with outline of crossmember drawn on rail during removal. Install and tighten mounting bolts to 95 N•m (70 ft. lbs.) torque.

(8) Connect filler tube and vent tube to fuel filler neck. Align marks made on hose and tube during removal.

(9) Connect sway bar ends to link arms. Tighten sway bar mounting nuts to 100 N•m (74 ft. lbs.) torque.

(10) Install exhaust system on hangers.

(11) Connect fuel supply, return and vent tubes. Refer to Quick-Connect Fittings in the Fuel Delivery section of this group.

(12) Lower vehicle.

(13) Fill fuel tank.

(14) Install fuel filler cap.

(15) Connect negative cable to battery.

CAUTION: When using the ASD Fuel System Test, the ASD relay and fuel pump relay remain energized for 7 minutes or until the test is stopped, or until the ignition switch is turned to the Off position.

(16) With the ignition key in ON position, access the DRB II ASD Fuel System Test to pressurize the fuel system. Check for leaks.

(17) Install tires. Refer to Group 22 for tightening specifications.

(18) Perform rear wheel alignment. Refer to Group 2, Suspension.

FUEL PUMP MODULE

Refer to Fuel Delivery section of this group for fuel pump module service.

FUEL LEVEL SENSOR

Refer to Fuel Delivery section of this group for fuel level sensor service.

FUEL TANK PRESSURE RELIEF/ROLLOVER VALVE

Refer to Fuel Delivery section of this group for roll-over valve service.



ACCELERATOR PEDAL AND THROTTLE CABLE

INDEX

	page		page
Accelerator Pedal Service	18	Throttle Cable Service	18

ACCELERATOR PEDAL SERVICE

CAUTION: When servicing the accelerator pedal or throttle cable, do not damage or kink the core wire inside the cable sheathing.

REMOVAL

(1) Working from the engine compartment, hold the throttle body throttle lever in the wide open position. Remove the throttle cable from the throttle body cam.

(2) From inside the vehicle, hold up the pedal and remove the cable retainer and throttle cable from the upper end of the pedal shaft (Fig. 1 and Fig. 2).

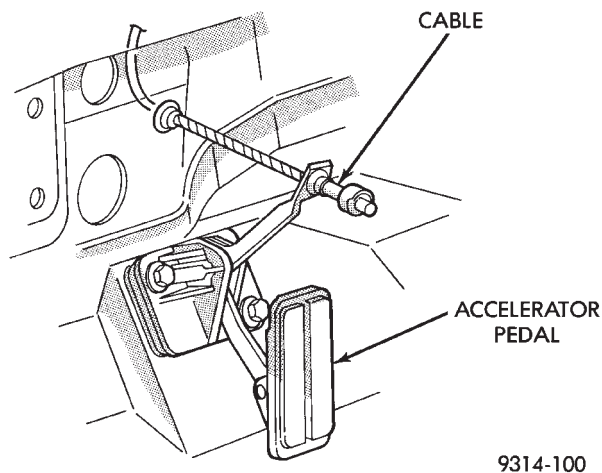


Fig. 1 Accelerator Pedal and Throttle Cable

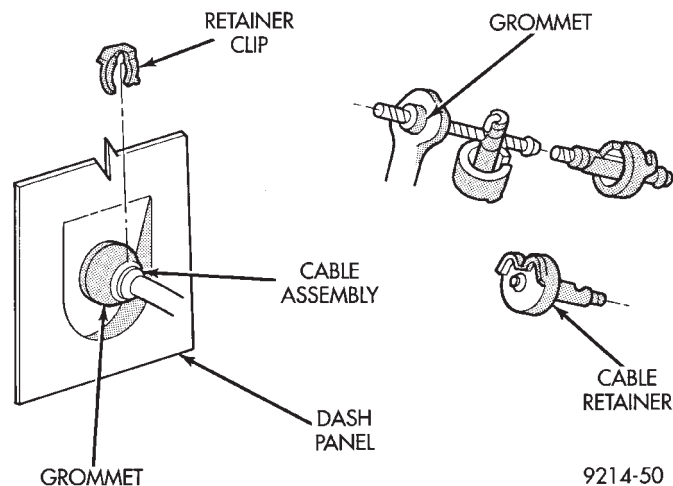


Fig. 2 Throttle Cable Removal/Installation

(3) Working from the passenger compartment, remove nuts from accelerator pedal base (Fig. 3). Remove pedal and base from vehicle.

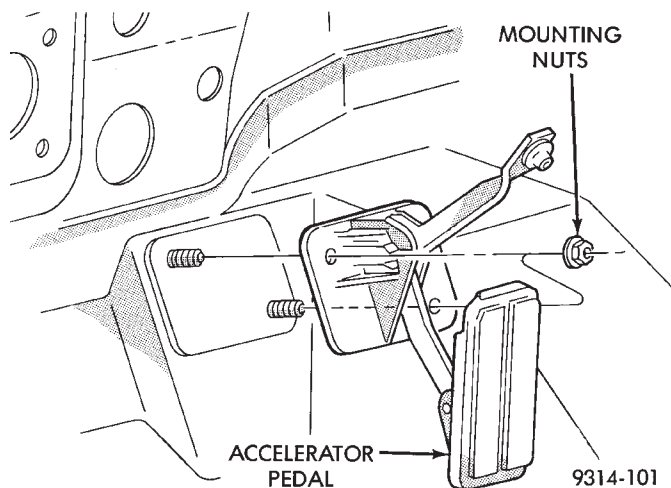


Fig. 3 Accelerator Pedal Removal/Installation

INSTALLATION

(1) Position accelerator pedal assembly over studs onto dash panel. Ensure carpet and insulation are trapped between the lip of the pedal base and the floor plan (Fig. 4). Install mounting nuts and tighten to 12 N•m (105 in. lbs.) torque.

(2) From inside the vehicle, hold up the pedal and install the throttle cable and cable retainer in the upper end of the pedal shaft.

(3) From the engine compartment, hold the throttle body lever in the wide open position and install the throttle cable.

THROTTLE CABLE SERVICE

CAUTION: When servicing the accelerator pedal, throttle cable or speed control cable, do not damage or kink the core wire inside the cable sheathing.

REMOVAL

(1) Working from the engine compartment, hold the throttle body throttle lever in the wide open position. Pull the cable forward and slide it out of the throttle body cam (Fig. 5 or Fig. 6).

(2) From inside the vehicle, hold up the pedal and remove the cable retainer and throttle cable from the upper end of the pedal shaft (Fig. 1).

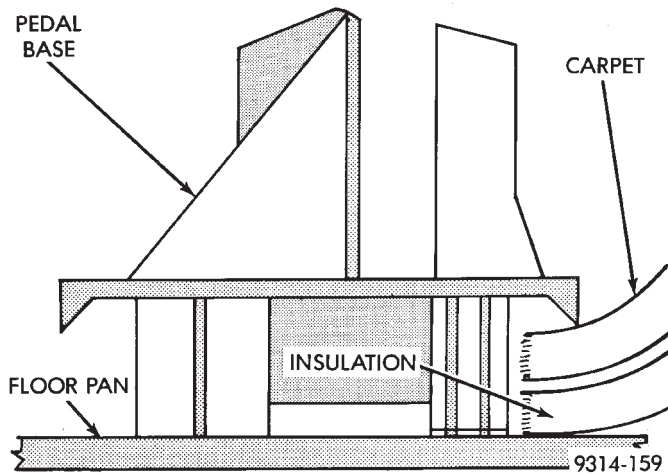


Fig. 4 Carpet and Insulation Placement

(3) Remove retainer clip from throttle cable and grommet at dash panel (Fig. 2).

(4) From the engine compartment, pull the throttle cable out of the dash panel grommet. The grommet should remain in the dash panel.

(5) Remove the throttle cable from throttle bracket by carefully compressing both retaining ears simultaneously. Then gently pull the throttle cable from throttle bracket.

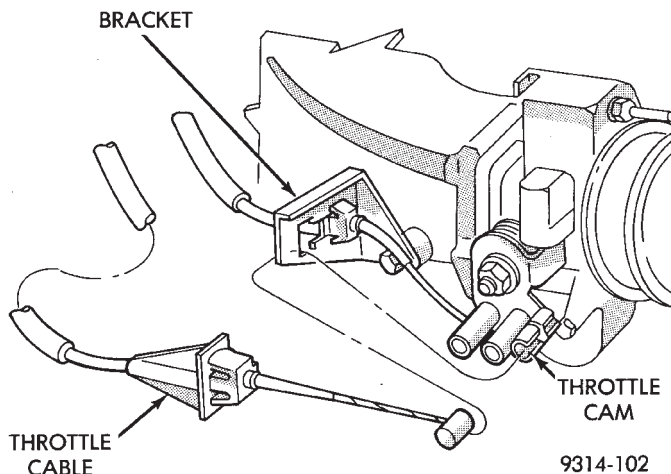


Fig. 5 Throttle Cable Removal/Installation—3.3L Engine

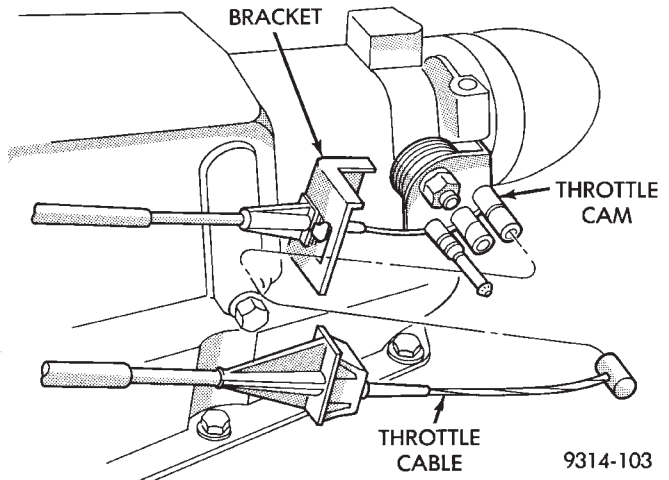


Fig. 6 Throttle Cable Removal/Installation—3.5L Engine

INSTALLATION

(1) From the engine compartment, push the housing end fitting into the dash panel grommet.

(2) Install the cable housing (throttle body end) into the cable mounting bracket on the engine.

(3) From inside the vehicle, hold up the pedal and install throttle cable and cable retainer in the upper end of the pedal shaft.

(4) At the dash panel, install the cable retainer clip between the end of the throttle cable fitting and grommet (Fig. 2).

(5) From the engine compartment, rotate the throttle lever to wide open and install the throttle cable. On 3.5L engines, ensure the power steering hose is routed through the hook on the throttle cable mounting bracket (Fig. 7). Make sure the throttle cam and power steering hose do not bind.

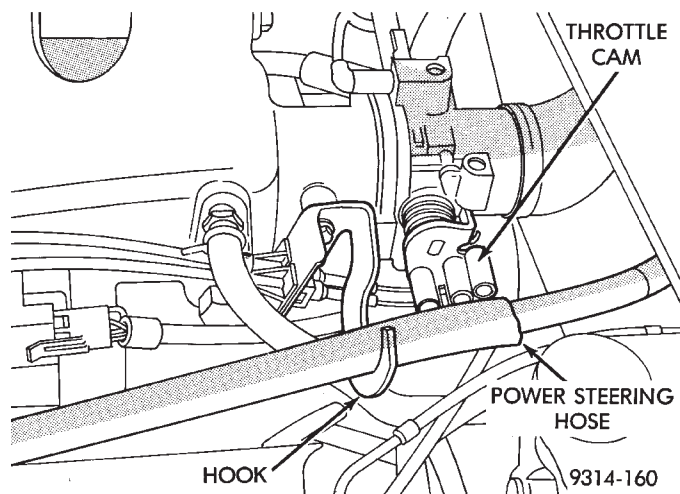


Fig. 7 Power Steering Hose and Bracket—3.5L Engine



SEQUENTIAL MULTI-PORT FUEL INJECTION—SYSTEM OPERATION

INDEX

	page		page
5 Volt Supply—PCM Output	32	Idle Air Control Motor—PCM Output	30
8-Volt Supply—PCM Output	32	Ignition Coil—PCM Output	30
Air Conditioning Compressor Clutch Relay—PCM Output	28	Ignition Sense—PCM Input	26
Air Conditioning Pressure Transducer—PCM Input	23	Knock Sensors (3.5L Engine)—PCM Input	25
ASD Sense—PCM Input	23	Malfunction Indicator (Check Engine) Lamp—PCM Output	31
Auto Shutdown And Fuel Pump Relays—PCM Output	28	Manifold Absolute Pressure Sensor—PCM Input	26
Battery Voltage—PCM Input	23	Manifold Tuning Valve (MTV) Solenoid (3.5L)—PCM Output	28
Brake Switch—PCM Input	23	Modes Of Operation	32
Camshaft Position Sensor—PCM Input	23	Powertrain Control Module	21
Charge Air Temperature Sensor—PCM Input	23	Radiator Fan Relays—PCM Output	32
Chrysler Collision Detection (CCD) Bus	20	SCI Circuits	23
Crankshaft Position Sensor—PCM Input	25	Sensor Return—PCM Input	27
Data Link Connector—PCM Output	28	Speed Control—PCM Input	27
Duty Cycle EVAP Purge Solenoid—PCM Output	29	Speed Control Relay—PCM Output	32
EGR Solenoid—PCM Output	29	Speed Control Servos—PCM Output	32
Engine Coolant Temperature Sensor—PCM Input	25	System Diagnosis	20
Fuel Injectors—PCM Output	29	Tachometer—PCM Output	32
Fuel Pressure Regulator	35	Throttle Bodies—3.5L Engine	34
General Information	20	Throttle Body—3.3L Engine	34
Generator Field—PCM Output	30	Throttle Position Sensor—PCM Input	27
Heated Oxygen Sensors—PCM Input	26	Transmission Control Module	22

GENERAL INFORMATION

The 3.3L and 3.5L engines use a sequential multi-port electronic fuel injection system (Fig. 1). The powertrain control module (PCM) operates the electronic fuel injection system. The PCM provides precise air/fuel ratios and ignition timing for all driving conditions.

The PCM regulates the air-fuel ratio, ignition coil dwell and idle speed. The PCM also operates the high speed and low speed cooling fans, charging system, speed control system and various emission control devices.

Various sensors and switches provide inputs to the PCM. The PCM converts all inputs into signals and regulates various systems based on the inputs. The PCM adjusts the systems it controls to meet changing operating conditions.

Fuel is injected into the intake port above the intake valve in precise metered amounts through electrically operated injectors. The 3.5L engine use bottom feed injectors while the 3.3L engine uses top feed injectors. The PCM operates the injectors in a specific sequence. The PCM maintains an air fuel ratio of 14.7 parts air to 1 part fuel by constantly adjusting injector pulse width. Injector pulse width refers to the amount of time an injector operates.

The PCM adjusts injector pulse width by opening and closing the ground path to the injectors. Engine RPM (speed) and manifold absolute pressure (air density) are the primary inputs that determine injector pulse width.

SYSTEM DIAGNOSIS

The powertrain control module (PCM) can test many of its own input and output circuits. If the PCM senses a fault in a major system, the PCM stores a diagnostic trouble code in memory.

Technicians can display stored diagnostic trouble codes by two different methods. The first is to cycle the ignition switch On - Off - On - Off - On within 5 seconds. Then count the number of times the malfunction indicator lamp (check engine lamp) on the instrument panel flashes on and off. The number of flashes represents the trouble code. There is a slight pause between the flashes representing the first and second digits of the code. Longer pauses separate individual trouble codes.

The second method of reading diagnostic trouble codes uses the DRBII scan tool. For diagnostic trouble code information, refer to the On-Board Diagnostics section in this group.

CHRYSLER COLLISION DETECTION (CCD) BUS

Various modules exchange information through a communications port called the CCD Bus. The powertrain control module (PCM) transmits the Malfunction Indicator Lamp (Check Engine) On/Off signal and engine RPM on the CCD Bus. PCM receives the Air Conditioning select input and speed control engage inputs over the CCD Bus. The PCM also receives the air conditioning evaporator temperature signal from the CCD Bus.

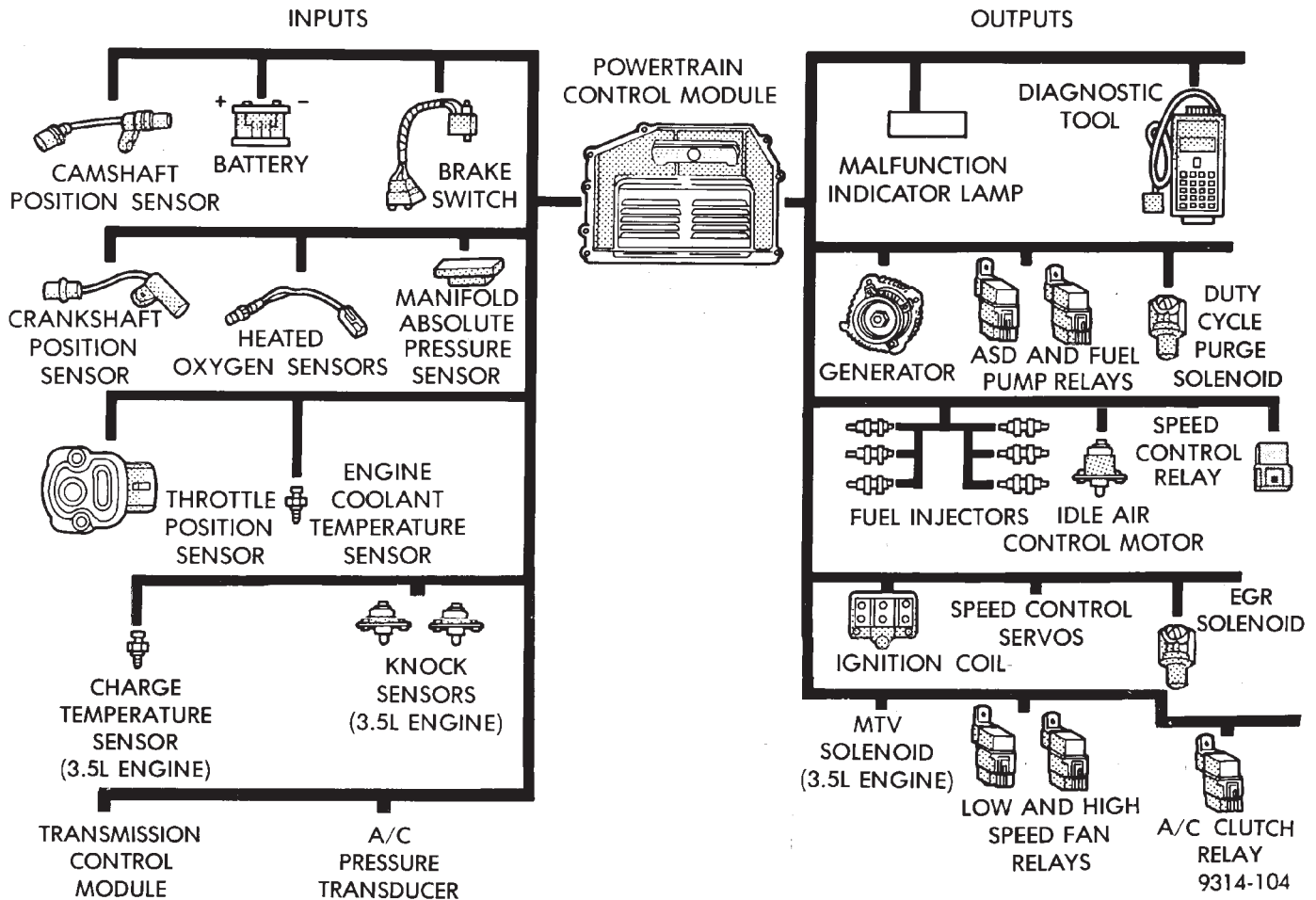


Fig. 1 Sequential Multi-Port Fuel Injection Components

The following components access or send information on the CCD Bus.

- Instrument Panel
- Body Control Module
- Air Bag System Diagnostic Module
- Full ATC Display Head
- ABS Module
- Transmission Control Module
- Powertrain Control Module
- Overhead Travel Module

POWERTRAIN CONTROL MODULE

The powertrain control module (PCM) is a digital computer containing a microprocessor (Fig. 2). The PCM receives input signals from various switches and sensors referred to as Powertrain Control Module Inputs. Based on these inputs, the PCM adjusts various engine and vehicle operations through devices referred to as Powertrain Control Module Outputs.

PCM Inputs:

- Air Conditioning Pressure Transducer
- Battery Voltage
- Brake Switch
- Camshaft Position Sensor
- CCD Bus

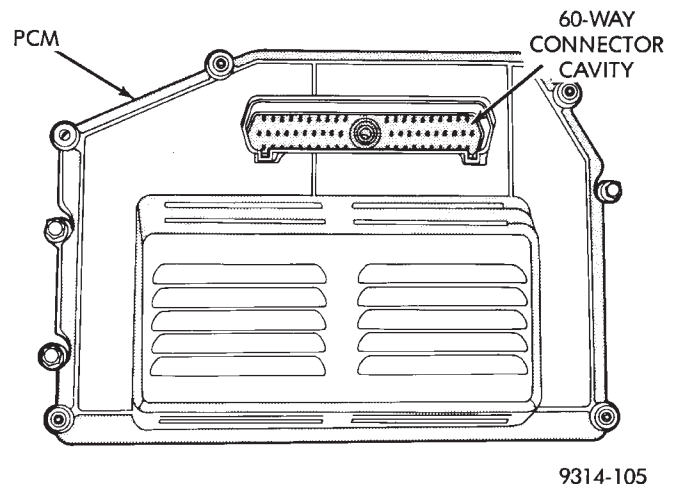


Fig. 2 Powertrain Control Module (PCM)

- Crankshaft Position Sensor
- Charge Air Temperature Sensor (3.5L Engine Only)
- Distance Sensor (from transmission control module)
- Transaxle Control Module
- Engine Coolant Temperature Sensor
- Knock Sensors (3.5L Engine only)



- Manifold Absolute Pressure (MAP) Sensor
- Heated Oxygen Sensors
- Ignition sense
- Park/Neutral (from transmission control module)
- SCI Receive
- Speed Control
- Throttle Position Sensor
- Torque Management Input (From Transmission Control Module)
- Vehicle Speed (from transmission control module)

PCM Outputs:

- Air Conditioning Clutch Relay
- Auto Shutdown (ASD) and Fuel Pump Relays
- Data Link Connector (CCD and SCI Transmit)
- Duty Cycle EVAP Purge Solenoid
- EGR Solenoid
- Fuel Injectors
- Generator Field
- High Speed Fan Relay
- Idle Air Control Motor
- Ignition Coils
- Low Speed Fan Relay
- MTV Solenoid
- Speed Control Relay
- Speed Control Vent Relay
- Speed Control Vacuum Relay

Based on inputs it receives, the powertrain control module (PCM) adjusts fuel injector pulse width, idle speed, ignition timing, and canister purge operation. The PCM regulates the cooling fans, air conditioning and speed control systems. The PCM changes generator charge rate by adjusting the generator field.

The PCM adjusts injector pulse width (air-fuel ratio) based on the following inputs.

- Battery Voltage
- Charge Air Temperature Sensor (3.5L Engine)
- Engine Coolant Temperature
- Engine Speed (crankshaft position sensor)
- Exhaust Gas Oxygen Content (heated oxygen sensors)
- Manifold Absolute Pressure
- Throttle Position

The PCM adjusts engine idle speed through the idle air control motor based on the following inputs.

- Brake Switch
- Engine Coolant Temperature
- Engine Speed (crankshaft position sensor)
- Park/Neutral (transmission gear selection)
- Throttle Position
- Vehicle Speed (from transmission control module)

The PCM adjusts ignition timing based on the following inputs.

- Charge Air Temperature (3.5L engine)
- Engine Coolant Temperature
- Engine Speed (crankshaft position sensor)
- Knock Sensor
- Manifold Absolute Pressure

- Park/Neutral (transmission gear selection)
- Throttle Position

The auto shutdown (ASD) and fuel pump relays are mounted externally, but turned on and off by the powertrain control module through the same circuit.

The camshaft and crankshaft signals are sent to the powertrain control module. If the PCM does not receive both signals within approximately one second of engine cranking, it deactivates the ASD and fuel pump relays. When these relays are deactivated, power is shut off to the fuel injectors, ignition coils, fuel pump and the heating element in each oxygen sensor.

The PCM contains a voltage converter that changes battery voltage to a regulated 8.0 volts. The 8.0 volts power the camshaft position sensor, crankshaft position sensor and vehicle speed sensor. The PCM also provides a 5.0 volts supply for the engine coolant temperature sensor, charge air temperature sensor, manifold absolute pressure sensor and throttle position sensor.

The PCM engine control strategy prevents reduced idle speeds until after the engine operates for 320 km (200 miles). If the PCM is replaced after 320 km (200 miles) of usage, update the mileage in new PCM. Use the DRBII scan tool to change the mileage in the PCM. Refer to the appropriate Powertrain Diagnostic Manual and the DRBII scan tool.

TRANSMISSION CONTROL MODULE

The transmission control module supplies two inputs to the PCM:

- Road Speed
- Torque Management (3.5L engine only)

ROAD SPEED

The transmission control module supplies the road speed and distance traveled inputs to the PCM. From these inputs and the throttle position sensor input, the PCM determines when a deceleration condition occurs.

TORQUE MANAGEMENT (3.5L ENGINE)

The PCM receives the torque management input from the transmission control module. The PCM receives the input when the transmission shifts gears. In response, the PCM shuts off a number of fuel injectors when the transmission shifts gears.

PARK/NEUTRAL SWITCH

The transmissions manual valve lever position sensor supplies the park/neutral input to the powertrain control module. The park/neutral switch input tells the PCM whether the transmission is in Park, Neutral, or a drive gear selection. This input effects idle speed, fuel injector pulse width and ignition timing.



SCI CIRCUITS

The powertrain control module (PCM) communicates with the DRB II scan tool through the serial communication interface (SCI) receive and transmit circuits. Technicians can connect the DRB II scan tool to the data link connector. The data link connector contains 6 terminals. Terminal 3 is the SCI Receive circuit. Terminal 4 is the SCI Transmit circuit.

AIR CONDITIONING PRESSURE TRANSDUCER—PCM INPUT

The powertrain control module (PCM) monitors the A/C compressor discharge (high side) pressure through the air conditioning pressure transducer. The transducer supplies an input to the PCM. The PCM engages the A/C compressor clutch if pressure is sufficient for A/C system operation.

ASD SENSE—PCM INPUT

The automatic shutdown (ASD) sense circuit informs the powertrain control module when the ASD relay contacts close. When energized, the ASD relay supplies battery voltage to the fuel injectors and ignition coils.

BATTERY VOLTAGE—PCM INPUT

The PCM monitors the battery voltage input to determine fuel injector pulse width and generator field control. If battery voltage is low, the PCM increases injector pulse width (period of time that the injector is energized).

BRAKE SWITCH—PCM INPUT

When the operator applies the brakes, the powertrain control module (PCM) receives an input from the brake switch. When the PCM receives the brake switch input a closed throttle input from the throttle position sensor simultaneously, it recognizes a deceleration condition. The PCM adjusts injector pulse width to compensate for the deceleration condition.

If the PCM receives a brake switch input while the speed control system is operating, the PCM disables the speed control system.

CAMSHAFT POSITION SENSOR—PCM INPUT

The camshaft position sensor provides cylinder identification to the powertrain control module (PCM) (Fig. 3 or Fig. 4). The sensor generates pulses as groups of notches on the camshaft sprocket pass underneath it (Fig. 5 or Fig. 6). The PCM keeps track of crankshaft rotation and identifies each cylinder by the pulses generated by the notches on the camshaft sprocket. Four crankshaft pulses follow each group of camshaft pulses.

When the PCM receives two cam pulses followed by the long flat spot on the camshaft sprocket, it knows that the crankshaft timing marks for cylinder one are next (on driveplate). When the PCM receives

one camshaft pulse after the long flat spot on the sprocket, cylinder number two crankshaft timing marks are next. After 3 camshaft pulses, the PCM knows cylinder four crankshaft timing marks follow. One camshaft pulse after the three pulses indicates cylinder five. The two camshaft pulses after cylinder 5 signals cylinder six (Fig. 5 or Fig. 6). The PCM can synchronize on cylinders 1 or 4.

When metal aligns with the sensor, voltage goes low (less than 0.3 volts). When a notch aligns with the sensor, voltage spikes high (5.0 volts). As a group of notches pass under the sensor, the voltage switches from low (metal) to high (notch) then back to low. The number of notches determine the amount of pulses. If available, an oscilloscope can display the square wave patterns of each timing events.

Top dead center (TDC) does not occur when notches on the camshaft sprocket pass below the cylinder. TDC occurs after the camshaft pulse (or pulses) and after the 4 crankshaft pulses associated with the particular cylinder. The arrows and cylinder call outs on Figures 5 and 6 represent which cylinder the flat spot and notches identify, they do not indicate TDC position.

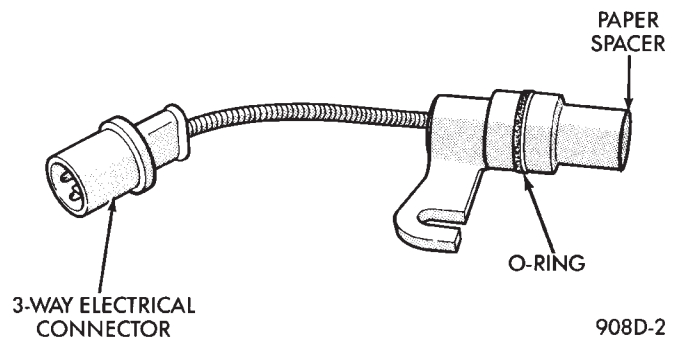


Fig. 3 Camshaft Position Sensor—3.3L Engine

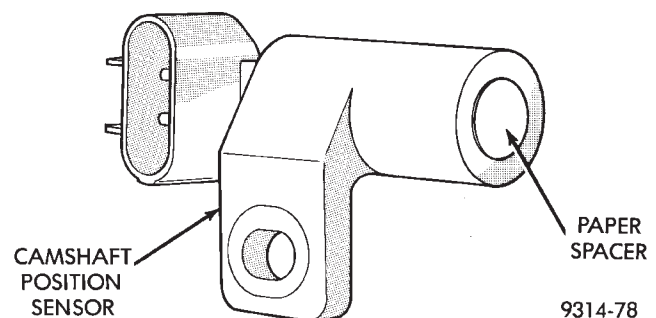


Fig. 4 Camshaft Position Sensor—3.5L Engine

The camshaft position sensor is mounted in the front of the timing case cover (Fig. 7 or Fig. 8).

CHARGE AIR TEMPERATURE SENSOR—PCM INPUT

The 3.5L engine uses a charge air temperature sensor, the 3.3L engine does not. The sensor threads into

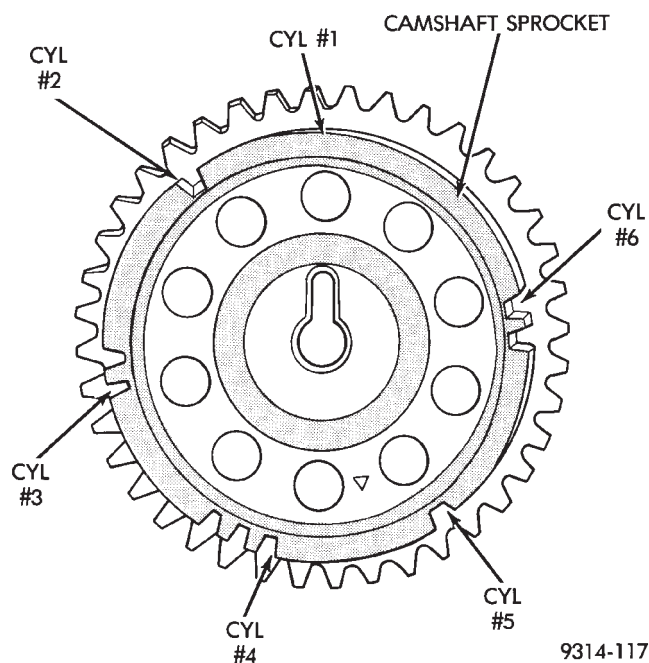


Fig. 5 Camshaft Sprocket—3.3L Engine

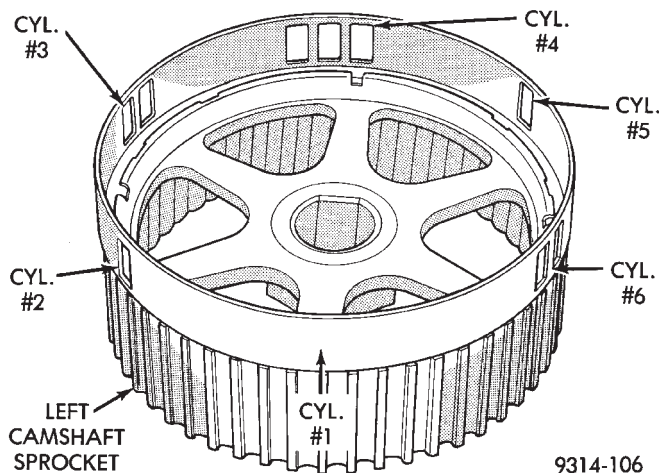


Fig. 6 Camshaft Sprocket—3.5L Engine

the intake manifold plenum and measures air temperature (Fig. 9). The sensor provides one of the inputs the PCM monitors when it adjust injector pulse width and spark advance.

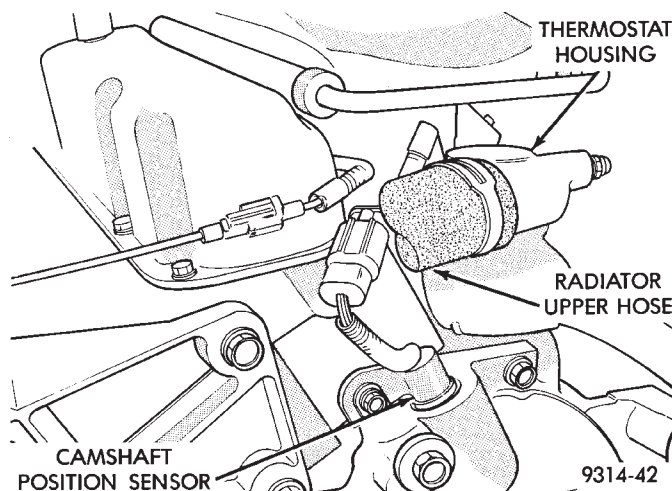


Fig. 7 Camshaft Position Sensor Location—3.3L Engine

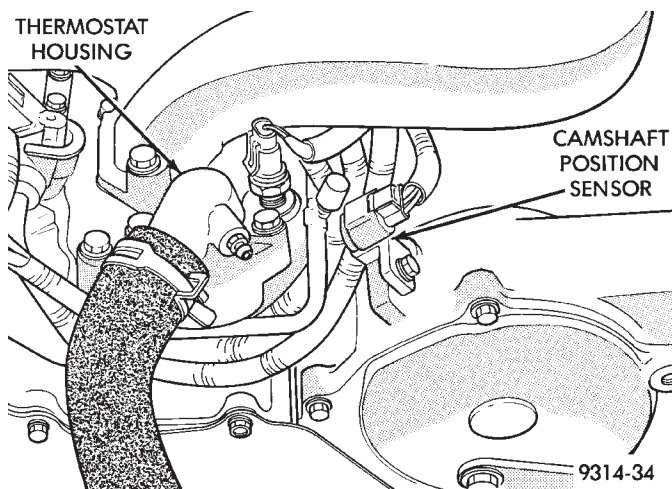


Fig. 8 Camshaft Position Sensor Location—3.5L Engine

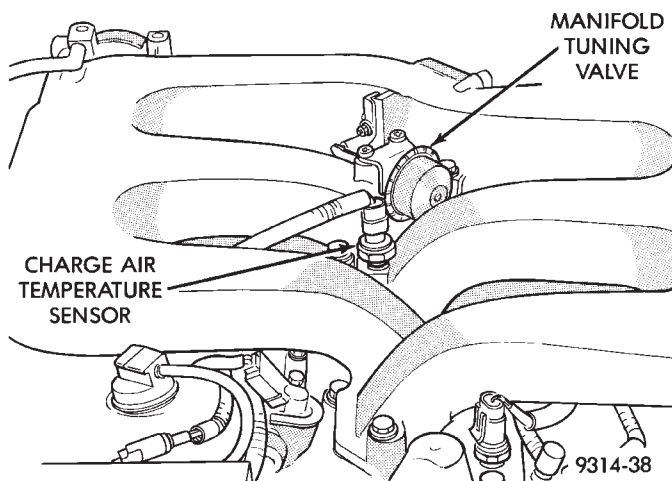


Fig. 9 Charge Air Temperature Sensor—3.5L Engine Only



CRANKSHAFT POSITION SENSOR—PCM INPUT

The crankshaft position sensor detects slots cut into the transmission driveplate extension. There are 3 sets of slots. Each set contains 4 slots, for a total of 12 slots (Fig. 10). Basic timing is set by the position of the last slot in each group. Once the powertrain control module (PCM) senses the last slot, it determines crankshaft position (which piston will next be at TDC) from the camshaft position sensor input. The 4 pulses generated by the crankshaft position sensor represent the 69°, 49°, 29°, and 9° BTDC marks. It may take the PCM one engine revolution to determine crankshaft position.

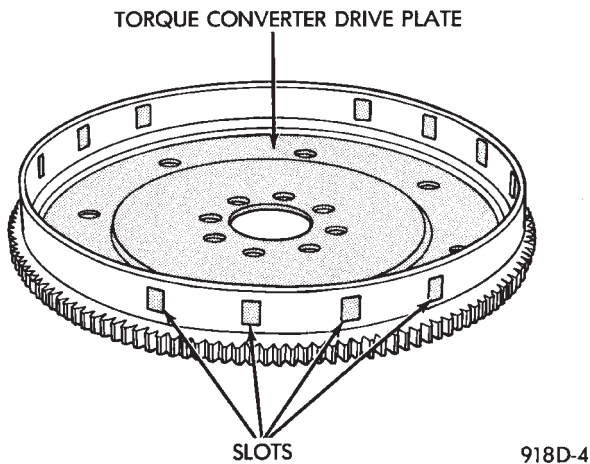


Fig. 10 Timing Slots

The PCM uses crankshaft position reference to determine injector sequence and ignition timing. Once the PCM determines crankshaft position, it begins energizing the injectors in sequence.

The crankshaft sensor is located on the passenger side of the transmission housing, above the differential housing (Fig. 11). The bottom of the sensor is positioned next to the drive plate.

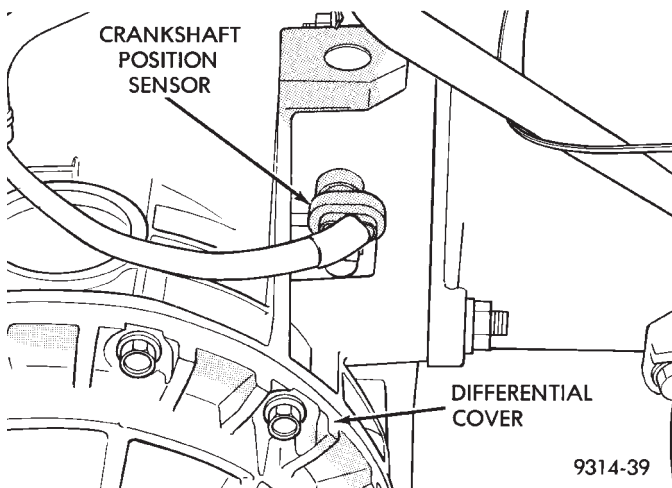


Fig. 11 Crankshaft Position Sensor Location

ENGINE COOLANT TEMPERATURE SENSOR—PCM INPUT

The engine coolant temperature sensor threads into the water jacket next to thermostat housing (Fig. 12 or Fig. 13). The sensor provides an input to the powertrain control module (PCM). As coolant temperature varies, the sensor resistance changes, resulting in a different input voltage to the PCM.

When the engine is cold, the PCM will demand slightly richer air-fuel mixtures and higher idle speeds until normal operating temperatures are reached.

The engine coolant sensor input also determines operation of the low and high speed cooling fans.

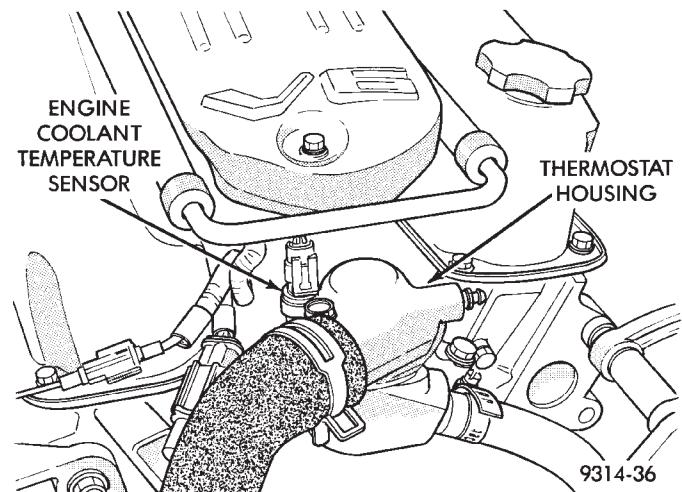


Fig. 12 Engine Coolant Temperature Sensor—3.3L Engine

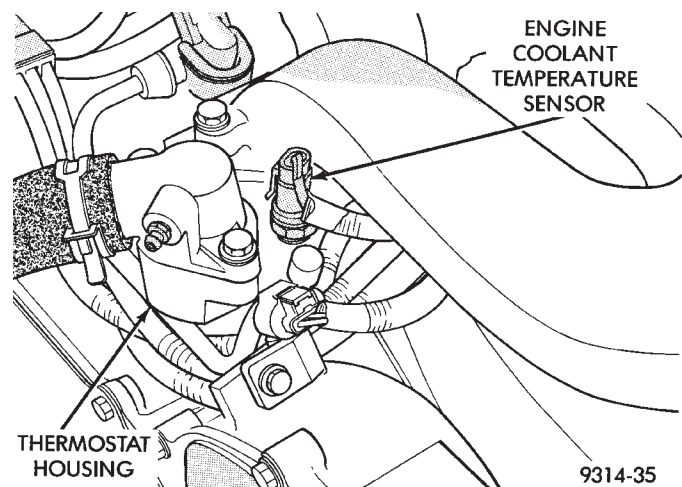


Fig. 13 Engine Coolant Temperature Sensor—3.5L Engine

KNOCK SENSORS (3.5L ENGINE)—PCM INPUT

Only the 3.5L engine uses knock sensors. The 3.5L engine has two knock sensors. One sensor for the right bank of cylinders, one for the left bank. The knock sensors thread into the top of the cylinder block below the cylinder heads (Fig. 14). When a



knock sensor detects a knock in one of the cylinders, it sends an input signal to the PCM. In response, the PCM retards ignition timing by a scheduled amount.

Knock sensors contain a crystal which constantly vibrates and sends an input voltage (signal) to the PCM while the engine operates. As the intensity of the crystal's vibration increase, the knock sensor output voltage also increases.

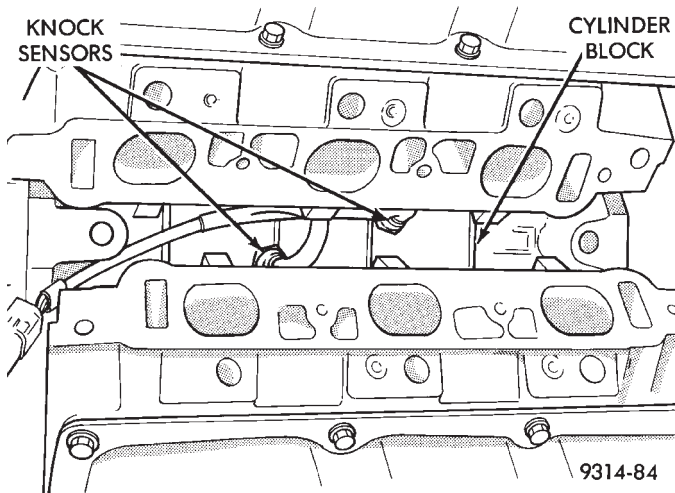


Fig. 14 Knock Sensor Locations—3.5L Engine Only

IGNITION SENSE—PCM INPUT

The ignition sense input informs the powertrain control module (PCM) that the ignition switch is in the crank or run position.

MANIFOLD ABSOLUTE PRESSURE SENSOR—PCM INPUT

The powertrain control module (PCM) supplies 5 volts to the MAP sensor. The MAP sensor converts intake manifold pressure into voltage. The PCM monitors the MAP sensor output voltage. As vacuum increases, MAP sensor voltage decreases proportionately. Also, as vacuum decreases, MAP sensor voltage increases proportionately.

During cranking, before the engine starts running, the PCM determines atmospheric air pressure from the MAP sensor voltage. While the engine operates, the PCM determines intake manifold pressure from the MAP sensor voltage. Based on MAP sensor voltage and inputs from other sensors, the PCM adjusts spark advance and the air/fuel mixture.

On 3.3L engines the MAP sensor mounts to the rear of the intake manifold plenum (Fig. 15). On 3.5L engines, the MAP sensor mounts to the drivers side of the intake manifold plenum (Fig. 16). The Map sensor must be in the horizontal position.

HEATED OXYGEN SENSORS—PCM INPUT

The fuel injection system uses two heated oxygen sensors, one in the outlet of each exhaust manifold (Fig. 17 or Fig. 18). Both sensors monitor the amount of oxygen in the exhaust gas stream. The left sensor

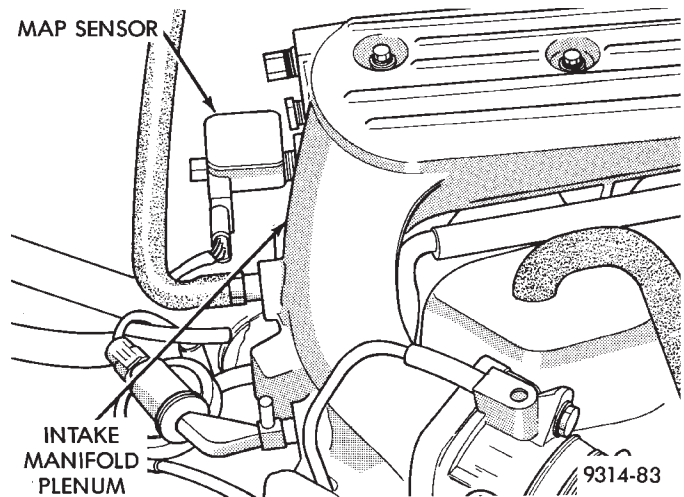


Fig. 15 MAP Sensor—3.3L Engine

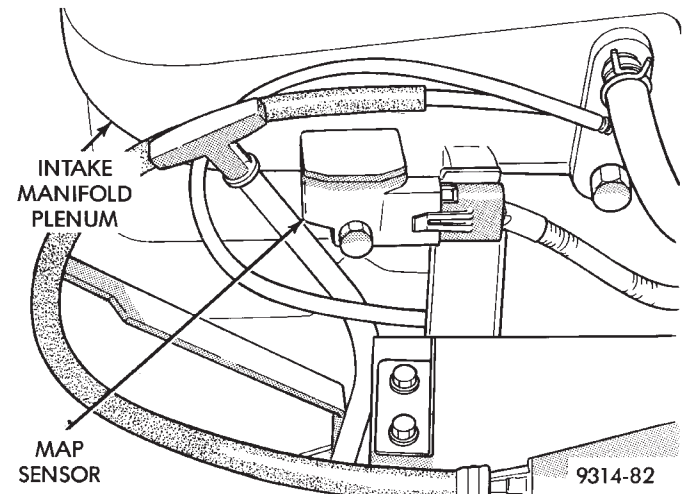


Fig. 16 MAP Sensor—3.5L Engine

monitors the odd numbered cylinders. The right sensor monitors the even numbered cylinders.

The inputs from the oxygen sensors tell the powertrain control module (PCM) the oxygen content of the exhaust gas. Based on the inputs from the two oxygen sensors, the PCM fine tunes the air-fuel ratio in each cylinder bank by adjusting injector pulse width.

The sensors produces from 0 to 1 volt, depending upon the oxygen content of the exhaust gas in the exhaust manifold. When a large amount of oxygen is present (caused by a lean air-fuel mixture), the sensors produce voltages as low as 0.1 volt. When there is a lesser amount of oxygen present (rich air-fuel mixture) the sensor produces a voltage as high as 1.0 volt. By monitoring the oxygen content and converting it to electrical voltage, the sensor acts as a rich-lean switch.

The oxygen sensors are equipped with a heating element. The heating element keeps the sensor at proper operating temperature during all operating modes. Maintaining correct sensor temperature at all times allows the system to enter into closed loop op-

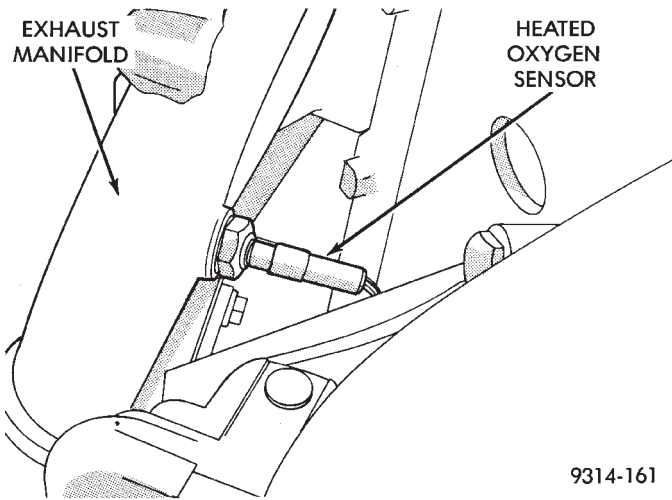


Fig. 17 Heated Oxygen Sensor—3.3L Engine

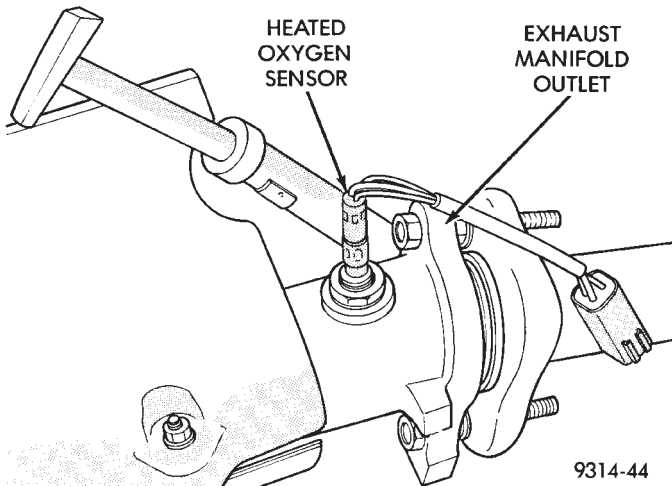


Fig. 18 Heated Oxygen Sensor—3.5L Engine

eration sooner. Also, it allows the system to remain in closed loop operation during periods of extended idle.

In Closed Loop operation the PCM monitors inputs from the heated oxygen sensors (along with other inputs) and adjusts the injector pulse width accordingly. During Open Loop operation the PCM ignores the inputs from the heated oxygens sensors. In Open Loop, the PCM adjusts injector pulse width based on preprogrammed (fixed) values and inputs from other sensors.

SENSOR RETURN—PCM INPUT

The sensor return circuit provides low noise ground reference for all of the systems sensors. The sensor return circuit connects to internal ground circuits within the powertrain control module.

SPEED CONTROL—PCM INPUT

The speed control system provides four separate voltages (inputs) to the PCM. The voltages correspond to the On, Off, Set, and Resume.

The speed control On voltage informs the powertrain control module (PCM) that the speed control system has been activated. The speed control Set voltage informs the PCM that a fixed vehicle speed has been selected. The speed control Resume voltage indicates the previous fixed speed is requested. The speed control Off voltage tells the PCM that the speed control system has deactivated. Refer to Group 8H for further speed control information.

THROTTLE POSITION SENSOR—PCM INPUT

The throttle position sensor mounts to the side of the throttle body (Fig. 19 or Fig. 20). Although the 3.5L engine has two throttle bodies, it only uses one TPS. On 3.5L engines, the TPS is mounted on the right side throttle body.

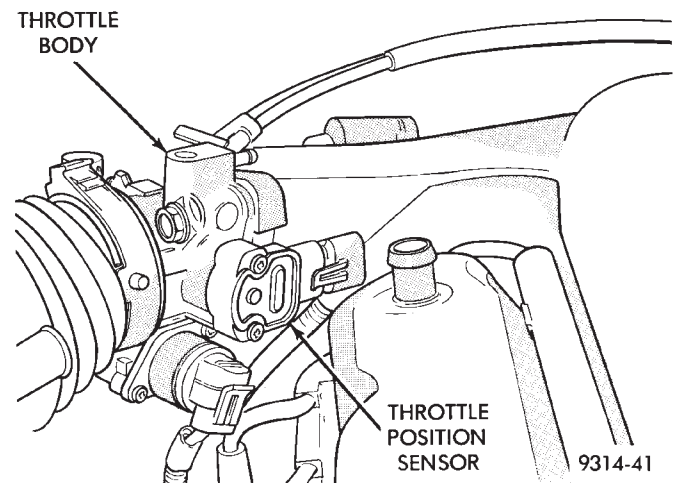


Fig. 19 Throttle Position Sensor—3.3L Engine

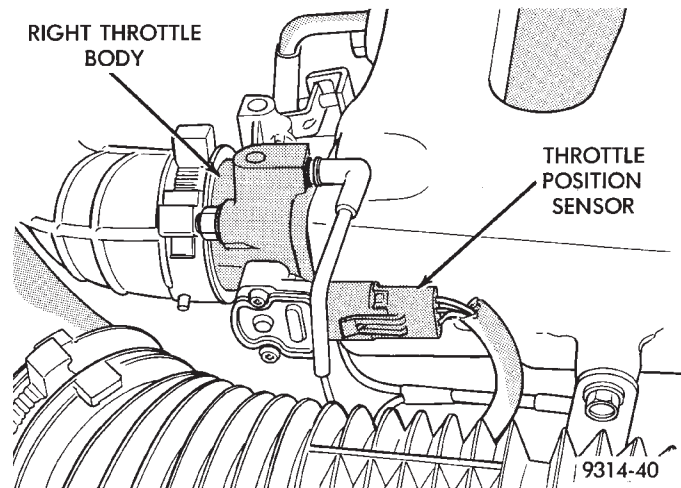


Fig. 20 Throttle Position Sensor—3.5L Engine

The sensor connects to the throttle blade shaft. The TPS is a variable resistor that provides the powertrain control module (PCM) with an input signal (voltage). The signal represents throttle blade position. As the position of the throttle blade changes, the resistance of the TPS changes.



The PCM supplies approximately 5 volts to the TPS. The TPS output voltage (input signal to the powertrain control module) represents throttle blade position. The TPS output voltage to the PCM varies from approximately 0.6 volt at minimum throttle opening (idle) to a maximum of 4.5 volts at wide open throttle.

Along with inputs from other sensors, the PCM uses the TPS input to determine current engine operating conditions. The PCM also adjusts fuel injector pulse width and ignition timing based on these inputs.

AIR CONDITIONING COMPRESSOR CLUTCH RELAY—PCM OUTPUT

The powertrain control module (PCM) operates the air conditioning clutch relay ground circuit. The battery supplies power to the solenoid side of the relay. The PCM grounds the relay when the operator puts the A/C or defrost switch in the ON position and it receives an acceptable input from the A/C pressure transducer. If the A/C pressure transducer input indicates high side pressure is too high or too low, the PCM will not ground the A/C compressor clutch relay.

With the engine operating, the PCM cycles the air conditioning clutch on and off during A/C operation. When the PCM senses low idle speeds or wide open throttle through the throttle position sensor, it de-energizes the A/C compressor clutch relay.

The A/C compressor clutch relay is located in the power distribution center (PDC) near the battery (Fig. 21). A decal on the inside of the PDC covers shows the locations of each relay and fuse contained in the PDC.

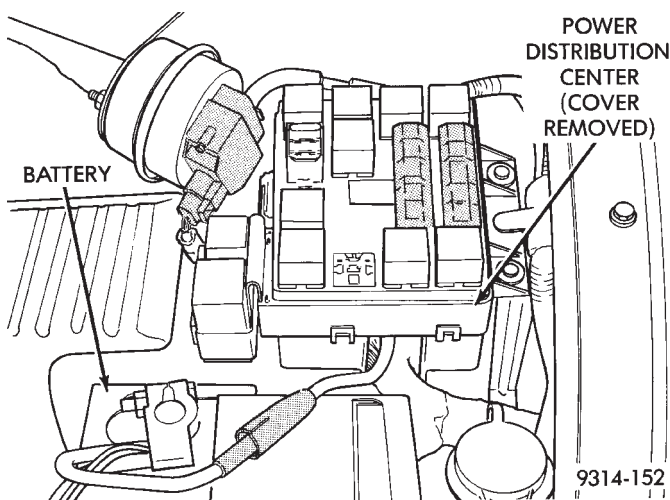


Fig. 21 Power Distribution Center

AUTO SHUTDOWN AND FUEL PUMP RELAYS—PCM OUTPUT

The PCM operates the auto shutdown (ASD) relay and fuel pump relay through one ground path. The PCM operates them by switching the ground path for

the solenoid side of the relays on and off. Both relays turn on and off at the same time.

The ASD relay connects battery voltage to the fuel injectors and ignition coil. The fuel pump relay connects battery voltage to the fuel pump.

The PCM turns the ground path off when the ignition switch is in the Off position. Both relays are off. When the ignition switch is in the On or Crank position, the PCM monitors the crankshaft position sensor and camshaft position sensor signals to determine engine speed and ignition timing (coil dwell). If the PCM does not receive a crankshaft position sensor signal and camshaft position sensor signal when the ignition switch is in the Run position, it de-energizes both relays. When the relays are de-energized, battery voltage is not supplied to the fuel injectors, ignition coil and fuel pump.

The ASD relay and fuel pump relay are located in the power distribution center (PDC) near the battery (Fig. 21). A decal on the inside of the PDC covers shows the locations of each relay and fuse contained in the PDC.

DATA LINK CONNECTOR—PCM OUTPUT

The data link connector (diagnostic connector) links the DRBII scan tool with the powertrain control module (PCM). Refer to On-Board Diagnostics in the General Diagnosis section of this group. The data link connector is located inside the vehicle, below instrument panel next to the center column (Fig. 22).

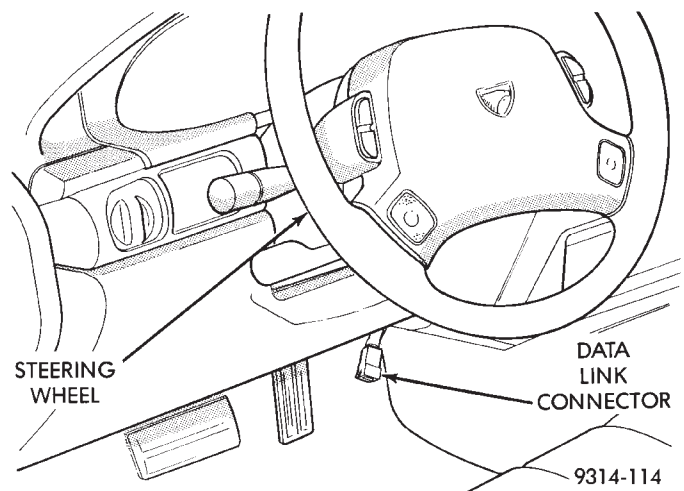


Fig. 22 Data Link Connector

MANIFOLD TUNING VALVE (MTV) SOLENOID (3.5L)—PCM OUTPUT

The MTV solenoid regulates the supply of vacuum to the manifold tuning valve. The PCM controls the MTV solenoid. The manifold tuning valve optimizes acoustical tuning of the intake system during wide open throttle operation throughout the RPM range. The valve opens a crossover passage in that connects both sides of the intake manifold plenum.



When energized, the MTV solenoid allows vacuum to reach and close the manifold tuning valve. When not energized, the solenoid closes and vacuum bleeds off from the manifold tuning valve vacuum motor. The manifold tuning valve opens the crossover when the solenoid de-energizes.

The MTV solenoid shares a bracket with the duty cycle EVAP purge solenoid. The solenoids and bracket attach to the right inner fender well next to the dash panel (Fig. 23).

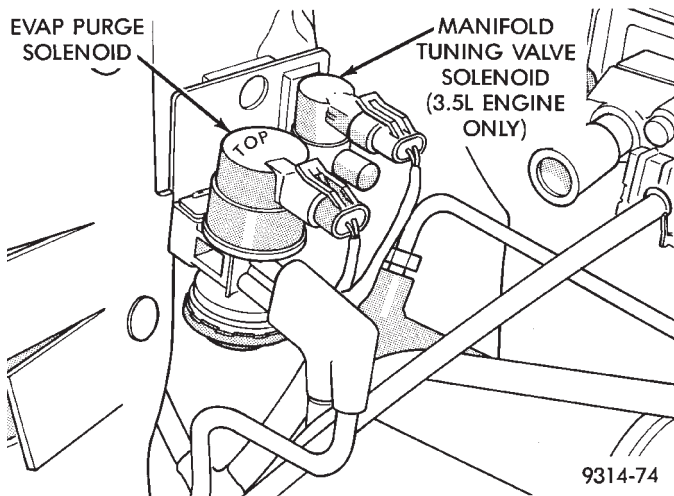


Fig. 23 EVAP Purge and MTV Solenoids

EGR SOLENOID—PCM OUTPUT

The electronic EGR transducer (EET) contains an electrically operated solenoid and a back-pressure transducer (Fig. 24). The powertrain control module (PCM) operates the solenoid. The PCM determines when to energize the solenoid. Exhaust system back-pressure controls the transducer.

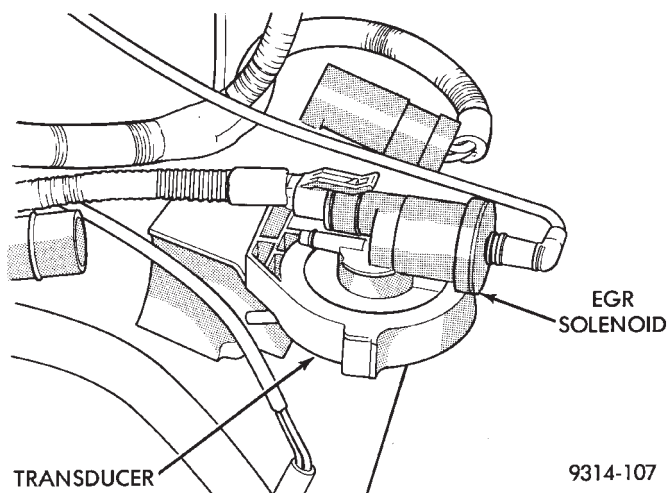


Fig. 24 EGR Solenoid

When the PCM energizes the solenoid, vacuum does not reach the transducer. Vacuum flows to the transducer when the PCM de-energizes the solenoid.

When exhaust system back-pressure becomes high enough, it fully closes a bleed valve in the transducer. When the PCM de-energizes the solenoid and back-pressure closes the transducer bleed valve, vacuum flows through the transducer to operate the EGR valve.

De-energizing the solenoid, but not fully closing the transducer bleed hole (because of low back-pressure), varies the strength of vacuum applied to the EGR valve. Varying the strength of the vacuum changes the amount of EGR supplied to the engine. This provides the correct amount of exhaust gas recirculation for different operating conditions.

DUTY CYCLE EVAP PURGE SOLENOID—PCM OUTPUT

The duty cycle EVAP purge solenoid regulates the rate of vapor flow from the EVAP canister to the throttle body. The powertrain control module (PCM) operates the solenoid.

During the cold start warm-up and the hot start time delay, the PCM does not energize the solenoid. When de-energized, no vapors are purged. The PCM de-energizes the solenoid during open loop operation.

The engine enters closed loop operation after it reaches a specified temperature and the time delay ends. During closed loop operation, the PCM energizes and de-energizes the solenoid approximately 5 to 10 times per second, depending upon operating conditions. The PCM varies the vapor flow rate by changing solenoid pulse width. Pulse width is the amount of time the solenoid energizes. The PCM adjusts solenoid pulse width based on fuel requirements.

The EVAP purge solenoid and bracket attach to the right inner fender well next to the dash panel (Fig. 23). The top of the solenoid has the word TOP on it. The solenoid will not operate unless it is installed correctly. If the vehicle has a 3.5L engine, the EVAP purge solenoid shares a bracket with the MTV solenoid.

FUEL INJECTORS—PCM OUTPUT

The 3.5L engine uses bottom feed injectors. Fuel from the rail enters the side of the injectors (Fig. 25). The 3.3L engines use top feed injectors (Fig. 26).

The automatic shutdown (ASD) relay supplies battery voltage to the injectors. The PCM controls the ground path for each injector in sequence. By switching the ground paths on and off, the PCM fine-tunes injector pulse width. Injector pulse width refers to the amount of time an injector operates.

The PCM determines injector synchronization from the camshaft position sensor and crankshaft position sensor inputs. The PCM grounds the ASD and fuel pump relays after receiving the camshaft position sensor and crankshaft position sensor inputs.

The PCM energizes the injectors in a sequential order during all engine operating conditions except



start-up. During start-up, when the coolant temperature is below 15° C (60° F), all injectors are energized at the same time. Above 15° C, the PCM energizes the injectors in sequence. Once the PCM determines crankshaft position, it begins energizing the injectors in sequence.

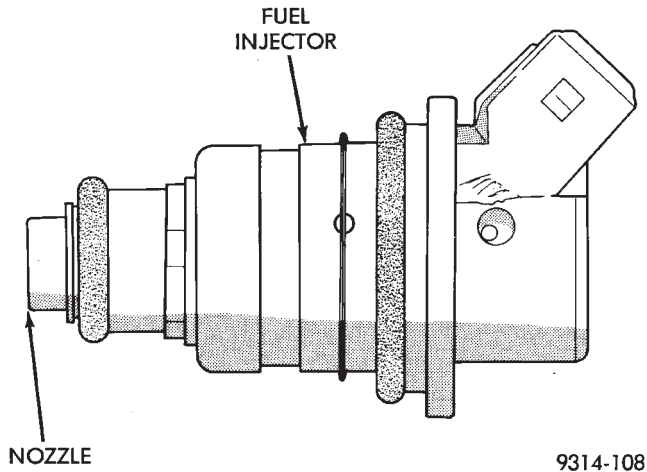


Fig. 25 Fuel Injector—3.5L Engine

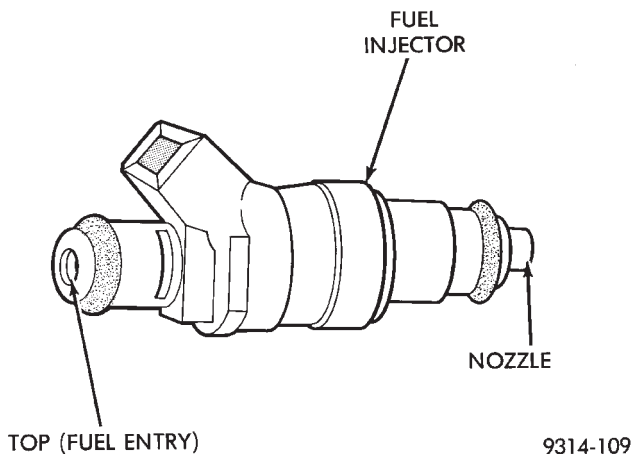


Fig. 26 Fuel Injector—3.3L Engine

GENERATOR FIELD—PCM OUTPUT

The powertrain control module (PCM) regulates the charging system voltage within a range of 12.9 to 15.0 volts. Refer to Group 8A for charging system information.

IGNITION COIL—PCM OUTPUT

The coil assembly consists of 3 coils molded together (Fig. 27). The coil assembly is mounted on the intake manifold. High tension leads route to each cylinder from the coil. The coil fires two spark plugs every power stroke. One plug is the cylinder under compression, the other cylinder fires on the exhaust stroke. The PCM determines which of the coils to charge and fire at the correct time.

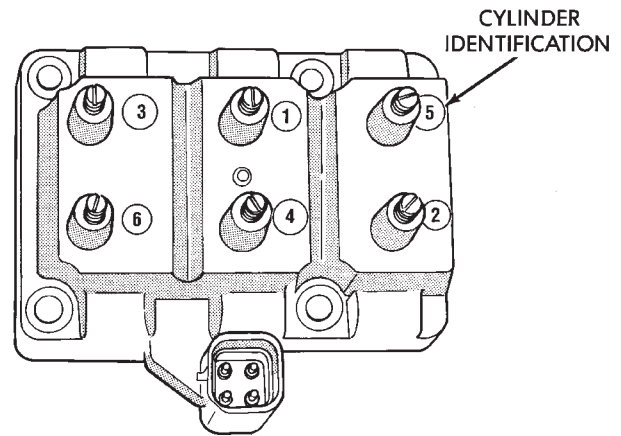


Fig. 27 Ignition Coil Pack

The auto shutdown (ASD) relay provides battery voltage to the ignition coil. The PCM provides a ground contact (circuit) for energizing the coil. When the PCM breaks the contact, the energy in the coil primary transfers to the secondary causing the spark. The PCM will de-energize the ASD relay if it does not receive the crankshaft sensor and camshaft sensor inputs. Refer to Auto Shutdown (ASD) Relay and Fuel Pump Relay—PCM in this section for relay operation.

IDLE AIR CONTROL MOTOR—PCM OUTPUT

3.3L ENGINE

The idle air control motor attaches to the throttle body (Fig. 28). The PCM operates the idle air control motor. The PCM adjusts engine idle speed through the idle air control motor to compensate for engine load or ambient conditions.

The throttle body has an air bypass passage that provides air for the engine at idle (the throttle blade is closed). The idle air control motor pintle protrudes into the air bypass passage and regulates air flow through it (Fig. 29).

The PCM adjusts engine idle speed by moving the idle air control motor pintle in and out of the bypass passage. The adjustments are based on inputs the PCM receives. The inputs effecting idle speed include the throttle position sensor, road speed (from transmission control module), coolant temperature sensor, battery voltage and battery temperature. Also various switch operations (brake, park/neutral, air conditioning) effect idle speed. The PCM prevents deceleration die out by increasing airflow when the throttle closes quickly.

3.5L ENGINE

The idle air control motor and housing attaches to the rear of the intake manifold plenum (Fig. 30). The housing opens to the rear runner in the intake man-

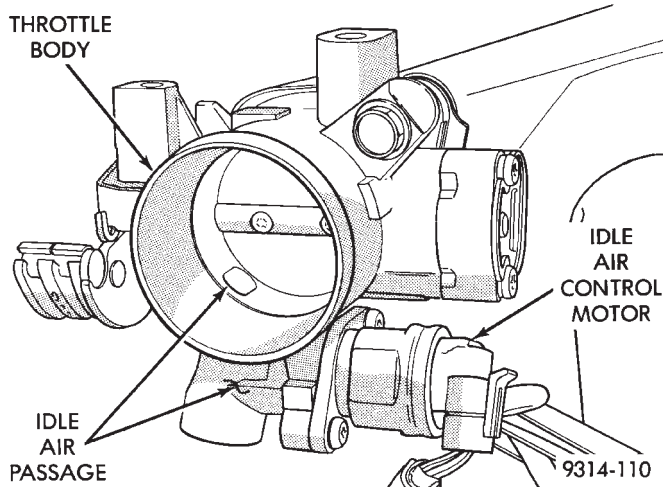


Fig. 28 Idle Air Control Motor—3.3L Engine

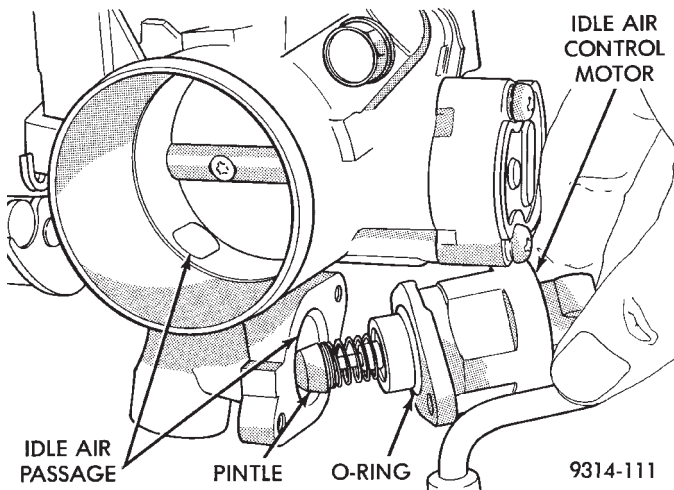


Fig. 29 Idle Air Passage—3.3L Engine

ifold plenum. A hose from the air cleaner plenum supplies filtered air to idle air control motor housing. The idle air control motor pintle protrudes into the housing and regulates air flow through it (Fig. 31).

The PCM adjusts engine idle speed by moving the idle air control motor pintle in and out of the opening in the housing. The adjustments are based on inputs to the PCM. The inputs effecting idle speed include the throttle position sensor, road speed (from transmission control module), coolant temperature sensor, battery voltage and battery temperature. Also, various switch operations (brake, park/neutral, air conditioning) effect idle speed. The PCM prevents deceleration die out by increasing airflow when the throttle closes quickly.

MALFUNCTION INDICATOR (CHECK ENGINE) LAMP—PCM OUTPUT

The PCM transmits the malfunction indicator (Check Engine) lamp signal over the CCD Bus. The lamp comes on each time the ignition key is turned ON and stays on for a 3 seconds bulb test. The mal-

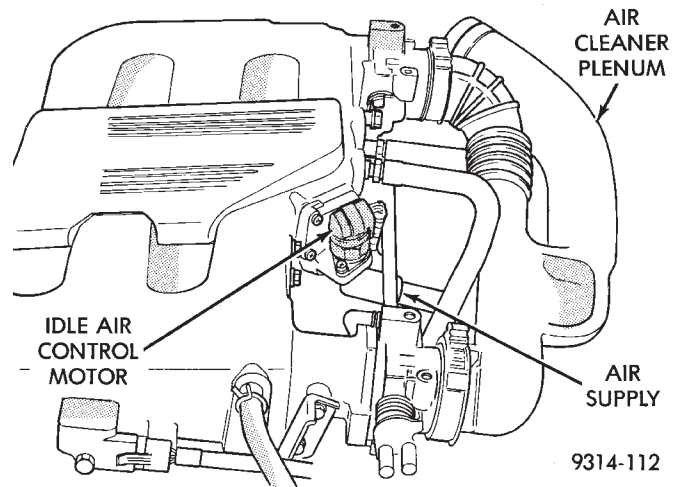


Fig. 30 Idle Air Control Motor—3.5L Engine

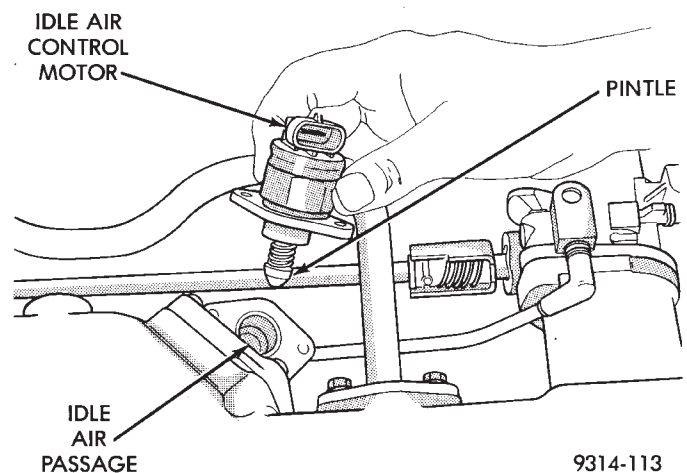


Fig. 31 Idle Air Passage—3.5L Engine

function indicator lamp warns the operator that the PCM has entered a Limp-in mode. During Limp-in Mode, the PCM attempts to keep the system operational. The malfunction indicator lamp signals the need for immediate service. In limp-in mode, the PCM compensates for the failure of certain components that send incorrect signals. The PCM substitutes inputs from other sensors for the incorrect signals.

Signals that can trigger the Malfunction Indicator (Check Engine) Lamp.

- Engine Coolant Temperature Sensor
- Manifold Absolute Pressure Sensor
- Throttle Position Sensor
- Battery Voltage Input
- Charging system

The malfunction indicator lamp can also display diagnostic trouble codes. Cycle the ignition switch on, off, on, off, on, within five seconds and the PCM displays any diagnostic trouble codes stored in memory. Refer to On Board Diagnostics in the General Diagnosis section of this Group for Diagnostic Trouble Code Descriptions.



RADIATOR FAN RELAYS—PCM OUTPUT

The cooling system uses two fans. Both fans operate at two different speeds, low and high. Depending on engine coolant temperature and A/C system high side pressure, the both fans operate at either low or high. The PCM controls radiator speed by grounding the coil side of either the low speed fan relay or the high speed fan relay. The ignition switch supplies voltage to the coil sides of the relay. When the PCM grounds the coil side of the relay, the contacts close and the battery supplies power to the fans.

The low speed and high speed fan relays are located in the power distribution center (PDC) near the battery (Fig. 21). A decal on the inside of the PDC covers shows the locations of each relay and fuse contained in the PDC.

FAN OPERATION—3.3L ENGINE

With the A/C off, the PCM energizes the low speed fan when engine coolant temperature reaches approximately 99°C (211°F). Also with the A/C off, the PCM de-energizes the low speed fan when coolant temperature drops to approximately 93°C (199°F).

The PCM energizes the high speed fan when engine coolant temperature reaches approximately 110°C (230°F). The PCM de-energizes the high speed fan and energizes the low speed fan when coolant temperature drops to approximately 104°C (219°F).

When the PCM receives an input from the A/C pressure transducer indicating high side pressure is approximately 1448 kPa (210 PSI), it energizes the low speed fan. The PCM de-energizes the low speed when the high side pressure drops to 861 kPa (125 PSI) if engine coolant temperature is below approximately 93°C (200°F).

When the PCM receives an input from the A/C pressure transducer indicating high side pressure is approximately 1724 kPa (250 PSI), it energizes the high speed fan. The PCM de-energizes the high speed fan and energizes the low speed when the high side pressure drops to 1586 kPa (230 PSI).

FAN OPERATION—3.5L ENGINE

With the A/C off, the PCM energizes the low speed fan when engine coolant temperature reaches approximately 104°C (219°F). Also with the A/C off, the PCM de-energizes the low speed fan when coolant temperature drops to approximately 99°C (210°F).

The PCM energizes the high speed fan when engine coolant temperature reaches approximately 110°C (230°F). The PCM de-energizes the high speed fan and energizes the low speed fan when coolant temperature drops to approximately 105°C (221°F).

When the PCM receives an input from the A/C pressure transducer indicating high side pressure is approximately 1448 kPa (210 PSI), it energizes the low speed fan. The PCM de-energizes the low speed

when the high side pressure drops to 861 kPa (125 PSI) if engine coolant temperature is below approximately 99°C (210°F).

When the PCM receives an input from the A/C pressure transducer indicating high side pressure is approximately 1724 kPa (250 PSI), it energizes the high speed fan. The PCM de-energizes the high speed fan and energizes the low speed when the high side pressure drops to 1586 kPa (230 PSI).

SPEED CONTROL RELAY—PCM OUTPUT

When the operator engages the speed control PCM receives a input from the speed control On switch. In response to the input, the PCM grounds the coil side of the speed control relay. The ignition switch supplies power to the coil and contact sides of the relay. When energized, the speed control relay supplies battery voltage to the speed control vacuum and vent servos. Refer to Group 8H for speed control information.

SPEED CONTROL SERVOS—PCM OUTPUT

The PCM operates the speed control vacuum and vent servos. The PCM supplies a ground for both servos. The speed control relay supplies, also operated by the PCM, supplies battery voltage to the servos. When the PCM supplies a ground to the vacuum servo, the speed control system opens the throttle plate to obtain or maintain the selected road speed. When the PCM supplies a ground to the vent servo, the speed control system releases the throttle plate. The PCM balances the two servos to maintain the set speed. Refer to Group 8H for speed control information.

TACHOMETER—PCM OUTPUT

The PCM broadcasts engine RPM on the CCD Bus. The tachometer on the instrument panel receives the input from the CCD Bus. The PCM calculates engine RPM from the crankshaft position sensor input.

5 VOLT SUPPLY—PCM OUTPUT

The PCM supplies 5 volts to the following sensors:

- A/C pressure transducer
- Manifold absolute pressure sensor
- Throttle position sensor

8-VOLT SUPPLY—PCM OUTPUT

The PCM supplies 8 volts to the following crankshaft position sensor and camshaft position sensor.

MODES OF OPERATION

As input signals to the powertrain control module (PCM) change, the PCM adjusts its response to output devices. For example, the PCM must calculate a different injector pulse width and ignition timing for idle than it does for wide open throttle (WOT). There



are several different modes of operation that determine how the PCM responds to the various input signals.

There are two different areas of operation, OPEN LOOP and CLOSED LOOP.

During OPEN LOOP modes the PCM receives input signals and responds according to preset PCM programming. Inputs from the heated oxygen (O₂) sensors are not monitored during OPEN LOOP modes.

During CLOSED LOOP modes the PCM monitors the inputs from the heated oxygen (O₂) sensors. This input indicates to the PCM whether or not the calculated injector pulse width results in the ideal air-fuel ratio of 14.7 parts air to 1 part fuel. By monitoring the exhaust oxygen content through the O₂ sensor, the PCM can fine tune injector pulse width. Fine tuning injector pulse width allows the PCM to achieve optimum fuel economy combined with low emissions.

The 3.3L and 3.5L multi-port fuel injection systems have the following modes of operation:

- Ignition switch ON (Zero RPM)
- Engine start-up
- Engine warm-up
- Cruise (Idle)
- Acceleration
- Deceleration
- Wide Open Throttle
- Ignition switch OFF

The engine start-up (crank), engine warm-up, and wide open throttle modes are OPEN LOOP modes. Under most operating conditions, the acceleration, deceleration, and cruise modes, **with the engine at operating temperature** are CLOSED LOOP modes.

IGNITION SWITCH ON (ZERO RPM) MODE

When the ignition switch activates the fuel injection system, the following actions occur:

- The PCM determines atmospheric air pressure from the MAP sensor input to determine basic fuel strategy.
- The PCM monitors the engine coolant temperature sensor and throttle position sensor input. The PCM modifies fuel strategy based on this input.

When the key is in the ON position and the engine is not running (zero rpm), the auto shutdown (ASD) relay and fuel pump relay are not energized. Therefore, battery voltage is not supplied to the fuel pump, ignition coil, and fuel injectors.

ENGINE START-UP MODE

This is an OPEN LOOP mode. The following actions occur when the starter motor is engaged.

If the PCM receives the camshaft and crankshaft signals, it energizes the auto shutdown (ASD) relay and fuel pump relay. These relays supply battery voltage to the fuel pump, fuel injectors and ignition

coil. If the PCM does not receive the camshaft and crankshaft signals within approximately one second, it de-energizes the ASD relay and fuel pump relay.

The PCM energizes all six injectors until it determines crankshaft position from the camshaft and crankshaft signals. The PCM determines crankshaft position within 1 engine revolution.

After determining crankshaft position, the PCM begins energizing the injectors in sequence. It adjusts injector pulse width and controls injector synchronization by turning the individual ground paths to the injectors On and Off.

When the engine idles within ± 64 RPM of its target RPM, the PCM compares current MAP sensor value with the atmospheric pressure value received during the Ignition Switch On (zero RPM) mode. If the PCM does not detect a minimum difference between the two values, it sets a MAP fault into memory.

Once the ASD and fuel pump relays have been energized, the PCM determines injector pulse width based on the following:

- Engine coolant temperature
- Manifold absolute pressure (MAP)
- Charge air temperature
- The number of engine revolutions since cranking was initiated

The PCM Monitors the following to determine spark advance (ignition timing) requirements:

- Engine coolant temperature sensor
- Crankshaft position sensor
- Camshaft position sensor
- Charge air temperature sensor
- MAP sensor
- Throttle position sensor

ENGINE WARM-UP MODE

This is an OPEN LOOP mode. The following inputs are received by the PCM:

- Engine coolant temperature
- Manifold absolute pressure (MAP)
- Charge air temperature (3.5L engine)
- Crankshaft position (engine speed)
- Camshaft position
- Throttle position
- A/C switch
- Battery voltage

The PCM adjusts injector pulse width and controls injector synchronization by turning the individual ground paths to the injectors On and Off.

The PCM adjusts ignition timing and engine idle speed. Engine idle speed is adjusted through the automatic idle speed motor.

CRUISE OR IDLE MODE

When the engine is at operating temperature this is a CLOSED LOOP mode. During cruising speed the following inputs are received by the PCM:



- Charge air temperature
- Engine coolant temperature
- Manifold absolute pressure
- Crankshaft position (engine speed)
- Camshaft position
- Throttle position
- Exhaust gas oxygen content
- A/C control positions
- Battery voltage

The PCM adjusts injector pulse width and controls injector synchronization by turning the individual ground paths to the injectors On and Off.

The PCM adjusts engine idle speed and ignition timing. The PCM adjusts the air/fuel ratio according to the oxygen content in the exhaust gas.

During certain idle conditions, the PCM may enter a variable idle speed strategy. During variable idle speed strategy the PCM adjusts engine speed based on the following inputs.

- Throttle position
- Battery voltage
- Battery temperature
- Coolant temperature

ACCELERATION MODE

This is a CLOSED LOOP mode. The PCM recognizes an abrupt increase in throttle position or MAP pressure as a demand for increased engine output and vehicle acceleration. The PCM increases injector pulse width in response to increased fuel demand.

DECELERATION MODE

This is a CLOSED LOOP mode. During deceleration the following inputs are received by the PCM:

- A/C pressure transducer
- A/C switch position
- Coolant temperature
- Manifold absolute pressure
- Crankshaft position (engine speed)
- Throttle position
- Exhaust gas oxygen content
- Battery voltage

The PCM may receive a closed throttle input from the throttle position sensor (TPS) when it senses an abrupt decrease in manifold pressure. This indicates a hard deceleration. The PCM may reduce injector pulse width. This helps maintain better control of the air-fuel mixture (as sensed through the O₂ sensor).

WIDE OPEN THROTTLE MODE

This is an OPEN LOOP mode. During wide-open-throttle operation, the following inputs are received by the PCM:

- Charge air temperature (3.5L only)
- Coolant temperature
- Manifold absolute pressure
- Engine speed
- Throttle position

When the PCM senses wide open throttle condition through the throttle position sensor (TPS) it de-energizes the A/C compressor clutch relay. This disables the air conditioning system.

The exhaust gas oxygen content input is not accepted by the PCM during wide open throttle operation. The PCM adjusts injector pulse width to supply a predetermined amount of additional fuel.

IGNITION SWITCH OFF MODE

When the operator turns the ignition switch to the OFF position, the following occurs:

- All outputs are turned off.
- No inputs are monitored.
- The PCM shuts down.

THROTTLE BODY—3.3L ENGINE

The throttle body assembly is located on the right side of the intake manifold plenum (Fig. 32). The throttle body houses the throttle position sensor and the idle air control motor. Air flow through the throttle body is controlled by a cable operated throttle blade.

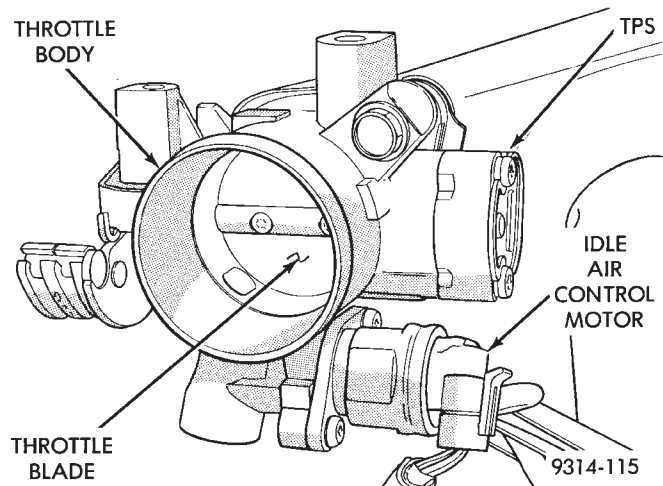


Fig. 32 Throttle Body—3.3L Engine

THROTTLE BODIES—3.5L ENGINE

The 3.5L engine has two throttle bodies. A shaft connects both throttle bodies and maintains synchronization. The throttle bodies connect to the rear of the intake manifold plenum (Fig. 33). The throttle position sensor (TPS) attaches to the right throttle body. Because the shaft maintains throttle body synchronization, the fuel injection system uses only one TPS.

If either throttle body is removed or replaced, the Throttle Body Synchronization procedure must be performed. Refer to Throttle Body Synchronization in the Multi-Port Fuel Injection—Service Procedures section of this group.

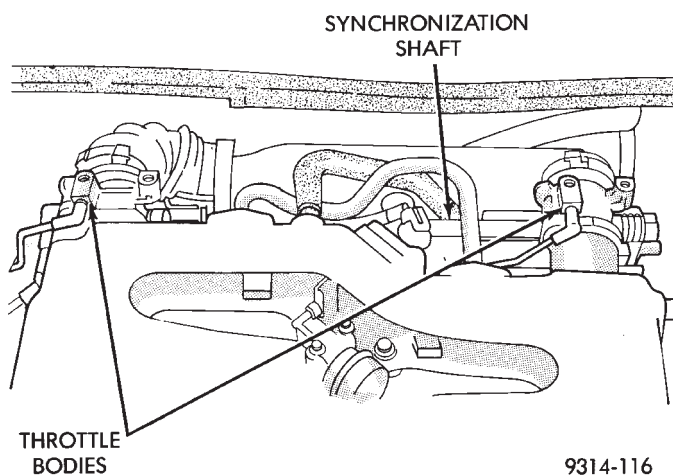


Fig. 33 Throttle Bodies—3.5L Engine

FUEL PRESSURE REGULATOR

The powertrain control module (PCM) does not control the fuel pressure regulator. The regulator is a mechanical device that maintains fuel system pressure. Refer to Fuel Pressure Regulator in the Fuel Delivery Section of this Group.

SEQUENTIAL MULTI-PORT FUEL INJECTION—GENERAL DIAGNOSIS

INDEX

	page		page
ASD and Fuel Pump Relays	40	Throttle Body Minimum Air Flow—3.3L Engine ..	43
Fuel Injection System Diagram	35	Throttle Body Minimum Air Flow—3.5L Engine ..	45
Fuel Injectors	39	Throttle Position Sensor	43
General Information	35	Transmission Driveplate	39
Heated Oxygen Sensor	43	Visual Inspection	35
Ignition Timing	46		

GENERAL INFORMATION

This section contains diagnostic tests for certain individual components. For system tests, refer to the On-Board Diagnostics section of this group. Also Refer to the DRBII scan tool and the appropriate Powertrain Diagnostic Manual. The On-Board Diagnostics section of this group has a description of diagnostic trouble codes. It also contains a list of the actuator tests performed by the DRBII scan tool.

FUEL INJECTION SYSTEM DIAGRAM

Refer to the System Operation portion of this section for a more complete description of the components shown in Fig. 1.

VISUAL INSPECTION

Before diagnosing or servicing the fuel injection system, perform a visual inspection for loose, disconnected, or misrouted wires and hoses. A thorough visual inspection that includes the following checks saves unnecessary test and diagnostic time.

(1) Remove the power distribution center cover. Check for blown fuses. Ensure all relays are properly installed (Fig. 2).

(2) Check the battery terminal connections for loose cables and corrosion.

(3) Check the MAP sensor electrical connection (Fig. 3 or Fig. 4).

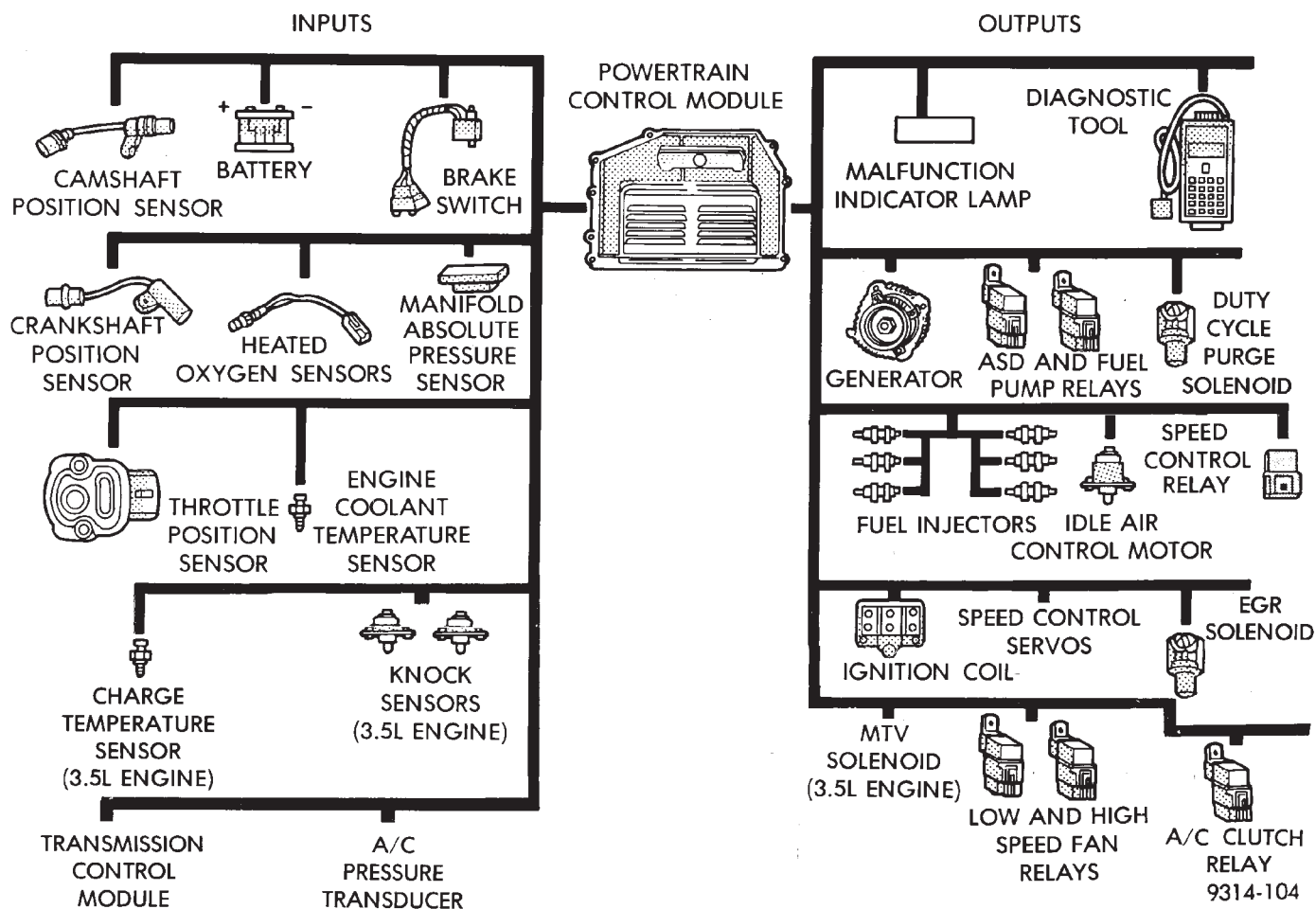


Fig. 1 Sequential Multi-Port Fuel Injection Components

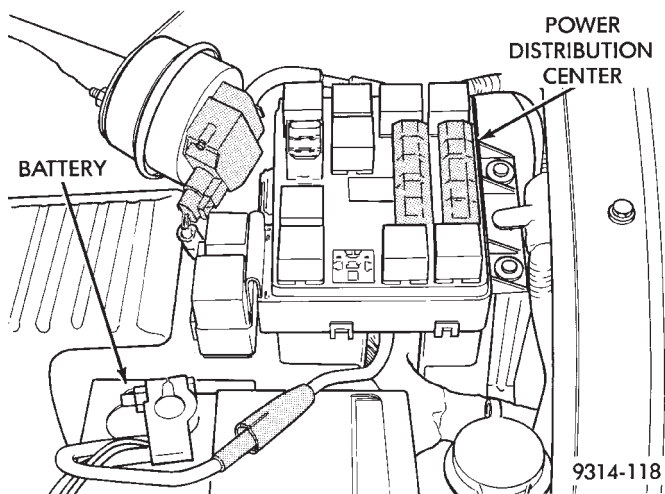


Fig. 2 Power Distribution Center

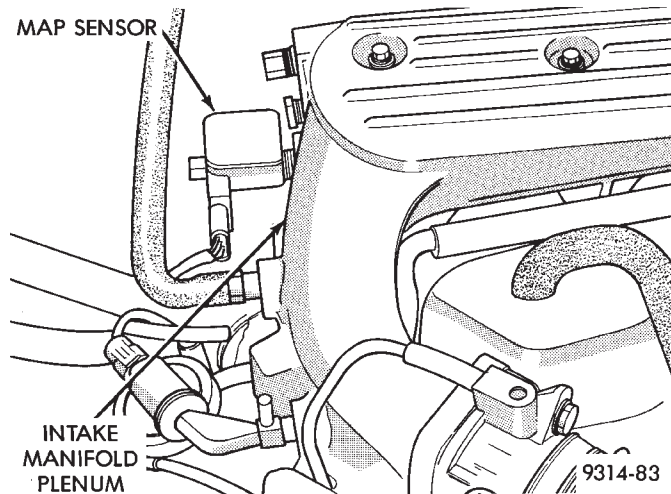


Fig. 3 MAP Sensor—3.3L Engine

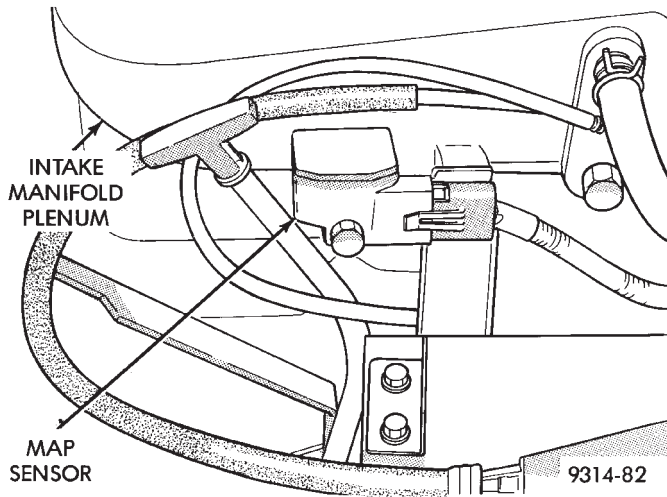


Fig. 4 MAP Sensor—3.5L Engine

(4) Ensure spark plug cables are firmly connected in the correct order to the coil pack and spark plugs.

(5) Ensure the electrical connector is completely attached to the idle air control motor (Fig. 5 or Fig. 6).

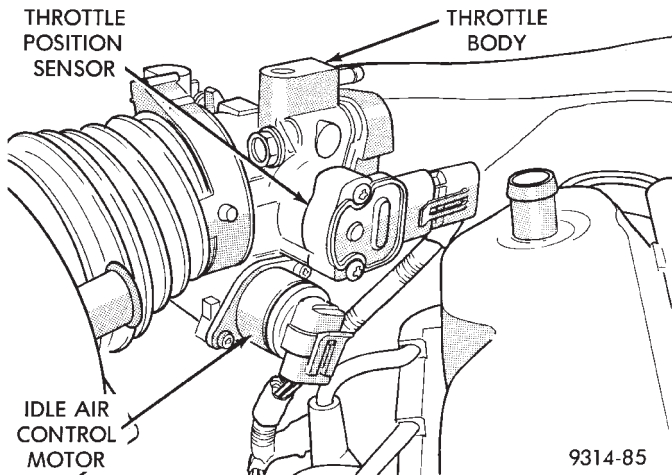


Fig. 5 Idle Air Control Motor—3.3L Engine

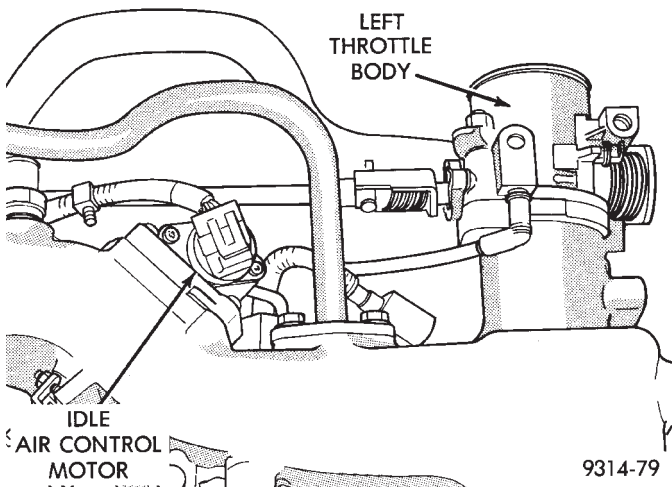


Fig. 6 Idle Air Control Motor—3.5L Engine

(6) Ensure electrical connector is attached to the throttle position sensor (Fig. 5 or Fig. 7).

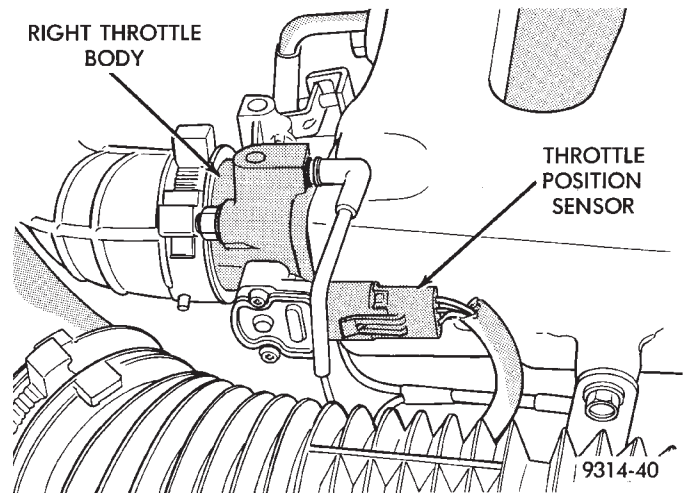


Fig. 7 Throttle Position Sensor—3.5L Engine

(7) Verify the electrical connector is attached to the engine coolant temperature sensor (Fig. 8 or Fig. 9).

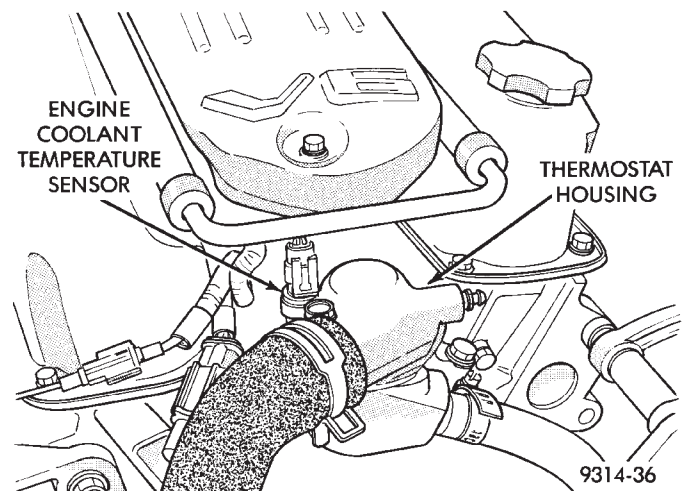


Fig. 8 Engine Coolant Temperature Sensor—3.3L Engine

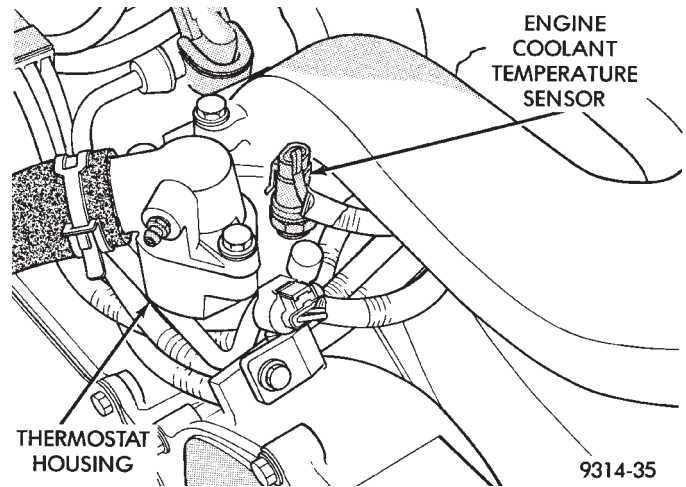


Fig. 9 Engine Coolant Temperature Sensor—3.5L Engine



(8) On 3.5L engines, ensure the air plenum hoses are attached to the idle air control motor and the make up air nipple for the PCV system (Fig. 10). Also ensure the PCV hose is connected to the PCV valve, not the idle air control motor.

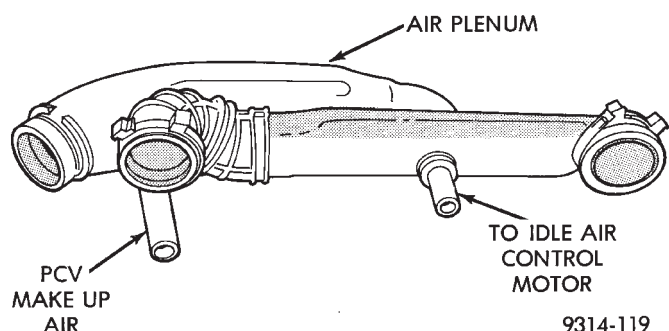


Fig. 10 Air Plenum—3.5L Engine

(9) Ensure purge hose is connected to throttle body (on 3.5L engines each throttle body has a purge hose).

(10) On 3.5L engines, ensure the vacuum hose is connected to the manifold tuning valve and the vacuum harness (Fig. 11).

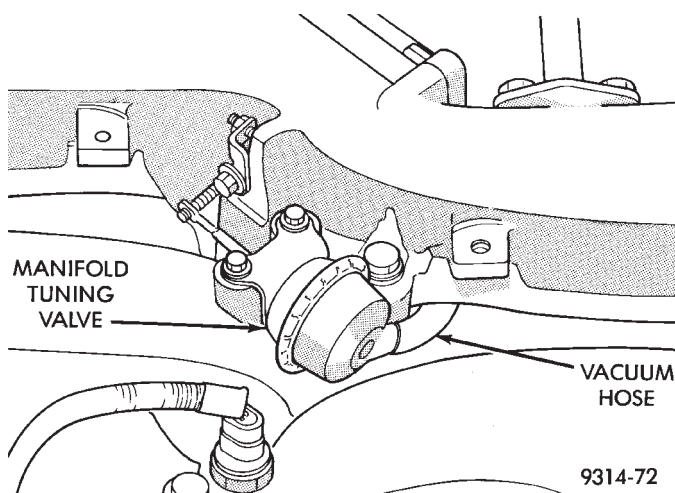


Fig. 11 Manifold Tuning Valve

(11) Ensure the vacuum hose is attached to the fuel pressure regulator (Fig. 12 or Fig. 13). Check the hose for cracks or leaks.

(12) Ensure the EVAP solenoid and MTV solenoid (3.5L only) electrical connectors are attached to the solenoids (Fig. 14).

(13) Inspect the air cleaner filter element. Replace as necessary.

(14) Inspect hose connections at the EVAP canister for leaks (Fig. 15). Remove the air cleaner to access the EVAP canister.

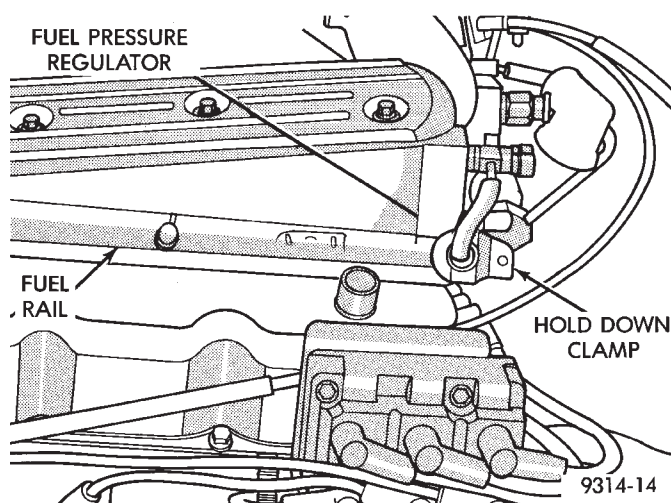


Fig. 12 Fuel Pressure Regulator—3.3L Engine

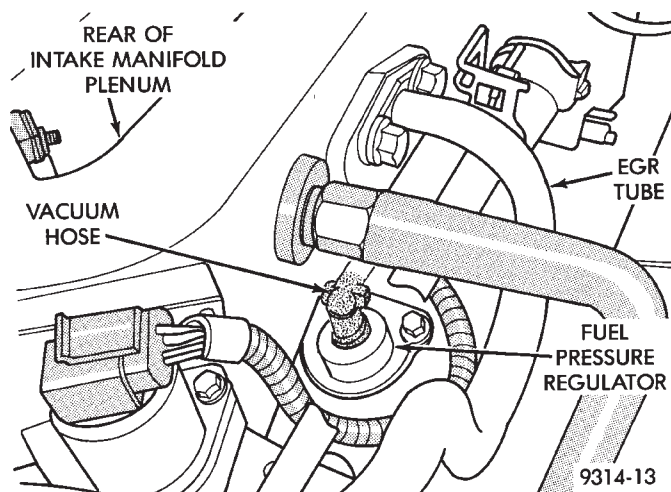


Fig. 13 Fuel Pressure Regulator—3.5L Engine

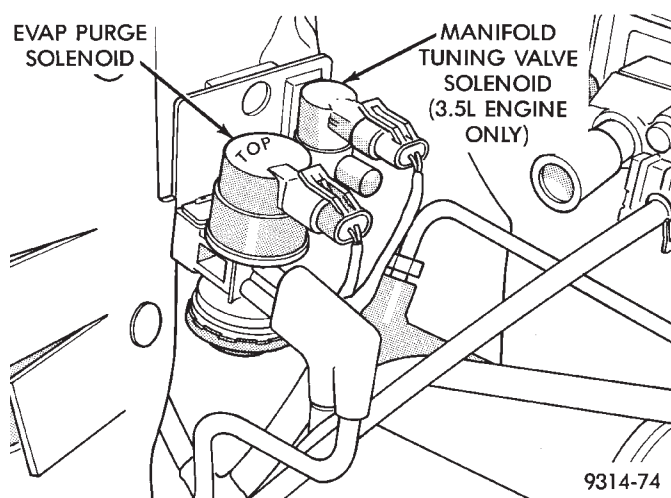


Fig. 14 EVAP Purge and MTV Solenoids

(15) Verify the 60-way connector is fully inserted into the powertrain control module (PCM) (Fig. 15). Ensure the wires are not stretched or pulled out of the socket.

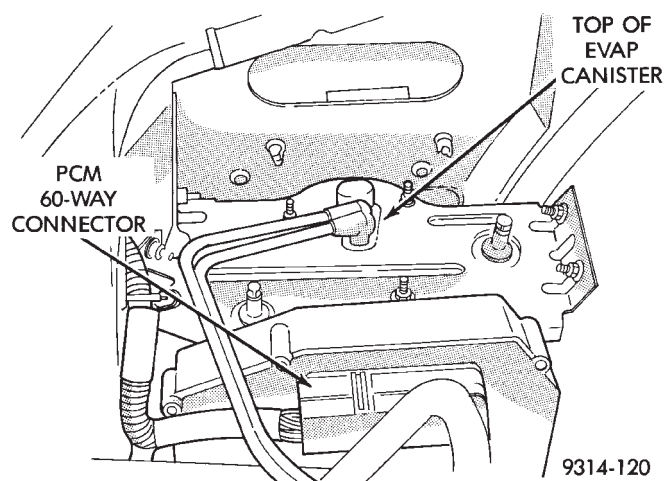


Fig. 15 EVAP Canister Hose Connections

(16) Ensure the accessory drive belt tension is correct.

(17) Check for loose or corroded connections at the generator (Fig. 16).

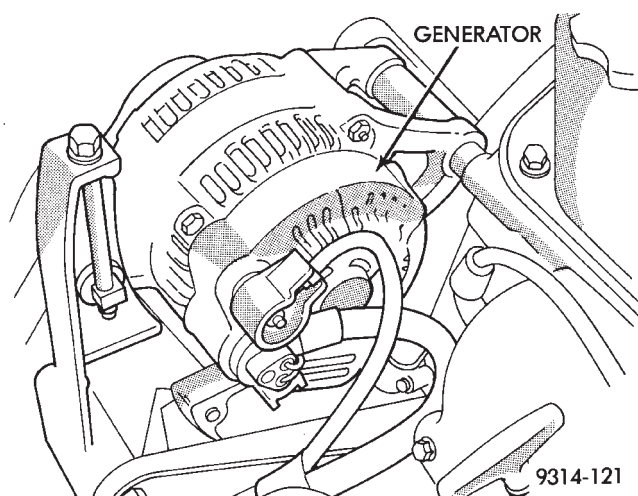


Fig. 16 Generator

(18) Check fuel supply and return tube connections for leaks.

(19) Verify electrical connector is attached to the crankshaft position sensor (Fig. 17).

(20) Ensure the electrical connectors are attached to the heated oxygens sensors (Fig. 18 or Fig. 19).

(21) Check for loose or corroded electrical connections at the starter motor (Fig. 20 or Fig. 21).

FUEL INJECTORS

For fuel injector diagnosis, refer to the Fuel Injector Diagnosis charts. For poor fuel economy diagnosis or engine miss, also refer to Transmission Driveplate in this section.

TRANSMISSION DRIVEPLATE

A cracked transmission driveplate could cause poor fuel economy and an engine miss. If the driveplate

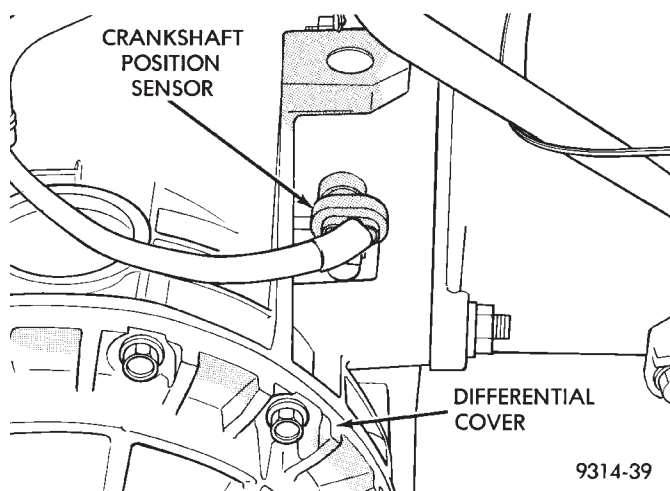


Fig. 17 Crankshaft Position Sensor

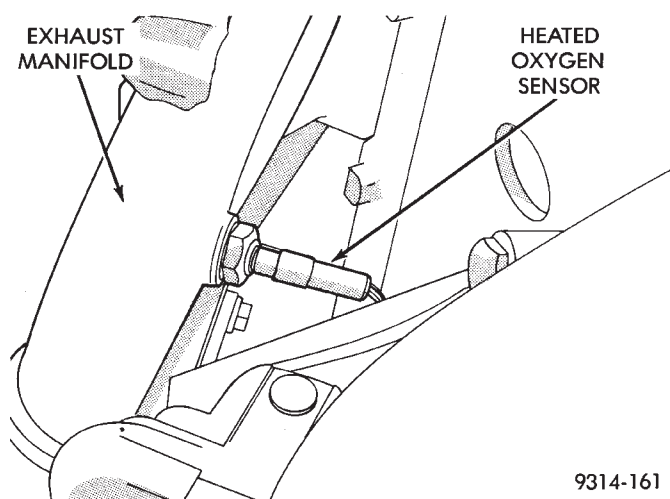


Fig. 18 Heated Oxygen Sensor—3.3L Engine

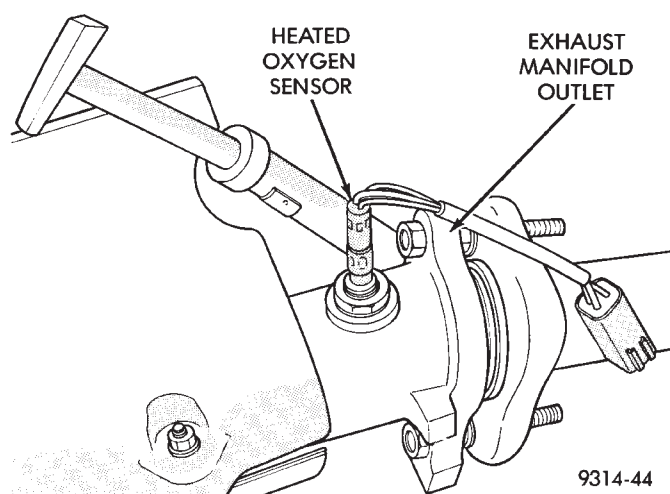


Fig. 19 Heated Oxygen Sensor—3.5L Engine

cracks, the camshaft position sensor and crankshaft position sensor signals could get out of synchronization and retard ignition timing. In worst cases, a

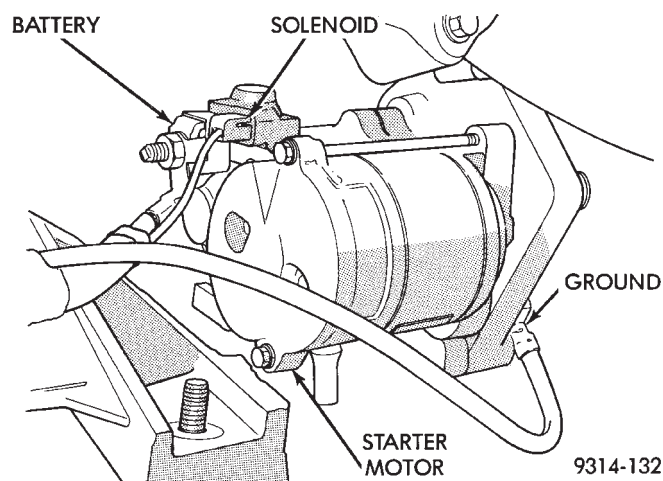


Fig. 20 Starter Motor—3.3L Engine

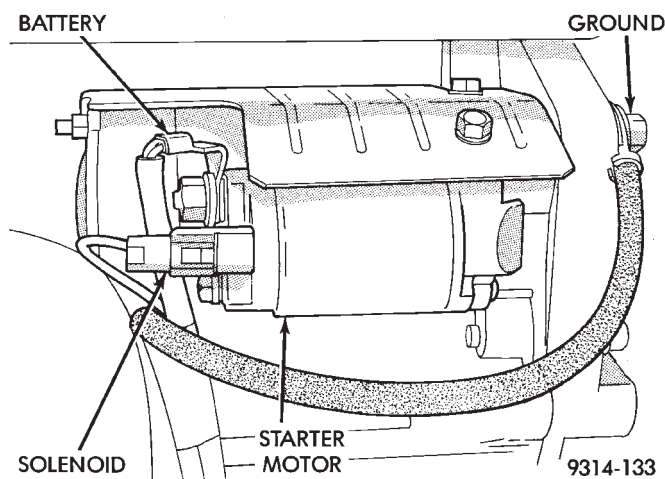


Fig. 21 Starter Motor—3.5L Engine

cracked driveplate may cause no-start conditions. Refer to Group 21 for driveplate service.

ASD AND FUEL PUMP RELAYS

The following description of operation and tests apply only to the automatic shutdown (ASD) and fuel pump relays. The terminals on the bottom of each relay are numbered (Fig. 22).

OPERATION

- Terminal number 30 is connected to battery voltage. For both the ASD and fuel pump relays, terminal 30 is connected to battery voltage at all times.
- The powertrain control module (PCM) grounds the coil side of the relay through terminal number 85.
- Terminal number 86 supplies voltage to the coil side of the relay.
- When PCM de-energizes the ASD and fuel pump relays, terminal number 87A connects to terminal 30. This is the Off position. In the off position, voltage is not supplied to the rest of the circuit. Terminal 87A is the center terminal on the relay.
- When the PCM energizes ASD and fuel pump relays, terminal 87 connects to terminal 30. This is the On position. Terminal 87 supplies voltage to the rest of the circuit.

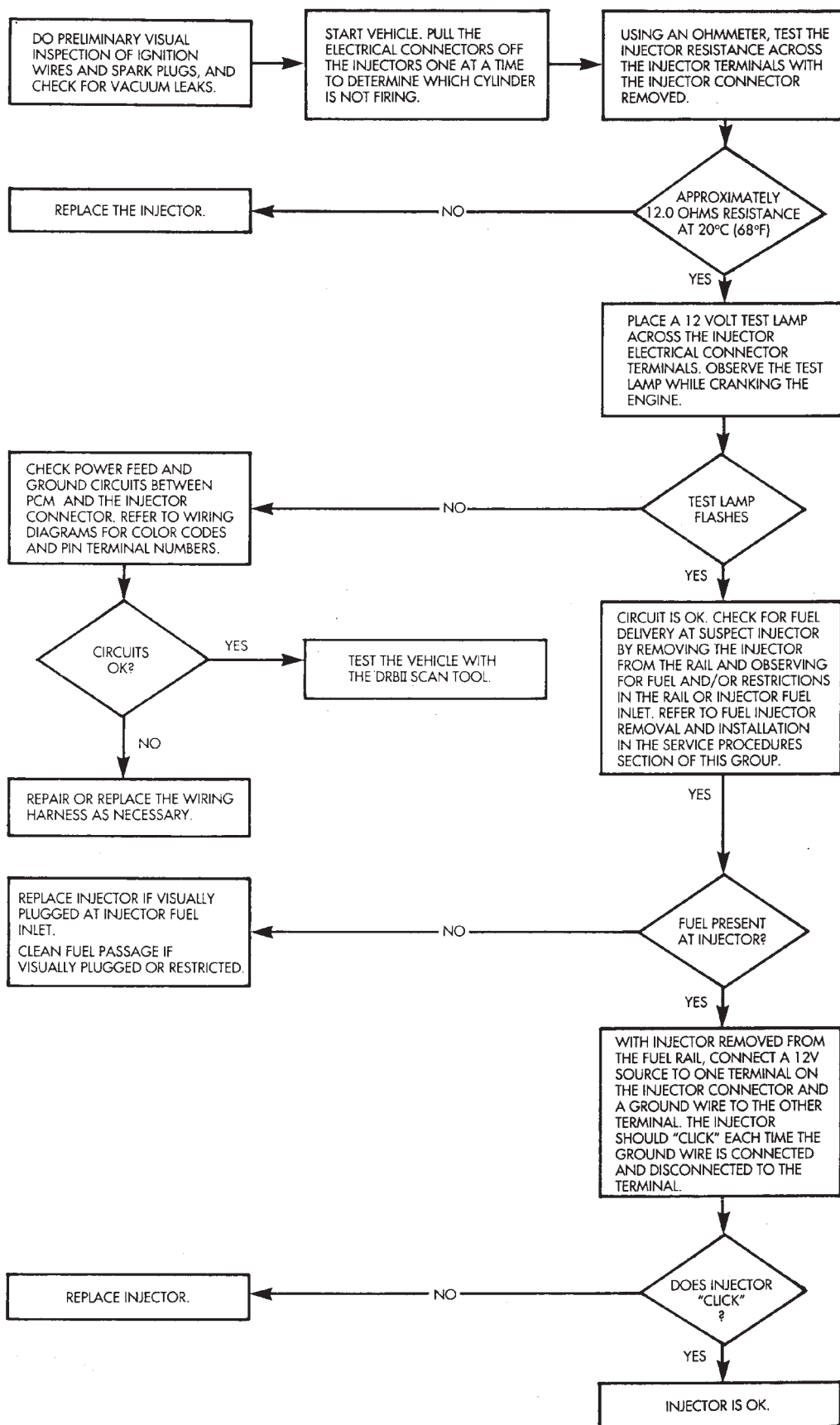
TESTING

The following procedure applies to the automatic shutdown (ASD) and fuel pump relays.

- (1) Remove relay from connector before testing.
- (2) With the relay removed from the vehicle, Use an ohmmeter to check the resistance between terminals 85 and 86. The resistance should be between 75 ± 5 ohms.
- (3) Connect the ohmmeter between terminals 30 and 87A. The ohmmeter should show continuity between terminals 30 and 87A.
- (4) Connect the ohmmeter between terminals 87 and 30. The ohmmeter should not show continuity at this time.

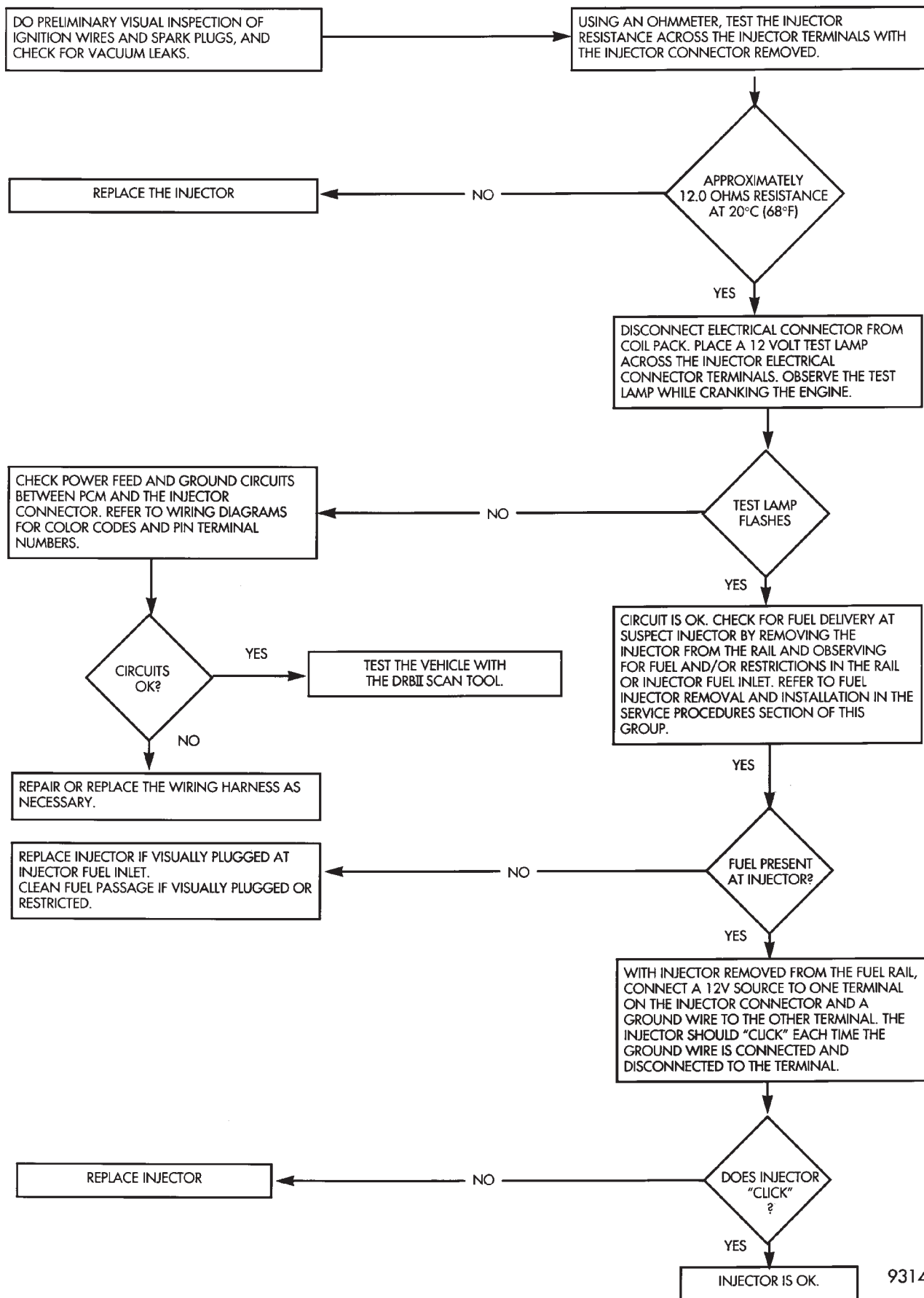


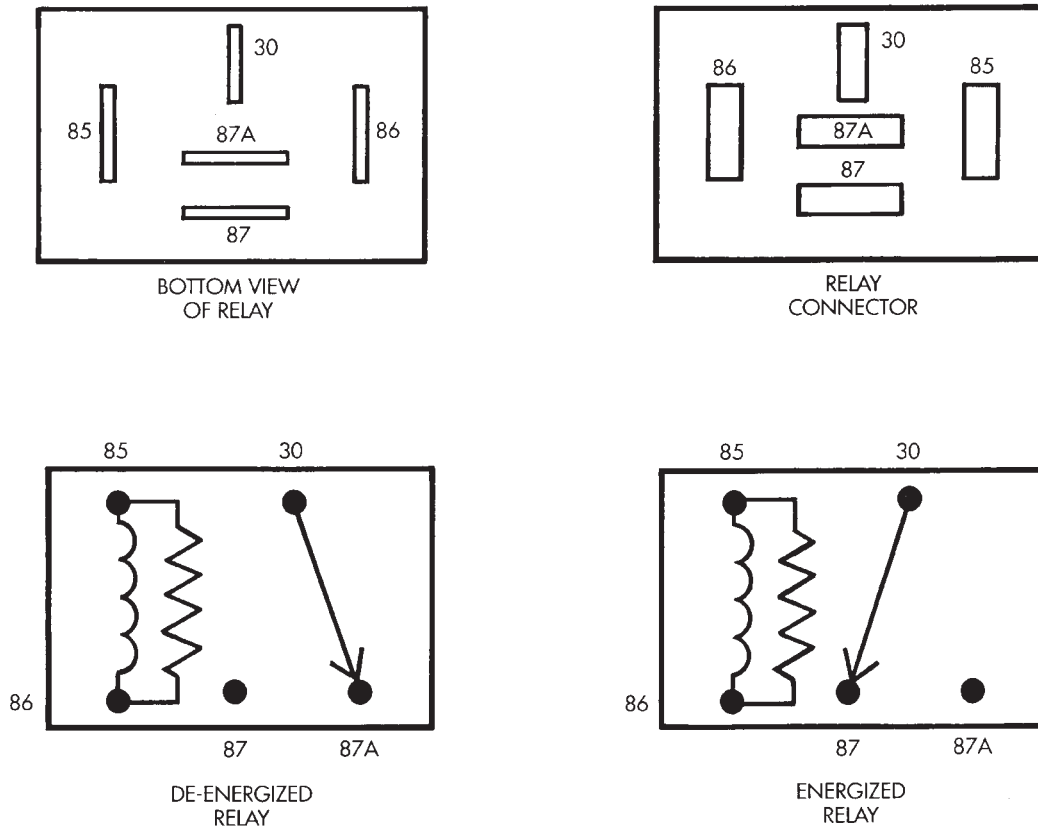
3.3L FUEL INJECTOR DIAGNOSIS





3.5L FUEL INJECTOR DIAGNOSIS





9214-157

Fig. 22 ASD and Fuel Pump Relay Terminals

(5) Connect one end of a jumper wire (16 gauge or smaller) to relay terminal 87. Connect the other end of the jumper wire to the ground side of a 12 volt power source.

(6) Connect one end of another jumper wire (16 gauge or smaller) to the power side of the 12 volt power source. **Do not attach the other end of the jumper wire to the relay at this time.**

WARNING: DO NOT ALLOW OHMMETER TO CONTACT TERMINALS 85 OR 86 DURING THIS TEST.

(7) Attach the other end of the jumper wire to relay terminal 86. This activates the relay. The ohmmeter should now show continuity between relay terminals 87 and 30. The ohmmeter should not show continuity between relay terminals 87A and 30.

(8) Disconnect jumper wires.

Replace the relay if it did not pass the continuity and resistance tests. If the relay passed the tests, it operates properly. Check the remainder of the ASD and fuel pump relay circuits. Refer to group 8W, Wiring Diagrams.

THROTTLE POSITION SENSOR

The throttle position sensor (TPS) can be tested with a digital voltmeter. The center terminal of the sensor is the output terminal.

With the ignition switch in the ON position, check

the output voltage at the center terminal wire of the connector. Check the output voltage at idle and at wide-open-throttle (WOT). At idle, TPS output voltage should be greater than 0.6 millivolts. At wide open throttle, TPS output voltage should be less than 4.5 volts. The output voltage should gradually increase as the throttle plate moves slowly from idle to WOT.

Check for spread terminals at the sensor and PCM connections before replacing the TPS.

HEATED OXYGEN SENSOR

Use an ohmmeter to test the heating element of the oxygen sensors. Disconnect the electrical connector from each oxygen sensor. The white wires in the sensor connector are the power and ground circuits for the sensor. Connect the ohmmeter test leads to terminals of the white wires in the heated oxygen sensor connector. Replace the heated oxygen sensor if the resistance is not between 5 and 7 ohms.

THROTTLE BODY MINIMUM AIR FLOW—3.3L ENGINE

(1) Warm engine in Park or Neutral until the cooling fan has cycled on and off at least once.

(2) Ensure that all accessories are off.

(3) Shut off engine.



(4) Disconnect the PCV valve hose from the intake manifold nipple (Fig. 23). Cap the PCV valve.

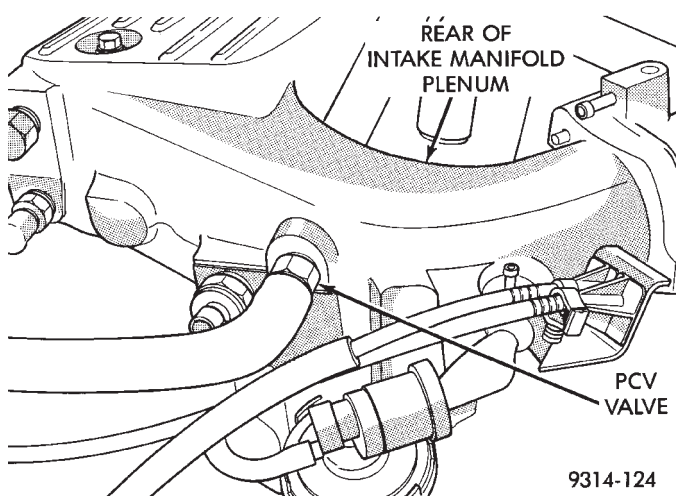


Fig. 23 PCV Valve—3.3L Engine

(5) Disconnect purge hose from the nipple on the throttle body (Fig. 24).

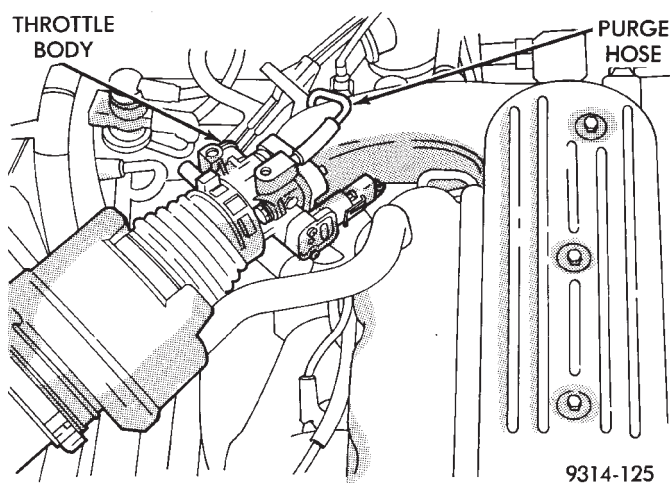


Fig. 24 Purge Hose—3.3L Engine

(6) Use a piece of hose to attach Air Metering Orifice 6457 (0.125 in. orifice) to the purge nipple on the throttle body (Fig. 25).

(7) Connect the DRBII scan tool to the data link connector inside the passenger compartment (Fig. 23).

(8) Restart the engine. Allow engine to idle for at least one minute.

(9) Using the DRBII scan tool, access Min. Airflow Idle Spd.

(10) The following will then occur:

- Idle air control motor will fully close
- Idle spark advance will become fixed
- DRBII scan tool displays engine RPM

(11) If idle RPM is within the range shown in the Idle Specification chart, throttle body minimum air-flow is set correctly.

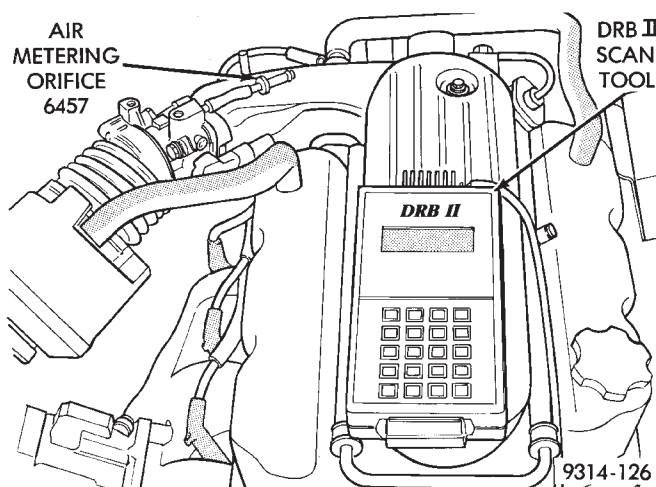


Fig. 25 Orifice 6457 Attached to Purge Nipple—3.3L Engine

MINIMUM AIR FLOW IDLE SPECIFICATIONS

Odometer Reading	IDLE RPM
Below 1000 Miles	540 - 840 RPM
Above 1000 Miles.....	600 - 840 RPM

9314-127

(12) If idle RPM is above specifications, use the DRBII scan tool to check idle air control motor operation. If idle air flow is below specification, shut off the engine and clean the throttle body as follows:

- (a) Remove the throttle body from engine.

WARNING: CLEAN THROTTLE BODY IN A WELL VENTILATED AREA. WEAR RUBBER OR BUTYL GLOVES, DO NOT LET MOPAR PARTS CLEANER COME IN CONTACT WITH EYES OR SKIN. AVOID INGESTING THE CLEANER. WASH THOROUGHLY AFTER USING CLEANER.

(b) While holding the throttle open, spray the entire throttle body bore and the manifold side of the throttle plate with Mopar Parts Cleaner. **Only use Mopar Parts Cleaner to clean the throttle body.**

(c) Using a soft scuff pad, clean the top and bottom of throttle body bore and the edges and manifold side of the throttle blade. **The edges of the throttle blade and portions of the throttle bore that are closest to the throttle blade when is closed, must be free of deposits.**

(d) Use compressed air to dry the throttle body.

(e) Inspect throttle body for foreign material.

(f) Install throttle body on manifold.

(g) Repeat steps 1 through 14. If the minimum air flow is still not within specifications, the problem is not caused by the throttle body.



- (13) Shut off engine.
- (14) Remove Air Metering Orifice 6457. Install purge hose.
- (15) Remove cap from PCV valve. Connect hose to PCV valve.
- (16) Remove DRBII scan tool.

THROTTLE BODY MINIMUM AIR FLOW— 3.5L ENGINE

If the vehicle has a low idle speed condition, first use the DRBII scan tool to check for proper operation of the idle air control motor. Refer to the DRBII scan tool and the appropriate Powertrain Diagnostic Manual. If the idle air control motor operates normally, clean the throttle bodies. Refer to Cleaning Coked Throttles Bodies.

CLEANING COKED THROTTLE BODIES

Coked throttle bodies will cause low idle speed and poor idle quality. Clean both throttle bodies and synchronize them before checking throttle body minimum air flow.

- (1) Remove the throttle bodies from engine.

WARNING: CLEAN THROTTLE BODY IN A WELL VENTILATED AREA. WEAR RUBBER OR BUTYL GLOVES, DO NOT LET MOPAR PARTS CLEANER COME IN CONTACT WITH EYES OR SKIN. AVOID INGESTING THE CLEANER. WASH THOROUGHLY AFTER USING CLEANER.

(2) While holding the throttle open, spray the entire throttle body bore and the manifold side of the throttle plate with Mopar Parts Cleaner. **Only use Mopar Parts Cleaner to clean the throttle body.**

(3) Using a soft scuff pad, clean the top and bottom of throttle body bore and the edges and manifold side of the throttle blade. **The edges of the throttle blade and portions of the throttle bore that are closest to the throttle blade when is closed, must be free of deposits.**

- (4) Use compressed air to dry the throttle bodies.
- (5) Inspect throttle bodies for foreign material.
- (6) Install throttle bodies on manifold.
- (7) Adjust throttle body synchronization. Refer Throttle Body Synchronization in the Sequential Multi-Port Fuel Injection—Service Procedures section of this group.

TESTING MINIMUM AIR FLOW—3.5L ENGINE

- (1) Warm engine in Park or Neutral until the cooling fan has cycled on and off at least once.
- (2) Ensure that all accessories are off.
- (3) Shut off engine.
- (4) Disconnect the PCV valve hose from the PCV valve (Fig. 26). Cap the PCV valve.
- (5) Disconnect purge hose from the nipple on each throttle body (Fig. 27).

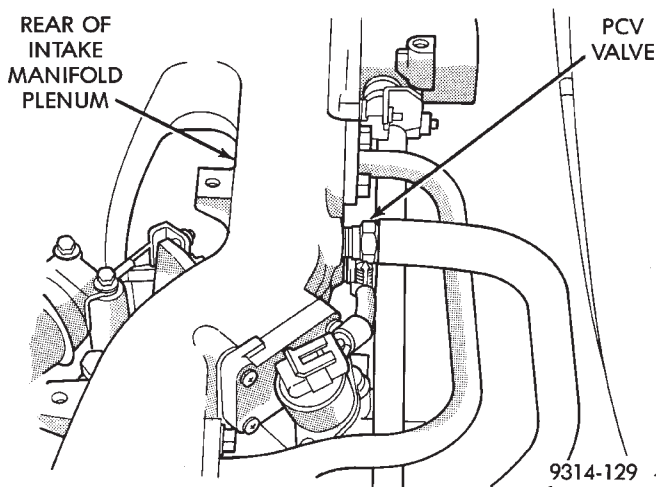


Fig. 26 PCV Valve—3.5L Engine

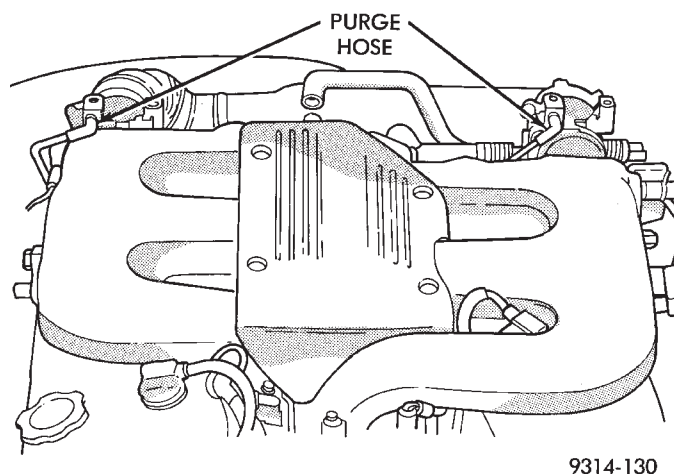


Fig. 27 Purge Hose—3.5L Engine

- (6) Use a piece of hose to attach an Air Metering Orifice 6457 (0.125 in. orifice) to the purge nipple on each throttle body (Fig. 28).

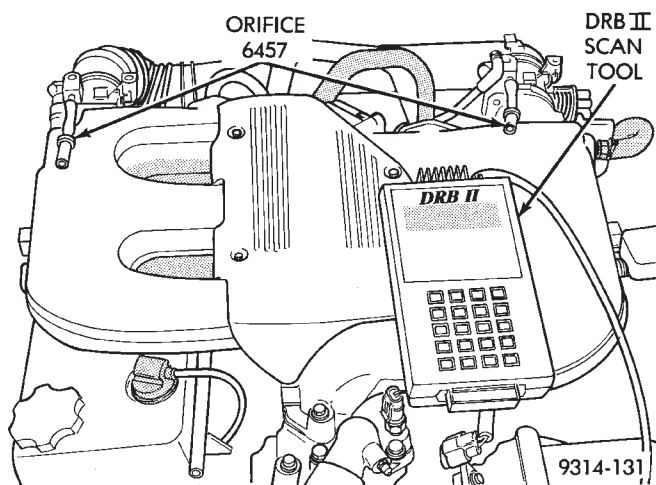


Fig. 28 Orifice 6457 Attached to Purge Nipples—
3.5L Engine

- (7) Connect the DRBII scan tool to the data link connector inside the passenger compartment (Fig. 23).



(8) Restart the engine. Allow engine to idle for at least one minute.

(9) Using the DRB II, access Min. Airflow Idle Spd.

(10) The following will then occur:

- Idle air control motor will fully close
- Idle spark advance will become fixed
- DRBII Scan tool displays engine RPM

(11) If idle RPM is within the range shown in the Idle Specification chart, throttle body minimum airflow is set correctly.

• If idle RPM is below specifications even though the idle air control motor operates normally and the throttle bodies were cleaned of coking and then synchronized, replace the throttle bodies.

• If idle RPM is above specifications reset throttle body synchronization. Also, recheck idle air control motor operation using the DRBII scan tool. If idle RPM is still above specifications after setting throttle body synchronization, check for leaking intake manifold plenum or gaskets.

(12) Shut off engine.

(13) Remove orifice 6457 from each throttle body. Install purge hoses.

(14) Remove cap from PCV valve. Connect hose to PCV valve.

(15) Remove DRBII scan tool.

IGNITION TIMING

Ignition timing is not adjustable.

3.5L MINIMUM AIR FLOW IDLE SPECIFICATIONS

Odometer Reading	IDLE RPM
Below 1000 Miles	700 - 1000 RPM
Above 1000 Miles.....	750 - 1100 RPM

9314-128



SEQUENTIAL MULTI-PORT FUEL INJECTION—ON-BOARD DIAGNOSTICS

INDEX

	page		page
Circuit Actuation Test Mode	49	Monitored Circuits	47
Diagnostic Trouble Codes	48	Non-Monitored Circuits	47
General Information	47	Powertrain Control Module 60-Way Connector ...	50
High and Low Limits	48	State Display Test Mode	48

GENERAL INFORMATION

The powertrain control module (PCM) monitors many different circuits in the fuel injection system. If the PCM senses a problem with a monitored circuit often enough to indicate an actual problem, it stores a diagnostic trouble code in the PCM's memory. If the problem is repaired or ceases to exist, the PCM cancels the diagnostic trouble code after 51 vehicle key on/off cycles.

Certain criteria must be met before the PCM stores a diagnostic trouble code in memory. The criteria may be a specific range of engine RPM, engine temperature, and/or input voltage to the PCM.

The PCM might not store a diagnostic trouble code for a monitored circuit even though a malfunction has occurred. This may happen because one of the diagnostic trouble code criteria for the circuit has not been met. **For example**, assume the diagnostic trouble code criteria requires the PCM 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 PCM). Because the condition happens at an engine speed above the maximum threshold (2000 rpm), the PCM will not store a diagnostic trouble code.

There are several operating conditions for which the PCM monitors and sets diagnostic trouble codes. Refer to Monitored Circuits and Non-Monitored Circuits in this section.

Technicians can display stored diagnostic trouble codes by two different methods. The first is to cycle the ignition switch On - Off - On - Off - On within 5 seconds. Then count the number of times the malfunction indicator lamp (check engine lamp) on the instrument panel flashes on and off. The number of flashes represents the trouble code. There is a slight pause between the flashes representing the first and second digits of the code. Longer pauses separate individual trouble codes.

The second method of reading diagnostic trouble codes uses the DRBII scan tool. The DRBII scan tool connects to the data link (diagnostic) connector in the vehicle (Fig. 1). For diagnostic trouble code information, refer to charts in this section.

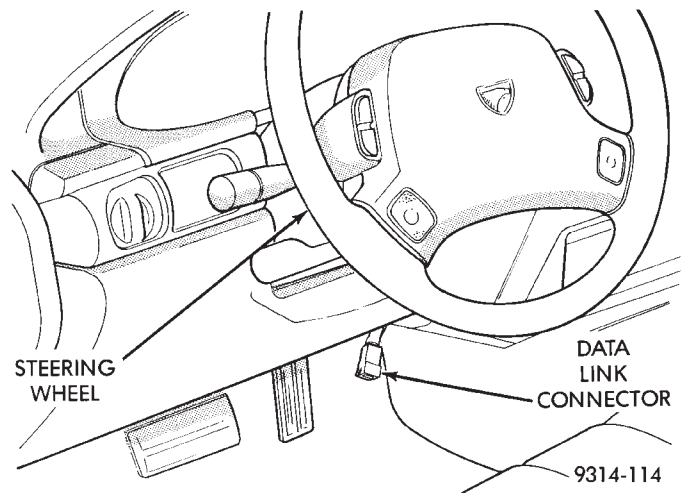


Fig. 1 Data Link (Diagnostic) Connector

MONITORED CIRCUITS

The PCM can detect certain fault conditions in the fuel injection system.

Open or Shorted Circuit - The PCM can determine if the sensor output (input to the PCM) is within proper range. Also, the PCM can determine open or shorted circuits.

Output Device Current Flow - The PCM senses whether output devices are hooked up. If a problem exists within the circuit, the PCM senses whether the circuit is open, shorted to ground, or shorted high.

Heated Oxygen Sensor - Once the system has entered closed loop, the PCM determines if the oxygen sensor is switching between rich and lean. Refer to Modes of Operation in the General Information section of this group for an explanation of closed loop operation.

NON-MONITORED CIRCUITS

The PCM does not monitor the following circuits, systems and conditions that could have malfunctions causing driveability problems. The PCM might not store diagnostic trouble codes for these conditions. However, problems with these systems may cause the PCM to store diagnostic trouble codes for other systems. For example, a fuel pressure problem will not register a fault directly, but could cause a rich or lean condition. This could cause the PCM to store an oxygen sensor diagnostic trouble code.



Fuel Pressure - The vacuum assisted fuel pressure regulator controls fuel system pressure. The PCM cannot detect a clogged fuel pump inlet filter, clogged in-line fuel filter, or a pinched fuel supply or return line. However, these could result in a rich or lean condition causing the PCM to store an oxygen sensor diagnostic trouble code.

Secondary Ignition Circuit - The PCM cannot detect an inoperative ignition coil, fouled or worn spark plugs, ignition cross firing, or open spark plug cables.

Engine Timing - The PCM cannot detect an incorrectly indexed timing chain, camshaft sprocket and crankshaft sprocket. However, these could result in a rich or lean condition causing the PCM to store an oxygen sensor diagnostic trouble code.

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 Mechanical Malfunctions - The PCM 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 rich or lean condition causing the PCM to store an oxygen sensor diagnostic trouble code.

Excessive Oil Consumption - Although the PCM monitors exhaust stream oxygen content when the system is in closed loop, it cannot determine excessive oil consumption.

Throttle Body Air Flow - The PCM cannot detect a clogged or restricted air cleaner inlet or filter element.

Evaporative System - The PCM cannot detect a disconnected (open vacuum line) restricted, plugged or loaded evaporative purge canister.

Vacuum Assist - The PCM cannot detect leaks or restrictions in the vacuum circuits of vacuum assisted engine control system devices. However, these could cause the PCM to store a MAP sensor diagnostic trouble code and cause a high idle condition.

PCM System Ground - The PCM cannot determine a poor system ground. However, one or more diagnostic trouble codes may be generated as a result of this condition.

PCM Connector Engagement - The PCM may not be able to determine spread or damaged connector pins. However, it might store diagnostic trouble codes as a result of spread connector pins.

HIGH AND LOW LIMITS

The PCM compares 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 stores a diagnostic trouble code in memory. Other diagnostic trouble code criteria might include engine RPM limits or input voltages from other sensors or switches that must be present before verifying a diagnostic trouble code condition.

DIAGNOSTIC TROUBLE CODES

A diagnostic trouble code indicates the powertrain control module (PCM) has recognized an abnormal condition in the system. Abnormal conditions are usually shorted or open circuits.

The technician can display diagnostic trouble codes in two ways. The first way is to cycle the ignition switch and count the number of times the malfunction indicator lamp (Check Engine lamp) on the instrument panel flashes on and off. The DRBII scan tool provides the second method of displaying diagnostic trouble codes. Diagnostic trouble codes indicate the results of a circuit failure, but do not directly identify the failed component.

For a list of Diagnostic Trouble Codes, refer to the charts at the end of this section.

OBTAINING DIAGNOSTIC TROUBLE CODES

USING DRBII SCAN TOOL

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

(1) Connect DRBII scan tool to the data link (diagnostic) connector located in the passengers compartment, below the center of instrument panel on the drivers side (Fig. 1).

(2) If possible, start the engine and cycle the **A/C** switch if applicable. Shut off the engine.

(3) Turn the ignition switch on, access Read Fault Screen. Record all the diagnostic trouble codes shown on the DRBII scan tool. [Observe the malfunction indicator lamp (check engine lamp) on the instrument panel. The lamp should light for 2 seconds then go out (bulb check)].

To erase diagnostic trouble codes, use the Erase Trouble Code data screen on the DRBII scan tool.

USING THE MALFUNCTION INDICATOR LAMP

(1) Cycle the ignition key On - Off - On - Off - On within 5 seconds.

(2) Count the number of times the malfunction indicator lamp (check engine lamp) on the instrument panel flashes on and off. The number of flashes represents the trouble code. There is a slight pause between the flashes representing the first and second digits of the code. Longer pauses separate individual trouble codes.

(3) Refer to the Diagnostic Trouble Code Charts at the end of this group.

STATE DISPLAY TEST MODE

The switch inputs to the powertrain control module (PCM) have two recognized states; HIGH and LOW. For this reason, the PCM cannot recognize the difference between a selected switch position versus an



open circuit, a short circuit, or a defective switch. If the State Display screen shows the change from HIGH to LOW or LOW to HIGH, assume the entire switch circuit to the PCM functions properly. From the state display screen, access either State Display Inputs and Outputs or State Display Sensors.

STATE DISPLAY INPUTS AND OUTPUTS

Connect the DRBII scan tool to the data link connector and access the State Display screen. Then access Inputs and Outputs. The following list contains the PCM system functions accessible through the Inputs and Outputs screen.

- A/C Clutch Relay
- ASD Relay
- ASD Sense
- Brake Switch
- EGR Solenoid
- Inverted A21
- MTV Solenoid (3.5L Engine)
- Park/Neutral Switch
- Radiator Low Speed Fan Relay
- Radiator High Speed Fan Relay
- Speed Control Relay
- Speed Control Set, Resume, and On/Off
- Speed Control Vacuum and Vent Solenoids
- Torque Management (3.5L Engine)

STATE DISPLAY SENSORS

Connect the DRBII scan tool to the vehicle and access the State Display screen. Then access Sensor Display. The following list contains the PCM system functions accessible through the Sensor Display screen.

- A/C Pressure Transducer
- AIS (idle air control motor)
- Baro
- Battery Temperature
- Car Speed
- Charge (charge temperature sensor—temperature and voltage)
- Charging System Goal
- Cool (coolant temperature and sensor voltage)
- Inj Width (pulse width)
- Knock Sensor #2
- Knock Sensor #1
- MAP (vacuum)
- MAP Volts
- Minimum TPS
- Mult Adap-L+
- Mult Adap-R+
- RPM
- Speed Control Target
- Speed Control Status
- Target RPM
- Total Advance
- TPS
- Volt Sense
- O2L (#1)

- O2R (#2)

CIRCUIT ACTUATION TEST MODE

The Circuit Actuation Test Mode checks for proper operation of output circuits or devices the powertrain control module (PCM) cannot internally recognize. The PCM attempts to activate these outputs and allow an observer to verify proper operation. Most of the tests provide an audible or visual indication of device operation (click of relay contacts, fuel spray, etc.). Except for intermittent conditions, if a device functions properly during testing, assume the device, its associated wiring, and driver circuit work correctly.

OBTAINING CIRCUIT ACTUATION TEST

Connect the DRBII scan tool to the vehicle and access the Actuators screen. The following is a list of the engine control system functions accessible through Actuators screens. Subordinate screens for each actuator test are also listed.

- (1) Stop All Tests
- (2) Engine RPM
 - Min Airflow
 - 900
 - 1000
 - 1100
 - 1200
 - 1300
 - 1500
 - 1700
 - 2000
- (3) Ignition Coil
 - Coil No. 1
 - Coil No. 2
 - Coil No. 3
- (4) Fuel Injector
 - Circuit No. 1
 - Circuit No. 2
 - Circuit No. 3
 - Circuit No. 4
 - Circuit No. 5
 - Circuit No. 6
- (5) Fuel System
- (6) Solenoid/Relay
 - (a) Solenoids
 - Purge Solenoid
 - Speed Control Solenoids
 - EGR Solenoid
 - Manifold Tuning Valve Solenoid
 - (b) Relays
 - Auto Shutdown
 - Radiator Fan
 - (c) All Sol/Rel
- (7) AIS Motor (idle air control motor)
- (8) Tachometer

**POWERTRAIN CONTROL MODULE 60-WAY CONNECTOR**

Check the powertrain control module (PCM) 60-way connector for the following.

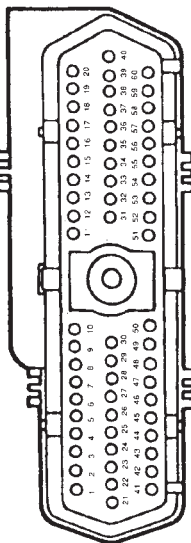
- Spread terminals
- Stretched or pulled out wires

- Undertightened or overtightened 60 way connector
Tighten the PCM connector to 4 N•m (35 in. lbs.) torque. When checking terminal pin outs, refer to the Powertrain Control Module 60-Way Connector Diagram for circuit wire colors and cavity numbers.



CAV	WIRE COLOR	DESCRIPTION	CAV	WIRE COLOR	DESCRIPTION			
1	DG/RD*	MAP SENSOR	37					
2	TN/BK*	ENGINE COOLANT TEMPERATURE SENSOR	38	GY	INJECTOR DRIVER #5			
3	RD/WT*	DIRECT BATTERY	39	GY/RD*	IDLE AIR CONTROL MOTOR (#1 TERMINAL)			
4	BK/LB*	SENSOR RETURN	40	BR/WT*	IDLE AIR CONTROL MOTOR (#3 TERMINAL)			
5	BK/WT*	SIGNAL GROUND	41	BK/DG*	LEFT HEATED OXYGEN SENSOR SIGNAL			
6	VT/WT*	5-VOLT OUTPUT (MAP AND TPS)	42	BK/LG*	KNOCK SENSOR #1 (3.5L ENGINE)			
7	OR	8-VOLT OUTPUT	43					
8	YL/DG*	TORQUE MANAGEMENT	44	TN/YL*	CAMSHAFT POSITION SENSOR			
9	DB/WT*	A21 SUPPLY (IGNITION START/RUN SENSE)	45	LG	SCI RECEIVE (DATA LINK CONNECTOR)			
10	GY/BK*	KNOCK SENSOR #2 (3.5L ENGINE)	46	WT/BK*	CCD BUS (-)			
11	BK/TN*	POWER GROUND	47	WT/OR*	VEHICLE SPEED INPUT			
12	BK/TN*	POWER GROUND	48	DB	A/C PRESSURE TRANSDUCER			
13	LB/BR*	INJECTOR DRIVER #4	49	TN/WT*	RIGHT HEATED OXYGEN SENSOR SIGNAL			
14	YL/WT*	INJECTOR DRIVER #3	50					
15	TN	INJECTOR DRIVER #2	51	DB/YL*	AUTO SHUTDOWN (ASD) RELAY AND FUEL PUMP RELAY			
16	WT/DB*	INJECTOR DRIVER #1	52	PK/BK*	PURGE SOLENOID			
17	DB/YL*	IGNITION COIL DRIVER #2	53	LG/RD*	SPEED CONTROL VENT SERVO			
18	RD/YL*	IGNITION COIL DRIVER #3	54					
19	GY	IGNITION COIL DRIVER #1	55	TN/RD*	SPEED CONTROL RELAY			
20	DG	GENERATOR FIELD CONTROL (VOLTAGE REGULATOR)	56					
21	BK/RD*	CHARGE AIR TEMPERATURE SENSOR (3.5L ENGINE)	57	DG/OR*	A142 CIRCUIT VOLTAGE SENSE			
22	OR/DB*	THROTTLE POSITION SENSOR (TPS)	58	BR/DB*	INJECTOR DRIVER #6			
23	RD/LG*	SPEED CONTROL SELECT	59	VT/BK*	IDLE AIR CONTROL MOTOR (#4 TERMINAL)			
24	GY/BK*	CRANKSHAFT REF. PICK-UP	60	YL/BK*	IDLE AIR CONTROL MOTOR (#2 TERMINAL)			
25	PK	SCI TRANSMIT	WIRE COLOR CODES					
26	VT/BR*	CCD BUS (+)	BK	BLACK	LB	LIGHT BLUE	VT	VIOLET
27			BR	BROWN	LG	LIGHT GREEN	WT	WHITE
28			DB	DARK BLUE	OR	ORANGE	YL	YELLOW
29	WT/PK*	BRAKE SWITCH	DG	DARK GREEN	PK	PINK	*	WITH TRACER
30	BR/YL*	PARK/NEUTRAL SIGNAL	GY	GRAY	RD	RED		
31	DB/PK*	RADIATOR FAN HIGH SPEED RELAY			TN	TAN		
32	WT	RADIATOR FAN LOW SPEED RELAY						
33	TN/RD*	SPEED CONTROL VACUUM SERVO						
34	DB/OR*	A/C CLUTCH RELAY						
35	GY/YL*	EGR SOLENOID						
36	VT/WT*	MTV SOLENOID (3.5L ENGINE)						

CONNECTOR
TERMINAL SIDE
SHOWN



9314-134

POWERTRAIN CONTROL MODULE 60-WAY CONNECTOR



DIAGNOSTIC TROUBLE CODE DESCRIPTION

TROUBLE CODE	DRBII DISPLAY	DESCRIPTION
11.....	No Reference Signal During Cranking	No camshaft position sensor reference signal detected during engine cranking.
13+**.....	No change in MAP from start to run	No difference recognized between the engine MAP reading and the barometric (atmospheric) pressure reading at start-up.
14+**.....	MAP voltage too low or MAP voltage too high	MAP sensor input below minimum acceptable voltage. MAP sensor input above maximum acceptable voltage.
15**.....	No vehicle speed signal	No vehicle distance (speed) sensor signal detected during road load conditions.
16.....	Knock Sensor Circuit	An open or shorted condition detected in the knock sensor circuit. DRBII scan tool specifies which knock sensor.
17.....	Engine is cold too long	Engine coolant temperature remains below normal operating temperatures during vehicle travel (thermostat).
21**.....	O ₂ signal stays at center or O ₂ signal too high voltage	Neither rich or lean condition detected from the oxygen sensor input. DRBII scan tool specifies which oxygen sensor. Oxygen sensor input voltage maintained above the normal operating range. DRBII scan tool specifies which oxygen sensor.
22+**.....	Coolant sensor voltage too high or Coolant sensor voltage too low	Coolant temperature sensor input above the maximum acceptable voltage. Coolant temperature sensor input below the minimum acceptable voltage.
23+**.....	Charge temp voltage too high or Charge temp voltage too low	Charge air temperature sensor input above the maximum acceptable voltage. Charge air temperature sensor input below the minimum acceptable voltage.
24+**.....	Throttle position sensor voltage high or Throttle position sensor voltage low	Throttle position sensor input above the maximum acceptable voltage. Throttle position sensor input below the minimum acceptable voltage.
25**.....	Idle air control motor circuits	A shorted condition detected in one or more of the idle air control motor circuits.
27+**.....	Injector control circuit	Injector output driver does not respond properly to the control signal. DRBII scan tool specifies injector by cylinder number.
31**.....	Purge solenoid circuit	An open or shorted condition detected in the purge solenoid circuit.

+ Check Engine Lamp On

** Check Engine Lamp On (California Only)



DIAGNOSTIC TROUBLE CODE DESCRIPTION (CONTINUED)

TRouble CODE	DRBII DISPLAY	DESCRIPTION
32**.....	EGR Solenoid or EGR system failure	An open or shorted condition detected in the EGR solenoid circuit. Failure detected in the EGR control system.
33.....	A/C clutch relay circuit or A/C sensor input high or A/C sensor input low	An open or shorted condition detected in the A/C clutch relay circuit. A/C pressure transducer input above the maximum acceptable voltage. A/C pressure transducer input below the minimum acceptable voltage.
34.....	Speed control solenoid circuits or MUX speed control switch high or MUX speed control switch low	An open or shorted condition detected in the speed control vacuum or vent solenoid circuits. Speed control switch input above the maximum acceptable voltage. Speed control switch input below the minimum acceptable voltage.
35.....	Low speed fan relay or High speed fan relay	An open or shorted condition detected in the radiator low speed fan relay circuits. An open or shorted condition detected in the radiator high speed fan relay circuits.
41.....	Alternator field not switching properly	An open or shorted condition detected in the alternator (generator) field control circuit.
42.....	Auto shutdown relay control circuit	An open or shorted condition detected in the auto shutdown relay circuit.
43+**.....	Ignition coil #1 primary circuit or Ignition coil #2 primary circuit or Ignition coil #3 primary circuit	Peak primary circuit current not achieved with maximum dwell time. Peak primary circuit current not achieved with maximum dwell time. Peak primary circuit current not achieved with maximum dwell time.
44.....	Battery temp voltage	An open or shorted condition exists in the engine coolant temperature sensor circuit or a problem exists in the PCM's battery temperature voltage circuit.
46+**.....	Charging system voltage too high	Battery voltage sense input above target charging voltage during engine operation.
47.....	Charging system voltage too low	Battery voltage sense input below target charging during engine operation. Also, no significant change detected in battery voltage during active test of alternator output.

+ Check Engine Lamp On

** Check Engine Lamp On (California Only)



DIAGNOSTIC TROUBLE CODE DESCRIPTION (CONTINUED)

TROUBLE CODE	DRBII DISPLAY	DESCRIPTION
51**	O ₂ signal stays below center (lean)	Oxygen sensor signal input indicates lean air/fuel ratio condition during engine operation. DRBII scan tool specifies which oxygen sensor.
52**	O ₂ signal stays above center (rich)	Oxygen sensor signal input indicates rich air/fuel ratio condition during engine operation. DRBII scan tool specifies which oxygen sensor.
53.....	Internal controller or SPI communications	PCM internal fault condition detected. PCM internal fault condition detected.
54.....	No sync pick-up signal	No fuel sync signal detected during engine rotation.
55.....	N/A	Completion of fault code display on Check Engine lamp.
62.....	Controller Failure EMR miles not stored	Unsuccessful attempt to update EMR mileage in the PCM EEPROM.
63.....	Controller Failure EEPROM write denied	Unsuccessful attempt to write to an EEPROM location by the PCM.
65.....	Manifold tuning valve	An open or shorted condition detected in the manifold tuning valve solenoid circuit.
66.....	No CCD Messages or No Body CCD Messages or No EATX CCD Messages	PCM did not receive messages from the CCD Bus. The PCM did not receive CCD Bus messages from the body control module. The PCM did not receive CCD Bus messages from the transmission control module.
77.....	Speed control relay	An open or shorted condition detected in the speed control relay circuit.

+ Check Engine Lamp On

** Check Engine Lamp On (California Only)



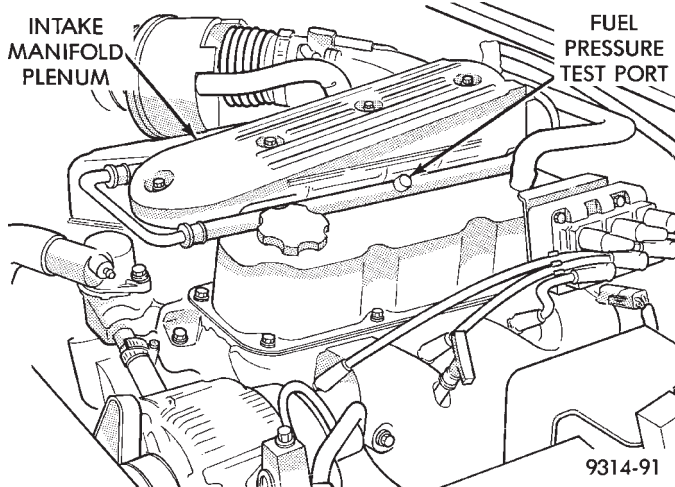
SEQUENTIAL MULTI-PORT FUEL INJECTION—SERVICE PROCEDURES

INDEX

	page		page
Camshaft Position Sensor—3.3L Engine	64	Idle Air Control Motor—3.3L Engine	67
Camshaft Position Sensor—3.5L Engine	64	Idle Air Control Motor—3.5L Engine	67
Charge Air Temperature Sensor—3.5L Engine	65	Intake Manifold Plenum—3.5L Engine	60
Crankshaft Position Sensor	65	Knock Sensors—3.5L Engine	68
Electronic Ignition Coil Pack—3.3L Engine	68	Manifold Absolute Pressure (MAP) Sensor	69
Electronic Ignition Coil Pack—3.5L Engine	68	Manifold Tuning Valve Solenoid—3.5L Engine	69
Engine Coolant Temperature Sensor	65	Manifold Tuning Valve—3.5L Engine	70
Evap Purge Solenoid	65	Powertrain Control Module (PCM)	70
Fuel Injectors—3.3L Engine	60	Throttle Bodies—3.5L Engine	56
Fuel Injectors—3.5L Engine	62	Throttle Body Synchronization—3.5L Engine	58
Fuel Rail—3.3L Engine	58	Throttle Body—3.3L Engine	55
Fuel System Pressure Release Procedure	55	Throttle Position Sensor (TPS)—3.3L Engine	71
Heated Oxygen Sensors—3.3L Engine	66	Throttle Position Sensor (TPS)—3.5L Engine	71
Heated Oxygen Sensors—3.5L Engine	67		

FUEL SYSTEM PRESSURE RELEASE PROCEDURE

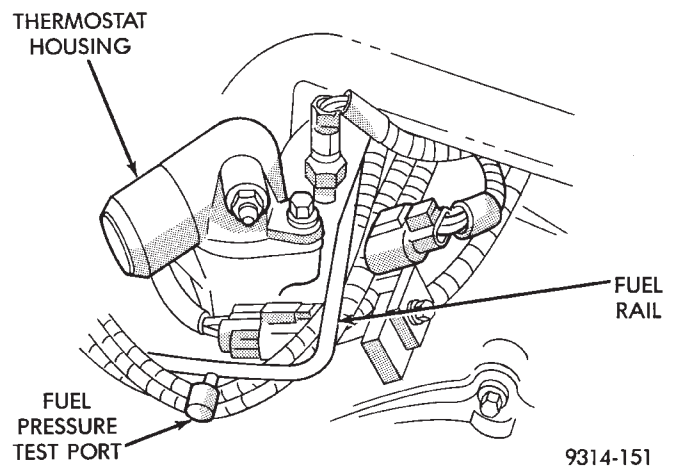
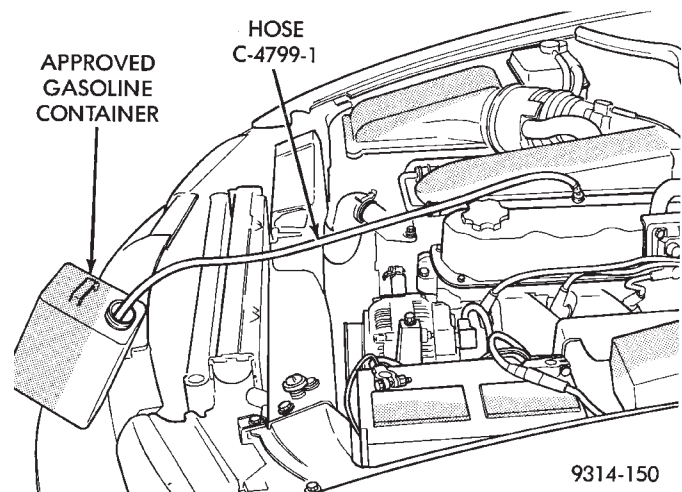
- (1) Disconnect negative cable from battery.
- (2) Remove fuel filler cap.
- (3) Remove the protective cap from the fuel pressure test port on the fuel rail (Fig. 1 or Fig. 2).

**Fig. 1 Fuel Pressure Test Port—3.3L Engine**

- (4) Place the open end of fuel pressure release hose, tool number C-4799-1, into an approved gasoline container. Connect the other end of hose C-4799-1 to the fuel pressure test port (Fig. 3). Fuel pressure will bleed off through the hose into the gasoline container. Fuel gauge C-4799-A contains hose C-4799-1.

THROTTLE BODY—3.3L ENGINE**REMOVAL**

- (1) Disconnect PCV make-up air hose from cylinder head cover. Remove air cleaner tube from throttle body (Fig. 4).
- (2) Disconnect purge hose from throttle body.

**Fig. 2 Fuel Pressure Test Port—3.5L Engine****Fig. 3 Releasing Fuel Pressure—Typical**

- (3) Rotate throttle lever to wide open throttle position and remove throttle cable and speed control cable (Fig. 5).

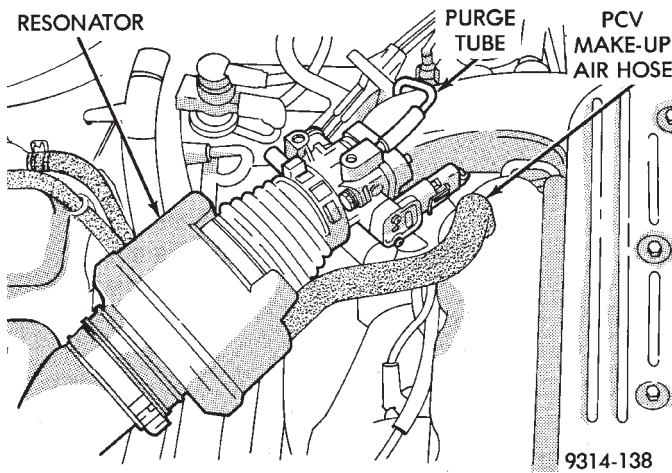


Fig. 4 PCV Make-Up Air Hose

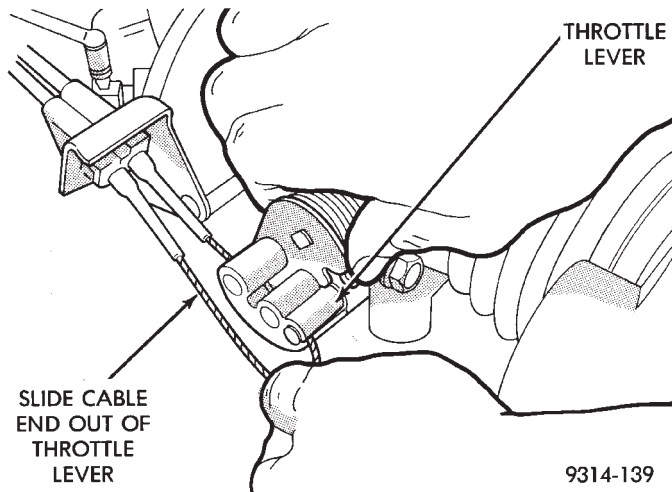


Fig. 5 Removing Throttle Cable and Speed Control Cable

(4) Disconnect electrical connectors from idle air control motor and throttle position sensor (Fig. 6).

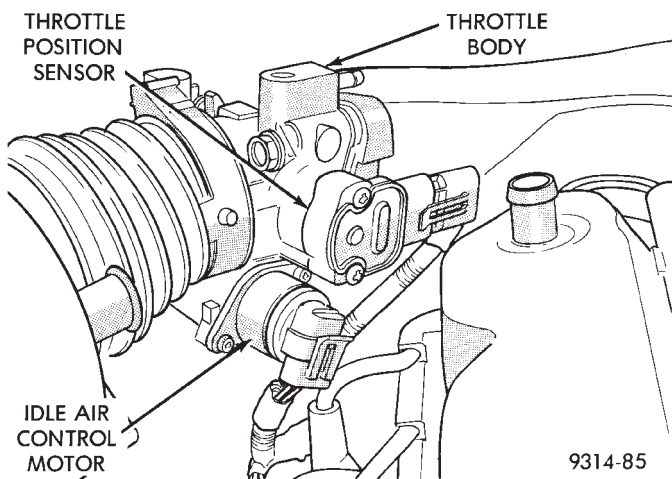


Fig. 6 Throttle Position Sensor

(5) Remove throttle body mounting bolts. Remove throttle body.

(6) Clean gasket surfaces on throttle body and intake manifold plenum.

INSTALLATION

(1) Install throttle body and new gasket. Tighten throttle body mounting bolts to 26 N•m (19 ft. lbs) torque.

(2) Attach electrical connectors to throttle position sensor and idle air control motor.

(3) Hold throttle lever to wide-open position. Install throttle cable and speed control cable.

(4) Connect purge tube to throttle body.

(5) Install air cleaner tube. Connect PCV make-up air hose to cylinder head cover.

THROTTLE BODIES—3.5L ENGINE

If only one throttle body is replaced, the other must be cleaned. Refer to Cleaning Coked Throttle Bodies.

CLEANING COKED THROTTLE BODIES

Coked throttle bodies will cause low idle speed and poor idle quality. When replacing one throttle body, always remove and clean the other throttle body. After installing the throttle bodies, set synchronization. Also, if the vehicle has low idle and the idle air control motor operates normally, clean both throttle bodies and synchronize them before checking throttle body minimum air flow. Refer to the General Diagnosis Section of this group for the Throttle Body Minimum Air Flow procedure.

(1) Remove the throttle bodies from engine.

WARNING: CLEAN THROTTLE BODY IN A WELL VENTILATED AREA. WEAR RUBBER OR BUTYL GLOVES, DO NOT LET MOPAR PARTS CLEANER COME IN CONTACT WITH EYES OR SKIN. AVOID INGESTING THE CLEANER. WASH THOROUGHLY AFTER USING CLEANER.

(2) While holding the throttle open, spray the entire throttle body bore and the manifold side of the throttle plate with Mopar Parts Cleaner. **Only use Mopar Parts Cleaner to clean the throttle body.**

(3) Using a soft scuff pad, clean the top and bottom of throttle body bore and the edges and manifold side of the throttle blade. **The edges of the throttle blade and portions of the throttle bore that are closest to the throttle blade when is closed, must be free of deposits.**

(4) Use compressed air to dry the throttle bodies.

(5) Inspect throttle bodies for foreign material.

(6) Install throttle bodies on manifold.

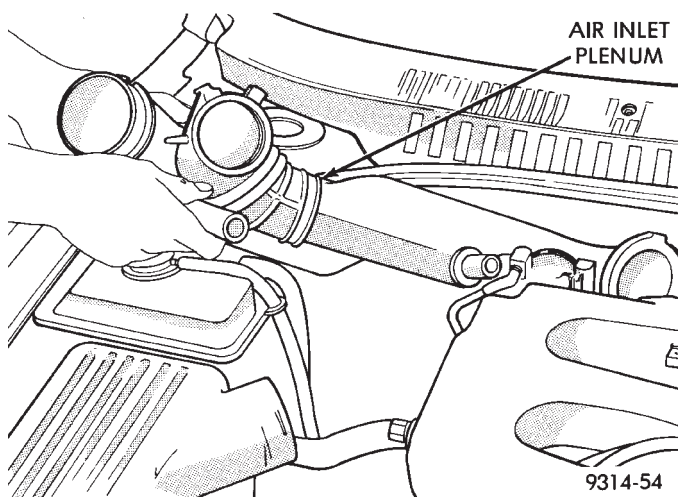
(7) Adjust throttle body synchronization. Refer to Throttle Body Synchronization in this section.



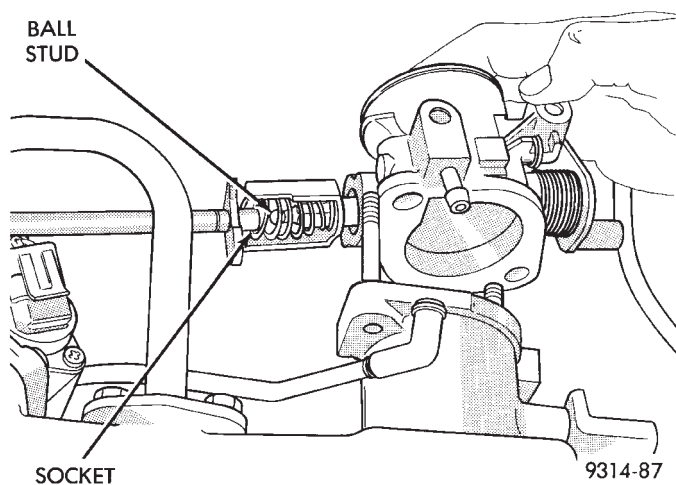
LEFT THROTTLE BODY

REMOVAL

- (1) Disconnect negative cable from battery
- (2) Hold throttle lever in wide open position. Remove throttle cable and speed control cables from throttle arm.
- (3) Remove tube connecting air cleaner to air plenum.
- (4) Disconnect air plenum from throttle bodies, PCV make up air tube and idle air control motor. Remove plenum from the right side of the vehicle (Fig. 7).

**Fig. 7 Air Intake Plenum Removal**

- (5) Disconnect purge hose from throttle body.
 - (6) Remove throttle body mounting nuts.
- The end throttle body shaft has a ball stud that fits into a socket in the synchronization shaft (Fig. 8).

**Fig. 8 Left Throttle Body Removal/Installation**

- (7) Slide throttle body back off of mounting studs. Separate the throttle body from the synchronization shaft. Remove throttle body.
- (8) Clean gasket from mating surfaces.

INSTALLATION

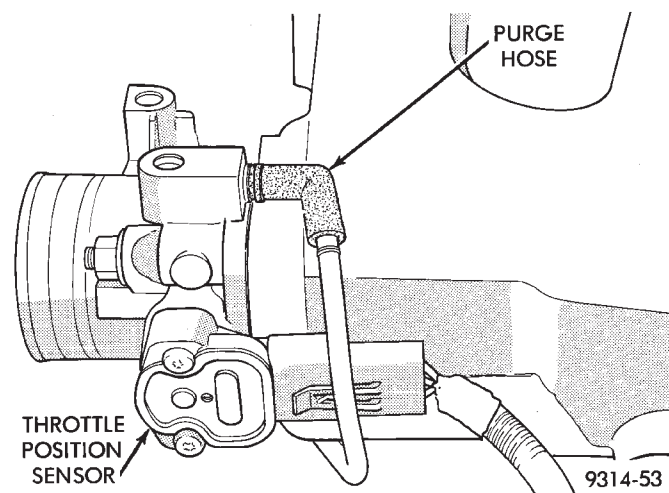
Prior to installing the left throttle body, remove and clean the right throttle body. Refer to Cleaning Coked Throttle Bodies in this section.

- (1) Position new gasket over throttle body mounting studs.
- (2) Connect throttle body to synchronization shaft. Ensure ball stud on end enters socket in end of synchronization shaft (Fig. 8). Ensure spring attaches to shaft and throttle body arm. Also, ensure the spring does not bind when opening and closing the throttle blade.
- (3) Install throttle body over mounting studs.
- (4) Tighten mounting nuts to 26 N•m (19 ft. lbs.) torque.
- (5) Connect purge tube to nipple on throttle body.
- (6) Hold throttle lever in wide open throttle position. Install throttle cable and speed control cable.
- (7) Check throttle body synchronization. Refer to Throttle Body Synchronization in this section.
- (8) Install air plenum.
- (9) Install air cleaner to air plenum tube.
- (10) Connect negative cable to battery.

RIGHT THROTTLE BODY

REMOVAL

- (1) Disconnect negative cable from battery
- (2) Remove tube connecting air cleaner to air plenum.
- (3) Disconnect air plenum from throttle bodies, PCV make up air tube and idle air control motor. Remove plenum from the right side of the vehicle (Fig. 7).
- (4) Disconnect purge hose from throttle body.
- (5) Disconnect electrical connector from throttle position sensor (Fig. 9).

**Fig. 9 Throttle Position Sensor—3.5L Engine**

- (6) Remove throttle body mounting nuts.
- The end throttle body shaft has a ball stud that fits into a socket in the synchronization shaft. Also, the



tang on the end of the throttle body lever fits into an opening in the bracket on the synchronization shaft (Fig. 10).

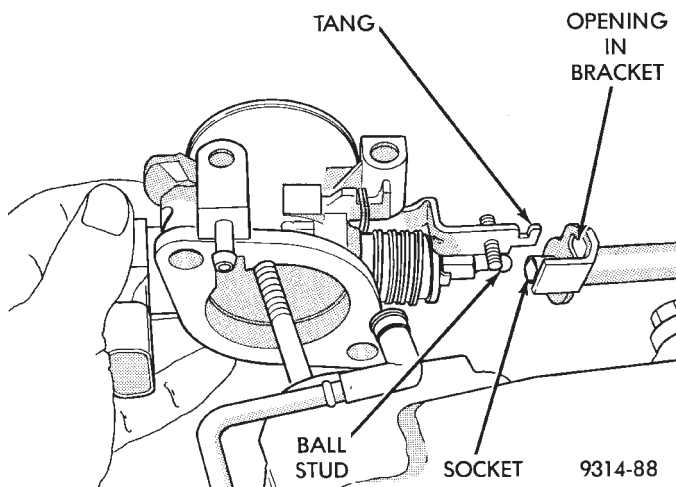


Fig. 10 Right Throttle Body Removal/Installation

(7) Slide throttle body back off of mounting studs. Separate the throttle body from the synchronization shaft. Remove throttle body.

(8) Clean gasket from mating surfaces.

INSTALLATION

Prior to installing the right throttle body, remove and clean the left throttle body. Refer to Cleaning Coked Throttle Bodies in this section.

(1) Position new gasket over throttle body mounting studs.

(2) Connect throttle body to synchronization shaft. Ensure ball stud on throttle body shaft enters socket in end of synchronization shaft. At the same time, the tang on the throttle lever locks into the bracket on the synchronization shaft (Fig. 10).

(3) Install throttle body over mounting studs.

(4) Tighten mounting nuts to 26 N•m (19 ft. lbs) torque.

(5) Connect purge tube to nipple on throttle body.

(6) Attach electrical connector to throttle position sensor.

(7) Check throttle body synchronization. Refer to Throttle Body Synchronization in this section.

(8) Install air plenum.

(9) Install air cleaner to air plenum tube.

(10) Connect negative cable to battery.

THROTTLE BODY SYNCHRONIZATION— 3.5L ENGINE

Synchronize the throttle bodies if there is a gap between the adjustment screw and the linkage lever (Fig. 12 and Fig. 13). Also, synchronize the throttle bodies after removing and installing the throttle bodies.

(1) Install .004 inch feeler gauge between the idle speed screw and throttle lever on the right throttle body (Fig. 11).

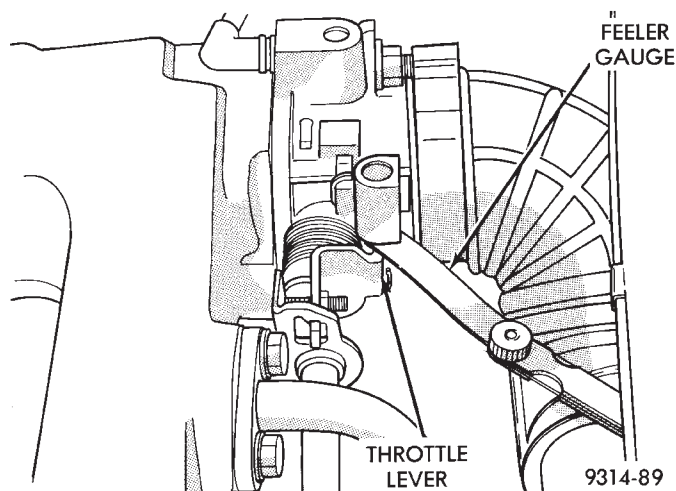


Fig. 11 Idle Speed Screw

(2) Loosen the adjustment screw locknut on the synchronization shaft (Fig. 12).

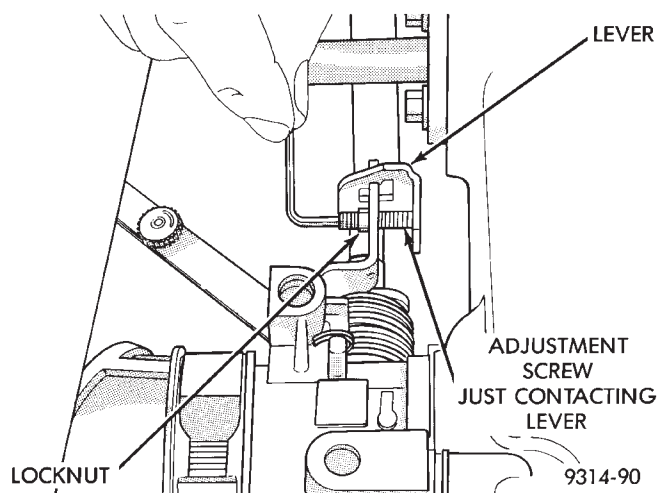


Fig. 12 Adjustment Screw

(3) Turn adjustment screw until it just contacts the lever on the synchronization shaft. Tighten the locknut to 4 N•m (36 in. lbs.) torque.

(4) Check clearance between the throttle lever and the idle speed screw. The 0.004 inch feeler gauge should drag when removed. Also, a 0.006 inch feeler gauge should not fit between throttle lever and idle speed screw.

FUEL RAIL—3.3L ENGINE

REMOVAL

(1) Release fuel system pressure. Refer to Fuel System Pressure Release Procedure in this section.

(2) Disconnect negative cable from battery.

(3) Disconnect air plenum from air cleaner and throttle body.



(4) Hold throttle lever in wide-open position. Remove throttle cable and speed control cable from lever.

(5) Compress locking tabs on throttle cable and speed control cable and remove them from bracket (Fig. 13).

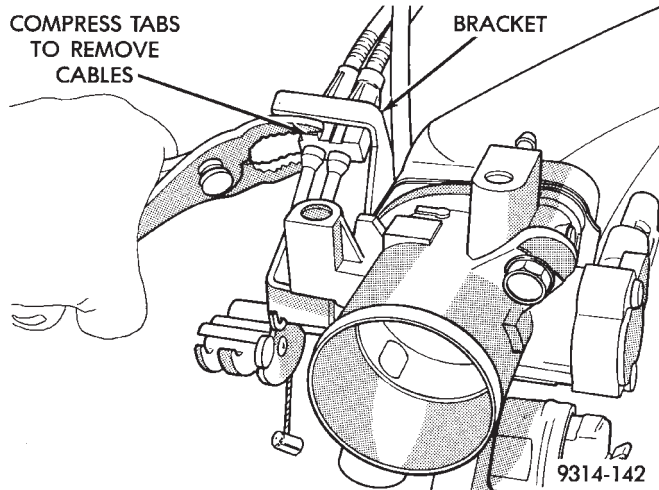


Fig. 13 Removing Throttle Cable and Speed Control Cable

(6) Disconnect electrical connector from solenoid on EGR valve transducer (Fig. 14).

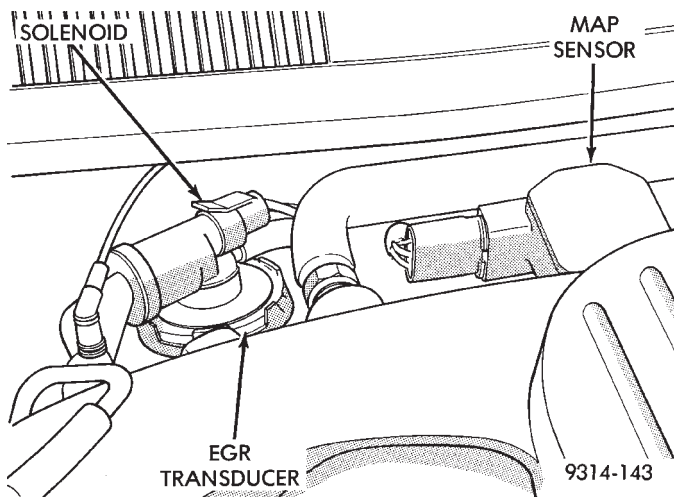


Fig. 14 EGR Transducer

(7) Disconnect electrical connector from MAP sensor (Fig. 14).

(8) Disconnect hose from PCV valve at rear of intake manifold plenum. Disconnect brake booster hose from nipple at rear of intake manifold plenum. Disconnect vacuum line from fuel pressure regulator.

(9) Disconnect purge hose from throttle body. Disconnect electrical connector from throttle position sensor and idle air control motor (Fig. 6).

(10) Remove EGR tube mounting screws at intake manifold plenum (Fig. 15).

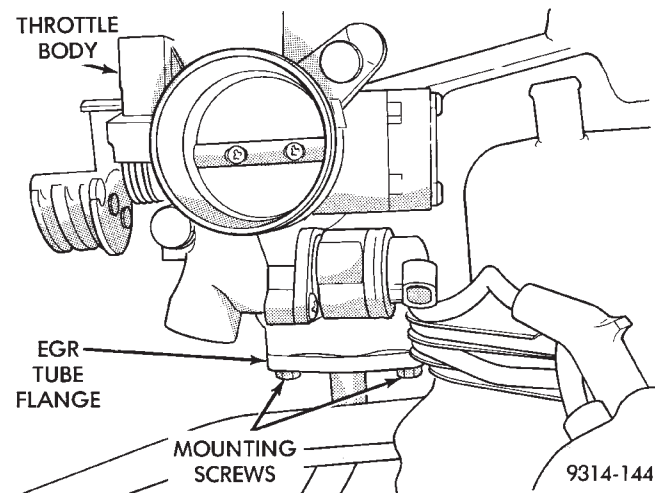


Fig. 15 EGR Tube

(11) Remove intake manifold plenum mounting bolts. Lift Plenum up off of engine. Cover intake manifold to prevent foreign material from entering engine.

(12) Disconnect fuel supply and return tube quick connect fittings at the rear of intake manifold (Fig. 16). Refer to Quick Connect Fittings in the Fuel Delivery Section of this Group.

(13) Remove screw from fuel tube clamp (Fig. 16). Separate fuel tubes from bracket.

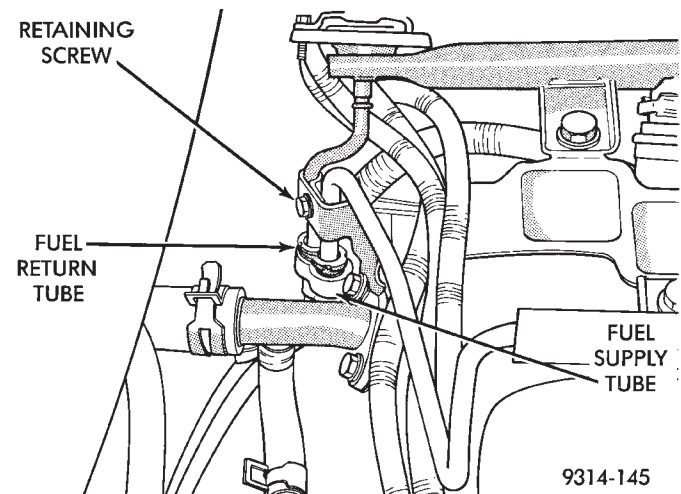


Fig. 16 Fuel Supply and Return Tubes

(14) Rotate injectors toward center of engine. Tag the injector connectors with their cylinder number. Disconnect electrical connector from injectors.

(15) Remove fuel rail mounting bolts (Fig. 17).

(16) Lift fuel rail straight up, off of engine. Cover fuel injector openings in intake manifold.

INSTALLATION

(1) Apply a light coating of clean engine oil to the O-ring on the nozzle end of each injector.

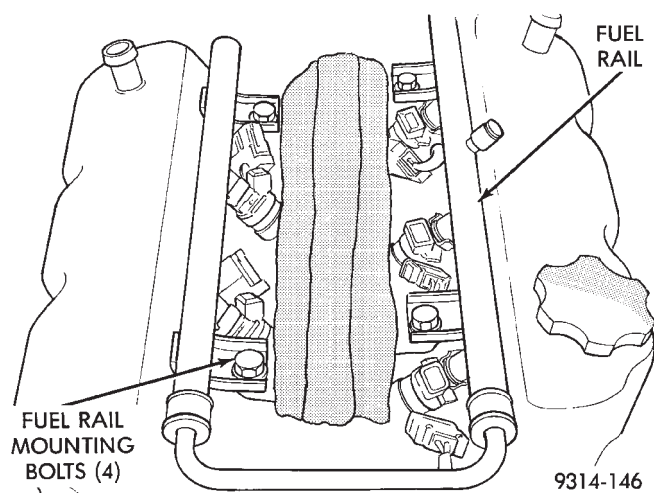


Fig. 17 Fuel Rail

(2) Insert fuel injector nozzles into openings in intake manifold. Seat the injectors in place. Tighten fuel rail mounting screws to 22 N•m (200 in. lbs.) torque.

(3) Attach electrical connectors to fuel injectors. Rotate injectors towards cylinder head covers.

(4) Connect fuel supply and return tubes to fuel rail. Refer to Quick Connect Fittings in the Fuel Delivery Section of this Group. Place clamp over fuel tubes and install retaining screw.

(5) Remove cover from intake manifold. Place plenum with new gasket on intake manifold. Loosely install mounting bolts.

(6) Place a new gasket on the EGR tube flange. Loosely install EGR tube mounting screws.

(7) Tighten Intake Manifold Plenum mounting bolts. Refer to Group 11 for tightening specifications and sequence.

(8) Tighten EGR tube mounting screws.

(9) Connect hoses to PCV valve and brake booster nipple.

(10) Attach electrical connectors to the MAP sensor and EGR transducer solenoid.

(11) Attach electrical connectors to throttle position sensor and idle air control motor.

(12) Install throttle cable and speed control cable in bracket.

(13) Hold throttle body lever in wide-open position. Install throttle and speed control cables.

(14) Connect purge hose to throttle body.

(15) Connect air plenum to air cleaner and throttle bodies.

(16) Connect negative cable to battery.

FUEL INJECTORS—3.3L ENGINE

REMOVAL

(1) Remove fuel rail. Refer to Fuel Rail—3.3L Engine in this section.

(2) Remove fuel injector retaining clip (Fig. 18).

(3) Pull injector out of cup on fuel rail.

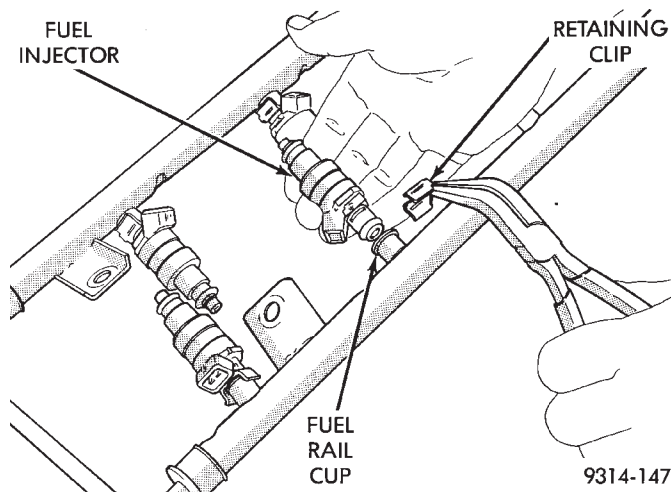


Fig. 18 Fuel Injector Removal/Installation—3.3L Engine

INSTALLATION

(1) Apply a light coating of clean engine oil to the upper O-ring.

(2) Install injector in cup on fuel rail.

(3) Install retaining clip.

(4) Install fuel rail. Refer to Fuel Rail—3.3L Engine in this section.

INTAKE MANIFOLD PLENUM—3.5L ENGINE

REMOVAL

(1) Release fuel system pressure. Refer to Fuel System Pressure Release Procedure in this section.

(2) Remove engine cover from top of intake manifold plenum.

(3) Remove accelerator cable and speed control cable from throttle arm (Fig. 19).

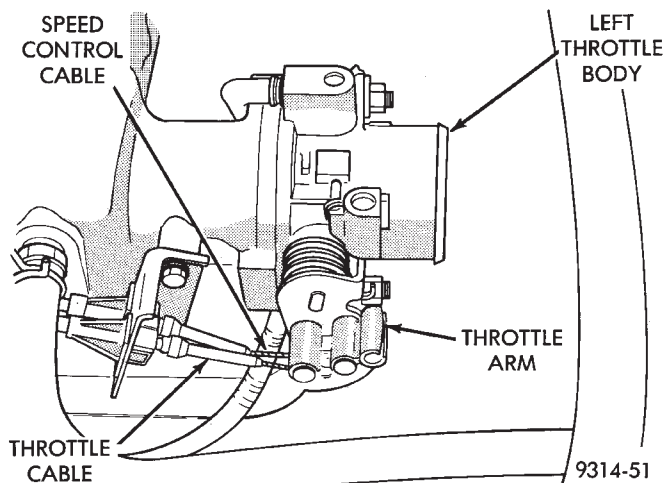


Fig. 19 Throttle Lever—3.5L Engine

(4) Disconnect electrical connector from idle air control motor (Fig. 20).



(5) Disconnect electrical connector from charge air temperature sensor (Fig. 20).

(6) Disconnect vacuum hose from manifold tuning valve (Fig. 20).

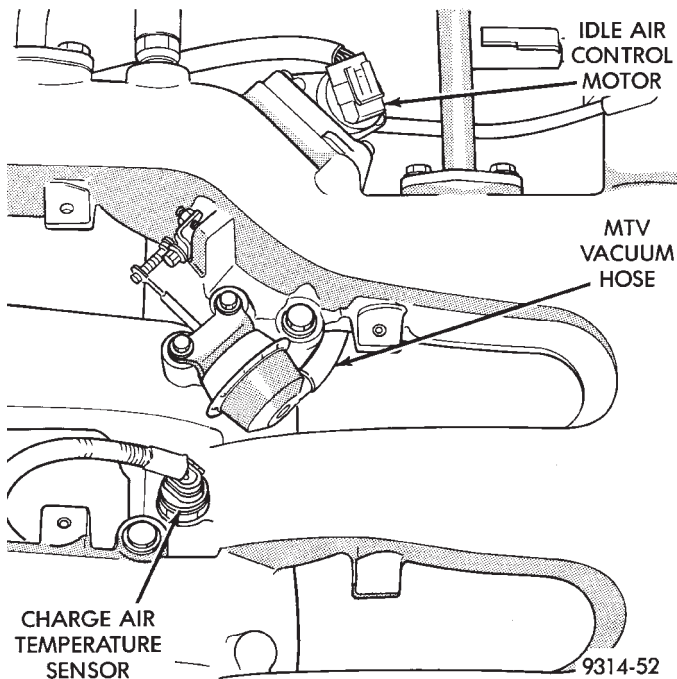


Fig. 20 Idle Air Control Motor—3.5L Engine

(7) Disconnect electrical connector from manifold absolute pressure (MAP) sensor (Fig. 21).

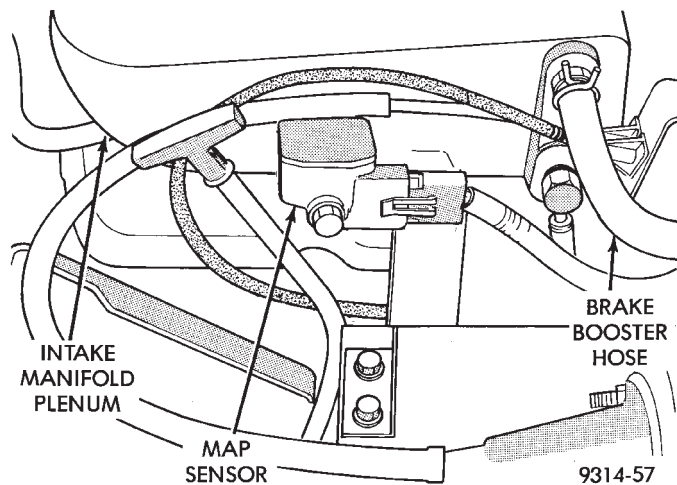


Fig. 21 MAP Sensor—3.5L Engine

(8) Disconnect electrical connector from throttle position sensor (Fig. 22).

(9) Disconnect purge hose from throttle bodies (Fig. 22).

(10) Disconnect PCV make-up air hose and idle air control motor supply hose (part of air inlet plenum). Remove air inlet plenum from behind manifold (Fig. 23).

(11) Disconnect PCV hose, brake booster hose and vacuum hoses from intake manifold.

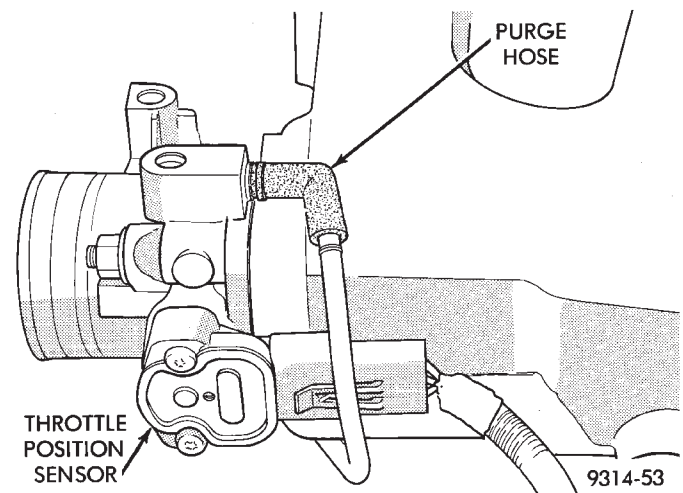


Fig. 22 Throttle Position Sensor—3.5L Engine

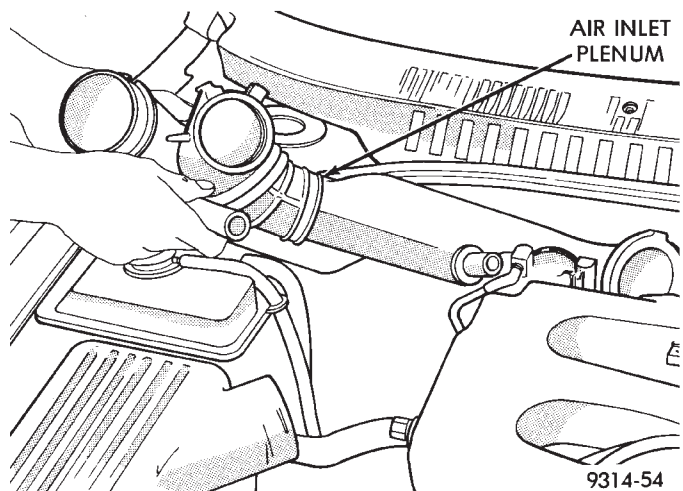


Fig. 23 Air Inlet Plenum—3.5L Engine

(12) Remove EGR tube mounting bolts at intake manifold plenum (Fig. 24). Discard gaskets.

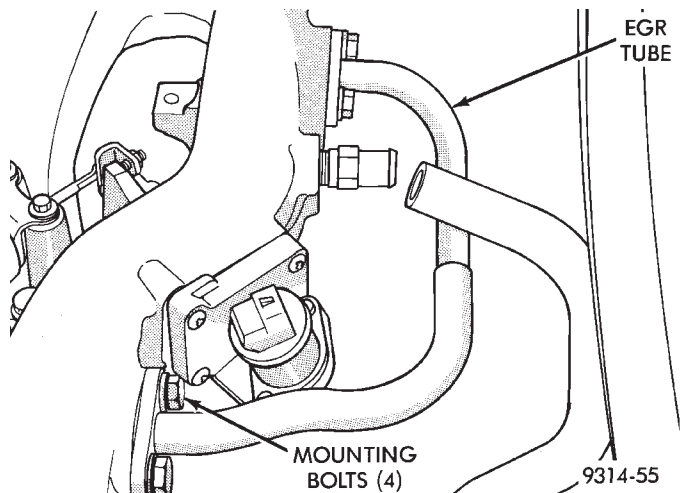
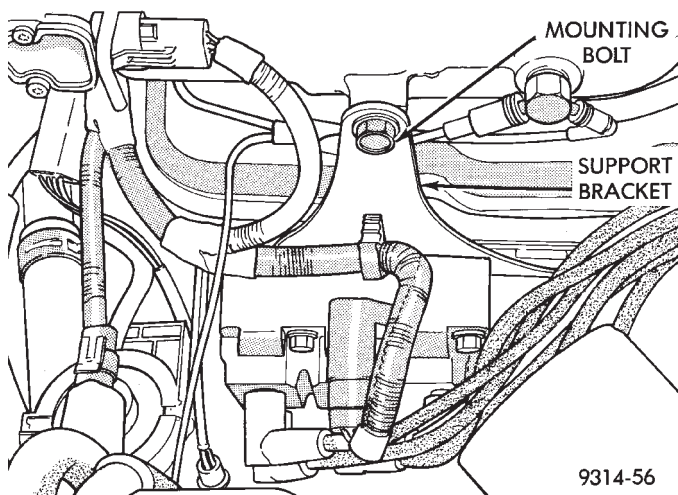


Fig. 24 EGR Tube Top Mounting Bolts

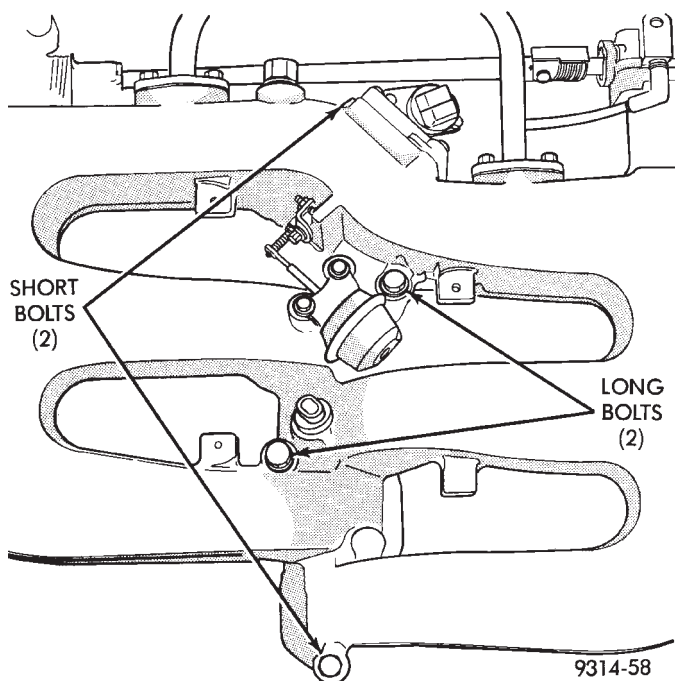
(13) Remove support bracket bolt on each side of plenum (Fig. 25).



9314-56

Fig. 25 Intake Manifold Plenum Support (Right Side)—3.5L Engine

(14) Remove intake manifold plenum mounting bolts. The plenum uses two different length bolts (Fig. 26).



9314-58

Fig. 26 Intake Manifold Plenum—3.5L Engine

(15) Remove intake manifold plenum. Discard gaskets. Cover the intake manifold openings with tape.

INSTALLATION

(1) Install intake manifold plenum with new gaskets. Refer to Group 11 for tightening sequence and specifications.

(2) Install and tighten support bracket bolts.

(3) Attach electrical connectors to MAP Sensor, TPS, idle air control motor and charge air temperature sensor.

(4) Connect vacuum hose to manifold tuning valve motor.

(5) Install EGR tube. Refer to Group 25 for EGR tube tightening sequence and specifications.

(6) Rotate throttle arm to wide open throttle position and install the speed control cable and throttle cable.

(7) Connect hose to PCV valve.

(8) Install air cleaner plenum.

(9) Install air cleaner to plenum hose.

(10) Connect brake booster hose to fitting on intake manifold plenum.

(11) Connect purge tubes to fittings on throttle bodies.

(12) Install cover on intake manifold plenum.

(13) Connect negative cable to battery.

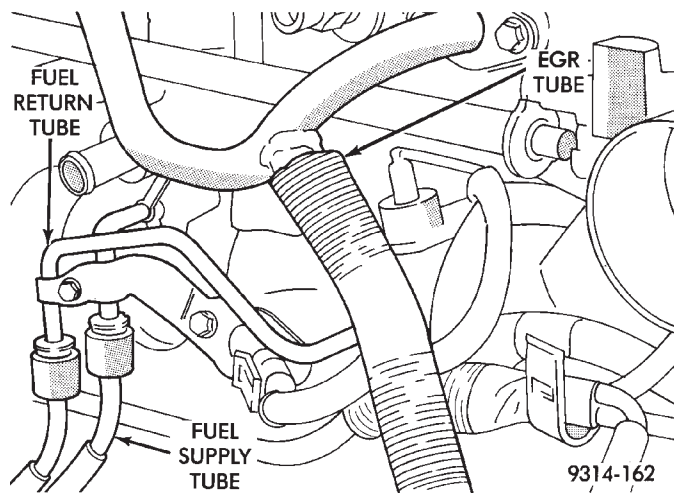
FUEL INJECTORS—3.5L ENGINE

REMOVAL

(1) Release fuel system pressure. Refer to Fuel System Pressure Release Procedure in this section.

(2) Remove intake manifold plenum. Refer to Intake Manifold Plenum—3.5L Engine in this section.

(3) Disconnect the fuel supply and return tubes from the fuel rail (Fig. 27). Connect fuel gauge adapter 6631 to the fuel supply tube end of the rail. Connect fuel hose 6668 to the fuel return tube end of the rail.



9314-162

Fig. 27 Fuel Supply and Return Tubes

(4) Place the other end of fuel hose 6668 into an approved gasoline container.

(5) To purge fuel from rail, spray a maximum of 379 kPa (55 psi) of compressed air into the end of adapter 6631 (Fig. 28).

If the injector connectors are not tagged with their cylinder number, tag them to identify the correct cylinder.

(6) Remove electrical connector from injectors.

(7) Remove the vacuum tube from the fuel pressure regulator (Fig. 29).

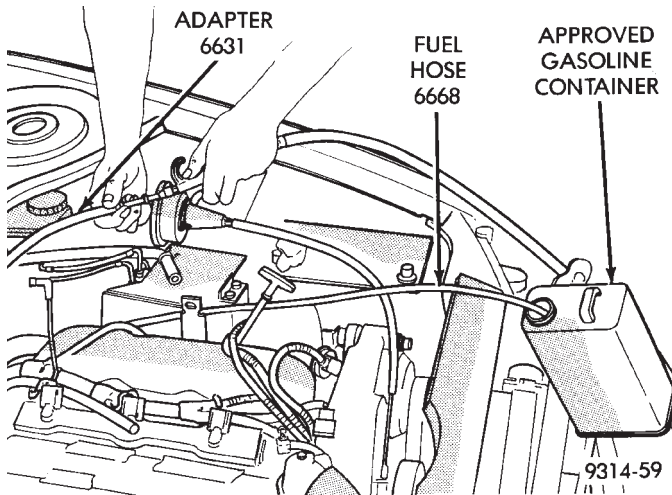


Fig. 28 Purging Fuel From Rail

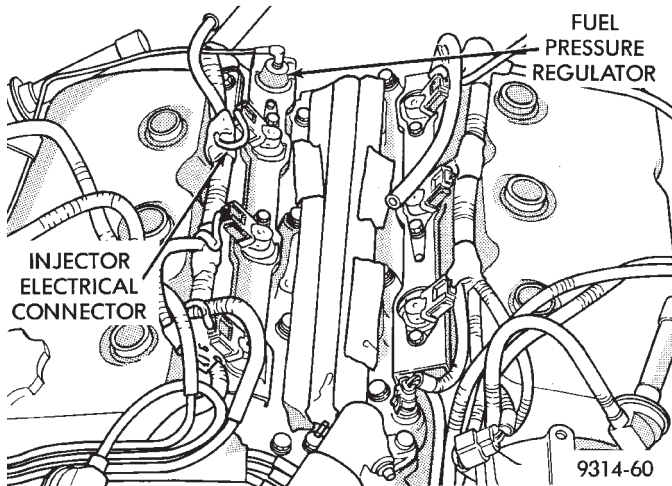


Fig. 29 Injector Electrical Connectors

- (8) Remove fuel rail mounting bolts (Fig. 30).
- (9) Remove injector clamp screw (Fig. 30).

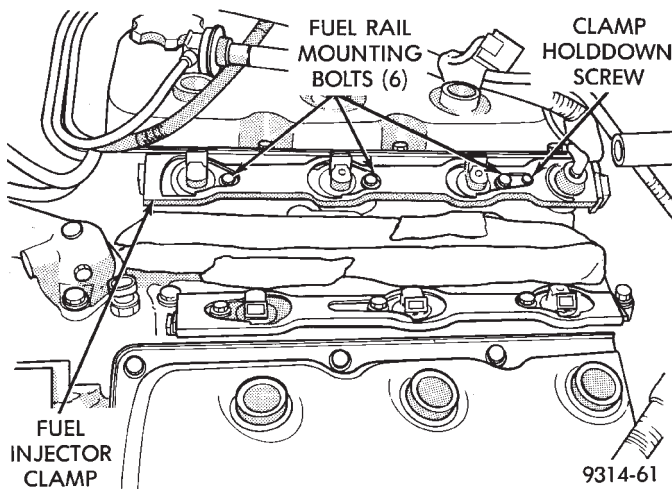


Fig. 30 Fuel Injector Clamp—3.5L Engine

- (10) Slide the injector clamp toward the rear of the engine, then lift the clamp off of the rail (Fig. 31).

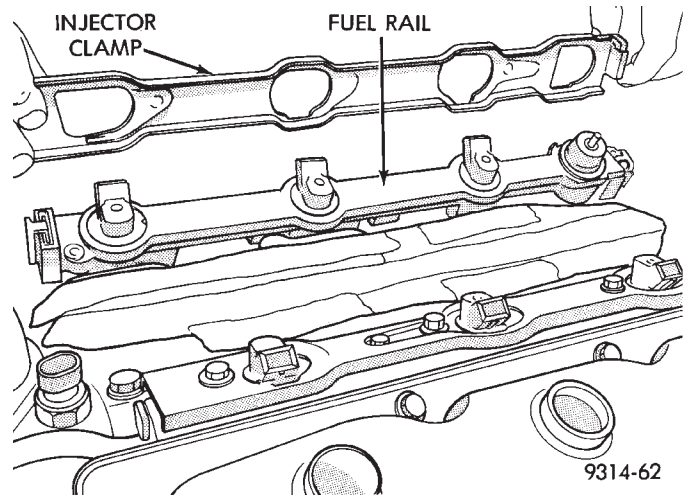


Fig. 31 Injector Clamp—3.5L Engine

- (11) Install fuel rail mounting bolts finger tight.
- (12) Using a thin flat screwdriver, pry the fuel injector out of the fuel rail (Fig. 32).

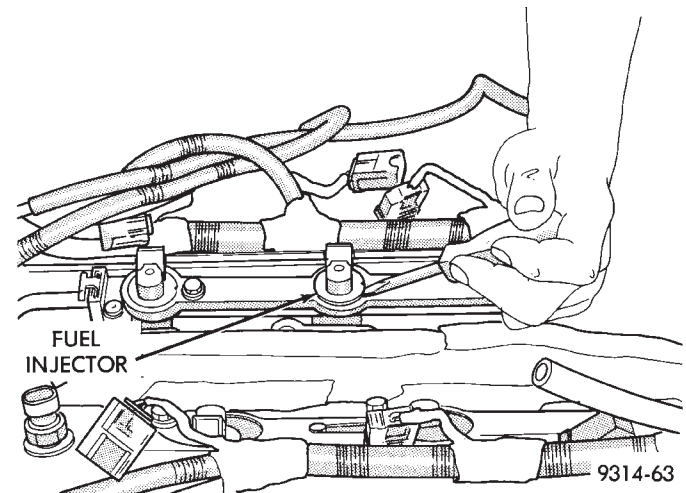


Fig. 32 Fuel Injector Removal—3.5L Engine

- (13) Ensure the upper and lower o-rings were removed with the injector. If not, remove them from the injector well in fuel rail (Fig. 33).

INSTALLATION

If the fuel rail was removed to service the injectors, use a new gasket when installing the rail.

- (1) Lightly lubricate the O-rings with a couple drops of clean engine oil.

When installing the injector, index the notch on the injector with the alignment tab on the fuel rail (Fig. 34).

- (2) Index injector with tab in fuel rail. Install injector.

- (3) Remove fuel rail mounting bolts.
- (4) Install fuel injector clamps.
- (5) Tighten fuel rail mounting bolts to 11 N•m (100 in. lbs.) torque.
- (6) Install fuel injector clamp screw.

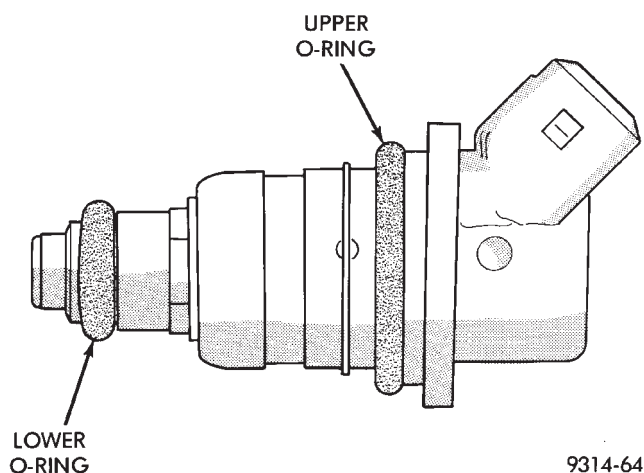


Fig. 33 Fuel Injector O-rings—3.5L Engine

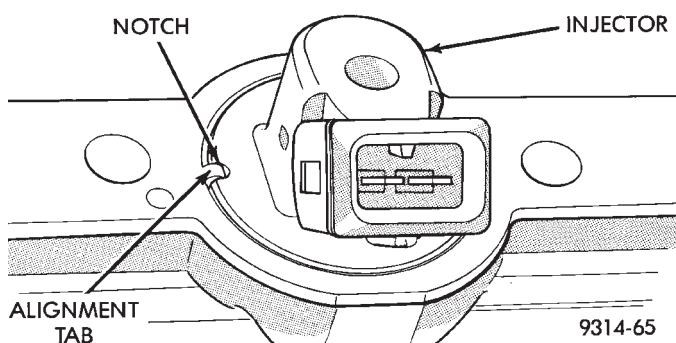


Fig. 34 Fuel Injector Alignment—3.5L Engine

- (7) Attach electrical connectors to fuel injectors.
- (8) Install intake manifold plenum. Refer to Intake Manifold Plenum—3.5L Engine in this section.

CAMSHAFT POSITION SENSOR—3.3L ENGINE

The camshaft position sensor is mounted in the front of the timing case cover (Fig. 35).

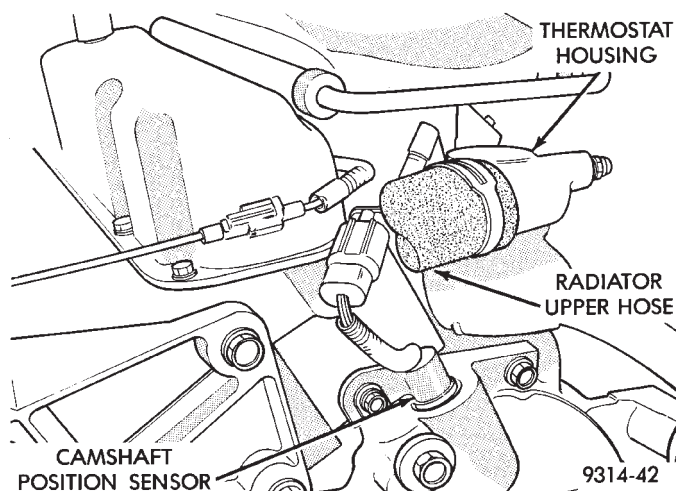


Fig. 35 Camshaft Position Sensor Location—3.3L Engine

REMOVAL

- (1) Disconnect electrical connector from sensor.
- (2) Remove camshaft position sensor screw.
- (3) Pull sensor up out of the chain case cover.

INSTALLATION

If the removed sensor is reinstalled, clean off the old spacer on the sensor face. A NEW SPACER must be attached to the face before installation. If the sensor is being replaced, confirm that the paper spacer is attached to the face and O-ring is positioned in groove of the new sensor (Fig. 36).

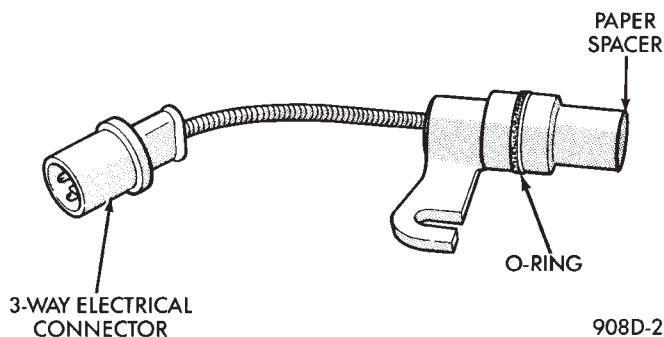


Fig. 36 Paper Spacer—3.3L Engine

- (1) Install sensor in the chain case cover and push sensor down until contact is made with the camshaft sprocket. While holding the sensor in this position, install and tighten the retaining bolt 12 N•m (105 in. lbs.) torque.
- (2) Attach electrical connector to sensor.

CAMSHAFT POSITION SENSOR—3.5L ENGINE

The camshaft position sensor is installed in the timing case cover above the left camshaft sprocket (Fig. 37).

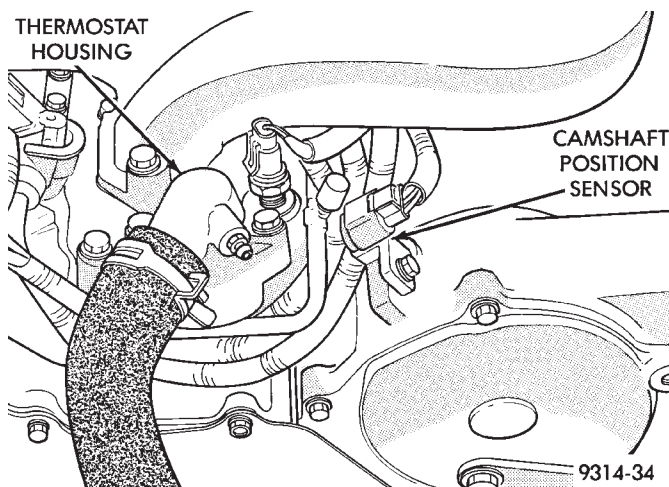


Fig. 37 Camshaft Position Sensor—3.5L Engine



REMOVAL

- (1) Disconnect electrical connector from sensor.
- (2) Remove camshaft position sensor screw.
- (3) Pull sensor up out of the chain case cover.

INSTALLATION

If the removed sensor is reinstalled, clean off the old spacer on the sensor face. A NEW SPACER must be attached to the face before installation. If the sensor is being replaced, confirm that the paper spacer is attached to the face and O-ring is positioned in groove of the new sensor (Fig. 38).

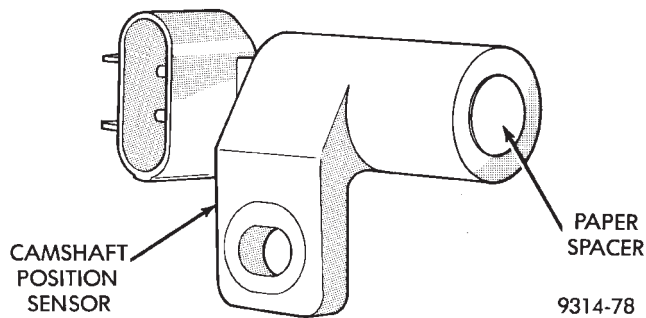


Fig. 38 Paper Spacer—3.5L Engine

(1) Install sensor in the chain case cover and push sensor down until contact is made with the camshaft sprocket. While holding the sensor in this position, install and tighten the retaining bolt 12 N•m (105 in. lbs.) torque.

(2) Attach electrical connector to sensor. Position connector away from the accessory belt.

CHARGE AIR TEMPERATURE SENSOR—3.5L ENGINE

The charge air temperature sensor threads into the intake manifold plenum (Fig. 39).

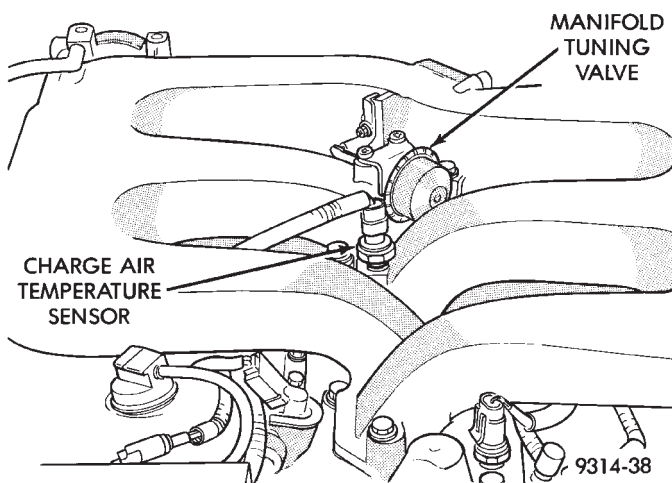


Fig. 39 Charge Air Temperature Sensor—3.5L Engine

REMOVAL

- (1) Remove engine cover.
- (2) Disconnect electrical connector from sensor.
- (3) Remove sensor.

INSTALLATION

- (1) Install sensor. Tighten sensor to 28 N•m (20 ft. lbs.) torque.
- (2) Attach electrical connector to sensor.
- (3) Install engine cover.

CRANKSHAFT POSITION SENSOR

The crankshaft sensor is located on the passengers side of the transmission housing, above the differential housing (Fig. 40). The bottom of the sensor is positioned above the drive plate.

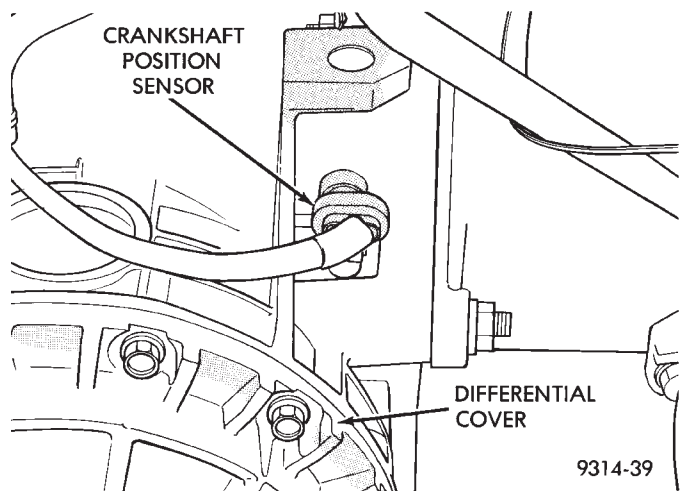


Fig. 40 Crankshaft Sensor Location

REMOVAL

- (1) Disconnect electrical connector from crankshaft position sensor.
- (2) Remove sensor mounting screw. Remove sensor.
- (3) Reverse procedure for installation.

ENGINE COOLANT TEMPERATURE SENSOR

The engine coolant sensor is located next to the thermostat housing (Fig. 41 or Fig. 42).

REMOVAL

- (1) With the engine cold, disconnect coolant sensor electrical connector.
- (2) Remove coolant sensor.

INSTALLATION

- (1) Install coolant sensor. Tighten sensor to 28 N•m (20 ft. lbs.) torque.
- (2) Attach electrical connector to sensor.

EVAP PURGE SOLENOID

The EVAP purge solenoid is mounted to the inner fender panel, near the passengers side of the dash

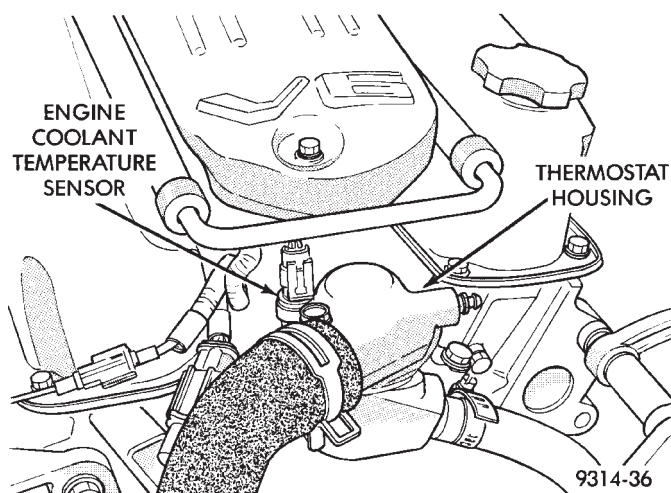


**Fig. 41 Engine Coolant Temperature Sensor—
3L Engine**

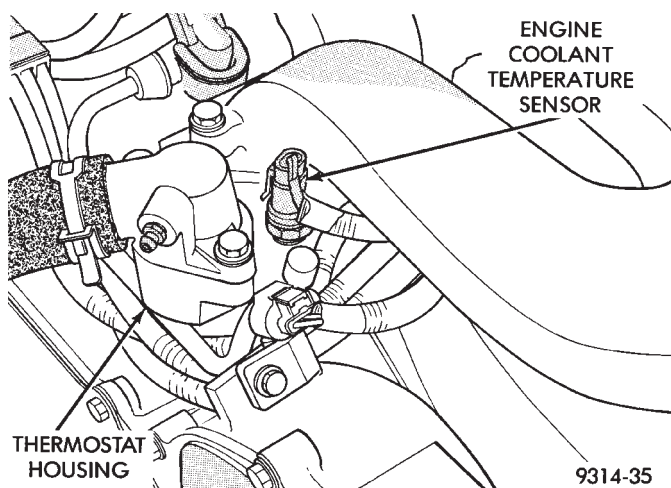


**Fig. 42 Engine Coolant Temperature Sensor—
3.5L Engine**

panel (Fig. 43). The top of the solenoid has the word TOP on it. The solenoid will not operate unless it is installed correctly. If the vehicle is equipped with a 3.5L engine, the EVAP solenoid shares a common mounting bracket with the MTV solenoid.

REMOVAL

- (1) Remove air cleaner tube.
- (2) Disconnect electrical connector from EVAP solenoid and, if equipped, the MTV solenoid (Fig. 43).
- (3) Disconnect vacuum harness from solenoid(s).
- (4) Remove solenoid bracket mounting screw. Remove bracket and solenoid(s).
- (5) Lift solenoid up off of bracket.

INSTALLATION

- (1) Install solenoid bracket with the top side up. The upper end of the solenoid has the word TOP on it.
- (2) Install bracket and solenoid(s).
- (3) Attach electrical connector to solenoid(s).

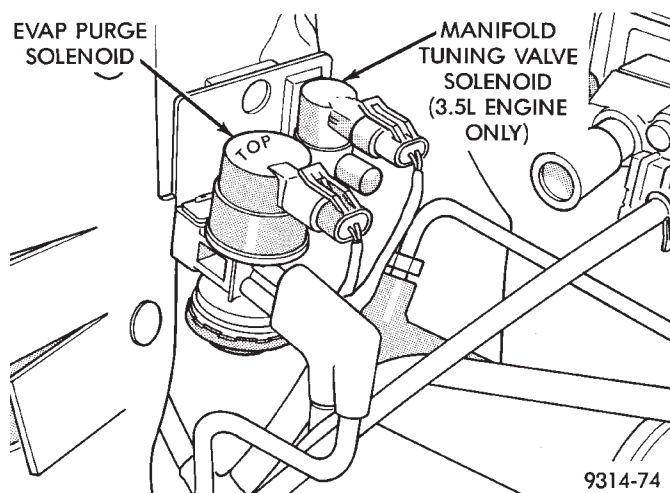


Fig. 43 EVAP Purge Solenoid and MTV Solenoid

(4) Connect vacuum harness to solenoid(s).

HEATED OXYGEN SENSORS—3.3L ENGINE

The 3.3L engine uses two heated oxygen sensors, one in each exhaust manifold. The sensors point toward the engine block.

REMOVAL

- (1) Raise vehicle on hoist.
- (2) Disconnect electrical connector.
- (3) Use a crow-foot wrench or open end wrench to remove heated oxygen sensor (Fig. 44).

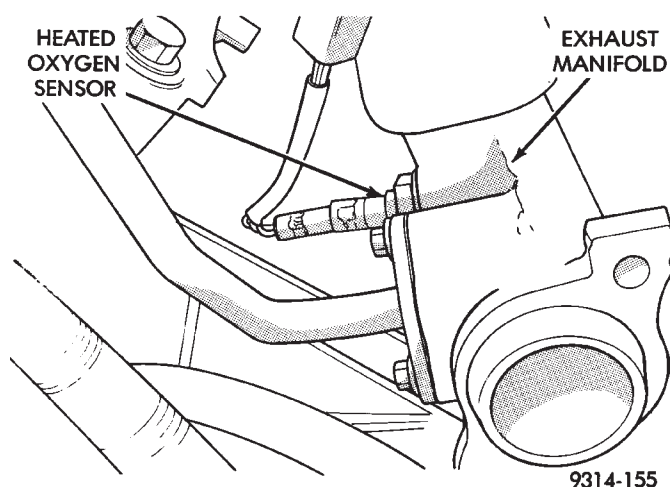


**Fig. 44 Heated Oxygen Sensor
Removal/Installation—3.3L Engine**

After removing the sensor, the exhaust manifold threads must be cleaned with an 18 mm X 1.5 + 6E tap. If reusing the original sensor, coat the sensor threads with an anti-seize compound such as Loctite 771-64 or equivalent. New sensors have compound on the threads and do not require an additional coating. Tighten the sensor to 28 N•m (20 ft. lbs.) torque.



HEATED OXYGEN SENSORS—3.5L ENGINE

The 3.5L engine uses two heated oxygen sensors, one in each exhaust manifold.

REMOVAL

- (1) To access the heated oxygen sensor on the right exhaust manifold, remove the air cleaner tube.
- (2) Disconnect the heated oxygen sensor electrical sensor.
- (3) Use a crow-foot wrench or tool C-4907 to remove oxygen sensor (Fig. 45).

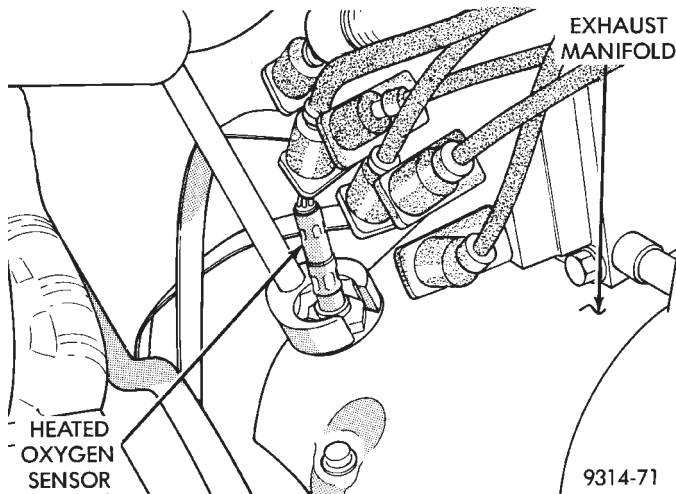


Fig. 45 Heated Oxygen Sensor Removal/Installation—3.5L Engine

After removing the sensor, the exhaust manifold threads must be cleaned with an 18 mm X 1.5 + 6E tap. If reusing the original sensor, coat the sensor threads with an anti-seize compound such as Loctite 771-64 or equivalent. New sensors have compound on the threads and do not require an additional coating. Tighten the sensor to 28 N•m (20 ft. lbs.) torque.

IDLE AIR CONTROL MOTOR—3.3L ENGINE

The idle air control motor attaches to the bottom of the throttle body (Fig. 46).

REMOVAL

- (1) Remove PCV make-up air hose.
- (2) Disconnect electrical connector from idle air control motor.
- (3) Remove idle air control motor mounting screws.
- (4) Remove idle air control motor. Ensure O-ring is removed with the motor.

INSTALLATION

- (1) The new idle air control motor has a new O-ring installed on it. If pintle measures more than 1 inch (25 mm) it must be retracted. Use the DRBII AIS Motor Open/Close Test to retract the pintle (battery must be connected.)
- (2) Carefully place idle air control motor into throttle body.

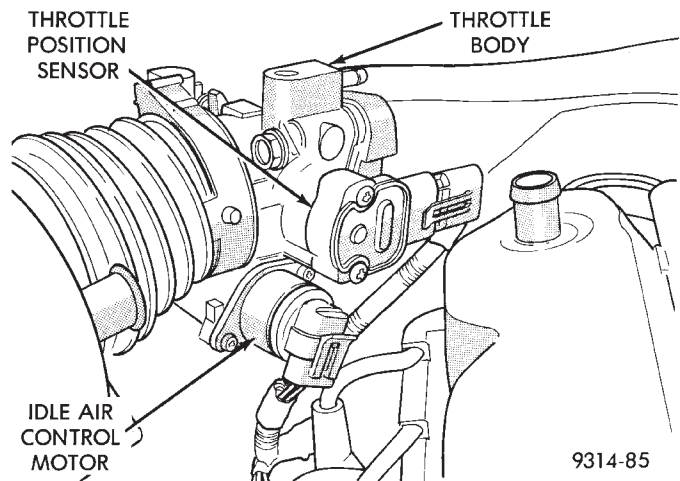


Fig. 46 Idle Air Control Motor—3.3L Engine

- (3) Install mounting screws. Tighten screws to 3 N•m (25 in. lbs.) torque.
- (4) Attach electrical connector to idle air control motor.
- (5) Install PCV make-up air.

IDLE AIR CONTROL MOTOR—3.5L ENGINE

The idle air control motor is located at the rear of the intake manifold plenum next to the left throttle body (Fig. 47).

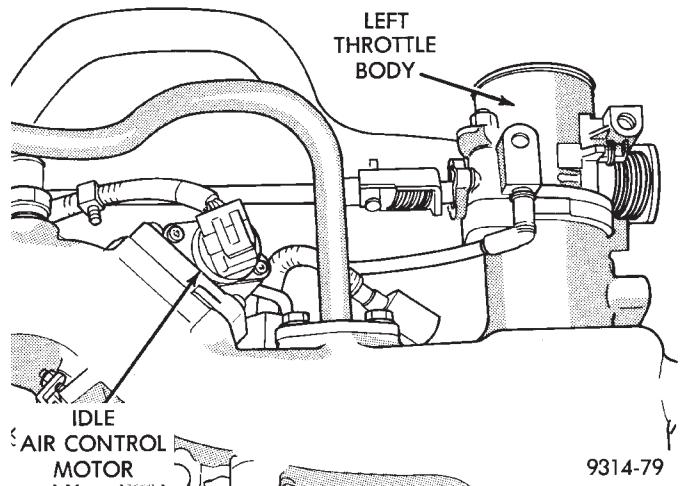


Fig. 47 Idle Air Control Motor

- (1) Remove electrical connector from idle air control motor.
- (2) Remove idle air control motor mounting screws.
- (3) Remove idle air control motor from throttle body. Ensure the O-ring is removed with the motor.

INSTALLATION

- (1) The new idle air control motor has a new O-ring installed on it. If pintle measures more than 1 inch (25 mm) it must be retracted. Use the DRBII AIS Motor Open/Close Test to retract the pintle (battery must be connected.)



(2) Carefully place idle air control motor into housing.

(3) Install mounting screws. Tighten screws to 3 N•m (25 in. lbs.) torque.

(4) Attach electrical connector to idle air control motor.

ELECTRONIC IGNITION COIL PACK—3.3L ENGINE

The electronic ignition coil pack attaches to the a bracket mounted on the left cylinder head (Fig. 48).

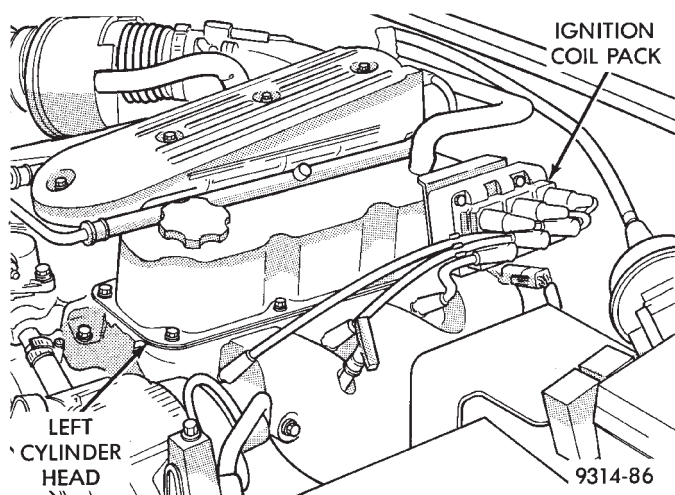


Fig. 48 Electronic Ignition Coil Pack—3.3L Engine

REMOVAL

- (1) Disconnect electrical connector from coil pack.
- (2) Remove coil pack mounting screws.
- (3) Remove coil. The spark plug cables are numbered for cylinder identification.
- (4) Transfer spark plug cables to new coil pack. The coil pack towers are numbered with the cylinder identification (Fig. 49).

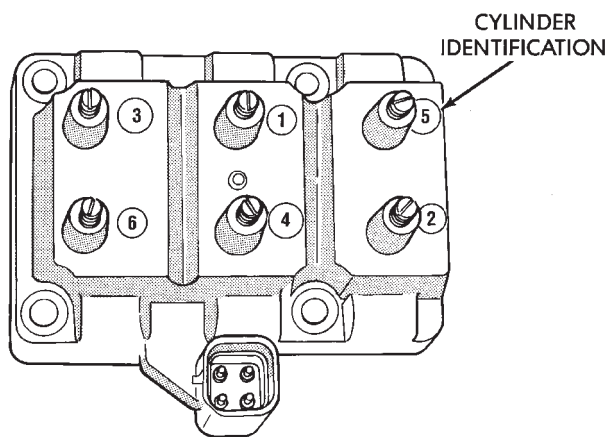


Fig. 49 Cylinder Identification

- (5) Reverse procedure for installation.

ELECTRONIC IGNITION COIL PACK—3.5L ENGINE

The ignition coil pack attaches to the right cylinder head (Fig. 50).

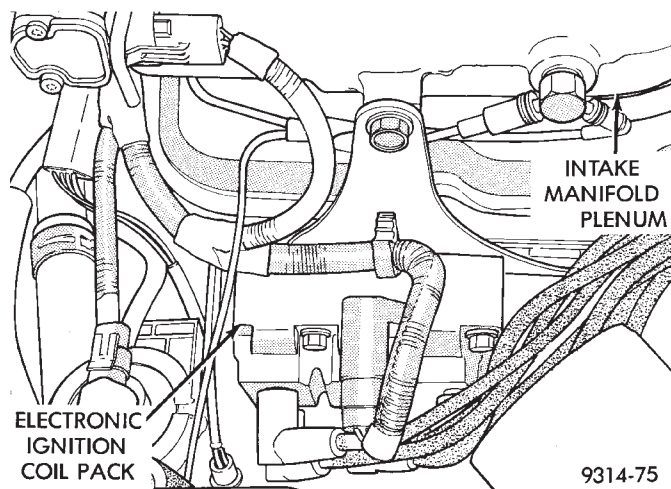


Fig. 50 Electronic Ignition Coil Pack—3.5L Engine

REMOVAL

- (1) Remove air cleaner hose.
- (2) Disconnect electrical connector from coil pack.
- (3) Remove coil pack mounting screws.
- (4) Remove coil. The spark plug cables are numbered for cylinder identification (Fig. 51).

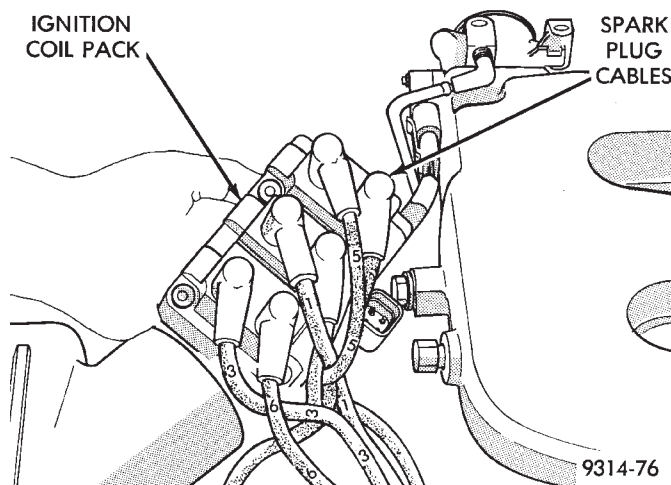


Fig. 51 Spark Plug Cable Identification

- (5) Transfer spark plug cables to new coil pack. The coil pack towers are numbered with the cylinder identification (Fig. 49).

- (6) Reverse procedure for installation.

KNOCK SENSORS—3.5L ENGINE

The 3.5L engine uses two knock sensors. The sensors thread into the cylinder block, directly below the intake manifold.

REMOVAL

- (1) Remove intake manifold plenum. Refer to Intake Manifold Plenum in this section.



- (2) Remove intake manifold. Refer to Group 11.
- (3) Disconnect electrical connector from knock sensor(s) (Fig. 52).

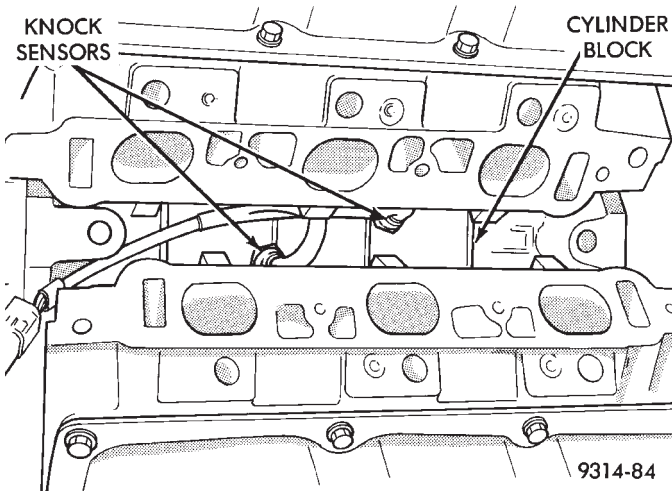


Fig. 52 Knock Sensor Location

- (4) Use a crows foot socket to remove the knock sensors.

INSTALLATION

- (1) Install knock sensor. Tighten knock sensor to 10 N•m (7 ft. lbs) torque. **Over or under tightening effects knock sensor performance resulting in possible improper spark control.**
- (2) Attach electrical connector to knock sensor.
- (3) Install intake manifold. Refer to Group 11.
- (4) Install intake manifold plenum. Refer to Intake Manifold Plenum in this section.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

On 3.3L engines, the MAP sensor threads into the rear of the intake manifold plenum (Fig. 53). On 3.5L engines, the MAP sensor threads into the left side of the intake manifold plenum (Fig. 54).

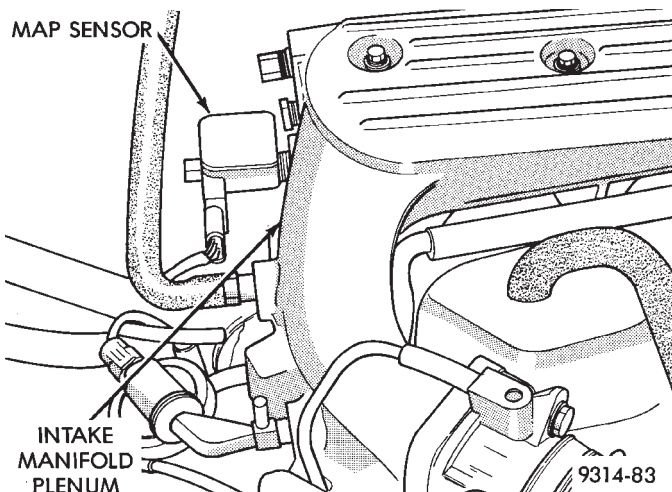


Fig. 53 MAP Sensor—3.3L Engine

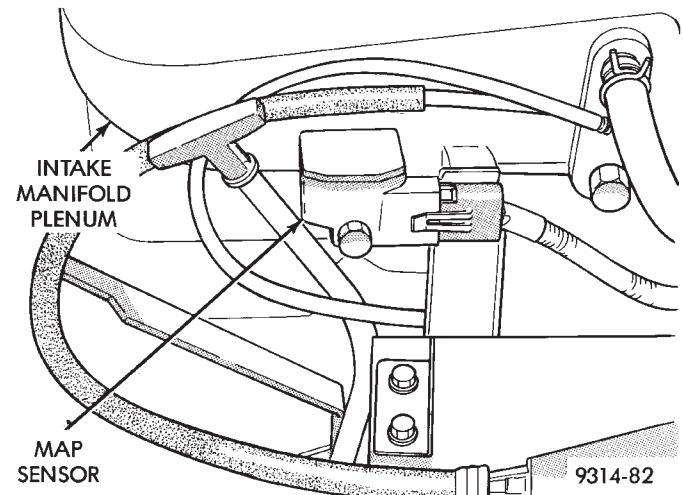


Fig. 54 MAP Sensor—3.5L Engine

REMOVAL

- (1) Disconnect the electrical connector from the MAP sensor.
- (2) Remove sensor.

INSTALLATION

- (1) Thread sensor into intake manifold plenum. Tighten sensor to 10 N•m (90 in. lbs.) torque and then rotate it to horizontal position.
- (2) Attach electrical connector to sensor.

MANIFOLD TUNING VALVE SOLENOID—3.5L ENGINE

The manifold tuning valve (MTV) solenoid is mounted to the inner fender panel, next to the EVAP purge solenoid near the passengers side of the dash panel (Fig. 55).

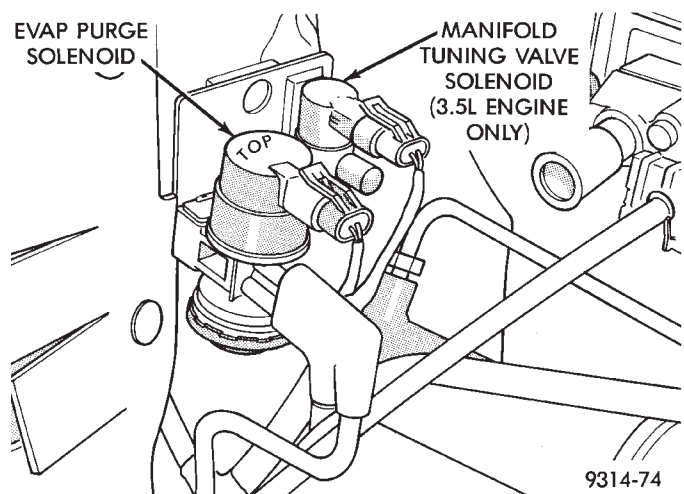


Fig. 55 MTV Solenoid—3.5L Only

REMOVAL

- (1) Remove air cleaner tube.
- (2) Remove electrical connectors from EVAP purge solenoid and manifold tuning valve solenoid (Fig. 55).



- (3) Disconnect vacuum harnesses from solenoids.
- (4) Remove solenoid mounting bracket screw.
- (5) Remove solenoids and bracket.
- (6) Lift MTV solenoid up off of bracket.
- (7) Reverse procedure for installation.

MANIFOLD TUNING VALVE—3.5L ENGINE

REMOVAL

- (1) Remove engine cover.
- (2) Disconnect vacuum hose from manifold tuning valve vacuum motor (Fig. 56).

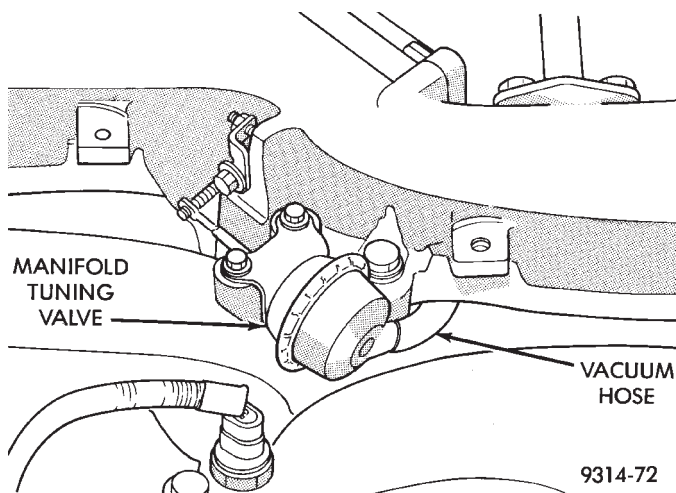


Fig. 56 Manifold Tuning Valve

- (3) Remove retaining clip from manifold tuning valve arm (Fig. 57)

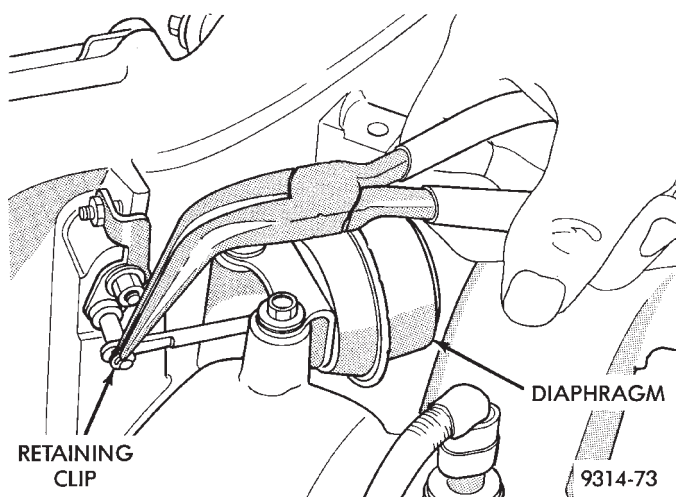


Fig. 57 Retaining Clip

- (4) Remove manifold tuning valve mounting screws. Remove tuning valve vacuum motor.

INSTALLATION

- (1) Install tuning valve. Tighten mounting screws to 11 N•m (8 ft. lbs.) torque.
- (2) Install retaining clip.

- (3) Connect vacuum hose to the manifold tuning valve vacuum motor.

POWERTRAIN CONTROL MODULE (PCM)

The PCM engine control strategy prevents reduced idle speeds until after the engine operates for 320 km (200 miles). If the PCM is replaced after 320 km (200 miles) of usage, update the mileage in new PCM. Use the DRBII scan tool to change the mileage in the PCM. Refer to the appropriate Powertrain Diagnostic Manual and the DRBII scan tool.

REMOVAL

- (1) Remove air cleaner.
- (2) Remove stud bolt and push pin attaching PCM to body (Fig. 58). The push pin has a center lock (shaft). Pull the center lock up to remove the push pin.
- (3) Lift PCM up. Disconnect PCM 60-way connector (Fig. 59).
- (4) Remove PCM.

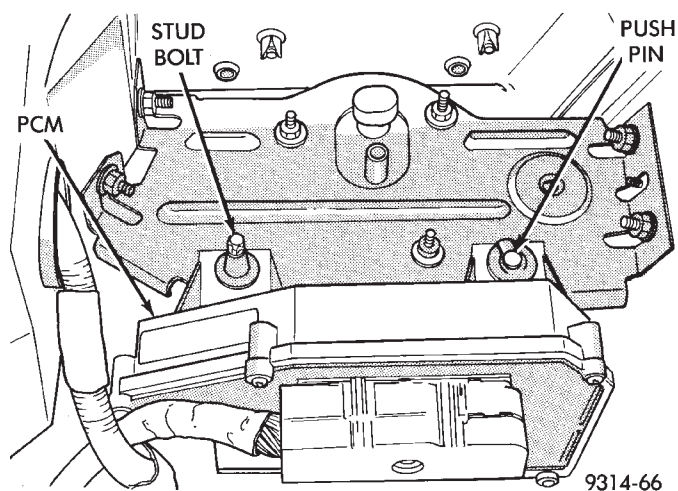


Fig. 58 PCM Location

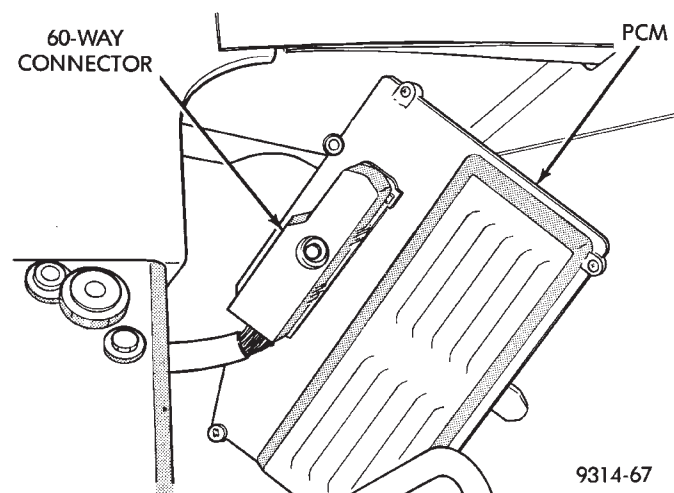


Fig. 59 PCM 60-Way Connector



INSTALLATION

- (1) Attach 60-way connector on PCM.
- (2) Install 60-way connector. Tighten 60-Way connector screw to 4 N•m (35 in. lbs.) torque.
- (3) Install PCM. Tighten stud bolt to 10 N•m (7 ft. lbs.) torque. Install push pin. Push down on center lock of pushpin.
- (4) Install air cleaner.

THROTTLE POSITION SENSOR (TPS)—3.3L ENGINE

The TPS attaches to the throttle body (Fig. 60).

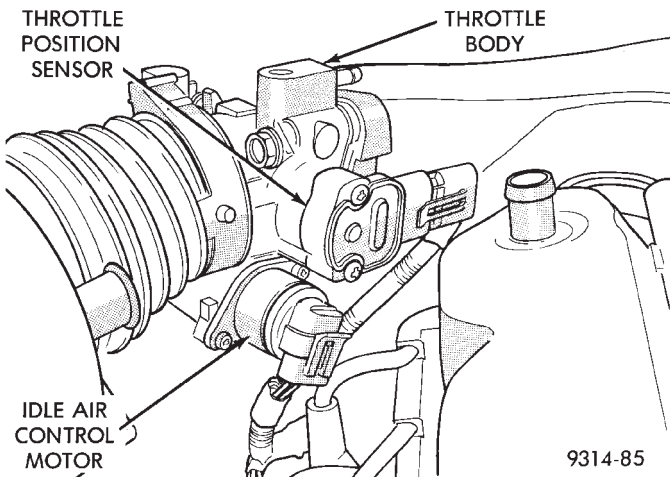


Fig. 60 Throttle Position Sensor—3.3L Engine

REMOVAL

- (1) Disconnect the TPS electrical connector (Fig. 60).
- (2) Remove the TPS mounting screws.
- (3) Remove the TPS.

INSTALLATION

(1) The throttle shaft end of the throttle body slides into a socket in the TPS (Fig. 61). The socket has two tabs inside it (Fig. 62). The throttle shaft rests against the tabs. When indexed correctly, the TPS can rotate clockwise a few degrees to line up the mounting screw holes with the screw holes in the throttle body. The TPS has slight tension when rotated into position. If it is difficult to rotate the TPS into position, install the sensor with the throttle shaft on the other side of the tabs in the socket. Tighten mounting screws to 3 N•m (25 in. lbs.) torque.

After installing the TPS, the throttle plate should be closed. If the throttle plate is open, install the sensor on the other side of the tabs in the socket.

- (2) Attach electrical connector to the TPS.

THROTTLE POSITION SENSOR (TPS)—3.5L ENGINE

The TPS is attached to the right throttle body (Fig. 63).

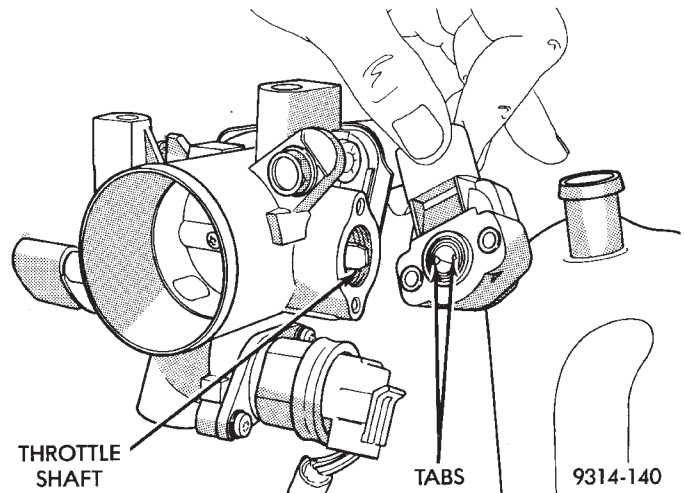


Fig. 61 Throttle Position Sensor Installation—3.3L Engine

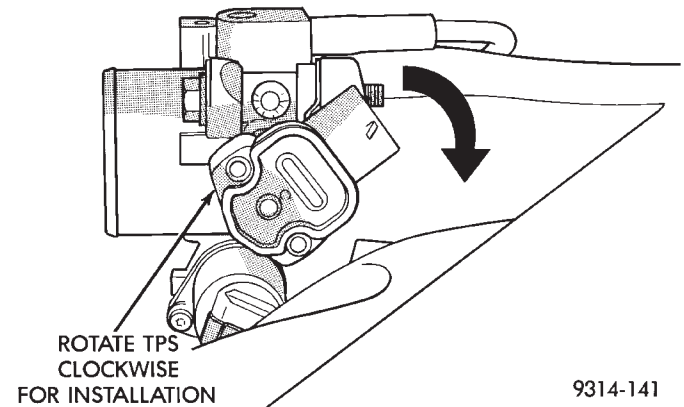


Fig. 62 Rotate TPS Clockwise For Alignment—3.3L Engine

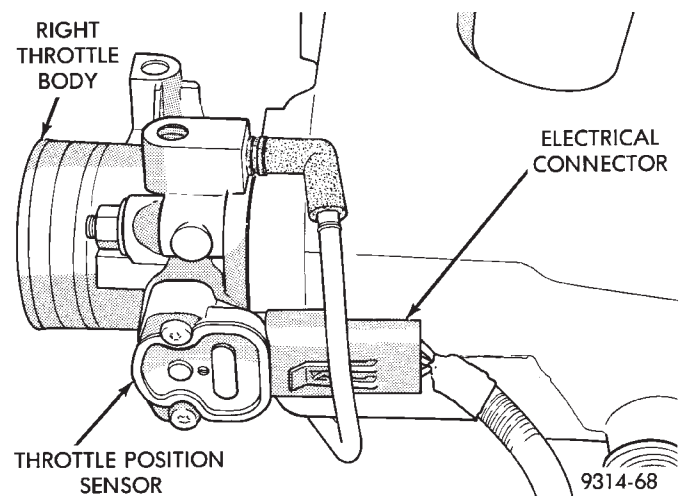


Fig. 63 Throttle Position Sensor—3.5L Engine

REMOVAL

- (1) Disconnect the TPS electrical connector (Fig. 63).
- (2) Remove the TPS mounting screws.
- (3) Remove the TPS.



INSTALLATION

(1) The throttle shaft end of the throttle body slides into a socket in the TPS (Fig. 64). The socket has two tabs inside it. The throttle shaft rests against the tabs. When indexed correctly, the TPS can rotate clockwise a few degrees to line up the mounting screw holes with the screw holes in the throttle body (Fig. 65). The TPS has slight tension when rotated into position. If it is dif-

ficult to rotate the TPS into position, install the sensor with the throttle shaft on the other side of the tabs in the socket. Tighten mounting screws to 3 N•m (25 in. lbs.) torque.

After installing the TPS, the throttle plate should be closed. If the throttle plate is open, install the sensor on the other side of the tabs in the socket.

(2) Attach electrical connector to the TPS.

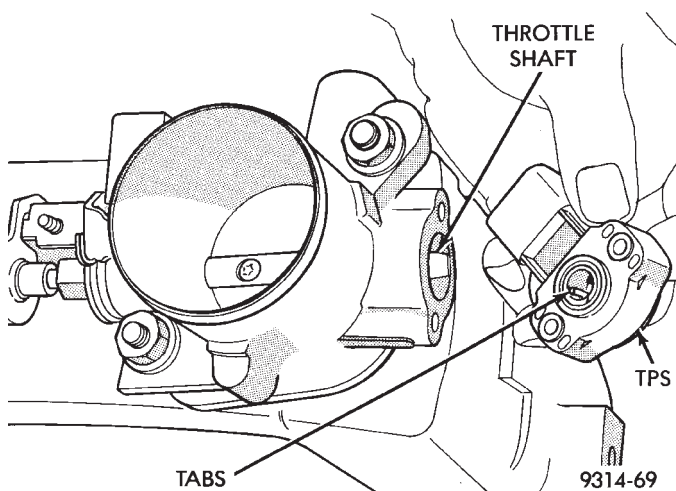


Fig. 64 Throttle Position Sensor Installation—3.5L Engine

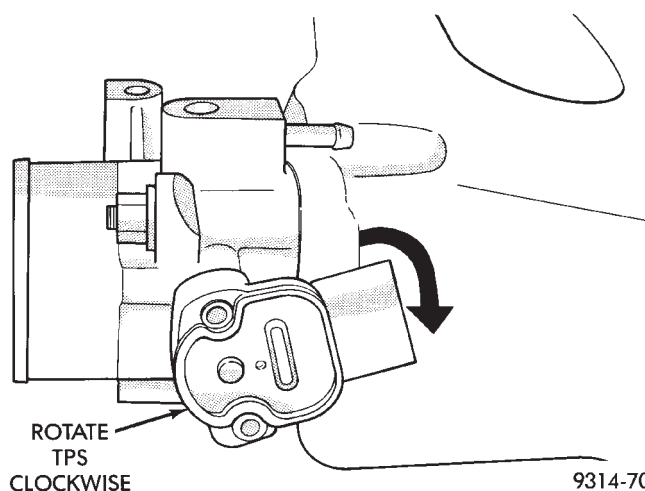


Fig. 65 Rotate TPS Clockwise For Alignment—3.5L Engine

SPECIFICATIONS

TORQUE

Description	Torque
3.5L Fuel Rail Mounting Bolts	11 N•m (100 in. lbs.)
3.5L Throttle Body Synchronization Shaft Adjustment Screw Lock Nut.....	4 N•m (36 in. lbs.)
Accelerator Pedal Mounting Nuts.....	12 N•m (105 in. lbs.)
Camshaft Position Sensor.....	12 N•m (105 in. lbs.)
Charge Air Temperature Sensor	28 N•m (20 ft. lbs.)
Crankshaft Position Sensor.....	12 N•m (105 in. lbs.)
Engine Coolant Temperature Sensor	28 N•m (20 ft. lbs.)
Fuel Pump Module Band Clamp	4 N•m (31 in. lbs.)
Fuel Tank Strap Bolts	60 N•m (44 ft. lbs.)
Fuel Filter Mounting Screw.....	12 N•m (110 in. lbs.)
Fuel Pressure Regulator Holddown Screw	7 N•m (60 in. lbs.)
Heated Oxygen Sensor	28 N•m (20 ft. lbs.)

Description	Torque
Idle Air Control Motor Mounting Screws	3 N•m (25 in. lbs.)
Ignition Coil.....	12 N•m (105 in. lbs.)
Knock Sensor.....	10 N•m (7 ft. lbs.)
Map Sensor (tighten to specification then rotate to horizontal position).....	10 N•m (90 in. lbs.)
MTV Vacuum Motor	11 N•m (8 ft. lbs.)
PCM 60-Way Connector	4 N•m (35 in. lbs.)
Rear Sway Bar.....	100 N•m (74 ft. lbs.)
Rear Suspension Crossmember Bolts.....	95 N•m (70 ft. lbs.)
Throttle Body Mounting Bolts.....	26 N•m (19 ft. lbs.)
TPS Mounting Screws	3 N•m (25 in. lbs.)

9314-163