

 Preview Solution CBR-2263-8

Mack Chassis - Timing Gear Plate Repair

Published 31 October 2024

Valid For

Mack AN, GR, LR, PI, TE model year 2018 to present

Solution

Information

As of October 2024, an updated part has been released with improved integrated seal. **The updated timing gear plate does not require seal conditioner.**

This solution has been updated to provide inspection guidelines for review prior to installing a new timing gear plate.

Repair Criteria

For inspection procedures and repair criteria, refer to TSB [M-212-003 Timing Gear Plate, Inspection](#) in Impact.

Tools

- **For Turbo Compound:** A new Turbo Component Support Tool has been developed. This tool is designed to support the TC unit in place while performing TGP Repair.
 - Tool Part Number 88800826.
 - For additional information, see Tool Bulletin [STB22-005M](#) and the [Trucks Academy Video](#).
- A list of other tools required can be found on the Job Aid included at the end of this solution.

Parts



- **PART KITS** have been developed to include all necessary parts for a complete repair.

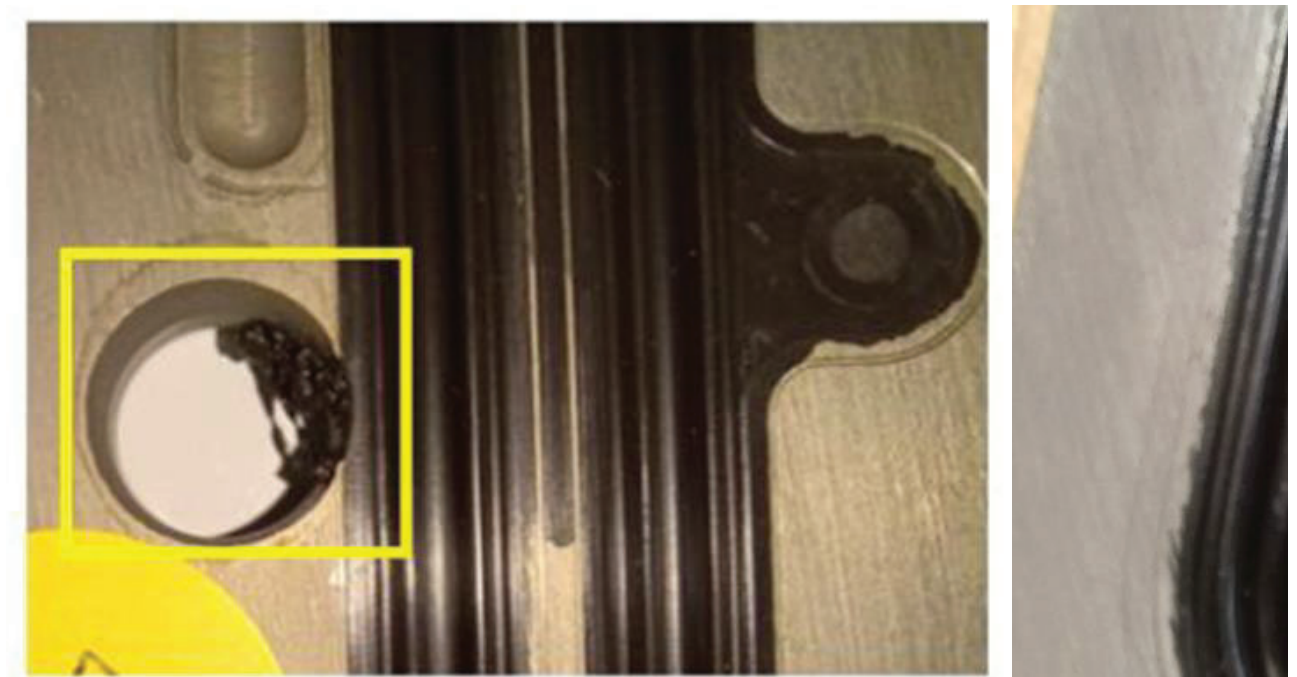
- **VGT Engines:** 24736966
- **Turbo Compound Engines:** 24736976

New Part Inspection

The new timing gear plate should be inspected prior to installation to ensure seal integrity. Refer to the images below for acceptable and unacceptable conditions.

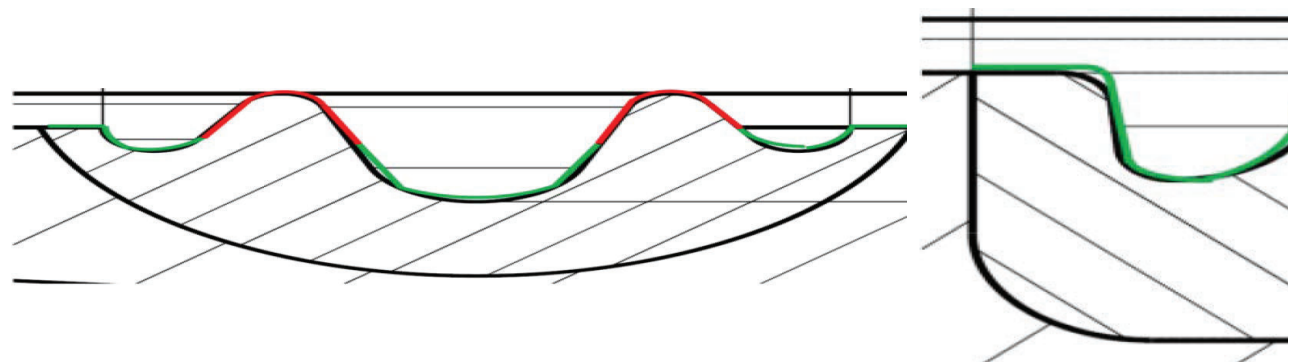
1. Bolt Holes

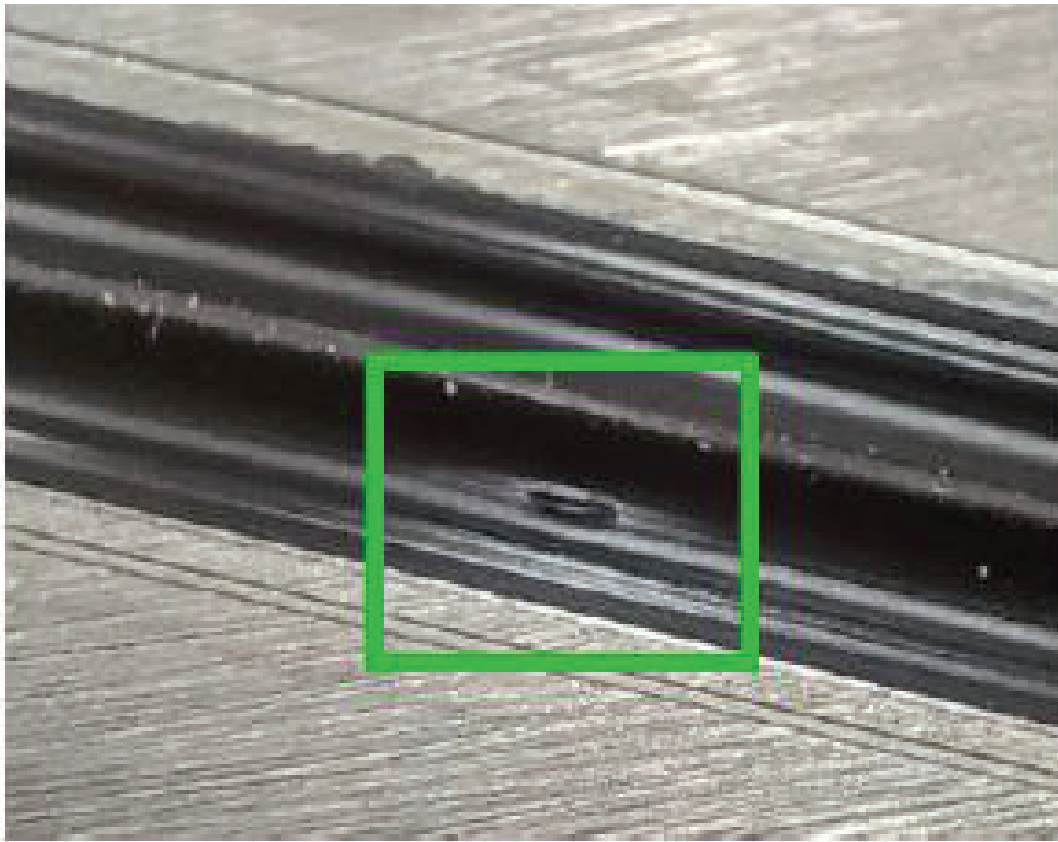
Extra seal material in bolt holes is acceptable and should be carefully removed prior to bolt installation.



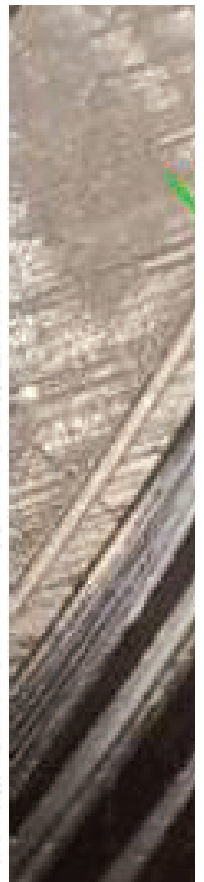
2. Surface Imperfection/Dents

If the Imperfection is in the groove section, the part can be used. If the imperfection is on the sealing beads, the part should not be used.





Good



Good



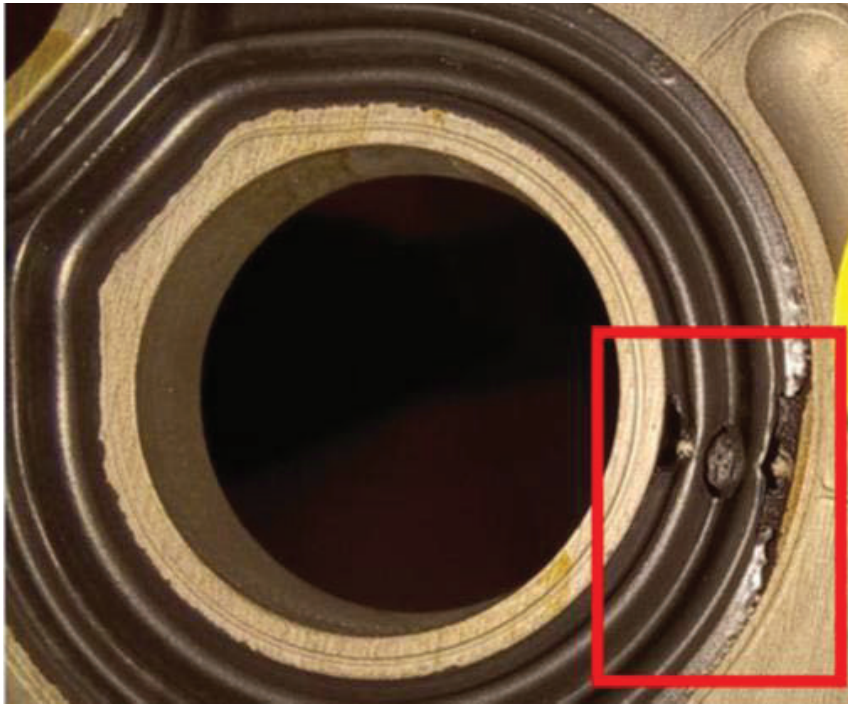
Do Not Use



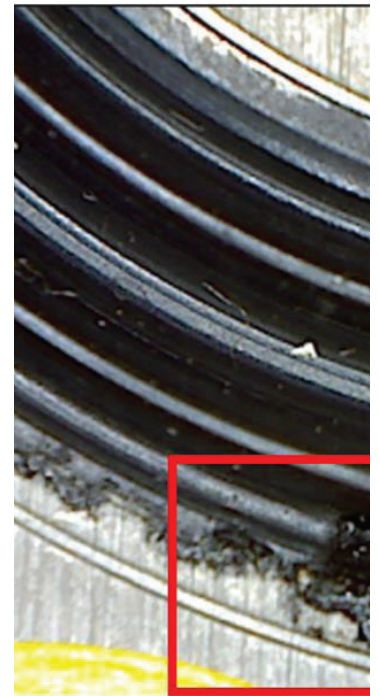
Do Not Use

3. Air Bubbles

If the air bubble is in the groove section, the part can be used. If the air bubble is on the sealing beads, the part should not be used.



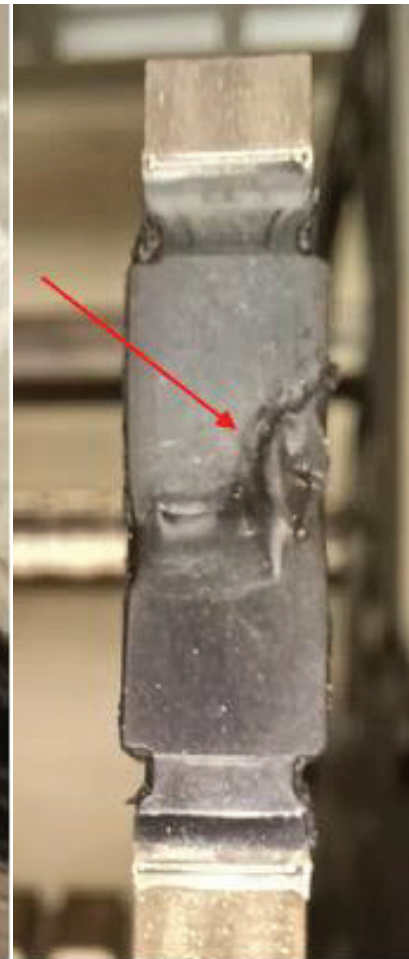
Do Not Use



Do Not Use

4. T Joint Dent/Imperfection

The edge of the T joint sections should be free of significant dents or blemishes.



Do Not Use

Repair

The timing gear plate replacement procedure in Impact should be utilized for this repair.

- The Impact procedure is Operation [2152-03-03-05 Timing Gear Plate, Replacement - Transmission and Clutch Removed](#).
- **IMPORTANT:** Loosening of the rocker shaft and overhead adjustment **IS NOT REQUIRED** when following the Impact instructions. There are new steps included in the Impact procedure for setting gear backlash.

Video

A video of the replacement procedure can be found below. Note that this video covers the old timing gear plate and includes application of the seal conditioner. **The updated timing gear plate does not require seal conditioner.**

Click the YouTube button in the lower right-hand corner of the video to view the video full-size.

Timing Gear Plate Repair



Job Aid

A Job Aid outlining repair times, document information, and a tool list can be found below (click on the pictures to expand to a larger size).



Mack TGP Job Aid v3.pdf

Warranty Information

Warranty Information can be found in the Warranty Operations Manual, [6.2.1.1 - TIMING GEAR PLATE - Clean Claim Template](#).

- Log in to TDP prior to clicking the link.

Additional Information

- Use of recommended oils is advised. The Recommended Oil List can be found in Impact or by clicking [here](#).

[Mack TGP Job Aid V3](#)



Share

to others that might find it helpful



Feedback

[Give feedback](#)

to help improve the content of this article

Timing Gear Plate, Inspection and Repair

M-212-003

(December 2022)

Valid for

All Mack Powered Trucks 2017 to current

Case description

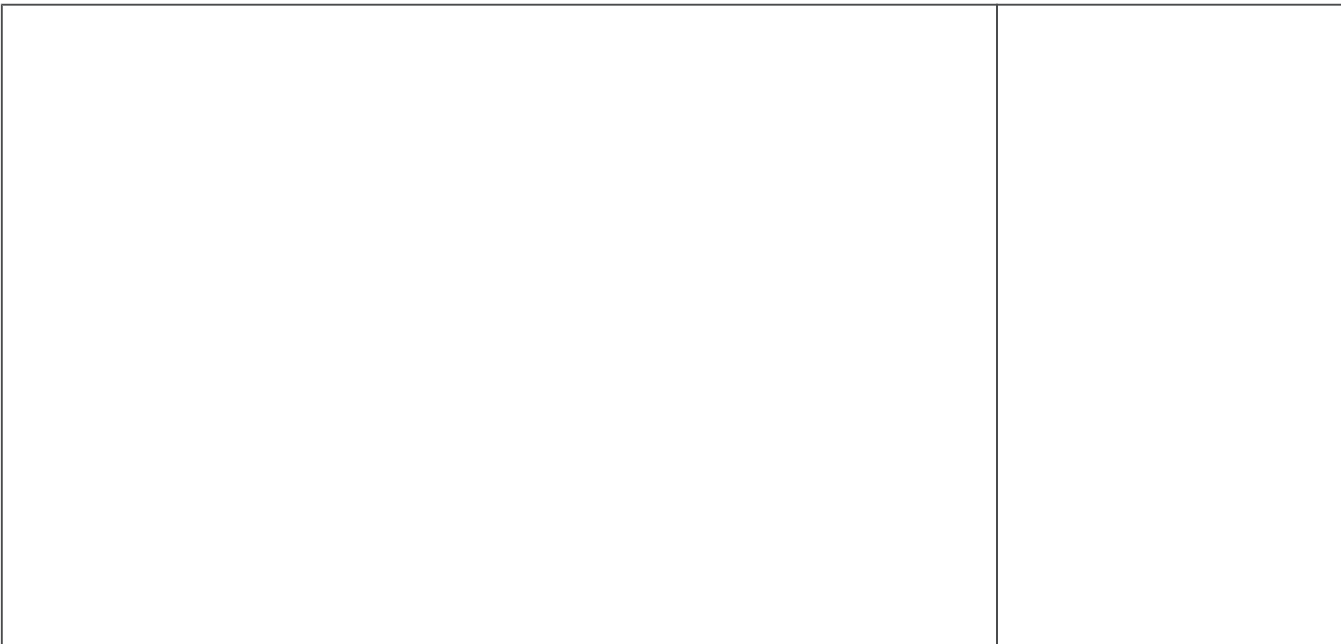
Mack Trucks with an 11L and 13L engine utilize two types of timing gear plates. In some instances, the timing gear plates may show evidence of an oil leak or oil weep. The information in this publication describes the differences between the two types of timing gear plates used, the inspection criteria for determining an oil weep vs an oil leak, and the recommended best practices for how to properly diagnose a leak, and what is considered a valid repair and updated repair instructions.

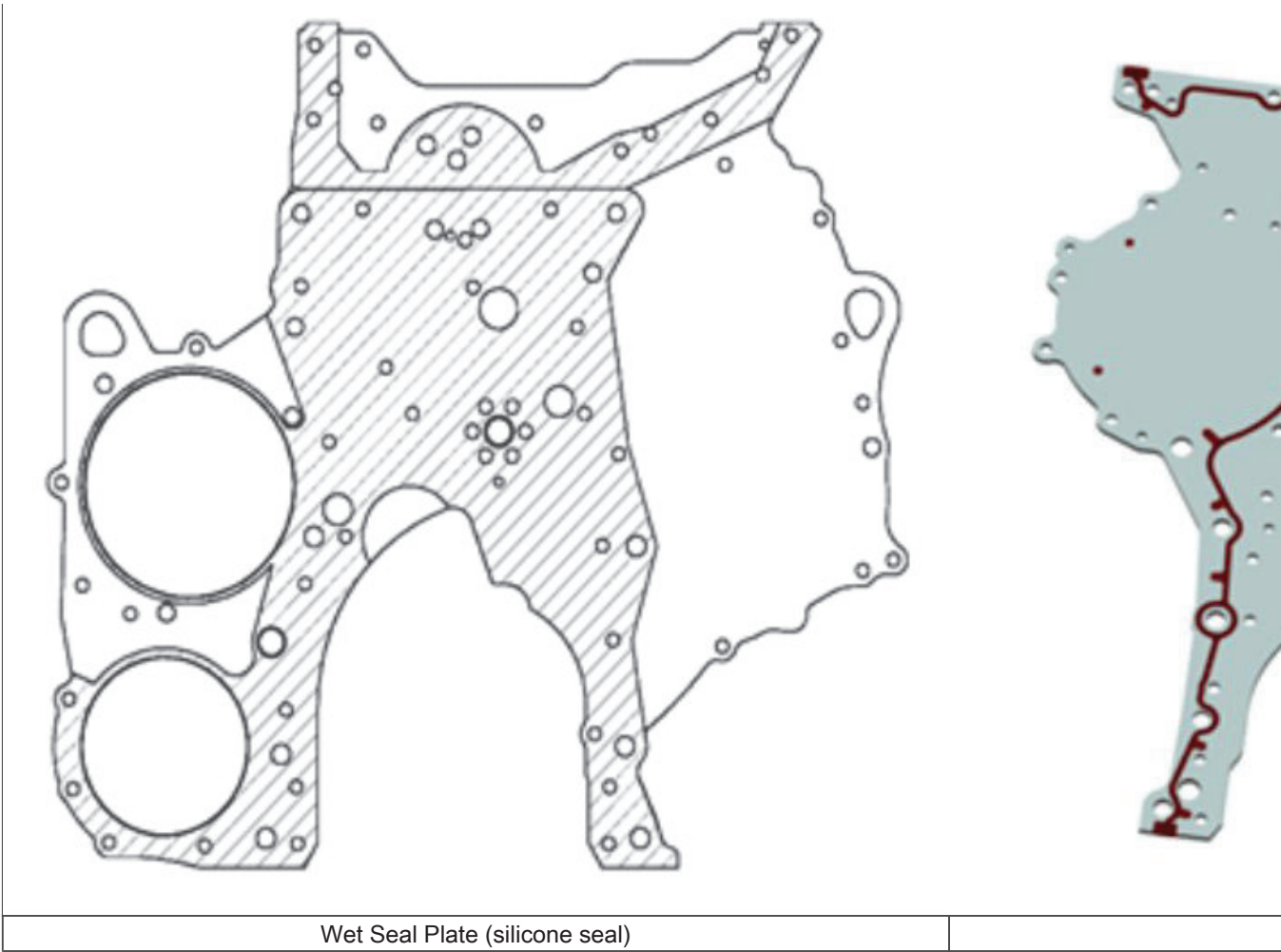
Types of timing gear plates

Wet seal plates are multiple time use and can be removed, cleaned and reinstalled with new sealant. Wet seal plates are used on 11L-13L engines from the start of production to current on the 11L and through April 2018 on the 13L VGT engines. The 13L turbo compound engine has never been built using the wet seal plate.

Important Note
13L Engine with a wet seal plate can be upgraded to the new integrated seal plate but will require additional components to be replaced. Refer to TPI 212-031, Timing Gear Plate for required parts list.

Integrated seal plates were introduced into production in 2017 models built with the 13L Turbo compound engine and 13L VGT engines built after April 2019. If a leak is found on an integrated seal plate or any damage is found to the integrated seal the plate must be replaced. The integrated plate is not repairable and must be replaced if any damage is found.





Repair criteria

Oil leak can be classified into two different categories, a weep, or an active leak.

Oil Weep is determined by the appearance of a thin accumulation of oil on the exterior of a part. The area will look like a dark stain or look damp in appearance (but not wet or dripping) and will likely collect dust and dirt.

Note: An oil weep is a normal condition seen around mechanical joints and does not require a repair.

Oil Leak is determined by the identification of oil actively accumulating on the exterior of a part. The area will be visibly saturated, can be seen actively accumulating and running from the area.

Note: An active leak is the only leak that is considered a valid warrantable repair.

Use the images below for a visual reference of the leak categories. If farther assist in needed determining the leak category, please follow normal support procedures.

Reference images of an oil weep (not a valid warrantable repair)	

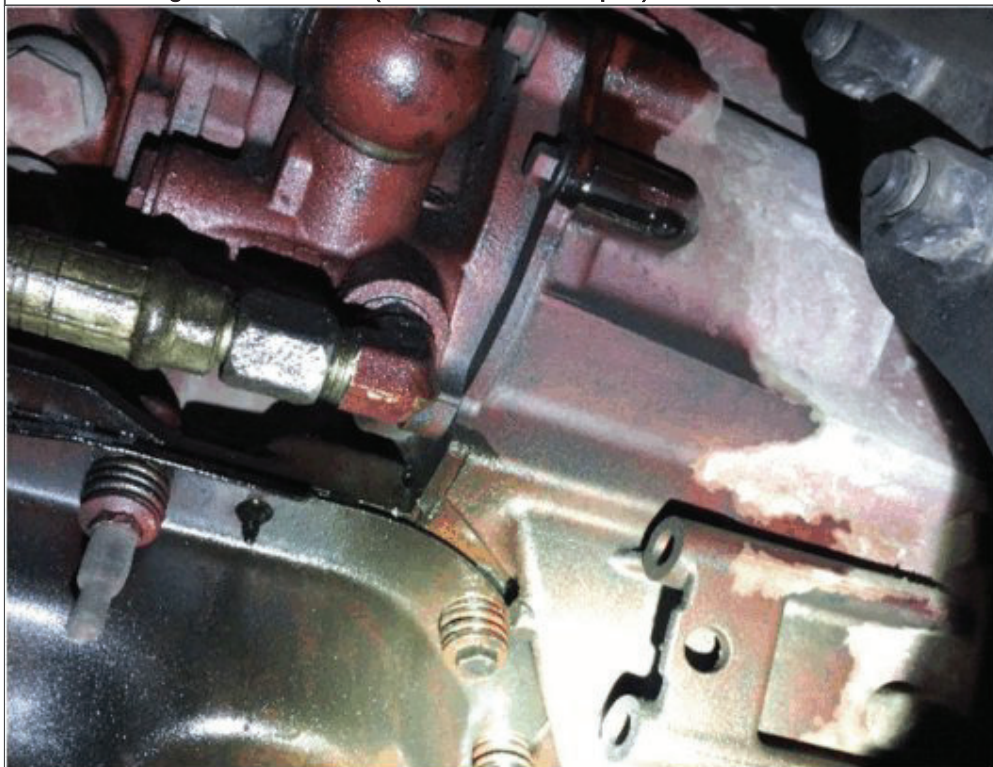


Dark spot or stain



Colle

Reference images for an oil leak (valid warrantable repair)



Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

Oil actively leaking

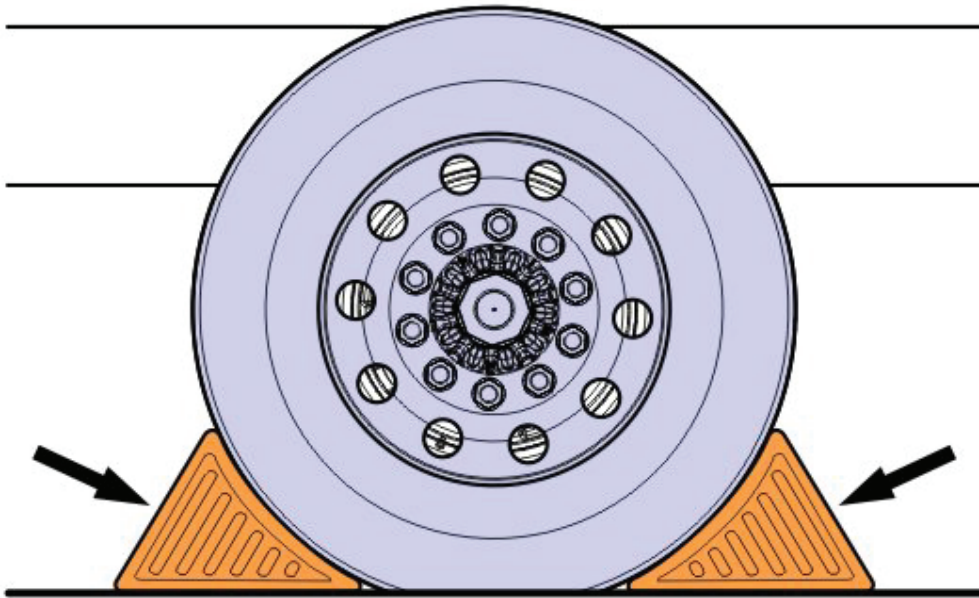
Oil stan



11L-13L Engine Oil Leak Diagnose

Note: When diagnosing a suspected timing gear plate leak, it is important to understand the difference between a weep and a leak.

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. Unlatch and raise the hood.
6. Visually inspect the Timing Gear Plate (TGP) for an active leak.
 1. If a **weep** is found (dark stain/dust and dirt) no further diagnostics is needed. Release truck back into service.
 2. If a **leak** is suspected, follow the steps below to properly diagnose and repair the leak.

When diagnosing a TGP leak

- A. Prior to cleaning the engine, document the suspected leak with pictures that clearly shows the accumulation of the oil leak as well as pictures of the suspected area.
- B. Thoroughly clean the suspected area.
- C. Load the engine (road test/regen) to get coolant and oil up to operating temperature.
- D. Verify oil is actively leaking.
- E. Document the oil leak with clear pictures of the active leak and the origin point.

Important Note

If further assistance is needed determining a leak request support using the normal process.
--

7. Once a leak is determined and documented with pictures, follow Impact repair instruction in function group 2152 for replacement of the TGP.

Important Note

If an integrated seal plate is leaking or if damage is found to the seal, it must be replaced with a new one.

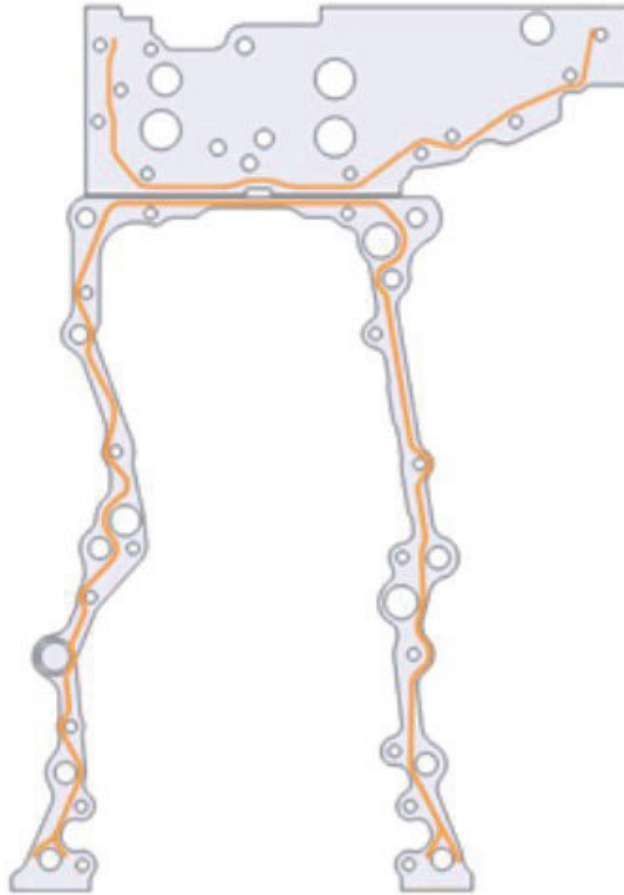
8. Verify the leak is repaired and release truck back into service.

Repair Information

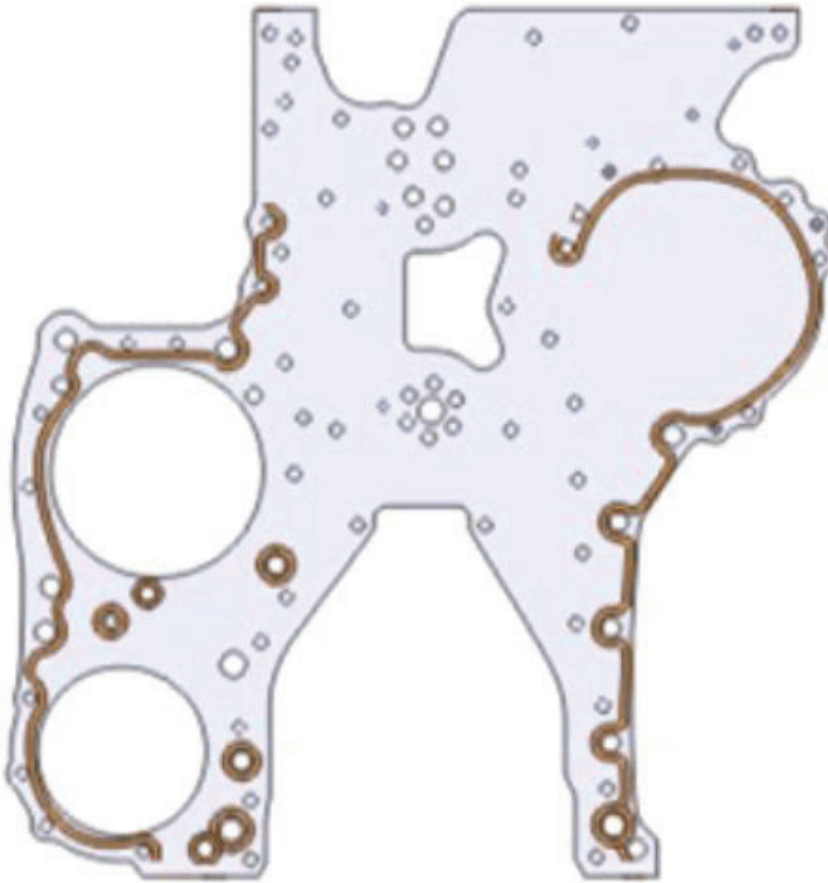
Timing gear plate kits are now available for the 13L VGT **24459407** and 13L TC engines **24459389** and includes a new seal conditioner **24533210**. This seal conditioner is used on the integrated TGP seal and is designed to extend the life of the TGP seal. Seal conditioner should be applied to the TGP seal anytime the seal is exposed (TGP replacement, flywheel housing removal, cylinder head removal and TC unit removal).

1. When installing a TGP, the seal conditioner should be applied to the back of the block and cylinder head. Make sure not to apply seal conditioner above the top holes of the cylinder head and below the dowel holes at the

bottom of the block. (Shown below). Any excess seal conditioner must be cleaned from the bolt holes and T-joints. This is to prevent seal conditioner from interfering with the securing hardware torque and the silicone sealant at the T-joints.



2. When installing the flywheel housing, the seal conditioner should be applied to TGP seal not the flywheel housing. Make sure not to apply seal conditioner above the top holes of the sealing surface and below the dowel holes at the bottom of the TGP. (Shown below). Any excess seal conditioner must be cleaned from the bolt holes and T-joints. This is to prevent seal conditioner from interfering with the securing hardware torque and the silicone sealant at the T-joints.



3. When installing the TC unit, the seal conditioner should be applied to the TC unit not the TGP. (Shown below). Any excess seal conditioner must be cleaned from the bolt holes. This is to prevent seal conditioner from interfering with the securing hardware torque.



Issued by

Technical Service

21527-3 Timing Gear Plate, Replacement

Transmission and Clutch Removed



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](#)



CAUTION

Risk of material damage.

Any damage or deformation to the EGR (Exhaust Gas Recirculation) pipes can affect their function and lifetime. The corrugated steel bellows are sensitive to dents.

- ▶ Use caution when working on or near the EGR pipes.
- ▶ Do not try to force the pipe into place by bending, twisting, or stretching the bellows.



WARNING

Risk of burn injuries.

Heated components and mechanical parts can cause burns.

- ▶ Exercise caution when working with heated components. Always use the appropriate protective equipment.



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.

Using the wrong type of oil filter could result in damage to bearings, crankshaft, and connected parts as a result of unfiltered oil entering the lubrication system.

- ▶ Only use oil filters approved by the manufacturer.



CAUTION

Service Information Advisory.

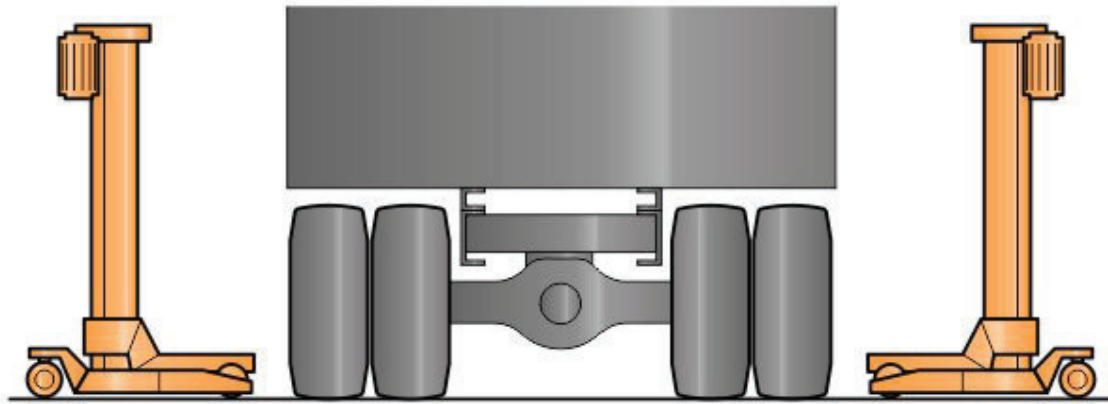
If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

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

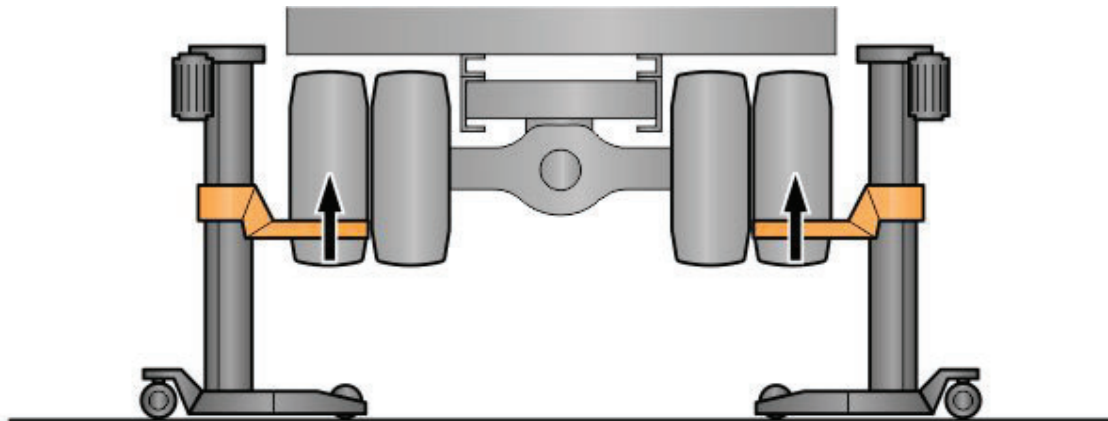
Special tools

85112740	88800031	88800502	88800570	88800619
88800820	88840317	88870002	88870012	88870039
9990166	9990192	9996049	9996400	9998267
9999683	9999696			

1	Unlatch and raise the hood.
2	Remove the lower right splash shield.
3	Remove the lower left splash shield.
4	Perform this procedure when the condition below is met. Conditions • Certain vehicle applications may require the engine cover to be removed ▶ Remove the engine cover if needed.  Service hint To gain better access to the engine.
5	Perform this procedure when the condition below is met. Conditions • If the vehicle is equipped with a removable bumper end cap ▶ Remove the end cap.
6	Position the column lifts.



7 Raise the vehicle.



8 Perform this procedure when the condition below is met.

Conditions

- If the coolant is not drained, then drain the coolant

- Drain the cooling system using either a coolant extractor or a drain hose and pan.

Required material

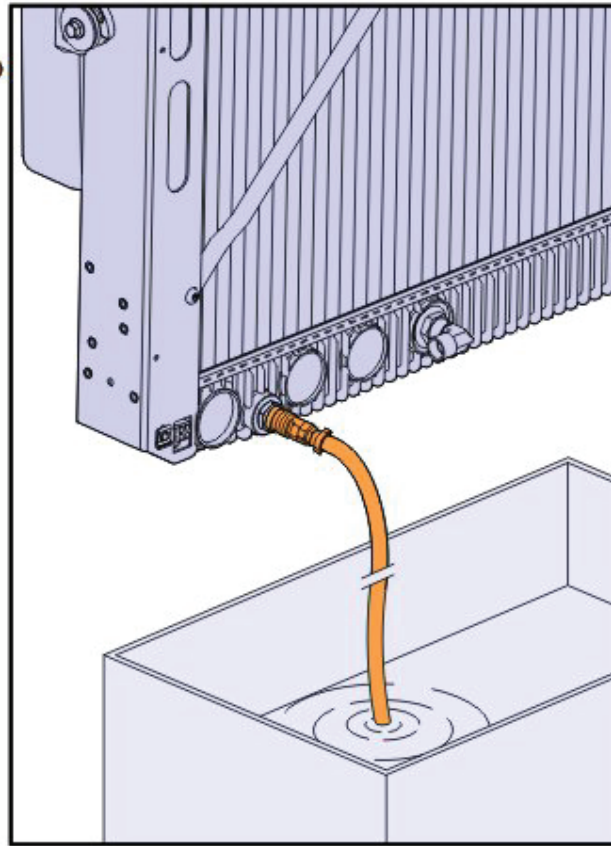
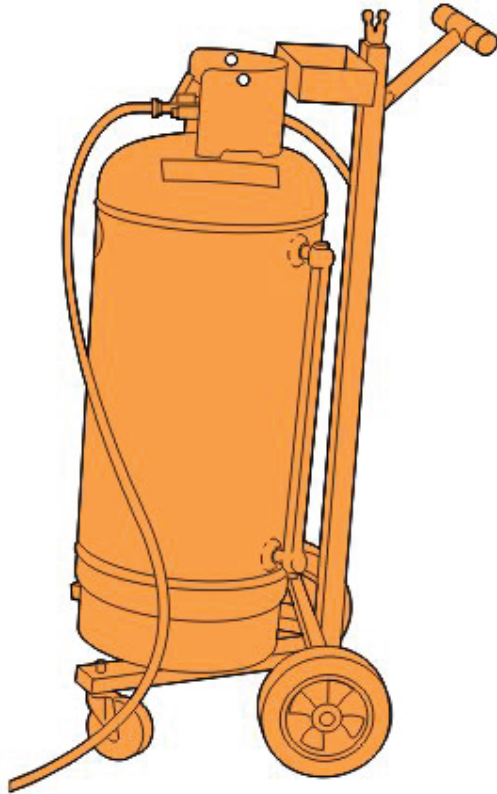
COOLANT EXTRACTOR/INJECTOR [85112740](#)

DRAIN HOSE [9996049](#)



Note

Take the collected coolant to a recycling facility as per local safety regulations.

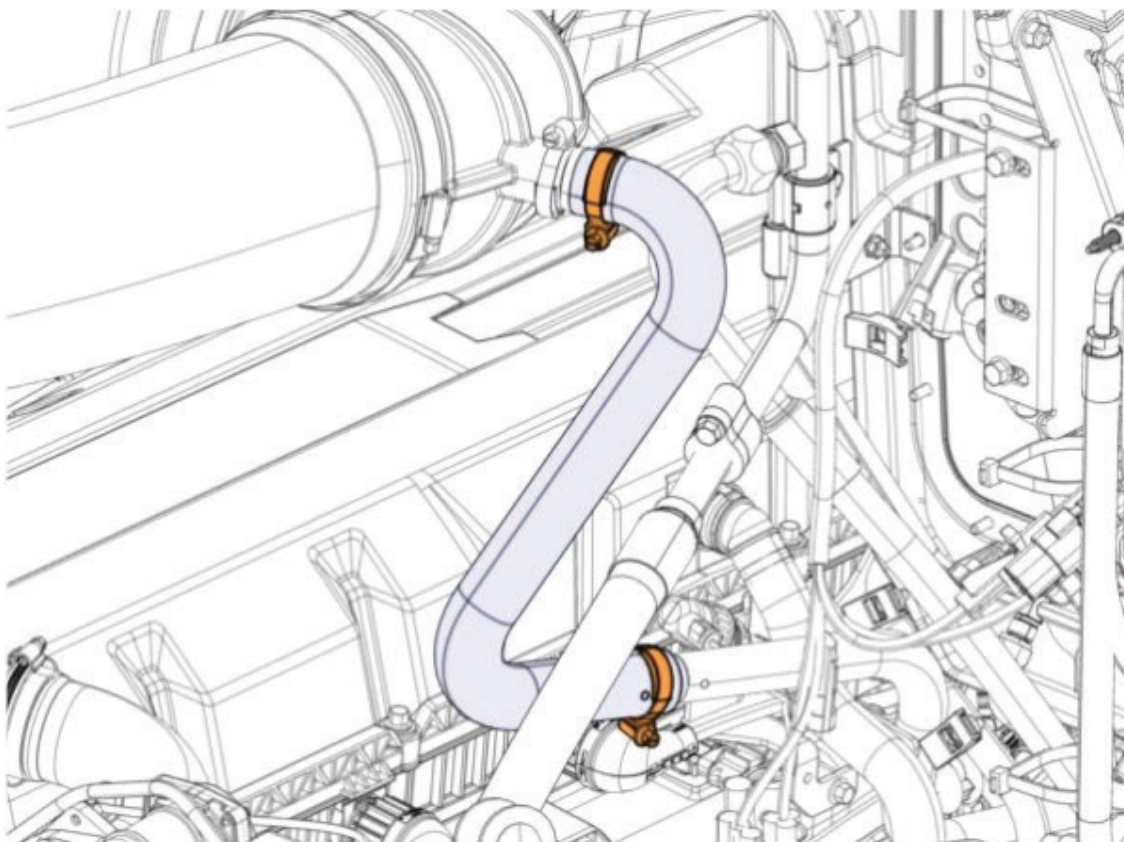


9 Loosen the clamps.

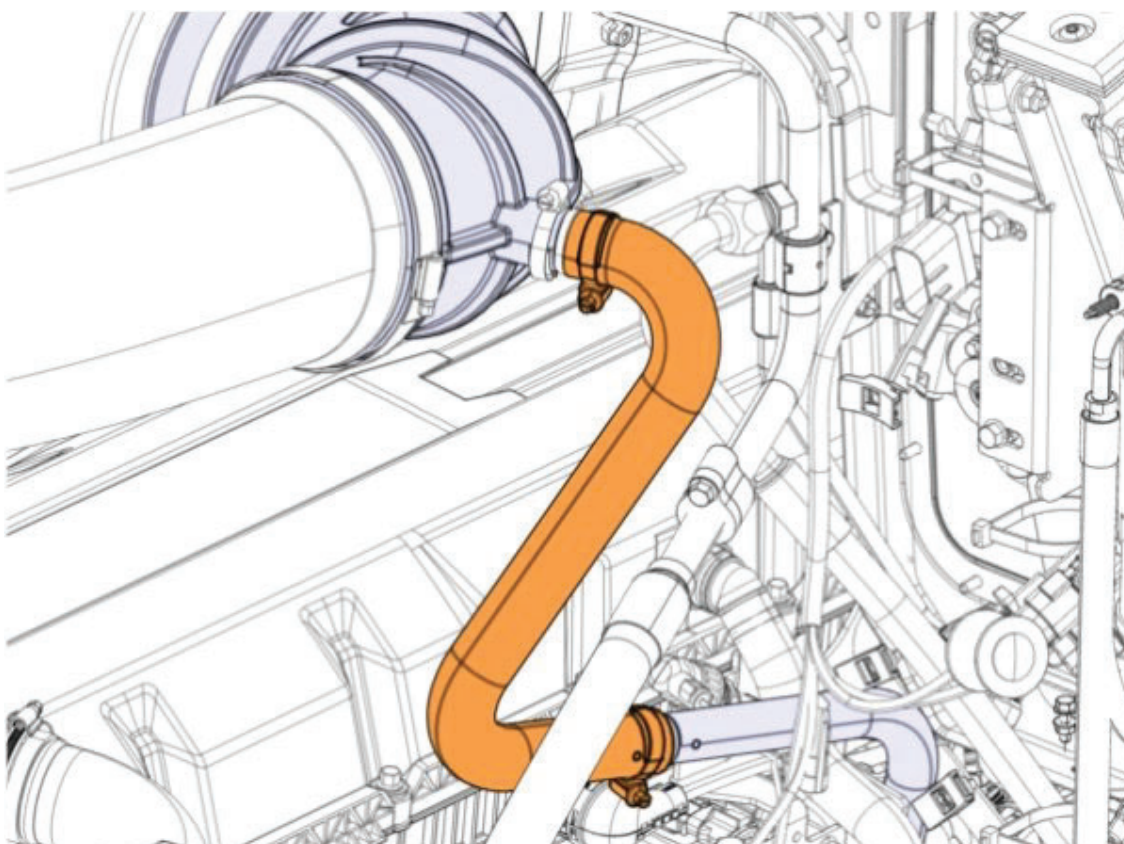


Note

Note the orientations and the positions.



10 Remove the hose.



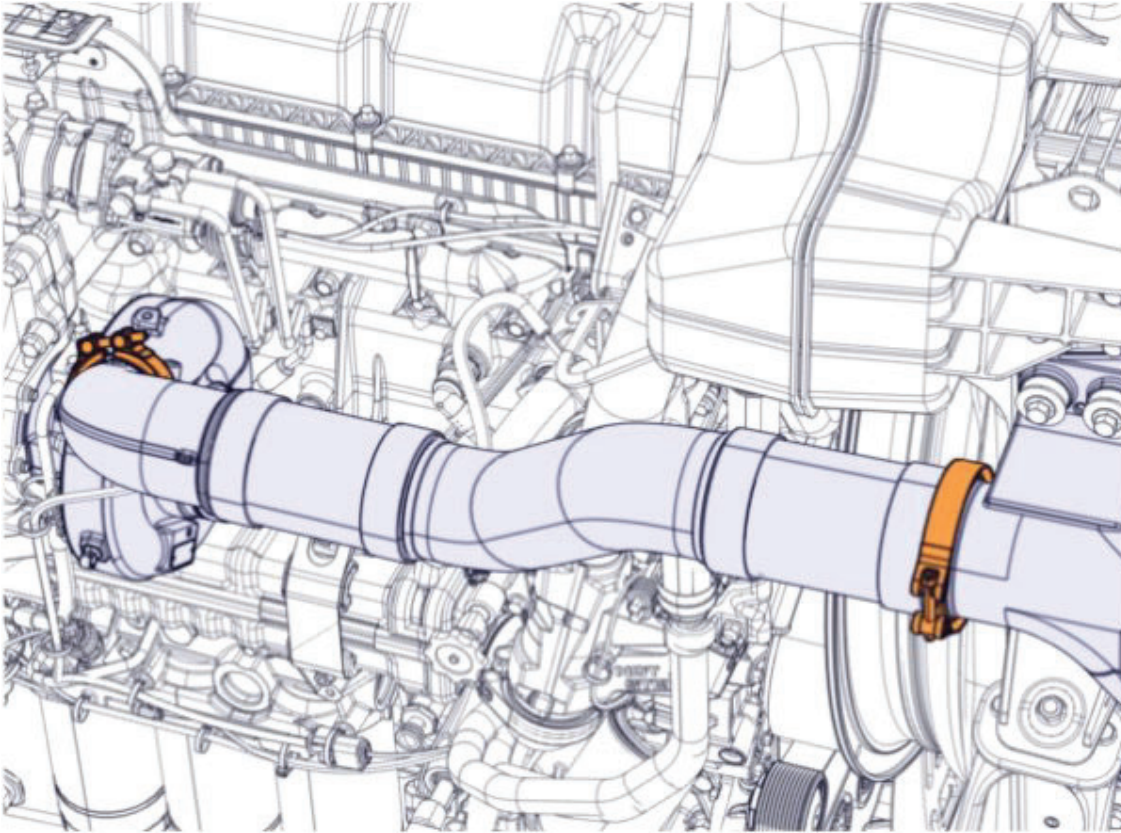
11 Remove the V-clamps.

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

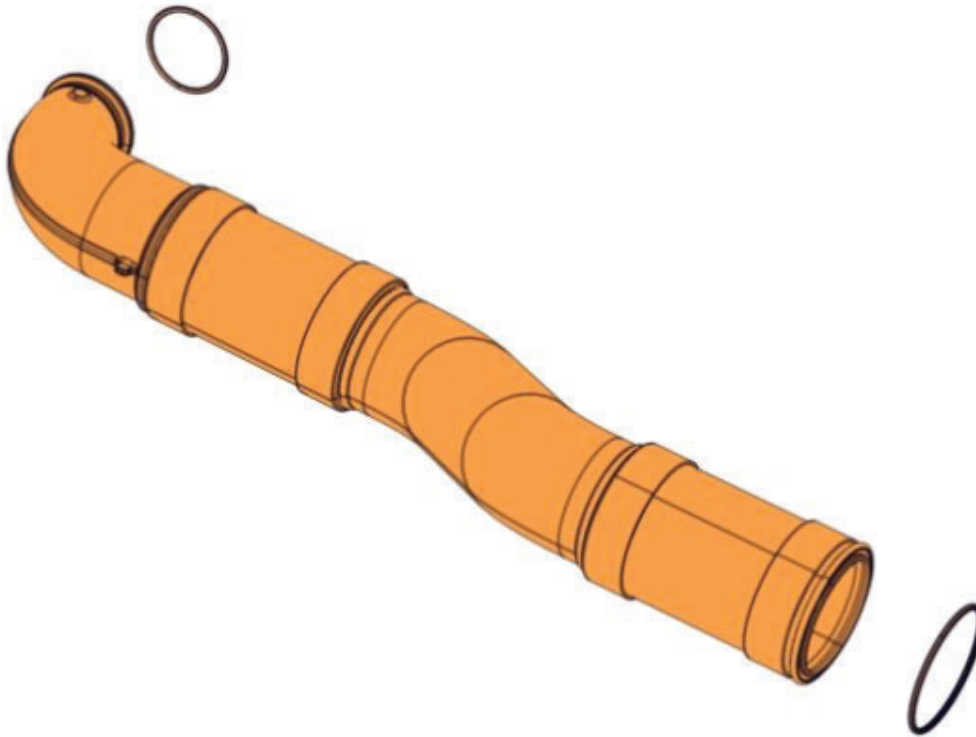
**Note**

Note the position.

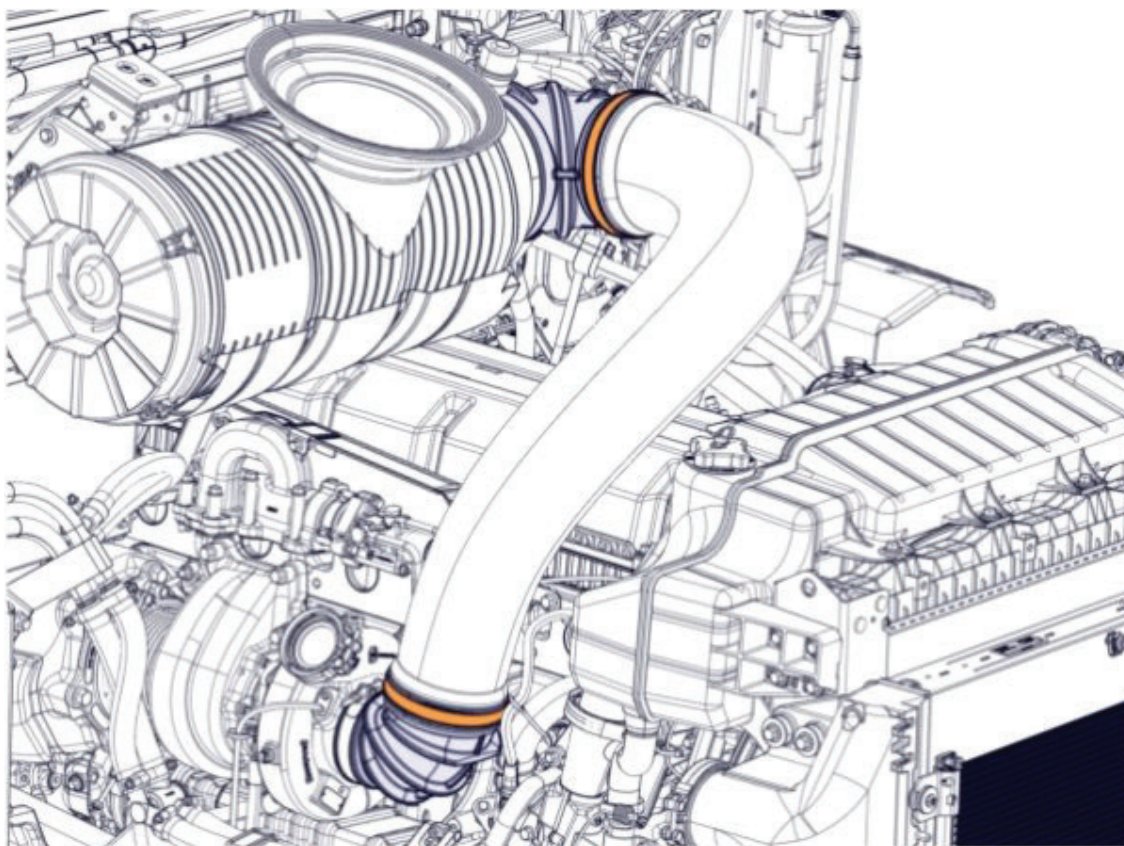


12	Remove the charge air pipe.
----	-----------------------------

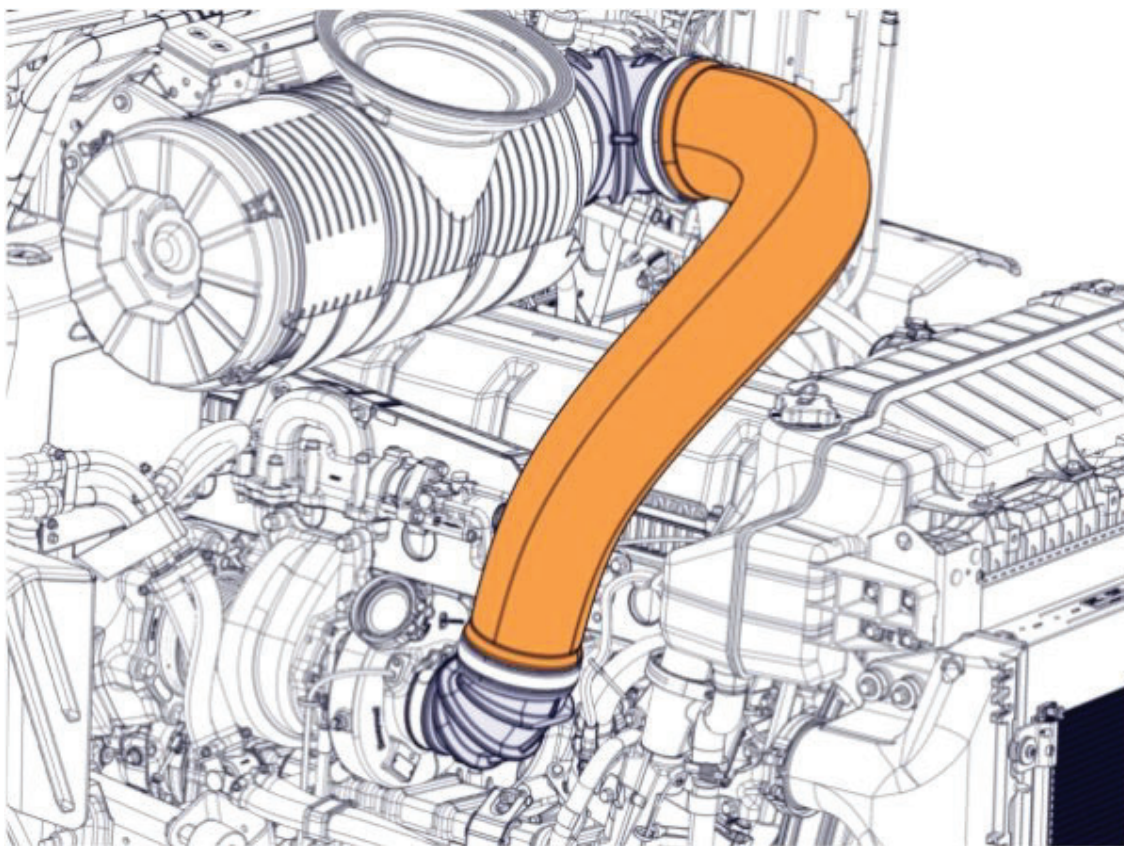
13	Remove the seals.
----	-------------------



14	Loosen the clamps. <table border="1" data-bbox="214 989 725 1094"><tr><td data-bbox="214 989 289 1062"></td><td data-bbox="289 989 725 1094"> Note Note the orientations and the positions. </td></tr></table>		Note Note the orientations and the positions.
	Note Note the orientations and the positions.		



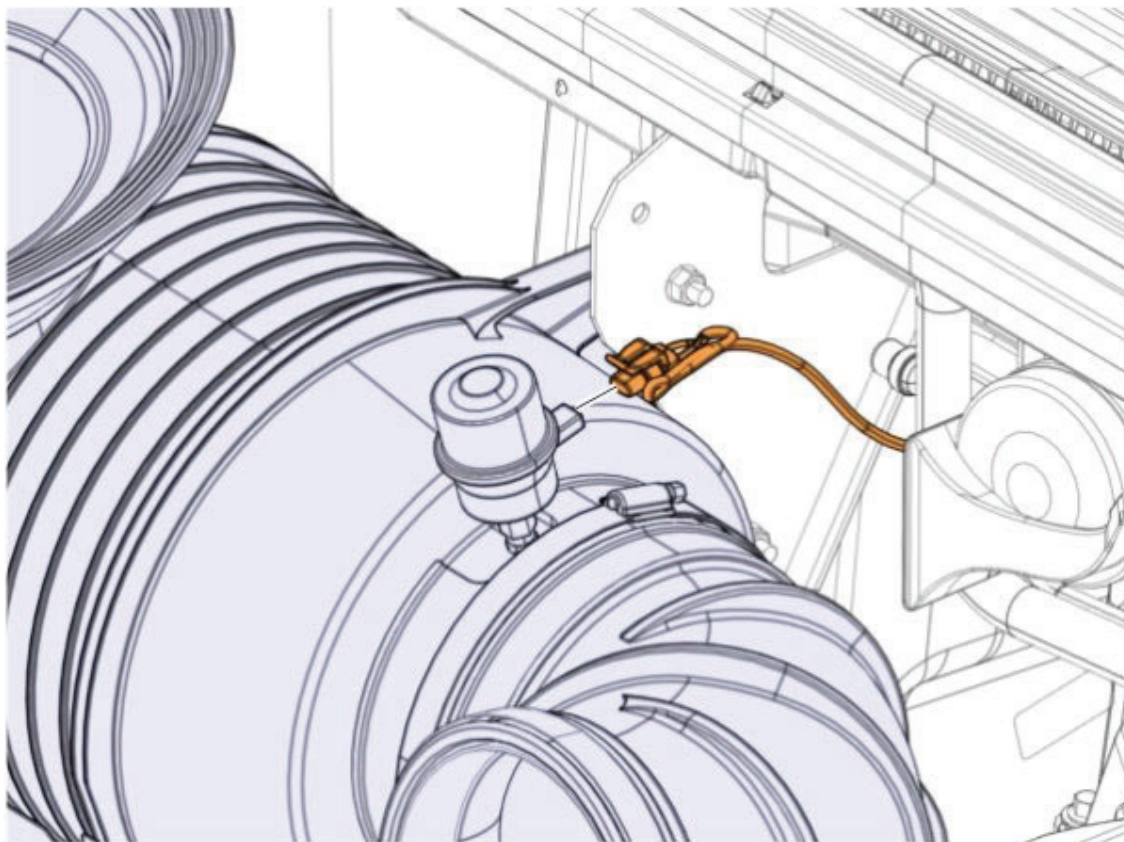
15	Remove the duct.
----	------------------



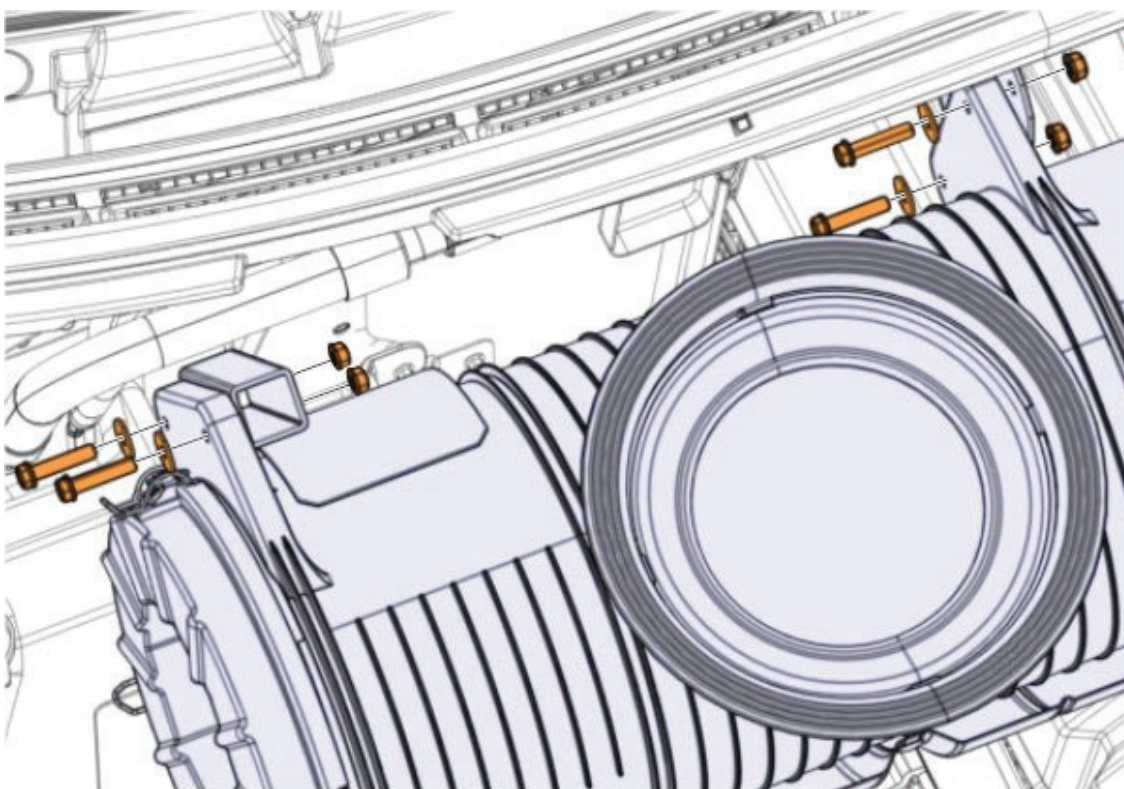
16	Disconnect the connector.
----	---------------------------

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

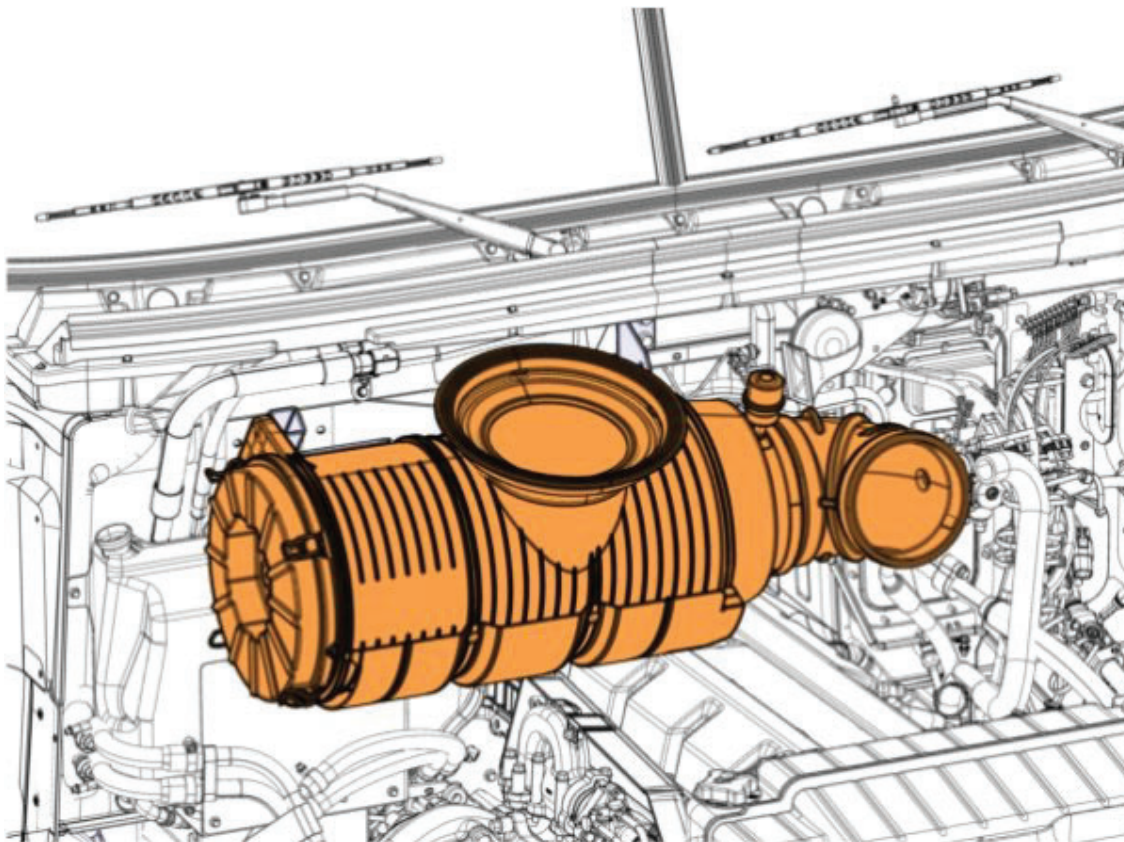
The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.



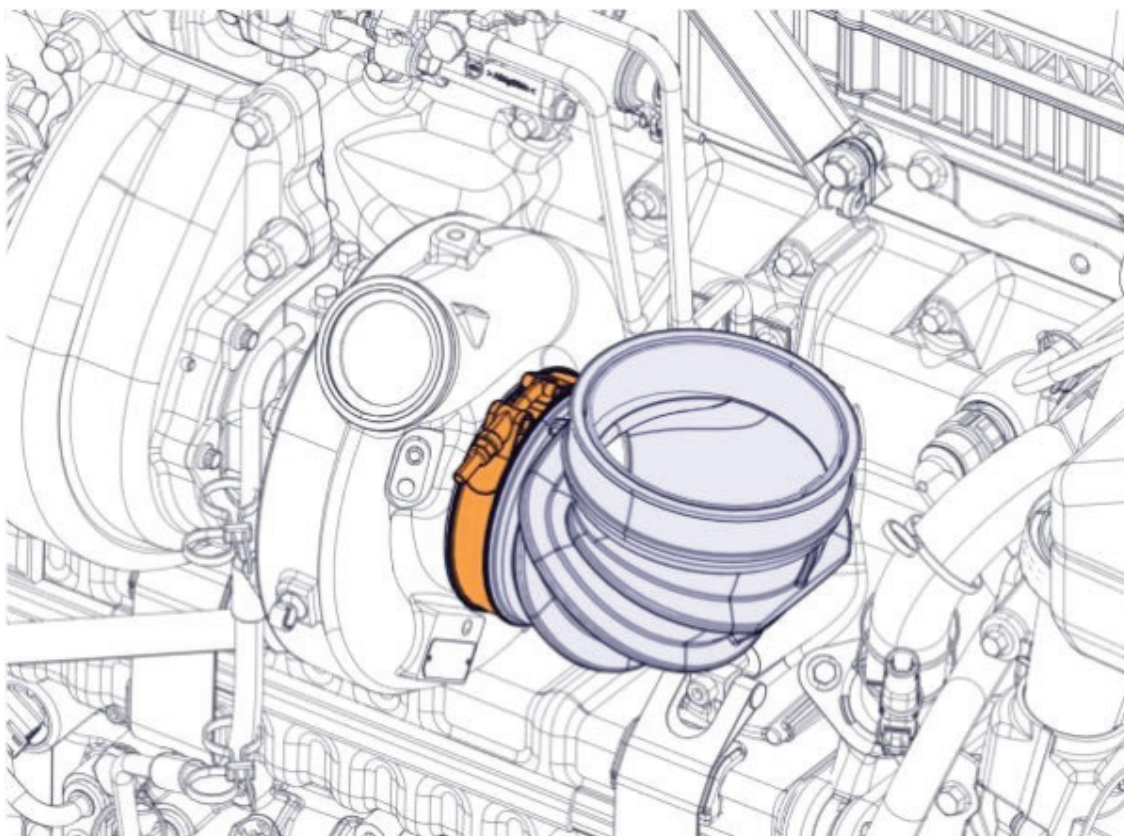
17	Remove the screws, nuts and the washers.
----	--



18	Remove the housing.
----	---------------------



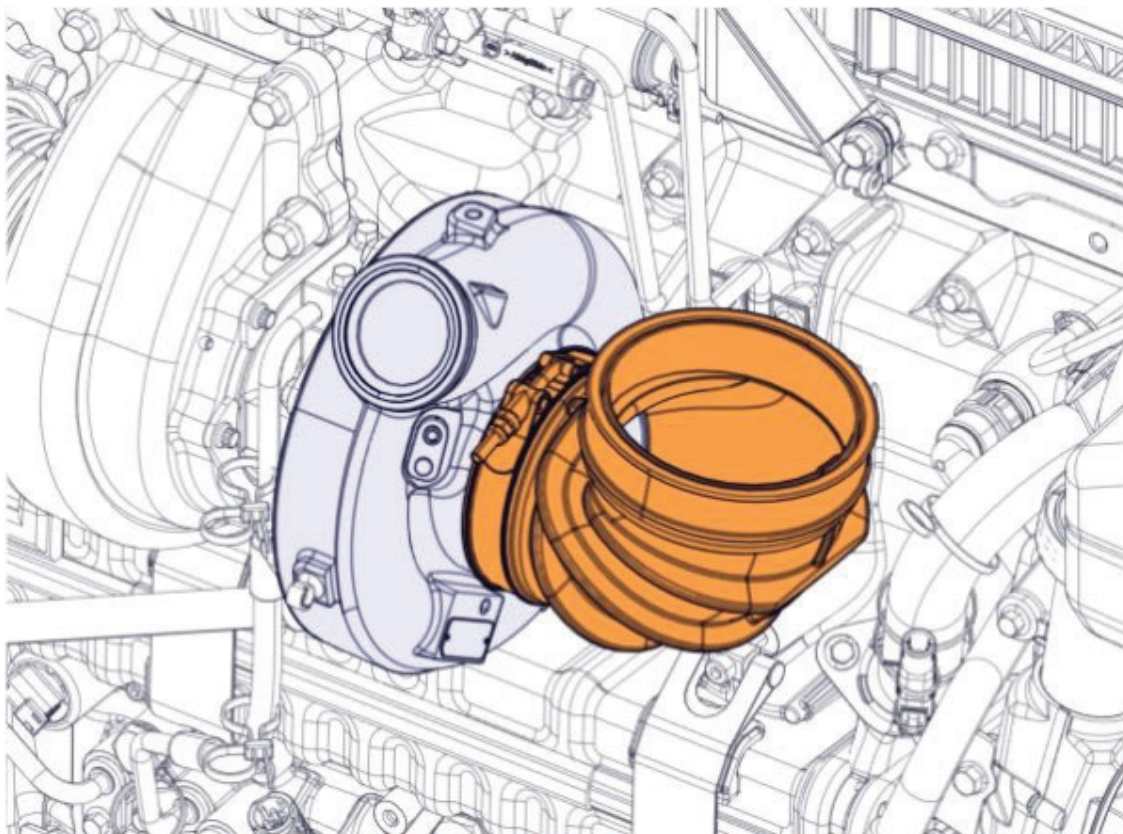
19	Loosen the clamp.
----	-------------------



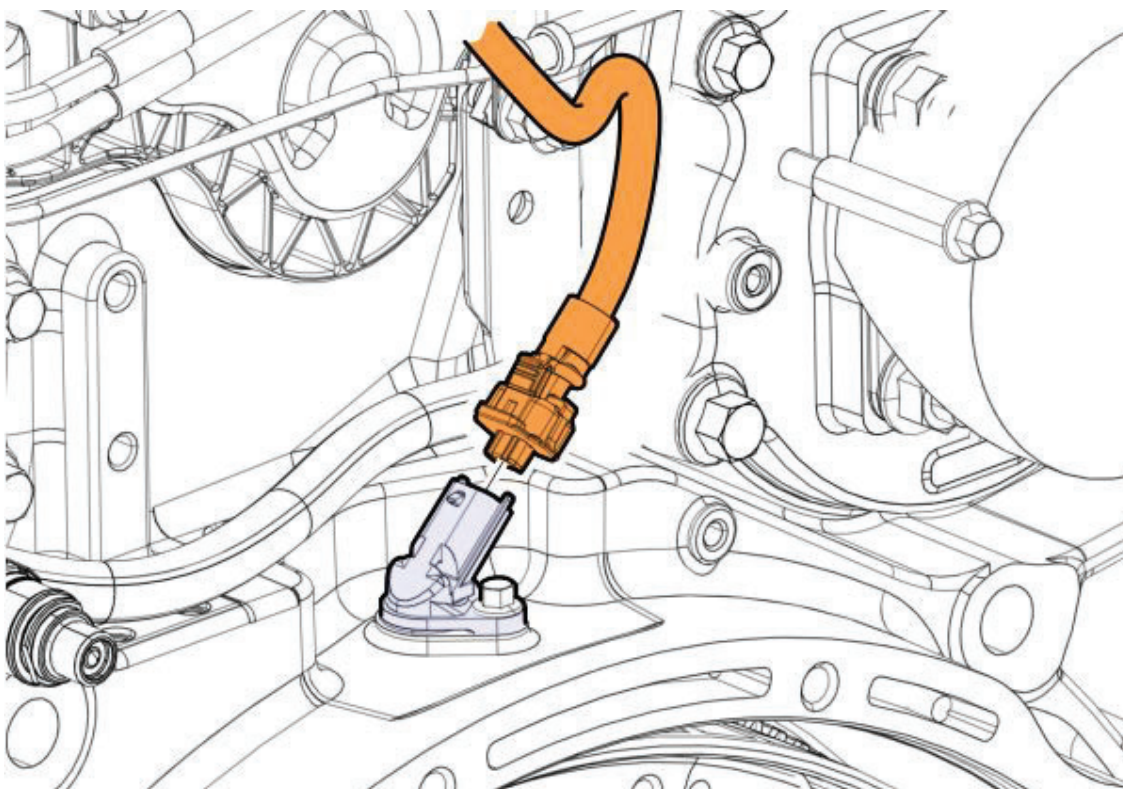
20	Remove the duct.
----	------------------

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.



21	Disconnect the connector.
----	---------------------------



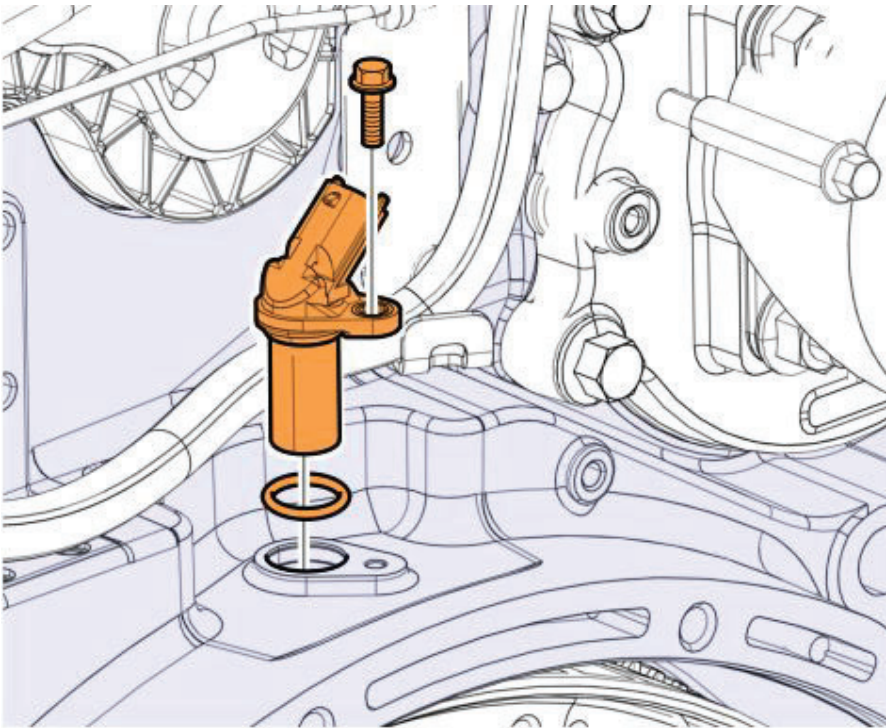
22	Remove the screw.
----	-------------------

23	Remove the sensor.
----	--------------------

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

24	Remove the O-ring.
----	--------------------

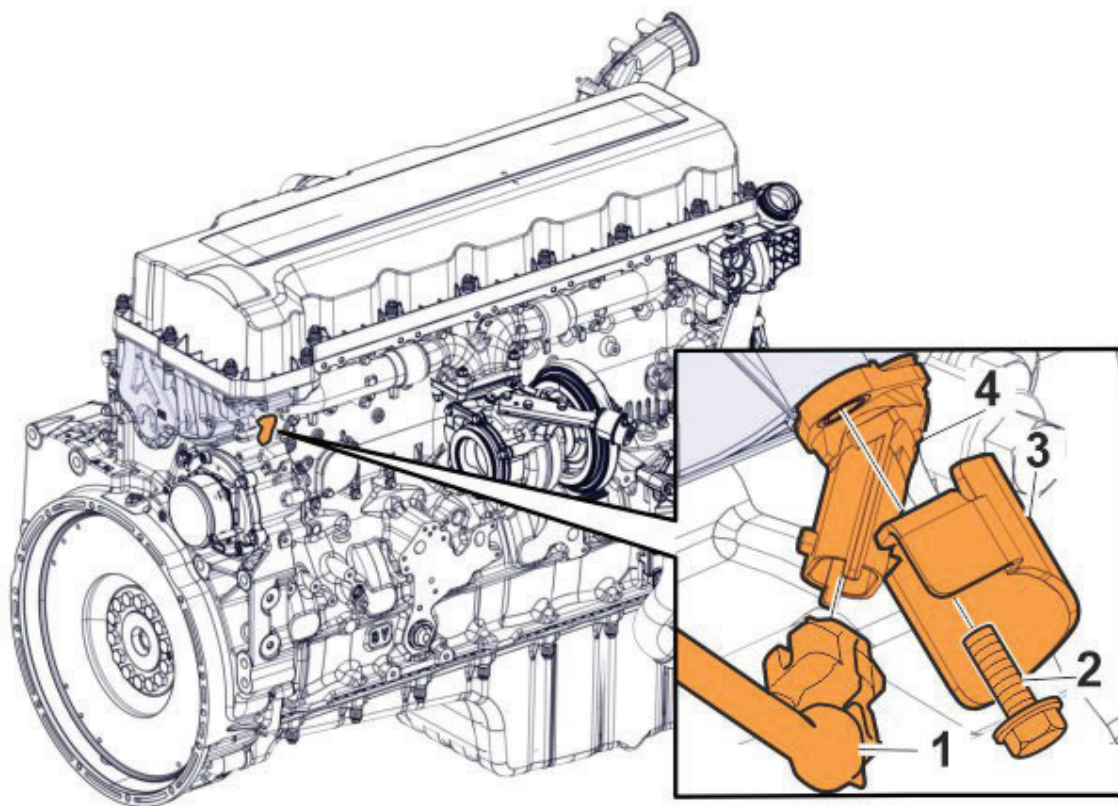


25	Disconnect the connector (1).
----	-------------------------------

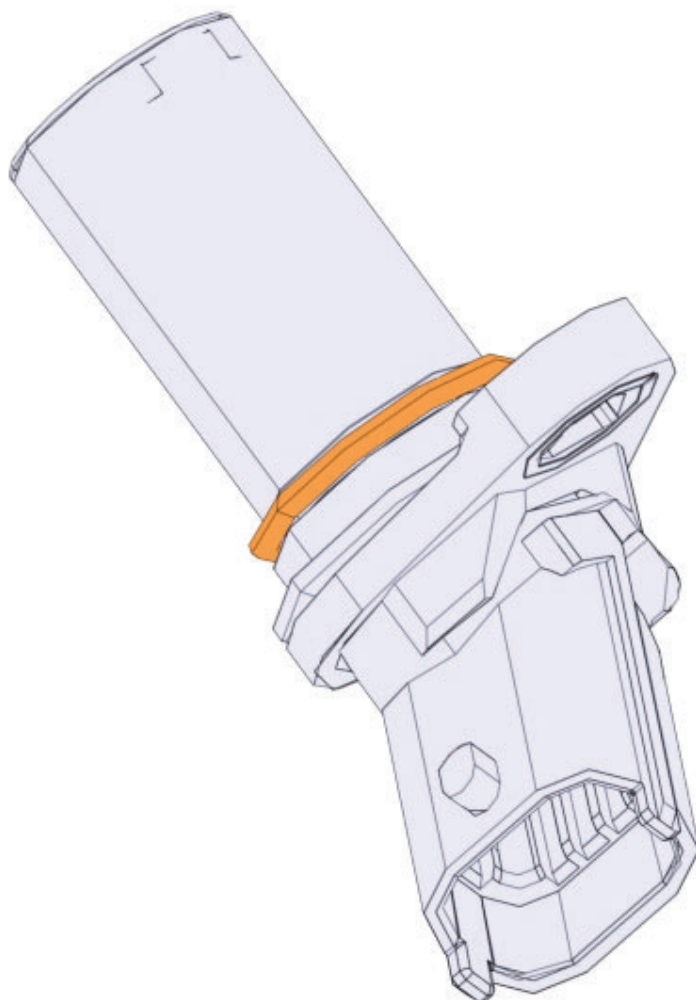
26	Remove the screw (2).
----	-----------------------

27	Remove the heat shield (3).
----	-----------------------------

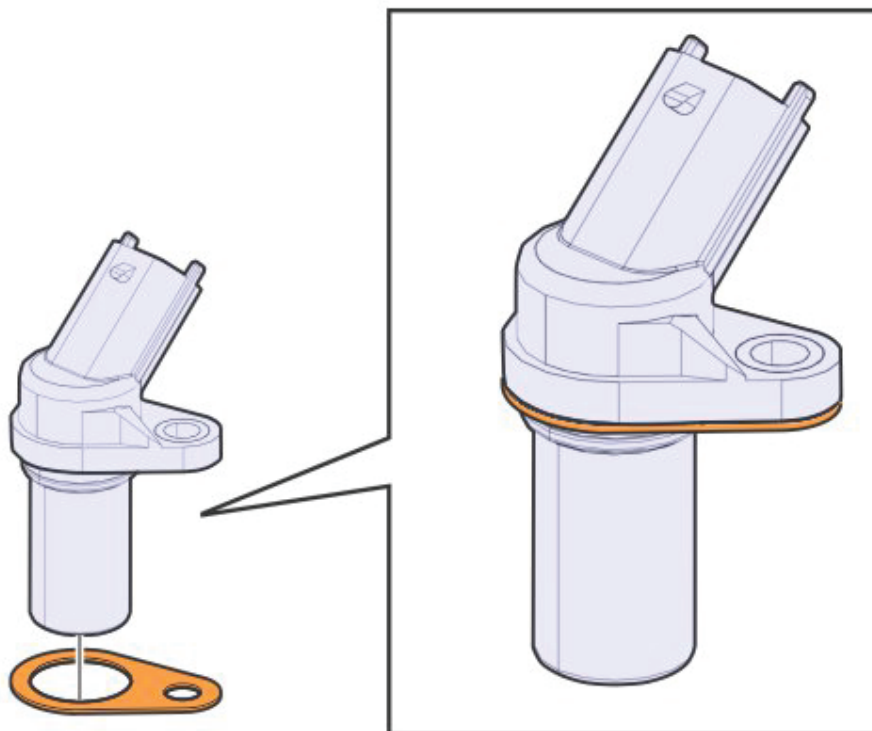
28	Remove the sensor (4).
----	------------------------



29	Remove the O-ring.
----	--------------------



30	Remove the shims as needed.
----	-----------------------------

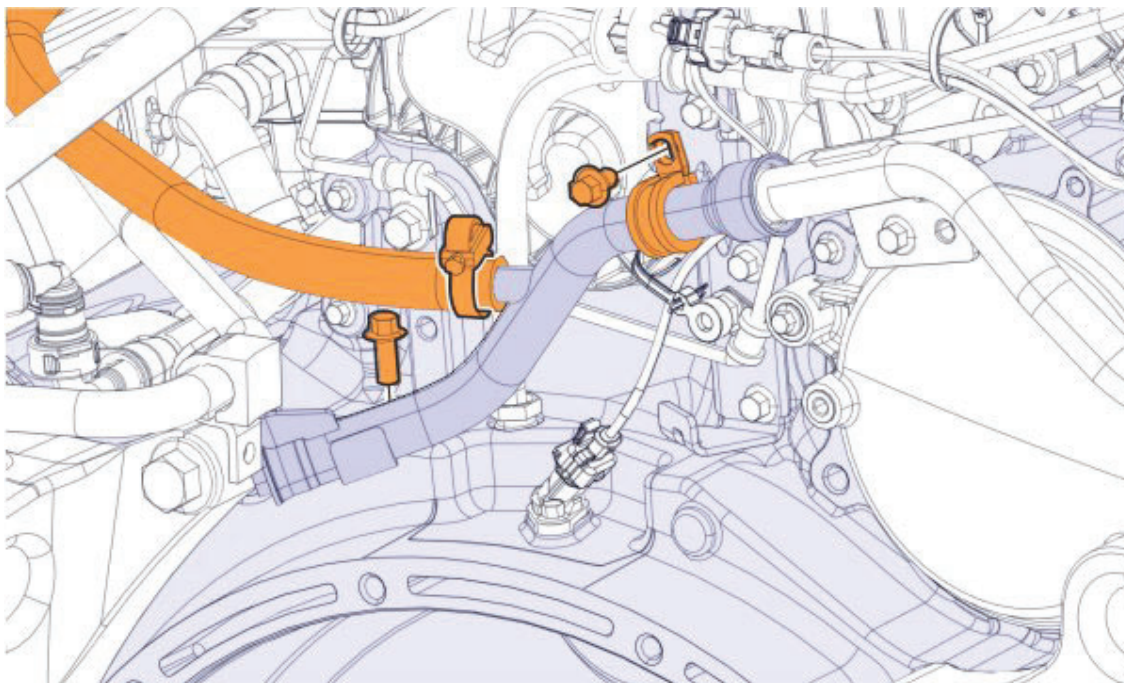


31	Loosen the clamp.
----	-------------------

32	Remove the hose.
----	------------------

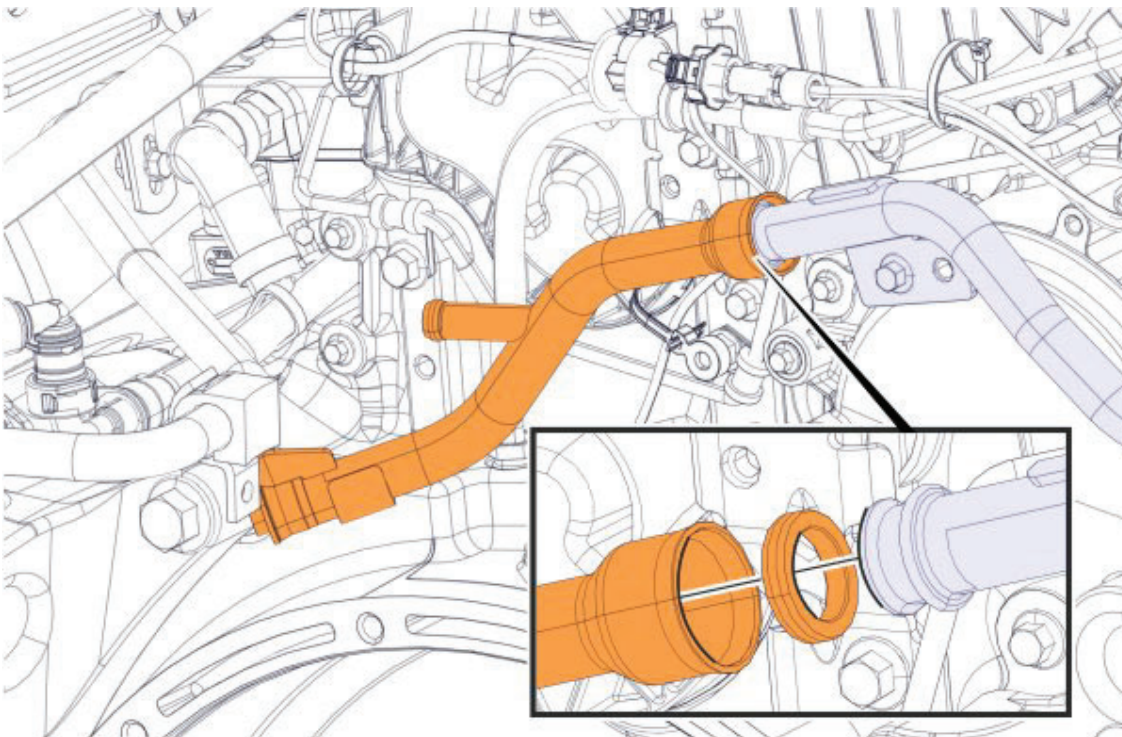
33	Remove the screws.
----	--------------------

34	Remove the clamp.
----	-------------------

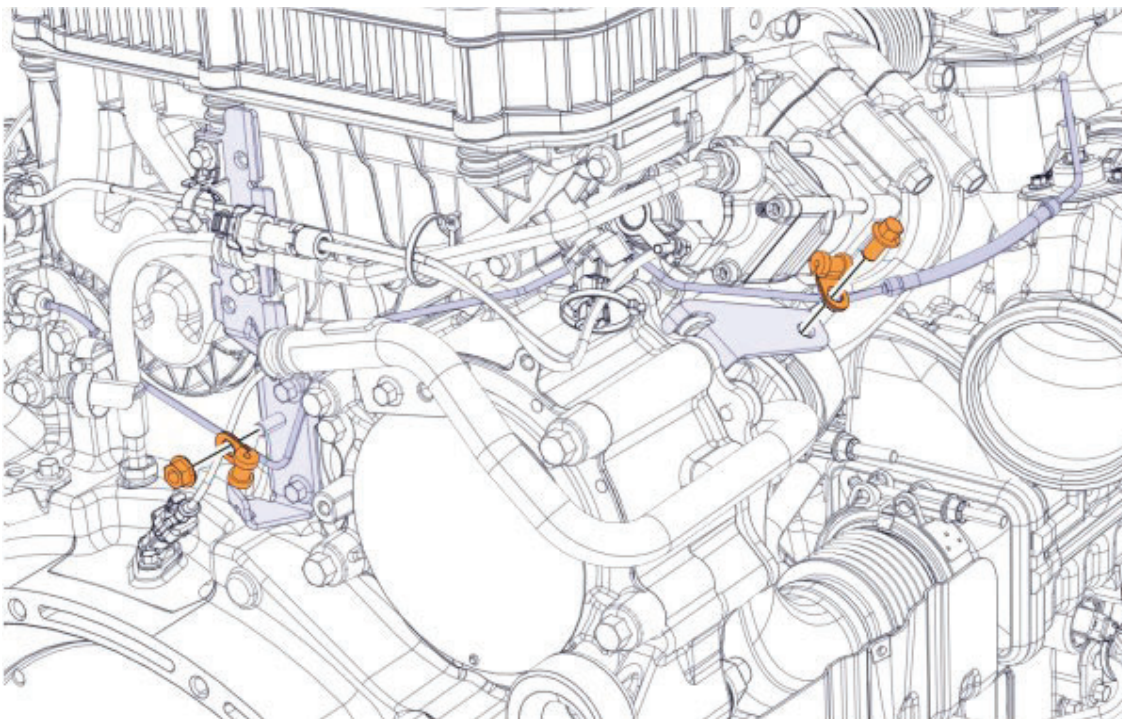


35	Remove the pipe.
----	------------------

36	Remove the seal.
----	------------------

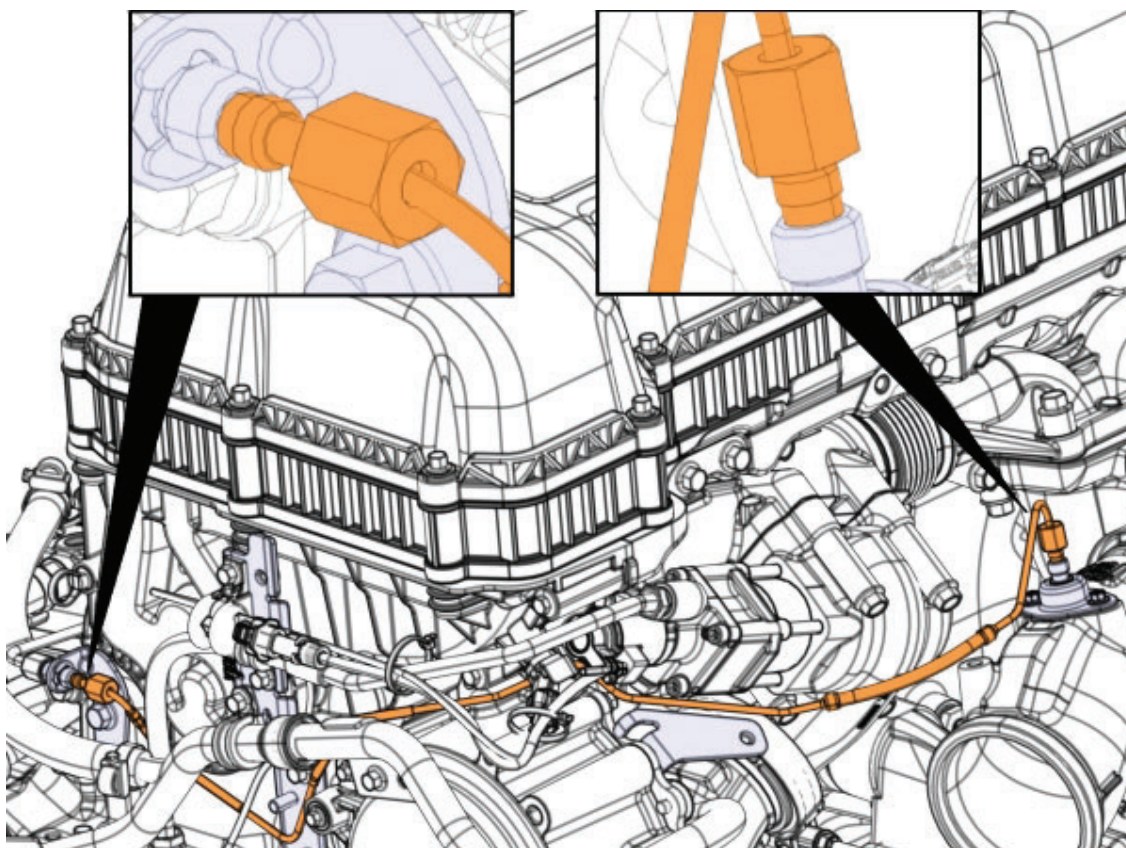


37	Remove the screws and clamps.
----	-------------------------------



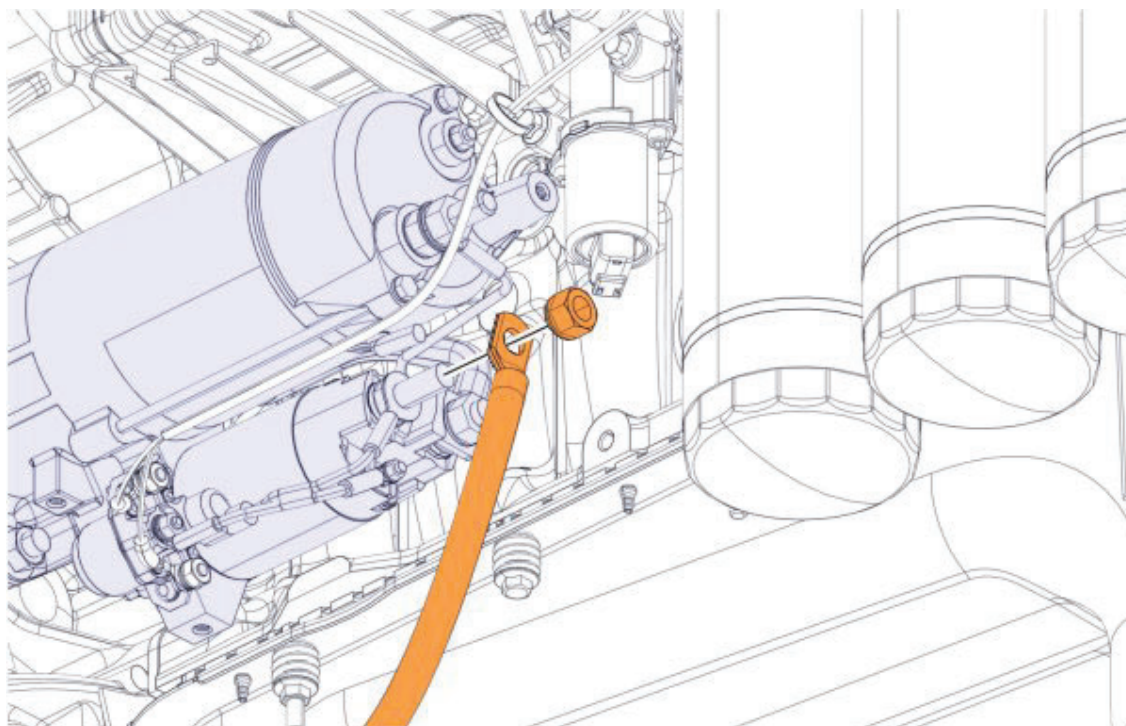
38	Loosen the nuts.
----	------------------

39	Remove the pipe.
----	------------------



40	Remove the nut.
----	-----------------

41	Remove the cable terminal.
----	----------------------------

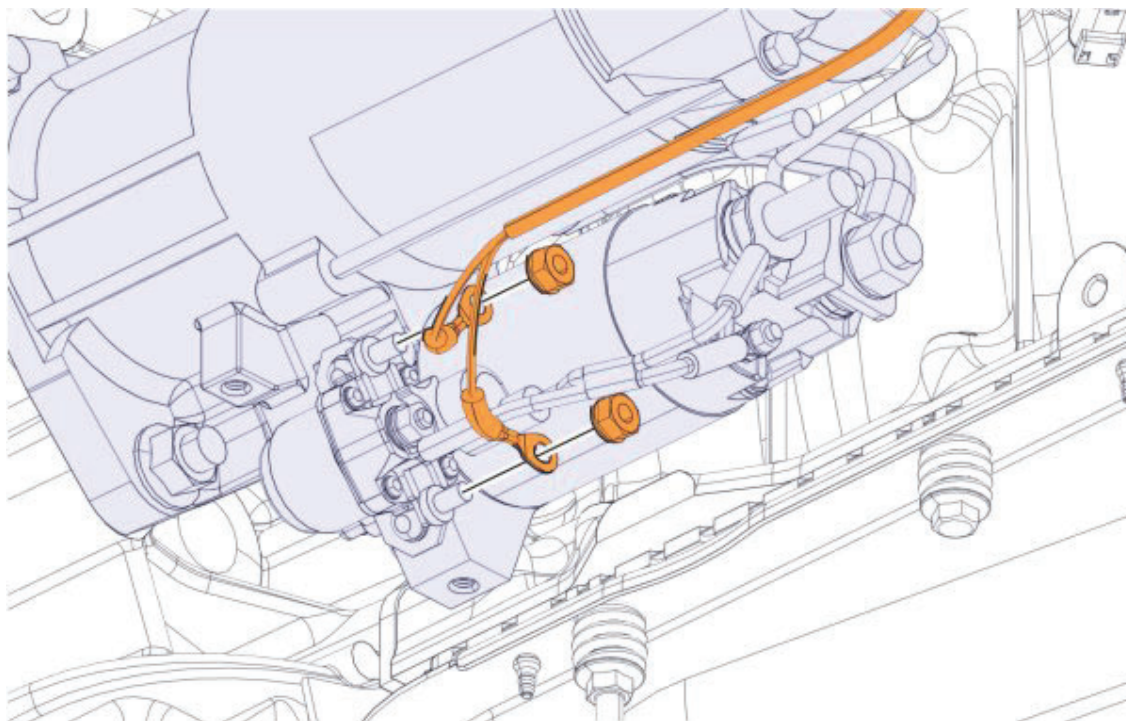


42	Remove the nuts.
----	------------------

43	Remove the cable terminals.
----	-----------------------------

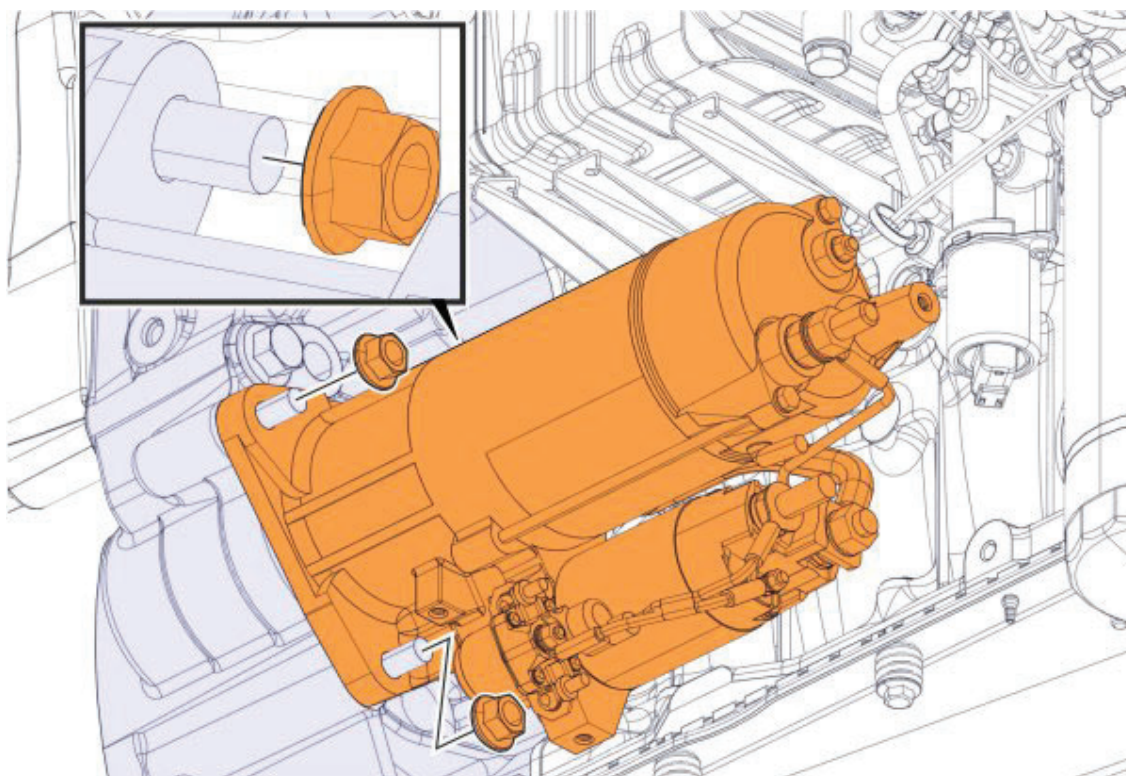
Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.



44 Remove the nuts.

45 Remove the starter motor.

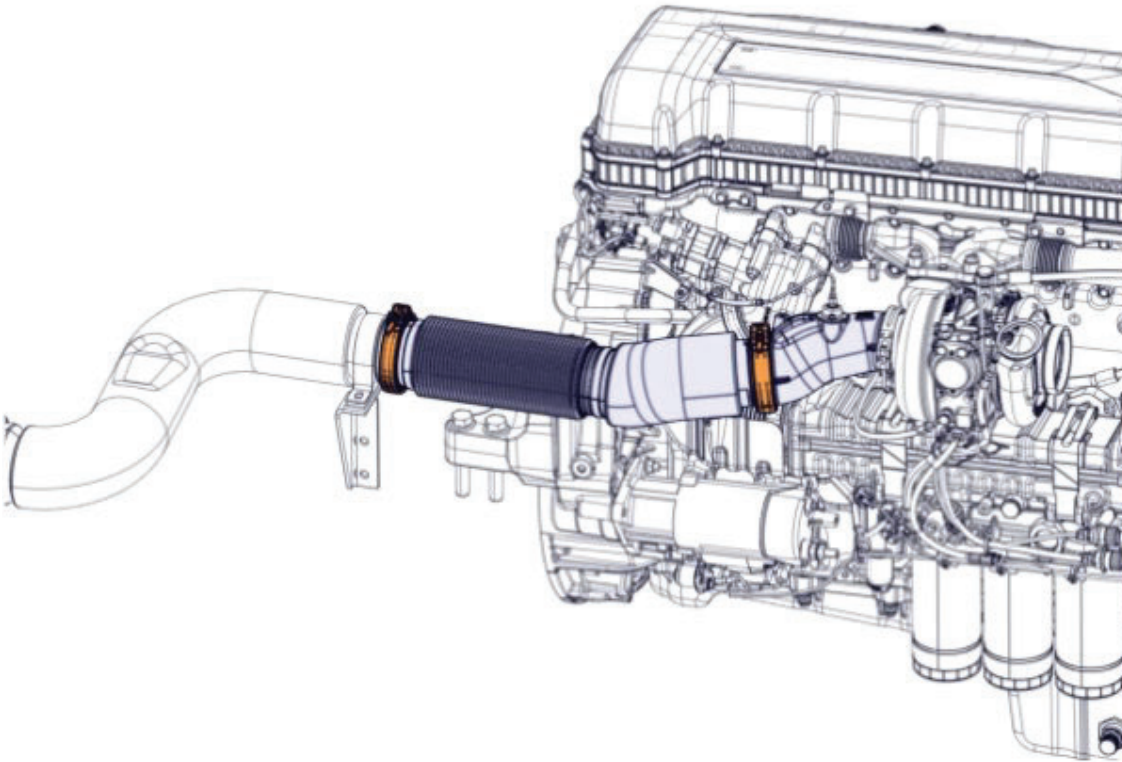


46 Remove the clamps.



Note

Note the orientations and the positions.

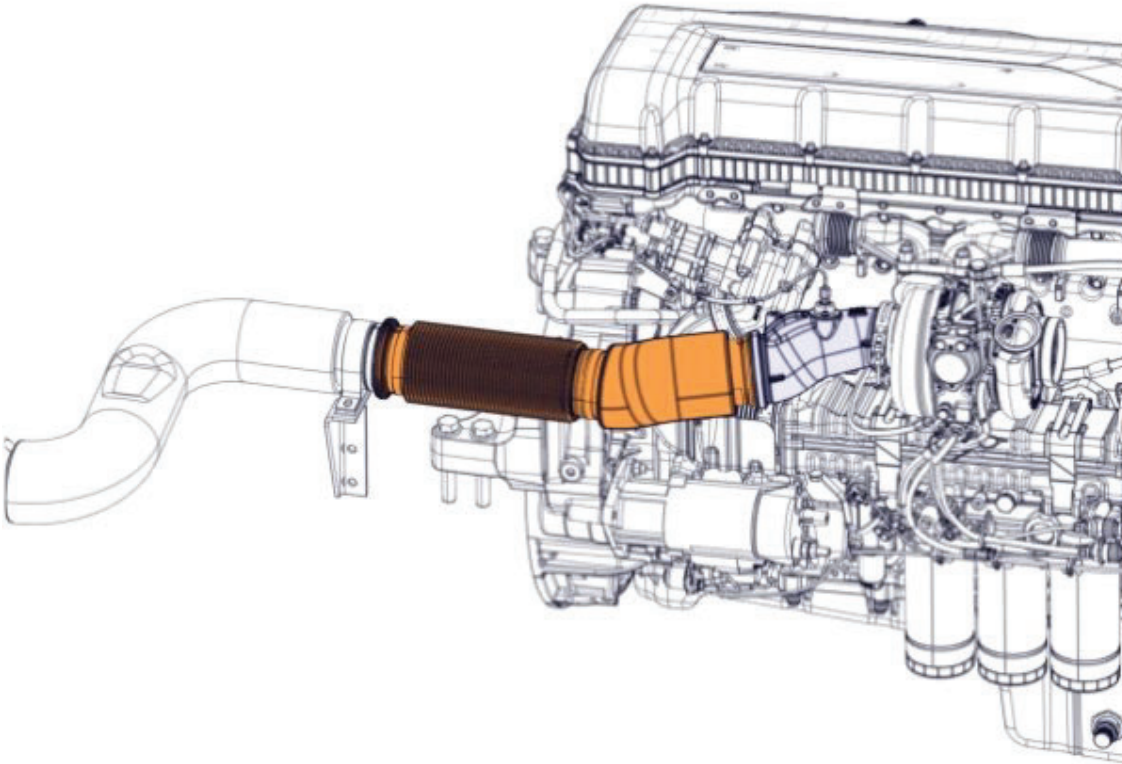


47 Remove the pipe.



Note

Note the orientation and the position.



48	Remove the gaskets.
----	---------------------



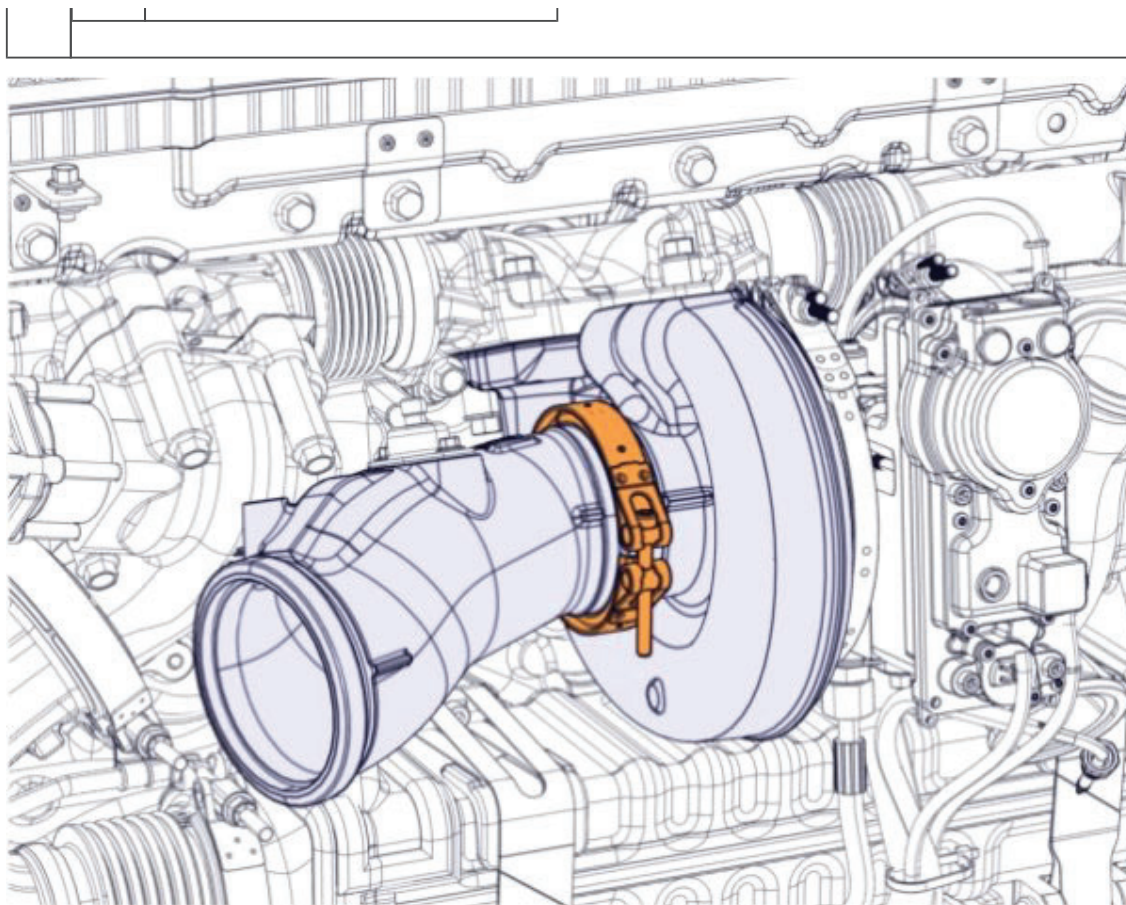
49	Remove the clamp.
----	-------------------

**Note**

Note the orientation and the position.

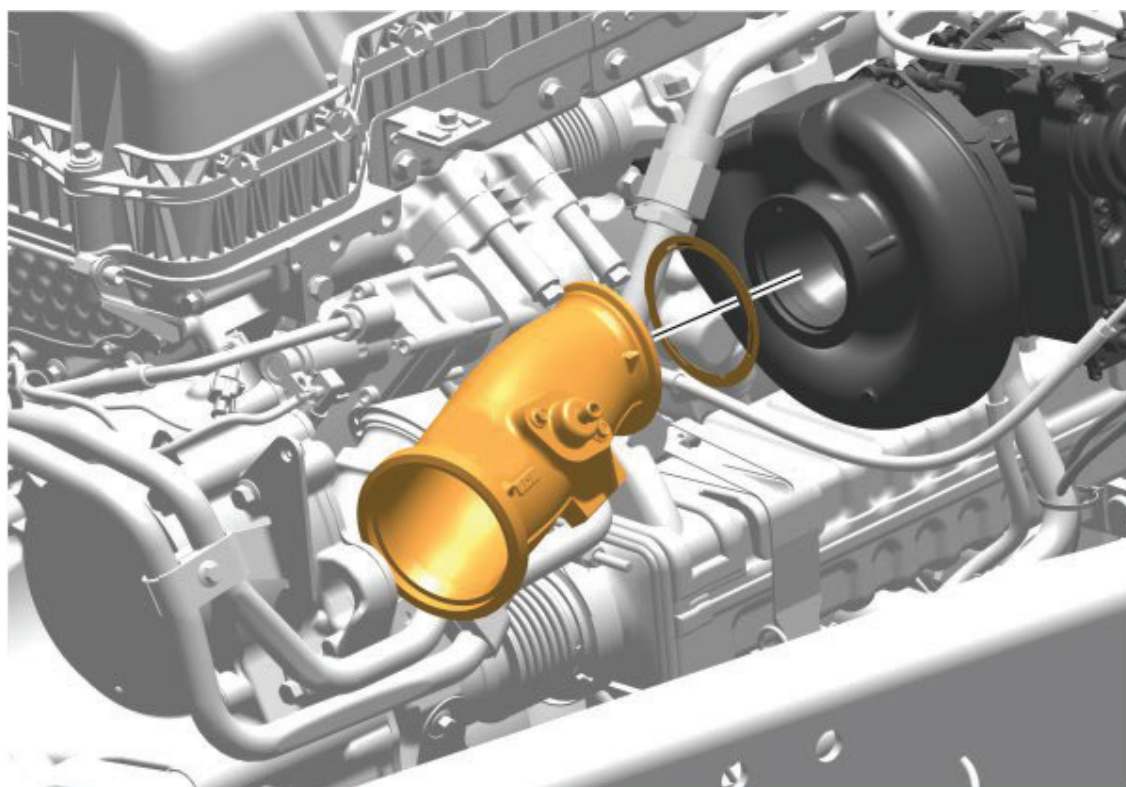
Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.



50	Remove the diffuser.
----	----------------------

51	Remove the gasket.
----	--------------------



Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

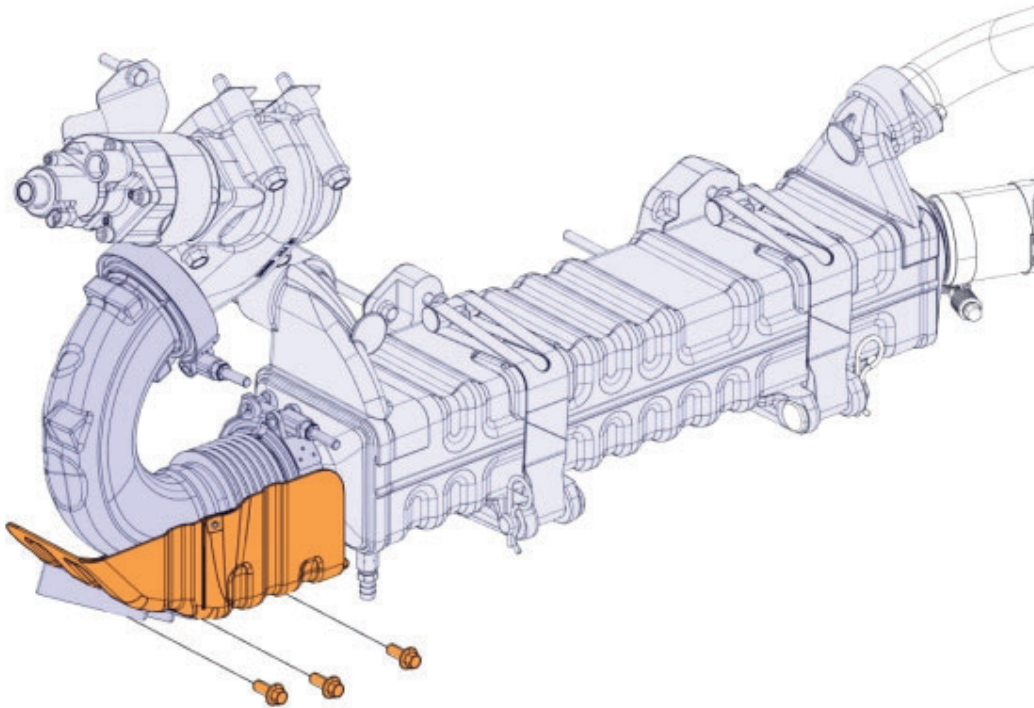
**WARNING****Risk of burn injuries.**

Heated components and mechanical parts can cause burns.

- ▶ Exercise caution when working with heated components. Always use the appropriate protective equipment.

52 Remove the screws.

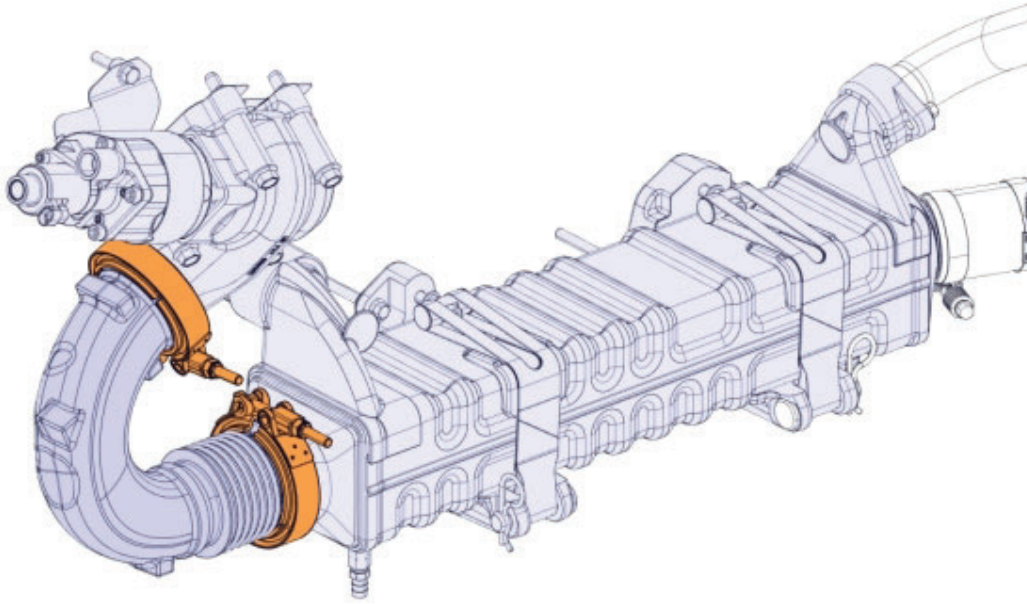
53 Remove the heat shield.



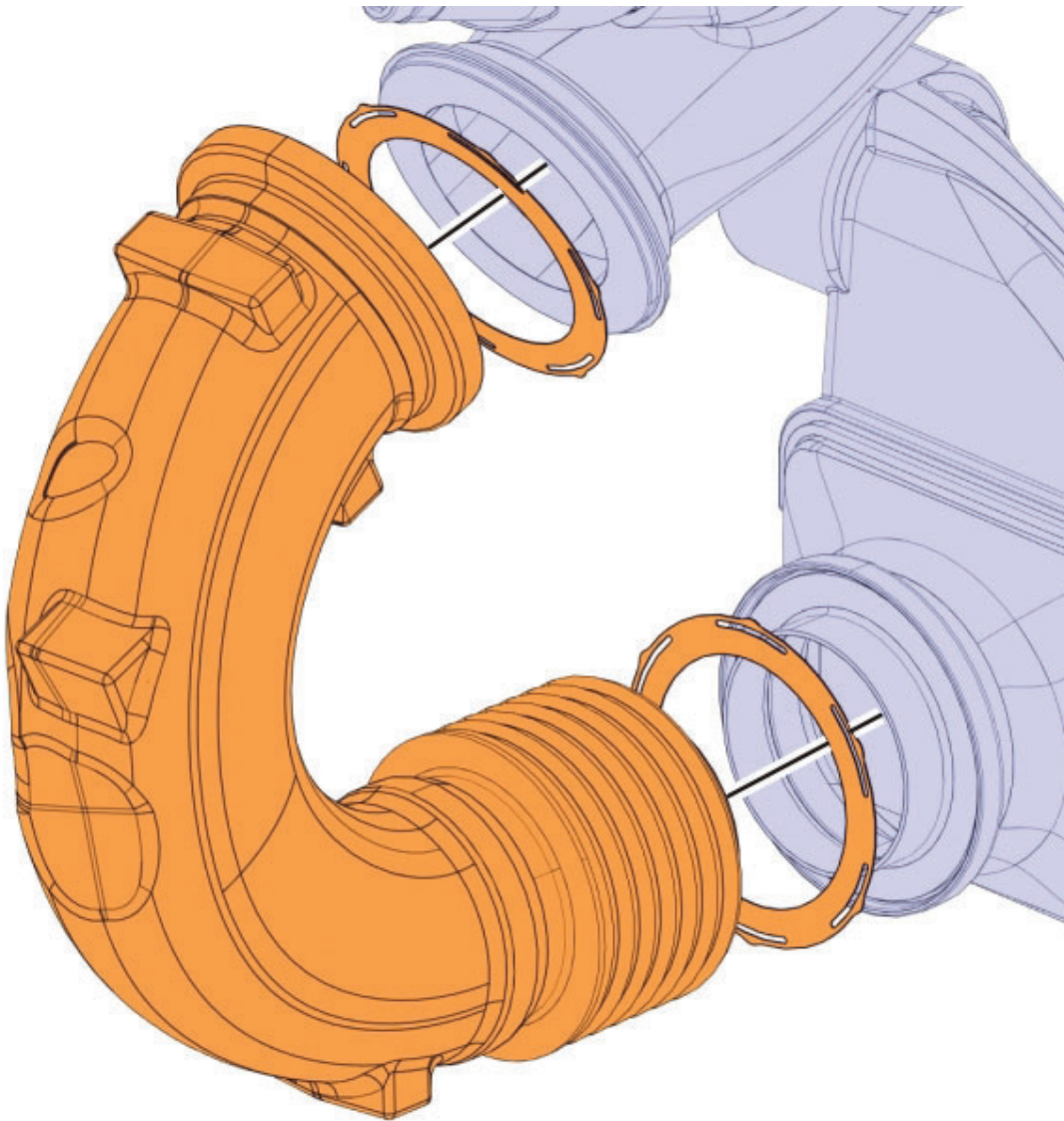
54 Remove the V-clamps.

**Note**

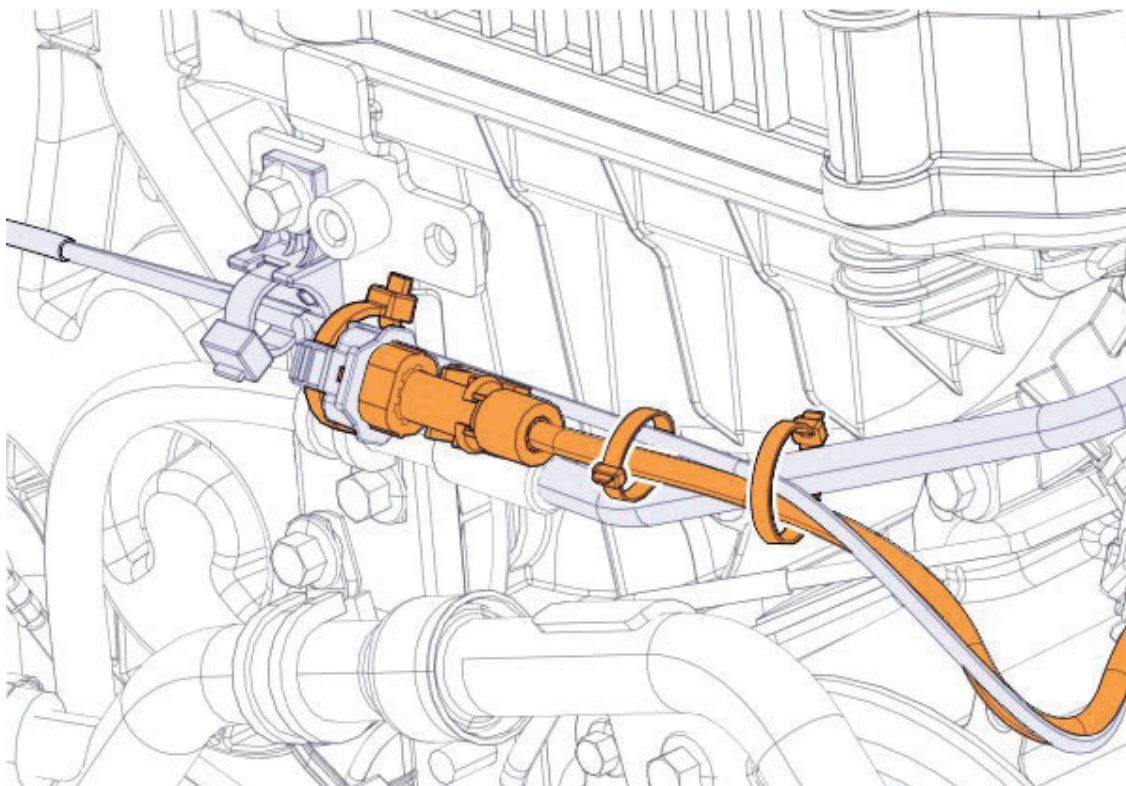
Note the V-clamp positions.



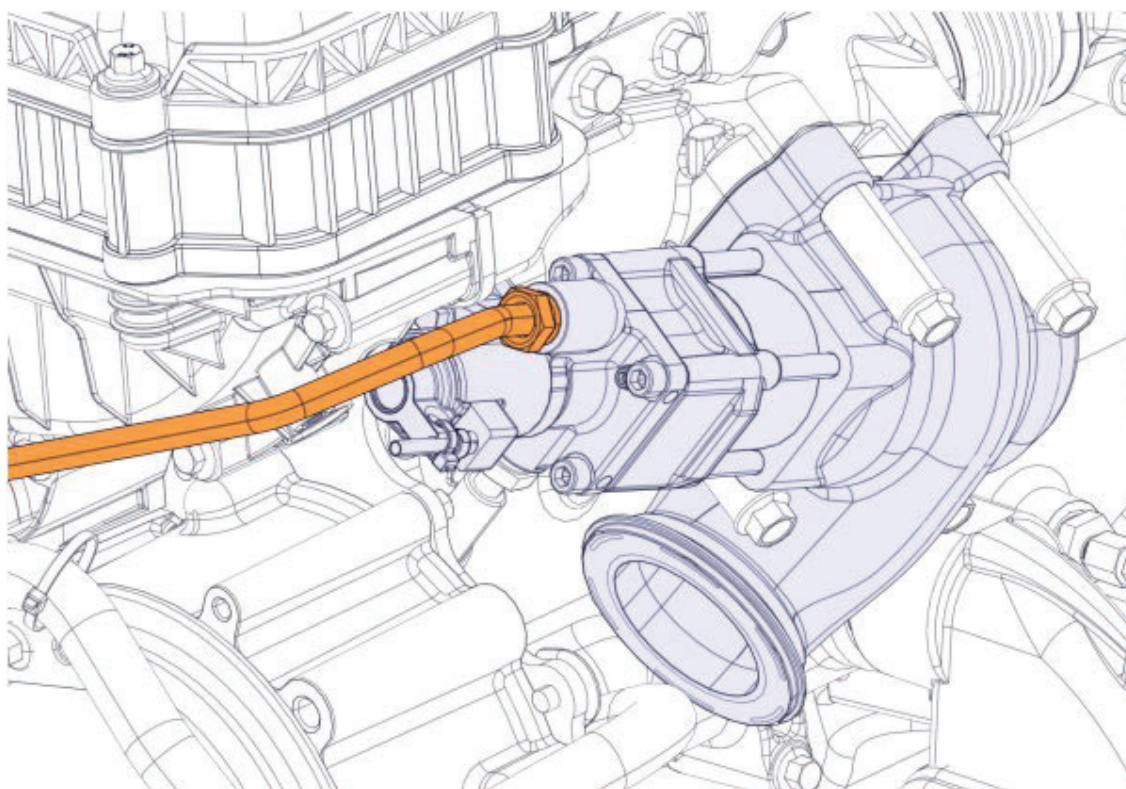
55	Remove the pipe.
56	Remove the gaskets.



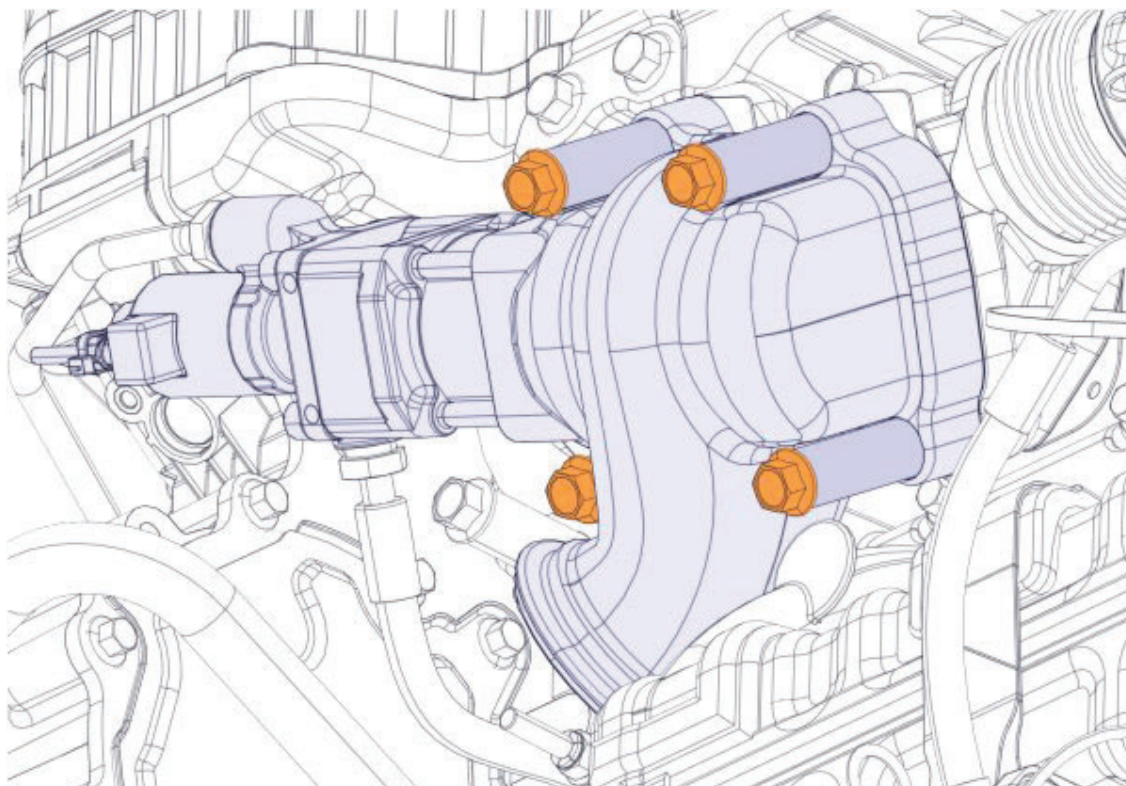
57	Remove the cable ties.
58	Disconnect the connector.
59	Move the cable aside.



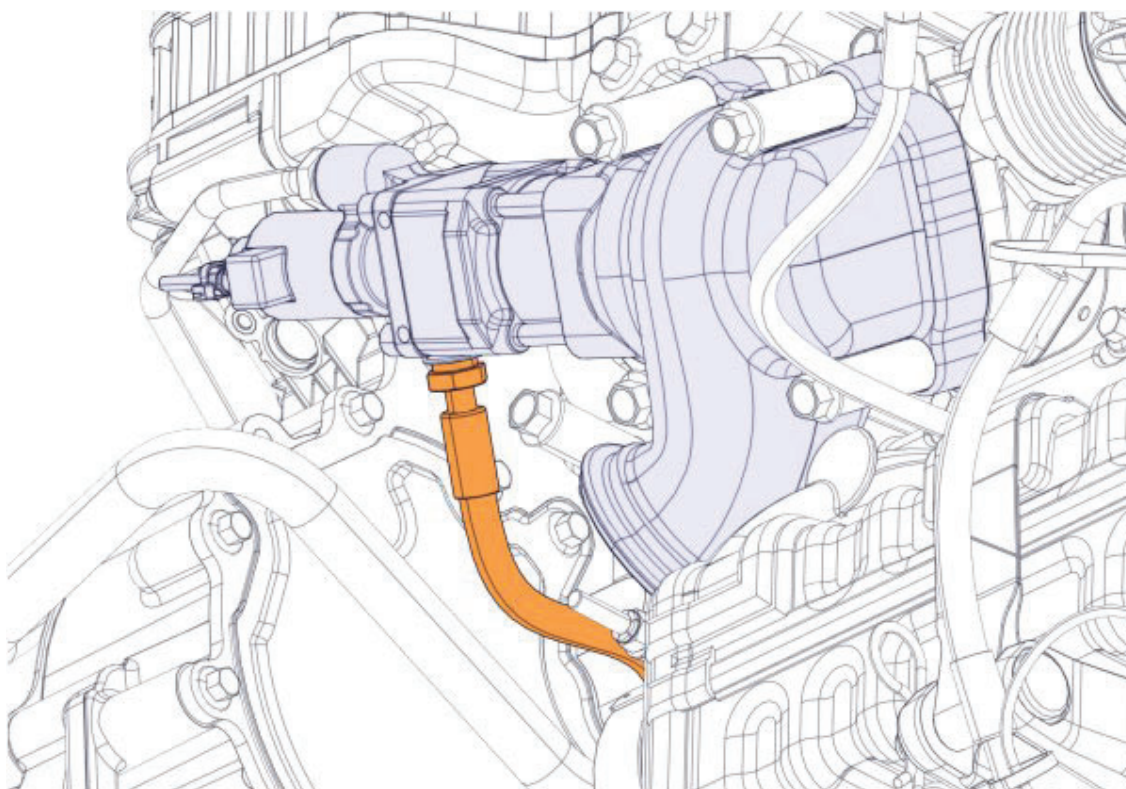
60	Loosen the pipe.
----	------------------



61	Loosen the screws.
----	--------------------

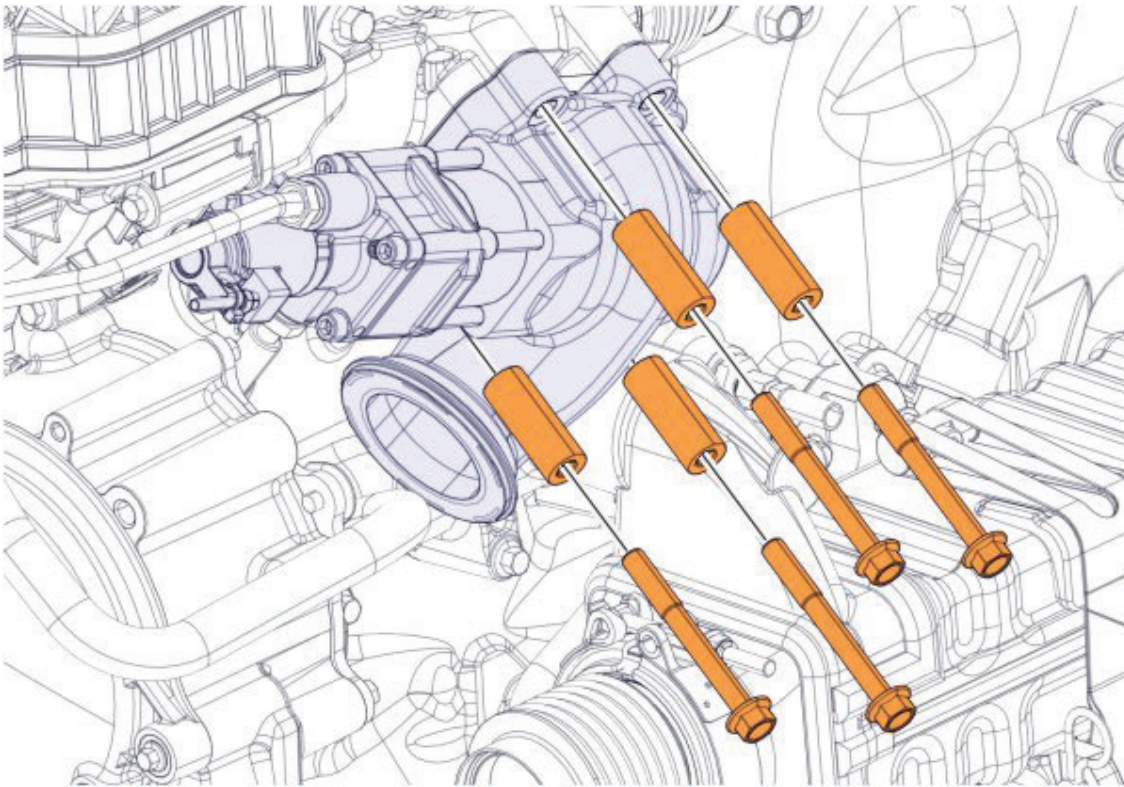


62	Loosen the pipe.
----	------------------

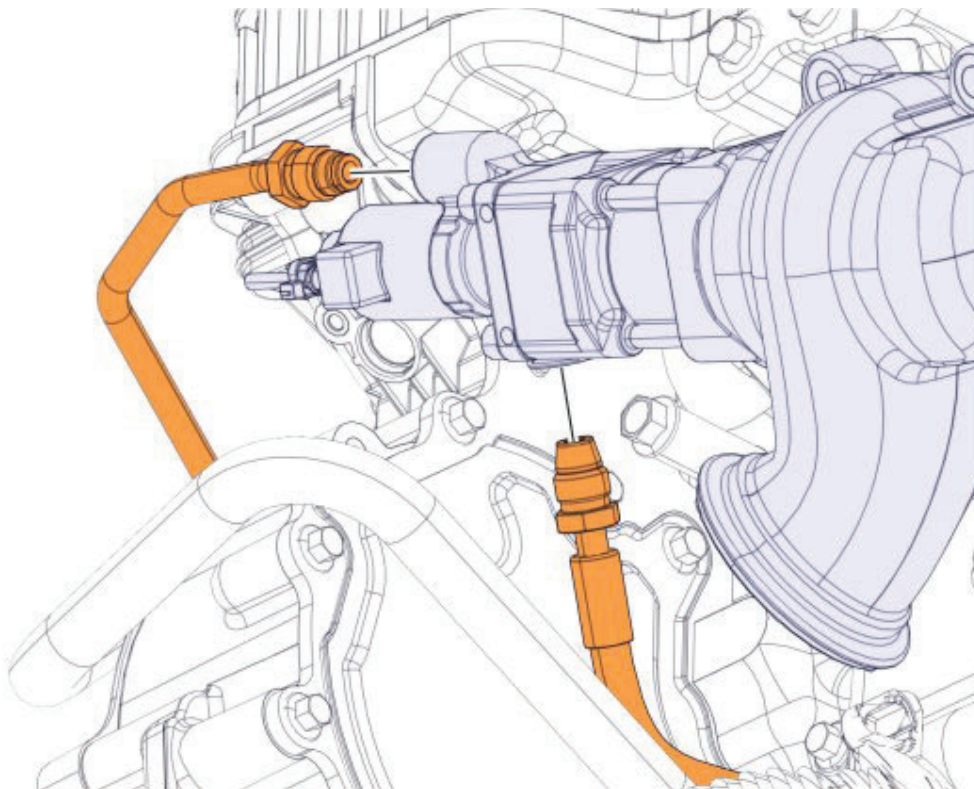


63	Remove the screws.
----	--------------------

64	Remove the spacers.
----	---------------------

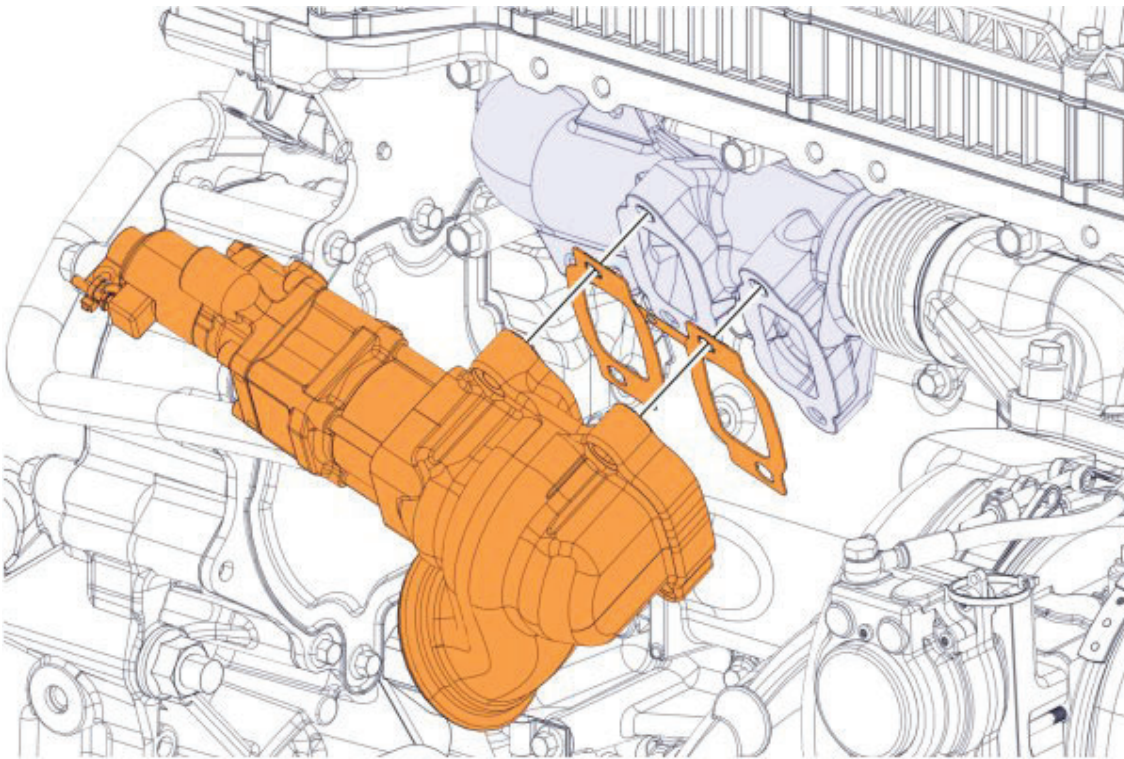


65	Remove the pipes.
----	-------------------

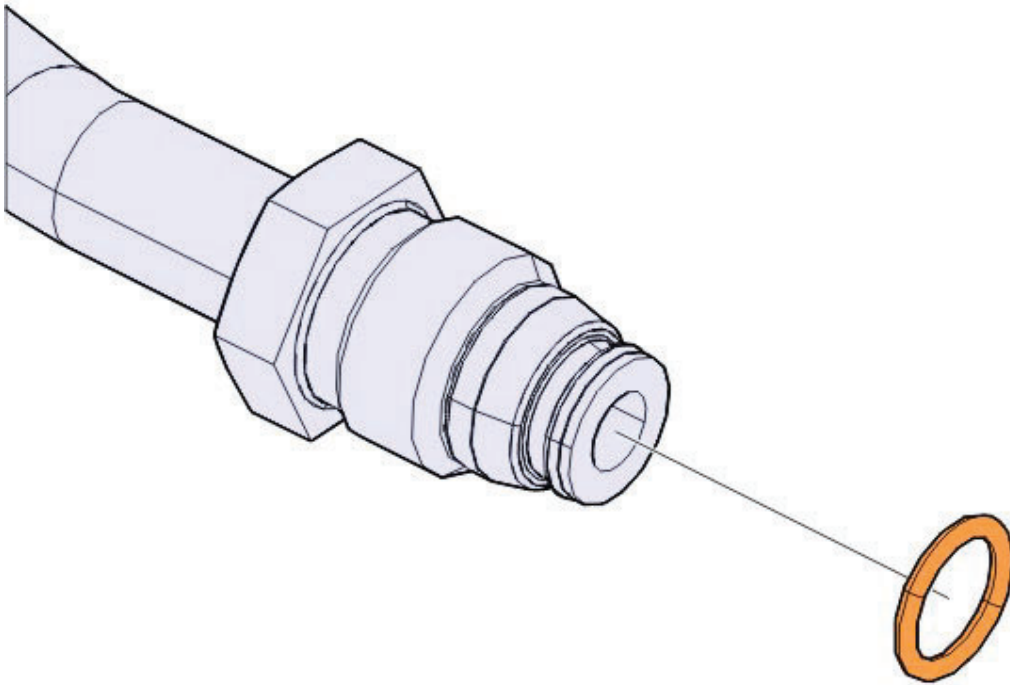


66	Remove the valve.
----	-------------------

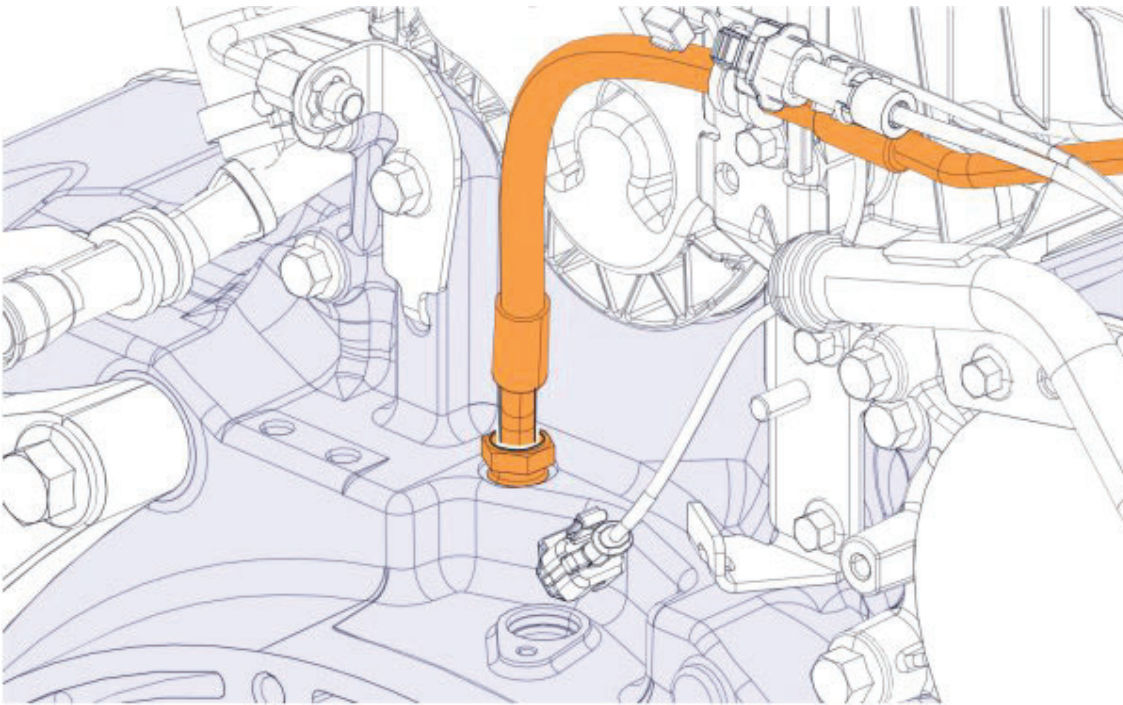
67	Remove the gasket.
----	--------------------



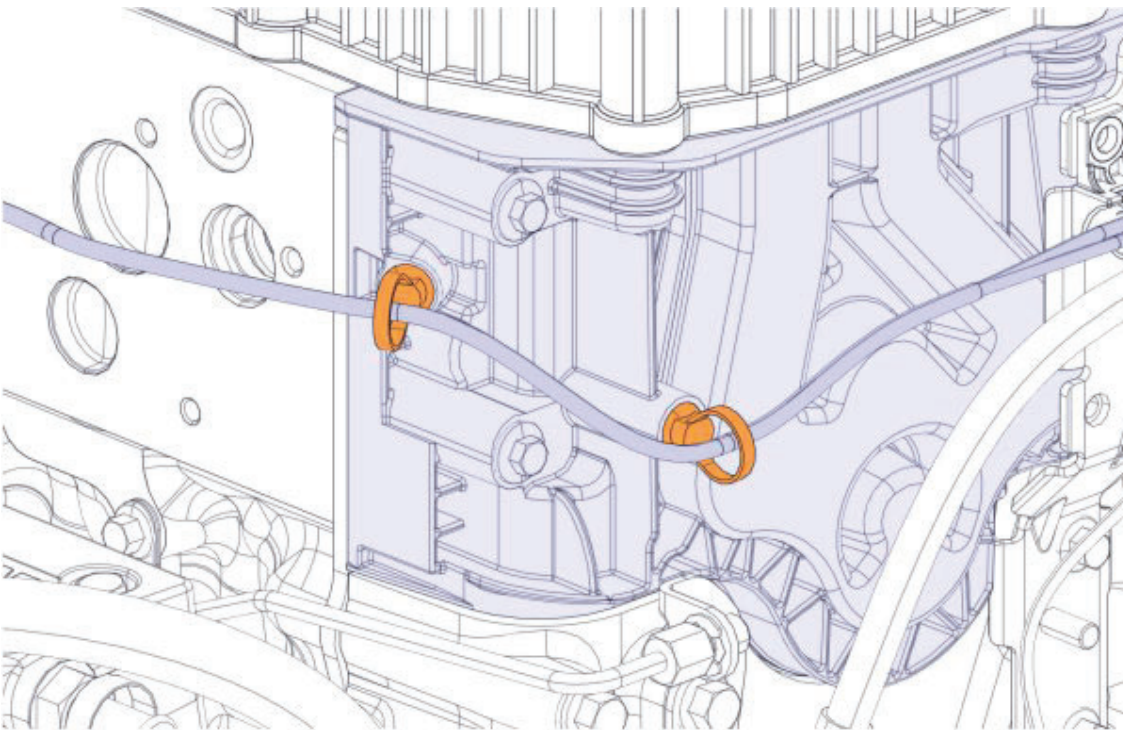
68	Remove the seal.
----	------------------



69	Loosen the nut.
70	Remove the hose.

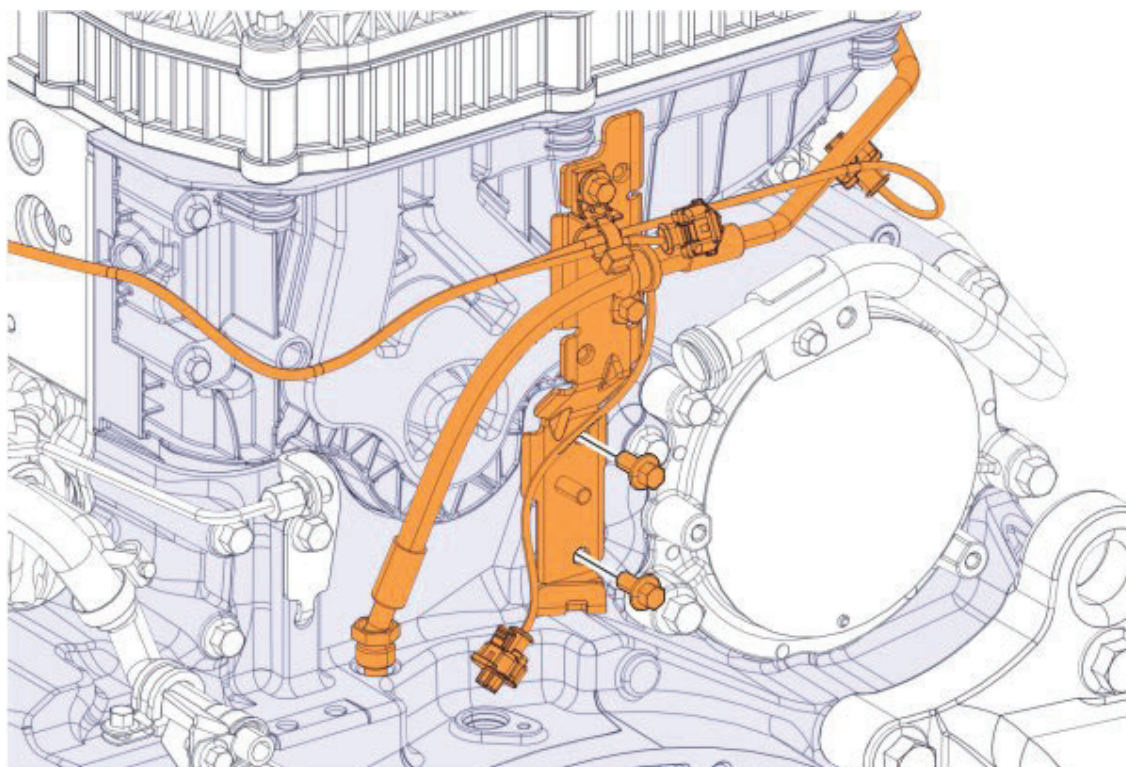


71	Remove the cable ties.
----	------------------------

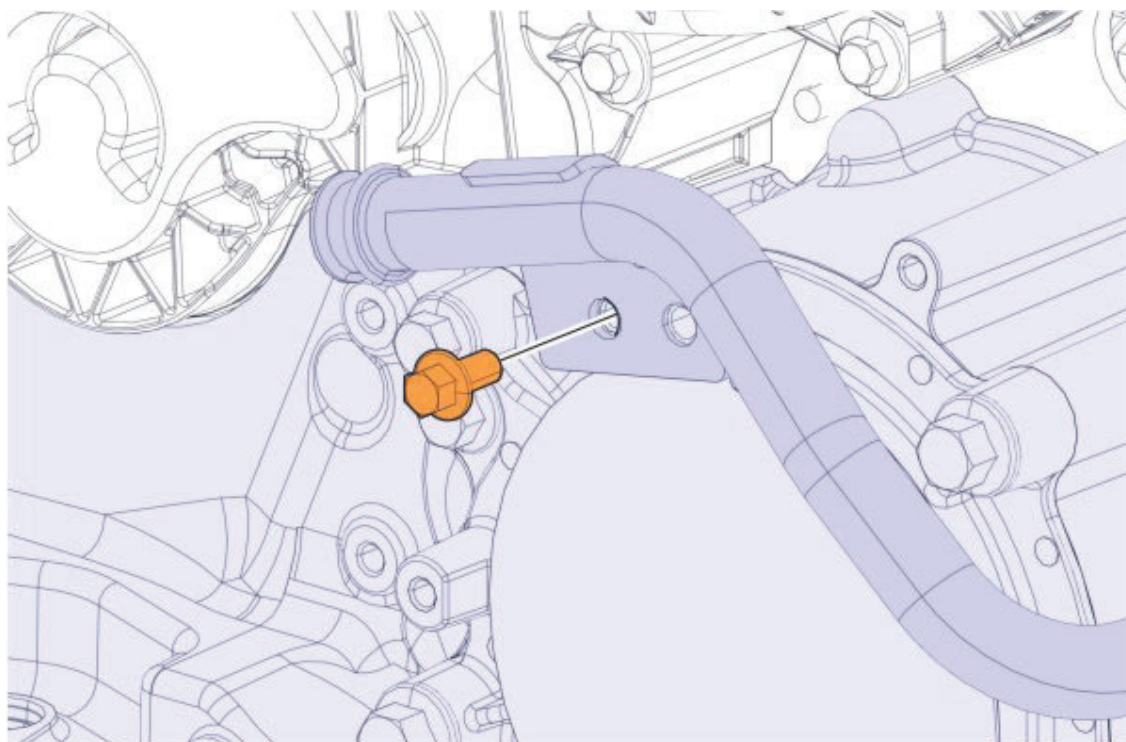


72	Remove the screws.
----	--------------------

73	Move the assembly aside.
----	--------------------------

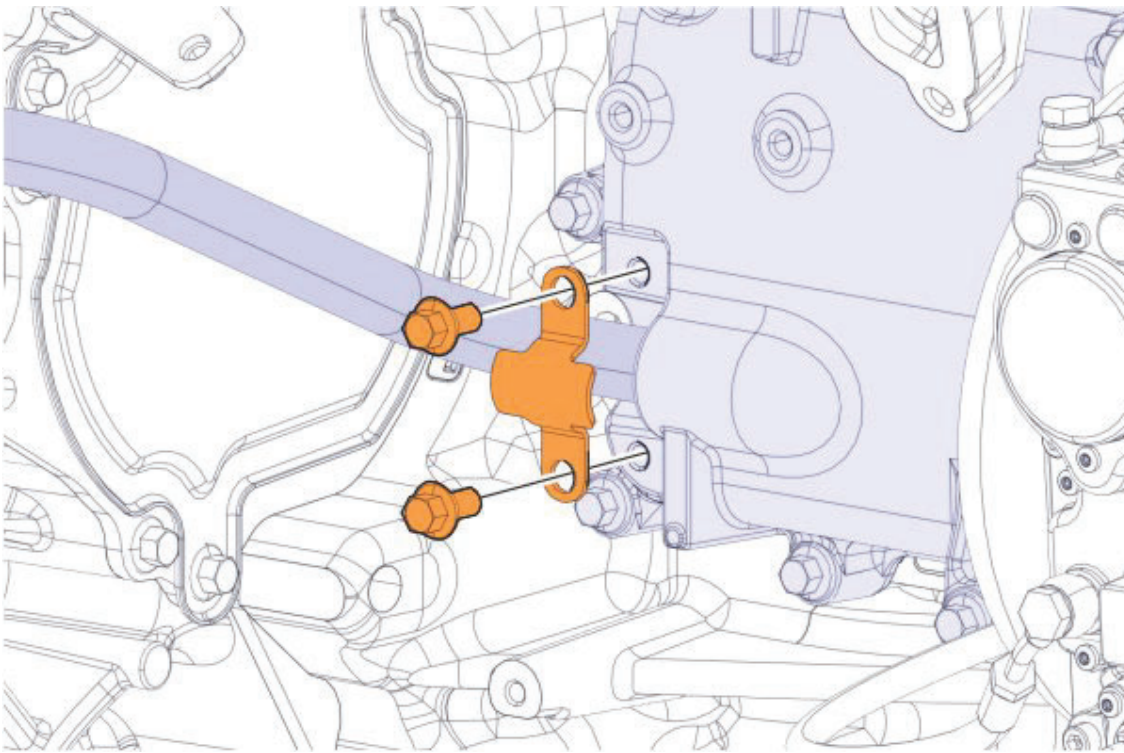


74	Remove the screw.
----	-------------------



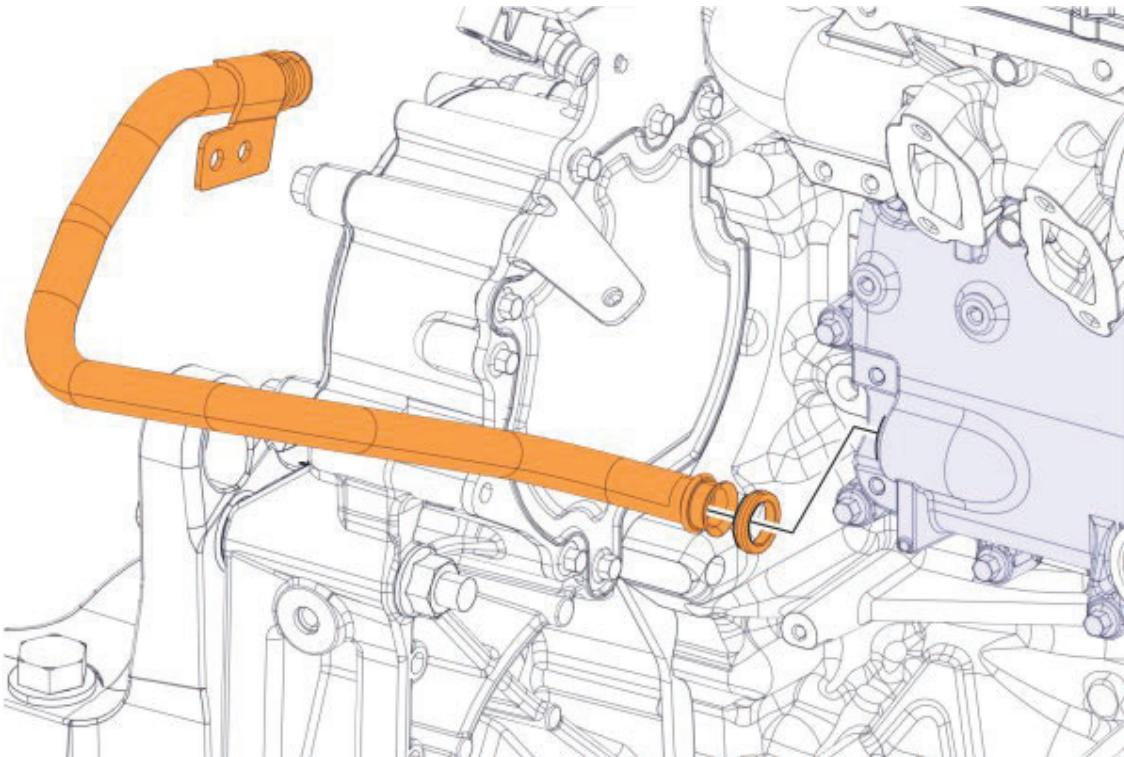
75	Remove the screws.
----	--------------------

76	Remove the clamp.
----	-------------------



77	Remove the pipe.
----	------------------

78	Remove the seal.
----	------------------



79	Remove the screws.
----	--------------------

80	Remove the pump.
----	------------------

	Note
--	--------------------

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.



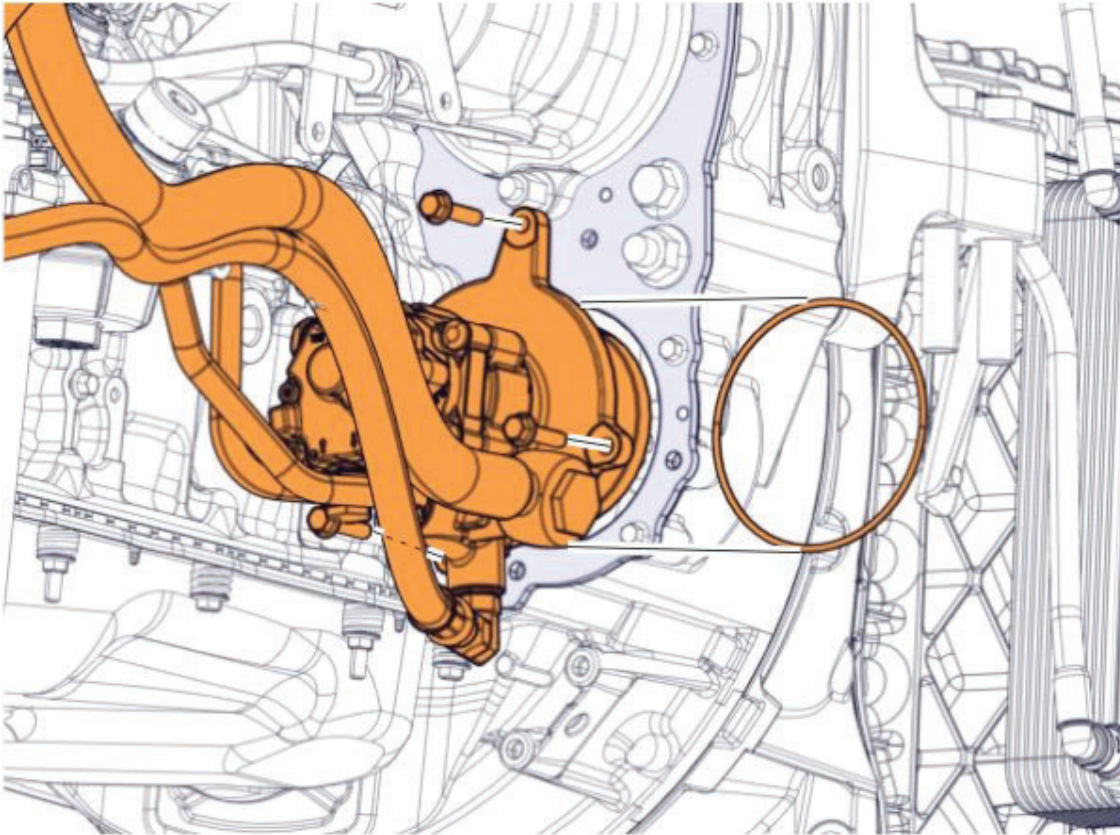
Leave the pipes connected to the pump.



Note

Support the pump.

81 Remove the seal.



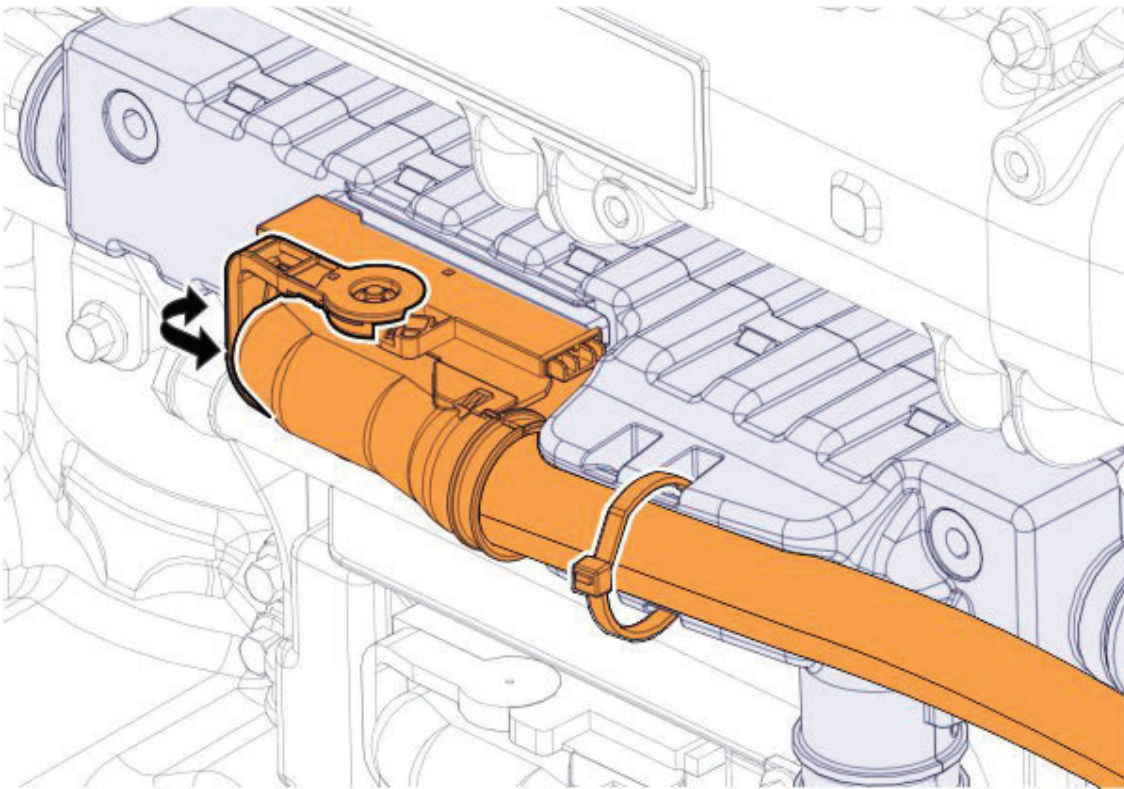
82 Remove the cable ties.



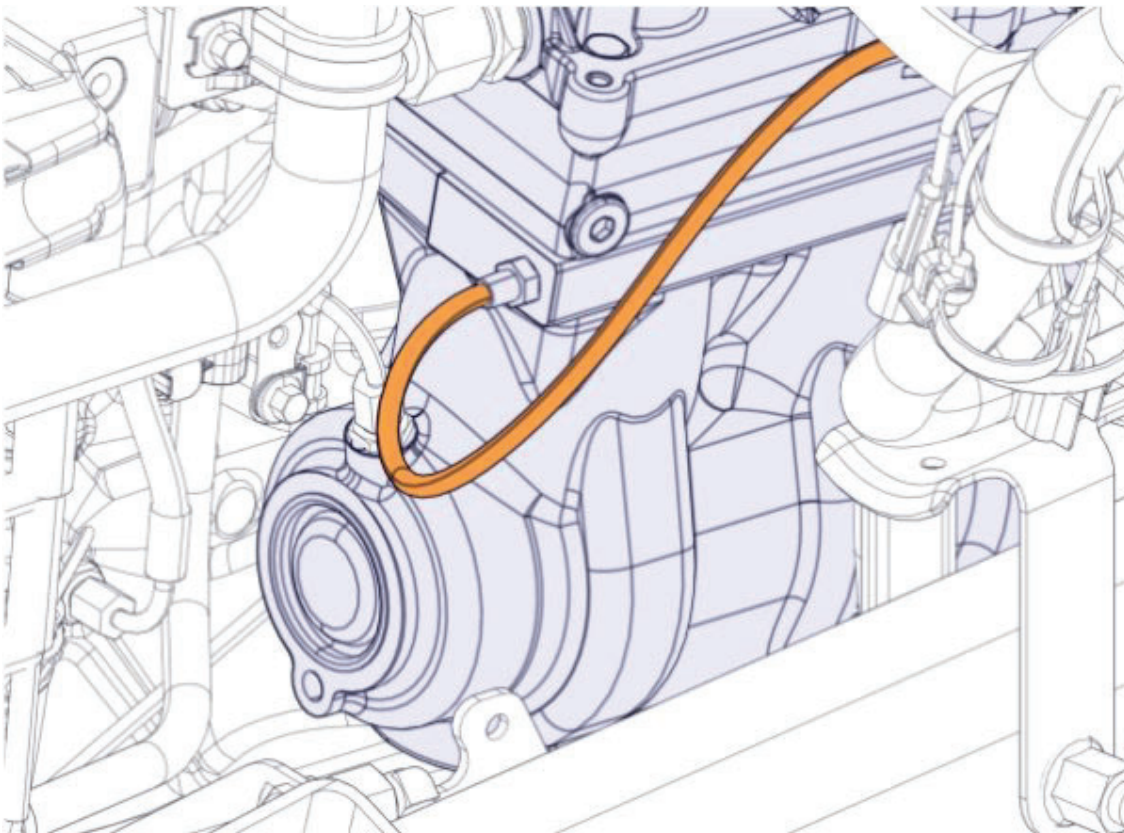
Note

Note the positions.

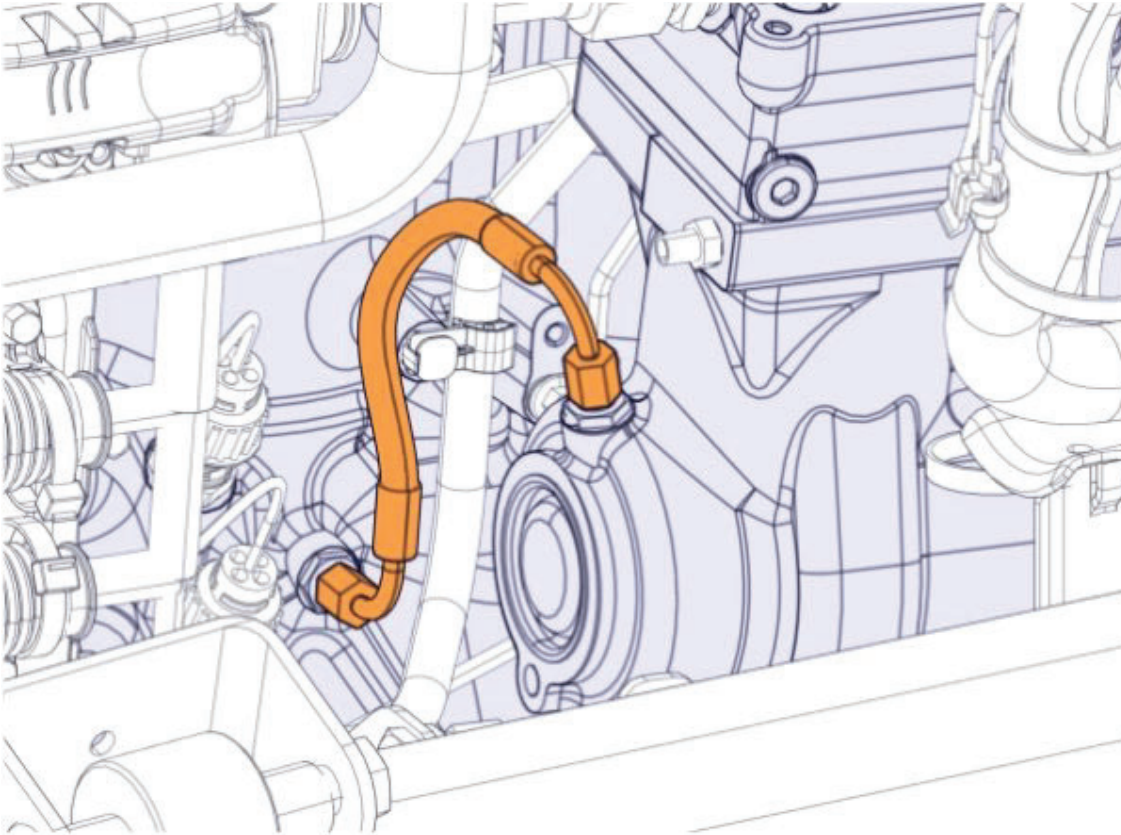
83 Disconnect the connector.



84	Disconnect the air line.	
	Required material	
	DISASSEMBLY TOOL	88870002

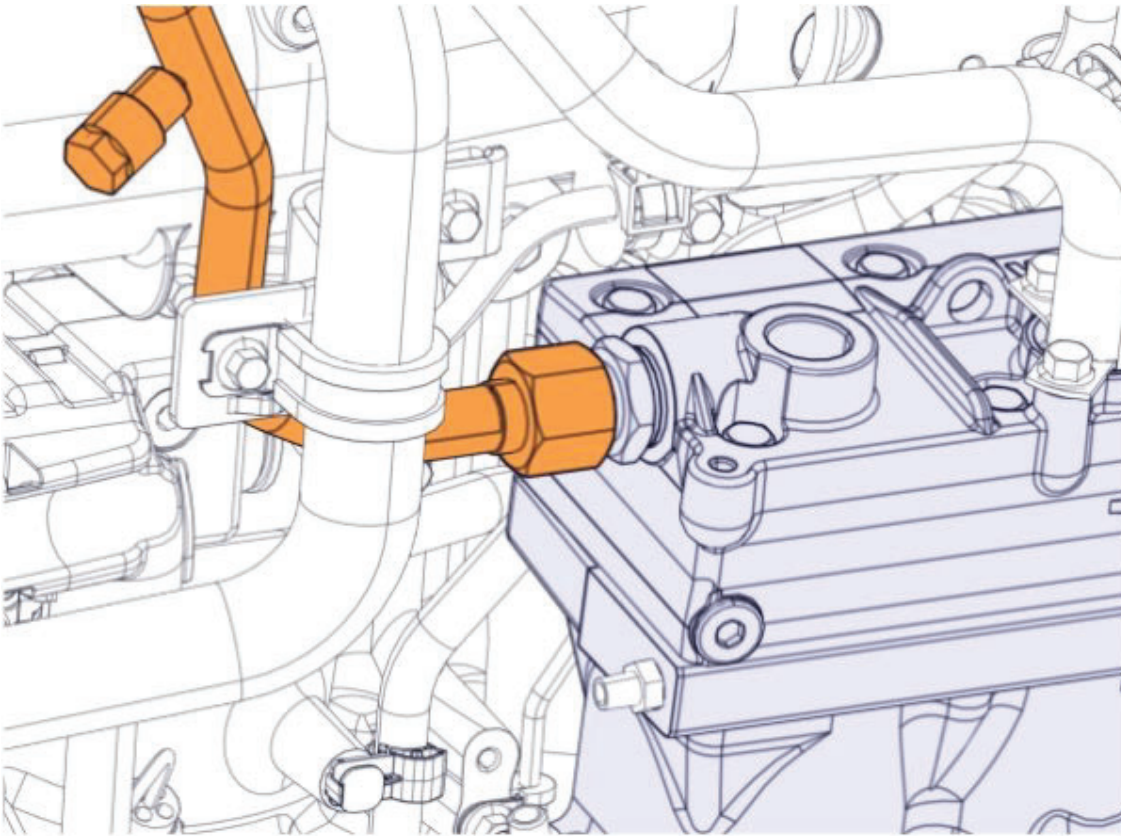


85	Remove the oil hose.
----	----------------------

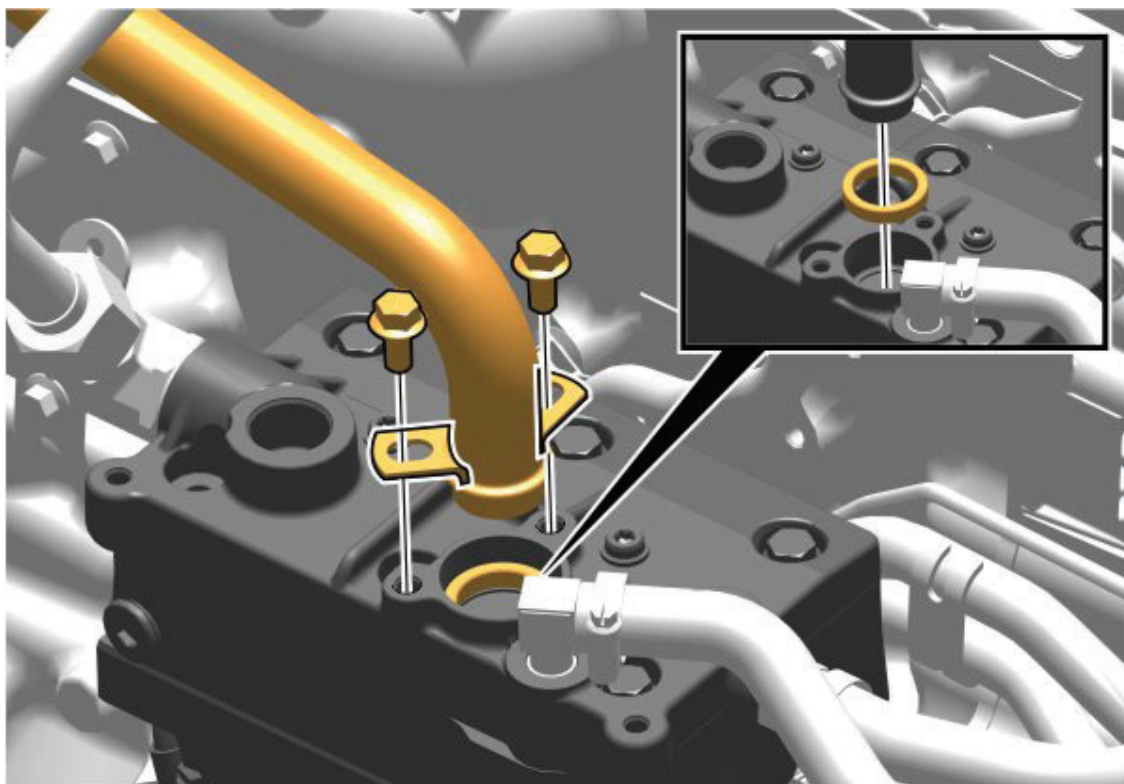


86	Loosen the nut.
----	-----------------

87	Remove the pipe.
----	------------------

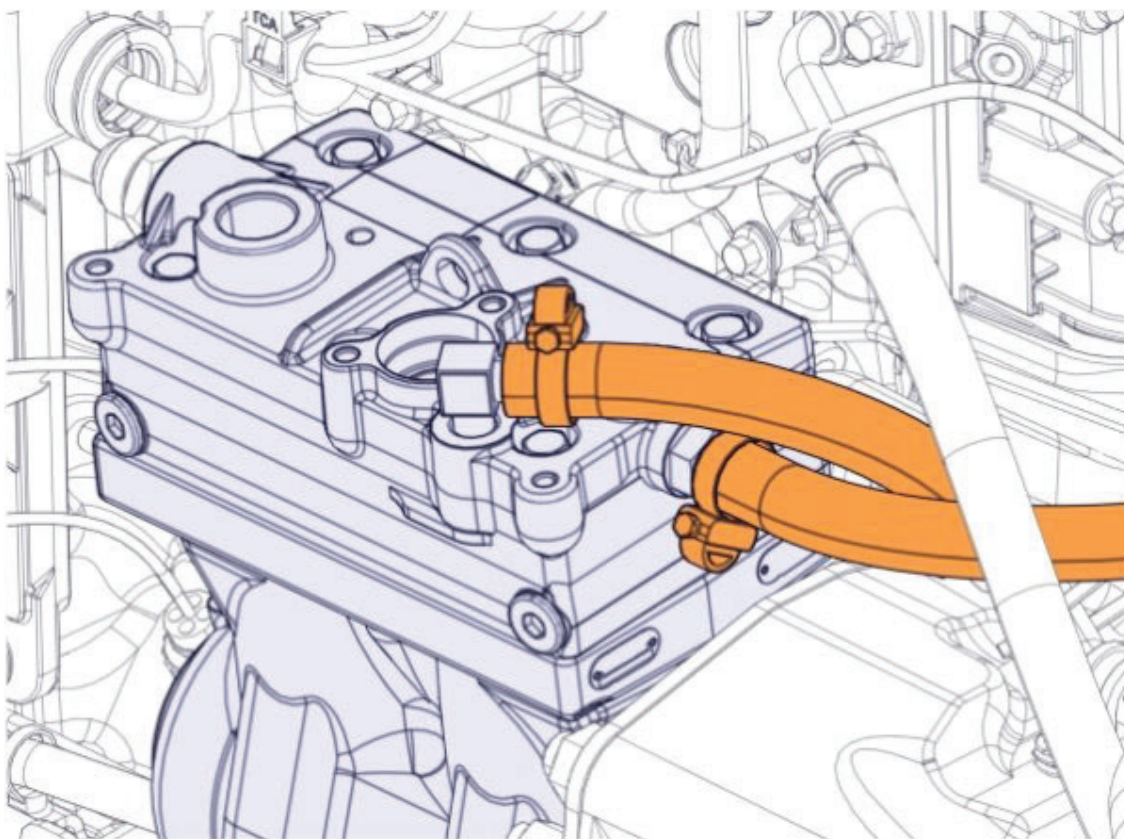


88	Remove the screws.
89	Remove the lock braces.
90	Move aside the pipe.
91	Remove the sealing ring.



92	Loosen the clamps.
-----------	--------------------

93	Remove the hoses.
-----------	-------------------



94	Remove the nuts.
-----------	------------------

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

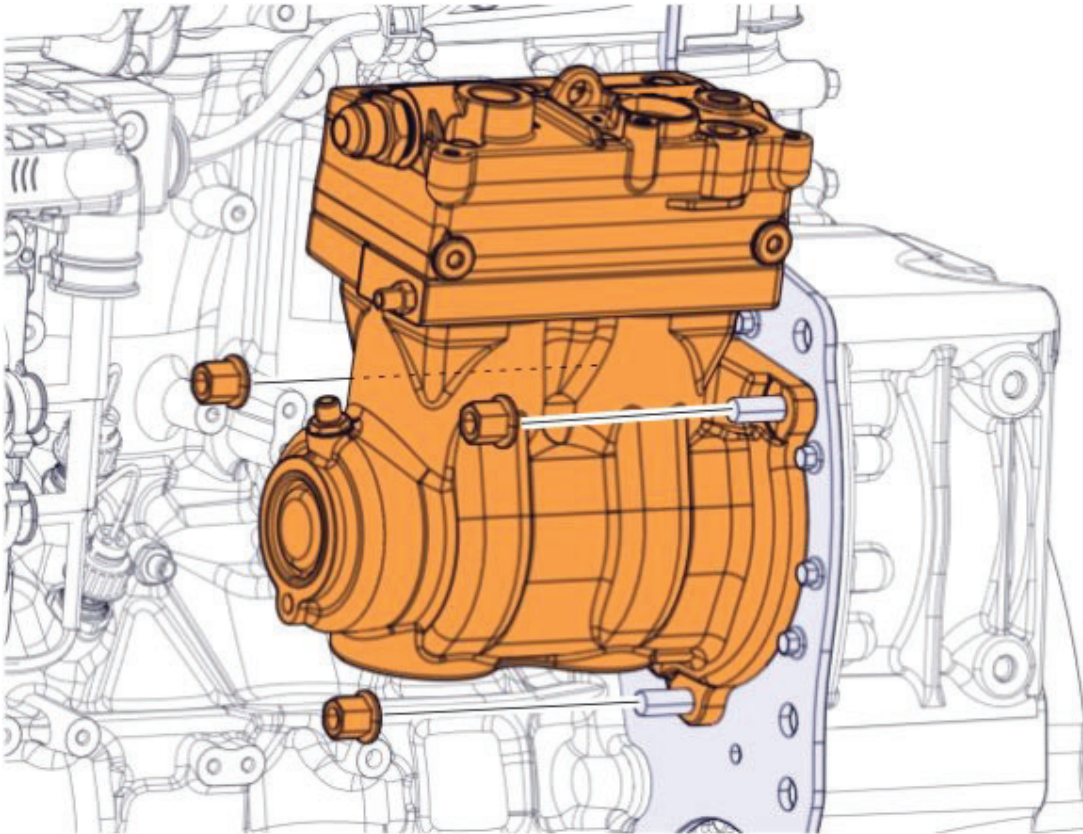
**CAUTION**

Risk of serious injury.

Heavy component.

- Exercise caution when moving the component. Use appropriate tools.

95 Remove the compressor.

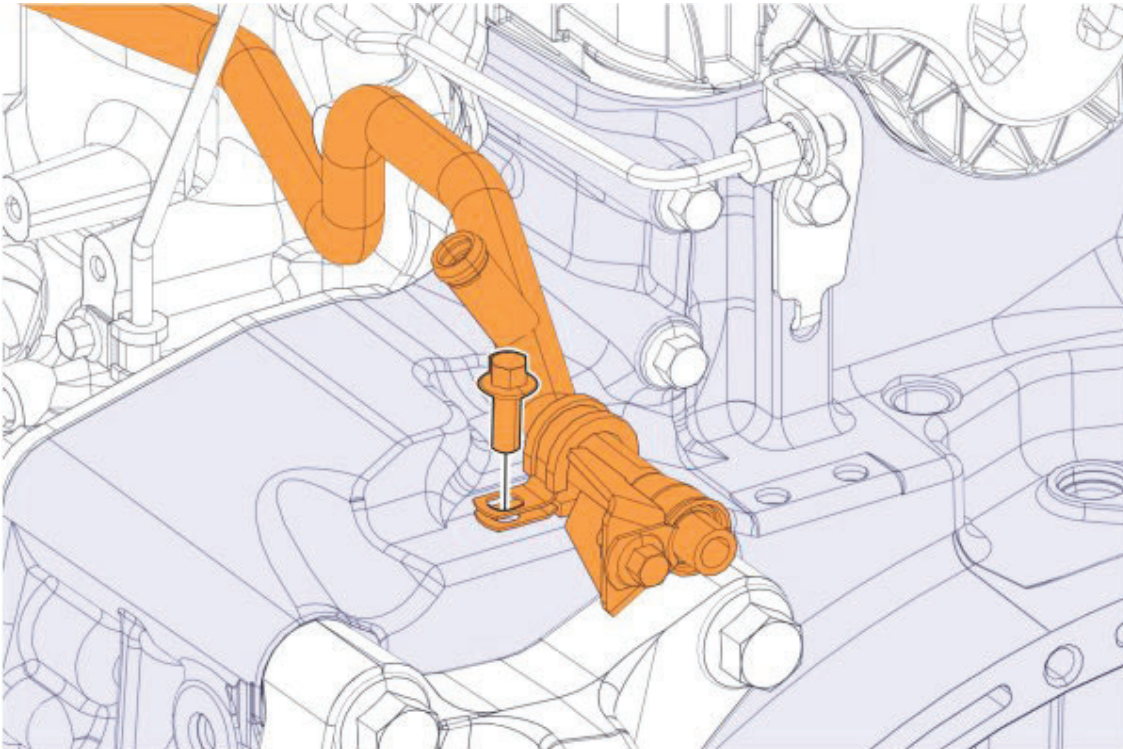


96 Remove the O-ring.



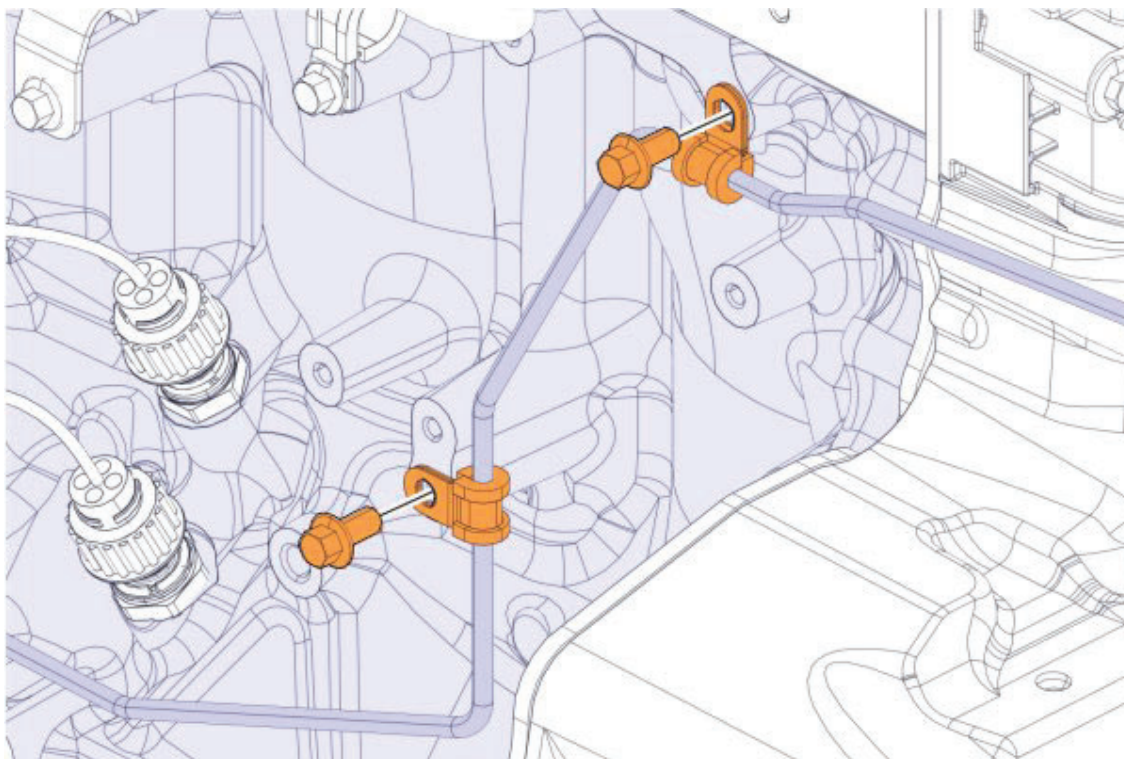
97	Remove the screw.
----	-------------------

98	Move aside the pipe.
----	----------------------



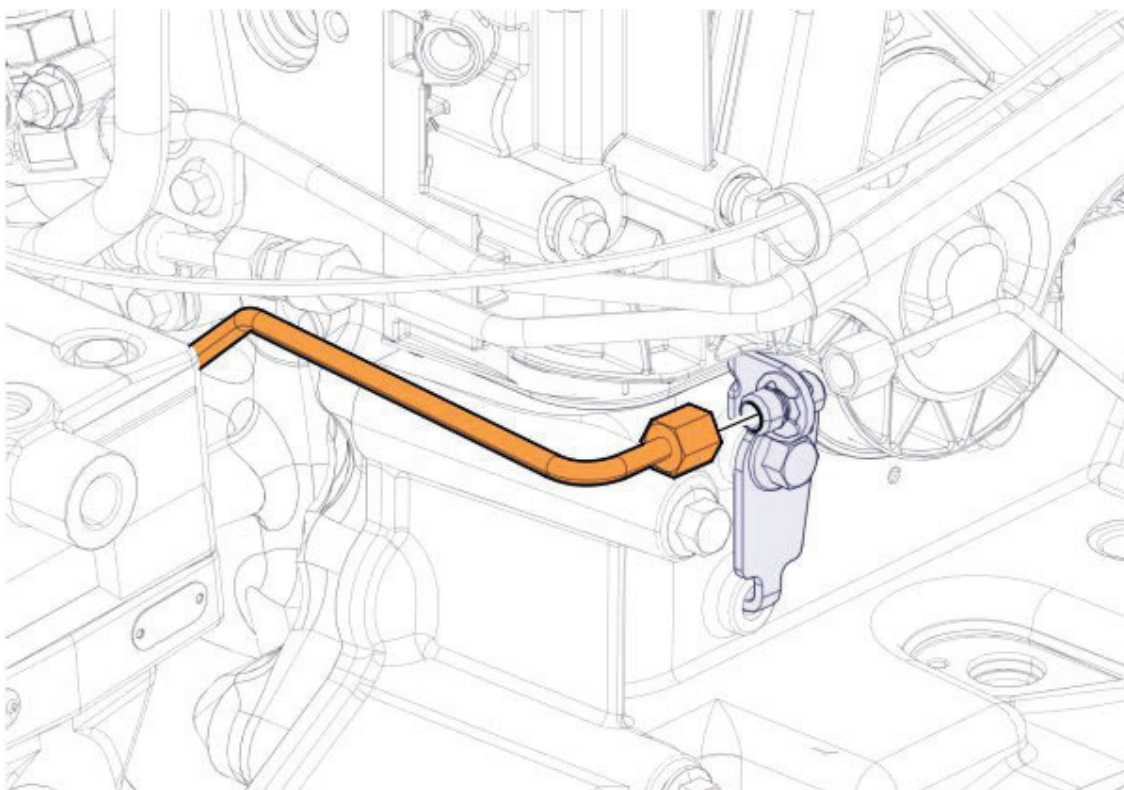
99	Remove the screws.
----	--------------------

100	Remove the clamps.
-----	--------------------



101	Loosen the nut.
-----	-----------------

102	Remove the pipe.
-----	------------------

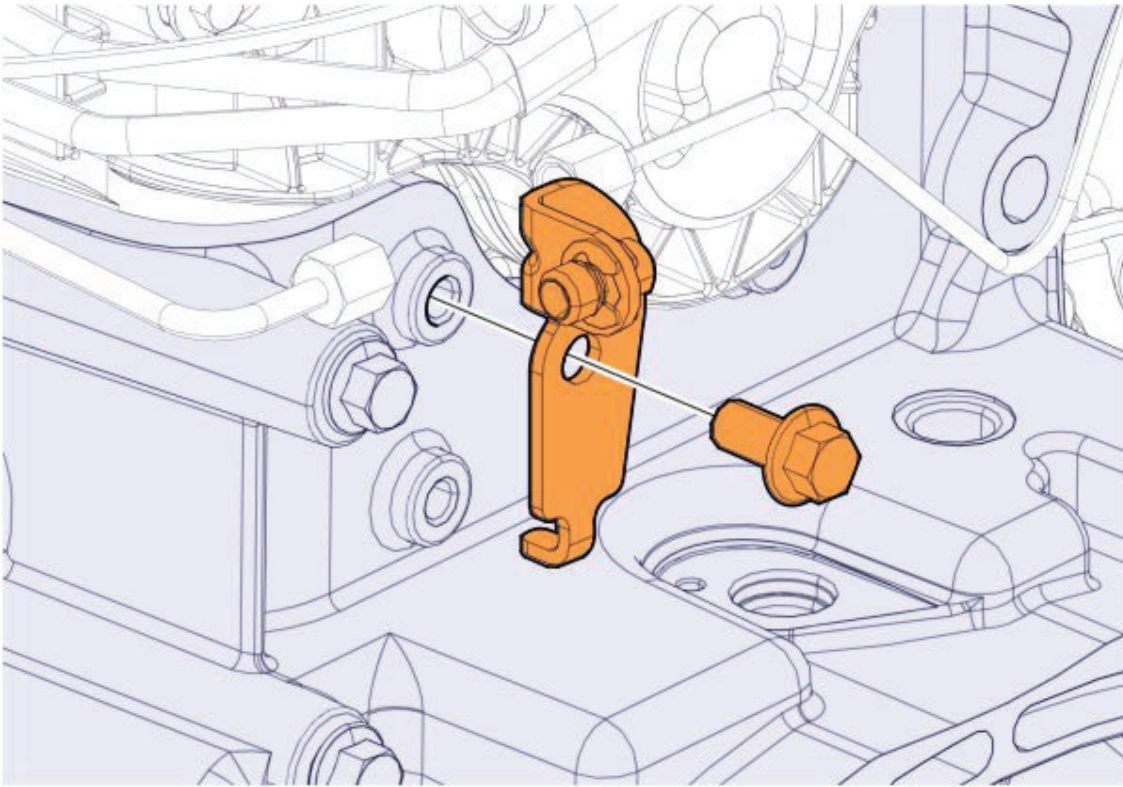


103	Remove the screw.
-----	-------------------

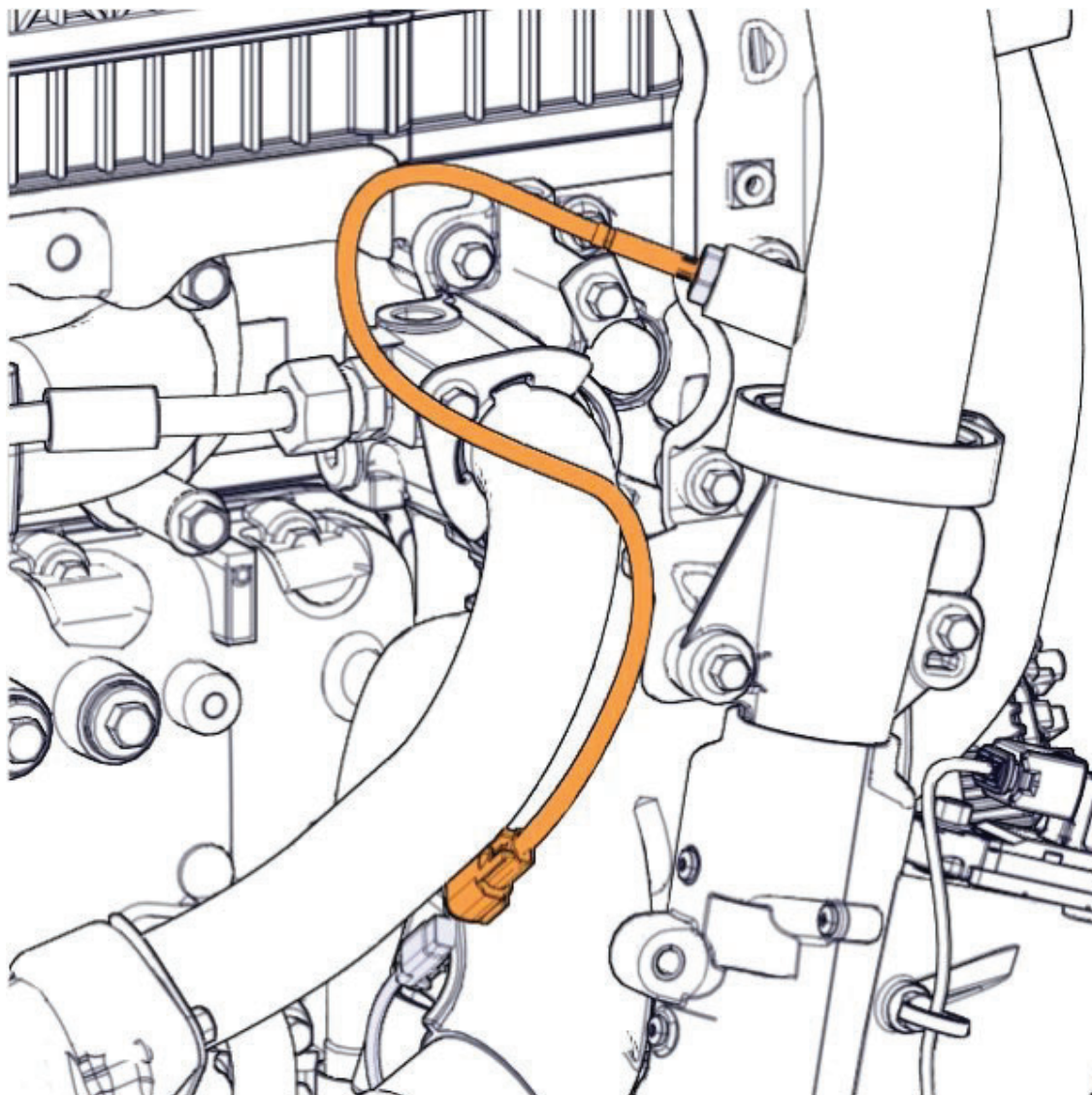
104	Remove the bracket.
-----	---------------------

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

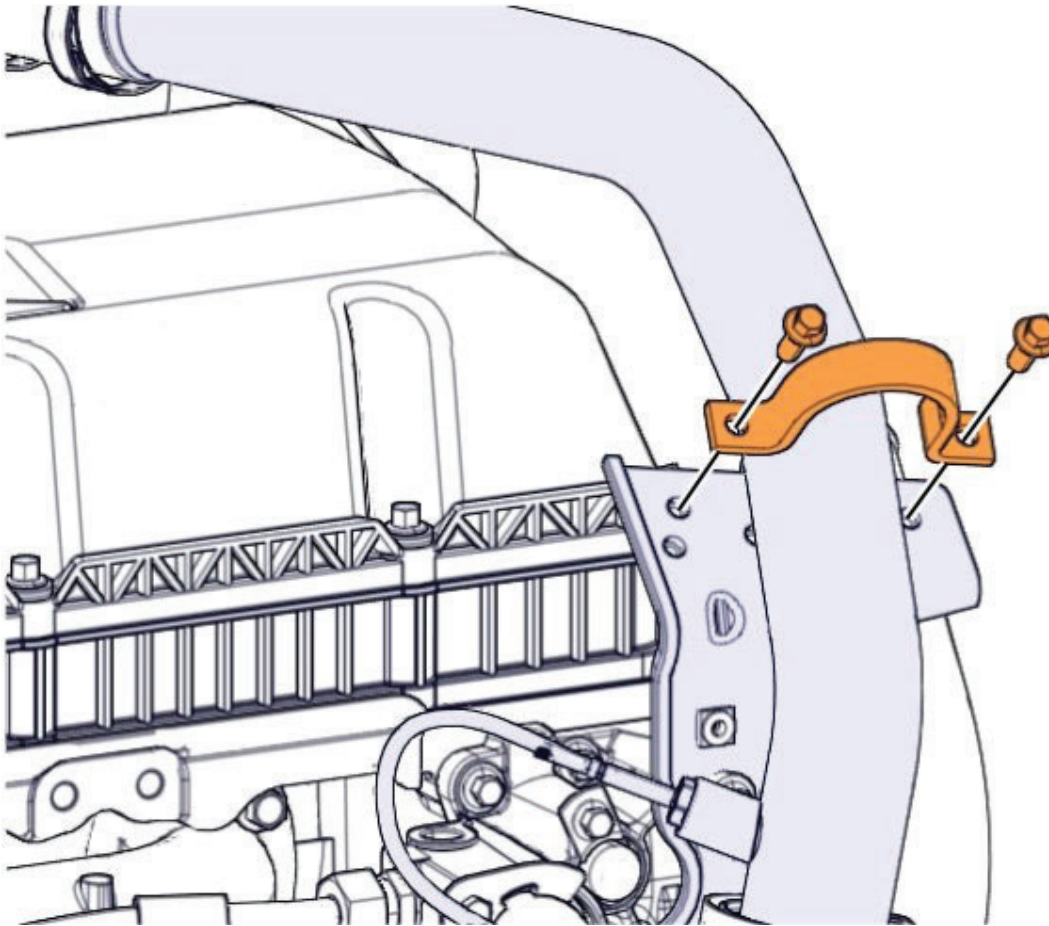


105	Disconnect the connector.
106	Remove the cable tie.



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

108	Remove the clamp.
-----	-------------------

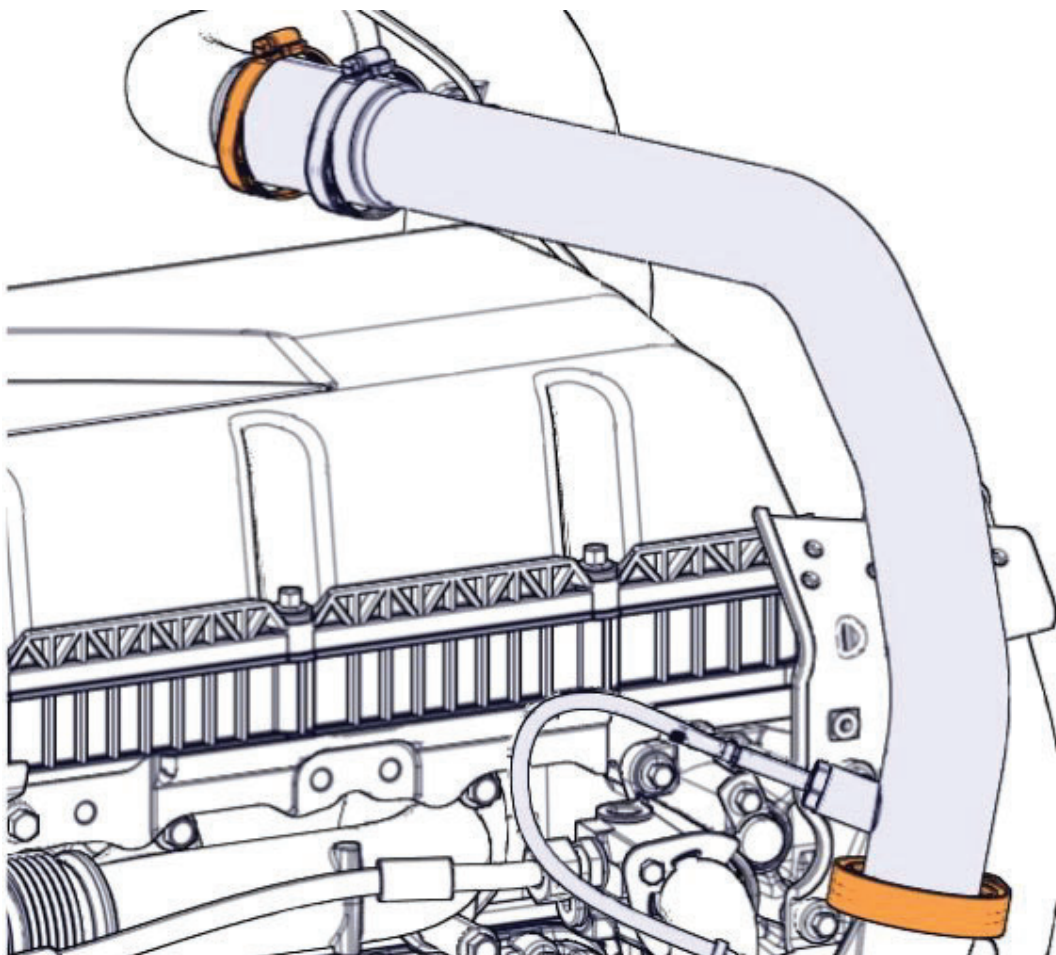


109 Loosen the clamps.

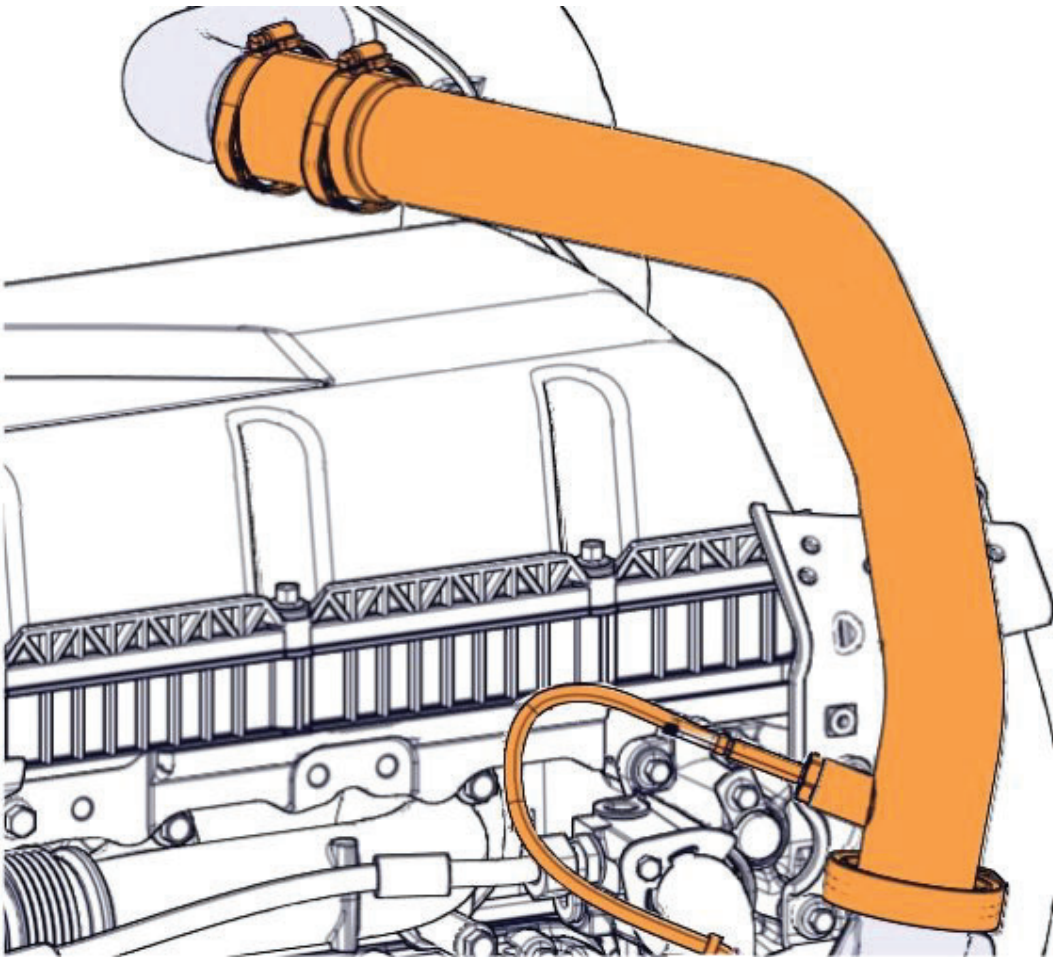


Note

Note the positions.

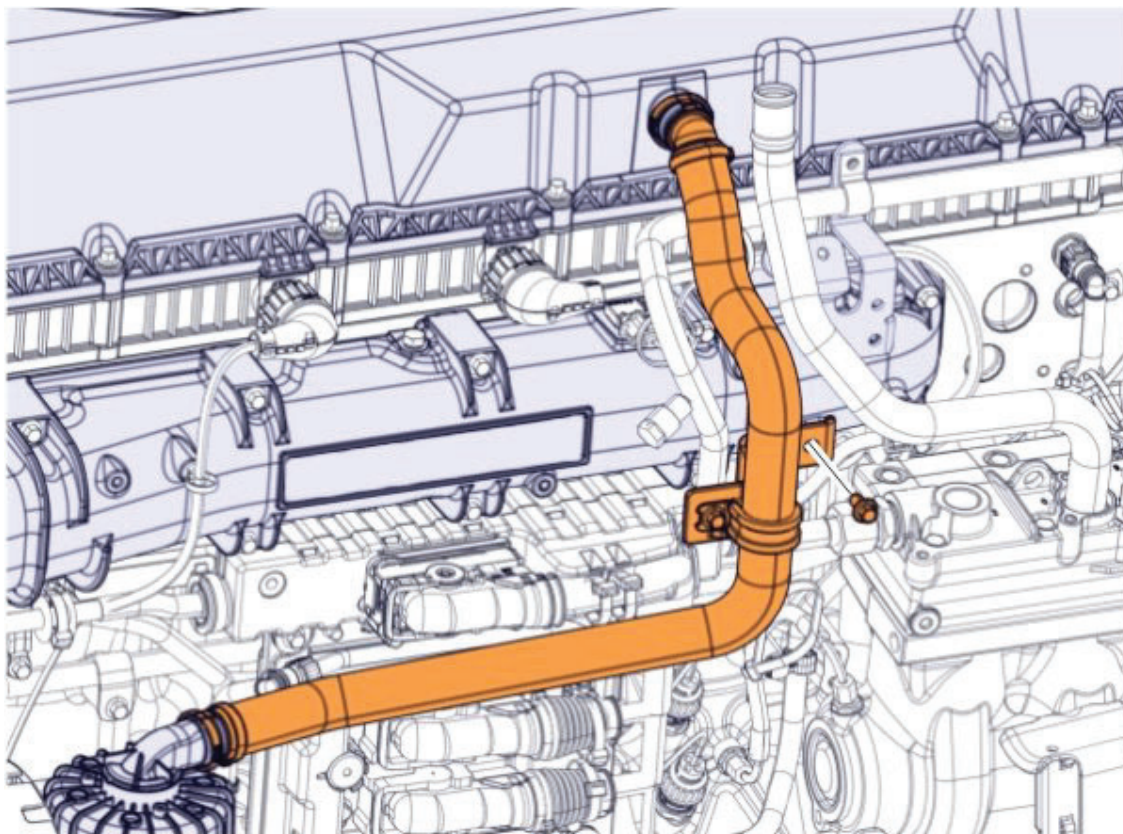


110	Remove the pipe.
-----	------------------



111	Remove the screw.
-----	-------------------

112	Remove the pipe.
-----	------------------

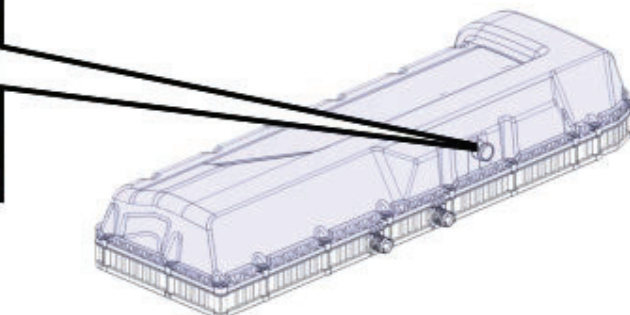
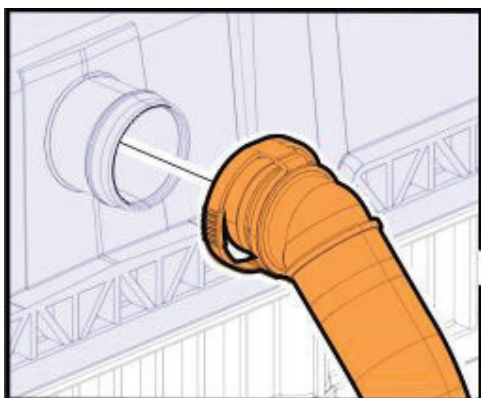


113 Remove the pipe.



Note

If not previously removed.



114 Loosen the screws.

115 Remove the valve cover.



Service hint

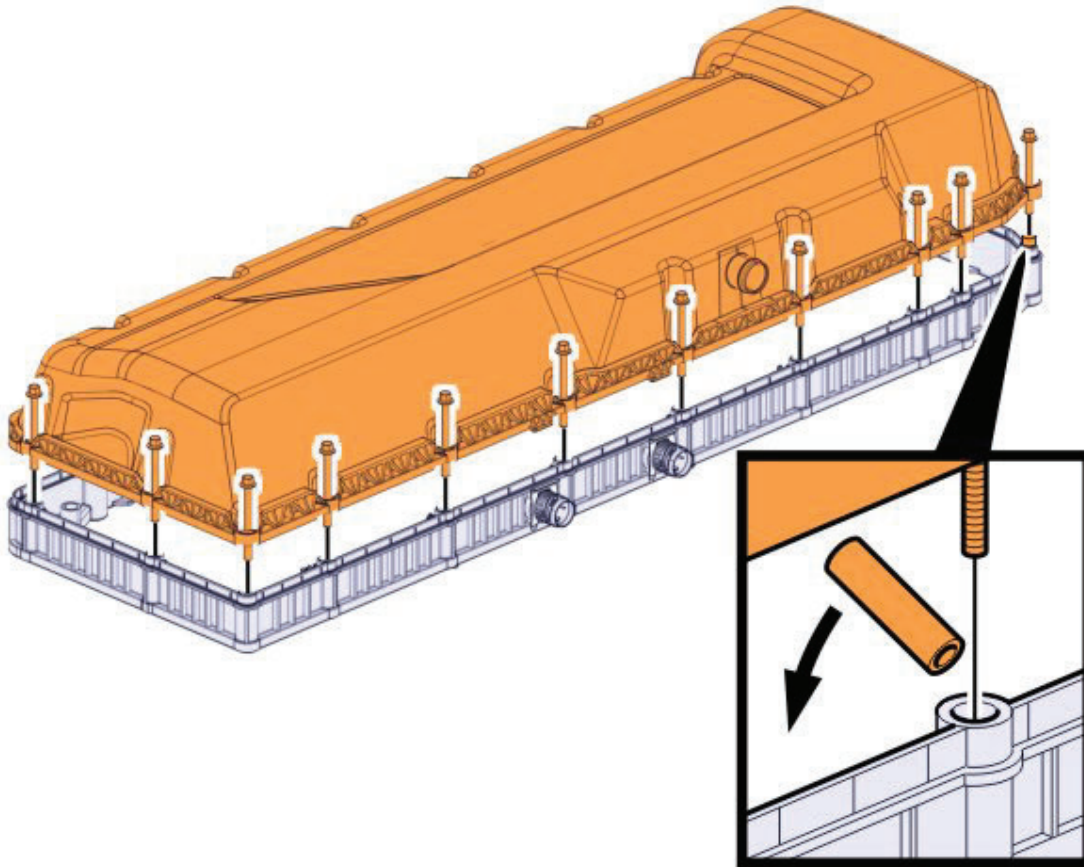
It is possible, when removing a valve cover screw, that the crush sleeve is drawn out with it. Take care to prevent the sleeve from falling into the gear train as this could result in engine damage.

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

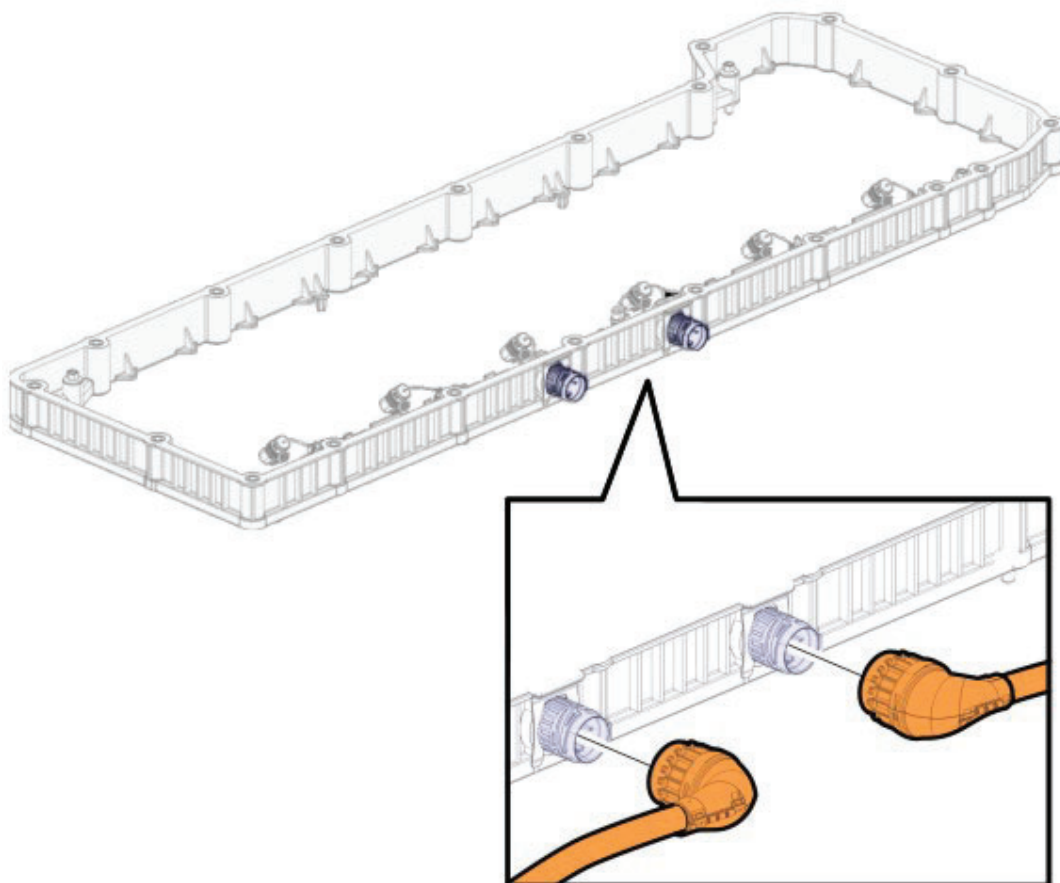
The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

**Service hint**

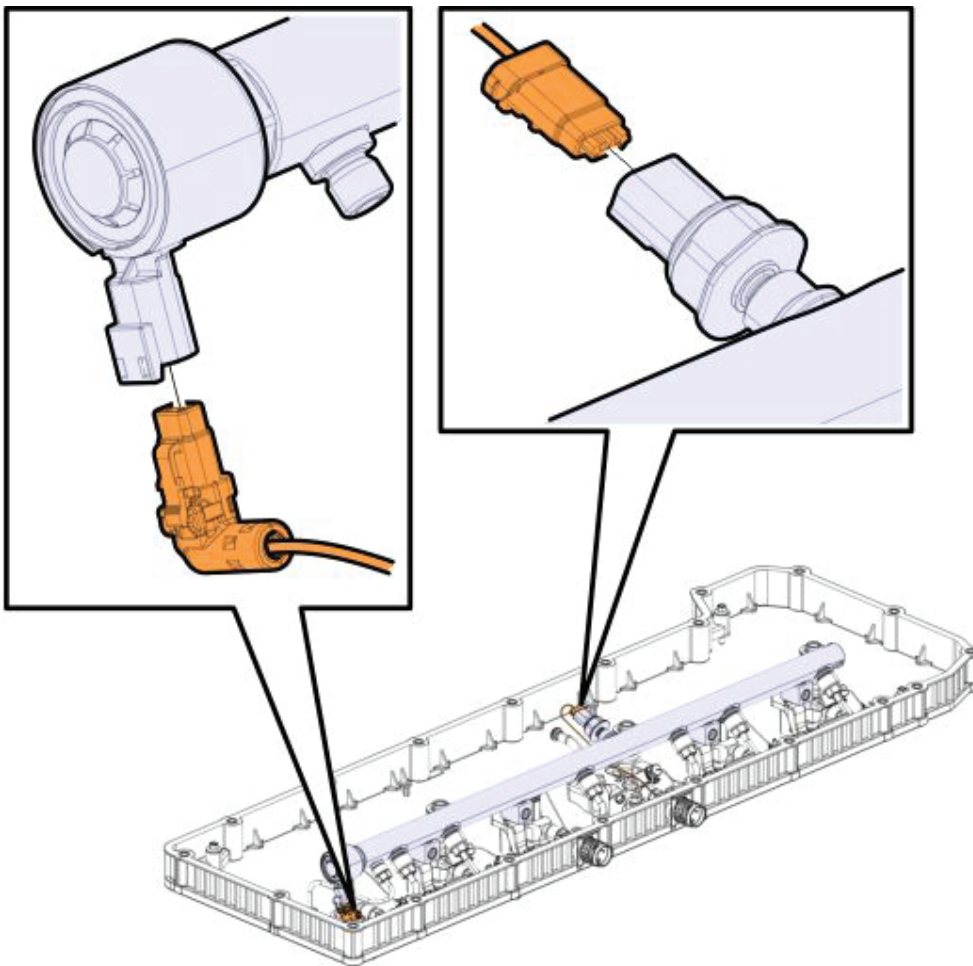
You do not need to loosen the valve or adjust the injector or the rocker arm shaft to replace the timing gear plate. A revised procedure for adjusting gear lash has been created.



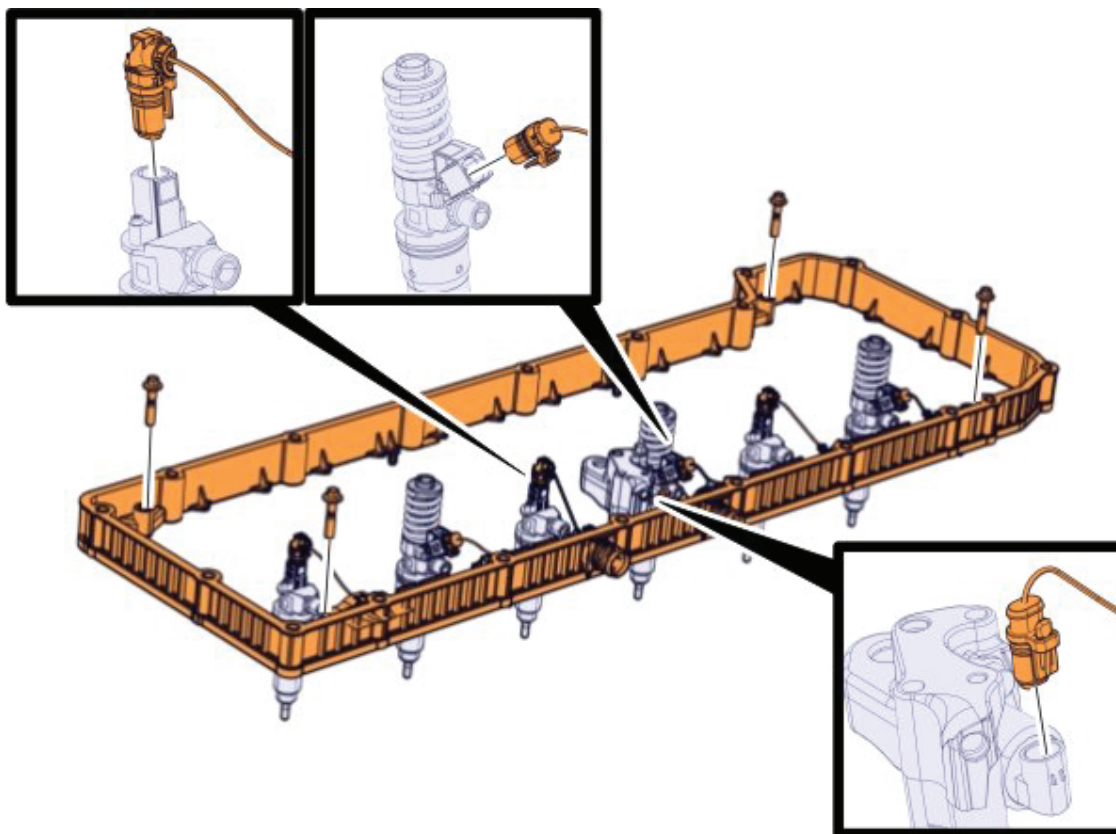
116 Disconnect the connectors.



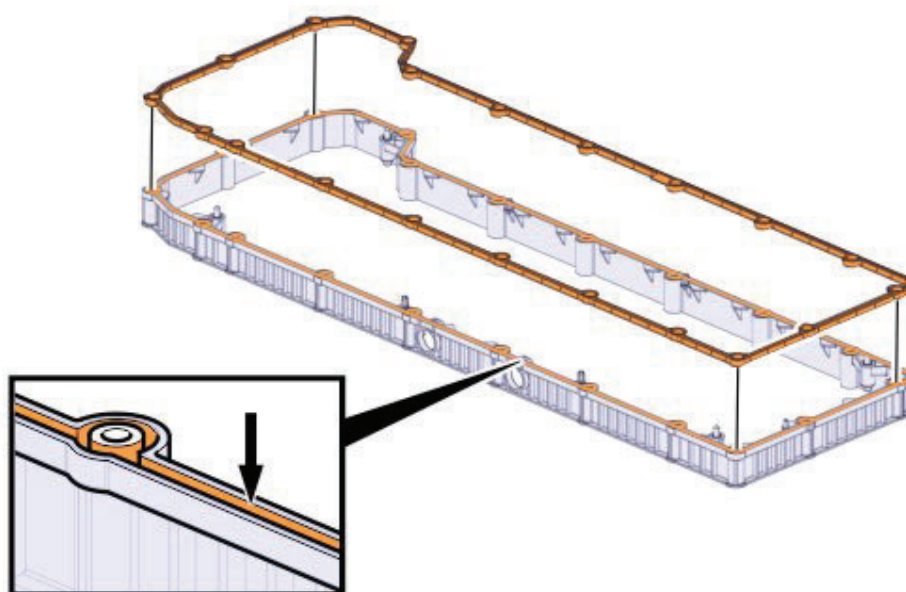
117	Disconnect the connectors.
-----	----------------------------



118	Loosen the screws.
119	Disconnect the connectors.
120	Remove the frame.



121 Remove the gasket.



122 Remove the screws.



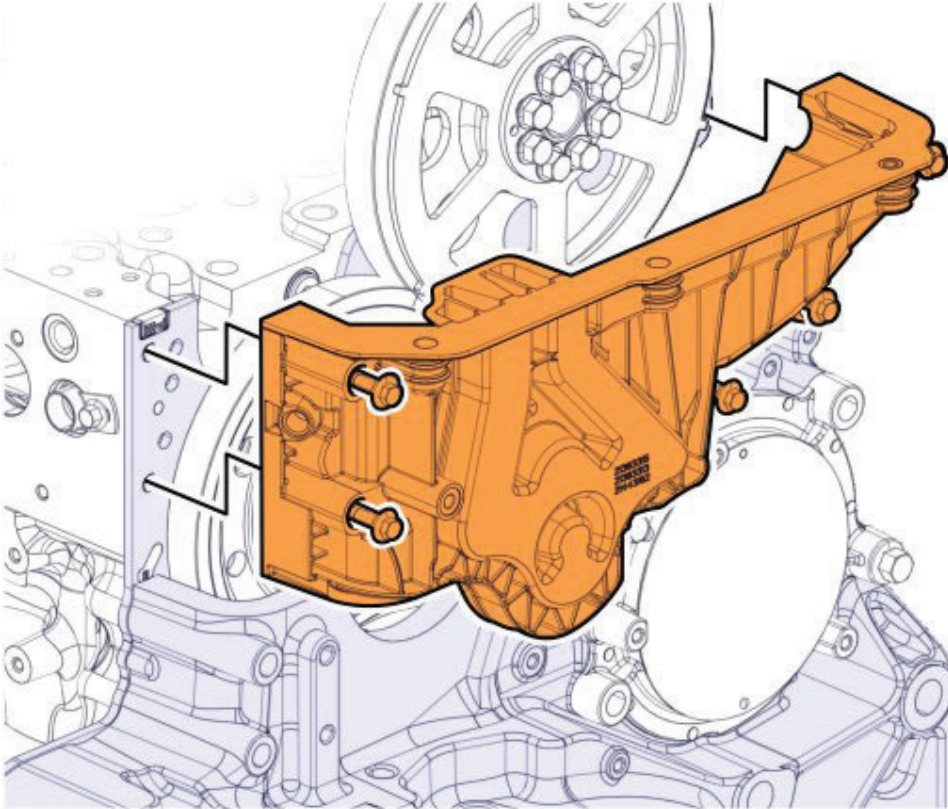
Service hint

The screws cannot be removed from the timing gear cover.

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

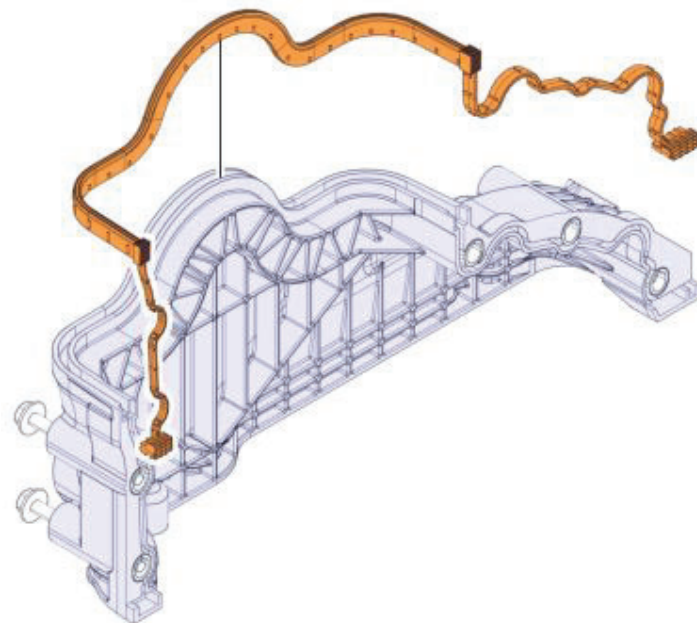
123	Remove the timing gear cover.
-----	-------------------------------



124	Remove the gasket.
-----	--------------------

**Note**

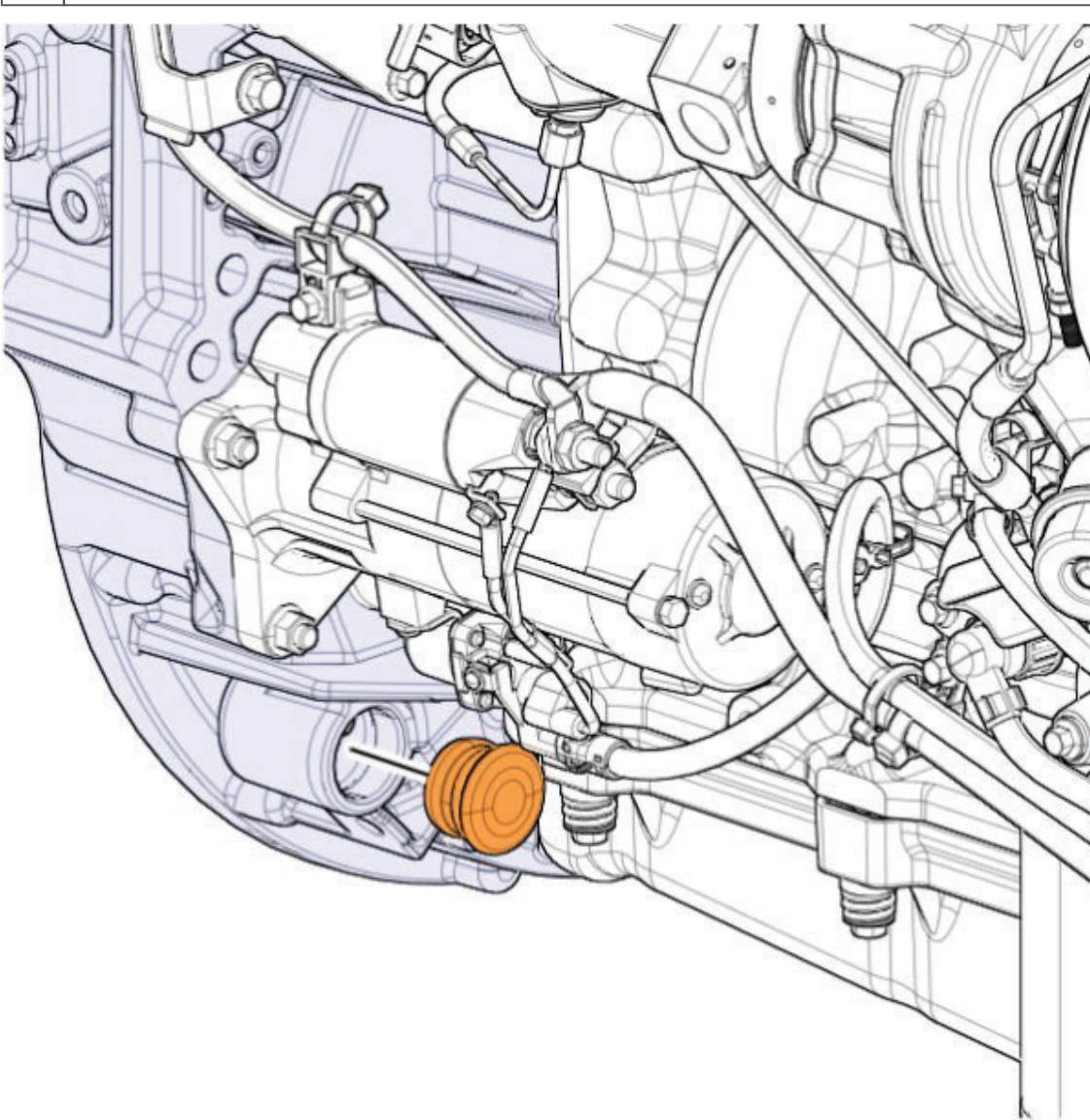
Discard the gasket.



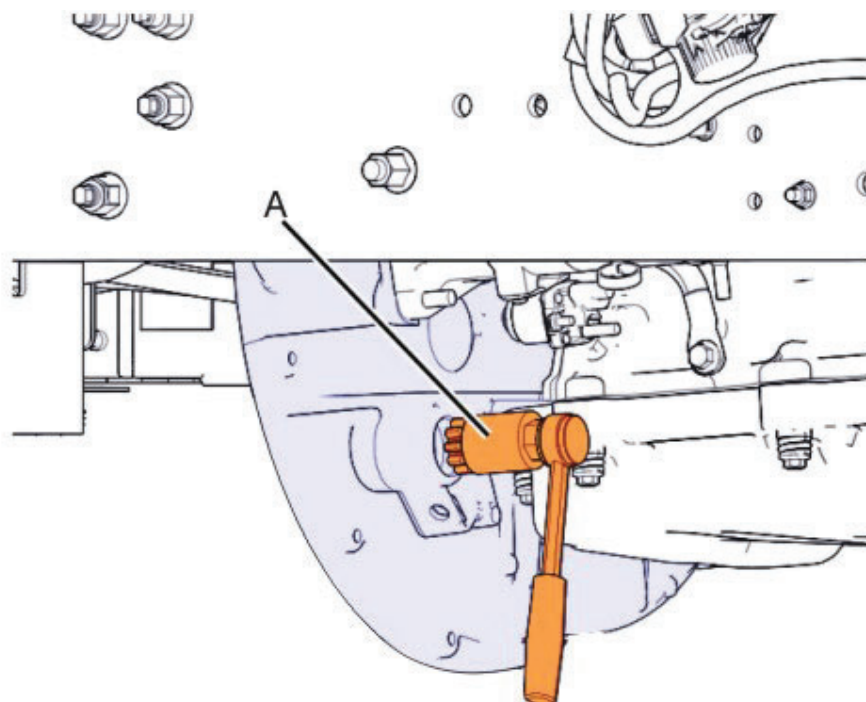
125	Remove the plug.
-----	------------------

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

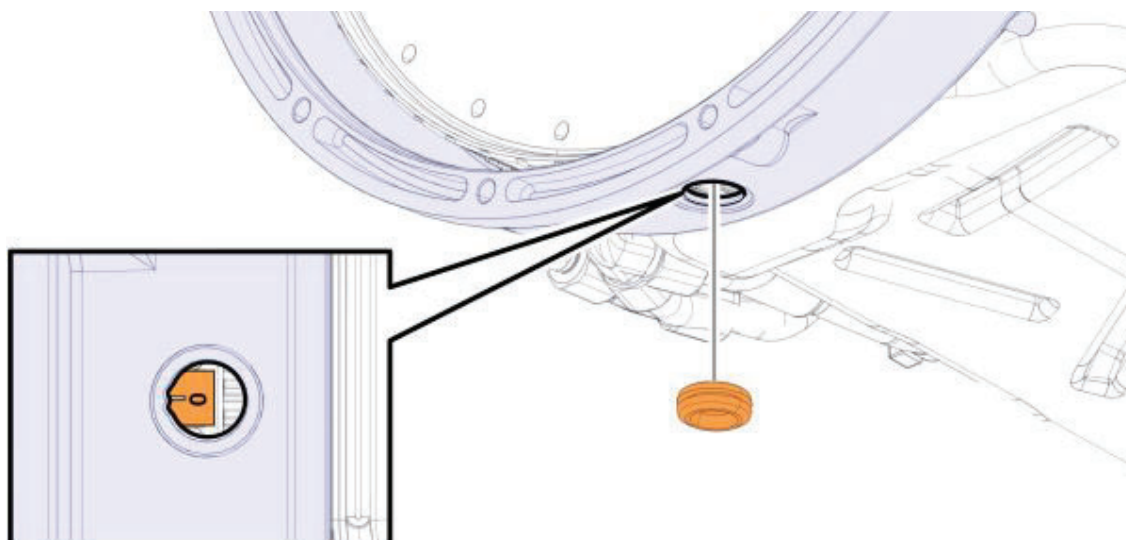
The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.



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



127	Remove the plug.
128	Check the marking (0).



129	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.
-----	--

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.


Note

Rotate the flywheel in the normal engine rotation direction.

130 This step contains 2 alternatives.

Select one of the valid alternatives below.

Alternative 1 / 2

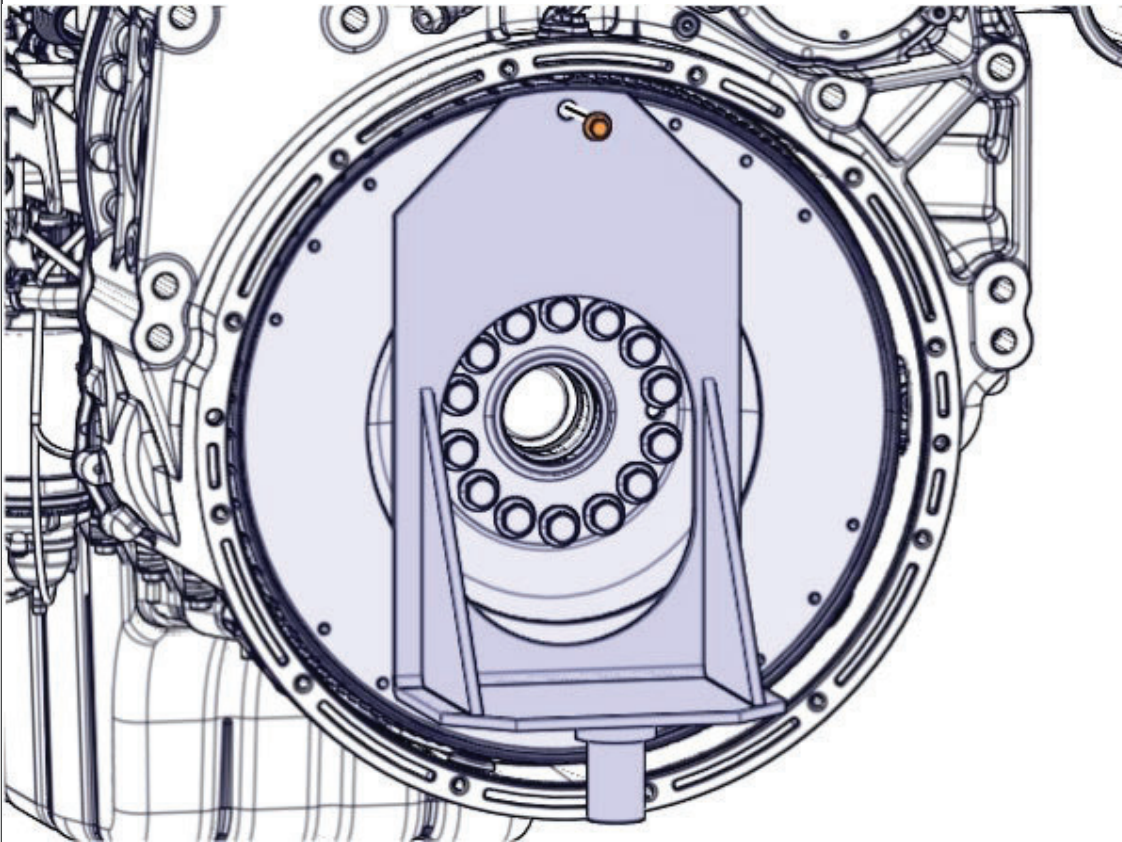
- Install the tool.

Required material

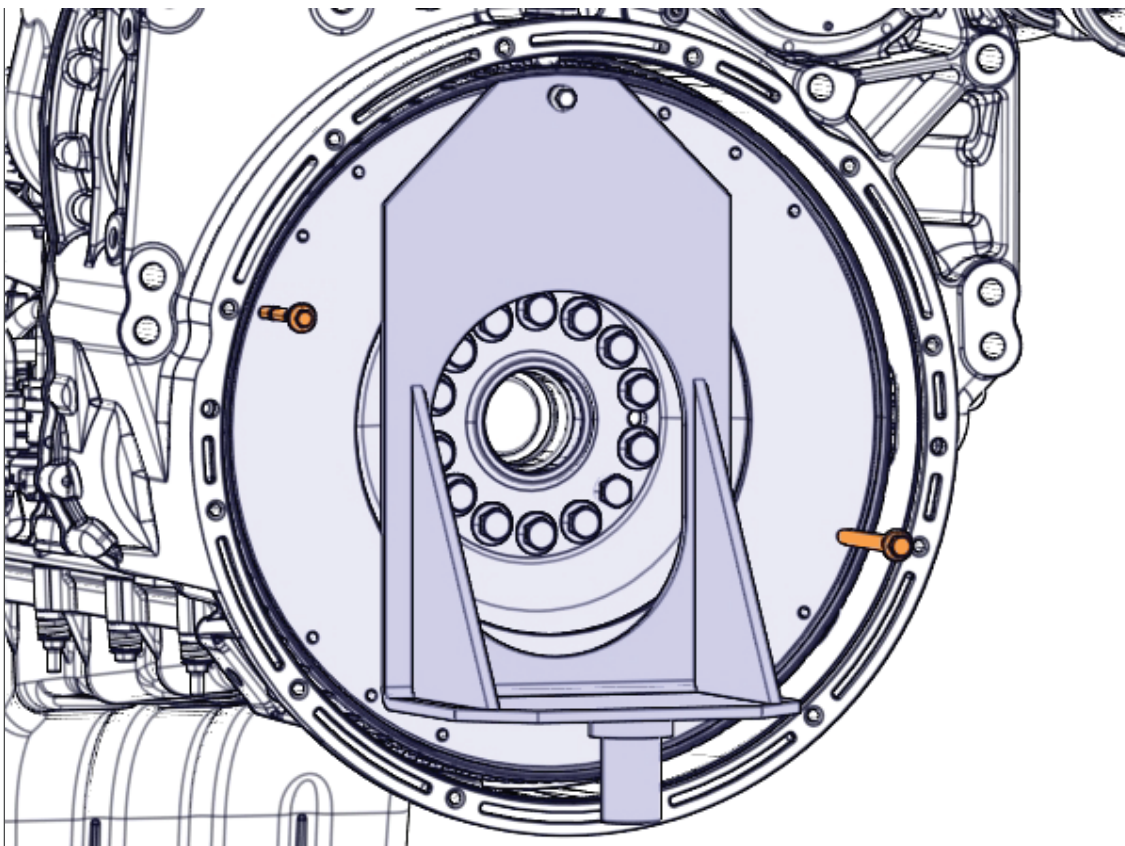
fixture

[88800570](#)

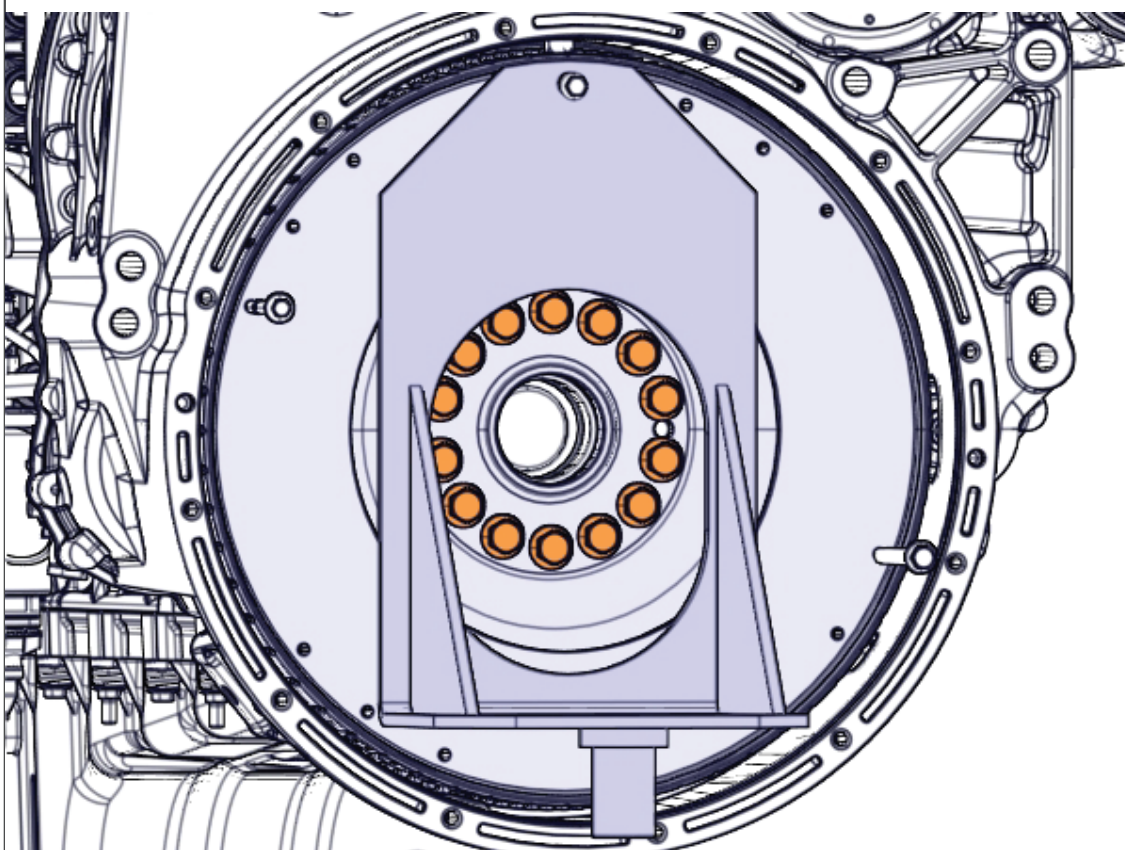
- Install the screw.



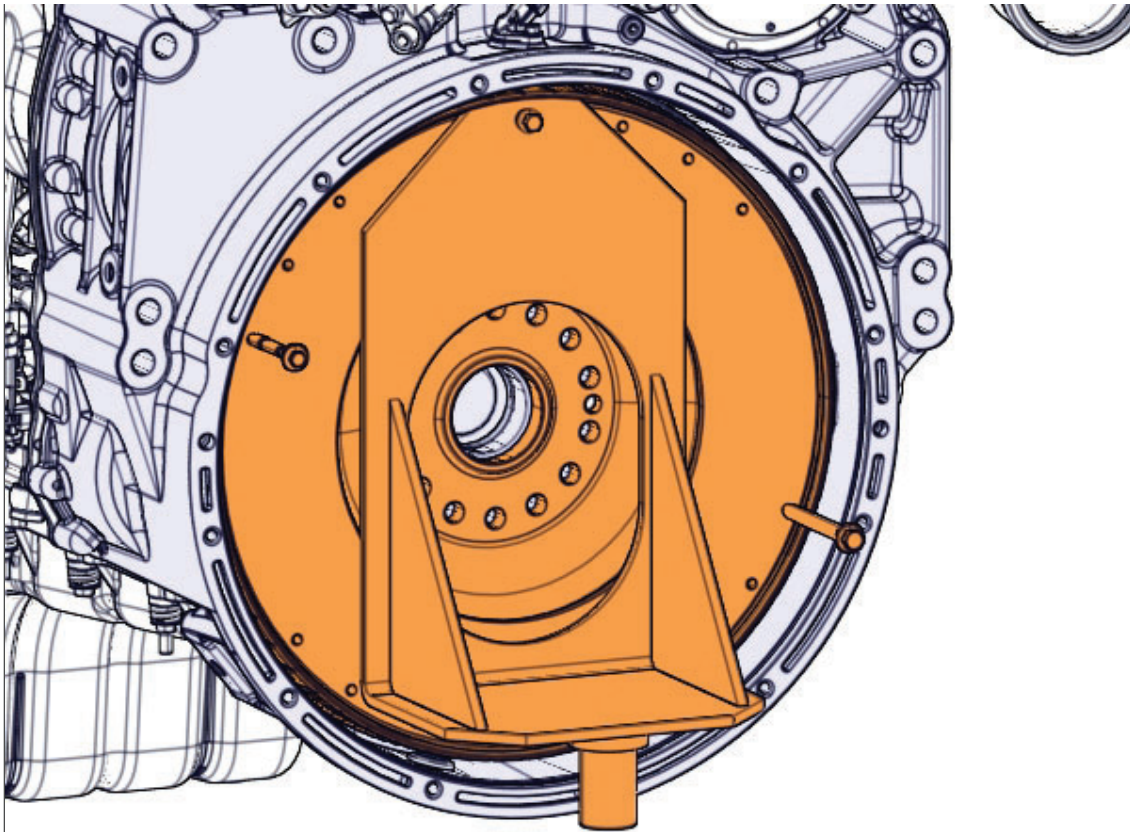
- Install the screws.



► Remove the screws.

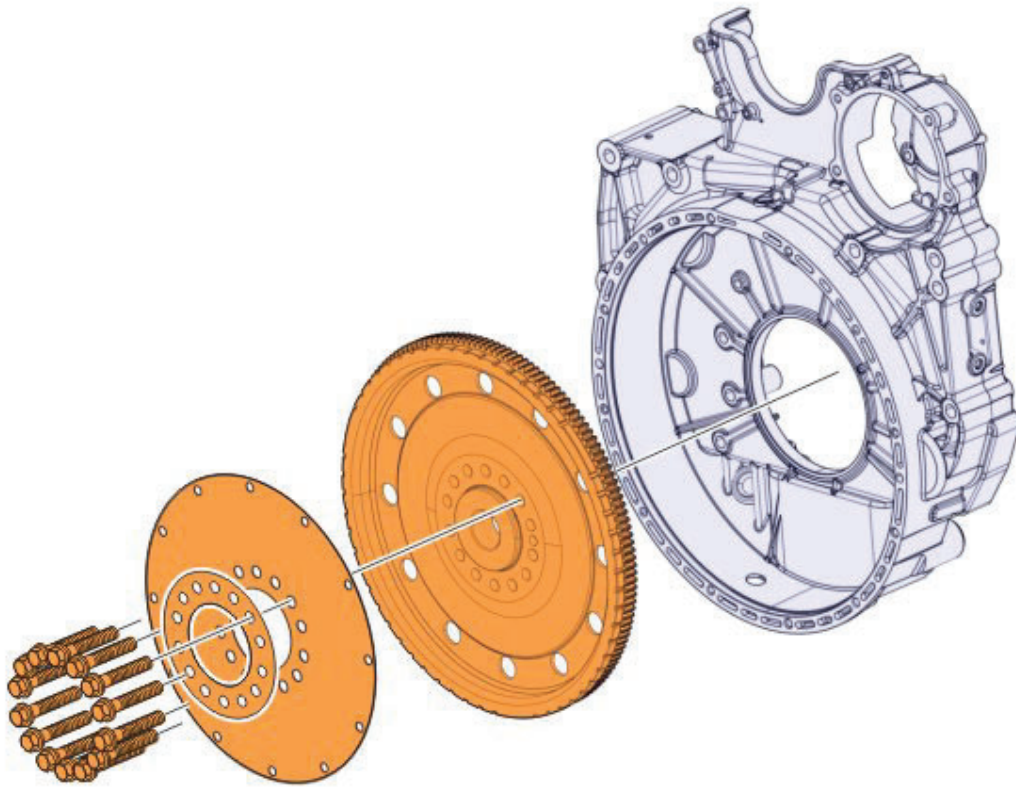


► Remove the flywheel.



Alternative 2 / 2

- | | |
|---|--------------------------|
| ▶ | Remove the screws. |
| ▶ | Remove the thrust plate. |
| ▶ | Remove the flexplate. |
| ▶ | Remove the flywheel. |



131	Position a draining container.
-----	--------------------------------

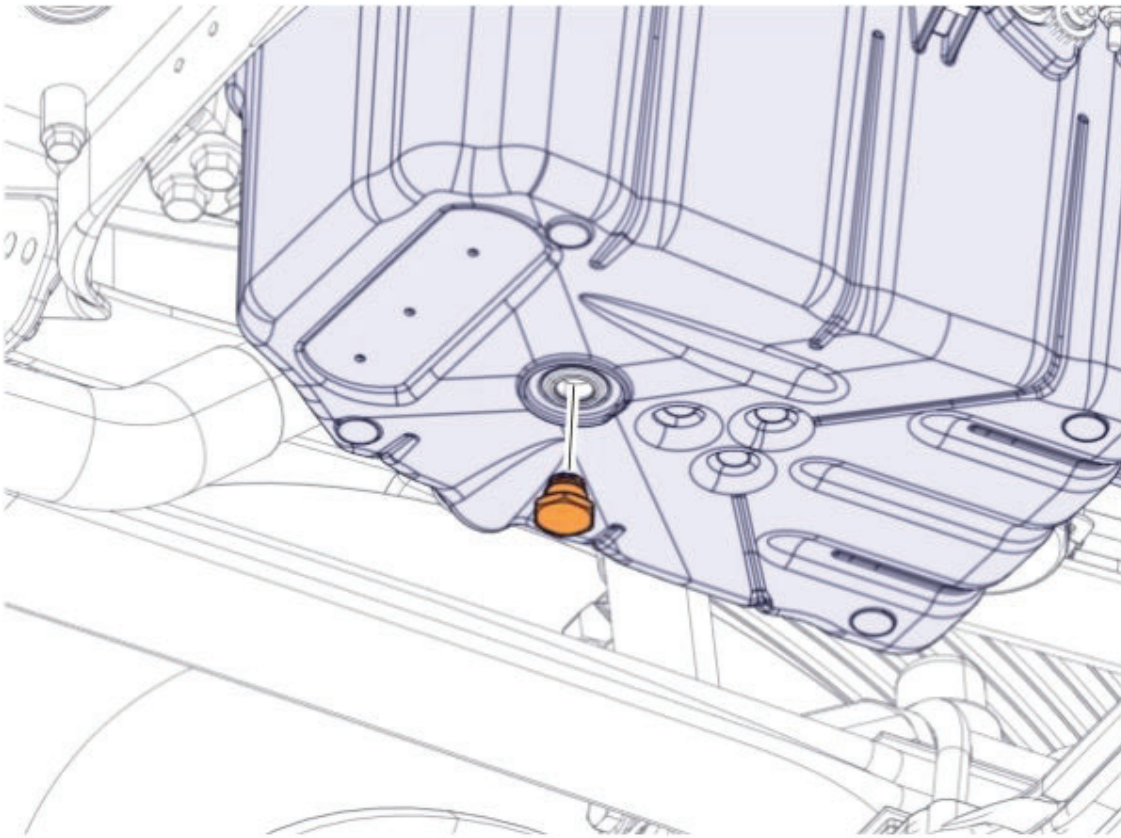
**WARNING****Risk of serious burns.**

Contact with a hot engine or hot engine oil can cause serious burns.

- | | |
|---|---|
| ► | Take precautions when draining the oil. Wear gloves and let the engine cool down before draining. |
|---|---|

132	Remove the drain plug.
-----	------------------------

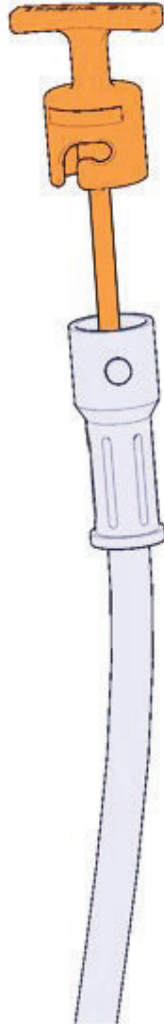
133	Drain the oil.
-----	----------------



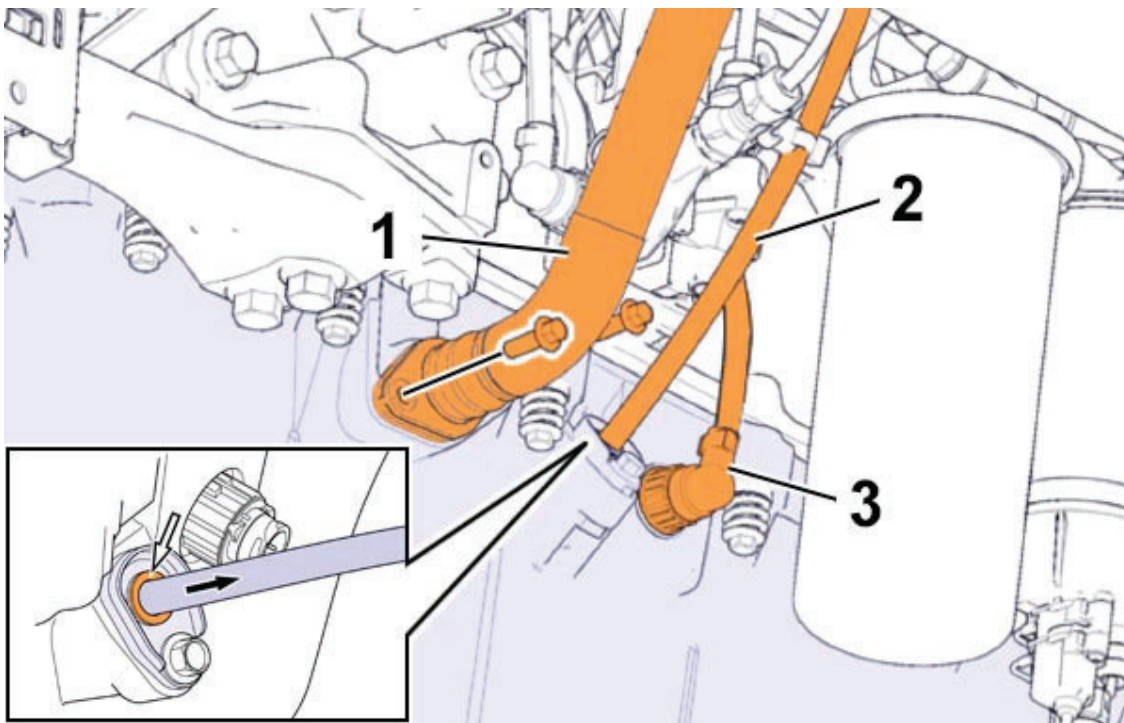
134	Install the drain plug. i Note Always use a new gasket.
-----	---

135	Torque tighten the plug. <table border="1" data-bbox="215 1213 1265 1367"> <tr> <th colspan="2" data-bbox="215 1213 849 1262">Tightening torque</th></tr> <tr> <td data-bbox="215 1262 849 1367">Oil pan, drain plug</td><td data-bbox="849 1262 1265 1367"> $60 \pm 10 \text{ Nm}$ $(44 \pm 7 \text{ lb}_f\cdot\text{ft})$ </td></tr> </table>	Tightening torque		Oil pan, drain plug	$60 \pm 10 \text{ Nm}$ $(44 \pm 7 \text{ lb}_f\cdot\text{ft})$
Tightening torque					
Oil pan, drain plug	$60 \pm 10 \text{ Nm}$ $(44 \pm 7 \text{ lb}_f\cdot\text{ft})$				

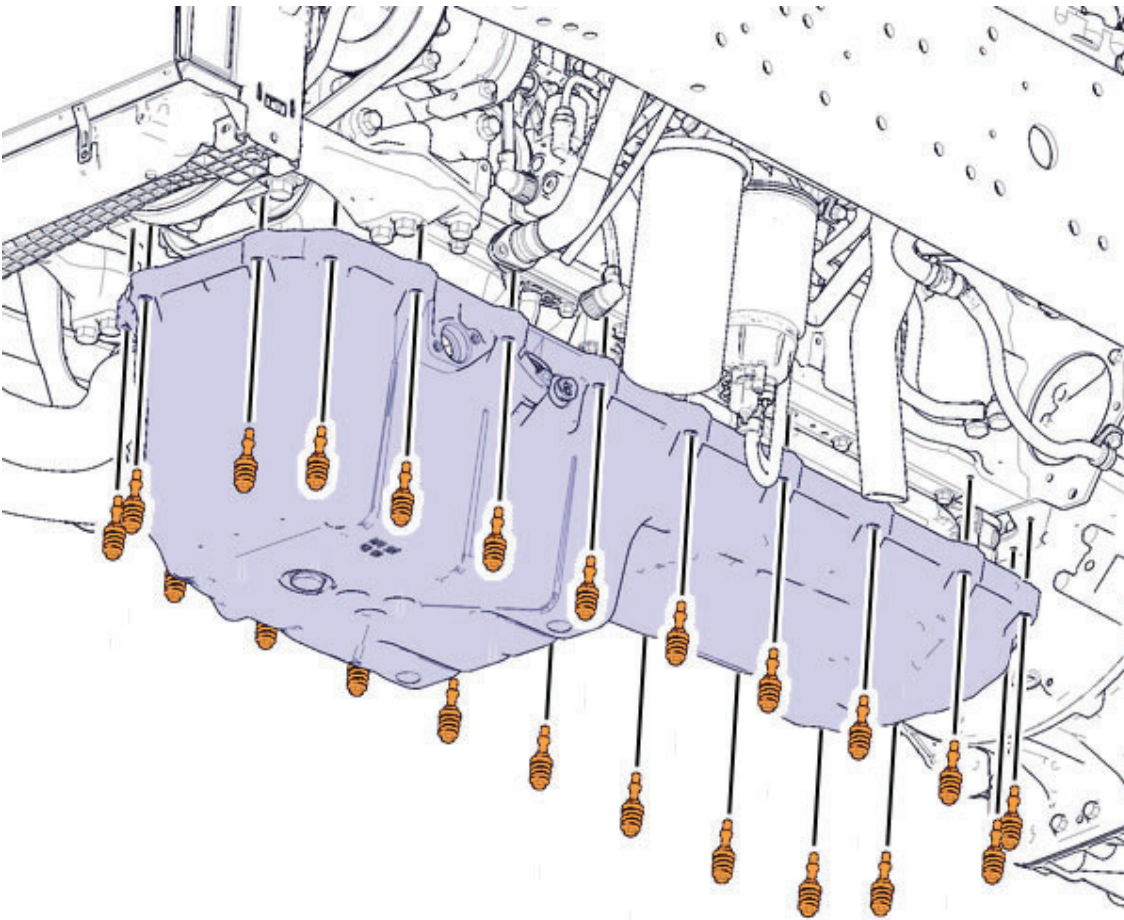
136	Remove the dipstick. <table border="1" data-bbox="215 1484 1265 1633"> <tr> <th colspan="2" data-bbox="215 1484 849 1533">Tech data</th></tr> <tr> <td data-bbox="215 1533 849 1633">The distance the dipstick is drawn out from the outer casing</td><td data-bbox="849 1533 1265 1633"> $\approx 0.5 \text{ m}$ $(1 \text{ ft} - 7.7 \text{ in})$ </td></tr> </table>	Tech data		The distance the dipstick is drawn out from the outer casing	$\approx 0.5 \text{ m}$ $(1 \text{ ft} - 7.7 \text{ in})$
Tech data					
The distance the dipstick is drawn out from the outer casing	$\approx 0.5 \text{ m}$ $(1 \text{ ft} - 7.7 \text{ in})$				



137	Disconnect the connector (3).
138	Depress the release ring (2) remove the dipstick pipe. i Note Pull to remove. i Note Use a suitable tool to depress.
139	Remove the screws.
140	Remove the pipe (1).



141	Remove the screws.
-----	--------------------

**142** Remove the oil pan.**Note**

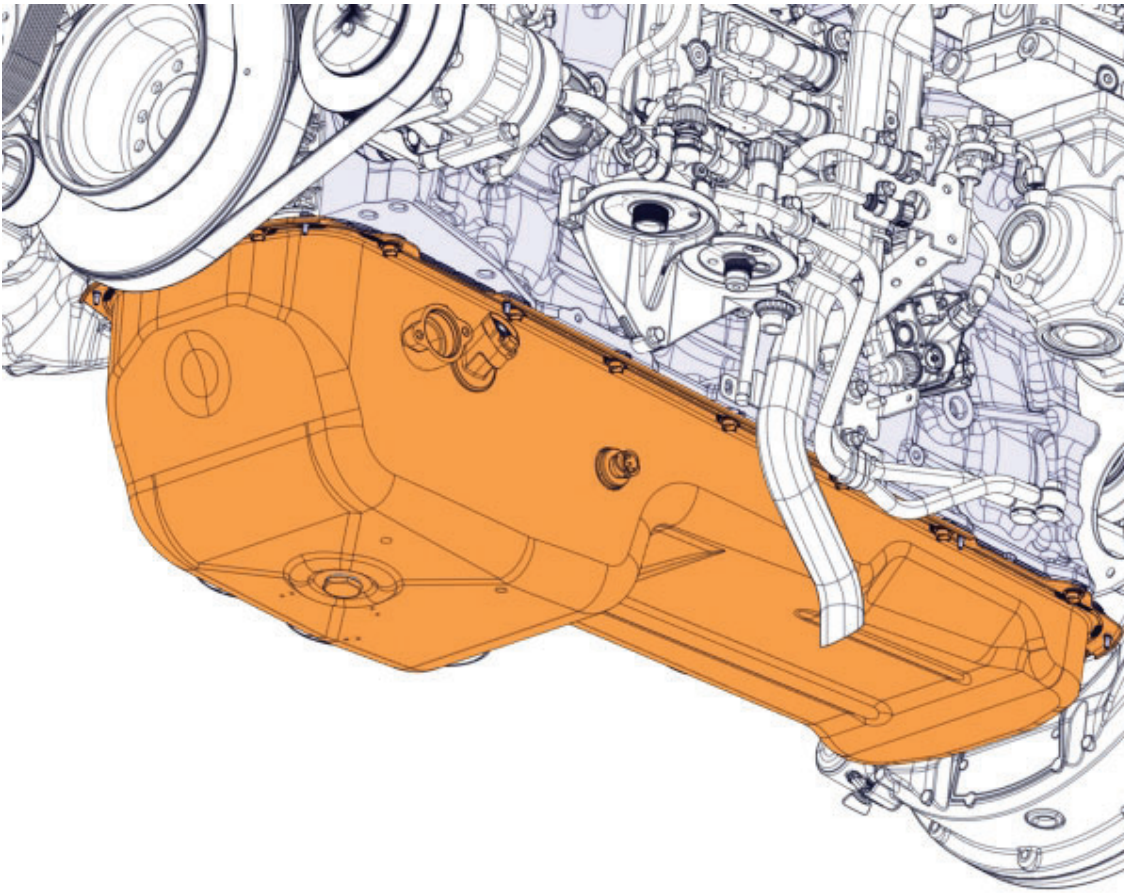
Get help if needed.

**Note**

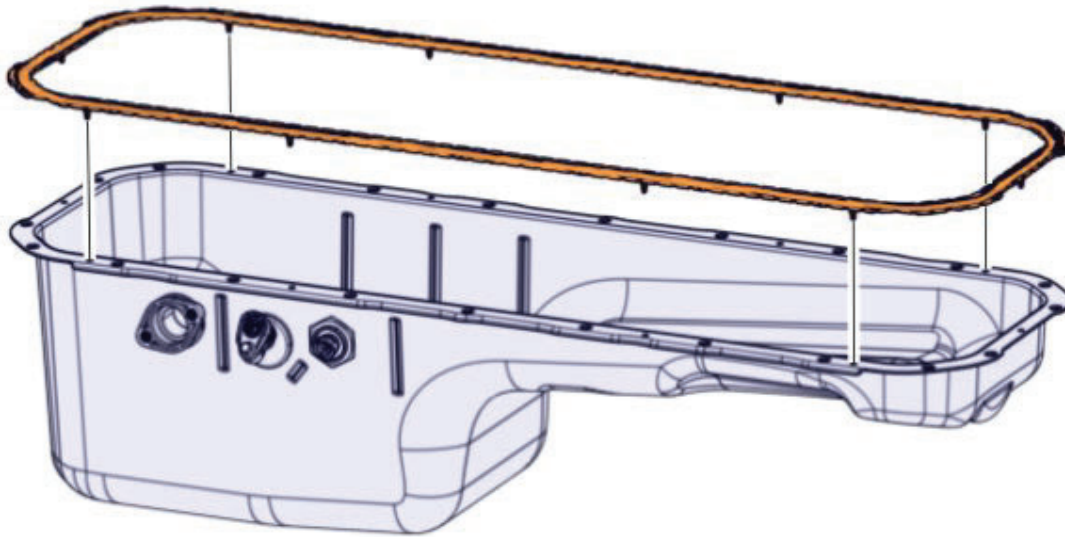
Lower the component carefully.

**Note**

Ensure that there is no damage to the oil pickup tube and oil pump gear.

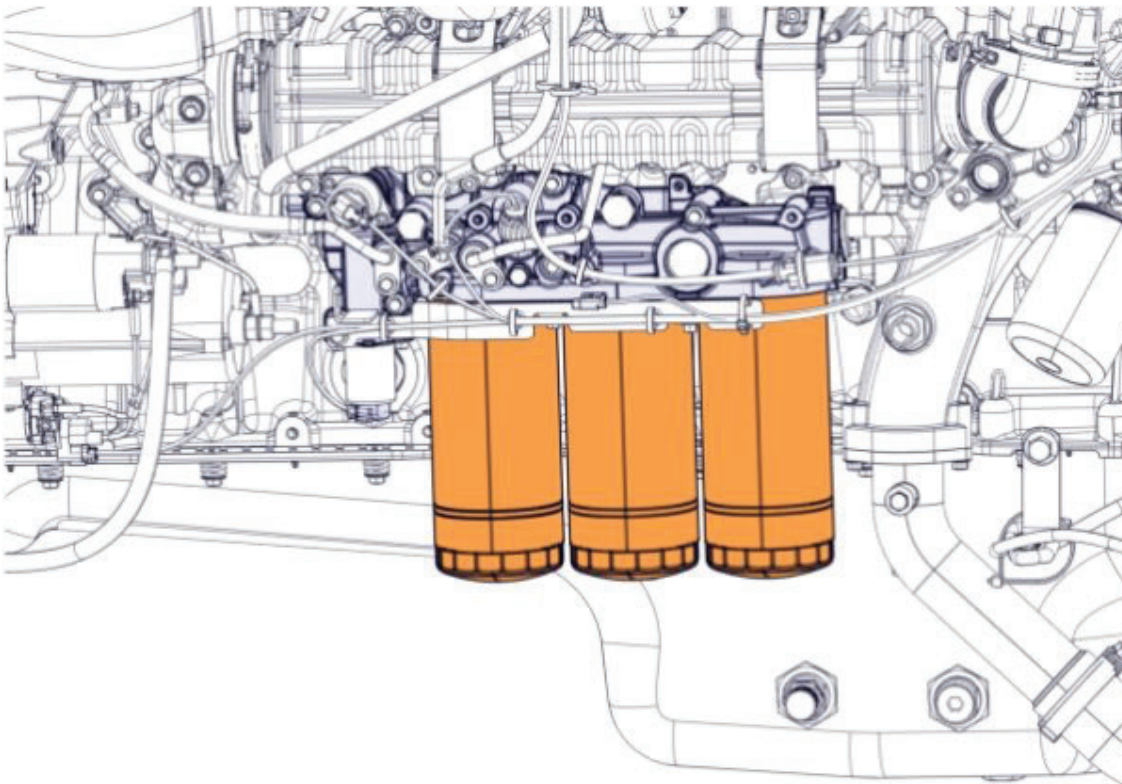


143	Remove the gasket.
------------	--------------------



144	Clean the oil filter housing.
-----	-------------------------------

145	Remove the oil filters.
-----	-------------------------



146 This step contains 2 alternatives.

Select one of the valid alternatives below.

Alternative 1 / 2

Conditions

- Old variant of seal

- ▶ Install tool (B) on tool (A).

Required material

IMPACT WRENCH	9996400
---------------	-------------------------

puller	9990192
--------	-------------------------



Note

Ensure that the tools are clean and intact.

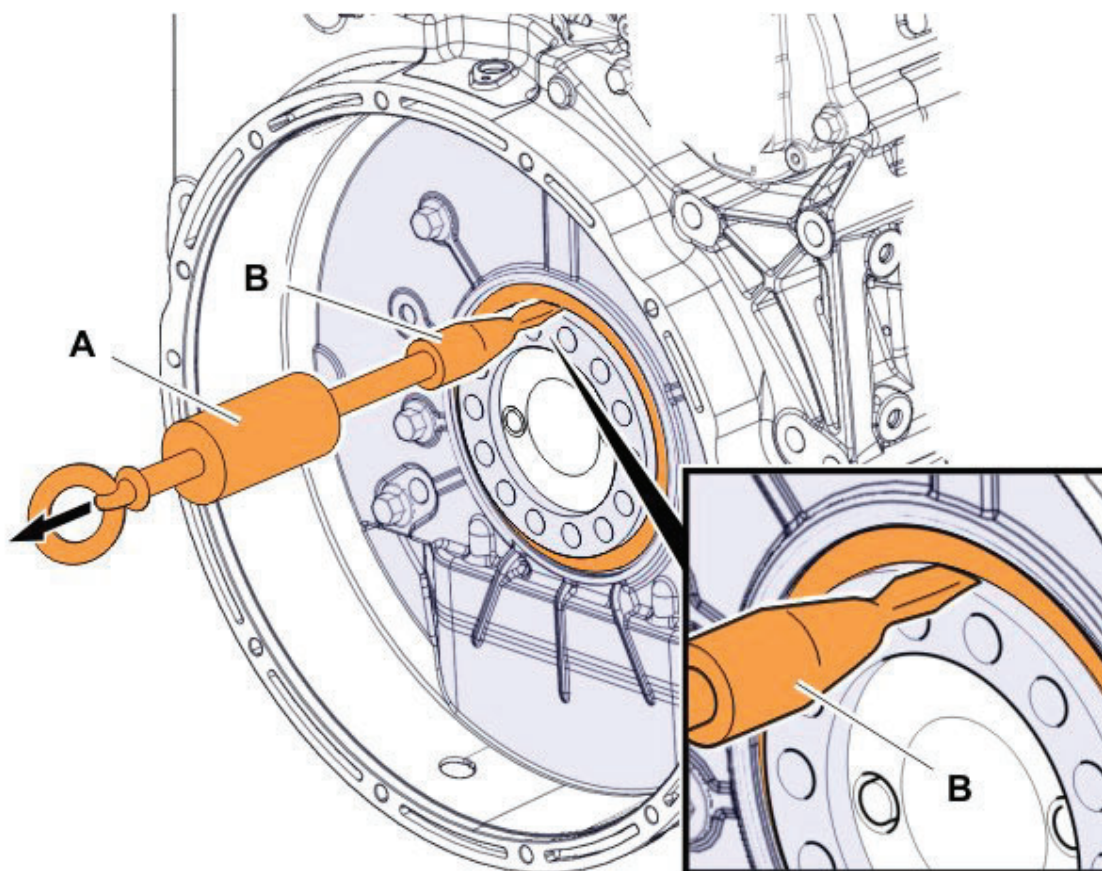
- ▶ Insert the puller (B) between the seal and the crankshaft using an impact wrench (A).



Note

Take care not to damage the crankshaft surface.

- ▶ Remove the seal.



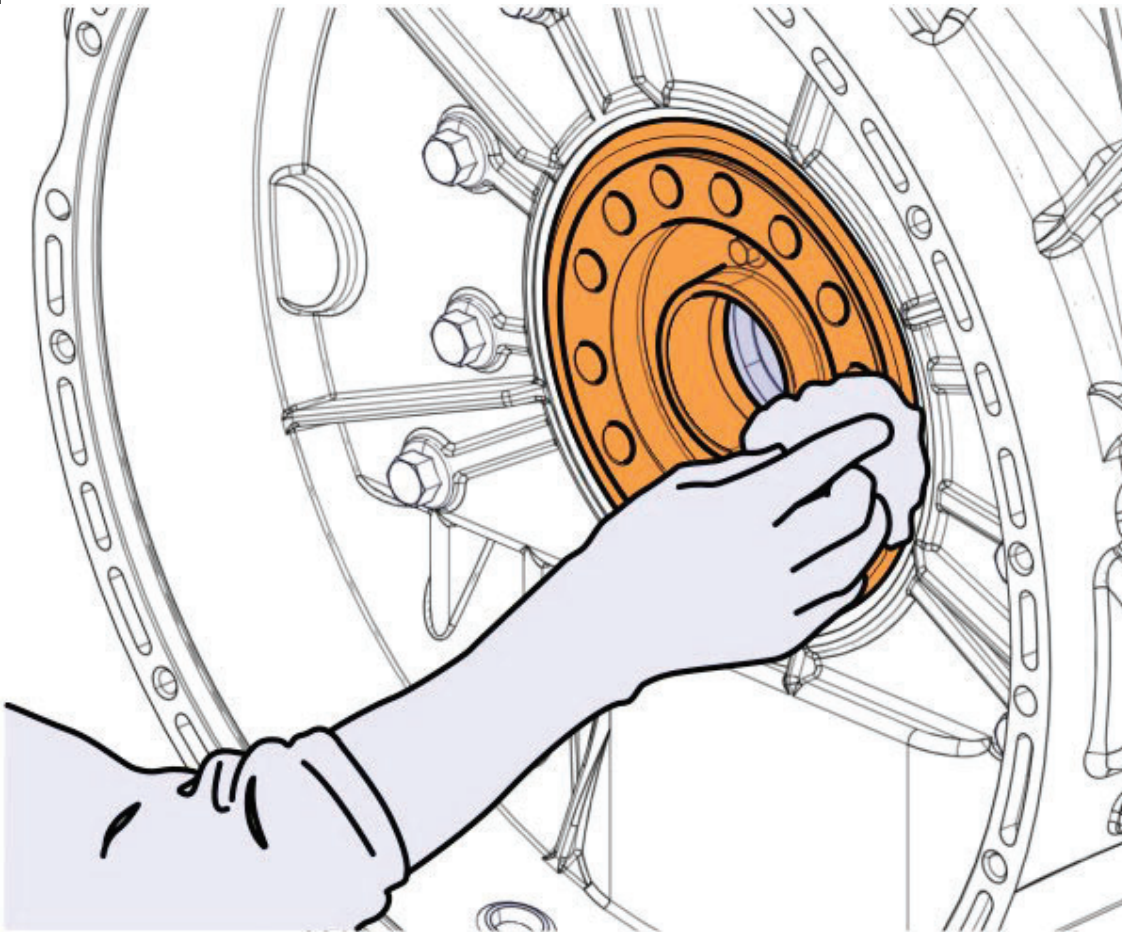
Alternative 2 / 2

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

Conditions

- New variant of seal
- Clean the area around the seal.



- Release the seal.



Service hint

Tap the seal to loosen it from the contact surfaces.



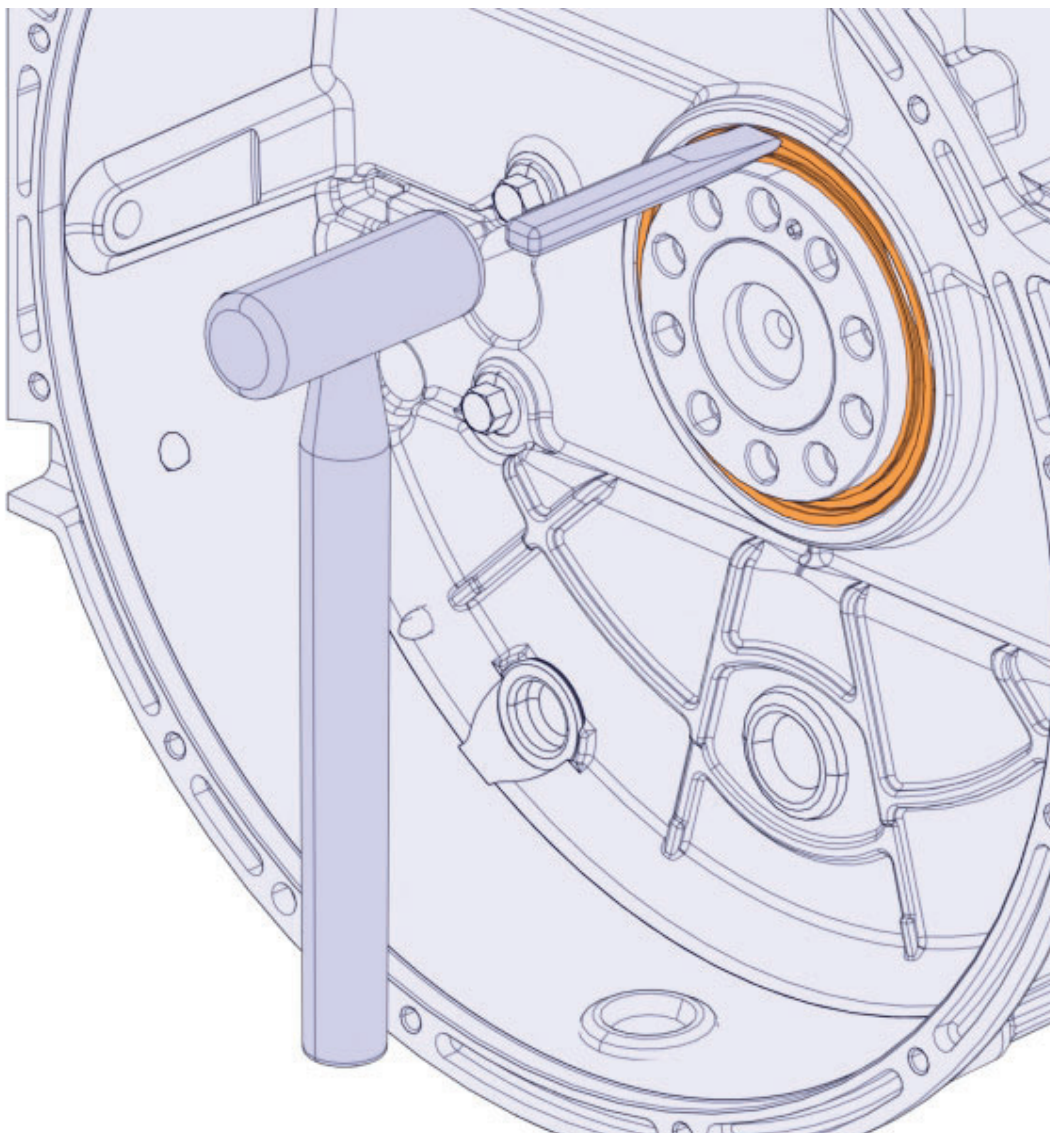
Service hint

Use a plastic chisel and a hammer.



Service hint

Lubricate the contact surfaces to facilitate removal of the seal.



- Install the tool.

Required material

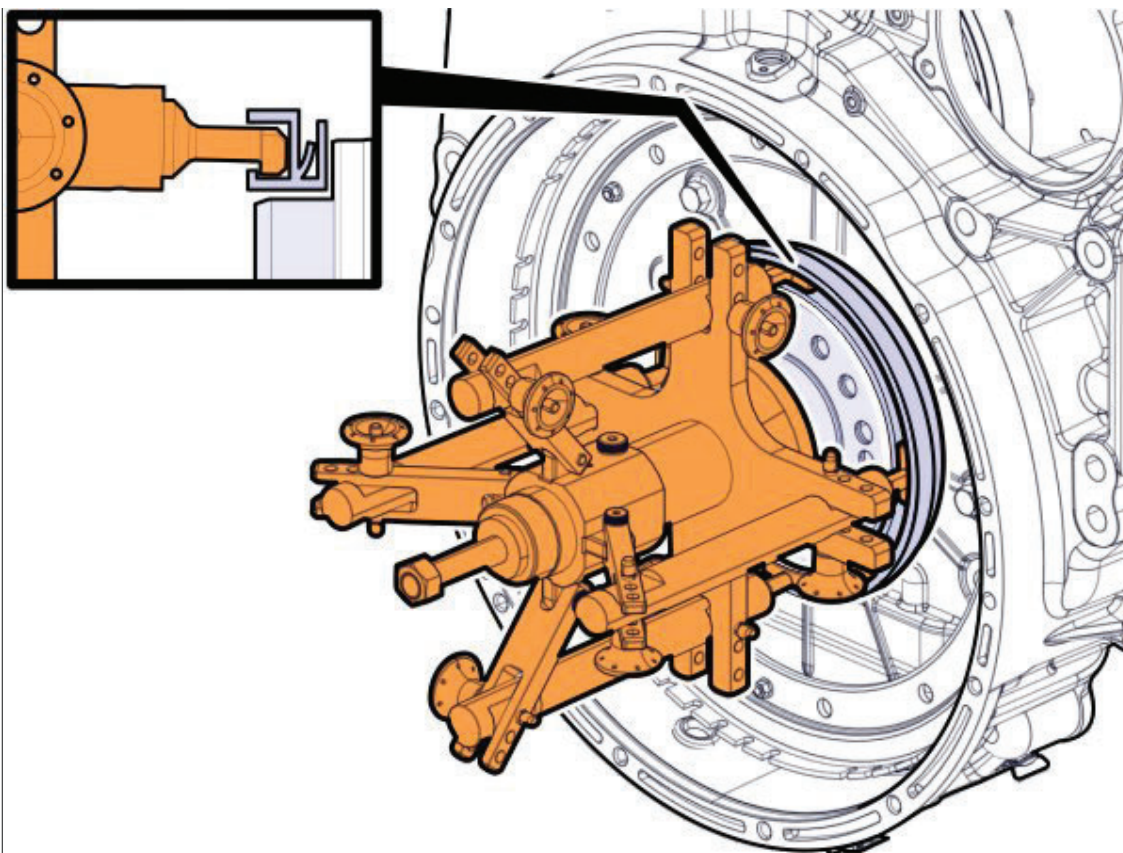
DISASSEMBLY TOOL

[88800502](#)



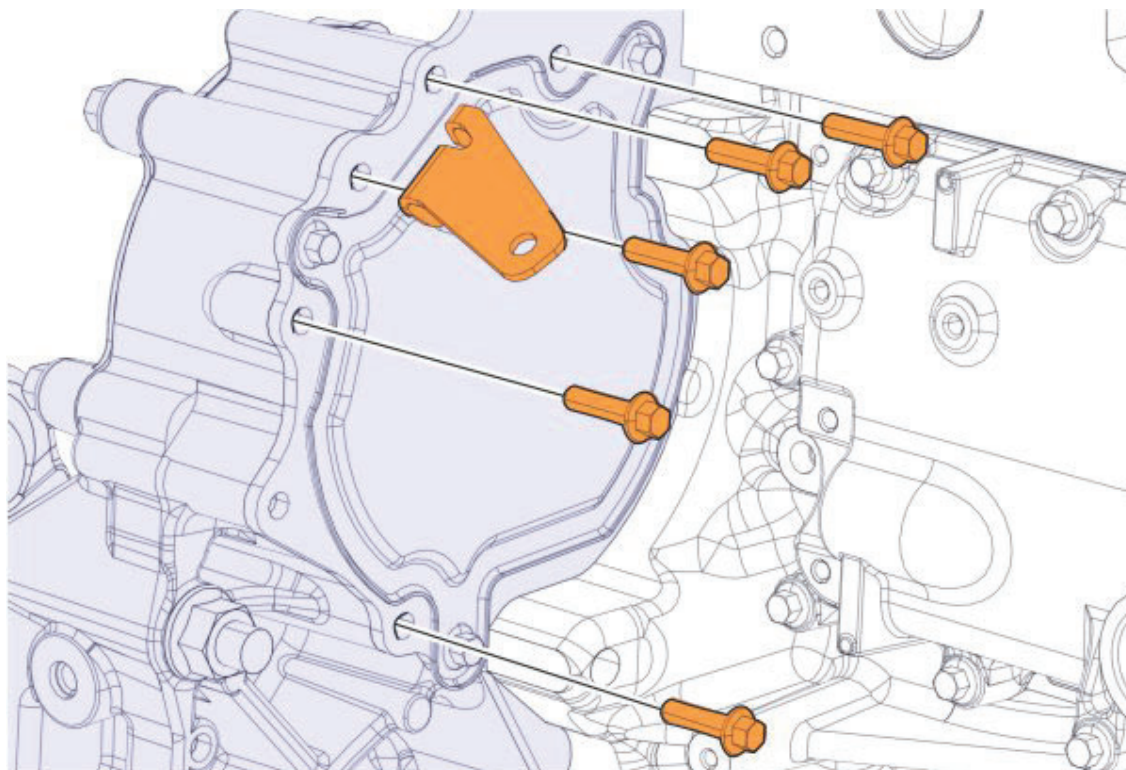
Note

The arms of the tool can be adjusted to different diameters.



► Remove the seal.

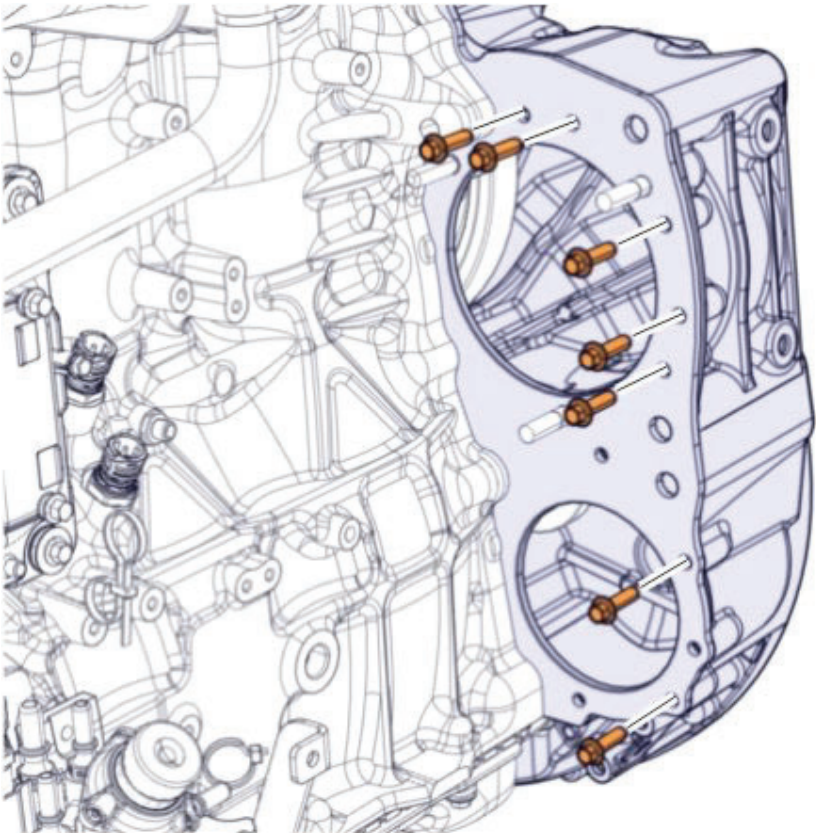
147 Remove the screws and bracket.



Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

148	Remove the screws.
	i Note Some housings may not include all the screws shown.



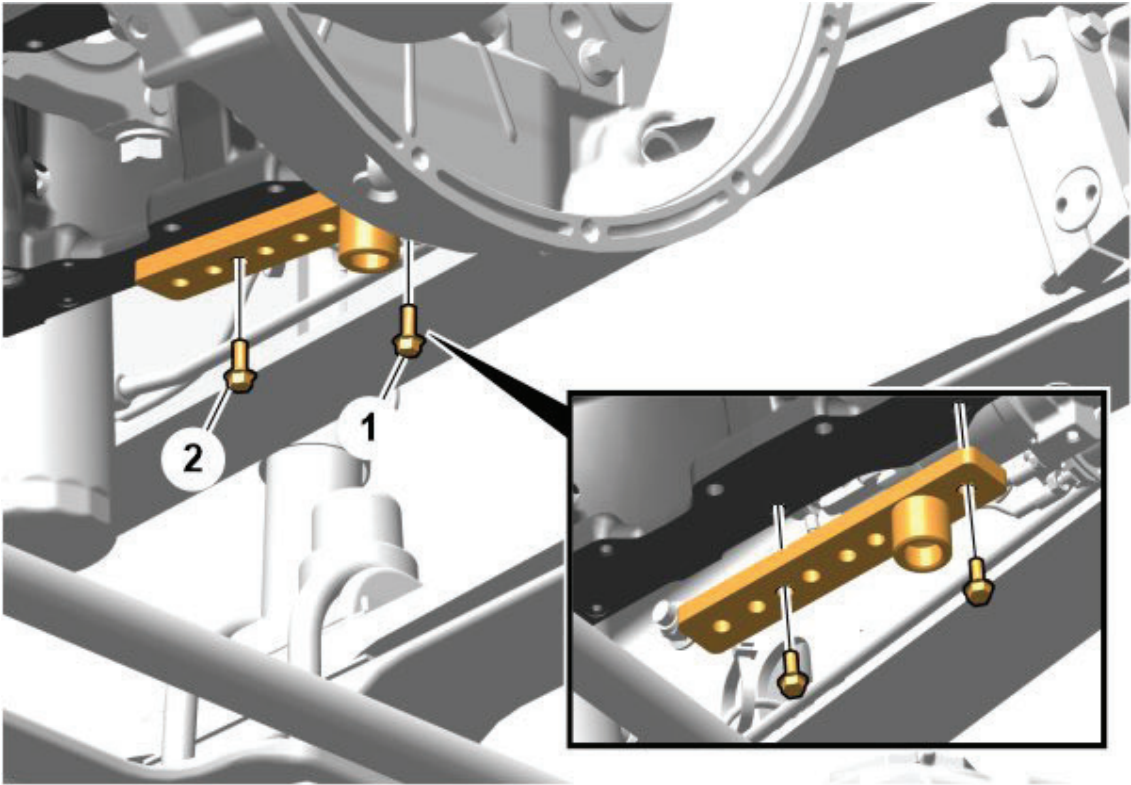
149	Install the alignment plate.
	Required material SUPPORT88800820
	💡 Service hint The plate is designed for universal mounting. Mount the plate that works best for your application.
	i Note Align the first hole in the plate with the first hole of the oil pan mounting flange at the rear of engine.

150	Install the screw (1).
-----	------------------------

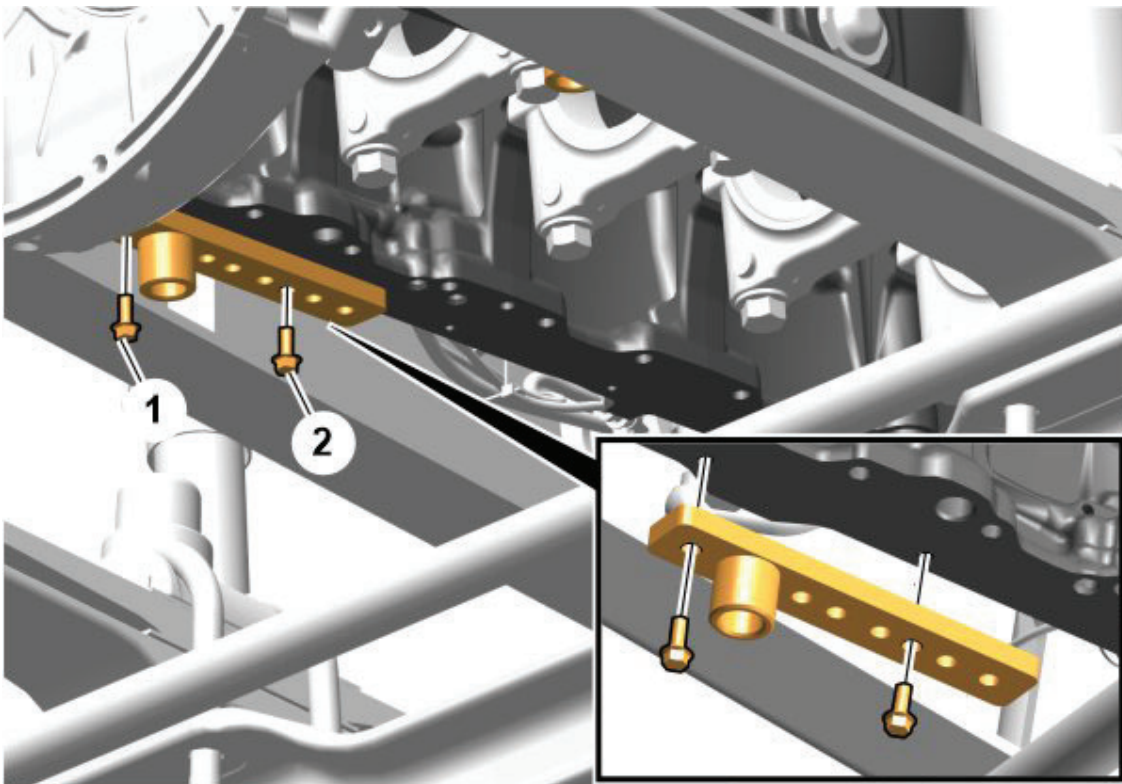
151	Install the screw (2) in the hole aligned with the cylinder block hole.
-----	---

152	Torque tighten the screws.
	Tightening torque

	Screw	M8
		24 ±4 Nm
		(18 ±3 lb _f ·ft)



153	Install the alignment plate.	
154	Install the screw (1).	
155	Install the screw (2) in the hole aligned with the cylinder block hole.	
156	Torque tighten the screws.	
	Tightening torque	
	Screw	M8
		24 ±4 Nm
		(18 ±3 lb _f ·ft)



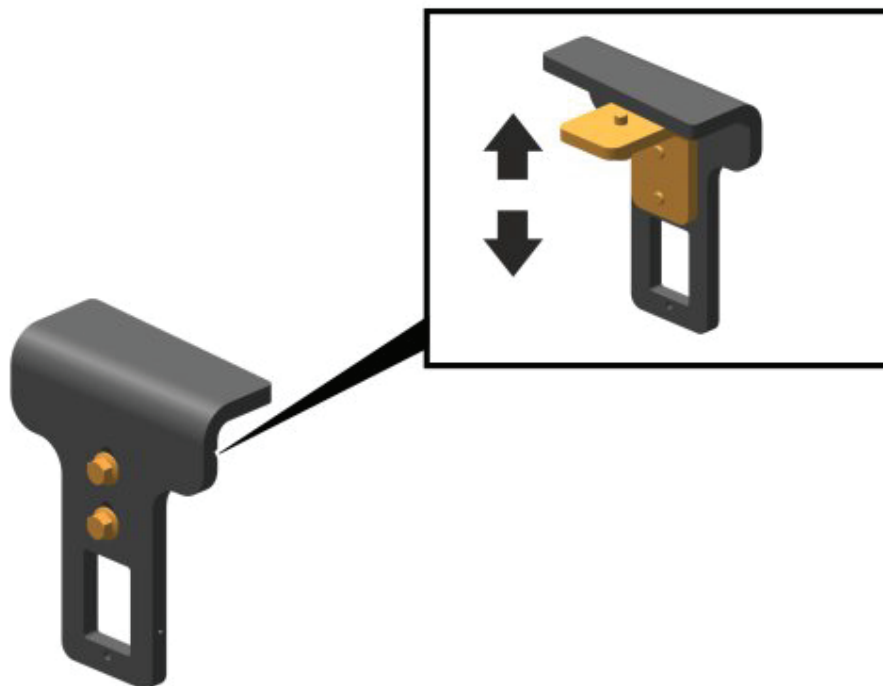
157 Loosen the screws.

158 Adjust the inner plate.



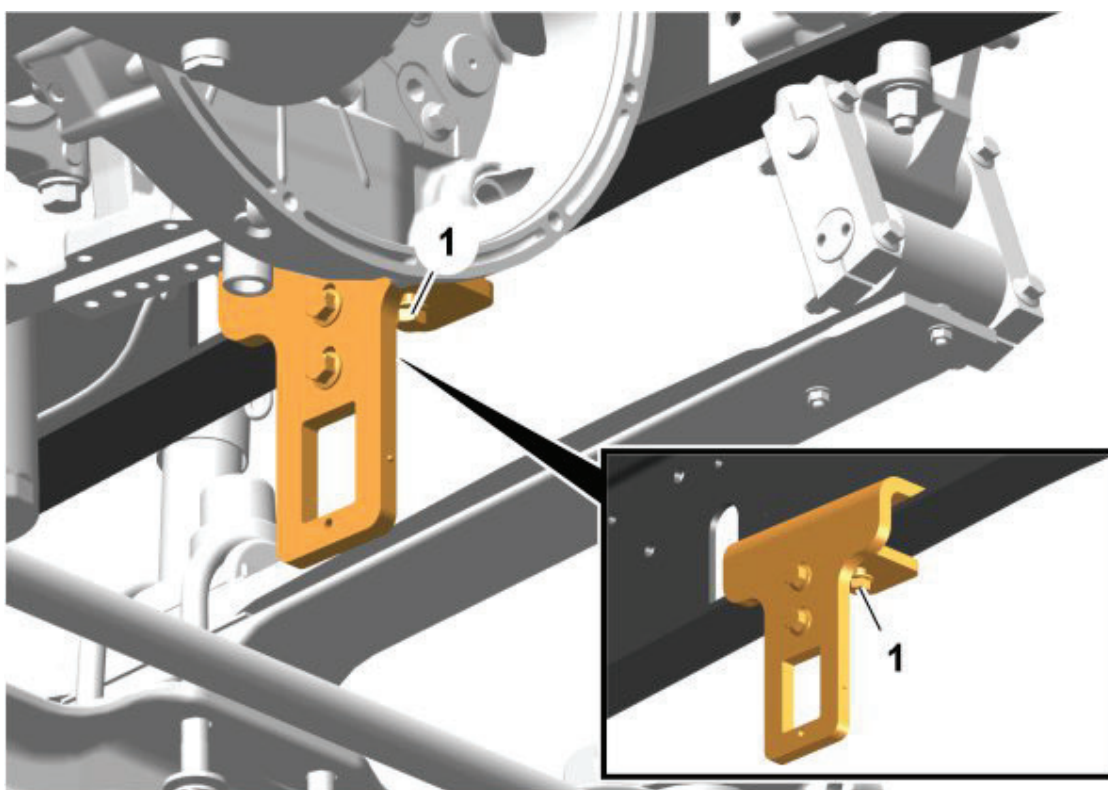
Service hint

Ensure that the inner plate moves freely.

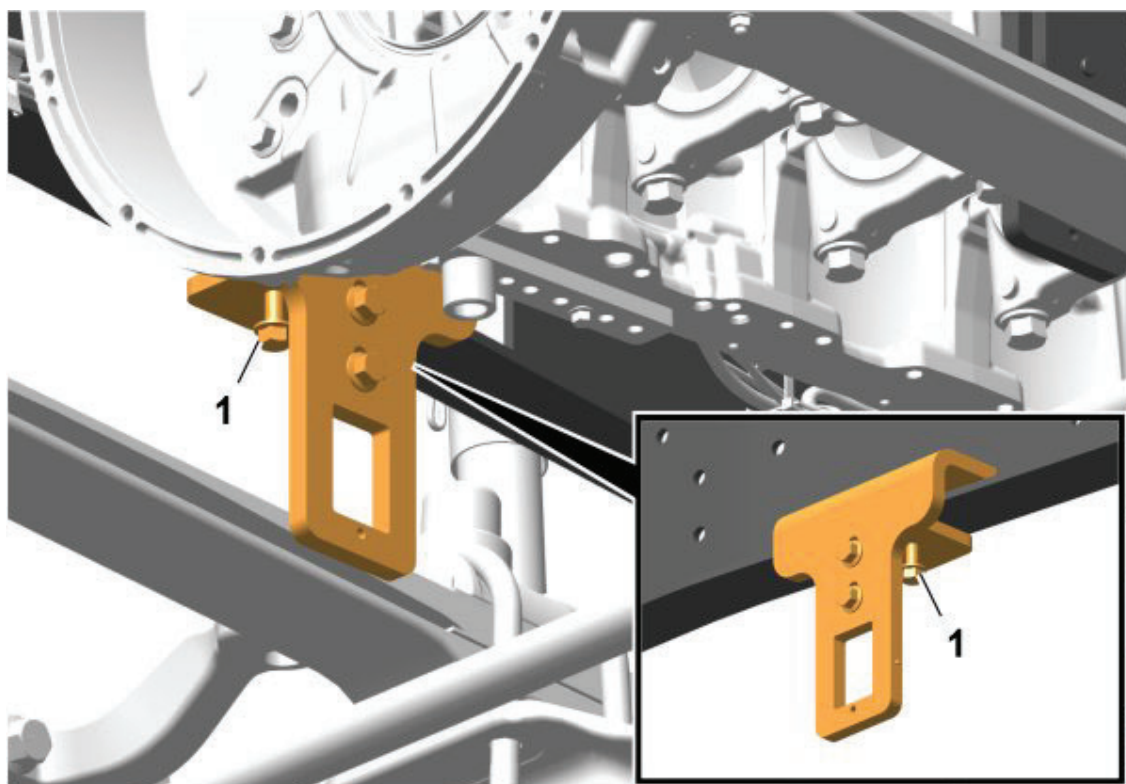


159	Perform the same procedure for the other bracket.
-----	---

160	Install the upright leg assembly.
	 Service hint If necessary, remove any standoff brackets before installing the upright leg assembly.
	 Note Ensure that the screw (1) is loosened to help in installing the upright leg assembly.



161	Install the upright leg assembly.
	 Service hint If necessary, remove any standoff brackets before installing the upright leg assembly.
	 Note Loosen the screw (1) to help in installing the upright leg assembly.

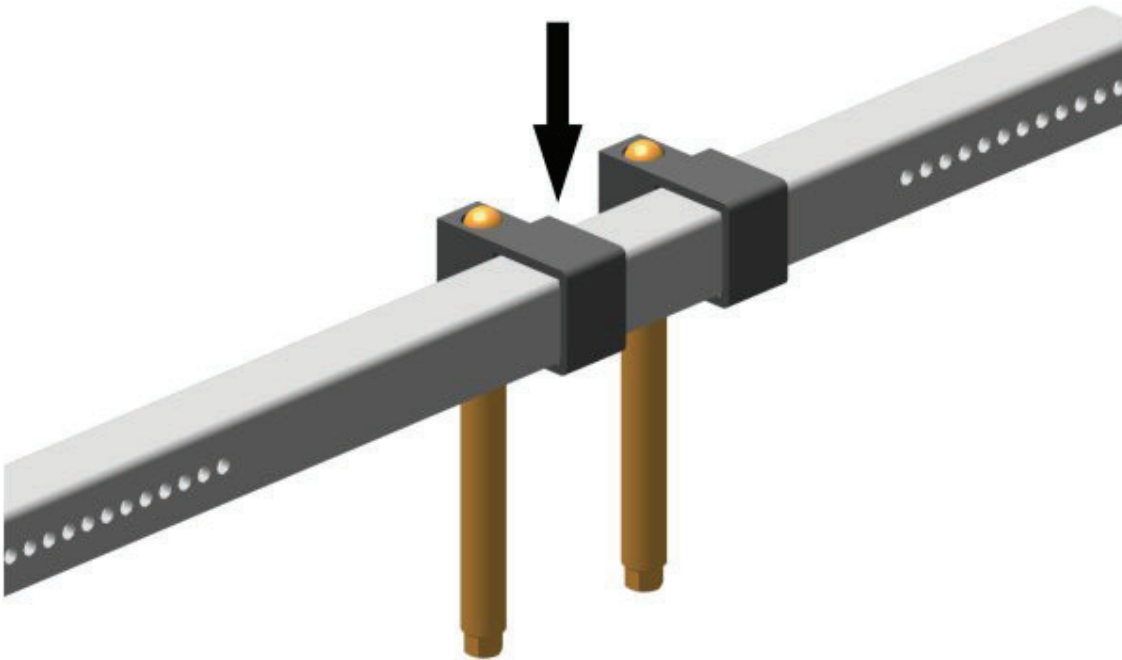


162	Install the thread bracket assemblies on the crossbar.
------------	--

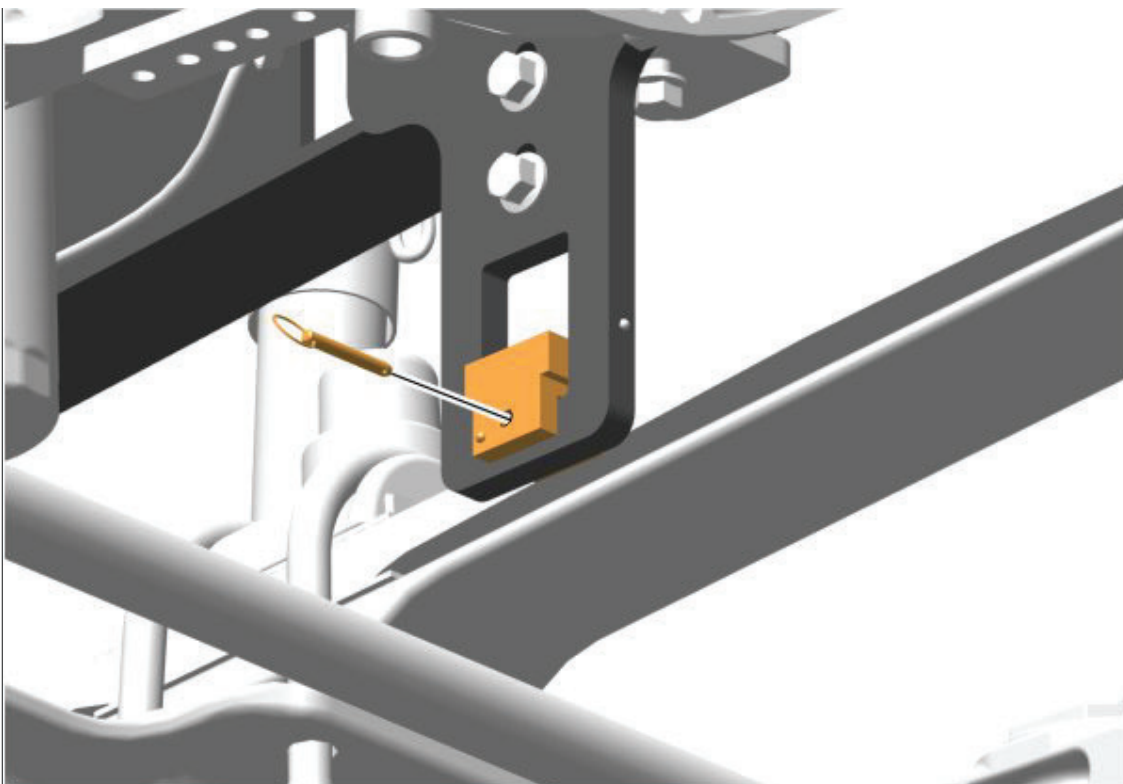


163	Lubricate the threaded rod and ball end assemblies.
------------	---

164	Put the weight jack screws to the retracted position.
------------	---

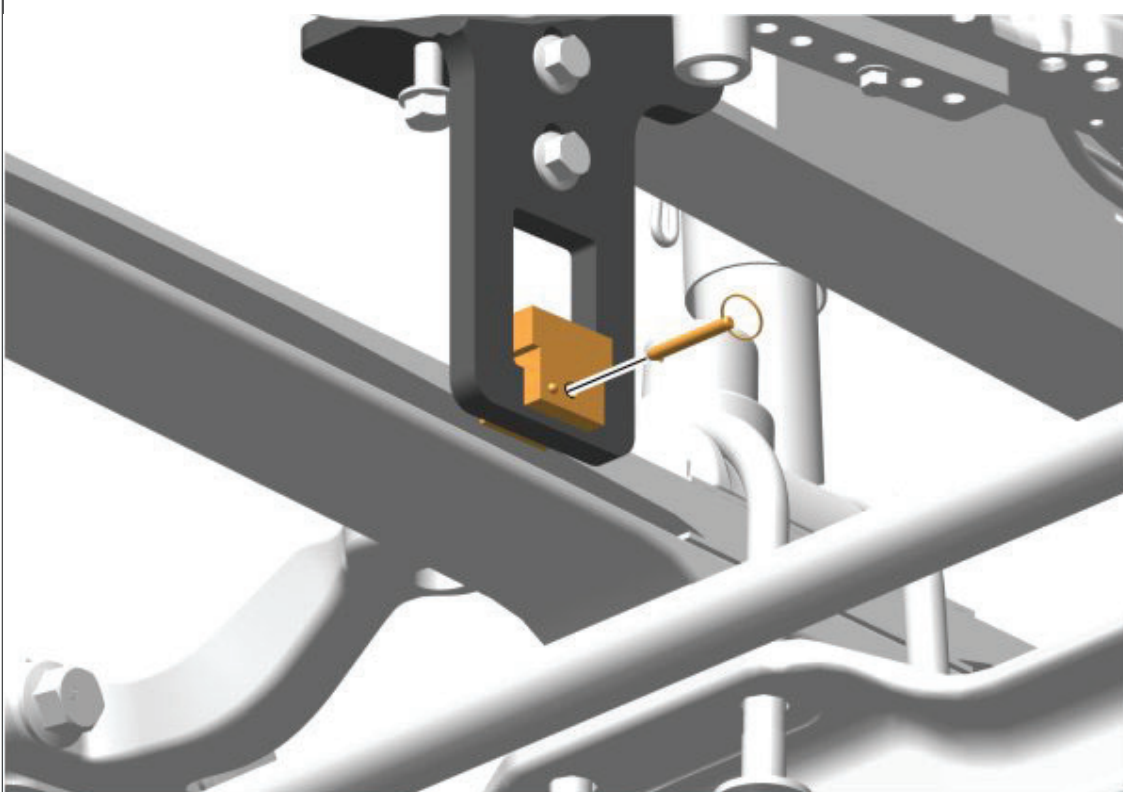


165	Perform this procedure when the condition below is met.
	Conditions
	If the crank angle is = 2.25°
	Install the spacer block.
	 Service hint
	The usage of the spacer blocks will vary per application. Ensure that the crossbar is installed at proper height using both the spacer blocks to prevent the crossbar from resting on any suspension component and or to prevent the crossbar from interfering on the bottom side of the engine.
	Install the wrist pin.

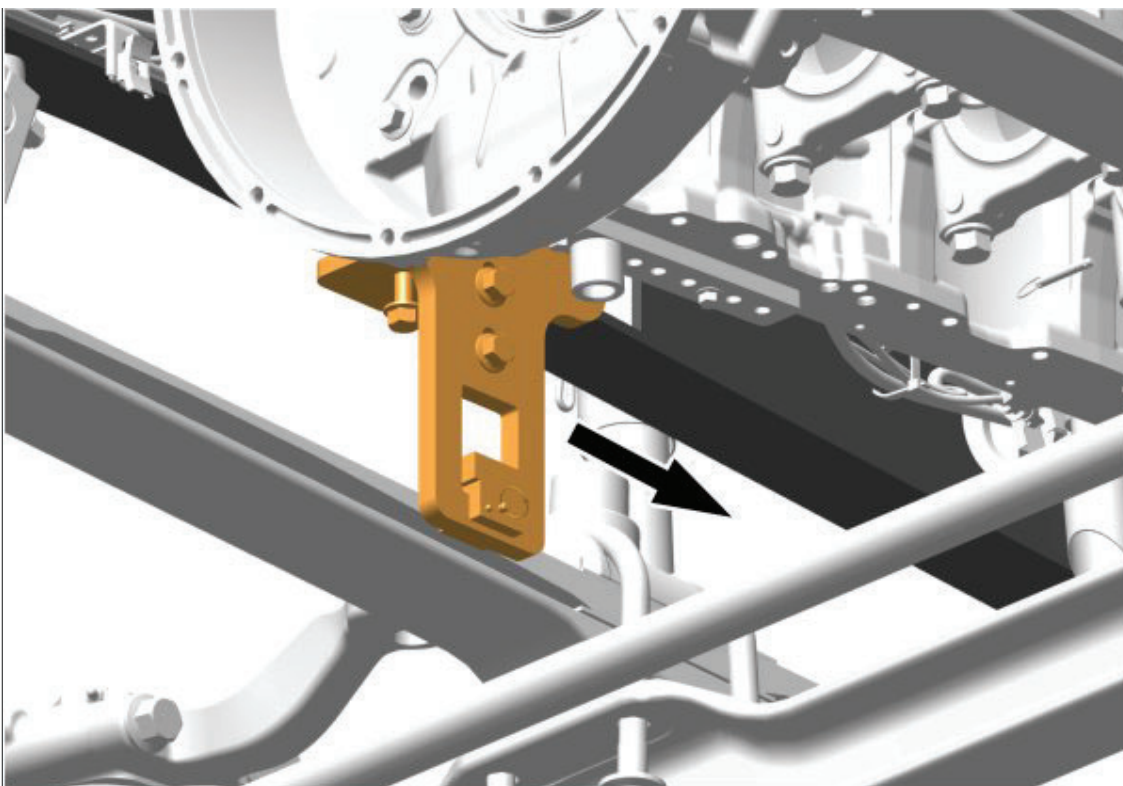


► Install the spacer block.

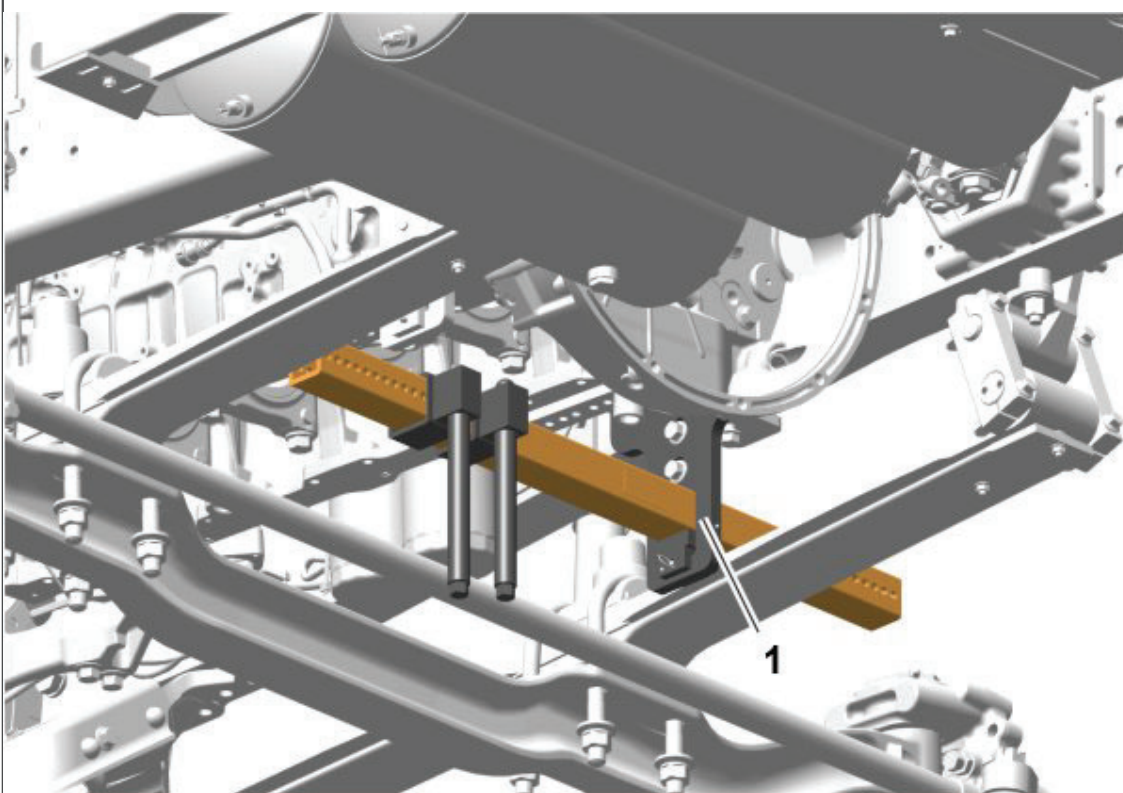
► Install the wrist pin.



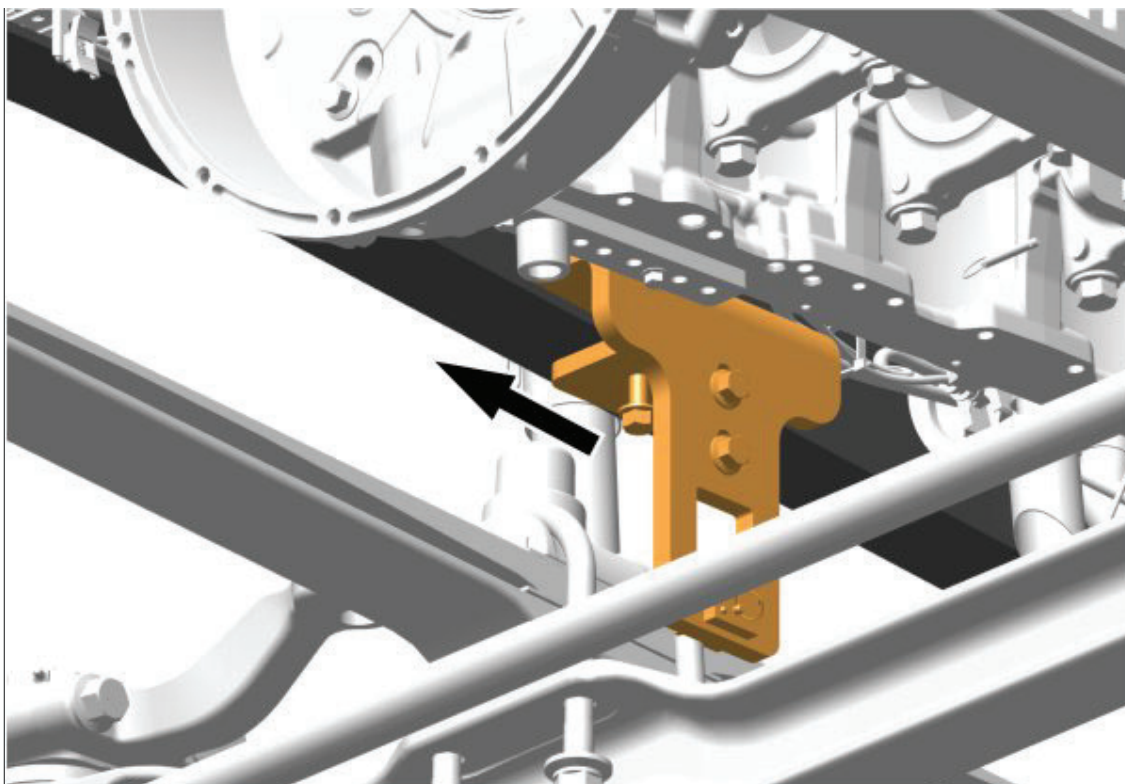
► Slide the upright leg assembly.



- Install the crossbar assembly inside the end (1) of the first upright leg assembly.



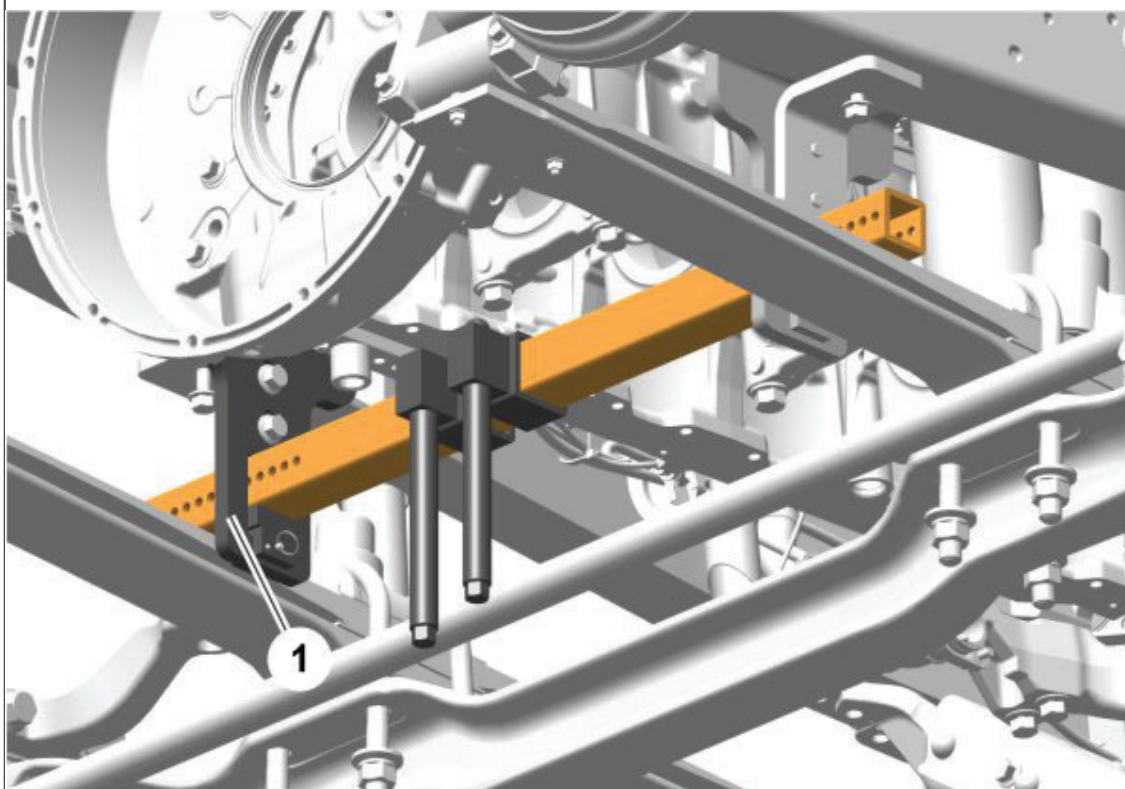
- Slide the upright leg assembly into the position.



- Install the crossbar assembly inside the end (1) of the other upright leg assembly.

**Note**

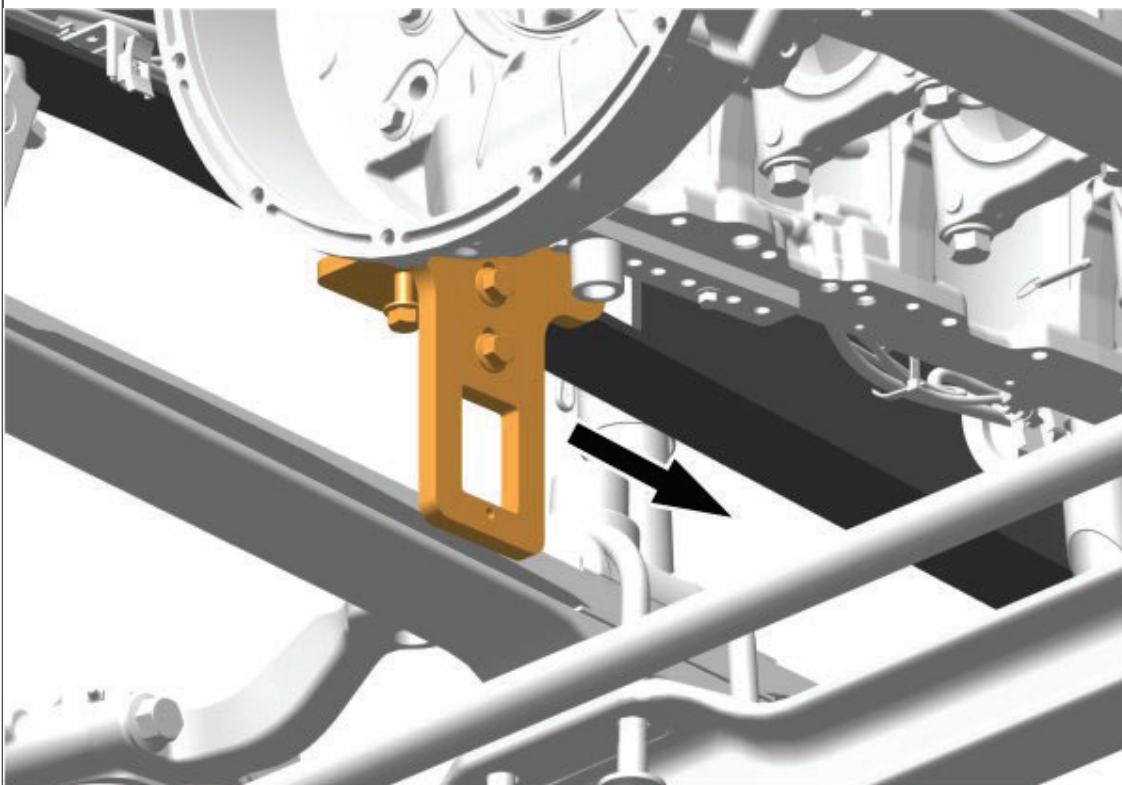
Ensure that the crossbar is not resting on the leaf springs.



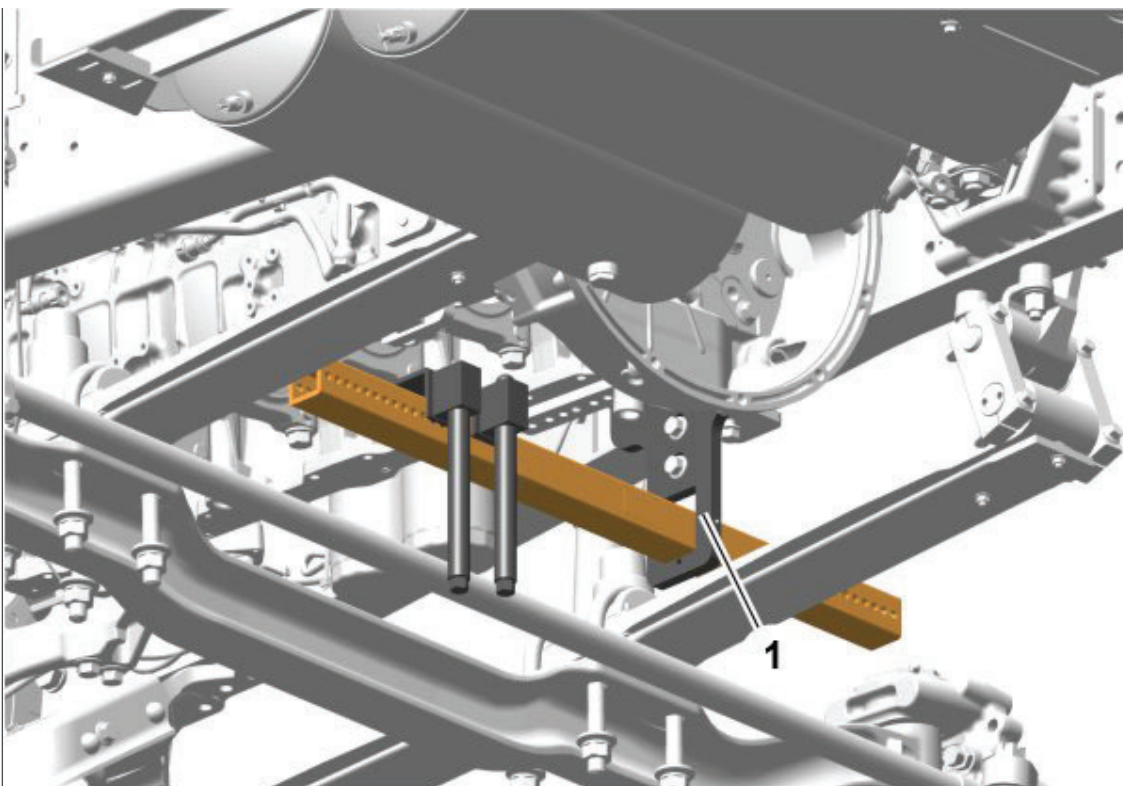
166 Perform this procedure when the condition below is met.

Conditions

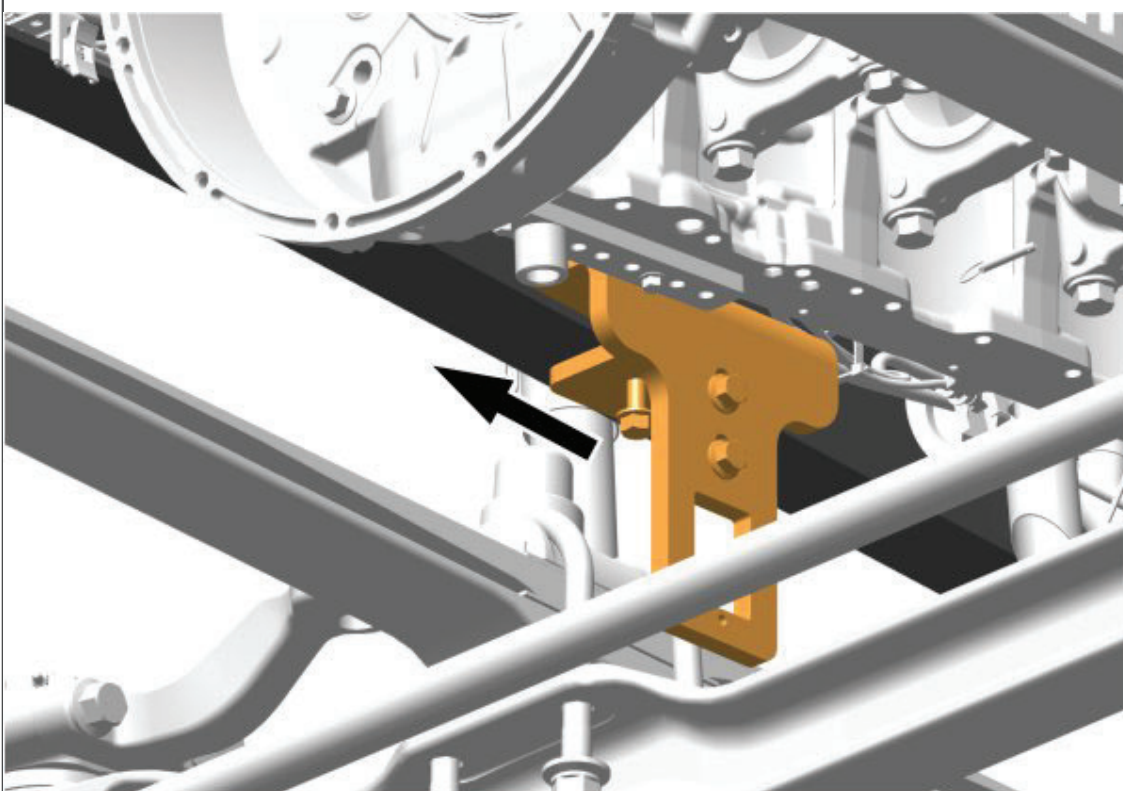
- If the crank angle is = 4°
- ▶ Slide the upright leg assembly.



- ▶ Install the crossbar assembly inside the end (1) of the first upright leg assembly.



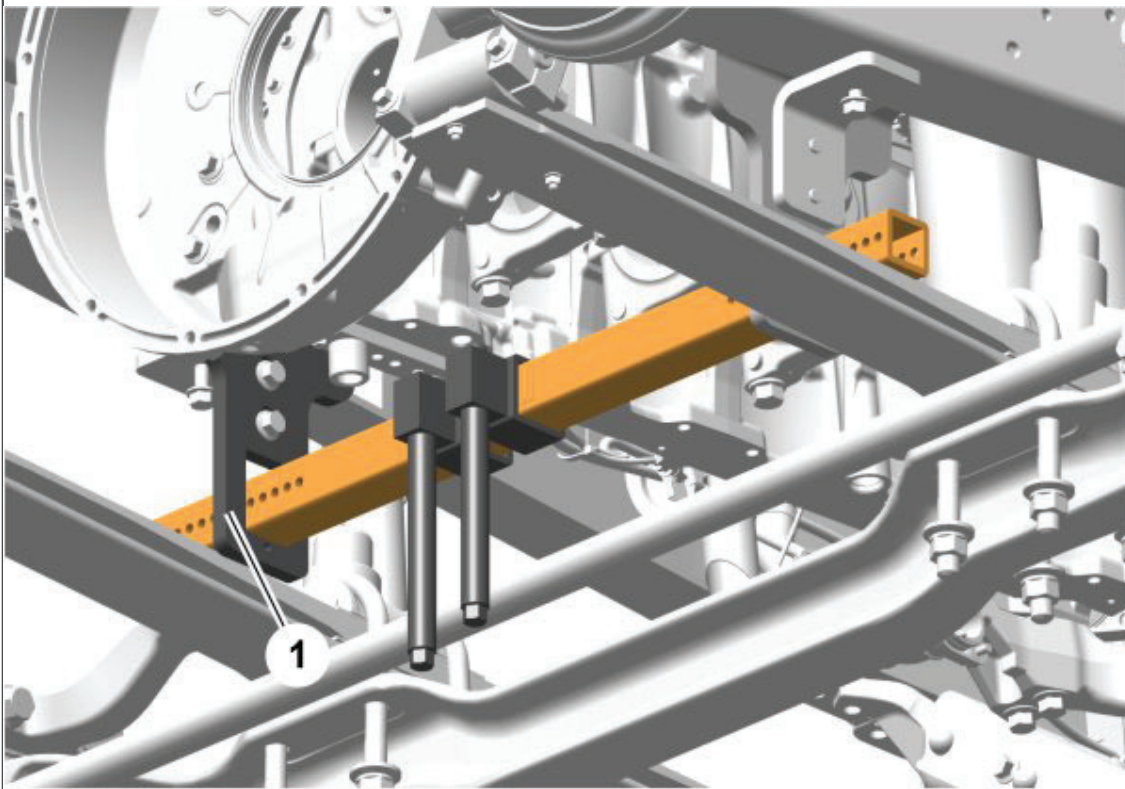
- Slide the upright leg assembly into the position.



- Install the crossbar assembly inside the end (1) of the other upright leg assembly.


Note

Ensure that the crossbar is not resting on the leaf springs.



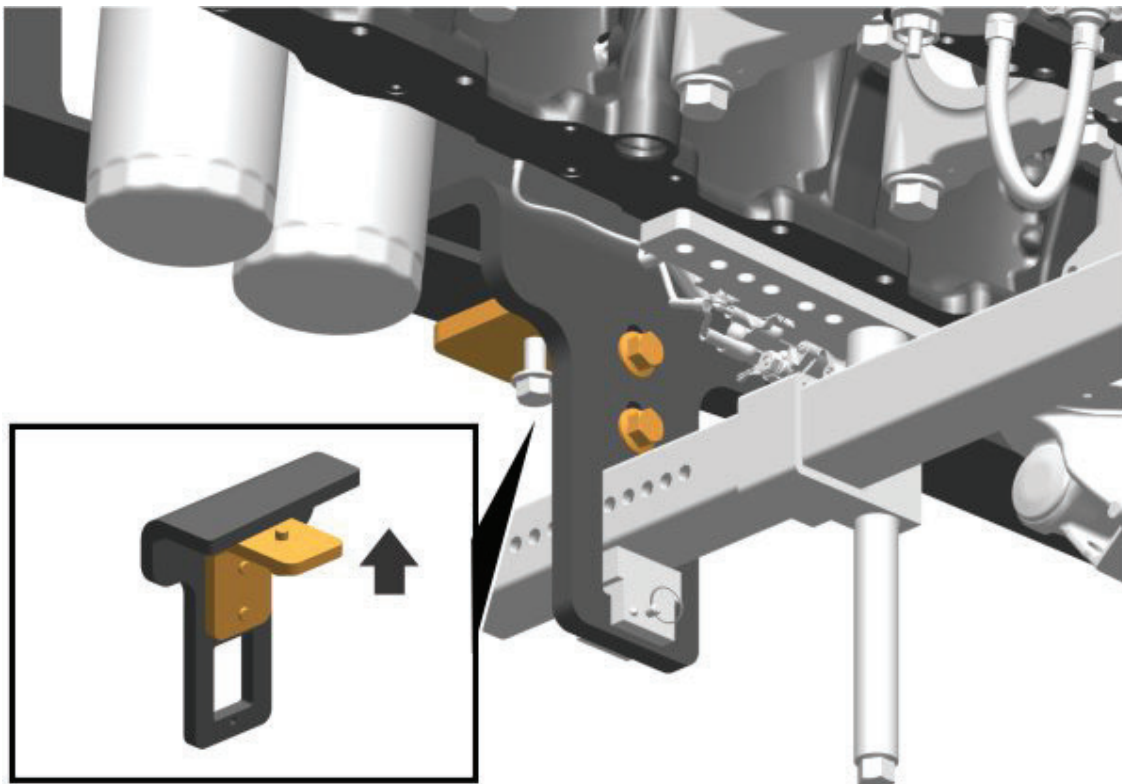
167 Push the bracket upwards against the frame rail.

168 Tighten the screws.



Service hint

Do not tighten the pinch screw at this time.



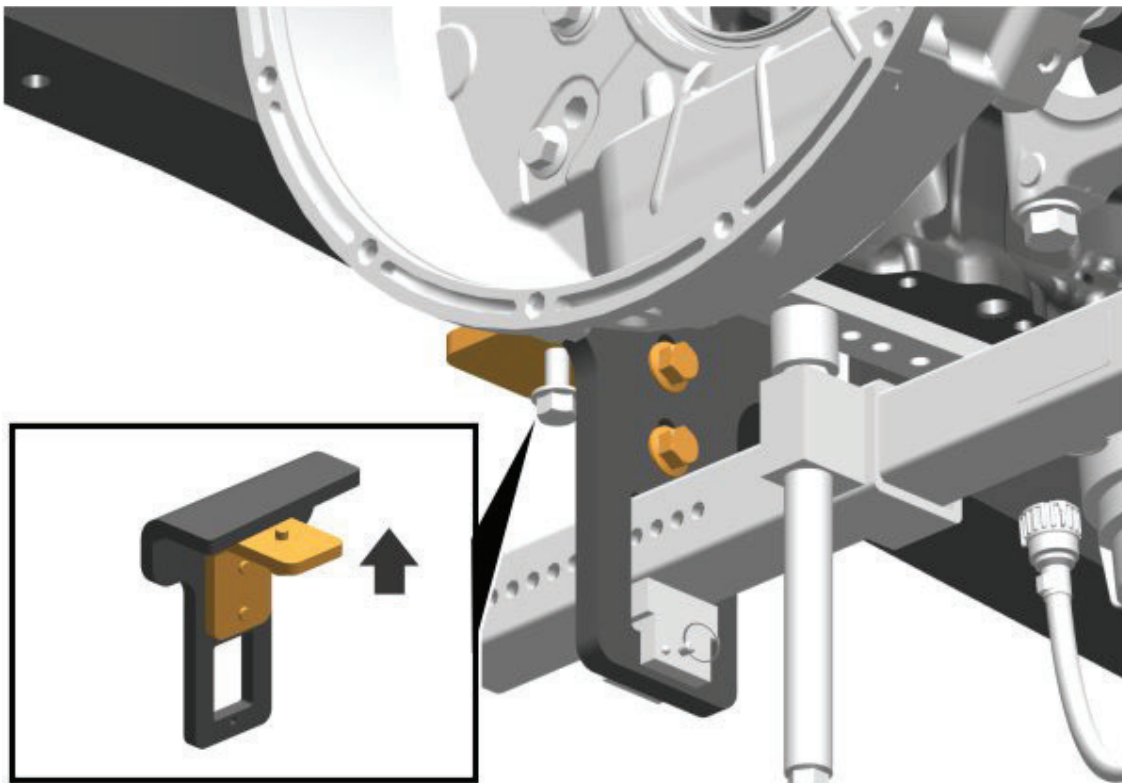
169 Push the bracket upwards against the frame rail.

170 Tighten the screws.



Service hint

Do not tighten the pinch screw at this time.

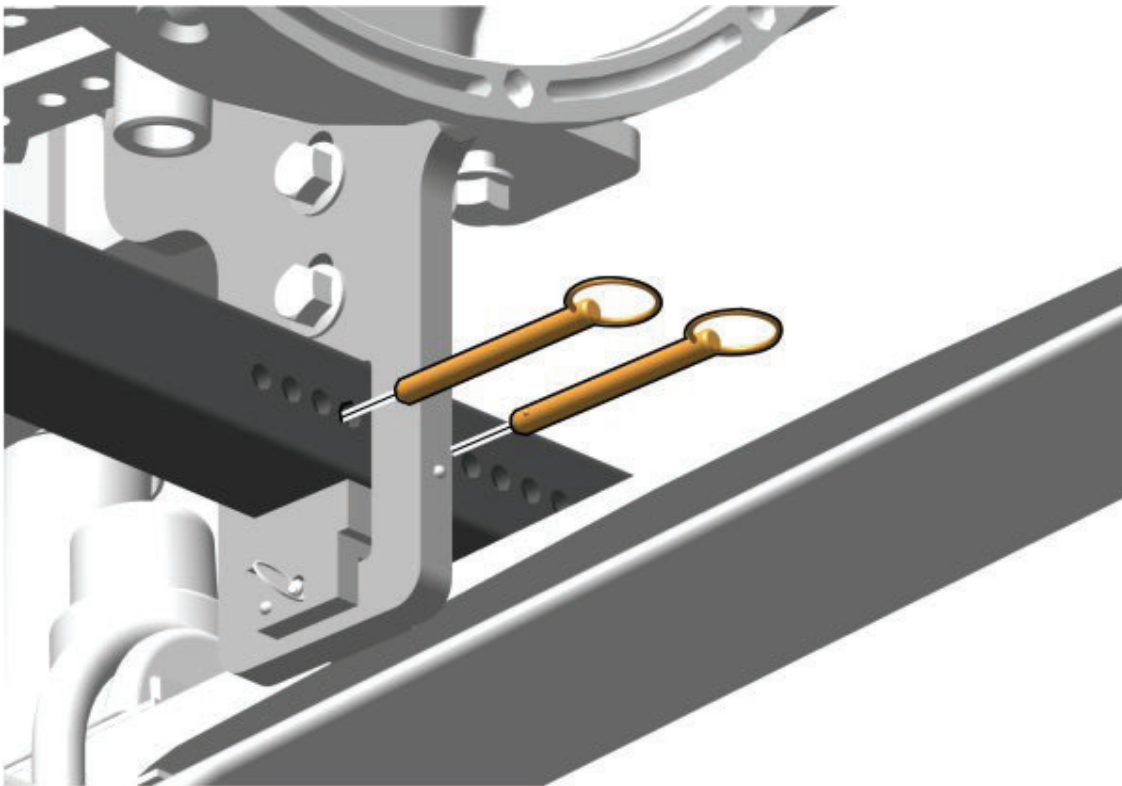


171 Install the pins.



Note

Ensure that the pins are installed on either side of the upright leg assembly.

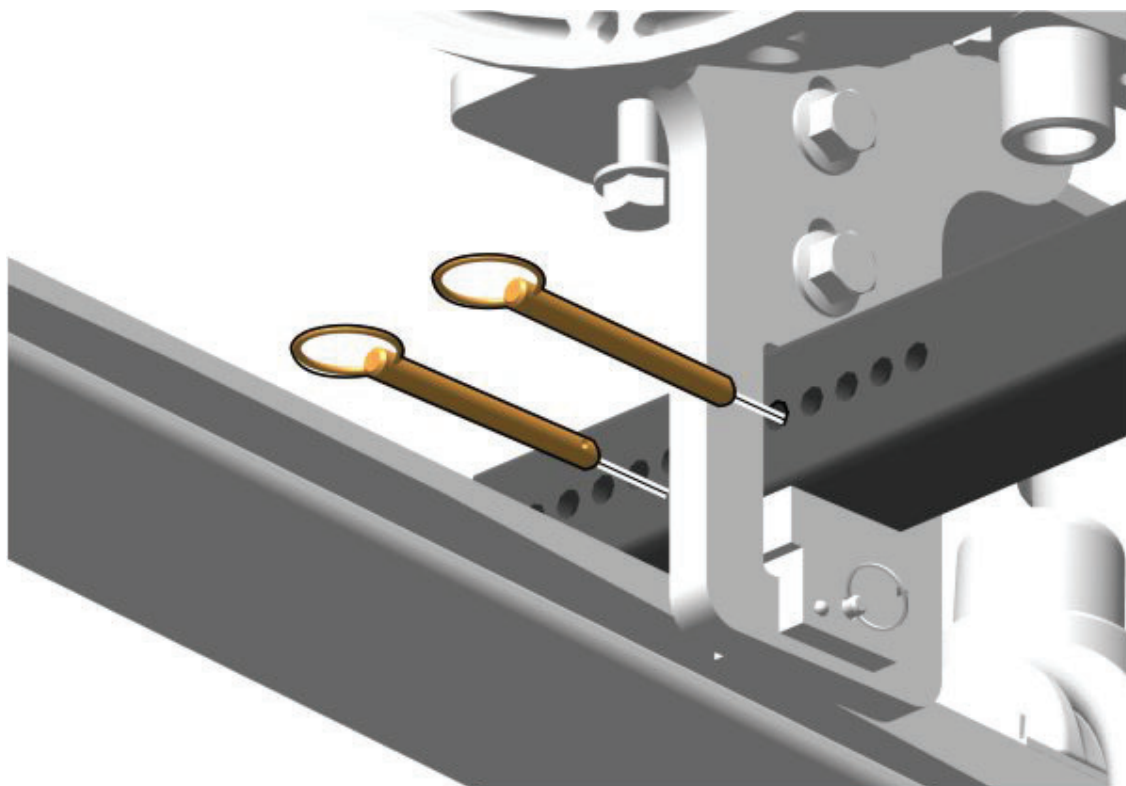


172 Install the pins.

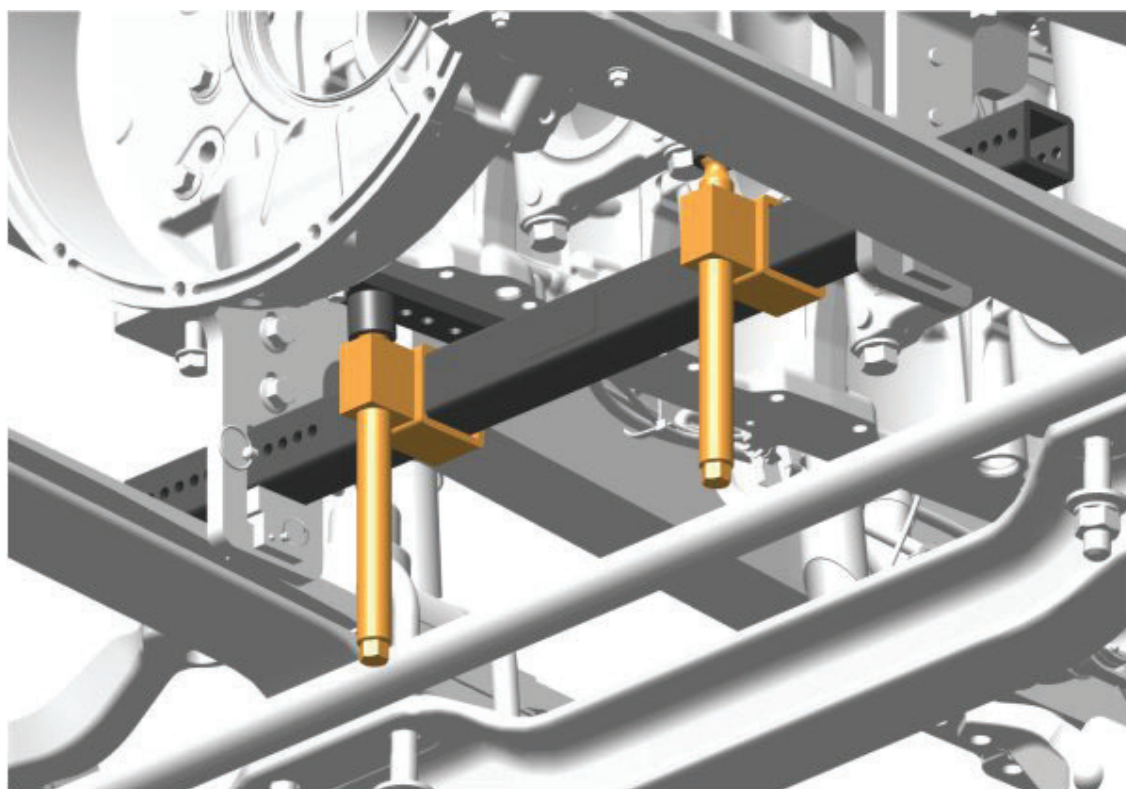


Note

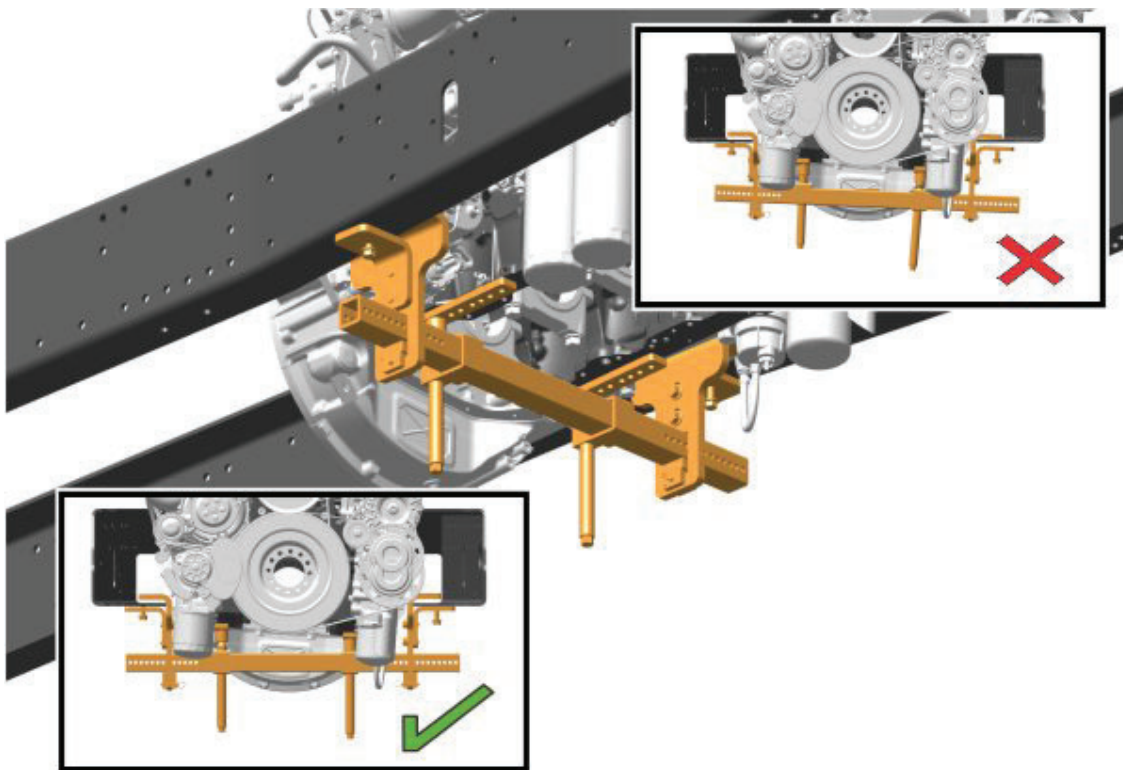
Ensure that the pins are installed on either side of the upright leg assembly.



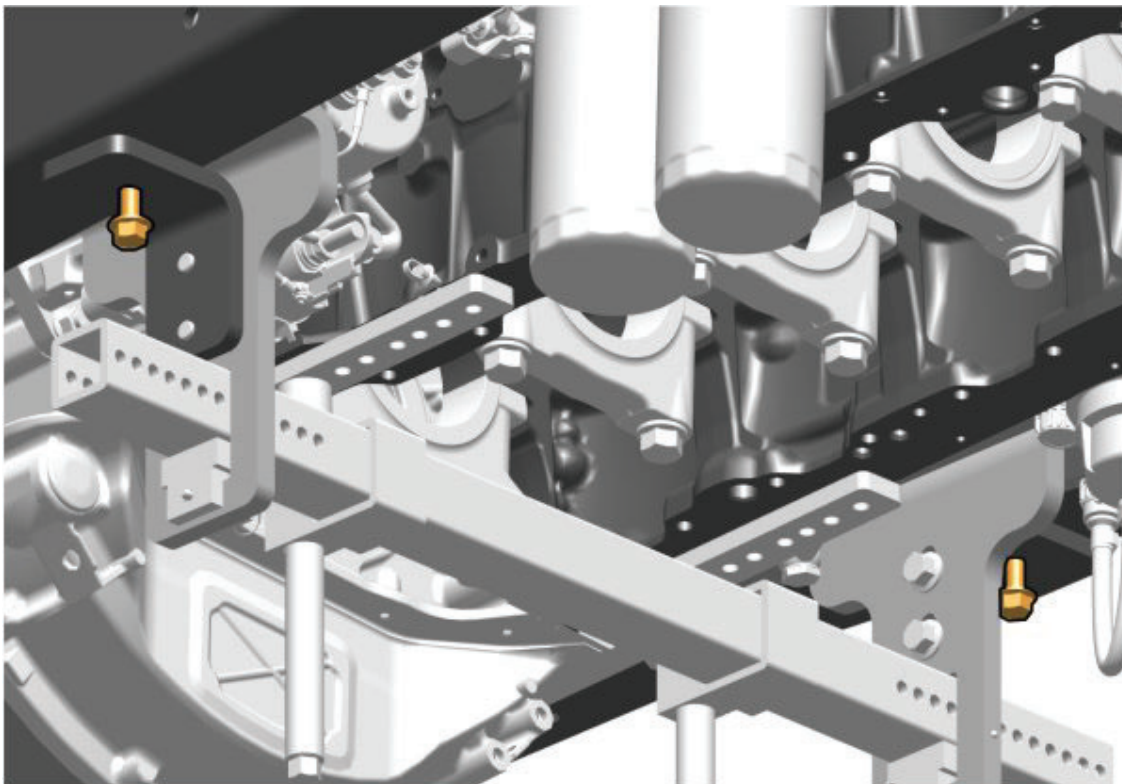
173	Align the threaded bracket assemblies.
-----	--



174	Before proceeding, ensure the correct alignment of the tool assembly.
-----	---



175 Tighten the pinch screws.



CAUTION

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

Risk of serious injury.

Heavy component.

- ▶ Exercise caution when moving the component. Use appropriate tools.



WARNING

Risk of personal injury.

Pinch point.

- ▶ Keep hands and fingers clear.

176 Safely lift and support the engine.



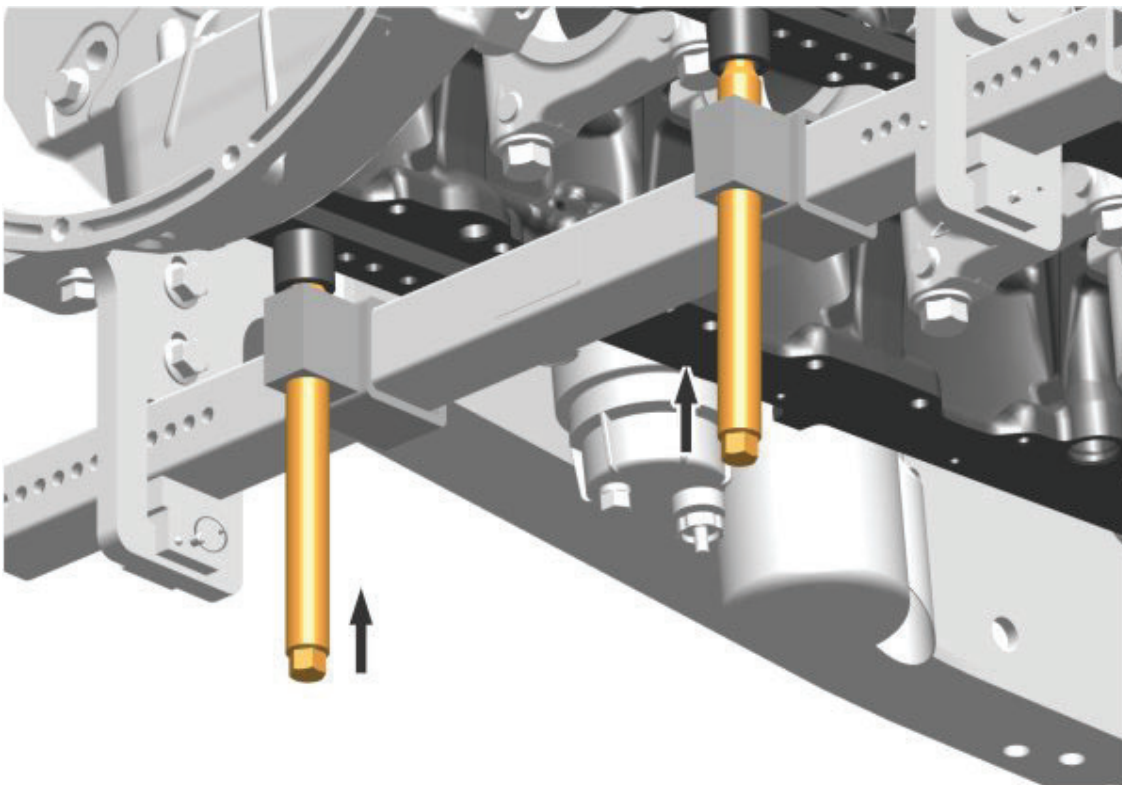
Service hint

Ensure that the engine is supported as to relieve pressure off the cushion mounts. This will aid in the engine bracket removal.

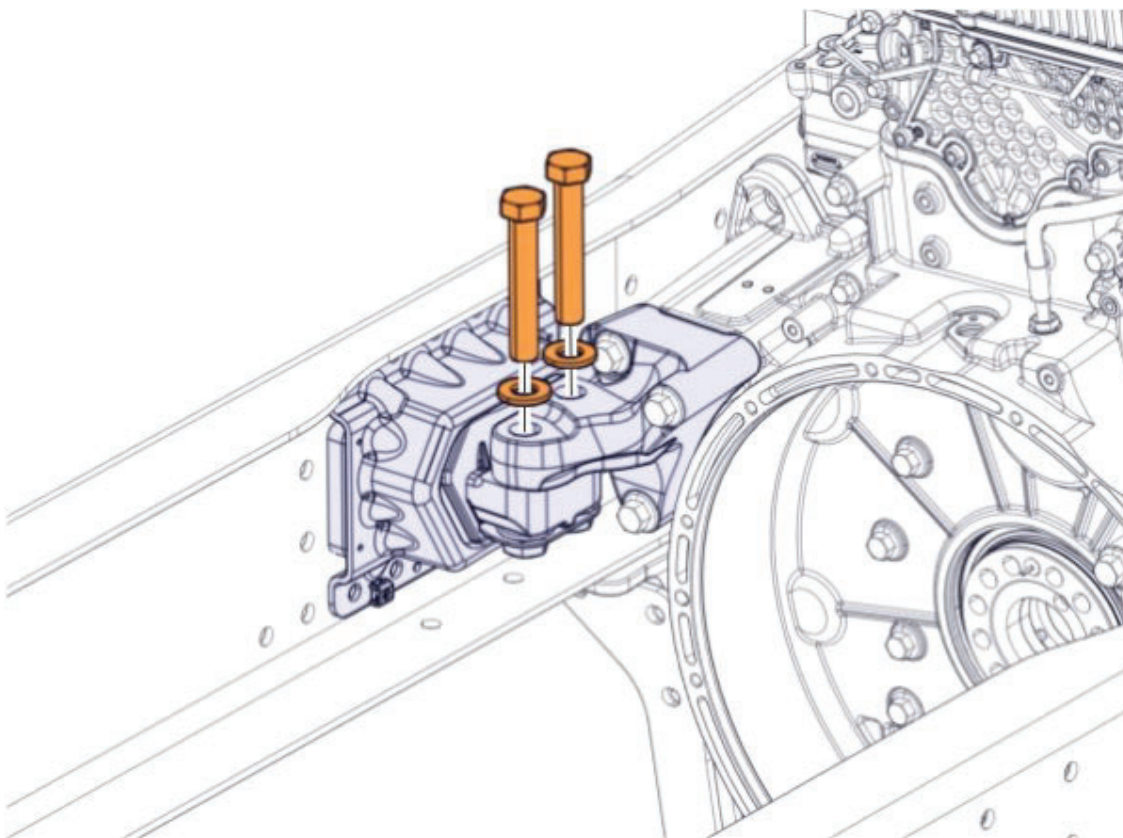


Note

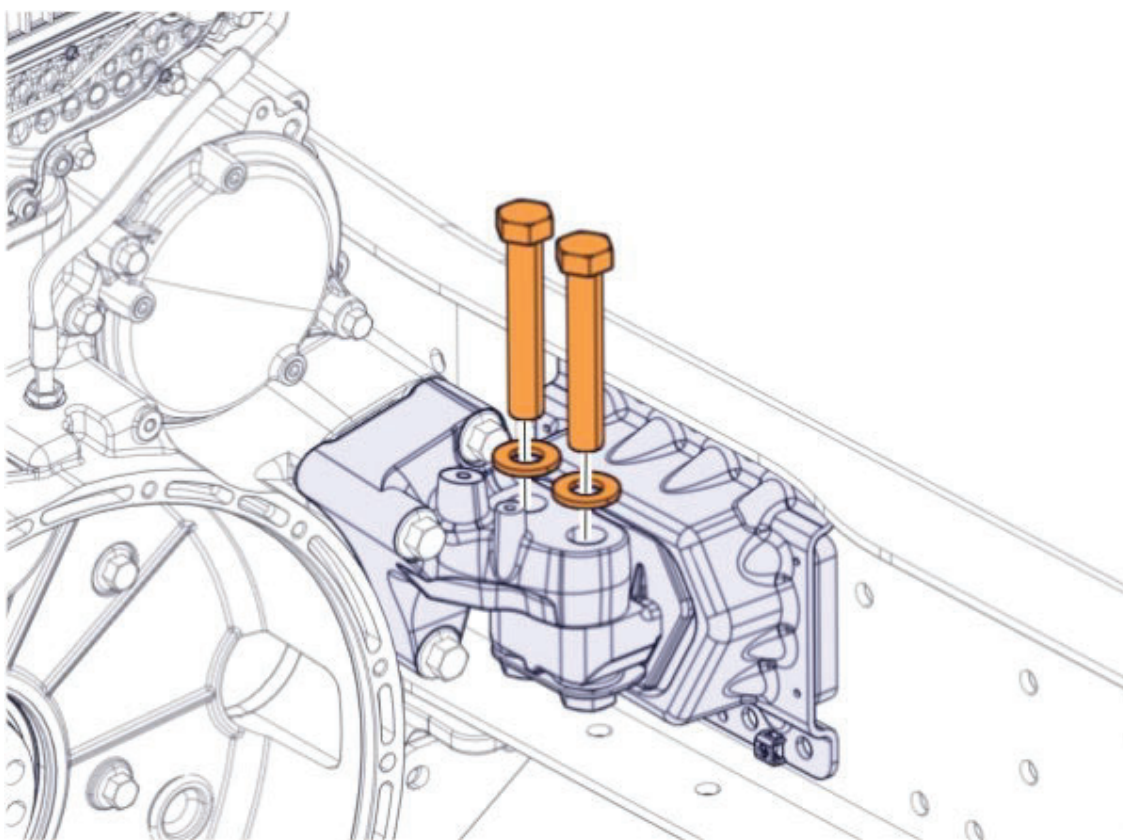
Use only hand tools.



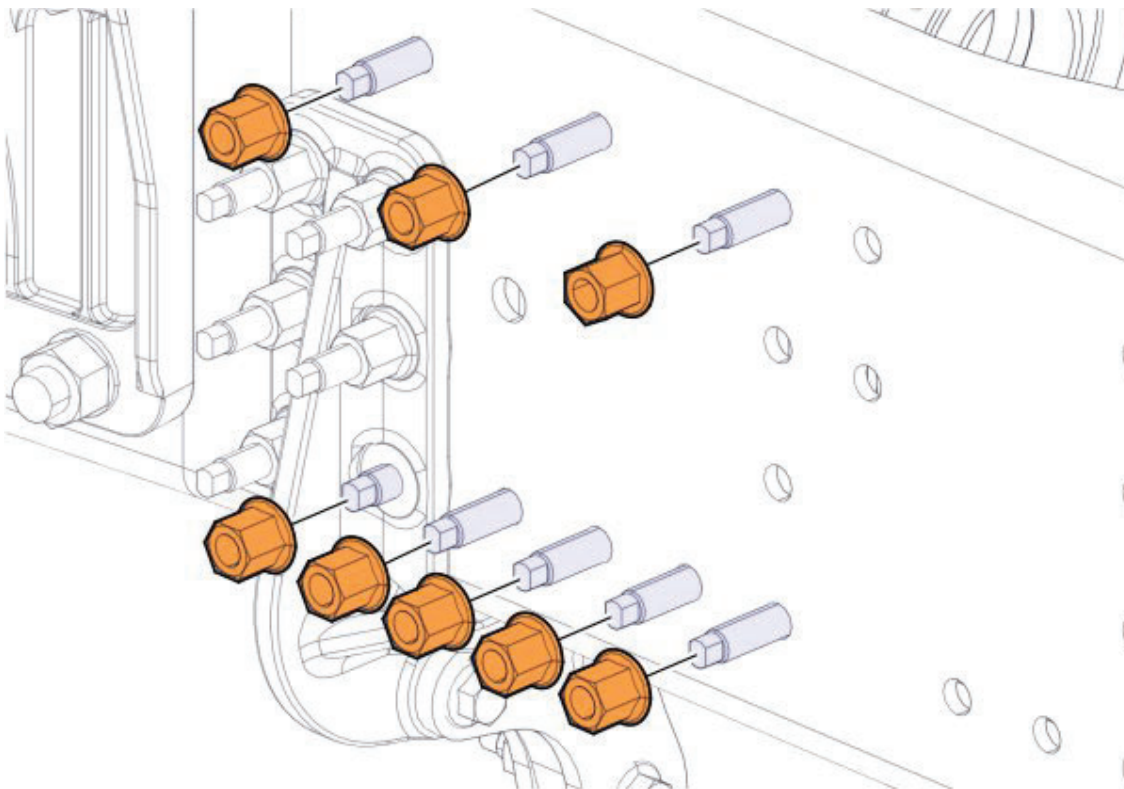
177 Remove the screws.



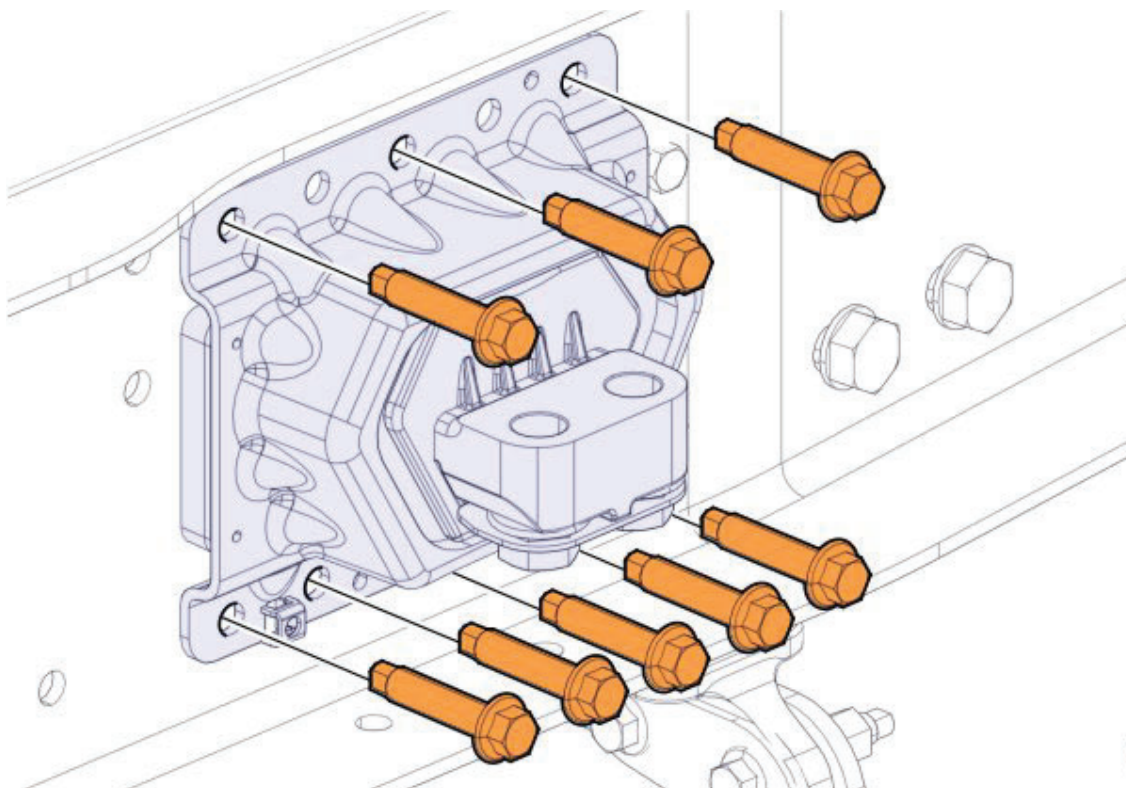
178	Remove the screws.
-----	--------------------



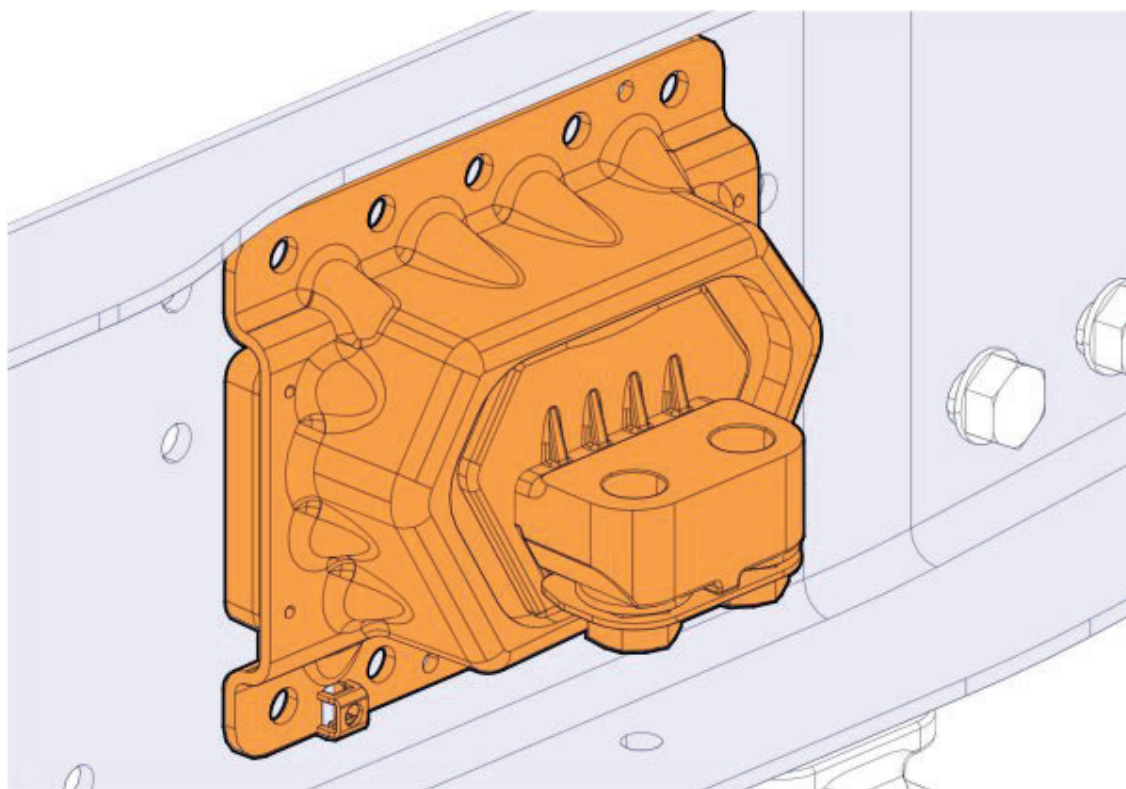
179	Remove the nuts.
-----	------------------



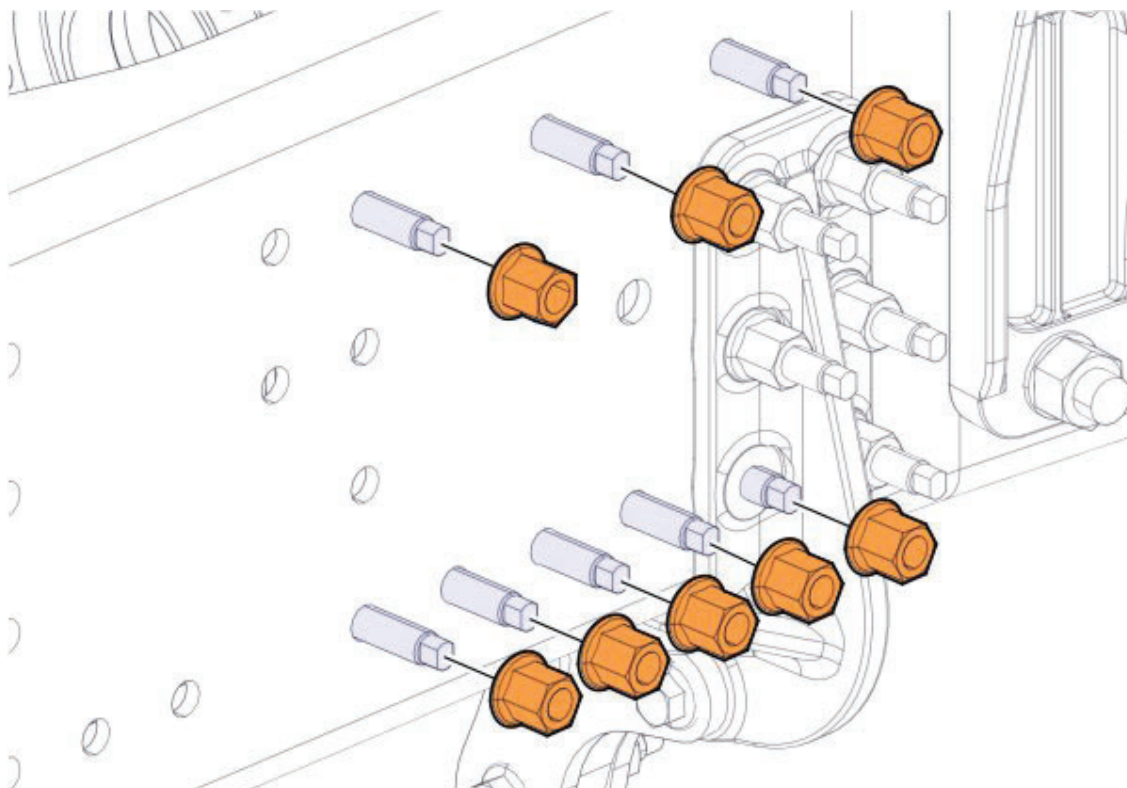
180	Perform this procedure when the condition below is met.
	Conditions
	If the screw has a non-removable nut
	Cut the nut to remove it.
181	Remove the screws.



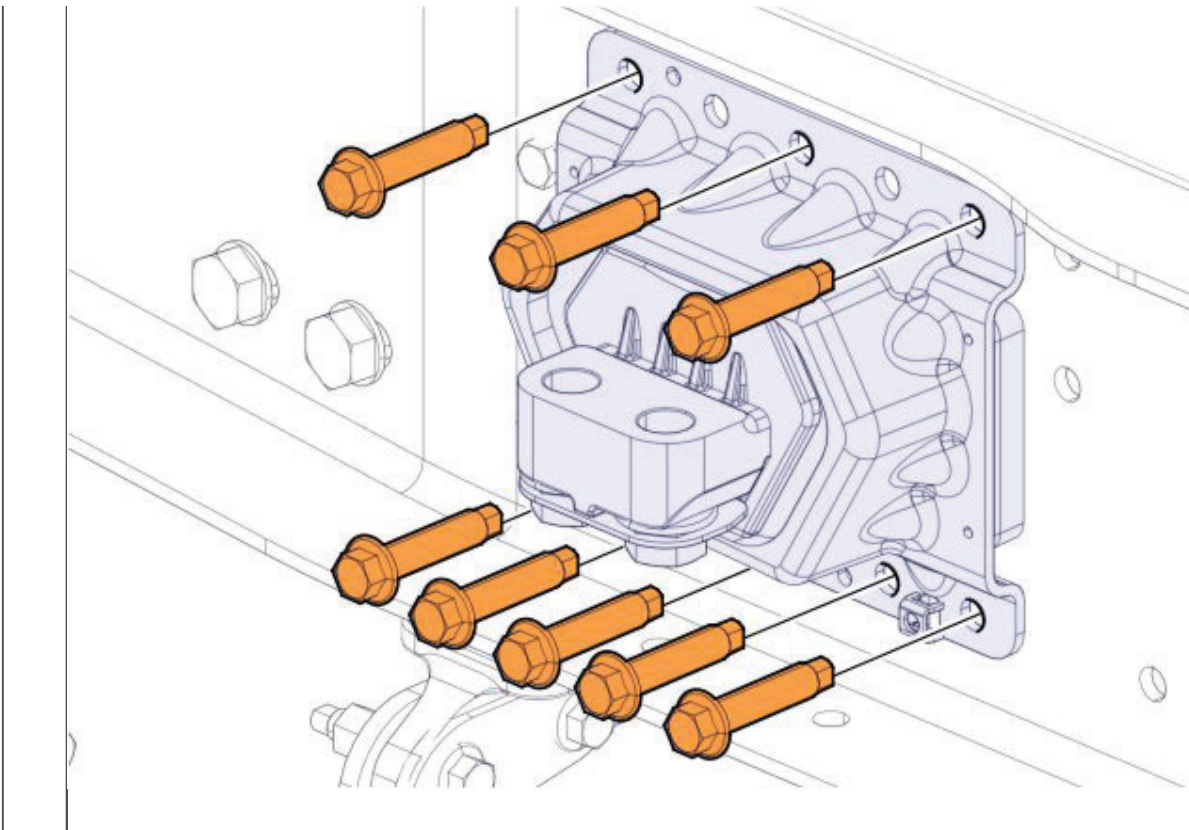
182	Remove the rubber cushion.
------------	----------------------------



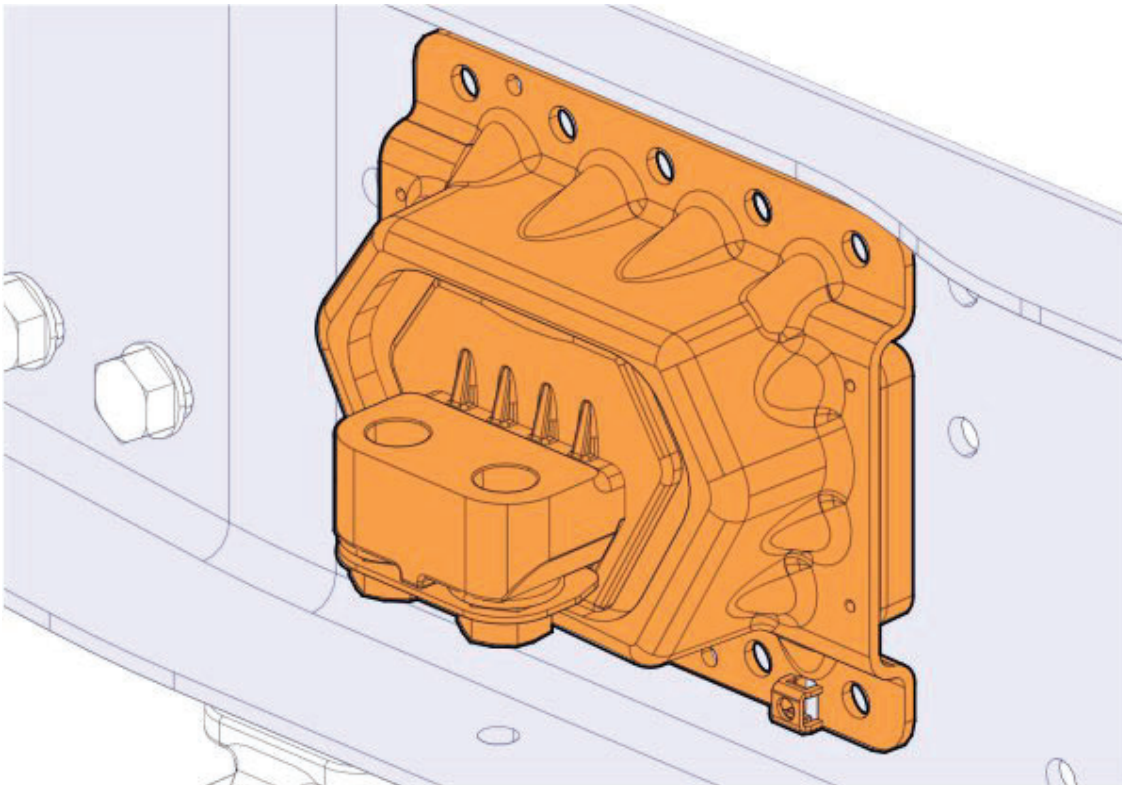
183	Remove the nuts.
------------	------------------



184	Perform this procedure when the condition below is met.
	Conditions
	If the screw has a non-removable nut
	Cut the nut to remove it.
	Remove the screws.

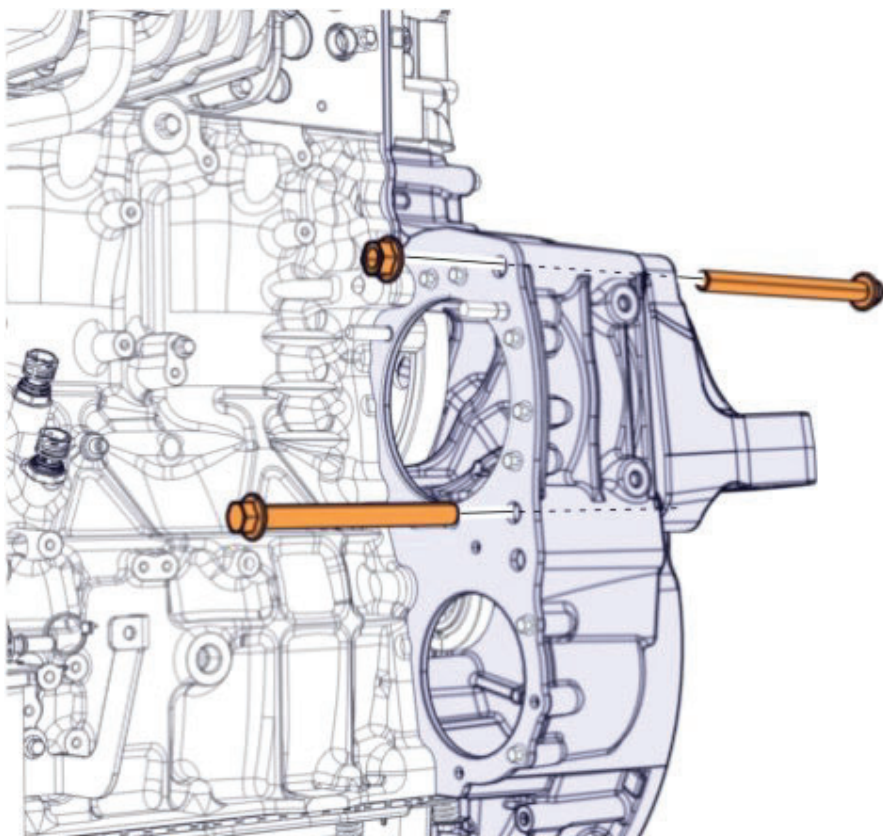


185	Remove the rubber cushion.
-----	----------------------------



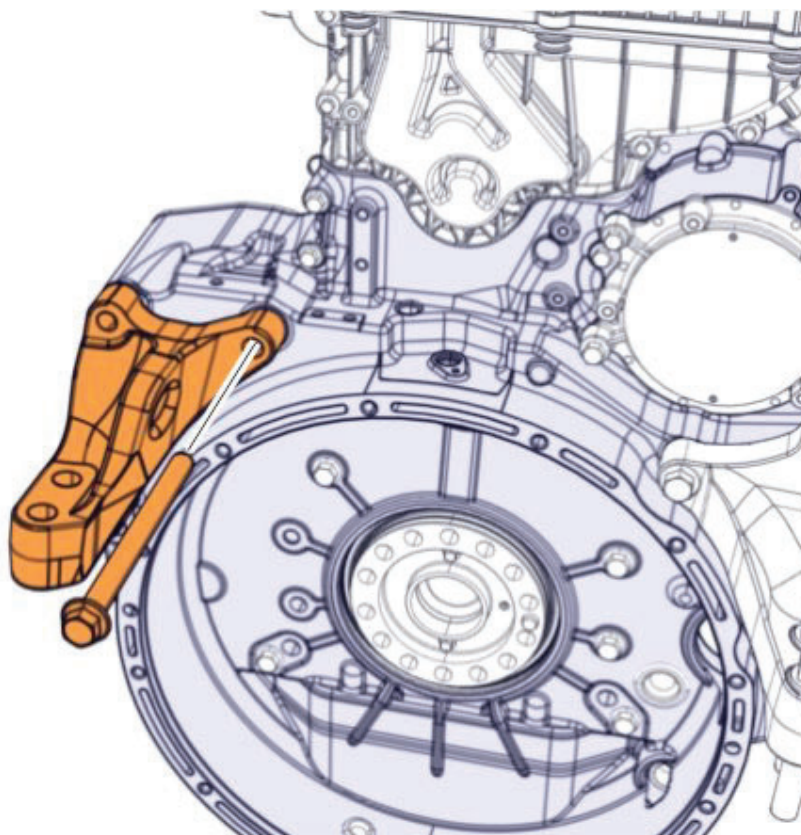
186	Remove the nut and screw.
-----	---------------------------

187	Remove the screw.
-----	-------------------



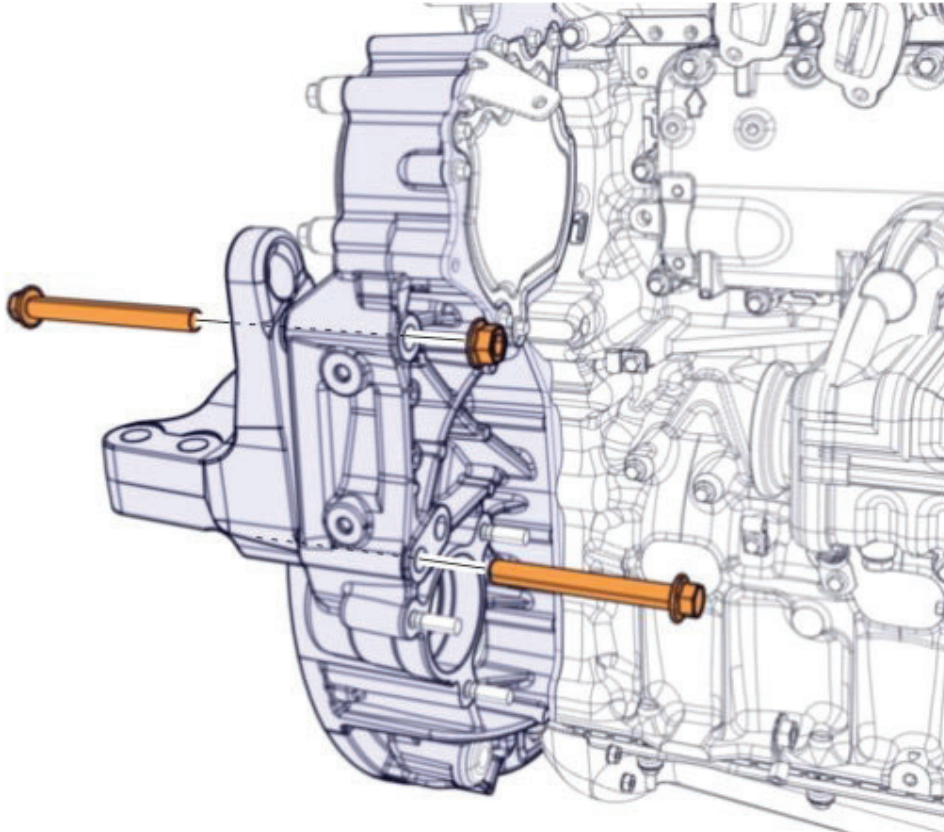
188	Remove the screw.
-----	-------------------

189	Remove the bracket.
-----	---------------------



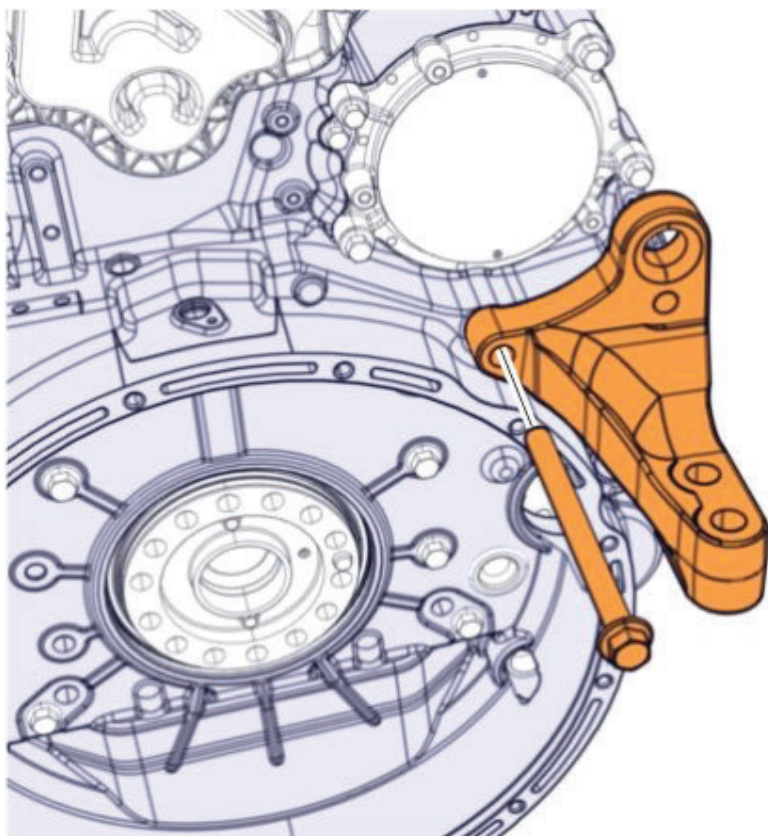
190	Remove the nut and screw.
-----	---------------------------

191	Remove the screw.
-----	-------------------

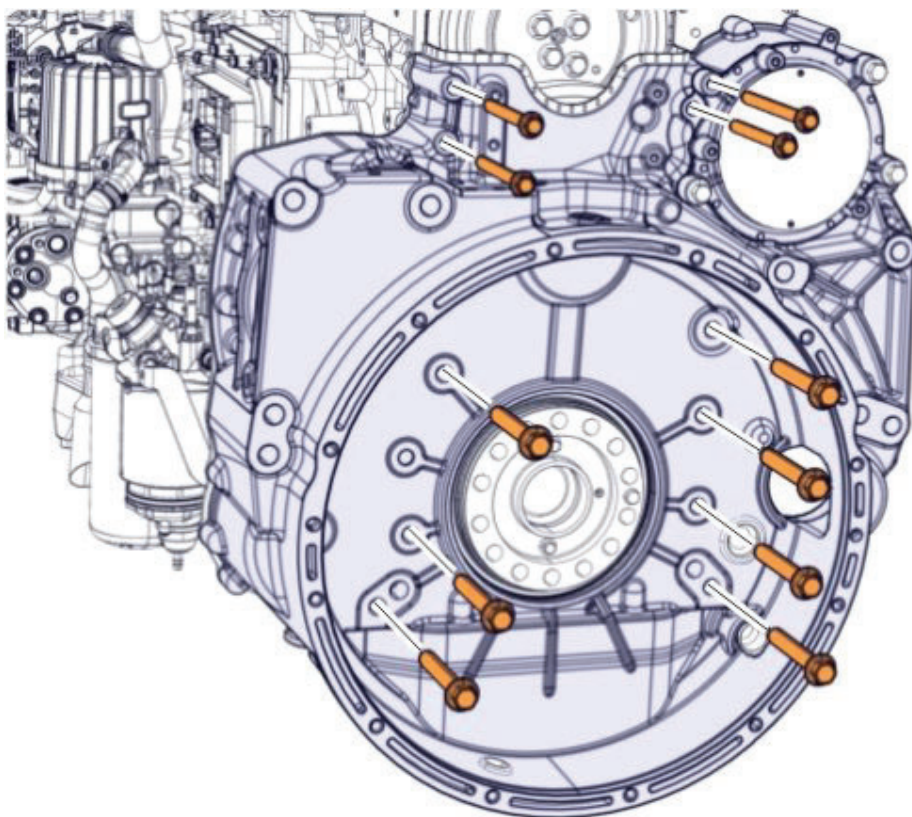


192	Remove the screw.
-----	-------------------

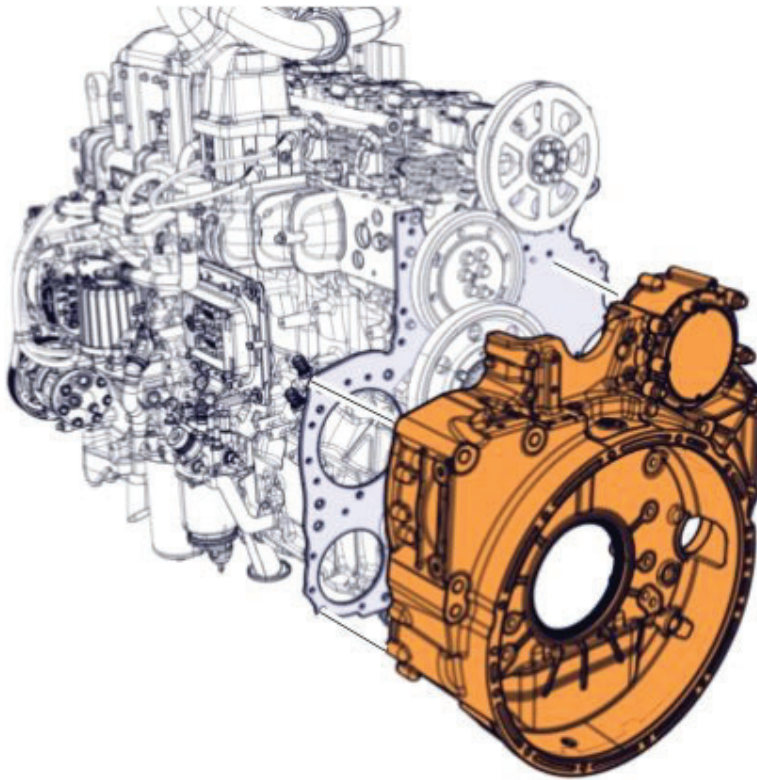
193	Remove the bracket.
-----	---------------------



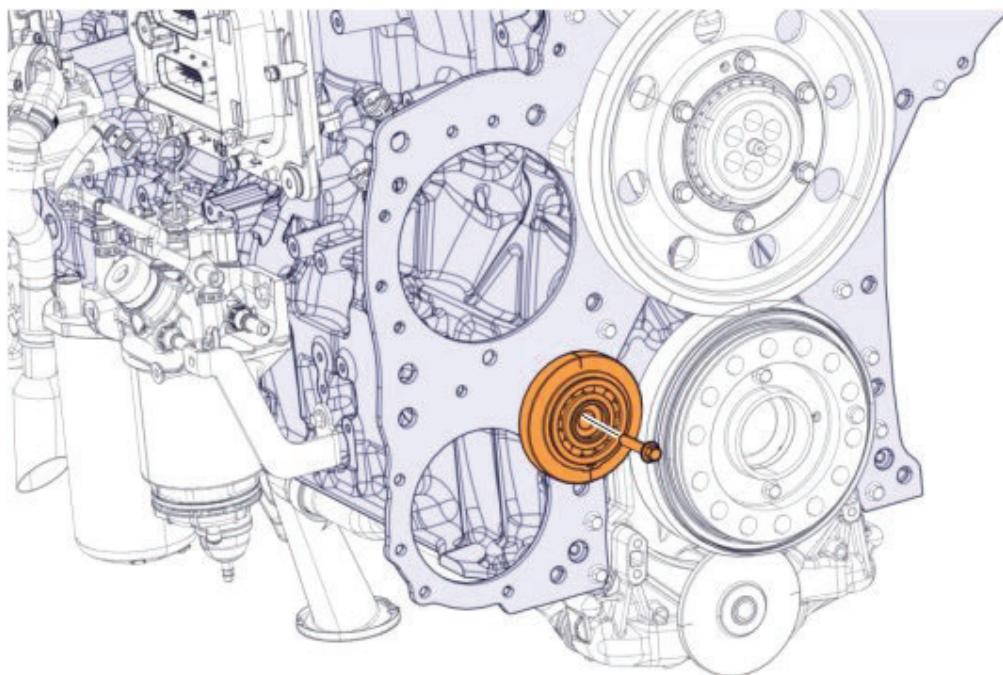
194	Remove the screws.
-----	--------------------



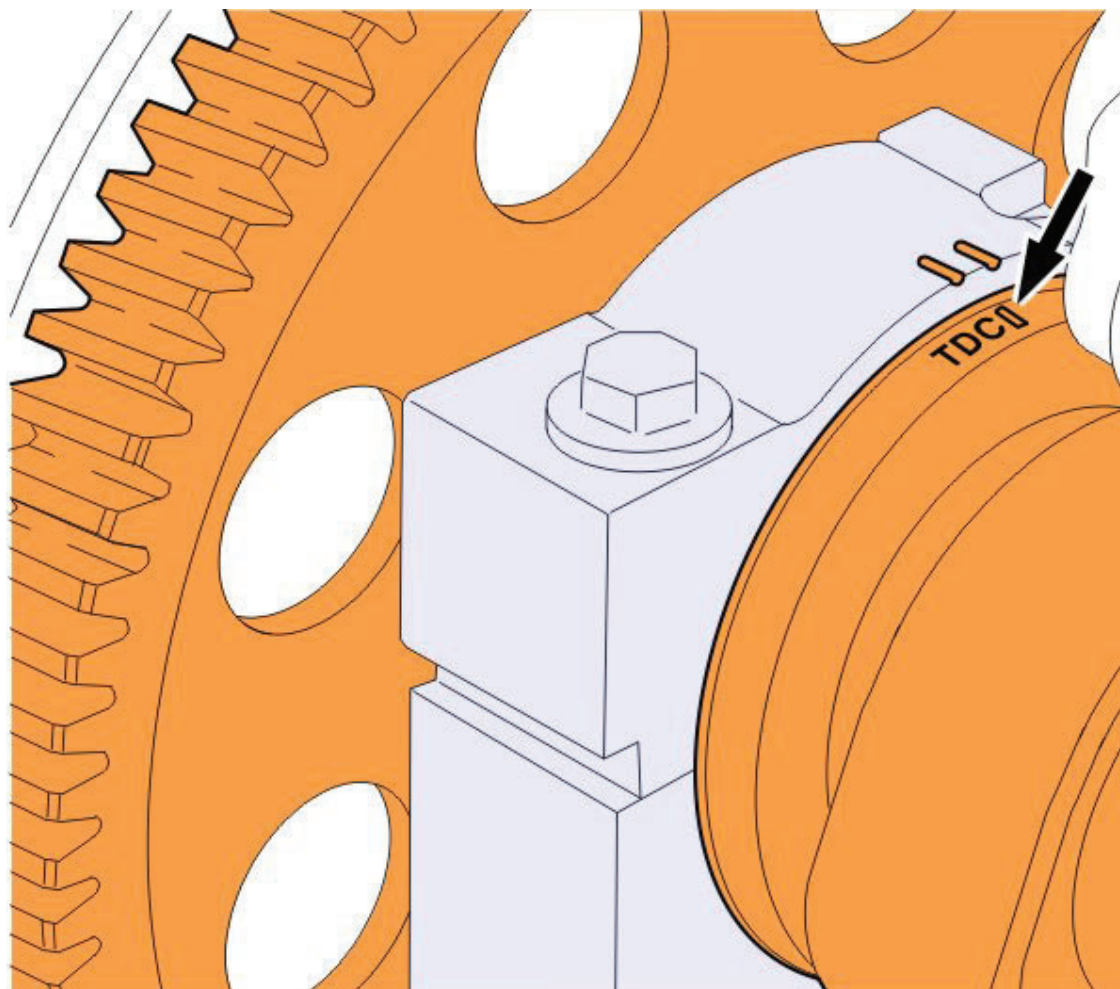
			CAUTION		
Risk of serious injury.					
Heavy component.					
▶ Exercise caution when moving the component. Use appropriate tools.					
195	Remove the flywheel housing.				



196	Remove the screw.
197	Remove the gear.
	Service hint The gear may be stuck in the timing gear plate. Loosely reinstall the fastener and use a suitable puller.



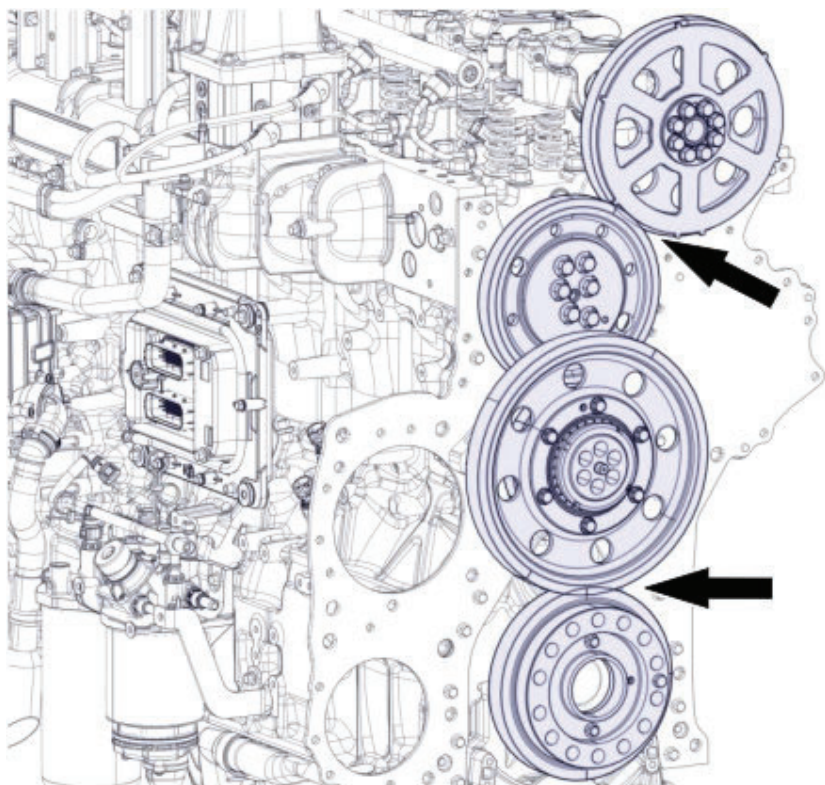
198 Check that the timing marks are at TDC.



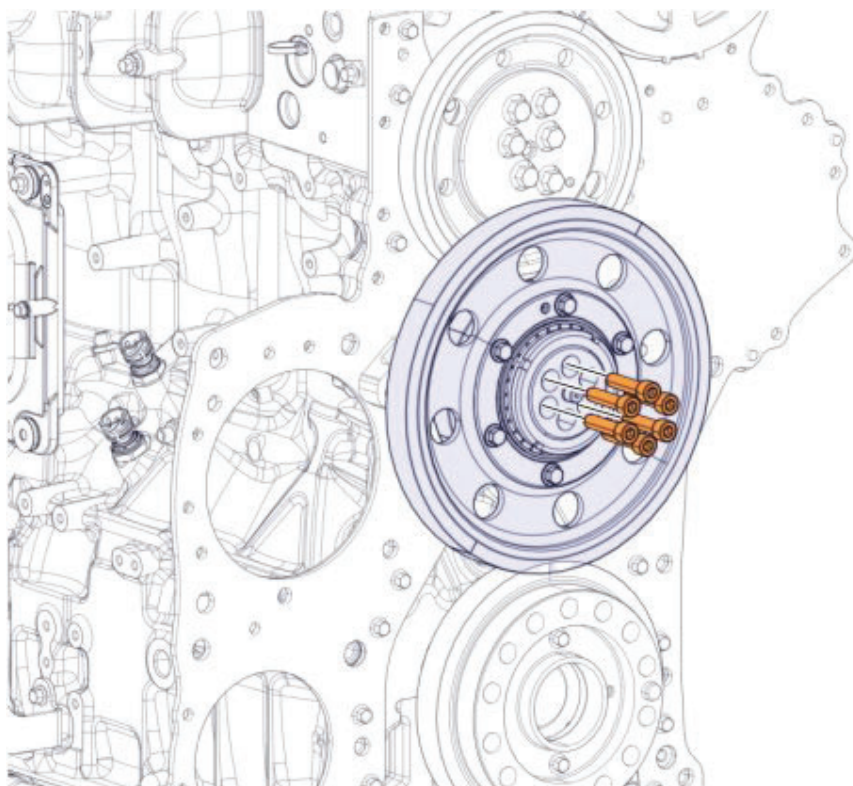
Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

199	Mark the gears for reference.
-----	-------------------------------



200	Remove the screws.
-----	--------------------



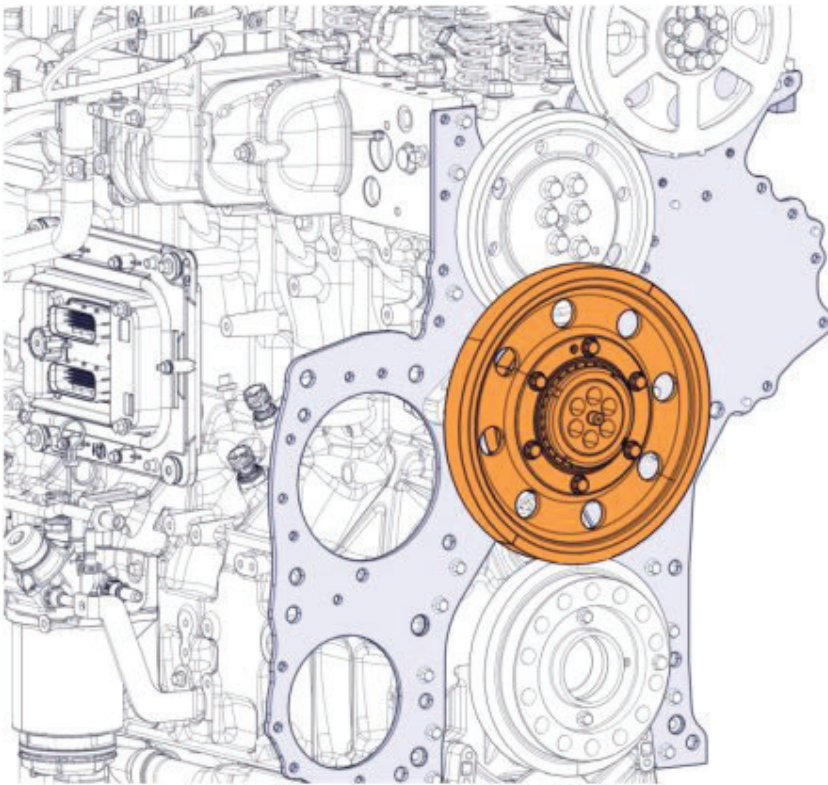
201	Remove the gears.
-----	-------------------

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

**Note**

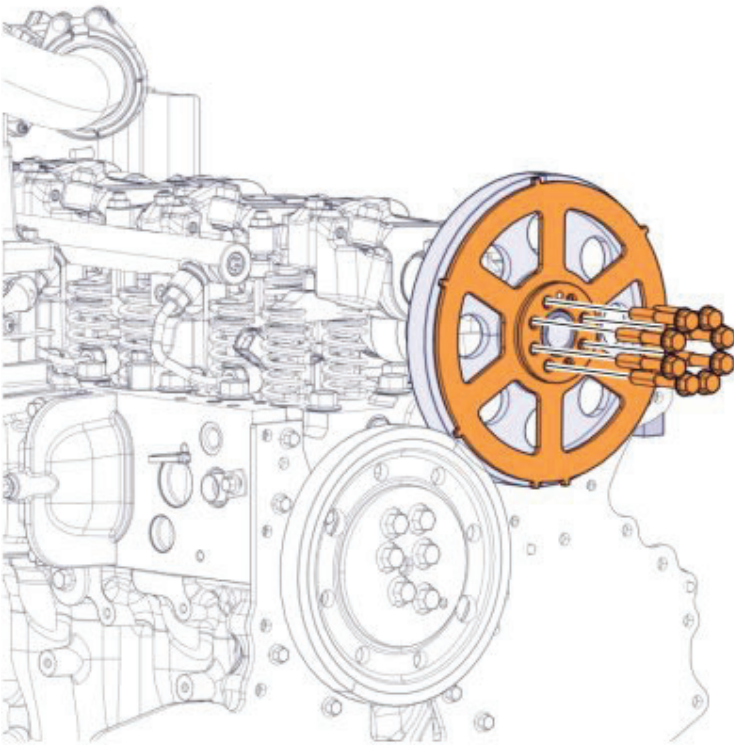
Do not separate the gears.



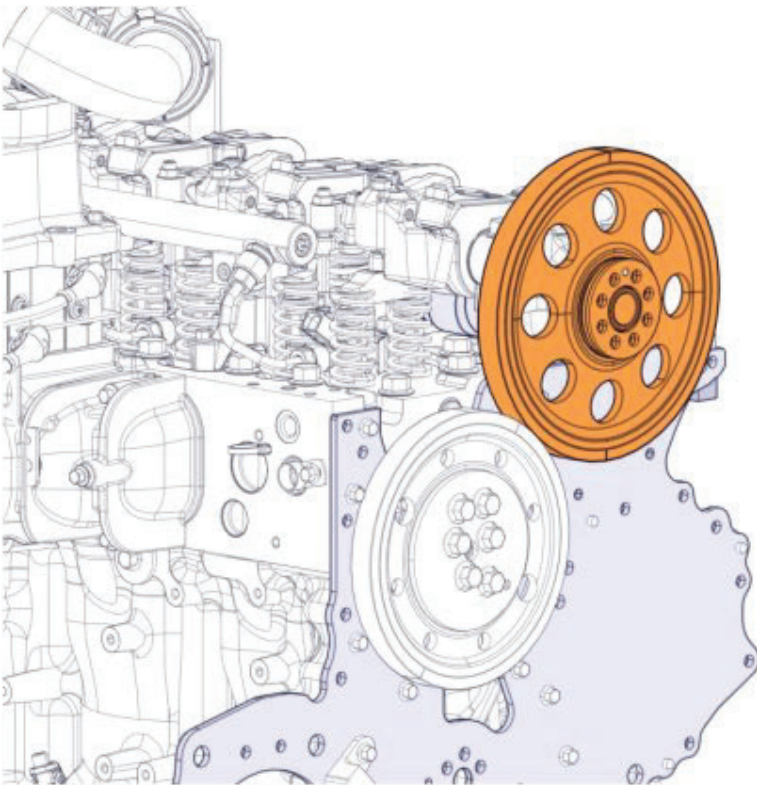
202 Remove the screws and the tone wheel.

**Note**

Discard the screws.



203	Remove the gear.
-----	------------------

**CAUTION**

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

Risk of material damage.

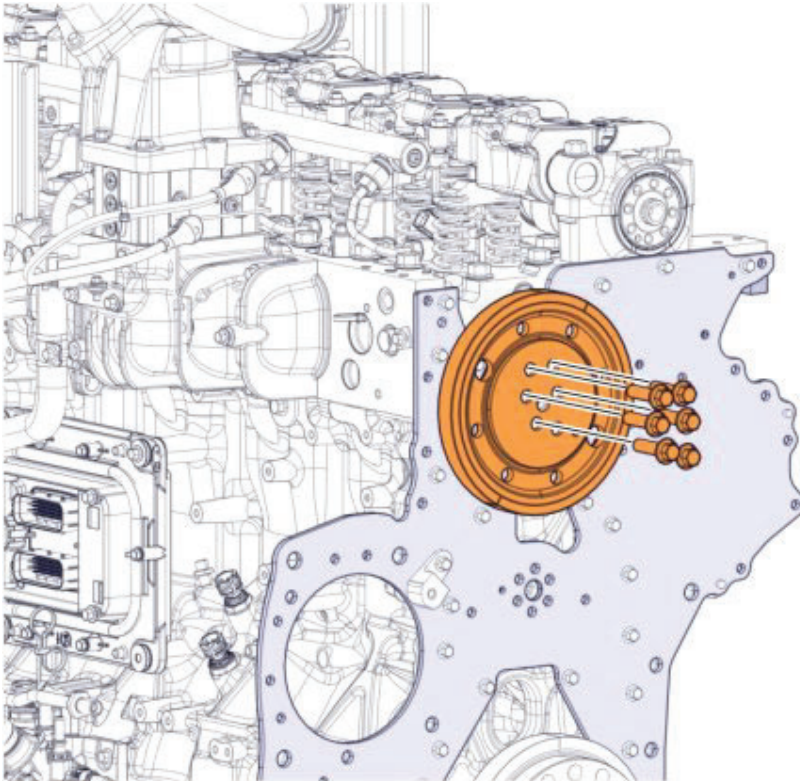
The idler gear can be damaged if mishandled.

- ▶ Take care while removing the idler gear screws.
- ▶ Secure the idler gear while removing the idler gear hub screws.

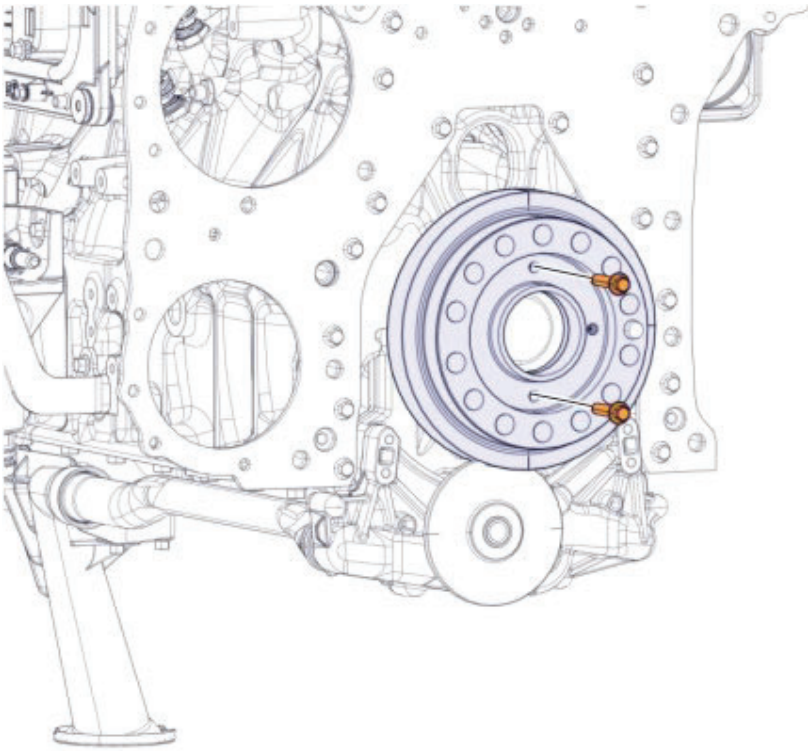
204 Remove the screws.

205 Remove the gear.

206 Remove the thrust washer.



207 Remove the screws.

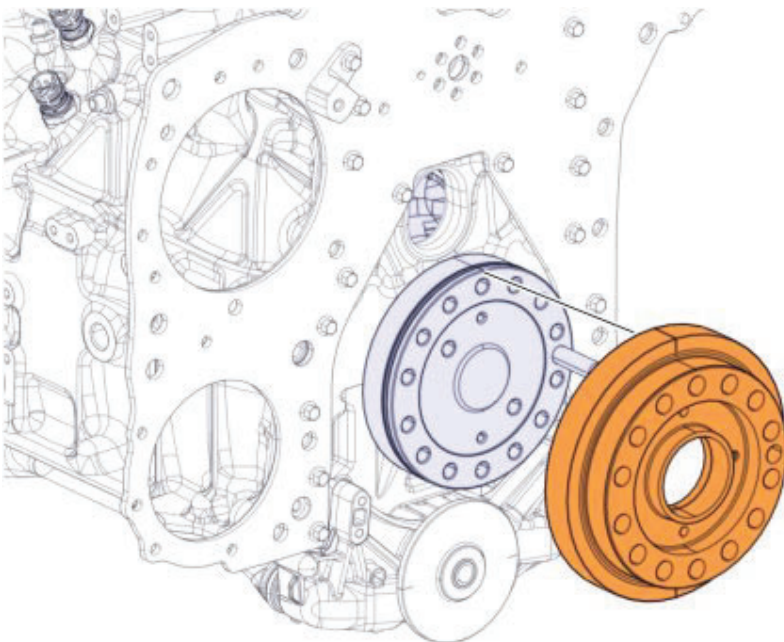


208 Remove the gear and the seal.



Note

Use a suitable tool.



209 Clean the crankshaft.

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

210 Install the seal.



Note

Use a new part.

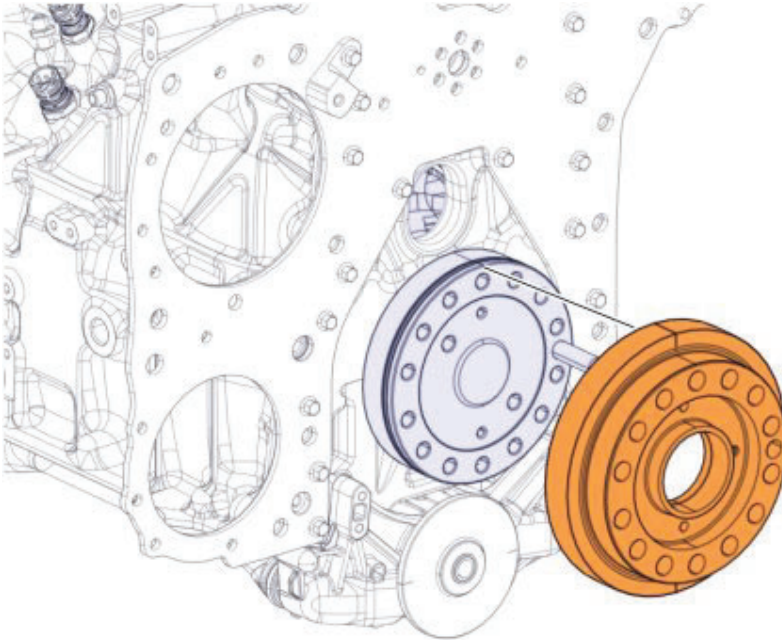
211 Lubricate the gear contact surface.



Note

Use recommended lubricant.

212 Install the gear.



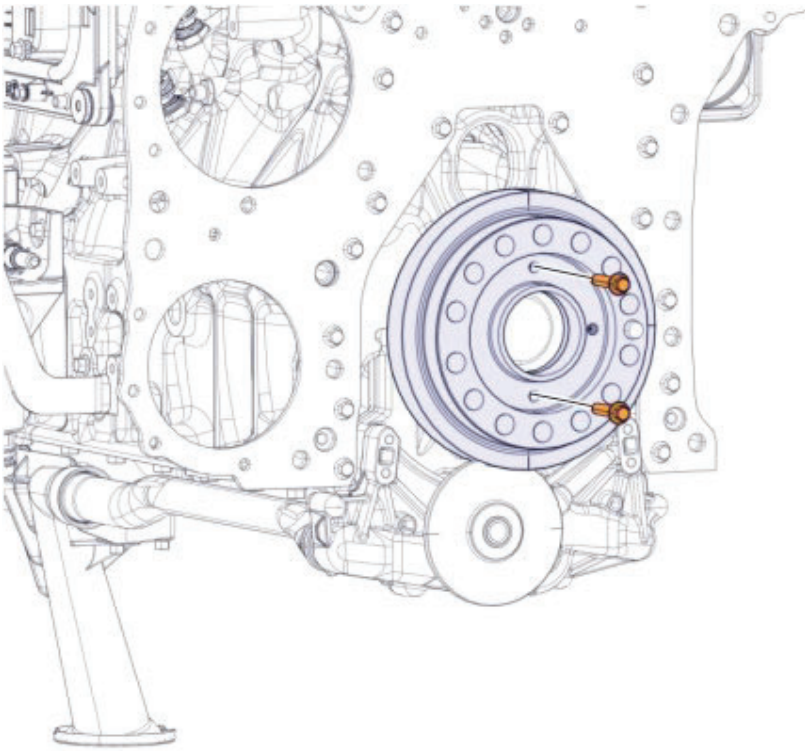
213 Install the screws.

214 Torque tighten the screws.

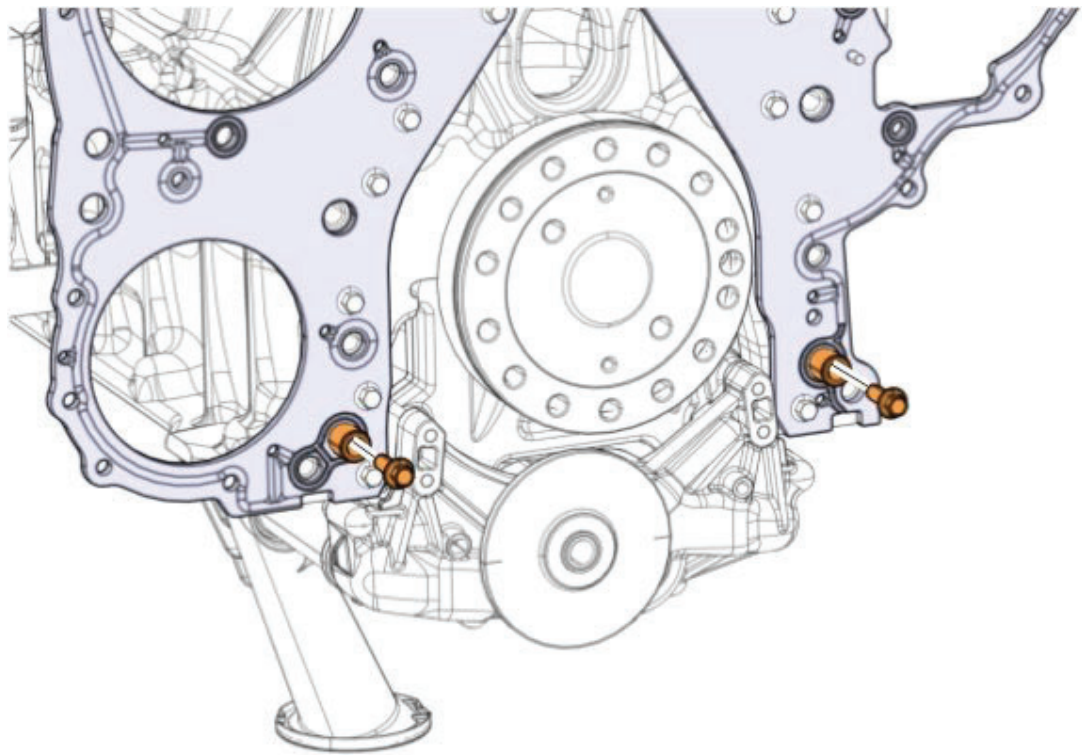
Tightening torque

Crankshaft gear, screw

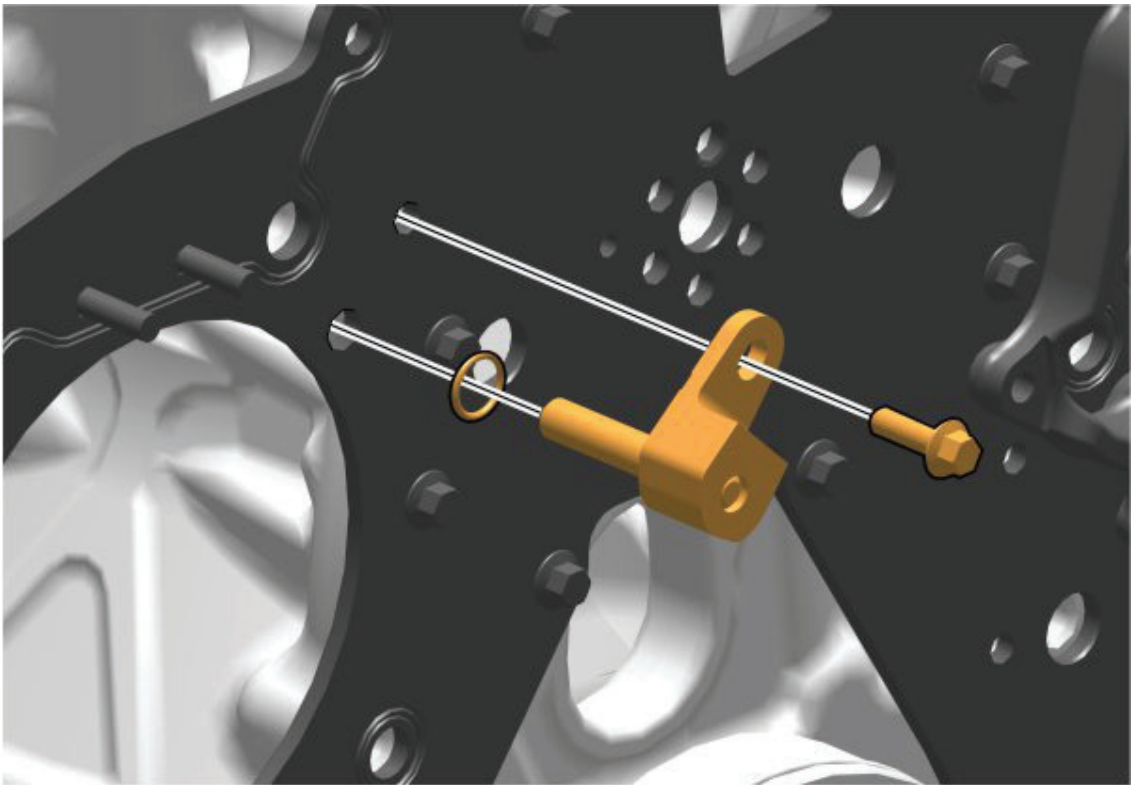
24 ±4 Nm
(18 ±3 lb_f·ft)



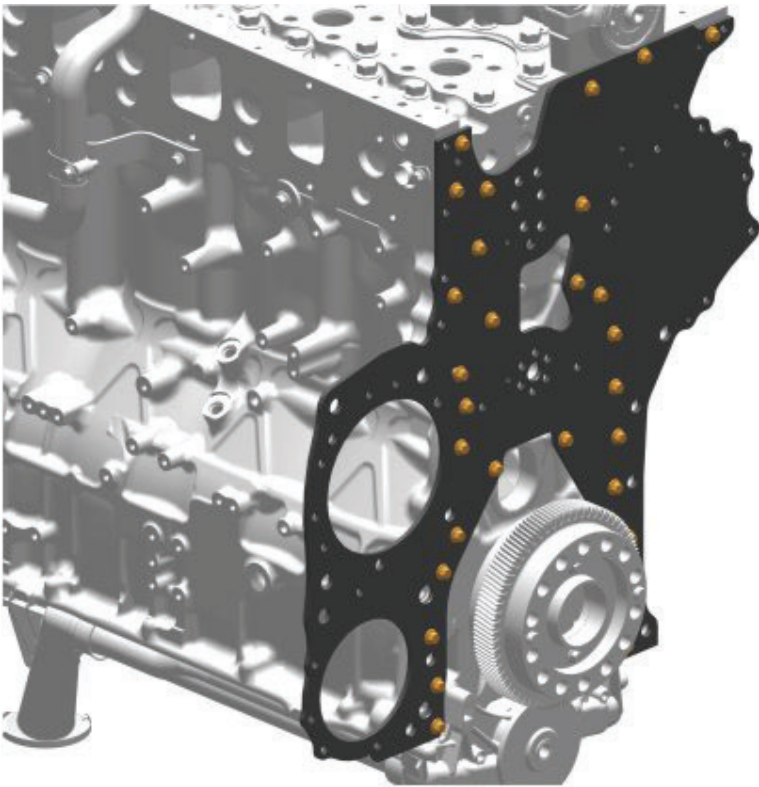
215	Install the tools.		
	Required material		
	GUIDE	9998267	2 pcs
	Note The tools act as guides for timing gear plate alignment. Do not remove the tools until the timing gear plate is installed.		
216	Torque tighten the screws.		
	Tightening torque		
	Timing gear plate, tool, screw		60 Nm (44 lb _f ·ft)



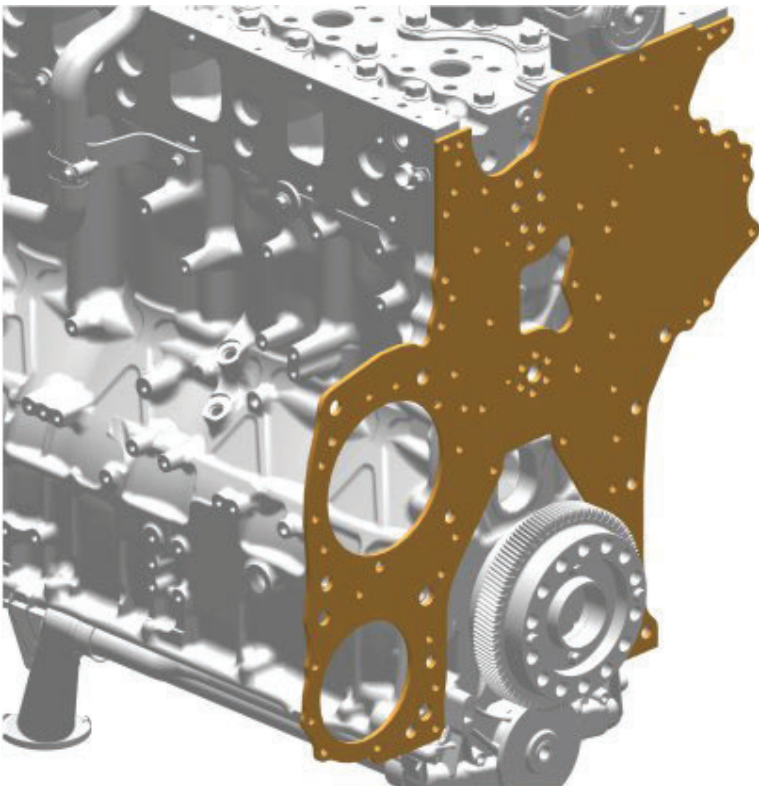
217	Remove the screw.
218	Remove the bracket. i Note Discard the O-ring.



			CAUTION		
Risk of serious injury.					
Heavy component.					
▶		Exercise caution when moving the component. Use appropriate tools.			
219	Remove the screws.				



220	Remove the timing gear plate.
-----	-------------------------------



221	Remove the screws.
-----	--------------------

222	Remove the noise shield.
-----	--------------------------

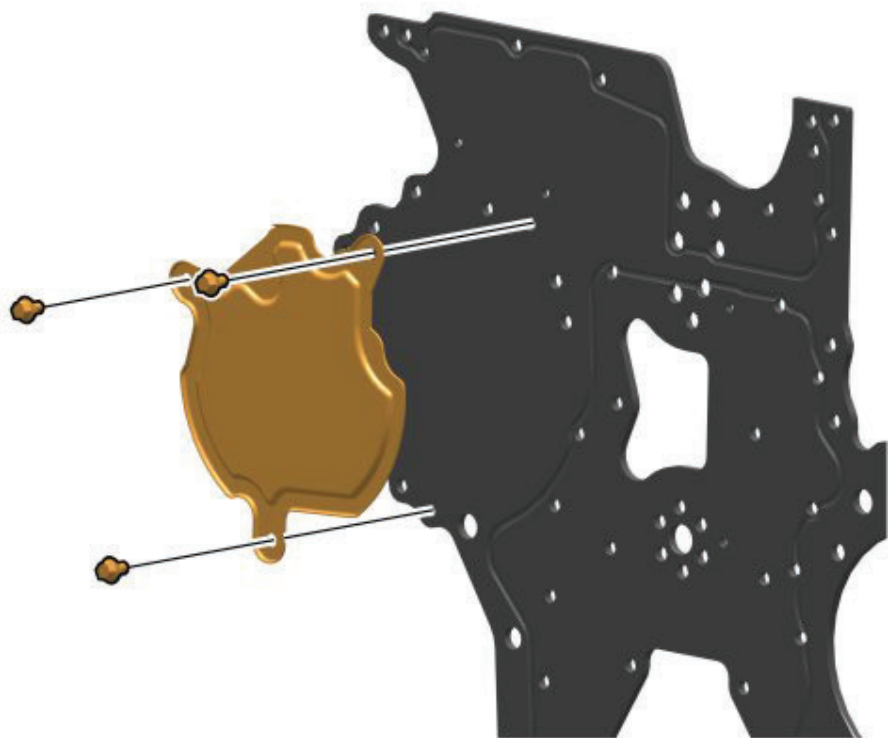
	Service hint
--	------------------------------

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

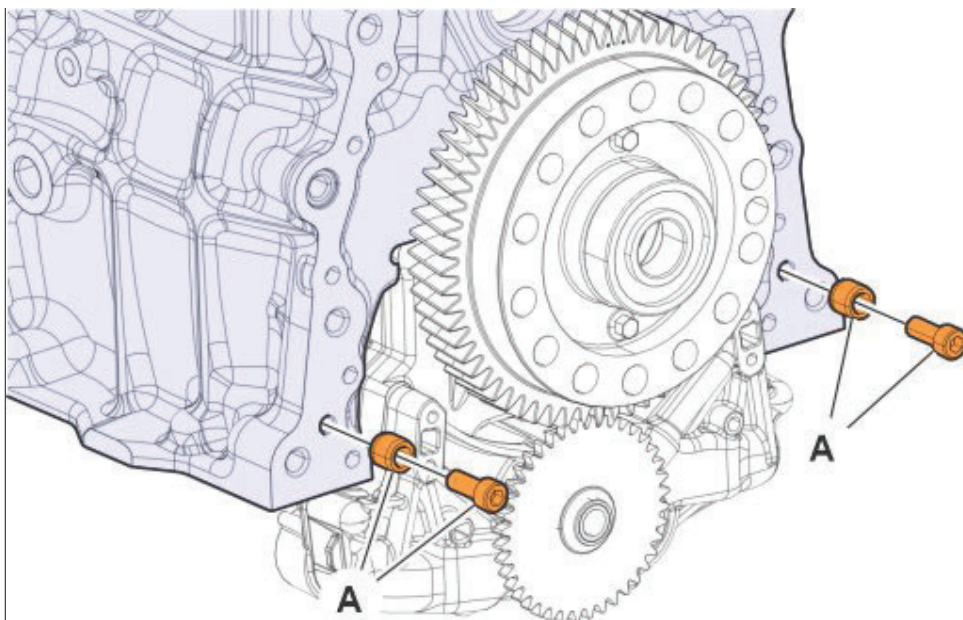
The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.



Discard the noise shield if the timing gear plate has integrated seals, because a new noise shield will come with the timing gear plate.



223	Perform this procedure when the condition below is met.		
	Conditions		
	If not previously installed		
	▶ Install the tools (A).		
	Required material		
	A	GUIDE	9998267 2 pcs
	Note Ensure that the tools are clean and damage free.		
	▶ Install the screws.		
	Note Hand tighten.		



224 Install the timing gear plate.



Note

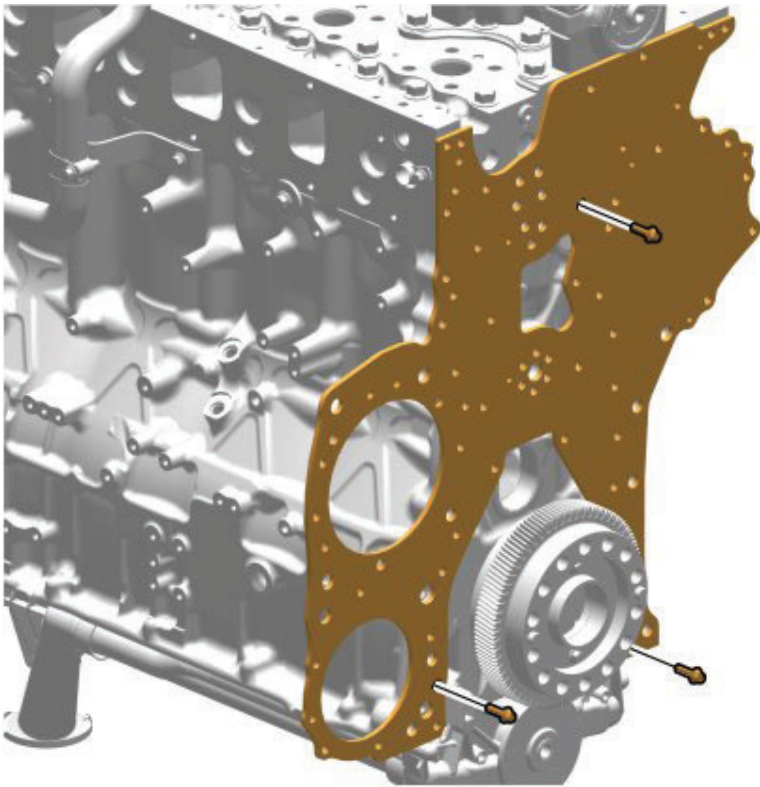
Ensure that the timing gear plate and the engine block are clean of sealant.

225 Install the screws.

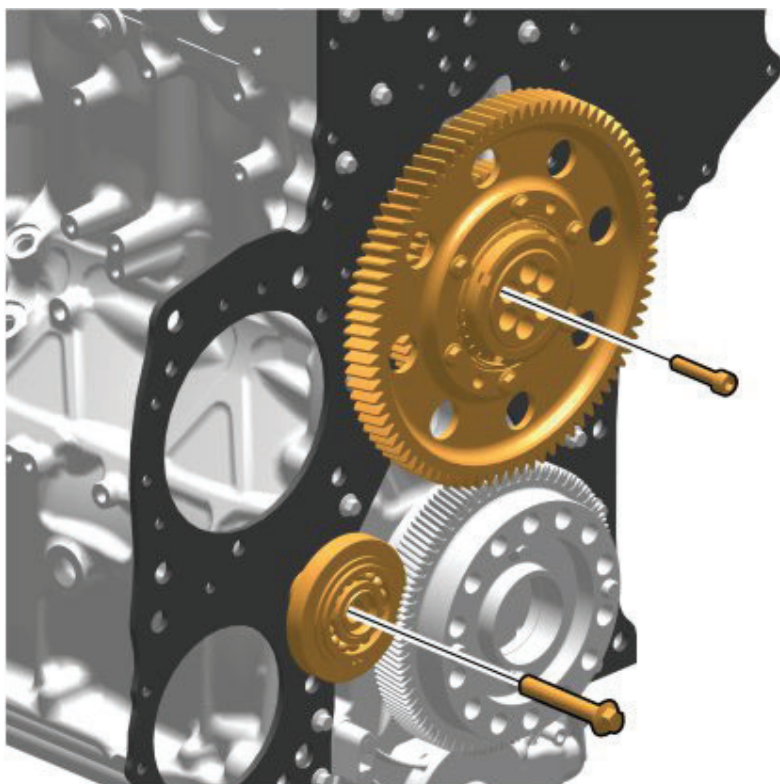


Note

Hand tighten the screws.

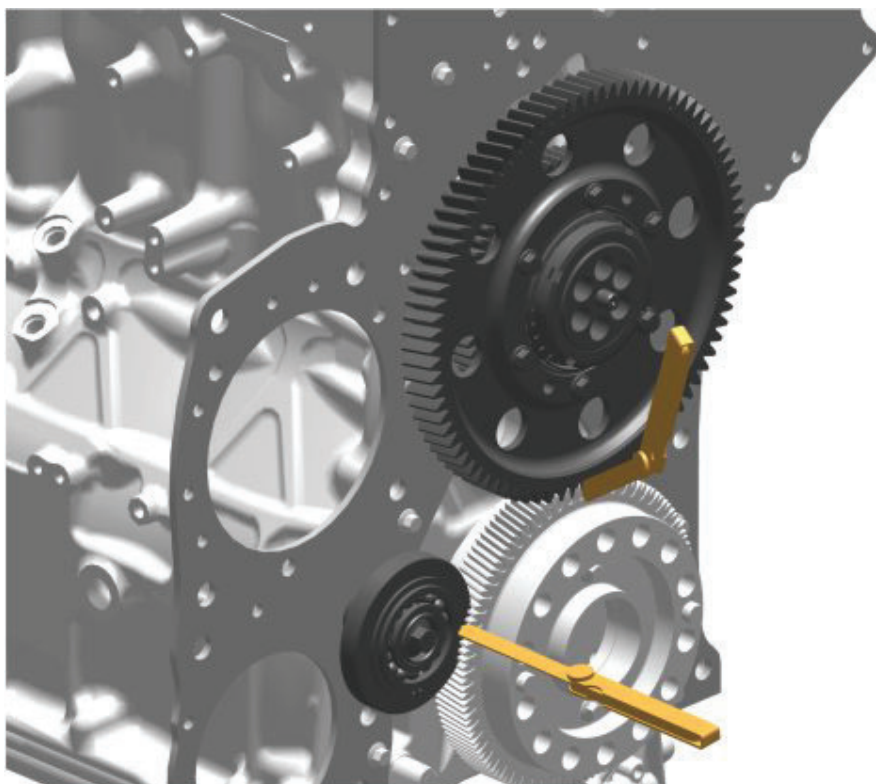


226	Install the gears.
227	Install the screws. i Note Use a washer for the small idler gear.
228	Hand tighten the screws.

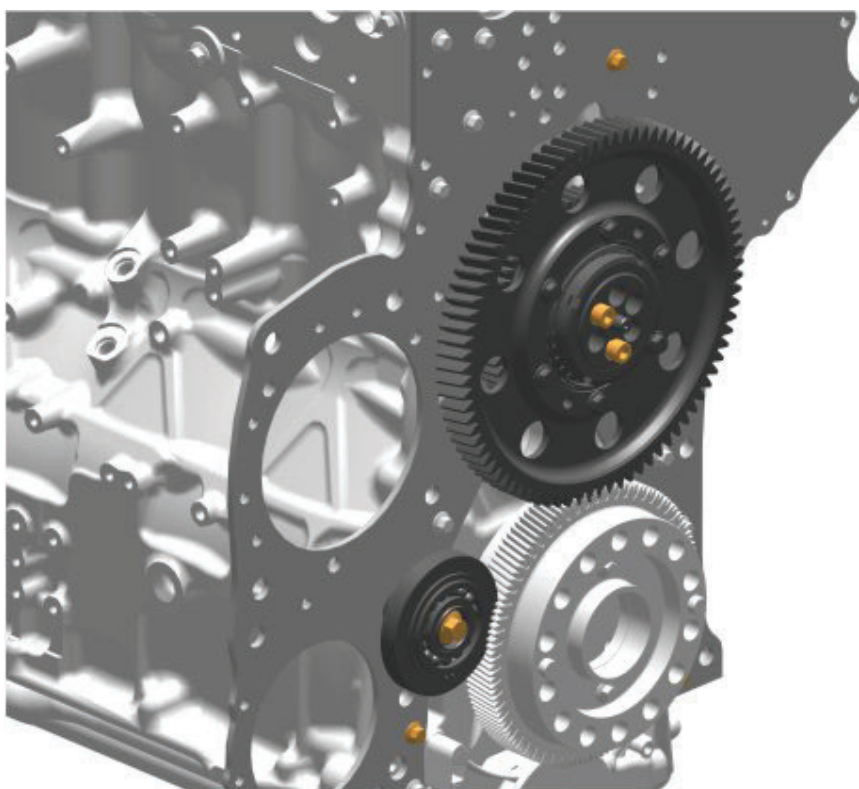


229	Install the feeler gauges.	
	Tech data	
	Feeler gauge, thickness	0.1 mm (0.004 in)

230	Adjust the clearance.	
	i Note Use a plastic mallet to adjust the timing gear plate.	
	i Note Ensure that the feeler gauges are difficult to move between the teeth.	
	i Note Ensure equal resistance on both feeler gauges.	



231	Tighten the screws.
-----	---------------------



232	Place a dial indicator into position.
-----	---------------------------------------

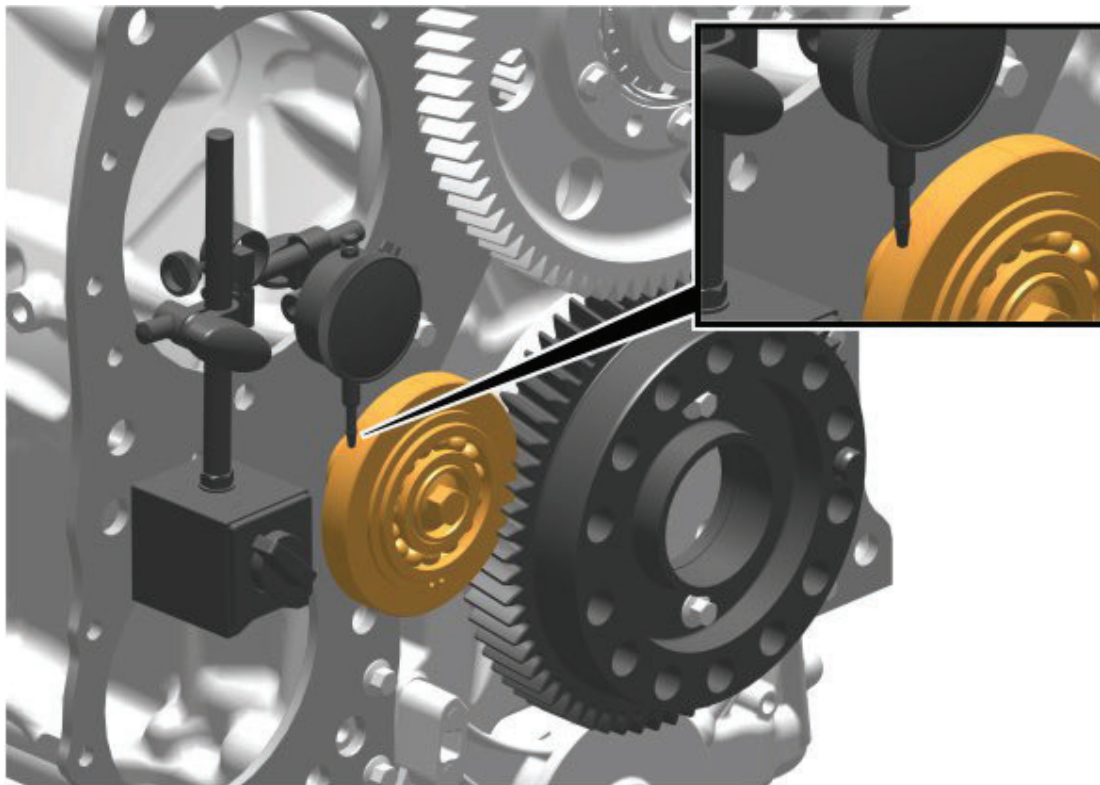
**Note**

Use caution that the timing plate seal is not damaged.

**Note**

Ensure that the probe tip touches the gear tooth.

233 Set the dial to zero.



234 Turn the idler gear by hand.

235 Read and record the amount of backlash.

Tech data

Idler gear, tooth flank clearance	0.05 – 0.17 mm (0.002 – 0.0067 in)
-----------------------------------	---------------------------------------

236 Perform this procedure when the condition below is met.

Conditions

- If the backlash is out of specification
- ▶ Adjust the timing plate.

237 Install the tools.

Required material

ROCKER INDICATOR	9999683
MAGNETIC STAND	9999696

**Note**

Ensure that the probe tip touches the gear tooth.

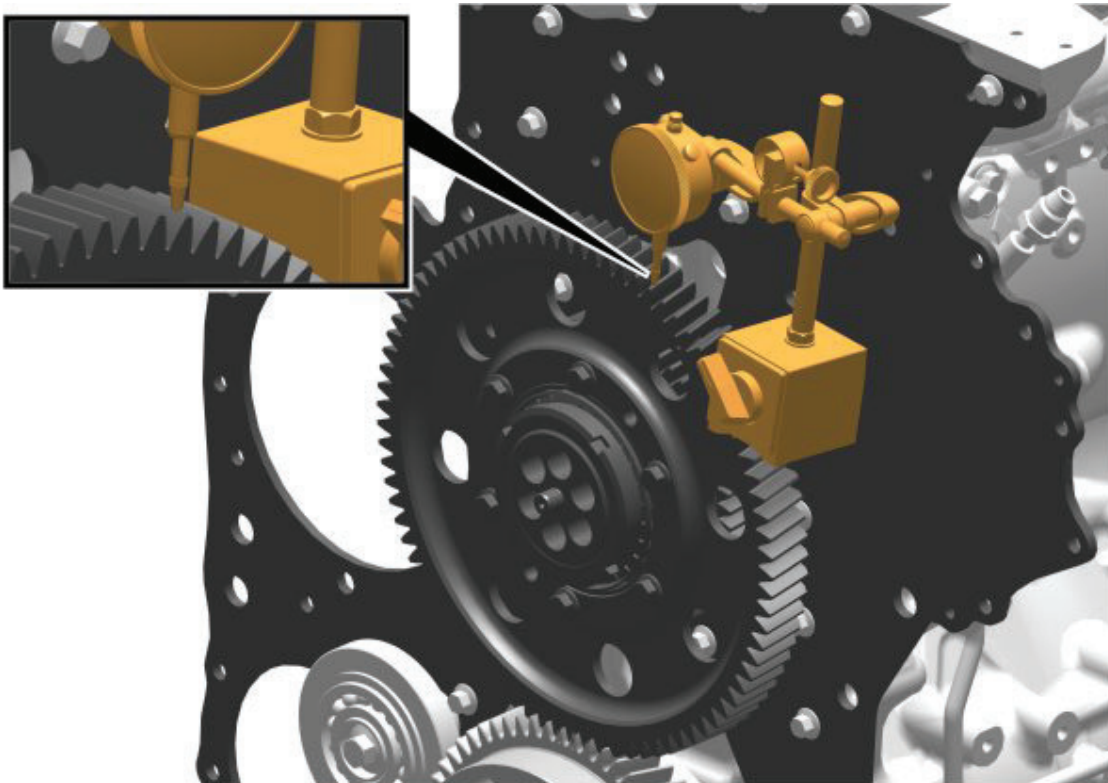
238 Check the backlash.

Tech data

Gear, backlash

0.05 – 0.17 mm

(0.002 – 0.0067 in)



239 Perform this procedure when the condition below is met.

Conditions

- If the backlash is out of the specification

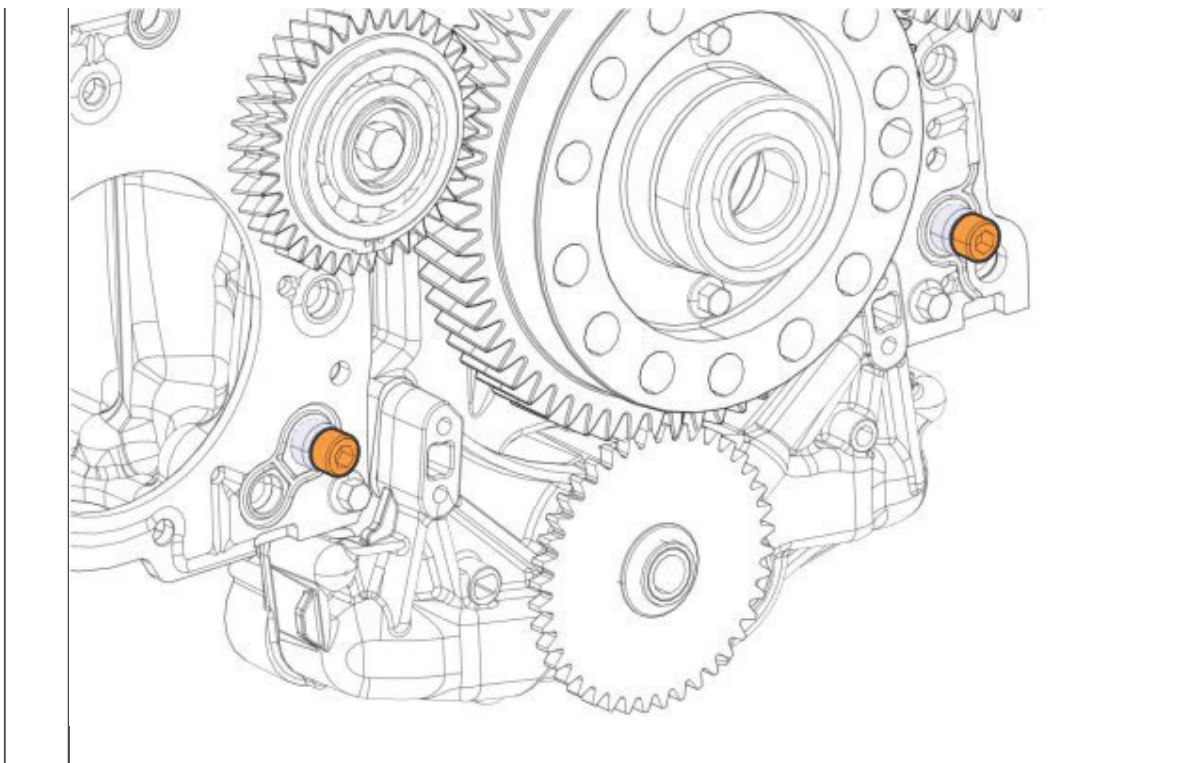
- ▶ Adjust the timing gear plate.

240 Perform this procedure when the condition below is met.

Conditions

- If all of the clearances are within the specifications

- ▶ Tighten the screws.



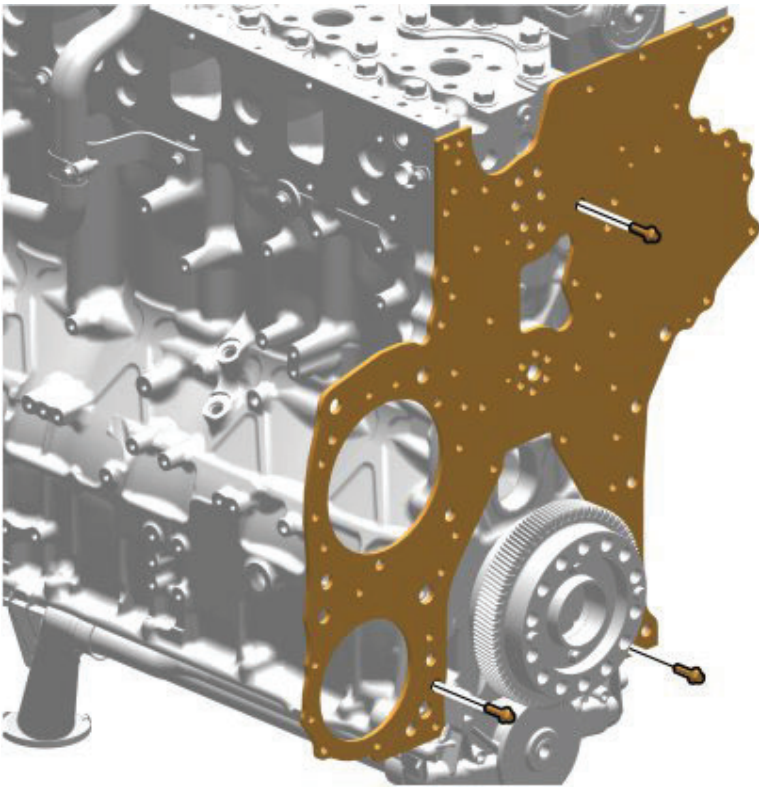
241	Remove the screws.
-----	--------------------

242	Remove the gears.
-----	-------------------

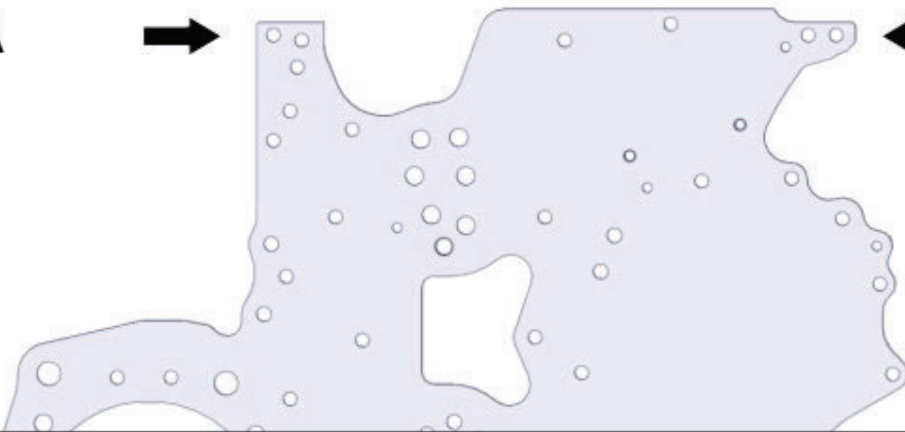
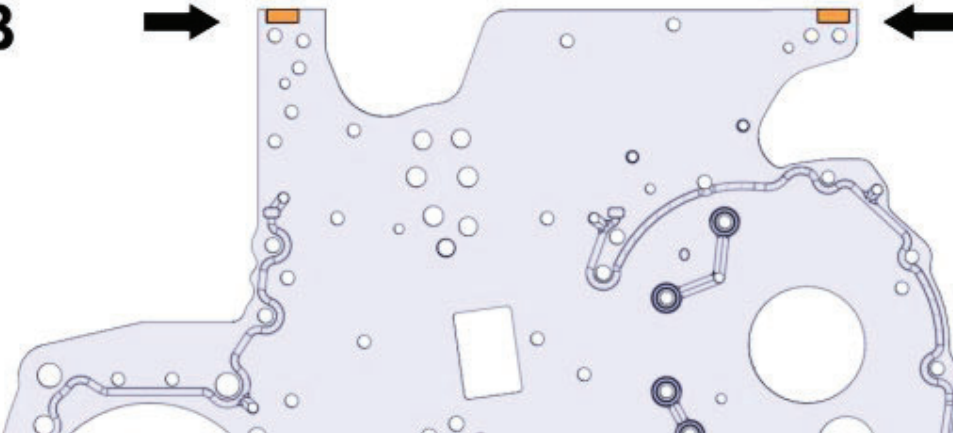


243	Remove the screws.
-----	--------------------

244	Remove the timing gear plate.
-----	-------------------------------



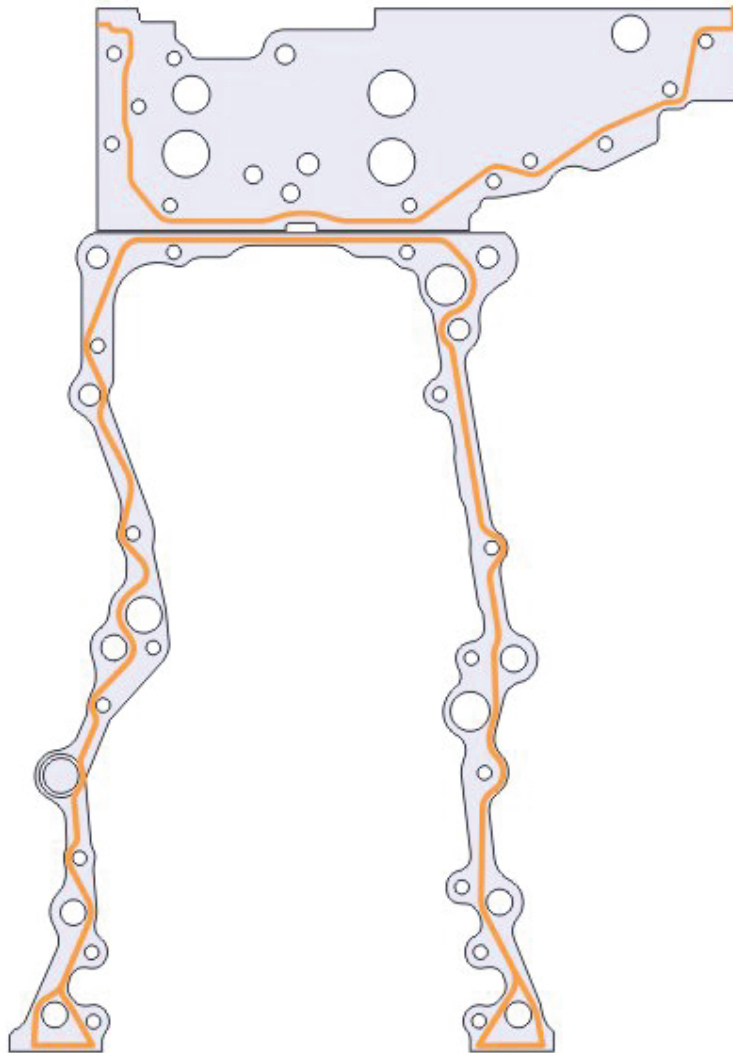
245	Verify the type of timing gear plate.
-----	---------------------------------------

A**B**

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

246	Perform this procedure when the condition below is met.				
	Conditions				
	Timing gear plate without integrated sealing (A).				
	► Clean the contact surfaces carefully.  Note Do not use any tools that may damage the sealing surfaces.				
	► Apply the sealant. <table> <tr> <th colspan="2">Tech data</th></tr> <tr> <td>Sealant, bead thickness</td><td>2 mm (0.08 in)</td></tr> </table>  Note Use a recommended sealant.  Note Ensure that the surfaces are completely clean from oil and grease.  Note Torque tighten the screws within 20 min of applying sealant.	Tech data		Sealant, bead thickness	2 mm (0.08 in)
Tech data					
Sealant, bead thickness	2 mm (0.08 in)				



247 Perform this procedure when the condition below is met.

Conditions

- Timing gear plate with integrated sealing (B).

- ▶ Clean the contact surfaces carefully.

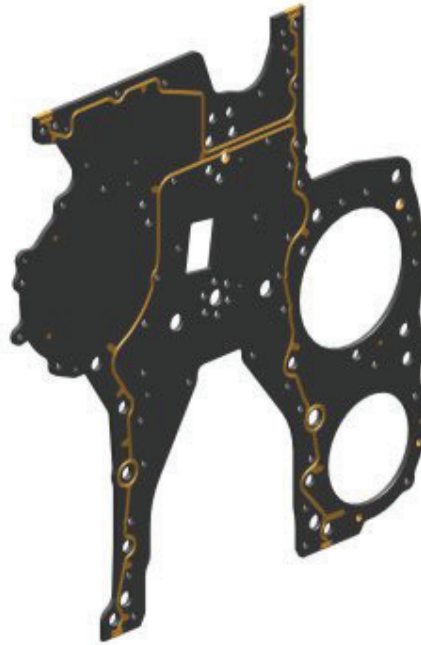


Note

Do not use any tools that may damage the sealing surfaces.

- ▶ Inspect the sealing strip surfaces on both side of the timing gear plate.

- ▶ If the sealing strip is completely loose or damaged, the timing gear plate must be replaced.



248 Apply the sealant.

Tech data

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



Note

Use a recommended sealant.



Note

Ensure that the surfaces are completely clean from oil and grease.

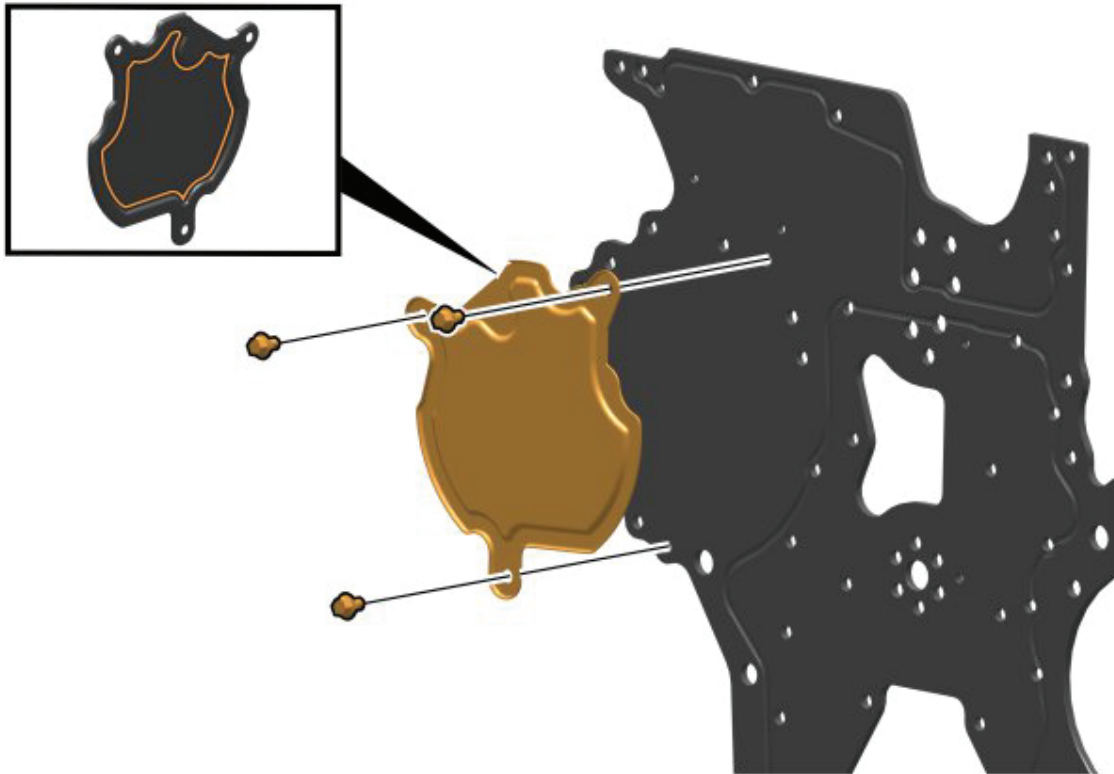
249 Install the noise shield.



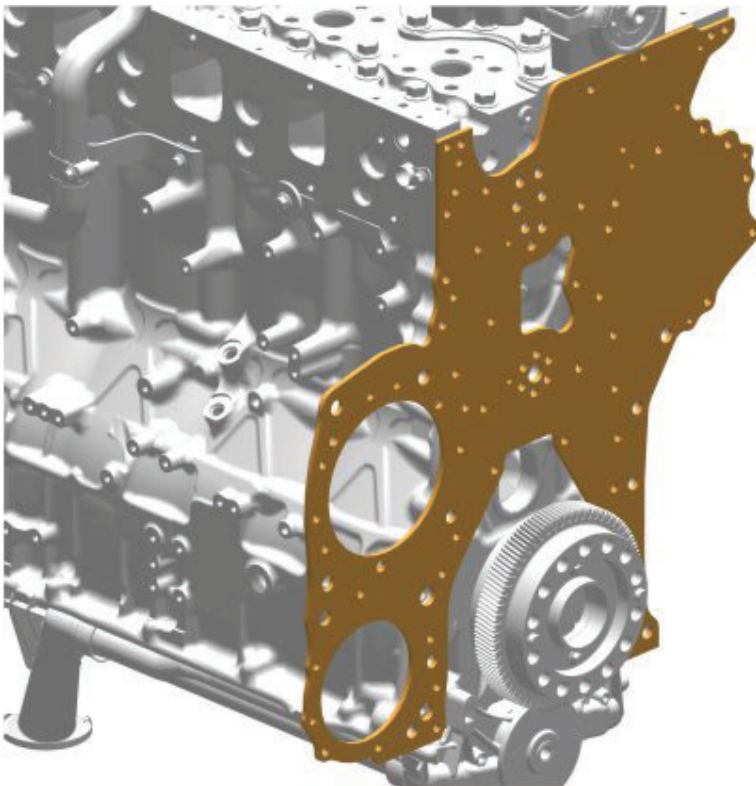
Note

Install the noise shield within 20 minutes of applying the sealant.

250 Fit the screws.



251 Install the timing gear plate.



252 Fit the screws.

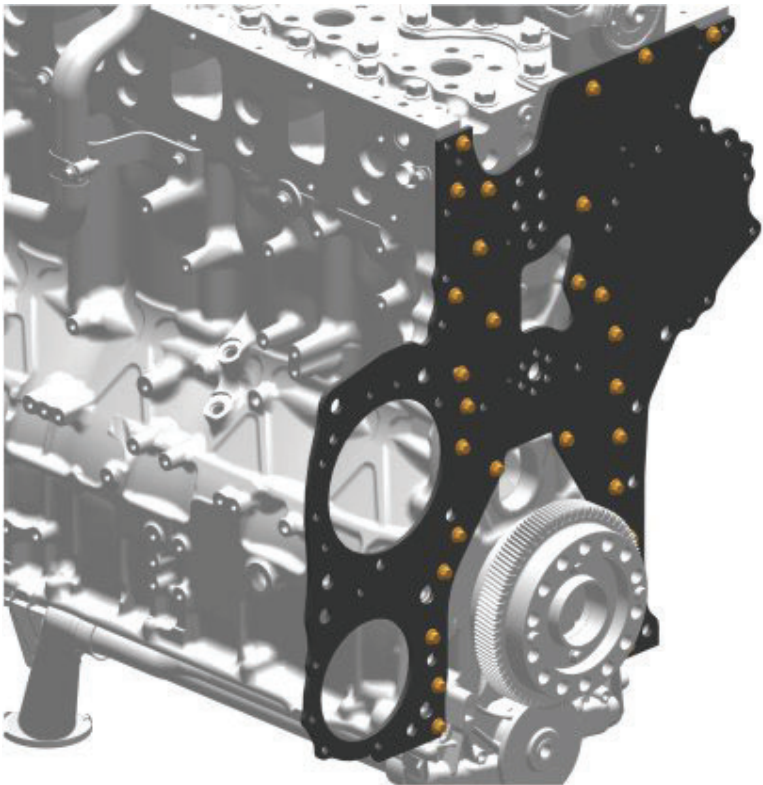


Note

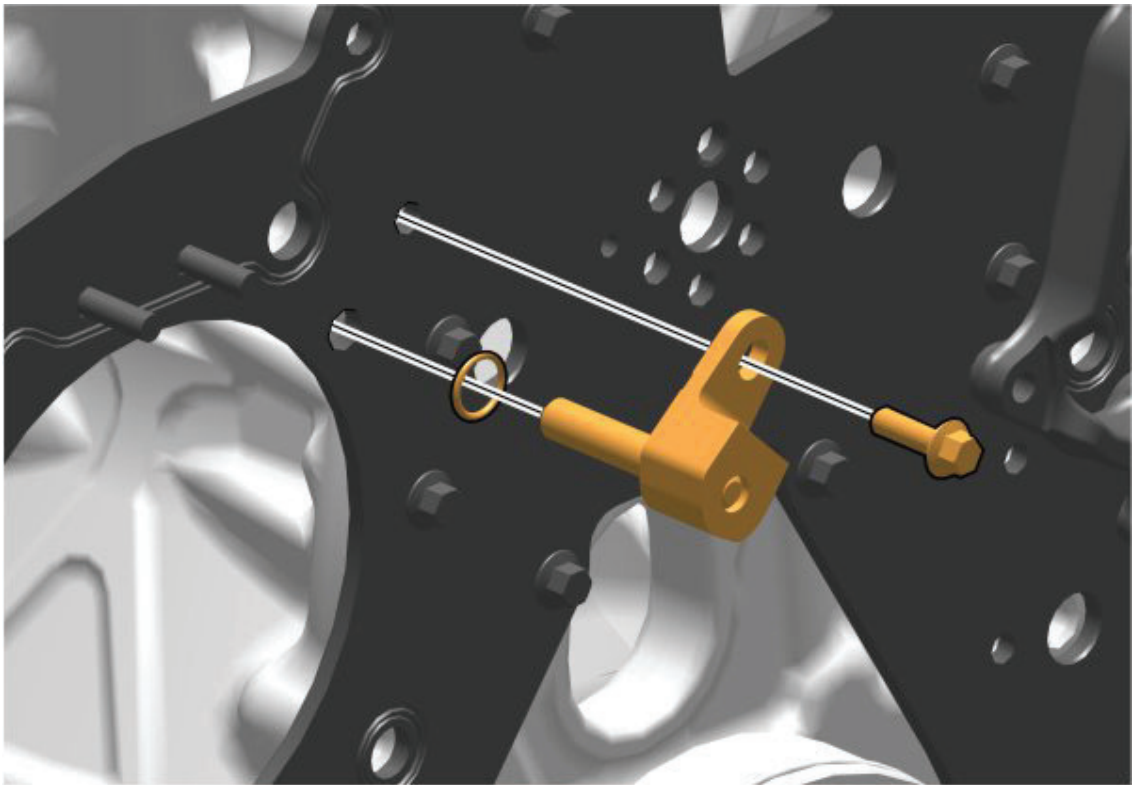
Use new parts.



Note
Only use screws that are pre-treated with locking compound.

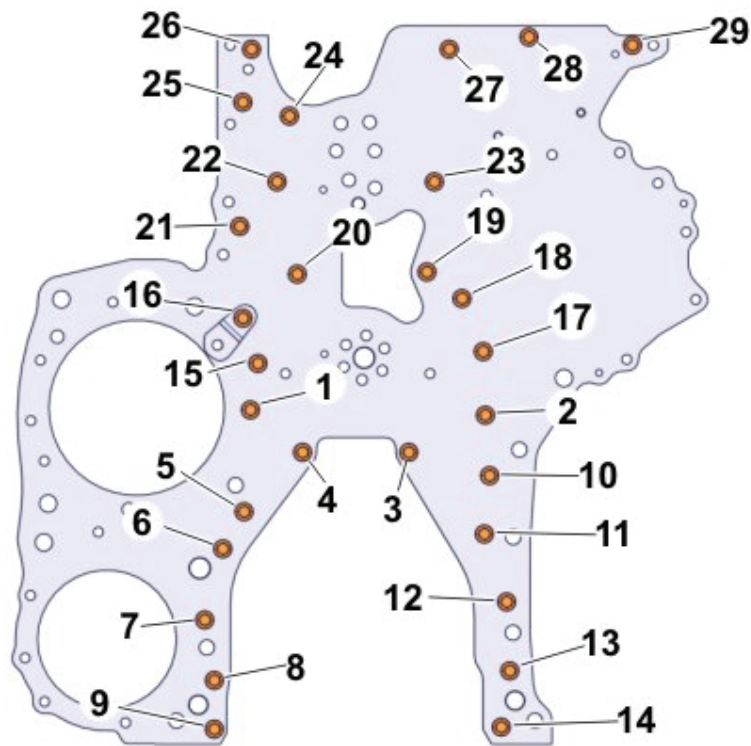


253	Lubricate the O-ring. i Note Use a new part. i Note Use a recommended oil.
254	Install the O-ring.
255	Install the bracket.
256	Install the screw.

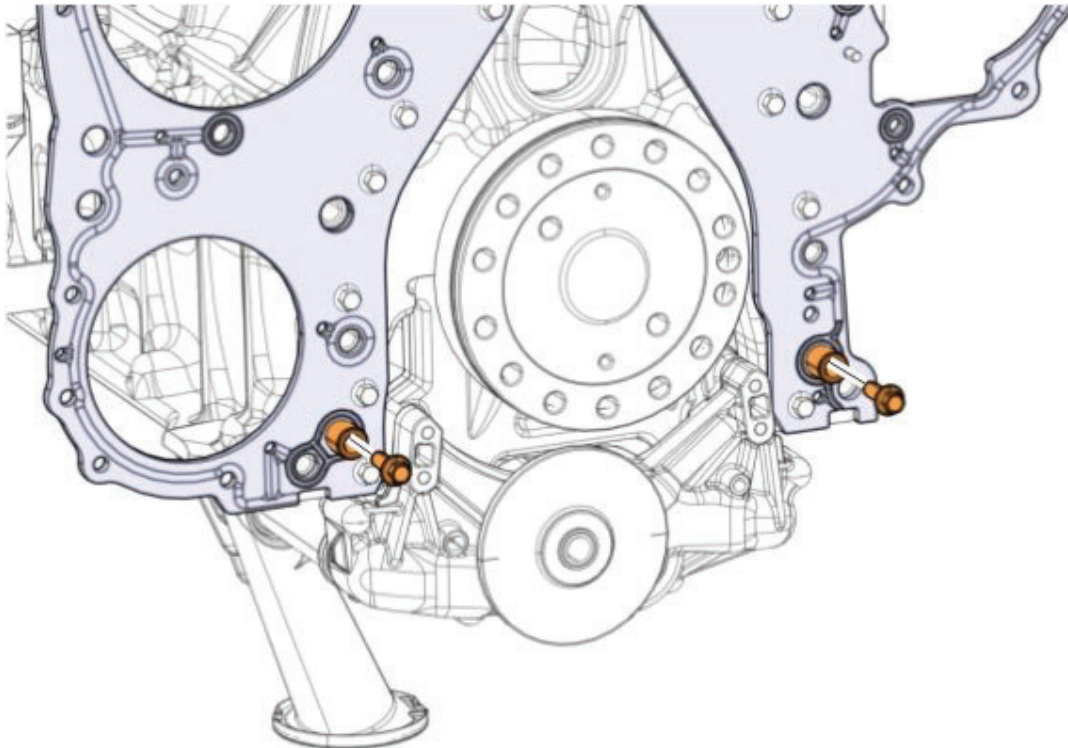


257	Tighten the screws to torque.
-----	-------------------------------

Tightening torque	
Timing gear plate, screw	Tightening sequence: 1 - 28
	28 ±4 Nm
	(21 ±3 lb _f -ft)



258	Remove the tools.
------------	-------------------



259	Clean the timing gear plate.
------------	------------------------------

260	Install the thrust washer.
------------	----------------------------

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

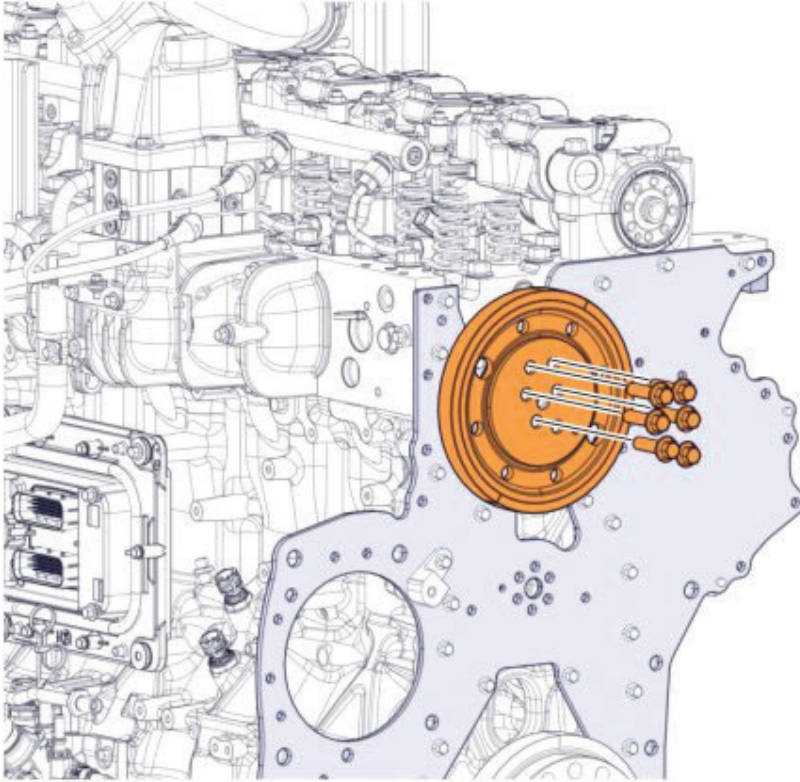
The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

261	Install the gear.
-----	-------------------

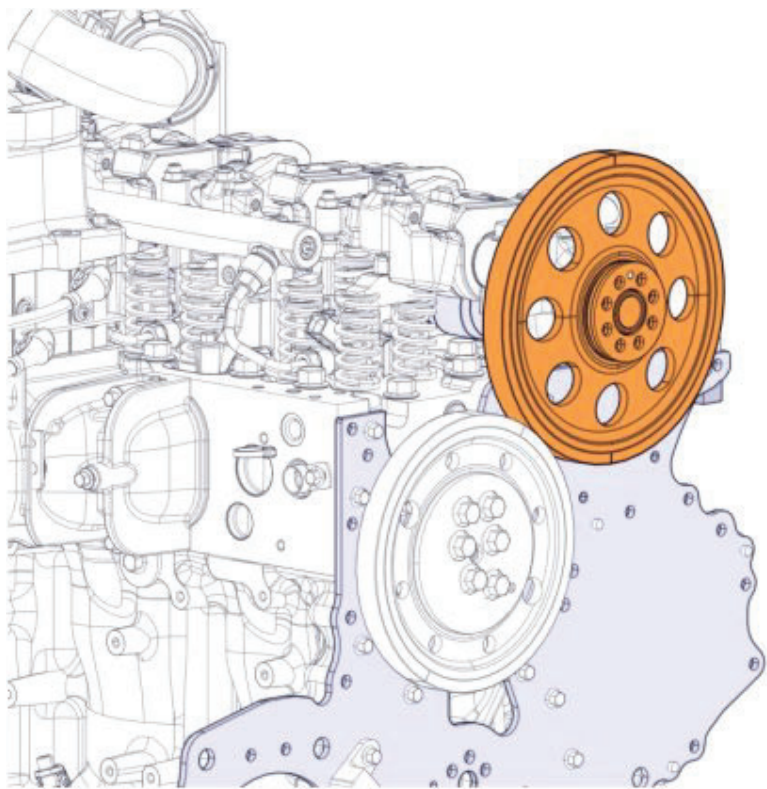
262	Install the screws.
-----	---------------------

**Note**

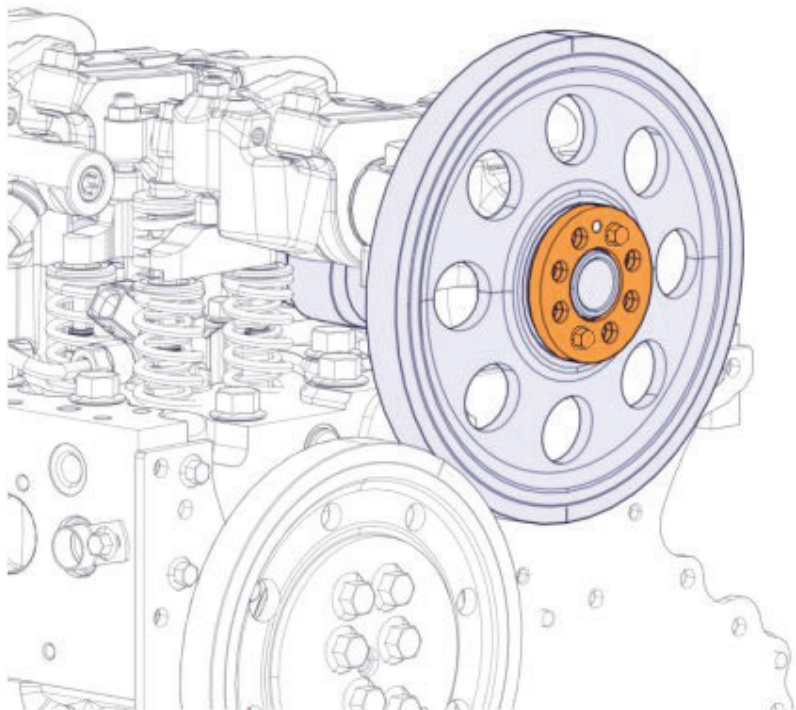
Hand tighten the screws.



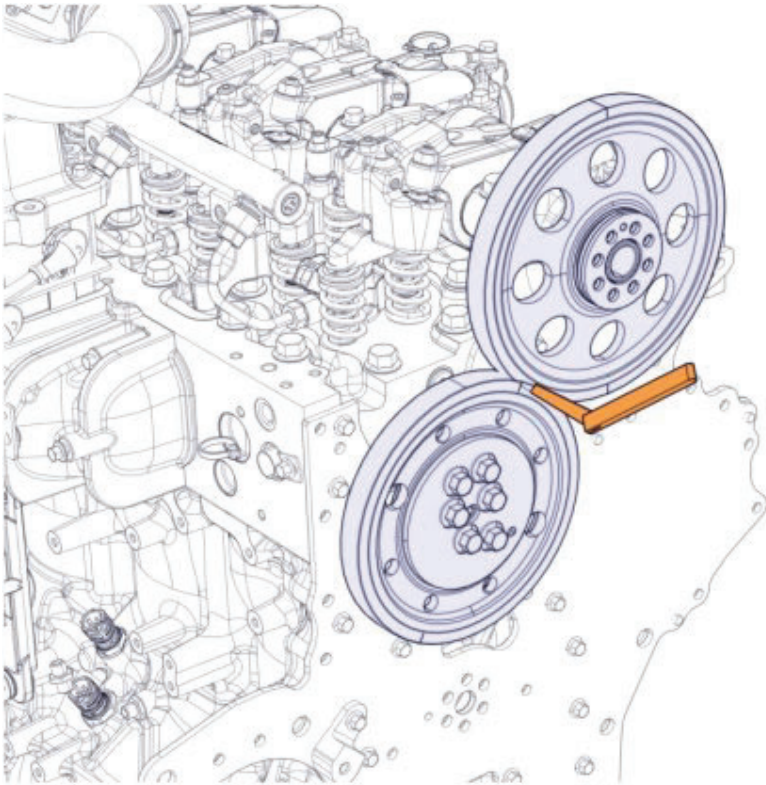
263	Install the gear.
-----	-------------------



264	Install the tool.	
	Required material	
	kit	88870039

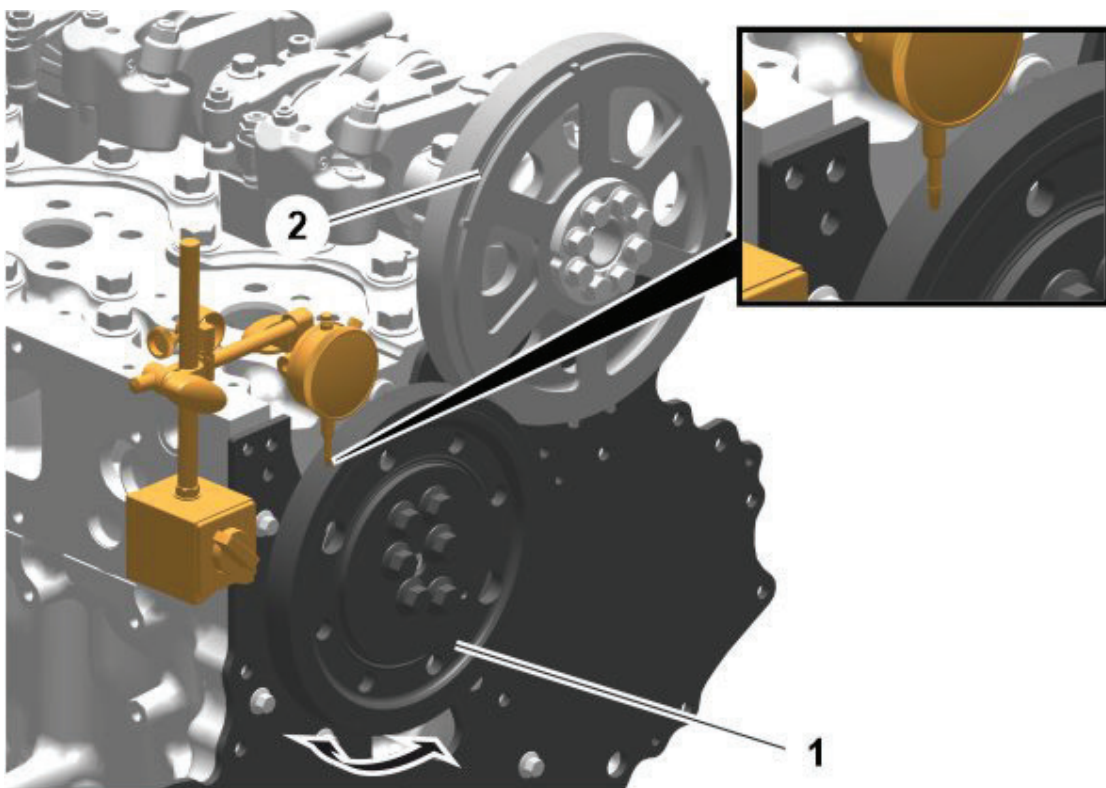


265	Install the feeler gauge.	
	Tech data	
	Feeler gauge, thickness	0.1 mm (0.004 in)

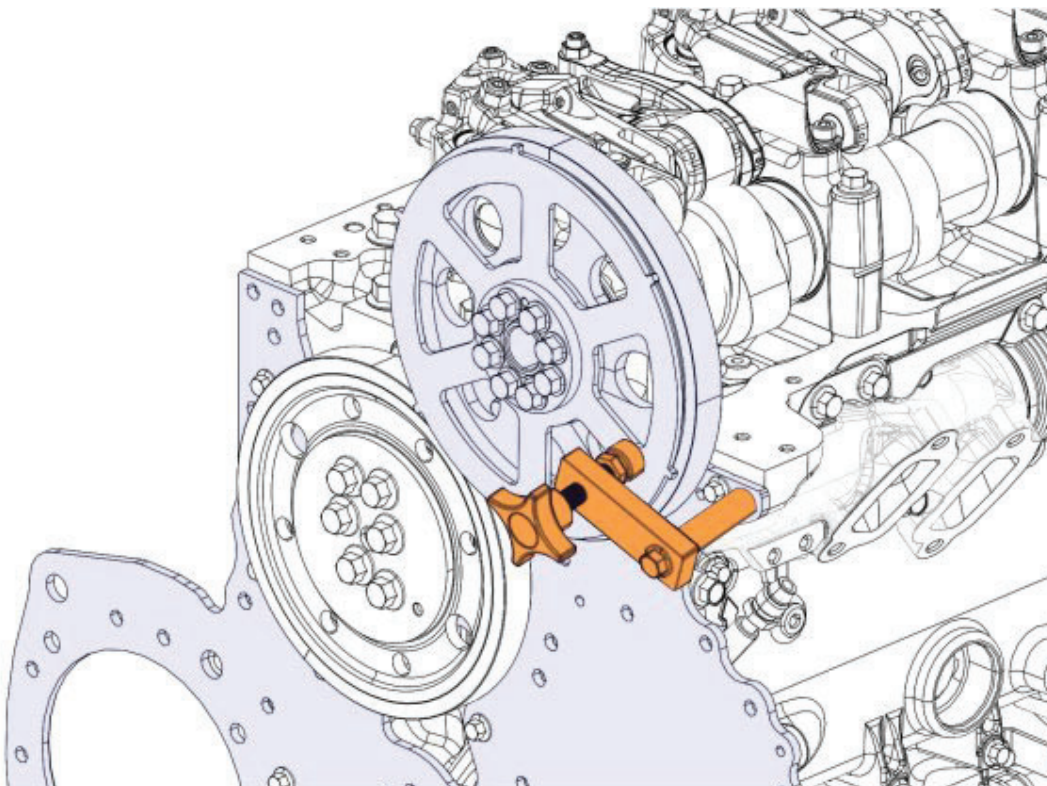


266	Adjust the clearance.	
		Note Adjust the idler gear to adjust the clearance.
		Note Ensure that a feeler gauge inserted between the teeth is difficult to move.

267	Install the tools.	
	Required material	
	MAGNETIC STAND	9999696
	ROCKER INDICATOR	9999683
		Note Ensure that the probe tip touches the gear tooth.



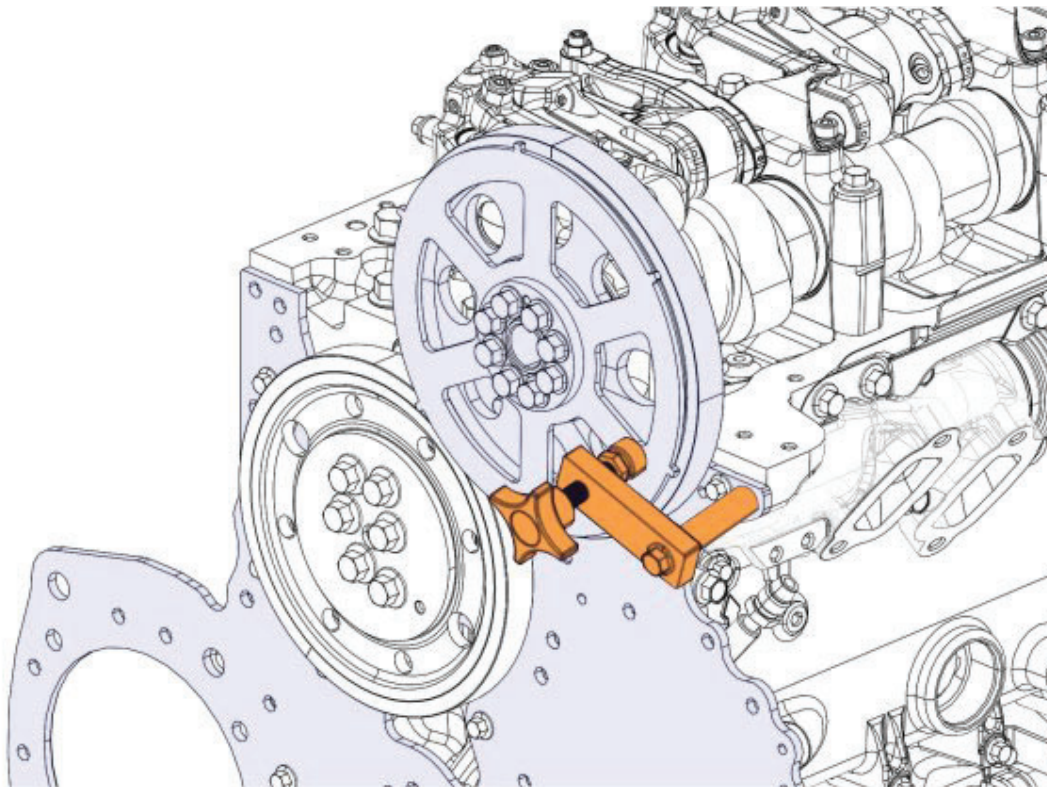
268	Install the tool.
	Required material
kit	88870039



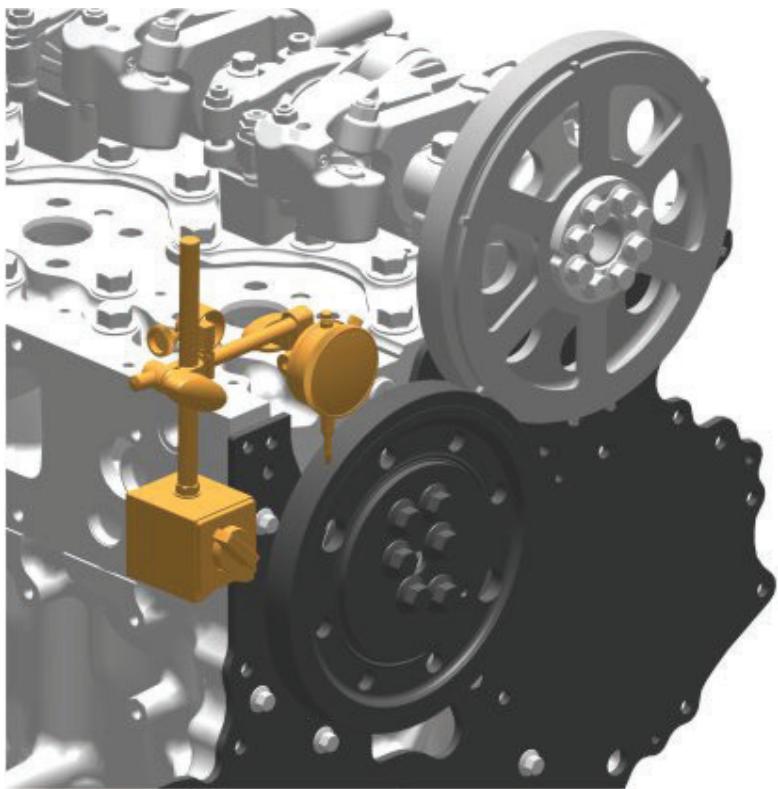
269	Check the backlash between gears 1 and 2.	
	Tech data	
	Backlash clearance	0.1 ±0.05 mm
		(0.004 ±0.002 in)

270	Perform this procedure when the condition below is met.	
Conditions		
•	If the backlash is not within specified value.	
▶	Readjust the gears.	
		Note The tool must be removed to readjust the gears.

271	Remove the tool.	
-----	------------------	--

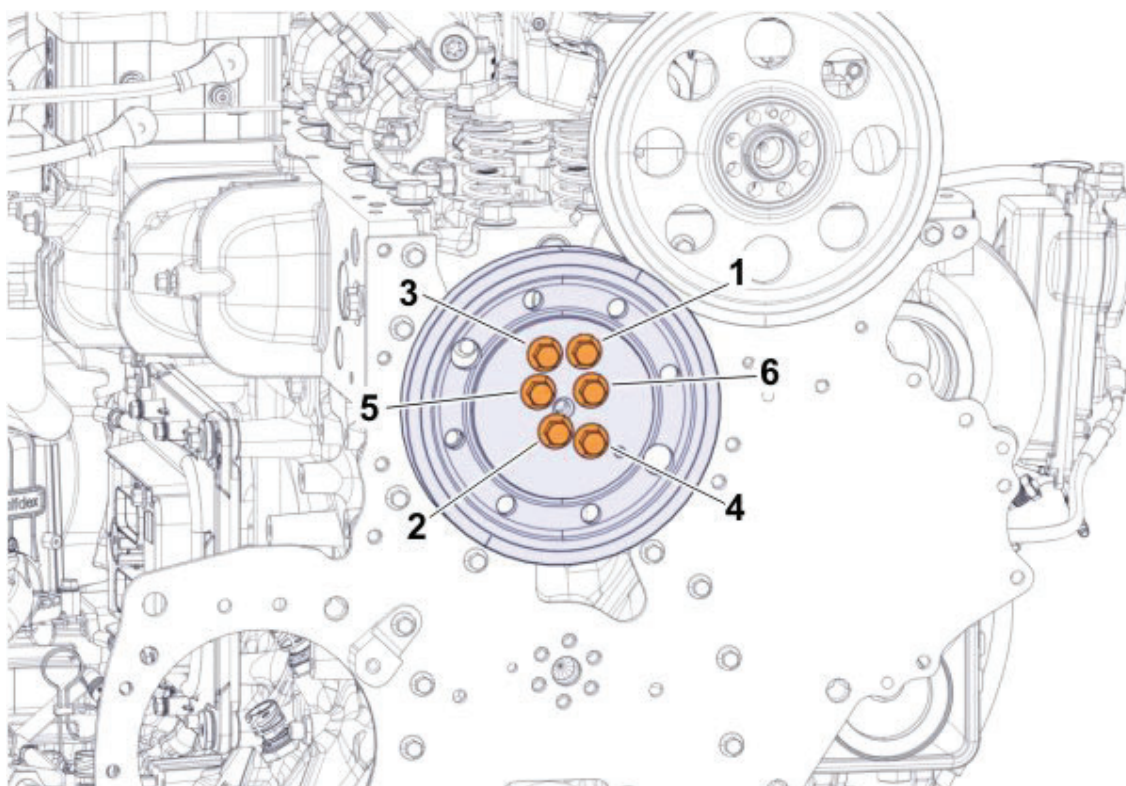


272	Remove the tools.	
-----	-------------------	--

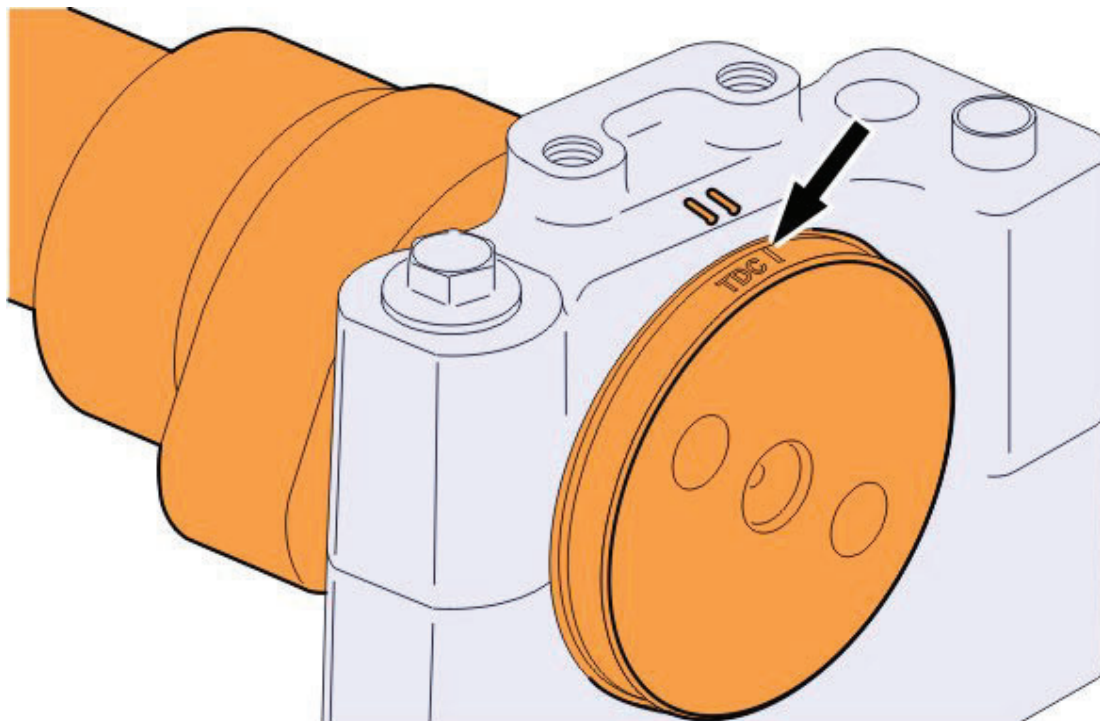


273	Torque tighten the screws.
-----	----------------------------

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°



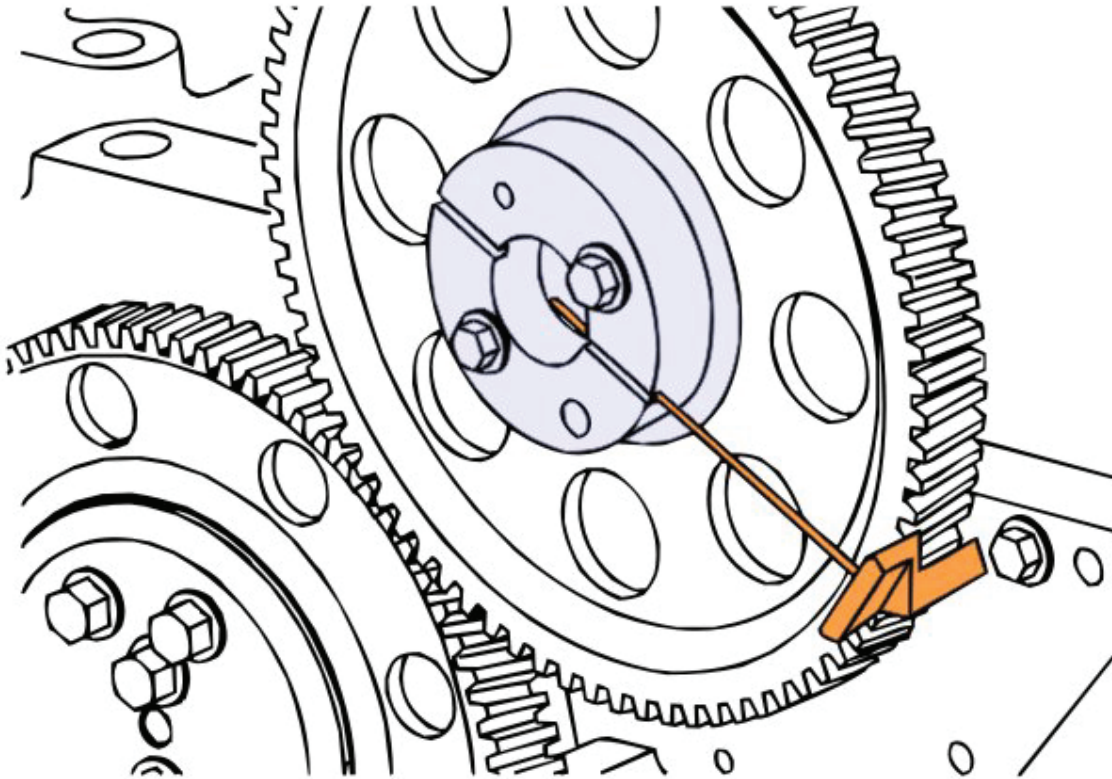
274 Verify that the camshaft position markings are at (TDC).



275 Install the cam gear aligner.

Required material

kit [88870039](#)



276 Install the gears.



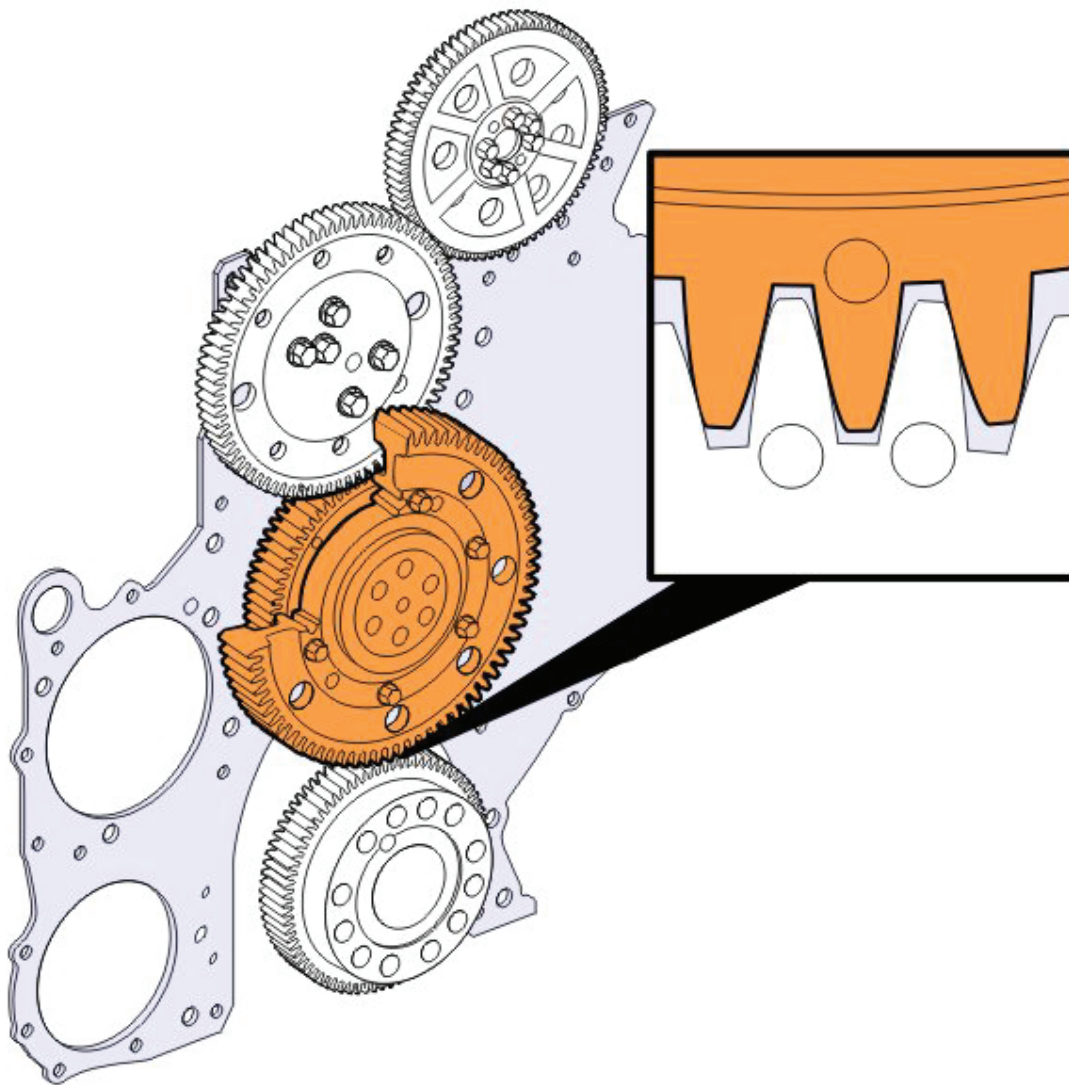
Note

Ensure the markings correctly align.



Note

Remove the cam gear aligner.



277 Install the screws.



Note

Use new parts.

278 Torque tighten the screws.

Tightening torque

Double idler gear, screw

1.

Tightening sequence: 1-6

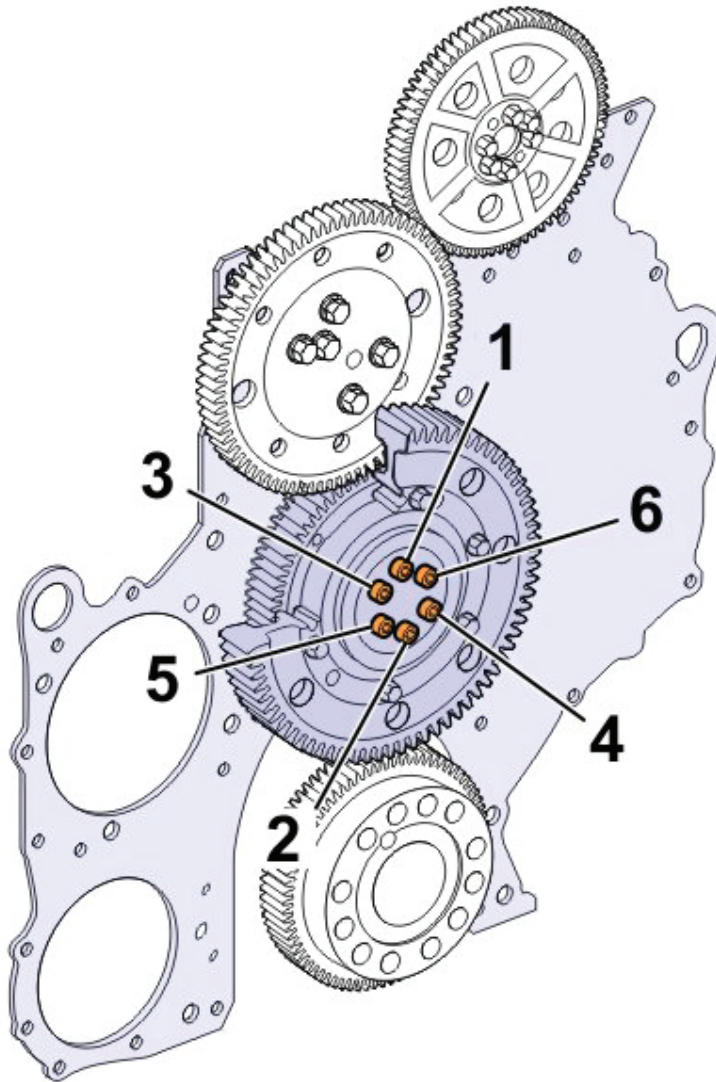
25 ±3 Nm

(18 ±2 lb_f-ft)

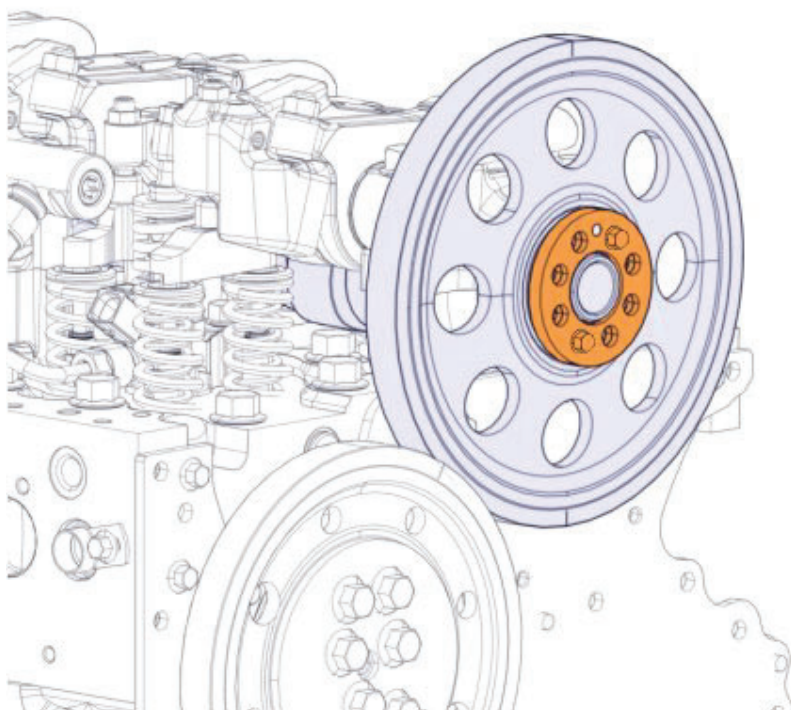
2.

Tightening sequence: 1-6

110 ±5°



279	Remove the tool.
-----	------------------

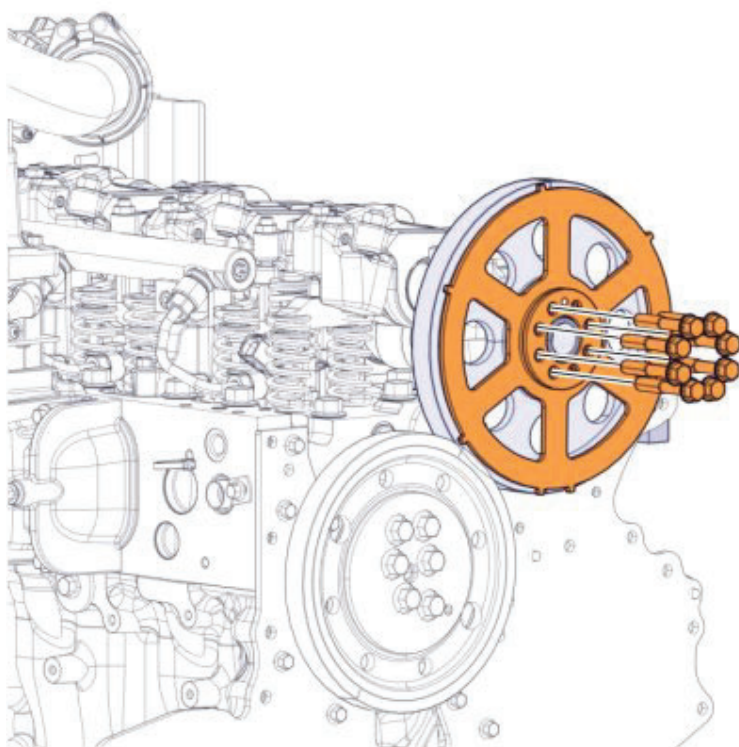


280 Install the tone wheel and screws.



Note

Use new screws.

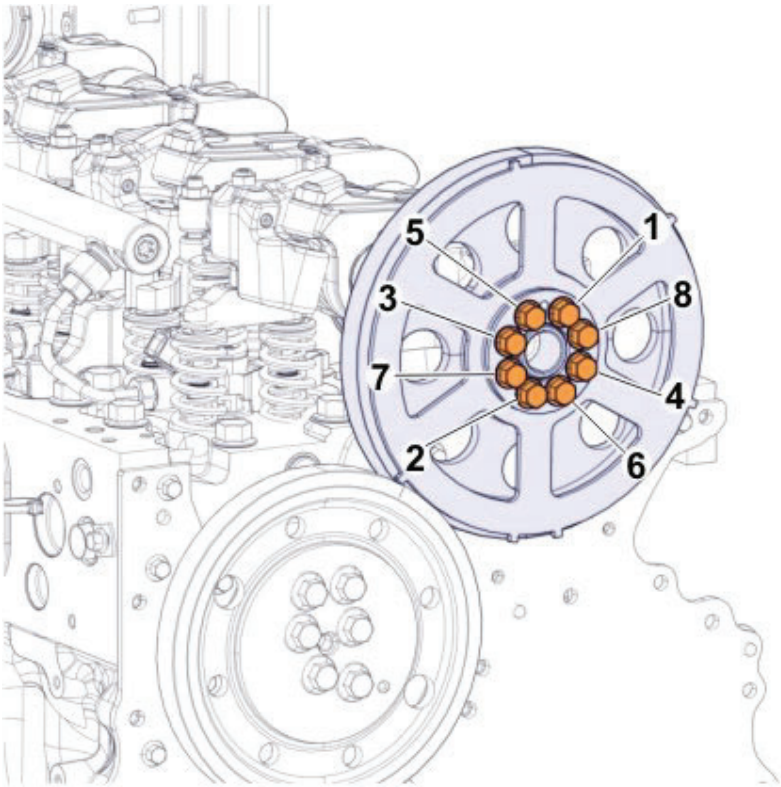


281 Torque tighten the screws.

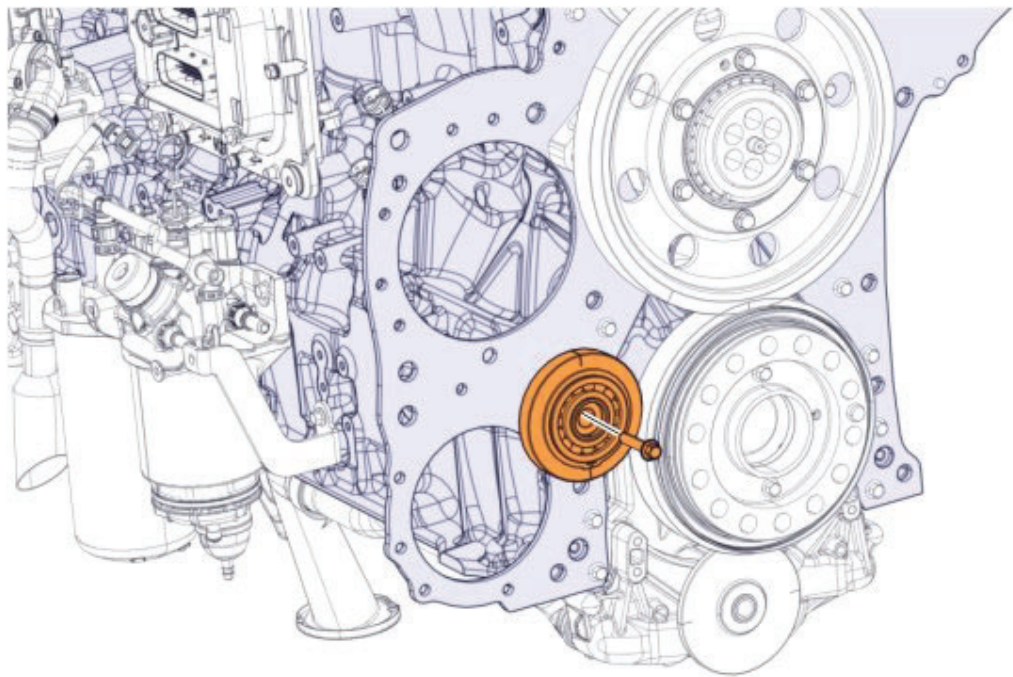
Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

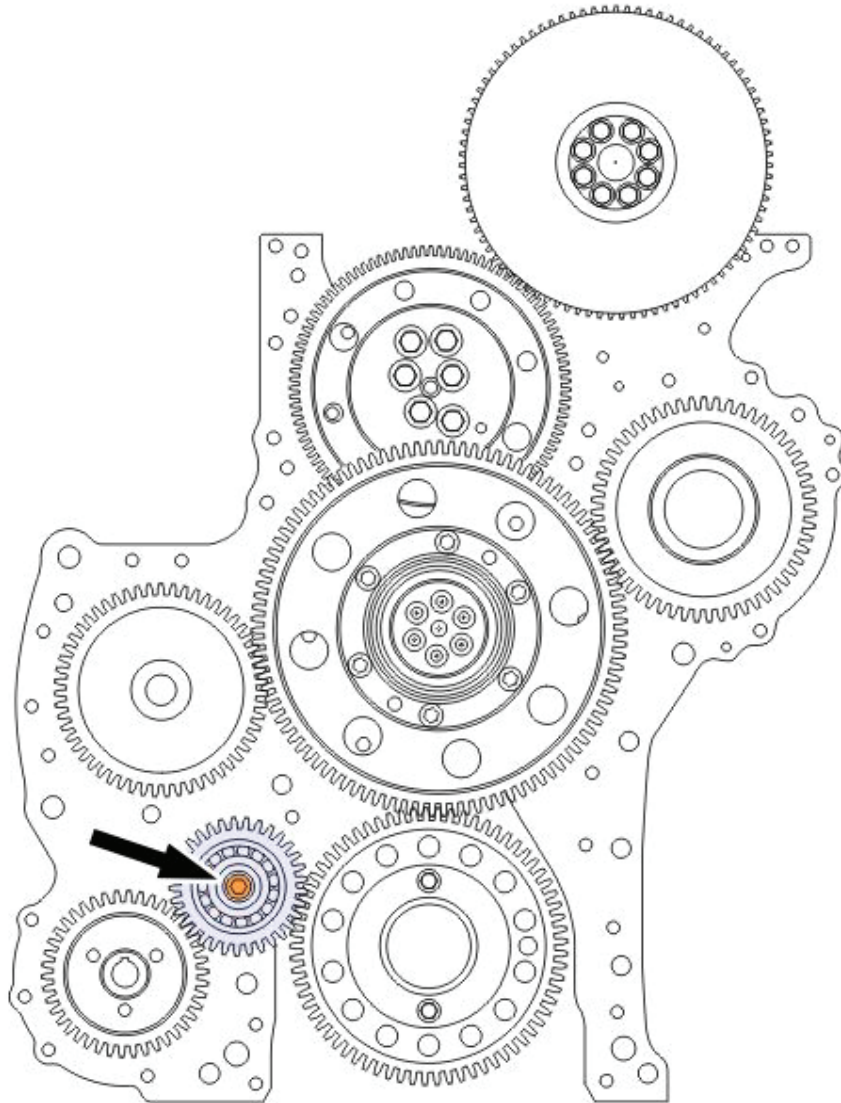
	Tightening torque		
	Camshaft gear, screw	1.	Tightening sequence: 1-8
			45 ±5 Nm (33 ±4 lb _f ·ft)
		2.	Tightening sequence: 1-8
			90 ±5°



282	Install the gear.
283	Install the screw.
284	Torque tighten the screw.



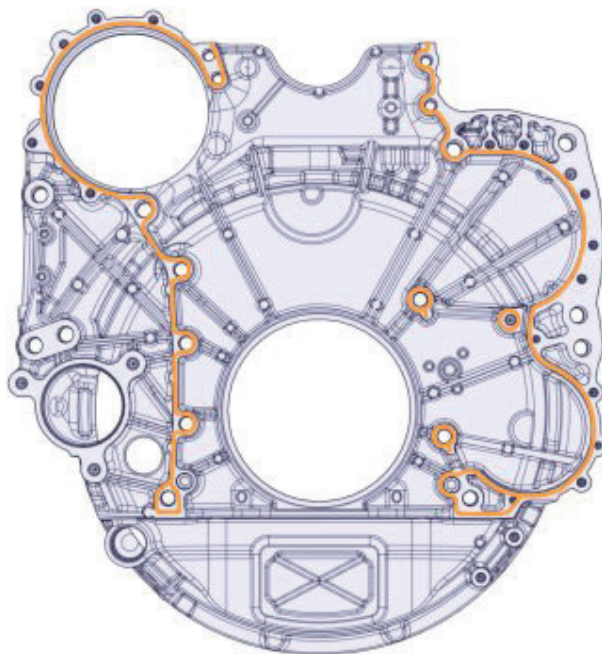
Tightening torque	
Idler gear, servo pump, screw	140 ±10 Nm (103 ±7 lb _f ·ft)



285	Perform this procedure when the condition below is met.	
	Conditions	
	•	Timing gear plate without integrated seal
	▶	Clean the contact surfaces.
	i Note Ensure that the surfaces are completely clean of sealant.	
	i Note Ensure that the surfaces are completely clean of oil and grease.	
	▶	Apply a bead of sealant.
Tech data		
Sealant, bead thickness		2 mm (0.08 in)

i **Note**
Use recommended sealant.

i **Note**
Install the flywheel housing within 20 minutes of sealant application.



286 Perform this procedure when the condition below is met.

Conditions

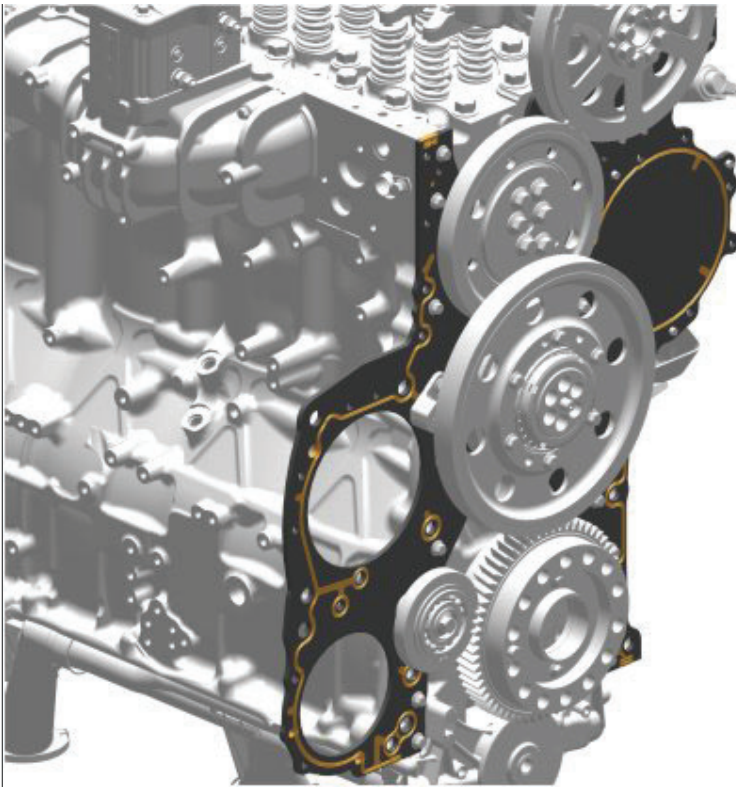
- Timing gear plate with integrated seal

- ▶ Clean the contact surfaces carefully.

i **Note**
Do not use any tools that may damage the sealing surfaces.

- ▶ Inspect the sealing strip surfaces on both side of the timing gear plate.

- ▶ If the sealing strip is completely loose or damaged, the timing gear plate must be replaced.

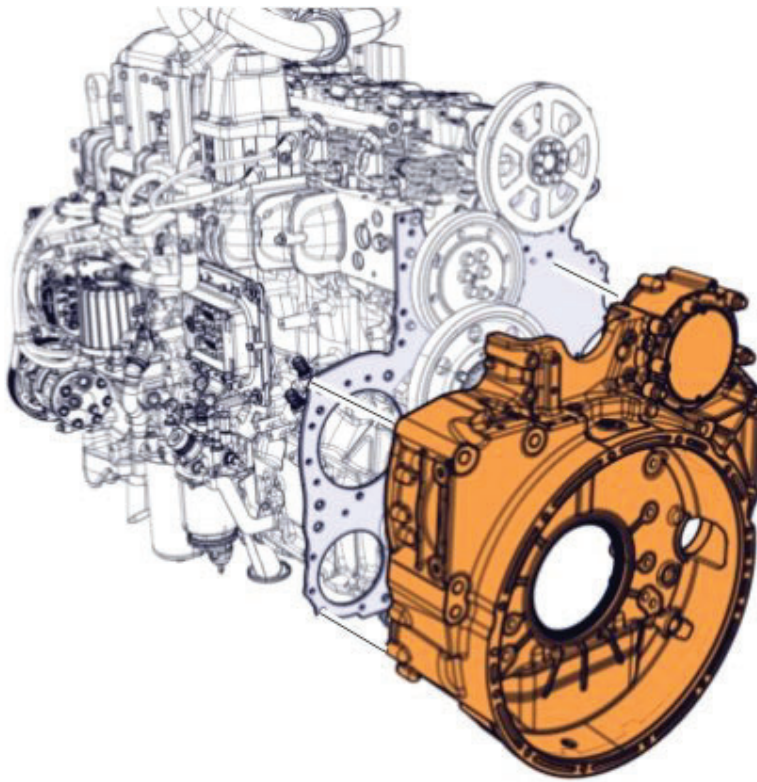
**CAUTION**

Risk of serious injury.

Heavy component.

- ▶ Exercise caution when moving the component. Use appropriate tools.

287 Install the flywheel housing.

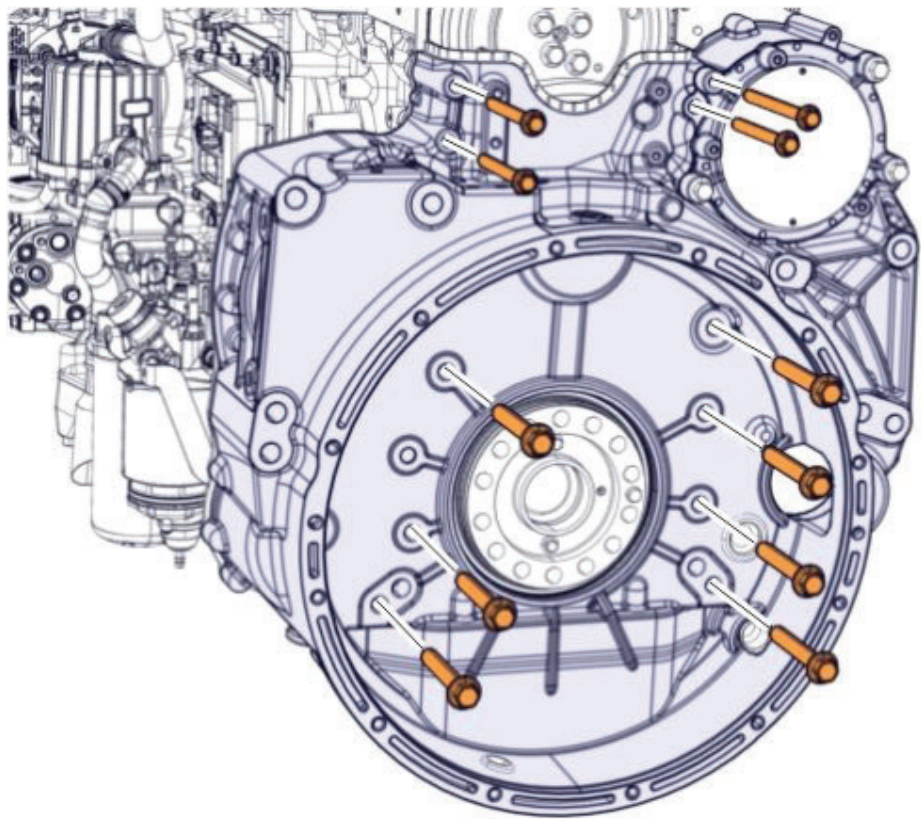


288 Install the screws.



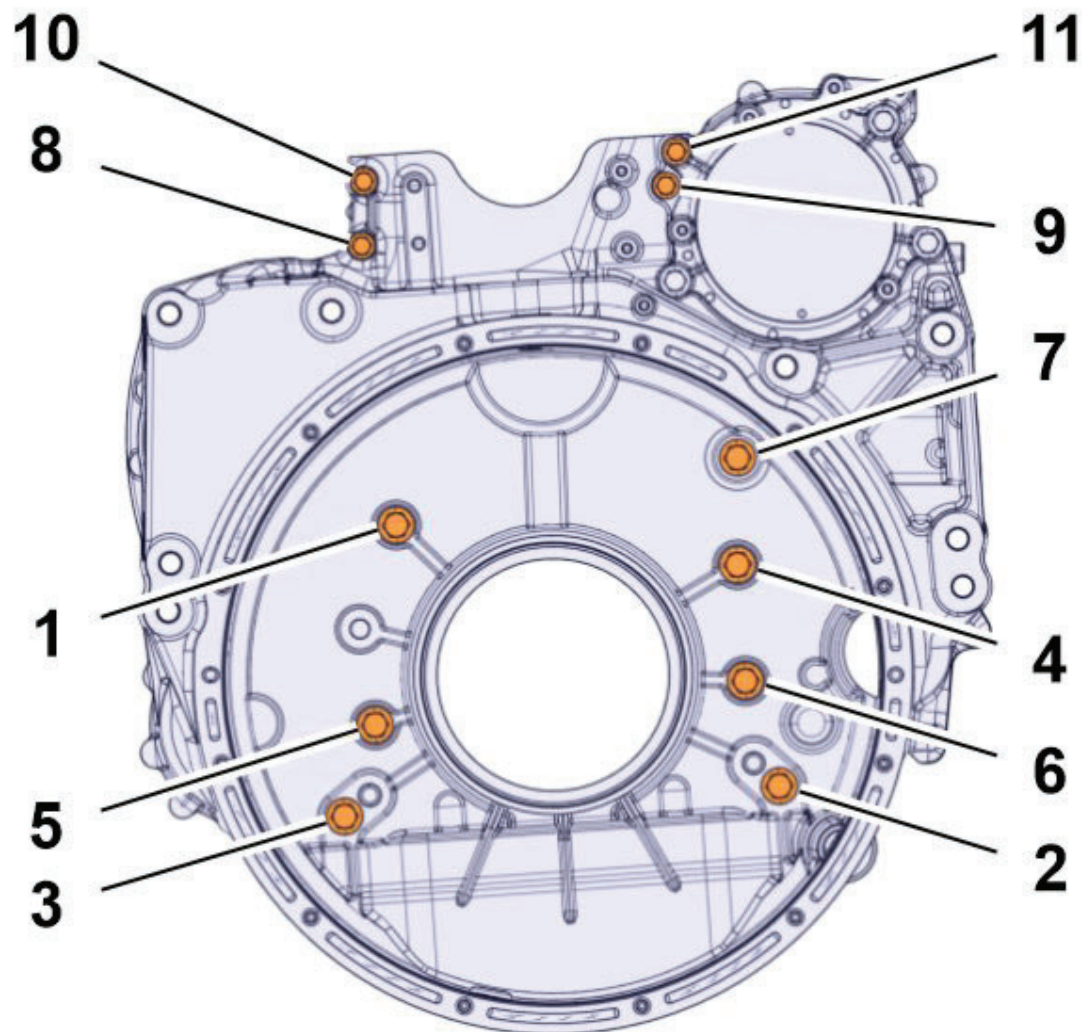
Note

Remove the alignment dowels.



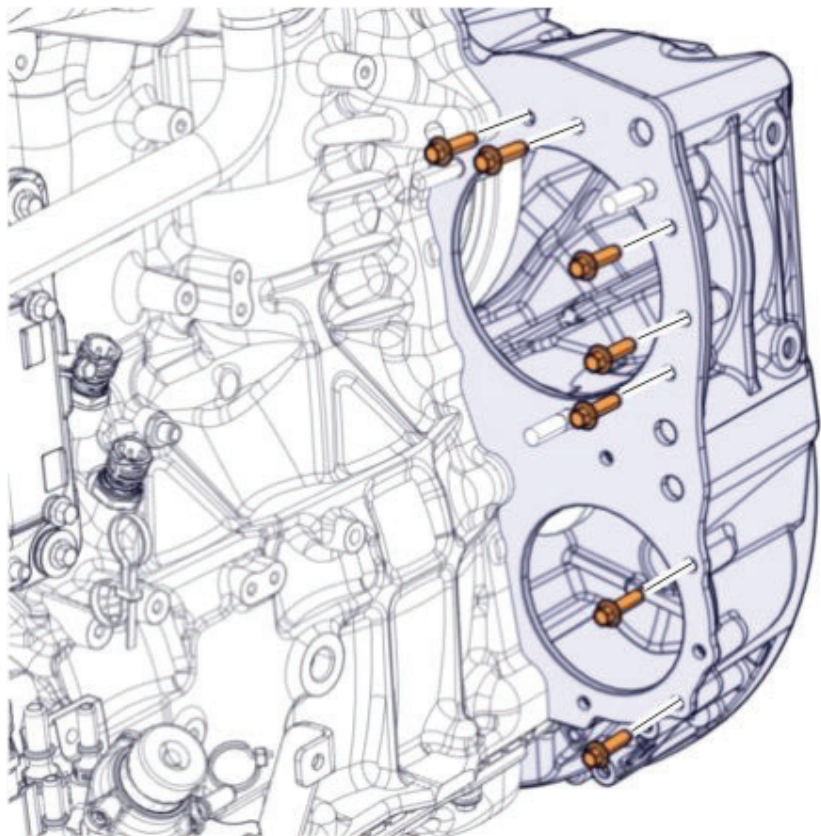
289	Tighten the screws to torque.
-----	-------------------------------

Tightening torque		
Flywheel housing, screw	1.	M14
		Tightening sequence: 1–7
		36 ±10 Nm (27 ±7 lb _f ·ft)
	2.	M14
		Tightening sequence: 1–7
		160 ±20 Nm (118 ±15 lb _f ·ft)
	3.	M10
		Tightening sequence: 8--11
		60 ±10 Nm (44 ±7 lb _f ·ft)

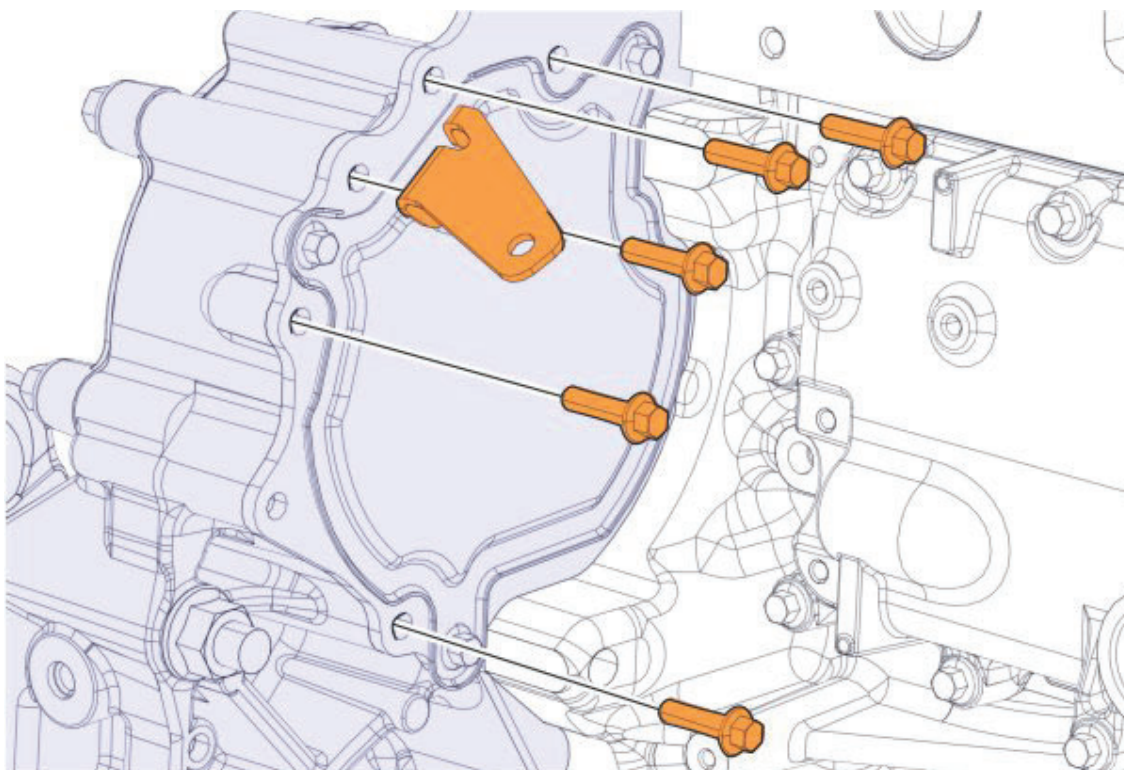


290	Install the screws. i Note Some housings may not include all the screws shown.
-----	---

291	Tighten the screws to torque.	
	Tightening torque	
	Screw	M8
		24 ±4 Nm
		(18 ±3 lb _f ·ft)

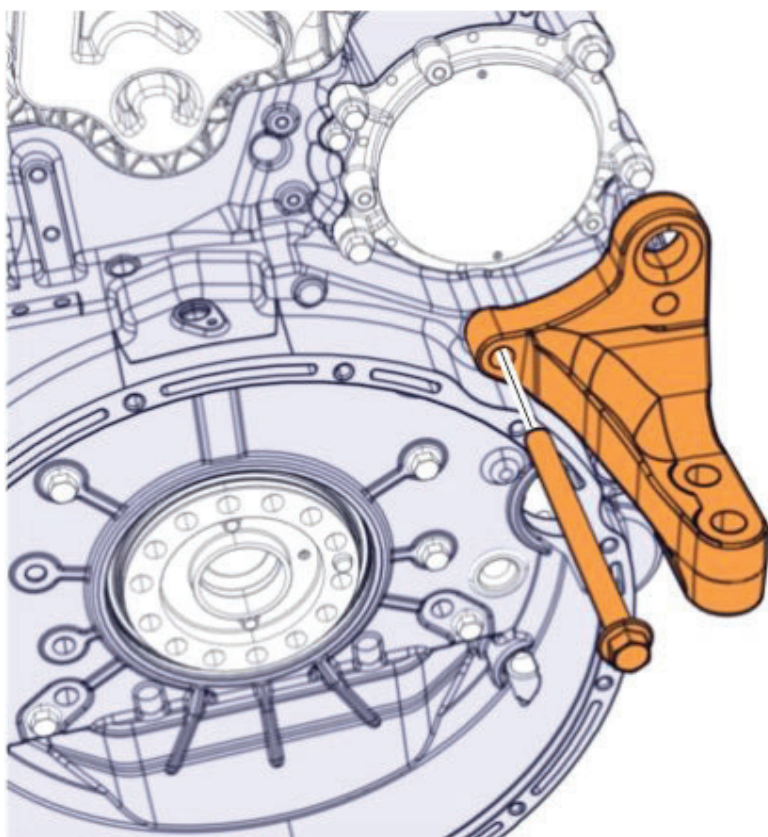


292	Install the bracket and the screws.	
293	Tighten the screws to torque.	
	Tightening torque	
	Screw	M8
		24 ±4 Nm
		(18 ±3 lb _f ·ft)



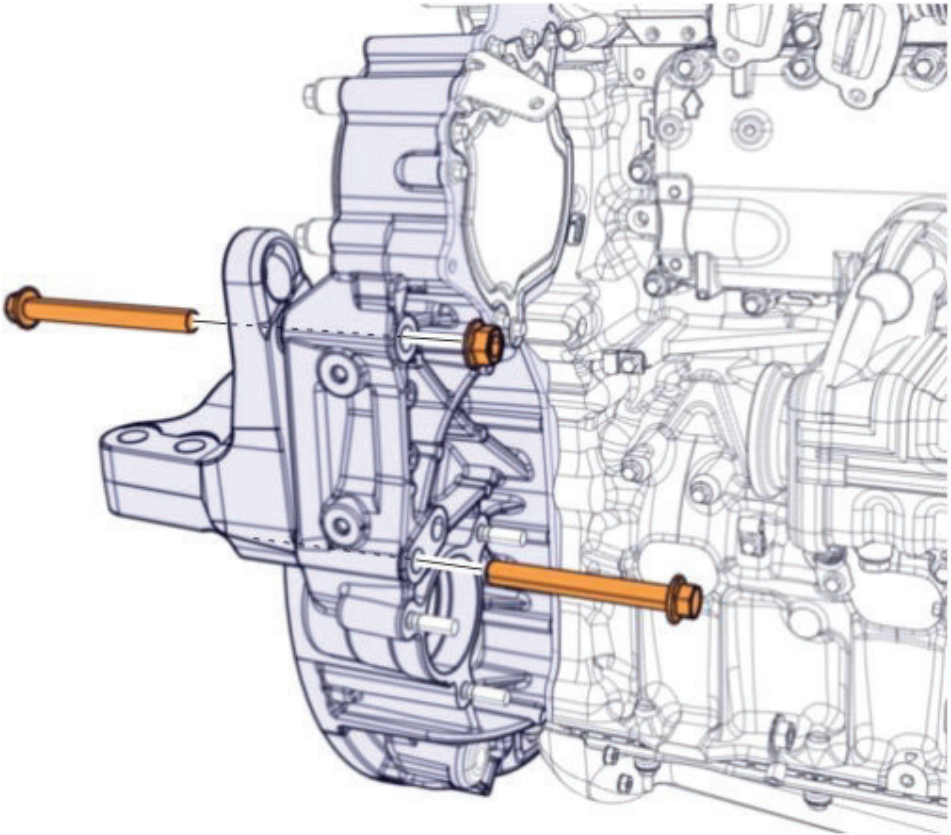
294 Install the bracket.

295 Install the screw.

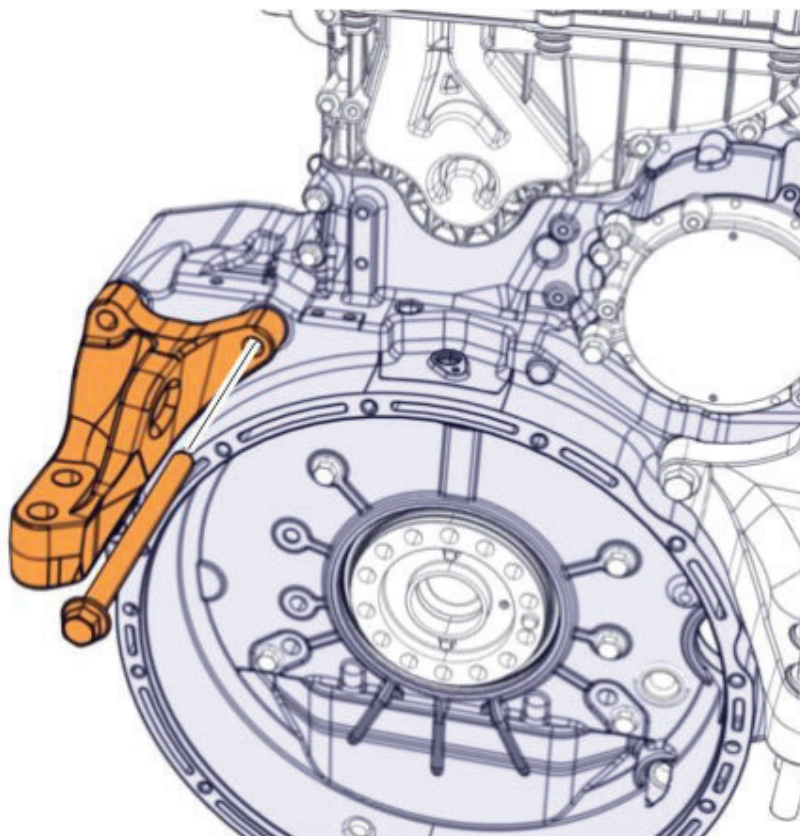


296 Install the screw.

297	Install the screw and nut.
-----	----------------------------

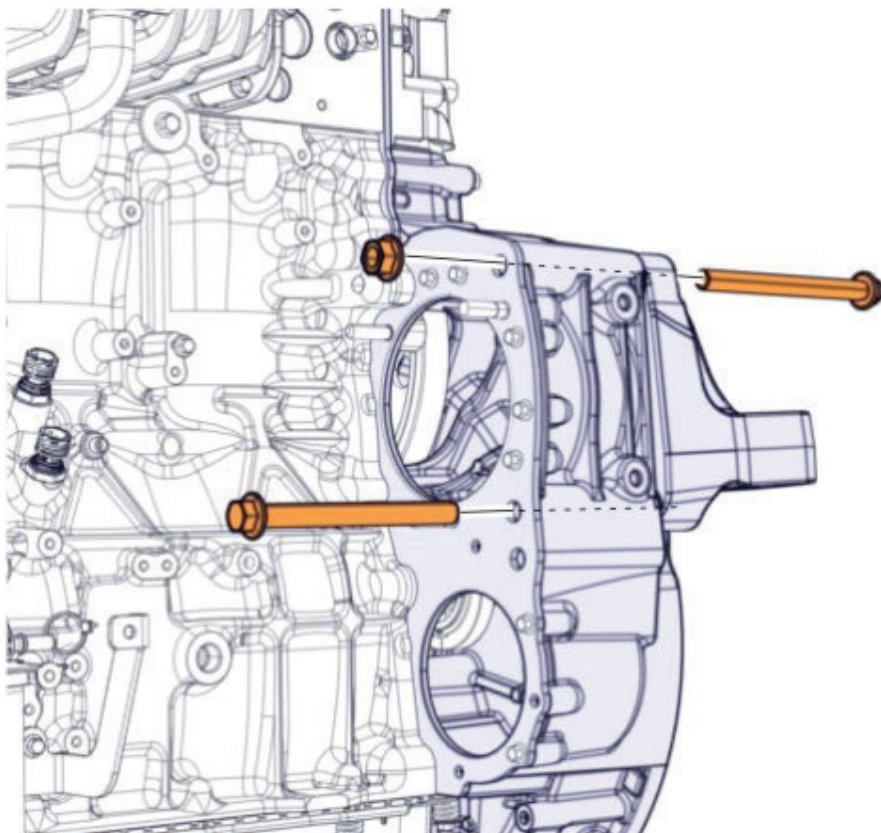


298	Torque tighten the screws and nut.	
	Tightening torque	
	Engine bracket, flywheel housing, rear, screw	300 ±30 Nm (221 ±22 lb _f ·ft)
299	Install the bracket.	
300	Install the screw.	



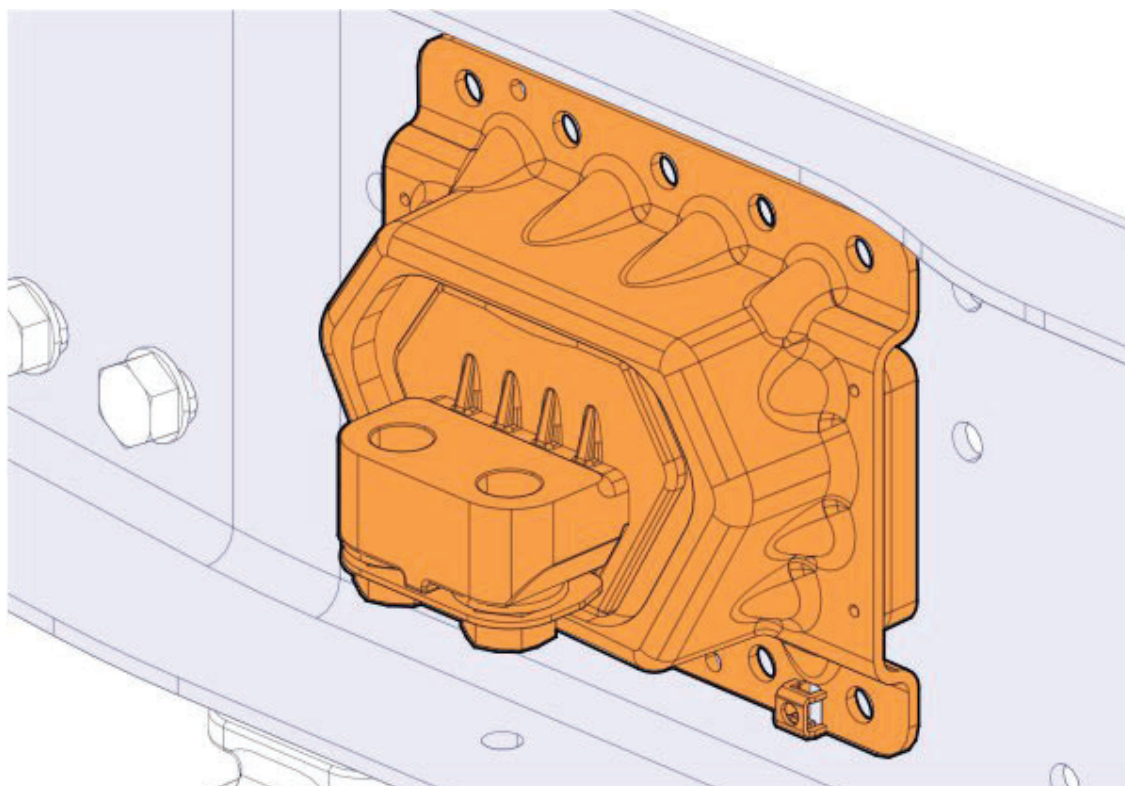
301	Install the screw.
-----	--------------------

302	Install the screw and nut.
-----	----------------------------

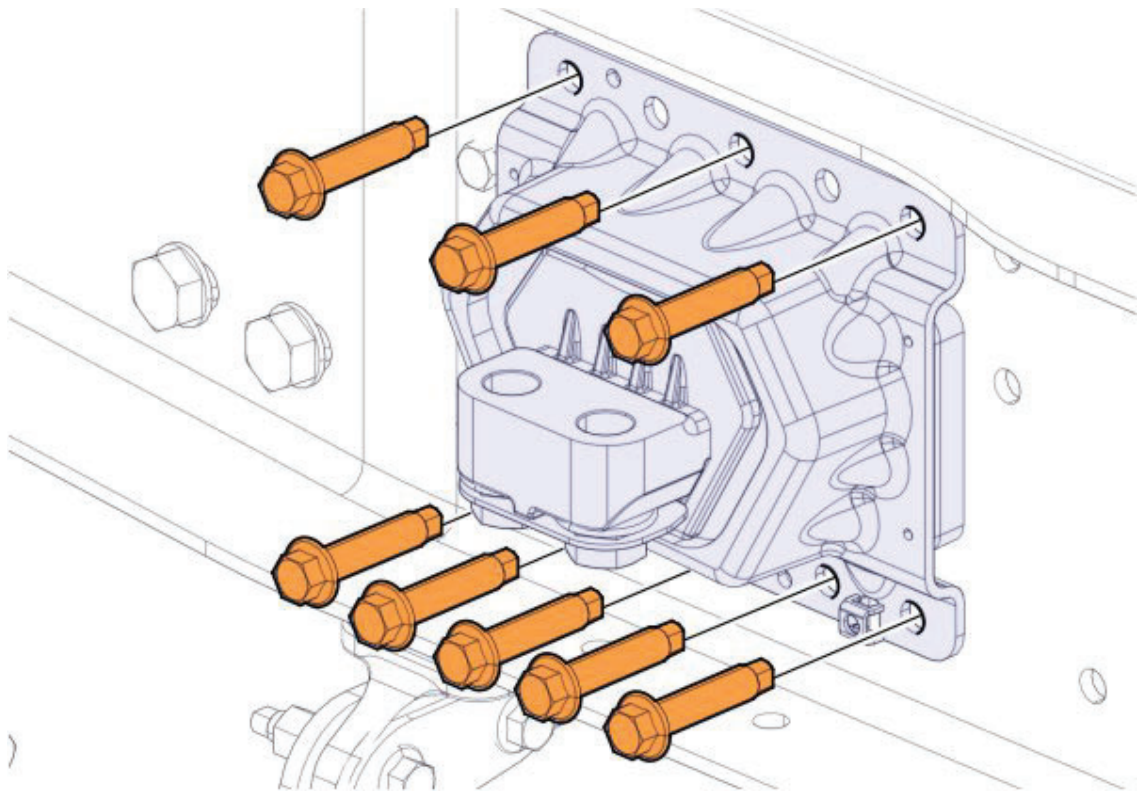


303	Torque tighten the screws and nut.	
	Tightening torque	
	Engine bracket, flywheel housing, rear, screw	300 ±30 Nm (221 ±22 lb _f ·ft)

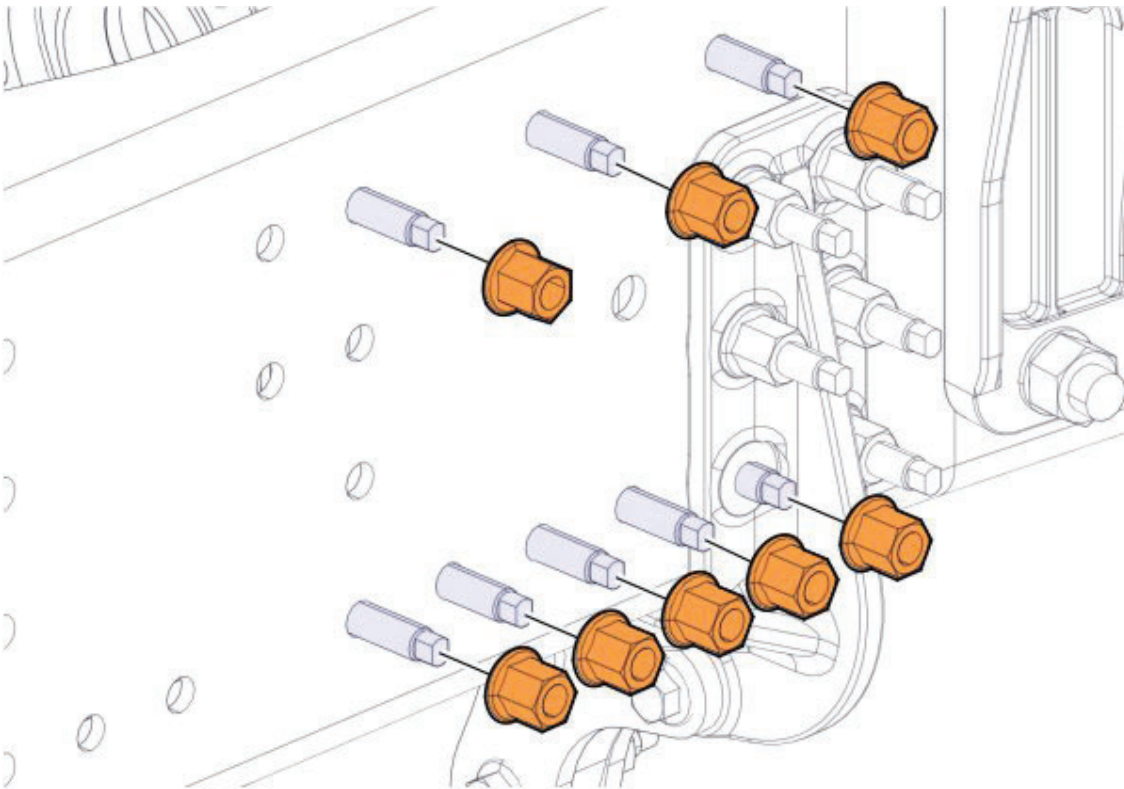
304	Install the rubber cushion.
-----	-----------------------------



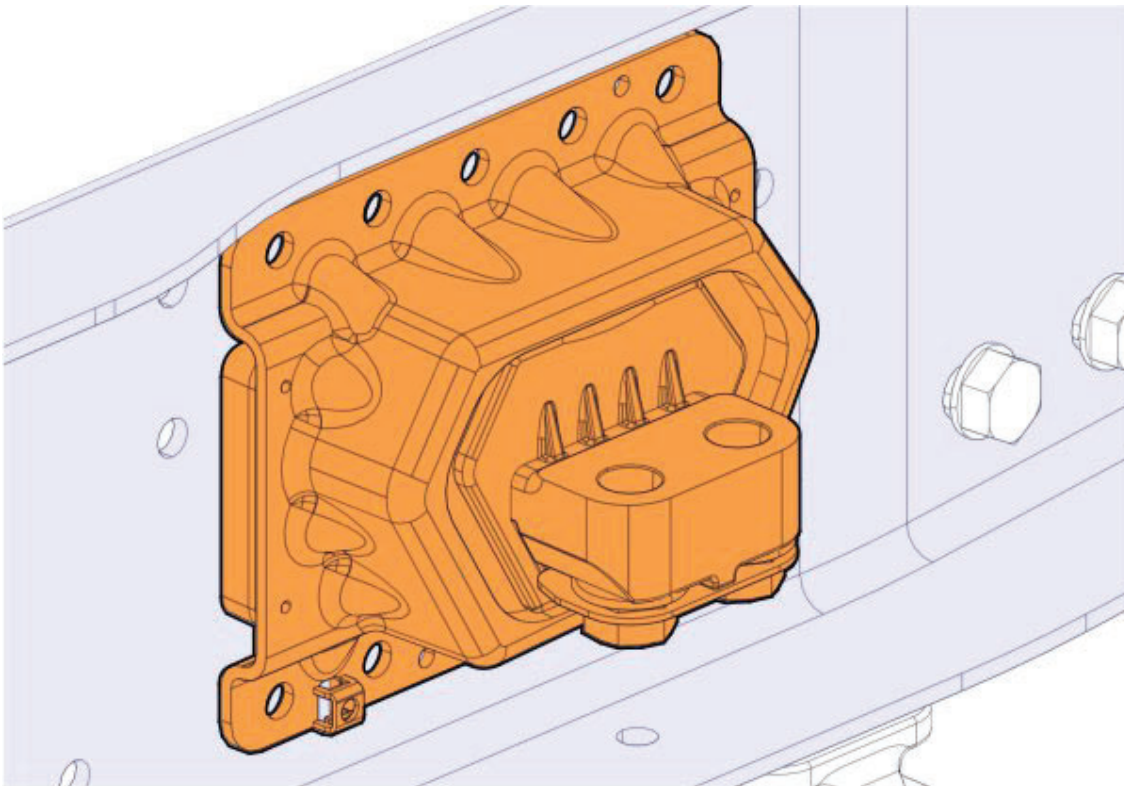
305	Install the screws.
-----	---------------------



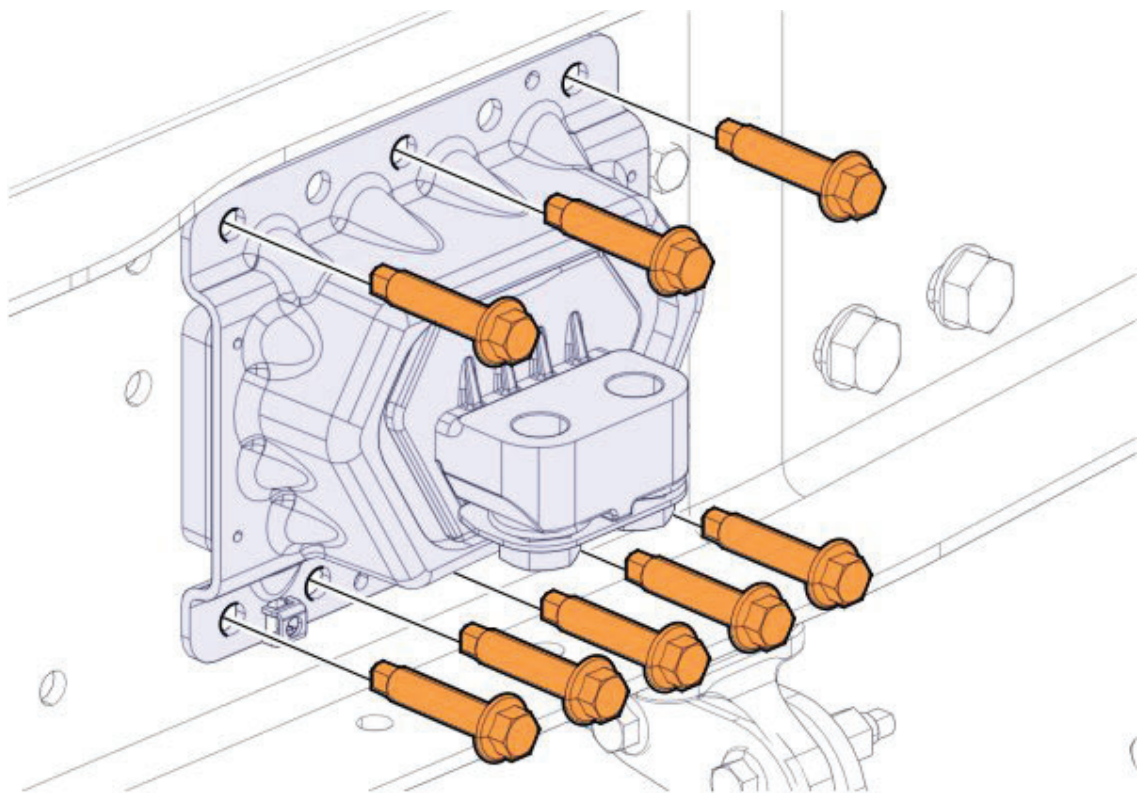
306	Install the nuts.	
307	Torque tighten the nuts.	
	Tightening torque	
	Rear cushion, screw	140 ±25 Nm (103 ±18 lb _f -ft)



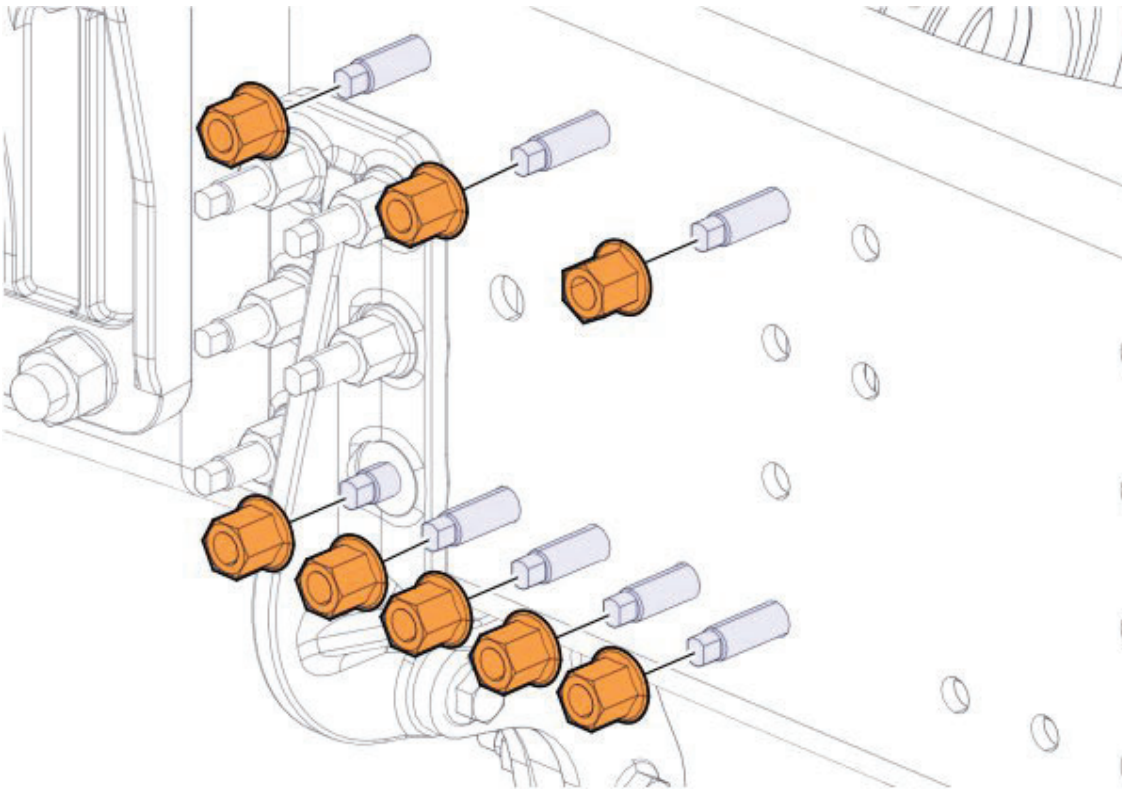
308 Install the rubber cushion.



309 Install the screws.



310	Install the nuts.	
311	Torque tighten the nuts.	
	Tightening torque	
	Rear cushion, screw	140 ±25 Nm (103 ±18 lb _f ·ft)



CAUTION

Risk of serious injury.

Heavy component.

- ▶ Exercise caution when moving the component. Use appropriate tools.



WARNING

Risk of personal injury.

Pinch point.

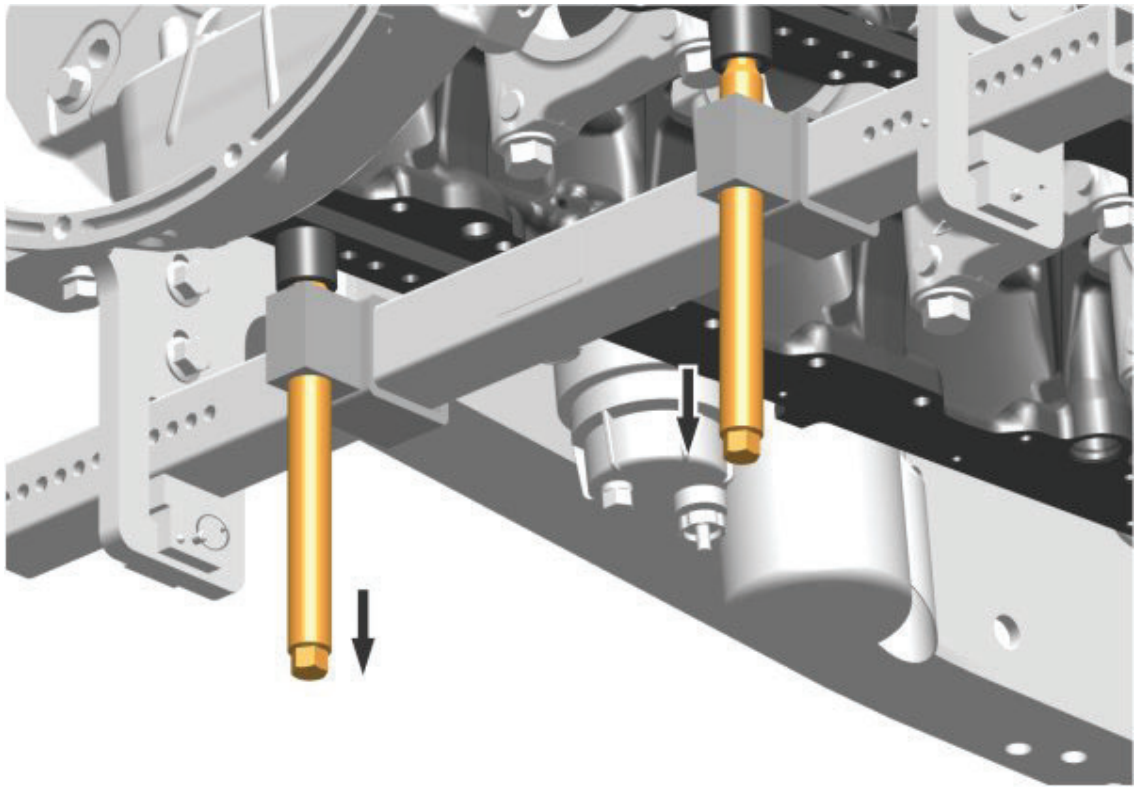
- ▶ Keep hands and fingers clear.

312 Lower the engine onto the rubber cushions.

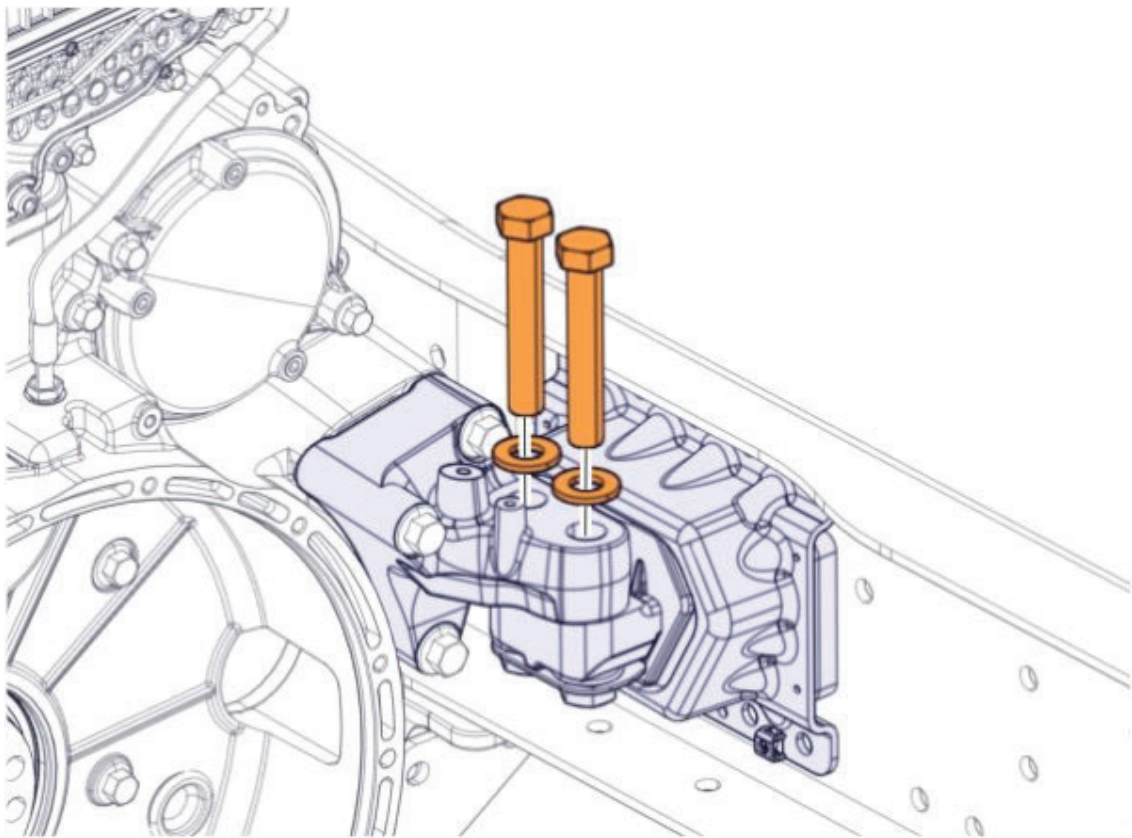


Note

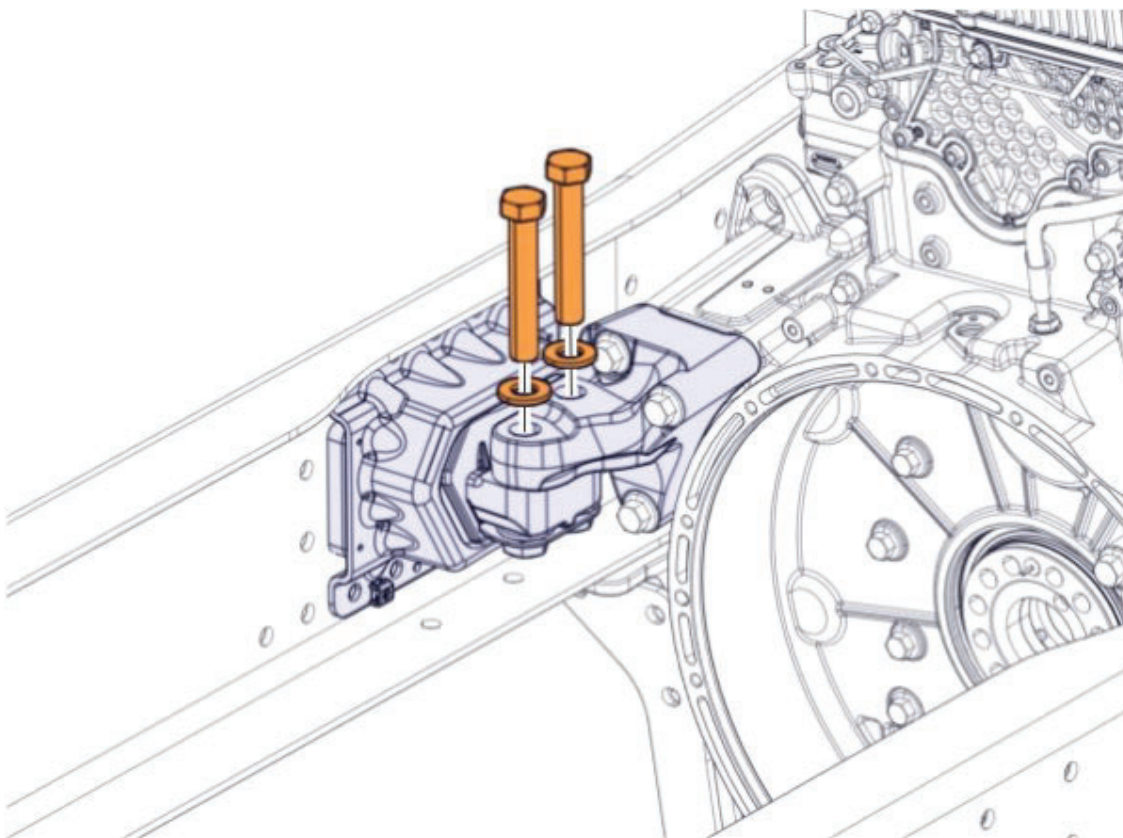
Use caution that no components are damaged.



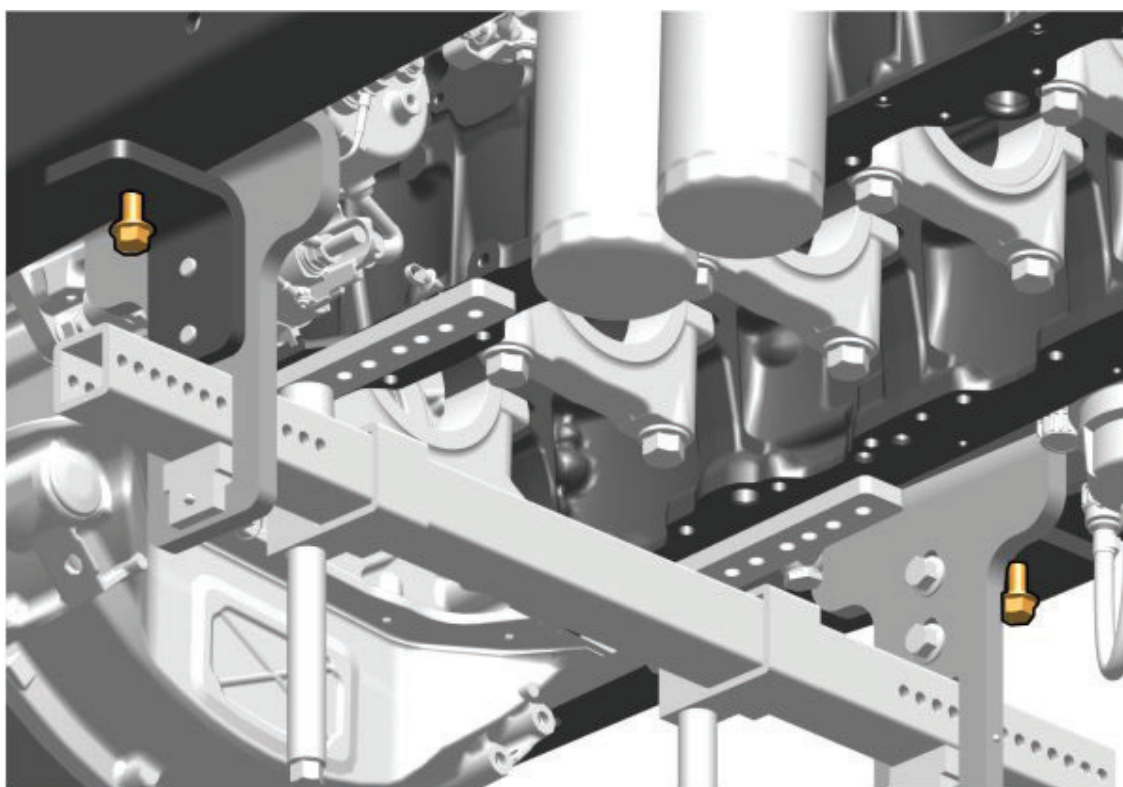
313	Install the washers and the screws.	
314	Tighten the screws to torque.	
	Tightening torque	
	Engine bracket, rubber cushion, rear, screw	540 ±40 Nm (398 ±30 lb _f ·ft)



315	Install the washers and the screws.	
316	Tighten the screws to torque.	
	Tightening torque	
	Engine bracket, rubber cushion, rear, screw	540 ±40 Nm (398 ±30 lb _f ·ft)



317	Loosen the pinch screws.
------------	--------------------------

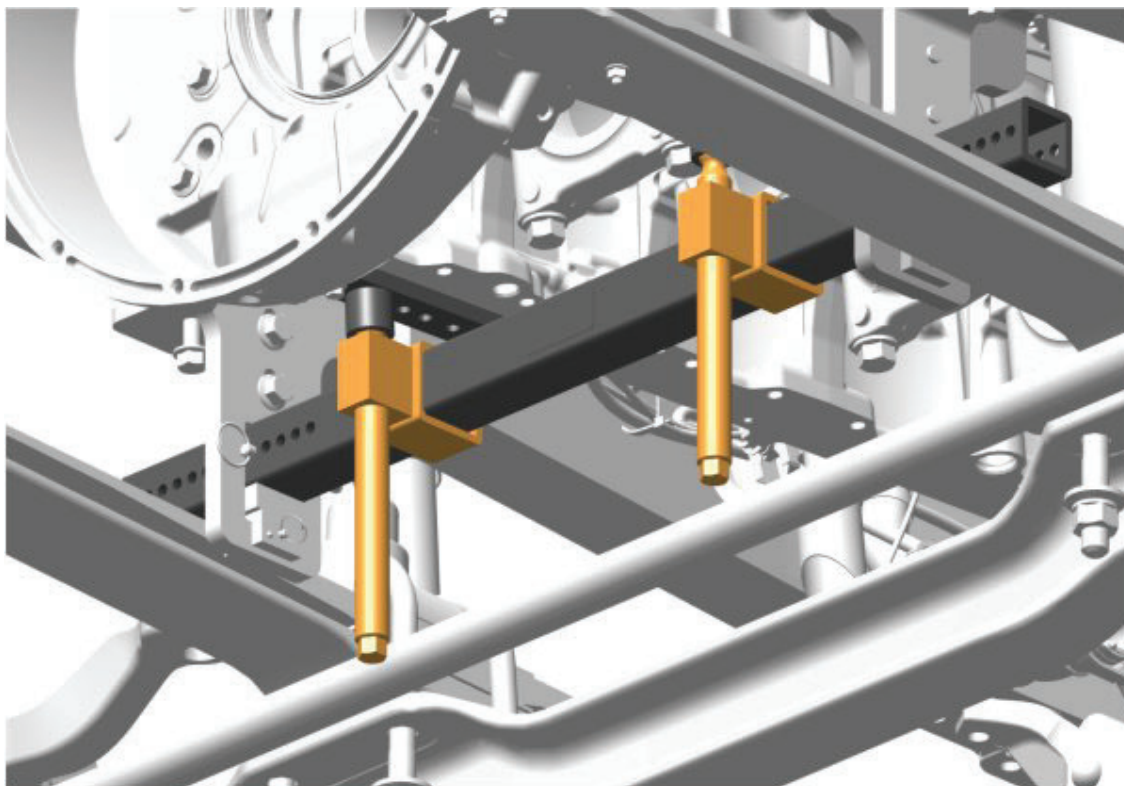


318	Retract the weight jack screws from the alignment plate assemblies.
------------	---

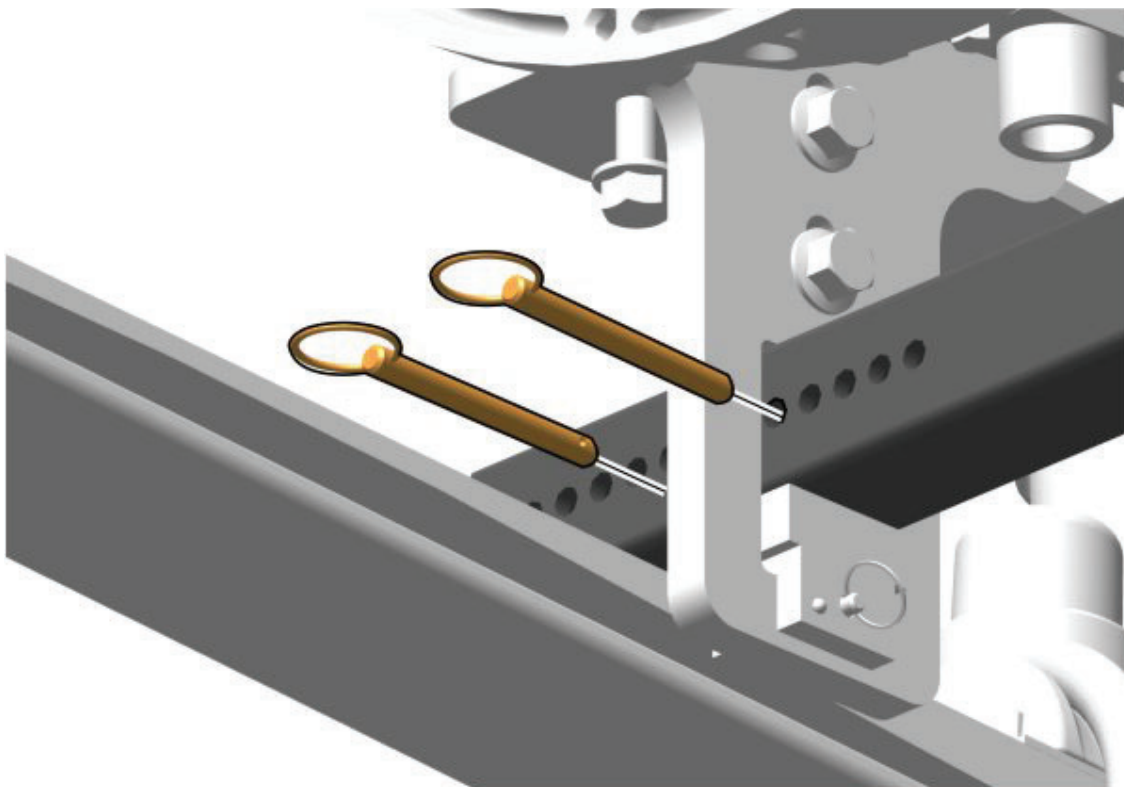
319	Move aside the threaded bracket assemblies.
------------	---

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

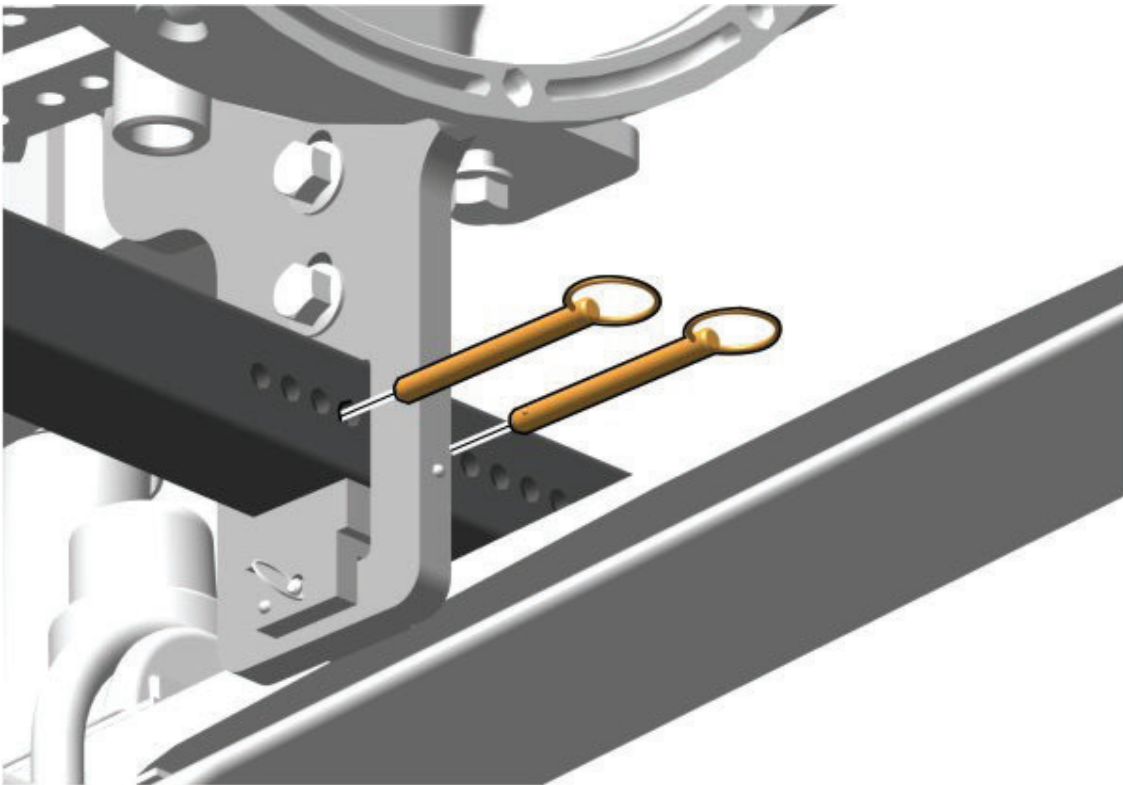
The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.



320	Remove the pins.
-----	------------------

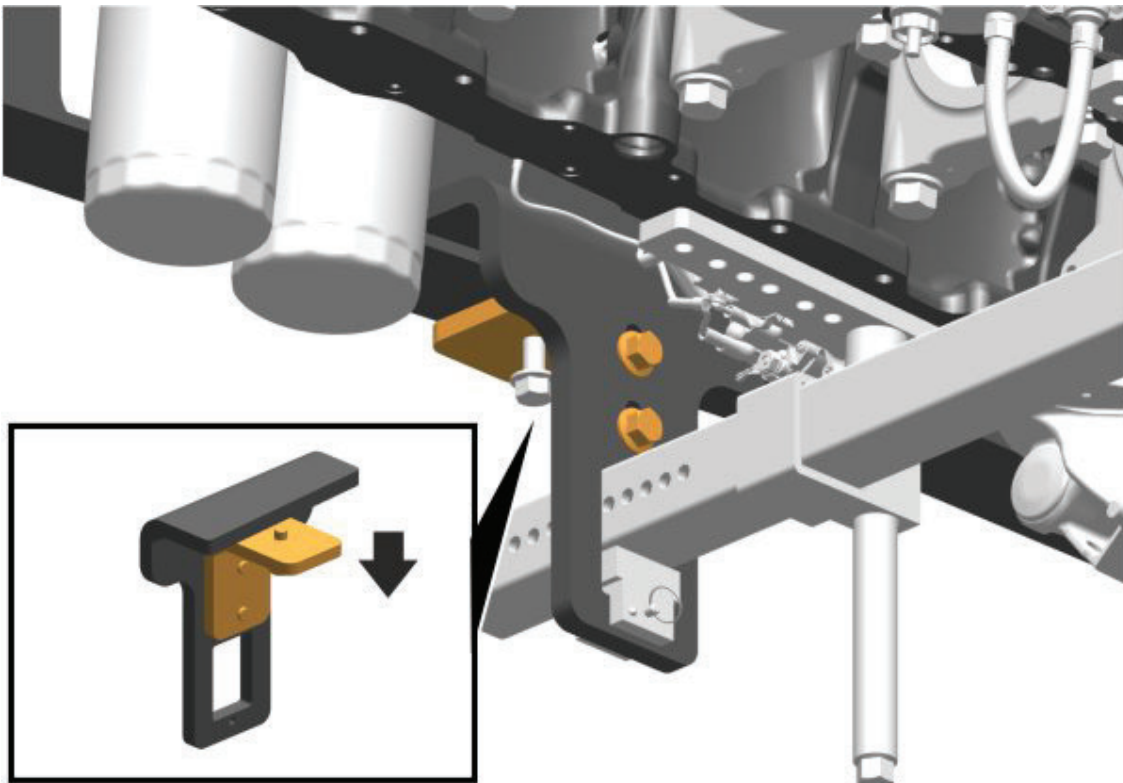


321	Remove the pins.
-----	------------------



322	Loosen the screws.
-----	--------------------

323	Lower the bracket away from the frame rail.
-----	---

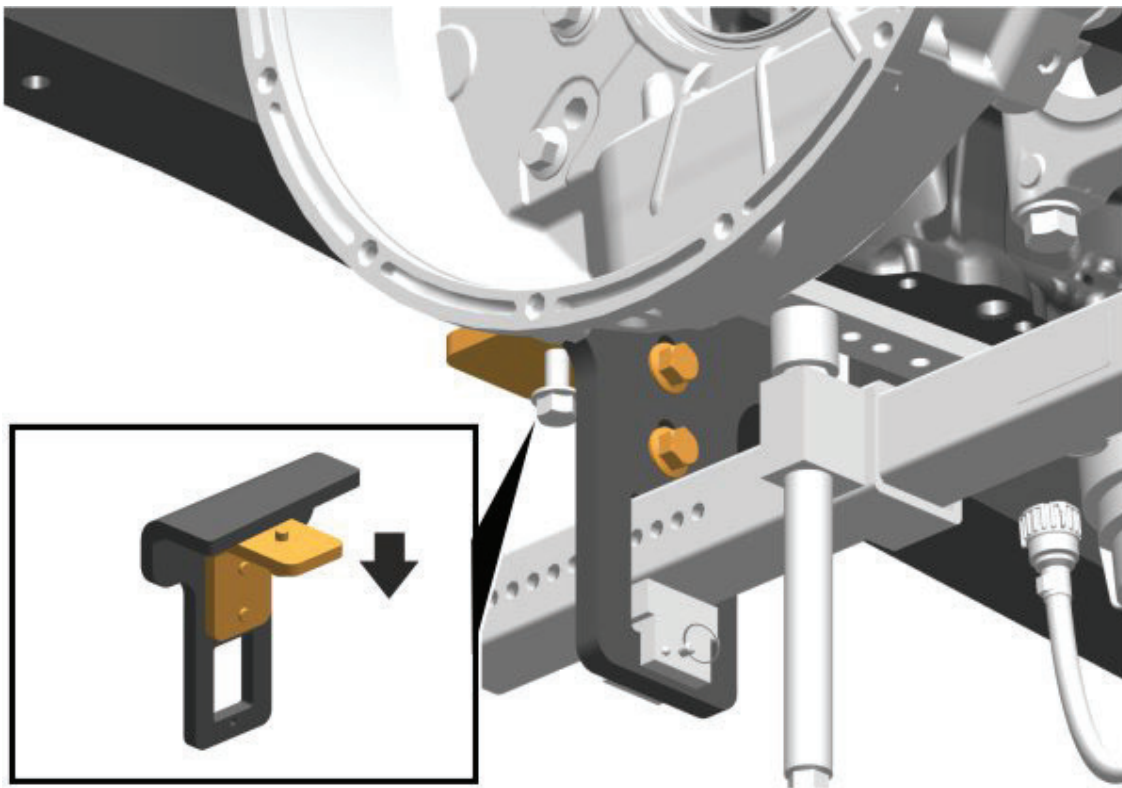


324	Loosen the screws.
-----	--------------------

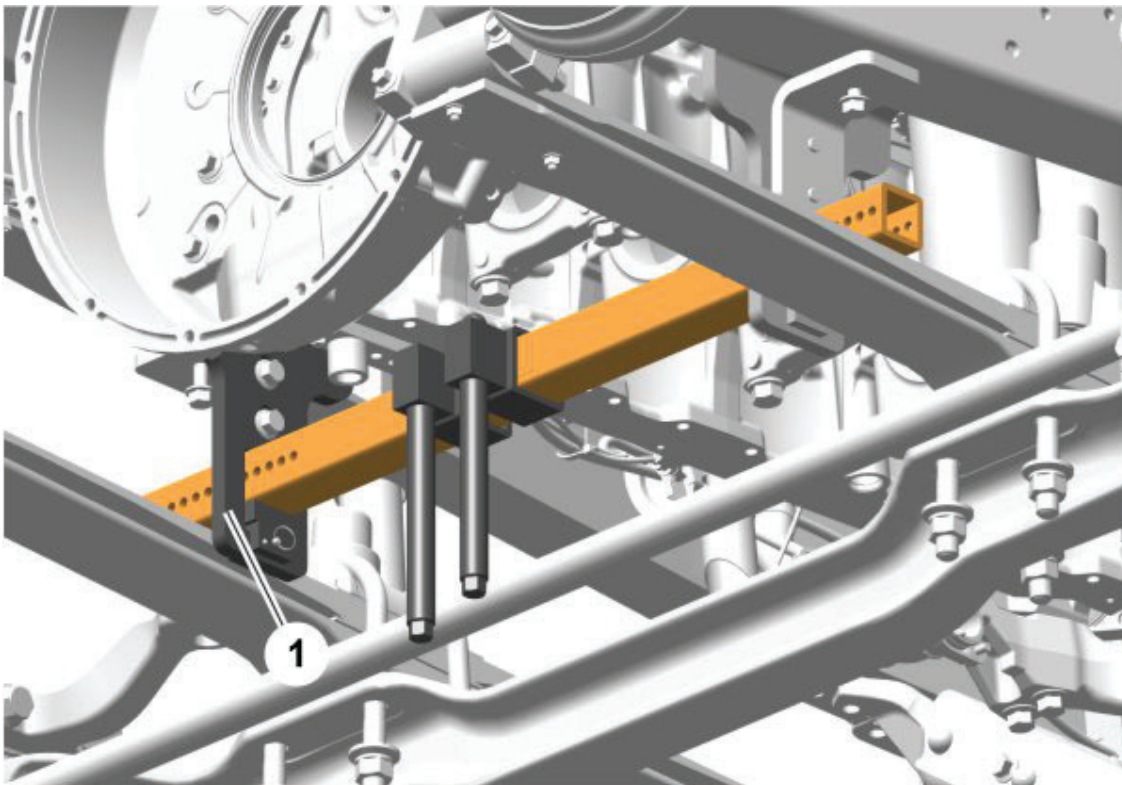
325	Lower the bracket away from the frame rail.
-----	---

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

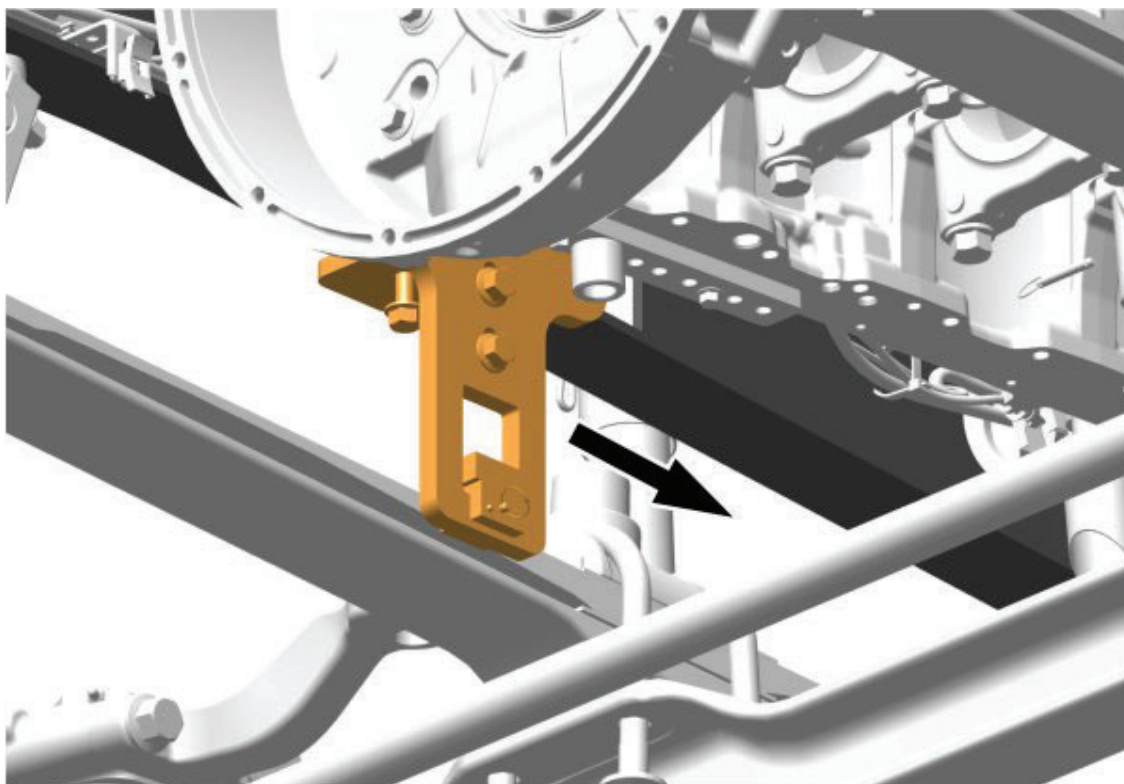
The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.



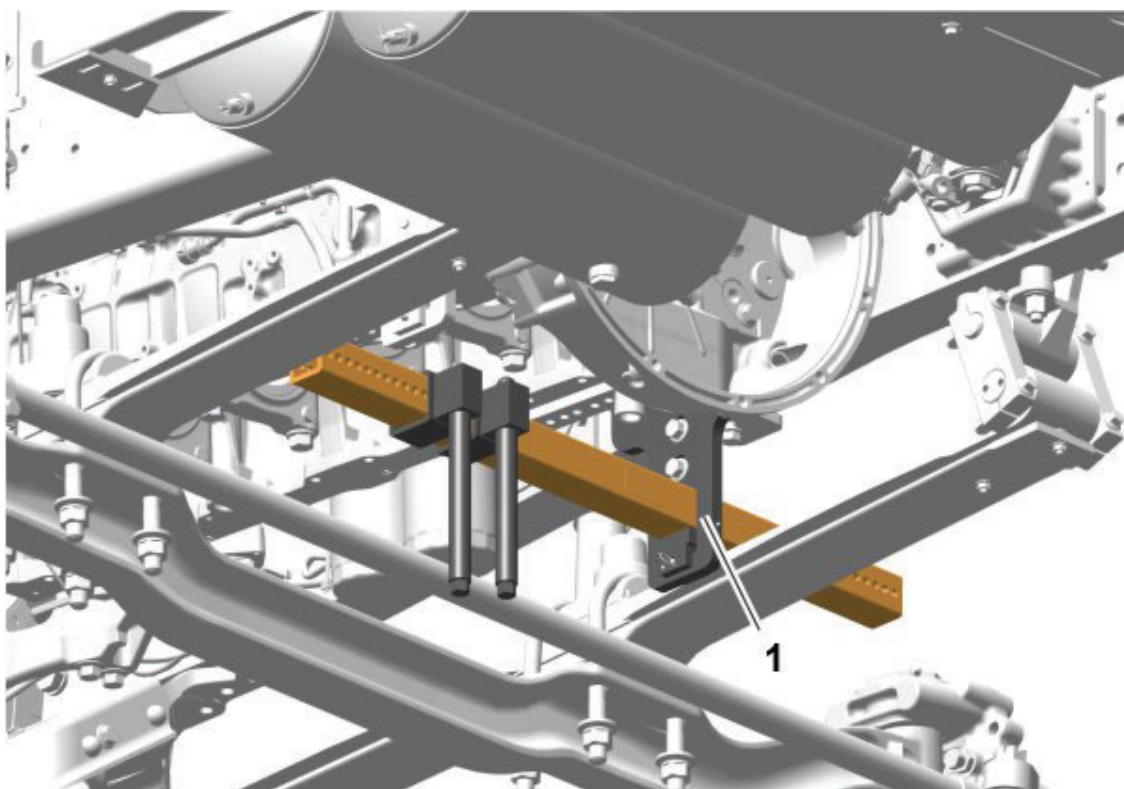
326 Remove the crossbar assembly from the end (1) of the other upright leg assembly.



327 Slide the upright leg assembly.

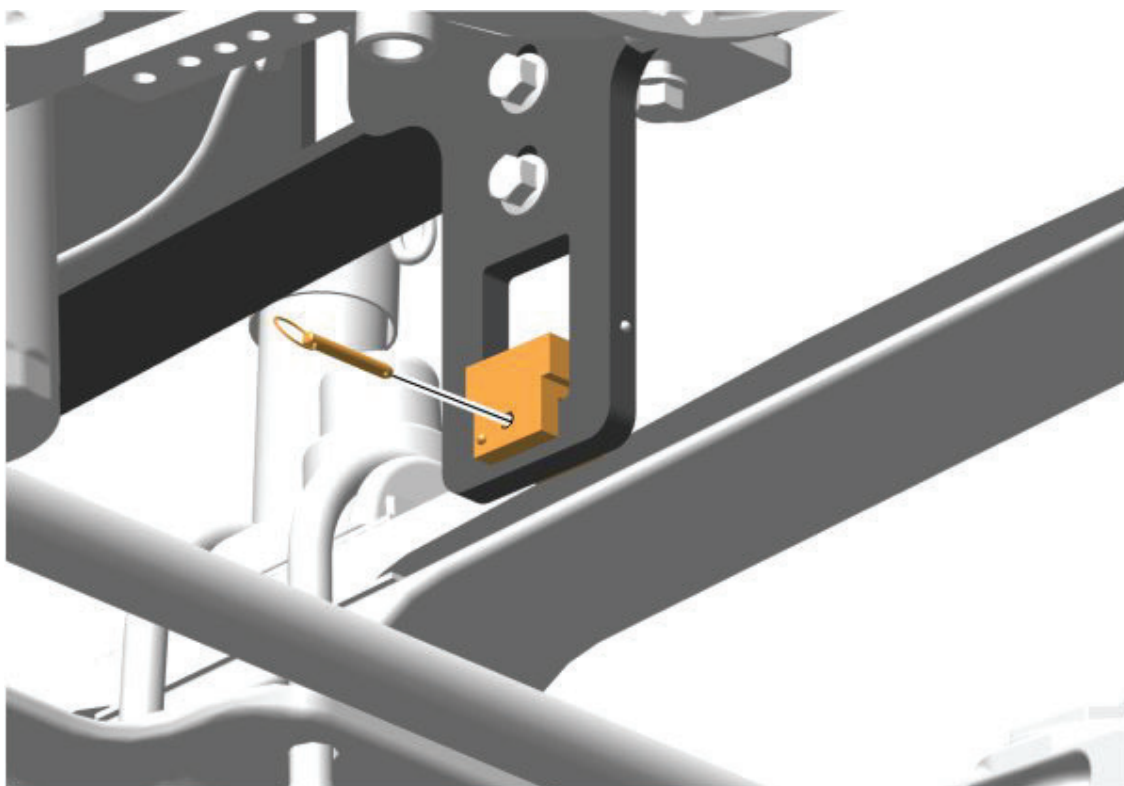


328	Remove the crossbar assembly from the end (1) of the first upright leg assembly.
------------	---



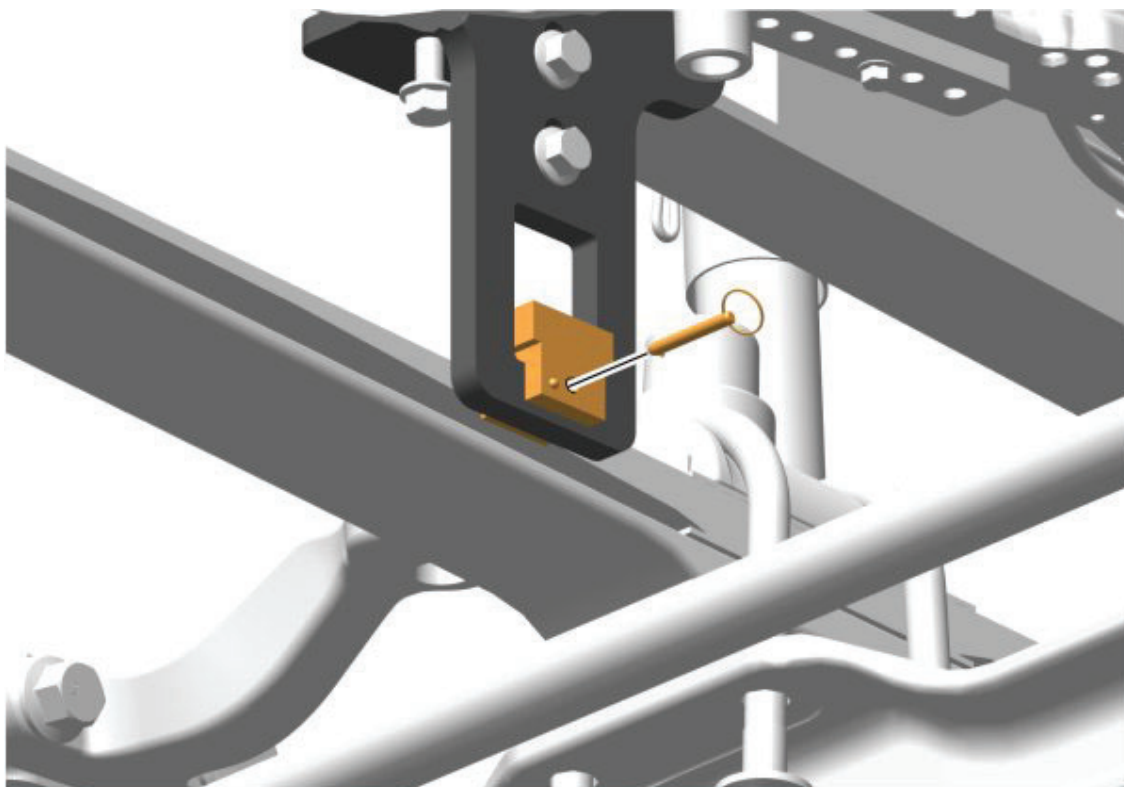
329	Remove the pin.
------------	-----------------

330	Remove the spacer block.
------------	--------------------------



331	Remove the pin.
-----	-----------------

332	Remove the spacer block.
-----	--------------------------



333	Remove the thread bracket assemblies form the crossbar.
-----	---

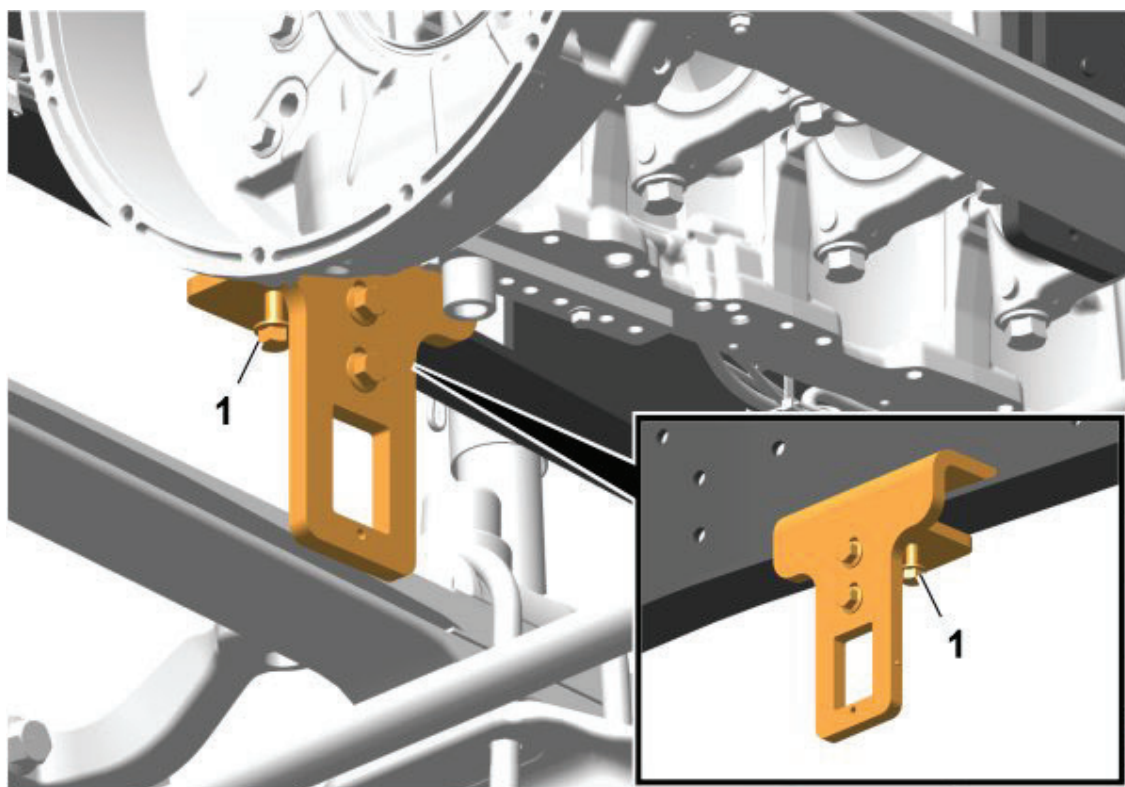


334 Remove the upright leg assembly.



Note

Fully loosen the screw (1) to help in removing the upright leg assembly.



335 Remove the upright leg assembly.

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

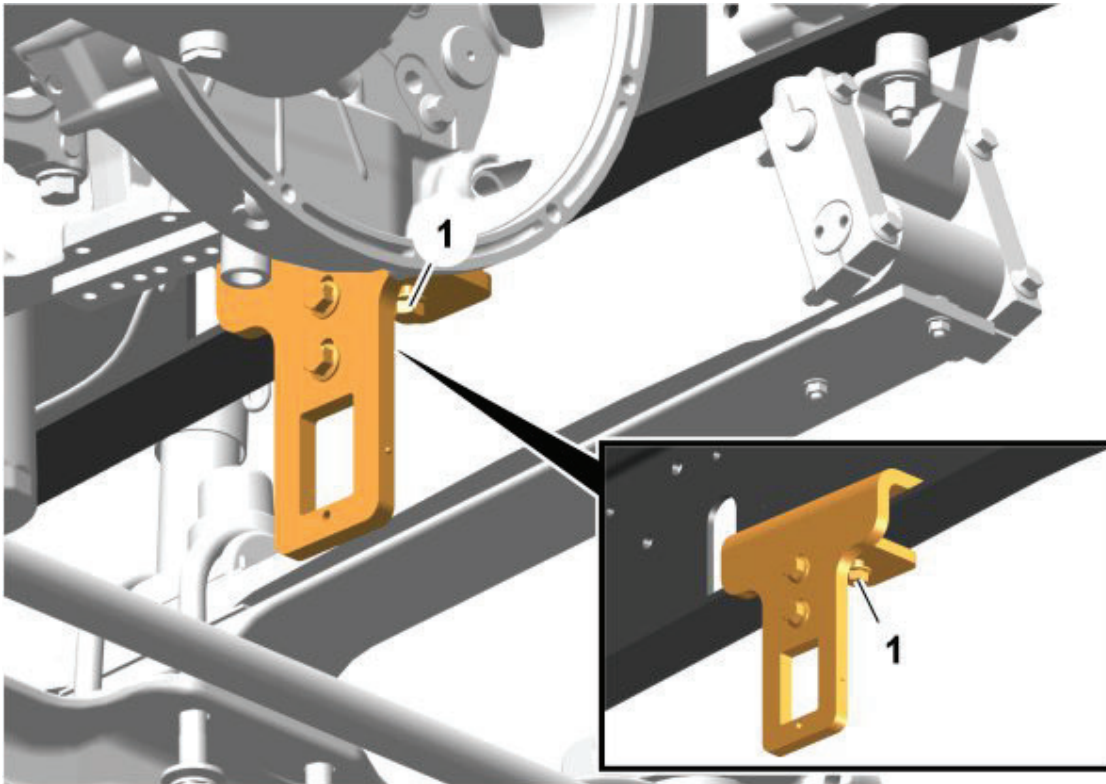
The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

**Note**

Fully loosen the screw (1) to help in removing the upright leg assembly.

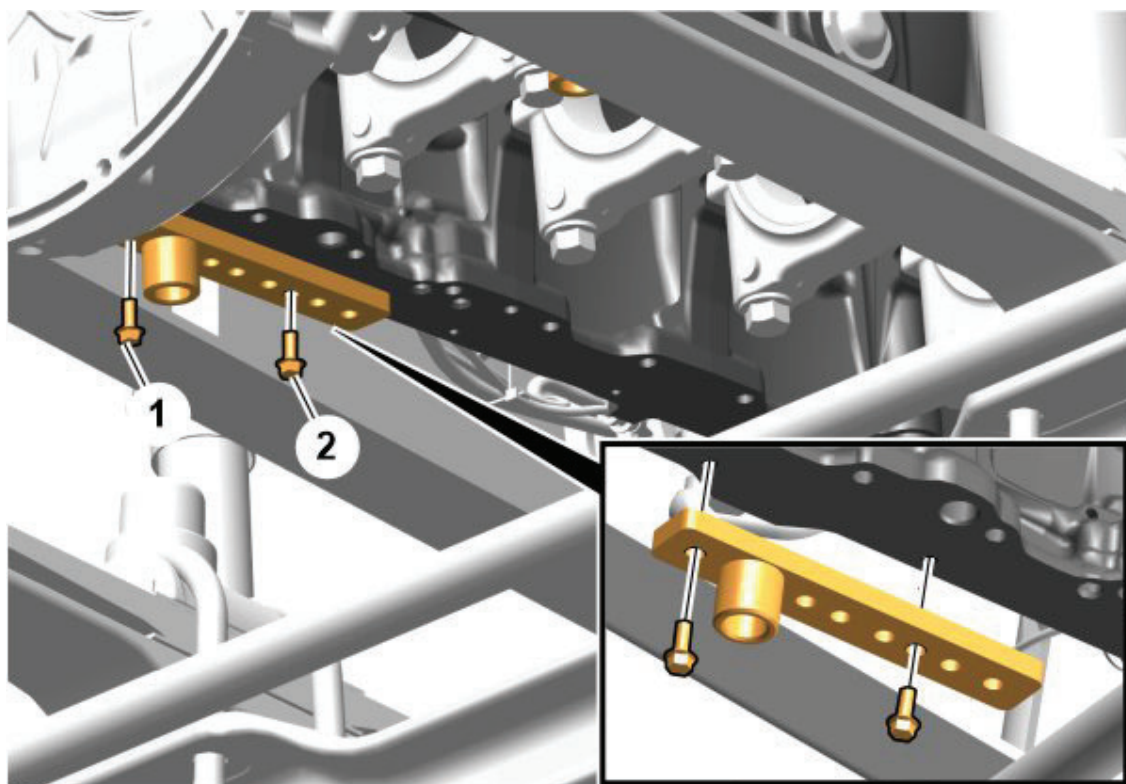
**Service hint**

After removing upright leg assemblies, reinstall any standoff brackets that were removed during assembly.



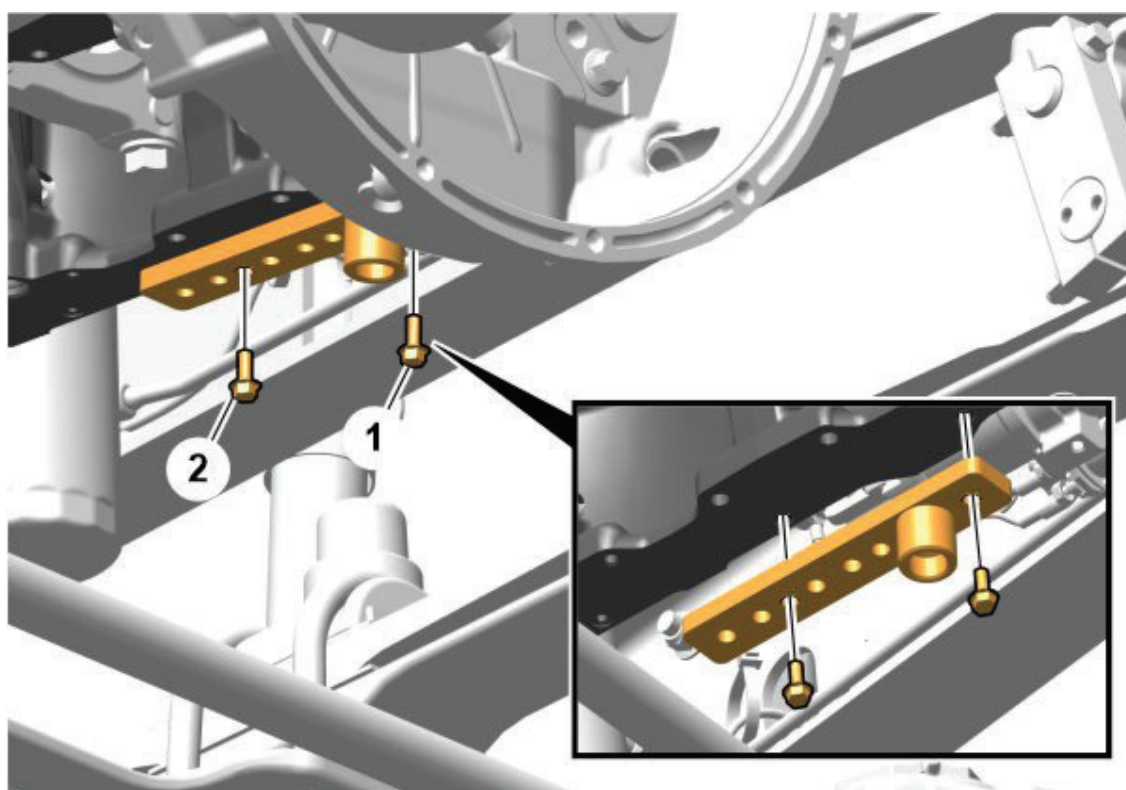
336 Remove the screws (1) and (2).

337 Remove the alignment plate.

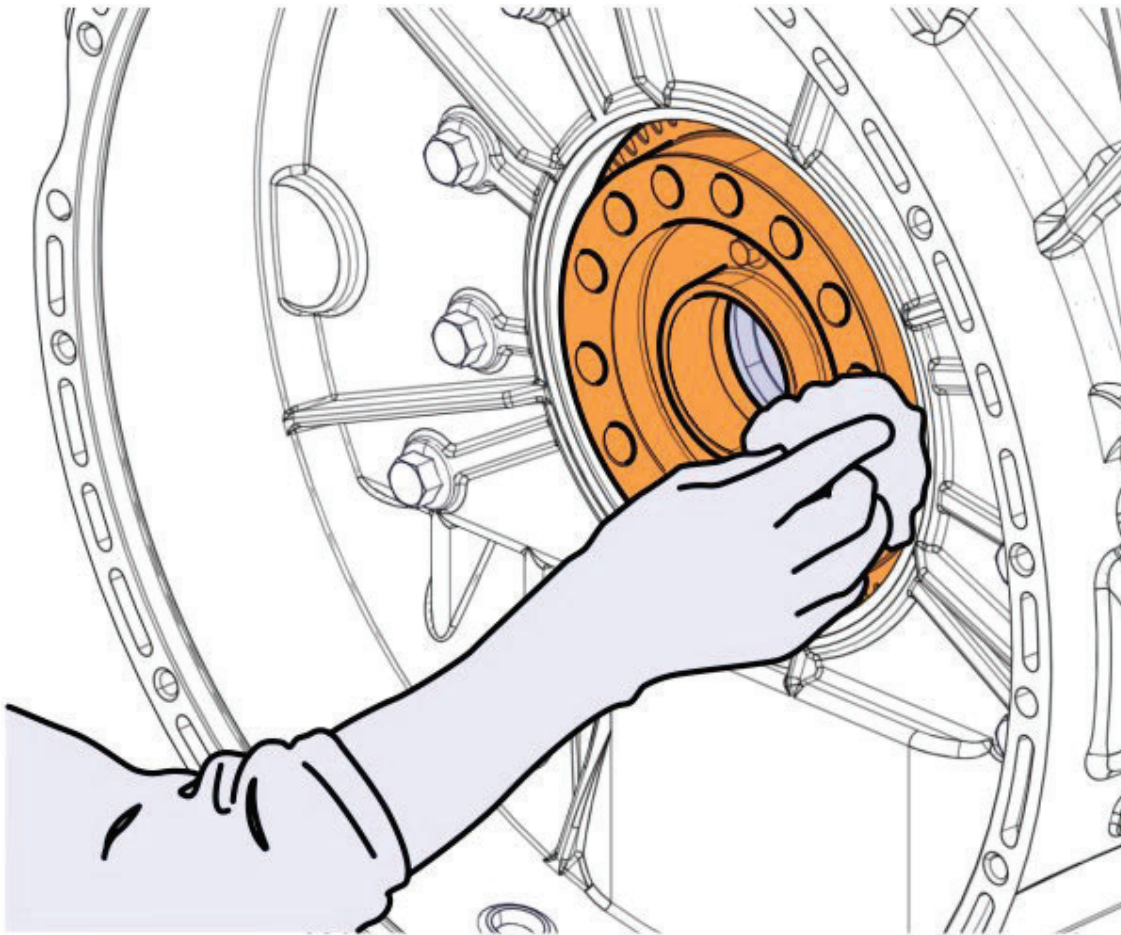


338	Remove the screws (1) and (2).
-----	--------------------------------

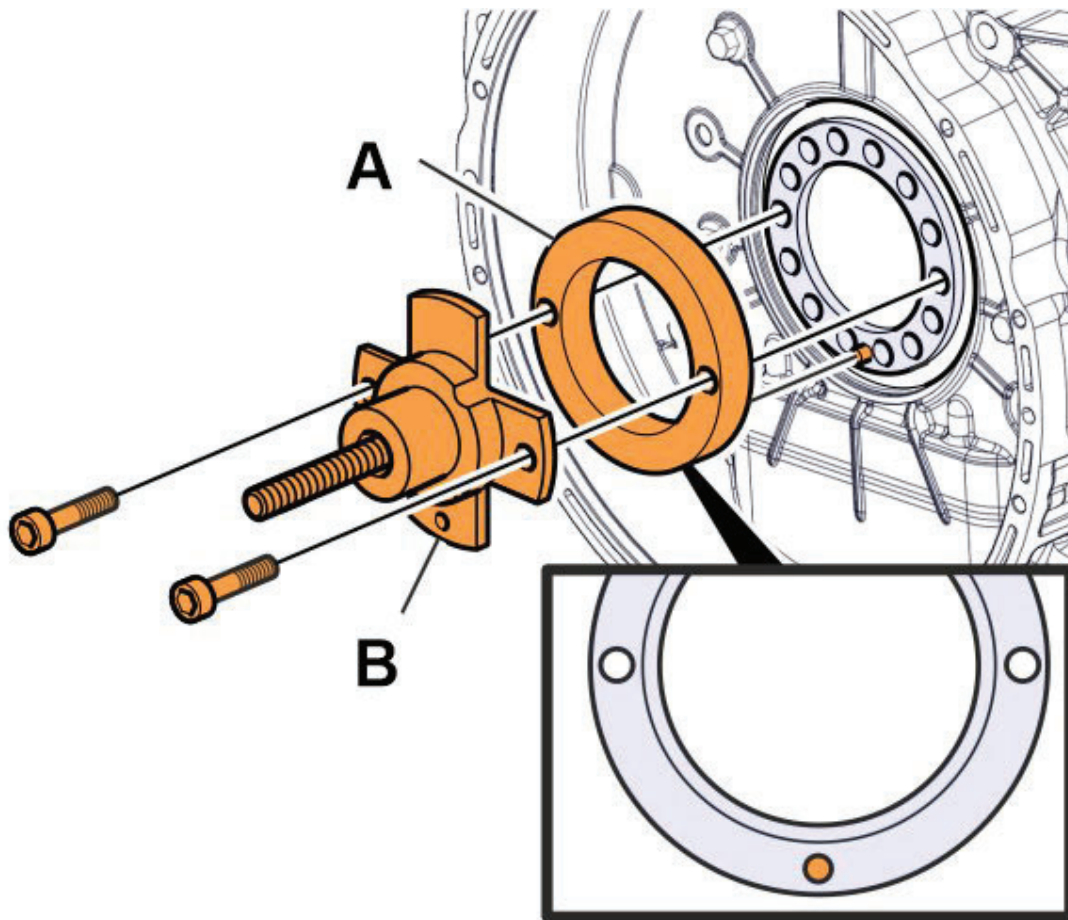
339	Remove the alignment plate.
-----	-----------------------------



340	Clean the contact surfaces.
-----	-----------------------------



341	Install the spacer and the tool on the crankshaft.		
342	Install the screws.		
	Required material		
	A	ASSEMBLY TOOL	88800619
	B	ASSEMBLY TOOL	9990166
	Service hint		
	Ensure that the spacer and the tool are properly positioned on the crankshaft's internal guide and are flat against the crankshaft before tightening the screws.		

**343** Position the seal.**Note**

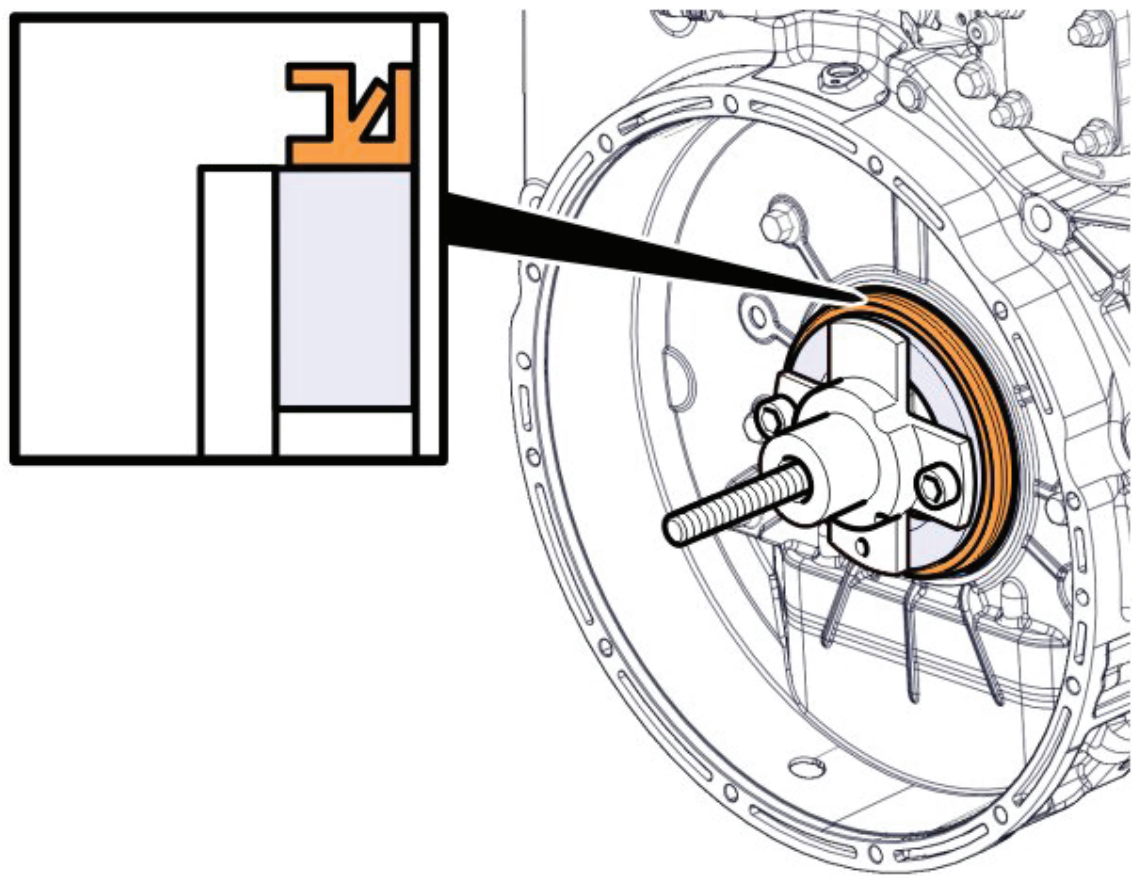
Always use a new type of seal.

**Note**

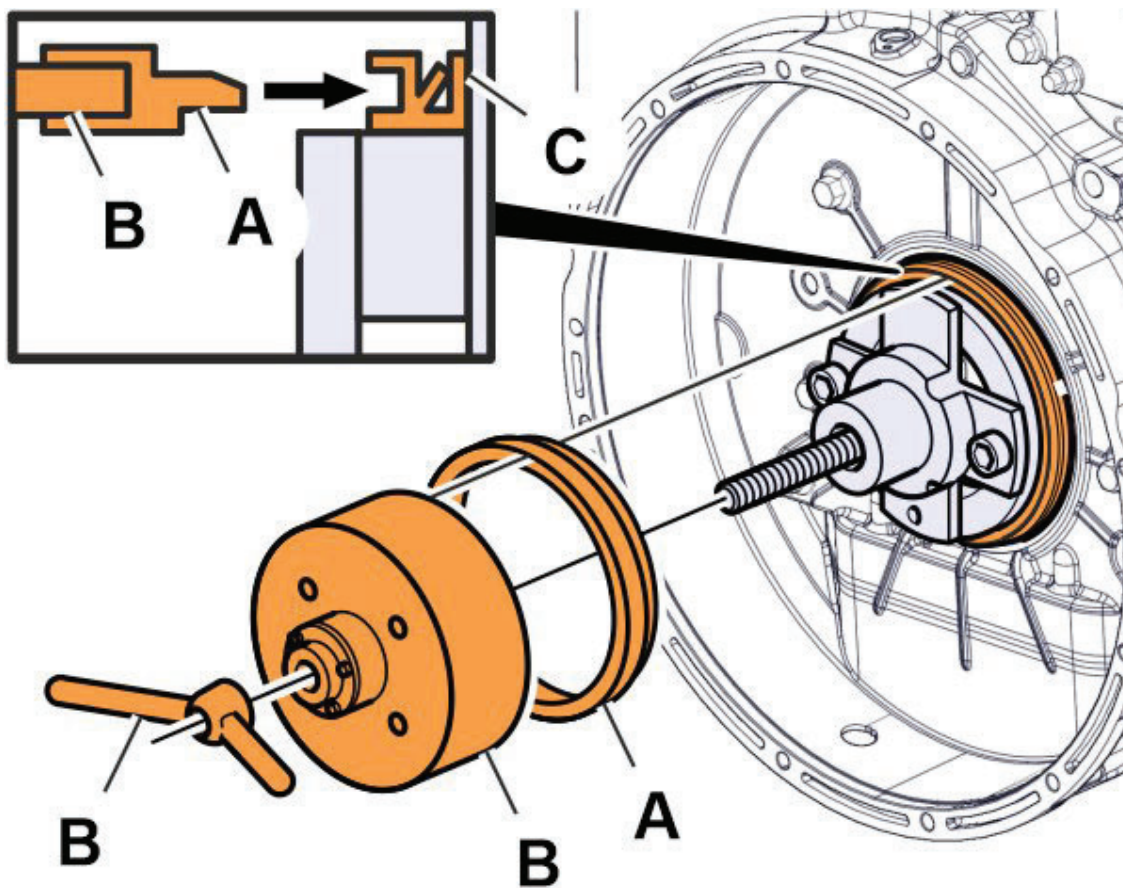
Lubricate the seal to facilitate installation.

**Service hint**

The text on the seal must be turned away from the engine.



344	Install the installation tool.		
	Required material		
	A	ASSEMBLY TOOL	88800619
	B	ASSEMBLY TOOL	9990166
	C	Seal	

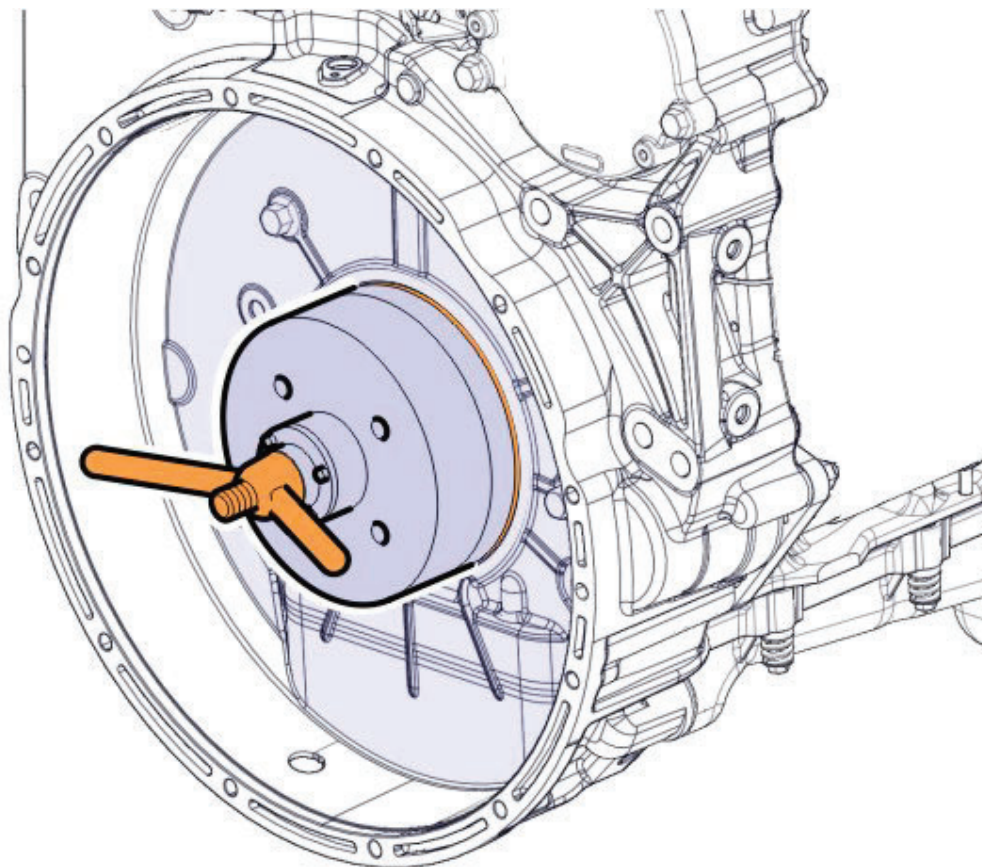


345 Press the cassette seal into place by turning the handle.

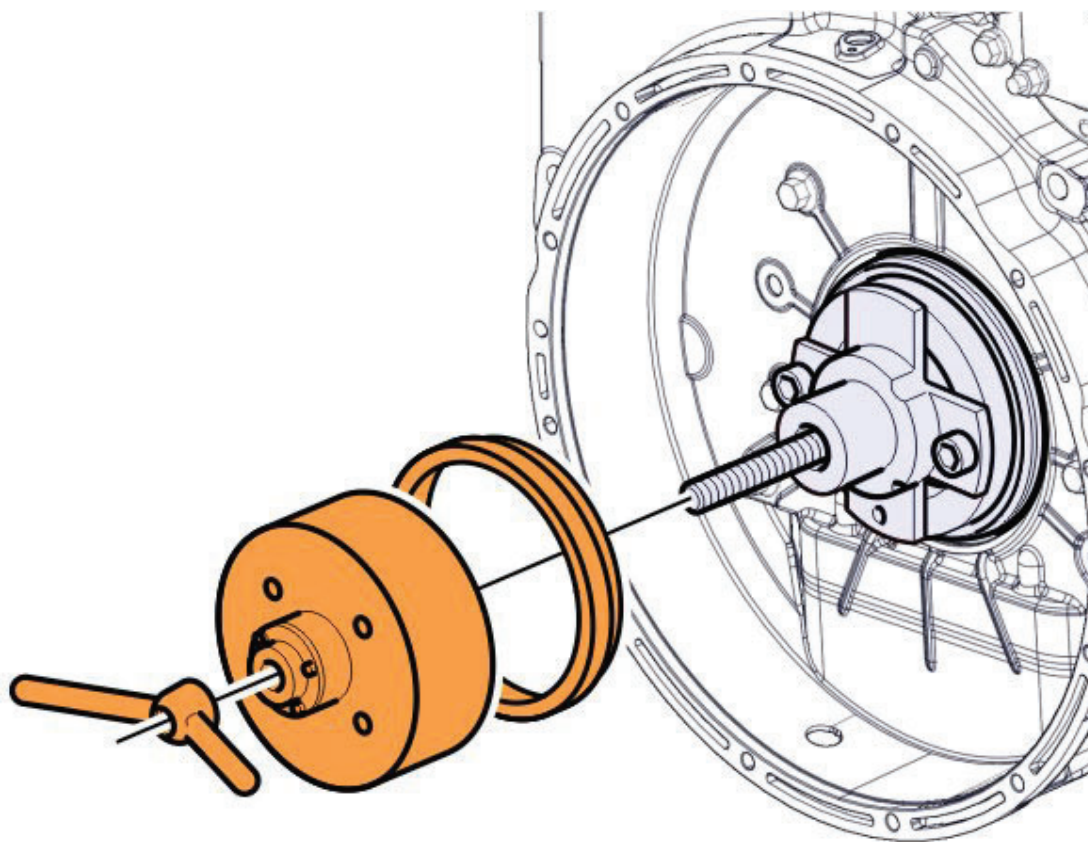


Note

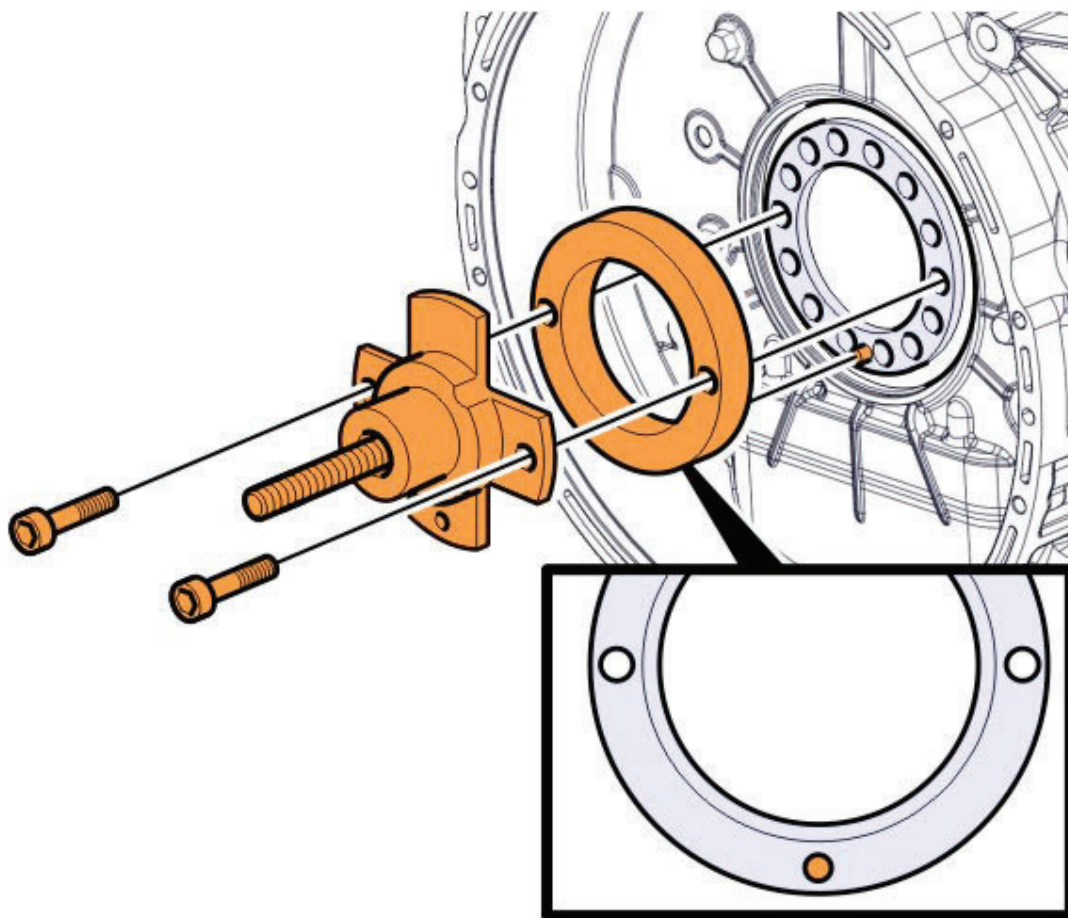
The cassette seal is correctly located in the flywheel housing when the tool bottoms out.



346	Remove the adapter and cover.
------------	-------------------------------



347	Remove the tool and the spacer.
------------	---------------------------------



348 Fill the filters with engine oil.



Note

Use new filters.

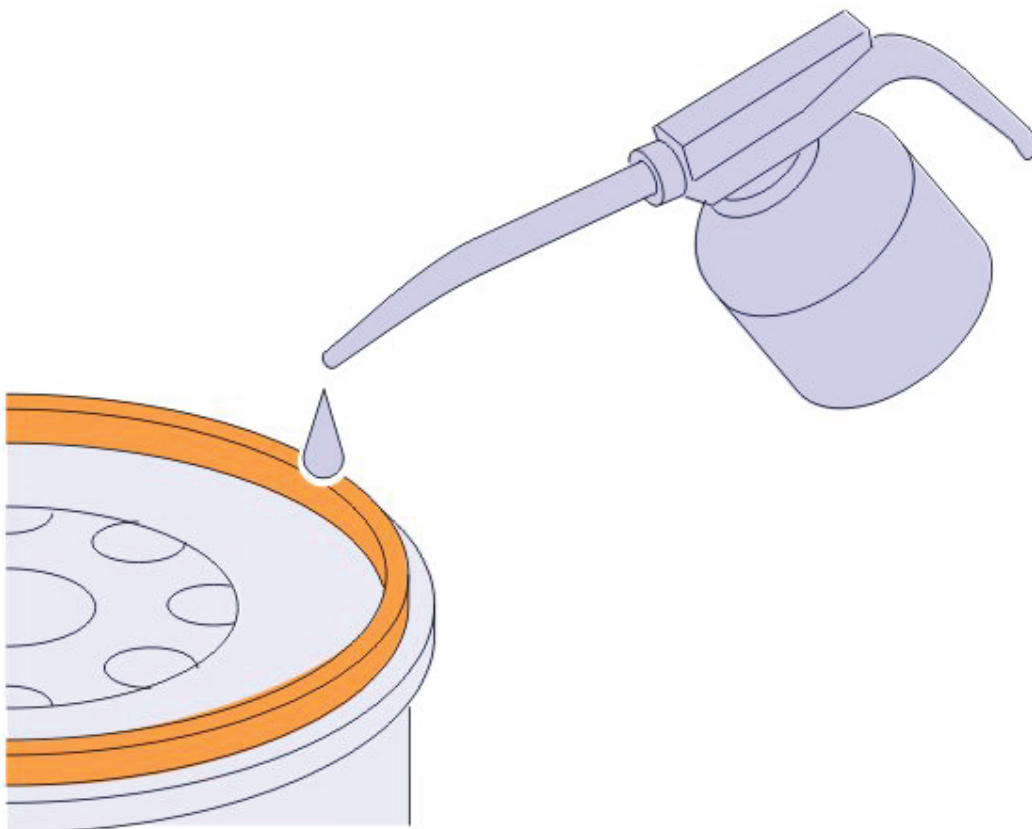


349 Apply engine oil to the gasket.

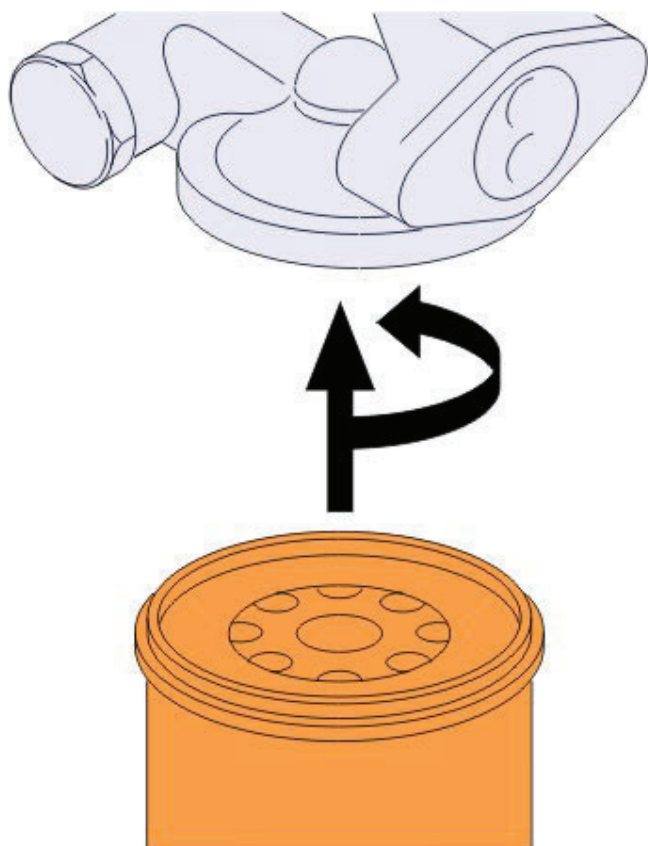


Note

Use recommended oil.

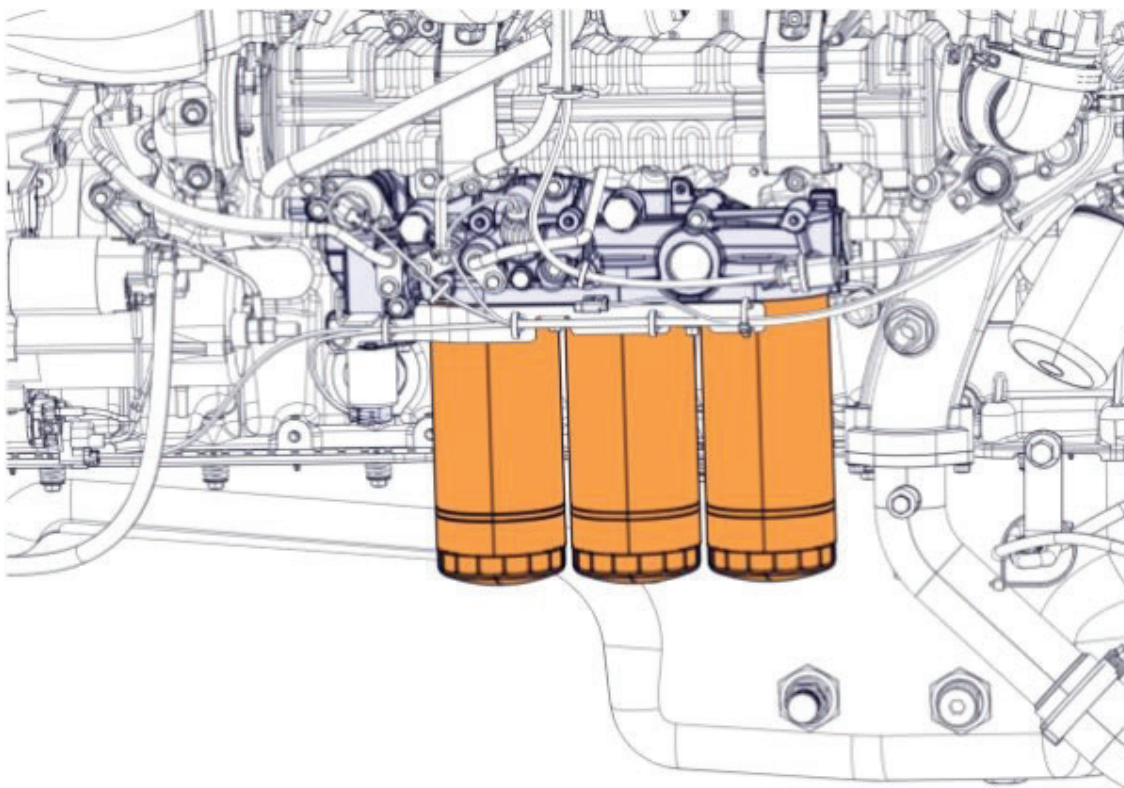


350	Install the filters.
-----	----------------------



 DANGER	
Risk of material damage, serious personal injury or death.	
Connections that are not tightened in accordance with specified tightening torques may cause leakage.	
▶	Tighten connections according to service information.

351	Torque-tighten the filters.	
	Tightening torque	
	Oil filter	25^{+5}_0 Nm $(18^{+4}_0 \text{ lb}_f\cdot\text{ft})$

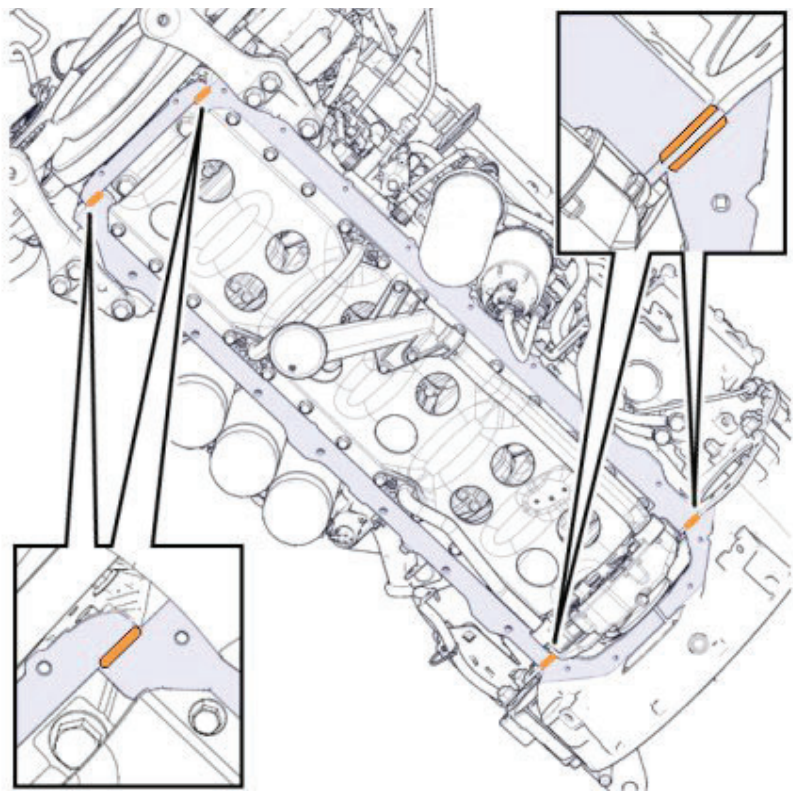


352	Clean the contact surfaces.	
	i	Note Ensure that the surfaces are completely clean of oil and grease

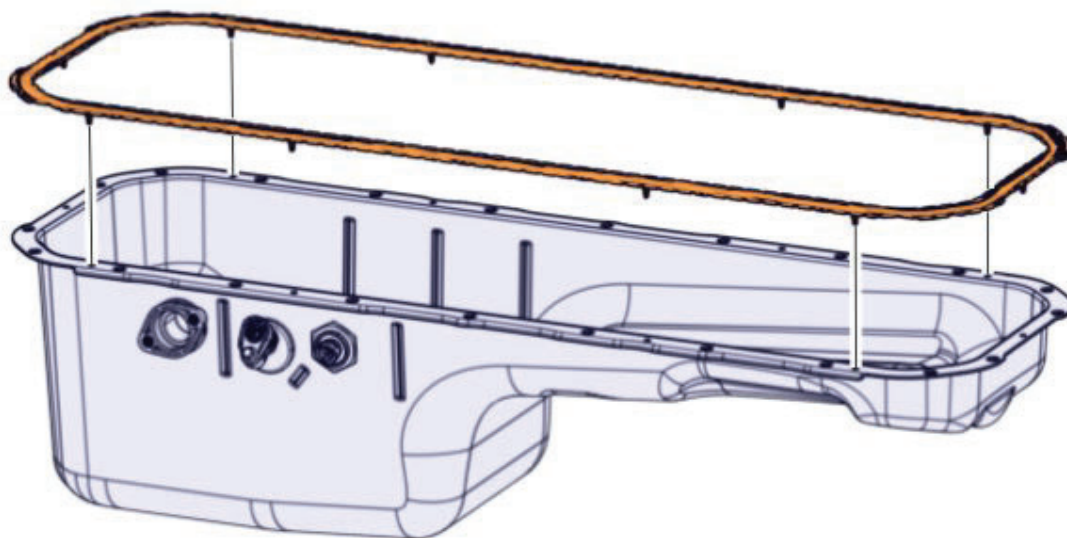
353	Remove hardened sealant.
------------	--------------------------

354	Apply recommended sealant as illustrated.
	Tech data

	Sealant, bead thickness	2 mm (0.08 in)



355	Install the gasket.	
		Note Use a new part.
		Note Install the gasket within 20 minutes of sealant application.

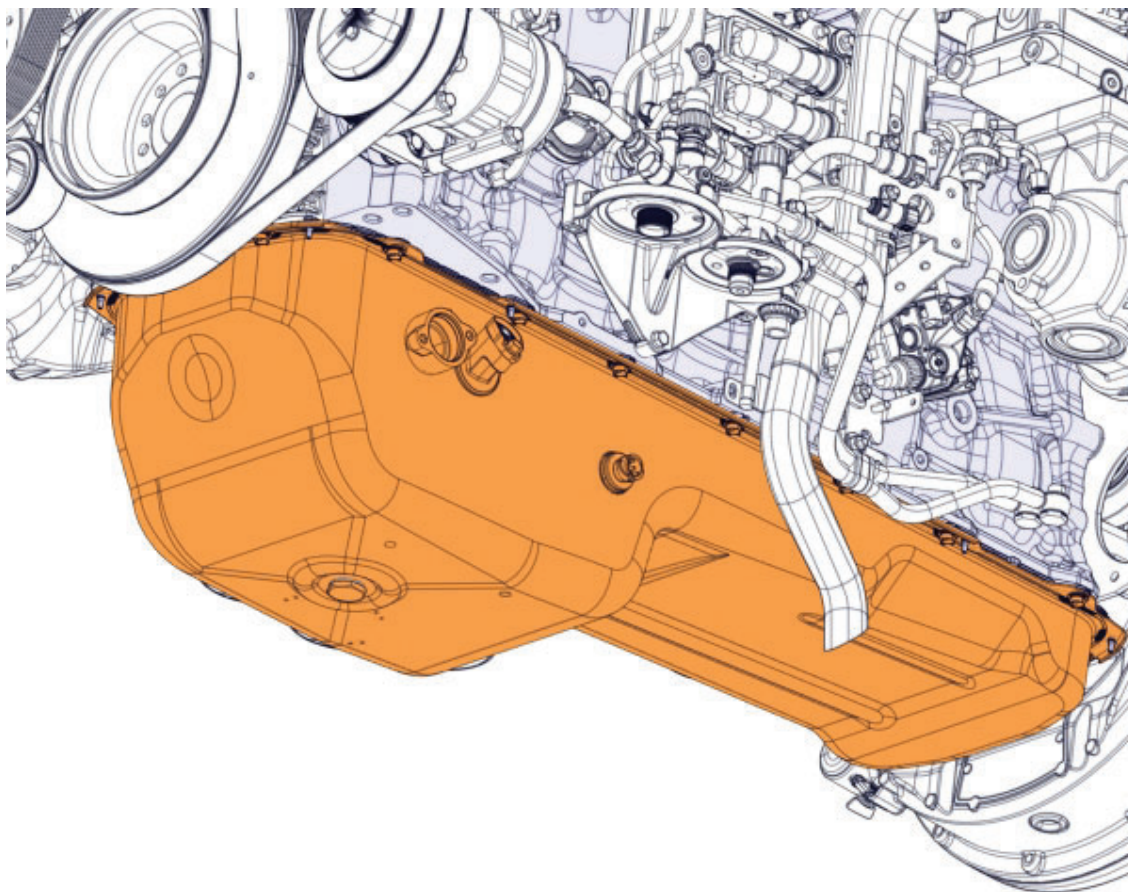


356 Install the oil pan.

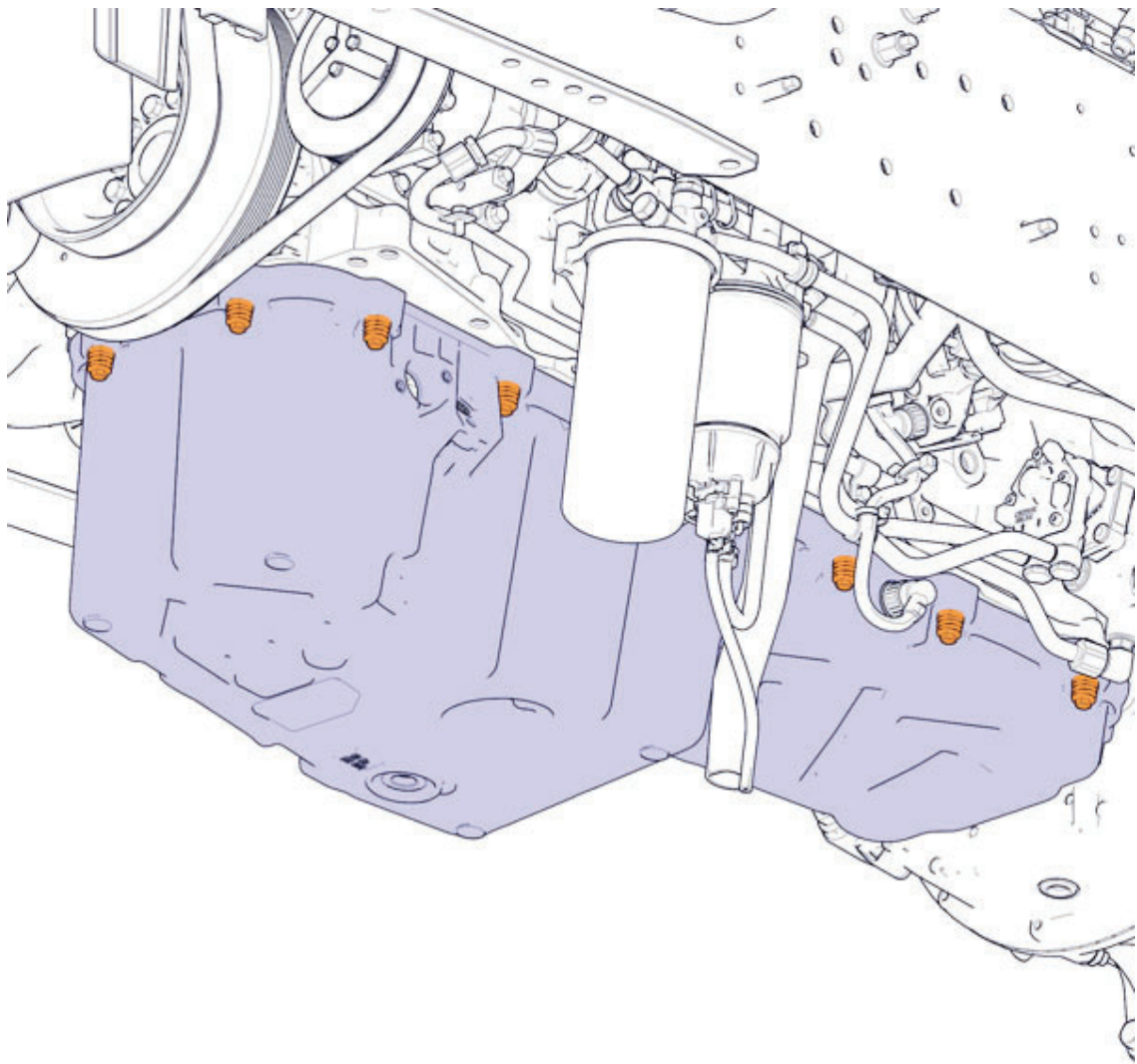


Note

Assistance may be required.

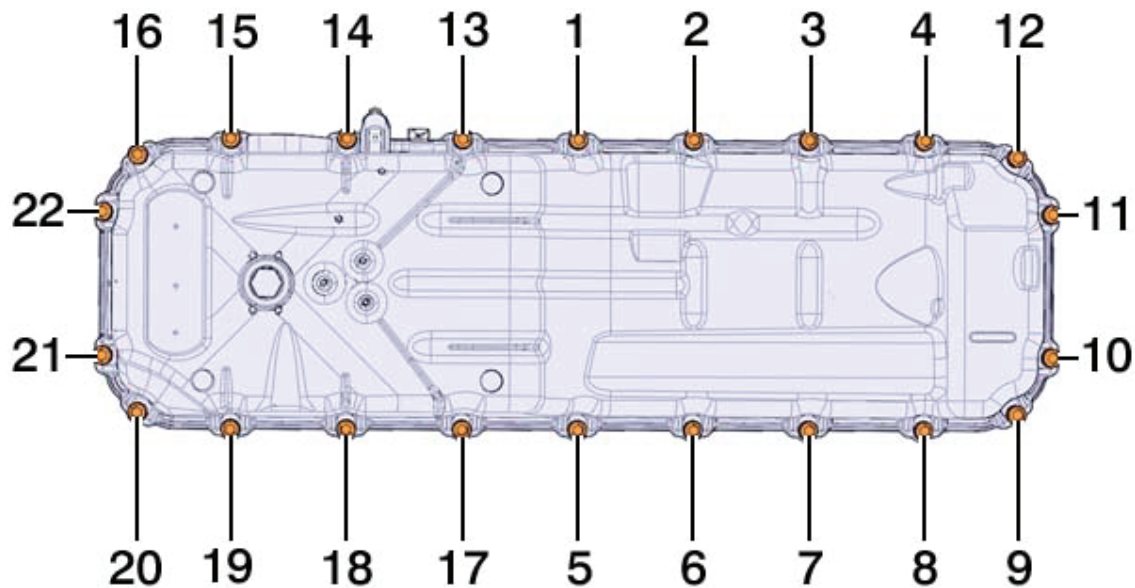


357	Install the screws.
------------	---------------------



358	Torque tighten the screws.
------------	----------------------------

Tightening torque	
Oil pan, screw	Tightening sequence: 1-22
	24 ±4 Nm
	(18 ±3 lb _f ·ft)



359 Install the seal.



Note

Use a new part.

360 Install the pipe (A).

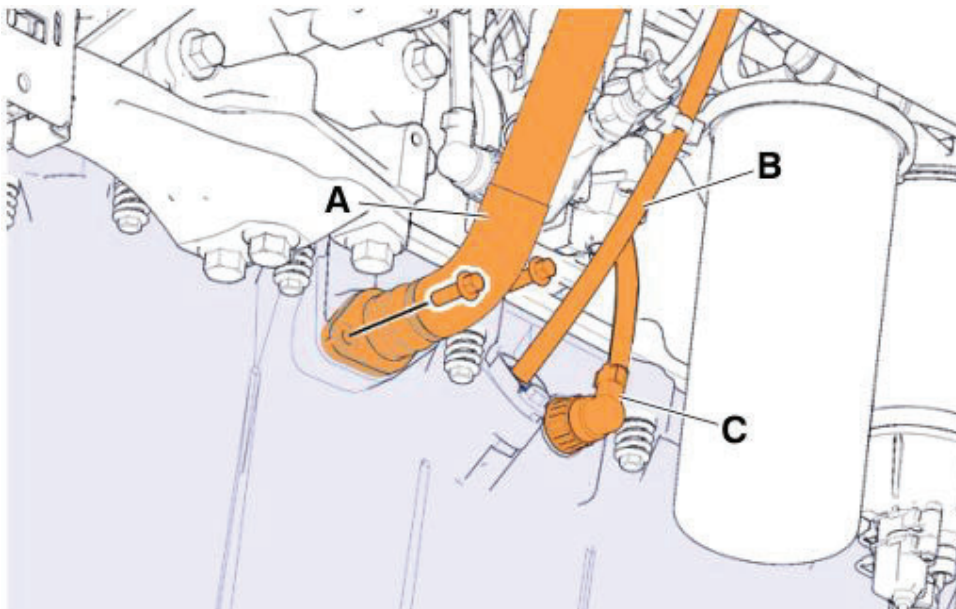
361 Install the outer casing (B).



Note

Check the outer casing for correct position.

362 Connect the connector (C).



363 This step contains 2 alternatives.

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

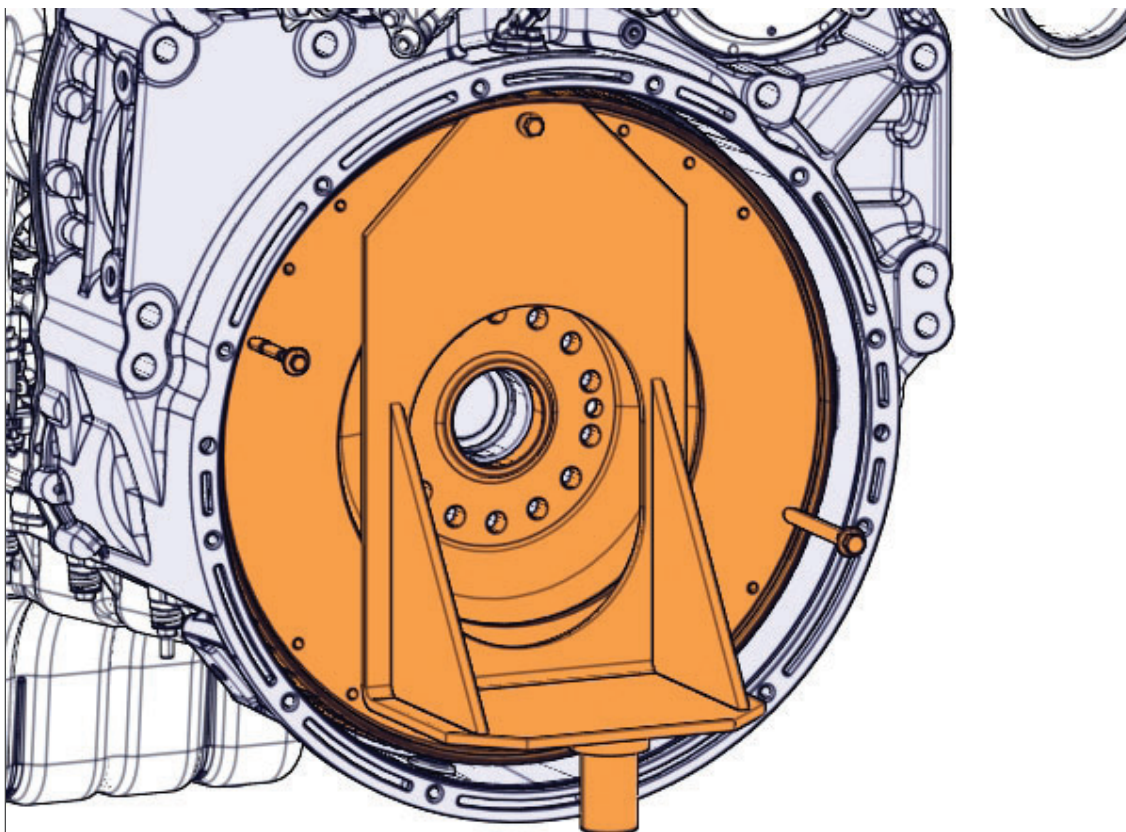
Select one of the valid alternatives below.

Alternative 1 / 2

- ▶ Clean the crankshaft flange.
- ▶ Check the crankshaft seal.



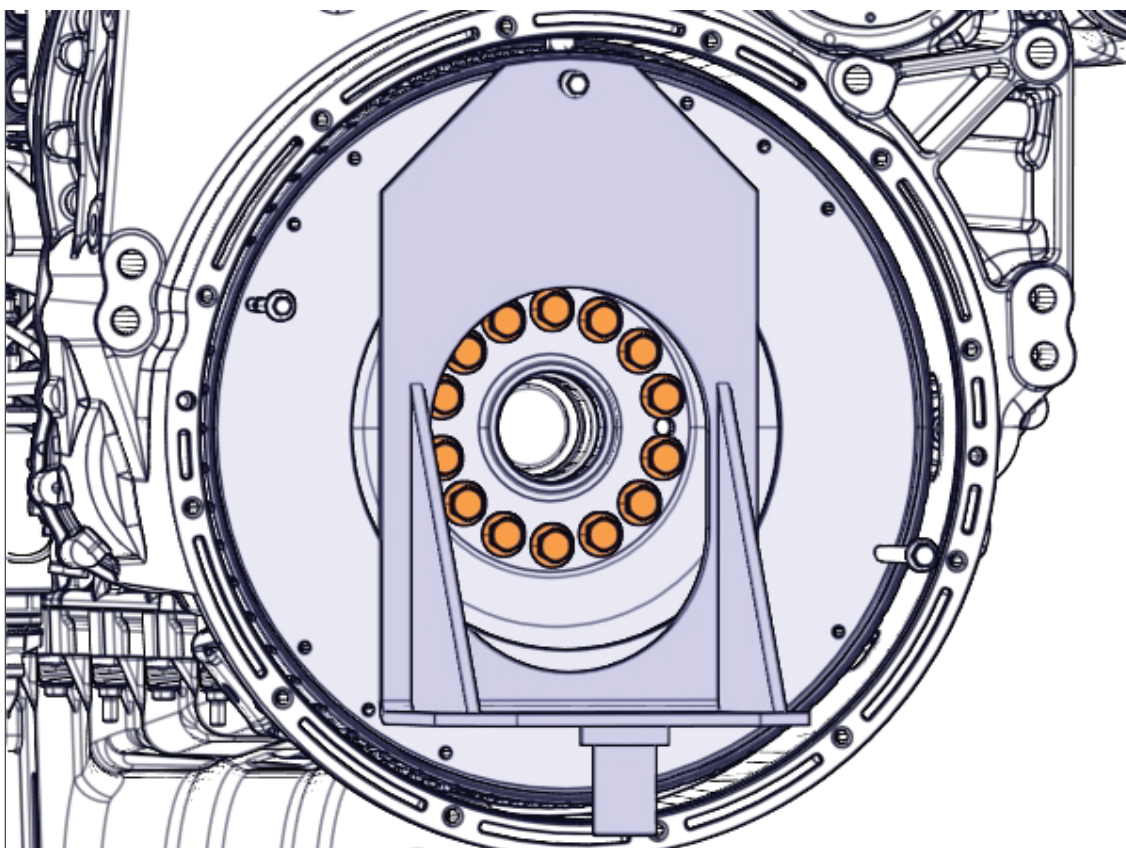
- ▶ Install the flywheel.



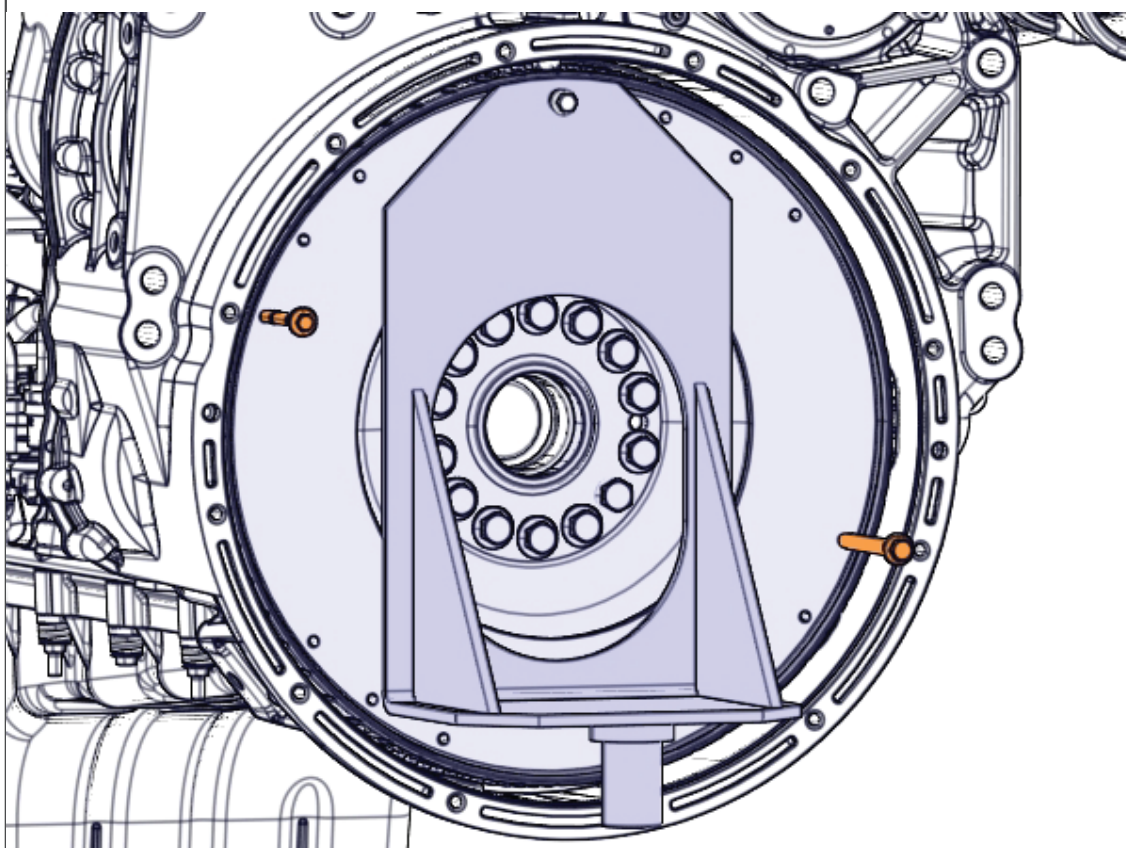
- Fit the screws.

**Note**

Hand tighten the screws.

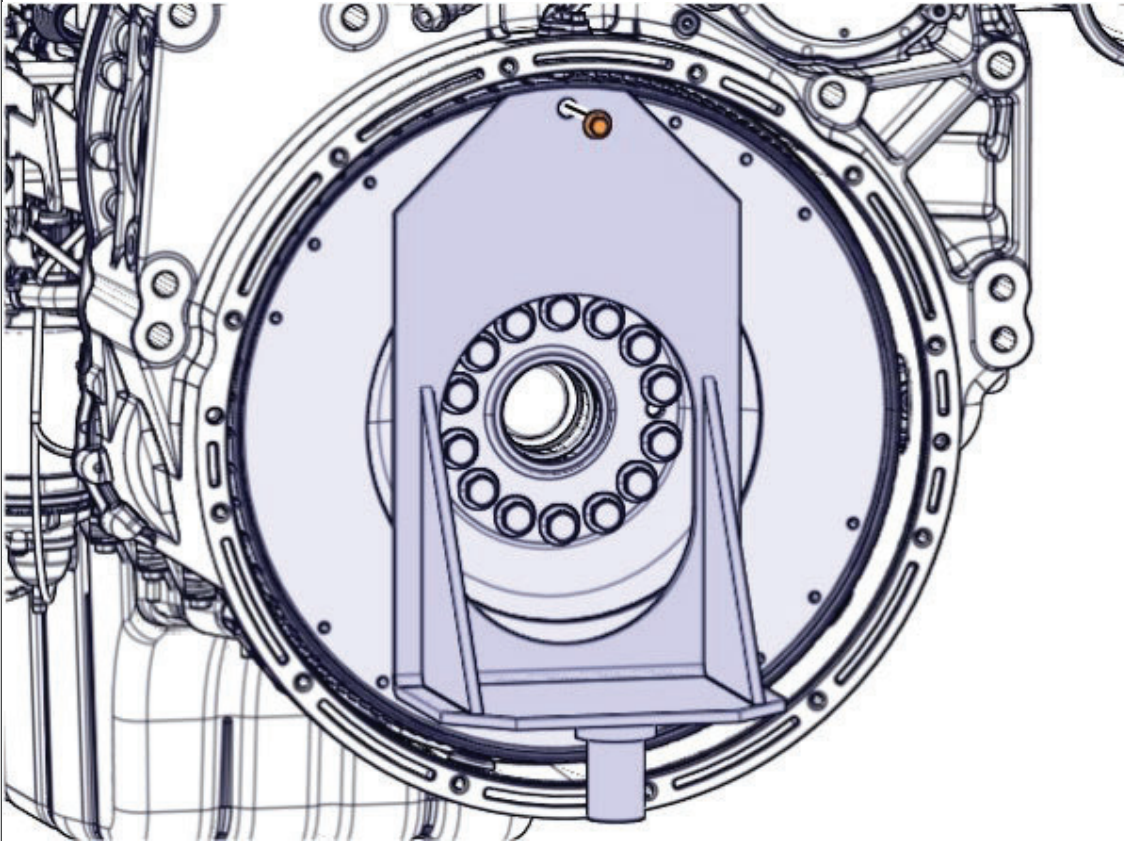


► Remove the screws.



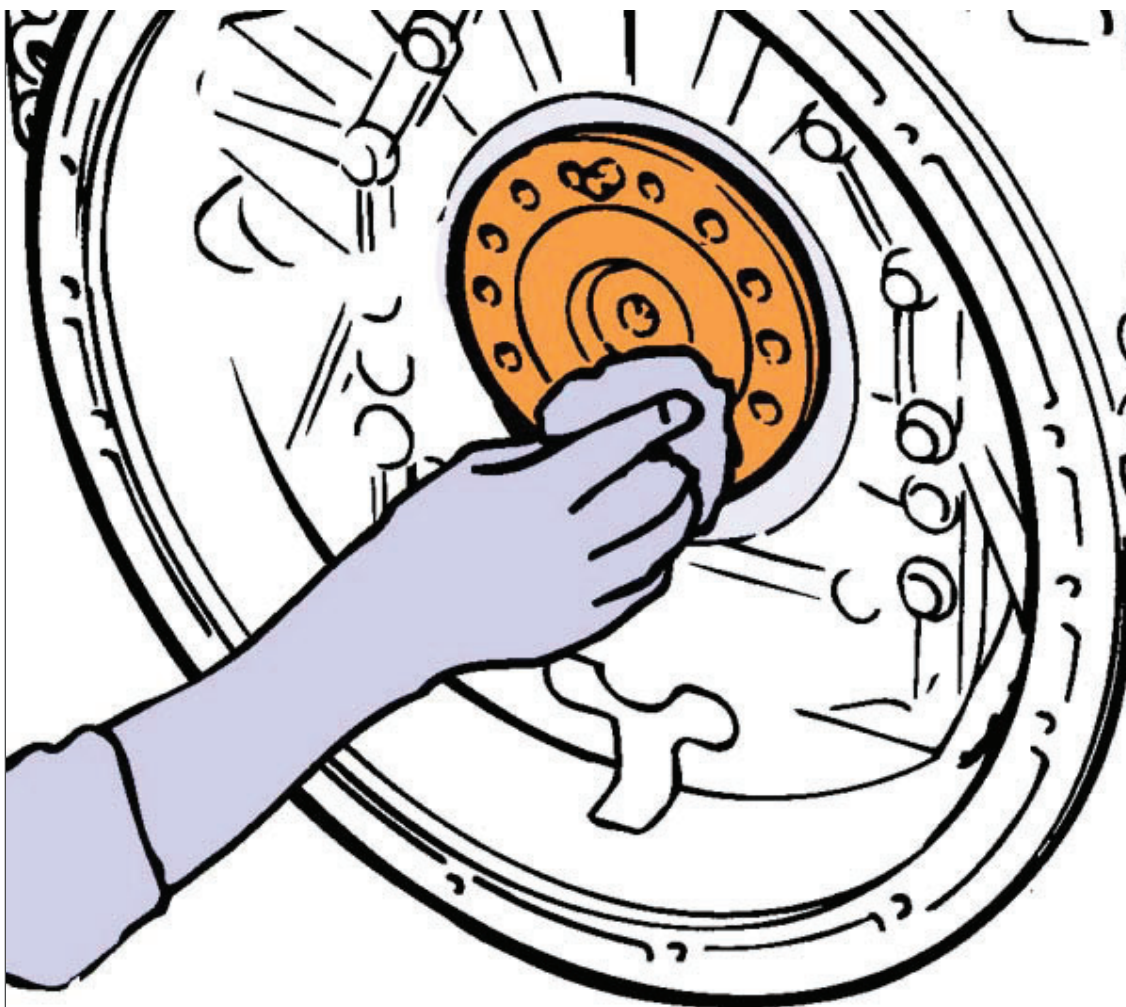
► Remove the screw.

- ▶ Remove the tool.

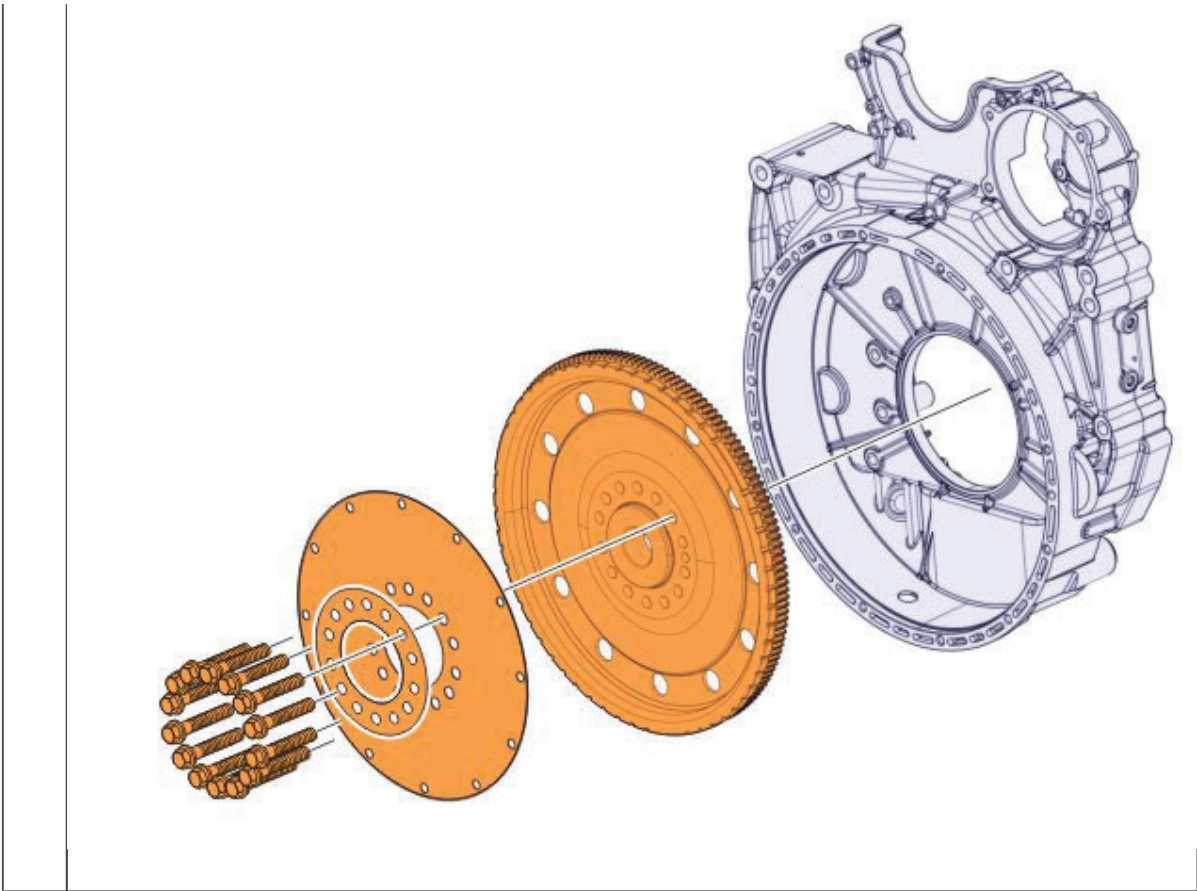


Alternative 2 / 2

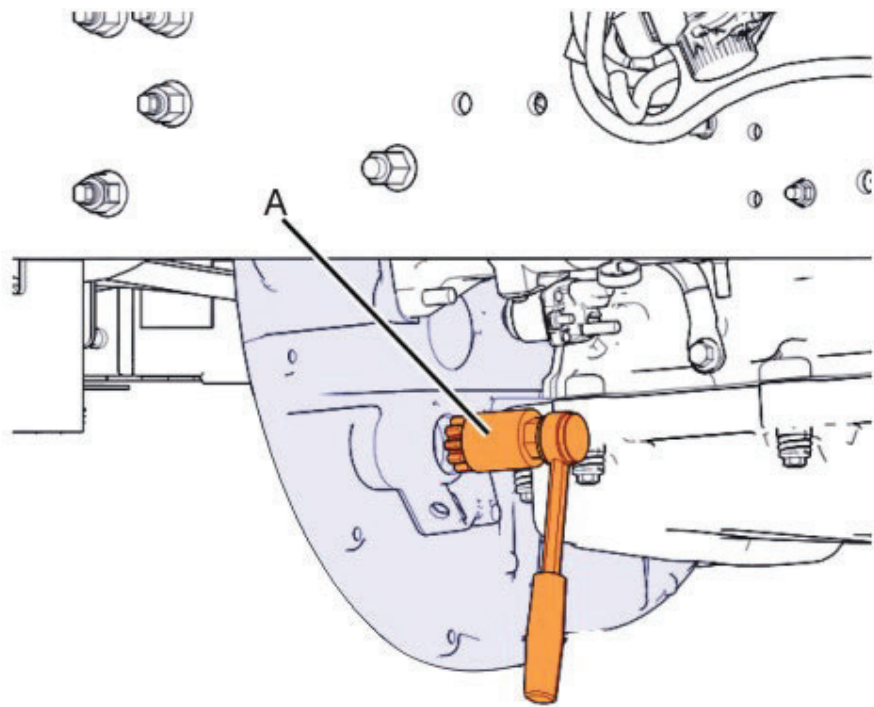
- ▶ Clean the crankshaft flange.
- ▶ Check the crankshaft seal.



▶	Install the flywheel.
▶	Install the flexplate.
▶	Install the thrust plate.
▶	Fit the screws.
i Note Hand tighten.	

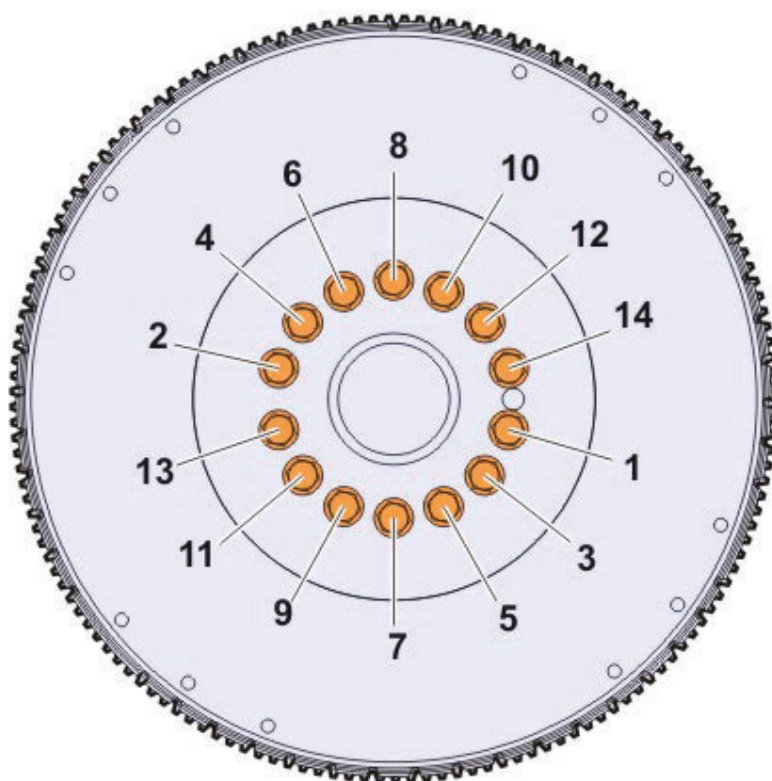


364	Install the cranking tool (A).	
	Required material	
	CRANKING TOOL	88840317



365	Torque tighten the screws.
-----	----------------------------

Tightening torque		
Flywheel, screw	1.	Tightening sequence: 1-14
		60 ±5 Nm (44 ±4 lb _f ·ft)
	2.	Tightening sequence: 1-14
		120 ±10°

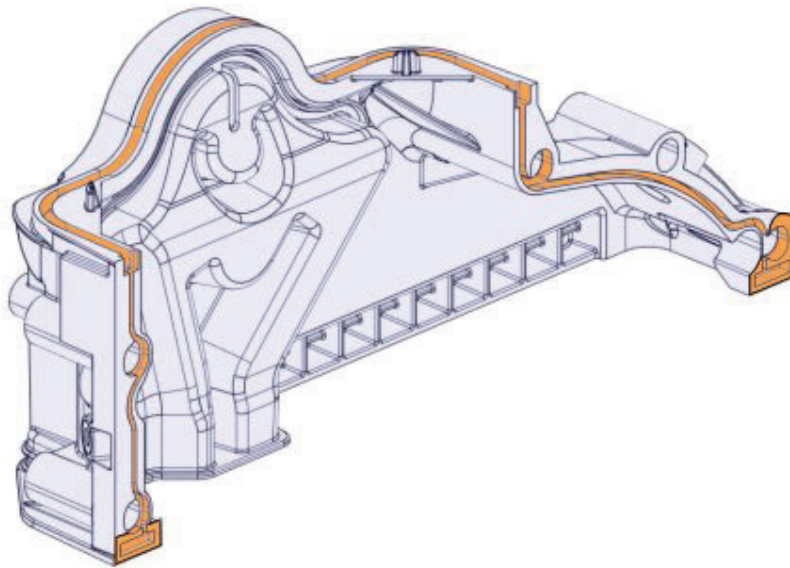


Note

Use the cranking tool with a drawbar handle as counterhold.

366

Clean the contact surfaces.

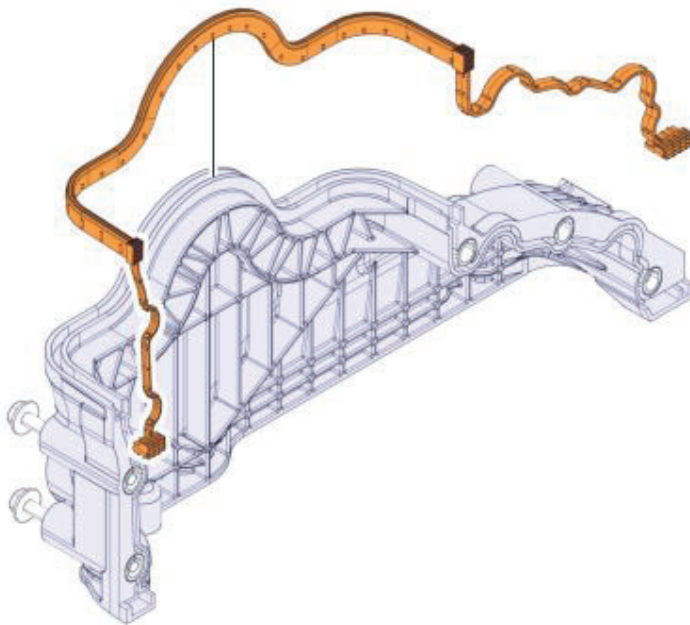


367 Install the gasket.



Note

Use a new part.



368 Clean the contact surfaces carefully.

369 Install the timing gear cover.



Note

Take care not to damage the gasket.

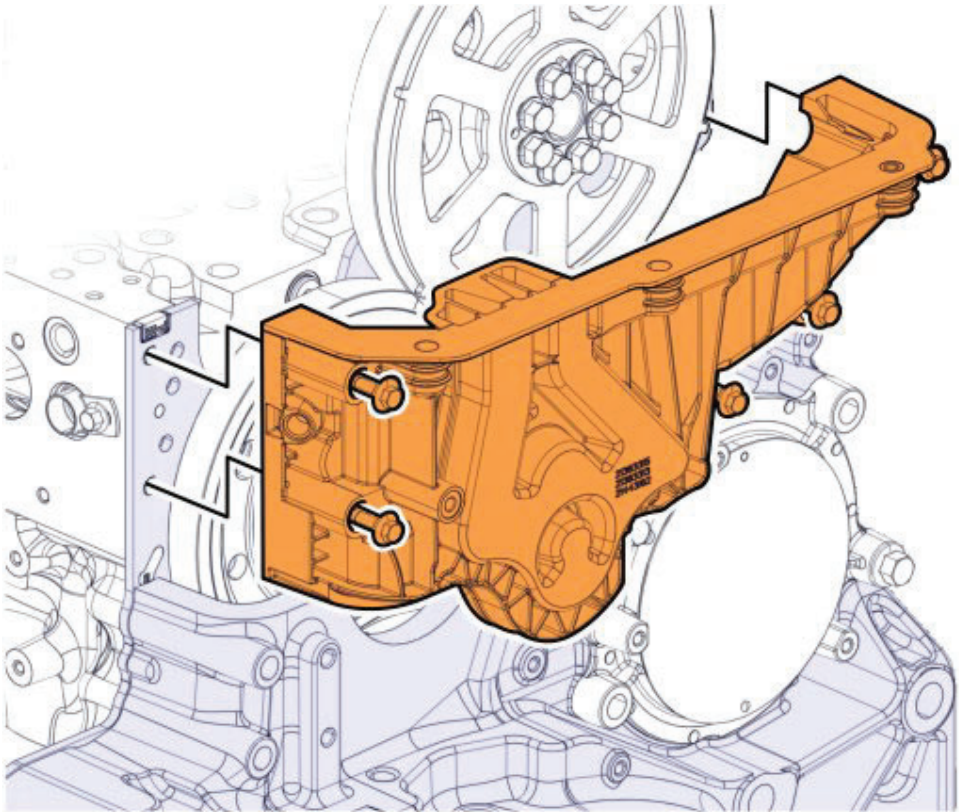
Note

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

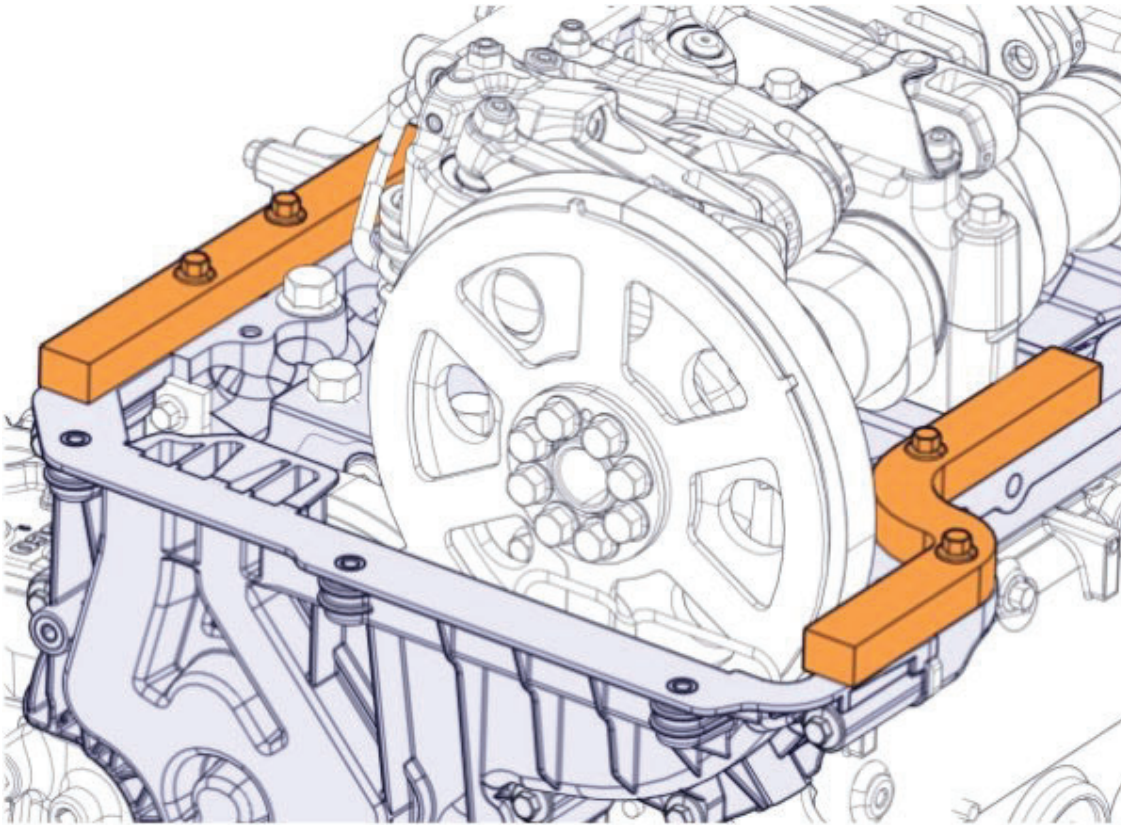
The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.



Check that the gasket is correctly located in the groove.



370	Install the tools.	
	Required material	
	kit	88870012



371 Gently tighten the timing gear cover screws.



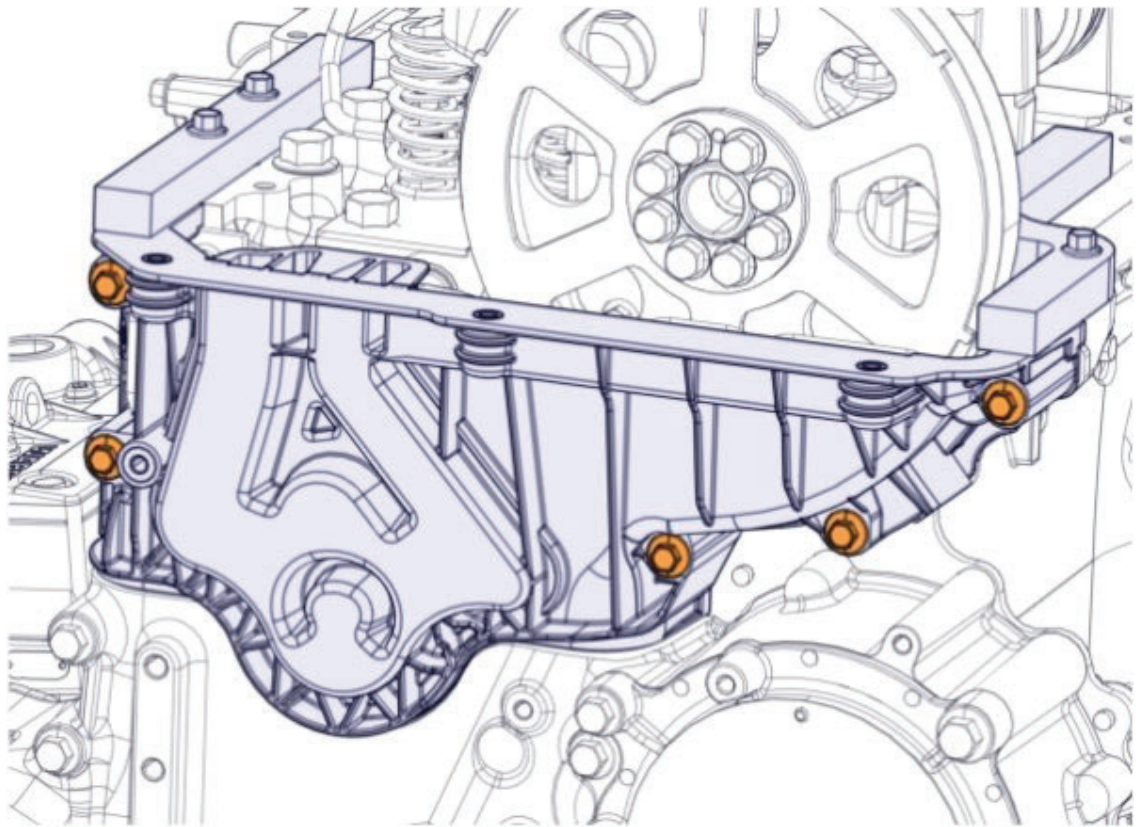
Note

Ensure that the timing gear cover aligns with the cylinder head on both sides.



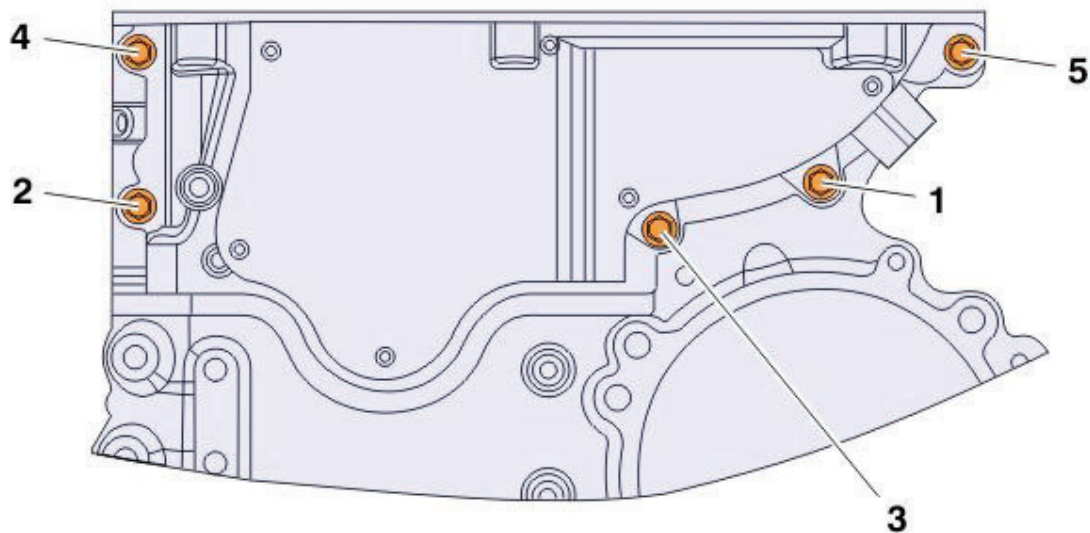
Note

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

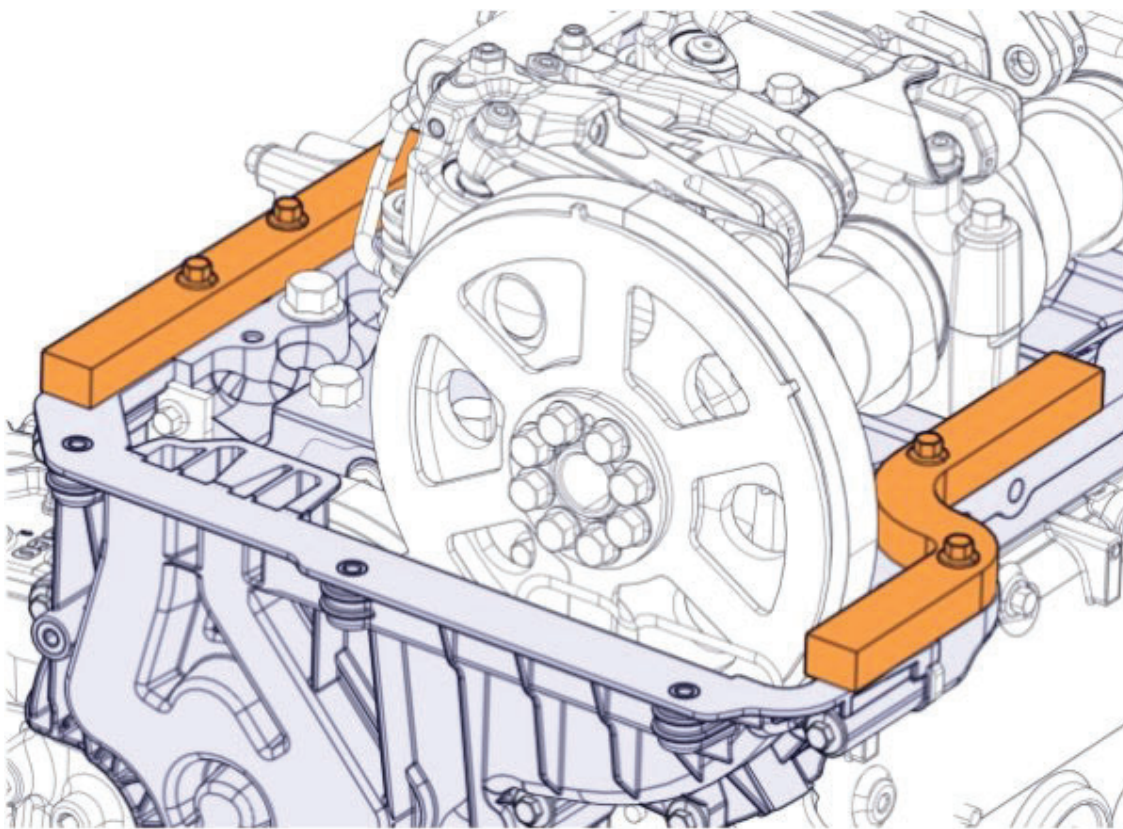


372	Torque tighten the screws.
-----	----------------------------

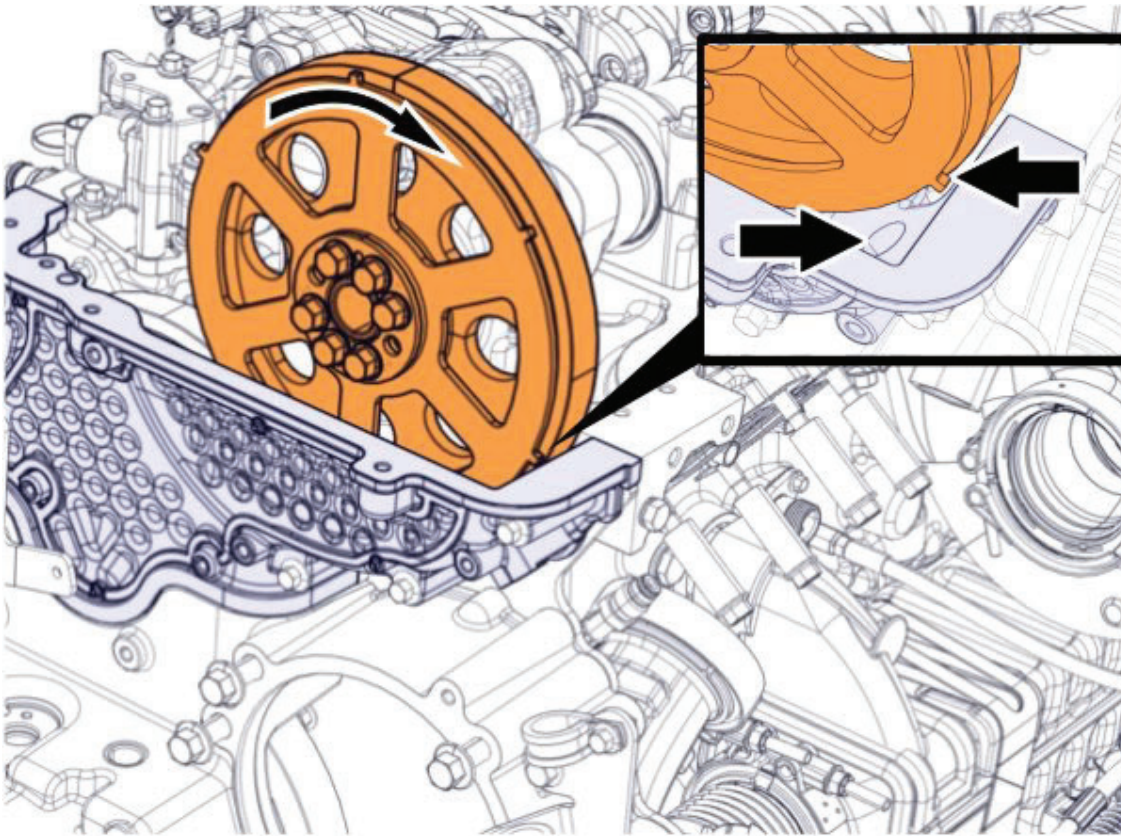
Tightening torque		
Upper timing gear casing, screw	1.	Tightening sequence: 1–2
		4 ±1 Nm (3 ±1 lb _f ·ft)
	2.	Tightening sequence: 1–5
		27 ±3 Nm (20 ±2 lb _f ·ft)



373 Remove the tools.

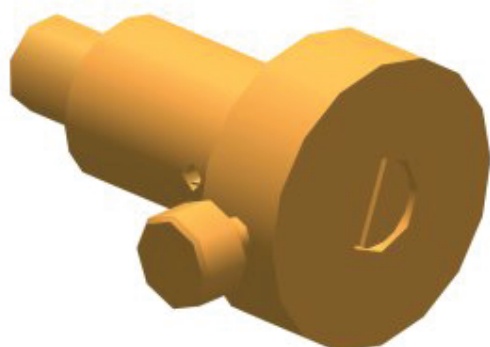


374 Rotate the gear so that a tooth on the sensor wheel aligns with the sensor location.

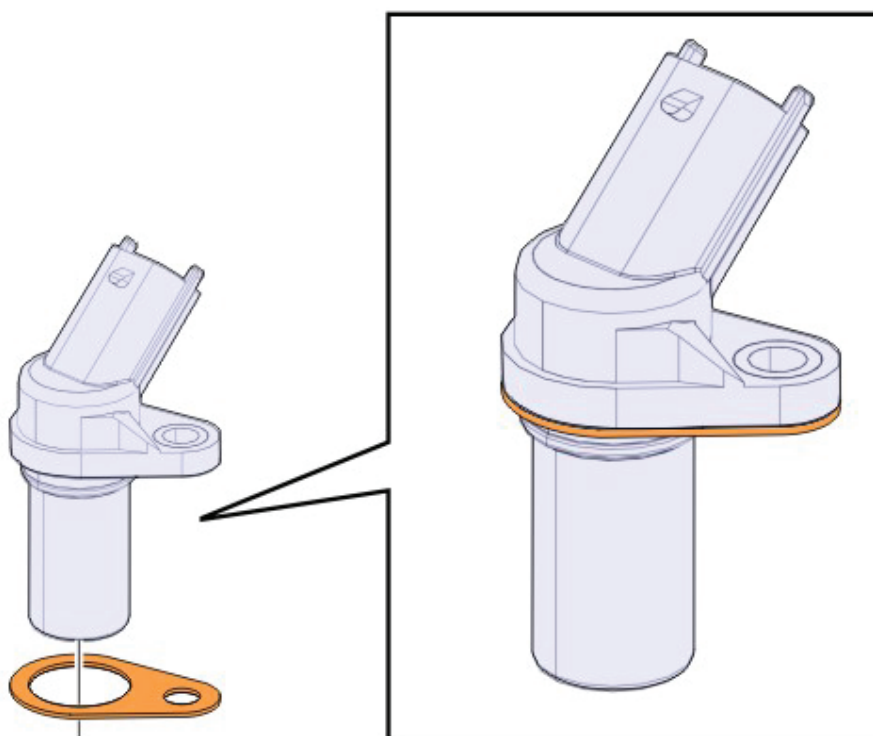


375	Install the setting tool.	
	Required material	
	SETTING TOOL	88800031

376	Read off the setting tool.	
	Impulse sensor, number of shims	
	Conditions: A: No edge outside the tool.	0 pcs
	Conditions: B: One edge outside the tool.	1 pc
	Conditions: C: Two edges outside the tool.	2 pcs



377	Remove the setting tool.
378	Install the shims as needed.



379	Remove the old sealant from the contact surfaces (A).
	Note Ensure that the surfaces are completely clean of sealant.

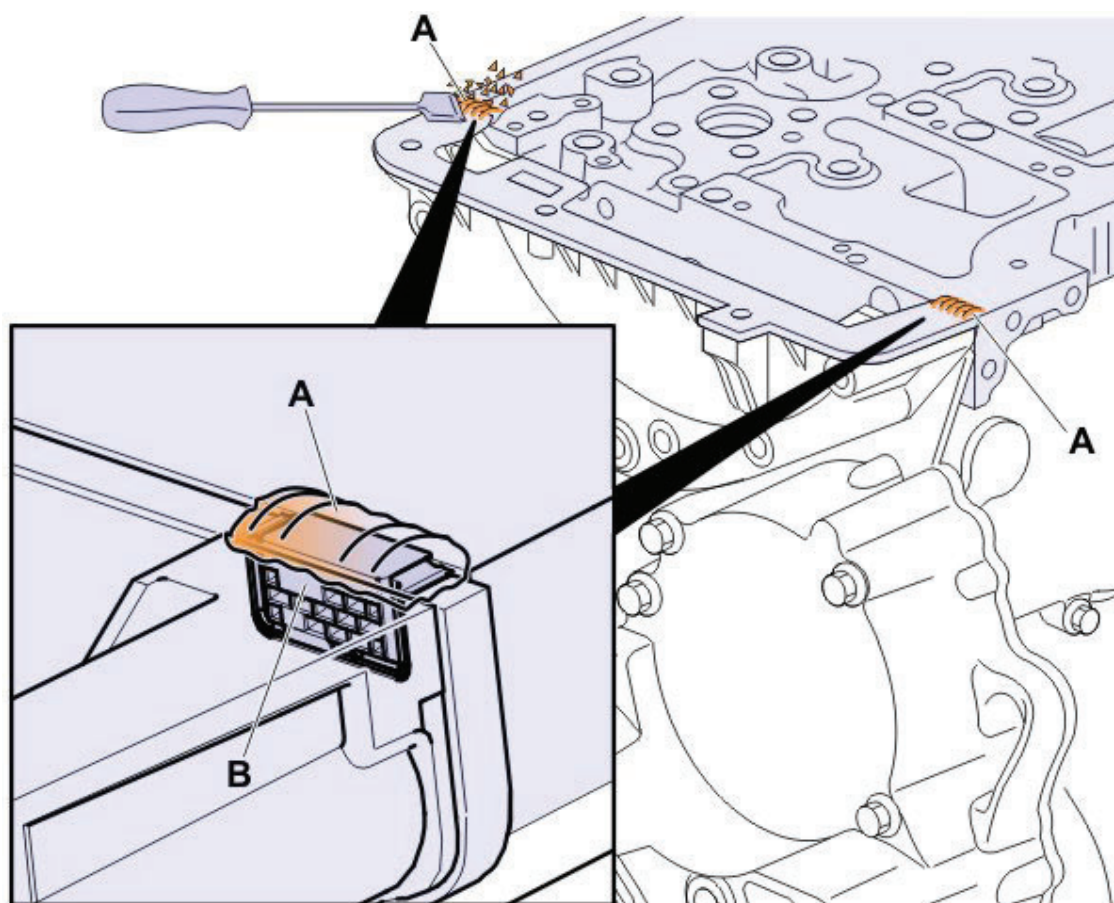
Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.



Note

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



380 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)
-------------------------	-------------------



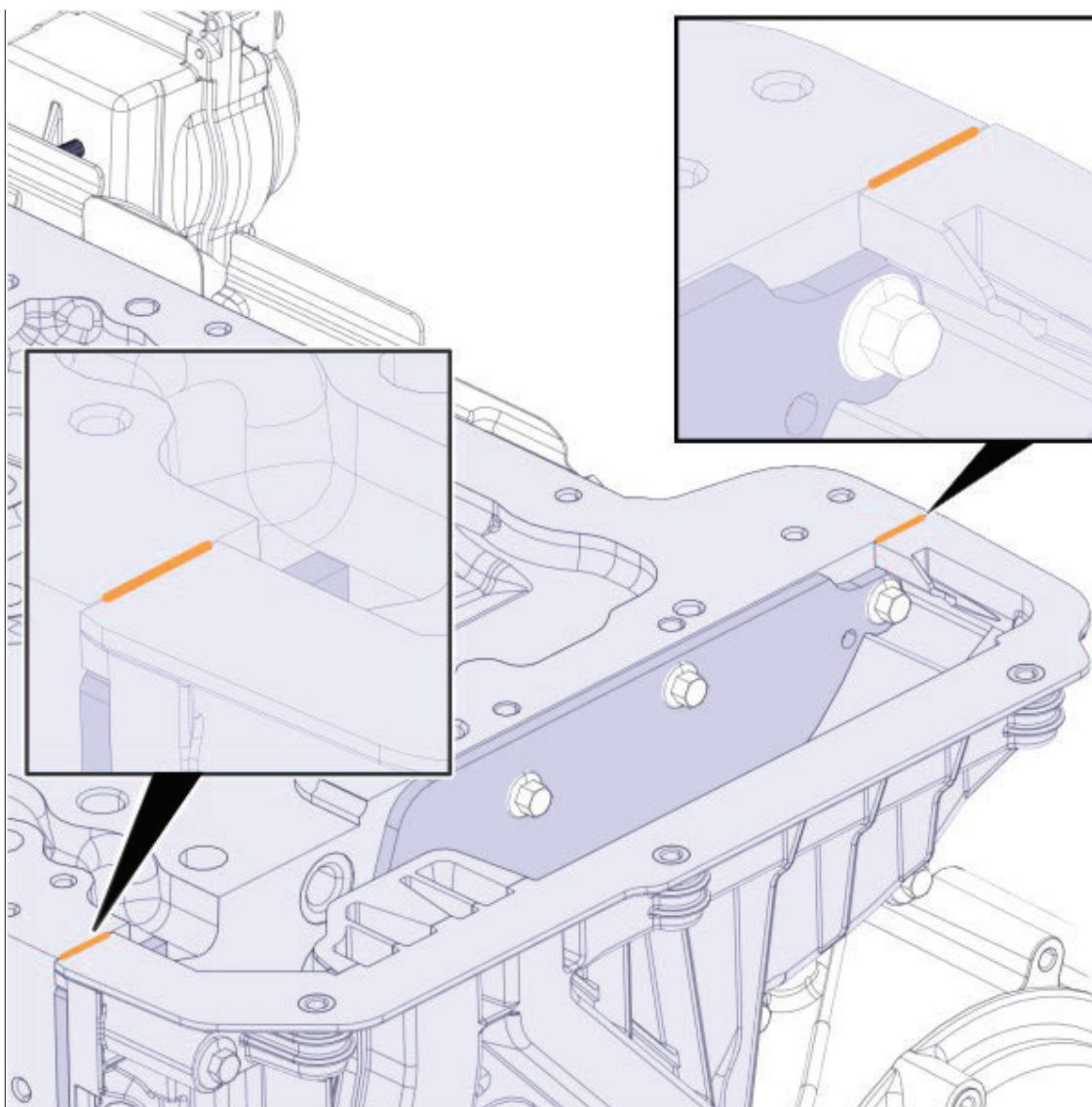
Note

Use recommended sealant.



Note

Install the valve cover within 20 minutes of applying the sealant.



381 Perform this procedure when the condition below is met.

Conditions

- Timing gear plate with integrated seal

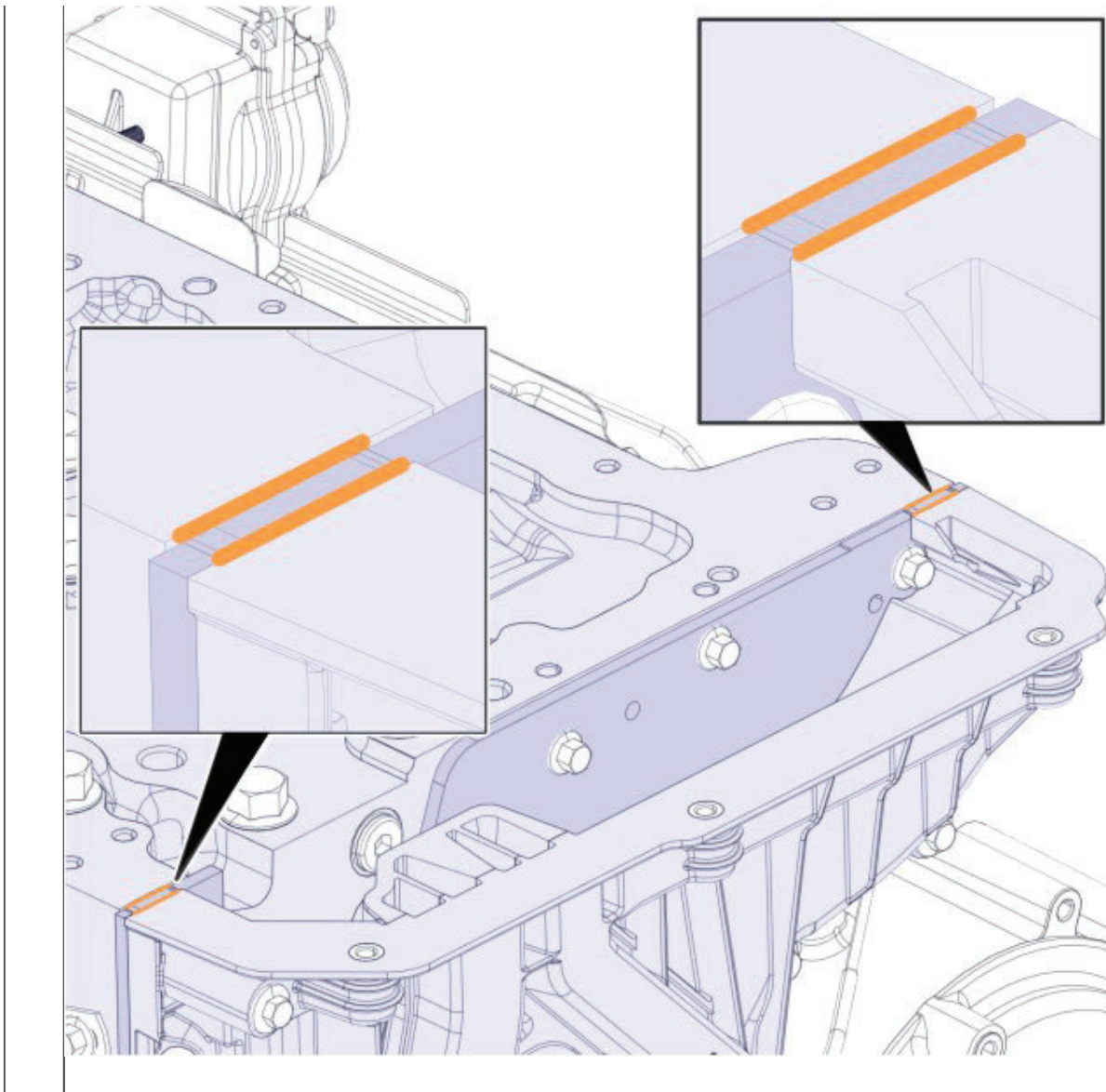
► Apply sealant.

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.



382 Clean the contact surfaces carefully.

383 Clean the groove.



Note

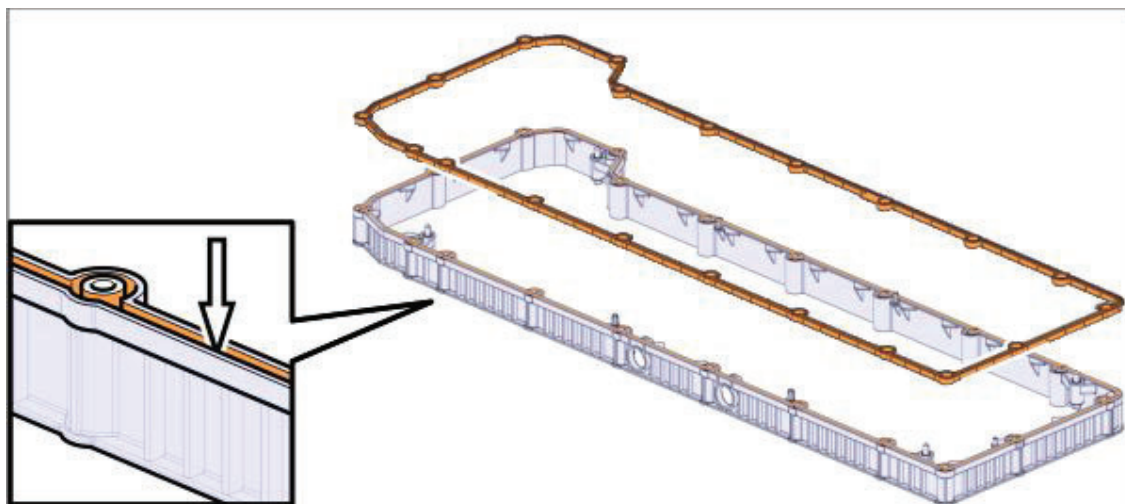
Ensure that the surfaces are completely clean from oil and grease.

384 Install the gasket.



Note

Use a new part.



385 Install the frame.

386 Tighten the screws to torque.

Tightening torque

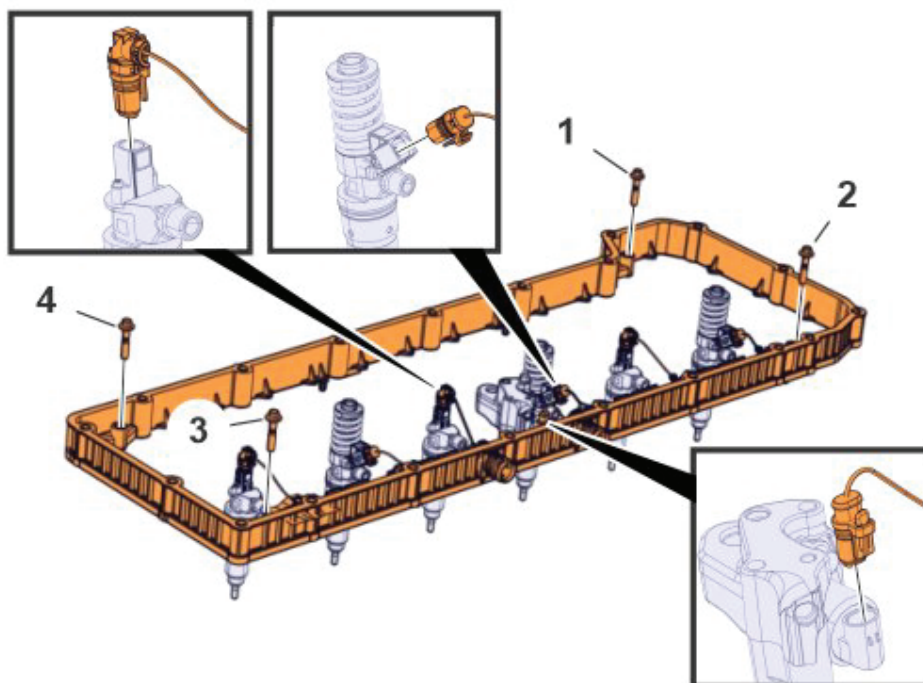
Lower valve cover, screw

Tightening sequence: 1-4

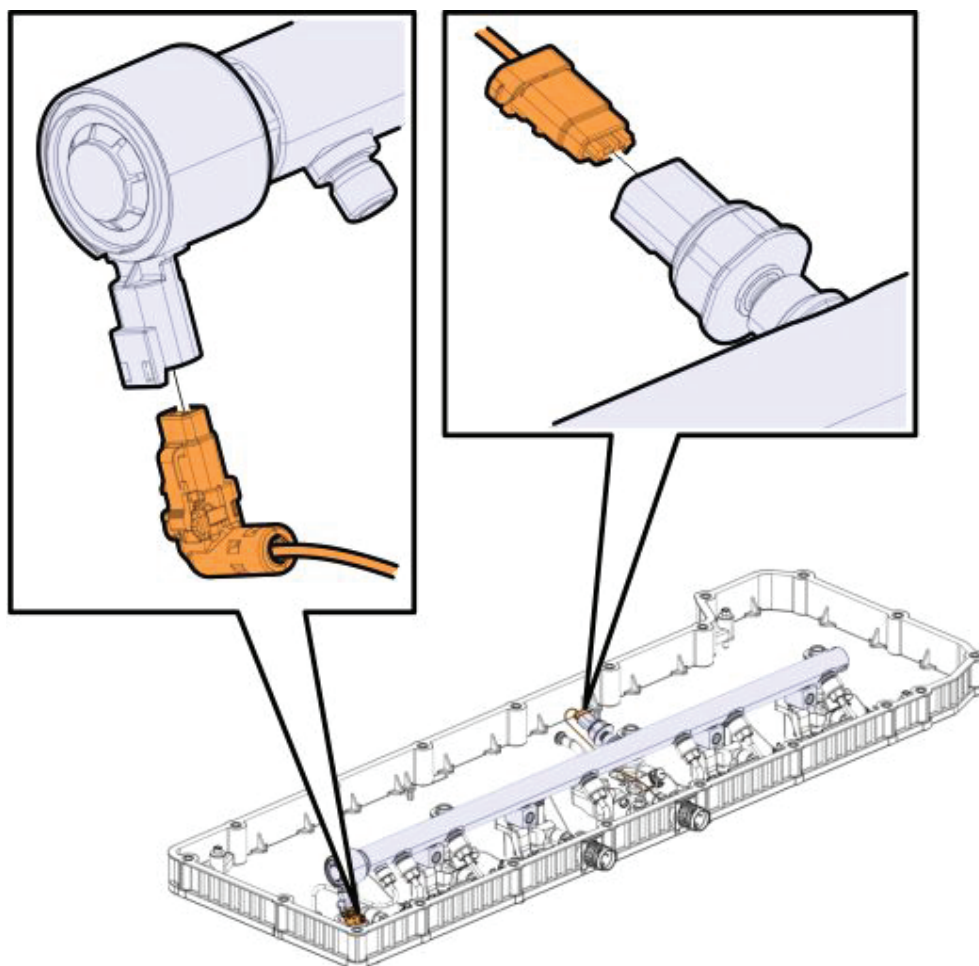
24 ±4 Nm

(18 ±3 lb_f·ft)

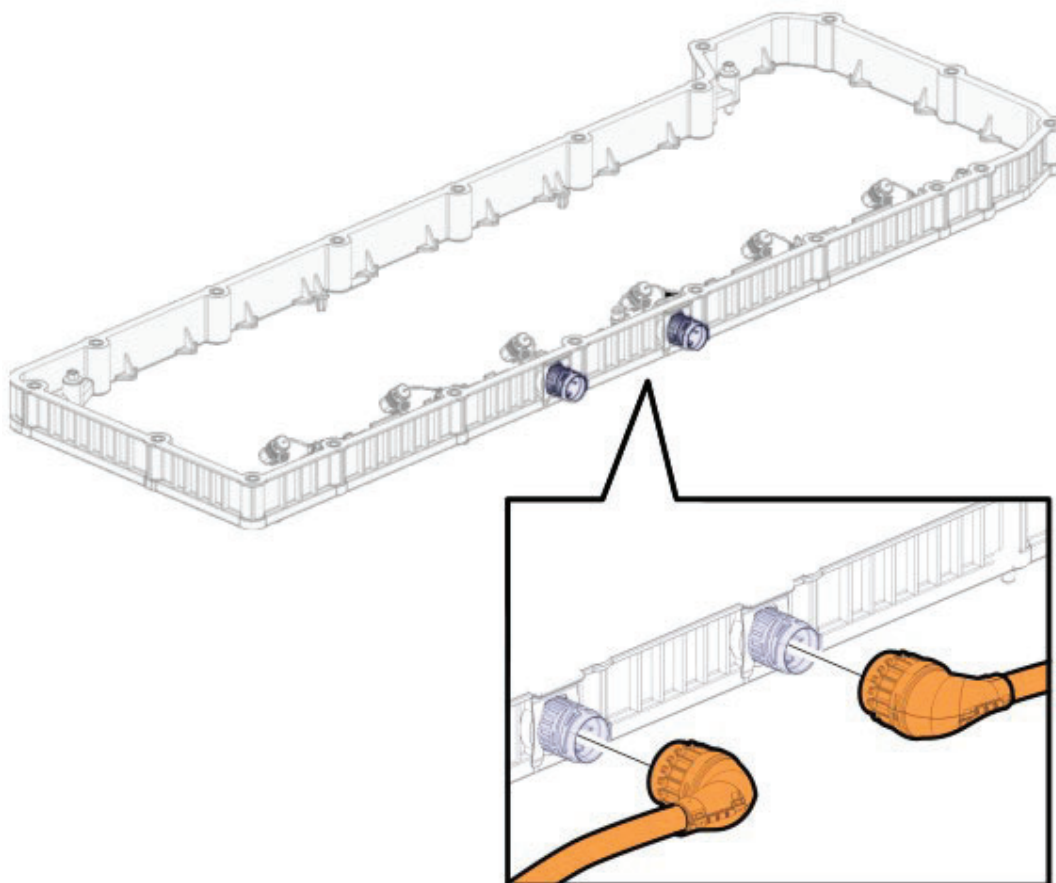
387 Connect the connectors.



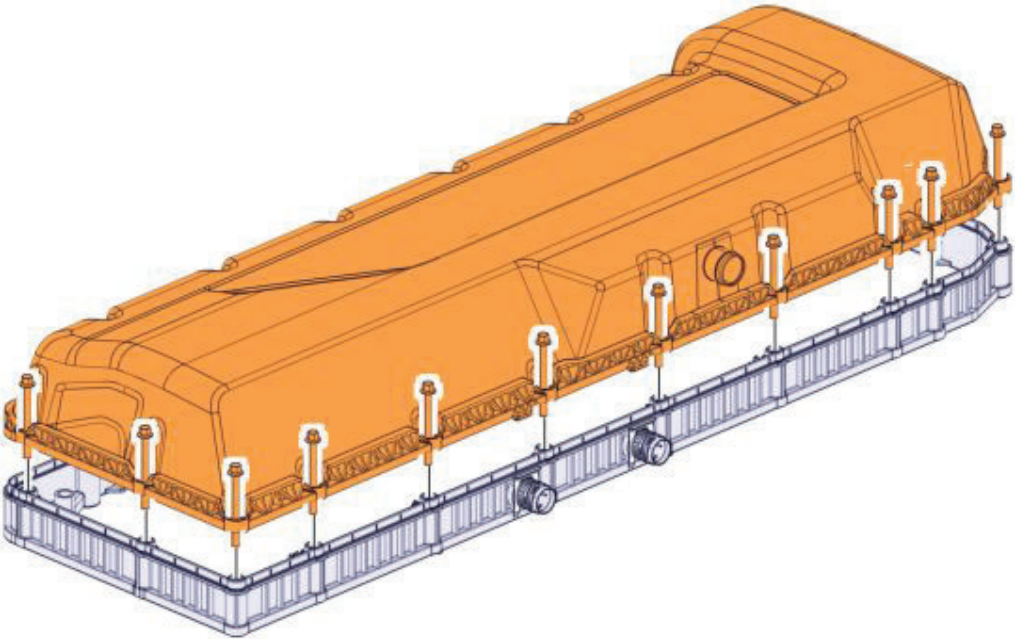
388 Connect the connectors.



389	Connect the connectors.
-----	-------------------------



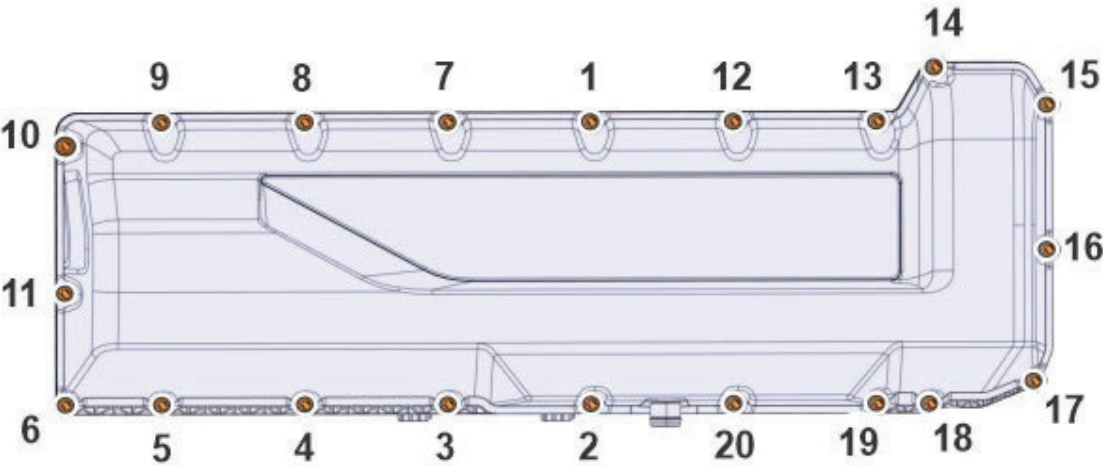
390	Position the screws. Note Inspect the gasket, replace as needed. Service hint Temporarily securing the screws at the rear of the cover in the uppermost position will aid in installation
391	Install the valve cover.



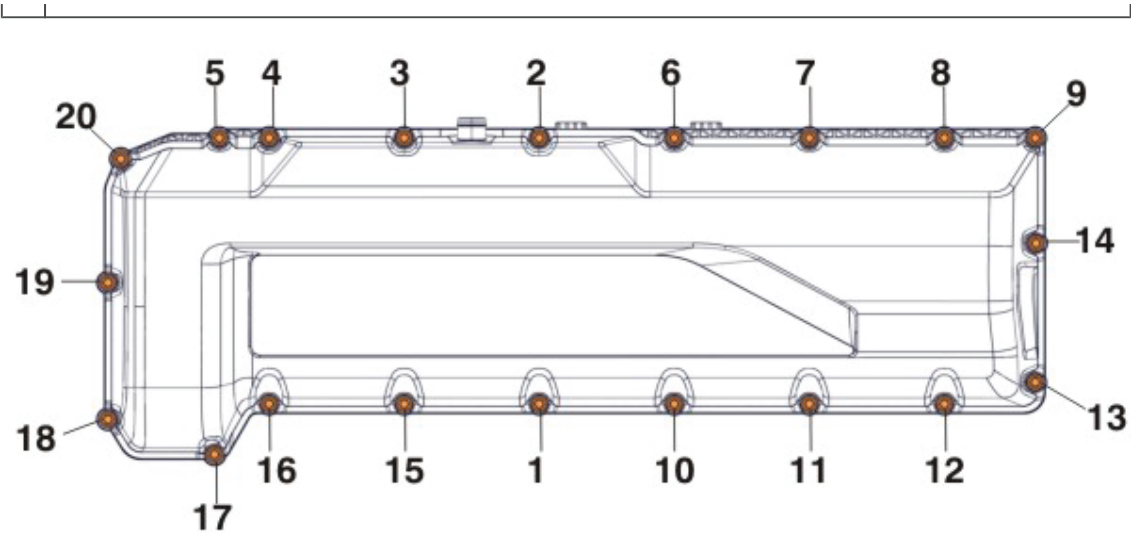
392

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)



393

Install the pipe.

i

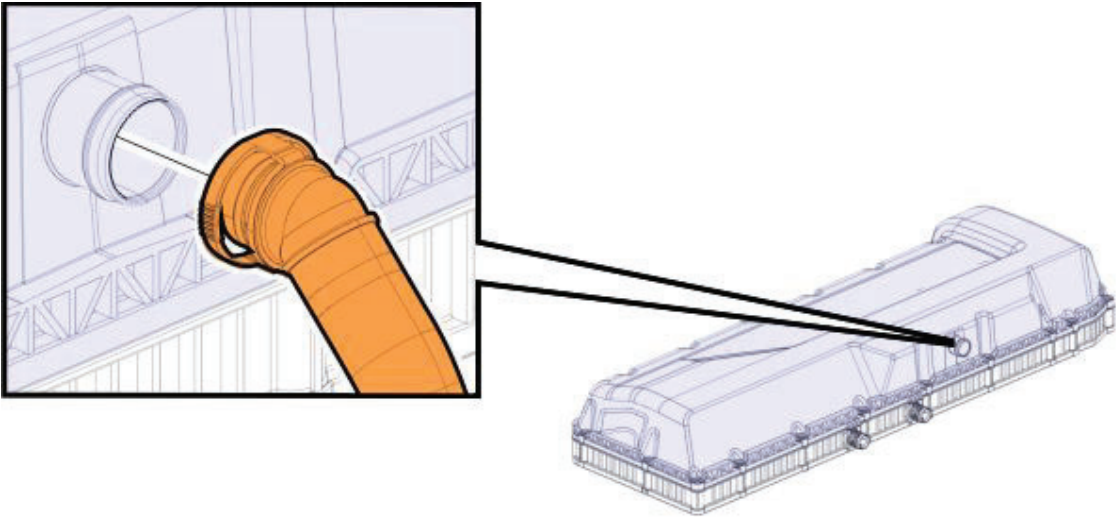
Note

If not previously installed.

i

Note

Inspect the internal sealing ring.



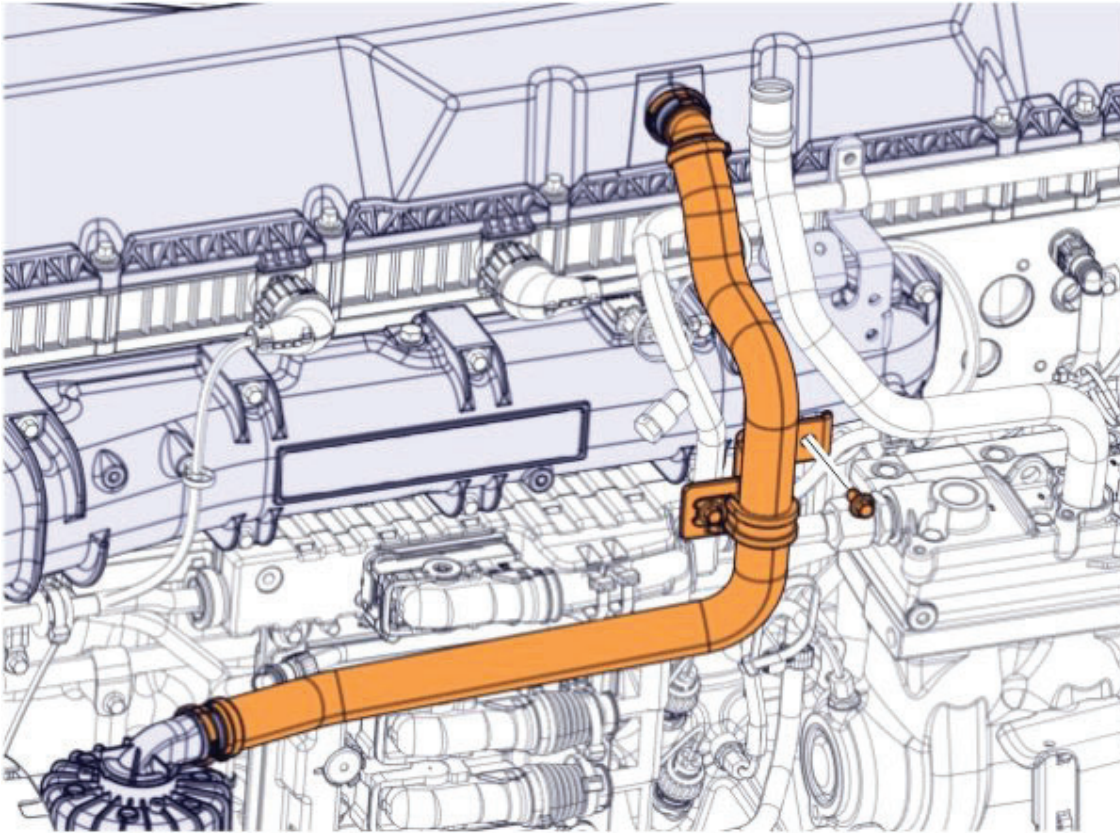
394

Install the pipe.

395

Install the screw.

396	Torque-tighten the screw.	
	Tightening torque	
	Screw	M8
		24 ±4 Nm (18 ±3 lb _f ·ft)

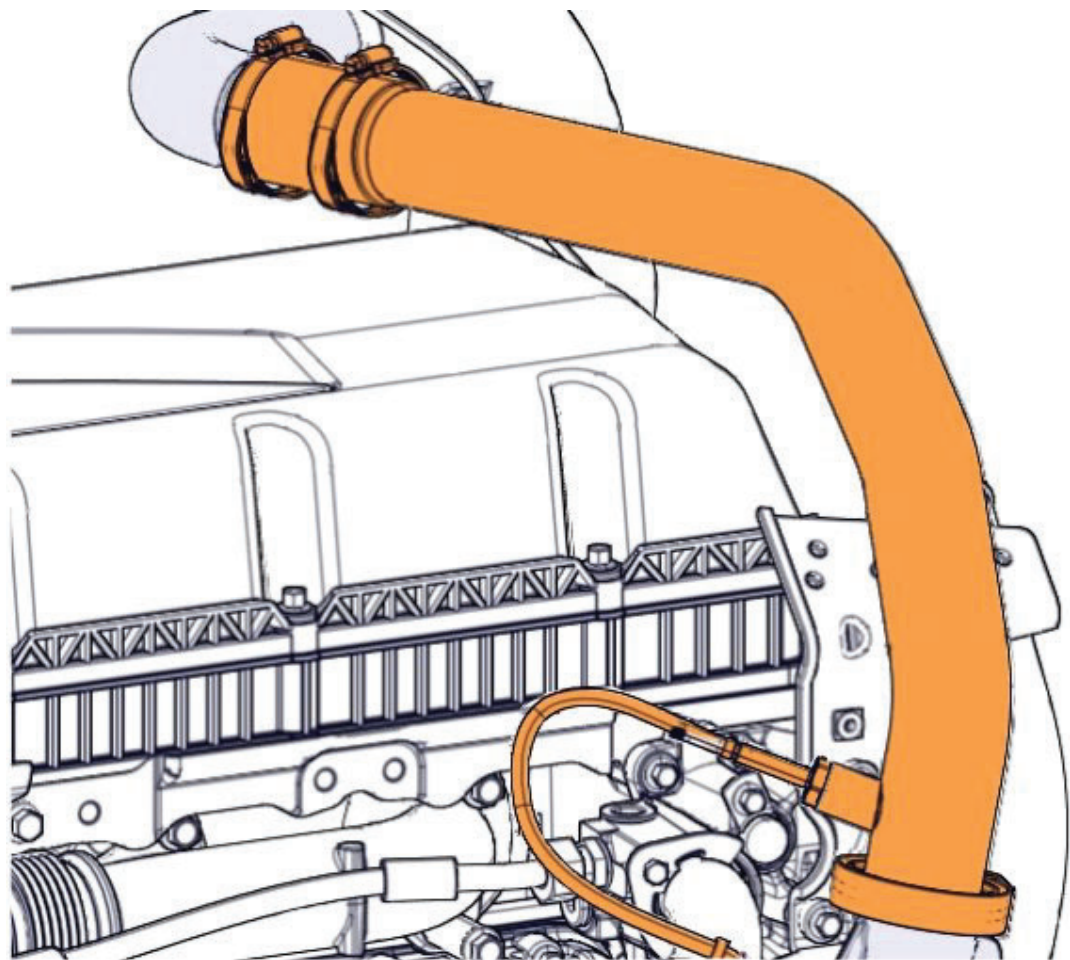


397 Install the pipe.

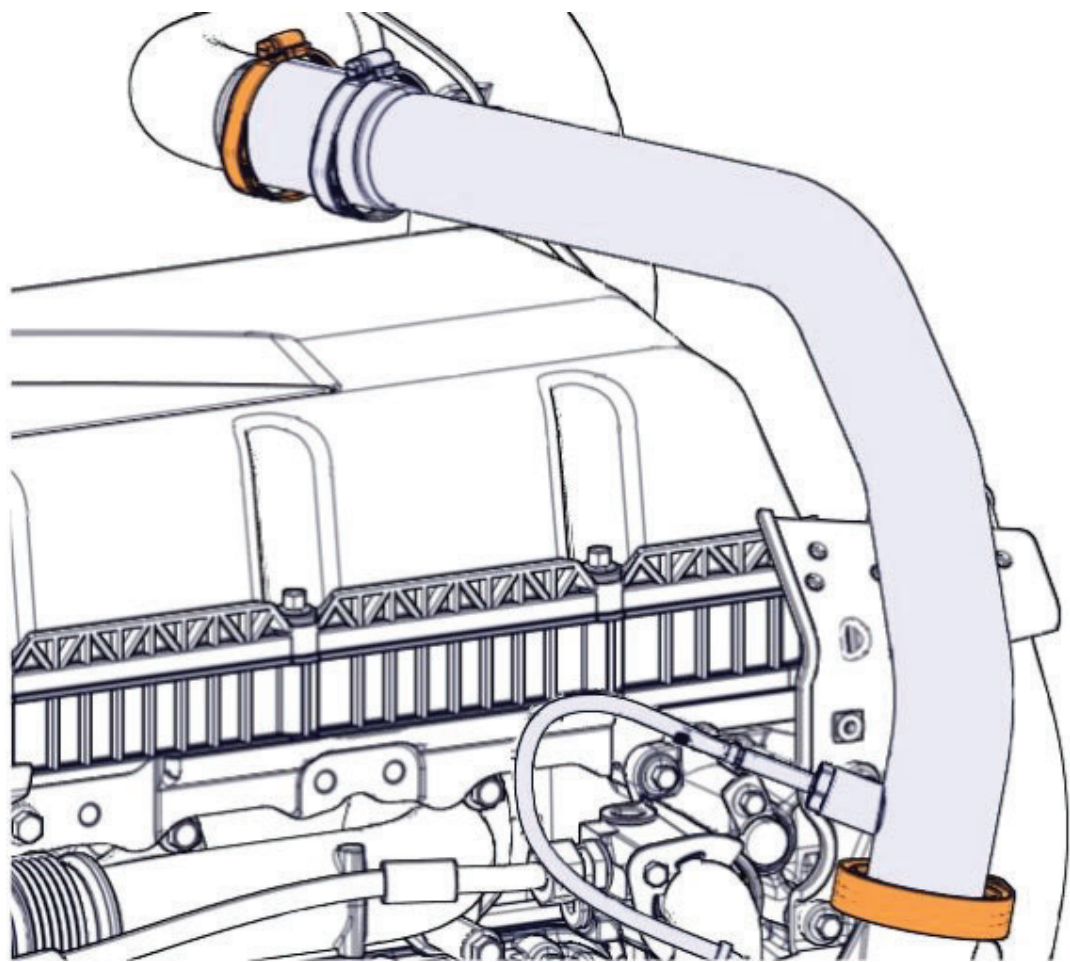


Note

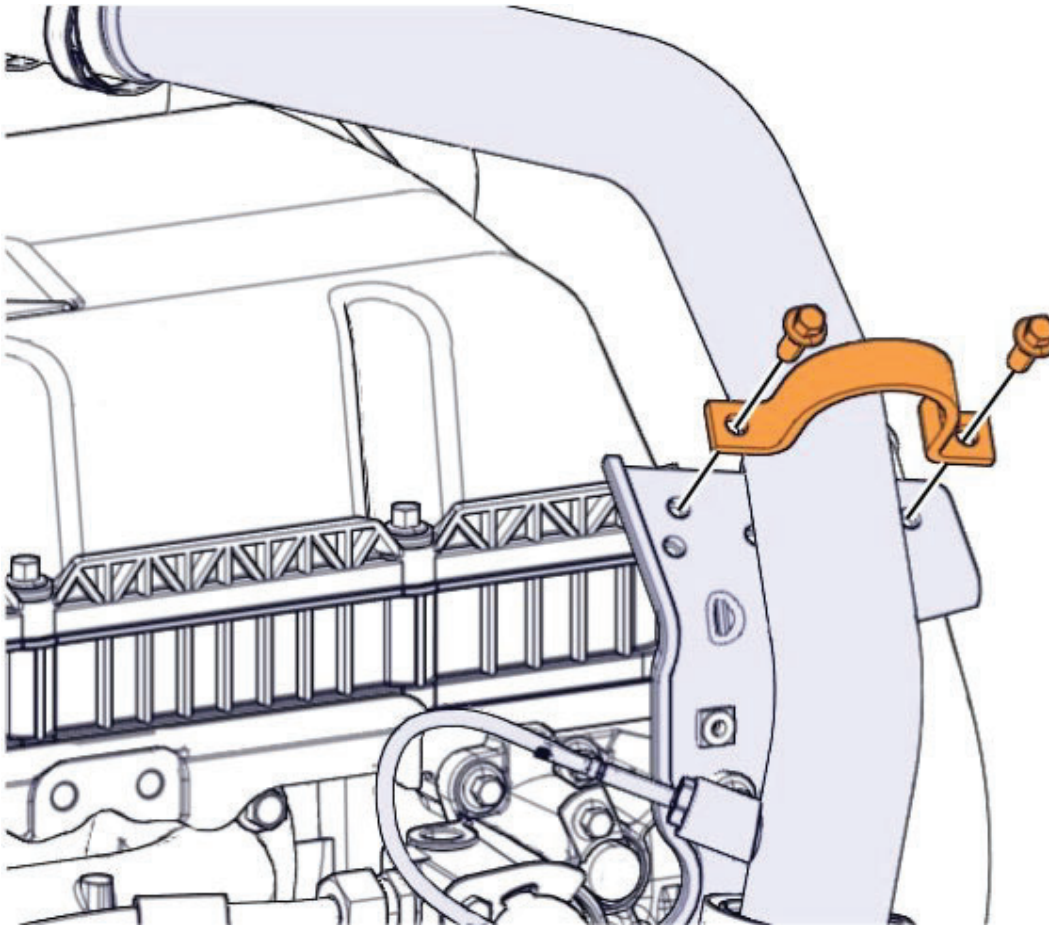
Check the sealing ring and hose for damage; replace as needed.



398	Position the clamps.	
	i Note	As noted.
399	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)



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

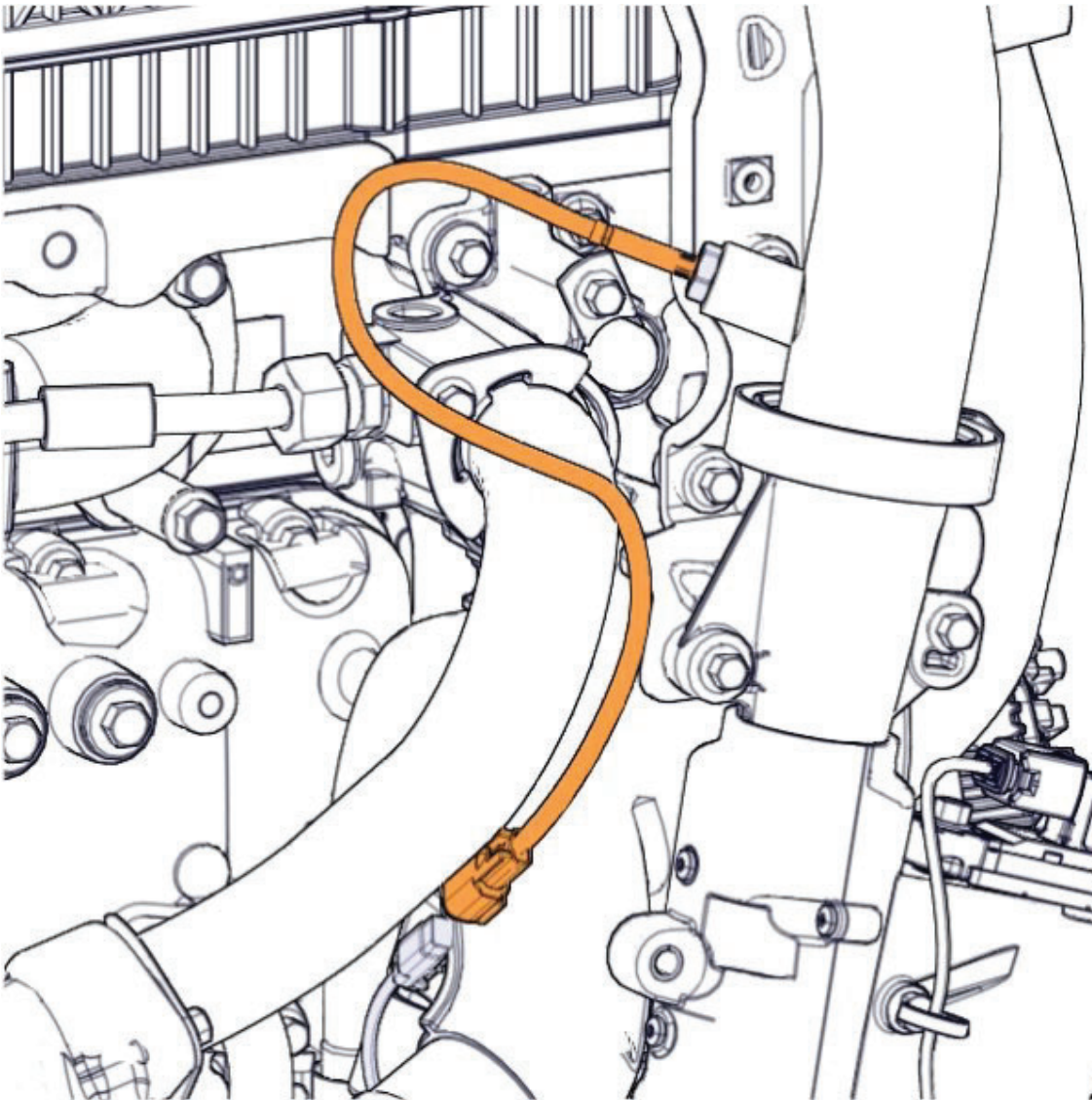


402	Connect the connector.
-----	------------------------

403	Install the cable tie.
-----	------------------------

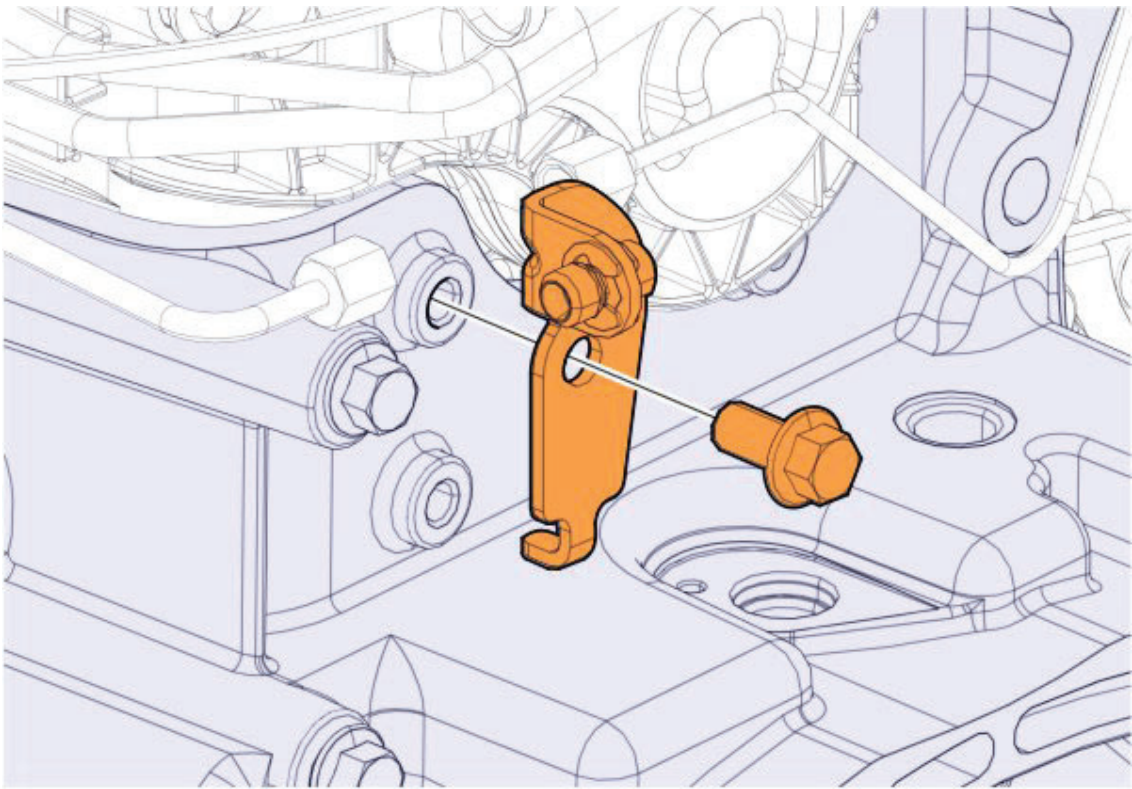
**Note**

Use a new part.

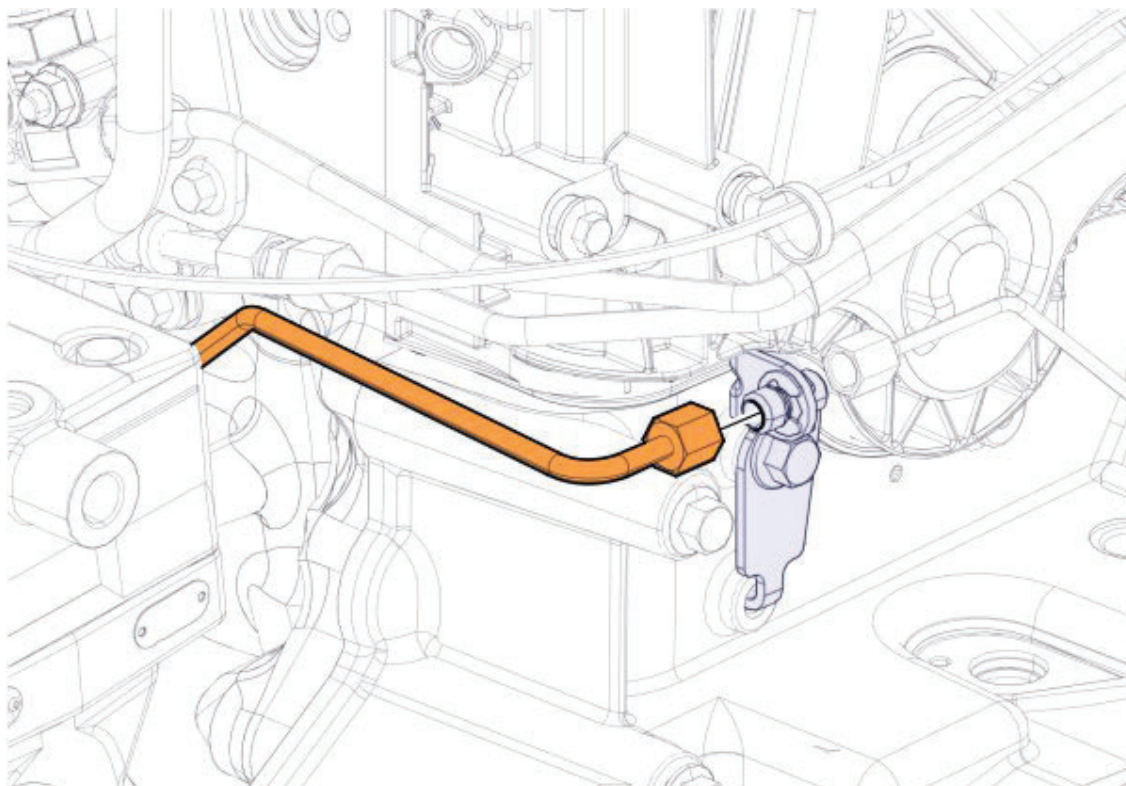


404	Install the bracket.
-----	----------------------

405	Install the screw.
-----	--------------------

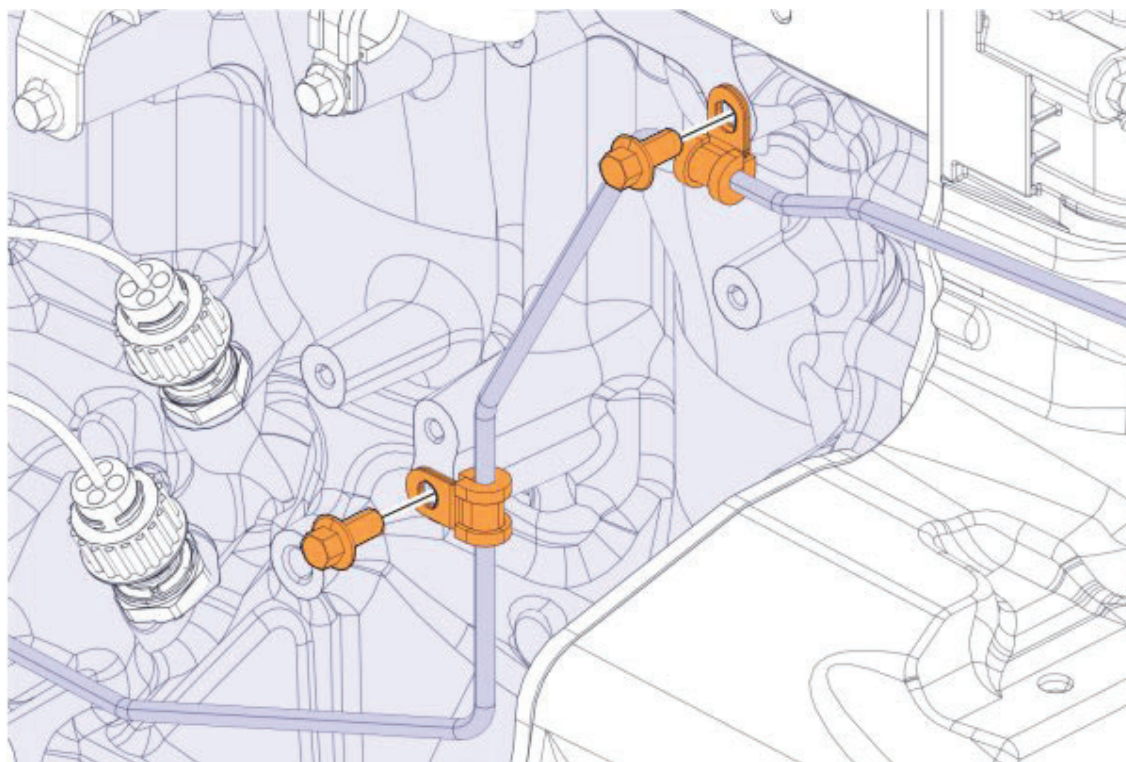


406	Install the nut.	
407	Tighten the nut to torque.	
	Tightening torque	
	Fitting	M4
		15 ±1 Nm
		(11 ±1 lb _f ·ft)



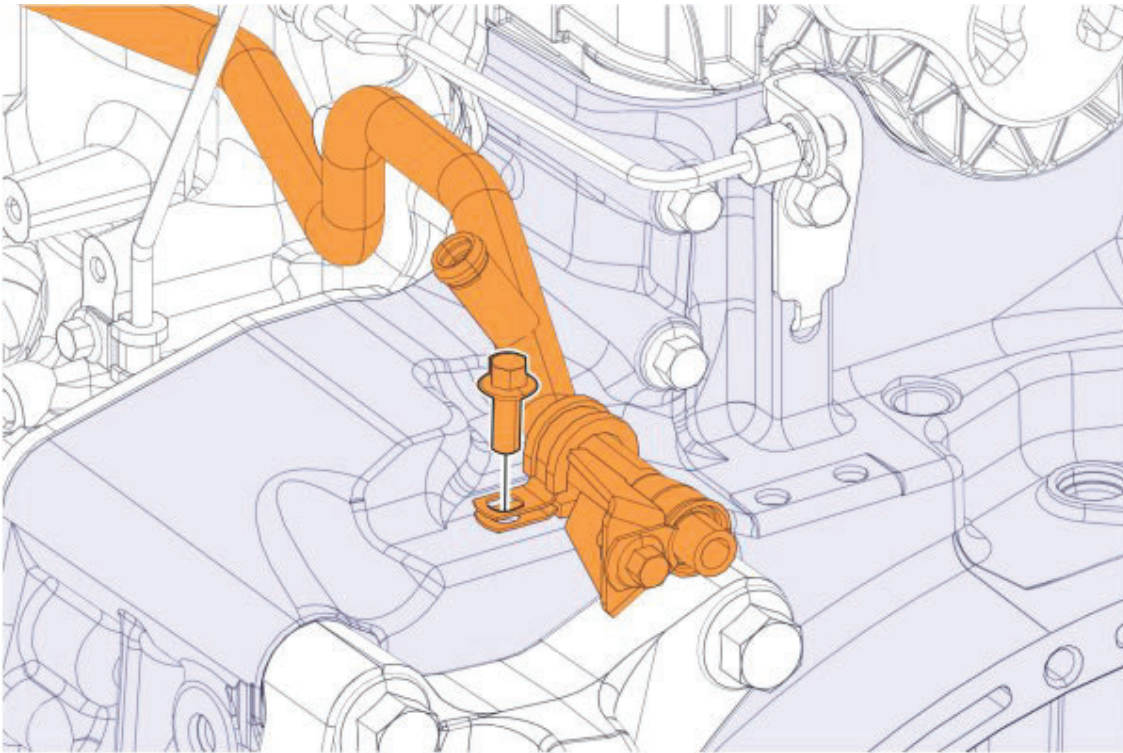
408	Install the clamps.
-----	---------------------

409	Fit the screws.
-----	-----------------



410	Position the pipe.
-----	--------------------

411	Install the screw.
-----	--------------------



412 Lubricate the O-ring.



Note

Use a new part.



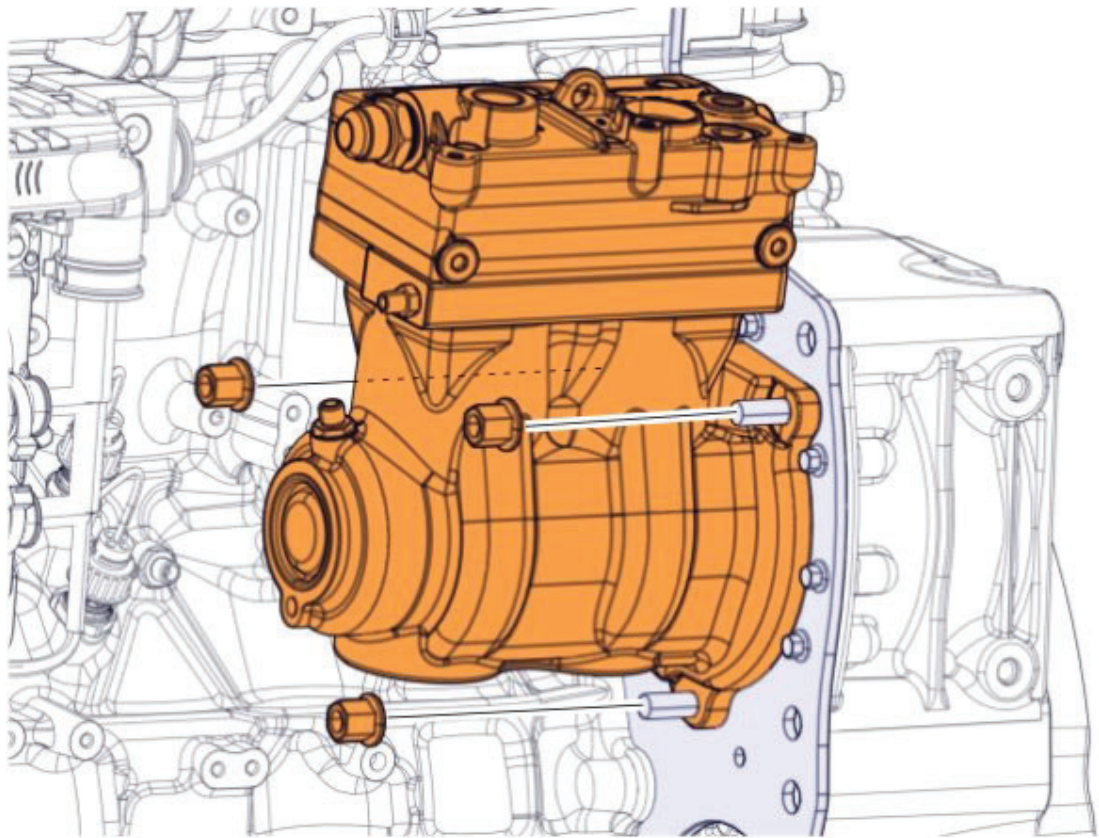
Note

Use a recommended oil.

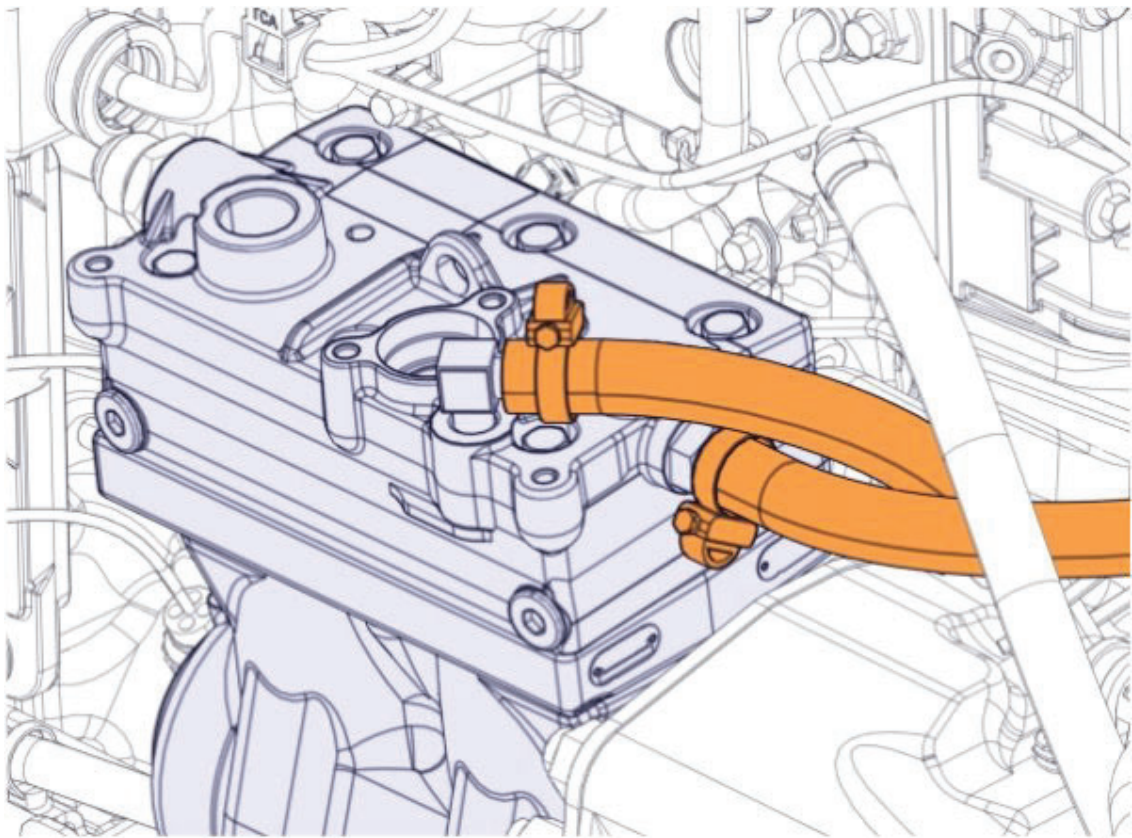
413 Install the O-ring.



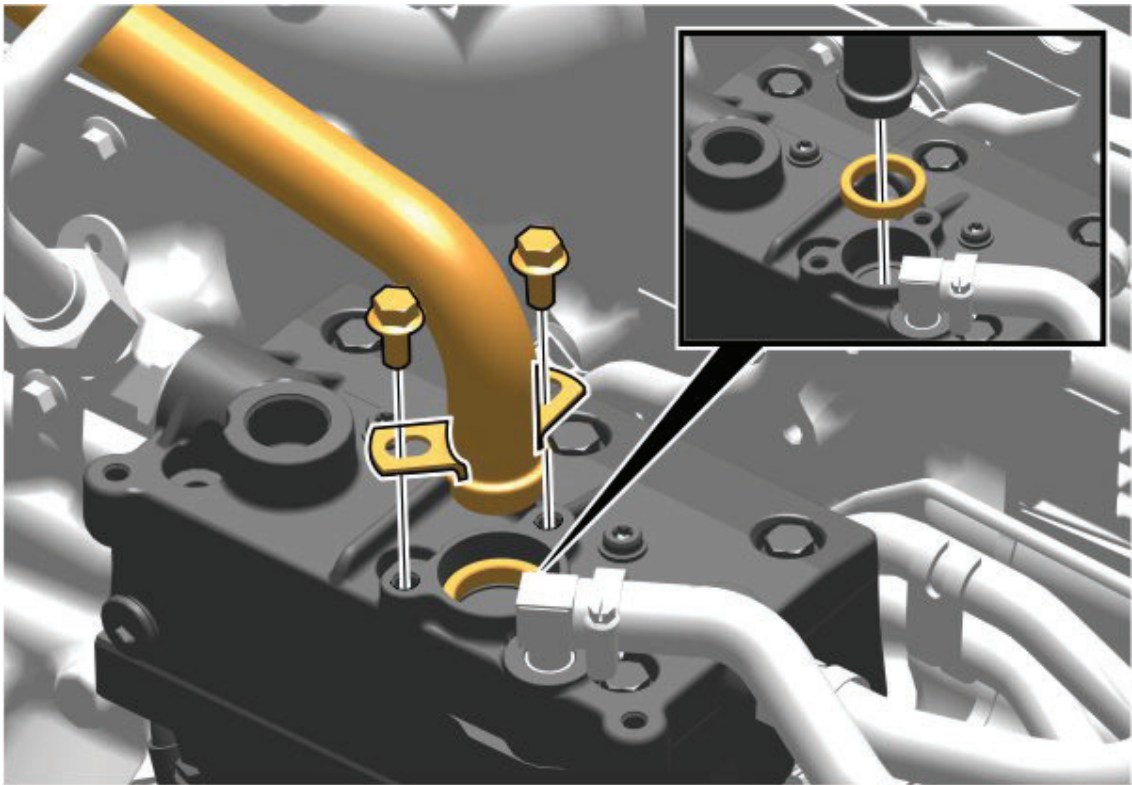
		 CAUTION			
Risk of serious injury.					
Heavy component.					
▶		Exercise caution when moving the component. Use appropriate tools.			
414		Install the compressor.			
		 Note Take care not to damage surrounding components.			
415		Install the nuts.			
416		Tighten the nuts to torque in a diagonal pattern.			
		Tightening torque			
		Air compressor, engine transmission attachment, screw		85 ±15 Nm (63 ±11 lb _f ·ft)	
417		Repeat the operation a second time.			



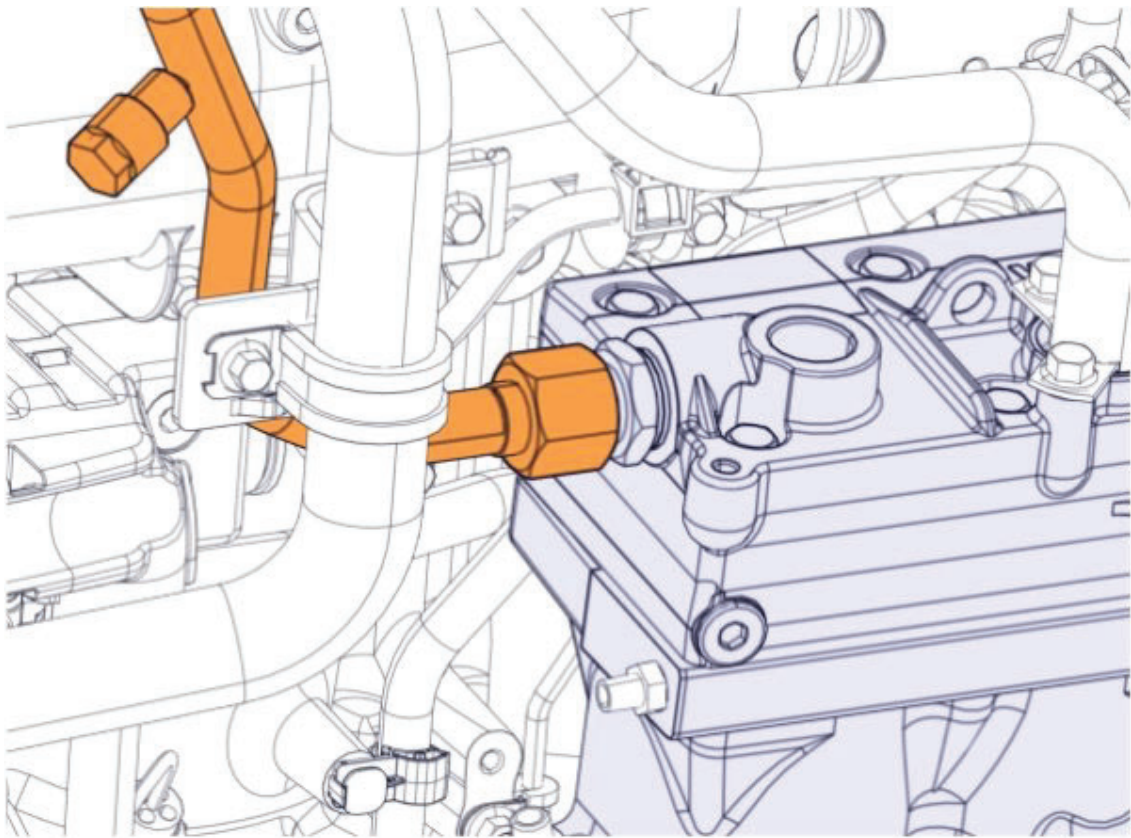
418	Connect the hoses.	
419	Tighten the clamps to torque.	
	Tightening torque	
	Compressor, coolant hose, clamp	3 ±0.5 Nm (2 ±0.4 lb _f ·ft)



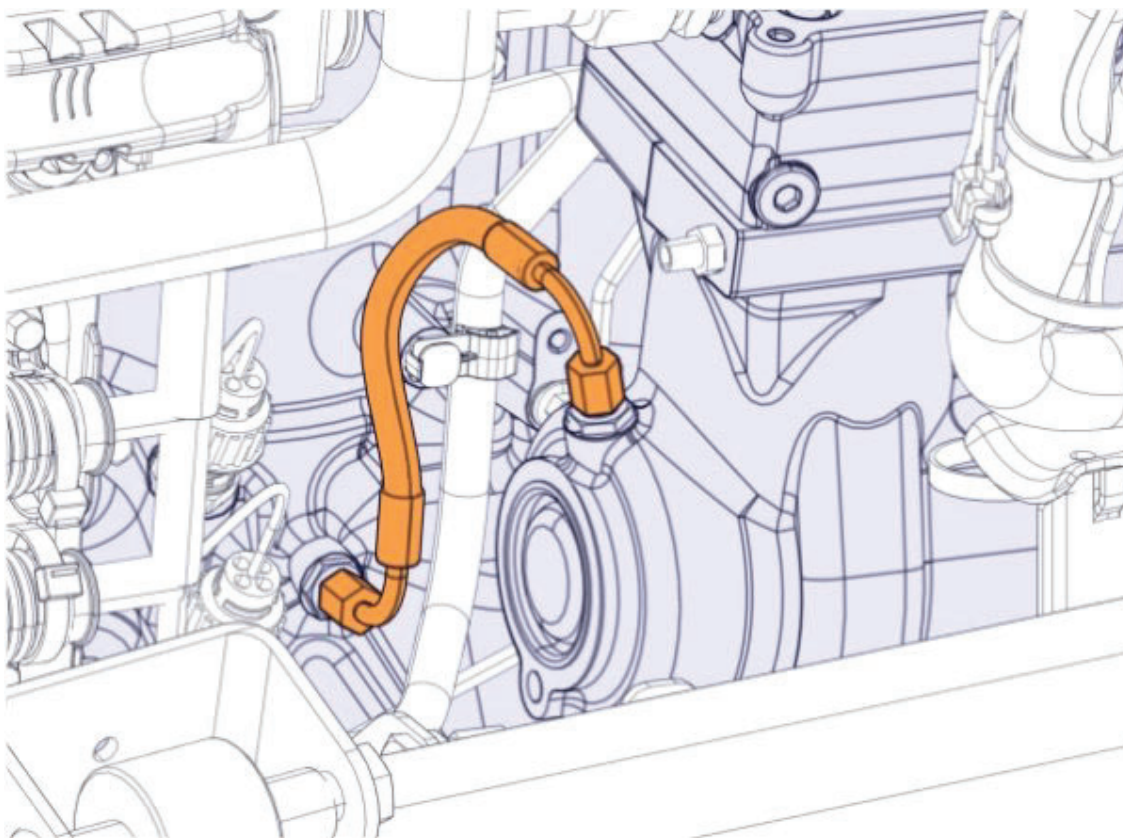
420	Lubricate the sealing ring.	
	i Note	Use a recommended oil.
421	Install the sealing ring.	
	i Note	Use a new part.
422	Install the pipe along with the lock braces.	
423	Fit the screws.	
424	Tighten the screws to torque.	
	Tightening torque	
	Lock brace, screw	M8
		24 ±4 Nm
		(18 ±3 lb _f ·ft)



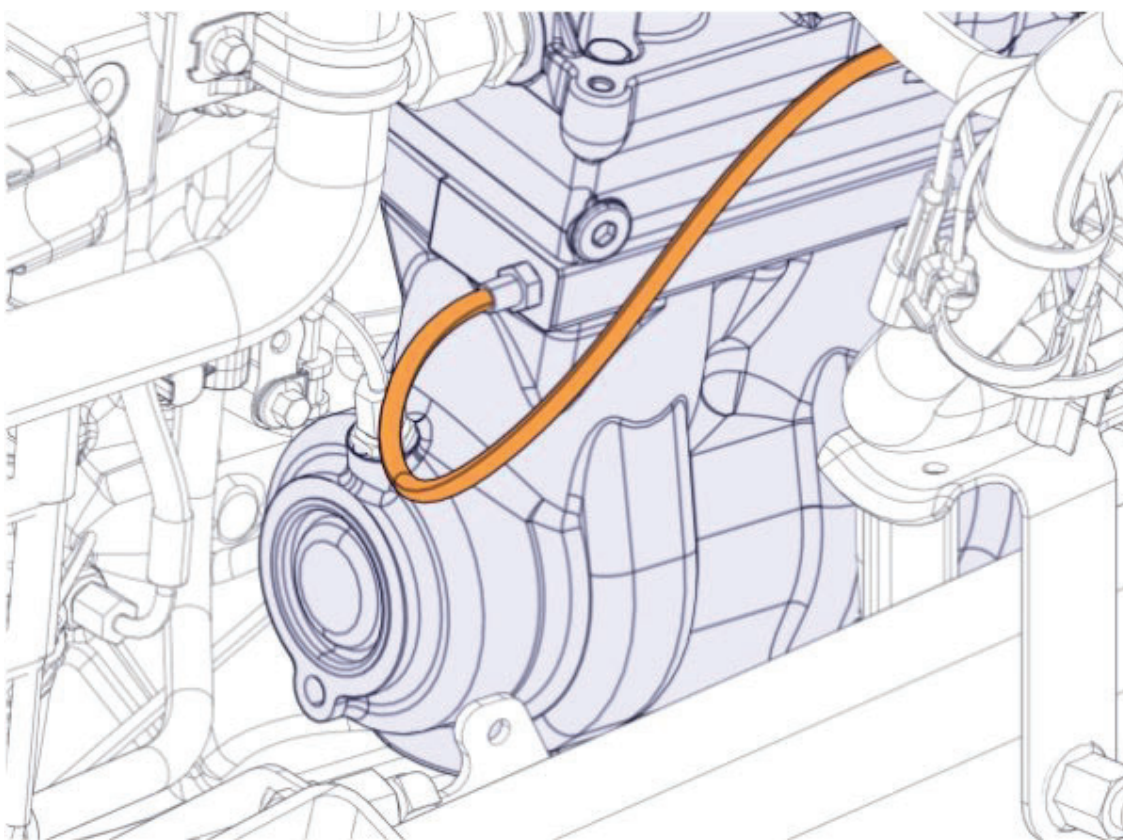
425	Install the pipe.	
426	Tighten the nut to torque.	
	Tightening torque	
	Compressor, air outlet, nut	130 ±20 Nm (96 ±15 lb _f ·ft)



427	Install the oil hose.	
428	Torque tighten the fitting nuts.	
	Tightening torque	
	Compressor, oil hose, fitting	15 ±3 Nm (11 ±2 lb _f ·ft)



429	Connect the air line.
-----	-----------------------

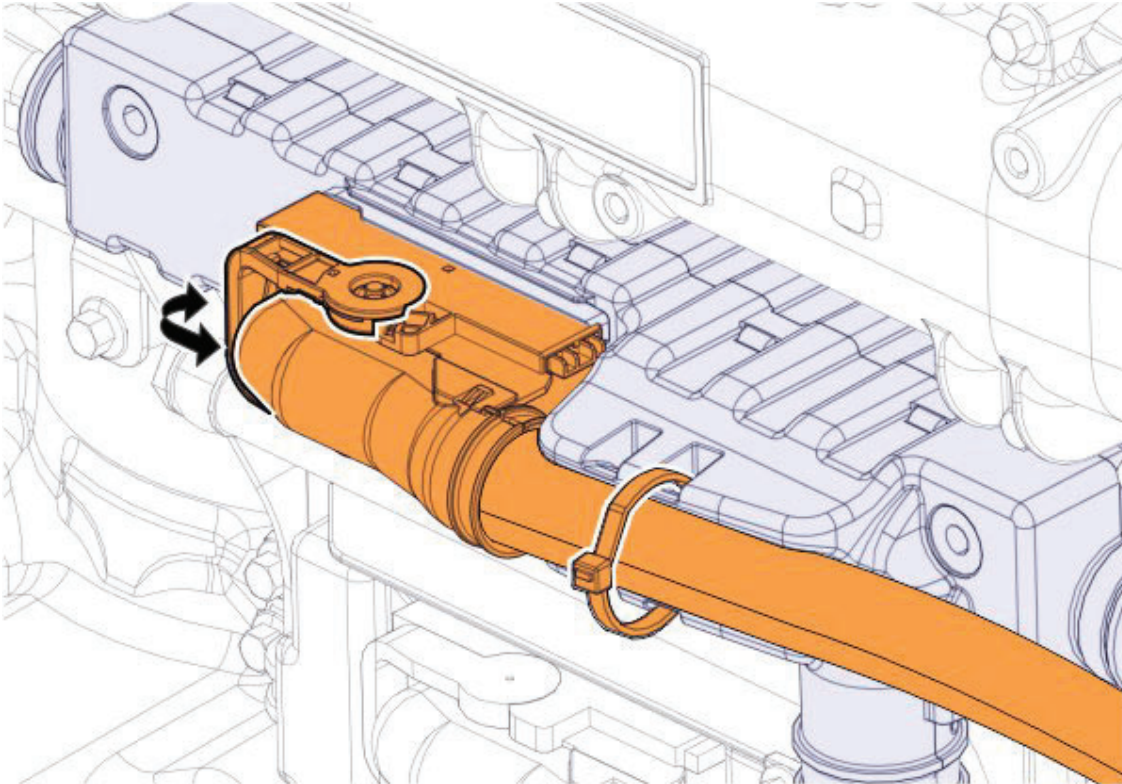


430	Connect the connector.
-----	------------------------

431 Install the cable ties.

i **Note**
Use new parts.

i **Note**
As noted.



432 Lubricate the seal.

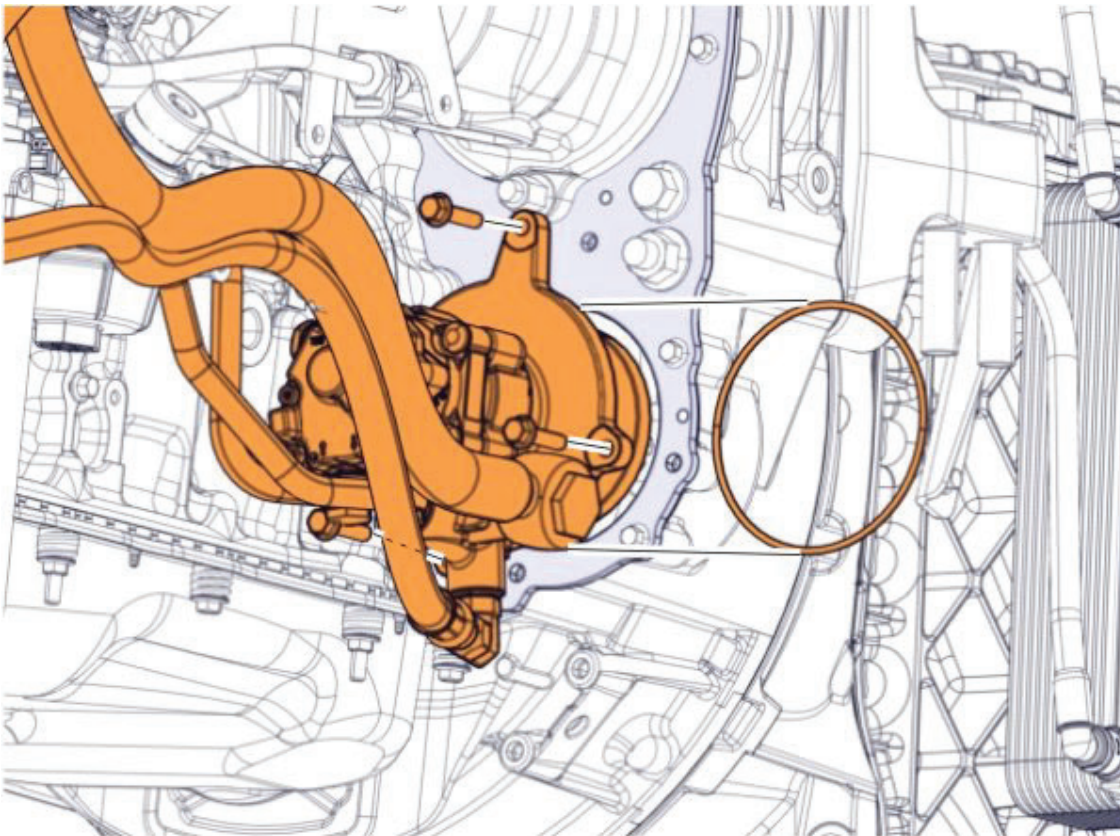
433 Install the seal.

i **Note**
Use a new part

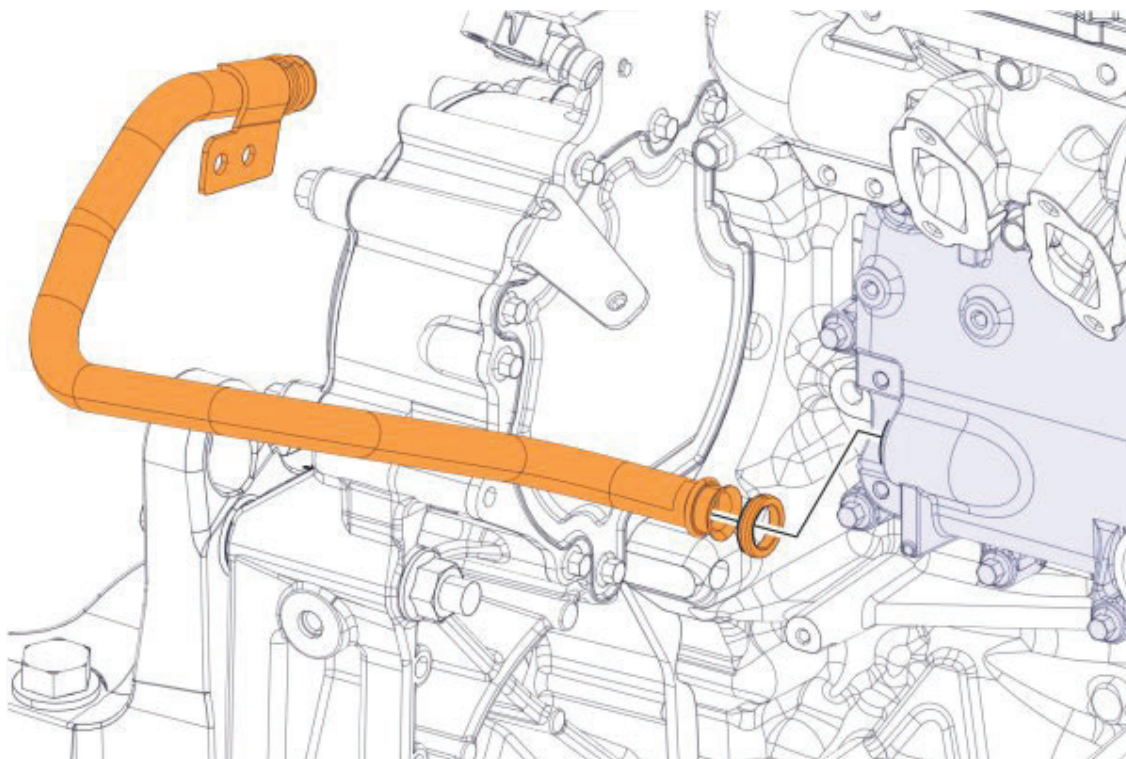
i **Note**
Use recommended oil.

434 Install the pump.

435 Install the screws.

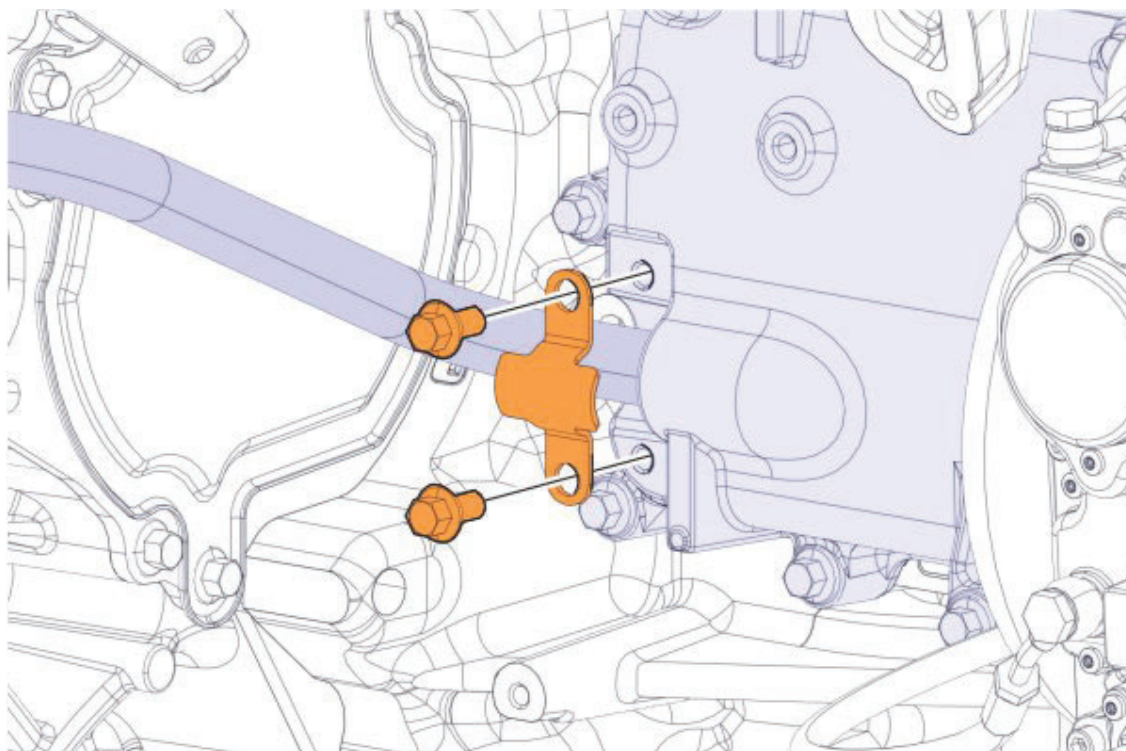


436	Torque tighten the screws.	
	Tightening torque	
	Screw	M8
		24 ±4 Nm
		(18 ±3 lb _f .ft)
437	Install the seal.	
	i Note Use a new part.	
438	Install the pipe.	

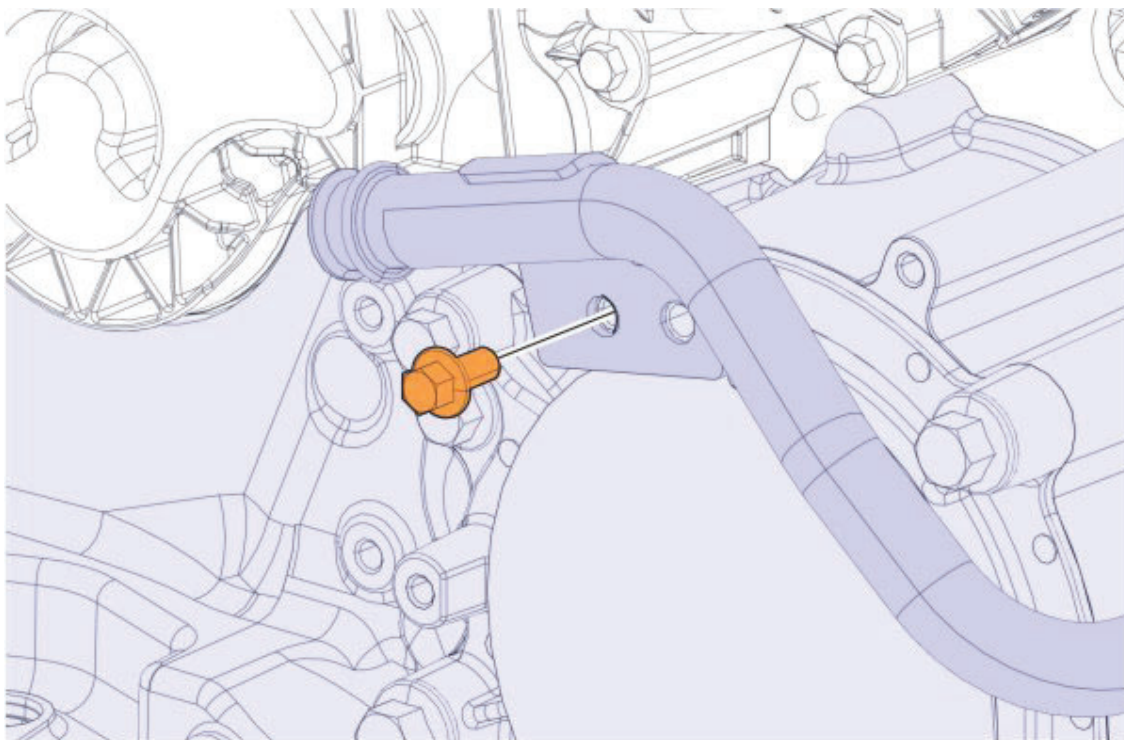


439	Install the clamp.
------------	--------------------

440	Install the screws.
------------	---------------------

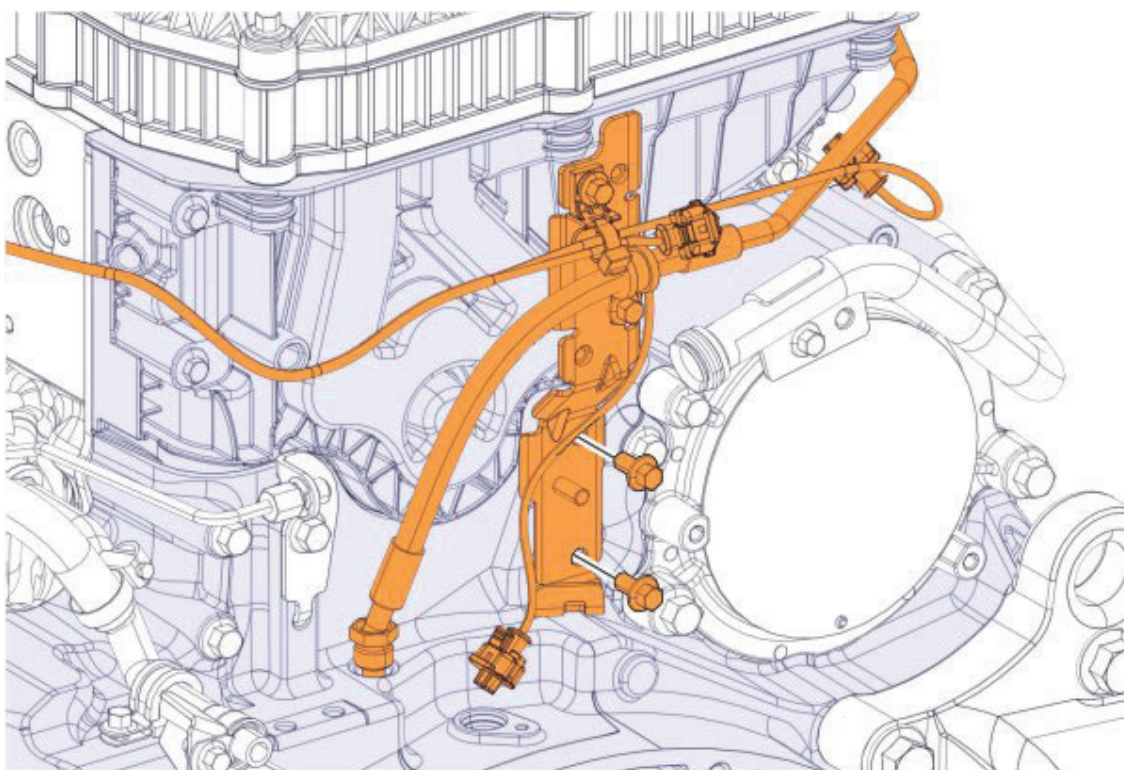


441	Install the screw.
------------	--------------------

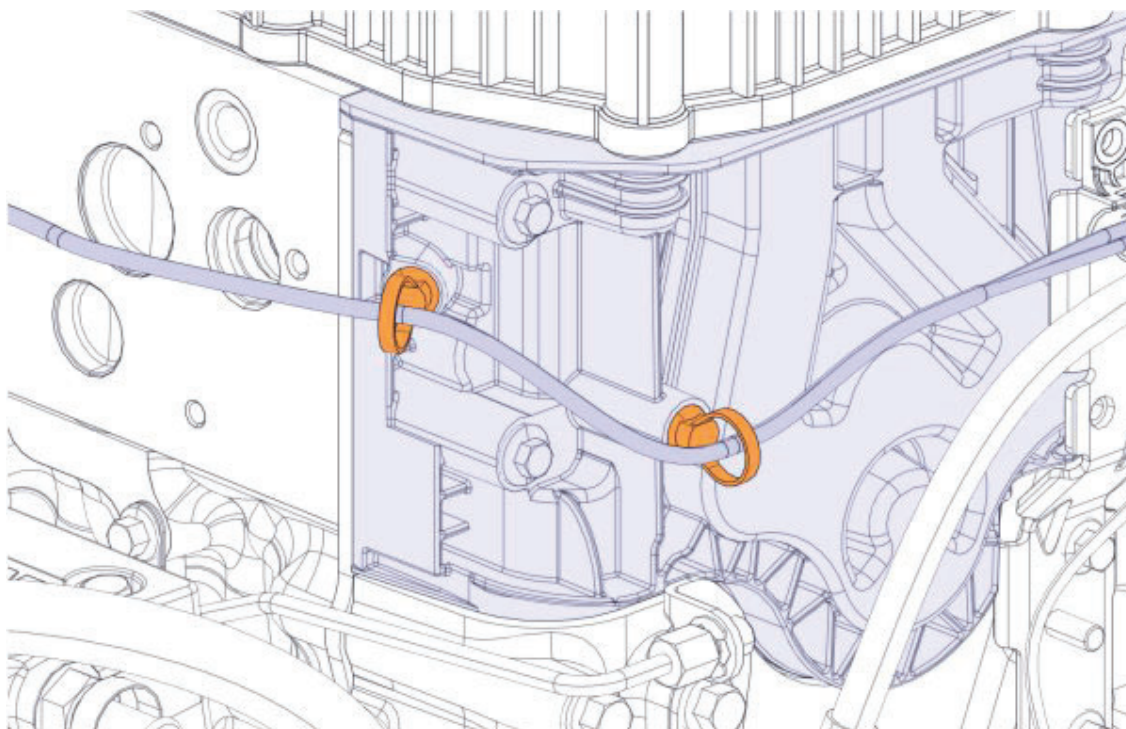


442	Position the assembly.
------------	------------------------

443	Fit the screws.
------------	-----------------

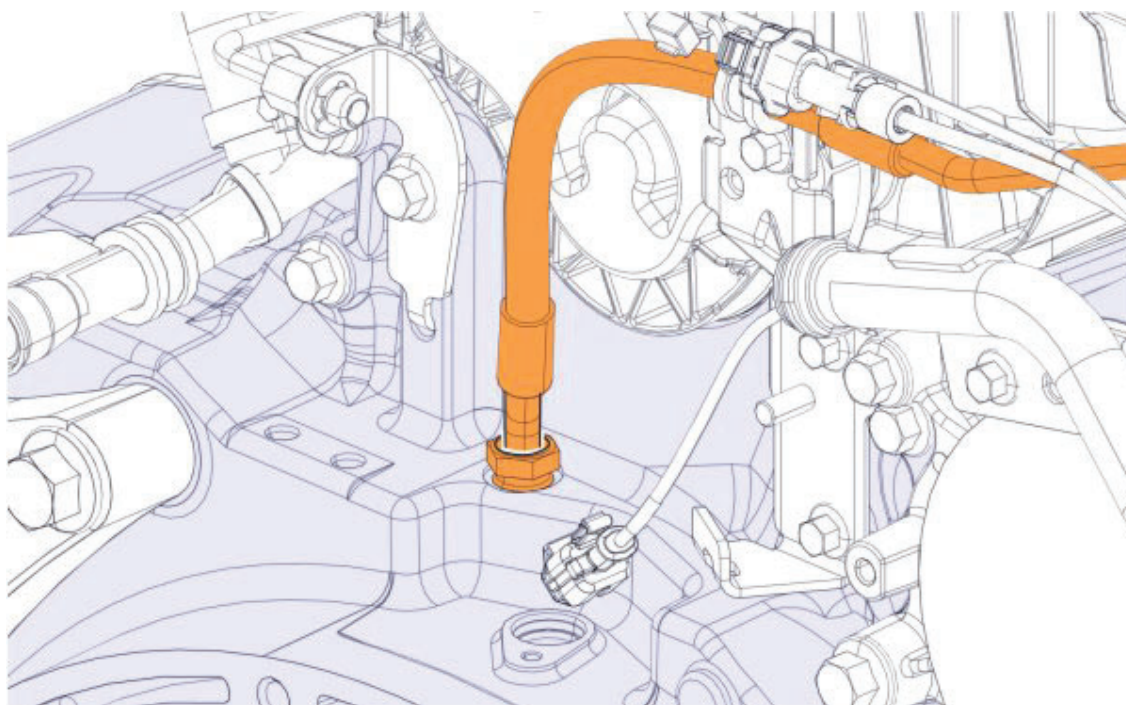


444	Install the cable ties.
i	Note Use new parts.



445 Install the hose.

446 Tighten the nut.



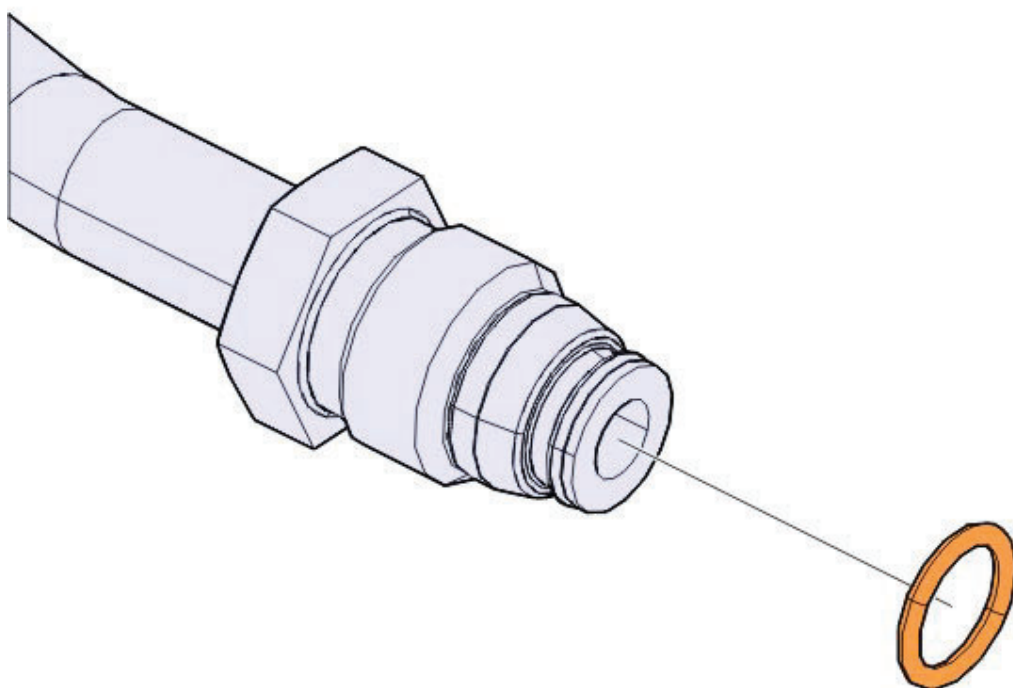
447 Clean the contact surface.

448 Install the seal.

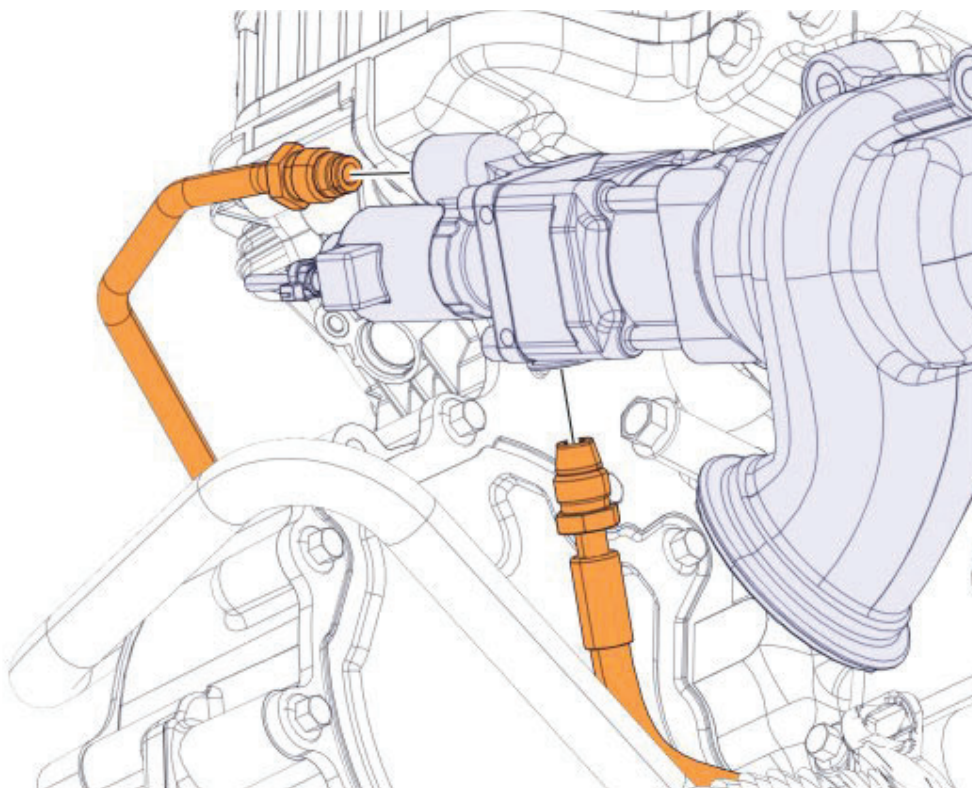


Note

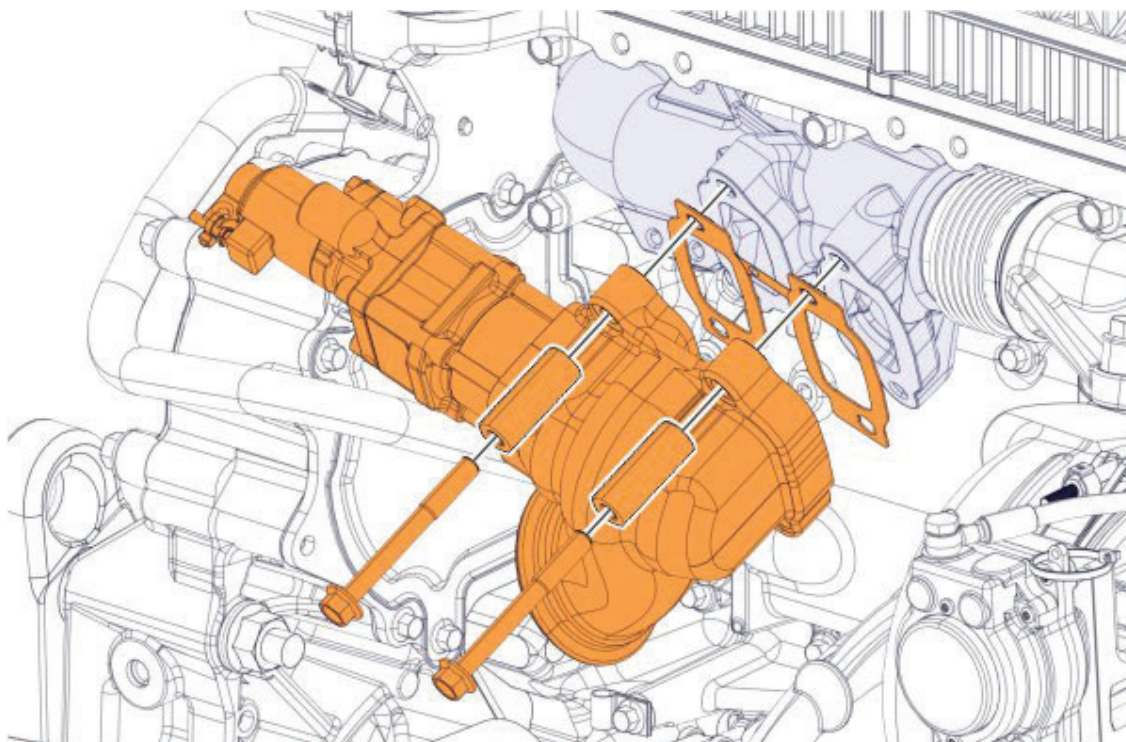
Use a new part.



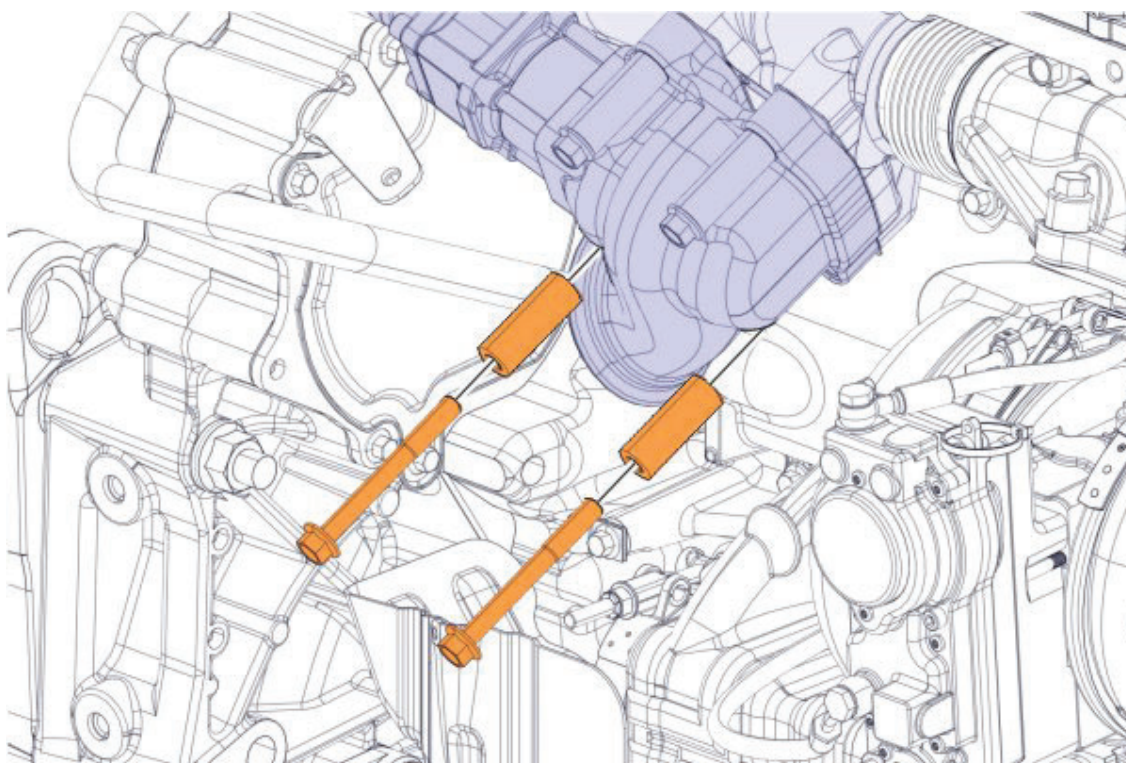
449	Install the pipes.
------------	--------------------



450	Install the gasket.
	Note Use a new part.
451	Position the valve.
452	Install the spacers.
453	Fit the screws.
	Note Use the two upper fasteners to hold the gasket in place.



454	Install the spacers.
455	Fit the screws.

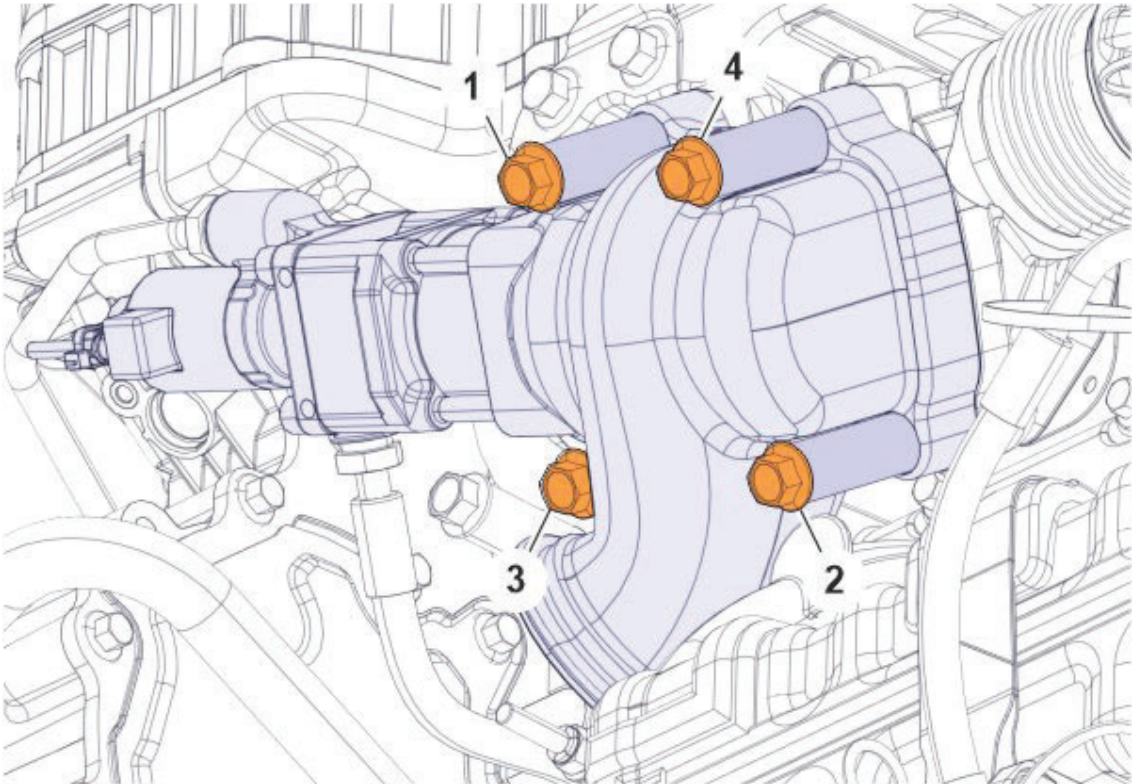


456	Tighten the screws to torque.		
	Tightening torque		
	EGR valve, screw	1.	Tightening sequence: 1–4

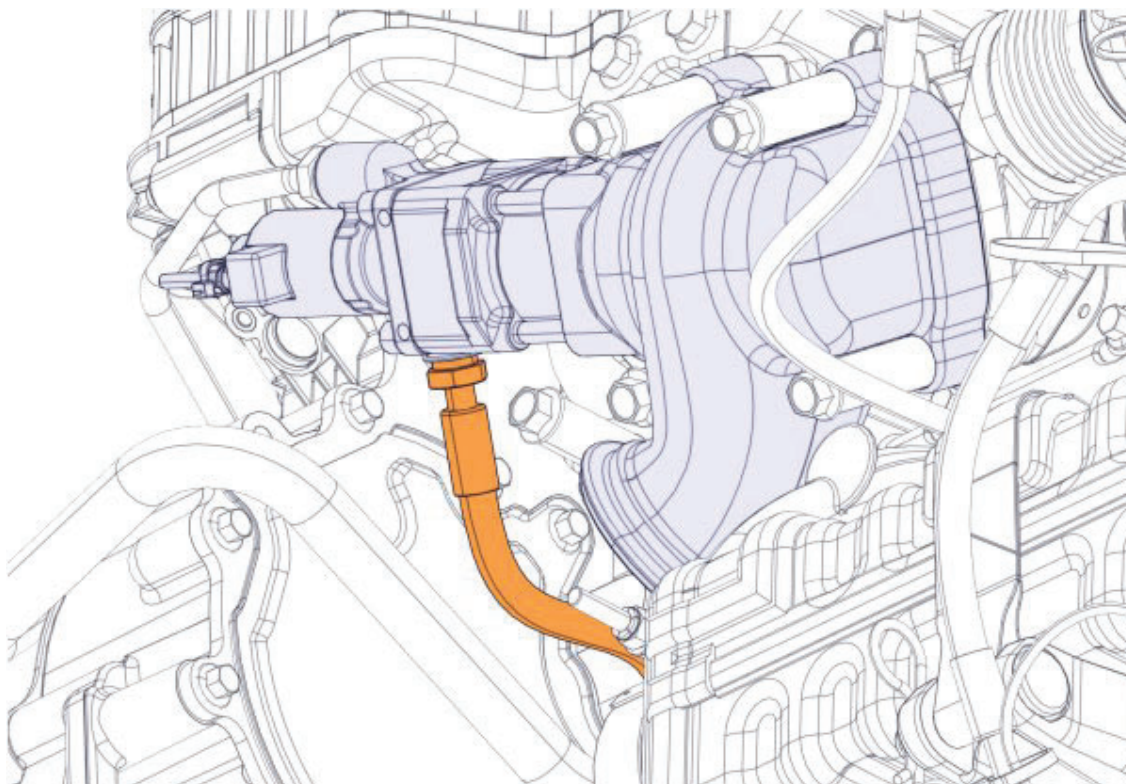
Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

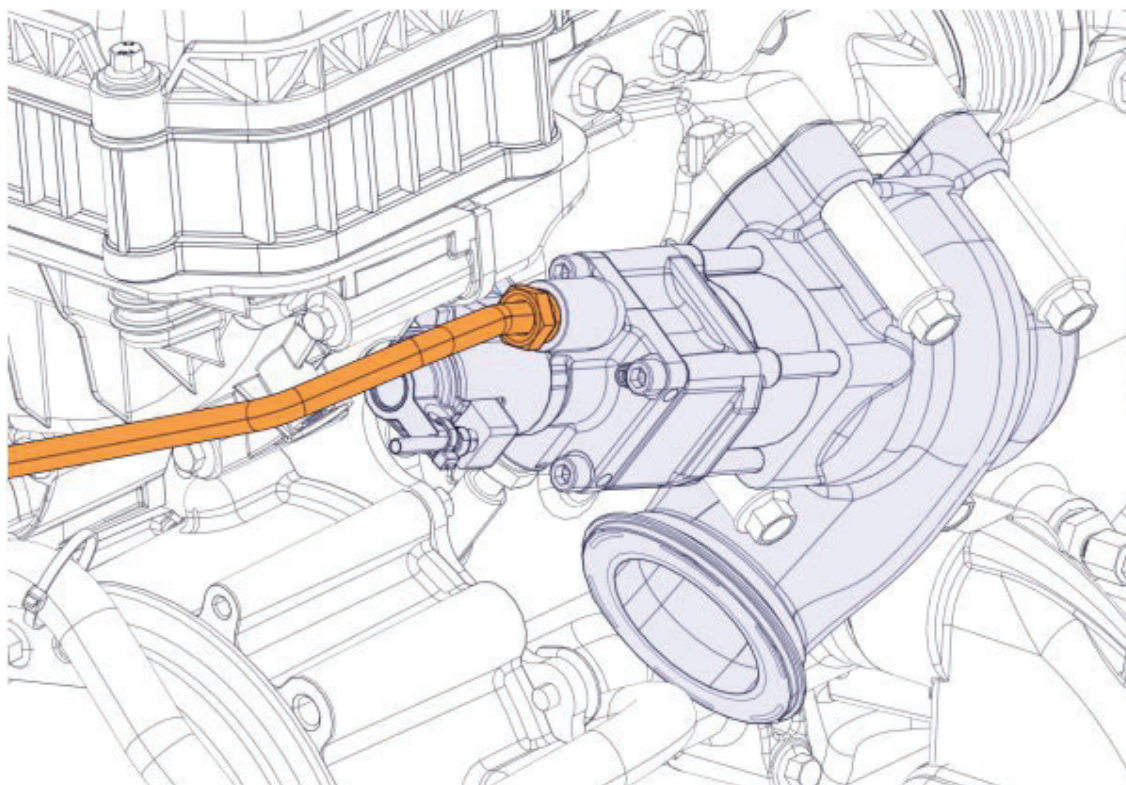
			20 ±4 Nm (15 ±3 lb _f ·ft)
		2.	Tightening sequence: 1–4
			52 ±4 Nm (38 ±3 lb _f ·ft)



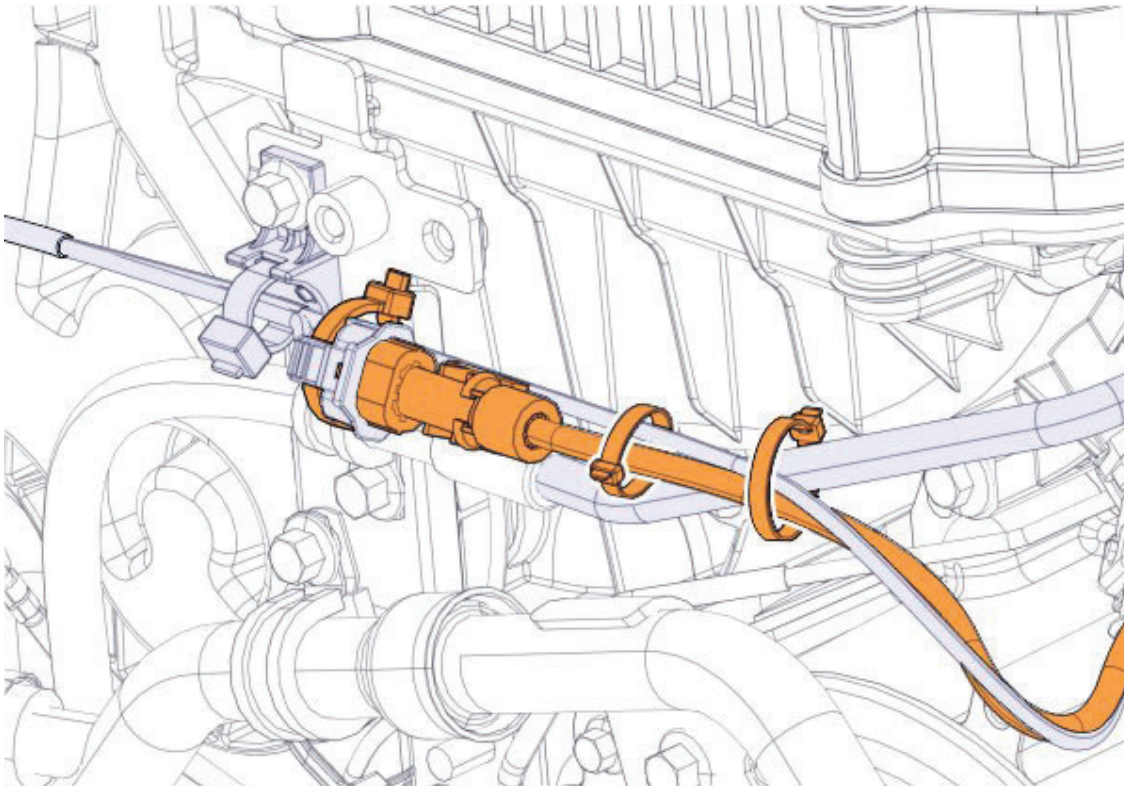
457	Tighten the pipe to torque.	
	Tightening torque	
	EGR valve, nipple	25 ±4 Nm (18 ±3 lb _f -ft)



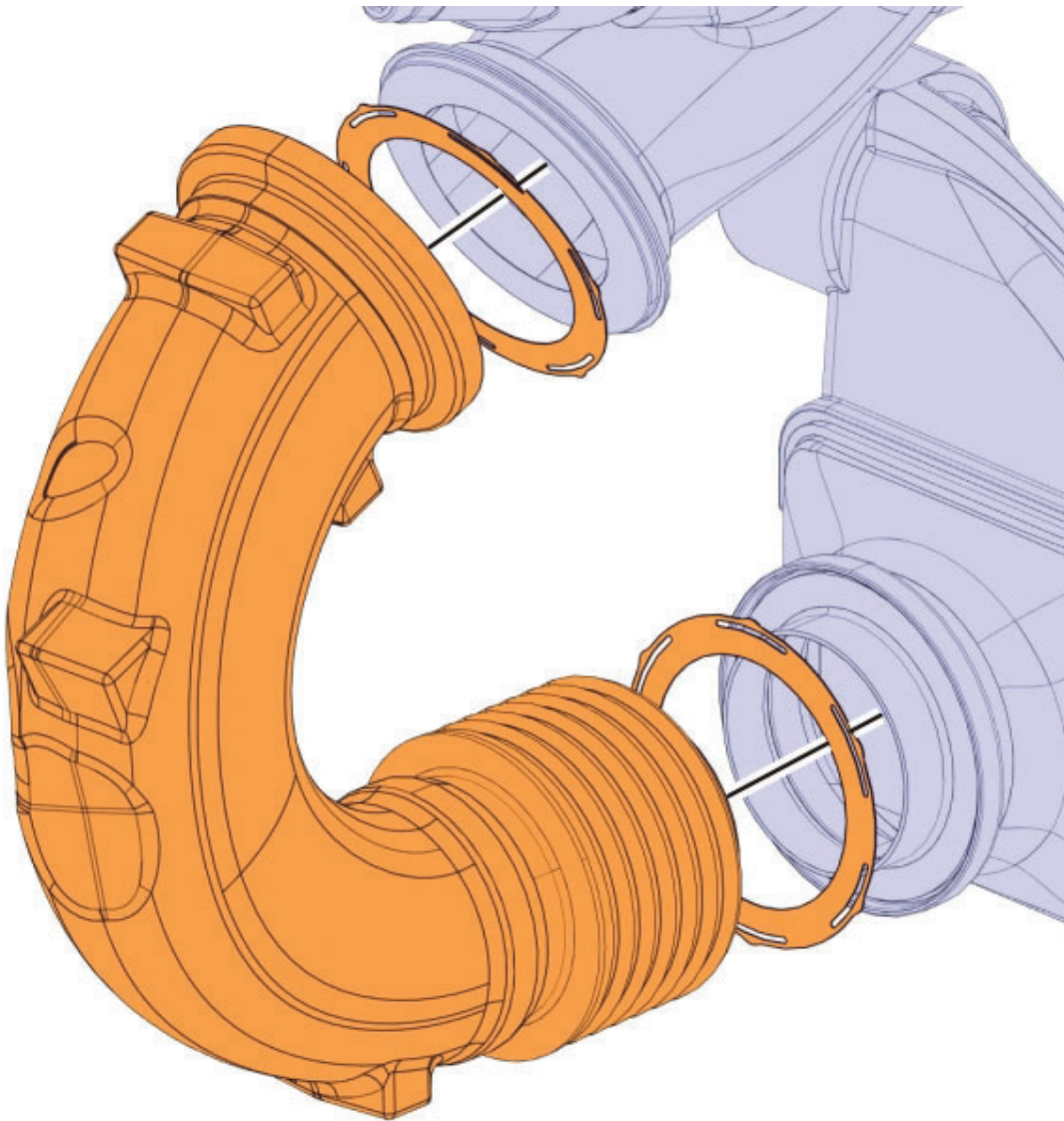
458	Tighten the pipe to torque.	
	Tightening torque	
	EGR valve, nipple	25 ±4 Nm (18 ±3 lb _f -ft)



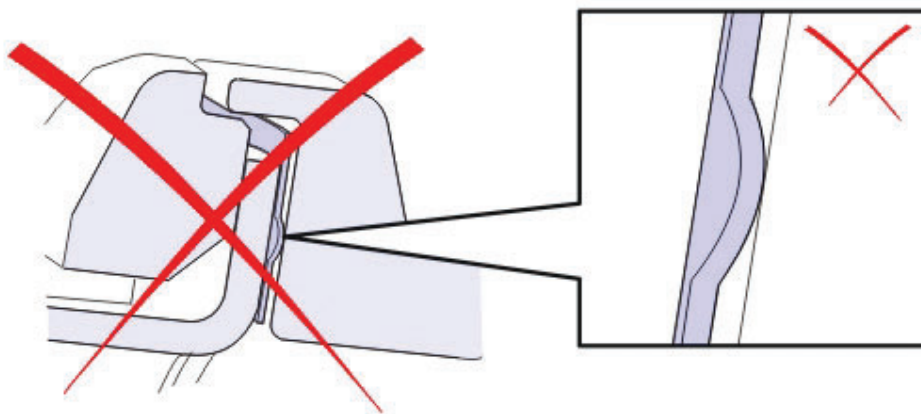
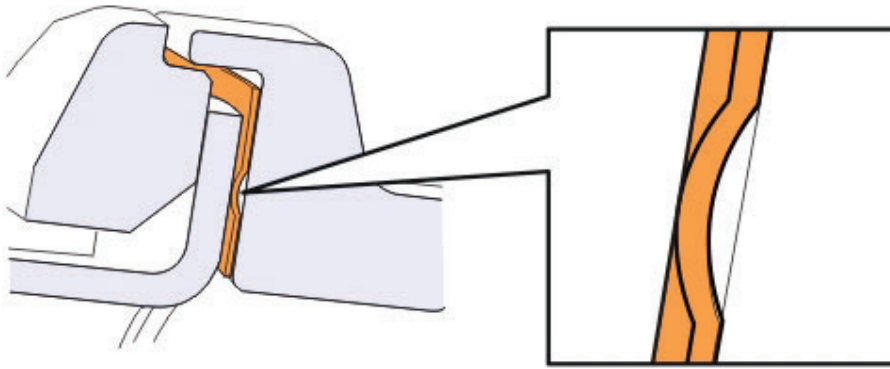
459	Position the cable.
460	Connect the connector.
461	Install the cable ties.  Note Use new parts.



462	Clean the contact surfaces.
463	Install the gaskets.  Note Use new parts.
464	Install the pipe.



465	Check that the gaskets are positioned correctly.
-----	--



466 Install the V-clamps.



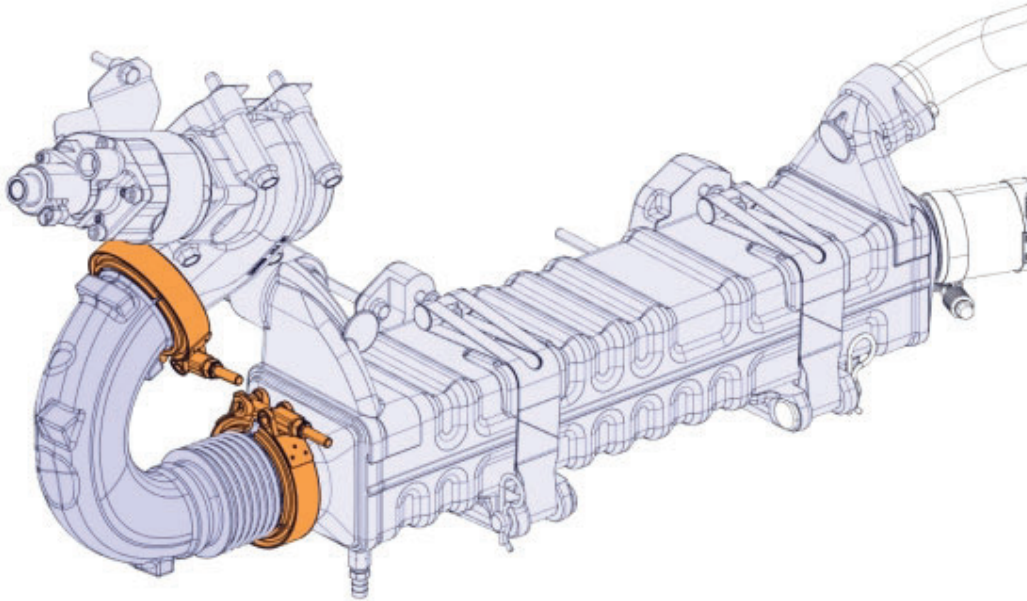
Note

Install as marked.



Note

Use new parts.



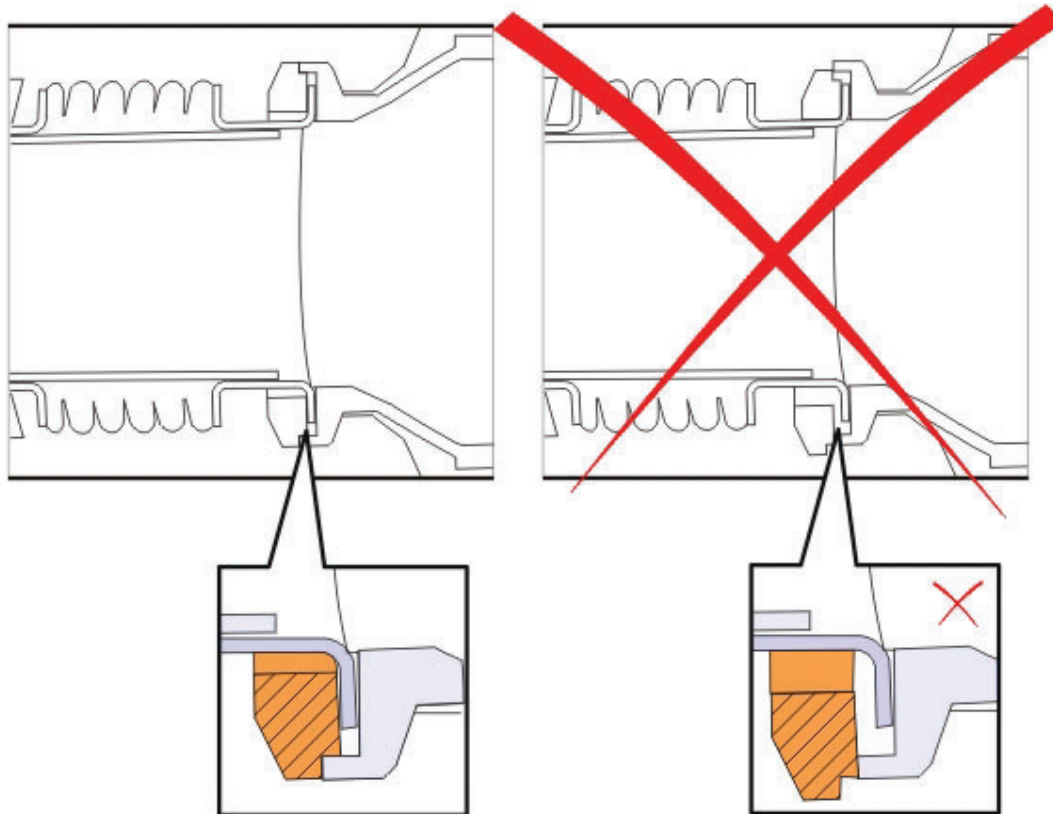
CAUTION

Risk of material damage.

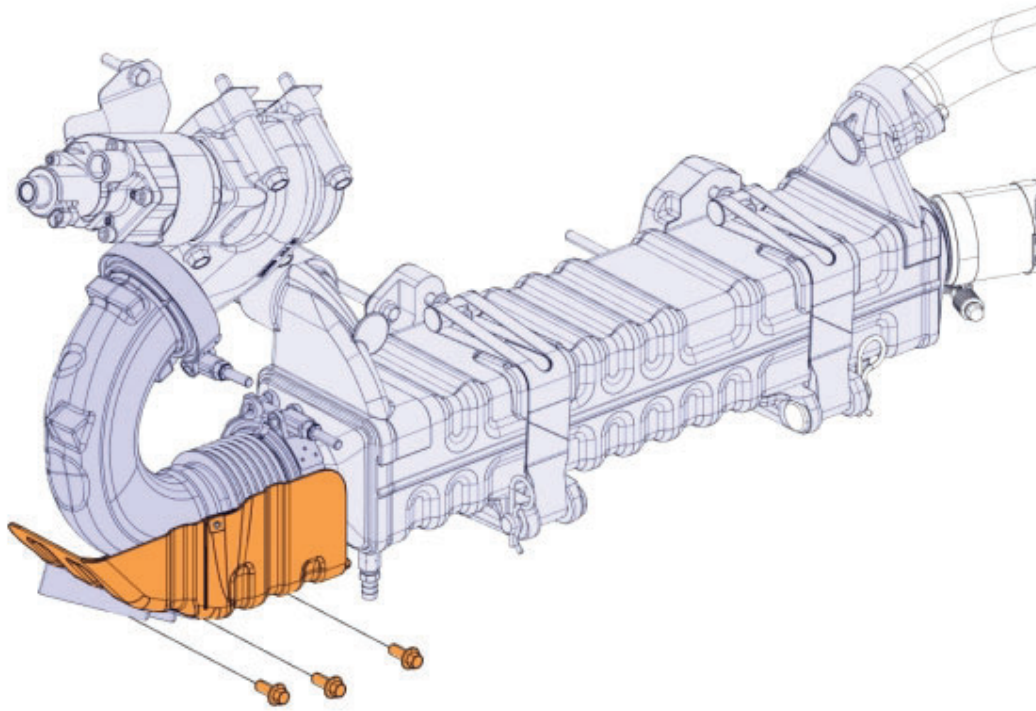
Incorrect installation of the gasket or collar will cause exhaust leakage. The exhaust leakage could damage components in the surrounding area.

- Pay close attention to installing the inlet pipe correctly. Ensure that the gasket and collar are positioned correctly.

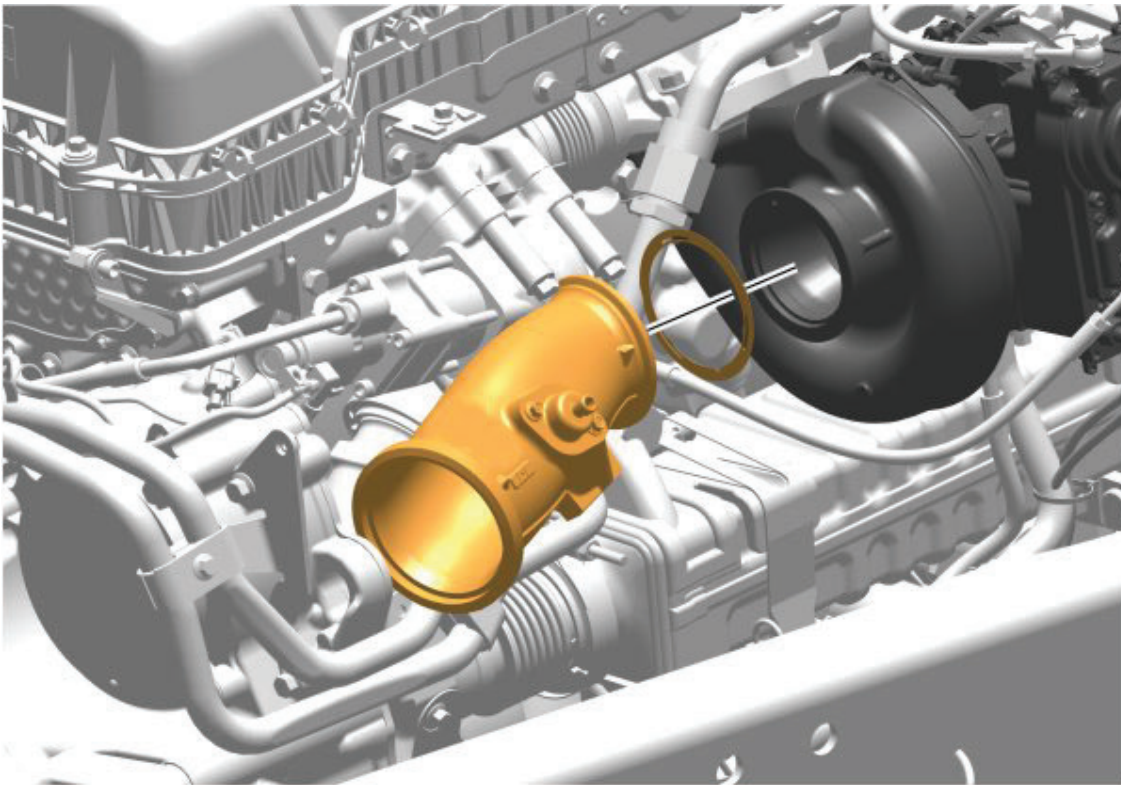
467 Check before tightening that the sliding collar is centered in the cooler flange.



468	Torque tighten the V-clamps.	
	Tightening torque	
	V-band clamp, screw	20 ±4 Nm (15 ±3 lb _f ·ft)
	i Note After tightening, check the position of the V-clamps.	
469	Install the heat shield.	
470	Fit the screws.	



471	Clean the mating surfaces.
472	 Note Use a new part.
473	Install the diffuser.



474 Install the clamp.



Note

Use a new part.



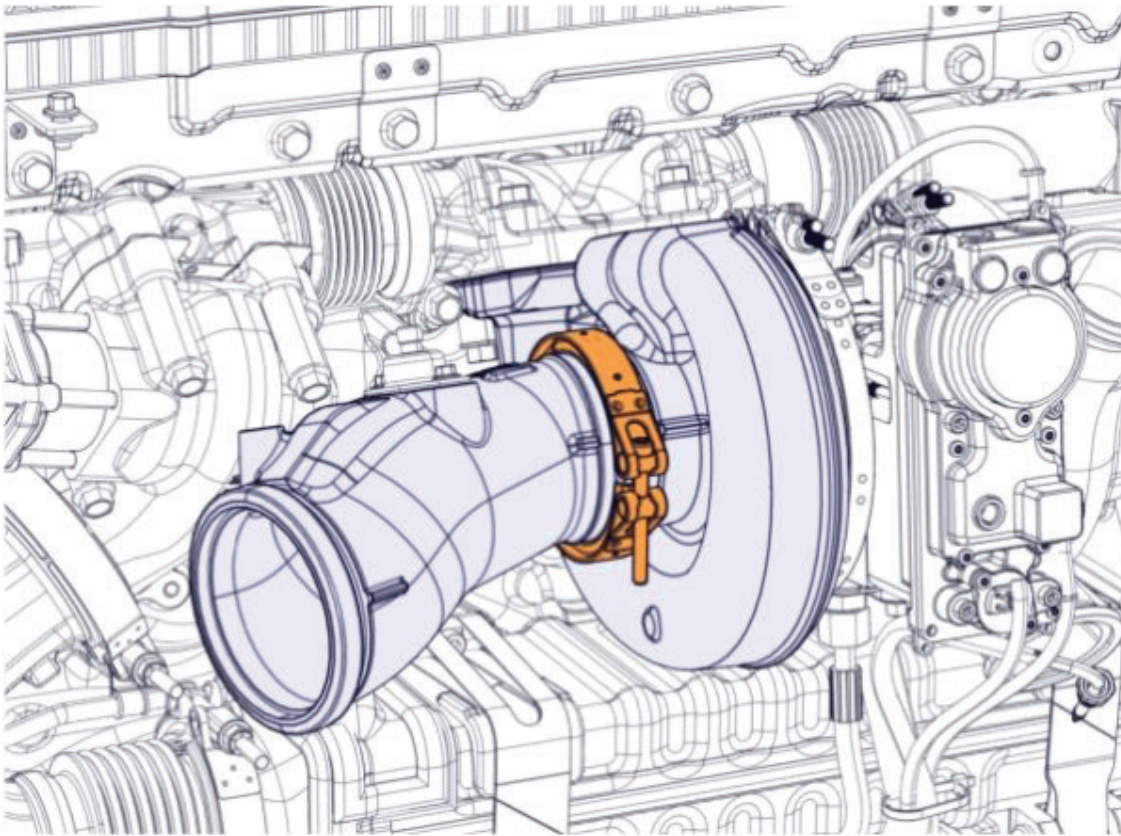
Note

Seat the clamp by tapping it into place between tightening sequences.



Note

Only use a suitable hand tool.

**DANGER**

Risk of material damage, serious personal injury or death.

Connections that are not tightened in accordance with specified tightening torques may cause leakage.

- Tighten connections according to service information.

475 Torque tighten the clamp in sequence.

Tightening torque

V-clamp, pre-torque	7 Nm (5 lb _f ·ft)
---------------------	---------------------------------

476 Seat the clamp by tapping it into place between tightening sequences.

Tightening torque

V-clamp, final torque	14 ±1.5 Nm (10 ±1 lb _f ·ft)
-----------------------	---

477 This step contains 2 alternatives.

Select one of the valid alternatives below.

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

Alternative 1 / 2**Conditions**

- If the pipe is reused
- ▶ Clean the pipe mating surfaces.
- ▶ Install the gaskets.

**Note**

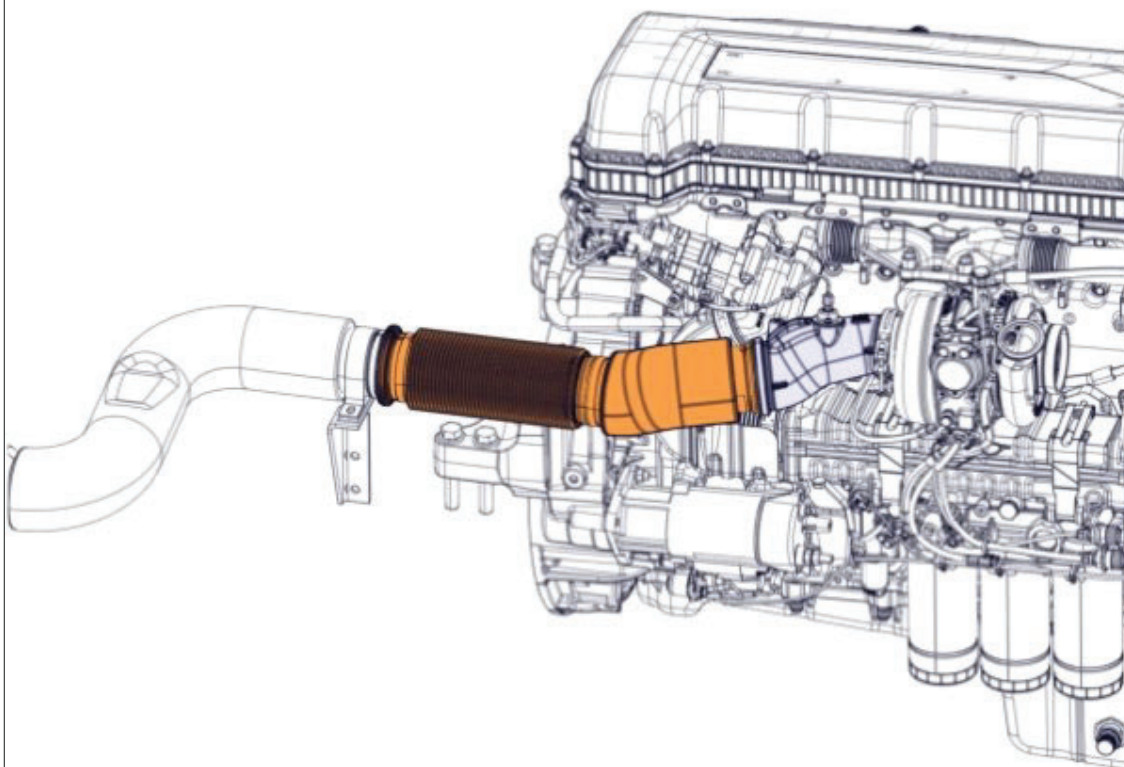
Use new parts.



- ▶ Install the pipe.

**Note**

As noted.



- Install the clamps.

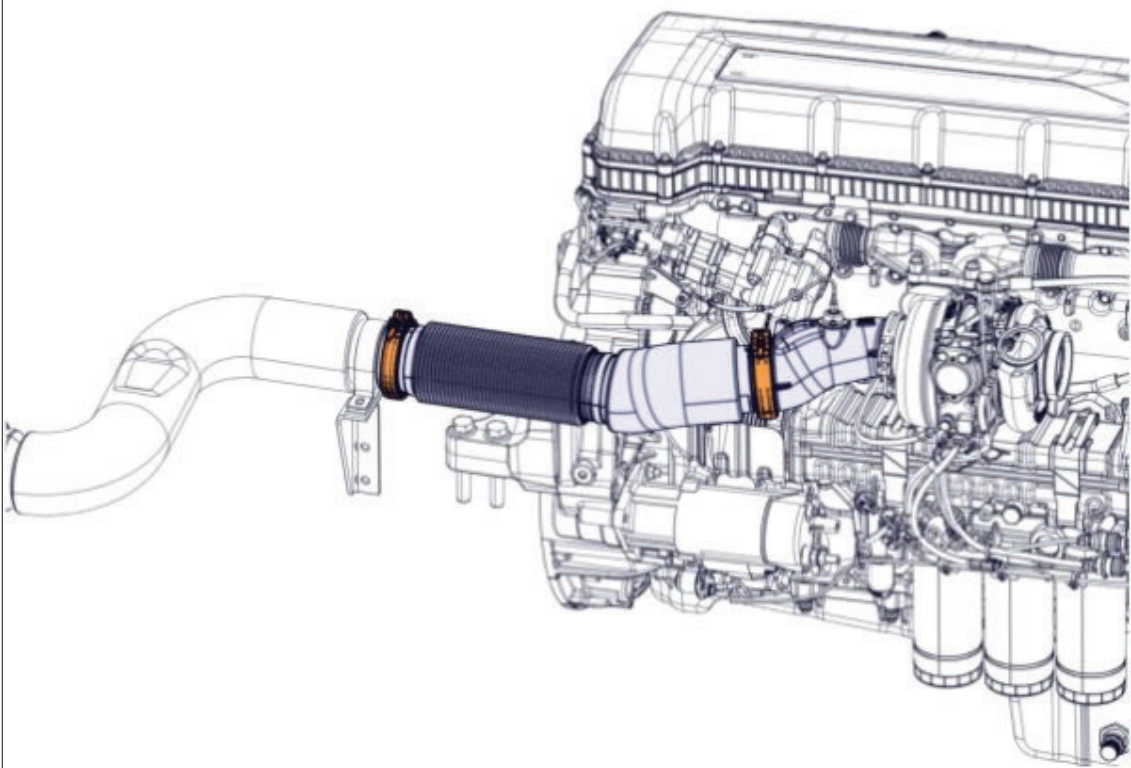
i	Note Use new parts.
----------	-------------------------------

i	Note As noted.
----------	--------------------------

- Torque tighten the clamps.

Tightening torque	
-------------------	--

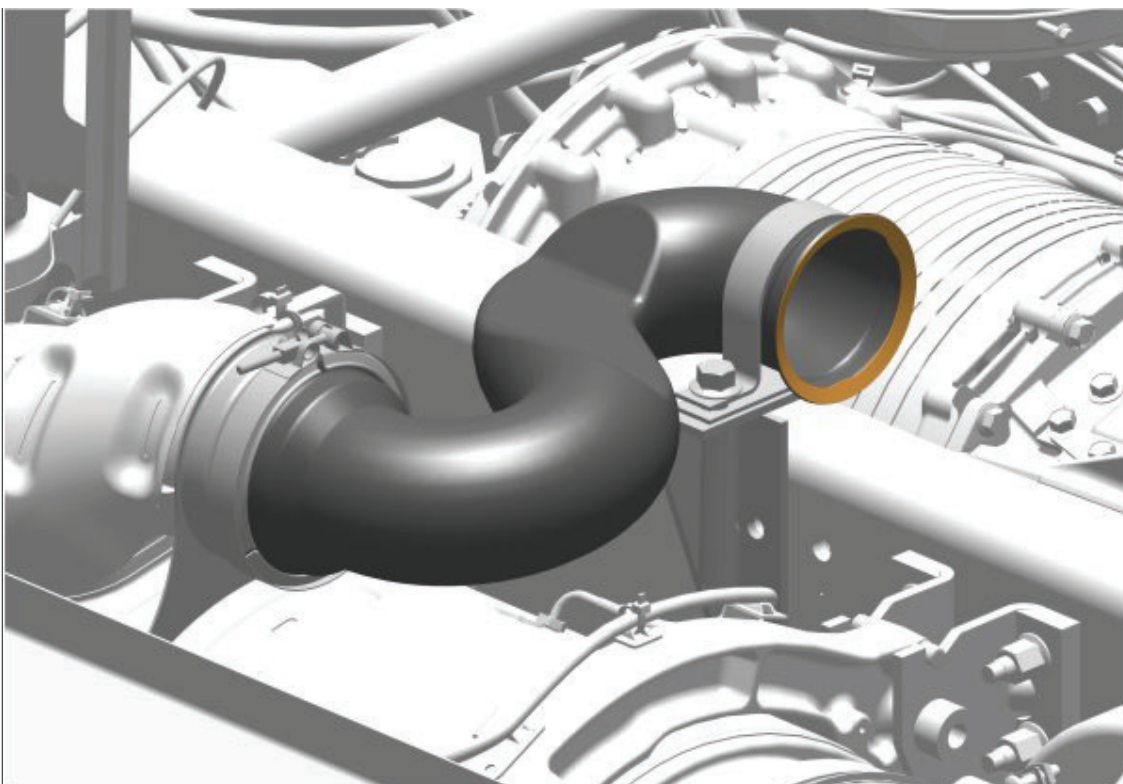
Pipe, clamp	5.6 Nm (4 lb _f ·ft)
-------------	-----------------------------------



Alternative 2 / 2

Conditions

- | | |
|---|-------------------------|
| • | If the pipe is replaced |
| ▶ | Clean the surface. |



- Check the length **(A)** of the flexible hose.

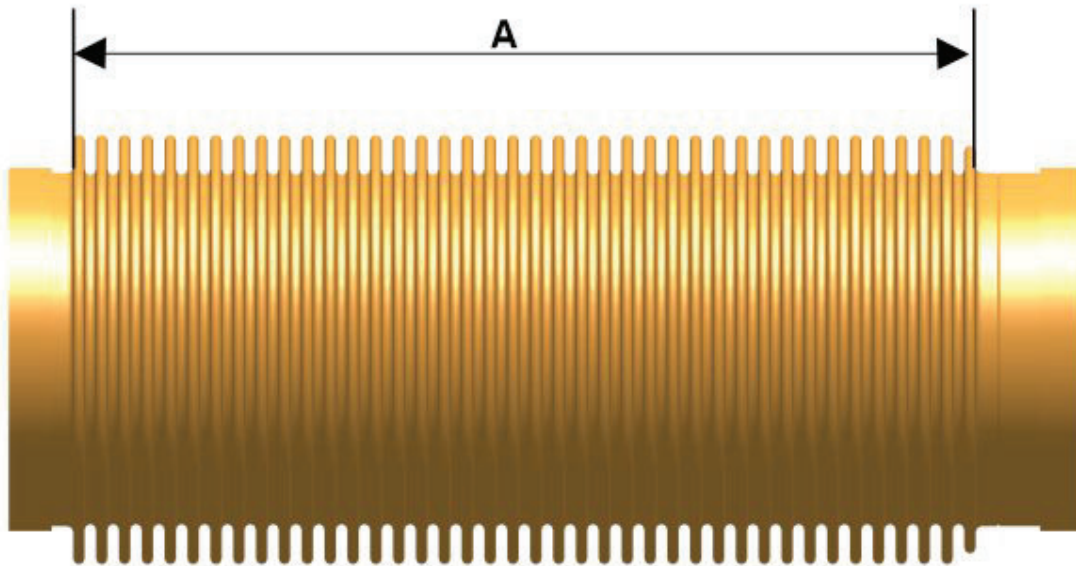
Tech data

Flexible hose, length (A)	267 ±10 mm (10.51 ±0.39 in)
---------------------------	--------------------------------



Note

Ensure that the length is according to the specification.



- Position the exhaust pipe.



Note

Use a new gasket.



Note

The markings indicate the flow direction.



Note

The exhaust pipe should be fixed as straight as possible.



Note

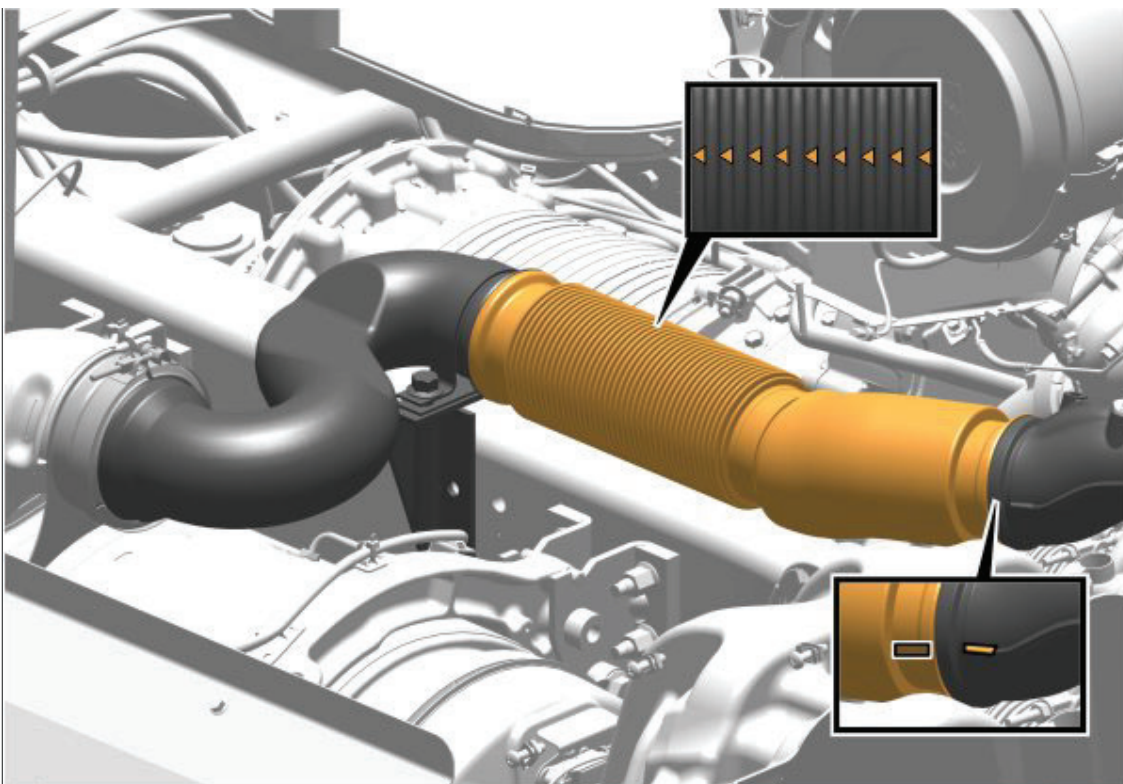
Ensure that flexible hose is not twisted or bent more than the specification.



Service hint

Ensure that 11 L engines are aligned with Red line.

Ensure that 13 L engines are aligned with Black line.



- Install the V-clamps.

**Note**

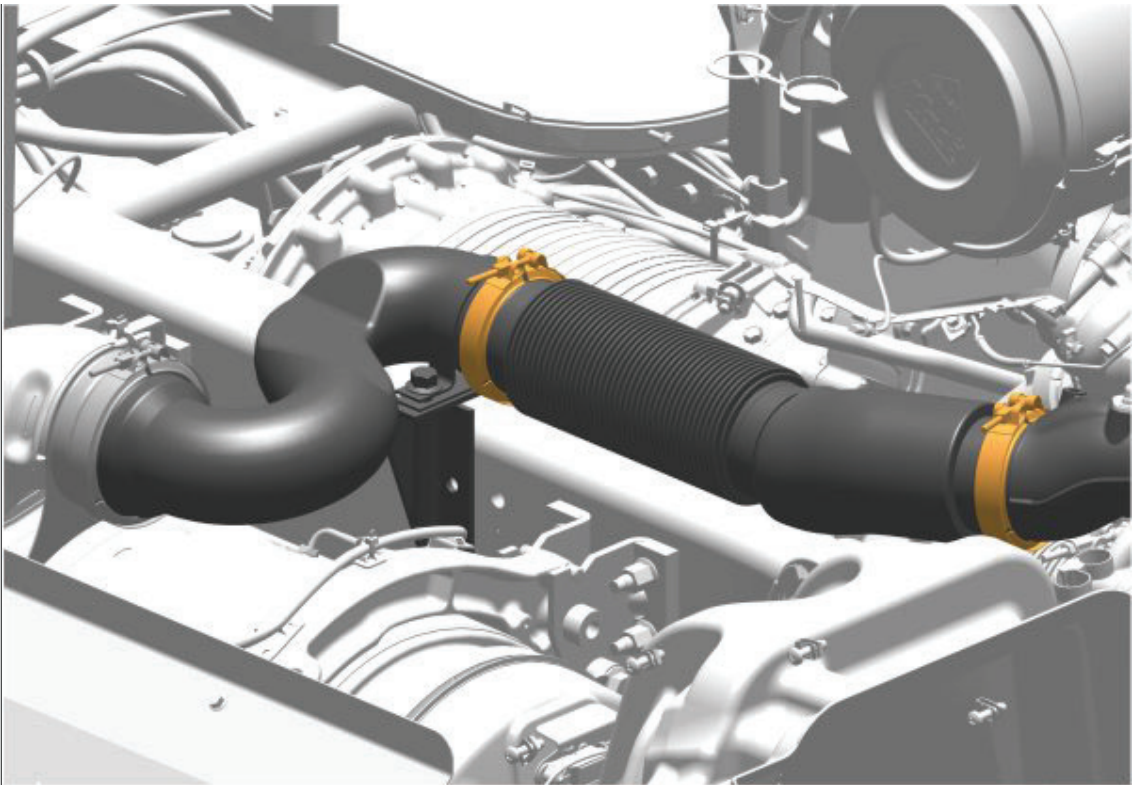
Use new parts.

**Note**

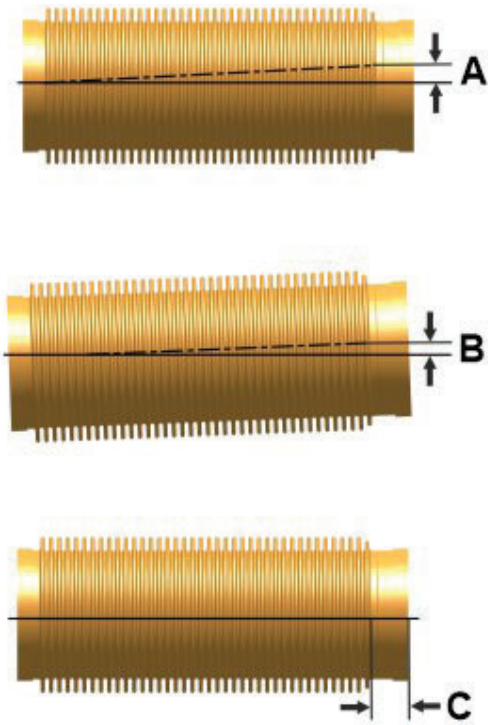
As noted.

**Note**

Do not torque tighten the V-clamps.



► Check the alignment of the flexible hose.			
Tech data			
Flexible hose, torsion displacement (A)	±2 mm (±0.08 in)		
Flexible hose, parallel displacement (B)	±5 mm (±0.2 in)		
Flexible hose, axial displacement (C)	±6.5 mm (±0.256 in)		
<table><tr><td></td><td>Note Ensure that the flexible hose is aligned according to specifications.</td></tr></table>			Note Ensure that the flexible hose is aligned according to specifications.
	Note Ensure that the flexible hose is aligned according to specifications.		



► Perform this procedure when the condition below is met.

Conditions

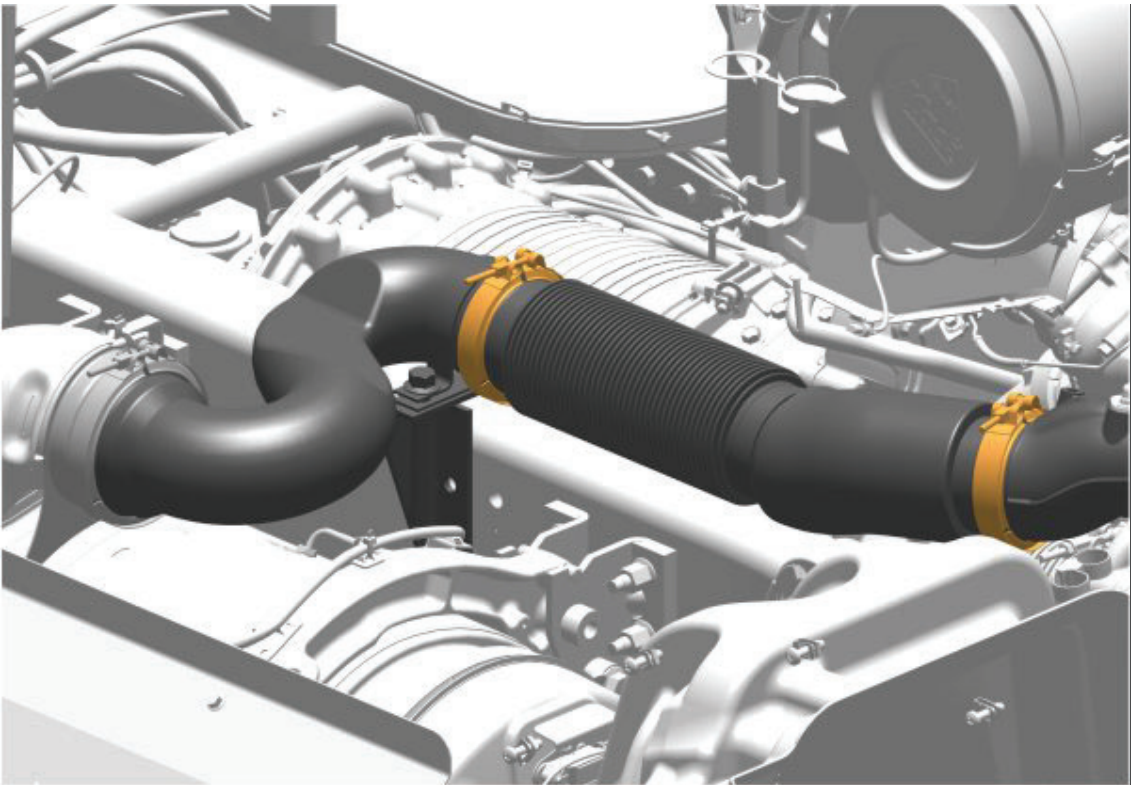
- If the flexible hose length and alignment is not according to the specification

► Loosen the exhaust pipe at the turbocharger end and align as per specifications.

► Torque tighten the V-clamps.

Tightening torque

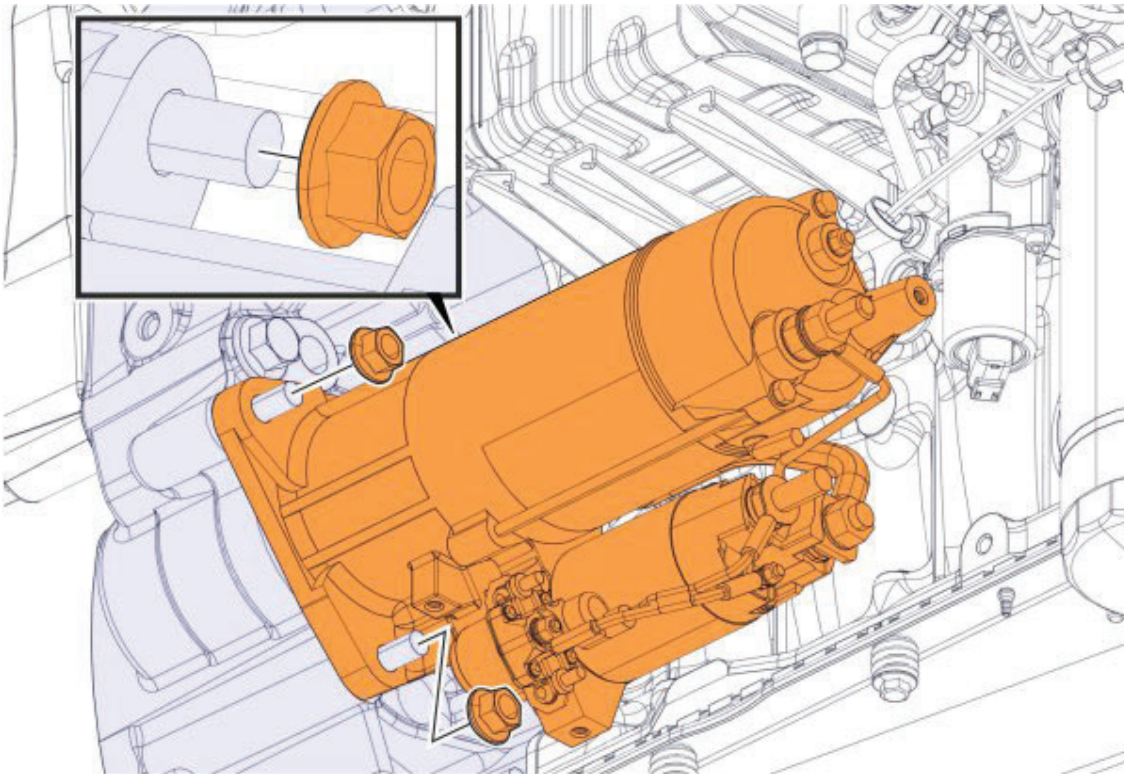
Pipe, clamp	5.6 Nm (4 lb _f ·ft)
-------------	-----------------------------------



478	Install the starter motor.
-----	----------------------------

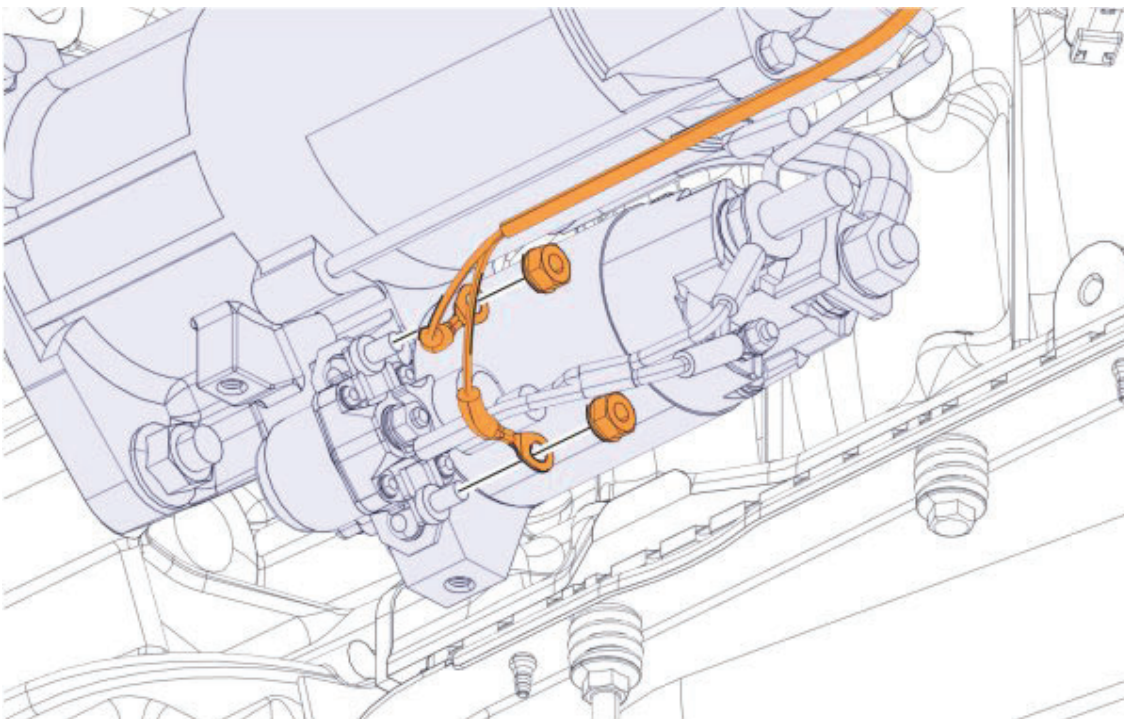
479	Install the nuts.
-----	-------------------

480	Tighten the nuts to torque.	
	Tightening torque	
	Starter motor, nut	48 ±8 Nm (35 ±6 lb _f ·ft)



481	Install the cable terminals.
------------	------------------------------

482	Install the nuts.
------------	-------------------



483	Install the cable terminal.
------------	-----------------------------

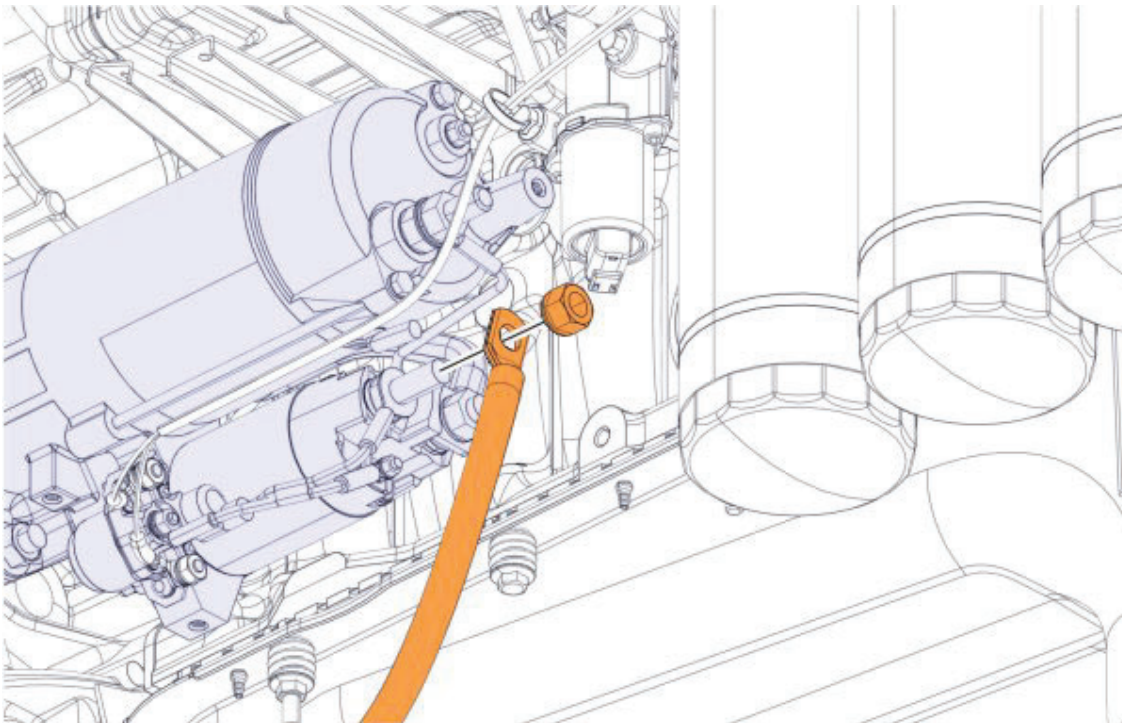
484	Install the nut.
------------	------------------

485	Torque tighten the nut.
------------	-------------------------

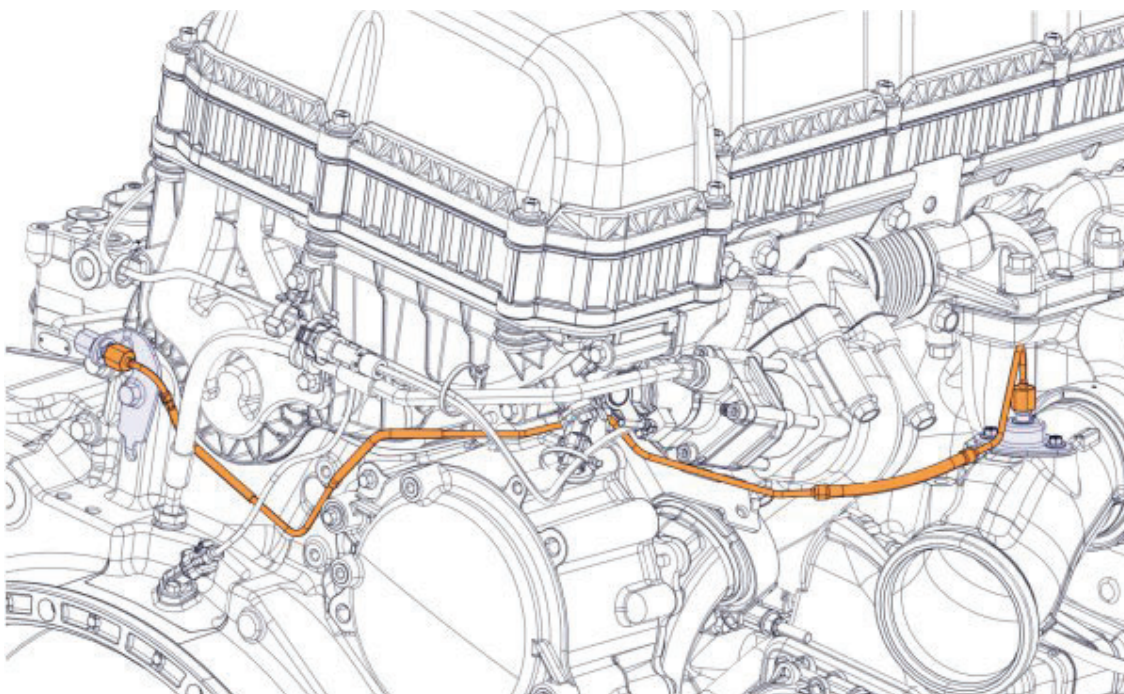
Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

Tightening torque	
Starter solenoid, terminal, nut	M10
	18 ±3.6 Nm
	(13 ±3 lb _f ·ft)
Tightening torque	
Starter solenoid, terminal, nut	M12
	25 ±5 Nm
	(18 ±4 lb _f ·ft)

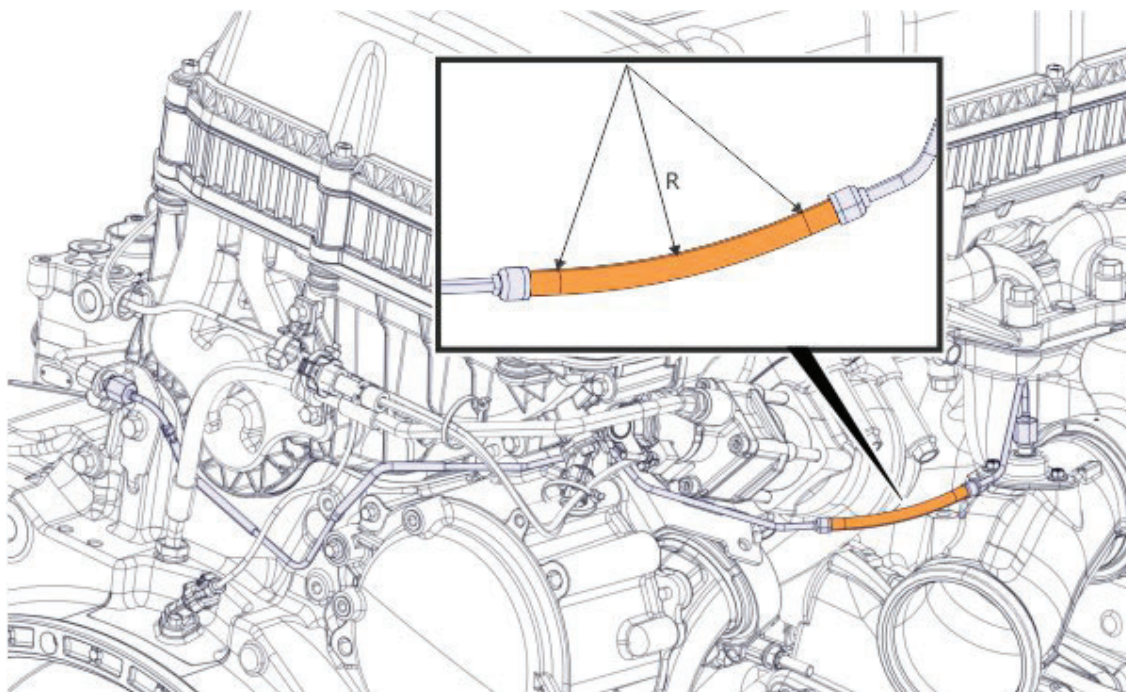


486	Position the pipe.	
	 Note The pipe can be reused only a limited number of times.	
	 Note If there are no clips, replace the pipe.	

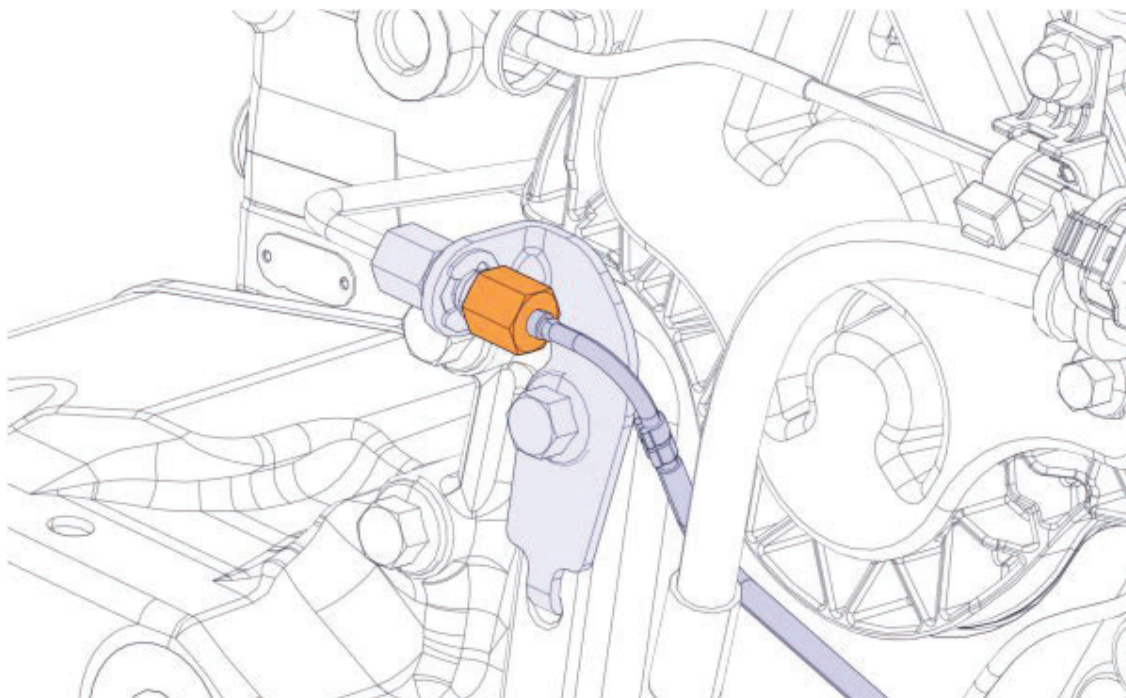


487	Perform this procedure when the condition below is met.
	Conditions
	• If the pipe is reused, remove a clip.
	▶ If there are no clips, replace the pipe.
	▶ If installing new pipe, do not remove any clips.
	Note If the pipe has been disconnected on either end for service, this counts as reuse.

488	Ensure that the tube is not bent at the crimp.				
	Tech data				
	<table border="1"> <tr> <td data-bbox="215 1379 846 1409">Fuel pipe, radius (R)</td><td data-bbox="854 1379 1273 1409">≥50 mm</td></tr> <tr> <td></td><td data-bbox="854 1421 1273 1451">(≥1.97 in)</td></tr> </table>	Fuel pipe, radius (R)	≥50 mm		(≥1.97 in)
Fuel pipe, radius (R)	≥50 mm				
	(≥1.97 in)				
	Note The minimum bend radius is 50mm at the flexible line.				
	Note Do not twist the tube and crimp.				



489	Install the nut.	
490	Tighten the nut to torque.	
	Tightening torque	
	Fuel pipe, nut	15 ±2 Nm (11 ±1 lb _f ·ft)



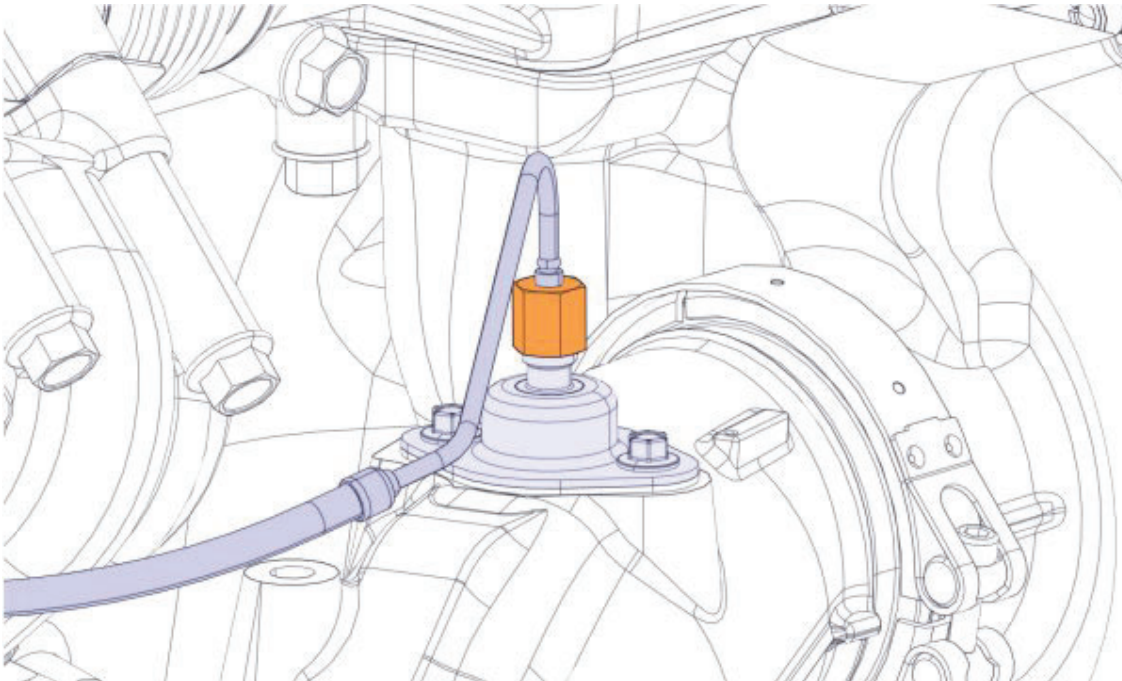
491	Install the nut.	
	Note	

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.



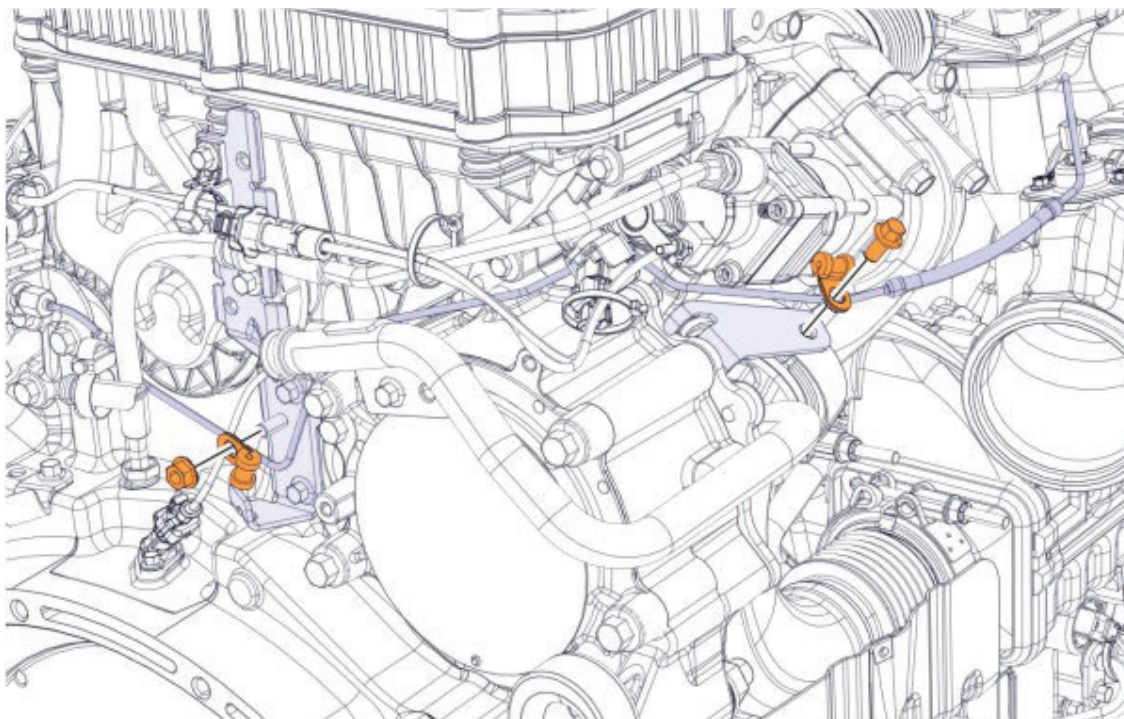
Hand tighten the nut.



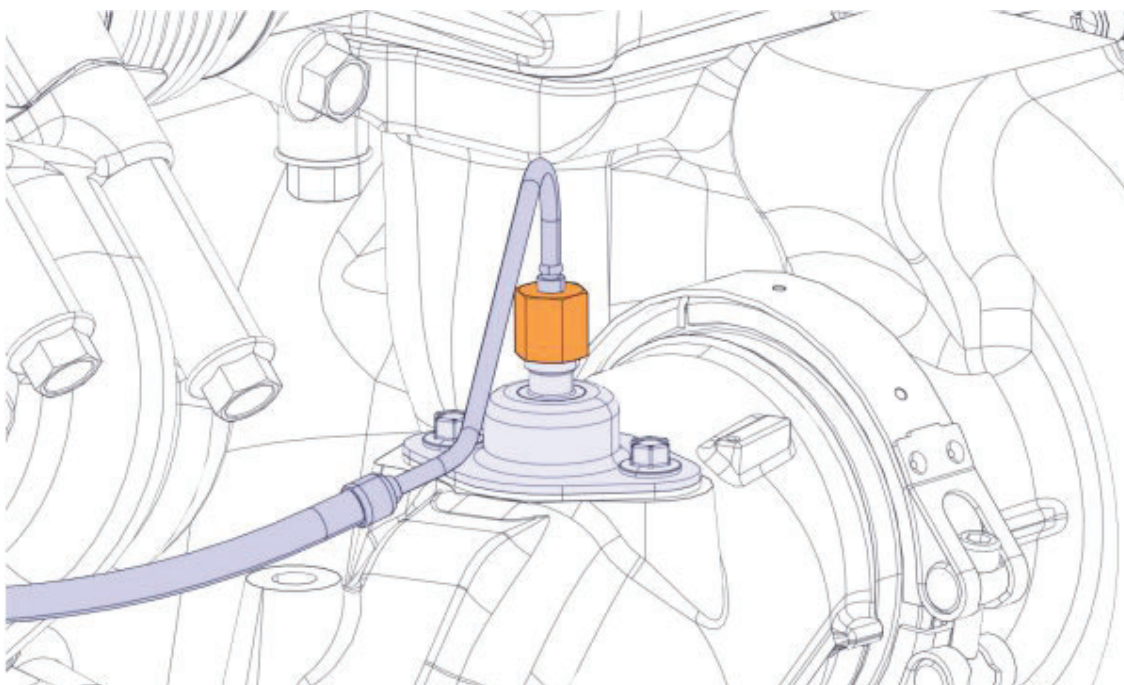
492 Install the clamp along with the screw and nut.

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

494 Tighten the nut to torque.	
Tightening torque	
Fuel pipe, nut	24 ±4 Nm (18 ±3 lb _f ·ft)

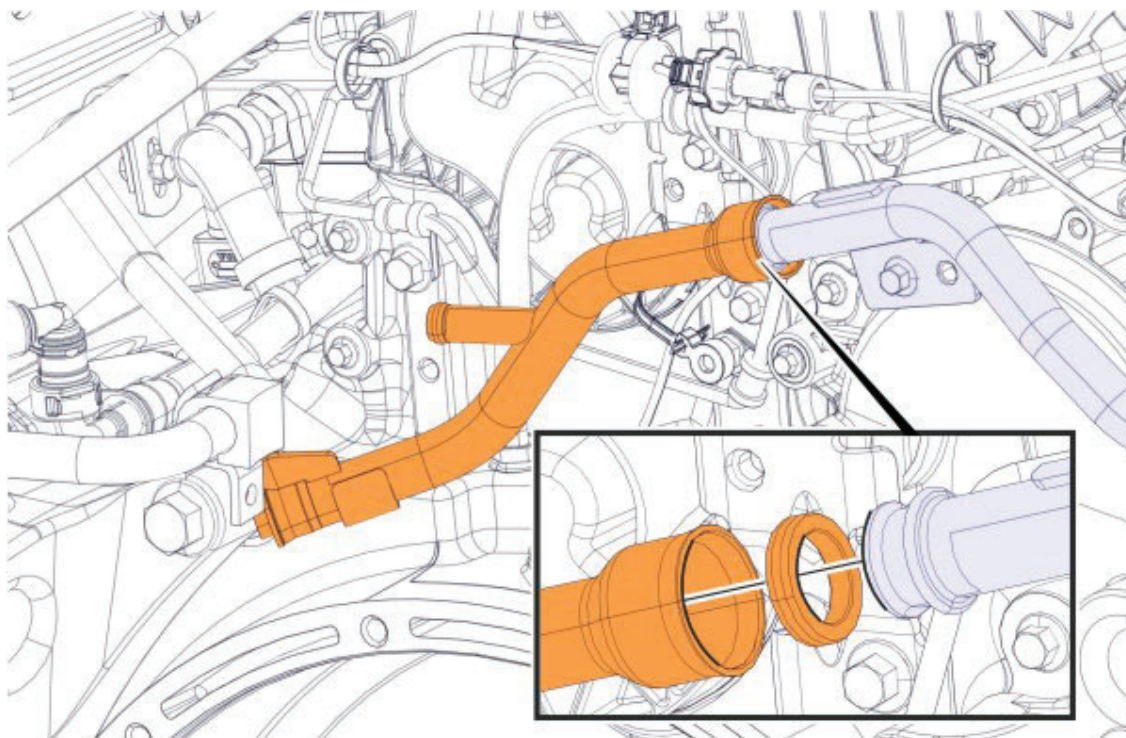


495	Tighten the nut to torque.	
	Tightening torque	
	Injector pipe, nut	25 ±6 Nm (18 ±4 lb _f ·ft)

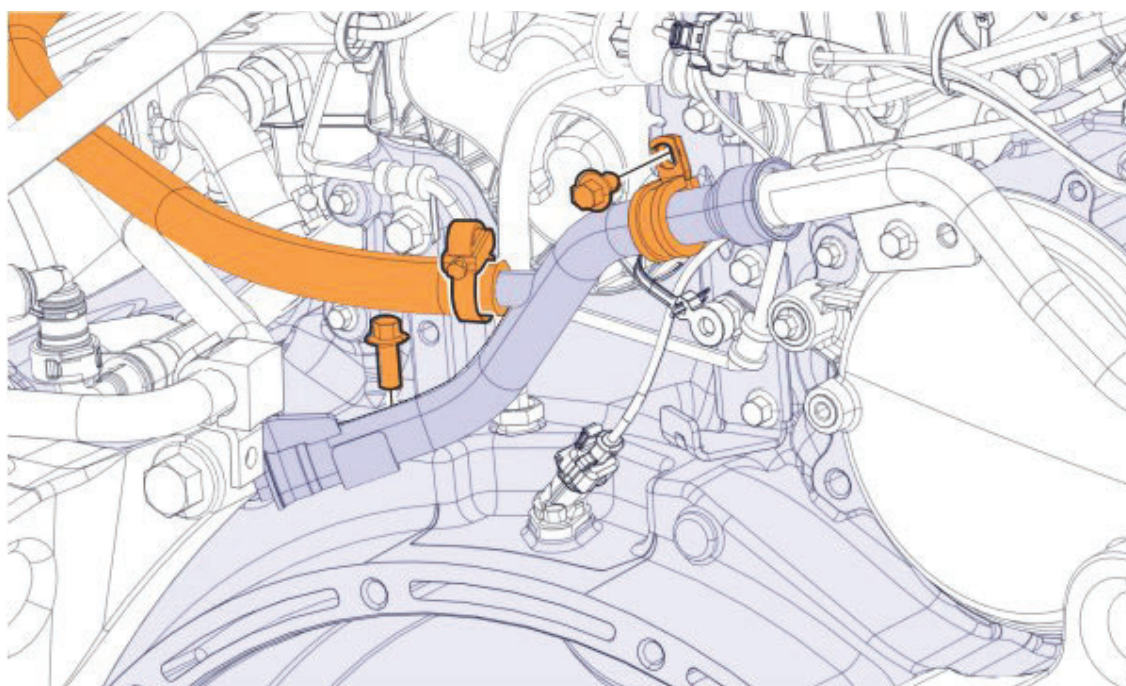


496	Install the seal.
-----	-------------------

497	Install the pipe.
-----	-------------------



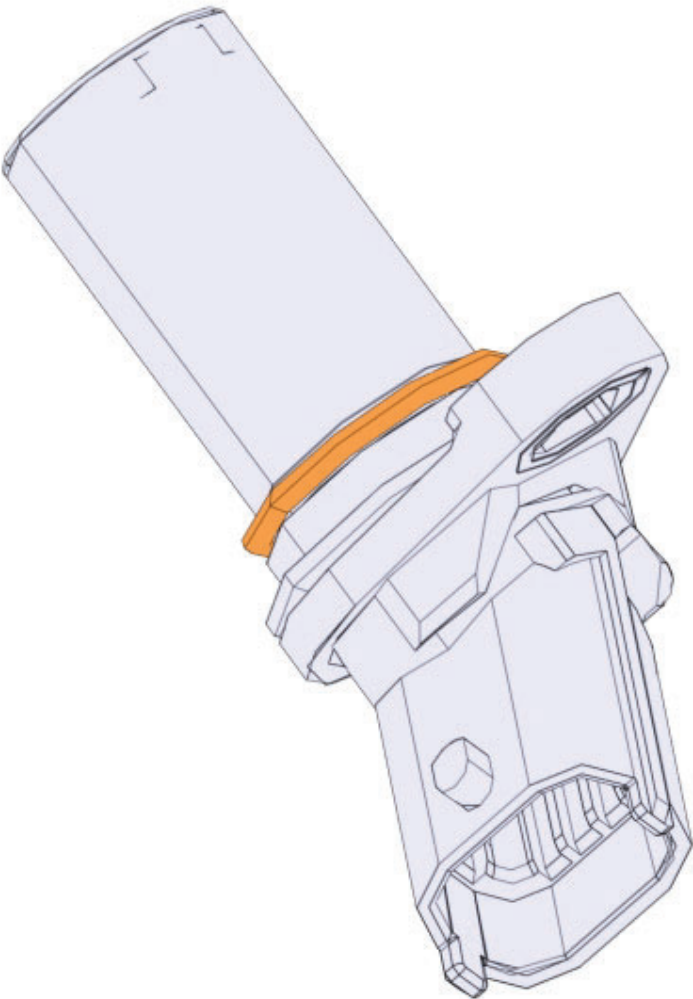
498	Install the clamp.
499	Install the screws.
500	Install the hose.
501	Tighten the clamp.



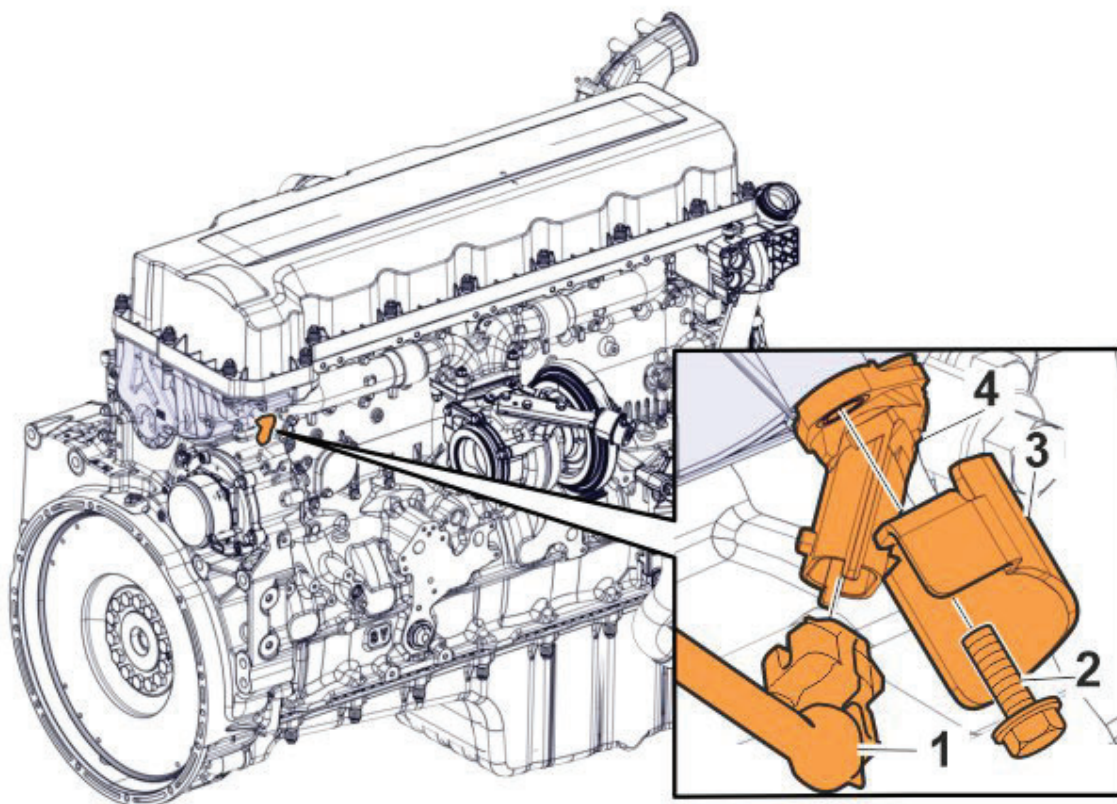
502	Install the o-ring.
	i Note Use a new part.

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

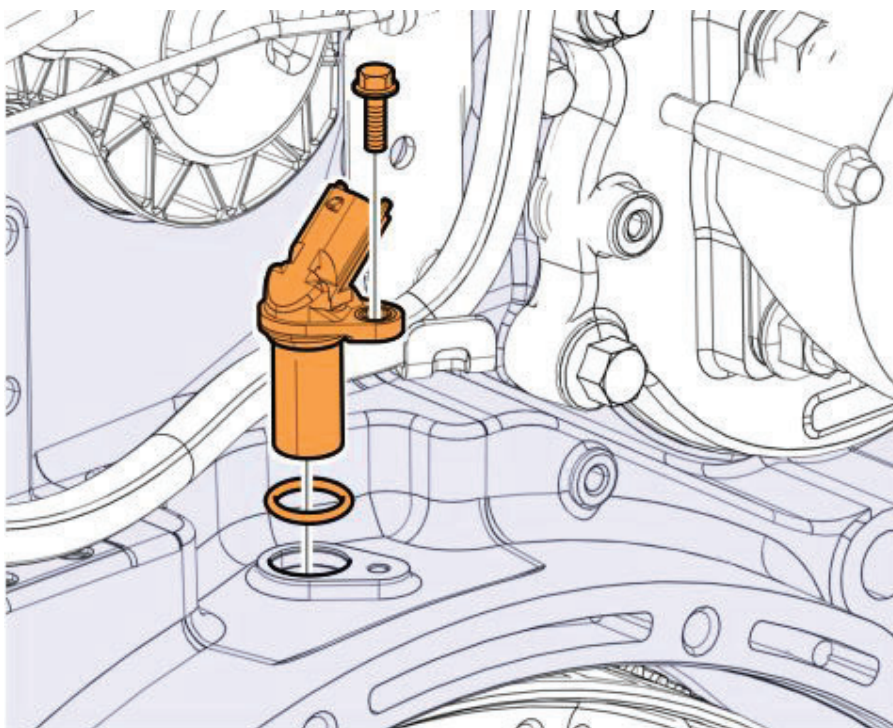
The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.



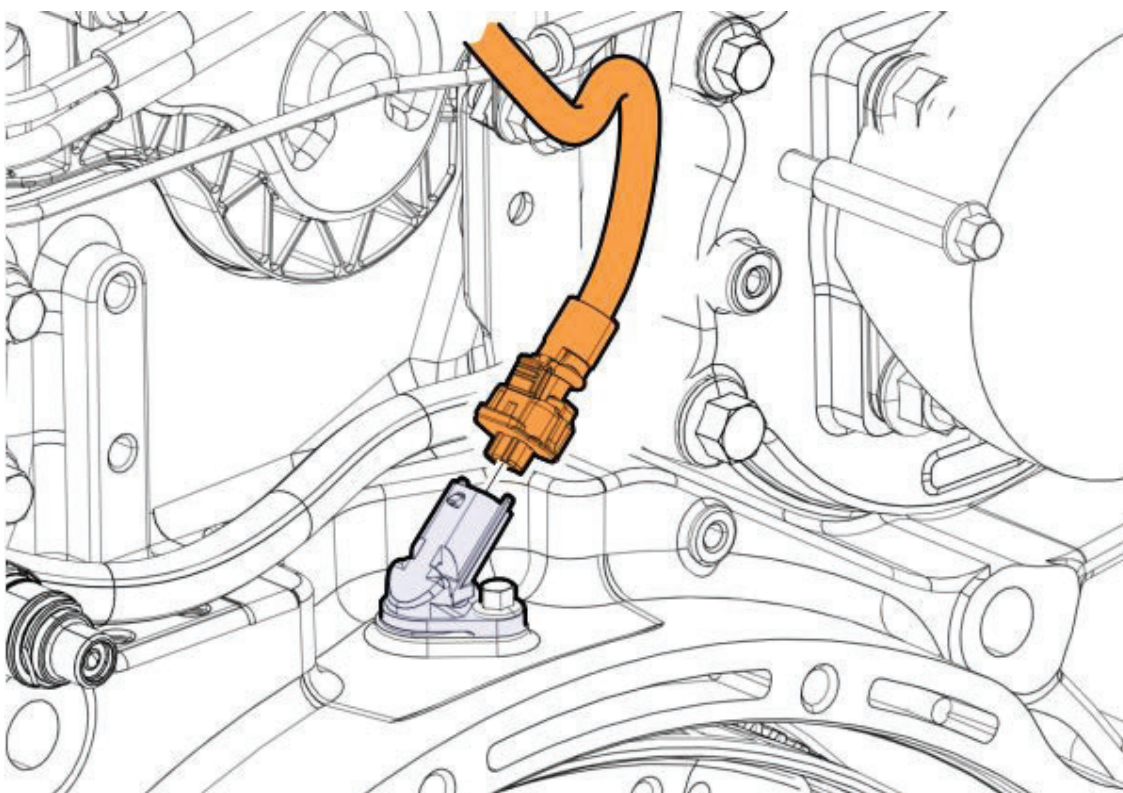
503	Install the sensor (4).	
		Service hint Install the sensor and shims previously recorded.
504	Install the heat shield (3).	
505	Install the screw (2).	
506	Tighten the screw to torque.	
	Tightening torque	
	Camshaft speed sensor, screw	8 ±2 Nm (6 ±1 lb _f -ft)
507	Connect the connector (1).	



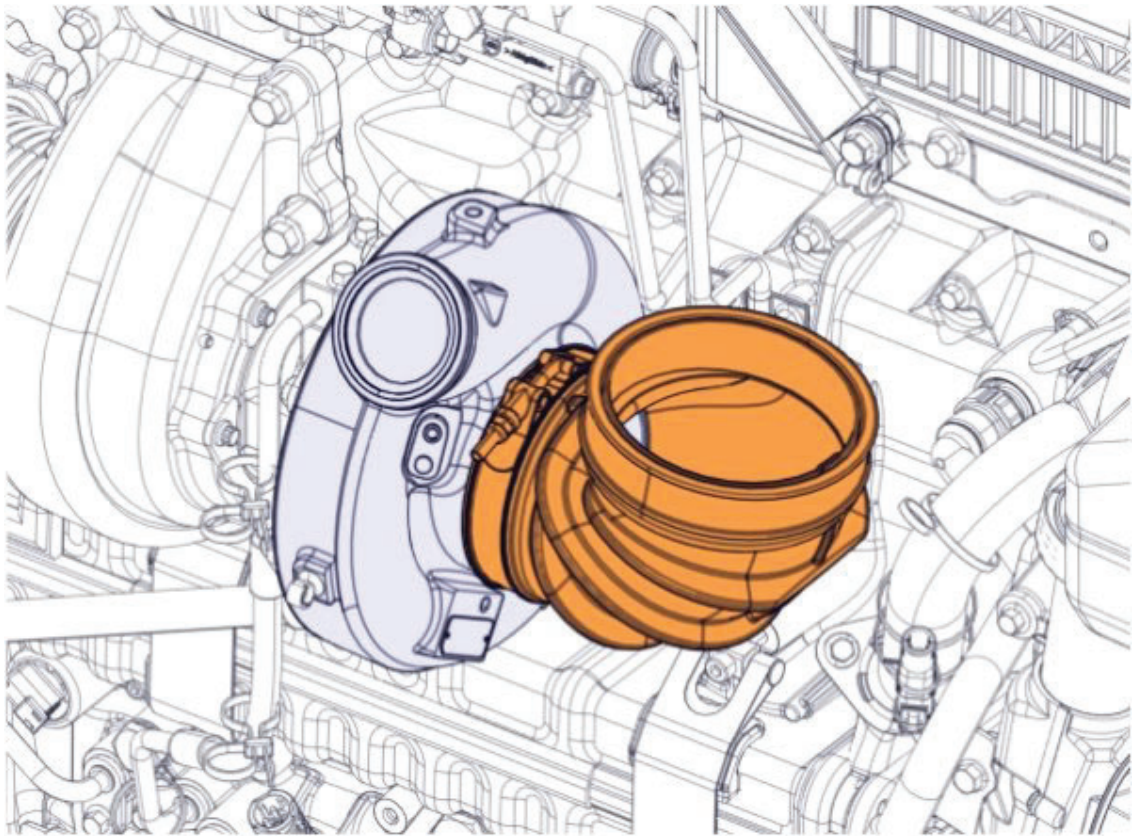
508	Install the O-ring.
	
Note	
Use a new part.	
509	Install the sensor.
510	Install the screw.
511	Torque tighten the screw.
Tightening torque	
Camshaft speed sensor, screw	$8 \pm 2 \text{ Nm}$ $(6 \pm 1 \text{ lb}_f\text{-ft})$



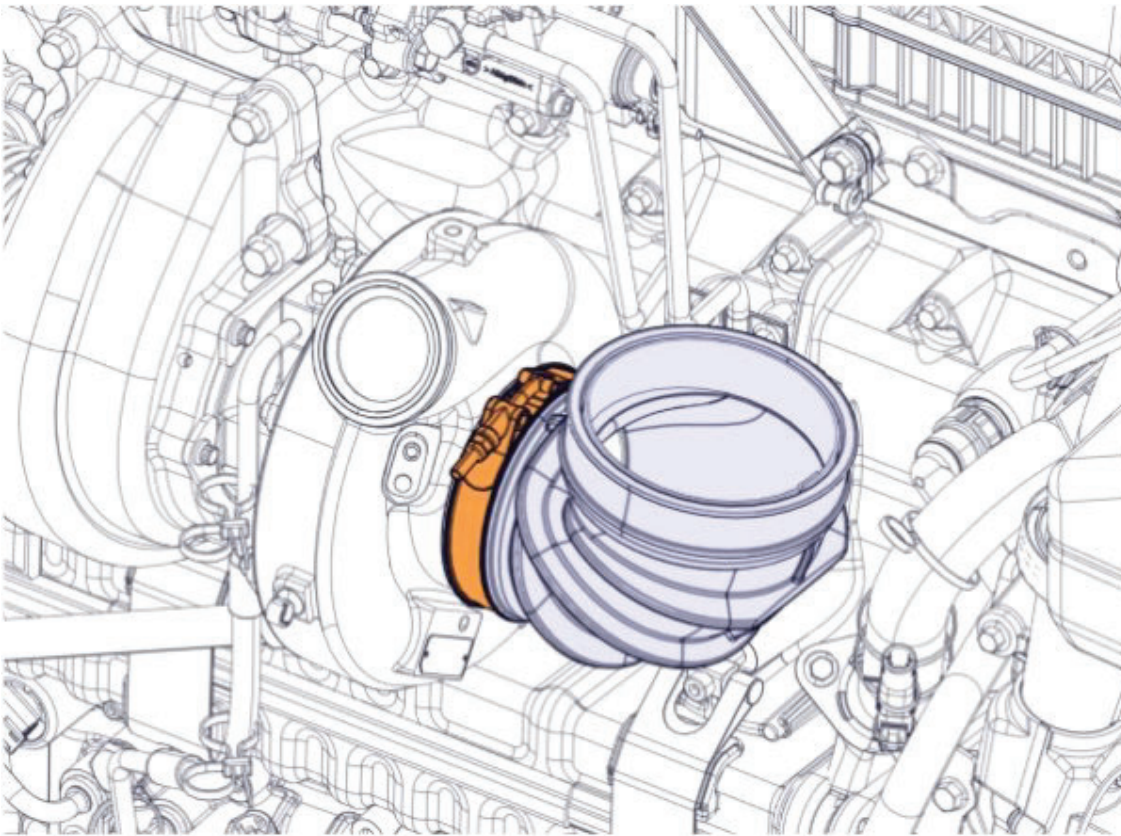
512 Connect the connector.



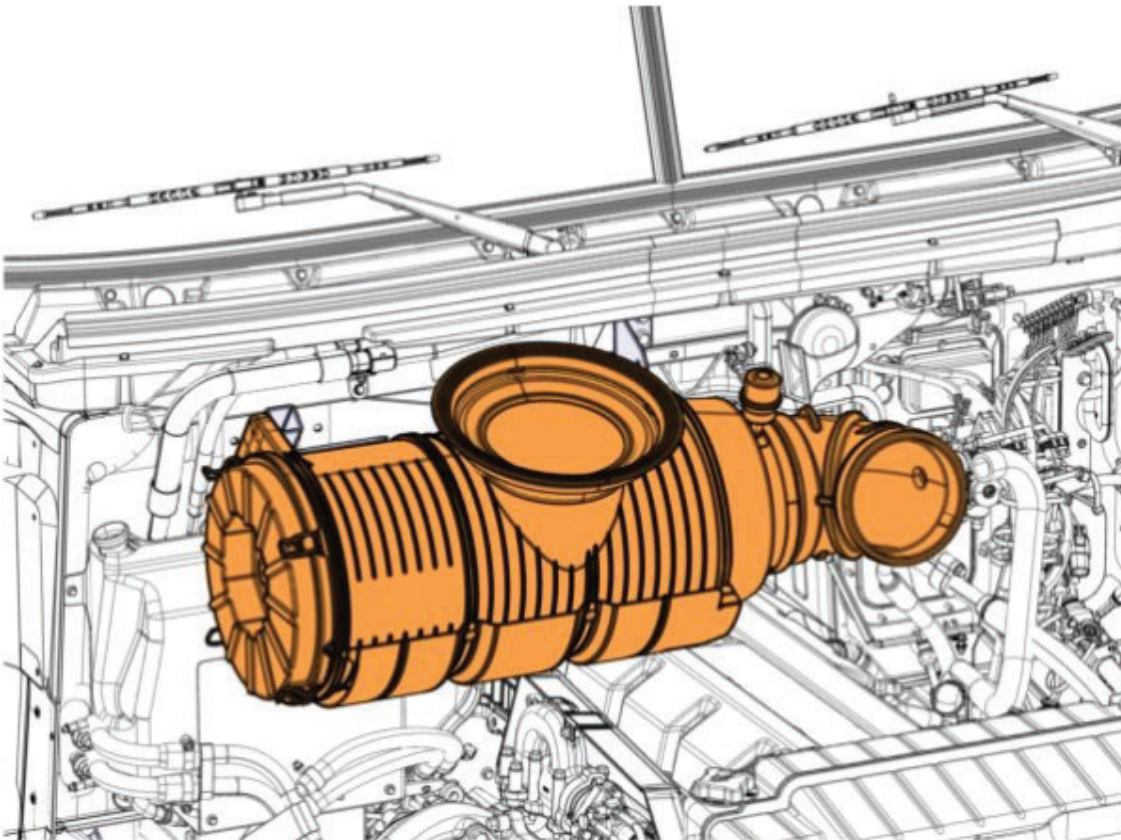
513 Install the duct.



514	Torque-tighten the clamp.	
	Tightening torque	
	Air duct, clamp	9 ±1 Nm (80 ±9 lb _f ·in)



515	Position the housing.
-----	-----------------------

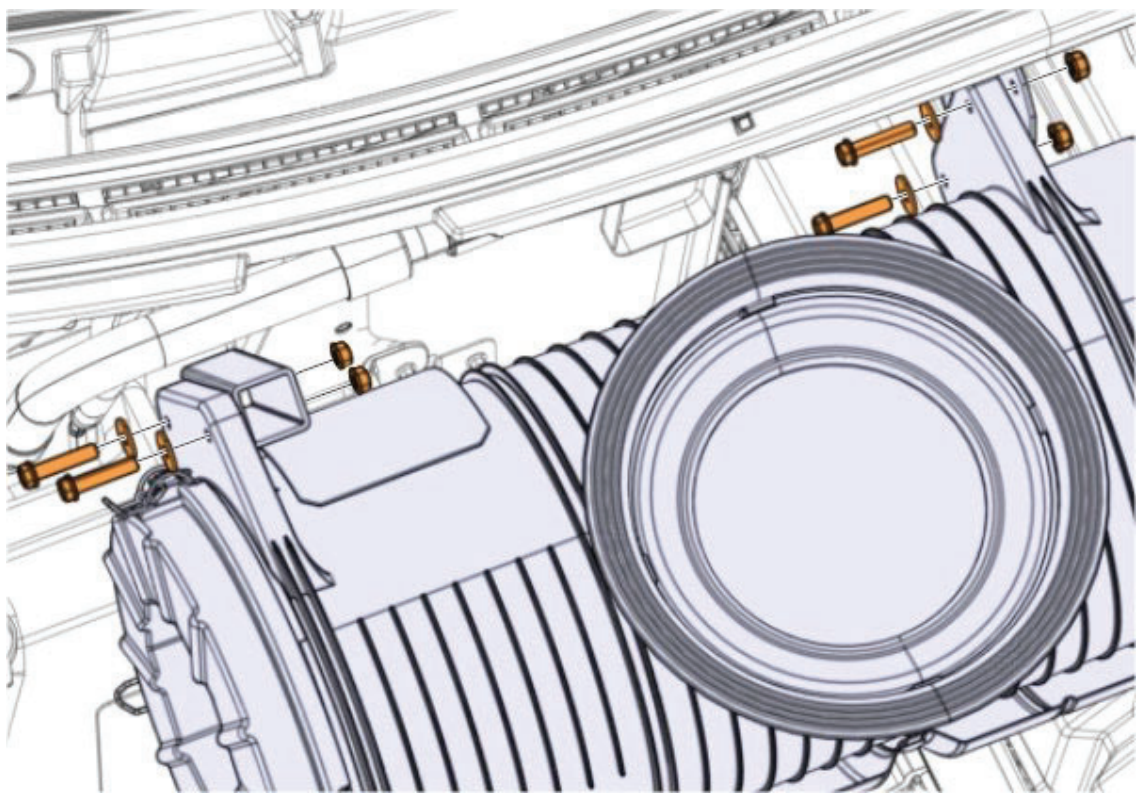


516	Install the screws, washers and the nuts.
-----	---

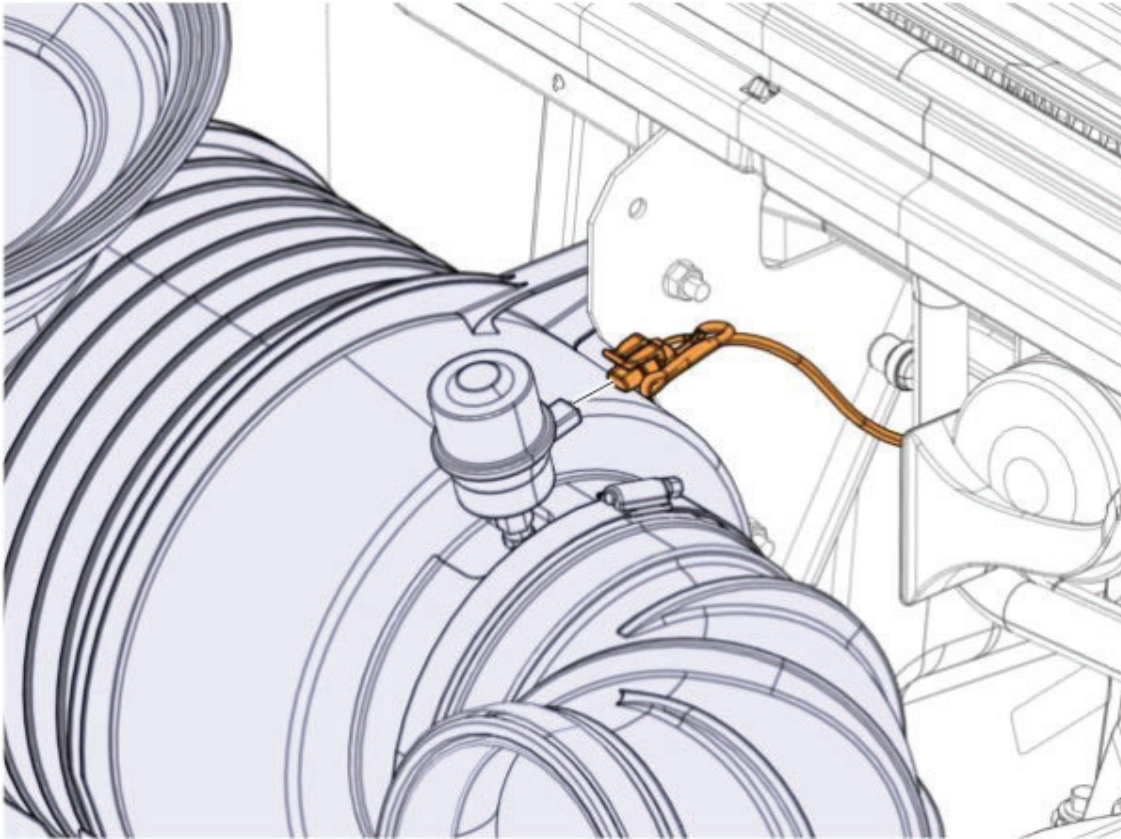
Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

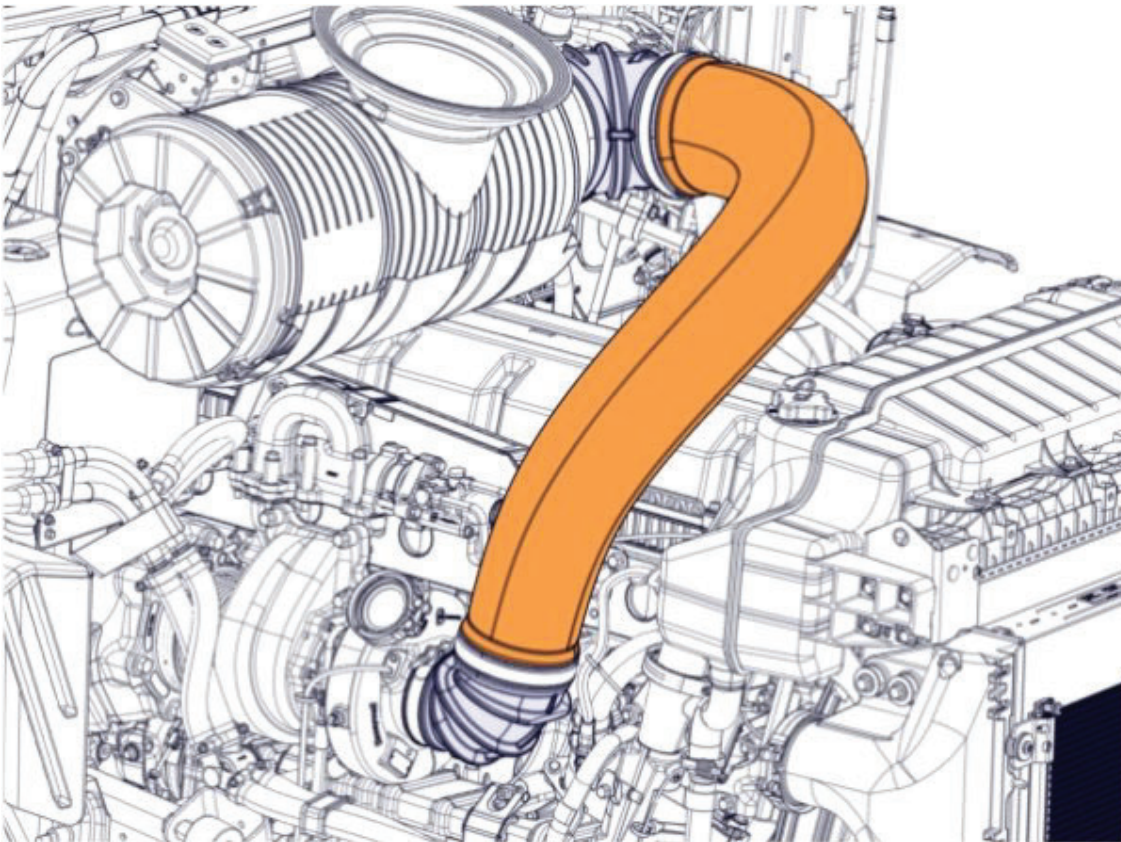
517	Torque tighten the screws.	
	Tightening torque	
	Air filter housing, screw	M8
		5.6 ±0.6 Nm
		(50 ±5 lb _f ·in)



518	Connect the connector.
-----	------------------------



519 Install the air duct.

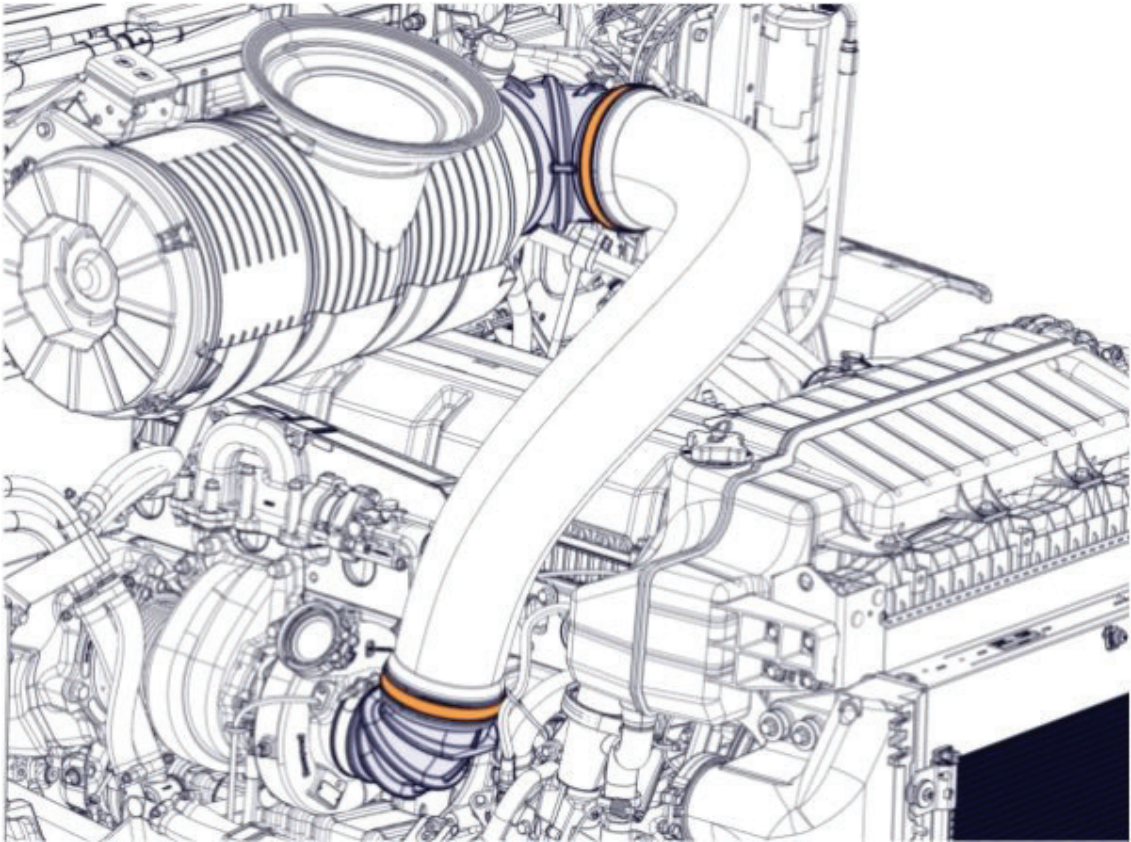


520 Tighten the clamps to torque.

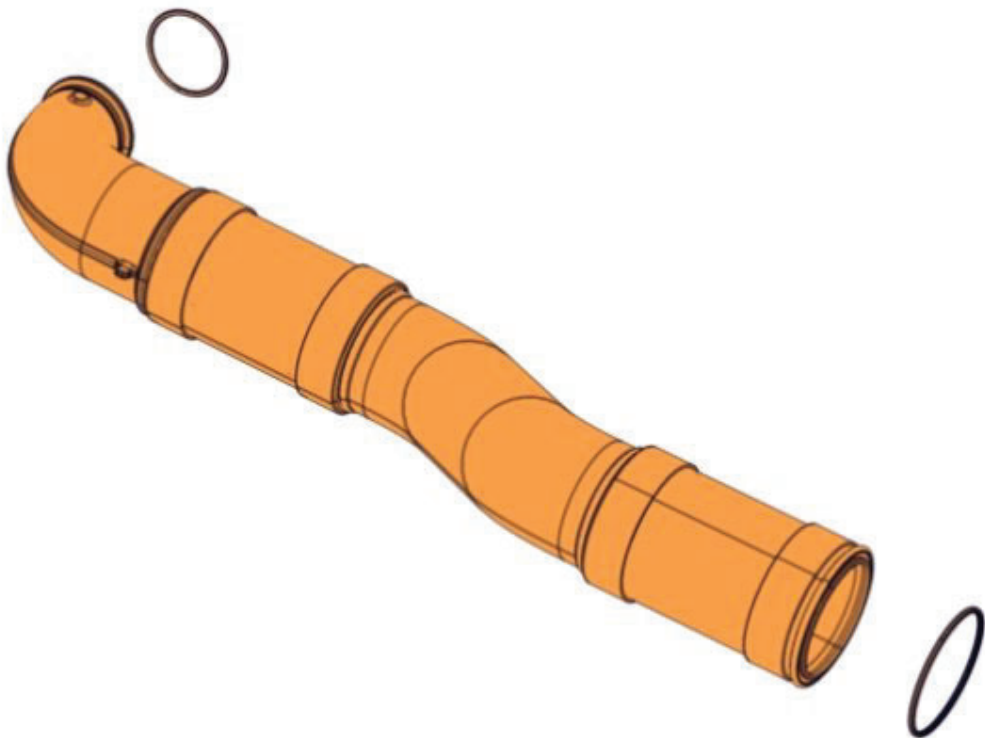
Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

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

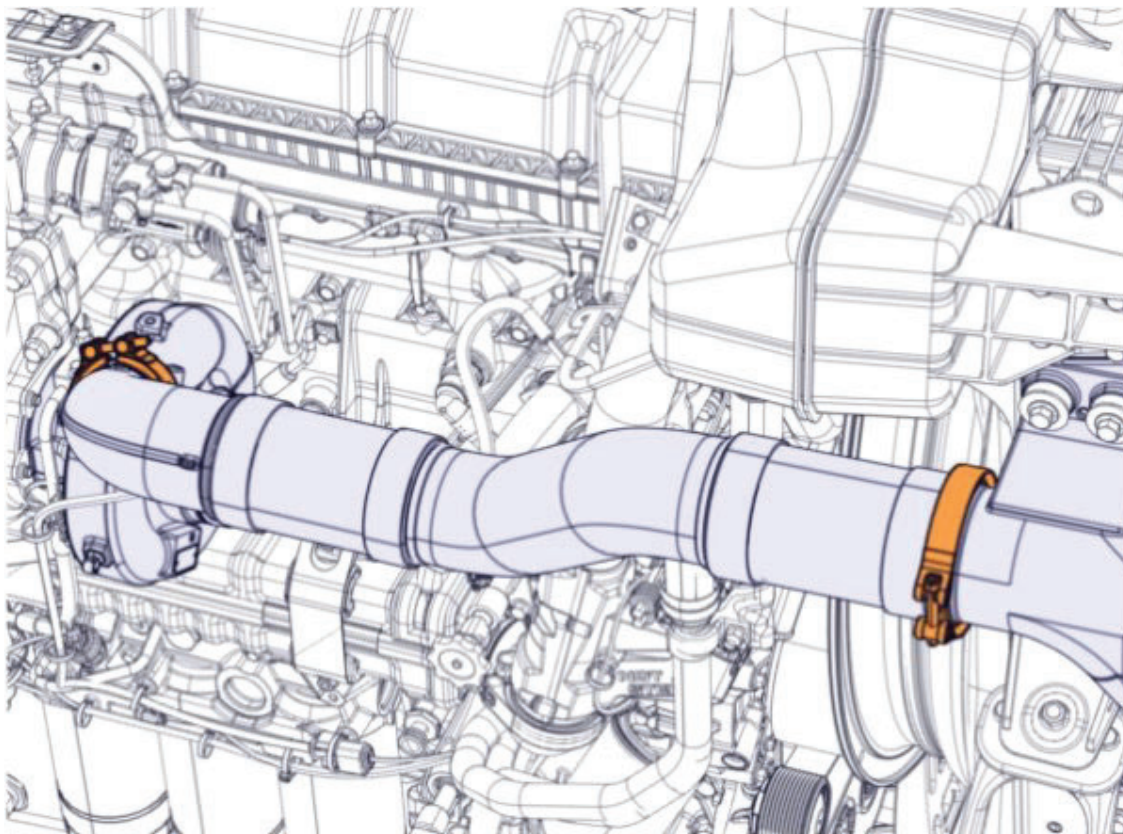


521	Install the seals.
i Note Inspect the seals, replace as needed.	
522	Install the charge air pipe.

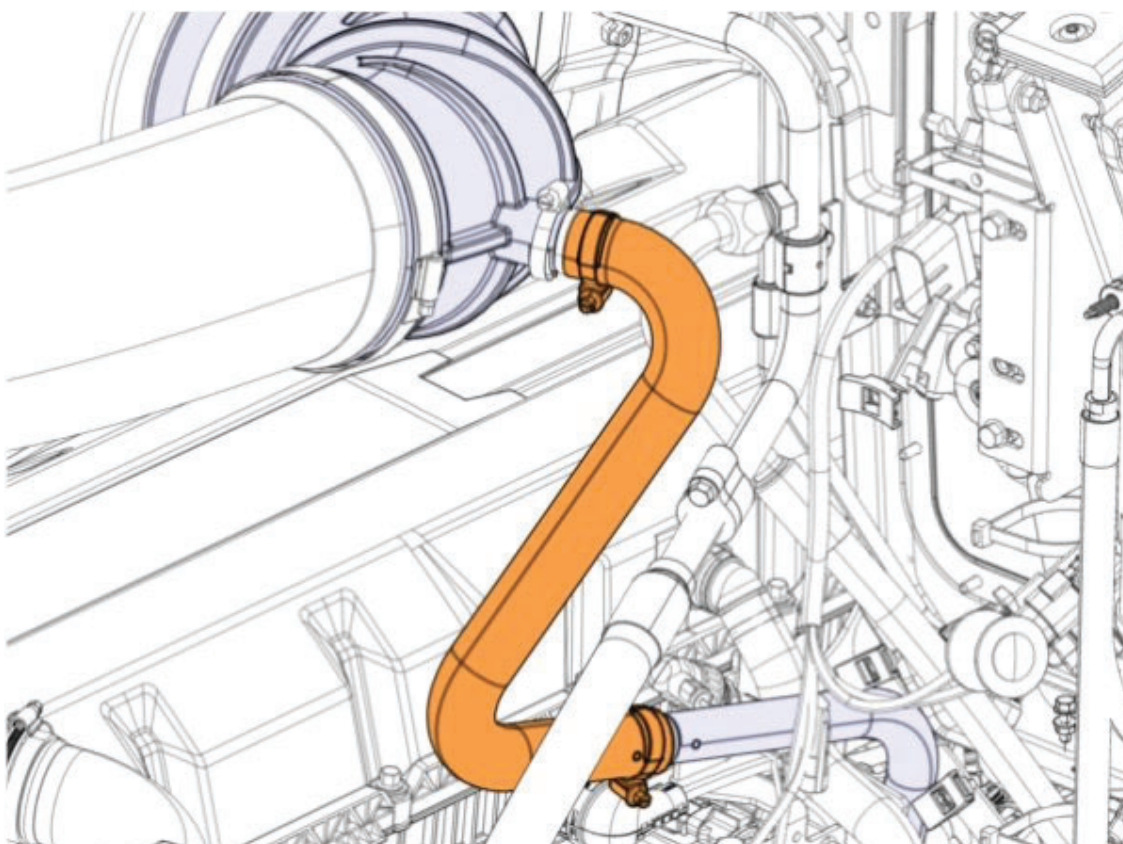


523	Install the V-clamps.	
	i Note	Note the orientation.

524	Tighten the V-clamps to torque.	
	Tightening torque	
	V-band clamp, screw	7 ±1 Nm (5 ±1 lb _f ·ft)



525	Install the hose.
-----	-------------------



526	Position the clamps.
-----	----------------------

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.



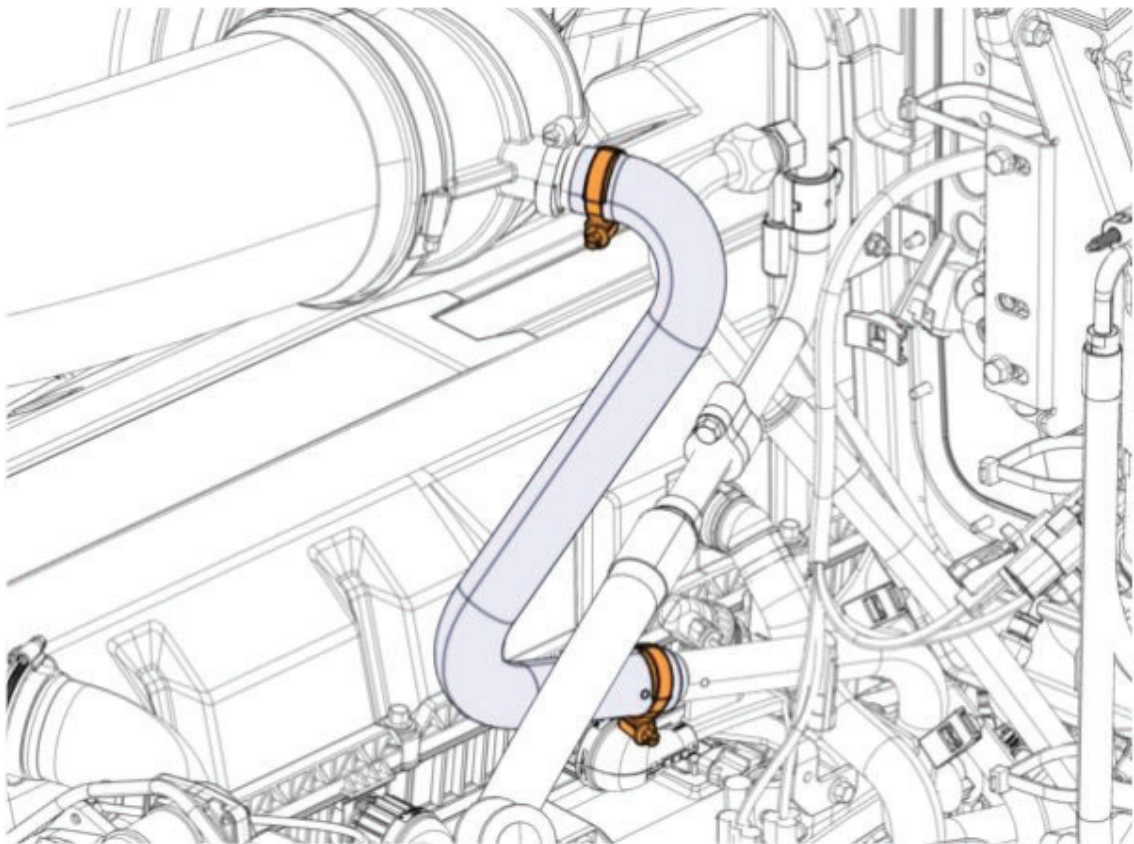
Note
As noted.

527 Tighten the clamps to torque.

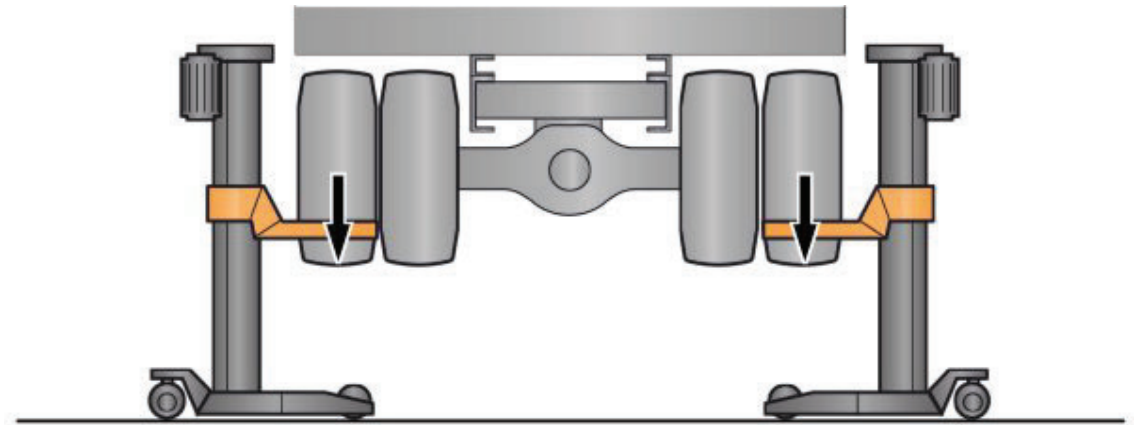
Tightening torque

Clamp, screw

$3.95 \pm 0.6 \text{ Nm}$
 $(35.0 \pm 5 \text{ lb}_f\cdot\text{in})$



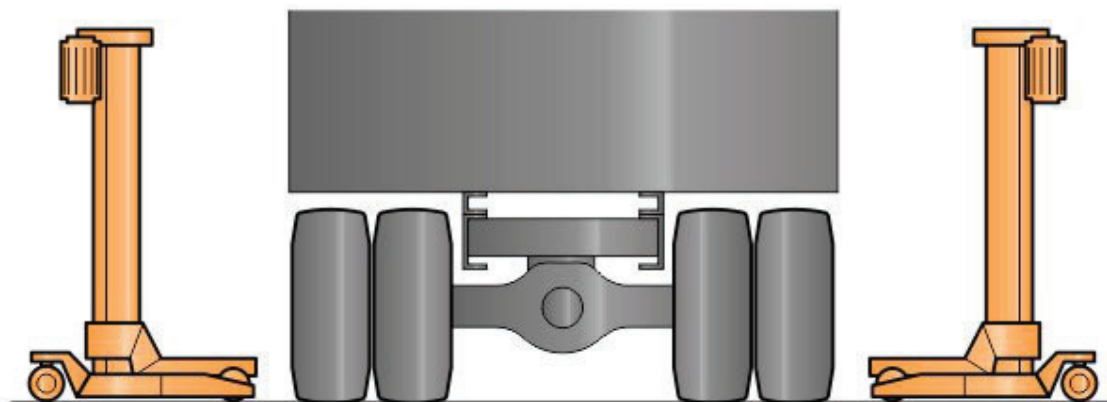
528 Lower the vehicle.



529 Remove the column lifts.

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.



530	Perform this procedure when the condition below is met.
	Conditions
	If all of the coolant connections have been made, fill the coolant system.
	Fill the cooling system.
	<i>i</i> Note Use approved coolant.



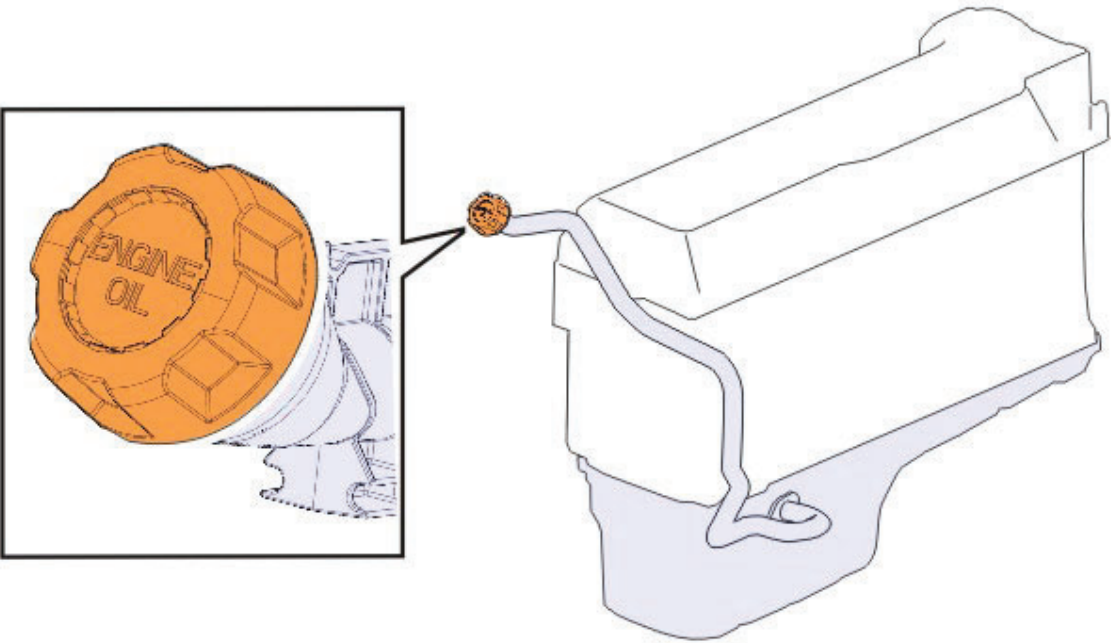
531	Perform this procedure when the condition below is met.
	Conditions
	• If the end cap is removed
	► Install the end cap.

532	Fill with engine oil.
-----	-----------------------

Copyright to this documentation belongs to the Volvo Group. No reproduction, copying, change, amendment or other similar disposal is entitled without prior written consent by the Volvo Group

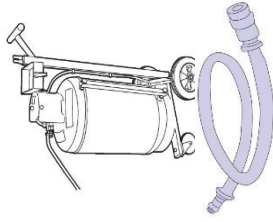
The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

	Note
	Use recommended oil.



533	Perform this procedure when the condition below is met.	
	Conditions	
	•	If the engine cover was removed for service
	►	Install the engine cover.
534	Install the lower left splash shield.	
535	Install the lower right splash shield.	
536	Lower the hood.	
		Note
		Ensure that the hood is latched.

Coolant Extractor 85112740



Drain Hose 9996049

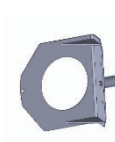
Disassembly Tool J-44773



Cranking Tool 88840317



Fixture 88800570



Impact Wrench 9996400



Puller 9990192



Disassembly Tool 88800502



Guide 9998267



Rocker Indicator 9999683



Magnetic Stand 9999696



Timing Kit J-44514B



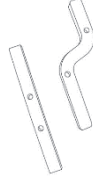
Assembly Tool 88800619



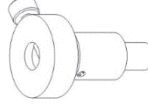
Assembly Tool 9990166



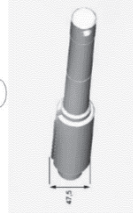
Align Tool 85111422



Setting Tool 8880031



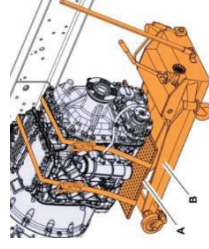
Align tool 9990024



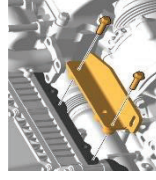
Fixture 9996857



Transmission jack and plate



TC Support Plate 88800826



Teardown 0-4 Hrs. 1) Secure the truck for service, disconnect negative cable. 2) Drain air and coolant. 3) Remove interior components. 4) Remove transmission. 5) Remove air cleaner box, CAC pipe and Diffuser pipe 6) Remove EGR valve, EGR crossover pipe, valve cover, spacer frame, and upper timing cover. 7) Remove all electrical, coolant lines, air lines, and brackets from the rear of the engine. 8) Remove air compressor, starter, and tandem pump.	Teardown 5-8 Hrs. 9) Remove oil pan and Remove oil filters. 10) Place the engine on TDC. 11) Raise and support the engine and Remove engine mounting brackets from flywheel housing. 12) Remove engine mounts from the frame. 13) Remove clutch, pressure plate, and flywheel. 14) Install TC support tool. (TC engine Only) 15) Remove all hardware securing the flywheel housing and remove the flywheel housing. 16) Remove timing gears • Tandem idler rear (a puller may be required to remove the gear) • TC Idler Gear (TC Engine Only) • Cam gear, Double idler gear and Adjustable idler gear 17) Install aligning dowels, removed TGP hardware, and remove TGP.
Install 9- 13 Hrs. 18) Apply seal conditioner to the block and head. 19) Install TGP and new mounting bolts. 20) Install all timing gears verifying timing and gear lash are correct. 21) Make sure to remove alignment dowels. 22) Apply seal conditioner to the TGP. 23) Install flywheel housing and torque all securing hardware to spec. 24) Remove TC support tool. (TC Engine Only) 25) Install engine mounting bracket to flywheel housing and engine mounts in frame. 26) Lower engine onto the engine mounts, install and torque engine mounting bolts. 27) Clean and install oil pan, hook up level sensor, dipstick, and fill tube. 28) Replace oil filters and fill engine with new oil. 29) Install rear main seal, flywheel, and starter 30) Install upper timing cover, valve cover, and EGR cross over pipe. 31) Install tandem pump, air compressor, all compressor line and connection. 32) Connect EI (engine interface) connector.	Install 14-17.8 Hrs. 33) Install all electrical, coolant lines, air lines, and brackets from the rear of the engine. 34) Install EGR valve, EGR hot pipe, diffuser pipe, flex pipe, and install hot side CAC pipe. 35) Install air cleaner housing and turbo inlet pipe. 36) Install clutch and pressure plate. 37) Ready transmission for installation and install trans. 38) Route and secure battery cables, trans cooler coolant lines, air lines, and electrical harness. 39) Install drive line. 40) Fill engine with coolant. 41) Connect batteries, Start engine and check for leaks.
Training Video available at macktrainingsupport.com	Additional Communications
Turbo Compound Support Bracket	TSB M-212-003 Timing gear plate, Inspection/Repair
Timing Gear Plate Install	Repair operation 2152-03-03-05 (Timing Gear Plate, Replacement) in Impact
Frame Mounted Engine Support Install	CBR-2263 Timing Gear Plate Repair

Special Tools Bulletin

To: Service Managers
Parts Managers
Technicians

Region: ☒ U.S.
☒ CAN

Bulletin:
Date: December 21, 2022
Valid to: December 31, 2023
Action Required? ☐ Yes ☒ No

From: Tyler Griffin – Proprietary Systems & Components Specialist.
Subject: Mack Essential Tool Shipment

The tools listed below will be shipped **automatically** to all Mack dealers (full-line, parts & service, and satellite locations) from the PDC. These tools are necessary to service the Mack product. Each dealer will be invoiced on **ET1201M**. **This tool is used to hold the Turbo Compound in place while performing Timing Gear Plate repairs. Repair instructions and videos are below.**

Part Number	Description	Quantity
88800826	13 L Turbo Compound Support Bracket	1

Please advise your parts department staff to expect these Essential Tools for the Service Department.

You may order additional Essential Tools; pricing is available on the Parts System.

Contact Information

If you have questions, please contact your District Service Manager.



Essential Special Tool 88800826

**Turbo Compound Support – *while performing
TGP (Timing Gear Plate) oil leak repairs***

Instructions:

1. Remove the starter.
2. Remove the Turbo Compound oil feed line.
3. Remove the EGR heat shield.
4. Remove top V-band clamp for the EGR cooler's hot pipe.
5. Remove bottom V-band clamp for the EGR cooler's hot pipe.
6. Remove the EGR cooler's hot pipe.
 - A. Make sure to remove the EGR cooler rear seal.
7. Disconnect and set aside the following line sets:
 - A. Aftertreatment Hydrocarbon Injector
 - B. Exhaust gas pressure line
 - C. Engine brake
 - D. Turbo compound buffer supply
8. – Unplug camshaft sensor harness.
9. – **IMPORTANT:** There is a key fastener/bolt that threads in the timing gear plate. This fastener/bolt is hidden and must be removed prior to installing the Turbo compound tool.
10. – Here you see the Turbo compound tool and its mounting hardware.
 - A. 2-3 fasteners depending on EM level.
11. – First you will remove the 2-exhaust heat shield mounting bolts, and Turbo Compound lifting eye bolt.
 - A. 2 fasteners depending on EM level.
12. – Next secure the Turbo Compound tool bracket to the cylinder head, utilizing the bolt holes from the previously removed exhaust heat shield bolts.
13. – At this point you will need to prep the threaded rod with one of the nuts from the hardware kit. You will thread one of the nuts about $\frac{1}{4}$ of the way up on the threaded rod.
14. – Securing the Turbo Compound tool mounting bracket to the Turbo Compound housing.
 - A. Slide the supplied threaded rod through the slotted hole in the Turbo Compound tool mounting bracket.
 - B. Thread the rod in the bolt hole from the previously removed Turbo Compound lifting eye bolt, thread the rod until it bottoms out.
 - C. Secure the rod to the Turbo Compound housing by running the previously installed nut flush with the housing, and slightly tighten.
 - D. Install the second nut above on the threaded rod above the Turbo Compound tool mounting bracket. Thread nut down flush with the mounting bracket and slightly tighten.
- 15– Tool Removal:
 - A. Loosen both nuts on the threaded rod.
 - B. Unthread rod from the Turbo Compound lifting eye bolt hole. You do not have to fully remove the threaded rod from the mounting bracket.
 - C. Remove both Turbo Compound tool mounting bracket bolts at cylinder head.

Please see attached training video that can also be found in TDP under training videos.

[TC Bracket Mack 1 - YouTube](#)

Warranty Operations Manual

Canada, United States, Latin America

Put your search topic here...



N

Index

◀Back

- TIMING GEAR PLATE - Clean Claim Template



Warranty Approval

The timing gear plate follows the major component coverage.

Resources & References

For further information on timing gear plate repairs & documentation, please reference the following in IMPACT and/or CBR:

- Technical Service Bulletin 212-003 - Timing Gear Plate, Inspection
- Detailed repair procedure instructions - 2152-03-03-05 Timing Gear Plate, Replacement

Claim Filing Instructions

- Claim Type: Vehicle Warranty
- Main Labor Operations:
 - 2152-03-02-04 Timing Gear Plate, Replacement
 - Note: SRT includes labor for R/R of the transmission, clutch, flywheel, flywheel housing, etc.
 - 1700-16-03-01 Diagnostic Time
 - Standard Diagnostic Time for this repair is 2 hours.
- Causal Part:
 - Use applicable causal part from Impact referencing the VIN and Function Group 215 – Timing Gears
- Remarks Tab:
 - Fill in the complaint, cause and correction sections describing the details of the failure.
- Attachments Tab:
 - Warranty requires 3 pictures be attached to the claim
 - See attachment - Timing Gear Plate for examples

Exclusions & Limitations

Failure to attach quality pictures to the claim that clearly illustrate the issue may result in claim denial.

Warranty will only cover timing gear plate claims on active leaks. To verify if you have an active leak reference TSB 212-003 Timing Gear Plate, Inspection.

Comeback repairs due to improper plate installation are non-warrantable.

Effective with R.O. Open April 26th:

Upgrading from a wet plate to an integrated seal is not covered, replacement part should be like for like.

Flywheel housings replaced for reasons other than an out of round condition, uneven sealing surface or 3 or more damaged bolt holes are not covered.

Timing gear plate repair kits are required, failure to use the kit will risk claim adjustment to reflect the price of the kits. (13L VGT Engine P/N 24459407 or 13L TC Engine P/N 24459389)

Documents

Timing Gear Plate