Air In The Fuel System Tests, Common Rail Fuel System - US17+OBD16 and Newer Emissions

Internal Content

For the proper testing procedures regarding Air In The Fuel System refer to Trucks Dealer - Impact - Service tab or click on one of the following:

Note: Select ID/Operation under the Search by tab. Search using the applicable ID/Operation number bellow.

2309-06-02-02 Air In The Fuel System, Check (Basic)

2309-06-02-04 Air In The Fuel System, Check (Advanced)

Tags k05600236 volvo mack

Related links and attachments

No links or attachments available

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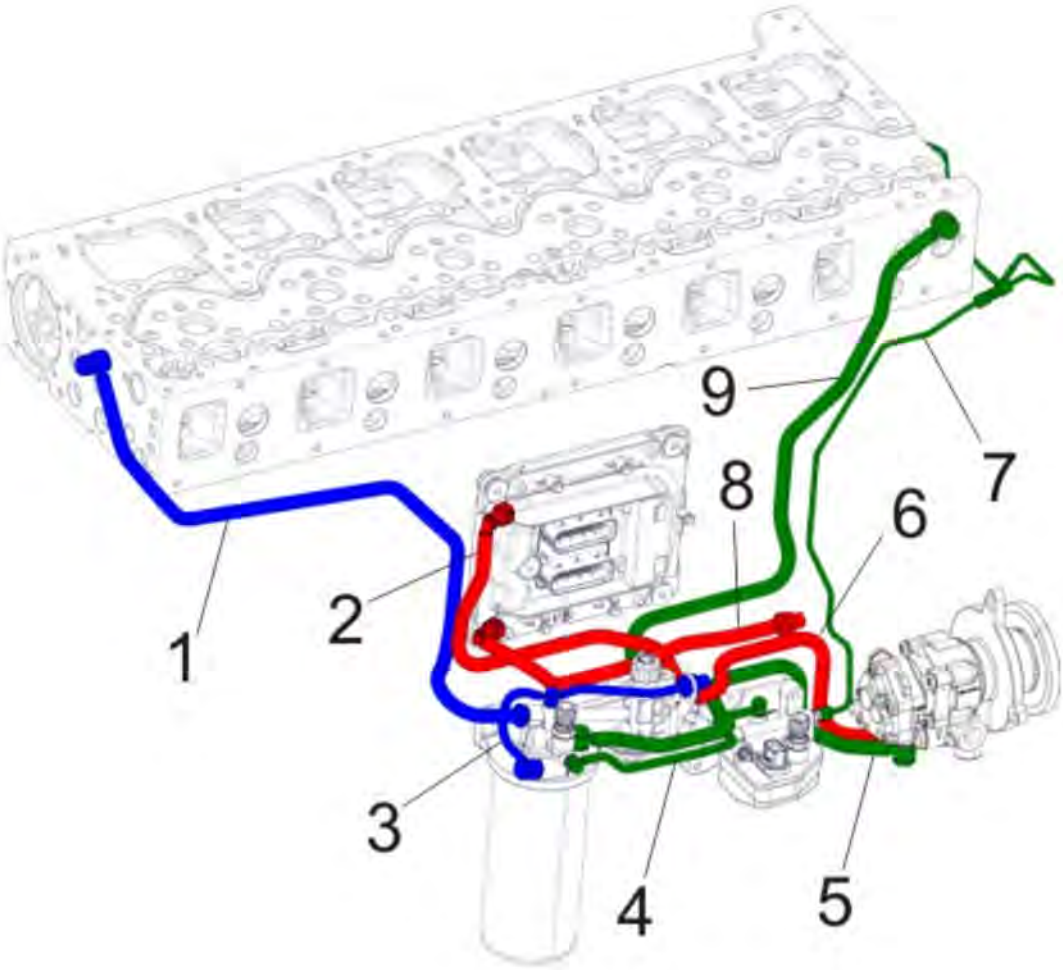
23008-2 Air in the Fuel System, Check (Basic)

You must read and understand the precautions and guidelines in Service Information, Function Group 20, "Engine Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

Note: Information is subject to change without notice.
Illustrations are used for reference only, and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

This is a mechanical check for air in the fuel system. For other fault tracing information, refer to the Guided Diagnostics under Symptom Based fault tracing.



D13 Engine Shown

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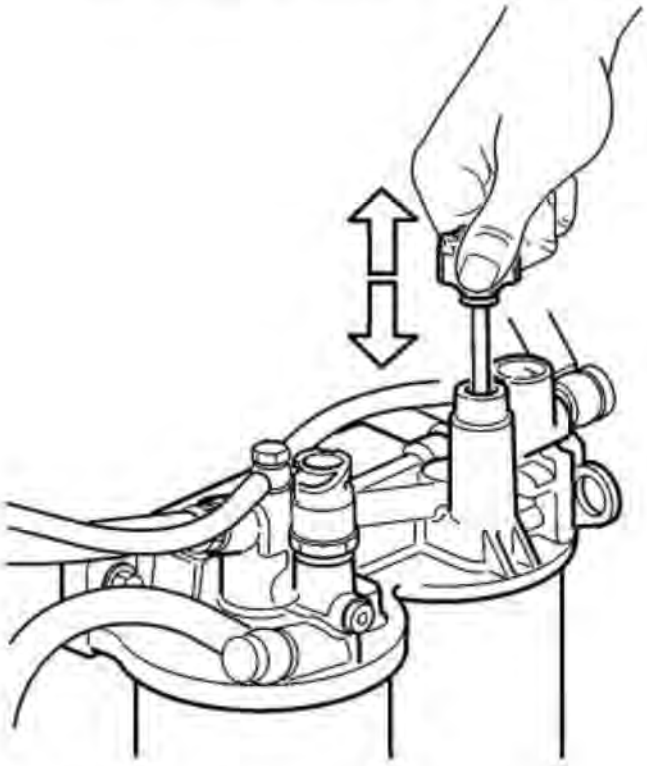
Note: Green lines are pressure, red lines are supply, blue lines are return.

1. Cylinder Head Fuel Return	6. Fuel Pump Inlet (Supply)
2. ECM Cooler to Fuel Filter	7. Fuel Supply to Aftertreatment Doser
3. Fuel Return to Tank (Fuel and Air)	8. ECM Cooler Supply from Fuel Tank
4. Fuel Supply to Aftertreatment Doser Module	9. Cylinder Head Fuel Supply
5. Fuel Pump Outlet (Pressure)	

Air in the fuel being supplied to the engine can cause a number of problems including hard starting and poor performance. Air can enter the fuel system at several points such as:

- Cracked pickup tube in the fuel tank (low fuel)
- Loose suction side fuel supply lines
- Damaged primary fuel filter seals
- Leaking frame mounted primary fuel water separator housing and fittings
- Leaking injector sleeve to injector seat
- Damaged engine-mounted fuel pump seals



The 1/4 turn lock hand primer pump is not a source for air in the fuel, but it will block off fuel supply to primary filter and engine will eventually run the primary filter dry of fuel if left in the unlocked position.

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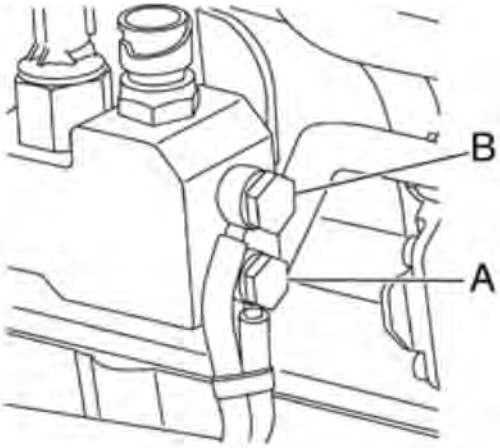

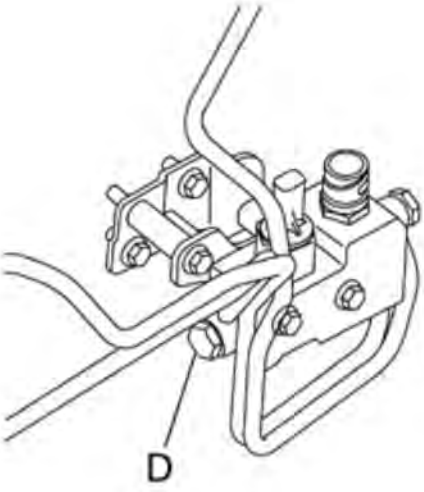

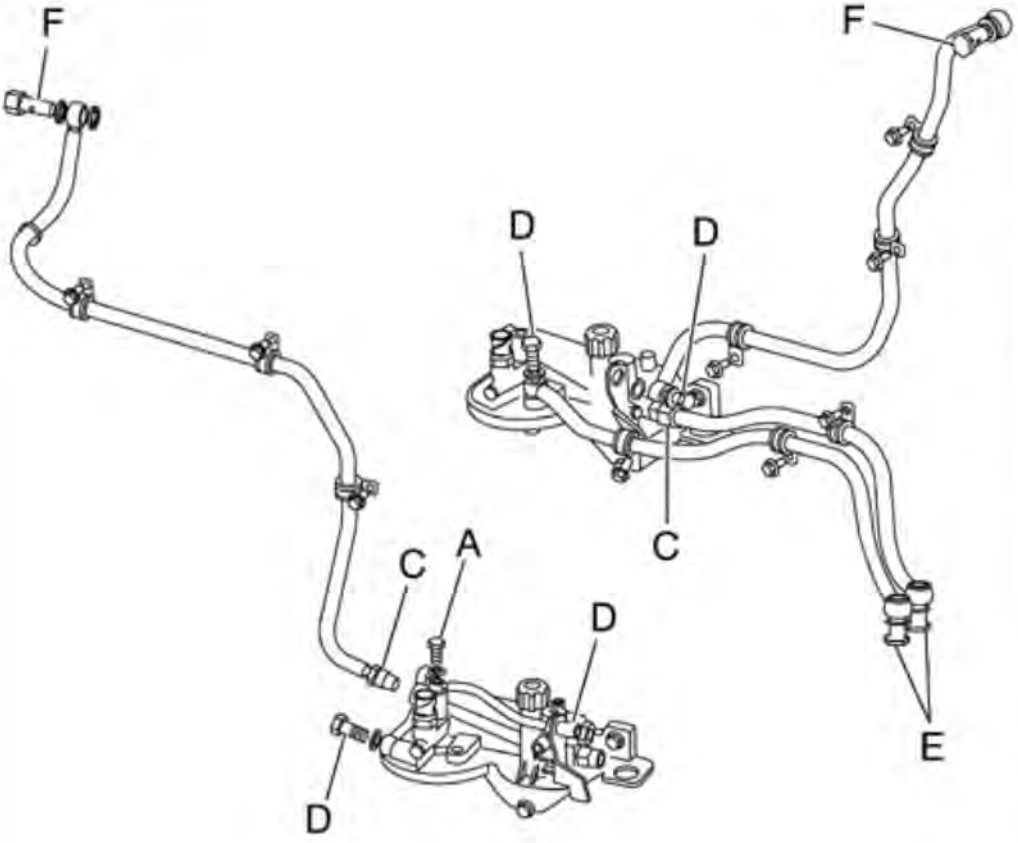

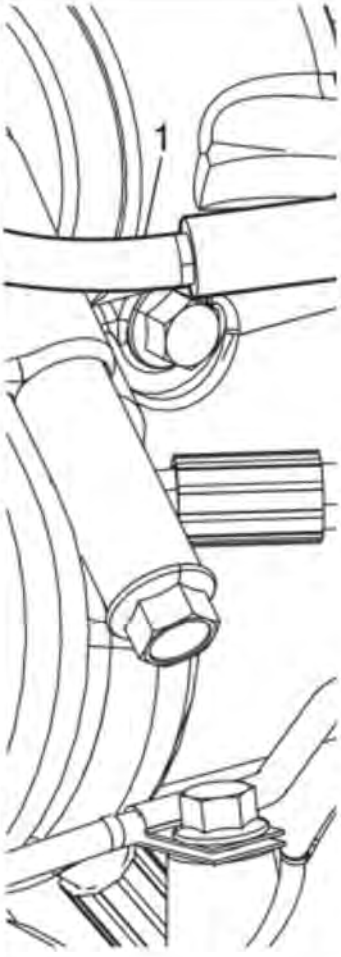

Fuel line fittings:

A.....18 ± 3 Nm (13 ± 2 ft-lb)

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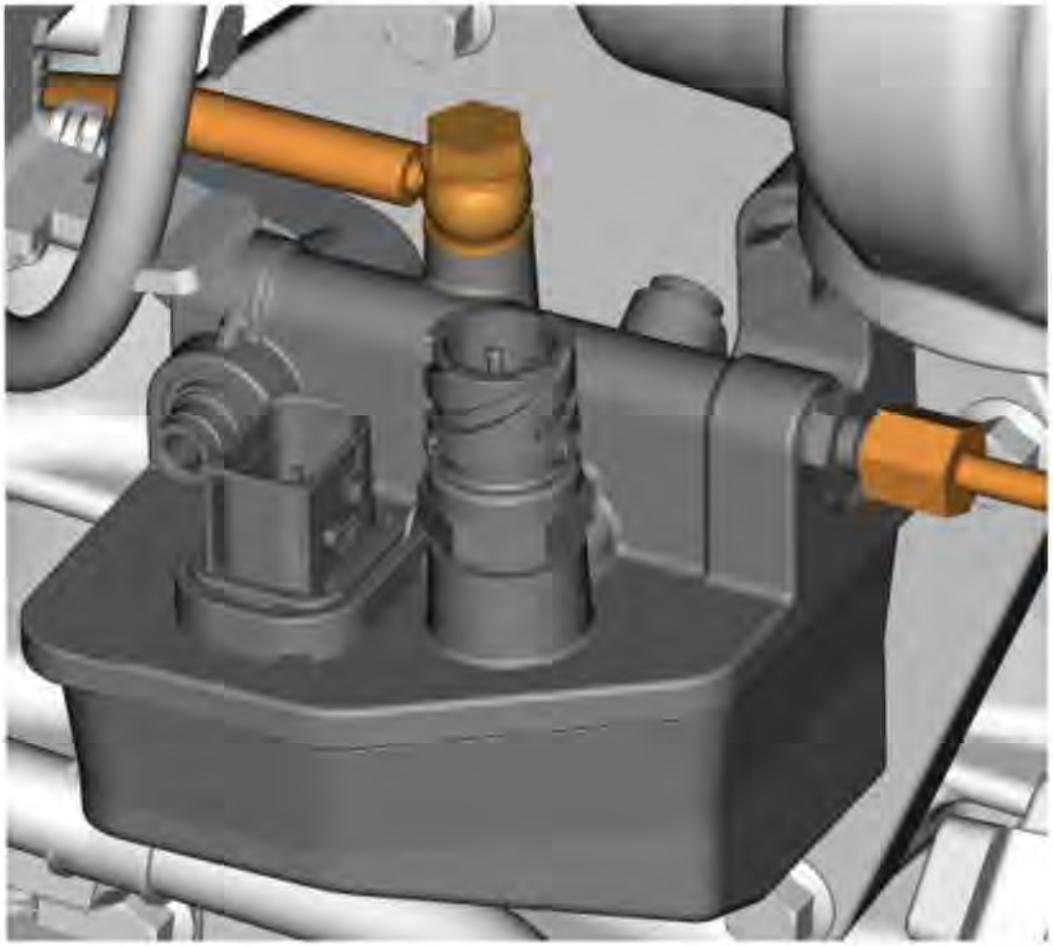
B.....28 ± 4 Nm (20.5 ± 3 ft-lb)
C.....30 ± 4 Nm (22 ± 3 ft-lb)
D.....35 ± 5 Nm (26 ± 4 ft-lb)
E.....40 ± 5 Nm (29.5 ± 4 ft-lb)
F.....48 ± 5 Nm (35 ± 4 ft-lb)
1.....Air Line
2.....Fuel Line 15 Nm (235 in-lb)
3.....Coolant Line

Note: From start of 2013 engine production, quick connect fittings are used at the engine control module (ECM) cooler.

Integrated Aftertreatment Hydrocarbon Dosing System



Tighten all Integrated Aftertreatment Hydrocarbon Dosing System fuel line fittings to 15 Nm (135 in-lb)

This procedure should only be used to check for air in fuel if directed to this information by symptom based Guided Diagnostics or the vehicle has one or more of these fuel system related symptoms:

- Engine is difficult to start
- Engine misfire
- Erratic fuel pressure (low fuel pressure should not be fault traced using this procedure)

If one or more of the fuel system related symptoms exist, use the Air In Fuel System Tester kits to help locate the point of entry.

Perform the following checks to eliminate obvious causes of air in the fuel system:

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1. Make sure there is adequate fuel in the fuel tank (above the pickup port)
2. Look and smell for leaks on the pressure side of the fuel system
3. Check that all fuel system connections are tight, sealed and that the lines are not kinked
4. Check the engine fuel filters for leaks or looseness

If after checking all the items listed above there is still air in the fuel system, perform the Check Air in the Fuel procedure.

Required Tools

Tool kit part numbers 88800236 and 88800475 are available to help in locating points of air entry into the fuel system.

The kits consist of:

- 6 m (20 ft) transparent hose assembly with 16 mm banjo and 3/8 NPTF
- 60 cm (2 ft) transparent hose assembly with 2 – 14 mm banjos
- 6 hex head capscrews
- 10 seal washers
- 5 hex nuts
- 1 plug
- 76 cm (30 in) transparent hose assembly with 1 – 14 mm banjo
- 4.5 m (15 ft) transparent hose assembly with 16 mm banjo and 3/8 NPTF

Note: Always follow the instructions in the kit for storage and use of the tool.

1

Caution

After using the fuel aeration test kit, thoroughly drain all remaining fuel from the test hoses, then install plugs, end caps and washers. This prevents accidental spillage that can result in fuel contamination.

Secure the vehicle for service by parking it on a flat level surface, applying the parking brake, chocking the rear wheel, and placing the transmission in neutral.

2

Place an approved container under the engine fuel filter housing to catch fuel that will spill from lines.

3

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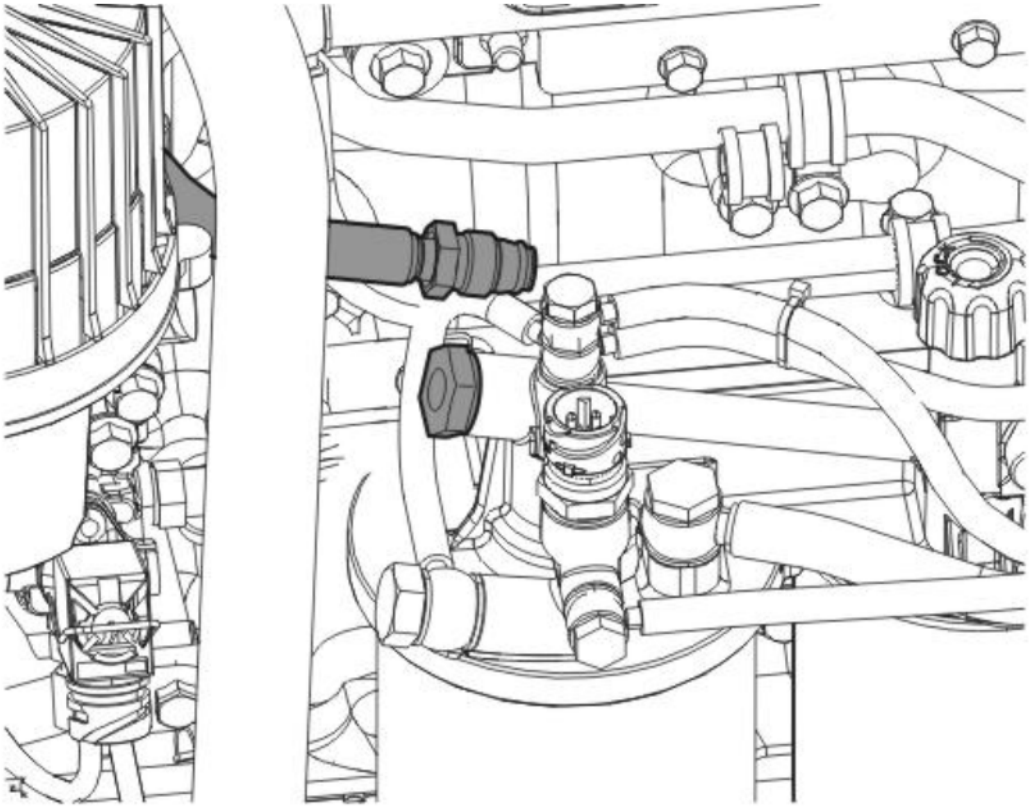

Remove cylinder head fuel return line hose connection at engine fuel filter housing and install plug from kit with new copper sealing washer.

Note: Plugging the fuel return port isolates all return fuel and directs it back to the tank through the clear hose. The test plug must make a good seal to the fuel filter housing or false test results can result.

4

Remove the overflow valve from fuel return port at front of cylinder head and move fuel line out of the way.

5

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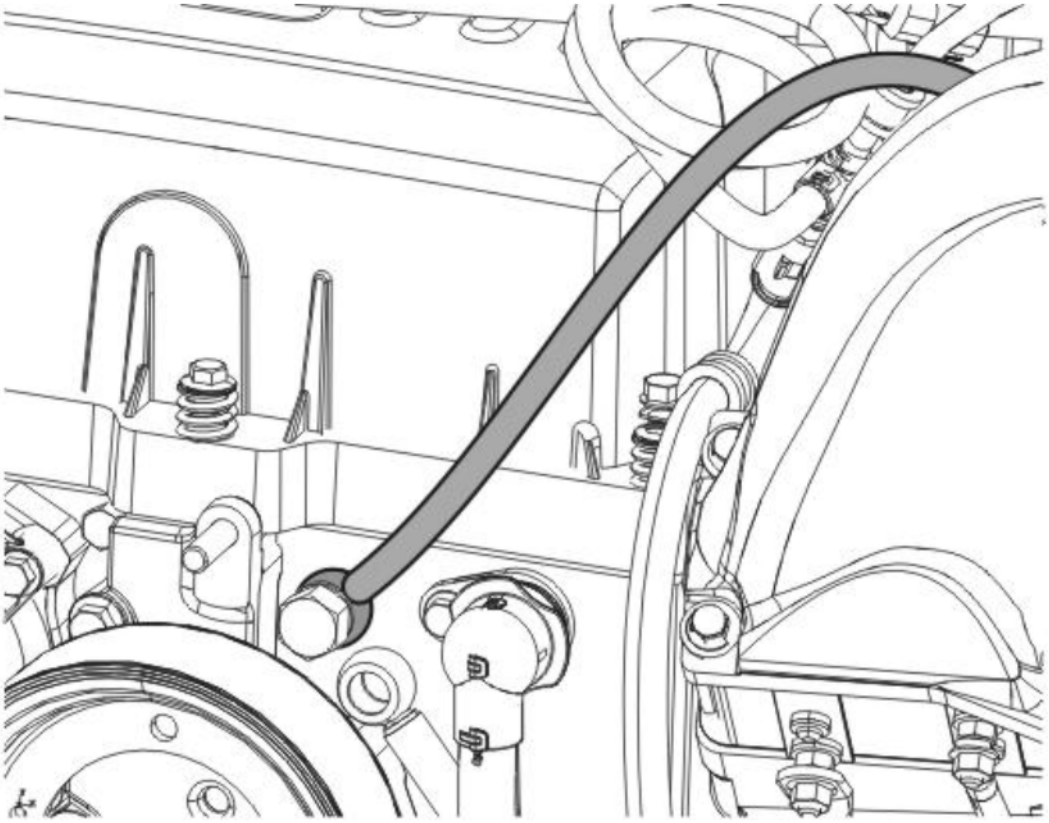

Note: Clean the connection points before installing the line.

Connect the 6 m (20 ft) test line from the kit to fuel return port at the front of the cylinder head using the overflow valve. Run the other end of the line into the fuel tank or a bucket.

6

Note: Only run the engine at idle to check for air in fuel. Do not increase engine RPMs. DO NOT perform air in fuel check as a road test.

Start the engine and run at idle a minimum of 5 minutes to fill the lines with fuel and purge out all the air introduced when connecting the lines. Monitor the test line for aeration several feet away from the engine. Do not check at cylinder head outlet. Fuel exiting the cylinder head will show disturbance, this is normal and should not be considered air in the fuel return.

Note: Some very small air bubbles in the line are acceptable.

- If large air pockets (thick foam) exist, air is getting into the fuel system. Continue to Air in Fuel System, Check (Advanced) described in the following pages.
- If there are no large air pockets (thick foam), air in fuel system is not the cause of the symptom. Remove the test line and reconnect the fuel line to the cylinder head using a new sealing washer. Tighten the connection to specification, refer to Function Group 20, Specifications.

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23014-2 Air in the Fuel System, Check (Advanced)

i	Illustrations may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

i	All threaded fasteners that do not have a tightening torque specification in the information are tightened to a standard torque. Standard torques are available in the following specification. Standard Tightening Torques

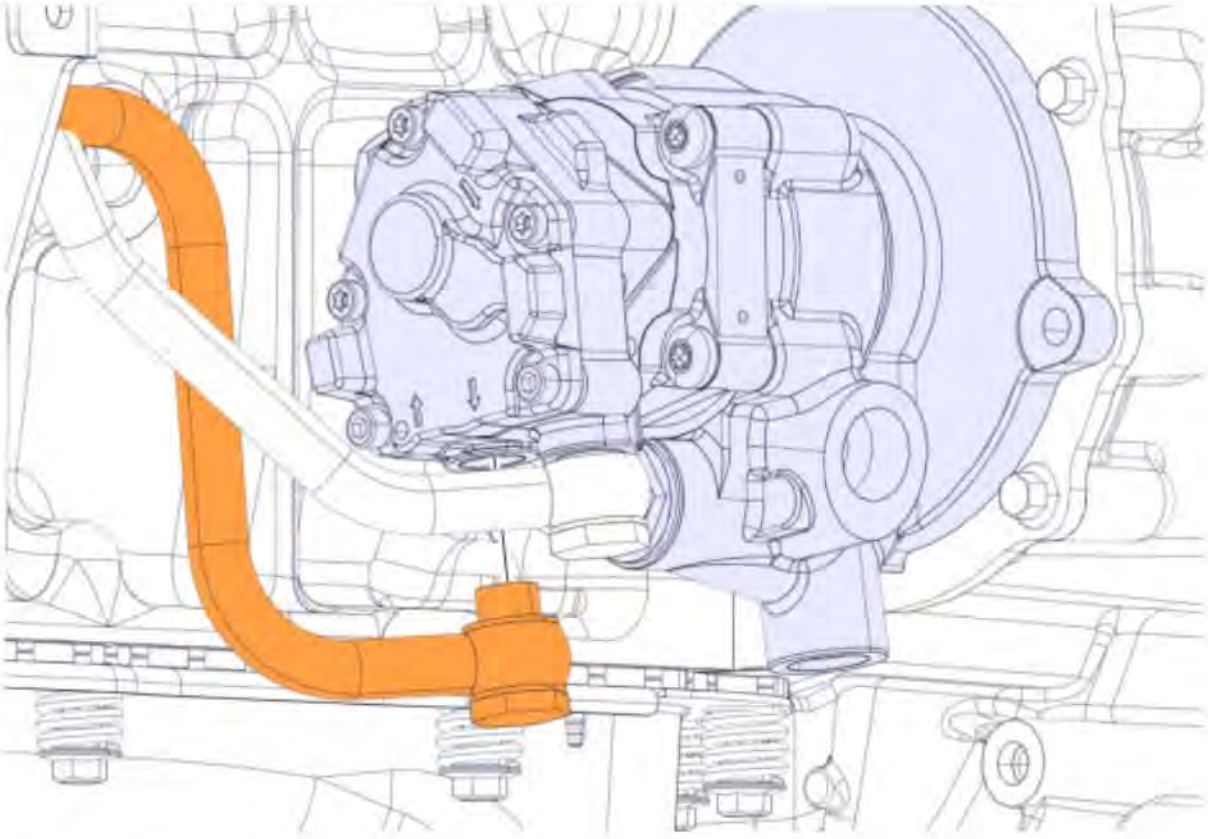
Special tools

88800475	88800625

Conditions

•	The vehicle must have failed 23008-2 Air in the fuel system, check (basic) before proceeding.

1	Remove the fuel inlet line.



2	Install the transparent fuel line.	
	Required material	
	kit	88800475

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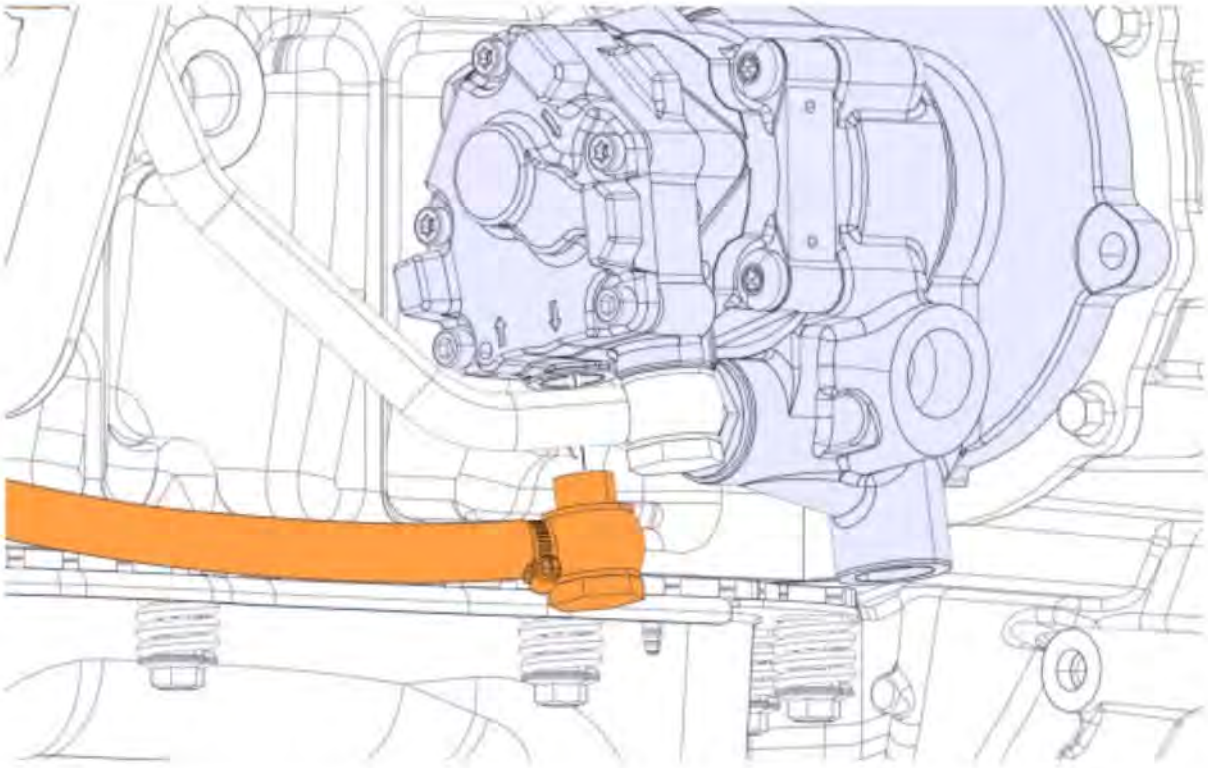

3	Install the sealing washers. **Note** Use new sealing washers.
4	Install the hollow screw.
5	Torque tighten the hollow screw.

Tightening torque	
Fuel pipe, hollow screw	40 ±5 Nm (30 ±4 lb_f·ft)

6	Remove the cap.
7	Install the transparent fuel line, making sure the end of the line is submerged in fuel.

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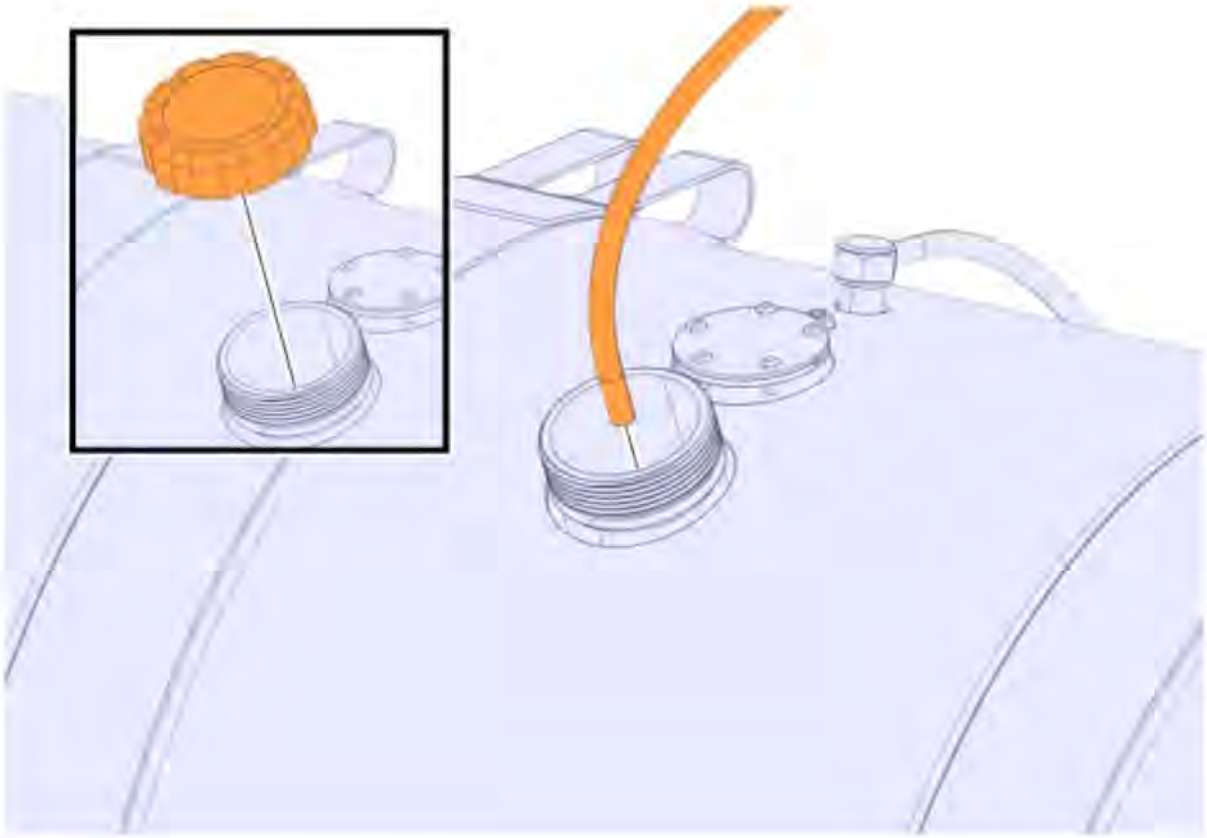

8	Secure the line to keep it away from the bottom of the fuel tank to prevent debris from entering the fuel system. Note This will help to prevent debris from entering the fuel system. Note If the tank is equipped with anti-theft fuel inlet, an alternative source of fuel will be necessary.
9	Start the engine.
10	Keep the engine RPM (Revolutions per Minute) high enough to keep the fuel system from losing prime.
11	Depress the accelerator pedal momentarily to the full position several times.
12	Allow the engine to idle five minutes.
13	Check the transparent fuel line from cylinder head return to fuel tank for the amount of air bubbles.

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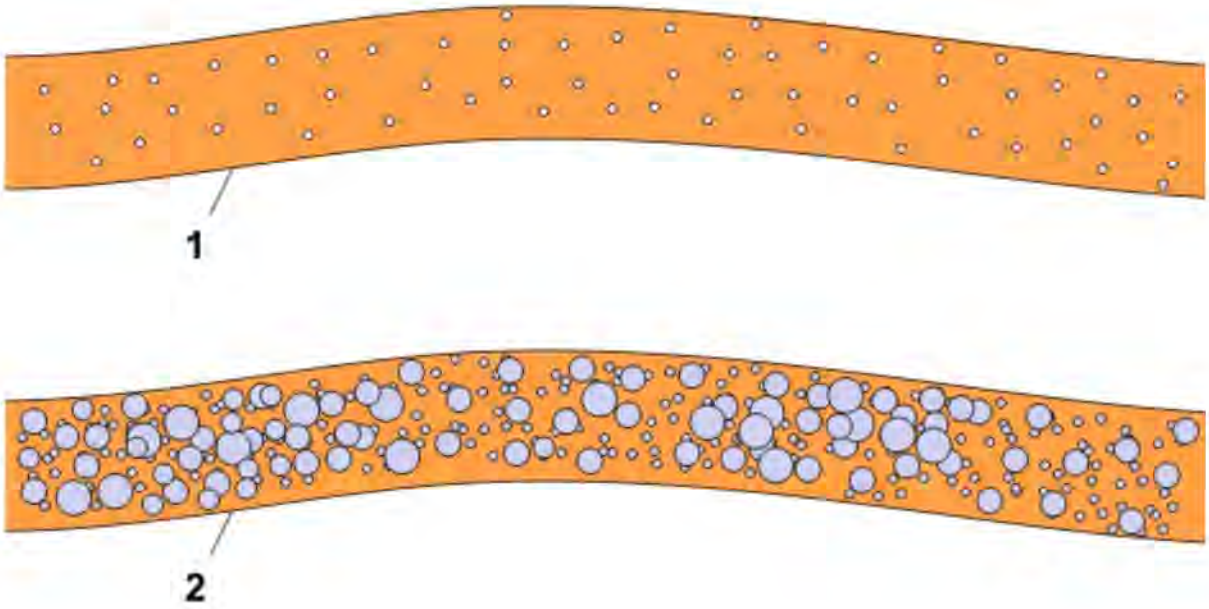

1	A normal amount of bubbles is acceptable.
2	An excessive amount of bubbles is not acceptable.

14	Stop the engine.

15	Perform this procedure when the condition below is met. Conditions

•	If a normal amount of air bubbles are detected in the transparent fuel line from the tank to pump inlet.
•	An excessive amount of air bubbles are detected in the transparent fuel line from the cylinder head to the tank.
▸	Check the cylinder head for possible leak at injector sleeves.

16	Perform this procedure when the condition below is met. Conditions

•	If a normal amount of air bubbles in fuel are detected in the transparent fuel line from the tank to fuel supply pump.
•	If a normal amount of air bubbles in fuel are detected in the transparent fuel line from the cylinder head to the fuel tank.
▸	Check the low pressure fuel system, proceed to the next step.

17	Remove the transparent fuel line out of the fuel in the tank to prevent siphoning.

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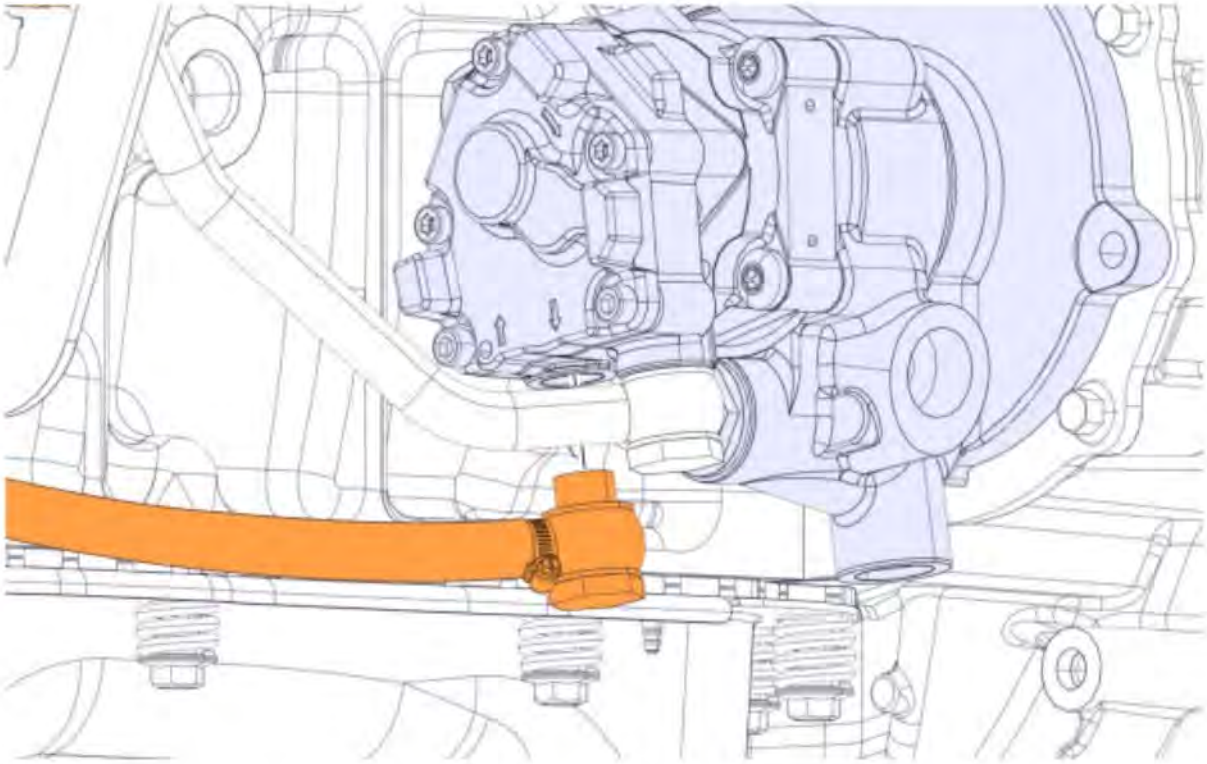
18	Remove the transparent fuel line from the fuel supply pump. Note Allow the fuel in the line to drain back into the fuel tank.



19	Install the original fuel line.

20	Install the sealing washers. Note Use new sealing washers.

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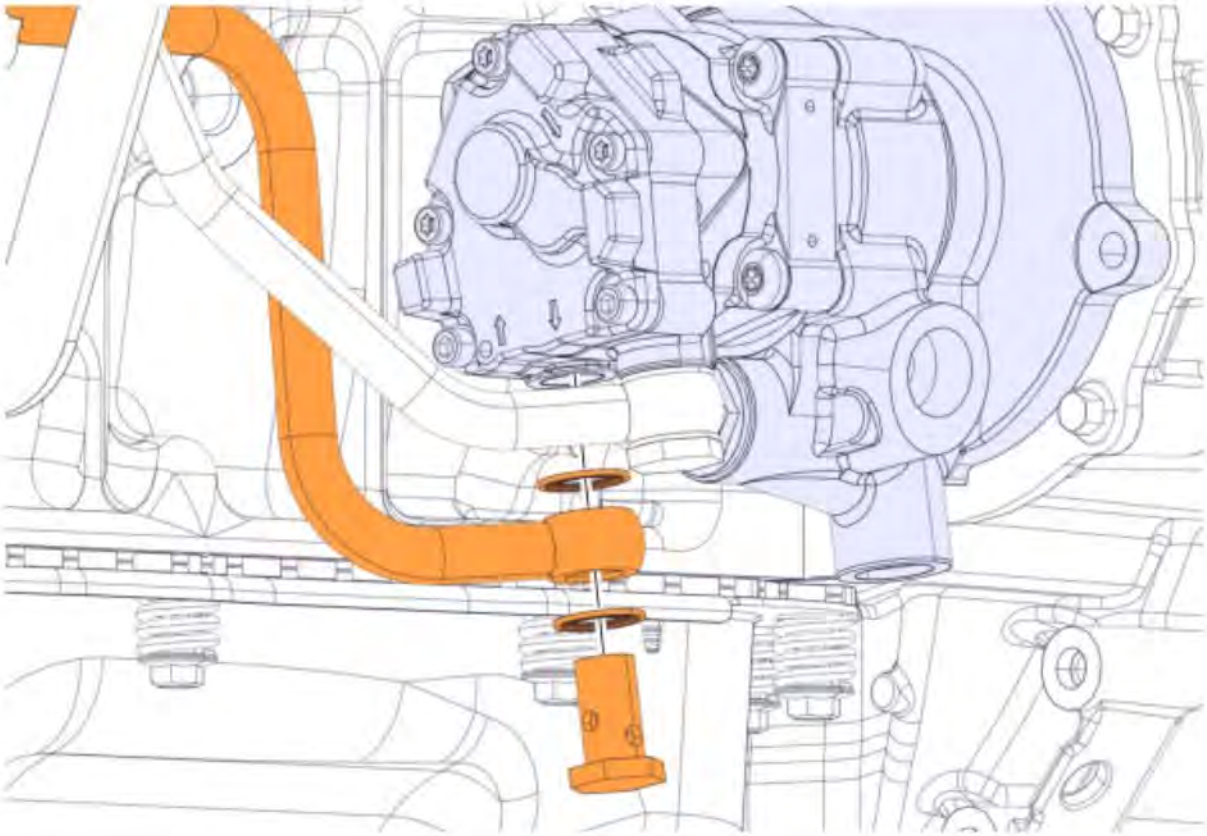

21	Install the hollow screw.

22	Torque tighten the hollow screw.

Tightening torque	
Fuel pipe, hollow screw	40 ±5 Nm (30 ±4 lb_f·ft)

23	Prime the fuel system.

i	Note Push the plunger until resistance is felt.

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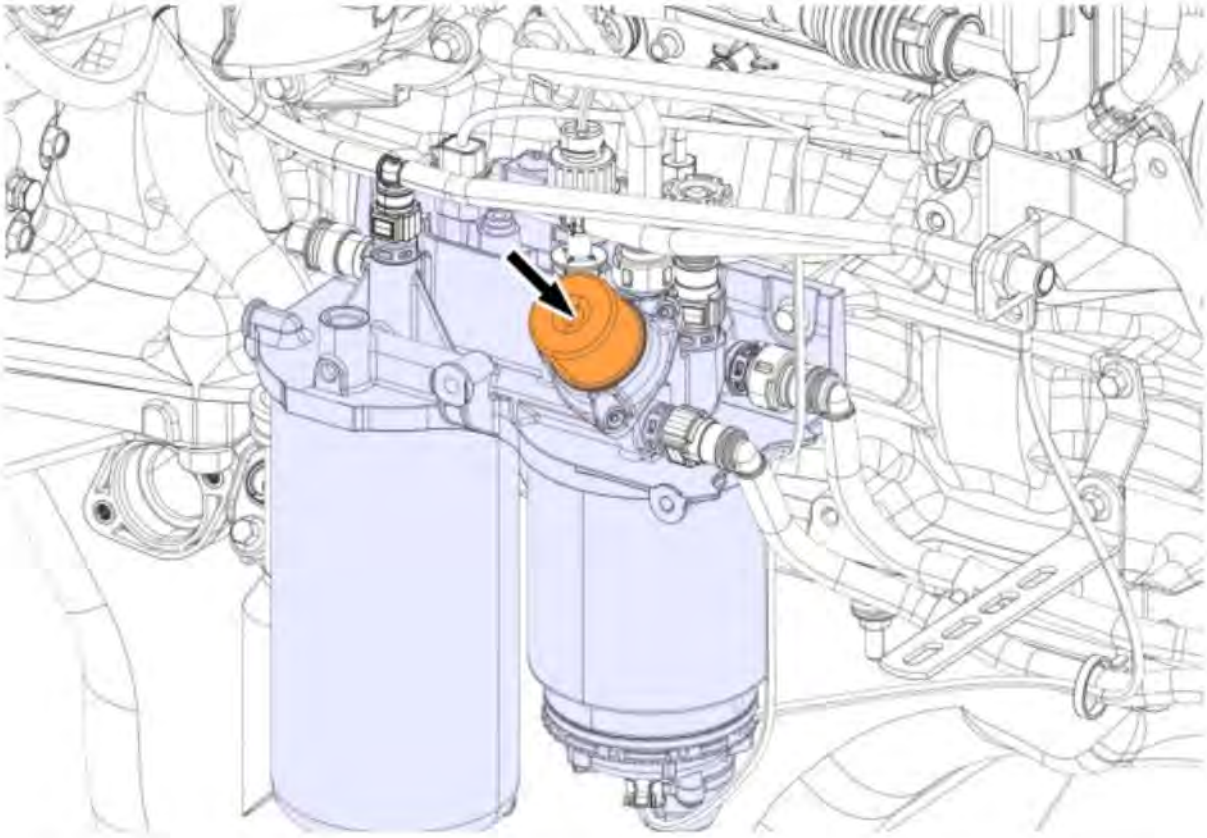

24	Start the engine.
25	Idle the engine.
26	Stop the engine.
27	Remove the fuel line.

Note
Cover openings to prevent debris from entering.

Service hint
Removing the fuel sensor may give more access.

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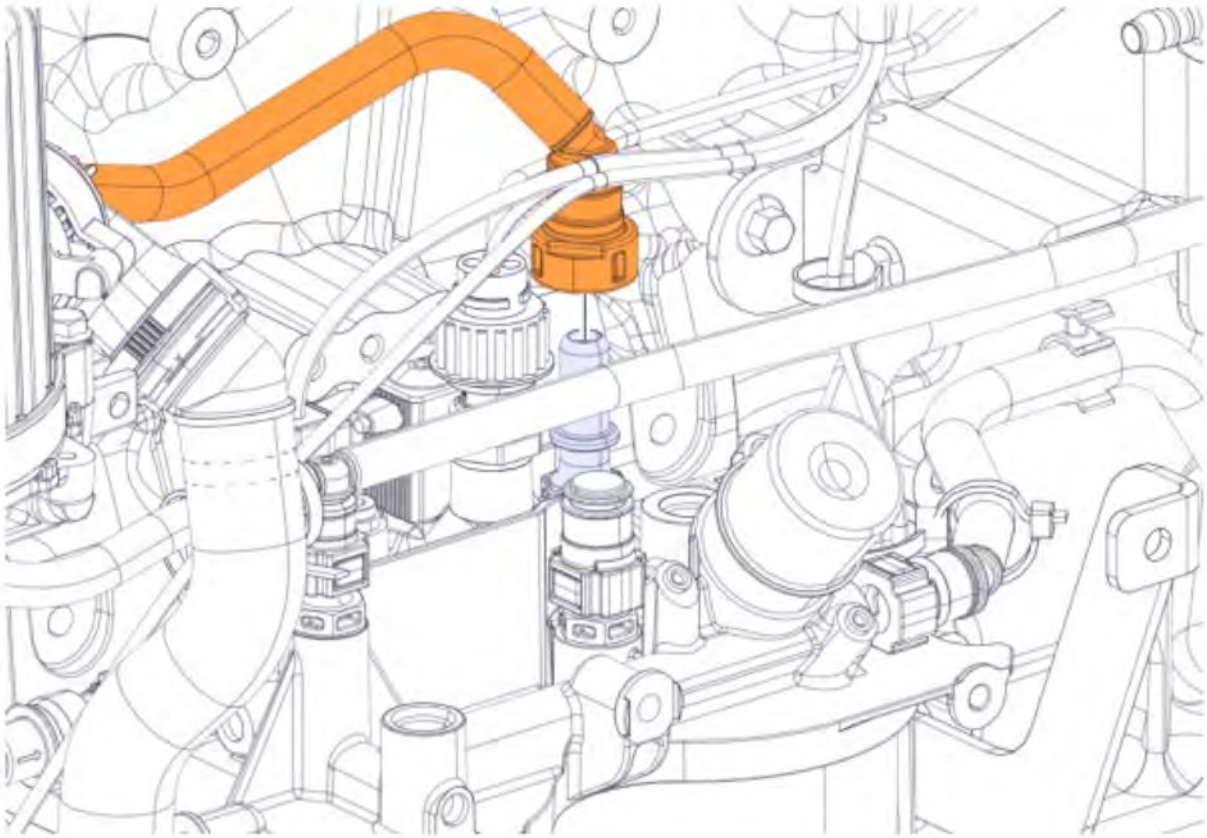
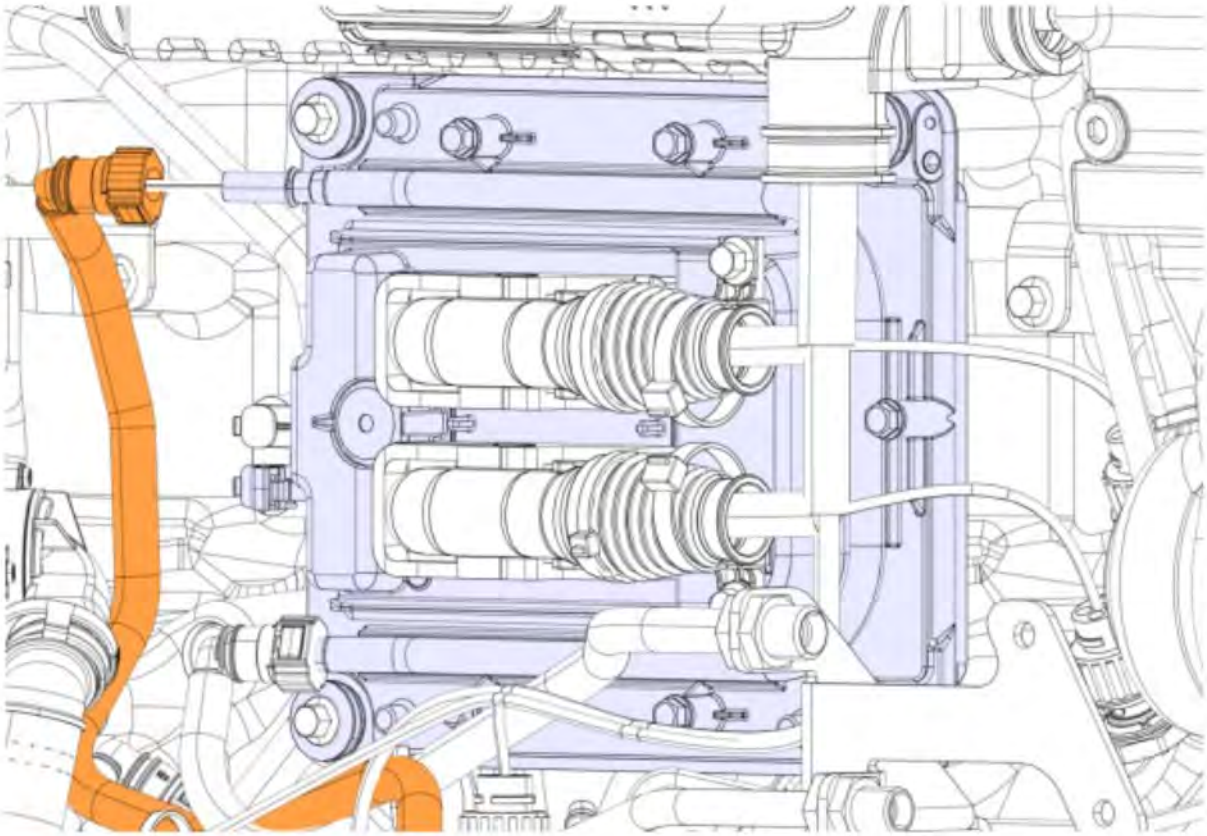


28	Remove the fuel line.



29	Install the transparent fuel line.
30	Tighten the hose clamp. Required material

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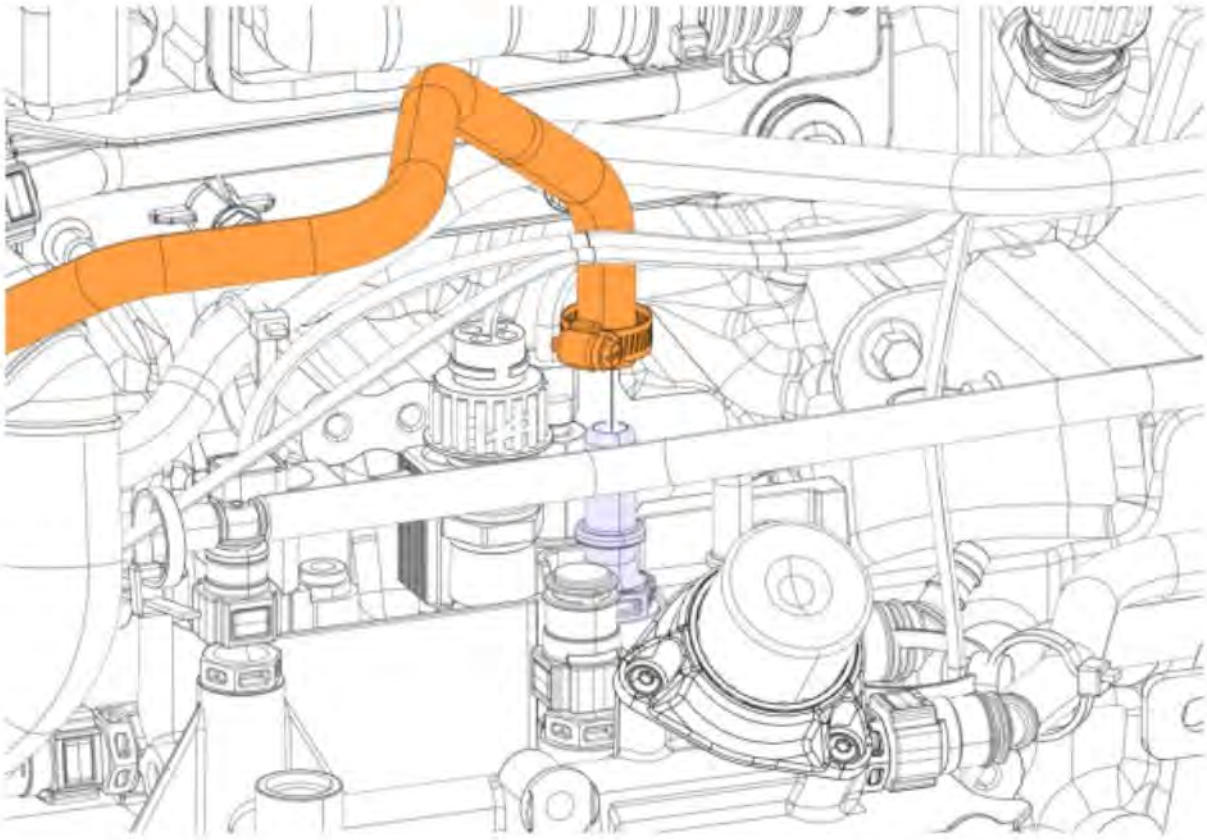
kit	88800625



31	Install the transparent fuel line.

32	Tighten the hose clamp. Note Reinstall the fuel sensor, if removed.

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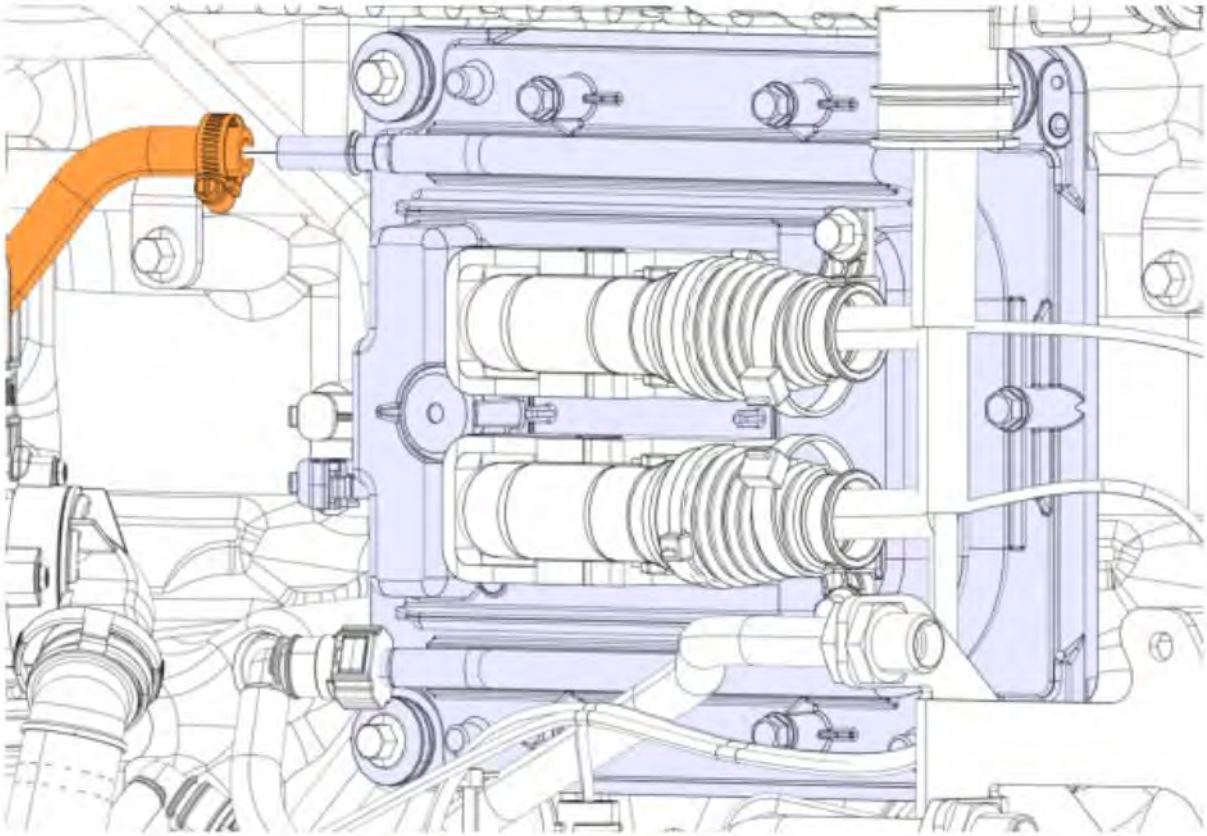
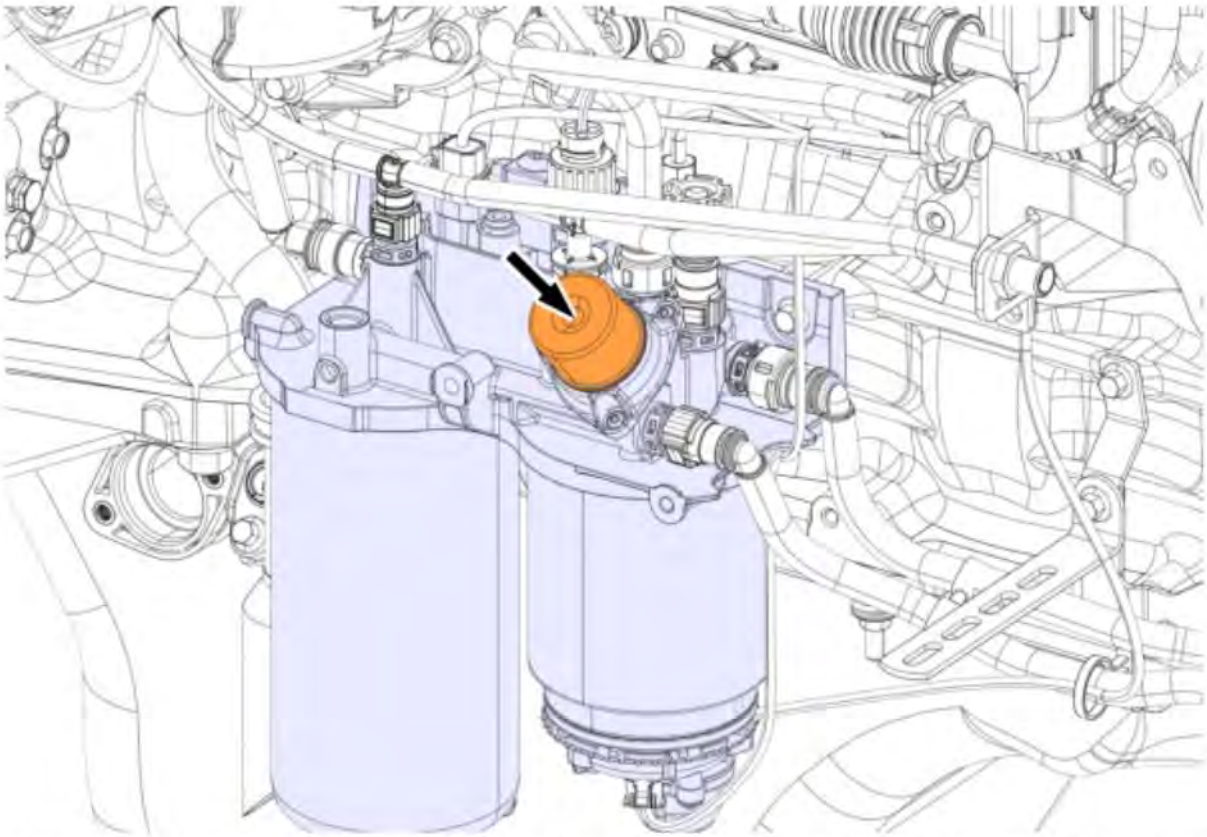


33	Prime the fuel system. **Note** Push the plunger until resistance is felt.



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34	Start the engine.
35	Depress the accelerator pedal momentarily to the full position several times.
36	Let the engine idle for 3 minutes.
37	Check the amount of air bubbles in the transparent fuel line from the ECM (Engine Control Module) cooler to the fuel filter housing.
38	Stop the engine.
39	Perform this procedure when the condition below is met. Conditions • If an excessive amount of air bubbles are detected in the transparent test line from the ECM to fuel filter housing. ▸ Check for leaks in the ECM cooler lines, splitter valves, supply line from fuel tank and for missing O-rings. ▸ Check for leaks in the frame mounted fuel filter, fuel tank pick up tube, and fuel fittings from ECM cooling loop back to fuel tank. ▸ If an excessive amount of air bubbles are detected in the transparent fuel line from the cylinder head, but a normal amount of air bubbles are detected in the transparent fuel line from the ECM cooler loop to the fuel filter housing, proceed to the next step.
40	Remove the nut.
41	Remove the clamp.

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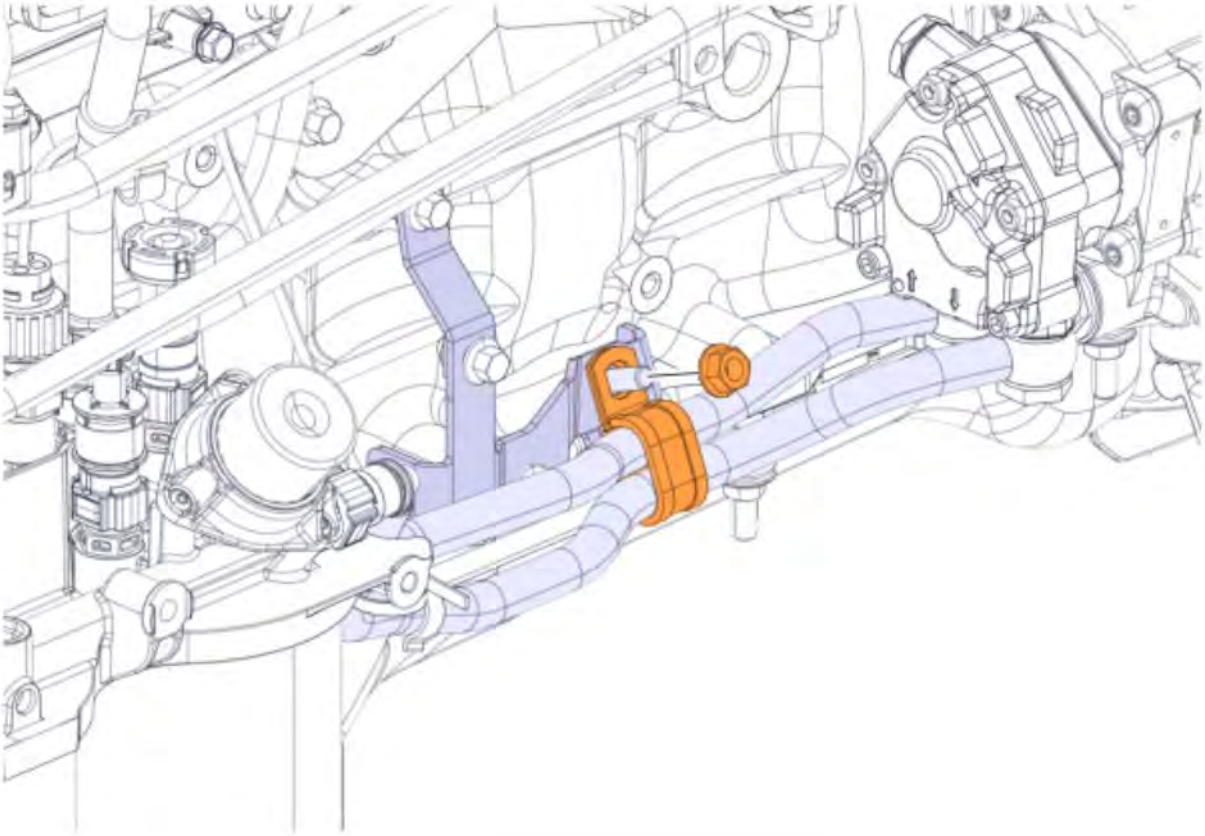
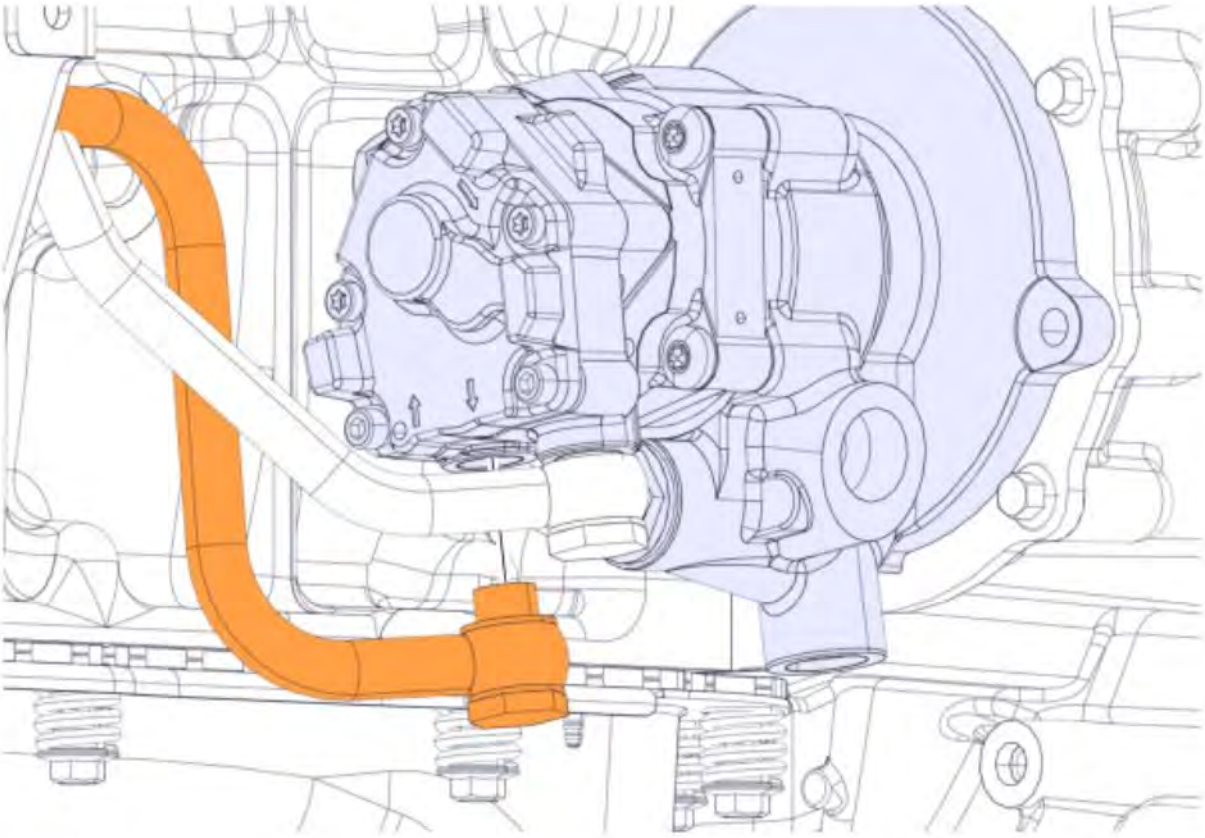


42	Remove the fuel inlet line.



43	Install the transparent fuel line to the pump inlet.

44	Install the sealing washers.

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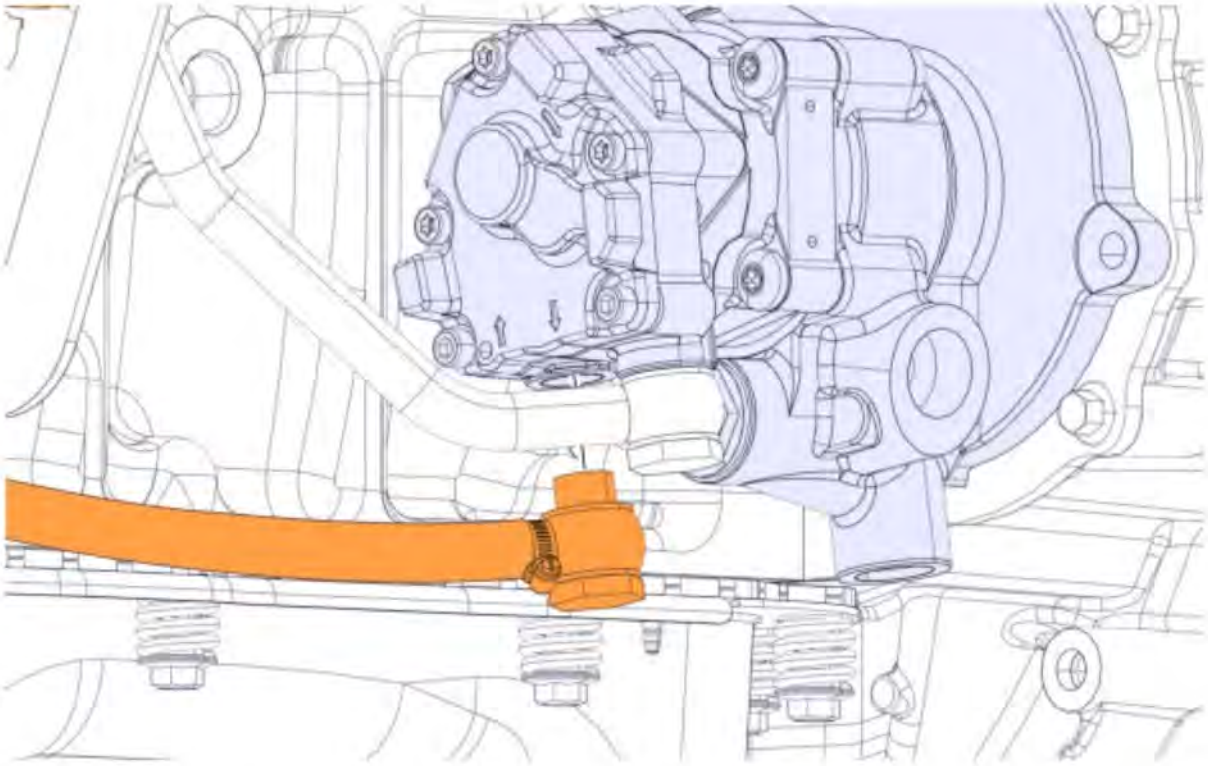
	Use new sealing washers.



45	Install the hollow screw.

46	Torque tighten the hollow screw.

Tightening torque	
Fuel pipe, hollow screw	40 ±5 Nm (30 ±4 lb_f·ft)

47	Remove the fuel line.

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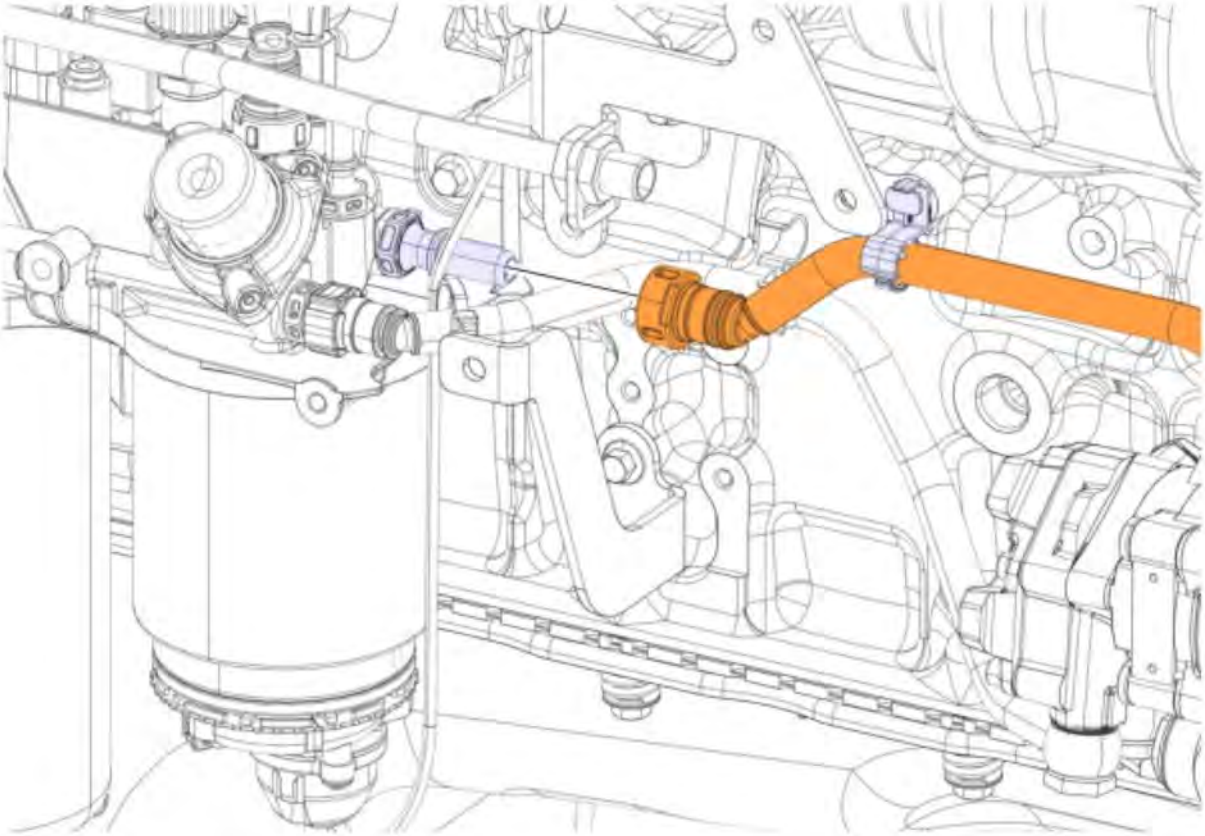
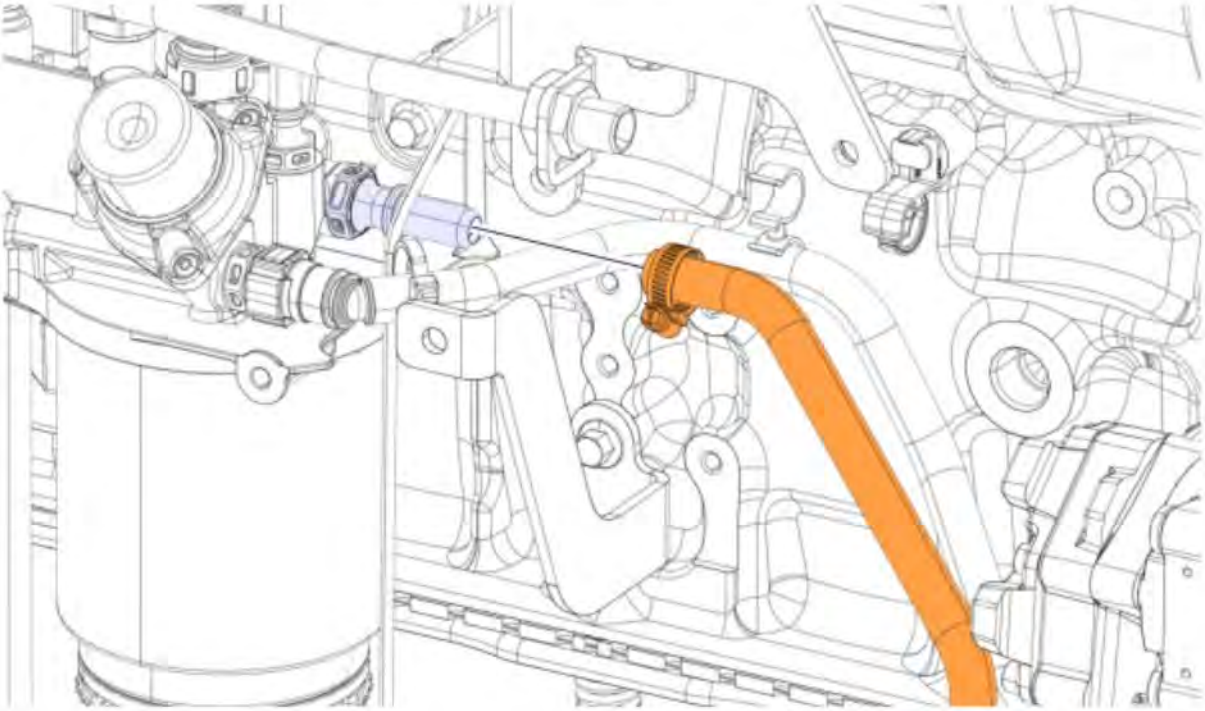


48	Install the transparent fuel line.

49	Tighten the clamp.



50	Prime the fuel system. Note Push the plunger until resistance is felt.

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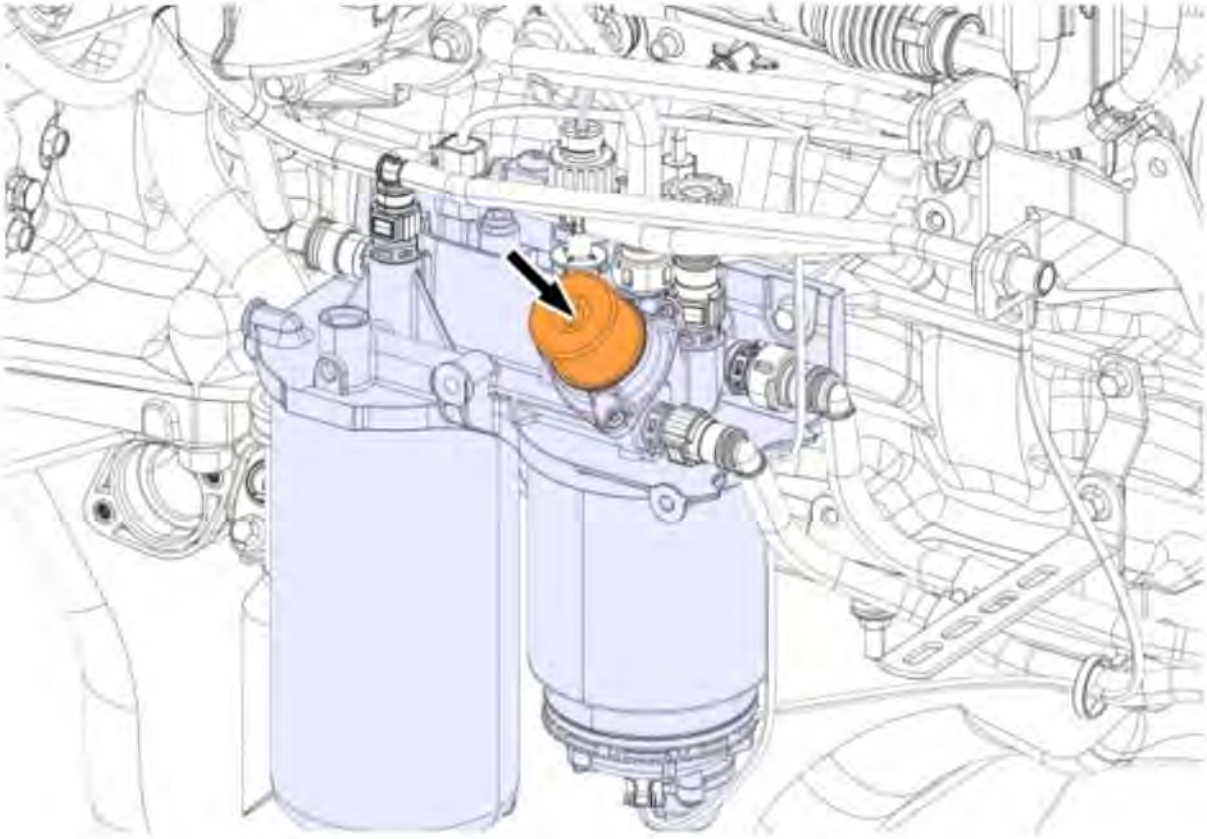

51	Start the engine.
52	Depress the accelerator pedal momentarily to the full position several times.
53	Let the engine idle for 3 minutes.
54	Check the amount of air bubbles in the transparent fuel line from the filter housing to fuel supply pump inlet.
55	Stop the engine.
56	Perform this procedure when the condition below is met. Conditions • If a normal amount of air bubbles are detected in both transparent fuel lines. ▸ Check the factory lines and fittings and banjo washers on the fuel supply pump.
57	Perform this procedure when the condition below is met. Conditions • If an excessive amount of air bubbles are detected in the transparent fuel line from the fuel filter housing to the supply pump inlet. ▸ Proceed to the next step.
58	Remove the fuel line.

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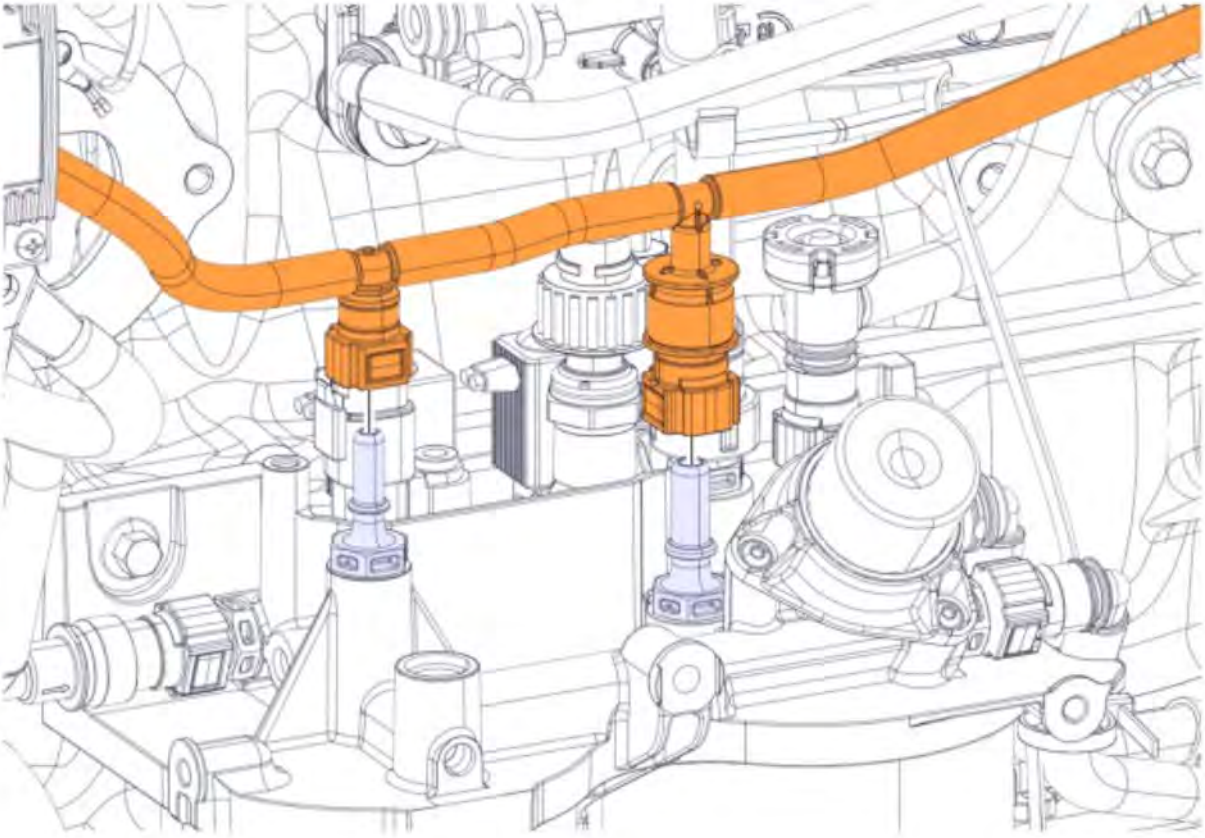
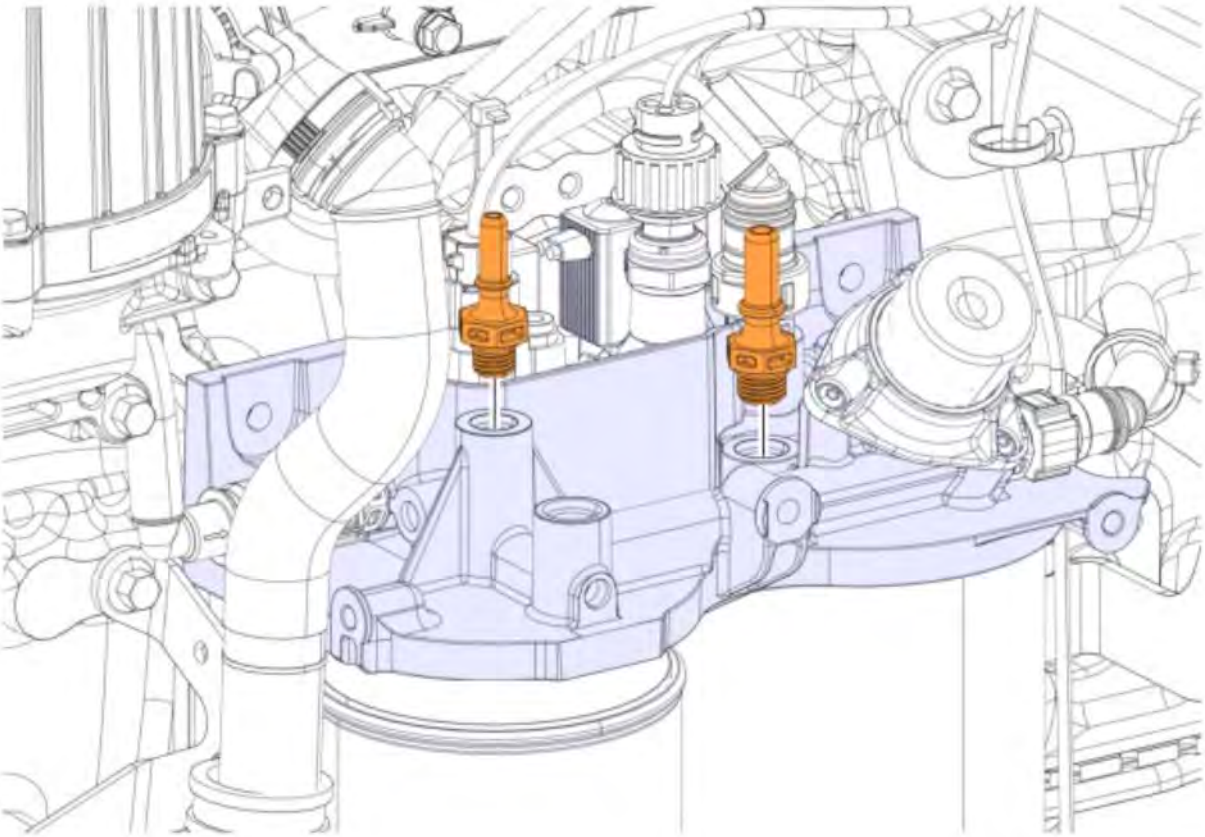


59	Remove the fittings.



60	Install the test plugs with sealing rings.	
	Tightening torque	
	Valve, air vent	5.5 ±0.6 Nm

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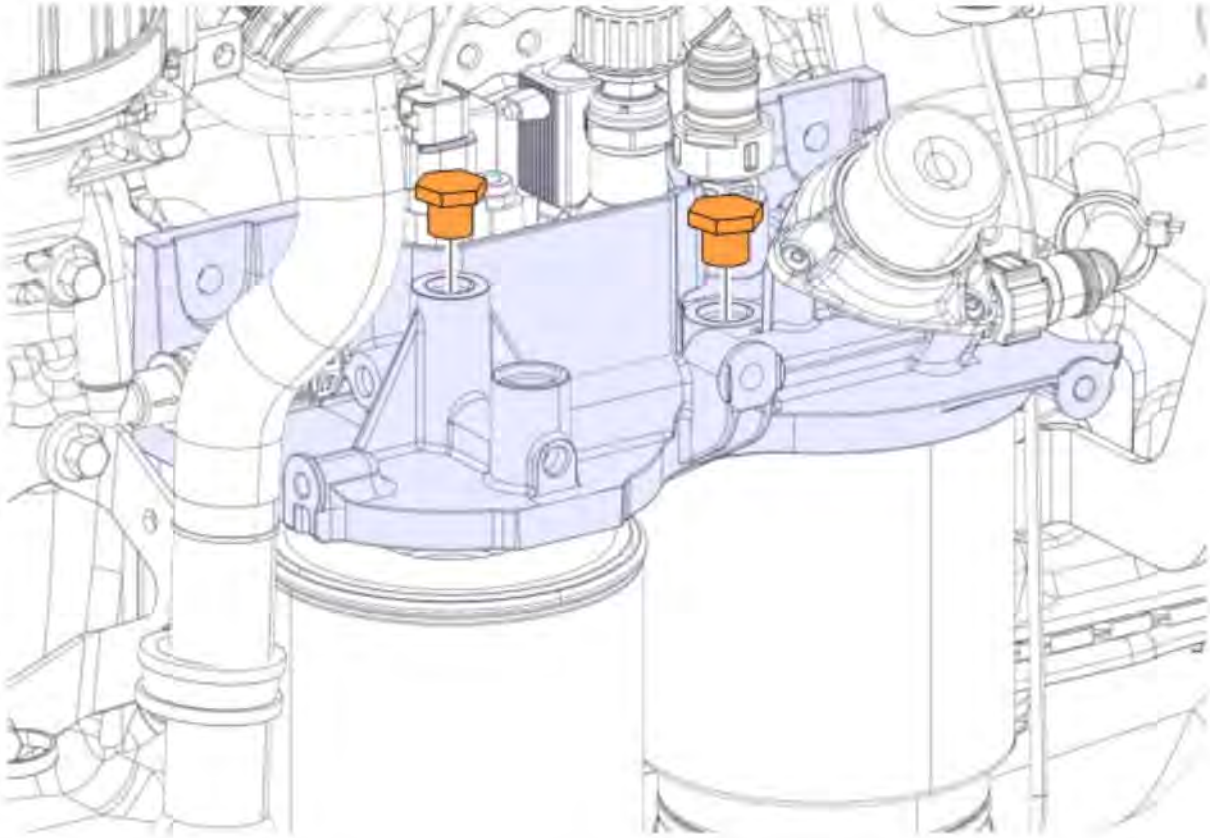
	(4 ±0.4 lb_f·ft)

Required material	
kit	88800625



61	Start the engine.
62	Allow the engine idle for 3 minutes.
63	Check the amount of air bubbles in the transparent fuel line from the fuel filter housing to the fuel supply pump.
64	Stop the engine.
65	Perform this procedure when the condition below is met. Conditions • If a normal amount of bubbles are detected. ▸ Proceed to the next step. ▸ Remove the test plugs.

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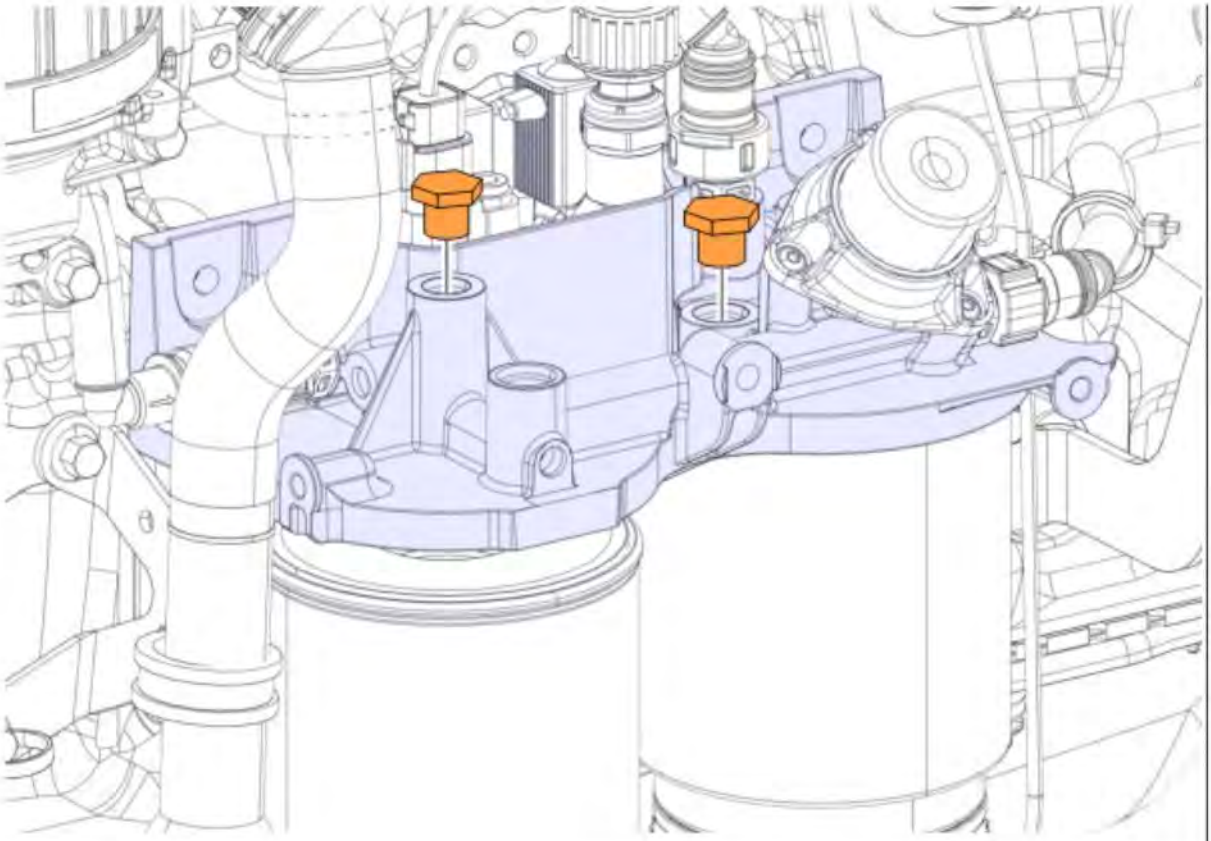
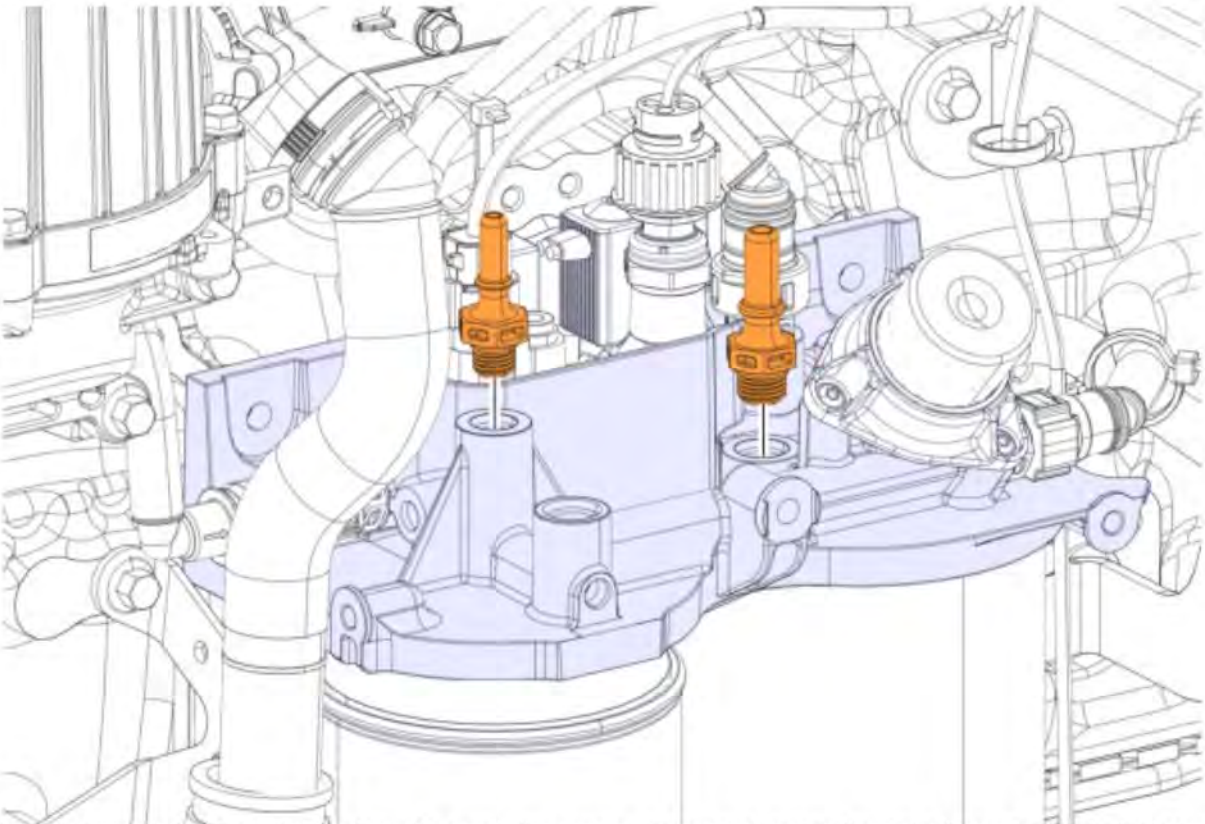


66	Install the fittings. **Note** Use new parts.



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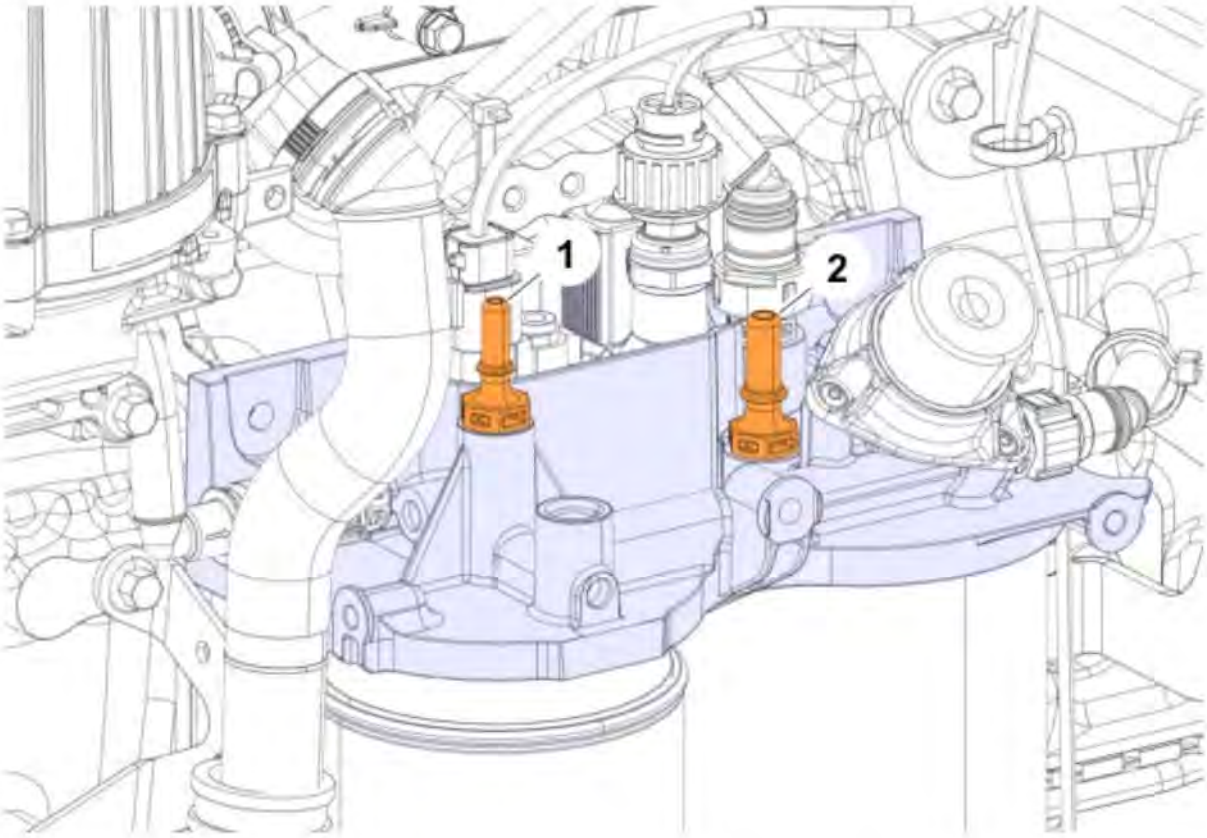
67	Torque tighten the fitting (1).

Tightening torque	
Valve, air vent	5.5 ±0.6 Nm (4 ±0.4 lb_f·ft)

68	Torque tighten the fitting (2).

Tightening torque	
Valve, air vent	6 ±1 Nm (4 ±1 lb_f·ft)



69	Install the fuel line.

i	Note Use a new part.

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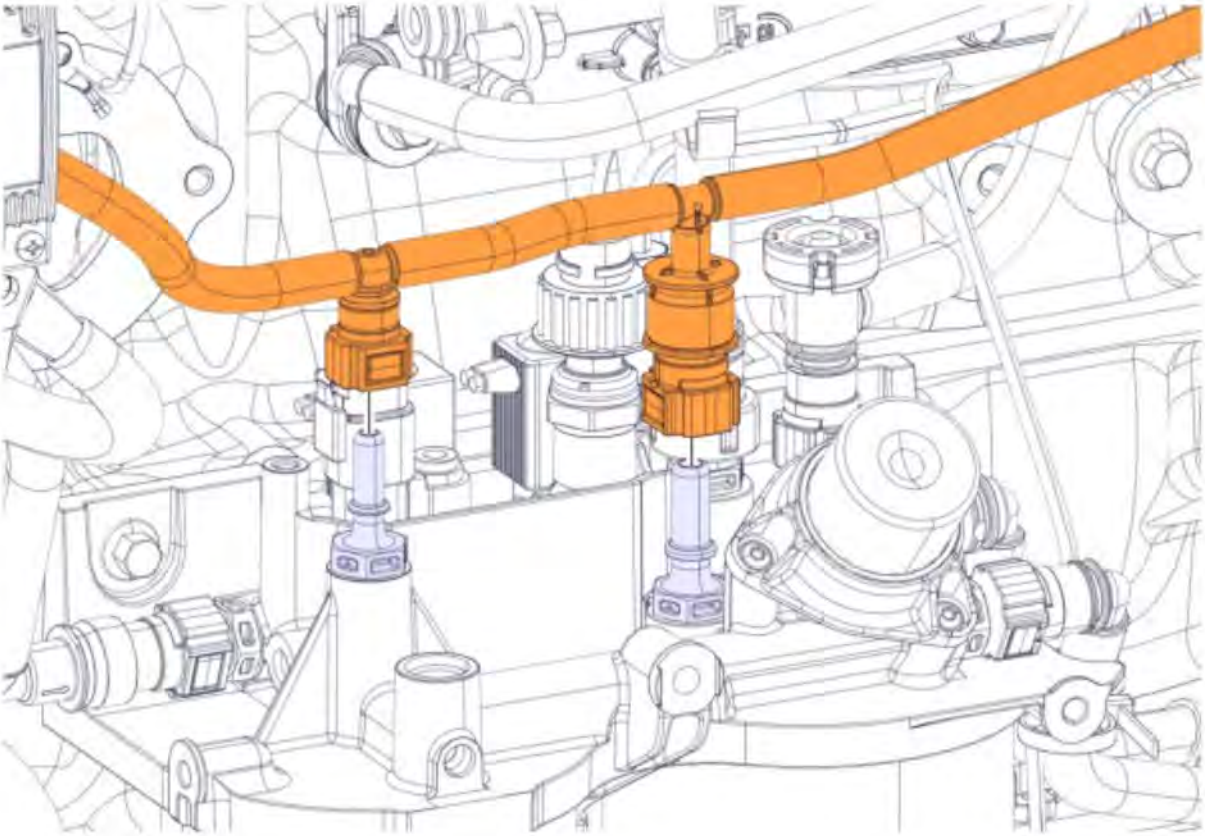

70	Perform this procedure when the condition below is met. Conditions • If an excessive amount of air bubbles are detected. ▸ Proceed to the next step.
71	Remove the fuel line.
72	Install the cap.

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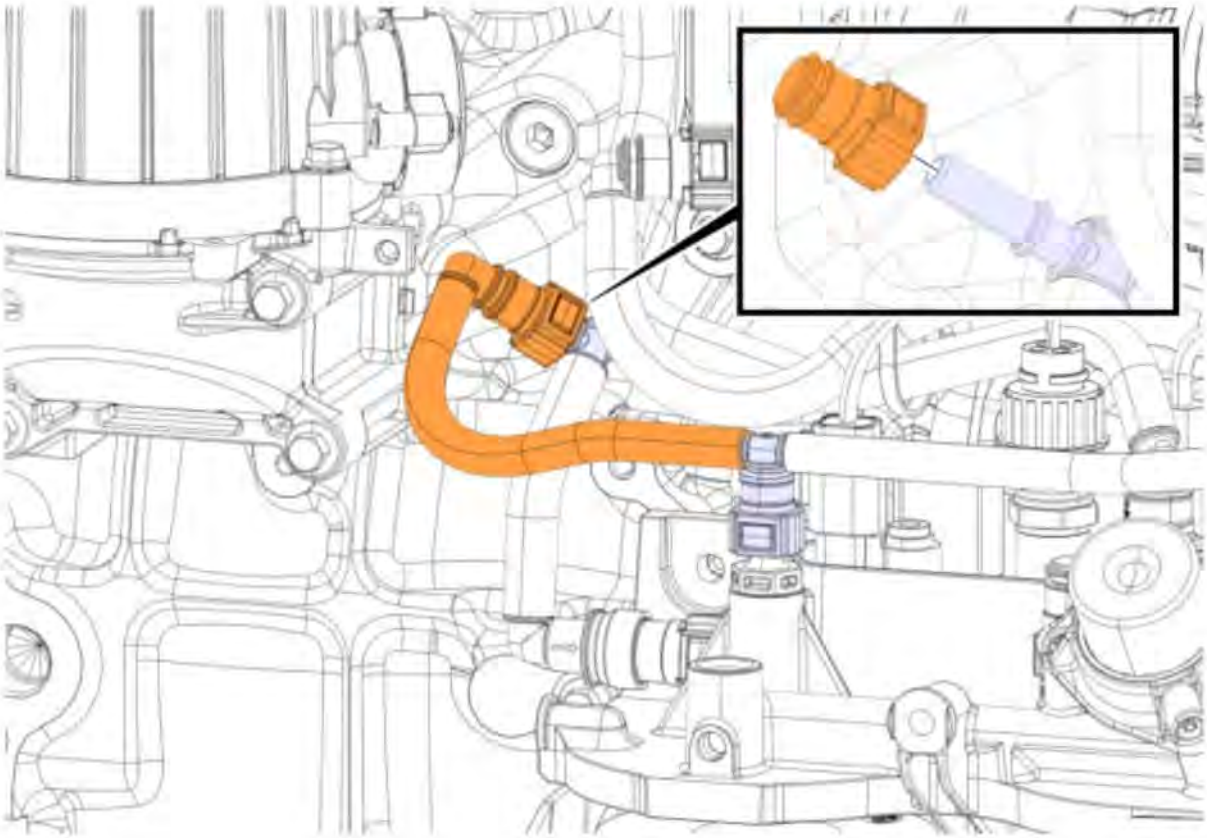

73	Start the engine.
74	Idle the engine for 3 minutes.
75	Check for air bubbles in the transparent fuel line from the filter housing to the supply pump.
76	Stop the engine.
77	Perform this procedure when the condition below is met. Conditions • If a normal amount of air bubbles are detected. ▸ Proceed to the next step. ▸ Replace the fuel line. Note Use new parts. Note Testing is completed, remove the tools, reinstall the parts.

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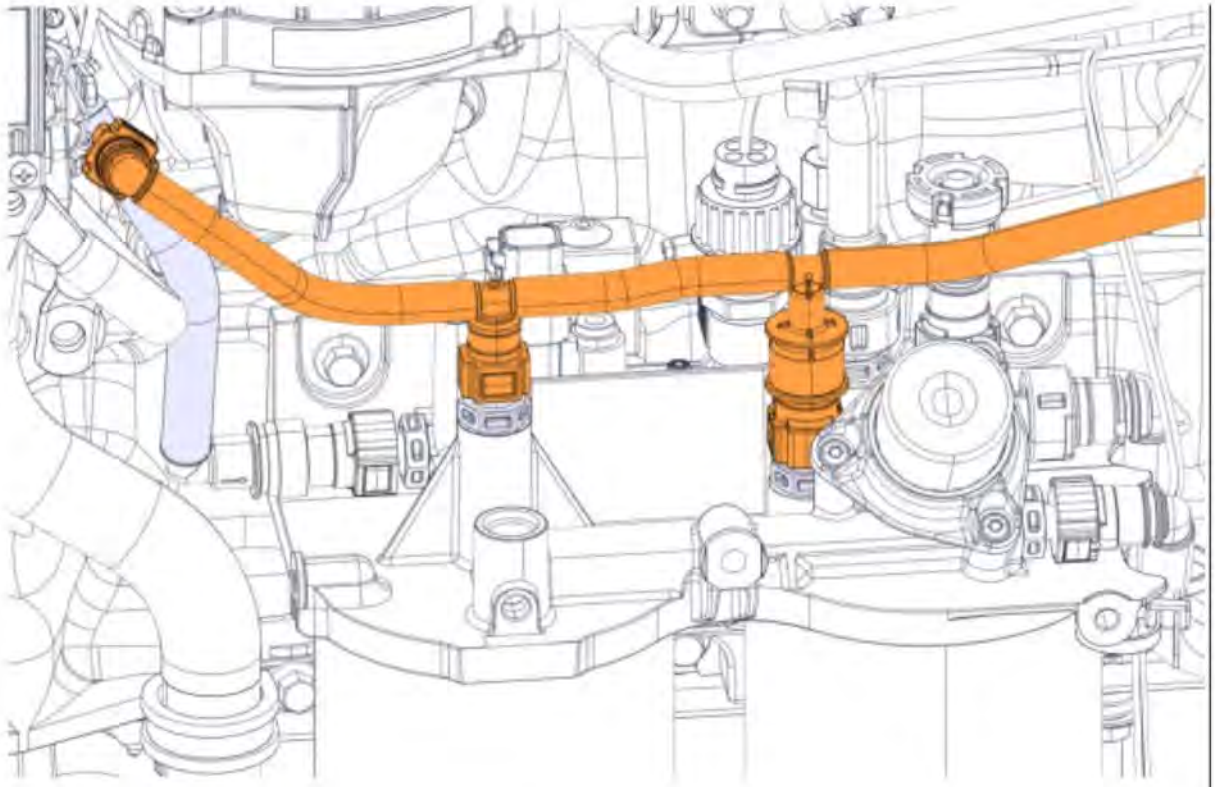

78	Perform this procedure when the condition below is met. Conditions

•	If an excessive amount of air bubbles are detected in the transparent fuel line from the filter housing to the supply pump.
▸	Proceed to the next step.

79	Remove the fuel line.

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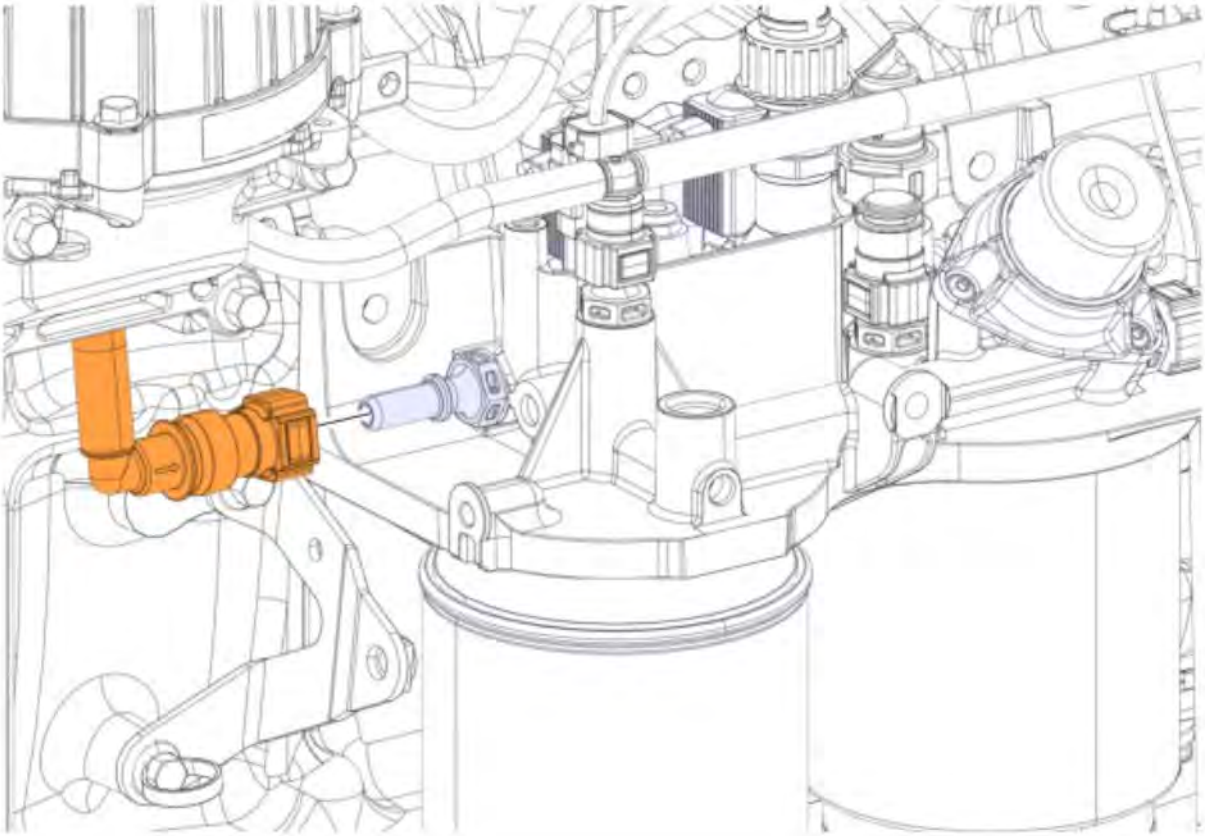
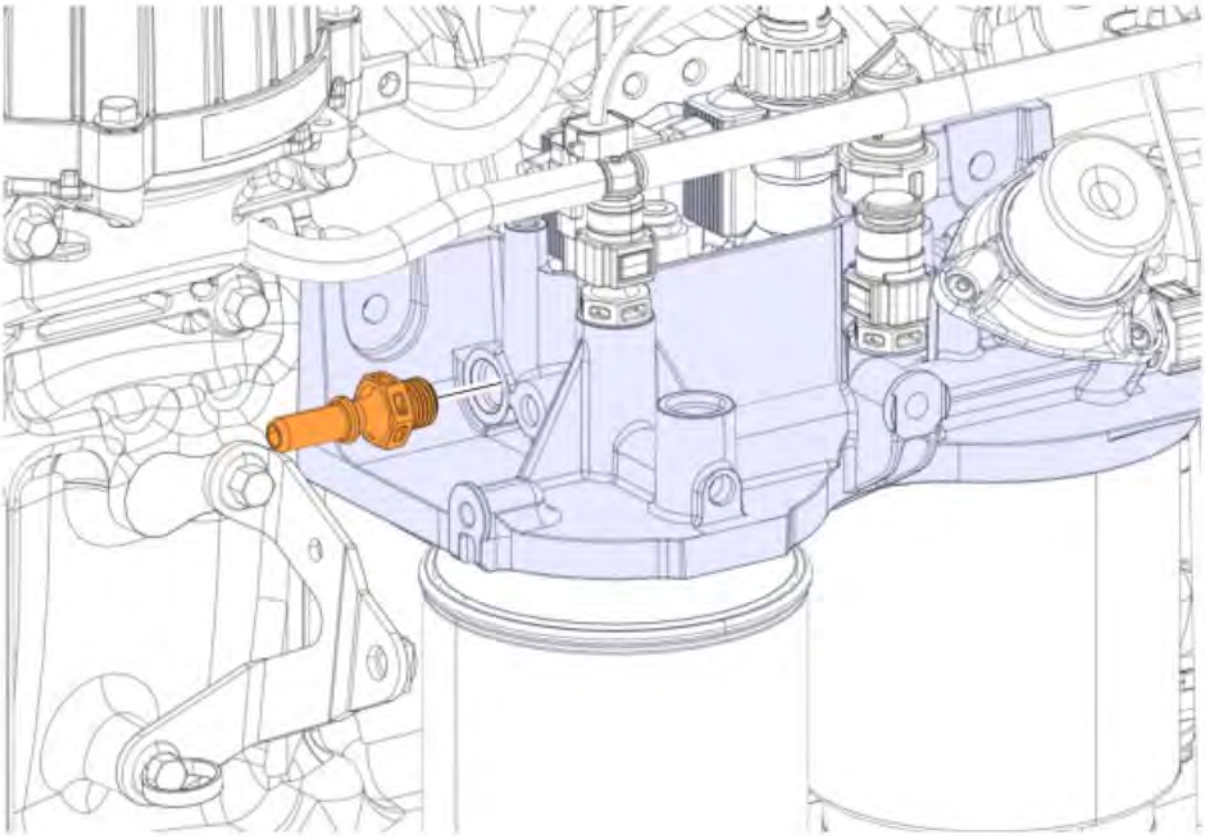


80	Remove the fitting.



81	Install the test plug with sealing ring.	
	Tightening torque	
	Fitting, M14	6 ±1 Nm

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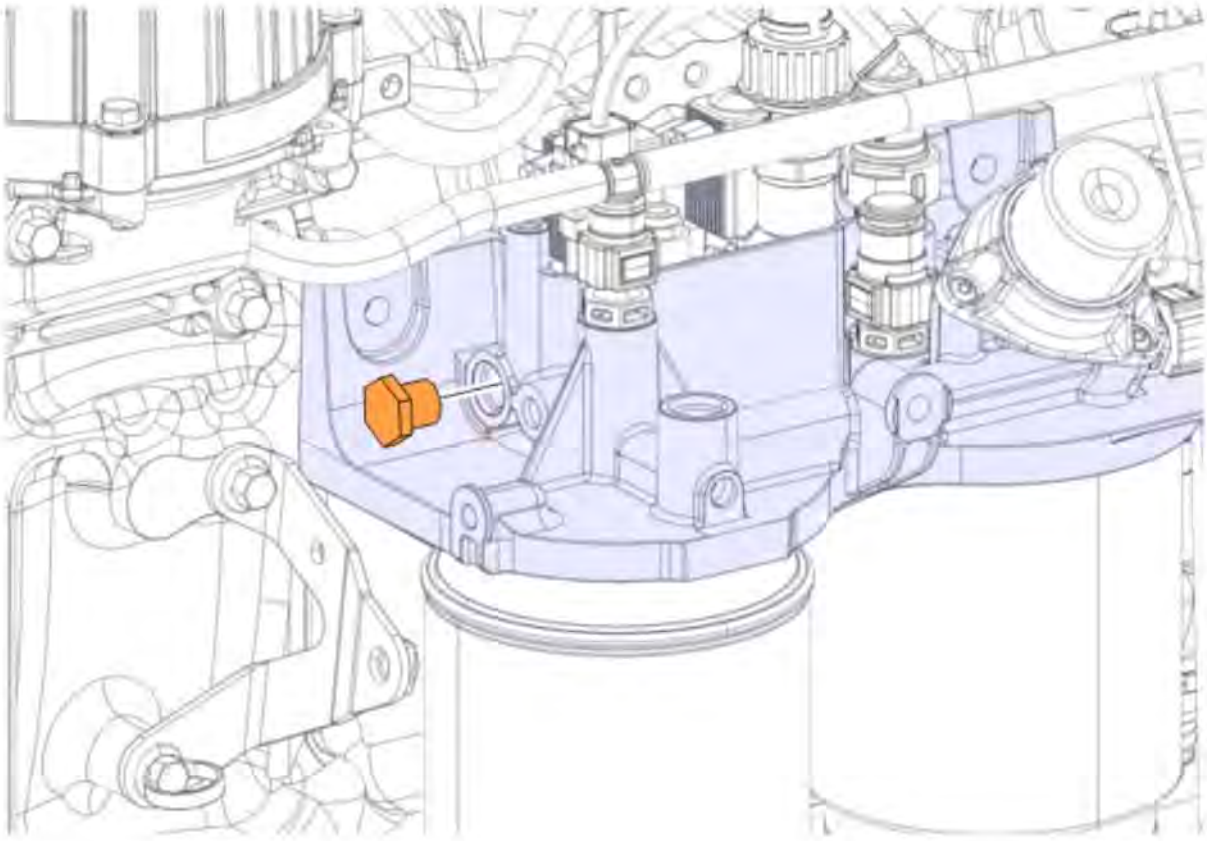
	(4 ±1 lb_f·ft)



82	Start the engine.
83	Let the engine idle for 3 minutes.
84	Check the amount of air bubbles in the transparent fuel line from the fuel filter housing to the fuel supply pump.
85	Stop the engine.
86	Perform this procedure when the condition below is met. Conditions • If a normal amount of air bubbles are detected in the transparent fuel line from the fuel filter housing to the fuel supply pump. ▸ Replace the fuel return line from the cylinder head and the fitting in the fuel filter housing. Note Testing is completed, remove the tools, re-install the parts.
87	Perform this procedure when the condition below is met. Conditions

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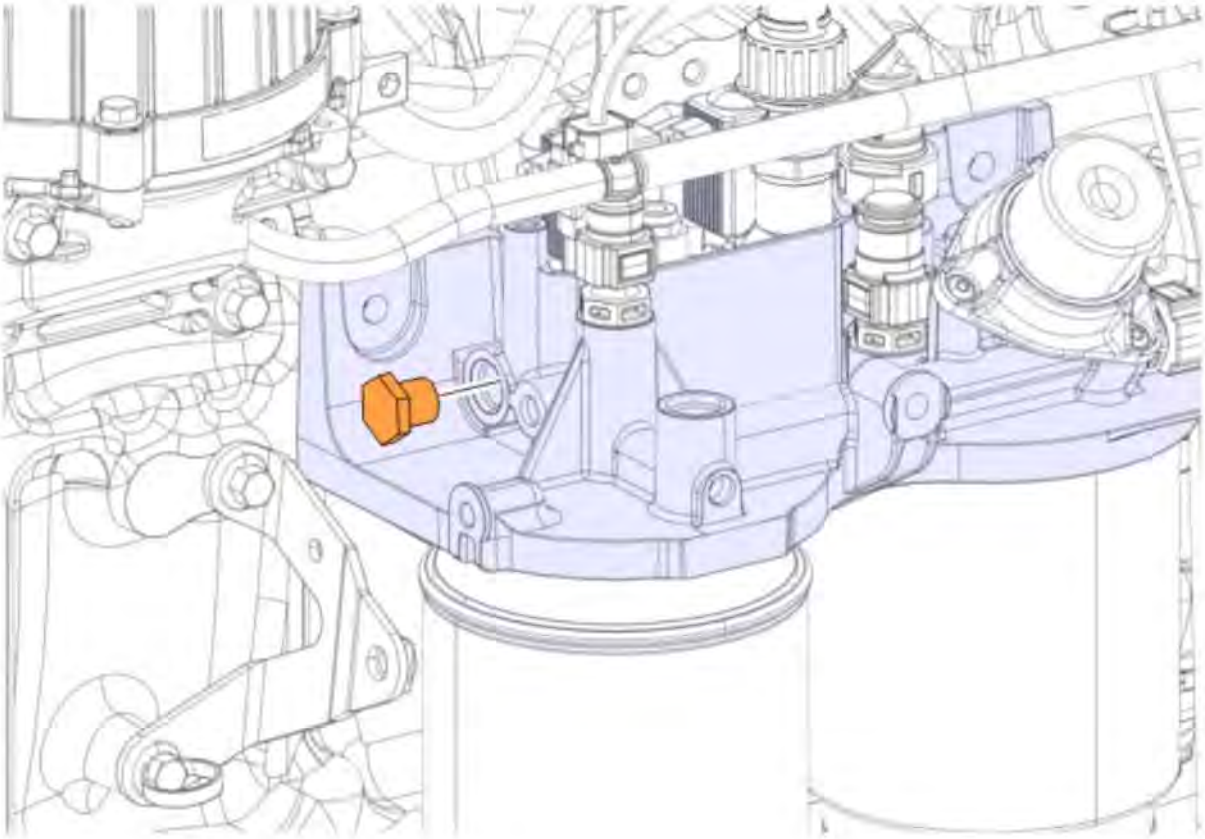
- If an excessive amount of air bubbles are detected in the transparent fuel line from the fuel filter housing to the fuel supply pump.

▸ Check the primary fuel filter, fuel filter housing, and block off plate (if equipped).

Note
Testing is completed, remove the tools, re-install the parts.

88 Remove the test plug.



89 Inspect the fuel fitting and seal for damage.

Note
Replace the fitting if damaged.

90 Install the fitting.

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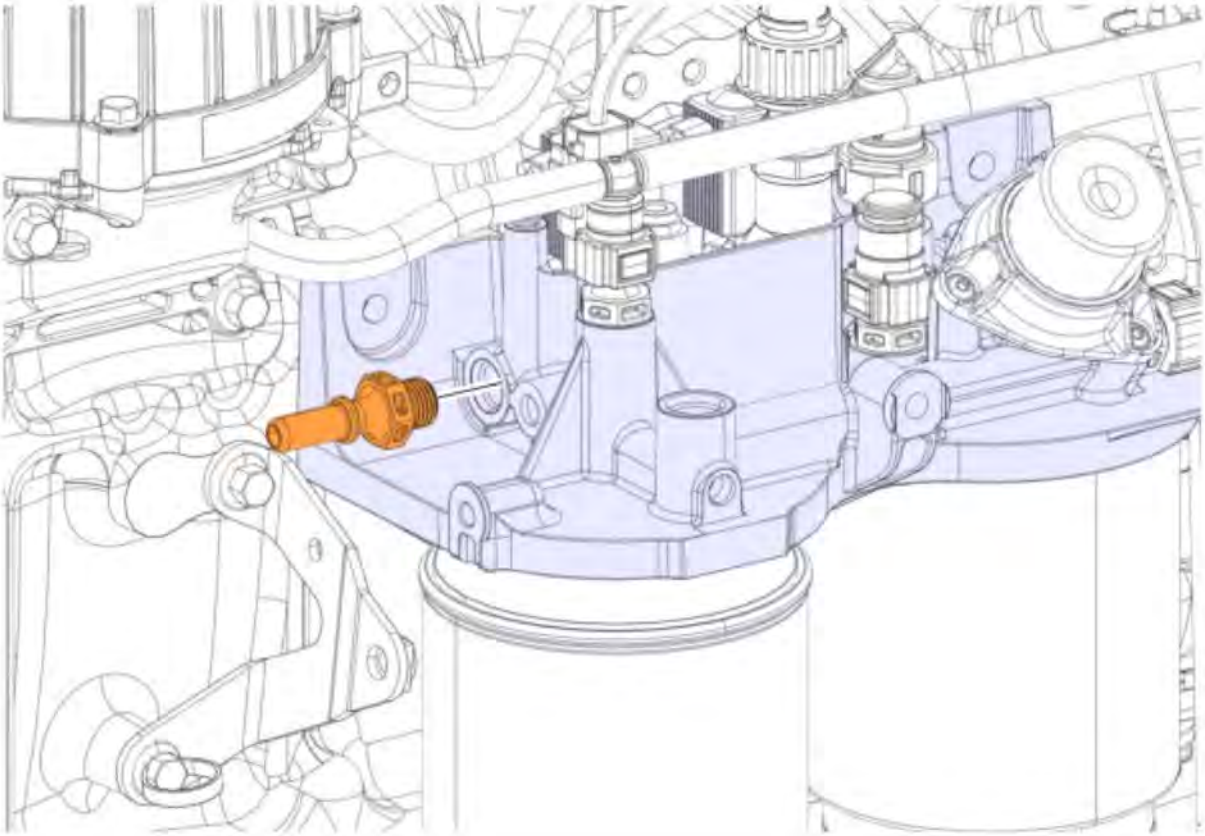

91	Torque tighten the fitting.	
	Tightening torque	
	Fitting, M14	6 ±1 Nm (4 ±1 lb_f·ft)

92	Install the fuel line.

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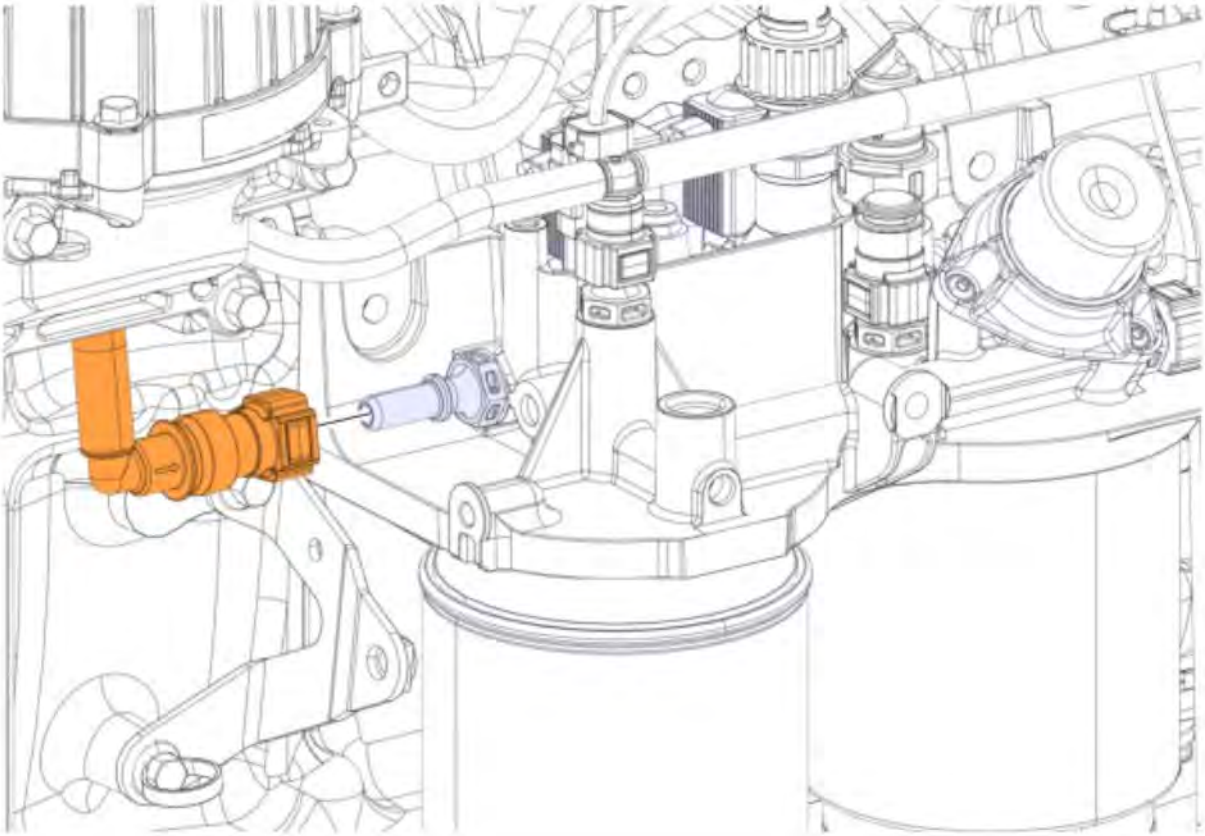
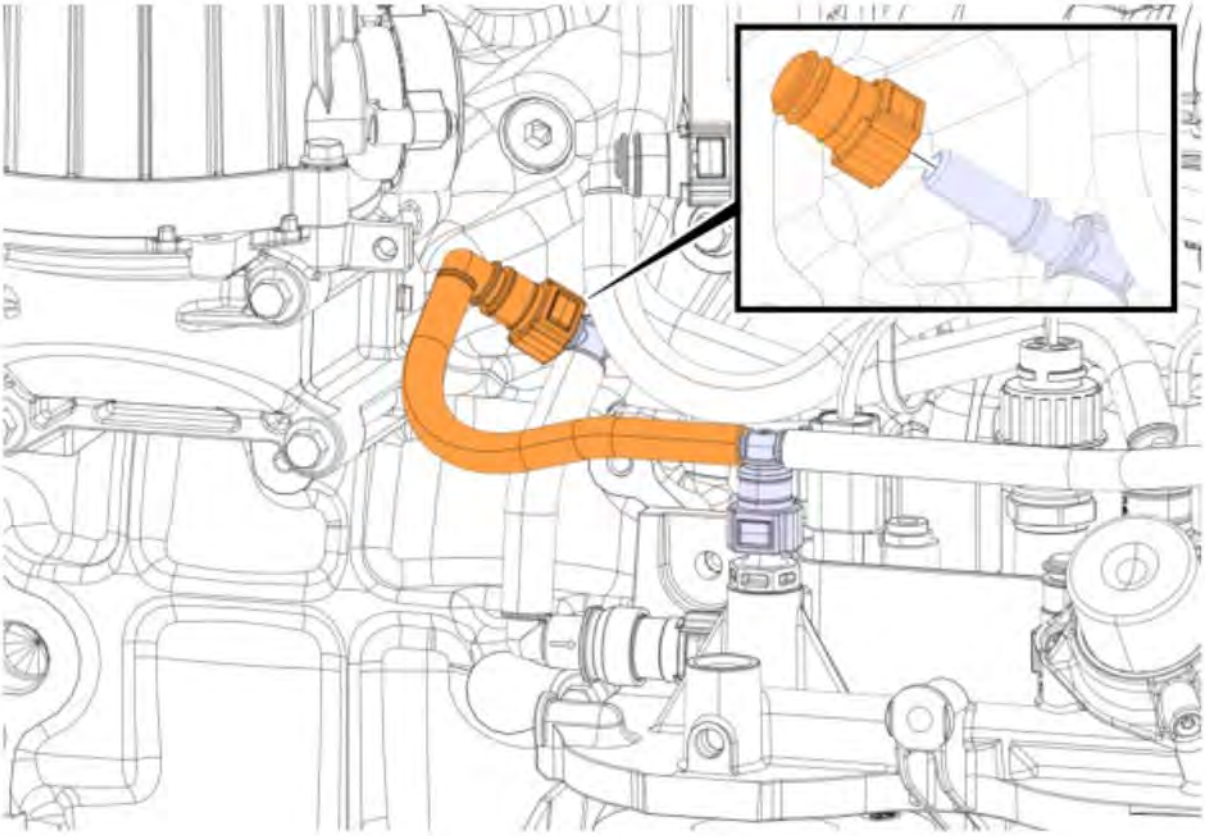


93	Remove the cap.

94	Install the fuel line.



95	Remove the test plugs.

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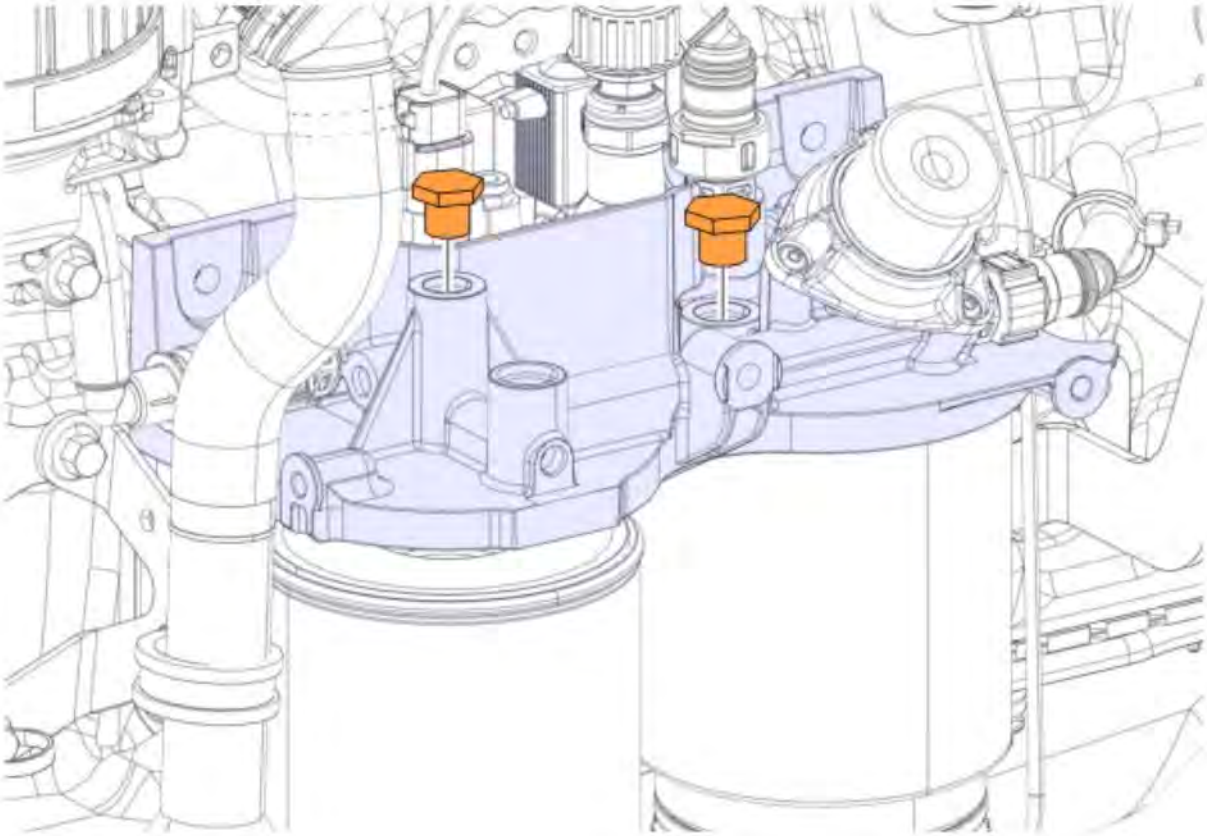

96	Inspect the fuel fittings and seals for damage. Note Replace the fitting if damaged.
97	Install the fittings.

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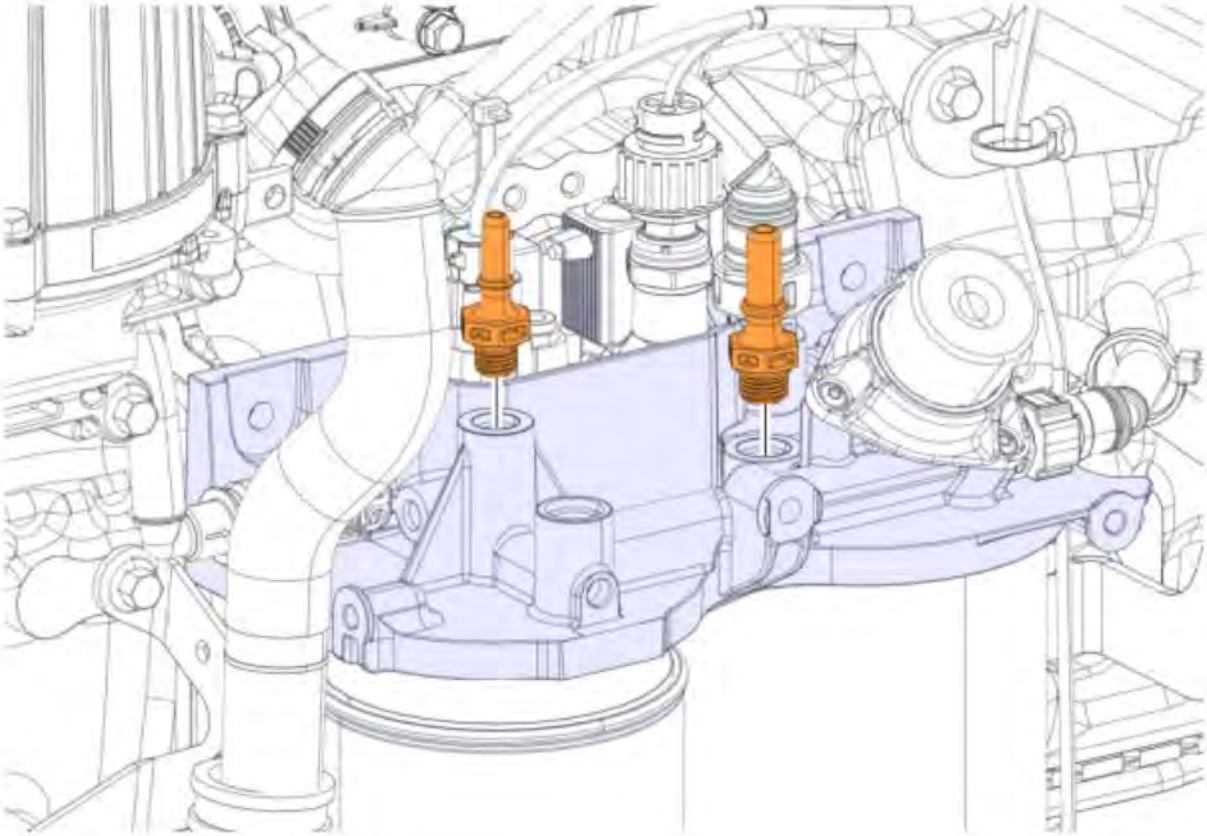

98	Torque tighten the fitting (1).	
	Tightening torque	
	Valve, air vent	5.5 ±0.6 Nm (4 ±0.4 lb_f·ft)

99	Torque tighten the fitting (2).	
	Tightening torque	
	Valve, air vent	6 ±1 Nm (4 ±1 lb_f·ft)

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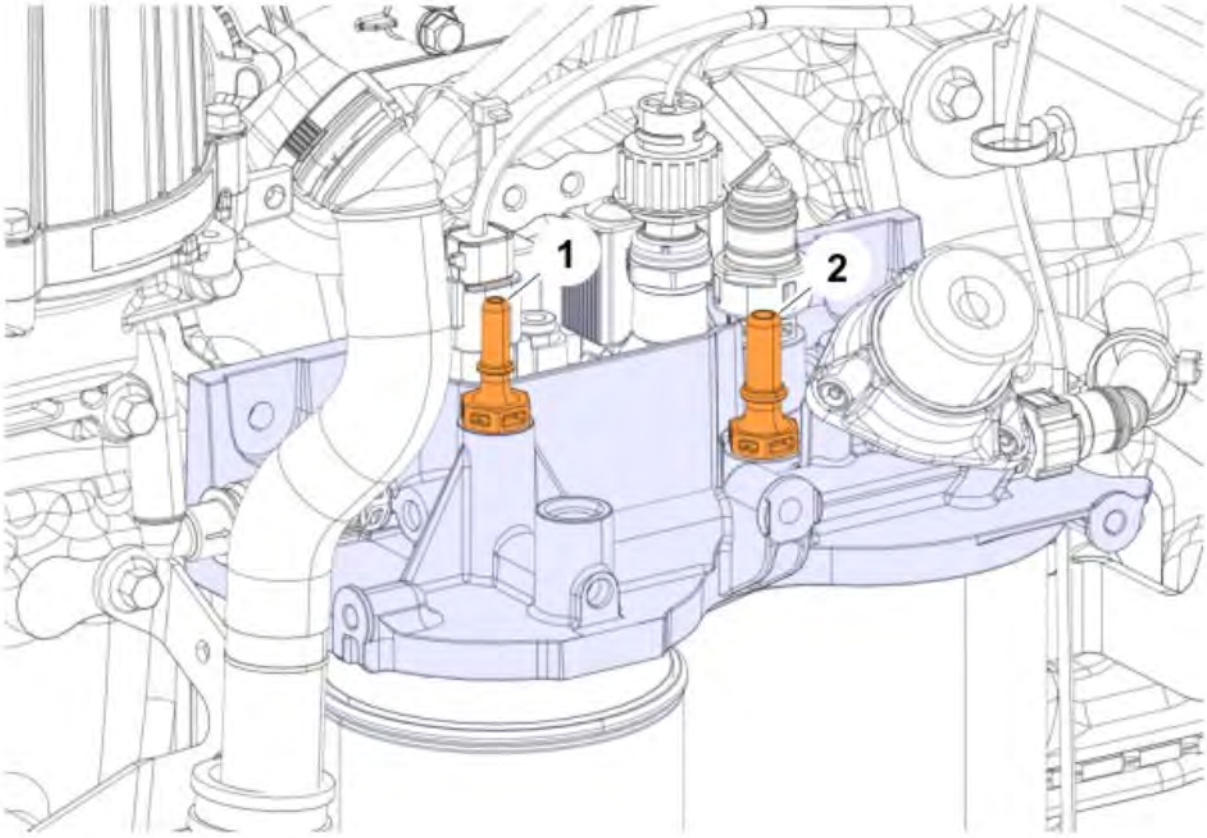
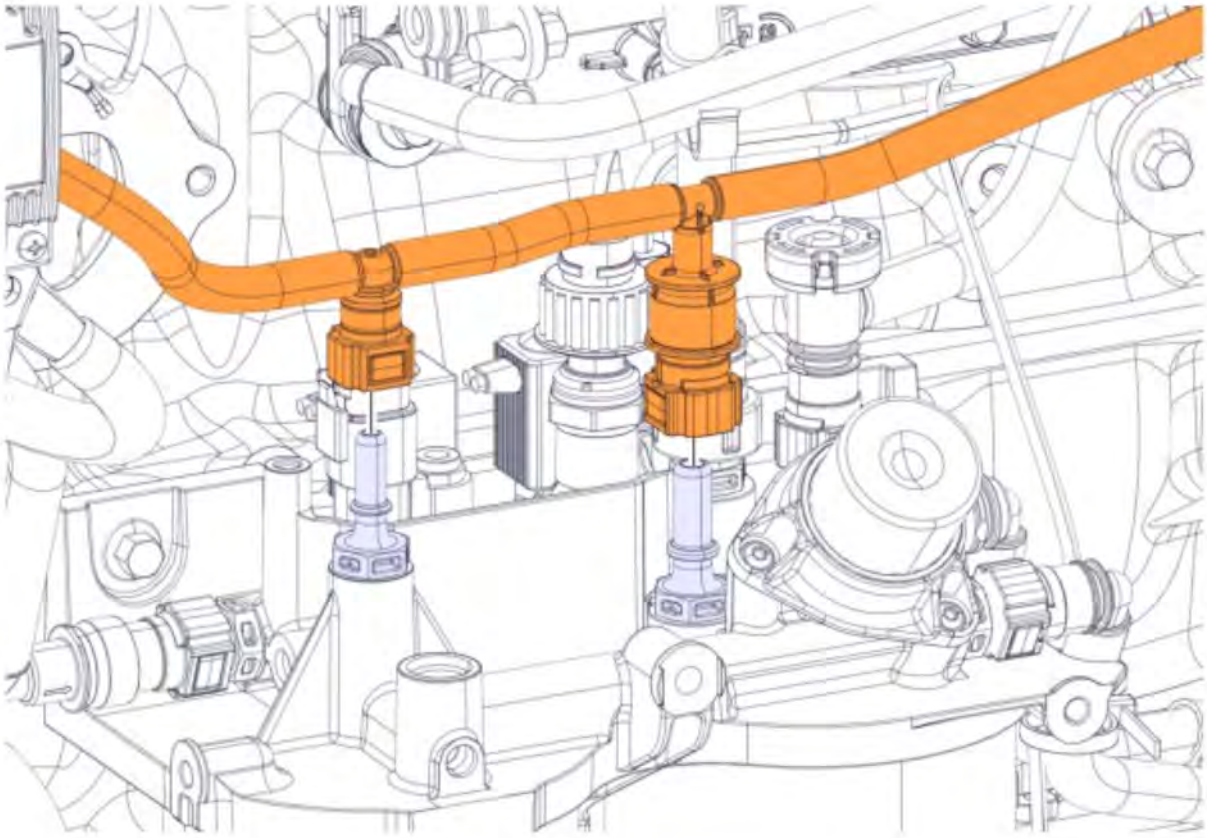


100	Install the fuel line.



101	Remove the transparent test line.

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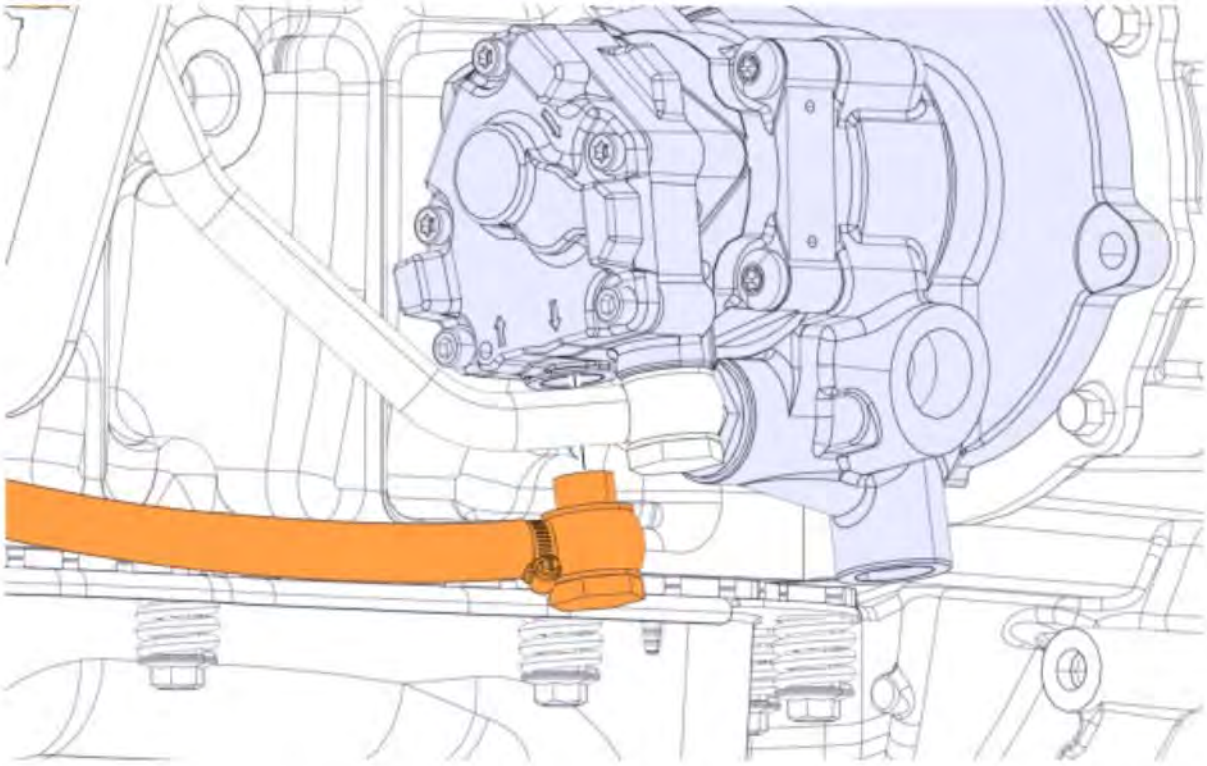
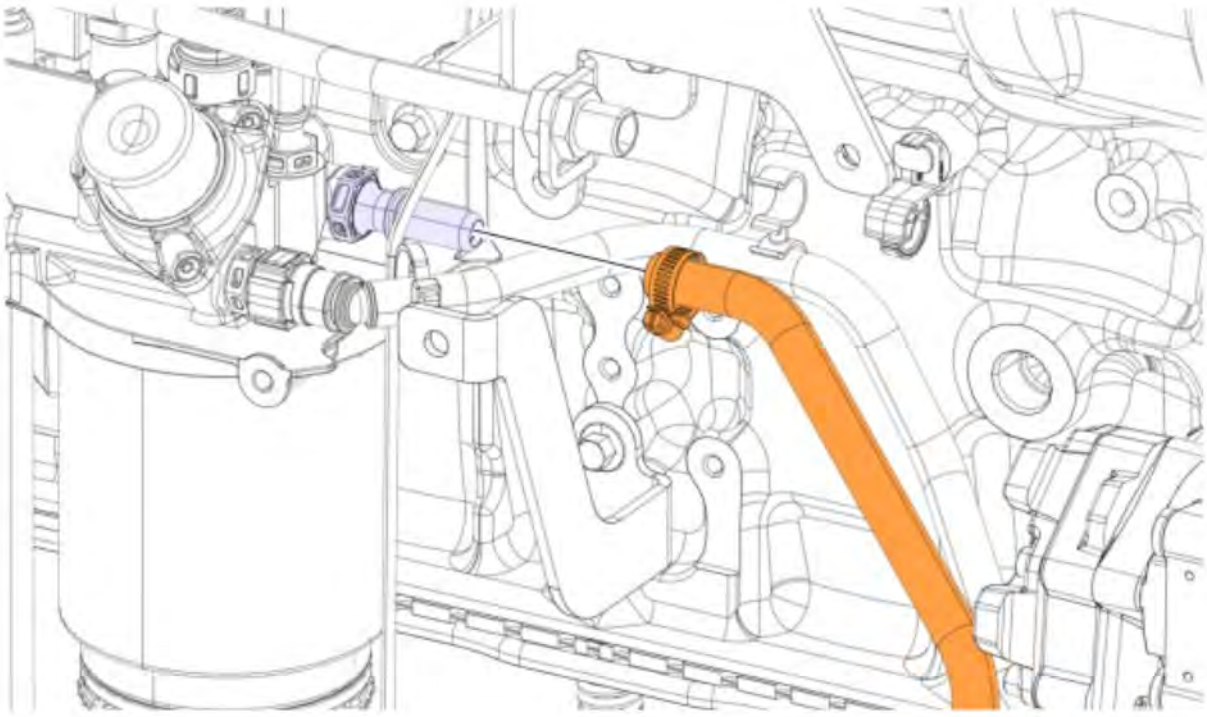


102	Remove the transparent test line.



103	Install the original fuel line. Note Use new sealing washers.

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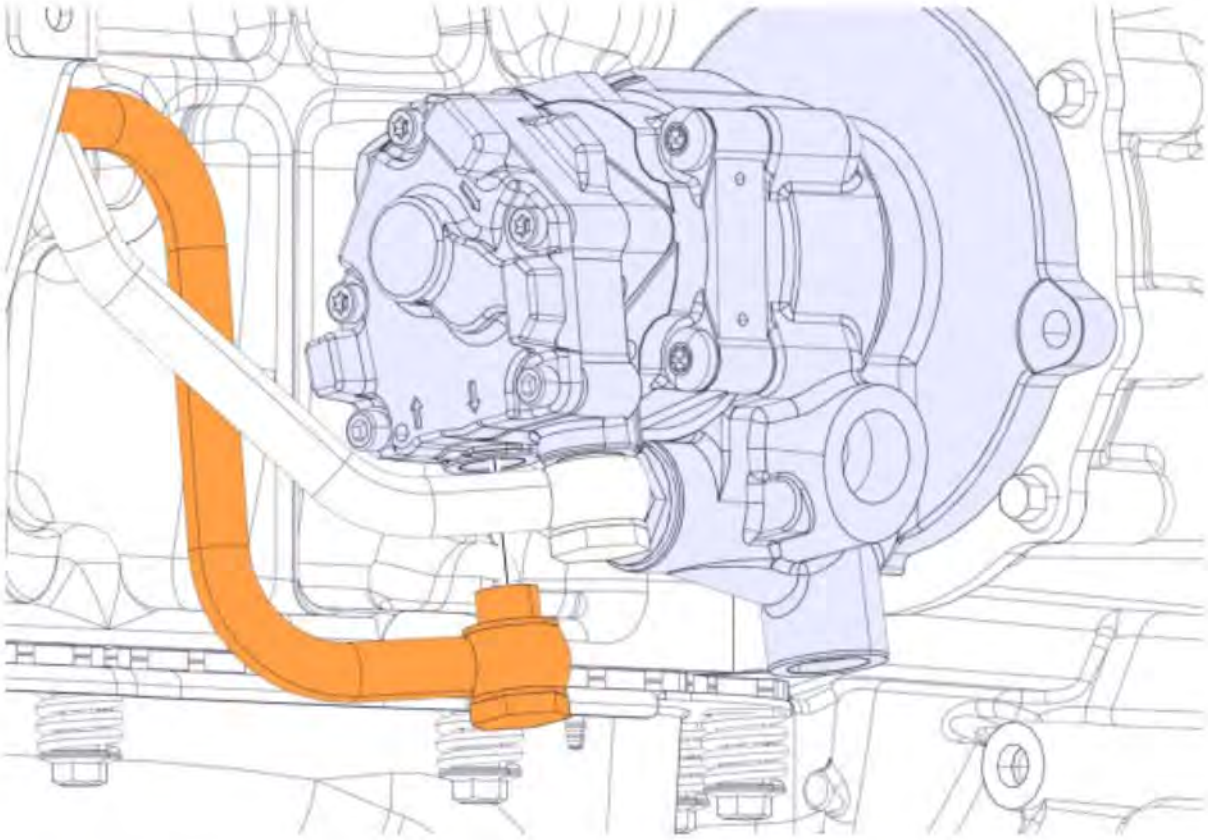

104	Torque tighten the hollow screw.	
	Tightening torque	
	Fuel pipe, hollow screw	40 ±5 Nm (30 ±4 lb_f·ft)

105	Install the fuel line.

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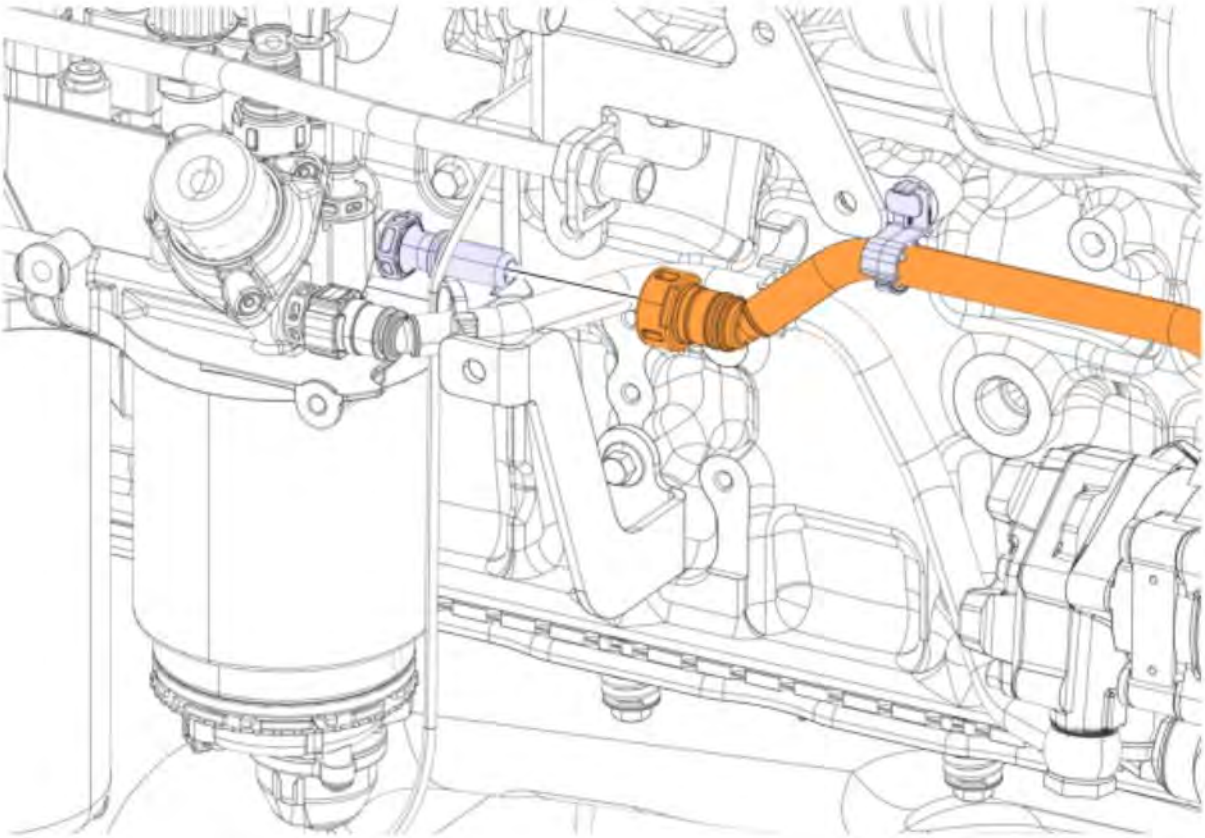
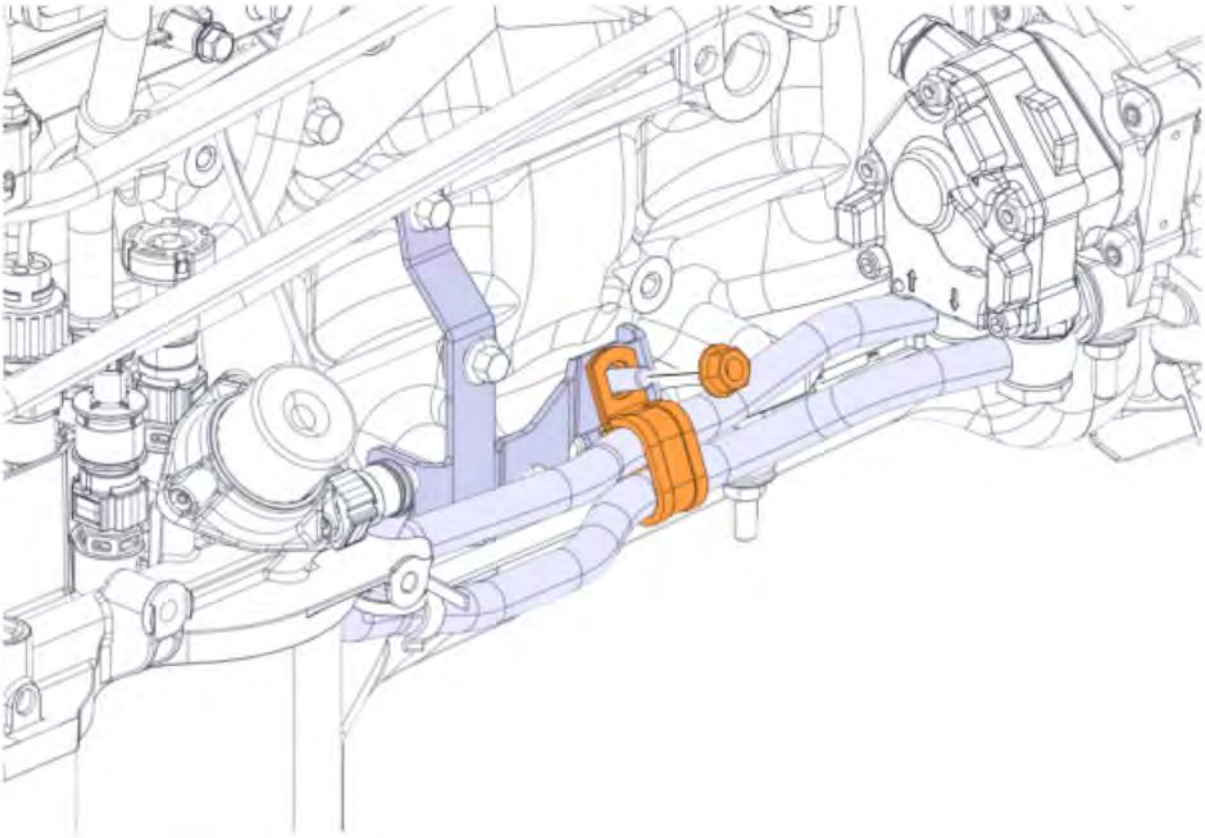


106	Install the clamp.



107	Remove the transparent test line.

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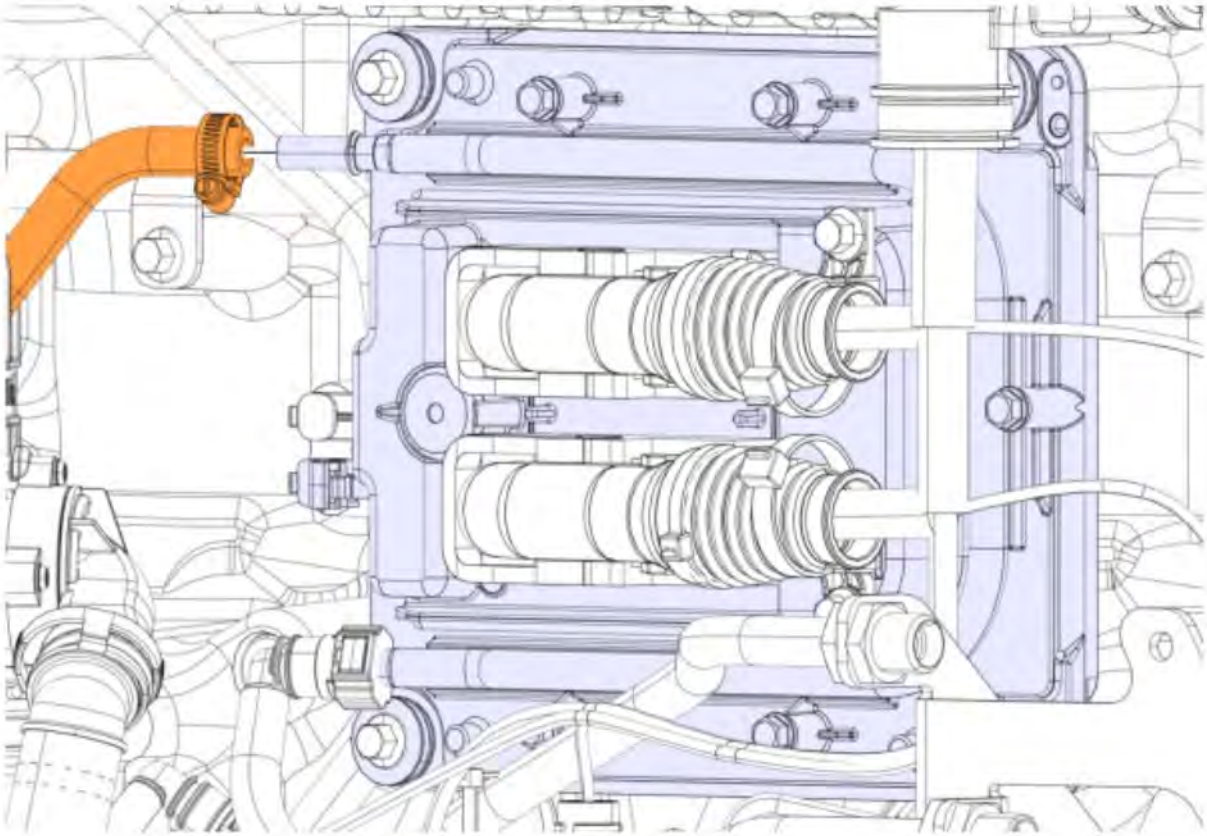
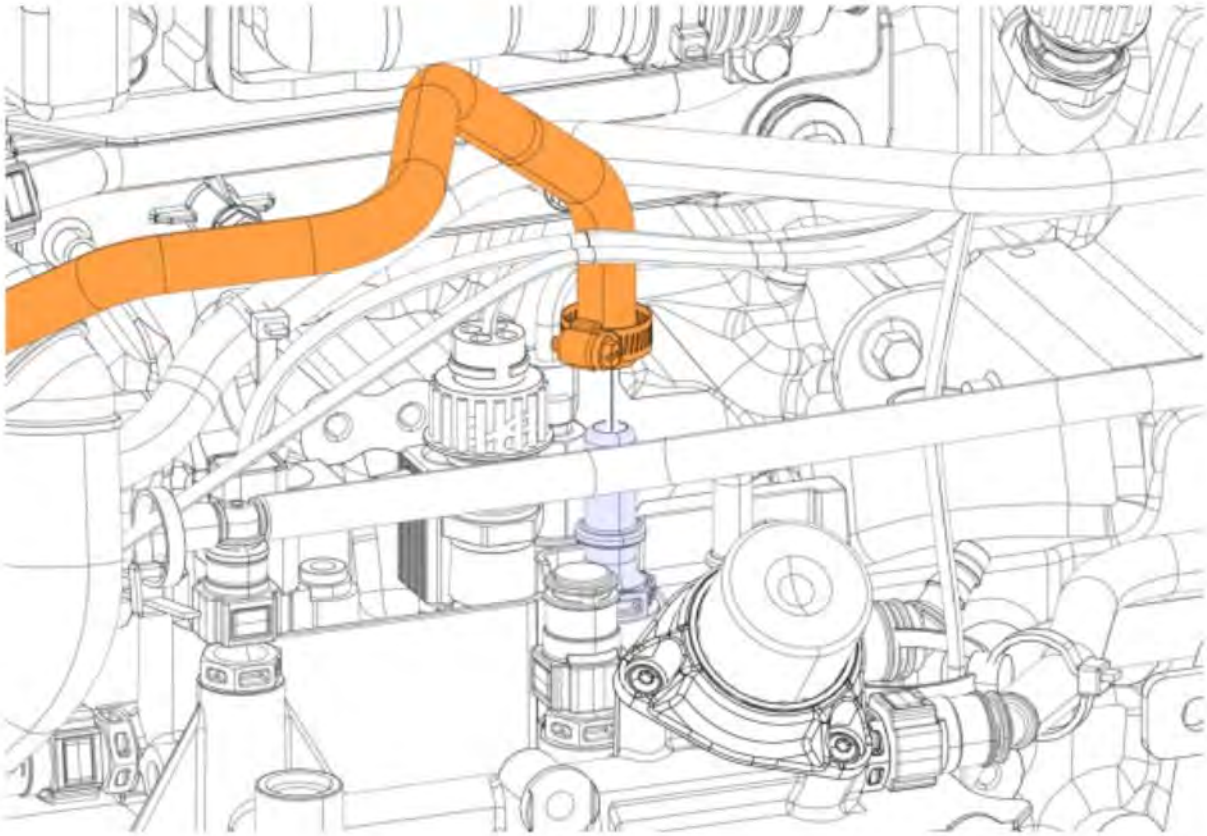


108	Remove the transparent test line.



109	Install the original fuel line.

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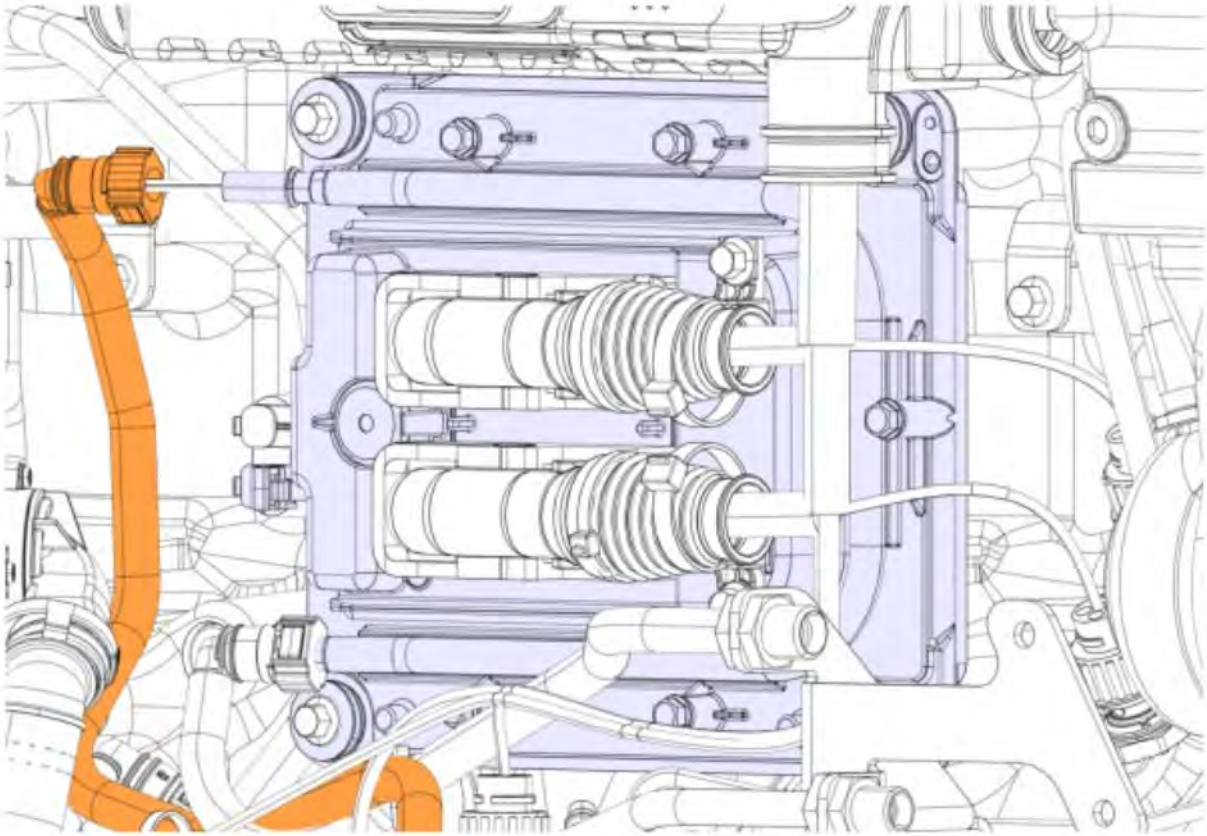
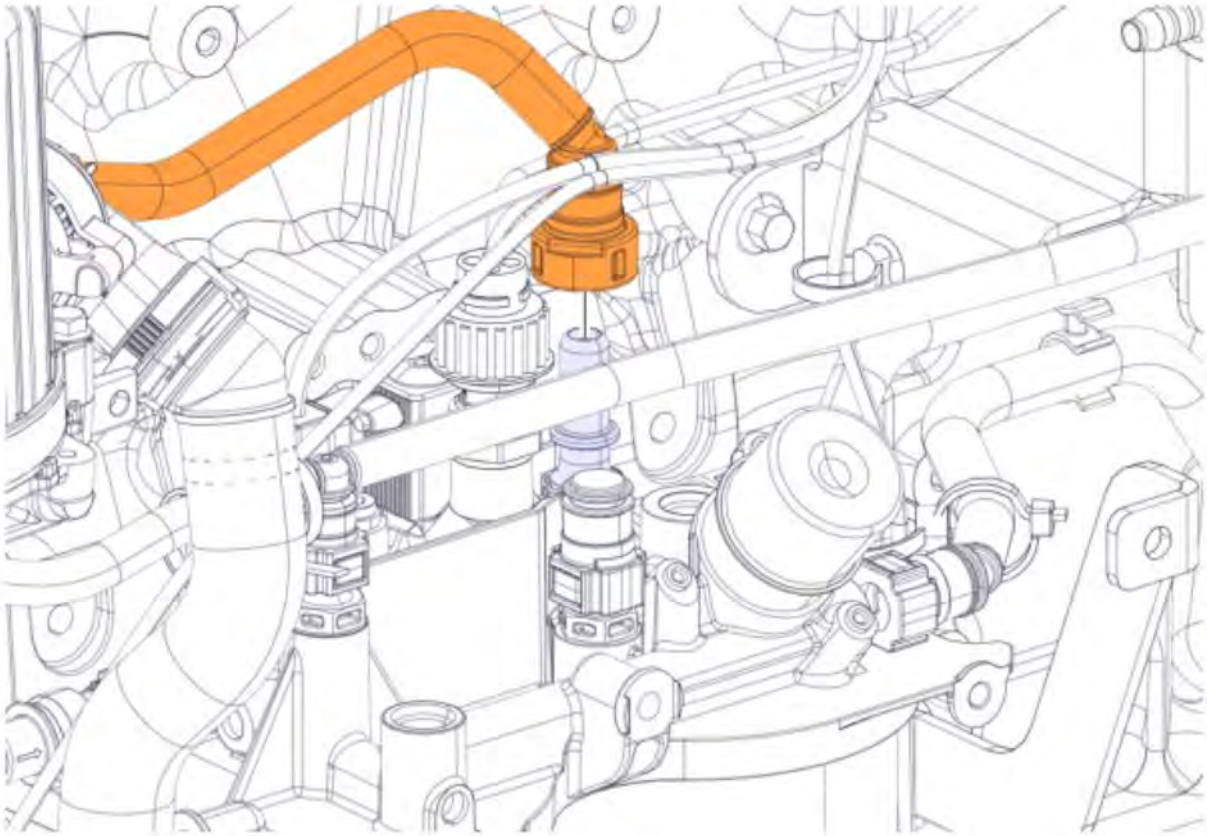


110	Install the original fuel line.



111	Prime the fuel system. **Note** Push the plunger until resistance is felt.

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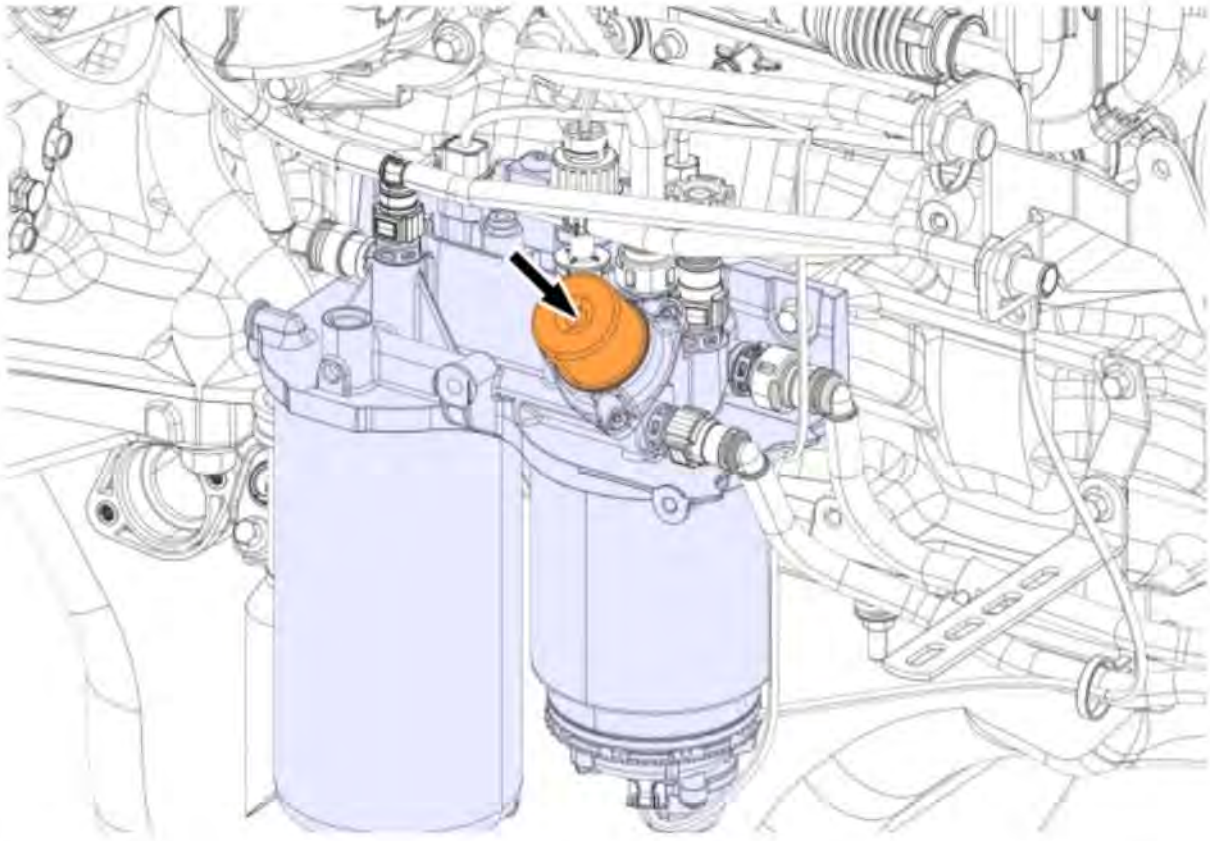

112	Start the engine.
113	Depress the accelerator pedal momentarily to the full position several times.
114	Let the engine idle for 3 minutes.
115	Check the amount of air bubbles in the transparent fuel line from the cylinder head to fuel tank.
116	Stop the engine.
117	Remove the transparent fuel line from the cylinder head.
118	Drain the remaining fuel from the line into the tank.

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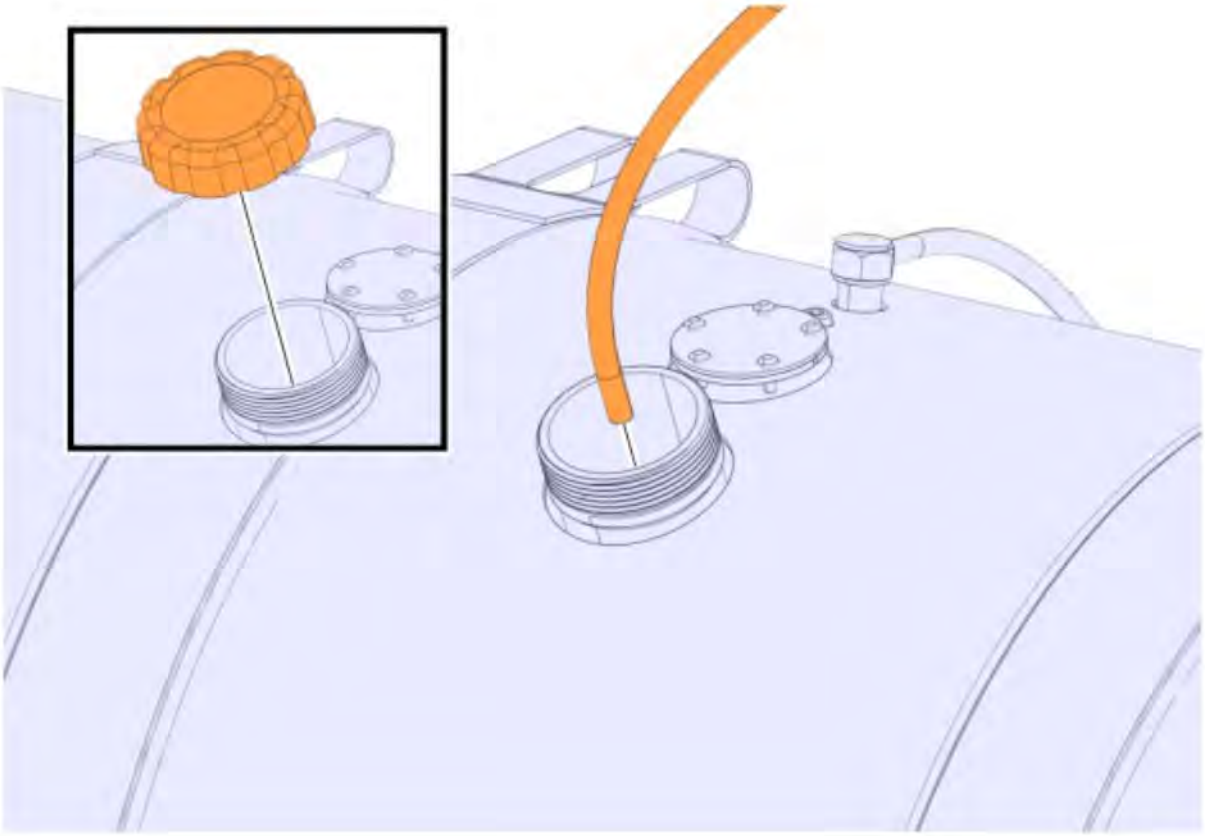
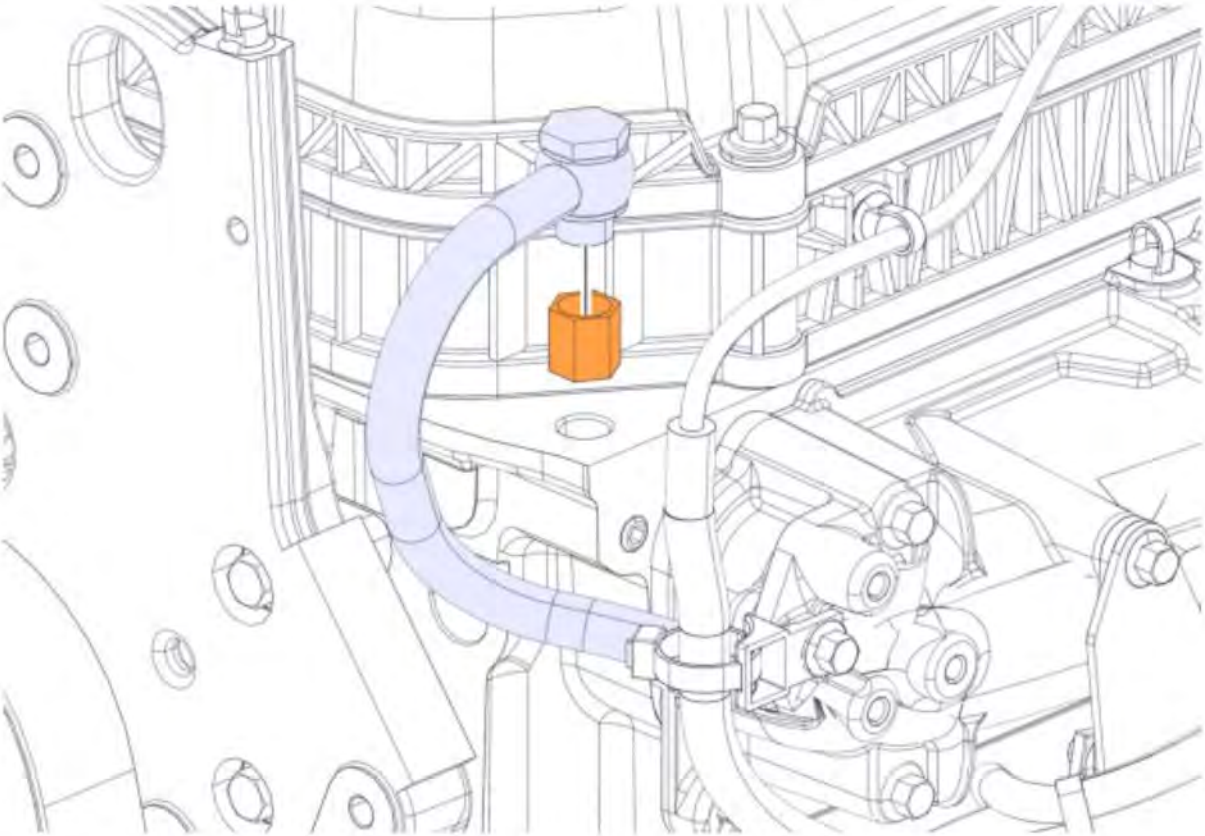


119	Install the fuel cap.
120	Remove the cap.
121	Remove the sealing washers.



122	Install the fuel line with hollow screw.

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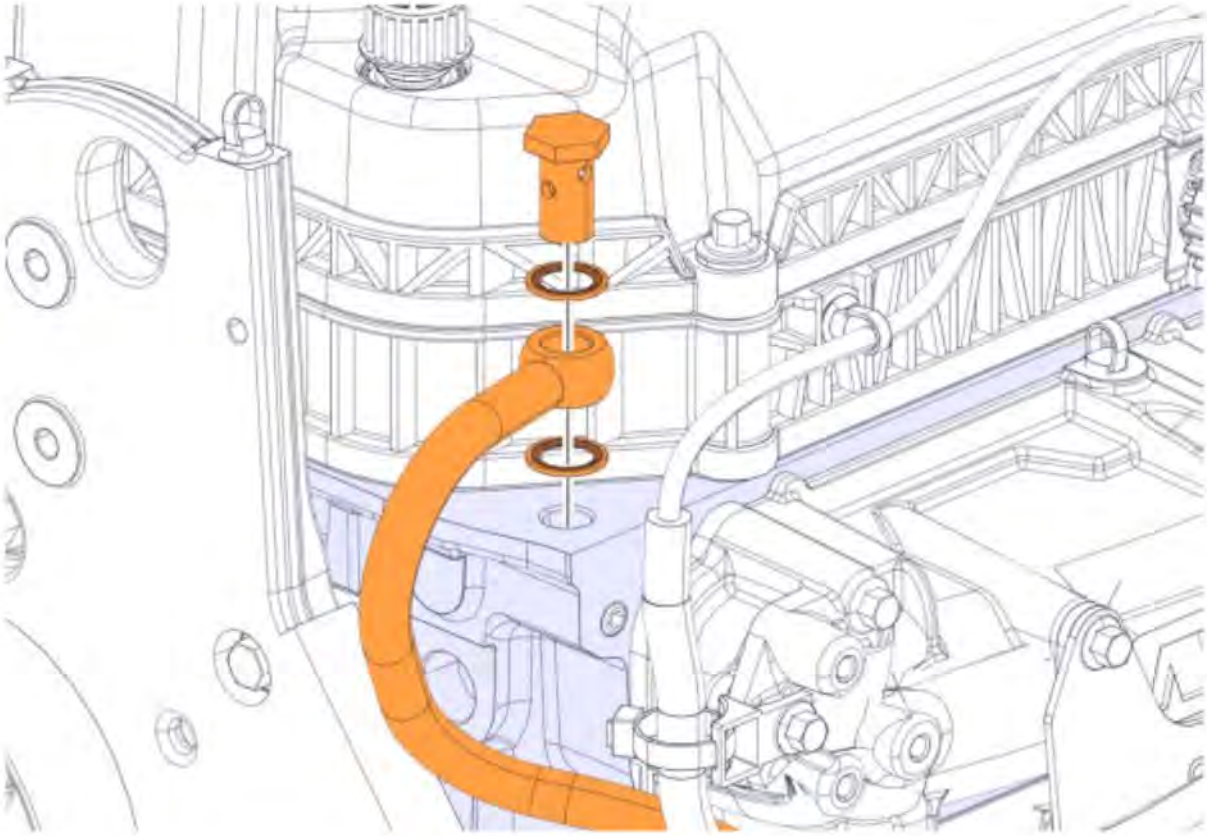
	Note Use new sealing washers.

123	Torque tighten the hollow screw.

Tightening torque	
Cylinder head, fuel pipe, hollow screw	48 ±5 Nm (35 ±4 lb_f·ft)



124	Start the engine.
125	Check for leaks.
126	Stop the engine.
127	Remove the exhaust hose.
128	Remove the wheel chocks.

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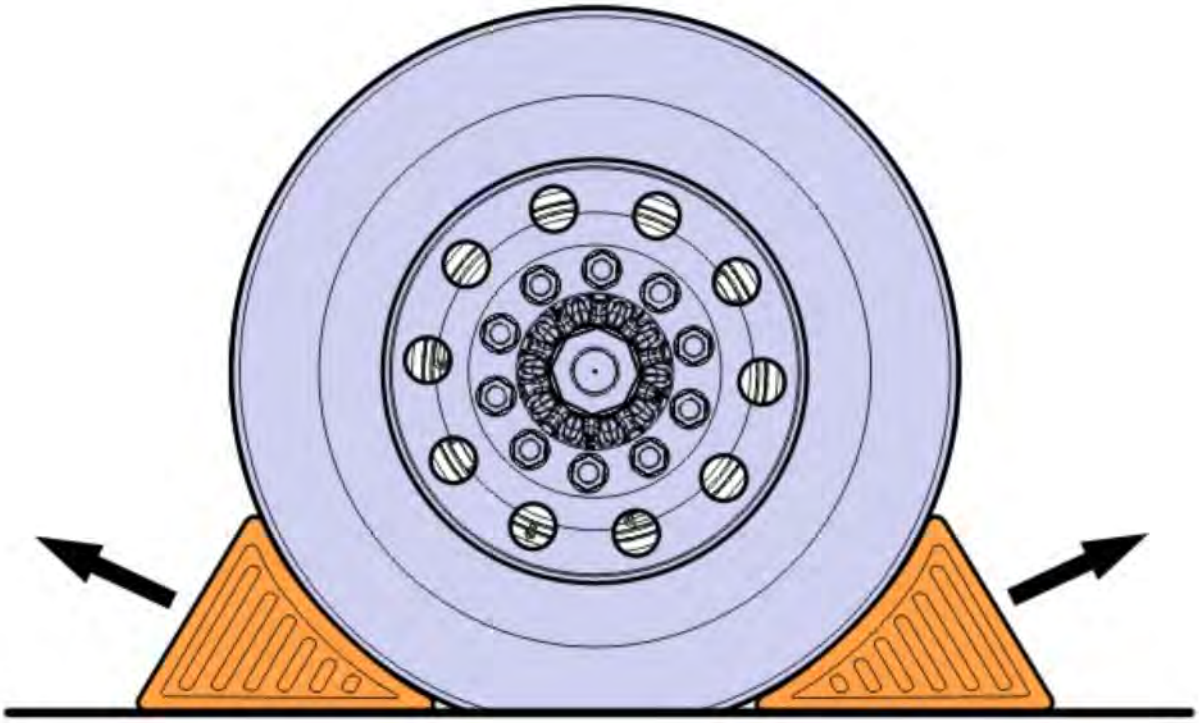

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