IGNITION SYSTEMS

CONTENTS

COMPONENT IDENTIFICATION/SYSTEM OPERATION

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GENERAL INFORMATION

Throughout this group, references are made to particular vehicle models by alphabetical designation or by the particular vehicle nameplate. A chart showing a breakdown of alphabetical designations is included in the Introduction group at the beginning of this manual.

This section of the group, Component Identification/System Operation, will discuss ignition system operation and will identify ignition system components.

For diagnostic procedures and adjustments, refer to the Diagnostics/Service Procedures section of this group.

For removal and installation of ignition system components, refer to the Component Removal/Installation section of this group.

For other useful information, refer to On-Board Diagnostics in the General Diagnosis sections of Group 14, Fuel System in this manual.

For operation of the DRB II Diagnostic Scan Tool, refer to the appropriate Powertrain Diagnostic Procedures service manual.

An Ignition specifications section is included at the end of this group. A general Maintenance Schedule (mileage intervals) for ignition related items can be found in Group 0, Lubrication and Maintenance. This schedule can also be found in the Owners Manual.

IGNITION SYSTEMS

Two different ignition operating systems are used. One system is used on the 4.0L 6 cylinder engine. The other is used on the 5.2L V-8 engine. Similarities and differences between the two systems will be discussed.

A multi-port, fuel injected engine is used on all models. The ignition system is controlled by the Powertrain Control Module (PCM) on all engines. The PCM was formerly referred to as the SBEC or engine controller.

The ignition system consists of:

- Spark Plugs
- Ignition Coil
- Secondary Ignition Cables
- Ignition distributor (contains rotor and camshaft position sensor)
- Powertrain Control Module (PCM)
- Crankshaft Position Sensor

AUTOMATIC SHUT DOWN RELAY (ASD) RELAY

The automatic shut down (ASD) relay is located in the Power Distribution Center (PDC) near the battery (Fig. 1). As one of its functions, it will supply battery voltage to the ignition coil. The ground circuit for the ASD relay is controlled by the Powertrain Control Module (PCM). The PCM regulates ASD relay operation by switching the ground circuit on-and-off.

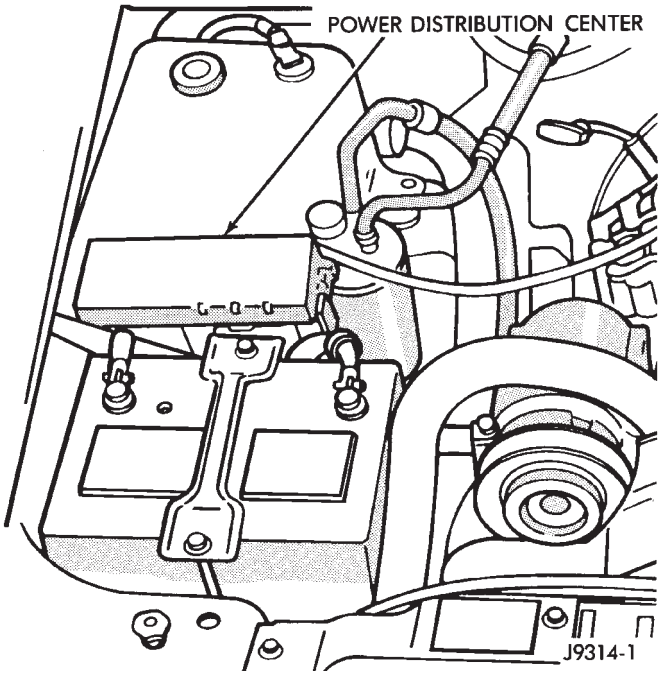

Fig. 1 Power Distribution Center

CAMSHAFT POSITION SENSOR

The camshaft position sensor is located in the ignition distributor (Figs. 2 or 3) on all engines.

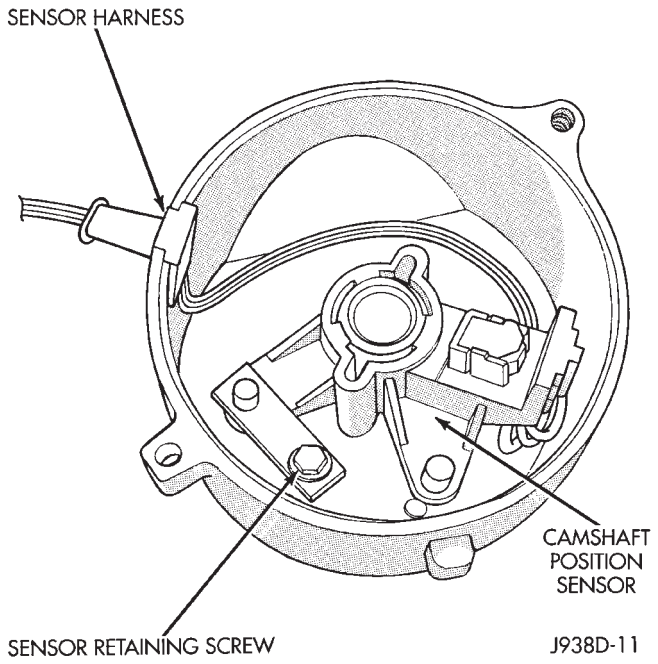

Fig. 2 Camshaft Position Sensor—4.0L Engine

The camshaft position sensor contains a hall effect device called a sync signal generator to generate a fuel sync signal. This sync signal generator detects a rotating pulse ring (shutter) on the distributor shaft. The pulse ring rotates 180 degrees through the sync signal generator. Its signal is used in conjunction with the crankshaft position sensor to differentiate between fuel injection and spark events. It is also used to synchronize the fuel injectors with their respective cylinders.

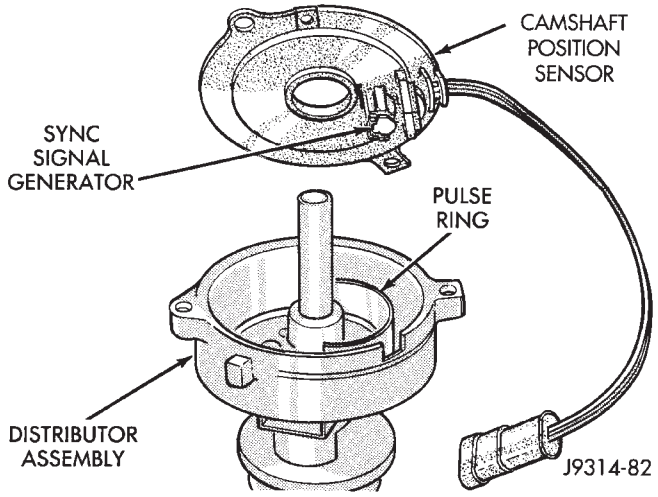

Fig. 3 Camshaft Position Sensor—5.2L Engine

When the leading edge of the pulse ring (shutter) enters the sync signal generator, the following occurs: The interruption of magnetic field causes the voltage to switch high resulting in a sync signal of approximately 5 volts.

When the trailing edge of the pulse ring (shutter) leaves the sync signal generator, the following occurs: The change of the magnetic field causes the sync signal voltage to switch low to 0 volts.

For component testing, refer to the Diagnostics/Service Procedures section of this group.

For removal and installation of this component, refer to the Component Removal/Installation section of this group.

CRANKSHAFT POSITION SENSOR

On 4.0L engines, the crankshaft position sensor is mounted to the transmission bellhousing at the left/rear side of the engine block (Fig. 4).

On 5.2L engines, the sensor is bolted to the top of cylinder block near the rear of the right cylinder head (Fig. 5).

Engine speed and crankshaft position are provided through the crankshaft position sensor. The sensor generates pulses that are the input sent to the Powertrain Control Module (PCM). The PCM interprets the sensor input to determine the crankshaft position. The PCM then uses this position, along with other inputs, to determine injector sequence and ignition timing.

The sensor is a hall effect device combined with an internal magnet. It is also sensitive to steel within a certain distance from it.

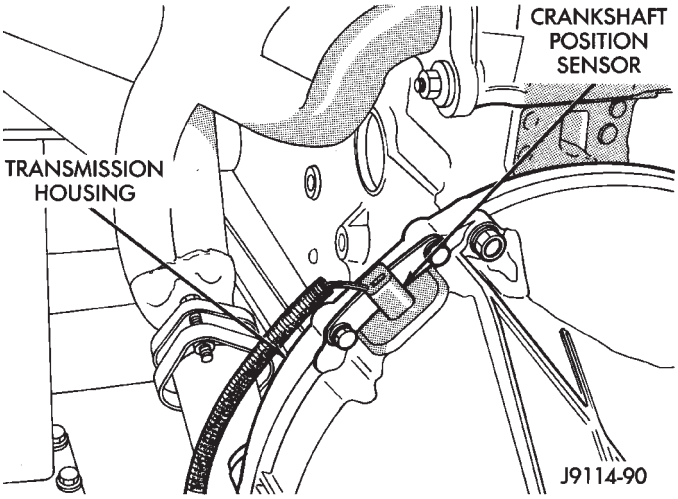

Fig. 4 Crankshaft Position Sensor—4.0L Engine

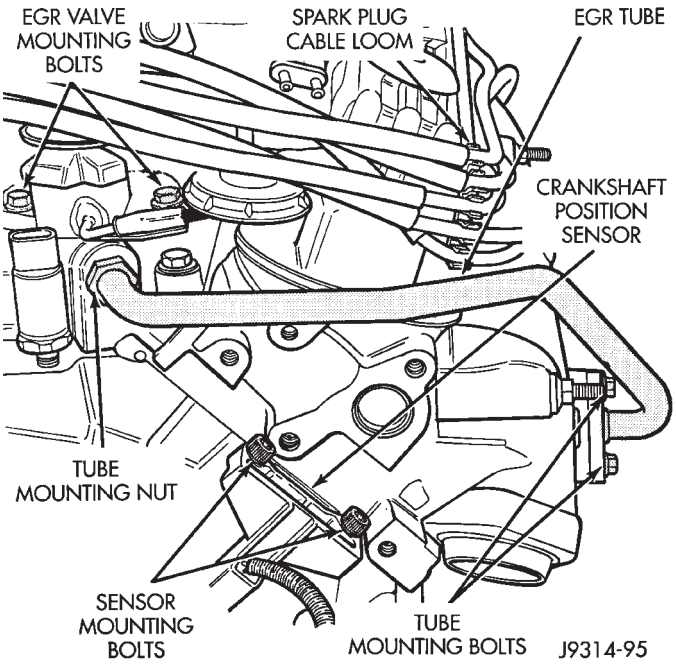

Fig. 5 Crankshaft Position Sensor—5.2L Engine—Typical

SENSOR OPERATION—4.0L ENGINE

The flywheel/drive plate has groups of four notches at its outer edge. On 4.0L engines there are three sets of notches (Fig. 6).

The notches cause a pulse to be generated when they pass under the sensor. The pulses are the input to the PCM. For each engine revolution there are there are 3 groups of four pulses generated on 4.0L 6 cylinder engines.

The trailing edge of the fourth notch, which causes the pulse, is four degrees before top dead center (TDC) of the corresponding piston.

The engine will not operate if the PCM does not receive a crankshaft position sensor input.

For component testing, refer to the Diagnostics/Service Procedures section of this group.

For removal and installation of this sensor, refer to the Component Removal/Installation section of this group.

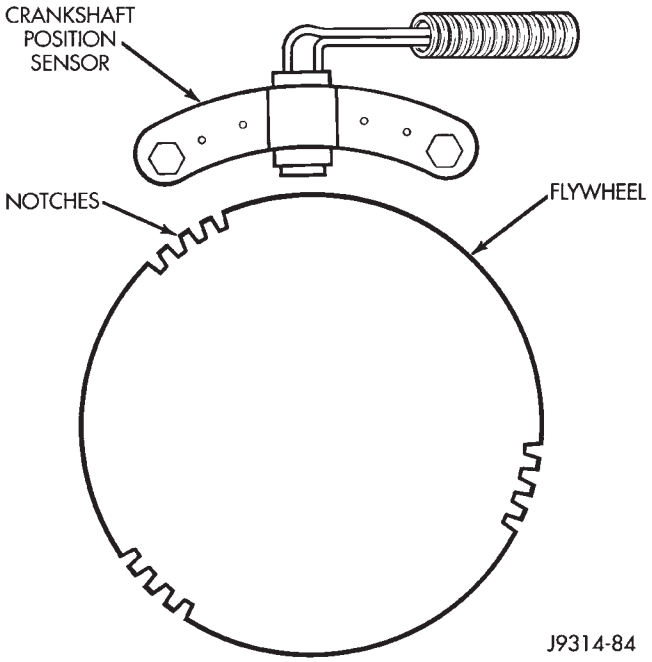

Fig. 6 Sensor Operation—4.0L Engine

SENSOR OPERATION—5.2L ENGINE

On 5.2L engines, the flywheel/drive plate has 8 single notches, spaced every 45 degrees, at its outer edge (Fig. 7).

The notches cause a pulse to be generated when they pass under the sensor. The pulses are the input to the PCM. For each engine revolution, there are 8 pulses generated on 5.2L V-8 engines.

The engine will not operate if the PCM does not receive a crankshaft position sensor input.

For component testing, refer to the Diagnostics/Service Procedures section of this group.

For removal and installation of this component, refer to the Component Removal/Installation section of this group.

DISTRIBUTORS

All engines are equipped with a camshaft driven mechanical distributor, containing a shaft driven distributor rotor. All distributors are equipped with an internal camshaft position (fuel sync) sensor. This sensor provides fuel injection synchronization and cylinder identification.

The distributors on the 4.0L and 5.2L engines do not have built in centrifugal or vacuum assisted advance. Base ignition timing and all timing advance is controlled by the Powertrain Control Module

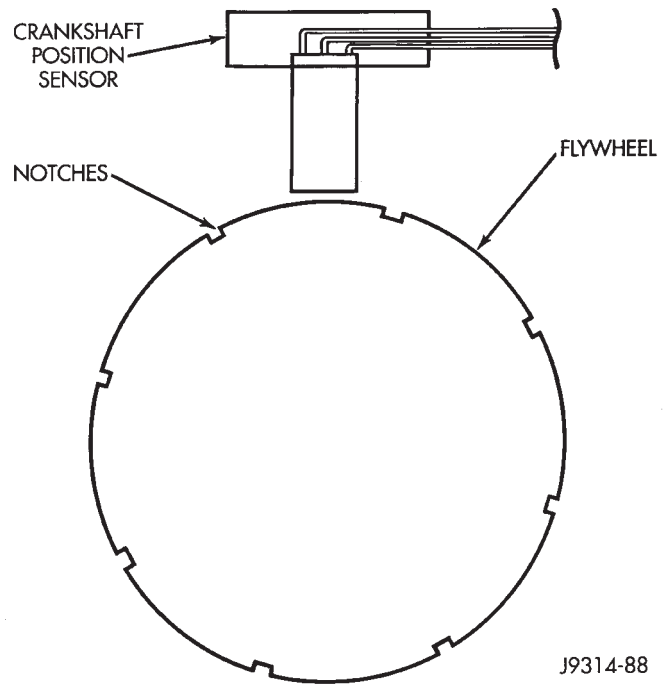

Fig. 7 Sensor Operation—5.2L Engine

(PCM). Because ignition timing is controlled by the PCM, **base ignition timing is not adjustable on any of these engines.**

On the 4.0L 6 cylinder engine, the distributor is locked in place by a notch on the distributor housing. The distributor holddown clamp bolt passes through this notch when installed. Because the distributor position is locked when installed, its rotational position can not be changed. **Do not attempt to modify the distributor housing to get distributor rotation. Distributor position will have no effect on ignition timing.**

On the 5.2L V-8 engine, the distributor is held to the engine in the conventional method using a holddown clamp and bolt. **Although the distributor on the 5.2L engine can be rotated, it will have no effect on ignition timing.**

All distributors contain an internal oil seal that prevents oil from entering the distributor housing. The seal is not serviceable.

For component testing, refer to the Diagnostics/Service Procedures section of this group.

For removal and installation of this component, refer to the Component Removal/Installation section of this group.

IGNITION COIL

Battery voltage is supplied to the ignition coil positive terminal from the ASD relay.

The Powertrain Control Module (PCM) opens and closes the ignition coil ground circuit for ignition coil operation.

Base ignition timing is not adjustable. By controlling the coil ground circuit, the PCM is able to set the base timing and adjust the ignition timing advance. This is done to meet changing engine operating conditions.

The ignition coil is not oil filled. The windings are embedded in an epoxy compound. This provides heat and vibration resistance that allows the ignition coil to be mounted on the engine.

On 4.0L 6 cylinder engines, the ignition coil is mounted to a bracket on the side of the engine (Fig. 8).

On 5.2L V-8 engines, the ignition coil is mounted to a bracket at the front of the right cylinder head (Fig. 9). This bracket is also used to mount the automatic belt tensioner.

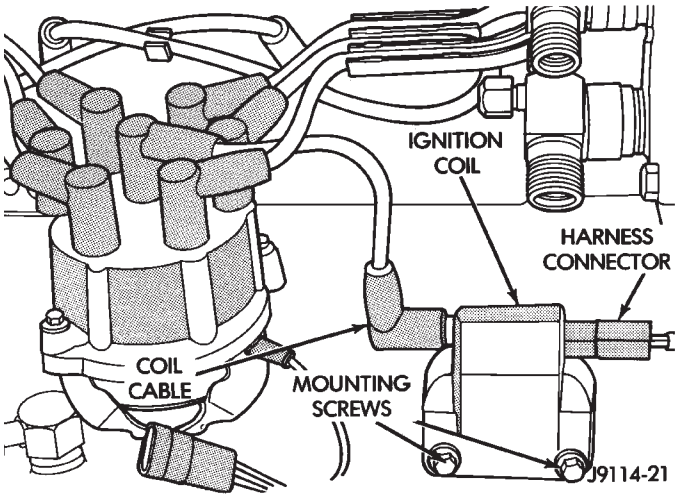

Fig. 8 Ignition Coil—4.0L Engine

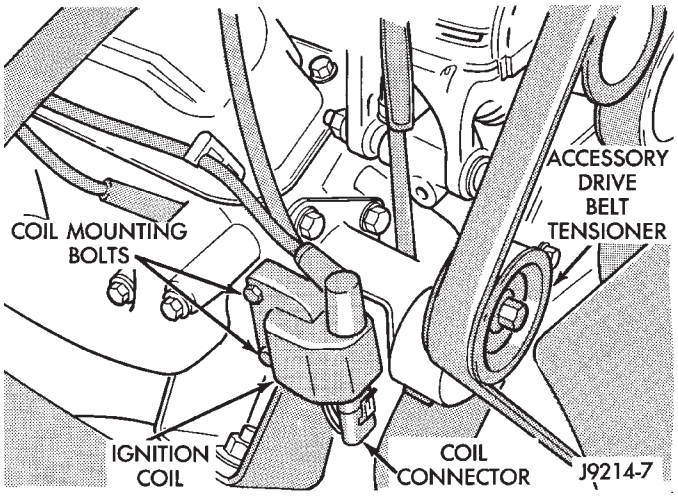

Fig. 9 Ignition Coil—5.2L Engine—Typical

For component testing, refer to the Diagnostics/Service Procedures section of this group.

For removal and installation of this component, refer to the Component Removal/Installation section of this group.

ENGINE COOLANT TEMPERATURE SENSOR

The sensor provides an input voltage to the Powertrain Control Module (PCM) relating coolant temperature. The PCM uses this input, along with inputs from other sensors, to determine injector pulse width and ignition timing. As coolant temperature varies, the coolant temperature sensor resistance will change, resulting in a different input voltage to the PCM.

When the engine is cold, the PCM will operate in the Open Loop Cycle. It will demand slightly richer air-fuel mixtures and higher idle speeds, until normal operating temperatures are reached. Refer to Modes Of Operation in Group 14, Fuel System for a description of Open and Closed Loop operation.

This sensor is installed in the thermostat housing on 4.0L 6 cylinder engines (Fig. 10).

This sensor is installed in the intake manifold near the thermostat housing on 5.2L V-8 engines (Fig. 11).

For component testing, refer to the Diagnostics/Service Procedures section of this group.

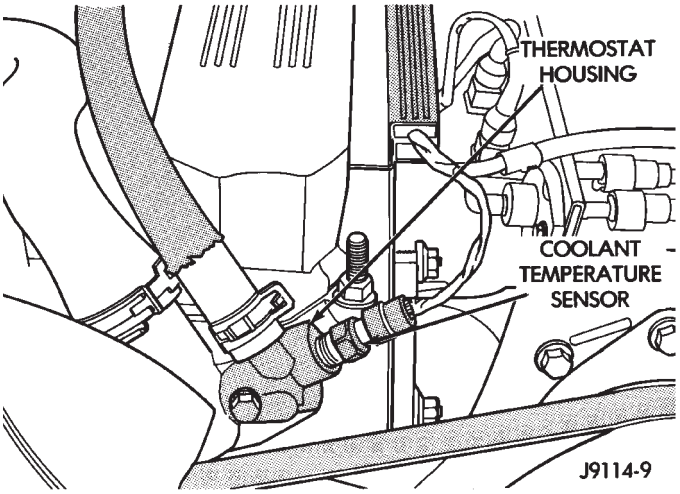

Fig. 10 Coolant Temperature Sensor—4.0L Engine

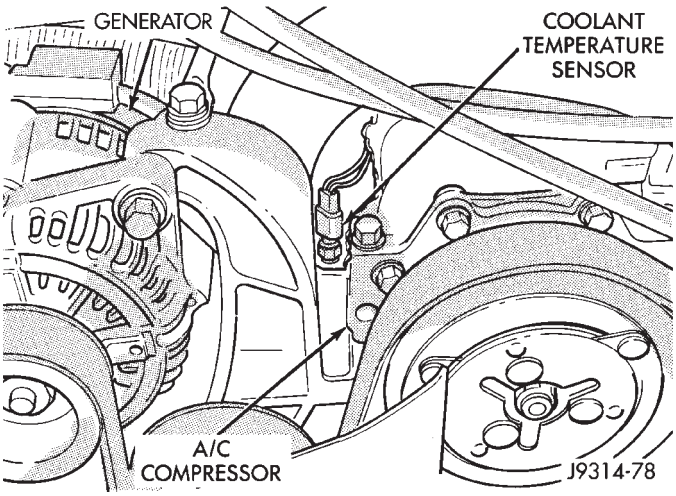

Fig. 11 Coolant Temperature Sensor—5.2L Engine

For removal and installation of this component, refer to the Component Removal/Installation section of this group.

INTAKE MANIFOLD CHARGE AIR TEMPERATURE SENSOR

The sensor element extends into the intake manifold air stream. It provides an input voltage to the Powertrain Control Module (PCM) indicating intake manifold air temperature. The input from this sensor is used along with inputs from other sensors to determine injector pulse width. As the temperature of the air-fuel stream in the manifold varies, the sensor resistance will change. This will result in a different input voltage to the PCM. For more information, refer to Group 14, Fuel System.

This sensor is installed in the intake manifold (Fig. 12, 4.0L engine or Fig. 13, 5.2L engine).

For component testing, refer to the Diagnostics/Service Procedures section of this group.

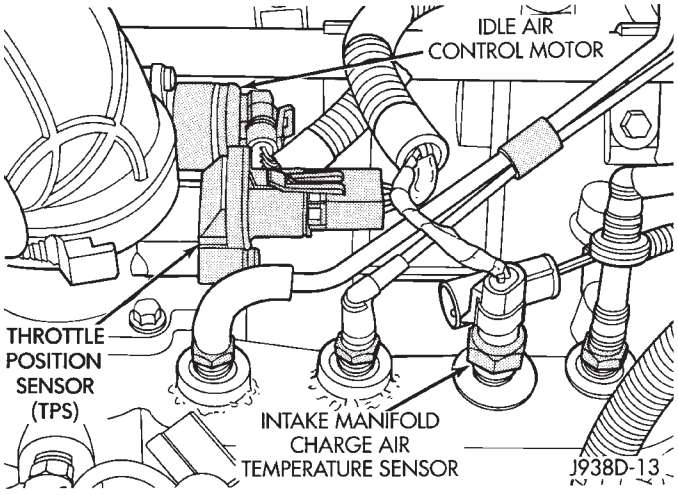

Fig. 12 Sensor Location—4.0L Engine

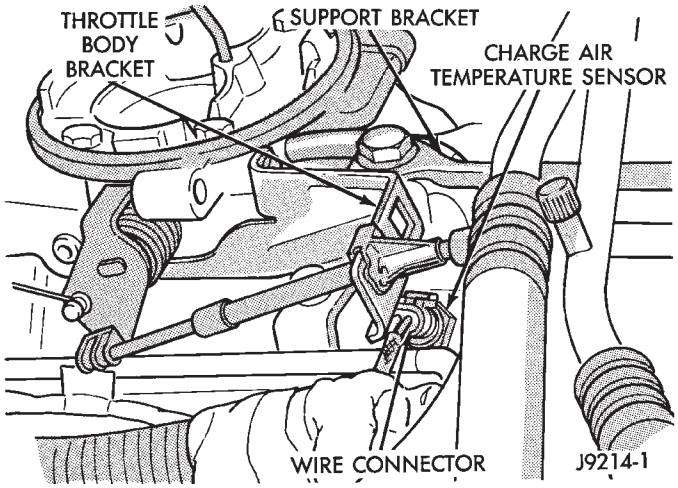

Fig. 13 Sensor Location—5.2L Engine—Typical

For removal and installation of this component, refer to the Component Removal/Installation section of this group.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

The MAP sensor reacts to absolute pressure in the intake manifold and provides an input voltage to the Powertrain Control Module (PCM). As engine load changes, manifold pressure varies, causing the MAP sensor voltage to change. This change results in a different input voltage to the PCM. The input voltage level supplies the PCM with information. This relates to ambient barometric pressure during engine start-up (cranking) and to engine load while the engine is running. The PCM uses this input, along with inputs from other sensors, to adjust air-fuel mixture.

For more information, refer to Group 14, Fuel System.

On 4.0L 6 cylinder engines, the MAP sensor is mounted on the dash panel (Fig. 14). It is connected to the throttle body with a vacuum hose and to the PCM electrically.

On 5.2L V-8 engines, the MAP sensor is mounted to the throttle body (Fig. 15). It is connected to the throttle body with an L-shaped rubber fitting and to the PCM electrically.

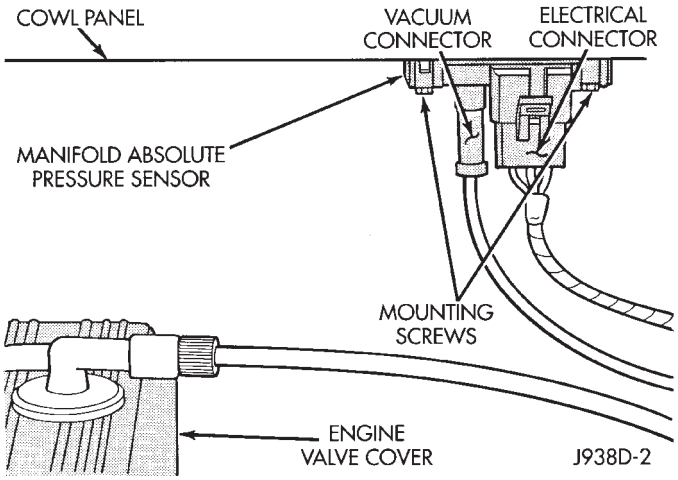

Fig. 14 MAP Sensor—4.0L Engine

For component testing, refer to the Diagnostics/Service Procedures section of this group.

For removal and installation of this component, refer to the Component Removal/Installation section of this group.

POWERTRAIN CONTROL MODULE (PCM)

The PCM (formerly called the SBEC or engine controller) is located in the right/rear side of the engine compartment (Fig. 16).

The ignition system is controlled by the PCM.

Base ignition timing by rotation of distributor is not adjustable. The PCM opens and closes the ignition coil ground circuit to operate the ignition coil.

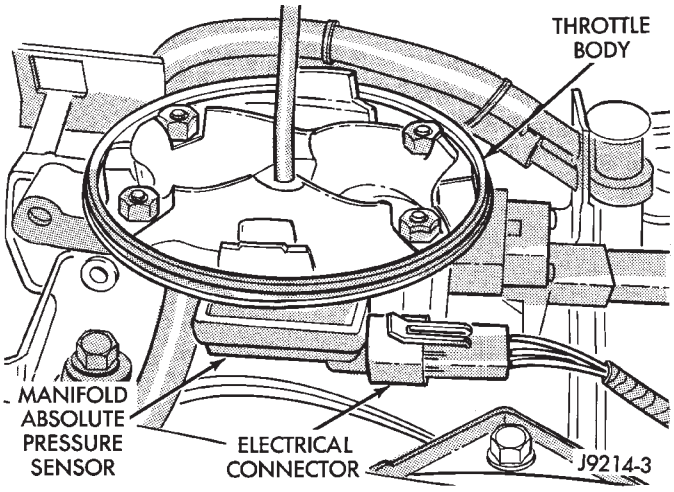

Fig. 15 MAP Sensor—5.2L Engine

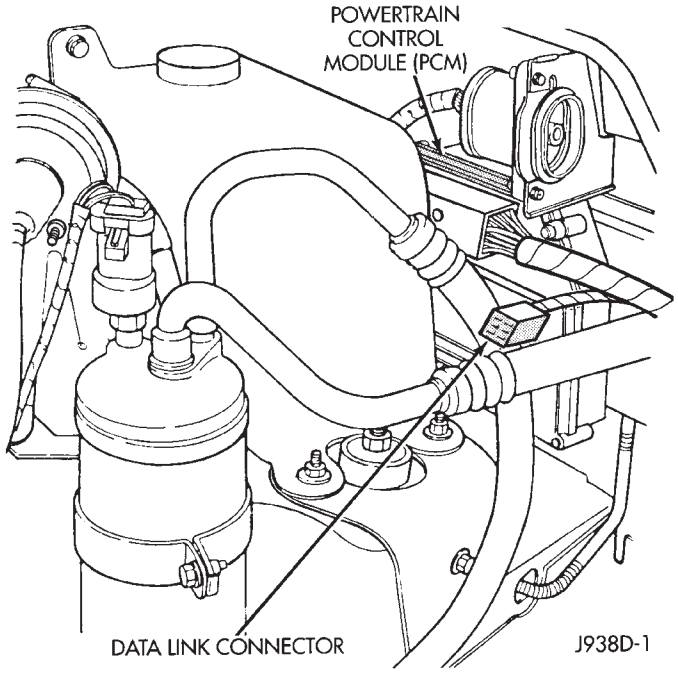

Fig. 16 PCM Location

This is done to adjust ignition timing, both initial (base) and advance, for changing engine operating conditions.

The amount of electronic spark advance provided by the PCM is determined by five input factors: Coolant temperature, engine rpm, intake manifold air temperature, manifold absolute pressure and throttle position.

For removal and installation of this component, refer to the Component Removal/Installation section of this group.

For diagnostics, refer to the appropriate Powertrain Diagnostic Procedures service manual for operation of the DRB II scan tool.

THROTTLE POSITION SENSOR

The sensor is mounted on the throttle body (Figs. 17 or 18). It is connected to the throttle blade shaft. The sensor is a variable resistor. It provides the Powertrain Control Module (PCM) with an input signal (voltage) that represents throttle blade position. As the position of the throttle blade changes, the resistance of the sensor changes.

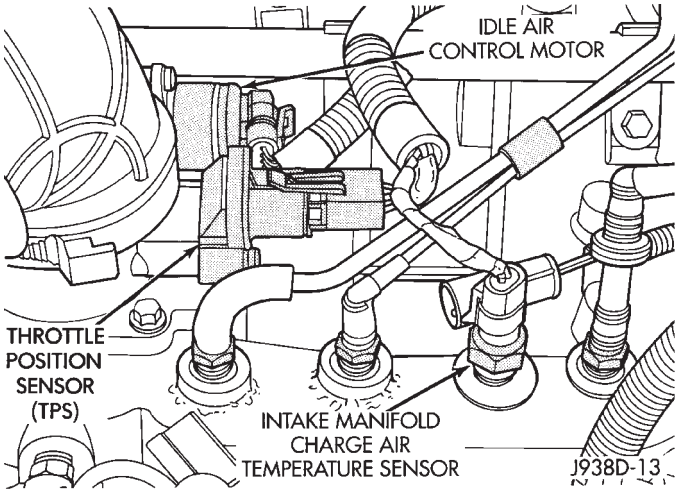

Fig. 17 Throttle Position Sensor—4.0L Engine

The PCM supplies approximately 5 volts to the sensor. The sensor output voltage (input signal to the PCM) represents the throttle blade position. The PCM receives an input signal voltage from the sensor. This will vary in an approximate range of from 1 volt at minimum throttle opening (idle), to 4 volts at wide open throttle. Along with inputs from other sensors, the PCM uses the sensor input to determine current engine operating conditions. It also will adjust fuel injector pulse width and ignition timing.

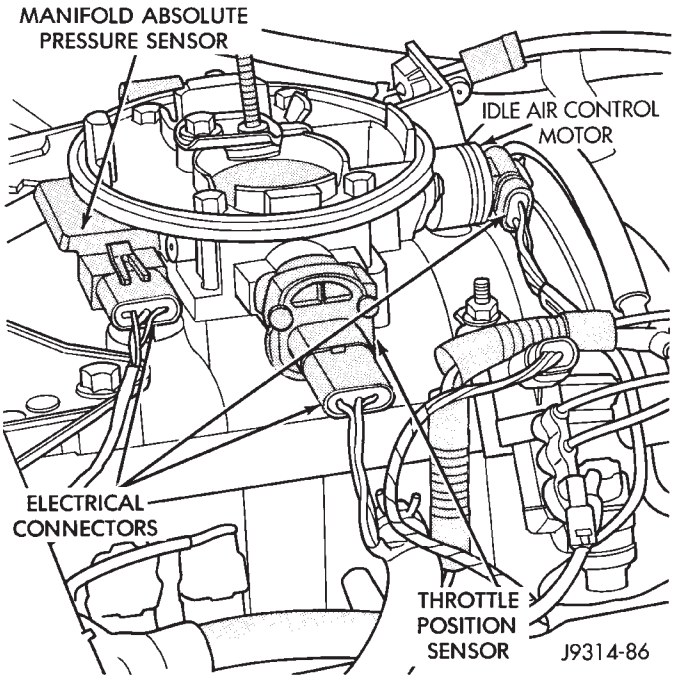

Fig. 18 Throttle Position Sensor—5.2L Engine—Typical

For component testing, refer to the Diagnostics/Service Procedures section of this group.

For removal and installation of this component, refer to the Component Removal/Installation section of this group.

DIAGNOSTICS/SERVICE PROCEDURES

INDEX

GENERAL INFORMATION

This section of the group, Diagnostics/Service Procedures, will discuss basic ignition system diagnostics and service adjustments.

For system operation and component identification, refer to the Component Identification/System Operation section of this group.

For removal or installation of ignition system components, refer to the Component Removal/Installation section of this group.

For other useful information, refer to On-Board Diagnostics in the General Diagnosis sections of Group 14, Fuel System in this manual.

For operation of the DRB II Diagnostic Scan Tool, refer to the appropriate Powertrain Diagnostic Procedures service manual.

AUTOMATIC SHUT DOWN (ASD) RELAY

Refer to Relays—Operation/Testing in the Group 14, Fuel System section of this service manual.

CAMSHAFT POSITION SENSOR TEST

The camshaft position sensor is located in the distributor on all engines.

To perform a complete test of this sensor and its circuitry, refer to the DRB II diagnostic scan tool. Also refer to the appropriate Powertrain Diagnostics Procedures manual. To test the sensor only, refer to the following:

4.0L OR 5.2L ENGINE

For this test, an analog voltmeter is needed. Do not remove the distributor connector from the distributor. Using small paper clips, insert them into the backside of the distributor wire harness connector to make contact with the terminals. Be sure that the connector is not damaged when inserting the paper clips. Attach voltmeter leads to these paper clips.

(1) Connect the positive (+) voltmeter lead into the sensor output wire. This is at done the distributor wire harness connector. For wire identification, refer to Group 8W, Wiring Diagrams.

(2) Connect the negative (-) voltmeter lead into the ground wire. For wire identification, refer to Group 8W, Wiring Diagrams.

(3) Set the voltmeter to the 15 Volt DC scale.

4.0L Engines: Remove distributor cap. Rotate (crank) engine with starter until pulse ring (Fig. 1) enters the magnetic pickup on camshaft position sensor. Distributor rotor should be pointed in 9 o'clock position. The movable pulse ring should now be within the sensor pickup.

5.2L Engines: Remove coil high-tension cable and all spark plug cables at distributor cap. Note and mark position of cables before removal (Fig. 2). Remove distributor cap from distributor (two screws). Rotate (crank) the engine until the distributor rotor is pointed towards the rear of vehicle. The movable pulse ring should now be within the sensor pickup.

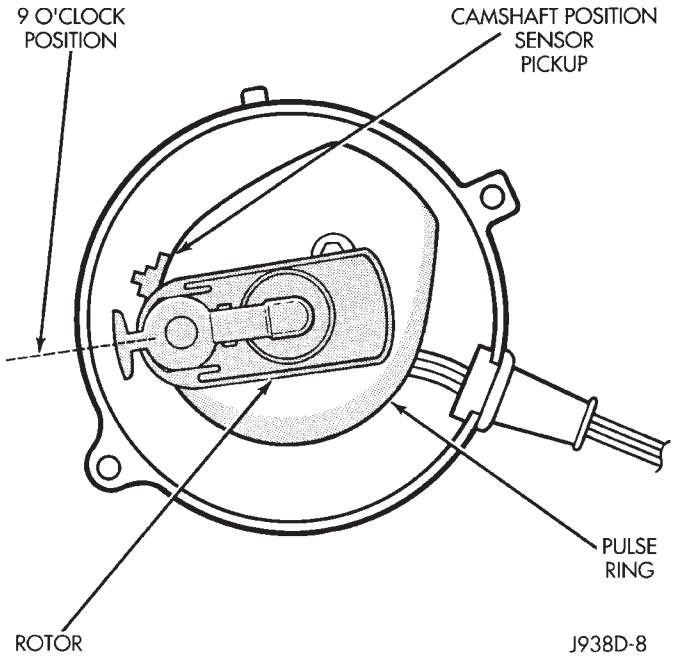

Fig. 1 Pulse Ring/Rotor Position—4.0L Engine

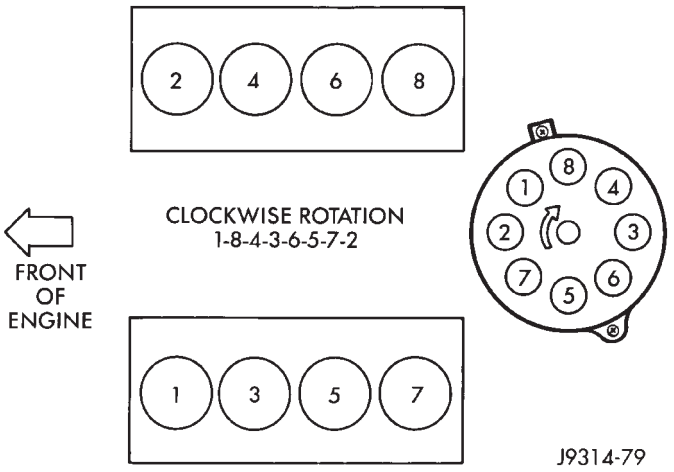

Fig. 2 Engine Firing Order—5.2L Engine

(4) Turn ignition key to ON position. Voltmeter should read approximately 5.0 volts.

(5) If voltage is not present, check the voltmeter leads for a good connection.

(6) If voltage is still not present, check for voltage at the supply wire. For wire identification, refer to Group 8W, Wiring Diagrams.

(7) If voltage is not present at supply wire, check for voltage at pin 7 of Powertrain Control Module (PCM) 60-way connector. Leave the PCM connector connected for this test.

(8) If voltage is still not present, perform vehicle test using the DRB II diagnostic scan tool.

(9) If voltage is present at pin 7, but not at the supply wire:

(a) Check continuity between the supply wire. This is checked between the distributor connector and pin 7 at the PCM. If continuity is not present, repair the harness as necessary.

(b) Check for continuity between the camshaft position sensor output wire and pin 44 at the PCM. If continuity is not present, repair the harness as necessary.

(c) Check for continuity between the ground circuit wire at the distributor connector and ground. If continuity is not present, repair the harness as necessary.

(10) While observing the voltmeter, crank the engine with ignition switch. The voltmeter needle should fluctuate between 0 and 5 volts while the engine is cranking. This verifies that the camshaft position sensor in the distributor is operating properly and a sync pulse signal is being generated.

If sync pulse signal is not present, replacement of the camshaft position sensor is necessary.

For removal or installation of ignition system components, refer to the Component Removal/Installation section of this group.

For system operation and component identification, refer to the Component Identification/System Operation section of this group.

CRANKSHAFT POSITION SENSOR TEST

To perform a complete test of this sensor and its circuitry, refer to the DRB II diagnostic scan tool. Also refer to the appropriate Powertrain Diagnostics Procedures manual. To test the sensor only, refer to the following:

On the 4.0L engine, the sensor is located on the transmission bellhousing at the left/rear side of the engine block (Fig. 3).

On the 5.2L engine, the sensor is located on the top of cylinder block near the rear of right cylinder head (Fig. 4).

(1) Near the rear of intake manifold, disconnect sensor pigtail harness connector from main wiring harness.

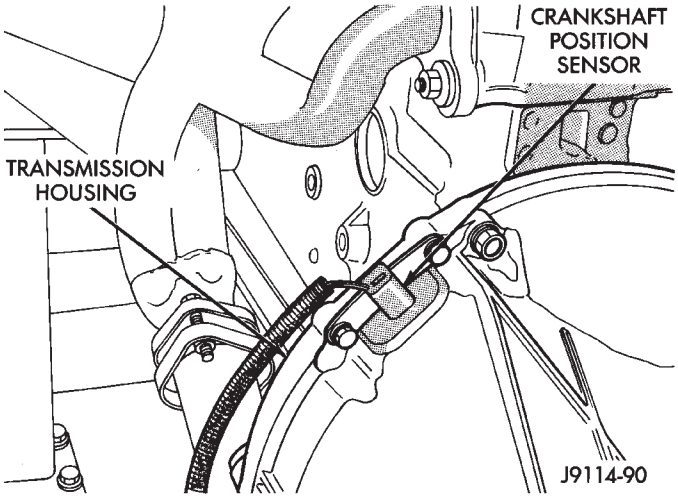

Fig. 3 Crankshaft Position Sensor—4.0L Engine

(2) Place an ohmmeter across terminals B and C (Fig. 5). Ohmmeter should be set to 1K-to-10K scale for this test. The meter reading should be open (no resistance). Replace sensor if a low resistance is indicated.

DISTRIBUTOR CAP

INSPECTION

Remove the distributor cap and wipe it clean with a dry lint free cloth. Visually inspect the cap for cracks, carbon paths, broken towers, or damaged rotor button (Figs. 6 and 7). Also check for white deposits on the inside (caused by condensation entering the cap through cracks). Replace any cap that displays charred or eroded terminals. The machined surface of a terminal end (faces toward rotor) will indicate some evidence of erosion from normal operation. Examine the terminal ends for evidence of mechanical interference with the rotor tip.

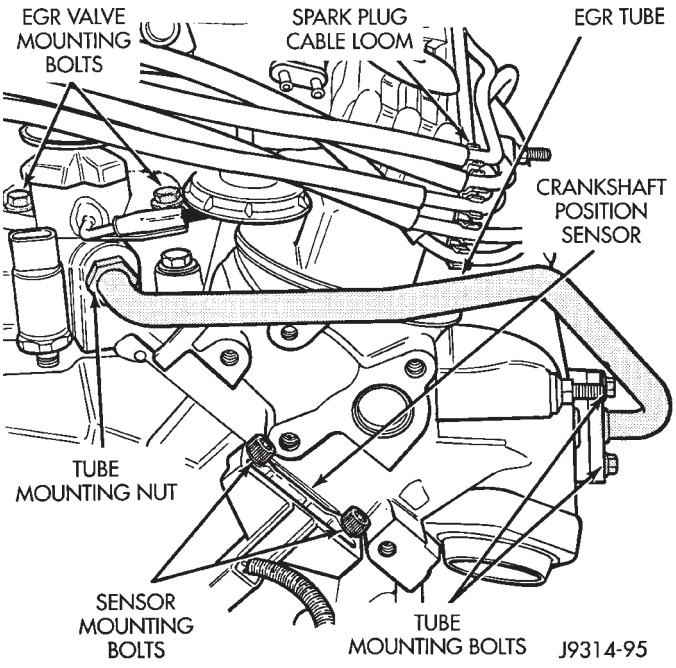

Fig. 4 Crankshaft Position Sensor—5.2L Engine—Typical

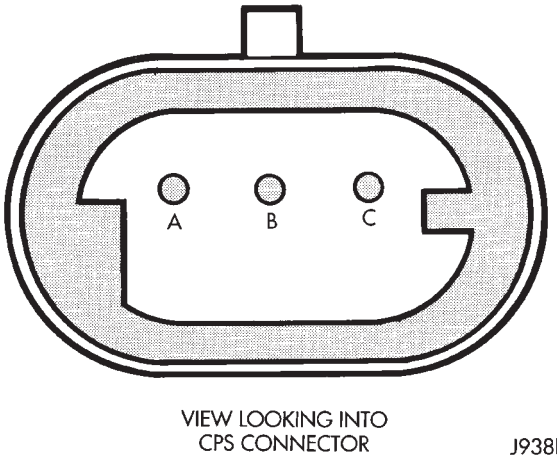

Fig. 5 Crankshaft Position Sensor Connector

If replacement of the distributor cap is necessary, transfer spark plug cables from the original cap to the new cap. This should be done one cable at a time. Each cable is installed onto the tower of the new cap that corresponds to its tower position on the original cap. Fully seat the cables onto the towers. If necessary, refer to the Engine Firing Order diagrams (Figs. 8 or 9).

DISTRIBUTOR ROTOR

Visually inspect the rotor (Figs. 10 or 11) for cracks, evidence of corrosion, or the effects of arcing on the metal tip. Also check for evidence of mechanical interference with the cap. Some charring is normal on the end of the metal tip. The silicone-dielectric-varnish-compound applied to the rotor tip for radio interfer-

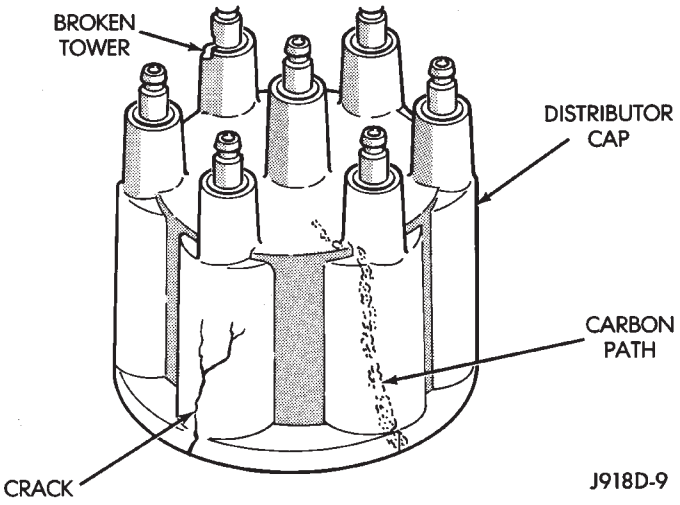

Fig. 6 Cap Inspection—External—Typical

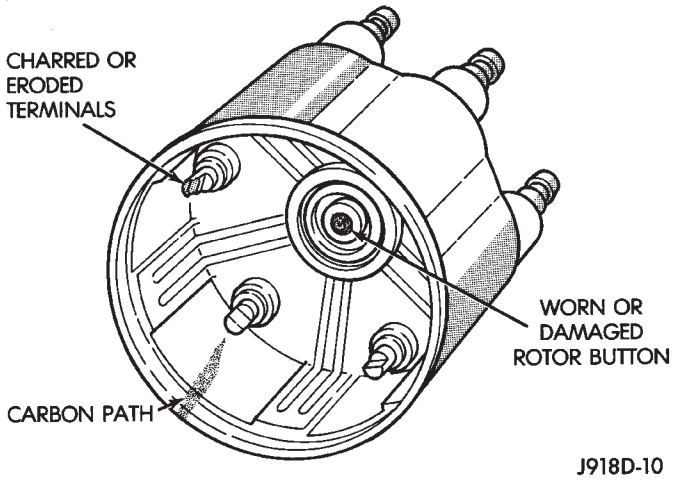

Fig. 7 Cap Inspection—Internal—Typical

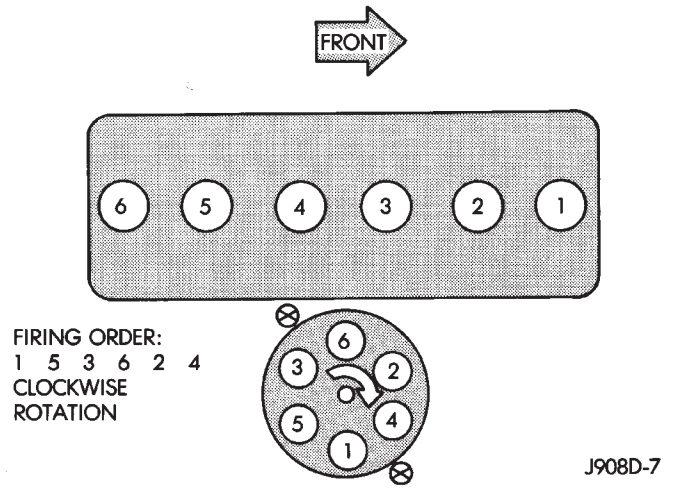

Fig. 8 Engine Firing Order—4.0L Engine

ence noise suppression, will appear charred. This is normal. **Do not remove the**

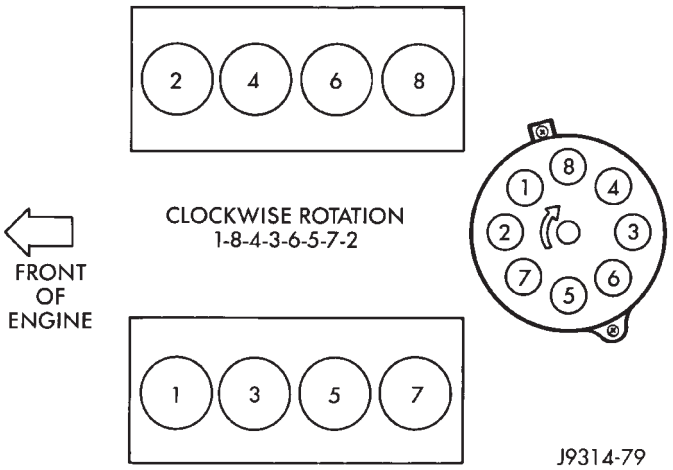

Fig. 9 Engine Firing Order—5.2L Engine

charred compound. Test the spring for insufficient tension. Replace a rotor that displays any of these adverse conditions.

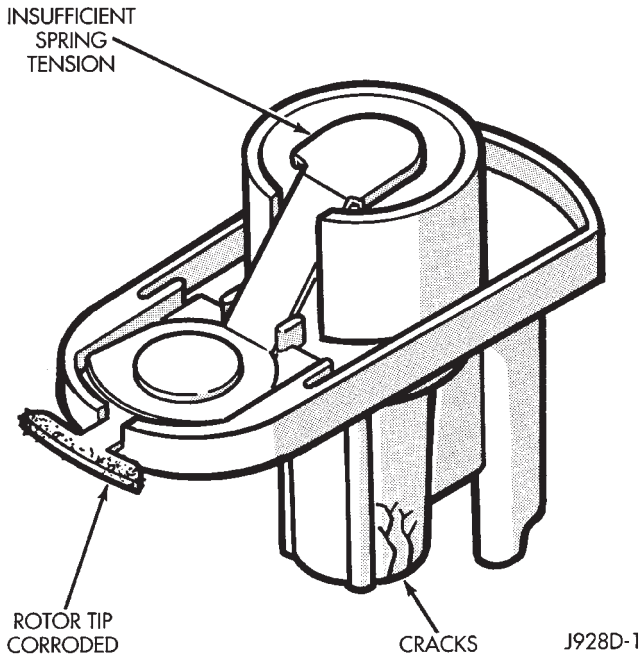

Fig. 10 Rotor Inspection—4.0L Engine—Typical

IGNITION COIL

To perform a complete test of the ignition coil and its circuitry, refer to the DRB II diagnostic scan tool. Also refer to the appropriate Powertrain Diagnostics Procedures manual. To test the coil only, refer to the following:

The ignition coil (Figs. 12 or 13) is designed to operate without an external ballast resistor.

Inspect the ignition coil for arcing. Test the coil according to coil tester manufacturer's instructions. Test the coil primary and secondary resistance. Replace any coil that does not meet specifications. Refer to the Ignition Coil Resistance chart.

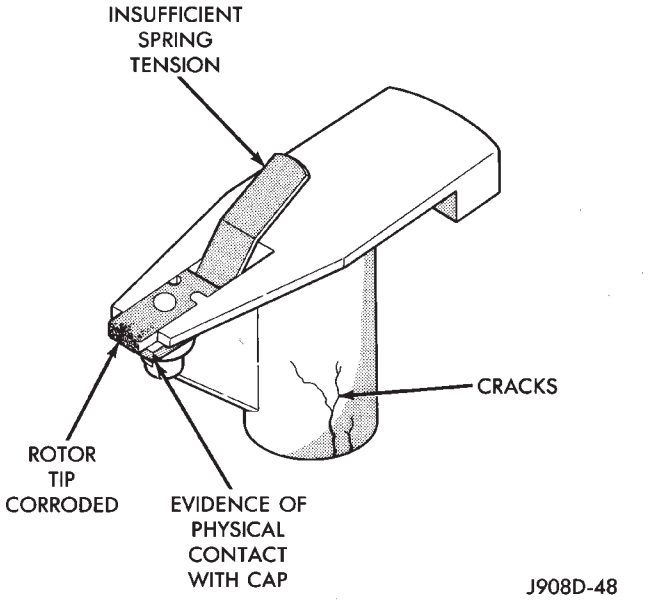

Fig. 11 Rotor Inspection—5.2L Engine—Typical

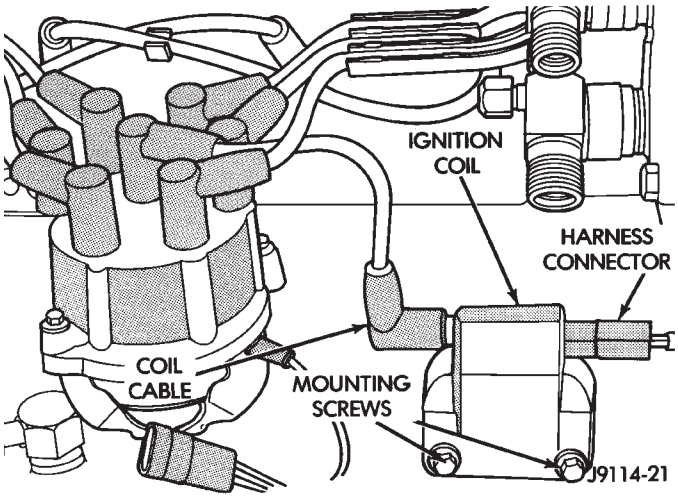

Fig. 12 Ignition Coil—4.0L Engine

If the ignition coil is being replaced, the secondary spark plug cable must also be checked. Replace cable if it has been burned or damaged.

Arcing at the tower will carbonize the cable nipple, which if it is connected to a new ignition coil, will cause the coil to fail.

If the secondary coil cable shows any signs of damage, it should be replaced with a new cable and new terminal. Carbon tracking on the old cable can cause arcing and the failure of a new ignition coil.

ENGINE COOLANT TEMPERATURE SENSOR TEST

To perform a complete test of this sensor and its circuitry, refer to the DRB II diagnostic scan tool.

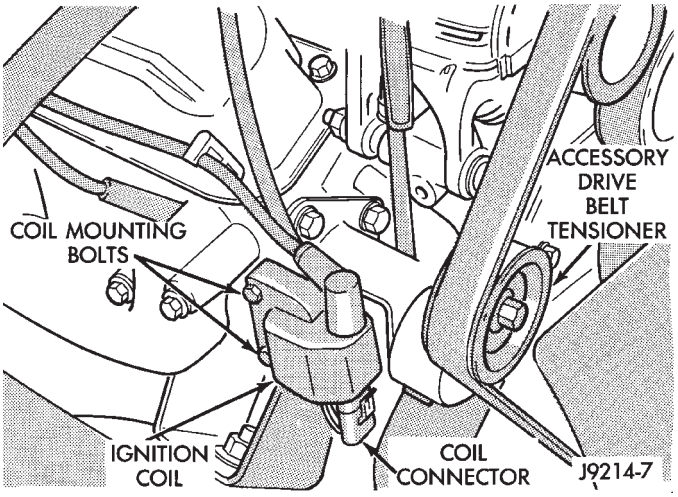

Fig. 13 Ignition Coil—5.2L Engine

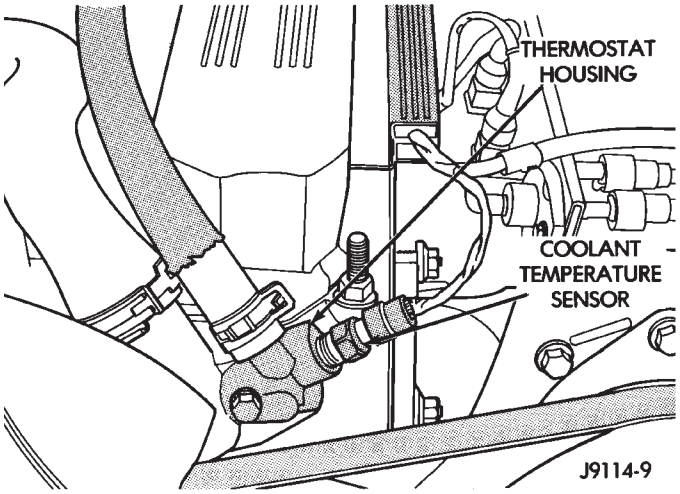

Fig. 14 Coolant Temperature Sensor—4.0L Engine

IGNITION COIL RESISTANCE

COIL (MANUFACTURER)	PRIMARY RESISTANCE 21–27°C (70–80°F)	SECONDARY RESISTANCE 21–27°C (70–80°F)
Diamond	0.97 - 1.18 Ohms	11,300 - 15,300 Ohms
Toyodenso	0.95 - 1.20 Ohms	11,300 - 13,300 Ohms

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Also refer to the appropriate Powertrain Diagnostics Procedures manual. To test the sensor only, refer to the following:

4.0L Engines: The sensor is installed in the thermostat housing (Fig. 14).

5.2L Engines: The sensor is located in a water passage of the intake manifold next to the thermostat housing (Fig. 15).

(1) Disconnect wire harness connector from sensor (Figs. 14 or 15). On 5.2L engines with air conditioning, do not pull directly on wiring harness. Fabricate an L-shaped hook tool from a coat hanger (approximately eight inches long). Place the hook part of tool under the connector for removal. The connector is snapped onto the sensor. It is not equipped with a lock type tab.

(2) Test the resistance of the sensor with a high input impedance (digital) volt-ohmmeter. The resistance should be less than 1340 ohms at normal engine operating idle temperature. For resistance values, refer to the Sensor Resistance chart. Replace the sensor if it is not within the range of resistance specified in the chart.

(3) Test continuity of the wire harness. This is done between Powertrain Control Module (PCM) wire harness connector terminal-2 and the sensor connector terminal. Also check continuity between wire harness terminal-4 to the sensor connector terminal. Repair the wire harness if an open circuit is indicated.

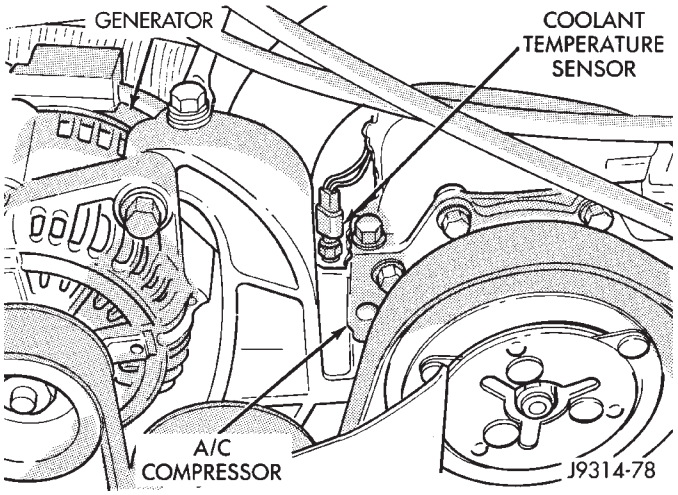

Fig. 15 Coolant Temperature Sensor—5.2L Engine

SENSOR RESISTANCE (OHMS)

TEMPERATURE		RESISTANCE (OHMS)	
C	F	MIN	MAX
−40	−40	291,490	381,710
−20	−4	85,850	108,390
−10	14	49,250	61,430
0	32	29,330	35,990
10	50	17,990	21,810
20	68	11,370	13,610
25	77	9,120	10,880
30	86	7,370	8,750
40	104	4,900	5,750
50	122	3,330	3,880
60	140	2,310	2,670
70	158	1,630	1,870
80	176	1,170	1,340
90	194	860	970
100	212	640	720
110	230	480	540
120	248	370	410

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IGNITION SECONDARY CIRCUIT DIAGNOSIS

CHECKING FOR SPARK

CAUTION: When disconnecting a high voltage cable from a spark plug or from the distributor cap, twist the rubber boot slightly (1/2 turn) to break it loose. Grasp the boot (not the cable) and pull it off with a steady, even force.

(1) Disconnect the ignition coil secondary cable from center tower of the distributor cap. Hold the cable terminal approximately 12 mm (1/2 in.) from a good engine ground (Fig. 16).

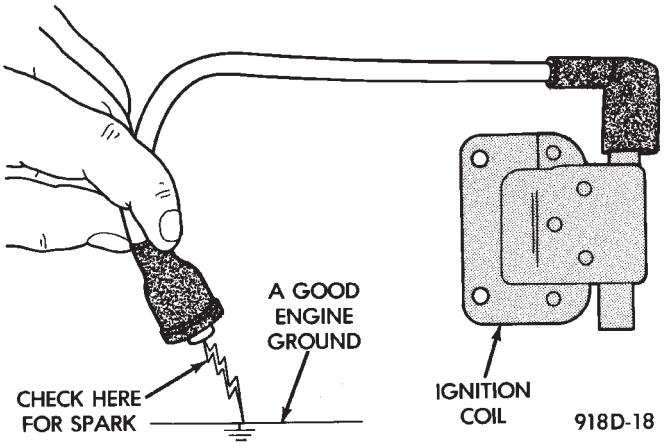

Fig. 16 Checking for Spark—Typical

WARNING: BE VERY CAREFUL WHEN THE ENGINE IS CRANKING. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR THE FAN. DO NOT WEAR LOOSE FITTING CLOTHING.

(2) Rotate (crank) the engine with the starter motor and observe the cable terminal for a steady arc. If steady arcing does not occur, inspect the secondary coil cable. Refer to Spark Plug Cables in this group. Also inspect the distributor cap and rotor for cracks or burn marks. Repair as necessary. If steady arcing occurs, connect ignition coil cable to the distributor cap.

(3) Remove a cable from one spark plug.

(4) Using insulated pliers, hold the cable terminal approximately 12 mm (1/2 in.) from the engine cylinder head or block while rotating the engine with the starter motor. Observe the spark plug cable terminal for an arc. If steady arcing occurs, it can be expected that the ignition secondary system is operating correctly. If steady arcing occurs at the spark plug cables, but the engine will not start, connect the DRB II diagnostic scan tool. Refer to the Powertrain Diagnostic Procedures service manual.

FAILURE TO START TEST

To prevent unnecessary diagnostic time and wrong test results, the previous Checking For Spark test should be performed prior to this test.

WARNING: SET PARKING BRAKE OR BLOCK THE DRIVE WHEELS BEFORE PROCEEDING WITH THIS TEST.

(1) Unplug the ignition coil harness connector at the coil (Figs. 17 or 18).

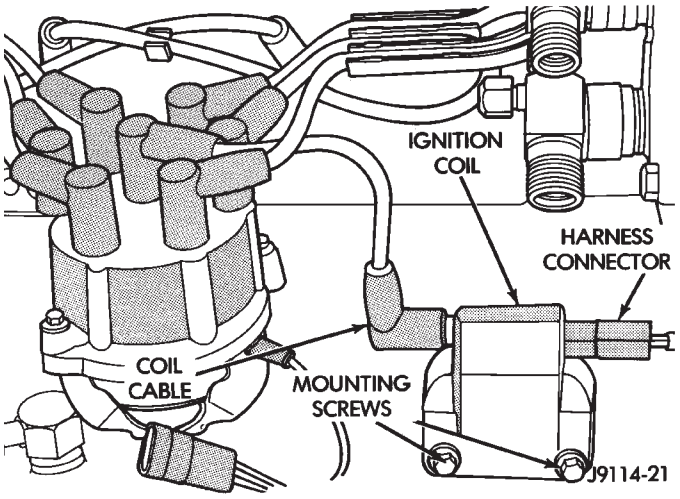

Fig. 17 Coil Harness Connector—4.0L Engine—Typical

(2) Connect a set of small jumper wires (18 gauge or smaller) between the ignition coil and coil electrical connector (Fig. 19).

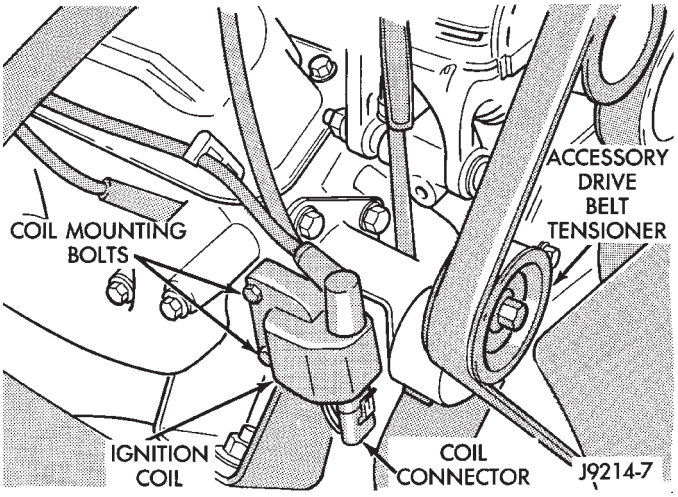

Fig. 18 Coil Harness Connector—5.2L Engine—Typical

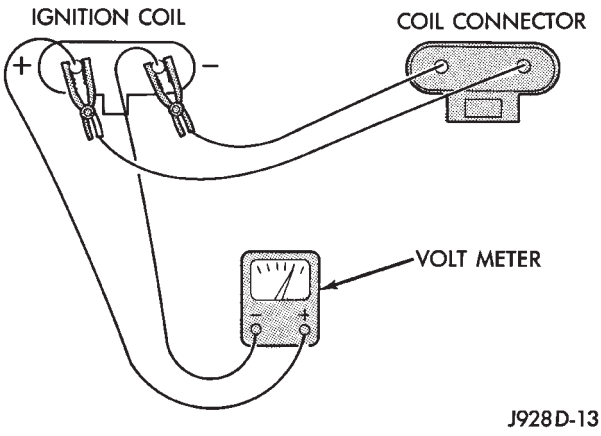

Fig. 19 Coil Terminals—Typical

(3) Determine that sufficient battery voltage (12.4 volts) is present for the starting and ignition systems.

(4) Crank the engine for 5 seconds while monitoring the voltage at the coil positive terminal (Fig. 19):

- If the voltage remains near zero during the entire period of cranking, refer to On-Board Diagnostics in Group 14, Fuel Systems. Check the powertrain control module and auto shutdown relay.
- If voltage is at near battery voltage and drops to zero after 1-2 seconds of cranking, check the camshaft position sensor-to-powertrain control module circuit. Refer to On-Board Diagnostics in group 14, Fuel Systems.
- If voltage remains at near battery voltage during the entire 5 seconds, turn the key off. Remove the 60-way connector (Fig. 20) from the powertrain control module (PCM). Check 60-way connector for any spread terminals.

(5) Remove test lead from the coil positive terminal. Connect an 18 gauge jumper wire between the battery positive terminal and the coil positive terminal.

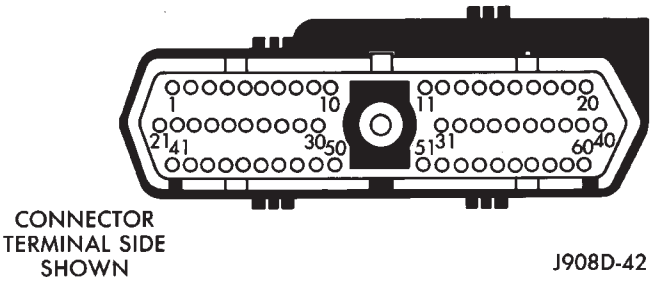

Fig. 20 PCM 60-Way Connector

(6) Make the special jumper shown in Figure 21. Using the jumper, **momentarily** ground terminal-19 of the 60-way connector. A spark should be generated at the coil cable when the ground is removed.

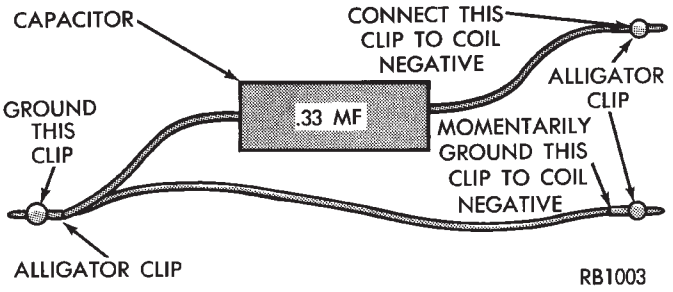

Fig. 21 Special Jumper Ground-to-Coil Negative Terminal

(7) If spark is generated, replace the powertrain control module (PCM).

(8) If spark is not seen, use the special jumper to ground the coil negative terminal directly.

(9) If spark is produced, repair wiring harness for an open condition.

(10) If spark is not produced, replace the ignition coil.

IGNITION TIMING

Base (initial) ignition timing is NOT adjustable on any of the 4.0L 6 cylinder or 5.2L V-8 engines. Do not attempt to adjust ignition timing by rotating the distributor.

All ignition timing functions are controlled by the powertrain control module (PCM). Refer to On-Board Diagnostics in the Multi-Port Fuel Injection—General Diagnosis section of Group 14, Fuel Systems for more information. Also refer to the appropriate Powertrain Diagnostics Procedures service manual for operation of the DRB II Scan Tool.

INTAKE MANIFOLD CHARGE AIR TEMPERATURE SENSOR TEST

To perform a complete test of this sensor and its circuitry, refer to the DRB II diagnostic scan tool. Also refer to the appropriate Powertrain Diagnostics Procedures manual. To test the sensor only, refer to the following:

(1) Disconnect the wire harness connector from the sensor (Figs. 22 or 23).

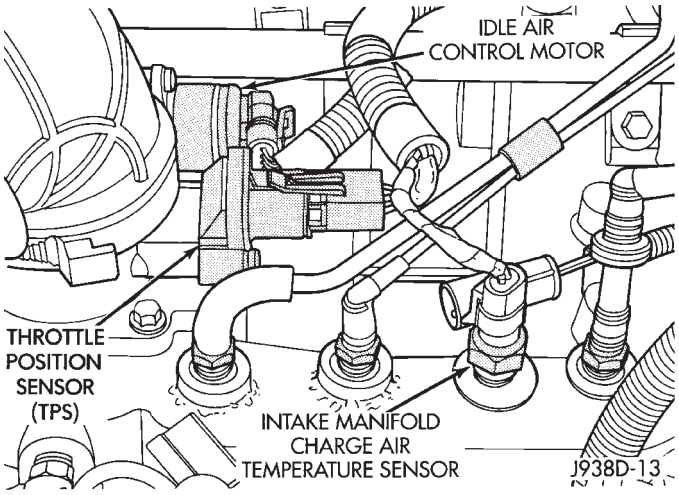

Fig. 22 Air Temperature Sensor—4.0L Engine

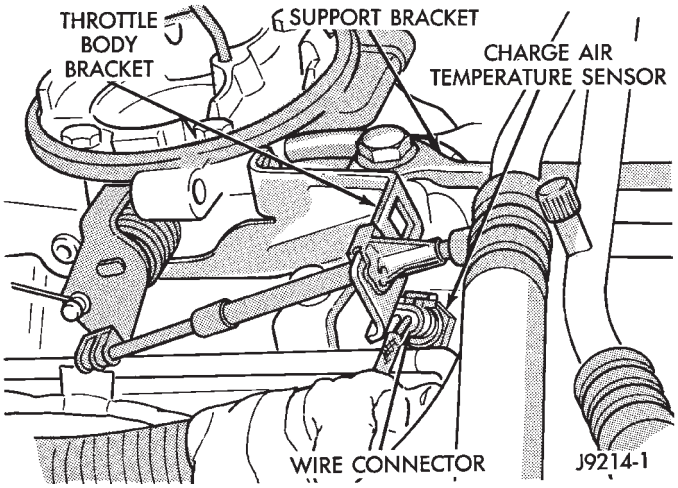

Fig. 23 Air Temperature Sensor—5.2L Engine—Typical

(2) Test the resistance of the sensor with a input impedance (digital) volt-ohmmeter. Do not remove the sensor from the engine for testing. For resistance values, refer to the Sensor Resistance chart. Replace the sensor if it is not within the range of resistance specified in the chart.

(3) Test the resistance of the wire harness. This is done between the Powertrain Control Module (PCM) wire harness connector terminal-2 and the sensor connector terminal. Also check continuity between terminal-4 to the sensor connector terminal. Repair the wire harness as necessary if the resistance is greater than 1 ohm.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR TEST

To perform a complete test of this sensor and its circuitry, refer to the DRB II diagnostic scan tool. Also refer to the appropriate Powertrain Diagnostics Procedures manual. To test the sensor only, refer to the following:

SENSOR RESISTANCE (OHMS)

TEMPERATURE		RESISTANCE (OHMS)	
C	F	MIN	MAX
−40	−40	291,490	381,710
−20	−4	85,850	108,390
−10	14	49,250	61,430
0	32	29,330	35,990
10	50	17,990	21,810
20	68	11,370	13,610
25	77	9,120	10,880
30	86	7,370	8,750
40	104	4,900	5,750
50	122	3,330	3,880
60	140	2,310	2,670
70	158	1,630	1,870
80	176	1,170	1,340
90	194	860	970
100	212	640	720
110	230	480	540
120	248	370	410

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4.0L Engines: The MAP sensor is located on the cowl panel near the rear of the engine valve cover (Fig. 24).

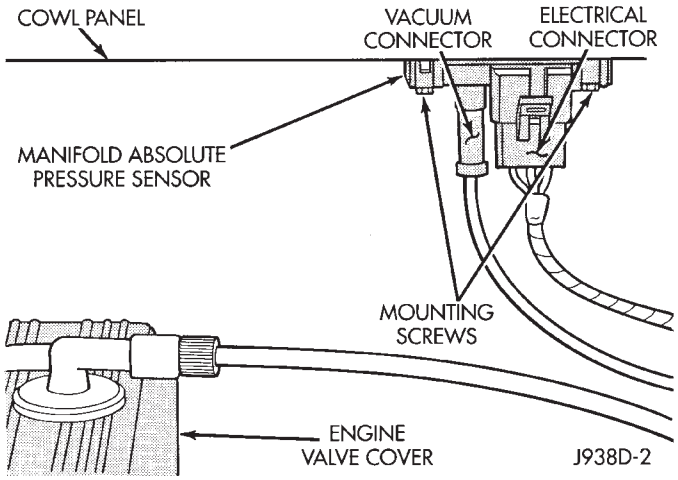

Fig. 24 MAP Sensor—4.0L Engine

5.2L Engine: The MAP sensor is located on the front of the throttle body (Fig. 25).

(1) 4.0L Engine: Inspect the sensor vacuum hose connections at the throttle body and sensor (Fig. 25). Repair as necessary.

5.2L Engines: Inspect the L-shaped rubber fitting located between the MAP sensor and throttle body (Fig. 26).

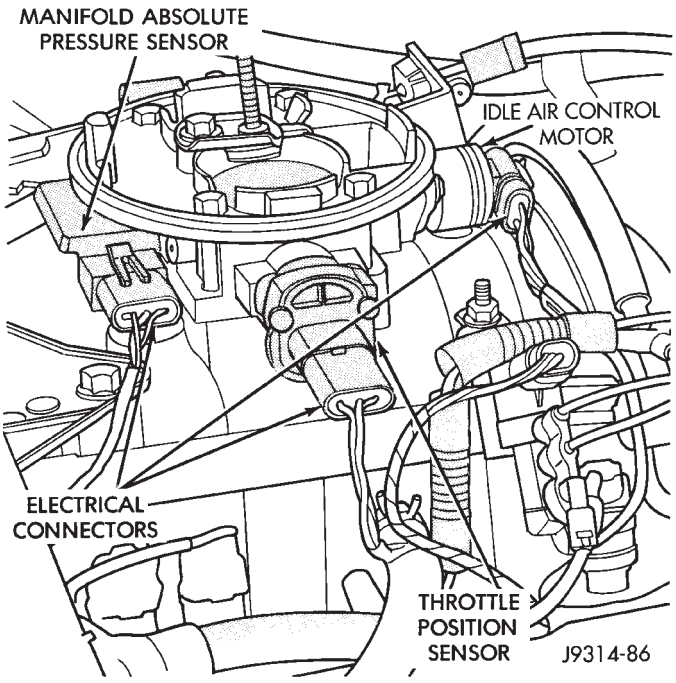

Fig. 25 MAP Sensor—5.2L Engine

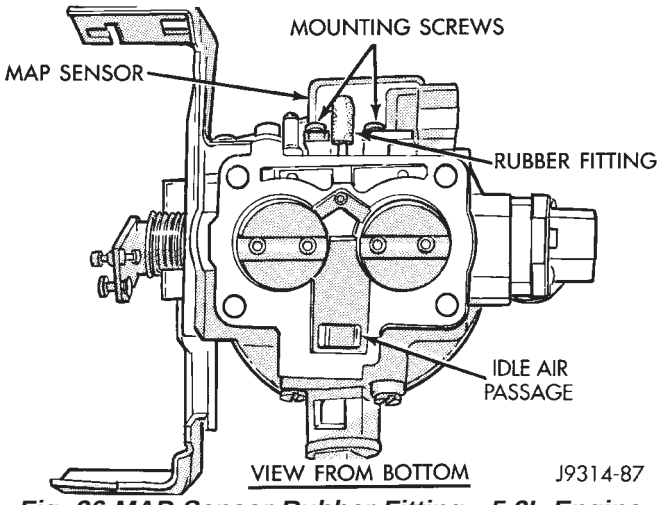

Fig. 26 MAP Sensor Rubber Fitting—5.2L Engine

CAUTION: When testing the sensor, be sure that the harness wires are not damaged by the test meter probes.

(2) Test the sensor output voltage at the sensor connector between terminals A and B as marked on the sensor body (Fig. 27). This is done with the ignition switch ON and the engine OFF. Output voltage should be 4-to-5 volts. **The voltage should drop to 1.5-to-2.1 volts with a hot, neutral idle speed condition.**

(3) Test Powertrain Control Module (PCM) terminal-1 for the same voltage described above to verify the wire harness condition. Repair as necessary.

(4) Test sensor supply voltage at sensor connector between terminals A and C with the ignition ON. The

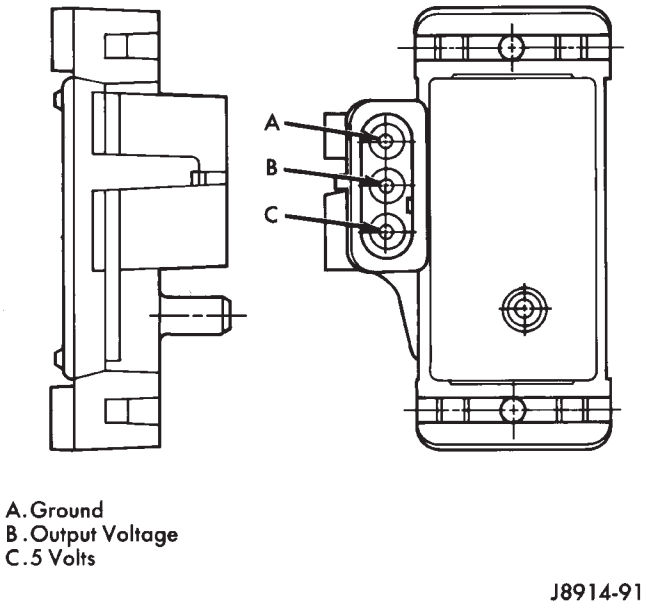

Fig. 27 MAP Sensor Test—Typical

voltage should be approximately 5 volts (±0.5V). Five volts (±0.5V) should also be at terminal-6 of the corresponding Powertrain Control Module (PCM) wire harness connector. Repair or replace the wire harness as necessary.

(5) Test the sensor ground circuit at sensor connector terminal-A and PCM connector terminal-4. Repair the wire harness if necessary.

(6) Test the sensor ground circuit at the PCM connector between terminal-4 and terminal-11 with an ohmmeter. If the ohmmeter indicates an open circuit, inspect for a defective sensor ground connection. Refer to Group 8W, Wiring for location of ground connection. If the ground connection is good, replace the PCM. If terminal-4 has a short circuit to 12 volts, correct this condition before replacing the PCM.

POWERTRAIN CONTROL MODULE (PCM)

The PCM (formerly called the SBEC or engine controller) is located in the right/rear side of the engine compartment.

The ignition system is controlled by the PCM.

For removal and installation of this component, refer to the Component Removal/Installation section of this group.

For diagnostics, refer to the appropriate Powertrain Diagnostic Procedures service manual for operation of the DRB II scan tool.

SPARK PLUGS

For spark plug removal, cleaning, gap adjustment and installation, refer to the Component Removal/Installation section of this group.

5.2L Engine: Spark plug heat shields are pressed into the cylinder head to surround each spark plug cable boot and spark plug (Fig. 28). These shields

protect the spark plug boots from damage (due to intense engine heat generated by the exhaust manifolds) and should not be removed. After the spark plug cable has been installed, the lip of the cable boot should have a small air gap to the top of the heat shield (Fig. 28).

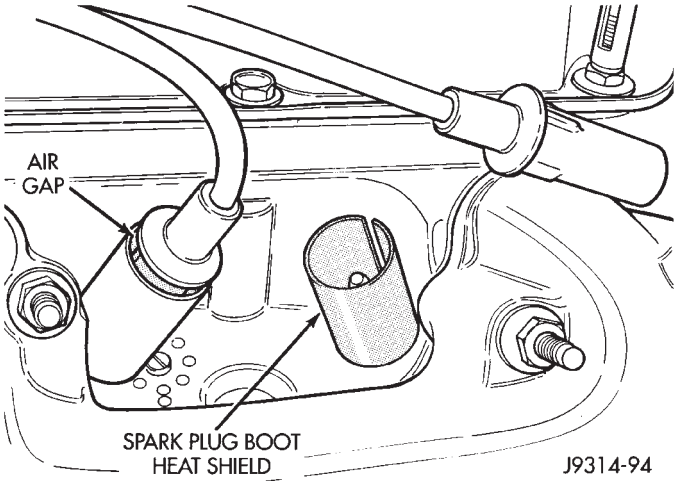

Fig. 28 Heat Shields—5.2L Engine

Faulty carbon and/or gas fouled plugs generally cause hard starting, but they will clean up at higher engine speeds. Faulty plugs can be identified in a number of ways: poor fuel economy, power loss, decrease in engine speed, hard starting and, in general, poor engine performance.

Remove the spark plugs and examine them for burned electrodes and fouled, cracked or broken porcelain insulators. Keep plugs arranged in the order in which they were removed from the engine. An isolated plug displaying an abnormal condition indicates that a problem exists in the corresponding cylinder. Replace spark plugs at the intervals recommended in the maintenance chart in Group 0, Lubrication and Maintenance.

Spark plugs that have low mileage may be cleaned and reused if not otherwise defective. Refer to the following Spark Plug Condition section of this group.

CONDITION

NORMAL OPERATING

The few deposits present on the spark plug will probably be light tan or slightly gray in color. This is evident with most grades of commercial gasoline (Fig. 29). There will not be evidence of electrode burning. Gap growth will not average more than approximately 0.025 mm (.001 in) per 1600 km (1000 miles) of operation. Spark plugs that have normal wear can usually be cleaned, have the electrodes filed, have the gap set and then be installed.

Some fuel refiners in several areas of the United States have introduced a manganese additive (MMT) for unleaded fuel. During combustion, fuel with MMT

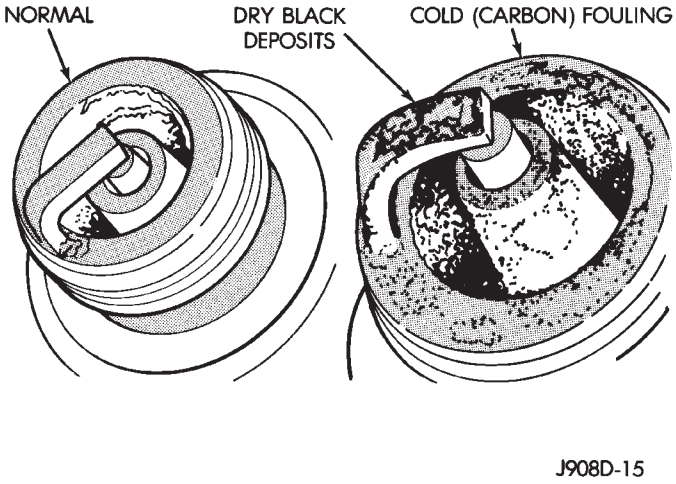

Fig. 29 Normal Operation and Cold (Carbon) Fouling

causes the entire tip of the spark plug to be coated with a rust colored deposit. This rust color can be misdiagnosed as being caused by coolant in the combustion chamber. Spark plug performance is not affected by MMT deposits.

COLD FOULING/CARBON FOULING

Cold fouling is sometimes referred to as carbon fouling. The deposits that cause cold fouling are basically carbon (Fig. 29). A dry, black deposit on one or two plugs in a set may be caused by sticking valves or defective spark plug cables. Cold (carbon) fouling of the entire set of spark plugs may be caused by a clogged air filter or repeated short operating times (short trips).

ELECTRODE GAP BRIDGING

Electrode gap bridging may be traced to loose deposits in the combustion chamber. These deposits accumulate on the spark plugs during continuous stop-and-go driving. When the engine is suddenly subjected to a high torque load, deposits partially liquefy and bridge the gap between electrodes (Fig. 30). This short circuits the electrodes. Spark plugs with electrode gap bridging can be cleaned using standard procedures.

SCAVENGER DEPOSITS

Fuel scavenger deposits may be either white or yellow (Fig. 31). They may appear to be harmful, but this is a normal condition caused by chemical additives in certain fuels. These additives are designed to change the chemical nature of deposits and decrease spark plug misfire tendencies. Notice that accumulation on the ground electrode and shell area may be heavy, but the deposits are easily removed. Spark plugs with scavenger deposits can be considered normal in condition and can be cleaned using standard procedures.

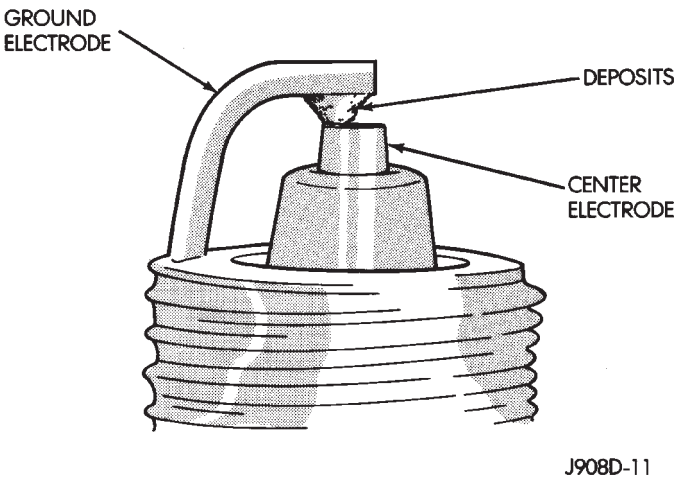

Fig. 30 Electrode Gap Bridging

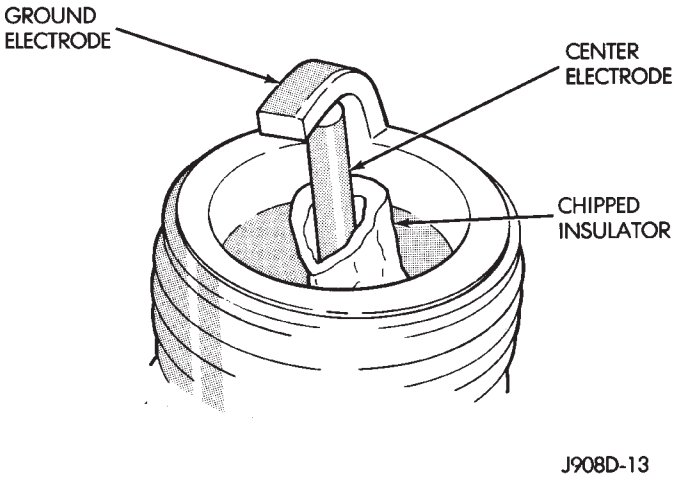

Fig. 32 Chipped Electrode Insulator

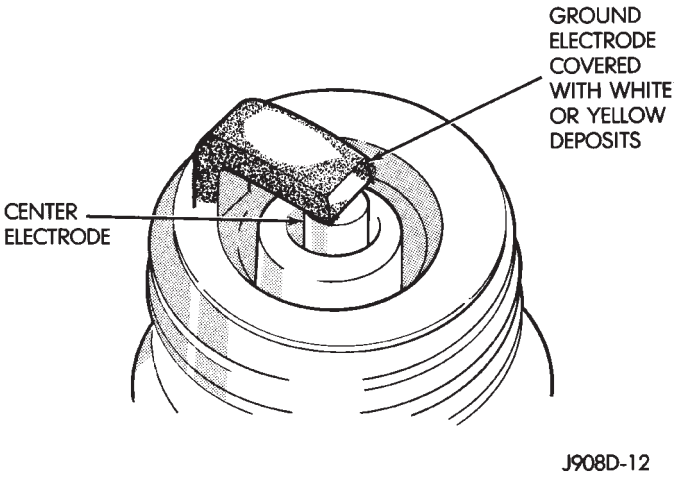

Fig. 31 Scavenger Deposits

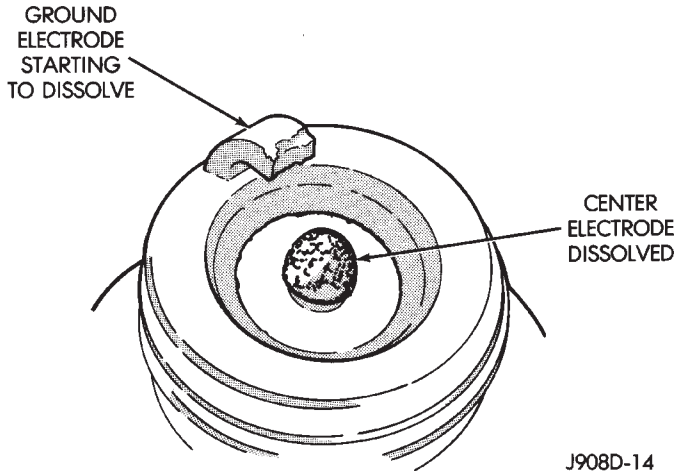

Fig. 33 Preignition Damage

CHIPPED ELECTRODE INSULATOR

A chipped electrode insulator usually results from bending the center electrode while adjusting the spark plug electrode gap. Under certain conditions, severe detonation can also separate the insulator from the center electrode (Fig. 32). Spark plugs with this condition must be replaced.

PREIGNITION DAMAGE

Preignition damage is usually caused by excessive combustion chamber temperature. The center electrode dissolves first and the ground electrode dissolves somewhat latter (Fig. 33). Insulators appear relatively deposit free. Determine if the spark plug has the correct heat range rating for the engine. Determine if ignition timing is over advanced, or if other operating conditions are causing engine overheating. (The heat range rating refers to the operating temperature of a particular type spark plug. Spark plugs are designed to operate within specific temperature ranges. This depends upon the thickness and length of the center electrodes porcelain insulator.)

SPARK PLUG OVERHEATING

Overheating is indicated by a white or gray center electrode insulator that also appears blistered (Fig. 34). The increase in electrode gap will be considerably in excess of 0.001 inch per 1000 miles of operation. This suggests that a plug with a cooler heat range rating should be used. Over advanced ignition timing, detonation and cooling system malfunctions can also cause spark plug overheating.

SPARK PLUG SECONDARY CABLES

5.2L Engine: Spark plug heat shields are pressed into the cylinder head to surround each spark plug cable boot and spark plug (Fig. 35). These shields protect the spark plug boots from damage (due to intense engine heat generated by the exhaust manifolds) and should not be removed. After the spark plug cable has been installed, the lip of the cable boot should have a small air gap to the top of the heat shield (Fig. 35).

Fig. 34 Spark Plug Overheating

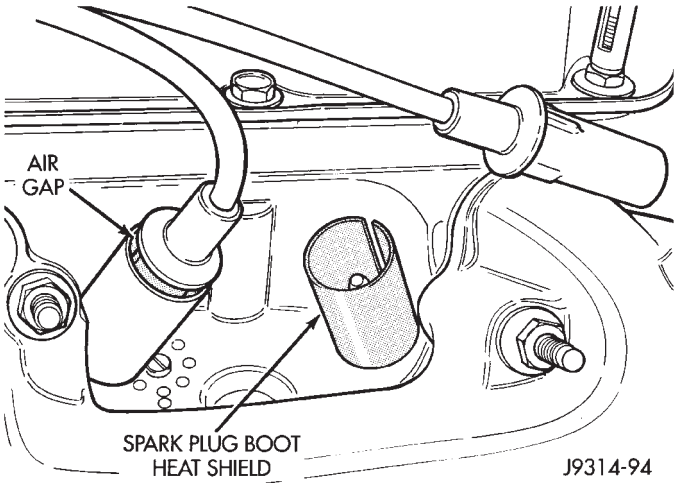

Fig. 35 Heat Shields—5.2L Engine

TESTING

Spark plug cables are sometimes referred to as secondary ignition cables or secondary wires. The cables transfer electrical current from the distributor to individual spark plugs at each cylinder. The spark plug cables are of nonmetallic construction and have a built in resistance. The cables provide suppression of radio frequency emissions from the ignition system.

Check the high-tension cable connections for good contact at the ignition coil, distributor cap towers and spark plugs. Terminals should be fully seated. The terminals and spark plug covers should be in good condition. Terminals should fit tightly to the ignition coil, distributor cap and spark plugs. The spark plug cover (boot) of the cable should fit tight around the spark plug insulator. Loose cable connections can cause corrosion and increase resistance, resulting in shorter cable service life.

Clean the high tension cables with a cloth moistened with a nonflammable solvent and wipe dry. Check for brittle or cracked insulation.

When testing secondary cables for damage with an oscilloscope, follow the instructions of the equipment manufacturer.

If an oscilloscope is not available, spark plug cables may be tested as follows:

CAUTION: Do not leave any one spark plug cable disconnected for longer than necessary during testing. This may cause possible heat damage to the catalytic converter. Total test time must not exceed ten minutes.

With the engine not running, connect one end of a test probe to a good ground. Start the engine and run the other end of the test probe along the entire length of all spark plug cables. If cables are cracked or punctured, there will be a noticeable spark jump from the damaged area to the test probe. The cable running from the ignition coil to the distributor cap can be checked in the same manner. Cracked, damaged or faulty cables should be replaced with resistance type cable. This can be identified by the words ELECTRONIC SUPPRESSION printed on the cable jacket.

Use an ohmmeter to test for open circuits, excessive resistance or loose terminals. Remove the distributor cap from the distributor. **Do not remove cables from cap**. Remove cable from spark plug. Connect ohmmeter to spark plug terminal end of cable and to corresponding electrode in distributor cap. Resistance should be 250 to 1000 Ohms per inch of cable. If not, remove cable from distributor cap tower and connect ohmmeter to the terminal ends of cable. If resistance is not within specifications as found in the Spark Plug Cable Resistance chart, replace the cable. Test all spark plug cables in this manner.

To test ignition coil-to-distributor cap cable, do not remove the cable from the cap. Connect ohmmeter to rotor button (center contact) of distributor cap and terminal at ignition coil end of cable. If resistance is not within specifications as found in the Spark Plug Cable Resistance chart, remove the cable from the distributor cap. Connect the ohmmeter to the terminal ends of the cable. If resistance is not within specifications as found in the Spark Plug Cable Resistance chart, replace the cable. Inspect the ignition coil tower for cracks, burns or corrosion.

SPARK PLUG CABLE RESISTANCE

MINIMUM	MAXIMUM
250 Ohms Per Inch	1000 Ohms Per Inch
3000 Ohms Per Foot	12,000 Ohms Per Foot

J908D-43

For removal and installation of spark plug cables, refer to Spark Plug Secondary Cables in the Component Removal/Installation section.

THROTTLE POSITION SENSOR TEST

To perform a complete test of this sensor and its circuitry, refer to the DRB II diagnostic scan tool. Also refer to the appropriate Powertrain Diagnostics Procedures manual. To test the sensor only, refer to the following:

The throttle position sensor can be tested with a digital voltmeter. The center terminal of the sensor connector is the output terminal (Figs. 36 or 37).

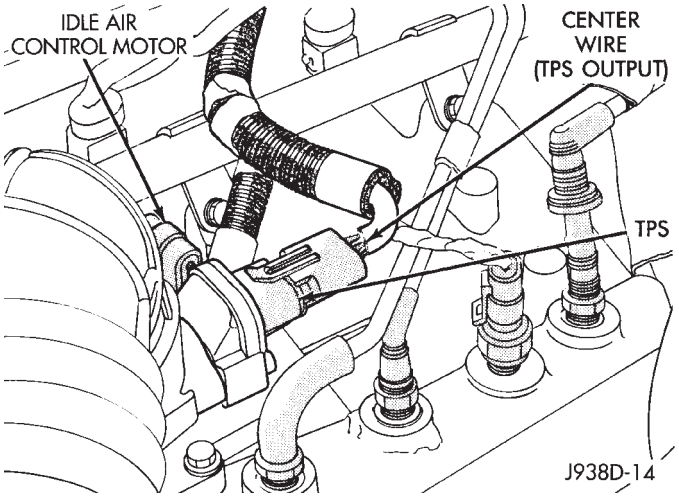

Fig. 36 Sensor Testing—4.0L Engine

With the ignition key in the ON position and engine not running, check the sensor output voltage at the center terminal wire of the connector. Check this at idle (throttle plate closed) and at wide open throttle (WOT). At idle, sensor output voltage should be greater than 200 millivolts. At wide open throttle, sensor output voltage must be less than 4.8 volts. The output voltage should increase gradually as the throttle plate is slowly opened from idle to WOT.

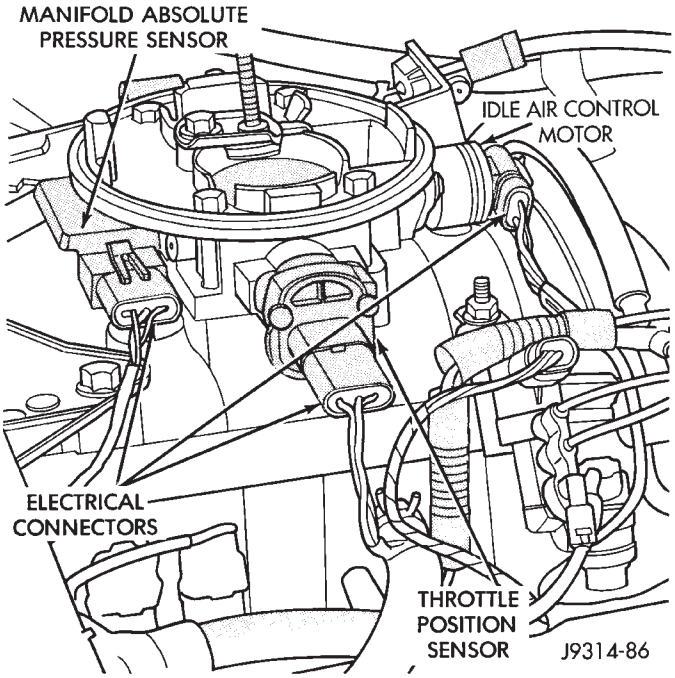

Fig. 37 Sensor Testing—5.2L Engine

OXYGEN SENSOR TESTS

For diagnosis, removal or installation, refer to Group 14, Fuel Systems in this manual.

COMPONENT REMOVAL/INSTALLATION

INDEX

GENERAL INFORMATION

This section of the group, Component Removal/Installation, will discuss the removal and installation of ignition system components.

For basic ignition system diagnostics and service adjustments, refer to the Diagnostics/Service Procedures section of this group.

For system operation and component identification, refer to the Component Identification/System Operation section of this group.

AUTOMATIC SHUT DOWN (ASD) RELAY

The ASD relay is installed in the Power Distribution Center (PDC) (Fig. 1). Relay location is printed on the PDC cover.

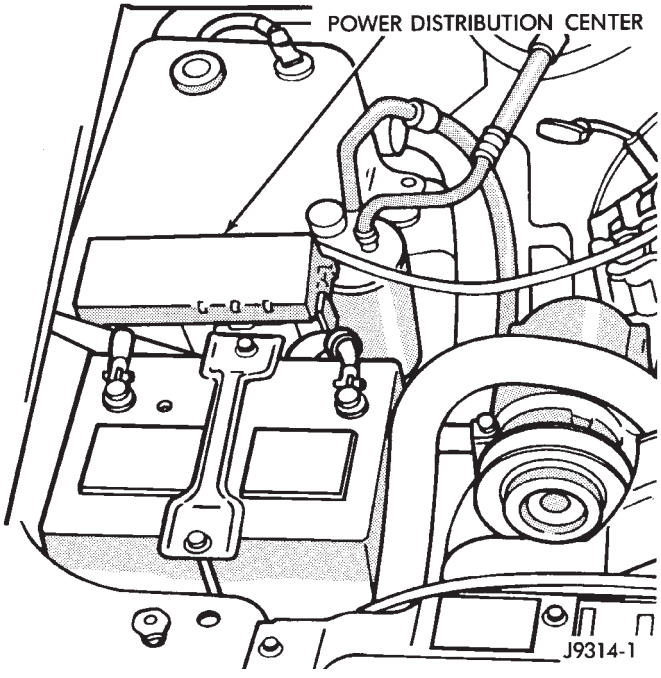

Fig. 1 Power Distribution Center

REMOVAL

(1) Remove the Power Distribution Center cover.

(2) Remove the relay by lifting straight up.

INSTALLATION

(1) Push the relay into the connector.

(2) Install the relay cover.

CAMSHAFT POSITION SENSOR

The camshaft position sensor is located in the distributor.

REMOVAL—4.0L ENGINE

(1) Remove the distributor. Refer to Distributor Removal.

(2) Remove the distributor rotor.

CAUTION: Do not position the distributor in a vise when removing or installing the drive gear roll pin. Support the distributor with wooden blocks.

(3) Mark the position of the gear and the shaft in line with the roll pin. The gear **MUST** be installed back to its original position on the distributor shaft.

(4) Using a small pin punch and hammer, remove the distributor gear roll (spring) pin (Fig. 2).

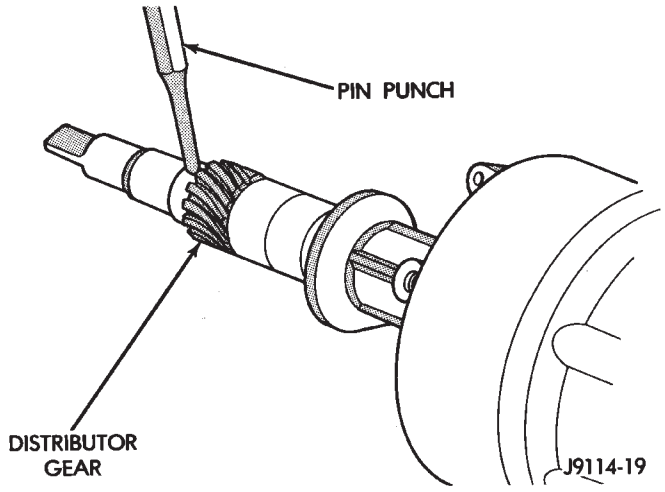

Fig. 2 Distributor Gear—Removal/Installation—4.0L Engine

(5) Lightly tap the end of the distributor shaft until distributor gear and thrust washer are removed.

(6) Slide the distributor shaft out of the distributor housing.

(7) Remove the camshaft position sensor mounting screw and positioning arm (Fig. 3).

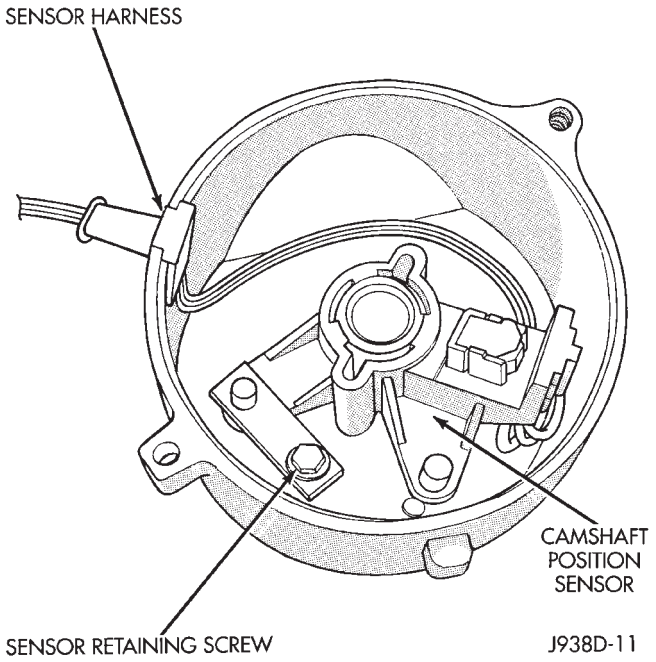

Fig. 3 Camshaft Position Sensor—4.0L Engine

(8) Slide the wire harness grommet out of the distributor housing. Remove the camshaft position sensor.

INSTALLATION—4.0L ENGINE

(1) Position the camshaft position sensor in the distributor housing. Place the wire harness grommet into the opening in the distributor housing.

(2) Install retaining arm and retaining screw.

(3) Install distributor shaft into distributor housing. Make sure the upper thrust washer is installed on the shaft.

(4) Position thrust washer and drive gear on distributor shaft.

(5) Note the previous **CAUTION** and install distributor drive gear roll pin.

(6) Install rotor.

(7) Install distributor.

REMOVAL—5.2L ENGINE

Distributor removal is not necessary to remove camshaft position sensor.

(1) Disconnect negative battery cable at battery.

(2) Remove coil high-tension cable and all spark plug cables at distributor cap. Note and mark position of cables (Fig. 4) before removal.

(3) Remove distributor cap from distributor (two screws).

(4) Disconnect camshaft position sensor wiring harness from main engine wiring harness.

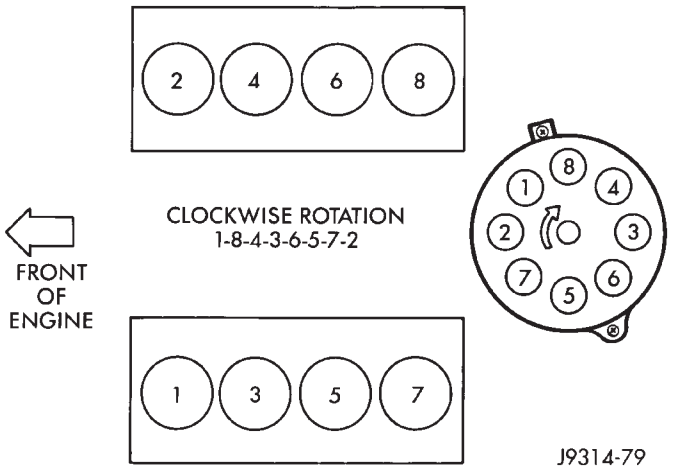

Fig. 4 Engine Firing Order—5.2L Engine

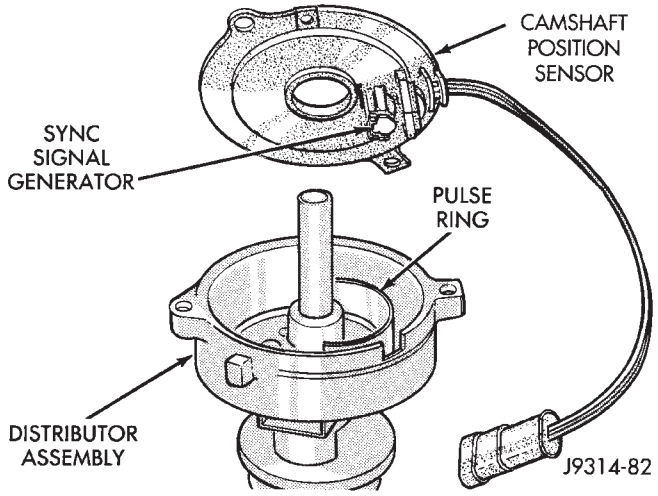

Fig. 5 Camshaft Position Sensor—5.2L Engine

(5) Remove distributor rotor from distributor shaft.

(6) Lift the camshaft position sensor assembly from the distributor housing (Fig. 5).

INSTALLATION—5.2L ENGINE

(1) Install camshaft position sensor to distributor. Align sensor into notch on distributor housing.

(2) Connect wiring harness.

(3) Install rotor.

(4) Install distributor cap. Tighten mounting screws.

(5) Install spark plug cables in correct firing order (Fig. 4) to distributor cap. Be sure all spark plug cables are firmly connected into distributor cap towers.

CRANKSHAFT POSITION SENSOR

REMOVAL—4.0L ENGINE

The crankshaft position sensor is mounted to the transmission bellhousing at the left/rear side of the engine block (Fig. 6).

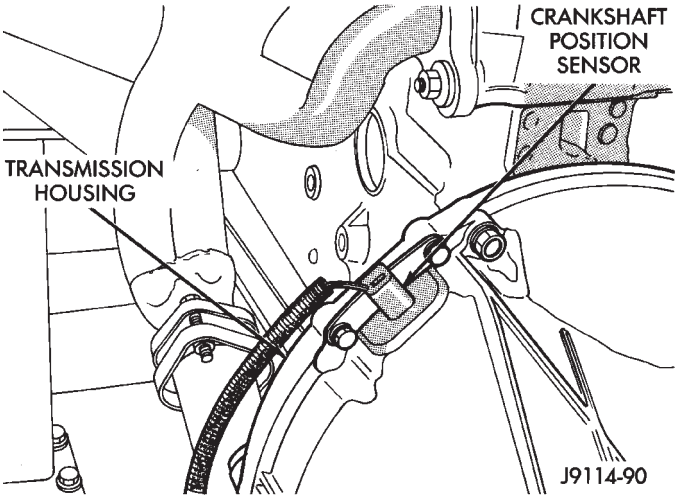

Fig. 6 Crankshaft Position Sensor—4.0L Engine

(1) Near the rear of the intake manifold, disconnect the pigtail harness on the sensor from the main electrical harness.

(2) Raise and support the vehicle.

(3) Remove the two sensor mounting bolts (Fig. 6).

(4) Remove the sensor.

(5) Remove clip from sensor wire harness.

INSTALLATION—4.0L ENGINE

(1) Install the sensor flush against the opening in the transmission housing.

(2) Install and tighten the two sensor mounting bolts to 19 N•m (14 ft. lbs.) torque.

CAUTION: The two bolts used to secure the sensor to the transmission are specially machined to correctly space the unit to the flywheel. Do not attempt to install any other bolts.

(3) Lower the vehicle.

(4) Connect the electrical connector to the sensor.

(5) Install clip on sensor wire harness.

REMOVAL—5.2L ENGINE

The sensor is bolted to the top of the cylinder block near the rear of right cylinder head (Fig. 7).

(1) Remove the spark plug cable loom and spark plug cables from valve cover mounting stud at rear of right valve cover (Fig. 7). Position spark plug cables to top of valve cover.

(2) Remove the right exhaust manifold heat shield nuts/bolts and remove heat shield (Fig. 8).

(3) Disconnect 2 hoses at Exhaust Gas Recirculation (EGR) valve. Note position of hoses at EGR valve before removal.

(4) Disconnect electrical connector and hoses at electric EGR transducer (EET). Note position of hoses at EET before removal.

(5) Remove 2 EGR valve mounting bolts (Fig. 7) and remove EGR valve. Discard old EGR gasket.

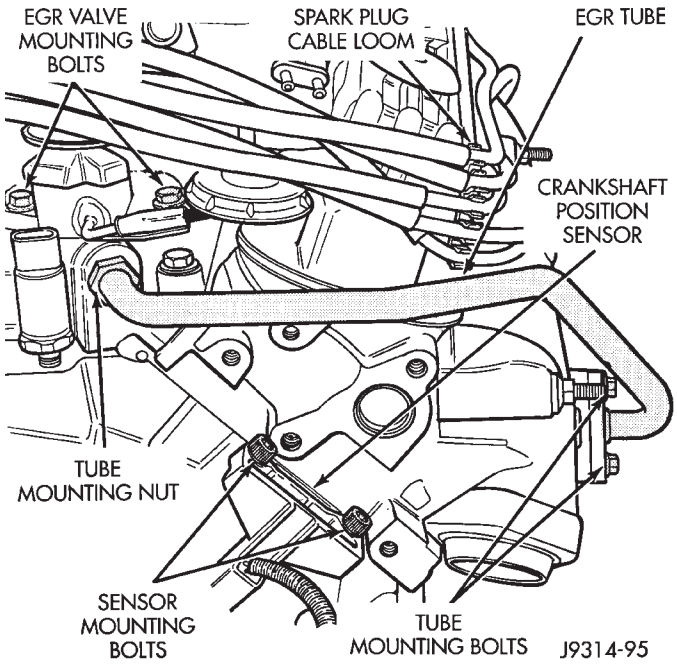

Fig. 7 Crankshaft Position Sensor—5.2L Engine

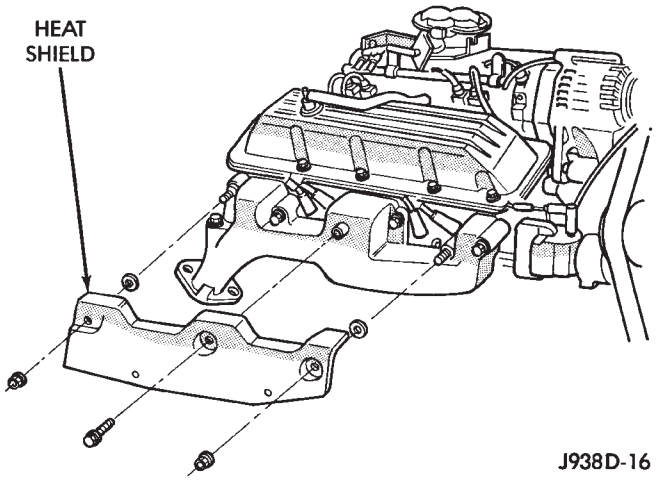

Fig. 8 Exhaust Manifold Heat Shield—5.2L Engine

(6) Disconnect electrical connector at engine oil pressure sending unit.

(7) To prevent damage to oil pressure sending unit, a special tool, such as number C-4597 must be used (Fig. 9). Remove sending unit from engine.

(8) Loosen EGR tube mounting nut at intake manifold (Fig. 7).

(9) Remove 2 EGR tube mounting bolts at exhaust manifold (Fig. 7) and remove EGR tube. Discard old gasket at exhaust manifold.

(10) Disconnect crankshaft position sensor pigtail harness from main wiring harness.

(11) Remove 2 sensor (recessed hex head) mounting bolts (Fig. 7) and remove sensor.

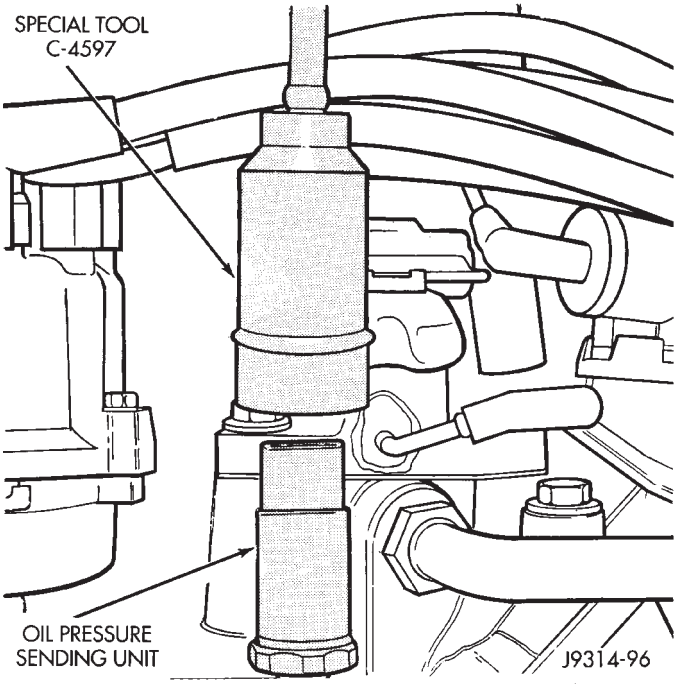

Fig. 9 Oil Pressure Sending Unit—Removal/Installation

INSTALLATION—5.2L ENGINE

(1) Position crankshaft position sensor to engine and install mounting bolts. Tighten bolts to 8 N●m (70 in. lbs.) torque.

(2) Connect main harness electrical connector to sensor.

(3) Clean the EGR tube and exhaust manifold (at EGR tube mounting point) of any old gasket material.

(4) Install a new gasket to exhaust manifold end of EGR tube and install EGR tube to both manifolds. Tighten tube mounting nut at intake manifold. Tighten 2 mounting bolts at exhaust manifold to 23 N●m (204 in. lbs.) torque.

(5) Coat the threads of the oil pressure sending unit with thread sealant. Do not allow any of the thread sealant to get into the sending unit opening, or the opening at the engine. Install sending unit to engine and tighten to 14 N●m (130 in. lbs.) torque. Install electrical connector to sending unit.

(6) Clean the intake manifold and EGR valve of any old gasket material.

(7) Install a new EGR valve gasket at intake manifold.

(8) Install EGR valve to intake manifold. Tighten 2 EGR bolts to 23 N●m (200 in. lbs.) torque.

(9) Position EET and install its electrical connector. Connect hoses between EGR valve and EET. Connect hose between main vacuum harness and EET.

(10) Install spark plug cable loom and spark plug cables to valve cover mounting stud.

(11) Install heat shield at right exhaust manifold.

ENGINE COOLANT TEMPERATURE SENSOR

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. COOLING SYSTEM MUST BE PARTIALLY DRAINED BEFORE REMOVING THE COOLANT TEMPERATURE SENSOR. REFER TO GROUP 7, COOLING.

REMOVAL—4.0L ENGINE

The sensor is installed in the thermostat housing (Fig. 10) on 4.0L engines.

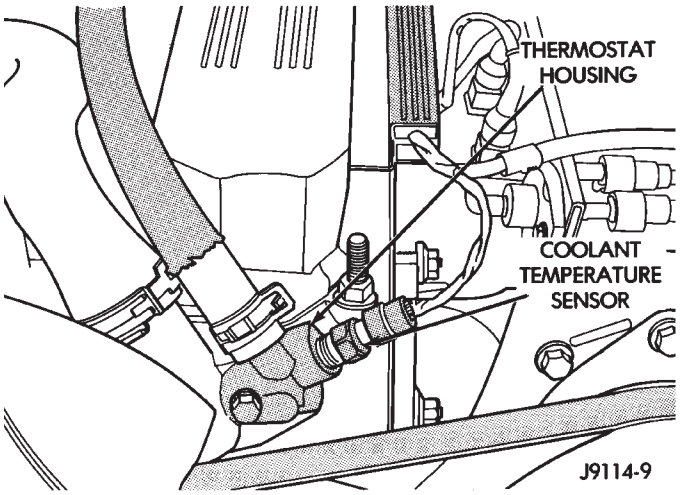

Fig. 10 Coolant Temperature Sensor—4.0L Engine

(1) Drain cooling system until the coolant level is below the cylinder head. For cooling system draining, refer to Group 7, Cooling.

(2) Disconnect the coolant temperature sensor wire connector.

(3) Remove the sensor from the thermostat housing (Fig. 10).

INSTALLATION—4.0L ENGINE

(1) Install coolant temperature sensor into the thermostat housing. Tighten to 28 N●m (21 ft. lbs.) torque.

(2) Connect the wire connector.

(3) Fill the cooling system. Refer to group 7, Cooling System.

REMOVAL—5.2L ENGINE

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. COOLING SYSTEM MUST BE PARTIALLY DRAINED BEFORE REMOVING THE COOLANT TEMPERATURE SENSOR. REFER TO GROUP 7, COOLING.

The engine coolant temperature sensor on the 5.2L engine is located in a water passage of the intake manifold next to the thermostat housing (Fig. 11).

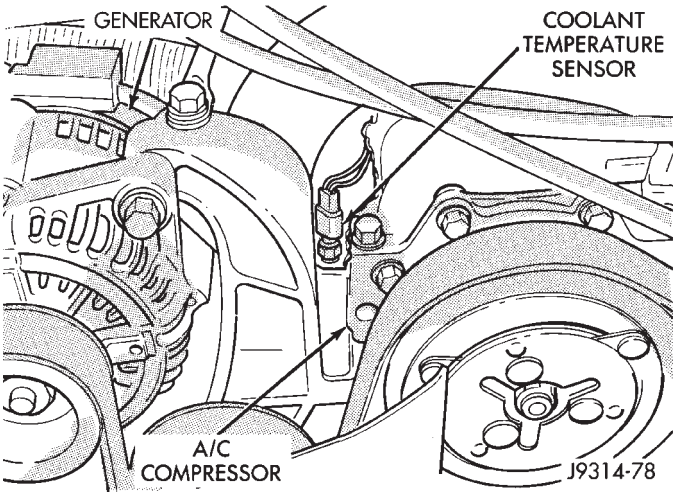

Fig. 11 Coolant Temperature Sensor—5.2L Engines

(1) Partially drain cooling system. Refer to Group 7, Cooling.

(2) Disconnect electrical connector from sensor (Fig. 11).

(3) Engines with air conditioning: When removing the connector from sensor, do not pull directly on wiring harness. Fabricate an L-shaped hook tool from a coat hanger (approximately eight inches long). Place the hook part of tool under the connector for removal. The connector is snapped onto the sensor. It is not equipped with a lock type tab.

(4) Remove sensor from intake manifold.

INSTALLATION—5.2L ENGINE

(1) Install sensor.

(2) Tighten to 7 N●m (5.5 ft. lbs.) torque.

(3) Connect electrical connector to sensor.

The sensor connector is symmetrical (not indexed). It can be installed to the sensor in either direction.

(4) Replace any lost engine coolant. Refer to Group 7, Cooling System.

DISTRIBUTOR

All distributors contain an internal oil seal that prevents oil from entering the distributor housing. The seal is not serviceable. The camshaft position sensor is located in the distributor on all engines.

REMOVAL—4.0L ENGINE

(1) Disconnect the negative battery cable at the battery.

(2) Scribe a mark on the distributor housing. Do this below the left side of (past) the number one spark plug cable post of the distributor cap. This will be used as a reference for number 1 cylinder firing position (Fig. 13).

(3) Remove the distributor cap.

(4) Turn the engine crankshaft in a clockwise direction until rotor is approaching scribe mark on distributor housing. Then slowly turn engine until timing mark on crankshaft vibration damper lines up with zero on front cover timing scale (Fig. 14).

The timing mark is on the edge of vibration damper closest to engine timing chain cover.

(5) Align the trailing edge of the rotor blade with the scribe mark on the distributor housing (Fig. 15).

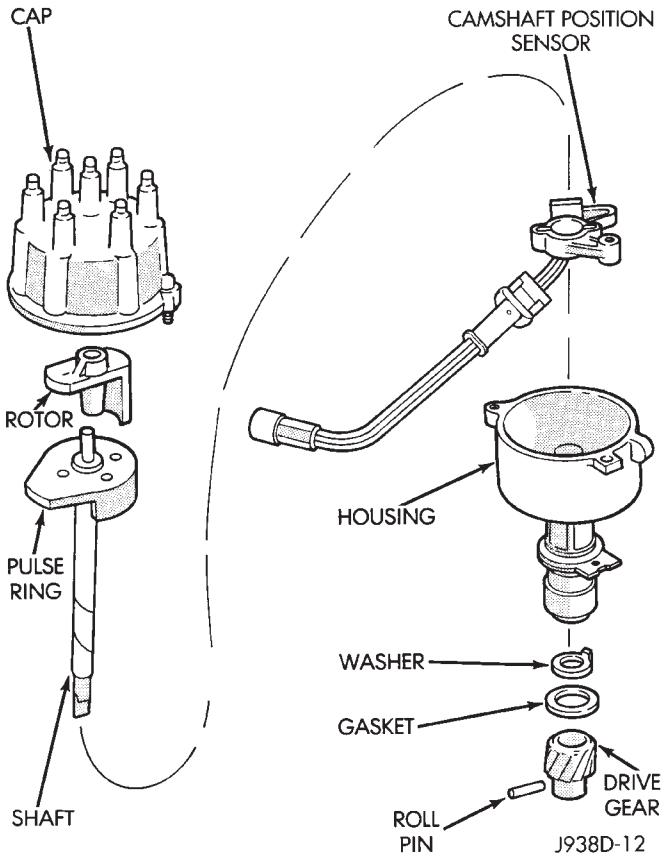

Fig. 12 Distributor—4.0L Engine—Typical

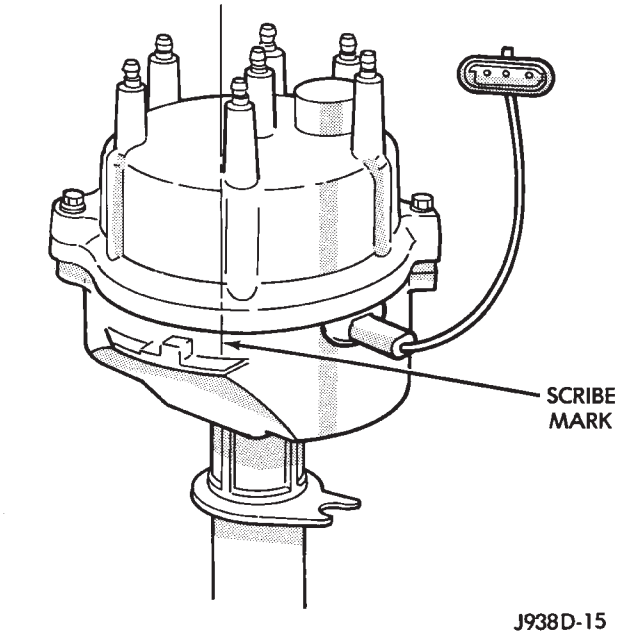

Fig. 13 Mark Distributor Housing—4.0L Engine

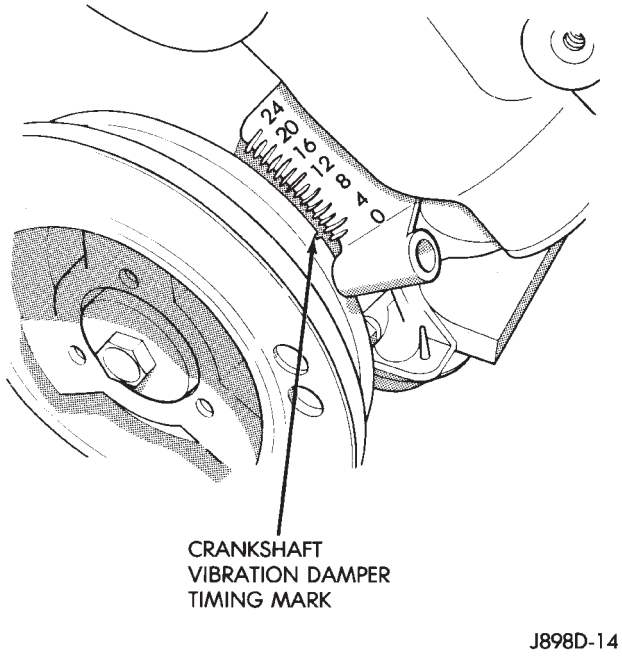

Fig. 14 Align Timing Marks—4.0L Engine

(6) Remove the distributor holddown bolt and

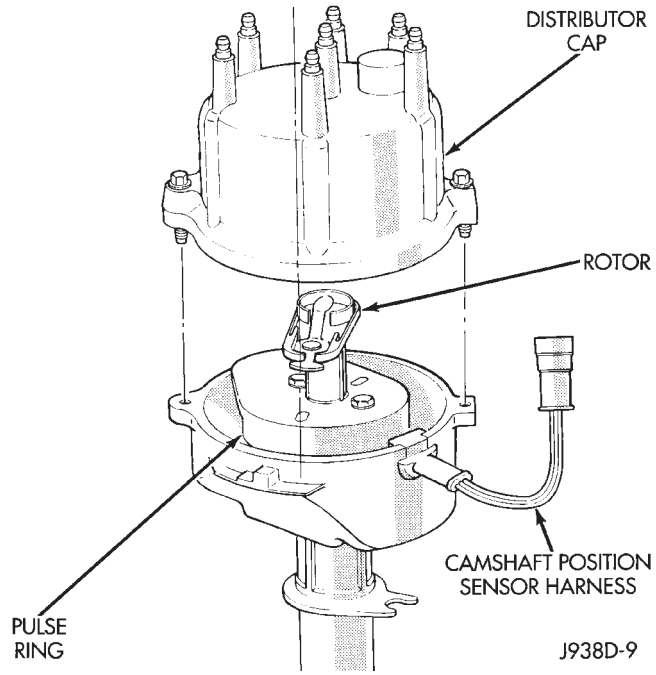

Fig. 15 Align Rotor Trailing Edge With Scribe Mark—4.0L Engine

clamp.

(7) Remove the distributor from the engine.

INSTALLATION—4.0L ENGINE

(1) Using a flat blade screwdriver, turn the oil pump gear shaft. Do this until the slot is slightly past the 11 o'clock position (Fig. 16).

The oil pump shaft is located down in the distributor hole.

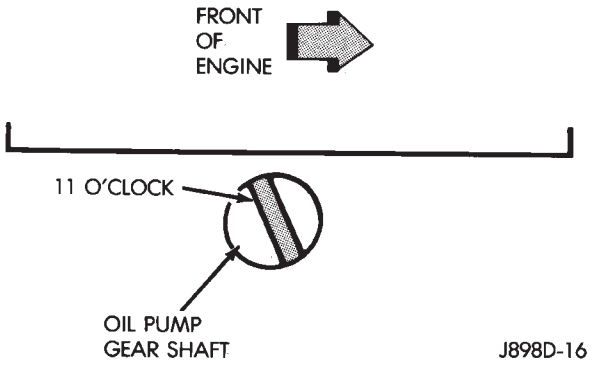

Fig. 16 Align Oil Pump Gear Shaft—4.0L Engine

(2) Install the rotor.

(3) Without engaging the distributor gear into the cam gear, position the distributor into the hole in the engine block. Be sure the distributor gasket is installed.

(4) Visually line up the holddown ear of the distributor housing with the holddown clamp hole (Fig. 17).

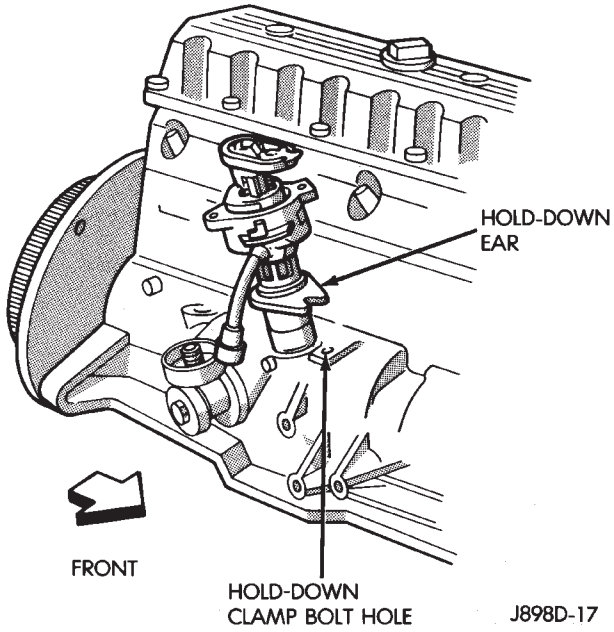

Fig. 17 Distributor Installation—4.0L Engine

(5) Turn the rotor to the 4 o'clock position (Fig. 18).

(6) Slide the distributor down into the block until it seats. Keep the holddown ear aligned to the hole in the block.

(7) The rotor should be in the 5 o'clock position. This is with the trailing edge of rotor blade lined up with scribe mark on distributor housing (number one spark plug cable post location).

(8) Install the distributor holddown clamp bolt and tighten to 23 N●m (17 ft. lbs.) torque.

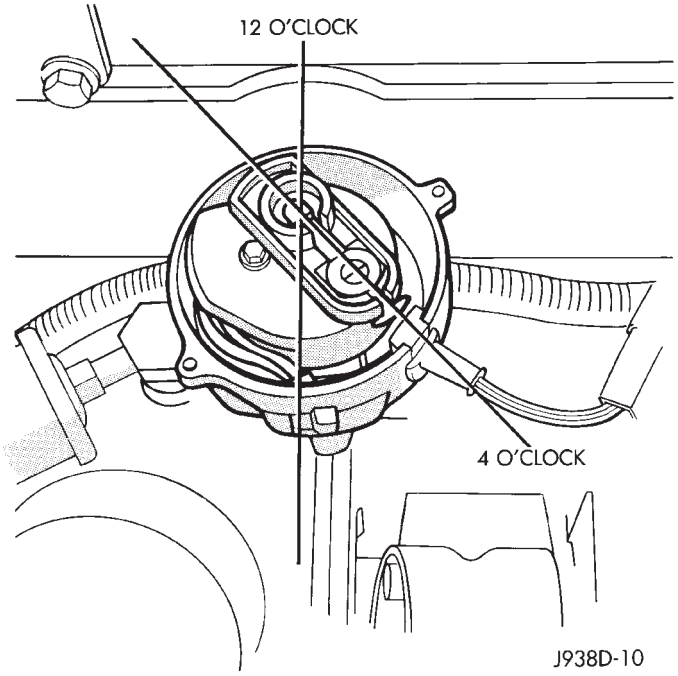

Fig. 18 Rotor Alignment—4.0L Engine

(9) Install the distributor cap and connect the distributor electrical connector.

(10) Connect battery cable to battery.

REMOVAL—5.2L ENGINE

CAUTION: Base ignition timing is not adjustable on the 5.2L V-8 engine. Distributors do not have built in centrifugal or vacuum assisted advance. Base ignition timing and timing advance are controlled by the Powertrain Control Module (PCM). Because a conventional timing light can not be used to adjust distributor position after installation, note position of distributor before removal.

(1) Disconnect negative battery cable at battery.

(2) Remove coil high-tension cable and all spark plug cables at distributor cap. Note and mark position of cables (Fig. 19) before removal.

(3) Remove distributor cap from distributor (two screws).

(4) Mark the position of distributor housing in relationship to engine or dash panel. This is done to aid in installation.

Before distributor is removed, the number one cylinder must be brought to the top dead center (TDC) firing position.

(5) Attach a socket to the Crankshaft Vibration Damper mounting bolt.

(6) Slowly rotate engine clockwise, as viewed from front, until indicating mark on crankshaft vibration damper is aligned to 0 degree (TDC) mark on timing chain cover (Fig. 20).

(7) The distributor rotor should now be aligned to the CYL. NO. 1 alignment mark (stamped) into the

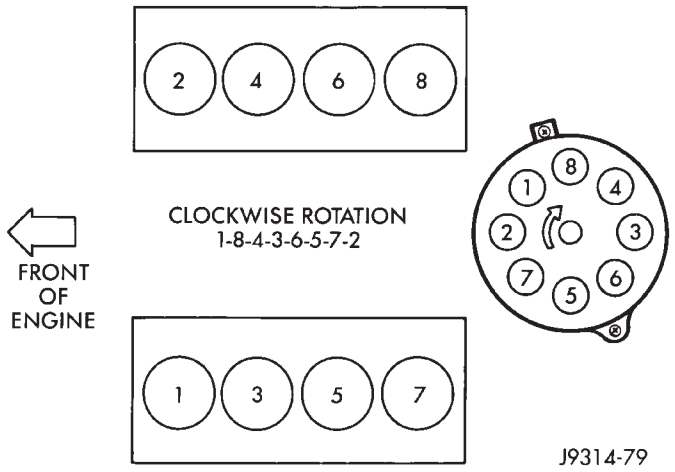

Fig. 19 Engine Firing Order—5.2L Engine

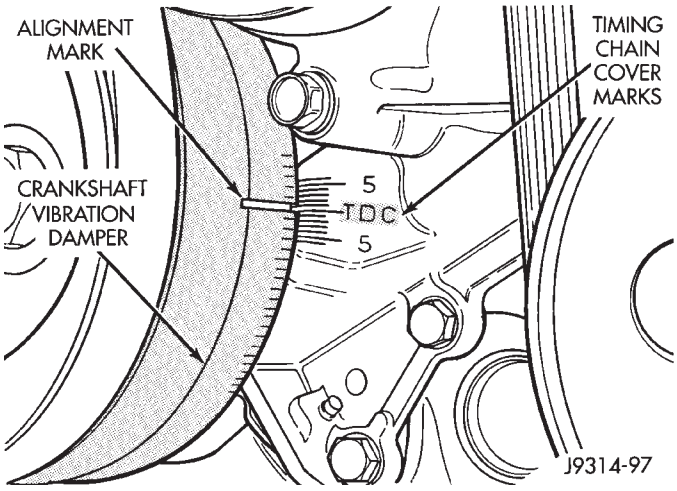

Fig. 20 Damper-To-Timing Chain Cover Alignment Marks—5.2L Engine

camshaft position sensor (Fig. 21). If not, rotate the crankshaft through another complete 360 degree turn. Note the position of the number one cylinder spark plug cable (on the cap) in relation to rotor. Rotor should now be aligned to this position.

(8) Disconnect camshaft position sensor wiring harness from main engine wiring harness.

(9) Remove distributor rotor from distributor shaft.

(10) Remove distributor holddown clamp bolt and clamp (Fig. 22). Remove distributor from vehicle.

CAUTION: Do not crank engine with distributor removed. Distributor/crankshaft relationship will be lost.

INSTALLATION—5.2L ENGINE

If engine has been cranked while distributor is removed, establish the relationship between distributor shaft and number one piston position as follows:

Rotate crankshaft in a clockwise direction, as viewed from front, until number one cylinder piston

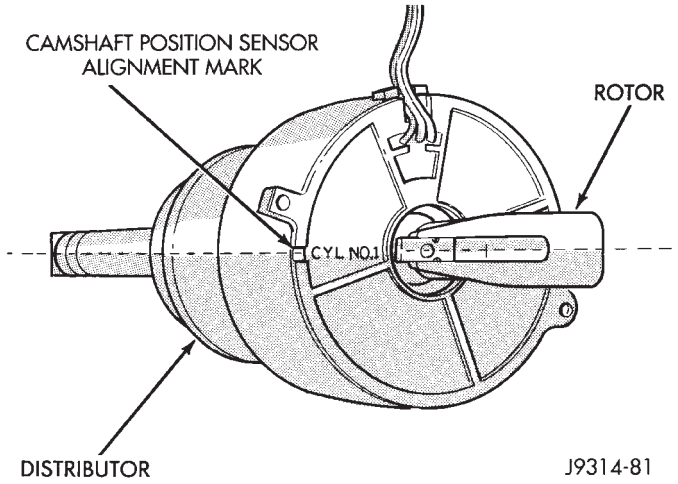

Fig. 21 Rotor Alignment Mark—5.2L Engine

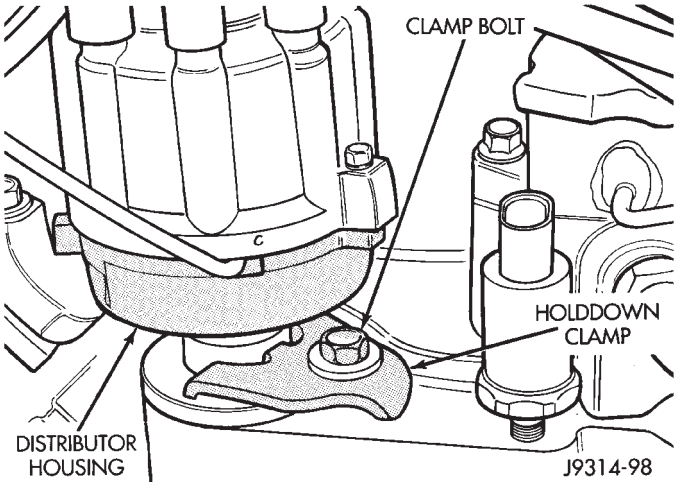

Fig. 22 Distributor Holddown Clamp—5.2L Engine

is at top of compression stroke (compression should be felt on finger with number one spark removed). Then continue to slowly rotate engine clockwise until indicating mark (Fig. 20) is aligned to 0 degree (TDC) mark on timing chain cover.

(1) Clean top of cylinder block for a good seal between distributor base and block.

(2) Lightly oil the rubber O-ring seal on the distributor housing.

(3) Install rotor to distributor shaft.

(4) Position distributor into engine to its original position. Engage tongue of distributor shaft with slot in distributor oil pump drive gear. Position rotor to the number one spark plug cable position.

(5) Install distributor holddown clamp and clamp bolt. Do not tighten bolt at this time.

(6) Rotate the distributor housing until rotor is aligned to CYL. NO. 1 alignment mark on the camshaft position sensor (Fig. 21).

(7) Tighten clamp holddown bolt (Fig. 22) to 22.5 N•m (200 in. lbs.) torque.

(8) Connect camshaft position sensor wiring harness to main engine harness.

(9) Install distributor cap. Tighten mounting screws.

(10) Install spark plug cables in correct firing order (Fig. 19) to distributor cap. Be sure all spark plug cables are firmly connected into distributor cap towers.

IGNITION COIL

The ignition coil is an epoxy filled type. If the coil is replaced, it must be replaced with the same type.

REMOVAL—4.0L ENGINE

The ignition coil is mounted to the right side of the 4.0L engine block next to the distributor (Fig. 23).

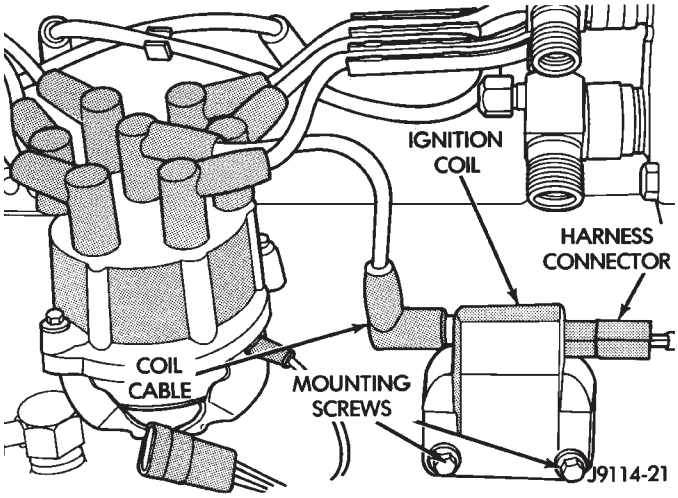

Fig. 23 Ignition Coil—4.0L Engine

(1) Disconnect the ignition coil secondary cable from ignition coil (Fig. 23).

(2) Disconnect engine harness connector from ignition coil.

(3) Remove ignition coil mounting screws. Remove coil.

INSTALLATION—4.0L ENGINE

(1) Install ignition coil to bracket on cylinder block with mounting screws.

(2) Connect engine harness connector to coil.

(3) Connect ignition coil cable to ignition coil.

REMOVAL—5.2L ENGINE

The ignition coil is mounted to a bracket near the front of the right engine cylinder head on 5.2L engines (Fig. 24).

(1) Disconnect the wiring and secondary cable from the ignition coil (Fig. 24).

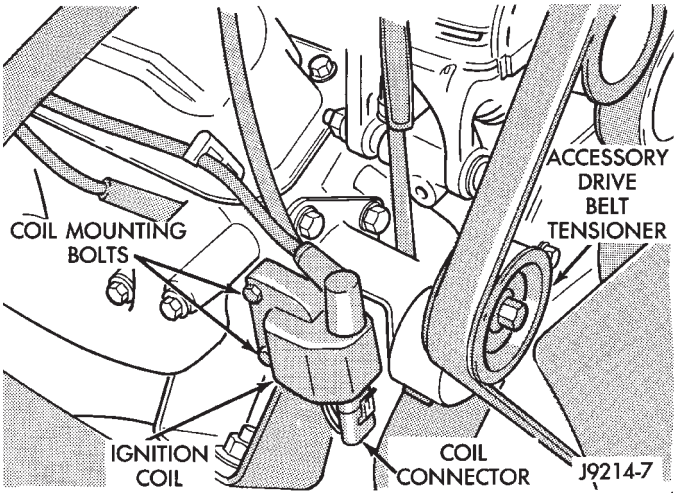

Fig. 24 Ignition Coil—5.2L Engine—Typical

WARNING: DO NOT REMOVE THE COIL MOUNTING BRACKET-TO-CYLINDER HEAD MOUNTING BOLTS. THE COIL MOUNTING BRACKET IS UNDER ACCESSORY DRIVE BELT TENSION. IF THIS BRACKET IS TO BE REMOVED FOR ANY REASON, ALL BELT TENSION MUST FIRST BE RELIEVED. REFER TO THE BELT SECTION OF GROUP 7, COOLING SYSTEM.

(2) Remove ignition coil from coil mounting bracket (two bolts).

INSTALLATION—5.2L ENGINE

(1) Install the ignition coil to coil bracket. If nuts and bolts are used to secure coil to coil bracket, tighten to 11 N●m (100 in. lbs.) torque. If the coil mounting bracket has been tapped for coil mounting bolts, tighten bolts to 5 N●m (50 in. lbs.) torque.

(2) Connect all wiring to ignition coil.

INTAKE MANIFOLD CHARGE AIR TEMPERATURE SENSOR

REMOVAL—4.0L ENGINE

The intake manifold charge air temperature sensor is installed into the intake manifold plenum (Fig. 25) on the 4.0L engine.

(1) Disconnect the electrical connector from the sensor.

(2) Remove the sensor from the intake manifold.

INSTALLATION—4.0L ENGINE

(1) Install the air temperature sensor into the intake manifold. Tighten the sensor to 13 N●m (10 ft. lbs.) torque.

(2) Connect the electrical connector to the sensor.

REMOVAL—5.2L ENGINE

The charge air temperature sensor is located in right-front side of intake manifold (Fig. 26) on the 5.2L engine.

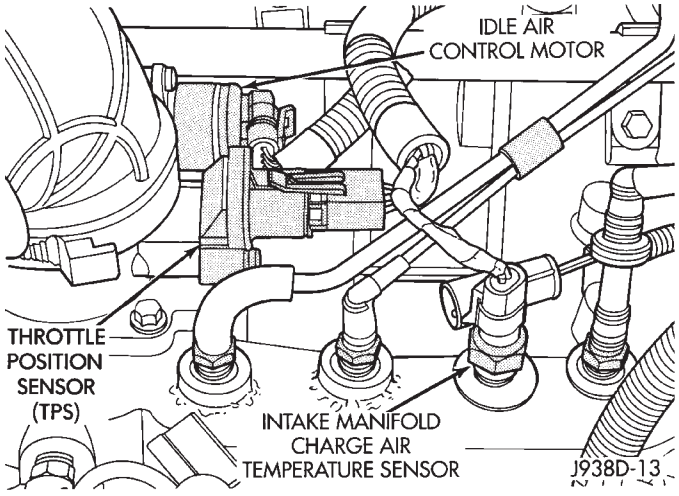

Fig. 25 Air Temperature Sensor—4.0L Engine

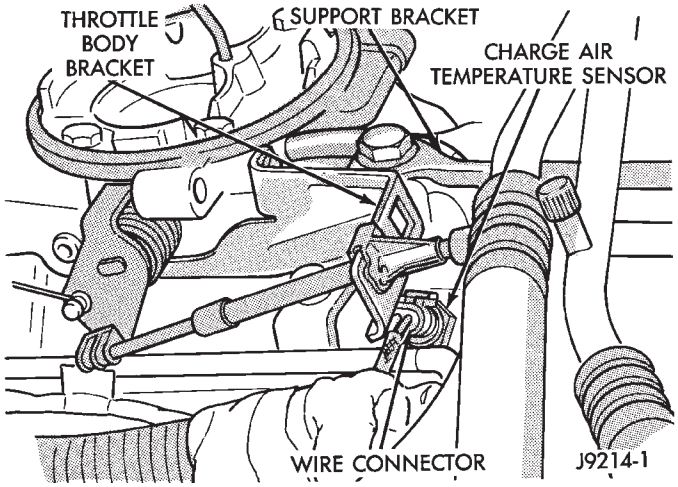

Fig. 26 Air Temperature Sensor—5.2L Engine—Typical

(1) Disconnect electrical connector at sensor (Fig. 26).

(2) Remove sensor from intake manifold.

INSTALLATION—5.2L ENGINE

(1) Install sensor to intake manifold. Tighten the sensor to 13 N●m (10 ft. lbs.) torque.

(2) Install electrical connector.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

REMOVAL—4.0L ENGINE

The sensor is located on the cowl panel near the rear of the engine valve cover (Fig. 27) if equipped with the 4.0L engine.

(1) Disconnect the sensor electrical connector (Fig. 27).

(2) Disconnect the sensor vacuum supply hose.

(3) Remove the two sensor mounting screws and remove sensor from vehicle.

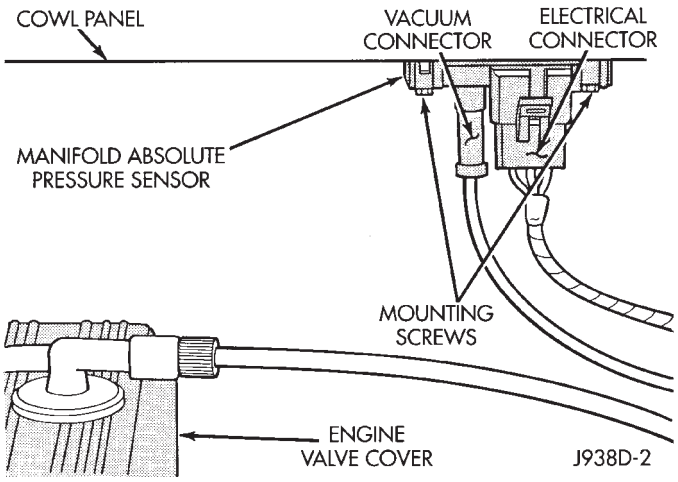

Fig. 27 MAP Sensor—4.0L Engine

INSTALLATION—4.0L ENGINE

(1) Install sensor to cowl panel. Install 2 screws and tighten to 3 N•m (25 in. lbs.) torque.

(2) Install the sensor vacuum supply hose.

(3) Connect the sensor electrical connector.

REMOVAL—5.2L ENGINE

The MAP sensor is located on the front of the throttle body (Fig. 28) if equipped with the 5.2L engine.

An L-shaped rubber fitting is used to connect the MAP sensor to throttle body (Fig. 29).

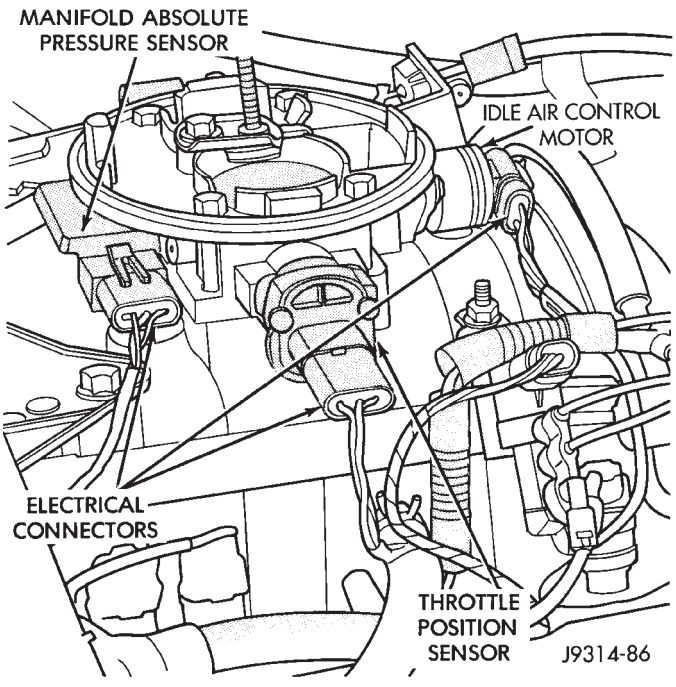

Fig. 28 MAP Sensor—5.2L Engine

The throttle body must be removed from the intake manifold for MAP sensor removal.

(1) Remove air intake tube at throttle body.

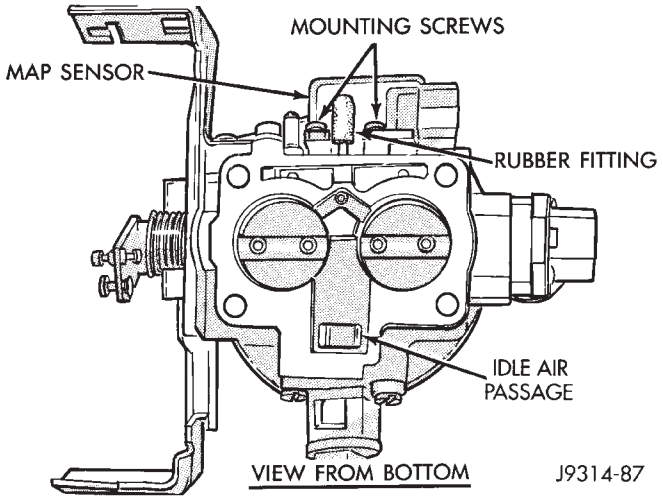

Fig. 29 MAP Sensor Rubber Fitting—5.2L Engine

(2) Remove throttle body. Refer to Throttle Body removal in the Group 14, Fuel System section of this manual.

(3) Remove two MAP sensor mounting screws (Fig. 29).

(4) While removing MAP sensor, slide the L-shaped rubber vacuum fitting (Fig. 29) from the throttle body.

(5) Remove rubber fitting from MAP sensor.

INSTALLATION—5.2L ENGINE

(1) Install L-shaped rubber fitting to MAP sensor.

(2) Position MAP sensor to throttle body while guiding L-shaped rubber fitting over throttle body fitting.

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

(4) Install throttle body. Refer to Throttle Body installation in the Group 14, Fuel System section of this manual.

(5) Install air intake tube.

OXYGEN (O_2) SENSOR

For diagnostics and removal/installation procedures, refer to Group 14, Fuel Systems, in this manual.

POWERTRAIN CONTROL MODULE (PCM)

The PCM is located on the cowl panel in the right/rear side of the engine compartment (Fig. 30).

REMOVAL

(1) Disconnect the negative battery cable at the battery.

(2) Remove the coolant reserve/overflow bottle (one bolt and two nuts) (Fig. 31)

(3) Loosen the 60-Way connector mounting bolt (Fig. 32).

(4) Remove the electrical connector by pulling straight back.

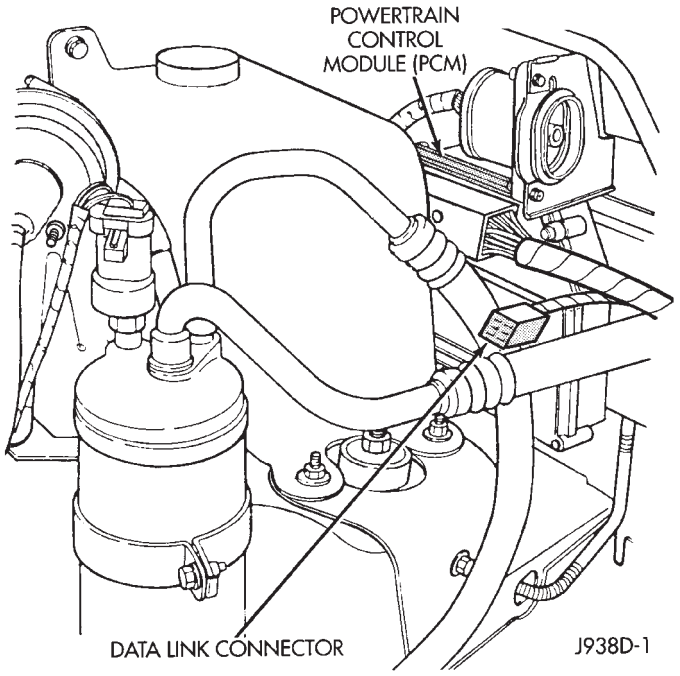

Fig. 30 PCM Location

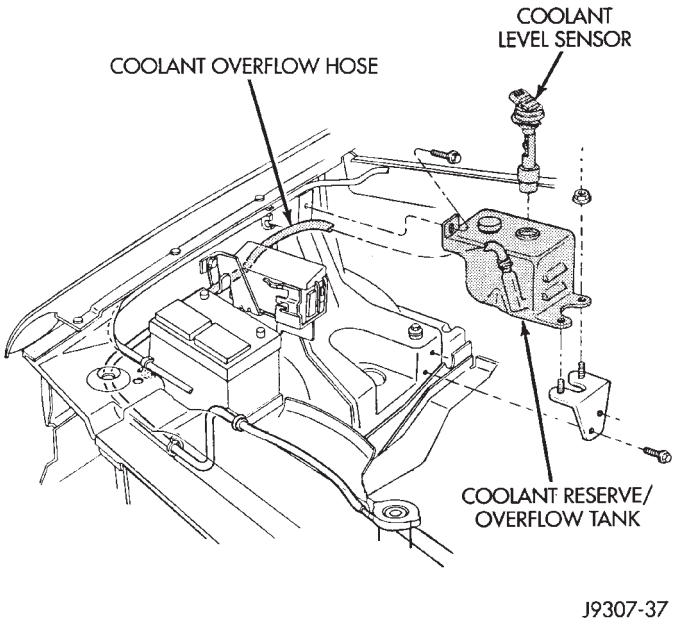

Fig. 31 Coolant Reserve/Overflow Bottle Mounting

(5) Remove the three PCM mounting bolts (Fig. 32).

(6) Remove PCM.

INSTALLATION

(1) Check the pins in the PCM 60-way electrical connector for damage. Repair as necessary.

(2) Install PCM. Tighten three mounting bolts to 1 N●m (9 in. lbs.) torque.

(3) Engage 60-way connector into PCM. Tighten connector mounting bolt to 4 N●m (35 in. lbs.) torque.

(4) Install coolant reserve/overflow bottle (Fig. 31).

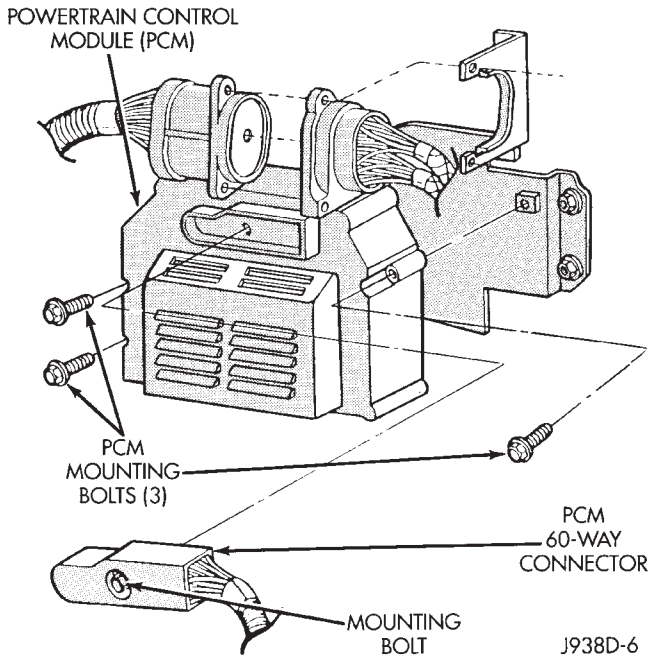

Fig. 32 PCM Mounting

(5) Connect negative cable to battery.

SPARK PLUGS

5.2L ENGINE. Spark plug cable heat shields are pressed into the cylinder head to surround each cable boot and spark plug (Fig. 33). These shields protect the spark plug boots from damage (due to intense engine heat generated by the exhaust manifolds) and should not be removed. After the spark plug cable has been installed, the lip of the cable boot should have a small air gap to the top of the heat shield (Fig. 33).

If removal of the heat shield(s) is necessary, remove the spark plug cable and compress the sides of shield for removal. Each shield is slotted to allow for

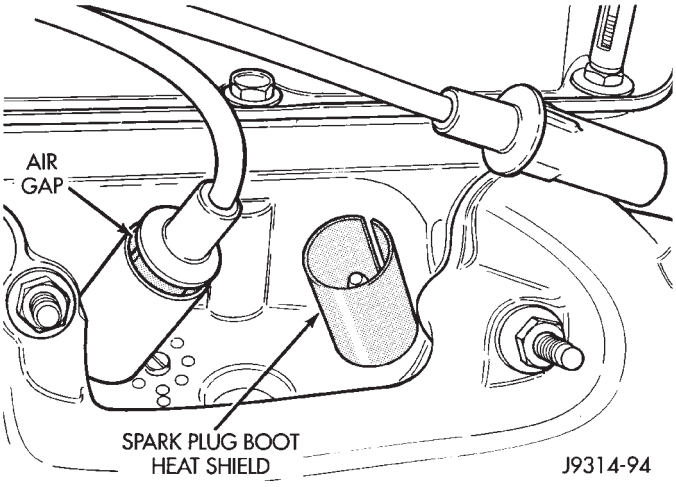

Fig. 33 Heat Shields—5.2L Engine

compression and removal. To install the shields, align shield to machined opening in cylinder head and tap into place with a block of wood.

PLUG REMOVAL

(1) Always remove spark plug or ignition coil cables by grasping at the cable boot. Turn the cable boot 1/2 turn and pull straight back in a steady motion. Never pull directly on the cable. Internal damage to cable will result.

(2) Prior to removing the spark plug, spray compressed air around the spark plug hole and the area around the spark plug. This will help prevent foreign material from entering the combustion chamber.

(3) Remove the spark plug using a quality socket with a rubber or foam insert.

(4) Inspect the spark plug condition. Refer to Spark Plugs in the Diagnostics/Service Procedures section of this group.

PLUG CLEANING

The plugs may be cleaned using commercially available spark plug cleaning equipment. After cleaning, file the center electrode flat with a small point file or jewelers file before adjusting gap.

PLUG GAP ADJUSTMENT

Check the spark plug gap with a gap gauge tool. If the gap is not correct, adjust it by bending the ground electrode (Fig. 34). **Never attempt to adjust the gap by bending the center electrode.**

SPARK PLUG GAP

- 4.0L Engine Spark Plug Gap: .89 mm (.035 in).
- 5.2L Engine Spark Plug Gap: .89 mm (.035 in).

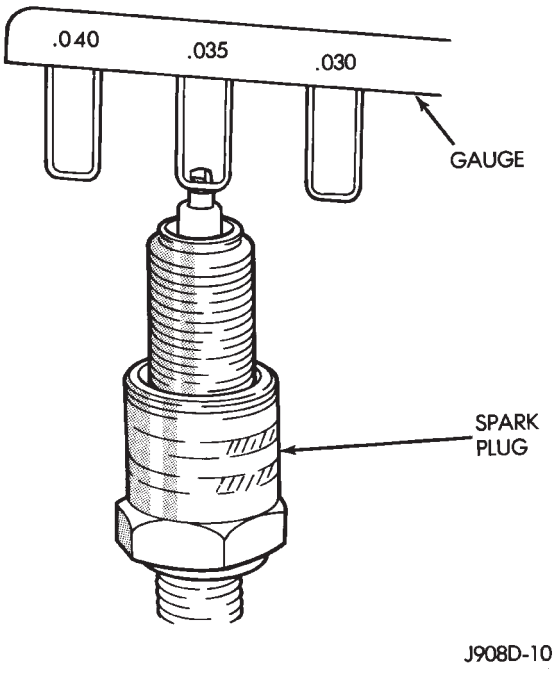

Fig. 34 Setting Spark Plug Gap—Typical

PLUG INSTALLATION

Always tighten spark plugs to the specified torque. Over tightening can cause distortion. This may result in a change in the spark plug gap.

When replacing the spark plug and ignition coil cables, route the cables correctly and secure them in the appropriate retainers. Failure to route the cables properly can cause the radio to reproduce ignition noise. It could cause cross ignition of the spark plugs, or short circuit the cables to ground.

(1) Start the spark plug into the cylinder head by hand to avoid cross threading.

(2) Tighten the spark plugs to 35-41 N●m (26-30 ft. lbs.) torque.

(3) Install spark plug cables over spark plugs.

SPARK PLUG SECONDARY CABLES

CAUTION: When disconnecting a high voltage cable from a spark plug or from the distributor cap, twist the rubber boot slightly (1/2 turn) to break it loose. Grasp the boot (not the cable) and pull it off with a steady, even force.

Install cables into the proper engine cylinder firing order (Figs. 35 or 36).

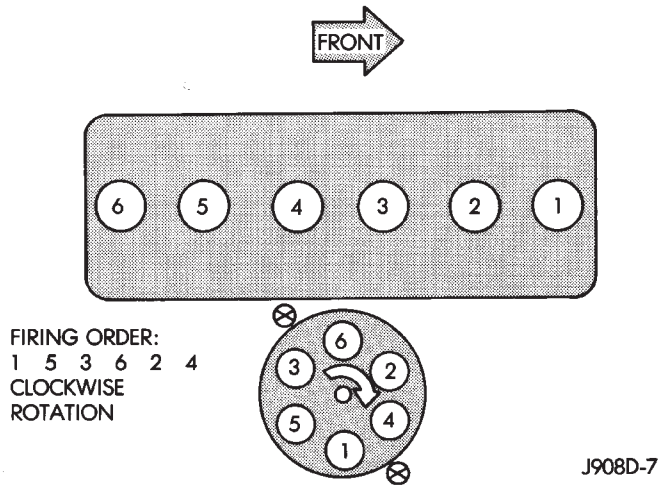

Fig. 35 Engine Firing Order—4.0L Engine

When replacing the spark plug and coil cables, route the cables correctly and secure in the proper retainers. Failure to route the cables properly can cause the radio to reproduce ignition noise. It could also cause cross ignition of the plugs, or short circuit the cables to ground.

When installing new cables, make sure a positive connection is made. A snap should be felt when a good connection is made between the plug cable and the distributor cap tower.

5.2L Engine: Spark plug cable boot heat shields are pressed into the cylinder head to surround each cable boot and spark plug (Fig. 37). These shields protect the spark plug boots from damage (due to in-

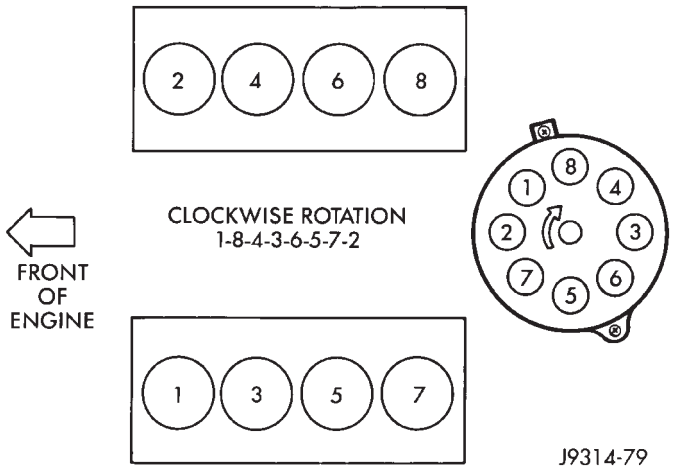

Fig. 36 Engine Firing Order—5.2L Engine

tense engine heat generated by the exhaust manifolds) and should not be removed. After the spark plug cable has been installed, the lip of the cable boot should have a small air gap to the top of the heat shield (Fig. 37).

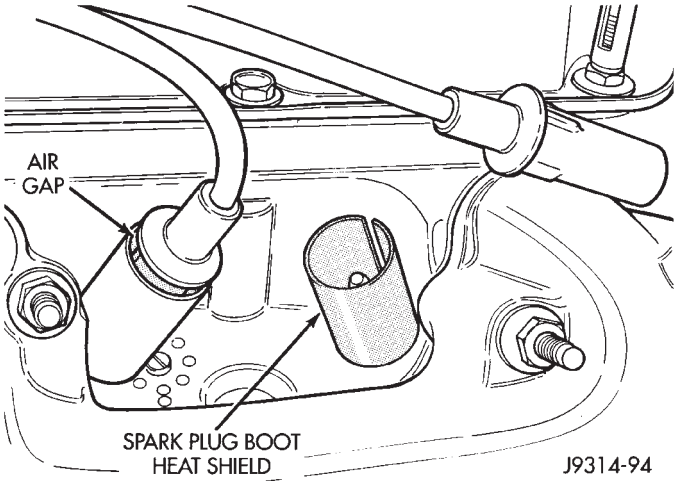

Fig. 37 Heat Shields—5.2L Engine

THROTTLE POSITION SENSOR (TPS)

REMOVAL—4.0L ENGINE

The throttle position sensor is mounted to the throttle body (Fig. 38) on the 4.0L engine.

(1) Disconnect sensor electrical connector.
(2) Remove the two sensor mounting screws.
(3) Remove sensor.

INSTALLATION—4.0L ENGINE

The throttle shaft end slides into a socket in the sensor (Fig. 39). The sensor must be installed so that it can be rotated a few degrees. (If the sensor will not rotate, install the sensor with the throttle shaft on the other side of the socket tangs). The sensor will be under slight tension when rotated.

(1) Install the throttle position sensor and two retaining screws.

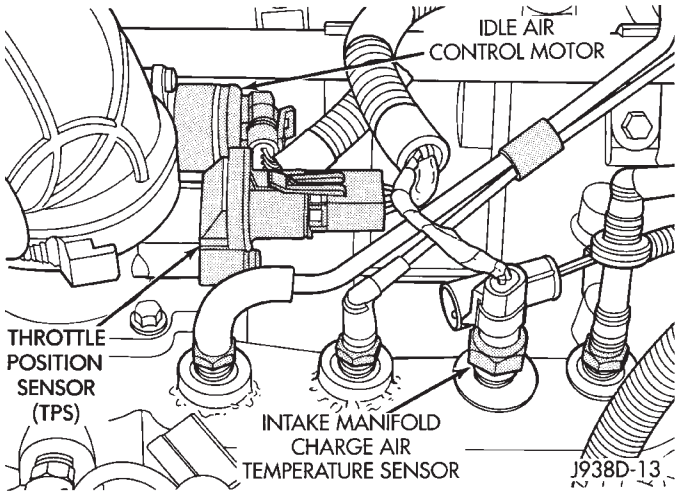

Fig. 38 TPS—4.0L Engine

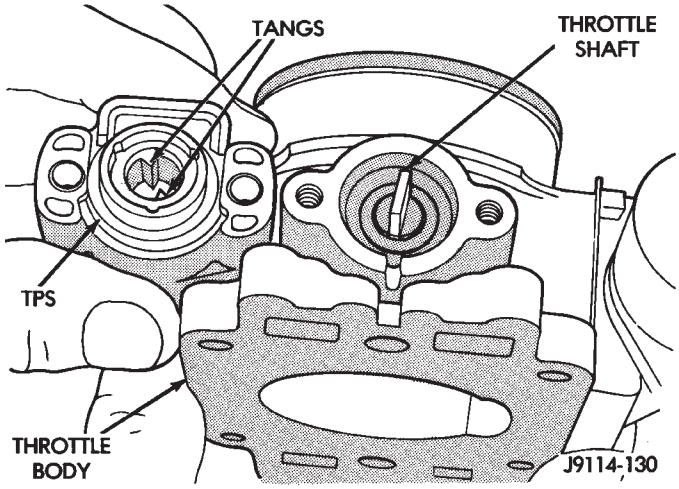

Fig. 39 TPS Installation—4.0L Engine

(2) Connect sensor electrical connector to sensor.
(3) Operate the throttle by hand to check for binding.

REMOVAL—5.2L ENGINE

The TPS is located on the side of the throttle body (Fig. 40) on the 5.2L engine.

(1) Remove air intake tube at throttle body.
(2) Disconnect TPS electrical connector (Fig. 40).
(3) Remove two TPS mounting screws (Fig. 41).
(4) Remove TPS from throttle body.

INSTALLATION—5.2L ENGINE

The throttle shaft end of the throttle body slides into a socket in the TPS (Fig. 42). The TPS must be installed so that it can be rotated a few degrees. If the sensor will not rotate, install the sensor with the throttle shaft on the other side of the socket tangs. The TPS will be under slight tension when rotated.

(1) Install the TPS and two retaining screws.
(2) Tighten screws to 7 N•m (60 in. lbs.) torque.

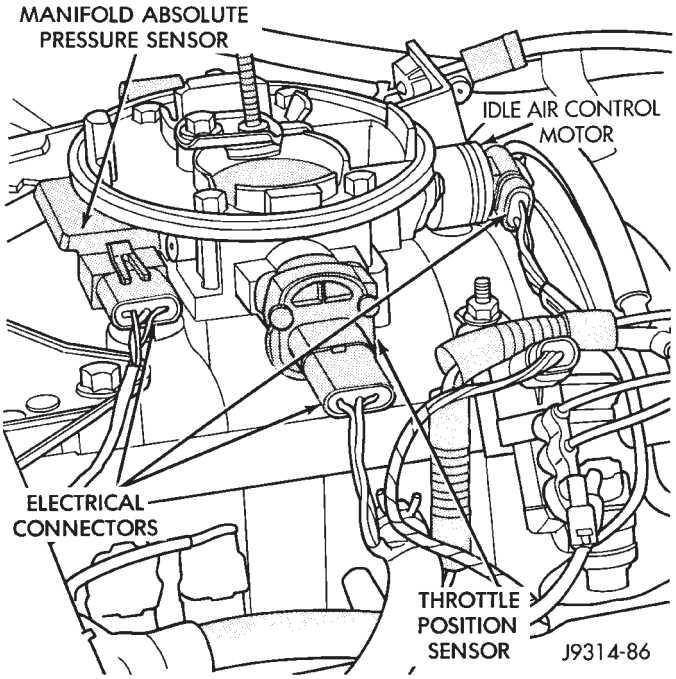

Fig. 40 TPS—5.2L Engine

(3) Manually operate the throttle control lever by hand to check for any binding of the TPS.
(4) Connect TPS electrical connector to TPS.
(5) Install air intake tube.

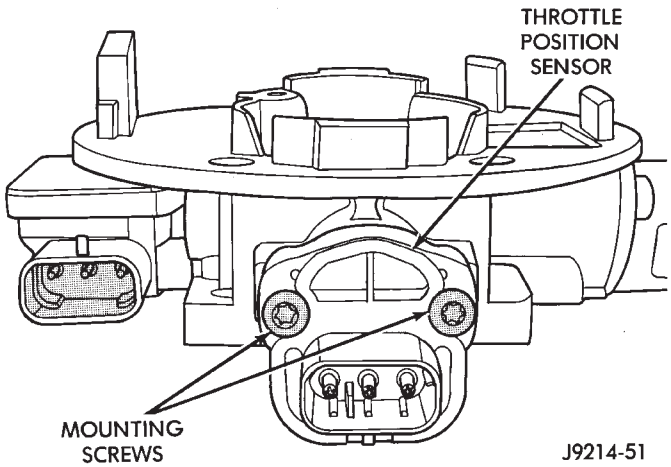

Fig. 41 TPS Mounting Screws—5.2L Engine

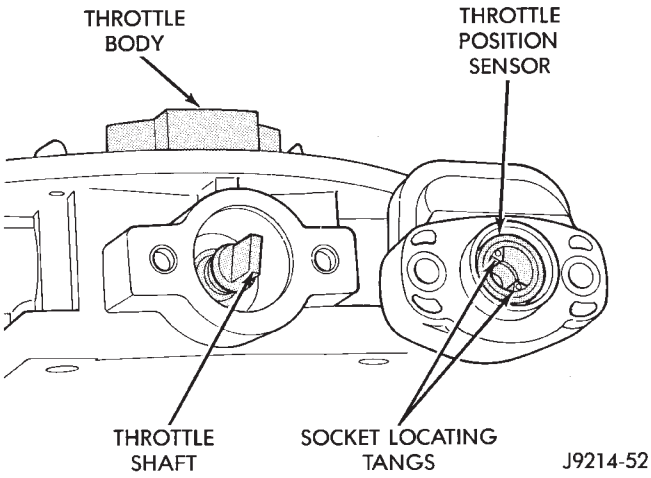

Fig. 42 TPS Installation—5.2L Engine

IGNITION SWITCH

INDEX

GENERAL INFORMATION

The ignition switch is located in the steering column. The Key-In-Switch and Halo Light are integral with the ignition switch. Refer to Group 8M for Key-In-Switch and Halo Light diagnosis.

IGNITION SWITCH AND KEY CYLINDER SERVICE

REMOVAL

(1) Disconnect negative battery cable.

(2) Tilt column: Remove tilt lever (counterclockwise).

(3) Remove upper and lower covers (three screws).

(4) Remove ignition switch mounting screws (Snap-on torx bit tool TTXR20B0 or equivalent required—Fig. 1).

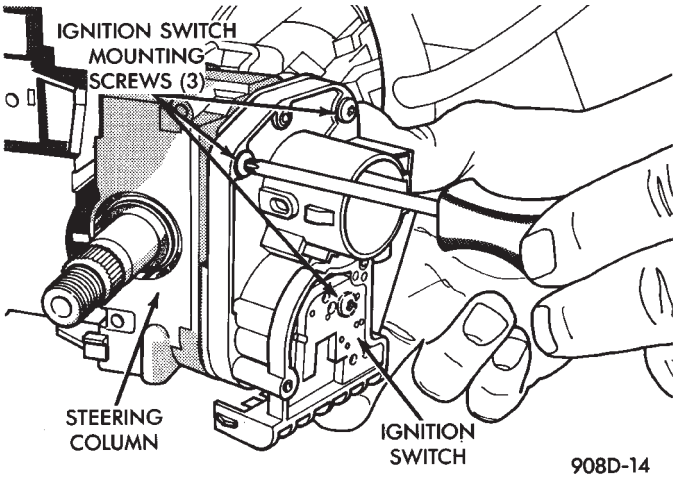

Fig. 1 Ignition Switch Screw Removal

(5) Gently pull switch away from the column. Release two connector locks on the 7-terminal wiring connector. Remove the connector from the ignition switch.

(6) Release connector lock on the Key-In-Switch and Halo Light 4-terminal connector. Remove the connector from the ignition switch (Fig. 2).

(7) Remove the key cylinder from the ignition switch as follows:

(a) With the key inserted and the ignition switch in the lock position, proceed as follows: Use a small screwdriver to depress the key cylinder retaining pin flush with the key cylinder surface (Fig. 3).

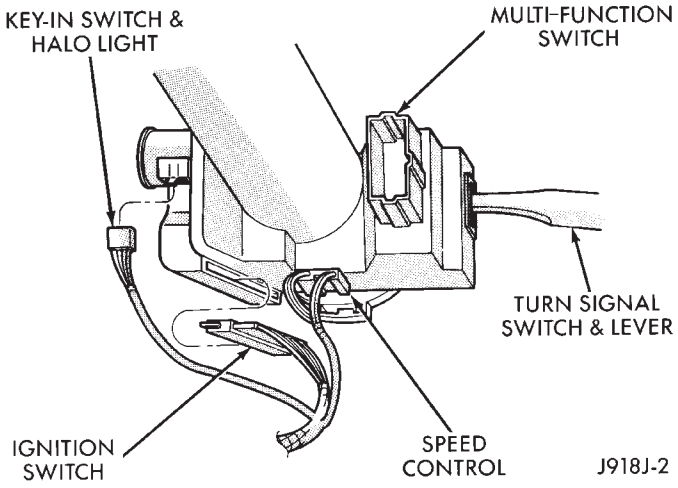

Fig. 2 Key in Switch and Halo Lamp Connector

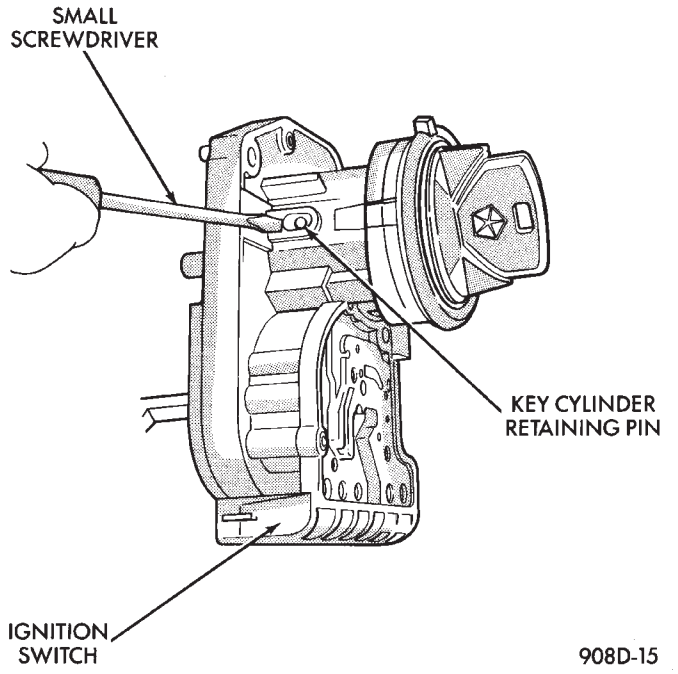

Fig. 3 Key Cylinder Retaining Pin

(b) Rotate the key clockwise to the OFF position. The key cylinder should now be unseated from the ignition switch assembly (Fig. 4).

CAUTION: Do not remove key cylinder at this time.

(c) With key cylinder in unseated position (key cylinder bezel about 1/8 inch above ignition switch

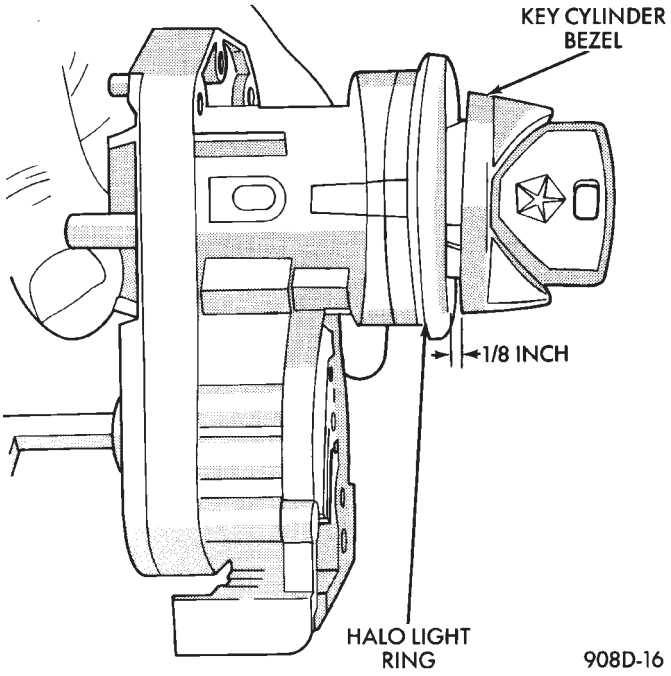

Fig. 4 Unseated Key Cylinder

halo light ring), proceed as follows: Rotate the key counterclockwise to the Lock position and remove the key.

(d) Remove key cylinder (Fig. 5).

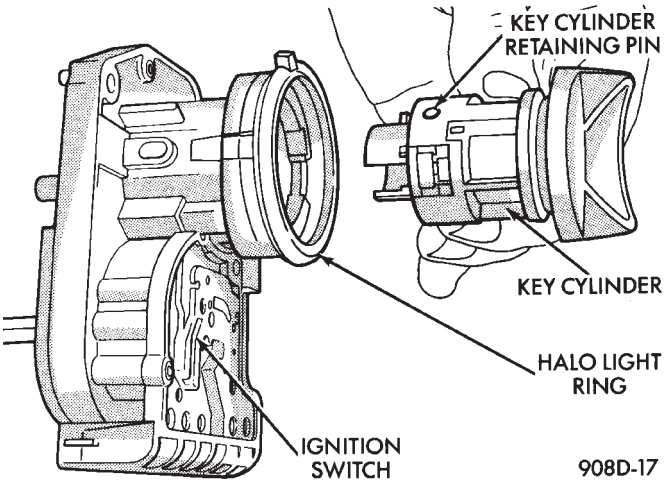

Fig. 5 Key Cylinder Removal

INSTALLATION

(1) Install electrical connectors to switch. Make sure that the switch locking tabs are fully seated in the wiring connectors.

(2) Mount ignition switch to the column (Fig. 6).

Park-lock dowel pin on ignition switch assembly must engage with column park-lock slider linkage (Fig. 7). Verify ignition switch is in lock position (flag is parallel with the ignition switch terminals) (Fig. 6). Apply a dab of grease to flag and pin. Position park-lock link and slider to mid-travel. Position ignition switch against lock housing face. Be sure pin is inserted into park-lock link contour slot. Tighten retaining screws to 2 N•m (17 in. lbs.) torque.

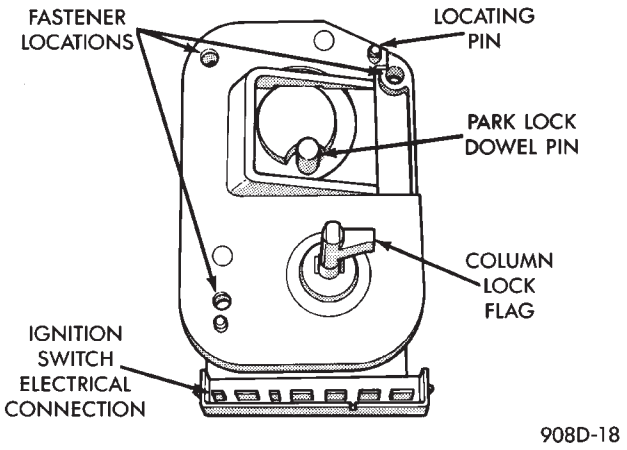

Fig. 6 Ignition Switch View From Column

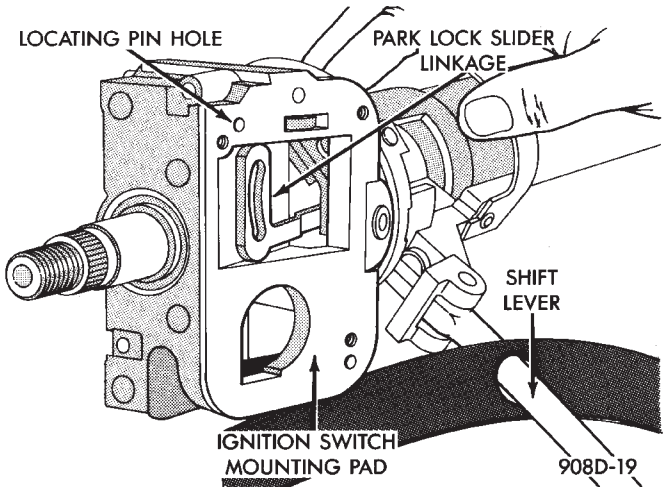

Fig. 7 Ignition Switch Mounting Pad

(3) Assemble cover to the column (3 screws). Tighten retaining screws to 2 N•m (17 in. lbs.) torque.

(4) Tilt column: Install tilt lever (clockwise).

(5) Install negative battery cable.

(6) Install key cylinder.

(a) With key cylinder and ignition in lock position, gently insert key cylinder into ignition switch assembly until it bottoms.

(b) Insert key. While gently pushing on the key cylinder (inward) toward the ignition switch, rotate key clockwise to end of travel.

(7) Check for proper operation of push-to-lock, halo lighting, Accessory, Lock, Off, Run, Start, column lock and shift lock (if applicable).

IGNITION SWITCH CIRCUITS

IGNITION SWITCH CONNECTOR LOOKING INTO SWITCH

WIRE CAVITY	WIRE COLOR	APPLICATION
1	YELLOW/DRK. BLUE	STARTER RELAY
2	YELLOW	IGNITION RUN/START
3	GRAY/BLACK	BRAKE WARNING LAMP
4	RED/WHITE	IGNITION SWITCH BATTERY FEED
5	ORANGE/BLACK	RUN ACCESSORY
6	VIOLET	ACCESSORY
7	PINK/BLACK	IGNITION SWITCH BATTERY FEED

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SPECIFICATIONS

GENERAL INFORMATION

The following specifications are published from the latest information available at the time of publication. **If anything differs between the specifications found on the Vehicle Emission Control Information (VECI) label and the following specifications, use specifications on VECI label.** The VECI label is located in the engine compartment.

SPARK PLUGS

ENGINE	PLUG TYPE	ELECTRODE GAP
4.0L 6 Cylinder	RC12LYC	0.089mm (0.035 in.)
5.2L V-8	RC12YC	0.089 mm (0.035 in.)

J9314-90

SPARK PLUG CABLE RESISTANCE

MINIMUM	MAXIMUM
250 Ohms Per Inch	1000 Ohms Per Inch
3000 Ohms Per Foot	12,000 Ohms Per Foot

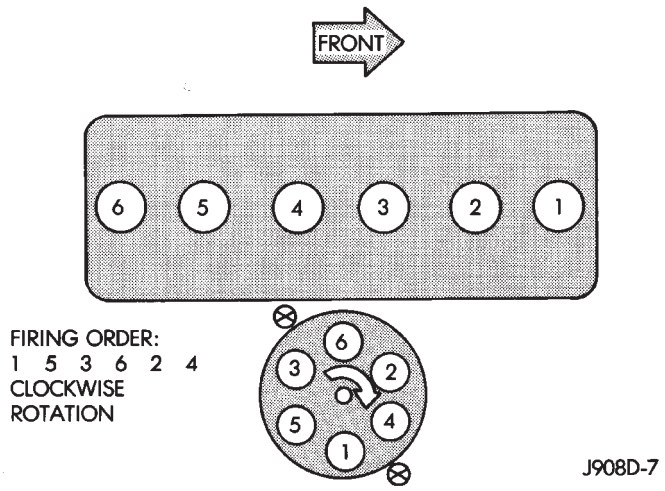
J908D-43

IGNITION COIL RESISTANCE

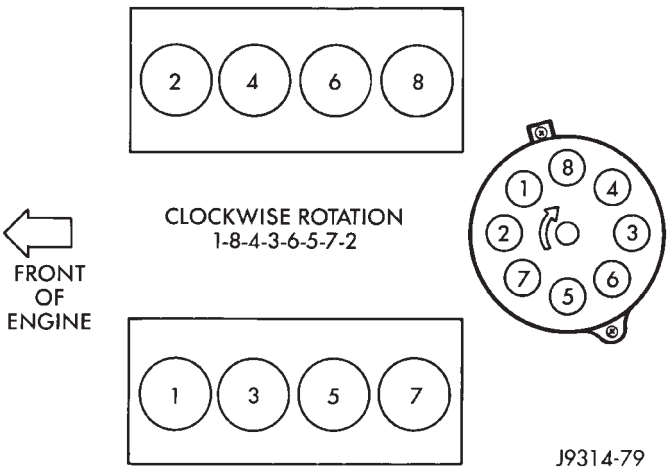
COIL (MANUFACTURER)	PRIMARY RESISTANCE 21–27°C (70–80°F)	SECONDARY RESISTANCE 21–27°C (70–80°F)
Diamond	0.97 - 1.18 Ohms	11,300 - 15,300 Ohms
Toyodenso	0.95 - 1.20 Ohms	11,300 - 13,300 Ohms

J918D-2

ENGINE FIRING ORDER—4.0L ENGINE



ENGINE FIRING ORDER—5.2L ENGINE



TORQUE

DESCRIPTION	TORQUE
Coolant Temperature Sensor (6 Cylinder)	28 N·m (21 ft. lbs.)
Coolant Temperature Sensor (V-8)	7 N·m (5 ft. lbs.)
Crankshaft Position Sensor Mounting Bolts (6 Cyl.)	19 N·m (14 ft. lbs.)
Crankshaft Position Sensor Mounting Bolts (V-8)	8 N·m (70 in. lbs.)
Distributor Hold Down Bolt	23 N·m (17 ft. lbs.)
Intake Manifold Charge Air Temp. Sensor	13 N·m (10 ft. lbs.)
Oxygen Sensor	30 N·m (22 ft. lbs.)
Powertrain Control Module (PCM) Mounting Screws	1 N·m (9 in. lbs.)
Powertrain Control Module (PCM) Elect. Connector	4 N·m (35 in. lbs.)
Spark Plugs 6 or 8 Cylinder	35-41 N·m (26-30 ft. lbs.)

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