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ENGINE ELECTRICAL

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DISTRIBUTOR IGNITION SYSTEM

➤ For information on understanding electricity and troubleshooting electrical circuits, please refer to Section 6 of this manual.

General Information

The ignition system on the 1.5L, 1993–96 1.8L, 2.0L SOHC, 1994–98 2.4L SOHC, 3.0L SOHC, and 3.5L engines uses a pointless type distributor, whose advance mechanism is controlled by the Engine Control Unit (ECU). On the 1.5L, 1.8L, 2.4L and 3.5L engines, the distributor houses a built in ignition coil and ignition power transistor. The 2.0L SOHC and 3.0L SOHC engines utilize a separate coil and transistor assembly.

When the ignition switch is turned **ON**, battery voltage is applied to the ignition coil primary winding. As the shaft of the distributor rotates, signals are transmitted from the powertrain control module to the ignition power transistor. These signals activate the power transistor to cause ignition coil primary winding current flow from the ignition coil negative terminal through the power transistor to ground repeatedly. This interruption induces high voltage in the ignition coil secondary windings, which is diverted through the distributor, spark plug cable and spark plug to ground, thus causing ignition in each cylinder.

Diagnosis and Testing

SECONDARY SPARK TEST

➤ See Figures 1 thru 6

The best way to perform this procedure is to use a spark tester (available at most automotive parts stores). Three types of spark testers are commonly available. The Neon Bulb type is connected to the spark plug wire and flashes with each ignition pulse. The Air Gap type must be adjusted to the individual spark plug gap specified for the engine. The last type of spark plug tester looks like a spark plug with a grounding clip on the side, but there is no side electrode for the spark to jump to. The last two types of testers allows the user to not only detect the presence of spark, but also the intensity (orange/yellow is weak, blue is strong).

1. Disconnect a spark plug wire at the spark plug end.
2. Connect the plug wire to the spark tester and ground the tester to an appropriate location on the engine.
3. Crank the engine and check for spark at the tester.
4. If spark exists at the tester, the ignition system is functioning properly.
5. If spark does not exist at the spark plug wire, perform diagnosis of the ignition system using individual component diagnosis procedures.

CYLINDER DROP TEST

➤ See Figures 7, 8, and 9

The cylinder drop test is performed when an engine misfire is evident. This test helps determine which cylinder is not contributing the proper power. The easiest way to perform this test is to remove the plug wires one at a time from the cylinders with the engine running.



Fig. 1 This spark tester looks just like a spark plug, attach the clip to ground and crank the engine to check for spark



Fig. 2 This spark tester has an adjustable air-gap for measuring spark strength and testing different voltage ignition systems



Fig. 3 Attach the clip to ground and crank the engine to check for spark



Fig. 4 This spark tester is the easiest to use just place it on a plug wire and the bulb voltage is detected and the bulb on the top will flash with each pulse



Fig. 5 A tool used by many professionals to check the secondary ignition pattern is an oscilloscope, similar to this one from UEI



Fig. 6 The setup of the oscilloscope is quite easy, just connect the ground lead and place the inductive pick-up on one of the plug wires

1. Place the transaxle in **P**, engage the emergency brake, and start the engine and let it idle.
2. Using a spark plug wire removing tool, preferably the plier type, carefully remove the boot from one of the cylinders.

*** WARNING

Make sure your body is free from touching any part of the car which is metal. The secondary voltage in the ignition system is high

and although it cannot kill you, it will shock you and it does hurt.

3. The engine will sputter, run worse, and possibly nearly stall. If this happens reinstall the plug wire and move to the next cylinder. If the engine runs no differently, or the difference is minimal, shut the engine off and inspect the spark plug wire, spark plug, and if necessary, perform component diagnostics as covered in this section. Perform the test on all cylinders to verify the which cylinders are suspect.



91052p14

Fig. 7 These pliers are insulated and help protect the user from shock as well as the plug wires from being damaged



91052p15

Fig. 8 To perform the cylinder drop test, remove one wire at a time and . . .



91052p16

Fig. 9 . . . note the idle speed and idle characteristics of the engine. The cylinder(s) with the least drop is the non-contributing cylinder(s)

Adjustments

There are no adjustments to the distributor ignition system other than the ignition timing adjustment. Refer to section 1 for ignition timing adjustment.

Ignition Coil

TESTING

1.5L, 1.8L, 2.4L, and 3.5L Engines

▶ See Figures 10, 11, and 12

➤ The ignition coil is an integral part of the distributor.

1. Measure the resistance of the primary ignition coil as follows:

a. Unplug the electrical connector at the distributor. Using an ohmmeter, measure the resistance between the two terminals of the distributor, **NOT THE WIRE HARNESS**, except for the 3.5L engine, in which you test across terminals 1 and 2 of the distributor.

b. Measure the resistance and compare to the desired specifications of:

- 0.9–1.2 ohms on the 1.5L, 1.8L, and 2.4L engines

- 0.5–0.7 ohms on the 3.5L engine

c. If the actual reading differs from the desired specification, replace the ignition coil.

d. If the measured value is within standard allowance, there are no broken wires or short circuits.

2. Measure the resistance of the secondary ignition coil as follows:

a. Insert one of the test leads into the secondary ignition coil terminal on top of the distributor cap.

b. Touch the second test lead to terminal 1 or terminal 2 of the distributor connector.

c. Measure the resistance and compare to the desired specifications of:

- 20–29 kilo-ohms on the 1.5L, 1.8L, and 2.4L engines

- 9–13 kilo-ohms on the 3.5L engine

d. If the measured value is within standard allowance, there are no broken wires or short circuits.

e. If the actual reading differs from the desired specification, replace the ignition coil.

2. Measure the resistance of the secondary ignition coil as follows:

a. Insert one of the test leads into the secondary ignition coil terminal on top of the distributor cap.

b. Touch the second test lead to terminal 1 or terminal 2 of the distributor connector.

c. Measure the resistance and compare to the desired specifications of:

- 20–29 kilo-ohms on the 2.0L SOHC engine

- 10.29–13.92 kilo-ohms on the 3.0L SOHC engine

d. If the measured value is within standard allowance, there are no broken wires or short circuits.

e. If the actual reading differs from the desired specification, replace the ignition coil.

2.0L SOHC and 3.0L SOHC Engines

▶ See Figure 13

1. Measure the resistance of the primary ignition coil as follows:

a. Unplug the electrical connector at the coil. Using an ohmmeter, measure the resistance between the two terminals of the coil, **NOT THE WIRE HARNESS**.

b. Measure the resistance and compare to the desired specifications of:

- 0.9–1.2 ohms on the 2.0L SOHC engine

- 0.72–0.88 ohms on the 3.0L SOHC engine

c. If the actual reading differs from the desired specification, replace the ignition coil.

d. If the measured value is within standard allowance, there are no broken wires or short circuits.

REMOVAL & INSTALLATION

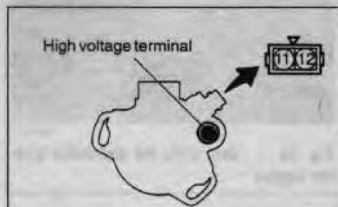
1.5L, 1.8L, 2.4L, and 3.5L Engines

➤ The ignition coil is an integral part of the distributor.

2.0L SOHC and 3.0L SOHC Engines

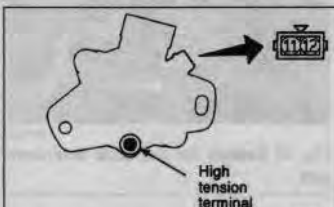
▶ See Figure 14

1. Disconnect the negative battery cable.
2. Remove the coil wire from the ignition coil by gripping the boot and not the cable.
3. Detach the electrical connectors for the coil.



93152g01

Fig. 10 Distributor connector pins and location—1.5L and 1.8L engines



93152g02

Fig. 11 Distributor connector pins and location—2.4L SOHC engine



93152g04

Fig. 12 Distributor connector pins and location—3.5L engine

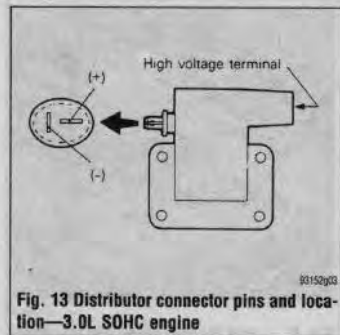


Fig. 13 Distributor connector pins and location—3.0L SOHC engine

93152g03

4. Remove the retaining screws and coil from engine.
5. Installation is the reverse of the removal procedure.

Distributor

REMOVAL & INSTALLATION

♦ See Figures 14, 15, 16, 17, and 18

Before removing the distributor, position No. 1 cylinder at Top Dead Center (TDC) on the compression stroke and align the timing marks.

1. Disconnect the negative battery cable.
2. Remove the ignition wire cover, if equipped.
3. Detach the distributor harness connector.
4. Remove the distributor cap with all ignition wires still connected. Remove the coil wire, if necessary.
5. Matchmark the rotor to the distributor housing and the distributor housing to the engine.
6. Remove the hold-down nut.
7. Carefully remove the distributor from the engine.

INSTALLATION

♦ See Figures 19 and 20

Timing Not Disturbed

1. Install a new distributor housing O-ring and lubricate with clean oil.

2. Install the distributor in the engine so the rotor is aligned with the matchmark on the housing and the housing is aligned with the matchmark on the engine. Be sure the distributor is fully seated and the distributor shaft is fully engaged.

3. Install the hold-down nut.
4. Attach the distributor harness connectors.
5. Install the distributor cap.
6. Connect the negative battery cable.
7. Adjust the ignition timing and tighten the hold-down nut to 8 ft. lbs. (11 Nm).

Timing Disturbed

1. Install a new distributor housing O-ring and lubricate with clean oil.
2. Position the engine so the No. 1 piston is at Top Dead Center (TDC) of its compression stroke and the mark on the vibration damper is aligned with 0 on the timing indicator.
3. Align the distributor housing and gear mating marks. Install the distributor in the engine so the slot or groove of the distributor's installation flange aligns with the distributor installation stud in the engine block. Be sure the distributor is fully seated. Inspect alignment of the distributor rotor making sure the rotor is aligned with the position of the No. 1 ignition wire in the distributor cap.

Power Transistor (Ignition Module)

REMOVAL & INSTALLATION

1.5L, 1.8L, 2.4L, and 3.5L Engines

The power transistor (ignition module) is an integral part of the distributor.

2.0L SOHC and 3.0L SOHC Engines

♦ See Figure 14

1. Disconnect the negative battery cable.
2. Detach the electrical connectors for the power transistor.
3. Remove the retaining screws and power transistor from engine.
4. Installation is the reverse of the removal procedure.

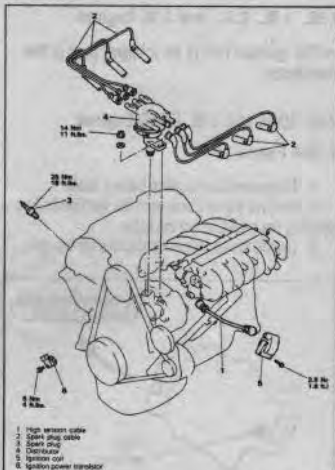


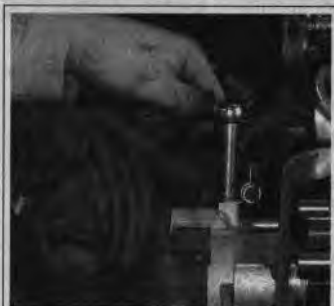
Fig. 14 Ignition system component locations—3.0L SOHC engine

93152g05



93152g01

Fig. 15 Detach the connectors from the distributor



93152g02

Fig. 16 Remove the bolt holding the wire harness and capacitor, then move the harness and capacitor to the side



93152g03

Fig. 17 Remove the distributor hold-down nuts . . .



93152g04

Fig. 18 . . . then slide the distributor from the engine

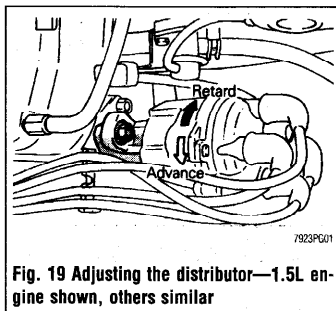


Fig. 19 Adjusting the distributor—1.5L engine shown, others similar

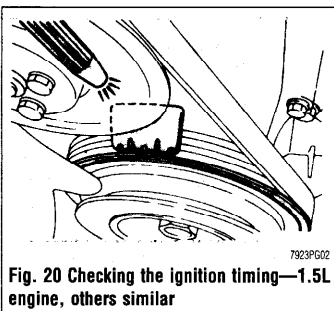


Fig. 20 Checking the ignition timing—1.5L engine, others similar

4. Install the hold-down nut.
5. Attach the distributor harness connectors.
6. Install the distributor cap.
7. Connect the negative battery cable.
8. Adjust the ignition timing and tighten the hold-down nut to 8 ft. lbs. (11 Nm).

Crankshaft and Camshaft Position Sensors

For procedures on the position sensors, please refer to Section 4 in this manual.

DISTRIBUTORLESS IGNITION SYSTEM

General Information

The ignition system found on the 1.6L, 1997-00 1.8L, 2.0L DOHC, 1999-00 2.4L SOHC, 2.4L DOHC, and 3.0L DOHC engines is a distributorless type. The advance of this system, like the distributor type ignition, is controlled by the Engine Control Unit (ECU) or Powertrain Control Module (PCM). The distributorless ignition system contains a crank angle/position sensor which detects the crank angle or position to each cylinder and converts this data into pulse signals. These signals are sent to the ECU/PCM, which calculates the engine rpm and regulates the fuel injection and ignition timing accordingly. The system also contains a top dead center sensor which detects the top dead center position of each cylinder and converts this data into pulse signals. These signals are then sent to the ECU/PCM, which calculates the sequence of fuel injection and engine rpm.

When the ignition switch is turned **ON**, battery voltage is applied to the ignition coil primary winding. As the crank angle sensor shaft rotates, ignition signals are transmitted from the multi port injection control unit to the power transistor. These signals activate the power transistor to cause ignition coil primary winding current to flow from the ignition coil negative terminal through the power transistor to ground or be interrupted, repeatedly. This action induces high voltage in the secondary winding of the ignition coil. From the ignition coil, the secondary winding current produced flows through the spark plug to ground, thus causing ignition in each cylinder.

Diagnosis and Testing

Refer to Diagnosis and Testing under Distributor Ignition in this section.

Adjustments

There are no adjustments to the distributorless ignition system other than the ignition timing adjustment. Refer to section 1 for ignition timing adjustment.

Ignition Coil(s)

TESTING

1.6L and 1990 2.0L DOHC Engines

♦ See Figures 21 and 22

1. Disconnect the negative battery cable and ignition coil harness connector.
2. Measure the primary coil resistance as follows:
 - a. Measure the resistance between terminals of the coil pack, **NOT THE WIRE HARNESS**, between **4** and **2** (coils at the No. 1 and No. 4 cylinder sides) of the ignition coil, and between terminals **4** and **1** (coils at the No. 2 and No. 3 cylinder sides).

- b. Compare reading to the desired primary coil resistance of 0.77-0.95 ohms.
3. Measure the coil secondary resistance as follows:
 - c. Detach the connector from the ignition coil.
 - d. Measure the resistance between the high-voltage terminals for the No. 1 and No. 4 cylinders, and between the high-voltage terminals for the No. 2 and No. 3 cylinders.
 - e. Compare the measured resistance to the desired secondary coil resistance of 10.3-13.9 kilo-ohms.
4. If the readings are not within the specified value, replace the ignition coil.

1991-93 2.0L DOHC Engines

♦ See Figures 23 and 24

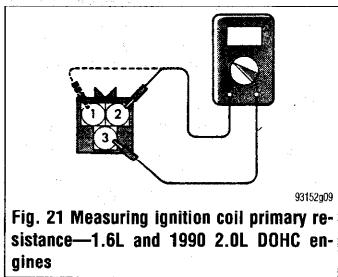


Fig. 21 Measuring ignition coil primary resistance—1.6L and 1990 2.0L DOHC engines

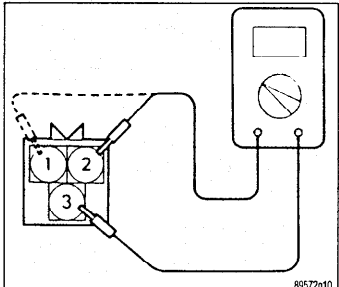


Fig. 23 Measuring the primary ignition coil resistance—1991-93 2.0L DOHC engines

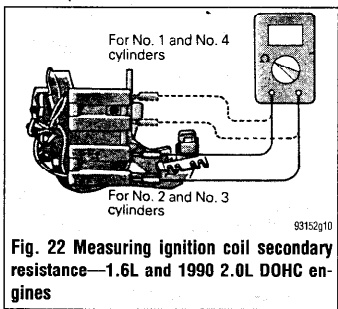


Fig. 22 Measuring ignition coil secondary resistance—1.6L and 1990 2.0L DOHC engines

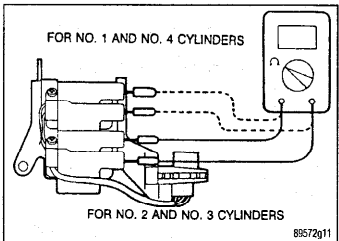


Fig. 24 Measuring ignition coil secondary resistance—1991-93 2.0L DOHC engines

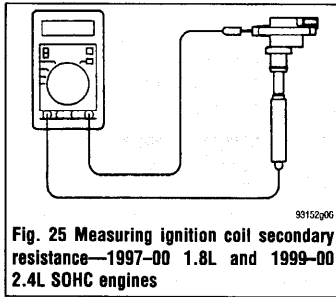


Fig. 25 Measuring ignition coil secondary resistance—1997-00 1.8L and 1999-00 2.4L SOHC engines

1. Disconnect the negative battery cable and ignition coil harness connector.
2. Measure the primary coil resistance as follows:
 - a. Measure the resistance between terminals **3** and **2** (coils at the No. 1 and No. 4 cylinder sides) of the ignition coil, and between terminals **3** and **1** (coils at the No. 2 and No. 3 cylinder sides).
 - b. Compare reading to the desired primary coil resistance of 0.70–0.86 ohms.
3. Measure the coil secondary resistance as follows:

- a. Detach the connector from the ignition coil.
 - d. Measure the resistance between the high-voltage terminals for the No. 1 and No. 4 cylinders, and between the high-voltage terminals for the No. 2 and No. 3 cylinders.
 - e. The desired secondary coil resistance is 11.3–15.3 kilo-ohms.
4. If the readings are not within the specified value, replace the ignition coil.

1997-00 1.8L and 1999-00 2.4L SOHC Engines

♦ See Figure 25

1. Measure the resistance of the secondary ignition coil as follows:
 - a. Insert one of the test leads into the secondary ignition coil terminal of the coil.
 - b. Touch the second test lead to terminal **1** or terminal **2** of the coil connector.
 - c. Measure the resistance and compare to the desired specifications of 9.4–12.8 kilo-ohms.
 - d. If the measured value is within standard allowance, there are no broken wires or short circuits.
 - e. If the actual reading differs from the desired specification, replace the ignition coil.

2.4L DOHC Engines

♦ See Figures 26 and 27

1. Disconnect the negative battery cable.
2. To check the primary coil resistance, perform the following:
 - a. Detach the electrical connector from the coil pack.
 - b. Using an ohmmeter, measure the resistance between the two terminals of the coil, **NOT THE WIRE HARNESS**.
 - c. If the resistance is not between 0.74–0.90 ohms, replace the ignition coil.

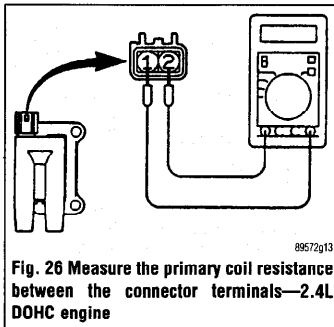


Fig. 26 Measure the primary coil resistance between the connector terminals—2.4L DOHC engine

3. To check the secondary coil resistance, perform the following:
 - a. Tag and disconnect the spark plug wires from the ignition coil.
 - b. Measure the secondary resistance of the coil between the towers of each individual coil.
 - c. If the resistance is not between 20.1–27.3 kilo-ohms, replace the ignition coil.

3.0L DOHC Engine

♦ See Figures 28 and 29

1. Measure the resistance of the primary ignition coil as follows:
 - a. Unplug the electrical connector at the coil pack. Using an ohmmeter, measure the resistance between the terminals of the coil pack, **NOT THE WIRE HARNESS**. Measure the resistance between terminals:
 - 2–3 for Coil **A**
 - 1–3 for Coil **B**
 - 4–3 for Coil **C**
 - b. Measure the resistance and compare to the desired specifications of 0.67–0.81 ohms.
 - c. If the actual reading differs from the desired specification, replace the ignition coil.

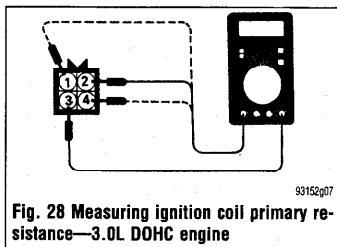


Fig. 28 Measuring ignition coil primary resistance—3.0L DOHC engine

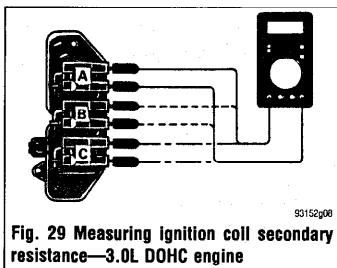


Fig. 29 Measuring ignition coil secondary resistance—3.0L DOHC engine

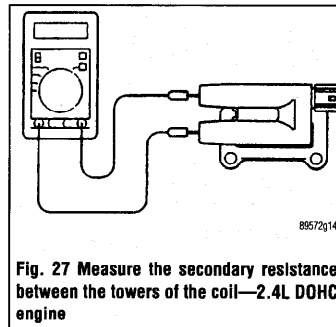


Fig. 27 Measure the secondary resistance between the towers of the coil—2.4L DOHC engine

- d. If the measured value is within standard allowance, there are no broken wires or short circuits.
2. Measure the resistance of the secondary ignition coil as follows:
 3. Insert the lead of the ohmmeter between coil pack cylinder terminals:
 - Between coil terminals **1–4** for Coil **A**
 - Between coil terminals **2–5** for Coil **B**
 - Between coil terminals **3–6** for Coil **C**
 - e. Measure the resistance and compare to the desired specifications of 11.3–15.3 kilo-ohms.
 - f. If the measured value is within standard allowance, there are no broken wires or short circuits.
 - g. If the actual reading differs from the desired specification, replace the ignition coil pack.

REMOVAL & INSTALLATION

1.6L, 2.0L DOHC, and 2.4L DOHC Engines

♦ See Figure 30

1. Disconnect the negative battery cable.
2. Tag and remove the spark plug wires from the ignition coil by gripping the boot and not the cable.

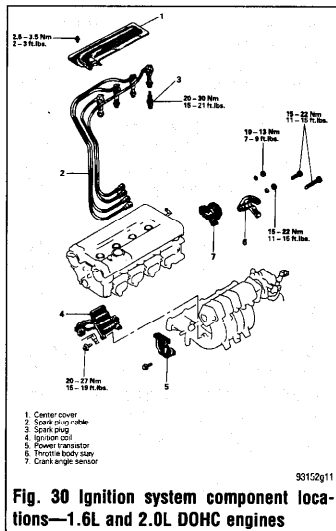


Fig. 30 Ignition system component locations—1.6L and 2.0L DOHC engines