

11 Liter Engines - Fuel In Oil

Published September 2022 - **Revised March 2024**

Valid for all vehicles built with a 11L engine

Vehicles built with an 11 liter engine may experience a complaint of excessive fuel in the oil. It is possible that the source of the fuel is the rear fuel galley plug in the cylinder head.

The presence of fuel in the oil may be accompanied by report of hard start, which would indicate a loss of pressure in the fuel system when the engine is not running.

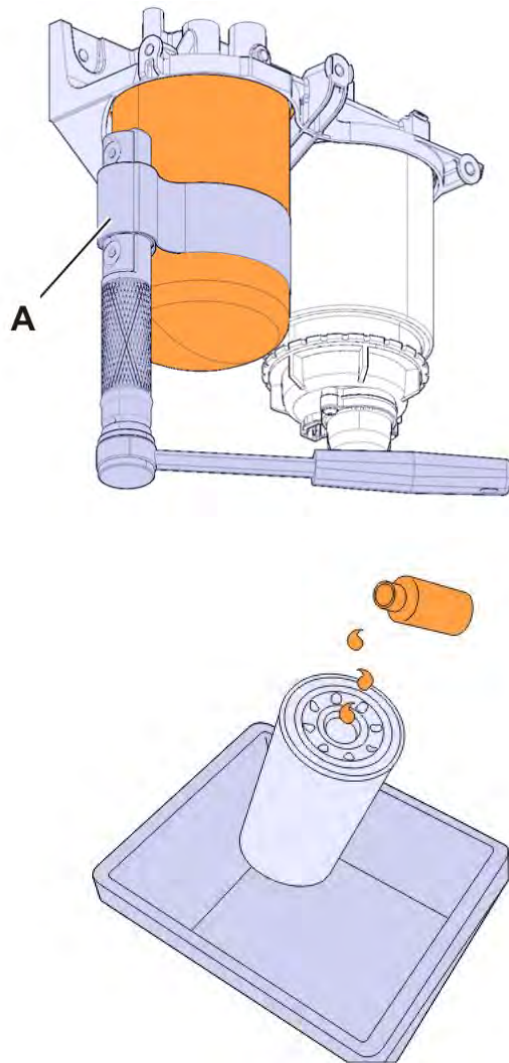
The location of the plug can be seen in the image below:



Diagnose

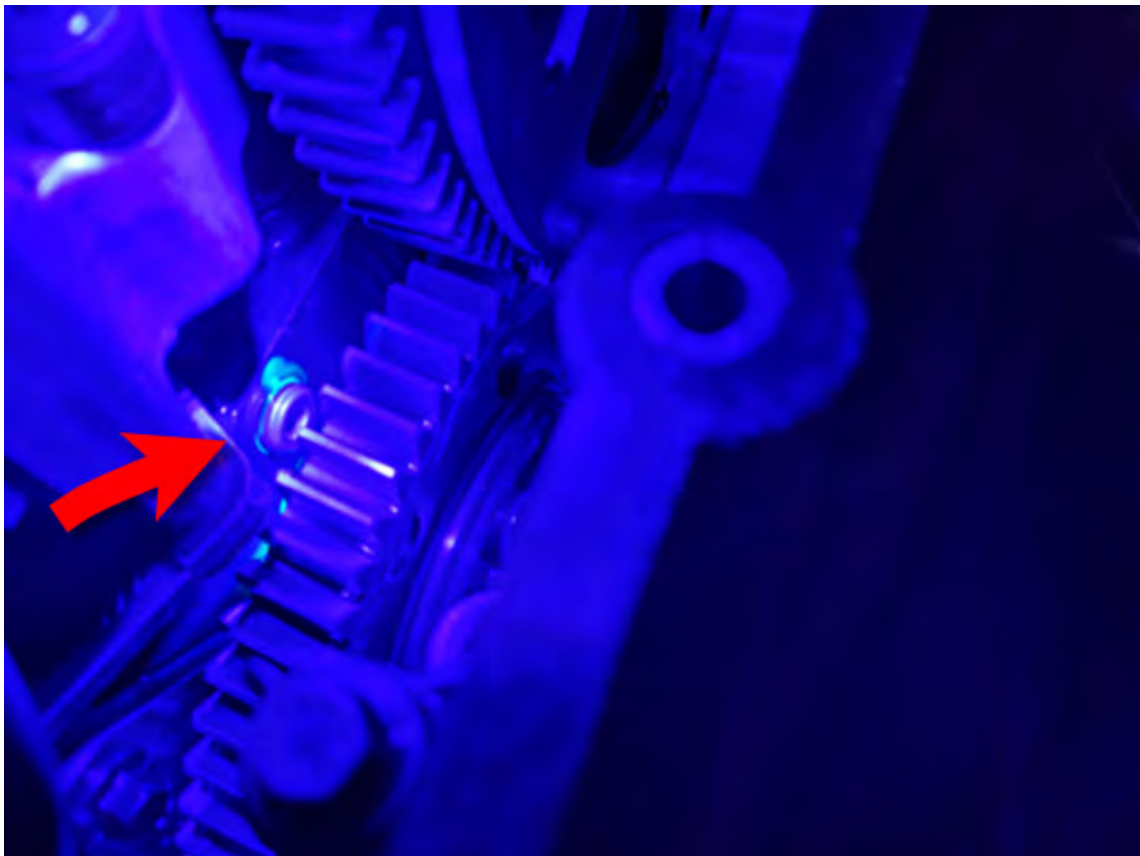
1. Remove the valve cover.
2. Add appropriate UV reactive dye to the secondary fuel filter by removing, then

reinstalling the filter.



3. Use the hand primer to pressurize the system.

4. Check the fuel plug location shown in the pictures above and below for evidence of fuel leakage.



Repair

1. Ensure engine is on TDC (Cam and Crank) before major disassembly.
2. Drain fuel galley.
3. Follow Impact ID/Operation [2154-03-02-01 Camshaft, Replacement](#) and STOP at step 84.
 - DO NOT REMOVE the camshaft or camshaft bearing caps.
4. With the rocker shaft, upper timing cover, and cam gear removed, remove the fasteners for the adjustable idler gear and slide the gear toward the rear of the truck.
 - NOTE: Timing gear plate fasteners will not allow for complete removal of adjustable idler gear.
5. Remove the leaking fuel galley plug.
6. Verify the fuel galley plug threads in the cylinder head are clean and free from damage.
7. Install a NEW fuel galley plug and torque to 40 Nm +/- 3 Nm.

8. Using the hand primer, prime fuel system and verify there are no fuel leaks around the newly installed plug.

9. Slide the adjustable idler back into original position and loosely install the 5 fasteners.

- NOTE: Use new fasteners.

10. Reassemble using Impact ID/Operation [2154-03-02-01 Camshaft, Replacement](#) starting at step 102.

- NOTE: Gear train backlash WILL have to be adjusted, follow Impact ID/Operation [2154-05-03-02](#).

11. If not done already, change engine oil and filters.

12. Start the engine and verify proper operation and no leaks are observed.

13. Release the unit.

Related links and attachments

No links or attachments available



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to others that might find it helpful



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to help improve the content of this article

21522-2 Camshaft, Replacement



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



Colors used in illustrations are for highlighting purposes only and do not correspond to the actual colors of the vehicle.



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](#)



WARNING

Risk of serious personal injury.

Using the wrong technique when rotating the crankshaft can cause serious personal injury.

- ▶ Use the recommended engine barring techniques for manually rotating the crankshaft. Do not rotate the engine by pulling or prying the fan.



CAUTION

Risk of material damage.

Risk of impurities being introduced into the fuel system.

- ▶ Ensure conditions of maximum cleanliness when carrying out any work on the fuel system.



CAUTION

Risk of skin injury.

High fuel pressure.

- ▶ The injection system may be pressurised. When working on the injection system, remove the first part cautiously



WARNING

Risk of burn injuries.

The coolant may be hot.

- ▶ The cooling system is under pressure and can reach a temperature sufficient to cause burns. Allow the coolant temperature to reach a safe level before starting the work.
- ▶ Remove the coolant tank cap carefully. Use appropriate protective equipment.



CAUTION

Risk of material damage.

The engine may be hot.

- ▶ Make the adjustment on a cold engine.

**CAUTION****Service Information Advisory.**

If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

- ▶ You must read and understand the precautions and guidelines in Service Information, Function Group 2, "General Safety Practices, Engine" before performing this procedure.

**CAUTION****Risk of material damage.**

Applying more sealant than a specified volume will lead to oil leakage. Excess sealant can result in over-compression and damage to the gasket.

- ▶ The surface must be thoroughly cleaned and free of oil, dirt or grease prior to applying the sealant.
- ▶ Oil or grease on the surface will prevent proper bonding of parts.

**CAUTION****Risk of material damage.**

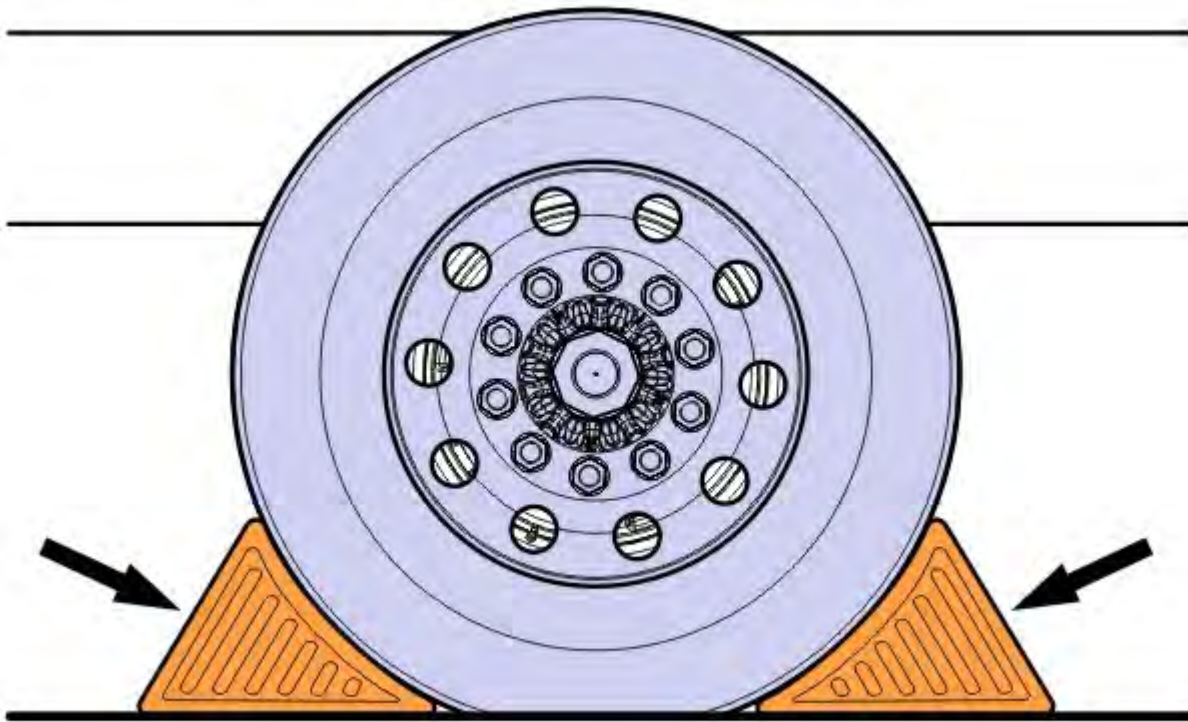
The turbocharger can be damaged if foreign particles enter the charge air system. Particles as small as 1 mm can cause damage.

- ▶ Observe maximum cleanliness when working on the charge air system. Cover or plug openings immediately.

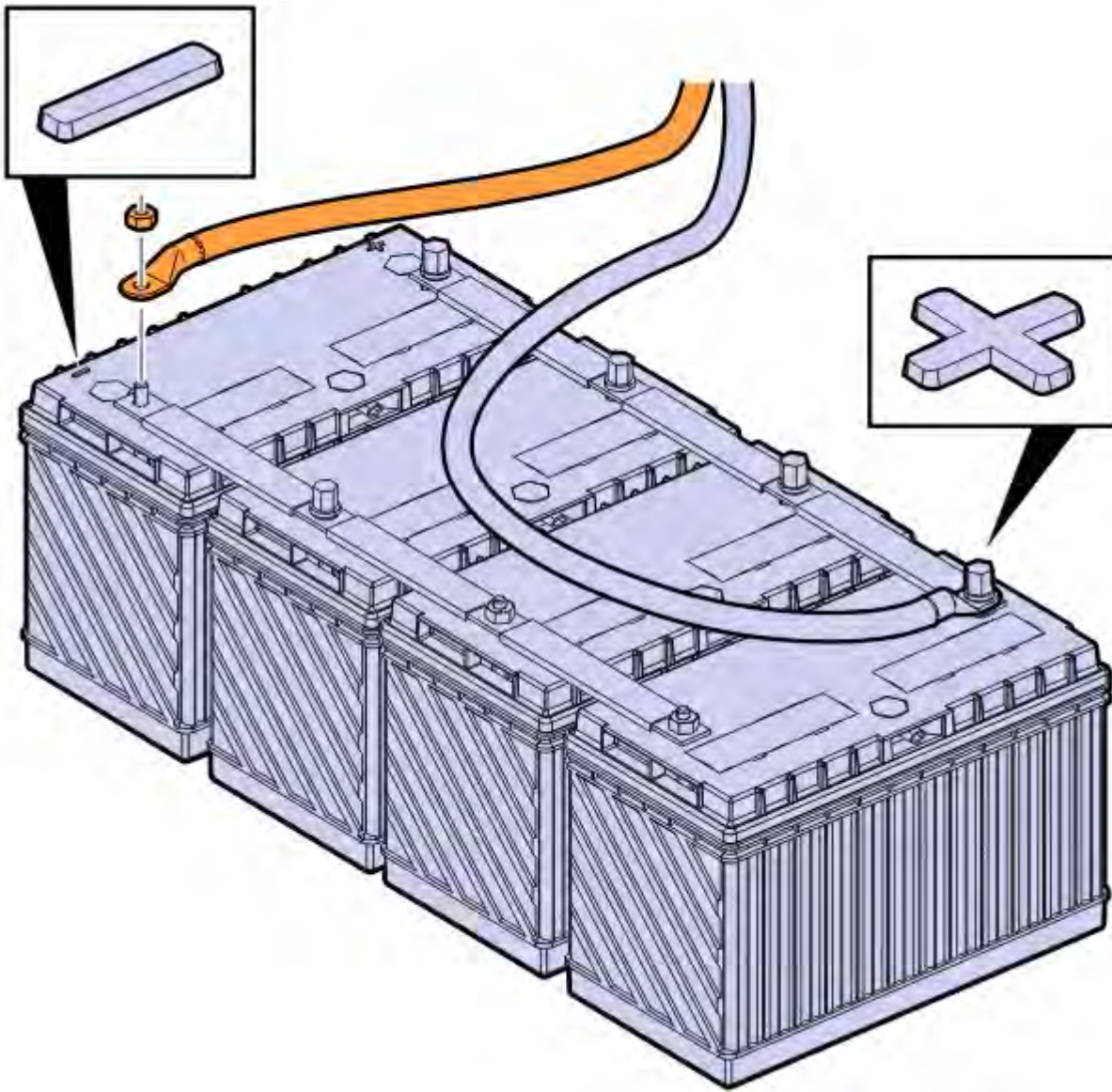
Special tools

85112740	J-42189	88800420	88840317	9992669
9996049	9996400	9998264	9999683	9999696
85109051	85109250	J-44514B		

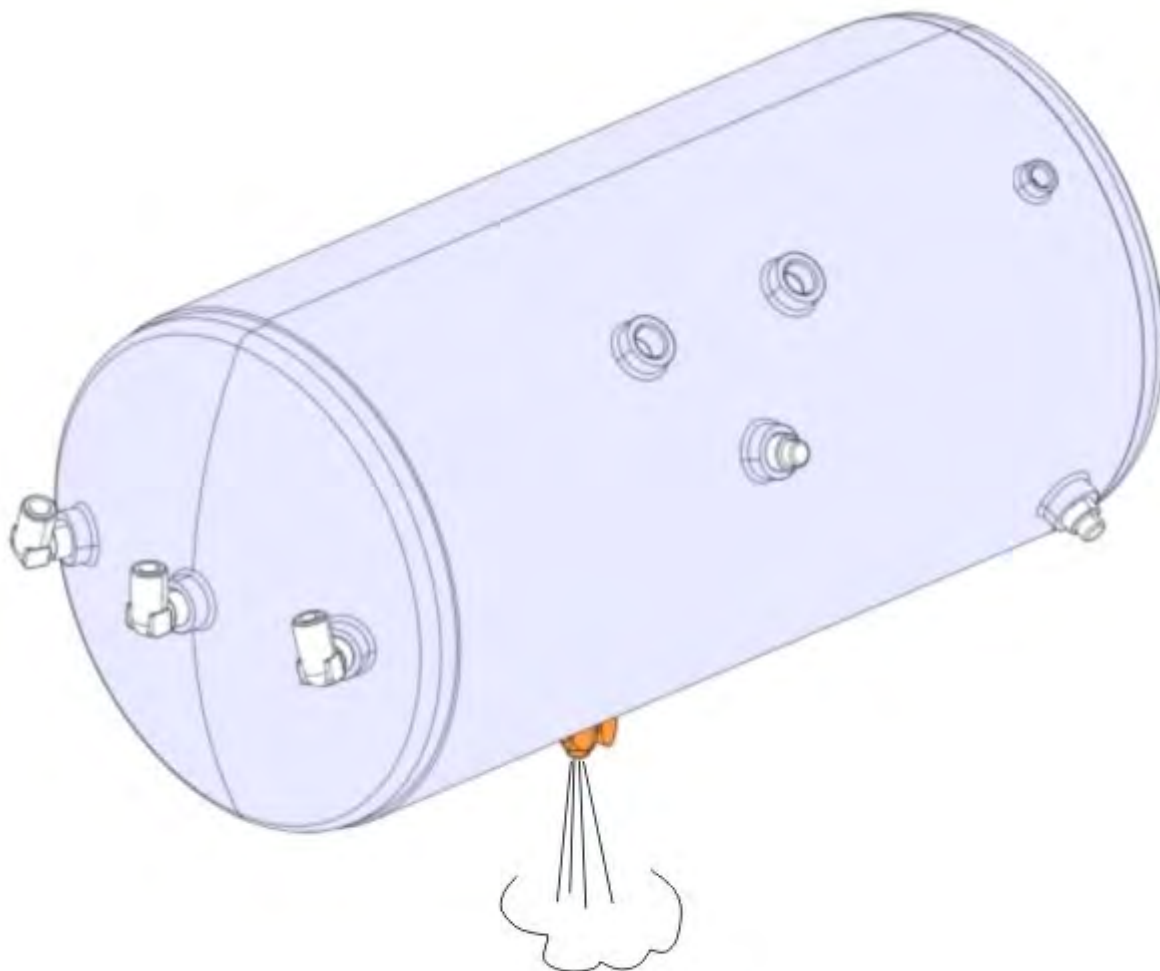
1	Park the vehicle on a level surface.
2	Apply the parking brake.
3	Place the gear lever in neutral.
4	Install the wheel chocks.



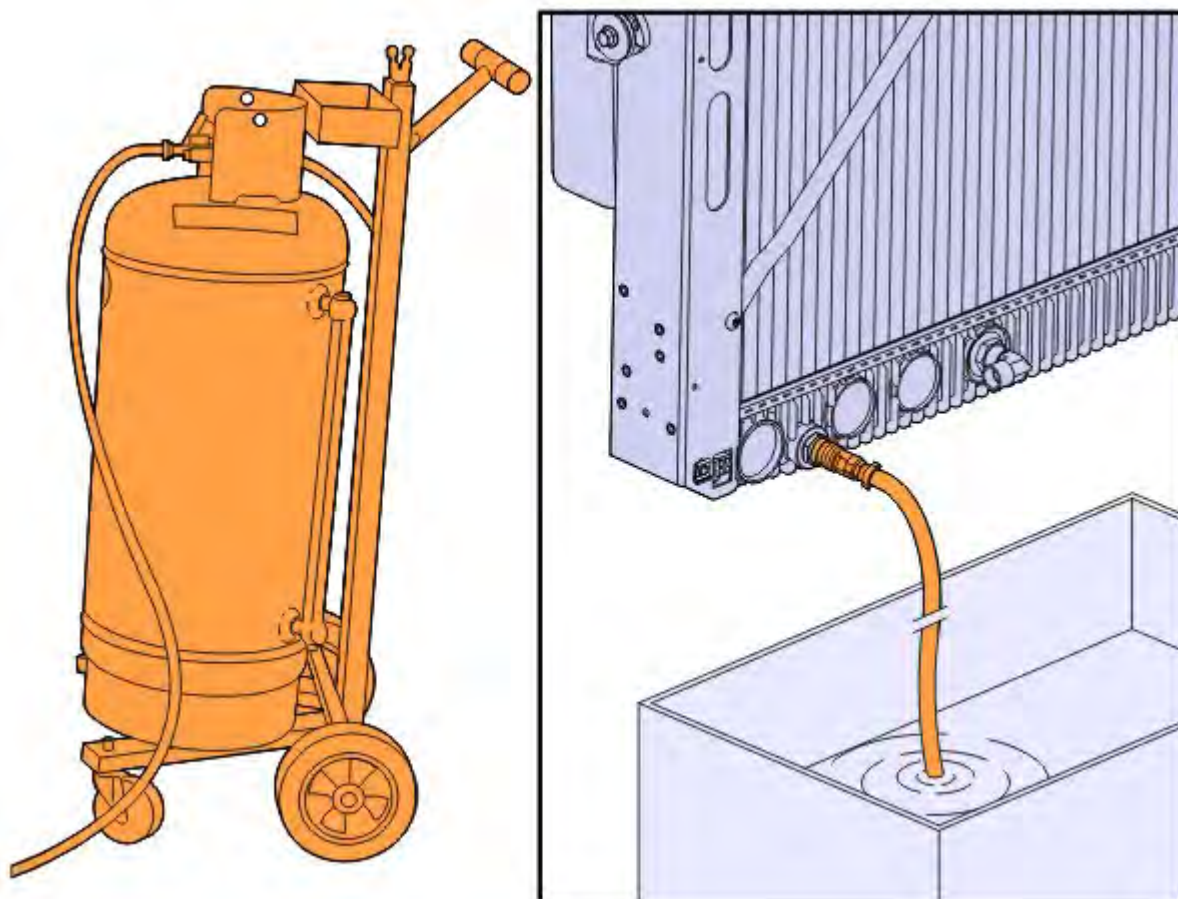
5	Disconnect the cable from the negative terminal.
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6	Drain the compressed air tanks.
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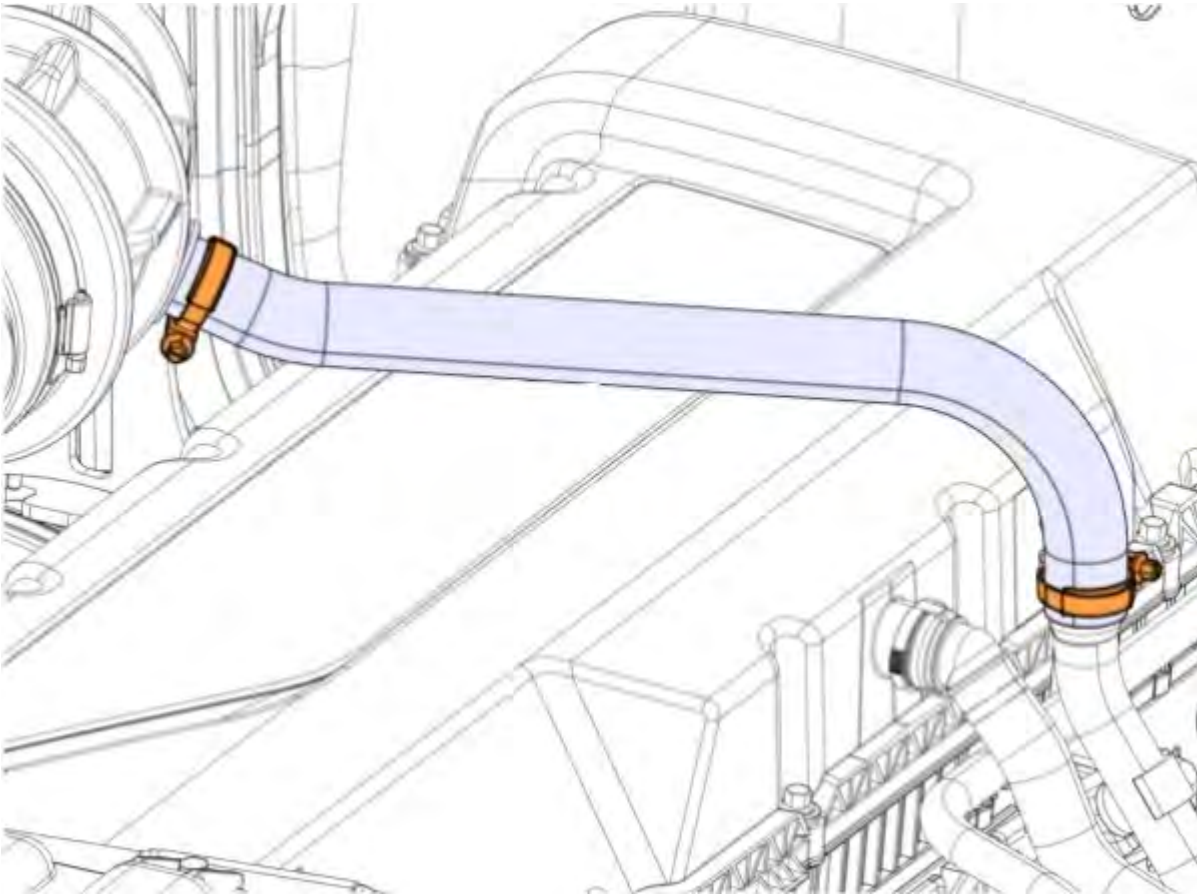


10 Loosen the clamps.

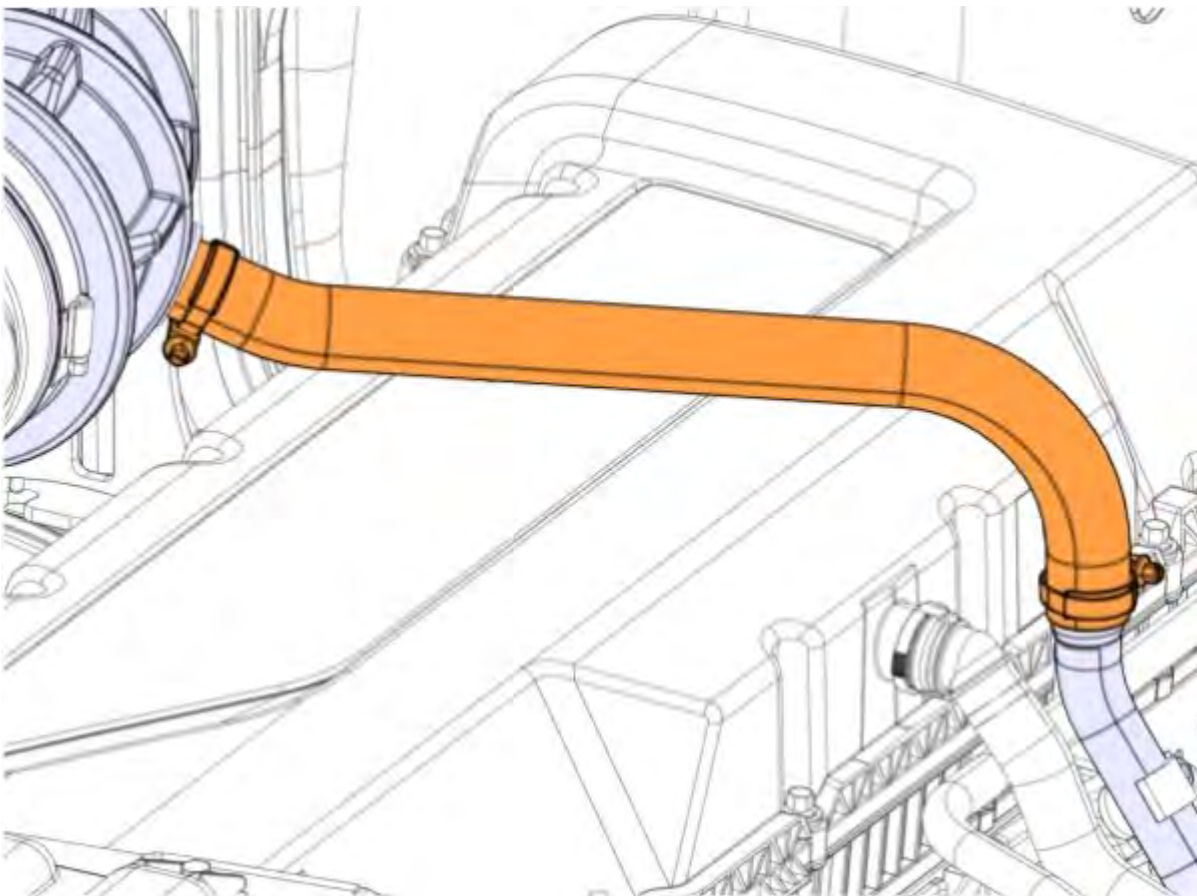


Note

Note the orientations and the positions.



11	Remove the hose.
----	------------------



12	Remove the cable ties.
----	------------------------

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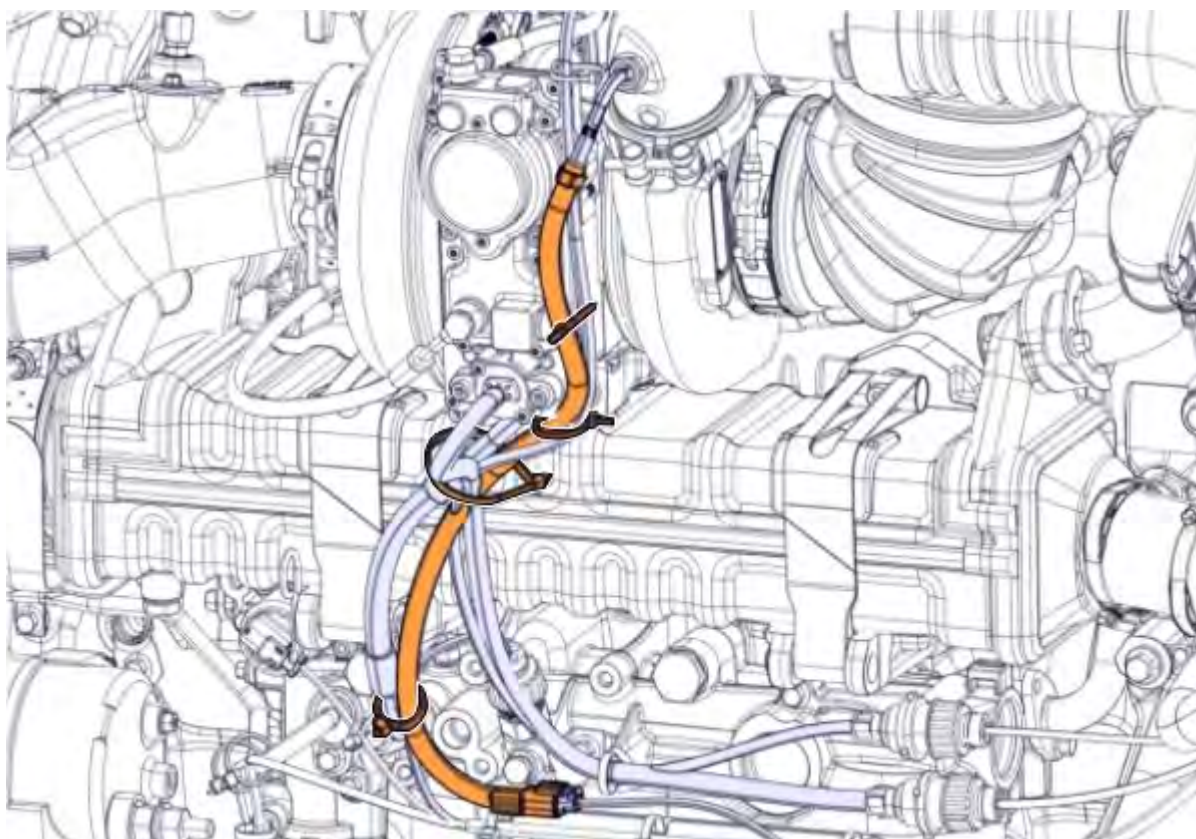
**Note**

Note the positions.

- 13** Disconnect the sensor connector.

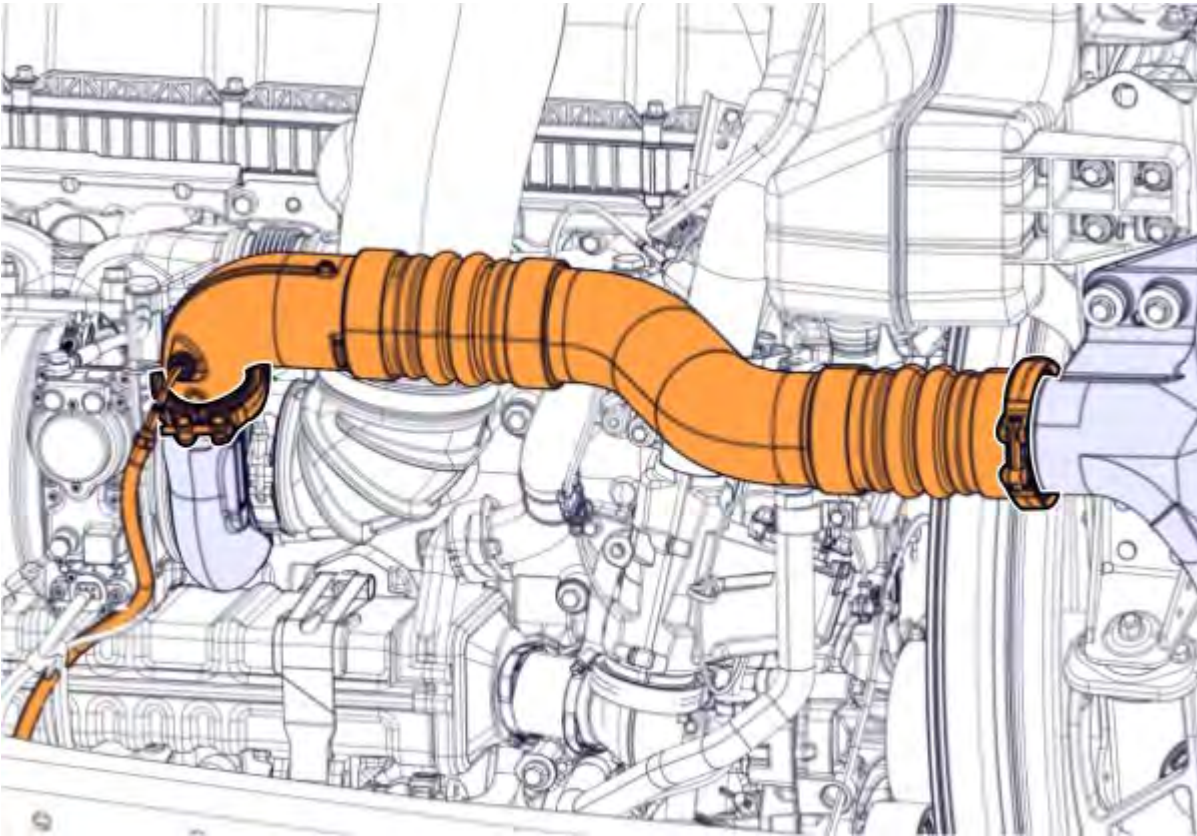
**Note**

To avoid damaging the sensor, do not remove from the pipe.



- 14** Loosen the clamps.

- 15** Remove the pipe assembly.

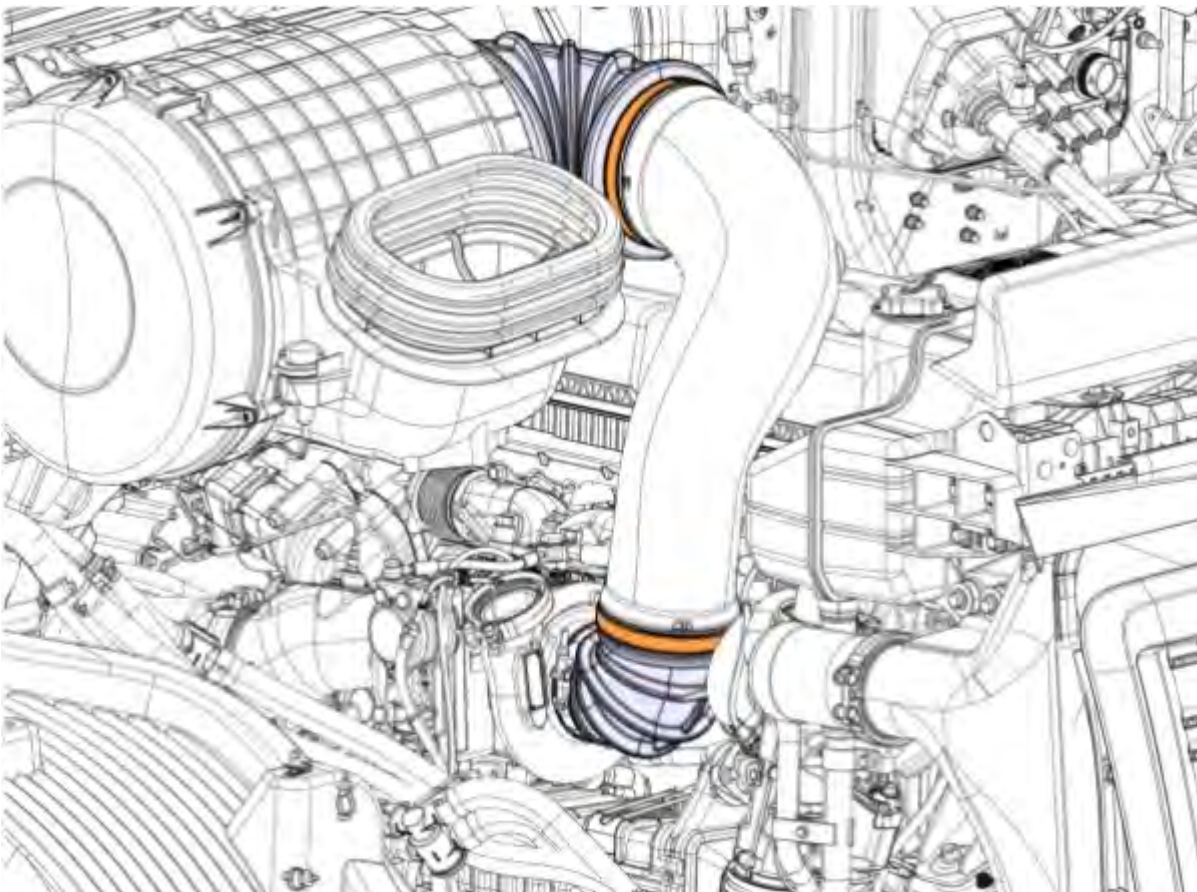


16 Loosen the clamps.

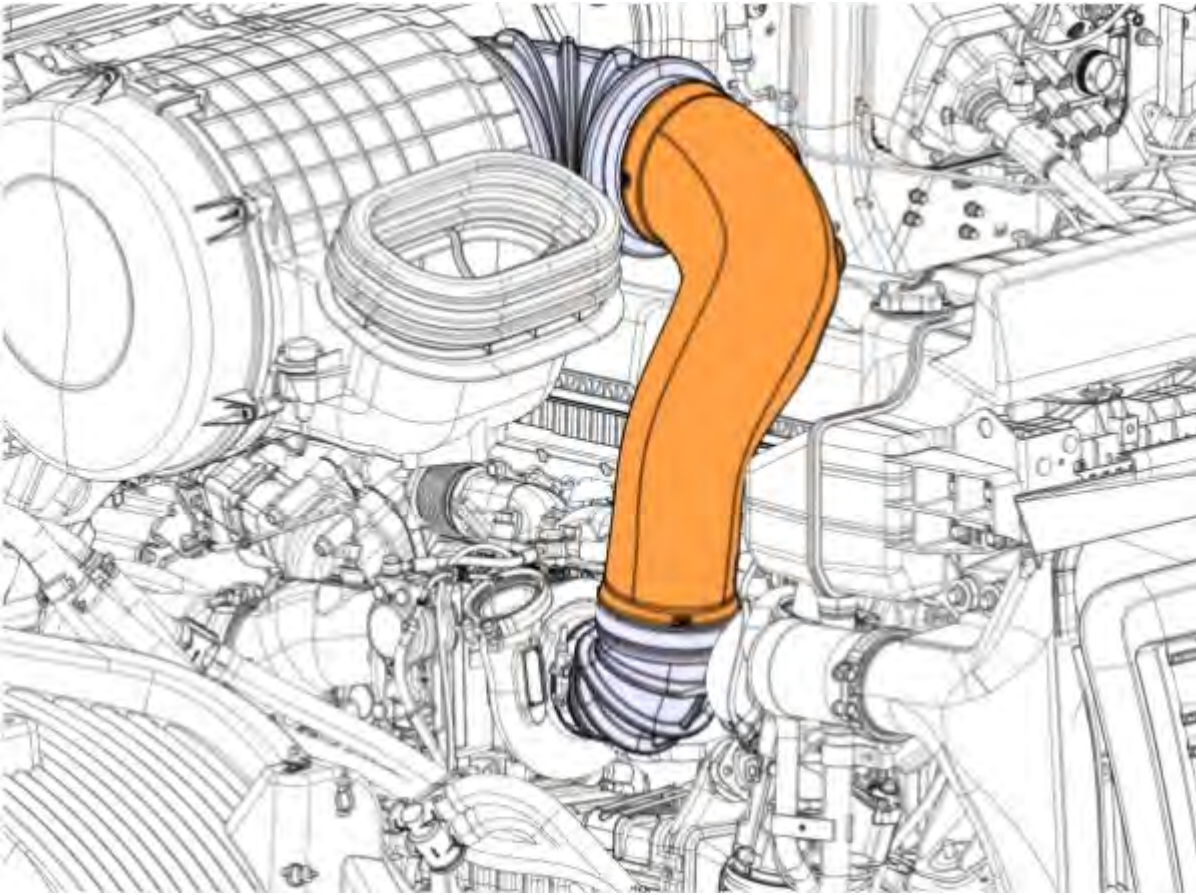


Note

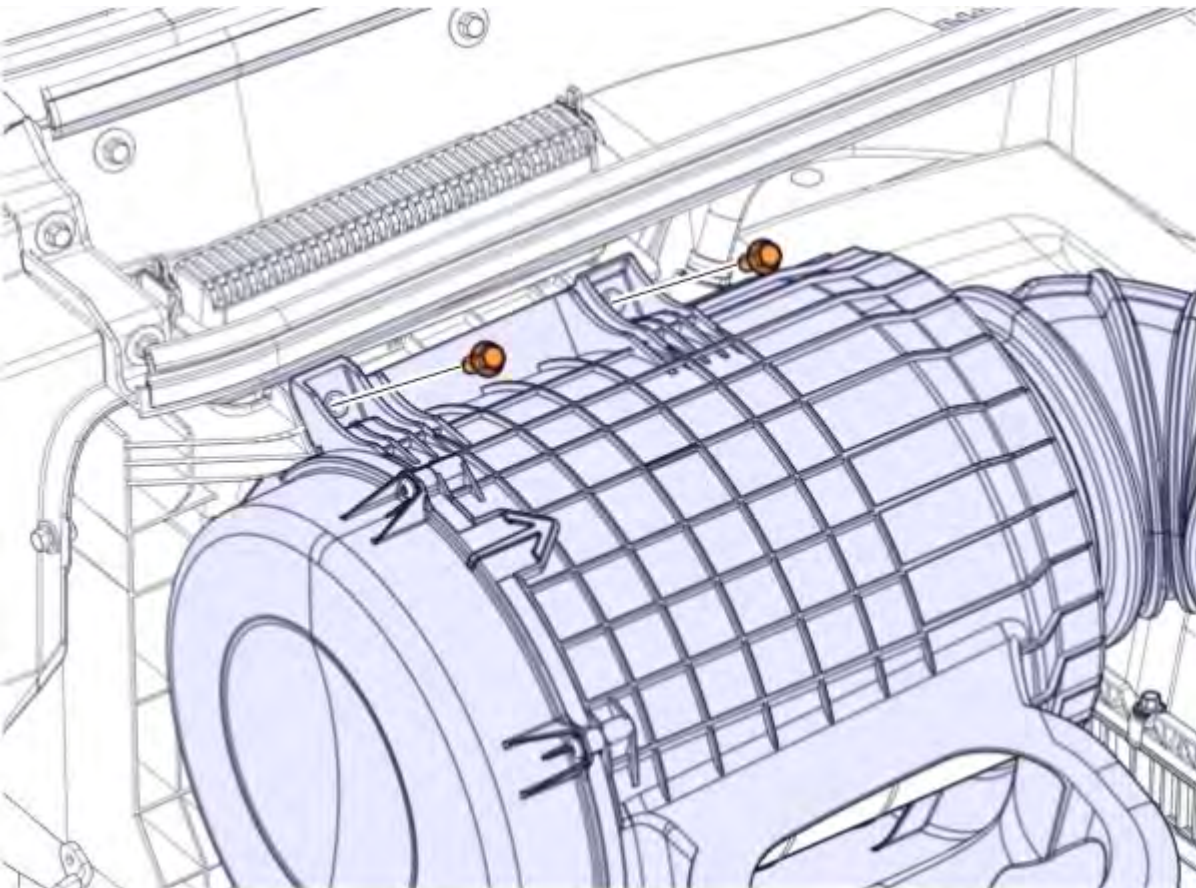
Note the orientations and the positions.



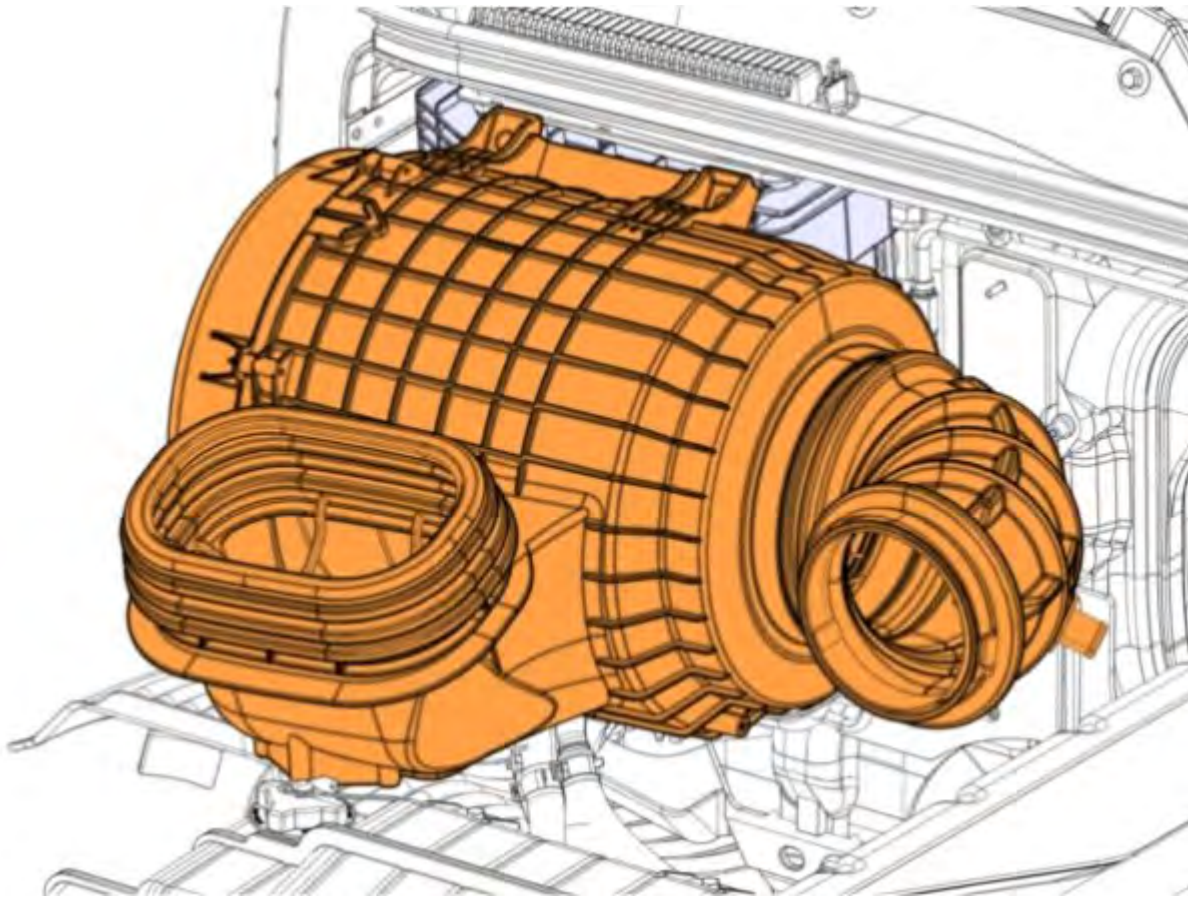
17	Remove the air duct.
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18	Remove the screws.
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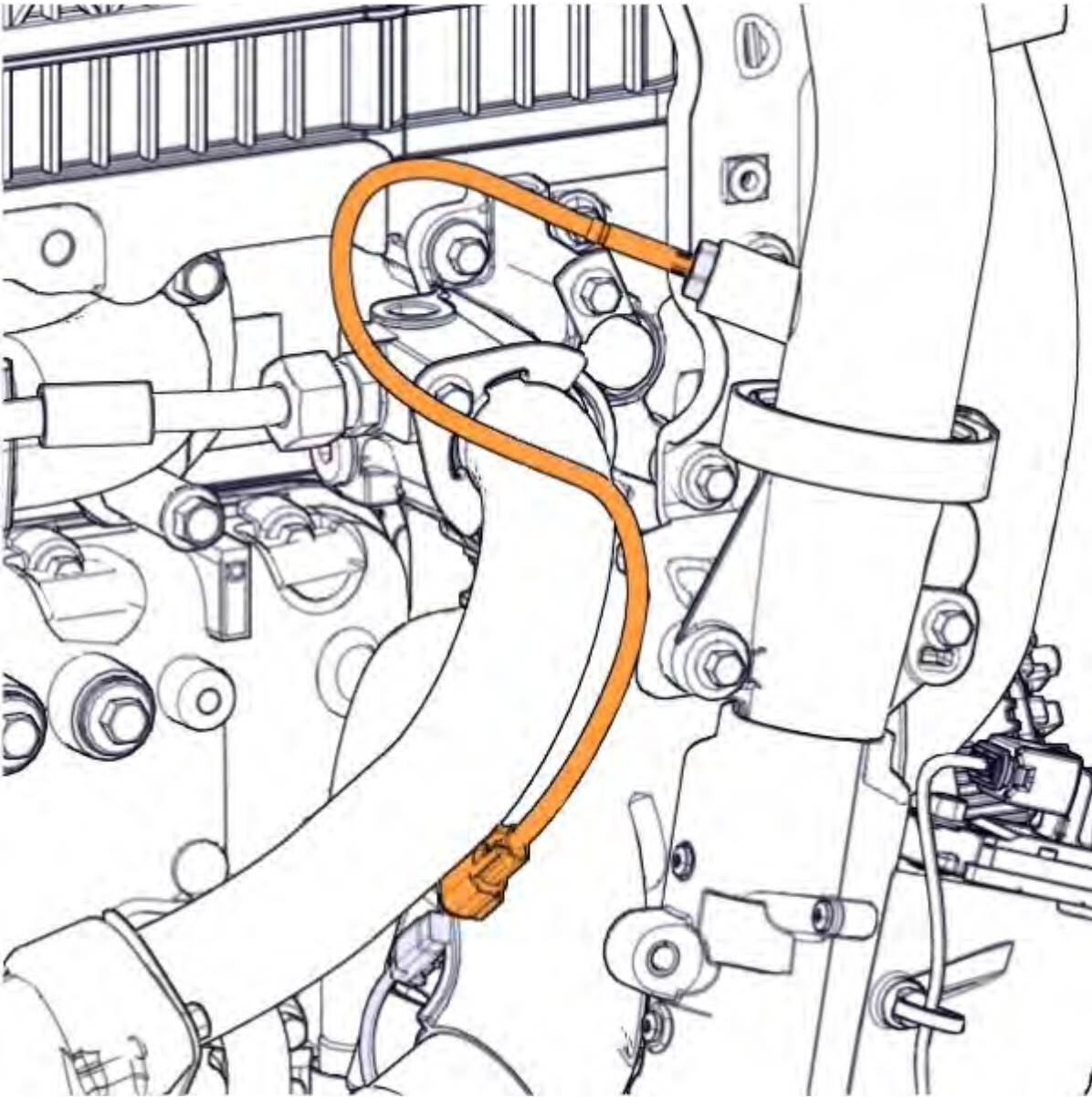


19	Remove the air filter housing.
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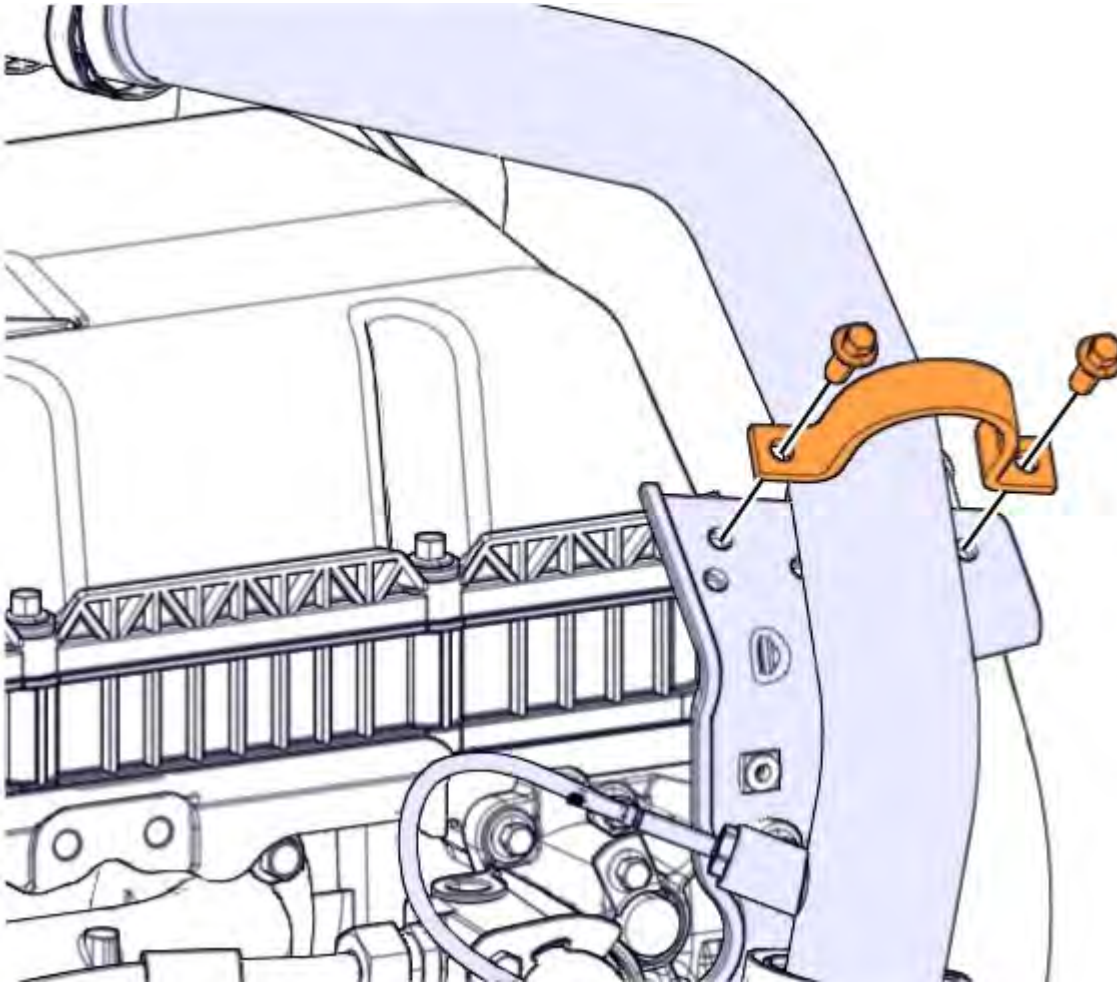


20	Disconnect the connector.
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21	Remove the cable tie.
----	-----------------------



22	Remove the screws.
23	Remove the clamp.

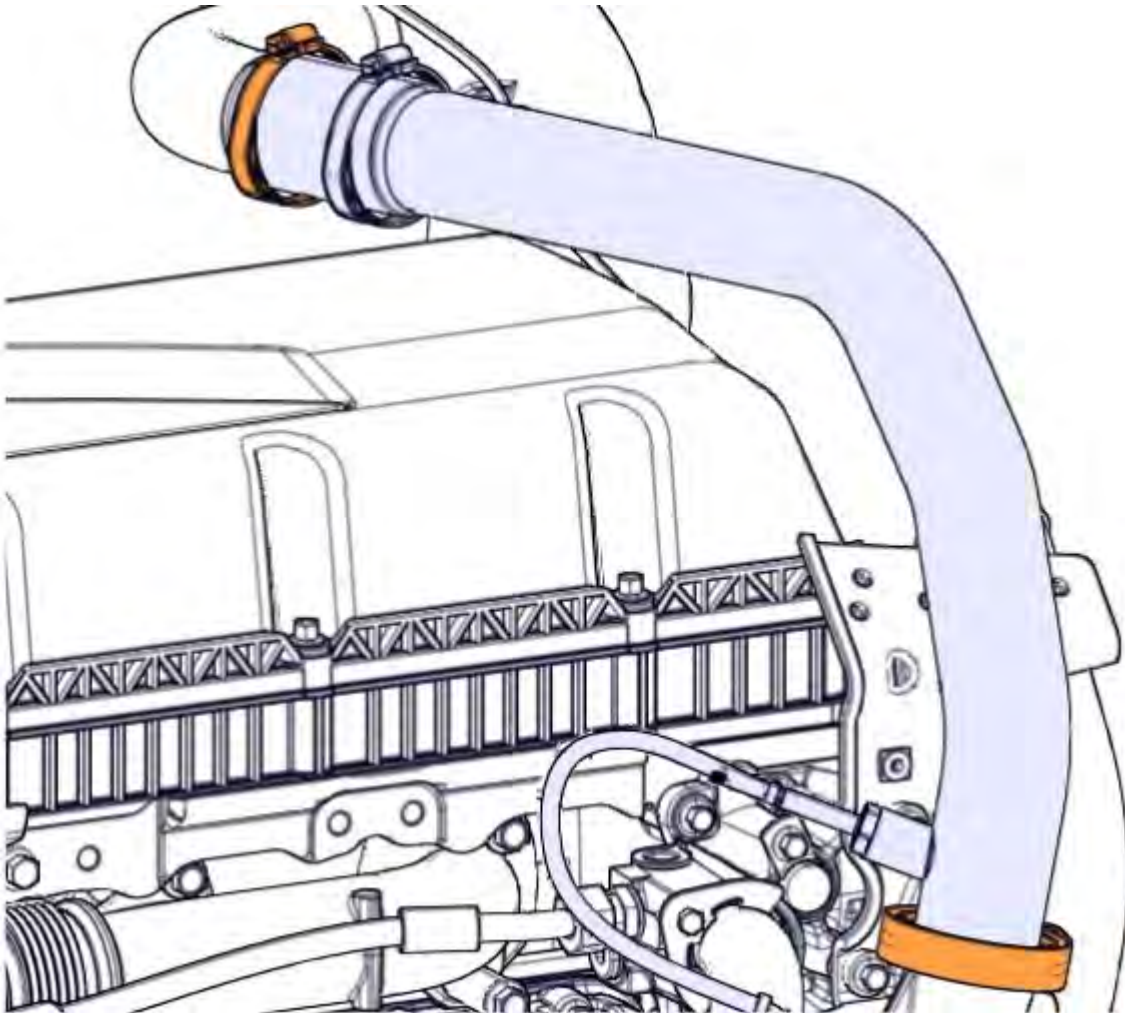


24 Loosen the clamps.

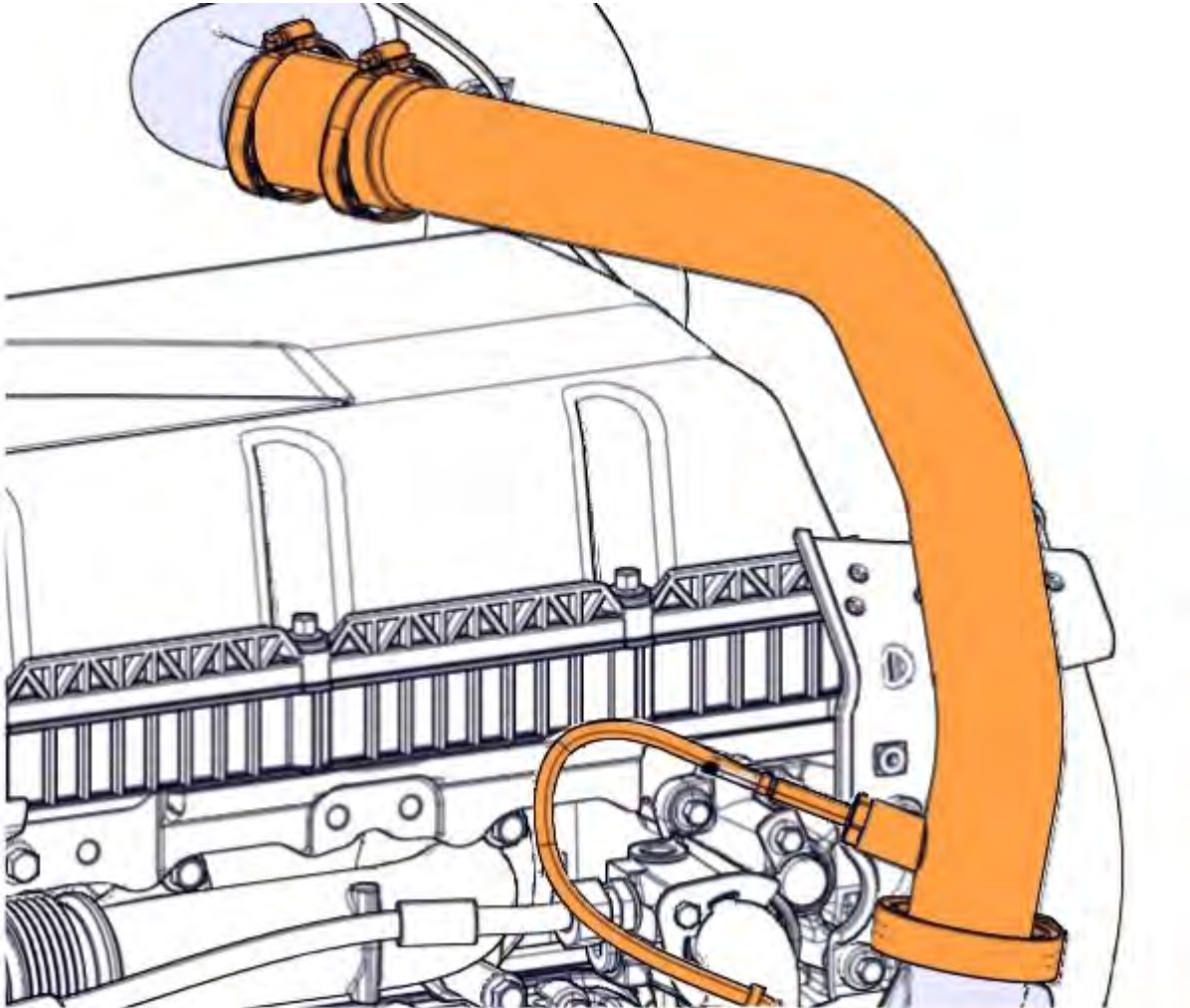


Note

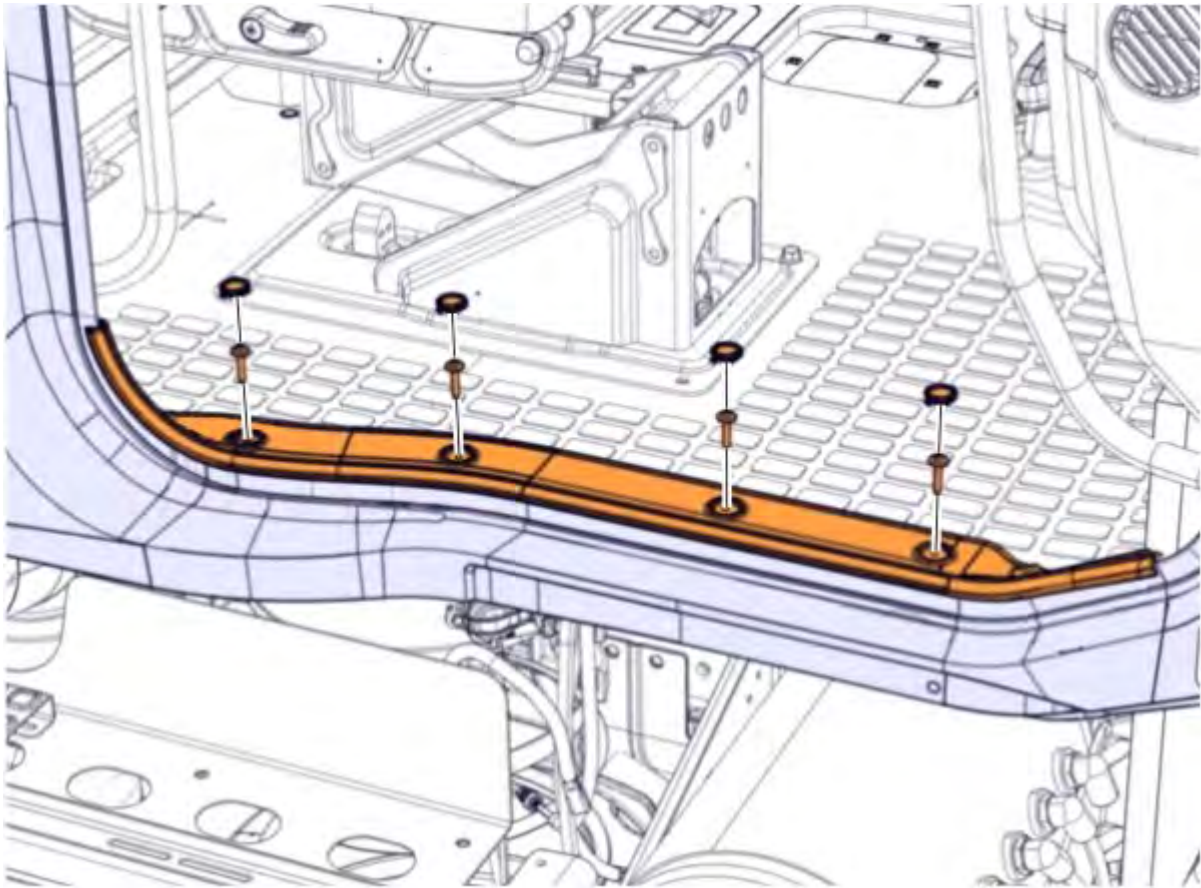
Note the positions.



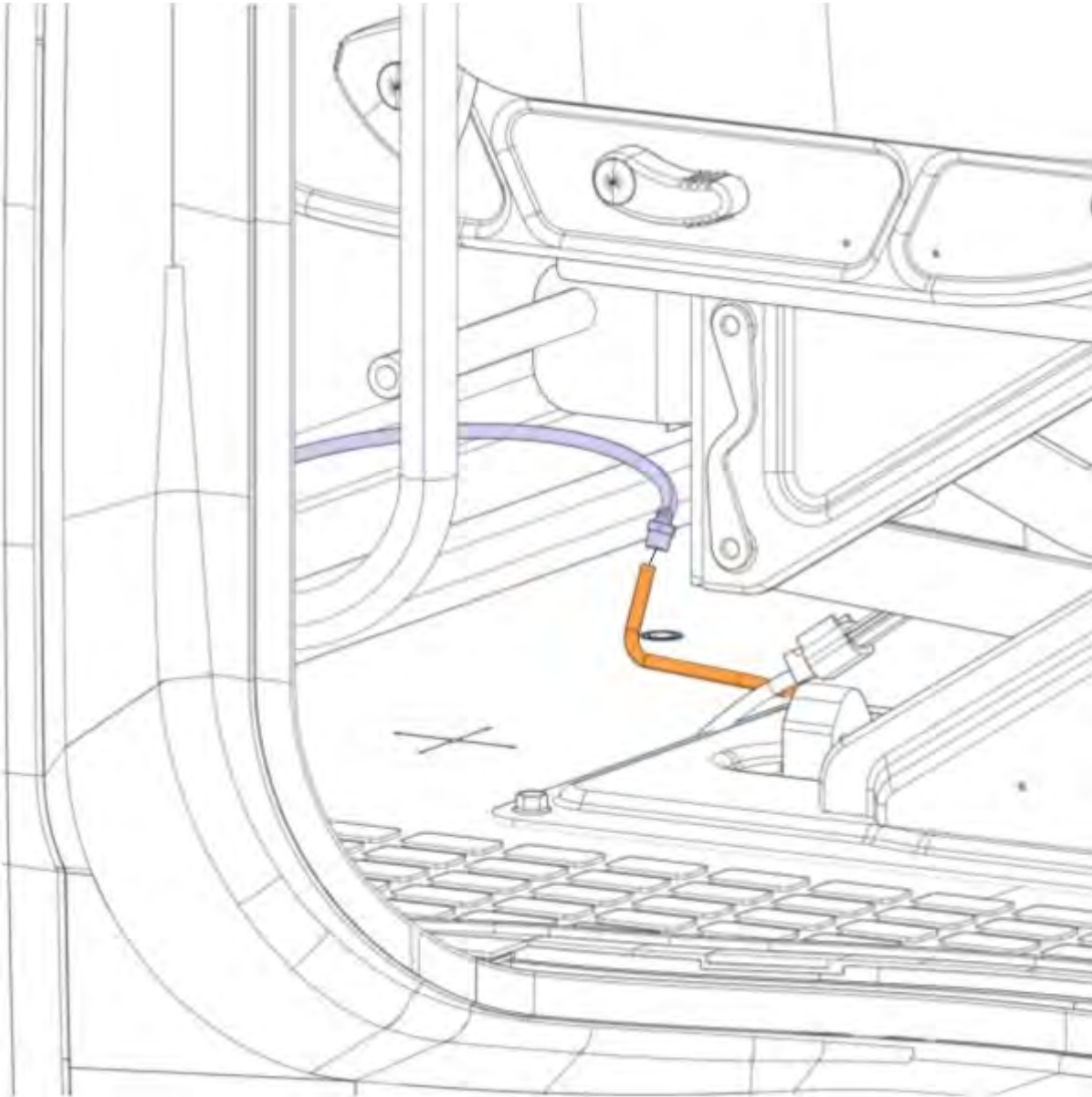
25	Remove the pipe.
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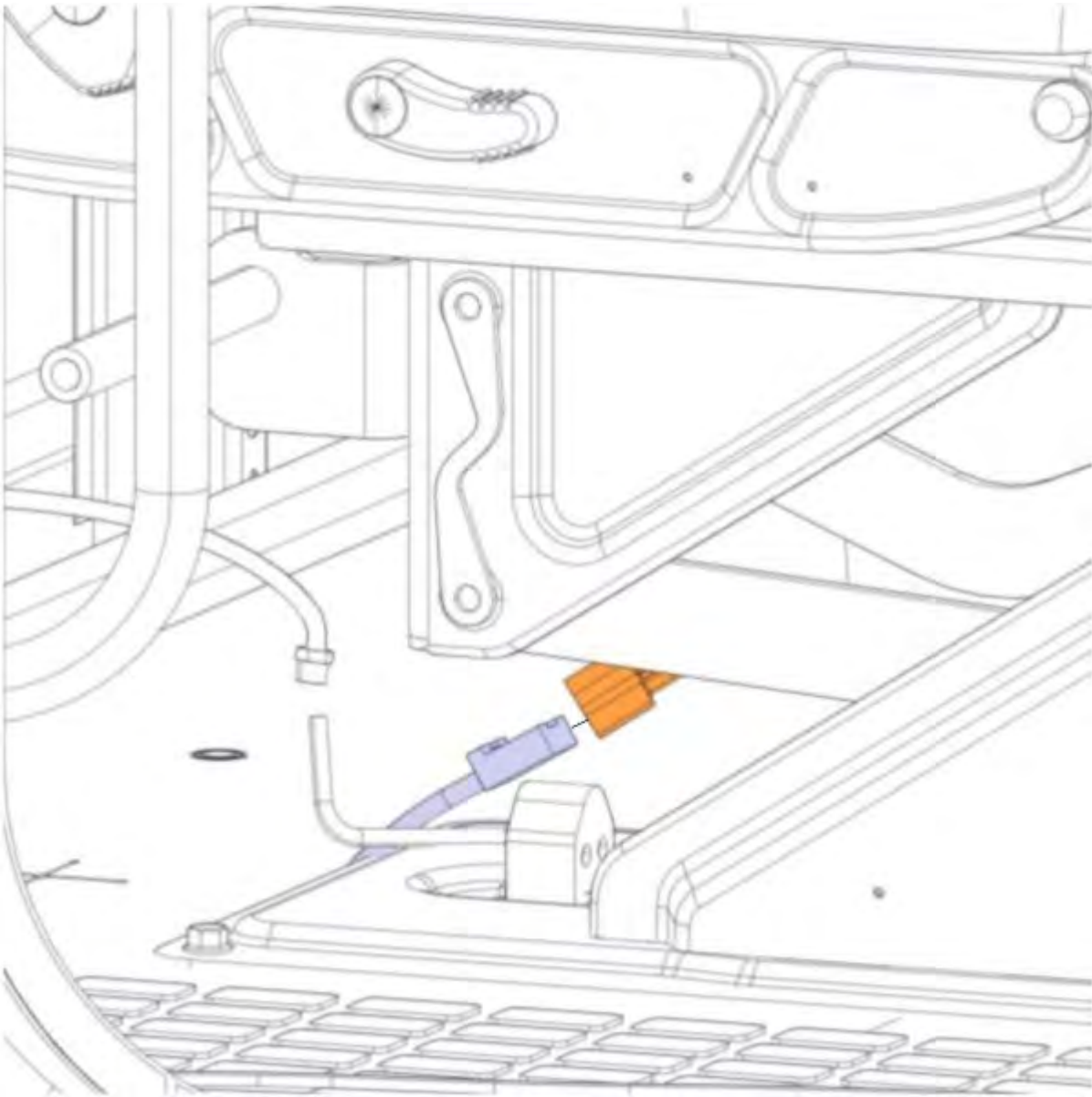
26	Remove the protecting covers.
27	Remove the screws.
28	Remove the panel.



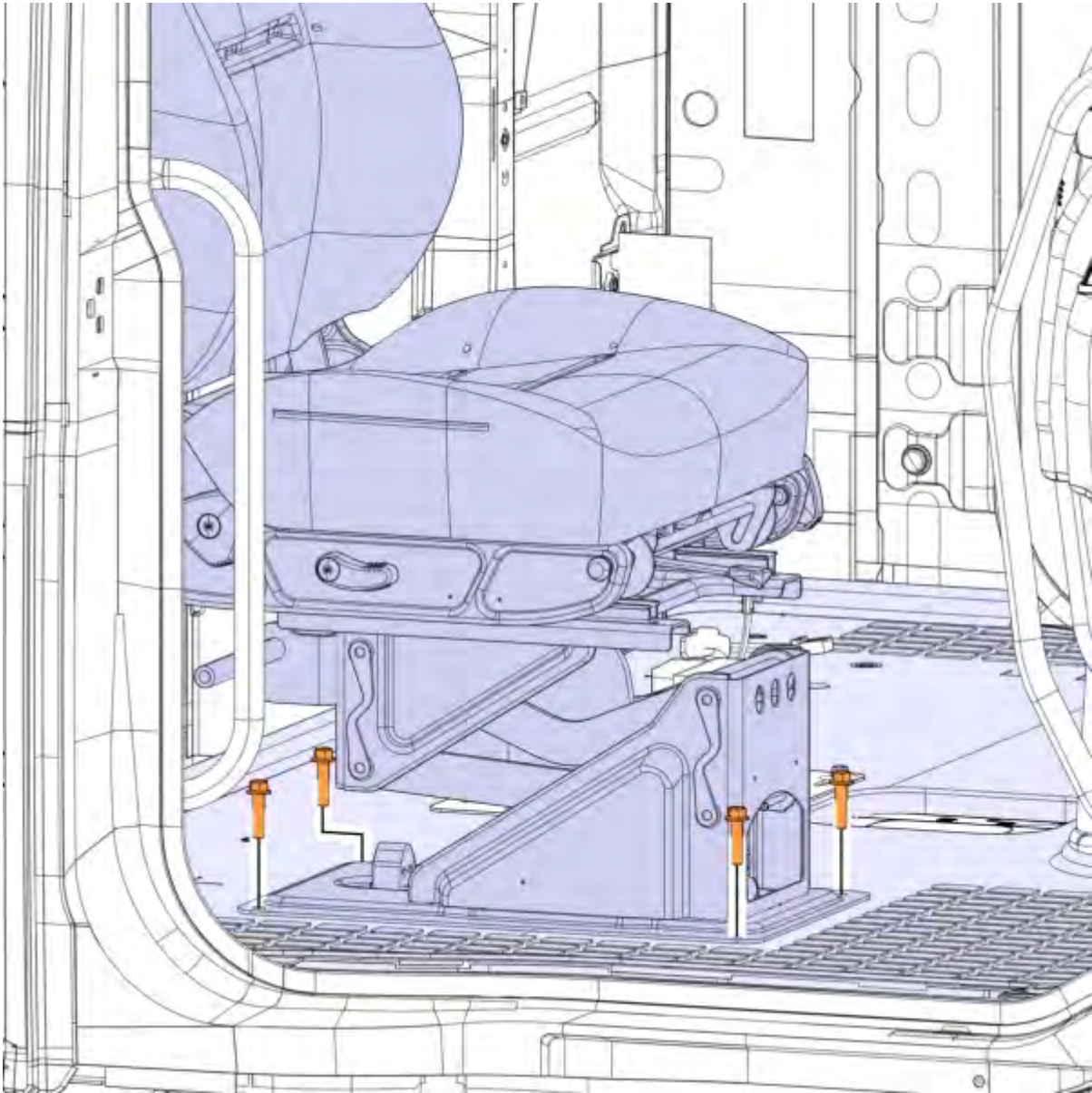
29	Remove the seat belt.	
30	Disconnect the air tube.	
	Required material	
	DISASSEMBLY TOOL	J-42189



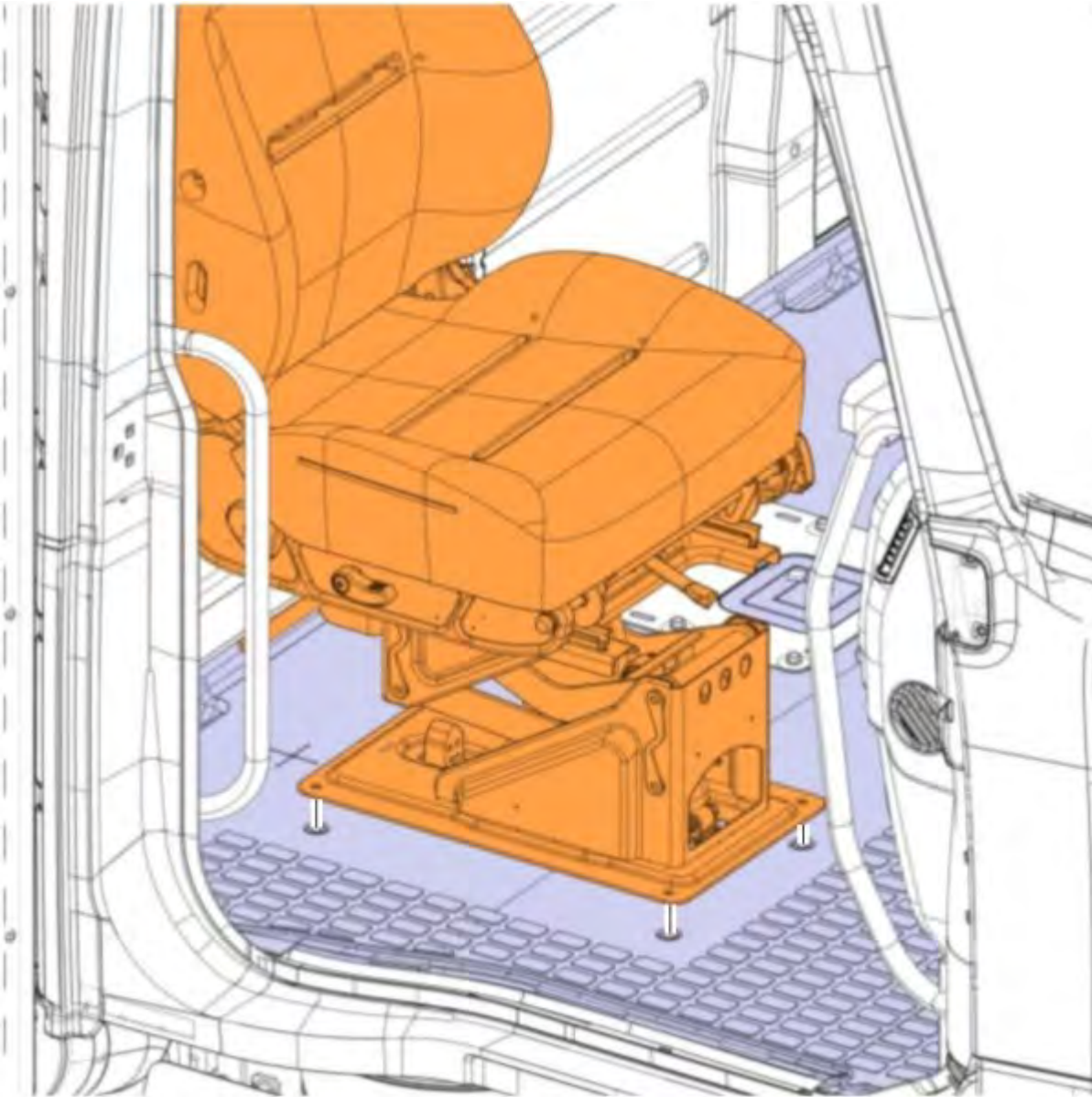
31	Disconnect the connector.
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32	Remove the screws.
----	--------------------



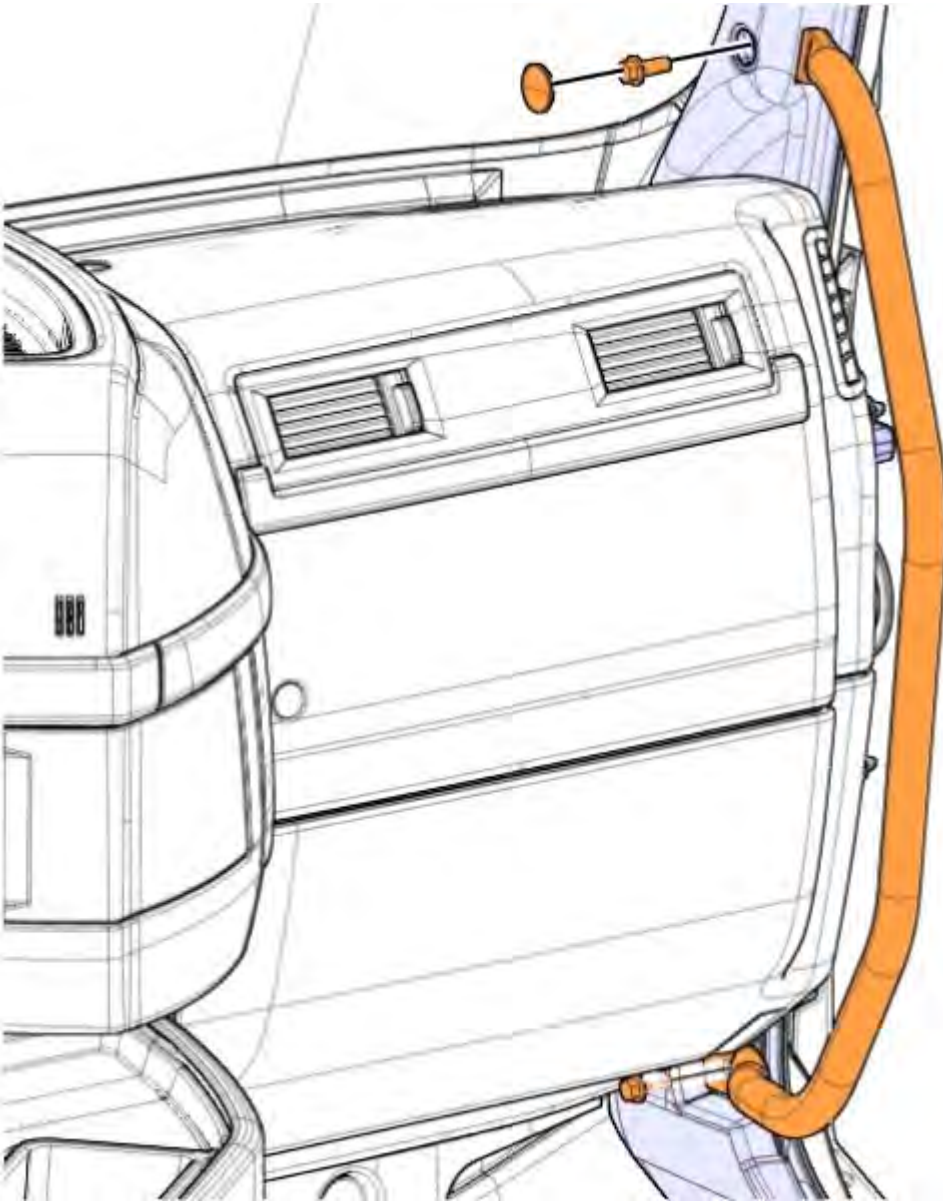
 WARNING	
Risk of serious injury. Heavy component.	
▶	Exercise caution when moving the component. Assistance is required.
33	Remove the seat from the cab.



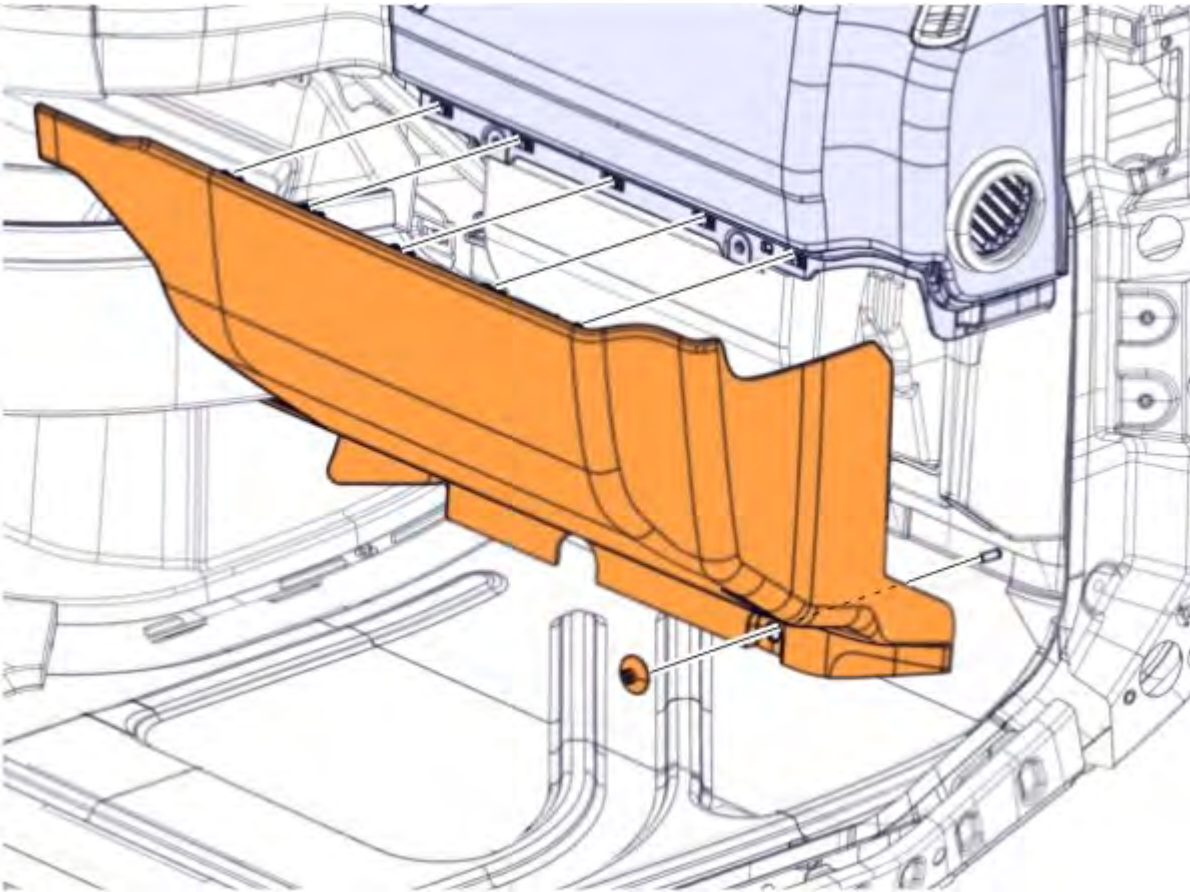
34	Remove the screw cover.
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35	Remove the screws.
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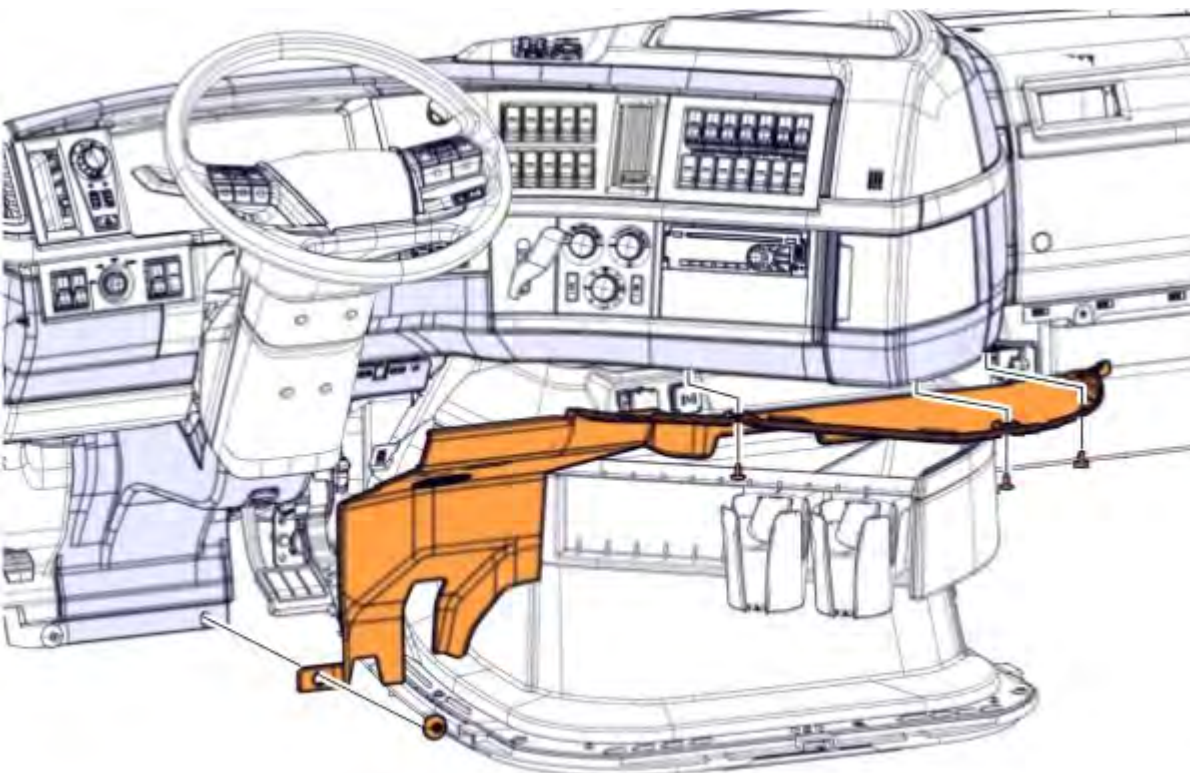
36	Remove the grab handle.
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37	Remove the nut.
38	Remove the panel.

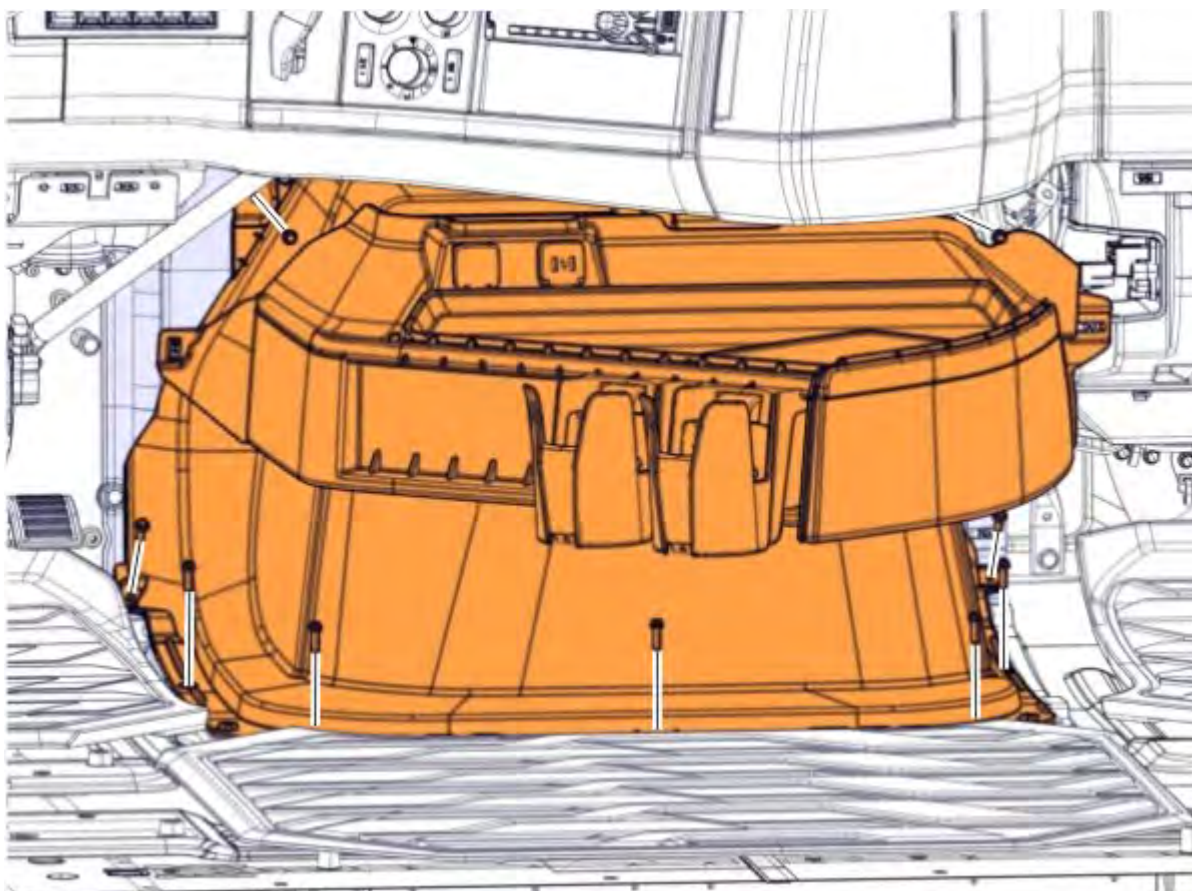


39 Remove the panel.

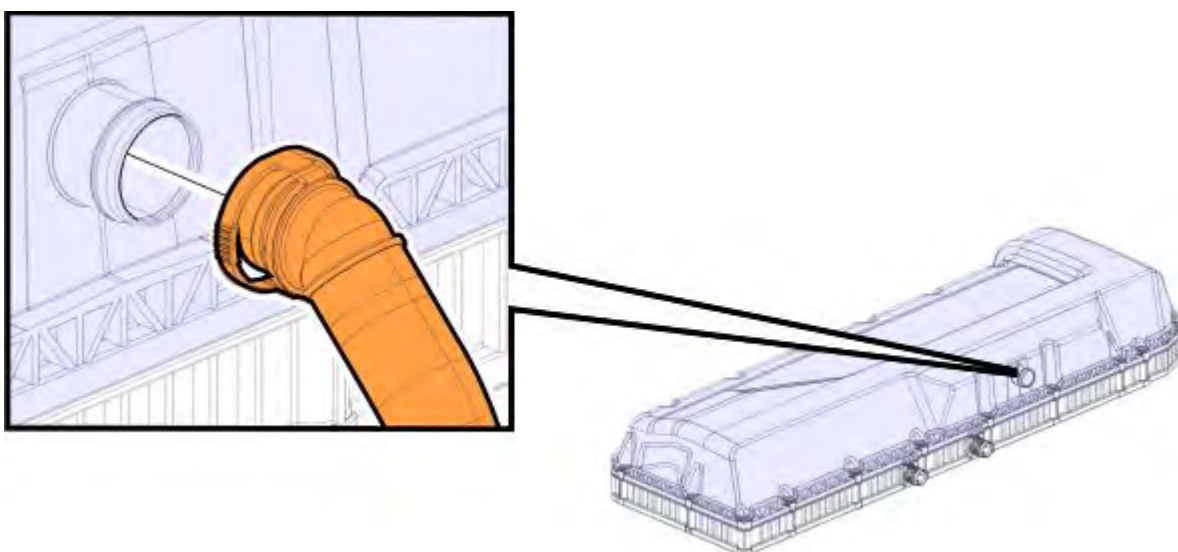


40 Move the floor cover to access the screws.

41	Remove the screws.
42	Remove the engine cover.
43	Disconnect the connector.



44	Remove the pipe.
	i Note If not previously removed.

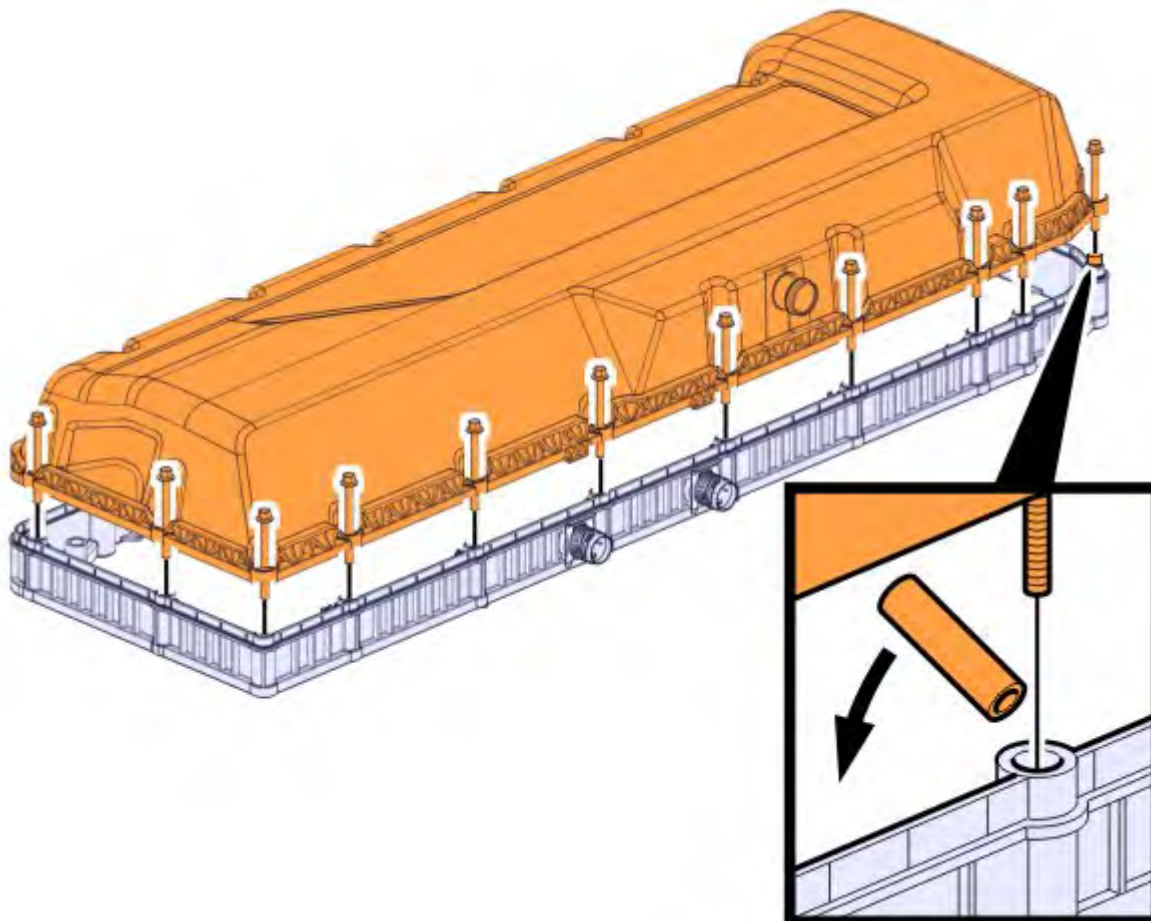


45	Loosen the screws.
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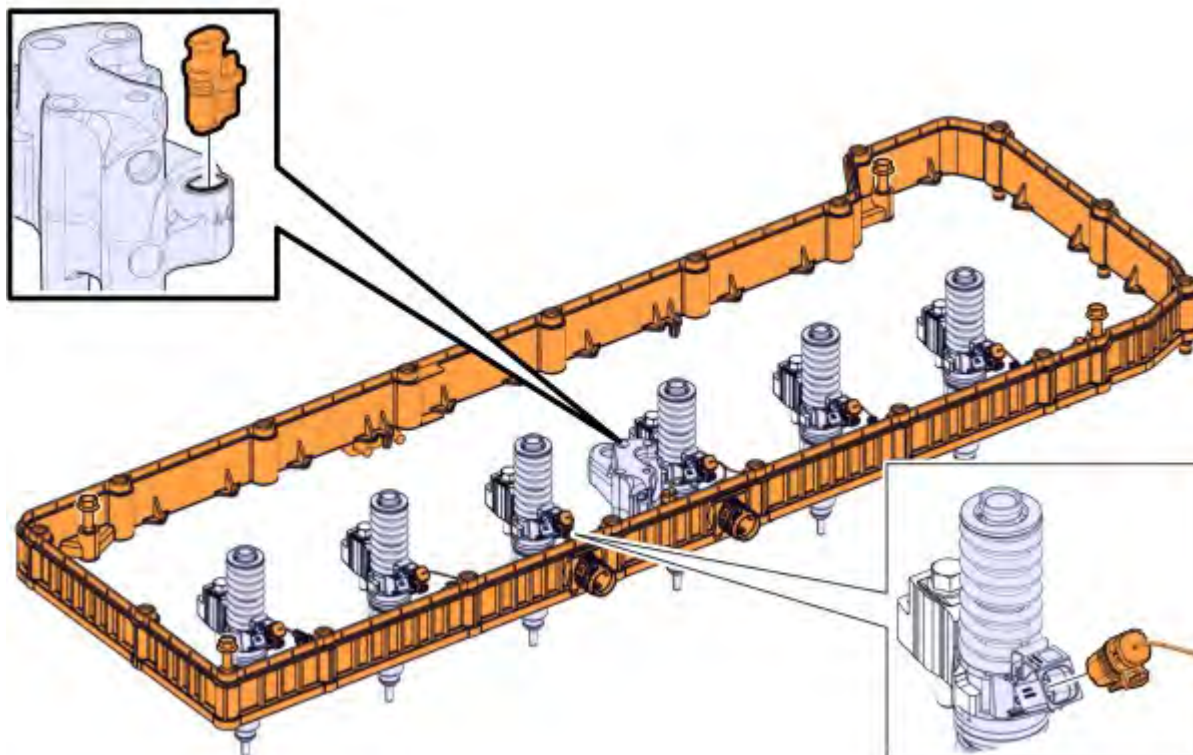
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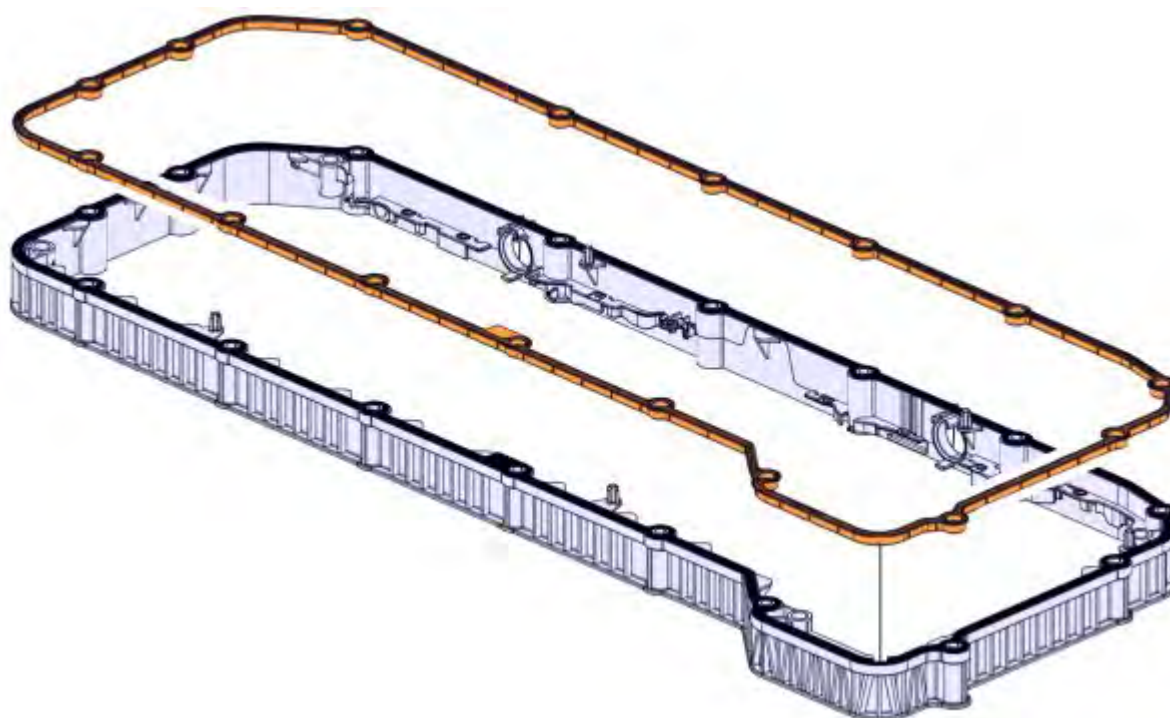
46	Remove the valve cover.  Service hint It is possible, when removing a valve cover screw, that the crush sleeve is drawn out with it. Take care to prevent the sleeve from falling into the gear train as this could result in engine damage.
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47	Disconnect the connectors.
48	Loosen the screws.
49	Remove the frame.

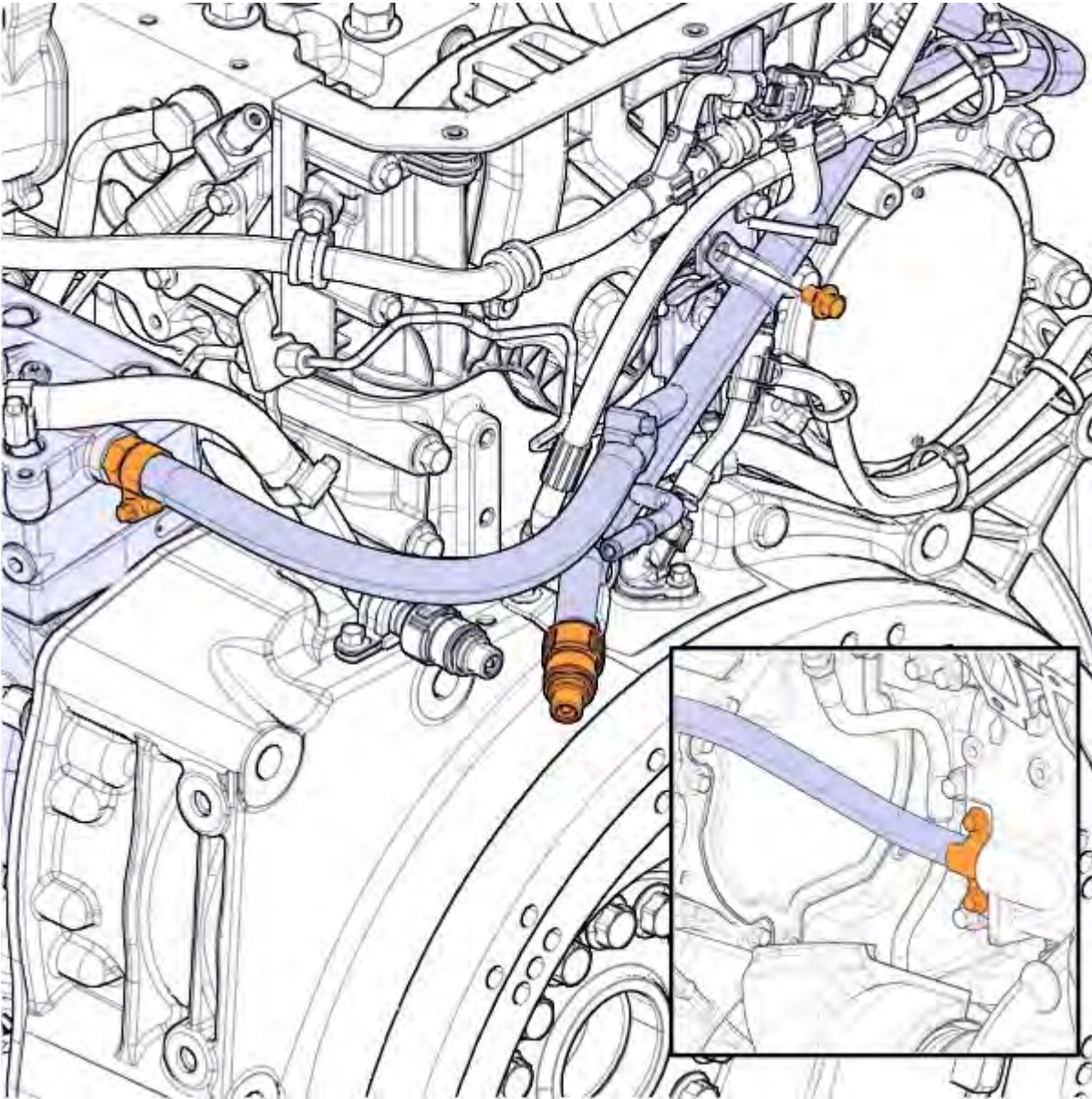


50	Remove the gasket.
----	--------------------

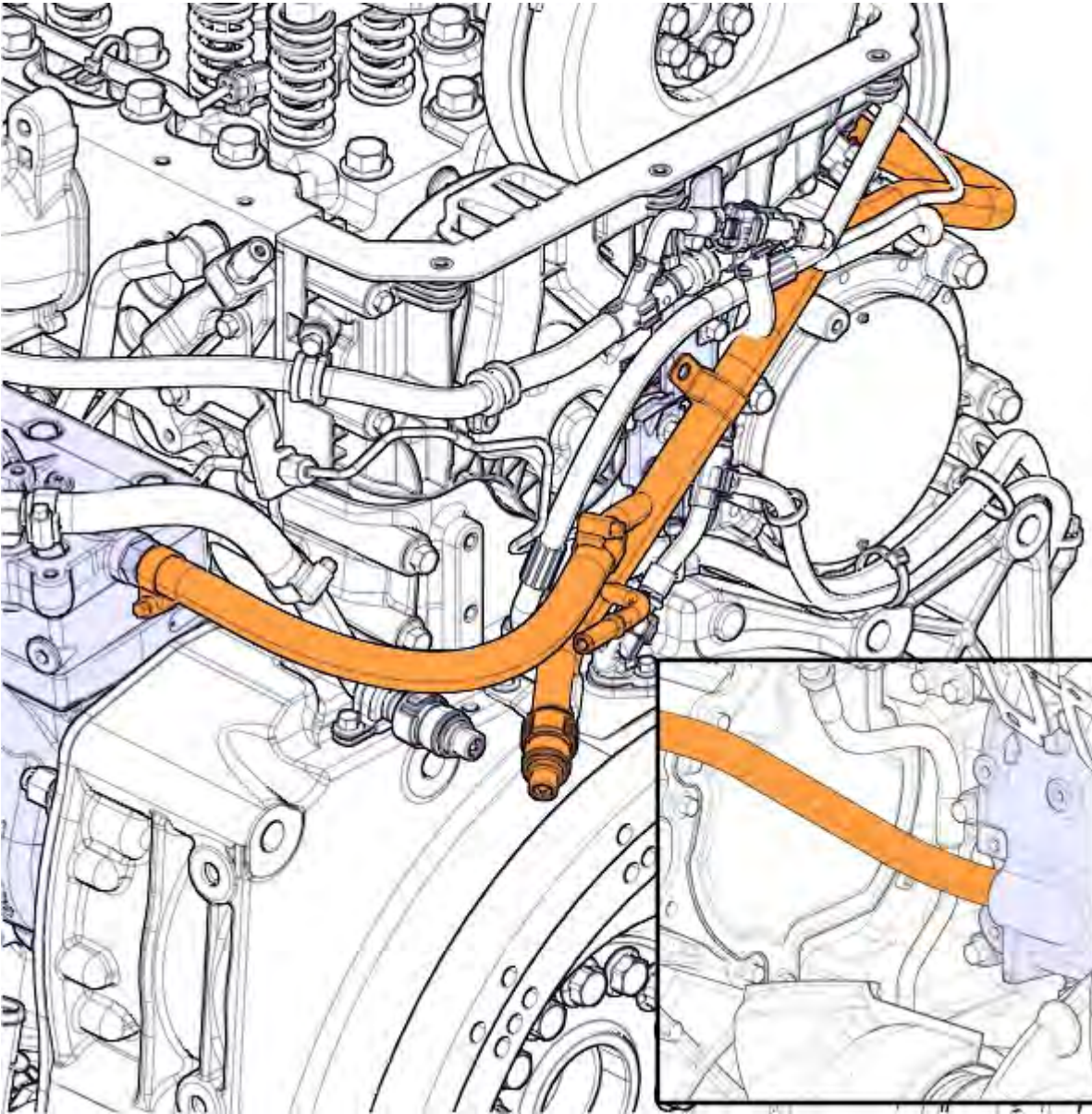


51	Remove the screws.
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52	Loosen the clamps.
----	--------------------



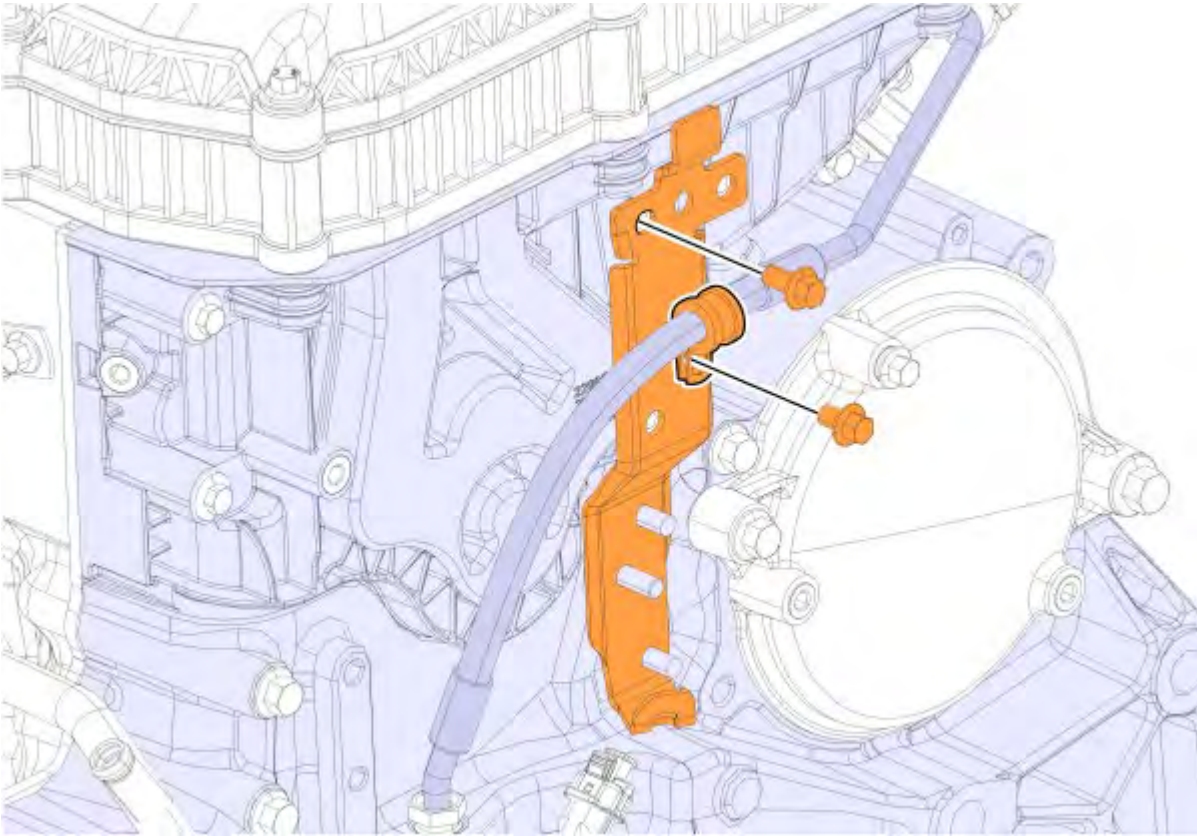
53	Remove the pipe.
----	------------------



54	Remove the screws.
----	--------------------

55	Remove the clamp.
----	-------------------

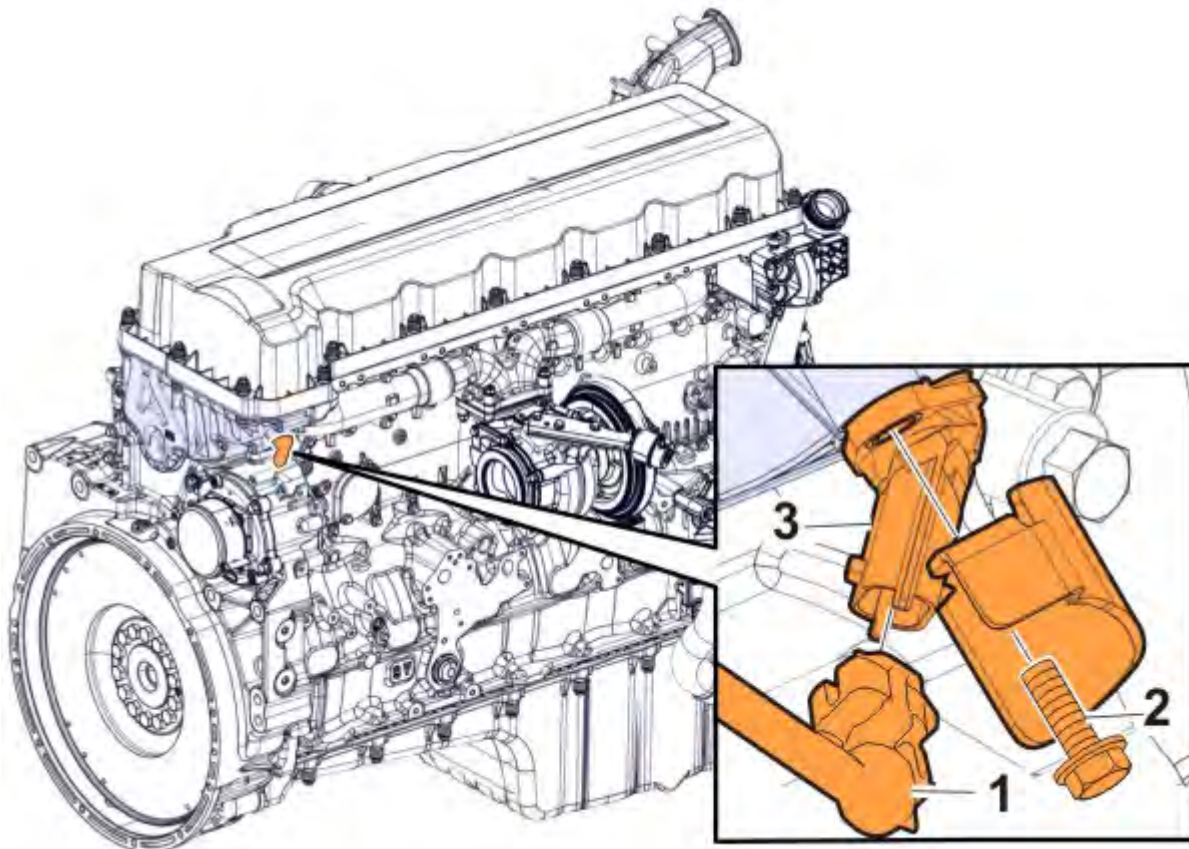
56	Remove the bracket.
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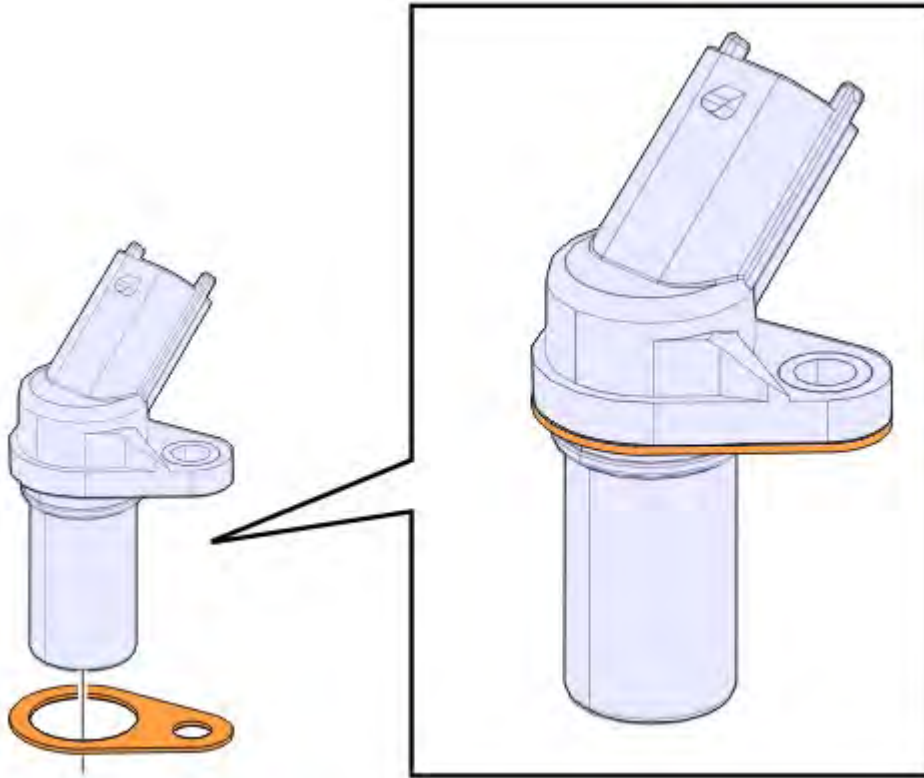
57	Disconnect the connector (1).
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58	Remove the screw (2).
----	-----------------------

59	Remove the sensor and the heat shield. (3).
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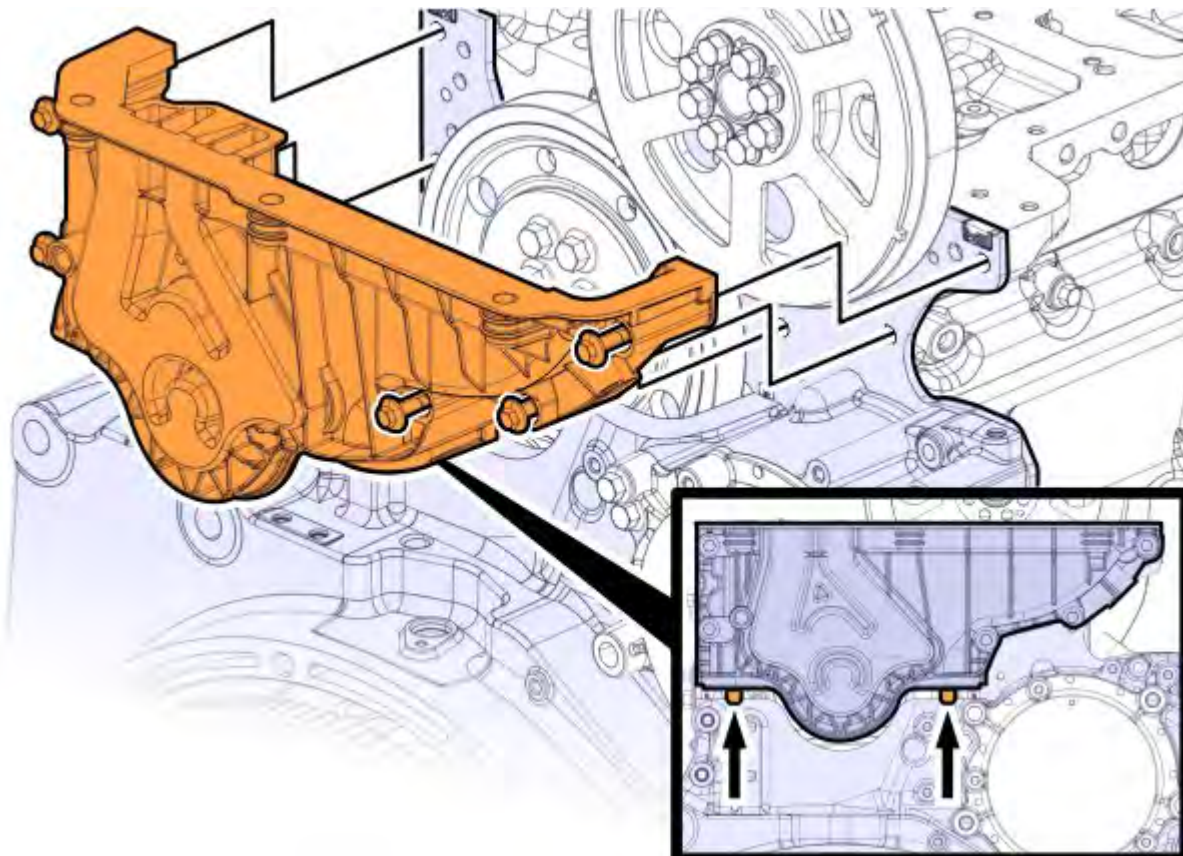
60	Be aware of possible shims.
----	-----------------------------



61	Disconnect the connector.
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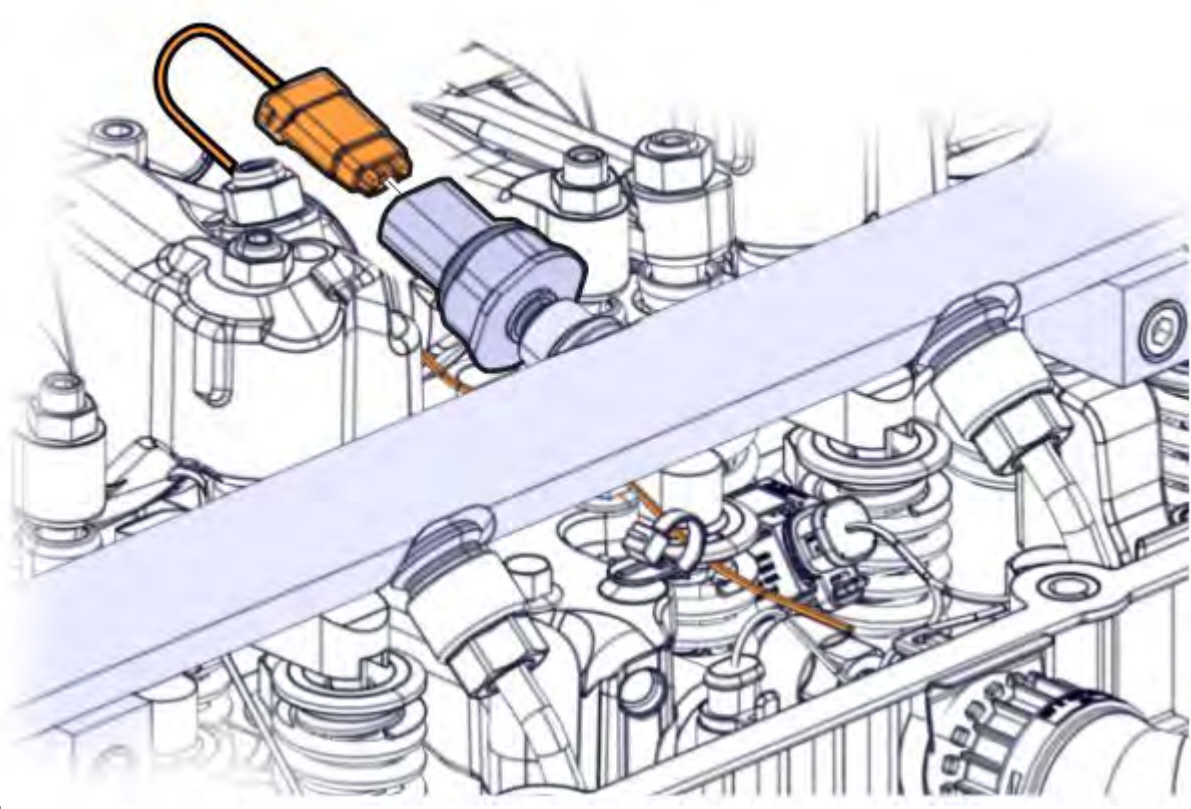
62	Remove the screws.
----	--------------------

63	Remove the cover.
----	-------------------



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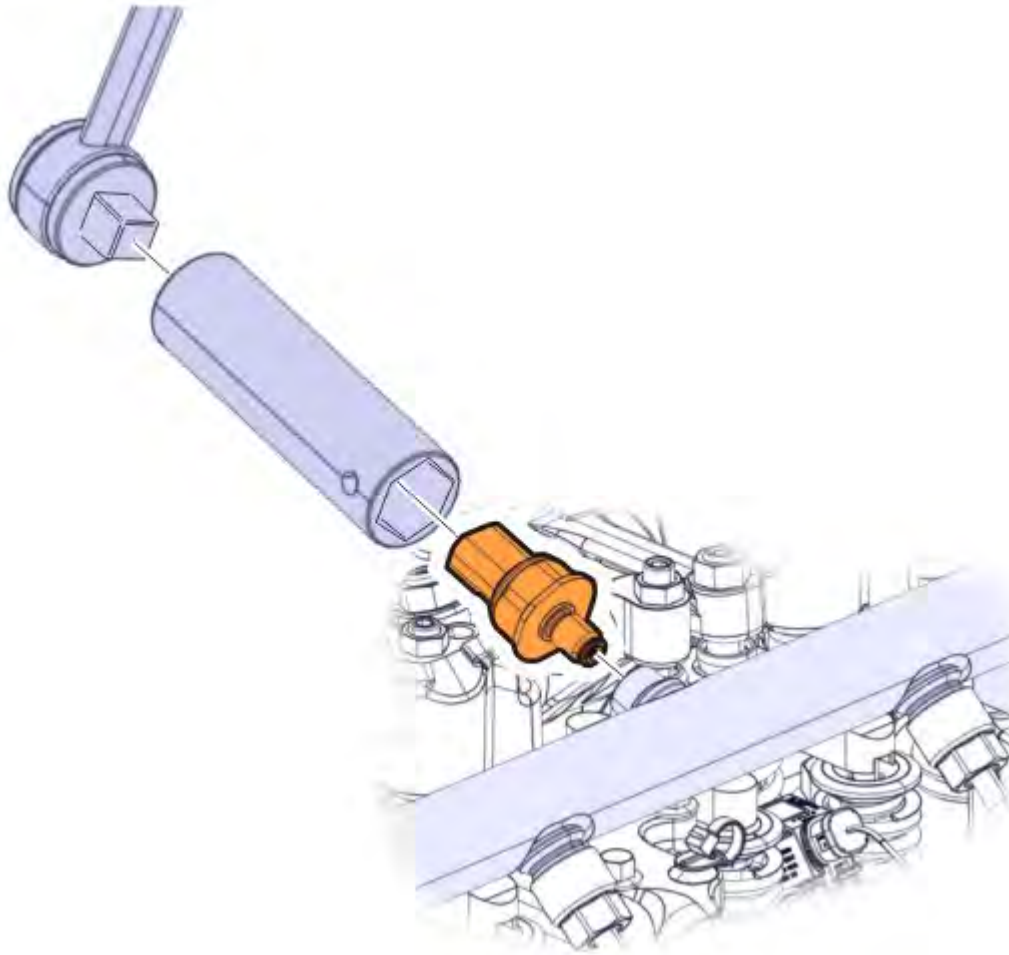
64	Perform this procedure when the condition below is met.
Conditions	
•	If not previously removed.
►	Disconnect the connector.
	

65	Clean around the sensor.
----	--------------------------

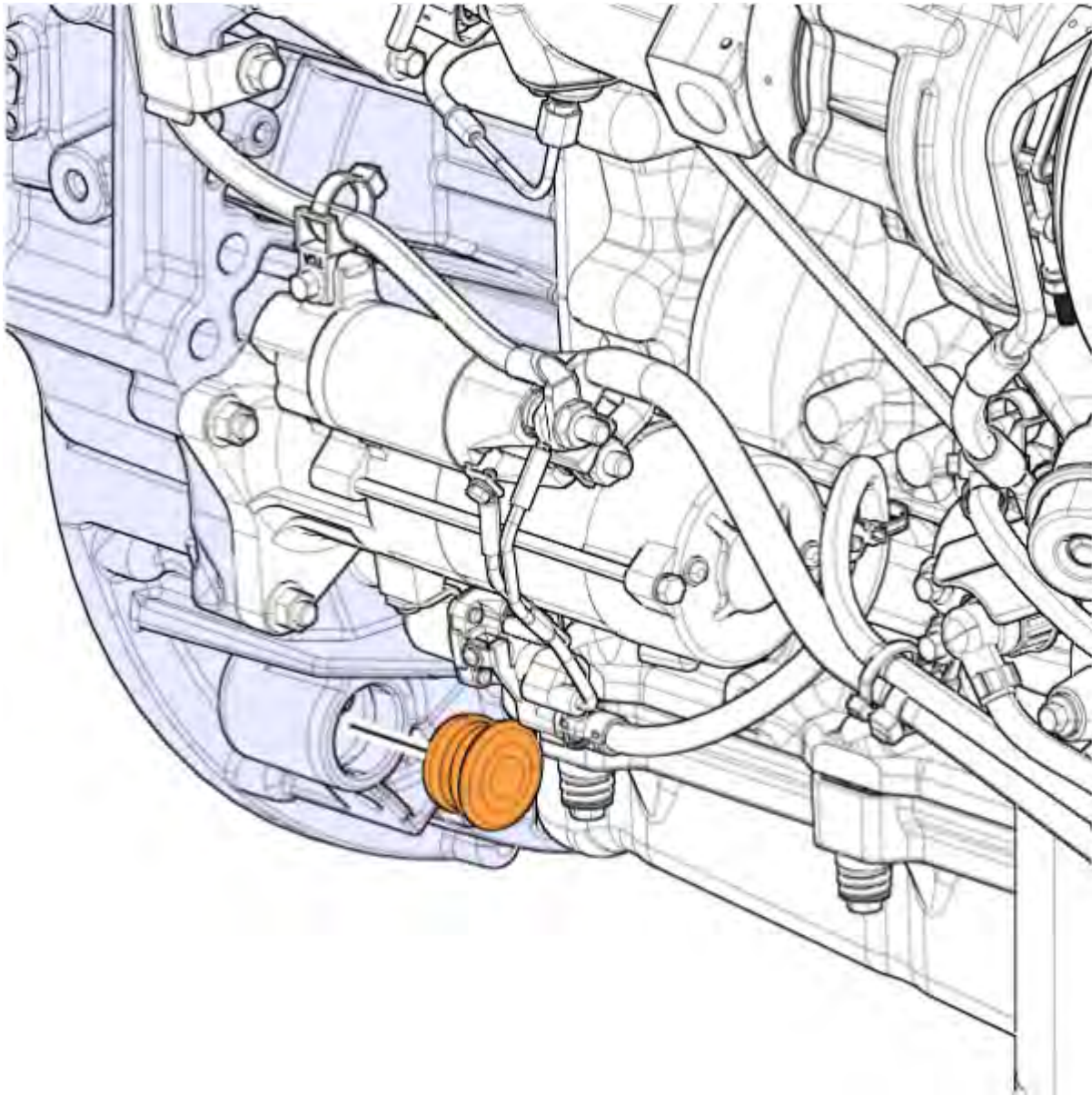
66	Remove the sensor.
----	--------------------

	
Risk of material damage.	
Component damage could occur if debris enters.	
►	Cover openings to prevent debris from entering.

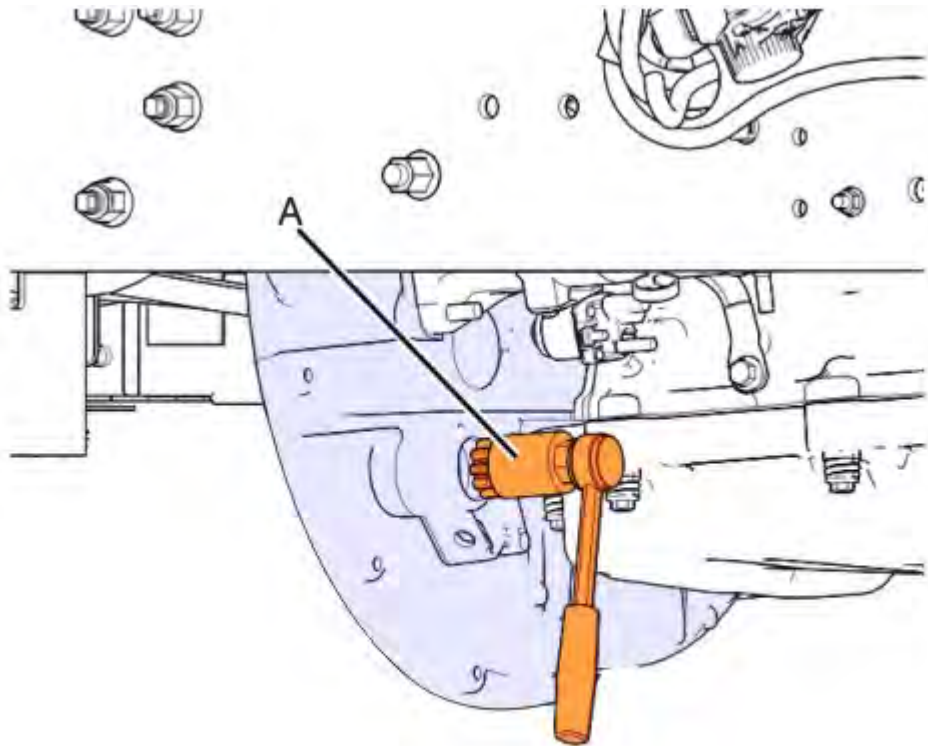
67	Cover or plug openings immediately.
----	-------------------------------------



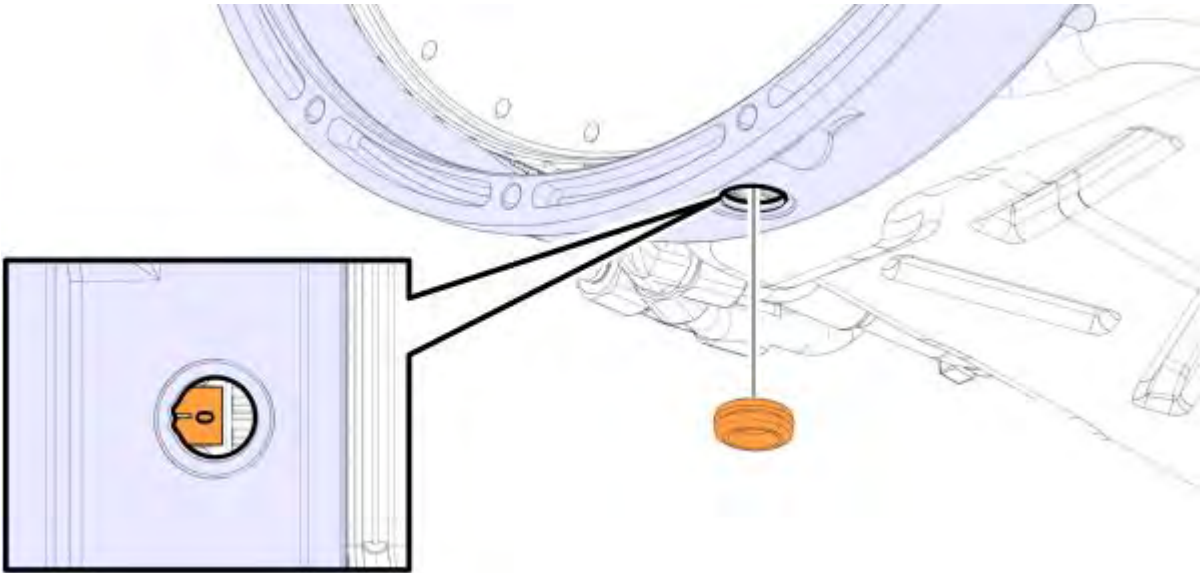
68	Remove the plug.
----	------------------



69	Install the cranking tool (A).	
	Required material	
	CRANKING TOOL	88840317



70	Remove the plug.
71	Check the marking (0).



72	Perform this procedure when the condition below is met.
	Conditions
	If the flywheel is not in the TDC (Top Dead Center) position
	Rotate the flywheel to the TDC marking (0).
	Note Do not use power tools.

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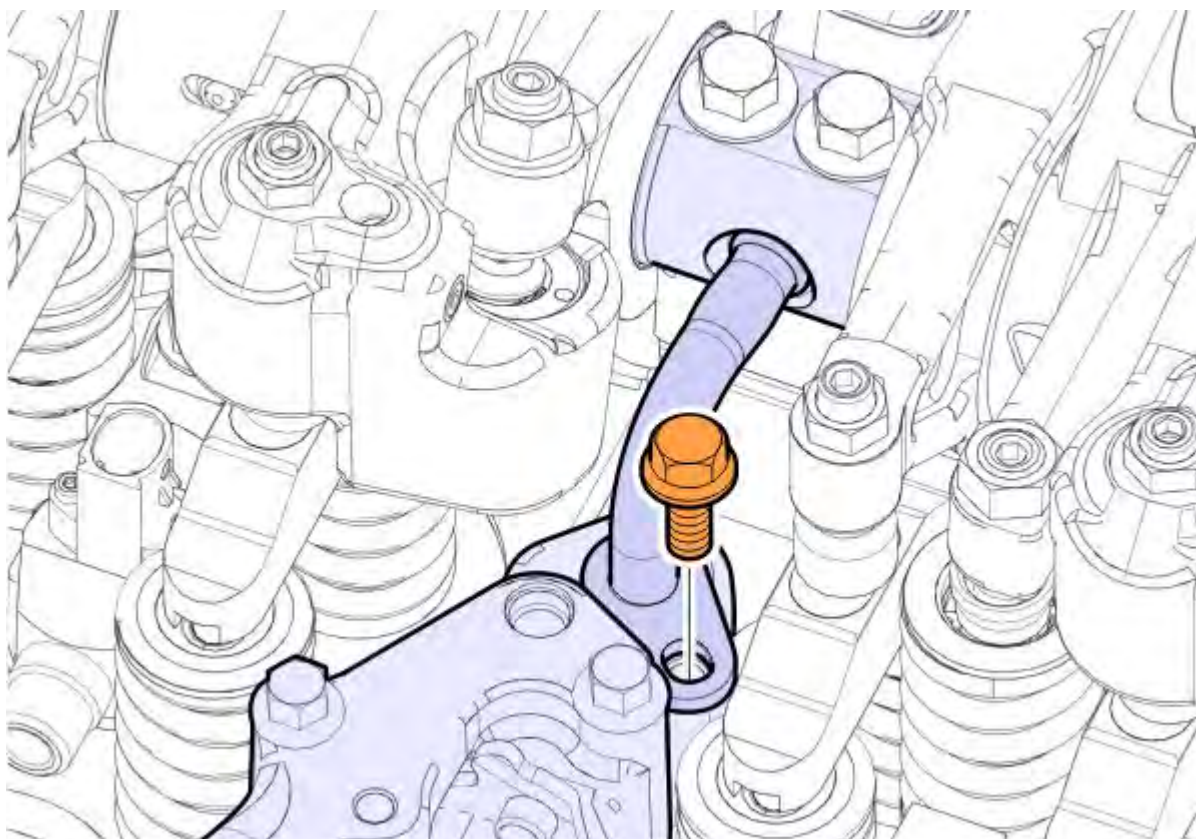
**Note**

Rotate the flywheel in the normal engine rotation direction.

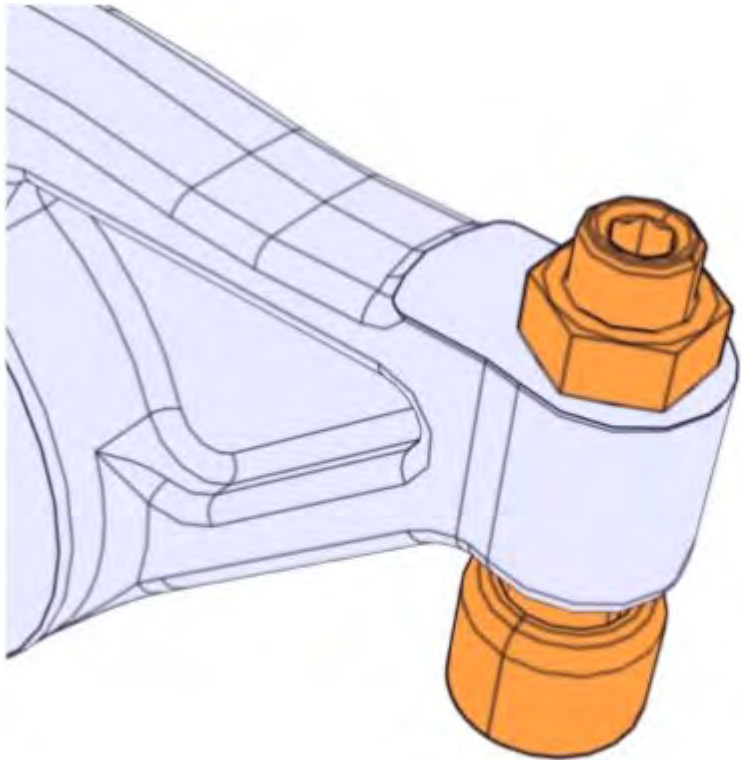
73 Remove the screw.

**Note**

The pipe is removed at a later stage along with the rocker arm shaft.

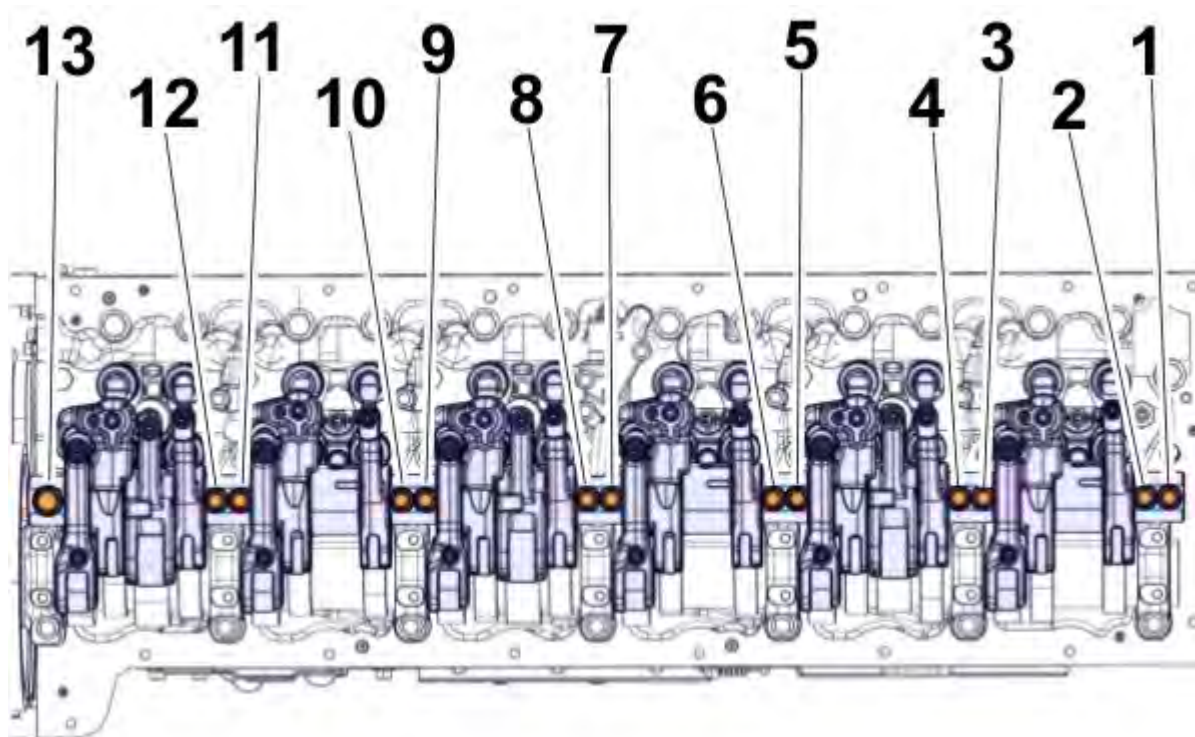


74 Loosen the adjustment screws.



75	Loosen the screws.
----	--------------------

Tightening torque		
Rocker arm shaft, screw	1.	Remove screws: 1–3–5–7–9–11
		6 pcs
	2.	Remove screws: 13–2–12–4–10–6–8
		7 pcs

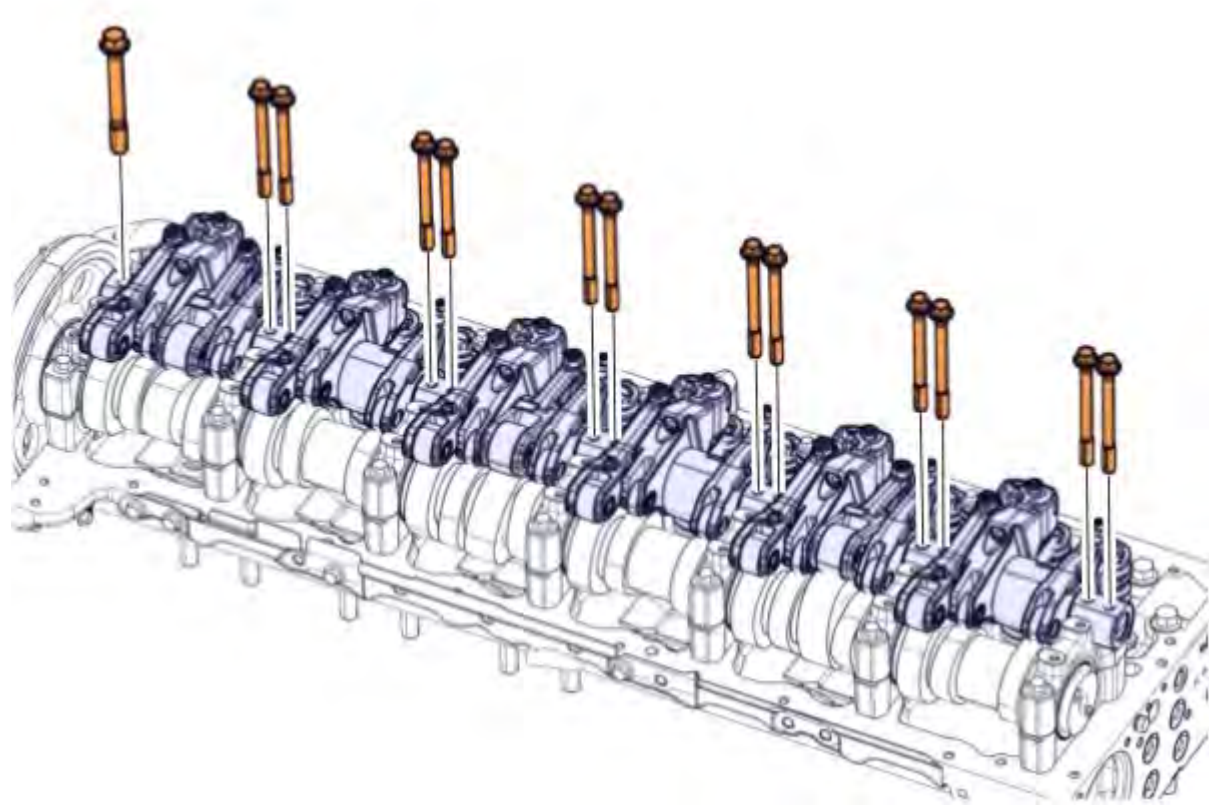


Note

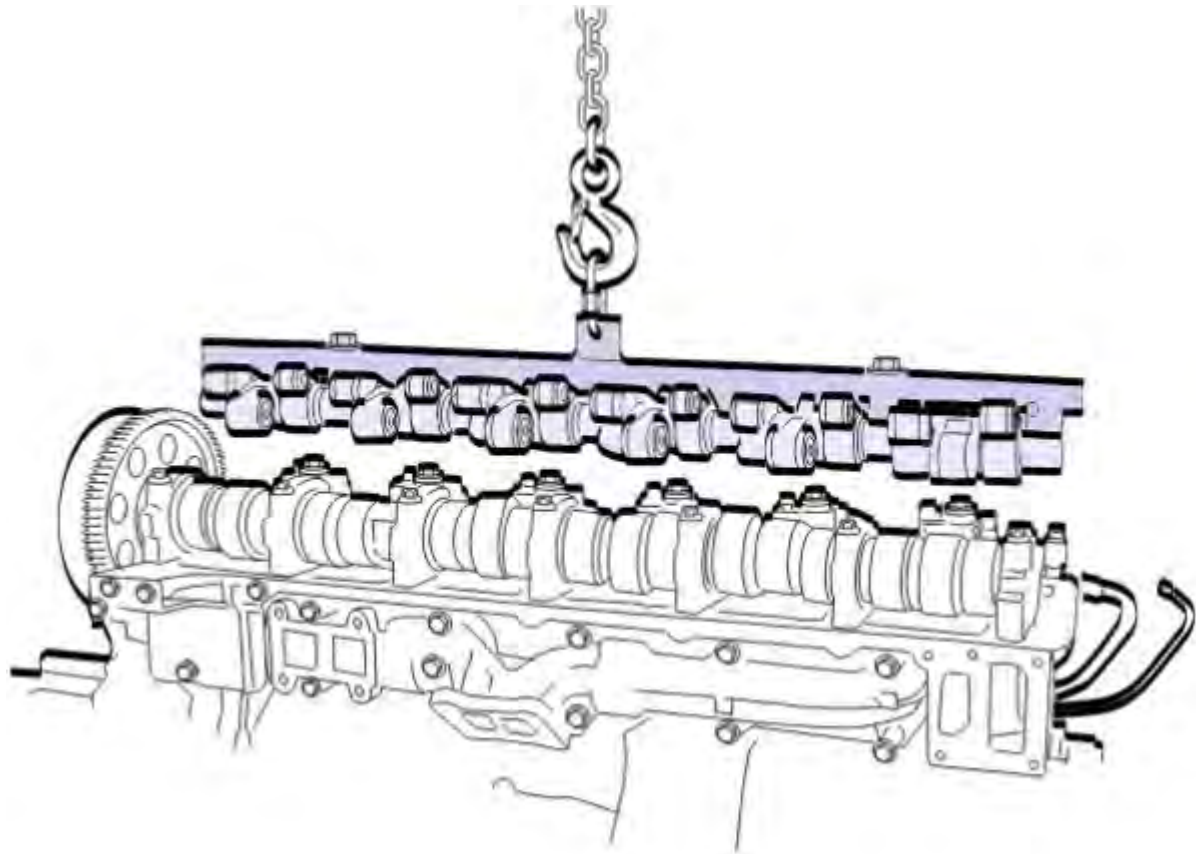
Loosen gradually in the sequence indicated.

76

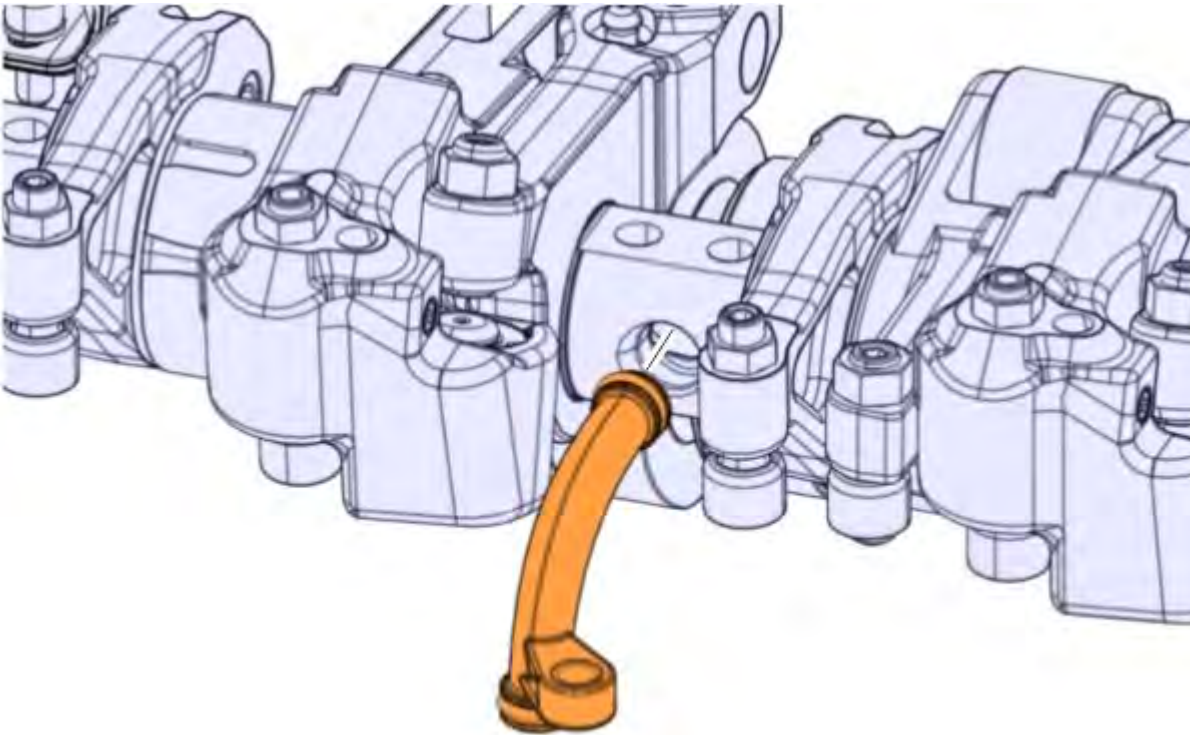
Remove the screws.



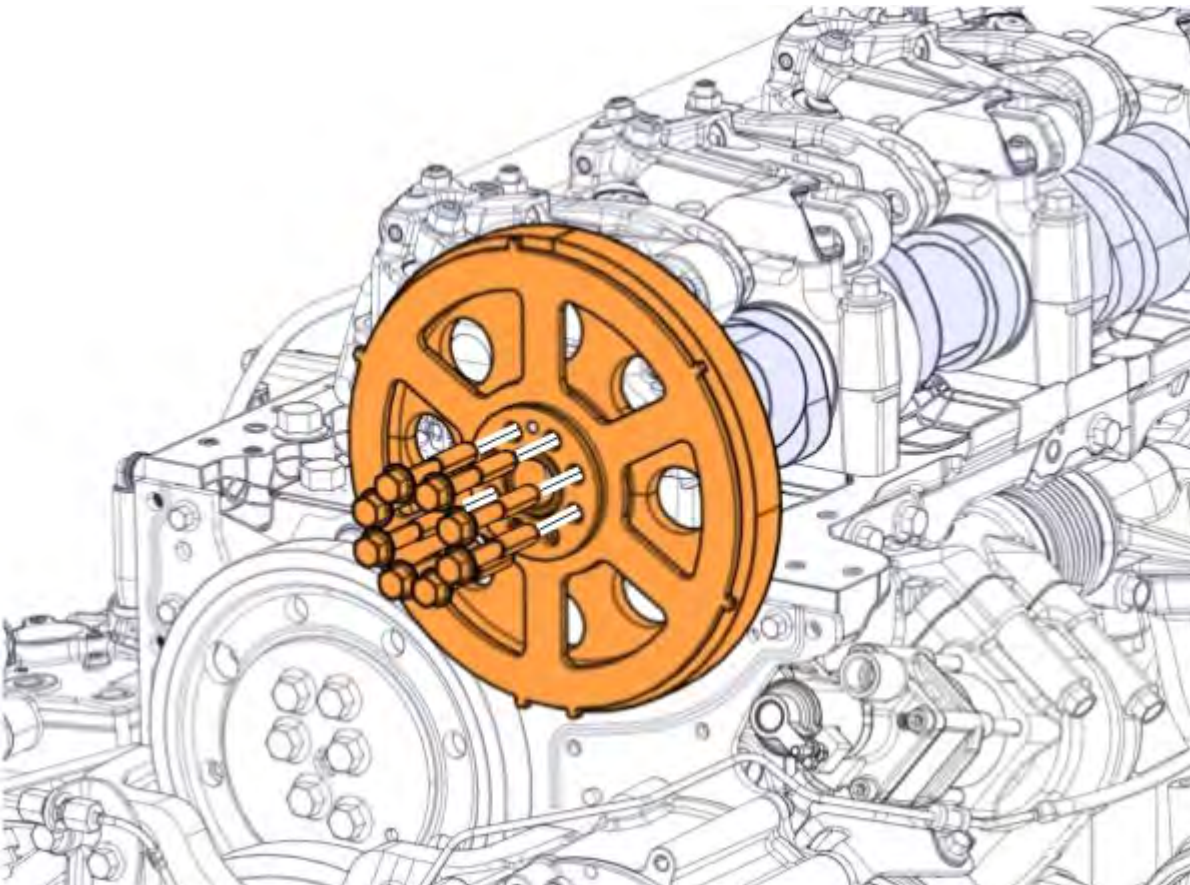
77	Install the lifting tool.	
	Required material	
	LIFTING TOOL	85109250



78	Remove the rocker arm shaft.
79	Remove the pipe. i Note Discard the pipe. Do not reuse.



80	Remove the screws.
81	Remove the gear and sensor wheel.



82 Remove the screws.



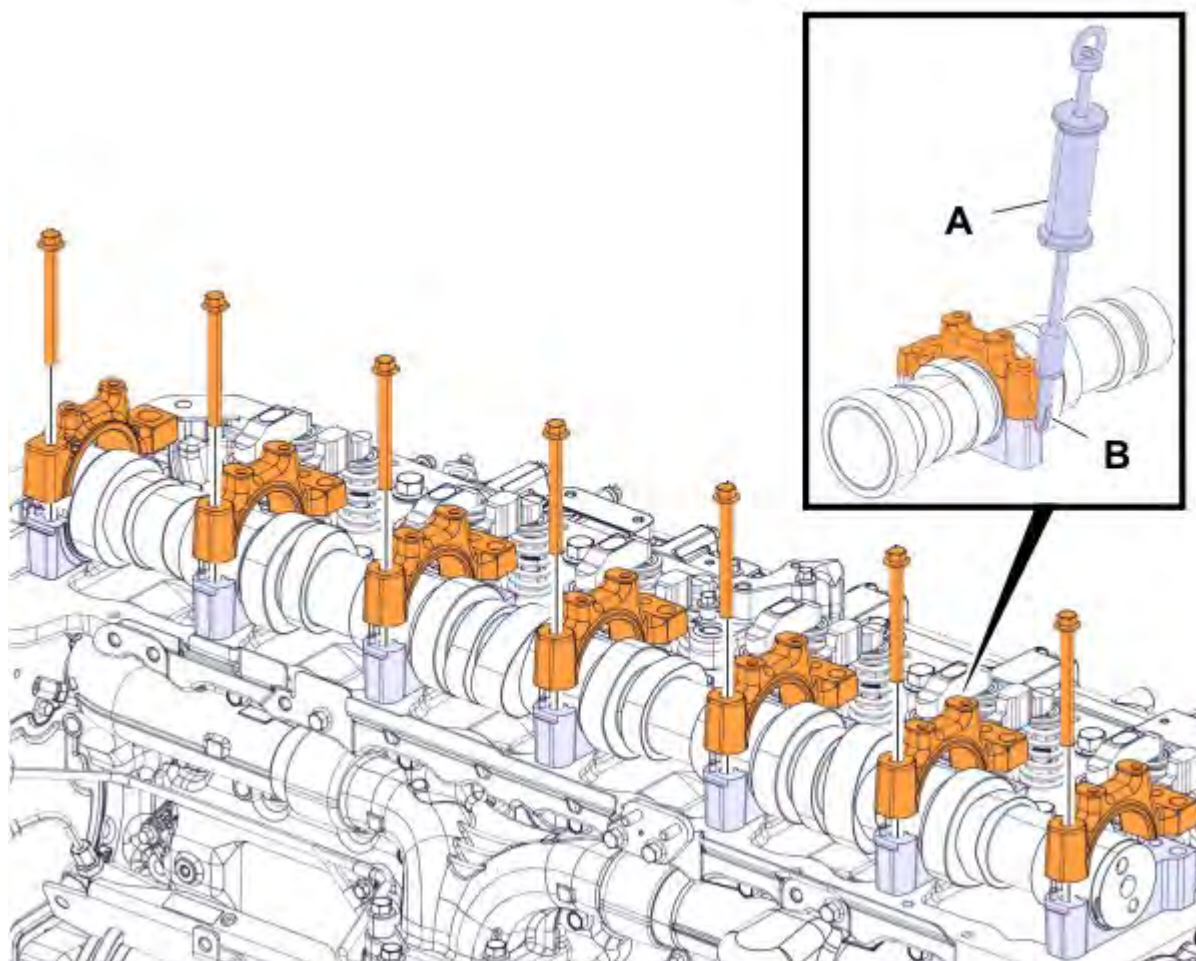
Note

Check that the camshaft caps are marked up.

83 Remove the caps.

Required material

A	IMPACT WRENCH	9996400
B	EXTRACTOR	88800420

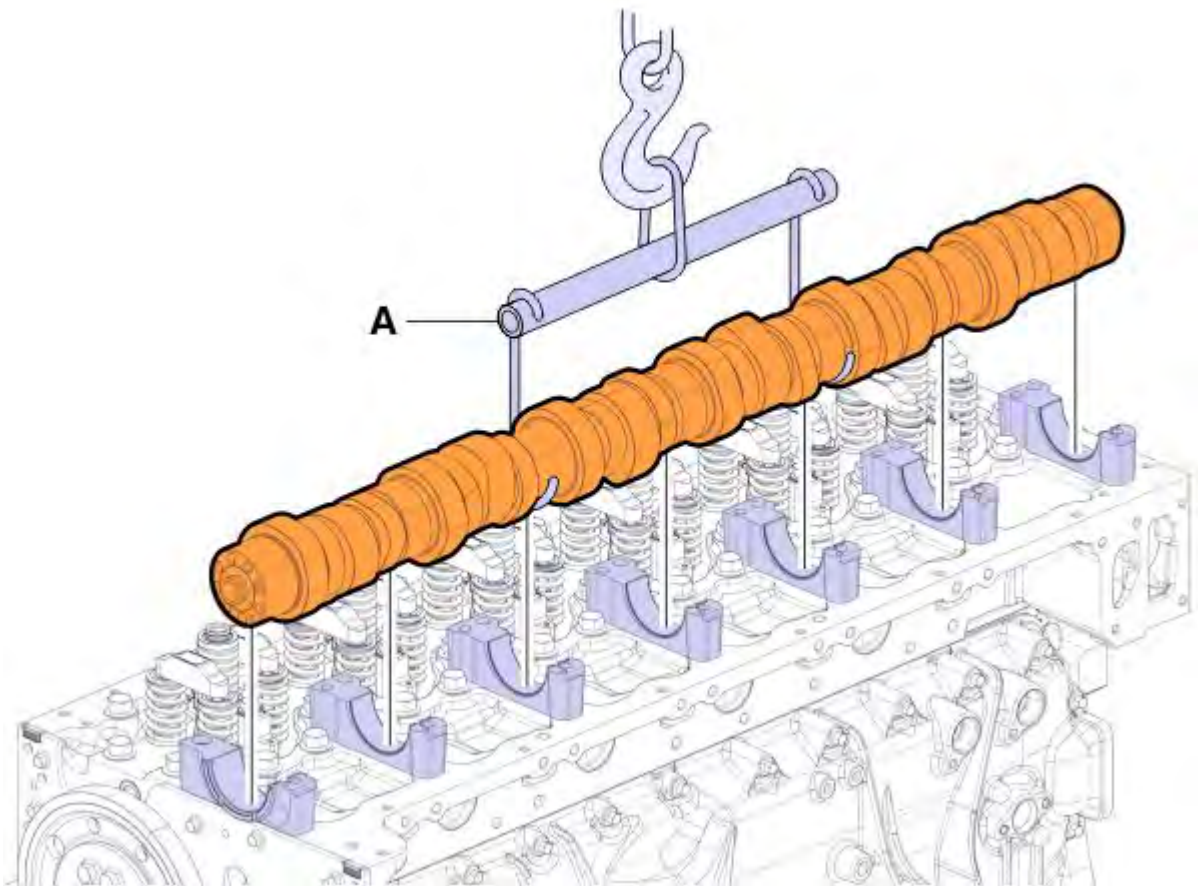


84 Install the tool (A).

Required material

LIFTING TOOL	9998264
--------------	-------------------------

85 Remove the camshaft.



86	Remove the bearing shells.
87	Check the bearing shells, brackets and caps for damage.

 **CAUTION**

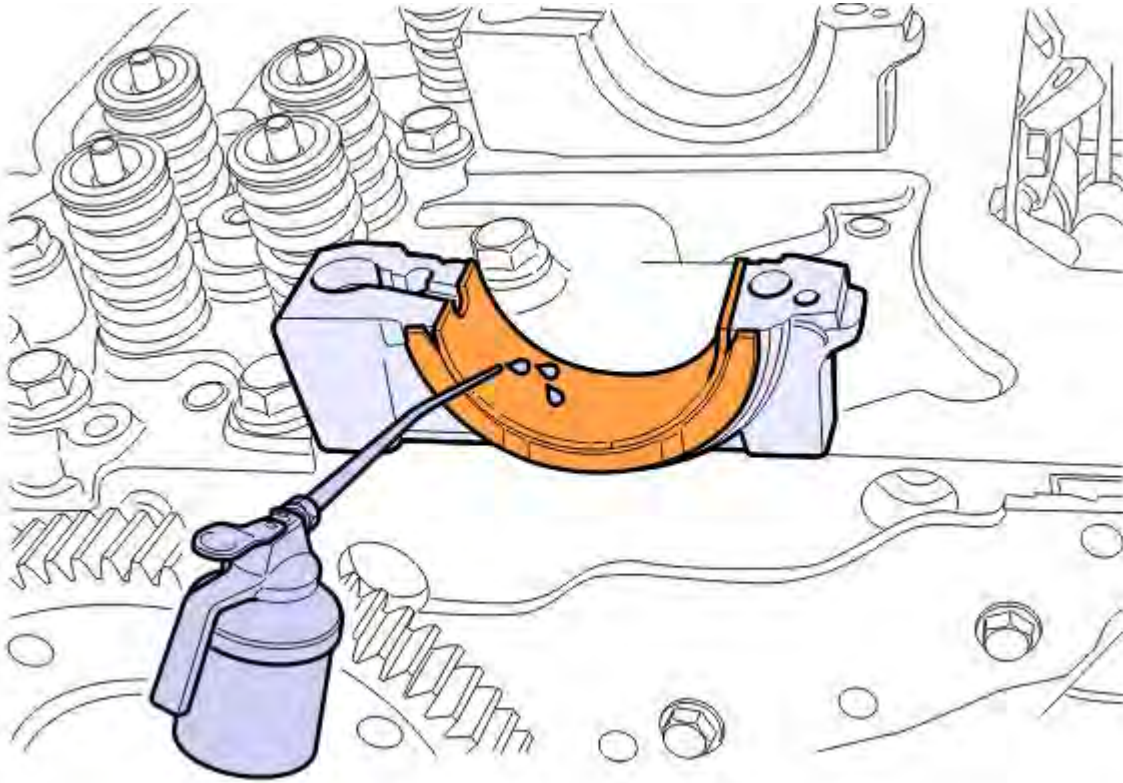
Risk of material damage.
Dirt and foreign bodies can damage the lubrication system.

- ▶ Ensure that the work area is clean.
- ▶ Cover or plug openings immediately. If work on removed parts is disrupted, cover the parts.
- ▶ Ensure that tools, gloves, and protective clothes are as clean as possible.

88	Install the bearing shells.  Note Use new parts.  Note The surface between the bearing shells and bearing housings must be free of oil.
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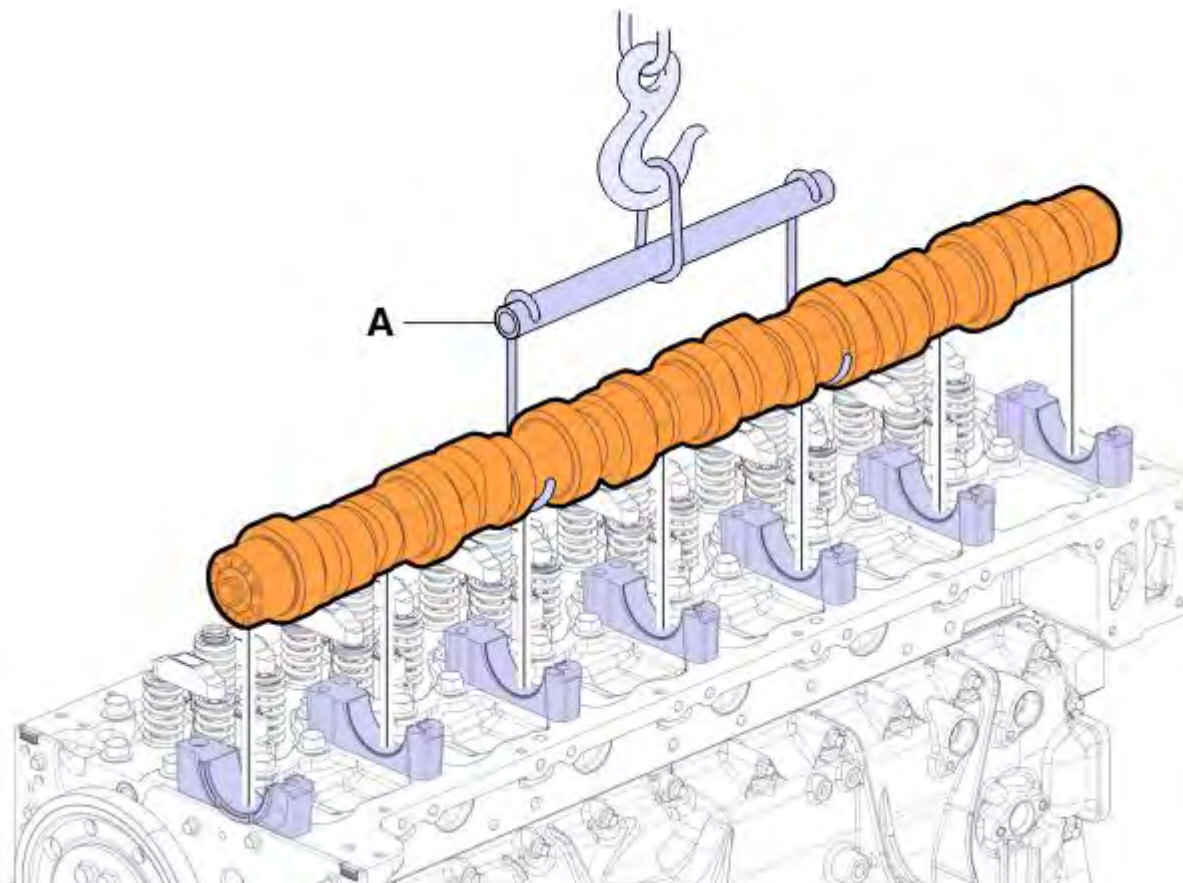
89	Lubricate all the bearing shells. Required material
----	--

Diesel Engine Oil



90	Install the camshaft.
----	-----------------------

91	Remove tool (A).
----	------------------



92 Install the caps.



Note

Check the markings.



Service hint

Carefully knock down the caps using a plastic mallet.

93 Install the sleeve (A) on bearing cap 7 to protect the guide sleeve.

Required material

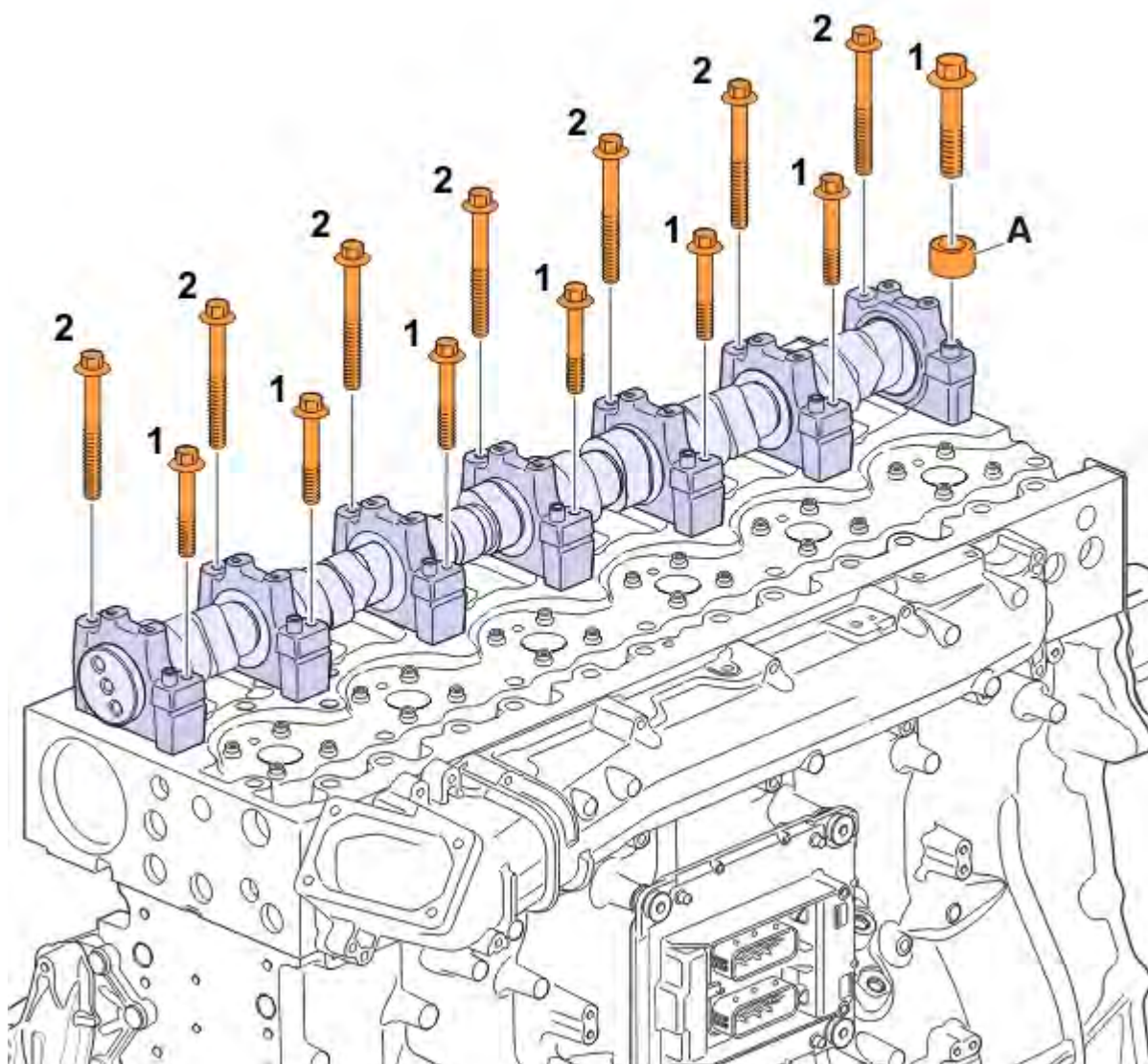
MANDREL

[9992669](#)

94 Install the temporary screws (1).

95 Install the permanent screws (2).

96 Tighten the screws.

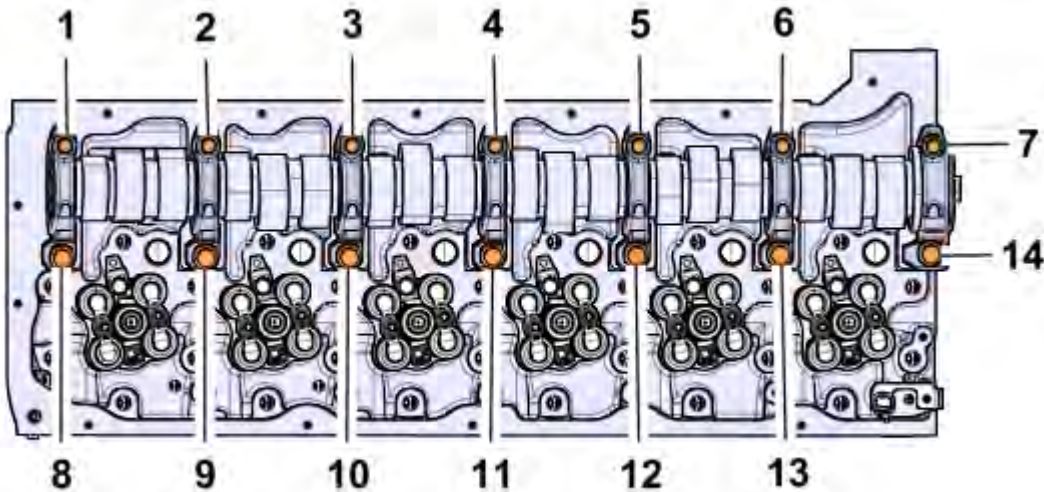


97 Torque tighten the screws.

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Tightening torque		
Camshaft bearing cap, screw	1.	Tightening sequence: 1–7
		25 ±3 Nm (18 ±2 lb _f ·ft)
	2.	Tightening sequence: 11,9,13
		90 ±5 Nm (66 ±4 lb _f ·ft)
	3.	Tightening sequence: 8,10,12,14
		60 ±5 Nm (44 ±4 lb _f ·ft)
	4.	Loosening sequence: 11,9,13
		0 Nm (0 lb _f ·ft)
	5.	Tightening sequence: 11,9,13
		60 ±5 Nm (44 ±4 lb _f ·ft)
	6.	Tightening sequence: 1–7
		90 ±5°
	7.	Tightening sequence: 8–14
		100 ±5°

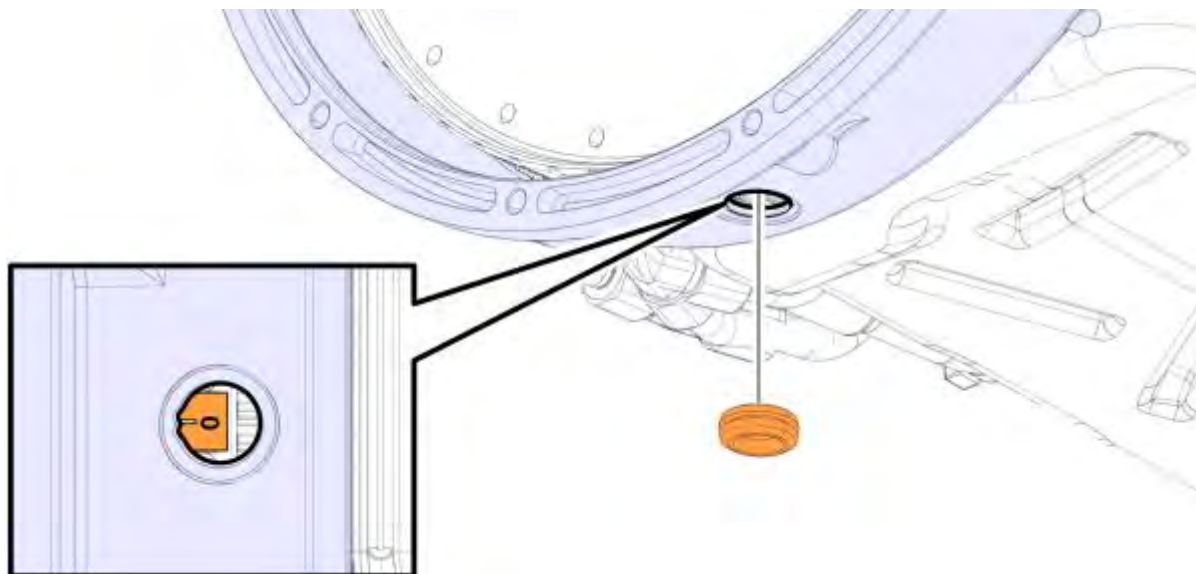


Note

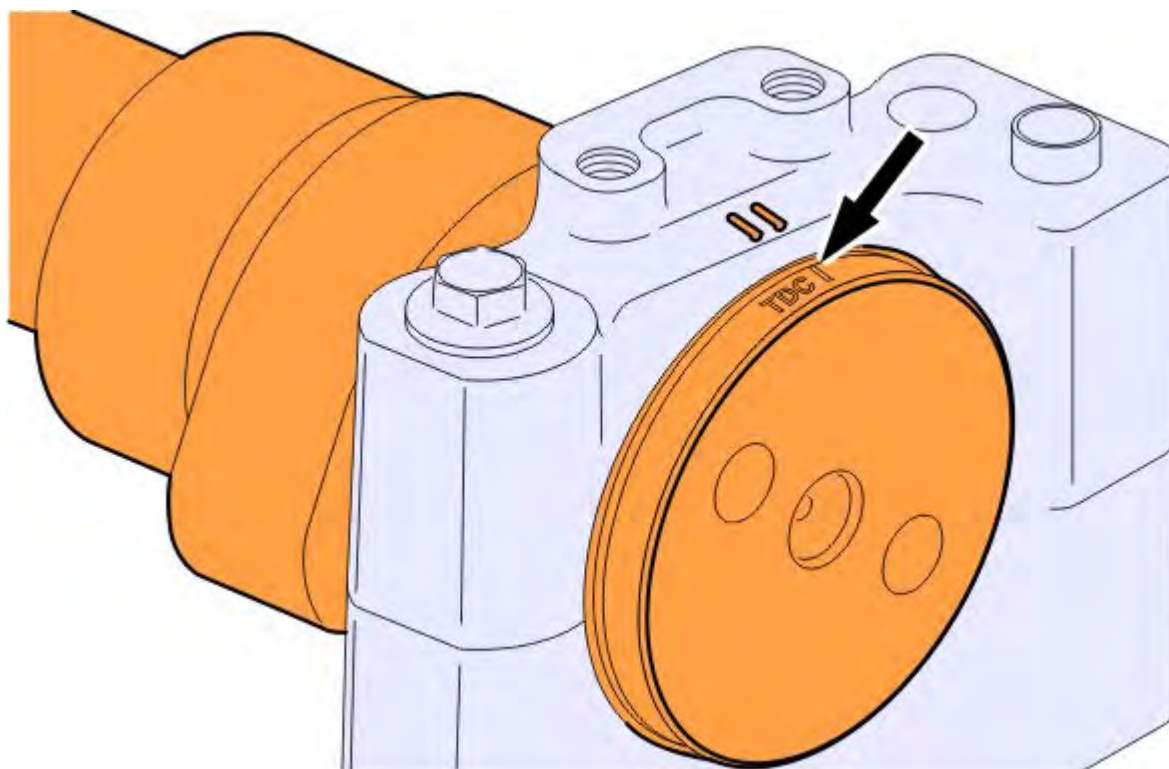
Check that the camshaft rotates easily after torque tightening each bearing cap.

98 Remove the temporary screws and sleeves.

99 Ensure that the marking (0) is in the correct position.



100 Turn the camshaft until the (TDC) mark aligns with the cap mark.



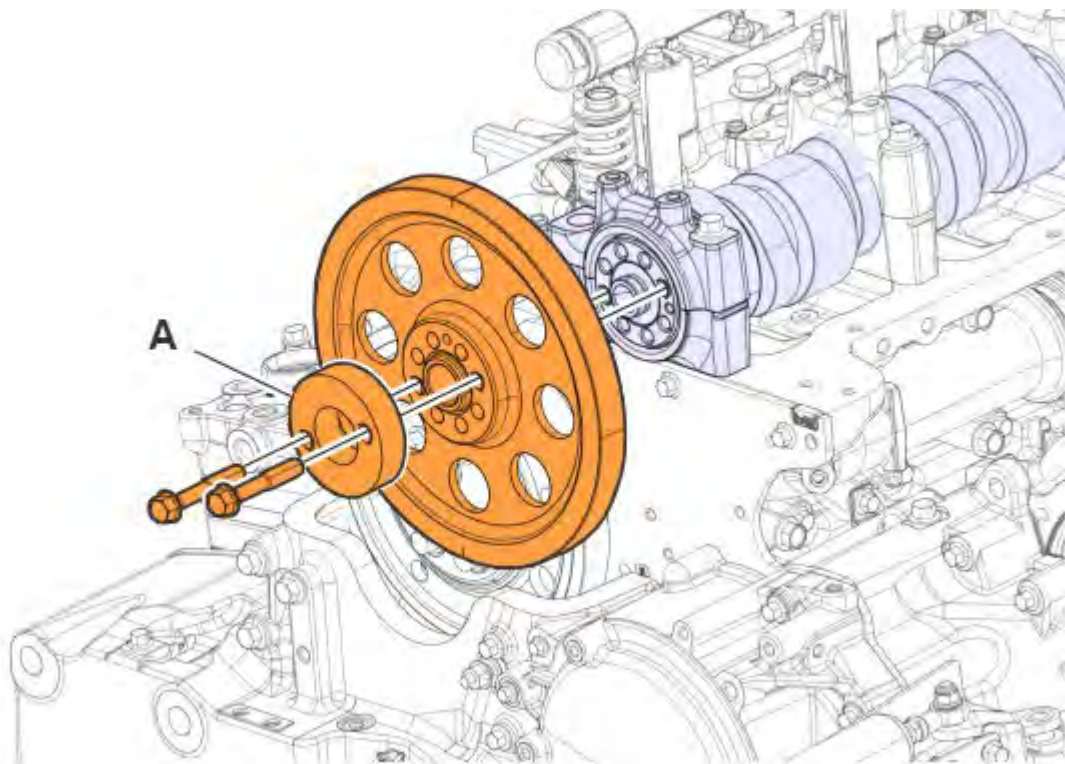
101 Install the camshaft gear.

102 Install the tool (A).

Required material

KIT [J-44514B](#)

103 Install the screws.



104

Measure the backlash between gears (1) and (2) using the tools.

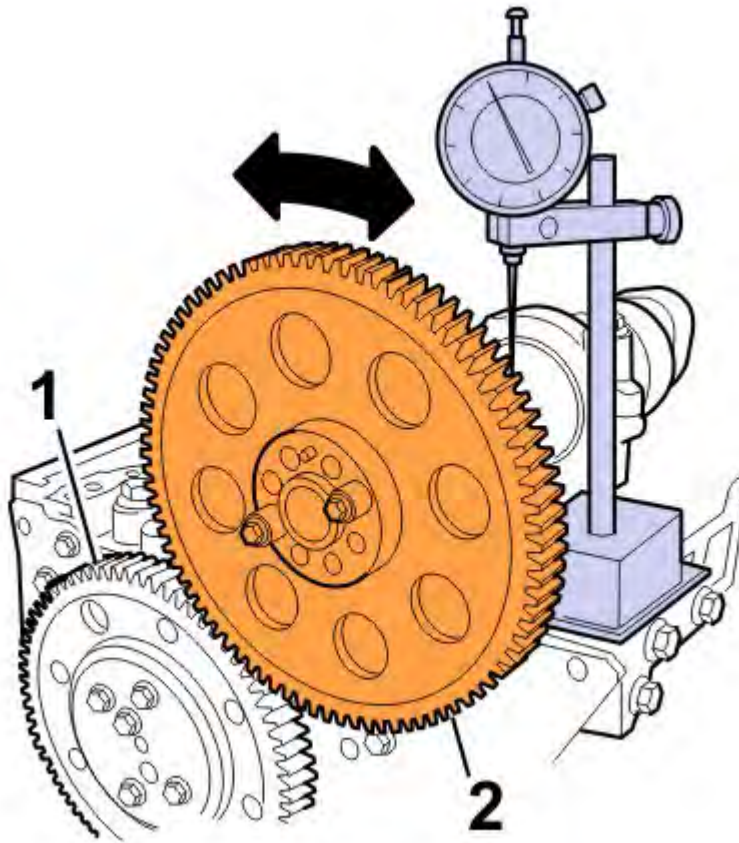
Tech data	
Backlash clearance	0.1 ±0.05 mm (0.004 ±0.002 in)
Required material	
ROCKER INDICATOR	9999683
MAGNETIC STAND	9999696
KIT	J-44514B



Note
Hold the idler gear (1) in place using a suitable tool to correctly check the backlash.

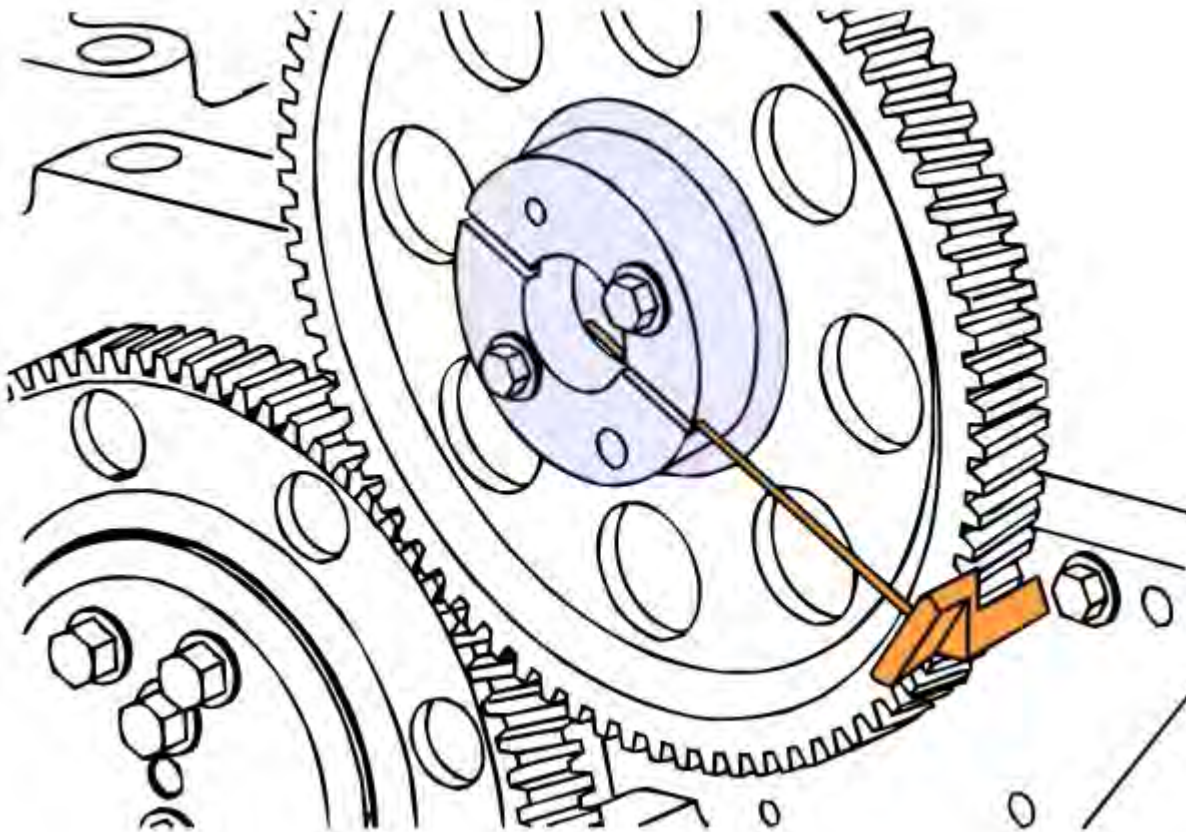


Note
If backlash is out of specification, adjust idler gear (1).



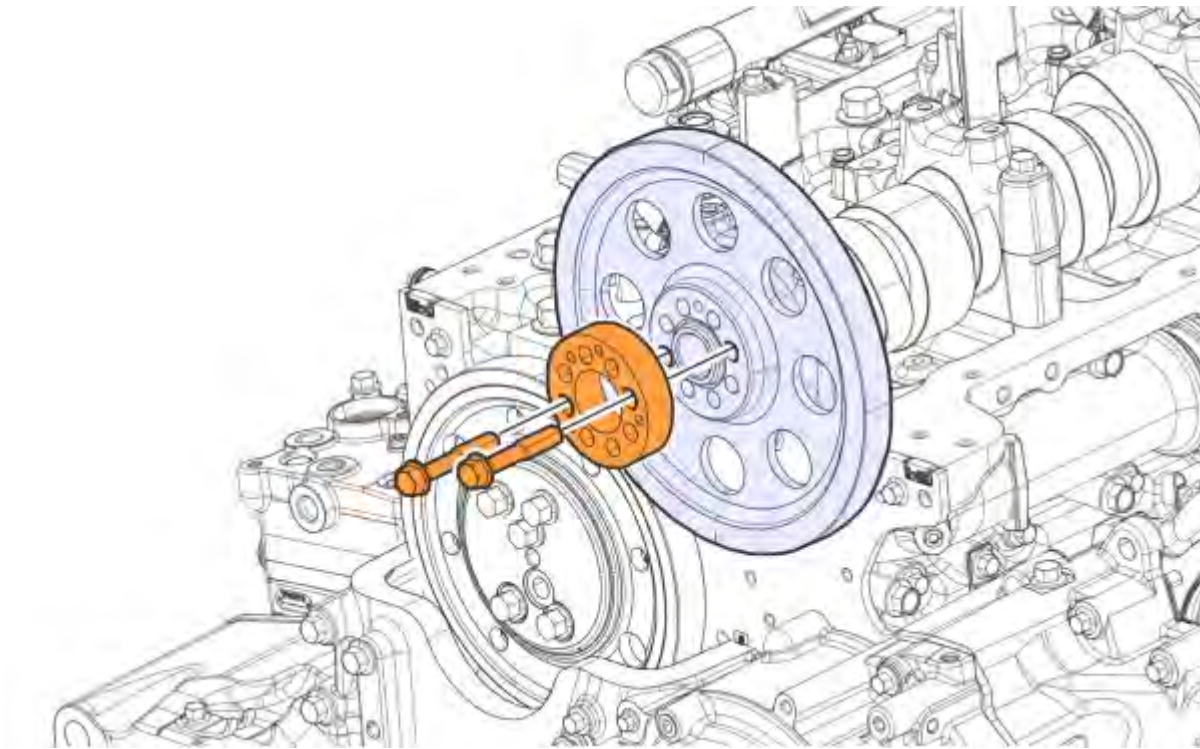
105	Check the timing mark.
-----	------------------------

106	Remove the tools.
-----	-------------------



107	Remove the screws.
-----	--------------------

108	Remove the tool.
-----	------------------



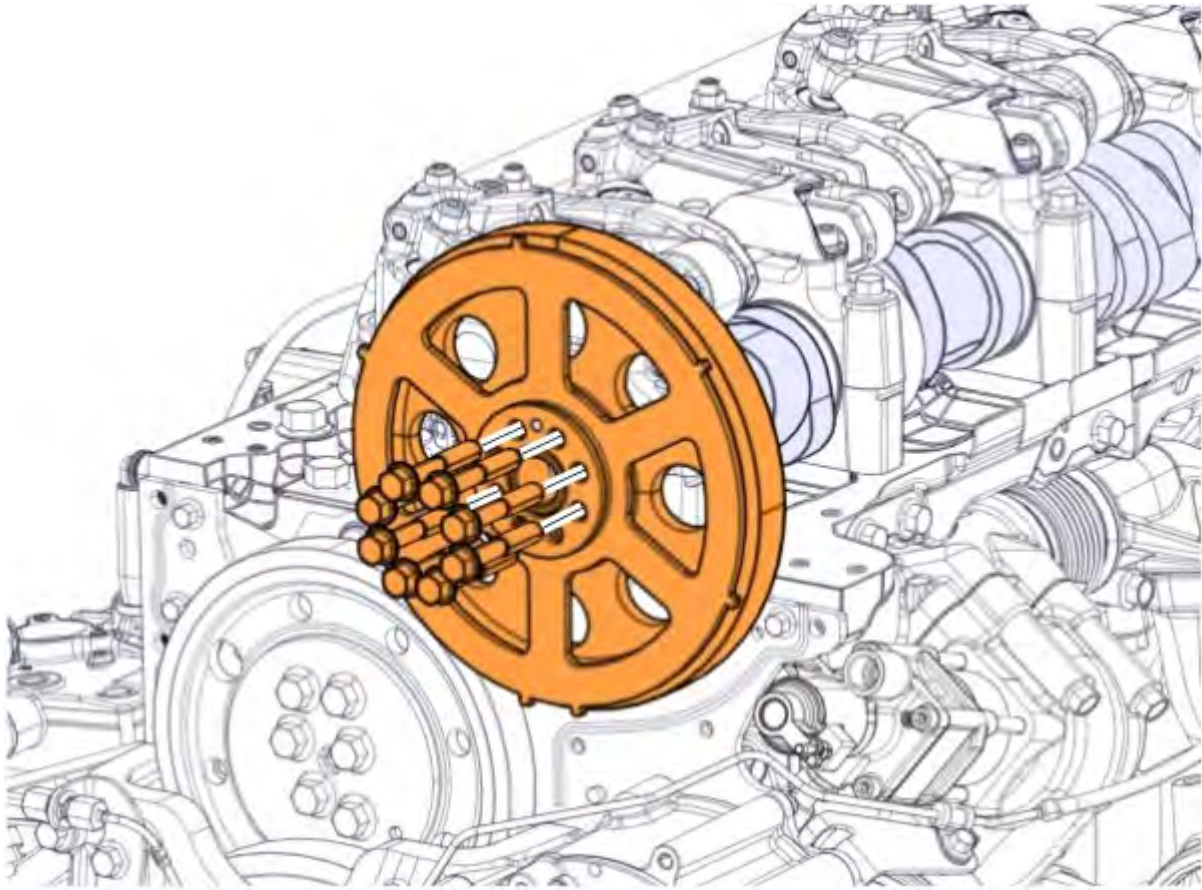
109	Install the gear and sensor wheel.
-----	------------------------------------

110	Install the screws.
-----	---------------------

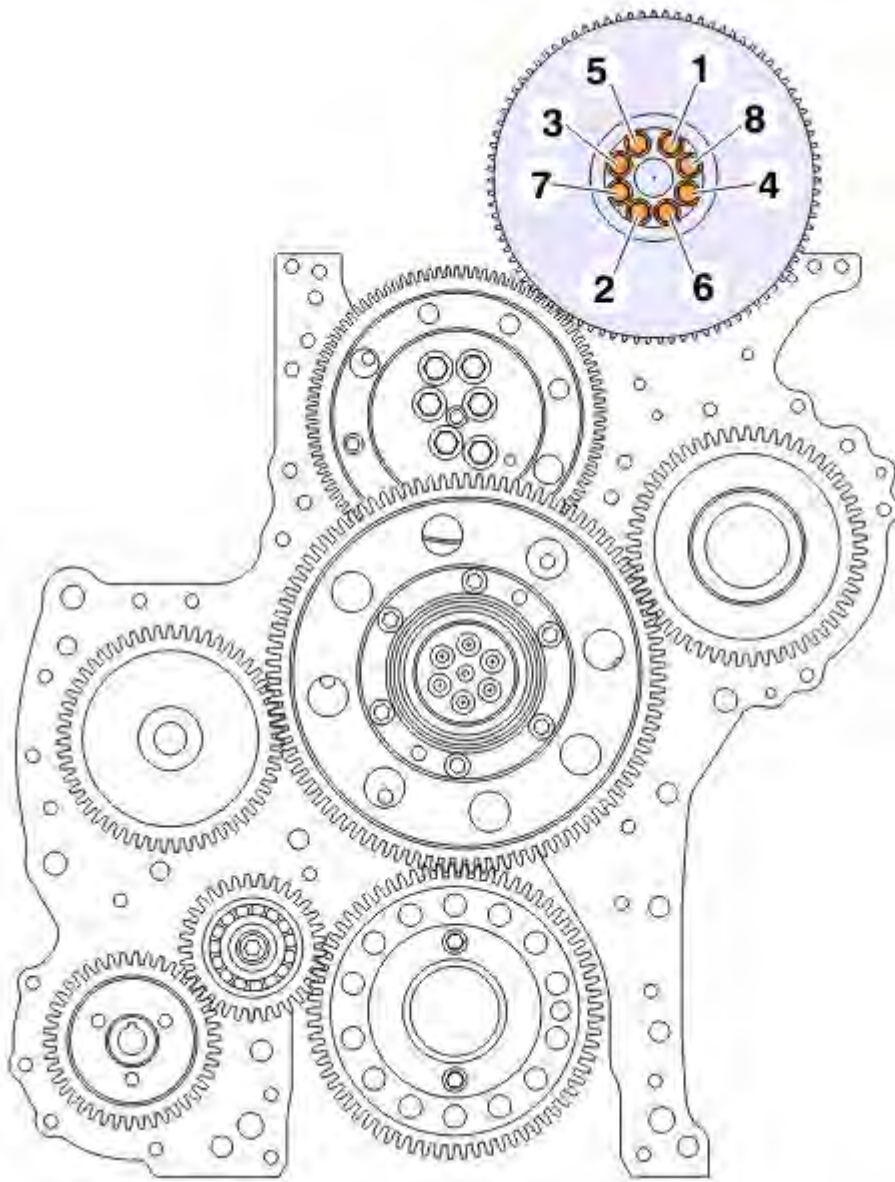
**Note**

Use new screws.

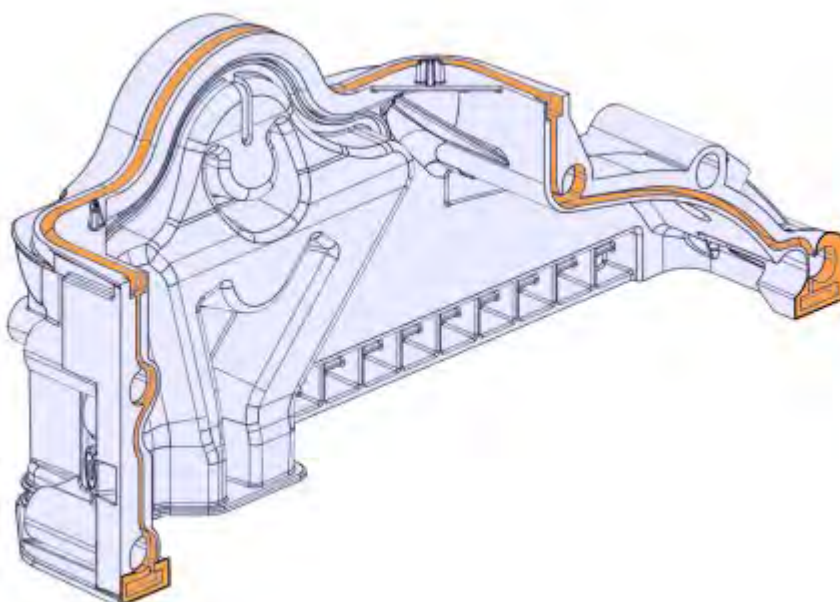
111	Torque tighten the screws.
-----	----------------------------



Tightening torque		
Gear, screw	1.	Tightening sequence: 1–8
		45 ±5 Nm (33 ±4 lb _f ·ft)
	2.	Tightening sequence: 1–8
		90 ±5°



112	Clean the contact surfaces.
-----	-----------------------------

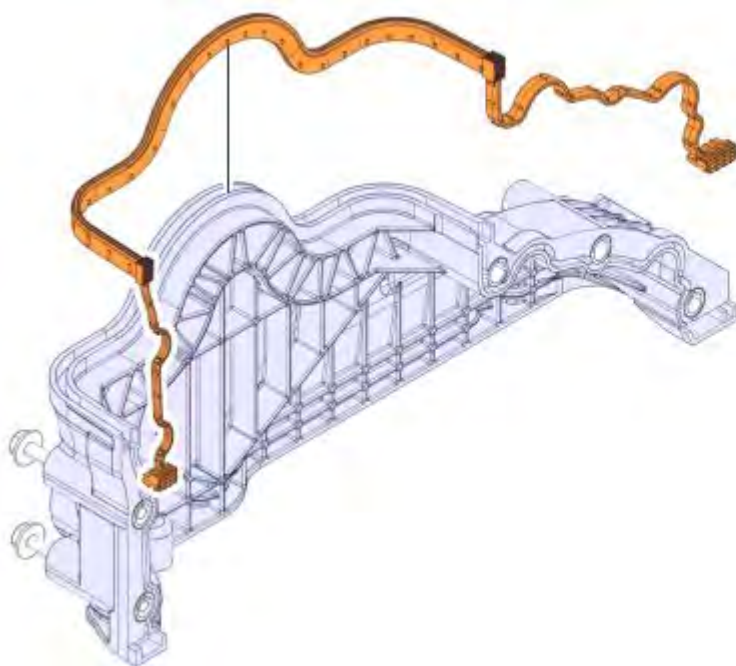


113 Install the gasket.



Note

Use a new part.

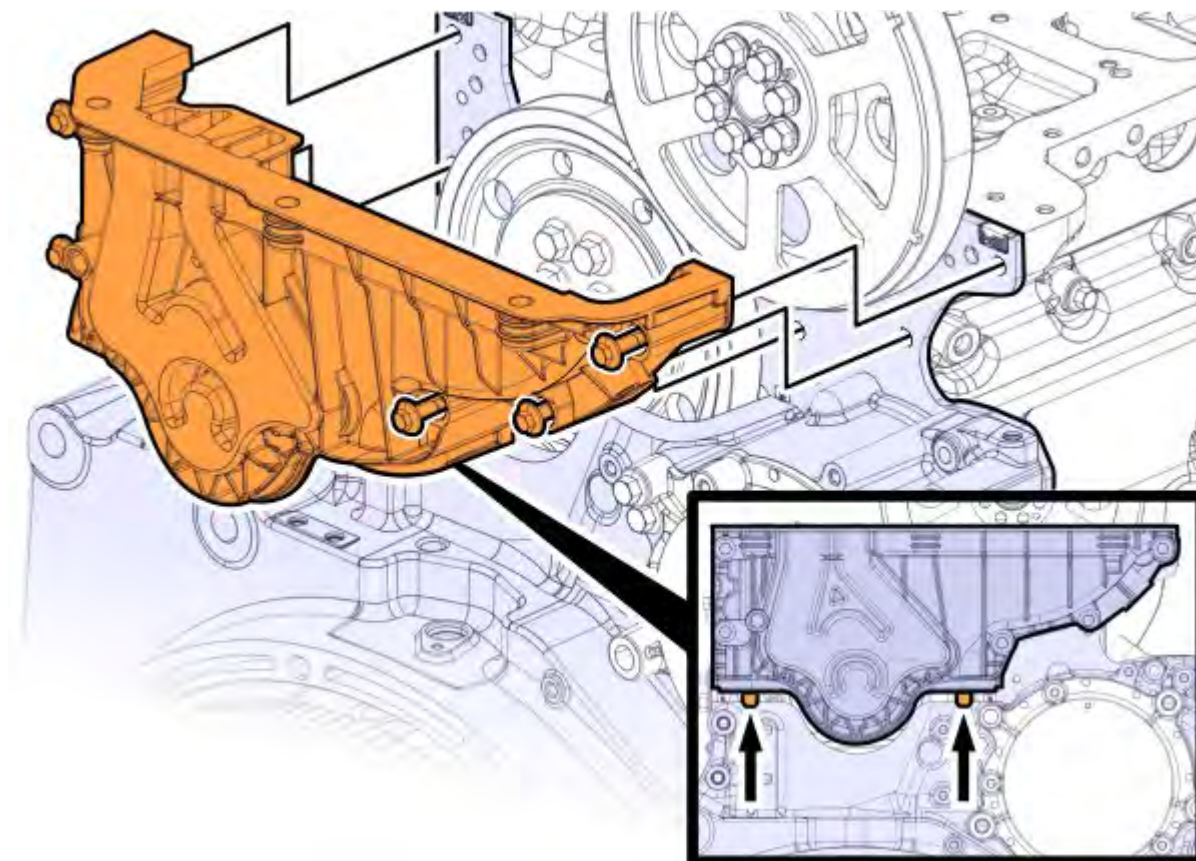


114 Install the timing gear cover.



Note

The dowels on the timing gear cover act as guides to avoid damaging the sealing strip during installation.

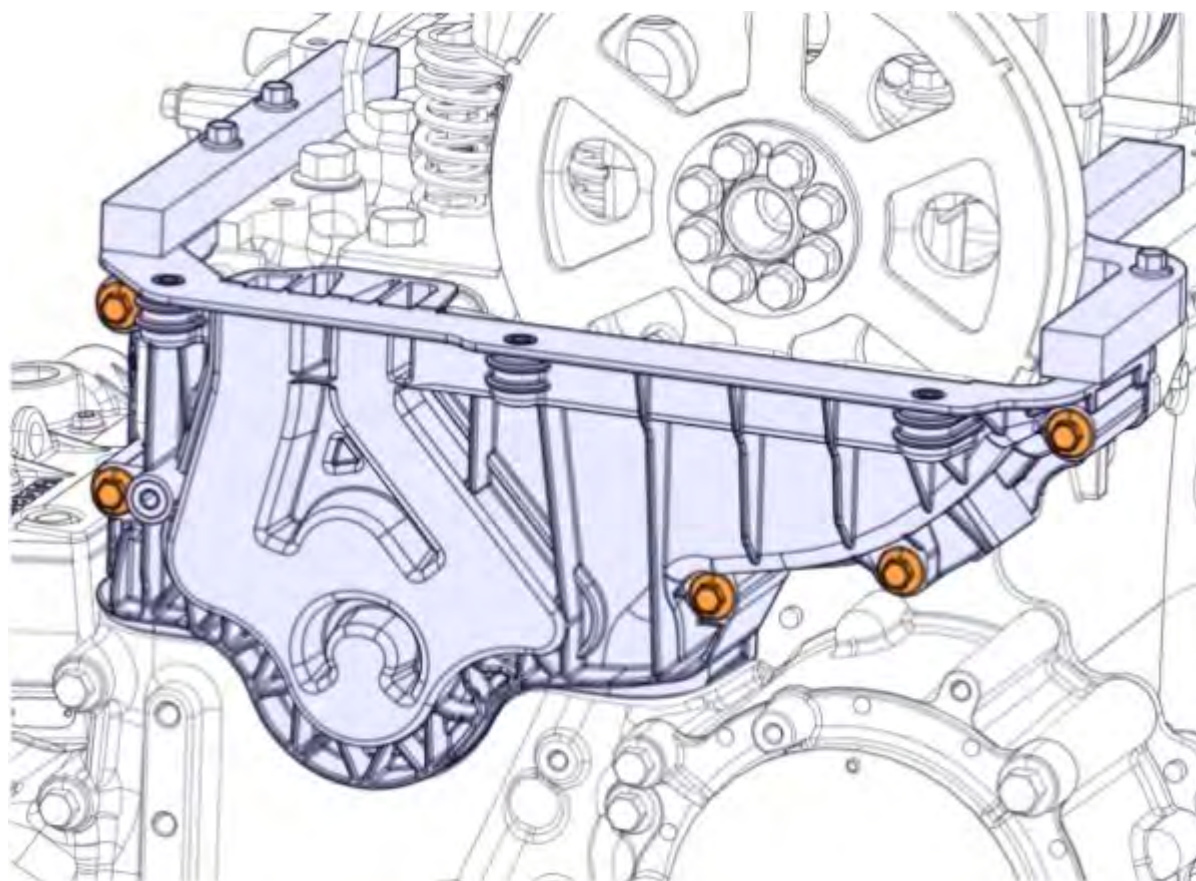


115 Lightly tighten the two timing gear cover screws.

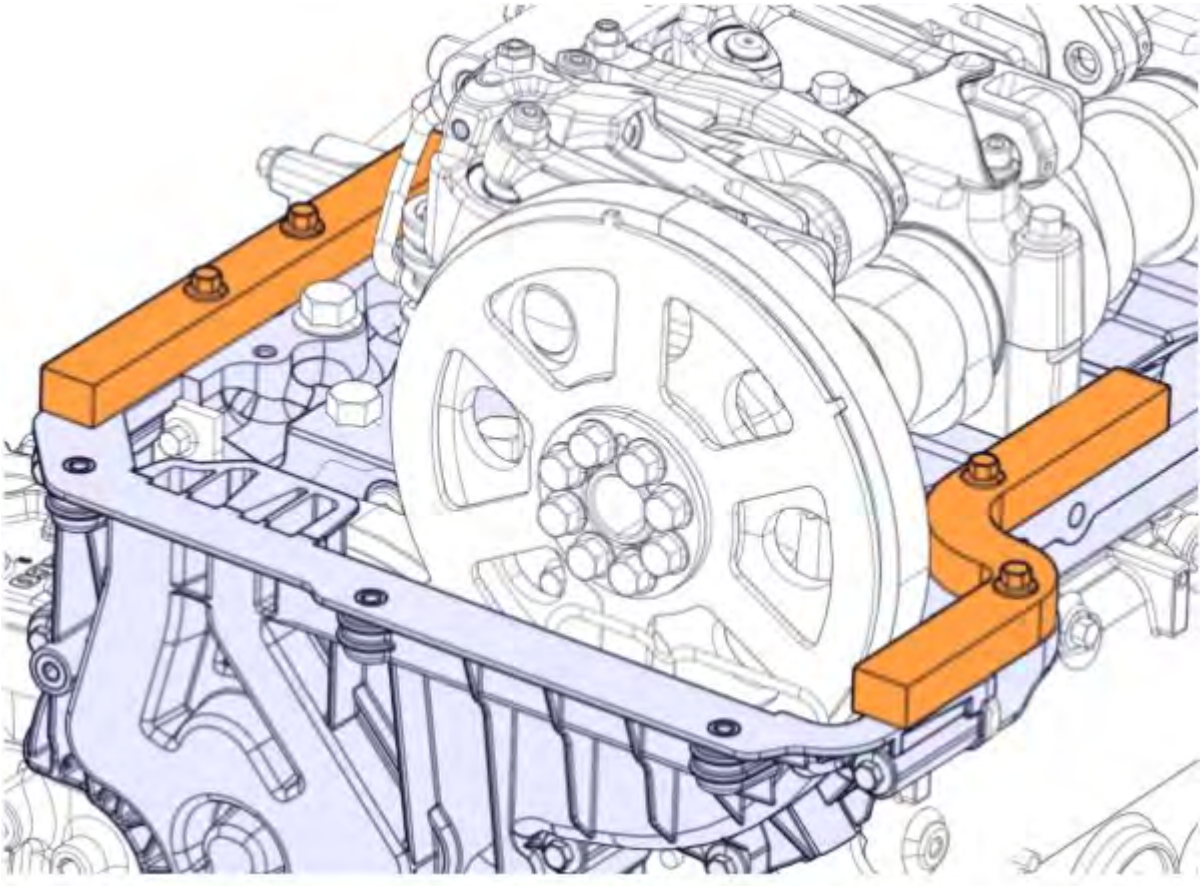


Note

Ensure that the timing gear cover is in contact with the timing gear plate.

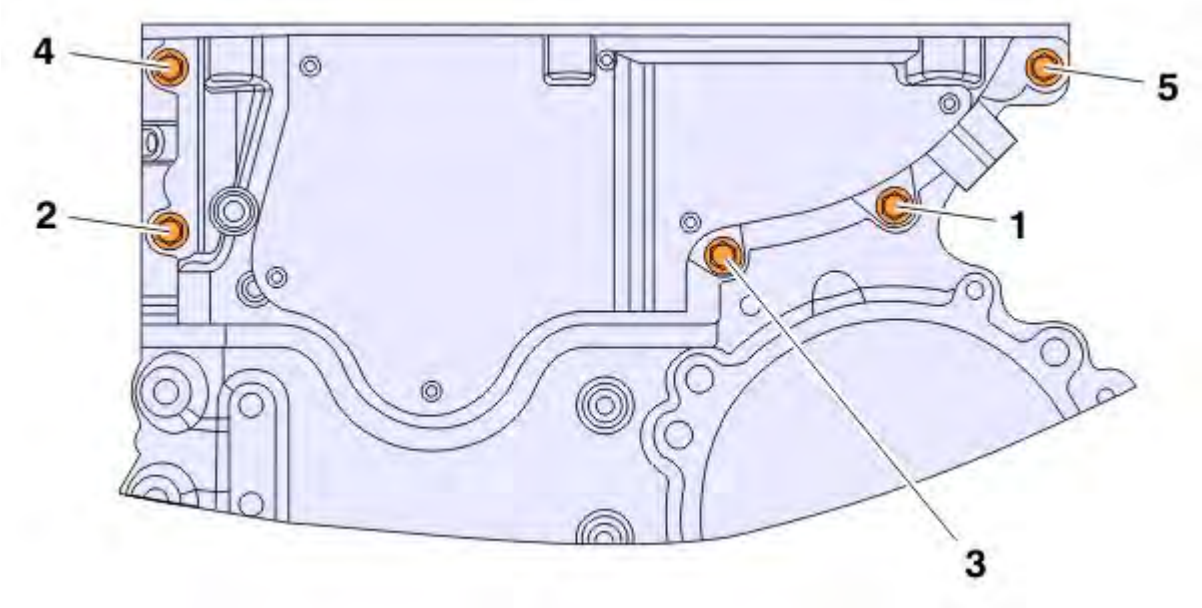


116	Connect the connector.		
117	Install the tools.		
	Required material		
	ASSEMBLY TOOL	85109051	2 pcs
118	Press down the timing gear cover with the required force.		
	Tightening torque		
	Tool, adjusting screw		27 ±3 Nm (20 ±2 lb _f ·ft)
	i Note Ensure that the timing gear cover aligns with the cylinder head on both sides.		

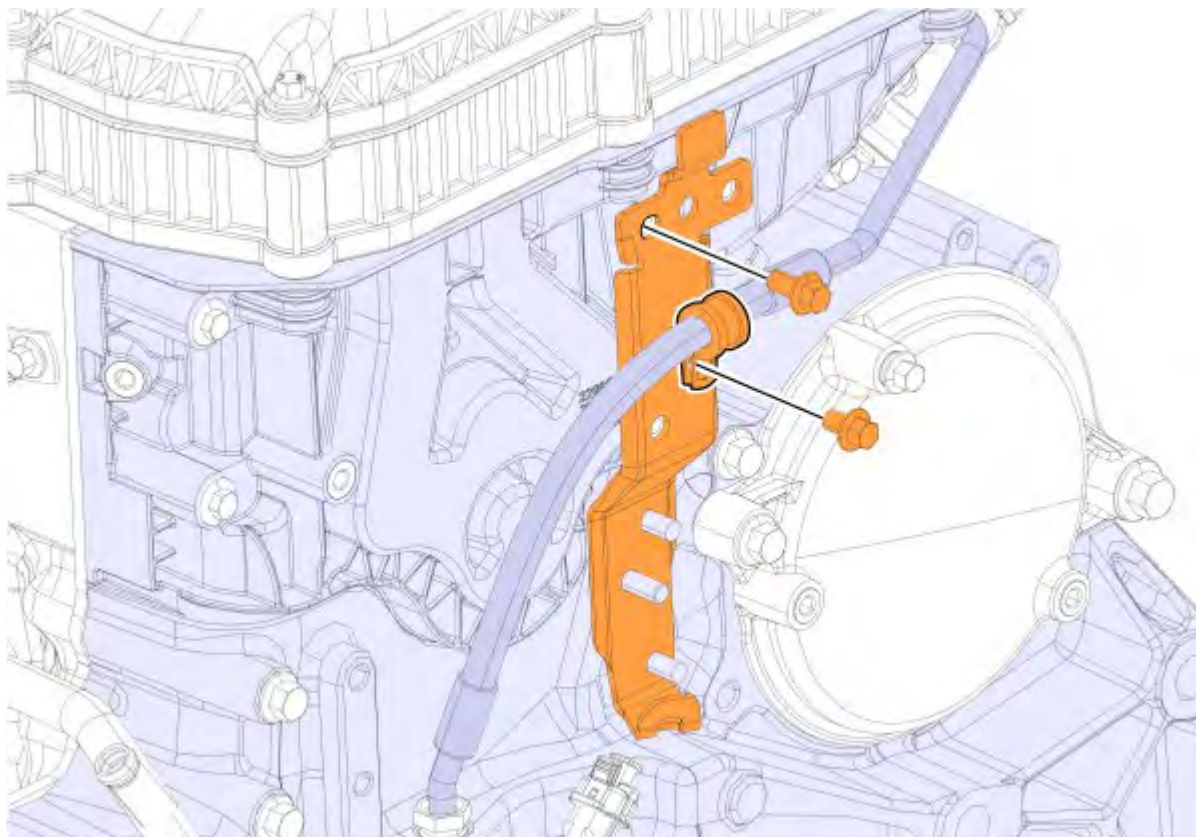


119	Torque tighten the screws.		
	Tightening torque		
	Upper timing gear casing, screw	1.	Tightening sequence: 1–2
			4 ±1 Nm (3 ±1 lb _f ·ft)

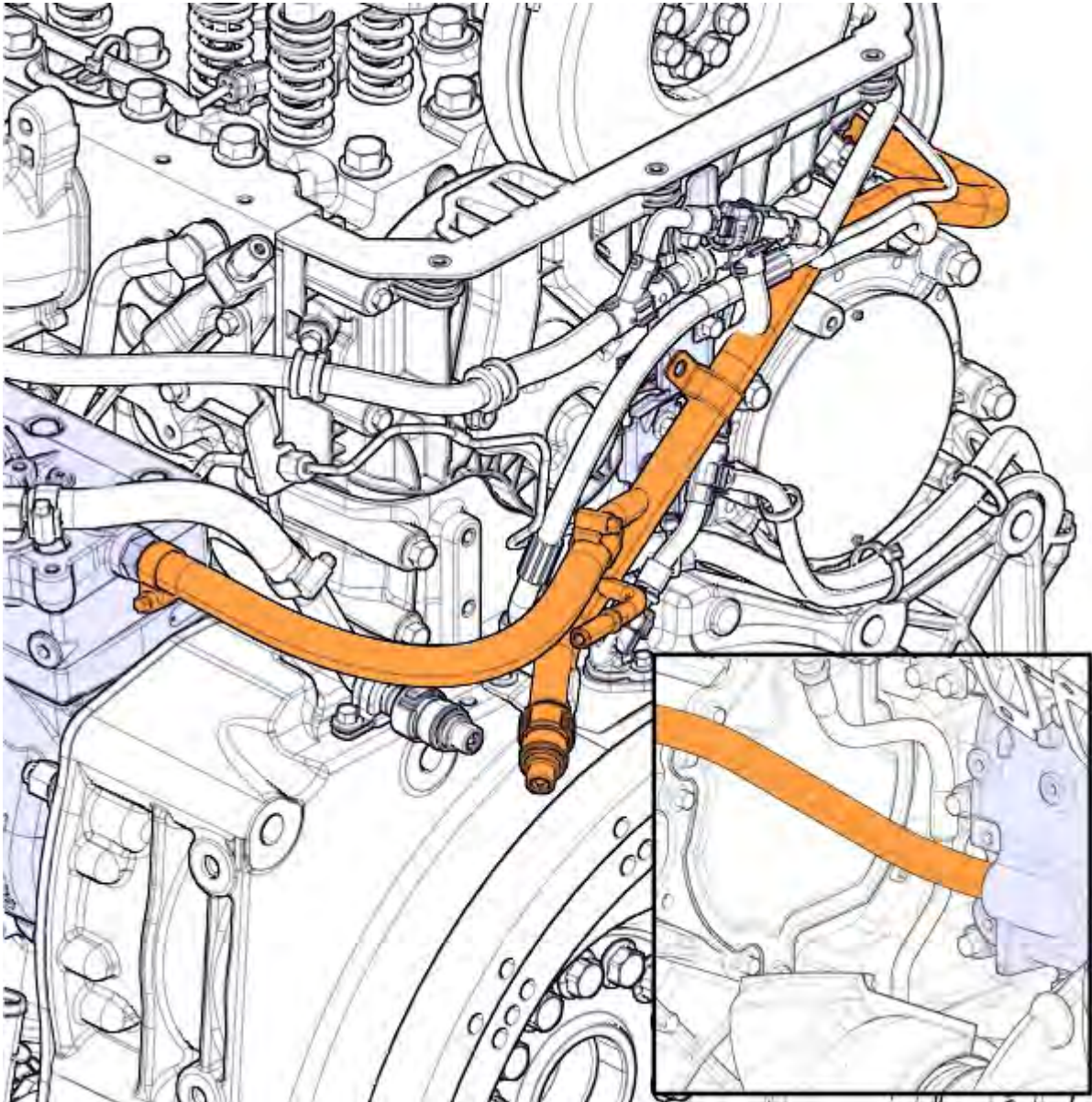
		2.	Tightening sequence: 1–5
			27 ±3 Nm
			(20 ±2 lb _f ·ft)



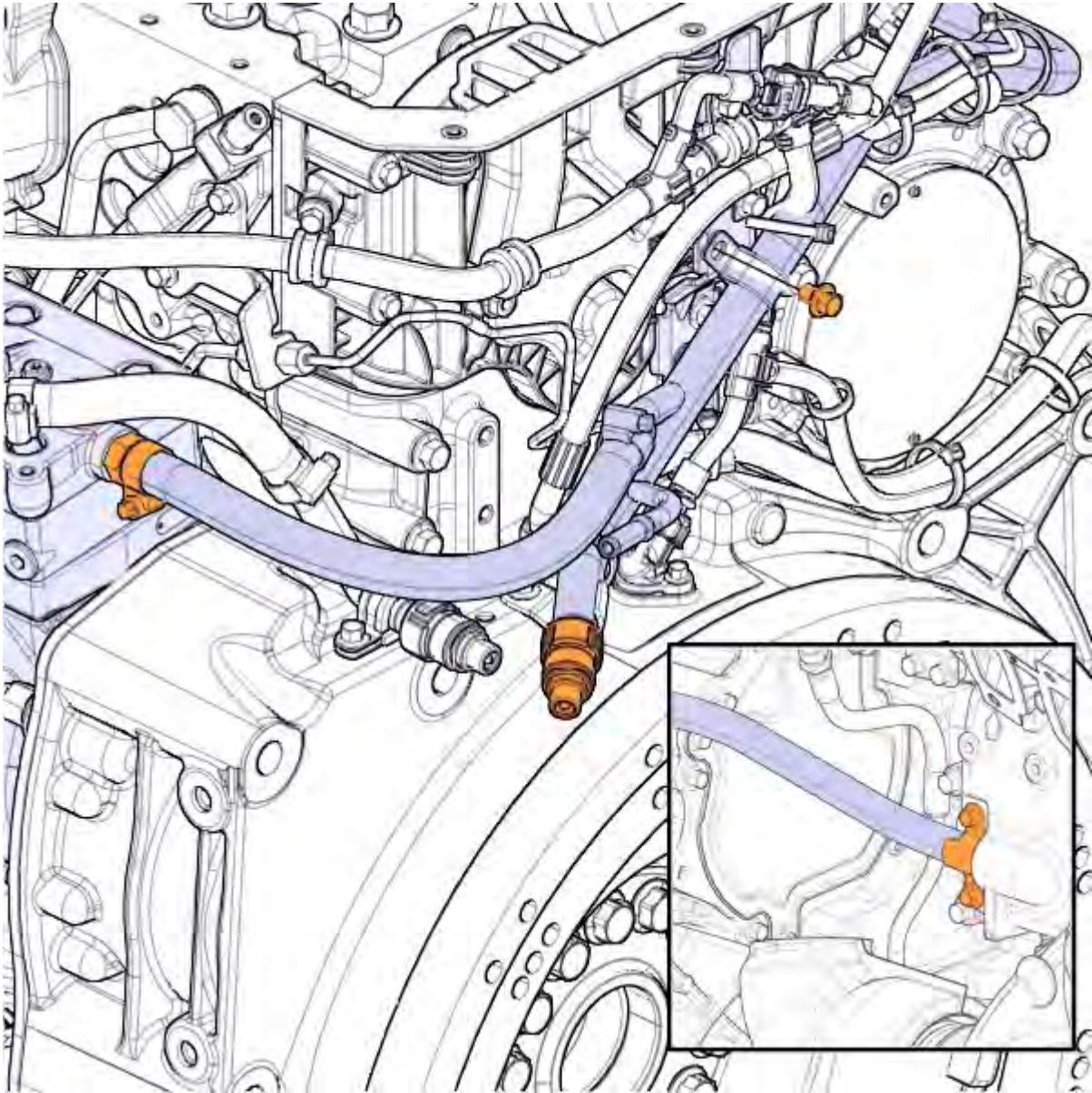
120	Remove the tools.	
121	Install the bracket.	
122	Install the clamp.	
123	Install the screws.	
124	Torque tighten the screws.	
	Tightening torque	
	Screw	M8
		24 ±4 Nm
		(18 ±3 lb _f ·ft)



125	Install the pipes.
------------	--------------------

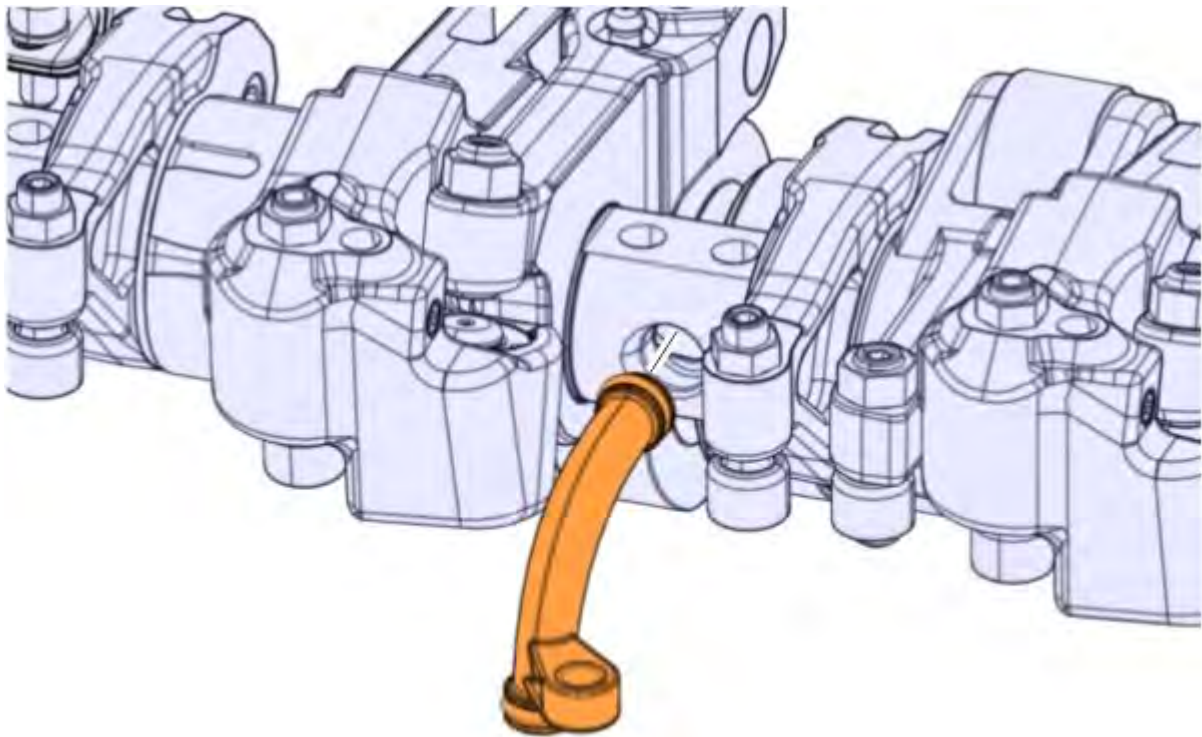


126	Install the clamps.	
127	Install the screws.	
	Tightening torque	
	Screw	M8
		24 ±4 Nm
		(18 ±3 lb _f ·ft)

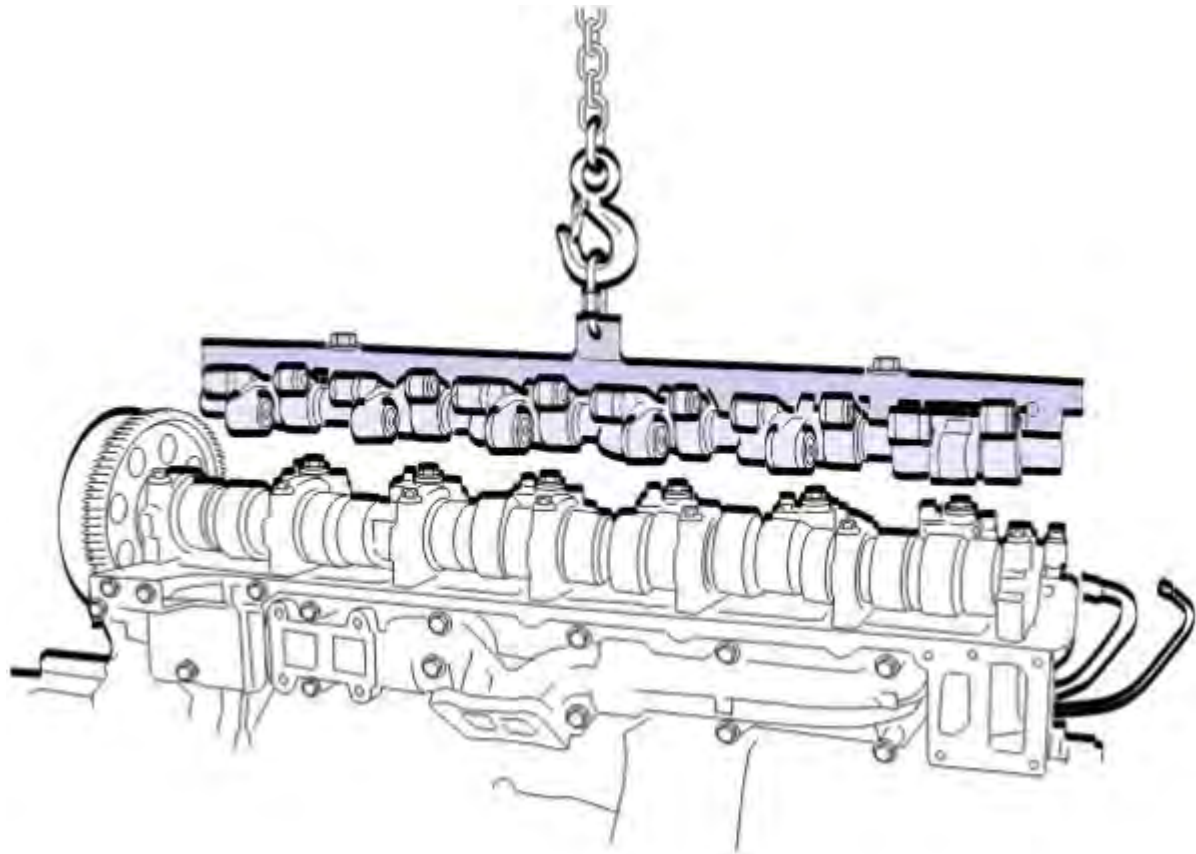


128	Lubricate the seals.	
	Required material	
	Diesel Engine Oil	
	i Note	Use new parts.

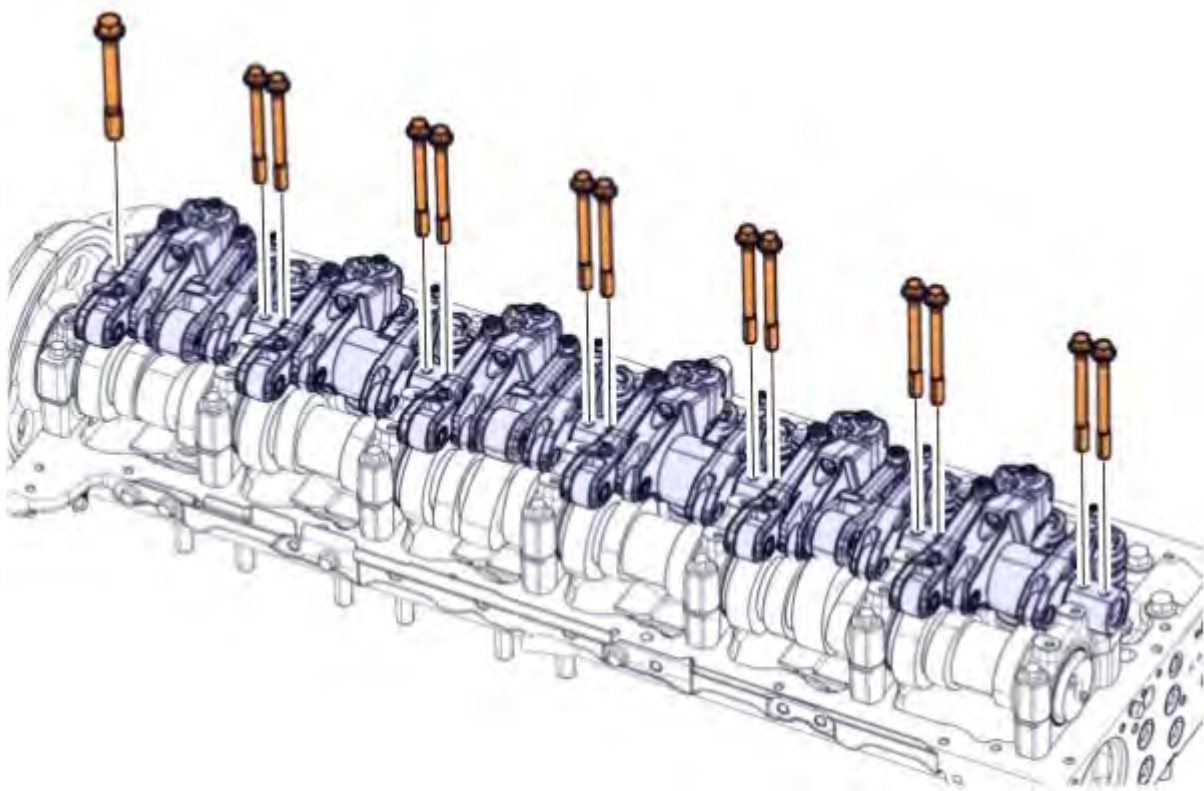
129	Install the pipe.	
	i Note	Use a new part.



130	Install the lifting tool.	
	Required material	
	LIFTING TOOL	85109250
131	Install the rocker arm shaft.	
	i Note Take care not to damage the oil pipe.	
132	Remove the cable ties.	
133	Remove the lifting tool.	

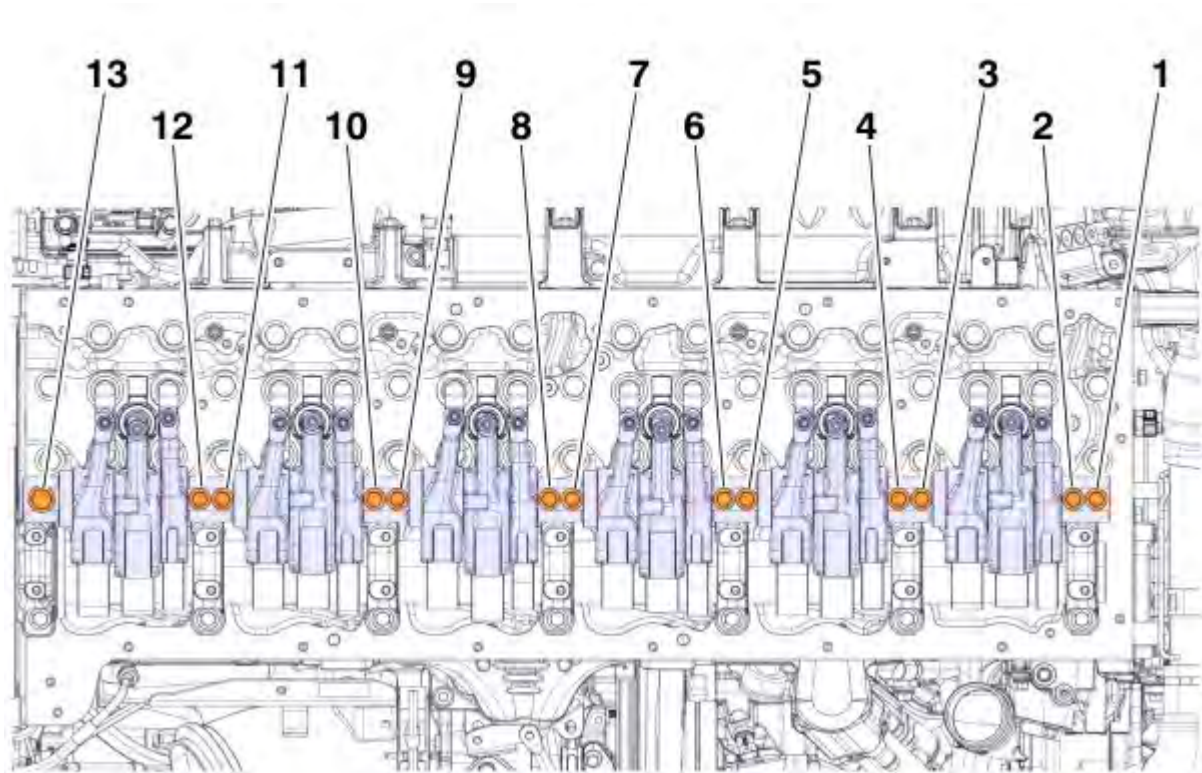


134	Install the screws.
	Note Note any marks on the screw heads.
	Note Each mark on the screw head indicates the amount of times the screw has been torqued. The screws may be torqued for maximum of three times.



135	Torque tighten the screws.
-----	----------------------------

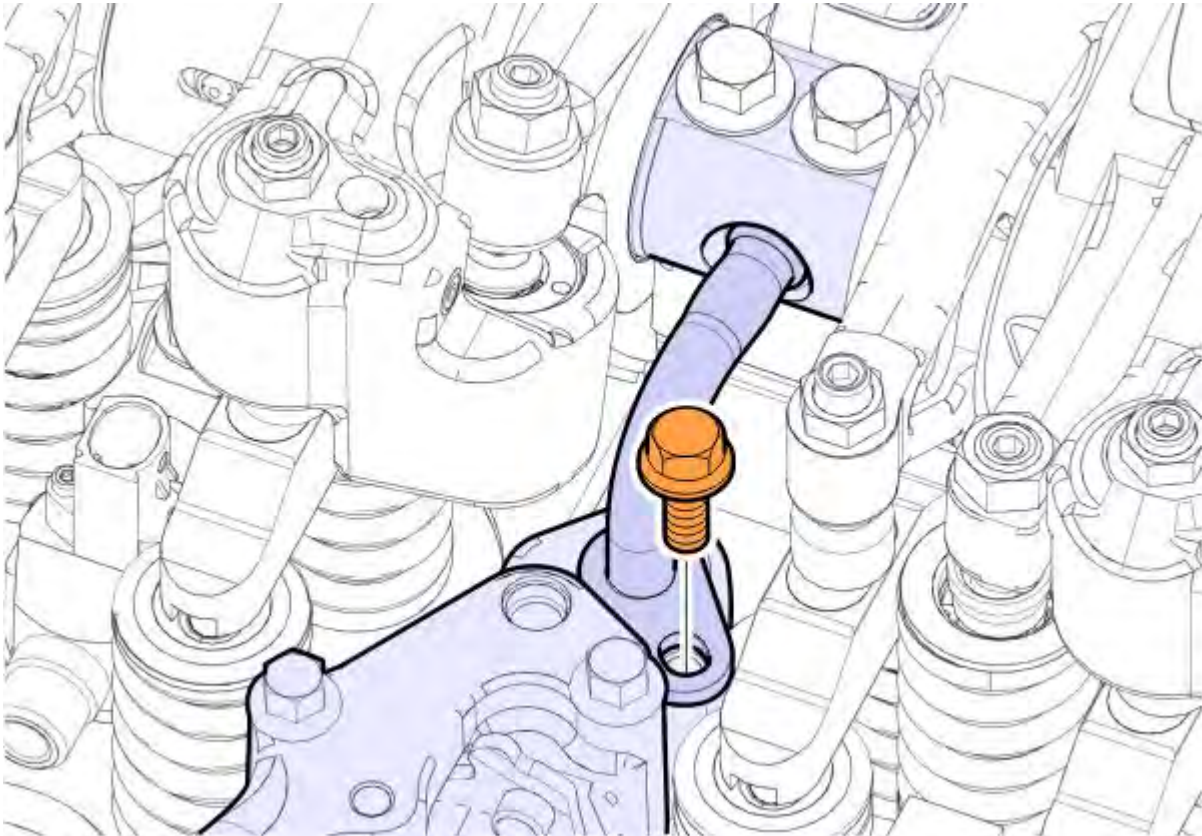
Tightening torque			
Rocker arm shaft, screw	1.	Tightening sequence: 8-6-10-4-12-2-13	
		60 ±5 Nm (44 ±4 lb _f -ft)	
	2.	Tightening sequence: 1-3-5-7-9-11	
		40 ±3 Nm (30 ±2 lb _f -ft)	
	3.	Tightening sequence: 1-3-5-7-9-11	
		120 ±5°	
	4.	Loosen the screws: 2-4-6-8-10-12	
		6 pcs	
	5.	Tightening sequence: 2-4-6-8-10-12	
		40 ±3 Nm (30 ±2 lb _f -ft)	
	6.	Tightening sequence: 2-4-6-8-10-12-13	
		120 ±5°	



136	Mark the screws.
-----	------------------

137	Install the screw.
-----	--------------------

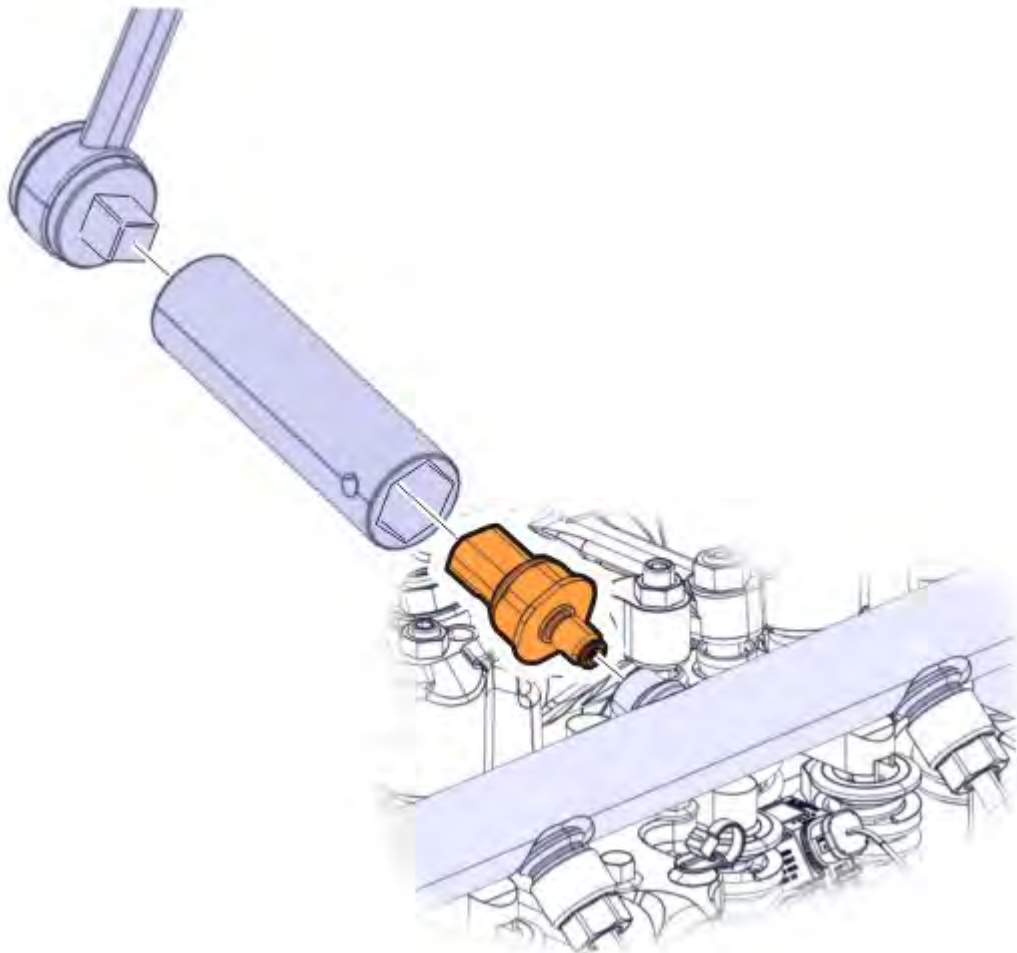
138	Torque tighten the screw.	
	Tightening torque	
	Oil pipe, screw	M8
		24 ±4 Nm
		(18 ±3 lb _f ·ft)



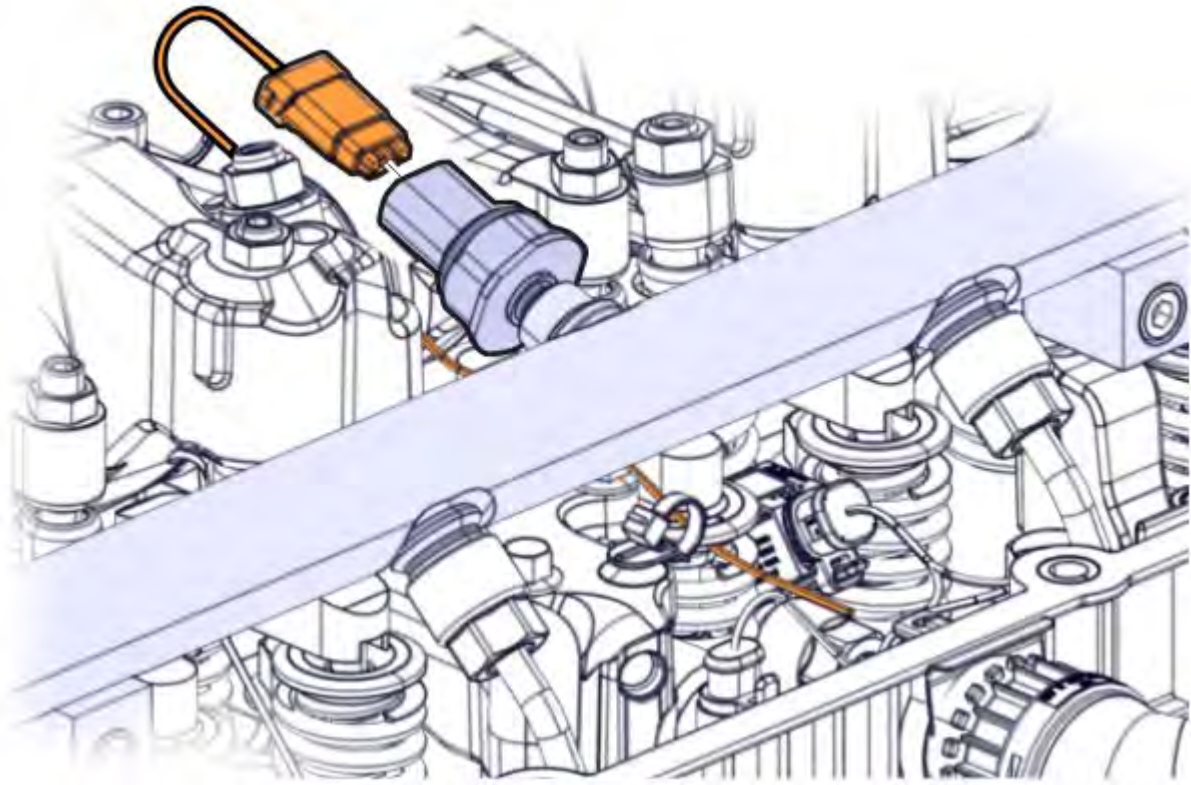
139	Remove the protecting cover and plug.
-----	---------------------------------------

140	Install the sensor.		
<table border="1"><tr><td></td><td>Note No sealant or thread locker should be used.</td></tr></table>		Note No sealant or thread locker should be used.	
	Note No sealant or thread locker should be used.		

141	Torque tighten the sensor.	
	Tightening torque	
	Pressure sensor, common rail	40 ±5 Nm (30 ±4 lb _f ·ft)



142	Perform this procedure when the condition below is met.	
	Conditions	
	•	If not previously installed
	►	Connect the connector.

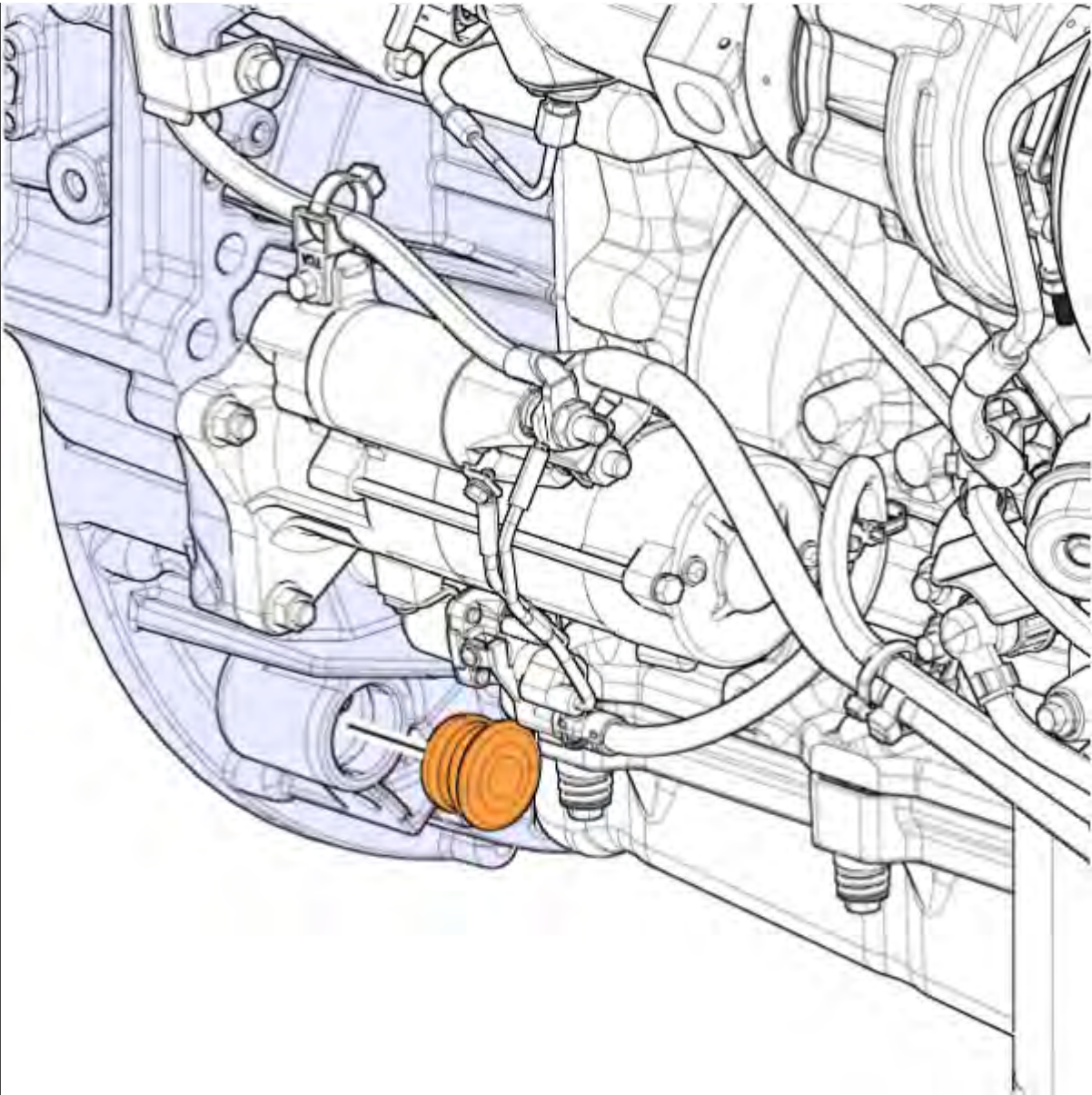


143 Perform this procedure when the condition below is met.

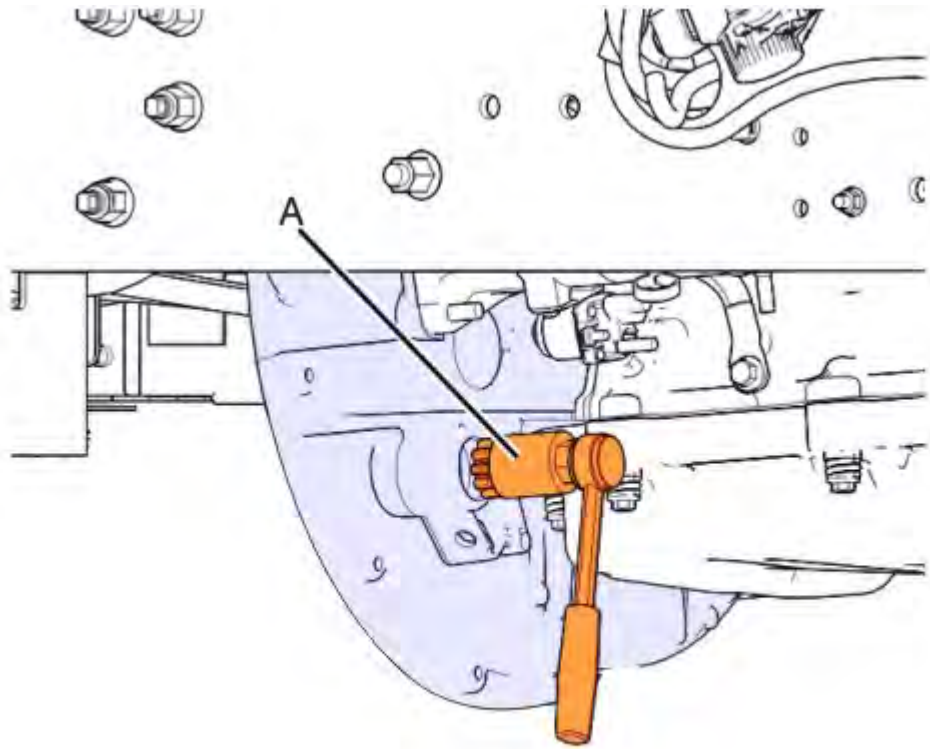
Conditions

- If not previously installed.

- ▶ Remove the plug.



► Install the cranking tool (A).	
Required material	
CRANKING TOOL	88840317



144 Note the camshaft marking.



Note
The marking can be for the adjustment of multiple cylinders.

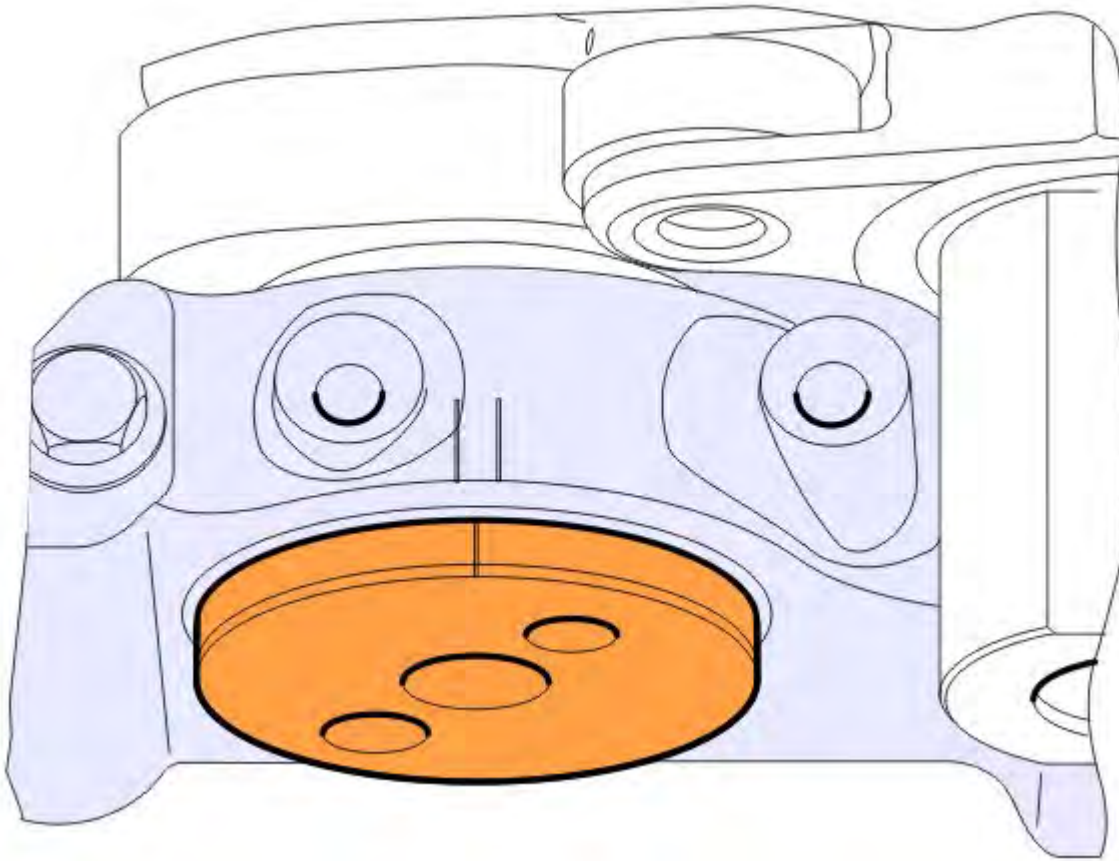


Note
When checking or adjusting, the mark must be centered between the lines on the camshaft cap.

145 Adjust the rocker arms according to the chart.

Camshaft marking

CAM POSITION	INLET	INJECTOR/PUMP	EXHAUST
3/PE2	Cylinder 3	Pump 2	Cylinder 2
6/PE4	Cylinder 6	Pump 4	Cylinder 4
2/E1	Cylinder 2	—	Cylinder 1
4/E5	Cylinder 4	—	Cylinder 5
1/E3	Cylinder 1	—	Cylinder 3

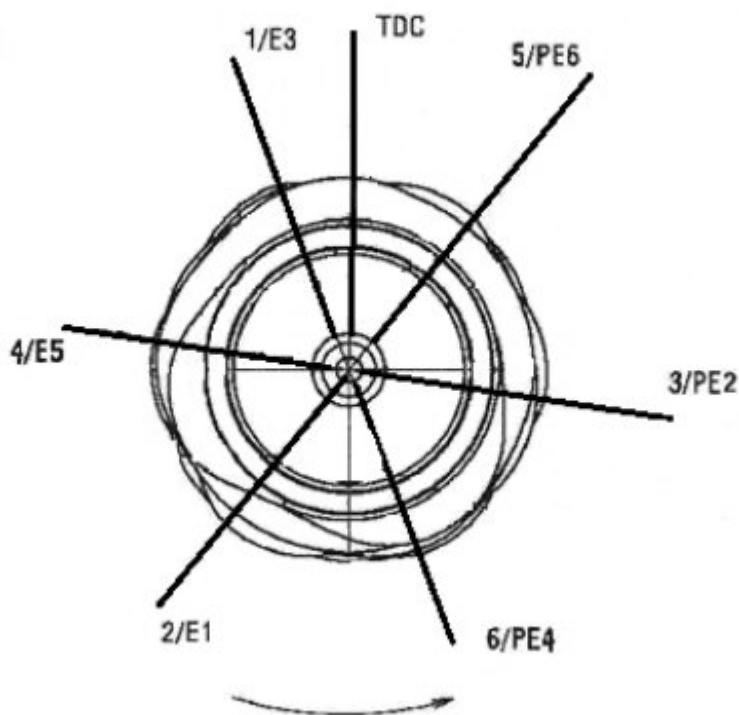


146 Rotate the crankshaft to the next timing mark on the camshaft.

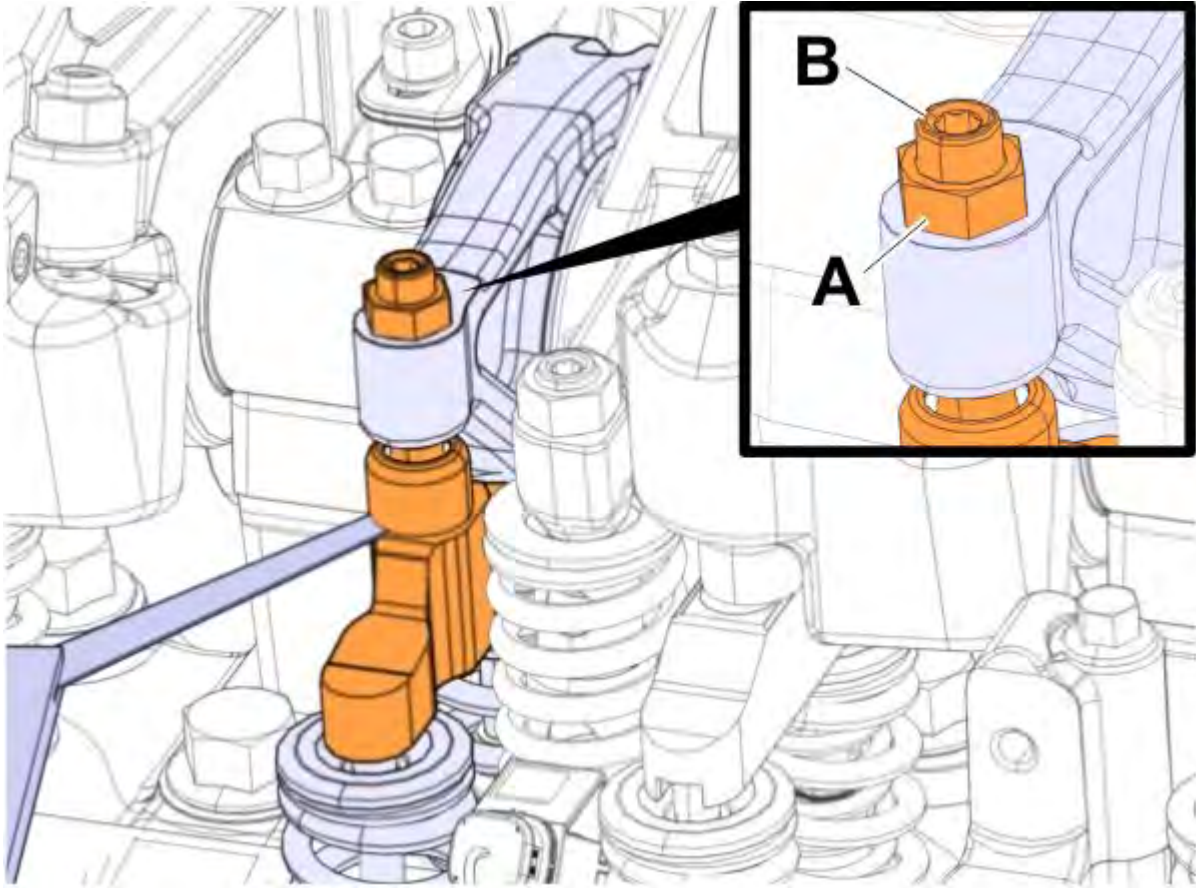


Note

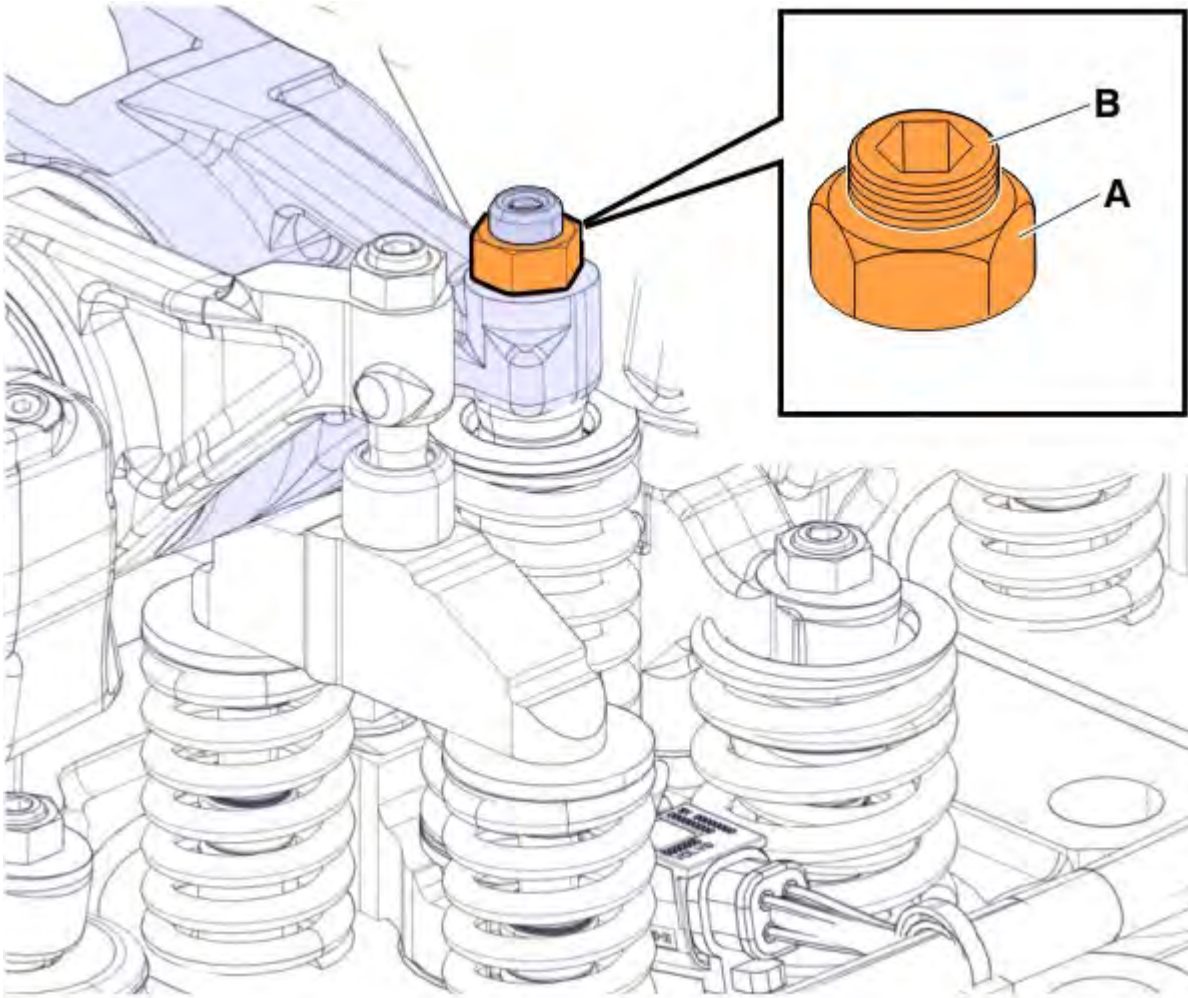
Rotate the crankshaft in the normal engine rotation direction.
Ask for assistance.



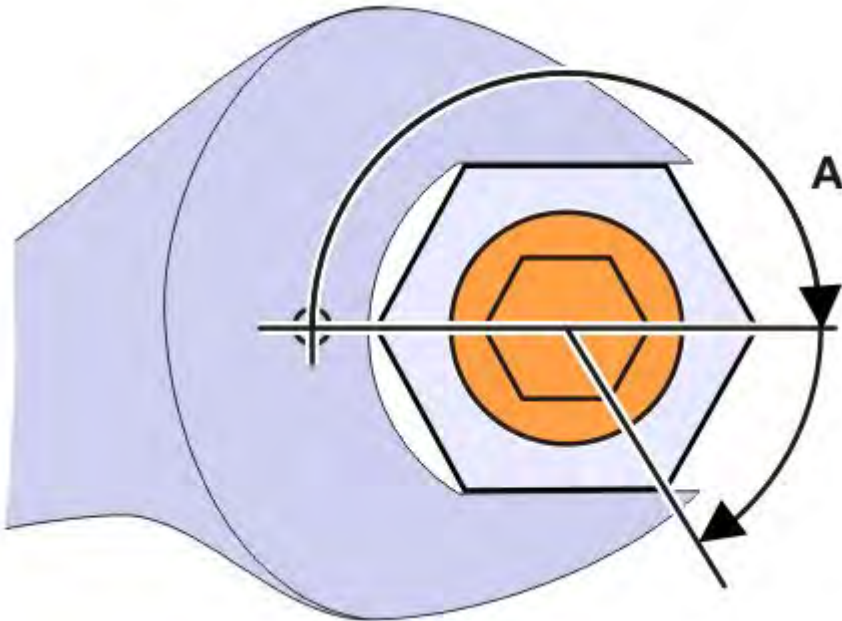
147	Check the inlet valve rocker arm clearance.	
	Tech data	
	Inlet valve, rocker arm, clearance	0.2 ±0.05 mm (0.008 ±0.002 in)



148	Perform this procedure when the condition below is met.	
	Conditions	
	•	If the valve clearance is not correct
	▶	Loosen the nut (A) .
	▶	Adjust the screw (B) until the feeler blade can be moved but there is some resistance.
	▶	Prevent the screw from turning (B) and tighten the nut (A) to torque.
	Tightening torque	
	Rocker arm, nut (intake)	38 ±4 Nm (28 ±3 lb _f -ft)
149	Loosen the nut (A) .	
150	Adjust the screw (B) until there is no clearance between the adjustment screw and the injector ball socket.	

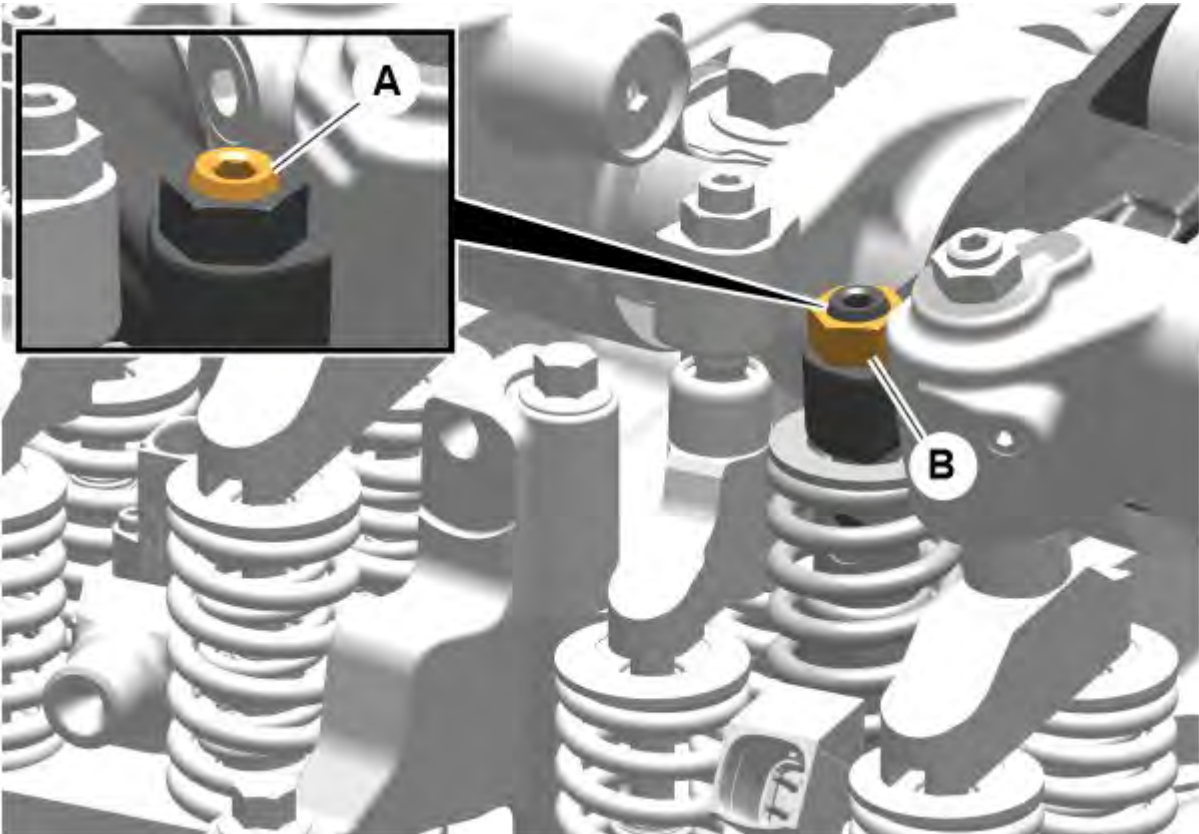


151	Angle tighten the screw (B).	
	Tech data	
	Injector, adjusting screw	240 ±20°



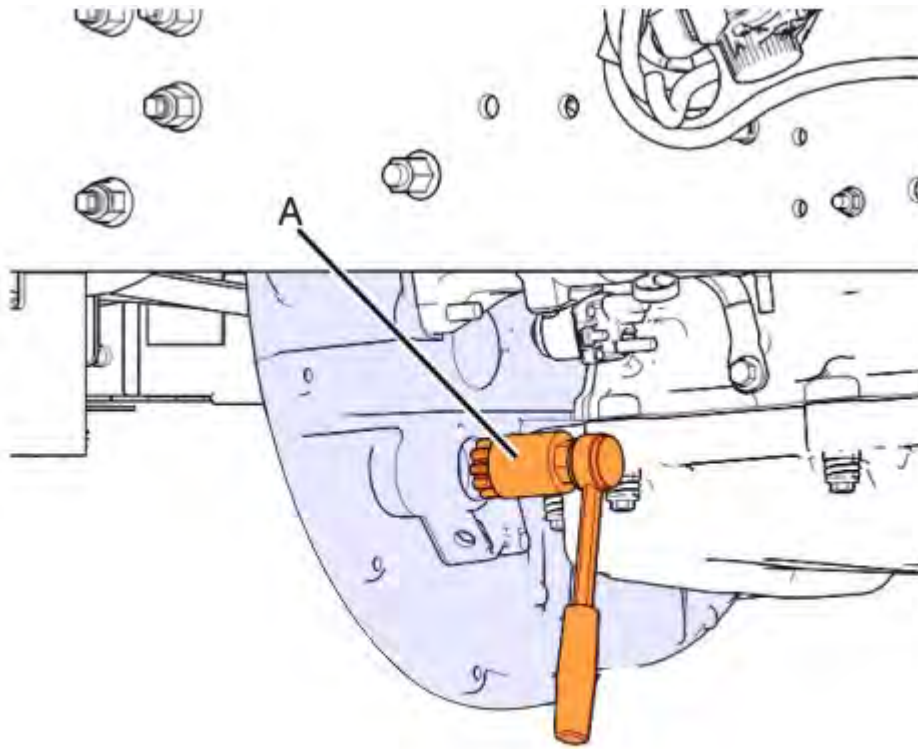
152	Prevent the screw (B) from turning and torque-tighten the nut (A).
-----	--

Tightening torque	
Injector, rocker arm, nut	52 ±4 Nm (38 ±3 lb _f ·ft)

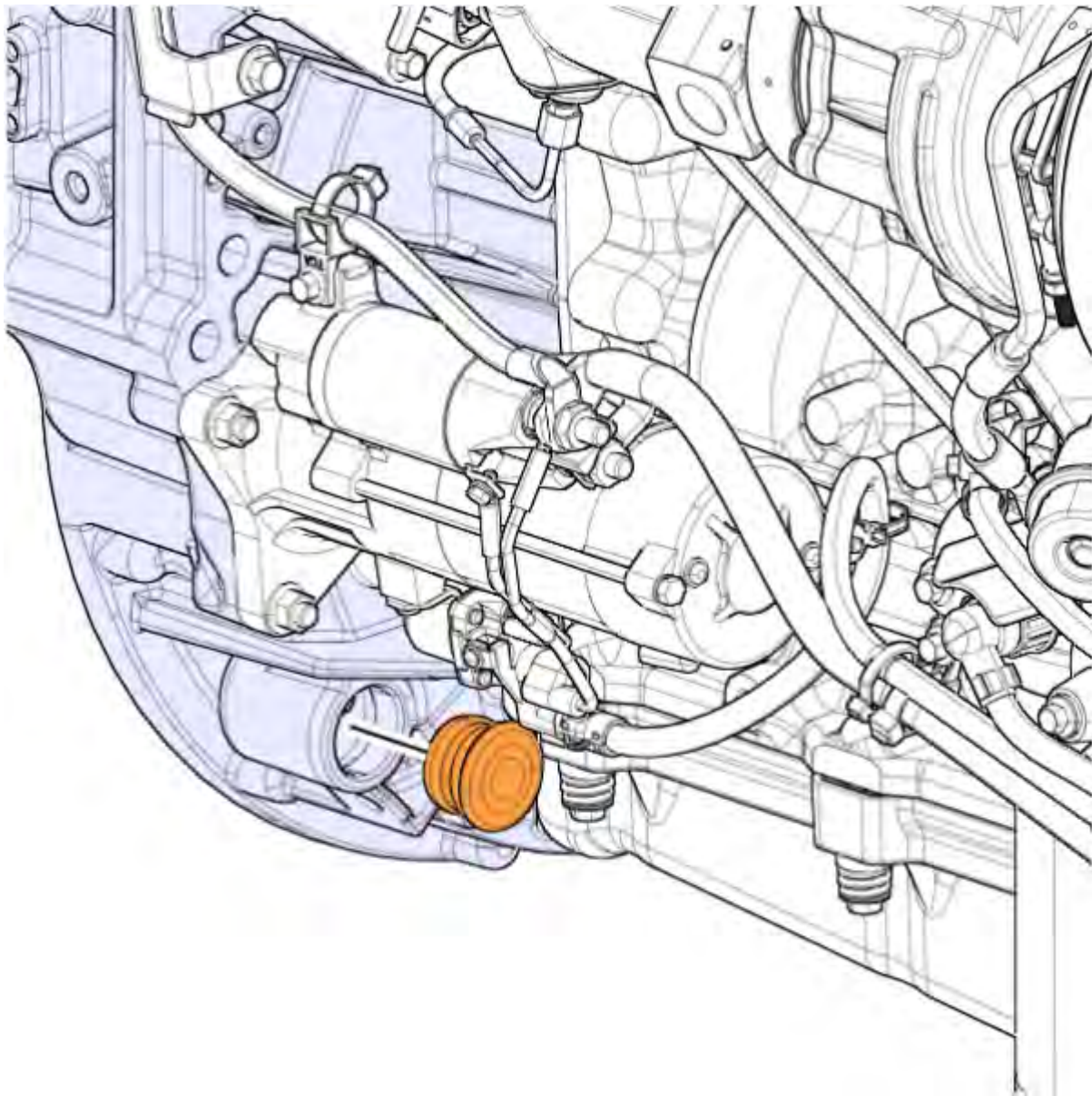


153	Adjust all the other rocker arms in the same way.
	Note Ask for assistance.

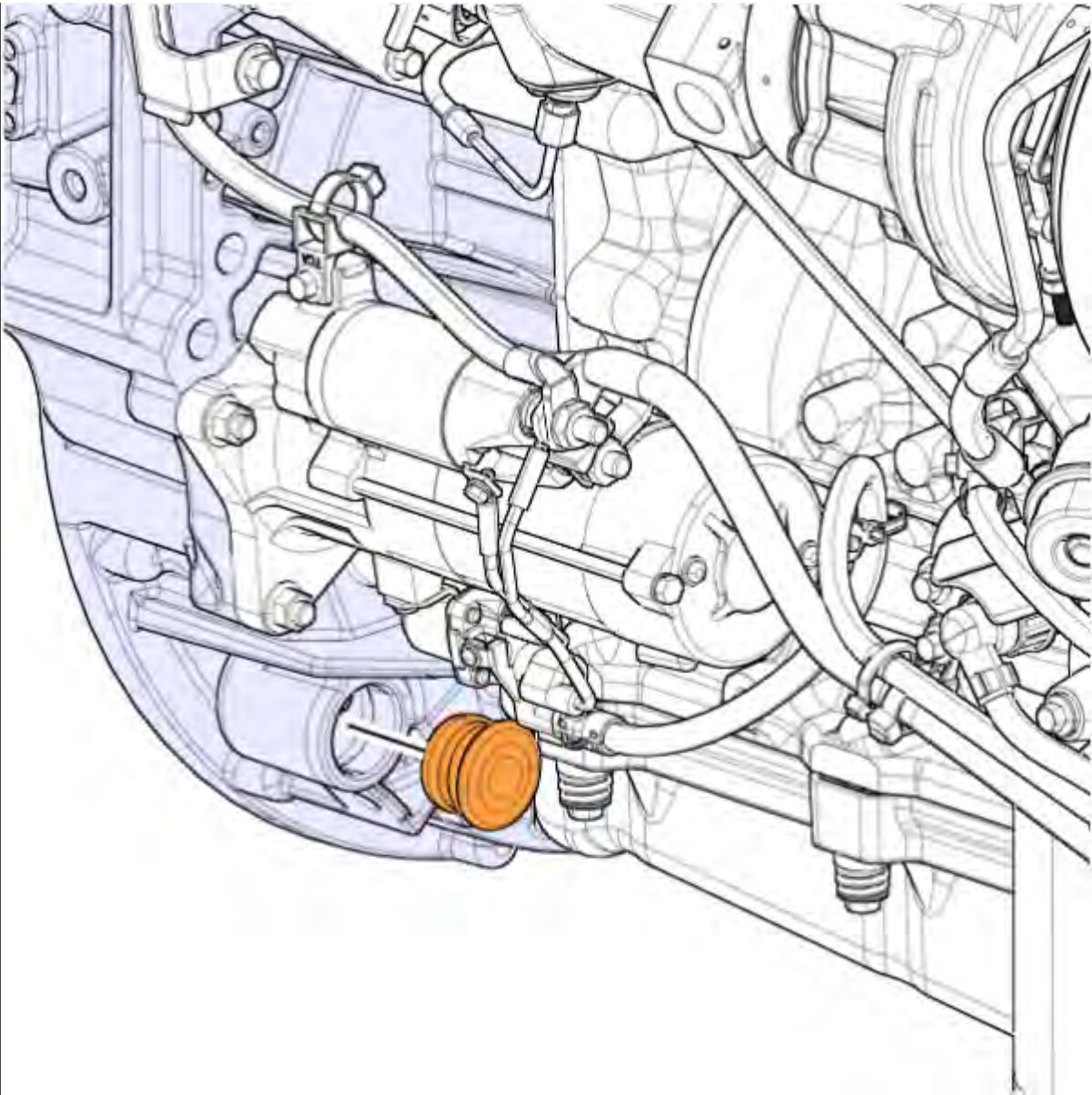
154	Remove the cranking tool (A).
Required material	
CRANKING TOOL	88840317



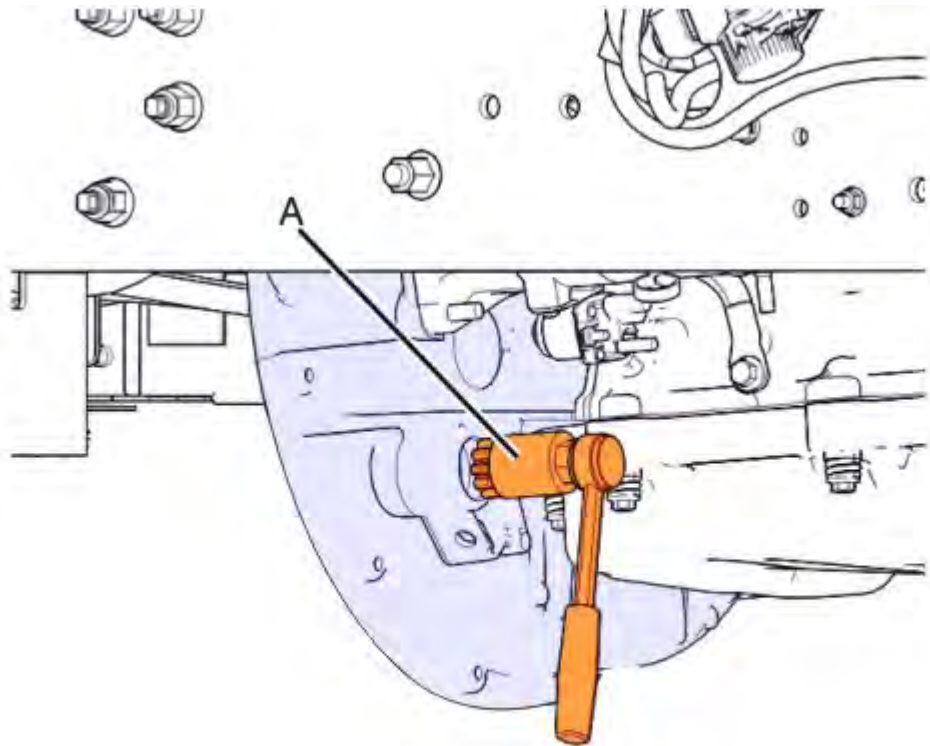
155	Install the plug.
------------	-------------------



156	Perform this procedure when the condition below is met.	
	Conditions	
	•	If not previously installed.
	▶	Remove the plug.



► Install the cranking tool (A).	
Required material	
CRANKING TOOL	88840317



157 Note the camshaft marking.

**Note**

The marking can be for the adjustment of multiple cylinders.

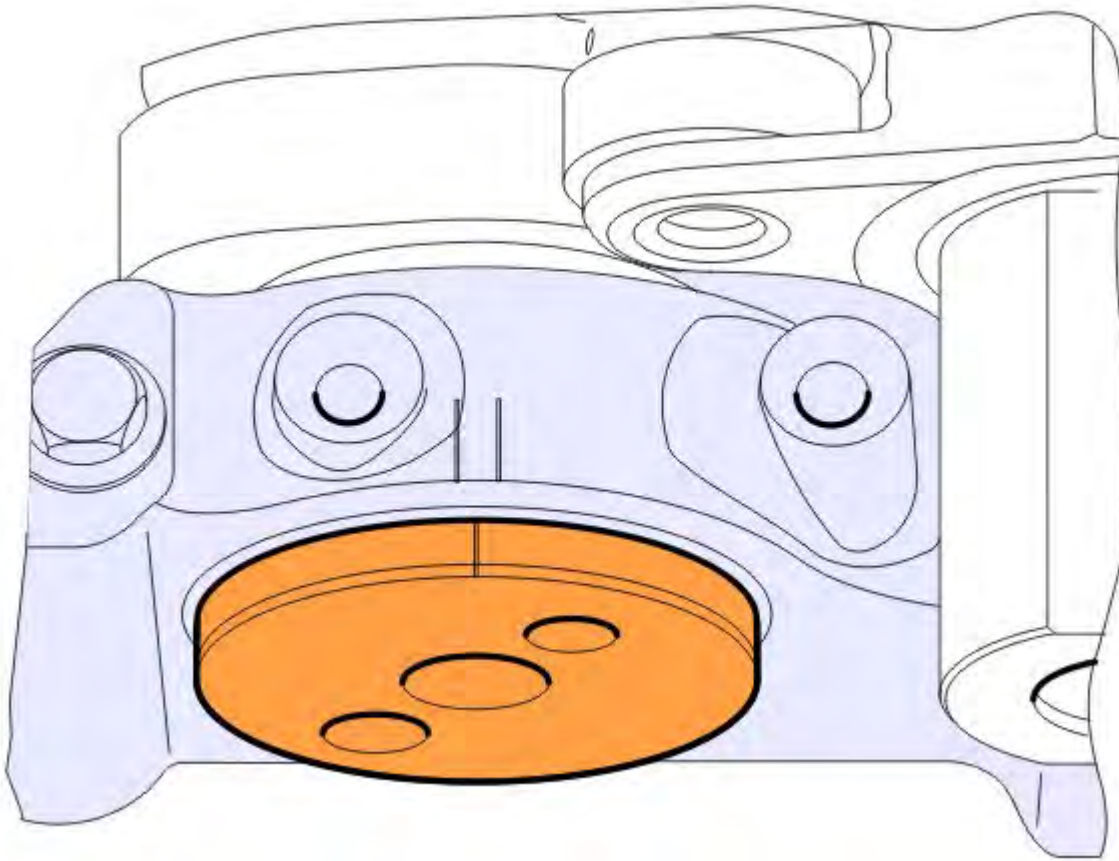
**Note**

When checking or adjusting, the mark must be centered between the lines on the camshaft cap.

158 Adjust the rocker arms according to the chart.

Camshaft marking

CAM POSITION	INLET	INJECTOR / PUMP	EXHAUST
4/5	Cylinder 4	—	Cylinder 5
2/1	Cylinder 2	—	Cylinder 1
6/P4	Cylinder 6	Pump 4	Cylinder 4
3/P2	Cylinder 3	Pump 2	Cylinder 2
5/P6	Cylinder 5	Pump 6	Cylinder 6



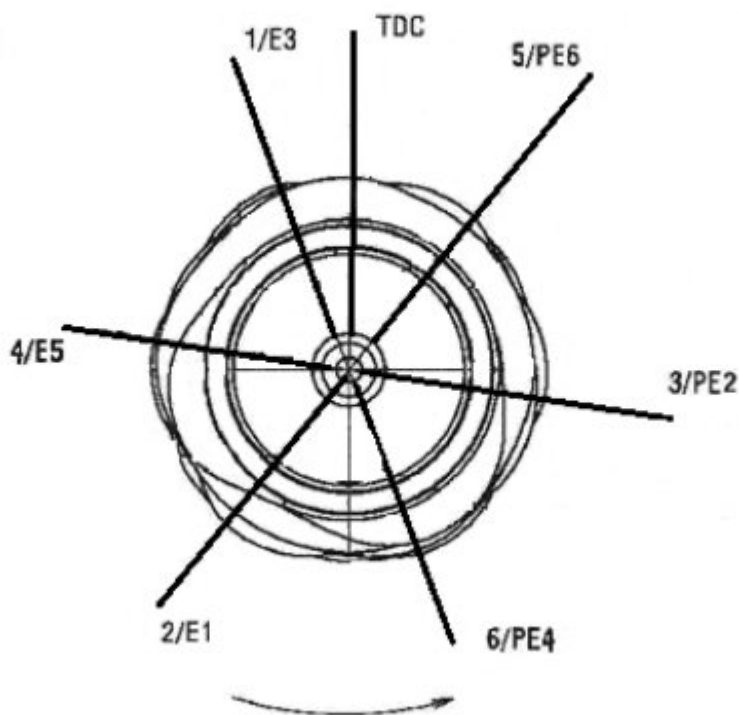
159 Rotate the crankshaft to the next timing mark on the camshaft.



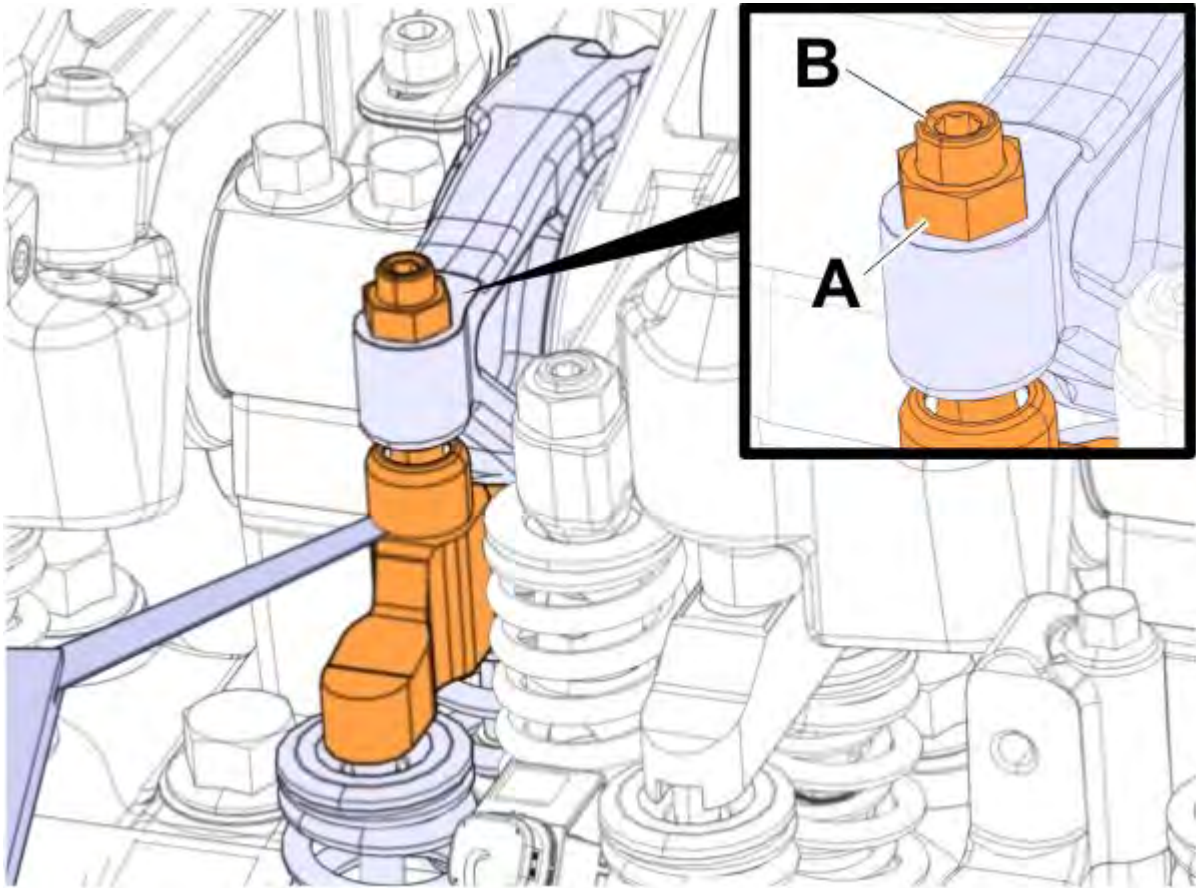
Note

Rotate the crankshaft in the normal engine rotation direction.

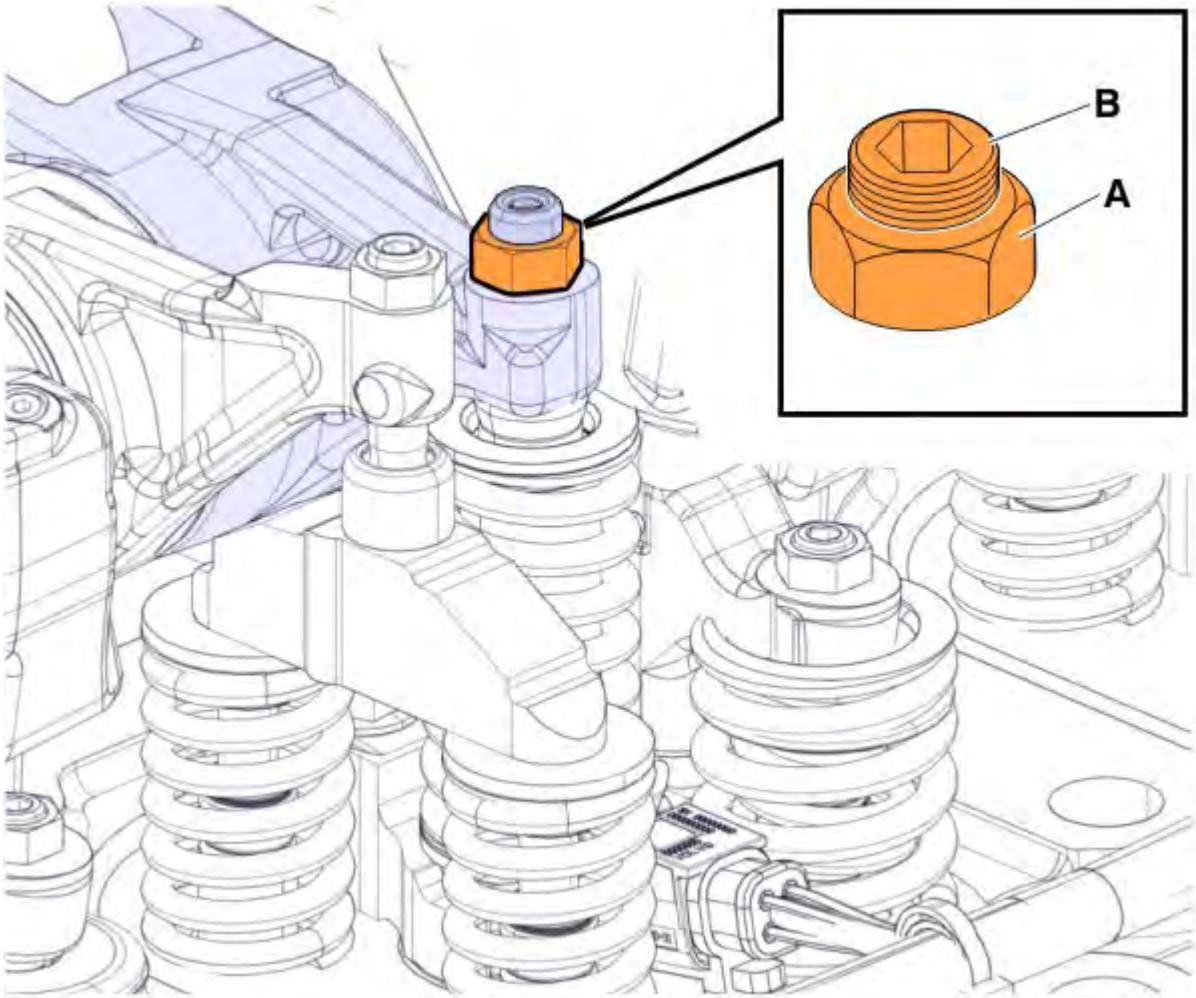
Ask for assistance.



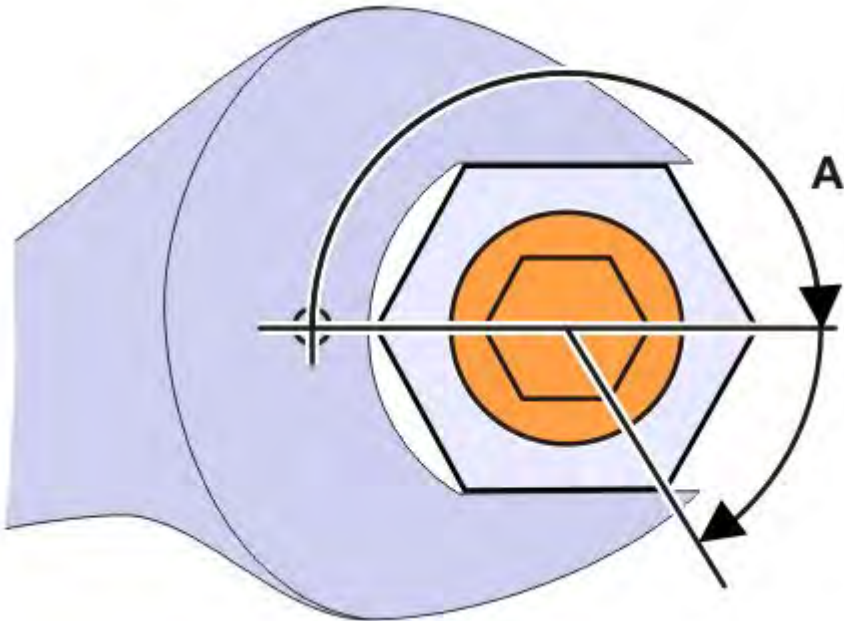
160	Check the inlet valve rocker arm clearance.	
	Tech data	
	Inlet valve, rocker arm, clearance	0.2 ±0.05 mm (0.008 ±0.002 in)



161	Perform this procedure when the condition below is met.	
	Conditions	
	•	If the valve clearance is not correct
	▶	Loosen the nut (A).
	▶	Adjust the screw (B) until the feeler blade can be moved but there is some resistance.
	▶	Prevent the screw from turning (B) and tighten the nut (A) to torque.
	Tightening torque	
	Rocker arm, nut (intake)	38 ±4 Nm (28 ±3 lb _f -ft)
162	Loosen the nut (A).	
163	Adjust the screw (B) until there is no clearance between the adjustment screw and the injector ball socket.	

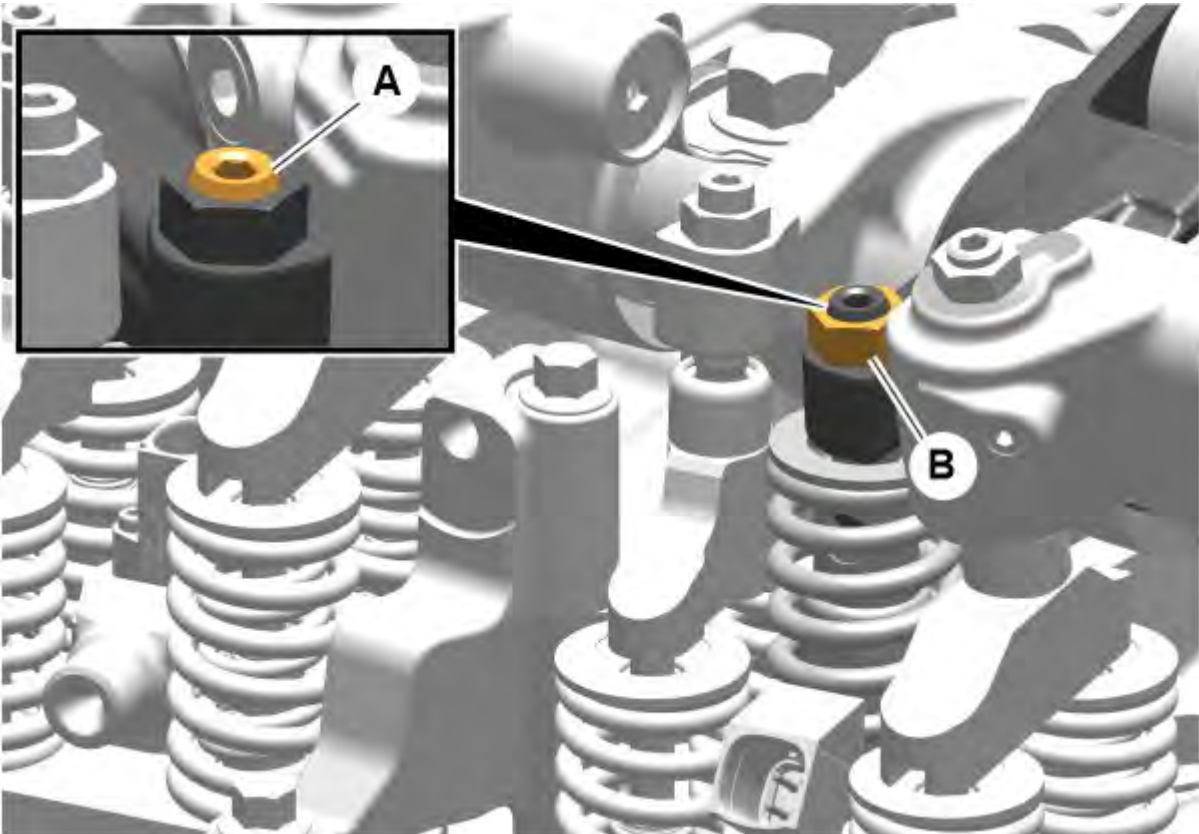


164	Angle tighten the screw (B).	
	Tech data	
	Injector, adjusting screw	240 ±20°

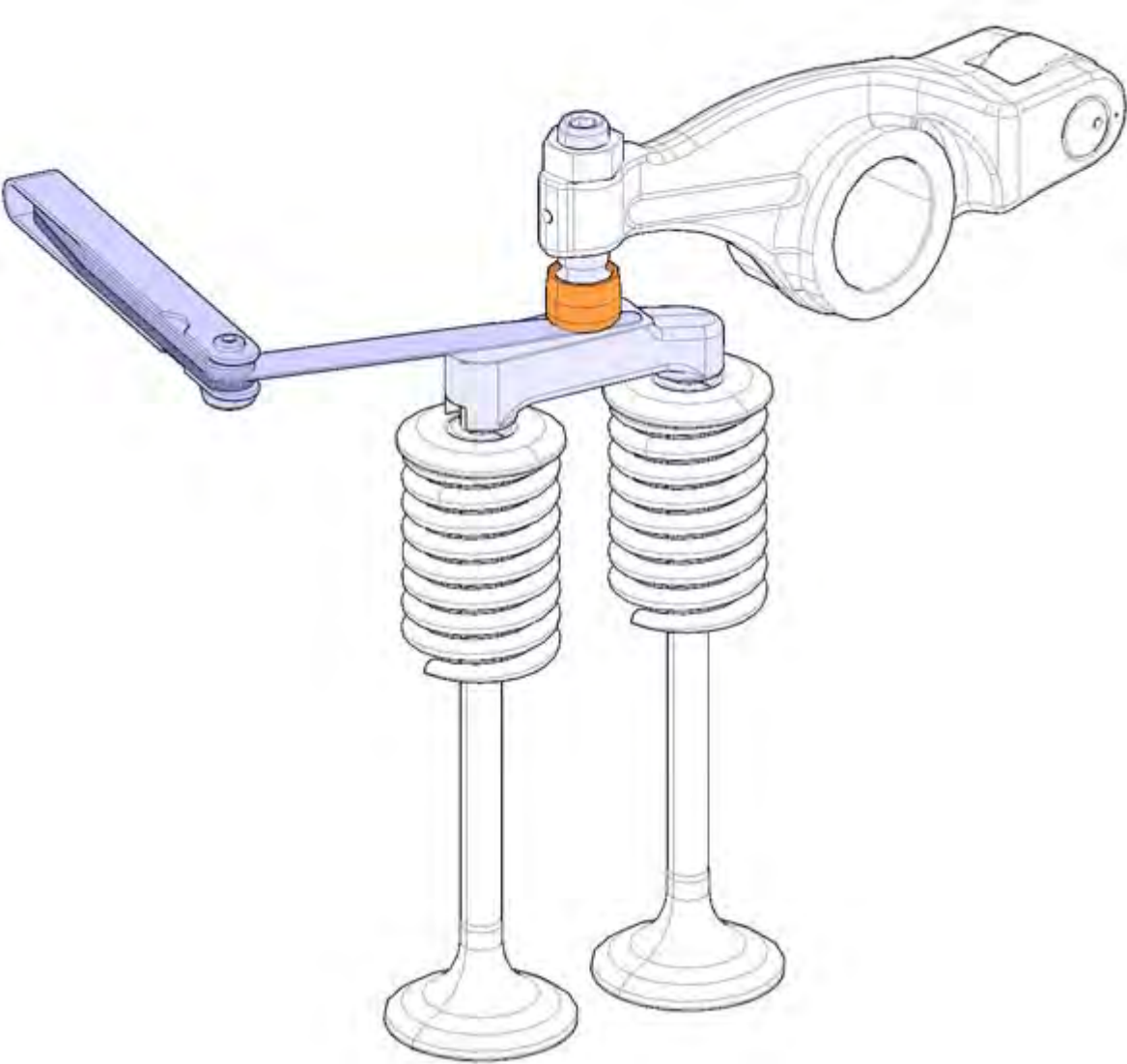


165	Prevent the screw (B) from turning and torque-tighten the nut (A).
-----	--

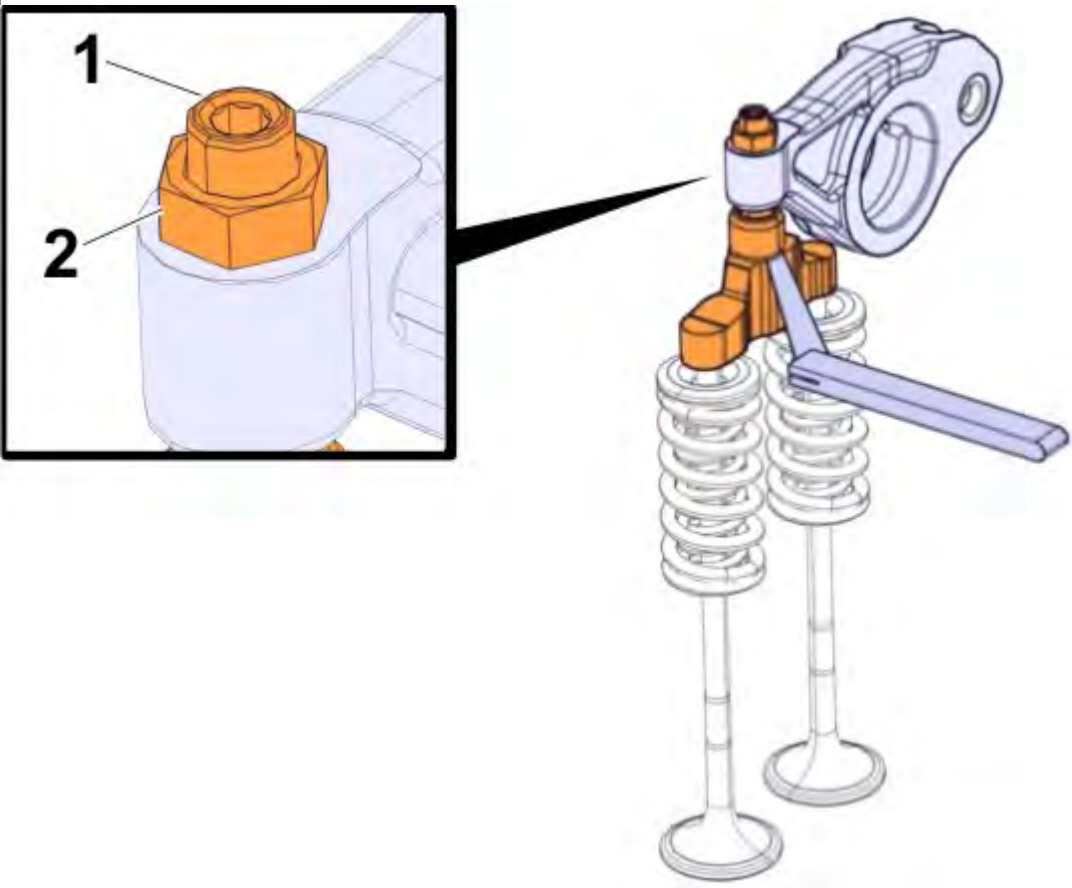
Tightening torque	
Injector, rocker arm, nut	52 ±4 Nm (38 ±3 lb _f ·ft)



166	Check the clearance.
Tech data	
Exhaust valve, rocker arm, clearance	0.8 ±0.05 mm (0.031 ±0.002 in)
 Note Use a set of feeler gauges.	

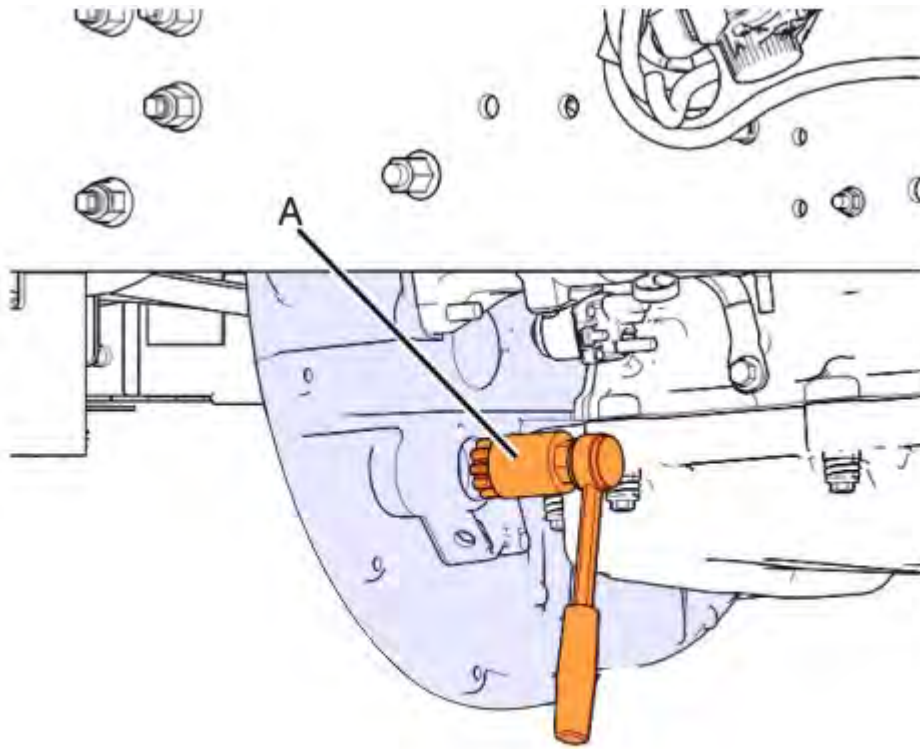


167	Perform this procedure when the condition below is met.	
	Conditions	
	•	If the valve clearance is not correct.
	▶	Loosen the nut (1).
	▶	Adjust the screw (2) until the feeler blade can be moved but there is some resistance.
	Tech data	
	Exhaust valve, rocker arm, clearance	0.80 ±0.05 mm (0.0315 ±0.002 in)
	▶	Prevent the screw from turning (2), and tighten the nut (A) to torque.
	Tightening torque	
	Rocker arm, nut (inlet and outlet)	38 ±4 Nm (28 ±3 lb _f ·ft)

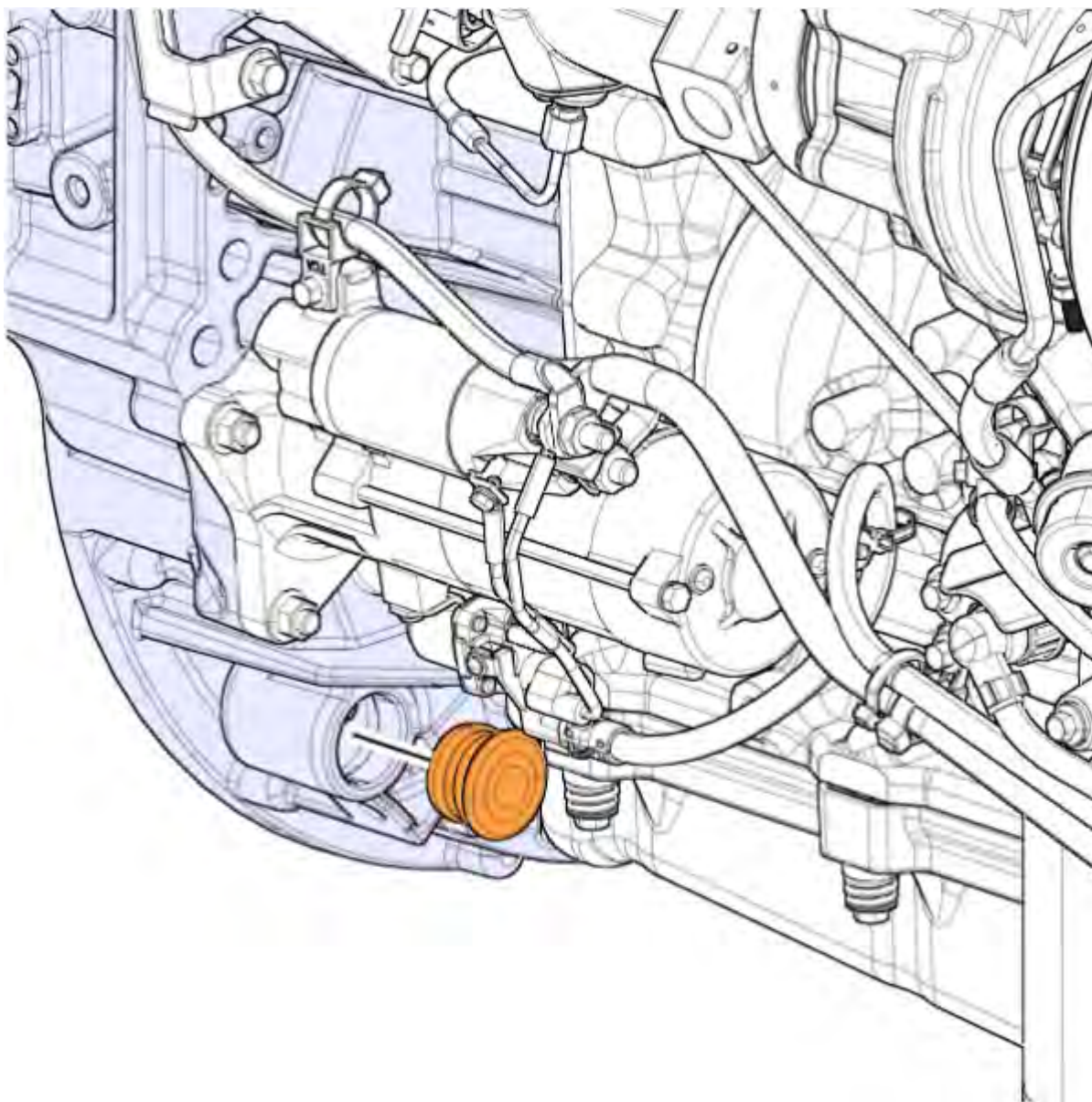


► Adjust all the other rocker arms in the same way.

168	Remove the cranking tool (A).		
	Required material		
	CRANKING TOOL		88840317



169	Install the plug.
------------	-------------------



170 Remove the old sealant from the contact surfaces **(A)**.



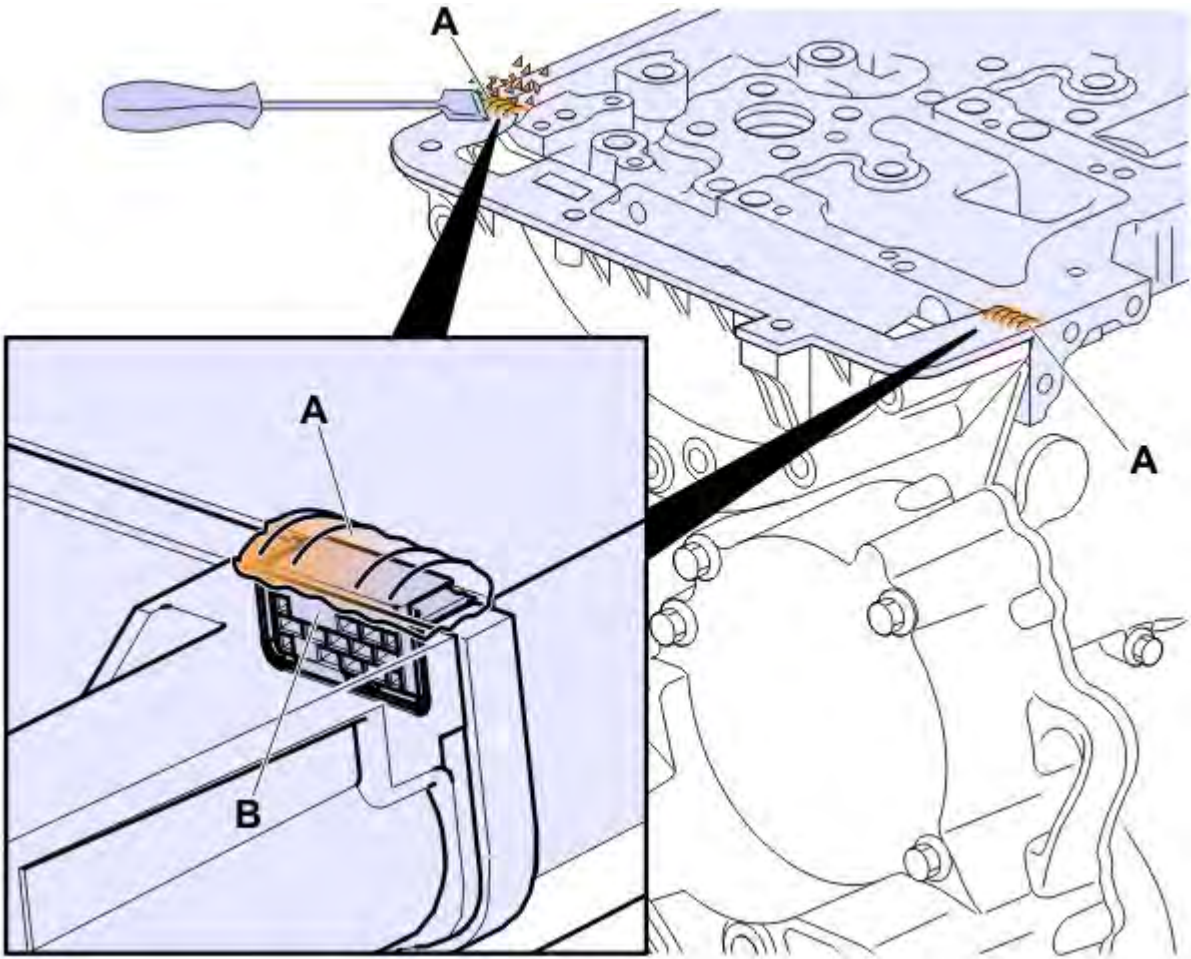
Note

Ensure that the surfaces are completely clean of sealant.

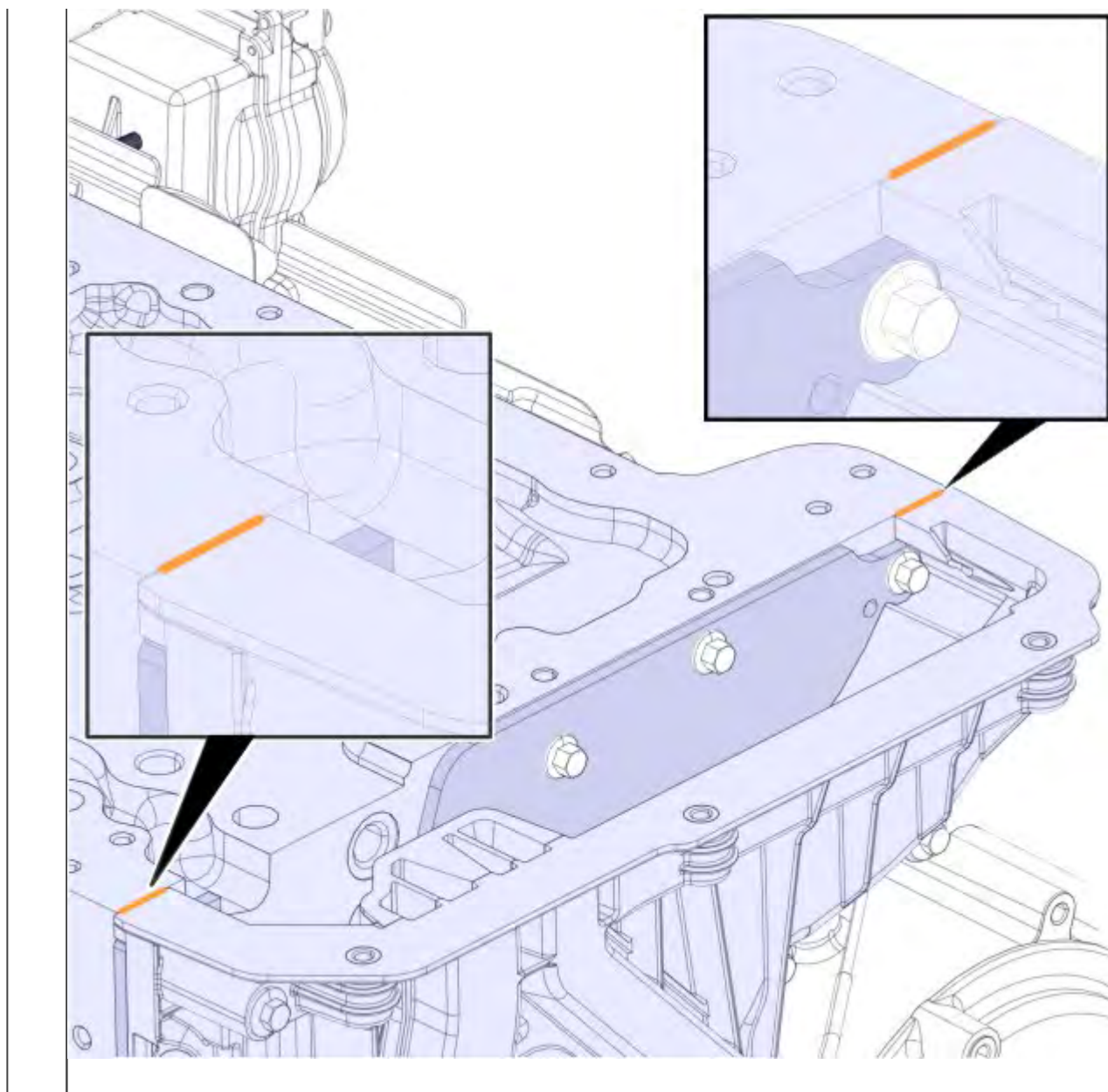


Note

Ensure that the sealant on the timing gear plate is not damaged **(B)**.



171	Perform this procedure when the condition below is met.	
	Conditions	
	• Timing gear plate without integrated seal	
	▶ Apply sealant.	
	Tech data	
	Sealant, bead thickness	2 mm (0.08 in)
	<i>i</i> Note Use recommended sealant.	
	<i>i</i> Note Install the valve cover within 20 minutes of applying the sealant.	



172 Perform this procedure when the condition below is met.

Conditions

- Timing gear plate with integrated seal

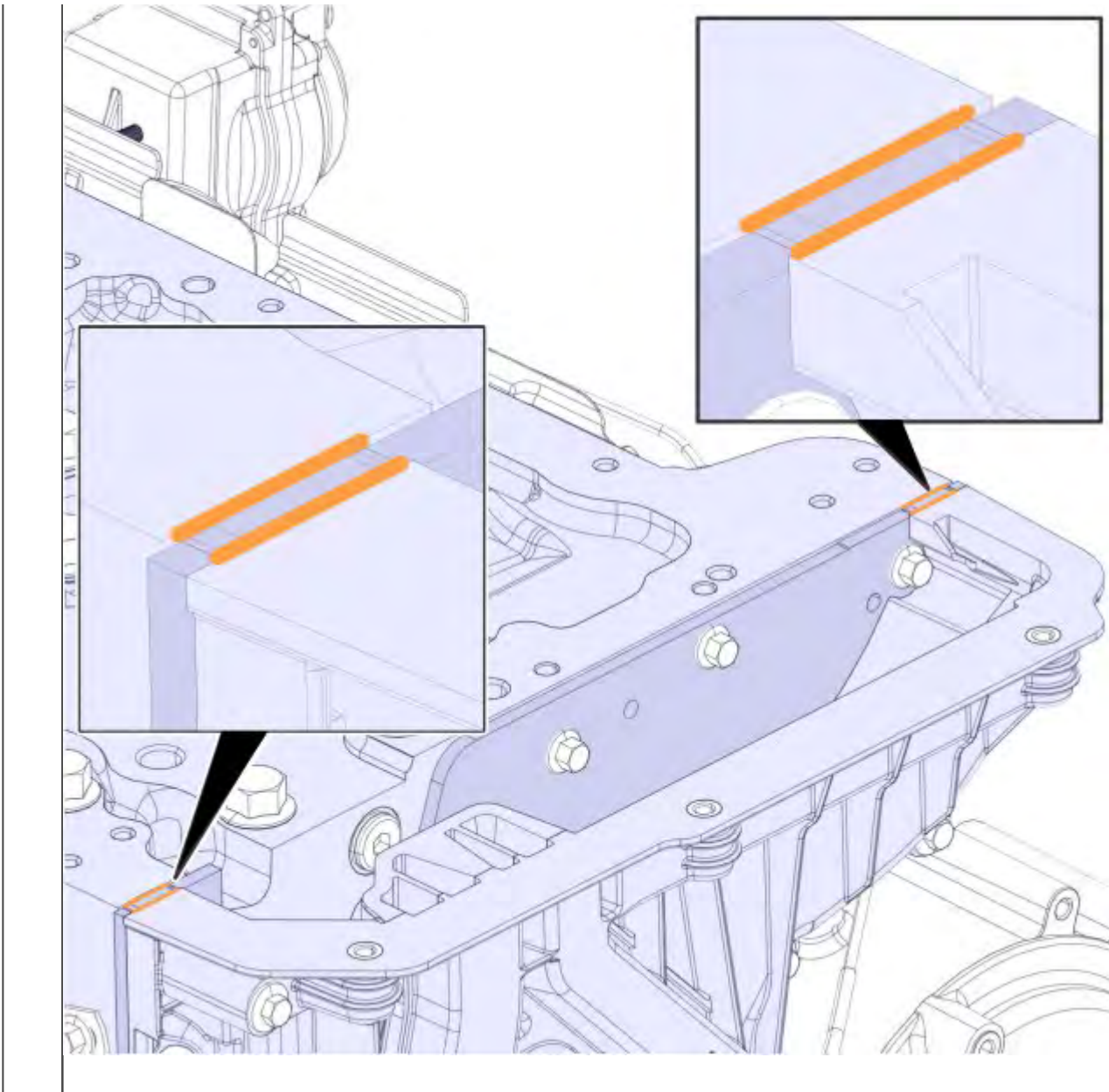
► Apply sealant.

Tech data

Sealant, bead thickness	2 mm (0.08 in)
-------------------------	-------------------

i **Note**
Use recommended sealant.

i **Note**
Install the valve cover within 20 minutes of applying the sealant.



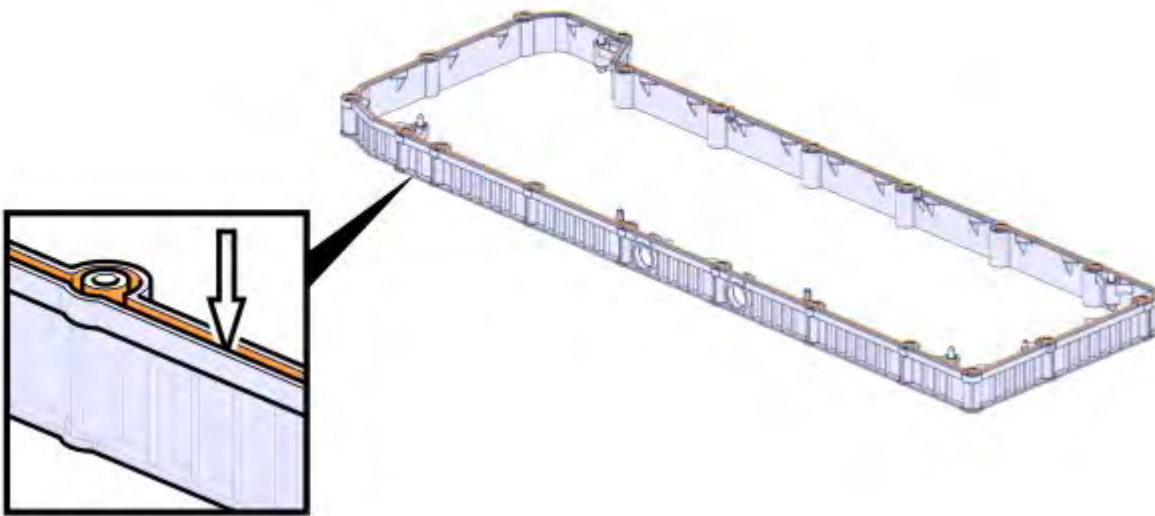
173 Clean the contact surfaces carefully.

174 Clean the groove.



Note

Ensure that the surfaces are completely free of oil and grease.

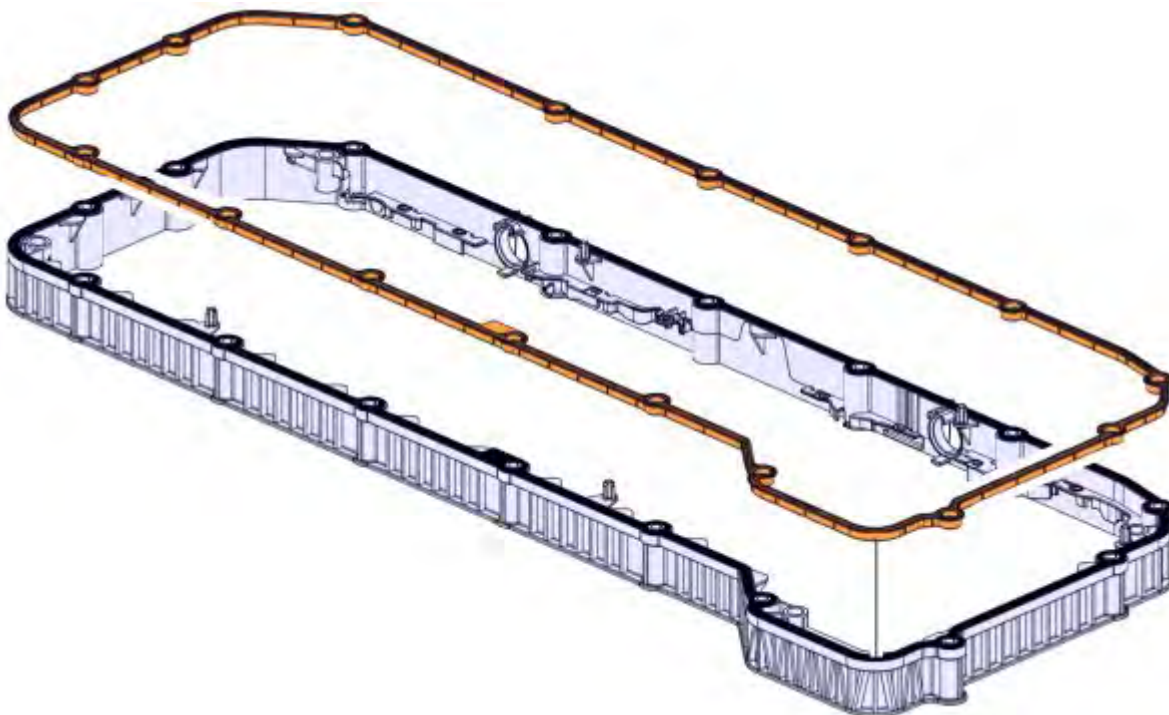


175 Install the gasket.



Note

Use a new part.



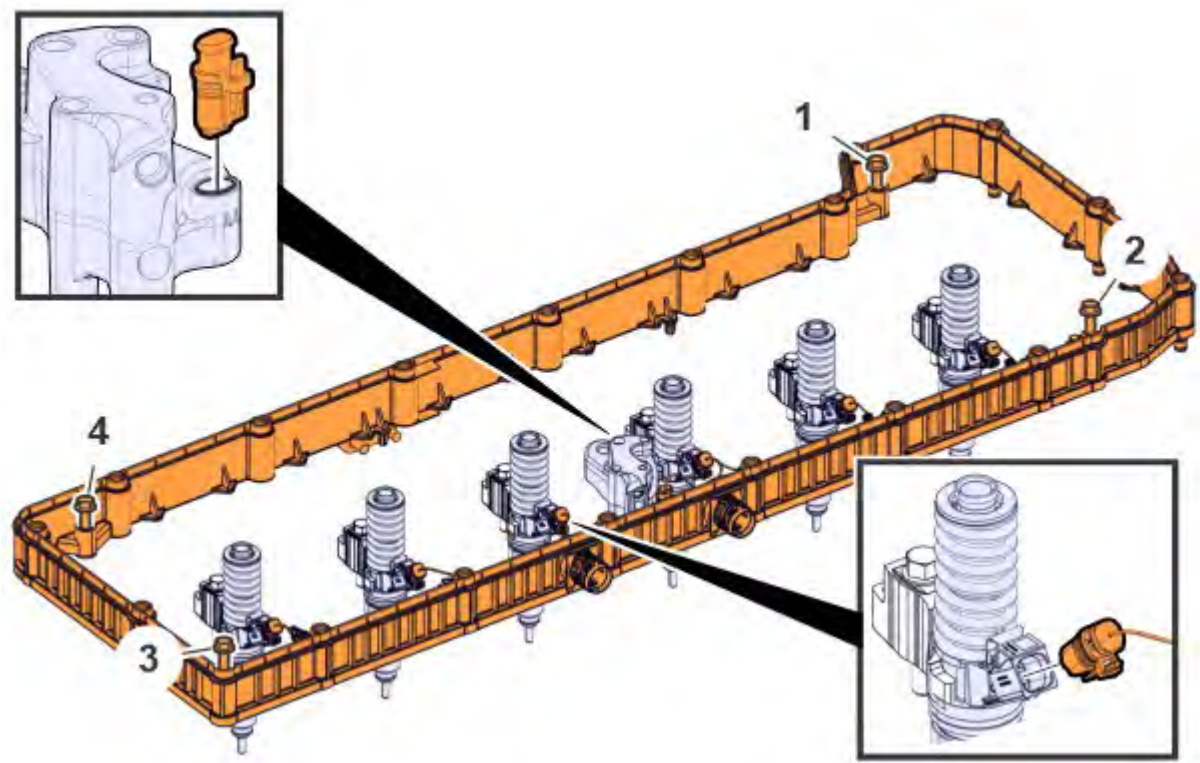
176 Install the frame.

177 Tighten the screws to torque.

Tightening torque	
Lower valve cover, screw	Tightening sequence: 1-4
	24 ±4 Nm (18 ±3 lb _f ·ft)

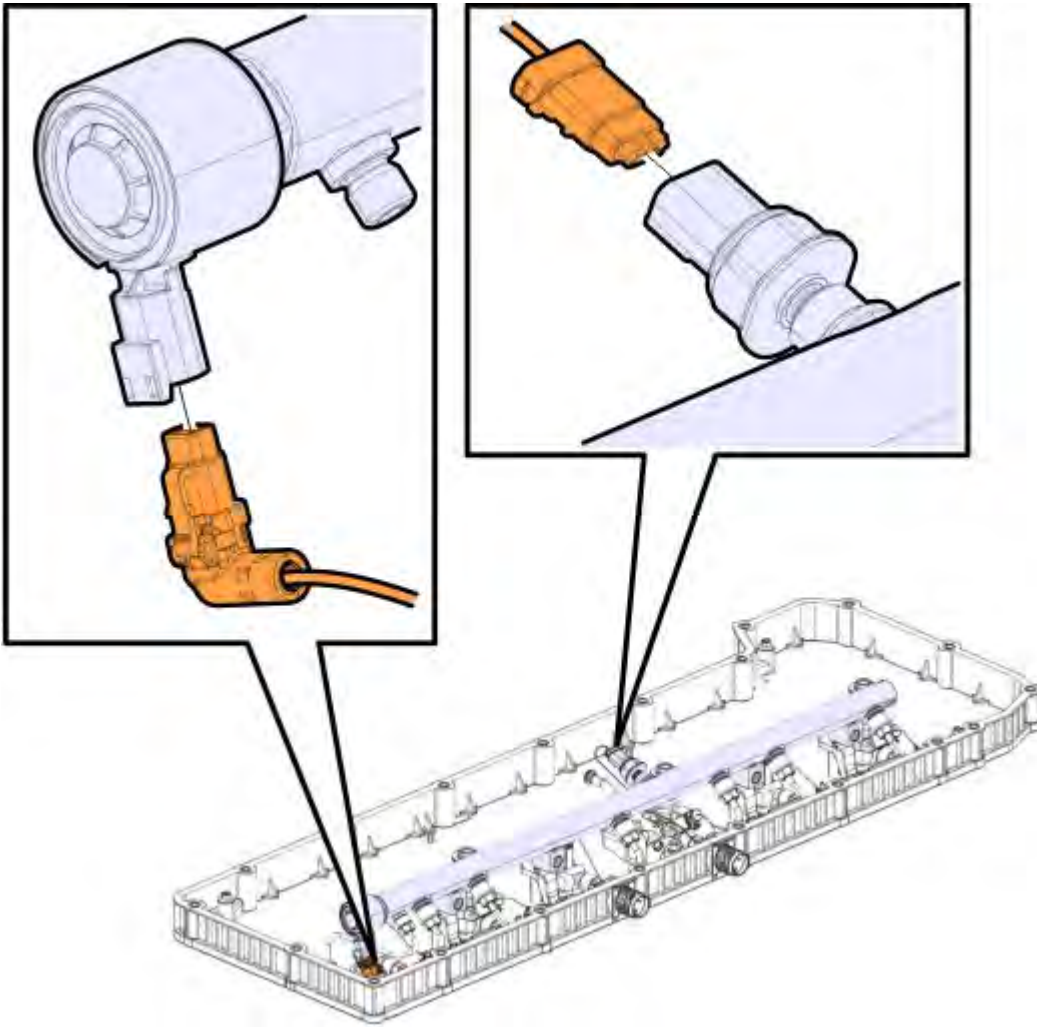
178

Connect the connectors.

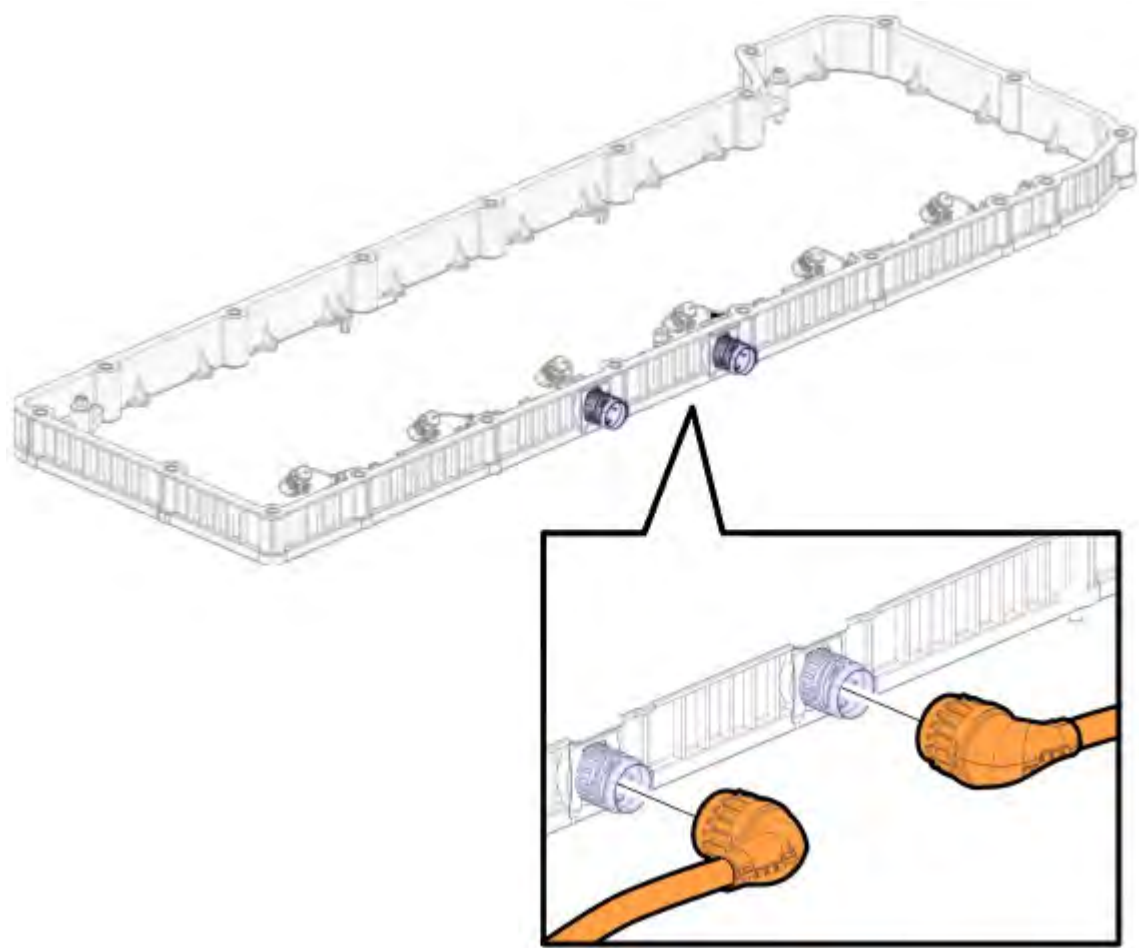


179

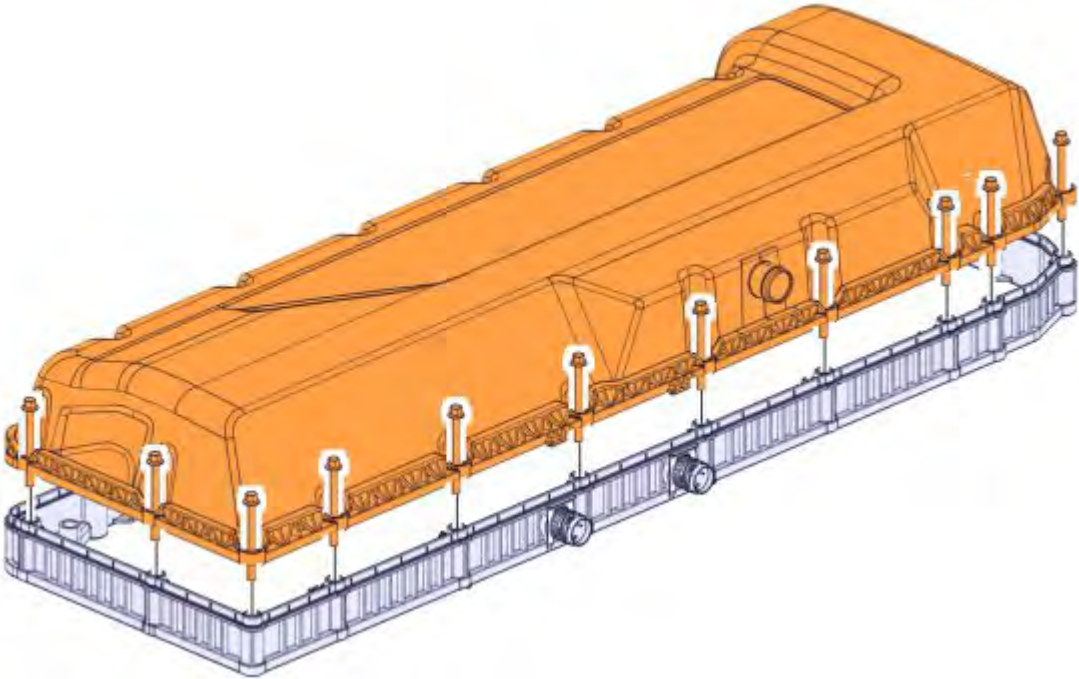
Connect the connectors.



180	Connect the connectors.
------------	-------------------------



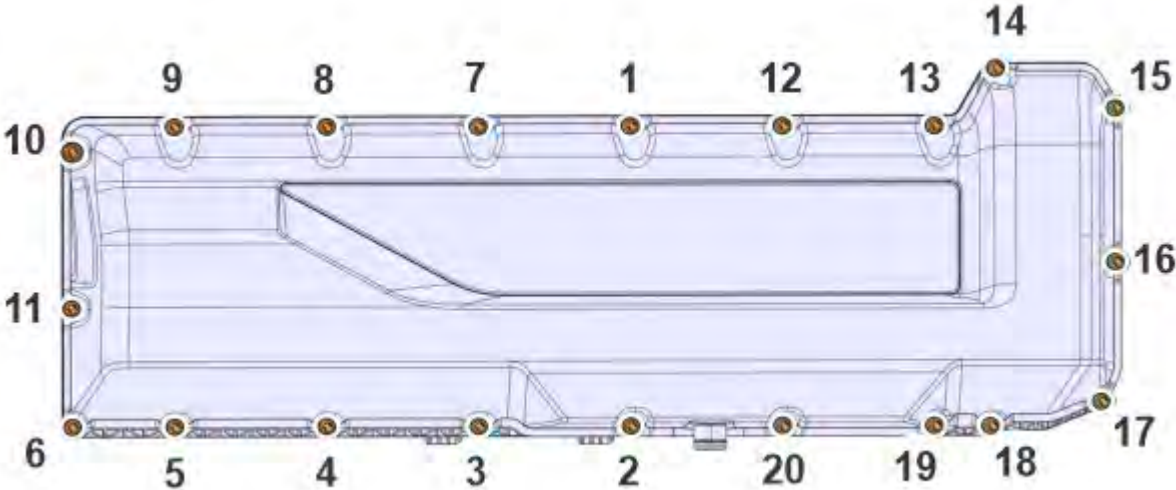
181	Position the screws.  Note Inspect the gasket, replace as needed.  Service hint Temporarily securing the screws at the rear of the cover in the uppermost position will aid in installation
182	Install the valve cover.



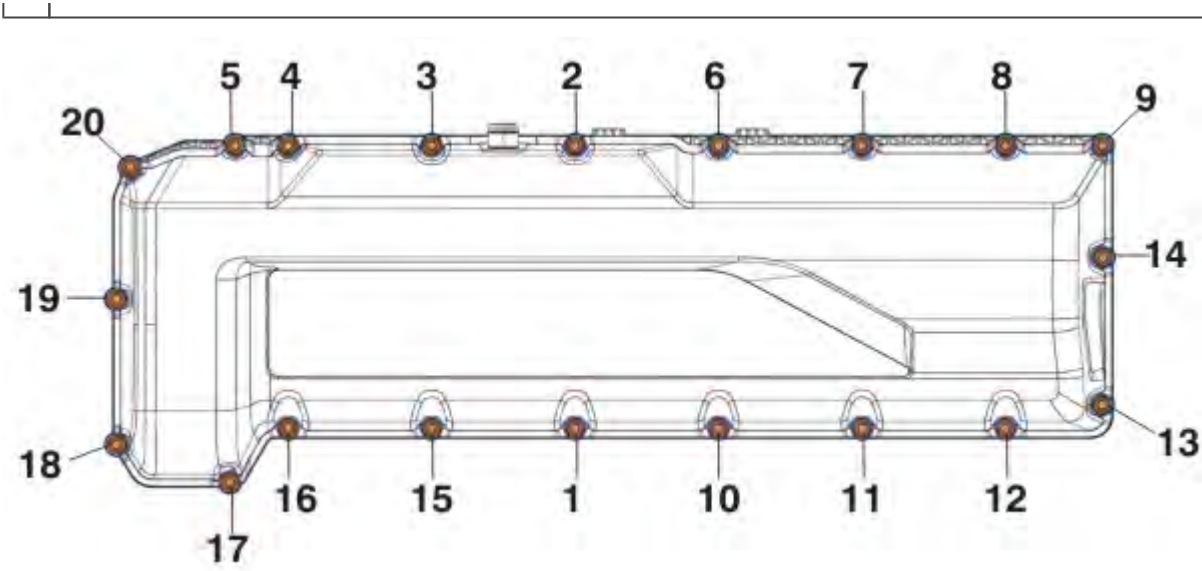
183

Tighten the screws to torque.

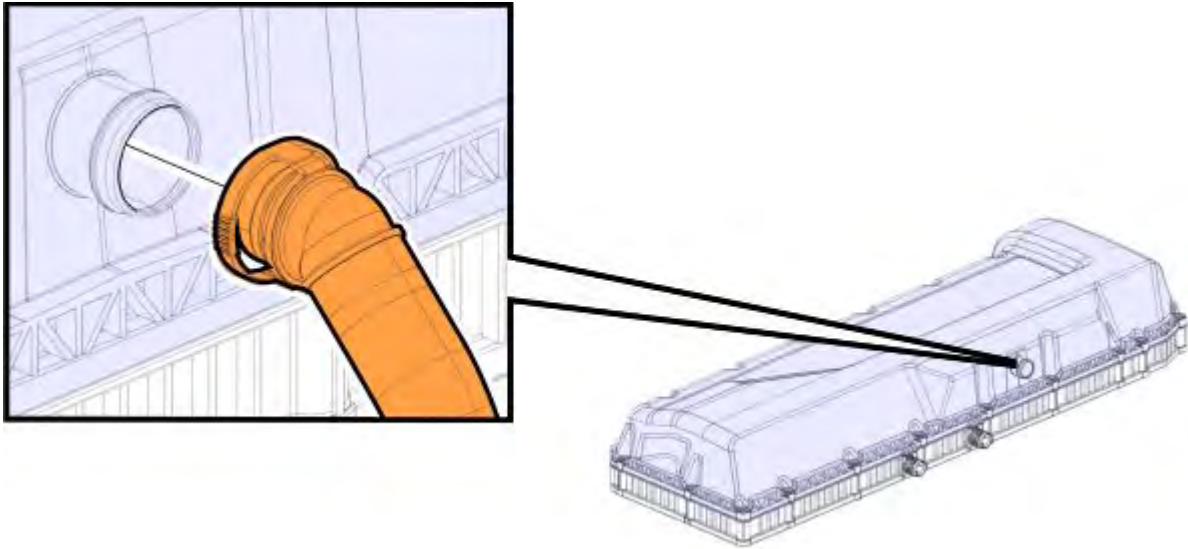
Tightening torque	
Valve cover, screw	Tightening sequence: 1–20
	24 ±4 Nm
	(18 ±3 lb _f ·ft)



Tightening torque	
Valve cover, screw	Tightening sequence: 1–20
	24 ±4 Nm
	(18 ±3 lb _f ·ft)

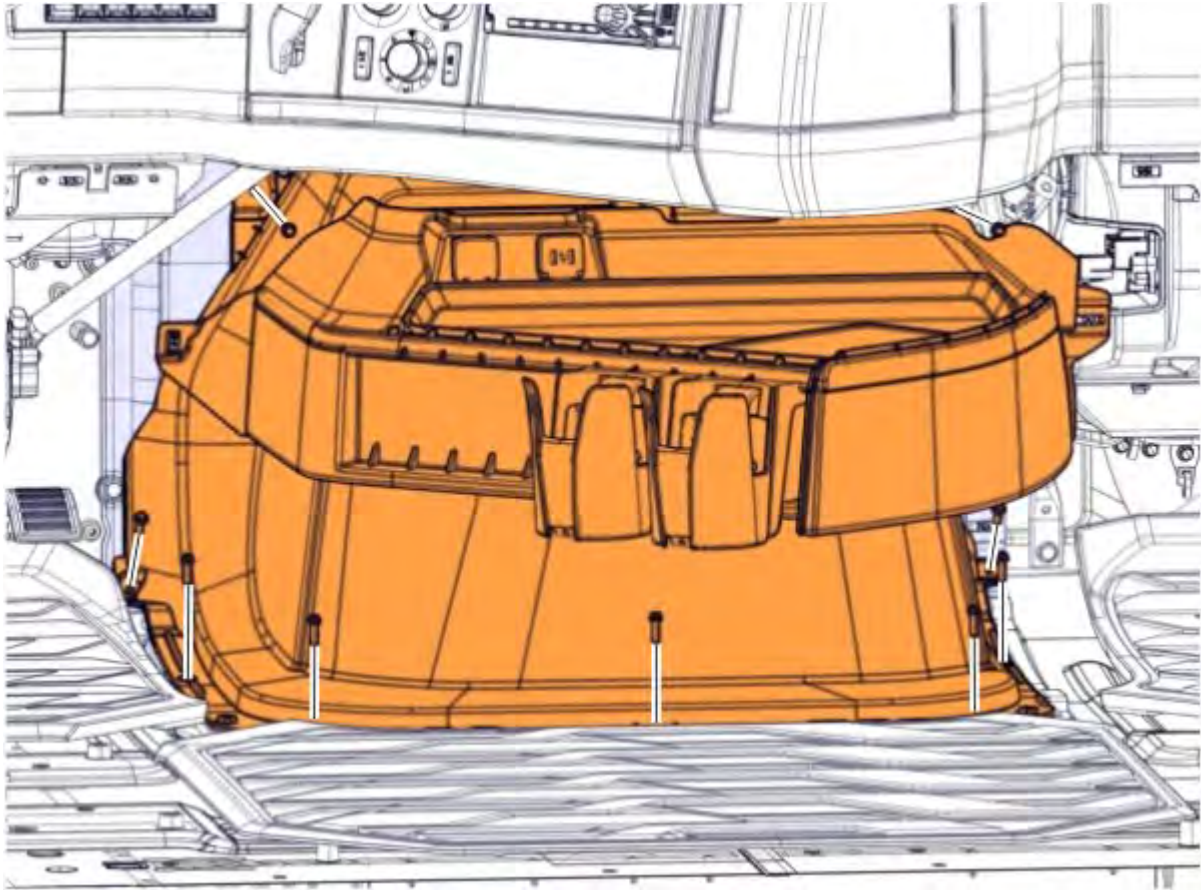


184	Install the pipe.
	Note If not previously installed.
	Note Inspect the internal sealing ring.

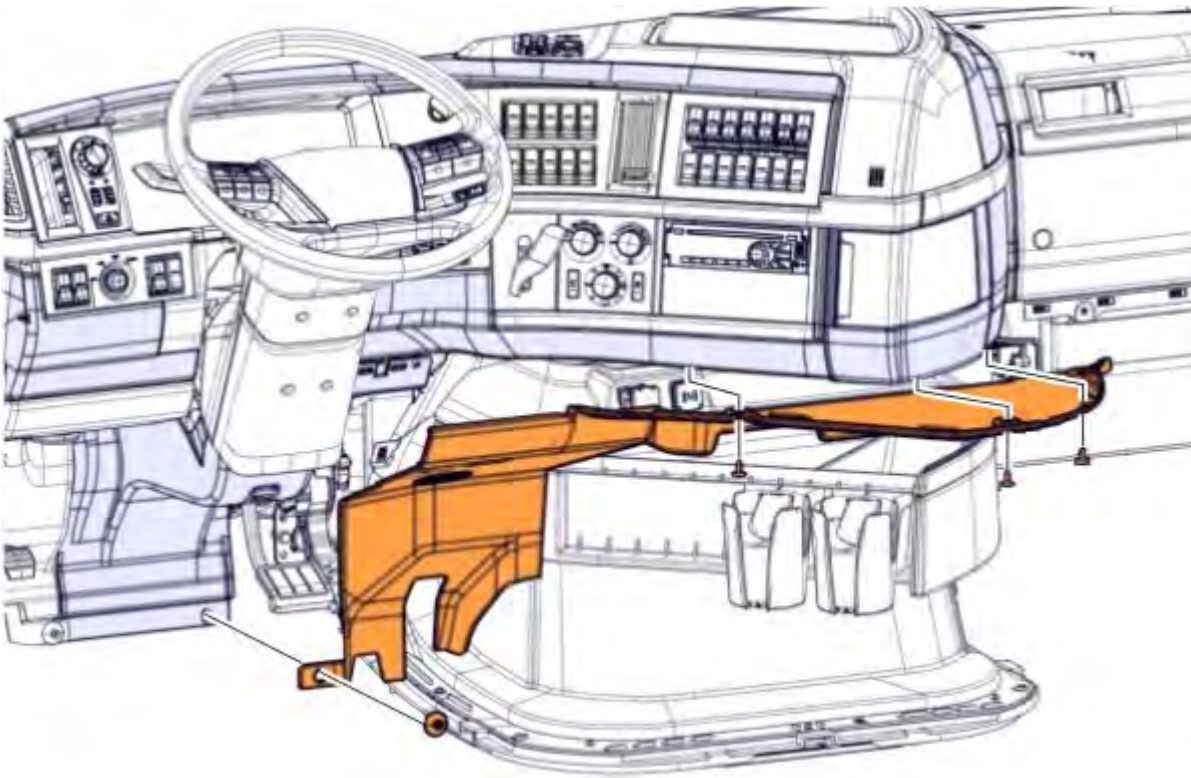


185	Connect the connector.
186	Install the engine cover.
187	Install the screws.
188	Tighten the screws to torque.
	Tightening torque
Screw	M5
	3.1 ±0.8 Nm

	(27 ±7 lb _f ·in)

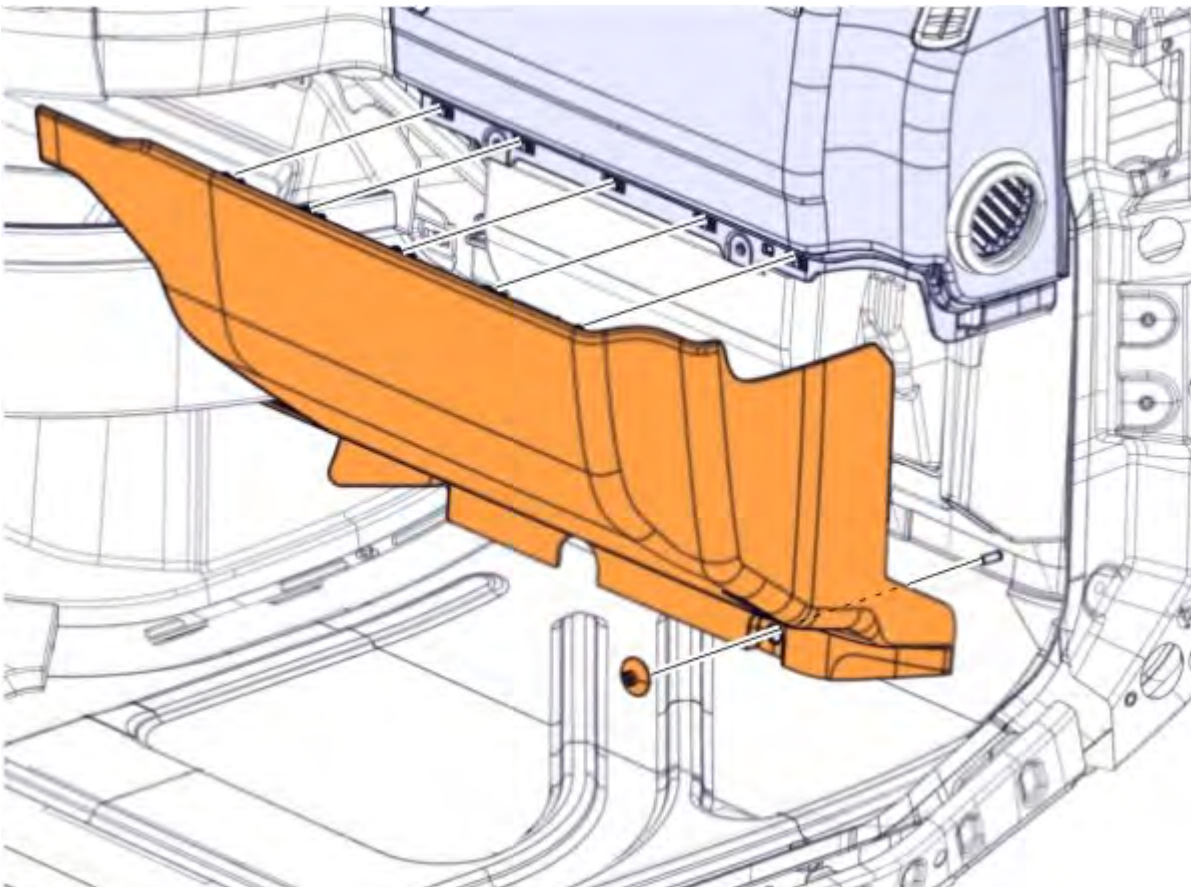


189	Install the plastic rivets.	
190	Install the screws.	
191	Tighten the screws to torque.	
	Tightening torque	
	Screw	M5
		3.1 ±0.8 Nm
		(27 ±7 lb _f ·in)

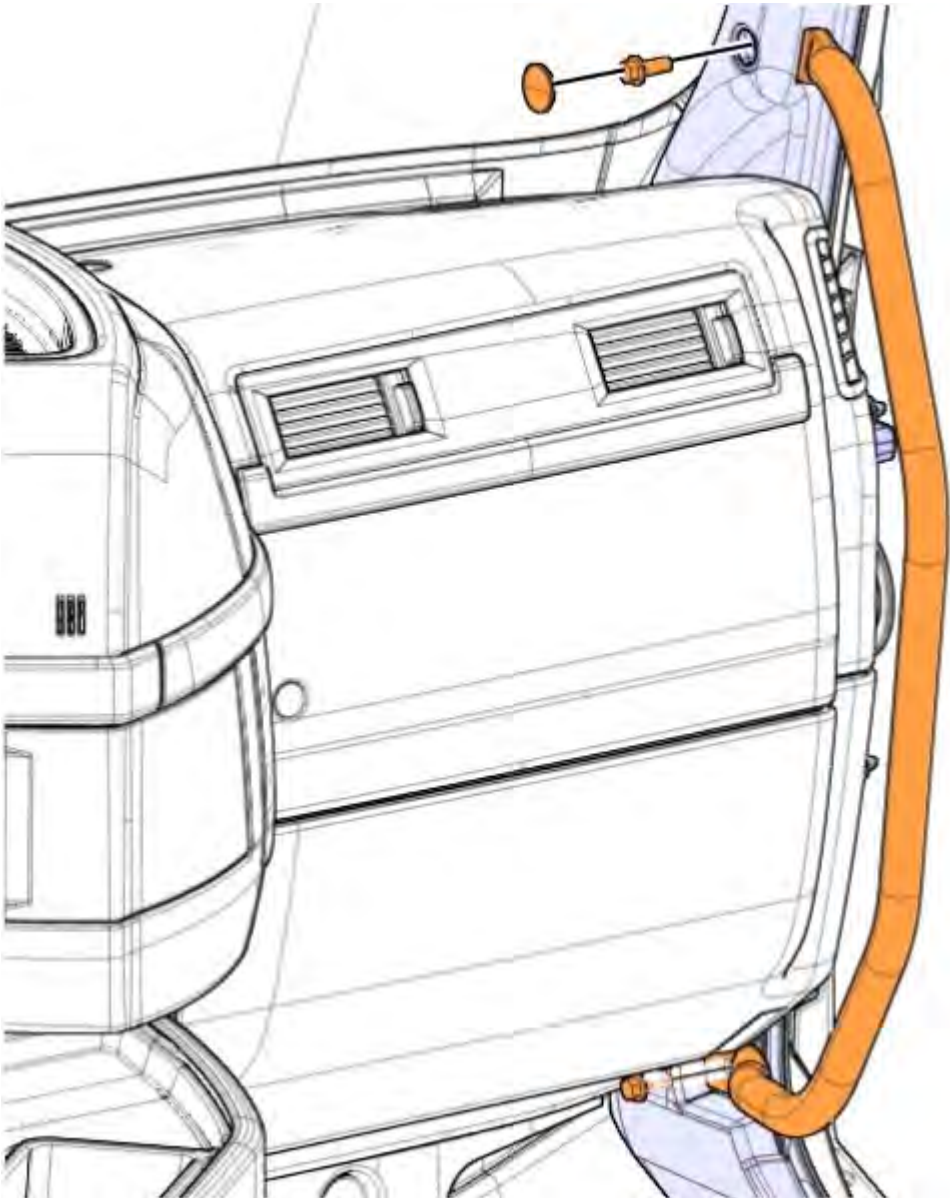


192	Install the panel.
-----	--------------------

193	Install the nut.
-----	------------------



194	Install the grab handle.	
195	Install the screws.	
196	Torque tighten the screws.	
	Tightening torque	
	Screw	M8
		24 ±4 Nm
		(18 ±3 lb _f ·ft)
197	Install the screw cover.	



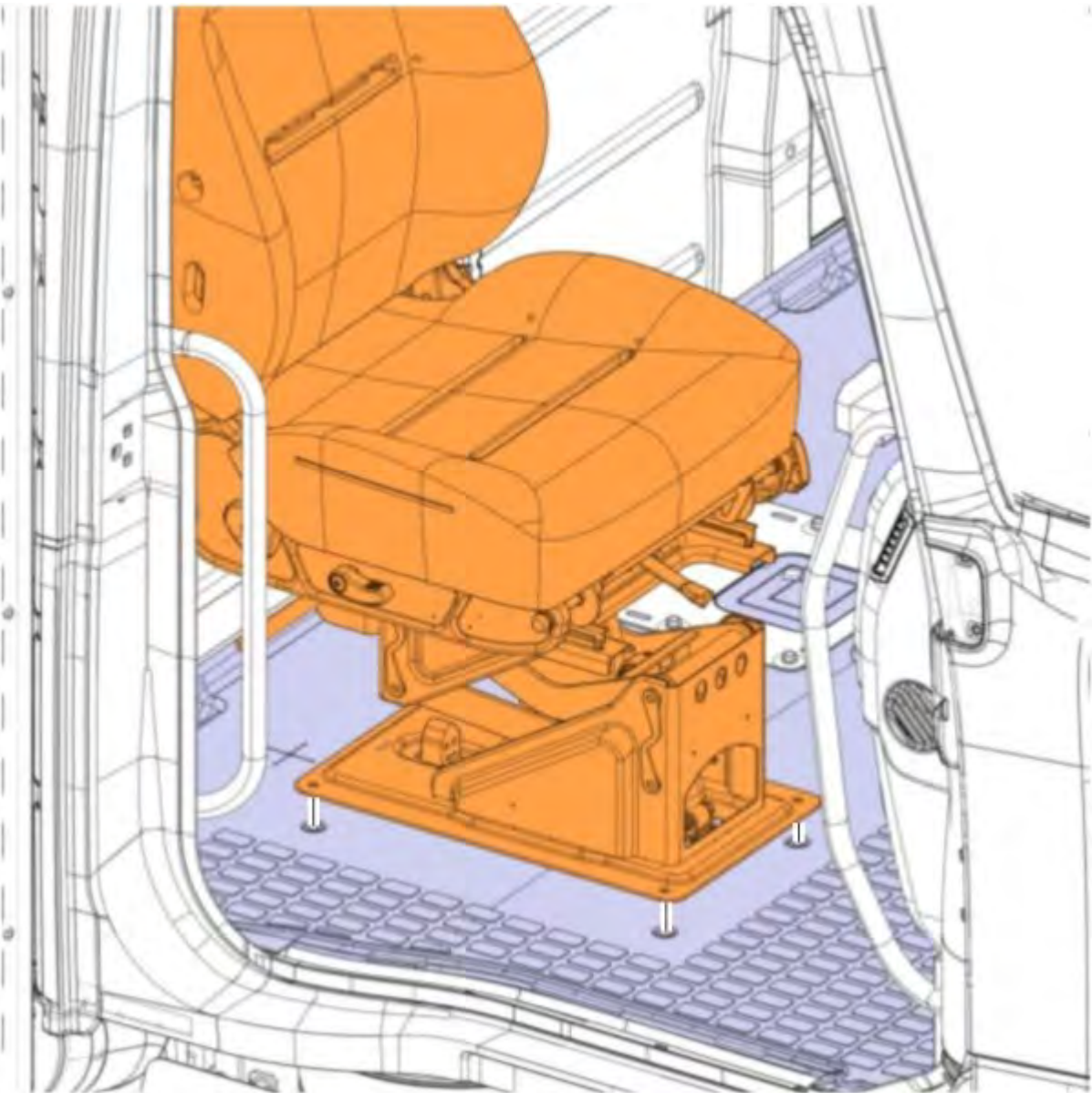
Risk of serious injury.

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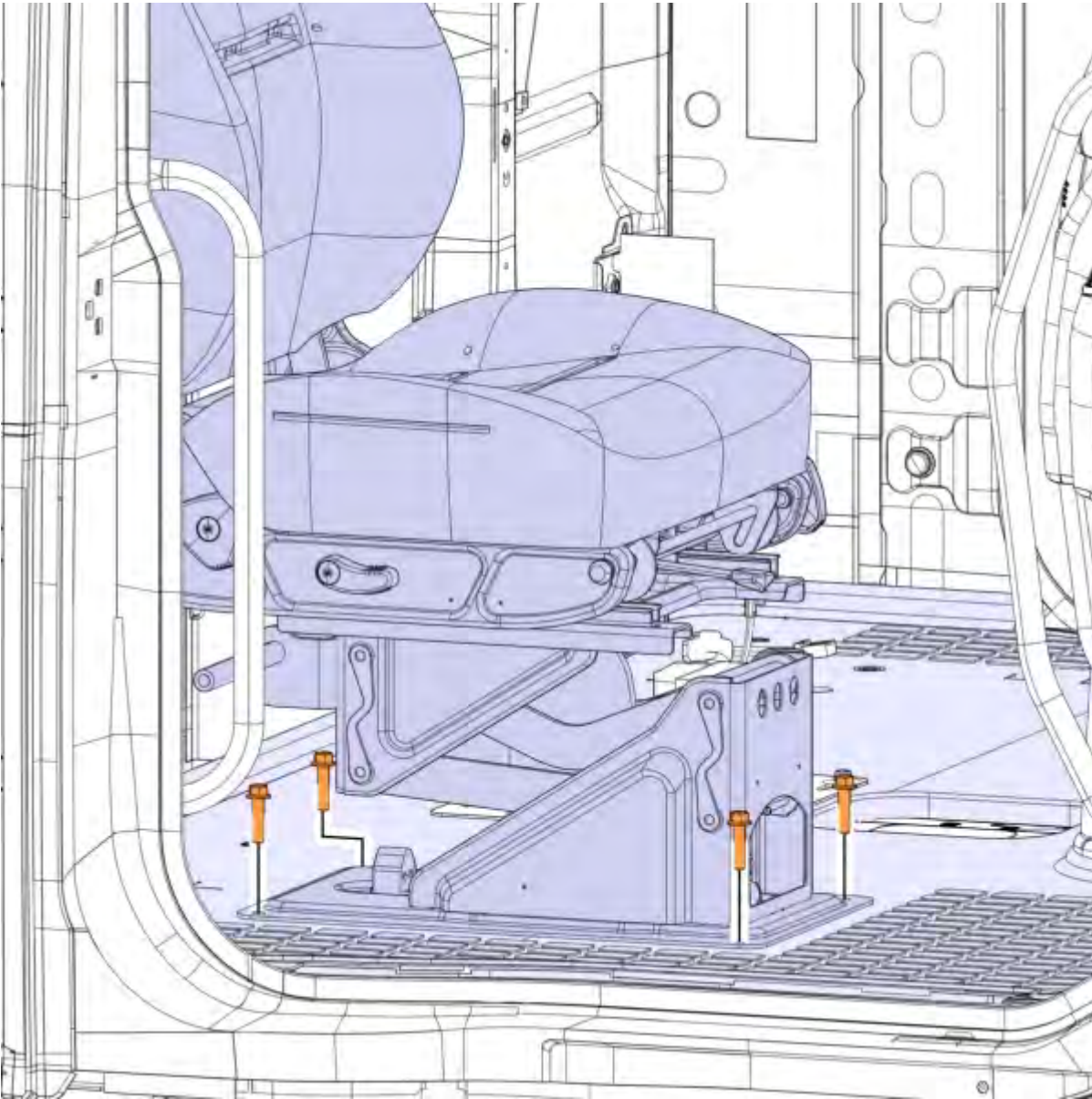
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Heavy component.	
▶	Exercise caution when moving the component. Assistance is required.

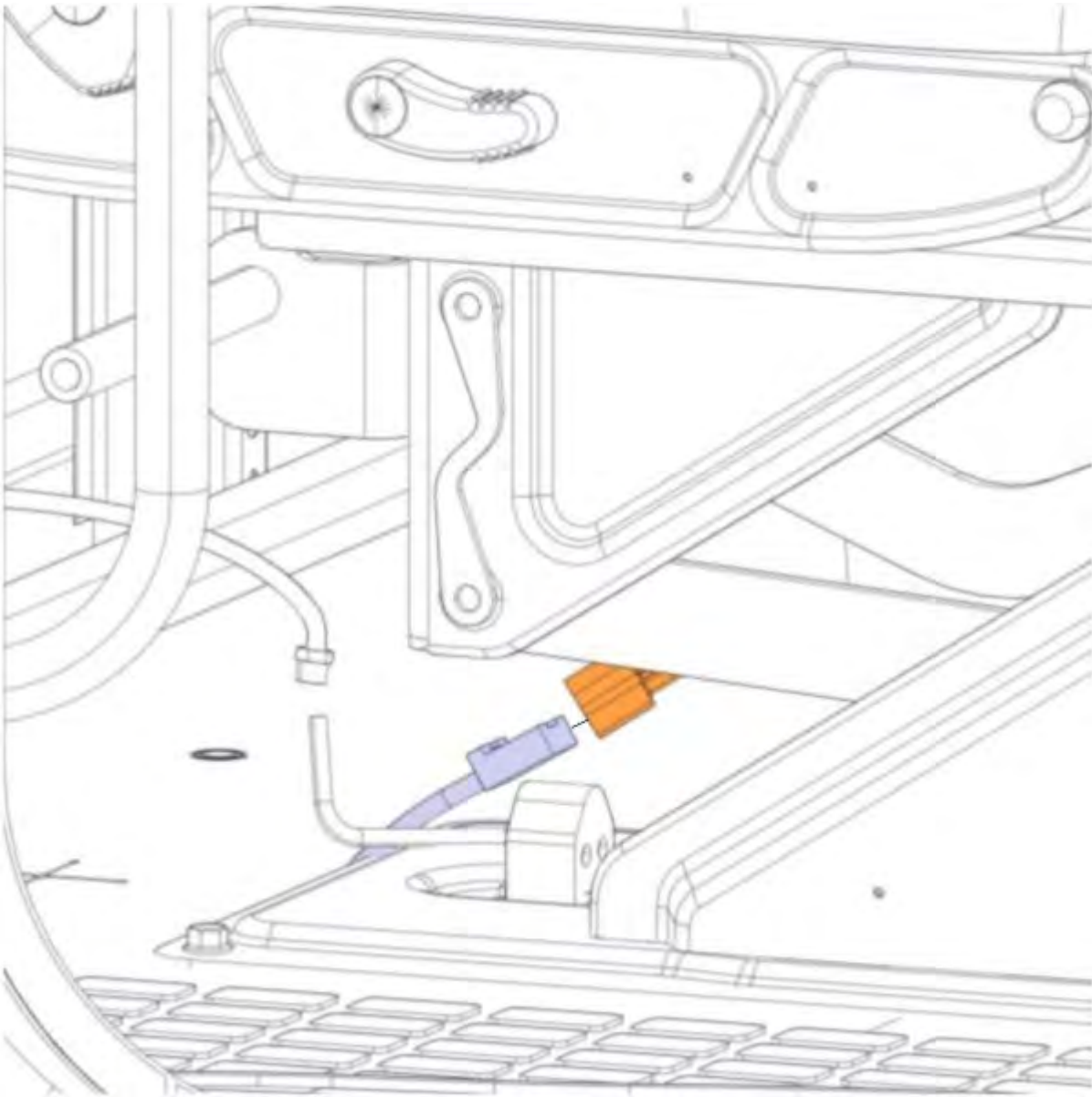
198	Position the seat in the cab.
-----	-------------------------------



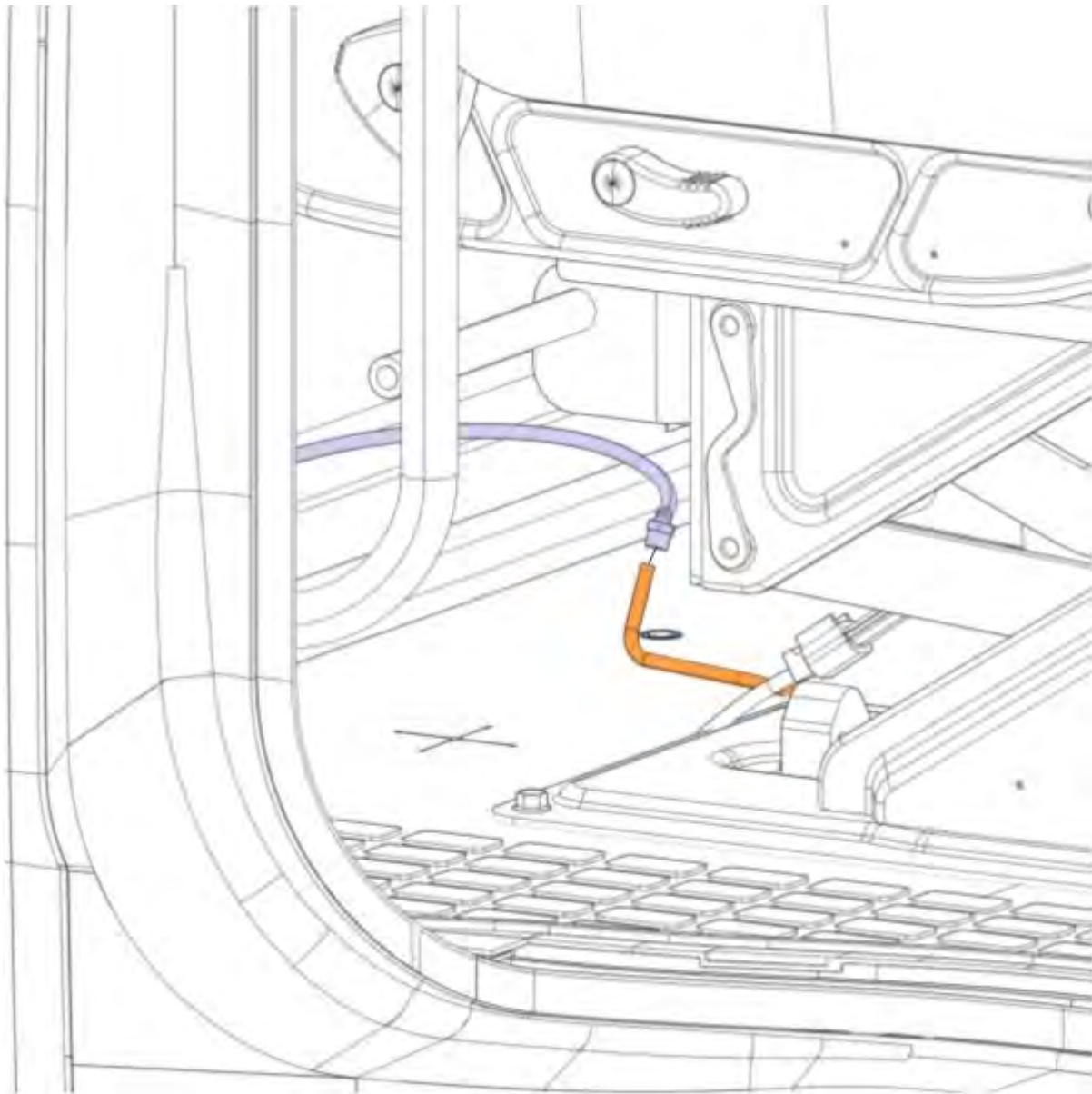
199	Install the screws.	
	Tightening torque	
	Seat, screw	M10
		48 ±8 Nm
		(35 ±6 lb _f ·ft)



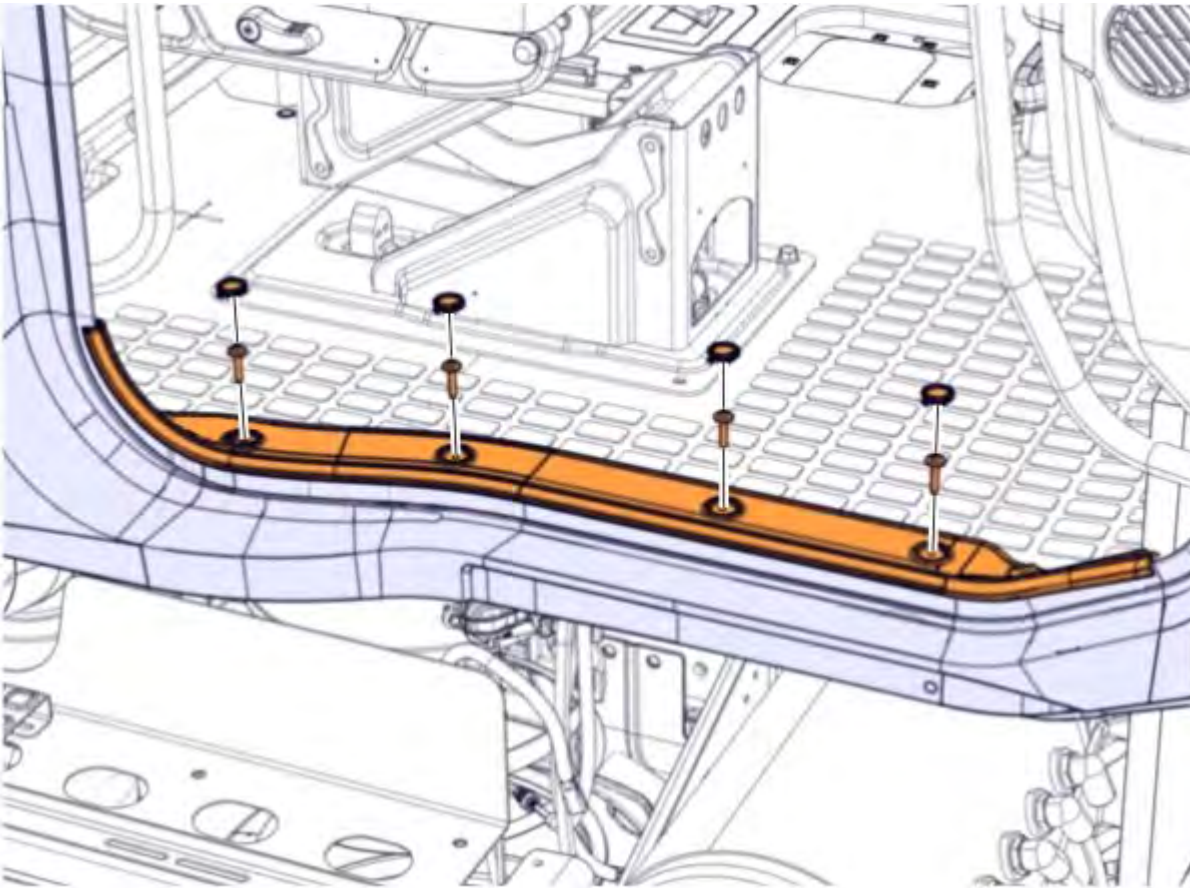
200	Connect the connector.
-----	------------------------



201	Connect the seat air hose.
-----	----------------------------



202	Install the seat belt.	
203	Install the panel.	
204	Install the screws.	
205	Torque tighten the screws.	
	Tightening torque	
	Interior panel, screw	3.4 ±0.6 Nm (30 ±5 lb _f ·in)
206	Install the protecting covers.	

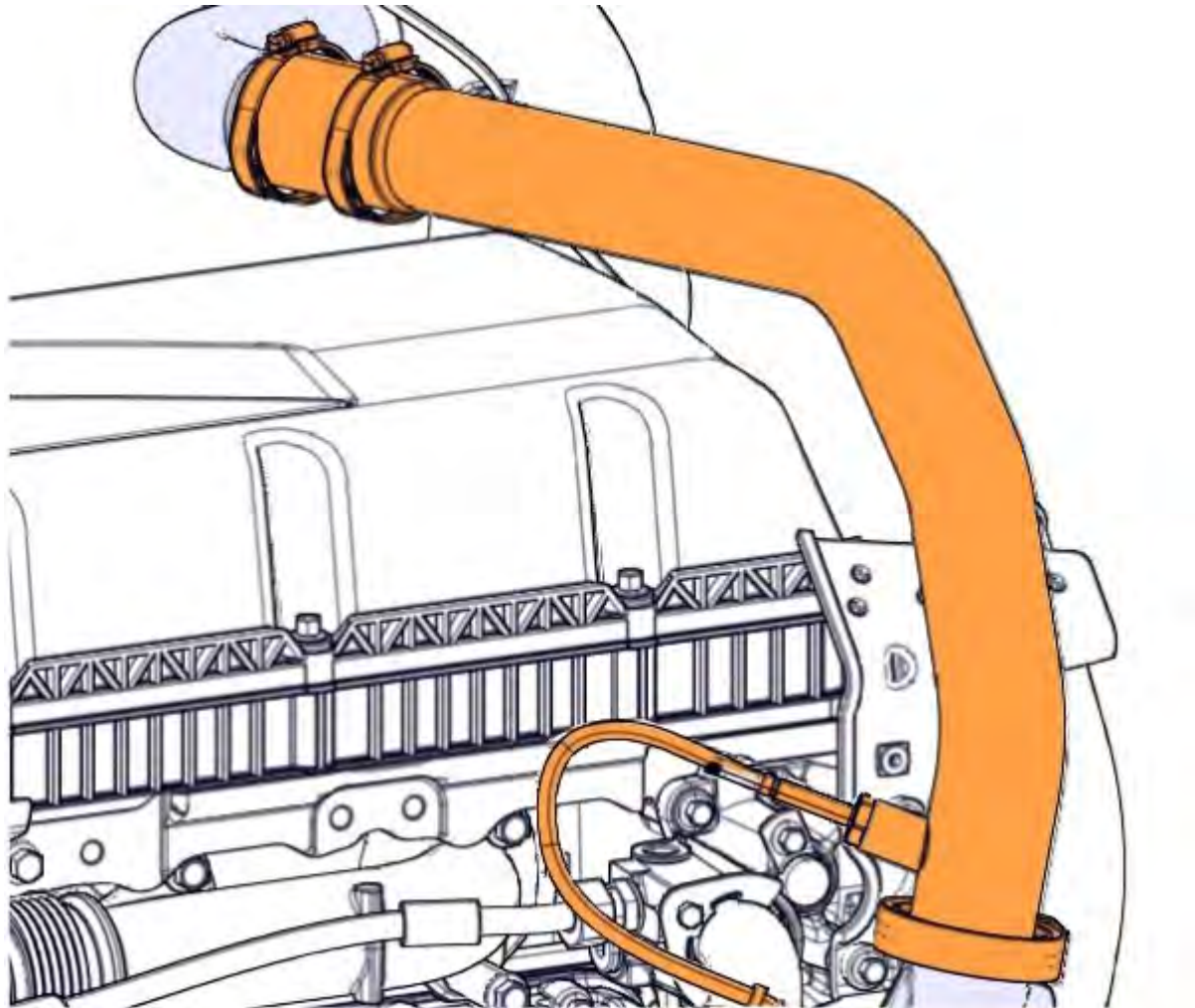


207 Install the pipe.



Note

Check the sealing ring and hose for damage; replace as needed.



208

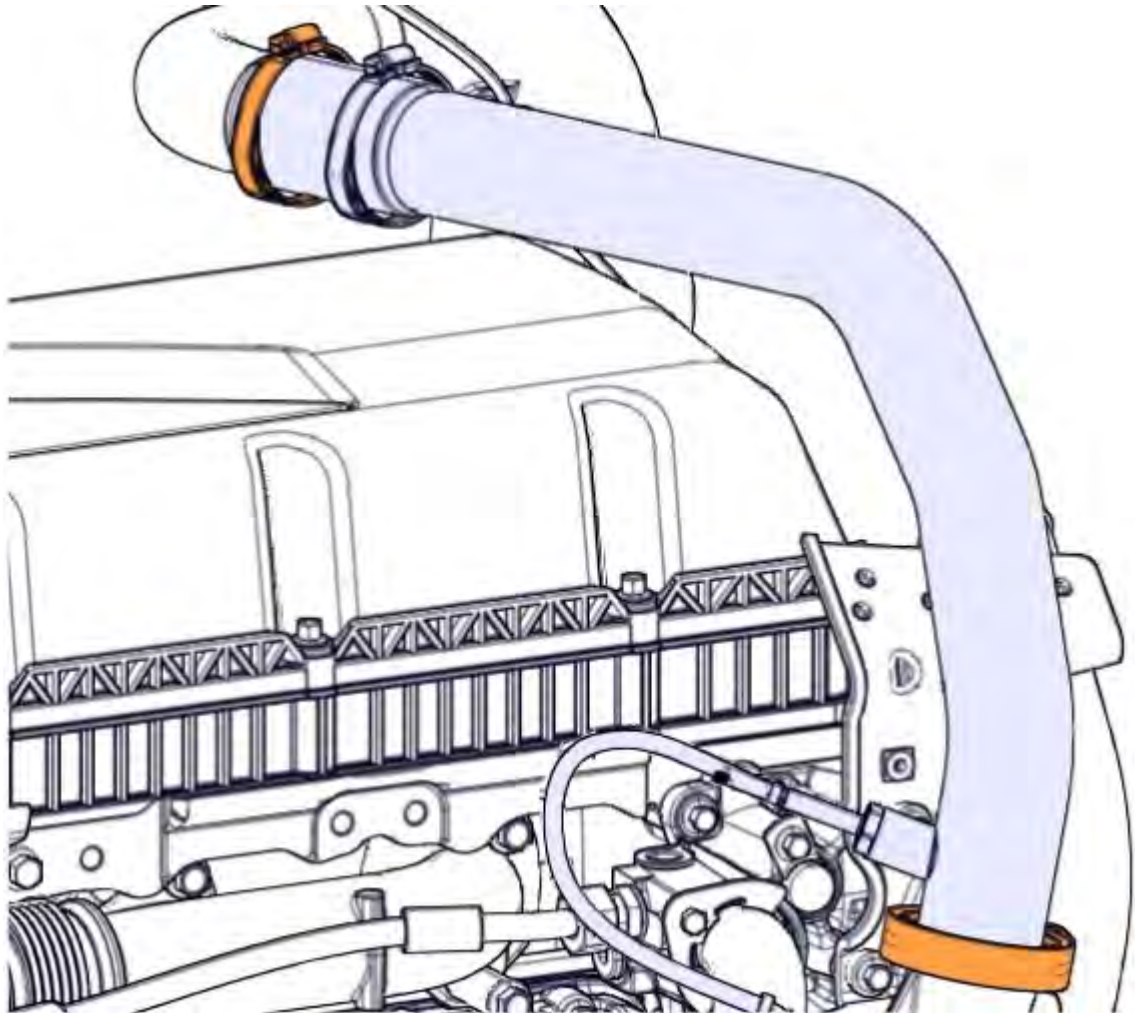
Position the clamps.

i

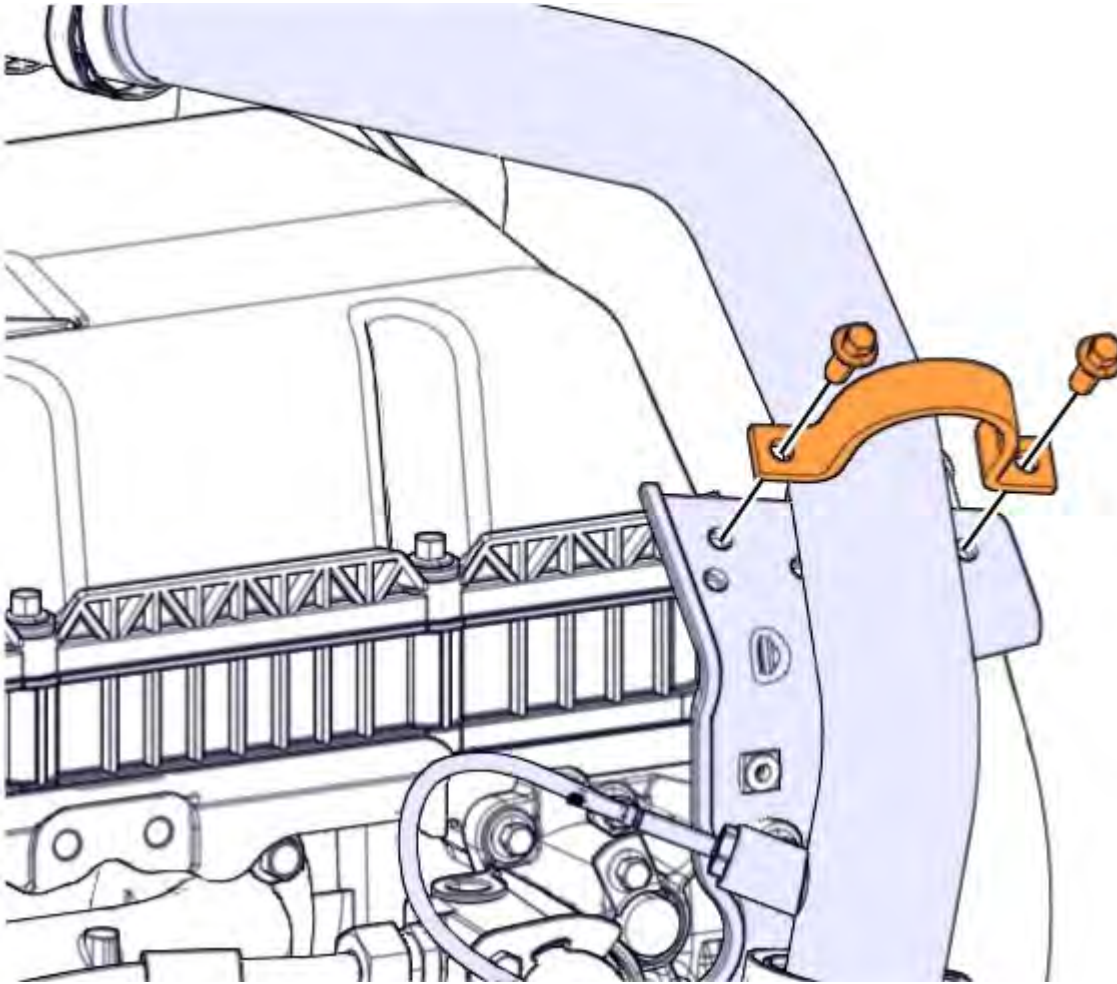
Note

As noted.

209	Tighten the clamps to torque.	
	Tightening torque	
	V band clamp screw	10.2 ±1 Nm (90 ±9 lb _f ·in)
	Tightening torque	
	Hose clamp	11.9 ±2 Nm (105 ±18 lb _f ·in)



210	Install the clamp.	
211	Torque tighten the screws.	
	Tightening torque	
	Screw	M8
		24 ±4 Nm
		(18 ±3 lb _f ·ft)

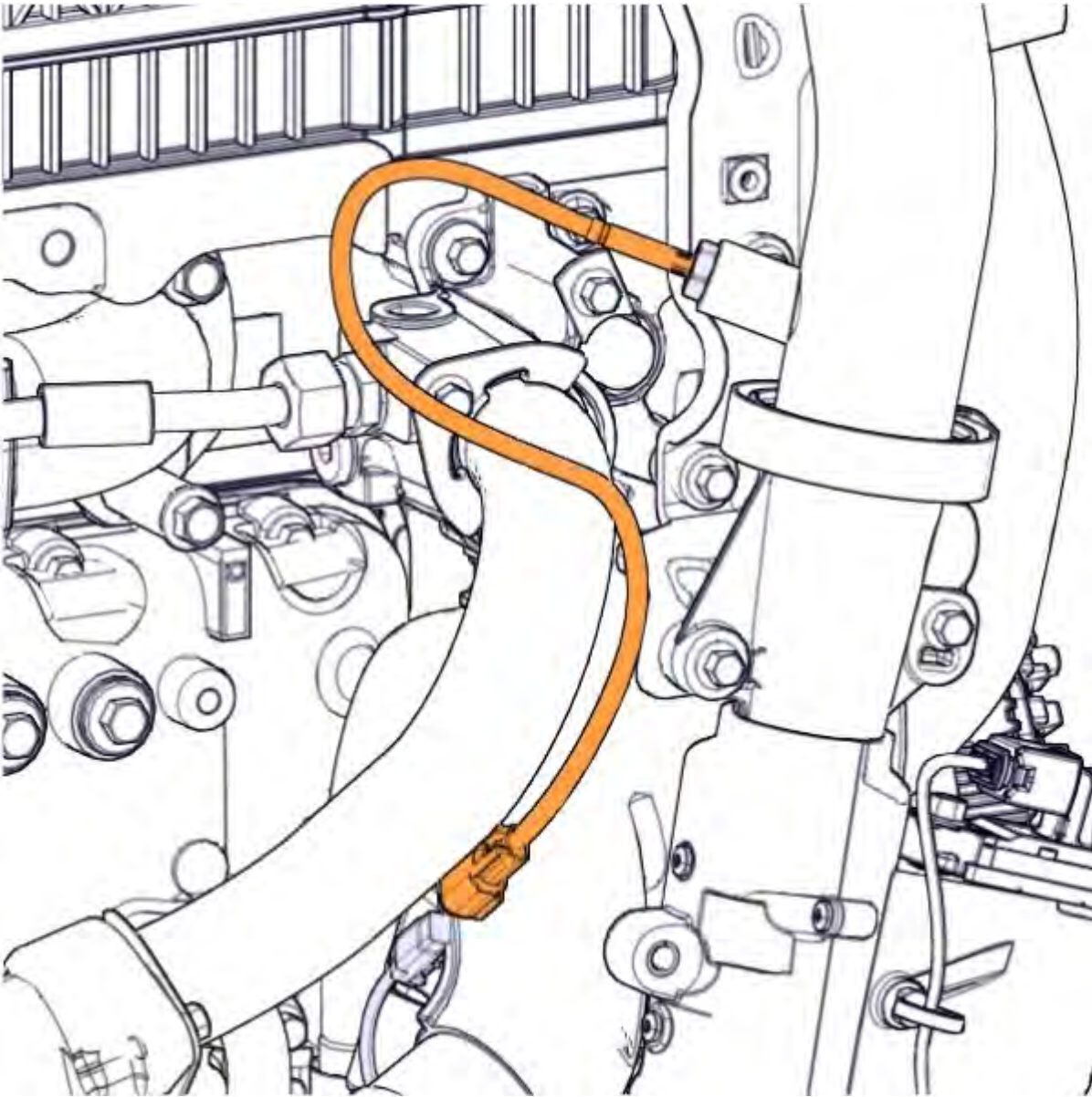


212	Connect the connector.
-----	------------------------

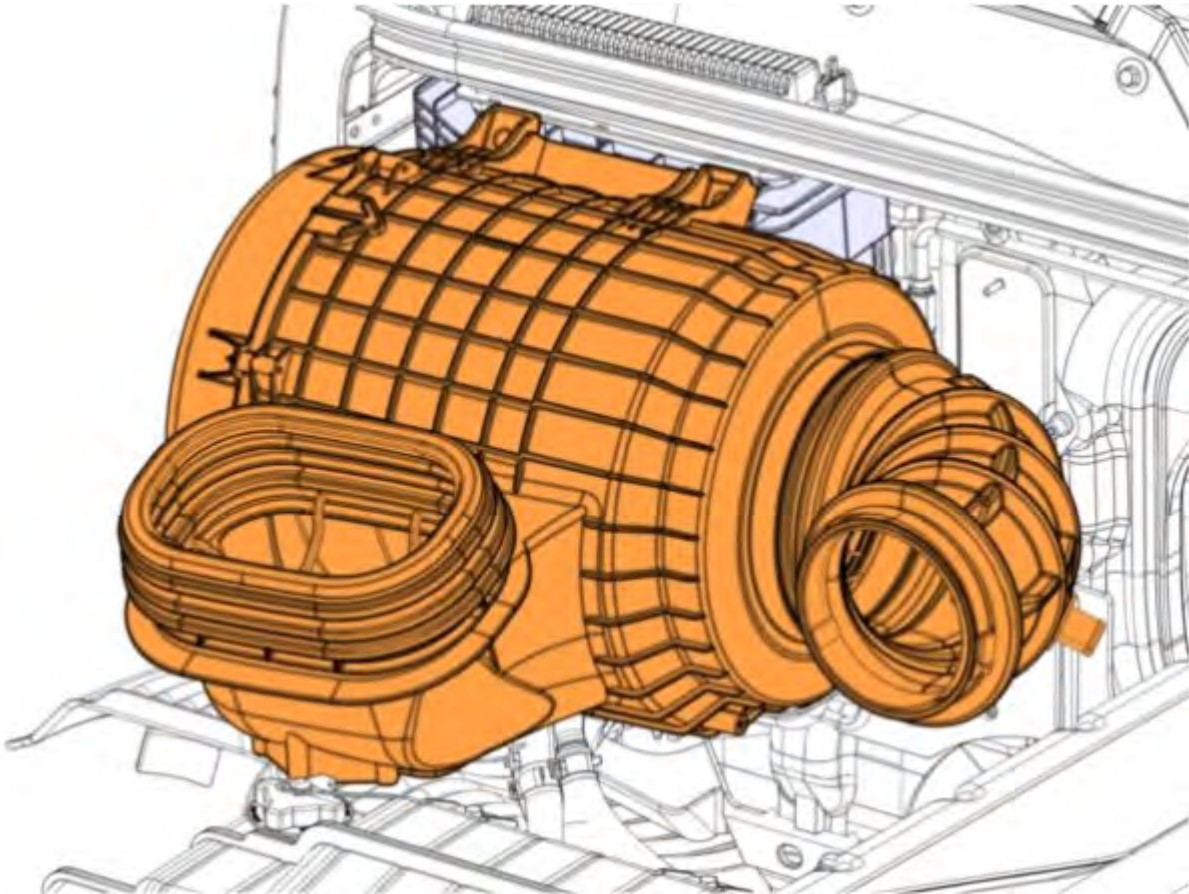
213	Install the cable tie.
-----	------------------------

**Note**

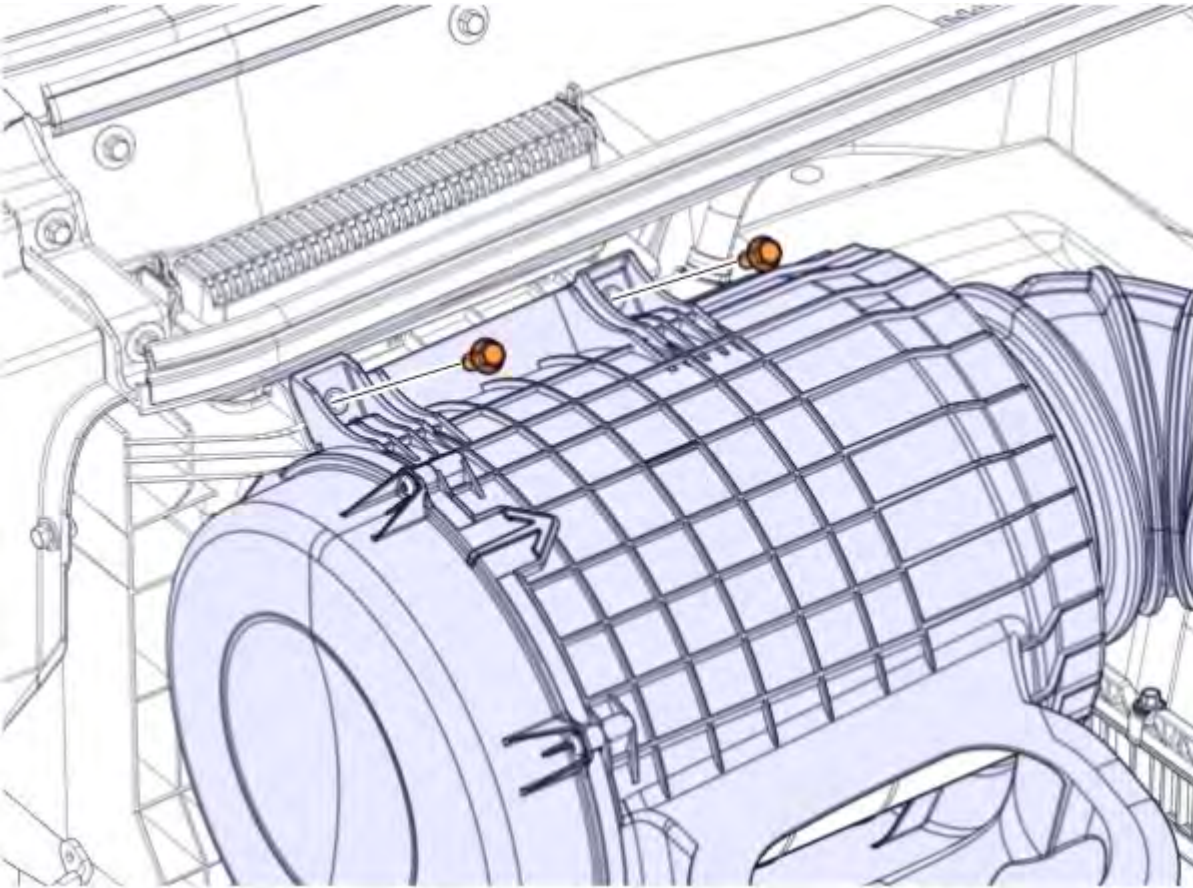
Use a new part.



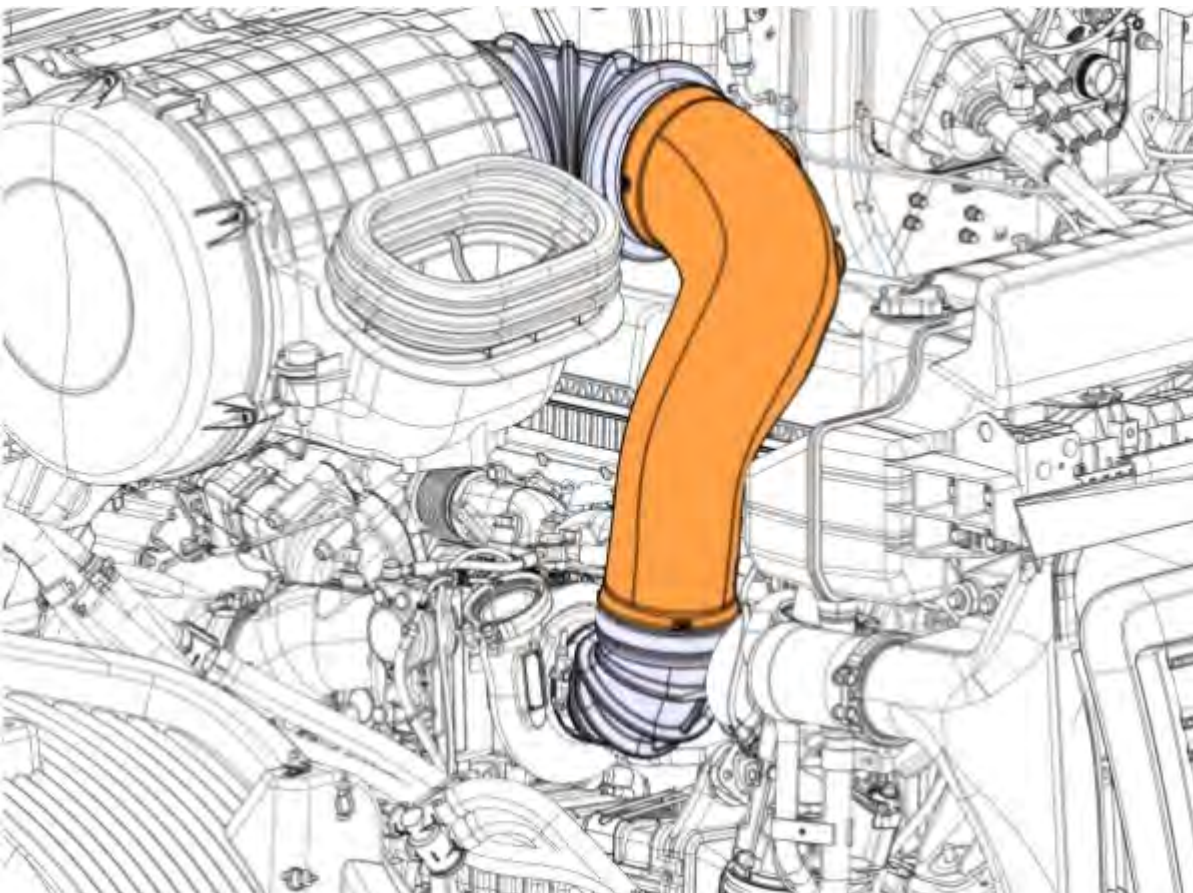
214	Install the air filter housing.
------------	---------------------------------



215	Install the screws.	
216	Torque tighten the screws.	
	Tightening torque	
	Screw	M10
		48 ±8 Nm
		(35 ±6 lb _f ·ft)



217 Install the air duct.

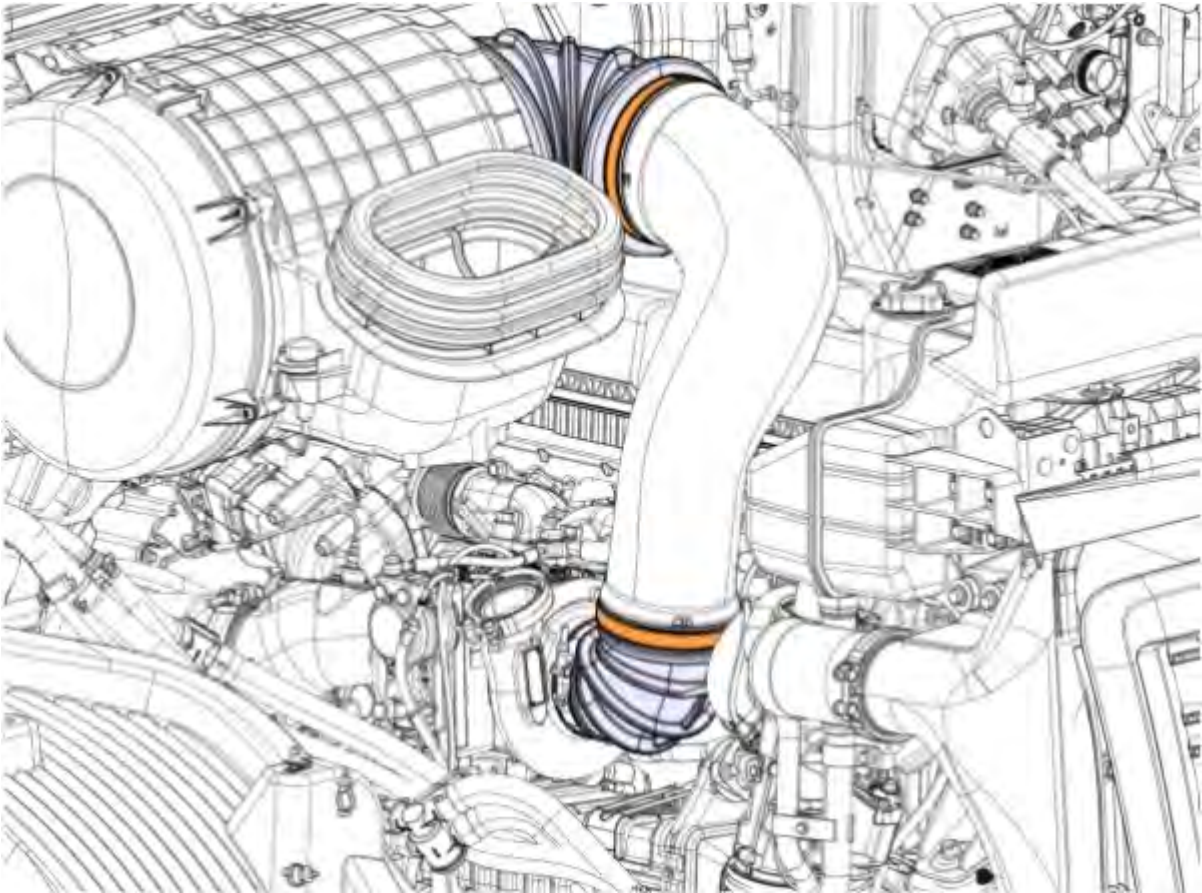


218 Tighten the clamps to torque.

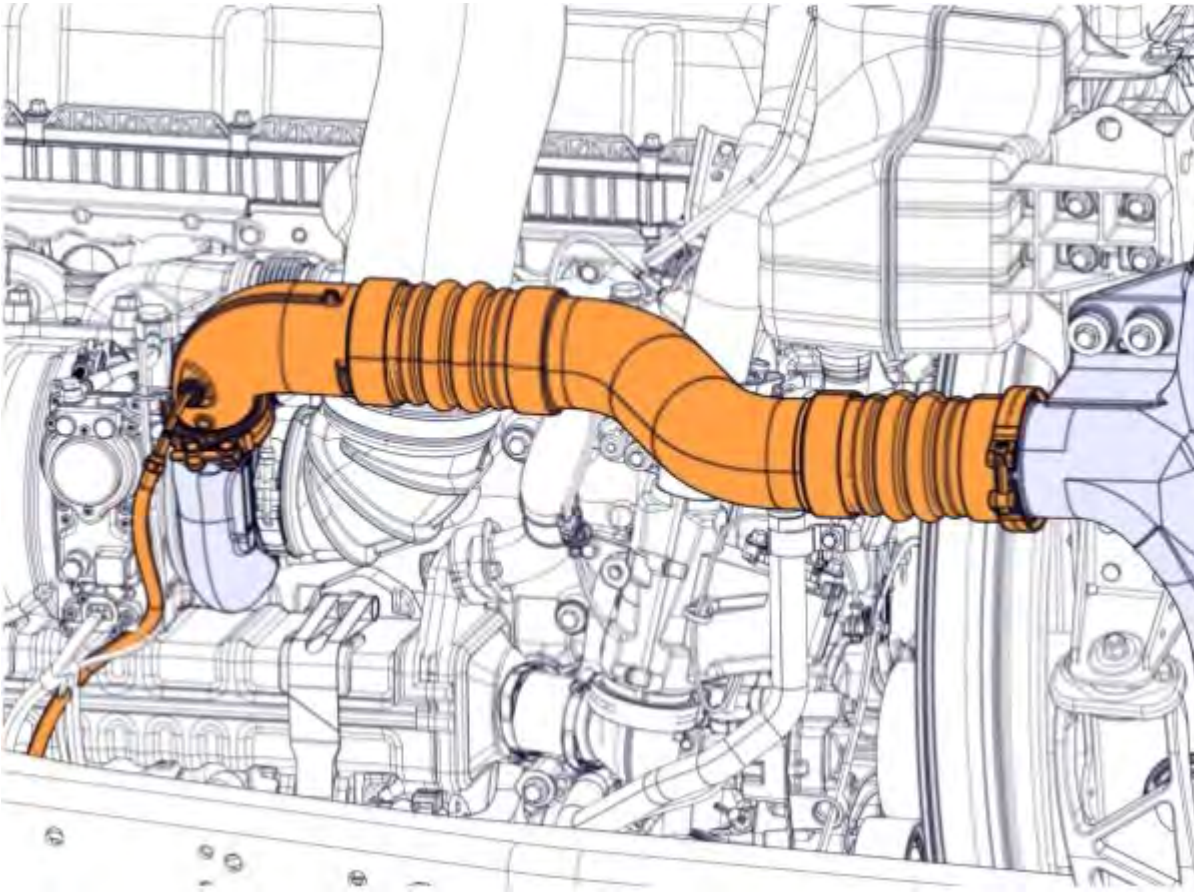
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Tightening torque	
Air duct, clamp	9 ±1 Nm (80 ±9 lb _f ·in)
i Note As noted.	

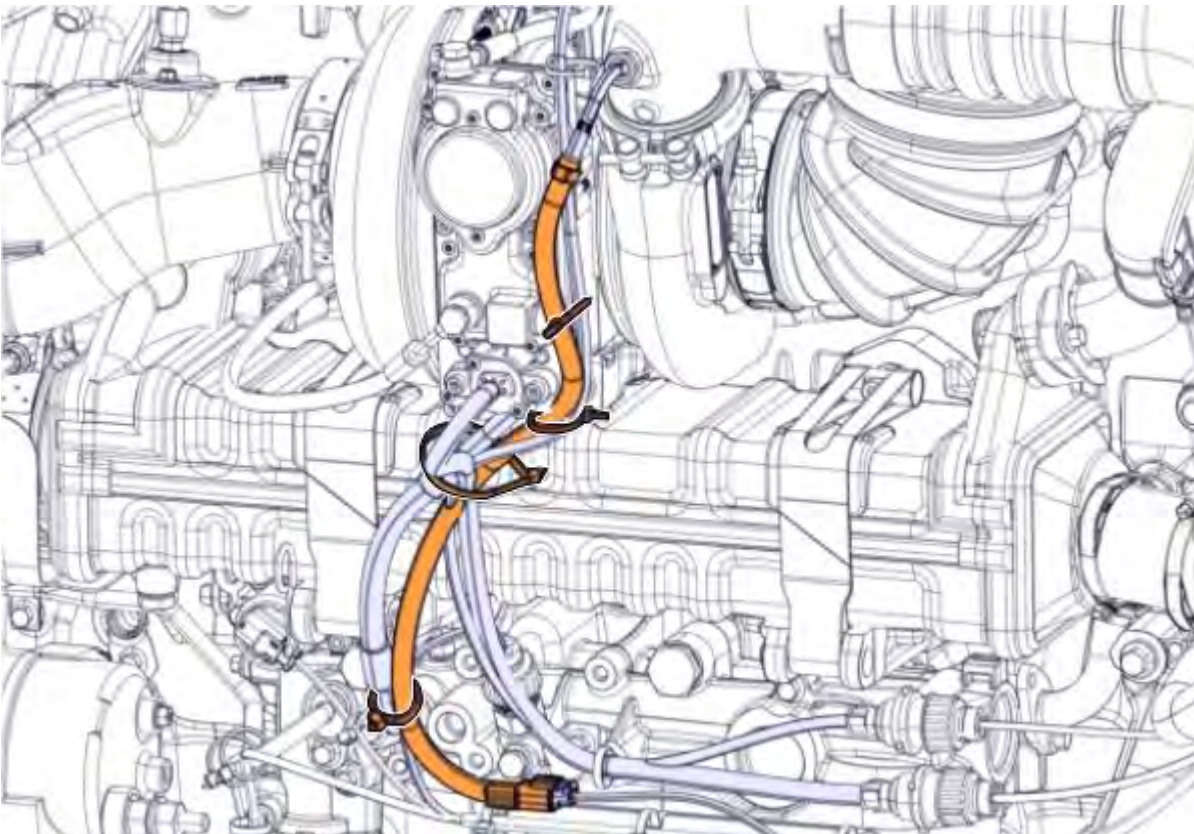


219	Install the pipe assembly.
i Note Inspect the seals, replace as needed.	
220	Torque tighten the clamps.
Tightening torque	
Air duct, clamp	9 ±1 Nm (80 ±9 lb _f ·in)



221	Connect the sensor connector.
-----	-------------------------------

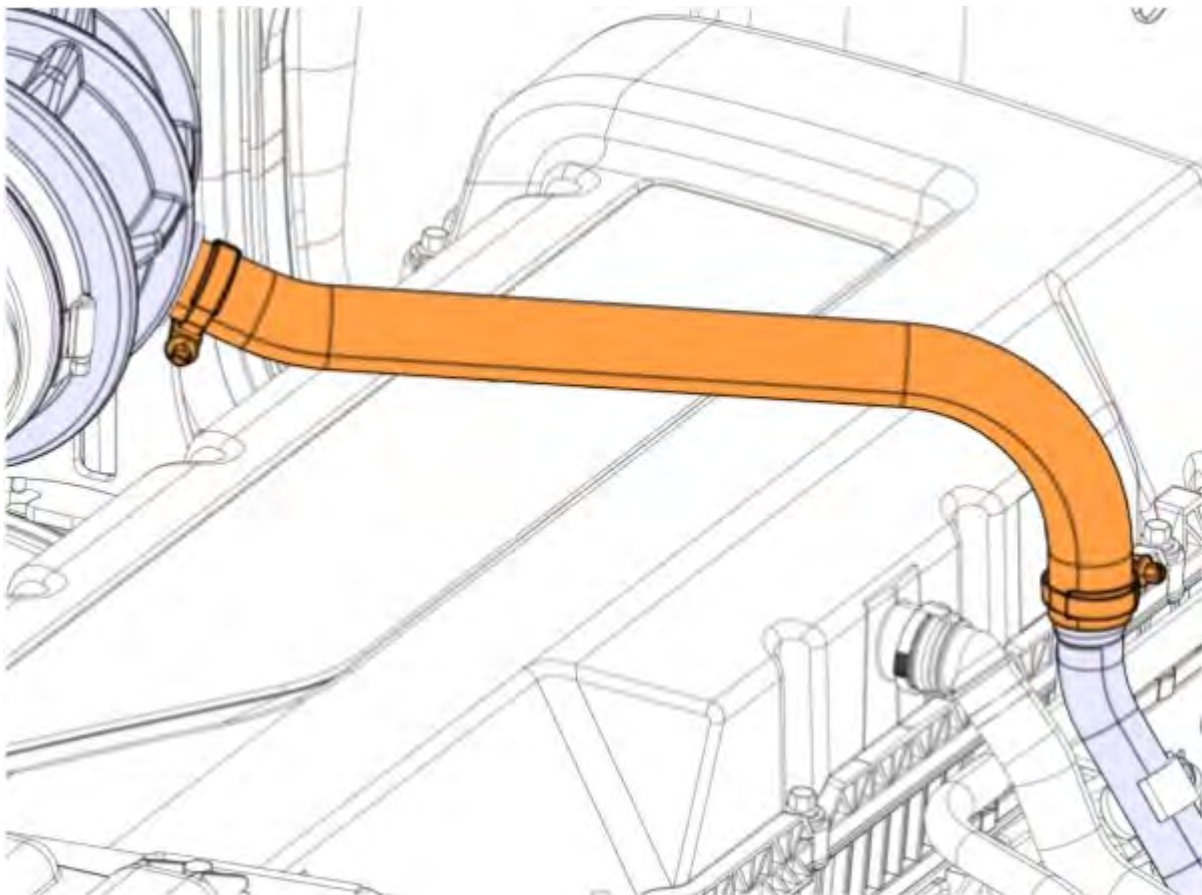
222	Secure the harness with the cable ties.
-----	---



223	Install the hose.
-----	-------------------

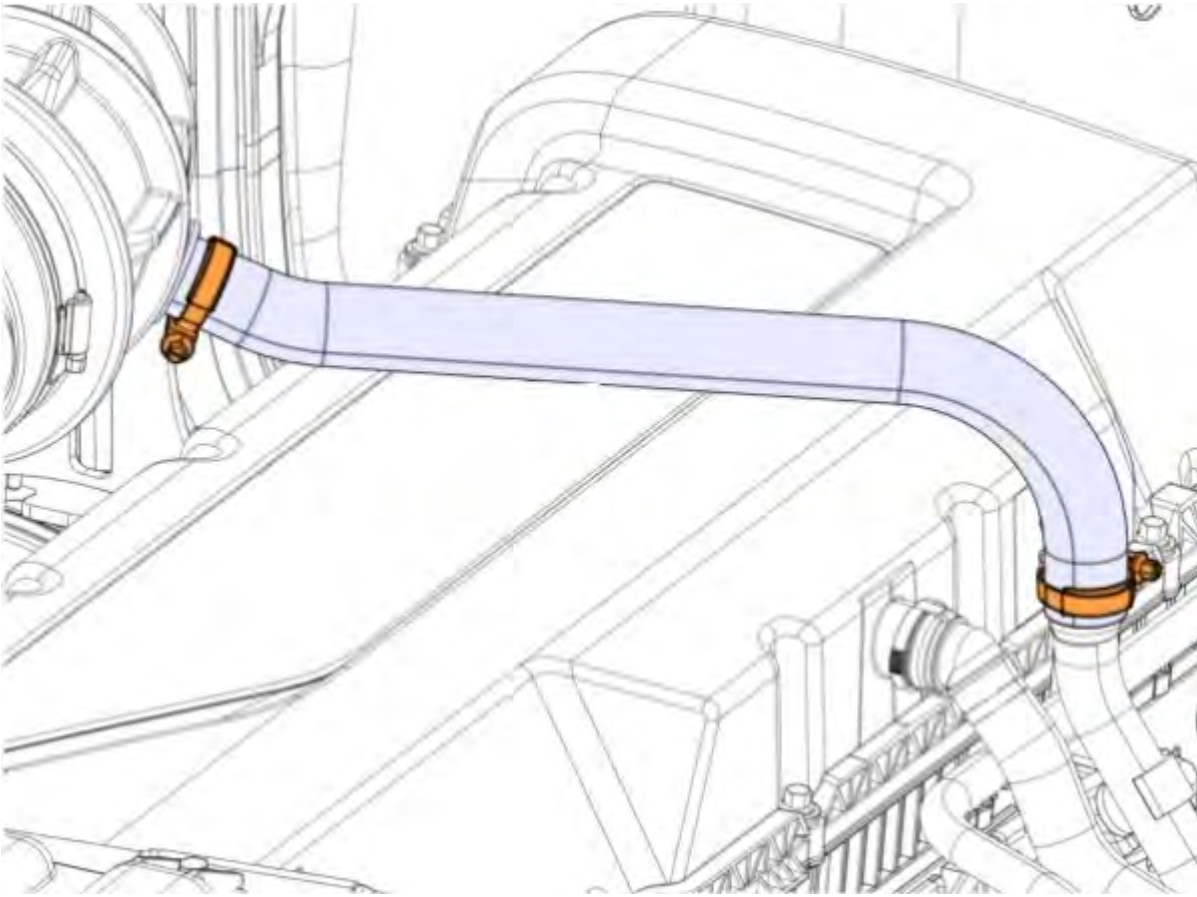
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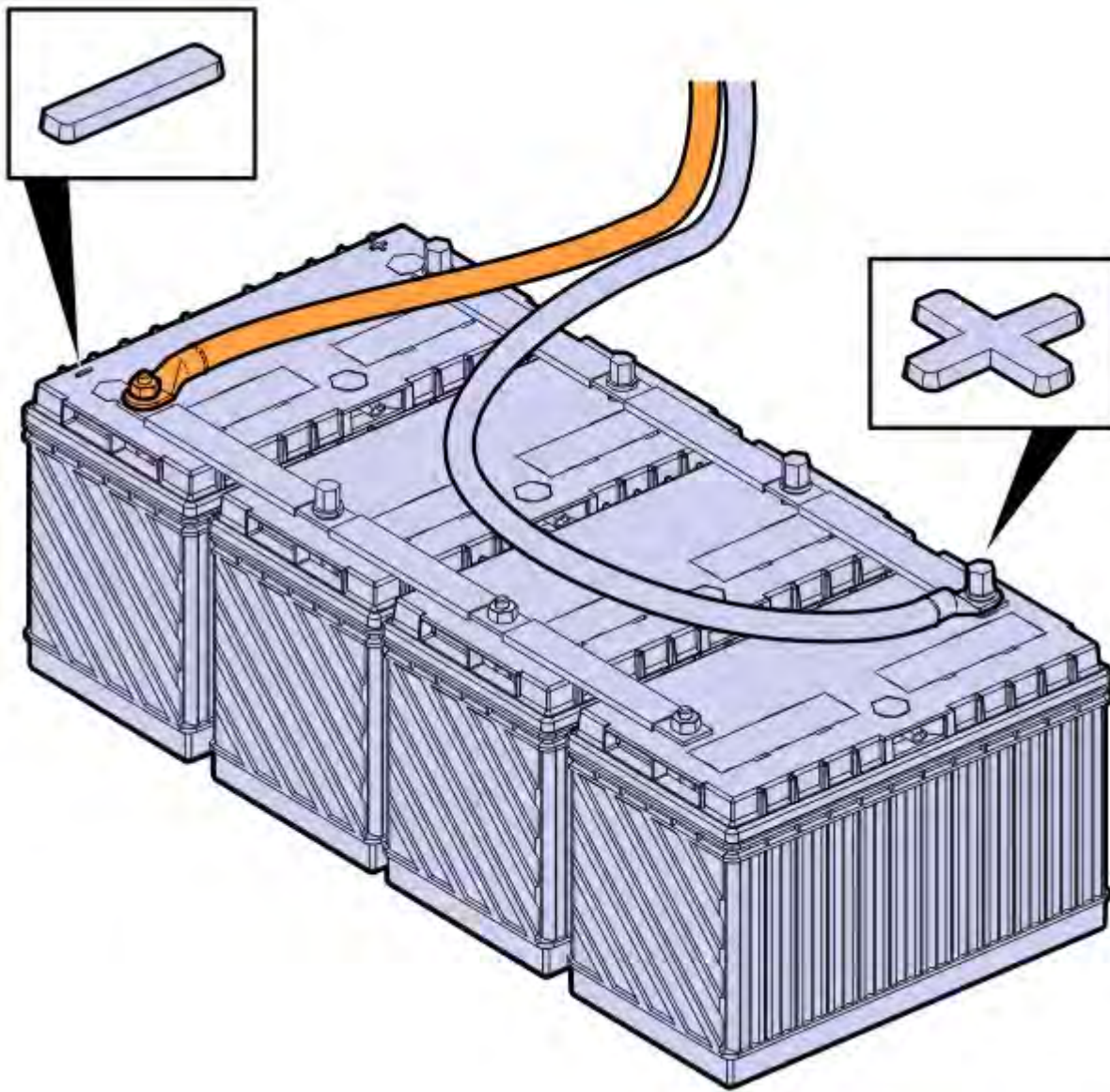


224	Position the clamps.	
	i Note	As noted.

225	Tighten the clamps to torque.	
	Tightening torque	
	Clamp, screw	3.95 ±0.6 Nm (35.0 ±5 lb _f ·in)



226	Connect the cable to the negative terminal.
------------	---



227 Fill the cooling system.



Note

Use approved coolant.

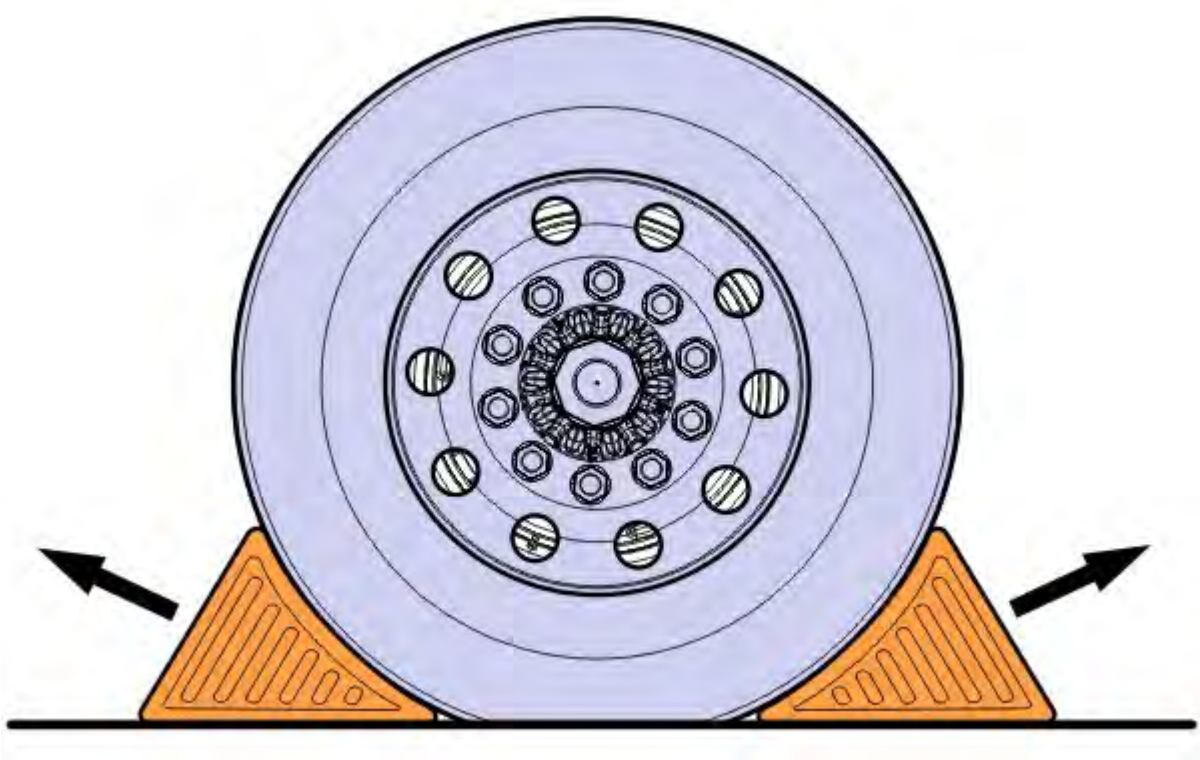


228	Start the engine.
229	Check for leakage.
230	Stop the engine.
231	Check the engine oil level and add if necessary.
232	Check the coolant level and top up if necessary.

233	Perform this procedure when the condition below is met.
	Conditions
	If the end cap is removed
	Install the end cap.

234	Lower the hood.
	 Note Ensure that the hood is latched.

235	Remove the wheel chocks.
-----	--------------------------



21574-3 Backlash Clearance, Camshaft, Adjustment

Valve cover, upper timing cover rocker arm shaft removed



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

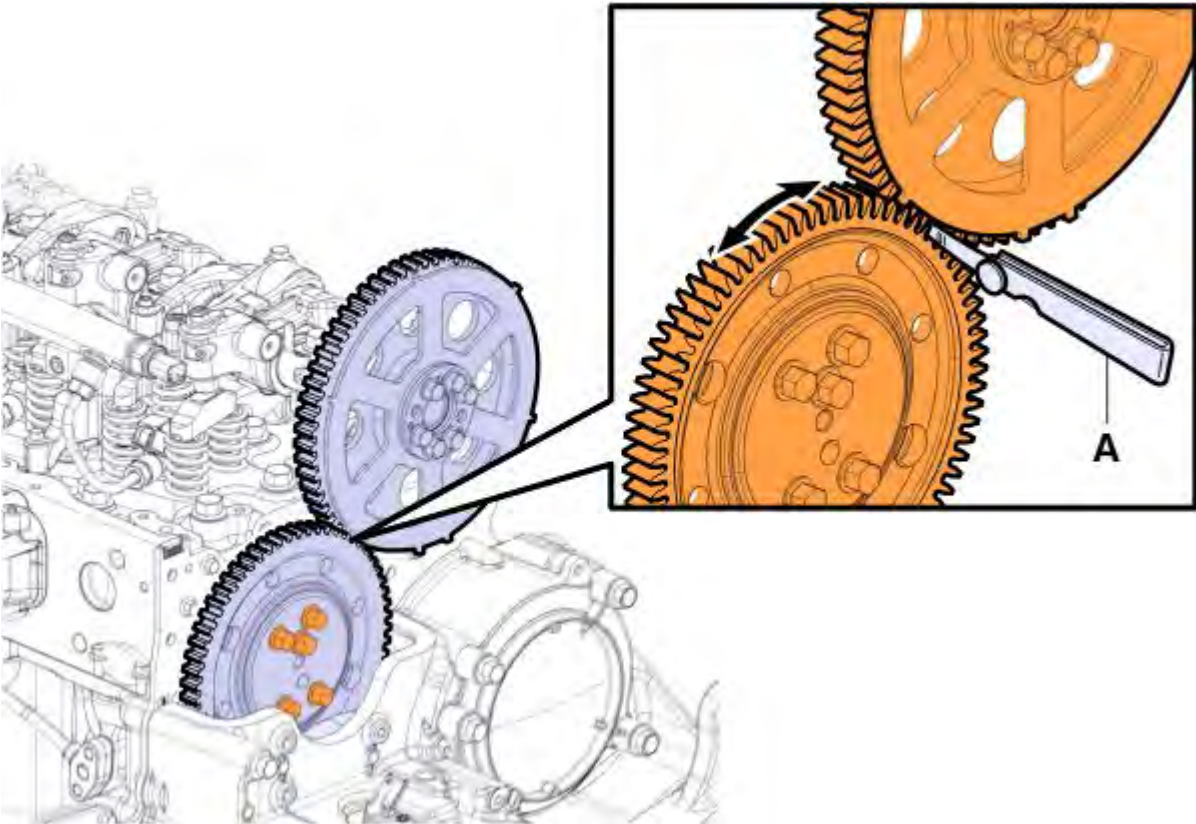


All threaded fasteners that do not have a tightening torque specification in the information are tightened to a standard torque. Standard torques are available in the following specification. ➡ [Standard Tightening Torques](#)

Special tools

9999683	9999696
-------------------------	-------------------------

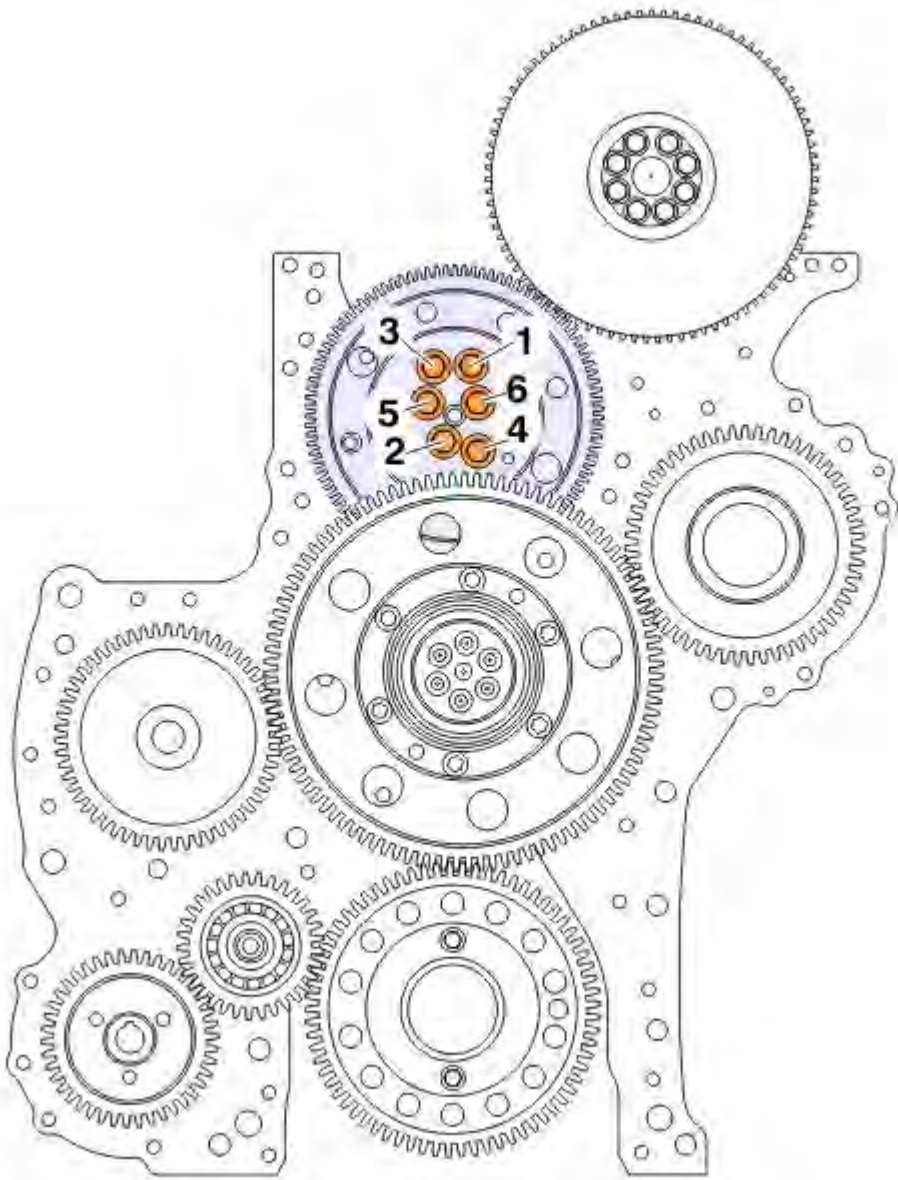
1	Loosen the screws in the idler gear.
2	Adjust the gear backlash clearance using the feeler gauge (A) by turning the gear.
Tech data	
Gear backlash clearance (A)	0.1 ±0.05 mm (0.004 ±0.002 in)



3	Torque tighten the screws.
---	----------------------------

Tightening torque	

Idler gear, screw	1.	Tightening sequence: 1–6
		35 ±4 Nm (26 ±3 lb _f ·ft)
	2.	Tightening sequence: 1–6
		120 ±5°



	Note	
	Leave the feeler gauge in place when tightening the screws.	

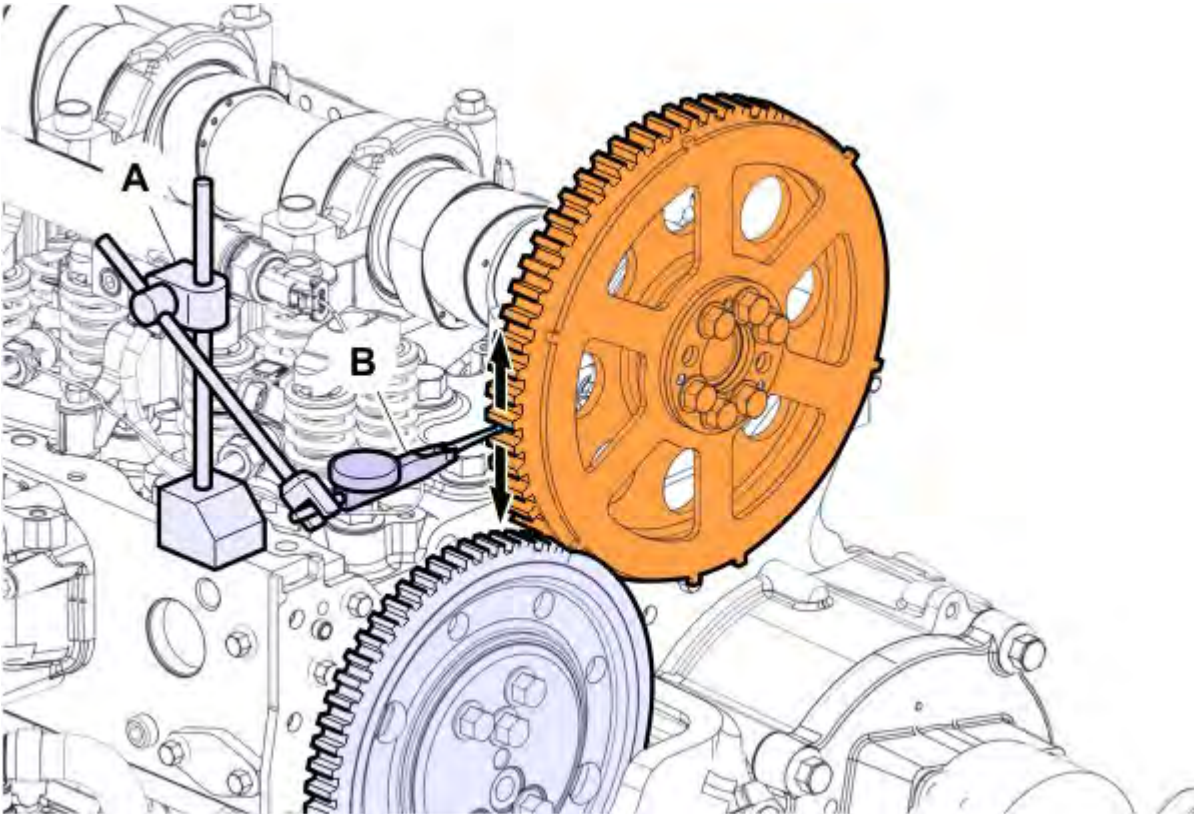
4	Check the gear backlash clearance using the tools (A) and (B) .	
	Tech data	
	Gear backlash clearance	0.1 ±0.05 mm (0.004 ±0.002 in)

Required material

ROCKER_INDICATOR	9999683
MAGNETIC STAND	9999696

**Note**

Hold the idler gear in place using a suitable tool to correctly check the gear backlash clearance.



5 Remove the tools.