

Disassembly and Assembly

1104D Industrial Engine

NH (Engine)
NJ (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

i02933646

Fuel Priming Pump - Remove and Install (Electric Fuel Priming Pump)

Removal 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 Systems Operation, Testing and Adjusting Manual, "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.

Note: Put identification marks on all hoses, on all hose assemblies, on wires and on all tube assemblies for installation purposes. Plug all hose assemblies and tube assemblies. This helps to prevent fluid loss and this helps to keep contaminants from entering the system.

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

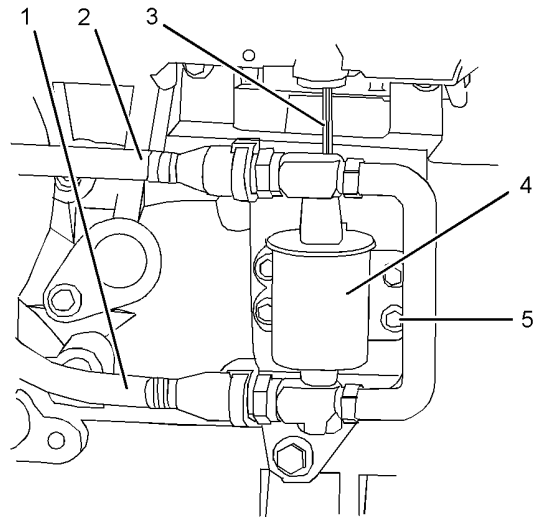


Illustration 1

g01269003

Typical example

3. Disconnect harness assembly (3) from electric priming pump (4).
4. Disconnect plastic tube assembly (1) and plastic tube assembly (2) from electric priming pump (4).

Note: If the tube assemblies have quick fit connections, ensure that the connections are clean before the tube assemblies and the electric priming pump are plugged.

5. Remove bolts (5) from electric priming pump (4).
6. Remove electric priming pump (4) from the mounting bracket.

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 Systems Operation, Testing and Adjusting Manual, "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 electric priming pump is clean and free from wear or damage. If necessary, replace the electric priming pump.

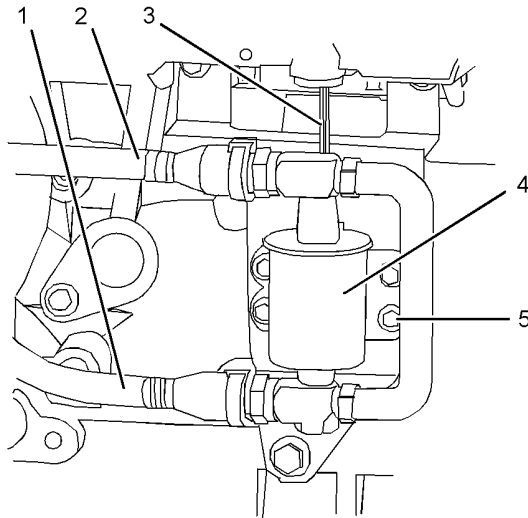


Illustration 2
Typical example

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2. Position electric priming pump (4) on the mounting bracket. Install bolts (5) to the electric priming pump.
 3. Tighten bolts (5) to a torque of 9 N·m (79 lb in).
 4. Remove all plugs from plastic tube assembly (1), plastic tube assembly (2) and electric priming pump (4). Connect plastic tube assembly (1) and plastic tube assembly (2) to electric priming pump (4).
- Note:** If the tube assemblies have quick fit connections, ensure that the connections are clean before the tube assemblies are connected.
5. Connect harness assembly (3) to electric priming pump (4).
 6. Turn the fuel supply to the ON position.
 7. Turn the battery disconnect switch to the ON position.
 8. Remove the air from the fuel system. Refer to Operation and Maintenance Manual, "Fuel System - Prime".

i02933647

Fuel Priming Pump - Remove and Install (Manual Priming Pump)

Removal 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 Systems Operation, Testing and Adjusting Manual, "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.

Note: Put identification marks on all hoses, on all hose assemblies, on wires and on all tube assemblies for installation purposes. Plug all hose assemblies and tube assemblies. This helps to prevent fluid loss and this helps to keep contaminants from entering the system.

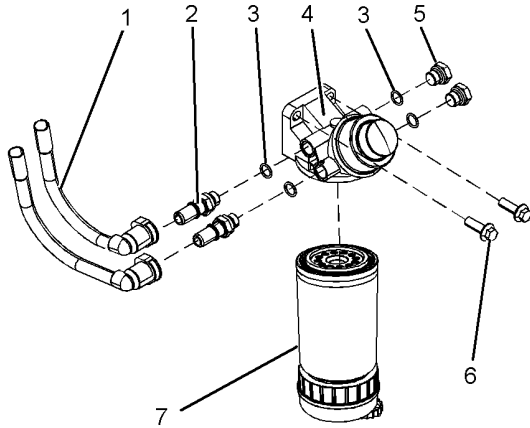


Illustration 3
Typical example

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1. Turn the fuel supply to the OFF position.
2. Drain primary filter (7). Refer to Operation and Maintenance Manual, "Fuel System Primary Filter (Water Separator) Element - Replace".
3. Disconnect plastic tube assemblies (1).

Note: If the tube assemblies have quick fit connections, ensure that the connections are clean before the tube assemblies are plugged.

4. Remove primary filter (7) from fuel priming pump (4). Refer to Operation and Maintenance Manual, "Fuel System Primary Filter (Water Separator) Element - Replace".
5. Remove bolts (6) from fuel priming pump (4). Remove fuel priming pump (4) from the mounting bracket.
6. If necessary, follow Step 6.a through Step 6.c in order to disassemble the fuel priming pump.
 - a. Remove connectors (2) from fuel priming pump (4).
 - b. Remove plugs (5) from fuel priming pump (4).
 - c. Remove O-ring seals (3) from connectors (2) and plugs (5).

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 Systems Operation, Testing and Adjusting Manual, "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 or damage. If necessary, replace the fuel priming pump.

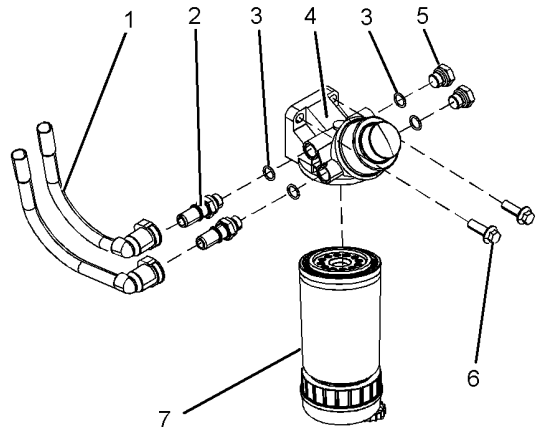


Illustration 4
Typical example

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2. If necessary, follow Step 2.a through Step 2.d in order to assemble fuel priming pump (4).
 - a. Install new O-ring seals (3) to connectors (2) and plugs (5).
 - b. Install connectors (2) to fuel priming pump (4).
 - c. Install plugs (5) to fuel priming pump (4).
 - d. Tighten the plugs and the connectors to a torque of 20 N·m (14 lb ft).

3. Position fuel priming pump (4) on the mounting bracket. Install bolts (6) to the fuel priming pump . Tighten the bolts to a torque of 44 N·m (32 lb ft).
4. Remove plugs from plastic tube assemblies (1). Connect plastic tube assemblies (1) to connectors (2).

Note: If the tube assemblies have quick fit connections, ensure that the connections are clean before the tube assemblies are connected.

5. Install a new primary filter (7) to fuel priming pump (4). Refer to Operation and Maintenance Manual, "Fuel System Primary Filter (Water Separator) Element - Replace".
6. Turn the fuel supply to the ON position.
7. Remove the air from the fuel system. Refer to Operation and Maintenance Manual, "Fuel System - Prime".

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

Removal Procedure

Table 1

Required Tools			
Tool	Part Number	Part Description	Qty
A	-	Strap Wrench	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 Systems Operation, Testing and Adjusting Manual, "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.

Note: Put identification marks on all hoses, on all hose assemblies, on wires and on all tube assemblies for installation purposes. Plug all hose assemblies and tube assemblies. This helps to prevent fluid loss and this helps to keep contaminants from entering the system.

1. Turn the fuel supply to the OFF position.
2. If necessary, remove the boost pressure sensor. Refer to Disassembly and Assembly, "Boost Pressure Sensor - Remove and Install".

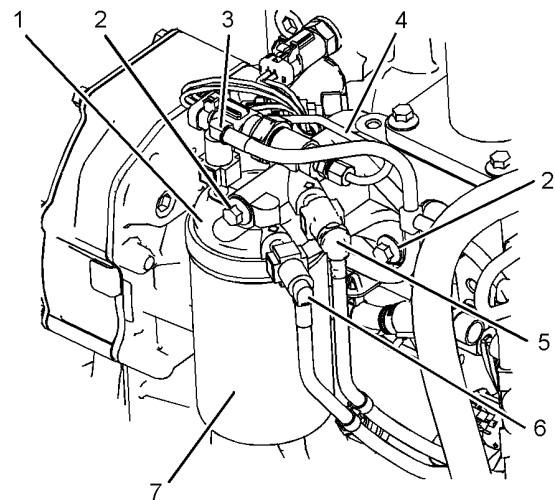


Illustration 5
Typical example

g01247416

3. Disconnect plastic tube assemblies (3), (5) and (6) from fuel filter base (1).

Note: If the tube assemblies have quick fit connections, ensure that the connections are clean before the tube assemblies and the fuel filter base are plugged.

4. Remove tube assembly (4), if equipped.
5. Use Tooling (A) in order to remove fuel filter (7). Refer to Operation and Maintenance Manual, "Fuel System Secondary Filter - Replace".

6. Remove bolts (2) from fuel filter base (1). Remove the fuel filter base from the cylinder head.

Note: Do not attempt to disassemble the fuel filter base.

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 Systems Operation, Testing and Adjusting Manual, "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 assembly.

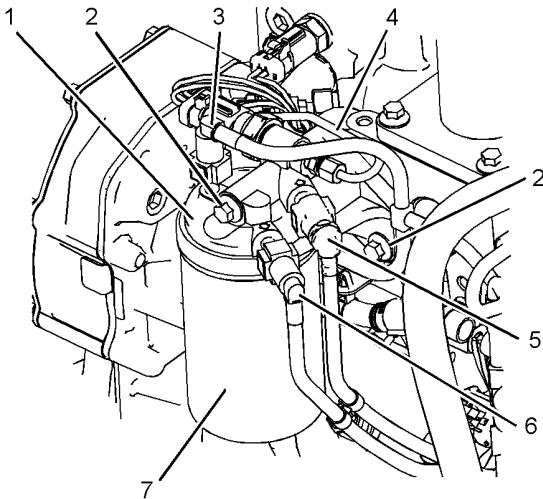


Illustration 6

g01247416

Typical example

2. Position fuel filter base (1) onto the cylinder head. Install bolts (2). Tighten the bolts to a torque of 22 N·m (16 lb ft).
3. Install a new fuel filter (7) to fuel filter base (1). Refer to Operation and Maintenance Manual, "Fuel System Secondary Filter - Replace" for the correct procedure.

4. If necessary, install the boost pressure sensor. Refer to Disassembly and Assembly, "Boost Pressure Sensor - Remove and Install".
5. Install tube assembly (4), if equipped. Tighten the nuts to a torque of 9 N·m (80 lb in).

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. Contaminated fuel will cause serious damage to the engine.

6. Remove plugs from plastic tube assemblies (3), (5), and (6) and fuel filter base (1). Connect plastic tube assemblies (3), (5) and (6) to fuel filter base (1).

Note: If the tube assemblies have quick fit connections, ensure that the connections are clean before the tube assemblies are connected.

7. Turn the fuel supply to the ON position.
8. Remove the air from the fuel system. Refer to Operation and Maintenance Manual, "Fuel System - Prime".

i02933650

Fuel Transfer Pump - Remove

Removal Procedure

Start By:

- a. Remove the mounting bracket for the electronic control module. Refer to Disassembly and Assembly, "ECM Mounting Bracket - Remove and Install".

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 Systems Operation, Testing and Adjusting Manual, "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.

Note: Put identification marks on all hoses, on all hose assemblies, on wires and on all tube assemblies for installation purposes. Plug all hose assemblies and tube assemblies. This helps to prevent fluid loss and this helps to keep contaminants from entering the system.

1. Turn the fuel supply to the OFF position.
2. If necessary, disconnect the hose for the crankcase breather from the clip that secures the hose to the engine oil pan. Position the hose away from the fuel transfer pump.

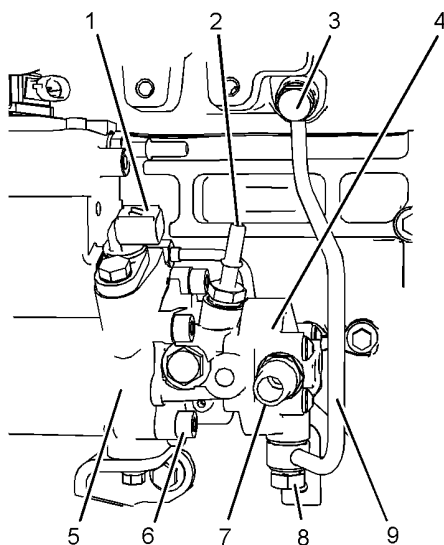


Illustration 7
Typical example g01247425

3. If necessary, disconnect the harness assembly from position sensor (1). Refer to Disassembly and Assembly, "Position Sensor (Fuel Injection Pump) - Remove and Install". Position the harness assembly away from the fuel transfer pump.

Note: If the tube assembly has quick fit connections, ensure that the connections are clean before the tube assembly is plugged.

4. Disconnect the plastic tube assembly from inlet connection (7) on the fuel transfer pump.

5. Remove the plastic tube assembly from outlet connection (2).
6. Remove outlet connection (2) from fuel transfer pump (4). Plug the open port in the fuel transfer pump immediately with a new plug. Remove the O-ring seal from the connection.

If necessary, remove inlet connection (7) from fuel transfer pump (4). Plug the open port in the fuel transfer pump immediately with a new plug. Remove the O-ring seal from the connection.

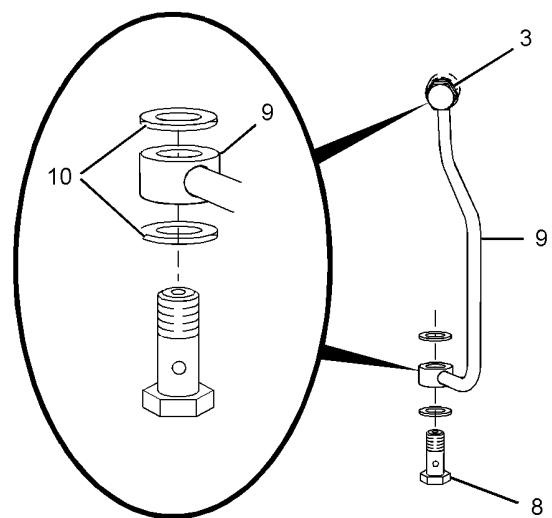


Illustration 8 g01457480

7. Loosen banjo bolt (3) and banjo bolt (8). Remove tube assembly (9) for the fuel return from the cylinder head to the fuel transfer pump.

Note: Disconnect the tube assembly at the fuel transfer pump first in order to drain the fuel from the cylinder head.

8. Remove banjo bolt (3) and sealing washers (10) from tube assembly (9).
9. Remove banjo bolt (8) and sealing washers (10) from tube assembly (9).
10. Use an allen wrench with a ball end in order to remove allen head bolts (6) that secure fuel transfer pump (4) to fuel injection pump (5).

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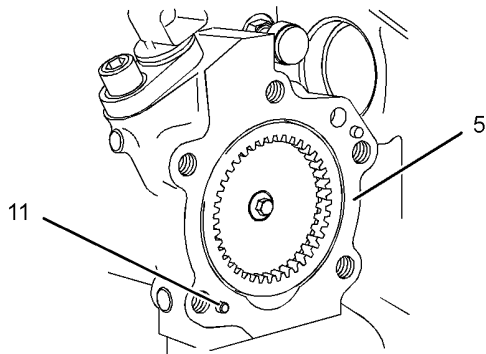


Illustration 9

g01254881

11. Remove the fuel transfer pump from fuel injection pump (5).

Note: Do not remove dowels (11) from the fuel injection pump.

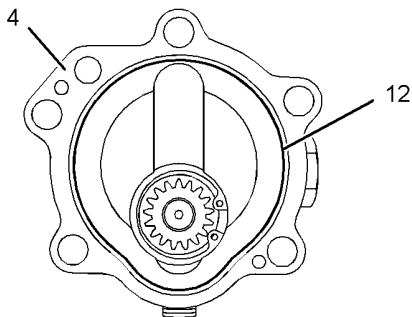


Illustration 10

g01254883

12. Remove O-ring seal (12) from fuel transfer pump (4).

Fuel Transfer Pump - Install

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 Systems Operation, Testing and Adjusting Manual, "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 faces of the fuel injection pump and the fuel transfer pump are clean and free from damage. Replace any components that are damaged.

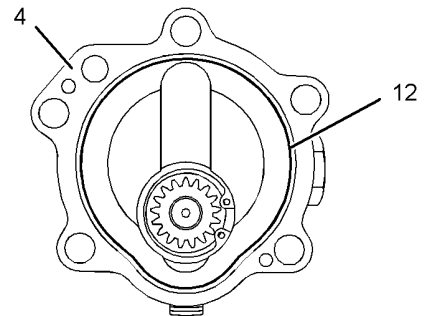


Illustration 11

g01254883

2. Install a new O-ring seal (12) for fuel transfer pump (4).

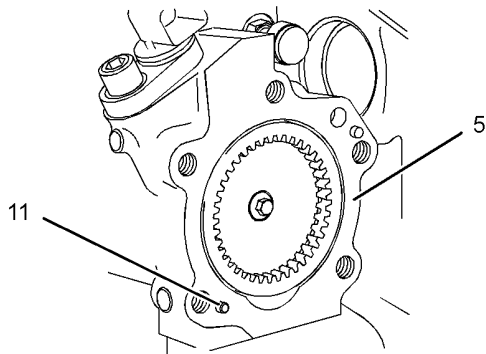


Illustration 12

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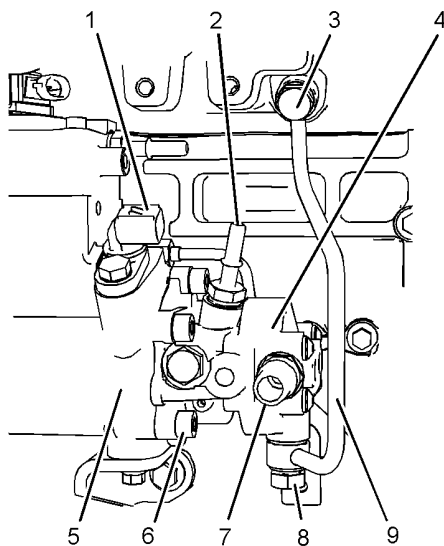


Illustration 13

g01247425

3. Align fuel transfer pump (4) with dowels (11) in fuel injection pump (5). Install the fuel transfer pump to the fuel injection pump.
4. Use an allen wrench with a ball end to install allen head bolts (6). Tighten the allen head bolts to a torque of 30 N·m (22 lb ft).
5. Install a new O-ring seal to outlet connection (2). Install outlet connection (2) to fuel transfer pump (4). Tighten the connection to torque of 15 N·m (11 lb ft).

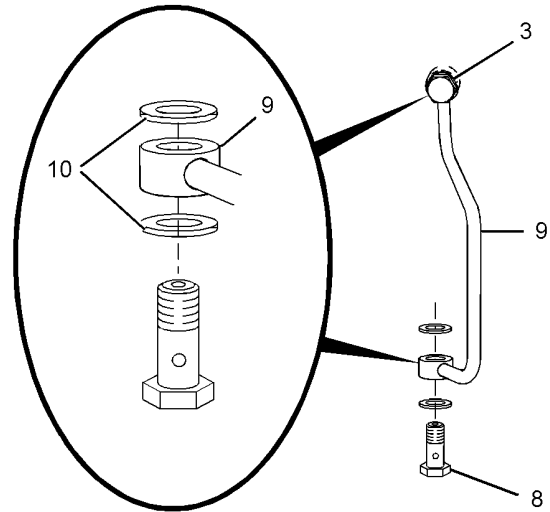


Illustration 14

g01457480

6. Install banjo bolt (8) and new sealing washers (10) to tube assembly (9).
 7. Install banjo bolt (3) and new sealing washers (10) to tube assembly (9).
 8. Install tube assembly (9) to the fuel return to fuel transfer pump (4) and to the cylinder head. Tighten banjo bolt (3) and banjo bolt (8) to a torque of 22 N·m (16 lb ft).
 9. If necessary, install a new O-ring seal to inlet connection (7). Install inlet connection (7) to fuel transfer pump (4). Tighten the connection to torque of 15 N·m (11 lb ft).
- Note:** If the tube assembly has quick fit connections, ensure that the connections are clean before the tube assembly is connected.
10. Install the plastic tube assembly to outlet connection (2) on the fuel transfer pump.
 11. Install the plastic tube assembly to inlet connection (7) on the fuel transfer pump.
 12. If necessary, connect the harness assembly to position sensor (1). Slide the locking tab into the locked position.
 13. If necessary, connect the hose for the crankcase breather to the clip that secures the hose to the engine oil pan.
 14. Install the mounting bracket for the electronic control module. Refer to Disassembly and Assembly, "ECM Mounting Bracket - Remove and Install".

15. Install the electronic control module. Refer to Disassembly and Assembly, "Electronic Control Module - Remove and Install".
16. Turn the fuel supply to the ON position.
17. Remove the air from the fuel system. Refer to Operation and Maintenance Manual, "Fuel System - Prime".

i02933644

Fuel Manifold (Rail) - Remove and Install

Removal Procedure

Start By:

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

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 Systems Operation, Testing and Adjusting Manual, "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.

Note: Put identification marks on all hoses, on all hose assemblies, on wires and on all tube assemblies for installation purposes. Plug all hose assemblies and tube assemblies. This helps to prevent fluid loss and this helps to keep contaminants from entering the system.

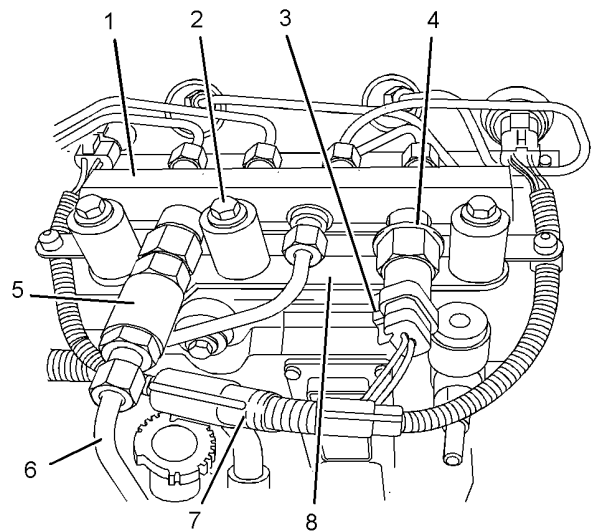


Illustration 15

g01243702

The fuel manifold is shown with fuel injection lines in position.

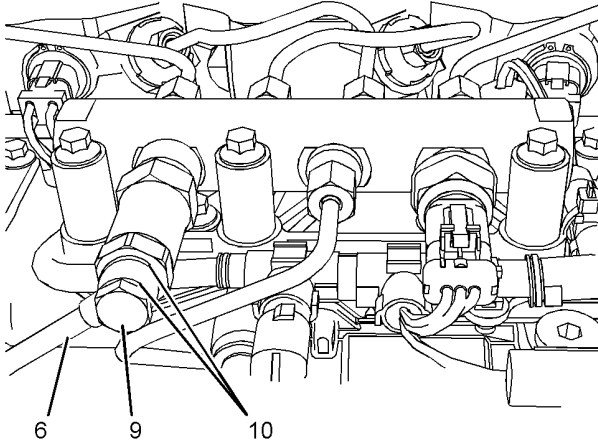


Illustration 16

g01763053

The fuel manifold is shown with fuel injection lines in position.

1. If necessary, remove fuel pressure sensor (4). Refer to Disassembly and Assembly, "Fuel Pressure Sensor - Remove and Install".
2. If fuel pressure sensor (4) does not require removal, slide locking tab (3) into the unlocked position. Disconnect the plug on harness assembly (7) from fuel pressure sensor (4).
3. Disconnect tube assembly (6) from fuel pressure relief valve (5). The tube assembly can be secured with a nut or with a banjo bolt. Immediately cap the open port in the pressure relief valve with a new cap. Immediately plug the open end of the tube assembly with a new plug.
4. If tube assembly (6) is secured with a banjo bolt, remove banjo bolt (9) and sealing washers (10). Refer to Illustration 16.

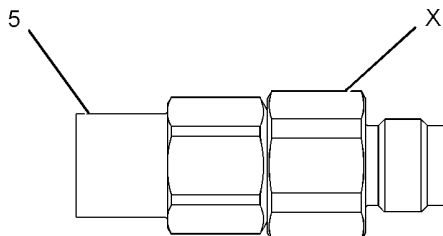


Illustration 17

g01800633

5. If necessary, remove fuel pressure relief valve (5). Use a deep socket in order to remove the fuel pressure relief valve.

Note: The fuel pressure relief valve should only be removed at Position (X). The fuel pressure relief valve is a two-piece assembly which should not be disassembled.

6. Remove bolts (2) from fuel manifold (1). Note the position of any brackets that are secured by the bolts.
7. Remove fuel manifold (1) from mounting bracket (8).
8. If necessary, remove the bolts and remove mounting bracket (8).

Installation Procedure

Table 2

Required Tools			
Tool	Part Number	Part Description	Qty
A	27610294	Injector Pipe Nut Tool	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 Systems Operation, Testing and Adjusting Manual, "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 or the fuel pressure sensor are installed.

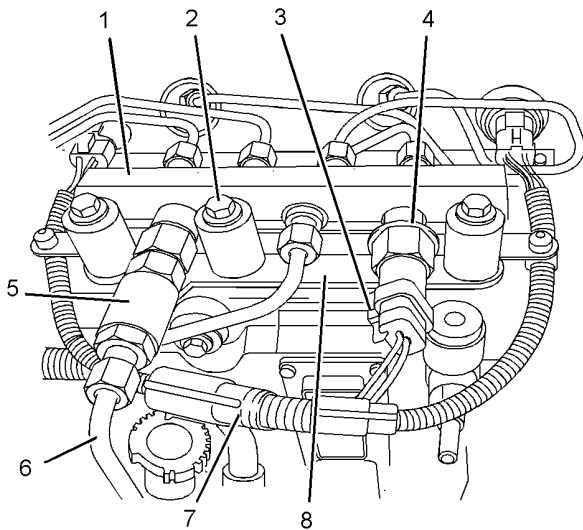


Illustration 18

g01243702

The fuel manifold is shown with fuel injection lines in position.

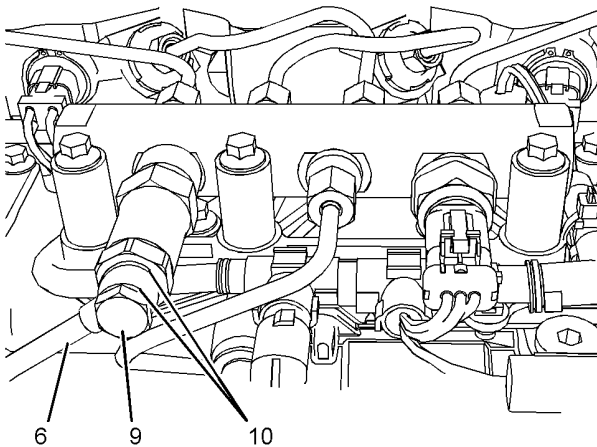


Illustration 19

g01763053

The fuel manifold is shown with fuel injection lines in position.

2. If necessary, install mounting bracket (8) and install the bolts. Tighten the bolts to a torque of 22 N·m (16 lb ft).
3. Position fuel manifold (1) onto mounting bracket (8). Install bolts (2) to the fuel manifold finger tight. Ensure that any brackets that are secured by bolts (2) are installed in the correct position.
4. Loosely install a new set of fuel injection lines. Refer to Disassembly and Assembly, "Fuel Injection Lines - Install" for more information.
5. Tighten bolts (2) to a torque of 22 N·m (16 lb ft).

6. Use Tooling (A) to tighten the nuts on the fuel injection lines to a torque of 30 N·m (22 lb ft). Refer to Disassembly and Assembly, "Fuel Injection Lines - Install" for more information.

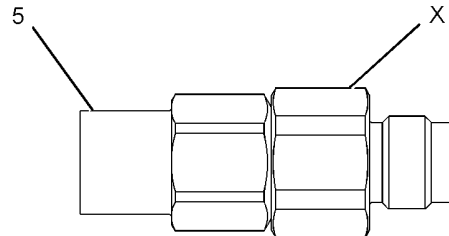


Illustration 20

g01800633

7. If necessary, install a new fuel pressure relief valve (5). Use a deep socket in order to tighten the fuel pressure relief valve. Tighten the fuel pressure relief valve to a torque of 120 N·m (89 lb ft).

Note: Fuel pressure relief valve (5) must only be tightened at Position (X). The fuel pressure relief valve is a two-piece assembly which should not be disassembled.

8. Remove the plug from tube assembly (6). Remove the cap from the appropriate port in fuel manifold (1). Connect tube assembly (6) to fuel pressure relief valve (5). If tube assembly (6) is secured with a nut, tighten the nut to a torque of 26 N·m (19 lb ft). Refer to Illustration 18.
9. If tube assembly (6) is secured with a banjo bolt, install new sealing washers (10) and install banjo bolt (9). Tighten the banjo bolt to a torque of 21 N·m (186 lb in).
10. If fuel pressure sensor (4) was removed from fuel manifold (1), install a new sealing washer and install the fuel pressure sensor. Refer to Disassembly and Assembly, "Fuel Pressure Sensor - Remove and Install" for more information.

If fuel pressure sensor (4) was not removed from fuel manifold (1), connect the plug on harness assembly (7) to fuel pressure sensor (4). Slide locking tab (3) into the locked position.

11. Remove the air from the fuel system. Refer to Operation and Maintenance Manual, "Fuel System - Prime" for more information.

i02933638

Fuel Injection Lines - Remove

Removal Procedure

Table 3

Required Tools			
Tool	Part Number	Part Description	Qty
A	U5MK1124	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 Systems Operation, Testing and Adjusting Manual, "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.

Note: Put identification marks on all hoses, on all hose assemblies, on wires and on all tube assemblies for installation purposes. Plug all hose assemblies and tube assemblies. This helps to prevent fluid loss and this helps to keep contaminants from entering the system.

1. Turn the fuel supply to the OFF position.

2. Turn the battery disconnect switch to the OFF position.

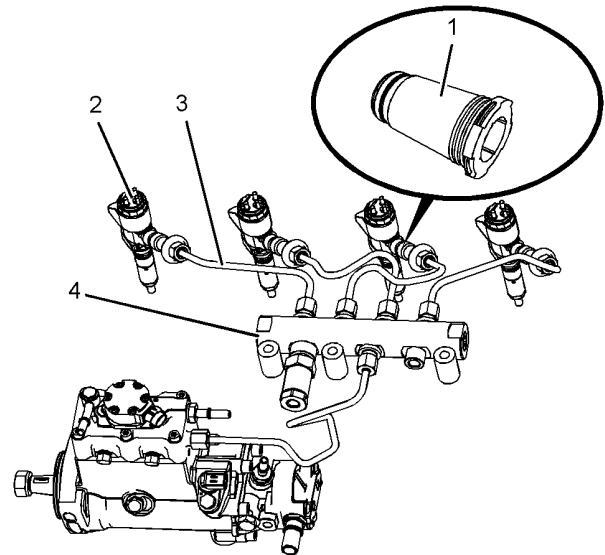


Illustration 21

g01457355

Typical example

3. Disconnect fuel injection line (3) from electronic unit injector (2).
4. Disconnect fuel injection line (3) from fuel manifold (4).
5. Remove fuel injection line (3). Discard the fuel injection line.
6. Plug the open port in fuel manifold (4) immediately. Use Tooling (A) in order to plug the open port.
7. Remove seal (1) from electronic unit injector (2) and from the base of the valve mechanism cover.
8. Use a new plug in order to plug the open port in electronic unit injector (2). Use Tooling (A) in order to plug the open port.
9. Repeat Step 3 through Step 8 in order to remove the remaining fuel injection lines from the electronic unit injectors.
10. If necessary, remove the crankcase breather. Refer to Disassembly and Assembly, "Crankcase Breather - Remove and Install".
11. Remove the electronic control module. Refer to Disassembly and Assembly, "Electronic Control Module - Remove and Install".

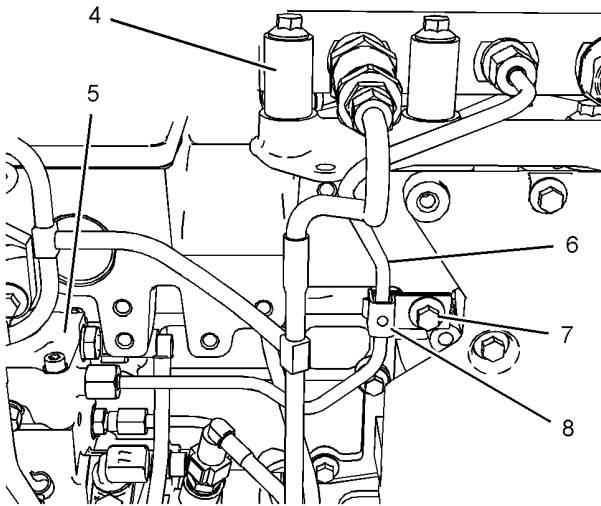


Illustration 22 g01254886
Typical example

12. Remove bolt (7) from clip (8).
13. Disconnect fuel injection line (6) from fuel injection pump (5).
14. Disconnect fuel injection line (6) from fuel manifold (4).
15. Remove fuel injection line (6). Discard the fuel injection line. Plug all open ports immediately. Use Tooling (A) in order to plug the open ports in the fuel manifold and in the fuel injection pump.

i02933637

Fuel Injection Lines - Install

Installation Procedure

Table 4

Required Tools			
Tool	Part Number	Part Description	Qty
B	27610294	Injector Pipe Nut Tool	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 Systems Operation, Testing and Adjusting Manual, "Cleanliness of Fuel System Components" for detailed information on the standards of cleanliness that must be observed during ALL work on the fuel system.

Note: The following procedure should be adopted in order to install the fuel injection lines when the electronic unit injectors or the fuel manifold have not been removed. If the electronic unit injectors or the fuel manifold have been removed, refer to Disassembly and Assembly, "Electronic Unit Injector - Install" and Disassembly and Assembly, "Fuel Manifold (Rail) - Remove and Install" for more information.

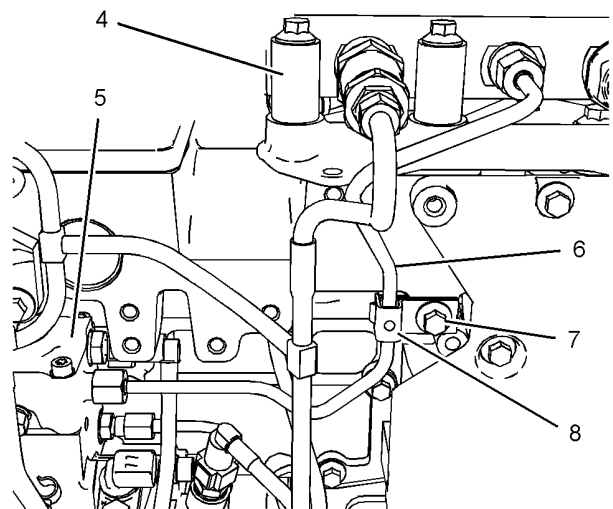


Illustration 23 g01254886
Typical example

1. Remove the caps from the port in fuel injection pump (5) and from the appropriate port in fuel manifold (4). Remove the caps from the new fuel injection line (6).
2. Loosely connect the nuts at both ends of fuel injection line (6), to fuel manifold (4) and to fuel injection pump (5). Ensure that the ends of the fuel injection line are correctly seated in the fuel injection pump and in the fuel manifold.

3. Use Tooling (B) to tighten the nuts on fuel injection line (6) to a torque of 30 N·m (22 lb ft).
4. Install bolt (7) to clip (8). Tighten bolt (7) to a torque of 22 N·m (16 lb ft).

Ensure that fuel injection line does not contact any other engine component.

5. Install the electronic control module. Refer to Disassembly and Assembly, "Electronic Control Module - Remove and Install".
6. If necessary, install the crankcase breather. Refer to Disassembly and Assembly, "Crankcase Breather - Remove and Install".

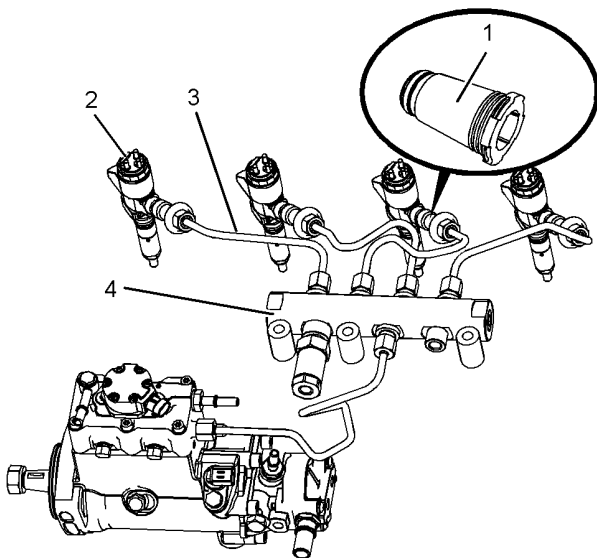


Illustration 24
Typical example
g01457387

i03458261

8. Remove the caps from the new fuel injection line (3).

Note: Ensure that a dust seal is installed to the fuel injection line. Install the fuel injection line for number one cylinder first. Install the fuel injection lines in numerical order.

9. Remove the caps from electronic unit injector (2) and from the appropriate port in fuel manifold (4).
10. Loosely connect the nuts at both ends of fuel injection line (3), to electronic unit injector (2) and to the appropriate port in fuel manifold (4). Ensure that the ends of the fuel injection line are correctly seated in the electronic unit injector and in the fuel manifold.
11. Use Tooling (B) to tighten the nuts on fuel injection line (3) to a torque of 30 N·m (22 lb ft). Ensure that the dust seal is seated correctly against seal (1).

12. Follow Step 7 through Step 11 in order to install the remaining fuel injection lines.

Note: Ensure that fuel injection lines do not contact any other engine component.

13. Turn the fuel supply to the ON position.
14. Turn the battery disconnect switch to the ON position.
15. Remove the air from the fuel system. Refer to Operations and Maintenance Manual, "Fuel System - Prime".

Fuel Injection Pump - Remove

Removal Procedure

Table 5

Required Tools			
Tool	Part Number	Part Description	Qty
A ⁽¹⁾	21825576	Crankshaft Turning Tool	1
A ⁽²⁾	27610291	Barring Device Housing	1
	27610289	Gear	1
B	27610212	Camshaft Timing Pin	1
C	27610211	Crankshaft Timing Pin	1
D	U5MK1124	Cap Kit	1

(1) Install Tooling to the front pulley.

(2) Install Tooling into the aperture for the electric starting motor.

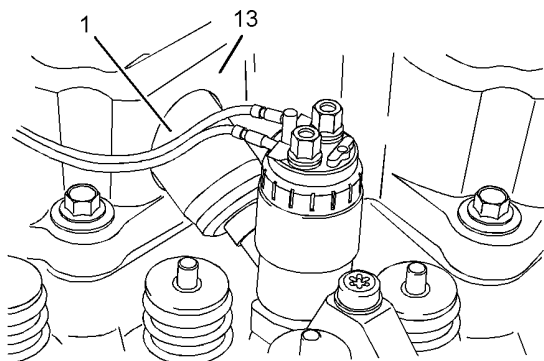


Illustration 25
Typical example
The valve mechanism cover is not shown for clarity.
g01271377

7. Install a new seal (1) to electronic unit injector (2) and to valve mechanism cover base (13).

Note: Ensure that the flange on the seal is flush with the valve mechanism cover base.

Start By:

- a. Remove the electronic control module. Refer to Disassembly and Assembly, "Electronic Control Module - Remove and Install".
- b. Remove the front cover. Refer to Disassembly and Assembly, "Front Cover - Remove and Install".

Note: Either Tooling (A) can be used. Use the Tooling that is most suitable.

 **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 Systems Operation, Testing and Adjusting Manual, "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.

Note: Put identification marks on all hoses, on all hose assemblies, on wires and on all tube assemblies for installation purposes. Plug all hose assemblies and tube assemblies. This helps to prevent fluid loss and this helps to keep contaminants from entering the system.

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

3. If necessary, remove the fuel filter base. Refer to Disassembly and Assembly, "Fuel Filter Base - Remove and Install".
4. If necessary, remove the fuel priming pump. Refer to Disassembly and Assembly, "Fuel Priming Pump - Remove and Install".
5. If necessary, remove the crankcase breather. Refer to Disassembly and Assembly, "Crankcase Breather - Remove and Install".
6. Use Tooling (A) in order to rotate the crankshaft so that number one piston is at the top center position on the compression stroke. Refer to Systems Operation, Testing and Adjusting, "Finding Top Centre Position for No.1 Piston".
7. Use Tooling (B) in order to lock the camshaft in the correct position. Use Tooling (C) in order to lock the crankshaft in the correct position. Refer to Disassembly and Assembly, "Gear Group (Front) - Remove and Install" for the correct procedure.
8. Remove the backlash from the fuel pump gear. Lock the fuel injection pump in the correct position and remove the fuel pump gear. Refer to Disassembly and Assembly, "Fuel Pump Gear - Remove" for the correct procedure.

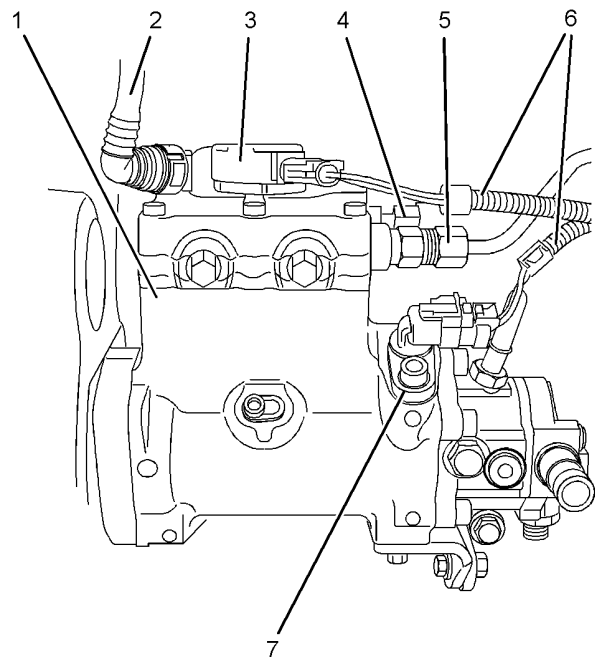


Illustration 26
Typical example

g01563275

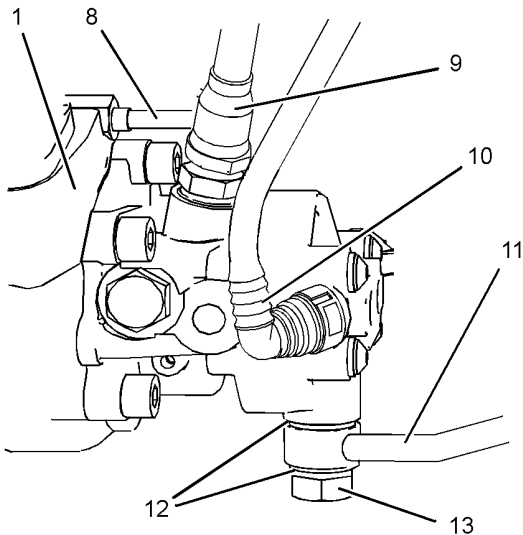


Illustration 27
Typical example g01563276

- 9. Disconnect plastic tube assembly (2) from fuel injection pump (1).
- 10. Disconnect harness assembly (6) from solenoid (3). Slide the locking tab into the unlocked position and disconnect harness assembly (6) from position sensor (7).

Note: The harness assembly should be positioned in order to avoid an obstruction to the fuel injection pump.

- 11. Disconnect plastic tube assembly (10) from fuel injection pump (1).
- 12. Disconnect plastic tube assembly (9) from fuel injection pump (1).
- 13. Disconnect plastic tube assembly (4) from fuel injection pump (1).
- 14. Remove banjo bolt (13) and remove sealing washers (12).
- 15. Plug or cap all open ports and tube assemblies immediately with new plugs or caps.

Note: Ensure that quick fit connections are clean before the tube assemblies are plugged.

- 16. Remove fuel injection line (5). Refer to Disassembly and Assembly, "Fuel Injection Lines - Remove". Use Tooling (D) in order to plug the open ports in the fuel injection pump and in the fuel manifold. Discard the fuel injection line.

- 17. Remove tube assembly (8) for the engine oil supply to the fuel injection pump. Remove the banjo bolt and the sealing washers from the tube assembly.

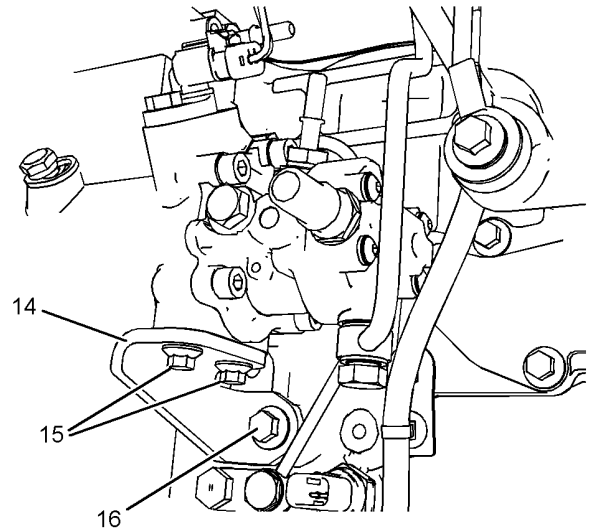


Illustration 28
Typical example g01566973

- 18. Remove bolts (15) and remove bolt (16). Remove support bracket (14).

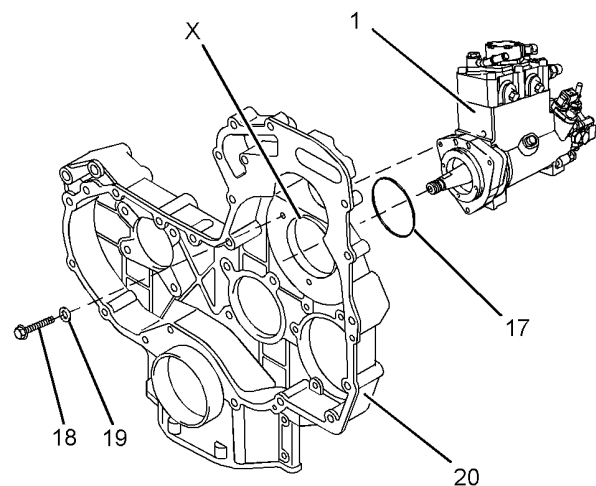


Illustration 29
Typical example g01801934

- 19. Remove bolts (18) and remove sealing washers (19).

Note: The fuel injection pump should be supported by hand as the bolts are removed.

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