

Disassembly and Assembly

404F-E22T and 404F-E22TA Industrial Engines

ER1 (Engine)
EQ1 (Engine)

Important Safety Information

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

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

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

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

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



The meaning of this safety alert symbol is as follows:

Attention! Become Alert! Your Safety is Involved.

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

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

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

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



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

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

Table of Contents

Disassembly and Assembly Section

Fuel Filter Base - Remove and Install (Secondary Fuel Filter)	4
Fuel Manifold (Rail) - Remove and Install	7
Fuel Injection Lines - Remove and Install	9
Exhaust Cooler (NRS) - Remove and Install	12
Throttle Valve (Intake Air) - Remove	15
Throttle Valve (Intake Air) - Install	15
Fuel Injection Pump - Remove	16
Fuel Injection Pump - Install	18
Fuel Injection Pump Gear - Remove	20
Fuel Injection Pump Gear - Install	21
Fuel Injector - Remove and Install	22
Turbocharger - Remove	25
Turbocharger - Install	26
Exhaust Gas Recirculation Valve - Remove and Install	29
Clean Emissions Module - Remove and Install	31
Exhaust Manifold - Remove and Install	33
Exhaust Elbow - Remove and Install (Exhaust Elbow between the Turbocharger and the Clean Emissions Module (CEM))	35
Support and Mounting (CEM) - Remove and Install	36
Inlet Manifold - Remove and Install	39
Inlet and Exhaust Valve Springs - Remove and Install	41
Inlet and Exhaust Valves - Remove and Install	43
Engine Oil Line - Remove and Install	46
Engine Oil Cooler - Remove and Install	48
Engine Oil Relief Valve - Remove and Install	50
Engine Oil Pump - Remove	51
Engine Oil Pump - Install	53
Water Pump - Remove and Install	56
Water Temperature Regulator Housing - Remove and Install	59
Engine Lifting Bracket - Remove and Install	61
Flywheel - Remove and Install	63
Crankshaft Rear Seal - Remove and Install	65
Crankshaft Wear Sleeve (Rear) - Remove and Install	67
Flywheel Housing - Remove and Install	69
Crankshaft Pulley - Remove and Install	70
Crankshaft Front Seal - Remove and Install	72
Housing (Front) - Remove	74
Housing (Front) - Install	75
Crankcase Breather - Remove and Install	77
Valve Mechanism Cover - Remove and Install	81
Rocker Shaft and Pushrod - Remove	85
Rocker Shaft - Disassemble	87
Rocker Shaft - Assemble	88
Rocker Shaft and Pushrod - Install	89
Cylinder Head - Remove	91
Cylinder Head - Install	93
Lifter Group - Remove and Install	95
Camshaft - Remove	96
Camshaft - Disassemble	97
Camshaft - Assemble	98
Camshaft - Install	99
Engine Oil Pan - Remove and Install	100
Pistons and Connecting Rods - Remove	101

Pistons and Connecting Rods - Disassemble	102
Pistons and Connecting Rods - Assemble	104
Pistons and Connecting Rods - Install	106
Connecting Rod Bearings - Remove (Connecting Rods in Position)	108
Connecting Rod Bearings - Install (Connecting Rods in Position)	109
Crankshaft Main Bearings - Remove	110
Crankshaft Main Bearings - Install	112
Crankshaft - Remove	115
Crankshaft - Install	116
Crankshaft Gear - Remove and Install	117
Bearing Clearance - Check	119
Primary Engine Speed/Timing Sensor - Remove and Install	120
Secondary Engine Speed/Timing Sensor - Remove and Install	121
Coolant Temperature Sensor - Remove and Install	122
Engine Oil Pressure Switch - Remove and Install	123
Temperature Sensor (Exhaust) - Remove and Install	124
Temperature Sensor (Catalyst Inlet) - Remove and Install	125
Boost Pressure Sensor - Remove and Install	125
Inlet Manifold Temperature Sensor - Remove and Install	126
Glow Plugs - Remove and Install	127
V-Belts - Remove and Install	128
Alternator - Remove and Install	130
Electric Starting Motor - Remove and Install	131

Index Section

Index	133
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Disassembly and Assembly Section

i06590688

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

Removal Procedure

NOTICE

Do not allow dirt to enter the fuel system. Thoroughly clean the area around a fuel system component that will be disconnected. Fit a suitable cover over disconnected fuel system component.

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.

Note: Place identification marks on all hoses for installation purposes. Plug all hoses and all the ports in the fuel filter base. Plugging hoses and ports helps prevent fluid loss, and plugging hoses and ports helps to keep contaminants from entering the fuel system.

Table 1

Required Tools			
Tool	Part Number	Part Description	Qty
A	T402254	Capping Kit	1

1. Turn the fuel supply to the OFF position.

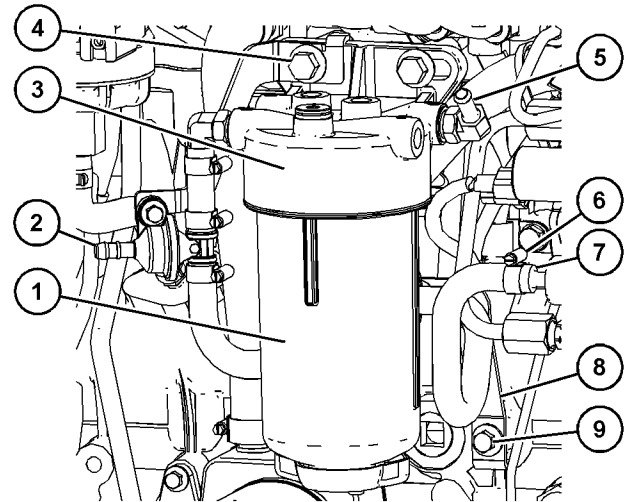


Illustration 1

g06026501

2. Disconnect the inlet hose from inlet elbow (5).
3. Install Tooling (A) to inlet elbow (5) and cap to the inlet hose.
4. Loosen hose clamp (6) and disconnect hose (7) from the high-pressure fuel pump.
5. Install Tooling (A) to hose (7) and cap to the high-pressure fuel pump connection.
6. Remove bolt (9) from bracket (8).
7. If necessary, remove fuel filter element (1). Refer to Operations and Maintenance Manual, "Fuel System Filter - Replace" for the correct procedure.
8. Loosen the hose clamp on the fuel return hose (not shown) and disconnect the hose from Transfer Pump Inlet Regulator (TPIR) (2).
9. Install plug to the fuel return hose and cap to TPIR (2).

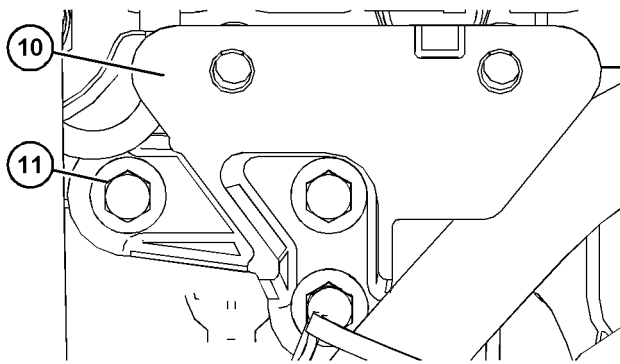


Illustration 2

g06026542

10. Remove bolts (4) and remove fuel filter base assembly (3) from bracket (10).

11. If necessary, remove bolts (11) and remove mounting bracket (10).

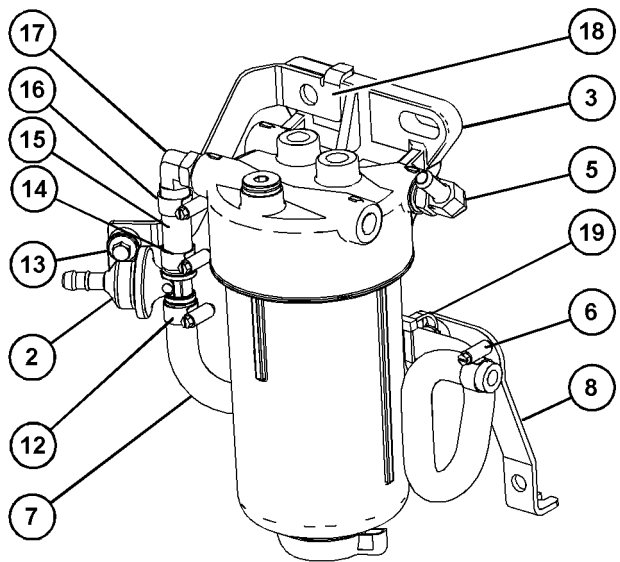


Illustration 3

g06026571

12. If necessary, follow Step 12.a through Step 12.f to disassemble the fuel filter base.

a. Cut cable strap (19) and remove bracket (8) from hose (7).

b. Loosen hose clamp (12) and remove hose (7) from TPIR (2). If necessary, remove hose clamp (12) and hose clamp (6) from hose (7). Cap the hose.

c. Remove bolt (13) and remove bracket (18).

Note: Before completing the following step, note the position of the TPIR.

d. Loosen hose clamp (14) and remove TPIR (2). Use Tooling (A) to cap the ports on the TPIR

e. Loosen hose clamp (16) and remove hose (15) from elbow (17). If necessary, remove hose clamp (14) and hose clamp (16) from hose (15). Cap the hose.

Note: Before completing the following step, note the position of the elbows.

f. Remove elbow (17) and elbow (5) from fuel filter base (3). Use Tooling (A) to cap the elbows and plug the open ports on the fuel filter base.

Installation Procedure

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

1. Ensure that the fuel filter base and the brackets are clean and free from damage. If necessary, replace any component that is worn or damaged.

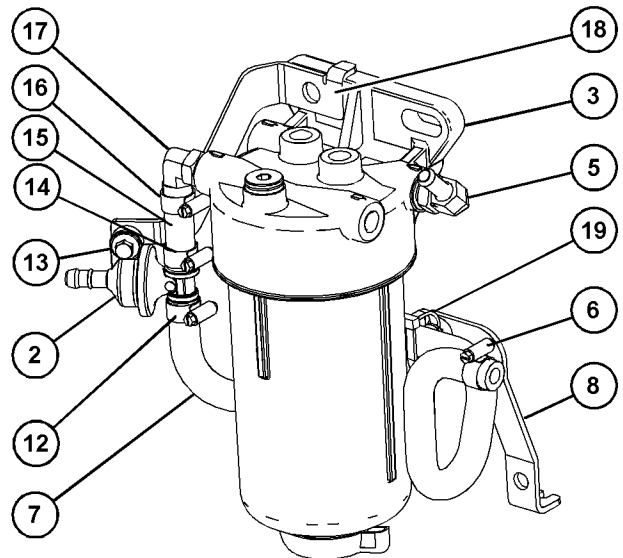


Illustration 4

g06026571

2. Position bracket (8) on the cylinder block and install bolt (9). Tighten the bolt to a torque of 26 N·m (230 lb in).

3. If necessary, follow Step 3.a through Step 3.i to assemble the fuel filter base.

a. Remove the plug from fuel filter base (3) and remove the cap from elbow (17).

Disassembly and Assembly Section

Note: During the following Step, ensure that the elbow is aligned as noted during removal.

- b. Install elbow (17) to fuel filter base (3) and tighten the elbow to a torque of 24 N·m (212 lb in).
- c. Remove the plug from fuel filter base (3) and remove the cap from elbow (5).

Note: During the following Step, ensure that the elbow is aligned as noted during removal.

- d. Install elbow (5) to fuel filter base (3) and tighten the elbow to a torque of 24 N·m (212 lb in).
- e. Assemble hose clamp (16) and hose clamp (14) to hose (15). Install the hose assembly on elbow (17) and tighten hose clamp (16) to a torque of 7.5 N·m (66 lb in).

Note: During the following Step, ensure that the TPIR is aligned as noted during removal.

- f. Remove the caps from Transfer Pump Inlet Regulator (TPIR) (2) and install the TPIR on hose (15). Tighten hose clamp (14) to a torque of 7.5 N·m (66 lb in).
- g. Assemble bracket (18) to fuel filter base (3) and align the bracket with the TPIR mount. Install bolt (13) and tighten the bolt to a torque of 10 N·m (89 lb in).
- h. Assemble hose clamp (12) and hose clamp (6) to hose (7). Install the hose assembly on TPIR (2) and tighten hose clamp (12) to a torque of 7.5 N·m (66 lb in).
- i. Assemble bracket (8) to hose (7) and secure with new cable strap (19).

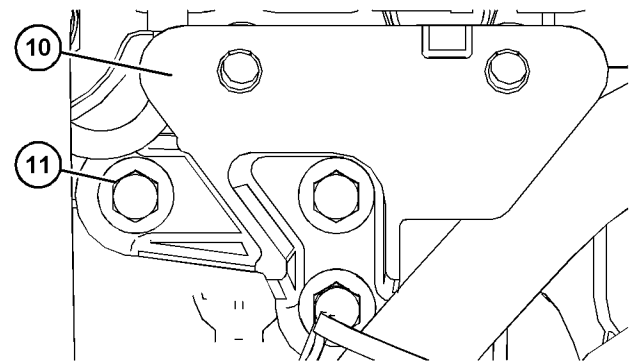


Illustration 5

g06026542

4. If necessary, position bracket (10) onto the cylinder block. Align the hose support clip with the lower bolt hole and install bolts (11) to the bracket. Tighten the bolts to a torque of 26 N·m (230 lb in).

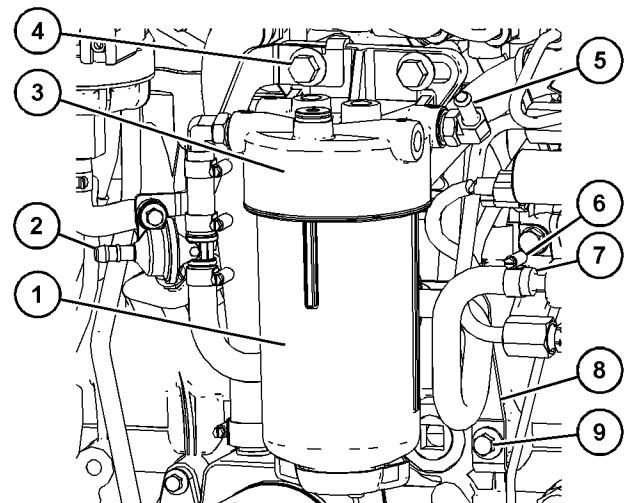


Illustration 6

g06026501

5. Position fuel filter base (3) onto mounting bracket (10).
6. Install bolts (4) to fuel filter base (3). Tighten bolts (4) to a torque of 50 N·m (37 lb ft).
7. If necessary, install a new fuel filter element (1). Refer to Operations and Maintenance Manual, "Fuel System Filter - Replace" for the correct procedure.
8. Remove plug from hose (7) and remove cap from the high-pressure fuel pump inlet connection.

9. Connect hose (7) to the high-pressure fuel pump inlet connection. Tighten hose clamp (6) to a torque of 7.5 N·m (66 lb in).

Note: Ensure that the hose does not come into contact any other engine components.

10. Remove cap from inlet elbow (5) and remove plug from the fuel inlet hose.
11. Connect the fuel inlet hose to elbow (5). Tighten the tube connection to a torque of 7.5 N·m (66 lb in).

Note: Ensure that the hose does not come into contact any other engine components.

12. Remove cap from Transfer Pump Inlet Regulator (TPIR) (2) and remove plug from the fuel return hose.
13. Connect the fuel return hose to TPIR (2). Tighten the hose clamp to a torque of 7.5 N·m (66 lb in).
14. Turn the fuel supply to the ON position.
15. Remove the air from the fuel system. Refer to Operation and Maintenance Manual, "Fuel System - Prime" for the correct procedure.

i06590695

Fuel Manifold (Rail) - Remove and Install

Removal Procedure

Start By:

- a. Remove the fuel injection lines. Refer to Disassembly and Assembly, "Fuel Injection Lines - Remove and Install" 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 authorised personnel that have the correct training.

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

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

NOTICE

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

Dispose of all fluids according to local regulations and mandates.

1. Ensure that all open ports are plugged or capped.

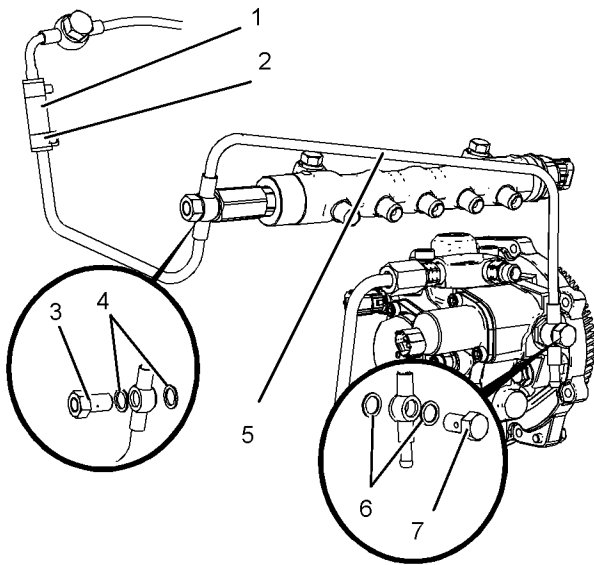


Illustration 7

g03817937

Install Procedure

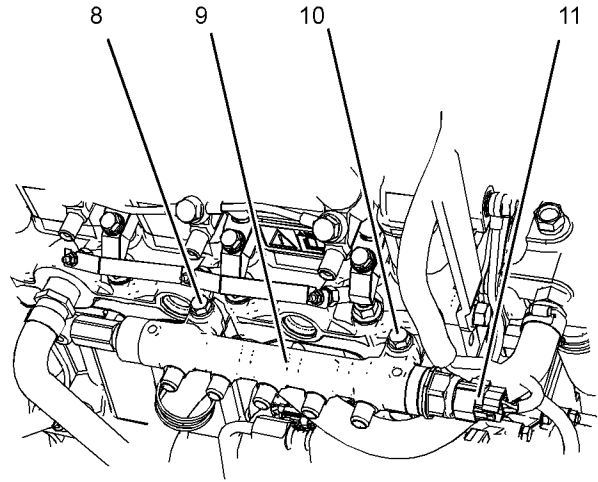


Illustration 9

g03817946

1. Position fuel rail (9) on engine.
2. Loosely install bolt (8) and bolt (10). Connect harness assembly (11) to the fuel manifold pressure sensor.

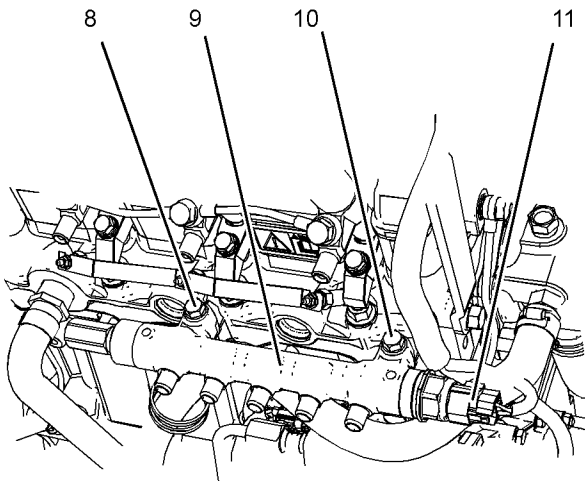


Illustration 8

g03817946

2. Open clip (2) and move clip up on hose (1).
3. Remove banjo bolt (3) and seal washers (4). Remove banjo bolt (7) and sealing washers (6).
4. Remove pipe (5) from hose (1) and remove pipe (5) from engine.
5. Disconnect harness (11) from fuel rail (9).
6. Remove bolt (8) and bolt (10). Remove fuel rail (9) from engine. Discard all old sealing washers.

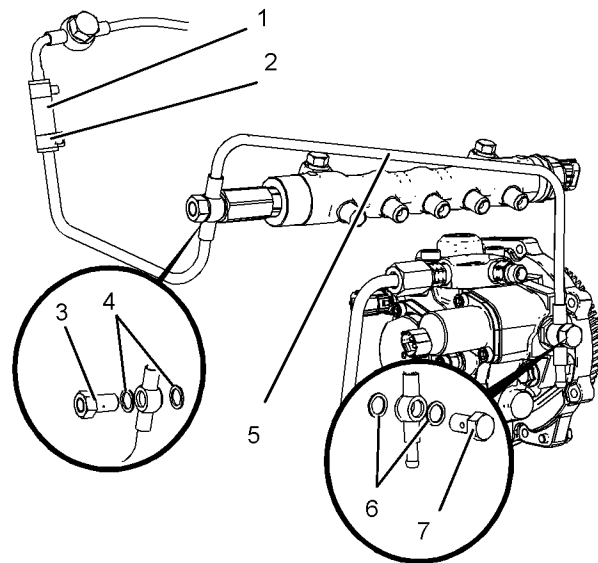


Illustration 10

g03817937

3. Install pipe (5) into hose (1). Position pipe (5) onto the engine.
4. Install banjo (3) and new washers (4). Install banjo (7) and new washers (6).

5. Open clip (2) and position on hose (1). Tighten banjo bolts (3) and (7) to a torque of 13 N·m (115 lb in).

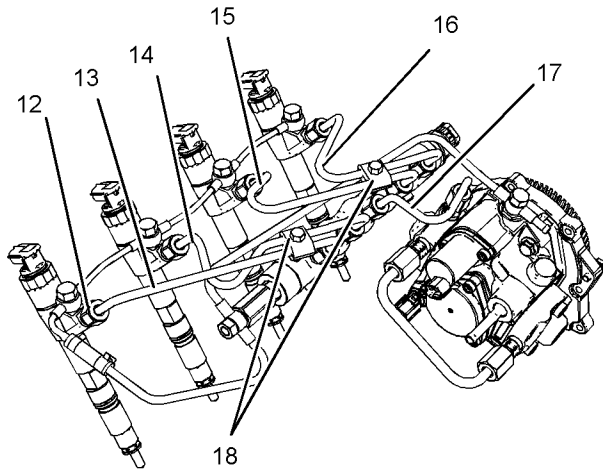


Illustration 11

g03818073

Note: Loosely install the fuel injection lines

6. Loosely install fuel lines (17), (16), (15), (14), and fuel line (13).
7. Loosely install clamps (18).
8. Tighten bolt (8) and bolt (10) to a torque of 26 N·m (230 lb in).

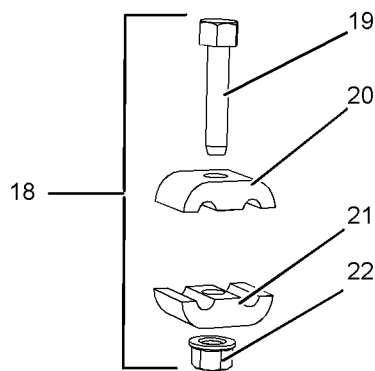


Illustration 12

g03818142

9. Ensure that isolator (20) and (21) are positioned correctly. Tighten nut (22) and bolt (19) to a torque of 10 N·m (89 lb in).
10. Tighten all fuel line connections (12) to a torque of 23 N·m (204 lb in).

11. Prime the fuel system, refer to Operation and Maintenance Manual, "Fuel System - Prime" for more information.

i06590698

Fuel Injection Lines - Remove and Install

Fuel Injection Lines Remove

WARNING

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

Table 2

Required Tools			
Tool	Part Number	Part Description	Qty
A	T402254	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.

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

Disassembly and Assembly Section

If necessary, remove the breather hoses, refer to this Disassembly and Assembly, "Crankcase Breather - Remove and Install" for more information.

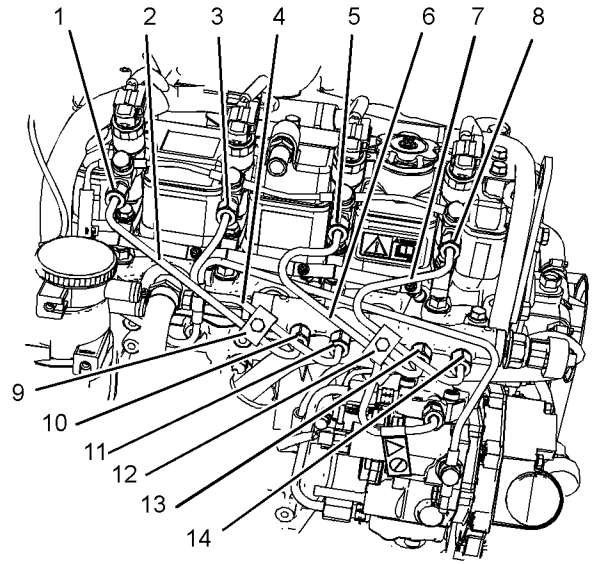


Illustration 13

g03816505

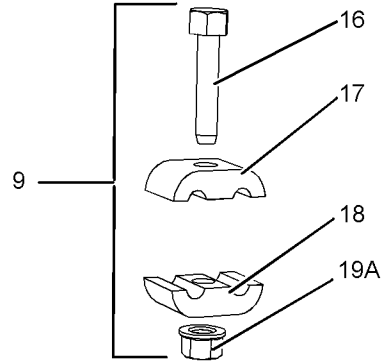


Illustration 14

g03816555

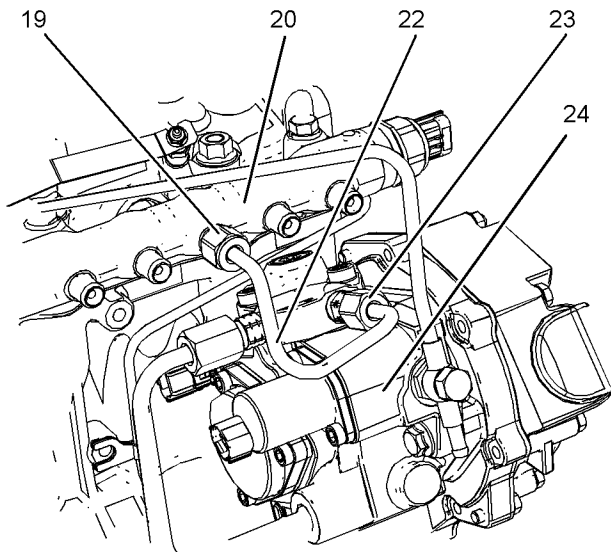


Illustration 15

g03816588

1. Remove clamp (9) and clamp (12).
2. Remove bolt (16) and nut (19A) from clamp assembly (9). Remove isolators (17) and (18). Remove bolt nut and isolators from clamp (12).
3. Disconnect nut (8) and nut (14). Remove fuel injection line (7). Install Tooling (A) to the fuel injector and the fuel manifold (20) when the fuel injection line is removed.
4. Disconnect nut (5) and nut (13). Remove fuel injection line (6). Install Tooling (A) to the fuel injector and the fuel manifold (20) when the fuel injection line is removed.
5. Disconnect nut (3) and nut (11). Remove fuel injection line (4). Install Tooling (A) to the fuel injector and the fuel manifold (20) when the fuel injection line is removed.
6. Disconnect nut (1) and nut (10). Remove fuel injection line (2). Install Tooling (A) to the fuel injector and the fuel manifold (20) when the fuel injection line is removed.
7. **Discard all fuel injection lines**
8. Disconnect nut (19) and nut (23). Remove fuel injection line (22) from manifold (20) and pump (24). Install Tooling (A) to the fuel pump and fuel manifold (20) when the fuel injection line is removed. **Discard the fuel injection line.**

Fuel Injection Lines Install

NOTICE

All plugs and caps must remain in position until the component is about to be installed

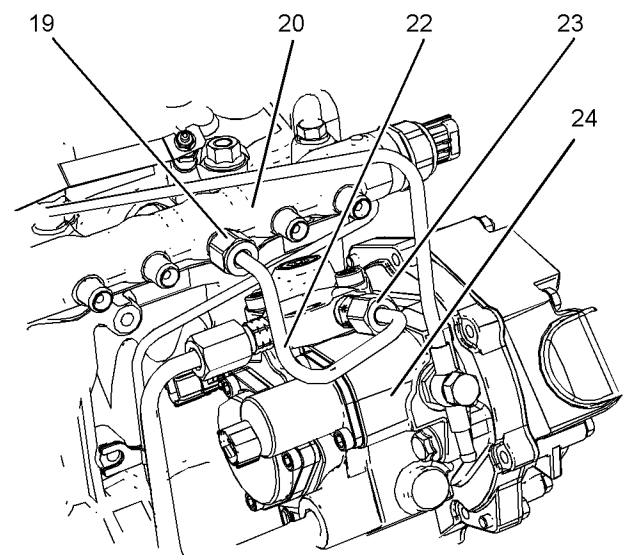


Illustration 16

g03816588

1. Position fuel injection line (22) onto fuel rail (20) and pump (24). Tighten nut (19) and nut (23) to a torque of 22.5 N·m (199 lb in).

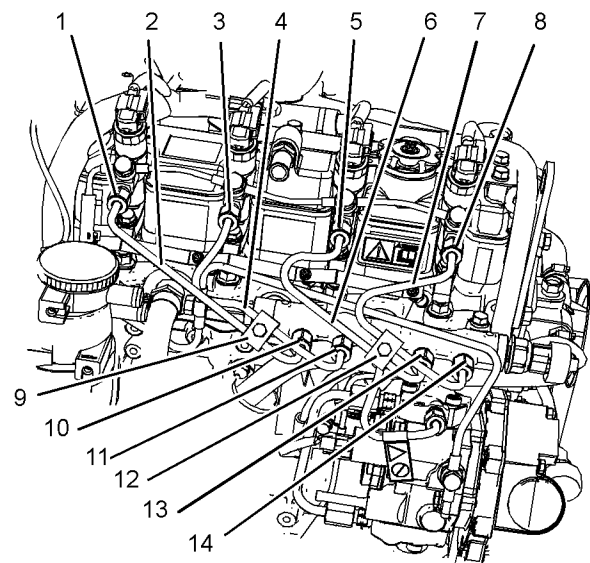


Illustration 17

g03816505

2. Position fuel injection line (2) onto fuel rail (20) and fuel injector. Loosely install fuel injection line. Position fuel injection line (4) onto fuel rail (20) and fuel injector. Loosely install fuel injection line.

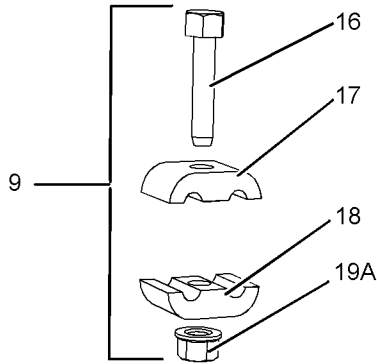


Illustration 18

g03816555

3. Position isolator (18) and isolator (17) onto fuel injection lines (2) and (4). Install nut (19A) and bolt (16). Tighten nut and bolt to a torque of 10 N·m (89 lb in).
4. Tighten nut (1) and nut (10) to a torque of 22.5 N·m (199 lb in). Tighten nut (3) and nut (11) to a torque of 22.5 N·m (199 lb in)
5. Position fuel injection line (6) onto fuel rail (20) and fuel injector. Loosely install fuel injection line. Position fuel injection line (7) onto fuel rail (20) and fuel injector. Loosely install fuel injection line.
6. Align isolator (18) and isolator (17) onto fuel injection lines (6) and (7). Install nut (19) and bolt (16). Tighten nut and bolt to a torque of 10 N·m (89 lb in).
7. Tighten nut (5) and nut (13) to a torque of 22.5 N·m (199 lb in). Tighten nut (8) and nut (14) to a torque of 22.5 N·m (199 lb in)
8. Turn the fuel supply to the ON position and turn the battery disconnect switch to the ON position. If necessary, install breather hoses refer to this Disassembly and Assembly, "Crankcase Breather - Remove and Install" for more information.

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

i06590789

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.
- b. Disconnect the air induction hose from the turbocharger. Refer to Disassembly and assembly, "Turbocharger - Remove" 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.

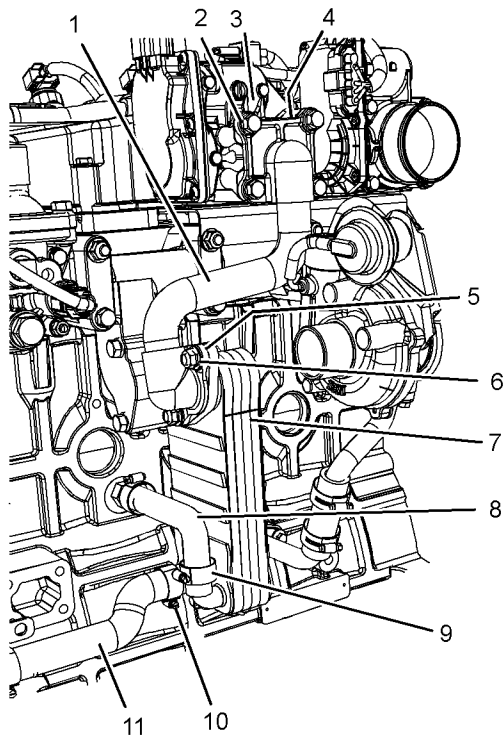


Illustration 19

g03815985

Alternator removed for clarity

1. Loosen hose clamp (10) on hose assembly (11). Disconnect hose assembly (11) from exhaust cooler (NRS) (7).
2. Loosen hose clamp (9) on hose assembly (8). Disconnect hose assembly (8) from exhaust cooler (NRS) (7).
3. Remove bolts (2) and nuts (6) from tube assembly (1).
4. Remove tube assembly (1) from exhaust cooler (NRS) (7) and exhaust gas recirculation (EGR) valve assembly (3).
5. Remove gasket (4) (not shown) and gasket (5) (not shown).

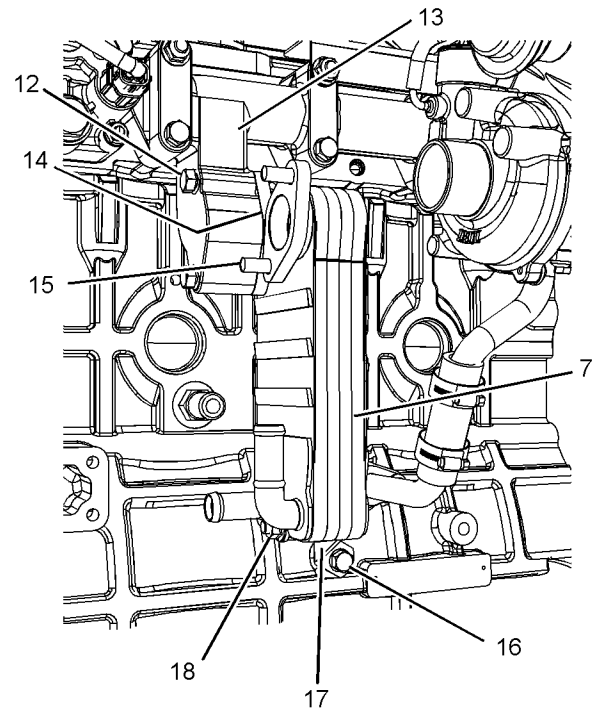


Illustration 20

g03816340

Typical example

6. Remove bolts (12) from exhaust cooler (NRS) assembly (7).
7. Remove gasket (14) (not shown) from between exhaust manifold (13) and exhaust cooler (NRS) assembly (7).
8. Remove nut (18) from bracket (17). Support exhaust cooler (NRS) assembly (7) as the bolt is removed.
9. Remove exhaust cooler (NRS) assembly (7).
10. If necessary, remove studs (15) from exhaust cooler (NRS) assembly (7).
11. Plug and cap all open ports on exhaust cooler (NRS) assembly (7).
12. If necessary, remove bolt (16) and remove bracket (17).

Installation Procedure

Table 3

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

Disassembly and Assembly Section

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

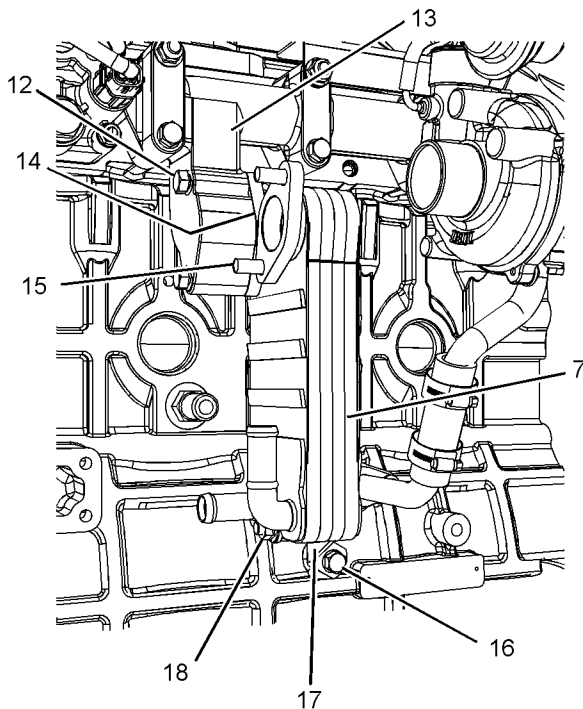


Illustration 21

g03816340

Typical example

2. Ensure that the exhaust cooler (NRS) assembly is free from restriction and external damage. Ensure that the exhaust cooler (NRS) assembly 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: Cleaning of the internal core of the exhaust cooler (NRS) should not be carried out.

3. Clean the gasket surfaces of exhaust cooler (NRS) assembly (7) and exhaust manifold (13).
4. If necessary, install studs (15) to exhaust cooler (NRS) assembly (7).
5. If necessary, position bracket (17) onto exhaust cooler (NRS) assembly (7). Ensure that the bracket is correctly orientated.
6. Loosely install nut and bolt (18).
7. Remove plug and cap from all open ports of exhaust cooler (NRS) assembly (7)

8. Position exhaust cooler (NRS) assembly (7) onto the cylinder block.
9. Install bolt (16) to bracket (17). Support exhaust cooler (NRS) assembly (7) as bolt (16) is installed.
10. Position a new gasket (14) (not shown) between exhaust manifold (13) and exhaust cooler (NRS) assembly (7).
11. Apply Tooling (A) to the threads of bolts (12). Install bolts (12) to exhaust cooler (NRS) assembly (7) hand tight.
12. Tighten bolts (12) to a torque of 25 N·m (221 lb in).
13. Tighten bolt (16) to a torque of 25 N·m (221 lb in)
14. Tighten locking nut (18) to a torque of 25 N·m (221 lb in). Ensure that bracket (17) is not strained as the nut is tightened.

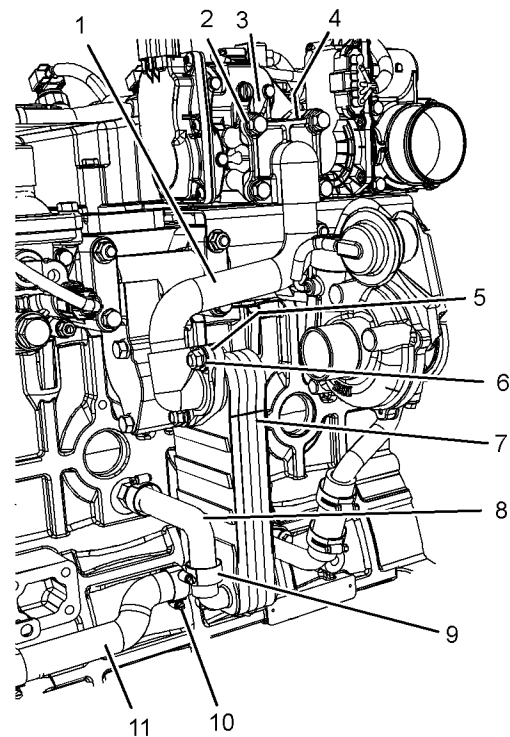


Illustration 22

g03815985

Typical example

15. Connect hose assembly (11) to exhaust cooler (NRS) (7). Tighten hose clamp (10) securely.
16. Connect hose assembly (8) to exhaust cooler (NRS) (7). Tighten hose clamp (9) securely.

17. Clean the gasket surfaces of tube assembly (1) and exhaust gas recirculation (EGR) valve assembly (3).
18. Apply Tooling (A) to the threads of bolts (2).
19. Position a new gasket (3) (not shown) and a new gasket (5) (not shown) onto tube assembly (1).
20. Position tube assembly (1) onto exhaust cooler (NRS) (7) and exhaust gas recirculation (EGR) valve assembly (3).
21. Apply Tooling (A) to the threads of studs (15).
22. Install bolts (2) and nuts (6) to tube assembly (1). Hand tighten the bolts and nuts.
23. Tighten bolts (2) and nuts (6) to a torque of 25 N·m (221 lb in). Ensure that tube assembly (1) is not strained as the bolts are tightened.

End By:

- a. Fill the cooling system with coolant. Refer to Operation and Maintenance Manual, "Cooling System Coolant - Change" for the correct procedure.
- b. Connect the air induction hose to the turbocharger. Refer to Disassembly and assembly, "Turbocharger - Install" for the correct procedure.

i06590792

Throttle Valve (Intake Air) - Remove

Removal Procedure

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

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.

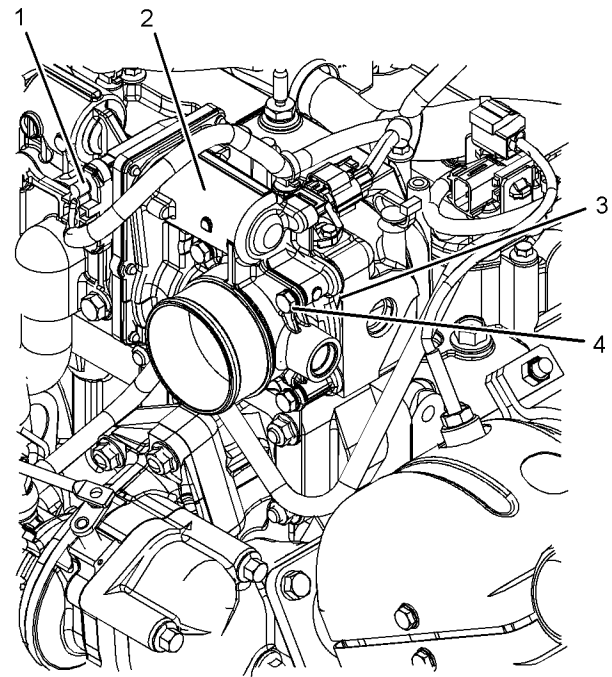


Illustration 23

g03819693

Typical example

1. Disconnect harness assembly (1) for throttle valve (2).
2. Remove bolts (4) from throttle valve (2). Support the throttle valve as the bolts (4) are removed.
3. Remove throttle valve (2) from the inlet manifold.
4. Remove gasket (7) (not shown).

i06609028

Throttle Valve (Intake Air) - Install

Installation Procedure

Table 4

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

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

1. Ensure that all components are clean and free from wear and damage. If necessary, replace any components that are worn or damaged.

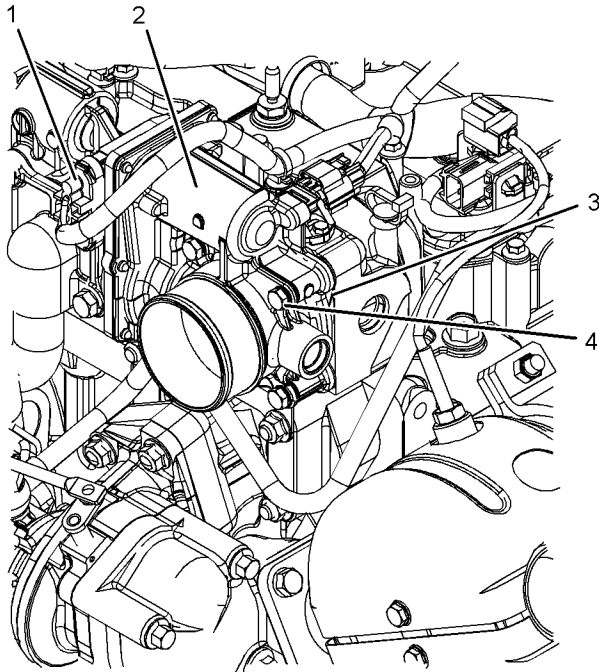


Illustration 24

g03819693

Typical example

2. Clean the gasket surface of exhaust gas recirculation valve (2) and the inlet manifold.
3. Position a new gasket (7) (not shown) onto throttle valve (2). Ensure that the gasket is correctly orientated.
4. Position throttle valve (2) onto the inlet manifold.
5. Apply Tooling (A) to the threads of bolts (4).
6. Install bolts (4) to throttle valve (2). Tighten the bolts to a torque of 10 N·m (89 lb in).

7. Connect harness assembly (1) for throttle valve (2).

i06591420

Fuel Injection Pump - Remove

Removal Procedure

Table 5

Required Tools			
Tool	Part Number	Part Description	Qty
A	T402254	Capping Kit	1

Start By:

- a. Remove the high-pressure fuel line from the fuel injection pump. Refer to Disassembly and Assembly, "Fuel Injection Lines - Remove and Install" for the correct procedure.
- b. Remove the fuel filter base. Refer to Disassembly and Assembly, "Fuel Filter Base - Remove and Install" 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 authorised personnel that have the correct training.

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

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

NOTICE

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

Dispose of all fluids according to local regulations and mandates.

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

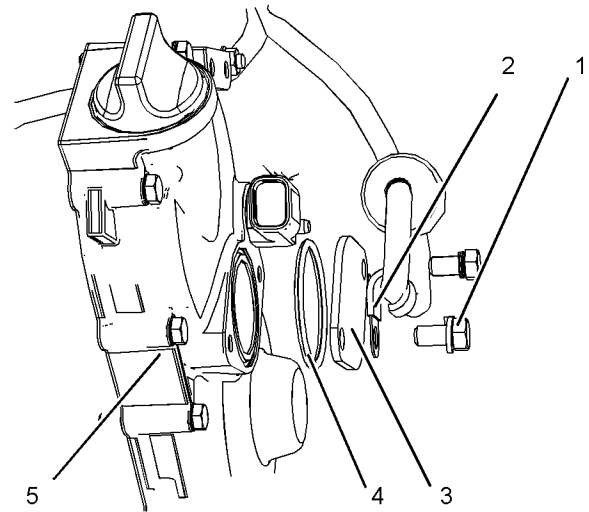


Illustration 25

g03819043

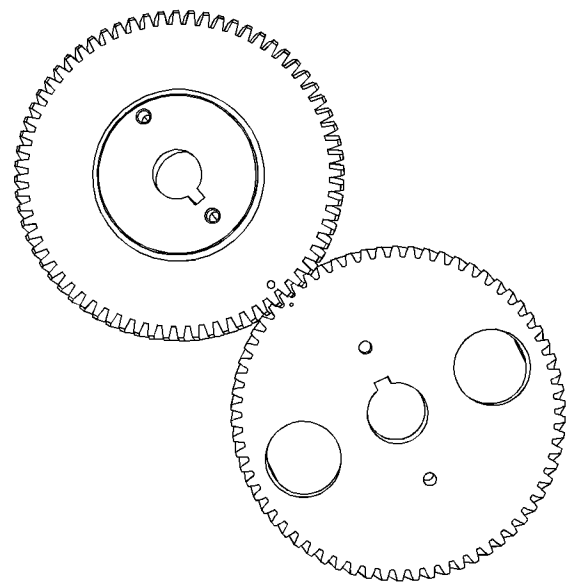


Illustration 26

g03841191

1. Remove bolts (1) from cover (5). Remove clip (2) complete with the wiring harness and position the wiring harness away from engine.
2. Remove plate (3) and O-ring seal (4) from cover (5).
3. Align the timing marks on the fuel injection pump gear and the camshaft gear as shown in Illustration 26 . Refer to Systems Operation Testing and Adjusting, "Fuel Injection Timing - Check" for more information.

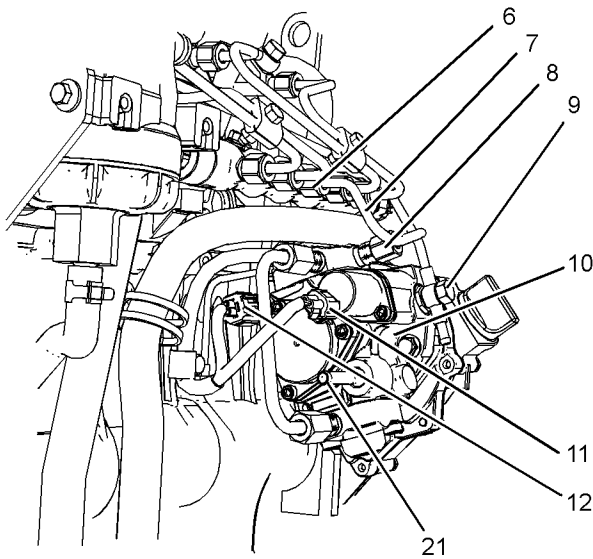


Illustration 27

g03818187

4. Disconnect the hose assembly for fuel inlet connection (21). Use Tooling (A) to plug and cap all open ports.
5. Disconnect harness (11) and harness (12) from fuel injection pump assembly (10).
6. Loosen nut (6) and nut (8). Remove fuel line (7), use Tooling (A) to plug and cap all open ports. Discard the fuel line.

Note: Repositioning of the high-pressure fuel line clamp may be necessary.

7. Remove banjo bolt (9) with sealing washers (not shown), use Tooling (A) to plug and cap all open ports. Discard the sealing washers.

Note: Make a temporary Mark on the bolts to aide installation.

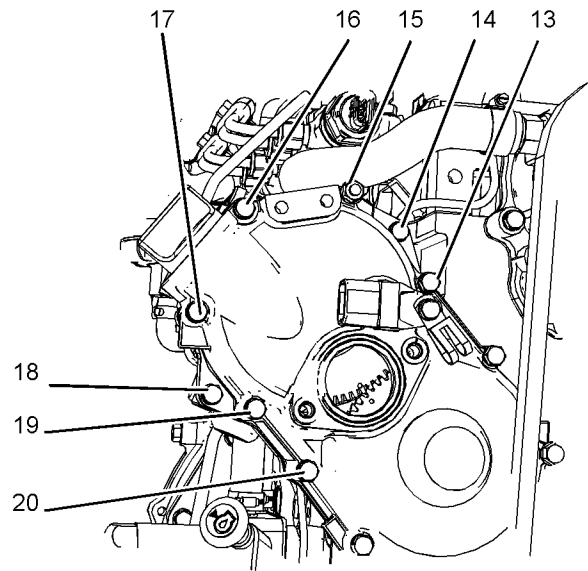


Illustration 28

g03818192

8. Remove bolts (13), (14), (16), (17), (18), (19) and (20).
9. Remove nut (15) and remove fuel injection pump assembly (10) and O-ring seal (not shown) from engine. Discard the O-ring seal.

i06591455

Fuel Injection Pump - Install

Installation Procedure

NOTICE

All plugs and caps must remain in position until the component is about to be installed

1. Rotate gear on the fuel injection pump to align the timing marks. Align the timing marks, refer to Systems Operation Testing and Adjusting, "Fuel Injection Timing - Check" for more information.

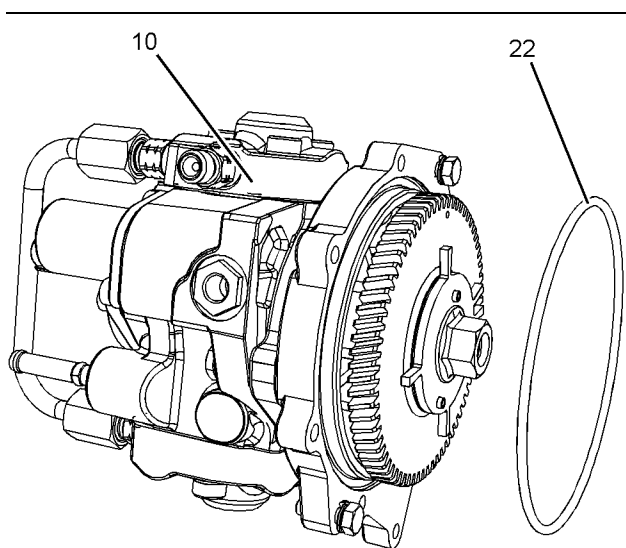


Illustration 29

g03850301

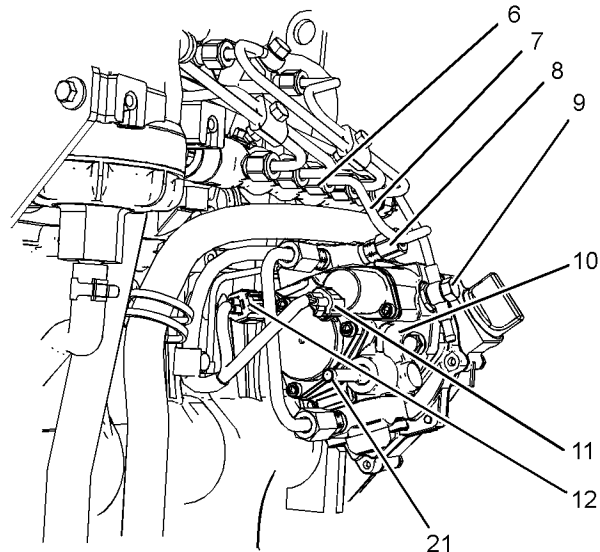


Illustration 31

g03818187

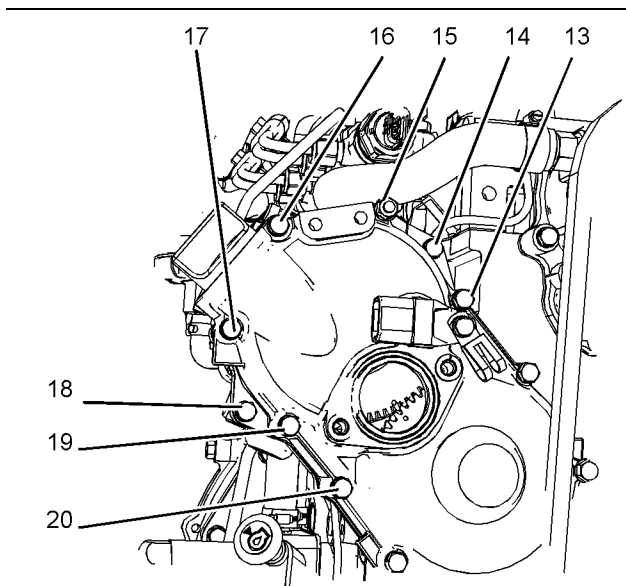


Illustration 30

g03818192

2. Install new O-ring (22) to fuel injection pump assembly (10).
 3. Install fuel injection pump assembly (10) to the front housing. Ensure that the timing mark on the fuel injection pump gear and the camshaft gear are aligned as shown in Illustration 30 .
 4. Install bolts (13), (14), (16), (17), (18), (19), and (20). Install nut (15). Tighten nut (15) and bolts (13), (14), (16), (17), (18), and (19) to a torque of 10 N·m (88 lb in).
 5. Install new fuel line (7) and tighten nuts (6) and (8) to a torque of 23 N·m (204 lb in).
- Note:** If the high-pressure fuel line clamp was repositioned during disassembly, return the clamp to the original position.
6. Install banjo bolt (9) with new sealing washer (not shown) and tighten the bolt to a torque of 13 N·m (115. lb in).
 7. Connect the fuel hose assembly to fuel inlet (21).
 8. Reconnect the harness assembly to fuel temperature sensor (12) and fuel solenoid (11).

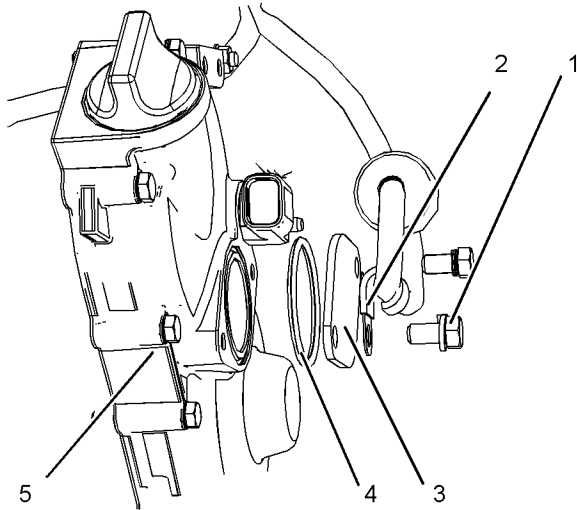


Illustration 32

g03819043

9. If necessary, replace O ring seal (4). Install O ring seal (4) into cover (5).
10. Install plate (3) and clip (2) complete with harness. Install bolts (1) and tighten to a torque of 26 N·m (230 lb in).
11. Install the fuel filter base, refer to Disassembly and Assembly, "Fuel Filter Base - Remove and Install" for the correct procedure.
12. Turn the fuel supply to the ON position. Turn the battery disconnect switch to the ON position.
13. Prime the fuel system, refer to Operation and Maintenance Manual, "Fuel system - Prime".

14. After replacement of the fuel injection pump, the fuel injection pump must be calibrated to prevent damage to the fuel system. Use the electronic service tool to perform "Fuel Pump Learn".

i06591457

Fuel Injection Pump Gear - Remove

Removal Procedure

Start By:

- a. Remove the fuel injection pump, refer to Disassembly and Assembly, "Fuel Injection Pump - 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 authorised personnel that have the correct training.

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

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

NOTICE

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

Dispose of all fluids according to local regulations and mandates.



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