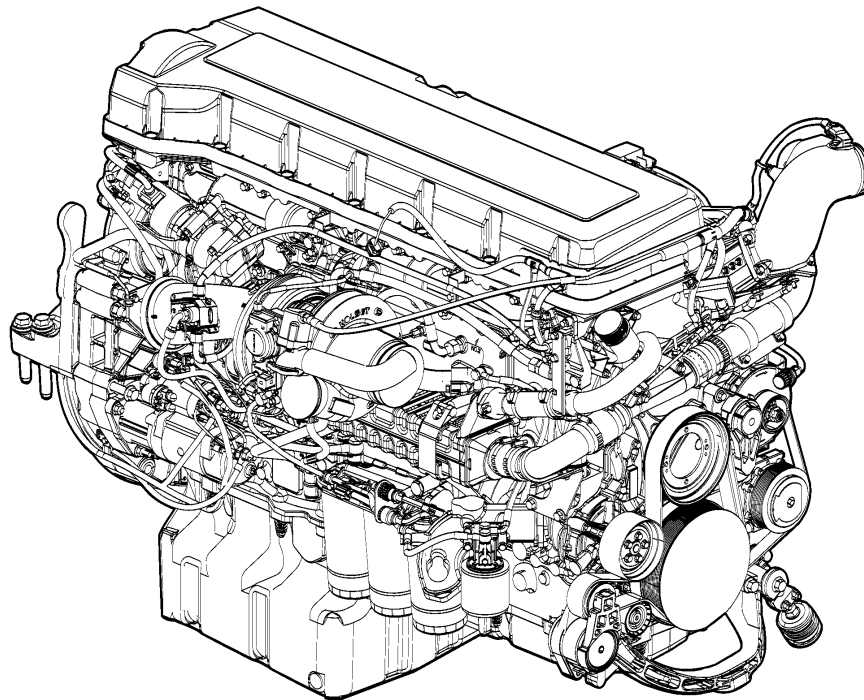


## Fuel System, Troubleshooting



W2005772

This information covers checking the fuel system of the Volvo D16F engine.

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**Note:** Information is subject to change without notice. Illustrations are used for reference only, and may differ slightly from the actual engine version. However, key components addressed in this information are represented as accurately as possible.

## Air in the Fuel System, Check

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

This is a mechanical check for air in the fuel system and includes a check to determine which cylinder might be introducing air to the fuel system. For other fault tracing information, refer to Service Information, group 23: "Fuel Supply Pressure, Fault Tracing, Checklist B."

Air in the fuel being supplied to the engine can cause a number of problems including hard starting, poor performance and excessive smoke. Air can enter the fuel system at several points such as the:

- suction side fuel supply lines.
- pick-up in the fuel tank.
- primary fuel filter.
- copper sleeve to injector seat.
- injector tip.
- fuel supply pump seals.

Locating the point of entry can be troublesome and time consuming. A kit has been developed to aid in this process. The kit (J42753) consists of:

- two fuel line sight glass assemblies.
- two transparent hose assemblies.
- a clamp.
- a washer.
- a hollow screw.
- copper gaskets.
- O-rings.

*Special tools: J42753*

## Check for Air in the Fuel



### CAUTION

After using the fuel aeration test kit, thoroughly drain all remaining fuel from the test hoses, then install plugs, end caps and washers. This prevents accidental spillage that can result in fuel contamination.

#### 1

Connect the 3/16 inch I.D. transparent hose to the air vent located at the fuel filter housing. Use the clamp provided in the fuel line kit to secure the hose. Route the hose back to the fuel tank and secure it to prevent it from coming out of the tank. Open the air vent 1-1/2 turns and prime the fuel system until the transparent hose is free of air. If the fuel system can be bled free of air, continue to step 3.

#### 2

If air continues to exist in the fuel, check for the following:

- That there is ample fuel in the fuel tank(s).
- Connections from the fuel tank to the fuel supply pump for suction leaks.
- Fuel/water separator for restrictions, suction side leaks or an incorrect micron element.
- That the primer pump is capable of pumping fuel.
- The fuel supply pump seal for failure.

#### 3

Close the fuel air vent and start the engine.

**Note:** If the engine does not start, the fuel system is most likely filling with air during cranking; skip to step 5.

#### 4

Once the engine starts, open the fuel air vent, located at the fuel filter housing, 1-1/2 turns with the transparent hose connected. Monitor for air in the fuel for 3 to 5 minutes. If air is present, continue to step 5. If not, then there is a possibility that air is entering the fuel system only under loaded conditions. If it is suspected that air is entering under loaded conditions, continue to step 5. If not, stop here. No further testing is required.

#### 5

If the engine would not start in step 3, continue aeration during cranking. Or if air is noted in the transparent hose while the engine is running, then install the following hoses and sight glasses to determine where the air is entering the fuel system.

#### 6

Install the sight glass hose assembly between the outlet port of the fuel supply pump and the fuel filter.

**7**

Remove the fuel supply (suction) line from the fuel supply pump and install the alternate transparent fuel supply line and route it back to the fuel tank.

**8**

Remove the fuel line at the overflow valve and install the sight glass assembly onto the overflow valve using a hollow screw (941686) from the kit, and route the line to the fuel tank.

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941686

**9**

Remove the transparent hose from the air vent at the fuel filter housing to the fuel tank and close the air vent. Secure all three lines to prevent them from coming out of the fuel inside the tank.

**Note:** For engines equipped with the small line located between the fuel supply pump and the top of the engine electronic control unit (ECU), this line must be disconnected from the fuel supply pump, and the port from which the line was removed must be plugged using two copper gaskets and washer (949873) supplied in the fuel line kit.

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949873

**10**

Using the primer pump, attempt to purge all air from the fuel system and start the engine.

**Note:** Purging time may vary.

**11**

Repeat the conditions in which aeration was previously noted or test under loaded conditions, i.e., dyno test.

**12**

Monitor the two sight glasses and transparent hose for aeration allowing 3 to 5 minutes for the sight glasses to clear.

**Note:** Shining a flashlight into the backside of the sight glass improves visibility.

**13**

If no air is noted in either sight glass and air was noted in previous steps, the air entry is most likely in the suction lines between the fuel supply pump and the fuel tank including the primary fuel filter, copper washers, O-rings and pick-up inside of the fuel tank(s).

**14**

If air is noted in the sight glass between the fuel supply pump and fuel filter, and the alternate fuel supply is supplying the fuel supply pump with a good flow of air-free fuel, the problem is most likely in the fuel pump seals.

**Note:** The fuel in the sight glass is under pressure. This compresses the air bubbles and they can appear to be small.

**15**

If air is noted in the sight glass at the cylinder head, but not in the sight glass at the outlet of the fuel supply pump (with no engine load), the problem is most likely within the cylinder head, i.e., copper sleeve to injector seat or injector tip leakage. See "Determine Which Cylinder is the Cause of Air Entering the Fuel" page 6.

**Note:** The sight glass shows small bubbles due to the turbulence created by the opening and closing of the overflow valve. To determine whether normal or abnormal aeration is occurring, use the transparent hose at the air vent at fuel filter housing. Open the air vent 1-1/2 turns and monitor for air. If the line is clear, then the aeration in the sight glass is normal. If the transparent hose indicates aeration, then the aeration in the sight glass is abnormal.

**16**

If air is noted only under loaded conditions, remove all six injectors and inspect the copper sleeve to the injector seat for signs of leakage.

## Determine Which Cylinder is the Cause of Air Entering the Fuel

 **CAUTION**

After using the fuel aeration test kit, thoroughly drain all remaining fuel from the test hoses, then install plugs, end caps and washers. This prevents accidental spillage that can result in fuel contamination.

**1**  
Disconnect the fuel line from the overflow valve at the cylinder head and install the sight glass and line assembly onto the overflow valve using a hollow screw (941686) from the kit, and route into the fuel tank. Tie down the line to prevent it from moving out of the tank.

**2**  
Remove the fuel supply line from the fuel supply pump and install the alternate fuel supply line onto the feed pump. Route the line back to the fuel tank. Tie down the line to prevent it from coming out of the fuel level inside the tank.

**Note:** For engines equipped with the small line located between the fuel supply pump and the top of the EECU, this line must be disconnected from the fuel supply pump. The port that the line was removed from must be plugged using two copper gaskets and the washer (949873) supplied in the fuel line kit.

949873

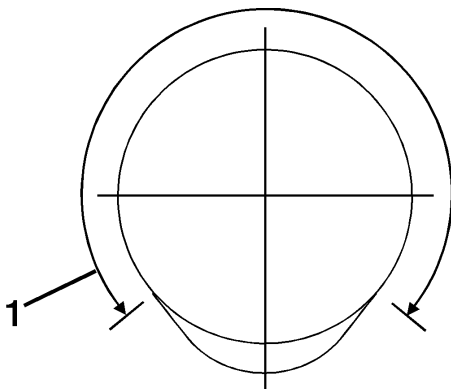
**3**  
Start the engine and allow three minutes for the sight glass to clear. Take note of the air present in the fuel sight glass.

**4**  
Stop the engine and remove the valve cover.

**5**  
Rotate the engine by hand until the rocker arm for the intake valve for cylinder number one is on the base circle of the cam (in other words, in position to be adjusted). Turn the adjusting screw down (clockwise) until all clearance has been removed and then continue turning an additional 1/4 turn (90 degrees). Install the valve cover and secure with four bolts.

 **CAUTION**

Do not turn the adjusting screw down more than 1/4 turn (90 degrees) after all clearance has been removed. Engine damage can result.



W2003027

Base Circle of Camshaft (1)

**6**



**CAUTION**

Run the engine only at idle speed with no load for this test. High engine speed or load can cause engine damage.

Use the hand primer pump to purge all air from the fuel system.

**7**

Restart the engine and monitor the sight glass in the cylinder head. If the air that was noted in step 3 is gone, then the problem is most likely in the cylinder number one (injector tip or injector to copper sleeve seat). Remove the injector and inspect the injector-to-copper sleeve seat. If the seat appears to be OK, replace the injector and perform the test again.

**8**

If the air that was noted in step 3 is not gone, stop the engine, remove the valve cover, back out (counterclockwise) the adjusting screw for the intake valve at cylinder number one half way around (180 degrees) and repeat the procedure (starting with step 5) on cylinder number two.

**9**

Continue the procedure until the cylinder that is introducing air into the fuel system has been located.

**10**

When the cylinder that is introducing air into the fuel system has been located, remove that injector and inspect the injector-to-copper sleeve seat. If the seat appears to be OK, replace the injector and perform the test again. If the seat and injector O-rings show signs of combustion leakage, clean the injector and replace the injector copper sleeve. Reinstall the injector with new O-rings and adjust all valves and injectors.

**11**

Start the engine and monitor the sight glass for air. If no air is present, then stop. If air is present, then test again as required.