1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

Servicing the crankcase ventilation system consists of checking the hoses for cracks or vacuum leaks and checking the hoses, calibrated nipple and flame guard for clogging. Remove the hose from the air inlet tube and with engine running, check for a presence of vacuum. If no vacuum is present, find the restriction in the PCV system.

1992 Volvo 940

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Fig. 1: The Vehicle Emissions Control Information (VECI) label will tell you with what emissions equipment your vehicle is equipped

When the engine is running, a small portion of the gases which are formed in the combustion chamber leak by the piston rings and enter the crankcase. Since these gases are under pressure they tend to escape from the crankcase and enter into the atmosphere. If these gases are allowed to remain in the crankcase for any length of time, they would contaminate the engine oil and cause sludge to build up. If the gases are allowed to escape into the atmosphere, they would pollute the air, as they contain unburned hydrocarbons. The crankcase emission control equipment recycles these gases back into the engine combustion chamber, where they are burned.

Crankcase gases are recycled in the following manner. While the engine is running, clean filtered air is drawn into the crankcase through the intake air filter and then through a hose leading to the oil filler cap or the valve cover . As the air passes through the crankcase it picks up the combustion gases and carries them out of the crankcase, up through the PCV valve, (Volvo calls it the flame guard) and into the intake manifold. After they enter the intake manifold they are drawn into the combustion chamber and are burned.

The most critical component of the system is the PCV valve. This vacuum-controlled valve regulates the amount of gases which are recycled into the combustion chamber. At low engine speeds the valve is partially closed, limiting the flow of gases into the intake manifold. As engine speed increases, the valve opens to admit greater quantities of the gases into the intake manifold. If the valve should become blocked or plugged, the gases will be prevented from escaping the crankcase by the normal route. Since these gases are under pressure, they will find their own way out of the crankcase. This alternate route is usually a weak oil seal or gasket in the engine. As the gas escapes by the gasket, it also creates an oil leak. Besides causing oil leaks, a clogged PCV valve also allows these gases to remain in the crankcase for an extended period of time, promoting the formation of sludge in the engine.

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Refer to Section 1 for removal and installation of the PCV valve. The PCV nipple should be removed and inspected every 60,000 miles (96,000 km).

1992 Volvo 940

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Fuel Delivery: FI | **Fuel:** GAS

The majority of the testing of the EVAP system is a visual inspection for damaged, leaking or missing components. Inspect the hoses to the throttle body, the canister, fuel tank, fuel filler pipe, and the filler cap. Any damaged components should be replaced.

Canister Purge Valve

1. Remove the inlet hose to the valve.
2. Connect a hand-held vacuum pump to the fitting and pump up vacuum.
3. If vacuum holds, valve is ok. If vacuum falls off, valve diaphragm is leaking, replace the valve.

1992 Volvo 940

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Changes in atmospheric temperature cause fuel tanks to breathe, that is, the air within the tank expands and contracts with outside temperature changes. If an unsealed system was used, when the temperature rises, air would escape through the tank vent tube or the vent in the tank cap. The air which escapes contains gasoline vapors.

The Evaporative Emission Control System provides a sealed fuel system with the capability to store and condense fuel vapors. When the fuel evaporates in the fuel tank, the vapor passes through vent hoses or tubes to a carbon filled evaporative canister. When the engine is operating the vapors are drawn into the intake manifold.

The vapors are drawn into the engine at idle as well as at operating speeds. This system is called a Bi-level Purge System where there is a dual source of vacuum to remove fuel vapor from the canister. The source of vacuum at idle is a tee in the PCV system.

A sealed, maintenance free evaporative canister is used. The canister is mounted under the vehicle on either side behind the wheel well. The canister is filled with granules of an activated carbon mixture. Fuel vapors entering the canister are absorbed by the charcoal granules.

Fuel tank pressure vents fuel vapors into the canister. They are held in the canister until they can be drawn into the intake manifold. The canister purge valve allows the canister to be purged at a predetermined time and engine operating conditions.

Vacuum for the canister is controlled by the canister purge valve. The valve is operated by the ECM. The ECM regulates the valve by switching the ground circuit on and off based on engine operating conditions. When energized, the valve prevents vacuum from reaching the canister. When not energized the valve allows vacuum to flow through to the canister.

During warm up and for a specified time after hot starts, the ECM energizes (grounds) the valve preventing vacuum from reaching the canister. When the engine temperature reaches the operating level of about 120°F (49°C), the ECM removes the ground from the valve allowing vacuum to flow through the canister and purges vapors through the throttle body. During certain idle conditions, the purge valve may be grounded to control fuel mix calibrations.

The fuel tank is sealed with a pressure-vacuum relief filler cap. The relief valves in the cap are a safety feature, preventing excessive pressure or vacuum in the fuel tank. If the cap is malfunctioning, and needs to be replaced, ensure that the replacement is the identical cap to ensure correct system operation.

During warm up and for a specified time after hot starts, the ECM energizes (grounds) the valve preventing vacuum from reaching the canister. When the engine temperature reaches the operating level of about 120°F (49°C), the ECM removes the ground from the valve allowing vacuum to flow through the canister and purges vapors through the throttle body. During certain idle conditions, the purge valve may be grounded to control fuel mix calibrations.

Some vehicles have added system components due to the EVAP system monitor incorporated in the OBD-II engine control system used on these years. Two, instead of one, EVAP canisters are used and they are mounted on the drivers side of the vehicle. The canister purge valve is located on the bracket with the canisters. A test port for pressurizing the EVAP system is included and located below the brake booster. The test port is used to pressurize the system with a special gas and serious precautions must be taken to avoid damage to the EVAP system and the fuel tank. This is a procedure best suited to a professional shop, due to the precautions and the equipment needed to test this system. The ECM can store trouble codes for EVAP system performance, a list of the codes is provided later in this section. Normal testing procedure can be used for any component listed in EVAP testing in this book.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

NOTE: To relieve fuel tank pressure, the filler cap must be removed before disconnecting any fuel system component.

Evaporative (Carbon) Canister

1. Disconnect the negative battery cable.
2. Raise and support the vehicle.
3. Remove the retaining bolts from the canister mounting bracket.
4. Remove the canister.
5. Label and disconnect the hoses on the top of the canister.
6. Remove the canister from the mounting bracket.

To install:

7. Install the canister in the mounting bracket.
8. Install and tighten the canister brackets retaining bolts.
9. Install the hoses in their proper locations.
10. Lower the vehicle.
11. Connect the negative battery cable.

Fig. 1: Remove the bolts from the canister bracket and . . .

Fig. 2: . . . lower the canister to access the hoses for removal

Fig. 3: Exploded view of the EVAP canister and hoses

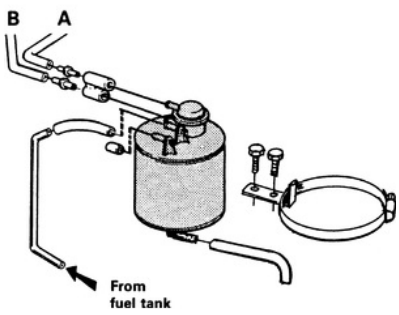
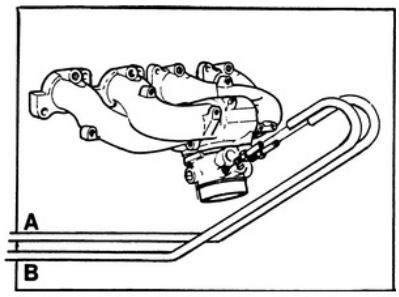


Fig. 4: EVAP system hose connections on the intake manifold



Canister Purge Valve

NOTE: The valve is located on the top of the canister. When the canister is removed, the valve can be removed from the canister by carefully pulling the valve off of the canister.

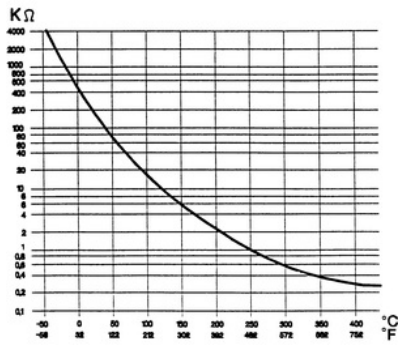
1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

EGR Temperature Sensor

1. Unplug the temperature sensor connector.
2. Measure the resistance between the terminals of the sensor. The resistance should be 0.1–4000 ohms. Use the temperature-to-resistance chart in this section for reference. If the value is out of range, replace the sensor.

Fig. 1: EGR temperature-to-resistance conversion chart

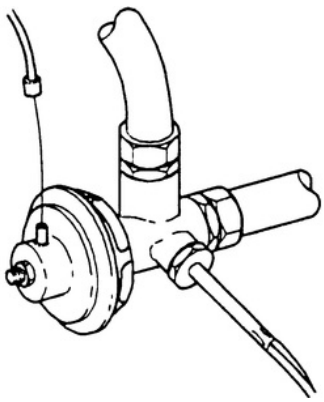


EGR Gas Flow Test

1. Connect a tachometer to the engine.
2. Remove the vacuum hose or rubber elbow from the EGR valve and connect a hand vacuum pump to the EGR valve vacuum nipple.
3. Start the engine and slowly apply vacuum to the EGR valve diaphragm.
4. The engine speed should drop as vacuum reaches 3–5 in. Hg and continue to drop as more vacuum is applied. The engine may even stall. This means EGR gas is flowing through the system.
5. If the engine speed doesn't drop, check for a failed EGR valve or plugged EGR passage. Remove the EGR valve and inspect/repair as necessary.

EGR Valve Leakage Test

Fig. 2: Remove the hose from the EGR valve to test the valve



1. Disconnect the negative battery cable.
2. Disconnect the hose from the fitting from the top of the EGR valve.
3. Connect a hand-held vacuum pump to the fitting and apply 15 inches of vacuum to the valve. Observe the gauge reading on the pump; if vacuum falls off, the diaphragm in the EGR valve has ruptured, and the EGR valve must be replaced. If vacuum remains, proceed to next step.
4. Remove the hose from the bottom of the EGR valve. Using compressed air (if available) and an air nozzle with rubber tip, apply 50 psi of regulated air pressure to the fitting.
5. Using your hand, open the throttle all the way, and listen inside the throttle body, if air is escaping, the poppet valve in the base of the EGR valve is leaking. Replace the EGR valve.

EGR Vacuum Controller

1. Remove the inlet hose of the EGR vacuum controller.
2. Connect a hand-held vacuum pump to the fitting and apply 10 inches of vacuum. If the vacuum falls off, the controller's diaphragm is leaking. Replace the EGR vacuum controller and retest. If OK, connect hose and proceed to the next step.
3. Remove the hose at the EGR vacuum controller inlet (if reinstalled after last test).
4. Connect a vacuum gauge to this hose.

5. Start the engine and bring it to operating temperature.
6. Hold the engine speed at approximately 1500 RPM. Check for steady manifold vacuum at this hose.

NOTE: To figure out what the vacuum should be, remove a vacuum hose directly from the intake manifold and measure the vacuum at 1500 RPM.

7. If manifold vacuum is not present, check for vacuum leaks in the line or an obstruction. Repair as necessary and retest. If manifold vacuum was OK, shut off engine, connect hose, and proceed to the next step.
8. Disconnect the hose at the vacuum controller outlet fitting.
9. Connect a vacuum gauge to this fitting.
10. Disconnect the electrical connector on the controller. This will simulate an open circuit at the controller.
11. Start the engine and bring it to operating temperature.
12. Hold the engine speed at approximately 2000 RPM while checking for vacuum flow through the vacuum controller.
13. The gauge reading will be low, at idle speed the gauge reading should be erratic. This is normal.
14. To allow full manifold vacuum to flow through the vacuum controller, exhaust backpressure must be present. It must be high enough to hold the bleed valve in the transducer portion of the controller closed. Have a helper momentarily (a few seconds) block the exhaust with a rag or other suitable device.

CAUTION
Make sure to have the helper wear heavy gloves to reduce the risk of burns from the exhaust gas or exhaust pipes.

15. As temporary backpressure is built, full manifold vacuum should be observed.
16. If full vacuum was present at the inlet fitting, but is not present at the outlet fitting, replace the valve control.

Fig. 3: Connect a hand-held vacuum pump to the inlet of the controller to check the controller valve diaphragm

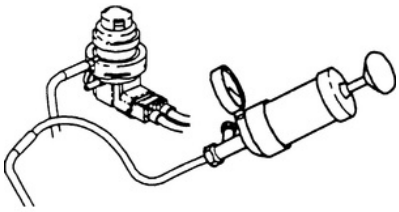


Fig. 4: Remove the outlet hose of the controller and . . .

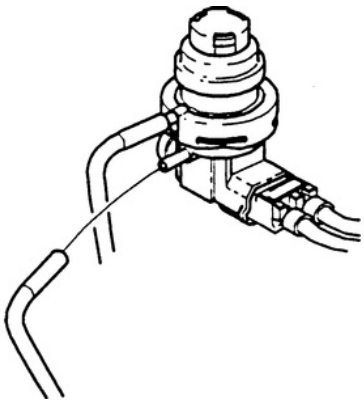
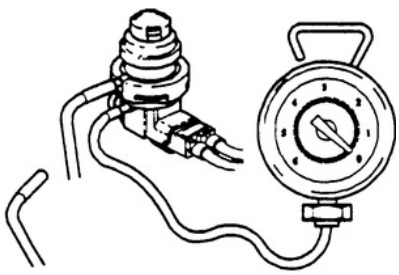


Fig. 5: . . . connect a vacuum gauge to the port to check operation of the controller valve

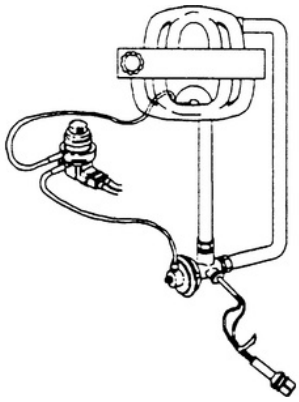


1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

System

Fig. 1: Diagram of the EGR system

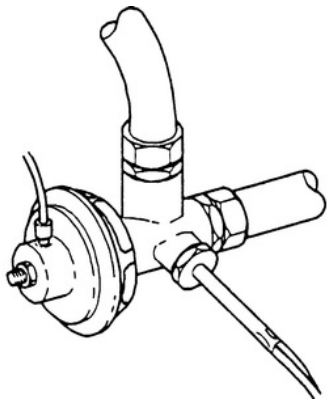


The Exhaust Gas Recirculation (EGR) system is designed to reintroduce exhaust gas into the combustion chambers, thereby lowering combustion temperatures and reducing the formation of oxides of nitrogen (NOx).

The amount of exhaust gas that is reintroduced into the combustion cycle is determined by several factors, such as: engine speed, engine vacuum, exhaust system backpressure, coolant temperature, throttle position. All EGR valves are vacuum operated. The EGR vacuum diagram for your particular vehicle is displayed on the Vehicle Emission Control Information (VECI) label.

EGR Valve

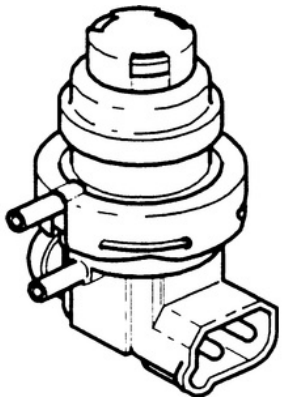
Fig. 2: A typical EGR valve



The EGR valve controls flow of exhaust gases from the exhaust manifold to the intake manifold. The valve is operated by control pressure from the EGR vacuum booster. The EGR valve is located under the intake manifold.

EGR Vacuum Controller

Fig. 3: An EGR vacuum controller



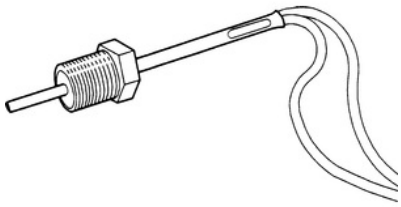
The vacuum controller controls pressure in the vacuum line to the EGR valve by means of the admission valve (lower section). The pressure in the intake manifold is supplied to the reducing valve (upper section). The valve uses an electrical signal to maintain optimum control of the EGR valve. The unit is also designed to allow for ambient air pressure. The vacuum

controller valve is located on the left-hand suspension strut tower or on the relay shelf above the electric cooling fan.

EGR Temperature Sensor

The EGR temperature sensor measures the temperature of exhaust gases returned to the intake manifold. This sensor has a positive temperature coefficient, which means that the resistance through the sensor will rise with the temperature. The sensor is designed to measure temperatures up to 930°F (500°C). Detection of temperature variations enables the control unit to determine whether or not the EGR system is working. The sensor is located in the EGR upper pipe, between the intake manifold and EGR valve.

Fig. 4: An EGR temperature sensor



1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

EGR Valve

1. Disconnect the negative battery cable.
2. Remove any components necessary to access the valve.
3. Unplug the EGR temperature sensor (if equipped).
4. Remove the EGR tube from the valve.
5. Remove the EGR valve mounting bolts.
6. Remove the EGR valve from the vehicle.

To install:

7. Clean the valve mounting surface.
8. Install a new gasket on the valve mounting surface.
9. Install the valve into place.
10. Tighten the valve mounting bolts.
11. Insert the EGR tube and tighten the fitting.
12. If equipped, plug in the EGR temperature sensor connector.
13. Install any components removed to access the valve.
14. Connect the negative battery cable.

Fig. 1: EGR valve location on the 2.3L 4-cylinder engines

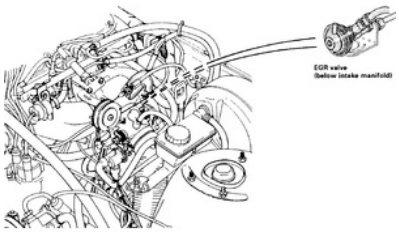


Fig. 2: Location of the EGR valve — 850 models

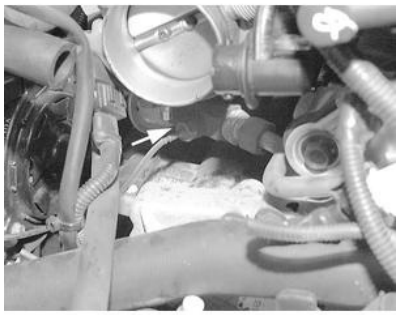


Fig. 3: Remove the two valve mounting bolts and . . .

Fig. 4: . . . lift the valve from the mounting surface

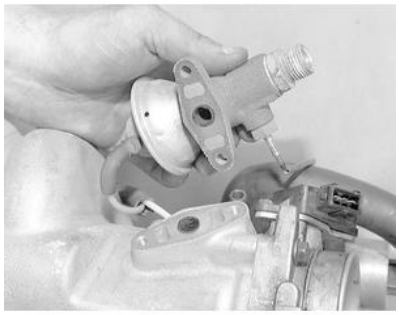
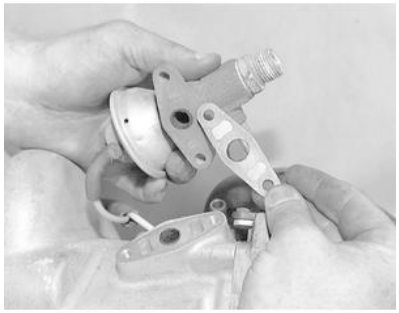


Fig. 5: Always replace the EGR gasket with a new one when replacing the valve



4>EGR Controller Valve

15. Disconnect the negative battery cable.
16. Label and remove the vacuum hoses and electrical connectors from the valve.
17. Remove the fasteners, then remove the valve.

To install:

18. Place the new valve into position and secure it with the mounting fasteners.
19. Attach the vacuum lines and wiring connectors to the valve.
20. Connect the negative battery cable.

EGR Temperature Sensor

1. Disconnect the negative battery cable.
2. Remove any necessary components to access the EGR valve and sensor.
3. Unplug the temperature sensor connector.
4. Using a proper size socket, remove the EGR temperature sensor from the valve.

To install:

5. Install the temperature sensor into the valve and tighten the sensor.
6. Plug the sensor connector in.
7. Install any components removed to access the valve.
8. Connect the negative battery cable.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

NOTE: Do not attempt to correct pump noise by lubricating the air pump. Never lubricate the air pump. Do not assume a pump is bad just because it's noisy.

Control Valve Functional Test

1. Run the engine to normal operating temperature, then increase the speed to 1,500 rpm.
2. Disconnect the vacuum hose at the valve inlet and verify that there is vacuum present.
3. With the engine running at 1,500 rpm, airflow should be felt and heard at the outlet side of the shut-off valve.
4. If the valve is not functioning properly, replace it.

Air Supply Pump Functional Check

1. Check and, if necessary, adjust the belt tension. Press at the mid-point of the belt's longest straight run. You should be able to depress the belt about $^{1}/_{2}$ in. (13mm) at most.
2. Run the engine to normal operating temperature and let it idle.
3. Disconnect the air supply hose from the shut-off valve. If the pump is operating properly, airflow should be felt at the hose. The flow should increase as you increase the engine speed. The pump is not serviceable and should be replaced if it is not functioning properly.

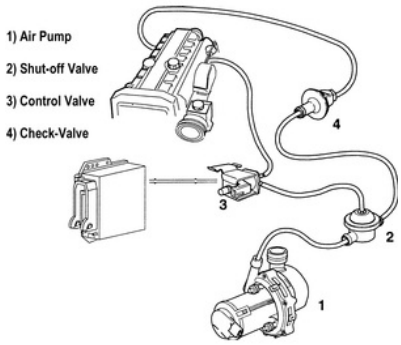
1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

The air injection system is used to inject fresh air into the exhaust manifolds or catalytic converters via an air control valve. The air is created by a air pump that is driven by the engine, it is located in the front of the engine and is propelled by a belt.

The system uses a shut-off valve which is used to prevent backfire in the exhaust system during sudden deceleration. When the throttle is suddenly closed, a too-rich air/fuel mixture may be created which could not normally be burned. This mixture becomes burnable when it reaches the exhaust area and combines with the injected air. The shut-off valve senses the sudden increase in the intake manifold vacuum causing the valve to open, allowing air from the air pump to pass through the valve and silencer into the atmosphere.

Fig. 1: Pulsed Secondary Air System



1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

Air Pump

1. Disconnect the negative battery cable.
2. Remove the drive belt.
3. Remove the air hose from the air pump.
4. Remove the pivot and adjusting bolts from the pump and bracket.
5. Remove the pump from the vehicle.

To install:

6. Install the pump on the mounting bracket and tighten the bolts.
7. Install the air hose onto the pump control valve.
8. Install and adjust the drive belt.
9. Connect the negative battery cable.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

See Section 1 for maintenance light resetting.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

A thermostatically controlled shutter is housed in the air cleaner. The thermostat senses the intake air temperature and changes the position of the shutter, to vary the proportions of hot and cold air entering the air cleaner.

Intake air preheating provides the engine with nearly constant temperature intake air, regardless of ambient air temperature. This provides for smooth engine running and prevents ice build-up.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

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1. Remove the air cleaner housing.
2. Remove the retaining clips and remove the shutter housing.

To install:

3. Place the shutter into position and install the retaining clips.
4. Install the air cleaner housing.

1992 Volvo 940

Submodel: | **Engine Type:** L4 | **Liters:** 2.3
Fuel Delivery: FI | **Fuel:** GAS

---

1. Remove the air cleaner housing.
2. Remove the shutter housing from the air cleaner.
3. Check the bushings and the mounting of the shutter.
4. Check the shutter position at the following temperatures:
    A. 41°F (5°C) or less
    B. Approximately 50°F (10°C)
    C. 59°F (16°C) or more
5. Replace the thermostat if the shutter does not function as specified.
6. Reassemble and install the air cleaner, making sure the air cleaner housing and ducts are sealing properly.