



# 1974-79 FUEL SYSTEMS

## Bosch CIS Fuel Injection – Saab & Volvo (Cont.)

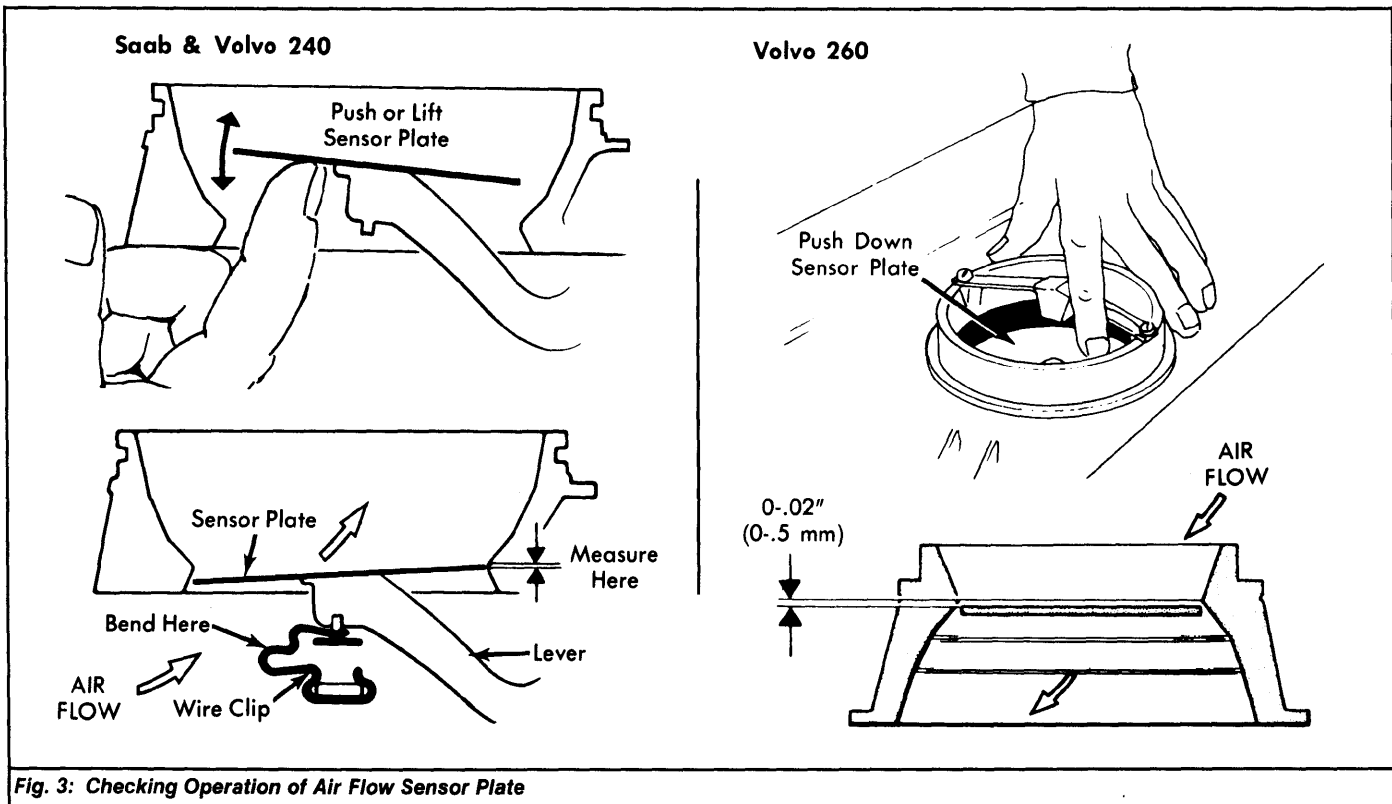


Fig. 3: Checking Operation of Air Flow Sensor Plate

6) On Saab and 240 Series, bend wire clip beneath sensor plate and lever (if necessary). See Fig. 3. On Volvo 260 Series, check that plate stop does not touch plate. Contact pin is adjustable inward using a drift and mallet (tap lightly). To drive pin outward, air sensor must be removed.

### AIRFLOW SENSOR PLATE REST POSITION

Application	Lowest Position	Maximum Position
Saab .....	.020" (.50 mm)	
Volvo .....		
240 Series .....	.040" (1.0 mm)	
260 Series .....	.020" (.50 mm)	

### COLD ENGINE CONTROL PRESSURE TEST

1) Install pressure gauge in fuel line between fuel distributor and control pressure regulator. See TEST EQUIPMENT HOOK-UP in this article. Turn pressure gauge knob or lever to OPEN position.

2) Unplug connector on control pressure regulator and turn ignition ON. Compare readings with cold engine control pressure graphs. See Fig. 4. If pressures are incorrect, replace control pressure regulator.

**NOTE:** All 1978-79 Volvo V6 engines have a vacuum connection from control pressure regulator to intake manifold or to open air. Cold or warm engine pressure readings will vary depending on whether this hose is connected or disconnected.

### WARM ENGINE CONTROL PRESSURE TEST

Turn pressure gauge knob or lever to OPEN position. Reconnect control pressure regulator connector (if disconnected). Turn ignition ON and allow pressure to stabilize. Compare readings with WARM ENGINE CONTROL PRESSURE TEST table. If pressures are incorrect, replace control pressure regulator.

### WARM ENGINE CONTROL PRESSURE TEST

Application	psi (kg/cm <sup>2</sup> )
1975-77 Models	
Saab .....	48.5-54.0 (3.4-3.8)
Volvo .....	49.7-55.3 (3.5-3.9)
1978-79 Models	
Saab .....	48.5-54.0 (3.4-3.8)
Volvo	
240 Series .....	50.0-55.0 (3.5-3.9)
260 Series	
Federal .....	50.0-55.0 (3.5-3.9)
Calif. (Lambda) .....	45.0-49.0 (3.15-3.45)

### REST PRESSURE TEST

Turn pressure gauge knob or lever to OPEN position. Reconnect control pressure regulator connector (if disconnected). Turn ignition ON until rest pressure is present. Rest pressure should be 24-34 psi (1.7-2.4 kg/cm<sup>2</sup>). If pressures are incorrect, replace control pressure regulator.

### SYSTEM (LINE) PRESSURE TEST

1) Turn pressure gauge knob or lever to CLOSED position. Turn ignition ON. Pressure should be 64-72.5 psi (4.5-5.1 kg/cm<sup>2</sup>). If pressure is too high, check for blocked fuel return line or defective line pressure regulator in fuel distributor.

2) If pressure is too low, check for low fuel pump pressure. Also check for a clogged fuel tank strainer, leaks in fuel line, or defective line pressure regulator in fuel distributor.

3) System (line) pressure can be adjusted by adding or removing shims from line pressure regulator in fuel distributor. Pressure can be increased by adding shims, decreased by removing them.

4) Shims are available in .004" (.10 mm) thickness to provide pressure change of .85 psi (.06 kg/cm<sup>2</sup>) or .020" (.5 mm) to provide pressure change of 4.3 psi (.3 kg/cm<sup>2</sup>). Thicker shims should be used first, thinner shims should be used when line pressure is more than 70 psi (4.9 kg/cm<sup>2</sup>).

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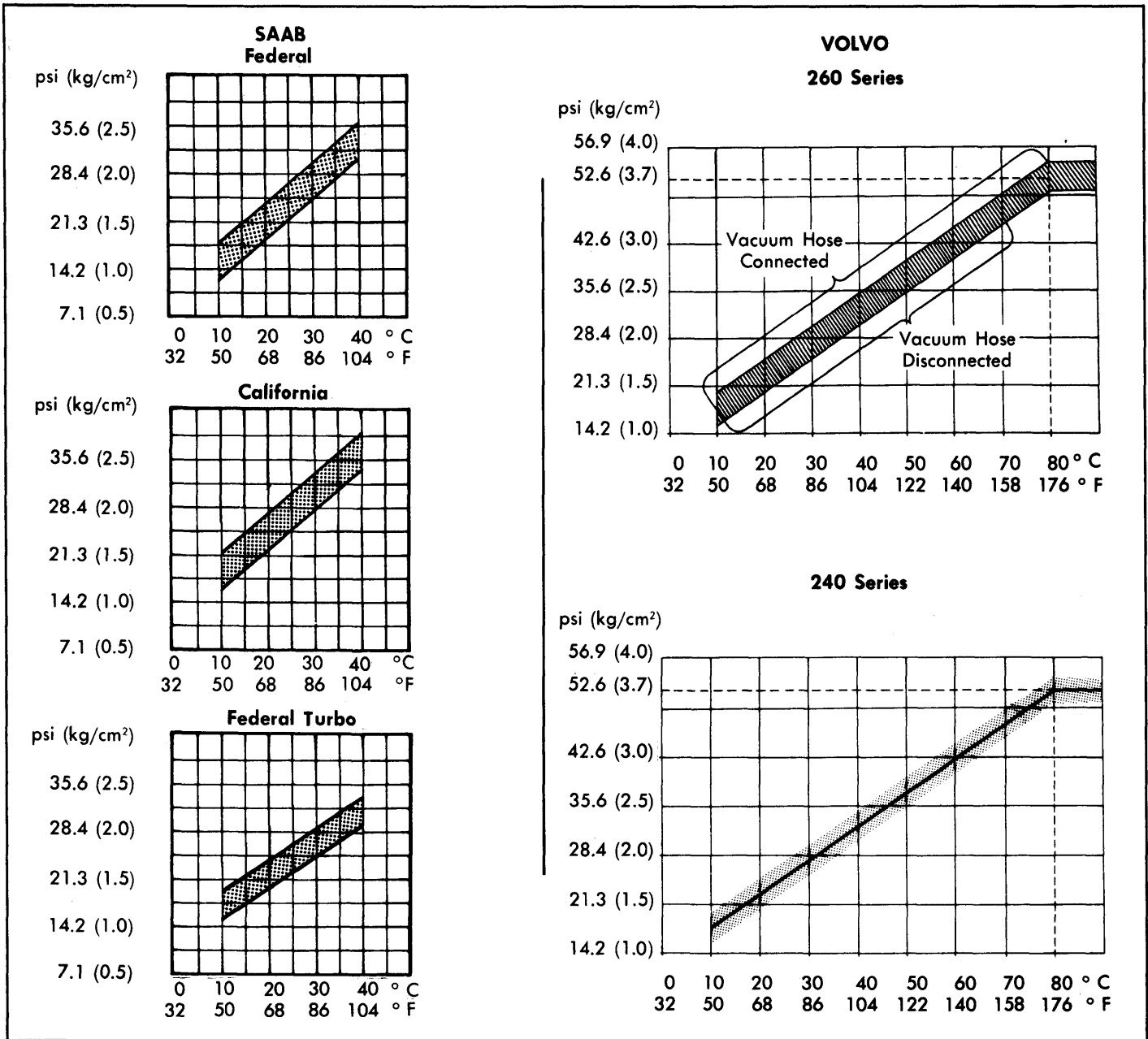


Fig. 4: Cold Engine Control Pressure Test (Pressure/Temperature Relationship) Graphs

### COLD START VALVE & THERMO-TIME SWITCH

- 1) Unplug cold start valve and unscrew valve from throttle valve housing. Leave fuel line connected. Connect jumper wires to cold start valve and attach to battery or headlight connections for power source.
- 2) On 1975-77 models, disconnect airflow sensor connector. This isolates the safety circuit and allows fuel pump to run with ignition ON and engine not running.
- 3) On 1978-79 Volvo, connect Test Relay (5170) to ignition coil. See Fig. 2. On 1978-79 Saab, use jumper wires between fuel pump relay circuit. This will permit fuel pump to operate with ignition ON, but engine off.
- 4) On all models, place cold start valve over a container. With ignition switch ON and voltage available to valve, fuel should spray for a short period (30 second maximum). Check for conical spray pattern.
- 5) If engine temperature is below 113°F (45°C), spray will be present when operating properly. If none occurs, check voltage at cold start valve. With starter energized, connect test lamp in series across valve contacts. Voltage indicates defective cold start valve.

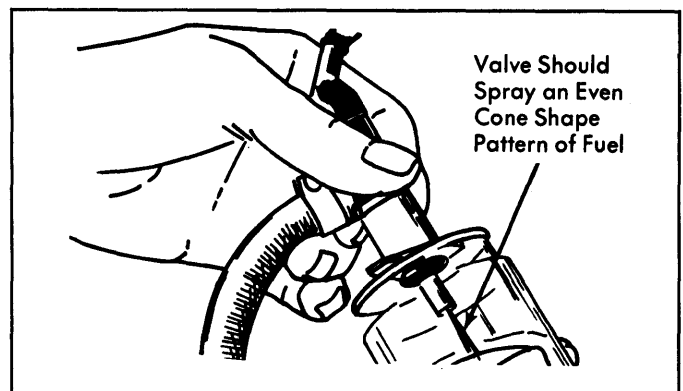


Fig. 5: Cold Start Valve Test

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6) On 1978-79 models, connect test lamp (with starter energized) to Blue/Yellow wire of cold start valve and ground. Voltage indicates defective thermo-time switch or defective wire between switch and cold start injector. If voltage is not present, check for defective wire between starter motor and cold start injector.

7) If engine temperature is above 113°F (45°C), and fuel injection occurs when starter is energized, either the switch or injector is defective. Remove connector from cold start injector. If there is injection when starter is energized, cold start injector is defective. If not, switch is defective.

### AUXILIARY AIR REGULATOR

1) On 1975-77 models, disconnect airflow sensor connector. This isolates the safety circuit and allows fuel pump to run with ignition ON and engine not running.

2) On 1978-79 Volvo, connect Test Relay (5170) to ignition coil. On 1978-79 Saab, connect jumper wires to fuel pump circuit. See TEST EQUIPMENT HOOK-UP in this article.

3) On 1975-77 Volvo, disconnect positive wire at alternator and remove vacuum hoses from auxiliary air regulator. On all models, unplug control pressure regulator connector.

4) Using a mirror and flashlight, check to see that air passage in regulator is open (cold engine). See Fig. 6. Turn ignition on and reconnect auxiliary air regulator vacuum hoses (if removed). Air passage in regulator should close after 5 minutes. If not, replace auxiliary air regulator.

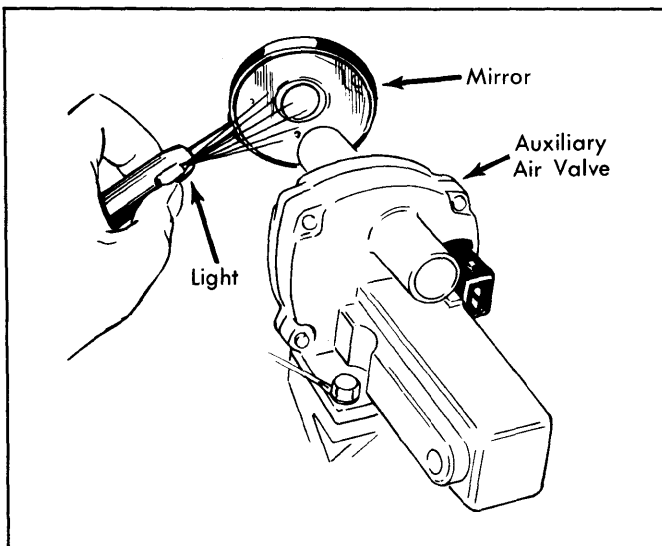


Fig. 6: Checking Auxiliary Air Valve Opening

### CONTROL PRESSURE REGULATOR

1) Unplug connector at control pressure regulator. With voltmeter, check for 11.5 volts at wiring harness connector. On 1975-77 models, disconnect air sensor connector and positive wire at alternator (Volvo only).

2) On 1978-79 Volvo, connect Test Relay (5170) to ignition coil. On 1978-79 Saab, connect jumper wires to fuel pump circuit and remove positive wire at alternator.

3) On all models, connect ohmmeter between positive terminal on control pressure regulator and ground. If ohmmeter reads infinity, replace control pressure regulator.

### INJECTORS

**Saab** – 1) Remove rubber bellows from airflow sensor. Unscrew injection valves from intake manifold. Place injectors in a container without disconnecting fuel lines.

2) Install jumper wires in fuel pump circuit and turn ignition ON to activate fuel pump. Lift lever in airflow sensor. Injectors should spray an even cone-shaped pattern of fuel. If not, clean or replace defective injectors.

3) Turn ignition switch OFF to obtain line pressure. With clean cloth, wipe injectors dry. Lift sensor lever again and check for leakage at injector nozzle tips. No fuel should leak within 15 seconds. If so, replace defective injectors.

**Volvo** – 1) Connect injector to Bosch Injector Tester (EFEP60 H) and apply pressure until injector opens. See Fig. 7. Pressure should be 37-51 psi (2.6-3.6 kg/cm<sup>2</sup>). If not, replace injector.

2) Lower pressure to 34 psi (2.4 kg/cm<sup>2</sup>). Observe nozzle tip. No fuel droplets should form within 15 seconds. If injector leaks, it must be replaced.

**NOTE:** Do not apply more than 85 psi (6 kg/cm<sup>2</sup>) to injector. If injector does not open, it must be replaced.

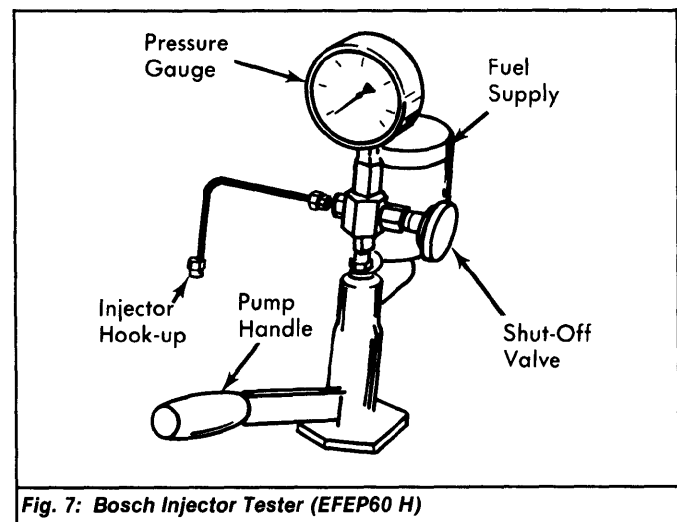


Fig. 7: Bosch Injector Tester (EFEP60 H)

### OXYGEN SENSOR (LAMBDA) SYSTEM

**1978-79 Saab** – 1) Use Bosch Tester (KDJE 7453) to measure open/close ratio of frequency/modulating valve of oxygen sensor system. Tester is connected to 2-terminal socket located near relay holder.

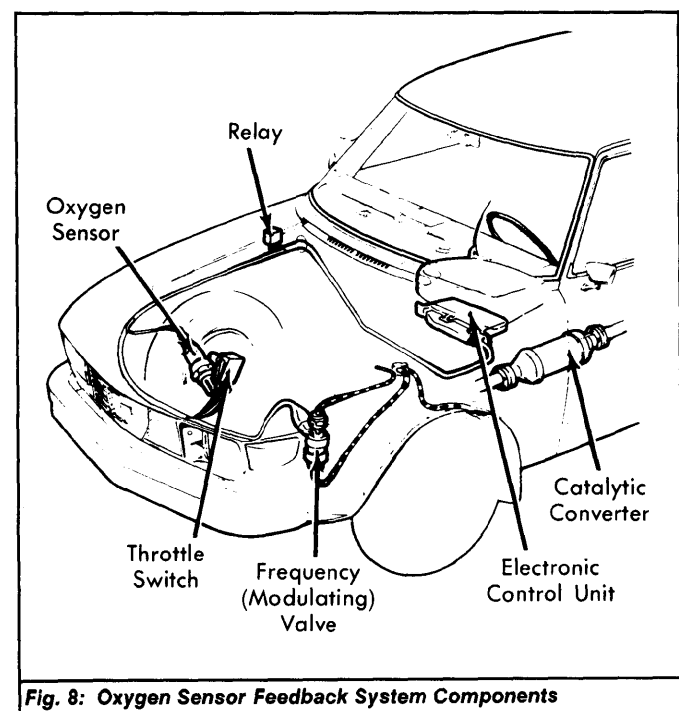
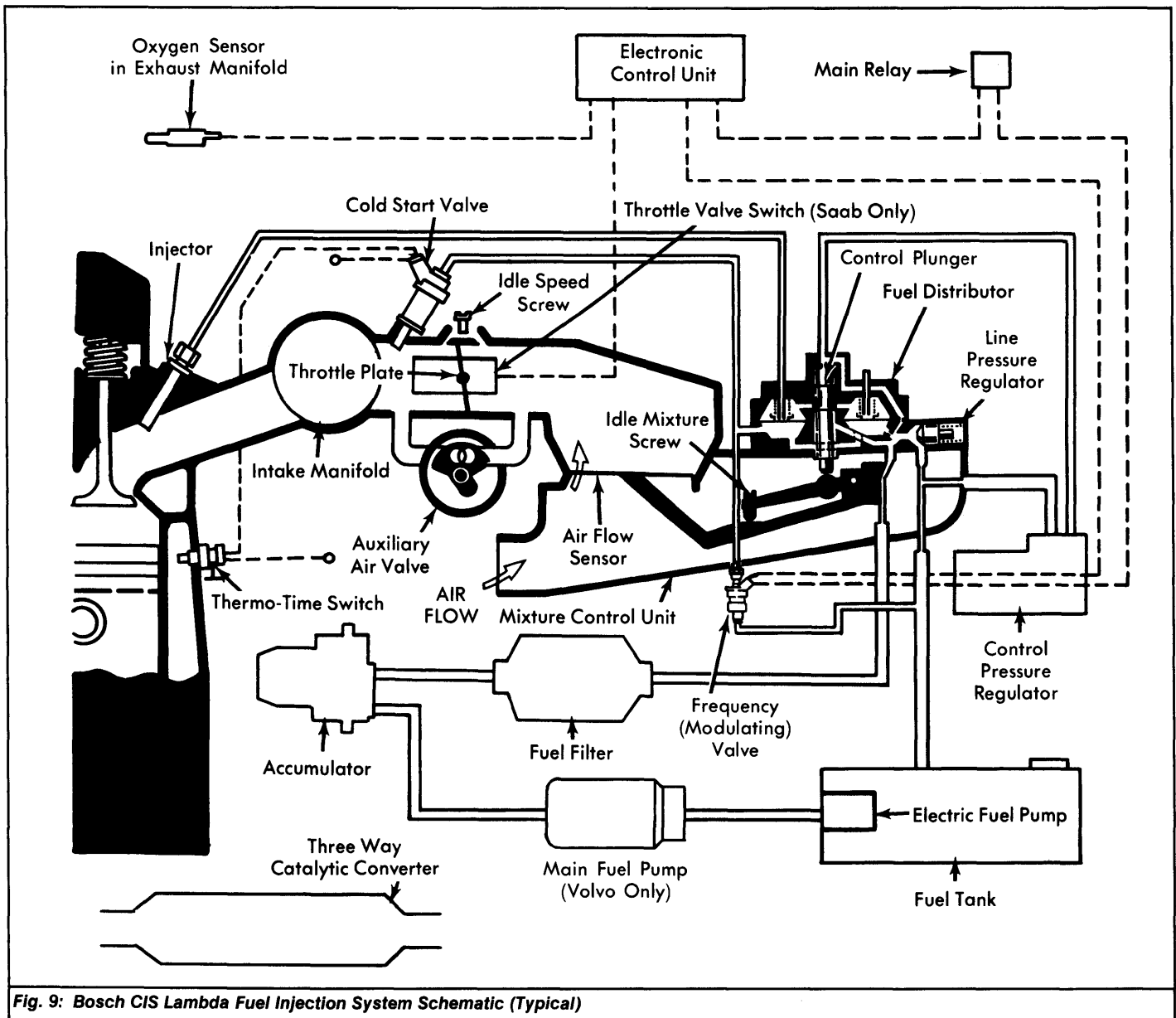


Fig. 8: Oxygen Sensor Feedback System Components

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**Fig. 9: Bosch CIS Lambda Fuel Injection System Schematic (Typical)**

- 2) With ignition switch OFF and jumper wire connected between terminals No. 30 to 87 in relay holder, connect tester. The modulating/frequency valve should operate and be easily heard (buzzing).
- 3) With oxygen sensor connected, tester reading should be 50-70 percent. This is fixed pulse relation existing before sensor has reached operating temperature or a defective sensor.
- 4) Disconnect cable from sensor and ground it. A reading in excess of 75 percent is possible. Disconnect sensor from ground, mixture will first become leaner, and reading will drop below 50 percent. It will then increase and level off at 50-70 percent.
- 5) Reconnect oxygen sensor cable and fully open throttle valve. See Fig. 8. Tester reading should level off at 35-55 percent. Reading on Turbo models should be 70-90 percent.
- 6) With engine running, observe variations due to pulse relation regulation. When oxygen sensor is still cold (about 1 minute after starting), a fixed pulse relation of 50-70 will occur. When engine is warm and CO% value correctly set, reading should vary back and forth between 40-60 percent readings.
- 7) If system is operating close to either end of scale, satisfactory regulation is usually not possible. If this occurs, an automatic monitoring system will cut in, regulating the system at a fixed pulse relation of 60 percent to open.

- 1978-79 Volvo – 1)** Connect dwell meter between instrument pickup connector and ground, to check duty cycle (open/close ratio) of frequency valve. Meter should be of high quality, capable of reading at least 70 degrees.
- 2) If buzzing sound exists at frequency valve, but there is no reading on dwell meter, check that dwell meter is suited for its purpose and is correctly connected.
  - 3) Also check the wire that dwell meter is plugged into. It should be transferring the signal from the electronic control unit to dwell meter. To check, disconnect electronic control unit. Use ohmmeter to check for closed circuit from terminal No. 17 of connector to pick-up point for dwell meter.
  - 4) To check oxygen sensor feedback, disconnect oxygen sensor lead. Check dwell reading (duty cycle), setting meter as you would for a 4 or 6-cylinder engine. If dwell reading is incorrect, check dwell meter or short circuit of electronic control unit.

**VOLVO DUTY CYCLE READINGS**

Application	Degrees
240 Series .....	49-59
260 Series .....	49-59
Engine Temp. Above 60°F (15°C) .....	40-50
Engine Temp. Below 60°F (15°C) .....	71-81

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5) If dwell meter reading is zero, check ground wires for electronic control unit at intake manifold. Check that terminal No. 8 of control unit is "live". Check voltage between terminals No. 8 and 16 and between terminals No. 5 and 8. If voltage is found between terminals, electronic control unit is defective.

6) If dwell meter reading is either 49-59 or 90 degrees, check voltage of frequency valve. If voltage is present, check resistance at valve for 2-3 ohms. Replace valve if not within specifications. If resistance is okay, reconnect frequency valve.

7) Turn ignition off, disconnect electronic control unit, and turn ignition on. Check for voltage at terminal No. 15 in connector. If no voltage is present, repair wire. If voltage is present, replace electronic control unit.

### REMOVAL & INSTALLATION

**NOTE:** Disconnect negative battery and relieve fuel pressure when removing fuel system components.

#### AIRFLOW SENSOR & MIXTURE CONTROL UNIT

**Removal & Installation (Saab)** – 1) Clean area around fuel connections on fuel distributor. Disconnect fuel lines from fuel distributor. Disconnect lines to injection nozzles before disconnecting control pressure line from distributor.

2) Remove rubber bellows from airflow sensor and throttle valve housing. Remove retaining bolts and remove mixture control unit from air cleaner. To install, reverse removal procedure. Make sure air cleaner element is properly positioned.

**Removal & Installation (Volvo)** – Clean area around fuel connections before removing fuel lines. Remove rubber bellows and strap for injection lines. Remove injection lines and control pressure line from fuel distributor. Remove mixture control unit. To install, reverse removal procedure.

#### FUEL DISTRIBUTOR

**Removal & Installation** – Remove mixture control unit from vehicle. Remove attaching screws from top of fuel distributor. DO NOT allow control plunger to fall out bottom of fuel distributor. To install, reverse removal procedure. Check movement of mixture control unit for binding or sticking.

#### CONTROL PRESSURE REGULATOR

**Removal & Installation** – Clean area around fuel fittings on regulator. Remove fuel lines. Unplug connector and remove attaching bolts. To install, reverse removal procedure. Check that fittings are tight and leak-free.

#### AUXILIARY AIR REGULATOR

**Removal & Installation** – Remove and plug hoses. Unplug connector and unscrew auxiliary air regulator. To install, reverse removal procedure.

#### THERMO-TIME SWITCH

**Removal & Installation** – Drain coolant below level of thermo-time switch or have replacement switch ready to install as soon as old one is removed. Use a deep-well socket to remove switch. To install, reverse removal procedure.

#### COLD START VALVE

**Removal & Installation** – Unplug connector at cold start valve. Clean area around fuel fitting and remove fuel lines. Remove screws and cold start valve. To install, reverse removal procedure. Make sure fittings are tight and leak-free.

#### INJECTORS

**Removal & Installation** – 1) Clean area around fuel line fittings at injectors (injection nozzles). Remove fuel lines. Hold injectors to prevent them from turning, while fuel lines are being removed.

2) Remove screws and retaining plate. Carefully pull injectors straight up and out of opening. If insulators are used, do not pull them out with injectors.

3) To install, reverse removal procedure. Be sure insulators are firmly in place. Install new "O" ring on insulator if it has been removed. Press injectors firmly into place and tighten fuel lines. DO NOT allow injectors to turn when installing fuel lines. Check for leaks.

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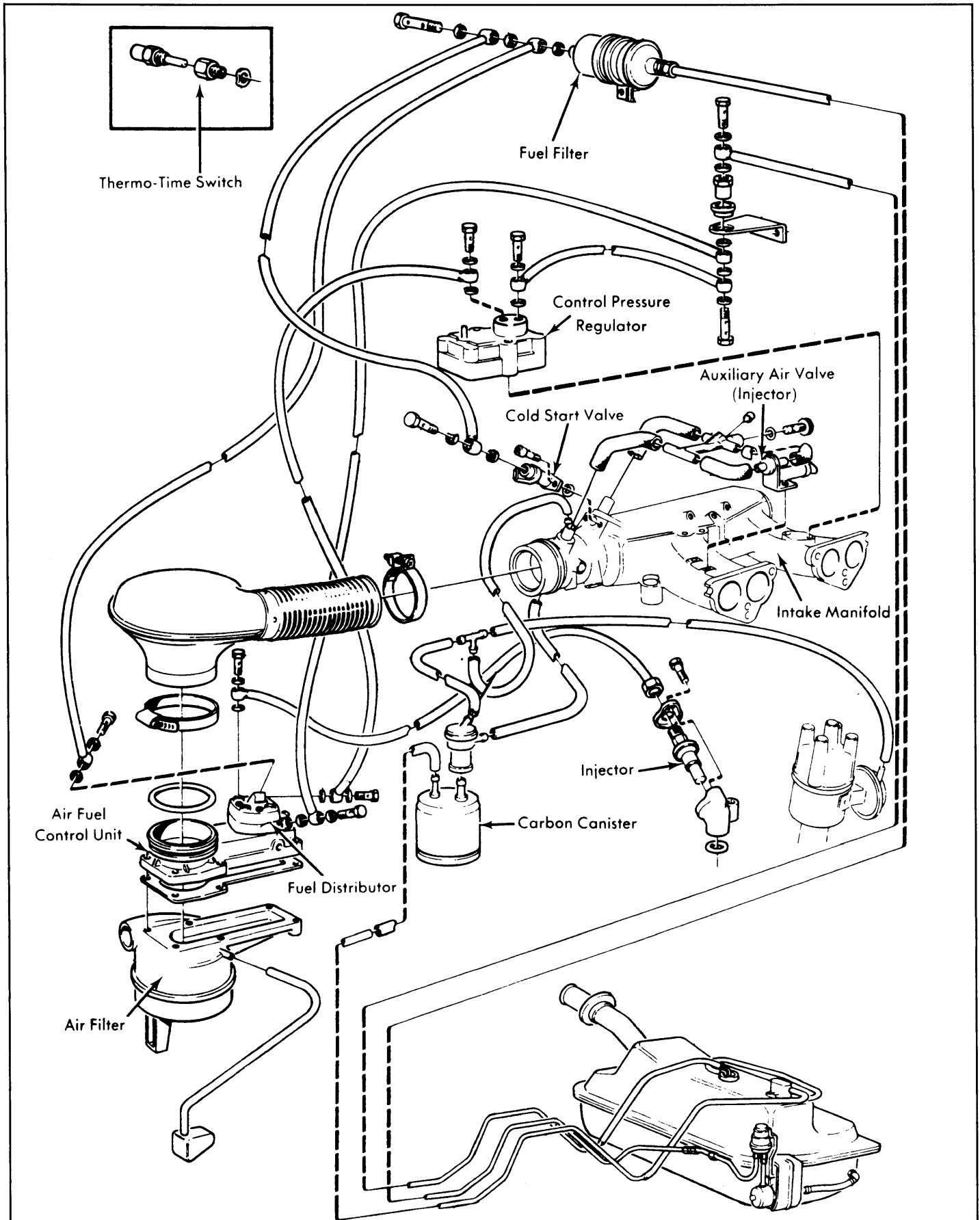


Fig. 10: 1975-77 Bosch CIS Fuel Injection System Components (Volvo)

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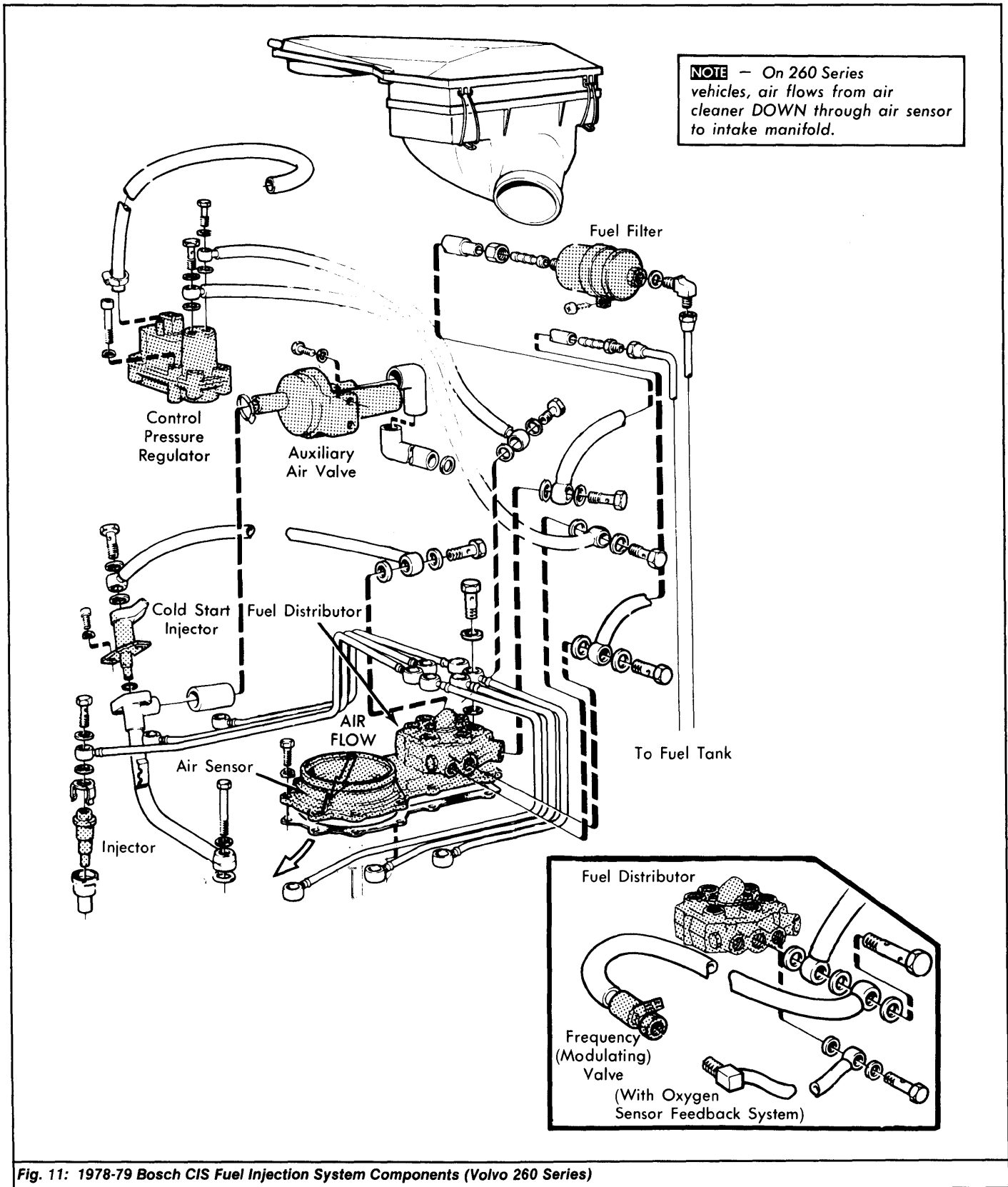


Fig. 11: 1978-79 Bosch CIS Fuel Injection System Components (Volvo 260 Series)