

SECTION 14

Ignition Systems and Timing Procedures

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Description and Operation

IGNITION SYSTEMS AND TIMING PROCEDURES

Engine Applications

All Engines

The Ignition System provides spark control to the engine during all modes of operation. The Ignition System consists of three sub-systems: Primary Ignition; Secondary Ignition and Timing Advance. All engines use a distributor mounted on the rear of the engine driven directly off the back of the camshaft.

Primary Ignition Components

These include the Coil Primary Circuit, the Power Relay, Ignition Module, and the Ignition Switch. When the Ignition Switch is turned on, the power relay closes and charges the primary coil windings. During engine running, the ignition module grounds the negative side of the coil primary circuit which induces spark.

Secondary Ignition Components

These include the Spark Plugs, Spark Plug Wires, Distributor Cap, Rotor, Coil Wire and Coil Secondary Circuit, the inductive charge built up in the secondary circuit sends a spark from the coil to the distributor where the rotor and distributor cap sent the spark to each spark plug.

Timing Advance Components

The 1.6L turbo uses Governor Weights, a Knock Controller and a Vacuum Advance/Boost retard Diaphragm. The 1.6L non-turbo uses Governor Weights and a Dual Diaphragm Vacuum Advance.

Coils

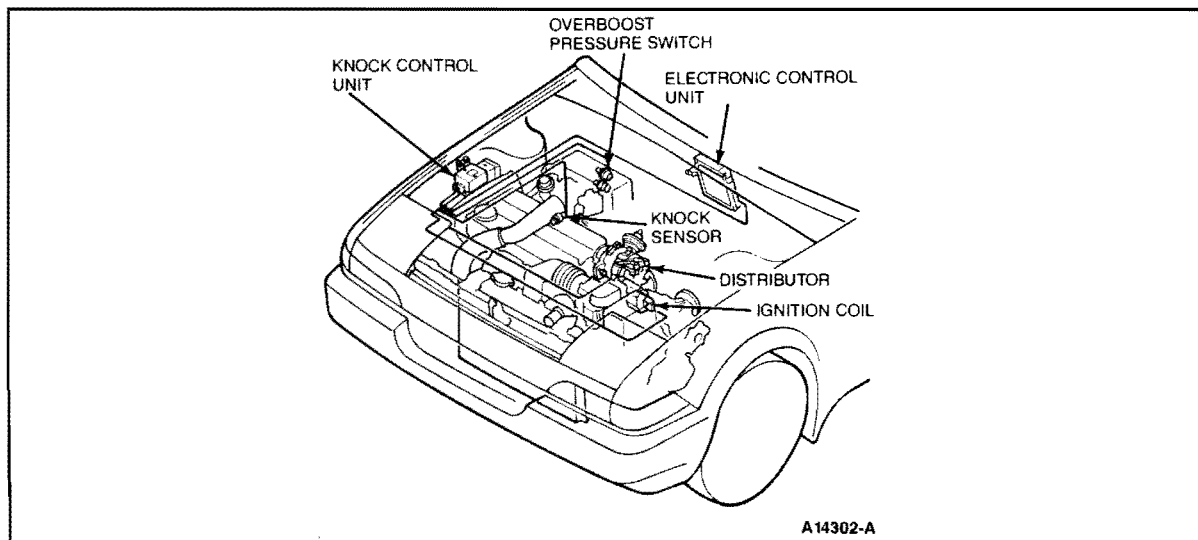
All engines use an iron core type Coil mounted near the driver's side strut tower.

Ignition Module

Both engines use a Distributor Mounted Ignition Module that operates independent of the ECA.

Description and Operation

COMPONENT LOCATION



Diagnosis and Testing

SYSTEM INSPECTION

1. Visually inspect the components of the Ignition System.

Look for:

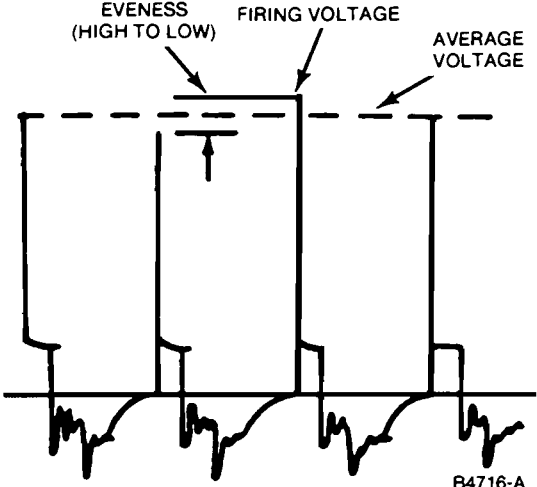
ELECTRICAL	MECHANICAL
• Discharged Battery • Damaged, Loose Connections • Damaged Electrical Insulation • Poor Coil, Distributor and Spark Plug Connections • Ignition Module Connections • Blown Fuses	• Damaged Vacuum Hoses • Damaged or Worn Rotor and Distributor Cap • Damaged Spark Plugs • Distributor Cap, Rotor and Spark Plug Wires are Properly Seated

2. Check the vehicle's maintenance schedule to ensure spark plugs and wires have been properly maintained.
3. Check spark plug wires and boots for signs of poor insulation that could cause cross firing.
4. A damaged or worn timing belt can cause symptoms that appear to be ignition timing related. Refer to shop manual basic engine section if necessary.
5. Make sure engine idle speed is within specification.

Diagnosis and Testing

**All
Engines**

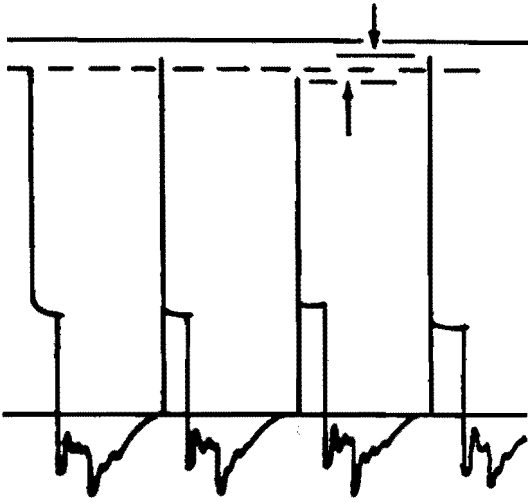
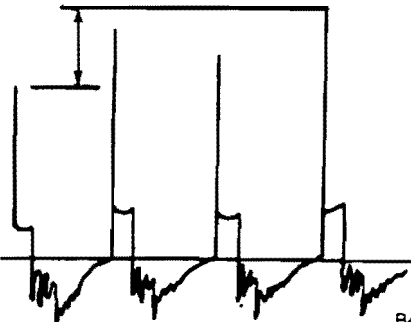
IGN

TEST STEP		RESULT	ACTION TO TAKE
IGN1	CHECK FIRING ORDER		
- Inspect the routing of the spark plug wires (Note engine rotation direction). - Make sure the wires follow the firing order 1-3-4-2. Is the firing order OK? 		Yes No	GO to IGN2. SERVICE as required.
IGN2	SPARK AT PLUGS		
- Connect spark tester between spark plug wire (plug end) and ground, crank engine, repeat on all spark plug wires. Does spark jump at each wire?		Yes No	INSPECT spark plugs (engine runs). GO to IGN3. GO to IGN4.
IGN3	SECONDARY DISPLAY		
NOTE: If this portion of the diagnostic procedure is to provide accurate results, it is essential that the calibration of your engine analyzer be maintained. Refer to your equipment manual. If this is not available, an estimate of the calibration can be made by connecting the spark tester to a properly operating ignition system and measuring the firing voltage of the tester only. The tester firing voltage should be approximately 28 KV. - Connect engine analyzer to view secondary ignition. - Slowly increase engine rpm, from idle to 2000 rpm, compare the engine analyzer display to the following illustrations.			GO to IGN3A .

Diagnosis and Testing

All Engines

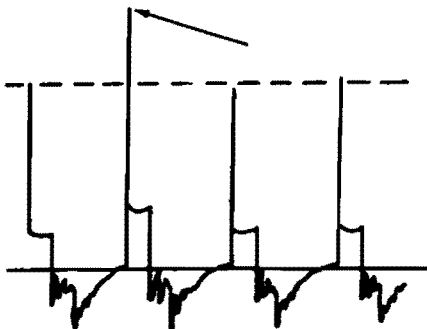
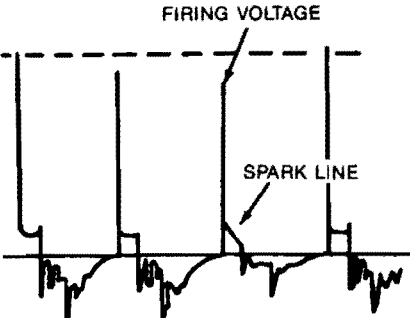
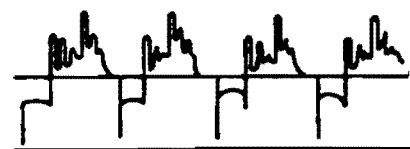
IGN

TEST STEP		RESULT	ACTION TO TAKE
IGN3A	SPARK AT PLUGS		
Is evenness of spark plug firing voltage and the average value of spark plug firing voltage normal and stable?		Yes No	GO to ADV1 . GO to IGN3B .
IGN3B	SECONDARY DISPLAY		
Is average value of spark plug firing voltage greater than normal?  B4717-A		Yes No	Problems affecting all cylinders: - CHECK coil wire for proper installation in coil and distributor cap. - Wide spark plug gaps or worn electrodes at all cylinders. - INSPECT cap and rotor for problems causing excessive cap-to-rotor gap. - INSPECT rotor blade for lack of silicone compound. - GO to IGN6. GO to IGN3C .
IGN3C	SECONDARY DISPLAY		
Is evenness of spark plug firing voltage greater than normal?  B4718-A		Yes No	Problems affecting some cylinders: - Wide spark plug gap(s) or worn electrode(s). - Improperly installed cap or rotor. GO to IGN3D .

Diagnosis and Testing

All Engines

IGN

TEST STEP	RESULT	ACTION TO TAKE
IGN3D SECONDARY DISPLAY • Is there consistently high spark plug firing voltage in one or more cylinders?  B4719-A	Yes No	Check if: — Spark plug wire(s) are firmly connected to distributor cap or spark plug. — Wide spark plug gap(s) or worn electrodes(s). — Open plug wire(s). — GO to IGN6 . GO to IGN3E .
IGN3E SECONDARY DISPLAY • Is there consistently low spark plug firing voltage or sloping spark line in one or more cylinders?  B4720-A	Yes No	— Fouled spark plug(s). — Narrow spark plug gap(s). — Spark plug wire(s) grounding on engine. — Carbon tracking in cap. GO to IGN3F .
IGN3F SECONDARY DISPLAY • Is spark plug firing voltage reversed?  B4721-A	Yes No	— Ignition coil primary circuit reversed. — CHECK wiring harness for ignition coil primary circuit. If OK, REPLACE ignition coil GO to IGN6 .

Diagnosis and Testing

**All
Engines**

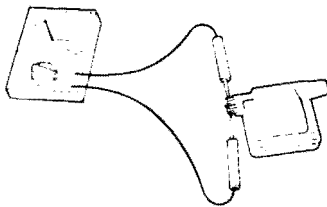
IGN

TEST STEP		RESULT	ACTION TO TAKE
IGN4	SPARK FROM COIL		
• Connect spark tester between coil secondary terminal and ground. • Crank engine. • Does spark jump?		Yes	GO to IGN5 .
		No	GO to IGN7 .
IGN5	CHECK DISTRIBUTOR ASSEMBLY		
• Check rotor, distributor cap, armature and module for wear breakage, cracks and carbon build-up (black build-up) and oxidation (white build-up). • Crank engine and verify the rotor turns steadily. • Does distributor appear to be OK?		Yes	GO to IGN6 .
		No	SERVICE as required.
IGN6	SPARK PLUG WIRE RESISTANCE		
• Remove distributor cap from distributor. • Check that spark plug wires are firmly seated in cap. • Disconnect spark plug end of suspect wire(s). • Measure resistance from terminal in cap to spark plug terminal. • Is resistance between 4,000 and 6,000 ohms per foot?		Yes	GO to ADV1 .
		No	REPLACE spark plug wire(s).

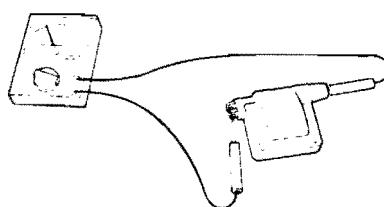
Diagnosis and Testing	All Engines	IGN
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TEST STEP	RESULT	ACTION TO TAKE
IGN7 SUPPLY VOLTAGE		
- Check voltage at the coil positive (+) terminal with the ignition switch in the ON position. Approximately 12 Volts?	Yes No	GO to IGN8 . SERVICE battery feed to the coil (fuse, wiring, ignition switch).
IGN8 NEGATIVE CHECK		
- Check voltage at the coil negative (–) terminal when turning the ignition switch to the START position Approximately 6 Volts?	Yes No	CHECK secondary ignition components (cap, rotor, plug wires). GO to IGN9 .
IGN9 IGNITION COIL CHECK		
- Disconnect wires from Ignition Coil. - Take measurements shown below. Are resistance readings within specifications?	Yes No	GO to IGN10 . REPLACE Ignition Coil.

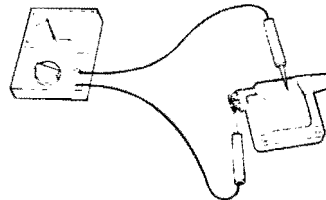
PRIMARY
0.8 TO 1.6 OHMS



SECONDARY
6K TO 30K OHMS



INSULATION
OPEN



A14321-A

Diagnosis and Testing**All
Engines****IGN**

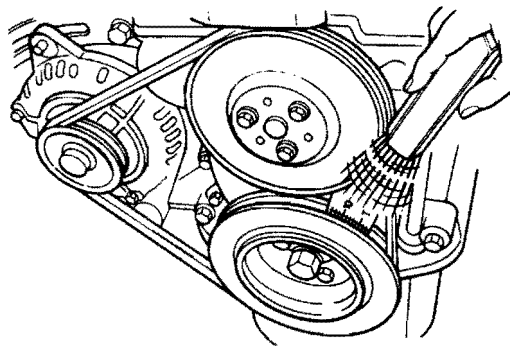
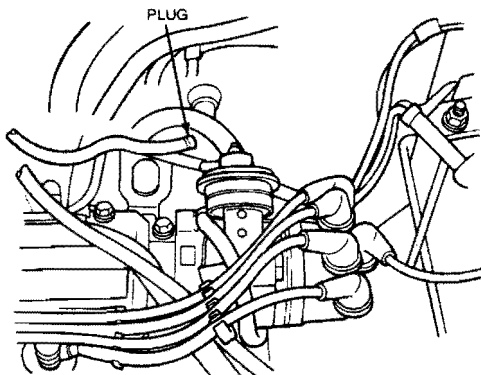
TEST STEP		RESULT	ACTION TO TAKE
IGN10	PICK-UP COIL CHECK		
• Check continuity of the Pick-Up Coil. • Is there continuity in the Pick-Up Coil?		Yes	REPLACE igniter unit.
		No	REPLACE Pick-Up Coil.

Diagnosis and Testing

All Engines

ADV

TEST STEP		RESULT	ACTION TO TAKE
ADV1 CHECK VACUUM SUPPLY			
• Check vacuum hoses to distributor diaphragm for cracks or bad connections. • Are vacuum hoses OK?		Yes	GO to ADV2 .
		No	SERVICE hose as required.
ADV2 TIMING INSPECTION			
• Disconnect and plug hoses from vacuum diaphragm. • Engine at operating temperature. • All electrical loads off. • At idle (850 ± 50 rpm). • Check timing. 2° ± 1° for Non-Turbo 12° ± 1° for Turbo • Is base timing correct?		Yes	GO to ADV3 .
		No	ADJUST timing.



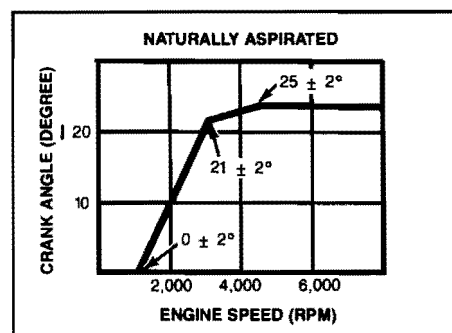
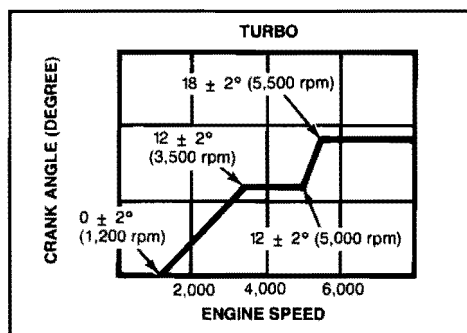
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Diagnosis and Testing

All Engines

ADV

TEST STEP		RESULT	ACTION TO TAKE
ADV3	CENTRIFUGAL ADVANCE		
- Warm engine. - Disconnect and plug vacuum advance hoses. - Monitor ignition timing while increasing engine speed. Does Centrifugal Advance operate properly?		Yes (Non-Turbo)	GO to ADV4 .
		Yes (Turbo)	GO to ADV5 .
		No	SERVICE Centrifugal Advance Assembly.



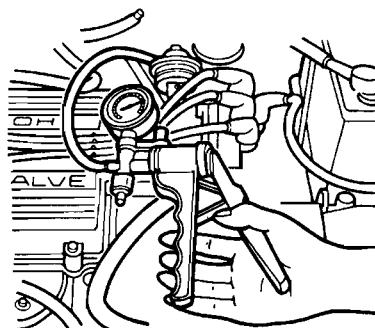
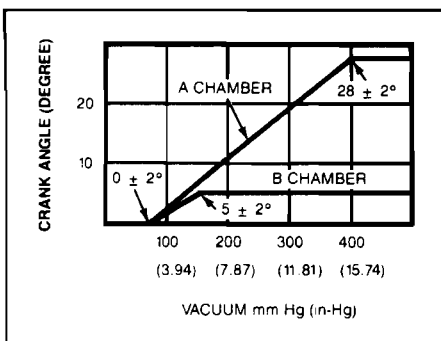
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Diagnosis and Testing

**1.6L
DOHC**

ADV

TEST STEP	RESULT	ACTION TO TAKE
ADV4 VACUUM ADVANCE		
• Disconnect and plug vacuum advance hoses. • Apply vacuum to chamber A and monitor ignition timing. • Remove vacuum from chamber A and apply the vacuum to chamber B. Monitor ignition timing. • Compare the readings to the chart below. • Does vacuum advance operate properly?	Yes No	CHECK vacuum hoses for leaks, cracks, and breakage; SERVICE as required. Return to Diagnostic Routines, Section 2. REPLACE vacuum diaphragm.



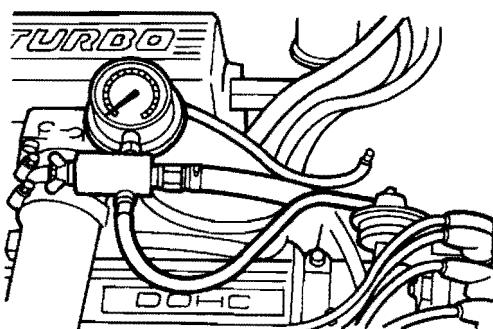
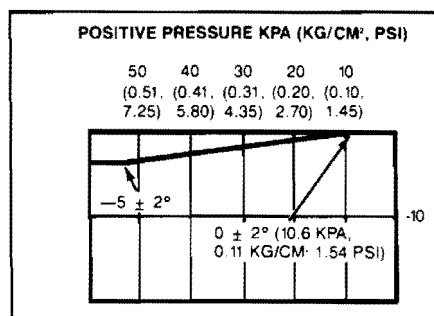
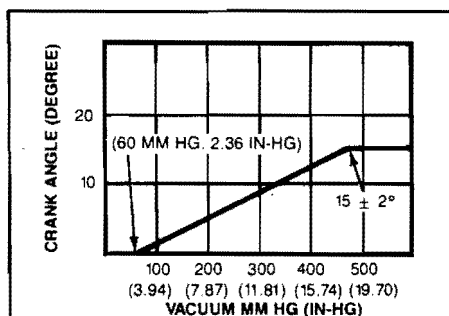
A14305-A

Diagnosis and Testing

1.6L TURBO

ADV

TEST STEP	RESULT	ACTION TO TAKE
ADV5 VACUUM ADVANCE		
- Disconnect and plug vacuum advance hoses. - Apply vacuum to the advance diaphragm and monitor ignition timing. - Remove vacuum and apply air pressure to the advance diaphragm (10 psi MAX). Monitor ignition timing. - Compare the readings to the chart below. Does the vacuum advance operate properly?	Yes No	CHECK vacuum hoses for leaks, cracks, breakage and proper routing. SERVICE as required. Return to Diagnostic Routines, Section 2. REPLACE vacuum diaphragm.



A14306-A

Specifications

SPECIFICATIONS

DESCRIPTION	SPECIFICATION	
Base Timing BTDC	1.6L DOHC	$2^{\circ} \pm 2^{\circ}$
	1.6L Turbo	$12^{\circ} \pm 2^{\circ}$
Spark Plug Gap (Inches)	1.6L DOHC	0.39 – 0.43
	1.6L Turbo	0.39 – 0.43
Firing Order	1 – 3 – 4 – 2	
Idle Speed	1.6L DOHC (MTX)	800 – 900
	1.6L DOHC (ATX)	800 – 900
	1.6L Turbo	800 – 900