

# F - BASIC TESTING

## 1995 Volvo 850

1995 ENGINE PERFORMANCE  
Volvo - Basic Diagnostic Procedures

850

### INTRODUCTION

**NOTE:** In this article, Engine Control Module (ECM) may also be referred to as Engine Control Unit (ECU).

The following diagnostic steps will help prevent overlooking a simple problem. This is also where to begin diagnosis for a no-start condition.

The first step in diagnosing any driveability problem is verifying the customer complaint with a test drive under the conditions the problem reportedly occurred.

Before entering self-diagnostics, perform a careful and complete visual inspection. Most engine control problems result from mechanical breakdowns, poor electrical connections or damaged/misrouted vacuum hoses. Before condemning the computerized system, perform each test listed in this article.

**NOTE:** Perform all voltage tests using a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance, unless otherwise instructed in test procedure.

### PRELIMINARY INSPECTION & ADJUSTMENTS

#### VISUAL INSPECTION

Visually inspect all electrical wiring. Look for chafed, stretched, cut or pinched wiring. Ensure electrical connectors fit tightly and are not corroded. Ensure vacuum hoses are properly routed and not pinched or cut. See M - VACUUM DIAGRAMS article to verify routing and connections (if necessary). Inspect air induction system for possible vacuum leaks.

#### MECHANICAL INSPECTION

##### Compression

Check engine mechanical condition using a compression gauge, vacuum gauge or engine analyzer. See engine analyzer manual for specific instructions.

**WARNING:** Do not use ignition switch during compression tests on fuel injected vehicles. Use a remote starter to crank engine. Fuel injectors on many models are triggered by ignition switch during cranking mode, which can create a fire hazard or contaminate engine oiling system.

#### COMPRESSION SPECIFICATIONS TABLE

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Application	Specification (Minimum)
Compression Pressure	..... 189-219 psi (13.2-15.3 kg/cm <sup>2</sup> )

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Exhaust System Backpressure

1) Exhaust system can be checked using a vacuum or pressure gauge. Remove oxygen sensor or air injection check valve (if equipped).

2) Connect a 1-10 psi pressure gauge, and run engine at 2500 RPM. If exhaust system backpressure is greater than 1 3/4-2 psi, exhaust system or catalytic converter is plugged.

3) If using a vacuum gauge, connect vacuum gauge hose to intake manifold vacuum port and start engine. Observe vacuum gauge. Open throttle part way and hold steadily. If vacuum gauge reading slowly drops after stabilizing, exhaust system should be checked for a restriction.

## FUEL SYSTEM

**WARNING:** Always relieve fuel pressure before disconnecting any fuel injection-related component. DO NOT allow fuel to contact engine or electrical components.

## FUEL PRESSURE

### Fuel Pressure

1) Before disconnecting, cover fuel line connector using shop towel to absorb any fuel spray. Connect Fuel Pressure Gauge (5011) between fuel line and fuel rail. Seal free end of hose using Plug (5266) or use Fuel Drainage Unit (981 2270, 2273 and 2282).

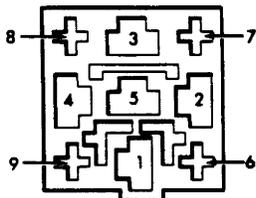
2) Lift cover on central electrical unit located in engine compartment and remove fuel pump relay. See Fig. 1.

3) Connect a jumper wire between relay terminals No. 1 and 3. See Fig. 2.

4) Turn ignition on. Fuel pump should start. Fuel filler cover can be removed to determine whether main pump is operating. Fuel pressure should be about 43.5 psi (3.06 kg/cm<sup>2</sup>). If pressure is too low, pinch return hose by hand and check whether pressure rises. DO NOT allow pressure to exceed 86 psi (6 kg/cm<sup>2</sup>).

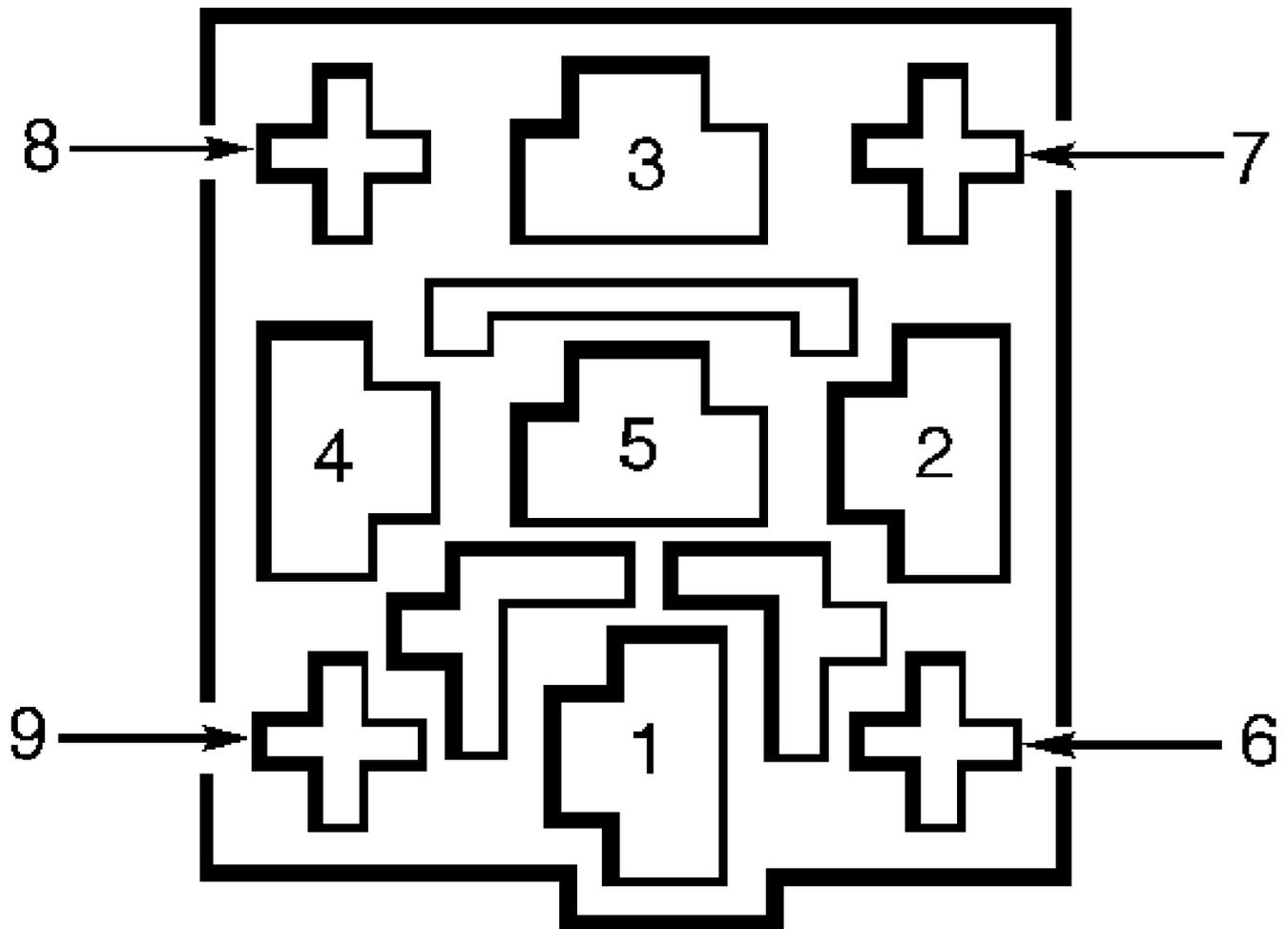
5) If pressure rises rapidly, pump and lines are okay. Replace pressure regulator and recheck line pressure. If pressure rises slowly, fuel filter, fuel pump strainer or fuel lines are blocked. If pressure does not rise, fuel pump is probably faulty.

6) If pressure is too high, remove jumper wire between relay or fuse terminals. Remove return hose from pressure regulator. Blow in pipe. Remove vacuum hose from pressure regulator. Blow in pipe. If both hoses are open, pressure regulator is defective. Replace regulator and recheck pressure.



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Fig. 1: Locating Fuel Pump Relay  
Courtesy of Volvo Cars of North America.



## 93G78481

Fig. 2: Identifying Fuel Pump Relay Terminals  
 Courtesy of Volvo Cars of North America.

CAUTION: Ensure ignition is off when connecting or disconnecting ECU connector.

### Fuel Pump Circuit

1) If fuel pump does not operate with ignition on, remove fuel pump relay. See Fig. 1. Connect jumper wire between fuel pump relay terminals No. 1 and 3. See Fig. 2. Turn ignition on. If fuel pump does not start, go to next step. If fuel pump starts, replace fuel pump relay.

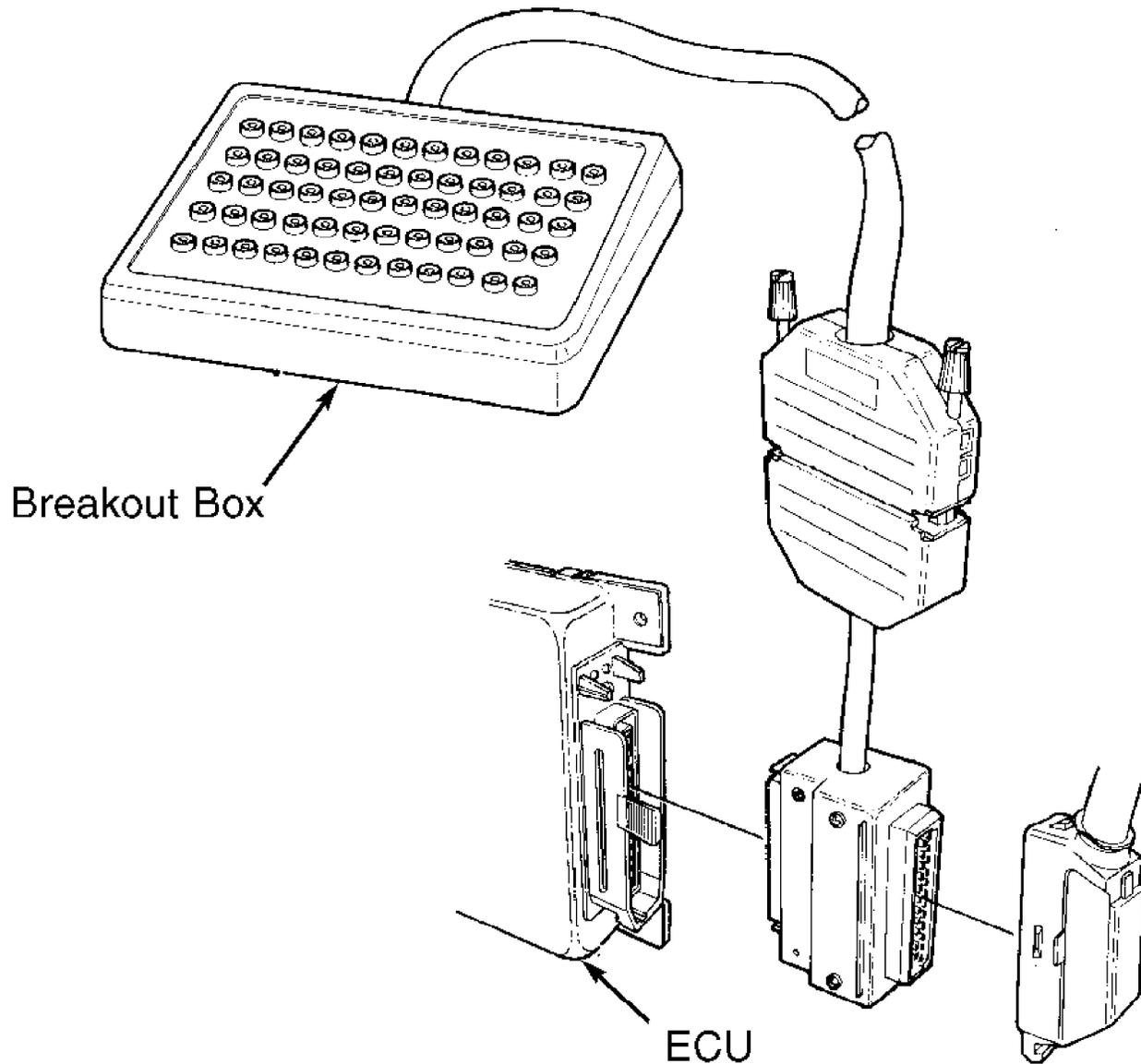
2) Turn ignition off. To check relay ground, connect ohmmeter between ground and fuel pump relay terminal No. 2. See Fig. 2. Ohmmeter should indicate about zero ohms. If ohmmeter does not indicate about zero ohms, check wiring between fuel pump relay and ground.

3) To check fuel pump relay voltage supply, connect voltmeter between ground and fuel pump relay terminal No. 1. See Fig. 2. Turn ignition on. Battery voltage should be present. If battery voltage is not present, check wiring between fuel pump relay and fuse No. 2.

4) Turn ignition off. Connect ohmmeter between ground and relay terminal No. 3. See Fig. 2. About 1.5 ohms should be present. If about 1.5 ohms are not present, check resistance at fuel pump connector to determine whether fault is in pump or wiring.

5) To check fuel injection control signal to fuel pump relay, connect voltmeter between ground and fuel pump relay terminal No. 4. See Fig. 2. Operate starter motor. If voltmeter indicates about 3 volts, replace relay.

6) If voltage is not to specification, check wiring between fuel pump relay and ECU. If wiring is okay, see ELECTRONIC CONTROL UNIT - IGNITION in the I - SYSTEM/COMPONENT TESTS article.



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Fig. 3: Connecting Breakout Box To ECU (Typical)  
Courtesy of Volvo Cars of North America.

## IGNITION CHECKS

## BOSCH EZ129K

1) Disconnect coil wire from distributor cap. Put coil wire next to ground and operate starter motor. If spark is present, check distributor rotor and cap. If spark is not present, go to next step.

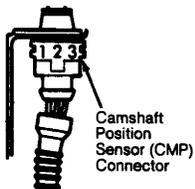
2) Connect voltmeter between ignition coil connector terminal No. 15 (Red wire) and ground. Turn ignition on. If battery voltage is not present, check voltage supply to ignition coil. If battery voltage is present, turn ignition off and go to next step.

3) Connect voltmeter between ignition coil terminal No. 1 (Blue wire) and ground. Operate starter motor. If about .7-1.3 volts are present, repeat test using new ignition coil. If about .7-1.3 volts are not present, turn ignition off and go to next step.

4) Disconnect engine speed sensor connector located close to flywheel. Connect an ohmmeter between sensor terminals. If resistance is about 200-400 ohms, go to next step and check Camshaft Position Sensor (CMP) signal. If resistance is not about 200-400 ohms, replace sensor.

NOTE: Engine speed sensor is also known as Vehicle Speed Sensor (VSS) or impulse sensor.

5) Remove intake hose. Bend aside rubber sleeve on CMP connector. Connect voltmeter between connector terminal No. 2 and ground. See Fig. 4. Operate starter motor. If voltage reading varies between 0-5 volts, go to step 7). If voltage reading does not vary between 0-5 volts, go to next step.



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Fig. 4: Identifying Camshaft Position Sensor (CMP) Terminals  
Courtesy of Volvo Cars of North America.

6) Connect voltmeter between CMP connector terminal No. 3 and ground. Turn ignition on. About 10 volts should be present. Turn ignition off. Connect an ohmmeter between CMP connector terminal No. 1 and ground. Ohmmeter should show about zero ohms. If voltage supply and ground are okay, repeat test using new CMP. If voltage supply and ground are not okay, reconnect intake hose and go to step 9).

7) If voltage reading varied between 0-5 volts in step 5), disconnect power stage connector at ignition coil. Bend back rubber sleeve on connector. Check ground supply by connecting ohmmeter between connector terminal No. 1 and ground. See Fig. 5. Ohmmeter should indicate zero ohms. Check voltage supply by connecting voltmeter between terminal No. 3 and ground. Turn ignition on. Battery voltage should be present.



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Fig. 5: Identifying Power Stage Connector Terminals  
Courtesy of Volvo Cars of North America.

8) Check power stage control signal by connecting voltmeter between terminal No. 4 and ground. Operate starter motor. Voltmeter

should indicate .7-1.3 volts. If ground, voltage and control signal are okay, repeat test using new power stage. If ground connection and voltage are faulty, check wiring. If control signal is not present, go to next step and check ECU input and output signals.

9) Connect Breakout Box (981 3190) and Adapter (981 3195) to distributor ignition ECU. See Fig. 3. Turn ignition switch to OFF position. Distributor ignition ECU is located in right side of engine compartment. Remove ECU cover. Disconnect distributor ignition ECU connector. Visually inspect all terminal connector sleeves to ensure no terminals are damaged.

10) To install breakout box, remove distributor ignition ECU. Press adapter onto distributor ignition ECU and pull lead upward through slot beside module. Press distributor ignition ECU, with adapter connected, into connector in bottom of ECU box. Connect breakout box to adapter 60-pin connector.

11) Ensure ignition is off. To check ECU input and output signals, connect ohmmeter between breakout box terminal No. 20 and ground, then between breakout box terminal No. 29 and ground. Ohmmeter should indicate about zero ohms in both cases.

12) Ensure ignition is off. Connect ohmmeter between breakout box terminals No. 20 and 2, and between breakout box terminals No. 20 and 15. Ohmmeter should indicate about zero ohms in both cases.

13) Ensure ignition is off. Connect voltmeter between breakout box terminals No. 20 and 10. Battery voltage should be present. Turn ignition on. Connect voltmeter between breakout box terminals No. 20 and 30. Battery voltage should be present.

14) Check engine speed sensor signal by connecting voltmeter between breakout box terminals No. 1 and 2. Operate starter motor. Voltmeter should indicate 300-400 millivolts. If signal is not present, check sensor. See Code 1-3-1 diagnosis procedures in the G - TESTS W/CODES article. If signal is present, go to next step and check Camshaft Position Sensor (CMP) signal.

NOTE: Engine speed sensor is also known as Vehicle Speed Sensor (VSS) or impulse sensor.

15) Connect voltmeter between breakout box terminals No. 20 and 4. Operate starter motor. Voltage should vary between 0-5 volts. If voltage is okay, go to next step. If voltage is not okay, connect voltmeter between breakout box terminals No. 20 and 14. Voltmeter should indicate about 10 volts. If voltage is present, but signal is not present, repeat test using new CMP. If voltage is not present, repeat test using new ECU.

16) If voltage was okay in step 15), connect voltmeter between breakout box terminals No. 20 and 43. Operate starter motor. Voltage should indicate about 5-7 volts. If voltage is not present, repeat test using ECU. If voltage is present, ignition system is operating properly.

## **IDLE SPEED & IGNITION TIMING**

NOTE: Idle speed and ignition timing are not adjustable. See the IDLE SPEED & CO LEVEL and IGNITION TIMING tables for specifications.

IDLE SPEED & CO LEVEL TABLE (1)

Application	Idle RPM	(2) CO Level
Non-Turbo		
Cooling Fan On	800	0.6%
Cooling Fan Off	825	0.6%

- (1) - Idle speed/CO level can only be checked, not adjusted.
  - (2) - Measured upstream of catalytic converter with oxygen sensor connected.
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IGNITION TIMING TABLE (Degrees BTDC @ RPM)

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Application	(1) Timing
Non-Turbo .....	8-12 @ 750-850

- (1) - Ignition timing computer-controlled. Not adjustable.
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**SUMMARY**

If no faults were found while performing BASIC DIAGNOSTIC PROCEDURES, proceed to G - TESTS W/CODES article. If no hard codes are found in self-diagnostics, proceed to the H - TESTS W/O CODES article for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.) or intermittent diagnostic procedures.