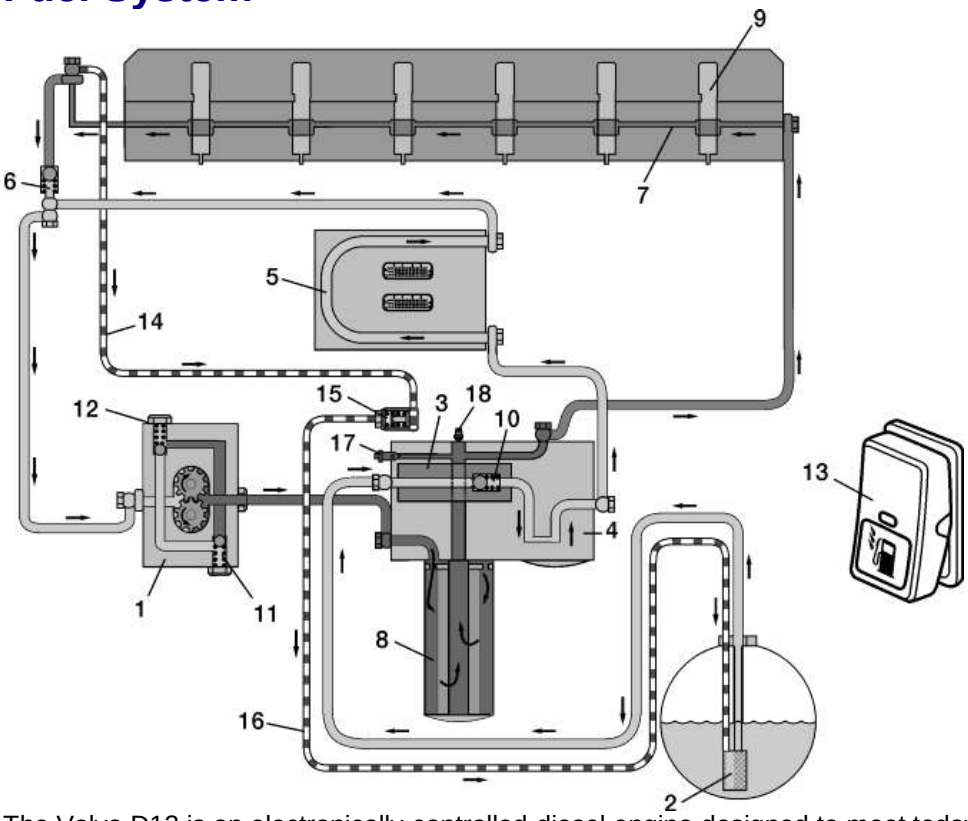
sb13395_fuel

Thursday, May 10, 2018 6:52 PM

Fuel System

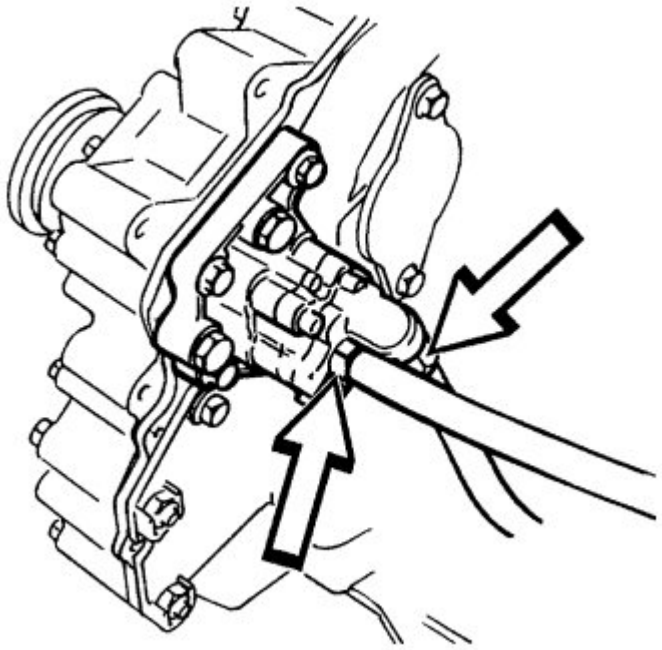


The Volvo D12 is an electronically-controlled diesel engine designed to meet today's strict environmental standards. Meeting these standards requires optimum combustion. This demands, among other things, injecting the exact amount of fuel into the combustion chamber under very high pressure, at precisely the correct time, depending on engine speed, load, temperature and other conditions.
Because totally mechanical injection systems cannot meet these demands, the engine is equipped with an electronically controlled injection system. An **engine ECU** (5) receives impulses from the accelerator pedal and a number of sensors on the engine. The sensors read signals which govern the injection procedure and send these signals to the EECU. The fuel system has a built-in diagnostic system, which electronically detects and traces any faults in the system.
Each cylinder has four valves. Individual differences always occur between the cylinders in an internal combustion engine. The engine has a cylinder balancing system, the purpose of which is to even out the amounts of fuel between the cylinders. Cylinder balancing takes place with the engine running at idle speed, providing certain preconditions have been met.

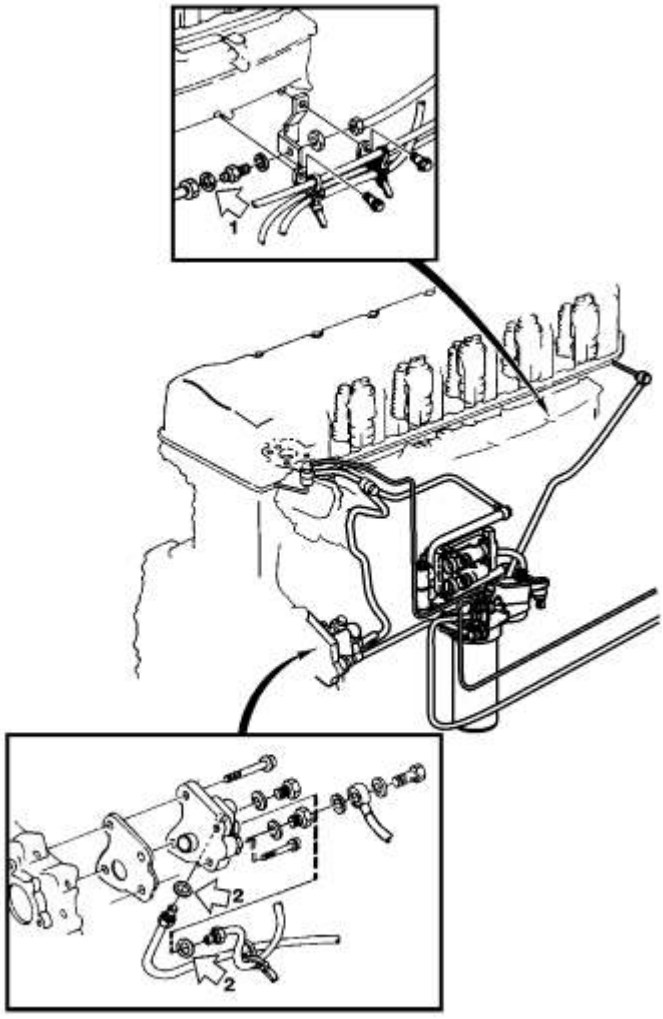
Fuel Line O-Rings

Always replace the fuel line O-rings when:

- troubleshooting for fuel aeration and/or
- performing any Service Procedure that requires the removal of engine fuel lines.



Removing fuel lines



Fuel line O-ring locations

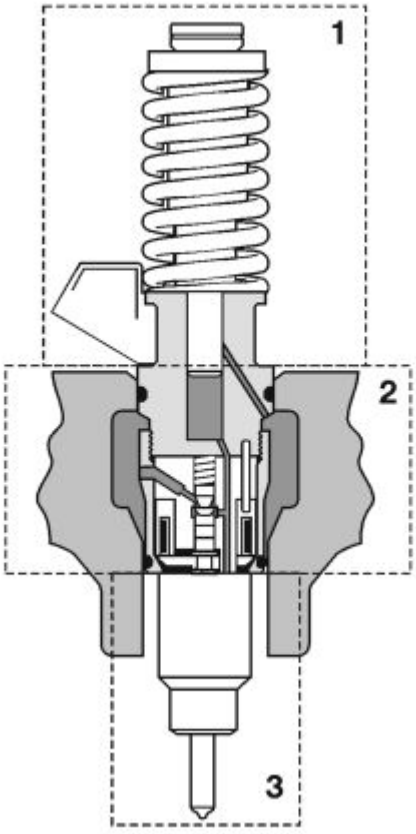
Unit Injectors

The fuel injection system of the D12 engine uses electronically-governed unit injectors that are electrically activated and mechanically driven via roller rocker arms from the camshaft lobe. They are vertically located in the center between the four valves in the cylinder head for each cylinder.
The electronic unit injector (EUI) combines an injection pump and an injector. An EUI can operate at

considerably higher injection pressure than a conventional injector. The EUI consists of three main components:

- **Pump** containing a cylinder and piston; this corresponds to the pump assembly in an injection pump.
- **Valve housing** with spill valve and needle-lift valve
- **Injector** with nozzle body, needle, and spring.

The upper part of the electronic unit injector, which includes the compression spring and valve housing, lies above the cylinder head.
The center part of the electronic unit injector, where the intake and outlet holes for the fuel are located, lies in the cylinder head fuel gallery. The electronic unit injector takes in fuel directly from the fuel gallery.
The lower part of the EUI is located in a copper sleeve against the bottom of the cylinder head, similar to a standard injector.
The EECU calculates injection timing and the amount of fuel to inject into the cylinder and transmits signals to the electromagnetically controlled fuel valve in the valve housing. The length of the injection time determines the amount of fuel injected into the cylinder.



Electronic unit injector (EUI)

1. Pump
2. Valve housing
3. Injector

Injector Operational Phases

Fill Phase

During the filling phase, the pump plunger is on its way up, the camshaft lobe is passing its highest point, and the rocker arm is on its way toward the camshaft basic circle.
The fuel valve is open, allowing fuel to flow into the EUI from the lower fuel gallery. It flows into the cylinder head and the EUI pump cylinder. Filling continues until the pump plunger reaches its upper position.

Spill Phase

The spill phase begins when the camshaft turns to the position at which the camshaft lobe forces the rocker arm to push the pump plunger down.
The fuel can now flow through the fuel valve, through the holes in the EUI and out through the fuel gallery. The spill phase continues as long as the fuel valve is open.

Injection Phase

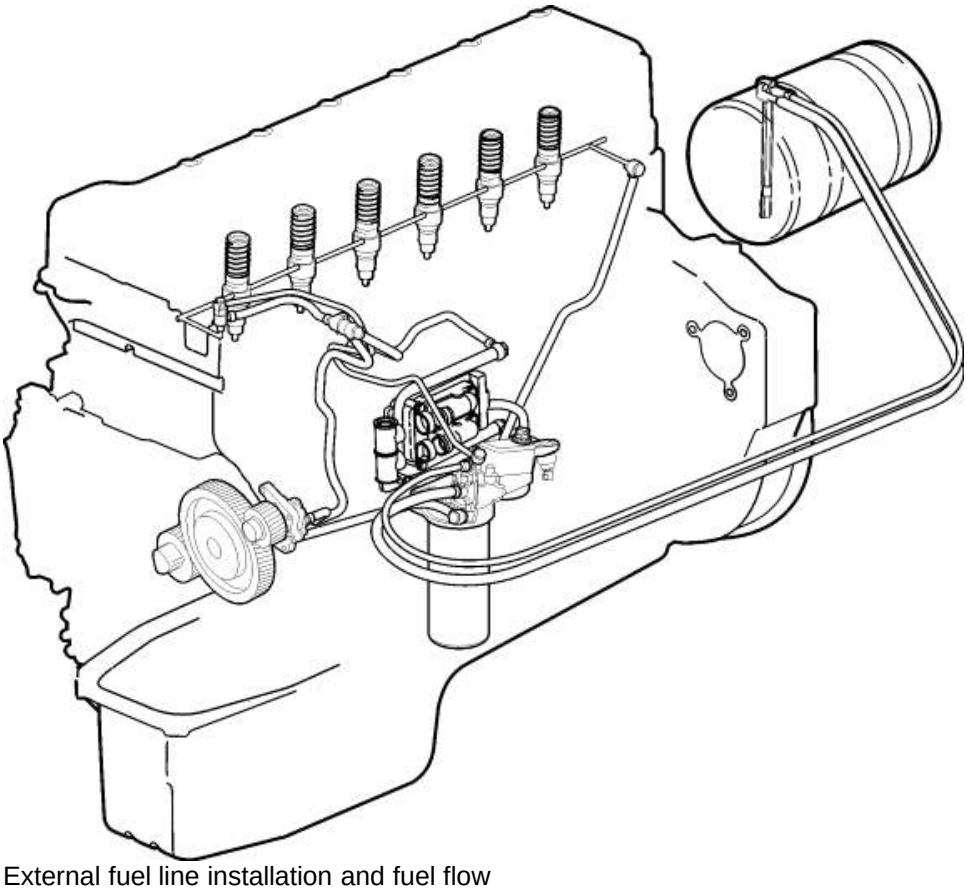
The injection phase begins when the fuel valve closes. The camshaft lobe and rocker arm continue to

press down the pump plunger and injection occurs as the route through the fuel valve closes. The injection phase continues as long as the fuel valve is closed.

Pressure Drop Phase

The injection phase ends when the fuel valve opens and pressure in the EUI drops below the nozzle opening pressure. The fuel flows through the open fuel valve, through the electronic unit injector holes and out through the fuel gallery. Note that the fuel valve position (closed or open) determines when the injection phase begins and ends. The time during which the fuel valve is closed determines the amount of fuel injected at each pump stroke.

Fuel Flow

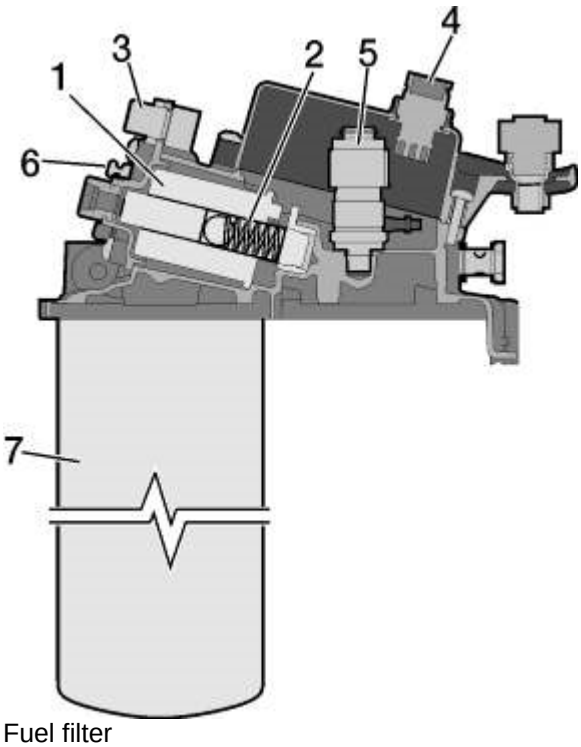


External fuel line installation and fuel flow

The D12D uses a fuel line through the cylinder head. The overflow valve is also located toward the front of the cylinder head at the valve cover.

Fuel Filter

The system is equipped with a large fuel filter located on the left-hand side of the engine. The filter insert consists of a special corrugated filter paper with a high resistance to water and very good filtering properties. In addition, a fine-gauge net filter on the fuel suction line in the fuel tank separates any possible solid impurities before the fuel is pumped up into the system.

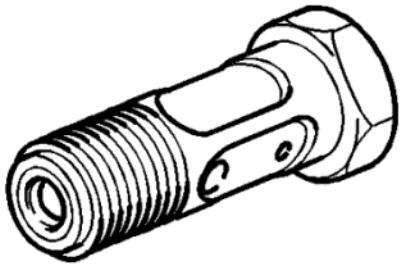


Fuel filter

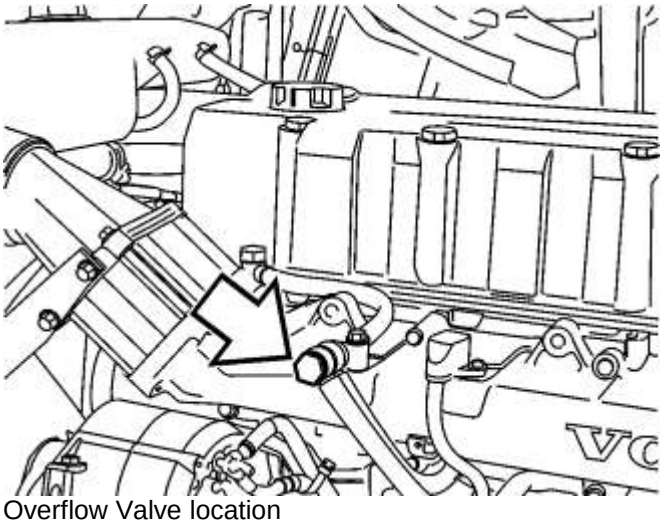
1. Electric pump
2. Relief valve
3. Air vent
4. Wiring harness connector
5. Fuel pressure sensor
6. Drain fitting
7. Fuel filter

Overflow Valve

The overflow valve, located in the outlet from the cylinder head fuel gallery, regulates the fuel system feed pressure. Opening pressure is about 345 kPa (50 psi). The high feed pressure ensures that the injectors are filled with fuel.
The valve is integrated with the hollow screw in the fuel outlet at the front of the cylinder head.



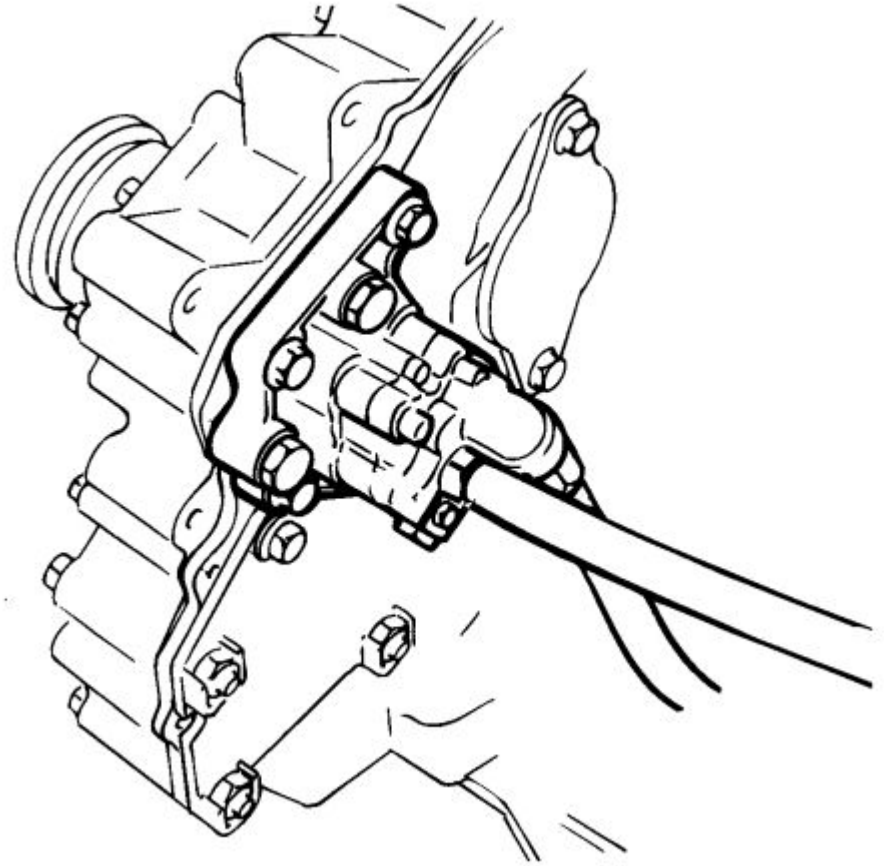
Overflow Valve



Overflow Valve location

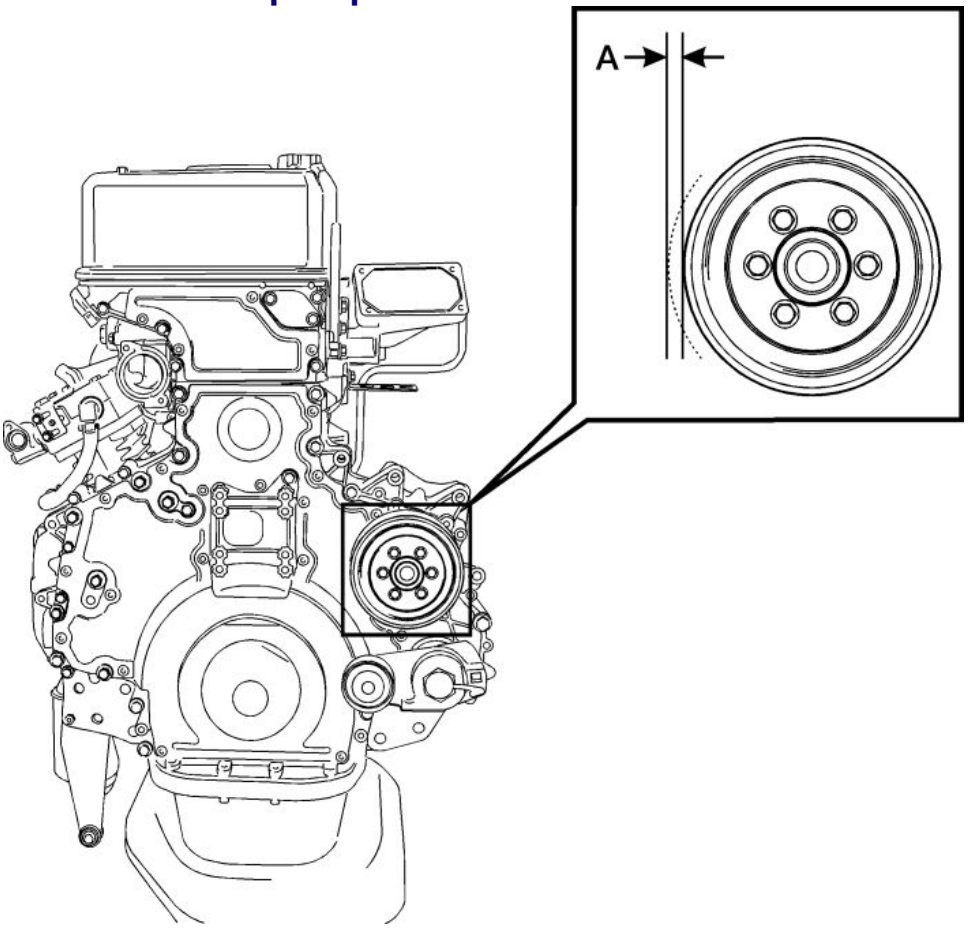
Fuel Feed Pump

The capacity of the pump has been adapted to give the correct pressure and flow to the EUI. Filling the EUIs requires relatively high pressure. The flow must be large enough to even out any fuel temperature differences in the cylinder head fuel gallery.



Fuel Feed Pump

Fuel Feed Pump Replacement



A = Radial Play
When replacing a D12 fuel supply pump for any reason, the accessory drive must also be inspected. There should be no radial or axial play in the accessory drive shaft. Radial play is movement parallel (side to side) to the face of the pulley. Do not confuse with backlash which is measured by turning the pulley. Axial play is movement perpendicular (in and out) to the face of the pulley. Release the tension on the alternator and fan belts before checking. This test is done by simply attempting to move the accessory drive pulley by hand.

Caution
Radial or axial play in the accessory drive shaft may cause premature failure of the fuel feed pump.

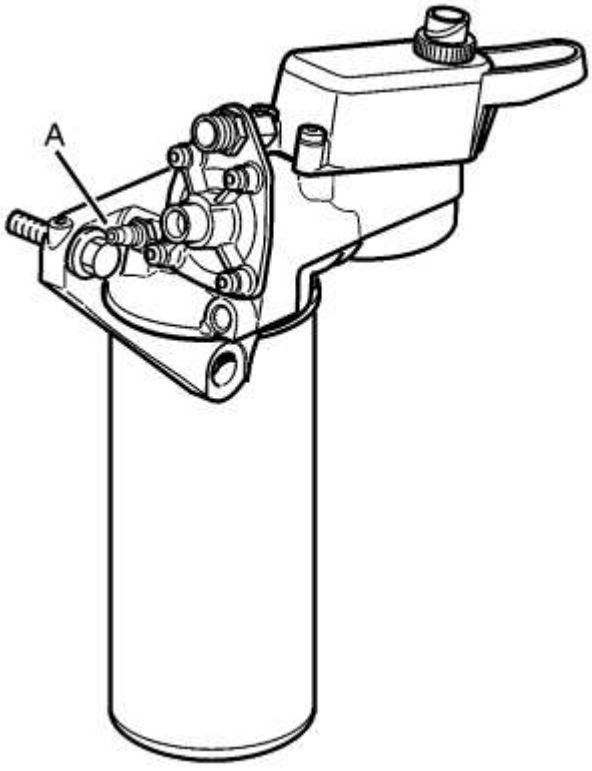
Electric Primer Pump

The electric primer is situated on the fuel filter bracket and is used to pump the fuel and bleed the system when the engine is not running.
The primer pump is activated using the dash-mounted switch. Bleeding/priming the fuel system takes approximately 4–5 minutes.
The pump also is cycled each time the ignition key switch is first turned ON.

Primer Pump Switch

Drain Fitting, Fuel Filter Housing

The drain fitting for the fuel system is located on the fuel filter housing (A).

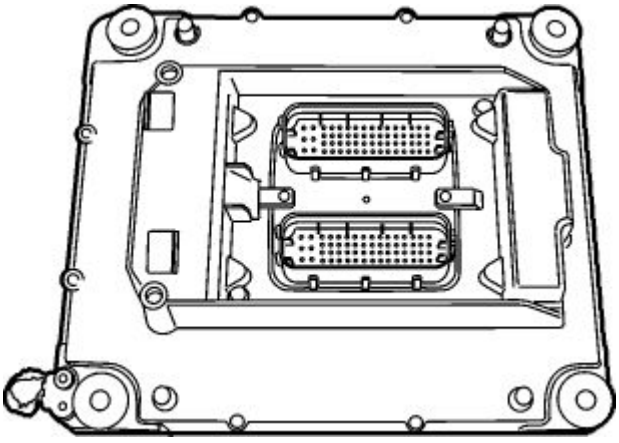


A	Bleed valve

Engine Electronic Control Unit (EECU)

The electronic control module is the central part of the injection system. It is located on the left-hand side of the engine. The EECU receives continuous information from the accelerator pedal and from several

sensors on the engine. It calculates the amount and the time to inject fuel into the cylinders. Electrical wiring to the EUI fuel valves transmits control signals to the injectors.
The EECU uses the flywheel sensor to monitor engine rotation and engine speed variations during a revolution. This allows the EECU to ensure that each EUI receives exactly the correct amount of fuel. The EECU stores information when a fault occurs or if something in the system is abnormal. Occassional faults are also stored and can be traced at a later stage.



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