1982 Fuel Injection

BOSCH LH JETRONIC — VOLVO

Some Non-Turbo 4-Cyl. Engines

DESCRIPTION

The Bosch LH Jetronic fuel injection system operates with a moderate fuel pressure, held constant by a line pressure regulator. Fuel is metered into the cylinders by electrically controlled solenoid valves in the injectors. The injectors are aimed at the intake valve of each cylinder.

The duration of the injection, usually a few milliseconds, is determined by an electronic control unit. The electronic control unit receives several signals on various driving, engine and outside conditions from a set of sensors. The most important sensor in the system is the air mass meter.

The signals from the air mass meter and exhaust gas oxygen sensor provide most of the information used by the control unit to maintain proper air/fuel ratios.

ELECTRONIC CONTROL UNIT

The electronic control unit is a microprocessor based computer that receives and evaluates readings from sensors located throughout the engine. The control unit then produces a control signal that is sent to the injectors so that the correct amount of fuel for any operating condition can be injected into the cylinders.

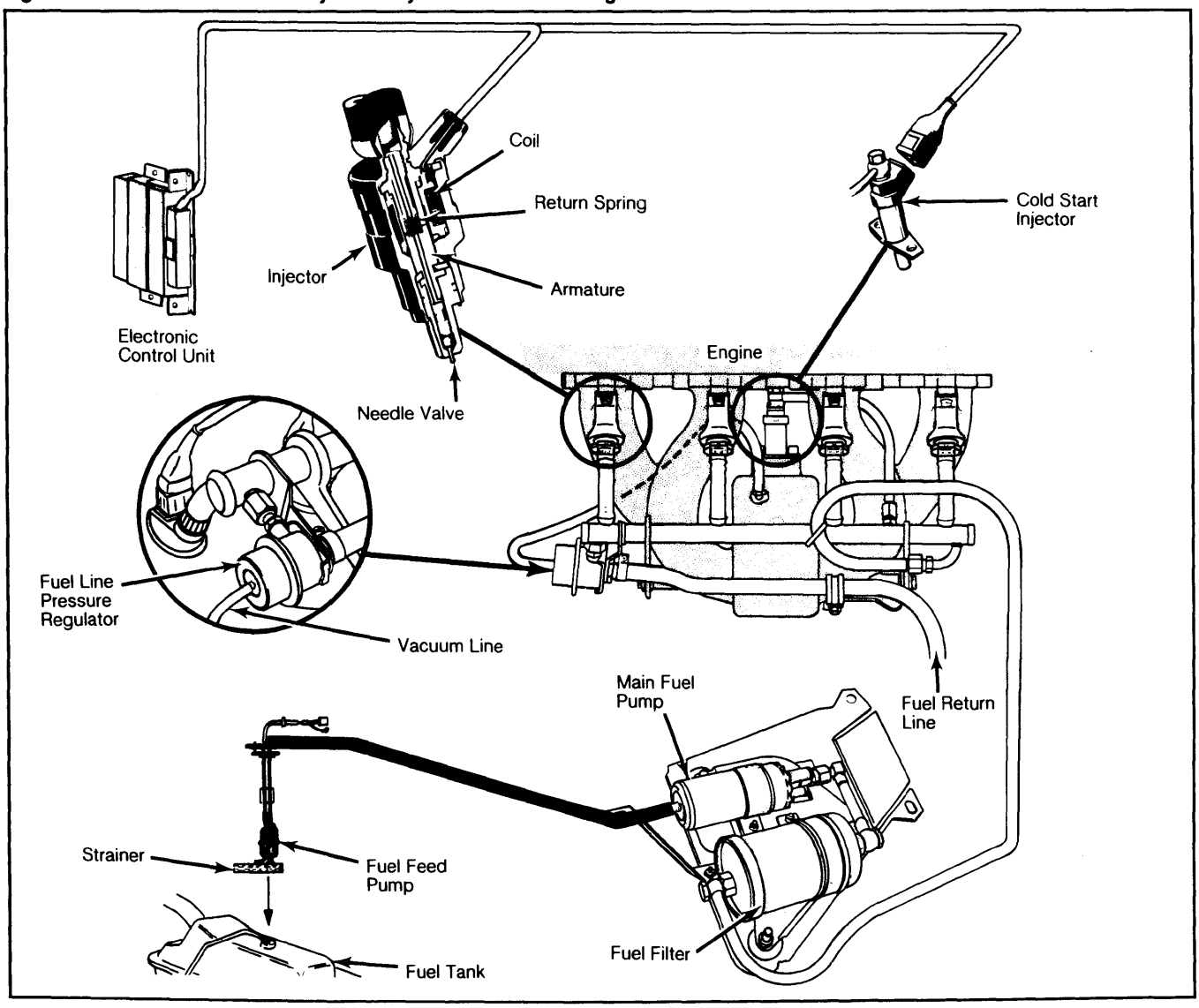
FUEL SYSTEM

The fuel system consists of the fuel tank, a fuel feed pump, fuel lines, an in-line fuel pump and filter and a line pressure regulator. *See Fig. 1.*

Fuel is supplied to the injection system at a constant pressure and volume. Only the injection duration needs to be varied to meet changing engine requirements.

The fuel feed pump is an electrically operated vane pump. The pump is located near the bottom of the fuel tank. Fuel is strained through a mesh screen before entering the fuel pump. There is a check valve on the

Fig. 1: Bosch LH Jetronic Fuel Injection System Fuel Flow Diagram



Fuel pressure in system is constant. Relieve pressure before servicing.

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outlet side of the fuel feed pump. This prevents the fuel supply line from draining back into the tank.

The main fuel pump and filter are attached to a bracket located underneath the vehicle, under the left rear seat. The main fuel pump is an electrically operated roller pump. The pump is equipped with a check valve to prevent back flow. The pump also has an overpressure relief valve which opens if the fuel system becomes clogged and the pressure rises too high.

INJECTORS

The injectors are located in the intake manifold and point directly at the intake valve. All 4 injectors are supplied with fuel from a common fuel manifold. The injection pulse is controlled by a needle valve assembly in the bottom of the injector. The needle valve is operated by an electric solenoid which is switched on and off by the electronic control unit.

COLD START INJECTOR

The cold start injector supplies extra fuel to the engine during cold starts. This injector is controlled by a signal from the thermal time switch. The cold start injector is a solenoid operated valve that operates only when the starter is energized.

FUEL PUMP RELAY

The fuel pump relay is located on the firewall under the dash. This relay energizes the fuel feed pump, through a separate fuse, and the main fuel pump.

SENSORS

Air Mass Meter

This meter continually measures the amount of air entering the engine intake system. The air mass meter consists of a platinum wire filament located in the intake air stream and a circuit board with a potentiometer for CO adjustment.

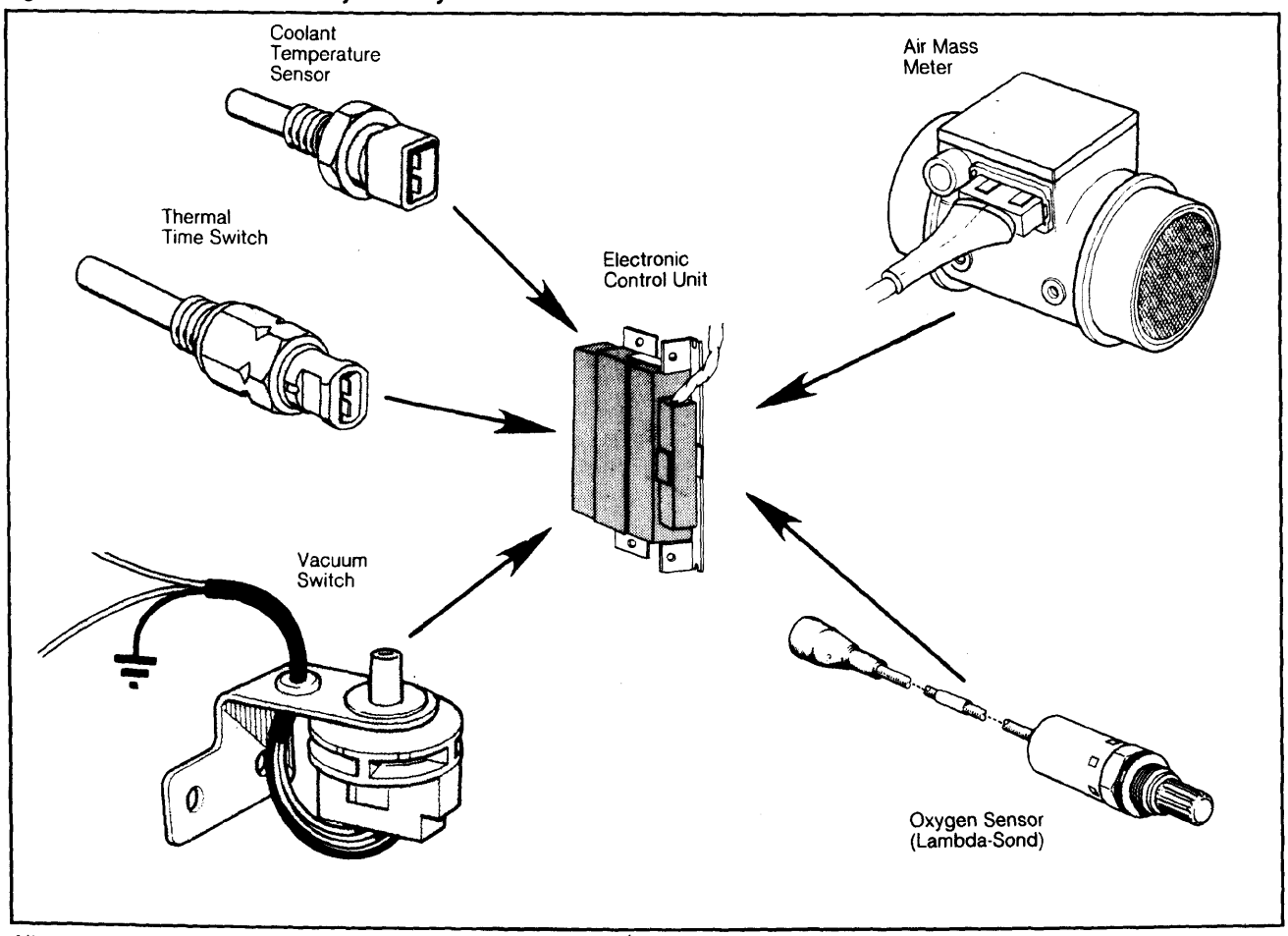
The wire filament sends a temperature related signal to the circuit board for processing. Once processed, the air flow signal is sent to the electronic control unit.

When the engine stops, the filament is heated to a high temperature for less than a second. This burns off any dirt that may have collected on the wire which could result in an incorrect air flow reading.

Oxygen Sensor (Lambda-Sond)

The oxygen sensor checks the exhaust gas for the presence of unburned oxygen. Unburned oxygen in the exhaust gas indicates incomplete combustion due to improper mixture, spark timing or other conditions. The oxygen sensor is located in the exhaust manifold.

Fig. 2: Bosch LH Jetronic Fuel Injection System Sensors



All sensors send the electronic control unit information on engine operating conditions.

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Vacuum Switch

The vacuum switch measures intake manifold vacuum. The vacuum signal tells the control unit how much of a load the engine is under. The vacuum switch is located on a bracket near the intake manifold.

Coolant Temperature Sensor

The coolant temperature sensor is located in the cylinder head. This sensor provides the electronic control unit with an engine temperature signal. If, for example, the sensor was to read high engine temperature with the cooling system operating properly, this would indicate combustion temperature that is too high.

The likely response of the control unit would be to richen the mixture to the point allowed by the oxygen sensor and air mass meter signals. This would lower combustion and engine temperature. This sensor also operates the temperature gauge.

Thermal Time Switch

This switch controls the current sent to the cold start injector. The thermal time switch is actuated by engine coolant temperature. When engine temperature reaches 95°F (35°C), the thermal time switch signals the control unit to shut off the cold start injector. The thermal time switch circuit is only energized when the starter motor is running.

Engine Speed

The engine speed signal is generated by the electronic ignition distributor. The low voltage ignition primary pulses are monitored at the low tension side of the ignition coil. Injection timing is regulated by this signal.

SYSTEM RELAY

The system relay is located on the firewall under the dash, next to the fuel pump relay. This relay provides current to the electronic control unit. It is energized during filament burn off after the ignition has been switched off.

TESTING

CAUTION: The Bosch LH Jetronic fuel injection system maintains constant fuel pressure in the fuel lines and component parts at all times. Be sure to relieve pressure before attempting to open system at any point for testing. Do not allow fuel to flow onto engine or electrical parts or allow an open flame in area while testing fuel system components.

ELECTRONIC CONTROL UNIT

1) Diagnosis of the Bosch LH Jetronic fuel injection system is accomplished by removing the connector from the control unit and checking all electric circuits ending at the connector. The tests will indicate the condition of all components and the wires leading to the tested terminal.

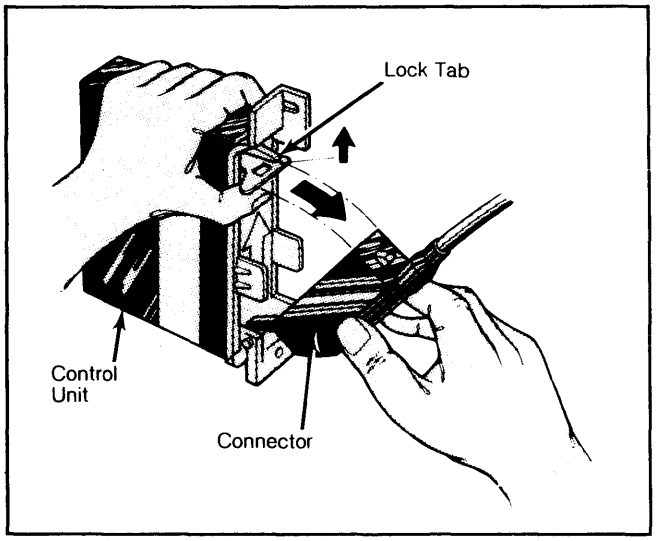
2) If there is a problem after all the tests are completed and no malfunction was found, the control unit is most likely at fault. Replace the control unit and recheck system to see that problem has disappeared.

3) Always check and repair all circuits before substituting a new control unit. If a new control unit is installed first, a faulty circuit may destroy the new control unit in the same manner as the old one. There is no testing procedure for the control unit other than substitution.

4) To gain access to the control unit and connector, remove kick panel located in front of right front door. The fuel injection control unit is the one on top, the bottom control unit is for the constant idle speed system.

5) Disconnect the wiring harness from the fuel injection control unit by pressing up on the lock spring on the top end of the connector while pulling outward and down on the top of the connector. DO NOT pull connector straight out. *See Fig. 3.*

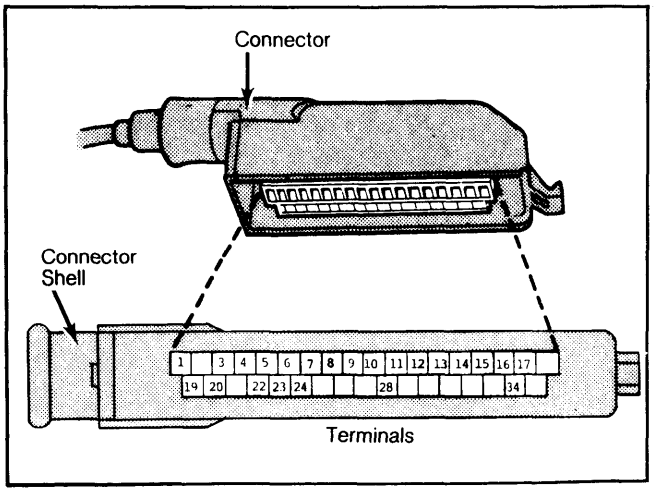
Fig. 3: Control Unit Conector Removal



Pull outward and down to remove connector.

6) The connector terminals are now accessible, but should not be used for testing on their front side. The front of the connector terminals can easily be damaged by test equipment. To perform tests, cut boot clamp off of end of connector and slide cover off of connector. Always test from inside of connector. Terminal numbers are shown on both sides of the connector. *See Fig. 4.*

Fig. 4: Connector Terminal Locations



Always use back of terminals for test connections.

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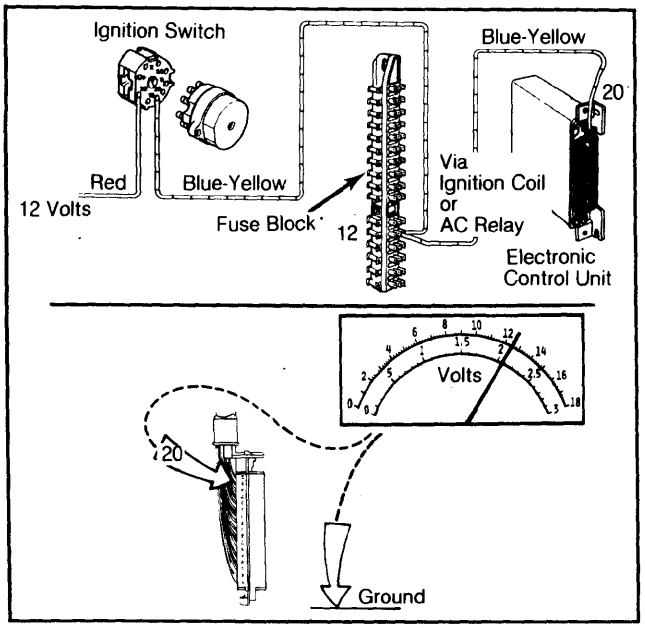
CAUTION: DO NOT use test connector located behind the battery. Special test equipment is required to use this connector and damage could result from using improper equipment.

IGNITION SWITCH CIRCUIT

Test voltage across terminal 20 to ground. Battery voltage should be indicated. If not, check the wiring all the way back to the ignition switch. *See Fig. 5.*

Fig. 5: Ignition Switch Circuit Test

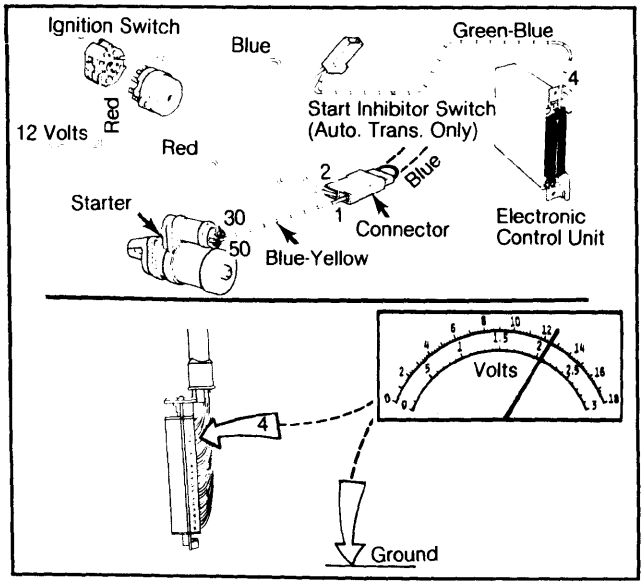


Circuit should receive full battery voltage.

STARTER MOTOR CIRCUIT

Crank the starter motor and measure voltage at terminal 4 to ground. Battery voltage should be indicated. If not, check the wiring all the way back to the ignition switch. *See Fig. 6.*

Fig. 6: Starter Motor Circuit Test

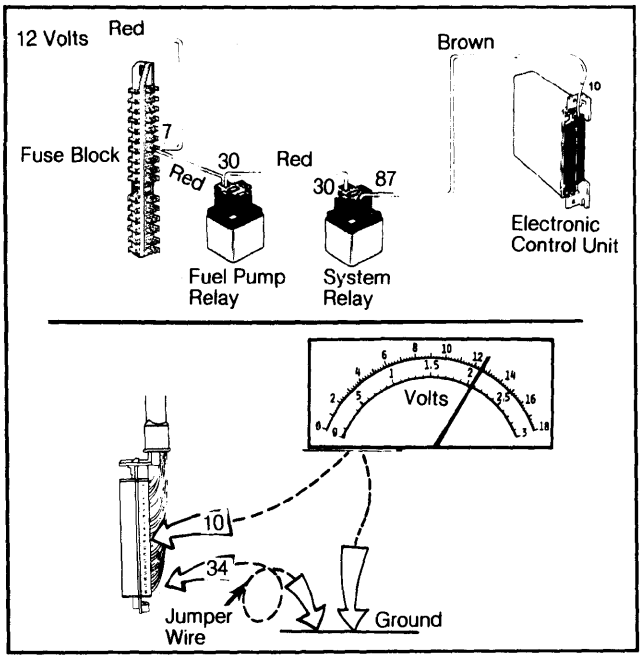


Circuit should receive full battery voltage.

SYSTEM RELAY POWER SUPPLY

Attach a jumper wire between termimal 34 and ground. Measure voltage across terminal 10 and ground. Battery voltage should be indicated. If not, check connector and wiring harness all the way back to the ignition switch. Check to see that system relay and fuse are okay. *See Fig. 7.*

Fig. 7: System Relay Power Supply Test



Circuit should receive full battery voltage

FUEL PUMP CIRCUIT

1) Attach a jumper wire from terminal 28 to ground. This will enable the fuel pump relay to energize without running the starter motor. Turn the ignition switch "ON" and listen at rear of vehicle for a buzzing sound that indicates fuel pumps are operating. *See Fig. 8.*

2) If pumps do not operate, check fuses 13, 7 and 5. Also, check fuel pump relay and wiring. To test the main fuel pump alone, remove fuses 5 and 7. Install an ammeter across the terminals of fuse 7. Switch ignition "ON". Ammeter should read 6.2-6.5 amps at 12 volts if the main fuel pump is operating properly. *See Fig. 9.*

3) To test the fuel feed pump alone, remove fuse 5 and install an ammeter across the fuse terminals. The ammeter should read 1-2 amps at 12 volts if the fuel feed pump is operating properly. *See Fig. 10.*

GROUND CIRCUITS

Using an Ohmmeter

Connect 1 lead of an ohmmeter to ground. Connect the other lead to each of terminals 5, 16 and 17 in turn. Ohmmeter should indicate 0 ohms at all 3 points. If any of the terminals shows a high resistance or infinite resistance, the wire connected to that terminal must be traced and repaired. *See Fig. 11.*

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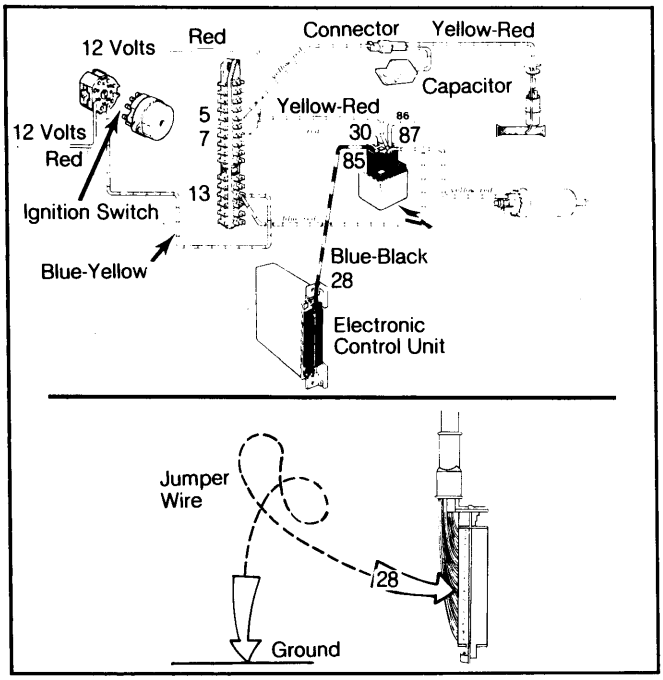
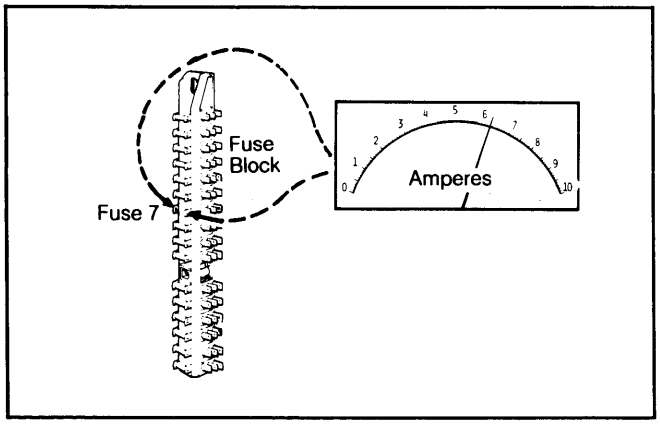
Fig. 8: Fuel Pump Circuit Test



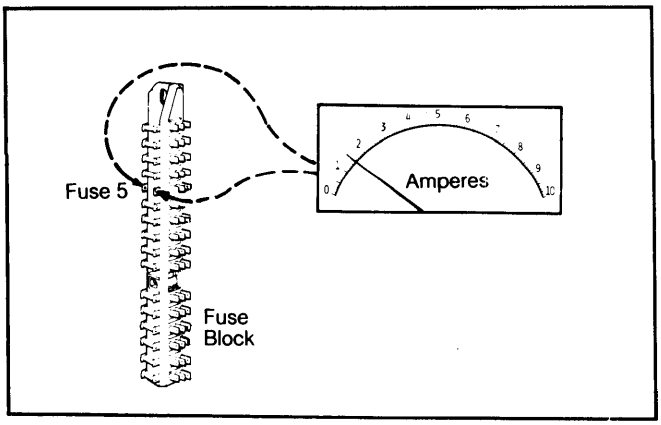
Pumps should operate when ignition switch is "ON".

Fig. 9: Main Fuel Pump Test



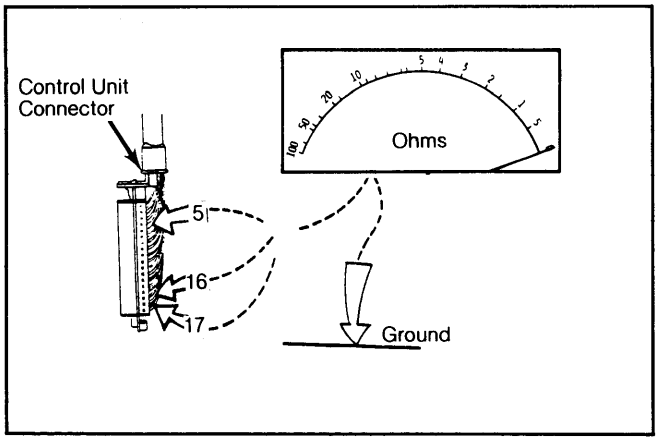
Pump should draw 6.2-6.5 amps at 12 volts.

Fig. 10: Fuel Feed Pump Test



Fuel feed pump should draw 1-2 amps at 12 volts.

Fig. 11: Ohmmeter Ground Circuit Test

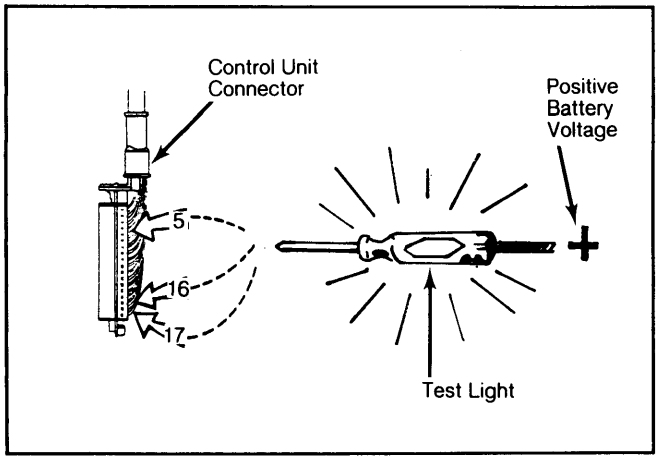


Continuity should be present at all 3 terminals.

Using a Test Light

Connect 1 lead of test light to the battery positive terminal or any location where full battery voltage is available. Connect the other lead of the test lamp to each of terminals 5, 16 and 17 in turn. The test light should illuminate fully at each terminal. If the test light does not illuminate fully at any terminal, the wire connected to that terminal must be traced and repaired. *See Fig. 12.*

Fig. 12: Test Light Ground Circuit Test



Test light should light up at all 3 terminals.

INJECTOR CIRCUITS

1) All injectors are energized by the fuel pump circuit. Injection time is controlled by grounding pairs of injectors at the control unit. To test the injector circuits an accurate ohmmeter is needed to measure resistances of 8 and 16 ohms.

2) Ground terminals 28 and 34. Connect an ohmmeter across terminals 10 and 14, and record resistance. Connect an ohmmeter across terminals 10 and 15, and record resistance. Resistance should be 8 ohms at each location. *See Fig. 13.*

3) If 16 ohms is measured at either terminal, an injector or the wire leading to it is faulty. To locate the faulty injector, disconnect the connector at each injector and test injector resistance separatly. Resistance for 1 injector should be 16 ohms.

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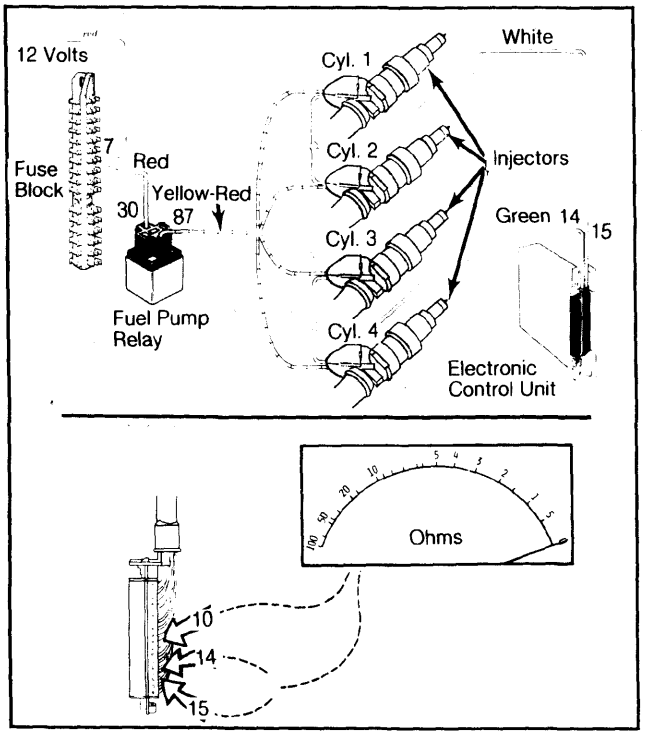
Fig. 13: Injector Circuit Test

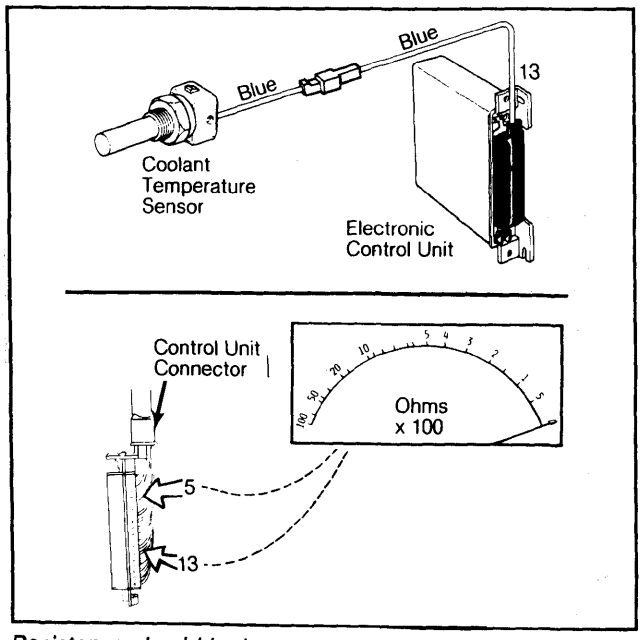


Both test points should read 8 ohms.

TEMPERATURE SENSOR CIRCUIT

1) Connect an ohmmeter across terminals 5 and 13. If sensor is operating properly, resistance should be 270-390 ohms with coolant at operating temperature (about 175°F or 80°C), 2,100-2,900 ohms at room temperature (about 68°F or 20°C) and 7,000-11,600 at temperatures below freezing (about 14°F or 10°C).

Fig. 14: Temperature Sensor Circuit Test



Resistance should be low at operating temperature.

2) If resistance is considerably higher than specifications, an open circuit is indicated. If resistance is at or near 0 ohms a short circuit is indicated. *See Fig. 14.*

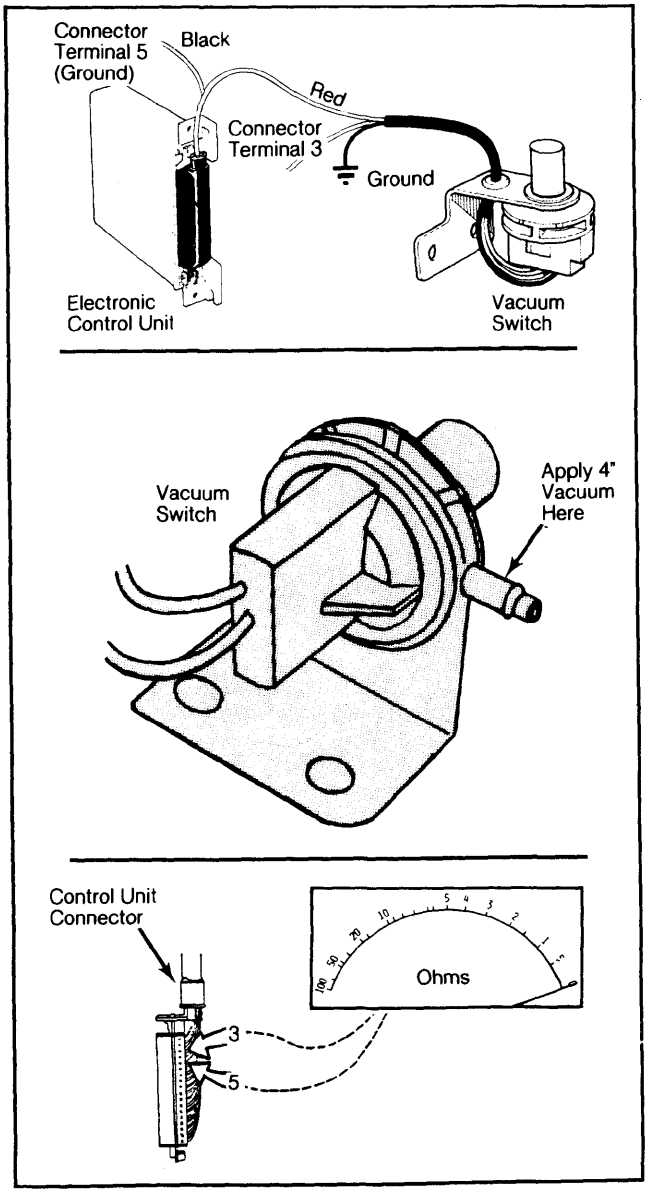
VACUUM SWITCH CIRCUIT

1) Connect a vacuum pump and gauge to vacuum switch. Connect an ohmmeter across terminals 3 and 5. With the vacuum switch at atmospheric pressure the ohmmeter should read 0 ohms resistance.

2) Pump vacuum up to 4" Hg at vacuum switch. Resistance should now read very high or infinite. High resistance when no vacuum is applied indicates an open circuit. Zero resistance when vacuum is applied indicates a short circuit.

3) Inability to maintain a vacuum at the vacuum switch indicates a faulty diaphragm in the switch and requires replacement of the switch. *See Fig. 15.*

Fig. 15: Vacuum Switch Circuit Test



A vacuum source and gauge are necessary for test.

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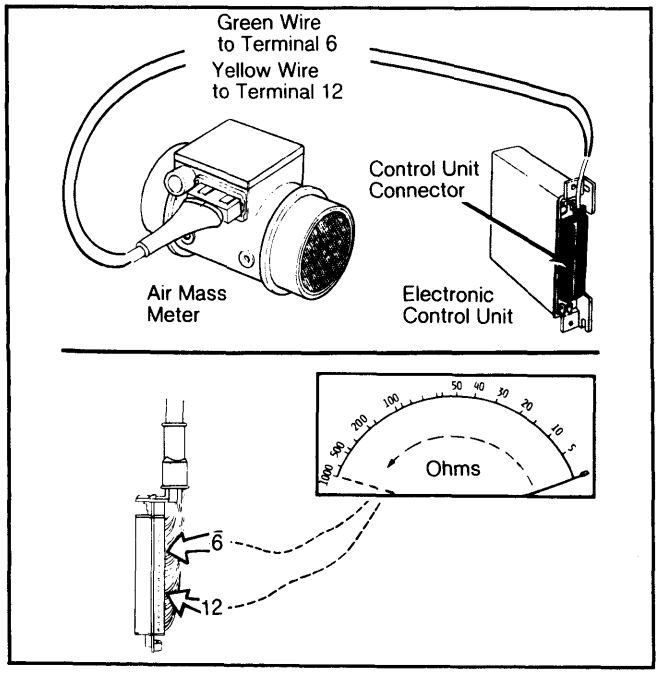
AIR MASS METER CIRCUIT

1) Connect an ohmmeter across terminals 6 and 12. Resistance should be between 0 and 1000 ohms. If resistance does not meet specifications, CO level must be adjusted. *See VOLVO TUNE-UP SERVICE PROCEDURES article.*

Fig. 16: Air Mass Meter Circuit Test



Resistance should be between 0 and 1,000 ohms.

2) If resistance is still out of specifications after adjusting CO or if CO cannot be adjusted, the circuit is defective. Turn the CO adjustment screw to the full counterclockwise position. If resistance is not at or near 1,000 ohms, a short circuit is indicated.

3) Turn the CO adjustment screw to the full clockwise position. If resistance is not at or near 0 ohms, an open circuit is indicated. *See Fig. 16.*

ADJUSTMENTS

HOT (SLOW) IDLE RPM

See VOLVO TUNE-UP PROCEDURES article.

IDLE MIXTURE

See VOLVO TUNE-UP PROCEDURES article.

Fig. 17: Bosch LH Jetronic Fuel Injection System Wiring Diagram