BOSCH CONTINUOUS INJECTION SYSTEM (CIS)

Porsche 911T - Later Models (1973)

DESCRIPTION

The Bosch Continuous Injection System (CIS) is neither a conventional mechanical or electronic fuel injection system. The main function of any carburetor or fuel injection system is to mix air and fuel for the most efficient combustion. In the CIS system, air requirement of engine is measured first and later the necessary fuel is added. Main components of the system are a fuel distributor, air sensor, two control pressure regulators, throttle valve, injection valves and a start valve.

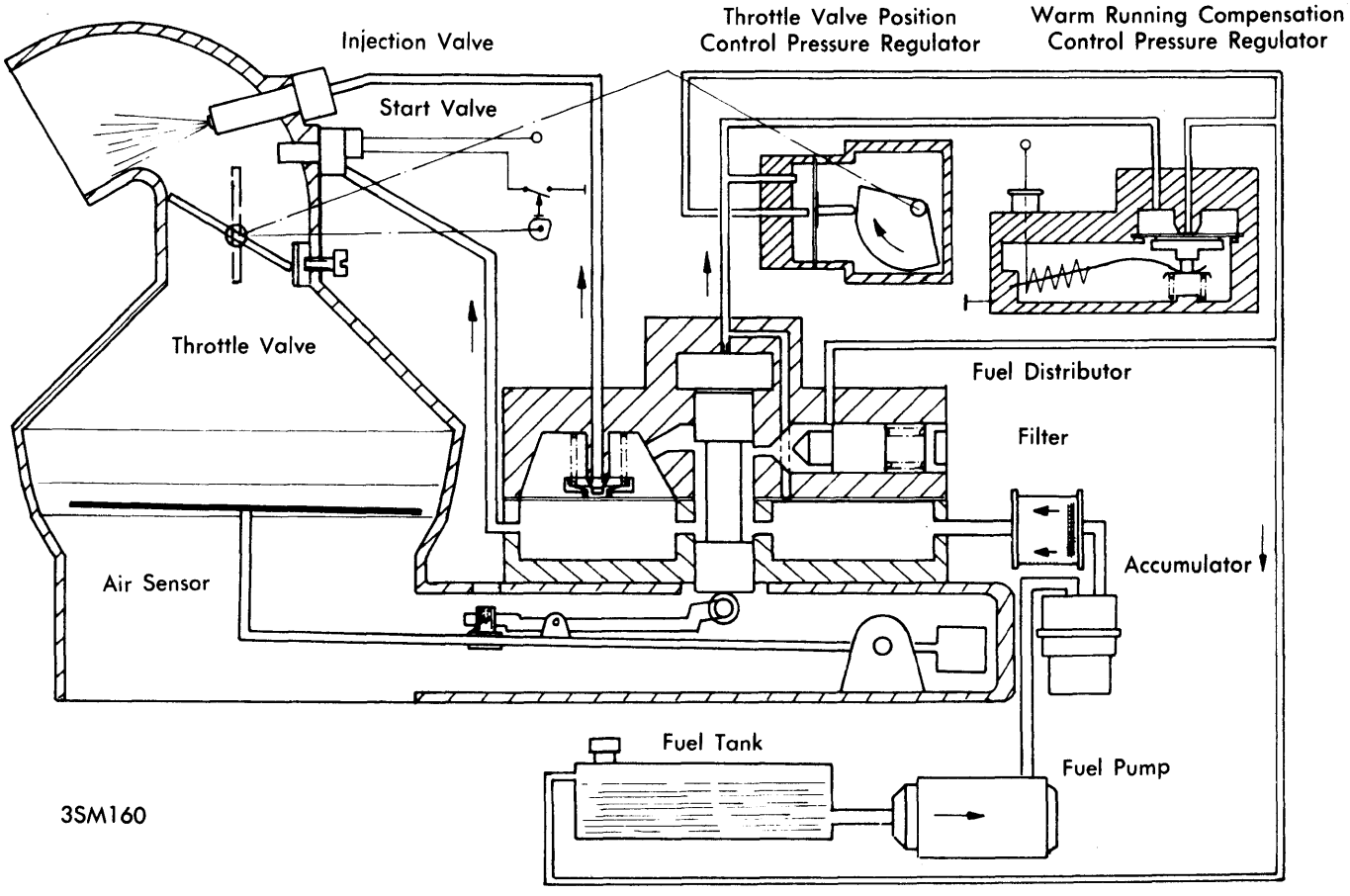
OPERATION

Depending on position of throttle valve, engine draws in more or less air. Ahead of throttle valve is an air funnel and an air flow sensor plate. This air flow plate is mounted on a pivoting lever and is counterbalanced. As more air flows into engine, sensor plate moves upward, thus opening wider a small metering slit, one for each cylinder. The size of the slit opening determines the amount of fuel injected under a constant pressure. In order to maintain a fuel pressure of precisely 4.5 bar (1 bar equals approximately 14.5 psi or 1 kg/sq. cm), a pressure relief valve is located in primary fuel circuit of fuel distributor. Excess fuel is diverted back to fuel tank. To assure that the quantity of fuel flowing through metering slits depends only on open area of slit, a pressure regulating valve (one for each cylinder) is used. In order to further control fuel quantity, counter pressure is used on top of fuel distributor plunger. The higher this pressure, the less the metering slits will be allowed to open and less fuel will be injected. Various control units control this counter pressure and are described below.

Warm Running Compensation Control Pressure Regulator – This device, mounted on engine crankcase, maintains correct air/fuel ratio during engine warm up. This regulator contains a bi-metallic spring connected to a spring loaded diaphragm. When engine is cold, it supplies minimum counter pressure to fuel distributor, thus allowing a richer mixture. As a heating coil in the unit, connected to ignition system, heats up it permits diaphragm to close off outlet opening, thus increasing control pressure to maximum of 3.7± .2 bar, and leaning mixture.

Throttle Valve Position Control Pressure Regulator – This device consists of a cam mounted on throttle shaft and acting on a spring loaded diaphragm. When throttle is at idle position, diaphragm keeps both inlet and outlet sufficiently open to maintain minimum pressure on plunger of 3.0 ± .05 bar. At mid-range throttle opening, control pressure is increased to 3.7 ± .2 bar to lean out mixture as necessary. As throttle is fully opened, pressure is again decreased to 2.9 ± .2 bar, thus slightly enriching mixture.

Starting System – Since air flow created by engine pistons during starting is not sufficient to operate plunger of fuel distributor, an additional start valve is provided in air distributor. Start valve recieves fuel from primary circuit of fuel distributor. This valve is activated whenever engine is cranked with hand throttle fully open. Solenoid of starter valve receives its current from starter circuit by way of a switch on hand throttle.



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Auxiliary Air Bypass – This device ensures a good air/fuel ratio under deceleration. High vacuum created below throttle valve on deceleration opens valve in auxiliary air bypass device. This allows fresh air to bypass closed throttle valve and lean out mixture as necessary.

Fuel Accumulator – This device allows fuel system to remain pressurized for a short period of time after engine is shut off. It also acts as a pressure damper to absorb initial pressure surge at moment ignition is switched on. This unit consists of a container in fuel delivery line with a spring loaded plunger.

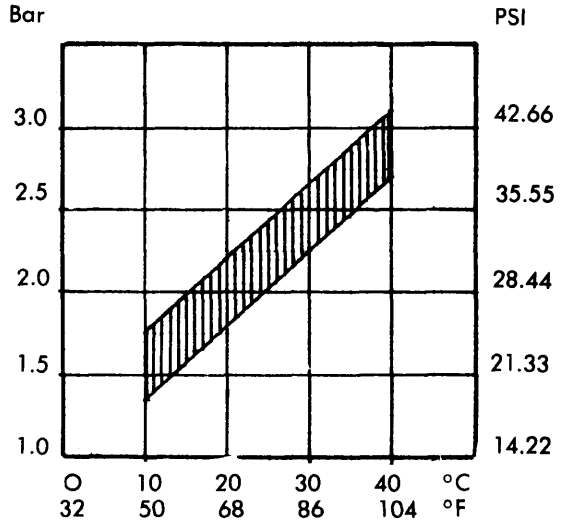
TESTING

Fuel Pump – Check that voltage at fuel pump is a minimum of 11.5 volts and that current draw is approximately 8.5 amps.

Warm Running Compensation Regulator – Check that voltage is a minimum of 11.5 volts. Use a ohmeter to check continuity of heater coil.

Start Valve – Check hand throttle switch by disconnecting start valve connector and connecting test lamp between valve and connector. Pull hand throttle lever all the way out and operate starter. With throttle open, light must light. With throttle closed, light must not light. Remove start valve but leave fuel line connected. Hold valve in a container and connect valve to B+ terminal of fuse box and ground. Switch on ignition briefly. Start valve should emit an even coneshaped spray. After disconnecting power, valve must not show any leakage with ignition ON.

Injection Valves – Opening pressure of injection valves should be 2.4-3.3 bar. Within a set of valves, the opening pressure difference should not exceed .6 bar. With a pressure of .5 bar below injector opening pressure, no droplet must fall for 15 seconds.



3SM162 **TEMPERATURE-PRESSURE CHART**

PRESSURE TESTING

NOTE – Special Porsch tool P378 manometer with three-way valve is necessary for measuring system pressures. To prevent dirt from entering system, clean all connections before disconnecting.

Tool Installation – Install three-way valve of tool in control pressure line at fuel distributor. With tool properly installed, fuel flow should be from fuel distributor, through three-way valve to control pressure regulators. Before checking pressure, bleed manometer lines as follows: Let manometer hang down with straight hoses and turn on ignition. Move lever on three-way valve at 10 second intervals in direction of fuel distributor. Repeat five times. Afterward hang manometer on center brace of engine hood. Complete tests in order indicated.

Engine Cold Test – This test checks rather control pressure is lowered sufficiently during warm up period to enrichen mixture. Set three-way valve to flow through position (valve lever points to manometer). Switch on ignition and open throttle valve about half way. Compare pressure reading with temperature-pressure chart.

Engine Warm Test – Leave three-way valve in flow through position and throttle half open. Disconnect wire from warm running compensation regulator and jumper to B+ terminal of fuse box. Heating element in regulator will begin to heat and as it does control pressure should slowly increase, obtaining a final value to 3.7 ± .2 bar. Bring throttle valve to idle position. Control pressure should now drop to 3.0 ± .05 bar (idle speed enrichment). This value can be adjusted slightly as follows: On control pressure regulator for throttle valve, loosen both screws and turn compensator as much as elongated holes will allow. If pressure cannot be regulated by this method, replace throttle valve compensator. Now, slowly open throttle, control pressure in part load range should increase to 3.7 ± .2 bar. At full throttle, pressure must drop to 2.9 ± .2 bar (full load enrichment). If these values are not reached, replace throttle control pressure regulator. Check warm up and throttle valve regulator for leakage as follows: Loosen return hose on warm-up regulator, raise control pressure to 3.7 bar, switch off ignition and completely disconnect return hose. If pressure remains above 2.5 bar, no leakage is present. If pressure drops to 1.5 to 2.5 bar and no fuel is flowing from return socket of warm up regulator, replace throttle valve regulator. If, however, fuel is flowing from warm up regulator, replace this regulator.

Primary Circuit Pressure – Turn three-way valve lever to closed position (lever points to fuel distributor connection). Turn ignition on. Pressure should raise to 4.5-5.2 bar. Now check seals of control pressure circuit as follows: With control pressure at 3.7 ± .2 bar and throttle half open, close off control pressure circuit (turn lever at three-way valve in direction of control pressure regulators). With ignition switch on, control pressure must not drop below .7 bar in 10 minutes. Pressure tests are now completed. Disconnect tool and reconnect all system connections. Switch on ignition and visually check connections for leaks.

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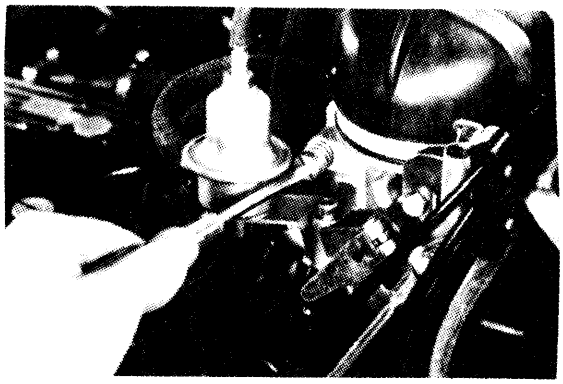
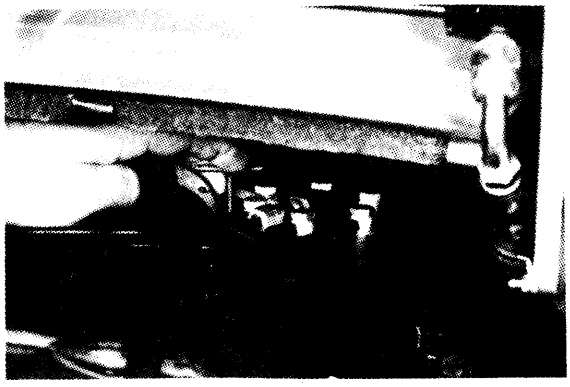
ADJUSTMENT

Idle Speed & Mixture – Make adjustment with engine at normal operating temperature and warm up regulator hot. Adjust idle speed by turning bypass screw at throttle valve housing. Idle speed should be 900 ± 50 RPM (man. trans.) or 950 ± 50 RPM (sportomatic trans.). Adjust mixture by adjusting screw on air sensor lever using adjusting wrench P 377.



3SM163 **ADJUSTING IDLE SPEED**



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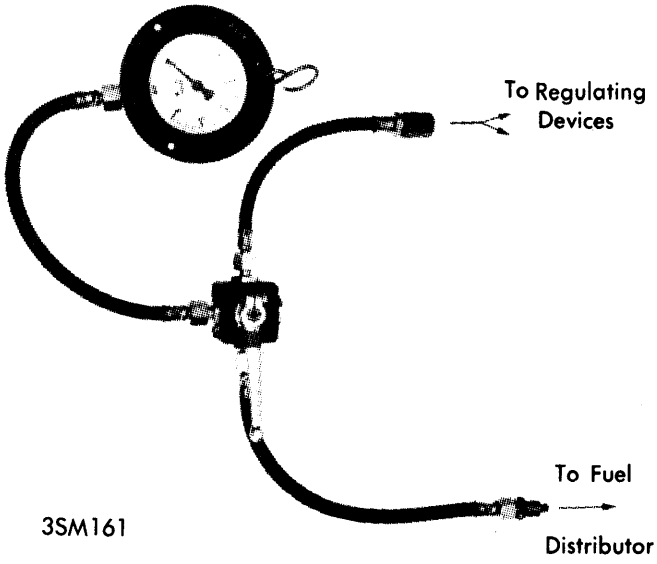
ADJUSTING IDLE MIXTURE

Mixture adjusting screw is accessible after removing plug in mixture regulator between fuel distributor and air sensor funnel. Adjust mixture to obtain a CO value at idle speed of 1.5-2% CO. Turn screw clockwise to richen mixture and counterclockwise to lean mixture. Make adjustment with no pressure applied to adjusting wrench or engine will stall.

Throttle Valve Control Pressure Regulator – Whenever this regulator is replaced, it must be adjusted to correct control pressure value at idle speed position. Proceed as follows: With warm up regulator hot, connect manometer tool P378 as described under "Pressure Testing". Set three-way valve lever to control pressure checking position. Turn pressure regulator in elongated slots until control pressure of 2.95 to 3.05 bar is reached. Tighten pressure regulator and check control pressure under part and full load.



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TOOL P 378