

# Disassembly and Assembly

---

## **854F-E34TA Industrial Engine**

---

## Table of Contents

### Disassembly and Assembly Section

Fuel Priming Pump - Remove and Install .....	5	Manifold (DEF Heater) - Remove and Install. . .	70
Flow Control Valve - Remove and Install.....	6	Solenoid Valve (DEF Heater Coolant) - Remove and Install.....	74
Fuel Filter Base - Remove and Install.....	8	Flexible Exhaust Pipe - Remove and Install (Flexible Exhaust Pipe from the Turbocharger and the Diesel Oxidation Catalyst (DOC))... ..	75
Water Separator and Fuel Filter (Primary) - Remove and Install .....	12	Flexible Exhaust Pipe - Remove and Install (Flexible Exhaust Pipe Between DOC and the SCR).....	76
Fuel Manifold (Rail) - Remove and Install....	14	Exhaust Manifold - Remove and Install (Side Mounted Turbocharger Exhaust Manifold) .. .	80
Fuel Injection Lines - Remove .....	17	Exhaust Manifold - Remove and Install (Top Mounted Turbocharger Exhaust Manifold) .. .	83
Fuel Injection Lines - Install .....	20	Support and Mounting (CEM) - Remove and Install (Flywheel Housing Mounted CEM)... ..	87
Exhaust Cooler (NRS) - Remove and Install . .	22	Support and Mounting (CEM) - Remove and Install (Top Mounted DOC) .....	88
Throttle Valve (Intake Air) - Remove and Install (Rear Facing Inlet Elbow) .....	24	Inlet Manifold - Remove and Install .....	91
Throttle Valve (Intake Air) - Remove and Install (Side Facing Inlet Elbow).....	26	Inlet and Exhaust Valve Springs - Remove and Install.....	94
Fuel Injection Pump - Remove .....	28	Inlet and Exhaust Valves - Remove and Install	96
Fuel Injection Pump - Install .....	29	Inlet and Exhaust Valve Guides - Remove and Install.....	99
Fuel Injection Pump Gear - Remove .....	31	Engine Oil Filter Base - Remove and Install .	100
Fuel Injection Pump Gear - Install .....	32	Engine Oil Cooler - Remove .....	102
Electronic Unit Injector - Remove .....	33	Engine Oil Cooler - Install .....	103
Electronic Unit Injector - Install .....	35	Engine Oil Relief Valve - Remove and Install	104
Turbocharger - Remove (Top Mounted Turbocharger).....	37	Engine Oil Pump - Remove .....	105
Turbocharger - Remove (Side Mounted Turbochargers).....	40	Engine Oil Pump - Install .....	106
Turbocharger - Install (Top Mounted Turbocharger).....	42	Water Pump - Remove .....	107
Turbocharger - Install (Side Mounted Turbocharger).....	45	Water Pump - Install .....	108
Wastegate Solenoid - Remove and Install... ..	47	Water Temperature Regulator - Remove and Install.....	109
Exhaust Gas Recirculation Valve - Remove and Install.....	49	Engine Lifting Bracket - Remove .....	110
Selective Catalytic Reduction (SCR) Canister - Remove and Install .....	53	Engine Lifting Bracket - Install .....	111
Clean Emissions Module - Remove and Install (Top Mounted Diesel Oxidation Catalyst (DOC)).....	55	Flywheel - Remove.....	112
Clean Emissions Module - Remove and Install (Flywheel Mounted Diesel Oxidation Catalyst (DOC)).....	56	Flywheel - Install.....	113
Diesel Exhaust Fluid Lines - Remove and Install.....	58	Crankshaft Rear Seal - Remove and Install . .	114
Diesel Exhaust Fluid Pump - Remove and Install.....	63	Flywheel Housing - Remove and Install (Stressed Cylinder Block) .....	116
DEF Injector and Mounting - Remove and Install.....	65	Flywheel Housing - Remove and Install (Non- Stressed Cylinder Block) .....	118
Diesel Exhaust Fluid Tank - Remove and Install.....	68	Power Take-Off Drive - Remove and Install. .	121
		Crankshaft Pulley - Remove and Install....	123
		Crankshaft Front Seal - Remove and Install.	124
		Front Cover - Remove and Install.....	126
		Idler Gear - Remove .....	128
		Idler Gear - Install .....	130
		Housing (Front) - Remove .....	132
		Housing (Front) - Install .....	133
		Accessory Drive - Remove and Install.....	136

## Table of Contents

Crankcase Breather - Remove .....	138	Temperature Sensor (Exhaust) - Remove and Install (Temperature Sensor Exhaust After SCR) .....	194
Crankcase Breather - Install .....	139	Temperature Sensor (Exhaust) - Remove and Install (Exhaust Manifold Temperature Sensor for NRS) .....	195
Valve Mechanism Cover - Remove and Install .....	140	Temperature Sensor (Exhaust) - Remove and Install .....	196
Rocker Shaft and Pushrod - Remove .....	144	Pressure Sensor (Exhaust Back Pressure) - Remove and Install .....	197
Rocker Shaft - Disassemble .....	146	Inlet Manifold Temperature Sensor - Remove and Install .....	199
Rocker Shaft - Assemble .....	146	Inlet Manifold Pressure Sensor - Remove and Install .....	200
Rocker Shaft and Pushrod - Install .....	147	Glow Plugs - Remove and Install .....	201
Cylinder Head - Remove .....	149	Alternator Belt - Remove and Install .....	202
Cylinder Head - Install .....	151	Idler Pulley - Remove and Install .....	204
Lifter Group - Remove and Install .....	153	Fan - Remove and Install .....	204
Camshaft - Remove and Install .....	155	Fan Drive - Remove and Install .....	205
Camshaft Gear - Remove and Install .....	156	Alternator - Remove .....	207
Camshaft Bearings - Remove and Install .....	158	Alternator - Install .....	208
Engine Oil Pan - Remove and Install (Pressed Steel Oil Pan) .....	159	Electric Starting Motor - Remove and Install	210
Engine Oil Pan - Remove and Install (Cast Iron Engine Oil Pan) .....	161		
Balancer - Remove .....	165	<b>Index Section</b>	
Balancer - Install .....	166	Index .....	212
Piston Cooling Jets - Remove and Install .....	168		
Pistons and Connecting Rods - Remove .....	169		
Pistons and Connecting Rods - Disassemble .....	171		
Pistons and Connecting Rods - Assemble .....	172		
Pistons and Connecting Rods - Install .....	173		
Connecting Rod Bearings - Remove (Connecting rods in position) .....	175		
Connecting Rod Bearings - Install (Connecting rods in position) .....	176		
Crankshaft Main Bearings - Remove and Install .....	177		
Crankshaft - Remove .....	180		
Crankshaft - Install .....	181		
Crankshaft Timing Ring - Remove and Install	183		
Bearing Clearance - Check .....	184		
Nitrogen Oxide Sensor - Remove and Install (Nitrogen Oxide Sensor on Engine) .....	185		
Camshaft Position Sensor - Remove and Install .....	188		
Crankshaft Position Sensor - Remove and Install .....	189		
Coolant Temperature Sensor - Remove and Install .....	190		
Engine Oil Pressure Switch - Remove and Install .....	191		
Fuel Temperature Sensor - Remove and Install .....	192		
Temperature Sensor (Exhaust) - Remove and Install (Temperature Sensor Exhaust before SCR) .....	193		

# Disassembly and Assembly Section

i06213355

## Fuel Priming Pump - Remove and Install

### Removal Procedure

Table 1

Required Tools			
Tool	Part Number	Part Description	Qty
A	T412504	Capping Kit	1

#### NOTICE

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

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

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

#### NOTICE

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

Dispose of all fluids according to local regulations and mandates.

1. Turn the fuel supply to the OFF position.

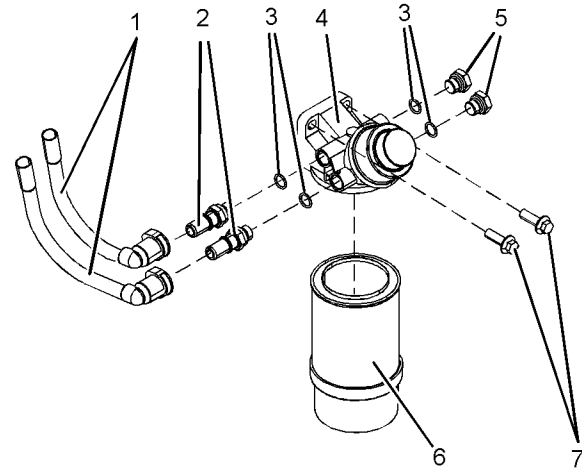


Illustration 1

g02988817

#### Typical example

2. Make a temporary identification mark on plastic tube assemblies (1) in order to show the correct position of the tube assemblies.
3. Place a suitable container below the fuel priming pump in order to catch any fuel that might be spilled. Drain primary filter (7). Refer to Operation and Maintenance Manual, "Fuel System Primary Filter (Water Separator) Element - Replace".
4. Disconnect plastic tube assemblies (1). Use Tooling (A) to plug the tube assemblies with new plugs.
5. Use Tooling (A) cap open connectors (2) on the fuel priming pump with new caps.
6. Remove primary filter (6) from fuel priming pump (4). Refer to Operation and Maintenance, "Fuel System Primary Filter (Water Separator) Element - Replace".
7. Remove bolts (7) from fuel priming pump (4). Remove fuel priming pump (4) from the mounting bracket.
8. If necessary, follow Steps 8.a. through 8.d. in order to disassemble fuel priming pump (4).
  - a. Remove connectors (2) from fuel priming pump (4). Use Tooling (A) to plug fuel priming pump (4).
  - b. Use Tooling (A) to cap connectors (2).
  - c. Remove plugs (5) from fuel priming pump (4). Use Tooling (A) to plug fuel priming pump (4).

- d. Remove O-ring seals (3) from connectors (2) and plugs (5).

## Installation Procedure (Mechanical Priming Pump)

### NOTICE

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

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

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

1. Ensure that fuel priming pump (4) is clean and free from wear or damage. If necessary, replace the fuel priming pump.

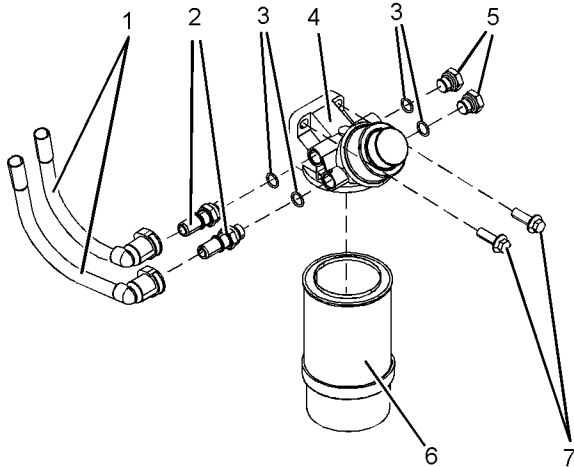


Illustration 2

g02988817

Typical example

- a. Install new O-ring seals (3) to plugs (5).
  - b. Remove caps from connectors (2). Install new O-ring seals (3) connectors (2).
  - c. Remove plugs from fuel priming pump (4).
  - d. Install connectors (2) to fuel priming pump (4).
  - e. Install plugs (5) to fuel priming pump (4).
  - f. 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 (7) to the fuel priming pump. Tighten the bolts to a torque of 44 N·m (32 lb ft).
  4. Remove the plugs from the plastic tube assemblies. Remove the caps from the connectors.
  5. Connect plastic tube assemblies (1) to connectors (2).
- Note:** Ensure that the plastic tube assemblies are installed in the original positions.
6. Install a new primary filter (6) to fuel priming pump (4). Refer to Operation and Maintenance Manual, "Fuel System Primary Filter (Water Separator) Element - Replace".
  7. Turn the fuel supply to the ON position.
  8. Prime the fuel system. Refer to Operation and Maintenance Manual, "Fuel System - Prime".

i06211125

## Flow Control Valve - Remove and Install

### Removal Procedure

Table 2

Required Tools			
Tool	Part Number	Part Description	Qty
A	T412504	Capping Kit	1

### WARNING

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

**NOTICE**

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

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

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

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

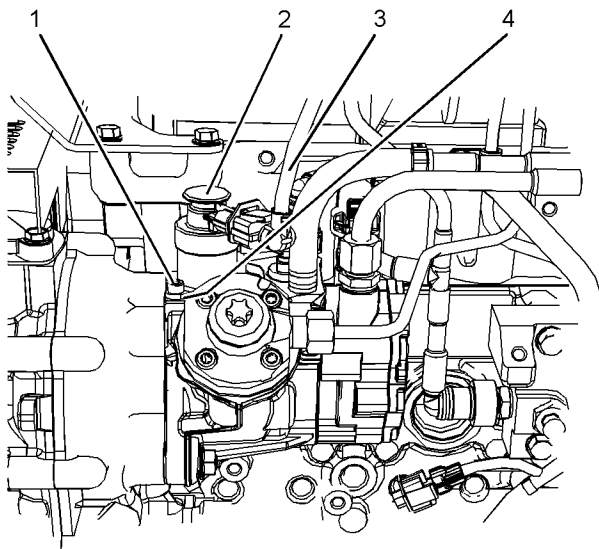


Illustration 3

g02539836

3. Clean the area around flow control valve (2) and fuel injection pump. Ensure that the area is free from contamination before beginning disassembly.
4. Disconnect harness assembly (3) from flow control valve (2).
5. Make temporary marks on the flow control valve and the fuel injection pump for installation purpose.
6. Remove Allen heads screws (1) from the flow control valve.
7. Remove the flow control valve from the fuel injection pump.

8. Use Tooling (A) in order to plug the fuel injection pump.
9. Remove O-ring seal (4) (not shown).

**Installation Procedure**

1. Ensure that all component at free from wear and damage. If any part of the flow control valve is worn or damaged, the flow control valve must be replaced as an assembly.

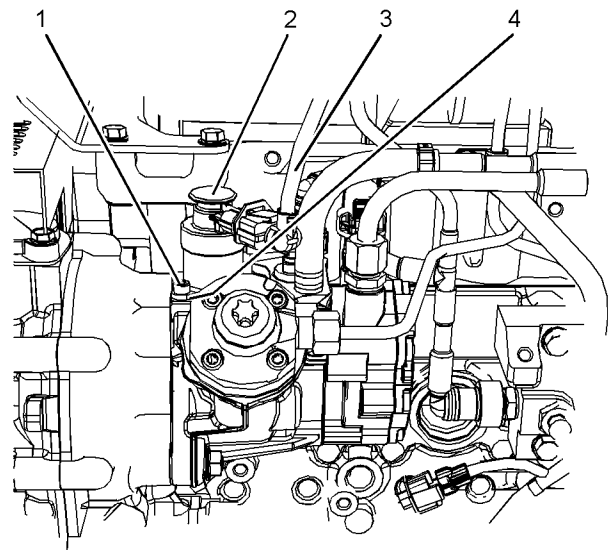


Illustration 4

g02539836

2. Position a new O-ring seal (4) (not shown) onto the flow control valve assembly.
3. Check O-ring seal (4) (not shown) is correctly positioned. Ensure that O-ring seal is not damaged.
4. Lubricate O-ring seal (4) (not shown) with clean fuel.

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

5. Remove Tooling (A) from the fuel injection pump.
6. Install flow control valve (3) to the fuel injection pump.
7. Install Allen head screws (2) from the flow control valve repair kit.
8. Tighten Allen head screws (2) equally until the flow control valve is seated correctly onto the fuel injection pump.

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

9. Tighten the Allen head screws to a torque of 9 N·m (80 lb in).
10. Connect harness assembly (1) to flow control valve (3).
11. Replace the filters for primary fuel system. Refer to Operation and Maintenance Manual, “Fuel System Primary (Water Separator) Element - Replace” for the correct procedure.
12. Replace the filters for secondary fuel system. Refer to Operation and Maintenance Manual, “Fuel System Secondary Filter - Replace” for the correct procedure.
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 Operation and Maintenance Manual, “Fuel System - Prime” for more information.

**End By:**

- a. After replacement of the flow control valve, the fuel injection pump requires a high-pressure fuel pump calibration procedure to be performed. Refer to Troubleshooting, “Fuel Rail Pressure Problem” for the correct procedure.

i06213344

## Fuel Filter Base - Remove and Install

### Removal Procedure

Table 3

Required Tools			
Tool	Part Number	Part Description	Qty
A	T412504	Capping Kit	1

---

#### NOTICE

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

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

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

---

#### NOTICE

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

Dispose of all fluids according to local regulations and mandates.

---

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

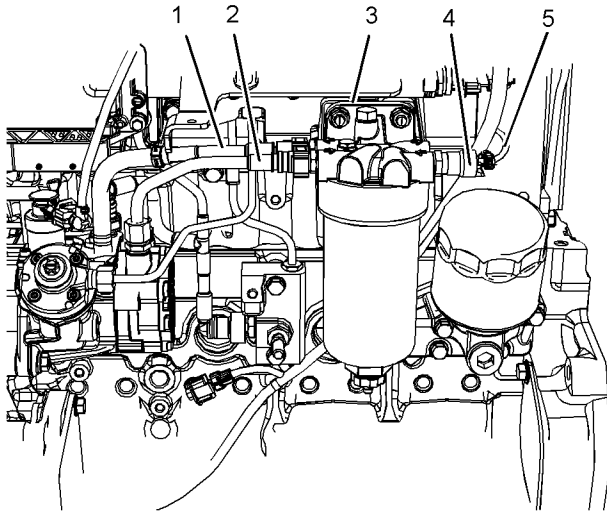


Illustration 5

g03011036

4. Make temporary identification marks on plastic tube assembly (1) and plastic tube assembly (2) in order to show the correct position of the plastic tube assemblies.
5. Place a suitable container below the fuel filter base in order to catch any fuel that might be spilled.
6. Disconnect plastic tube assembly (1) and plastic tube assembly (2) from fuel filter base (3).
7. Use Tooling (A) in order to plug plastic tube assembly (1) and plastic tube assembly (2)
8. Use Tooling (A) in order to cap the connection on fuel filter base (3).
9. Slide locking tab in to the unlock position. Disconnect harness assembly (5) from fuel temperature sensor (4).

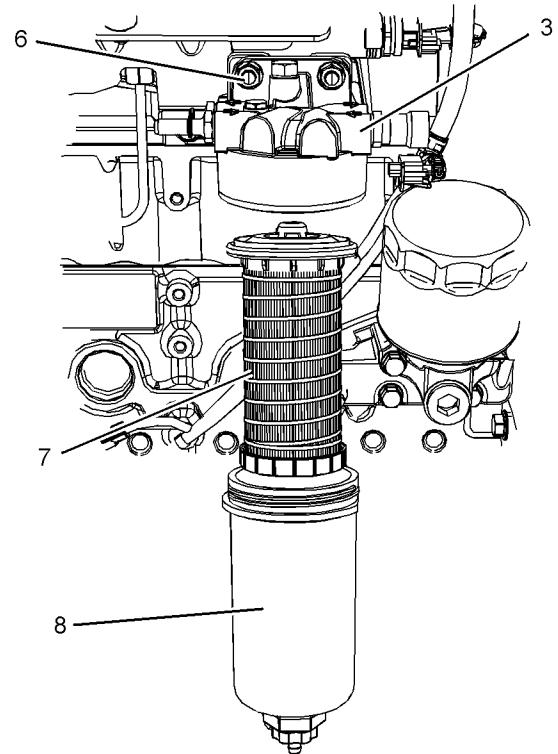


Illustration 6

g03011037

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

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



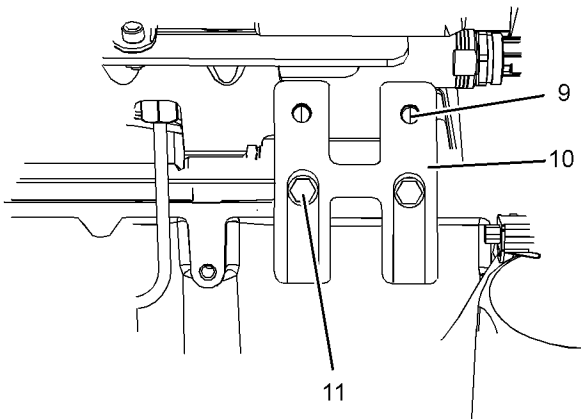


Illustration 7

g03011038

12. If necessary, follow Step 1.c. through Step 12.c. in order to remove the bracket for secondary fuel filter.

- a. Remove bolts (11) fuel filter bracket (10).
- b. Remove fuel filter bracket (10) from the valve mechanism cover.
- c. If necessary, remove studs (9) from fuel filter bracket (10).

## Installation Procedure

### NOTICE

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

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

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

### NOTICE

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

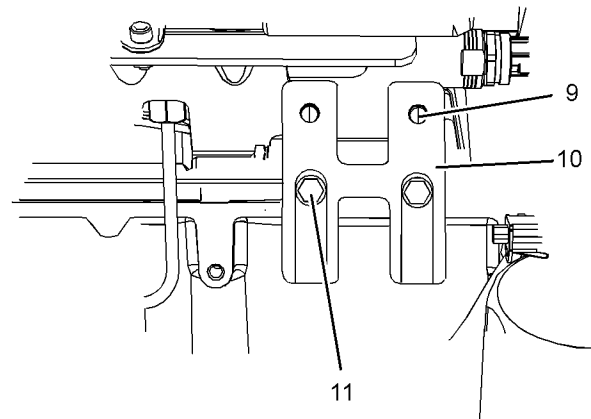


Illustration 8

g03011038

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

- a. If necessary, install studs (9) to fuel filter bracket (10). Tighten studs (9) to a torque of 18 N·m (159 lb in).
- b. Position fuel filter bracket (10) onto the valve mechanism cover. Install bolts (11) to fuel filter bracket (10).
- c. Tighten bolts (11) to a torque of 25 N·m (221 lb in).

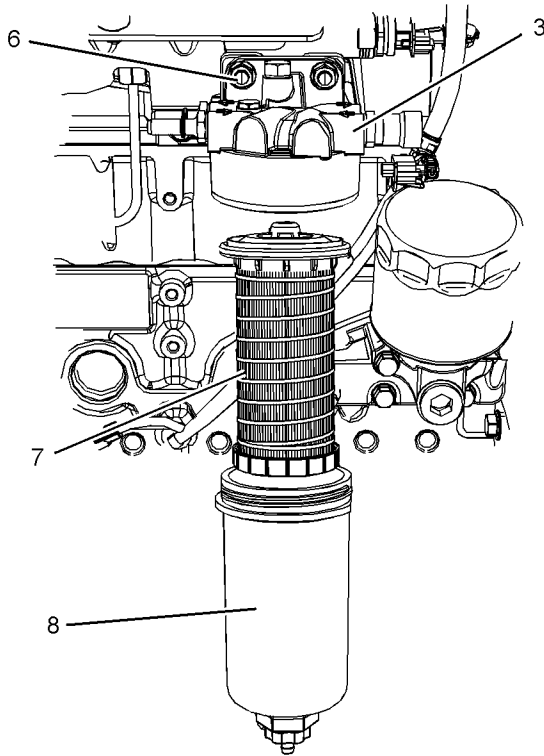


Illustration 9

g03011037

2. Ensure that fuel filter base (3) is clean and free from damage. If necessary, replace the complete fuel filter base and filter assembly.
3. Position fuel filter base (3) on the mounting bracket. Install nuts (6). Tighten the bolts to a torque of 25 N·m (221 lb in).
4. If necessary, install a new fuel filter (7) to canister (8). Install canister (8) to fuel filter base (3). Refer to Operation and Maintenance Manual, "Fuel System Secondary Filter - Replace" for the correct procedure.

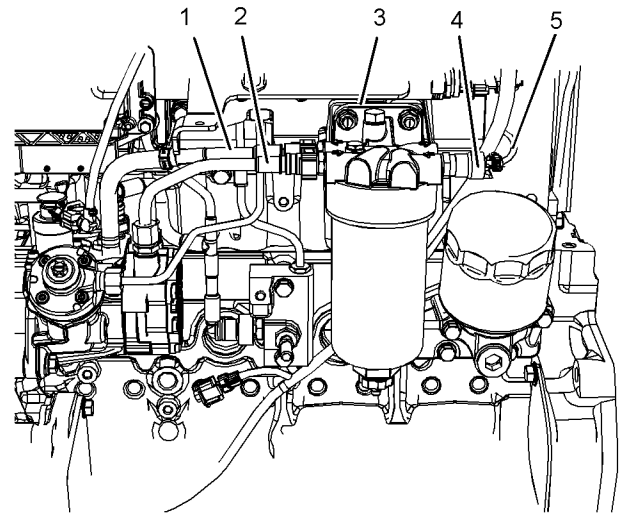


Illustration 10

g03011036

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

#### NOTICE

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

6. Connect plastic tube assembly (1) and plastic tube assembly (2) to the fuel filter base.
7. Connect harness assembly (5) to fuel temperature sensor (4). Slide locking tab in to the lock position.
8. Turn the fuel supply to the ON position.
9. Turn the battery disconnect switch to the ON position.

#### End By:

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

i06214222

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

### Removal Procedure

Table 4

Required Tools			
Tool	Part Number	Part Description	Qty
A	T412504	Capping Kit	1

#### NOTICE

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

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

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

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

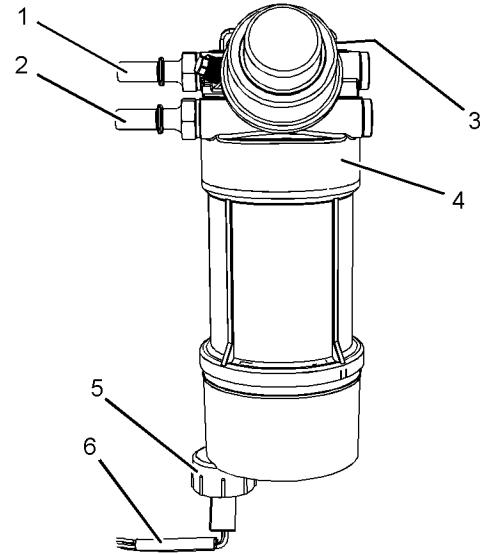


Illustration 11

g03011667

3. Make temporary identification marks on plastic tube assemblies in order to show the correct position of the plastic tube assemblies.
4. Place a suitable container below the fuel filter base in order to catch any fuel that might be spilled.
5. Disconnect the plastic tube assembly from connecting (1). Use Tooling (A) in order to plug the plastic tube assemblies. Use Tooling (A) in order to cap the connection (1).
6. Disconnect the plastic tube assembly from connecting (2). Use Tooling (A) in order to plug the plastic tube assemblies. Use Tooling (A) in order to cap the connection (2).
7. Disconnect the Original Equipment Manufactures (OEM) harness assembly (6) from water in fuel sensor (5).
8. Remove bolts (2) (not shown) and remove the assembly of primary fuel filter (4) from the mounting bracket.

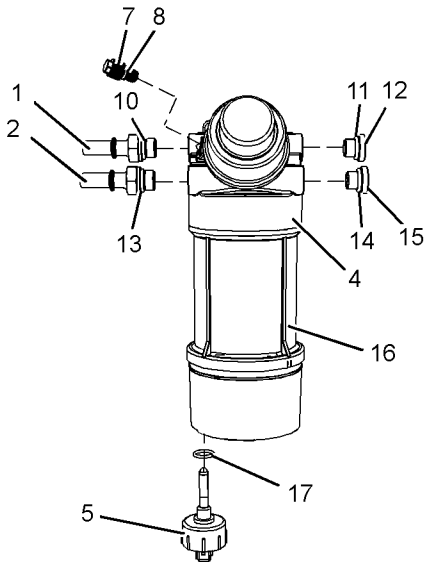


Illustration 12

g03011668

9. If necessary, follow Step 9.a. through Step 9.g. in order to disassemble the assembly of primary fuel filter (4).
  - a. Remove vent screw assembly (7) and remove O-ring seal (8). Use Tooling (A) in order to plug the primary fuel filter (4). Use Tooling (A) in order to cap vent screw assembly (7).
  - b. Remove connection (1) and remove O-ring seal (10). Use Tooling (A) in order to plug the primary fuel filter (4). Use Tooling (A) in order to cap connection (1).
  - c. Remove connection (2) and remove O-ring seal (13). Use Tooling (A) in order to plug the primary fuel filter (4). Use Tooling (A) in order to cap connection (1).
  - d. Remove plug (12) and remove O-ring seal (13). Use Tooling (A) in order to plug the primary fuel filter (4).
  - e. Remove plug (15) and remove O-ring seal (14). Use Tooling (A) in order to plug the primary fuel filter (4).
  - f. Remove water in fuel sensor (6) and remove O-ring seal (17).
  - g. Remove the filter element from fuel filter canister (16). Refer to Operation and Maintenance Manual, "Fuel System Primary Filter (Water Separator) Element - Replace" for the correct procedure.

## Installation Procedure

### NOTICE

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

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

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

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

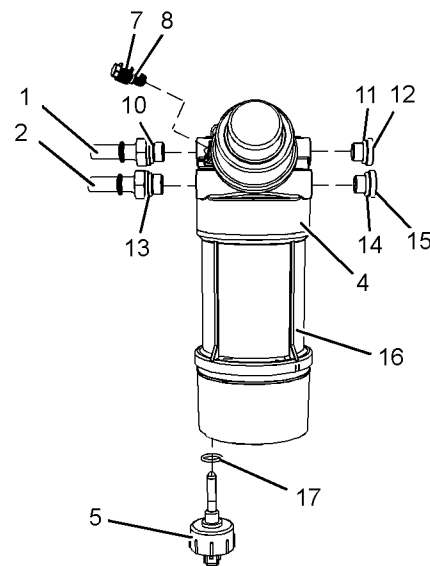


Illustration 13

g03011668

2. If necessary, follow Step 2.a. through Step 2.i. in order to assembly primary fuel filter (1).
  - a. Install a new filter element to fuel filter canister (16). Refer to Operation and Maintenance Manual, "Fuel System Primary Filter (Water Separator) Element - Replace" for the correct procedure.
  - b. Remove cap from connection (1). Install a new O-ring seal (10) to connection (1).
  - c. Remove plug from primary fuel filter (4). Install connection (1) to primary fuel filter (4). Tighten the connection to a torque of 20 N·m (177 lb in).

- d. Remove cap from connection (2). Install a new O-ring seal (13) to connection (2).
- e. Remove plug from primary fuel filter (4). Install connection (2) to primary fuel filter (4). Tighten the connection to a torque of 20 N·m (177 lb in).
- f. Install a new O-ring seal (13) to plug (12). Install plug (12) to primary fuel filter (4). Tighten the plug to a torque of 20 N·m (177 lb in).
- g. Install a new O-ring seal (14) to plug (15). Install plug (15) to primary fuel filter (4). Tighten the plug to a torque of 20 N·m (177 lb in).
- h. Remove cap from vent screw assembly (7). Install a new O-ring seal (8) to vent screw assembly (7). Install vent screw assembly (7) to primary fuel filter (4). Tighten the vent screw assembly securely.
- i. Install a new O-ring seal (17) to water in fuel sensor (5). Install water in fuel sensor (5) to primary fuel filter (4). Tighten water in fuel sensor (5) hand tight.

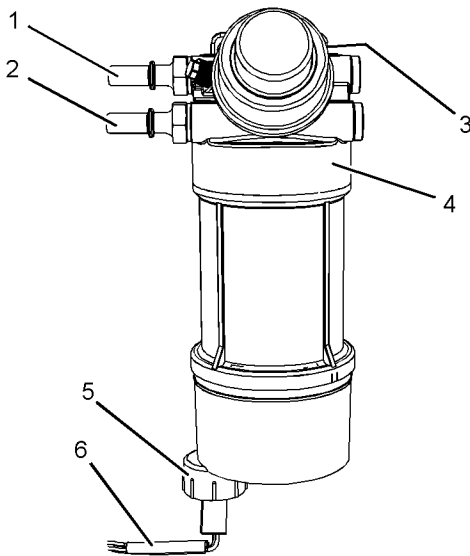


Illustration 14

g03011667

3. Position the assembly of primary fuel filter (4) onto the mounting bracket.
4. Install bolts (3) (not shown) to the assembly of primary fuel filter (4). Tighten the bolts to a torque of 50 N·m (37 lb ft).

---

**NOTICE**

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

---

5. Remove plug from the plastic tube assembly. Remove cap from connecting (1) on primary fuel filter (4). Connect the plastic tube assembly to connecting (1) on primary fuel filter (4).
6. Remove plug from the plastic tube assembly. Remove cap from connecting (2) on primary fuel filter (4). Connect the plastic tube assembly to connecting (2) on primary fuel filter (4).
7. Connect the OEM harness assembly (6) to water in fuel sensor (5).
8. Turn the fuel supply to the ON position.
9. Turn the battery disconnect switch to the ON position.

**End By:**

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

i06213354

## Fuel Manifold (Rail) - Remove and Install

### Removal Procedure

Table 5

Required Tools			
Tool	Part Number	Part Description	Qty
A	T412504	Capping Kit	1

**Start By:**

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

**WARNING**

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

---

**NOTICE**

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

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

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

**Note:** Plug or cap all open ports with new plugs or new caps.

1. Thoroughly clean the area around fuel manifold (12).

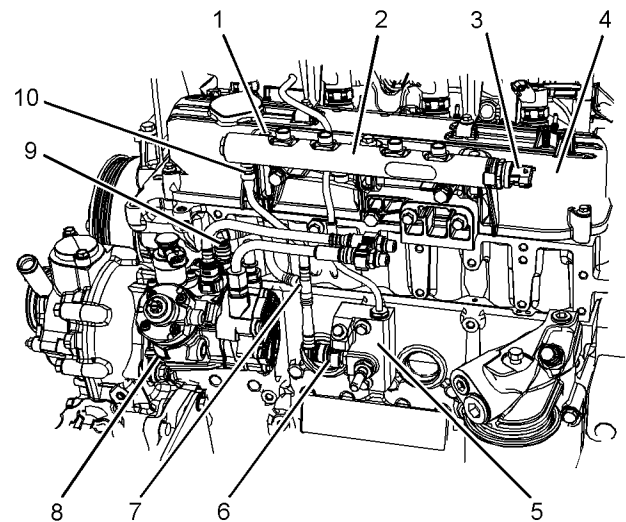


Illustration 15

g03784524

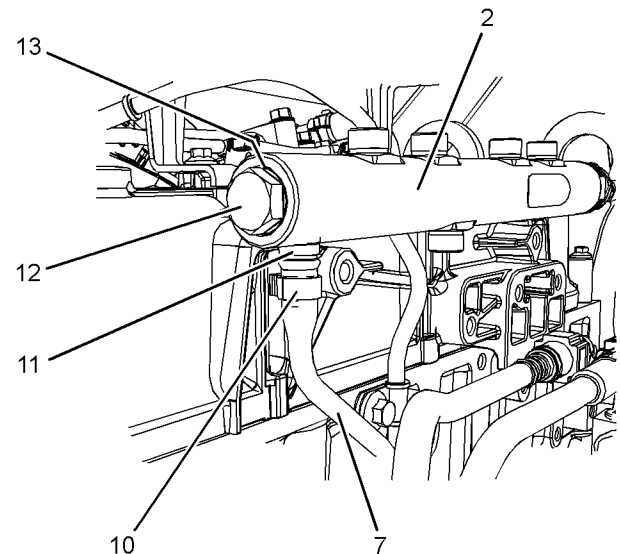


Illustration 16

g03784525

2. Disconnect the wiring harness from fuel pressure sensor (3).
3. Disconnect hose assembly connection (9) from fuel injection pump (8).
4. Disconnect hose assembly connection (6) from fuel distribution block (5).
5. Remove bolts (1) from fuel manifold (2). Remove the fuel manifold from the valve mechanism cover (4).
6. If necessary, follow Step 6.a. through Step 6.e. in order to remove plastic tube assembly (7).

- a. Release hose clamp (10) on plastic tube assembly (7).
  - b. Disconnect plastic tube assembly (7) from the fuel manifold (2).
  - c. Use Tooling (A) to cap the open port in fuel manifold (2) with a new cap.
  - d. Remove seal (11).
  - e. Use Tooling (A) to plug the open end of plastic tube assembly (7) with a new plug.
7. If necessary, remove fuel pressure relief valve (12) and O-ring seal (13) (not shown) from the fuel manifold.
  8. If necessary, remove fuel pressure sensor (3) from the fuel manifold.

## Installation Procedure

### NOTICE

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

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

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

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

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

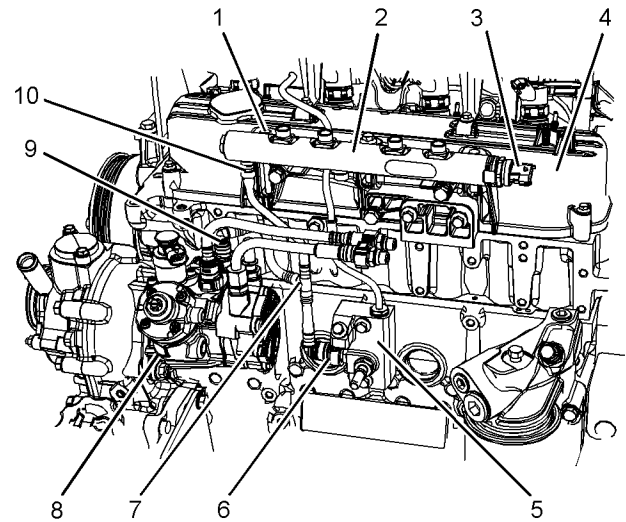


Illustration 17

g03784524

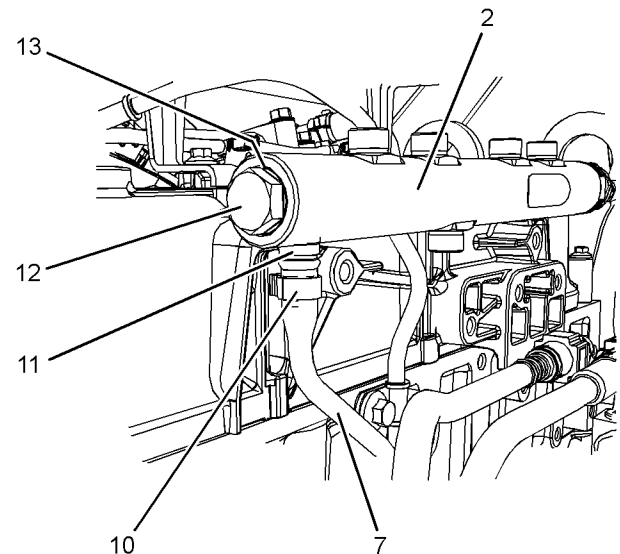


Illustration 18

g03784525

2. If necessary, install fuel pressure relief valve (12) and new O-ring seal (13) (not shown) to fuel manifold (2). Tighten fuel pressure relief valve (12) to a torque of 100 N·m (74 lb ft).
3. If necessary, install fuel pressure sensor (3) to the fuel manifold. Tighten fuel pressure sensor (3) to a torque of 70 N·m (52 lb ft).
4. If necessary, follow Step 4.a. through Step 4.d. in order to install tube assembly (7) to fuel manifold (2).
  - a. Position hose clamp (10) onto plastic tube assembly (7).

- b. Install new seal (11) into plastic tube assembly (7).
- c. Install plastic tube assembly (7) to fuel manifold (2).

**Note:** Ensure that the plastic tube assembly is correctly orientated.

- d. Tighten hose clamp (10) securely.
  5. Position fuel manifold (2) onto valve mechanism cover (4). Install bolts (1) to fuel manifold (2) finger tight.
  6. Install new fuel injection lines finger tight. Refer to Disassembly and Assembly, “Fuel Injection Lines - Install” for the installation procedure.
- Note:** Do not torque the nuts for the fuel injection lines at this stage of the assembly procedure.
7. Tighten bolts (1) to a torque of 25 N·m (221 lb in).
  8. Tighten the nuts for the fuel injection lines. Refer to Disassembly and Assembly, “Fuel Injection Lines - Install” for the correct torque.
  9. Remove the plug from connection (9) and install plastic tube assembly (7) to the fuel injection pump (8).
  10. Remove the plug from connection (6) and install plastic tube assembly (7) to distribution block (5).
  11. For the remaining installation procedure for the fuel injection lines, refer to Disassembly and Assembly, “Fuel Injection Lines - Install”.

#### End By:

- a. If a new fuel manifold is installed, it will be necessary to use the electronic service tool in order to perform the “Rail Pressure Valve Learn Reset” procedure.

i06213347

## Fuel Injection Lines - Remove

### Removal Procedure

Table 6

Required Tools			
Tool	Part Number	Part Description	Qty
A	T412504	Capping Kit	1
B	-	LASER 4920 1/2 Inch Drive HP Fuel Line Socket Set	1

### WARNING

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

#### NOTICE

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

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

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

#### 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 and on wires and all tube assemblies for installation purposes. Plug all hose assemblies and tube assemblies. Plugging all hose assemblies and tube assemblies will help to prevent fluid loss and 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 Clean Emissions Module (CEM). Refer to Disassembly and Assembly, “Clean Emissions Module - Remove” for the correct procedure.



## Disassembly and Assembly Section

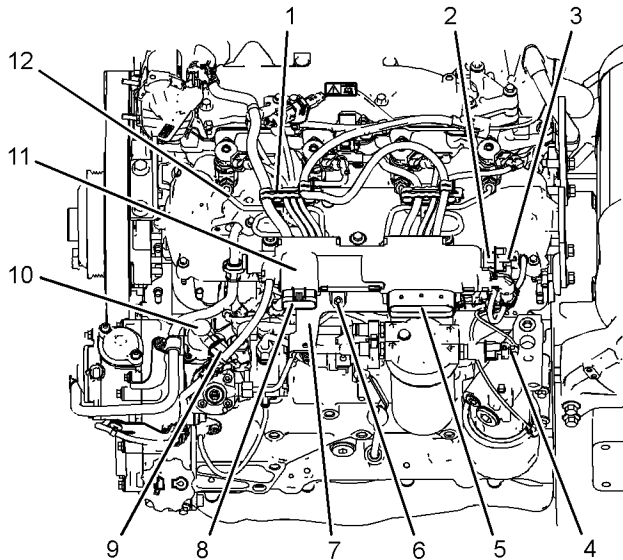


Illustration 19

g03774865

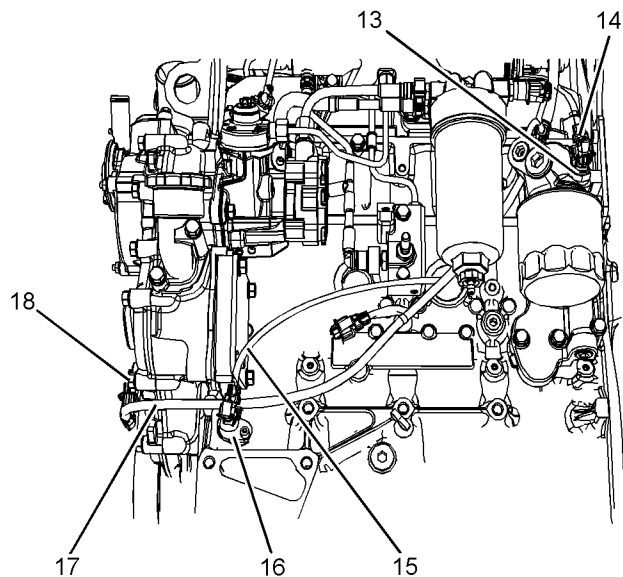


Illustration 20

g02683476

8. If necessary, cut cable straps in order to remove the wiring harness assemblies.
  9. Slide the locking tab for wiring harness assembly (15) into the unlocked position. Disconnect wiring harness assembly (15) from crankshaft position sensor (16).
  10. Slide the locking tab for wiring harness assembly (17) into the unlocked position. Disconnect wiring harness assembly (17) from camshaft position sensor (18).
  11. Slide the locking tab for wiring harness assembly (9) into the unlocked position. Disconnect wiring harness assembly (9) from the fuel metering valve (10).
  12. Disconnect the wiring harness assembly from fuel temperature sensor (4).
  13. Remove bolt (6) from wiring harness assembly (11).
  14. Position the wiring harness assembly (11) away from fuel injection lines (12).
4. Disconnect the Original Equipment Manufacturers (OEM) wiring harness assembly from connection (5) and connection (8).
  5. Open cable support clamps (1) from the wiring harness assemblies.
  6. Slide the locking tab for wiring harness assembly (3) into the unlocked position. Disconnect wiring harness assembly (3) from pressure sensor (2).
  7. Disconnect wiring harness assembly (14) from oil pressure switch (13).

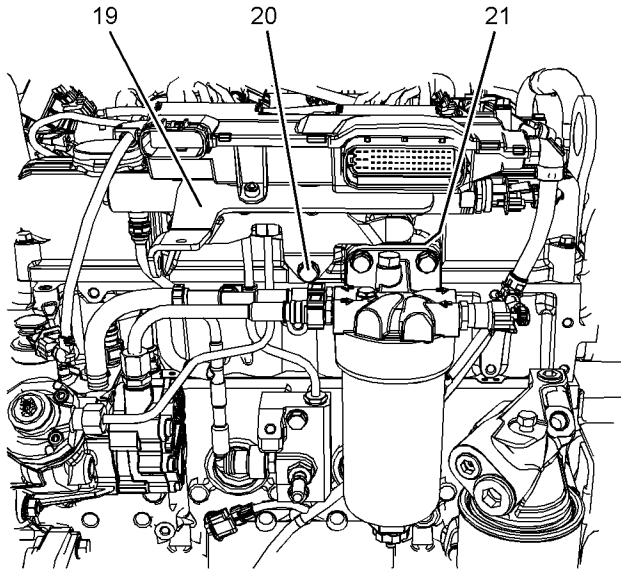


Illustration 21

g02848956

19. Clean the area around the nuts for fuel injection lines (12). Ensure that the area is free from contamination before beginning disassembly.
20. Use Tooling (B) in order to disconnect fuel injection line (12) from the electronic unit injector (27).
21. Use Tooling (B) in order to disconnect fuel injection line (12) from fuel manifold (24).
22. Remove fuel injection line (12). **Discard the fuel injection lines.**
23. Use Tooling (A) in order to cap all open ports immediately in fuel manifold (24) and electronic unit injectors (27).
24. Repeat Step 19 through Step 23 in order to remove the remaining fuel injection lines from the fuel manifold to the electronic unit injectors.

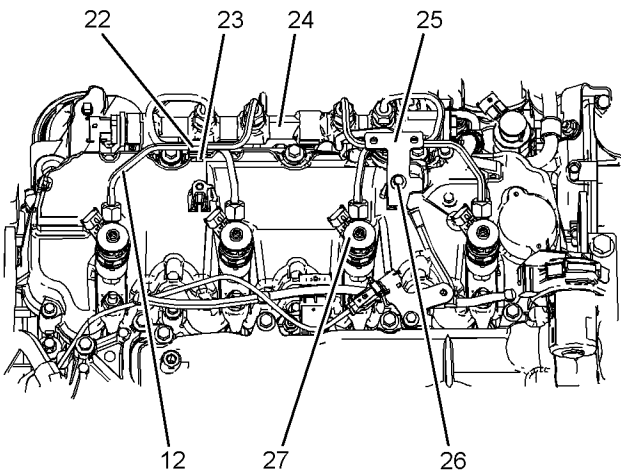


Illustration 22

g03775330

15. If necessary, remove the fuel filter base mounting bracket (21) (not shown). Refer to Disassembly and Assembly, "Fuel Filter Base - Remove and Install" for the correct procedure.
  16. Remove bolt (23) from tube clamp (22). Remove tube clamp (22) from fuel injection lines (12).
- Note:** Make temporary marks to identify the position of the tube clamps.
17. Repeat Step 16 in order to remove the remaining tube clamps.
  18. Remove bolt (26). Remove bracket (25) from the valve mechanism cover.

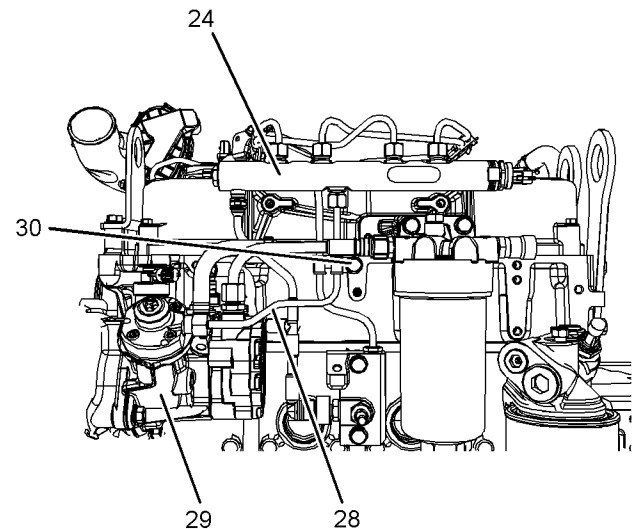


Illustration 23

g03829598

25. Clean the area around the nuts for fuel injection line (28). Ensure that the area is free from contamination before beginning disassembly.
26. Remove bolt (30) from the bracket for fuel injection line (28).
27. Disconnect fuel injection line (28) from fuel injection pump (29).
28. Disconnect fuel injection line (28) from fuel manifold (24).
29. Remove fuel injection line (28). **Discard the fuel injection line.**

30. Use Tooling (A) in order to cap all open ports immediately in fuel manifold (24) and in fuel injection pump (29).

i06213346

## Fuel Injection Lines - Install

### Installation Procedure

Table 7

Required Tools			
Tool	Part Number	Part Description	Qty
B	-	LASER 4920 1/2 Inch Drive HP Fuel Line Socket Set	1

#### NOTICE

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

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

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

**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 - Install" for more information.

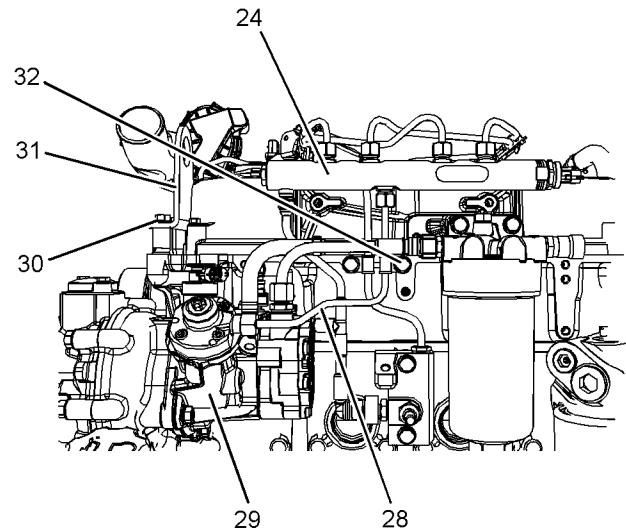


Illustration 24

g03829607

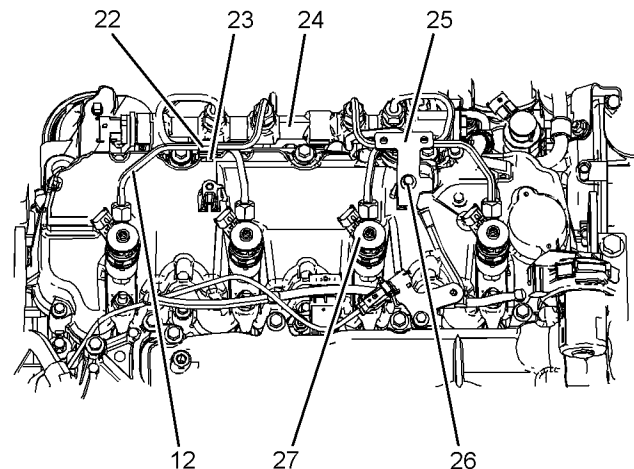


Illustration 25

g03776763

1. Remove the relevant plug from fuel manifold (24) and fuel injection pump (29).
2. Remove the caps from new fuel injection line (28).
3. Position new fuel injection line (28) onto fuel injection pump (29) and fuel manifold (24). Loosely install nuts for the fuel injection line onto the fuel manifold and the fuel injection pump.
4. Loosely install bolt (32).
5. Use Tooling (B) to tighten the nuts on fuel injection line (23) to a torque of 25 N·m (221 lb in).

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

6. Tighten bolt (32) to a torque of 25 N·m (221 lb in).
7. Remove the caps from the port of the electronic unit injector and from the appropriate port in fuel manifold (16).
8. Loosely connect the nuts at both ends of new fuel injection line (12) to the electronic unit injector and to the appropriate port in fuel manifold (16). Ensure that the ends of the fuel injection line are correctly seated in the electronic unit injector and in the fuel manifold.
9. Repeat Step 7 through Step 8 in order to install the remaining new fuel injection lines.
10. Position clamp (22) onto fuel injection lines (12) and install clamp bolt (20). Tighten the bolt to a torque of 10 N·m (89 lb in).

**Note:** Ensure that the rubber separator is correctly installed around the fuel injection lines. Ensure that fuel injection lines do not contact any other engine component.

11. Repeat Step 10 for the remaining fuel injection lines.
12. Use Tooling (B) to tighten the nuts on fuel injection line (12) to a torque of 25 N·m (221 lb in).
13. Position bracket (25) onto the valve mechanism cover. Install bolt (26) and tighten the bolt to a torque of 10 N·m (89 lb in).
14. If necessary, reinstall the front engine lifting eye (31). Install bolts (30) and tighten the bolts to a torque of 45 N·m (33 lb ft).

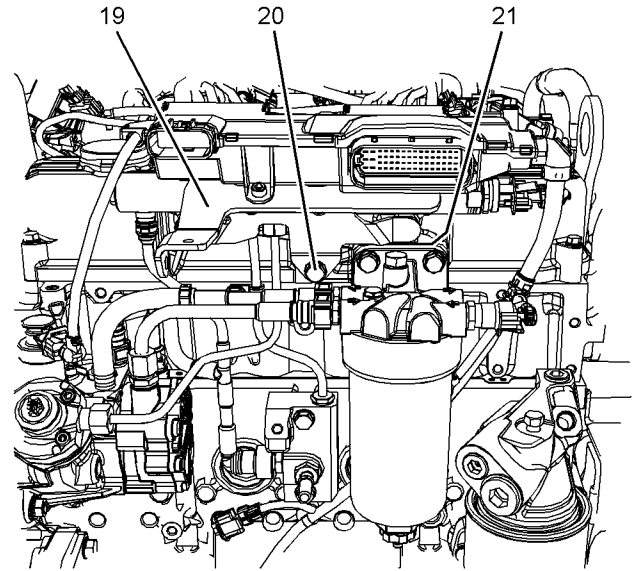


Illustration 26

g02849446

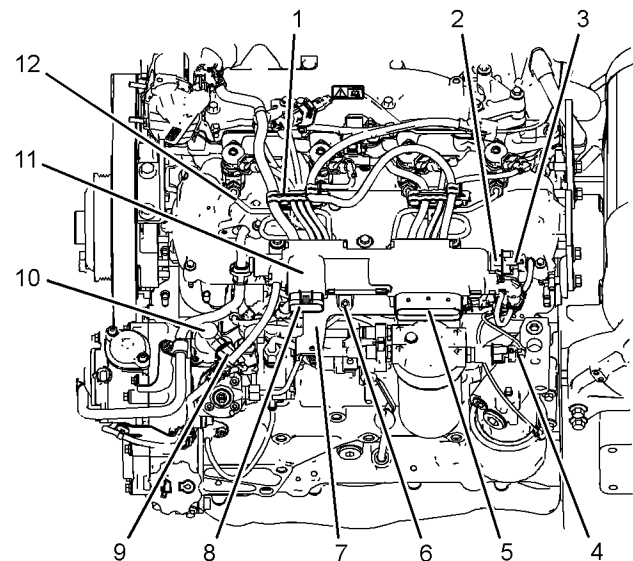


Illustration 27

g03774865

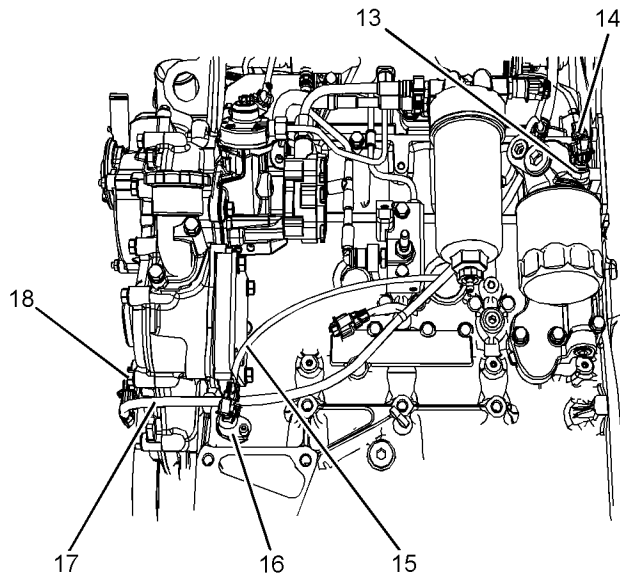


Illustration 28

g02699462

15. Position bracket (19) onto the valve mechanism cover. Install bolts (20) and tighten the bolts to a torque of 25 N·m (221 lb in).
16. Install the fuel filter base mounting bracket (21) (not shown). Refer to Disassembly and Assembly, "Fuel Filter Base - Remove and Install" for the correct procedure.
17. Position the wiring harness assembly (11) over fuel injection lines (12).
18. Install bolt (6) to wiring harness assembly (11). Tighten the bolt to a torque of 10 N·m (89 lb in).
19. Position wiring harness assembly onto cable support clamps (1). Secure the clamps and install to brackets (25).
20. Connect wiring harness assembly (9) to fuel metering valve (10). Slide the locking tab for wiring harness assembly (9) into the locked position.
21. Connect wiring harness assembly (14) to oil pressure switch (13).
22. Connect wiring harness assembly (3) to pressure sensor (2). Slide the locking tab for wiring harness assembly (3) into the locked position.
23. Connect wiring harness assembly to fuel temperature sensor (4). Slide the locking tab for wiring harness assembly into the locked position.
24. Connect wiring harness assembly (15) to crankshaft position sensor (16). Slide the locking tab for wiring harness assembly (15) into the locked position.
25. Connect wiring harness assembly (17) to camshaft position sensor (18). Slide the locking tab for wiring harness assembly (17) into the locked position.
26. Install cable straps to the wiring harness assembly in the relevant positions. Ensure that the cable straps meet the OEM specifications.
27. Install the OEM wiring harness assembly to connection (5) and connection (8).
28. If necessary, install the Clean Emissions Module (CEM). Refer to Disassembly and Assembly, "Clean Emissions Module - Install" for the correct procedure.
29. Turn the fuel supply to the ON position.
30. Turn the battery disconnect switch to the ON position.
31. Remove trapped air from the fuel system. Refer to the Operation and Maintenance Manual, "Fuel System - Prime" for the correct procedure.

i06211115

## Exhaust Cooler (NRS) - Remove and Install

### Removal Procedure

#### Start By:

- a. Drain the coolant from the cooling system into a suitable container for storage or disposal. Refer to Operation and Maintenance Manual, "Cooling System Coolant - Change" for the correct procedure.

### WARNING

**Sulfuric Acid Burn Hazard may cause serious personal injury or death.**

The exhaust gas cooler may contain a small amount of sulfuric acid. The use of fuel with sulfur levels greater than 15 ppm may increase the amount of sulfuric acid formed. The sulfuric acid may spill from the cooler during service of the engine. The sulfuric acid will burn the eyes, skin and clothing on contact. Always wear the appropriate personal protective equipment (PPE) that is noted on a material safety data sheet (MSDS) for sulfuric acid. Always follow the directions for first aid that are noted on a material safety data sheet (MSDS) for sulfuric acid.

**Note:** Plug or cap all open ports with new plugs or caps.

1. If necessary, remove the diesel particulate filter mounting bracket. Refer to Disassembly and Assembly, "Support and Mounting (CEM) - Remove and Install" for the correct procedure.

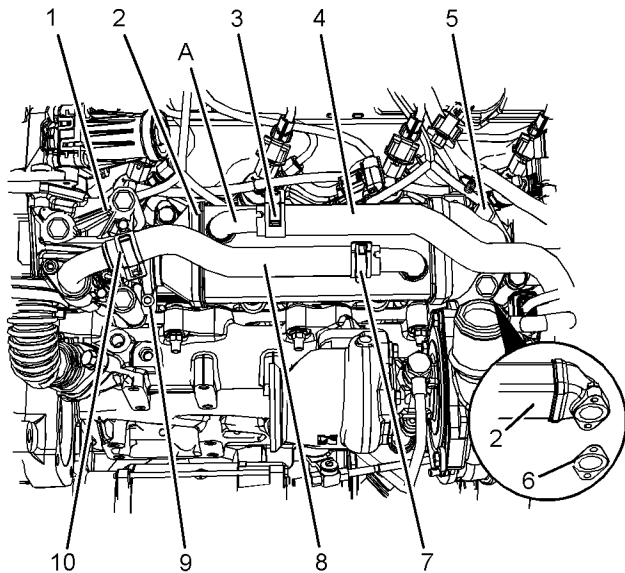


Illustration 29

g02717244

2. Position hose clamp (3) away from the coolant inlet in Position (A). Disconnect hose (4) from exhaust cooler assembly (2).
3. Reposition hose clamp (7) and hose clamp (10) in order to allow removal of hose (8). Disconnect hose (8) from exhaust cooler assembly (2).
4. Loosen V-band clamp (9) and position the clamp away from the Exhaust Gas Recirculation (EGR) valve assembly (1).
5. Remove bolts (5) from exhaust cooler assembly (2).

**Note:** If studs are installed, it will be necessary to remove the studs.

6. Remove exhaust cooler assembly (2) from the induction manifold.
7. Remove gasket (6).
8. Remove clamp (9) from the exhaust cooler assembly.

## Installation Procedure

1. Check all components for wear and damage. If necessary, replace any components that are worn or damaged.

**Note:** Remove plugs and caps that were previously installed prior to assembly.

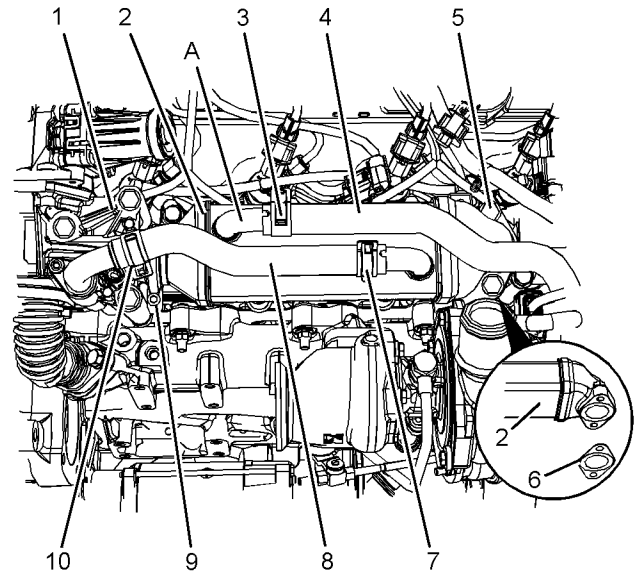


Illustration 30

g02717358

2. Ensure that the NRS exhaust cooler is free from restriction and external damage. Ensure that the NRS exhaust cooler and tube assemblies are free from wear and damage. Refer to Systems Operation Testing and Adjusting, "Exhaust Cooler (NRS) - Test" for the correct inspection procedure.

**Note:** The NRS exhaust cooler should not be internally cleaned.

3. Check that the sealing face on the EGR valve assembly (1) and the diffuser is clean and free from damage.
4. Install a new clamp (9) to NRS mixer chamber (1).

**Note:** Ensure that the clamp is correctly orientated to prevent contact with any other engine components.

5. Position a new gasket (6) onto the induction manifold.
6. Position exhaust cooler assembly (2) onto the induction manifold. Install bolts (5) finger tight. If studs were installed instead of bolts, install the studs. Tighten the studs to a torque of 10 N·m (89 lb in).

**Note:** Ensure that the exhaust cooler assembly (2) can still move freely.

7. Tighten clamp (9) to a torque of 10 N·m (89 lb in)
8. Tighten bolts (5) to a torque of 25 N·m (221 lb in)

9. Connect hose (4) to exhaust cooler assembly (2) in Position (A). Position hose clamp (3) onto the coolant inlet.
10. Install hose assembly (8) to exhaust cooler assembly (2). Position hose clamp (7) and position hose clamp (10) and tighten securely.
11. If necessary, install the diesel particulate filter mounting bracket. Refer to Disassembly and Assembly, "Support and Mounting (CEM) - Remove and Install" for the correct procedure.

**End By:**

- a. Fill the cooling system with coolant. Refer to Operation and Maintenance Manual, "Cooling System Coolant - Change" for the correct procedure.

i06213414

## Throttle Valve (Intake Air) - Remove and Install (Rear Facing Inlet Elbow)

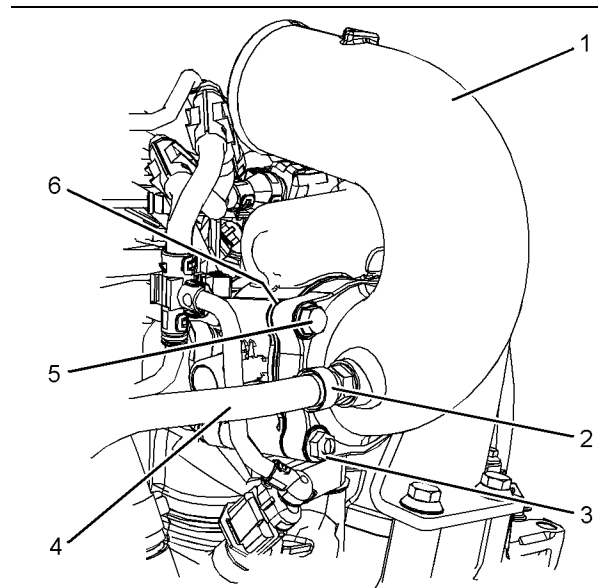
**Removal Procedure**

Illustration 31

g02906277

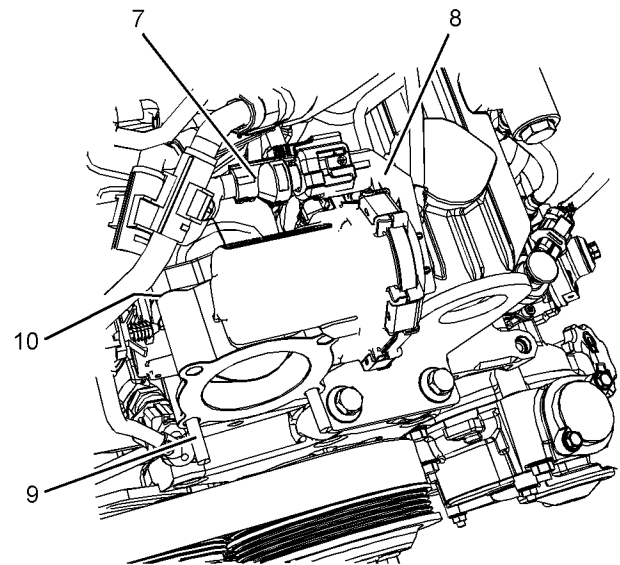


Illustration 32

g02906317

1. Loosen the hose clamp and disconnect the hose assembly from elbow (1).
2. Slide the locking tab into the unlocked position and disconnect harness assembly (7) from throttle valve (8).
3. Loosen hose clamp (2) and disconnect hose assembly (4) from elbow (1).
4. Remove bolts (5) and remove nuts (3) from the elbow.
5. Remove the air inlet elbow from studs (9).
6. Remove gasket (6) (not shown).

- 7. Remove throttle valve (8) from studs (9).
- 8. Remove gasket (6) (not shown).
- 9. If necessary, remove studs (9). Refer to Disassembly and Assembly, "Inlet Manifold - Remove and Install" for the correct procedure.

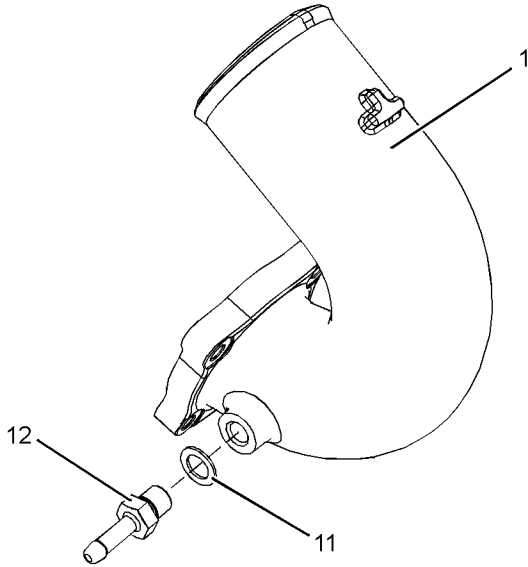


Illustration 33 g02906404

- 10. If necessary, remove adaptor (12) and sealing washer (11) from elbow (1).

**Installation Procedure**

- 1. Check all components for wear and damage. If necessary, replace any components that are worn or damaged.

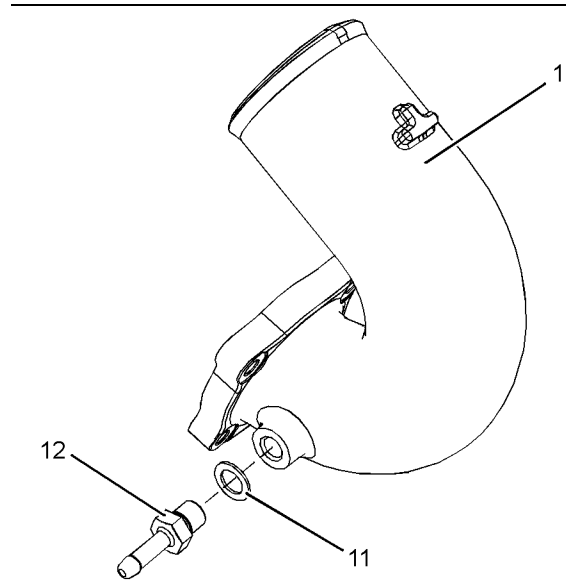


Illustration 34 g02906404

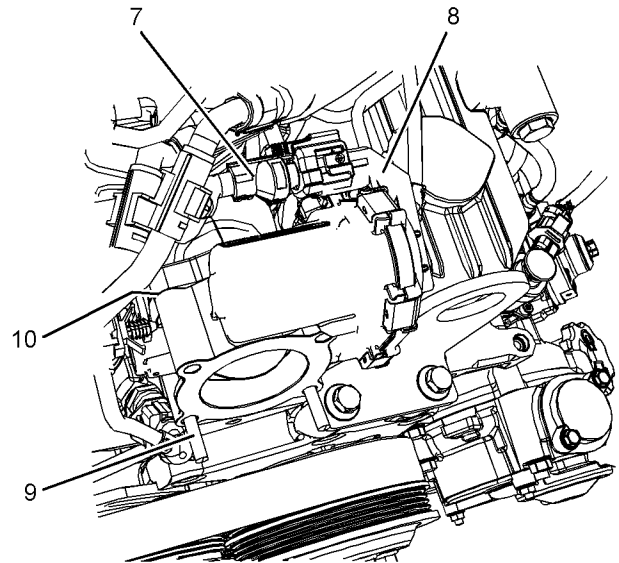


Illustration 35 g02906317





**Download the full PDF manual instantly.**

**Our customer service e-mail:**

**[aservicemanualpdf@yahoo.com](mailto:aservicemanualpdf@yahoo.com)**