

Disassembly and Assembly

1600 Series Industrial Engine

XGA (Engine)
XGB (Engine)
XGD (Engine)
XGE (Engine)
XGF (Engine)
XGH (Engine)

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Disassembly and Assembly Section

i04638569

Fuel Filter Base - Remove (1606A and 1606D Engines)

Removal Procedure

Table 1

Required Tools			
Tool	Part Number	Part Description	Qty
A	29990075	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 fuel supply to the OFF position.
2. Turn the battery disconnect switch to the OFF position.

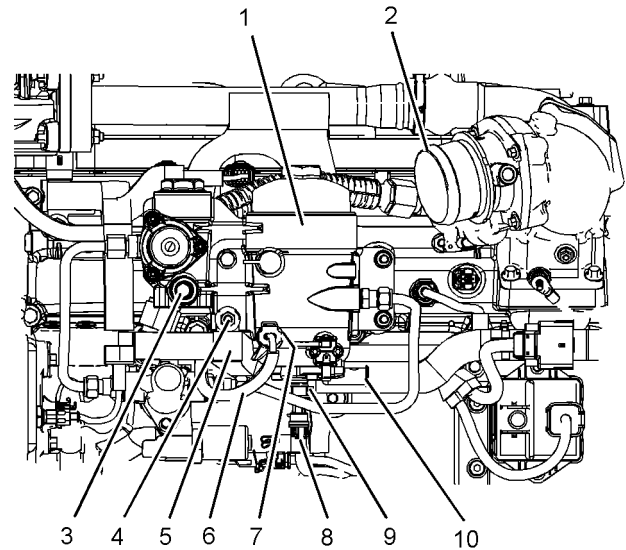


Illustration 1

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3. If necessary, disconnect hose assembly from inlet connection (2).
4. Drain the fuel from fuel filter base (1). Refer to the Operation and Maintenance Manual, "Fuel System Primary Filter/Water Separator - Drain" for the correct procedure.
5. Disconnect the fuel hose assembly from inlet connection (3) on fuel filter base (1).
6. Use Tooling (A) in order to plug the fuel hose assembly. Use Tooling (A) in order to cap connection (3).
7. Disconnect fuel hose assembly from return connection (10) on fuel filter base (1).
8. Use Tooling (A) in order to plug the fuel hose assembly. Use Tooling (A) in order to cap connection (10).
9. Disconnect harness assembly (6) from water in fuel sensor (7) (not shown).
10. Disconnect harness assembly (8) from fuel pressure sensor (9).
11. Remove nut (4) and disconnect harness assembly (5) from the stud bolt on fuel filter base (1).

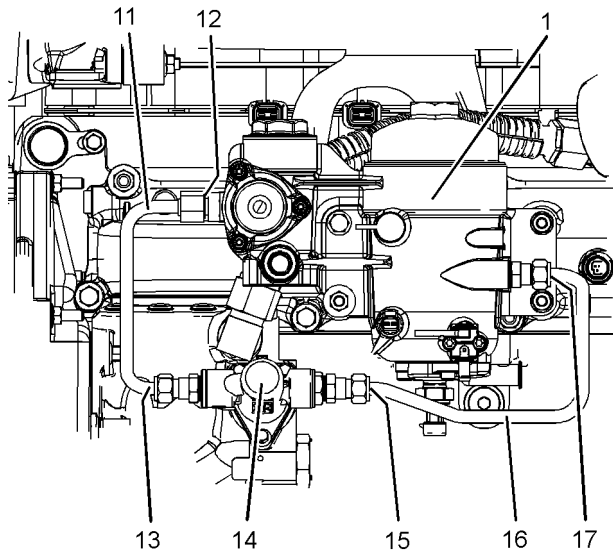


Illustration 2

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12. Disconnect tube assembly (11) from fuel filter base (1) and fuel transfer pump (14).
13. Remove O-ring seal (12) (not shown) from the connection on fuel filter base (1).
14. Use Tooling (A) in order to cap the connection on fuel filter base (1).
15. Use Tooling (A) in order to cap fuel transfer pump (14).
16. Remove seal (13) (not shown) from tube assembly (11).
17. Use Tooling (A) in order to cap tube assembly (11).
18. Disconnect tube assembly (16) from fuel filter base (1) and fuel lift pump (14).
19. Remove seal (15) (not shown) and seal (17) (not shown) tube assembly (16).
20. Use Tooling (A) in order to cap tube assembly (16).
21. Use Tooling (A) in order to cap the connection on fuel filter base (1) and fuel lift pump (14).

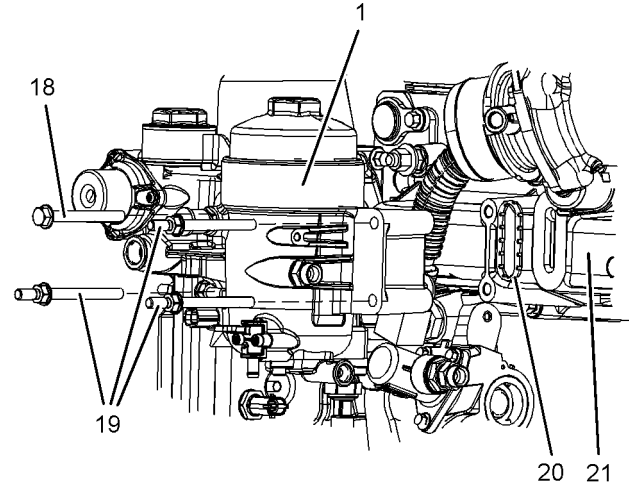


Illustration 3

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22. Remove bolt (18) and stud bolts (19) from fuel filter base (1). Support the fuel filter base as the bolts are removed.

Note: Note the position of the different length bolts and different types of bolts for installation purposes.

23. Remove fuel filter base (1) from inlet manifold (21).
24. Remove gasket seal (20).

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Fuel Filter Base - Disassemble (1606A and 1606D Engines)

Disassembly Procedure

Start By:

- a. Remove the fuel filter base. Refer to Disassembly and Assembly, "Fuel Filter Base - Remove".

NOTICE

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

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

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

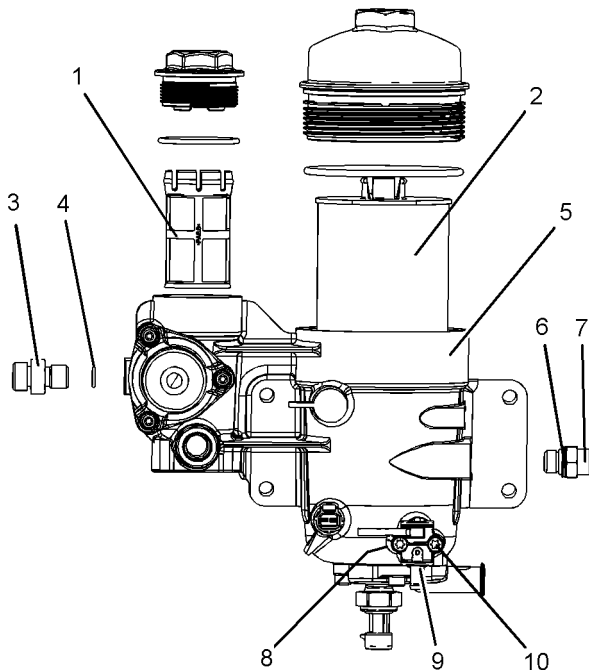


Illustration 4

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1. Remove primary fuel filter (1). Refer to the Operation and Maintenance Manual, "Fuel System Primary Filter - Clean/Inspect/Replace" for the correct procedure.
2. Remove secondary fuel filter (2). Refer to the Operation and Maintenance Manual, "Fuel System Secondary Filter - Replace" for the correct procedure.
3. Remove connection (3) from fuel filter base (4). Remove O-ring (4) from the connection.
4. Remove connection (7) from fuel filter base (4). Remove O-ring (6) from the connection.

5. Remove Torx screws (10). Remove drain valve (9) assembly from fuel filter base (4).
6. Remove O-ring (8) (not shown).

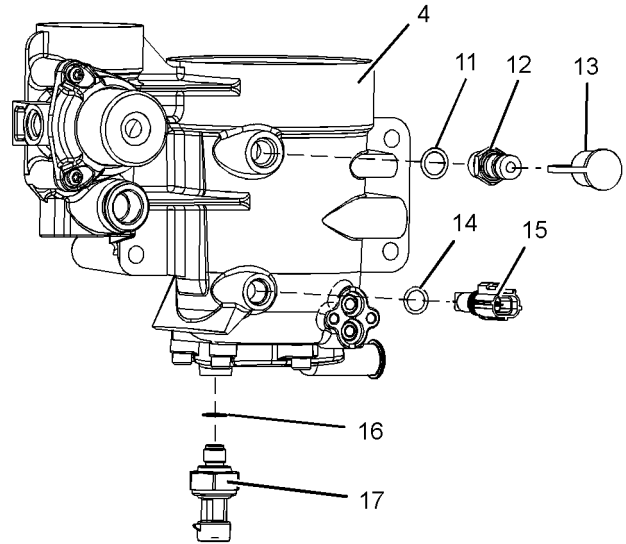


Illustration 5

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7. Use a deep socket in order to remove fuel pressure sensor (14) from fuel filter base assembly (4).
8. Remove O-ring seal (16) from the fuel pressure sensor.
9. Use a suitable tool in order to remove water in fuel sensor (15) from fuel filter base assembly (4).
10. Remove O-ring seal (16) from the water in fuel sensor.
11. Remove dust cap (13) from fuel sampling valve (12).
12. Use a deep socket in order to remove fuel sampling valve (12) from fuel filter base assembly (4).
13. Remove O-ring seal (5) from the fuel sampling valve.

 **WARNING**

Personal injury can result from being struck by parts propelled by a released spring force.

Make sure to wear all necessary protective equipment.

Follow the recommended procedure and use all recommended tooling to release the spring force.

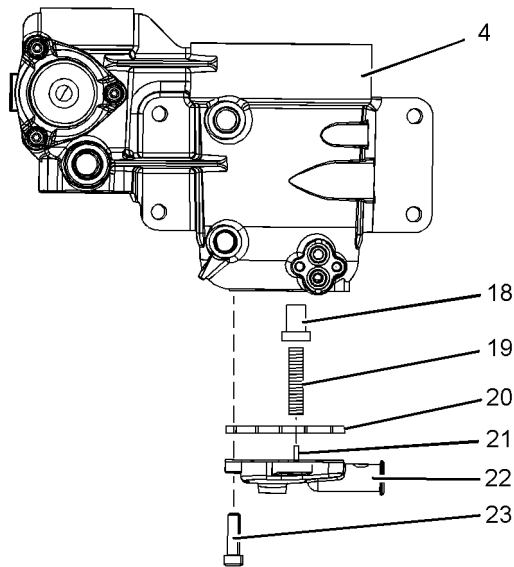


Illustration 6 g03159778

14. Remove Torx screws (23). Support cover plate (22) as the Torx screws are loosened.
15. Remove cover plate (22), spring (19), and valve (18) from fuel filter housing (4).
16. Ensure that spring locator (21) is not damaged.
17. Remove gasket seal (20).

i04638611

Fuel Filter Base - Assemble (1606A and 1606D Engines)

Assembly 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, free from restriction, and free from damage. If necessary, replace the complete fuel filter base and filter assembly.

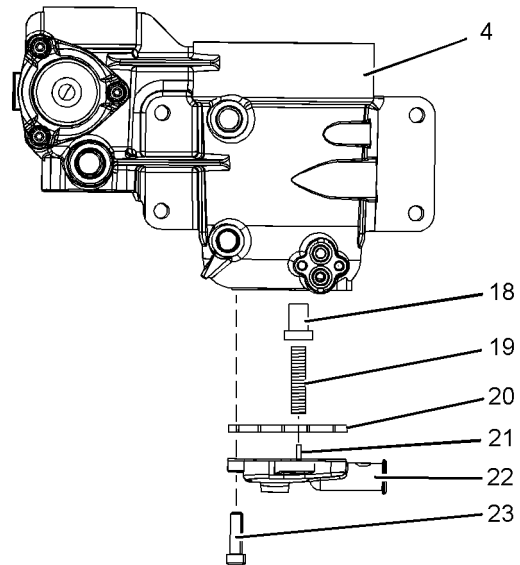


Illustration 7 g03159778

2. Install a new gasket seal (20) to cover plate (22). Ensure that the gasket seal is correctly seated into the recess in the cover plate.
3. Install valve (18) into fuel filter base (4). Ensure that the valve is correctly installed into the fuel filter housing. Ensure that the valve can freely move.
4. Install spring (19) into valve (18). Ensure that the spring is correctly installed into the valve.
5. Position cover plate (22) onto spring (19). Ensure that spring (19) is correctly located onto locator (21) in the cover plate.
6. Install Torx screws (23) to cover plate (22).
7. Tighten Torx screws (23) evenly in order to pull cover plate (22) into position on fuel filter base (4).
8. Tighten Torx screws (23) to a torque of 10 N·m (89 lb in).

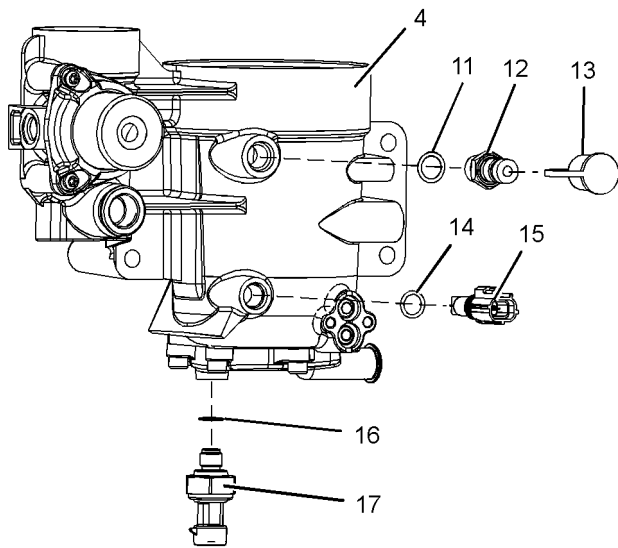


Illustration 8

g02797583

9. Install a new O-ring seal (16) from fuel pressure sensor (17).
10. Install fuel pressure sensor (17) to fuel filter base assembly (4).
11. Use a deep socket in order to tighten fuel pressure sensor to a torque of 11 N·m (97 lb in).
12. Install a new O-ring seal (16) to the water in fuel sensor.
13. Use a suitable tool in order to install water in fuel sensor (15) to fuel filter base assembly (4). Tighten the fuel sensor to a torque of 2 N·m (18 lb in).
14. Install a new O-ring seal (5) to fuel sampling valve (12).
15. Use a deep socket in order to install fuel sampling valve (12) to fuel filter base assembly (4). Tighten the fuel sampling valve to a torque of 17 N·m (150 lb in).
16. Install dust cap (13) to fuel sampling valve (12).

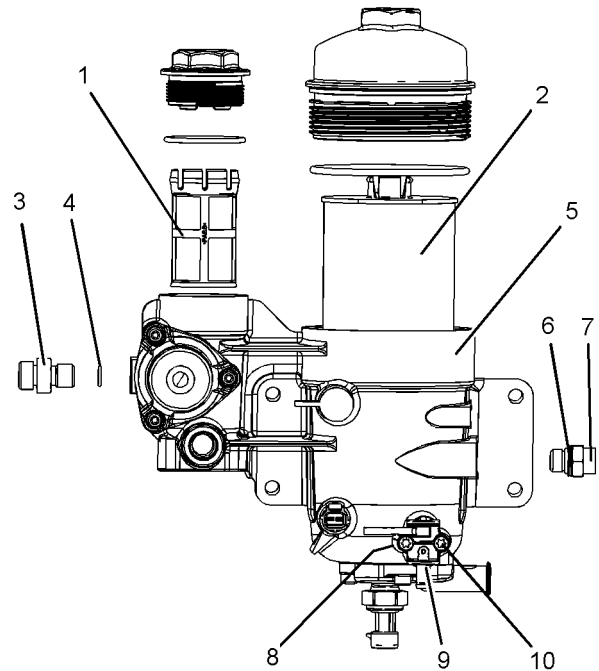


Illustration 9

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17. Install a new O-ring (4) to connection (3).
18. Install connection (3) to fuel filter base (4). Tighten the connection to a torque of 18 N·m (159 lb in).
19. Install a new O-ring (6) to connection (7).
20. Install connection (7) to fuel filter base (4). Tighten the connection to a torque of 18 N·m (159 lb in).
21. Install a new O-ring (8) (not shown) into recess in fuel filter base (4). Position drain valve (9) assembly to fuel filter base (4).
22. Install Torx screws (10) finger tight.
23. Tighten Torx screws (10) to a torque of 5 N·m (44 lb in).
24. Ensure that drain valve (9) move freely after the Torx screws have been tightened.
25. Install a new primary fuel filter (1). Refer to the Operation and Maintenance Manual, "Fuel System Primary Filter - Clean/Inspect/Replace" for the correct procedure.
26. Install a new secondary fuel filter (2). Refer to the Operation and Maintenance Manual, "Fuel System Secondary Filter - Replace" for the correct procedure.

End By:

- a. Install the fuel filter base. Refer to Disassembly and Assembly, "Fuel Filter Base - Install".

i04640250

Fuel Filter Base - Install (1606A and 1606D engines)

Installation Procedure

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

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.

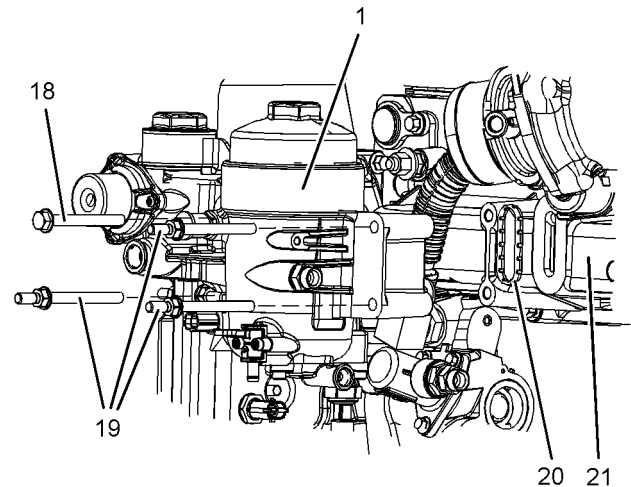


Illustration 10

g03158357

2. Position a new gasket seal (20) into the recess of fuel filter base (1).
3. Position fuel filter base (1) onto inlet manifold (21).
4. Install bolt (18) and stud bolts (19) to fuel filter base (1). Support the fuel filter base as the bolts are installed.

Note: Ensure that the different length bolts and the different types of bolts are installed to the bolts original position.

5. Tighten bolt (18) and stud bolts (19) to a torque of 31 N·m (274 lb in).

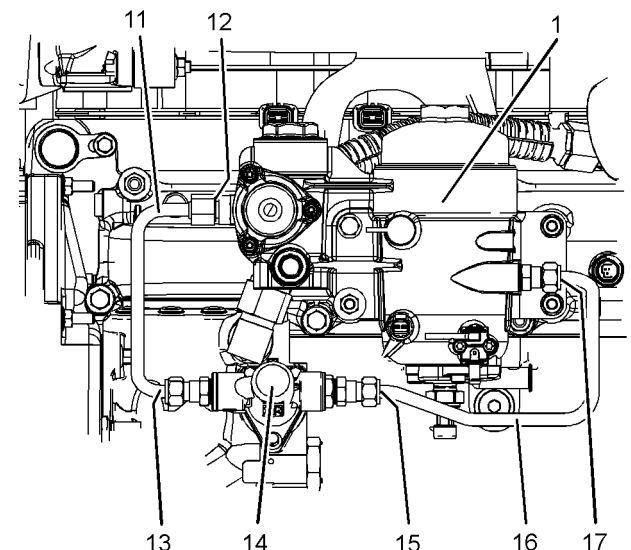


Illustration 11

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6. Remove the caps from the connections on fuel filter base (1) and fuel lift pump (14).
7. Position a new O-ring seal (12) (not shown) onto the connection on fuel filter base (1).
8. Remove the caps from tube assembly (11).
9. Install a new seal (13) (not shown) to tube assembly (11).
10. Connect tube assembly (11) to fuel filter base (1) and fuel lift pump (14).
11. Tighten tube nut for tube assembly (11) on fuel filter base (1) to a torque of 31 N·m (22 lb ft).
12. Tighten tube nut on tube assembly (11) to a torque of 18 N·m (159 lb in).
13. Remove the caps from the connections on fuel filter base (1) and fuel lift pump (14).
14. Remove the caps from tube assembly (16).
15. Install new seal (15) (not shown) and new seal (17) (not shown) to tube assembly (16).
16. Connect tube assembly (16) to fuel filter base (1) and fuel lift pump (14).
17. Tighten tube nuts on tube assembly (16) to a torque of 18 N·m (159 lb in).
20. Remove the caps from fuel hose assembly and the return connection (10) on fuel filter base (1).
21. Connect the fuel hose assembly onto return connection (10) on fuel filter base (1).
22. Position harness assembly (5) onto the stud bolt on fuel filter base (1). Install nut (4) and tighten the nut to a torque of 18 N·m (159 lb in). Ensure that harness assembly (5) is not strained or twisted as the nut are tightened.
23. Connect harness assembly (6) onto the water in fuel sensor (7) (not shown).
24. Connect harness assembly (8) onto fuel pressure sensor (9).
25. If necessary, install hose assembly to inlet connection (2). Securely tighten hose clamps.
26. Turn the battery disconnect switch to the ON position.
27. Turn the fuel supply to the ON position.

End By:

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

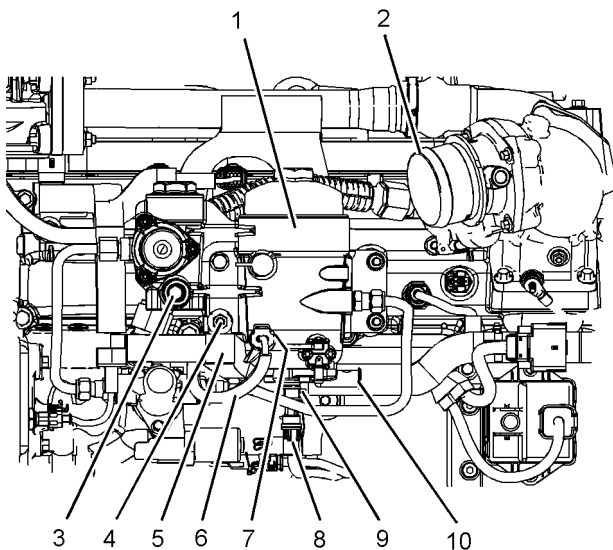


Illustration 12

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18. Remove the caps from the fuel hose assembly and inlet connection (3) on fuel filter base (1).
19. Connect the fuel hose assembly onto inlet connection (3) on fuel filter base (1).

i04893431

Switch (Water in Fuel) - Remove and Install (1606A and 1606D Engines)

Removal Procedure

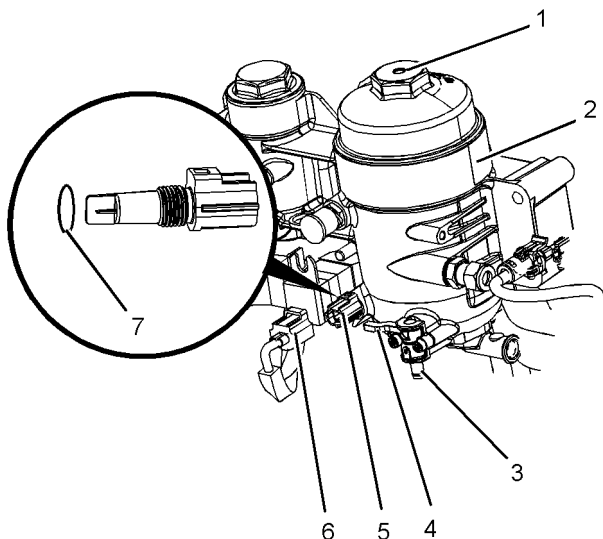


Illustration 13

g03151157

1. Ensure that fuel filter base (2) is clean and free from dirt.
2. Attach a suitable tube onto drain (3). Loosen cap (1) on fuel filter base (2) in order to allow atmospheric pressure to act upon the fuel. Rotate the cap three and a half turns in order to allow the vent hole to be accessed.
3. Open drain valve (4) and drain fuel from fuel filter base (2). Close drain valve (4).
4. Tighten cap (1) to a torque of 25 N·m (221 lb in)
5. Disconnect harness assembly (6) from switch (5).
6. Use a suitable tool in order to remove switch (5) from fuel filter base (2).
7. Remove O ring seal (7) from switch (5).

Installation Procedure

1. Install a new O ring seal (7) onto switch (5).
2. Use a suitable tool in order to install switch (5) into fuel filter base (2).
3. Tighten switch (5) to a torque of 2 N·m (17 lb in).

4. Connect harness assembly (6) to switch (5).

End By:

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

i04640253

Fuel Transfer Pump - Remove (1606A and 1606D Engines)

Removal Procedure

Table 2

Required Tools			
Tool	Part Number	Part Description	Qty
A	29990075	Capping Kit	1

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.

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

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.

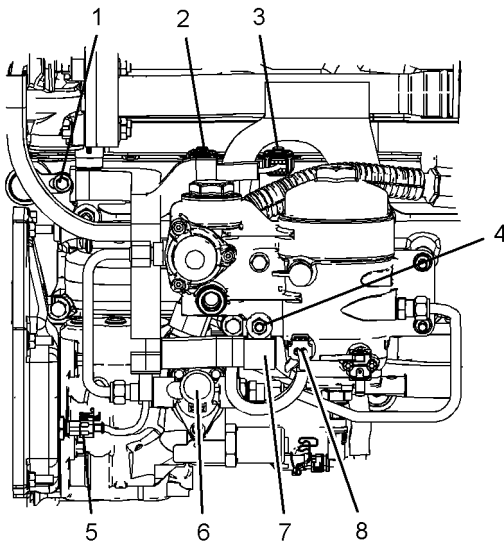


Illustration 14

g03175857

3. Place a suitable container below fuel transfer pump (6) in order to catch any fuel that might be spilled.
4. Slide the locking tab into the unlocked position. Disconnect harness assembly (2).
5. Slide the locking tab into the unlocked position. Disconnect harness assembly (3).
6. Remove nut (1) and nut (4) from harness assembly (7).
7. Disconnect harness assembly (8) from the water in fuel sensor.
8. Slide the locking tab into the unlocked position. Disconnect harness assembly (5) from the engine oil temperature sensor.
9. Position harness assembly (7) away from transfer pump (6).

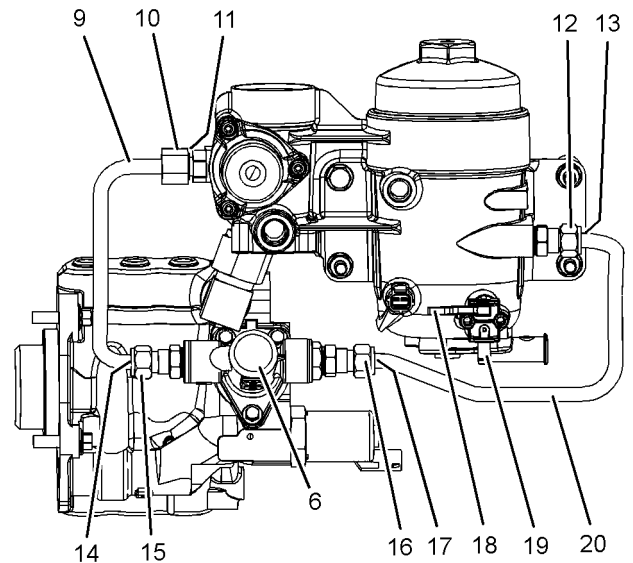


Illustration 15

g03176033

10. Attach a suitable tube onto drain (19). Loosen the cap on the fuel filter base in order to allow atmospheric pressure to act upon the fuel. Rotate the cap three and a half turns in order to allow the vent hole to be accessed.
11. Open drain valve (18) and drain the fuel from the fuel filter base. Close drain valve (18).
12. Tighten the cap on the fuel filter base to a torque of 25 N·m (221 lb in)
13. Loosen tube nut (10) and tube nut (15) on tube assembly (9) and drain the fuel from the system.
14. Loosen tube nut (12) and tube nut (16) on tube assembly (20) and drain the fuel from the system.
15. Remove tube assembly (9) and tube assembly (20).
16. Remove O-ring seal (11) (not shown) from the connection in the fuel filter base. Use Tooling (A) in order to cap the connection in the fuel filter base.
17. Use Tooling (A) in order to cap the connections in fuel transfer pump (6).
18. Remove seal (14) (not shown) from tube assembly (9). Use Tooling (A) in order to cap tube assembly (9)
19. Remove seal (13) (not shown) and seal (17) (not shown) from tube assembly (20).
20. Use Tooling (A) in order to cap tube assembly (20)

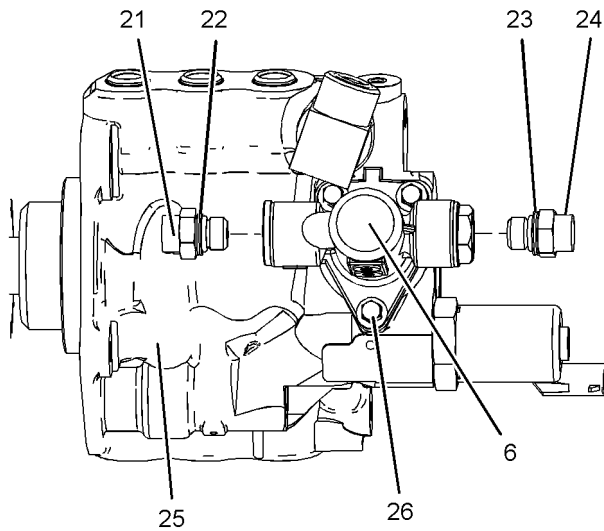


Illustration 16

g03176216

21. If necessary, follow Step 21.a through Step 21.f in order to remove connections from fuel transfer pump (6).
 - a. Remove connection (21) from fuel transfer pump (6).
 - b. Remove O-ring seal (22) from connection (18).
 - c. Use Tooling (A) in order to cap connection (21).
 - d. Remove connection (24) from fuel transfer pump (6).
 - e. Remove O-ring seal (23) from connection (24).
 - f. Use Tooling (A) in order to cap connection (24).
22. Loosen evenly bolts (26) and remove bolts (26) from transfer pump (6).
23. Remove transfer pump (6) from high-pressure oil pump (25)
24. Use Tooling (A) in order to plug high-pressure oil pump (25).

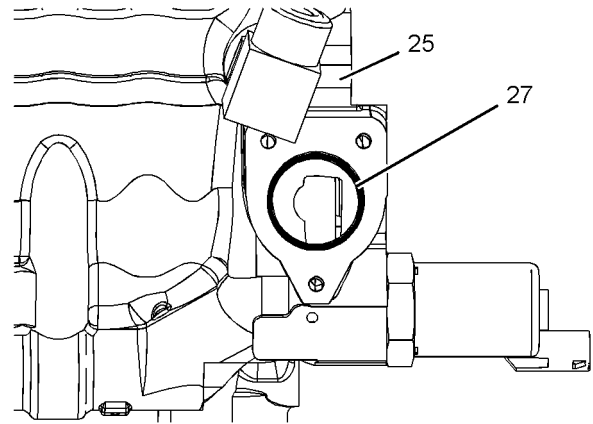


Illustration 17

g03176276

25. Remove O ring seal (27) from high-pressure oil pump (25).

i04640255

Fuel Transfer Pump - Install (1606A and 1606D Engines)

Installation Procedure

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

1. Ensure that the fuel transfer pump is clean and free from damage.

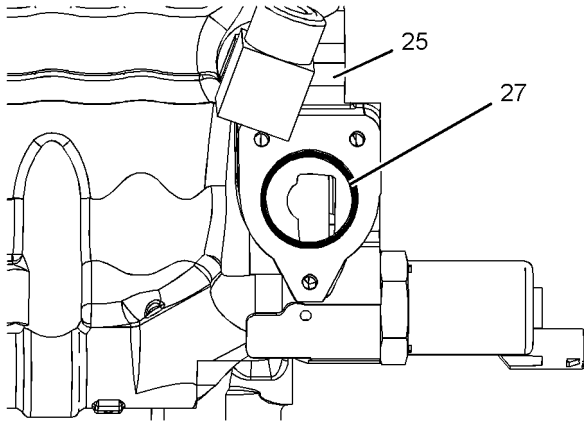


Illustration 18

g03176276

2. Remove the plug from high-pressure oil pump (25).
3. Position a new O-ring seal (27) into the recess of high-pressure oil pump (25).

Note: Ensure that the O-ring seal is correctly seated into the recess of the high-pressure oil pump.

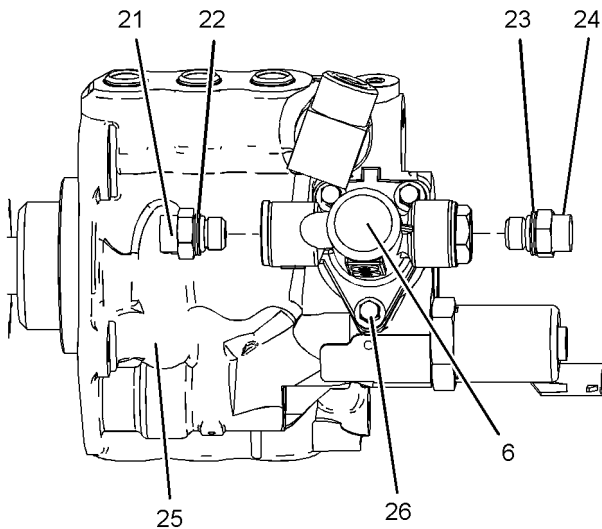


Illustration 19

g03176216

4. Position transfer pump (6) onto high-pressure oil pump (25). Install bolts (26) and tighten the bolts down evenly.
5. Tighten bolts (26) to a torque of 13 N·m (115 lb in).
6. Install a new O ring seal (22) to connection (21).

7. Install the connection to transfer pump (6). Tighten connection (21) to a torque of 18 N·m (159 lb in).
8. Install a new O ring seal (23) to connection (24).
9. Install the connection to transfer pump (6). Tighten connection (24) to a torque of 18 N·m (159 lb in).

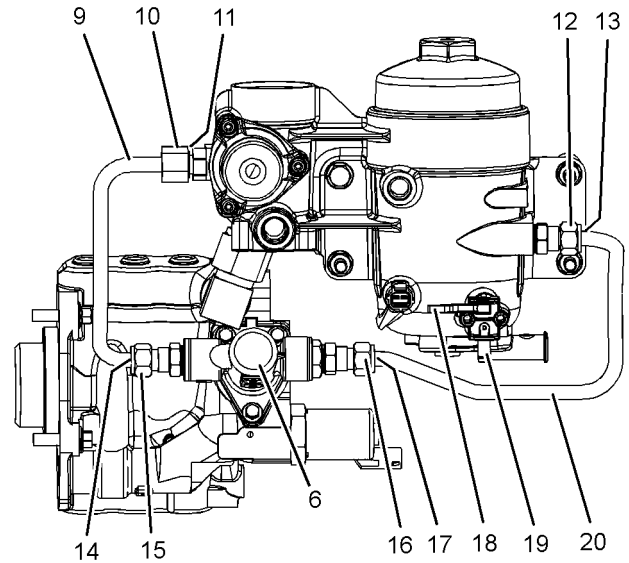


Illustration 20

g03176033

10. Ensure that tube assembly (9) and tube assembly (20) are clean, free damage, and free from restriction.
11. Remove the cap from connection on the fuel filter base. Install a new O-ring seal (11) (not shown) to the connection.
12. Remove the caps from tube assembly (9). Install a new seal (14) (not shown) to the tube assembly.
13. Install tube assembly (9) to transfer pump (6). Tighten tube nut (10) and tube nut (15) for tube assembly (9) hand tight.
14. Remove caps from tube assembly (20). Install new seal (14) (not shown) and new seal (14) (not shown) to the tube assembly.
15. Install tube assembly (20) to transfer pump (6). Tighten tube nut (12) and tube nut (16) for tube assembly (20) hand tight.
16. Tighten tube nut (10) to a torque of 31 N·m (22 lb ft).
17. Tighten tube nut (15) to a torque of 18 N·m (159 lb in).
18. Tighten tube nut (12) and tube nut (16) to a torque of 18 N·m (159 lb in).

i04893417

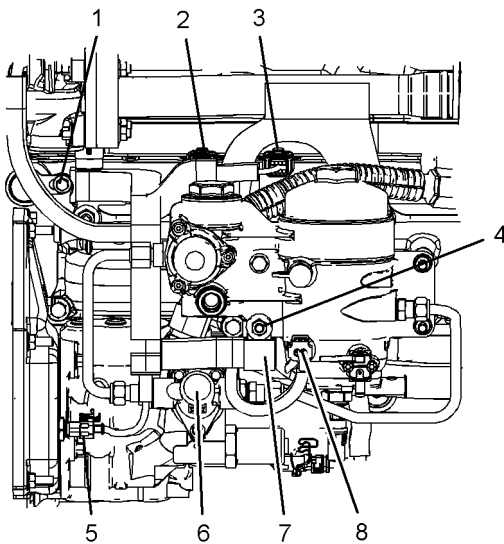


Illustration 21

g03175857

19. Position harness assembly (7) onto the stud bolts.
20. Install nut (1) and nut (4) hand tight.
21. Connect harness assembly (5) to the engine oil temperature sensor. Slide the locking tab into the locked position.
22. Connect harness assembly (8) to the water in fuel sensor.
23. Tighten nut (1) to a torque of 18 N·m (159 lb in). Ensure that harness assembly (7) is not strained or twisted as the nut are tightened.
24. Tighten nut (4) to a torque of 18 N·m (159 lb in). Ensure that harness assembly (7) is not strained or twisted as the nut are tightened.
25. Connect harness assembly (2) and harness assembly (3). Slide the locking tabs into the locked position.
26. Prime the fuel system. Refer to Operation and Maintenance Manual, "Fuel System - Prime".

Exhaust Gas Recirculation Cooler - Remove and Install (1606D Engines)

Removal Procedure

1. 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.

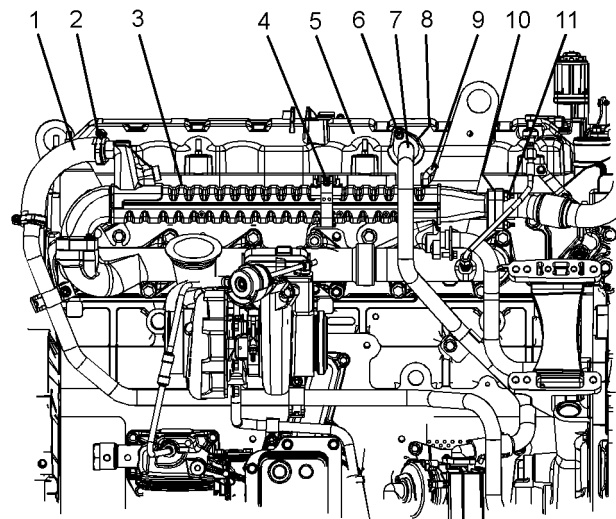


Illustration 22

g03075897

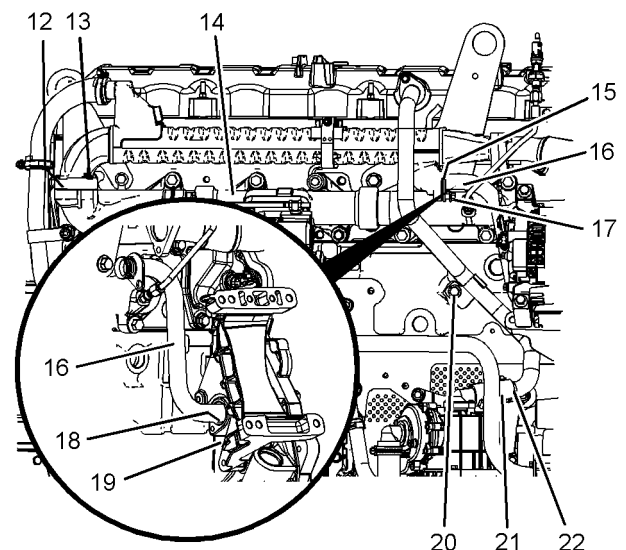


Illustration 23

g03075903

2. Loosen hose clamp (2) and disconnect hose assembly (1) from exhaust gas recirculation cooler (3).
3. Loosen the hose clamp for hose assembly (9).
4. Remove hose assembly (9) from exhaust gas recirculation cooler (3).
5. Remove bolt (6) and bolt (20) from tube assembly (7).
6. Loosen hose clamp (22) for tube assembly (7).
7. Remove tube assembly (7) from valve mechanism cover (5) and hose assembly (21). Remove O-ring seal (8) (not shown) from tube assembly (7).
8. Prior to and during removal of bolts (11) apply releasing fluid to the bolts.
9. Remove bolts (11) and remove gasket (10) (not shown).
10. Prior to and during removal of bolts (13) apply releasing fluid to the bolts.
11. Remove bolts (13).
12. Remove the nut from the assembly of clamp (4). Position clamp (4) away from exhaust gas recirculation cooler (3).
13. Remove the clamp plate from exhaust gas recirculation cooler (3).
14. Remove bolt (17) from tube assembly (16).
15. Remove exhaust gas recirculation cooler (3) from exhaust manifold (14) and tube assembly (16).
16. Remove gasket (12) (not shown) from exhaust manifold (14).
17. Remove tube assembly (16) from front housing (19).
18. Remove O-ring seal (15) (not shown) from O-ring seal (18) (not shown) from tube assembly (16).

Installation Procedure

Table 3

Required Tools			
Tool	Part Number	Part Description	Qty
A	CV60889	Anti-Seize Compound	1

1. Ensure that the exhaust gas recirculation cooler is clean and free from restriction. Refer to Systems Operation, Testing and Adjusting, "Exhaust Cooler (NRS) - Test" for the correct procedure.

Note: The exhaust gas recirculation cooler should not be disassembled or cleaned.

2. Ensure that the exhaust gas recirculation cooler is free from wear and damage. If necessary, replace exhaust gas recirculation cooler as an assembly.
3. Ensure that all tube assemblies are clean and free from restriction, wear, and damage. If necessary, replace any components that are worn or damaged.

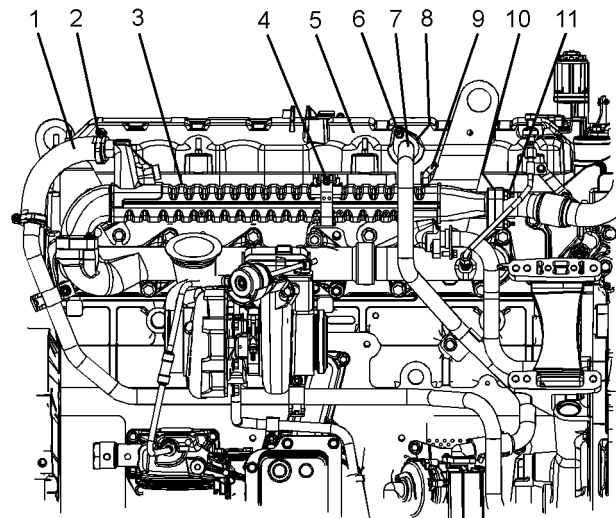


Illustration 24

g03075897

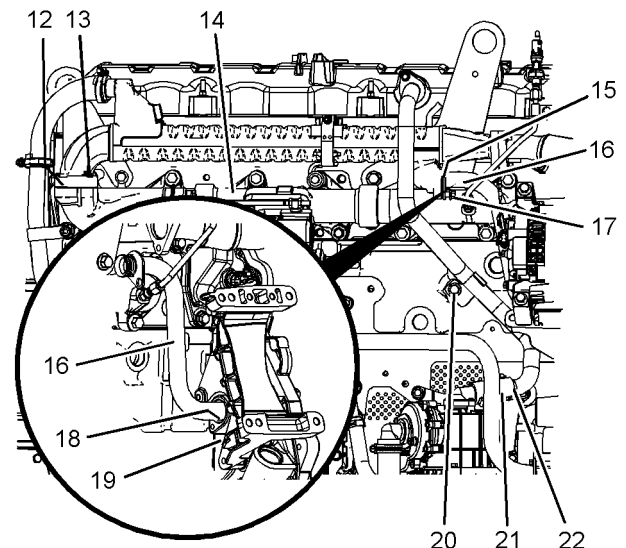


Illustration 25

g03075903

4. Install a new O-ring seal (15) (not shown) and a new O-ring seal (18) (not shown) to tube assembly (16).

5. Install tube assembly (16) to front housing (19). Ensure that the tube assembly is correctly orientated and is fully installed to the front housing
6. Position a new gasket (12) (not shown) onto exhaust gas recirculation cooler (3). Ensure that the gasket is correctly seated onto the exhaust gas recirculation cooler.
7. Position exhaust gas recirculation cooler (3) onto exhaust manifold (14) and install tube assembly (16) into exhaust gas recirculation cooler (3).

Note: Ensure that the exhaust gas recirculation cooler is correctly positioned onto the exhaust manifold. Ensure that the tube assembly is correctly seated into the exhaust gas recirculation cooler.

8. Apply Tooling (A) to the threads of new bolts (13). Install bolts (13) hand tight.
9. Position a new gasket (10) (not shown) between exhaust gas recirculation cooler (3) and the tube assembly.
10. Apply Tooling (A) to the threads of new bolts (11). Install bolts (11) hand tight.
11. Apply Tooling (A) to the threads of new bolts (17). Ensure that the clamp for tube assembly (16) is correctly located into exhaust gas recirculation cooler (3)
12. Install bolts (17) hand tight.
13. Position the assembly of clamp (4) onto exhaust gas recirculation cooler (3).

Note: Ensure that the clamp is correctly located onto the exhaust gas recirculation cooler.

14. Apply Tooling (A) to the threads of the nut for clamp (4). Install the nut for clamp (4) hand tight.
15. Tighten bolts (13) to a torque of 31 N·m (274 lb in).
16. Tighten bolts (11) to a torque of 24 N·m (212 lb in).
17. Tighten bolt (17) to a torque of 31 N·m (274 lb in).
18. Tighten the nut for clamp (4) to a torque of 8 N·m (71 lb in).
19. Connect hose assembly (1) to exhaust gas recirculation cooler (3). Tighten hose clamp (2) securely.
20. Install hose assembly (9) to exhaust gas recirculation cooler (3).
21. Tighten the hose clamp for hose assembly (9) securely.

22. Install a new O-ring seal (8) (not shown) to tube assembly (7).
23. Install tube assembly (7) to valve mechanism cover (5) and hose assembly (19). Ensure that the tube assembly is correctly seated in to valve mechanism cover (5) and hose assembly (19).
24. Install bolt (6) and bolt (18) to tube assembly (7) hand tight.
25. Tighten bolt (6) to a torque of 13 N·m (115 lb in).
26. Tighten bolt (18) to a torque of 62 N·m (45 lb ft).
27. Securely tighten hose clamp (20) for tube assembly (7).
28. Fill the cooling system with coolant. Refer to Operation and Maintenance Manual, "Cooling System Coolant - Change" for the correct procedure.

i04640256

Electronic Unit Injector - Remove (1606A and 1606D Engines)

Removal Procedure

Table 4

Required Tools			
Tool	Part Number	Part Description	Qty
A	27610307	T40 Torx Socket	1
B	29990075	Capping Kit	1

Start By:

- a. Remove the unit injector actuation oil manifold. Refer to Disassembly and Assembly, "Unit Injector Actuation Oil Manifold - Remove and Install".

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

1. Turn the fuel supply to the OFF position.

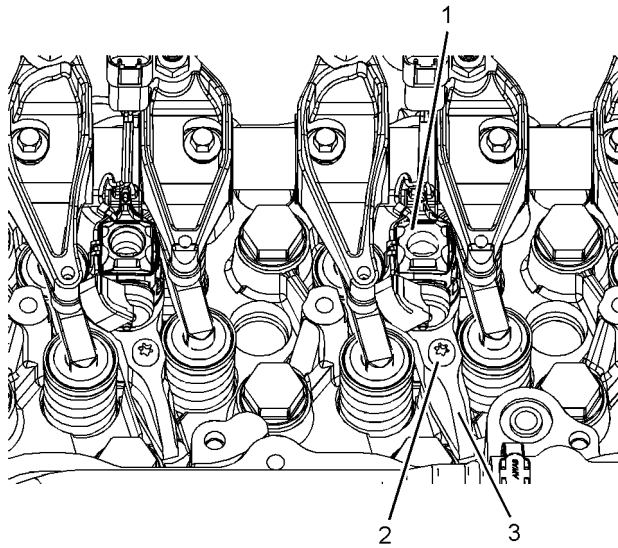


Illustration 26

g03174696

2. Place an identification mark on electronic unit injector (1) for installation purposes. Each electronic unit injector must be reinstalled in the original location in the cylinder head.
3. Use Tooling (A) to loosen fully Torx bolt (2). As Torx bolt (2) is loosened, the electronic unit injector will self extract from the cylinder head.
4. Remove electronic unit injector (1) and clamp assembly (3) from the cylinder head.

Note: Always handle electronic unit injector with care.

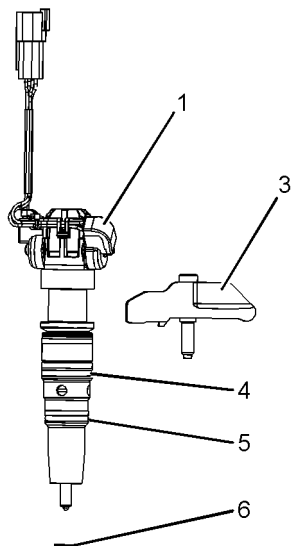


Illustration 27

g03174716

5. Remove clamp assembly (3) from electronic unit injector (1).

6. Remove O-ring seal (4) and O-ring seal (5) from electronic unit injector (1).
 7. Use a suitable tool in order to remove sealing washer (6) from electronic unit injector (1). Ensure that the sealing washer is removed from the cylinder head.
- Note:** Ensure that the nozzle for the electronic unit injector is not damaged in any way on removal of the sealing washer.
8. Use Tooling (C) in order to cap and plug electronic unit injector (1).
 9. If necessary, follow Step 1 through Step 8 in order to remove the remaining electronic unit injectors.

i04640270

Electronic Unit Injector - Install (1606A and 1606D Engines)

Installation Procedure

Table 5

Required Tools			
Tool	Part Number	Part Description	Qty
D	GE50028	Vacuum Pump	1
	GE50046	Fluid Sampling Bottle	1
	GE50030	Tube 7.9 mm (0.31 inch) OD	1
E	-	Large Bore Brush	1

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

1. Use Tooling (E) to clean the carbon deposit from the inside of the electronic unit injector sleeve.
2. Use Tooling (D) to remove the fuel and oil from the cylinder. Evacuate as much fuel and oil as possible from the cylinder before installing the electronic unit injector. Several evacuations may be necessary.

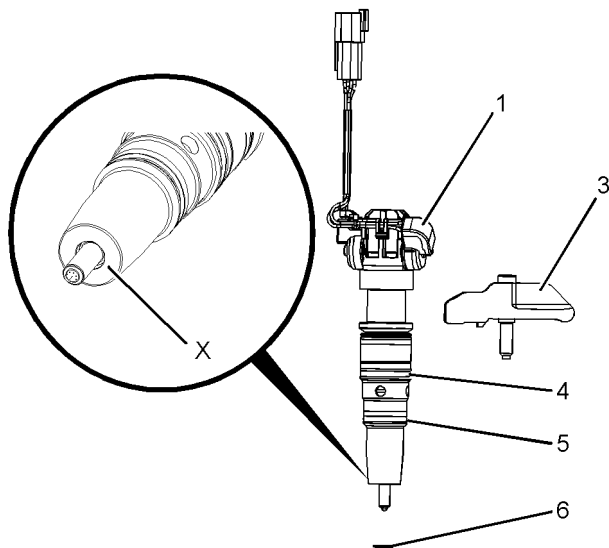


Illustration 28

g03174796

3. Ensure that the seat Area (X) of electronic unit injector (1) is clean and free from carbon.
4. Install a new O-ring seal (4) and a new O-ring seal (5) onto the electronic unit injector.
5. Install a new sealing washer (6) onto electronic unit injector (1).

Note: Ensure that the nozzle for the electronic unit injector is not damaged in any way as a new sealing washer is installed.

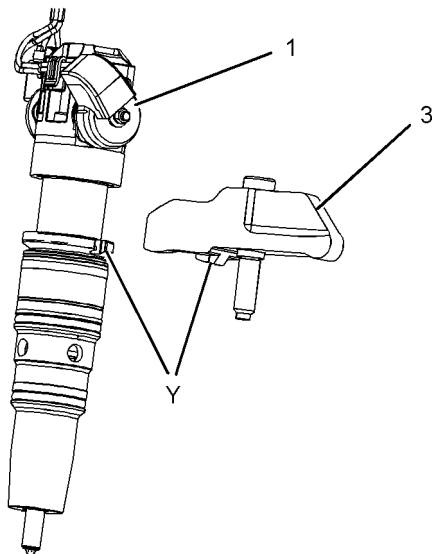


Illustration 29

g03174836

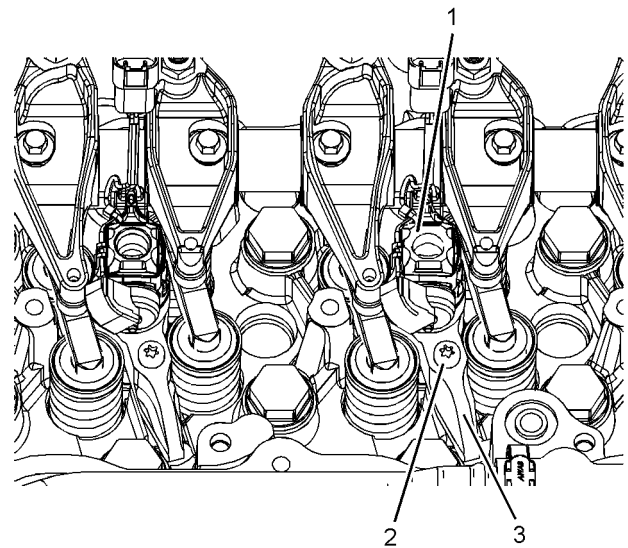


Illustration 30

g03174696

6. Position clamp assembly (3) on to electronic unit injector (1). Ensure that the clamp assembly is correctly located into the electronic unit injector in Position (Y).
7. Install electronic unit injector (2) into the original location in the cylinder head.
8. Use Tooling (A) in order to tighten Torx bolt (2) hand tight.
9. Tighten Torx bolt (4) to a torque of 41 N·m (30 lb ft).
10. If necessary, repeat Step 1 through Step 9 in order to install the remaining electronic unit injectors (2).
11. Turn the fuel supply to the ON position.
12. Install the unit injector actuation oil manifold. Refer to Disassembly and Assembly, "Unit Injector Actuation Oil Manifold - Remove and Install".
13. Remove the air from the fuel system. Refer to Systems Operation, Testing and Adjusting, "Fuel System - Prime".

i04640271

Electronic Unit Injector Sleeve - Remove (1606A and 1606D Engines)

Removal Procedure

Table 6

Required Tools			
Tool	Part Number	Part Description	Qty
A	27610362	(1" x 8 TPI UNC) Thread Tap	1
		Guide	1
		Adapter	1
B	27610311	Slide Hammer Puller	1
C	-	(5/8"X 18 TPI UNF) by 4" Long Stud	1

Start By:

- a. Remove the electronic unit injectors. Refer to Disassembly and Assembly, "Electronic Unit Injector - Remove".

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

1. Drain the coolant from the engine. Refer to Operation and Maintenance Manual, "Cooling System Coolant - Change".

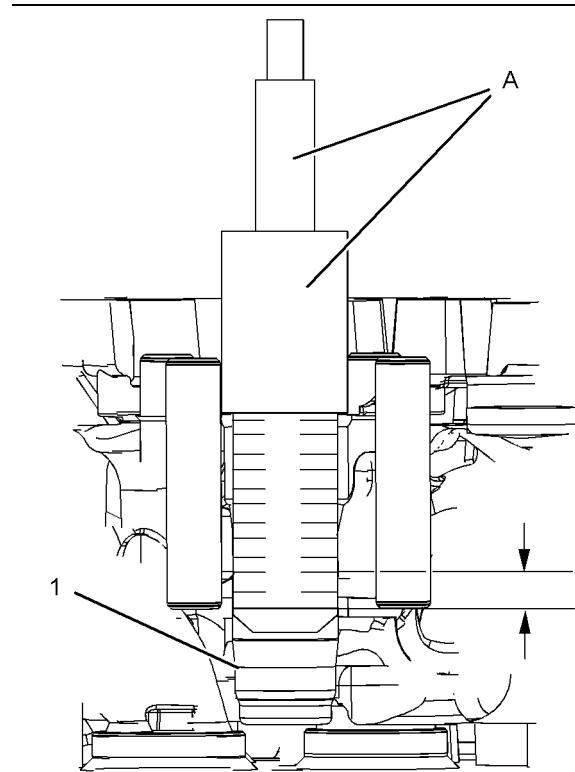


Illustration 31

g03175098

2. Plugging of an electronic unit injector sleeve (1) will be necessary in order to stop debris entering the cylinder bore. Plugging of the electronic unit injector sleeve will only be required if the cylinder head is still installed to the engine.
3. Apply lubricant to the thread tap of Tooling (A). Use the guide and the threaded tap of Tooling (A) in order to cut a thread in electronic unit injector sleeve (1). Screw in the thread tap of Tooling (A) into the electronic unit injector sleeve by 19 mm (0.75 inch).
4. Remove both the guide and the thread tap of Tooling (A) from the electronic unit injector sleeve.

i04640272

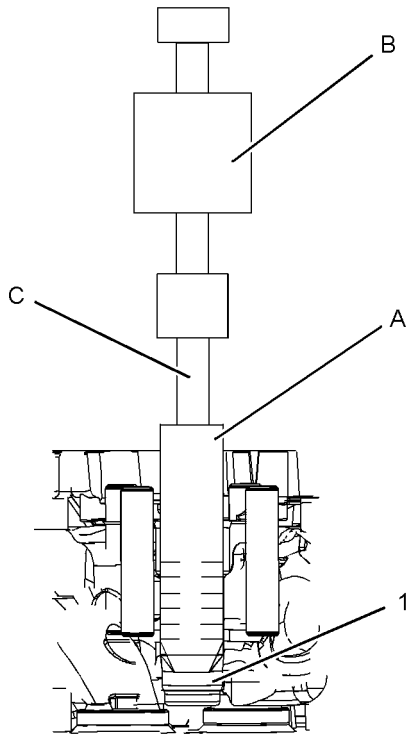


Illustration 32

g03175457

5. Install the adapter of Tooling (A) into electronic unit injector sleeve (1).
6. Install to Tooling (C) to Tooling (A).
7. Install Tooling (B) to Tooling (C).
8. Use Tooling (B), Tooling (C), and Tooling (A) in order to extract electronic unit injector sleeve (1) from the cylinder head.
9. If necessary, follow Step 2 through Step 8 in order to remove the remaining electronic unit injector sleeve (1) from the cylinder head.

Electronic Unit Injector Sleeve - Install (1606A and 1606D Engines)

Installation Procedure

Table 7

Required Tools			
Tool	Part Number	Part Description	Qty
C	27610363	Injector Sleeve Installation Tool	1
D	-	Loctite 620 Retaining Compound	1

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

NOTICE

Ensure that the electronic unit injector sleeve and the cylinder head bore are completely free of oil, dirt, and sealant debris.

1. Use a suitable tool in order to clean the parent bore of the electronic unit injector sleeve in the cylinder head.

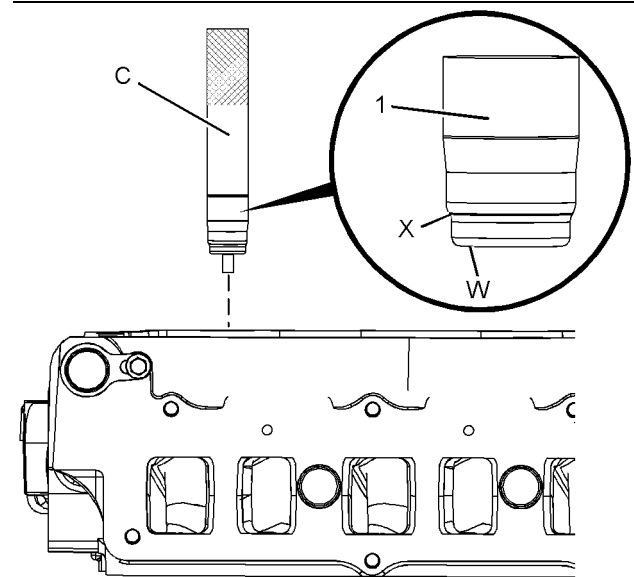


Illustration 33

g03175820

2. Apply a small continuous bead of Tooling (D) to Surface (X) and Surface (W) of electronic unit injector sleeve (1).

Note: Do not apply Tooling (D) to the cylinder head surfaces. Apply Tooling (D) to the electronic unit injector sleeve only.

3. Position Tooling (C) and electronic unit injector sleeve (1) into the cylinder head.
4. Use a suitable driver in order to install Tooling (C) and electronic unit injector sleeve (1) into the cylinder head.

Note: Ensure that the electronic unit injector sleeve is correctly seated in the cylinder head.

5. Remove Tooling (C). Use a clean towel and remove excess Tooling (D). Use a soft nylon brush in order to clean the electronic unit injector sleeve.
6. Ensure that electronic unit injector sleeve (1) is free from damage.
7. If necessary, repeat Step 2 through Step 6 in order to install remaining electronic unit injector sleeve to the cylinder head.
8. Fill the coolant from the engine. Refer to Operation and Maintenance Manual, "Cooling System Coolant - Change".

End By:

- a. Install the electronic unit injectors. Refer to Disassembly and Assembly, "Electronic Unit Injector - Install".

i04964493

Injection Actuation Pressure Control Valve - Remove and Install (Injection Pressure Regulator (IPR) Valve for 1606A and 1606D Engines)

Removal Procedure

Table 8

Required Tools			
Tool	Part Number	Part description	Qty
A	29990075	Capping Kit	1
B	29990076	IPR Valve Socket	1

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

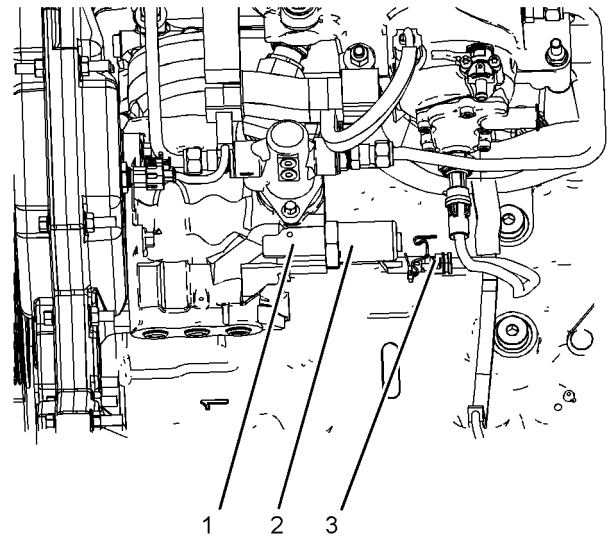


Illustration 34

g03174996

1. Disconnect harness assembly (3) from injection actuation pressure control valve (2).
2. Using tooling (B) in order to remove actuation pressure control valve (2) from unit injector hydraulic pump (1).
3. Use Tooling (A) in order to plug unit injector hydraulic pump (1).

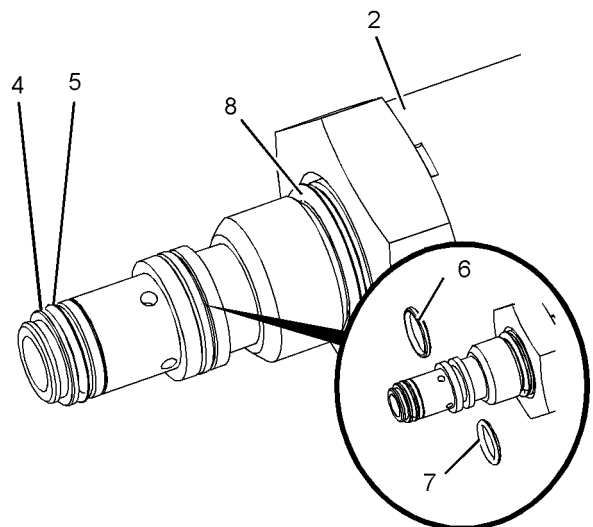


Illustration 35

g03175138

4. Remove O ring (4) and backing ring (5). Remove outer seal (6) and inner O ring seal (7) from injection actuation pressure control valve (2).
5. Remove O ring seal (8) from injection actuation pressure control valve (2).

Installation Procedure

Table 9

Required Tools			
Tool	Part Number	Part description	Qty
B	29990076	IPR Valve Socket	1

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

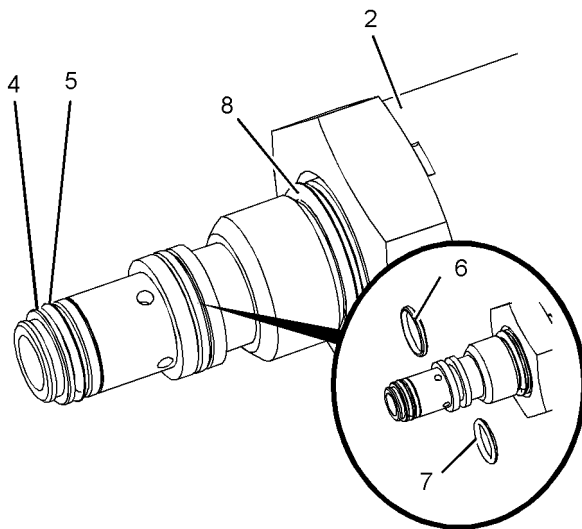


Illustration 36

g03175138

Note: Only stretch the seals the minimum amount during installation.

1. Install a new O ring seal (8) onto injection actuation pressure control valve (2).
2. Install a new inner O ring seal (7) and then install a new outer seal (6) onto injection actuation pressure control valve (2).
3. Install a new backing ring (5) and install a new O ring seal (4) onto injection actuation pressure control valve (2).

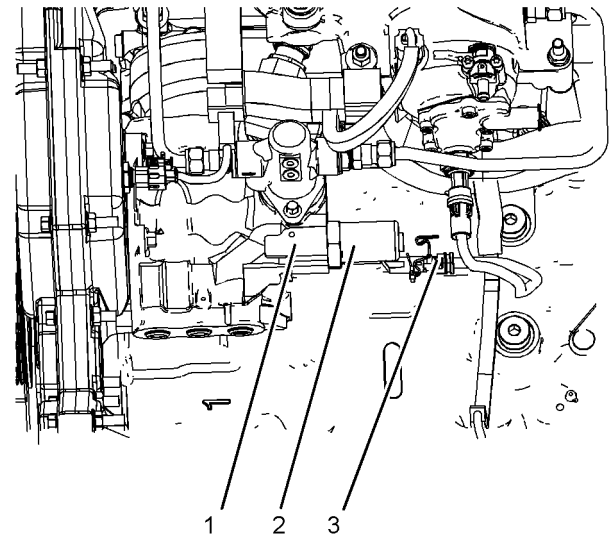


Illustration 37

g03174996

4. Remove the cap from unit injector hydraulic pump (1).
5. Lubricate all O-ring seals for injection actuation pressure control valve (2) with clean engine oil.
6. Install injection actuation pressure control valve (2) into unit injector hydraulic pump (1) by hand.
7. Using tooling (B) tighten actuation pressure control valve (2) to a torque of 50 N·m (36 lb ft).
8. Connect harness assembly (3) to injection actuation pressure control valve (2).

i04893428

Injection Actuation Pressure Control Sensor - Remove and Install (1606A and 1606D Engines)

Removal Procedure

Table 10

Required Tools			
Tool	Part Number	Part Description	Qty
A	29990075	Capping Kit	1

Start By:

- a. Remove the valve mechanism cover. Refer to Disassembly and Assembly, "Valve Mechanism Cover - Remove and Install" for the correct procedure.

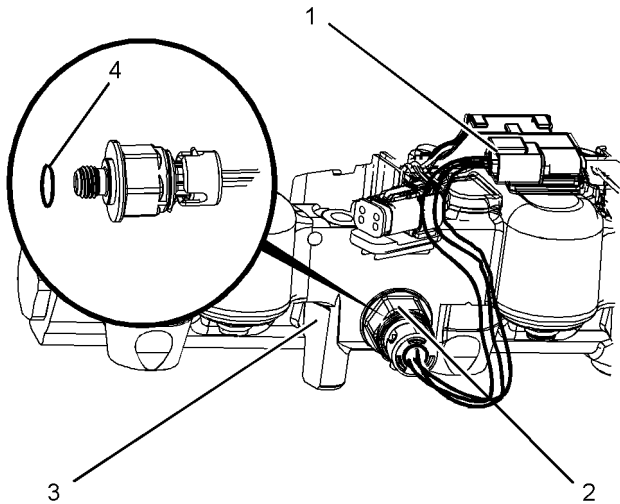


Illustration 38

g03150618

Typical example

1. Disconnect harness assembly (1) from injection actuation pressure control sensor (2).
2. Use a suitable tool in order to remove injection actuation pressure control sensor (2) from unit injector actuation oil manifold (3).
3. Use Tooling (A) in order to cap injection actuation pressure control sensor (2) and plug unit injector actuation oil manifold (3).
4. Remove O-ring seal (4) from injection actuation pressure control sensor (2).

Installation Procedure

1. Ensure that all components are clear and free from damage.
2. Remove the cap from injection actuation pressure control sensor (2).
3. Install a new O-ring seal (4) to injection actuation pressure control sensor (2).
4. Lubricate O-ring seal (4) with clean engine oil.
5. Remove the plug from unit injector actuation oil manifold (3). Install injection actuation pressure control sensor (2) into unit injector actuation oil manifold (3) hand tight.

6. Use a suitable tool in order to tighten injection actuation pressure control sensor (2) to a torque of 18 N·m (159 lb in).
7. Connect harness assembly (1).

End By:

- a. Install the valve mechanism cover. Refer to Disassembly and Assembly, "Valve Mechanism Cover - Remove and Install" for the correct procedure.

i04647301

Unit Injector Hydraulic Pump - Remove and Install (1606A and 1606D Engines)**Removal Procedure**

Table 11

Required Tools			
Tool	Part Number	Part Description	Qty
A	29990075	Capping Kit	1

Start By:

- a. Remove fuel filter base. Refer to Disassembly and Assembly, "Fuel Filter Base - Remove".



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