

# SECTION 03: FUEL SYSTEM

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## 1. FUEL SYSTEM WITH DETROIT DIESEL SERIES 60 ENGINE

### 1.1 DESCRIPTION

Figure 1 shows a schematic of the fuel system. Fuel is drawn from the fuel tank through a manual shut-off valve, a primary fuel filter (fuel-filter/water-separator) before it enters the MCM and the fuel pump. If the vehicle is equipped with the optional “Davco Fuel Pro 382”, this one replaces the primary fuel filter. Leaving the pump under pressure, the fuel flows through a secondary fuel filter and a shut-off valve, then to the cylinder head. The fuel reaches the injectors in the cylinder head through passages within the head. Excess fuel exits at the rear of the head just above the inlet, through a restrictive return fitting which maintains fuel pressure in the system. Finally, the fuel flows through the check valve and the fuel cooler before it returns to the fuel tank. One preheater is available: 104 000 BTU. If the vehicle is equipped with the 104 000 BTU preheater, the fuel is drawn from the fuel tank through the fuel filter to the preheater. Excess fuel returns to the fuel tank.

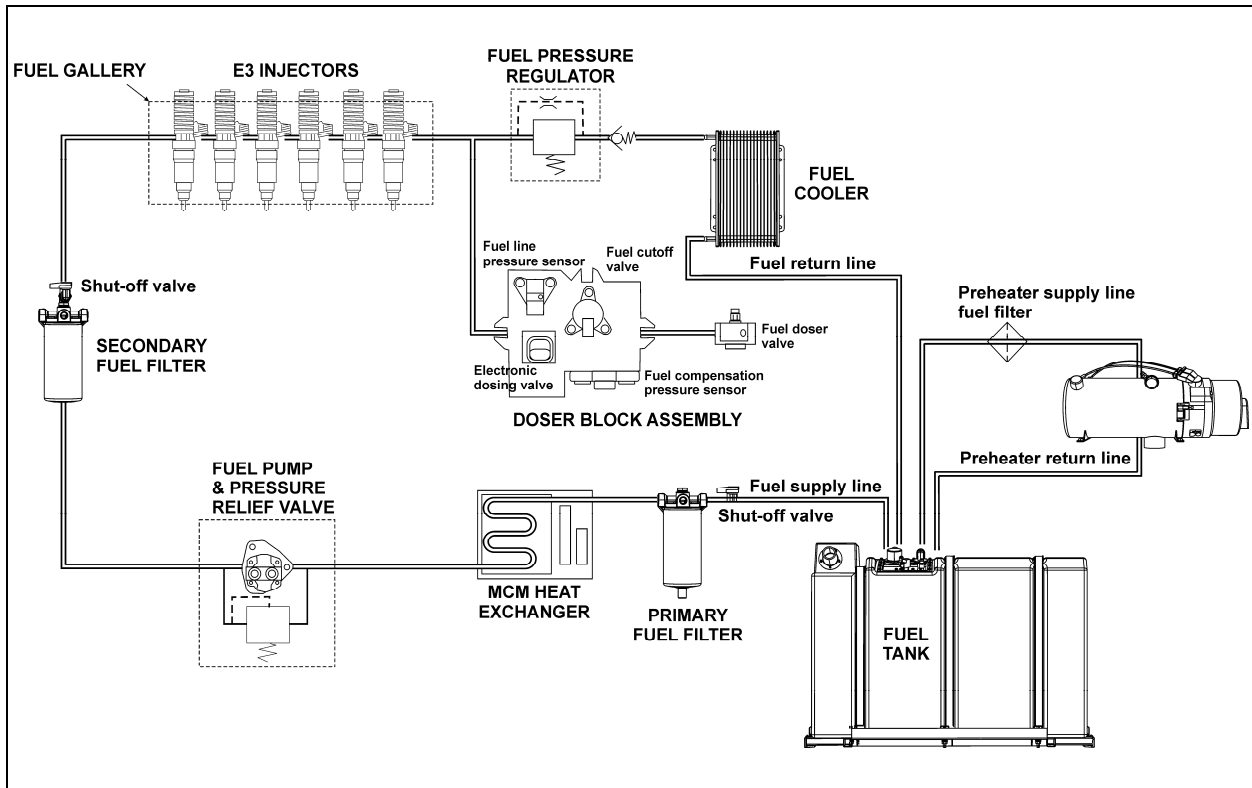


FIGURE 1: FUEL SYSTEM SCHEMATIC (DDC SERIES 60 ENGINE)

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### 1.2 FUEL VALVES

Manual shut-off valves on engine fuel-supply line are located on the R.H. side of engine compartment. A manual shut-off valve is located at the inlet side of the primary fuel filter under the starter or at the inlet side of Davco Fuel Pro 382 fuel filter. Another manual shut-off valve is located at the outlet side of the secondary fuel filter. Shut-off valve are designed to prevent loss of fuel prime at time of filter replacement. No manual valve is required on preheater fuel-supply line, since the positive-displacement fuel pump (located close to the fuel tank) prevents fuel flow when not activated.

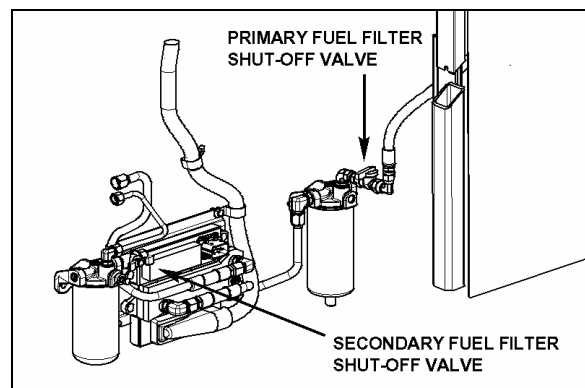


FIGURE 2: MANUAL SHUT-OFF VALVES LOCATION (DDC S60 ENGINE)

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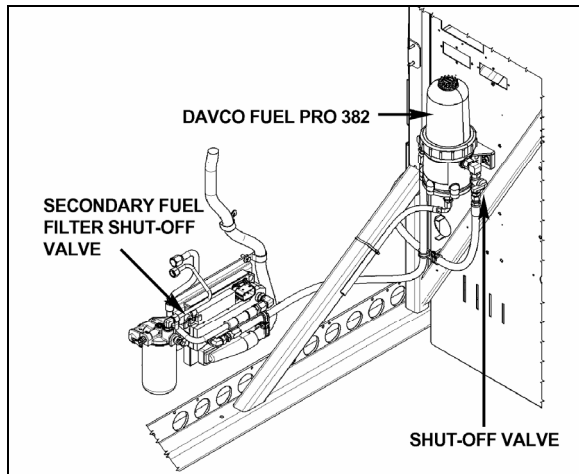


FIGURE 3: MANUAL SHUT-OFF VALVE WITH DAVCO FUEL PRO 382 (DDC S60 ENGINE) 03073

### 1.3 FUEL FILTERS

The fuel system is equipped with primary (strainer or optional fuel/water separator) and secondary fuel filters for additional protection of the injectors. A Racor fuel/water separator may be installed in primary filter location (Fig. 4).

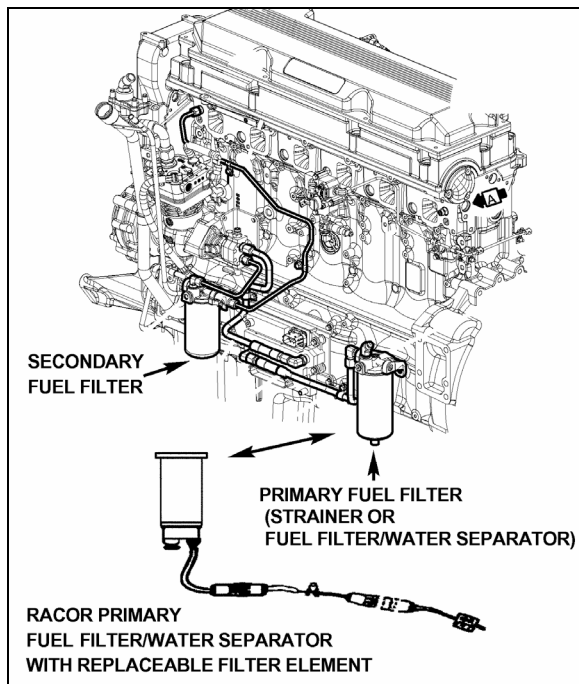


FIGURE 4: ENGINE R.H. SIDE 03069

#### NOTE

The operating conditions and cleanliness of type of fuel used determine the service intervals of the filter/water separator element and the secondary fuel filter cartridge.

#### NOTE

For information on the Davco Fuel Pro 382 fuel filter, refer to paragraph 3.

### 1.4 RACOR FUEL/WATER SEPARATOR SERVICING



#### MAINTENANCE

The Racor fuel/water separator should be drained periodically, or when the water separator telltale light on the dashboard illuminates.

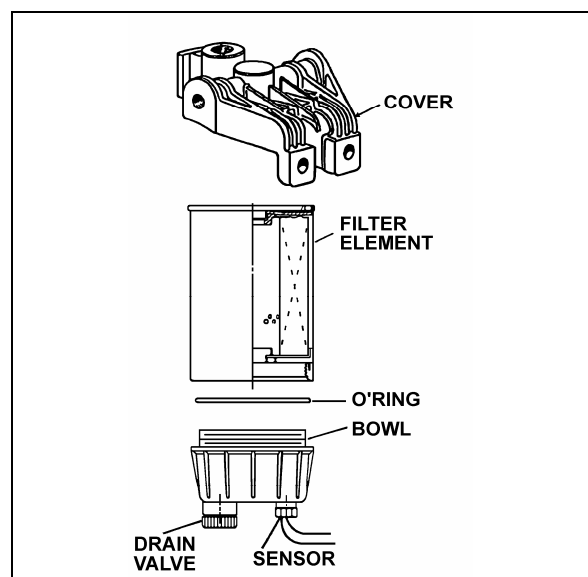


FIGURE 5: RACOR FUEL /WATER SEPARATOR 03025

Replace the fuel/water separator element as follows:


1. Drain the fuel /water separator by opening the drain valve.
2. With engine "OFF" and engine fuel supply line shut-off valves closed; remove the filter cartridge and bowl assembly from cover (for valve location, see "1.2. FUEL VALVES" in this section).
3. Separate bowl from filter cartridge. Clean bowl and O-ring groove.

#### NOTE


Bowl is reusable, do not discard.

4. Lubricate O-ring with clean diesel fuel or motor oil and place it in bowl groove.

- Screw bowl onto new filter cartridge snugly by hand.

 <b>CAUTION</b>
Do not use tool to tighten. Tighten by hand only.

- Lubricate filter seal with clean diesel fuel or motor oil.
- Fill filter cartridge with clean diesel fuel and attach onto cover. Handtighten an additional 1/3 to 1/2 turn after making full seal contact.
- Open shut-off valves of the engine fuel supply line.
- Run the engine and check for leaks.

 <b>CAUTION</b>
If the fuel/water separator continuously requires draining, it is possible that water or sediment has accumulated in the fuel tank. To correct this situation, open the drain plug under the tank when the fuel gauge indicates tank is 1/4 full in order to drain any contaminant.

1.5 SPIN-ON TYPE FUEL FILTER SERVICING (PRIMARY & SECONDARY)


The primary and secondary fuel filters are located on the R.H. side of the engine. The primary filter is located below the starter, and the secondary fuel filter is below the air compressor. The threaded sleeves that accept the filters body are different sizes to prevent mismatching. Primary filter thread is 1" X 12 while secondary is 13/16" X 12. The word "primary" or "secondary" is cast onto the top of the respective adaptor.

<b>NOTE</b>
<i>The fuel filter adaptors are mounted to the engine block with two bolts each. Torque these bolts to 43-54 lbf•ft (58-73 N•m).</i>

A method of determining when filters are clogged to the extent that they should be changed is based on the fuel pressure at the cylinder head fuel inlet fitting and the inlet restriction at the fuel pump. In a clean system, the maximum pump-inlet restriction should not exceed 6 inches of mercury (20.3 kPa) and must

not exceed 12 inches of mercury (41 kPa) with a dirty system.


At normal operating speeds and with the standard fuel pressure regulator, the fuel pressure at the cylinder head inlet is 58-72 psi (400-50 kPa). Change the fuel filters whenever the inlet restriction at the fuel pump reaches 12 inches of mercury (41 kPa) at normal operating speeds. Also, change whenever the fuel pressure at the cylinder head inlet fitting falls to the minimum fuel pressure given above.

 <b>MAINTENANCE</b>
The primary and secondary fuel filters are of a spin-on type and must be replaced every 12,500 miles (20 000 km) or once a year, whichever comes first. If the primary fuel filter is a fuel filter/water separator type, it is equipped with a positive seal drain-valve to prevent water infiltration in engine fuel system. To drain, loosen positive seal drain-valve below filter and tighten after water has been flushed out.

Change the filter cartridge(s) as follows:

<b>NOTE</b>
<i>Use a suitable band wrench or filter wrench, such as J22775, to remove the filters.</i>

- Stop engine, place a suitable container under the filter.
- Close the secondary and primary filter shut-off valve (for valve location, See paragraph 1.2. FUEL VALVES").
- Using a band filter wrench, unscrew and discard filters.
- Fill new filter cartridge(s) with clean fuel oil. Apply a thin coat of clean fuel oil on gasket.
- Install new filters. Tighten until filter is snug against the gasket, with no side movement. Rotate an additional 1/2 turn by hand.

 <b>CAUTION</b>
Mechanical tightening of the fuel filters is not recommended and may result in seal and/or cartridge damage. Tighten the fuel filters by hand only.

- Open engine fuel supply line shut-off valves.

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7. Start the engine and check for leaks.

### **NOTE**

*There is a fuel system shut-off valve on the discharge side of the secondary fuel filter. This check valve is designed to prevent fuel loss at time of filter replacement.*

### 1.6 FUEL PUMP INSTALLATION

The fuel pump is driven off of the rear of the air compressor.

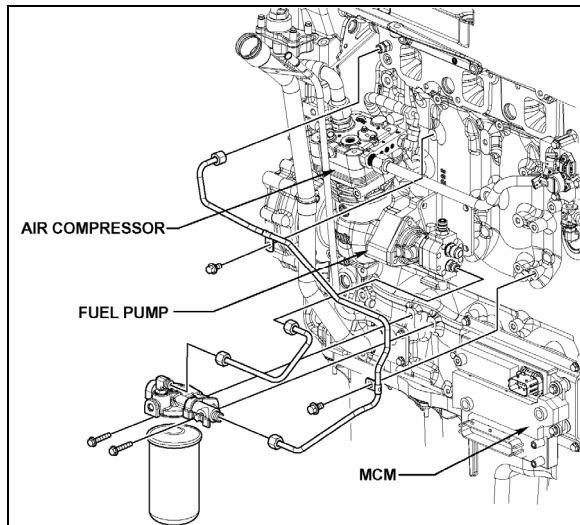


FIGURE 6: FUEL PUMP LOCATION

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1. If removed, install inlet and outlet fittings in the cover of the fuel pump.

### **NOTE**

*New fittings have sealant already applied. When reusing fittings, coat the threads lightly with Loctite Pipe Sealant, Detroit Diesel number J 26558-92, or equivalent, before installing. To prevent sealant from entering fuel system, do not apply to the first two threads of the fitting. Do not use Teflon tape or paste on the fittings.*

2. Install drive coupling in drive hub of the fuel pump. Install a new gasket to the mounting flange of the pump.
3. Index the drive coupling with the drive hub on the end of the air compressor crankshaft and align the pump mounting bolt holes with those in the air-compressor rear cover.

### **NOTE**

*When correctly positioned, the outlet fitting on the pump should be in approximately an 8 o'clock position when viewed from the rear, and the drain opening in the pump body facing down.*

4. Seat the fuel pump squarely against the air compressor. Pilot the flange on the pump body, in the opening in the rear cover of the compressor. Install three mounting bolts and tighten them to 22-28 lbf-ft (30-38 Nm).
5. Connect the fuel inlet and outlet lines to the fuel pump and tighten.
6. Prime engine fuel system before starting engine to ensure pump seal lubrication and prompt engine starting.

## 2. FUEL SYSTEM WITH VOLVO D13 ENGINE

### 2.1 DESCRIPTION

#### *NOTE*

For additional information concerning Volvo D13 engine components or engine-related components, consult Volvo Trucks Canada or Volvo Trucks North America Web Site under: Parts & Service. On Volvo web site, you will find detailed service procedures for parts replacement, repair and maintenance.

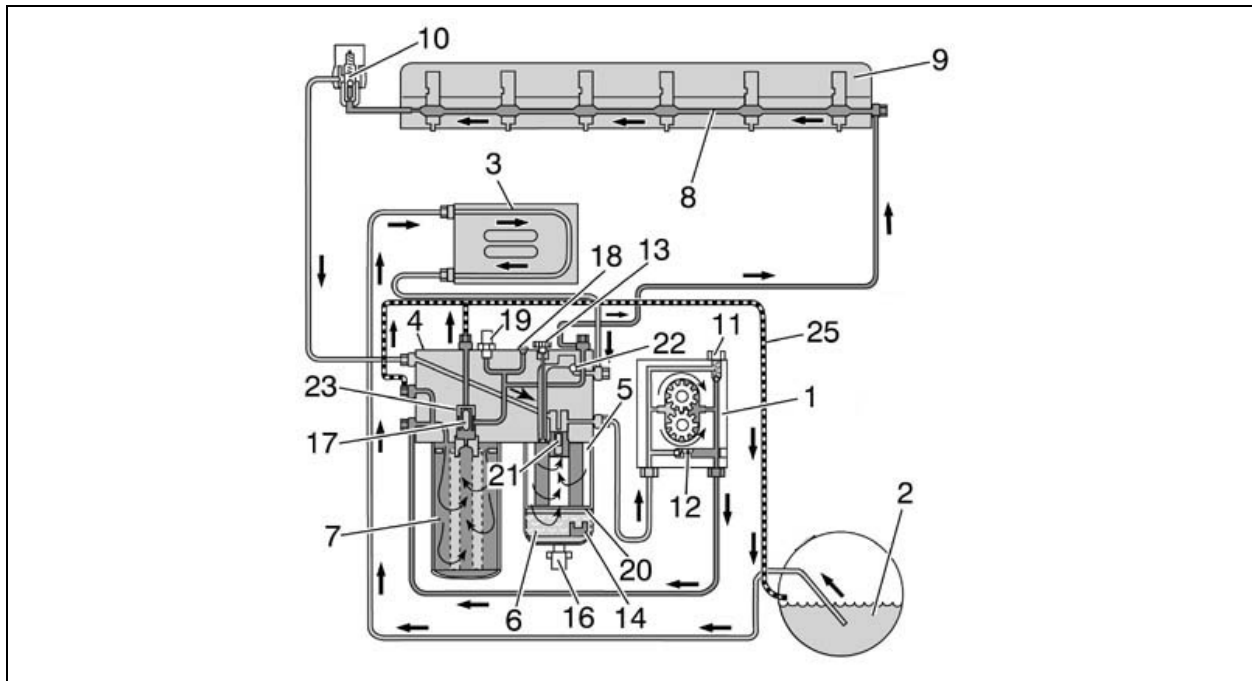


FIGURE 7: FUEL SYSTEM SCHEMATIC (VOLVO D13 ENGINE)

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Fuel is drawn up the fuel lines by the supply pump (1) through the pickup tube in the tank (2) and through the Engine Electronic Control Unit (EECU) cooling coil (3) and into the fuel filter housing (4). The fuel housing is equipped with a primary fuel filter (fuel/water separator) consisting of a filter cartridge and a water separation bowl.

The supply pump (1) forces the fuel into the fuel filter housing through the secondary filter (main) to a cylinder head longitudinal gallery (8). This channel supplies each unit injector (9) with pressurized fuel by a circular groove around each unit injector in the cylinder head. The overflow valve (10) controls the fuel supply pressure to the unit injectors.

The return fuel from the overflow valve (10) is returned back to the fuel filter housing and is mixed with the fuel from the fuel tank in a channel within the fuel filter housing (4).

#### Supply Pump Valves

Two valves are located in the supply pump (1). The safety valve (11) allows fuel to flow back to the suction side when the pressure becomes too high, e.g., if the fuel filter is blocked or is too restricted. The non-return valve (12) opens when the hand-priming pump is used.

#### Automatic Bleeding

If air gets into the system, it is bled when the engine starts. During bleeding, air is pressed out through the fuel filter housing over to the fuel tank through the return line (25). Bleeding for the filter replacement is controlled by valves (17) and (23).

#### Other

The fuel filter housing eliminates the need to drain the fuel when replacing the filter. The valve pegs (17) and (21) close when the fuel filter is

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removed. It is not necessary to bleed the fuel system after replacing the filter, since this is performed automatically when the engine is started and runs for more than 2 minutes.

The plugged outlet (18) is fitted on the fuel filter housing. This outlet is used when measuring supply pressure after the fuel filter with an external pressure gauge. The pressure sensor (19) on the fuel filter housing monitors the supply pressure after the fuel filter. A fault code is displayed on the instrument cluster if the fuel supply pressure is less than the specified value.

### Hand Priming Pump

The hand priming pump (13) is located on the fuel filter housing and is used to pump fuel (when engine is not running) after the fuel system has been drained for repair, etc. The non-return valve (22) for the hand priming pump is also located in the fuel filter housing.

## 2.2 FUEL VALVES

The manual shut-off valve on engine fuel-supply line is located on the R.H. side of engine compartment. A manual shut-off valve is located at the inlet side of the primary fuel filter or at the inlet side of Davco Fuel Pro 382 fuel filter. Shut-off valve is designed to prevent loss of fuel prime. No manual valve is required on preheater fuel-supply line, since the positive-displacement fuel pump (located close to the fuel tank) prevents fuel flow when not activated.

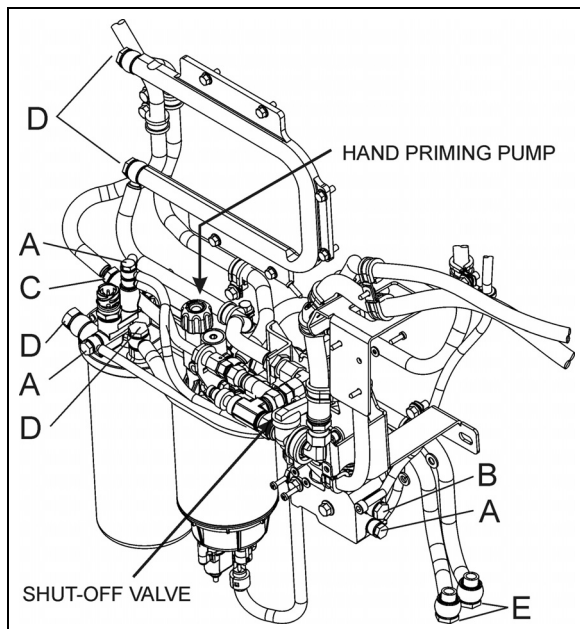


FIGURE 8: MANUAL SHUT-OFF VALVE (VOLVO D13 ENGINE)

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FUEL LINE FITTINGS – VOLVO D13 ENGINE		
A	13 ± 2 ft-lb	(18 ± 3 Nm)
B	20.5 ± 3 ft-lb	(28 ± 4 Nm)
C	22 ± 3 ft-lb	(30 ± 4 Nm)
D	26 ± 4 ft-lb	(35 ± 5 Nm)
E	29.5 ± 4 ft-lb	(40 ± 5 Nm)
F	35 ± 4 ft-lb	(48 ± 5 Nm)

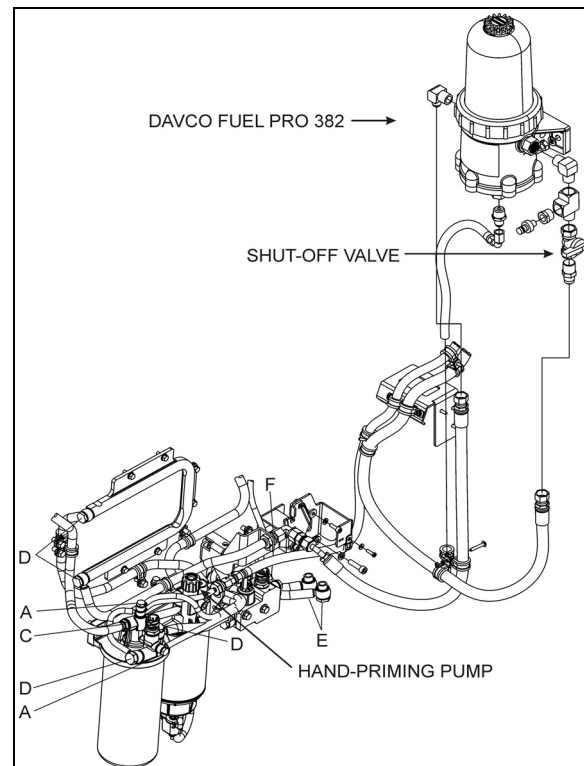


FIGURE 9: MANUAL SHUT-OFF VALVE LOCATION WITH DAVCO FUEL PRO 382 (VOLVO D13 ENGINE)

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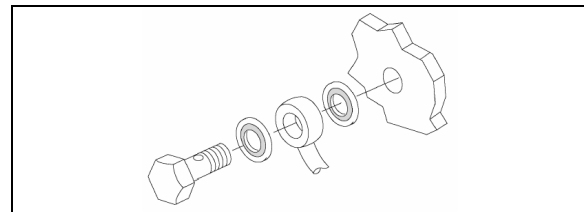


FIGURE 10: FUEL LINE COMPRESSION FITTING



## CAUTION

Always replace the fuel line compression sealing washers when troubleshooting for fuel aeration or performing any service procedure that requires the removal of engine fuel lines.

## 2.3 FUEL FILTERS

A primary fuel filter is installed on the engine. This filter consists of a filter cartridge, a water separation bowl with a drain valve. It is used to prevent water from entering the fuel system.





## MAINTENANCE

The primary and secondary fuel filters are of a spin-on type and must be replaced at **every engine oil change**.

The primary fuel filter should be drained periodically or when the telltale light on the dashboard illuminates if equipped with this system. To drain water, loosen the drain valve below the separator. Place an appropriate container under the filter. Close the drain valve when finished.

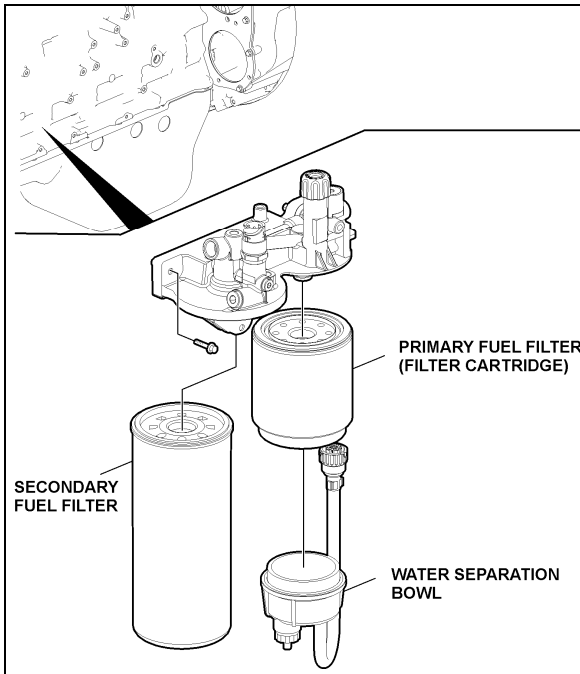
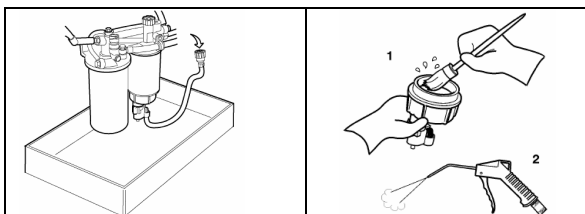


FIGURE 11: FUEL FILTERS WITH VOLVO D13 ENGINE  
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### 2.3.1 Primary Fuel Filter Replacement

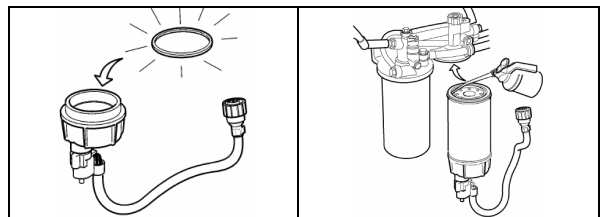
1. Stop engine, close the fuel supply line shut-off valve.
2. Place an appropriate container under the fuel filter housing, then drain the water from the water separation bowl.
3. Disconnect the fuel/water separator indicator electrical connector.



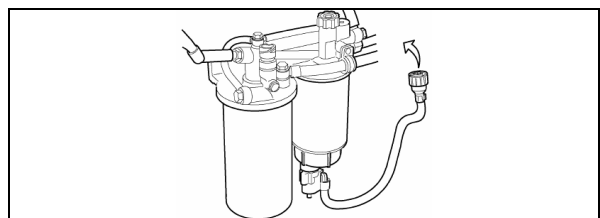
4. Unscrew and remove the primary fuel filter from the fuel filter housing. Drain filter.
5. Unscrew and remove the separation bowl from the filter cartridge.
6. Remove and discard the old gasket from the water separation bowl. Clean the bowl thoroughly and then blow dry with filtered compressed air.



7. Check that the drainage hole in the water separator bowl is not blocked.
8. Apply a thin coating of clean engine oil to the surface of the water separation bowl.



9. Install a new gasket to the water separation bowl and then reinstall the separation bowl to the new primary fuel filter cartridge.
10. Apply a thin coating of clean engine oil to the surface of the primary fuel filter, install the primary fuel filter to the fuel filter housing, then tighten the primary fuel filter 1/2-3/4 turn.



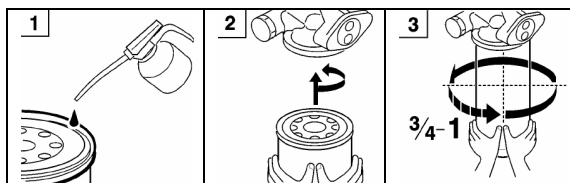
11. Connect the electrical connector for the water/fuel separation bowl indicator.
12. Open the fuel supply line shut-off valve.
13. Purge air from the filter by operating the priming pump to draw fuel and fill the filter. When using the hand priming pump, approximately 100 strokes will be required.

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14. Start the engine and carry out a fuel-tightness check. Let the engine run for about 5 minutes to remove air pockets from the fuel system.

### 2.3.2 Secondary Fuel Filter Replacement

1. Stop engine, close the fuel supply line shut-off valve. Place an appropriate container under the fuel filter housing.
2. Clean around sealing area on fuel filter and housing.
3. Unscrew and remove the secondary fuel filter from the fuel filter housing.
4. Apply a thin coating of clean engine oil to the gasket of the secondary fuel filter. Screw the fuel filter into position. Tighten the filter  $\frac{3}{4}$  to 1 turn after the gasket makes contact with the fuel filter housing.



### CAUTION

Fuel in the old filter **must absolutely not** be poured into the new filter. This kind of contaminated fuel can damage the unit injectors.

5. Prime the fuel system by pumping the hand priming pump on the fuel filter housing until resistance is felt indicating that the system is full of fuel.
6. Start the engine and carry out a fuel-tightness check. Let the engine run for about 5 minutes to remove air pockets from the fuel system.

### 2.4 PRIMING THE FUEL SYSTEM

The fuel system will need to be bled if:

- The vehicle has run out of fuel.
- The engine has not been running for an extended period of time.
- Service work has been done on the fuel system, (tank, fuel lines, filters, valves, etc.) for example cleaning or replacing fuel filter cartridges.
- The engine is new or rebuilt.



### CAUTION

When priming the system, movement of the primer pump should be as up and down as possible. Avoid putting any side load on the pump or causing a binding condition. Failure to follow these instructions could prematurely damage the primer pump.

### NOTE

When the fuel system is empty, 200 or more pump strokes may be needed to properly prime system. There are no bleed nipples to be opened to prime the fuel system.

1. Stop engine;
2. Unlock the hand pump by turning the handle counterclockwise.
3. Prime the system by moving the primer pump in an up and down pumping motion. Avoid putting any side load on the pump or causing a binding condition.
4. Lock the hand primer pump by retracting it into the housing and turning it clockwise.
5. Start the engine and run it at an increased idle speed for approximately 5 minutes to remove any remaining air in the system. Check the fuel system for leaks.

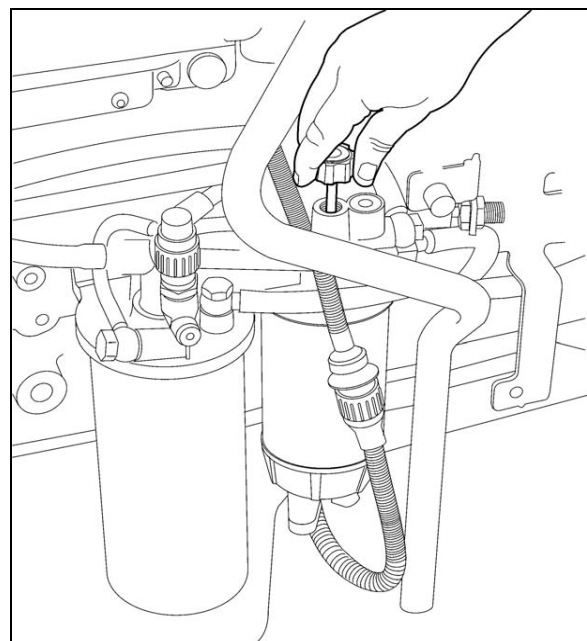


FIGURE 12: HAND PRIMING PUMP

2.5 FUEL PUMP REMOVAL AND INSTALLATION

The pump is located underneath the air compressor and is accessible through the engine compartment R.H. access door.

To remove the pump, proceed as follows:

- Clean around the fuel pump and fuel lines. Position a container to catch any fuel that might drain from the pump or lines.
- Remove the fuel pump.

**NOTE**

Only unfasten the bolts marked with arrows.

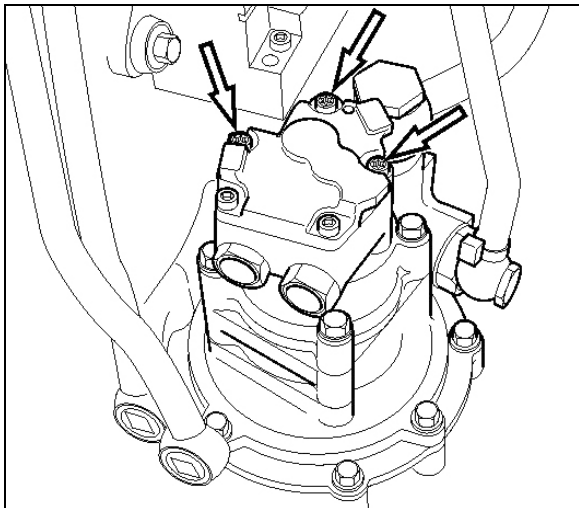


FIGURE 13: FUEL PUMP REMOVAL



**CAUTION**

Ensure to clean around the head of the bolts. Debris will prevent the tool from fitting properly and cause damage to the fasteners..

- Check that the adapter and fuel pump drive axle are not damaged.

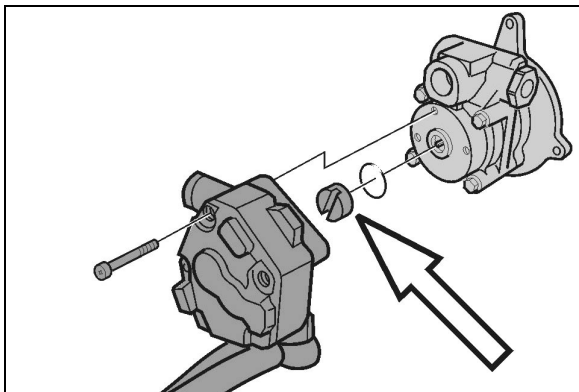


FIGURE 14: FUEL PUMP DRIVE AXLE

- Install the fuel pump. Torque-tighten bolts to specification.

**NOTE**

Use a new sealing ring. Check that the fuel pump drive axle sits correctly in the power steering pump.

- Using the hand primer on the fuel filter housing, prime the fuel system.
- Start the engine and let run for 5 minutes. Make sure that there are no leaks.

3. DAVCO FUEL PRO 382

The optional Fuel Pro 382 diesel fuel filter system consists of a permanently mounted fuel processor, a replaceable filter element, a filter element cover and collar and a fluid filter base assembly. This system is installed between the fuel tank and the fuel pump and is designed to be the only fuel filter in the fuel system. The filter serves as a water separator as well as a fuel filter (refer to figure 15).

The filter fibers used in the Davco Fuel Pro 382 element may cause the fuel level to read artificially high when the filter is first installed. Over the first few days, the filter fibers eventually become fully saturated and the fuel level will drop to normal levels. Do not be concerned about an abnormally high fuel level when a new Davco element is installed.

When new, the fuel level as seen through the clear cover in the 382 filter is very low. It rises as dirt collects on the filter from the bottom up. Restriction remains consistently low because fuel always flows through clean, new media.



**MAINTENANCE**

Replace Fuel Pro 382 filter element when the fuel level in the see-thru filter cover reaches the top of the filter element or after one year of service, whichever comes first.

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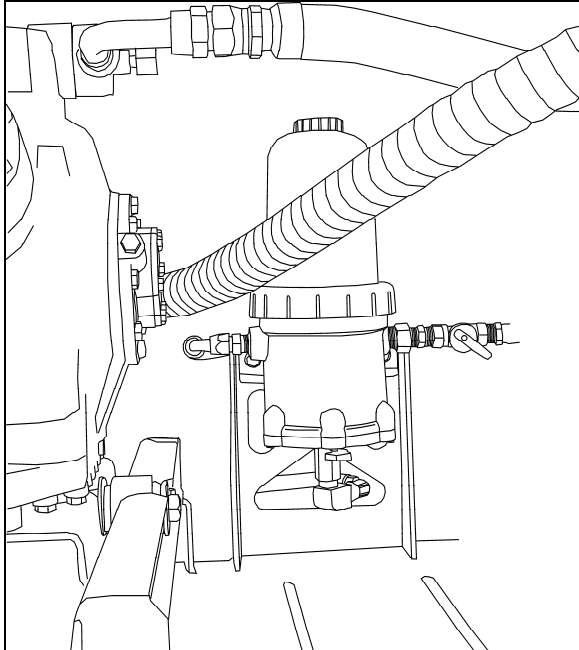


FIGURE 15: DAVCO FUEL PRO 382 FUEL FILTER 03062

### Filter replacement:

1. Stop engine;
2. Place a suitable container under the fuel processor;
3. Close the shut-off valve at the inlet side of the fuel filter;
4. Open the drain valve at the base of the fuel processor and drain the fuel until it is below the level of the filter;
5. Untighten upper collar, remove cover, filter hold down spring, filter element and cover seal;
6. Dispose of used filter element;
7. Ensure the filter grommet is included at the base of the new filter element and then install the element onto the center stud;
8. Ensure the filter spring is installed at the top of the cover. If missing, the spring must be replaced to insure proper filter operation.
9. Wipe the cover lid and seal clean. After ensuring the seal is properly positioned at the base of the cover, install the cover and collar onto the fuel processor. Tighten the collar by hand until secure;
10. Fill the cover full of clean fuel through spin off cap located on top of cover. Install vent cap seal and then reinstall the cap and tighten by hand only;

11. Open the shut-off valve;
12. Start engine, raise rpm for 2-3 minutes, hand tighten collar again;
13. After the air is purged and with the engine still running, slowly loosen the vent cap on the filter cover. The fuel level in the cover will start falling. When the fuel level falls to the top of the collar, tighten the vent cap quickly by hand;
14. Shut down the engine and hand-tighten the collar again.

### NOTE

*Fuel Pro 382 also accepts standard secondary spin-on fuel filters.*

### ENVIRONMENTAL NOTICE

*Diesel fuel is an environmentally hazardous product. Dispose in an environmentally friendly manner.*

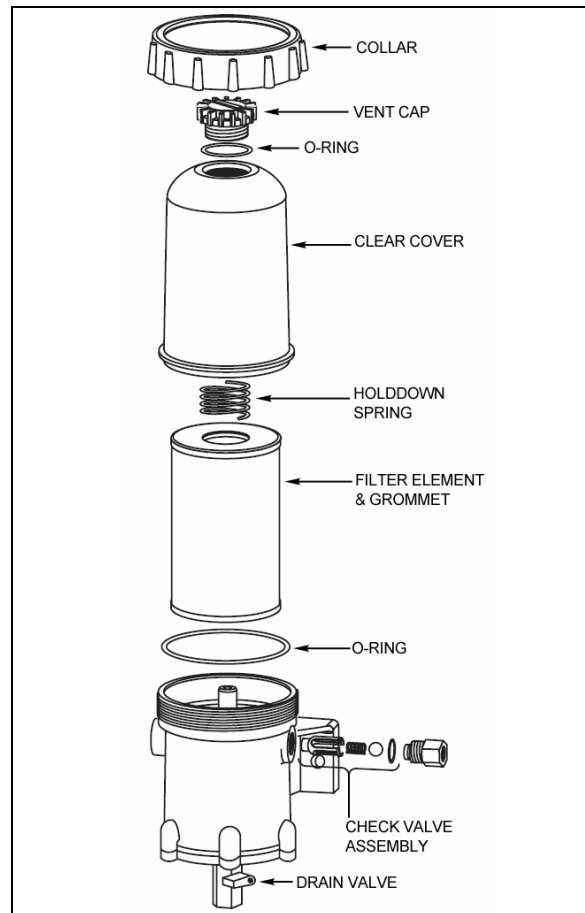




FIGURE 16: DAVCO FUEL PRO 382 EXPLODED VIEW 03034

**4. FUEL LINES AND FLEXIBLE HOSES**

Make a visual check for fuel leaks at all engine-mounted fuel lines and connections and at the fuel tank suction and return lines. Since fuel tanks are susceptible to road hazards, leaks in this area may best be detected by checking for accumulation of fuel under the tank. Engine performance and auxiliary equipment is greatly dependent on the ability of flexible hoses to transfer lubricating oil, air, coolant and fuel oil. Diligent maintenance of hoses is an important step in ensuring efficient, economical and safe operation of engine and related equipment.


 <p><b>MAINTENANCE</b></p>
<p>Check hoses daily as part of the pre-start-up inspection. Examine hoses for leaks and check all fittings, clamps and ties carefully. Make sure that the hoses are not resting on or touching shafts, couplings, and heated surfaces, including exhaust manifolds, any sharp edges or other obviously hazardous areas.</p>

Since all machinery vibrates and moves to a certain extent, clamps and ties can fatigue with age. To ensure continued proper support, inspect fasteners frequently and tighten or replace them as necessary. Refer to the schematic diagram of the fuel system (Fig. 1 & 7).

 <p><b>CAUTION</b></p>
<p>Oil level above the dipstick full mark or a decrease in lube oil consumption may indicate internal fuel leaks. Check oil level frequently.</p>

**5. PREHEATER FUEL FILTER**

The preheater fuel filter is located beside the preheater in the dedicated compartment above the rear wheelhousing, on the L.H. side of vehicle.

 <p><b>MAINTENANCE</b></p>
<p>Replace preheater fuel filter every 50,000 miles (80 000 km) or once a year, whichever comes first.</p>


**6. FUEL TANK**

X3-45 coaches are equipped with a high-density cross-link polyethylene fuel tank with a capacity of 208 US gallons (787 liters).

On all vehicles, fuel filling access doors on both sides of vehicle provide direct access to filler necks; offering the added advantage of refueling from either side of vehicle.

A pressure relief valve on the fuel tank connection-panel relieves high-pressure buildup and an overflow tube allows offset air in the tank to escape during filling. For 95% of the tank volume, 5% of tank inside space is kept filled with air with no exit opening, allowing for a fuel expansion safety margin. A drain plug, accessible from under the vehicle, is fitted at the bottom of the tank.

**6.1 TANK REMOVAL**

 <p><b>DANGER</b></p>
<p>Park vehicle safely, apply parking brake, stop engine and set battery master switch(es) to the OFF position prior to working on the vehicle. Before working under an air-suspended vehicle, it is strongly recommended to support the body at the recommended jacking points.</p>

<p><i><b>NOTE</b></i></p>
<p><i>Before removal, the fuel tank should be completely drained by unscrewing the drain plug. Ensure that the container used has a capacity equal to the amount of fuel remaining in the tank.</i></p>

1. Open the condenser door and remove the fuel tank access panel. The rear baggage compartment fuel tank access panel may also be removed to facilitate access to components.
2. If applicable, unscrew clamps retaining L.H. side filler tube to the fuel tank, then disconnect tube and remove it.
3. Unscrew clamps retaining R.H. side filler tube to fuel tank and filler neck. Disconnect tube and remove it.
4. If applicable, unscrew preheater supply line, preheater return line, auxiliary return line and/or auxiliary return line from fuel tank connection-panel.

## Section 03: FUEL SYSTEM

5. Unscrew engine supply and return lines from fuel tank connection-panel, identify them for reinstallation.
6. Disconnect electrical wiring from tank on connection plate.
7. From under the vehicle, on R.H. side, unscrew the 4 bolts (2 in front, 2 in back) retaining the tank support to the frame.
8. From under the vehicle, on the L.H. side, unscrew the 2 bolts (1 in front, 1 in back) retaining the tank support to the frame.
9. Carefully remove tank from under the vehicle.



### DANGER

Before removing the bolts securing the tank support to the frame, make sure the tank is supported adequately. Failure to do so could result in injury as well as damage to the tank.

### 6.2 TANK INSTALLATION

To install tank, simply reverse the "Tank Removal" procedure.

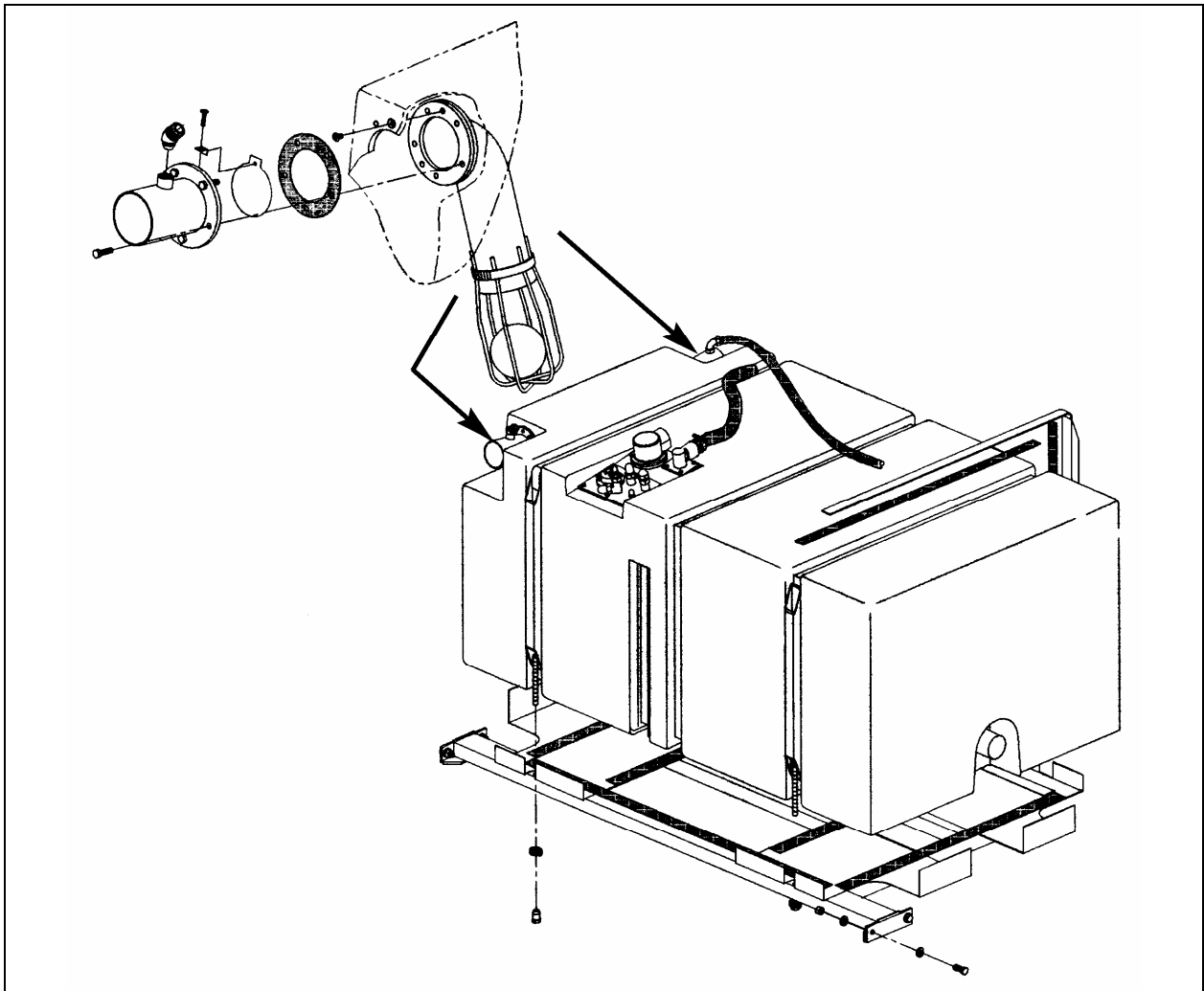


FIGURE 17: 208 US GAL. FUEL TANK

03063

### 6.3 FUEL TANK VERIFICATION

Inspect fuel tank from under vehicle for leaks or fuel traces. If a leak is detected, repair immediately as per "Polyethylene Fuel Tank Repair" in this section.

**DANGER**

Park vehicle safely, apply parking brake, stop engine and set battery master switch(es) to the OFF position prior to working on the vehicle.

Before working under an air-suspended vehicle, it is strongly recommended to support the body at the recommended jacking points.

### 6.4 POLYETHYLENE FUEL TANK REPAIR

**NOTE**

Fuel level must be lower than perforation to carry out this procedure.

**DANGER**

Park vehicle safely, apply parking brake, stop engine and set battery master switch(es) to the OFF position prior to working on the vehicle.

1. Locate perforation on fuel tank.
2. If necessary, remove fuel tank as per instructions in this section.
3. Drill perforation with a 23/64" bit. Make sure drill hole is perfectly round.
4. Insert a screw (Prevost #500196) and a washer (Prevost #5001244) into anchor nut (Prevost #500331).
5. Place assembly in drill hole. Tighten screw by 10 complete turns. Refer to Fig. 18.
6. Apply sealant on head plug (Prevost #507300) and seal hole with the head plug.

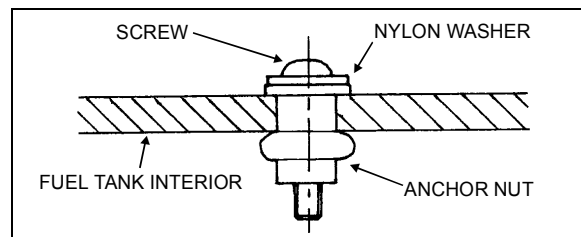


FIGURE 18: FUEL TANK REPAIR 03014

## 7. FUEL SPECIFICATIONS

The quality of fuel oil used for high-speed diesel engine operation is a very important factor in obtaining satisfactory engine performance, long engine life and acceptable exhaust emission levels.

The U.S. Environmental Protection Agency (EPA) has issued new standards to improve air quality by significantly reducing emissions through a combination of cleaner-burning diesel engines and vehicles.

To meet EPA standards, the petroleum industry produces **Ultra Low Sulfur Diesel** (ULSD) fuel, also referred to as S15, containing a maximum 15ppm (parts-per-million) sulfur.

On-highway diesel engines meeting 2007 emission regulations are designed to operate **ONLY** with ULSD fuel. ULSD fuel will enable the use of cleaner technology diesel engines and vehicles with advanced emissions control devices, resulting in significantly improved air quality.

### 7.1 FUEL TYPE

EPA-07 engines like the DDC 2007 Series 60 are designed to run on **Ultra Low Sulfur Diesel** (ULSD) fuel, which can contain no more than 15 ppm sulfur.

Fuel used must meet engine manufacturer's specification. For Detroit Diesel engines refer to "Diesel Fuel Specifications" as stated in DDC publication 7SE270 LUBRICATING OIL, FUEL, AND FILTERS. Similarly for Volvo engine.

**CAUTION**

ULSD fuel is necessary to avoid fouling the engine's Aftertreatment Device (ATD). Improper fuel use will reduce the efficiency of the engine's Aftertreatment System and may permanently damage the system.

**CAUTION**

Owners of 2007 and later model year on-highway diesel engine must refuel only with ULSD fuel.

## Section 03: FUEL SYSTEM

### **NOTE**

*Burning Low Sulfur Diesel fuel (instead of ULSD fuel) in 2007 and later model year diesel engines is illegal and punishable with civil penalties.*

### **NOTE**

*Engine and vehicle manufacturers expect ULSD fuel to be fully compatible with the existing fleet, including 2006 and earlier model year vehicles. In some instances, the introduction of ULSD fuel to older vehicles may affect fuel system components or loosen deposits in fuel tanks. As part of a good maintenance program, owners and operators of existing cars, trucks and buses are encouraged to monitor their diesel-powered vehicles closely for potential fuel system leaks or premature fuel filter plugging during the change-over to ULSD fuel.*

### **NOTE**

*Like Low Sulfur Diesel fuel, ULSD fuel requires good lubricity and corrosion inhibitors to prevent unacceptable engine wear. As necessary, additives to increase lubricity and to inhibit corrosion will be added to ULSD fuel prior to its retail sale.*

### 7.2 BLENDING

Only ultra low sulfur kerosene – No.1 diesel with no more than 15ppm sulfur may be blended with ULSD fuel to improve cold weather performance. With so many kerosene formulations on the market, care must be taken to select kerosene with a maximum of 15ppm sulfur.

Blend rates remain the same as with Low Sulfur Diesel fuel.

### 7.3 BIODIESEL FUELS

ULSD-B5 biodiesel may be used. B5 tells you the percentage of biodiesel mixed in with ULSD. B5 is 5% biodiesel and 95% ULSD.

Fuel used must meet engine manufacturer's specification for biodiesel fuel. For Detroit Diesel engines refer to "Diesel Fuel Specifications" as stated in DDC publication 7SE270 LUBRICATING OIL, FUEL, AND FILTERS. Similarly for Volvo engines.

Biodiesel fuels are alkyl esters of long chain fatty acids derived from renewable resources. Detroit Diesel highly recommends biodiesel fuels made from soybean or rapeseed oil through the proper transesterification reaction process. Other feedstock source of biodiesel fuels such as animal fat and used cooking oils are not recommended by Detroit Diesel. Biodiesel fuels meeting ASTM D6751 specification and from BQ-9000 accredited producer, prior to blending can be mixed up to 5% maximum by volume in petroleum diesel fuel. The resulting mixture must meet the fuel properties listed in Table 5-1 (see Detroit Diesel publication 7SE270 LUBRICATING OIL, FUEL, AND FILTERS.) and ASTM D975 specification. Failures attributed to the use of biodiesel fuel will not be covered by Volvo, Detroit Diesel or Prevost product warranty. Also, any engine performance problem related to the use of biodiesel fuel would not be recognized nor considered as Volvo, Detroit Diesel or Prevost's responsibility.

### 8. AIR CLEANER (DRY TYPE)

The vehicle is equipped with a dry-type replaceable element air cleaner, located in the engine compartment. Access the air cleaner through the engine R.H. side door. Engine air enters the air cleaner through (2) two intake ducts located just above engine side doors. It then flows through a pre-cleaner and finally through the air cleaner. The pre-cleaner removes dust and moisture by means of a discharge tube at the bottom of the element. It is in series with a replaceable impregnated paper filter element (air cleaner).

#### 8.1 PRE-CLEANER SERVICING



### **MAINTENANCE**

The pre-cleaner is designed to be self-cleaning; however, it should be inspected and any accumulated foreign material removed during the periodic replacement of the impregnated paper filter element.

#### 8.2 AIR CLEANER SERVICING

Stop the engine, open the R.H. side engine compartment door, and loosen the wing nut retaining the air cleaner element to the air cleaner. Remove the element by pulling on the handle in the center of the air cleaner element.



Install cleaner element as follows:

1. Inspect the gasket-sealing surface inside the air cleaner. It must be smooth, flat and clean;
2. Install the air cleaner element;
3. Make sure that the element seals securely;
4. Inspect element cover gasket and replace if necessary.


Whenever it becomes necessary to remove the air cleaner assembly (dry type) for maintenance or other repair in this area, great care should be taken when installing air cleaner assembly.

The pre-filter should be installed snugly in the air duct and clamped tightly to the air cleaner inlet to prevent any dust infiltration into the air cleaner.

### 8.3 GENERAL RECOMMENDATIONS

The following maintenance procedures will ensure efficient air cleaner operation:

1. Keep the air cleaner housing tight on the air intake pipe;
2. Make sure the correct filters are used for replacement;
3. Keep the air cleaner properly assembled so the joints are air-tight;
4. Immediately repair any damage to the air cleaner or related parts;
5. Inspect, clean or replace the air cleaner or elements as operating conditions warrant. Whenever an element has been removed from the air cleaner housing the inside surface of the housing must be cleaned with a soft clean cloth;
6. Periodically inspect the entire system. Dust-laden air can pass through an almost invisible crack or opening which may eventually cause damage to an engine;
7. Never operate the engine without an element in the air cleaner assembly;

	<p><b>CAUTION</b></p>
<p>Do not ignore the Warning given by the air restriction indicator. This could result in serious engine damage.</p>	

8. Store new elements in a closed area free from dust and possible damage.

### 8.4 AIR CLEANER RESTRICTION INDICATOR

A resettable restriction indicator may be installed on the engine air-intake duct, clearly visible from the rear engine compartment. The indicator monitors the vacuum level between the air filter and the engine. A red marker is displayed when the air filter is clogged and must be replaced. Reset by pressing on the indicator's extremity.

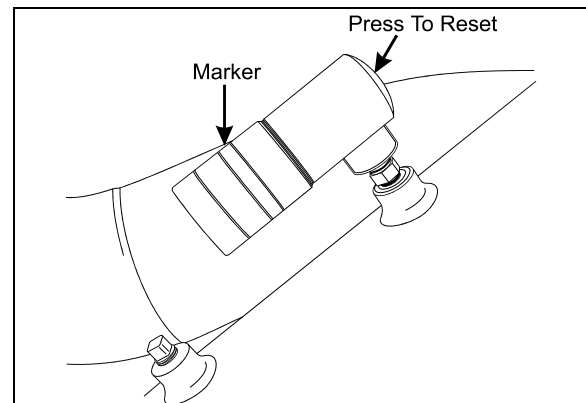


FIGURE 19: RESTRICTION INDICATOR

01052

### 9. FUEL COOLER – DETROIT DIESEL SERIES 60 ONLY

The fuel cooler serves to cool the surplus diesel fuel after it has exited the cylinder head, on its way back to the fuel tank. It is accessible through the engine radiator door, and is located in front of the charge air cooler (CAC) and the coolant radiator (Fig. 21 & 22).

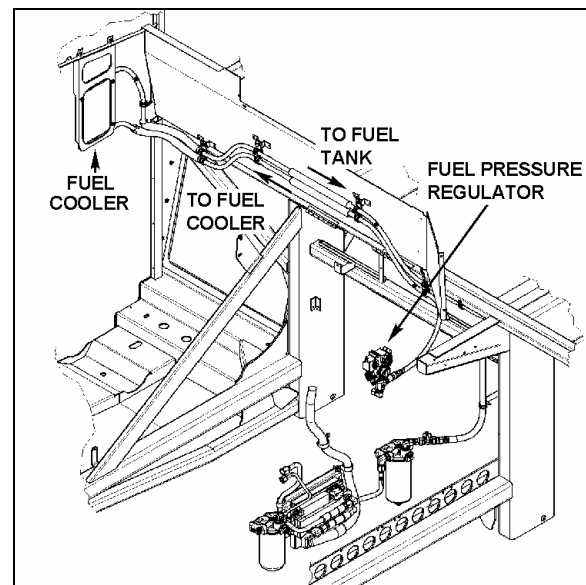


FIGURE 20: FUELRETURN LINE

03078

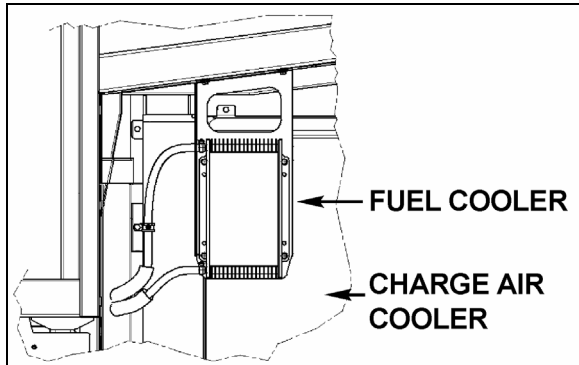


FIGURE 21: FUEL COOLER LOCATION 03079

## 10. FUEL PEDAL

The EFPA (Electronic Foot Pedal Assembly) connects the accelerator pedal to a potentiometer (a device that sends an electrical signal to the ECM, which varies in voltage, depending on how far down the pedal is depressed). The EFPA is installed in the space normally occupied by a mechanical foot pedal. It has maximum and minimum stops that are built into the unit during manufacturing.

### 10.1 FUEL PEDAL ADJUSTMENT

The EFPA contains a throttle position sensor that varies the electrical signal sent to the ECM. The sensor must be adjusted whenever an EFPA is serviced. In addition, the sensor should be adjusted any time codes 21 and 22 are flashed.

With the ignition "ON" and the proper diagnostic tool (DDR) (for information regarding the DDR, see "01 ENGINE" in this manual), check the throttle counts at idle and full throttle positions. Proper pedal output should be 20/30 counts at idle and 200/235 at full throttle. If adjustment is necessary, remove the potentiometer retaining screws and rotate the potentiometer clockwise to increase counts or counterclockwise to decrease. When correct output is confirmed, tighten retaining screws.

### 10.2 POTENTIOMETER REPLACEMENT

1. Disconnect cable harness connector.
2. Loosen the two screws and remove potentiometer. Retain for re-assembly.
3. Discard potentiometer (Fig. 23).



## CAUTION

Note the routing and clamping locations of the cable before disassembly. Proper cable routing and fastening is critical to the operation of this system. Marking the foot pedal assembly to record cable routing is recommended.

2. Position new potentiometer. Press potentiometer onto the potentiometer shaft, matching cutouts in shaft to drive tangs of potentiometer. Apply hand pressure until potentiometer has bottomed out in housing. Reinstall screws (Fig. 23) and tighten just enough to secure potentiometer lightly. Tighten screws to 10 - 20 Lbf-in (1.13 - 2.26 Nm).
3. Reconnect electronic foot pedal assembly's cable harness to the ECM connector. If potentiometer calibration is necessary (see "FUEL PEDAL ADJUSTMENT" in this section).



## CAUTION

Make sure the cable harness is routed correctly, and securely installed so that it does not become pinched, stretched, or otherwise damaged during vehicle operation.

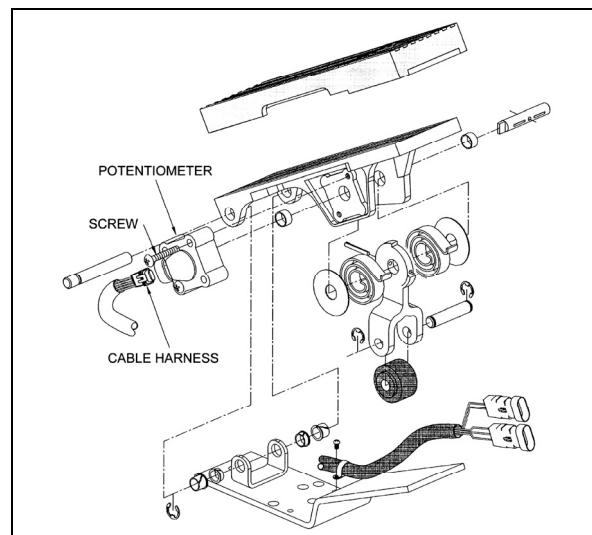


FIGURE 22: ELECTRONIC FOOT PEDAL ASSEMBLY 03035

**11. SPECIFICATIONS**

**Davco Fuel Pro 382 Fuel Filter / Water Separator Element**

Prevost number .....510795

**Racor Primary Fuel Filter / Water Separator (optional)**

(May be used instead of regular primary filter (never use with a primary filter).

Make ..... Racor

Type ..... Replaceable cartridge

ELEMENT

Prevost number .....531390

BOWL

Prevost number .....531389

DRAIN VALVE AND SEAL

Prevost number .....531397

O-RING

Prevost number .....531398

PROBE/WATER SENSOR

Prevost number .....531391

**Primary Fuel Filter (Fuel/Water Separator) With Detroit Diesel Series 60 Engine**

Make .....AC

Type ..... Spin-on

Filter No. ....T-915D

Prevost number .....032700

Element torque ..... 1/2 turn after gasket contact

**Primary Fuel Filter (Fuel/Water Separator) With Volvo D13 Engine**

Part number .....20879806

Filter torque..... 1/2-3/4 turn after gasket contact

**Secondary Fuel Filter With Detroit Diesel Series 60 Engine**

Make .....AC

Type ..... Spin-on

Filter No. ....T-916D

Prevost number .....510794

Element torque ..... 1/2 turn after gasket contact

**Secondary Fuel Filter With Volvo D13 Engine**

Part number .....20405160

Filter torque..... 3/4- 1 turn after gasket contact

**Section 03: FUEL SYSTEM**

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**Fuel tank Capacity**

Standard (X3-45).....208 US gallons (787 liters)

**Air Cleaner**

Make ..... Nelson

Prevost Number .....530206

Service Part No ..... 7182 8N

Prevost number (element cartridge) .....530197

**Air Cleaner Restriction Indicator**

Make ..... Donaldson

Model .....RBX00-2220

Indicates .....at 20" (508 mm) of water

Prevost number .....530161

**Preheater Fuel Filter**

Make ..... Webasto

Prevost number .....871037

**Fuel Cooler**

Make ..... Long Manufacturing

Prevost number .....531422