

# Disassembly and Assembly

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## **1104D Industrial Engine**

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NH (Engine)  
NJ (Engine)

# Table of Contents

## Disassembly and Assembly Section

Fuel Priming Pump - Remove and Install (Electric Fuel Priming Pump) .....	5	Front Cover - Remove and Install .....	73
Fuel Priming Pump - Remove and Install (Manual Priming Pump) .....	6	Gear Group (Front) - Remove and Install .....	75
Fuel Filter Base - Remove and Install (Secondary Fuel Filter) .....	8	Idler Gear - Remove .....	78
Fuel Transfer Pump - Remove .....	9	Idler Gear - Remove .....	79
Fuel Transfer Pump - Install .....	11	Idler Gear - Remove .....	81
Fuel Manifold (Rail) - Remove and Install .....	13	Idler Gear - Install .....	82
Fuel Injection Lines - Remove .....	16	Idler Gear - Install .....	84
Fuel Injection Lines - Install .....	17	Idler Gear - Install .....	85
Fuel Injection Pump - Remove .....	18	Housing (Front) - Remove .....	87
Fuel Injection Pump - Install .....	21	Housing (Front) - Install .....	89
Fuel Injection Pump Gear - Remove .....	23	Accessory Drive - Remove .....	91
Fuel Injection Pump Gear - Install .....	25	Accessory Drive - Disassemble .....	92
Electronic Unit Injector - Remove .....	26	Accessory Drive - Assemble .....	92
Electronic Unit Injector - Install .....	30	Accessory Drive - Install .....	93
Turbocharger - Remove (Top Mounted Turbocharger ) .....	35	Crankcase Breather - Remove and Install (Filtered Breather) .....	94
Turbocharger - Remove (Side Mounted Turbochargers) .....	37	Crankcase Breather - Remove and Install (Unfiltered Breather) .....	96
Turbocharger - Install (Top Mounted Turbocharger ) .....	38	Valve Mechanism Cover - Remove and Install .....	96
Turbocharger - Install (Side Mounted Turbochargers) .....	40	Valve Mechanism Cover Base - Remove and Install .....	98
Wastegate Solenoid - Remove and Install .....	41	Rocker Shaft and Pushrod - Remove .....	101
Exhaust Manifold - Remove and Install (Top Mounted Exhaust Manifold) .....	42	Rocker Shaft - Disassemble .....	102
Exhaust Manifold - Remove and Install (Side Mounted Exhaust Manifold) .....	44	Rocker Shaft - Assemble .....	103
Exhaust Elbow - Remove and Install .....	45	Rocker Shaft and Pushrod - Install .....	104
Inlet and Exhaust Valve Springs - Remove and Install .....	46	Cylinder Head - Remove .....	105
Inlet and Exhaust Valves - Remove and Install .....	50	Cylinder Head - Install .....	109
Engine Oil Filter Base - Remove and Install .....	52	Lifter Group - Remove and Install .....	112
Engine Oil Cooler - Remove .....	54	Camshaft - Remove and Install .....	113
Engine Oil Cooler - Install .....	55	Camshaft Gear - Remove and Install .....	115
Engine Oil Relief Valve - Remove and Install (Engines with a Balancer Unit) .....	56	Camshaft Bearings - Remove and Install .....	117
Engine Oil Relief Valve - Remove and Install (Engines Without a Balancer Unit) .....	57	Engine Oil Pan - Remove and Install (Aluminum and Pressed Steel Oil Pans) .....	119
Engine Oil Pump - Remove and Install (Engines Without a Balancer Unit) .....	58	Engine Oil Pan - Remove and Install (Cast Iron Oil Pan) .....	121
Water Pump - Remove .....	61	Balancer - Remove .....	124
Water Pump - Install .....	62	Balancer - Install .....	126
Water Temperature Regulator - Remove and Install .....	63	Piston Cooling Jets - Remove and Install .....	129
Flywheel - Remove .....	64	Pistons and Connecting Rods - Remove .....	130
Flywheel - Install .....	65	Pistons and Connecting Rods - Disassemble .....	131
Crankshaft Rear Seal - Remove .....	66	Pistons and Connecting Rods - Assemble .....	132
Crankshaft Rear Seal - Install .....	67	Pistons and Connecting Rods - Install .....	134
Flywheel Housing - Remove and Install .....	68	Connecting Rod Bearings - Remove (Connecting rods in position) .....	136
Crankshaft Pulley - Remove and Install (Engines With an Automatic Belt Tensioner) .....	70	Connecting Rod Bearings - Install (Connecting rods in position) .....	137
Crankshaft Pulley - Remove and Install (Engines Without an Automatic Belt Tensioner) .....	71	Crankshaft Main Bearings - Remove and Install (Crankshaft in position) .....	139
Crankshaft Front Seal - Remove and Install .....	72	Crankshaft - Remove .....	143
		Crankshaft - Install .....	146
		Crankshaft Timing Ring - Remove and Install .....	149
		Crankshaft Gear - Remove and Install .....	150
		Bearing Clearance - Check .....	152
		Crankshaft Position Sensor - Remove and Install .....	153
		Position Sensor (Fuel Injection Pump) - Remove and Install .....	153
		Coolant Temperature Sensor - Remove and Install .....	154
		Engine Oil Pressure Sensor - Remove and Install .....	156
		Fuel Pressure Sensor - Remove and Install .....	157
		Boost Pressure Sensor - Remove and Install .....	158

## Table of Contents

---

Inlet Air Temperature Sensor - Remove and Install .....	159
Glow Plugs - Remove and Install .....	160
V-Belts - Remove and Install (Engines Without an Automatic Belt Tensioner ) .....	161
Alternator Belt - Remove and Install (Engines With an Automatic Belt Tensioner) .....	162
Fan - Remove and Install .....	163
Fan Drive - Remove and Install .....	164
Electronic Control Module - Remove and Install ..	165
ECM Mounting Bracket - Remove and Install .....	168
Alternator - Remove (Engines Without an Automatic Belt Tensioner) .....	169
Alternator - Remove (Engines With an Automatic Belt Tensioner) .....	170
Alternator - Install (Engines Without an Automatic Belt Tensioner) .....	170
Alternator - Install (Engines With an Automatic Belt Tensioner) .....	171
Electric Starting Motor - Remove and Install .....	171
Air Compressor - Remove and Install .....	172
Vacuum Pump - Remove and Install .....	177

## Index Section

Index .....	178
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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.

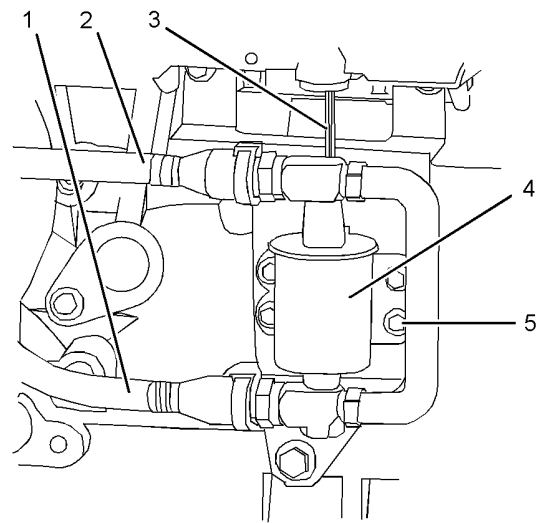


Illustration 1

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.

i02933647

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

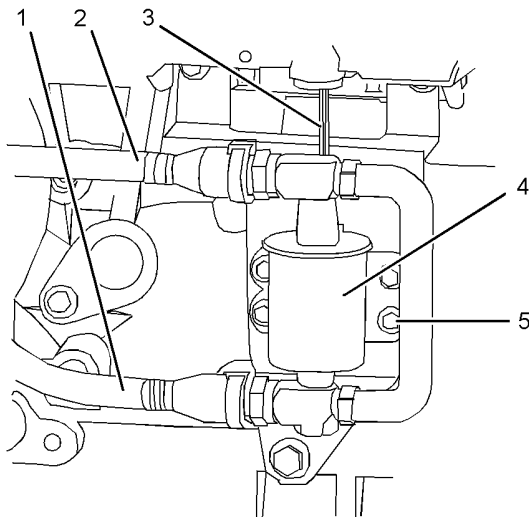


Illustration 2  
Typical example

g01269003

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".

## 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.

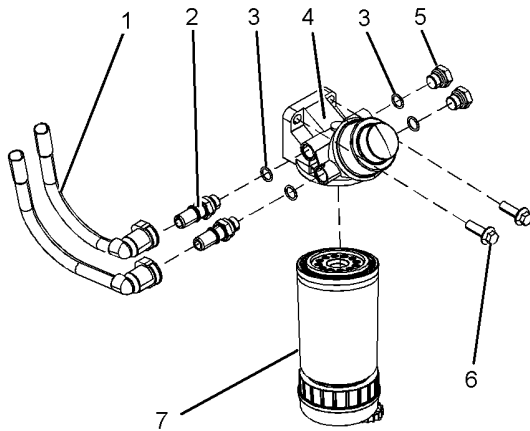


Illustration 3

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Typical example

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.

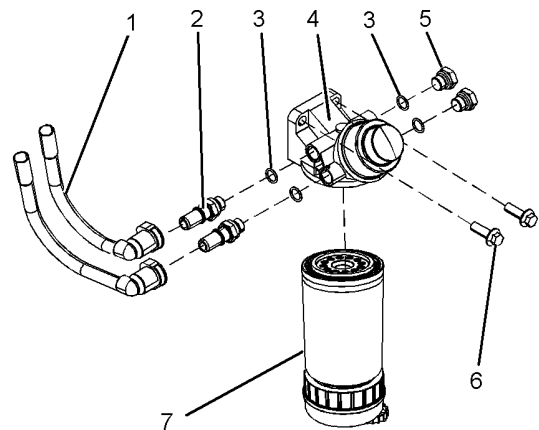


Illustration 4

g01753133

Typical example

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".

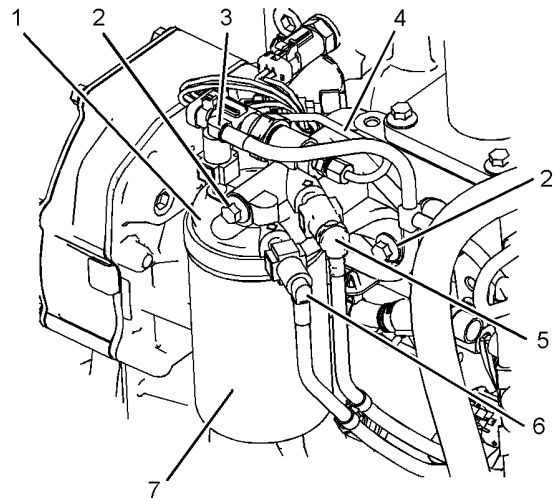


Illustration 5

g01247416

Typical example

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".

- 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.

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

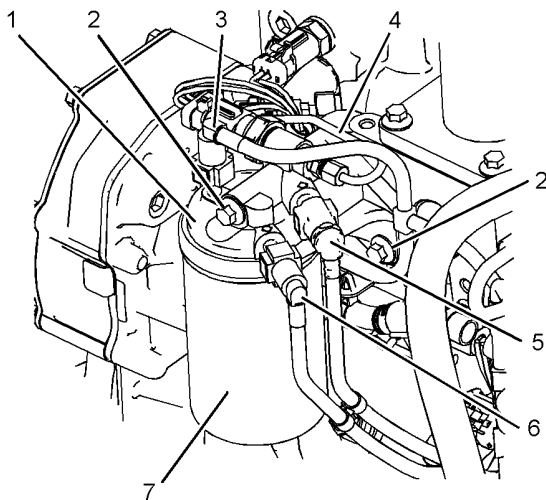


Illustration 6

g01247416

Typical example

- 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).
- 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.

- If necessary, install the boost pressure sensor. Refer to Disassembly and Assembly, "Boost Pressure Sensor - Remove and Install".
- 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.

- 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.

- Turn the fuel supply to the ON position.
- 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:

- 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.

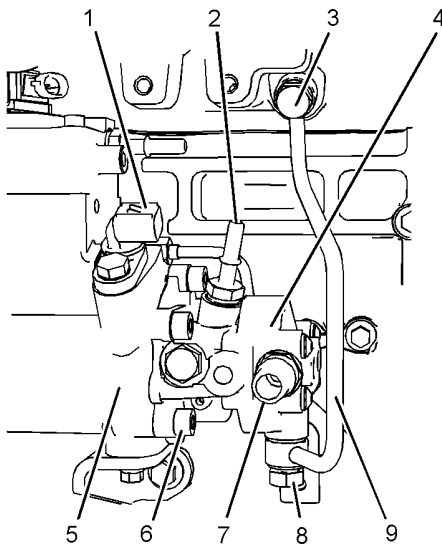


Illustration 7  
Typical example  
g01247425

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.

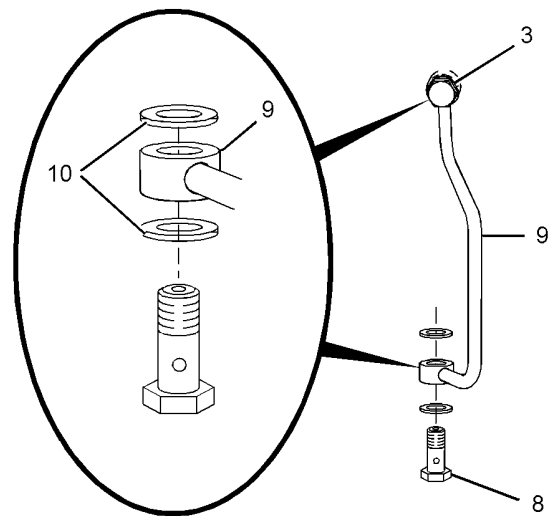


Illustration 8  
g01457480

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).

i02933648

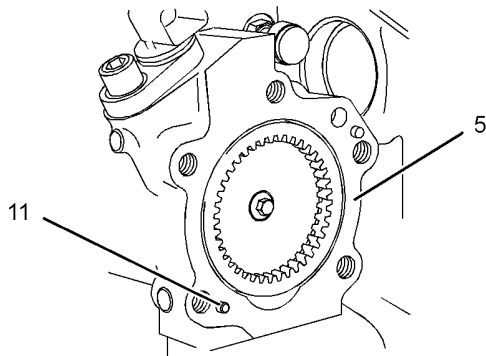


Illustration 9

g01254881

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

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

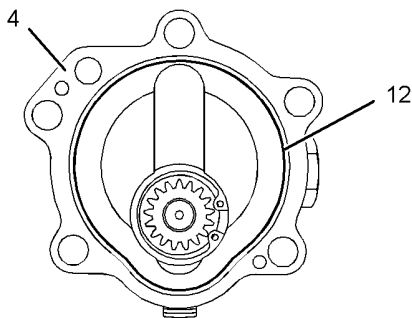


Illustration 10

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.

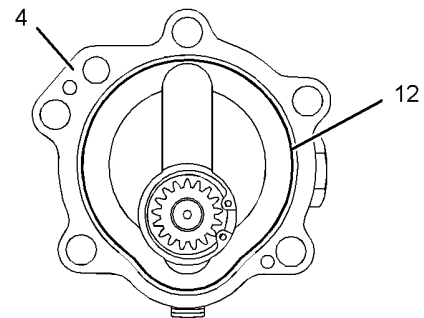


Illustration 11

g01254883

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

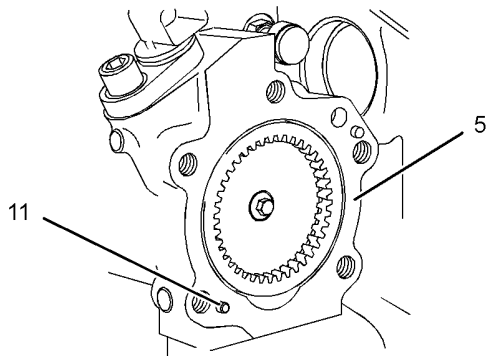


Illustration 12

g01254881

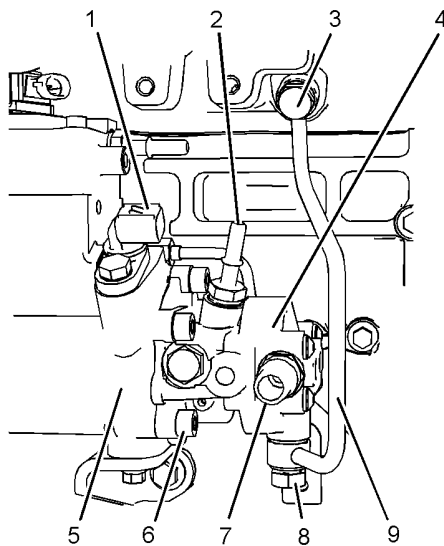


Illustration 13

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).

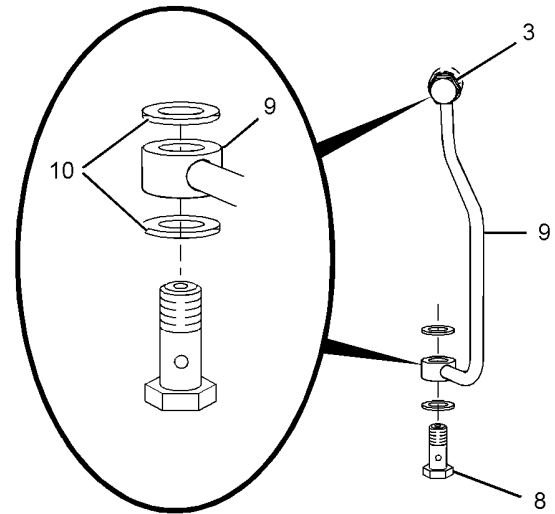


Illustration 14

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.

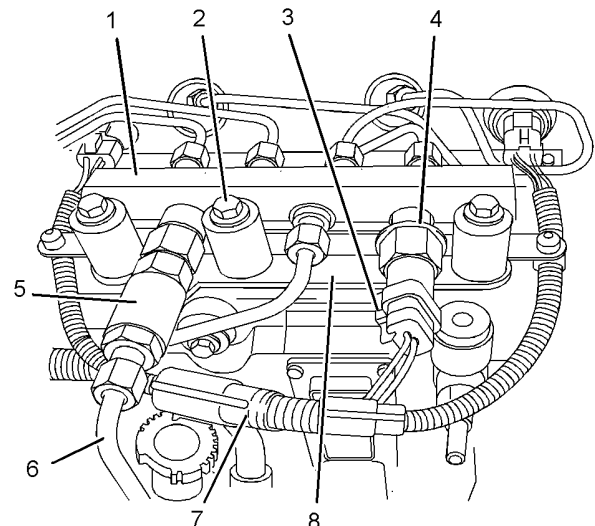


Illustration 15

g01243702

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

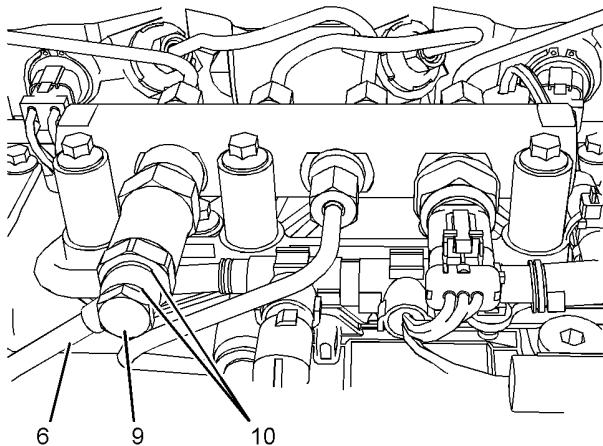


Illustration 16

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.

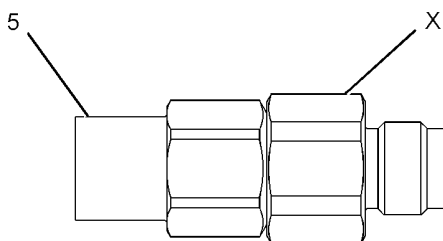


Illustration 17

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.

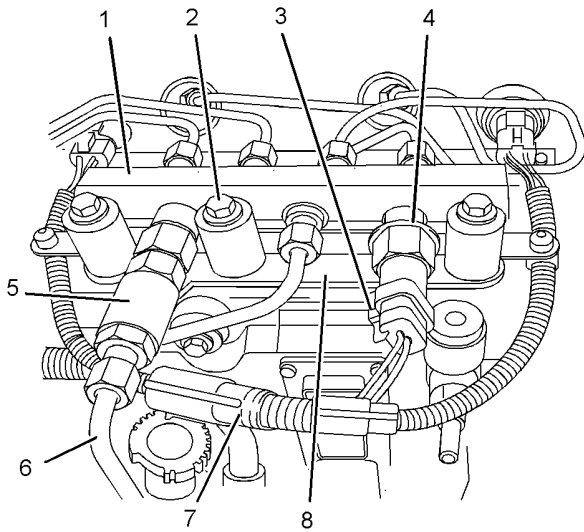


Illustration 18 g01243702  
The fuel manifold is shown with fuel injection lines in position.

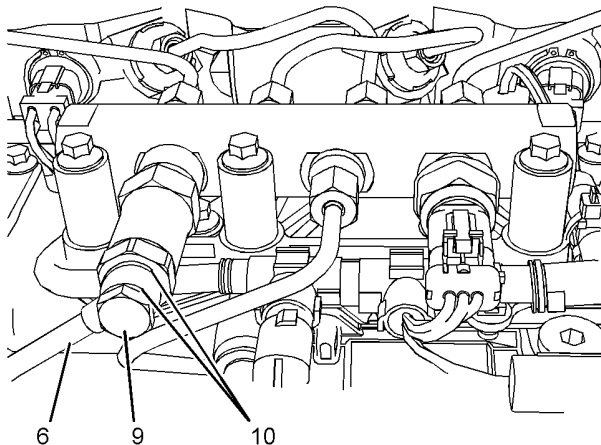


Illustration 19 g01763053  
The fuel manifold is shown with fuel injection lines in position.

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.

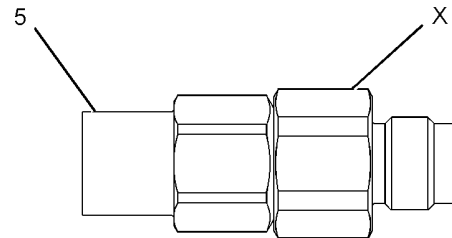


Illustration 20 g01800633

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.

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## 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.

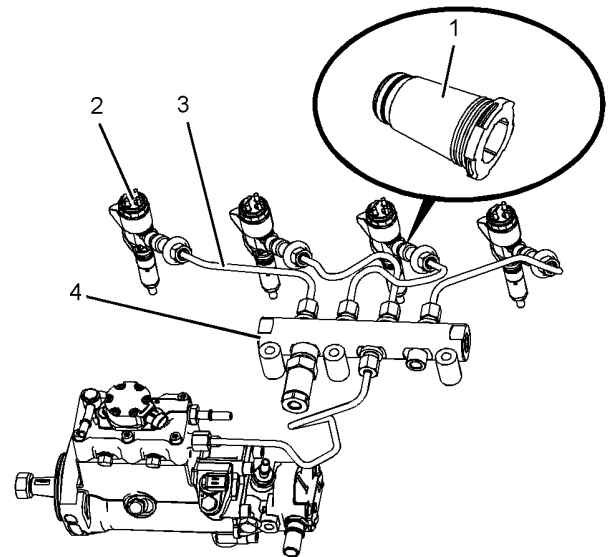


Illustration 21

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".

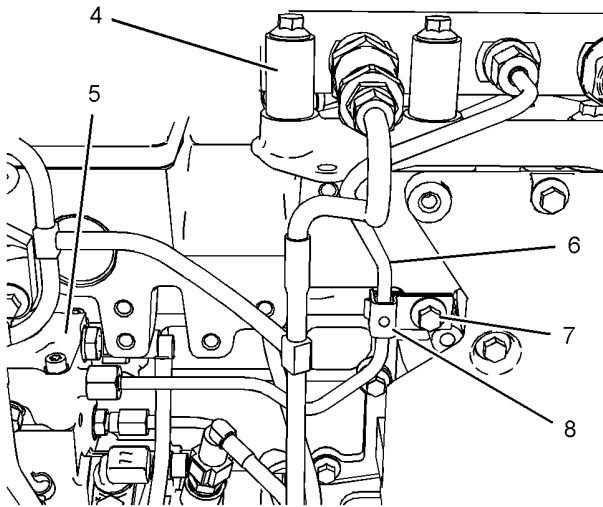


Illustration 22  
Typical example g01254886

- 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.

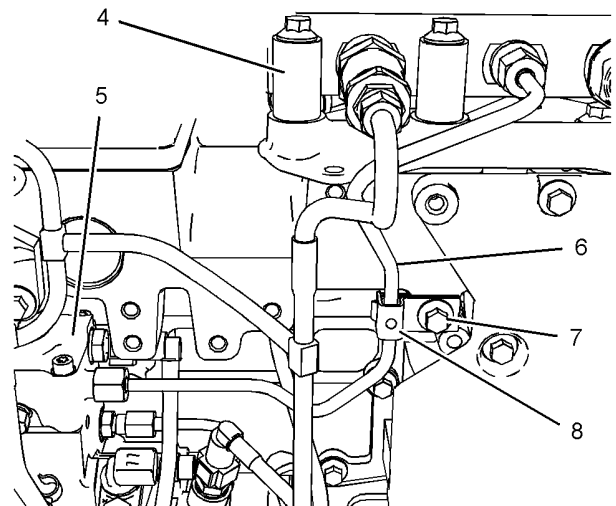


Illustration 23  
Typical example g01254886

- 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".

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".

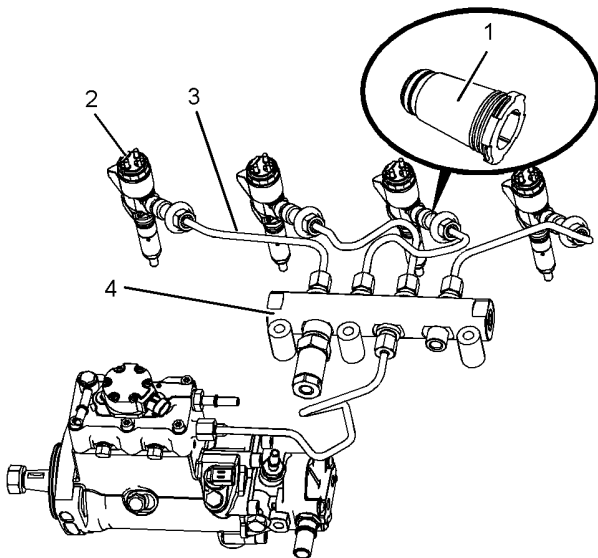


Illustration 24  
Typical example

g01457387

i03458261

## Fuel Injection Pump - Remove

### Removal Procedure

Table 5

Required Tools			
Tool	Part Number	Part Description	Qty
A <sup>(1)</sup>	21825576	Crankshaft Turning Tool	1
A <sup>(2)</sup>	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

<sup>(1)</sup> Install Tooling to the front pulley.

<sup>(2)</sup> Install Tooling into the aperture for the electric starting motor.

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.

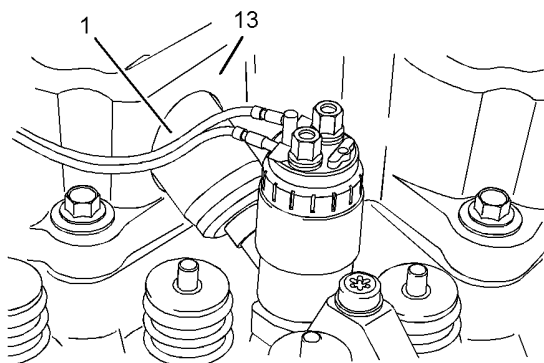


Illustration 25  
Typical example

The valve mechanism cover is not shown for clarity.

g01271377

**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.

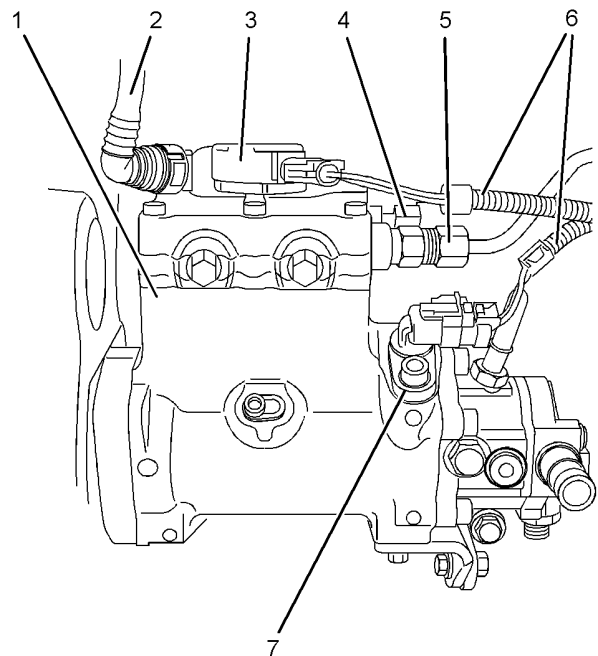


Illustration 26  
Typical example

g01563275

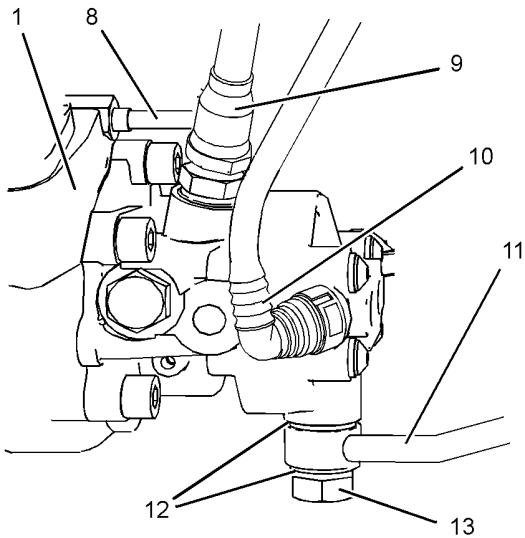


Illustration 27  
Typical example g01563276

- 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.

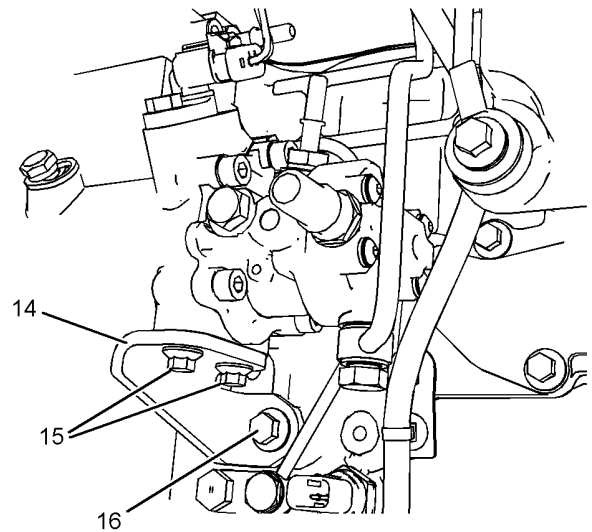


Illustration 28  
Typical example g01566973

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

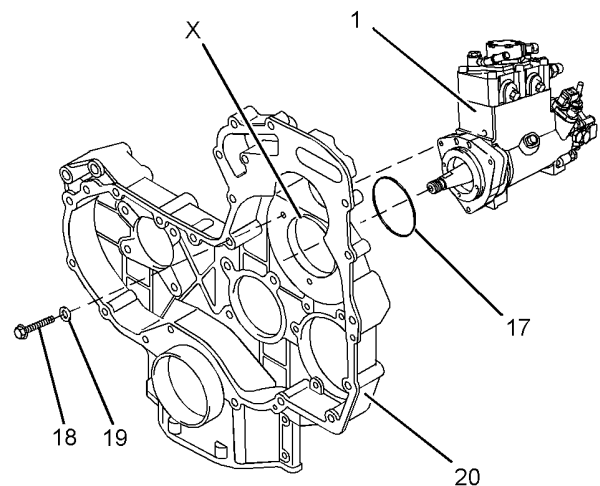


Illustration 29  
Typical example g01801934

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

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

20. Carefully remove fuel injection pump (1) from front housing (20). Ensure that bore (X) in the front housing is not damaged as the fuel injection pump is removed.

21. Remove O-ring seal (17) from fuel injection pump (1).

i03401825

## Fuel Injection Pump - Install

### Installation Procedure

Table 6

Required Tools			
Tool	Part Number	Part Description	Qty
A <sup>(1)</sup>	21825576	Crankshaft Turning Tool	1
A <sup>(2)</sup>	27610291	Barring Device Housing	1
	27610289	Gear	1
B	27610212	Camshaft Timing Pin	1
C	27610211	Crankshaft Timing Pin	1
E	27610352	Fuel Injection Pump Timing Tool	1
F	21820221	POWERPART Rubber Grease	-

(1) The Crankshaft Turning Tool is used on the front pulley.

(2) This Tool is used in the aperture for the electric starting motor.

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

#### 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.

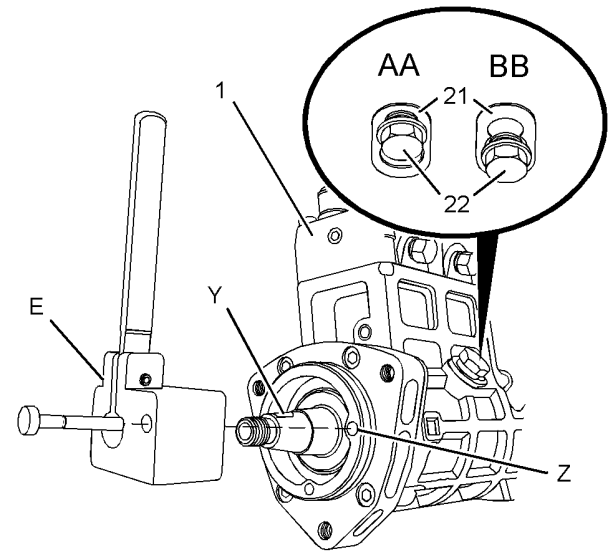


Illustration 30

g01572496

Typical example

**Note:** A new fuel injection pump is supplied, locked in the correct position. Do not unlock the fuel injection pump before installation.

1. If the fuel injection pump timing has been lost, it is possible to reset the fuel injection pump timing. Follow Step 1.a through Step 1.e in order to reset the fuel injection pump timing.

- a. Loosen locking screw (22) and slide spacer (21) to Position (AA). Tighten locking screw (22) to a torque of 9 N·m (80 lb in). This will prevent the locking screw from tightening against the shaft of the fuel injection pump.

The fuel injection pump is now unlocked.

- b. Position Tooling (E) onto the shaft of fuel injection pump (1). Align the lever of Tooling (E) with Keyway (Y) and engage the lever into the keyway.

**Note:** The lever of Tooling (E) should be a close fit in the keyway. If the lever is a loose fit in the keyway, it is not possible to reset the fuel injection pump timing.

- c. Rotate the shaft of the fuel injection pump and engage the pin of Tooling (E) into Hole (Z).

The fuel injection pump timing is now set in the correct position.

- d. Loosen locking screw (22) and slide spacer (21) to Position (BB). Tighten locking screw (22) to a torque of 9 N·m (80 lb in). The locking screw is now tightened against the shaft of the fuel injection pump.

The fuel injection pump is now locked.



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