

# Disassembly and Assembly

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## **1204E-E44TA and 1204E-E44TTA Industrial Engines**

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MK (Engine)  
ML (Engine)

## Important Safety Information

Most accidents that involve product operation, maintenance and repair are caused by failure to observe basic safety rules or precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs. A person must be alert to potential hazards. This person should also have the necessary training, skills and tools to perform these functions properly.

**Improper operation, lubrication, maintenance or repair of this product can be dangerous and could result in injury or death.**

**Do not operate or perform any lubrication, maintenance or repair on this product, until you have read and understood the operation, lubrication, maintenance and repair information.**

Safety precautions and warnings are provided in this manual and on the product. If these hazard warnings are not heeded, bodily injury or death could occur to you or to other persons.

The hazards are identified by the "Safety Alert Symbol" and followed by a "Signal Word" such as "DANGER", "WARNING" or "CAUTION". The Safety Alert "WARNING" label is shown below.



The meaning of this safety alert symbol is as follows:

**Attention! Become Alert! Your Safety is Involved.**

The message that appears under the warning explains the hazard and can be either written or pictorially presented.

Operations that may cause product damage are identified by "NOTICE" labels on the product and in this publication.

**Perkins cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this publication and on the product are, therefore, not all inclusive. If a tool, procedure, work method or operating technique that is not specifically recommended by Perkins is used, you must satisfy yourself that it is safe for you and for others. You should also ensure that the product will not be damaged or be made unsafe by the operation, lubrication, maintenance or repair procedures that you choose.**

The information, specifications, and illustrations in this publication are on the basis of information that was available at the time that the publication was written. The specifications, torques, pressures, measurements, adjustments, illustrations, and other items can change at any time. These changes can affect the service that is given to the product. Obtain the complete and most current information before you start any job. Perkins dealers or Perkins distributors have the most current information available.



**When replacement parts are required for this product Perkins recommends using Perkins replacement parts.**

**Failure to heed this warning can lead to premature failures, product damage, personal injury or death.**

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## Disassembly and Assembly Section

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### Fuel Priming Pump - Remove and Install (Electric Fuel Lift Pump (EFLP))

#### Removal Procedure

Table 1

Required Tools			
Tool	Part Number	Part Description	Qty
A	T410437	Cap Kit	1

#### NOTICE

Ensure that all adjustments and repairs that are carried out to the fuel system are performed by authorized personnel that have the correct training.

Before beginning ANY work on the fuel system, refer to Operation and Maintenance Manual, "General Hazard Information and High Pressure Fuel Lines" for safety information.

Refer to System Operation, Testing and Adjusting, "Cleanliness of Fuel System Components" for detailed information on the standards of cleanliness that must be observed during ALL work on the fuel system.

#### NOTICE

Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Dispose of all fluids according to local regulations and mandates.

1. Turn the fuel supply to the OFF position.
2. Turn the battery disconnect switch to the OFF position.

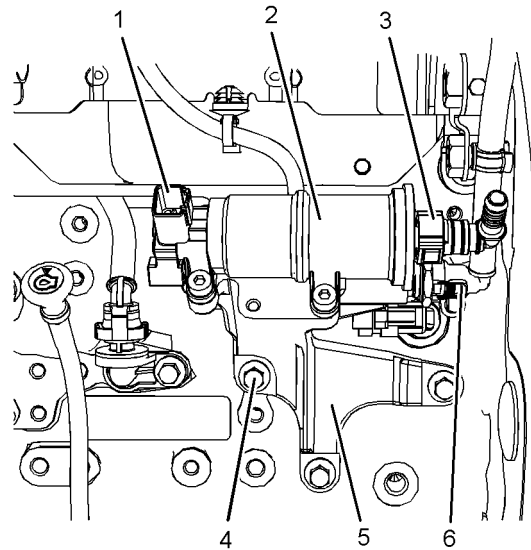


Illustration 1

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3. Make a temporary identification mark on plastic tube assemblies in order to show the correct position of the tube assemblies.
4. Disconnect plastic tube assembly (3) and plastic tube assembly (6) from fuel priming pump (2).
5. Use Tooling (A) in order to plug the plastic tube assemblies. Use Tooling (A) in order to cap the connections for plastic tube assemblies on the fuel priming pump.
6. Disconnect Original Equipment Manufactures (OEM) wiring harness assembly (1) from fuel priming pump (2).
7. Remove bolts (4) from bracket (5).  
**Note:** Support the bracket as the bolts are removed.
8. Remove fuel priming pump (3) and bracket (5) as an assembly from the cylinder block.

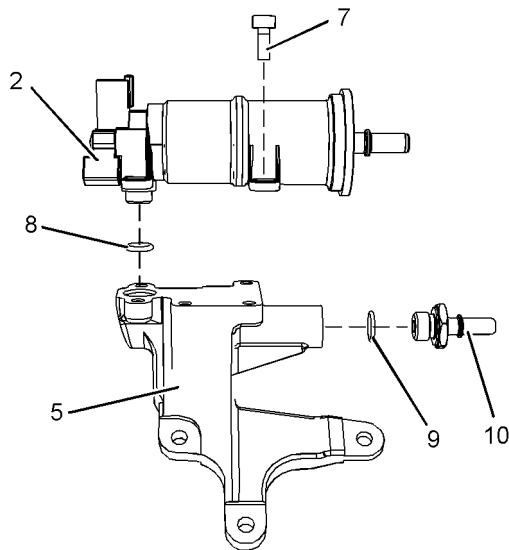


Illustration 2

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9. If necessary, follow Step 9.a through Step 9.d in order to remove fuel priming pump (2) from bracket (5).
  - a. Remove allen head screws (7) from fuel priming pump (2).
  - b. Remove fuel priming pump (2) from bracket (5).
  - c. Remove O-ring seal (8).
  - d. If necessary, remove connection (10) from bracket (5). Remove O-ring seal (9) from connection (10).

## Installation Procedure

### NOTICE

Ensure that all adjustments and repairs that are carried out to the fuel system are performed by authorized personnel that have the correct training.

Before beginning ANY work on the fuel system, refer to Operation and Maintenance Manual, "General Hazard Information and High Pressure Fuel Lines" for safety information.

Refer to System Operation, Testing and Adjusting, "Cleanliness of Fuel System Components" for detailed information on the standards of cleanliness that must be observed during ALL work on the fuel system.

1. Ensure that the fuel priming pump is clean and free from wear and damage. If necessary, replace the fuel priming pump.

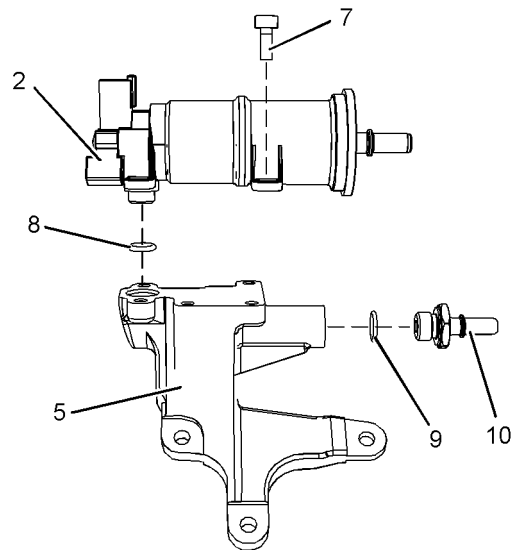


Illustration 3

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2. If necessary, follow Step 2.a through Step 2.d in order to install fuel priming pump (2) from bracket (5).
    - a. If necessary, install a new O-ring seal (9) to connection (10). Install connection (10) to bracket (5). Tighten the connection to a torque of 20 N·m (177 lb in).
    - b. Install a new O-ring seal (8) to fuel priming pump (2).
    - c. Position fuel priming pump (2) onto bracket (5).
- Note:** Ensure that the fuel priming pump is correctly located onto the bracket.
- d. Install new allen head screws (7). Tighten the allen head screws to a torque of 9 N·m (80 lb in).

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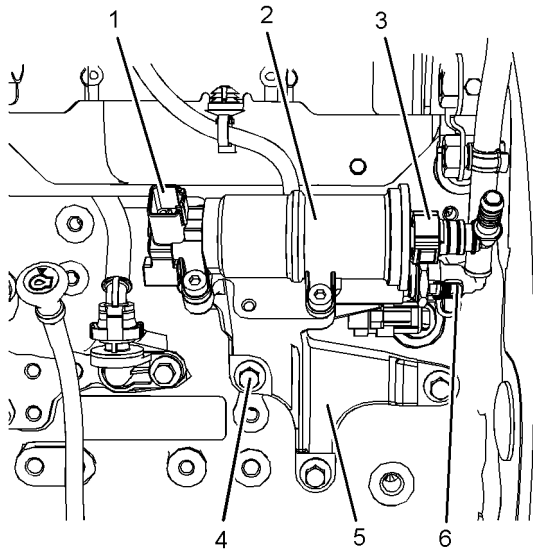


Illustration 4

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3. Position fuel priming pump (3) and bracket (5) as an assembly onto the cylinder block.
4. Install bolt (4) to bracket (5). Tighten the bolt to a torque of 22 N·m (195 lb in).
5. Remove plugs from plastic tube assembly (3) and plastic tube assembly (5). Remove cap from connections on fuel priming pump (2).
6. Connect plastic tube assembly (3) and plastic tube assembly (5) to fuel priming pump (2).
7. Connect (OEM) wiring harness assembly (1) to fuel priming pump (2).
8. Turn the fuel supply to the ON position.
9. Turn the battery disconnect switch to the ON position.
10. Prime the fuel system. Refer to Operation and Maintenance Manual, "Fuel System - Prime" for the correct procedure.

## Flow Control Valve - Remove and Install

### Removal Procedure

#### Start By:

- a. Remove the crankcase breather. Refer to Disassemble and Assemble, "Crankcase Breather - Remove" for the correct procedure.

### **! WARNING**

Contact with high pressure fuel may cause fluid penetration and burn hazards. High pressure fuel spray may cause a fire hazard. Failure to follow these inspection, maintenance and service instructions may cause personal injury or death.

#### NOTICE

Ensure that all adjustments and repairs that are carried out to the fuel system are performed by authorized personnel that have the correct training.

Before beginning ANY work on the fuel system, refer to Operation and Maintenance Manual, "General Hazard Information and High Pressure Fuel Lines" for safety information.

Refer to System Operation, Testing and Adjusting, "Cleanliness of Fuel System Components" for detailed information on the standards of cleanliness that must be observed during ALL work on the fuel system.

1. Turn the fuel supply to the OFF position.
2. Turn the battery disconnect switch to the OFF position.

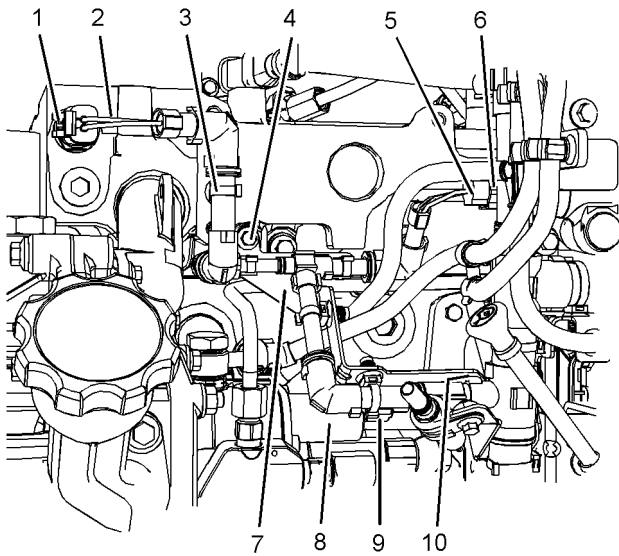


Illustration 5

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3. Slide locking tab (1) into the unlocked position. Disconnect harness assembly (2) from the coolant temperature sensor.
4. Cut cable strap (3).
5. Disconnect harness assembly (5) from fuel pressure sensor (6).
6. Disconnect assembly (9) from flow control valve (8).
7. Remove bolt (4) and bolt (10) (not shown) from bracket (7).
8. Position bracket (7) and the harness assembly away from the fuel injection pump.

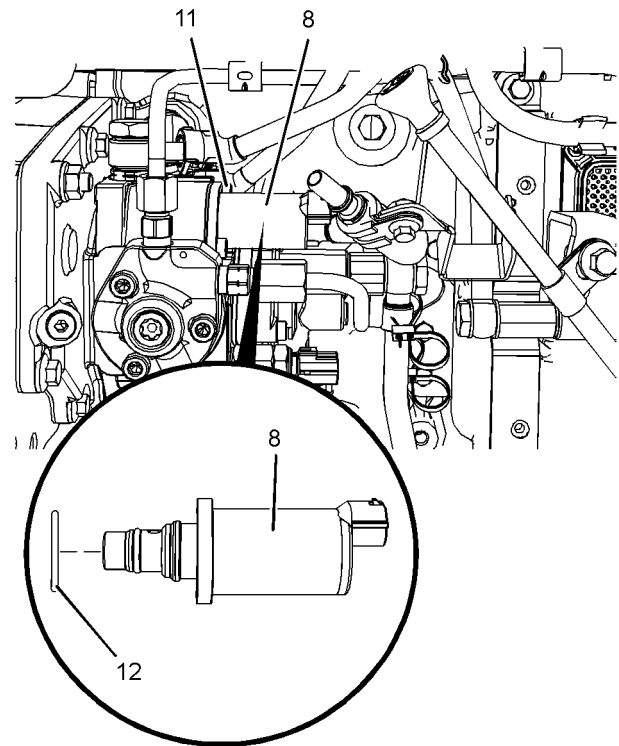


Illustration 6

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9. Clean the area around flow control valve (8) and fuel injection pump. Ensure that the area is free from contamination before beginning disassembly.
10. Make temporary marks on flow control valve (8) and the fuel injection pump for installation purpose.
11. Remove allen heads screws (11) from flow control valve (8).
12. Remove flow control valve (8) from the fuel injection pump. Remove O-ring seal (12).

## Installation Procedure

1. Ensure that all component at free from wear and damage. If any part of the flow control valve is worn or damaged, the flow control valve must be replaced as an assembly. The flow control valve kit contains the guide pins in order to install the flow control valve assembly.



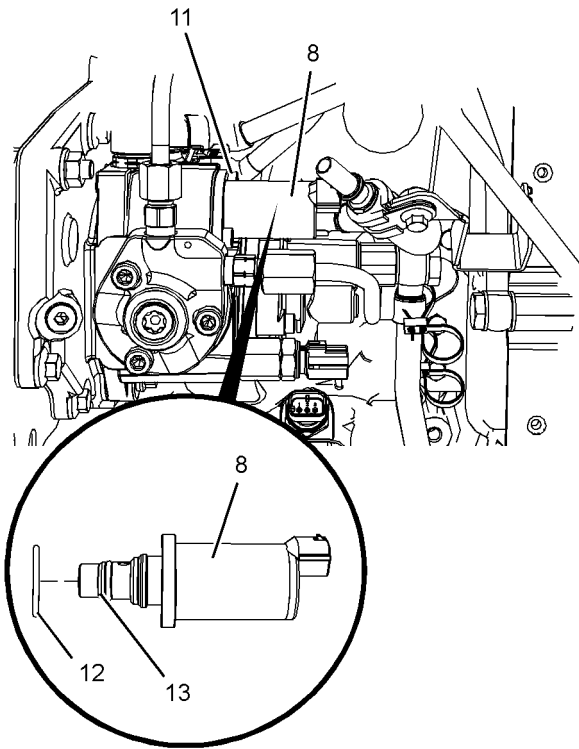


Illustration 7

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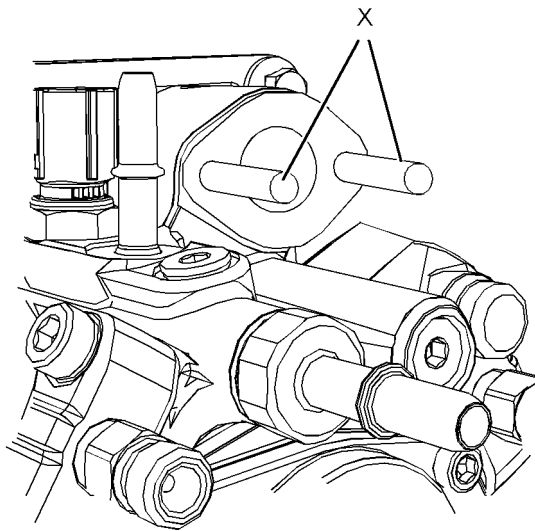


Illustration 8

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Flow control valve guide pins

2. Position a new O-ring seal (12) onto the fuel injection pump.

**Note:** Ensure that the O-ring seal is correctly seated into the recess of the fuel injection pump.

3. Check O-ring seal (13) is correctly positioned. Ensure that O-ring seal (13) is not damaged.

**Note:** If the O-ring seal is damaged, a new flow control valve assembly must be installed.

4. Install guide pins into Position (X) on the fuel injection pump.

**Note:** Note the guide pins are part of the flow control valve repair kit.

5. Lubricate O-ring seal (13) with clean fuel.

**Note:** Ensure that the O-ring seals are not damaged or misaligned.

6. Position flow control valve (8) onto guide pins.

**Note:** Ensure that the flow control valve is correctly orientated

7. Install flow control valve (8) to the fuel injection pump.

8. Remove guide pins from the fuel injection pump.

9. Install allen head screws (11).

10. Tighten allen head screws (11) equally until the flow control valve is seated correctly onto the fuel injection pump.

**Note:** Ensure that the allen head screws are tightened equally. Failure to ensure that the allen head screws are tightened equally will result in damage to the fuel injection pump.

11. Tighten the allen head screws to a torque of 9 N·m (80 lb in).

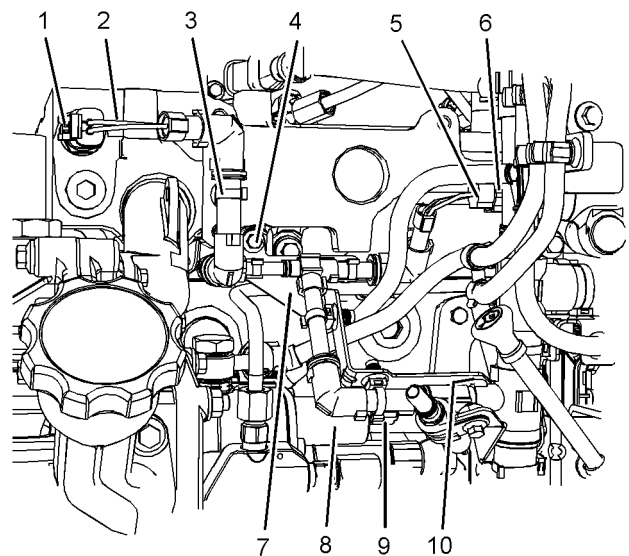


Illustration 9

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12. Position bracket (7) and harness assembly onto fuel injection pump.

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13. Install bolt (4) and bolt (10) (not shown) to bracket (7). Tighten the bolts to a torque of 9 N·m (80 lb in).
  14. Connect harness assembly (5) to fuel pressure sensor (6).
  15. Connect harness assembly (9) to flow control valve (8).
  16. Connect harness assembly (2) to the coolant temperature sensor. Slide locking tab (1) into the locked position.
  17. Install a new cable strap (3).
- Note:** Ensure that the cable strap meets the Original Equipment Manufactures (OEM) specification.
18. Replace the filters for primary fuel system. Refer to Operation and Maintenance Manual, "Fuel System Primary (Water Separator) Element - Replace" for the correct procedure.
  19. Replace the filters for secondary fuel system. Refer to Operation and Maintenance Manual, "Fuel System Secondary Filter - Replace" for the correct procedure.
  20. Turn the fuel supply to the ON position.
  21. Turn the battery disconnect switch to the ON position.
  22. Install the crankcase breather. Refer to Disassemble and Assemble, "Crankcase Breather - Install" for the correct procedure.
  23. Remove the air from the fuel system. Refer to Operation and Maintenance Manual, "Fuel System - Prime" for more information.
  24. After replacement of the flow control valve, the fuel injection pump must be calibrated. Use the electronic service tool to perform "High Pressure Fuel Pump Calibration".

## Fuel Filter Base - Remove and Install (Twin Secondary Fuel Filter)

### Removal Procedure

Table 2

Required Tools			
Tool	Part Number	Part Description	Qty
A	T410437	Cap Kit	1

#### NOTICE

**Ensure that all adjustments and repairs that are carried out to the fuel system are performed by authorized personnel that have the correct training.**

**Before beginning ANY work on the fuel system, refer to Operation and Maintenance Manual, "General Hazard Information and High Pressure Fuel Lines" for safety information.**

**Refer to System Operation, Testing and Adjusting, "Cleanliness of Fuel System Components" for detailed information on the standards of cleanliness that must be observed during ALL work on the fuel system.**

#### NOTICE

Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Dispose of all fluids according to local regulations and mandates.

1. Turn the fuel supply to the OFF position.
2. Turn the battery disconnect switch to the OFF position.
3. Drain the secondary filters. Refer to Operation and Maintenance Manual, "Fuel System Secondary Filter - Replace" for the correct procedure.

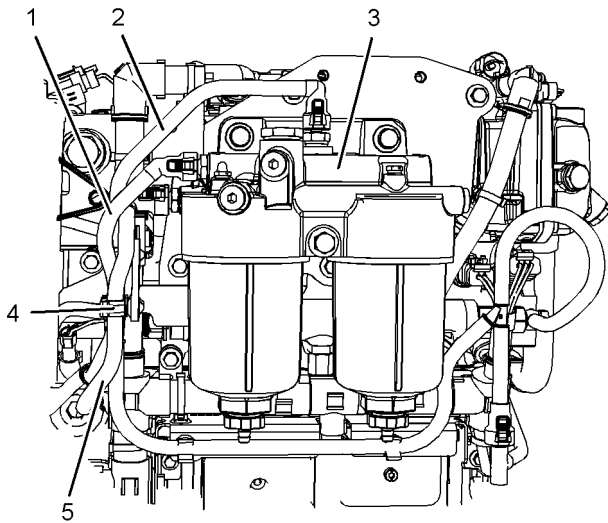


Illustration 10

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4. Make temporary identification marks on all the plastic tube assemblies in order to show the correct position of the tube assemblies.
5. Place a suitable container below the fuel filter base in order to catch any fuel that might be spilled.
6. Disconnect plastic tube assembly (1), plastic tube assembly (2), and plastic tube assembly (5) from fuel filter base (3).
7. Remove plastic tube assembly (1), plastic tube assembly (2), and plastic tube assembly (5) from clips (4).
8. Use Tooling (A) in order to plug the plastic tube assemblies with new plugs. Use Tooling (A) in order to cap the ports in the fuel filter base with new caps.

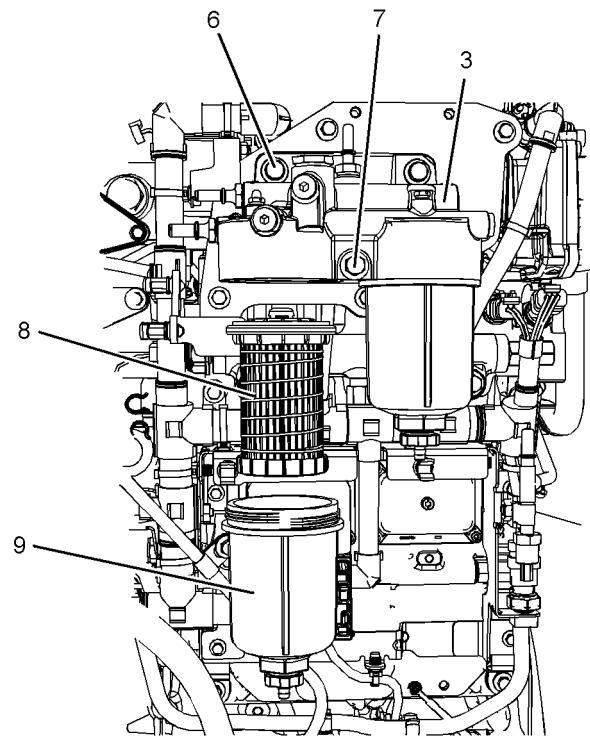


Illustration 11

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9. Remove secondary filters (8) from canisters (9). Refer to Operation and Maintenance Manual, "Fuel System Secondary Filter - Replace" for the correct procedure.
10. Remove bolts (6) and bolts (7) from fuel filter base (3). Remove the fuel filter base from the mounting bracket.

**Note:** Do not disassemble the fuel filter base.

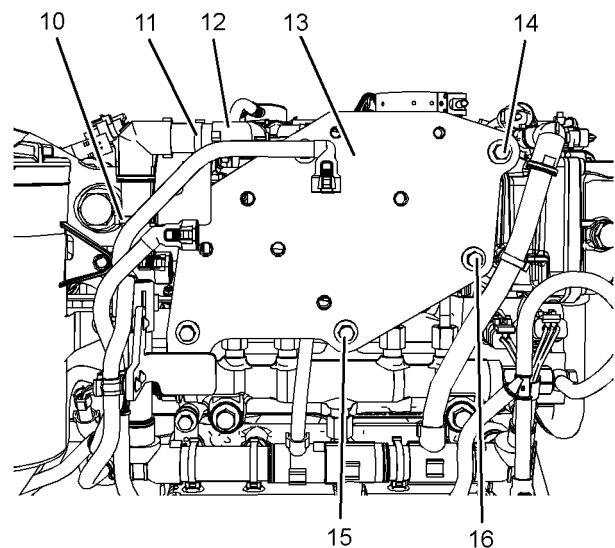


Illustration 12

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11. If necessary, follow Step 11.a through Step 11.c in order to remove the bracket for secondary fuel filter.

- a. Cut cable strap (10) and cable strap (11) from harness assembly (12).
- b. Remove bolts (11), bolts (12) and bolt (16) from fuel filter bracket (10).

**Note:** Note position of different length bolts.

- c. Remove fuel filter bracket (10) from the NRS induction mixer assembly.

## Installation Procedure

### NOTICE

Ensure that all adjustments and repairs that are carried out to the fuel system are performed by authorized personnel that have the correct training.

Before beginning ANY work on the fuel system, refer to Operation and Maintenance Manual, "General Hazard Information and High Pressure Fuel Lines" for safety information.

Refer to System Operation, Testing and Adjusting, "Cleanliness of Fuel System Components" for detailed information on the standards of cleanliness that must be observed during ALL work on the fuel system.

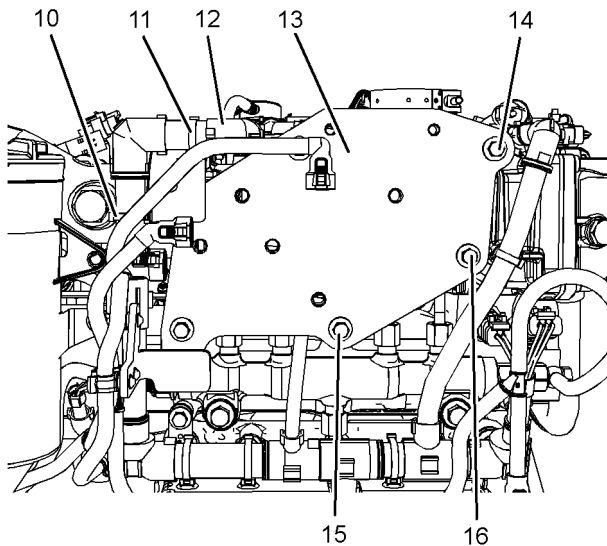


Illustration 13

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1. If necessary, follow Step 1.a through Step 1.d in order to install the bracket for secondary fuel filter.

- a. Position fuel filter bracket (10) onto the NRS induction mixer assembly.

b. Install bolts (11), bolts (12) and bolt (16) to fuel filter bracket (10).

c. Tighten bolts (11), bolts (12) and bolt (16) to a torque of 22 N·m (195 lb in).

d. Install new cable strap (10) and cable strap (11) to harness assembly (12).

**Note:** Ensure that the cable straps meet the Original Equipment Manufactures (OEM) specification.

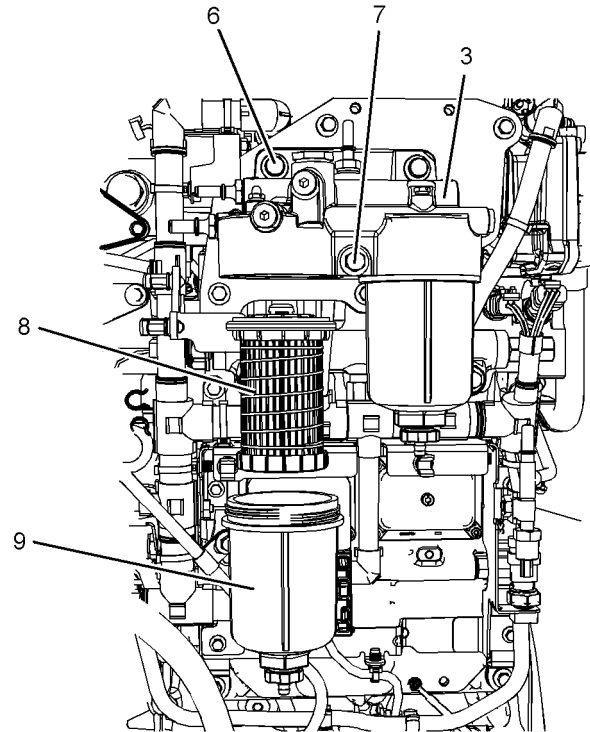


Illustration 14

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2. Ensure that fuel filter base (3) is clean and free from damage. If necessary, replace the complete fuel filter base and filter assembly.

3. Position fuel filter base (3) on the mounting bracket. Install bolts (6) and bolts (7). Tighten the bolts to a torque of 44 N·m (32 lb ft).

4. If necessary, install new fuel filters (8) to canisters (9). Refer to Operation and Maintenance Manual, "Fuel System Secondary Filter - Replace" for the correct procedure.

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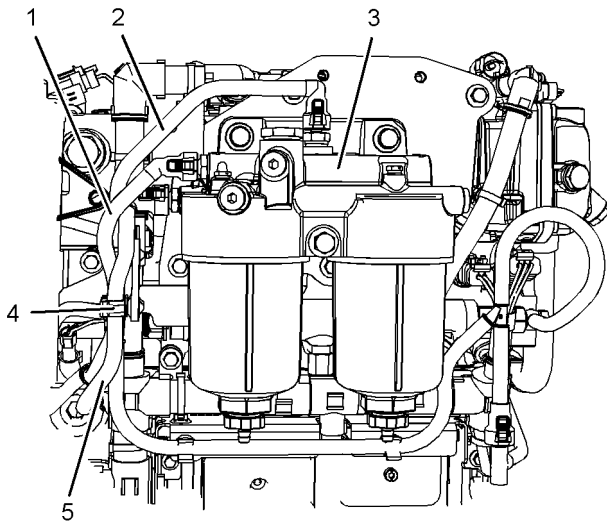


Illustration 15

g02597024

5. Remove the plugs from the plastic tube assemblies. Remove the caps from the ports in the fuel filter base.

#### NOTICE

Ensure that the plastic tube assemblies are installed in the original positions. Failure to connect the plastic tube assemblies to the correct ports will allow contamination to enter the fuel system. Serious damage to the engine will result if contaminated fuel enters the fuel system.

6. Connect plastic tube assembly (1), plastic tube assembly (2), and plastic tube assembly (5) to fuel filter base (3).
7. Install plastic tube assembly (1), plastic tube assembly (2), and plastic tube assembly (5) to clips (4).
8. Turn the fuel supply to the ON position.
9. Turn the battery disconnect switch to the ON position.

#### End By:

- a. Remove the air from the fuel system. Refer to Operation and Maintenance Manual, "Fuel System - Prime" for the correct procedure.

## Fuel Filter Base - Remove and Install (Single Secondary Fuel Filter)

### Removal Procedure

Table 3

Required Tools			
Tool	Part Number	Part Description	Qty
A	T410437	Cap Kit	1

#### NOTICE

Ensure that all adjustments and repairs that are carried out to the fuel system are performed by authorized personnel that have the correct training.

Before beginning ANY work on the fuel system, refer to Operation and Maintenance Manual, "General Hazard Information and High Pressure Fuel Lines" for safety information.

Refer to System Operation, Testing and Adjusting, "Cleanliness of Fuel System Components" for detailed information on the standards of cleanliness that must be observed during ALL work on the fuel system.

#### NOTICE

Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Dispose of all fluids according to local regulations and mandates.

1. Turn the fuel supply to the OFF position.
2. Drain the secondary filter. Refer to Operation and Maintenance Manual, "Fuel System Secondary Filter - Replace" for the correct procedure.

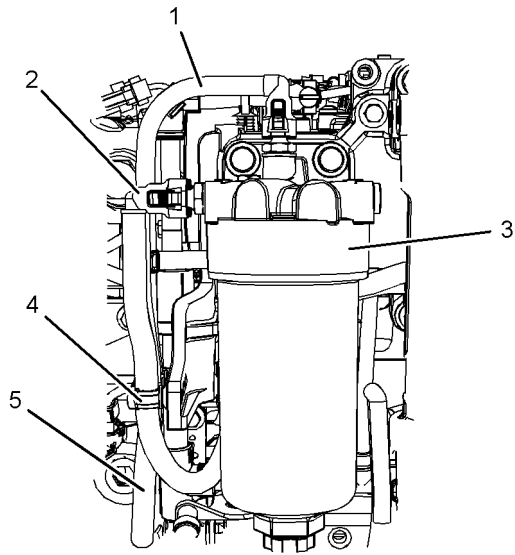


Illustration 16

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3. Make temporary identification marks on plastic tube assemblies in order to show the correct position of the tube assemblies.
4. Place a suitable container below the fuel filter base in order to catch any fuel that might be spilled.
5. Disconnect plastic tube assembly (1), plastic tube assembly (2), and plastic tube assembly (5) from the fuel filter base.
6. Remove plastic tube assembly (1), plastic tube assembly (2), and plastic tube assembly (5) from clips (4).
7. Use Tooling (A) in order to plug the plastic tube assemblies with new plugs. Use Tooling (A) in order to cap the ports in the single secondary fuel filter with new caps.

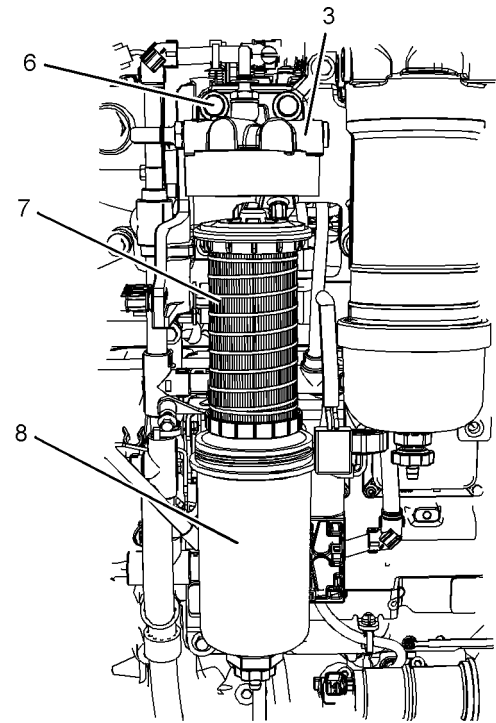


Illustration 17

g02526918

8. Remove canister (8) from fuel filter base (3). Remove secondary filter (7). Refer to Operation and Maintenance Manual, "Fuel System Secondary Filter - Replace" for the correct procedure.
9. Remove bolts (6) from fuel filter base (3). Remove the fuel filter base from the mounting bracket.

**Note:** Do not disassemble the fuel filter base.

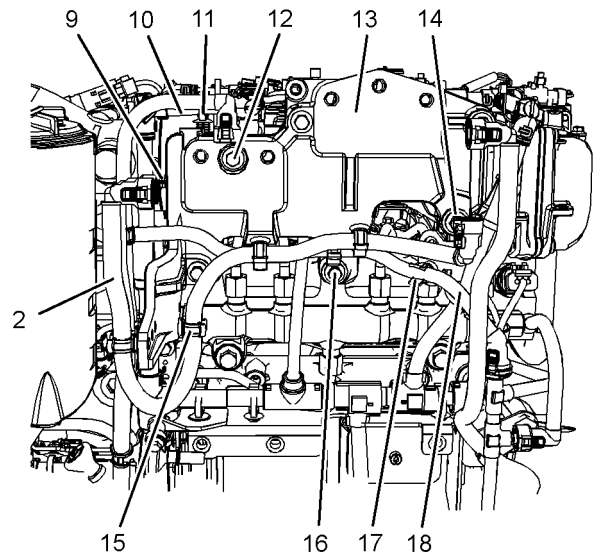


Illustration 18

g02599177

10. If necessary, follow Step 1.f through Step 10.e in order to remove the bracket for secondary fuel filter.
- Cut cable strap (9) and cable strap (11) from harness assembly (10).
  - Remove plastic tube assembly (2) from clips (15).
  - Remove plastic tube assembly (18) from clips (17).
  - Remove bolts (12), bolts (14) and bolt (16) from fuel filter bracket (13).
- Note:** Note position of different length bolts.
- Remove fuel filter bracket (13) from the NRS induction mixer assembly.

## Installation Procedure

### NOTICE

Ensure that all adjustments and repairs that are carried out to the fuel system are performed by authorized personnel that have the correct training.

Before beginning ANY work on the fuel system, refer to Operation and Maintenance Manual, "General Hazard Information and High Pressure Fuel Lines" for safety information.

Refer to System Operation, Testing and Adjusting, "Cleanliness of Fuel System Components" for detailed information on the standards of cleanliness that must be observed during ALL work on the fuel system.

### NOTICE

Ensure that the wiring harness assembly is correctly routed and the cable straps are not over tightened. Over tightening of the cable straps will damage the wiring harness and the convoluting.

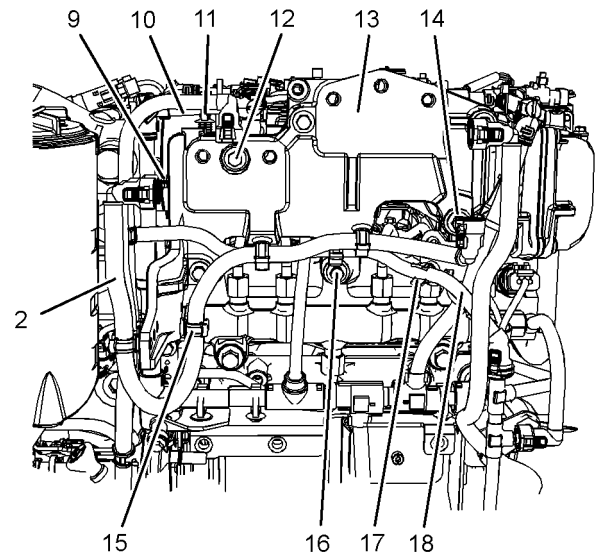


Illustration 19

g02599177

- If necessary, follow Step 1.a through Step 1.f in order to install the bracket for secondary fuel filter.
  - Position fuel filter bracket (13) onto the NRS induction mixer assembly.
  - Install bolts (12), bolts (14) and bolt (16) to fuel filter bracket (13).
  - Tighten bolts (12), bolts (14) and bolt (16) to a torque of 22 N·m (195 lb in).
  - Install plastic tube assembly (2) to clips (15).
  - Install plastic tube assembly (18) to clips (17).
  - Install new cable strap (9) and cable strap (11) to harness assembly (10).

**Note:** Ensure that the cable straps meet the Original Equipment Manufactures (OEM) specification.

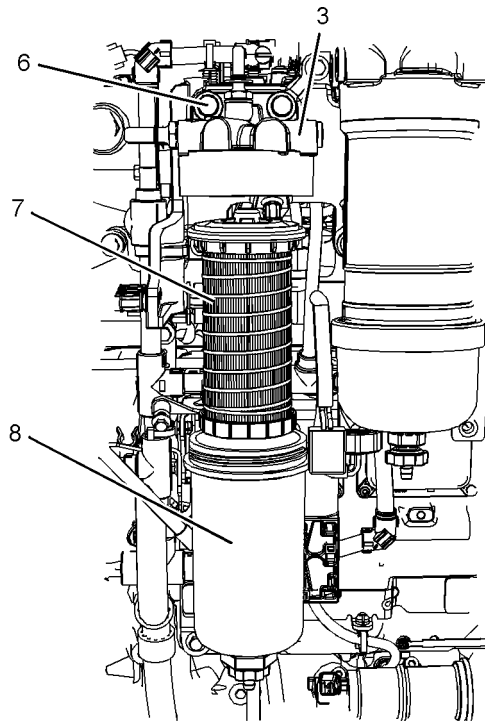


Illustration 20

g02526918

2. Ensure that fuel filter base (3) is clean and free from damage. If necessary, replace the complete fuel filter base and filter assembly.
3. Position fuel filter base (3) on the mounting bracket. Install bolts (6). Tighten the bolts to a torque of 44 N·m (32 lb ft).
4. If necessary, install a new fuel filter (7) to canister (8). Install canister (8) to fuel filter base (3). Refer to Operation and Maintenance Manual, "Fuel System Secondary Filter - Replace" for the correct procedure.

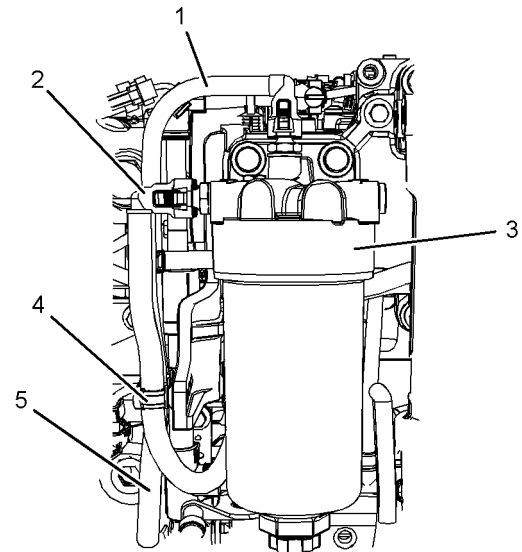


Illustration 21

g02526916

5. Remove the plugs from the plastic tube assemblies. Remove the caps from the ports in the fuel filter base.

#### NOTICE

Ensure that the plastic tube assemblies are installed in the original positions. Failure to connect the plastic tube assemblies to the correct ports will allow contamination to enter the fuel system. Allowing contamination to enter the fuel system will cause serious damage to the engine.

6. Connect plastic tube assembly (1), plastic tube assembly (2), and plastic tube assembly (5) to the fuel filter base.
7. Install plastic tube assembly (1), plastic tube assembly (2), and plastic tube assembly (5) to clips (4).
8. Turn the fuel supply to the ON position.

#### End By:

- a. Remove the air from the fuel system. Refer to Operation and Maintenance Manual, "Fuel System - Prime" for the correct procedure.



i04485918

## Water Separator and Fuel Filter (Primary) - Remove and Install

### Removal Procedure

Table 4

Required Tools			
Tool	Part Number	Part Description	Qty
A	T410437	Cap Kit	1

#### NOTICE

Ensure that all adjustments and repairs that are carried out to the fuel system are performed by authorized personnel that have the correct training.

Before beginning ANY work on the fuel system, refer to Operation and Maintenance Manual, "General Hazard Information and High Pressure Fuel Lines" for safety information.

Refer to System Operation, Testing and Adjusting, "Cleanliness of Fuel System Components" for detailed information on the standards of cleanliness that must be observed during ALL work on the fuel system.

1. Turn the battery disconnect switch to the OFF position.
2. Turn the fuel supply to the OFF position.

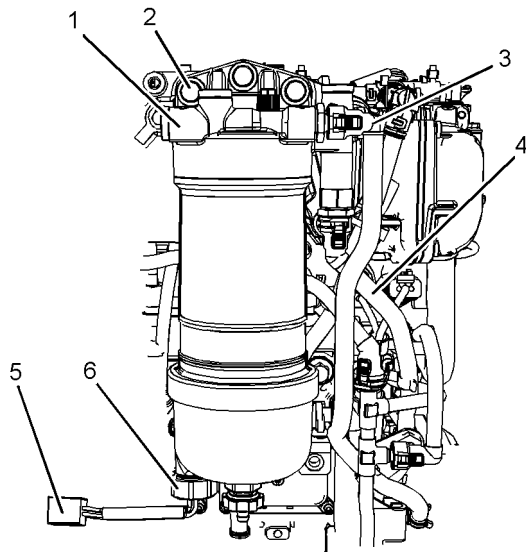


Illustration 22

g02524979

3. Make temporary identification marks on plastic tube assemblies in order to show the correct position of the plastic tube assemblies.
4. Place a suitable container below the fuel filter base in order to catch any fuel that might be spilled.
5. Disconnect plastic tube assembly (3) and plastic tube assembly (4) from the assembly of primary fuel filter (1). Use Tooling (A) in order to plug the plastic tube assemblies with new plugs. Use Tooling (A) in order to cap the ports in the primary fuel filter with new caps.
6. Disconnect the Original Equipment Manufactures (OEM) harness assembly from the connection on harness assembly (5) for water in fuel sensor (6).
7. Remove bolts (2) and remove the assembly of primary fuel filter (1) from the mounting bracket.

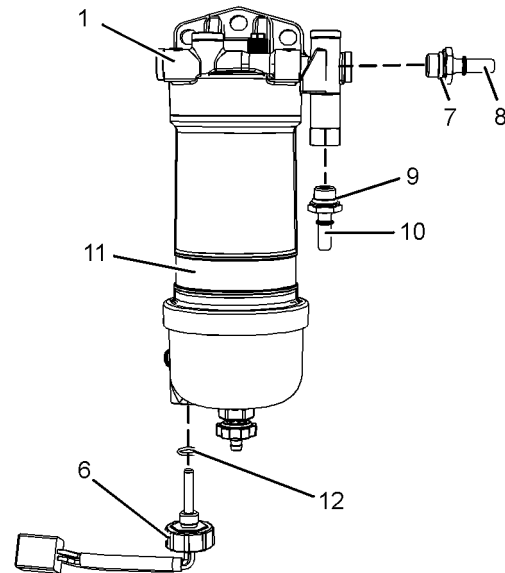


Illustration 23

g02524997

8. If necessary, follow Step 8.a through Step 8.d in order to disassembly the assembly of primary fuel filter (1).
  - a. Remove connection (7) and remove O-ring seal (8). Use Tooling (A) in order to plug the primary fuel filter (1) with new plug. Use Tooling (A) in order to cap connection (7) with new caps.
  - b. Remove connection (10) and remove O-ring seal (9). Use Tooling (A) in order to plug the primary fuel filter (1) with new plug. Use Tooling (A) in order to cap connection (10) with new caps.
  - c. Remove water in fuel sensor (6) and remove O-ring seal (12).

- d. Remove the filter element from fuel filter canister (11). Refer to Operation and Maintenance Manual, "Fuel System Primary Filter (Water Separator) Element - Replace" for the correct procedure.

## Installation Procedure

### NOTICE

Ensure that all adjustments and repairs that are carried out to the fuel system are performed by authorized personnel that have the correct training.

Before beginning ANY work on the fuel system, refer to Operation and Maintenance Manual, "General Hazard Information and High Pressure Fuel Lines" for safety information.

Refer to System Operation, Testing and Adjusting, "Cleanliness of Fuel System Components" for detailed information on the standards of cleanliness that must be observed during ALL work on the fuel system.

1. Ensure that the fuel filter base is clean and free from damage. If necessary, replace the complete fuel filter base and filter assembly.

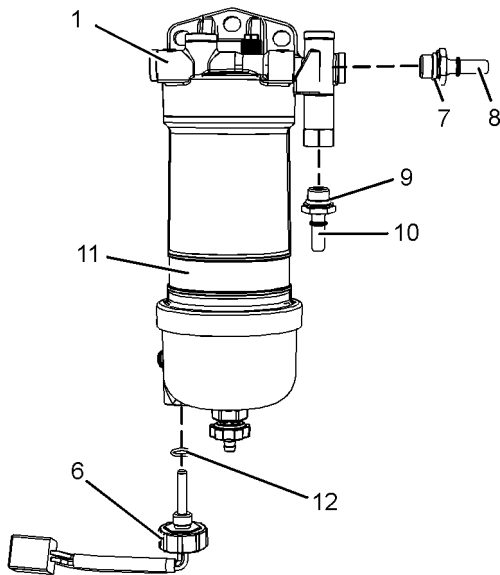


Illustration 24

g02524997

2. If necessary, follow Step 2.a through Step 2.f in order to assembly primary fuel filter (1).
  - a. Install a new filter element to fuel filter canister (11). Refer to Operation and Maintenance Manual, "Fuel System Primary Filter (Water Separator) Element - Replace" for the correct procedure.

- b. Remove caps from connection (7). Install a new O-ring seal (8) to connection (7).
- c. Remove cap from primary fuel filter (1). Install connection (7) to primary fuel filter (1). Tighten the connection to a torque of 20 N·m (177 lb in).
- d. Remove caps from connection (10). Install a new O-ring seal (9) to connection (10).
- e. Remove cap from primary fuel filter (1). Install connection (10) to primary fuel filter (1). Tighten the connection to a torque of 20 N·m (177 lb in).
- f. Install a new O-ring seal (12) to water in fuel sensor (6). Install water in fuel sensor (6) to primary fuel filter (1). Tighten water in fuel sensor (6) hand tight.

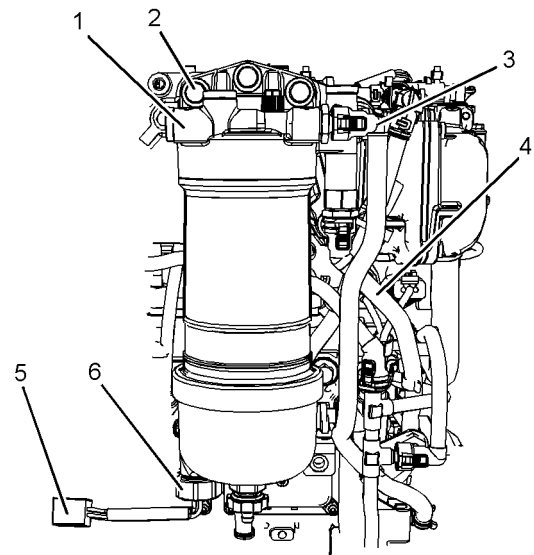


Illustration 25

g02524979

3. Position the assembly of primary fuel filter (1) onto the mounting bracket.
4. Install bolts (2) to the assembly of primary fuel filter (1). Tighten the bolts to a torque of 44 N·m (32 lb ft).
5. Remove the plugs from the plastic tube assemblies. Remove the caps from the connections on the primary fuel filter.

### NOTICE

Ensure that the plastic tube assemblies are installed in the original positions. Failure to connect the plastic tube assemblies to the correct ports will allow contamination to enter the fuel system. Serious damage to the engine will result if contaminated fuel enters the fuel system.

6. Connect plastic tube assembly (3) and plastic tube assembly (4) to primary fuel filter (1).
7. Connect the OEM harness assembly to the connection on harness assembly (5) for water in fuel sensor (6).
8. Turn the fuel supply to the ON position.
9. Turn the battery disconnect switch to the ON position.

**End By:**

- a. Remove the air from the fuel system. Refer to Operation and Maintenance Manual, "Fuel System - Prime" for the correct procedure.

i04485872

## Fuel Manifold (Rail) - Remove and Install

### Removal Procedure

Table 5

Required Tools			
Tool	Part Number	Part Description	Qty
A	T410437	Cap Kit	1

**Start By:**

- a. Remove the fuel injection lines. Refer to Disassembly and Assembly, "Fuel Injection Lines - Remove" for the correct procedure.

**⚠ WARNING**

Contact with high pressure fuel may cause fluid penetration and burn hazards. High pressure fuel spray may cause a fire hazard. Failure to follow these inspection, maintenance and service instructions may cause personal injury or death.

**NOTICE**

Ensure that all adjustments and repairs that are carried out to the fuel system are performed by authorized personnel that have the correct training.

Before beginning ANY work on the fuel system, refer to Operation and Maintenance Manual, "General Hazard Information and High Pressure Fuel Lines" for safety information.

Refer to System Operation, Testing and Adjusting, "Cleanliness of Fuel System Components" for detailed information on the standards of cleanliness that must be observed during ALL work on the fuel system.

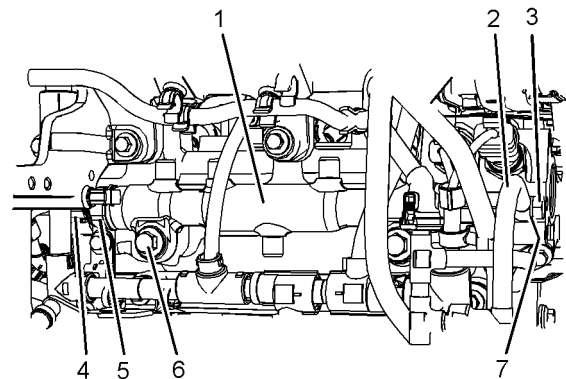


Illustration 26

g02484242

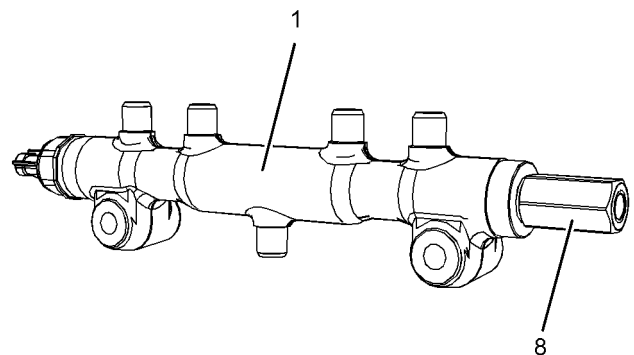


Illustration 27

g02484286

1. Thoroughly clean the area around fuel manifold (1).
2. Disconnect harness assembly (4) from fuel pressure sensor (5).
3. Remove banjo bolt (3) from plastic tube assembly (2). Use Tooling (A) to plug the plastic tube assembly. Remove sealing washers (7) (not shown). Use Tooling (A) to plug fuel manifold (1).
4. Remove bolts (6).

5. Remove fuel manifold (1) from the cylinder block.
6. If necessary, remove fuel pressure relief valve (8) from fuel manifold (1). Ref to Disassembly and Assembly, "Relief Valve (Fuel) - Remove and Install" for the correct procedure.

## Installation Procedure

### NOTICE

Ensure that all adjustments and repairs that are carried out to the fuel system are performed by authorized personnel that have the correct training.

Before beginning ANY work on the fuel system, refer to Operation and Maintenance Manual, "General Hazard Information and High Pressure Fuel Lines" for safety information.

Refer to System Operation, Testing and Adjusting, "Cleanliness of Fuel System Components" for detailed information on the standards of cleanliness that must be observed during ALL work on the fuel system.

1. Ensure that all ports on the fuel manifold are capped. Ensure that the fuel manifold is externally clean and free from damage.

**Note:** Do not install a fuel manifold that has not been capped. All caps must be left in place until the fuel injection lines are installed.

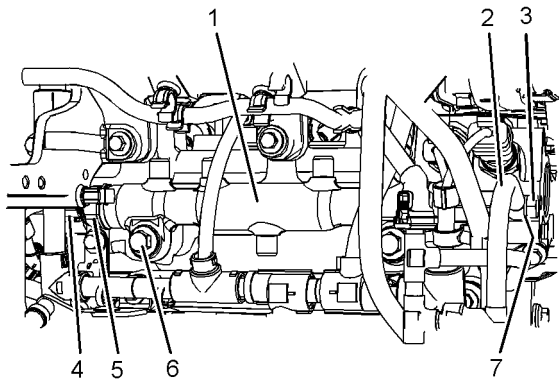


Illustration 28

g02484242

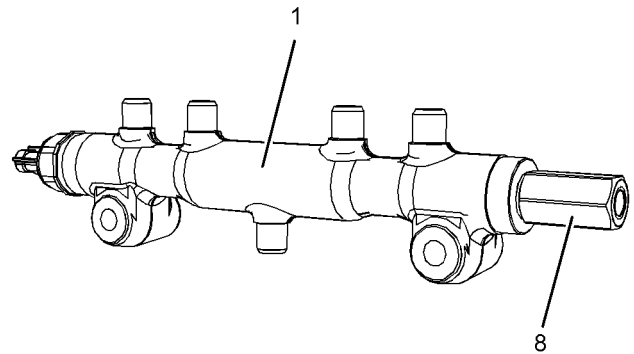


Illustration 29

g02484286

2. If necessary, install fuel pressure relief valve (8) to fuel manifold (1). Ref to Disassembly and Assembly, "Relief Valve (Fuel) - Remove and Install" for the correct procedure.
3. Position fuel manifold (1) onto the cylinder block. Install bolts (6) to fuel manifold (1) finger tight.
4. Install a new set of seals to the electronic unit injectors and a new set of fuel injection lines. Refer to Disassembly and Assembly, "Fuel Injection Lines - Install" for the correct procedure.
5. Tighten bolts (6) to a torque of 22 N·m (195 lb in).
6. Install a new sealing washer (7) (not shown) to banjo bolt (3).
7. Remove plug from plastic tube assembly (2). Install assembly of banjo bolt (3) to plastic tube assembly (2). Install remaining new sealing washer (7) (not shown) to banjo bolt (3).
8. Install banjo bolt (3) and plastic tube assembly (2) to pressure relief valve (8) finger tight.
9. Tighten banjo bolts (3) to a torque of 15 N·m (133 lb in).
10. Connect harness assembly (4) to fuel pressure sensor (5).
11. Remove the air from the fuel system. Refer to Operation and Maintenance Manual, "Fuel System - Prime" for the correct procedure.

i04494469

# Relief Valve (Fuel) - Remove and Install

## Removal Procedure

Table 6

Required Tools			
Tool	Part Number	Part Description	Qty
A	T410437	Cap Kit	1

**⚠ WARNING**

Contact with high pressure fuel may cause fluid penetration and burn hazards. High pressure fuel spray may cause a fire hazard. Failure to follow these inspection, maintenance and service instructions may cause personal injury or death.

**NOTICE**

Ensure that all adjustments and repairs that are carried out to the fuel system are performed by authorized personnel that have the correct training.

Before beginning ANY work on the fuel system, refer to Operation and Maintenance Manual, “General Hazard Information and High Pressure Fuel Lines” for safety information.

Refer to System Operation, Testing and Adjusting, “Cleanliness of Fuel System Components” for detailed information on the standards of cleanliness that must be observed during ALL work on the fuel system.

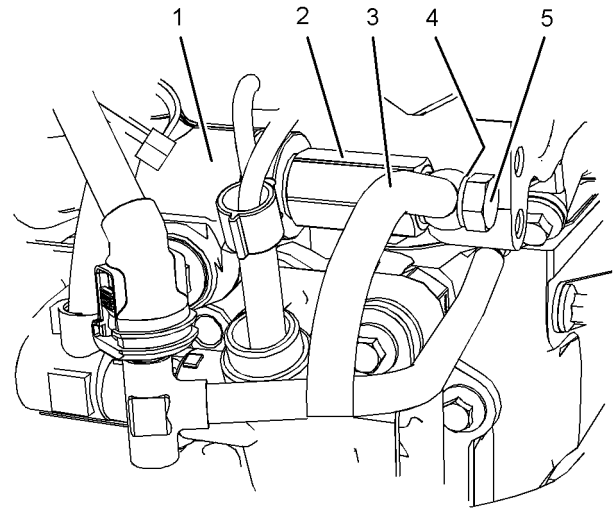


Illustration 30

g02673936

Typical example

1. Thoroughly clean the area around fuel manifold (1) and fuel pressure relief valve (2).
2. Remove banjo bolt (5) and remove sealing washers (4) (not shown).
3. Position plastic tube assembly (3) away from fuel pressure relief valve (2). Use Tooling (A) in order to immediately cap the open port in fuel pressure relief valve (2) with a new cap. Tooling (A) in order to immediately plug the open end of plastic tube assembly (3) with a new plug.
4. Follow Step 4.a through Step 4.c in order to remove the fuel pressure relief valve from the fuel manifold.
  - a. Ensure that the area around the fuel pressure relief valve (2) and fuel manifold (1) is still thoroughly clean.
  - b. Use a deep socket in order to remove the fuel pressure relief valve (2) from fuel manifold (1).
  - c. Use Tooling (A) in order to immediately plug the open port in fuel manifold (1). Use Tooling (A) in order to immediately cap the fuel pressure relief valve (2).

## Installation Procedure

Table 7

Required Tools			
Tool	Part Number	Part Description	Qty
B	21825607	Degree Wheel	1

---

**NOTICE**

Ensure that all adjustments and repairs that are carried out to the fuel system are performed by authorized personnel that have the correct training.

Before beginning ANY work on the fuel system, refer to Operation and Maintenance Manual, “General Hazard Information and High Pressure Fuel Lines” for safety information.

Refer to System Operation, Testing and Adjusting, “Cleanliness of Fuel System Components” for detailed information on the standards of cleanliness that must be observed during ALL work on the fuel system.

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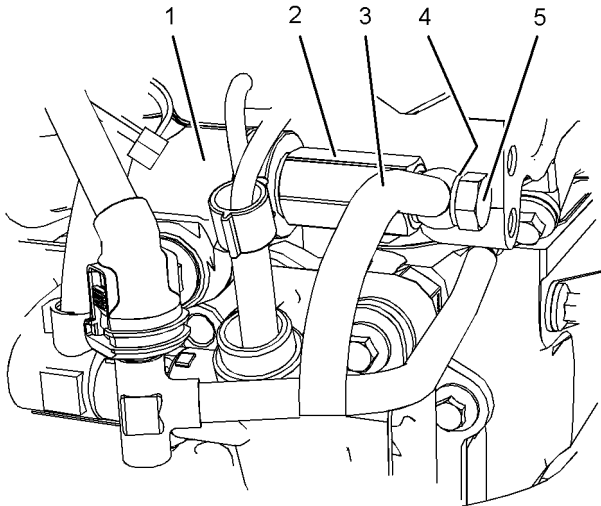


Illustration 31

g02673936

Typical example

1. Follow Step 1.a through Step 1.f in order to install the fuel pressure relief valve to the fuel manifold.
  - a. Remove the plug from the port in fuel manifold (1).
  - b. Immediately clean the threads in fuel manifold (1) for fuel pressure relief valve (2). Ensure that the thread is clean and free from debris. Ensure that the thread in the fuel manifold (2) is free from damage.
  - c. Immediately plug the open port in fuel manifold (1) with a new cap after cleaning and inspection.
  - d. Remove the cap from the threaded end of fuel pressure relief valve (2). Lubricate the thread of the pressure relief valve with clean fuel.

- e. Remove the plug from the port of fuel manifold (1). Use a deep socket in order to install the fuel pressure relief valve (2) into fuel manifold (1) hand tight.
  - f. Tighten fuel pressure relief valve (2) to a snug torque of 30 N·m (266 lb in). Use Tooling (B) in order to rotate the fuel pressure relief valve in a clockwise direction for an additional 24 degrees in order to achieve the final torque.
2. Remove the plug from plastic tube assembly (3).
  3. Install a new sealing washer (4) (not shown) onto banjo bolt (5). Position banjo bolt (5) onto plastic tube assembly (3) and install remaining new sealing washer (4) (not shown) onto the banjo bolt.
  4. Remove the plug from fuel pressure relief valve (2).
  5. Position plastic tube assembly (3) onto fuel pressure relief valve (2). Tighten banjo bolt (5) hand tight.
  6. Tighten banjo bolt (5) to a torque of 15 N·m (133 lb in).
  7. Remove the air from the fuel system. Refer to Operation and Maintenance Manual, “Fuel System - Prime” for the correct procedure.

i04485866

## Fuel Injection Lines - Remove

### Removal Procedure

#### Start By:

- a. Remove crankcase breather canister and plastic tube assemblies. Refer to Disassembly and Assembly, “Crankcase Breather - Remove” for the correct procedure.
- b. Remove secondary fuel filter assembly. Refer to Disassembly and Assembly, “Fuel Filter Base (Single Secondary Fuel Filter) - Remove and Install” for the correct procedure.
- c. Remove water separator and fuel filter (Primary). Refer to Disassembly and Assembly, “Water Separator and Fuel Filter (Primary) - Remove and Install” for the correct procedure.
- d. Remove the Inlet Air Control (NRS Induction Mixer). Refer to Disassembly and Assembly, “Inlet Air Control (NRS Induction Mixer) - Remove” for the correct procedure.



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