

# 1974-79 FUEL SYSTEMS

## Bosch CIS Fuel Injection – Audi & Volkswagen

**Audi: 1975-79 Fox, 100, 100LS, 5000**  
**Volkswagen: 1976-79 Dasher, Rabbit, Scirocco**

### DESCRIPTION & OPERATION

The Bosch Continuous Injection System (CIS) is a mechanically operated system. It injects fuel to each cylinder in amounts determined by the volume of air flow through the air intake system. Intake air required by the engine is metered by an airflow sensor located in the air inlet.

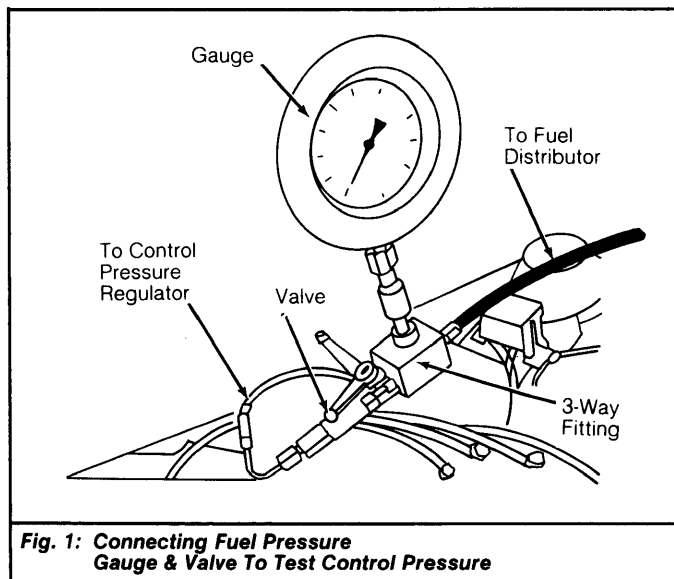
Sensor is activated by a circular plate attached to an arm and pivot assembly which is extremely sensitive to air flow. This sensor plate is raised or lowered by the incoming flow of air, and in turn, raises or lowers a plunger in the fuel distributor. This plunger acts to increase or decrease amount of fuel to be injected at each cylinder.

Main CIS components include: control pressure regulator, airflow sensor, fuel distributor, thermo-time switch, auxiliary air regulator, cold start valve, injectors, electric fuel pump, fuel accumulator, auxiliary air valve, and a fuel filtering system. Some Federal, manual transmission equipped Audi models use a deceleration valve.

### TEST EQUIPMENT HOOK-UP

#### INSTALLING & BLEEDING PRESSURE GAUGE & VALVE

- 1) Before any pressure tests can be completed, it is necessary to install and bleed air from Pressure Gauge and Valve (VW1318 or P378). Install gauge and valve between control pressure regulator and fuel distributor, with valve assembly on control pressure regulator side of gauge.
- 2) To bleed air from valve, hang gauge downward below valve and connecting lines. Open and close valve 4-5 times at 10 second intervals. Raise gauge so that it is now above valve and lines and proceed with testing.
- 3) Valves from the same manufacturer may appear the same, but may vary in interior design. When checking rest pressure or control pressure, be sure valve on tester is OPEN. When checking system (line) pressure, be sure valve is CLOSED. See Fig. 1.



### TESTING

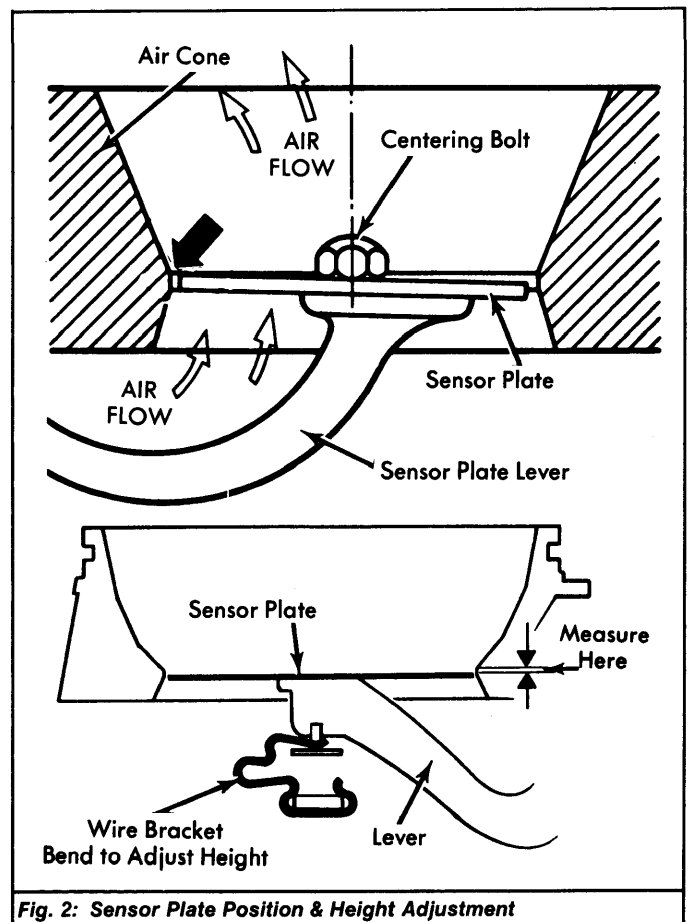
**NOTE: Disconnect airflow sensor, if equipped, and positive wire from alternator when testing electrical circuits on an engine that is not running, but has ignition ON. Also disconnect high tension cable from ignition coil terminal No. 4 so engine will not start accidentally.**

### FUEL PUMP

**1978-79 Models** – Remove fuel pump relay. Install Adapter Switch (US4480/3) and turn switch on. Fuel pressure should be 49-54 psi (3.4-3.8 kg/cm<sup>2</sup>). Turn adapter switch off and check that fuel pressure drops to 28-37 psi (2.0-2.6 kg/cm<sup>2</sup>).

### AIRFLOW SENSOR & MIXTURE CONTROL UNIT

- 1) Operate starter or run engine at idle. Turn ignition OFF after pressure has built up and stabilized. Remove air duct assembly. Lift sensor plate by hand until it is slightly unseated. Gradually raise plate to limit of upward travel.
- 2) Steady resistance should be felt over entire travel of sensor plate. No tight or binding spots should be evident. If so, check for dirty pivot or need for lubrication.
- 3) Ensure sensor plate is centered in inlet cone. If adjustment is needed, loosen centering bolt. Insert a .004" (.10 mm) feeler gauge around outside edge of sensor plate while sensor plate is seated. Apply locking compound to threads and tighten centering bolt
- 4) When sensor plate is pushed down quickly there should be no resistance felt. If binding or sticking is evident, replace sensor plate. Now, lift sensor plate and push down quickly. DO NOT bottom stop plate. Control pressure resistance should be felt. If not, clean control plunger or replace fuel distributor as necessary.
- 5) If sensor plate lever is hard to move in upward direction but moves freely when pushed down, control plunger is sticking or binding. Remove fuel distributor and clean control plunger in solvent. Reinstall plunger and recheck. Replace fuel distributor if plunger still sticks or binds.
- 6) To adjust sensor plate position for height in cone, loosen fuel line to control pressure regulator where line is connected to fuel distributor. Fuel is under pressure and some fuel will escape when fitting is loosened at fuel distributor.
- 7) Upper edge of sensor plate must not be above edge of air cone. See Fig. 2. Plate may be positioned slightly lower, but not more than .020"



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## Bosch CIS Fuel Injection – Audi & Volkswagen (Cont.)

(.5 mm). If too high or too low, adjust by bending wire bracket beneath sensor plate. Check idle speed and CO% level after making sensor plate adjustments.

### COLD ENGINE CONTROL PRESSURE TEST

1) Install pressure gauge and valve in fuel line between fuel distributor and control pressure regulator. See TEST EQUIPMENT HOOK-UP in this article. Valve assembly should be on control pressure regulator side of gauge.

2) Turn ignition on. With fuel pump running, bleed and then OPEN valve. Disconnect control pressure regulator. Start and run engine at idle for a maximum of one minute.

3) Note control pressure and compare to graph. See Fig. 3. At about 68°F (20°C), pressure should read between 18-24 psi (1.3-1.7 kg/cm<sup>2</sup>). If pressure does not read within specifications, replace control pressure regulator.

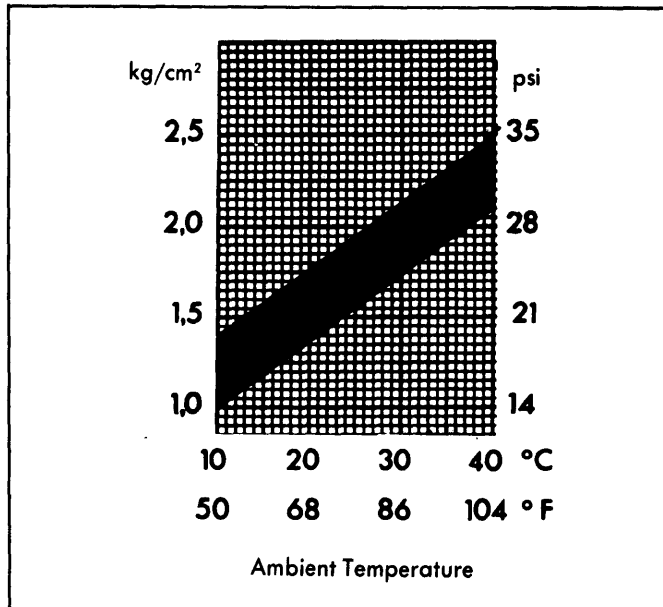


Fig. 3: Cold Engine Control Pressure Test Graph

### WARM ENGINE CONTROL PRESSURE TEST

1) Keep pressure gauge and valve connected in same manner as cold engine control pressure test. Bridge fuel pump relay. Reconnect control pressure regulator unplugged during cold engine control pressure test.

2) OPEN valve at pressure gauge. Start and run engine at idle until fuel pressure stabilizes. Reading should be 48-54 psi (3.4-3.8 kg/cm<sup>2</sup>). If not, replace control pressure regulator.

**NOTE:** On 1978-79 Audi 5000, pressure should be 49-53 psi (3.5-3.8 kg/cm<sup>2</sup>) with control pressure regulator vacuum hose connected; 39-43 psi (2.8-3.1 kg/cm<sup>2</sup>) with vacuum hose disconnected.

### REST PRESSURE TEST

**1978-79 Models** – Perform warm engine control pressure test first. Remove bridge from fuel pump relay. Pressure should drop to 28-37 psi (2.0-2.6 kg/cm<sup>2</sup>). If pressure drops below 28 psi (2.0 kg/cm<sup>2</sup>), fuel pump check valve is probably defective.

### SYSTEM (LINE) PRESSURE TEST

1) Connect and bleed pressure gauge and valve in same manner as for cold engine control pressure test. Keep fuel pump relay bridged. Be sure electrical plugs are connected to control pressure regulator and auxiliary air regulator.

2) Ensure electric fuel pump activates when ignition switch is turned ON and that fuel filter is clean. CLOSE valve at pressure gauge. Start and run engine at idle.

3) System (line) pressure should be 64-74 psi (4.5-5.2 kg/cm<sup>2</sup>). If not, clean, check or adjust fuel distributor pressure regulator (relief) valve. If system pressure is low, check for leaks between fuel pump and control pressure regulator. Also check for defective fuel pump.

4) System pressure may be adjusted by adding to or removing shims from valve. See Fig. 4. Pressure will be changed 1 psi (.06 kg/cm<sup>2</sup>) by a .004" (.1 mm) shim or 4 psi (.3 kg/cm<sup>2</sup>) by a .020" (.5 mm) shim.

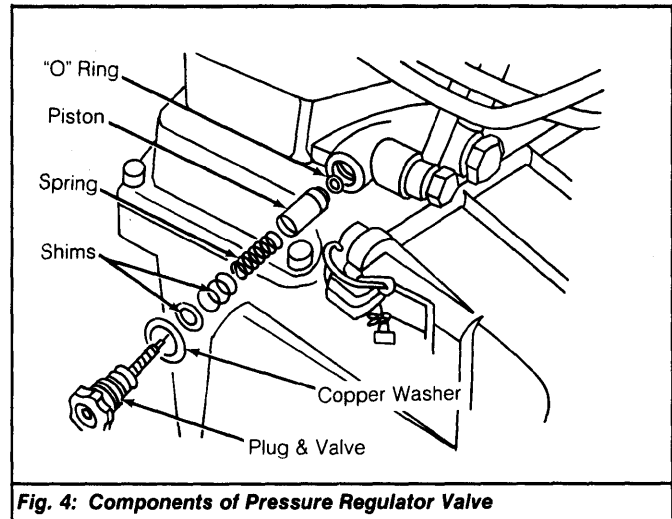


Fig. 4: Components of Pressure Regulator Valve

### LEAK TEST

**1978-79 Models** – 1) Check for correct system (line) pressure. Remove bridge from fuel pump relay and wait 10 minutes. Pressure should hold 25 psi (1.8 kg/cm<sup>2</sup>) for at least 20 minutes. If not, replace fuel pump check valve.

2) If pressure holds, but engine operates with an excessively lean mixture, replace fuel filter and test delivery rate. With filter in good condition and pump running for exactly 30 seconds, delivery volume should be 24 ounces (750 cc).

**NOTE:** With system pressure correct on Audi 5000, pinch intake hose between fuel tank and fuel pump and turn ignition OFF. If pressure does not drop, replace fuel pump check valve. If pressure continues to drop, replace "O" ring in fuel distributor pressure regulator valve.

### COLD START VALVE

**1975-76 Models** – 1) Obtain 2 different colored wires that are at least 30" (760 mm) long. Obtain 2 alligator clips and a female connector that will plug into cold start valve. Fabricate cold start valve jumper wire. See Fig. 5.

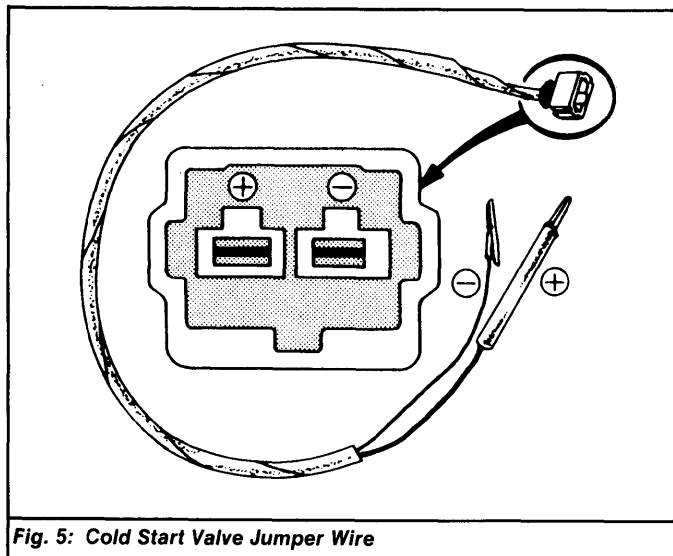
2) Remove cold start valve from engine. DO NOT disconnect fuel line. Place cold start valve into fuel resistant container with nozzle pointing down into container.

**NOTE:** Since thermo-time switch opens cold start valve of a cold engine, ensure switch is properly operating. See THERMO-TIME SWITCH test in this article.

3) Remove connector from cold start valve. Connect one terminal of valve to ignition coil terminal. Connect remaining valve terminal to ground. Remove fuel pump relay from fuse block and connect a jumper wire between terminals No. 13 and 14 marked in fuse block.

4) Disconnect airflow sensor and positive lead at alternator. Have an assistant turn ignition on. Fuel should spray from cold start valve into container in a steady cone-shaped pattern.

5) Disconnect jumper wire at ignition coil and check cold start valve for leaks. With ignition on (fuel pump running). Wipe nozzle of cold start valve dry with clean cloth. No drops of fuel should form on tip of valve within one minute. Replace cold start valve leaks or does not perform as specified.



**Fig. 5: Cold Start Valve Jumper Wire**

- 1977-79 Models** – 1) Unplug connector from cold start valve. Tape connector to prevent accidental sparking. Disconnect air sensor and positive wire from alternator. Disconnect high tension cable from terminal No. 4 of ignition coil so engine will not start.
- 2) Remove cold start valve from engine. DO NOT disconnect fuel line. Place cold start valve into fuel resistant container with nozzle pointing down into container.
- 3) Connect jumper wire from one terminal of cold start valve to ignition coil terminal No. 15. Connect another jumper wire from remaining terminal on cold start valve to a good ground.

**NOTE: Cold start valve receives power from terminal No. 50. All other electrical components of fuel system receive positive current from the fuel pump relay. Terminal No. 30 is permanently connected to battery positive current, terminal No. 50 only while starter is operated, and terminal No. 15 only when ignition is on.**

- 4) Activate fuel pump by removing fuel pump relay and bridging pump relay terminals No. 13 and 14. Turn ignition on. Fuel should spray from cold start valve into container in a steady cone-shaped pattern.
- 5) Turn ignition off (fuel pump running). Wipe nozzle of cold start valve dry with clean cloth. No drops of fuel should form on tip of valve within one minute. Replace cold start valve leaks or does not perform as specified.

### THERMO-TIME SWITCH

**1975-76 Models** – With engine cold, unplug cold start valve and control pressure regulator. Connect voltmeter across disconnected plug of cold start valve. Start engine and check that circuit is closed (meter indicates voltage). If meter does not indicate voltage, replace thermo-time switch.

- 1977-79 Models** – 1) Ensure coolant temperature is below 95°F (35°C) on Volkswagen and 104°F (40°C) on Audi. Unplug cold start valve on end of intake manifold. Disconnect terminal No. 4 on ignition coil.
- 2) Connect test light across harness plug terminals. Operate starter for 15-20 seconds. Test light should come on for 1-8 seconds, then become noticeably dimmer or go out.
- 3) If test light does not glow, attach leads to ground and one terminal of harness plug. Operate starter. If test light does not glow, repeat test with leads reversed (connected to other terminal and ground).
- 4) If test light does not glow, wiring to starter solenoid is defective. If test light glows without starter operating, wires may be reversed at starter solenoid (wire for terminal No. 50 may be on terminal No. 30).
- 5) If voltage is reaching test light, but test light did not glow for the 1-8 seconds when starter was operated for 15-20 seconds in step 2), replace thermo-time switch.

### AUXILIARY AIR REGULATOR

**1978-79 Audi** – 1) With engine cold, unplug connector from auxiliary air regulator. Start engine and check idle speed. Pinch hose from auxiliary air regulator to rubber air duct. Idle speed should drop.

2) Reconnect electrical connector to auxiliary air regulator. Repeat test with a warm engine. Idle speed should remain constant with hose pinched. If not, replace auxiliary air regulator.

**1975-77 Models & 1978-79 Volkswagen** – 1) With engine cold, disconnect both hoses from auxiliary air regulator. Unplug control pressure regulator, mixture control unit, and positive wire from alternator. Turn ignition on.

2) With aid of a mirror and light, observe gate valve opening in regulator. Valve should be OPEN. Run and warm up engine at idle. Observe gate valve as engine warms up. Valve should close within 5 minutes.

3) If valve does not close in allotted time, shut engine off and unplug connector at auxiliary air regulator. Measure resistance across regulator terminals for 30 ohms.

4) If ohmmeter reads infinity or considerably below 30 ohms, replace regulator. If within specifications, check for voltage at plug. If none, check power relay or pump relay.

### CONTROL PRESSURE REGULATOR

**1975-76 Models** – Disconnect control pressure regulator and check for at least 11.5 volts at plug. Disconnect air sensor and positive lead at alternator. Connect ohmmeter between pressure regulator positive terminals and ground. If ohmmeter indicates infinity, replace pressure regulator.

**1977-79 Models** – 1) Unplug airflow sensor and positive wire from alternator. Install pressure gauge and set valve to OPEN. See TEST EQUIPMENT HOOK-UP in this article. Turn ignition on, without starting engine.

2) Unplug control pressure regulator and measure voltage at plug. If none, check power relay and fuel pump relay (if equipped). If voltage is available at pump relay, problem lies with wire connecting control pressure regulator and pump relay.

3) If voltage is reaching regulator plug, check resistance across regulator terminals for 20 ohms. If resistance varies greatly, replace control pressure regulator.

### INJECTOR NOZZLES

**CAUTION: Do not allow open flame or sparks in area while testing and servicing fuel system components, to avoid possibility of fire or explosion.**

1) Remove one injector from manifold tube, leaving fuel hose attached to injector. Pull injector straight out. Disconnect high tension cable from terminal No. 4 of ignition coil to prevent engine from starting.

2) Point injector into a glass jar. Have an assistant operate starter for 15 seconds while you observe spray pattern. Spray pattern which should be steady and cone-shaped.

3) Turn ignition off. Hold injector horizontally. No fuel should drip from injector nozzle tip. Repeat test for each injector. Replace injectors that do not perform as specified.

**NOTE: When installing injectors, soak rubber seals in gasoline briefly. Be sure injectors are fully pressed into seat.**

### DECELERATION VALVE

**1978-79 Audi Federal Man. Trans. Equipped Models Only** – 1) Disconnect and plug hose from side of deceleration valve. Start and run engine for a few seconds at 3000 RPM. Let throttle snap close and check for suction at connection where hose was removed.

2) Remove vacuum hose at "T" fitting and plug hose. Start and run engine for a few seconds at 3000 RPM. Let throttle snap close. No suction should be felt where first hose was removed. If so, replace deceleration valve.

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## Bosch CIS Fuel Injection – Audi & Volkswagen (Cont.)

### REMOVAL & INSTALLATION

#### MIXTURE CONTROL UNIT

**Removal & Installation** – 1) Disconnect negative battery cable and relieve fuel pressure. Clean fuel line connections and disconnect them, tagging each one to ensure correct installation.

2) Disconnect air duct from air sensor and throttle valve housing. Use tip of screwdriver to snap loose retainers holding bottom part of air cleaner. Prevent unit from falling.

3) Carefully remove mixture control unit, taking care that fuel does not spill on engine or electrical connections. To install, reverse removal procedure.

#### FUEL DISTRIBUTOR

**Removal & Installation** – 1) Disconnect negative battery cable and relieve fuel pressure. Clean and remove fuel lines at fuel distributor. Remove fuel distributor retaining bolts.

2) Carefully lift fuel distributor up and away. Use care to avoid dropping control plunger from underside of fuel distributor. To install, reverse removal procedure.

3) If control plunger has been removed, dampen with fuel before installing. Small shoulder of plunger must be inserted first. Install fuel distributor using new "O" rings.

#### CONTROL PRESSURE REGULATOR

**Removal & Installation** – Disconnect negative battery cable and relieve fuel pressure. Clean fuel lines and disconnect. Unplug connector from regulator. Remove 2 screws holding regulator to engine block. Remove regulator and gasket. To install, reverse removal procedure.

#### AUXILIARY AIR REGULATOR

**Removal & Installation** – Remove vacuum hose connections to valve. Unplug electrical connector(s). Remove 2 screws holding regulator to manifold tube of the intake air distributor. To install, reverse removal procedure.

#### THERMO-TIME SWITCH

**Removal & Installation** – 1) Relieve cooling system pressure. Drain enough coolant from system to bring level below that of thermo-time switch. Switch is located on coolant adapter on engine block. On 1975 100 models, switch is located on temperature transmitter housing (behind temperature transmitter).

2) Unplug electrical harness from thermo-time switch. Using a deep well socket, remove thermo-time switch. To install, reverse removal procedure. Apply sealer around threaded part of new switch.

#### COLD START VALVE

**Removal & Installation** – 1) Disconnect negative battery cable and relieve fuel pressure. Cold start valve is bolted to intake manifold, behind throttle valve housing.

2) Clean around fuel line and remove line from valve. Unplug connector from cold start valve. Remove bolt(s) holding cold start valve and lift out valve. To install, reverse removal procedure.

#### INJECTORS

**Removal & Installation** – 1) Disconnect negative battery cable and relieve fuel pressure. Clean fuel line connection at injector thoroughly. Remove fuel line from injector.

2) Pull steadily upward on injector to remove. To install, reverse removal procedure. Be sure new "O" rings are soaked in gasoline for a few minutes prior to installation.

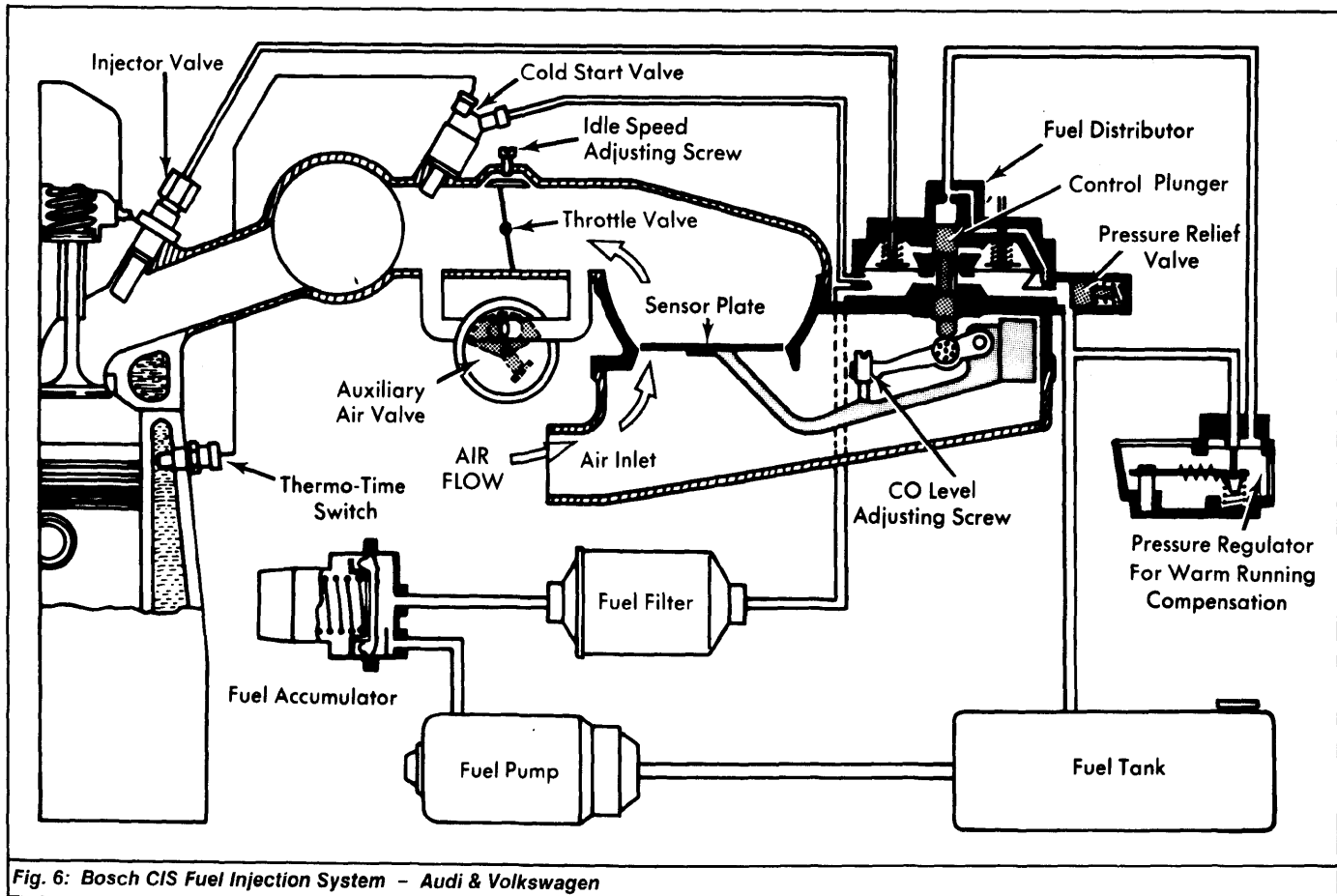


Fig. 6: Bosch CIS Fuel Injection System – Audi & Volkswagen