Fault tracing

Section Group 2 24

CI Fuel Injection System 240/260

CI Fuel Injection System 240/260 1976–1978

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Contents

	Page
Introduction	1
Specifications/description	2
Special tools	7
CI System, B21F, exploded view	9
CI System, B27F, exploded view	10
Fault tracing guide (quick reference)	11
Symptoms:	
Cold engine difficult to start or no start	12
Warm engine difficult to start	14
Cold & warm engine difficult to start	15
Erratic running engine/cold or during warmup	16
Erratic running warm engine	17
Erratic running engine cold & warm	18
Erratic running engine & high fuel consumption	19
Rough idle	20
Low top speed (poor engine performance)	21
High fuel consumption	22
Fault Analysis:	
Fuel pump operation – simple check A1–A3	23
Fuel pump inoperative – 1976–1977 vehicles A4–A10	24
– 1978 vehicles A11–A17	26
Fuel Supply:	
Line pressure too low B1–B3	29
Excessive line pressure B4	30
Floating County	00
Electrical Supply:	0.1
	31
	31
Air intake/throttle valve – B21F D1–D2	32
– B27F D3–D6	33
Air flow sensor – B21F E1–E4	34
- B2/F E5-E8	35
Cold start injector / thermal time switch	37
Auxiliary air valva	40
Line and rest pressure H1_H13	13
Control pressure	43
Injectors & fuel distributor	52
	52
CO Emissions Check:	
B21F not equipped	
with Oxygen Sensor Feedback System	56
B2/F not equipped	
With Oxygen Sensor Feedback System LI-L/	57
BZ IF equipped with Owners Senser Foodback System	60
B27E aquipped with	00
Oxygen Sensor Feedback System N1–N11	62
	02
Additional information:	
Eliminating Oxygen Sensor Feedback System	66
Wiring Diagrams:	
240 – 1976	68
– 1977	70
– 1978	72
260 – 1976	74
– 1977	76
– 1978	78

Introduction

The fault tracing instructions in this manual are presented with the assumption that all mechanical, electrical or emission system faults which may have existed have been eliminated. The following items in the above mentioned areas should have been checked using appropriate methods specified in the associated Service Manual.

Mechanical

- Compression
- Valve clearance
- All vacuum lines and connections
- Transmission kickdown cable and throttle valve adjustments
- Air cleaner
- Ducts
- Intake manifold (leaks)

Electrical

- Spark plugs
- Spark plug leads
- Distributor cap
- Ignition coil
- Timing (including advance mechanism)
- All electrical connections

Emission Controls

- Crankcase ventilation system (PCV valve)
- Exhaust gas recirculation system
- Air injection reactor system
- Evaporative control system
- Lambda-sond system (see op. 01-07)
- Catalytic converter

Specifications

Refer to the "Specifications" Section 0 (03) in the Service Manuals for proper clearances and other values regarding systems other than the Fuel Injection System.

Common symptoms

Only those symptoms which are most common and easily detected are dealt with in this manual.

Complex symptoms

In the event that several CI System components fail, or more complex symptoms occur, it may be necessary to overhaul the entire system. Perform a complete analysis before proceeding with extensive repairs.

Overhaul

Performing operations B1 to J10 will provide a continuous fault tracing of the fuel injection system. Refer to the "Repair and Maintenance" Section 2 (Group 24) in the Service Manuals for complete overhaul instructions.

Additional information

The Oxygen Sensor Feedback System (Lambda Sond System) is in a way a subsystem within the fuel system.

Information on how to isolate that system is therefore included as operations 01–07.

3-step information

Many of the fault-tracing procedures contain an illustration, a brief statement and a more detailed instruction. This 3-step format is designed to provide the mechanic with an overview of the particular fault-tracing operation or procedure. This, in many cases, is sufficient to enable the experienced mechanic to proceed without additional instruction. Others may need the more detailed instruction to review or learn what is needed to accomplish the operation.

Note: If CI System parts are replaced, the idle speed and CO level must be checked and readjusted as necessary.

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> Group 24 Fuel System

Specifications/Description



Fuel feed pump

The fuel feed pump was introduced during the 1977 model year. It can be retrofitted on earlier year cars, see Service Bulletins No. 12A and 14, Group 24.

A number of 1976 260 Series Models were equipped with fuel feed pumps.

The fuel feed pump is located in the gas tank (integral with the fuel tank gauge sender). Fuel is thereby supplied under low pressure to the main fuel pump thus reducing the possibility of vapor lock.

A non-return valve causes fuel to be maintained under low pressure in the hose between the two pumps with the engine not running.

Current consumption: 1-2 amps.



Fuel pump and accumulator

1976–1977 Models: located on a bracket attached to the outside of the fuel tank.

On 1977 Models the protector plate for the fuel pump was redesigned so that the fuel pump can be removed without loosening the fuel pump bracket.

1978 Models: Location for fuel pump and accumulator was changed from the fuel tank to the cross member under the floor of the vehicle (beneath the rear seat).

260 Series: fuel accumulator capacity increased from 20 cm³ to 40 cm³, improving starting capabilities at all temperatures.

The fuel pump is an electric, roller type pump, capable of supplying approx. 1.6 liters (1.7 qts) of fuel at 5 kp/cm^2 (=70 psi).

Current consumption: max. 8.5 amps.

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Cl System, Fault Tracing – Specifications / Description –



87

86

30-87c

85 87

870 30

Fuel filter

This paper element filter is located on the firewall, see illustration.

Replacement intervals: 40,000 km 30,000 miles

Relays

On 1976 Models, the main relay and the fuel pump relay are located to the left on the front of the firewall, behind the ignition coil.

On 1977 Models, the two relays are moved to the inside of the firewall.



On 1978 Models, the main relay, the fuel pump relay and the switch at the air flow sensor have been replaced by one electronic type relay. It is located in the passenger compartment, to the left up behind the firewall.

The electronic fuel pump relay is a standard cut-in type with a pulse sensor that reacts to the signals from the electronic module in the ignition system. With the engine running (ignition system firing), the pulse sensor allows voltage to pass through from connection 15 and activate the relay.

> Group 24 Fuel system

Cl System, Fault Tracing

- Specifications / Description -



B21F and B27F

Line pressure:

Rest pressure: - minimum:

maximum

 $1.7 \text{ kp/cm}^2 = 24 \text{ psi}$ below injector opening

4.5-5.2 kp/cm²

64-75 psi

pressure



Line pressure regulator

Location: in fuel distributor, see CI Fuel System exploded views (B21F) and (B27F).

Line and rest pressure adjustment

Remove or add shims in the line pressure regulator

There are two shims available:

0.1 mm provides 0.06 kp/cm² = 0.8 psi pressure difference.

0.5 mm provides 0.3 kp/cm² = 4.3 psi pressure difference.

Use the thicker shims for adjustment where possible. When shims are added, the line pressure will increase and the rest pressure will decrease. If shims are removed, the line pressure will decrease and the rest pressure will increase.

Control pressure regulator

Regulation in the control pressure regulator is provided by a bimetal spring which is influenced by:

- ambient temperature
- and a heating coil wrapped around the bimetal spring. The heating coil is energized during starter motor and engine operation.



B21F

Control pressure, engine at normal operating temperature:

 $3.7 \pm 0.2 \text{ kp/cm}^2$ 50-55 psi

Control pressure, cold engine: - see diagram at left

Group 24 Fuel system



B27F

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120997

The B27 control pressure regulator contains a tube with one of the following connections:

- Federal specification vehicles to the rear of the intake manifold which provides vacuum to the tube. This causes enrichment of the air/fuel mixture at maximum speed.
- California specification vehicles (also Lambda sond equipped) to open air.



Control pressure, engine at normal operating temperature:

Tube vented to atmospheric pressure: $3.3 \pm 0.15 \text{ kp/cm}^2$ 45-49 psi

Tube connected to vacuum: $3.7 \pm 0.2 \text{ kp/cm}^2$ 50-55 psi

Control pressure, cold engine: - see diagram at left.

High altitude areas

B21F and B27F (1977 year models): A special control pressure regulator Volvo P/N 1219952 is used. It incorporates an altitude compensating device and is ventilated to open air.

(Bosch P/N 0438140021)

CI System, Fault Tracing - Specifications / Description -





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125922



Injectors

The injectors contain a spring-loaded disc type valve.

Opening pressure: $2.6-3.6 \text{ kp/cm}^2 = 37-51 \text{ psi}$

No leakage permitted below 2.4 kp/cm² = 34 psi.

Cold start injector

Supplies extra fuel to the engine when starting. The solenoid operated valve operates each time the starter is energized and is calibrated to deliver fuel at the following rates:

B21F: 0.115 liter/min at 4.5 kp/cm²

B27F: 0.165 liter/min at 4.5 kp/cm²

Thermal time switch

Controls current to the cold start injector and is influenced by:

- the temperature of the engine coolant. This causes termination of cold start fuel injection at engine temperatures:
 - 35° C or higher for B21F 15° C or higher for B27F

a heating coil acting on the bi-metal switch. This provides for a maximum injection time of 7.5 seconds at -20°C, which decreases at higher temperatures.

Auxiliary air valve

Bypasses the throttle valve and supplies additional air during warm-up. Contains an air valve which is controlled by a bi-metallic spring. It is influenced by air temperature and a heating

coil.

Completely opens at -30° C Completely closes at +70° C

Starting at + 20° C it will close after 5 minutes warm-up.



Cl System, Fault Tracing – Special Tools –

Special Tools



Group 24 Fuel system

Cl System, Fault Tracing – Special Tools –



Group 24 Fuel system

CI System, B21F – Exploded View



CI System, B27F – Exploded View



Group 24 Fuel system

Quick reference fault tracing guide

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	Contro	Just Name	A Colder	their of the second	at saine	sireus sireus some some trage	trad at	Symp work of orthology Apost	otom	S Note: Numbers in S columns repr of likely occu	Symptom resent order irance.
/	1	1	1	1	1	/	1	4	1.	Causes	Info
1 2 10	1 2	1 2	3 4	2 3	1 2	1 2	1 2	1 2	1	Causes other than CI fuel: Battery weak Ignition Compression	
15 16	a a Jim	7 6	5	6	8 6	8 6	7 3	6 5	10 8	Vacuum leaks Extreme cold CO	0 • 1 • 0 o • 1 • 0 •
11 12	4 5		2	4 5	7 5	7 5	6	2000 2000	9 6	Emission control systems: EGR Oxygen sensor feedback system	* 01–07
13 14			12. ¹⁵ .				11.122	7	enil	Catalytic converter Evaporative control	*
3 5 8		3 4		1	3	28	4 5	3	3	Air supply: Air intake system Air induction system Air flow sensor	D1-D5 E1-E8
4 6		- 1-1	-						4	Fuel supply: Fuel pump operation Main relay operation (1976–77 only) Fuel leakage	A1-A17 C2 B1
7						3			5	Injectors: Cold start injector, thermal time switch Injectors	F1-F9 J1-J11
1000	3	5	1	1	4	4	2011	4	7	Fuel system pressures: Line and rest pressures Control pressure	H1-H13

* Refer to appropriate Service Manual



Fuel system





Symptom - warm engine difficult to start



Group 24 Fuel system

Symptom – cold & warm engine difficult to start





1

Group 24 Fuel system

Probable cause	Remedy
CI fuel system control pressure	Refer to op. I1–I11
Ignition system	Check ignition timing.
Compression	Check engine compression
EGR system	Check operation of EGR valve or refer to Emis
Oxygen sensor feedback system (Lambda sond)	Eliminate system using op. 01–07 or refer to Oxygen Sensor Feedback System Manual.
Vacuum leaks	Check all hoses and connections.
	Troubleshoot entire CI fuel system. Perform procedural operations within Groups A through J in this manual.
CI fuel system malfunction	Effect repair using the following Repair & Main- tenance Manuals, as necessary: B21F – TP 11121 B27F – TP 11122
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Group 24 Fuel system





CI System, Fault Tracing – Fuel pump –

Fault analysis

Fuel pump operation - simple check

First check appropriate mechanical, electrical and emission control system items as indicated previously before proceeding with the following trouble analysis.



CI System, Fault Tracing – Fuel pump –

Fuel pump inoperative

First check appropriate mechanical, electrical and emission control system items as indicated previously before proceeding with the following trouble analysis. Reference wiring diagram at rear of this manual.











Cl System, Fault Tracing - Fuel supply -

B1

B2

Fuel supply

Some 1976 models and all 1977-78 models are equipped with a fuel feed pump (tank pump). With this arrangement, the line to the fuel pump is kept under approximately 0.2 kp/cm^2 (=3 psi) pressure. This will eliminate risk of vapor pockets forming in the fuel line to the main fuel pump.

Line pressure too low

First check appropriate mechanical, electrical and emission control system items as indicated previously before proceeding with the following trouble analysis.



Check for leakage between the fuel pump and the fuel distributor (external leakage).

Also check for leakage at the fuel accumulator.

1978: Remove the fuel tank cap to release any overpressure in the fuel tank. Disconnect the hose (fuel accumulator-fuel tank) from the fuel accumulator. Check the fuel accumulator for leakage and re-install the hose.

Repair as necessary.

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Check fuel feed (tank) pump

Connect an ammeter between the interference suppressor and the tank pump.

Set ignition to ON (activate fuel pump). (See op. A1-A3).

Correct current flow is 1-2 amps.

No current flow:

Check - fuse in trunk.

for voltage to the fuel feed pump.

Incorrect current flow:

Check the fuel feed pump and filter. If current flow is below normal, check the fuel level.

Cl System, Fault Tracing – Fuel supply –



Check fuel pump capacity

Remove the fuel tank cap to release any overpressure.

B3

Disconnect the return line at the connection in the engine compartment. Hold the disconnected end of the return line over a measuring glass.

Set ignition to ON (activate fuel pump) for 30 seconds and then switch OFF again.

There should be a minimum quantity of 0.8 liter fuel in the measuring glass.

Incorrect fuel pump capacity:

Check fuel filter. If serviceable, then test system using a new fuel pump. If this does not remedy the problem, check fuel lines and fuel flow sensor.

Excessive line pressure

First check appropriate mechanical, electrical and emission control system items as indicated previously before proceeding with the following trouble analysis.



Cl System, Fault Tracing - Electrical supply -

C1

C2

Electrical supply

First check appropriate mechanical, electrical and emission control system items as indicated previously before proceeding with the following trouble analysis.



Check fuses

1976–77: Fuse No. 5, 8 amps. Protects the main relay and the fuel pump relay circuits.

Fuse No. 7, 16 amps.

Protects the fuel pump, fuel feed pump, control pressure regulator and the auxiliary air valve circuits.

1978:

Fuse No. 5, 8 amps. Protects the electronic fuel pump relay circuit.

Fuse No. 7, 16 amps. Protects the fuel pump, fuel feed pump, control pressure regulator and the auxiliary air valve circuits.

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Check main relay (1976–1977)

Operate the starter motor. Check for voltage at main relay terminal 30/51 with the starter motor energized.

If there is no voltage, check for voltage at main relay terminal 87 with the starter motor energized.

No voltage:

Indicates that the wire from the starter motor to main relay terminal 87 is defective.

Voltage:

Indicates that the main relay is defective.

Cl System, Fault Tracing – Air intake –

Air intake/throttle valve (B21F)

First check appropriate mechanical, electrical and emission control system items as indicated previously before proceeding with the following trouble analysis.



CI System, Fault Tracing - Air intake -

D3

D4

D5

Air intake/throttle valves (B27F)

First check appropriate mechanical, electrical and emission control system items as indicated previously before proceeding with the following trouble analysis.

Check air intake system for air leaks (visual inspection). Check: 1. Auxiliary air valve hose connections. 2. Cold start injector hose connections. 3. CO adjustment plug. 4. Remaining hose connections. 5. For leaks in O-rings and gaskets.



Remove the front intake manifold to check the throttle valves.

Throttle valves.

Check that the throttle valves are securely attached, correctly centered and do not bind. Use new O-rings and gaskets when re-installing the front intake manifold.

Cl System, Fault Tracing – Air flow sensor –

Air flow sensor (B21F)

First check appropriate mechanical, electrical and emission control system items as indicated previously before proceeding with the following trouble analysis.



Check that air flow sensor plate is centered in venturi.

The air flow sensor plate must not touch the venturi at any point or have excessive side clearance.

E1

E2

E3

Incorrect position:

Check that the lever has no side play. Loosen the center screw and adjust plate position.



Check air flow sensor plate rest position.

The top side of the air flow sensor plate should be flush with, or no more than $1 \text{ mm} (0.04^{"})$ below, the lower edge of the cone.

Incorrect position:

Adjust by squeezing together or straightening the wire bracket "A" underneath the air flow sensor plate.

Check that the air flow sensor does not seize or bind.

Raise the air flow sensor plate and then release it. The plate should immediately return to its initial position.

NOTE:

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The control pressure will cause resistance when the plate is lifted. This must not be confused with jamming.
CI System, Fault Tracing – Air flow sensor –

F4

E5

E6



In case of incorrect operation.

Remove the air flow sensor and fuel distributor assembly.

Overhaul/replace as necessary. See Repair & Maintenance Service Manual, TP 11121.

(B27F)



Check that air flow sensor plate is centered in venturi.

The air flow sensor plate must not touch the venturi at any point or have excessive side clearance.

Incorrect position:

Check that the lever has no side play. Loosen the center screw and adjust plate position.

121018-2V



Check air flow sensor plate rest position.

The distance shown should be 0–0.5 mm (0–0.02'').

If misaligned, check plate lever for distortion and position of contact pin.

Check that the plate stop does not touch the plate.

Contact pin is adjustable (inward) using a drift and mallet. Light to moderate tapping is sufficient to move pin. Removal of the air flow sensor is necessary to drive pin outward.

121018-2X

Cl System, Fault Tracing - Air flow sensor -



Check that the air flow sensor does not seize or bind.

E7

E8

Depress the sensor plate and release it. The plate should return immediately.

NOTE:

The control pressure will cause some resistance when the sensor plate is depressed. Do not confuse this resistance with seizing.

Possible faults:

- Lever seizes in housing.
- Lever pivot seizes in housing.Plunger binds.



In case of incorrect operation:

Remove the air flow sensor and fuel distributor assembly.

Overhaul/replace as required. See Repair & Maintenance Service Manual, TP 11122.

Cold start injector/thermal time switch

First check appropriate mechanical, electrical and emission control system items as indicated previously before proceeding with the following trouble analysis.



CI System, Fault Tracing - Cold start injector -



Check for cold start injector leakage.

A fuel leak may cause erratic running and high fuel consumption.

The cold start injector must not leak more than 1 drop/minute, otherwise it should be replaced.

120375



F5

F4

Cold engine

Check that the cold start injector injects fuel when the starter motor is energized.

At ambient temperature of -20° C (-4° F) or colder, the cold start injector should inject for about 7.5 seconds. The injection period gradually decreases as the temperature rises, and stops altogether at temperatures above +35° C (109° F) or after engine has been cranked a few times in succession.

F6

120374

Fuel not injected, engine cold:

Check for voltage at the cold start injector when the starter motor is energized.

Voltage:

Indicates defective cold start injector.

NOTE:

If engine has been cranked several times in succession the thermal time switch will cut out and a no voltage condition will appear.

No voltage:

Proceed to next op.

F7

F8





No voltage in op. F6:

Check for voltage between the connector and the chassis with the starter motor energized. 1976-1978 = blue/yellow cable - chassis.

Voltage:

Indicates thermal time switch cutout or defective thermal time switch. Check also for defective wire between thermal time switch and cold start injector.

No voltage:

Indicates defective wire between starter motor and cold start injector.

Warm engine

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Check if the cold start injector injects fuel when the starter motor is energized.

The injector must not inject fuel when the engine is warm (above $+35^{\circ}$ C $= 112^{\circ}$ F).

If fuel is injected with warm engine, there may be two causes:

- 1. Thermal time switch defective.
- 2. Cold start injector defective.

To establish correct cause, proceed to next op.

F9

Cold start fuel injected, engine warm:

Remove the connector from the cold start injector to eliminate influence from the thermal time switch. If there is injection when the starter motor is energized, the cold start injector is defective. No injection at this time indicates a defective thermal time switch. - Cold start injector -

Quick reference for possible problems involving cold start injector

Cold engine

Condition:

Cold start injector does not inject fuel when the starter motor is energized:

Action:

Check for voltage to the cold start injector.

- Voltage: Indicates a defective cold start injector.
- No voltage: Indicates defective thermal time switch or electrical wires.

Condition:

The cold start injectors operate but the engine does not start.

Check:

- Fuel system for leakage.
- Auxiliary air valve.
- Control pressure.



Condition:

The cold start injector operates when engine temperature is above 35° C (109° F):

Action:

40

Disconnect the wire connector at the cold start injector.

- Injector still injects: replace it.
- Injection stops: indicates defective thermal time switch.

Condition:

Cold start injector does not operate and engine does not start.

Check:

- Leaking fuel system.
- Injectors leaking.
- Incorrect line pressure.
- Incorrect rest pressure.
- Incorrect CO adjustment.

Cl System, Fault Tracing - Auxiliary air valve -

G1

Auxiliary air valve

First check appropriate mechanical, electrical and emission control system items as indicated previously before proceeding with the following trouble analysis.



1

Check auxiliary air valve.

The auxiliary air valve should be partly open at room temperature, fully open at -30° C(=-22° F) and fully closed at +70°C (=158°F), or after 5 minutes of engine operation.

NOTE:

After heating up, it may take an hour for the auxiliary air valve to return to a position which corresponds to the ambient temperature.

For B27F: Use mirror and light to check.



Check operation of bi-metallic spring (with engine off).

For this check, the wires at the auxiliary air valve should be connected, ignition ON and the fuel pump running (see op. A1-A3). (The auxiliary air valve and control pressure regulator are also energized.)

The valve should be fully closed after approximately 5 minutes of operation.

If not, tap lightly on the valve as engine vibrations normally contribute to closing.

119818

G2

Cl System, Fault Tracing - Auxiliary air valve -



If the auxiliary air valve still does not close:

G3

G4

Check for voltage. Remove the wire connector and check for voltage across the connector terminals.

No voltage: Indicates defective wire or voltage supply.



valve not operating: Check resistance of auxiliary air valve.

Voltage across the wire terminals, auxiliary air

B21F: approximately 49 ohms B27F: approximately 21 ohms

No reading, or incorrect reading, indicates the auxiliary air valve is defective.

120763

CI System, Fault Tracing – Line and rest pressure –

Line and rest pressure

First check appropriate mechanical, electrical and emission control system items as indicated previously before proceeding with the following trouble analysis.



Cl System, Fault Tracing – Line and rest pressure –



CI System, Fault Tracing - Line and rest pressure -







Pressure drop:

Check the rest pressure during a 20 minute period.

After 20 minutes there should be a remaining pressure of:

min. 1 kp/cm² = 14 psi

H8

H7

Pressure drops too low:

Check the rest pressure with the valve on tool 5011 in position 1.

The control pressure regulator must be warm. Repeat op. D5 (run fuel pump) to build up pressure in the system.

Set the valve on tool 5011 to position 1 (toward the fuel distributor) and note the pressure.



Check the rest pressure with the valve on tool 5011 in position 3.

If necessary, run the fuel pump again to build up pressure in the system.

Set the valve on tool 5011 to position 3 (towards the control pressure regulator) and note the pressure.

Alternative readings

Consistent but incorrect rest pressure in position 1 and 3.

Proceed to op. H12.

Rest pressure drops or is incorrect in position 3.

First check that the control pressure regulator is warm. Test using a new control pressure regulator.

Rest pressure drops in position 1. Proceed to op. H10.



45



Cl System, Fault Tracing – Line and rest pressure –





Check for leakage between fuel pump and fuel distributor (external leakage).

Set the valve on tool 5011 to position 1 (toward the fuel distributor).

Check for leakage (also at the fuel accumulator).

1978 models: Remove the tank cap to release any overpressure in the fuel tank. Disconnect the hose from the fuel tank at the fuel accumulator. Check the fuel accumulator for leakage and reinstall the hose.

H11

H10

Check the line pressure regulator for leakage.

Run the fuel pump to build up pressure in the system.

Remove the fuel tank cap to release any overpressure in the fuel tank.

Separate the return line (junction at filter) and hold the end of the hose upward.

If fuel runs out of the hose, it indicates that the line pressure regulator is leaking. Replace the O-ring in the line pressure regulator. If this does not remedy the problem, replace the fuel distributor.

If the line pressure regulator is not leaking, the fuel pump check valve must be defective and should be replaced. This can be checked by blocking the flexible pickup line.

H12



Check and adjust line and rest pressures.

Line pressure:

123291

Set the valve on tool 5011 to position 1 (toward the fuel distributor). Operate the fuel pump.

Read line pressure. It should be: 4.5–5.3 kp/cm² = 64–75 psi.



Cl System, Fault Tracing – Line and rest pressure –

H13

Adjusting line and rest pressures.

Adjustment is made by adding or removing shims in the line pressure regulator.

Both the line and shut-off pressures are equally affected when adjusting. Both pressures increase if additional shims are installed and reduce if shims are removed.

Shims are available in two thicknesses:

0.1 mm (0.004") = provides a pressure change of 6 kPa (0.06 kp/cm² = 0.85 psi)

0.5 mm (0.020'') = provides a pressure change of 30 kPa $(0.3 \text{ kp/cm}^2 = 4.3 \text{ psi})$

The thicker shims should be used first when adjusting.

The thinner shims should be used when the line pressure is 490 kPa (4.9 kp/cm² = 70 psi) or more, and the shut-off pressure is lower than 170 kPa (1.7 kp/cm² = 24 psi).

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Control pressure

First check appropriate mechanical, electrical and emission control system items as indicated previously before proceeding with the following trouble analysis.

Prepare for test

5011 5032 5032 5116

Connect pressure gauge 5011 between control pressure regulator and fuel distributor.

Disconnect the white wire from terminal 1 on the ignition coil (safety measure).

Set ignition switch to ON.

IЗ

I2

I1

Cold engine.

1232-97

Disconnect the connector from the control pressure regulator.

Omit this op. if the test concerns engine with warm start problems.



Cl System, Fault Tracing - Control pressure -



Operate the fuel pump.

1976-1977:

Remove the connector from the air flow sensor to start the fuel pump.

1978:

Install test relay 5170 to start the fuel pump.

Check control pressure.



*I*5

14

Set the valve on tool 5011 to position 2 (at right angle to the hoses).

Read the control pressure.

I6



Cold start problems.

The control pressure regulator should be at ambient temperature.

Proper control pressure for different ambient temperatures can be obtained from the chart.

Pressure too low:

Test using new control pressure regulator.

Excessive pressure:

- 1. Set ignition switch to OFF.
- 2. Remove the cap from the fuel tank to release any over pressure.
- 3. Check if the return line from the control pressure regulator is blocked (refer to op. B4).
- 4. If the line is not blocked replace control pressure regulator and re-check pressure.

Cl System, Fault Tracing – Control pressure –



Warm start problems. NOTE:

With cold control pressure regulator (engine), the fuel pump must run for 5 minutes before this check is accomplished.

17

18

During this time, the control pressure regulator will heat up because of internal current flow.

Correct control pressures:

B21F and B27F: **3.7** \pm **0.2** kp/cm² (3.5–3.9 kp/cm² = 50–55 psi).

123302

Incorrect readings.

Excessive pressure.

Check that the return line from the control pressure regulator is not restricted (see op. B4).

Pressure too low: See op. 19–111.

kp/cm² 4.0 3.7 3.0 Vacuum hose connected 2.0 Vacuum hose disconnected 1.0 0 50 10 20 40 60 70 80° C 30 32 50 68 86 104 122 140 158 170 F

B27F only:

Vacuum control test, engine running. NOTE:

On 1977 model vehicles manufactured to "California" specifications, the vacuum hose should be vented to open air. Use portion of chart for "vacuum hose disconnected".

Check control pressure with engine running with and without vacuum.

For in-between temperatures, obtain correct pressure in the chart.

With engine at normal operating temperature, the control pressure should drop from 3.7 ± 0.2 kp/cm² to 3.3 ± 0.2 kp/cm² = 44–50 psi.

If the control pressure is incorrect or changes to incorrect pressure, this indicates a defective control pressure regulator.

Group 24 Fuel system

CI System, Fault Tracing – Control pressure –



Cl System, Fault Tracing – Injectors, fuel distributor –

Injectors and fuel distributor

First check appropriate mechanical, electrical and emission control system items as indicated previously before proceeding with the following trouble analysis.



Cl System, Fault Tracing – Injectors, fuel distributor –



Cl System, Fault Tracing - Injectors, fuel distributor -





Connect the measuring tool (contains individual measuring glasses).

J7

J8

Measuring tool (9995014) hoses must be extended to prevent crimps.

119820

Cl System, Fault Tracing – Injectors, fuel distributor –

J9

Check injector deviation (test only in case of obvious engine malfunction).

Note: To obtain correct reading, all hoses should be empty or full at start of test.

With fuel pump running, lift the air flow sensor plate halfway. Hold it there until one of the measuring glasses has been filled to 100 cm³. Read the other measuring glasses. Maximum deviation 20 %.

In case of malfunction:

If injector deviation exceeds 20 %, repeat the test to confirm.

If test results are confirmed:

Swap two injector hoses at the distributor (exchange hoses of one incorrect and one correct operating injector) and repeat the test.

If same injector persists faulty, injector or injector fuel supply line is defective. See "Testing and Cleaning Injectors" in Service Manual TP 11121 (B21F) or TP 11122 (B27F).

If fault changes to the other injector, the fuel distributor is defective.



J10

Service the fuel distributor. Procedures:

- Remove fuel distributor. Check O-ring.

- Remove plunger. Check for scratches or deposits. Deposits may be removed, using finger nail, NO TOOLS.
- Check for seizure by turning plunger and at the same time move the plunger in and out. If seizing occurs, replace the fuel distributor assembly.
- Install O-ring and fuel distributor assembly.

NOTE:

Do not overtighten fuel distributor retaining screws.

For complete overhaul see "Air-Fuel Control Unit" in Service Manual TP 11121 (B21F) or TP 11122 (B27F).

CO emissions check B21F NOT equipped with oxygen sensor feedback system



K1

Adjust idle speed (temporary setting) Connect instruments for measuring engine rpm and CO. Start engine.

NOTE. Engine should be at normal operating temperature.

Adjust idle speed as follows:

900 rpm B21F Manual

800 rpm B21F Automatic

K2



Check CO reading before catalytic converter

Attach CO gauge at fitting on header pipe just before catalytic converter.

Check CO. If necessary adjust CO to 1.0 $\%~\pm$ 0.3 %.

NOTE:

Engine should be at normal operating temperature.





Check CO reading after catalytic converter

CO reading should be 0-0.5 %.

NOTE:

If engine is not at operating temperature, this reading connot be obtained.

Set idle speed (final setting) 900 rpm.

L1

L2

L3

B27F NOT equipped with oxygen sensor feedback system



Adjust idle speed

Connect instruments for measuring engine rpm and CO. Start engine.

NOTE:

Engine should be at normal operating temperature.

Adjust idle speed.

900 rpm



Check CO Set valve to

Set valve to position 2 (center position). In this position exhaust gases are admitted from both engine banks = total reading.

CO should be 1.0 $\pm~$ 0.3 % (0.7–1.3 %).

NOTE:

When reading, the plug in the CO adjustment hole (on top of fuel distributor) must be installed, or the hole blocked.

From now on, air filter and hoses must be attached, otherwise emissions will be affected.



Adjust CO

Valve in position 2.

Remove plug and copper washer for CO adjustment. Use inhex wrench 5102 to adjust CO. Engine idle rpm should be 900.

NOTE:

After each adjustment, wrench 5102 must be removed and the hole covered to prevent a lean mixture while the CO reading is made. Counterclockwise adjustment reduces CO, clockwise adjustment increases CO. Reinstall plug and copper washer.

L4

Check CO balance, left cylinder bank.

Set valve to position 1 (toward left cylinder bank) and read CO.

It should be 1.0 $\pm~$ 0.3 % for left bank.

NOTE: Excessive HC reading might indicate misfiring.



Cl System, Fault Tracing - CO check -





Left bank

118821



Check CO balance, right cylinder bank

Set valve to position 3 (toward right cylinder bank) and read CO.

It should be 1.0 ± 0.3 % for right bank.

NOTE:

Excessive HC reading might indicate misfiring.

Setting CO balance

16

L5

Air adjusting screw (3) permits a certain quantity of air to bypass the throttle valve at idle. This air quantity is split between the cylinder banks and is balanced by screws (1) and (2). Screw (1) for right cylinder bank and screw (2) for left cylinder bank. A decrease in air flow by screw (2) will mean an increase in air flow to screw (1) and vice versa. If the CO balance reading is incorrect, adjust by

turning one screw up or the other down,

CO reading should be equal for both banks and correct for the total system.

NOTE: left side intake manifold goes to right bank, and right side to left bank.

L6a

Example 1: CO lower on left cylinder bank

NOTE:

Left side intake manifold goes to right bank, and right side goes to left bank.

Valve in position 3 (toward right bank). Adjust screws (1) up or (2) down until correct reading of 1.0 \pm 0.3 % is obtained. Idle speed 900 rpm.

L6b

Check CO balance

Turn valve to position 1 (toward left bank) and check that same CO readings are obtained for left and right banks.



Group 24 Fuel system

CI System, Fault Tracing – CO check –

L6c

L6d



Example 2: CO higher on left bank Valve in position 3 (toward right bank). Adjust screw (1) down or screw (2) up until correct reading of $1.0 \pm 0.3\%$ is obtained. Idle speed 900 rpm.

118820



Check CO balance

Turn valve to position 1 (toward left bank) and check that same CO readings are obtained for left and right banks, total system must have correct reading with valve in position 2, center position.

<image><image><image>

- End of examples -

L7

Make final CO adjustment Valve in position 2 (for total CO). Adjust CO to $1.0 \pm 0.3 \%$.

Engine speed 900 rpm.

Cl System, Fault Tracing – CO check –

B21F equipped with oxygen sensor feedback system



Disconnect sensor wire

M1

M2

M3



Attach CO meter

Attach at fitting before catalytic converter on exhaust pipe.



Adjust idle (temporary setting)

900 rpm B21F with manual transmission.

800 rpm B21F with automatic transmission.

Cl System, Fault Tracing – CO check –



B27F equipped with oxygen sensor feedback system



Disconnect sensor wire



Adjust idle speed

Connect instruments for measuring engine rpm and CO. Start engine.

NOTE: Engine should be at normal operating temperature.

Adjust idle speed. 900 rpm

N3

N2

N1

5151

Check CO

Set valve to position 2 (center position). In this position exhaust gases are admitted from both engines banks = total reading. CO should be $1.0 \pm 0.3 \%$ (0.7–1.3 %).

NOTE:

When reading, the plug in the CO adjustment hole (on top of fuel distributor) must be installed, or the hole blocked.

From now on, air filter and hoses must be attached, otherwise emissions will be affected.

CI System, Fault Tracing – CO check –





Adjust CO

Valve in position 2.

Remove plug and copper washer from CO adjustment. Use inhex wrench 5102 to adjust CO. Engine idle rpm should be 900.

NOTE:

After each adjustment, wrench 5102 must be removed and the hole covered to prevent a lean mixture while the CO reading is made. Counterclockwise adjustment reduces CO, clockwise adjustment increases CO. Re-install plug and copper washer.

N5

N4

Check CO balance, left cylinder bank

Set valve to position 1 (toward left cylinder bank) and read CO.

It should be 1.0 $\pm~$ 0.3 % for left bank.

NOTE: Excessive HC reading might indicate misfiring.

N6

N7



Check CO balance, right cylinder bank Set valve to position 3 (toward right cylinder bank) and read CO.

It should be 1.0 \pm 0.3 % for right bank.

NOTE:

Excessive HC reading might indicate misfiring.

Setting CO balance

Air adjusting screw (3) permits a certain quantity of air to bypass the throttle valve at idle. This air quantity is split between the cylinder banks and is balanced by screws (1) and (2). Screw (1) for right cylinder bank and screw (2) for left cylinder bank. A decrease in air flow by screw (2) will mean an increase in air flow to screw (1) and vice versa. If the CO balance reading is incorrect, adjust by turning one screw up or the other down.

CO reading should be equal for both banks and correct for the total system.

NOTE: left side intake manifold goes to right bank and right side to left bank.



Cl System, Fault Tracing - CO check -





Example 1: CO lower on left cylinder bank.

NOTE:

Left side intake manifold goes to right bank, and right side goes to left bank.

Valve in position 3 (toward right bank). Adjust screws (1) up or (2) down until correct reading of 1.0 ± 0.3 % is obtained. Idle speed 900 rpm.

N7b

N7a



Turn valve to position 1 (toward left bank) and check that same CO readings are obtained for left and right banks.

N7c



Example 2: CO higher on left bank Valve in position 3 (toward right bank). Adjust screw (1) down or screw (2) up until correct reading of 1.0 ± 0.3 % is obtained. Idle speed 900 rpm.

N7d

Check CO balance

Turn valve to position 1 (toward left bank) and check that same CO readings are obtained for left and right banks, total system must have correct reading with valve in position 2, center position.



End of examples



Cl System, Fault Tracing – CO check –

N8

N9



Make final CO adjustment Valve in position 2 (for total CO). Adjust CO to $1.0 \pm 0.3 \%$.

Engine speed 900 rpm.

Stop engine



Reconnect sensor wire Read CO meter. CO should drop below 1 %.

N10

118819

Set idle speed (final setting)

900 rpm

N11

Stop engine

Disconnect instruments and CO gauge.

CAUTION: Connecting nipples for CO gauge are VERY HOT.

Reinstall exhaust pipe plugs.

Cl System, Fault Tracing – Lambda sond –

Additional Information

Oxygen Sensor Feedback System

- A malfunction of this system may appear as:
- Difficult starting with engine at normal operating temperature
- Erratic idle
- Poor engine performance, especially in lower speed ranges
- Poor gas mileage



The following procedure can be used as a simple check of the oxygen sensor feedback system.

Set ignition switch to ON

Do not start engine.

NOTE: This check must be made in an area free from noise which could prevent hearing the buzzing sound from the frequency valve.

123291



Operate the fuel pump

1976–1977: Remove the connector from the air flow sensor to start the fuel pump.

1978: Install test relay 5170 to start the fuel pump.

03

01

02

Check for buzzing sound from frequency valve

If no buzzing sound occurs, or if there is strong reason to believe that this system is defective, proceed to the following steps.

If buzzing sound occurs, disconnect test relay (1978 models) or install connector previously removed (1976–1977 models).



Cl System, Fault Tracing – Lambda sond –

04

05

06



12962

Connect dwell meter

Use dwell meter to check duty cycle (ratio open/close) of frequency valve.

- NOTE: The dwell meter should be of high quality with a scale reading of at least 70°.
 - Example: Sun instruments, recent models.

Connect the meter between the pick-up connector and ground (see illustration).

Disconnect sensor Remove wire to Lambda-sond sensor in exhaust manifold.

Check dwell meter reading (duty cycle) Set meter as you would for 4 cylinder engine.

Reading should be: B21F: 49–59° B27E: 40–50°

B27F: $40-50^{\circ}$ - at engine temperature of + 15°C (60° F) or above.

 $71-81^{\circ}$ – at temperatures below + 15° C (60° F).

A thermal switch senses the coolant temperature and closes at temperatures below + 15°C. (This provides for the change in frequency valve duty cycle).

If the readings are not correct, troubleshoot the oxygen sensor feedback system using the associated fault tracing manual. Cl System, Fault Tracing – Wiring Diagram, 240/1976 –

CI Fuel Injection System 240/1976

Fuse No. 5 Instruments Turn signals Indicator lights Relay, fuel injection system

Fuse No. 7 Clock Fuel pump

Starting engine

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M

M

11

Cl System, Fault Tracing – Wiring Diagram, 240/1977 –



CI Fuel Injection System 240/1977

Cl System, Fault Tracing – Wiring Diagram, 240/1978 –



Cl System, Fault Tracing - Wiring Diagram, 240/1978 -



Cl System, Fault Tracing – Wiring Diagram, 260/1976 –



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Cl System, Fault Tracing – Wiring Diagram, 260/1977 –





Cl System, Fault Tracing – Wiring Diagram, 260/1978 –







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