1974-79 FUEL SYSTEMS
Bosch CIS Fuel Injection – Porsche

Carrera, Turbo Carrera, 911, 911S, 911SC, 924, 928, 930 Turbo

DESCRIPTION & OPERATION

The Bosch Continuous Injection System (CIS) is a mechanical system. Its entire operation is based upon the metering or sensing of the amount of intake air required to run the engine under different conditions. All intake air must pass through the mixture control unit which contains an air sensor plate within a cone shaped venturi.

Sensor plate is movable and is very sensitive to the incoming flow of air. Plate is mounted on a pivoting lever which is connected to a fuel control piston (plunger) in the fuel distributor. As the sensor plate is raised or lowered by differences in amount of air flow, the plunger is raised or lowered in the fuel distributor and determines amount of fuel to be injected into each cylinder.

System is made up of airflow sensor, fuel distributor), control pressure regulator, auxiliary air valve, auxiliary air regulator, thermo-time switch/valve, cold start valve, injectors, electric fuel pump(s), fuel accumulator, a fuel filtering system, and connecting lines and hoses.

On 1978-79 911SC, 928, and 930 Turbo models, the control pressure regulator vacuum connections have been reversed. The tapping below the throttle is now connected to the side of the regulator rather than the top. Control pressure regulators on 911SC and 930 Turbo work differently.

On 1978-79 911SC, when engine is stationary or vacuum is low, control pressure is low. Only the external spring is effective on control valve. At idling, internal spring is activated as diaphragm is lifted by vacuum. Control pressure is increased. Near full throttle, vacuum decreases, the internal spring pressure decreases and control pressure is lowered. Fuel mixture becomes richer.

On 1978-79 930 Turbo, when engine is stationary, during normal operation or at low boost pressures up to about 1.5 psi (.1 kg/cm²), both springs are effective and control pressure is high. A drop in pressure (full throttle enrichment) takes place when a pressure in excess of 1.5 psi (.1 kg/cm²) exists above the diaphragm. Full throttle enrichment cannot be checked until boost pressure reaches about 4.35 psi (.3 kg/cm²).

TEST EQUIPMENT HOOK-UP

INSTALLING PRESSURE TEST GAUGE

1) Install Pressure Gauge (P378) and valve assembly in fuel line, between control pressure regulator and fuel distributor. *See Fig. 1.* Bleed valve before use.

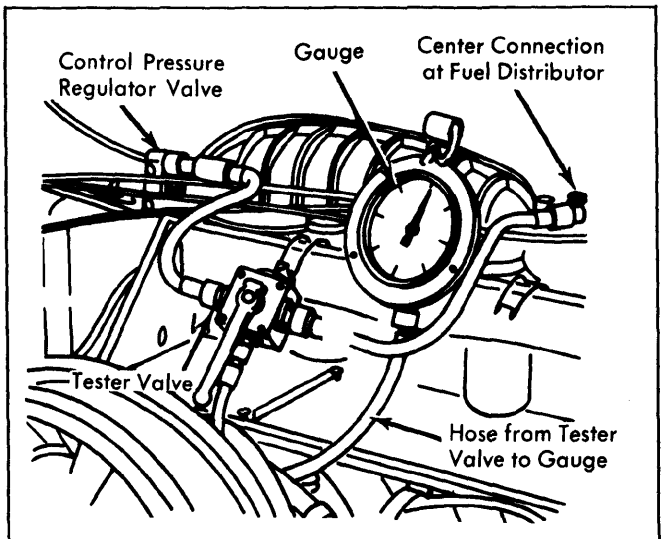

Fig. 1: Pressure Gauge & Valve Assembly

2) Valves from the same manufacturer may appear the same, but may vary in internal design. When checking rest or control pressures, be sure valve on tester is OPEN. When checking system (line) pressure, be sure valve is CLOSED.

NOTE: Be sure to remove bridge (jumper wire) from fuel pump relay upon completion of pressure tests (if used).

TESTING

AIRFLOW SENSOR & MIXTURE CONTROL UNIT

1) On 911 series, 924, and Turbo Carrera, remove air cleaner assembly. Working through air inlet opening, raise sensor plate lever from below. On other models, push down on sensor plate from above. Resistance to sensor plate movement should be even and constant throughout entire range of travel.

NOTE: On 911 series, 924 and Turbo Carrera, air flow is upward around sensor plate. On 928 and 930 Turbo models, air flow is downward. See Fig. 2.

2) On all models, loosen line to control pressure regulator at fuel distributor to relieve fuel pressure. Upper edge of sensor plate should be flush with lip of venturi.

3) On 924 and Carrera, adjust height of sensor plate by bending wire bracket beneath sensor plate. On 911 series, a screw and lock nut assembly is used to adjust sensor plate height. A rubber stopping block limits downward movement of lever.

NOTE: On 928 and 930 Turbo, the spring-loaded sensor plate stop is set at factory and cannot be adjusted.

4) Now check sensor plate position with control pressure applied. Turn ignition on and disconnect airflow sensor. If sensor plate raises slightly on (drops slightly on 911 series, 924 and Carrera) by a maximum of .04" (1 mm), operation is satisfactory.

5) Plate may not move at all under control pressure and this condition is also satisfactory. *See Fig. 2.* If necessary, replace leaf spring on sensor plate stop.

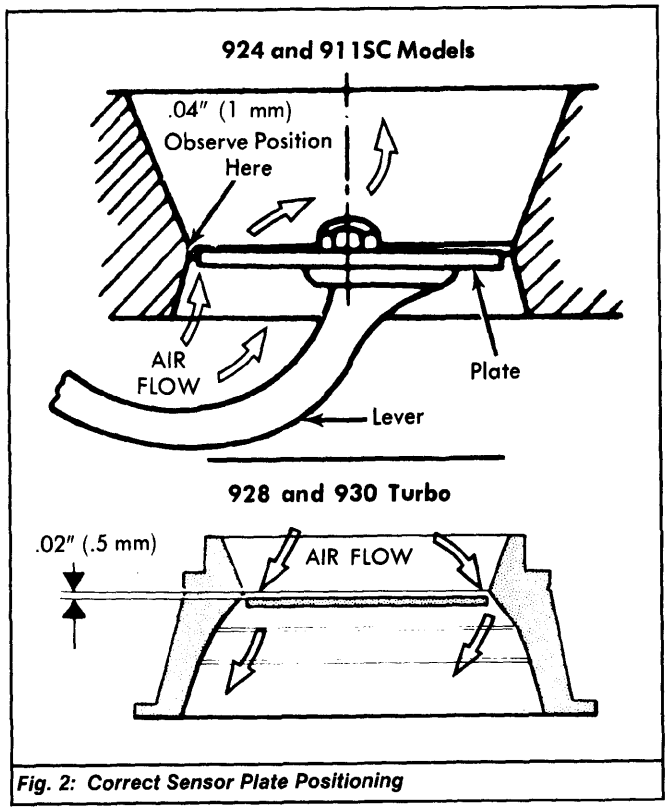

Fig. 2: Correct Sensor Plate Positioning

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1974-79 FUEL SYSTEMS
Bosch CIS Fuel Injection – Porsche (Cont.)

6) To center sensor plate within air cone, remove retaining bolt. Coat bolt threads with locking compound and install bolt finger tight. Using a feeler gauge, center sensor plate so that a .004" (.10 mm) gap exists between plate and air cone wall. Tighten retaining bolt to 43-48 INCH lbs. (4.9-5.4 N.m). Recheck gap after tightening.

COLD ENGINE CONTROL PRESSURE TEST

NOTE: On 930 Turbo, cold engine control pressure cannot be checked due to the design of its control pressure regulator.

1) With engine cold, turn ignition on. Unplug connector at airflow sensor and control pressure regulator. On 928, unplug connector at auxiliary air regulator. Pull out fuel pump relay (in passenger's footwell) and bridge terminals No. 87 and 30 to turn on fuel pump.
2) On all models, open valve and read pressure on gauge. On 928, cold engine control pressure should be as indicated in 928 COLD ENGINE CONTROL PRESSURE TEST table.
3) On all other models, compare readings with cold engine control pressure graph. *See Fig. 3.* If pressures are incorrect, replace control pressure regulator.

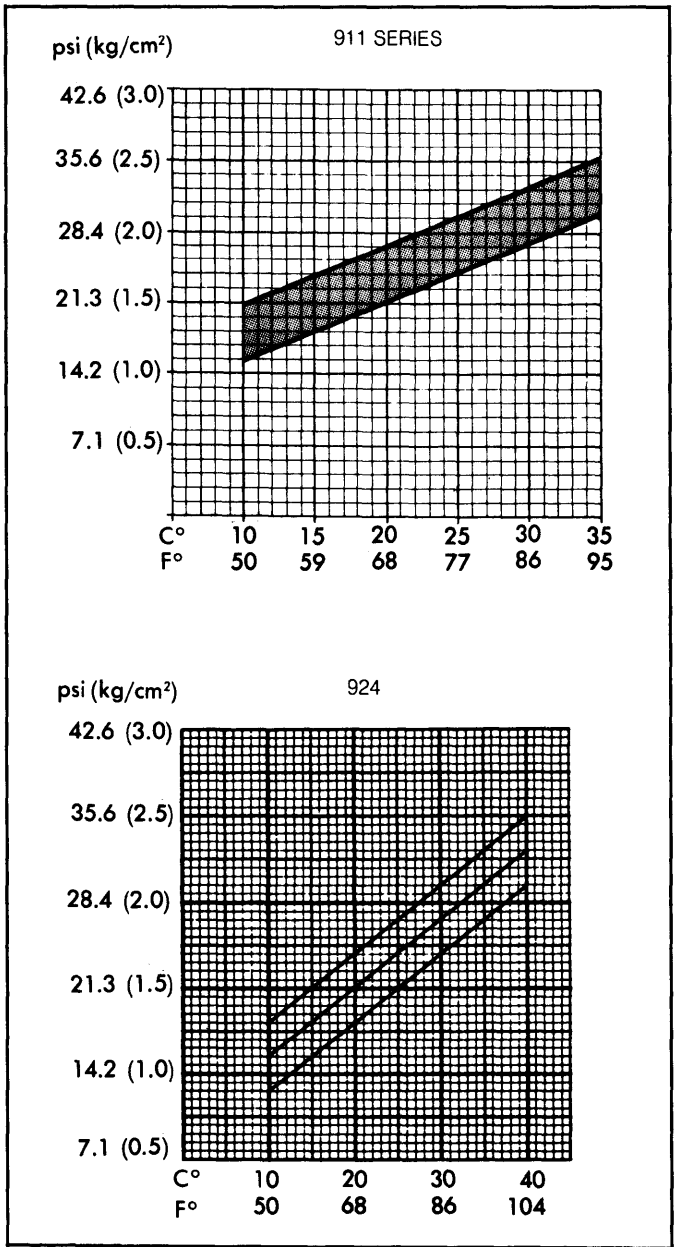

Fig. 3: Cold Engine Control Pressure Graphs

928 COLD ENGINE CONTROL PRESSURE TEST [1]

Application	psi (kg/cm²)
Engine Not Running	16.7-21.0 (1.17-1.48)
Engine At Idle Speed	23.9-28.3 (1.68-1.99)

[1] – Measured at ambient temperature of 68°F (20°C).

WARM ENGINE CONTROL PRESSURE TEST

1974-76 Models – 1) Connect pressure gauge and valve assembly as in cold engine control pressure test. Remove mounting plate cover in engine compartment. Remove right, rear relay from mounting plate and set relay aside.
2) Install a jumper wire across terminals No. 87 and 30 of spare relay, and insert this relay on mounting plate in place of original relay. Turn ignition on (fuel pump should run).
3) Control pressure should rise slowly and attain 40.5-44.7 psi (2.8-3.1 kg/cm²). If pressure fails to reach specified value, replace control pressure regulator. After testing, reinstall original relay on mounting plate.
1977 Models – 1) Connect pressure gauge and valve assembly as in cold engine control pressure test. On Turbo Carrera, unplug mixture control unit connector.
2) Control pressure should increase slowly to 38-44 psi (2.7-3.1 kg/cm²). Time will vary with ambient temperature. If pressure does not reach specified level, replace control pressure regulator.
3) On 911S and 924, be sure that control pressure regulator is connected. Disconnect airflow sensor. Turn ignition on. Allow control pressure regulator to heat up/ When indicator gauge stops rising, take pressure reading. Pressure should be 50-55 pi (3.5-3.9 kg/cm²). If not, replace regulator.
1978-79 Models – 1) Connect pressure gauge and valve assembly as in cold engine control pressure test. Be sure that control pressure regulator is connected. Disconnect airflow sensor. On 928 models, be sure plug to auxiliary air regulator is also installed.
2) On all models, open valve on pressure gauge. Turn ignition on and wait 2-3 minutes. Check pressure with engine stopped. Start and run engine at idle speed until engine reaches normal operating temperature. Check pressure once again. Pressures should be as specified in WARM ENGINE CONTROL PRESSURE TEST table. If not, replace control pressure regulator.

WARM ENGINE CONTROL PRESSURE TEST

Application	Stopped psi (kg/cm²)	Idling psi (kg/cm²)
924	49.3-55.1	49.3-55.1
	(3.47-3.88)	(3.47-3.88)
911SC	39.2-45.0	46.4-52.2
	(2.75-3.16)	(3.26-3.67)
928	41.3-45.7	50.0-54.4
	(2.91-3.21)	(3.52-3.82)
930 Turbo [1]	49.3-55.1	49.3-55.1
	(3.47-3.88)	(3.47-3.88)

[1] – With boost pressure above 4.36 psi (.32 kg/cm²), warm control pressure should be 39.2-45.0 psi (2.75-3.16 kg/cm²). Boost pressure at 4000 RPM should be 11.6-12.6 psi (.82-.89 kg/cm²).

SYSTEM (LINE) CONTROL PRESSURE

1977-79 Models – 1) Connect pressure gauge and valve assembly as in cold engine control pressure test. Be sure fuel supply, fuel pump(s) and filter are in good working order. Close valve on test equipment. Disconnect airflow sensor and turn ignition on.
2) Pressures should be as specified in SYSTEM (LINE) CONTROL PRESSURE TEST table. If not, adjust pressure by adding or removing shims beneath outer spring of pressure regulator (located in fuel distributor housing).

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1974-79 FUEL SYSTEMS
Bosch CIS Fuel Injection - Porsche (Cont.)

SYSTEM (LINE) CONTROL PRESSURE TEST

Application	psi (kg/cm²)
1977 Models	
911S & 924	65.3-75.4 (4.6-5.3)
Turbo Carrera	85-95 (6.0-6.7)
1978-79 Models	
924	65.3-75.4 (4.6-5.3)
911SC	65.3-72.5 (4.6-5.1)
928	72.5-84.1 (5.1-5.9)
930 Turbo	87.0-97.2 (6.1-6.8)

LEAK TEST

1978-79 Models - **1)** Connect pressure gauge and valve assembly as in cold engine control pressure test. Start and run engine until it reaches normal operating temperature. Turn engine off and after 10-20 minute periods, record gauge readings. Pressures should be as specified in LEAK TEST GAUGE READINGS table.
2) If pressure is not maintained after 20 minutes, check for defective "O" ring in pressure regulating valve of fuel distributor. Also check for leaks at fuel pump check valve, cold start valve, control pressure regulator, or accumulator.

LEAK TEST GAUGE READINGS

Application	psi (kg/cm²) After 10 Min.	psi (kg/cm²) After 20 Min.
924	24.7 (1.7)	21.7 (1.5)
928	24.6 (1.7)	21.7 (1.5)
911SC	[1]	[1]
930 Turbo	24.1 (1.7)	21.3 (1.4)

[1] - Information not available from manufacturer.

INJECTOR OPENING TEST

1978-79 Models - Injectors must be tested (after removal from engine), using an injector tester. On 924, opening pressure is 36.26-52.21 psi (2.55-3.67 kg/cm²). On 928, opening pressure is 43.51-59.47 psi (3.06-4.18 kg/cm²). Specifications for 911SC and 930 Turbo not available from manufacturer.

COLD START VALVE & THERMO-TIME SWITCH

1976-77 Models & 1978-79 924 & 928 - **1)** With engine cold, remove cold start valve. DO NOT disconnect wires or fuel line. Disconnect hot lead at ignition coil. Point cold start valve down into fuel resistant container.
2) Have an assistant turn ignition on and operate starter. Valve must spray an even, cone-shaped pattern for about 1-8 seconds. *See Fig. 4.* If not, replace cold start valve.

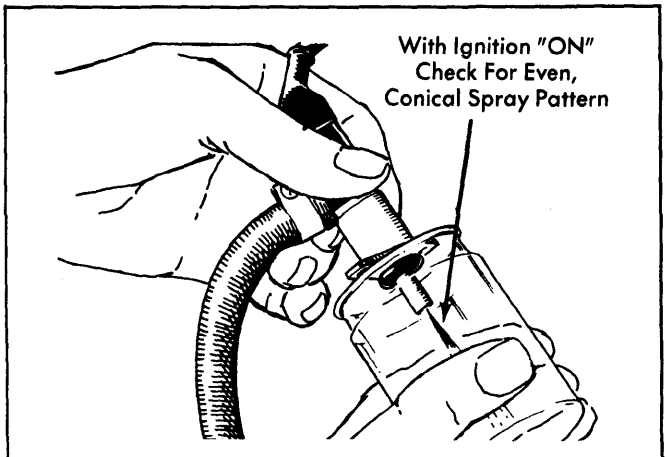

Fig. 4: Testing Cold Start Valve

3) Check valve for leaks by turning ignition on. Disconnect airflow sensor. Fuel pump(s) should still be operating. With clean cloth, wipe cold start valve tip dry. No fuel should leak from valve within one minute. Replace valve if defective.
4) To check thermo-time switch (except Turbo Carrera), unplug cold start valve connector. Attach voltmeter to harness connector. Disconnect hot lead at ignition coil and operate starter. Voltmeter should deflect for about 1-8 seconds. If not, replace thermo-time switch.

NOTE: Ensure that coolant temperature is below 95°F (35°C) when testing thermo-time switch. Above that temperature, thermo-time switch does not operate and cannot be tested with voltmeter.

THERMO-VALVE

1976-77 Carrera & Turbo Carrera - Thermo-valve should be open when cold. Engine should run at increased idle to ensure quick warm-up of thermo reactors. As thermo-valve slowly heats and cuts-off vacuum to air valve, the engine idle speed should drop to normal idle as auxiliary air valve closes. If these conditions occur, the thermo-valve is operating properly. If not, replace thermo-valve.
1977 911S & 1978-79 911SC - Remove vacuum hose from side fitting of control pressure regulator (hose from thermo-valve). Turn ignition on and disconnect airflow sensor. Blow through disconnected hose. Valve should not leak air when closed. At 68°F (20°C), valve should open after 20-33 seconds. Replace valve if faulty.

NOTE: The 930 Turbo thermo-valve is electrically-heated and is controlled by the fuel pump relay. The 911SC has an electrically-heated thermo-valve installed, through a "T" fitting, in vacuum retard line. Vacuum passes through thermo-valve to side inlet of control pressure regulator.

1978-79 930 Turbo - **1)** Thermo-valve should be closed when cold, preventing vacuum from reaching distributor vacuum retard unit. Engine should run for 15-20 seconds at increased idle (approximately 2000 RPM).
2) When engine starts and valve is actuated, vacuum is permitted to reach distributor vacuum retard unit. Idle speed should drop to 950-1050 RPM (normal idle). If these conditions occur, the thermo-valve is operating properly. If not, replace thermo-valve.

AUXILIARY AIR REGULATOR

1978-79 Models - Detach hose at regulator. Using mirror and flashlight, check to see that air passage in regulator is open. *See Fig. 5.* Disconnect airflow sensor and turn ignition on. Air passage in regulator should close after 5 minutes. If not, replace regulator.

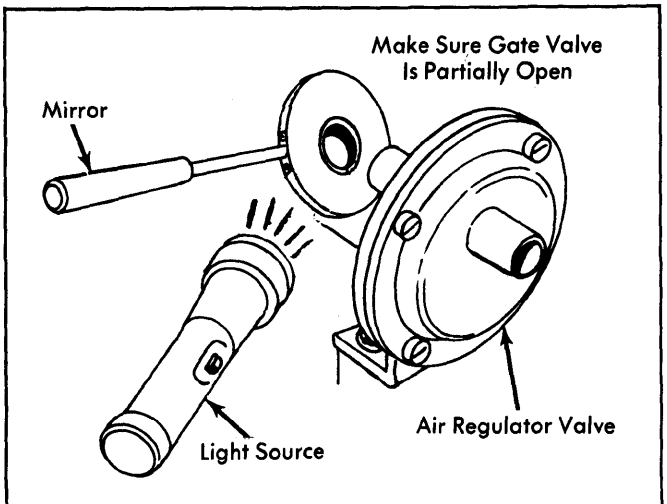

Fig. 5: Checking Auxiliary Air Regulator

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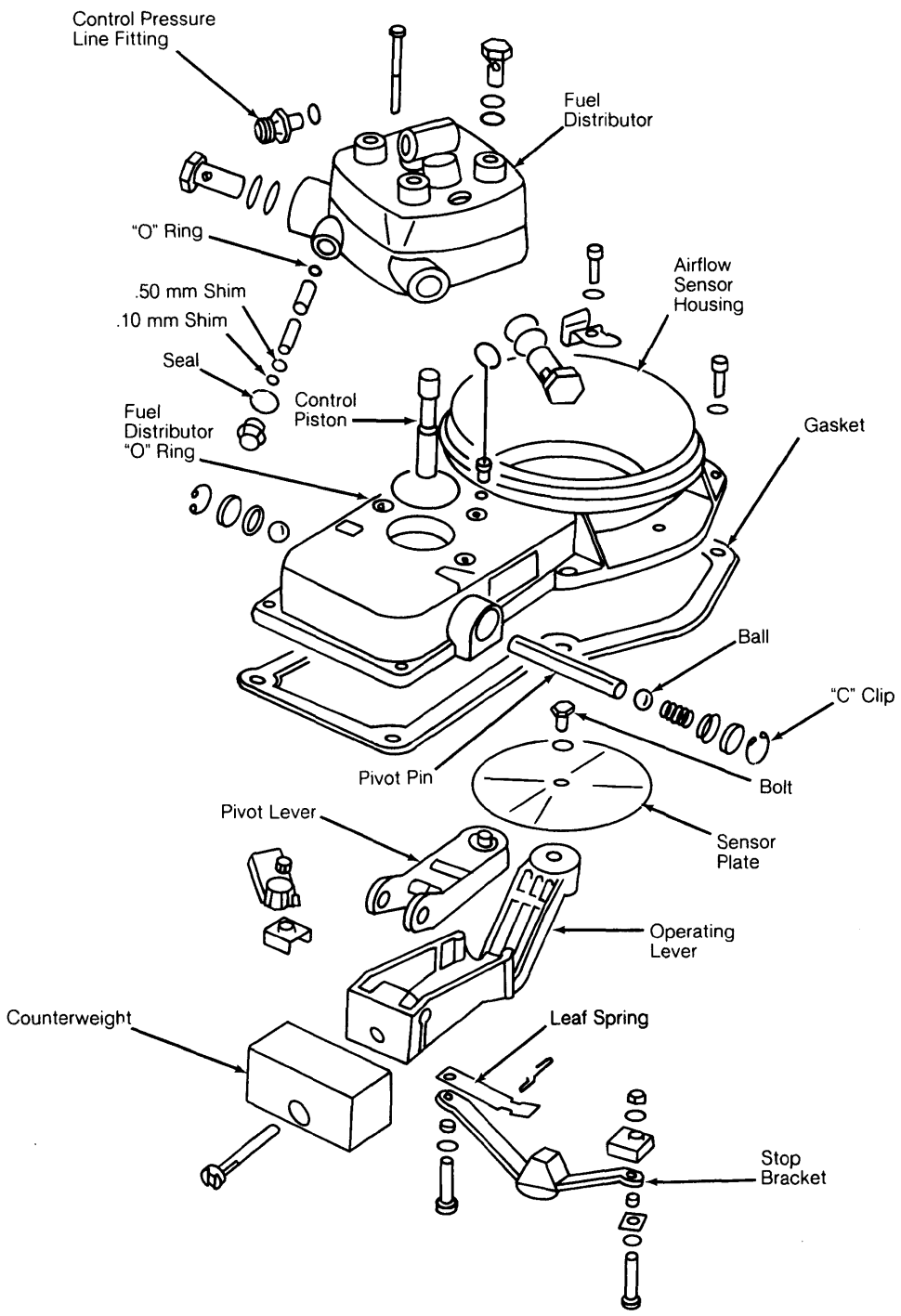

Fig. 6: Exploded View of 924 Mixture Control Unit

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1974-79 FUEL SYSTEMS
Bosch CIS Fuel Injection – Porsche (Cont.)

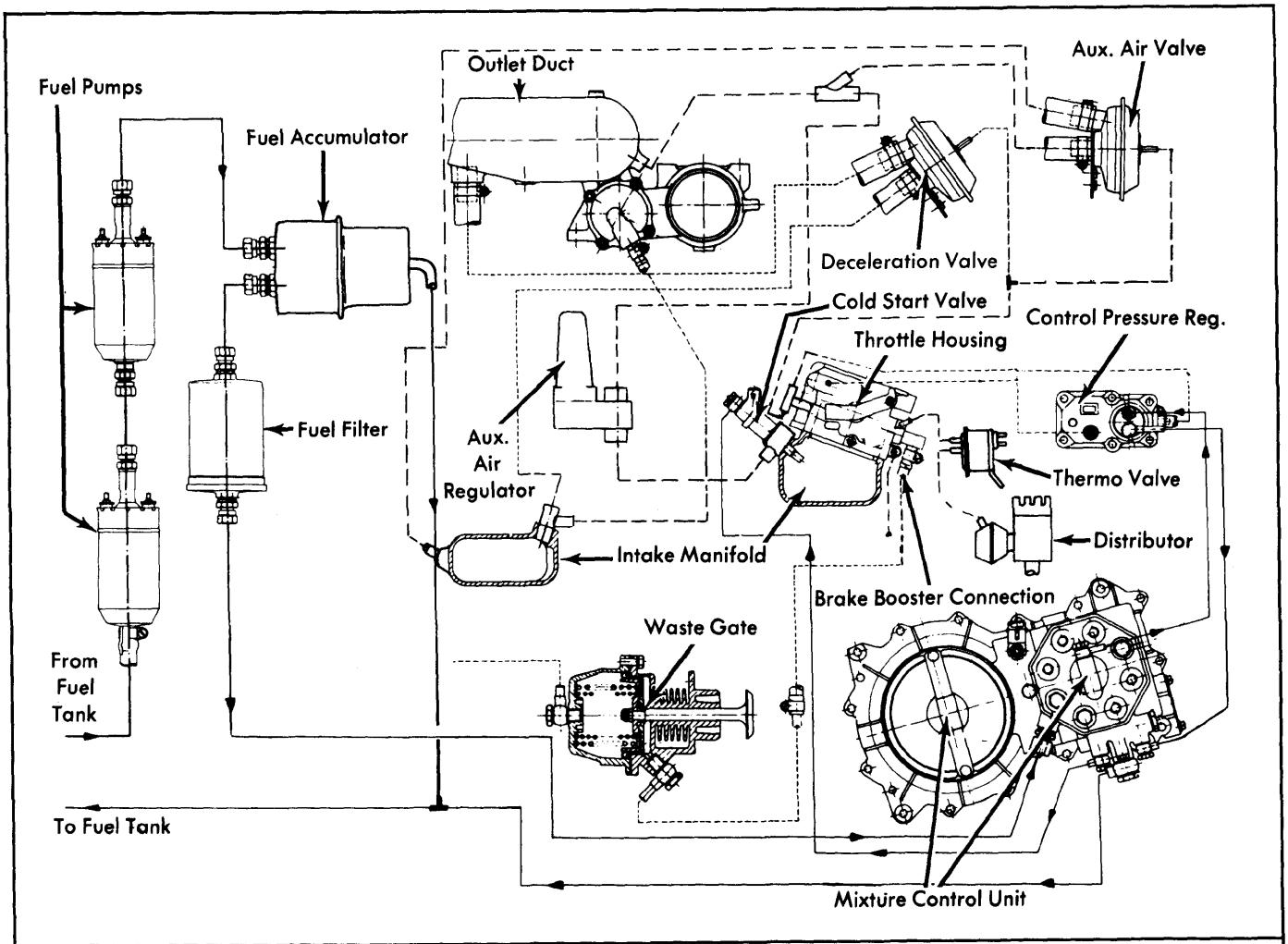

Fig. 7: Bosch CIS Fuel Injection System – Porsche (Typical)

CONTROL PRESSURE REGULATOR

1977-79 Models – 1) Ensure engine oil temperature is above 120°F (50°C) and that engine is fully warmed up. Disconnect wires at control pressure regulator. Disconnect airflow sensor and turn ignition on.
2) Using a voltmeter, check voltage at regulator wires. Voltage should be a minimum of 11.5 volts. Using ohmmeter (ignition off), check resistance of heating coil. Reading should be about 20 ohms. Replace control pressure regulator if defective.

REMOVAL & INSTALLATION

NOTE: Disconnect negative battery cable(s) and relieve fuel pressure before opening fuel system.

MIXTURE CONTROL UNIT

Removal & Installation – 1) Remove rubber boot or air cleaner attachment from air sensor. Clean around all fuel line fittings. Remove fuel line fittings from fuel distributor.
2) Detach wire plugs, loosen (6) Allen bolts and remove mixture control unit. To install, reverse removal procedure. Use new gaskets for housing and a new "O" ring beneath fuel distributor (if removed). *See Fig. 6.*

FUEL DISTRIBUTOR

Removal & Installation – Clean area around fuel fittings and remove. Remove (3) retaining screws from top of fuel distributor. Remove fuel distributor, using care not to drop control piston out from bottom. To install, reverse removal procedure. Ensure control piston is clean. Use new "O" ring seal between fuel distributor housing and mixture control housing.

CONTROL PRESSURE REGULATOR

Removal & Installation – Unplug control pressure regulator connector. Loosen hollow fuel line bolts. Loosen (2) Allen bolts and remove regulator. To install, reverse removal procedure. Tighten hollow bolts to 7 ft. lbs. (9.5 N.m) and upper bolts to 11 ft. lbs. (15 N.m).

AUXILIARY AIR VALVE

Removal & Installation – Unplug connector off auxiliary air valve and loosen hose clamps. Remove Allen screws and auxiliary air valve. To install, reverse removal procedure.

INJECTORS

Removal & Installation – 1) Unscrew coupling nut from injector line. Install Puller (P384) on end of injector and pull straight upward. Remove rubber bushing if it sticks in support sleeve.
2) To install, reverse removal procedure. Use a drop of oil on rubber bushing and install in head. Press injector firmly into support sleeve until it bottoms. Reinstall fuel line and check for leaks.

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