

SECTION 9B

Fuel Delivery / Turbocharger System

Contents

Description and Operation	9B-1
Fuel Delivery Systems	9B-1
Fuel Filter	9B-2
Fuel Injector.....	9B-3
Fuel Pressure Regulator	9B-4
Fuel Pump	9B-5
Fuel Pump Relay	9B-6
1.3L Component Locations — Fuel Delivery System.....	9B-7
1.6L Component Location — Fuel Delivery System	9B-9
1.8L Component Location — Fuel Delivery System	9B-10
2.0L and 2.5L Component Location — Fuel Delivery System.....	9B-11
Diagnosis and Testing.....	9B-12
Fuel Delivery Systems	9B-12
1.3L Electrical Schematic	9B-12
1.6L Electrical Schematic	9B-13
1.8L Electrical Schematic	9B-14
2.0L Electrical Schematic	9B-15

SECTION 9B

Fuel Delivery / Turbocharger System

Contents (continued)

2.5L Electrical Schematic	9B-16
System Inspection	9B-17
Pinpoint Tests F — Fuel Pressure Test	9B-19
Pinpoint Tests FA — No Fuel Pressure Test	9B-22
Pinpoint Tests FB — Low Fuel Pressure Test	9B-32
Pinpoint Tests FC — High Fuel Pressure Test	9B-37
Pinpoint Tests FD — Fuel Injector Test	9B-38
Fuel Injector Tester / Cleaner	9B-40
Description and Operation	9B-41
Turbocharger Systems — 1.6L Turbo	9B-41
Boost Pressure Switch (BPS)	9B-42
1.6L Turbo Component Location	9B-43
Diagnosis and Testing	9B-44
Turbocharger Systems — 1.6L	9B-44
System Inspection	9B-44
Pinpoint Tests LP — Turbocharging Diagnosis	9B-45
Pinpoint Tests PFO — Turbocharging Noise Diagnosis	9B-50

SECTION 9B

Fuel Delivery / Turbocharger System

Contents (continued)

Specifications / Special Service Tools	9B-52
Specifications	9B-52
Special Service Tools / Equipment.....	9B-53

Description and Operation

Fuel Delivery Systems

Basic Operation

The fuel delivery system supplies fuel to the fuel injectors at a constant pressure and in the correct volume for efficient combustion. Major components of the system include:

- Fuel tank
- Fuel lines
- Fuel pump
- Fuel filter
- Fuel pressure regulator
- Fuel pressure regulator control solenoid
- Fuel rail
- Fuel injectors
- Fuel pump relay
- Inertia fuel shutoff switch
- Fuel pump switch (built into the Volume Air Flow Meter) (1.6L and 1.8L only)

Powertrain Control Module (PCM) Control of Air / Fuel Ratio

The Powertrain Control Module (PCM) controls the rate of fuel injection in response to the signals received from the operator controls and from the sensors and switches which monitor the engine conditions. It adjusts the fuel delivery rate for all major operating modes including:

- Normal driving
- Cold engine start-up
- Acceleration
- Deceleration
- Transaxle shift (CD4E and 4EAT only)
- Engine overspeed shutoff
- A / C cutout during cranking
- Turbo overboost pressure relief (1.6L Turbo only)

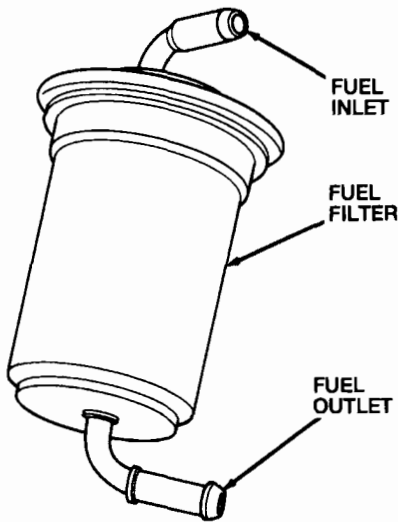
<p>Description and Operation</p>	<p>All Engines</p>	<p>Fuel Filter</p>
---	---------------------------	---------------------------

Fuel Filter

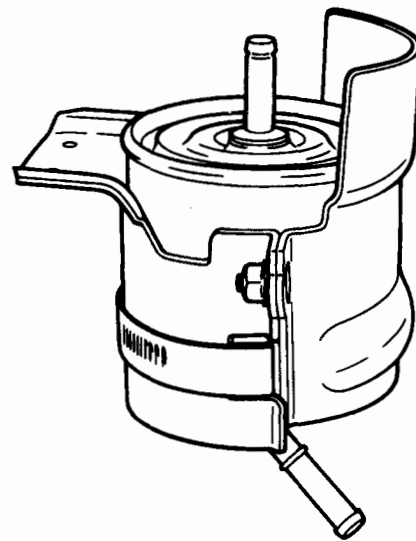
The fuel filter strains particles from the fuel through a paper element. This filtration process removes solid particles from the fuel that may clog the small orifices inside the fuel injectors.

1.3L, 1.6L

1.8L, 2.0L, 2.5L



A14610-B



A16769-A

Engine	Location
1.3L	Mounted near LH front strut tower.
1.6L, 1.8L	Mounted on the center of the cowl.
2.0L, 2.5L	Mounted between the transaxle and the LH strut tower.

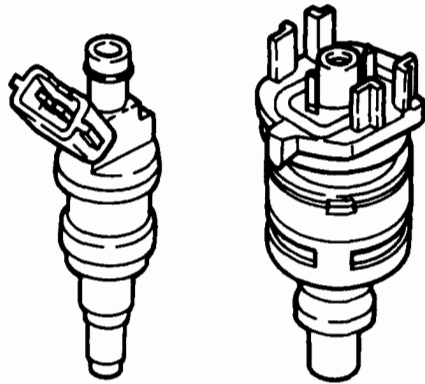
Description and Operation	All Engines	Fuel Injectors
----------------------------------	--------------------	-----------------------

Fuel Injector

The Fuel Injectors (INJ) are solenoid operated needle valves that control fuel flow into the engine. The injector valve body consists of a solenoid actuated pintle or needle valve assembly that sits on a fixed size orifice. The fuel pressure, maintained by a fuel pressure regulator, is variable depending on intake manifold vacuum. Fuel flow to the engine is regulated by how long the injectors are activated by the Powertrain Control Module (PCM) and by fuel pressure.

The 1.3L, 1.6L, 1.8L, and 2.0L engines use top feed injectors, whereas the 2.5L engine uses side feed injectors.

1.3L, 1.6L, 1.8L, 2.0L 2.5L



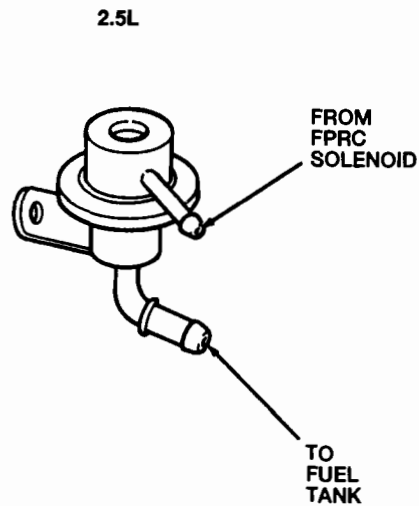
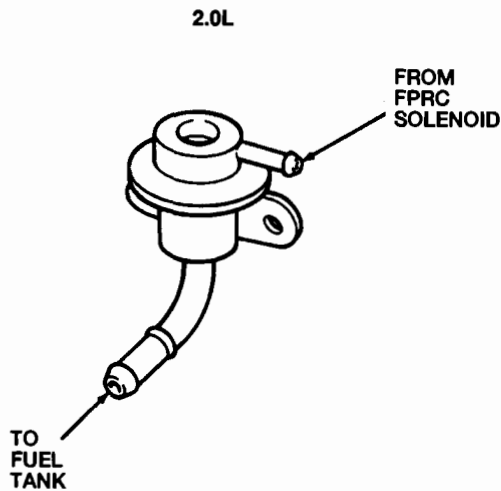
A16762-B

Engine	Location
1.3L, 1.6L, 1.8L, 2.0L, 2.5L	Mounted to the fuel rail and attached to the intake manifold.

<p>Description and Operation</p>	<p>All Engines</p>	<p>Fuel Pressure Regulator</p>
---	---------------------------	---------------------------------------

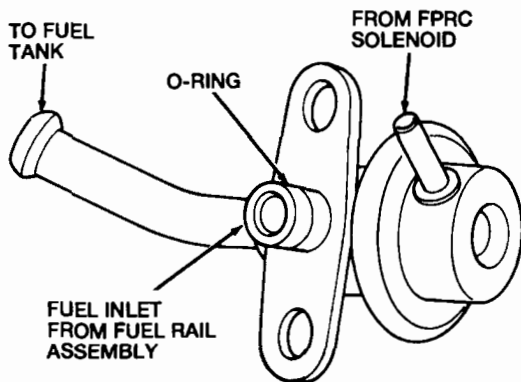
Fuel Pressure Regulator

The fuel pressure regulator adjusts the amount of fuel pressure supplied to the injectors. The fuel pressure regulator is controlled by a vacuum actuated diaphragm inside the regulator. The diaphragm vacuum is supplied by the Fuel Pressure Regulator Control (FPRC) solenoid, except on the 1.3L engine which supplies vacuum directly from the intake manifold.



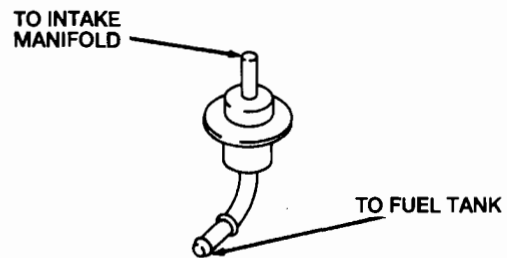
A16761-B

1.6L, 1.8L



A14041-E

1.3L



A20509-B

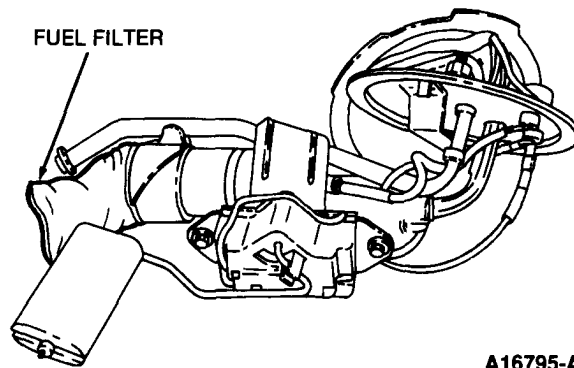
Engine	Location
1.3L, 1.6L, 1.8L, 2.0L, 2.5L	Mounted to the end of the fuel rail on the LH side of the engine.

<p>Description and Operation</p>	<p>All Engines</p>	<p>Fuel Pump</p>
---	---------------------------	-------------------------

Fuel Pump

The Fuel Pump (FP) filters the solid particles from the fuel and causes pressure which allows the fuel to be transmitted from the fuel tank to the engine. The fuel pump is driven by an internal motor, which creates pressure in the fuel lines. The fuel pump circuit ground is controlled by the Powertrain Control Module (PCM) to operate the fuel pump.

All vehicles have a fuel pump test connector, which will turn on the fuel pump whenever the terminal is jumped to ground with the key ON. On 1.3L, 1.8L, and 2.5L vehicles these terminals are integrated into the data link connector (Super STAR II connector on 2.0L vehicles). The fuel pump test connector on the 1.6L is located near the right strut in the engine compartment. The data link connector (1.8L) is located near the left strut in the engine compartment. The data link connector (1.3L and 2.5L) and the Super STAR II connector (2.0L) are located near the battery on the left side of the engine compartment.



Engine	Location
1.3L, 1.6L, 1.8L, 2.0L, 2.5L	Located in the fuel tank.

<p>Description and Operation</p>	<p>All Engines</p>	<p>Fuel Pump Relay</p>
---	---------------------------	-------------------------------

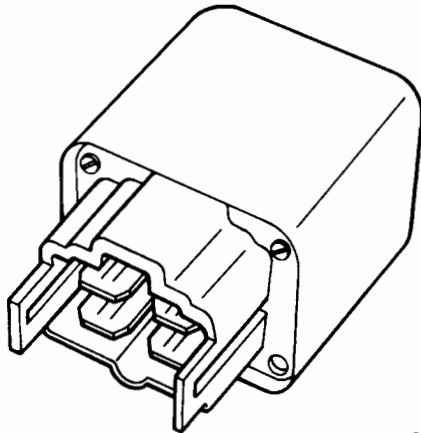
Fuel Pump Relay

The Fuel Pump Relay (FPR) supplies voltage to the fuel pump when activated. When the ignition is switched into the ON or START position, power is supplied to the FPR and to the Powertrain Control Module (PCM).

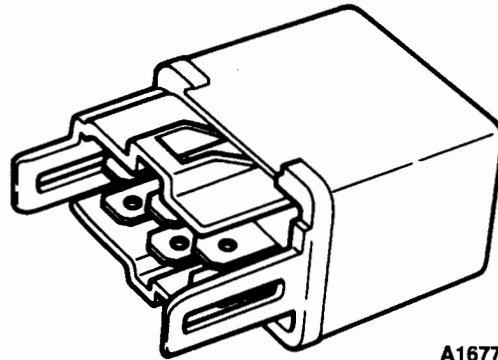
On 1.6L and 1.8L vehicles, the FPR is activated when the ignition switch is turned to the START position and remains activated by the fuel pump switch in the Volume Air Flow (VAF) meter while the engine is running. On the 1.3L, 2.0L and 2.5L vehicles, the FPR is controlled by the PCM, which grounds the relay to activate it while the engine is cranking and running.

2.0L, 2.5L

1.3L, 1.6L, 1.8L



A16829-A

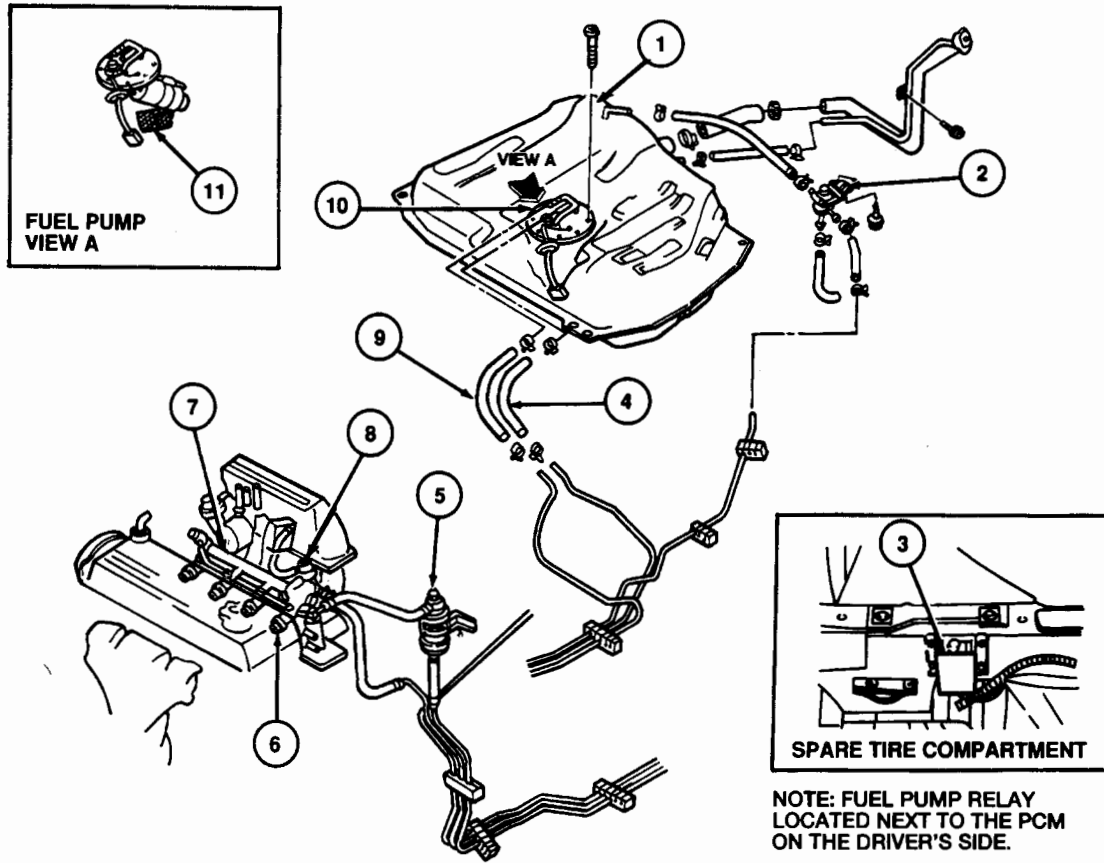


A16777-A

Engine	Location
1.3L	Located under the LH side of the instrument panel.
1.6L, 1.8L	Located forward of the center console near PCM.
2.0L, 2.5L	Located in the main fuse panel.

Description and Operation

1.6L Component Location — Fuel Delivery System

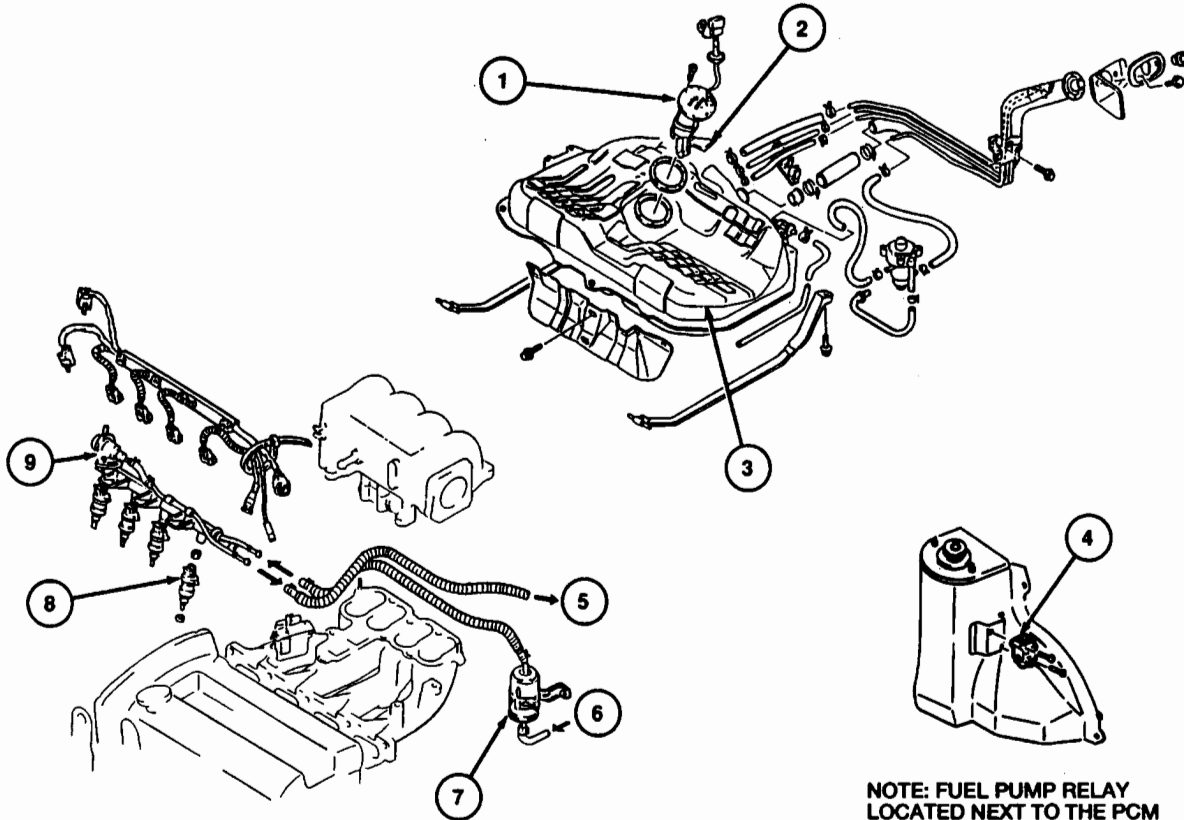


A14759-D

Item	Description
1	Fuel Tank
2	Rollover / Vent Valve
3	Inertia Fuel Shutoff Switch
4	Fuel Return Hose
5	Fuel Filter (High-Pressure Side)
6	Fuel Injector
7	Fuel Rail
8	Fuel Pressure Regulator
9	Fuel Main Hose
10	Fuel Pump
11	Fuel Filter

Description and Operation

1.8L Component Location — Fuel Delivery System



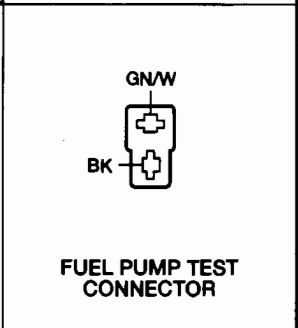
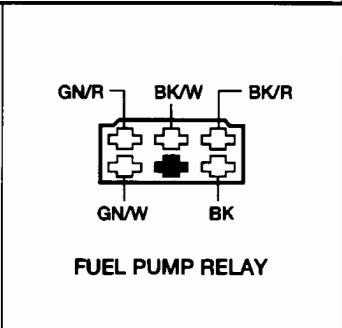
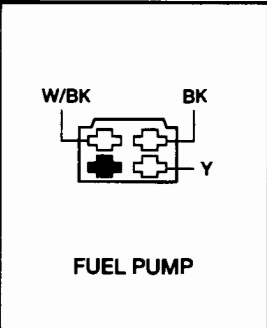
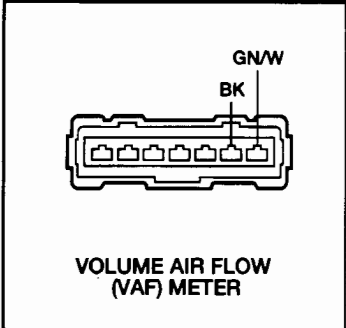
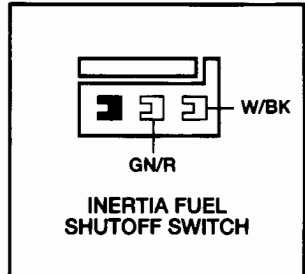
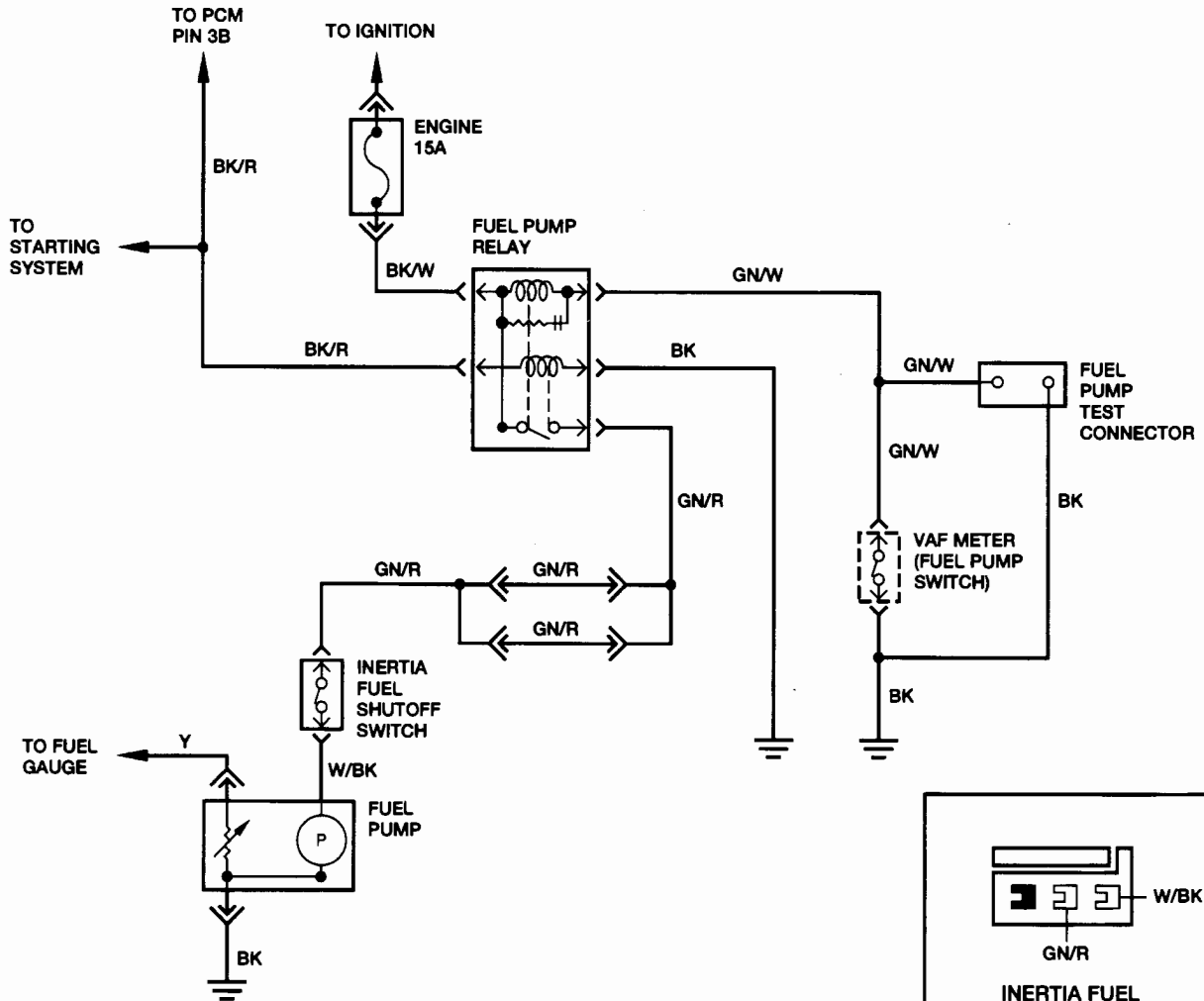
**NOTE: FUEL PUMP RELAY
LOCATED NEXT TO THE PCM
ON THE PASSENGER SIDE.**

A14015-E

Item	Description
1	Fuel Pump
2	Fuel Filter (Low-Pressure Side)
3	Fuel Tank
4	Inertia Fuel Shutoff Switch
5	To Fuel Tank
6	From Fuel Tank
7	Fuel Filter (High-Pressure Side)
8	Fuel Injector
9	Fuel Pressure Regulator

Diagnosis and Testing

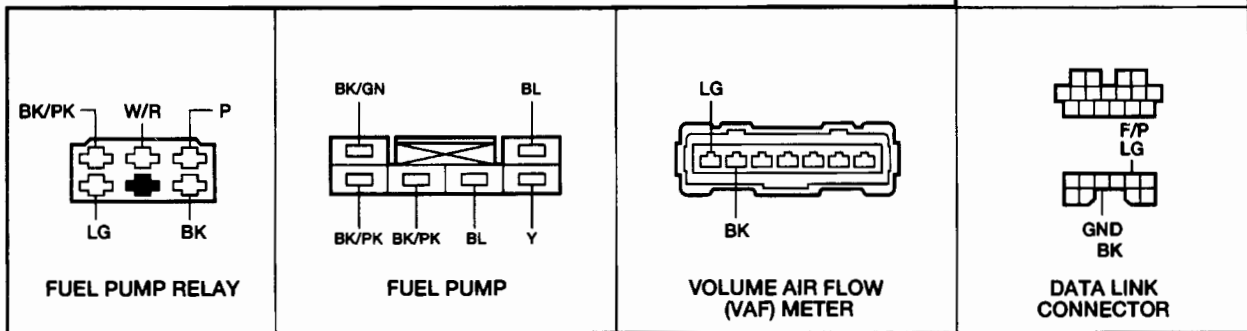
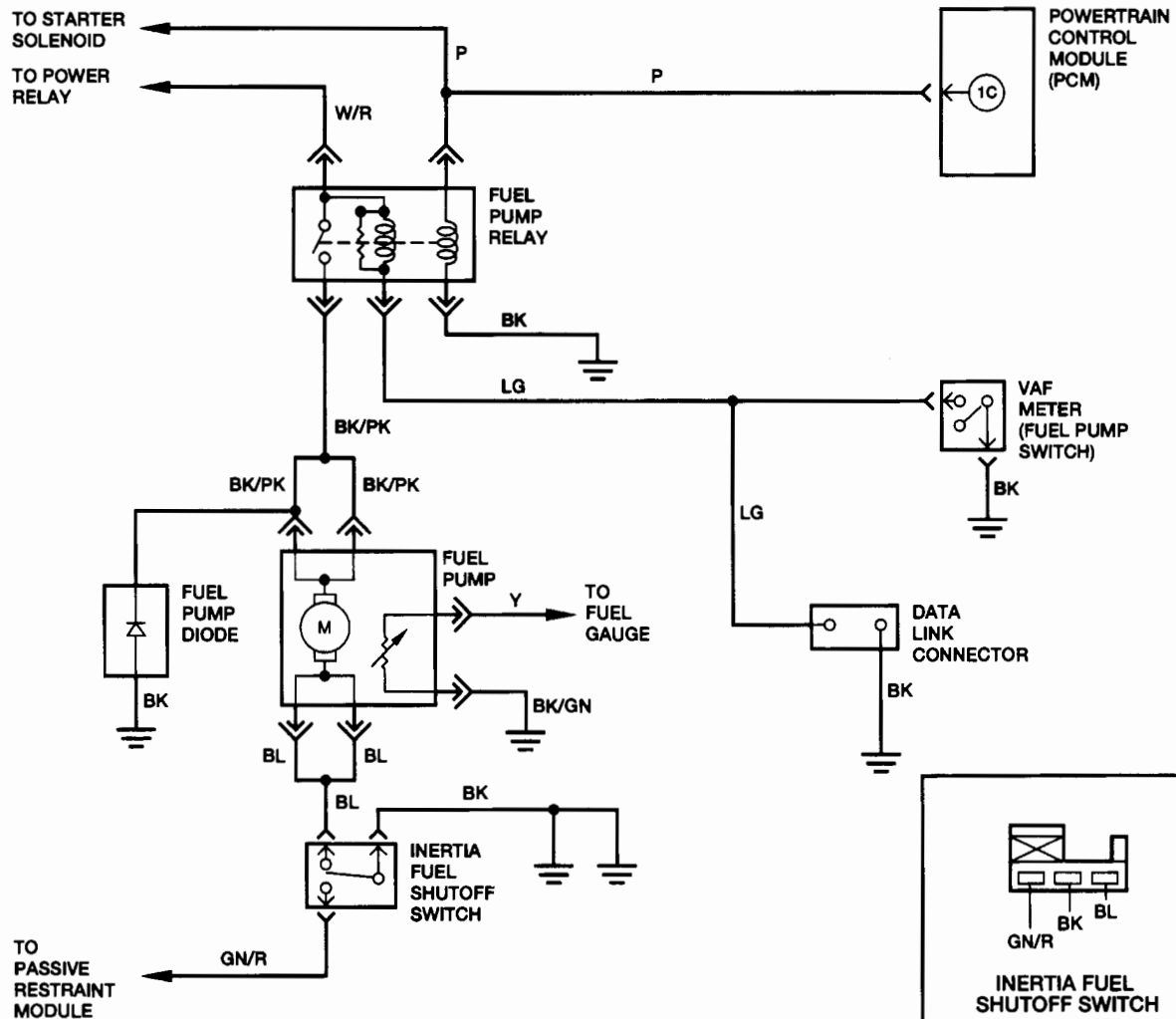
1.6L Electrical Schematic



A15130-D

Diagnosis and Testing

1.8L Electrical Schematic



A14019-G

Diagnosis and Testing

System Inspection

1. Visually inspect the components of the fuel delivery system.

VISUAL INSPECTION CHART

Mechanical	Electrical
<ul style="list-style-type: none"> ● Loose, leaking, or damaged fuel or vacuum lines ● Leaking fuel injectors ● Adverse driveability symptoms, such as rough idle, hard to start, misses, surges, hesitates, backfires ● Insufficient fuel in fuel tank 	<ul style="list-style-type: none"> ● Discharged battery ● Damaged connectors ● Damaged insulation ● Damaged components in the fuel system ● Fuse integrity ● Tripped inertia fuel shutoff switch

2. Exercise the wiring and connectors for the solenoids and other electrical components for obvious problems due to looseness, corrosion, or other damage.
3. If a component is suspected as the obvious cause of a malfunction, correct the cause before proceeding to the next step.
4. If all system inspection checks are OK, proceed to the Pinpoint Tests.

WARNING

— INSTRUCTIONS

FUEL IN THE FUEL SYSTEM REMAINS UNDER HIGH PRESSURE EVEN WHEN THE ENGINE IS NOT RUNNING. TO AVOID INJURY OR FIRE, RELEASE THE FUEL PRESSURE FROM THE FUEL SYSTEM BEFORE DISCONNECTING ANY FUEL LINE. TO RELEASE THE PRESSURE FROM THE SYSTEM PERFORM THE FOLLOWING:

- a. Start the engine.
- b. To stop the fuel pump, disconnect the fuel pump relay.

Engine	Location
1.3L	Under LH side of instrument panel.
1.6L	Center of instrument panel next to the PCM.
1.8L	Center of instrument panel in front of selector lever.
2.0L and 2.5L	Main fuse panel in the engine compartment.

- c. After the engine stalls, turn off the ignition.
- d. Install the fuel pump relay.
- e. Use a rag as protection from the fuel spray and disconnect the fuel hoses. Plug the hoses after disconnection.

Diagnosis and Testing

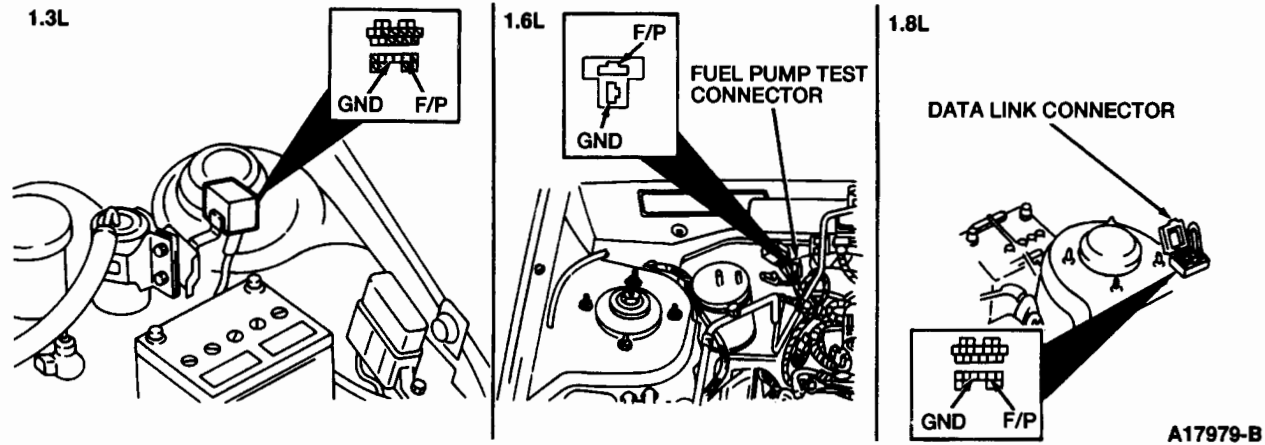
- f. Before testing or starting the vehicle, prime the system by grounding the fuel pump test pin and turning the key ON for 10 seconds.
- g. Check for fuel leaks.
- h. Turn the key OFF and remove ground.

Diagnosis and Testing	All Engines	F
------------------------------	--------------------	----------

Pinpoint Tests F — Fuel Pressure Test

TEST STEP		RESULT	ACTION TO TAKE
F1	PERFORM FUEL PRESSURE TEST		
<p>WARNING: BEFORE STARTING THESE TESTS, RELEASE THE FUEL PRESSURE FROM THE FUEL SYSTEM TO REDUCE THE RISK OF INJURY OR FIRE, AS OUTLINED IN "WARNING — INSTRUCTIONS".</p> <ul style="list-style-type: none"> • After releasing the fuel pressure as outlined in System Inspection, install Rotunda Fuel Pressure Tester 014-00748 or equivalent with EFI Test Adapter D87C-9974-A in the fuel line between the fuel filter and the fuel rail (between fuel rails on 2.5L), with its main valve open and its drain valve closed. Refer to illustration on following page. • Jump the fuel pump test terminal to ground. Refer to illustration below. • Key ON. • Is the fuel pressure within specification (refer to specifications in this section)? 		Yes No, (If zero) (If low) (If high)	▶ GO to FD1 . ▶ GO to FA1 . ▶ GO to FB1 . ▶ GO to FC1 .

Fuel Pump Test Connector



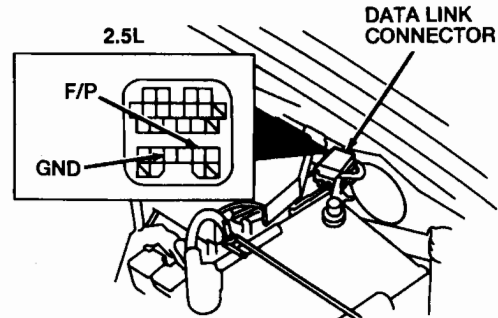
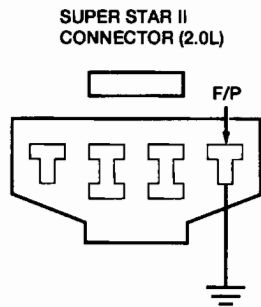
Diagnosis and Testing

All Engines

F

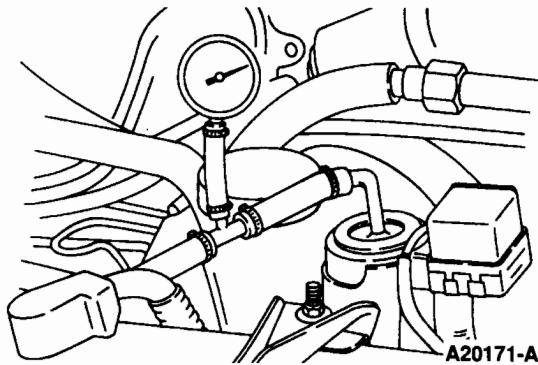
Fuel Pump Test Connectors (Continued)

2.0L

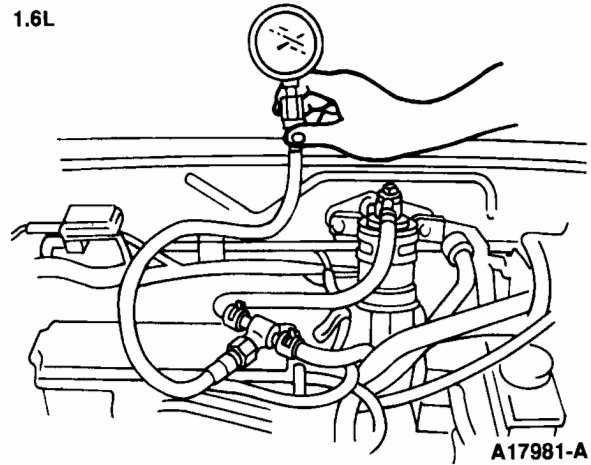


Fuel Pressure Test Setup

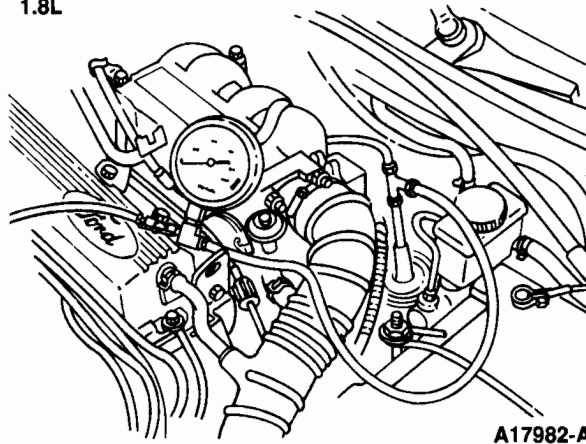
1.3L



1.6L



1.8L



Diagnosis and Testing	All Engines	FA
------------------------------	--------------------	-----------

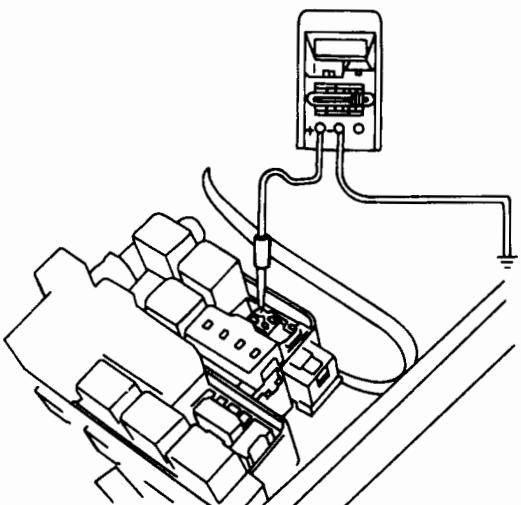
Pinpoint Tests FA — No Fuel Pressure Test

TEST STEP		RESULT	ACTION TO TAKE												
FA1	CHECK FUEL PUMP MOTOR <ul style="list-style-type: none"> ● Relieve the fuel pressure; follow the procedures as outlined in "WARNING — INSTRUCTIONS" in System Inspection at the beginning of the Diagnosis and Testing procedures. ● Connect Rotunda Fuel Pressure Tester 014-00748 or equivalent to the fuel filter with main valve closed and drain valve closed. Refer to illustrations in Test Step F1. ● Jump the fuel pump test terminal to ground. Refer to illustrations in Test Step F1 for terminal locations. ● Key ON. ● Is the maximum fuel pressure within specification (refer to specifications in this section)? 	Yes No	<ul style="list-style-type: none"> ▶ GO to FA2. ▶ REPLACE the fuel pump. 												
FA2	CHECK VOLTAGE TO FUEL PUMP <ul style="list-style-type: none"> ● Key OFF. ● Jump the fuel pump test terminal to ground. Refer to illustration in Test Step F1 for terminal locations. ● Disconnect the fuel pump connector at the fuel pump assembly. ● Key ON. ● Measure the voltage on the following wires at the fuel pump connector. <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="text-align: center;">Engine</th> <th style="text-align: center;">Wire Color</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1.3L</td> <td style="text-align: center;">GN/Y</td> </tr> <tr> <td style="text-align: center;">1.6L</td> <td style="text-align: center;">W/BK</td> </tr> <tr> <td style="text-align: center;">1.8L</td> <td style="text-align: center;">BK/PK</td> </tr> <tr> <td style="text-align: center;">2.0L</td> <td style="text-align: center;">BK/W</td> </tr> <tr> <td style="text-align: center;">2.5L</td> <td style="text-align: center;">BK/W</td> </tr> </tbody> </table> <ul style="list-style-type: none"> ● Is the voltage between 10-14 volts? <p style="margin-top: 10px;">NOTE: Check inertia fuel shutoff switch for "tripped" condition. Reset if tripped.</p>	Engine	Wire Color	1.3L	GN/Y	1.6L	W/BK	1.8L	BK/PK	2.0L	BK/W	2.5L	BK/W	Yes (1.3L, 1.8L) Yes (1.6L, 2.0L, 2.5L) No	<ul style="list-style-type: none"> ▶ GO to FA14. ▶ GO to FA13. ▶ GO to FA3.
Engine	Wire Color														
1.3L	GN/Y														
1.6L	W/BK														
1.8L	BK/PK														
2.0L	BK/W														
2.5L	BK/W														

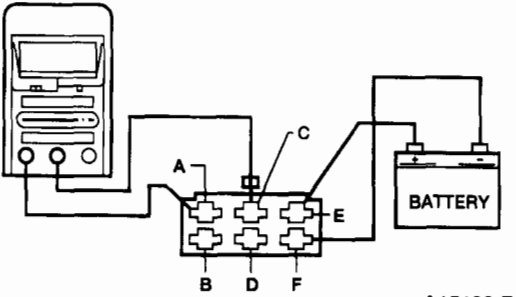
Diagnosis and Testing	All Engines	FA
------------------------------	--------------------	-----------

TEST STEP		RESULT	ACTION TO TAKE												
FA3	CHECK FOR SHORT(S) TO GROUND <ul style="list-style-type: none"> ● Key OFF. ● Disconnect the fuel pump relay. ● Disconnect the Powertrain Control Module (PCM) on 1.3L, 2.0L, and 2.5L. ● Disconnect the fuel pump connector at the fuel pump assembly. ● Measure the resistance between the following wires at the fuel pump relay connector and ground. <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Engine</th> <th style="text-align: center;">Wire Color</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1.3L</td> <td style="text-align: center;">GN/Y W/BK</td> </tr> <tr> <td style="text-align: center;">1.6L</td> <td style="text-align: center;">GN/R GN/W</td> </tr> <tr> <td style="text-align: center;">1.8L</td> <td style="text-align: center;">BK/PK LG</td> </tr> <tr> <td style="text-align: center;">2.0L</td> <td style="text-align: center;">LG W/Y</td> </tr> <tr> <td style="text-align: center;">2.5L</td> <td style="text-align: center;">LG W/Y</td> </tr> </tbody> </table> <ul style="list-style-type: none"> ● Are the resistances greater than 10,000 ohms? 	Engine	Wire Color	1.3L	GN/Y W/BK	1.6L	GN/R GN/W	1.8L	BK/PK LG	2.0L	LG W/Y	2.5L	LG W/Y	Yes No	► GO to FA4 . ► SERVICE the wire(s) in question for short.
Engine	Wire Color														
1.3L	GN/Y W/BK														
1.6L	GN/R GN/W														
1.8L	BK/PK LG														
2.0L	LG W/Y														
2.5L	LG W/Y														

Diagnosis and Testing	All Engines	FA
------------------------------	--------------------	-----------

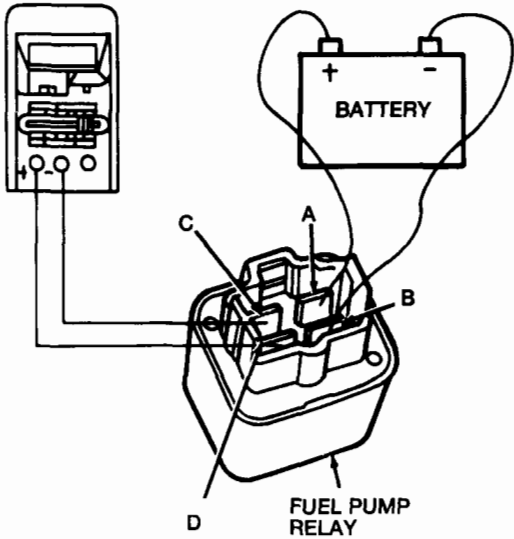
TEST STEP		RESULT	ACTION TO TAKE																																							
FA4	<p>CHECK POWER SUPPLY TO FUEL PUMP RELAY</p> <ul style="list-style-type: none"> ● Key OFF. ● Disconnect the fuel pump relay. ● Key ON. ● Measure the voltage on the following wires at the fuel pump relay connector. <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Engine</th> <th>Wire Color</th> <th>Key</th> <th>Voltage</th> </tr> </thead> <tbody> <tr> <td rowspan="2">1.3L</td> <td>Y/BK</td> <td>ON</td> <td>10-14 volts</td> </tr> <tr> <td>Y/BK</td> <td>ON</td> <td>10-14 volts</td> </tr> <tr> <td rowspan="2">1.6L</td> <td>BK/W</td> <td>ON</td> <td>10-14 volts</td> </tr> <tr> <td>BK/R</td> <td>START</td> <td>10-14 volts</td> </tr> <tr> <td rowspan="2">1.8L</td> <td>W/R</td> <td>ON</td> <td>10-14 volts</td> </tr> <tr> <td>P</td> <td>START</td> <td>10-14 volts</td> </tr> <tr> <td rowspan="2">2.0L</td> <td>W/R</td> <td>ON</td> <td>10-14 volts</td> </tr> <tr> <td>W/GN</td> <td>ON</td> <td>10-14 volts</td> </tr> <tr> <td rowspan="2">2.5L</td> <td>R/BK</td> <td>ON</td> <td>10-14 volts</td> </tr> <tr> <td>R/BK</td> <td>ON</td> <td>10-14 volts</td> </tr> </tbody> </table> <p style="text-align: center;">2.0L and 2.5L Shown</p> <div style="text-align: center;">  </div> <p style="text-align: right;">A16753-A</p> <ul style="list-style-type: none"> ● Is the voltage approximately battery voltage? 	Engine	Wire Color	Key	Voltage	1.3L	Y/BK	ON	10-14 volts	Y/BK	ON	10-14 volts	1.6L	BK/W	ON	10-14 volts	BK/R	START	10-14 volts	1.8L	W/R	ON	10-14 volts	P	START	10-14 volts	2.0L	W/R	ON	10-14 volts	W/GN	ON	10-14 volts	2.5L	R/BK	ON	10-14 volts	R/BK	ON	10-14 volts	<p>Yes (2.0L, 2.5L)</p> <p>Yes(1.3L, 1.6L, 1.8L)</p> <p>No (1.6L, 1.8L)</p> <p>No (1.3L, 2.0L, 2.5L)</p>	<ul style="list-style-type: none"> ▶ GO to FA6. ▶ GO to FA5. ▶ SERVICE the wire(s) in question. ▶ GO to Pinpoint Test VPWR in EEC Pinpoint Tests, Section 6B. If VPWR is OK, SERVICE wire(s) for open(s).
Engine	Wire Color	Key	Voltage																																							
1.3L	Y/BK	ON	10-14 volts																																							
	Y/BK	ON	10-14 volts																																							
1.6L	BK/W	ON	10-14 volts																																							
	BK/R	START	10-14 volts																																							
1.8L	W/R	ON	10-14 volts																																							
	P	START	10-14 volts																																							
2.0L	W/R	ON	10-14 volts																																							
	W/GN	ON	10-14 volts																																							
2.5L	R/BK	ON	10-14 volts																																							
	R/BK	ON	10-14 volts																																							

Diagnosis and Testing	All Engines	FA
------------------------------	--------------------	-----------

TEST STEP		RESULT	ACTION TO TAKE												
FA5	<p>CHECK FUEL PUMP RELAY (1.3L, 1.6L, AND 1.8L ONLY)</p> <ul style="list-style-type: none"> ● Key OFF. ● Remove the fuel pump relay. ● Apply 12 volts across the following terminals on the fuel pump relay. ● Follow the chart below and measure the resistance between the C-terminal and the A-terminal. <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Engine</th> <th style="text-align: center;">Terminals "E" and "F"</th> <th style="text-align: center;">Terminals "C" and "B"</th> <th style="text-align: center;">Resistance at "C" and "A"</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1.3L, 1.6L, 1.8L</td> <td style="text-align: center;">12 volts applied 0 volts applied</td> <td style="text-align: center;">N/A N/A</td> <td style="text-align: center;">Less than 5 ohms Greater than 10,000 ohms</td> </tr> <tr> <td style="text-align: center;">1.6L, 1.8L</td> <td style="text-align: center;">N/A N/A</td> <td style="text-align: center;">12 volts applied 0 volts applied</td> <td style="text-align: center;">Less than 5 ohms Greater than 10,000 ohms</td> </tr> </tbody> </table> <p style="text-align: center;">Fuel Pump Relay Terminals¹ 1.3L, 1.6L, and 1.8L</p>  <p style="text-align: center;">● Are the resistance readings OK?</p>	Engine	Terminals "E" and "F"	Terminals "C" and "B"	Resistance at "C" and "A"	1.3L, 1.6L, 1.8L	12 volts applied 0 volts applied	N/A N/A	Less than 5 ohms Greater than 10,000 ohms	1.6L, 1.8L	N/A N/A	12 volts applied 0 volts applied	Less than 5 ohms Greater than 10,000 ohms	<p>Yes (1.6L, 1.8L)</p> <p>Yes (1.3L)</p> <p>No</p>	<ul style="list-style-type: none"> ▶ GO to FA7. ▶ GO to FA10. ▶ REPLACE the fuel pump relay.
Engine	Terminals "E" and "F"	Terminals "C" and "B"	Resistance at "C" and "A"												
1.3L, 1.6L, 1.8L	12 volts applied 0 volts applied	N/A N/A	Less than 5 ohms Greater than 10,000 ohms												
1.6L, 1.8L	N/A N/A	12 volts applied 0 volts applied	Less than 5 ohms Greater than 10,000 ohms												

¹ NOTE: This is not the harness connector.

Diagnosis and Testing	All Engines	FA
------------------------------	--------------------	-----------

TEST STEP		RESULT	ACTION TO TAKE						
FA6	CHECK FUEL PUMP RELAY (2.0L, 2.5L ONLY) <ul style="list-style-type: none"> ● Key OFF. ● Remove the fuel pump relay. ● Apply 12 volts across the following terminals on the fuel pump relay. ● Follow the chart below and measure the resistance between the C-terminal and the D-terminal. <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Engine</th> <th style="text-align: center;">Terminals "A" and "B"</th> <th style="text-align: center;">Resistance at "C" and "D"</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">2.0L, 2.5L</td> <td style="text-align: center;">12 volts applied 0 volts applied</td> <td style="text-align: center;">Less than 5 ohms Greater than 10,000 ohms</td> </tr> </tbody> </table> <p style="margin-top: 10px;">2.0L and 2.5L</p>  <p style="text-align: center; margin-top: 5px;">A16467-A</p> <ul style="list-style-type: none"> ● Are the resistance readings OK? 	Engine	Terminals "A" and "B"	Resistance at "C" and "D"	2.0L, 2.5L	12 volts applied 0 volts applied	Less than 5 ohms Greater than 10,000 ohms	Yes No	<ul style="list-style-type: none"> ▶ GO to FA10. ▶ REPLACE the fuel pump relay.
Engine	Terminals "A" and "B"	Resistance at "C" and "D"							
2.0L, 2.5L	12 volts applied 0 volts applied	Less than 5 ohms Greater than 10,000 ohms							
FA7	CHECK FUEL PUMP RELAY GROUND (1.6L, 1.8L ONLY) <ul style="list-style-type: none"> ● Key OFF. ● Remove the fuel pump relay from the harness. ● Measure the resistance between the fuel pump relay connector "BK" wire and ground. ● Is the resistance less than 5 ohms? 	Yes No	<ul style="list-style-type: none"> ▶ GO to FA8. ▶ SERVICE the "BK" wire for opens. 						


Diagnosis and Testing

All Engines

FA

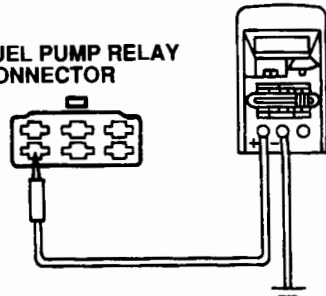
TEST STEP		RESULT	ACTION TO TAKE
FA8	<p>CHECK VAF METER GROUND (1.6L, 1.8L ONLY)</p> <ul style="list-style-type: none"> ● Key OFF. ● Remove the fuel pump relay. ● Access Volume Air Flow (VAF) meter door. ● Measure the resistance between the fuel pump relay connector and ground while moving the door in the VAF meter. (Refer to the chart below for wire color.) ● Leave the fuel pump relay test connector open. 	<p>Yes (1.8L)</p> <p>Yes (1.6L)</p> <p>No</p>	<ul style="list-style-type: none"> ▶ SERVICE the "BK/PK" wire between the fuel pump relay and the fuel pump. ▶ GO to FA11. ▶ GO to FA9.

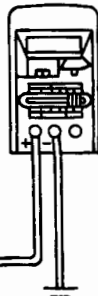
AIR CLEANER COVER



MEASURING DOOR

FUEL PUMP RELAY CONNECTOR





A17983-A

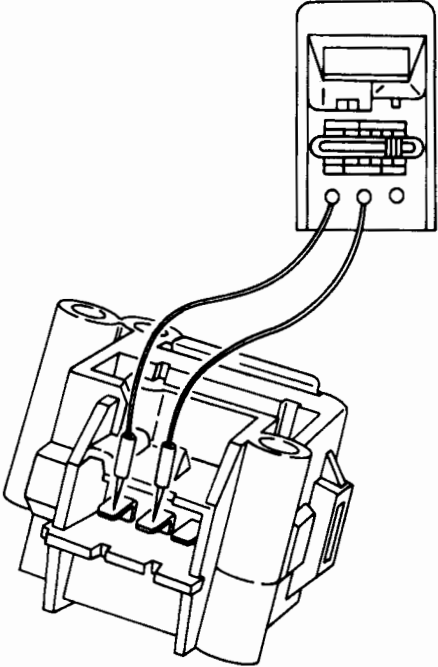
Engine	Fuel Pump Relay Wire	VAF Door	Resistance (ohms)
1.6L	GN/W	Closed	Greater than 10,000
		Open	Less than 5
1.8L	LG	Closed	Greater than 10,000
		Open	Less than 5

● Are the resistances OK?

Diagnosis and Testing	All Engines	FA
------------------------------	--------------------	-----------

TEST STEP		RESULT	ACTION TO TAKE																	
FA9	CHECK VAF FUEL PUMP SWITCH (1.6L, 1.8L ONLY)	Yes No	▶ SERVICE the VAF "BK" wire, or the wire from the fuel pump relay to the VAF. ▶ REPLACE the VAF meter.																	
	<ul style="list-style-type: none"> ● Key OFF. ● Disconnect the Volume Air Flow (VAF) meter wire harness connector. ● Measure the resistance between the following terminals on the VAF meter while moving the VAF meter door. (Match the wire colors shown with the corresponding VAF terminals.) <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Engine</th> <th>VAF Terminals</th> <th>Door</th> <th>Resistance (ohms)</th> </tr> </thead> <tbody> <tr> <td>1.6L</td> <td>GN/W, BK</td> <td>Closed Open</td> <td>Greater than 10,000 Less than 5</td> </tr> <tr> <td>1.8L</td> <td>LG, BK</td> <td>Closed Open</td> <td>Greater than 10,000 Less than 5</td> </tr> </tbody> </table> <ul style="list-style-type: none"> ● Are the resistances OK? 			Engine	VAF Terminals	Door	Resistance (ohms)	1.6L	GN/W, BK	Closed Open	Greater than 10,000 Less than 5	1.8L	LG, BK	Closed Open	Greater than 10,000 Less than 5					
Engine	VAF Terminals	Door	Resistance (ohms)																	
1.6L	GN/W, BK	Closed Open	Greater than 10,000 Less than 5																	
1.8L	LG, BK	Closed Open	Greater than 10,000 Less than 5																	
FA10	CHECK FUEL PUMP RELAY TO PCM CONTINUITY (1.3L, 2.0L and 2.5L ONLY)	Yes (1.3L) Yes (2.0L, 2.5L) No	▶ SERVICE the "GN/Y" wire between the fuel pump relay and the fuel pump. ▶ GO to FA11 . ▶ SERVICE wire(s) in question for open.																	
	<ul style="list-style-type: none"> ● Key OFF. ● Remove the fuel pump relay. ● Disconnect the Powertrain Control Module (PCM). ● Install the Rotunda Breakout Box 007-00033 or equivalent. ● Measure the resistance of the following wires between the fuel pump relay and the PCM. <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Engine</th> <th>PCM Pin</th> <th>BOB Pin</th> <th>PCM Wire Color</th> <th>Fuel Pump Relay Wire Color</th> </tr> </thead> <tbody> <tr> <td>1.3L</td> <td>1H</td> <td>55</td> <td>W/BK</td> <td>W/BK</td> </tr> <tr> <td>2.0L</td> <td>22 8</td> <td>22 8</td> <td>LG W/Y</td> <td>LG W/Y</td> </tr> <tr> <td>2.5L</td> <td>3T</td> <td>52B</td> <td>LG</td> <td>LG</td> </tr> </tbody> </table> <ul style="list-style-type: none"> ● Is the resistance less than 5 ohms? 			Engine	PCM Pin	BOB Pin	PCM Wire Color	Fuel Pump Relay Wire Color	1.3L	1H	55	W/BK	W/BK	2.0L	22 8	22 8	LG W/Y	LG W/Y	2.5L	3T
Engine	PCM Pin	BOB Pin	PCM Wire Color	Fuel Pump Relay Wire Color																
1.3L	1H	55	W/BK	W/BK																
2.0L	22 8	22 8	LG W/Y	LG W/Y																
2.5L	3T	52B	LG	LG																

Diagnosis and Testing	All Engines	FA
------------------------------	--------------------	-----------

	TEST STEP	RESULT	ACTION TO TAKE						
FA11	<p>CHECK INERTIA FUEL SHUTOFF SWITCH (1.6L, 2.0L AND 2.5L ONLY)</p> <ul style="list-style-type: none"> ● Key OFF. ● Disconnect and remove the inertia fuel shutoff switch from the vehicle. ● Measure the resistance between the terminals shown on the inertia fuel shutoff switch. ● Sharply shake the inertia fuel shutoff switch to verify that the switch trips. ● Measure the resistance between the terminals shown on the inertia fuel shutoff switch. <div style="text-align: center; margin: 10px 0;">  <p>A17984-A</p> </div> <table border="1" style="width: 100%; border-collapse: collapse; margin: 10px 0;"> <thead> <tr> <th style="width: 50%;">Switch Position</th> <th style="width: 50%;">Resistance</th> </tr> </thead> <tbody> <tr> <td>Open (Tripped)</td> <td>Greater than 10,000 ohms</td> </tr> <tr> <td>Closed (Set)</td> <td>Less than 5 ohms</td> </tr> </tbody> </table> <ul style="list-style-type: none"> ● Are the resistances OK and does the switch trip when shaken sharply? 	Switch Position	Resistance	Open (Tripped)	Greater than 10,000 ohms	Closed (Set)	Less than 5 ohms	<p>Yes</p> <p>No</p>	<p>▶ GO to FA12.</p> <p>▶ REPLACE the inertia fuel shutoff switch.</p>
Switch Position	Resistance								
Open (Tripped)	Greater than 10,000 ohms								
Closed (Set)	Less than 5 ohms								

Diagnosis and Testing	All Engines	FA
------------------------------	--------------------	-----------

TEST STEP		RESULT	ACTION TO TAKE												
FA 15	CHECK INERTIA FUEL SHUTOFF SWITCH (1.3L AND 1.8L) <ul style="list-style-type: none"> ● Key OFF. ● Disconnect and remove the inertia fuel shutoff switch from the vehicle. ● Shake the inertia fuel shutoff switch sharply to verify that the switch trips. ● Measure the resistance between the indicated terminals of the inertia fuel shutoff switch under the following conditions: <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">Engine</th> <th>Resistance Check Points</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1.3L</td> <td>Between the switch terminals that connect to the GN and BK wires</td> </tr> <tr> <td style="text-align: center;">1.8L</td> <td>Between the switch terminals that connect to the BL and BK wires</td> </tr> </tbody> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Switch Position</th> <th>Resistance</th> </tr> </thead> <tbody> <tr> <td>Open (tripped)</td> <td>Greater than 10,000 ohms</td> </tr> <tr> <td>Closed (set)</td> <td>Less than 5 ohms</td> </tr> </tbody> </table> <ul style="list-style-type: none"> ● Are the resistances OK and does the inertia fuel shutoff switch trip when shaken sharply? 	Engine	Resistance Check Points	1.3L	Between the switch terminals that connect to the GN and BK wires	1.8L	Between the switch terminals that connect to the BL and BK wires	Switch Position	Resistance	Open (tripped)	Greater than 10,000 ohms	Closed (set)	Less than 5 ohms	Yes No	<ul style="list-style-type: none"> ▶ GO to FA 16. ▶ REPLACE the inertia fuel shutoff switch.
Engine	Resistance Check Points														
1.3L	Between the switch terminals that connect to the GN and BK wires														
1.8L	Between the switch terminals that connect to the BL and BK wires														
Switch Position	Resistance														
Open (tripped)	Greater than 10,000 ohms														
Closed (set)	Less than 5 ohms														
FA 16	CHECK INERTIA FUEL SHUTOFF SWITCH GROUND (1.3L AND 1.8L ONLY) <ul style="list-style-type: none"> ● Key OFF. ● Disconnect the inertia fuel shutoff switch connector. ● Measure the resistance between the inertia fuel shutoff switch connector and ground. <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">Engine</th> <th style="width: 15%;">Wire</th> <th>Resistance (ohms)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1.3L</td> <td style="text-align: center;">BK</td> <td style="text-align: center;">Less than 5</td> </tr> <tr> <td style="text-align: center;">1.8L</td> <td style="text-align: center;">BK</td> <td style="text-align: center;">Less than 5</td> </tr> </tbody> </table> <ul style="list-style-type: none"> ● Is the resistance less than 5 ohms? 	Engine	Wire	Resistance (ohms)	1.3L	BK	Less than 5	1.8L	BK	Less than 5	Yes No	<ul style="list-style-type: none"> ▶ GO to FB2. ▶ SERVICE the "BK" wire. 			
Engine	Wire	Resistance (ohms)													
1.3L	BK	Less than 5													
1.8L	BK	Less than 5													

Diagnosis and Testing	All Engines	FB
------------------------------	--------------------	-----------

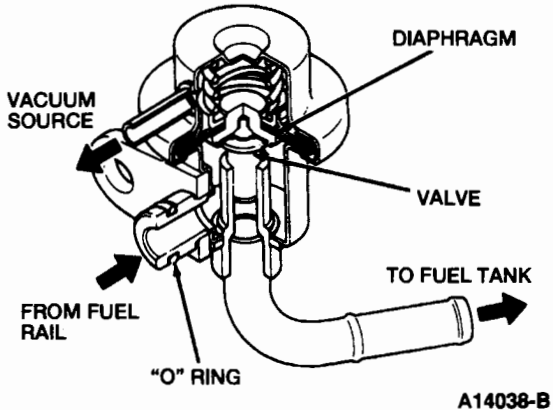
Pinpoint Tests FB — Low Fuel Pressure Test

TEST STEP		RESULT	ACTION TO TAKE												
FB1	CHECK POWER SUPPLY TO FUEL PUMP <ul style="list-style-type: none"> ● Key OFF. ● Disconnect the fuel pump connector at the fuel pump assembly. ● Jump the fuel pump test terminal to ground. Refer to illustration in Test Step F1 for terminal locations. ● Key ON. ● Measure the voltage on the following wires at the fuel pump connector. <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Engine</th> <th style="text-align: center;">Wire Color</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1.3L</td> <td style="text-align: center;">GN/Y</td> </tr> <tr> <td style="text-align: center;">1.6L</td> <td style="text-align: center;">W/BK</td> </tr> <tr> <td style="text-align: center;">1.8L</td> <td style="text-align: center;">BK/PK</td> </tr> <tr> <td style="text-align: center;">2.0L</td> <td style="text-align: center;">BK/W</td> </tr> <tr> <td style="text-align: center;">2.5L</td> <td style="text-align: center;">BK/W</td> </tr> </tbody> </table> <ul style="list-style-type: none"> ● Is the voltage between 10-14 volts? 	Engine	Wire Color	1.3L	GN/Y	1.6L	W/BK	1.8L	BK/PK	2.0L	BK/W	2.5L	BK/W	Yes No	<ul style="list-style-type: none"> ▶ GO to FB2. ▶ GO to FA1.
Engine	Wire Color														
1.3L	GN/Y														
1.6L	W/BK														
1.8L	BK/PK														
2.0L	BK/W														
2.5L	BK/W														
FB2	CHECK IN-LINE FUEL FILTER CONDITION <ul style="list-style-type: none"> ● Observe "WARNING — INSTRUCTIONS" in System Inspection at the beginning of the Diagnosis and Testing procedures to release the fuel system pressure to avoid fuel spillage and injury. ● Remove the high pressure in-line fuel filter for inspection. ● Inspect the filter element for contamination or blockage. ● Compare the customer's service record and driving conditions versus the recommended maintenance schedule. ● Is the fuel filter free of contamination, blockage, and within the recommended maintenance schedule? 	Yes No	<ul style="list-style-type: none"> ▶ GO to FB3. ▶ SERVICE the fuel filter as required. RERUN Test F1. 												

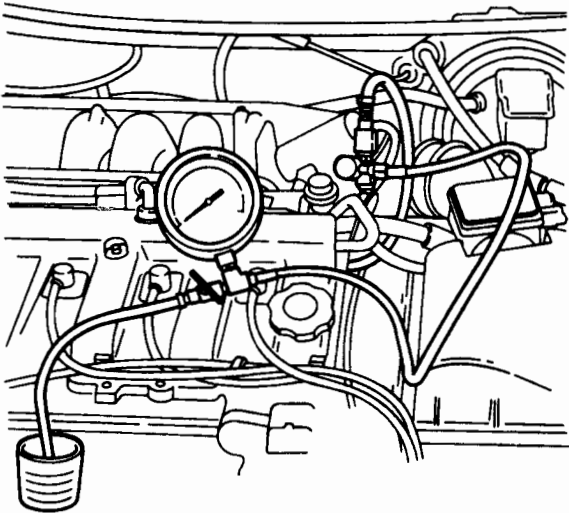
Diagnosis and Testing	All Engines	FB
------------------------------	--------------------	-----------

TEST STEP		RESULT	ACTION TO TAKE
FB3	CHECK FUEL PRESSURE REGULATOR DIAPHRAGM CONDITION <ul style="list-style-type: none"> ● Observe "WARNING — INSTRUCTIONS" in System Inspection at the beginning of the Diagnosis and Testing procedures to avoid fuel spillage and injury. ● Install Rotunda Fuel Pressure Tester 014-00748 or equivalent with EFI Test Adapter D87C-9974-A in the fuel line between the fuel filter and fuel rail (between fuel rails on 2.5L), with its main valve open and its drain valve closed. Refer to illustrations in Test Step F1. ● Start the engine and run for 10 seconds. ● Stop the engine and wait 10 seconds. ● Start the engine again and run for 10 seconds. ● Stop the engine and remove the vacuum hose from the pressure regulator. ● Examine the vacuum port in the pressure regulator for evidence of fuel leakage through the diaphragm. ● Is the vacuum port OK? 	Yes No	<ul style="list-style-type: none"> ▶ GO to FB4. ▶ REPLACE the fuel pressure regulator and RERUN Test F1.
FB4	CHECK FUEL PRESSURE REGULATOR PRESSURE LEAKDOWN <ul style="list-style-type: none"> ● Reconnect the vacuum hose. ● With the Rotunda Fuel Pressure Tester 014-00748 or equivalent still installed from previous test, run the engine for a minimum of 30 seconds. ● Stop the engine and observe the fuel pressure after 5 minutes. ● Is the fuel pressure greater than 147 kPa (21 psi) after 5 minutes? 	Yes No	<ul style="list-style-type: none"> ▶ GO to FB5. ▶ REPEAT this test step. If the fuel pressure still drops more than specified, test the injector for leakage (refer to Test Step FD4). If injectors are OK, REPLACE the fuel pressure regulator. RERUN Test F1.

Diagnosis and Testing	All Engines	FB
------------------------------	--------------------	-----------

TEST STEP		RESULT	ACTION TO TAKE
FB5	<p>CHECK FUEL PRESSURE REGULATOR VALVE SEAT LEAKAGE</p> <ul style="list-style-type: none"> ● Connect Rotunda Vacuum Tester 021-00037 or equivalent to the fuel return tube on the fuel pressure regulator and apply a 508 mm-Hg (20 in-Hg) vacuum. ● Observe the vacuum gauge for at least 10 seconds. <p>Fuel Pressure Regulator</p>  <ul style="list-style-type: none"> ● Does the vacuum drop lower than 254 mm-Hg (10 in-Hg) in 10 seconds? 	<p>Yes</p> <p>No</p>	<p>▶ REPLACE the fuel pressure regulator. RERUN Test F1.</p> <p>▶ GO to FB6.</p>

Diagnosis and Testing	All Engines	FB
------------------------------	--------------------	-----------

	TEST STEP	RESULT	ACTION TO TAKE
FB6	<p>CHECK FUEL PUMP FLOW VOLUME</p> <ul style="list-style-type: none"> ● Observe "WARNING — INSTRUCTIONS" in System Inspection at the beginning of the Diagnosis and Testing procedures to avoid fuel spillage and injury. ● Connect the Rotunda Fuel Pressure Tester 014-00748, or equivalent with EFI Test Adapter D87C-9974-A between the fuel filter and fuel rail (between fuel rails on 2.5L), with the main valve closed and the drain valve opened. Refer to illustrations in Test Step F 1. ● Place the bypass hose (yellow) in a measuring container inside an empty overflow container. ● Jump the fuel pump test terminal to ground. Refer to the illustrations in Test Step F 1 for terminal locations. ● Key ON. ● Collect fuel in the measuring vessel for 10 seconds. <p>2.0L Shown</p> <div style="text-align: center;">  <p style="text-align: center;">A16754-A</p> </div> <ul style="list-style-type: none"> ● Is the amount of fuel collected within specification (refer to specifications in this section)? 	<p>Yes</p> <p>No</p>	<ul style="list-style-type: none"> ▶ GO to FB7. ▶ SERVICE the fuel pump inlet screen, and RERUN this test. If flow is still not within specified limits, REPLACE the fuel pump and RERUN Test F1.

Diagnosis and Testing	All Engines	FB
------------------------------	--------------------	-----------

TEST STEP		RESULT	ACTION TO TAKE
FB7	CHECK FUEL PUMP VALVE LEAKDOWN		
<ul style="list-style-type: none"> ● Observe "WARNING — INSTRUCTIONS" in System Inspection at the beginning of the Diagnosis and Testing procedures to avoid fuel spillage and injury. ● Connect the Rotunda Fuel Pressure Tester 014-00748, or equivalent with EFI Test Adapter D87C-9974-A between the fuel filter and fuel rail with both the main and drain valves closed. Refer to illustration in Test Step F1. ● Jump the fuel pump test terminal to ground. Refer to illustration in Test Step F1 for terminal locations. ● Key ON. ● Run the fuel pump for 30 seconds minimum. ● Remove the jumper and note fuel pressure on the gauge for 3 minutes. ● Does the output fuel pressure decrease more than 13.78 kPa (2 psi) in 3 minutes? 		<p>Yes</p> <p>No</p>	<p>▶ REPLACE the fuel pump. RERUN Test F1.</p> <p>▶ GO to FD1.</p>

Diagnosis and Testing	All Engines	FC
------------------------------	--------------------	-----------

Pinpoint Tests FC — High Fuel Pressure Test

TEST STEP		RESULT	ACTION TO TAKE
FC1	CHECK FUEL PRESSURE REGULATOR FOR CAUSE OF HIGH PRESSURE		
	<ul style="list-style-type: none"> ● Observe "WARNING — INSTRUCTIONS" in System Inspection at the beginning of the Diagnosis and Testing procedures to avoid fuel spillage and injury. ● Check the fuel pressure regulator housing for damage or dents that could cause a higher spring load on the fuel pressure regulator. ● Check the integrity of the fuel pressure regulator diaphragm (refer to the procedure described in Test Step FB3). ● Is the fuel system free of defects that could cause the fuel pressure regulator to produce excessive fuel system pressure? (Refer to fuel pressure specification in the specifications chart.) 	Yes No	<ul style="list-style-type: none"> ▶ GO to FC2. ▶ REPAIR or REPLACE damaged components as required. RERUN Test Step F1. If the pressure is still high, GO to FC2.
FC2	CHECK FUEL RETURN FOR CAUSE OF HIGH FUEL PRESSURE		
	<ul style="list-style-type: none"> ● Observe "WARNING — INSTRUCTIONS" in System Inspection at the beginning of the Diagnosis and Testing procedures to avoid fuel spillage and injury. ● Remove the fuel return line at the pressure regulator and at the fuel tank. ● Provide a suitable fuel receptacle at the tank end of the return line to avoid fuel spillage. ● Check the fuel return line for restriction due to blockage, kinking, or pinching by blowing through it with 34.5-68.9 kPa (5-10 psi) regulated shop air. ● Is the fuel return line free of any restriction that could cause excessive fuel pressure? 	Yes No	<ul style="list-style-type: none"> ▶ REPLACE the fuel pressure regulator. RERUN Test Step F1. ▶ REPAIR the defects. CLEAN or REPLACE the faulty components as required to remove the cause of high pressure. RERUN Test F1.

Diagnosis and Testing	All Engines	FD
------------------------------	--------------------	-----------

Pinpoint Tests FD — Fuel Injector Test

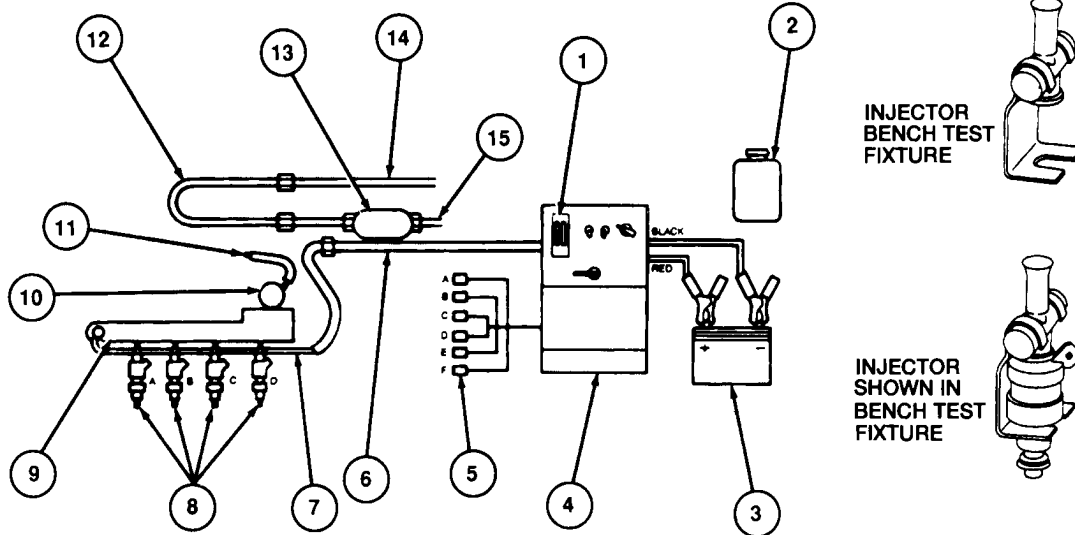
TEST STEP		RESULT	ACTION TO TAKE
FD1	CHECK FUEL INJECTION FUNCTION		
	<ul style="list-style-type: none"> ● With the engine warmed and idling (or cranking if it does not start) and using a mechanic's stethoscope or equivalent, listen for regularly operating sounds at each fuel injector. ● Is normal operating sound present? 	Yes No	<ul style="list-style-type: none"> ▶ GO to FD4. ▶ GO to FD2.
FD2	CHECK FUEL INJECTOR ELECTRICAL SIGNAL		
	<p>CAUTION: Do not connect a test lamp to the injector harness. Damage may result to the Powertrain Control Module (PCM).</p> <ul style="list-style-type: none"> ● Check the electrical continuity of the injector between each injector and the PCM as follows: <ul style="list-style-type: none"> — Disconnect the fuel injector lead and insert the continuity checker from Rotunda Fuel Injector Tester / Cleaner 113-00015 or equivalent into the injector lead plug. — Start or crank engine. — Observe whether the continuity checker blinks (showing a completed circuit for the injector being tested). ● Repeat the check for each injector. ● Do all injector circuit leads show continuity? 	Yes No	<ul style="list-style-type: none"> ▶ GO to FD3. ▶ CHECK for 12 volts at each injector wire with key ON. SERVICE wire as required. REFER to Pinpoint Test SCG in Section 6B.
FD3	CHECK FUEL INJECTOR RESISTANCE		
	<ul style="list-style-type: none"> ● Observe "WARNING — INSTRUCTIONS" in System Inspection at the beginning of the Diagnosis and Testing procedures to avoid fuel spillage and injury. ● Disconnect the electrical connectors from the injectors. If necessary, remove the fuel injectors to gain access to the injector terminals. ● Measure the electrical resistance across the terminals of each injector. ● Is the resistance of each injector approximately 12-16 ohms (20°C [68°F])? 	Yes No	<ul style="list-style-type: none"> ▶ GO to FD4. ▶ REPLACE the faulty injectors. RERUN Test Step FD1 and if OK, GO to Test Step FD4.

Diagnosis and Testing	All Engines	FD
------------------------------	--------------------	-----------

TEST STEP		RESULT	ACTION TO TAKE
FD4	CHECK FUEL INJECTORS (CLEANING AND LEAKAGE)		
	<p>NOTE: This procedure does not require the matching of injector color with flow gauge band color on the Fuel Injector Tester / Cleaner.</p> <ul style="list-style-type: none"> ● Observe "WARNING — INSTRUCTIONS" in System Inspection at the beginning of the Diagnosis and Testing procedures to avoid fuel spillage and injury. ● Use the Rotunda Fuel Injector Tester / Cleaner 113-00015, or equivalent and accompanying instructions to clean the fuel injectors. Refer to illustration on following page. ● With the Fuel Injector Tester / Cleaner still installed on the fuel system, note any significant pressure loss due to injector leakage when the tester pump is turned to OFF. ● Check each fuel injector individually for leakage as required, using the fuel injector bench tester and the fuel injector bench testing procedure associated with the Fuel Injector Tester / Cleaner. Verify that each injector leakage rate is within specification (1 drop / 2 minutes maximum). <p>NOTE: The 2.5L fuel injector has side inject fuel injectors. Therefore they can not be bench tested. See procedure below.</p> <ul style="list-style-type: none"> ● For 2.5L injector testing: <ul style="list-style-type: none"> — Disconnect the fuel rail from the intake manifold. Leave fuel hoses connected. — Jumper the F / P terminal of Data Link Connector to ground. — Key ON. — Verify that each injector leakage rate is within specification (1 drop / 2 minutes maximum). ● Is the leakage rate for individual injectors within specifications? 	<p>Yes</p> <p>No</p>	<ul style="list-style-type: none"> ▶ RETURN to the Diagnostic Routines. ▶ REPLACE faulty fuel injectors as required.

Diagnosis and Testing	All Engines	FD
------------------------------	--------------------	-----------

Fuel Injector Tester / Cleaner



A14047-C

Item	Description
1	Flow Gauge
2	Reservoir
3	Battery
4	Cleaner / Tester
5	Test Harness
6	Cleaner Supply Hose
7	Fuel Supply Line
8	Injectors
9	Fuel Rail
10	Fuel Pressure Regulator
11	Plug Line Fuel Return
12	"U" Tube
13	Filter
14	Fuel Return
15	Fuel Supply

Description and Operation

Turbocharger Systems — 1.6L Turbo

Basic Operation

The turbocharger system improves the engine power output by compressing the inlet air to a denser charge. Up to approximately 60 percent increase above the atmospheric pressure is attainable. It utilizes some of the energy in the hot exhaust gas to turn the turbine which drives the air compressor. The turbine and the air compressor comprise the turbocharger assembly, together with the exhaust bypass device, or the wastegate. Since considerable heat is added to the air during compression, the air is cooled by routing it through a heat exchanger, the Charge Air Cooler (CAC). This reduces the possibility of preignition and engine damage from overheating. From the charge air cooler, the cooler air is ducted through the Volume Air Flow (VAF) meter to the engine intake manifold.

Boost Pressure Control

The boost pressure control system consists of a wastegate valve and a wastegate actuator. The actuator, which is controlled by turbo boost pressure, controls the wastegate valve, which opens and closes the exhaust gas bypass passage.

The amount of turbocharger boost is limited to a maximum of 56 kPa (8.1 psi) by the wastegate and actuator. Under normal to moderate loads, the wastegate valve is closed and the intake air pressure changes in accordance with the engine rpm and the amount of exhaust gas. Under heavy loads, the intake air pressure in the air inlet duct reaches 56 kPa (8.1 psi), the pressure acts on the diaphragm and overcomes the force of the spring within the actuator, and the wastegate valve opens the bypass passage. As a result, the flow of exhaust gas applied to the turbine wheel drops, the rpm of the turbine wheel drops, and the boost pressure drops accordingly.

Overboost Protection

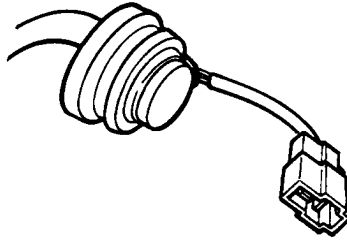
If the actual intake manifold pressure reaches 77 kPa (11 psi) and the calculated intake manifold pressure (calculated from the amount of intake air and engine speed) reaches a predetermined level, the fuel injection will be cut to prevent engine damage. Under this condition the turbo boost gauge will be indicating in the red sector of the gauge.

Further information regarding the makeup of the system and its relationship to other engine / emission systems may be found in the schematic diagram, Section 3B of this manual.

Description and Operation

Boost Pressure Switch (BPS)

The Boost Pressure Switch (BPS) sends a signal to the Powertrain Control Module (PCM) when the boost pressure reaches 71.8 to 79.8 kPa (10.4 to 11.6 psi). This is used for overboost protection.

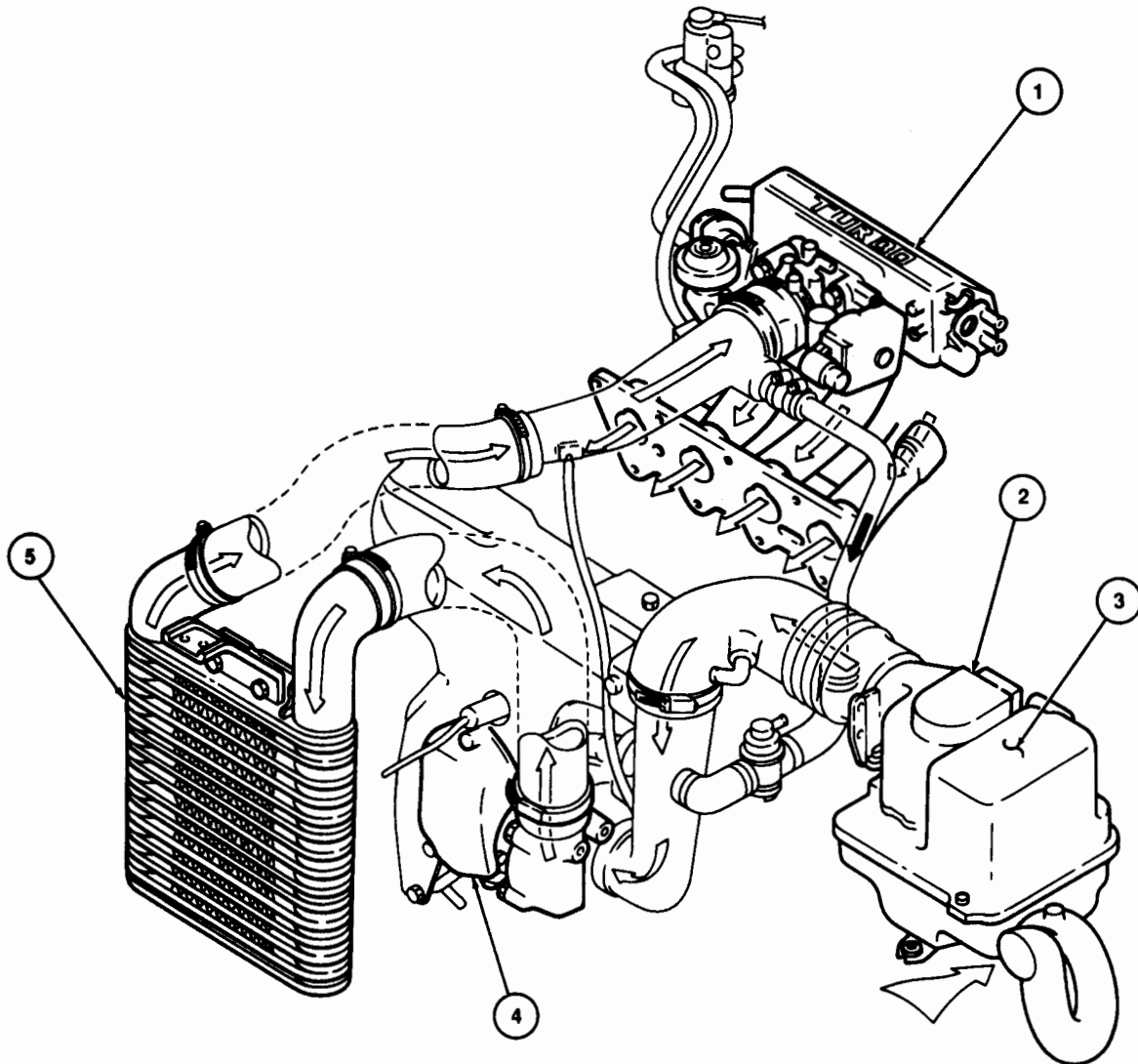


A14753-A

Engine	Location
1.6L Turbo	Behind the intake manifold.

Description and Operation

1.6L Turbo Component Location



A18141-A

Item	Description
1	Intake Manifold
2	Volume Air Flow Meter and Intake Air Temperature Sensor
3	Air Cleaner
4	Turbocharger
5	Charge Air Cooler

Diagnosis and Testing

Turbocharger Systems — 1.6L

System Inspection

1. Visually inspect the components of the turbocharger system.

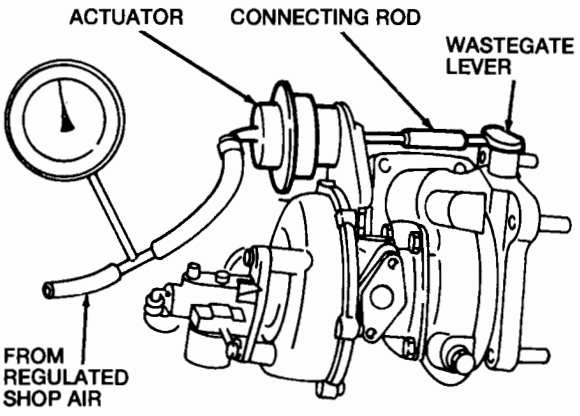
VISUAL INSPECTION CHART

Mechanical	Electrical
<ul style="list-style-type: none"> ● Air cleaner element conditions ● Air duct damage, looseness ● Vacuum hose damage, pinching, kinking, poor connections ● Wastegate, actuator, or linkage damaged or binding ● Oil leakage from turbocharger ● Unusual noise with engine operating 	<ul style="list-style-type: none"> ● Damaged connections or insulation ● Damaged volume air flow meter

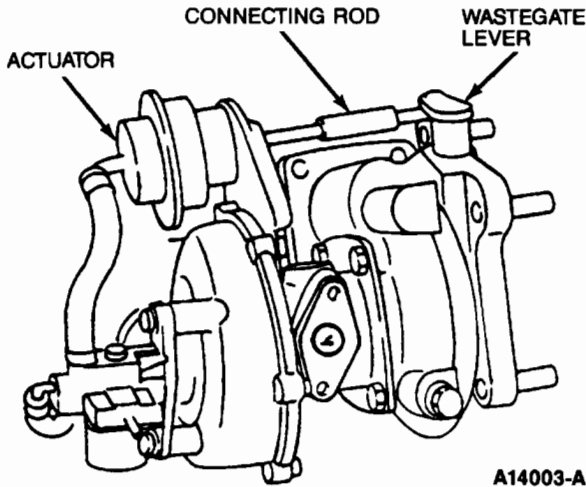
2. Exercise the wiring and the connectors for the knock control module, Powertrain Control Module (PCM), and other electronic components to detect obvious problems due to looseness, corrosion, or other damage.
3. Check the air and vacuum lines and the connections for looseness, pinching, kinking, misrouting or other obvious causes for malfunction.
4. If a component is suspected as the obvious cause for the malfunction, correct the defect before proceeding.
5. For noise diagnosis, go to PFO1.
6. If all checks are OK, proceed to the Pinpoint Tests.

Diagnosis and Testing	1.6L Turbo	LP
------------------------------	-------------------	-----------

Pinpoint Tests LP — Turbocharging Diagnosis

TEST STEP		RESULT	ACTION TO TAKE
LP1	<p>CHECK TURBOCHARGER BOOST ACTUATOR FUNCTION</p> <ul style="list-style-type: none"> Remove the exhaust manifold heat shields from the turbocharger area. Disconnect the actuator hose at the solenoid end. Connect a regulated air pressure source to the actuator hose with a Rotunda Vacuum / Pressure Tester 059-00008 or equivalent teed in. Apply 58.9 kPa (8.5 psi) specified pressure to open the wastegate. 	<p>Yes</p> <p>No</p>	<p>▶ GO to LP2.</p> <p>▶ REPLACE the actuator, rod, and mounting plate as an assembly.</p>
 <p style="text-align: center;">A14004-B</p> <ul style="list-style-type: none"> Does the wastegate open? 			

Diagnosis and Testing	1.6L Turbo	LP
------------------------------	-------------------	-----------

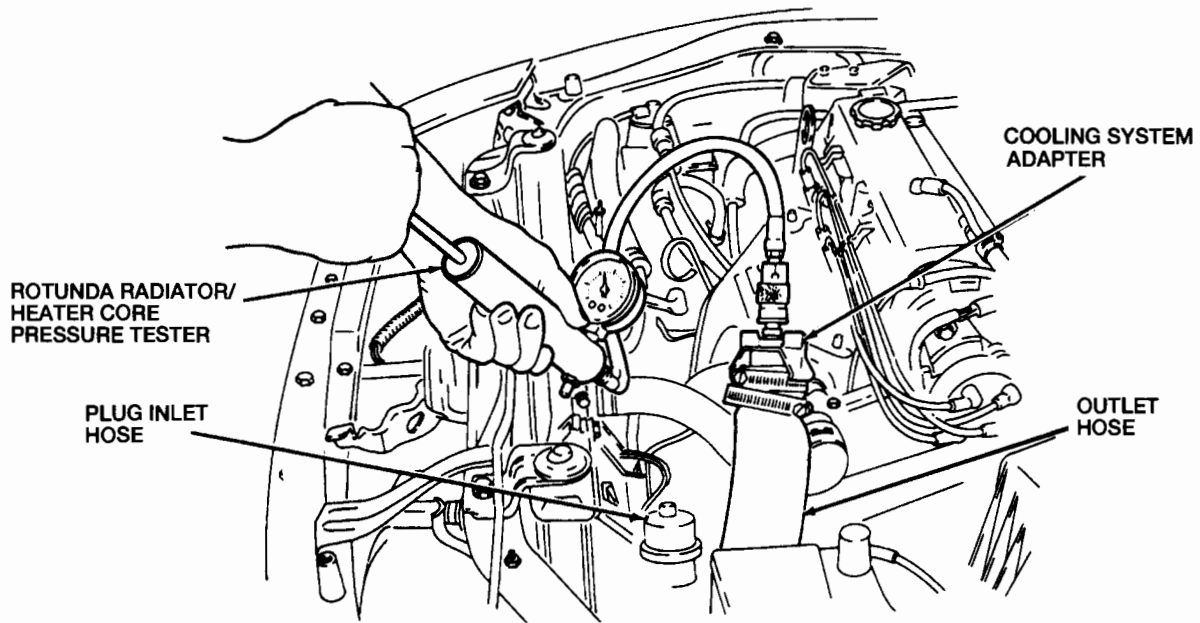
TEST STEP		RESULT	ACTION TO TAKE
LP2	<p>CHECK TURBOCHARGER WASTEGATE FUNCTION</p> <ul style="list-style-type: none"> ● Disconnect the connecting rod from the wastegate lever. ● Manually rotate the lever from the fully open to the fully closed position. 	<p>Yes</p> <p>No</p>	<ul style="list-style-type: none"> ▶ GO to LP3. ▶ REPLACE the turbocharger.
 <p style="text-align: right;">A14003-A</p>			
<ul style="list-style-type: none"> ● Does the wastegate lever move freely? 			

Diagnosis and Testing

1.6L Turbo

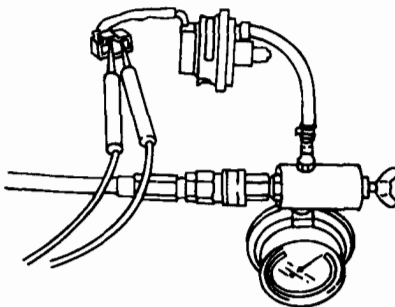
LP

TEST STEP		RESULT	ACTION TO TAKE
LP3	CHECK CHARGE AIR COOLER (CAC) LEAKAGE		
	<ul style="list-style-type: none"> ● Visually inspect the charge air cooler for cracks, restrictions, or other damage. ● Disconnect the inlet and outlet hoses leading from the charge air cooler. ● Plug the inlet hose with a solid plug. ● Connect Rotunda Radiator/Heater Core Pressure Tester 021-00012 or equivalent and Rotunda Cooling System Adapter 021-00053 to the charge air cooler outlet hose as shown. ● Apply 83-103 kPa (12-15 psi) of pressure. ● Does the charge air cooler maintain pressure? 	Yes No	<ul style="list-style-type: none"> ▶ GO to LP4. ▶ LOCATE and REPAIR the leak, or REPLACE the charge air cooler.



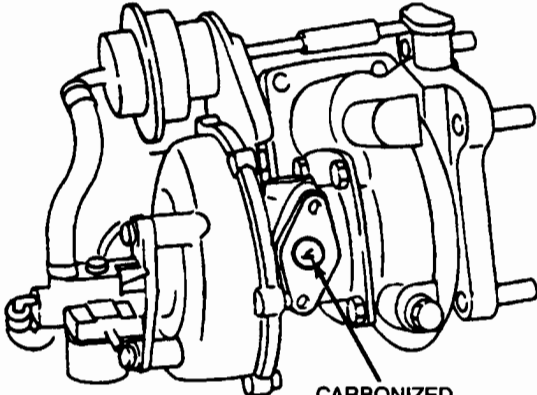
A14006-B

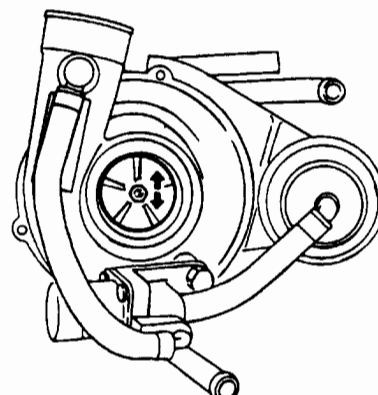
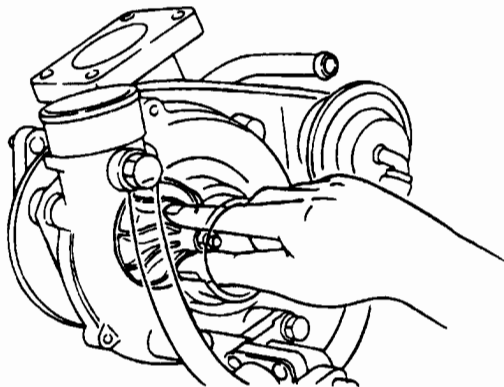
Diagnosis and Testing	1.6L Turbo	LP
------------------------------	-------------------	-----------

TEST STEP		RESULT	ACTION TO TAKE
LP5	<p>PERFORM BOOST PRESSURE SWITCH INSPECTION</p> <ul style="list-style-type: none"> ● Key OFF. ● Disconnect the boost pressure switch connector. ● Apply 71.8-79.8 kPa (10.4-11.6 psi) to the boost pressure switch. ● Measure the resistance between the terminals of the boost pressure switch. <div style="text-align: center;">  <p>A17090-A</p> </div> <ul style="list-style-type: none"> ● Is the resistance less than 5 ohms between the boost pressure switch terminals with air pressure applied, and greater than 10,000 ohms between the terminals with no air pressure applied? 	<p>Yes</p> <p>No</p>	<ul style="list-style-type: none"> ▶ GO to LP6. ▶ REPLACE the boost pressure switch.
LP6	<p>CHECK BOOST PRESSURE SWITCH GROUND</p> <ul style="list-style-type: none"> ● Key OFF. ● Disconnect the boost pressure switch connector. ● Measure the resistance between the "BK" wire at the boost pressure switch connector and ground. ● Is the resistance less than 5 ohms? 	<p>Yes</p> <p>No</p>	<ul style="list-style-type: none"> ▶ RETURN to the Diagnostic Routines, Section 2B. ▶ SERVICE the "BK" wire.

Diagnosis and Testing	1.6L Turbo	PFO
------------------------------	-------------------	------------

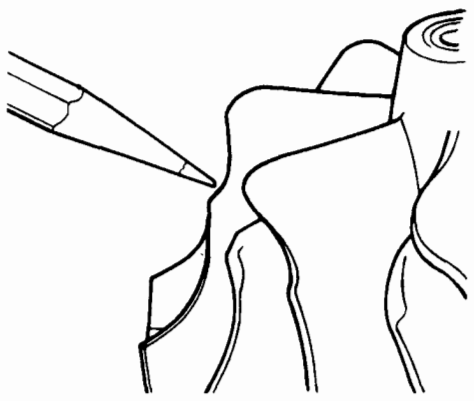
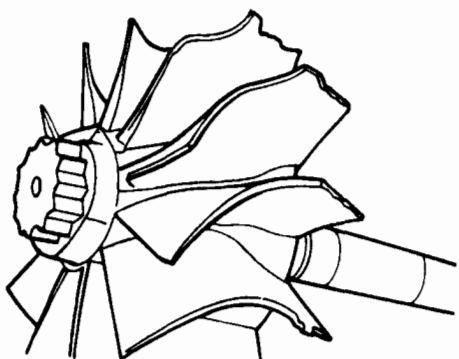
Pinpoint Tests PFO — Turbocharging Noise Diagnosis

	TEST STEP	RESULT	ACTION TO TAKE
PFO1	<p>CHECK TURBOCHARGER LUBE SYSTEM</p> <ul style="list-style-type: none"> Remove the turbocharger oil return pipe at the center housing. Verify whether the housing or the pipe are blocked by carbonized oil. 	<p>Yes</p> <p>No</p>	<p>▶ GO to PFO2.</p> <p>▶ REPLACE the turbocharger and/or the oil return pipe as required.</p>
	 <p style="text-align: center;">A14009-A</p> <ul style="list-style-type: none"> Are both the turbocharger housing and the oil return pipe free of blockage? 		
PFO2	<p>CHECK TURBOCHARGER SHAFT DEFLECTION</p> <ul style="list-style-type: none"> Remove the turbo air inlet pipe and the front (exhaust outlet) pipe, exposing the turbo rotor at both ends. Manually push the rotor back and forth (axially) and up and down (radially) to verify whether the rotor blades scrape the housing. Manually spin the rotor to verify whether the bearings turn smoothly and quietly. Does the rotor turn smoothly and quietly without scraping? 	<p>Yes</p> <p>No</p>	<p>▶ GO to PFO3.</p> <p>▶ REPLACE the turbocharger assembly.</p>



A14010-A

Diagnosis and Testing	1.6L Turbo	PFO
------------------------------	-------------------	------------

TEST STEP		RESULT	ACTION TO TAKE
PFO3	CHECK TURBOCHARGER ROTOR VANE CONDITION		
	<ul style="list-style-type: none"> With the turbo inlet pipe and the front pipe (exhaust) removed from the turbocharger, visually inspect the turbine wheel and the impeller wheel for excessive wear or damage due to erosion, foreign objects, oil leakage, or overheating, as illustrated. Is the rotor free of any evidence of worn or damaged turbine or impeller (compressor) vanes? 	Yes No	<ul style="list-style-type: none"> GO to PFO4. REPLACE the turbocharger assembly.
<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>WORN IMPELLER WHEEL VANES</p>  </div> <div style="text-align: center;"> <p>DAMAGED TURBINE WHEEL VANES</p>  </div> </div> <p style="text-align: right;">A14011-B</p>			
PFO4	CHECK TURBOCHARGER SEAL LEAKAGE		
	<ul style="list-style-type: none"> With the compressor outlet hose and the front pipe (exhaust) removed from the turbocharger, visually inspect the removed pipes and their connecting passages in the turbo housing for the presence of oil or coolant. Are the air or exhaust passages in the turbocharger or the connecting pipes free of oil, carbonized oil, or coolant? 	Yes No	<ul style="list-style-type: none"> RETURN to the Diagnostic Routines, Section 2B. REPLACE the turbocharger assembly.

Specifications/Special Service Tools

Specifications

GENERAL SPECIFICATIONS

Description	Specification
Fuel Pump Outlet Pressure (Maximum Output, Key ON, Engine Off)	
1.3L	More than 340 kPa (50 psi)
1.6L	441-588 kPa (64-85 psi)
1.8L	441-588 kPa (64-85 psi)
2.0L	441-630 kPa (64-92 psi)
2.5L	500-630 kPa (72-92 psi)
Fuel Pump Pressure (Fuel Pump Terminal Grounded, Key ON, Engine Off)	
1.3L	265-320 kPa (38-46 psi)
1.6L	255-289 kPa (37-42 psi)
1.8L	265-314 kPa (38-46 psi)
2.0L	255-320 kPa (37-46 psi)
2.5L	270-310 kPa (39-45 psi)
Fuel Pump Pressure (Key ON, Engine Running, Pressure Regulator Vacuum Hose Connected)	
1.3L	210-260 kPa (30-38 psi)
1.6L	189-231 kPa (27-34 psi)
1.8L	216-264 kPa (31-38 psi)
2.0L	207-262 kPa (30-38 psi)
2.5L	207-248 kPa (30-36 psi)
Fuel Pump Pressure (Key ON, Engine Running, Pressure Regulator Vacuum Hose Disconnected)	
1.3L	265-320 kPa (38-46 psi)
1.6L	249-297 kPa (36-43 psi)
1.8L	275-336 kPa (40-49 psi)
2.0L	269-310 kPa (39-45 psi)
2.5L	269-310 kPa (39-45 psi)
Fuel Pump Volume	
1.3L, 1.6L, 1.8L, 2.0L, 2.5L	167 cc (5.5 ounces) / 10 seconds
Fuel Pump Check Valve Leakage	2 psi maximum in 3 minutes
Fuel Injector Leakage	1 drop maximum per 2 minutes
Fuel Injector Resistance	12-16 ohms
Fuel Pressure Regulator Pressure Leakdown	34 kPa (5 psi) maximum in 60 seconds
Fuel Pressure Regulator Vacuum Leakage at Valve Seat	10 in-Hg maximum / 10 seconds starting with 20 in-Hg vacuum

SPECIFICATIONS — 1.6L TURBO

Description	Specification
Boost Pressure, Maximum	56 kPa (8.1 psi)
Turbo Wastegate - Air Pressure to Open	56 kPa (8.1 psi)

Specifications / Special Service Tools

Special Service Tools / Equipment

SPECIAL SERVICE TOOLS

Tool Number	Description
D87C-9974-A	EFI Test Adapter

ROTUNDA EQUIPMENT

Model	Description
014-00748	Fuel Pressure Testing Kit (includes adapters)
105-00051	73 Digital Multimeter
113-00015	Fuel Injector Tester / Cleaner (includes adapters)
021-00037	Vacuum Tester
007-0041B	Super STAR II Tester
007-00033	Breakout Box
021-00012	Radiator / Heater Core Pressure Tester
059-00008	Vacuum / Pressure Tester
021-00053	Cooling System Adapter