## BOSCH CIS INJECTION SYSTEM – AUDI & VOLKSWAGEN

**Audi (Federal Only)**
**4000**
**5000**
**Volkswagen (Federal Only)**
**Dasher**
**Jetta**
**Rabbit**
**Rabbit Pickup**
**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 air flow 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. See *Fig. 6*.

Main components of the CI System are: Control Pressure Regulator, Air Sensor, Fuel Distributor, Thermo-Time Switch, Auxiliary Air Regulator, Cold Start Valve and Injectors, Electric Fuel Pump, Fuel Accumulator, Auxiliary Air Valve and a hot start pulse relay.

### TESTING

CAUTION – *Before making any electrical tests on an engine that is not running, but has ignition "ON", disconnect positive wire from alternator and high tension cable from terminal 4 of ignition coil.*

NOTE – *Cold start valve receives power from terminal 50. All other electrical components of fuel system receive positive current from the pump relay. Terminal 30 is permanently connected to positive current, terminal 50 only while starter is operated (connected to control circuit of starter); and terminal 15 only when ignition is ON.*

#### FUEL PUMP OPERATION

1) Remove fuel pump relay. Install bridging adaptor (US 4480/3) or connect a fused jumper wire between sockets in relay board (L13 and L14) that correspond to terminals 30 and 87 on relay.

2) Fuel pressure should climb to 49-54 psi (3.4-3.8 kg/cm²). With switch off or jumper removed, pressure should be 28-37 psi (2.0-2.6 kg/cm²).

#### MIXTURE CONTROL UNIT (AIR FLOW SENSOR)

1) Activate fuel pump with bridging adaptor switch (US4480/3). Leave ignition OFF. Remove air duct assembly.

2) Lift sensor plate with magnet or by hand until it is slightly unseated. Gradually raise plate to limit of upward travel.

3) 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.

4) Ensure sensor plate is centered in inlet cone. If adjustment is needed, use suitable tool (1109 or equivalent) or insert a .004" (.10 mm) feeler gauge around outside of sensor plate while in seated position. Centering bolt should be slightly loosened. Apply Loctite to threads and tighten bolt after adjustment.

5) If plate cannot be centered and lever appears off center, remove air sensor housing and clamping bolt on lever counterweight. Coat bolt with Loctite, install finger tight, and center lever. Tighten bolt and check lever position.

6) To adjust sensor plate height, run engine until warm, then turn engine off. Remove rubber boot and check plate level. Bend clip up or down carefully until plate is even with bottom rim of air cone. Readjust CO% and idle after moving sensor plate. See *Fig. 2*.

7) Run fuel pump for a few seconds. Using strong magnet or small pliers, move plate up and down. It should move in both directions without sticking or binding. If plate sticks while moving upward, fuel distributor plunger may be at fault.

8) Remove fuel distributor from air sensor housing. Check plunger for free movement, being careful not to drop it. Wash in solvent, then lubricate with gasoline and be sure "O" ring is seated properly. If plunger still hangs up, fuel distributor must be replaced.

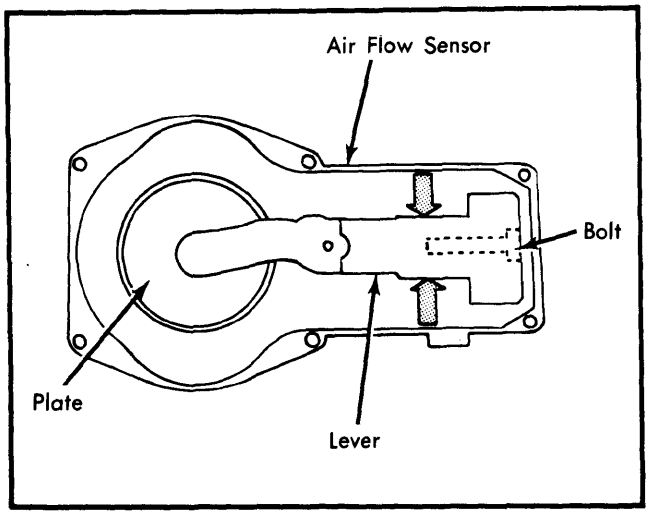


***Fig. 1 Sensor Plate Lever Location***

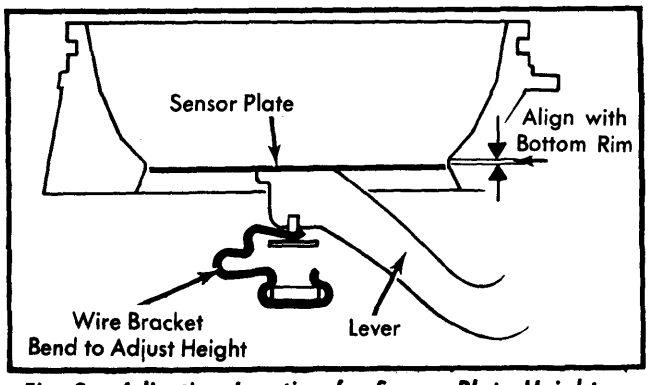


***Fig. 2 Adjusting Location for Sensor Plate Height***

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### INSTALLING AND BLEEDING PRESSURE GAUGE AND VALVE

NOTE – *Before any pressure tests can be completed, it is necessary to install and bleed air from a gauge and valve, such as VW1318 or P378.*

1) Although pressure testing valves and gauges may appear identical to those pictured in this article, DISREGARD handle position shown when making pressure tests on fuel system.

NOTE – *Valves from the same manufacturer may appear the same, but may vary in interior design. When checking rest pressure or control pressure (either cold or warm), be sure valve on tester is OPEN. When checking system (line) pressure, be sure valve is CLOSED.*

2) Install gauge and valve between control pressure regulator and fuel distributor, with valve toward control pressure regulator.

3) To bleed air from valve, hang gauge downward below valve and connecting lines. Open and close valve 4 or 5 times at 10 second intervals. Raise gauge so that it is now above valve and lines and proceed with testing.

### COLD ENGINE CONTROL PRESSURE TEST

NOTE – *Engine must be cold for this test, preferably having set overnight at test site without operation.*

1) Install pressure gauge and valve in fuel line between fuel distributor and control pressure regulator.

2) Valve assembly should be on control pressure regulator side of gauge. *See Fig. 3*.

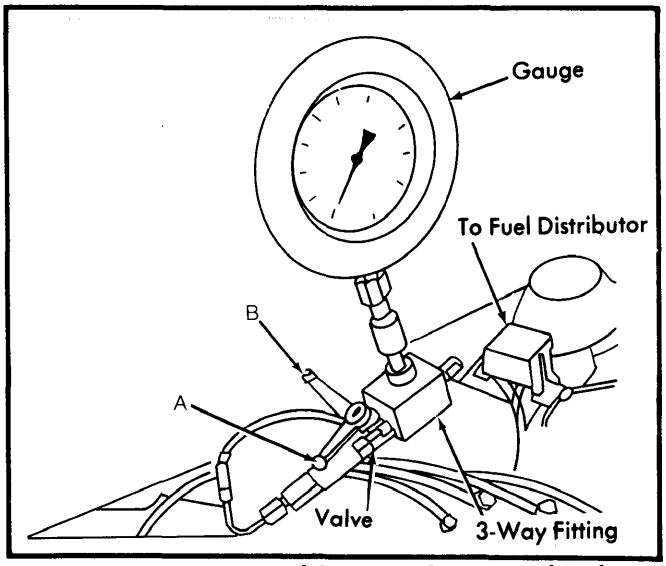


***Fig. 3 Connecting Fuel Pressure Gauge and Valve To Test Control Pressure***

3) Turn ignition ON. With fuel pump running, bleed and then OPEN valve.

4) Unplug electrical connectors from control pressure regulator and auxiliary air regulator. Start engine and idle for maximum of one minute.

5) Note control pressure and refer to graph in *Fig. 4*. At normal room temperature, about 68° F (20° C), pressure should read between 18-24 psi (1.3-1.7 kg/cm²).

6) If pressure does not read within specifications, replace control pressure regulator.

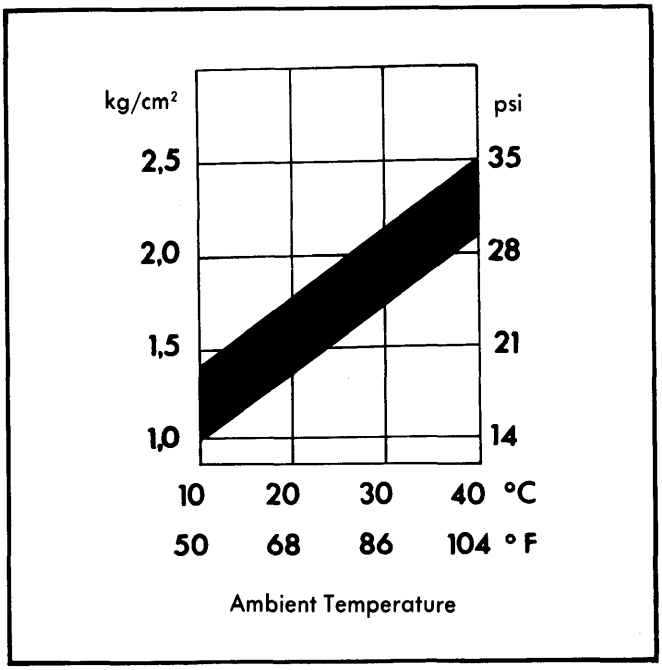


***Fig. 4 Graph Showing Cold Control Pressure at Various Temperatures***

### WARM ENGINE CONTROL PRESSURE TEST

NOTE – *Connect pressure testing gauge and valve in same manner as for Cold Engine Control Pressure Test. Keep pump relay bridged.*

1) Be sure to connect control pressure regulator electrical plug, previously removed. OPEN valve. *See Fig. 3.*

2) Start engine and idle until fuel pressure stabilizes. Reading should be 48-54 psi (3.4-3.8 kg/cm²).

NOTE – *On Audi 5000, pressure should be 49-53 psi (3.5-3.8 kg/cm²) with control pressure regulator vacuum hose connected; 39-43 psi (2.8-3.1 kg/cm²) with hose disconnected.*

3) If control pressure does not increase enough, remove plug from control pressure regulator and connect a test lamp across terminals. If lamp does not light, either power or ground connection is bad. If lamp lights with engine idling and pressure is too low, replace regulator.

### SYSTEM (LINE) PRESSURE TEST

NOTE – *Connect and bleed pressure gauge and valve in same manner as for Control Pressure Test. Keep fuel pump relay bridged. Be sure electrical plugs are connected to control pressure regulator and auxiliary air regulator.*

1) Ensure electric fuel pump activates when ignition switch is turned ON and that fuel filter is clean.

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2) CLOSE valve *(Fig. 3)*. Start engine and run at idle.

3) System (line) pressure should be 64-74 psi (4.5-5.2 kg/cm²). If not within specifications, clean, check and adjust fuel distributor pressure regulator (relief) valve.

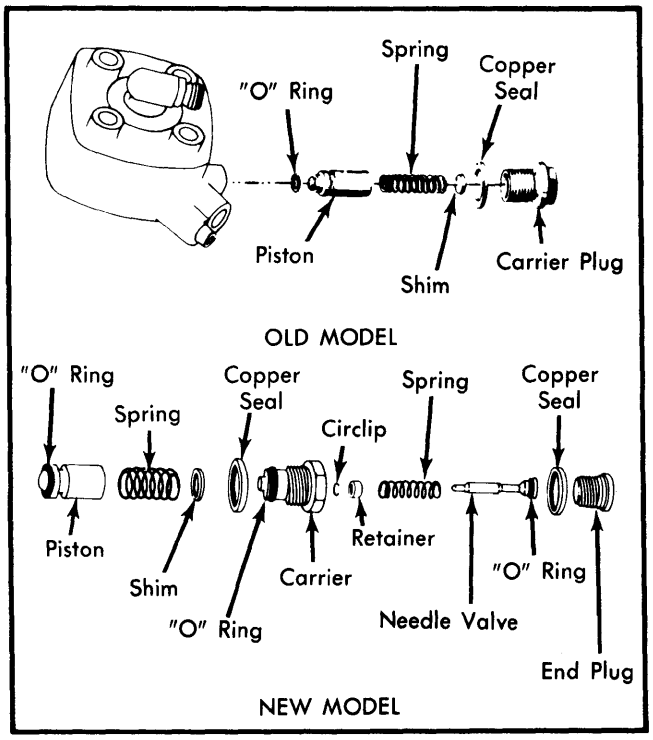


***Fig. 5 Components of Pressure Regulator Valve***

4) System pressure may be adjusted by adding to or removing shims from valve. See *Fig. 5*. Pressure will be changed 1 psi (.06 kg/cm²) by a .004" (.1 mm) shim or 4 psi (.3 kg/cm²) by a .020" (.5 mm) shim.

5) If system pressure is low, check for leaks between fuel pump and control pressure regulator. Also check for defective fuel pump.

### LEAK AND FLOW RATE TEST

1) Check for correct system (line) pressure, bleed pressure gauge, then move lever to OPEN position. Gauge should read 49-54 psi (3.4-3.8 kg/cm²). Turn engine "OFF"; pressure should drop to a maximum of 37 psi (2.6 kg/cm²).

2) If pressure is too high, readjust system pressure and retest. Pressure should hold at a minimum of 26 psi (1.8 kg/cm²) after 10 minutes, and 23 psi (1.6 kg/cm²) after 20 minutes.

3) If pressure drops too much, restart and warm-up engine. Turn engine off, pinch off hose between fuel tank and pump, and recheck pressure drop. If pressure is now okay, pump check valve is leaking. If not, check relief valve in mixture control unit, or leaking injectors or cold start valve.

4) Test fuel pump flow rate by removing return line at fuel distributor and placing open end in container. With pump running for exactly 30 seconds, flow should measure 24 oz. (750 cc) on pump with push-on terminals, or 30 oz. (900 cc) on pump with bolt-on terminals.

### PULSE RELAY & COLD START VALVE

1) Disconnect high tension wire 4 from distributor and connect to ground. Remove cold start valve, but leave fuel line and wiring connected. Point valve into container.

2) With engine coolant below 90°F (35°C), crank engine with starter. Valve should spray for 1-8 seconds in cone-shaped pattern, then stop spraying momentarily. Valve should continue to spray periodically in pulses as starter is operated.

3) With engine warmed up, valve should spray fuel after 2 seconds, then stop. It will begin to spray periodically in pulses if the engine is still cranked.

4) If spray does not pulse, check for open or shorted wires. If wiring is good, replace pulse relay.

### AUXILIARY AIR REGULATOR

NOTE – *Test must be performed on cold engine only.*

1) Remove electrical connector from auxiliary air regulator. Start engine and run at idle. Pinch either hose at auxiliary air regulator. Idle speed should drop slightly.

2) Reconnect plug at auxiliary air regulator and warm up engine. Pinch either hose at regulator; idle speed should not change.

3) If idle speed decreases when hose is pinched, disconnect electrical connector and connect a test lamp across terminals. If test lamp is lit with engine running, auxiliary air regulator must be replaced.

4) If voltage is reaching regulator plug, check resistance across regulator terminals. Resistance should measure 16-22 ohms on all models. If resistance varies, replace control pressure regulator.

### CONTROL PRESSURE REGULATOR

1) Check control pressure regulator (cold and warm). If not to specifications, replace regulator.

2) Disconnect electrical plug from air flow sensor and the positive wire from alternator. Install pressure gauge and set valve to open. Turn ignition ON without starting engine.

3) Disconnect electrical plug from control pressure regulator and measure voltage at plug. If none, check power relay and pump relay. If voltage is available at pump relay, problem lies with wire connecting control pressure regulator and pump relay.

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

## BOSCH CIS INJECTION SYSTEM – AUDI & VOLKSWAGEN (Cont.)

### INJECTOR NOZZLES

NOTE – *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 4 of ignition coil to prevent engine from starting.

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

3) Turn ignition switch OFF. Hold injector horizontally. No fuel should drip from injector nozzle. If injector does not perform to specifications, replace it. Repeat test for each injector.

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

## REMOVAL & INSTALLATION

### MIXTURE CONTROL UNIT

CAUTION – *On all models, disconnect battery ground cable and relieve fuel pressure before removing mixture control unit.*

1) Clean all fuel connections completely and disconnect them, tagging each one to insure correct installation later.

2) Disconnect air duct from air sensor and throttle valve housing.

3) Use tip of screwdriver to snap loose the retainers holding bottom part of air cleaner. Prevent unit from falling. Carefully remove mixture control unit, taking care that fuel does not spill on engine or electrical connections.

4) To install, reverse removal procedure. Use new gasket beneath upper section of mixture control unit.

### FUEL DISTRIBUTOR

CAUTION – *On all models, disconnect battery ground cable and relieve fuel pressure before removing fuel distributor.*

1) 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 control plunger falling out from underside of fuel distributor.

3) If control plunger has been removed, dampen with fuel before installing.

NOTE – *Small shoulder of plunger must be inserted first.*

4) Install fuel distributor using new O-rings.

### CONTROL PRESSURE REGULATOR FOR WARM RUNNING COMPENSATION

CAUTION – *On all models, disconnect battery ground cable and relieve fuel pressure before removing control pressure regulator.*

1) Clean fuel lines and disconnect. Remove electrical connections to regulator.

2) Remove two screws holding regulator to engine block. Remove regulator and gasket.

3) To install, reverse removal procedure, using new gasket.

### AUXILIARY AIR REGULATOR

1) Remove vacuum hose connections to valve. Remove electrical connection(s).

2) Remove two screws holding regulator to No. 4 cylinder manifold tube of the intake air distributor.

3) To install, reverse removal procedure.

### THERMO-TIME SWITCH

1) Relieve any cooling system pressure and drain enough coolant from system to bring level below that of time switch.

2) Switch is located on coolant adaptor on engine block. Unplug electrical harness plug from thermo-time switch.

3) Using a deep socket (to avoid damaging electrical terminals on top of switch), remove thermo-time switch.

4) To install switch, reverse removal procedure. Suitable sealing compound may be needed to ensure proper seal of new switch.

### COLD START VALVE

CAUTION – *On all models, disconnect battery ground cable and relieve fuel pressure before removing cold start valve.*

1) Cold start valve is bolted to intake manifold behind throttle valve housing. Clean around fuel line and remove line from valve.

2) Remove electrical connector from cold start valve.

3) Remove bolt(s) holding cold start valve and lift out valve.

4) To install, reverse removal procedure.

### INJECTORS

CAUTION – *On all models, disconnect battery ground cable and relieve fuel pressure before removing injectors.*

1) Clean fuel line connection at injector thoroughly. Remove fuel line from injector with special tool (P384) or equivalent.

2) Pull steadily upward on injector to remove.

3) To install, reverse removal procedure. Be sure "O" rings are soaked in gasoline for a few minutes prior to installation.

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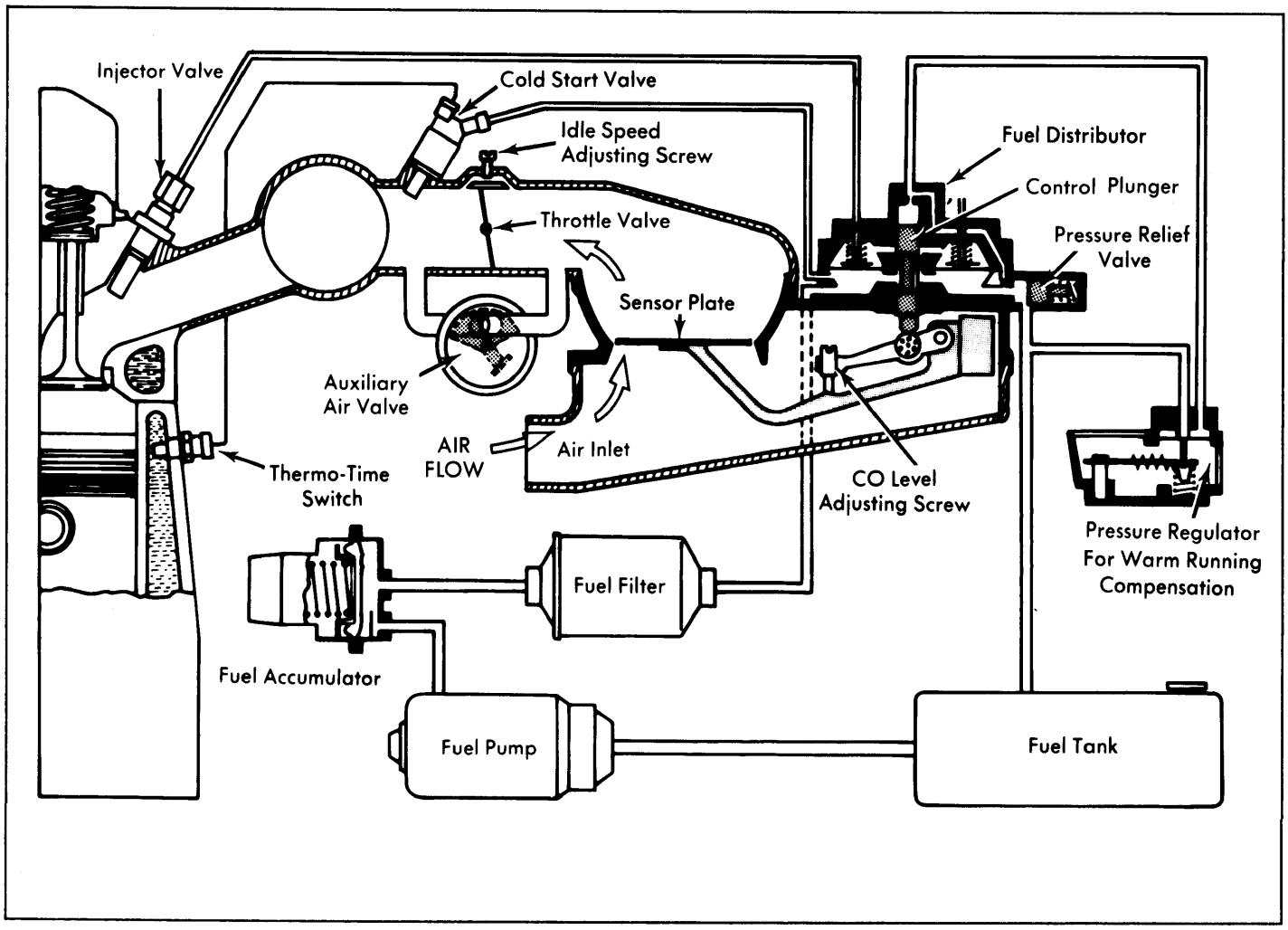


*Fig. 6 Functional Diagram of Volkswagen & Audi Bosch CIS Fuel Injection System*