

## CONTENTS

<b>SECTION CHANGE LOG</b> .....	<b>3</b>
<b>1. TORQUE TABLES</b> .....	<b>4</b>
1.1 FUEL SYSTEM .....	4
1.2 MISCELLANEOUS TORQUES .....	4
<b>2. FUEL SYSTEM</b> .....	<b>5</b>
2.1 FUEL VALVES .....	5
2.2 FUEL FILTERS .....	5
2.2.1 <i>Primary Fuel Filter Replacement</i> .....	6
2.2.2 <i>Secondary Fuel Filter Replacement</i> .....	8
2.3 PRIMING THE FUEL SYSTEM .....	8
2.4 DAVCO FUEL PRO 382 .....	9
2.4.1 <i>Priming fuel system</i> .....	9
2.4.2 <i>Filter replacement</i> .....	9
2.5 FUEL PUMP REMOVAL AND INSTALLATION .....	10
<b>3. FUEL LINES AND FLEXIBLE HOSES</b> .....	<b>11</b>
<b>4. PREHEATER FUEL FILTER</b> .....	<b>11</b>
<b>5. FUEL TANK</b> .....	<b>12</b>
5.1 POLYETHYLENE FUEL TANK .....	12
5.2 TANK REMOVAL (POLYETHYLENE) .....	12
5.3 TANK INSTALLATION (POLYETHYLENE) .....	13
5.4 FUEL TANK VERIFICATION (POLYETHYLENE) .....	13
5.5 POLYETHYLENE FUEL TANK REPAIR .....	14
5.6 STEEL FUEL TANK (OPTIONAL) .....	14
5.7 STEEL FUEL TANK DRAIN PLUG .....	14
5.8 STEEL TANK REMOVAL .....	15
5.9 STEEL TANK INSTALLATION .....	16
5.10 FUEL TANK YEARLY INSPECTION .....	16
<b>6. FUEL SPECIFICATIONS</b> .....	<b>17</b>
6.1 FUEL TYPE .....	18
6.2 BLENDING .....	18
6.3 BIODIESEL FUELS .....	18
6.3.1 <i>Biodiesel Fuels and Preheater</i> .....	19
6.3.2 <i>Biodiesel Fuels and the Engine</i> .....	19
<b>7. AIR CLEANER (DRY TYPE)</b> .....	<b>19</b>
7.1 PRE-CLEANER SERVICING .....	19
7.2 AIR CLEANER SERVICING .....	19
7.2.1 <i>Checking restriction indicator</i> .....	19
7.2.2 <i>Replacing the Filter</i> .....	19
7.3 GENERAL RECOMMENDATIONS .....	21
7.4 AIR CLEANER RESTRICTION INDICATOR .....	21
<b>8. FUEL PEDAL</b> .....	<b>22</b>
8.1 FUEL PEDAL ADJUSTMENT .....	22

8.2 POTENTIOMETER REPLACEMENT .....22

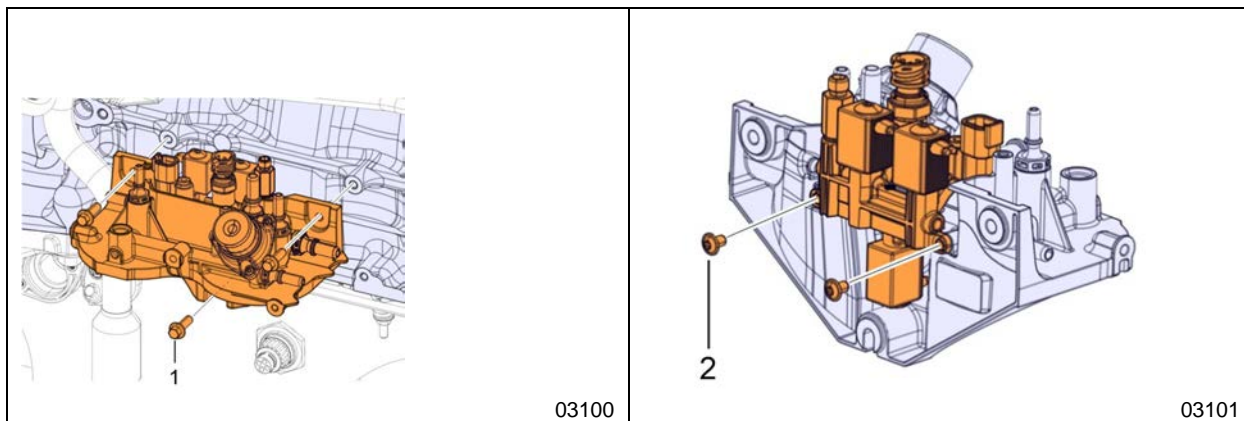
**9. SPECIFICATIONS ..... 23**

**SECTION CHANGE LOG**

DESCRIPTION		DATE
1	Added: information about specific fuel filters for GHG17 engines	Sept. 7, 2017
2	Commuter Coach info added (steel fuel tank & air filter restriction indicator)	May 29 2018
3		
4		
5		
6		

1. TORQUE TABLES

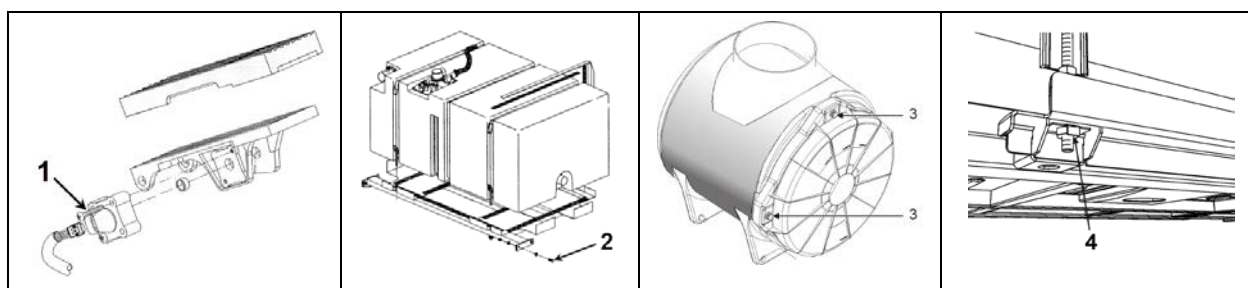
1.1 FUEL SYSTEM



**FUEL FILTER HOUSING – VOLVO D13 ENGINE**

No	DESCRIPTION	TORQUE
1	Fuel filter housing assembly screws	15-21 lb-ft (20-28 Nm)
2	Dosing module mounting screws	7,5 lb-ft (10 Nm)

1.2 MISCELLANEOUS TORQUES



**MISCELLANEOUS TORQUES**

No	DESCRIPTION	TORQUE
1	Brake pedal potentiometer holding screws	10-20 lb-in (1,13-2,26 Nm)
2	Fuel tank support to frame	55 lb-ft (75 Nm)
3	Air filter cover plastic screws (4)	10-15 lb-ft (14-20 Nm)
4	Steel fuel tank retaining straps	20 lb-ft (27 Nm)

## 2. FUEL SYSTEM

### 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.

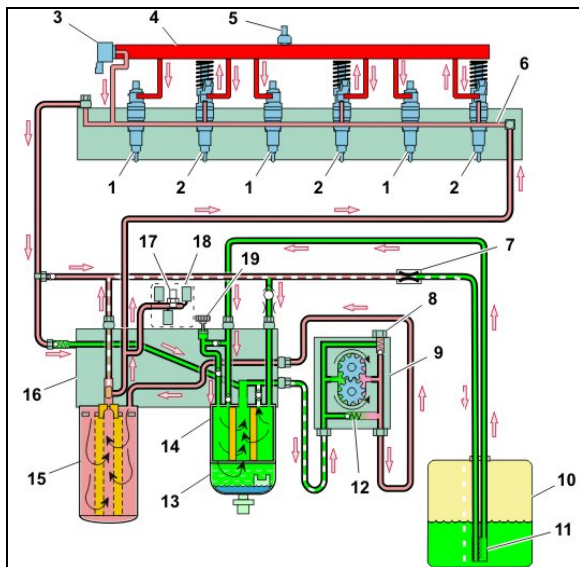


FIGURE 1: FUEL SYSTEM SCHEMATIC (VOLVO D13 ENGINE)

- 1 Non-pumping injector
- 2 Pumping injector
- 3 Fuel pressure relief valve
- 4 Common rail
- 5 Rail pressure sensor
- 6 Fuel channel (gallery)
- 7 Restrictor
- 8 Overpressure relief valve
- 9 Fuel pump
- 10 Fuel tank
- 12 Check valve
- 13 Bowl (fuel/water separator)
- 14 Primary Filter
- 15 Filter
- 16 Fuel filter housing

- 17 Fuel pressure sensor (low pressure system)
- 18 Aftertreatment hydrocarbon injector module
- 19 Hand pump (fuel primer pump)

### 2.1 FUEL VALVES

The manual shut-off valve is located on the inlet side of the primary fuel filter or on the inlet side of Davco Fuel Pro 382 fuel filter.

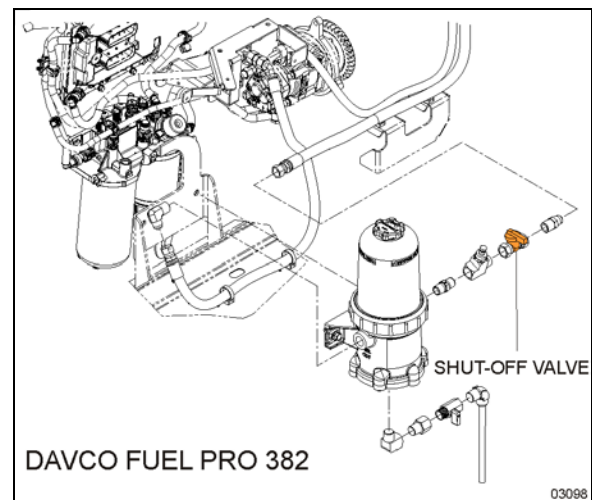


FIGURE 2: MANUAL SHUT-OFF VALVE LOCATION WITH DAVCO FUEL PRO 382

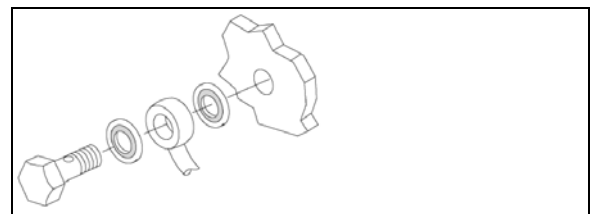


FIGURE 3: FUEL LINE COMPRESSION FITTING

### 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.

### 2.2 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 (aka pre-filter and main filter) fuel filters are of a spin-on type and must be replaced at the intervals specified by the Lubrication And Servicing Schedule in Section 24: LUBRICATION & SERVICING.

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.

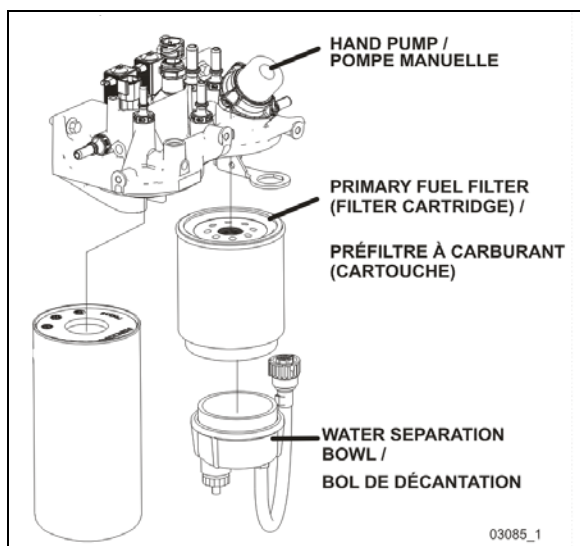
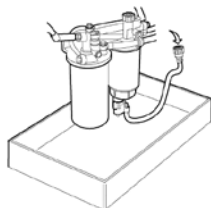


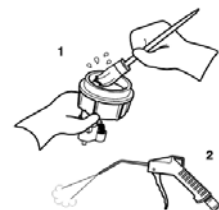
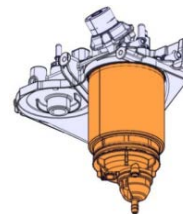
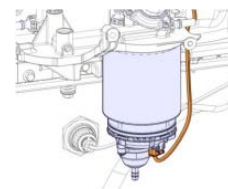
FIGURE 4: FUEL FILTERS WITH VOLVO D13 ENGINE

### 2.2.1 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 water separator indicator electrical connector.



4. Unscrew and remove the primary fuel filter assembly from the fuel filter housing. Drain filter.
5. Unscrew and remove the water 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.

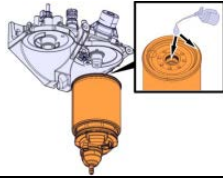


8. Apply clean engine oil to the water separation bowl new gasket. **Do not install pre-GHG17 fuel filters on GHG17 engines.**



9. Install the new filter to the bowl. Tighten the filter by hand. Do not overtighten.

10. Clean the contact surface and apply engine oil to the filter seals (inner & outer).



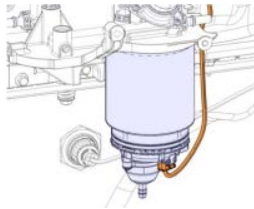
### CAUTION

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

11. Tighten the new dry primary fuel filter to the fuel filter housing by hand. Rotate clockwise until the seal is tight against the housing. Then rotate clockwise another 1/2-3/4 turn.

If the fuel filter is being replaced at this time, proceed to "Secondary Fuel Filter Replacement".

12. Plug the connector.



13. Open the fuel supply line shut-off valve.
14. Prime the system by operating hand primer pump until resistance is felt indicating that the system is full of fuel.
15. 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.



### CAUTION

#### Primary & secondary fuel filters on GHG17 engines

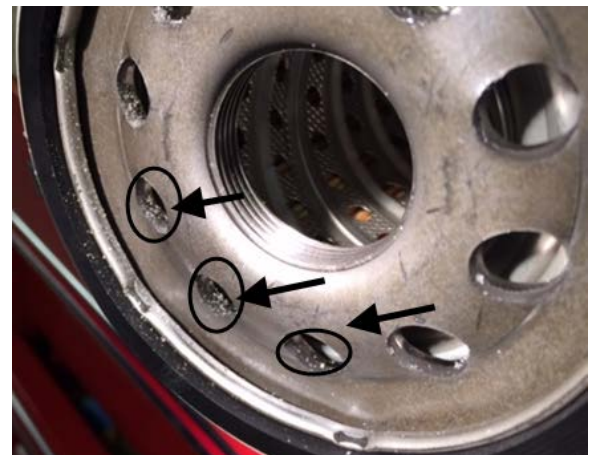
**Do not** install pre-GHG17 fuel filters on GHG17 engines.

Although the thread pitch is the same, these filters do not fit and may cause serious issues with the fuel system.

Refer to Impact for the appropriate fuel filters part numbers.

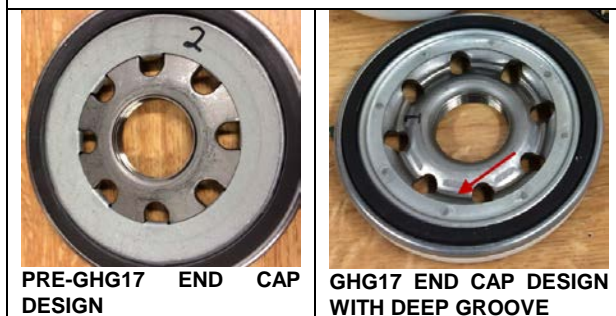


ALUMINUM PARTICLES ON THE FILTER RESTRICTOR (FUEL FILTER HOUSING)



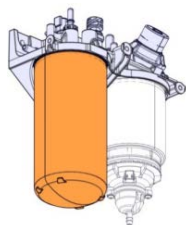
ALUMINUM PARTICLES FOUND ON A PRE-GHG17 FILTER CAUSED BY GRINDING OF THE TOP OF THE FILTER INTO THE FILTER RESTRICTOR

### Difference between secondary fuel filter end caps



#### 2.2.2 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. On the new filter, apply clean engine oil to the inner & outer seals. **Do not install pre-GHG17 fuel filters on GHG17 engines.**

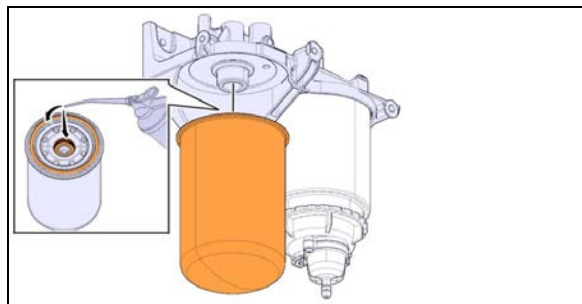


FIGURE 5: SECONDARY FUEL FILTER

5. Screw the new dry fuel filter in place. Rotate clockwise until the seal contacts the base. Then rotate clockwise another 1/2 - 3/4 turn.



### 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.

6. 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.
7. 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 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.

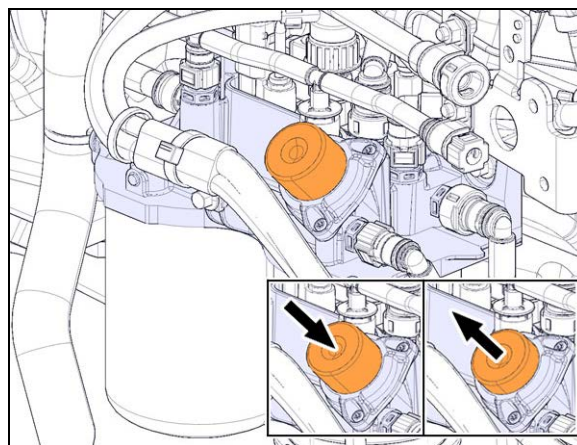


FIGURE 6: HAND PRIMING PUMP

### 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.



If a Fuel Pro 382 fuel processor is installed on the vehicle, refer to paragraph 2.4 Davco Fuel Pro 382 otherwise, perform the steps below:

1. Prime filter by operating hand primer pump until resistance is felt indicating that the system is full of fuel.
2. 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.

## 2.4 DAVCO FUEL PRO 382

The optional Fuel Pro 382 fuel processor is installed between the fuel tank and the fuel pump. This system serves as a water separator as well as a fuel filter (Figure 7).

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.

Fuel level 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.

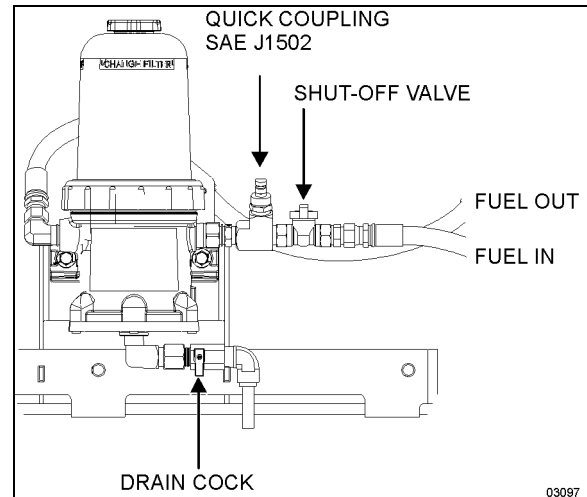


FIGURE 7: DAVCO FUEL PRO 382 INSTALLATION

### 2.4.1 Priming fuel system

To prime the fuel system, turn the engine off and then proceed as follows:

Close the shut-off valve on the “fuel in” side of the Fuel Pro unit and then pump fuel into the engine through the quick coupling. When completed, open the shut-off valve and keep on pumping fuel about ten seconds to fill the fuel line located between the Fuel Pro unit and the fuel tank.

### 2.4.2 Filter replacement

1. Stop engine;
2. Place a suitable container under the fuel processor;
3. Close the shut-off valve on the “fuel in” side of the fuel filter;
4. Open the drain valve at the base of the Fuel Pro body and drain the fuel until it is below the collar level;
5. Untighten the collar, remove clear cover, filter spring, filter element and cover seal;
6. Dispose of used filter element, cover seal and vent cap seal;
7. Using a clean shop rag, clean the cover, the collar and threads on the Fuel Pro body.
8. Ensure the filter grommet is included in the base of the new filter element and then install the element onto the center stud;

9. Ensure the filter spring is installed at the top of the clear cover. If missing, the spring must be replaced to insure proper filter operation.
10. After ensuring the seal is properly positioned at the base of the clear cover, install it with the collar onto the fuel processor. Apply downward pressure to the top of the clear cover and then tighten the collar by hand until secured;
11. Fill the clear cover with clean diesel fuel until it reaches the top of the filter through spin off vent cap located on top of clear cover.
12. Install vent cap seal and then reinstall the cap and tighten by hand until it clicks;
13. Open the shut-off valve;
14. Start engine, raise rpm for 2-3 minutes, hand tighten collar again.
15. 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 about one inch above the top of the collar, tighten the vent cap quickly by hand.
16. Shut down the engine and hand-tighten the collar again.

**ENVIRONMENTAL NOTICE**

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

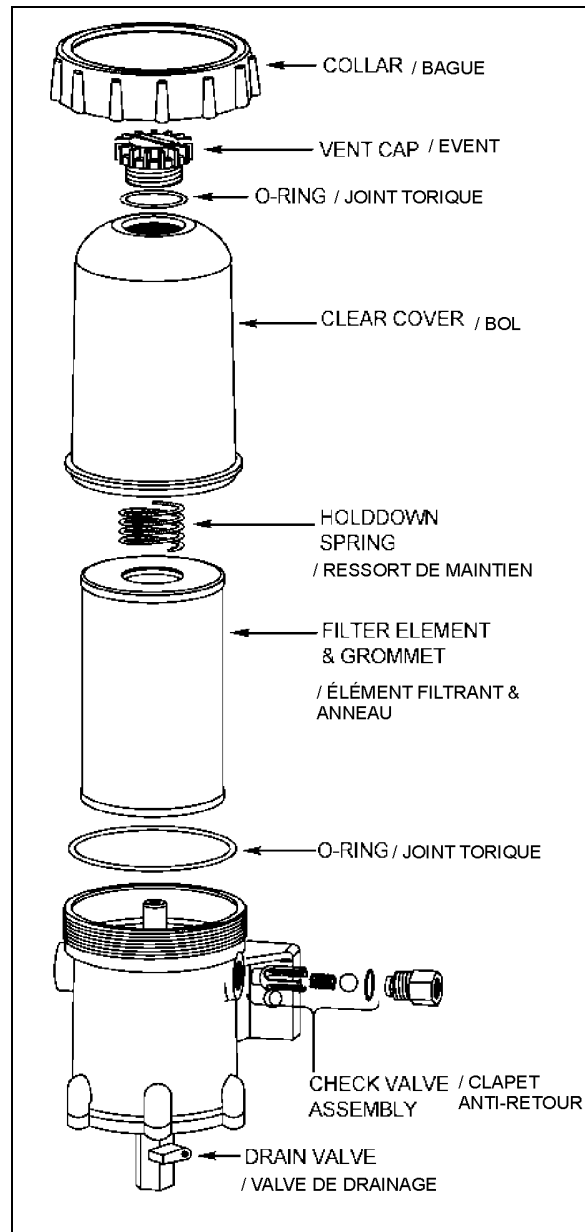


FIGURE 8: DAVCO FUEL PRO 382 EXPLODED VIEW

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## 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.

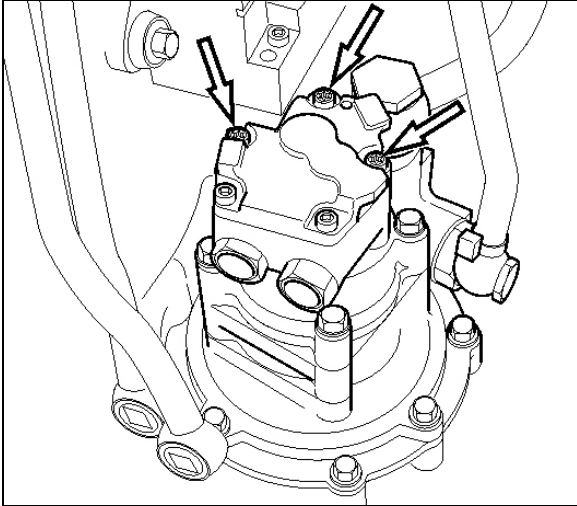


FIGURE 9: FUEL PUMP REMOVAL

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

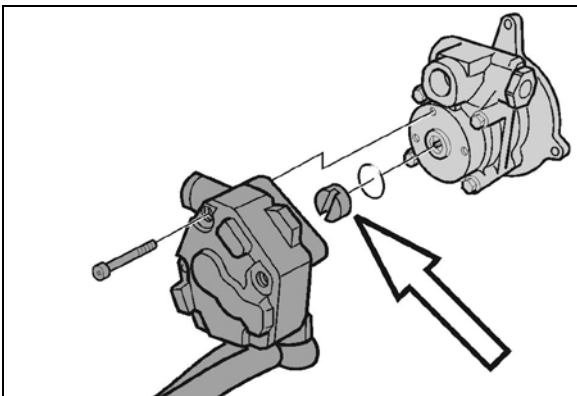


FIGURE 10: FUEL PUMP DRIVE AXLE

**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. 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.

**MAINTENANCE**

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.

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 (Figure 1).

**CAUTION**

Oil level above the dipstick full mark or a decrease in lube oil consumption may indicate internal fuel leaks. Check oil level frequently.

**4. PREHEATER FUEL FILTER**

On H3 series vehicles, the preheater fuel filter is located beside the preheater in the dedicated compartment above the rear wheelhousing, on the L.H. side of vehicle.

On X3 series vehicles, the preheater fuel filter is located beside the preheater in the engine coolant heater compartment, and is accessible by opening the evaporator compartment door.



## MAINTENANCE

Replace preheater fuel filter at the intervals specified by the Lubrication And Servicing Schedule in Section 24: LUBRICATION & SERVICING.

### 5. FUEL TANK

#### 5.1 POLYETHYLENE FUEL TANK

All H3 series vehicles are equipped with a high-density cross-link polyethylene fuel tank with a legal capacity (corresponding to 95% of gross capacity) of 222 US gallons / 840 liters. The tank is located just forward of the last baggage compartment, between the A/C condenser and evaporator. 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.

X3 series are equipped with a high-density cross-link polyethylene fuel tank with a legal capacity (corresponding to 95% of gross capacity) of 208 US gallons (787 liters). The fuel filling access door is located on the R.H. side of vehicle providing easy fuel filling.

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.

#### 5.2 TANK REMOVAL (POLYETHYLENE)



### WARNING

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

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

### NOTE

*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.*

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. On H3 series vehicles only, 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.
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.

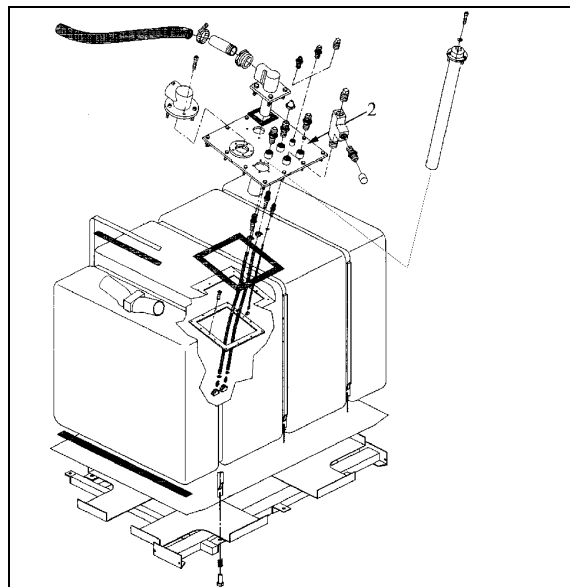


FIGURE 11: 222 US GALLONS FUEL TANK

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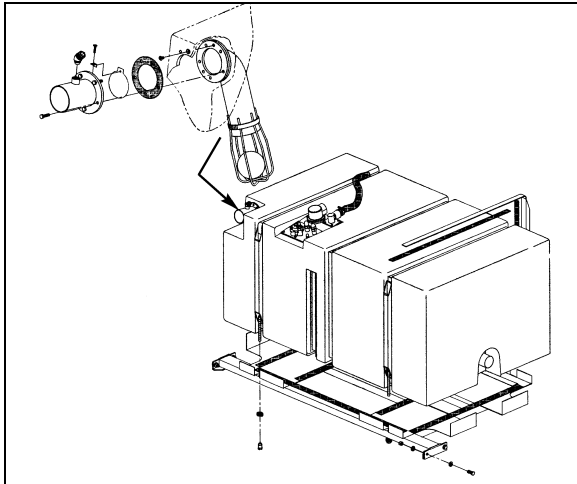


FIGURE 12: 208 US GALLONS FUEL TANK 03094



### WARNING

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.

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.

### 5.3 TANK INSTALLATION (POLYETHYLENE)

Tank installation is the reverse of removal.

#### NOTE

Fastening of rubber flap must always be on top, in line with clamp screw.

#### NOTE

Insert check valve assembly in right-side filler hose, use hose clamp to fix it. Repeat with left side filler hose on H3 series vehicles.

#### NOTE

When reinstalling lines, use Loctite 567 type thread sealant on line fittings.



### WARNING

For proper assembly, check connections and fasteners for tightness.

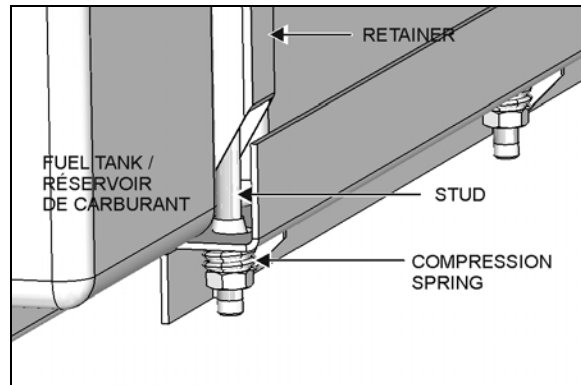


FIGURE 13: FUEL TANK RETENTION 03019\_2

For each fuel tank retainers (Figure 13):

1. Clean nuts and stud threads.
2. Apply a Loctite 242 type thread adhesive on stud threads.
3. Fix the retainers to the tank platform. Tighten the nuts to compress the spring completely and then loosen 3 turns.
4. Lift tank assembly and fasten tank support to vehicle.

**TORQUE: 55 lb-ft (75 Nm)**

### 5.4 FUEL TANK VERIFICATION (POLYETHYLENE)

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.



### WARNING

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

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

## 5.5 POLYETHYLENE FUEL TANK REPAIR

**NOTE**

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

**WARNING**

Park vehicle safely, apply parking brake, stop engine and set battery master switches to the OFF position before 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 drilled hole. Tighten screw by 10 complete turns. Refer to Figure 14.
6. Apply sealant on head plug (Prevost #507300) and seal hole with the head plug.

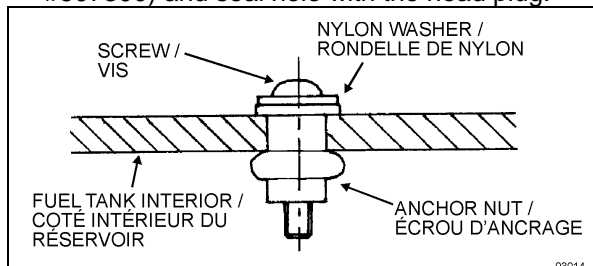


FIGURE 14: FUEL TANK REPAIR

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## 5.6 STEEL FUEL TANK (OPTIONAL)

Some X3-45 Commuter coaches may be equipped with an optional steel fuel tank with a legal capacity (corresponding to 95% of gross capacity) of 180 US gallons (681 liters) and 6.3 US gallons of unusable fuel.

The fuel filling access door is located on the R.H. side of vehicle providing easy fuel filling. A Level Control Valve (LCV) on the fuel tank connection panel relieves pressure buildup and allows offset air in the tank to escape during filling. A whistle mounted at the LCV outlet can be heard as air escapes. During fueling, the LCV will close when the fuel reaches the level in

the tank corresponding to 95% of the tank volume, permitting a small build-up of pressure in the tank. When the back pressure reaches between 1.1 and 1.5 psig it forces the filling nozzle to close automatically.

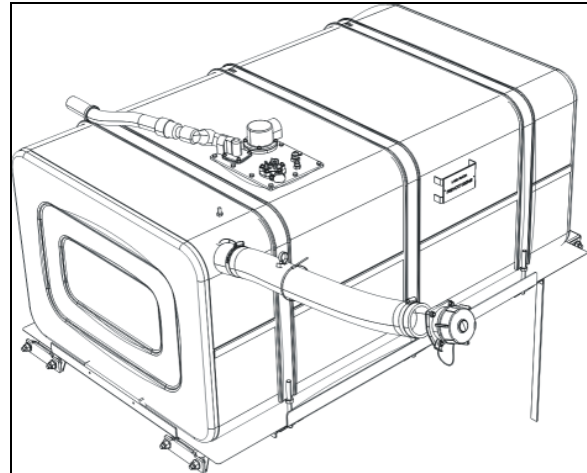


FIGURE 15: STEEL FUEL TANK ASSEMBLY

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.

## 5.7 STEEL FUEL TANK DRAIN PLUG

**NOTE**

For faster emptying, it is recommended to siphon fuel through the opening left on the connection panel once the pressure relief valve is removed.

Apply **Loctite 567 Thread Sealant** on drain plug. With any sealant, the first one or two threads should be left uncovered to avoid system contamination.

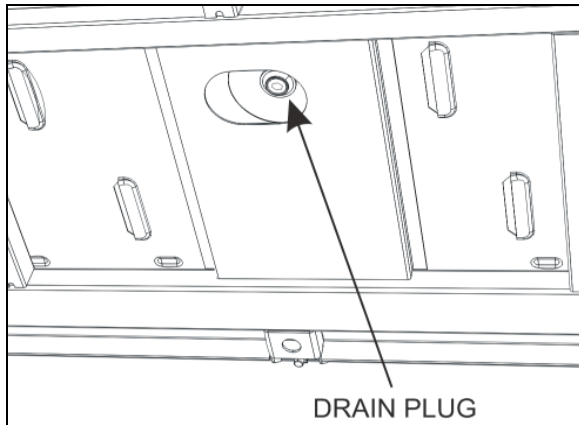


FIGURE 16: FUEL TANK DRAIN PLUG

The proper method of assembling this tapered threaded drain plug is to screw it to the finger tight position and then wrench tighten further 2-3 turns. If leakage persists, check for damaged threads.

### 5.8 STEEL TANK REMOVAL



## 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 chassis at the recommended jacking points.

### NOTE

Before removal, the fuel tank should be completely emptied by unscrewing the drain plug. For faster emptying, it is recommended to siphon fuel through the opening left on the connection panel once the pressure relief valve is removed.

Ensure that the container used has a capacity equal to the amount of fuel remaining in the tank.

1. Open the condenser door.
2. Unscrew clamps retaining R.H. side filler tube to fuel tank and filler neck. Disconnect tube and remove it.
3. Unscrew engine fuel supply and return lines from fuel tank connection panel.

4. Disconnect the fuel level sender electrical wires (3wires). Prior disconnecting, identify the wires and proper terminal on the fuel level sender as reference for reinstallation (Figure 17).
5. Using mobile column lifts, raise the vehicle to gain access to the fuel tank support from underneath.
6. Before removing the bolts securing the tank support to the chassis, lower the vehicle and make sure the tank support is adequately supported with jack stands or wood blocks. Failure to do so could result in injury as well as damage to the tank.



## DANGER

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

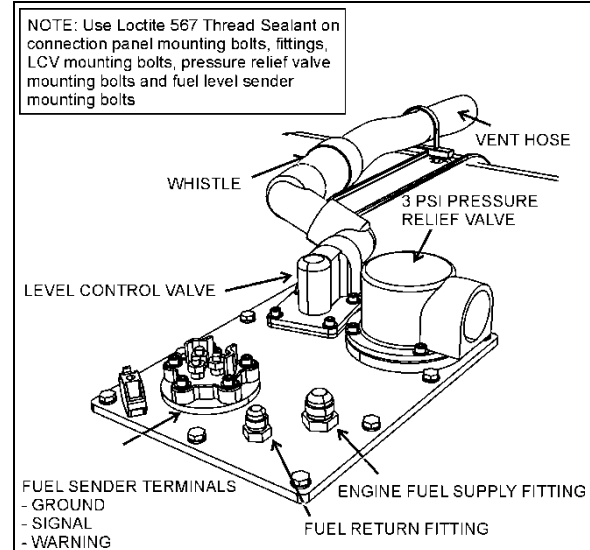


FIGURE 17: FUEL TANK CONNECTION PANEL

7. Once properly supported, unscrew the bolts (6) holding the fuel tank support to the vehicle chassis.
8. Lift the coach until it is high enough to clear the fuel tank. The fuel tank will rest on the floor.

### 5.9 STEEL TANK INSTALLATION

To install tank, simply reverse the "Tank Removal" procedure. Apply Valvoline anti-corrosion compound on retainer strap studs, nuts and fuel tank cradle mounting bolts.

Fasten tank to cradle (tank straps).

**TORQUE: 20 lb-ft (27 Nm)**

Fasten tank support to vehicle.

**TORQUE: 55 lb-ft (75 Nm)**

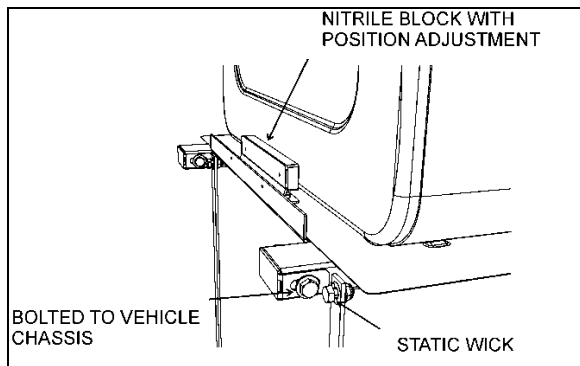


FIGURE 18: FUEL TANK SUPPORT MOUNTING BOLTS

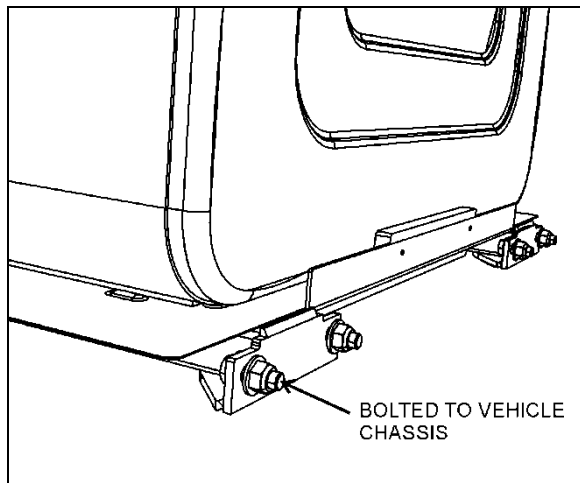


FIGURE 19: FUEL TANK SUPPORT MOUNTING BOLTS

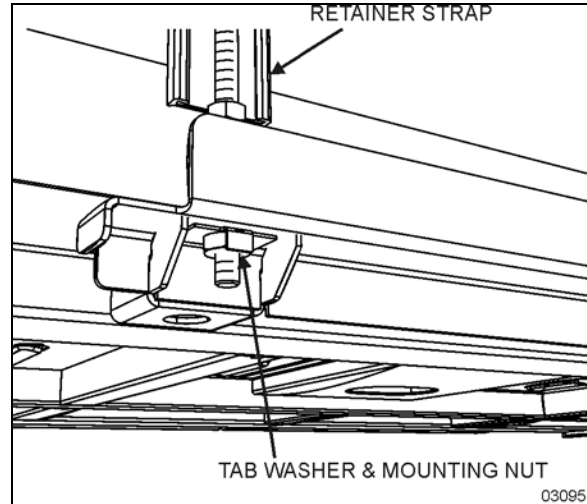


FIGURE 20: FUEL TANK STRAP MOUNTING

### 5.10 FUEL TANK YEARLY INSPECTION

Perform an external visual inspection of the fuel tank from under the vehicle to detect fuel traces or leaks.

Perform a visual inspection of the fuel tank connection panel. Make sure there are no loose connections. Investigate and correct the cause of any fuel leaks.

Inspect all fuel tank mountings and cradle attachment points. Inspect fasteners and replace them as necessary as described in the procedure that follows.

1. Raise the vehicle with safe lifting equipment and procedures.
2. Place jack stands under the fuel tank cradle.



FIGURE 21: JACK STANDS UNDER THE FUEL TANK CRADLE

3. Carefully inspect fuel cradle mounting bolts, 6 locations (Figure 22).



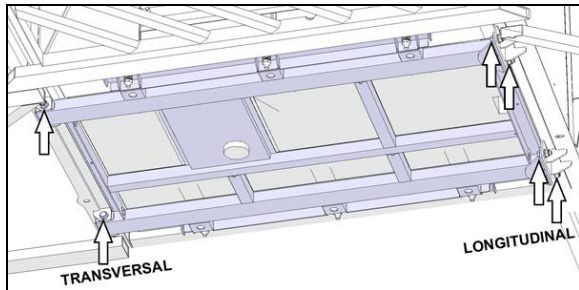


FIGURE 22: LOCATION OF MOUNTING POINTS

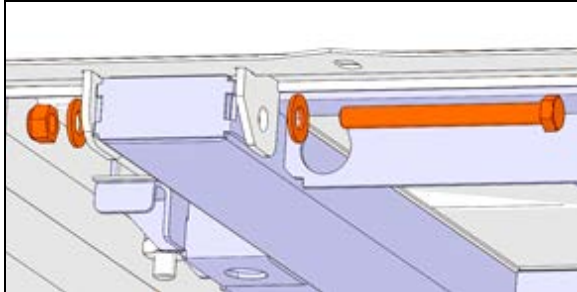


FIGURE 23: TRANSVERSE SCREWS, 2 LOCATIONS

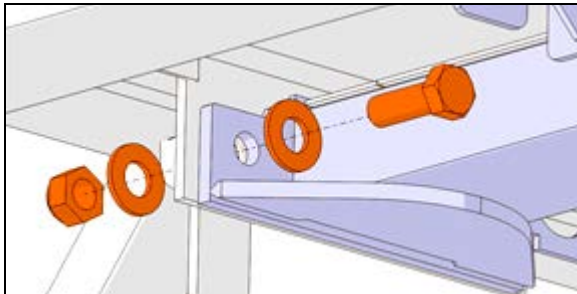


FIGURE 24: LONGITUDINAL SCREWS, 4 LOCATIONS

4. Replace any bolt showing **signs of wear** by new hardware. **DO NOT REUSE NUTS.** Perform replacement one screw location at a time with appropriate support. Apply torque seal mark.

**Torque: 82 lbf-ft.**

#### Hardware part number and description

# 5001941 screw, cap hex M12x1.75x120 g10.9

# 500806 screw, cap hex M12x1.75x35 g10.9

# 500811 nut, hex sto M12-1.75 G10

# 500958 flat washer ss .531x1.062x.095

# 030082 U-shim 3.175mm thick (0.125 in)

# 030083 U-shim 0.953mm thick (0.038 in)

5. On the transversal screw joints (Figure 25) any visible gap between cradle support tubing and vehicle frame mounting lugs is not acceptable.

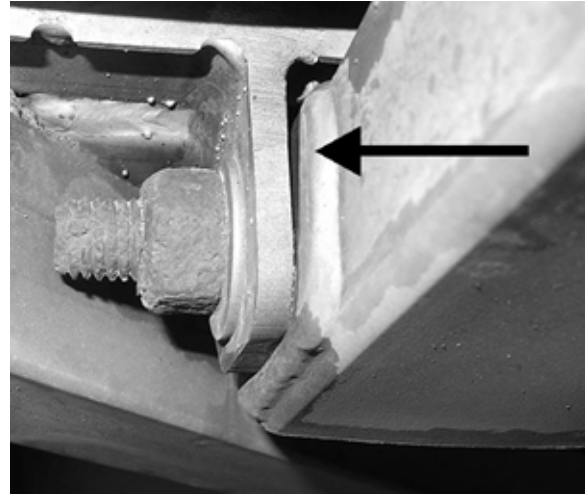


FIGURE 25: VISIBLE GAP ON TRANSVERSAL SCREW JOINT

6. If shims are not present, the visible gap should be shimmed using U-shims #030082 and/or #030083 as required.

7. Shim arrangement may vary and may be stacked on both sides (Figure 26).

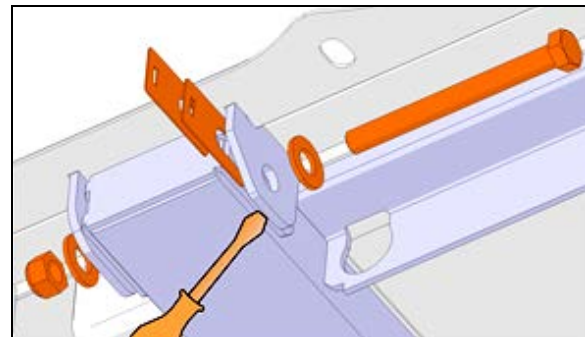


FIGURE 26: SHIM INSTALLATION, TRANSVERSE SCREW. ARRANGEMENT MAY VARY

## 6. FUEL SPECIFICATIONS

The quality of fuel 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 of 15ppm (parts-per-million) sulfur.

On-highway diesel engines meeting 2010 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.

## 6.1 FUEL TYPE

EPA-10 and later engines like the Volvo D13 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. Refer to Volvo engine specifications.



### CAUTION

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



### CAUTION

Owners of 2010 and later model year on-highway diesel engine must refuel only with ULSD fuel.

### NOTE

*Burning Low Sulfur Diesel fuel (instead of ULSD fuel) in 2010 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.*

## 6.2 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.

## 6.3 BIODIESEL FUELS

Biodiesel up to a maximum of 20% blend (B20) may be used and will not affect the manufacturers' mechanical warranty as to engine and emissions system related components, provided the biofuel used in the blend conforms to ASTM D6751, B1 to B5 blends conform to ASTM D975, and B6 to B20 blends conform to ASTM D7467. Also, any engine performance problem related to the use of biodiesel fuel would not be recognized nor considered as Volvo or Prevost's responsibility.

However, Volvo engines are certified to comply with U.S. EPA and California emissions standards based upon the use of *test fuels* with specifications established by these regulatory agencies.

Alternative fuels, including biodiesel, that are not substantially similar to the required *test fuels* may adversely affect engine emissions compliance. As a result, Volvo does not warrant the engine will conform to applicable Federal or California emissions limits when operated on biodiesel or other alternative fuels that are not substantially similar to specified test fuels used for certification.

Additional maintenance care must be carried-out for the following systems:

### 6.3.1 Biodiesel Fuels and Preheater

For operation of the preheater with biodiesel, a retrofit is mandatory. Refer to the guidelines outlined in the last version of the Valeo Workshop Manual for Thermo 230, 300, 350, available on the Technical Publications USB flash drive and on PrevoSt technical publications website.

### 6.3.2 Biodiesel Fuels and the Engine


Use an oil sampling method to establish the appropriate oil drain interval for your application.

Fuel filter change intervals should be analyzed and adjusted accordingly.

## 7. 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 an intake duct on the R.H. side of the rear cap, next to the last window. 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).

### 7.1 PRE-CLEANER SERVICING

	<h2>MAINTENANCE</h2>
<p>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.</p>	

### 7.2 AIR CLEANER SERVICING

Replacing the air filter cartridge is important to preserve a good air quality at a sufficient level.

Neglecting this servicing could lead to an efficiency loss and eventual engine problems. Follow these steps to replace the filter cartridge:

#### 7.2.1 Checking restriction indicator

Locate the restriction gage in the engine compartment, at the back of the vehicle. Consisting of a black tube, it is fixed on the main intake hose.

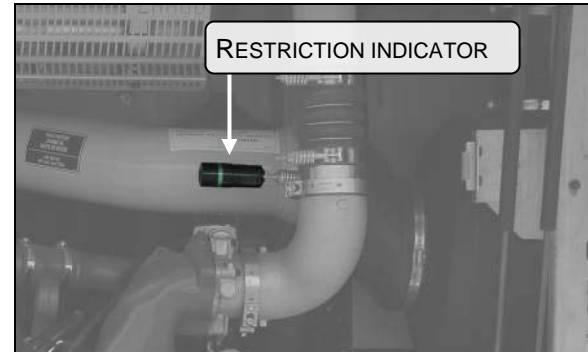


FIGURE 27 RESTRICTION INDICATOR LOCATION

*Indication of a need to replace the filter will be apparent once its line turns red. Proper operation will be indicated by a green line. Consult the servicing schedule for time intervals between each regular filter change.*

#### 7.2.2 Replacing the Filter

- Remove the four filter cover plastic bolts. The filter itself can be removed by pulling it with gentle movements from left to right and up/down. A residual suction may occur, creating additional resistance.
- Empty the drain rubber valve located under the filter housing; if damaged this part can be ordered and changed.

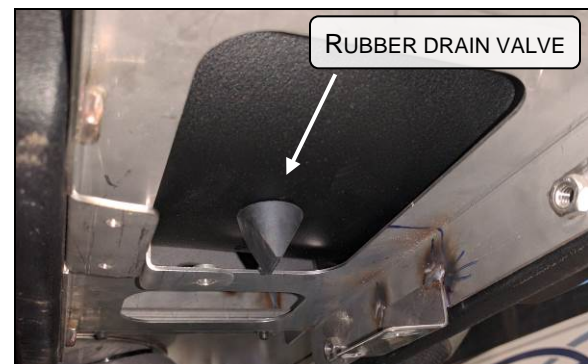


FIGURE 28 RUBBER DRAIN VALVE UNDER FILTER

- Using a clean damp cloth, wipe the sealing flange and the inside of the outlet tube.



FIGURE 29

- Look for traces of dirt and particles on the outer surface of the old filter, indicating possible leakage. If so, the leakage cause should be investigated and solved.
- Unbox the new filter, inspect the inner sealing surface for potential non-conformities; Do not wipe the surface as it is factory sprayed with a dry lubricant for an easier mounting.

Insert new filter by gently pushing it inside the filter housing.



**CAUTION**

Avoid pushing it by its center; use both hands and push on its outer rim until it is well seated. (It should be exceeding the housing by around 2-1/2 inches as shown)

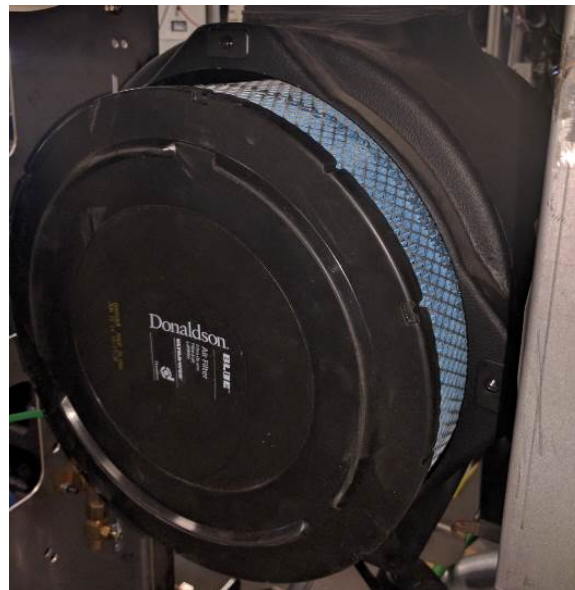


FIGURE 30

- Replace the filter cover and tighten the 4 plastic bolts using recommended torque settings (as displayed on filter cover).

**TORQUE: 10-15 lb-ft (14-20 Nm)**



FIGURE 31

**WARNING:** The cover is not supposed to apply pressure on the filter. If so, the filter needs to be pushed further in the housing.

- Reset the restriction gage by pushing on the right-hand side button.

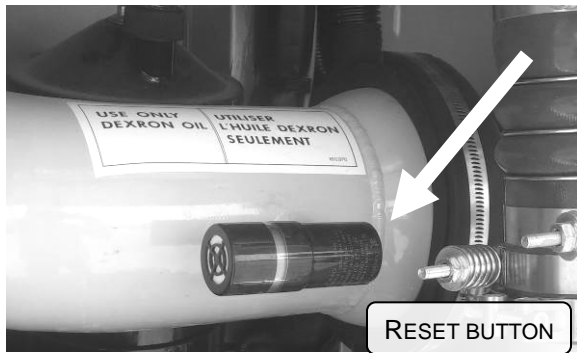


FIGURE 32

### 7.3 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;



### CAUTION

Do not ignore the Warning given by the air restriction indicator. This could result in serious engine damage.

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

### 7.4 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 cleaner and the engine. A red marker is displayed when the air cleaner is clogged and must be replaced. Reset by pressing on the indicator's extremity.

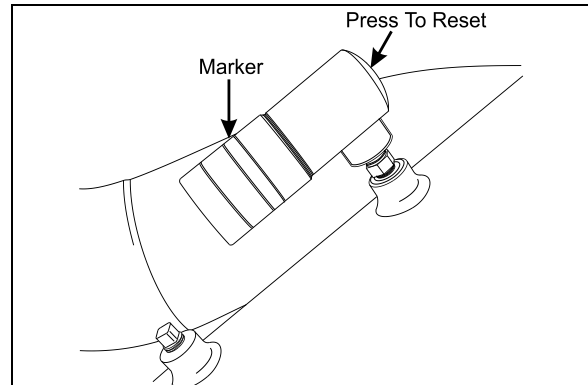


FIGURE 33: RESTRICTION INDICATOR

01052

#### NOTE

*Some vehicles may be equipped with a slightly different "clear body" restrictor indicator. This type of indicator is usually combined with a warning light located on the rear control panel. Reset by pressing on the indicator's extremity.*





## MAINTENANCE

### Air cleaner

Change the filter element when indicated by the restriction indicator or at the intervals specified by the Lubrication And Servicing Schedule in Section 24: LUBRICATION & SERVICING.

## 8. 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.

### 8.1 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.

### 8.2 POTENTIOMETER REPLACEMENT

1. Disconnect cable harness connector.
2. Loosen the two screws and remove potentiometer. Retain for re-assembly.
3. Discard potentiometer (Figure 34).



## 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.

4. 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 (Figure 34) and tighten just enough to secure potentiometer lightly.

**TORQUE: 10-20 lb-in (1,13-2,26 Nm)**

5. 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.

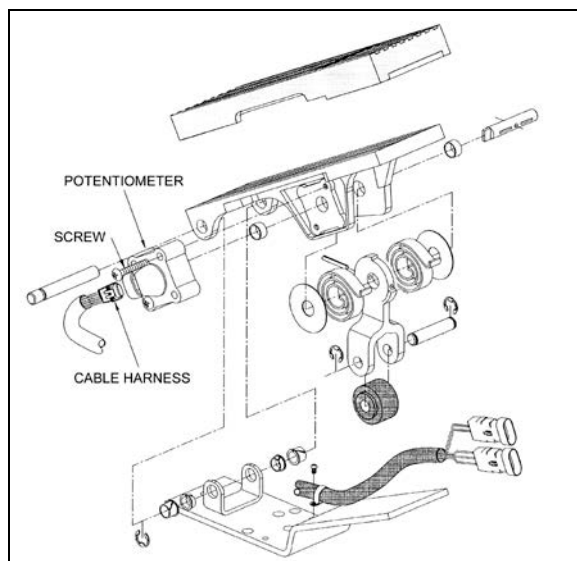


FIGURE 34: ELECTRONIC FOOT PEDAL ASSEMBLY 03035

## 9. SPECIFICATIONS

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

Max Fuel Flow .....	180 US gal/h (681 l/h)
Water removal @ 25 microns .....	99.6%
Dirt holding capacity @ 25 microns.....	110 g

### Primary Fuel Filter (Fuel/Water Separator)

Filter type .....	Spin-on cartridge
Filter drain interval .....	Dashboard telltale light warning
Filter torque.....	½-¾ turn after gasket contact

### Secondary Fuel Filter (Main)

Filter type .....	Spin-on cartridge
Filter torque.....	¾- 1 turn after gasket contact

### Fuel tank Capacity

H3 series vehicles .....	222 US gallons (840 liters)
X3 series vehicles.....	208 US gallons (787 liters)
X3 series vehicles (steel tank) .....	180 US gallons (681 liters)

### Air Cleaner

Filter type .....	Dry-type replaceable element
Filter change interval .....	Red marker on restriction indicator

### Preheater Fuel Filter

Heater type .....	Thermo 300 High pressure atomizer
Heater power .....	104000 btu/h
Pump flow .....	1.05 US gal/h (4 l/h)

