

IGNITION CONTROL

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IGNITION CONTROL

DESCRIPTION

The ignition system is controlled by the Powertrain Control Module (PCM) on all engines.

3.7L V-6 ENGINE

The 3.7L V-6 engine uses a separate ignition coil for each cylinder. The one-piece coil bolts directly to

the cylinder head. Rubber boots seal the secondary terminal ends of the coils to the top of all 6 spark plugs. A separate electrical connector is used for each coil.

Because of coil design, spark plug cables (secondary cables) are not used. A distributor is not used with the 3.7L engine.

Two knock sensors (one for each cylinder bank) are used to help control spark knock.

IGNITION CONTROL (Continued)

The Auto Shutdown (ASD) relay provides battery voltage to each ignition coil.

The ignition system consists of:

- 6 Spark Plugs
- 6 Separate Ignition Coils
- 2 Knock Sensors
- Powertrain Control Module (PCM)
- Also to be considered part of the ignition system are certain inputs from the Crankshaft Position, Camshaft Position, Throttle Position, 2 knock and MAP Sensors

4.7L V-8 ENGINE

The 4.7L V-8 engine uses a separate ignition coil for each cylinder. The one-piece coil bolts directly to the cylinder head. Rubber boots seal the secondary terminal ends of the coils to the top of all 8 spark plugs. A separate electrical connector is used for each coil.

Because of coil design, spark plug cables (secondary cables) are not used. A distributor is not used with the 4.7L engine.

Two knock sensors (one for each cylinder bank) are used to help control spark knock.

The Auto Shutdown (ASD) relay provides battery voltage to each ignition coil.

The ignition system consists of:

- 8 Spark Plugs
- 8 Separate Ignition Coils
- 2 Knock Sensors
- Powertrain Control Module (PCM)
- Also to be considered part of the ignition system are certain inputs from the Crankshaft Position, Camshaft Position, Throttle Position, 2 knock and MAP Sensors

5.7L V-8 ENGINE

For additional information, also refer to Ignition Coil Description and Operation.

The 5.7L V-8 engine is equipped with 16 spark plugs. Two plugs are used for each cylinder. The 5.7L is also equipped with 8 separate and independent ignition coils. The one-piece coil bolts directly to the cylinder head cover and attaches the coils secondary output terminal directly to a spark plug using a rubber boot seal. Each coil is also equipped with a second output terminal. This second terminal connects a conventional spark plug cable directly to a spark plug on the opposite cylinder bank. A separate primary electrical connector is used for each coil.

Eight conventional spark plug cables are used with the 5.7L. These cables connect a coil on one cylinder bank, directly to a spark plug on the opposite cylinder bank. The cables are placed and routed in a special plastic loom to keep them separated. This loom is clipped to the intake manifold. To prevent a mismatch of cables, a corresponding spark plug / coil number is displayed on each plug cable: 1/6, 2/3, 4/7

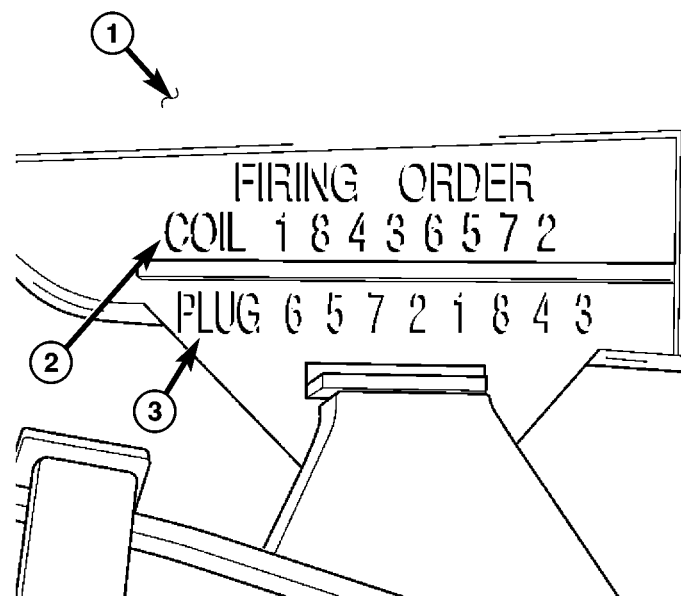
and 5/8. These numbers can also be found on the top of the intake manifold to the right of the throttle body (Fig. 1).

Two knock sensors (one for each cylinder bank) are used to help control spark knock.

The 5.7L engine will not use a conventional distributor.

The ignition system consists of:

- 16 Spark Plugs (2 per cylinder)
- 8 Separate, Dual-Secondary Output, Ignition Coils
- 2 Knock Sensors
- 8 Secondary Ignition Cables
- Powertrain Control Module (PCM)
- Also to be considered part of the ignition system are certain inputs from the Crankshaft Position, Camshaft Position, Throttle Position, 2 knock and MAP Sensors



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Fig. 1 FIRING ORDER / CABLE ROUTING - 5.7L V-8 ENGINE

- 1 - TOP OF INTAKE MANIFOLD
- 2 - CYLINDER FIRING ORDER (IGNITION COIL NUMBER)
- 3 - CORRESPONDING SPARK PLUG NUMBER

5.9L V-8 ENGINE

The 5.9L V-8 ignition system will use a conventional distributor and 1 remotely mounted coil. Conventional spark plug cables are used with the 5.9L.

Knock sensors are not used with the 5.9L engine.

The ignition system consists of:

- 8 Spark Plugs
- 1 Ignition Coil
- Secondary Ignition Cables
- Distributor (contains rotor and camshaft position sensor)
- Powertrain Control Module (PCM)

IGNITION CONTROL (Continued)

• Also to be considered part of the ignition system are certain inputs from the Crankshaft Position, Camshaft Position, Throttle Position and MAP Sensors

8.0L V-10 ENGINE

. The 8.0L V-10 engine is equipped with 2 remote coil packs. Conventional spark plug cables are used with the 8.0L engine. The 8.0L engine will not use a conventional distributor

The ignition coils are individually fired, but each coil is a dual output. Refer to Ignition Coil for additional information.

Knock sensors are not used with the 8.0L engine. The ignition system consists of:

- 10 Spark Plugs
- 2 Ignition Coil packs containing 10 individual coils
- 10 Secondary Ignition Cables
- Powertrain Control Module (PCM)
- Also to be considered part of the ignition system are certain inputs from the Crankshaft Position, Camshaft Position, Throttle Position and MAP Sensors

SPECIFICATIONS**SPECIFICATIONS - TORQUE - IGNITION**

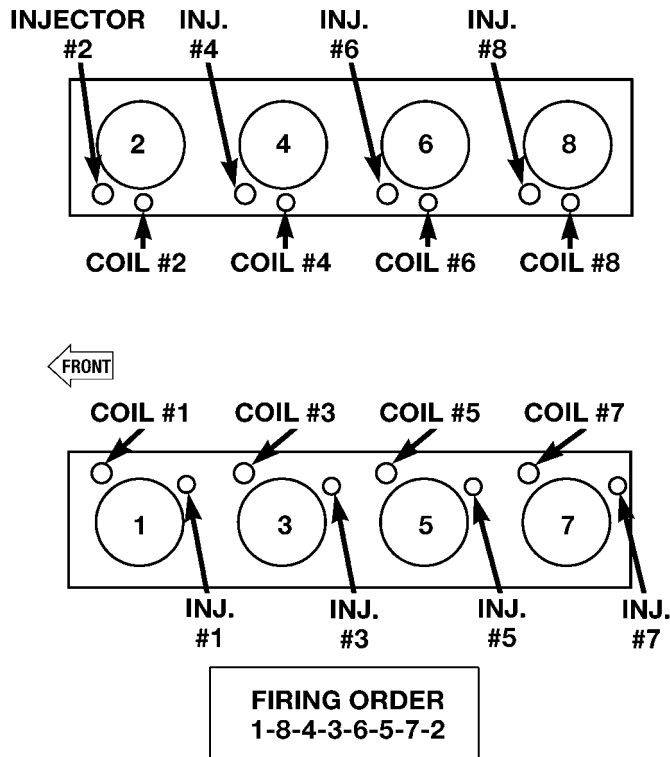
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Camshaft Position Sensor - 3.7L V-6 Engine	12	-	106
Camshaft Position Sensor - 4.7L V-8 Engine	12	-	106
Camshaft Position Sensor - 5.7L V-8 Engine	12	9	105
Camshaft Position Sensor - 8.0L V-10 Engine	6	-	50
Crankshaft Position Sensor - 3.7L V-6 Engine	28	21	205
Crankshaft Position Sensor - 4.7L V-8 Engine	28	21	205
Crankshaft Position Sensor - 5.7L V-8 Engine	12	9	105
Crankshaft Position Sensor - 5.9L V-8 Engine	8	-	70
Crankshaft Position Sensor - 8.0L V-10 Engine	8	-	70
Distributor Hold Down Bolt - 5.9L V-8 Engine	23	17	-
Ignition Coil Mounting - 5.9L V-8 Engine (if tapped bolts are used)	5	-	50
Ignition Coil Mounting - 5.9L V-8 Engine (if nuts/bolts are used)	11	-	100
Ignition Coil Mounting - 3.7L V-6 Engine	8	-	70
Ignition Coil Mounting - 4.7L V-8 Engine	8	-	70
Ignition Coil Mounting - 5.7L V-8 Engine	12	9	105 (± 20)
Ignition Coil Mounting - 8.0L V-10 Engine	10	-	90
* Knock Sensor - 3.7L V-6 Engine	20	15	176
* Knock Sensor - 4.7L V-8 Engine	20	15	176
* Knock Sensor - 5.7L V-8 Engine	20	15	176
Spark Plugs - 3.7L V-6 Engine	27	20	-
Spark Plugs - 4.7L V-8 Engine	27	20	-
** Spark Plugs - 5.7L V-8 Engine	18 (± 3)	13 (± 2)	-
Spark Plugs - 5.9L V-8 Engine	41	30	-
Spark Plugs - 8.0L V-10 Engine	41	30	-
* Do not apply any sealant, thread-locker or adhesive to bolts. Poor sensor performance may result.			
** Torque critical tapered design. Do not exceed 15 ft. lbs.			

IGNITION CONTROL (Continued)

ENGINE FIRING ORDER - 3.7L V-6

1 - 6 - 5 - 4 - 3 - 2

ENGINE FIRING ORDER - 4.7L V-8



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FIRING ORDER / CABLE ROUTING - 5.7L V-8 ENGINE

Eight conventional spark plug cables are used with the 5.7L. These cables connect a coil on one cylinder bank, directly to a spark plug on the opposite cylinder bank. The cables are placed and routed in a special plastic loom to keep them separated. This loom is clipped to the intake manifold. To prevent a mismatch of cables, a corresponding spark plug / coil number is displayed on each plug cable: 1/6, 2/3, 4/7 and 5/8. These numbers can also be found on the top of the intake manifold to the right of the throttle body (Fig. 2).

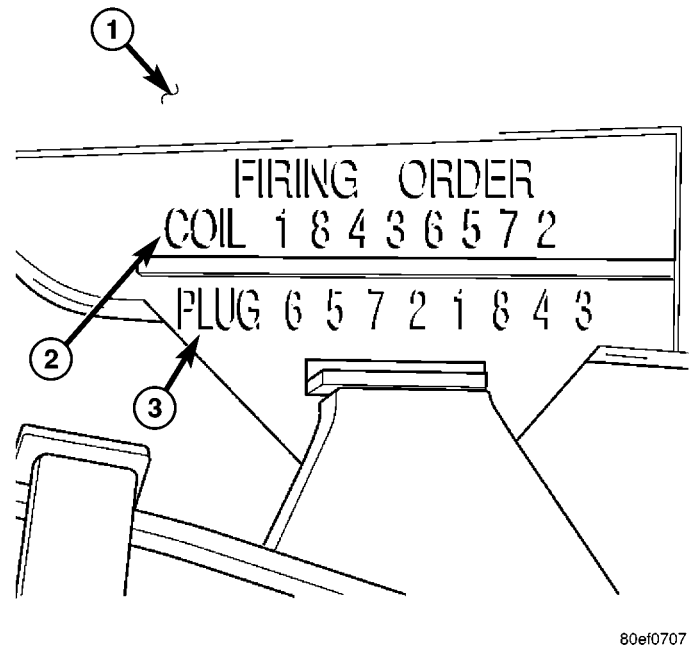
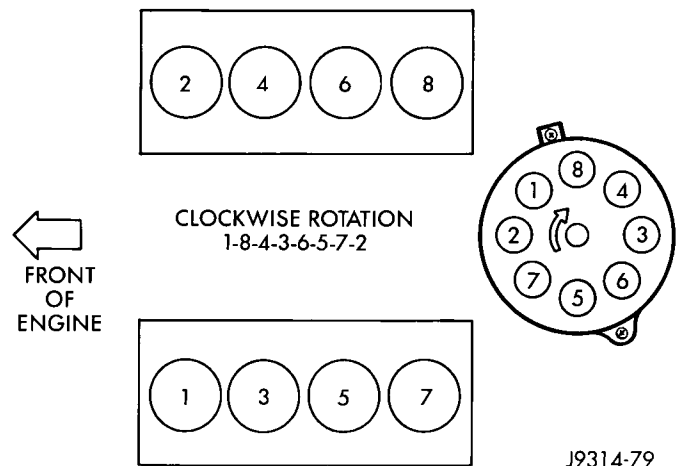
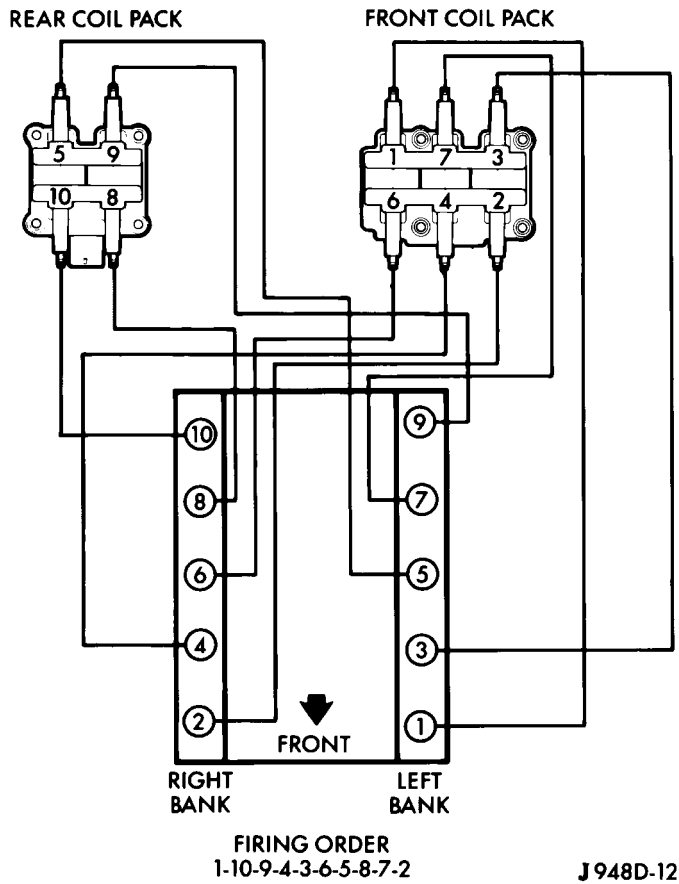


Fig. 2 FIRING ORDER / CABLE ROUTING - 5.7L V-8 ENGINE

ENGINE FIRING ORDER - 5.9L V-8



IGNITION CONTROL (Continued)**SPARK PLUG CABLE ORDER – 8.0L V-10 ENGINE****SPARK PLUG CABLE ORDER – 8.0L V-10 ENGINE****SPARK PLUG CABLE RESISTANCE**

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

SPARK PLUGS

ENGINE	PLUG TYPE	ELECTRODE GAP
3.7L V-6	ZFR6F - 11G (NGK)	1.1 (0.042 in.)
4.7L V-8	RC12MCC4	1.01 mm (.040 in.)
5.7L V-8	Champion - RE14MCC4	1.14 mm (.045 in.)
5.9L V-8	RC12LC4	1.01 mm (.040 in.)
8.0L V-10	QC9MC4	1.14 mm (.045 in.)

IGNITION CONTROL (Continued)

IGNITION COIL RESISTANCE - 3.7L V-6

PRIMARY RESISTANCE 21-27°C (70-80°F)	SECONDARY RESISTANCE 21-27°C (70-80°F)
0.6 - 0.9 Ohms	6,000 - 9,000 Ohms

IGNITION COIL RESISTANCE - 5.7L V-8

PRIMARY RESISTANCE @ 21-27°C (70-80°F)
0.558 - 0.682 Ohms (Plus or Minus 10% @ 70-80° F)

IGNITION COIL RESISTANCE - 4.7L V-8

PRIMARY RESISTANCE 21-27°C (70-80°F)	SECONDARY RESISTANCE 21-27°C (70-80°F)
0.6 - 0.9 Ohms	6,000 - 9,000 Ohms

IGNITION COIL RESISTANCE - 5.9L

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

**IGNITION COIL RESISTANCE - 8.0L V-10
ENGINE**

Primary Resistance: 0.53-0.65 Ohms. Test across the primary connector. Refer to text for test procedures.
Secondary Resistance: 10.9-14.7K Ohms. Test across the individual coil towers. Refer to text for test procedures.

IGNITION TIMING

Ignition timing is not adjustable on any engine.

**AUTOMATIC SHUT DOWN
RELAY****DESCRIPTION - PCM OUTPUT**

The 5-pin, 12-volt, Automatic Shutdown (ASD) relay is located in the Power Distribution Center (PDC). Refer to label on PDC cover for relay location.

OPERATION**OPERATION - PCM OUTPUT**

The ASD relay supplies battery voltage (12+ volts) to the fuel injectors and ignition coil(s). With certain emissions packages it also supplies 12-volts to the oxygen sensor heating elements.

The ground circuit for the coil within the ASD relay is controlled by the Powertrain Control Module (PCM). The PCM operates the ASD relay by switching its ground circuit on and off.

The ASD relay will be shut-down, meaning the 12-volt power supply to the ASD relay will be de-activated by the PCM if:

- the ignition key is left in the ON position. This is if the engine has not been running for approximately 1.8 seconds.
- there is a crankshaft position sensor signal to the PCM that is lower than pre-determined values.

OPERATION - ASD SENSE - PCM INPUT

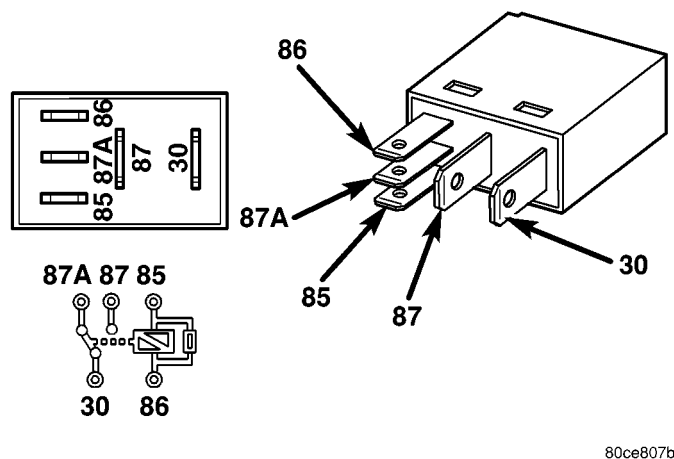
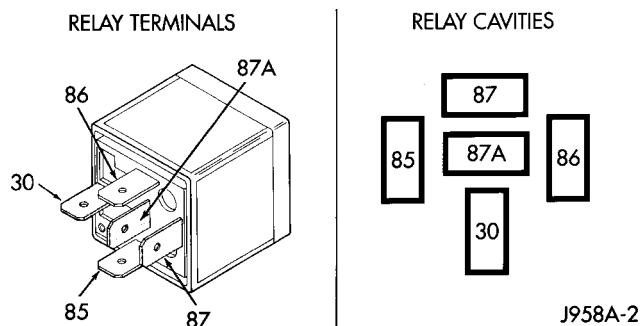
A 12 volt signal at this input indicates to the PCM that the ASD has been activated. The relay is used to connect the oxygen sensor heater element, ignition coil and fuel injectors to 12 volt + power supply.

This input is used only to sense that the ASD relay is energized. If the Powertrain Control Module (PCM) does not see 12 volts at this input when the ASD should be activated, it will set a Diagnostic Trouble Code (DTC).

AUTOMATIC SHUT DOWN RELAY (Continued)

DIAGNOSIS AND TESTING - ASD AND FUEL PUMP RELAYS

The following description of operation and tests apply only to the Automatic Shutdown (ASD) and fuel pump relays. The terminals on the bottom of each relay are numbered. Two different types of relays may be used, (Fig. 3) or (Fig. 4).

**Fig. 3 TYPE 1 RELAY (ISO MICRO RELAY)****Fig. 4 ASD AND FUEL PUMP RELAY TERMINALS—TYPE 2****TERMINAL LEGEND**

NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

- Terminal number 30 is connected to battery voltage. For both the ASD and fuel pump relays, terminal 30 is connected to battery voltage at all times.
- The PCM grounds the coil side of the relay through terminal number 85.

- Terminal number 86 supplies voltage to the coil side of the relay.

- When the PCM de-energizes the ASD and fuel pump relays, terminal number 87A connects to terminal 30. This is the Off position. In the off position, voltage is not supplied to the rest of the circuit. Terminal 87A is the center terminal on the relay.

- When the PCM energizes the ASD and fuel pump relays, terminal 87 connects to terminal 30. This is the On position. Terminal 87 supplies voltage to the rest of the circuit.

The following procedure applies to the ASD and fuel pump relays.

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

- (5) Connect one end of a jumper wire (16 gauge or smaller) to relay terminal 85. Connect the other end of the jumper wire to the ground side of a 12 volt power source.

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

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

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

- (8) Disconnect jumper wires.

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

REMOVAL

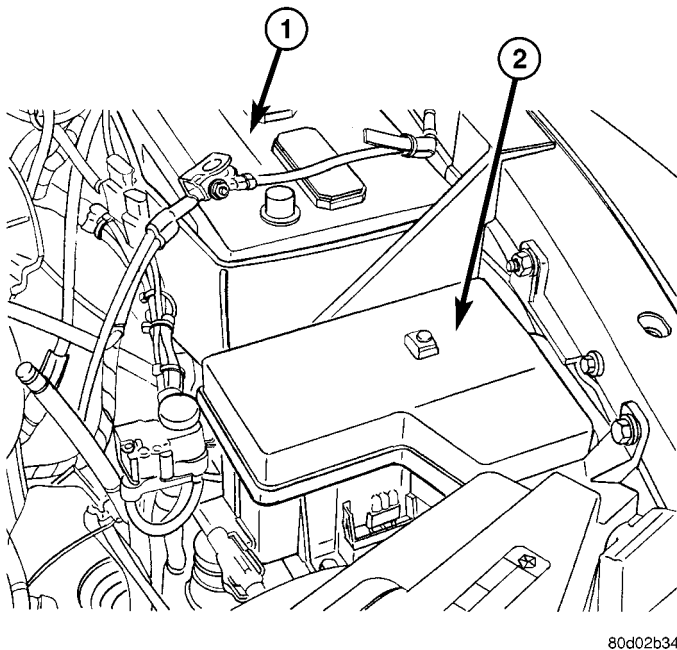
The ASD relay is located in the Power Distribution Center (PDC) (Fig. 5). Refer to label on PDC cover for relay location.

- (1) Remove PDC cover.
- (2) Remove relay from PDC.

AUTOMATIC SHUT DOWN RELAY (Continued)

(3) Check condition of relay terminals and PDC connector terminals for damage or corrosion. Repair if necessary before installing relay.

(4) Check for pin height (pin height should be the same for all terminals within the PDC connector). Repair if necessary before installing relay.



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Fig. 5 PDC LOCATION

- 1 - BATTERY
2 - PDC (POWER DISTRIBUTION CENTER)

INSTALLATION

The ASD relay is located in the Power Distribution Center (PDC) (Fig. 5). Refer to label on PDC cover for relay location.

- (1) Install relay to PDC.
- (2) Install cover to PDC.

CAMSHAFT POSITION SENSOR**DESCRIPTION****3.7L V-6**

The Camshaft Position Sensor (CMP) on the 3.7L 6-cylinder engine is bolted to the right-front side of the right cylinder head.

4.7L V-8

The Camshaft Position Sensor (CMP) on the 4.7L V-8 engine is bolted to the right-front side of the right cylinder head.

5.7L V-8

The Camshaft Position Sensor (CMP) on the 5.7L V-8 engine is located below the generator on the timing chain / case cover on the right/front side of engine.

5.9L Diesel

The Camshaft Position Sensor (CMP) on the 5.9L diesel engine is located below the fuel injection pump. It is bolted to the back of the timing gear cover.

5.9L V-8 Gas

The Camshaft Position Sensor (CMP) on the 5.9L V-8 engine is located inside the distributor.

8.0L V-10

The Camshaft Position Sensor (CMP) on the 8.0L V-10 engine is located on the timing chain / case cover on the left/front side of engine.

OPERATION**3.7L V-6**

The Camshaft Position Sensor (CMP) sensor on the 3.7L V-6 engine contains a hall effect device referred to as a sync signal generator. A rotating target wheel (tonewheel) for the CMP is located at the front of the camshaft for the right cylinder head (Fig. 6). This sync signal generator detects notches located on a tonewheel. As the tonewheel rotates, the notches pass through the sync signal generator. The signal from the CMP sensor is used in conjunction with the Crankshaft Position Sensor (CKP) to differentiate between fuel injection and spark events. It is also used to synchronize the fuel injectors with their respective cylinders.

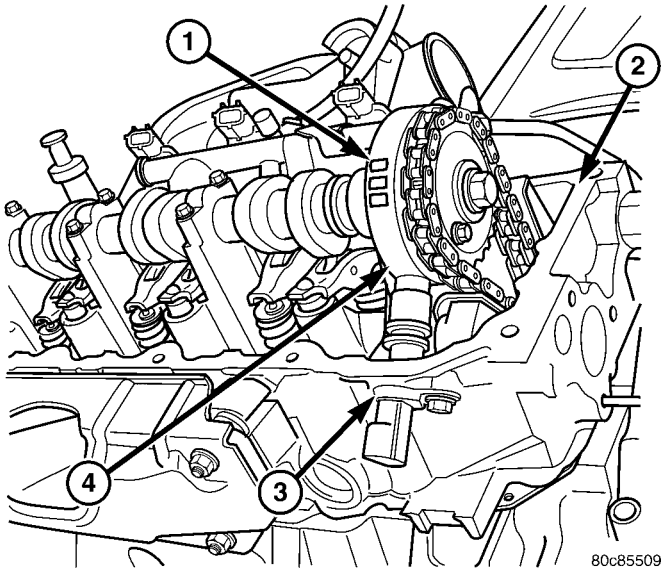
When the leading edge of the tonewheel notch enters the tip of the CMP, the interruption of magnetic field causes the voltage to switch high, resulting in a sync signal of approximately 5 volts.

When the trailing edge of the tonewheel notch leaves then tip of the CMP, the change of the magnetic field causes the sync signal voltage to switch low to 0 volts.

4.7L V-8

The CMP sensor on the 4.7L engine contains a hall effect device called a sync signal generator to generate a fuel sync signal. This sync signal generator detects notches located on a tonewheel. The tonewheel is located at the front of the camshaft for the right cylinder head (Fig. 7). As the tonewheel rotates, the notches pass through the sync signal generator. The pattern of the notches (viewed counter-clockwise from front of engine) is: 1 notch, 2 notches, 3 notches,

CAMSHAFT POSITION SENSOR (Continued)

**Fig. 6 CMP OPERATION- 3.7L V-6**

- 1 - NOTCHES
- 2 - RIGHT CYLINDER HEAD
- 3 - CMP
- 4 - TONEWHEEL (TARGET WHEEL)

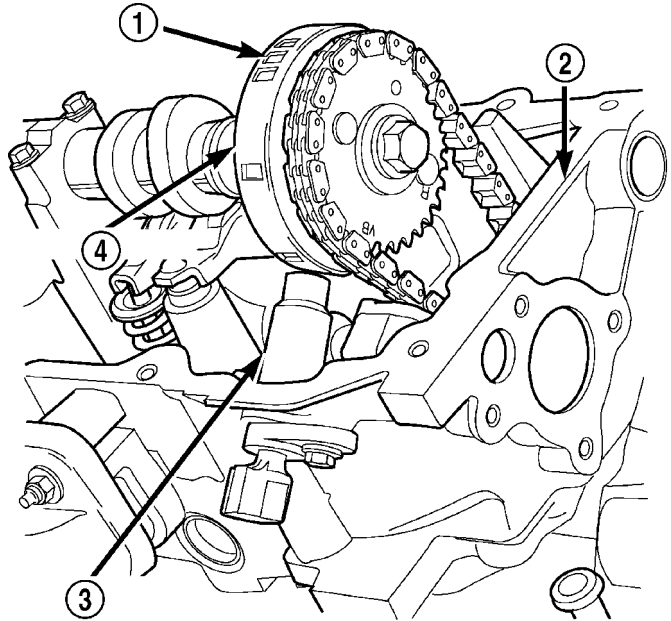
3 notches, 2 notches 1 notch, 3 notches and 1 notch. The signal from the CMP sensor is used in conjunction with the crankshaft position sensor to differentiate between fuel injection and spark events. It is also used to synchronize the fuel injectors with their respective cylinders.

5.7L V-8

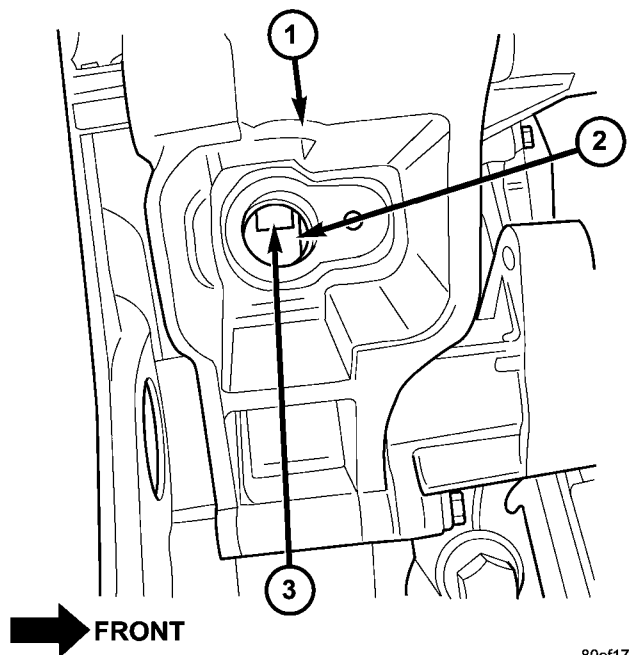
The CMP sensor is used in conjunction with the crankshaft position sensor to differentiate between fuel injection and spark events. It is also used to synchronize the fuel injectors with their respective cylinders. The sensor generates electrical pulses. These pulses (signals) are sent to the Powertrain Control Module (PCM). The PCM will then determine crankshaft position from both the camshaft position sensor and crankshaft position sensor.

The tonewheel is located at the front of the camshaft (Fig. 8). As the tonewheel rotates, notches (Fig. 8) pass through the sync signal generator.

When the cam gear is rotating, the sensor will detect the notches. Input voltage from the sensor to the PCM will then switch from a low (approximately 0.3 volts) to a high (approximately 5 volts). When the sensor detects a notch has passed, the input voltage switches back low to approximately 0.3 volts.

**Fig. 7 CMP AND TONEWHEEL OPERATION - 4.7L V-8**

- 1 - NOTCHES
- 2 - RIGHT CYLINDER HEAD
- 3 - CAMSHAFT POSITION SENSOR
- 4 - TONEWHEEL

**Fig. 8 CMP OPERATION - 5.7L ENGINE**

- 1 - TIMING CHAIN COVER
- 2 - TONEWHEEL
- 3 - NOTCHES

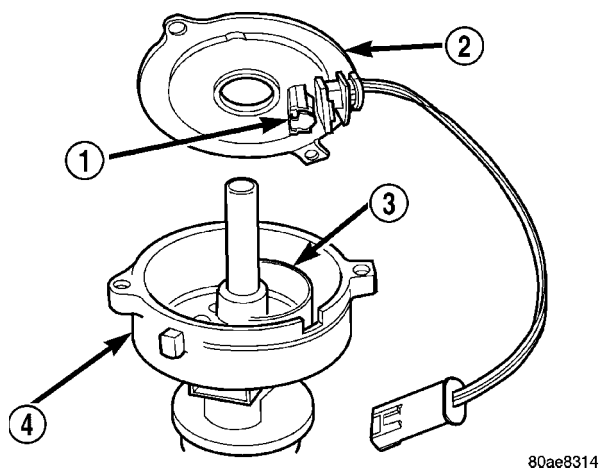
CAMSHAFT POSITION SENSOR (Continued)

5.9L V-8 Gas

The CMP sensor on the 5.9L V-8 engine 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) (Fig. 9) 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 (CKP) sensor to differentiate between fuel injection and spark events. It is also used to synchronize the fuel injectors with their respective cylinders.

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.

**Fig. 9 CMP / PULSE RING - 5.9L GAS ENGINE**

- 1 - SYNC SIGNAL GENERATOR
- 2 - CAMSHAFT POSITION SENSOR
- 3 - PULSE RING
- 4 - DISTRIBUTOR ASSEMBLY

5.9L Diesel

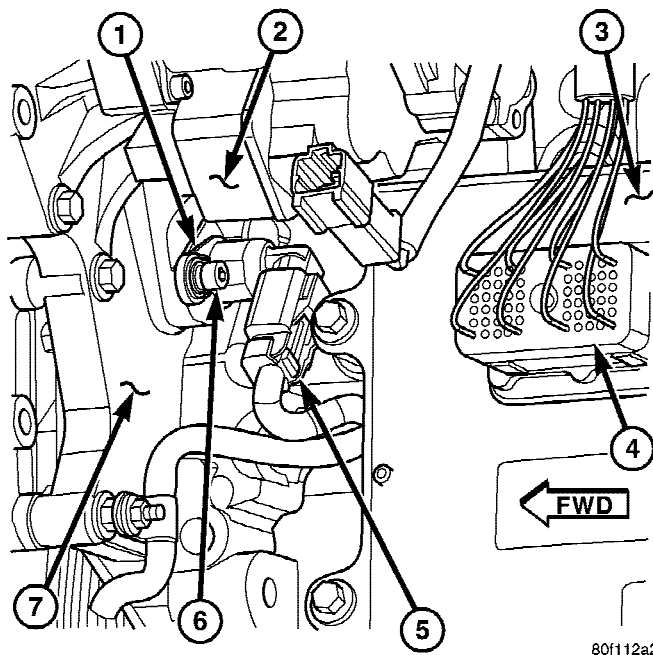
The Camshaft Position Sensor (CMP) contains a hall effect device. A rotating target wheel (tonewheel) for the CMP is located on the front timing gear. This hall effect device detects notches located on the tonewheel. As the tonewheel rotates, the notches pass the tip of the CMP.

When the leading edge of the tonewheel notch passes the tip of the CMP, the following occurs: The interruption of magnetic field causes the voltage to switch high resulting in a signal of approximately 5 volts.

When the trailing edge of the tonewheel notch passes the tip of the CMP, the following occurs: The

change of the magnetic field causes the signal voltage to switch low to 0 volts.

The CMP (Fig. 10) provides a signal to the Engine Control Module (ECM) at all times when the engine is running. The ECM uses the CMP information primarily on engine start-up. Once the engine is running, the ECM uses the CMP as a backup sensor for engine speed. The Crankshaft Position Sensor (CKP) is the primary engine speed indicator for the engine after the engine is running.



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Fig. 10 5.9L DIESEL CMP

- 1 - CMP
- 2 - FUEL INJECTION PUMP (BOTTOM)
- 3 - ELECTRONIC CONTROL MODULE (ECM)
- 4 - ECM ELEC. CONNECTOR
- 5 - CMP ELEC. CONNECTOR
- 6 - CMP MOUNTING BOLT
- 7 - BACK OF TIMING GEAR COVER

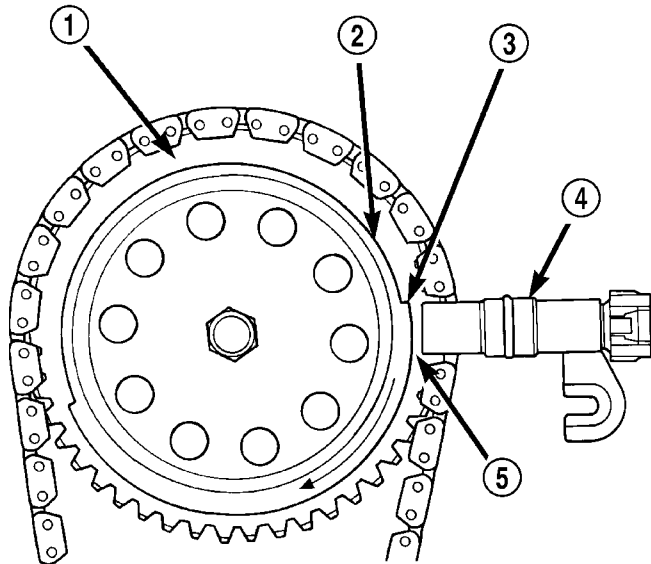
8.0L V-10

The CMP sensor 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. The sensor generates electrical pulses. These pulses (signals) are sent to the Powertrain Control Module (PCM). The PCM will then determine crankshaft position from both the camshaft position sensor and crankshaft position sensor.

A low and high area are machined into the camshaft drive gear (Fig. 11). The sensor is positioned in the timing gear cover so that a small air gap (Fig. 11) exists between the face of sensor and the high machined area of cam gear.

CAMSHAFT POSITION SENSOR (Continued)

When the cam gear is rotating, the sensor will detect the machined low area. Input voltage from the sensor to the PCM will then switch from a low (approximately 0.3 volts) to a high (approximately 5 volts). When the sensor detects the high machined area, the input voltage switches back low to approximately 0.3 volts.



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Fig. 11 CMP SENSOR OPERATION - 8.0L V-10 ENGINE

- 1 - CAM DRIVE GEAR
- 2 - LOW MACHINED AREA
- 3 - HIGH MACHINED AREA
- 4 - CAMSHAFT POSITION SENSOR
- 5 - AIR GAP

REMOVAL

3.7L V-6

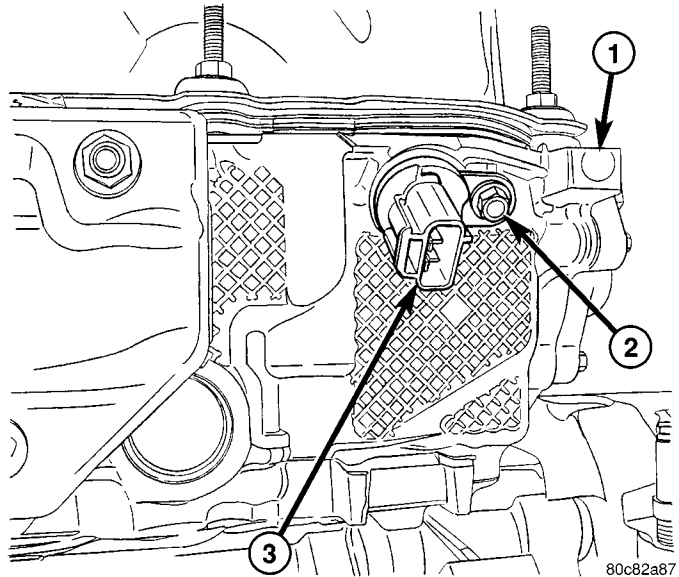
The Camshaft Position Sensor (CMP) on the 3.7L V-6 engine is bolted to the front/top of the right cylinder head (Fig. 12).

- (1) Disconnect electrical connector at CMP sensor.
- (2) Remove sensor mounting bolt (Fig. 12).
- (3) Carefully twist sensor from cylinder head.
- (4) Check condition of sensor o-ring.

4.7L V-8

The Camshaft Position Sensor (CMP) on the 4.7L V-8 engine is bolted to the front/top of the right cylinder head (Fig. 13).

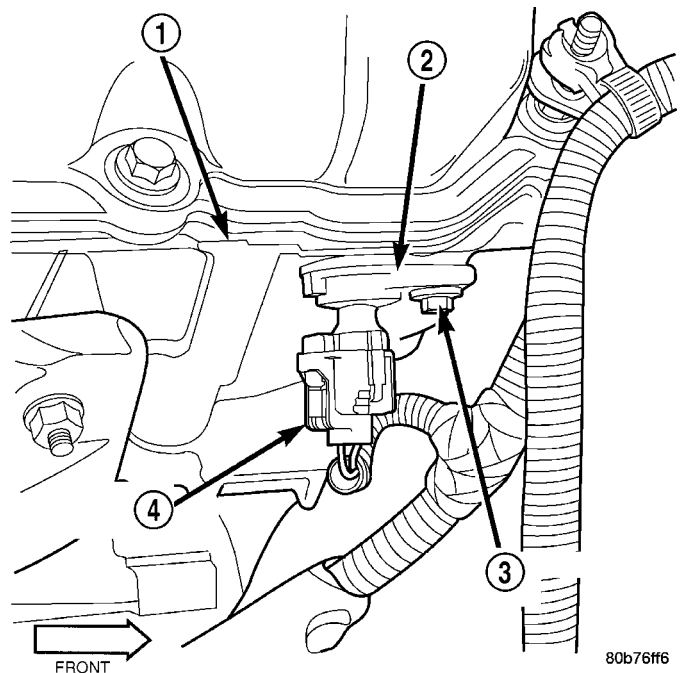
- (1) Raise and support vehicle.
- (2) Disconnect electrical connector at CMP sensor (Fig. 13).



80c82a87

Fig. 12 CMP LOCATION - 3.7L

- 1 - RIGHT/FRONT OF RIGHT CYLINDER HEAD
- 2 - CMP MOUNTING BOLT
- 3 - CMP LOCATION



80b76ff6

Fig. 13 CMP LOCATION - 4.7L

- 1 - RIGHT CYLINDER HEAD
- 2 - CAMSHAFT POSITION SENSOR
- 3 - MOUNTING BOLT
- 4 - ELEC. CONNECTOR

- (3) Remove sensor mounting bolt (Fig. 13).
- (4) Carefully twist sensor from cylinder head.
- (5) Check condition of sensor o-ring.

CAMSHAFT POSITION SENSOR (Continued)

5.7L V-8

The Camshaft Position Sensor (CMP) on the 5.7L V-8 engine is located on right side of timing chain cover below generator (Fig. 14).

- (1) Disconnect electrical connector at CMP sensor.
- (2) Remove sensor mounting bolt (Fig. 15).
- (3) Carefully twist sensor from cylinder head.
- (4) Check condition of sensor o-ring.

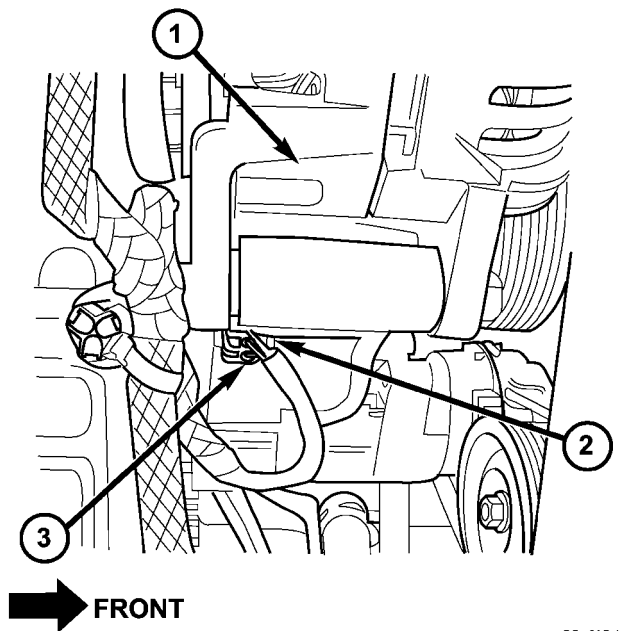


Fig. 14 CMP LOCATION - 5.7L

- 1 - GENERATOR
- 2 - CMP LOCATION
- 3 - ELECTRICAL CONNECTOR

5.9L Diesel

The Camshaft Position Sensor (CMP) on the 5.9L diesel engine is located below the fuel injection pump. It is bolted to the back of the timing gear cover (Fig. 16).

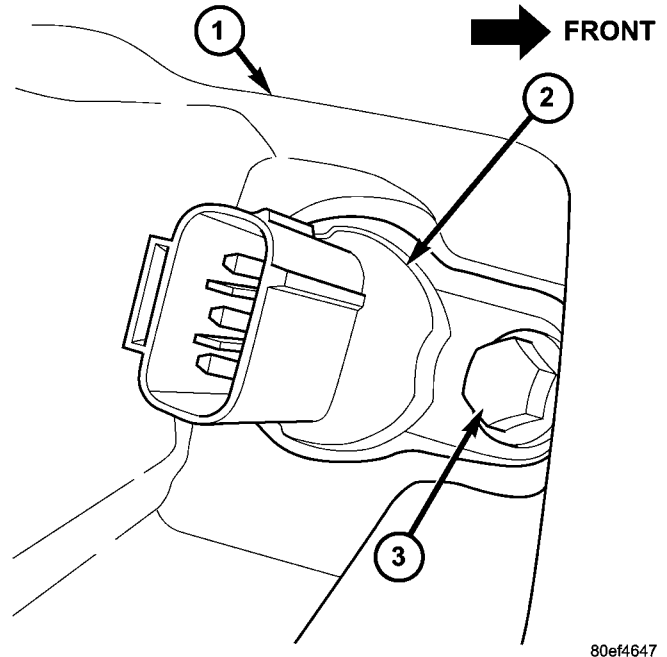
- (1) Disconnect electrical connector at CMP sensor (Fig. 16).
- (2) Remove sensor mounting bolt.
- (3) Carefully twist sensor from timing gear cover.
- (4) Check condition of sensor o-ring.

5.9L V-8 Gas

The Camshaft Position Sensor (CMP) is located inside the distributor (Fig. 17).

Distributor removal is not necessary to remove camshaft position sensor.

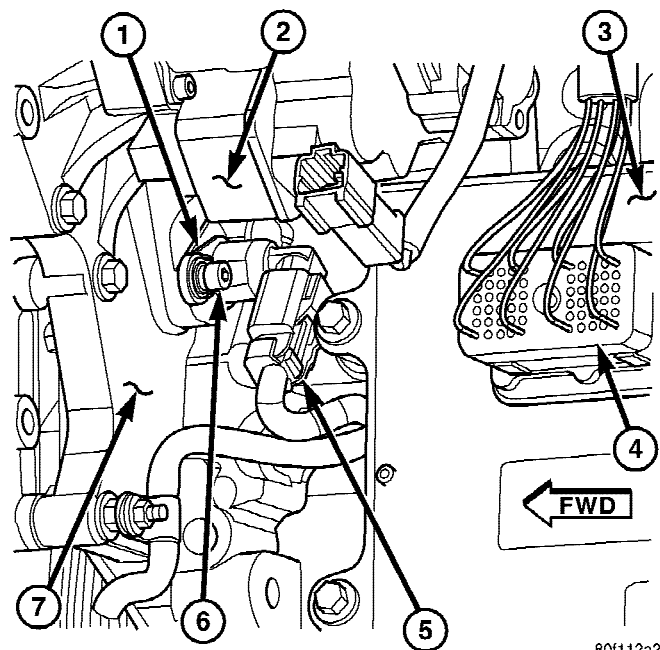
- (1) Disconnect negative cable from battery.
- (2) Remove air cleaner tubing at throttle body, and at air filter housing.
- (3) Remove distributor cap from distributor (two screws).



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Fig. 15 CMP REMOVAL / INSTALLATION - 5.7L V-8

- 1 - TIMING CHAIN COVER (RIGHT/FRONT)
- 2 - CMP SENSOR
- 3 - MOUNTING BOLT



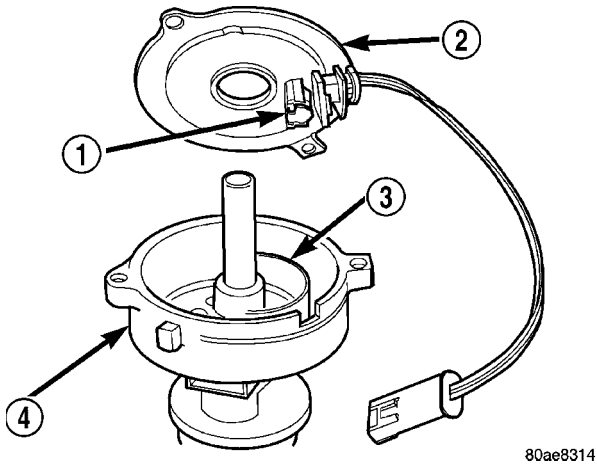
80f112a2

Fig. 16 5.9L DIESEL CMP

- 1 - CMP
- 2 - FUEL INJECTION PUMP (BOTTOM)
- 3 - ELECTRONIC CONTROL MODULE (ECM)
- 4 - ECM ELEC. CONNECTOR
- 5 - CMP ELEC. CONNECTOR
- 6 - CMP MOUNTING BOLT
- 7 - BACK OF TIMING GEAR COVER

CAMSHAFT POSITION SENSOR (Continued)

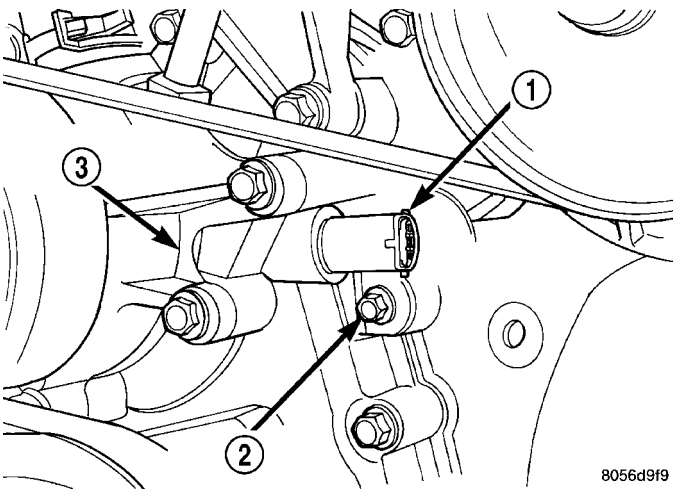
- (4) Disconnect camshaft position sensor wiring harness from main engine wiring harness.
- (5) Remove distributor rotor from distributor shaft.
- (6) Lift camshaft position sensor assembly from distributor housing (Fig. 17).

**Fig. 17 DISTRIBUTOR AND CMP LOCATION - 5.9L**

- 1 - SYNC SIGNAL GENERATOR
- 2 - CAMSHAFT POSITION SENSOR
- 3 - PULSE RING
- 4 - DISTRIBUTOR ASSEMBLY

8.0L V-10

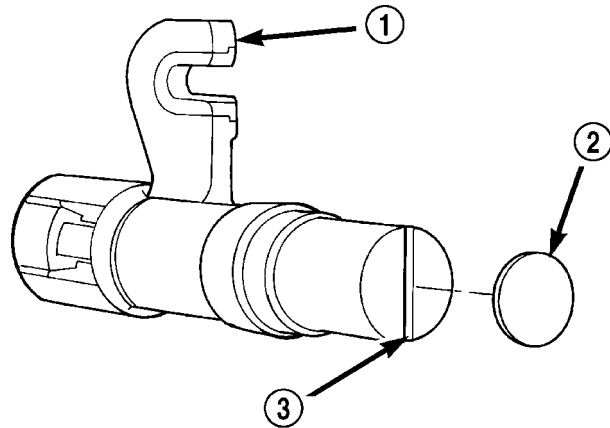
The camshaft position sensor is located on the timing chain case/cover on the left-front side of the engine (Fig. 18).

**Fig. 18 CMP LOCATION - 8.0L**

- 1 - CAMSHAFT POSITION SENSOR
- 2 - MOUNTING BOLT
- 3 - TIMING CHAIN CASE/COVER

A thin plastic rib is molded into the face of the sensor (Fig. 19) to position the depth of sensor to the upper cam gear (sprocket). This rib can be found on both the new replacement sensors and sensors that were originally installed to the engine. The first time

the engine has been operated, part of this rib may be sheared (ground) off. Depending on parts tolerances, some of the rib material may still be observed after removal.



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Fig. 19 SENSOR DEPTH POSITIONING RIB - 8.0L V-10 ENGINE

- 1 - CAMSHAFT POSITION SENSOR
- 2 - PAPER SPACER
- 3 - RIB MATERIAL (FOR SENSOR DEPTH POSITIONING)

Refer to either of the following procedures; Replacing Old Sensor With Original, or Replacing With New Sensor:

REPLACING OLD SENSOR WITH ORIGINAL

If the original camshaft position sensor is to be removed and installed, such as when servicing the timing chain, timing gears or timing chain cover, use this procedure.

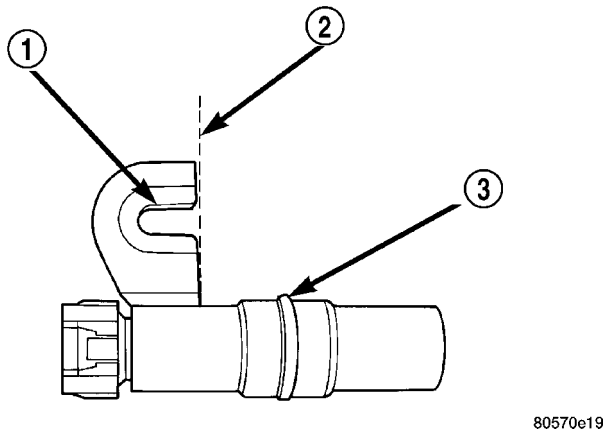
- (1) Disconnect sensor harness connector from sensor.
- (2) Remove sensor mounting bolt (Fig. 18).
- (3) Carefully pry sensor from timing chain case/cover in a rocking action with two small screwdrivers.
- (4) Remove sensor from vehicle.
- (5) Check condition of sensor o-ring (Fig. 20).

REPLACING WITH NEW SENSOR

If a new replacement camshaft position sensor is to be installed, use this procedure.

- (1) Disconnect sensor wiring harness connector from sensor.
- (2) Remove sensor mounting bolt (Fig. 18).
- (3) Carefully pry sensor from timing chain case/cover in a rocking action with two small screwdrivers.
- (4) Remove sensor from vehicle.

CAMSHAFT POSITION SENSOR (Continued)

**Fig. 20 CAMSHAFT SENSOR O-RING – 8.0L**

- 1 - SLOTTED MOUNTING HOLE
 2 - SCRIBE LINE
 3 - CAMSHAFT POSITION SENSOR O-RING

INSTALLATION**3.7L V-6**

The Camshaft Position Sensor (CMP) on the 3.7L V-6 engine is bolted to the front/top of the right cylinder head (Fig. 12).

- (1) Clean out machined hole in cylinder head.
- (2) Apply a small amount of engine oil to sensor o-ring.
- (3) Install sensor into cylinder head with a slight rocking and twisting action.

CAUTION: Before tightening sensor mounting bolt, be sure sensor is completely flush to cylinder head. If sensor is not flush, damage to sensor mounting tang may result.

- (4) Install mounting bolt and tighten. Refer to torque specifications.
- (5) Connect electrical connector to sensor.

4.7L V-8

The Camshaft Position Sensor (CMP) on the 4.7L V-8 engine is bolted to the front/top of the right cylinder head (Fig. 13).

- (1) Clean out machined hole in cylinder head.
- (2) Apply a small amount of engine oil to sensor o-ring.
- (3) Install sensor into cylinder head with a slight rocking action. Do not twist sensor into position as damage to o-ring may result.

CAUTION: Before tightening sensor mounting bolt, be sure sensor is completely flush to cylinder head. If sensor is not flush, damage to sensor mounting tang may result.

- (4) Install mounting bolt and tighten. Refer to Torque Specifications.
- (5) Connect electrical connector to sensor.

5.7L V-8

The Camshaft Position Sensor (CMP) on the 5.7L V-8 engine is bolted to the right / front side of the timing chain cover (Fig. 14) or (Fig. 15).

- (1) Clean out machined hole in cylinder head.
- (2) Apply a small amount of engine oil to sensor o-ring.
- (3) Install sensor into cylinder head with a slight rocking action. Do not twist sensor into position as damage to o-ring may result.

CAUTION: Before tightening sensor mounting bolt, be sure sensor is completely flush to timing chain cover. If sensor is not flush, damage to sensor mounting tang may result.

- (4) Install mounting bolt and tighten. Refer to Torque Specifications.
- (5) Connect electrical connector to sensor.

5.9L Diesel

The CMP is located on the back of the timing gear cover (Fig. 16).

- (1) Clean out machined hole in back of timing gear cover.
- (2) Apply a small amount of engine oil to sensor o-ring.
- (3) Install sensor into timing gear cover with a slight rocking action. Do not twist sensor into position as damage to o-ring may result.

CAUTION: Before tightening sensor mounting bolt, be sure sensor is completely flush to back of timing chain cover. If sensor is not flush, damage to sensor mounting tang may result.

- (4) Install mounting bolt and tighten. Refer to Torque Specifications.
- (5) Connect electrical connector to sensor.

5.9L Gas

The camshaft position sensor is located inside the distributor (Fig. 17).

- (1) Install camshaft position sensor to distributor. Align sensor into notch on distributor housing.
- (2) Connect engine wiring harness to sensor pigtail harness.
- (3) Install rotor.
- (4) Install distributor cap. Tighten 2 mounting screws.
- (5) Install air filter tubing.
- (6) Connect battery cable.

CAMSHAFT POSITION SENSOR (Continued)

8.0L V-10

If Replacing Old Sensor With Original

The camshaft position sensor is located on the timing chain case/cover on the left-front side of the engine (Fig. 18).

When installing a used camshaft position sensor, the sensor depth must be adjusted to prevent contact with the camshaft gear (sprocket).

(1) Observe the face of the sensor. If any of the original rib material remains (Fig. 19), it must be cut down flush to the face of the sensor with a razor knife. Remove only enough of the rib material until the face of the sensor is flat. Do not remove more material than necessary as damage to sensor may result. Due to a high magnetic field and possible electrical damage to the sensor, never use an electric grinder to remove material from sensor.

(2) From the parts department, obtain a peel-and-stick paper spacer (Fig. 19). These special paper spacers are of a certain thickness and are to be used as a tool to set sensor depth.

(3) Clean the face of sensor and apply paper spacer (Fig. 19).

(4) Apply a small amount of engine oil to the sensor o-ring (Fig. 20).

A low and high area are machined into the camshaft drive gear (Fig. 21). The sensor is positioned in the timing gear cover so that a small air gap (Fig. 21) exists between the face of sensor and the high machined area of cam gear.

Before the sensor is installed, the cam gear may have to be rotated. This is to allow the high machined area on the gear to be directly in front of the sensor mounting hole opening on the timing gear cover.

Do not install sensor with gear positioned at low area (Fig. 22) or (Fig. 21). When the engine is started, the sensor will be broken.

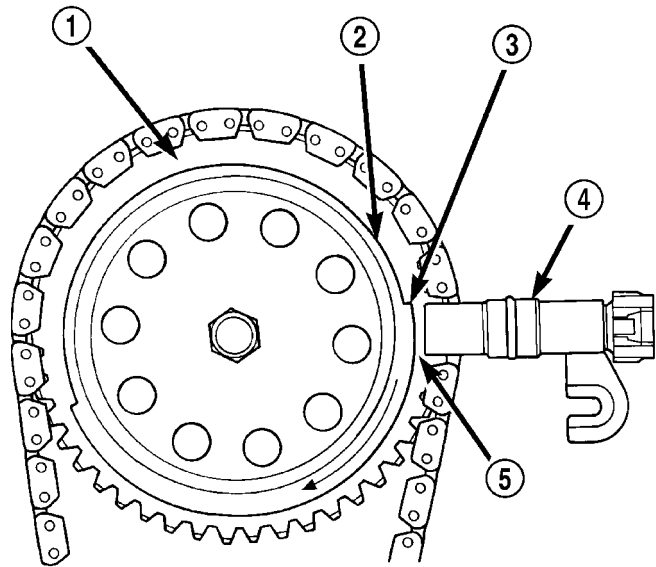
(5) Using a 1/2 in. wide metal ruler, measure the distance from the cam gear to the face of the sensor mounting hole opening on the timing gear cover (Fig. 22).

(6) If the dimension is approximately 1.818 inches, it is OK to install sensor. Proceed to step Step 9.

(7) If the dimension is approximately 2.018 inches, the cam gear will have to be rotated.

(8) Attach a socket to the vibration damper mounting bolt and rotate engine until the 1.818 inch dimension is attained.

(9) Install the sensor into the timing case/cover with a slight rocking action until the paper spacer contacts the camshaft gear. Do not install the sensor mounting bolt. Do not twist the sensor into position as damage to the o-ring or tearing of the paper spacer may result.



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Fig. 21 SENSOR OPERATION – 8.0L V-10 ENGINE

- 1 - CAM DRIVE GEAR
- 2 - LOW MACHINED AREA
- 3 - HIGH MACHINED AREA
- 4 - CAMSHAFT POSITION SENSOR
- 5 - AIR GAP

(10) Scratch a scribe line into the timing chain case/cover to indicate depth of sensor (Fig. 20).

(11) Remove the sensor from timing chain case/cover.

(12) Remove paper spacer from sensor. This step must be followed to prevent the paper spacer from getting into the engine lubrication system.

(13) Again, apply a small amount of engine oil to sensor o-ring.

(14) Again, install the sensor into the timing case/cover with a slight rocking action until the sensor is aligned to scribe line.

(15) Install sensor mounting bolt and tighten to 6 N·m (50 in. lbs.) torque.

(16) Connect engine wiring harness to sensor.

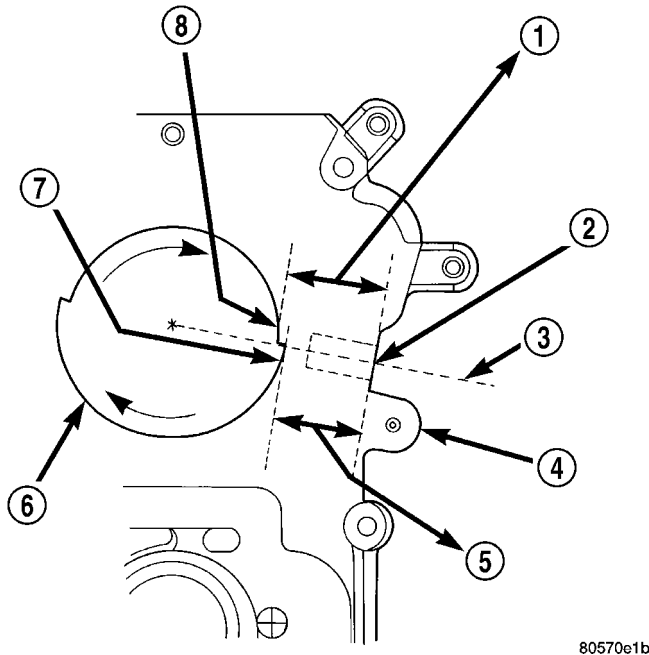
Replacing With a New Sensor

(1) Apply a small amount of engine oil to the sensor o-ring (Fig. 20).

A low and high area are machined into the camshaft drive gear (Fig. 21). The sensor is positioned in the timing gear cover so that a small air gap (Fig. 21) exists between the face of sensor and the high machined area of cam gear.

Before the sensor is installed, the cam gear may have to be rotated. This is to allow the high machined area on the gear to be directly in front of the sensor mounting hole opening on the timing gear cover.

CAMSHAFT POSITION SENSOR (Continued)



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Fig. 22 SENSOR DEPTH DIMENSIONS - 8.0L V-10 ENGINE

- 1 - 2.018" DO NOT INSTALL SENSOR
- 2 - SENSOR MOUNTING HOLE OPENING
- 3 - SENSOR CENTER LINE
- 4 - TIMING CHAIN COVER
- 5 - 1.818" OK TO INSTALL SENSOR
- 6 - CAM DRIVE GEAR
- 7 - HIGH MACHINED AREA
- 8 - LOW MACHINED AREA

Do not install sensor with gear positioned at low area (Fig. 22) or (Fig. 21). When the engine is started, the sensor will be broken.

(2) Using a 1/2 in. wide metal ruler, measure the distance from the cam gear to the face of the sensor mounting hole opening on the timing gear cover (Fig. 22).

(3) If the dimension is approximately 1.818 inches, it is OK to install sensor. Proceed to step Step 9.

(4) If the dimension is approximately 2.018 inches, the cam gear will have to be rotated.

(5) Attach a socket to the vibration damper mounting bolt and rotate engine until the 1.818 inch dimension is attained.

(6) Install the sensor into the timing case/cover with a slight rocking action. Do not twist the sensor into position as damage to the o-ring may result. Push the sensor all the way into the cover until the rib material on the sensor (Fig. 19) contacts the camshaft gear.

(7) Install the mounting bolt and tighten to 6 N·m (50 in. lbs.) torque.

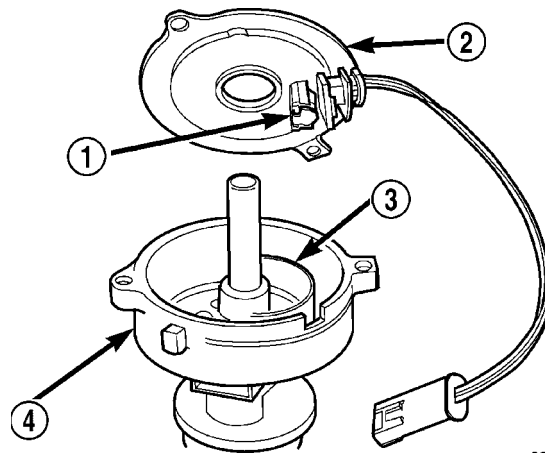
(8) Connect sensor wiring harness to engine harness.

When the engine is started, the rib material will be sheared off the face of sensor. This will automatically set sensor air gap.

DISTRIBUTOR

DESCRIPTION

All 5.9L V-8 engines are equipped with a camshaft driven mechanical distributor (Fig. 23) containing a shaft driven distributor rotor. All distributors are equipped with an internal camshaft position (fuel sync) sensor (Fig. 23).



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Fig. 23 DISTRIBUTOR AND CAMSHAFT POSITION SENSOR - 5.9L

- 1 - SYNC SIGNAL GENERATOR
- 2 - CAMSHAFT POSITION SENSOR
- 3 - PULSE RING
- 4 - DISTRIBUTOR ASSEMBLY

OPERATION

The distributor does not have built in centrifugal or vacuum assisted advance. Base ignition timing and all timing advance is controlled by the Powertrain Control Module (PCM). Because ignition timing is controlled by the PCM, **base ignition timing is not adjustable.**

The distributor is held to the engine in the conventional method using a hold-down clamp and bolt. **Although the distributor 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.

DISTRIBUTOR (Continued)

REMOVAL

CAUTION: Base ignition timing is not adjustable on any 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 cable from battery.
- (2) Remove air cleaner tubing.
- (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.

(5) Before distributor is removed, the number one cylinder must be brought to the Top Dead Center (TDC) firing position.

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

(7) 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. 24).

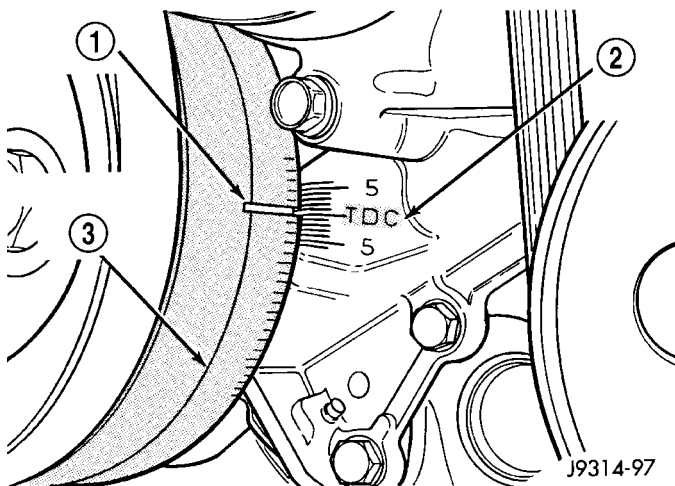


Fig. 24 DAMPER-TO-COVER ALIGNMENT MARKS — TYPICAL

- 1 - ALIGNMENT MARK
- 2 - TIMING CHAIN COVER MARKS
- 3 - CRANKSHAFT VIBRATION DAMPER

(8) The distributor rotor should now be aligned to the CYL. NO. 1 alignment mark (stamped) into the camshaft position sensor (Fig. 25). 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.

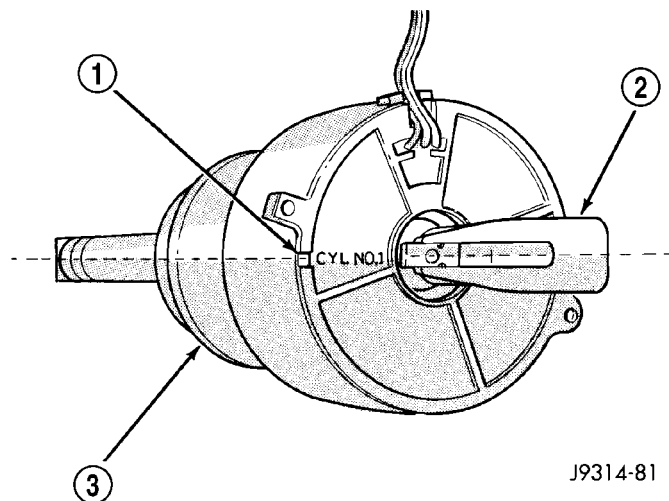


Fig. 25 ROTOR ALIGNMENT MARK

- 1 - CAMSHAFT POSITION SENSOR ALIGNMENT MARK
- 2 - ROTOR
- 3 - DISTRIBUTOR

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

(10) Remove distributor rotor from distributor shaft.

(11) Remove distributor holddown clamp bolt and clamp (Fig. 26). Remove distributor from vehicle.

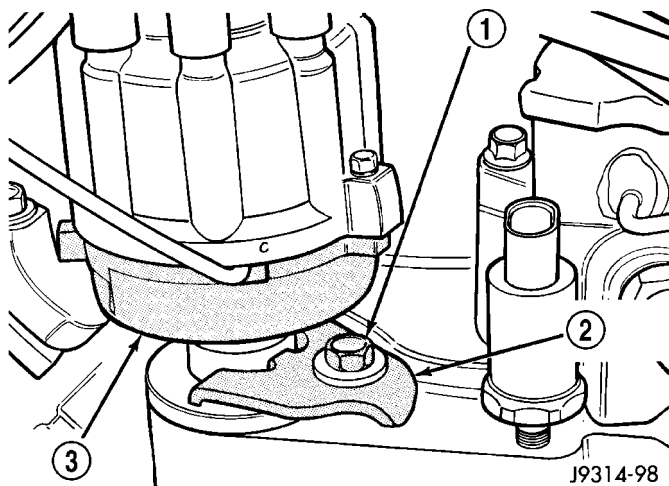


Fig. 26 DISTRIBUTOR HOLDDOWN CLAMP

- 1 - CLAMP BOLT
- 2 - HOLDDOWN CLAMP
- 3 - DISTRIBUTOR HOUSING

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

DISTRIBUTOR (Continued)

INSTALLATION

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 is at top of compression stroke (compression should be felt on finger with number one spark plug removed). Then continue to slowly rotate engine clockwise until indicating mark (Fig. 24) 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. 25).

(7) Tighten clamp holddown bolt (Fig. 26) 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) Refer to the following, Checking Distributor Position.

Checking Distributor Position

To verify correct distributor rotational position, the DRB scan tool must be used.

WARNING: WHEN PERFORMING THE FOLLOWING TEST, THE ENGINE WILL BE RUNNING. BE CAREFUL NOT TO STAND IN LINE WITH THE FAN BLADES OR FAN BELT. DO NOT WEAR LOOSE CLOTHING.

(1) Connect DRB scan tool to data link connector. The data link connector is located in passenger compartment, below and to left of steering column.

(2) Gain access to SET SYNC screen on DRB.

(3) Follow directions on DRB screen and start engine. Bring to operating temperature (engine must be in "closed loop" mode).

(4) With engine running at **idle speed**, the words **IN RANGE** should appear on screen along with 0°. This indicates correct distributor position.

(5) If a plus (+) or a minus (-) is displayed next to degree number, and/or the degree displayed is not zero, loosen but do not remove distributor holddown clamp bolt. Rotate distributor until **IN RANGE** appears on screen. Continue to rotate distributor until achieving as close to 0° as possible. After adjustment, tighten clamp bolt to 22.5 N·m (200 in. lbs.) torque.

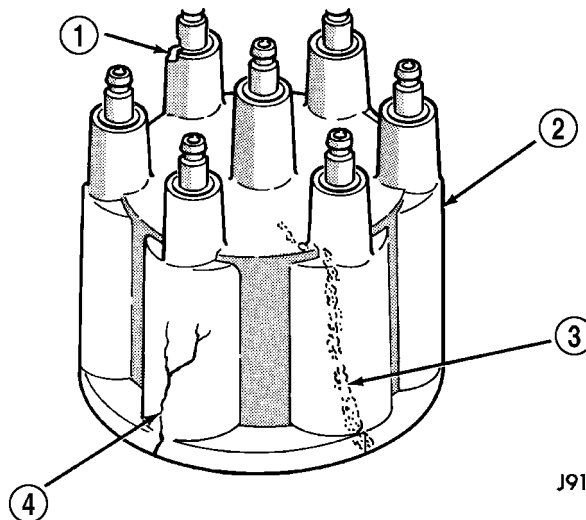
Do not attempt to adjust ignition timing using this method. Rotating distributor will have no effect on ignition timing. All ignition timing values are controlled by Powertrain Control Module (PCM).

After testing, install air cleaner tubing.

DISTRIBUTOR CAP

DIAGNOSIS AND TESTING - DISTRIBUTOR CAP - 5.9L V-8

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 (Fig. 27) or (Fig. 28). 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.

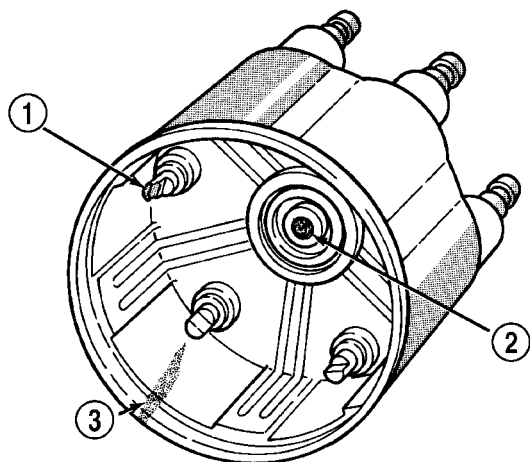


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Fig. 27 CAP INSPECTION—EXTERNAL—TYPICAL

- 1 - BROKEN TOWER
- 2 - DISTRIBUTOR CAP
- 3 - CARBON PATH
- 4 - CRACK

DISTRIBUTOR CAP (Continued)



J918D-10

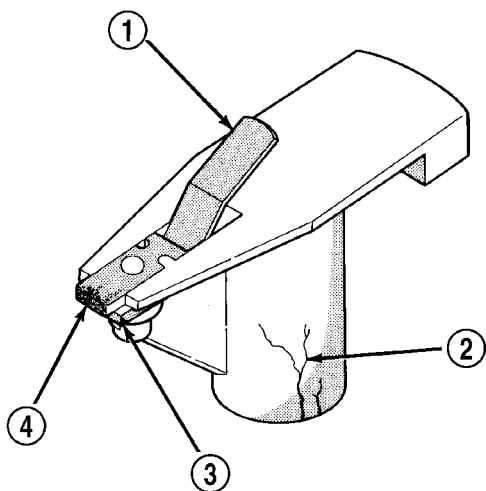
Fig. 28 CAP INSPECTION—INTERNAL—TYPICAL

- 1 - CHARRED OR ERODED TERMINALS
- 2 - WORN OR DAMAGED ROTOR BUTTON
- 3 - CARBON PATH

DISTRIBUTOR ROTOR

DIAGNOSIS AND TESTING - DISTRIBUTOR ROTOR - 5.9L V-8

Visually inspect the rotor (Fig. 29) 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 interference noise suppression, will appear charred. This is normal. **Do not remove the charred compound.** Test the spring for insufficient tension. Replace a rotor that displays any of these adverse conditions.



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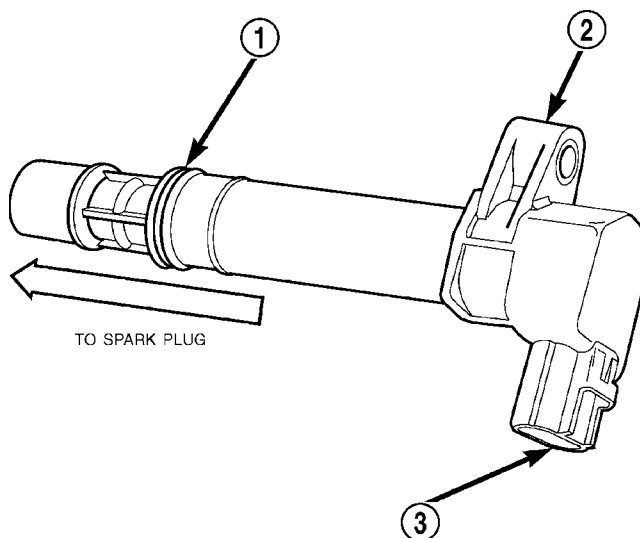
Fig. 29 ROTOR INSPECTION—TYPICAL

- 1 - INSUFFICIENT SPRING TENSION
- 2 - CRACKS
- 3 - EVIDENCE OF PHYSICAL CONTACT WITH CAP
- 4 - ROTOR TIP CORRODED

IGNITION COIL

DESCRIPTION**3.7L V-6**

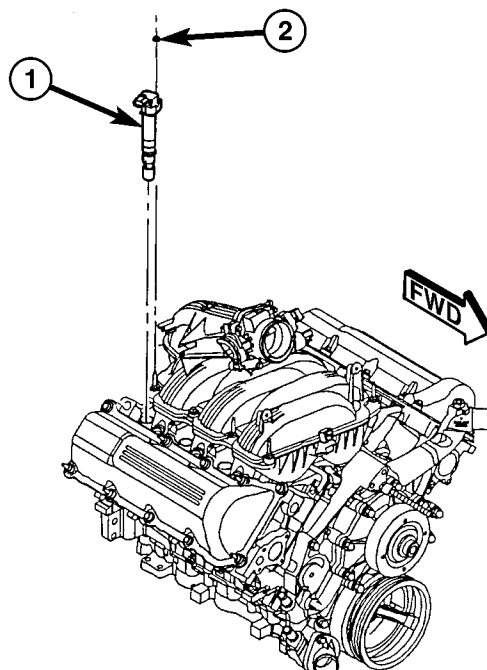
The 3.7L V-6 engine uses 6 dedicated, and individually fired coil for each spark plug (Fig. 30). Each coil is mounted directly into the cylinder head and onto the top of each spark plug (Fig. 31).



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Fig. 30 IGNITION COIL - 3.7L V-6/ 4.7L V-8

- 1 - O-RING
- 2 - IGNITION COIL
- 3 - ELECTRICAL CONNECTOR



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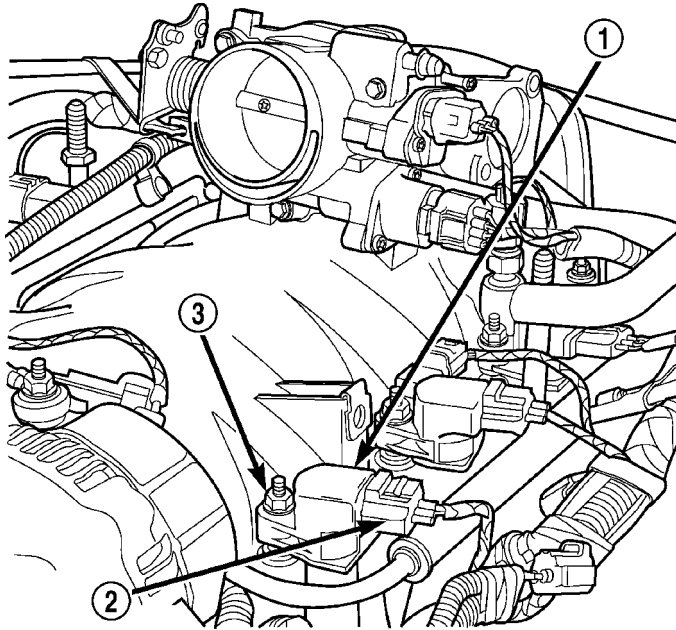
Fig. 31 IGNITION COIL LOCATION - 3.7L V-6

- 1 - IGNITION COIL
- 2 - COIL MOUNTING NUT

IGNITION COIL (Continued)

4.7L V-8

The 4.7L V-8 engine uses 8 dedicated, and individually fired coil (Fig. 30) for each spark plug. Each coil is mounted directly to the top of each spark plug (Fig. 32).



80b76fe7

Fig. 32 IGNITION COIL LOCATION - 4.7L V-8

- 1 - IGNITION COIL
- 2 - COIL ELECTRICAL CONNECTOR
- 3 - COIL MOUNTING STUD/NUT

5.7L V-8

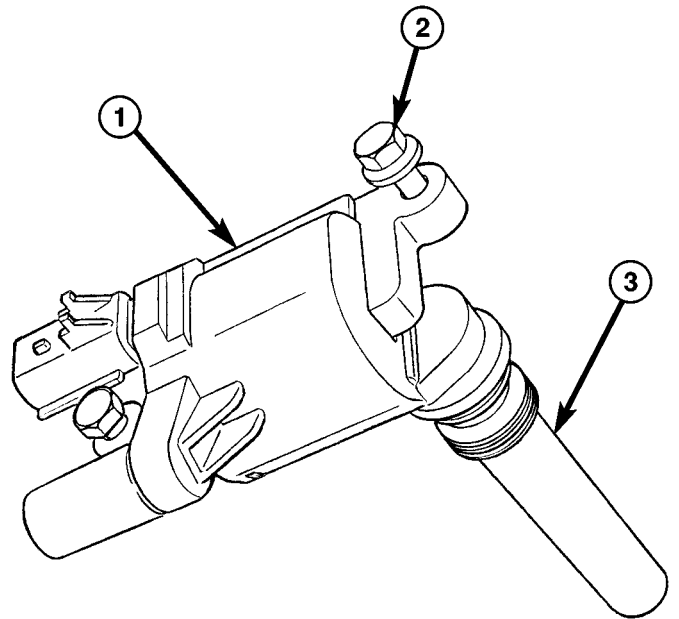
The 5.7L V-8 engine uses 8 dedicated, and individually fired coil (Fig. 33) for each pair of spark plugs. Each coil is mounted directly to the top of each spark plug (Fig. 34). Each coil is bolted to the valve cover.

5.9L V-8

A single ignition coil is used (Fig. 35) or (Fig. 36). The coil is not oil filled. The coil windings are embedded in an epoxy compound. This provides heat and vibration resistance that allows the coil to be mounted on the engine.

8.0L V-10

Two separate coil packs containing a total of five independent coils are attached to a common mounting bracket. They are located above the right engine valve cover (Fig. 37). The coil packs are not oil filled. The front coil pack contains three independent epoxy filled coils. The rear coil pack contains two independent epoxy filled coils.



80f01112

Fig. 33 IGNITION COIL - 5.7L V-8

- 1 - IGNITION COIL
- 2 - MOUNTING BOLTS (2)
- 3 - BOOT TO SPARK PLUG

OPERATION**3.7L V-6**

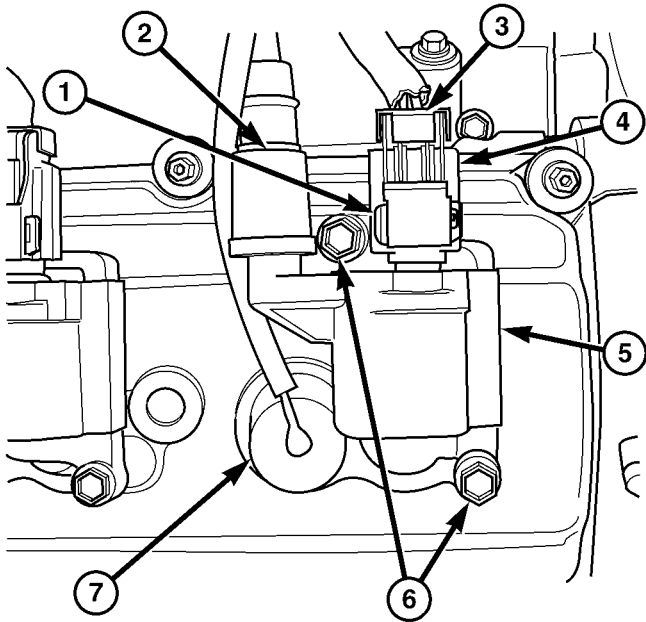
Battery voltage is supplied to the 6 individual ignition coils from the ASD relay. The Powertrain Control Module (PCM) opens and closes each ignition coil ground circuit at a determined time for ignition coil operation.

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.

Because of coil design, spark plug cables (secondary cables) are not used with the 3.7L V-6 engine.

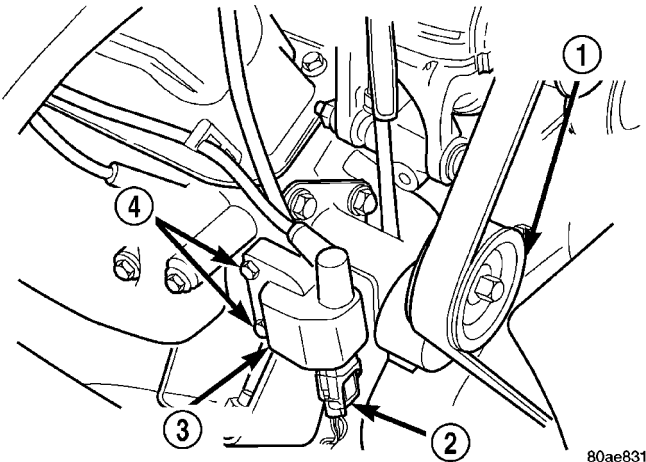
IGNITION COIL (Continued)



80ef8970

Fig. 34 IGNITION COIL R/I — 5.7L V-8

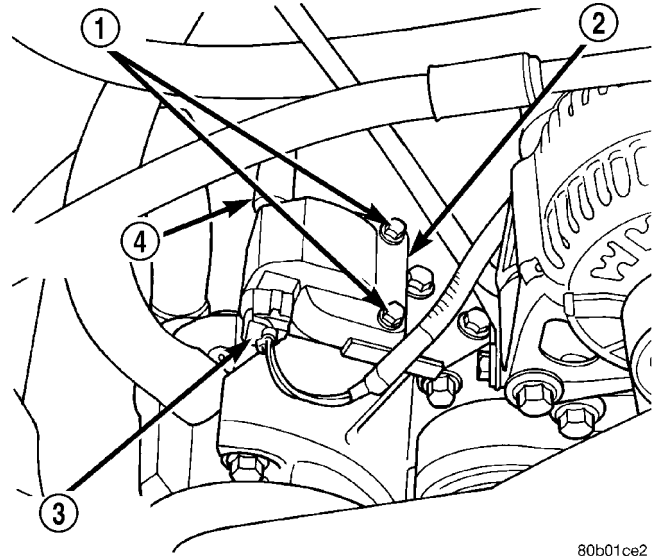
- 1 - SLIDE LOCK (SLIDE OUTWARD TO UNLOCK)
- 2 - SPARK PLUG CABLE (TO OPPOSITE CYLINDER BANK SPARK PLUG)
- 3 - RELEASE LOCK / TAB (PUSH HERE)
- 4 - ELEC. CONNECTOR
- 5 - IGNITION COIL
- 6 - COIL MOUNTING BOLTS (2)
- 7 - SPARK PLUG CABLE (TO OPPOSITE CYLINDER BANK IGNITION COIL)



80ae8315

Fig. 35 IGNITION COIL LOCATION - 5.9L V-8 (EXCEPT HDC)

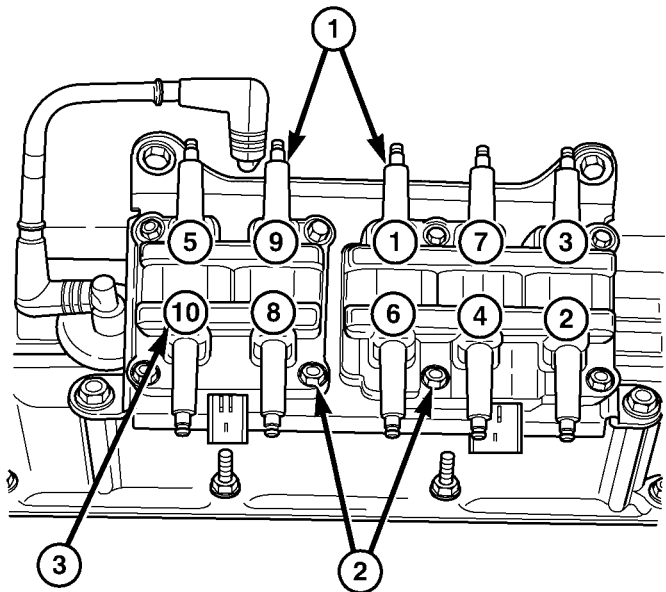
- 1 - ACCESSORY DRIVE BELT TENSIONER
- 2 - COIL CONNECTOR
- 3 - IGNITION COIL
- 4 - COIL MOUNTING BOLTS



80b01ce2

Fig. 36 IGNITION COIL LOCATION - 5.9L HDC V-8

- 1 - COIL MOUNTING BOLTS
- 2 - IGNITION COIL
- 3 - COIL ELEC. CONNECTOR
- 4 - SECONDARY CABLE



80ef8974

Fig. 37 8.0L V-10 COIL PACKS

- 1 - IGNITION COILS
- 2 - COIL MOUNTING BOLTS (8)
- 3 - ENGINE CYLINDER NUMBER

IGNITION COIL (Continued)

4.7L V-8

Battery voltage is supplied to the 8 individual ignition coils from the ASD relay. The Powertrain Control Module (PCM) opens and closes each ignition coil ground circuit at a determined time 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.

Because of coil design, spark plug cables (secondary cables) are not used with the 4.7L V-8 engine.

5.7L V-8

The ignition system is controlled by the Powertrain Control Module (PCM) on all engines.

A "wasted spark" system is used on the 5.7L engine combining paired, or dual-firing coils, and 2 spark plugs per cylinder. The coils and spark plugs are connected with paired, secondary high-voltage cables.

Each cylinder is equipped with 1 dual-output coil. Meaning one coil mounts directly over one of the dual spark plugs for 1 high-voltage output. A second high-voltage output is supplied directly from the same coil (using a plug cable) to one of the dual spark plugs on a corresponding (paired) cylinder on the opposite cylinder bank.

Each coil fires 2 spark plugs simultaneously on each of the cylinder banks (one cylinder on compression stroke and one cylinder on exhaust stroke). **EXAMPLE :** When the #1 cylinder is on compression stroke and ready for spark, the #1 coil will fire one of the dual spark plugs on the #1 cylinder (directly below the coil). The other dual spark plug on the #1 cylinder will be fired by the #6 coil. At the same time, the #1 coil will fire a "wasted spark" to one of the dual spark plugs at the #6 cylinder as coil #6 also fires a "wasted spark" to one of the dual spark plugs at the #6 cylinder.

The firing order is paired at cylinders 1/6, 2/3, 4/7, 5/8. Basic cylinder firing order is 1-8-4-3-6-5-7-2.

Battery voltage is supplied to all of the ignition coils positive terminals from the ASD relay. If the PCM does not see a signal from the crankshaft and camshaft sensors (indicating the ignition key is ON but the engine is not running), it will shut down the ASD circuit.

Base ignition timing is not adjustable on the 5.7L V-8 engine. By controlling the coil ground circuits, 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 PCM adjusts ignition timing based on inputs it receives from:

- The engine coolant temperature sensor
- The crankshaft position sensor (engine speed)
- The camshaft position sensor (crankshaft position)
- The manifold absolute pressure (MAP) sensor
- The throttle position sensor
- Transmission gear selection

5.9L V-8

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

Battery voltage is supplied to the ignition coil positive terminal from the ASD relay. If the PCM does not see a signal from the crankshaft and camshaft sensors (indicating the ignition key is ON but the engine is not running), it will shut down the ASD circuit.

Base ignition timing is not adjustable on any engine. 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.

Conventional spark plug cables (secondary cables) are used with the 5.9L V-8 engine.

8.0L V-10

When one of the 5 independent coils discharges, it fires two paired cylinders at the same time (one cylinder on compression stroke and the other cylinder on exhaust stroke).

Coil firing is paired together on cylinders:

- Number 5 and 10
- Number 9 and 8
- Number 1 and 6
- Number 7 and 4
- Number 3 and 2

The ignition system is controlled by the Powertrain Control Module (PCM) on all engines.

Battery voltage is supplied to all of the ignition coils positive terminals from the ASD relay. If the PCM does not see a signal from the crankshaft and camshaft sensors (indicating the ignition key is ON but the engine is not running), it will shut down the ASD circuit.

Conventional spark plug cables (secondary cables) are used with the 8.0L V-10 engine.

Base ignition timing is not adjustable on the 8.0L V-10 engine. By controlling the coil ground circuits, the PCM is able to set the base timing and adjust the ignition timing advance. This is done to meet changing engine operating conditions.

IGNITION COIL (Continued)

The PCM adjusts ignition timing based on inputs it receives from:

- The engine coolant temperature sensor
- The crankshaft position sensor (engine speed)
- The camshaft position sensor (crankshaft position)
- The manifold absolute pressure (MAP) sensor
- The throttle position sensor
- Transmission gear selection

REMOVAL

3.7L V-6

An individual ignition coil is used for each spark plug (Fig. 30). The coil fits into machined holes in the cylinder head. A mounting stud/nut secures each coil to the top of the intake manifold (Fig. 31). The bottom of the coil is equipped with a rubber boot to seal the spark plug to the coil. Inside each rubber boot is a spring. The spring is used for a mechanical contact between the coil and the top of the spark plug. These rubber boots and springs are a permanent part of the coil and are not serviced separately. An o-ring (Fig. 30) is used to seal the coil at the opening into the cylinder head.

(1) Depending on which coil is being removed, the throttle body air intake tube or intake box may need to be removed to gain access to coil.

(2) Disconnect electrical connector from coil by pushing downward on release lock on top of connector and pull connector from coil.

(3) Clean area at base of coil with compressed air before removal.

(4) Remove coil mounting nut from mounting stud (Fig. 31).

(5) Carefully pull up coil from cylinder head opening with a slight twisting action.

(6) Remove coil from vehicle.

4.7L V-8

An individual ignition coil is used for each spark plug (Fig. 30). The coil fits into machined holes in the cylinder head. A mounting stud/nut secures each coil to the top of the intake manifold (Fig. 32). The bottom of the coil is equipped with a rubber boot to seal the spark plug to the coil. Inside each rubber boot is a spring. The spring is used for a mechanical contact between the coil and the top of the spark plug. These rubber boots and springs are a permanent part of the coil and are not serviced separately. An o-ring (Fig. 30) is used to seal the coil at the opening into the cylinder head.

(1) Depending on which coil is being removed, the throttle body air intake tube or intake box may need to be removed to gain access to coil.

(2) Disconnect electrical connector (Fig. 32) from coil by pushing downward on release lock on top of connector and pull connector from coil.

(3) Clean area at base of coil with compressed air before removal.

(4) Remove coil mounting nut from mounting stud (Fig. 32).

(5) Carefully pull up coil from cylinder head opening with a slight twisting action.

(6) Remove coil from vehicle.

5.7L V-8

Before removing or disconnecting any spark plug cables, note their original position. Remove cables one-at-a-time. To prevent ignition crossfire, spark plug cables **MUST** be placed in cable tray (routing loom) into their original position.

An individual ignition coil (Fig. 33) is used at each cylinder. The coil mounts to the top of the valve cover with 2 bolts (Fig. 34). The bottom of the coil is equipped with a rubber boot to seal the spark plug to the coil. Inside each rubber boot is a spring. The spring is used for a mechanical contact between the coil and the top of the spark plug.

(1) Depending on which coil is being removed, the throttle body air intake tube or intake box may need to be removed to gain access to coil.

(2) Unlock electrical connector (Fig. 34) by moving slide lock first. Press on release lock (Fig. 34) while pulling electrical connector from coil.

(3) Disconnect secondary high-voltage cable from coil with a twisting action.

(4) Clean area at base of coil with compressed air before removal.

(5) Remove 2 mounting bolts (note that mounting bolts are retained to coil).

(6) Carefully pull up coil from cylinder head opening with a slight twisting action.

(7) Remove coil from vehicle.

(8) Before installing spark plug cables to either the spark plugs or coils, or before installing a coil to a spark plug, apply dielectric grease to inside of boots.

5.9L V-8

The coil is not oil filled. The coil windings are embedded in an epoxy compound. This provides heat and vibration resistance that allows the coil to be mounted on the engine. If the coil is replaced, it must be replaced with the same type.

5.9L V-8 LDC-Gas Engines: The coil is mounted to a bracket that is bolted to the front of the right engine cylinder head (Fig. 35). This bracket is mounted on top of the automatic belt tensioner bracket using common bolts.

IGNITION COIL (Continued)

WARNING: 5.9L V-8 LDC-GAS ENGINES: 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.

5.9L V-8 HDC-Gas Engine: The coil is mounted to a bracket that is bolted to the air injection pump (AIR pump) mounting bracket (Fig. 36).

- (1) Disconnect primary coil connector from ignition coil.
- (2) Disconnect secondary cable from ignition coil.
- (3) Remove ignition coil from coil mounting bracket (two bolts).

8.0L V-10

Two separate coil packs containing a total of five independent coils are attached to a common mounting bracket located above the right engine valve cover (Fig. 37). The front and rear coil packs can be serviced separately.

- (1) Depending on which coil is being removed, the throttle body air intake tube or intake box may need to be removed to gain access to coils.
- (2) Remove secondary spark plug cables from coil packs. Note position of cables before removal.
- (3) Disconnect primary wiring harness connectors at coil packs.
- (4) Remove four (4) coil pack-to-coil mounting bracket bolts for coil pack being serviced (Fig. 37).
- (5) Remove coil(s) from mounting bracket.

INSTALLATION**3.7L V-6**

- (1) Using compressed air, blow out any dirt or contaminants from around top of spark plug.
- (2) Check condition of coil o-ring and replace as necessary. To aid in coil installation, apply silicone to coil o-ring.
- (3) Position ignition coil into cylinder head opening and push onto spark plug. Do this while guiding coil base over mounting stud.
- (4) Install coil mounting stud nut. Refer to torque specifications.
- (5) Connect electrical connector to coil by snapping into position.
- (6) If necessary, install throttle body air tube.

4.7L V-8

- (1) Using compressed air, blow out any dirt or contaminants from around top of spark plug.
- (2) Check condition of coil o-ring and replace as necessary. To aid in coil installation, apply silicone to coil o-ring.
- (3) Position ignition coil into cylinder head opening and push onto spark plug. Do this while guiding coil base over mounting stud.
- (4) Install coil mounting stud nut. Refer to torque specifications.
- (5) Connect electrical connector to coil by snapping into position.
- (6) If necessary, install throttle body air tube.

5.7L V-8

- (1) Using compressed air, blow out any dirt or contaminants from around top of spark plug.
- (2) Before installing spark plug cables to either the spark plugs or coils, or before installing a coil to a spark plug, apply dielectric grease to inside of boots.
- (3) Position ignition coil into cylinder head opening and push onto spark plug. Twist coil into position.
- (4) Install 2 coil mounting bolts. Refer to torque specifications.
- (5) Connect electrical connector to coil by snapping into position.
- (6) Install cable to coil. To prevent ignition cross-fire, spark plug cables **MUST** be placed in cable tray (routing loom) into their original position. Refer to Spark Plug Cable Removal for a graphic.
- (7) If necessary, install throttle body air tube.

5.9L V-8

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

- (1) Install 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 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.

8.0L V-10

- (1) Position coil packs to mounting bracket (primary wiring connectors face downward).
- (2) Install coil pack mounting bolts. Tighten bolts to 10 N·m (90 in. lbs.) torque.
- (3) Install coil pack-to-engine mounting bracket (if necessary).
- (4) Connect primary wiring connectors to coil packs (four wire connector to front coil pack and three wire connector to rear coil pack).
- (5) Connect secondary spark plug cables to coil packs. Refer to (Fig. 38) for correct cable order.

IGNITION COIL (Continued)

(6) If necessary, install throttle body air tube or box.

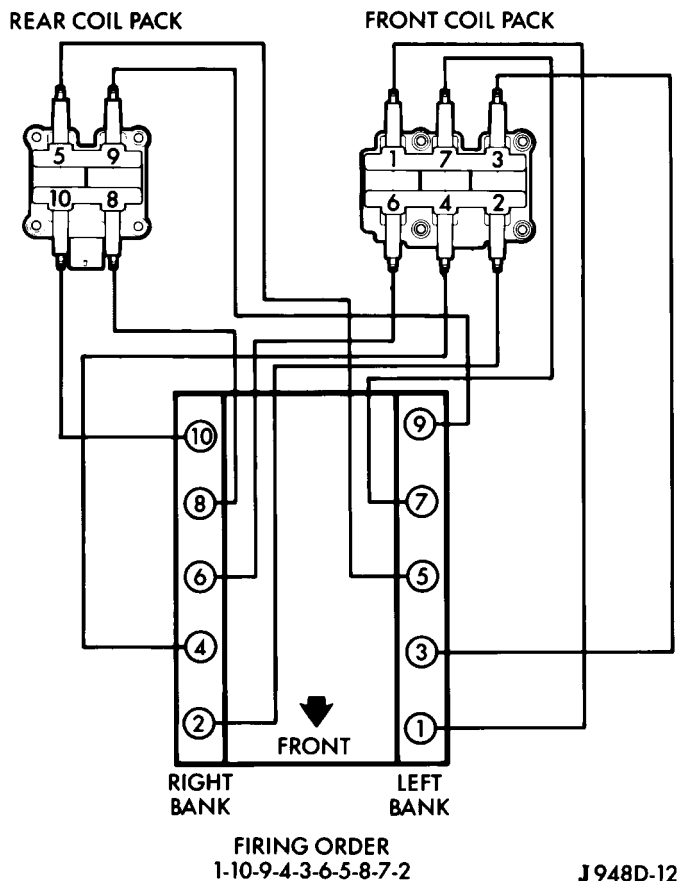


Fig. 38 SPARK PLUG CABLE ORDER - 8.0L V-10

KNOCK SENSOR

DESCRIPTION

The sensors are used only with 3.7L V-6, 4.7L V-8 and 5.7L V-8 engines. On 3.7L V-6 and 4.7L V-8 engines, the 2 knock sensors are bolted into the cylinder block under the intake manifold.

On 5.7L V-8 engines, 2 knock sensors are also used. These are bolted into each side of the cylinder block (outside) under the exhaust manifold.

OPERATION

3.7L V-6 / 4.7L V-8 / 5.7L V-8 Engines Only

Two knock sensors are used; one for each cylinder bank. When the knock sensor detects a knock in one of the cylinders on the corresponding bank, it sends an input signal to the Powertrain Control Module (PCM). In response, the PCM retards ignition timing for all cylinders by a scheduled amount.

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

The voltage signal produced by the knock sensor increases with the amplitude of vibration. The PCM receives the knock sensor voltage signal as an input. If the signal rises above a predetermined level, the PCM will store that value in memory and retard ignition timing to reduce engine knock. If the knock sensor voltage exceeds a preset value, the PCM retards ignition timing for all cylinders. It is not a selective cylinder retard.

The PCM ignores knock sensor input during engine idle conditions. Once the engine speed exceeds a specified value, knock retard is allowed.

Knock retard uses its own short term and long term memory program.

Long term memory stores previous detonation information in its battery-backed RAM. The maximum authority that long term memory has over timing retard can be calibrated.

Short term memory is allowed to retard timing up to a preset amount under all operating conditions (as long as rpm is above the minimum rpm) except at Wide Open Throttle (WOT). The PCM, using short term memory, can respond quickly to retard timing when engine knock is detected. Short term memory is lost any time the ignition key is turned off.

NOTE: Over or under tightening the sensor mounting bolts will affect knock sensor performance, possibly causing improper spark control. Always use the specified torque when installing the knock sensors.

REMOVAL

3.7L V-6 / 4.7L V-8

The 2 knock sensors are bolted into the cylinder block under the intake manifold (Fig. 39). or (Fig. 40).

NOTE: The left sensor is identified by an identification tag (LEFT). It is also identified by a larger bolt head. The Powertrain Control Module (PCM) must have and know the correct sensor left/right positions. Do not mix the sensor locations.

(1) Disconnect knock sensor dual pigtail harness from engine wiring harness. This connection is made near rear of engine.

(2) Remove intake manifold. Refer to Engine section.

(3) Remove sensor mounting bolts (Fig. 39), or (Fig. 40). Note foam strip on bolt threads. This foam is used only to retain the bolts to sensors for plant assembly. It is not used as a sealant. Do not apply any adhesive, sealant or thread locking compound to these bolts.

KNOCK SENSOR (Continued)

- (4) Remove sensors from engine.

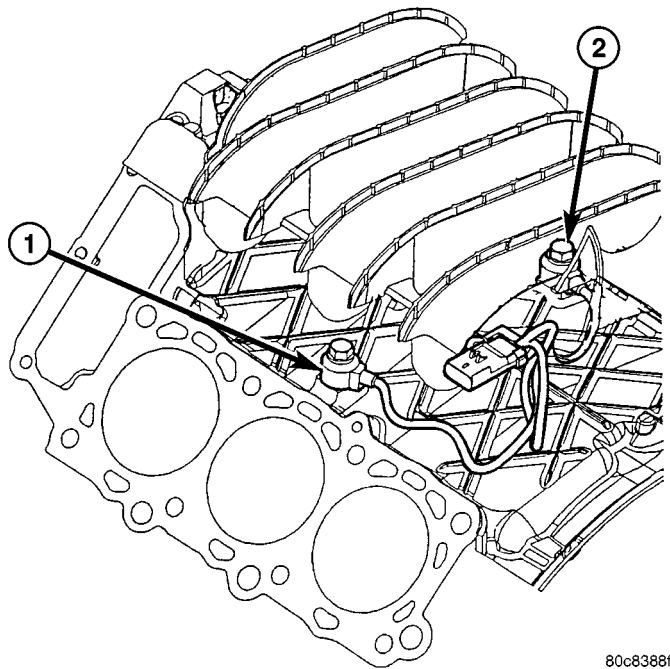


Fig. 39 KNOCK SENSOR — 3.7L V-6

- 1 - KNOCK SENSORS (2)
2 - MOUNTING BOLTS

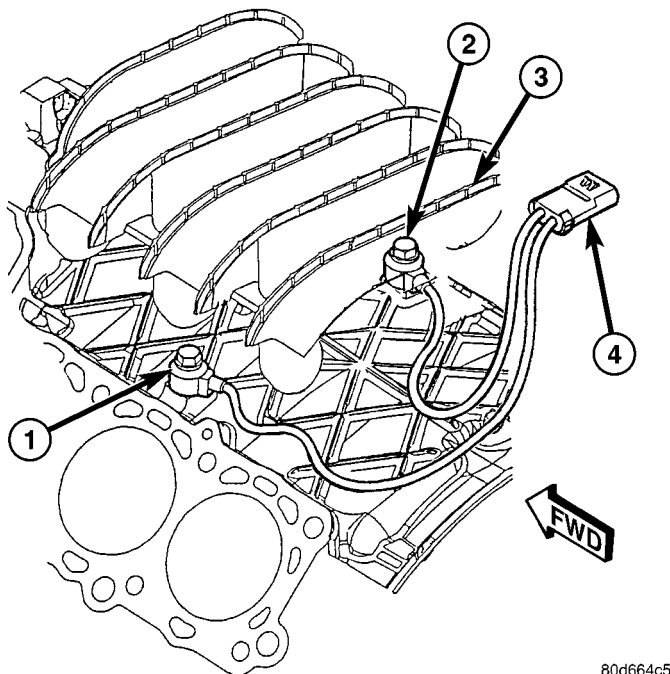


Fig. 40 KNOCK SENSOR — 4.7L V-8

- 1 - KNOCK SENSORS (2)
2 - MOUNTING BOLTS
3 - INTAKE MANIFOLD (CUTAWAY)
4 - PIGTAIL CONNECTOR

5.7L V8

Two sensors are used. Each sensor is bolted into the outside of cylinder block below the exhaust manifold (Fig. 41).

- (1) Raise vehicle.
- (2) Disconnect knock sensor electrical connector.
- (3) Remove sensor mounting bolt (Fig. 41). Note foam strip on bolt threads. This foam is used only to retain the bolts to sensors for plant assembly. It is not used as a sealant. Do not apply any adhesive, sealant or thread locking compound to these bolts.
- (4) Remove sensor from engine.

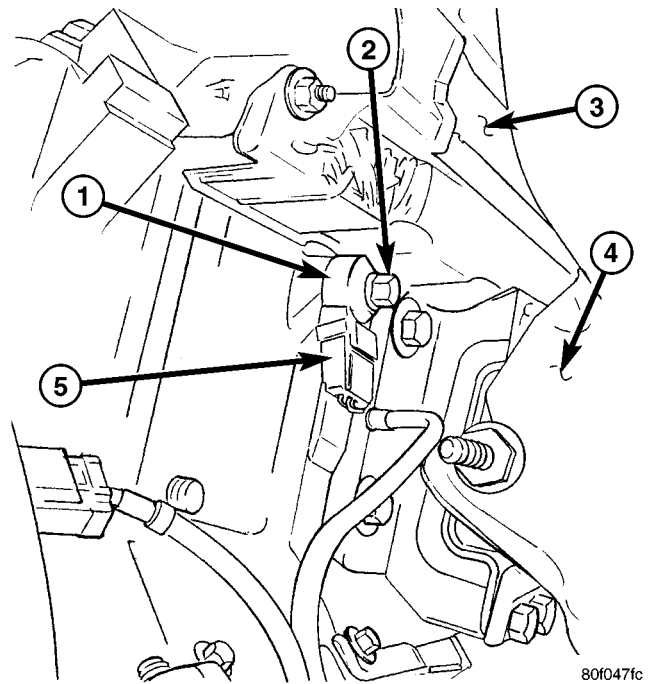


Fig. 41 5.7L KNOCK SENSOR (RIGHT SENSOR SHOWN)

- 1 - KNOCK SENSOR (RIGHT SENSOR SHOWN)
2 - MOUNTING BOLT
3 - EXHAUST MANIFOLD
4 - RIGHT ENGINE MOUNT
5 - ELEC. CONNECTOR

INSTALLATION

3.7L V-6 / 4.7L V-8

NOTE: The left sensor is identified by an identification tag (LEFT). It is also identified by a larger bolt head. The Powertrain Control Module (PCM) must have and know the correct sensor left/right positions. Do not mix the sensor locations.

- (1) Thoroughly clean knock sensor mounting holes.
- (2) Install sensors into cylinder block.

KNOCK SENSOR (Continued)

NOTE: Over or under tightening the sensor mounting bolts will affect knock sensor performance, possibly causing improper spark control. Always use the specified torque when installing the knock sensors. The torque for the knock sensor bolt is relatively light for an 8mm bolt.

NOTE: Note foam strip on bolt threads. This foam is used only to retain the bolts to sensors for plant assembly. It is not used as a sealant. Do not apply any adhesive, sealant or thread locking compound to these bolts.

(3) Install and tighten mounting bolts. Refer to torque specification.

(4) Install intake manifold. Refer to Engine section.

(5) Connect knock sensor wiring harness to engine harness at rear of intake manifold.

5.7L V-8

- (1) Thoroughly clean knock sensor mounting hole.
- (2) Install sensor into cylinder block.

NOTE: Over or under tightening the sensor mounting bolts will affect knock sensor performance, possibly causing improper spark control. Always use the specified torque when installing the knock sensors. The torque for the knock sensor bolt is relatively light for an 8mm bolt.

NOTE: Note foam strip on bolt threads. This foam is used only to retain the bolts to sensors for plant assembly. It is not used as a sealant. Do not apply any adhesive, sealant or thread locking compound to these bolts.

(3) Install and tighten mounting bolt. Refer to torque specification.

- (4) Install electrical connector to sensor.

SPARK PLUG

DESCRIPTION

Resistor type spark plugs are used on all engines.

Sixteen spark plugs (2 per cylinder) are used with 5.7L V-8 engines.

DIAGNOSIS AND TESTING - SPARK PLUG CONDITIONS

To prevent possible pre-ignition and/or mechanical engine damage, the correct type/heat range/number spark plug must be used.

Always use the recommended torque when tightening spark plugs. Incorrect torque can distort the spark plug and change plug gap. It can also pull the plug threads and do possible damage to both the spark plug and the cylinder head.

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. A single plug displaying an abnormal condition indicates that a problem exists in the corresponding cylinder. Replace spark plugs at the intervals recommended in the Lubrication and Maintenance section.

Spark plugs that have low mileage may be cleaned and reused if not otherwise defective, carbon or oil fouled.

CAUTION: Never use a motorized wire wheel brush to clean the spark plugs. Metallic deposits will remain on the spark plug insulator and will cause plug misfire.

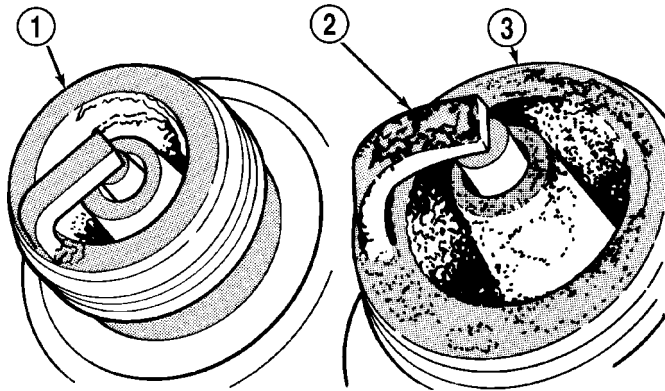
Spark plug resistance values range from 6,000 to 20,000 ohms (when checked with at least a 1000 volt spark plug tester). **Do not use an ohmmeter to check the resistance values of the spark plugs. Inaccurate readings will result.**

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. 42). There will not be evidence of electrode burning. Gap growth will not average more than approximately 0.025 mm (.001 in) per 3200 km (2000 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 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 may be affected by MMT deposits.

SPARK PLUG (Continued)



J908D-15

Fig. 42 NORMAL OPERATION AND COLD (CARBON) FOULING

- 1 - NORMAL
- 2 - DRY BLACK DEPOSITS
- 3 - COLD (CARBON) FOULING

COLD FOULING/CARBON FOULING

Cold fouling is sometimes referred to as carbon fouling. The deposits that cause cold fouling are basically carbon (Fig. 42). 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 cleaner element or repeated short operating times (short trips).

WET FOULING OR GAS FOULING

A spark plug coated with excessive wet fuel or oil is wet fouled. In older engines, worn piston rings, leaking valve guide seals or excessive cylinder wear can cause wet fouling. In new or recently overhauled engines, wet fouling may occur before break-in (normal oil control) is achieved. This condition can usually be resolved by cleaning and reinstalling the fouled plugs.

OIL OR ASH ENCRUSTED

If one or more spark plugs are oil or oil ash encrusted (Fig. 43), evaluate engine condition for the cause of oil entry into that particular combustion chamber.

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. 44). This short circuits the electrodes. Spark plugs with

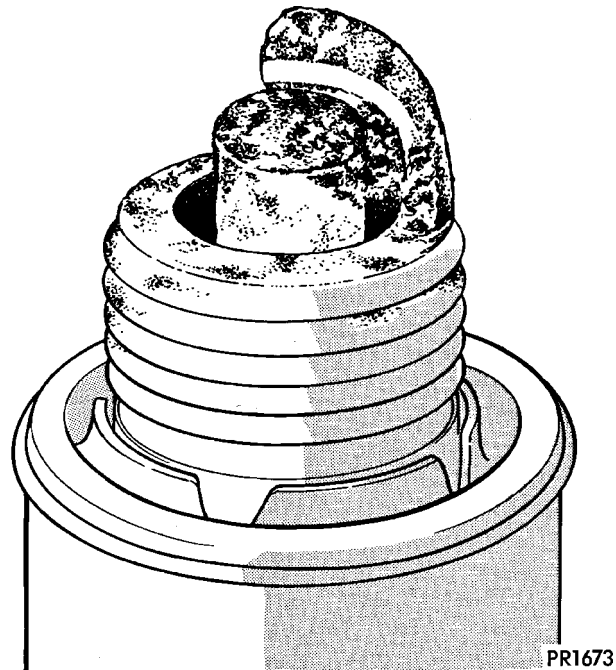
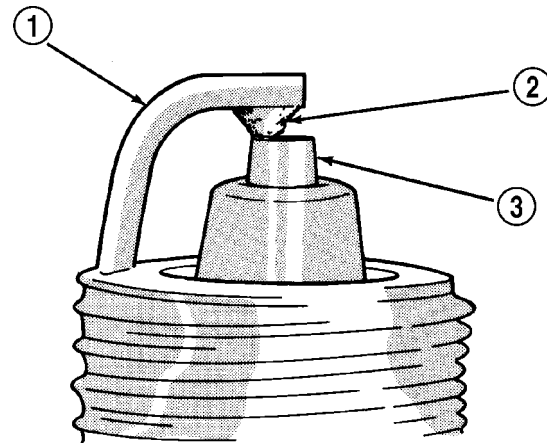


Fig. 43 OIL OR ASH ENCRUSTED

electrode gap bridging can be cleaned using standard procedures.



J908D-11

Fig. 44 ELECTRODE GAP BRIDGING

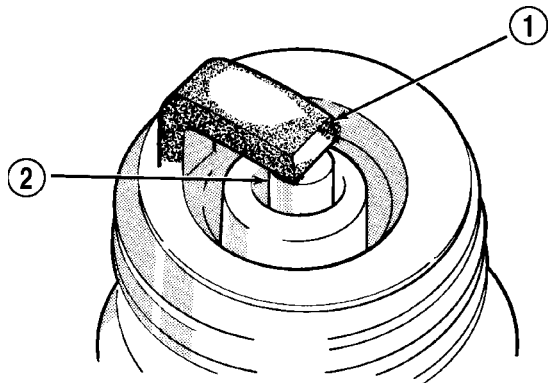
- 1 - GROUND ELECTRODE
- 2 - DEPOSITS
- 3 - CENTER ELECTRODE

SCAVENGER DEPOSITS

Fuel scavenger deposits may be either white or yellow (Fig. 45). 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 nor-

SPARK PLUG (Continued)

mal in condition and can be cleaned using standard procedures.



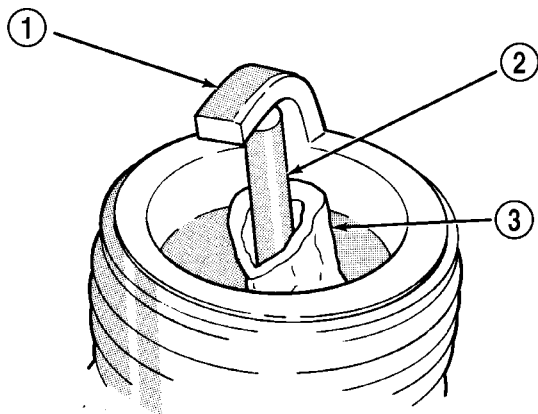
J908D-12

Fig. 45 SCAVENGER DEPOSITS

- 1 - GROUND ELECTRODE COVERED WITH WHITE OR YELLOW DEPOSITS
2 - CENTER ELECTRODE

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. 46). Spark plugs with this condition must be replaced.



J908D-13

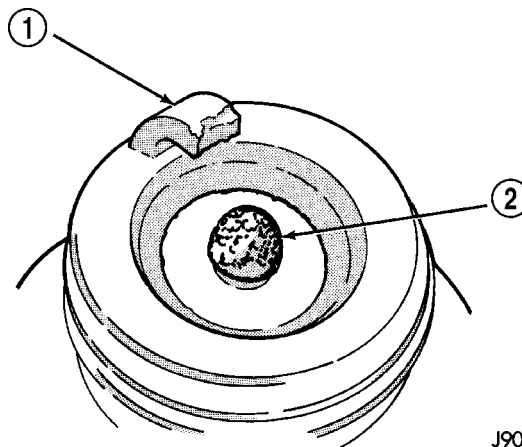
Fig. 46 CHIPPED ELECTRODE INSULATOR

- 1 - GROUND ELECTRODE
2 - CENTER ELECTRODE
3 - CHIPPED INSULATOR

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. 47). 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.)



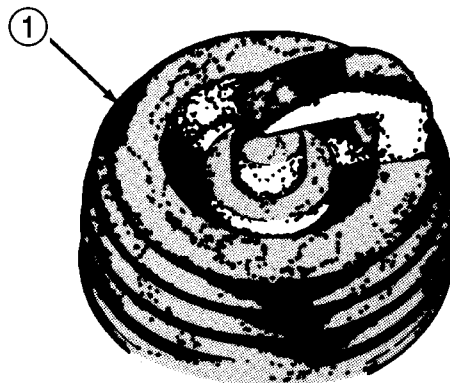
J908D-14

Fig. 47 PREIGNITION DAMAGE

- 1 - GROUND ELECTRODE STARTING TO DISSOLVE
2 - CENTER ELECTRODE DISSOLVED

SPARK PLUG OVERHEATING

Overheating is indicated by a white or gray center electrode insulator that also appears blistered (Fig. 48). The increase in electrode gap will be considerably in excess of 0.001 inch per 2000 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.



J908D-16

Fig. 48 SPARK PLUG OVERHEATING

- 1 - BLISTERED WHITE OR GRAY COLORED INSULATOR

SPARK PLUG (Continued)

REMOVAL

3.7L V-6

Each individual spark plug is located under each ignition coil. Each individual ignition coil must be removed to gain access to each spark plug. Refer to Ignition Coil Removal/Installation.

(1) Remove necessary air filter tubing at throttle body.

(2) Prior to removing ignition coil, spray compressed air around coil base at cylinder head.

(3) Prior to removing spark plug, spray compressed air into cylinder head opening. This will help prevent foreign material from entering combustion chamber.

(4) Remove spark plug from cylinder head using a quality socket with a rubber or foam insert. Also check condition of ignition coil o-ring and replace as necessary.

(5) Inspect spark plug condition. Refer to Diagnostics and Testing - Spark Plug Conditions.

4.7L V-8

Each individual spark plug is located under each ignition coil. Each individual ignition coil must be removed to gain access to each spark plug. Refer to Ignition Coil Removal/Installation.

(1) Remove necessary air filter tubing at throttle body.

(2) Prior to removing ignition coil, spray compressed air around coil base at cylinder head.

(3) Prior to removing spark plug, spray compressed air into cylinder head opening. This will help prevent foreign material from entering combustion chamber.

(4) Remove spark plug from cylinder head using a quality socket with a rubber or foam insert. Also check condition of ignition coil o-ring and replace as necessary.

(5) Inspect spark plug condition. Refer to Diagnostics and Testing - Spark Plug Conditions.

5.7L V-8

Eight of the 16 spark plugs are located under an ignition coil; the other 8 are not. If spark plug being removed is under coil, coil must be removed to gain access to spark plug. Refer to Ignition Coil Removal/Installation and observe all CAUTIONS and WARNINGS.

Before removing or disconnecting any spark plug cables, note their original position. Remove cables one-at-a-time. To prevent ignition crossfire, spark plug cables **MUST** be placed in cable tray (routing loom) into their original position. Refer to Spark Plug Cable Removal for a graphic.

Before installing spark plug cables to either the spark plugs or coils, apply dielectric grease to inside of boots.

(1) Remove necessary air filter tubing at throttle body.

(2) Prior to removing ignition coil (if coil removal is necessary), spray compressed air around coil base at cylinder head cover.

(3) Prior to removing spark plug, spray compressed air into cylinder head opening. This will help prevent foreign material from entering combustion chamber.

(4) Remove spark plug from cylinder head using a quality socket with a rubber or foam insert.

(5) Inspect spark plug condition. Refer to Diagnostics and Testing - Spark Plug Conditions.

5.9L V-8

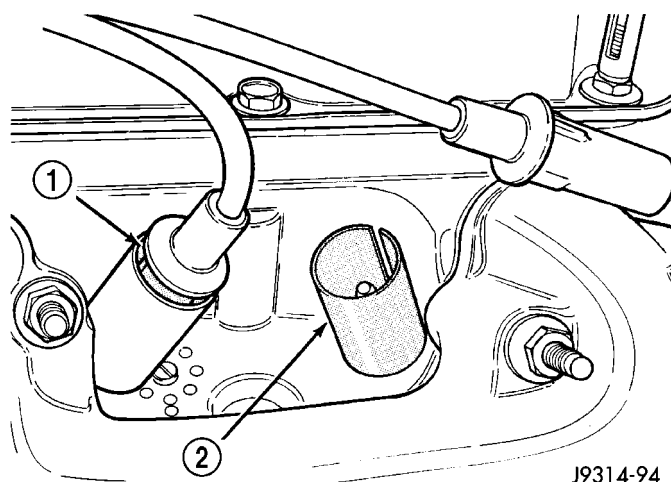
On 5.9L V-8 engines, spark plug cable heat shields are pressed into the cylinder head to surround each cable boot and spark plug (Fig. 49).

(1) Always remove spark plug or ignition coil cables by grasping at the cable boot (Fig. 50). 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 Diagnostics and Testing - Spark Plug Conditions.

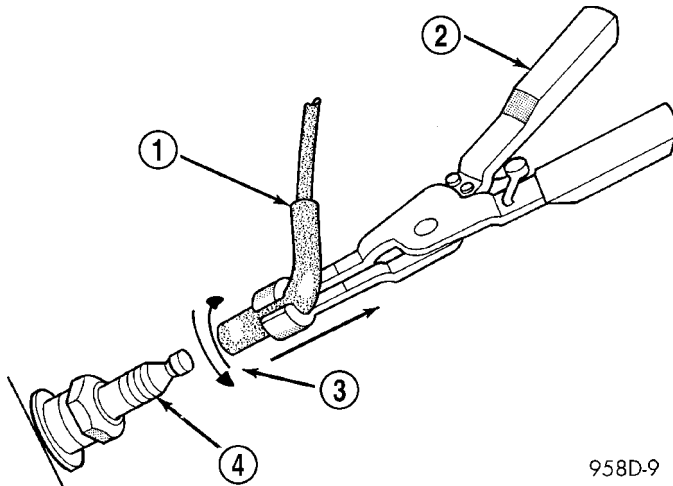


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Fig. 49 HEAT SHIELDS - 5.9L V-8

- 1 - AIR GAP
- 2 - SPARK PLUG BOOT HEAT SHIELD

SPARK PLUG (Continued)



958D-9

Fig. 50 CABLE REMOVAL - 5.9L / 8.0L

- 1 - SPARK PLUG CABLE AND BOOT
- 2 - SPARK PLUG BOOT PULLER
- 3 - TWIST AND PULL
- 4 - SPARK PLUG

8.0L V-10

(1) Always remove spark plug or ignition coil cables by grasping at the cable boot (Fig. 50). 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.

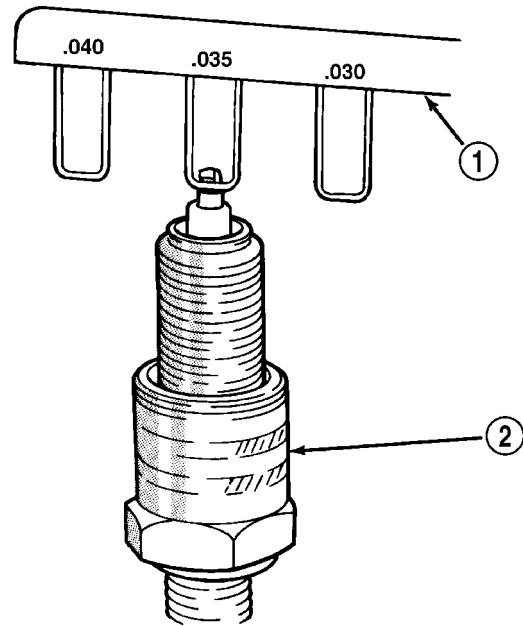
(4) Inspect the spark plug condition. Refer to Diagnostics and Testing - Spark Plug Conditions.

CLEANING**CLEANING AND ADJUSTMENT**

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

CAUTION: Never use a motorized wire wheel brush to clean spark plugs. Metallic deposits will remain on spark plug insulator and will cause plug misfire.

Adjust spark plug gap with a gap gauging tool (Fig. 51).



J908D-10

Fig. 51 SETTING SPARK PLUG GAP - TYPICAL

- 1 - GAUGE TOOL
- 2 - SPARK PLUG

INSTALLATION**3.7L V-6**

Special care should be taken when installing spark plugs into the cylinder head spark plug wells. Be sure the plugs do not drop into the plug wells as electrodes can be damaged.

Always tighten spark plugs to the specified torque. Over tightening can cause distortion resulting in a change in the spark plug gap or a cracked porcelain insulator.

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

(2) Tighten spark plugs. Refer to torque specifications.

(3) Before installing ignition coil(s), check condition of coil o-ring and replace as necessary. To aid in coil installation, apply silicone to coil o-ring.

(4) Install ignition coil(s). Refer to Ignition Coil Removal/Installation.

SPARK PLUG (Continued)

4.7L V-8

CAUTION: The 4.7L V-8 engine is equipped with copper core ground electrode spark plugs. They must be replaced with the same type/number spark plug as the original. If another spark plug is substituted, pre-ignition will result.

Special care should be taken when installing spark plugs into the cylinder head spark plug wells. Be sure the plugs do not drop into the plug wells as electrodes can be damaged.

Always tighten spark plugs to the specified torque. Over tightening can cause distortion resulting in a change in the spark plug gap or a cracked porcelain insulator.

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

(2) Tighten spark plugs. Refer to torque specifications.

(3) Before installing ignition coil(s), check condition of coil o-ring and replace as necessary. To aid in coil installation, apply silicone to coil o-ring.

(4) Install ignition coil(s). Refer to Ignition Coil Removal/Installation.

5.7L V-8

(1) Special care should be taken when installing spark plugs into the cylinder head spark plug wells. Be sure the plugs do not drop into the plug wells as electrodes can be damaged.

(2) Start the spark plug into cylinder head by hand to avoid cross threading aluminum threads. To aid in installation, attach a piece of rubber hose, or an old spark plug boot to spark plug.

(3) The 5.7L V-8 is equipped with torque critical design spark plugs. Do not exceed 15 ft. lbs. torque. Tighten spark plugs. Refer to torque specifications.

(4) Before installing spark plug cables to either the spark plugs or coils, apply dielectric grease to inside of boots.

(5) To prevent ignition crossfire, spark plug cables **MUST** be placed in cable tray (routing loom) into their original position. Refer to Spark Plug Cable Removal for a graphic.

(6) Install ignition coil(s) to necessary spark plugs. Refer to Ignition Coil Installation.

(7) Install spark plug cables to remaining spark plugs. Remember to apply dielectric grease to inside of boots.

5.9L V-8

Special care should be taken when installing spark plugs into the cylinder head spark plug wells. Be sure the plugs do not drop into the plug wells as electrodes can be damaged.

Always tighten spark plugs to the specified torque. Over tightening can cause distortion resulting in a change in the spark plug gap or a cracked porcelain insulator.

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 spark plugs. Refer to torque specifications.

(3) Install spark plug cables to spark plugs. On 5.9L V-8 engines, spark plug cable heat shields are pressed into the cylinder head to surround each spark plug cable boot and spark plug (Fig. 53). 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. 53).

8.0L V-10

Special care should be taken when installing spark plugs into the cylinder head spark plug wells. Be sure the plugs do not drop into the plug wells as electrodes can be damaged.

Always tighten spark plugs to the specified torque. Over tightening can cause distortion resulting in a change in the spark plug gap or a cracked porcelain insulator.

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 spark plugs. Refer to torque specifications.

(3) Install spark plug cables to spark plugs.

IGNITION COIL CAPACITOR

DESCRIPTION

One coil capacitor is used. It is located in the right-rear section of the engine compartment.

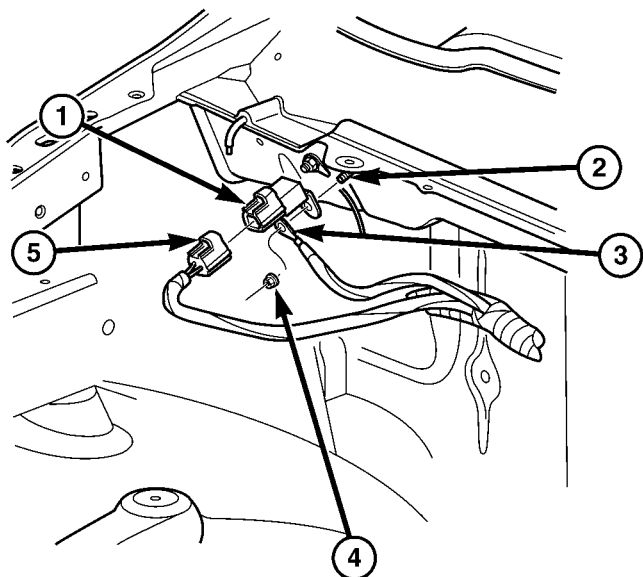
OPERATION

The coil capacitor(s) help dampen the amount of conducted electrical noise to the camshaft position sensor, crankshaft position sensor, and throttle position sensor. This noise is generated on the 12V supply wire to the ignition coils and fuel injectors.

REMOVAL

The coil capacitor is located in the right-rear section of the engine compartment. It is attached with a mounting stud and nut.

- (1) Disconnect electrical connector at capacitor (Fig. 52).
- (2) Remove mounting nut and remove ground strap.
- (3) Remove capacitor.



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Fig. 52 CAPACITOR LOCATION

- 1 - COIL CAPACITOR
- 2 - MOUNTING STUD
- 3 - GROUND STRAP
- 4 - MOUNTING NUT
- 5 - ELEC. CONNECT.

INSTALLATION

- (1) Position capacitor to mounting stud.
- (2) Position ground strap to mounting stud.
- (3) Tighten nut to 7 N·m (60 in. lbs.) torque.
- (4) Connect electrical connector to coil capacitor.

SPARK PLUG CABLE

DESCRIPTION

Spark plug cables are sometimes referred to as secondary ignition wires, or secondary ignition cables.

Plug cables are used only on the 5.7L V-8, 5.9L V-8 and 8.0L V-10 engines.

OPERATION

The spark plug cables transfer electrical current from the ignition coil(s) and/or distributor, to individual spark plugs at each cylinder. The resistive spark plug cables are of nonmetallic construction. The cables provide suppression of radio frequency emissions from the ignition system.

Plug cables are used only on the 5.7L V-8, 5.9L V-8 and 8.0L V-10 engines.

DIAGNOSIS AND TESTING - SPARK PLUG CABLES

Cable routing is important on certain engines. To prevent possible ignition crossfire, be sure the cables are clipped into the plastic routing looms. Refer to Spark Plug Cable Removal for additional information. Try to prevent any one cable from contacting another. Before removing cables, note their original location and routing. Never allow one cable to be twisted around another.

Check the spark plug cable connections for good contact at the coil(s), distributor cap towers (if applicable), and spark plugs. Terminals should be fully seated. The insulators should be in good condition and should fit tightly on the coil, distributor and spark plugs. Spark plug cables with insulators that are cracked or torn must be replaced.

Clean high voltage ignition cables with a cloth moistened with a non-flammable solvent. Wipe the cables dry. Check for brittle or cracked insulation.

On 5.9L V-8 engines, spark plug cable heat shields are pressed into the cylinder head to surround each spark plug cable boot and spark plug (Fig. 53). 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. 53).

TESTING

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:

SPARK PLUG CABLE (Continued)

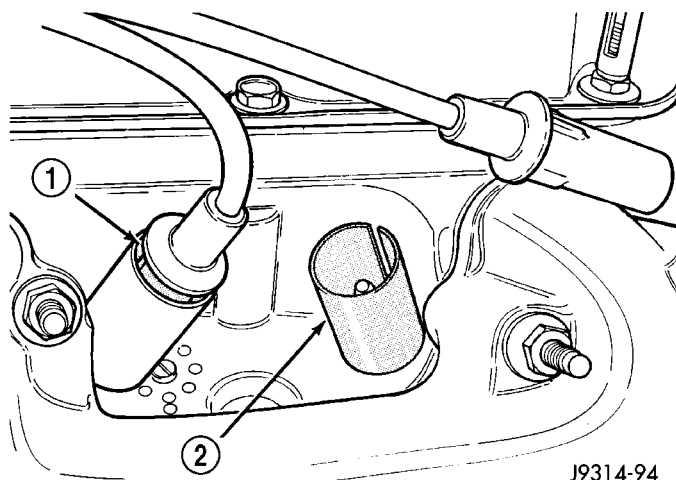


Fig. 53 HEAT SHIELDS - 5.9L V-8

- 1 - AIR GAP
2 - SPARK PLUG BOOT HEAT SHIELD

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.

Except 5.7L V-8 : With the engine running, remove spark plug cable from spark plug (one at a time) and hold next to a good engine ground. If the cable and spark plug are in good condition, the engine rpm should drop and the engine will run poorly. If engine rpm does not drop, the cable and/or spark plug may not be operating properly and should be replaced. Also check engine cylinder compression.

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. If equipped, 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.

SPARK PLUG CABLE RESISTANCE

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

To test ignition coil-to-distributor cap cable (if applicable), 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.

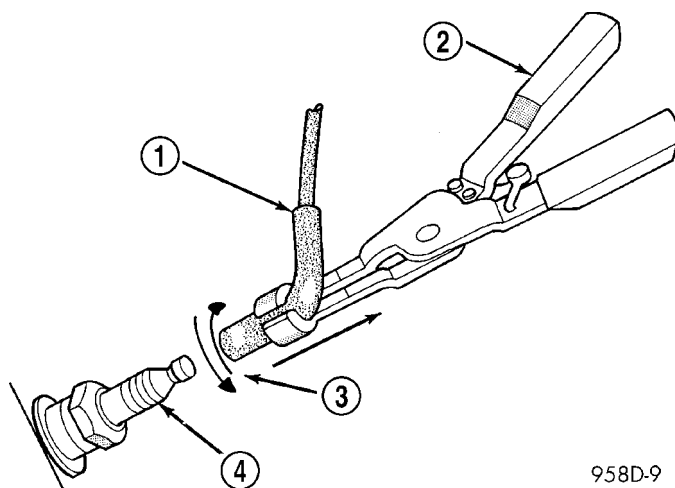
REMOVAL

5.9L V-8 / 8.0L V-10

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 (Fig. 54). Grasp the boot (not the cable) and pull it off with a steady, even force.

On 5.9L V-8 engines, spark plug cable heat shields are pressed into the cylinder head to surround each spark plug cable boot and spark plug (Fig. 53). 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. 53).

SPARK PLUG CABLE (Continued)



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Fig. 54 CABLE REMOVAL - 5.9L V-8 / 8.0L V-10

- 1 - SPARK PLUG CABLE AND BOOT
- 2 - SPARK PLUG BOOT PULLER
- 3 - TWIST AND PULL
- 4 - SPARK PLUG

5.7L V-8

Spark plug cables on the 5.7L engine are paired on cylinders 1/6, 2/3, 4/7 and 5/8. Before removing or disconnecting any spark plug cables, note their original position (Fig. 55). Remove cables one-at-a-time. To prevent ignition crossfire, spark plug cables

MUST be placed in cable tray (routing loom) into their original position. The cable retention clips (Fig. 55) must also be securely locked.

Before installing spark plug cables to either the spark plugs or coils, apply dielectric grease to inside of boots.

If cable tray removal is necessary, release the 4 tray-to-manifold retention clips (Fig. 55).

INSTALLATION

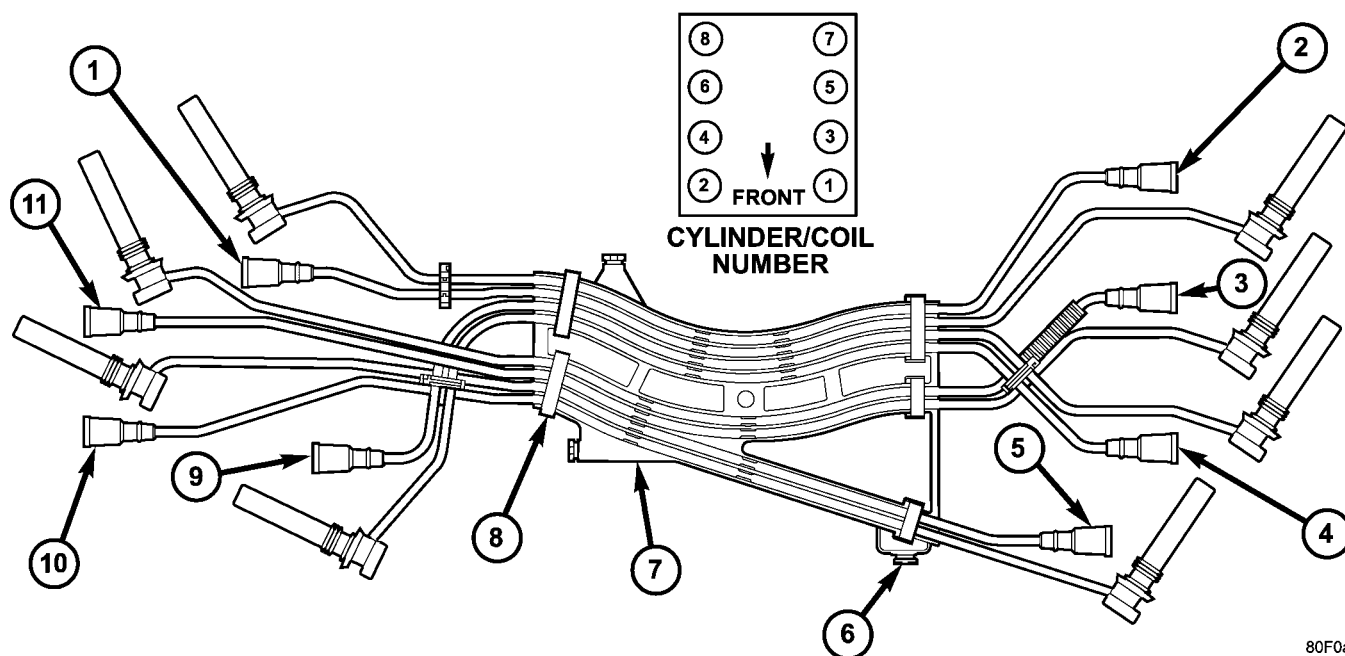
Install cables into the proper engine cylinder firing order sequence. Refer to Specifications.

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

5.7L V-8

Refer to Spark Plug Cable Removal for information.



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Fig. 55 5.7L SPARK PLUG CABLE ROUTING

- 1 - #8 COIL-TO- #5 SPARK PLUG (MARKED 5/8)
- 2 - #5 COIL-TO- #8 SPARK PLUG (MARKED 5/8)
- 3 - #7 COIL-TO- #4 SPARK PLUG (MARKED 4/7)
- 4 - #3 COIL-TO- #2 SPARK PLUG (MARKED 2/3)
- 5 - #1 COIL-TO- #6 SPARK PLUG (MARKED 1/6)
- 6 - CLIPS (TRAY-TO-MANIFOLD RETENTION)
- 7 - CABLE TRAY
- 8 - CLIPS (SPARK PLUG CABLE-TO-TRAY- RETENTION)
- 9 - #2 COIL-TO- #3 SPARK PLUG (MARKED 2/3)
- 10 - #6 COIL-TO- #1 SPARK PLUG (MARKED 1/6)
- 11 - #4 COIL-TO- #7 SPARK PLUG (MARKED 4/7)