1. Open vent valve (1) on the fuel injection pump and turn on the fuel tank supply valve.

2. Unlock and operate the priming pump plunger until the flow of fuel from the vent valve is continuous and free of air bubbles.

3. Close vent valve (1) and lock the priming pump plunger. Ensure that any spilled fuel is cleaned up.

   **NOTICE**
   Do not crank the engine continuously for more than 30 seconds. Allow the starting motor to cool for two minutes before cranking the engine again.

4. Start the engine. The engine may run rough. Run the engine at low idle until the engine runs smoothly. If the engine will not start, further priming may be necessary. If the engine starts and the engine continues to misfire or smoke, further priming may be necessary.

   If further priming is necessary, perform Steps 5 through 9.

   **NOTICE**
   Do not let the tops of fuel nozzles turn when the fuel line nuts are loosened or tightened.

   The nozzles will be damaged if the top of the nozzle turns in the body.

   The engine will be damaged if a defective fuel injection nozzle is used because the shape of fuel (spray pattern) that comes out of the nozzles will not be correct.

5. Loosen fuel injection line nuts (2) at the cylinder head.

6. Unlock and operate the priming pump plunger until the flow of fuel from the fuel injection lines is continuous and free of air bubbles.

7. Lock the priming pump plunger.

8. Tighten the fuel injection line nuts (2). Refer to Specifications for more information on the proper torques. Ensure that any spilled fuel is cleaned up.

   **NOTICE**
   Do not crank the engine continuously for more than 30 seconds. Allow the starting motor to cool for two minutes before cranking the engine again.

9. Start the engine.

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**Fuel System Primary Filter/Water Separator Element - Replace**

**SMCS Code:** 1260-510; 1260; 1263-510; 1263

Water in the fuel can cause the engine to run rough. Water in the fuel may cause fuel system components to fail. If the fuel has been contaminated with water, the element should be changed before the regularly scheduled interval.

The primary filter/water separator also provides filtration in order to help extend the life of the secondary fuel filter. The element should be changed regularly. The primary filter/water separator should be changed when the vacuum gauge (if equipped) registers 50 to 70 kPa (15 to 20 In Hg).

**Replace the Element**

**WARNING**

Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire. To help prevent possible injury, turn the start switch off when changing fuel filters or water separator elements. Clean up fuel spills immediately.

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**Diagram**

1. Vent valve
2. Base
3. Can
4. Element
5. Drain plug

Illustration 31

1. Close the main fuel supply valve.

2. Remove drain plug (5). Depress vent valve (1) in order to start the flow of fuel. Allow the fuel to drain into a suitable container. Dispose of the fuel properly.

3. Install the drain plug.
4. Remove can (3) from base (2).

5. Remove element (4) from the can. Dispose of the used element.

6. Remove the gasket. Clean the following components:
   - Can
   - Gasket
   - Base

   Inspect the gasket for damage and for deterioration. Replace the gasket, if necessary.

7. Install the gasket. Lubricate the gasket with clean diesel fuel.

   **NOTICE**
   The primary filter/water separator may be prefilled with fuel to avoid rough running/stalling of the engine due to air. Do not fill the secondary filter with fuel before installation. The fuel would not be filtered and could be contaminated. Contaminated fuel will cause accelerated wear to fuel system parts.

8. Install a new element in the can. The can may be filled with fuel at this time.

9. Install the can on the base. Tighten the can by hand. Do not use tools in order to tighten the can.

   **NOTICE**
   The water separator is under suction during normal engine operation. Ensure that the vent plug is tightened securely to help prevent air from entering the fuel system.

10. Open the main fuel supply valve.

11. Start the engine and check for leaks. Run the engine for one minute. Stop the engine and check for leaks again.

    Leaks are difficult to detect while the engine is running. The primary filter/water separator is under suction. A leak will allow air to enter the fuel. The air in the fuel can cause low power due to aeration of the fuel. If air enters the fuel, ensure that all components are properly tightened.

**Fuel System Secondary Filter - Replace**

**SMCS Code:** 1261-510-SE

**WARNING**

Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire. To help prevent possible injury, turn the start switch off when changing fuel filters or water separator elements. Clean up fuel spills immediately.

**NOTICE**

Do not allow dirt to enter the fuel system. Thoroughly clean the area around a fuel system component that will be disconnected. Fit a suitable cover over any disconnected fuel system components.

1. Stop the engine.

2. Shut off the fuel tank supply valve.

   **NOTICE**
   Use a suitable container to catch any fuel that might spill. Clean up any spilled fuel immediately.

3. Remove fuel filter (2).

4. Clean the gasket sealing surface of the fuel filter base. Ensure that all of the old gasket is removed.

5. Apply clean diesel fuel to the new fuel filter gasket.

   **NOTICE**
   Do not fill the secondary fuel filter with fuel before installing. The fuel would not be filtered and could be contaminated. Contaminated fuel will cause accelerated wear to fuel system parts.
6. Install the new fuel filter. Spin the fuel filter onto the fuel filter base until the gasket contacts the base. Use the rotation index marks on the filters as a guide for proper tightening. Tighten the filter for an additional 3/4 turn by hand. Do not overtighten the filter.

Fuel System Water Separator - Drain

SMCS Code: 1263-543

WARNING

Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire.

Illustration 33

Water in the fuel can cause fuel system components to fail. Drain the water separator daily. Drain the water separator more frequently when a large concentration of water is present in the fuel system.

1. Close the fuel supply valve.

NOTICE

Use a suitable container to catch any fuel that might spill. Clean up any spilled fuel immediately.

2. Remove drain plug (5). Depress vent valve (1) in order to start the flow. Allow the water to drain into a suitable container. Allow the water to flow until fuel flows from the drain.

3. Install the drain plug. Dispose of the liquid properly.

4. Open the fuel supply valve.

NOTICE

The water separator is under suction during normal engine operation. Ensure that the drain valve is tightened securely to help prevent air from entering the fuel system.
Fuel Tank Water and Sediment - Drain

SMCS Code: 1273-543-M&S

Fuel Tank

Fuel quality is critical to the performance and to the service life of the engine. Water in the fuel can cause excessive fuel system wear. Condensation occurs during the heating and cooling of fuel. The condensation occurs as the fuel passes through the fuel system and the fuel returns to the fuel tank. This causes water to accumulate in fuel tanks. Draining the fuel tank regularly and obtaining fuel from reliable sources can help to eliminate water in the fuel.

Drain the Water and the Sediment

Fuel tanks should contain some provision for draining water and draining sediment from the bottom of the fuel tanks.

Open the drain valve on the bottom of the fuel tank in order to drain the water and the sediment. Close the drain valve.

Check the fuel daily. Drain the water and sediment from the fuel tank after operating the engine or drain the water and sediment from the fuel tank after the fuel tank has been filled. Allow five to ten minutes before performing this procedure.

Fill the fuel tank after operating the engine in order to drive out moist air. This will help prevent condensation. Do not fill the tank to the top. The fuel expands as the fuel gets warm. The tank may overflow.

Some fuel tanks use supply pipes that allow water and sediment to settle below the end of the fuel supply pipe. Some fuel tanks use supply lines that take fuel directly from the bottom of the tank. If the engine is equipped with this system, regular maintenance of the fuel system filter is important.

Fuel Storage Tanks

Drain the water and the sediment from the fuel storage tank during the following conditions:

- Weekly
- Oil change
- Refill of the tank

This will help prevent water or sediment from being pumped from the storage tank into the engine fuel tank.

If a bulk storage tank has been refilled or moved recently, allow adequate time for the sediment to settle before filling the engine fuel tank. Internal baffles in the bulk storage tank will also help trap sediment. Filtering fuel that is pumped from the storage tank helps to ensure the quality of the fuel. When possible, water separators should be used.
Governor Housing - Drain

SMCS Code: 1287-543

Illustration 34

(1) Governor housing
(2) Bolt
(3) Plug

The governor housing (1) is mounted on the rear of the fuel injection pump. Condensation can collect over time in the governor housing. There are two drains which are located at the rear (bottom) of the governor housing. Perform the following procedure in order to drain the water from the governor housing:

1. Remove bolt (2) and plug (3).
2. Allow the water and sediment to drain.
3. Install bolt (2) and plug (3). Refer to the Operation and Maintenance Manual, “Torque Specifications” topic (Maintenance Section) for the proper torques.
4. Prime the fuel system. Refer to the Operation and Maintenance Manual, “Fuel System - Prime” topic (Maintenance Section) for more information on priming the fuel system.

Heat Exchanger - Inspect

SMCS Code: 1379-040

The interval for the maintenance of the plate type heat exchanger depends on the operating environment of the vessel and on the operating time. The sea water that is circulated through the heat exchanger and the amount of operating time of the vessel affects the following items:

- Cleanliness of the heat exchanger plates
- Effectiveness of the heat exchanger system

Operating in water that contains silt, sediment, salt, algae, etc will adversely affect the heat exchanger system. In addition, intermittent use of the vessel will adversely affect the heat exchanger system.

The following items indicate that the heat exchanger may require cleaning:

- Increased coolant temperature
- Engine overheating
- Excessive pressure drop between the water inlet and the water outlet

An operator that is familiar with the normal operating temperature of the coolant can determine when the coolant temperature is out of the normal range. Inspection and maintenance of the heat exchanger are required if the engine is overheating.

Your Caterpillar dealer has the equipment and the trained personnel that are needed in order to measure the pressure drop across the heat exchanger.

The procedure for cleaning the heat exchanger is the same procedure that is used for cleaning the aftercooler core. Refer to the Operation and Maintenance Manual, “Aftercooler Core - Clean/Test” topic (Maintenance Section). For more information on servicing the heat exchanger, consult your Caterpillar dealer.
Hoses and Clamps - Inspect/Replace

**SMCS Code:** 7554-040; 7554-510

Inspect all hoses for leaks that are caused by the following conditions:

- Cracking
- Softness
- Loose clamps

Replace hoses that are cracked or soft. Tighten any loose clamps.

**NOTICE**

Do not bend or strike high pressure lines. Do not install bent or damaged lines, tubes or hoses. Repair any loose or damaged fuel and oil lines, tubes and hoses. Leaks can cause fires. Inspect all lines, tubes and hoses carefully. Tighten all connections to the recommended torque.

Check for the following conditions:

- End fittings that are damaged or leaking
- Outer covering that is chafed or cut
- Exposed wire that is used for reinforcement
- Outer covering that is ballooning locally
- Flexible part of the hose that is kinked or crushed
- Armoring that is embedded in the outer covering

A constant torque hose clamp can be used in place of any standard hose clamp. Ensure that the constant torque hose clamp is the same size as the standard clamp.

Due to extreme temperature changes, the hose will heat set. Heat setting causes hose clamps to loosen. This can result in leaks. A constant torque hose clamp will help to prevent loose hose clamps.

Each installation application can be different. The differences depend on the following factors:

- Type of hose
- Type of fitting material
- Anticipated expansion and contraction of the hose

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**Replace the Hoses and the Clamps**

**WARNING**

Pressurized System: Hot coolant can cause serious burns. To open the cooling system filler cap, stop the engine and wait until the cooling system components are cool. Loosen the cooling system pressure cap slowly in order to relieve the pressure.

1. Stop the engine. Allow the engine to cool.
2. Loosen the cooling system filler cap slowly in order to relieve any pressure. Remove the cooling system filler cap.
3. Drain the coolant into a suitable, clean container. The coolant can be reused.
4. Remove the hose clamps.
5. Disconnect the old hose.
6. Replace the old hose with a new hose.

**Note:** For torques on hose clamps, see this Operation and Maintenance Manual, “Torque Specifications” (Maintenance Section).

7. Install the hose clamps with a torque wrench.

**Note:** For the proper coolant to use, see this Operation and Maintenance Manual, “Coolant Recommendations” (Maintenance Section).

8. Refill the cooling system.
9. Clean the cooling system filler cap. Inspect the cooling system filler cap’s gaskets. Replace the cooling system filler cap if the gaskets are damaged. Install the cooling system filler cap.
10. Start the engine. Inspect the cooling system for leaks.
**Magnetic Pickups - Clean/Inspect**

**SMCS Code:** 7400-040; 7400-070

Illustration 35  
Typical example  
(1) Magnetic pickup  
(2) Flywheel housing

1. Remove magnetic pickup (1) from flywheel housing (2). Check the condition of the end of the magnetic pickup. Check for signs of wear and contaminants.

2. Clean the metal shavings and other debris from the face of the magnet.

3. Install the magnetic pickup and adjust the magnetic pickup. Refer to the Service Manual for the installation procedure.

**Marine Transmission Oil Cooler - Clean/Inspect**

**SMCS Code:** 3320-040; 3320-070

The procedure for cleaning the marine transmission oil cooler is the same procedure that is used for cleaning the aftercooler core. Refer to the Operation and Maintenance Manual, “Aftercooler Core - Clean/Test” topic (Maintenance Section). For more information on servicing the marine transmission oil cooler, refer to the OEM recommendations or consult your Caterpillar dealer.
Marine Transmission Oil Level - Check

SMCS Code: 3081-535

Marine Transmission Operation, Maintenance, Warranty, and Parts Support

Caterpillar Inc. encourages customers to refer to a Caterpillar dealer and/or to the OEM dealer for information on the following items:

- Marine transmission operation
- Maintenance of the marine transmission

All support for the warranty will be the responsibility of the OEM. All parts support for the marine transmission will be the responsibility of the OEM. This parts support includes both the installation of parts and the resolution of any service problems.

Refer to the OEM recommendations on the nameplate for the following information about the model of the marine transmission:

- Lubrication specifications
- Requirements for maintenance

Oil Fumes Filter - Replace

SMCS Code: 1317-510

Illustration 37

(1) Hose clamp
(2) Clip
(3) Housing

1. Loosen hose clamp (1). Remove the hose.

2. Unfasten clips (2). Remove the cover and the seal from housing (3).

Illustration 38

(3) Housing
(4) Nut
(5) Filter element

3. Remove nuts (4). Remove filter elements (5) from housing (3). Discard the used elements.

4. Clean the inside of the filter housing with a clean cloth.

5. Install new elements (5) and tighten nuts (4).

6. Clean the cover and the seal with a clean cloth. Inspect the condition of the seal. Replace the seal, if necessary.

7. Install the seal and the cover. Fasten clips (2).