



## Volvo Chassis - Timing Gear Plate Repair

### Internal Content

2018 vgt and newer

## Information

This solution provides supplementary information to be used when installing a Timing Gear Plate with Integrated Seal.

## Repair Criteria

For inspection procedures and repair criteria, refer to TSB [V-212-001 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 [STB23-005V](#) 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. New Seal Conditioner will be included in all kits (instructions for seal condition application below):
  - **VGT Engines:** Spare Parts Kit 24459407
  - **Turbo Compound Engines:** Spare Parts Kit 24459389



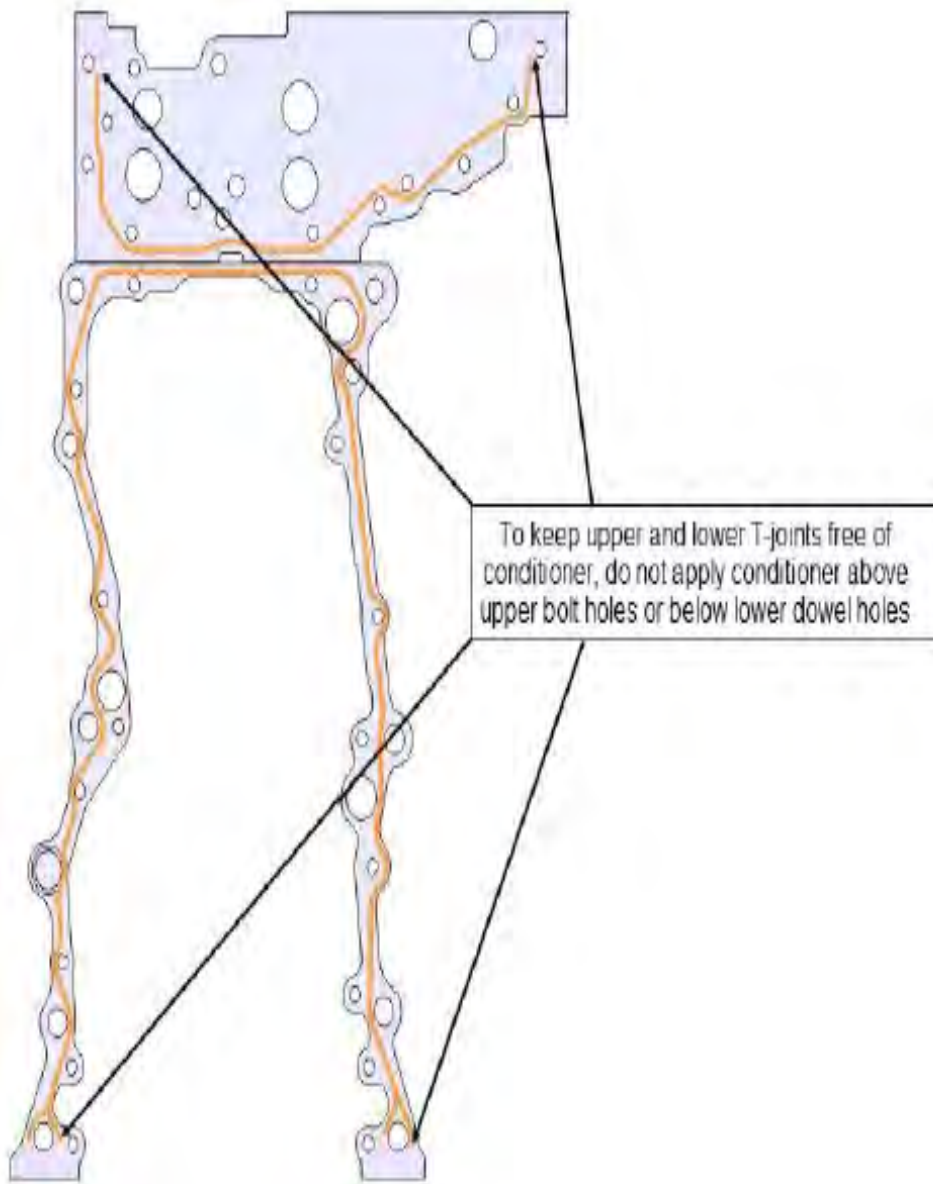
## Repair

The timing gear plate replacement procedure in Impact should be utilized for this repair **in addition to the supplementary installation steps for application of the seal conditioner below.**

- 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.

## Seal Conditioner Application

1. Clean engine block TGP seal mating surface of any oil, grease, dirt. Inspect and clean the TGP bolt holes in rear of the engine block.
2. Apply a **LIGHT FILM** of the seal conditioner (included in the part kit) with a gloved finger to the TGP mating seal surface of the block.
  - Avoid getting conditioner in bolt holes.
  - Remove any excess seal conditioner from bolt holes.
  - **IMPORTANT:** To keep conditioner from contaminating the T-joints, conditioner should not be applied beyond the corresponding dowel or bolt holes in the block. The correct application pattern is shown below:



**2a. IMPORTANT:** For a turbo compound engine, grease should be applied **to the surface of the TC unit.**



3. Install the TGP on the engine block per the Impact procedure. **Remove any excess seal conditioner from T-joints.**
4. Refer to the Impact operation for installation of timing gears and set-up procedures.
5. Prior to the installation of the flywheel housing (FWH) onto the TGP, clean the FWH mating surface of any oil, grease, dirt. Inspect and clean the TGP bolt holes in the FWH.
6. Complete the installation of the flywheel housing onto the engine following the procedure in Impact.
7. After the flywheel housing has been reinstalled, wipe away any excess conditioner from the joints.

## Job Aid

▲ 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)





<ol style="list-style-type: none"> <li>Secure the truck for service, disconnect negative cable.</li> <li>Drain air and coolant.</li> <li>Remove interior components.</li> <li>Remove transmission.</li> <li>Remove air cleaner box, CAC pipe and Diffuser pipe.</li> <li>Remove EGR valve, EGR crossover pipe, valve cover, spacer frame, and upper timing cover.</li> <li>Remove all electrical, coolant lines, air lines, and brackets from the rear of the engine.</li> <li>Remove air compressor, intake, and tandem pump.</li> </ol>	<p><b>Teardown</b> 0-4 Hrs.</p>	<ol style="list-style-type: none"> <li>Remove oil pan and remove oil filters.</li> <li>Place the engine on TDC.</li> <li>Raise and support the engine and Remove engine mounting brackets from flywheel housing.</li> <li>Remove engine mounts from the frame.</li> <li>Remove clutch, pressure plate, and flywheel.</li> <li>Install TC support tool. (TC engine Only)</li> <li>Remove all hardware securing the flywheel housing and remove the flywheel housing.</li> <li>Remove timing gears                     <ul style="list-style-type: none"> <li>Tandem slider rear (a puller may be required to remove the gear)</li> <li>TC slider Gear (TC Engine Only)</li> <li>Cam gear, Double slider gear and Adjustable slider gear</li> </ul> </li> <li>Install aligning dowels, removed TGP hardware, and remove TGP.</li> </ol>	<p><b>Teardown</b> 5-8 Hrs.</p>
<ol style="list-style-type: none"> <li>Apply seal conditioner to the block and head.</li> <li>Install TGP and new mounting bolts.</li> <li>Install all timing gears verifying timing and gear lash are correct.</li> <li>Make sure to remove alignment dowels.</li> <li>Apply seal conditioner to the TGP.</li> <li>Install flywheel housing and torque all securing hardware to spec.</li> <li>Remove TC support tool. (TC Engine Only)</li> <li>Install engine mounting bracket to flywheel housing and engine mounts in frame.</li> <li>Lower engine onto the engine mounts, install and torque engine mounting bolts.</li> <li>Clean and install oil pan, hook up level sensor, dipstick, and fill tube.</li> <li>Replace oil filters and fill engine with new oil.</li> <li>Install rear main leak, flywheel, and stator.</li> <li>Install upper timing cover, valve cover, and EGR cross over pipe.</li> <li>Install tandem pump, air compressor, air compressor line and connector.</li> <li>Connect E1 (engine interface) connector.</li> </ol>	<p><b>Install</b> 9-13 Hrs.</p>	<ol style="list-style-type: none"> <li>Install all electrical, coolant lines, air lines, and brackets from the rear of the engine.</li> <li>Install EGR valve, EGR hot pipe, diffuser pipe, fan pipe, and install hot side CAC pipe.</li> <li>Install air cleaner housing and turbo inlet pipe.</li> <li>Install clutch and pressure plate.</li> <li>Ready transmission for installation and install trans.</li> <li>Route and secure battery cables, fans cooler coolant lines, air lines, and electrical harness.</li> <li>Install drive line.</li> <li>Fill engine with coolant.</li> <li>Connect batteries, start engine and check for leaks.</li> </ol>	<p><b>Install</b> 14-17.8 Hrs.</p>
<p>Training Video available at <a href="http://VolvoTrainingsupport.com">VolvoTrainingsupport.com</a></p>		<p><b>Additional Communications</b></p>	
<p>Turbo Compound Support Bracket</p>		<p>TSB M-212-001 Timing gear plate, Inspection/Repair</p>	
<p>Timing Gear Plate Install</p>		<p>Repair operation 2152-03-03-05 (Timing Gear Plate, Replacement) in Impact</p>	

## 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](#).

Live UI  
 Tags [volvo](#) [tgp](#) [oil leak](#) [timing gear plate](#)  
 Categories

Make and Model > Volvo > VNL

Make and Model > Volvo > VNR

Make and Model > Volvo > VNX

Make and Model > Volvo > VAH

Make and Model > Volvo > VHD

Powerplant > Volvo > D11

Powerplant > Volvo > D13

Vehicle System > Engine

### Related links and attachments

No links or attachments available




### Feedback


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## 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](#)

 <b>CAUTION</b>	
<b>Risk of material damage.</b>	
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.

 <b>WARNING</b>	
<b>Risk of burn injuries.</b>	
Heated components and mechanical parts can cause burns.	
▶	Exercise caution when working with heated components. Always use the appropriate protective equipment.

 <b>WARNING</b>	
<b>Risk of burn injuries.</b>	
The coolant may be hot.	
▶	The cooling system is under pressure and can reach the temperature sufficient to cause burns. Allow the coolant temperature to reach the safe level before starting the work.
▶	Remove the coolant tank cap carefully. Use appropriate protective equipment.

 <b>CAUTION</b>	
<b>Risk of material damage.</b>	
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.

 <b>CAUTION</b>	
<b>Service Information Advisory.</b>	

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**

<a href="#">85112740</a>	<a href="#">88800031</a>	<a href="#">88800502</a>	<a href="#">88800570</a>	<a href="#">88800619</a>
<a href="#">88840317</a>	<a href="#">9990166</a>	<a href="#">9990192</a>	<a href="#">9996049</a>	<a href="#">9996400</a>
<a href="#">9998267</a>	<a href="#">9999683</a>	<a href="#">9999696</a>	<a href="#">85111422</a>	<a href="#">J-44514B</a>
<a href="#">J-44773</a>				

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.

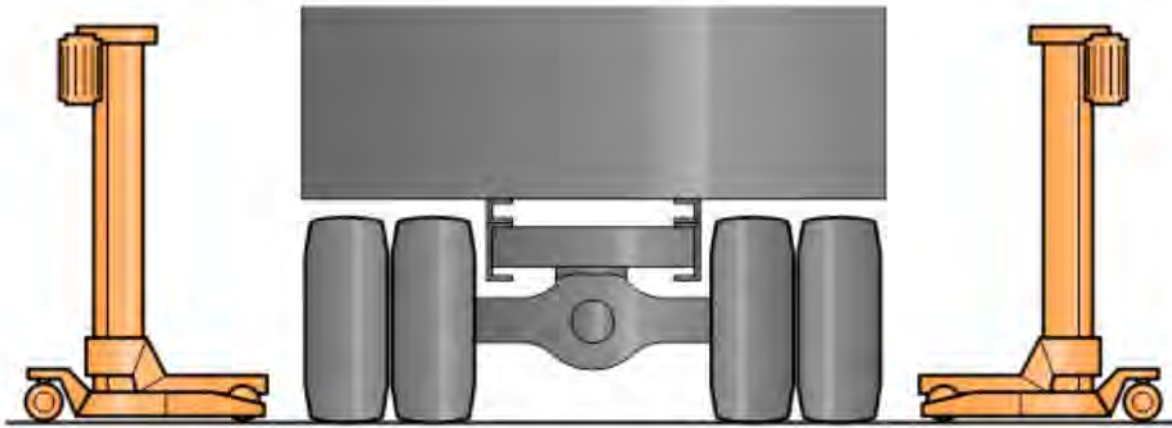
**Conditions**

- If the vehicle is equipped with a removable bumper end cap

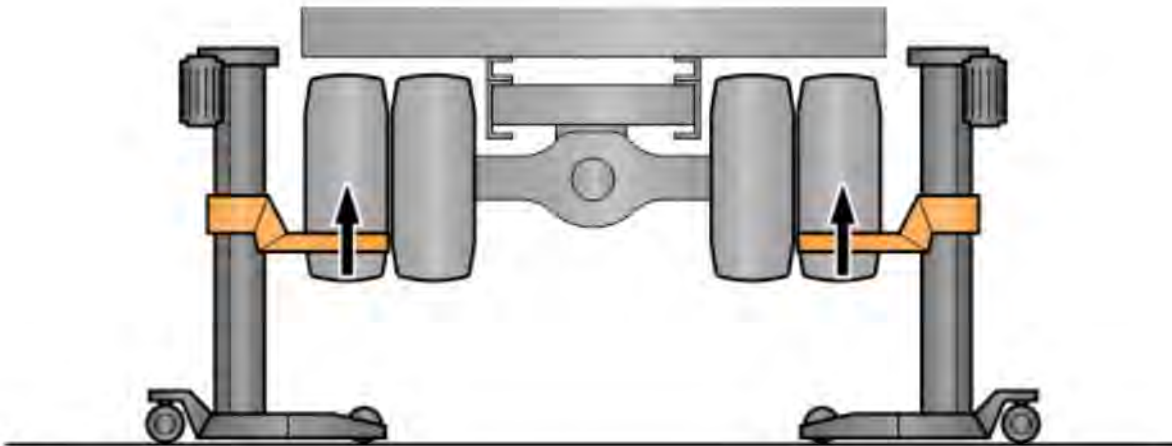
▶ Remove the end cap.

6 Position the column lifts.





7 Raise the vehicle.



8 Perform this procedure when the condition below is met.

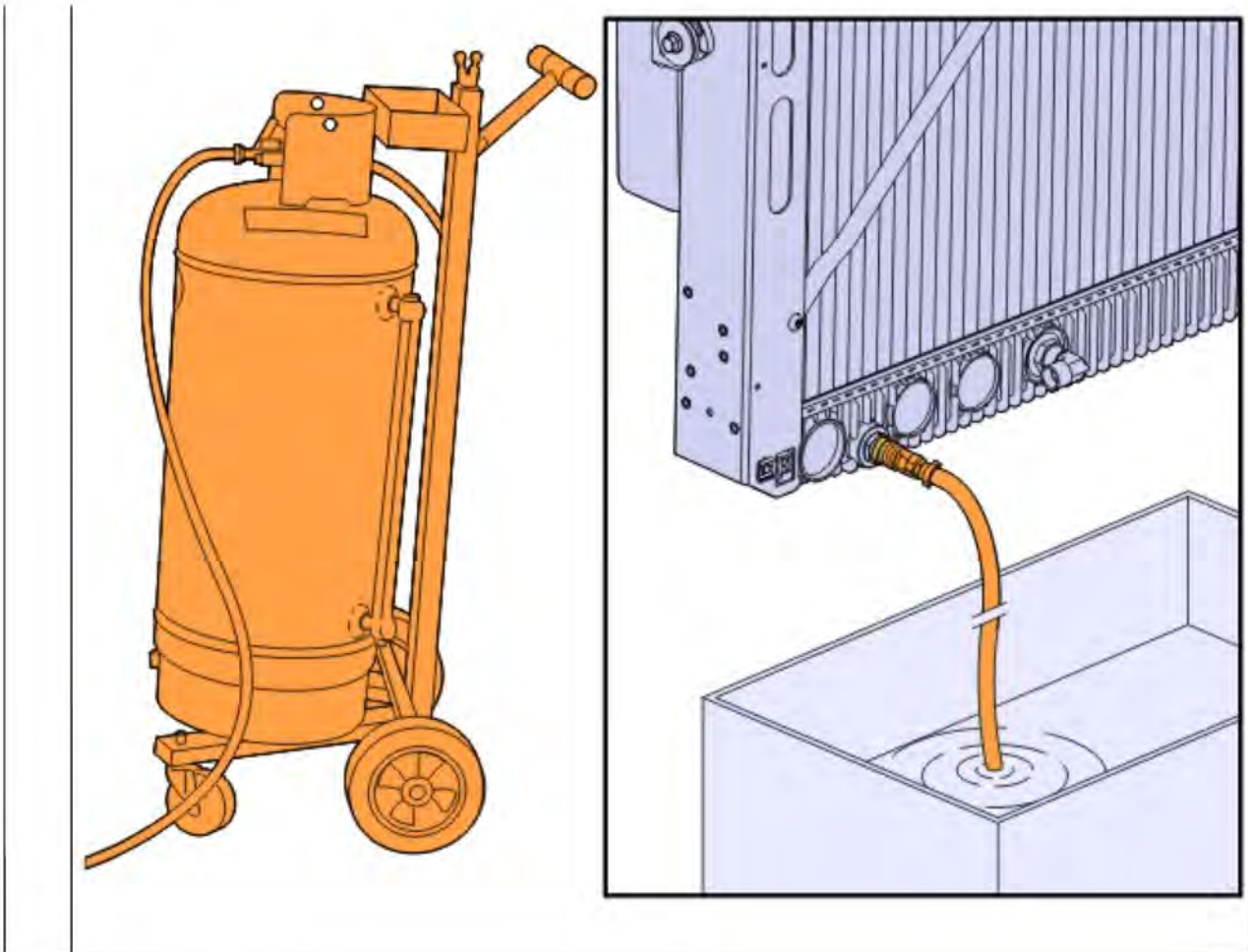
**Conditions**

- 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	<a href="#">85112740</a>
DRAIN_HOSE	<a href="#">9996049</a>

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

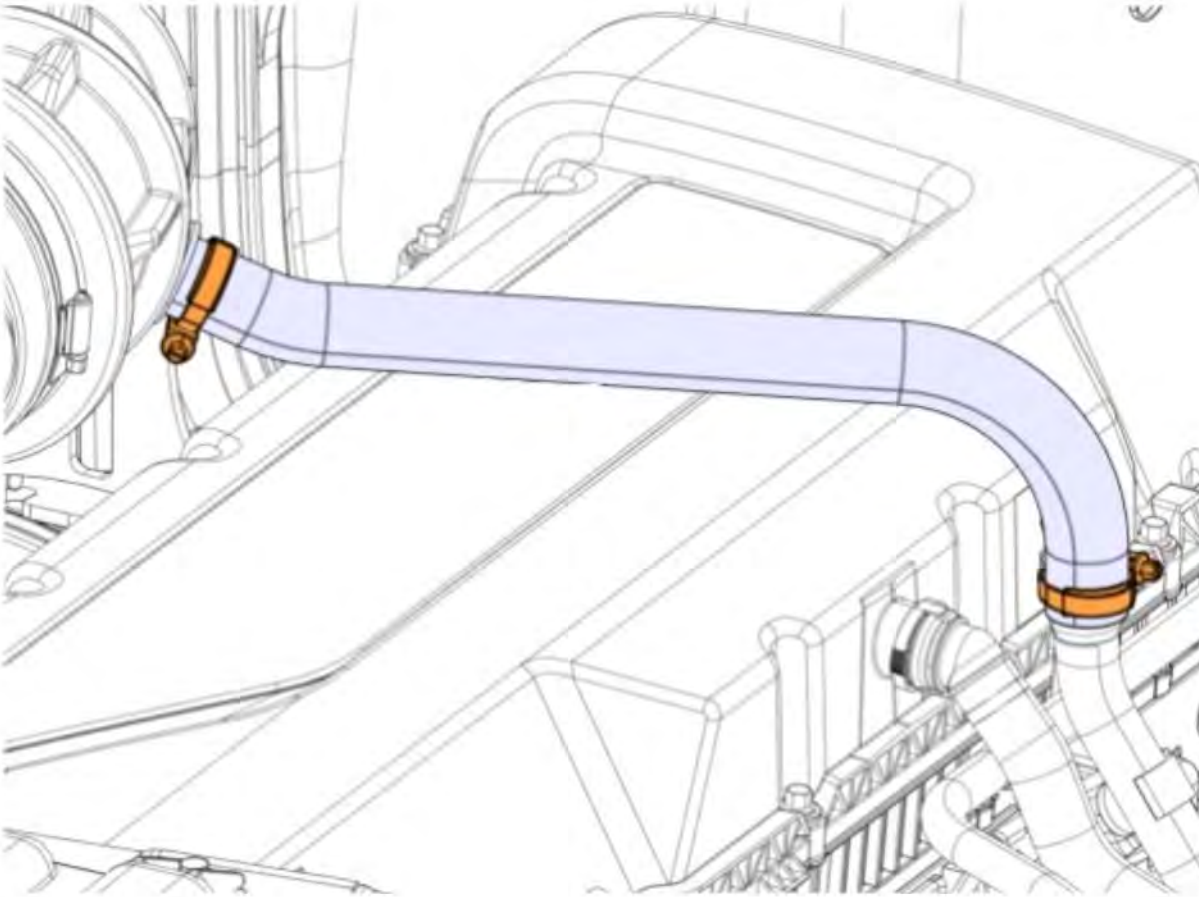


9 Loosen the clamps.

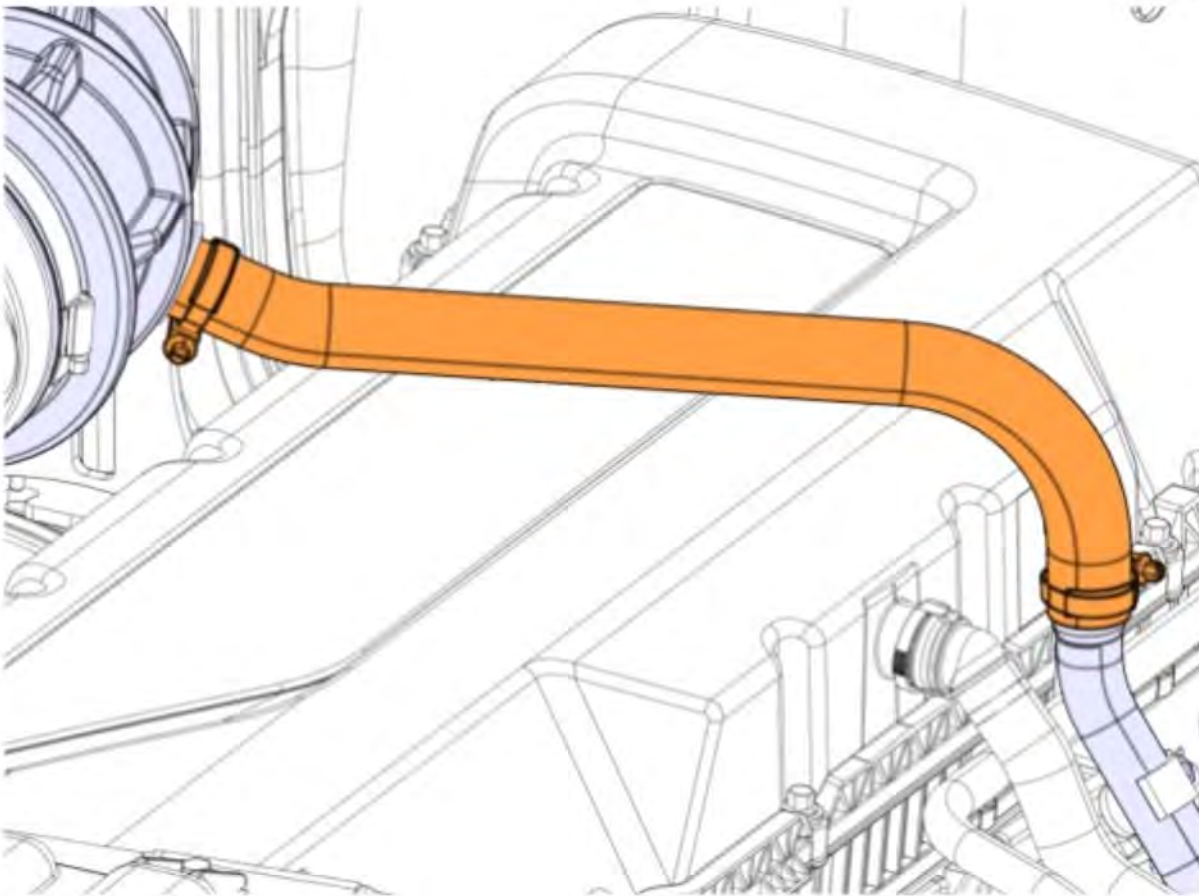


**Note**

Note the orientations and the positions.



10 Remove the hose.

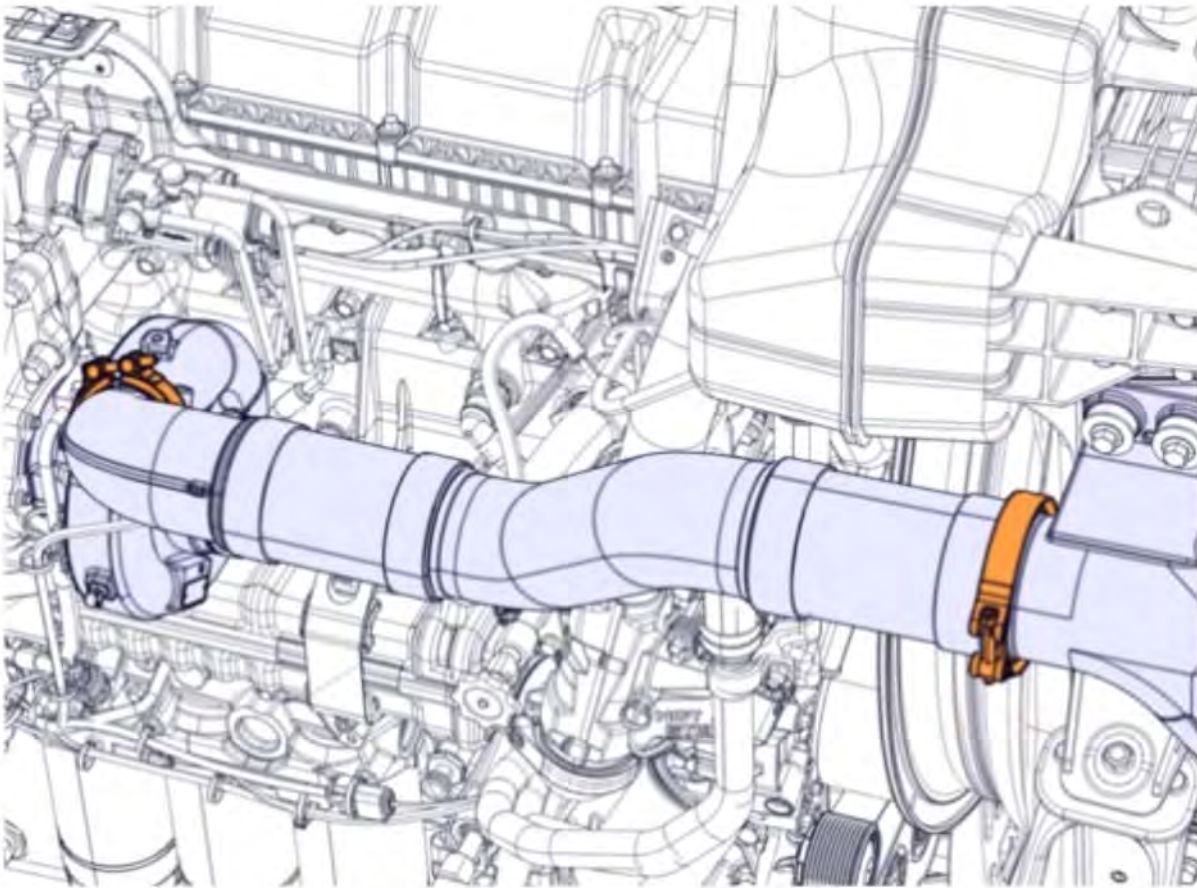


11 Remove the V-clamps.



**Note**

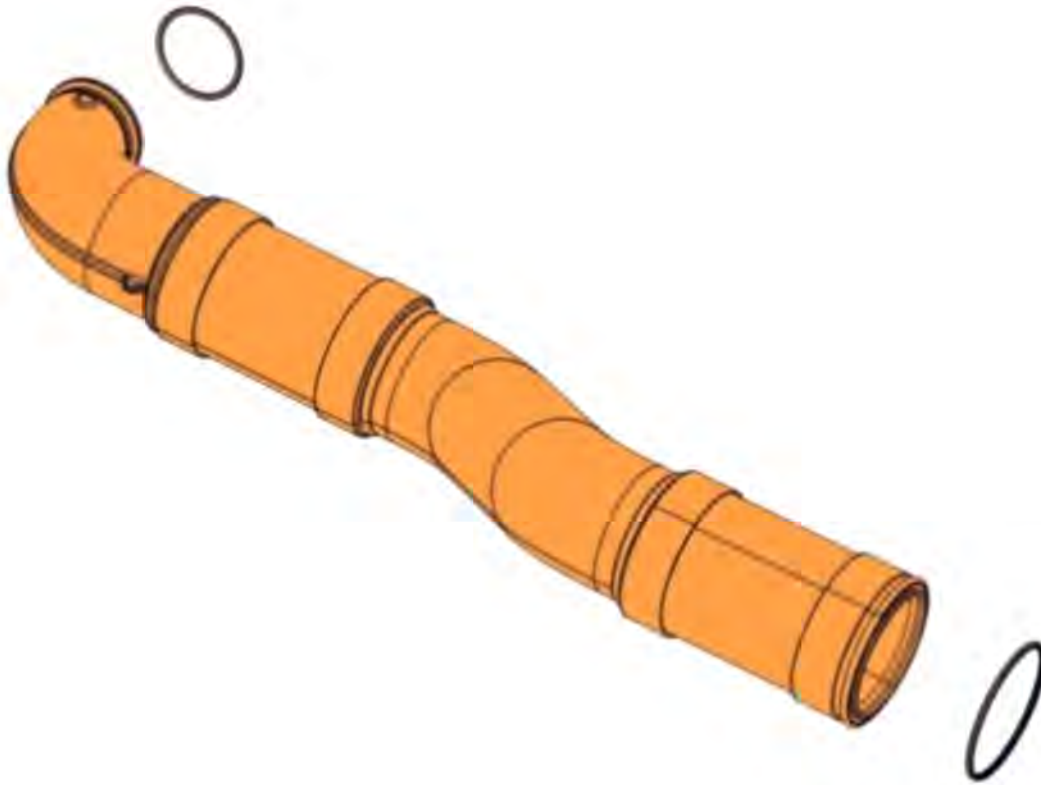
Note the position.



12	Remove the charge air pipe.
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13	Remove the seals.
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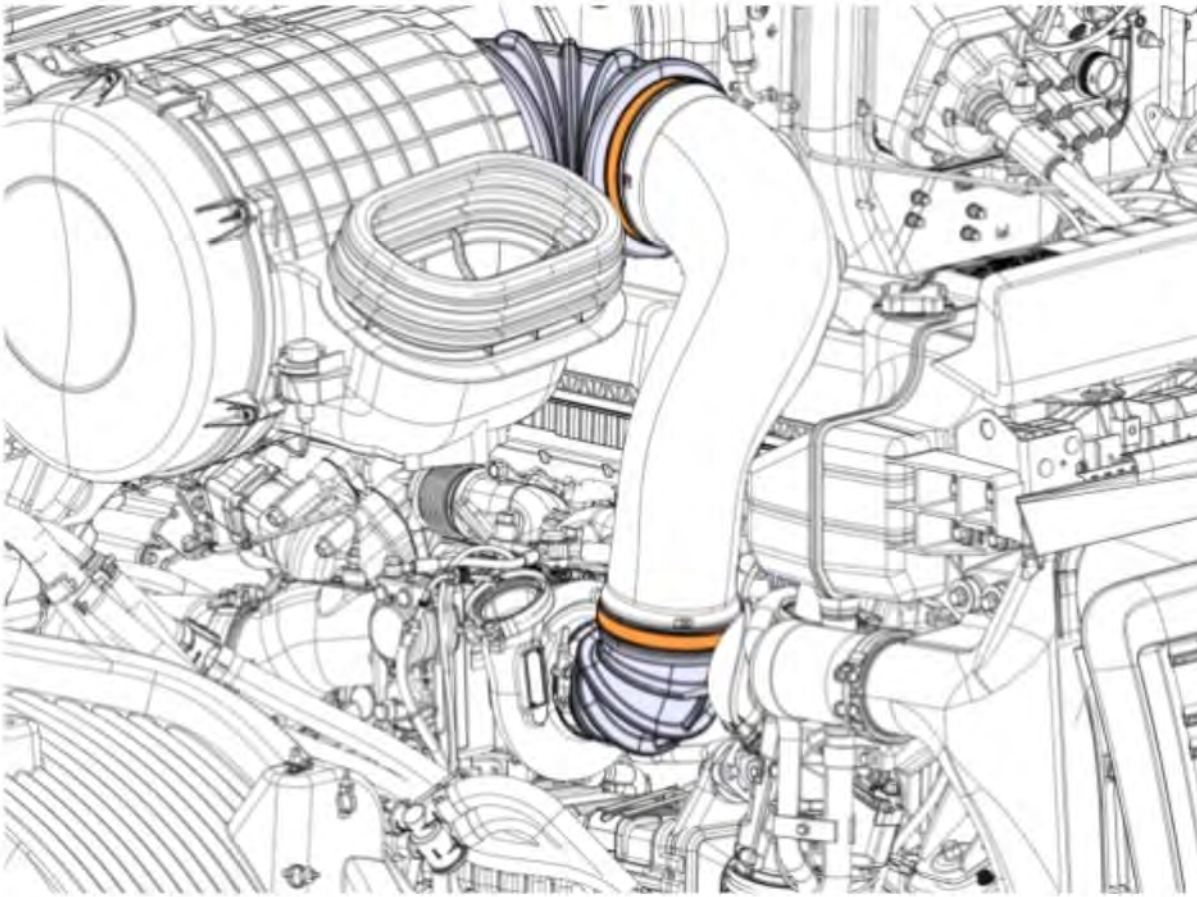


14 Loosen the clamps.

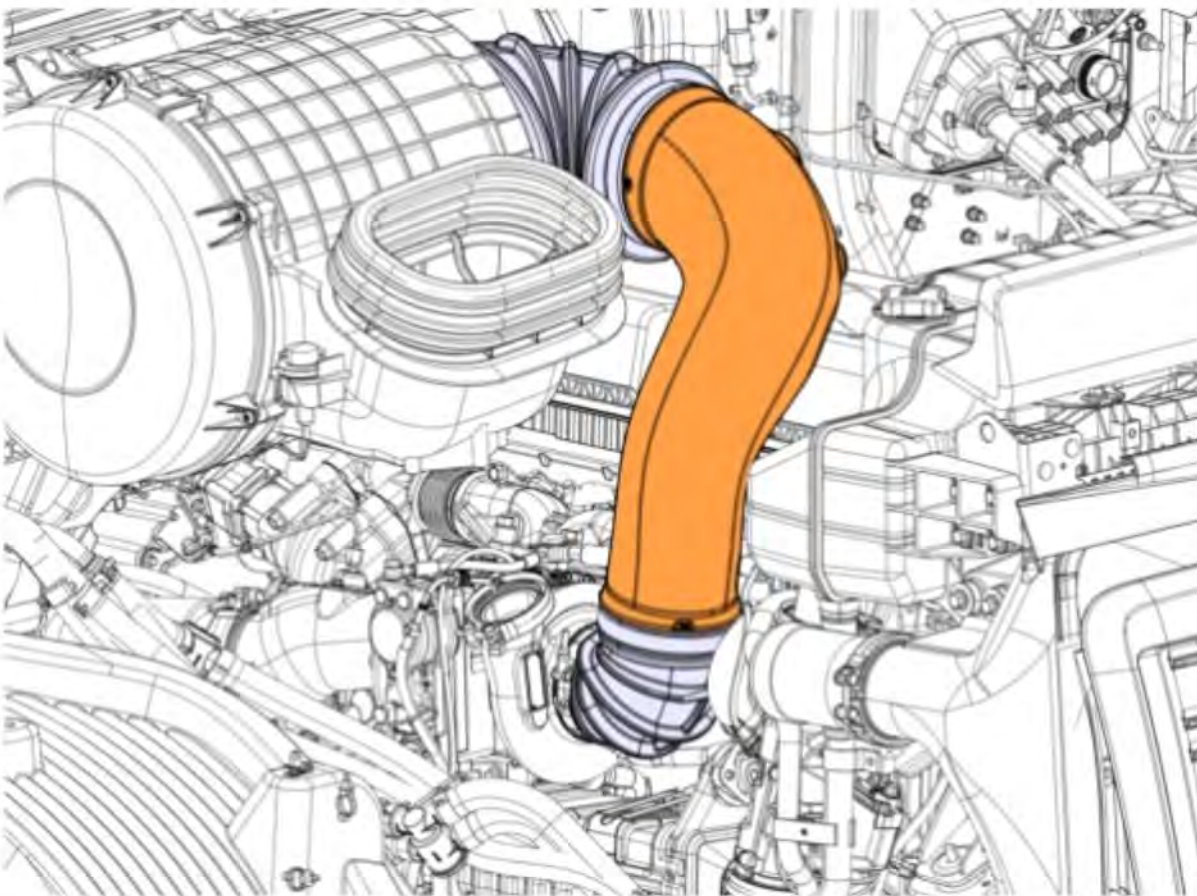


**Note**

Note the orientations and the positions.

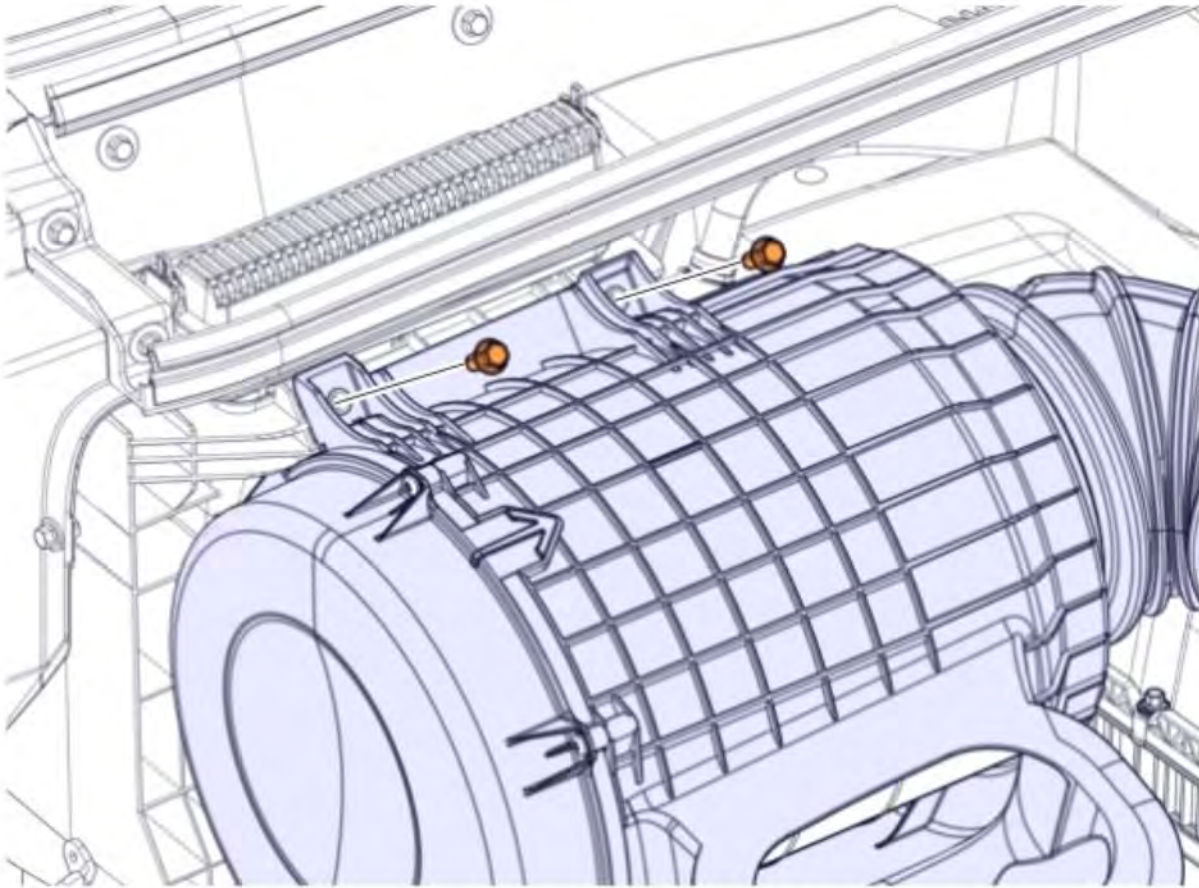


**15** Remove the air duct.

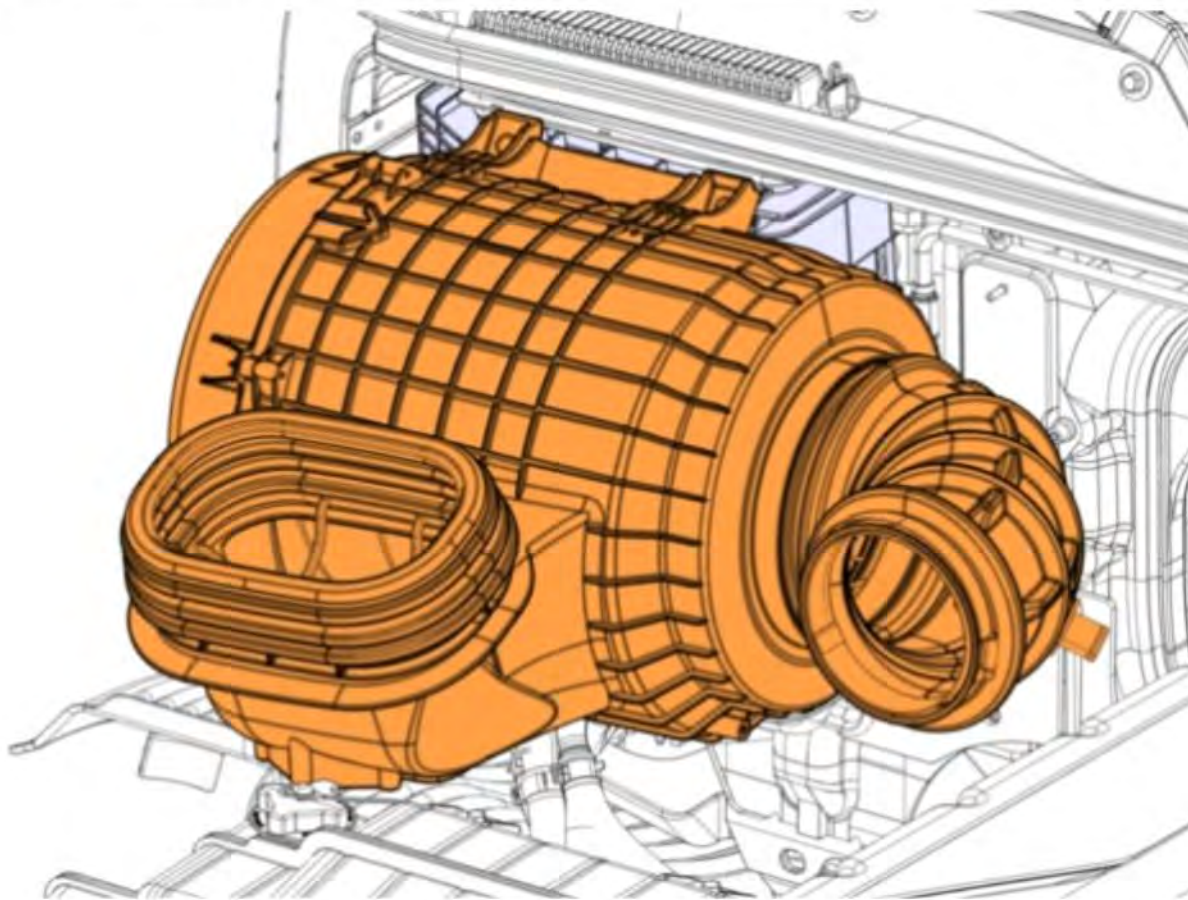


**16** Remove the screws.





**17** Remove the air filter housing.

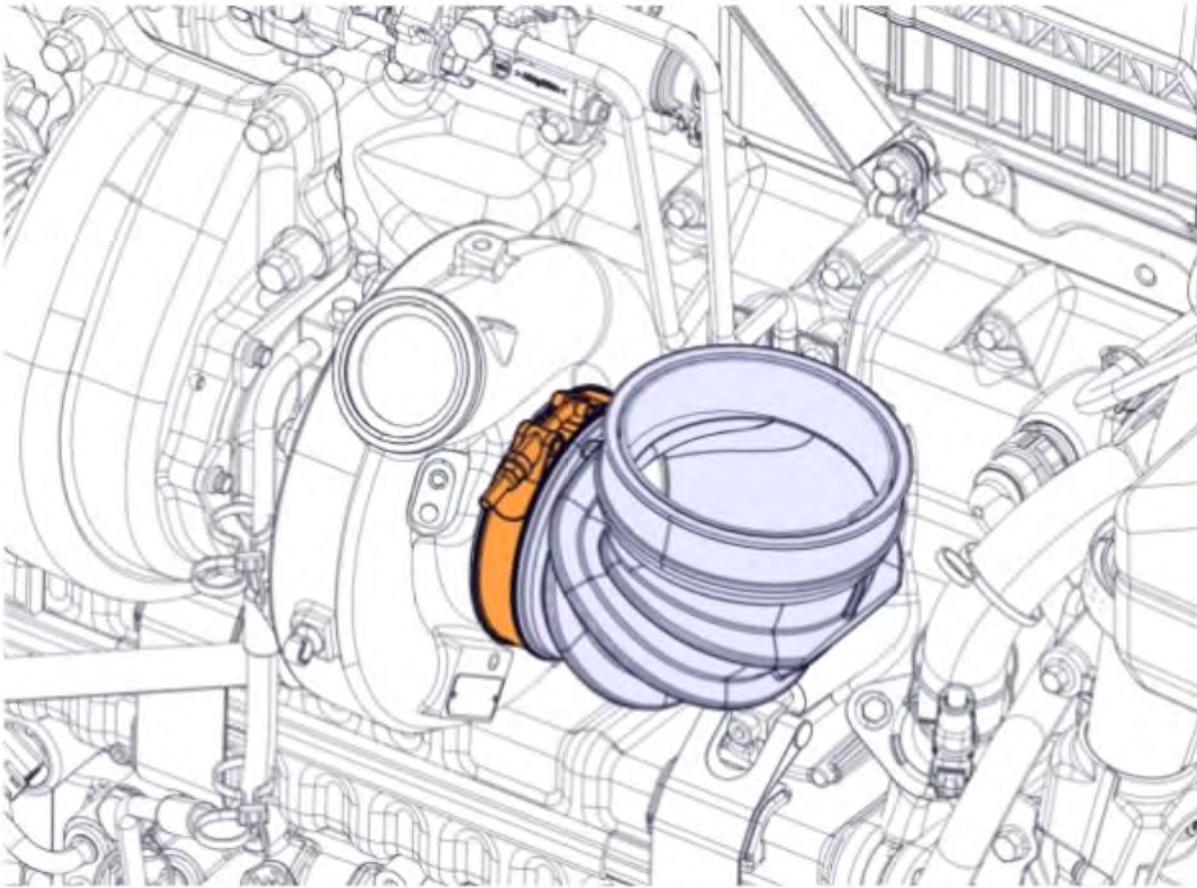


**18** Loosen the clamp.

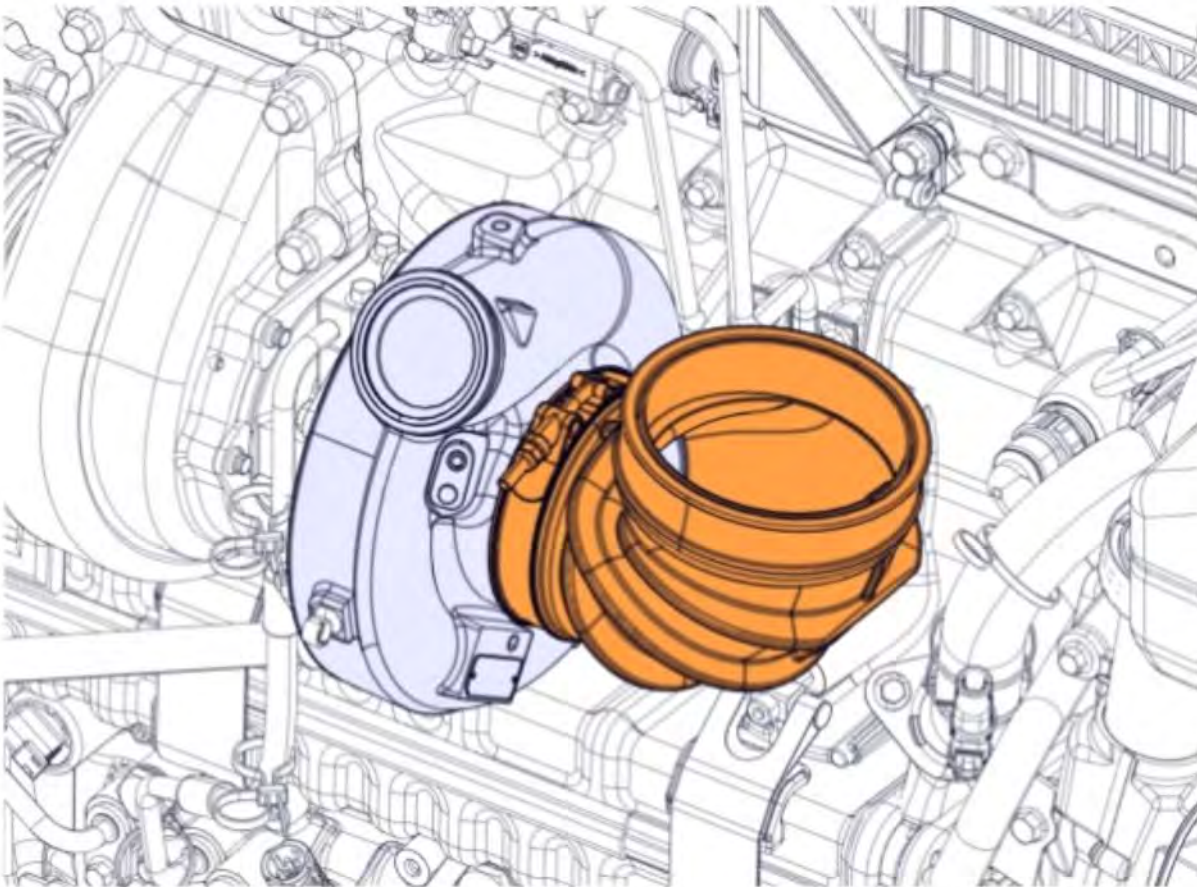
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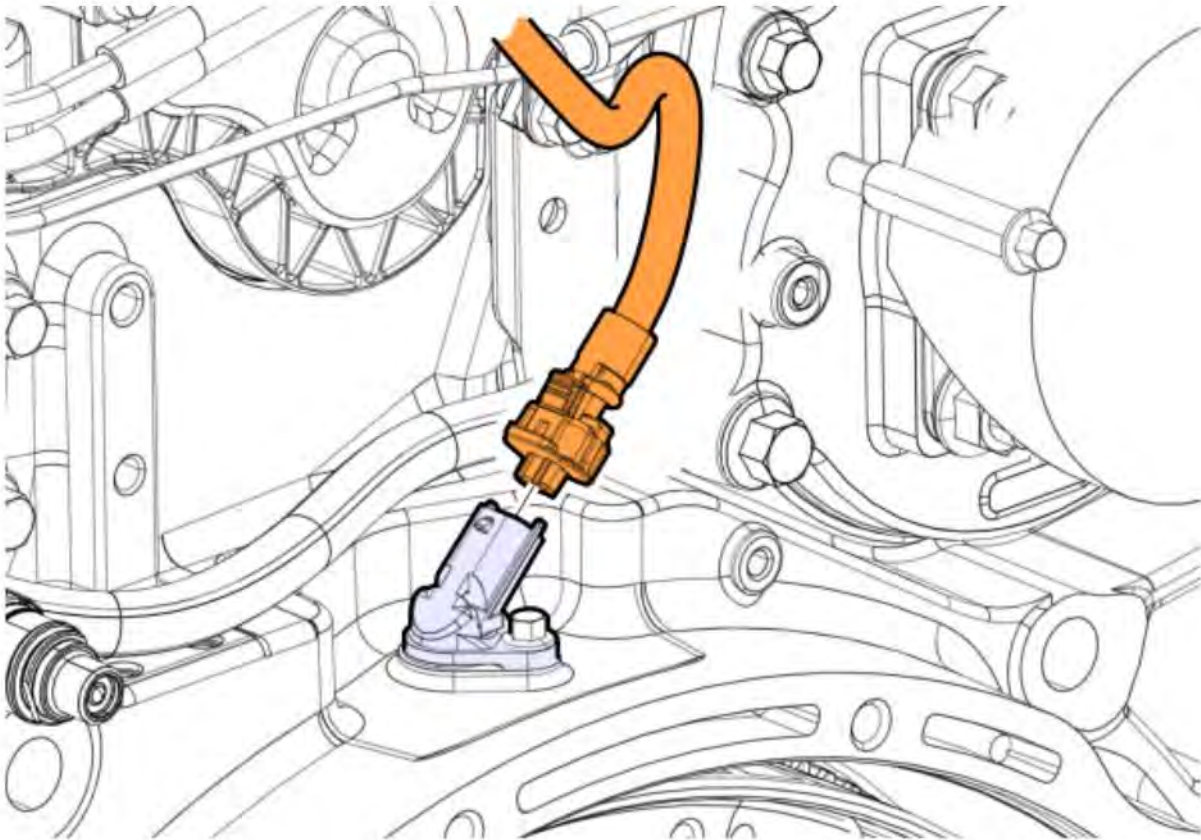


**19** Remove the duct.



**20** Disconnect the connector.

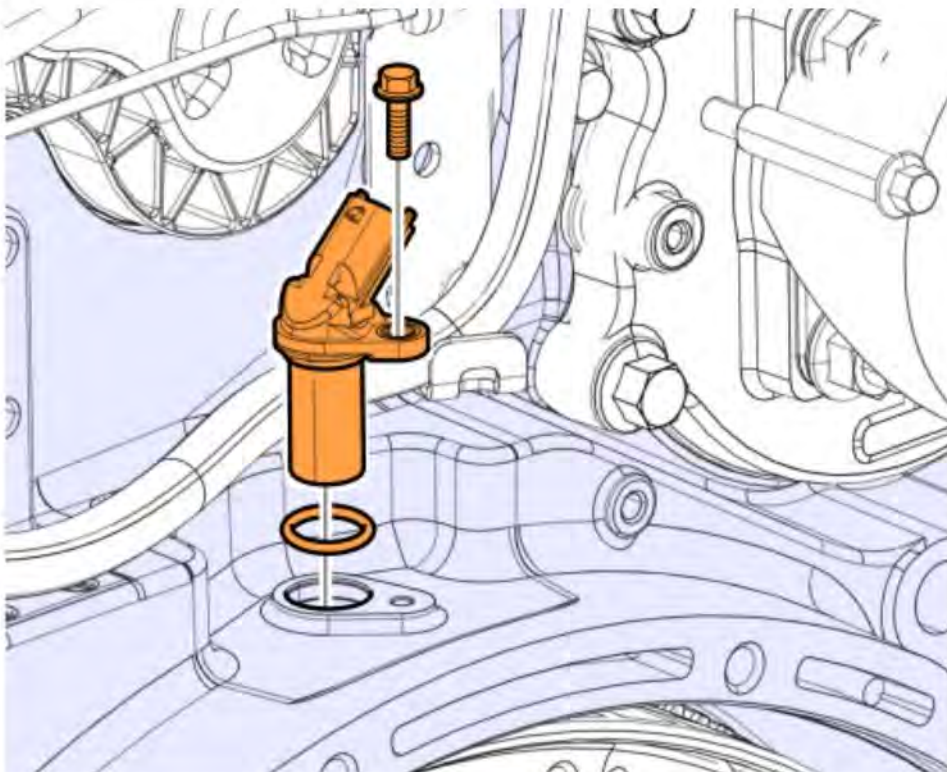




21	Remove the screw.
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22	Remove the sensor.
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23	Remove the O-ring.
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24	Disconnect the connector (1).
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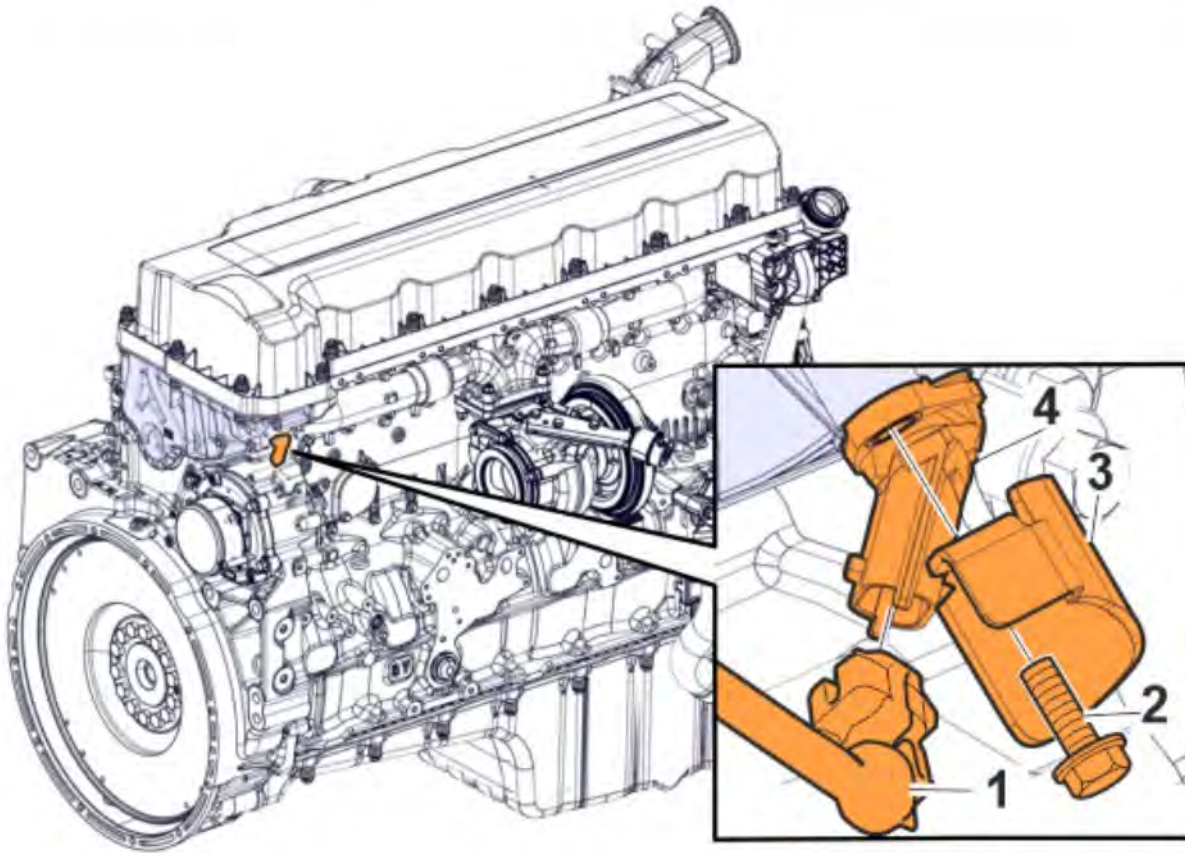
25	Remove the screw (2).
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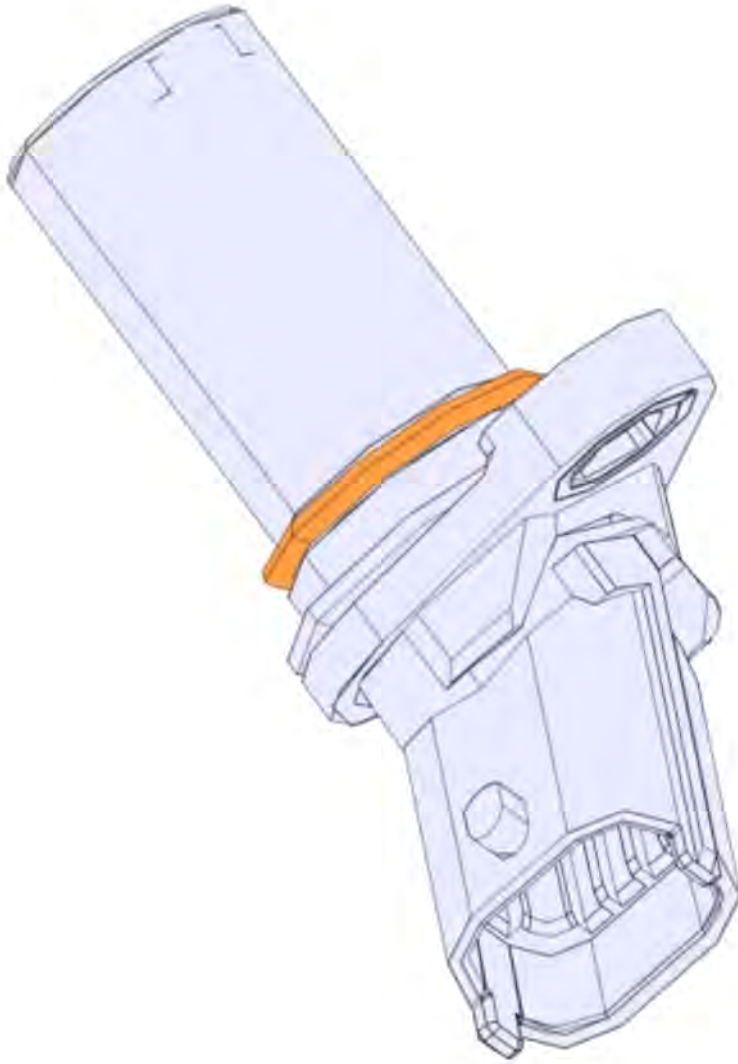
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26	Remove the heat shield (3).
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27	Remove the sensor (4).
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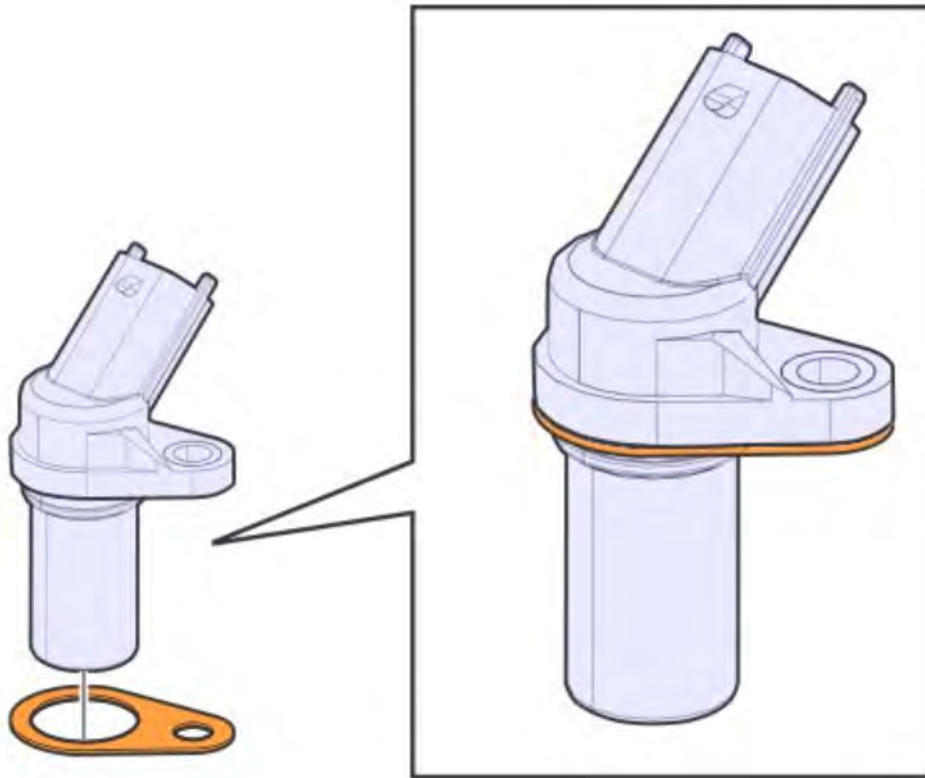


28	Remove the O-ring.
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29	Remove the shims as needed.
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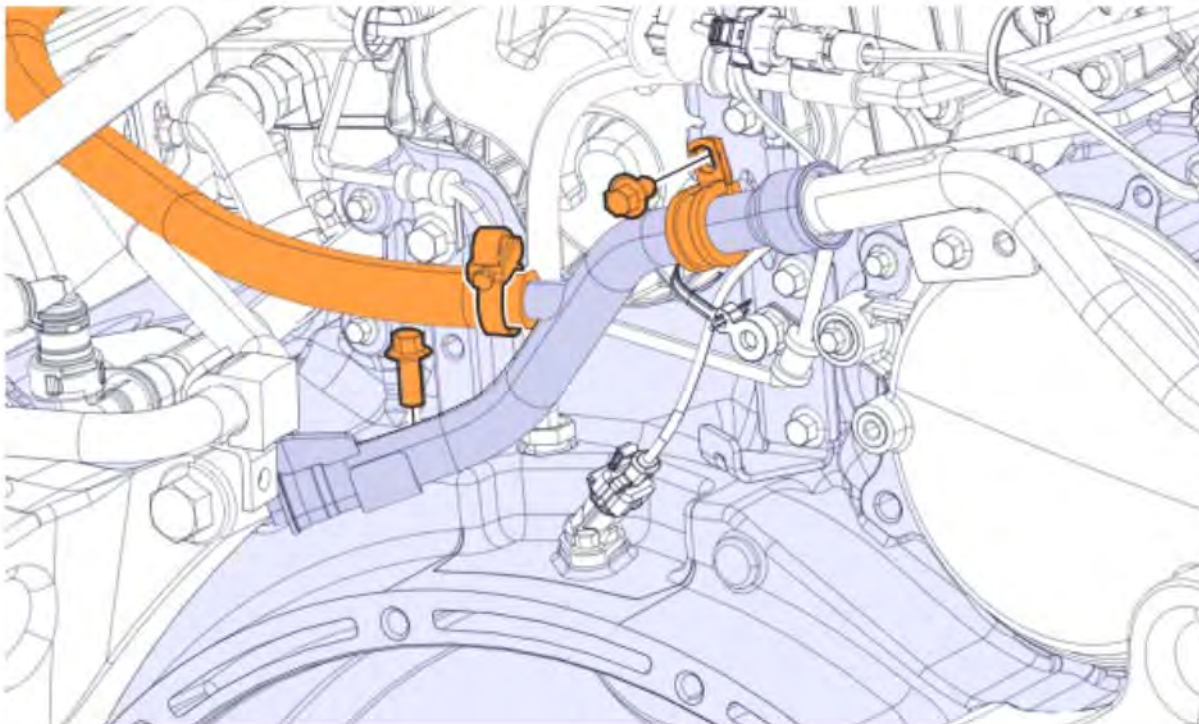


<b>30</b>	Loosen the clamp.
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<b>31</b>	Remove the hose.
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<b>32</b>	Remove the screws.
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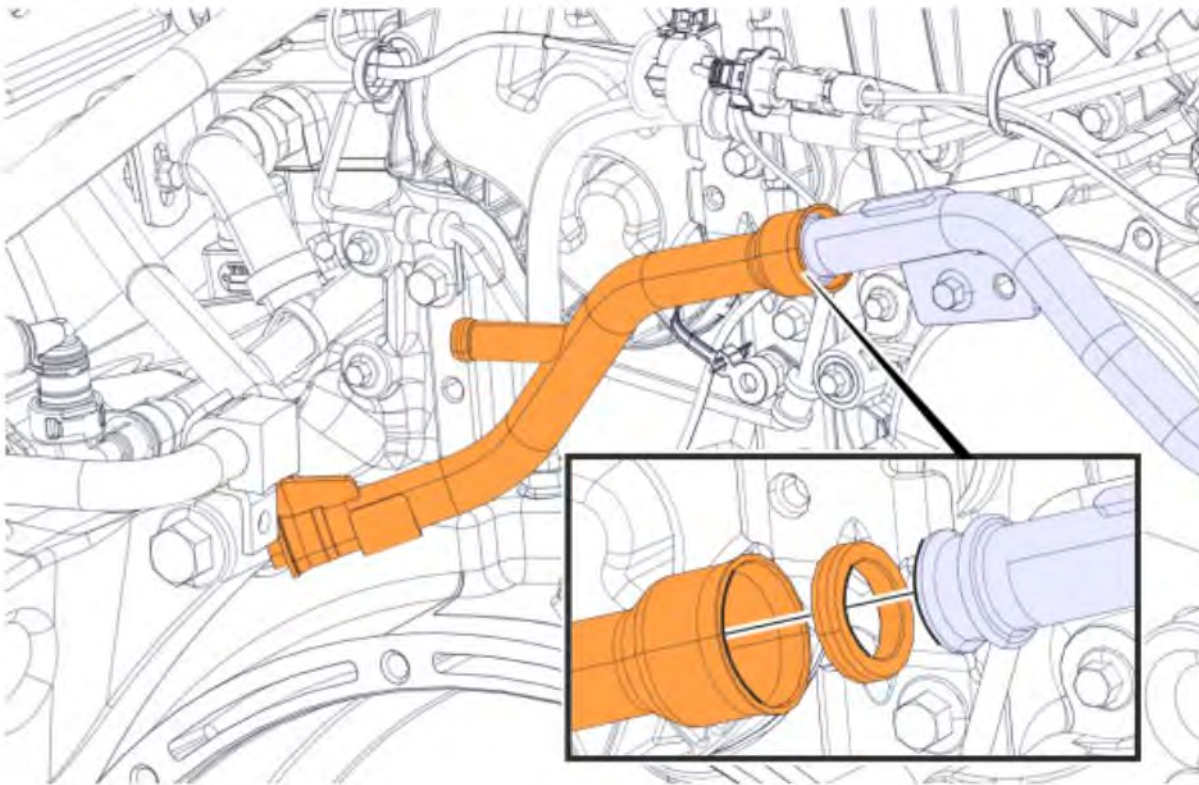
<b>33</b>	Remove the clamp.
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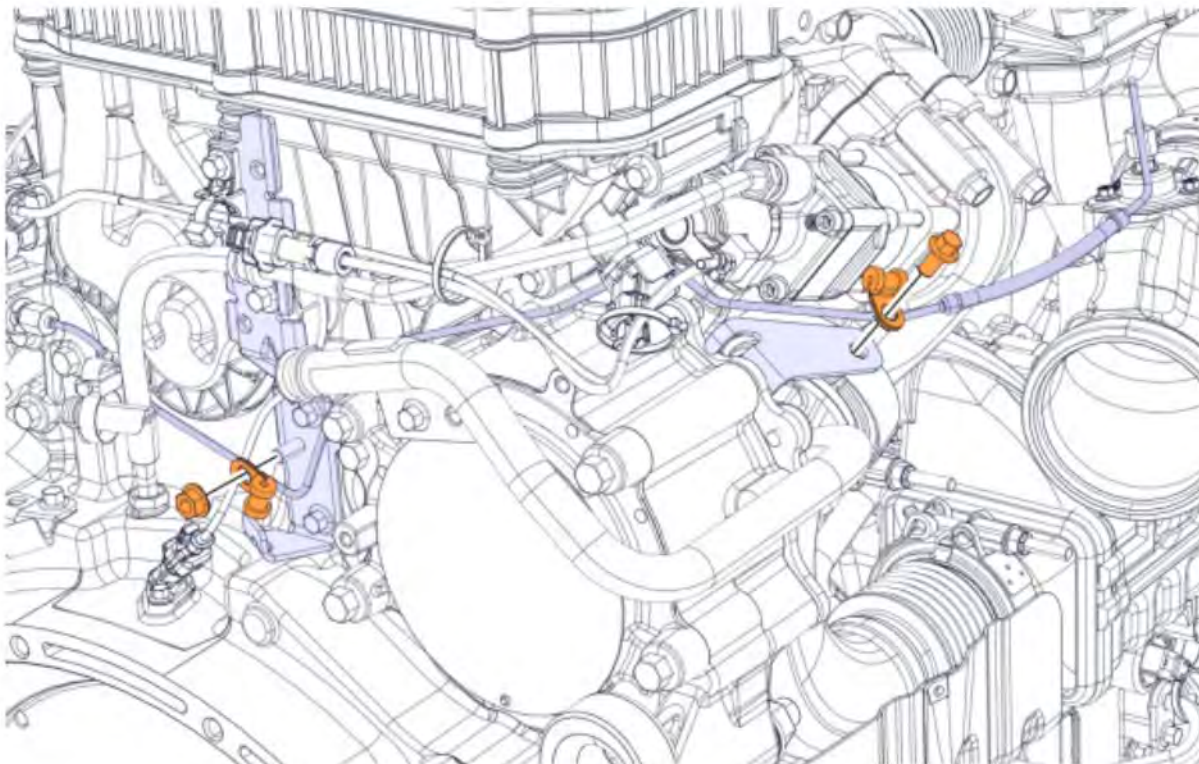
<b>34</b>	Remove the pipe.
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35 Remove the seal.



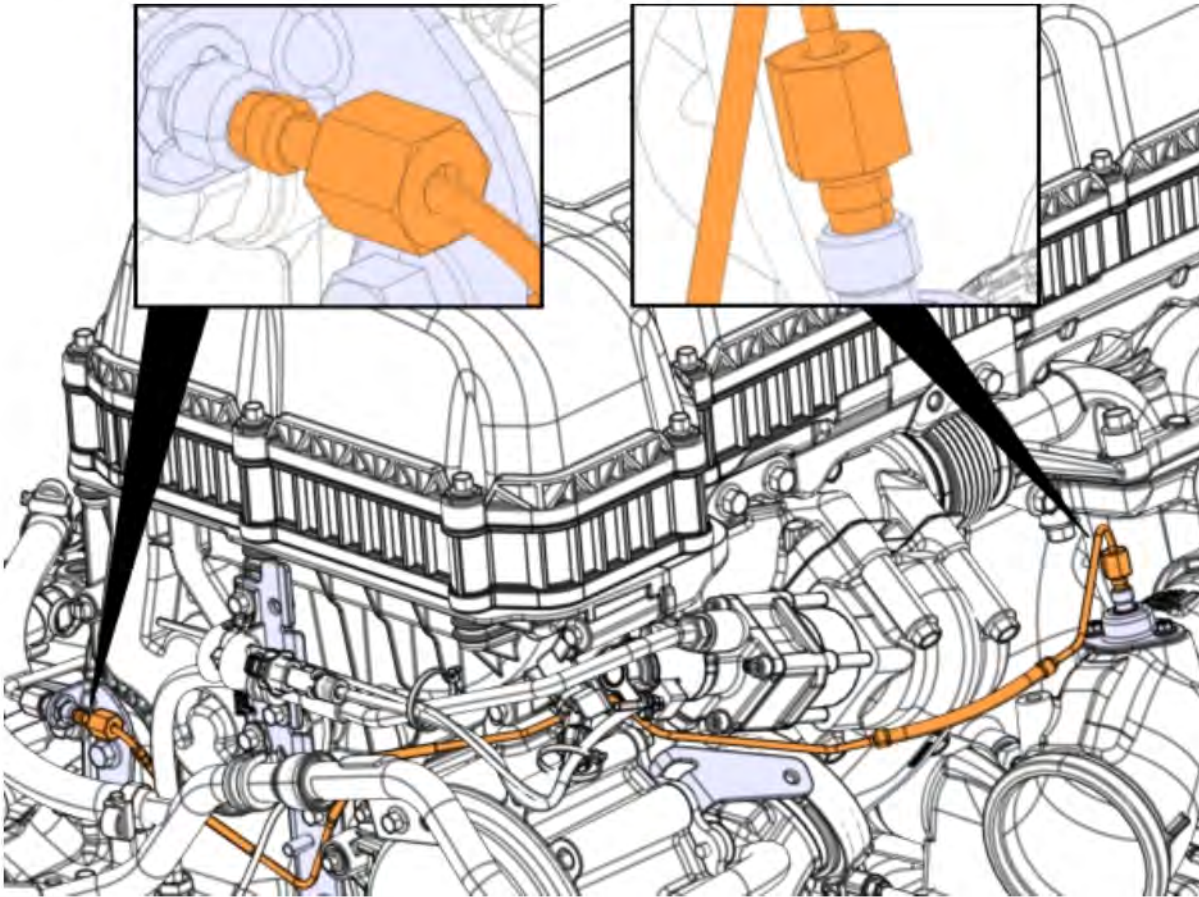
36 Remove the screws and clamps.



37 Loosen the nuts.

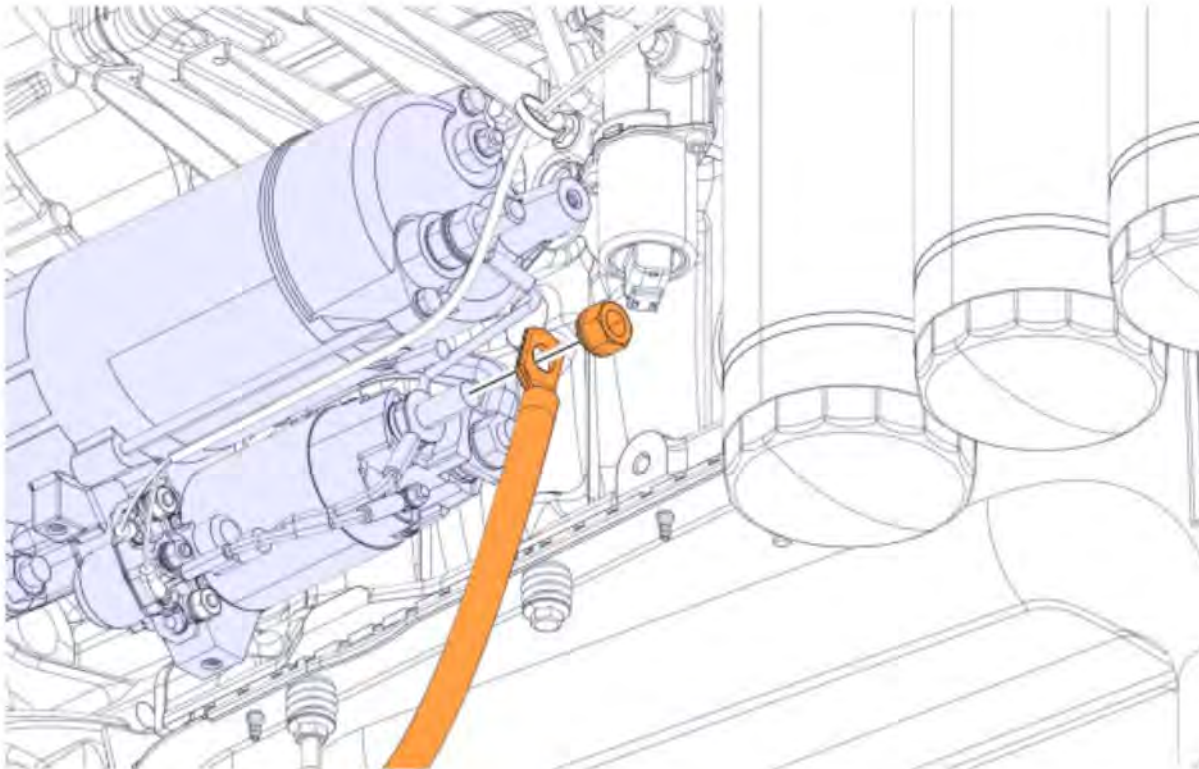
38 Remove the pipe.





<b>39</b>	Remove the nut.
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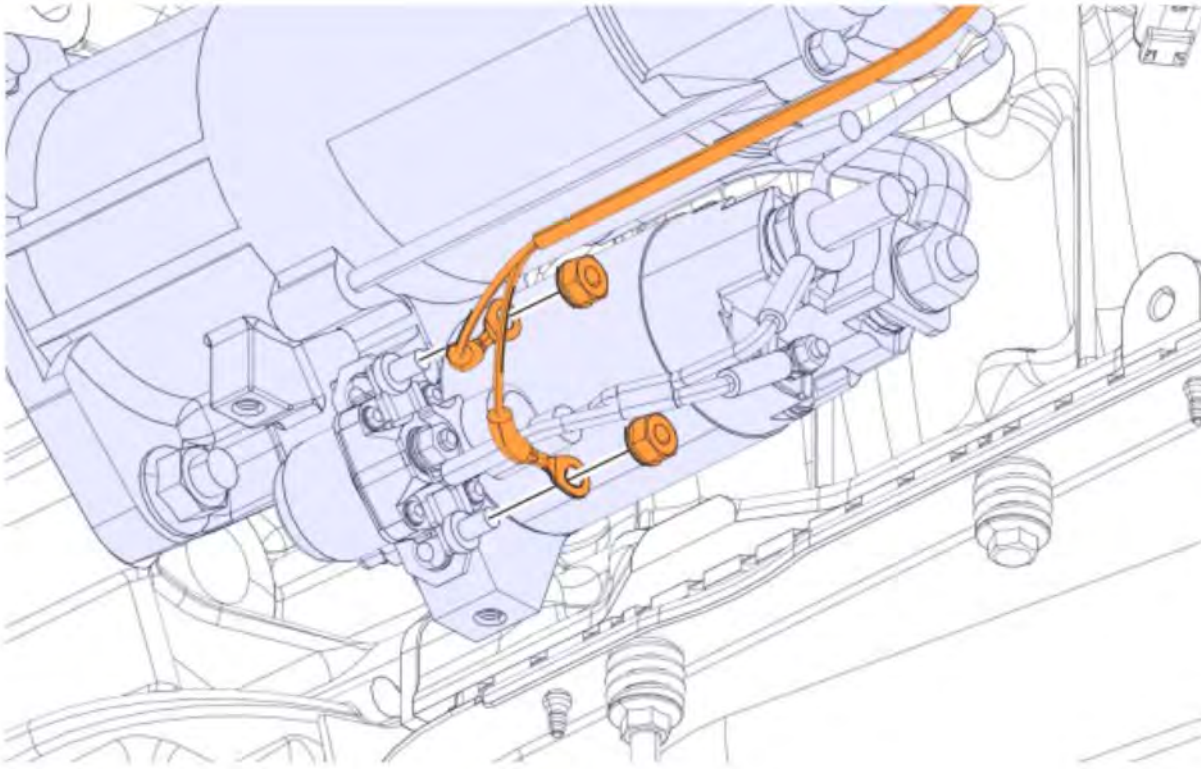
<b>40</b>	Remove the cable terminal.
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<b>41</b>	Remove the nuts.
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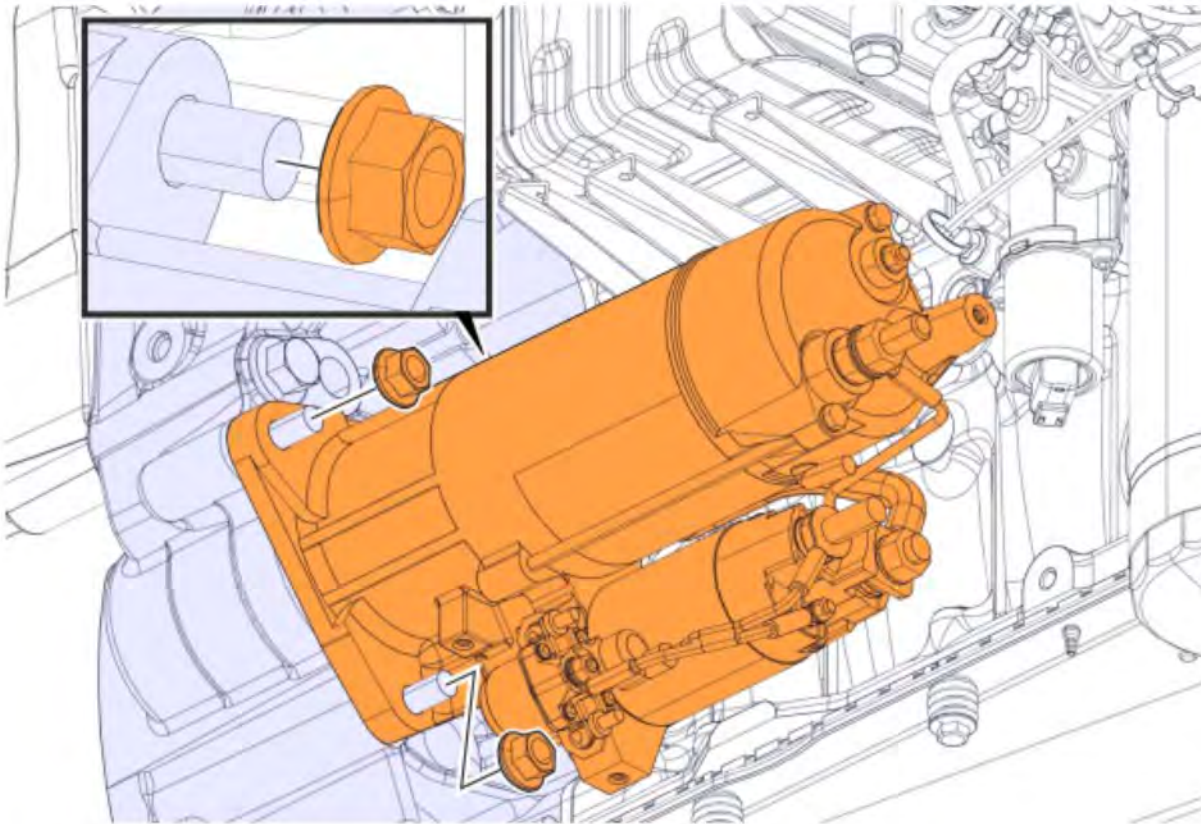
<b>42</b>	Remove the cable terminals.
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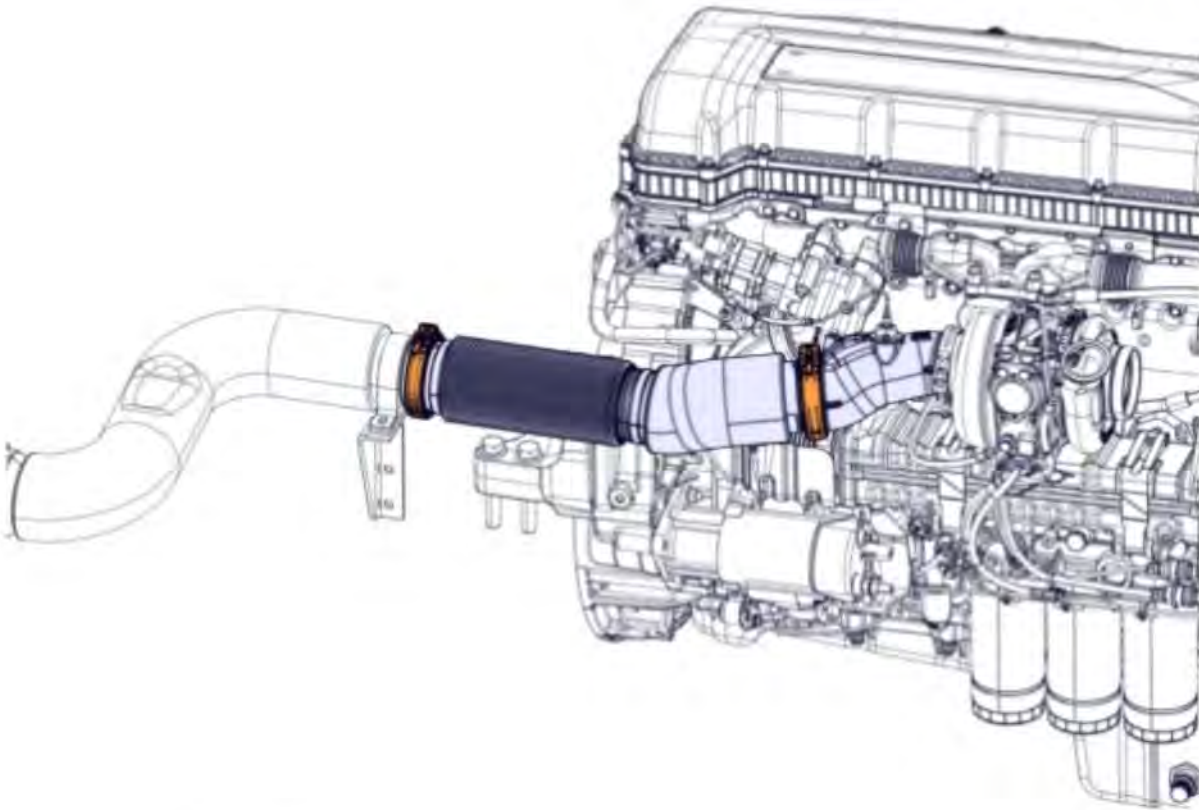
43 Remove the nuts.

44 Remove the starter motor.



45 Remove the clamps.

**i** **Note**  
Note the orientations and the positions.



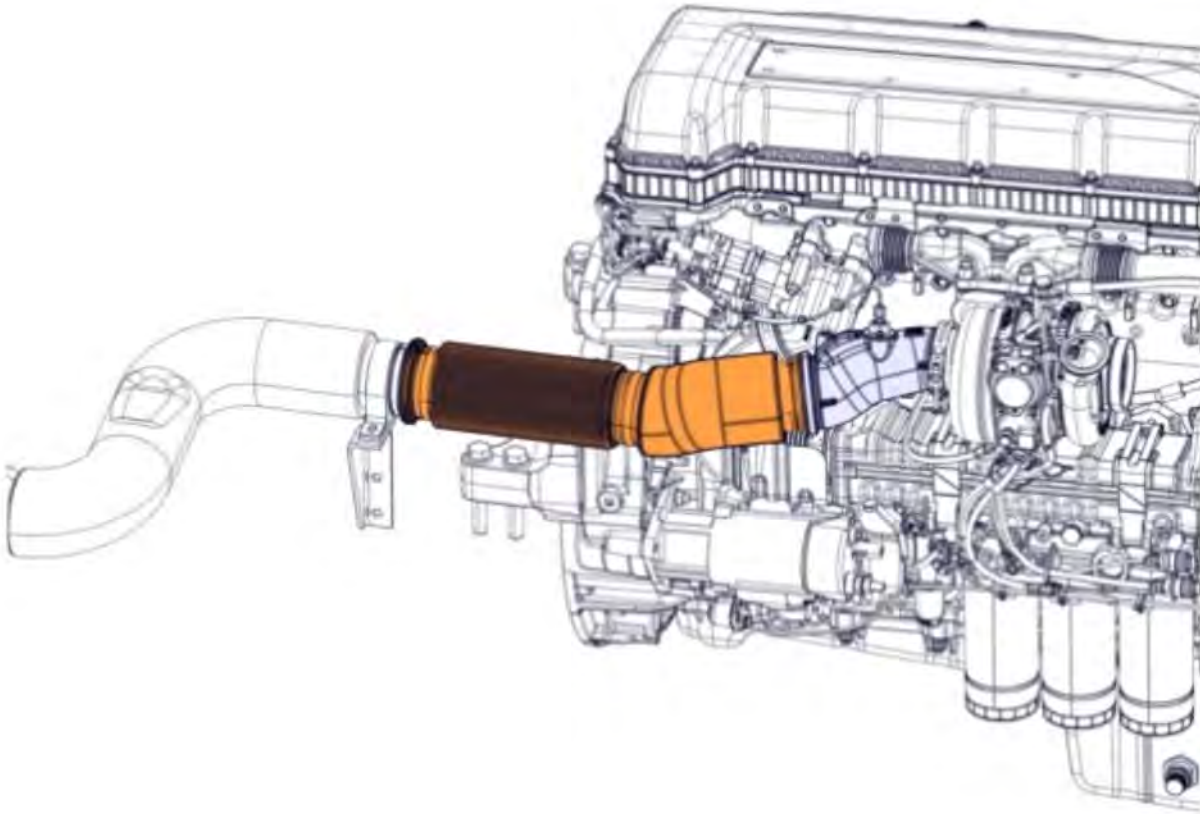
46 Remove the pipe.



**Note**

Note the orientation and the position.





47	Remove the gaskets.
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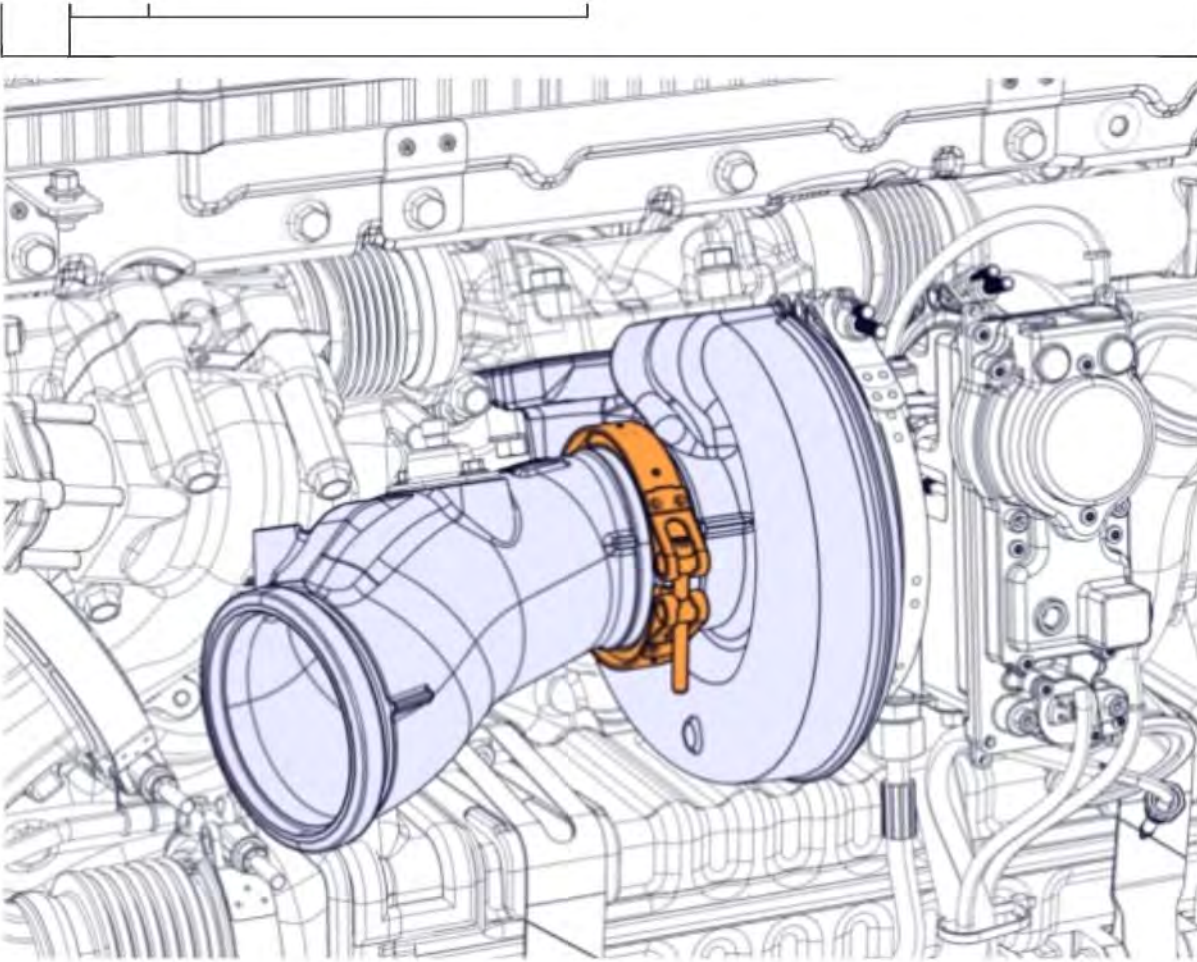


48	Remove the clamp.
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<b>i</b>	<b>Note</b> Note the orientation and the position.
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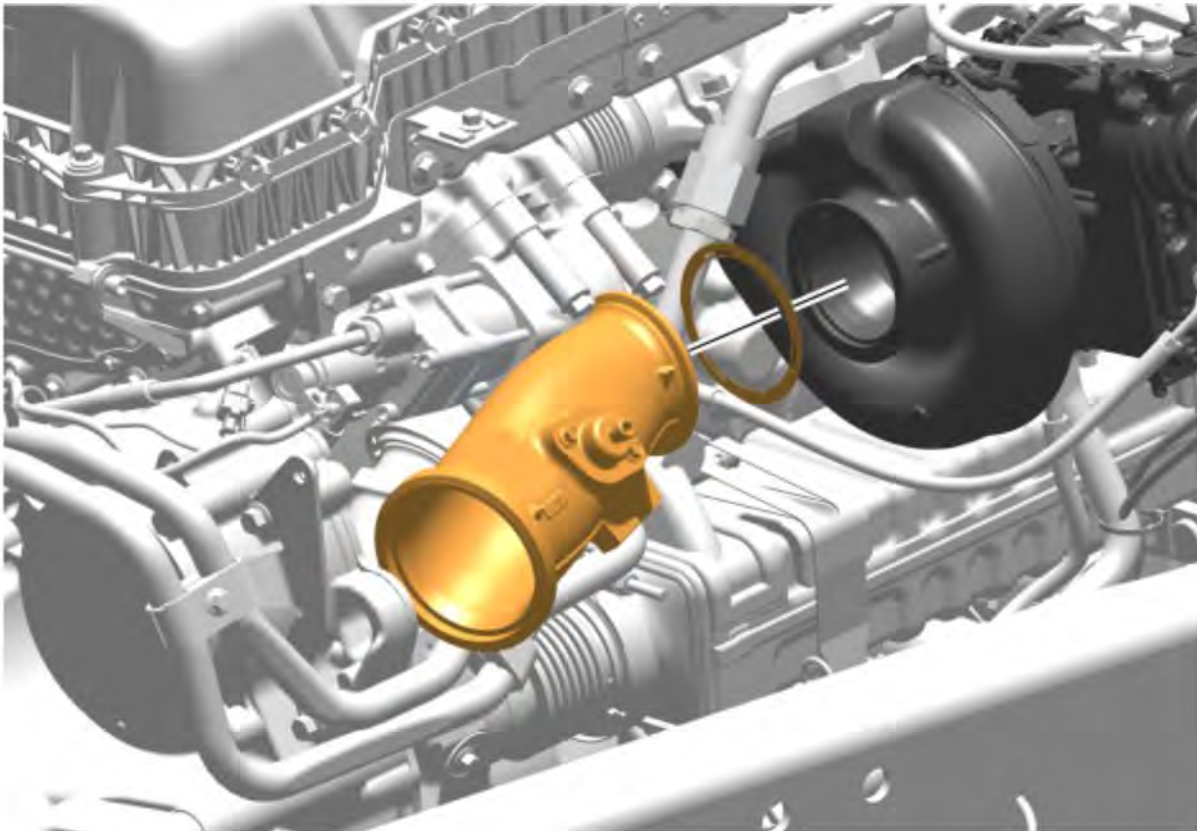
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49	Remove the diffuser.
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50	Remove the gasket.
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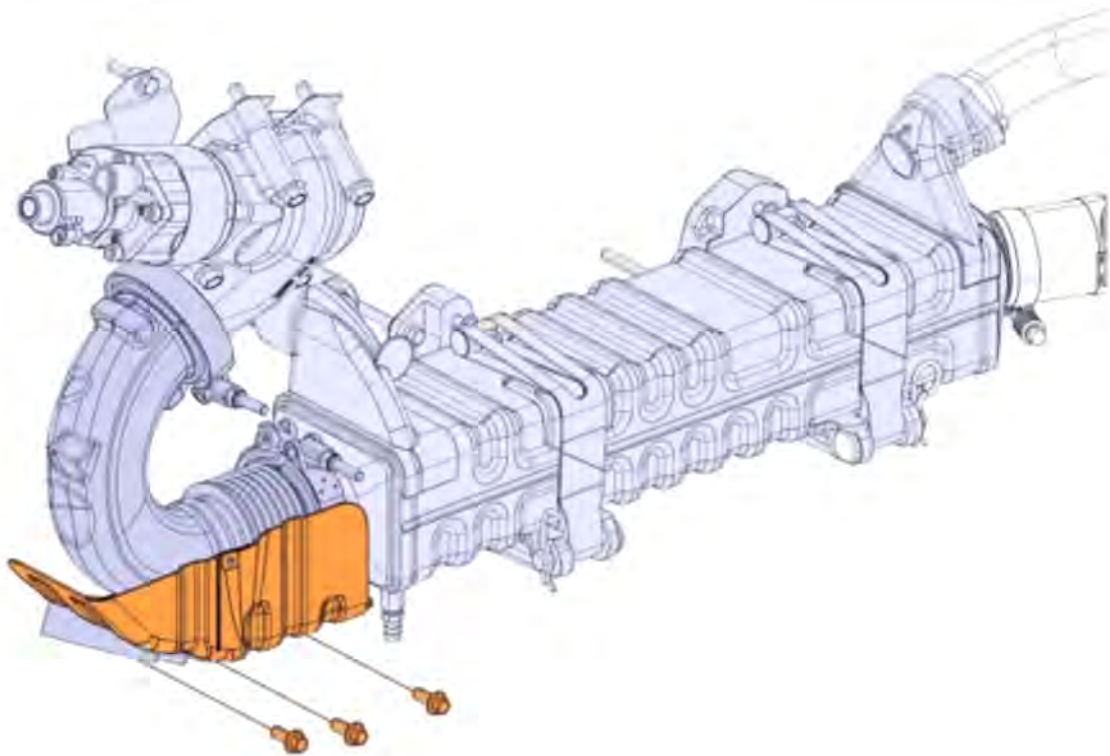
**WARNING****Risk of burn injuries.**

Heated components and mechanical parts can cause burns.

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

51 Remove the screws.

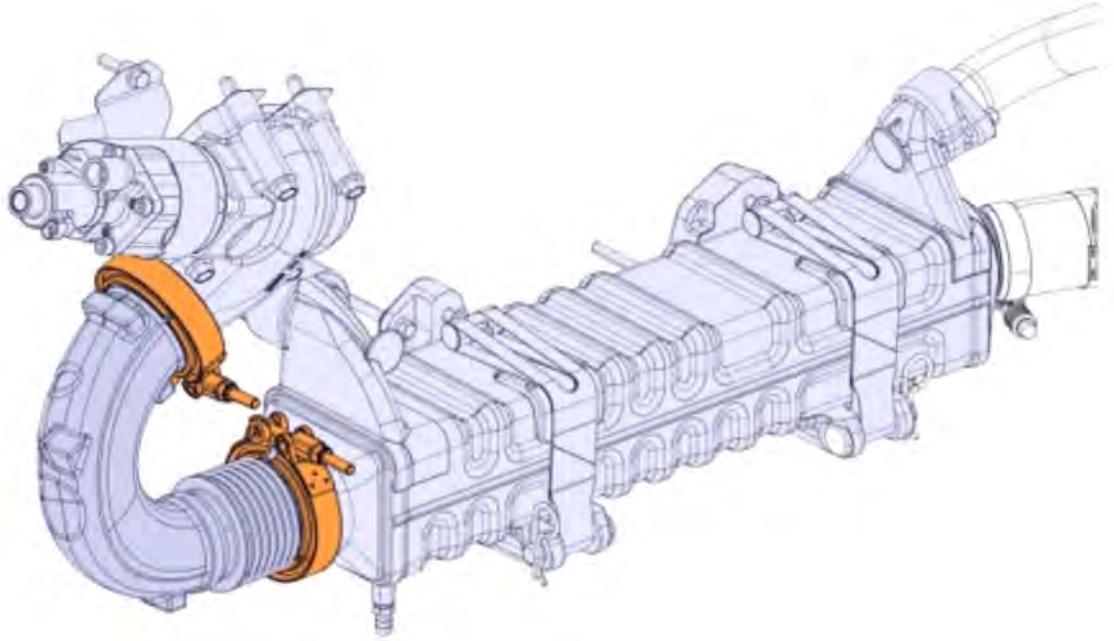
52 Remove the heat shield.



53 Remove the V-clamps.

**Note**

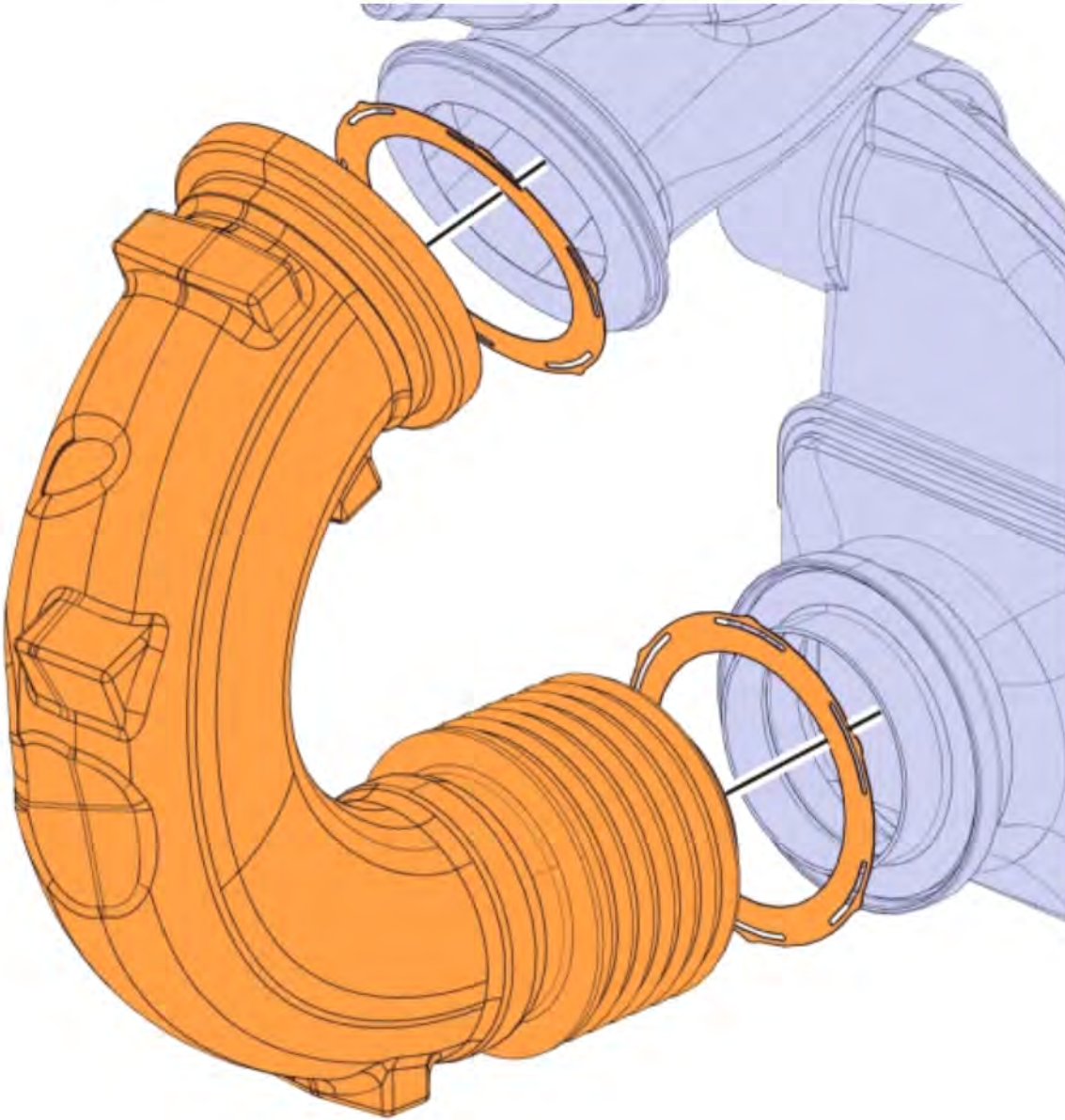
Note the V-clamp positions.



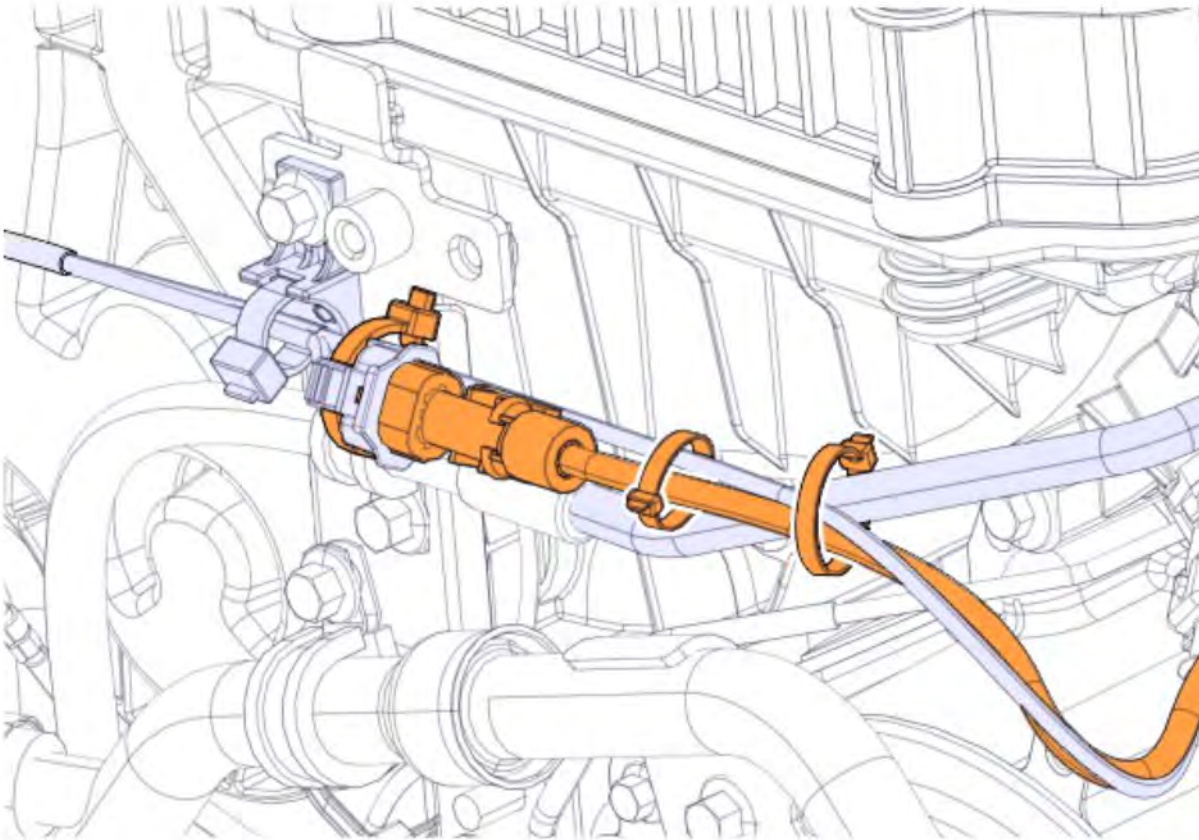
54	Remove the pipe.
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55	Remove the gaskets.
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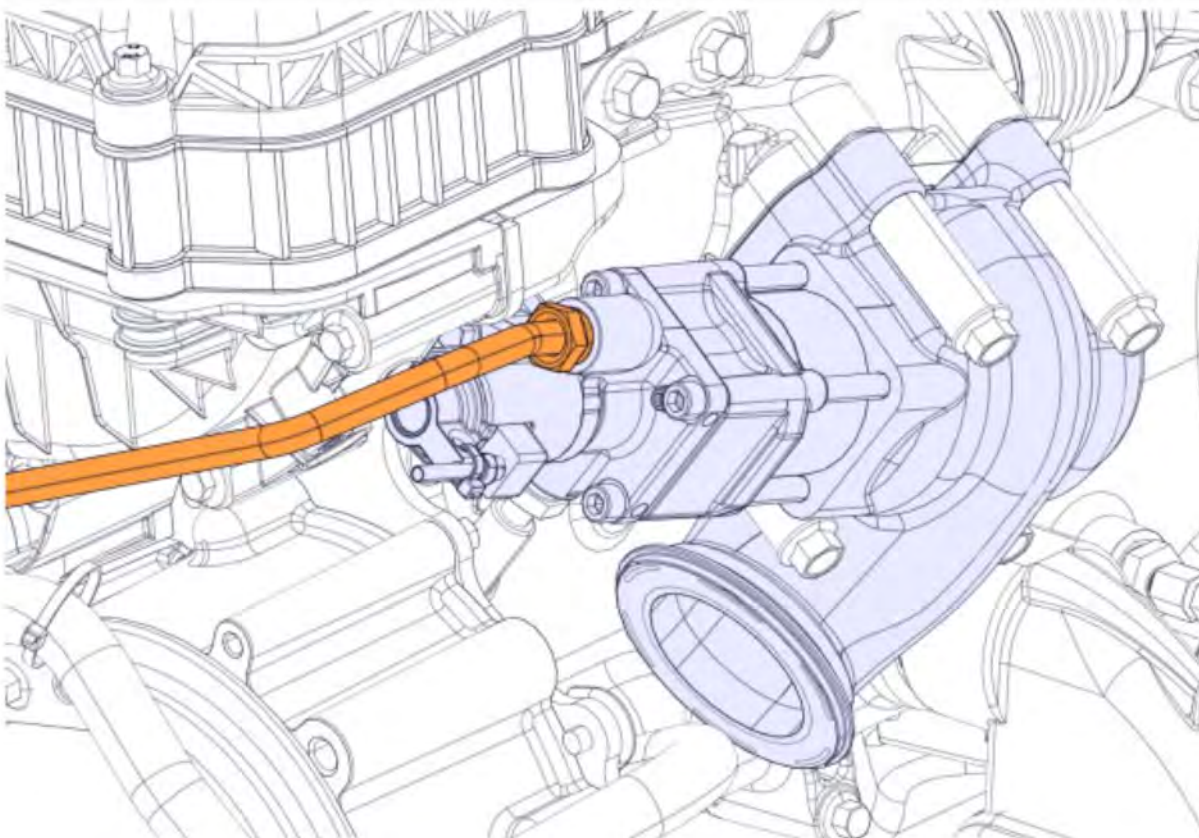




56	Remove the cable ties.
57	Disconnect the connector.
58	Move the cable aside.

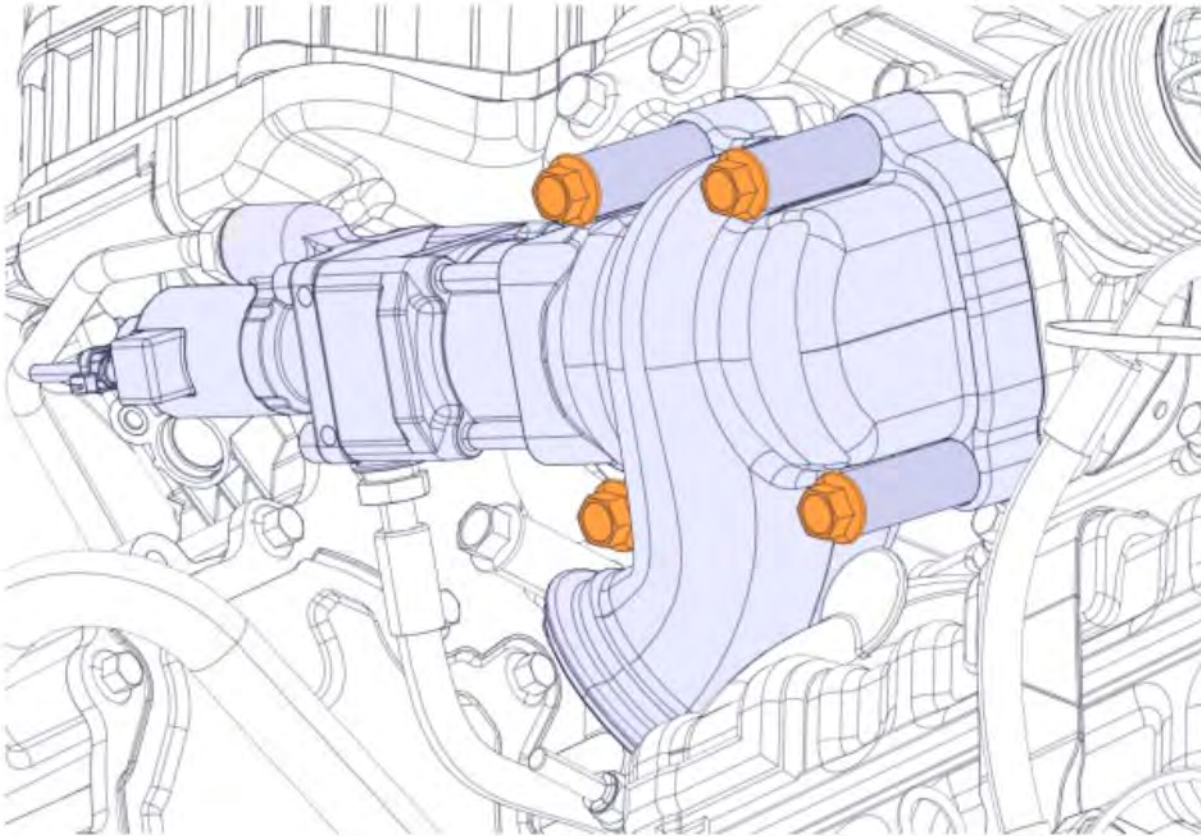


**59** Loosen the pipe.

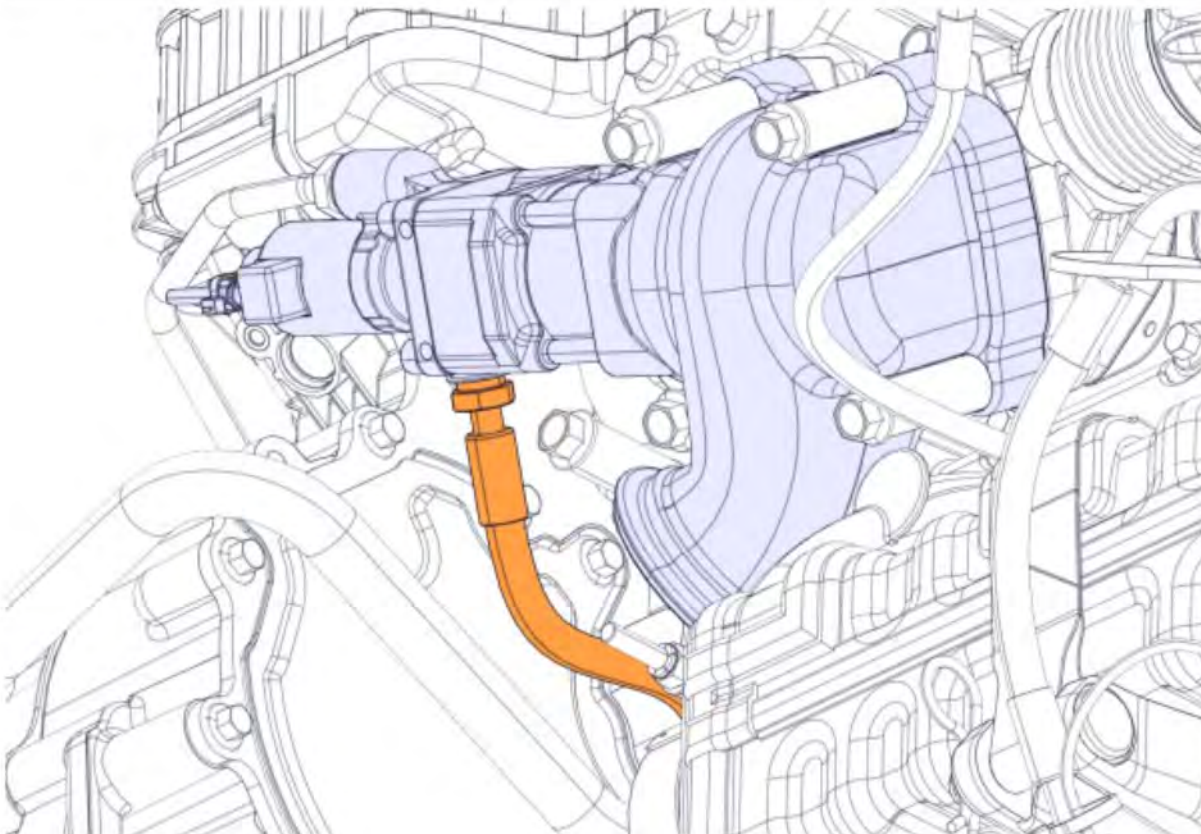


**60** Loosen the screws.





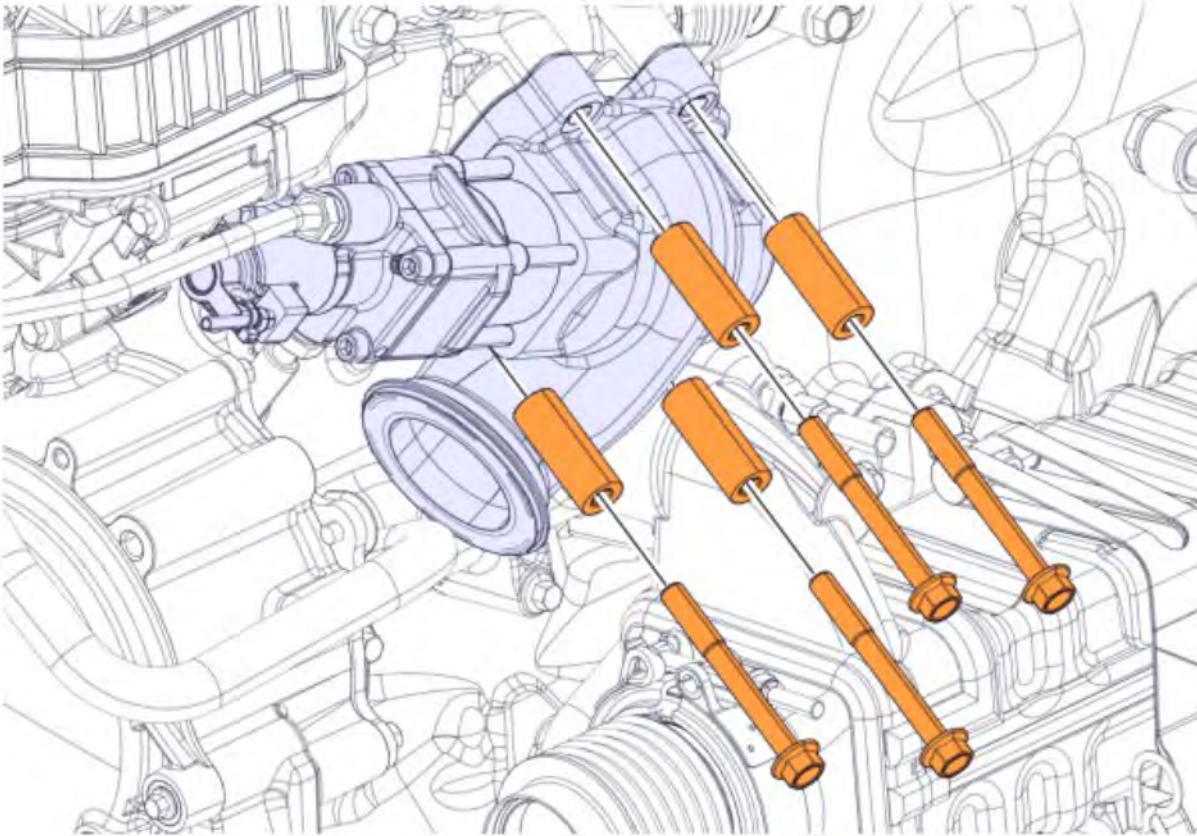
61	Loosen the pipe.
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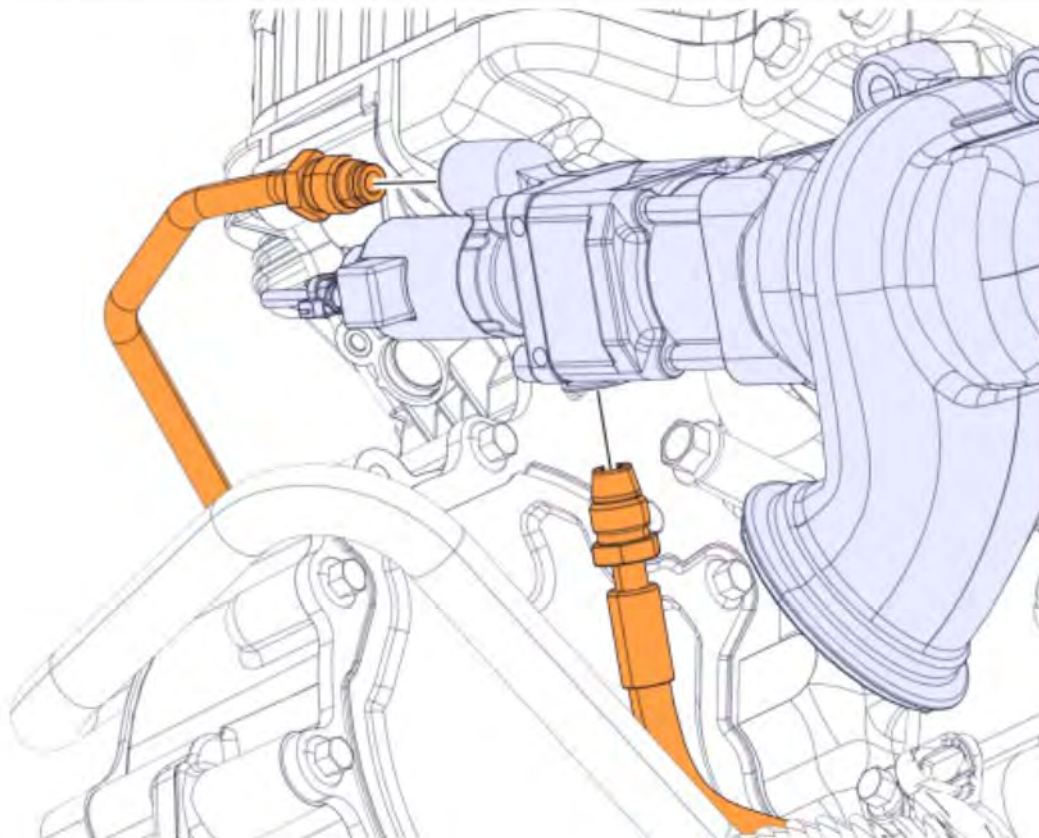
62	Remove the screws.
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63	Remove the spacers.
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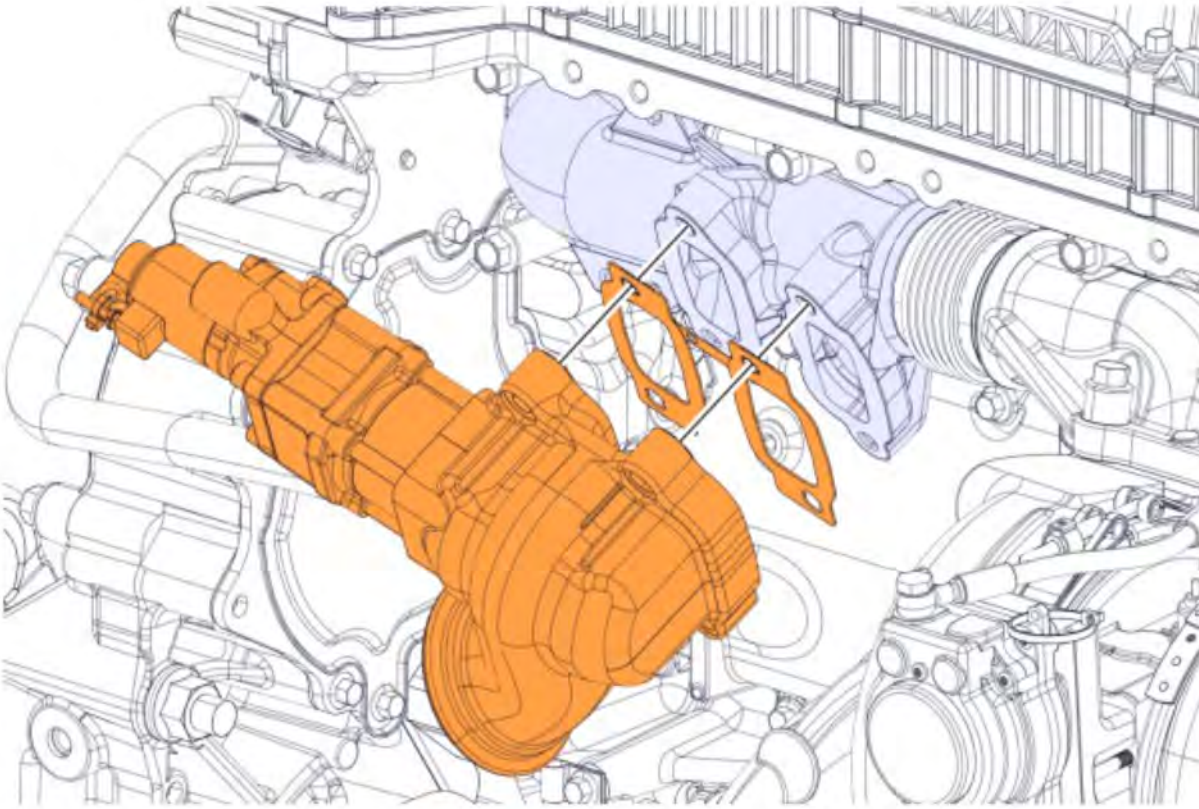


<b>64</b>	Remove the pipes.
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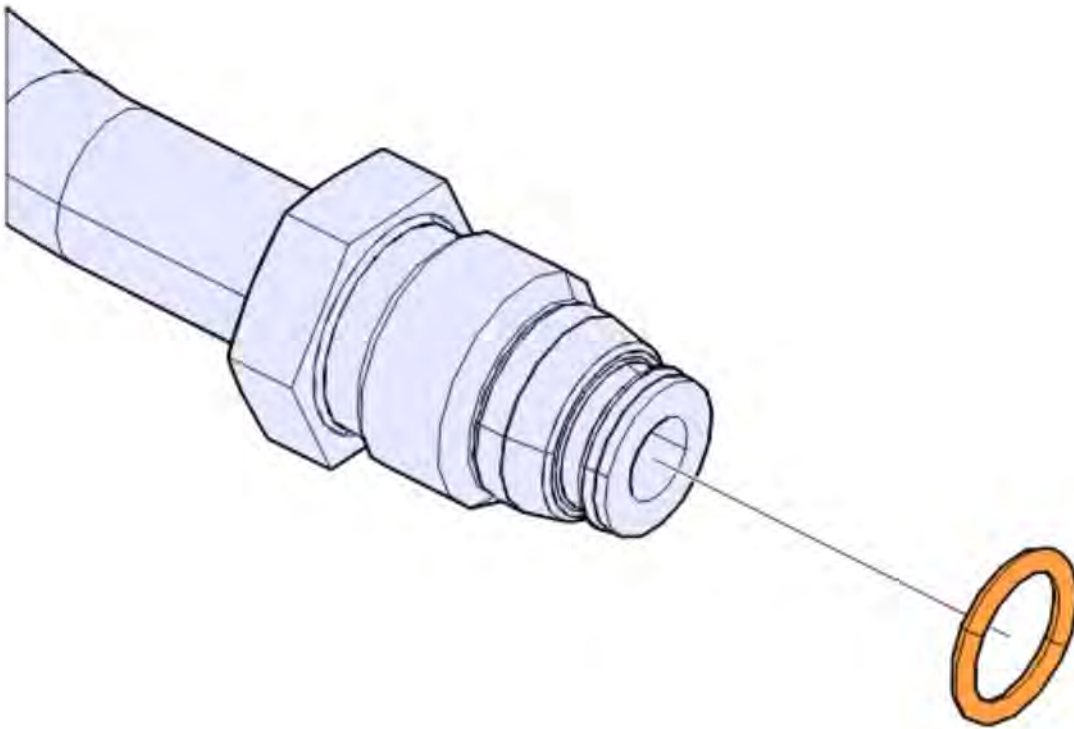
<b>65</b>	Remove the valve.
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<b>66</b>	Remove the gasket.
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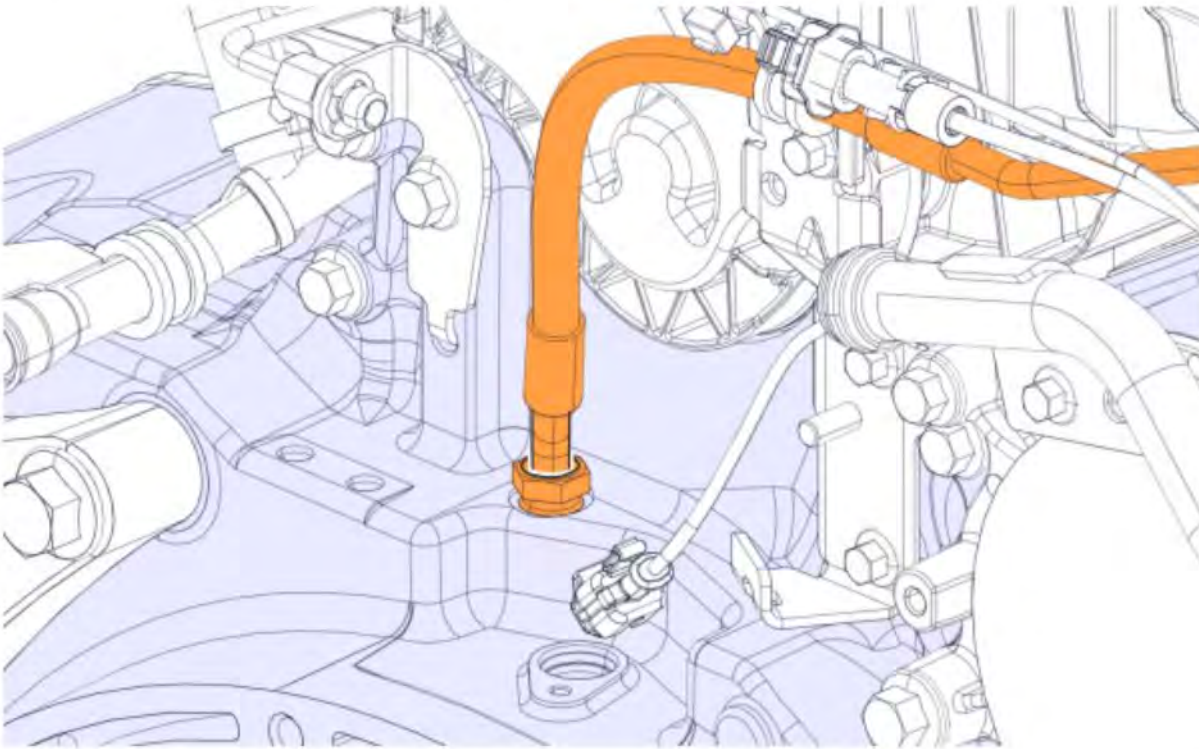
67	Remove the seal.
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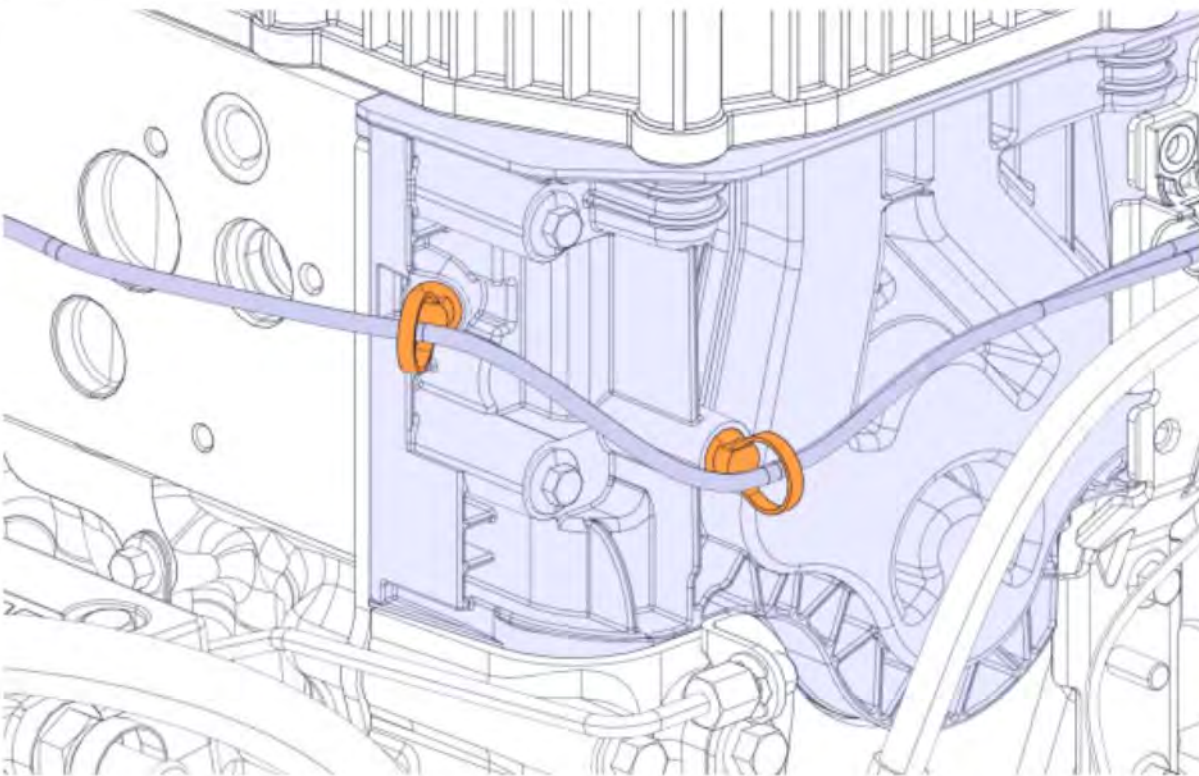


68	Loosen the nut.
----	-----------------

69	Remove the hose.
----	------------------



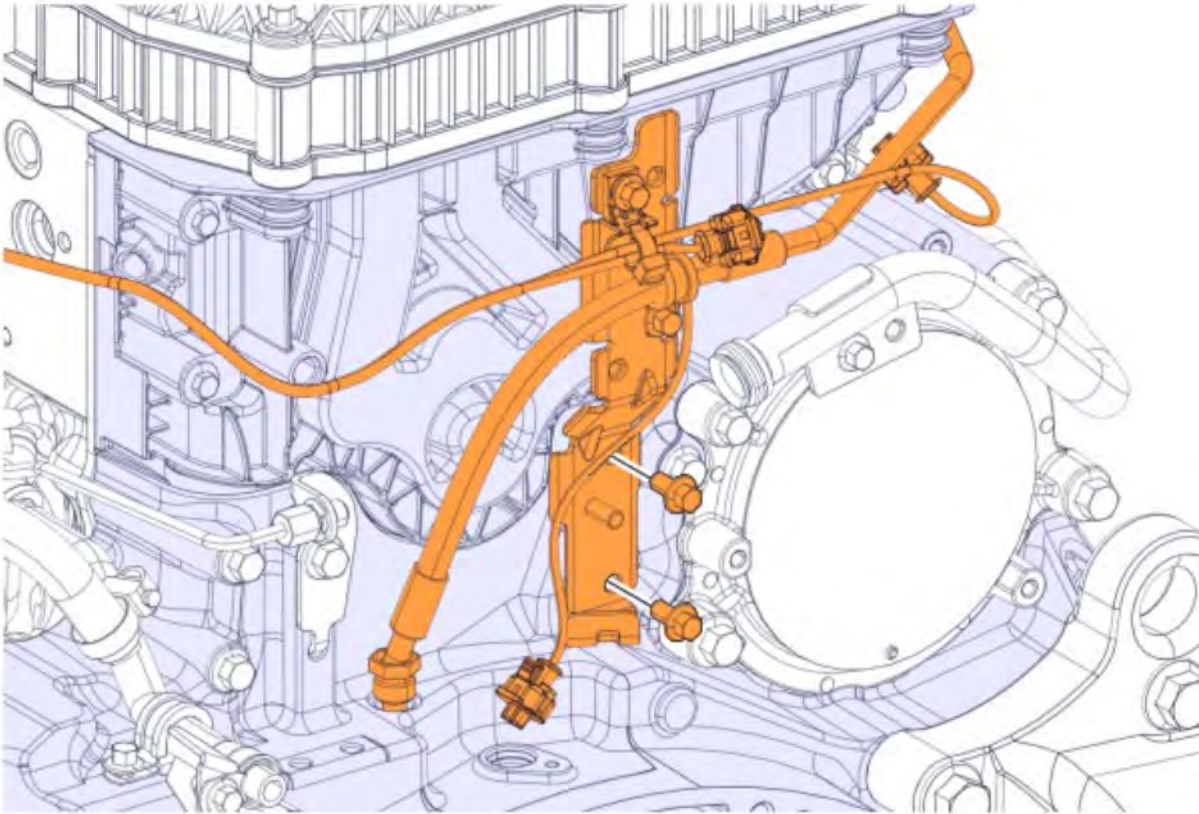
70	Remove the cable ties.
----	------------------------



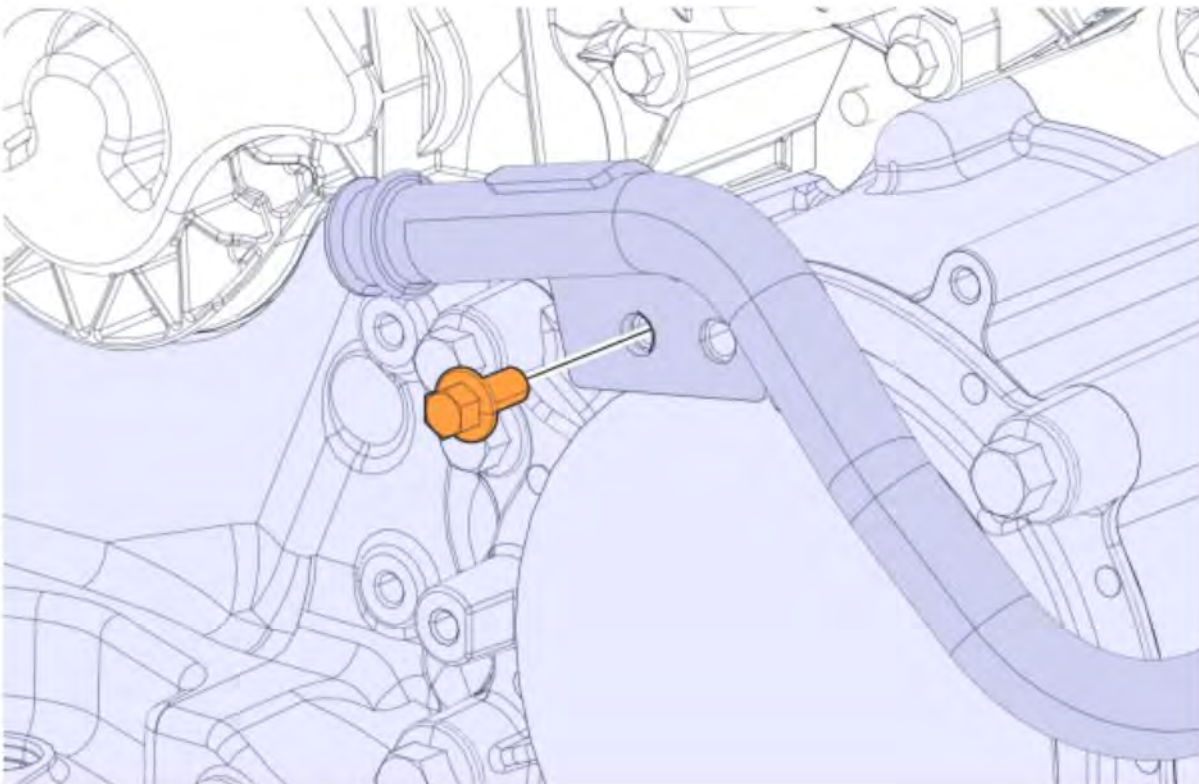
71	Remove the screws.
----	--------------------

72	Move the assembly aside.
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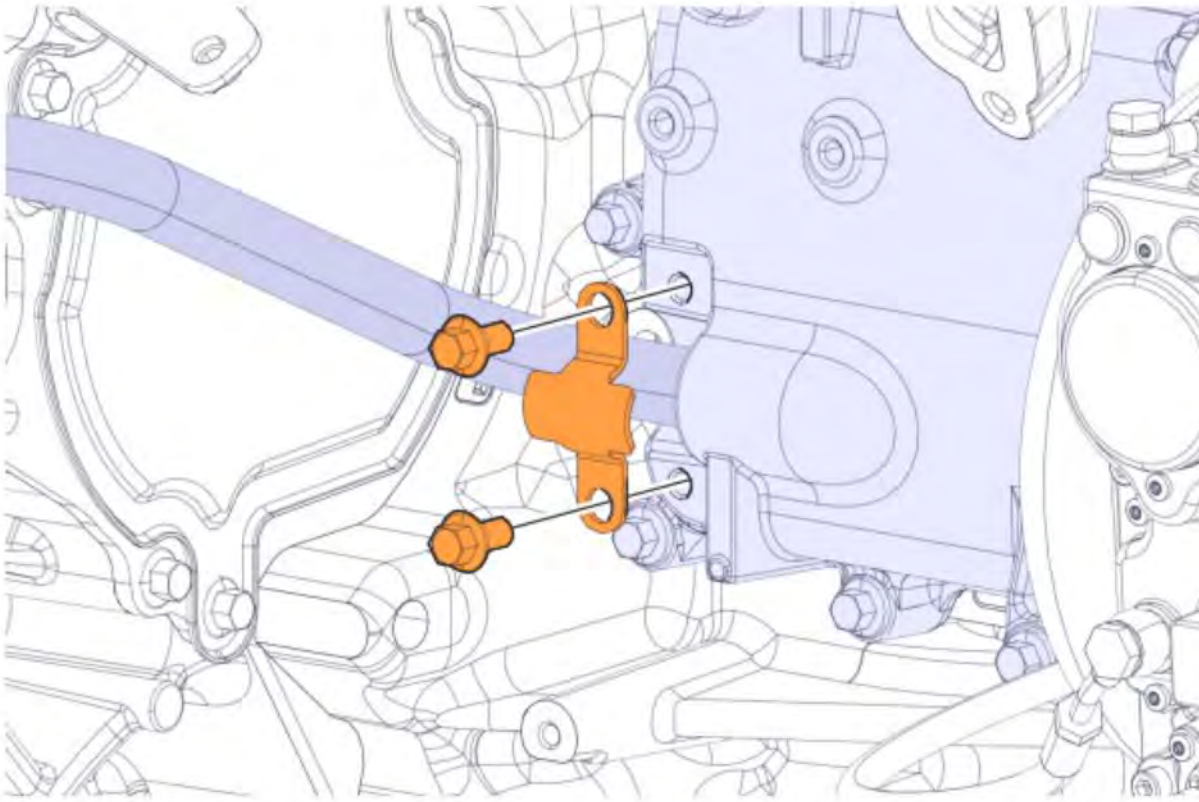
<b>73</b>	Remove the screw.
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<b>74</b>	Remove the screws.
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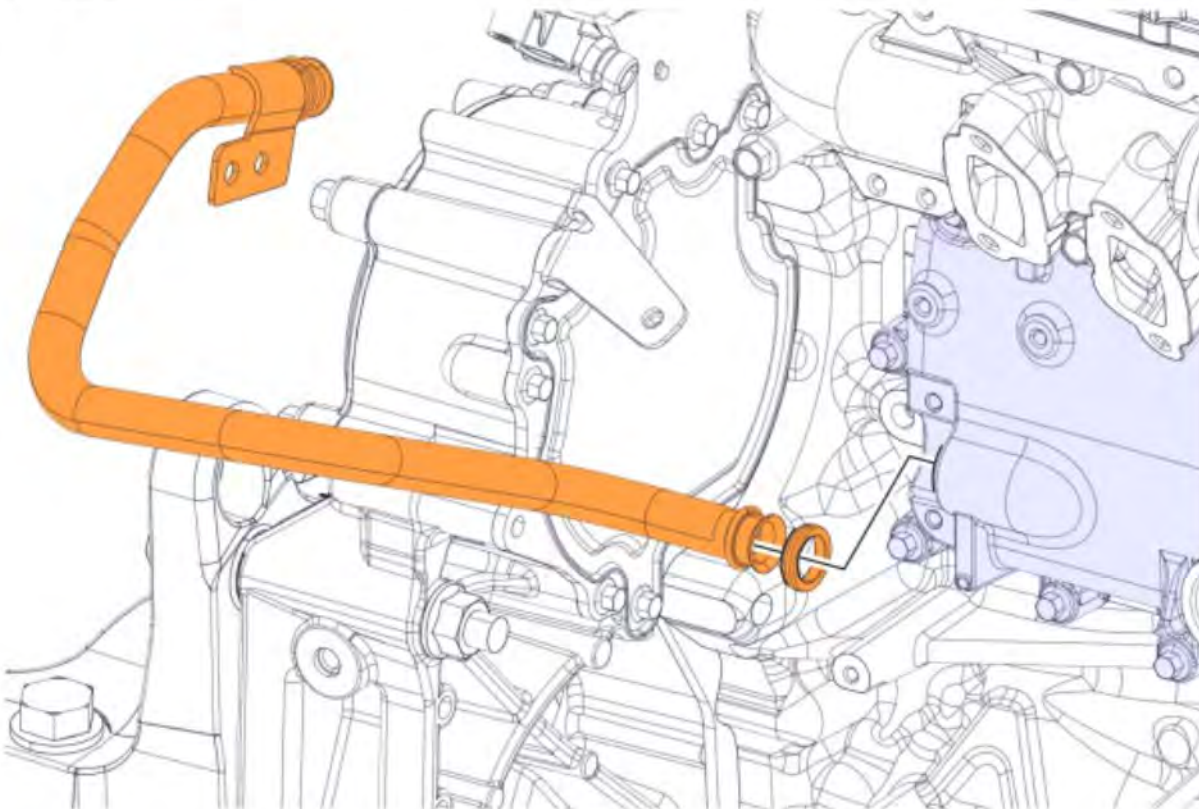
<b>75</b>	Remove the clamp.
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<b>76</b>	Remove the pipe.
-----------	------------------

<b>77</b>	Remove the seal.
-----------	------------------



<b>78</b>	Remove the screws.
-----------	--------------------

<b>79</b>	Remove the pump.
-----------	------------------

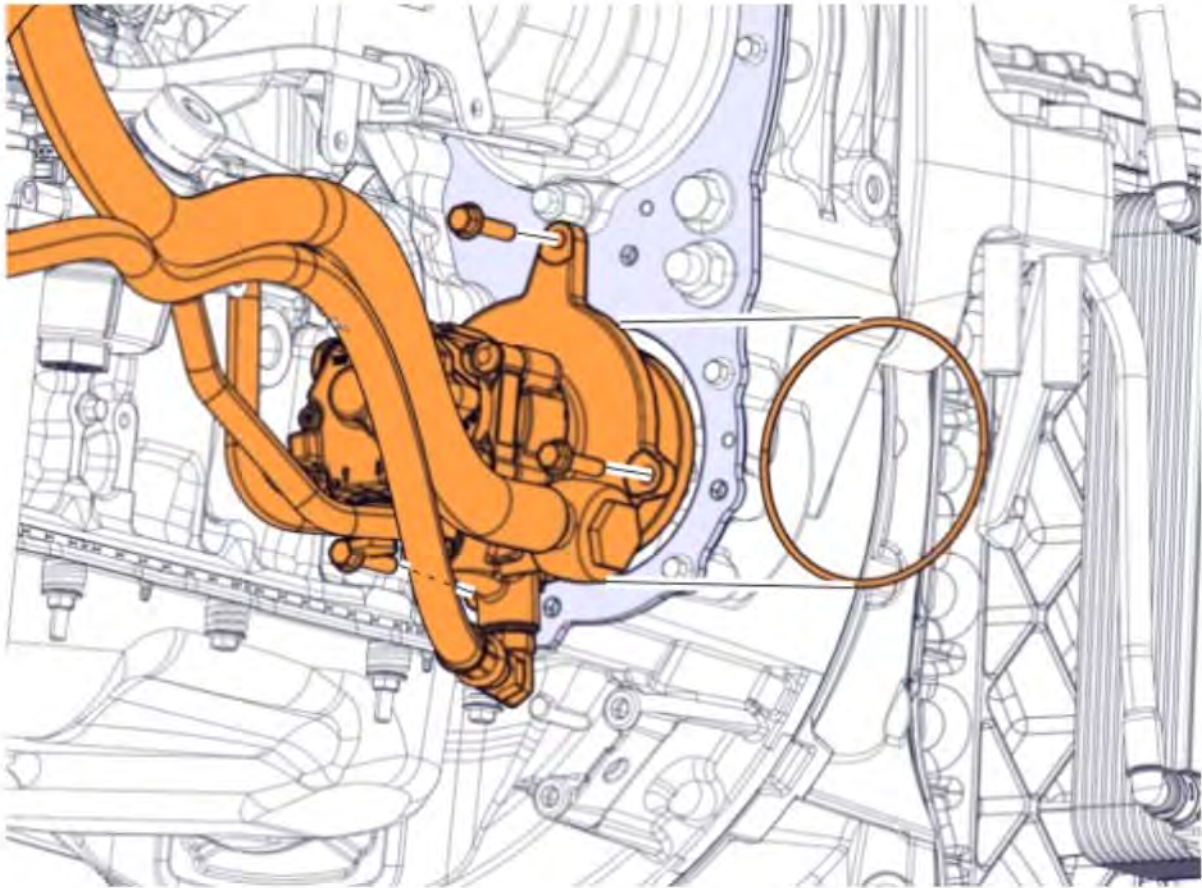
**Note**

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<b>i</b>	Leave the pipes connected to the pump.
<b>i</b>	<b>Note</b> Support the pump.

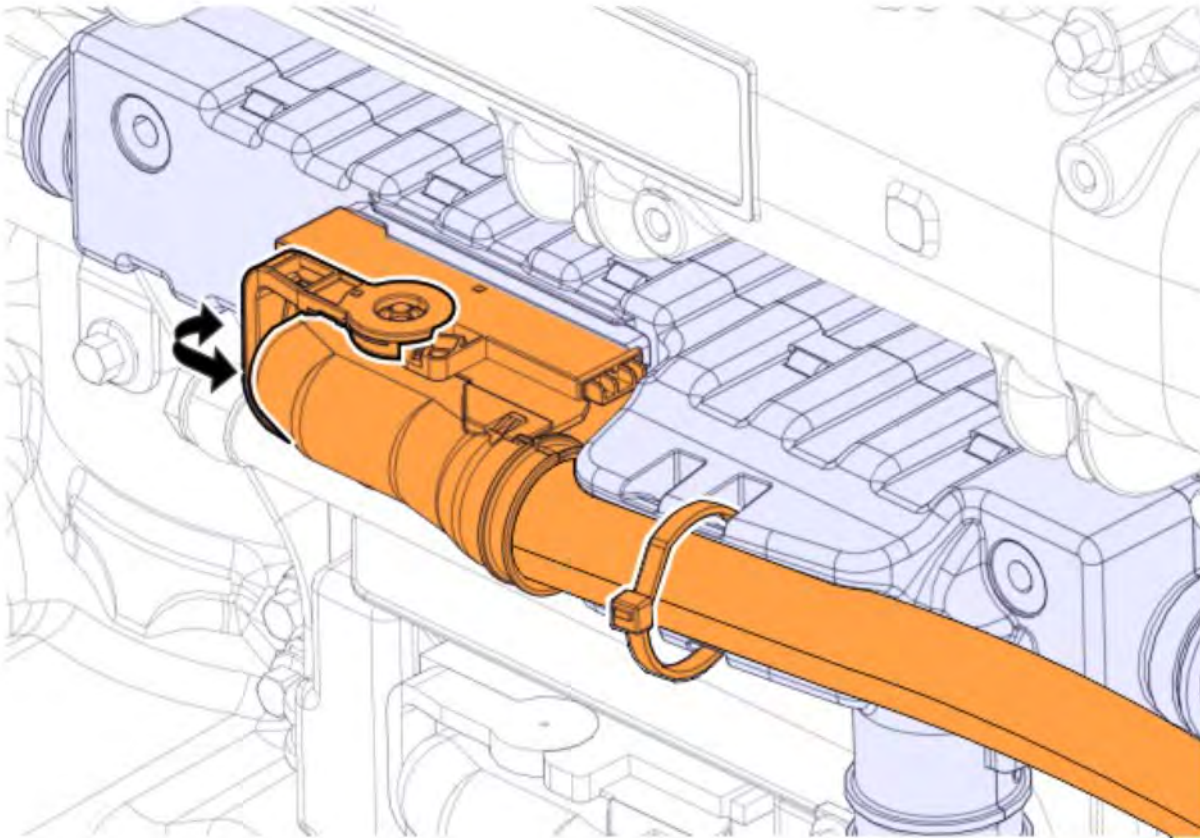
**80** Remove the seal.



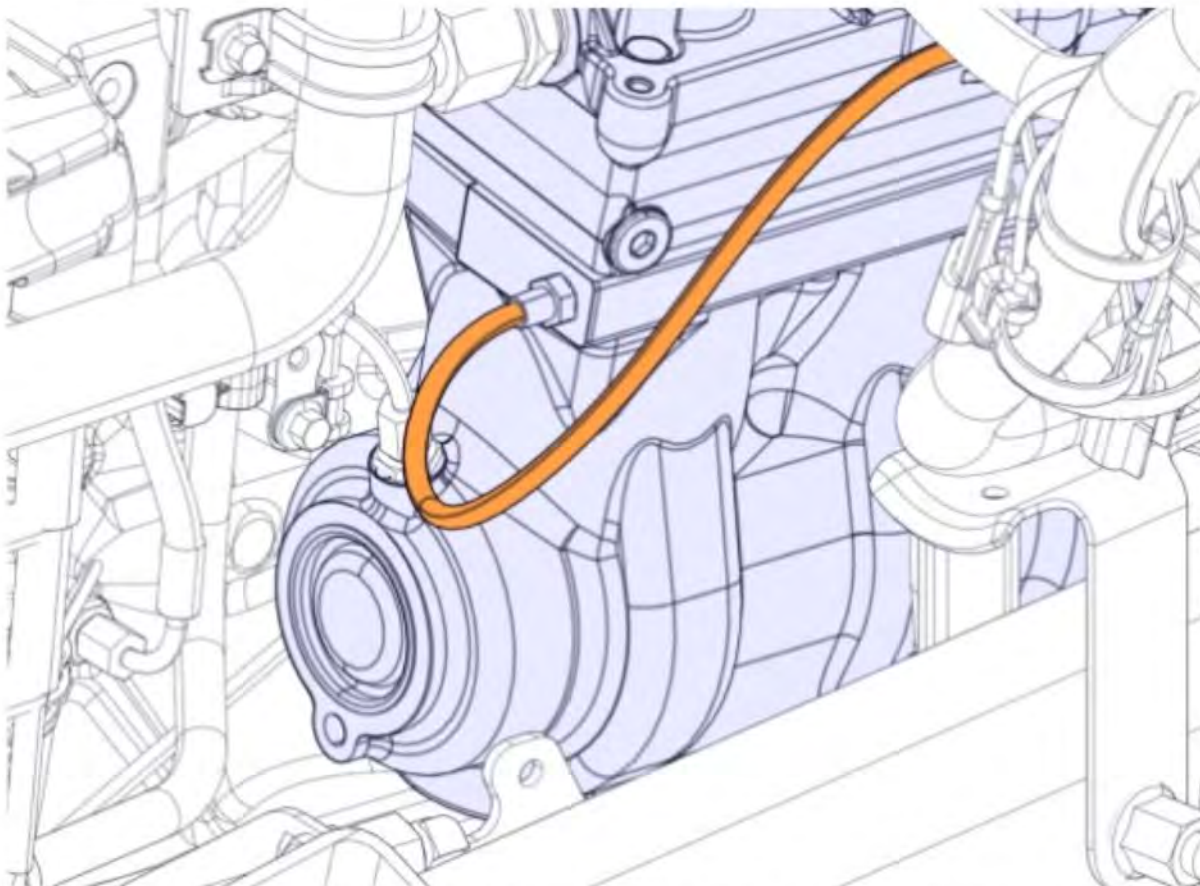
<b>81</b>	Remove the cable ties.
<b>i</b>	<b>Note</b> Note the positions.

**82** Disconnect the connector.





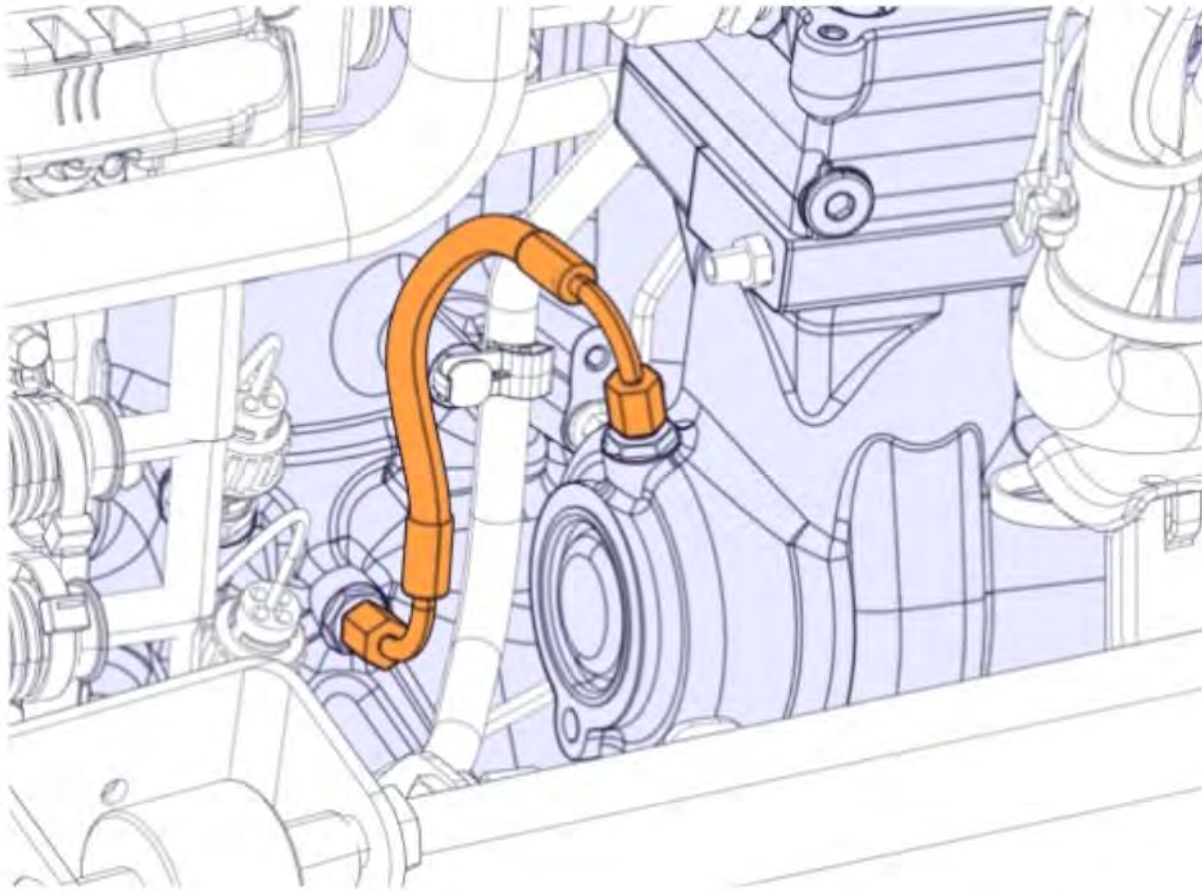
<b>83</b>	Disconnect the air line.	
	<b>Required material</b>	
	DISASSEMBLY TOOL	<a href="#">J-44773</a>



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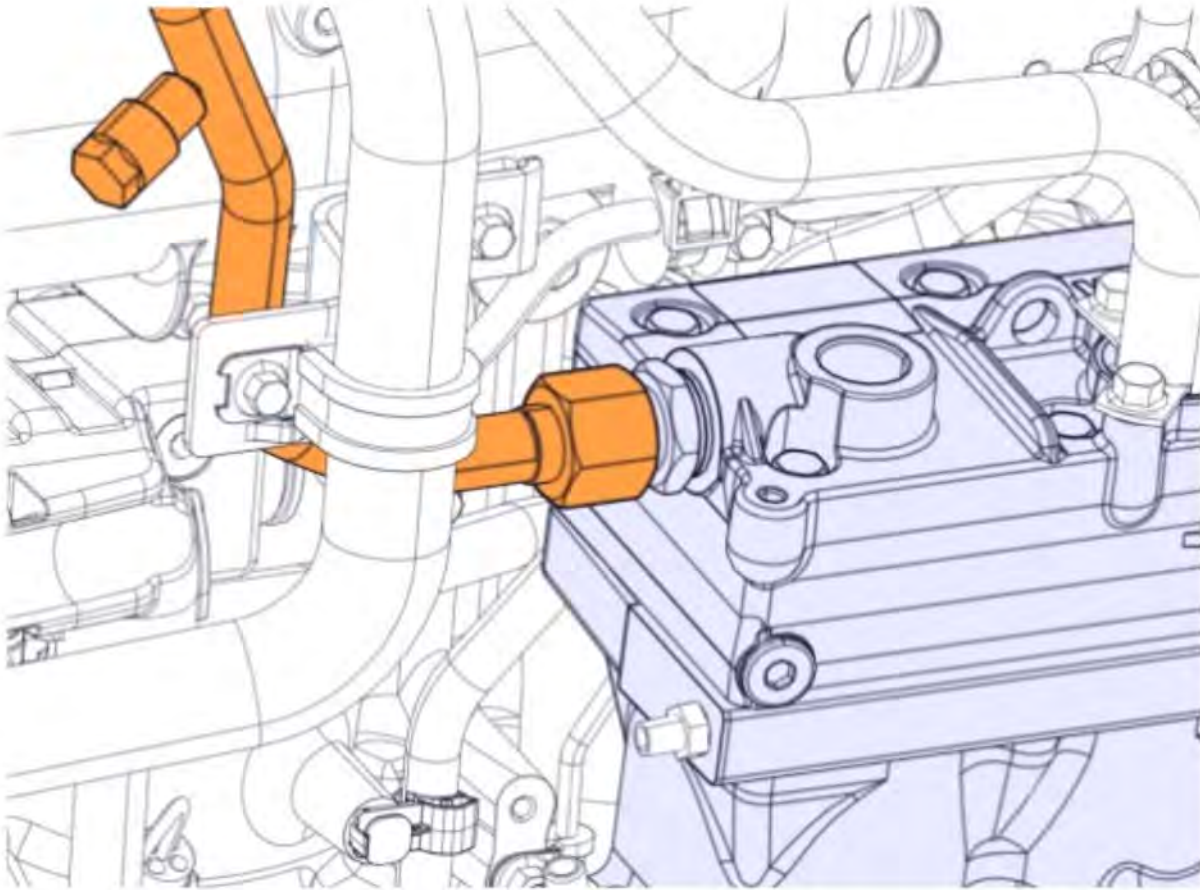
84	Remove the oil hose.
----	----------------------



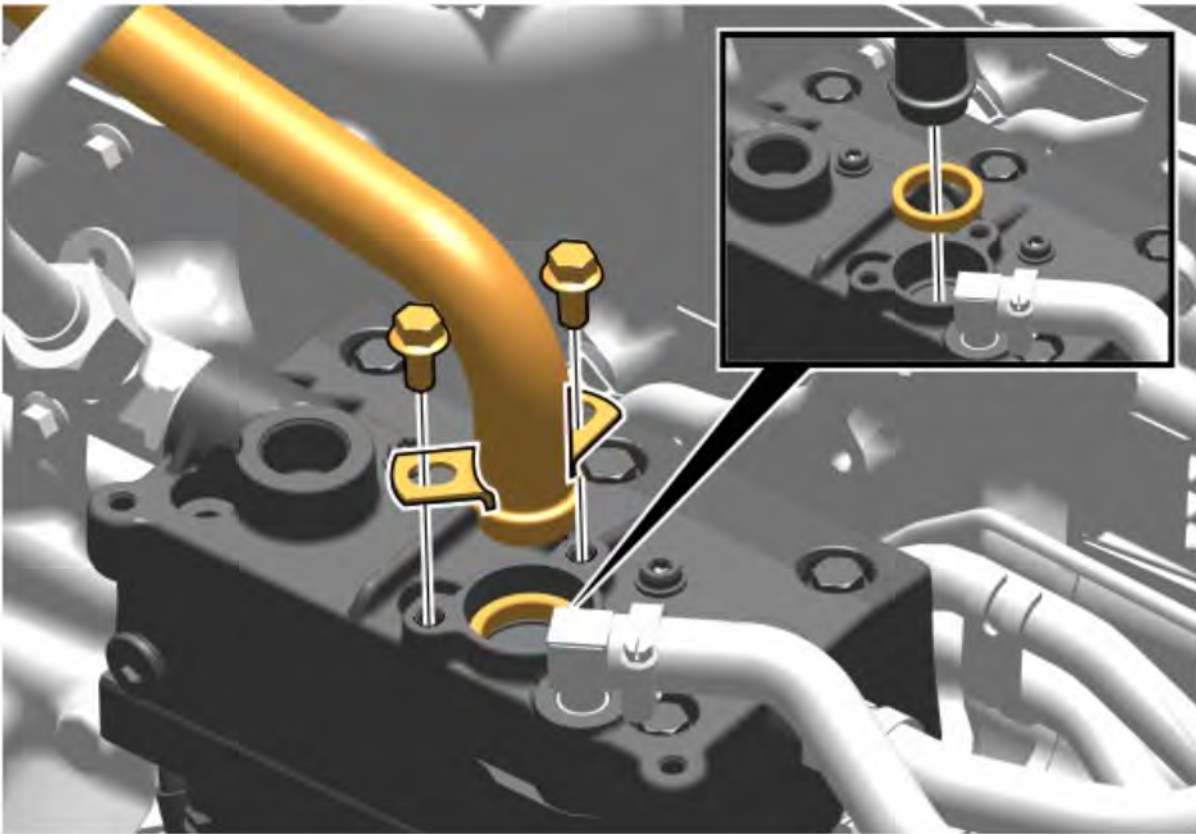
85	Loosen the nut.
----	-----------------

86	Remove the pipe.
----	------------------



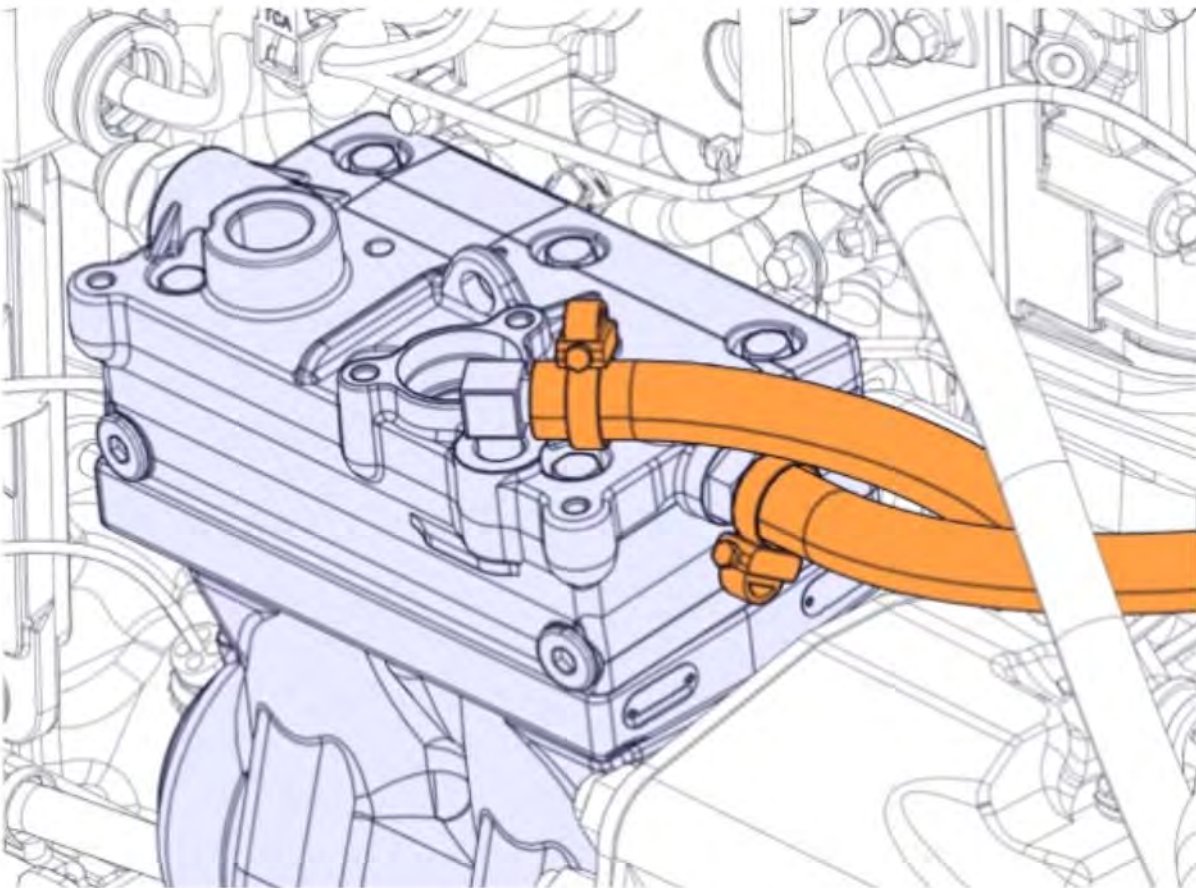


87	Remove the screws.
88	Remove the lock braces.
89	Move aside the pipe.
90	Remove the sealing ring.



91	Loosen the clamps.
----	--------------------

92	Remove the hoses.
----	-------------------



93	Remove the nuts.
----	------------------

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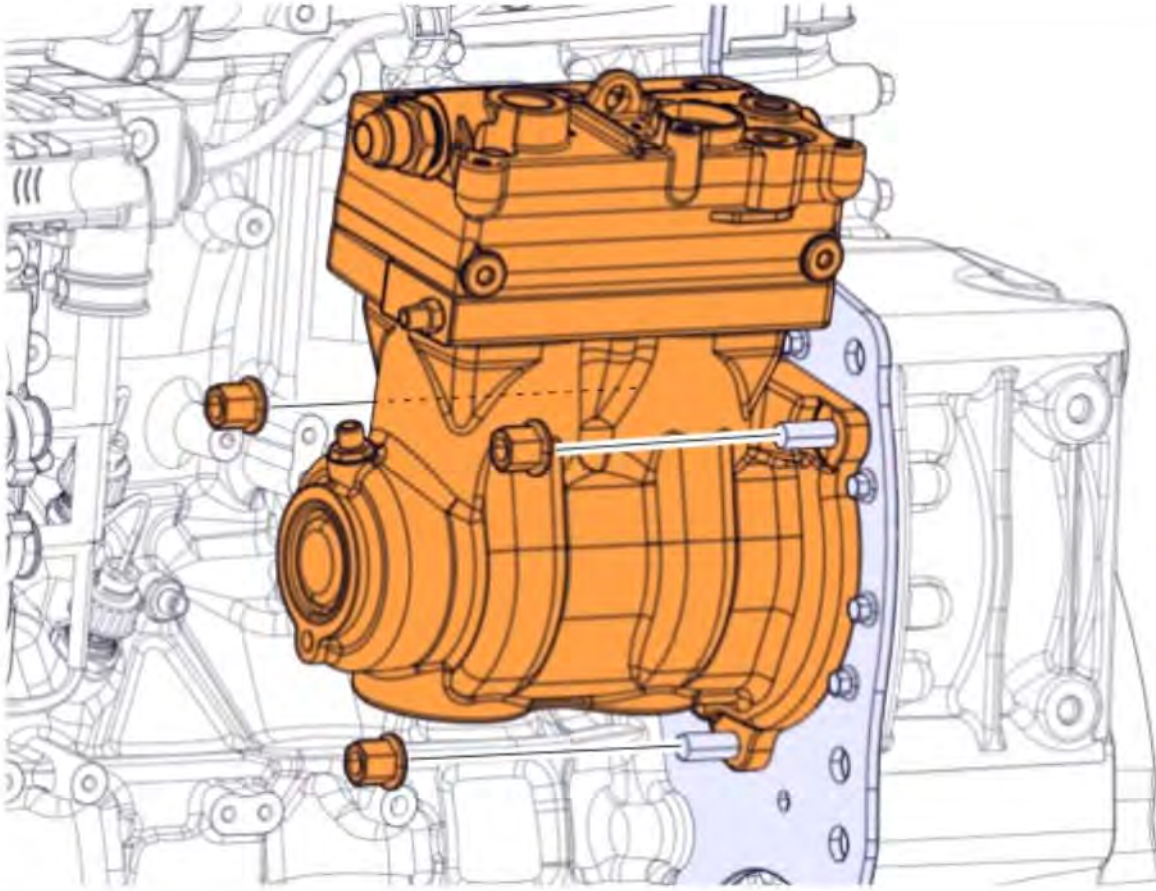
The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.



**CAUTION****Risk of serious injury.**

Heavy component.

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

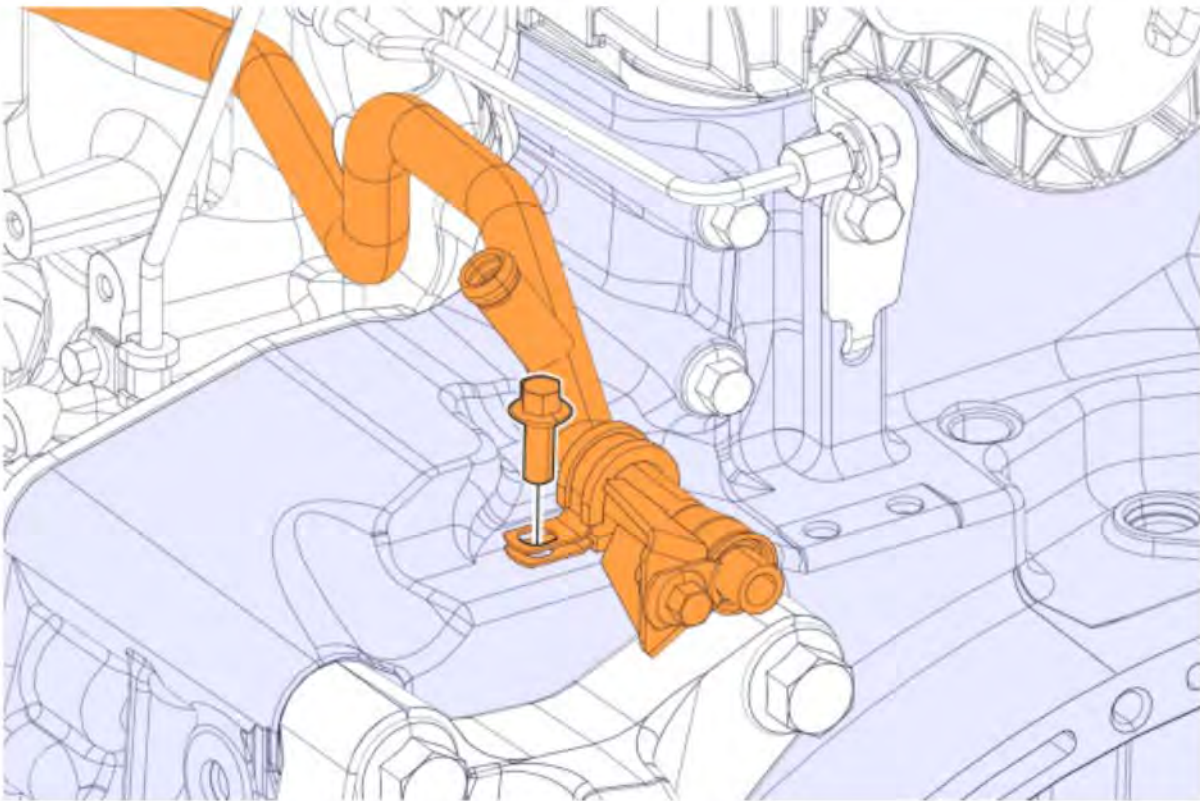
**94** Remove the compressor.**95** Remove the O-ring.





<b>96</b>	Remove the screw.
-----------	-------------------

<b>97</b>	Move aside the pipe.
-----------	----------------------



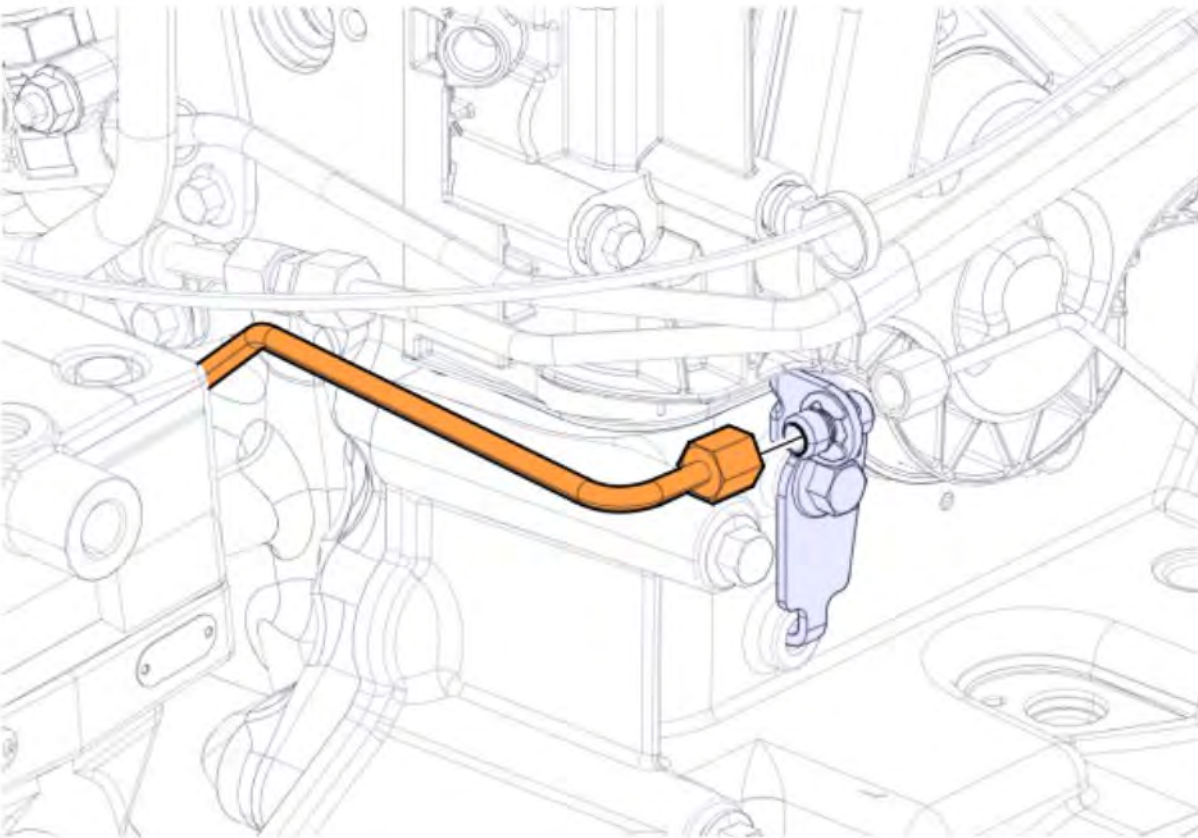
<b>98</b>	Remove the screws.
-----------	--------------------

<b>99</b>	Remove the clamps.
-----------	--------------------



100	Loosen the nut.
-----	-----------------

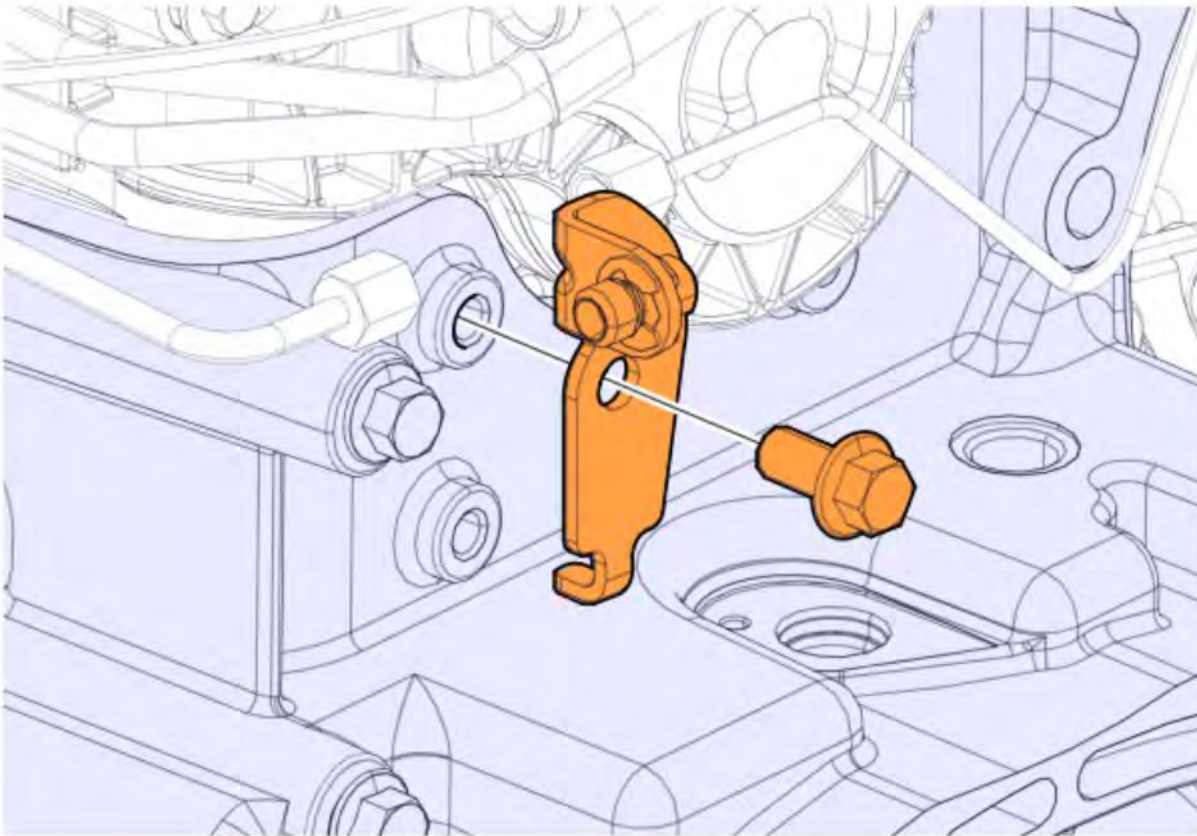
101	Remove the pipe.
-----	------------------



102	Remove the screw.
-----	-------------------

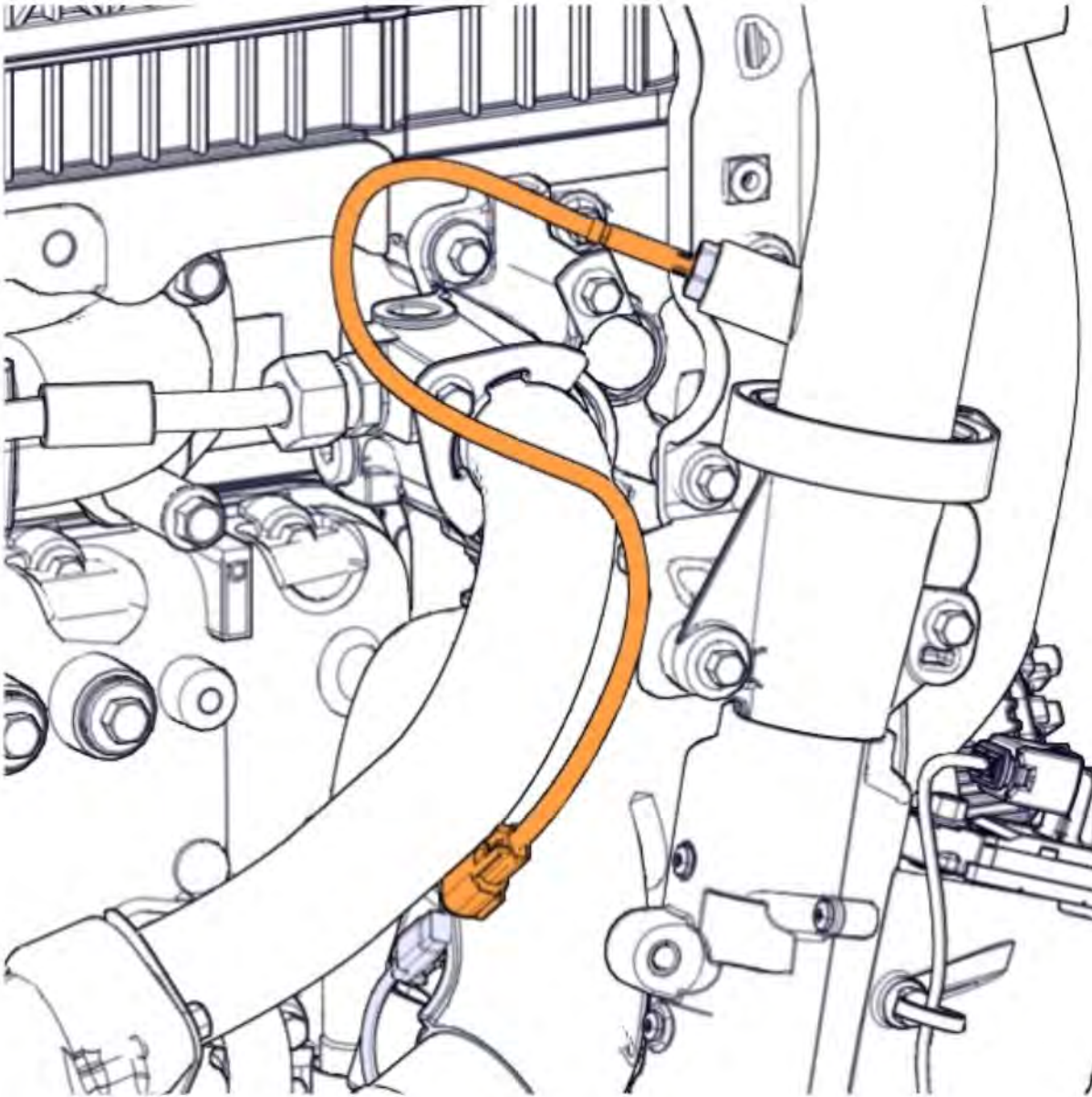
103	Remove the bracket.
-----	---------------------





104	Disconnect the connector.
-----	---------------------------

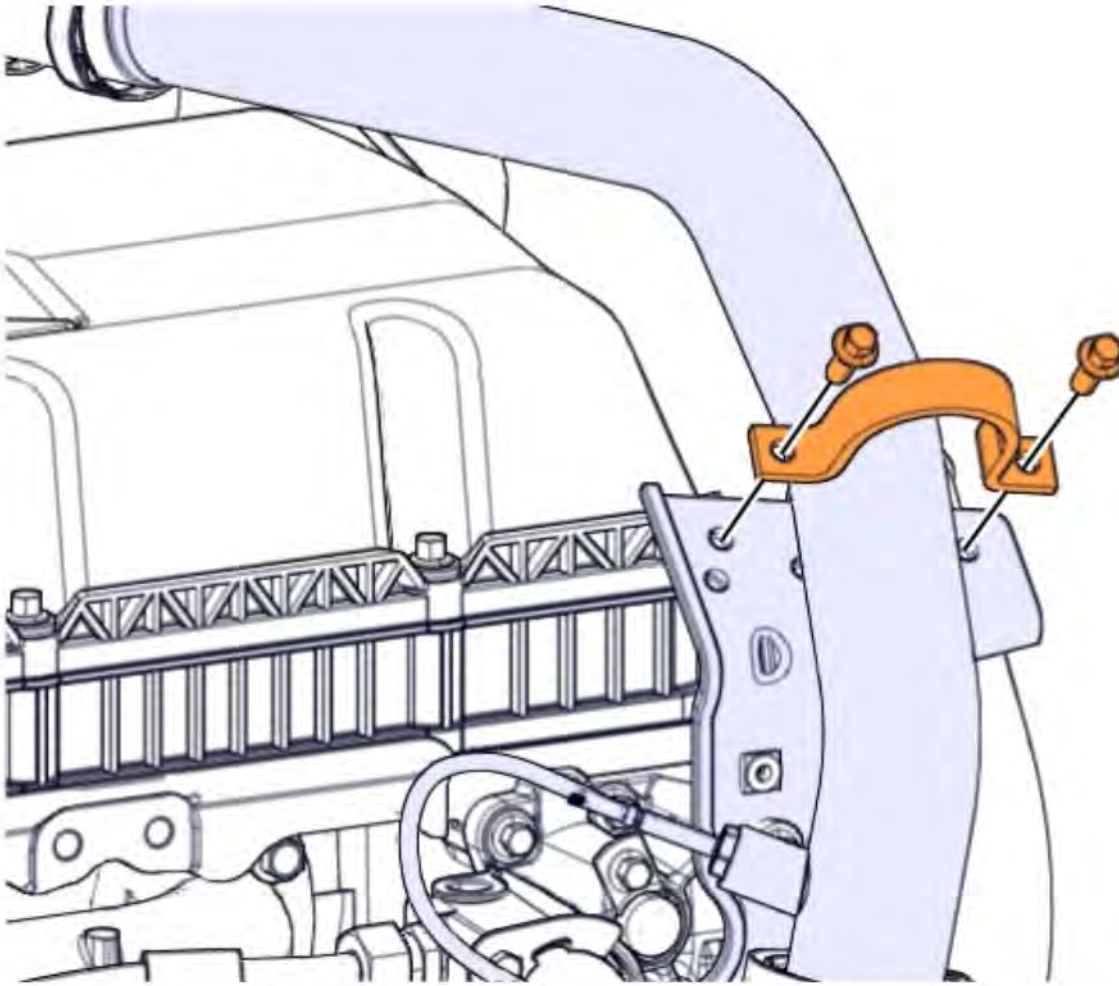
105	Remove the cable tie.
-----	-----------------------



106	Remove the screws.
-----	--------------------

107	Remove the clamp.
-----	-------------------



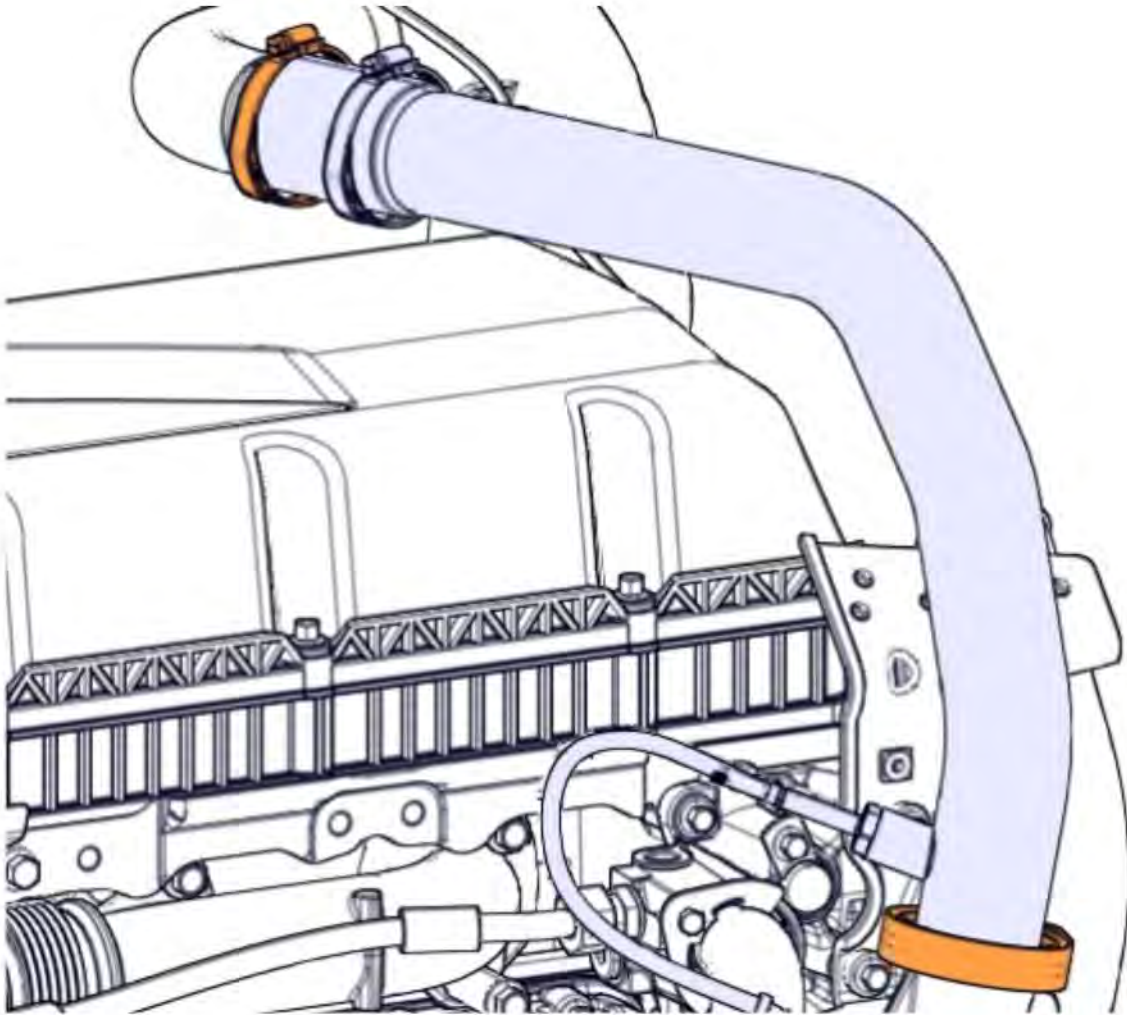


108 Loosen the clamps.



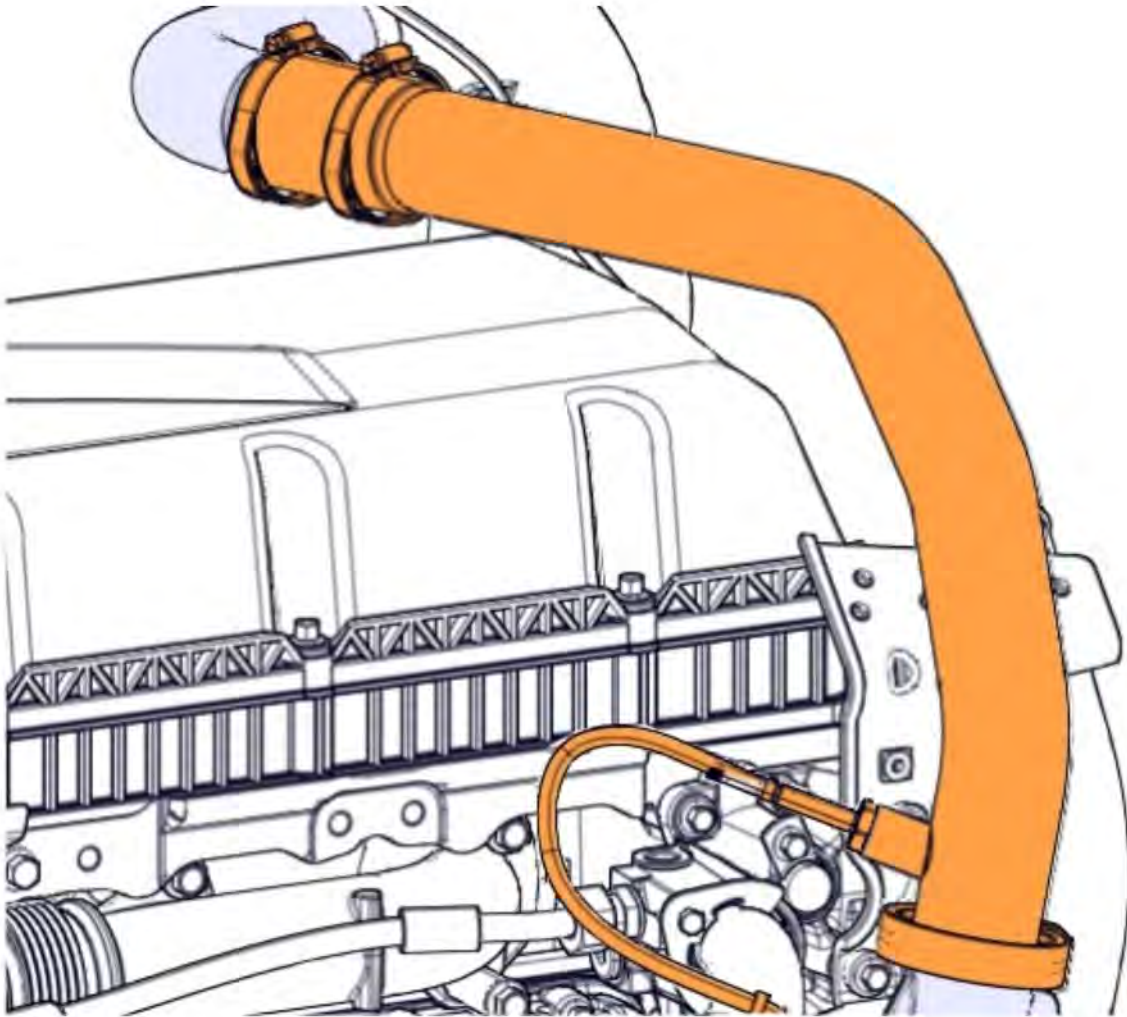
**Note**

Note the positions.



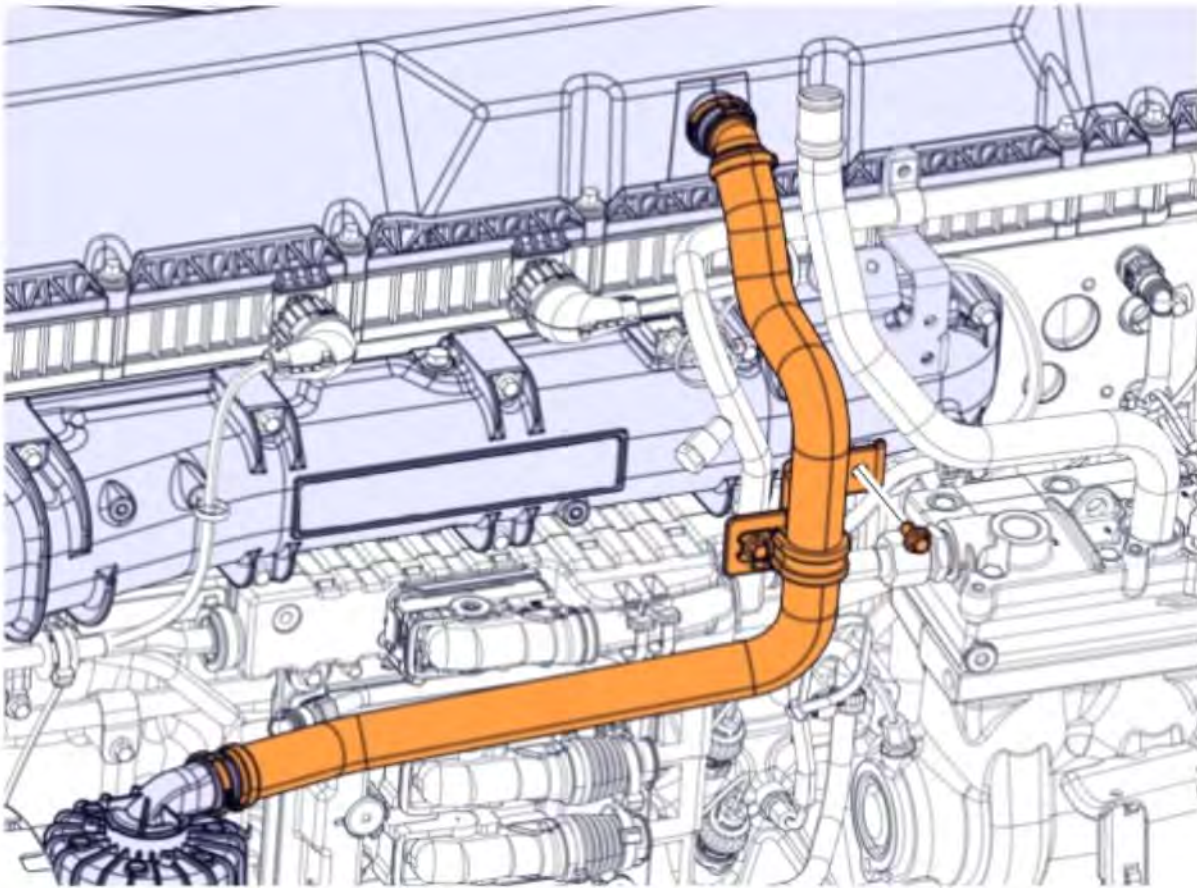
109	Remove the pipe.
-----	------------------





110	Remove the screw.
-----	-------------------

111	Remove the pipe.
-----	------------------

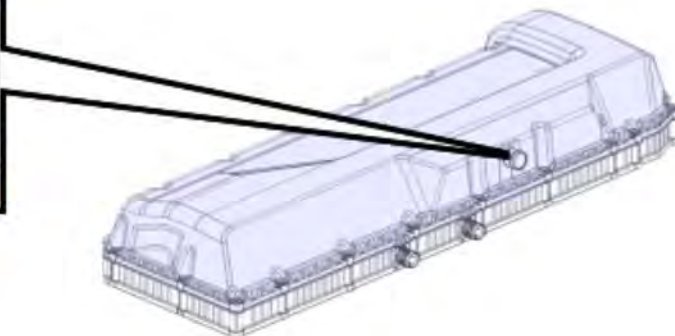
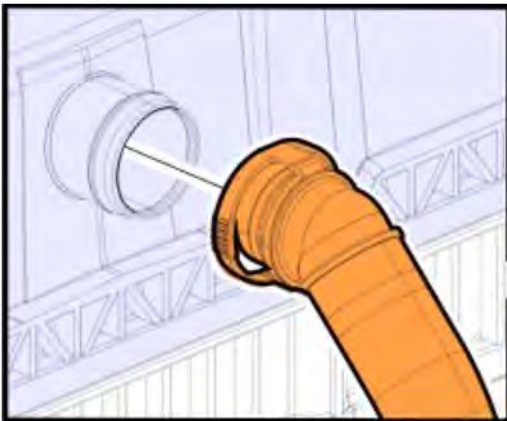


112 Remove the pipe.



**Note**

If not previously removed.



113 Loosen the screws.

114 Remove the valve cover.



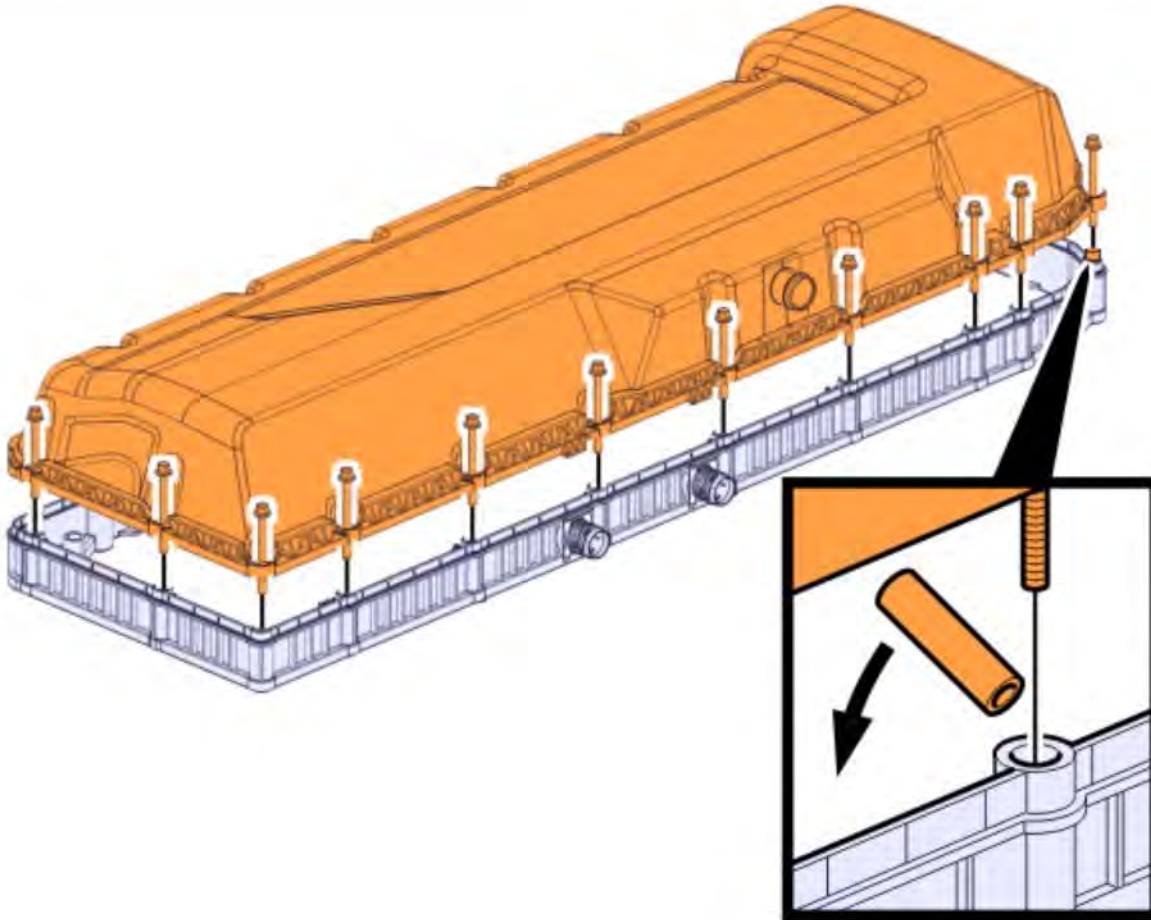
**Service hint**

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.

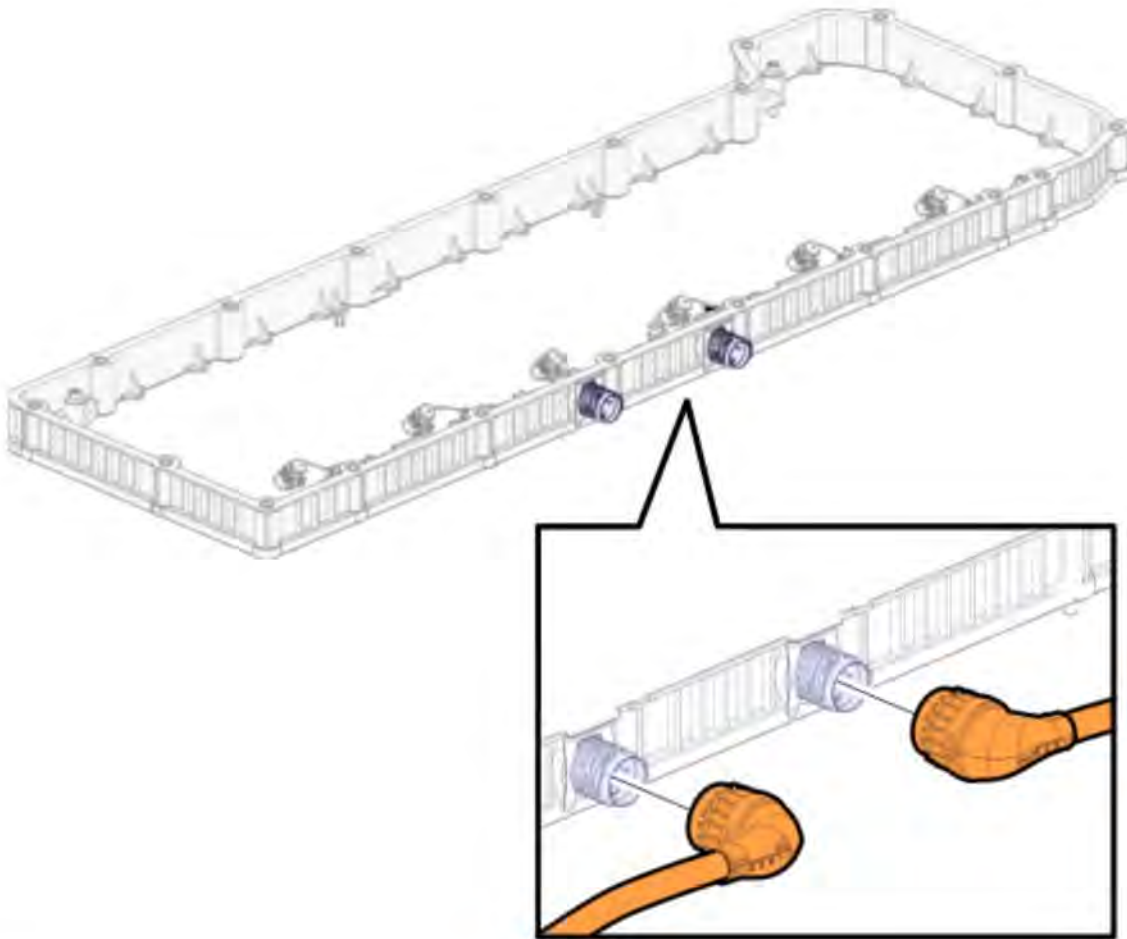


**Service hint**

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.

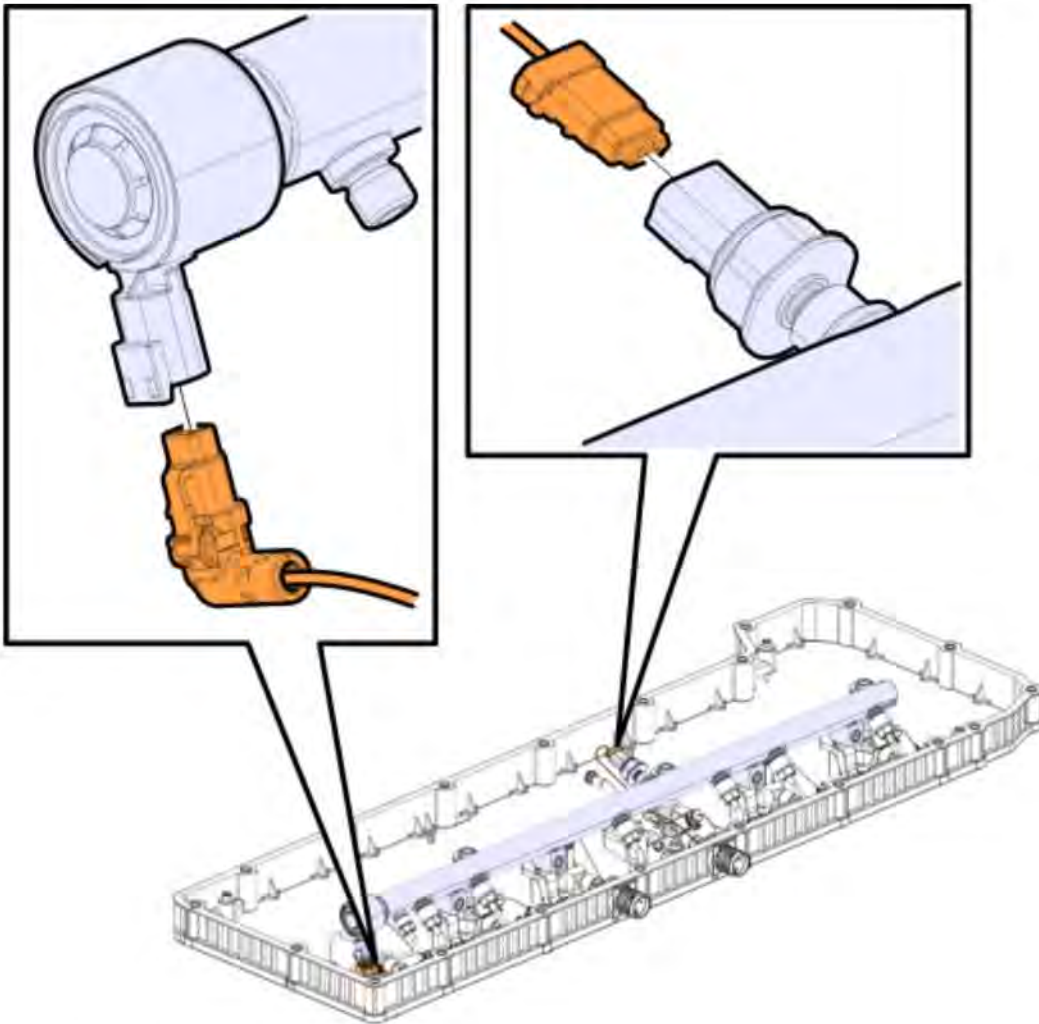


**115** Disconnect the connectors.



<b>116</b>	Disconnect the connectors.
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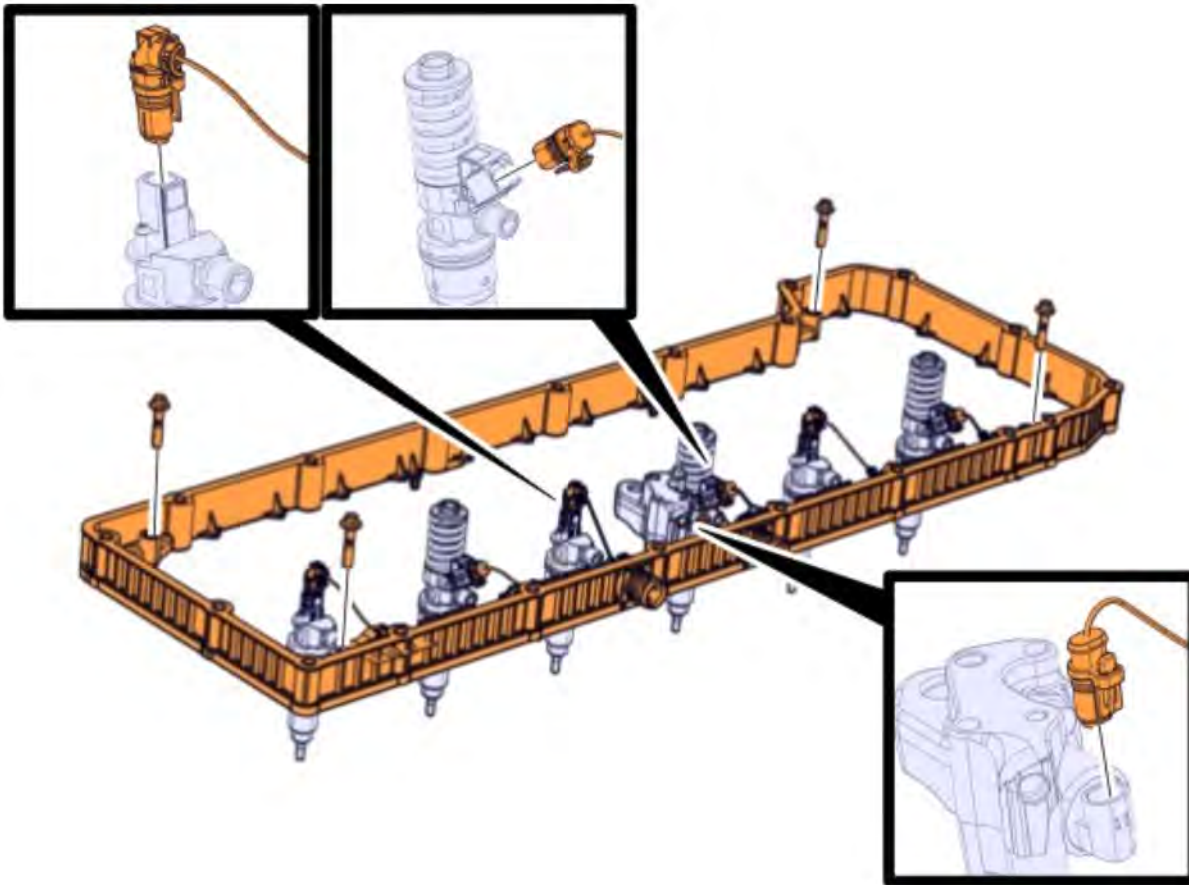




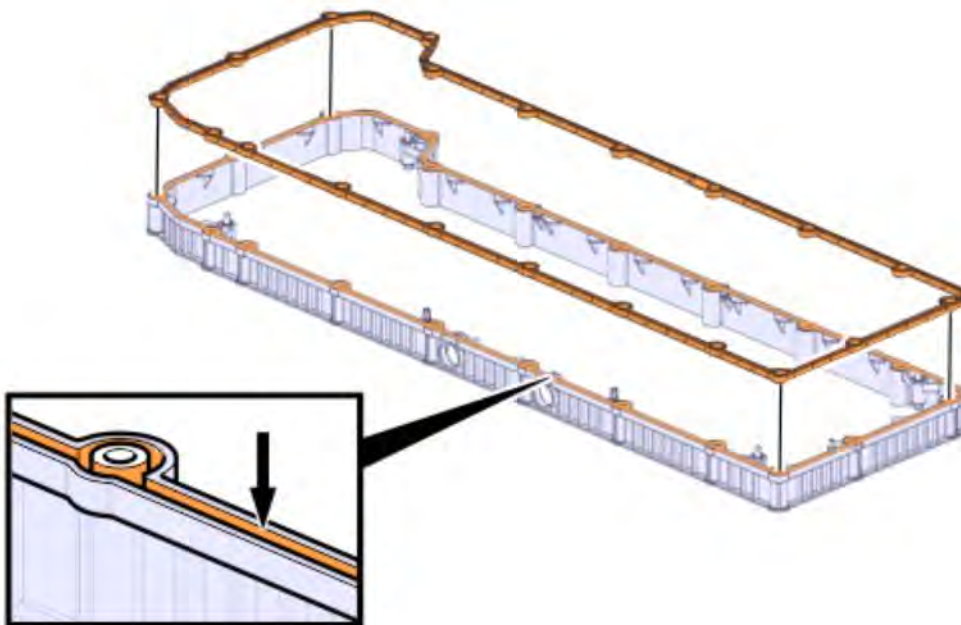
117	Loosen the screws.
-----	--------------------

118	Disconnect the connectors.
-----	----------------------------

119	Remove the frame.
-----	-------------------



120 Remove the gasket.



121 Remove the screws.

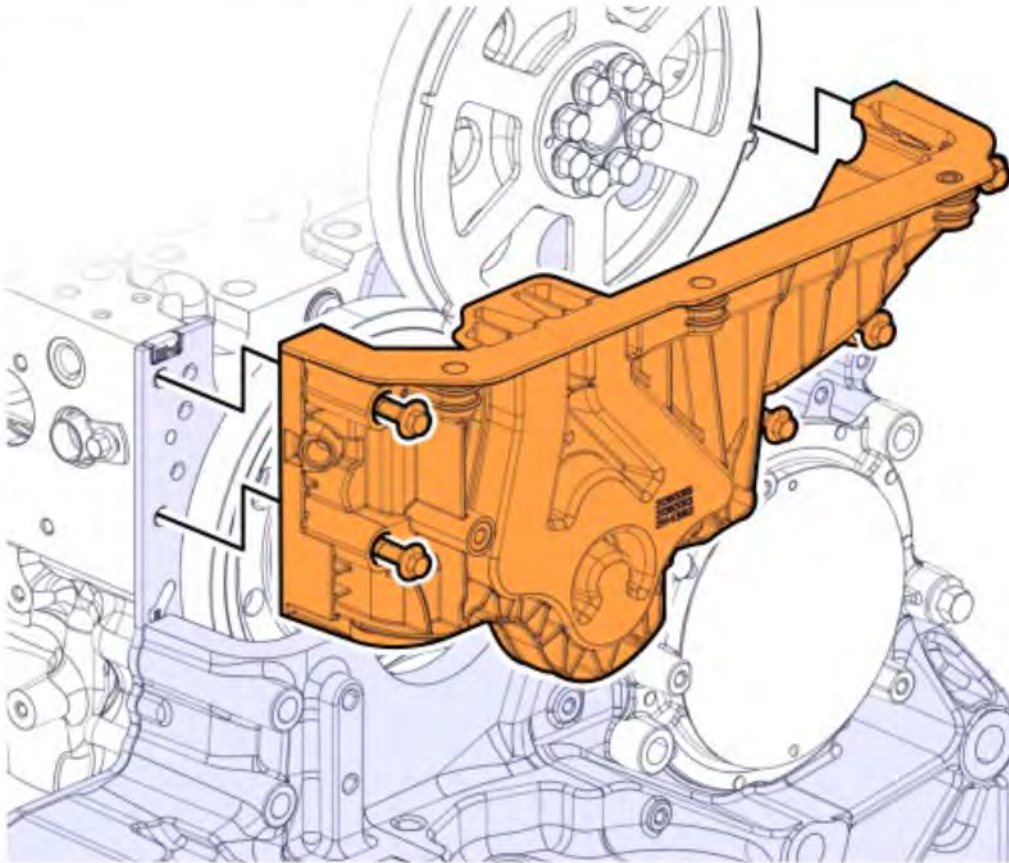


**Service hint**

The screws cannot be removed from the timing gear cover.



122 Remove the timing gear cover.

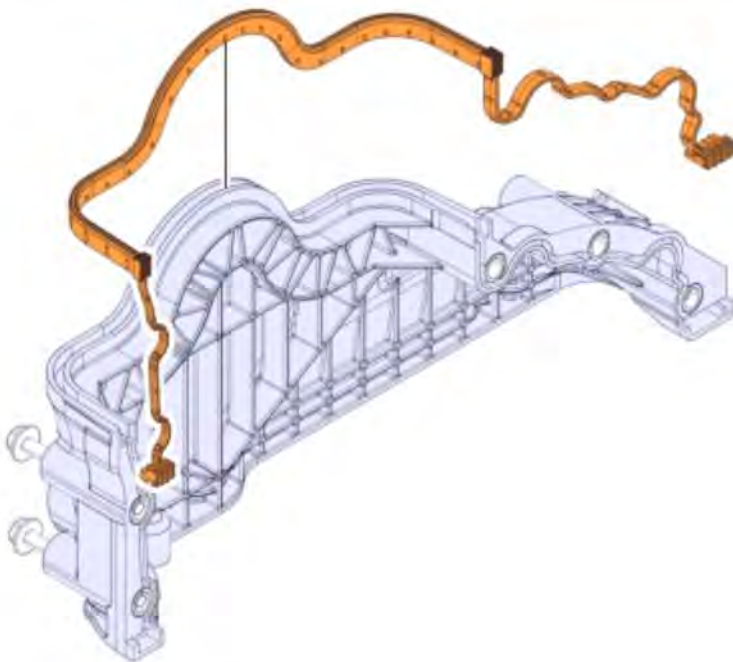


123 Remove the gasket.



**Note**

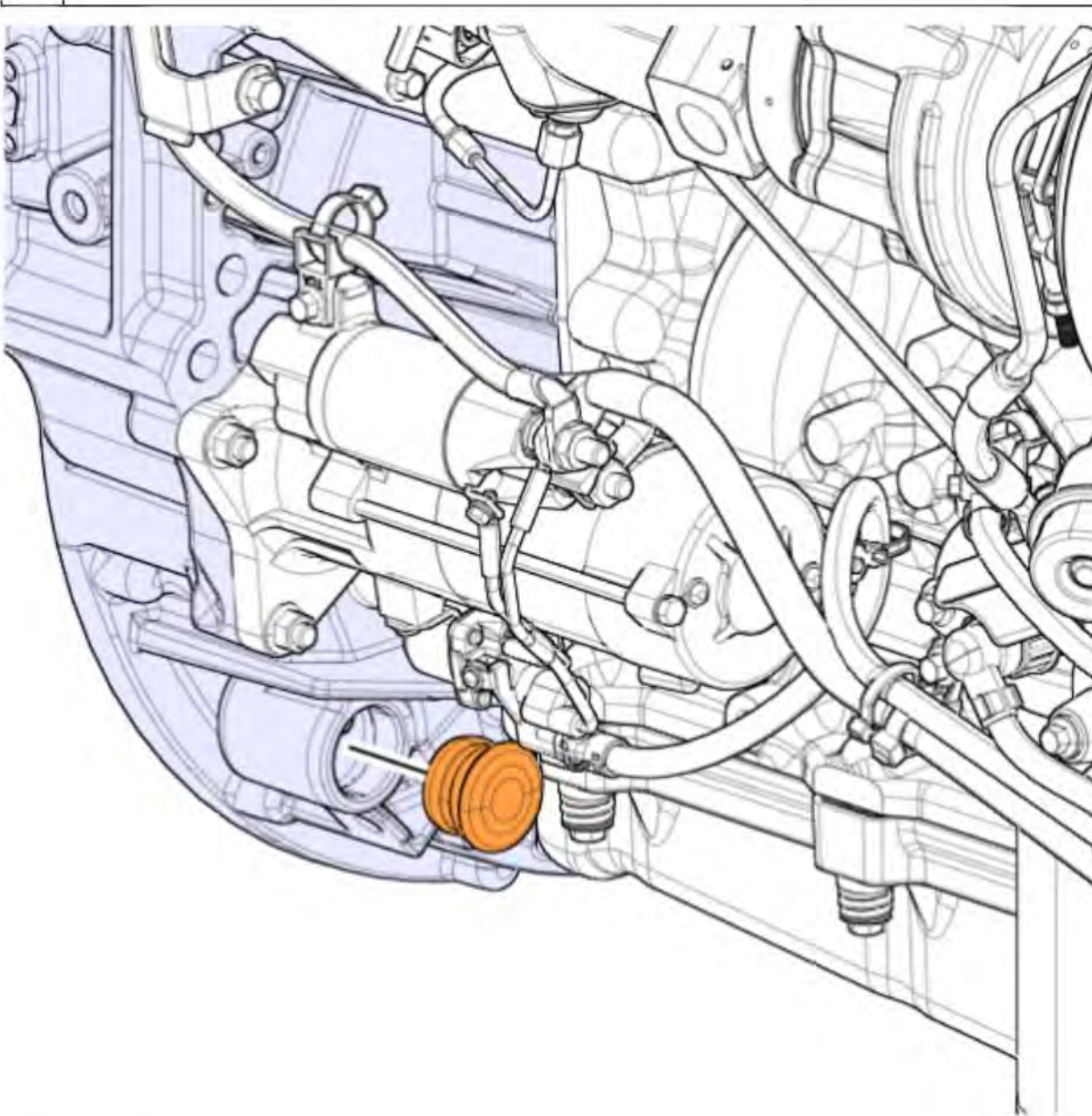
Discard the gasket.



124 Remove the plug.

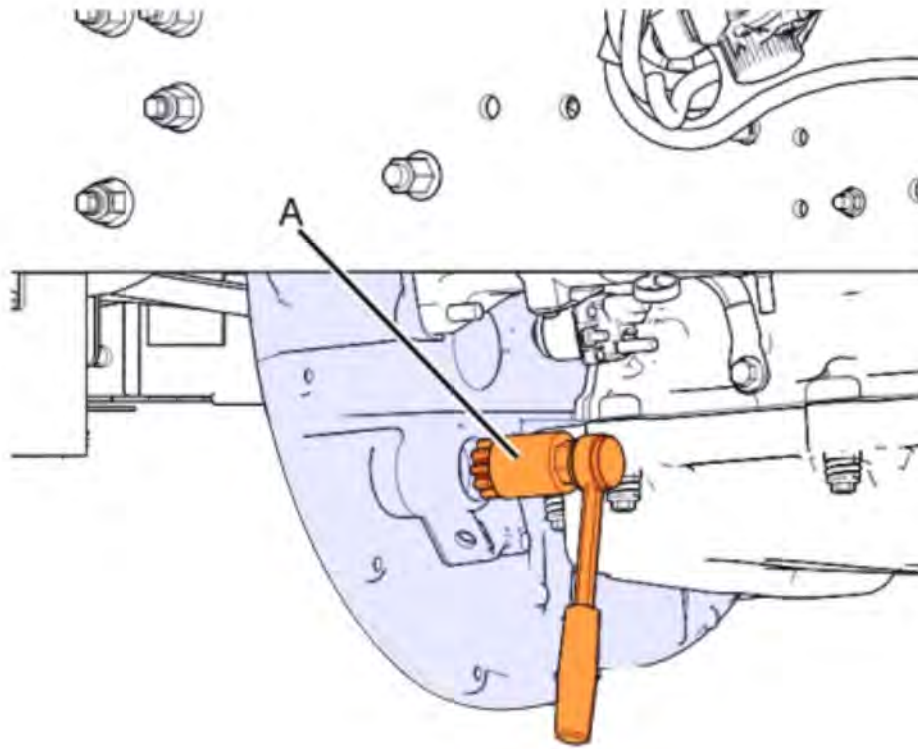
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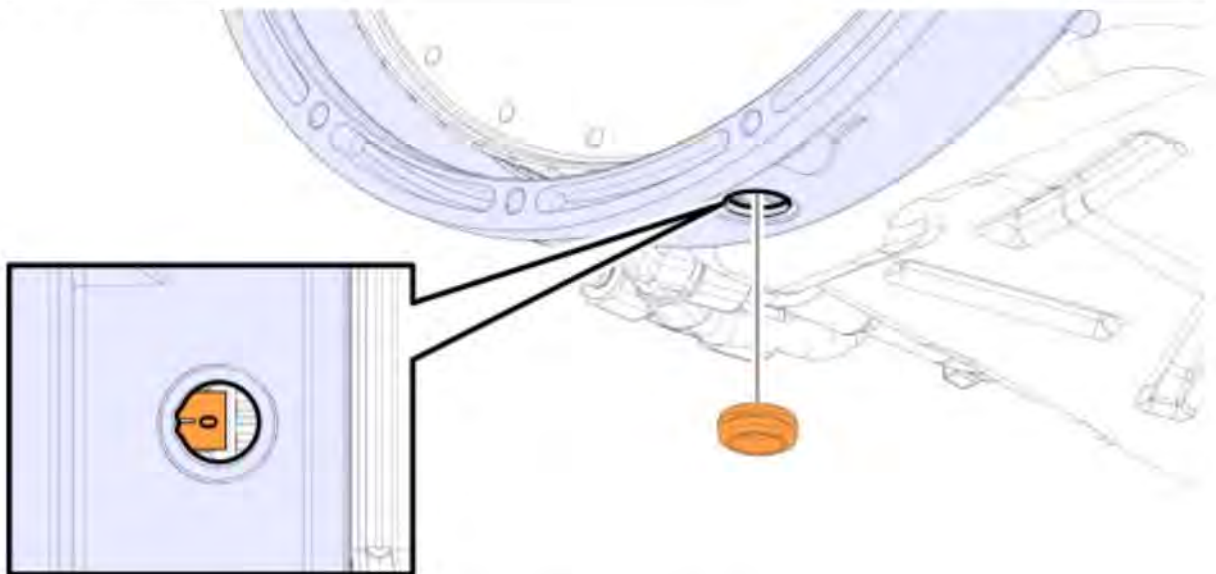
125	Install the cranking tool (A).
<b>Required material</b>	
CRANKING TOOL	<a href="#">88840317</a>





126 Remove the plug.

127 Check the marking (0).



128 Perform this procedure when the condition below is met.

**Conditions**

- If the flywheel is not in the TDC (Top Dead Center) position.

- ▶ Rotate the flywheel to the TDC marking (0).



**Note**

Do not use power tools.

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**Note**

Rotate the flywheel in the normal engine rotation direction.

129 This step contains 2 alternatives.

Select one of the valid alternatives below.

**Alternative 1 / 2**

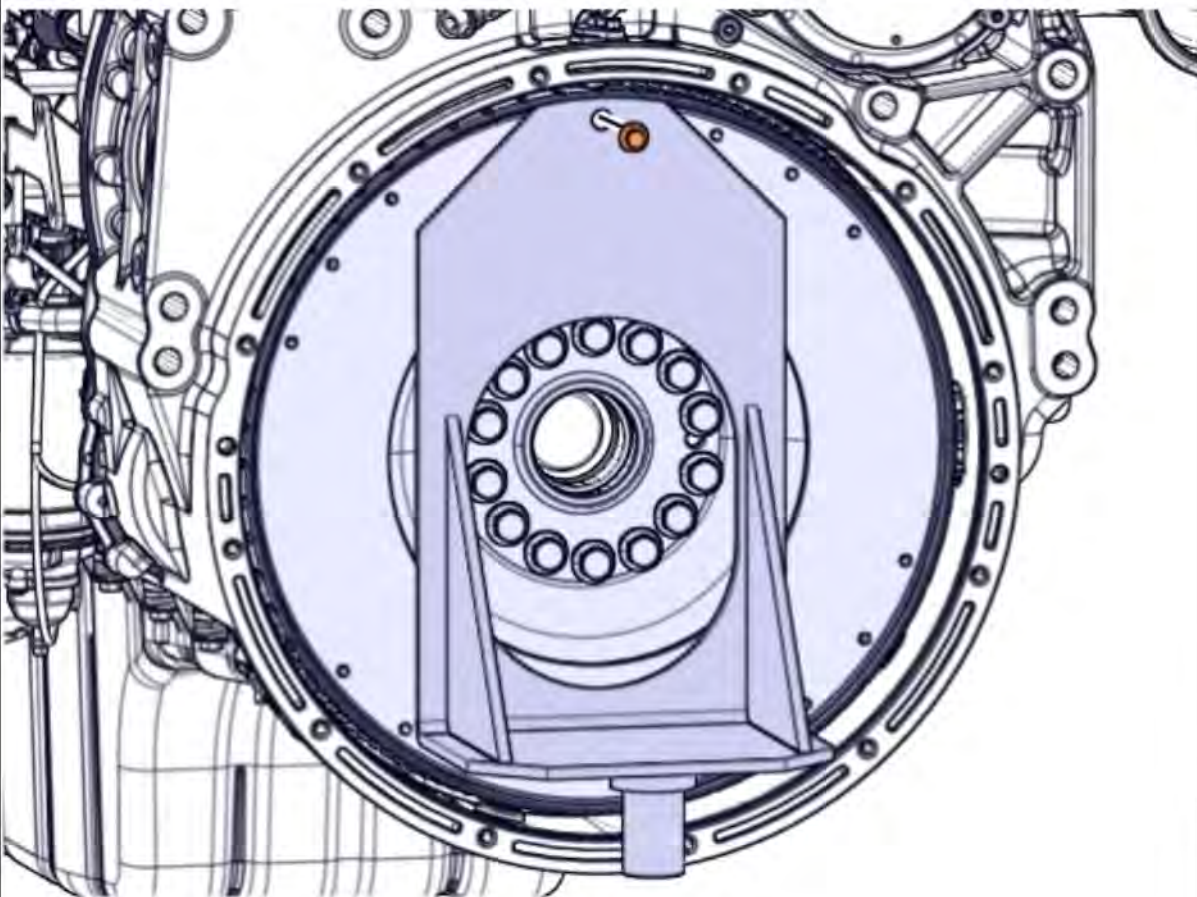
- ▶ Install the tool.

**Required material**

fixture

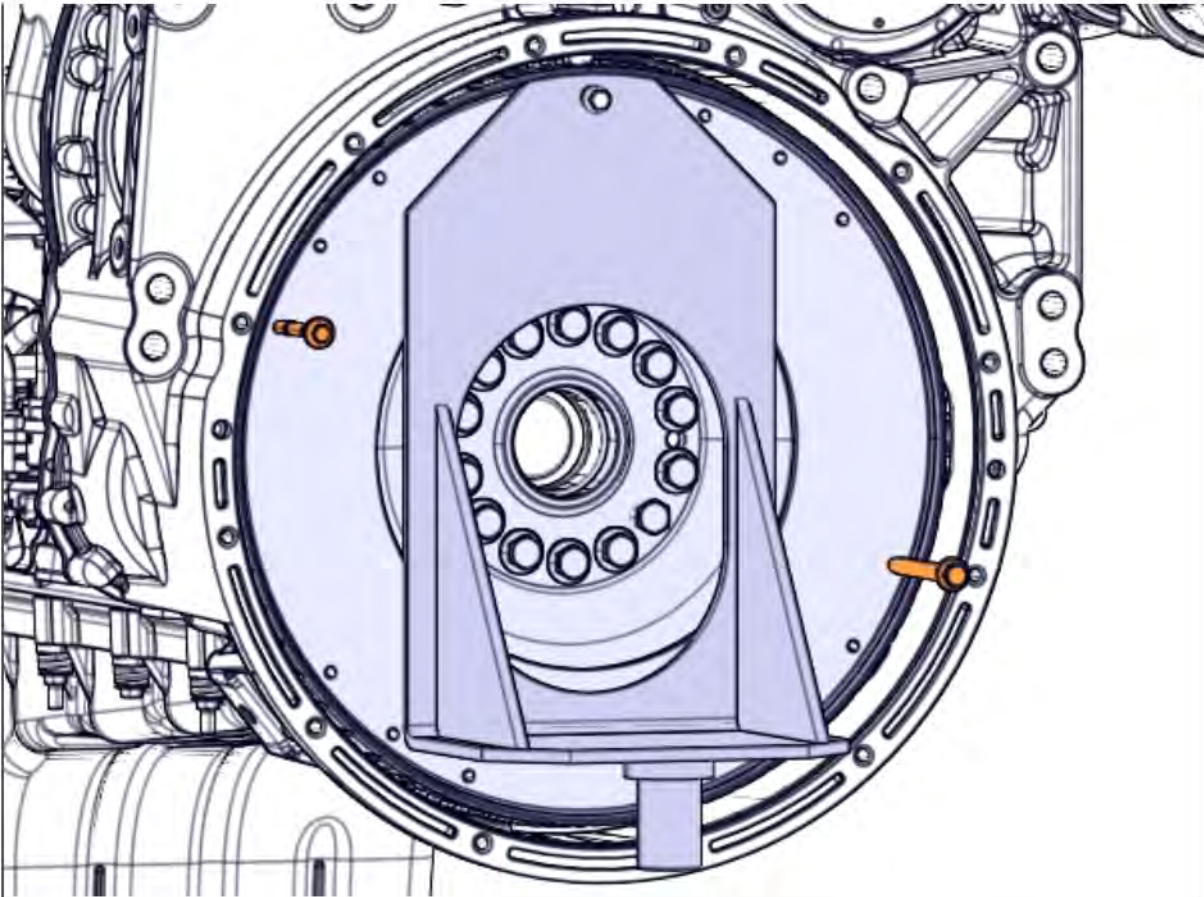
[88800570](#)

- ▶ Install the screw.

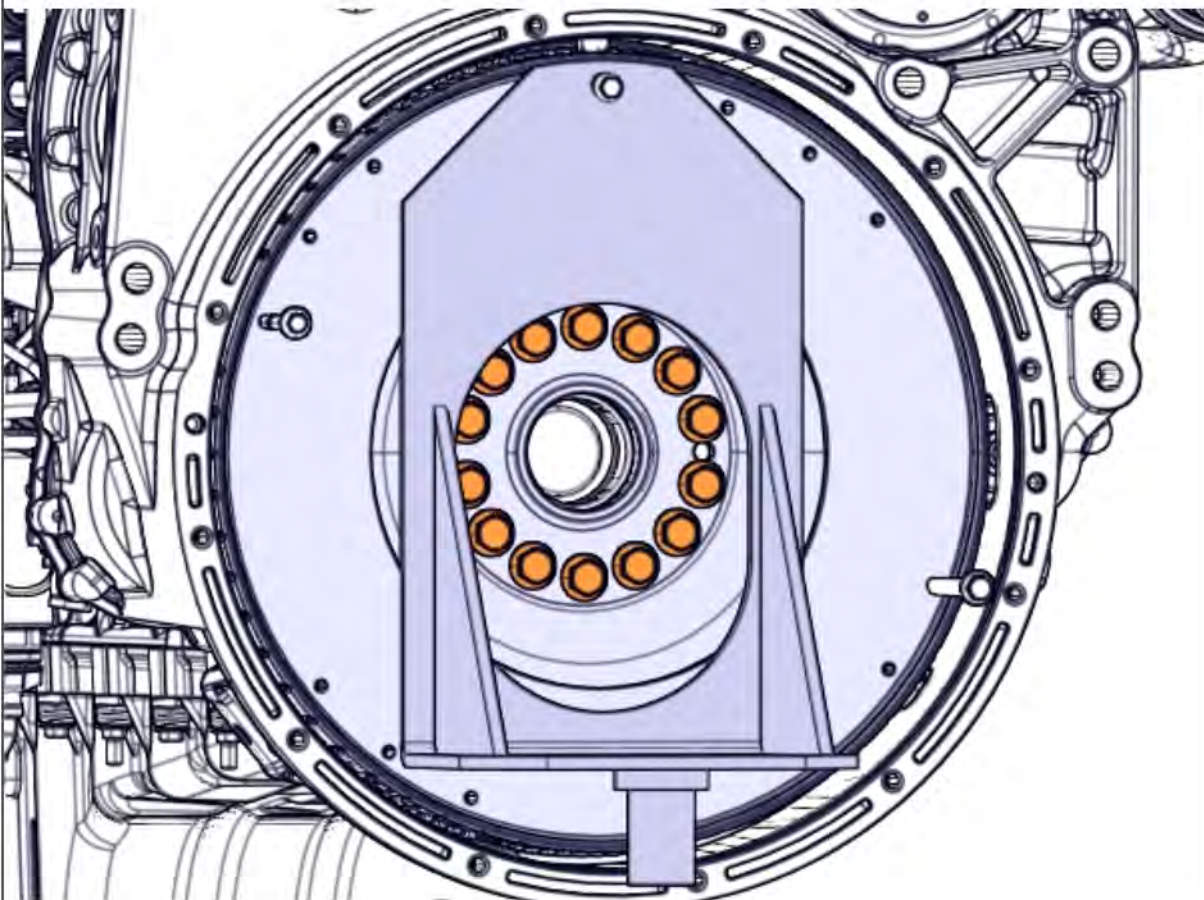


- ▶ Install the screws.



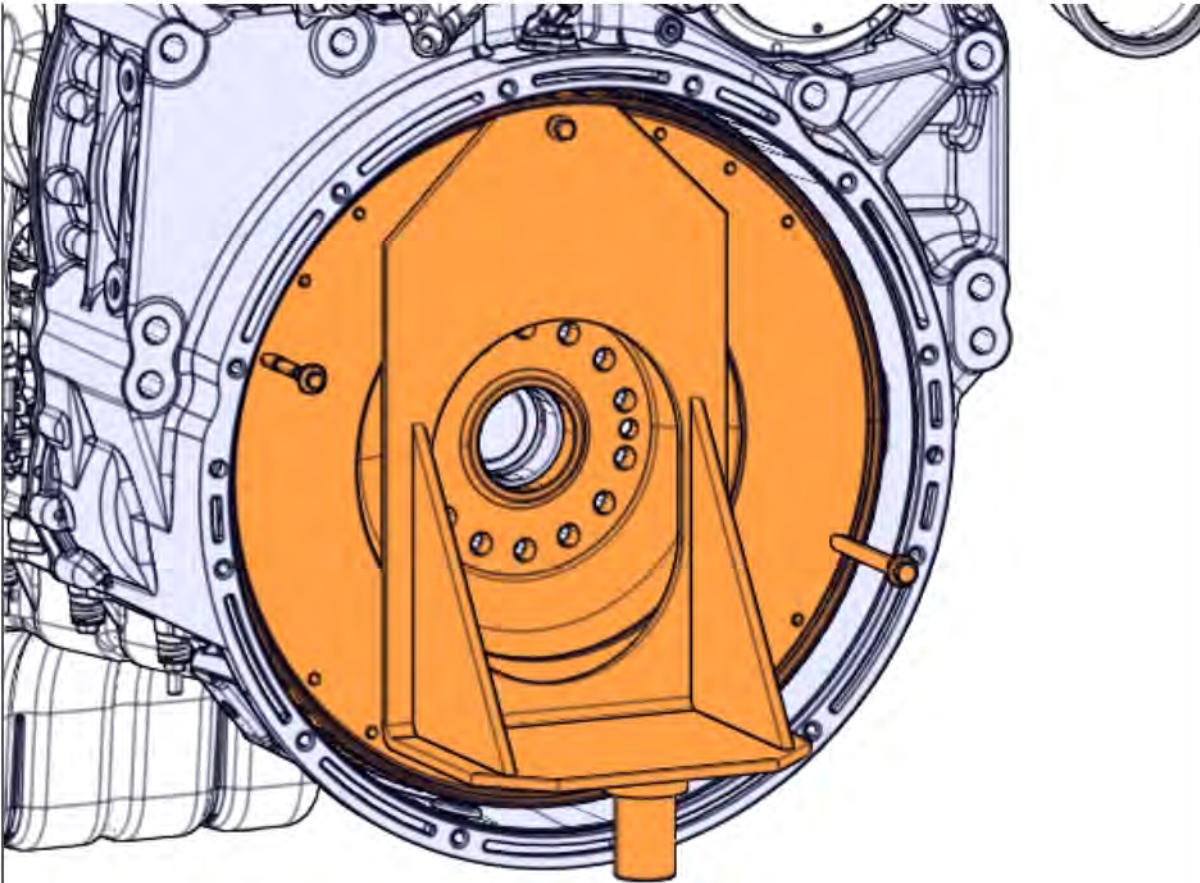


▶ Remove the screws.



▶ Remove the flywheel.

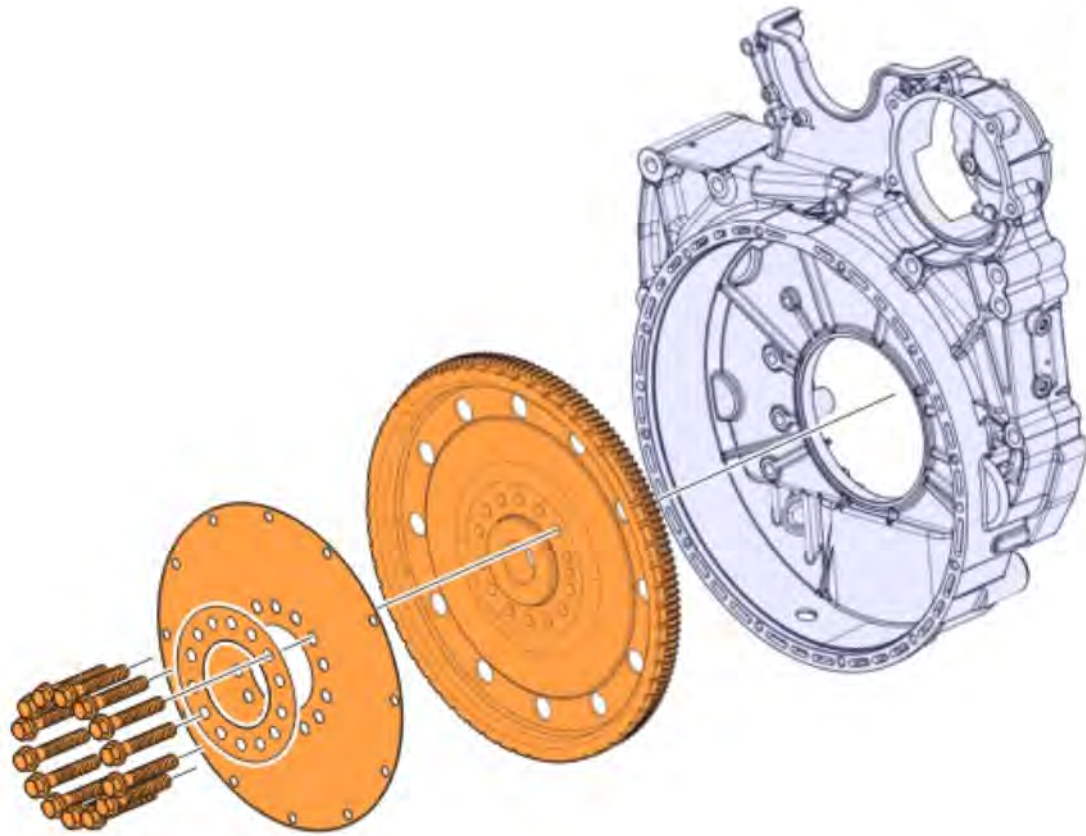




**Alternative 2 / 2**

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





**130** Position a draining container.



**WARNING**

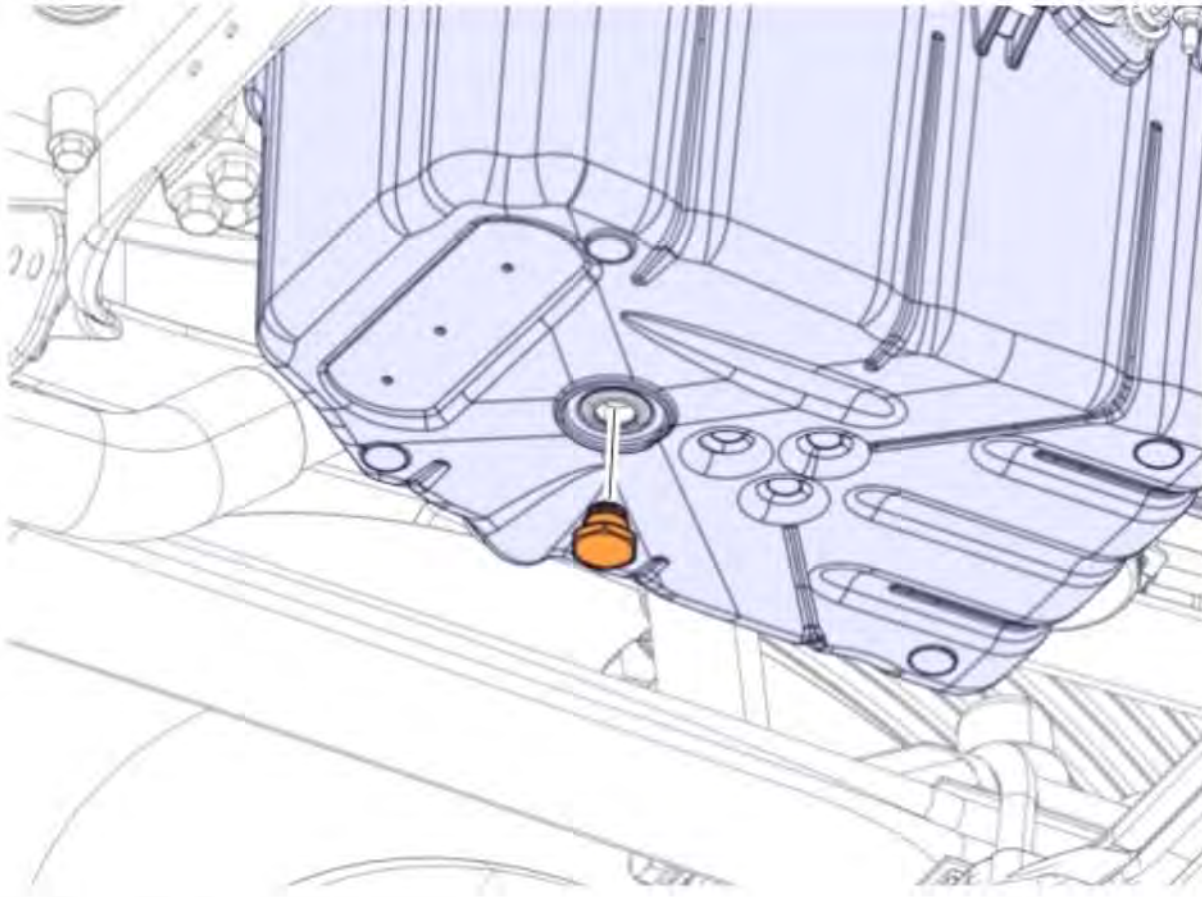
**Risk of serious burns.**

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.

**131** Remove the drain plug.

**132** Drain the oil.





<b>133</b>	Install the drain plug.		
	<table border="1" style="width: 100%;"> <tr> <td style="width: 10%; text-align: center;"><b>i</b></td> <td><b>Note</b> Always use a new gasket.</td> </tr> </table>	<b>i</b>	<b>Note</b> Always use a new gasket.
<b>i</b>	<b>Note</b> Always use a new gasket.		

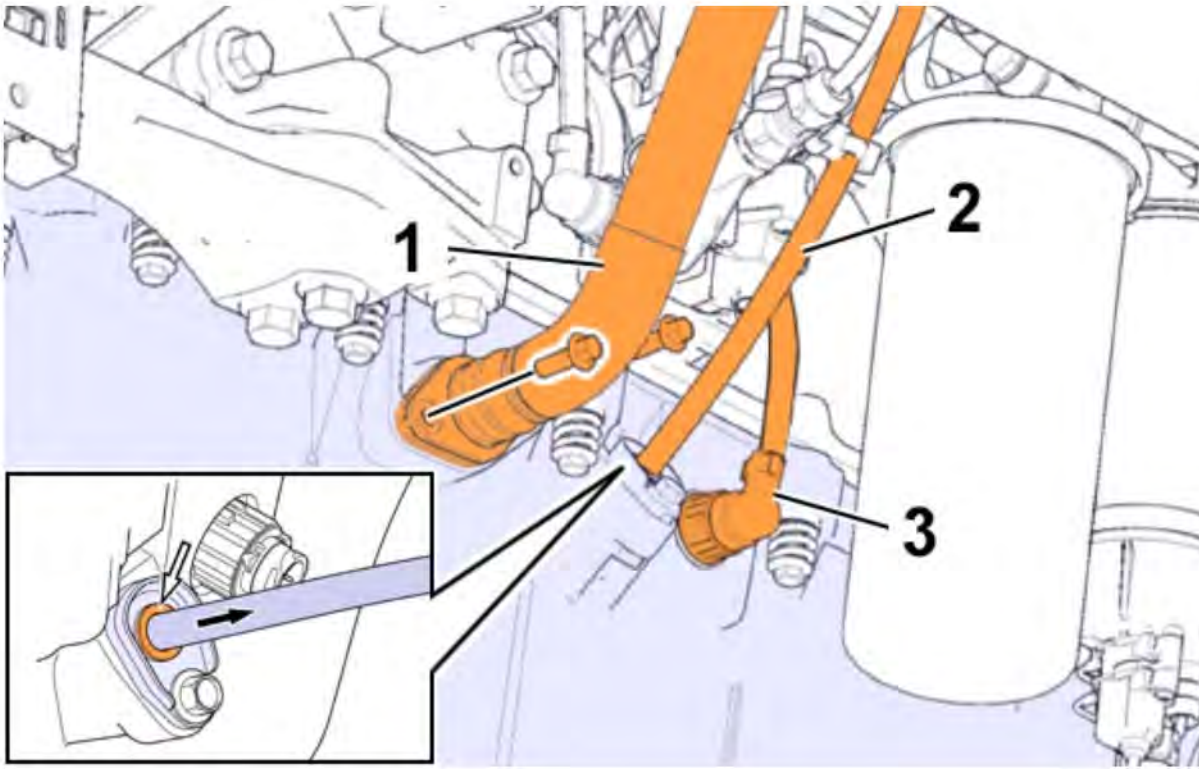
<b>134</b>	Torque tighten the plug.	
	<b>Tightening torque</b>	
	Oil pan, drain plug	60 ±10 Nm (44 ±7 lb <sub>f</sub> ·ft)

<b>135</b>	Remove the dipstick.	
	<b>Tech data</b>	
	The distance the dipstick is drawn out from the outer casing	≈ 0.5 m (1 ft – 7.7 in)



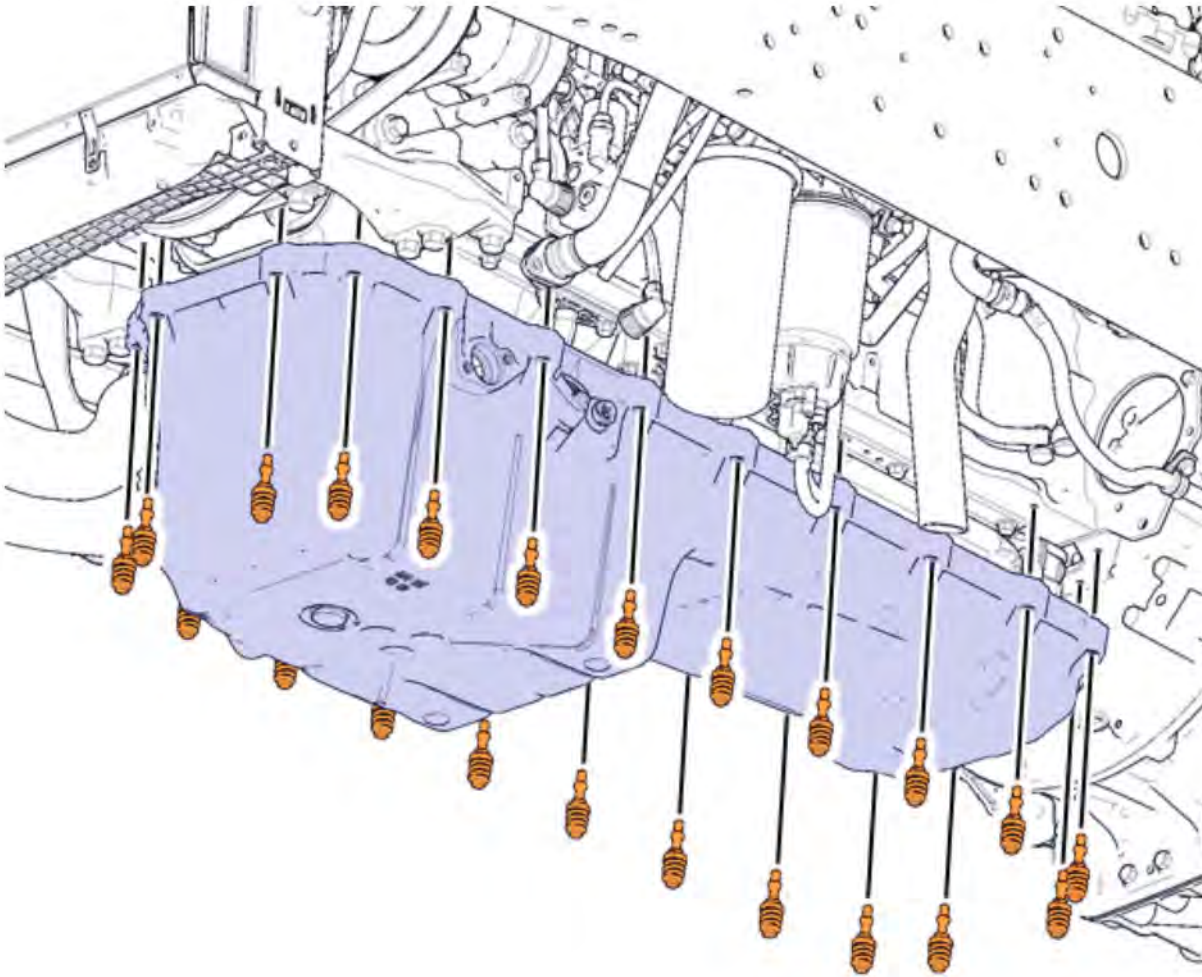


136	Disconnect the connector (3).
137	Depress the release ring (2) remove the dipstick pipe.
	<b>Note</b> Pull to remove.
	<b>Note</b> Use a suitable tool to depress.
138	Remove the screws.
139	Remove the pipe (1).



140	Remove the screws.
-----	--------------------



**141** Remove the oil pan.**Note**

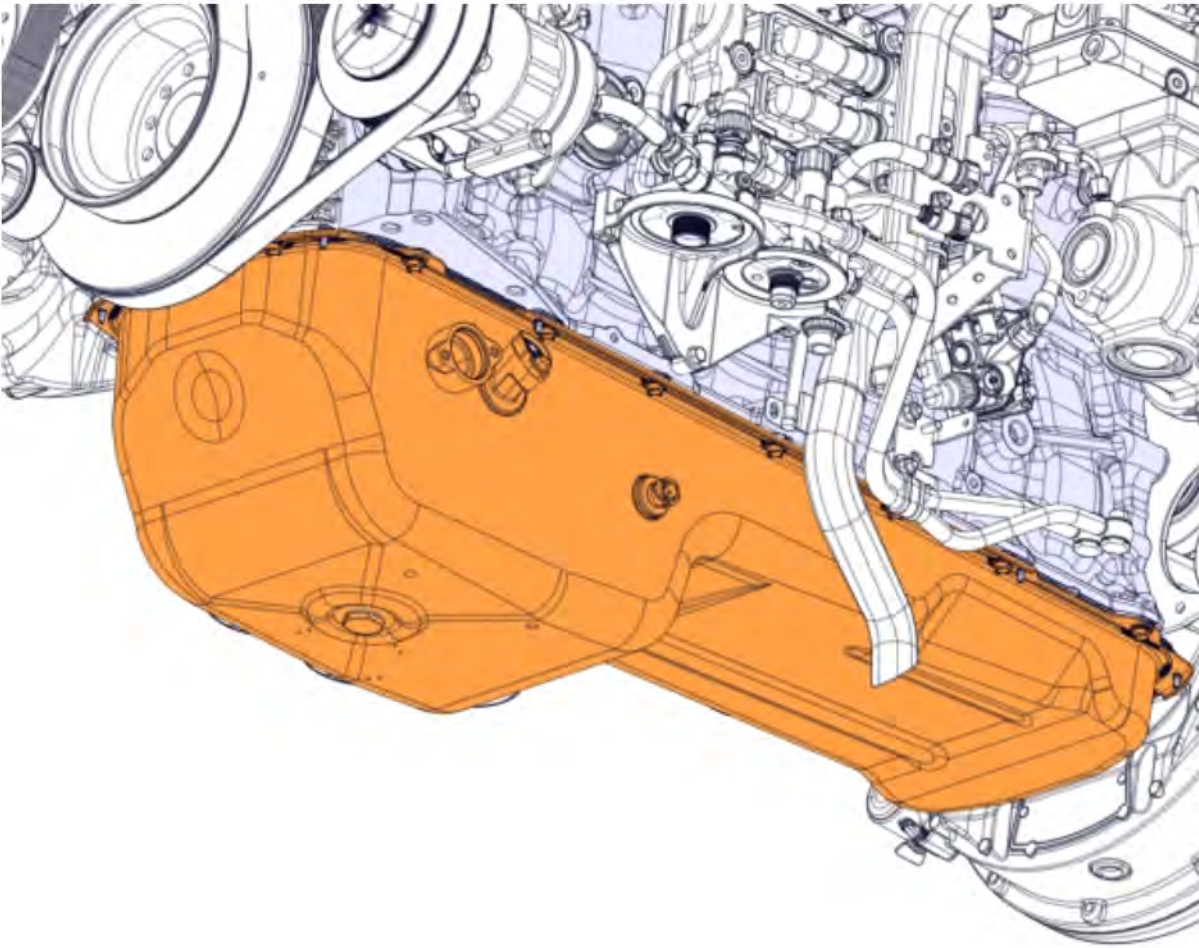
Get help if needed.

**Note**

Lower the component carefully.

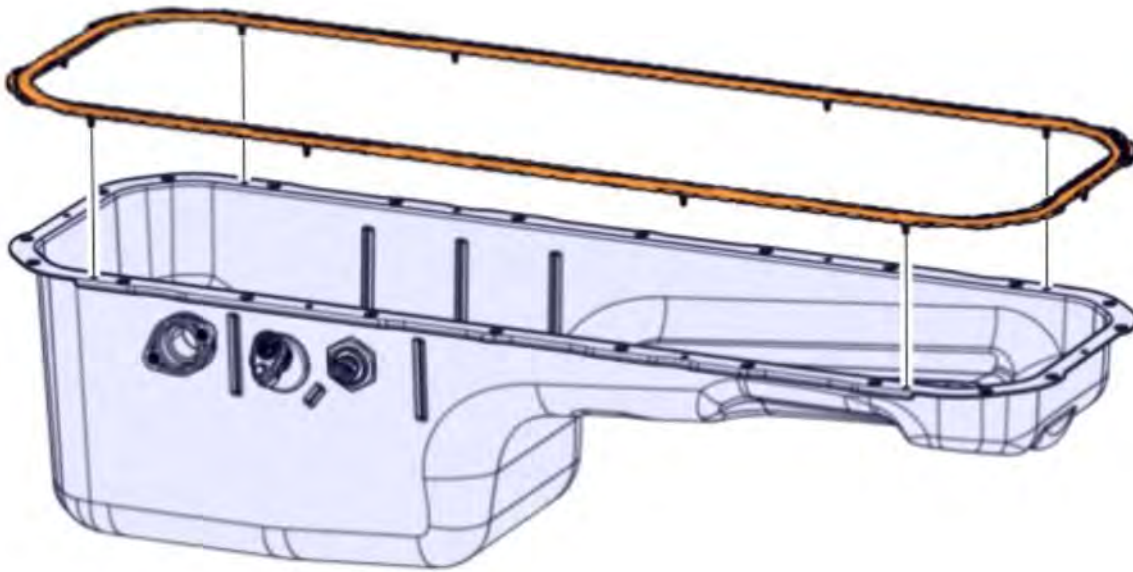
**Note**

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



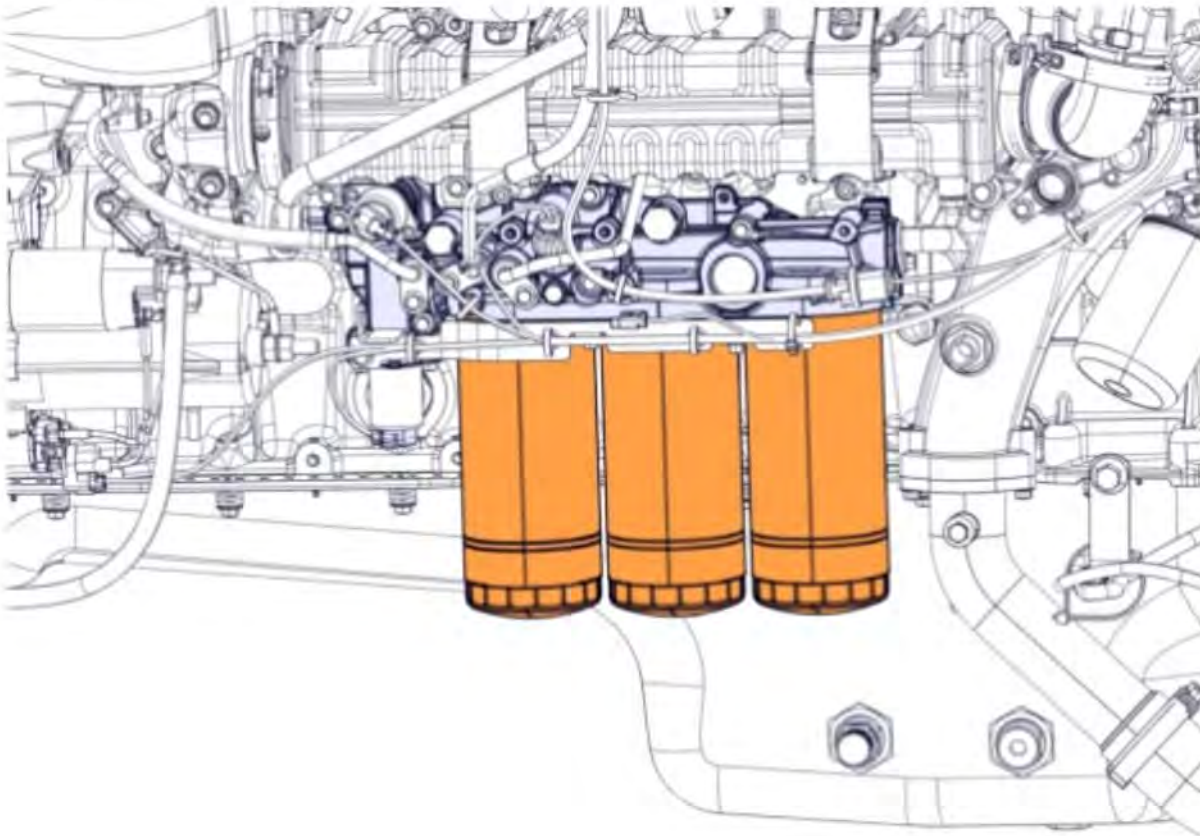
142	Remove the gasket.
-----	--------------------





143	Clean the oil filter housing.
-----	-------------------------------

144	Remove the oil filters.
-----	-------------------------



**145** 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**

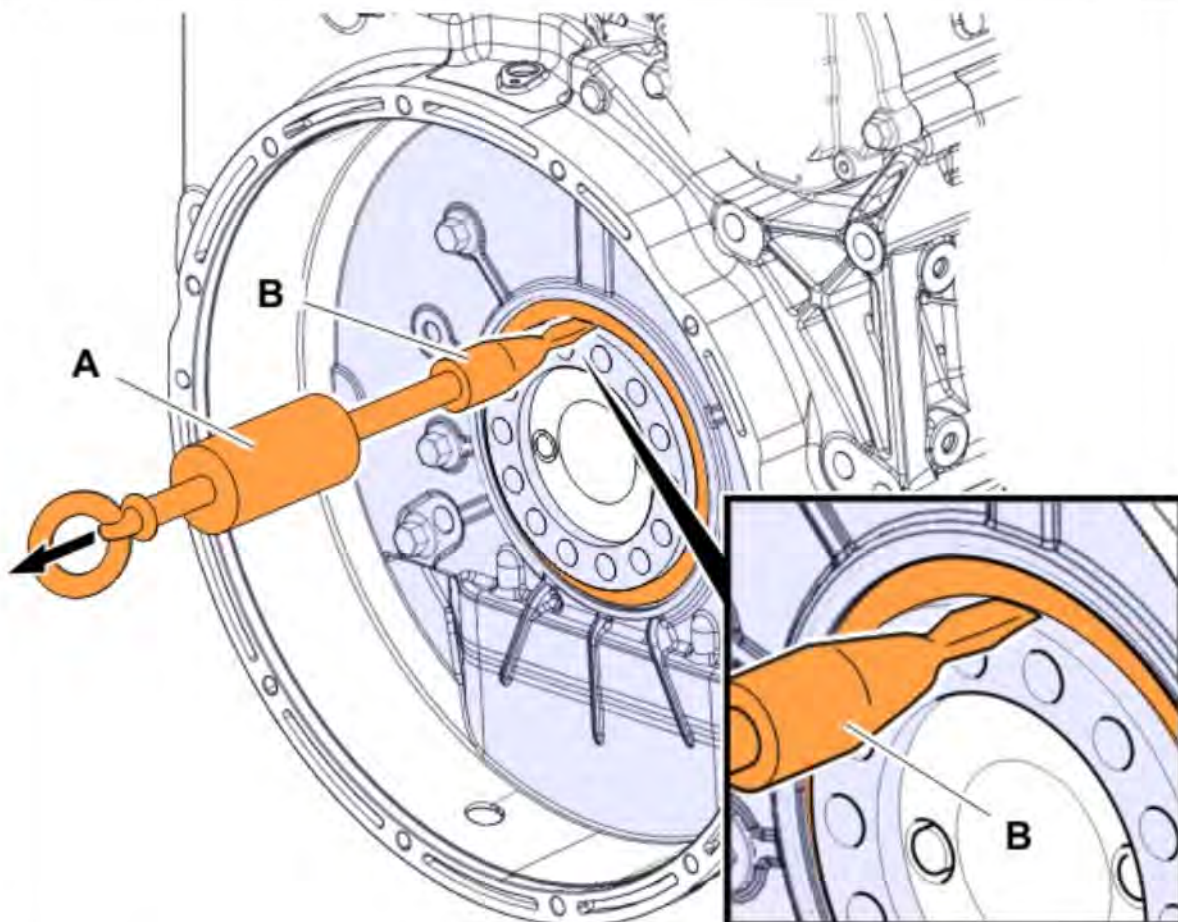
IMPACT WRENCH	<a href="#">9996400</a>
puller	<a href="#">9990192</a>

**i** **Note**  
 Ensure that the tools are clean and intact.

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

**i** **Note**  
 Take care not to damage the crankshaft surface.

▶ Remove the seal.



**Alternative 2 / 2**

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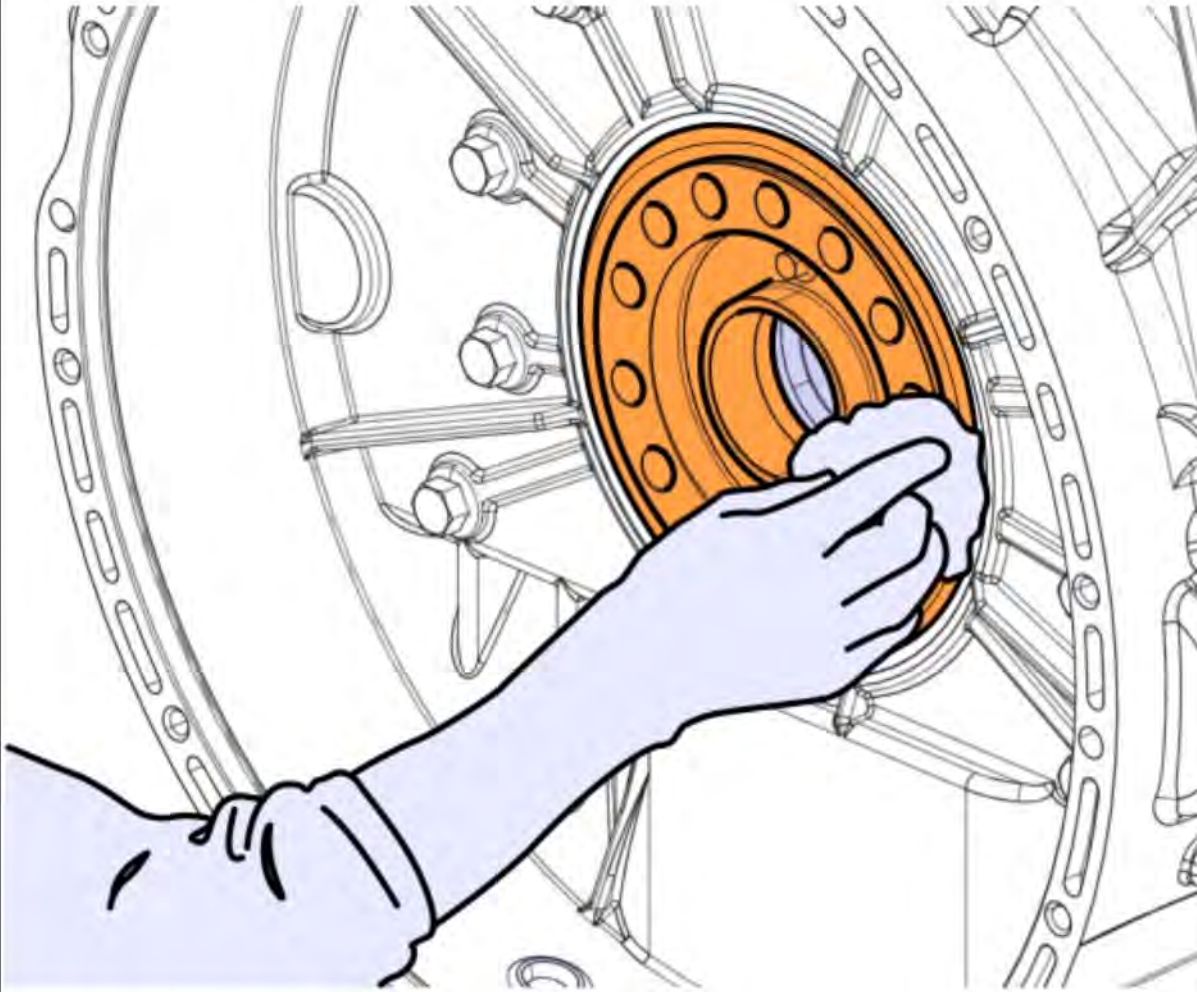
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### Conditions

- 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.



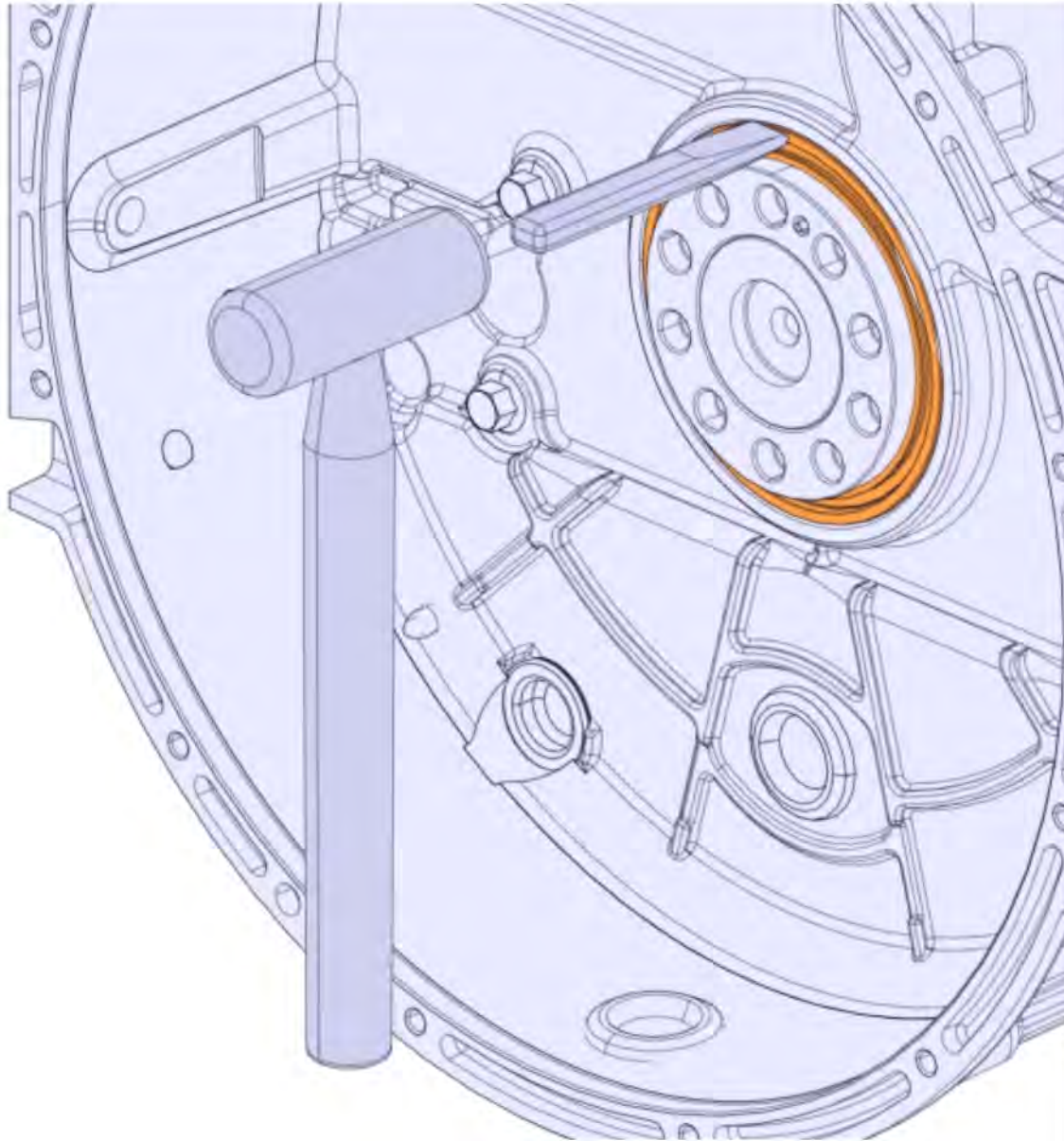
#### Service hint

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

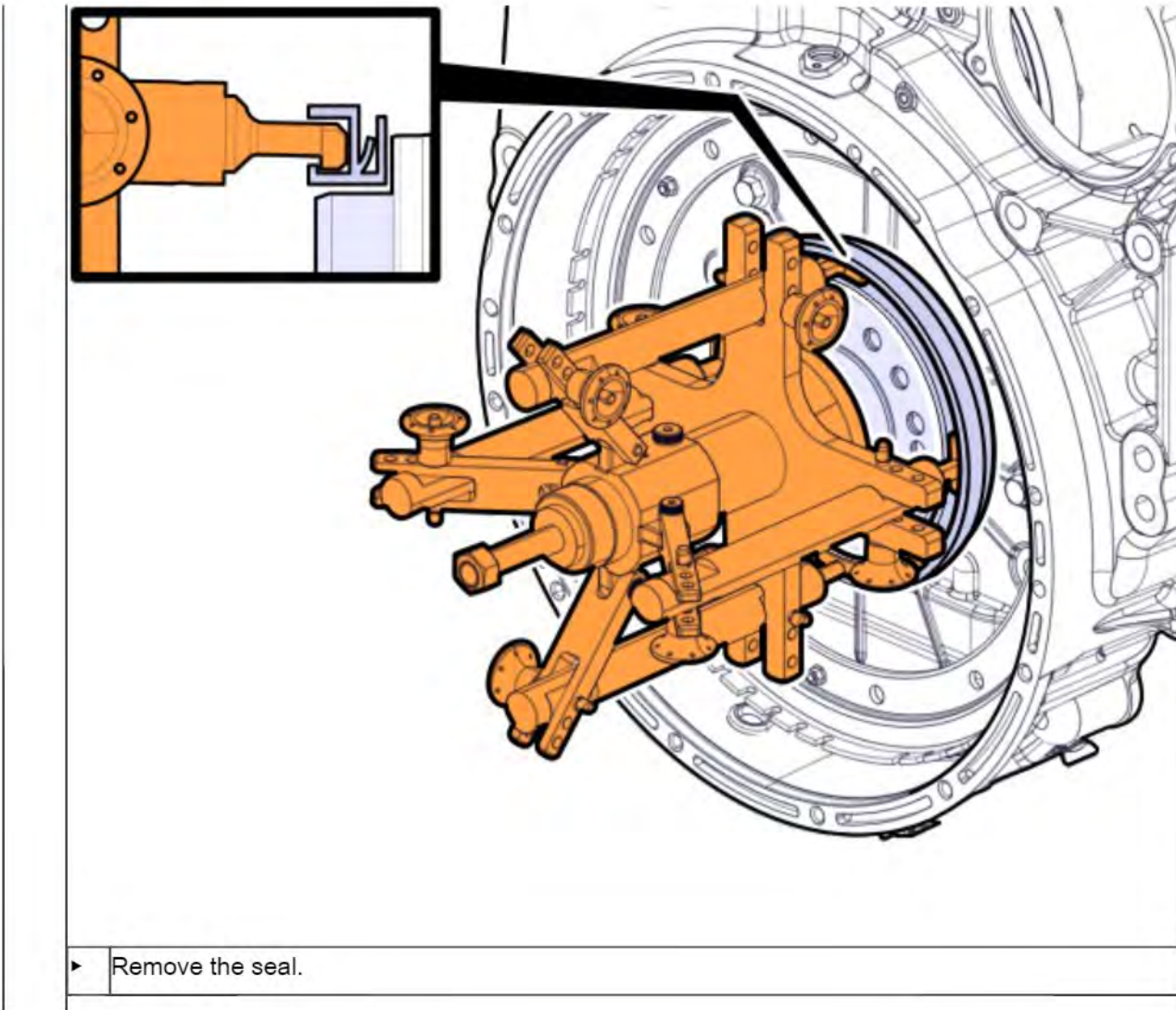
[88800502](#)



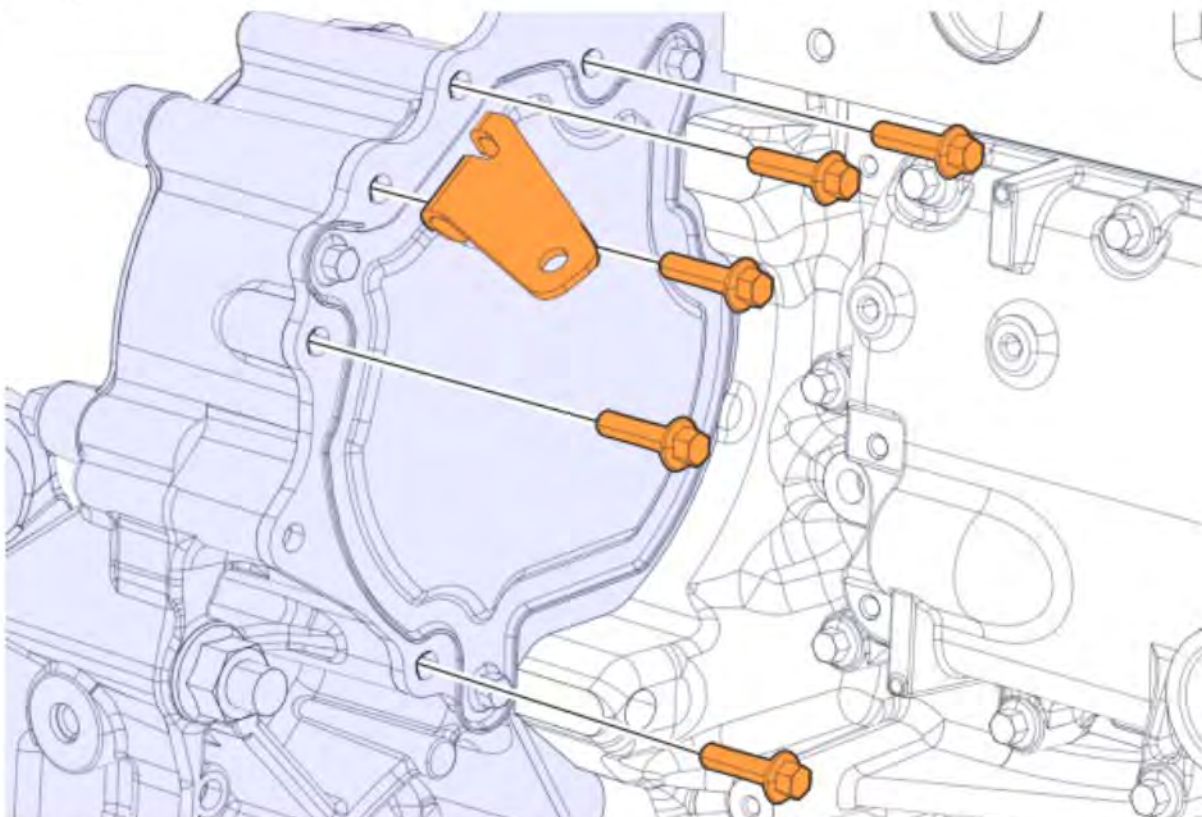
**Note**

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





**146** Remove the screws and bracket.



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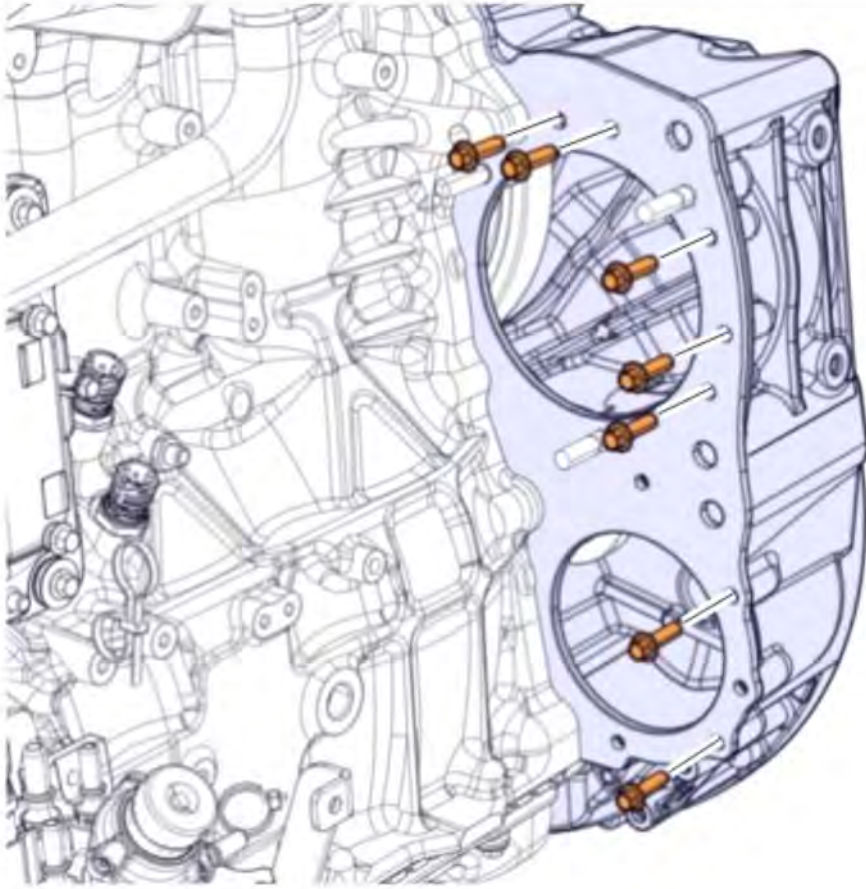
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147 Remove the screws.



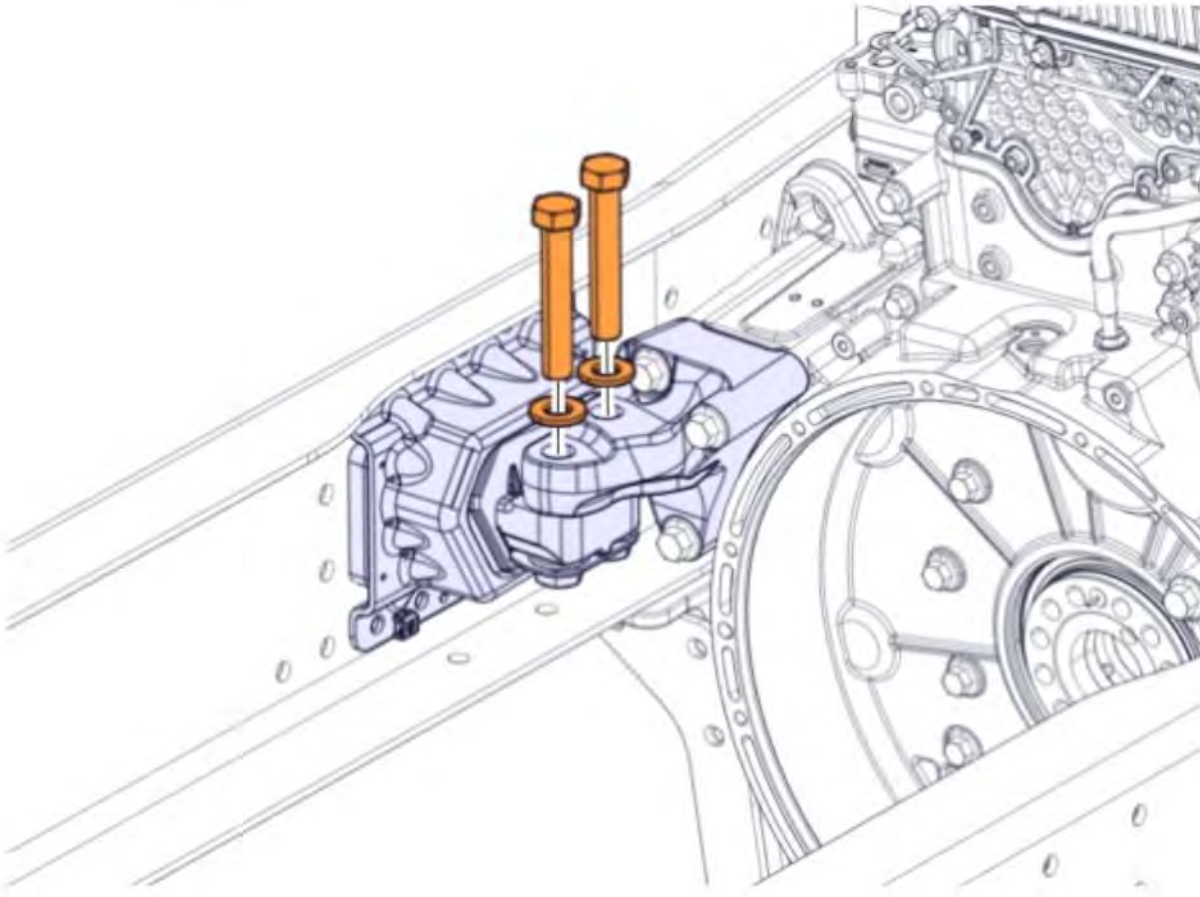
**Note**

Some housings may not include all the screws shown.

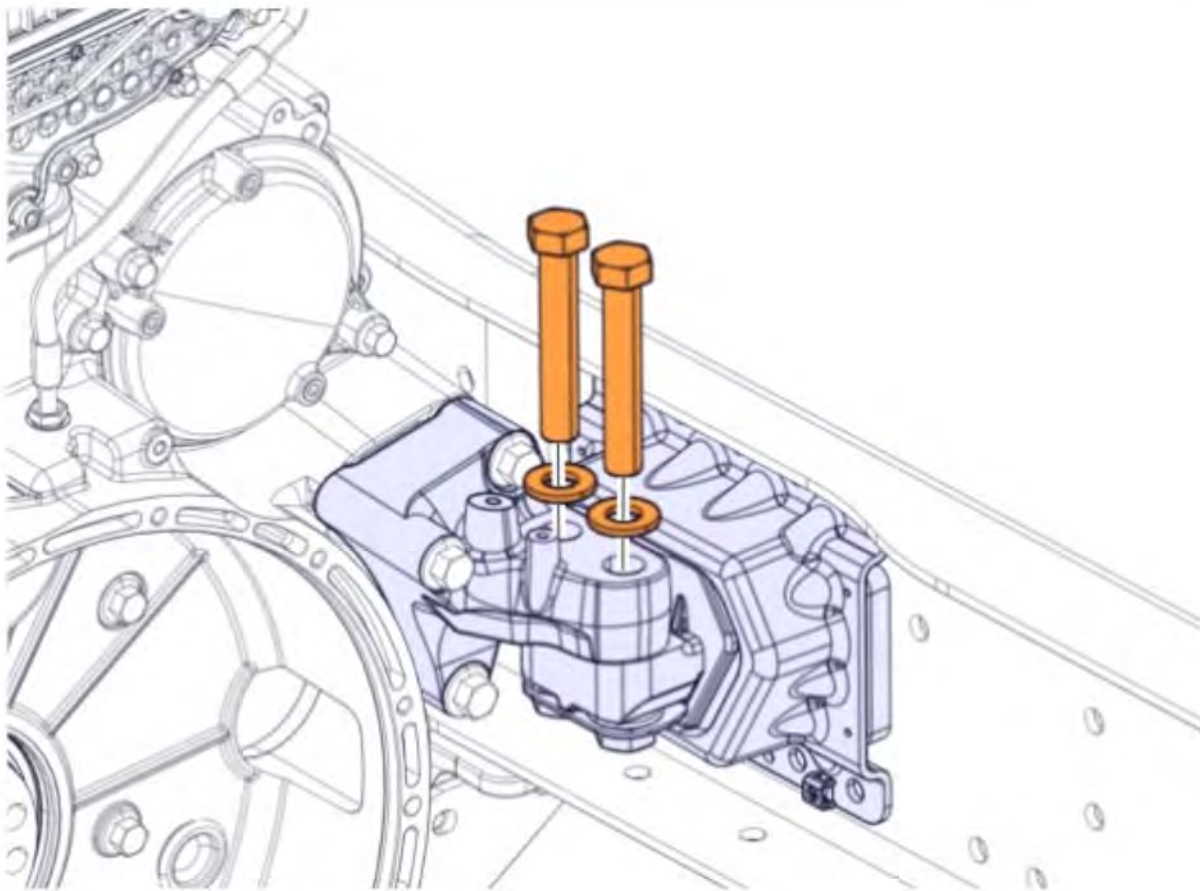


148 Remove the screws.





149 Remove the screws.



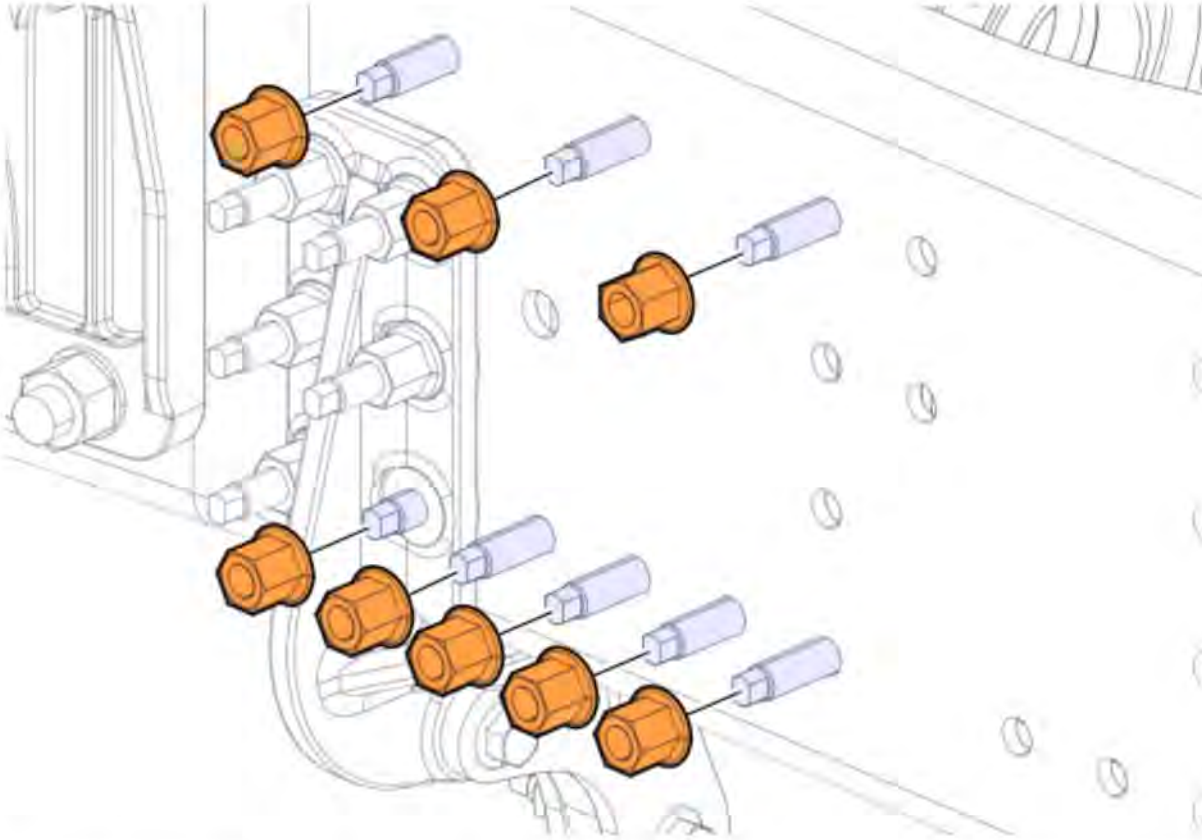
	<b>CAUTION</b>
---	----------------

**Risk of serious injury.**  
Heavy component.

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

**150** Safely lift and support the engine.

**151** Remove the nuts.



**152** Perform this procedure when the condition below is met.

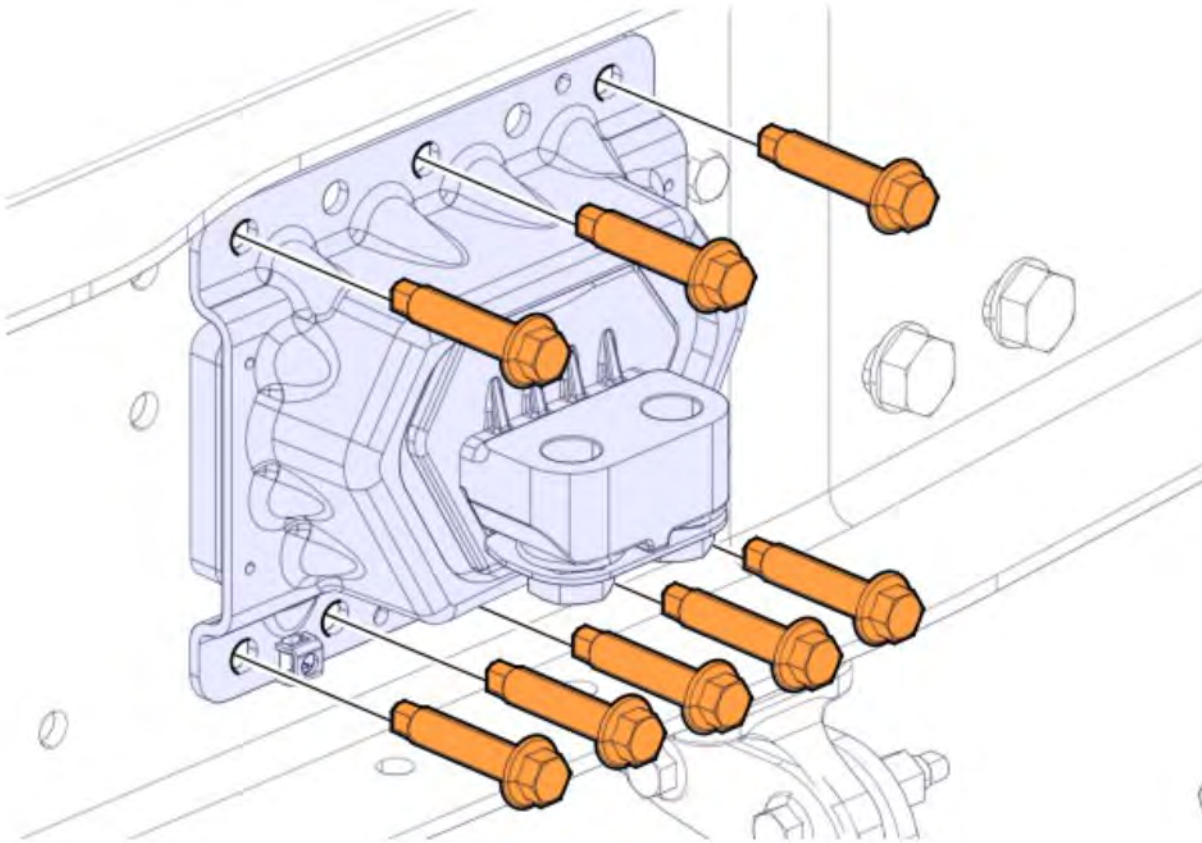
**Conditions**

- If the screw has a non-removable nut

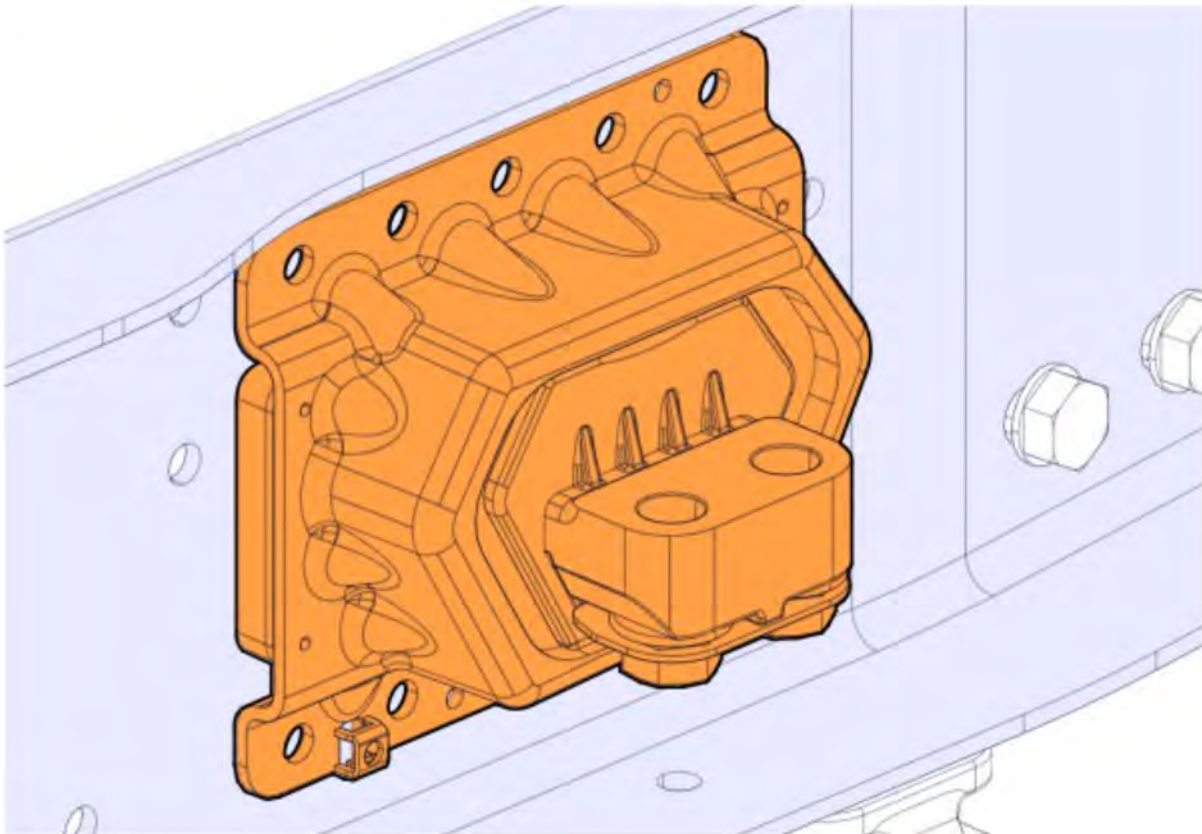
▶ Cut the nut to remove it.

**153** Remove the screws.

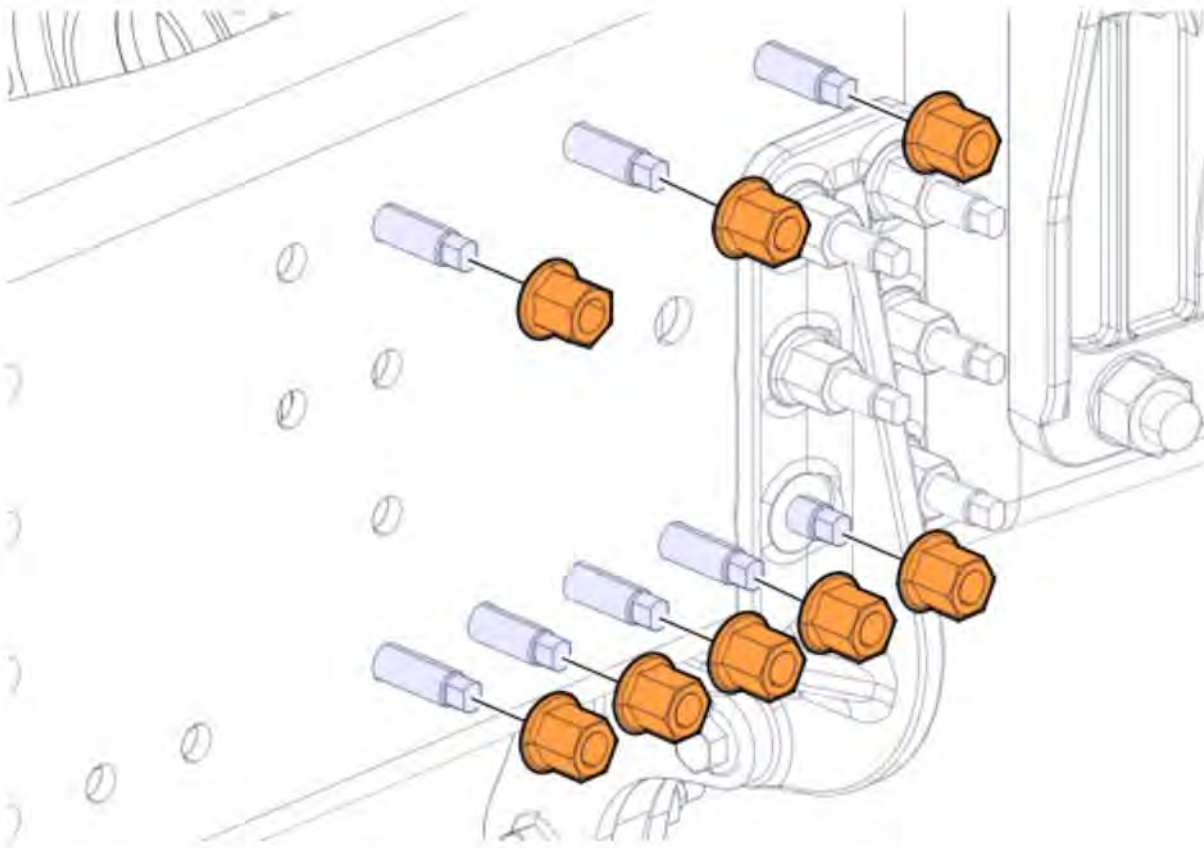




**154** Remove the rubber cushion.

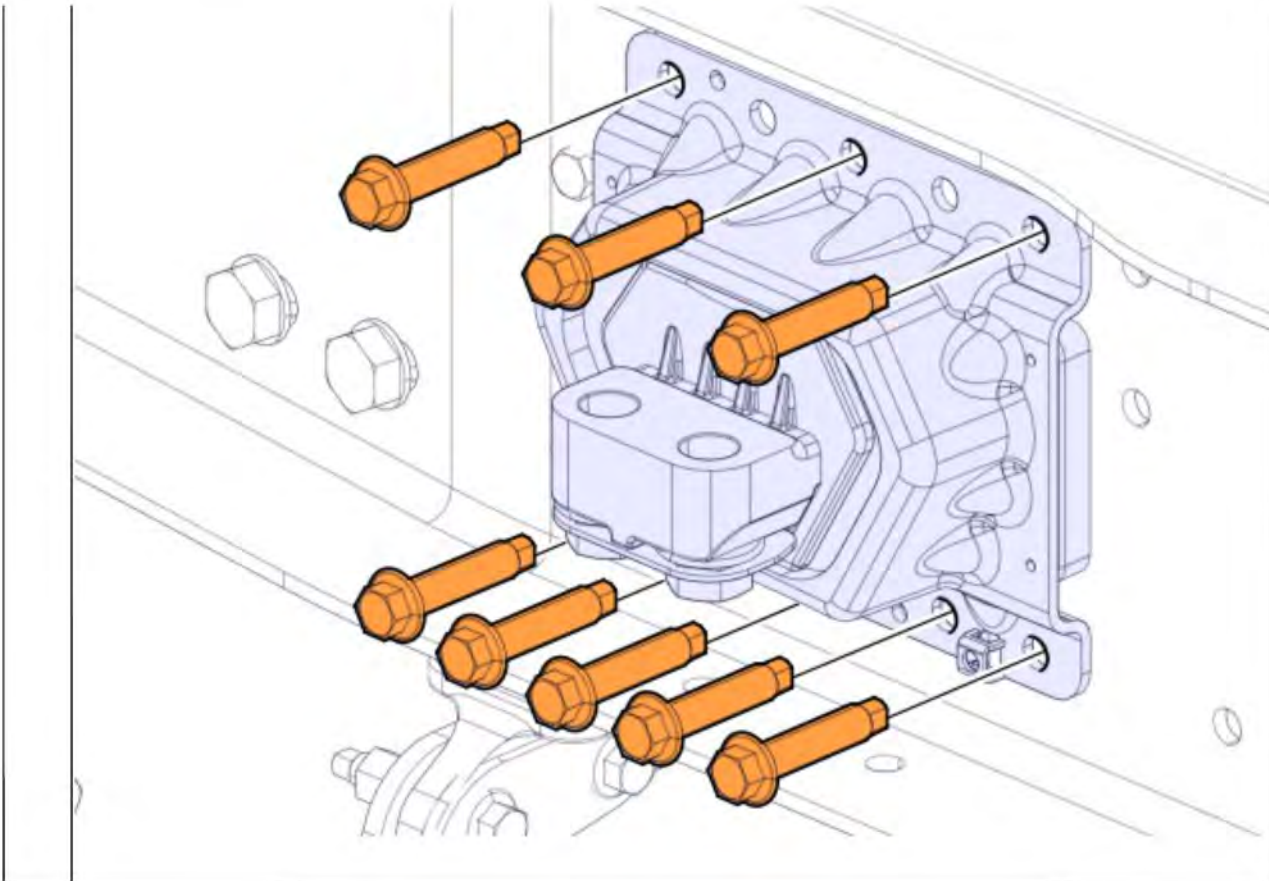


**155** Remove the nuts.

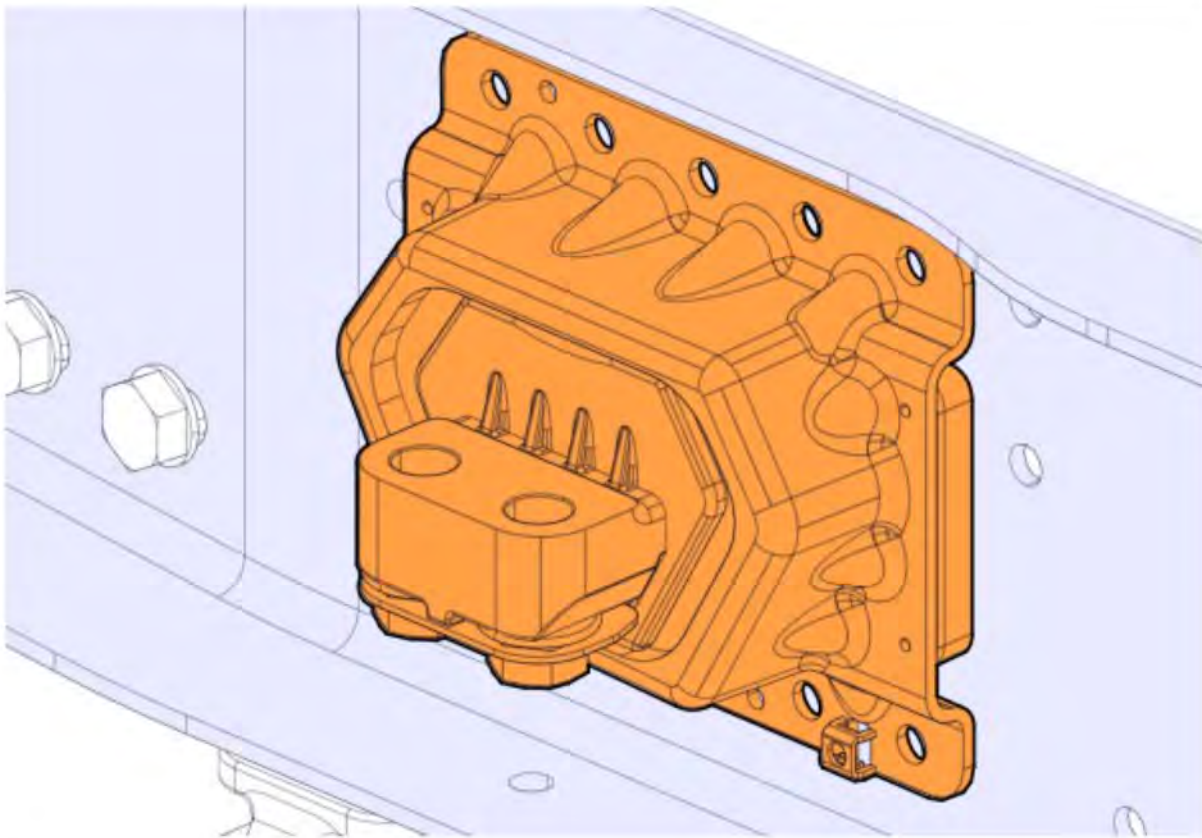


<b>156</b>	Perform this procedure when the condition below is met.
	<b>Conditions</b>
	<ul style="list-style-type: none"> <li>• If the screw has a non-removable nut</li> </ul>
	<ul style="list-style-type: none"> <li>▶ Cut the nut to remove it.</li> </ul>
	<ul style="list-style-type: none"> <li>▶ Remove the screws.</li> </ul>



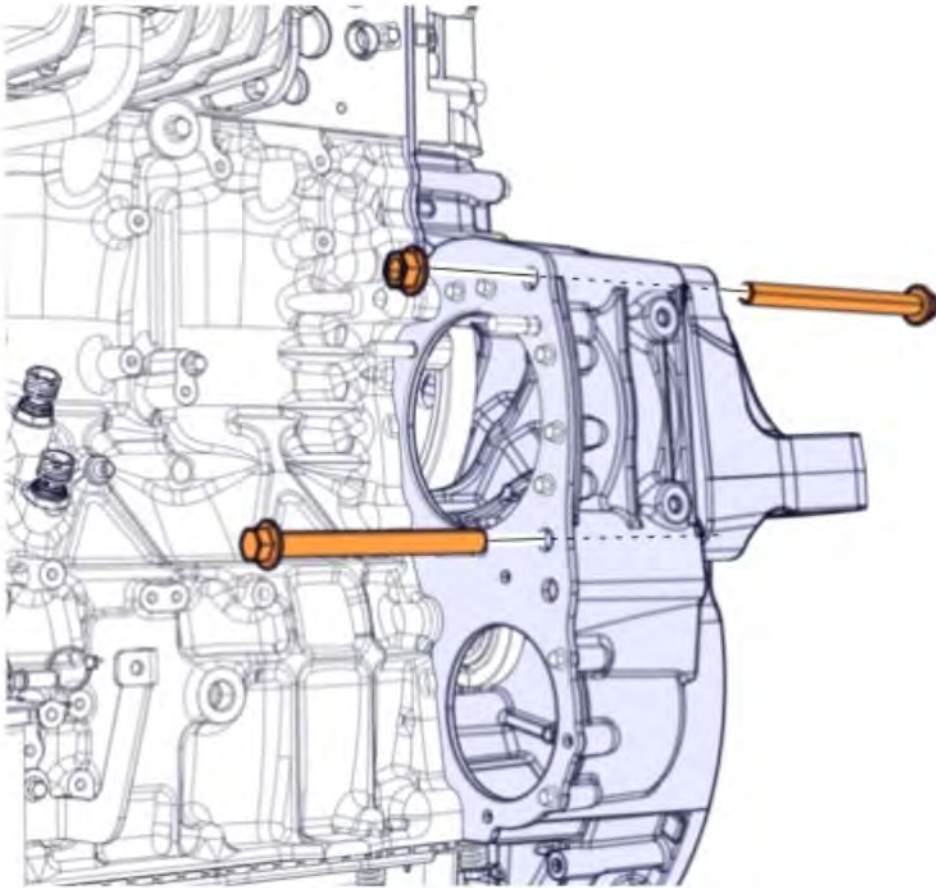


**157** Remove the rubber cushion.



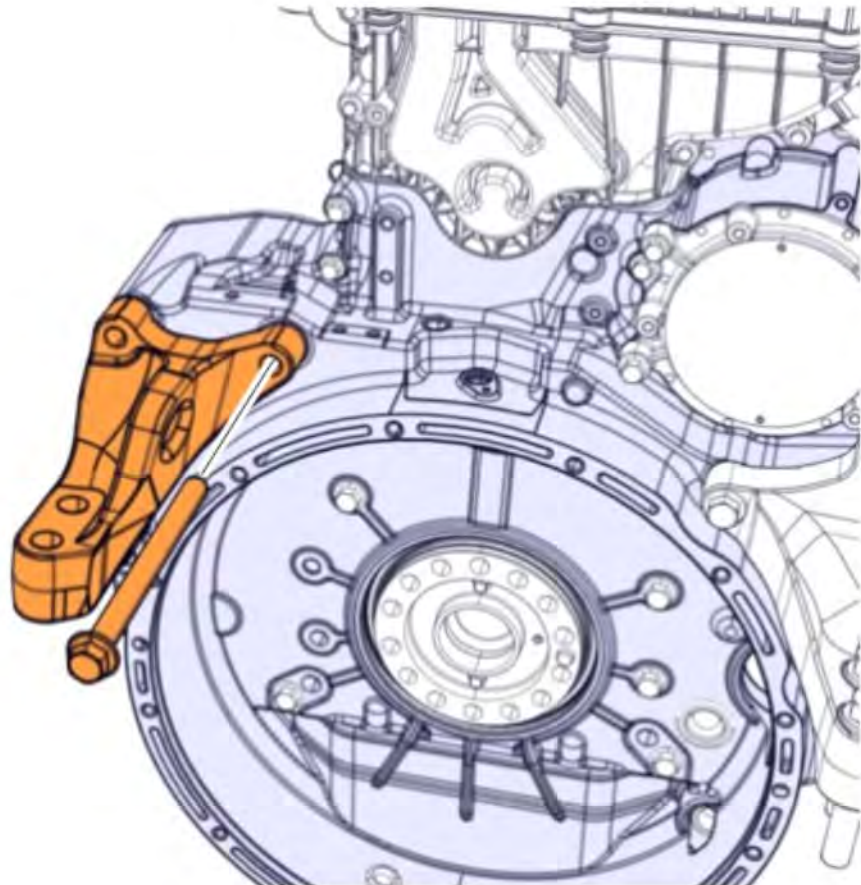
**158** Remove the nut and screw.

**159** Remove the screw.



<b>160</b>	Remove the screw.
------------	-------------------

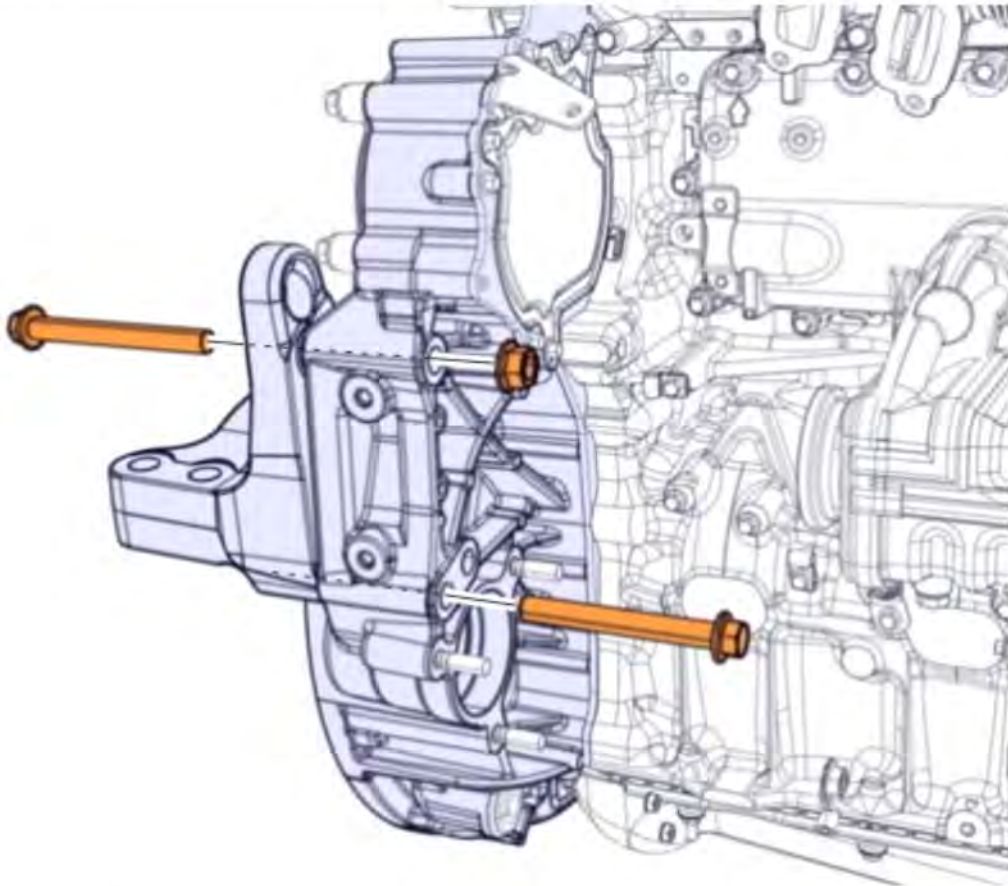
<b>161</b>	Remove the bracket.
------------	---------------------





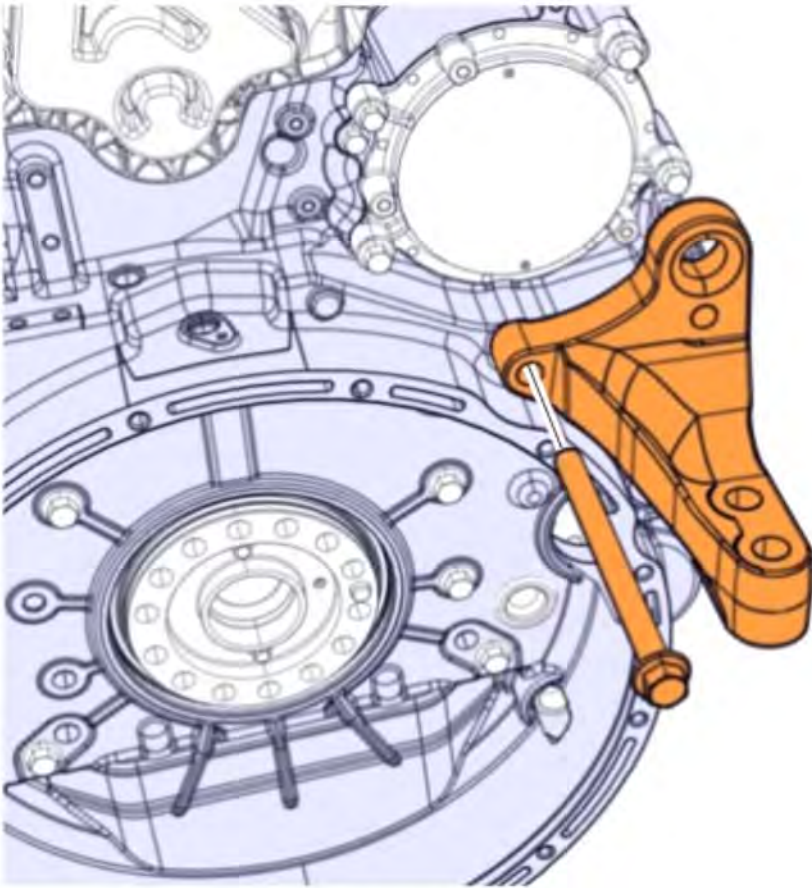
162	Remove the nut and screw.
-----	---------------------------

163	Remove the screw.
-----	-------------------

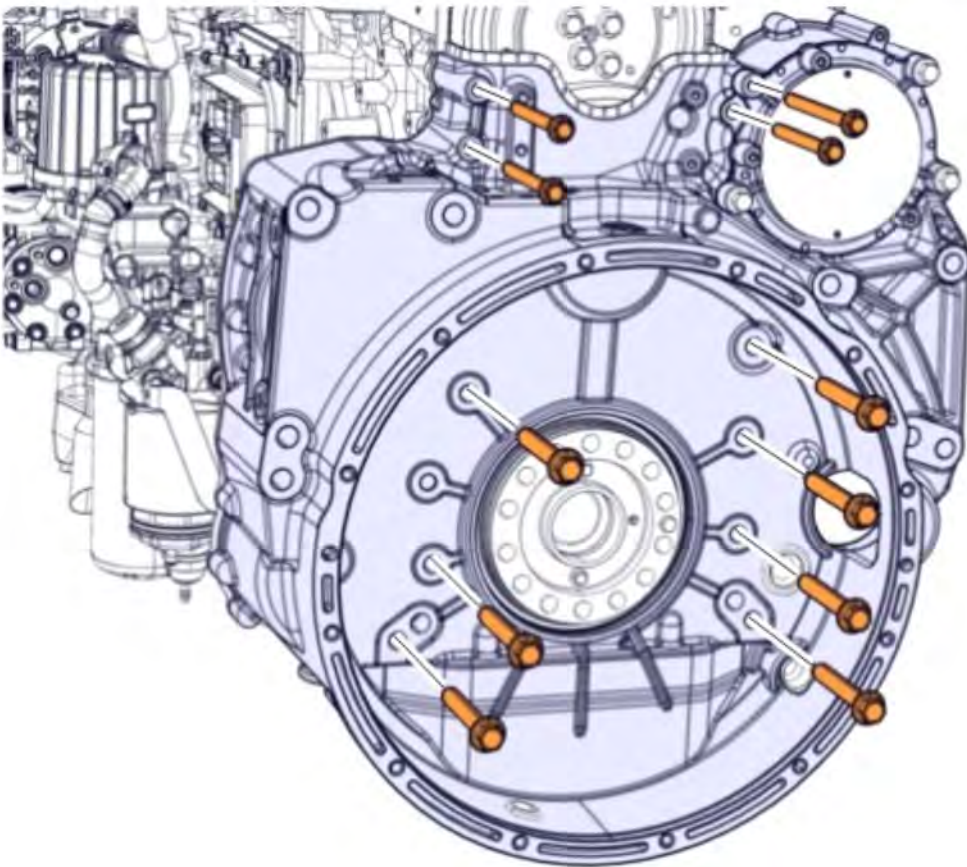


164	Remove the screw.
-----	-------------------

165	Remove the bracket.
-----	---------------------



166 Remove the screws.

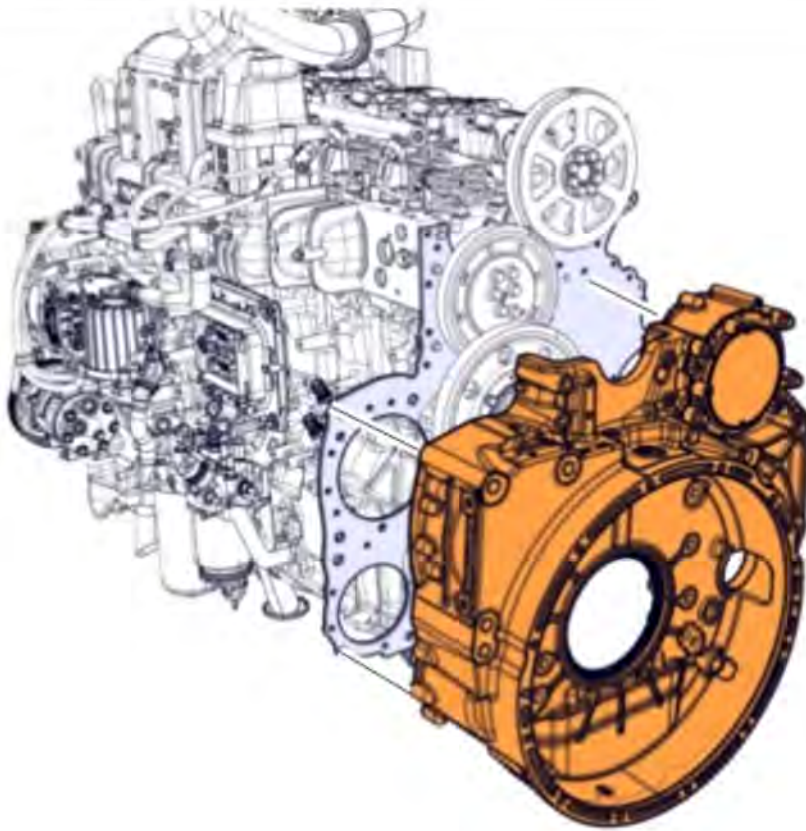




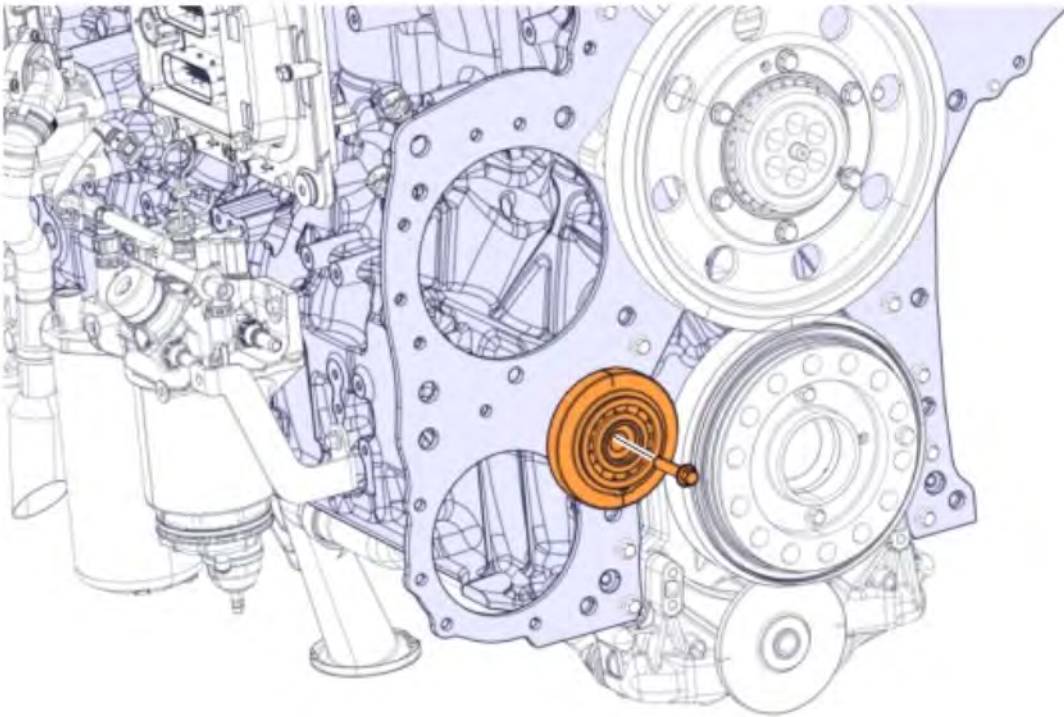
**CAUTION****Risk of serious injury.**

Heavy component.

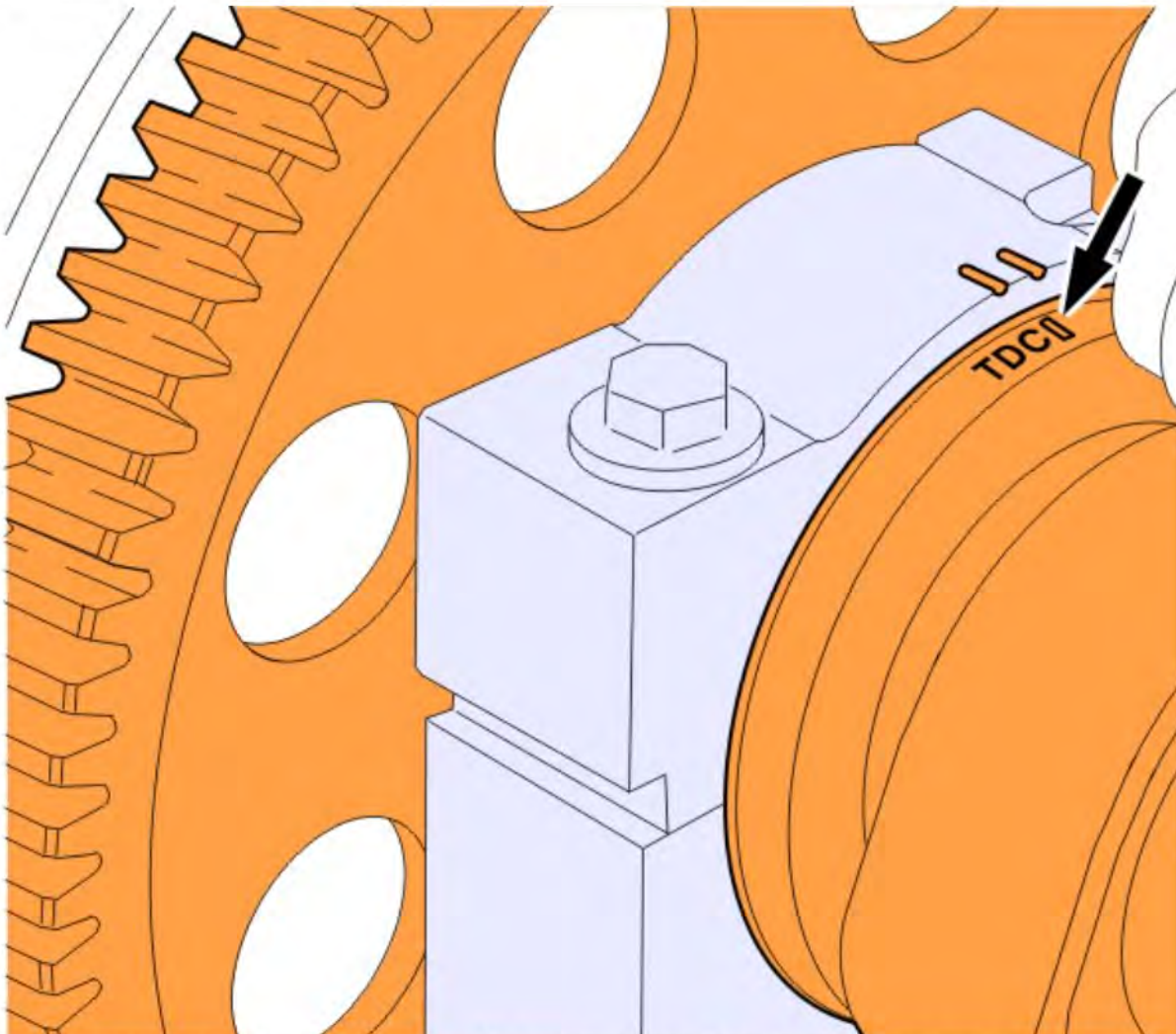
▶ Exercise caution when moving the component. Use appropriate tools.

**167** Remove the flywheel housing.**168** Remove the screw.**169** Remove the gear.**Service hint**

The gear may be stuck in the timing gear plate. Loosely reinstall the fastener and use a suitable puller.



170 Check that the timing marks are at TDC.

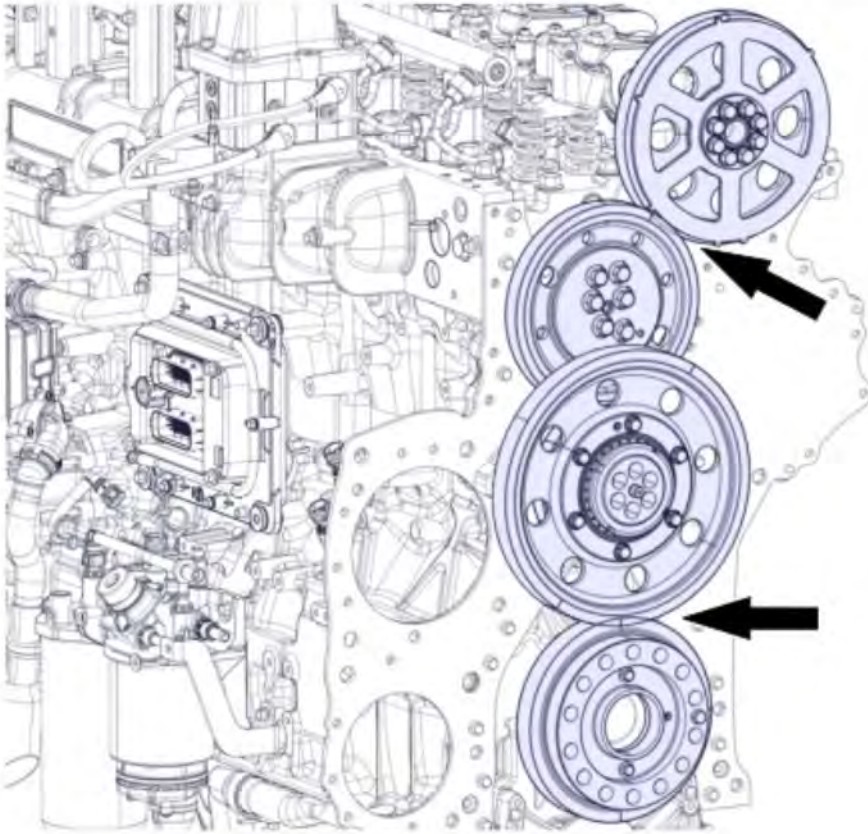


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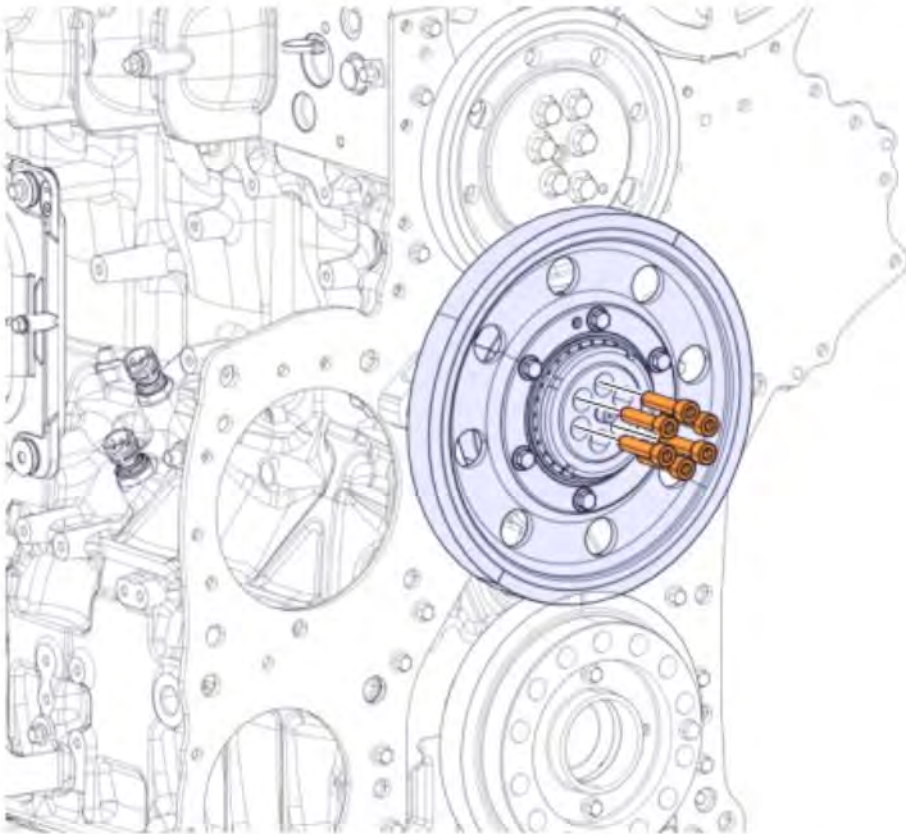
The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.



171 Mark the gears for reference.



172 Remove the screws.



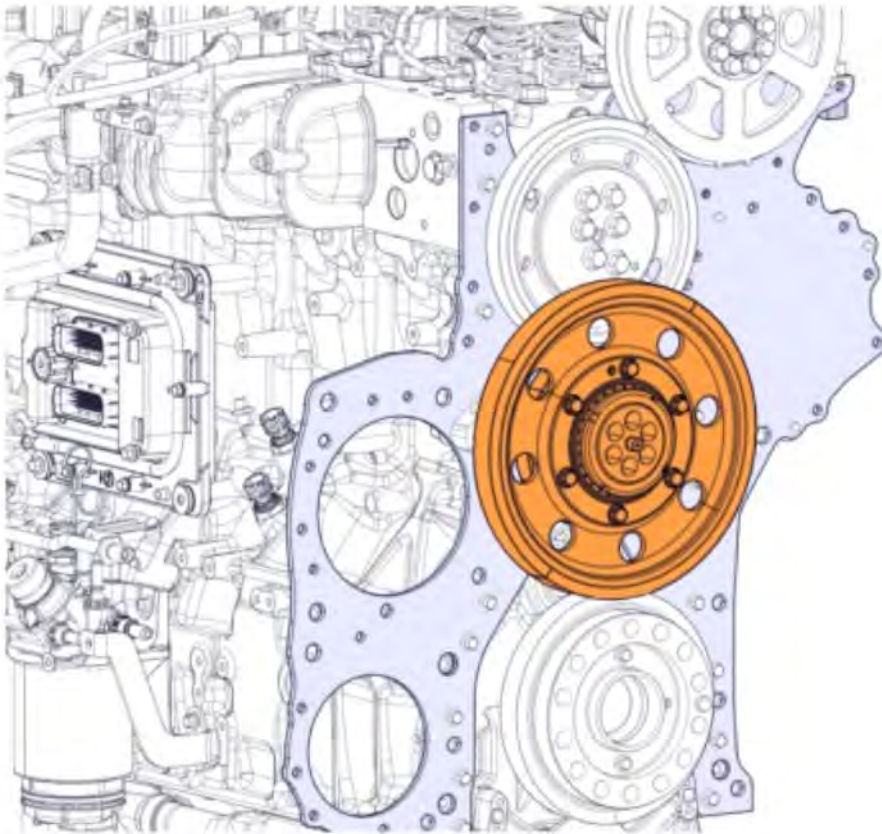
173 Remove the gears.

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**Note**

Do not separate the gears.

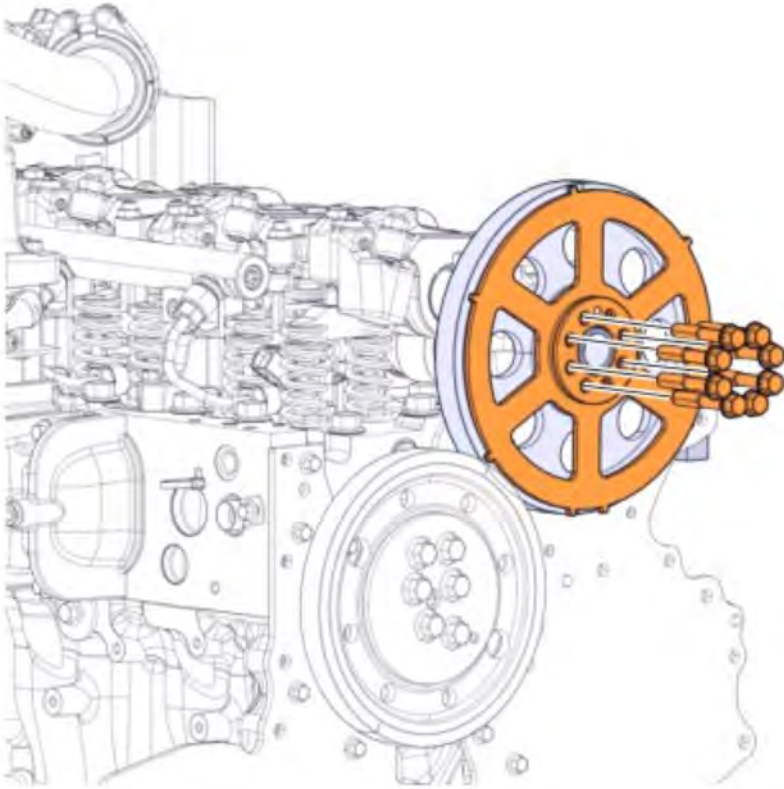


174 Remove the screws and the tone wheel.

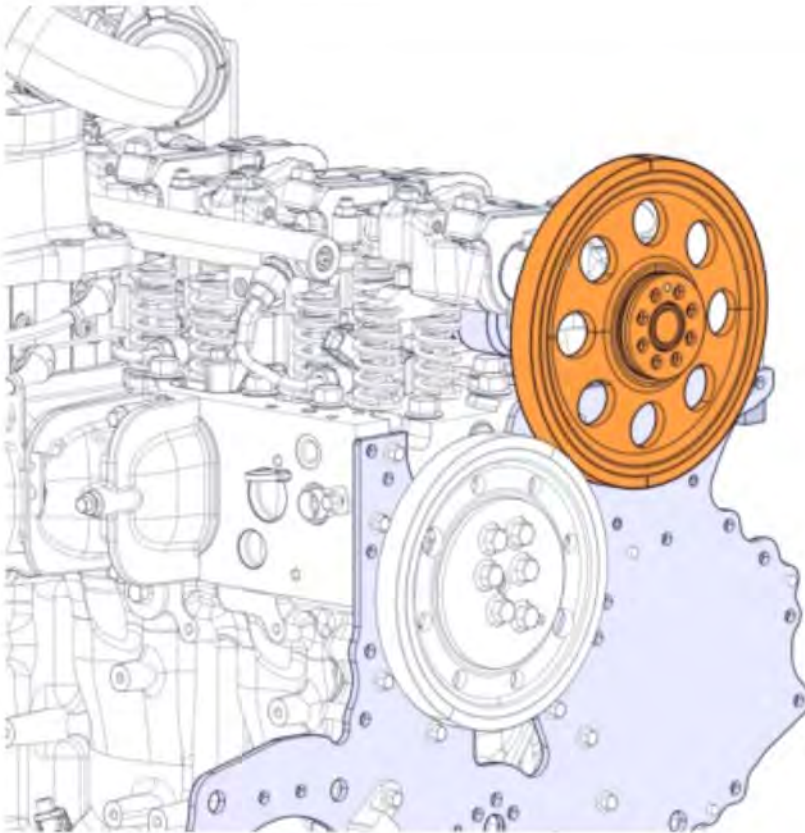
**Note**

Discard the screws.





175 Remove the gear.



**CAUTION**

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**Risk of material damage.**

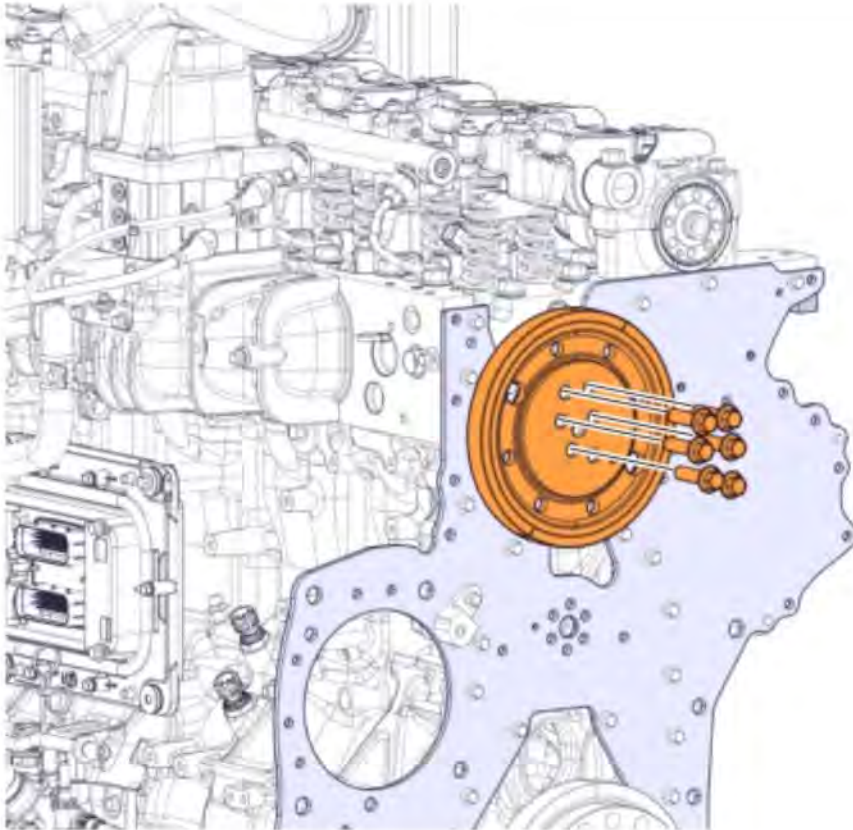
The idler gear can be damaged if mishandled.

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

**176** Remove the screws.

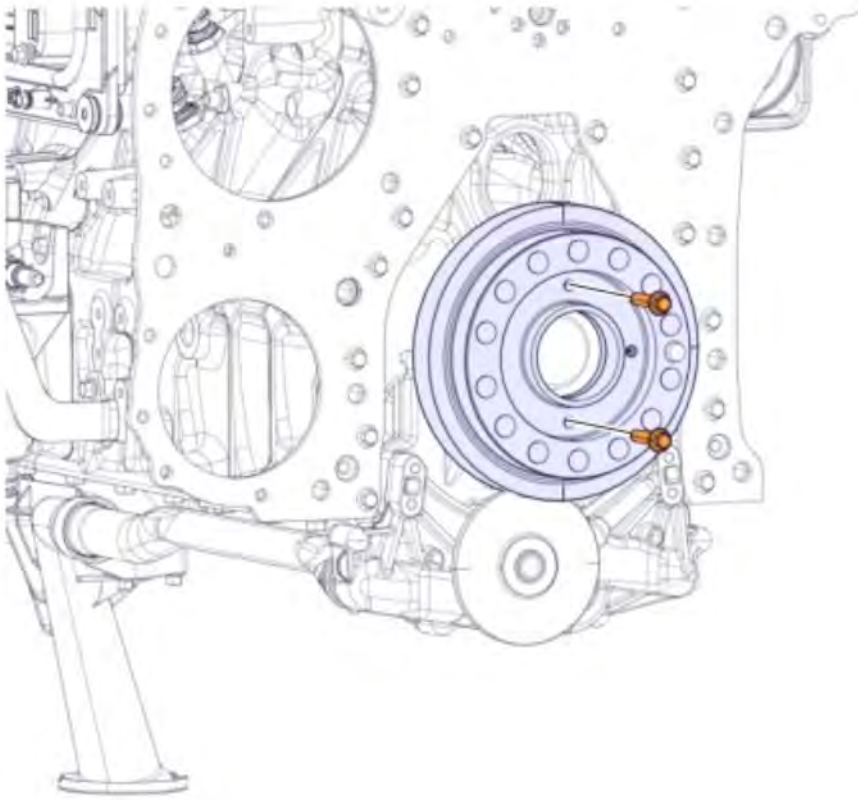
**177** Remove the gear.

**178** Remove the thrust washer.



**179** Remove the screws.



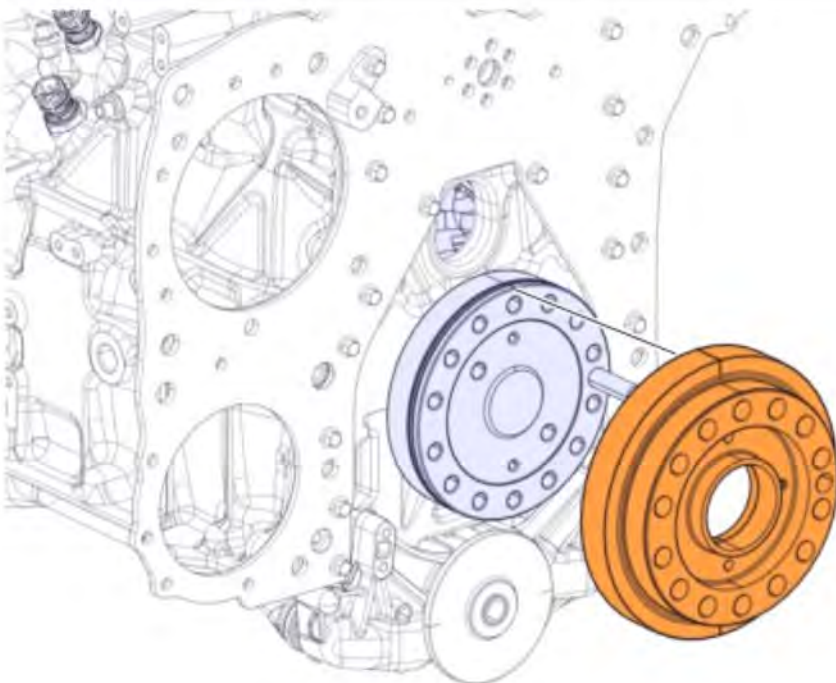


**180** Remove the gear and the seal.



**Note**

Use a suitable tool.



**181** Clean the crankshaft.

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182 Install the seal.



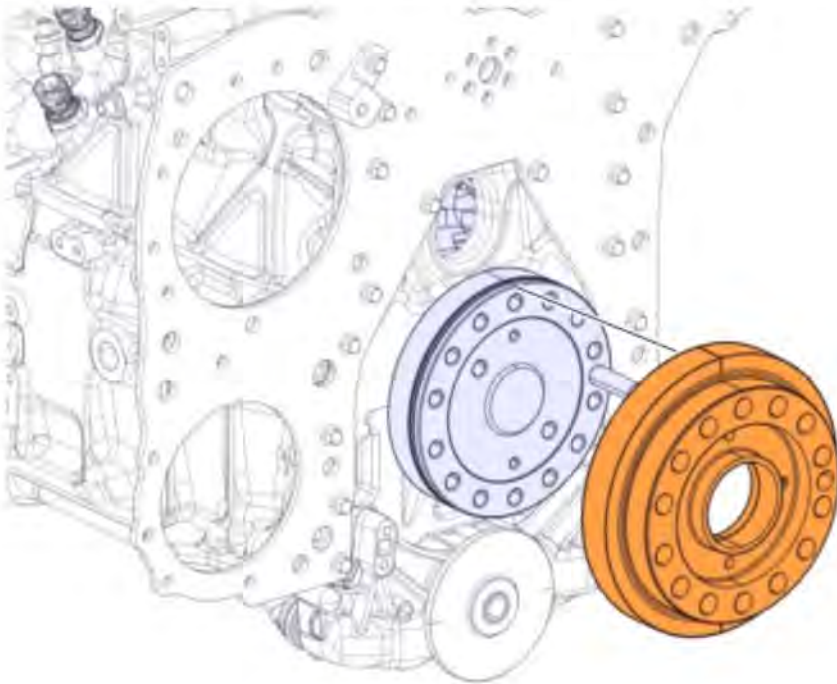
**Note**  
Use a new part.

183 Lubricate the gear contact surface.



**Note**  
Use recommended lubricant.

184 Install the gear.



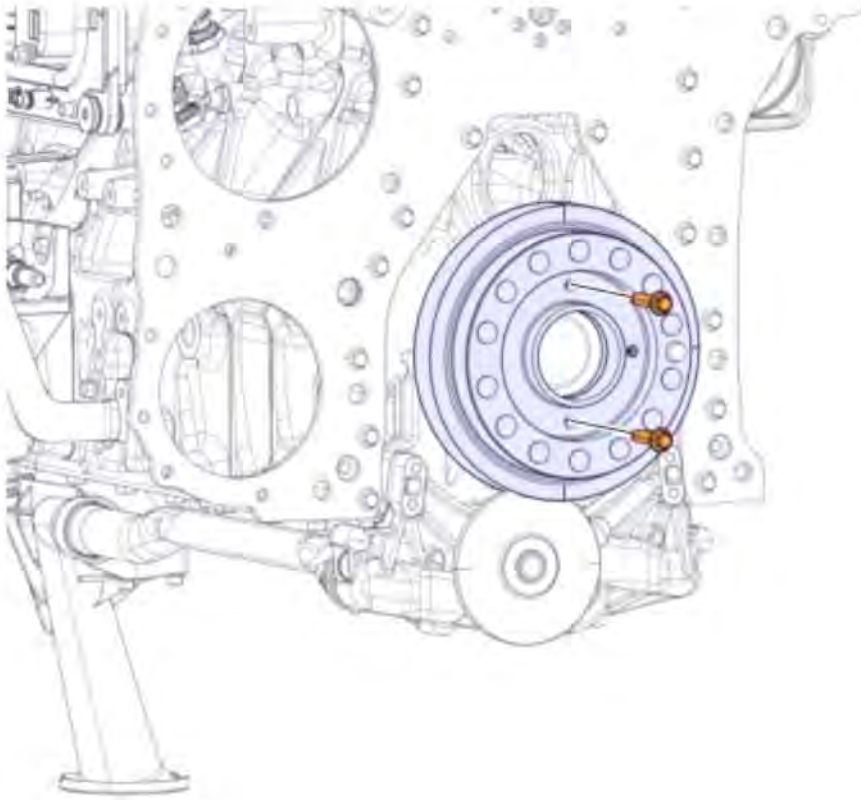
185 Install the screws.

186 Torque tighten the screws.

**Tightening torque**

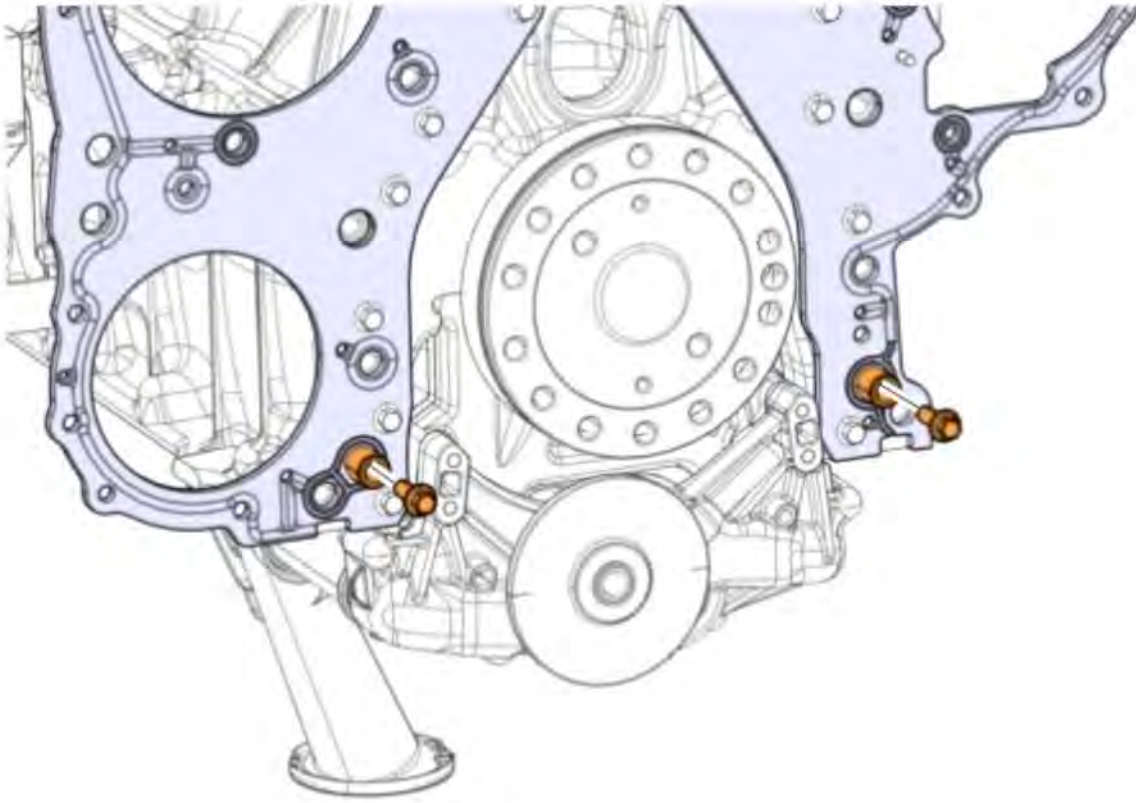
Crankshaft gear, screw	24 ±4 Nm (18 ±3 lb <sub>f</sub> -ft)
------------------------	---





<b>187</b>	Install the tools.							
	<b>Required material</b>							
	GUIDE	<a href="#">9998267</a>	2 pcs					
	<table border="1"> <tr> <td style="text-align: center;"><b>i</b></td> <td><b>Note</b></td> </tr> <tr> <td colspan="2">The tools act as guides for timing gear plate alignment.</td> </tr> <tr> <td colspan="2">Do not remove the tools until the timing gear plate is installed.</td> </tr> </table>			<b>i</b>	<b>Note</b>	The tools act as guides for timing gear plate alignment.		Do not remove the tools until the timing gear plate is installed.
<b>i</b>	<b>Note</b>							
The tools act as guides for timing gear plate alignment.								
Do not remove the tools until the timing gear plate is installed.								

<b>188</b>	Torque tighten the screws.	
	<b>Tightening torque</b>	
	Timing gear plate, tool, screw	60 Nm (44 lb <sub>f</sub> ·ft)



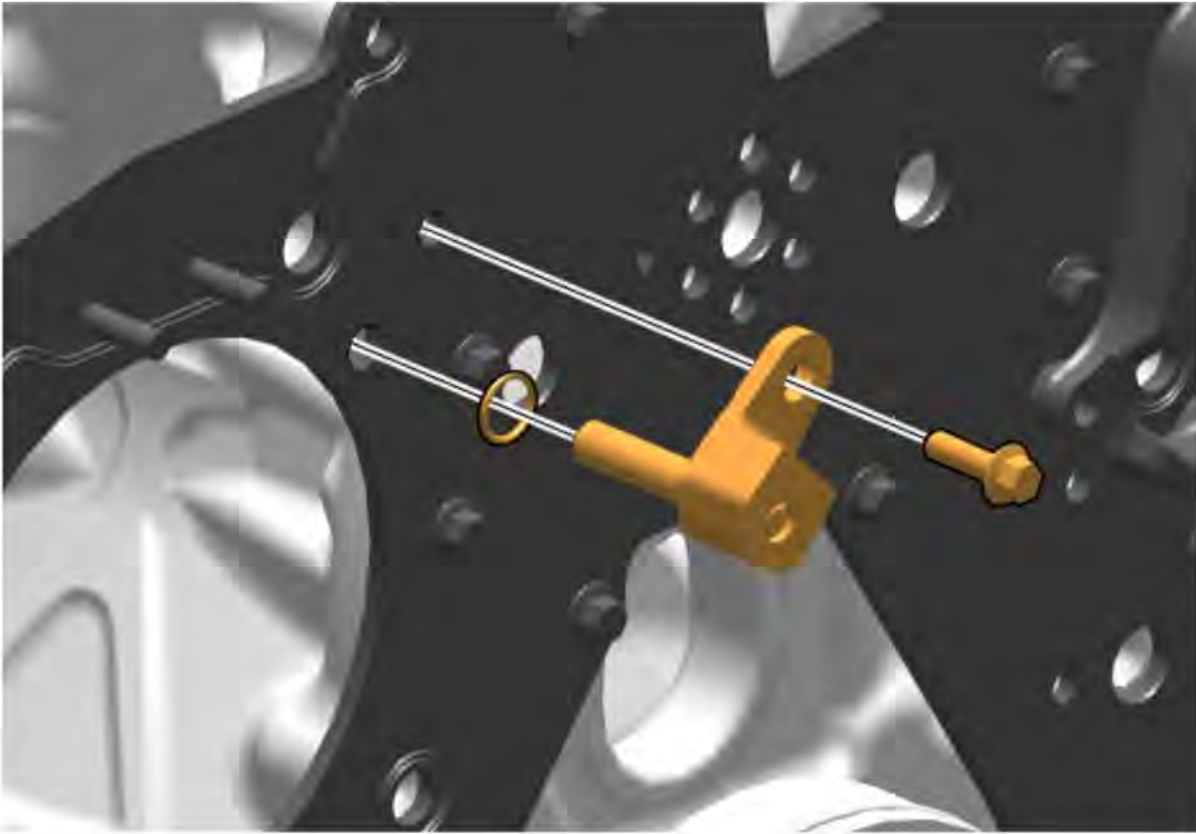
189	Remove the screw.
-----	-------------------

190	Remove the bracket.
-----	---------------------

**Note**

Discard the O-ring.

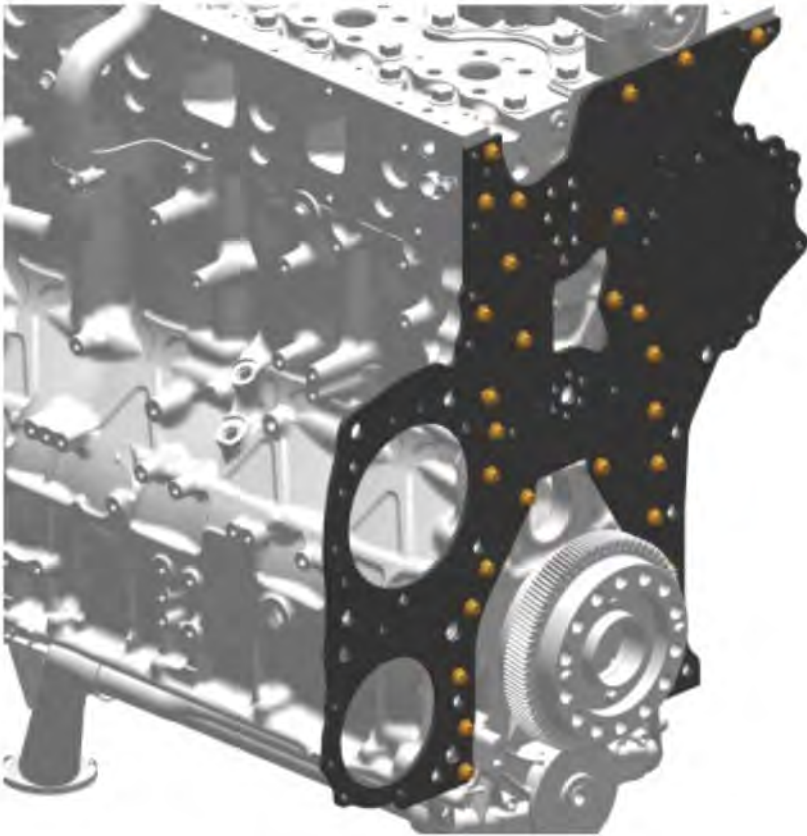


**CAUTION****Risk of serious injury.**

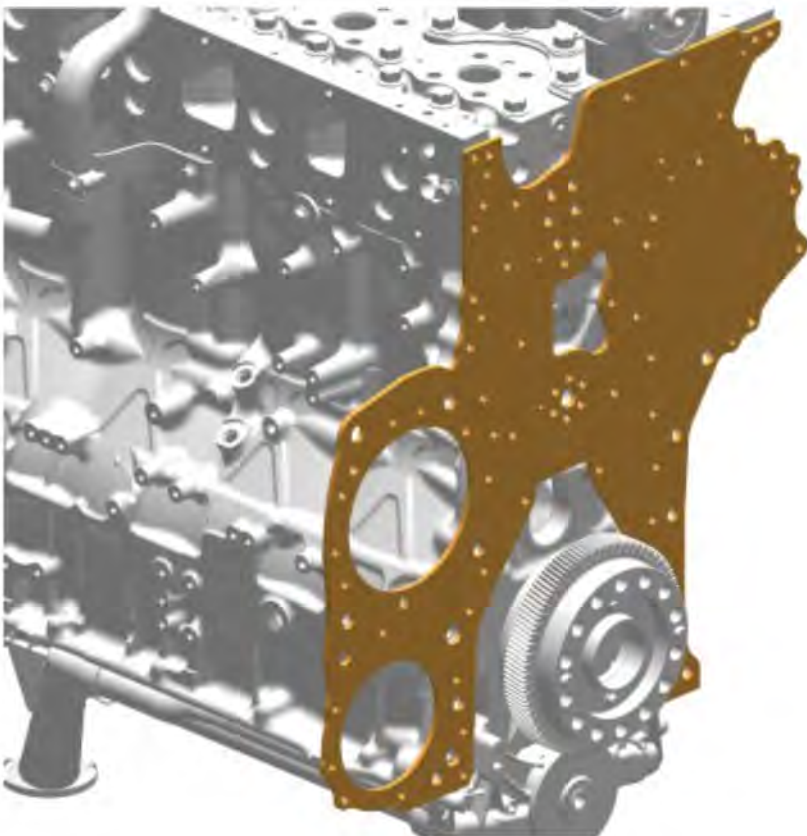
Heavy component.

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

**191** Remove the screws.



<b>192</b>	Remove the timing gear plate.
------------	-------------------------------



<b>193</b>	Remove the screws.
------------	--------------------

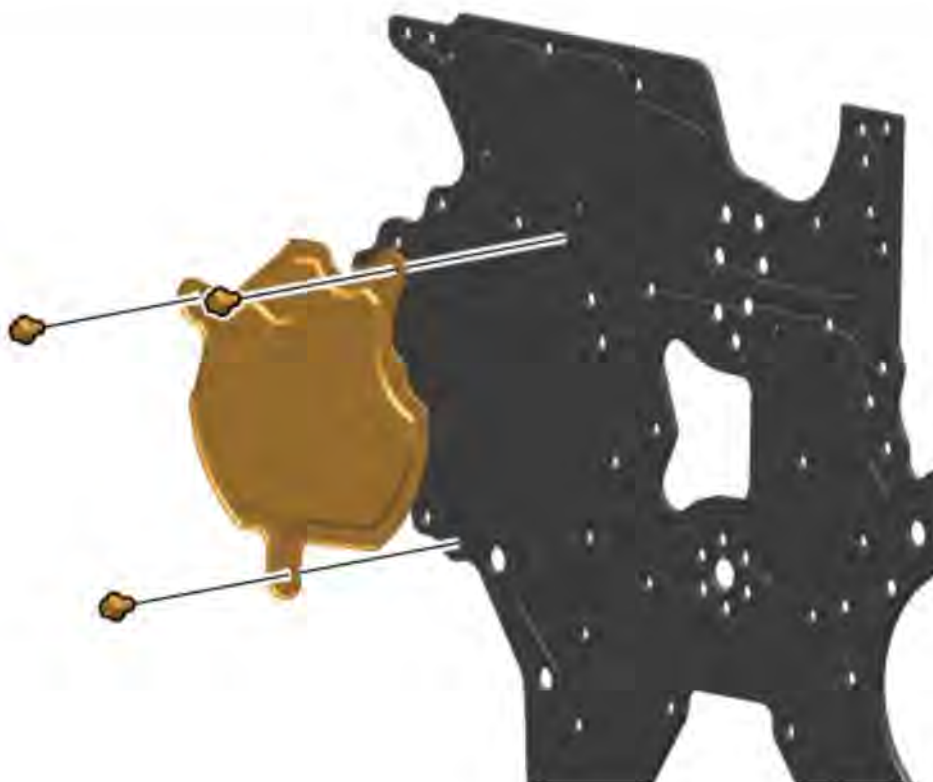
<b>194</b>	Remove the noise shield.
------------	--------------------------

[Service hint](#)

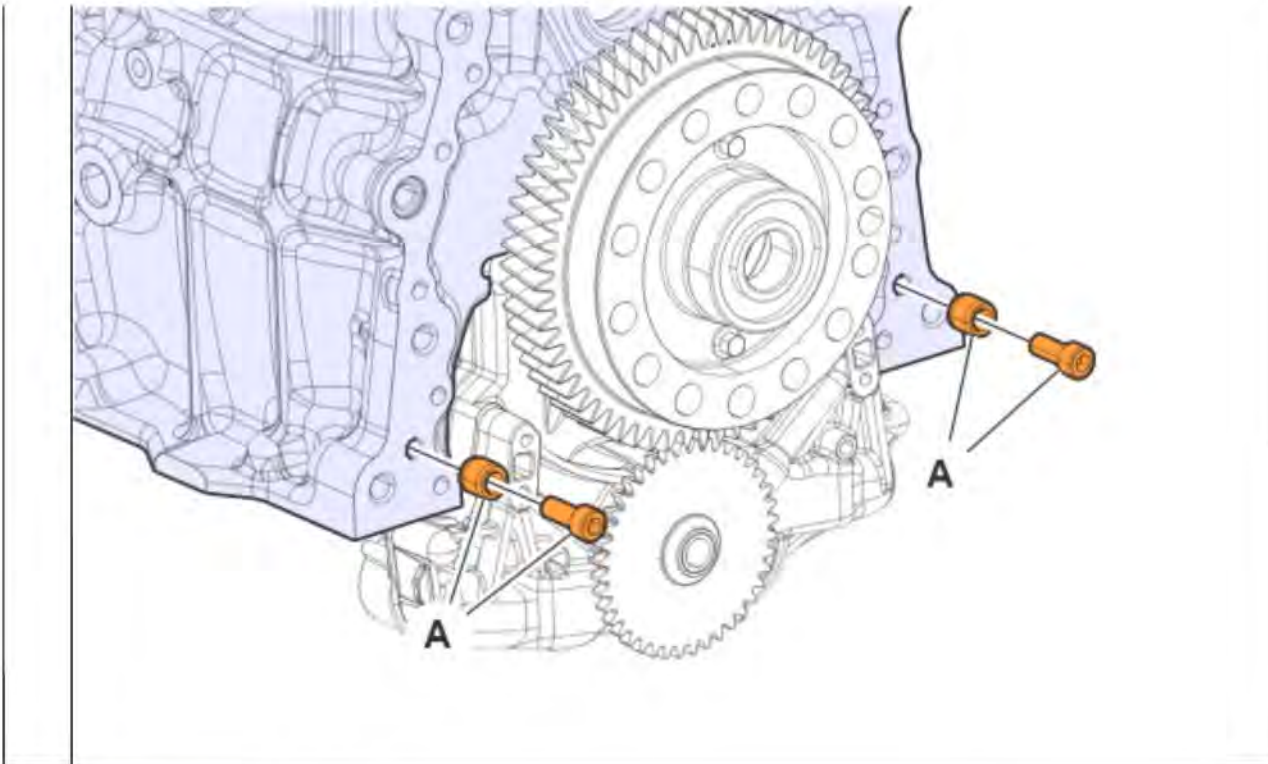




Discard the noise shield if the timing gear plate has integrated seals, because a new noise shield will come with the timing gear plate.



<b>195</b>	Perform this procedure when the condition below is met.				
<b>Conditions</b>					
<ul style="list-style-type: none"> <li>If not previously installed</li> </ul>					
▶ Install the tools (A).					
<b>Required material</b>					
A	GUIDE	<a href="#">9998267</a>	2 pcs		
<table border="1" style="width: 100%;"> <tr> <td style="width: 5%; text-align: center;"><b>i</b></td> <td><b>Note</b> Ensure that the tools are clean and damage free.</td> </tr> </table>				<b>i</b>	<b>Note</b> Ensure that the tools are clean and damage free.
<b>i</b>	<b>Note</b> Ensure that the tools are clean and damage free.				
▶ Install the screws.					
<table border="1" style="width: 100%;"> <tr> <td style="width: 5%; text-align: center;"><b>i</b></td> <td><b>Note</b> Hand tighten.</td> </tr> </table>				<b>i</b>	<b>Note</b> Hand tighten.
<b>i</b>	<b>Note</b> Hand tighten.				



**196** Install the timing gear plate.



**Note**

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

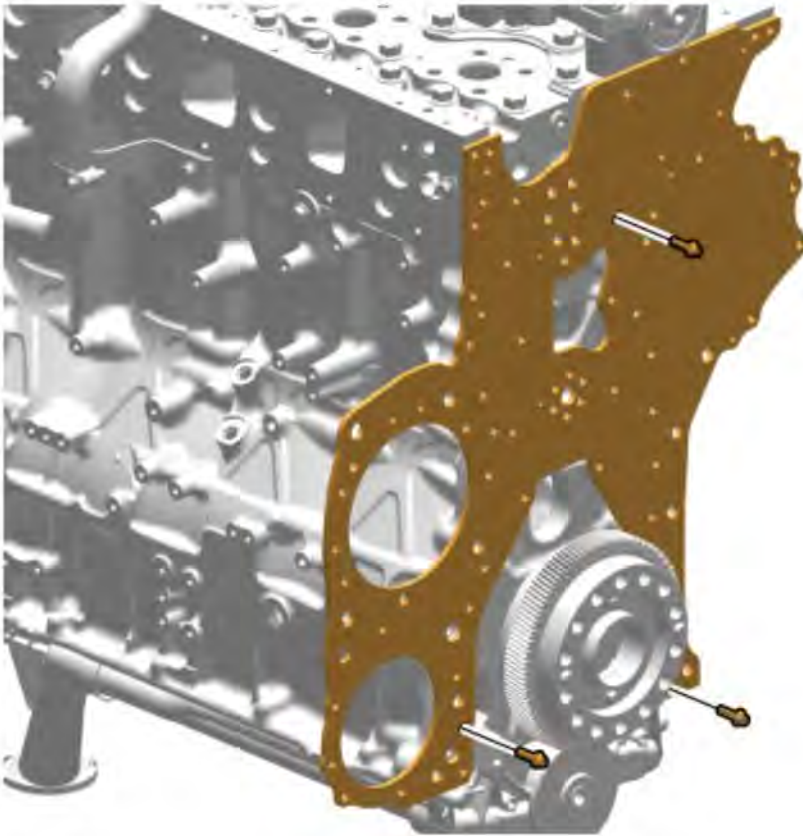
**197** Install the screws.






**Note**

Hand tighten the screws.





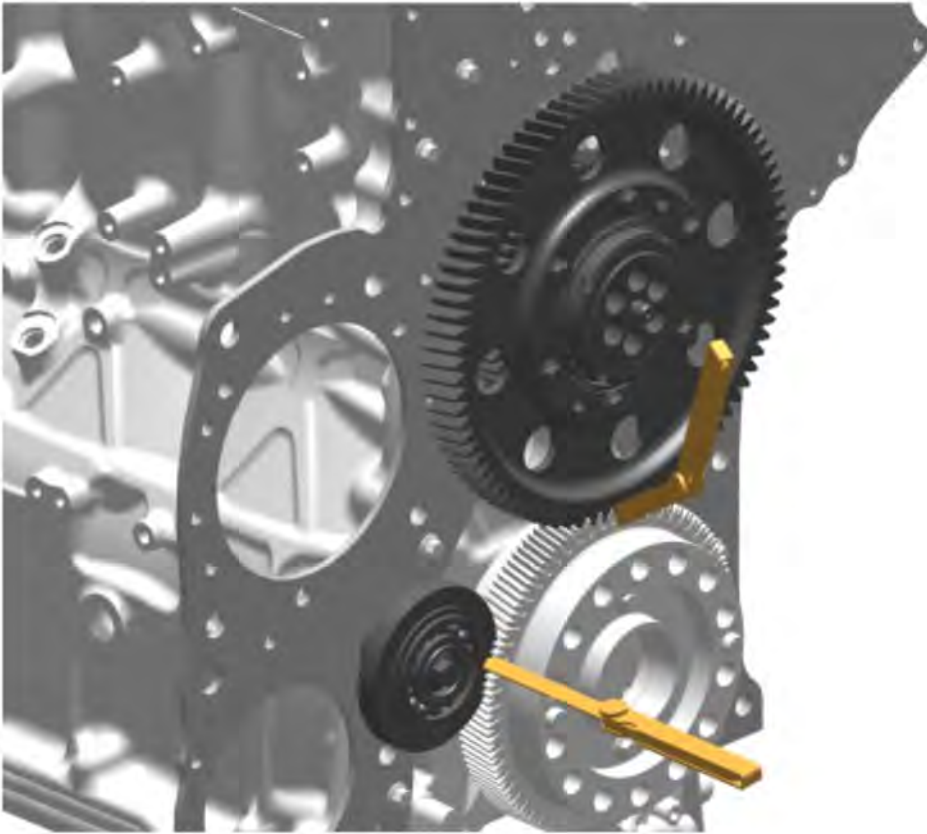
198	Install the gears.		
199	Install the screws. <table border="1" data-bbox="159 1086 686 1187"><tr><td></td><td><b>Note</b> Use a washer for the small idler gear.</td></tr></table>		<b>Note</b> Use a washer for the small idler gear.
	<b>Note</b> Use a washer for the small idler gear.		
200	Hand tighten the screws.		



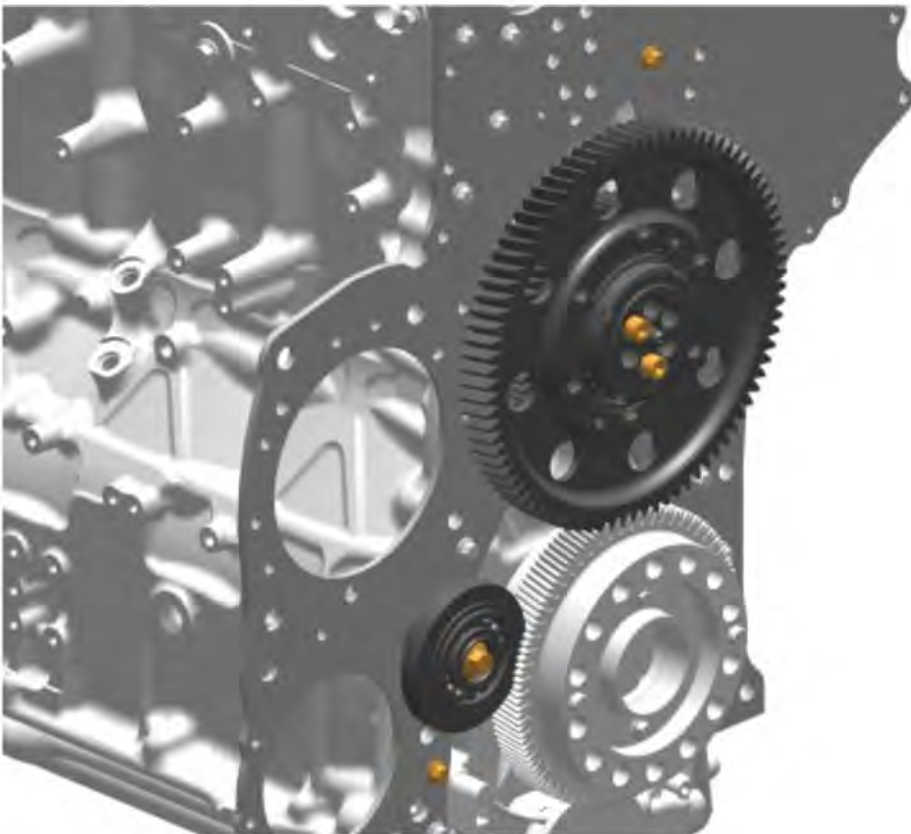
201	Install the feeler gauges.	
	<b>Tech data</b>	
	Feeler gauge, thickness	0.1 mm (0.004 in)

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





203 Tighten the screws.



204 Place a dial indicator into position.

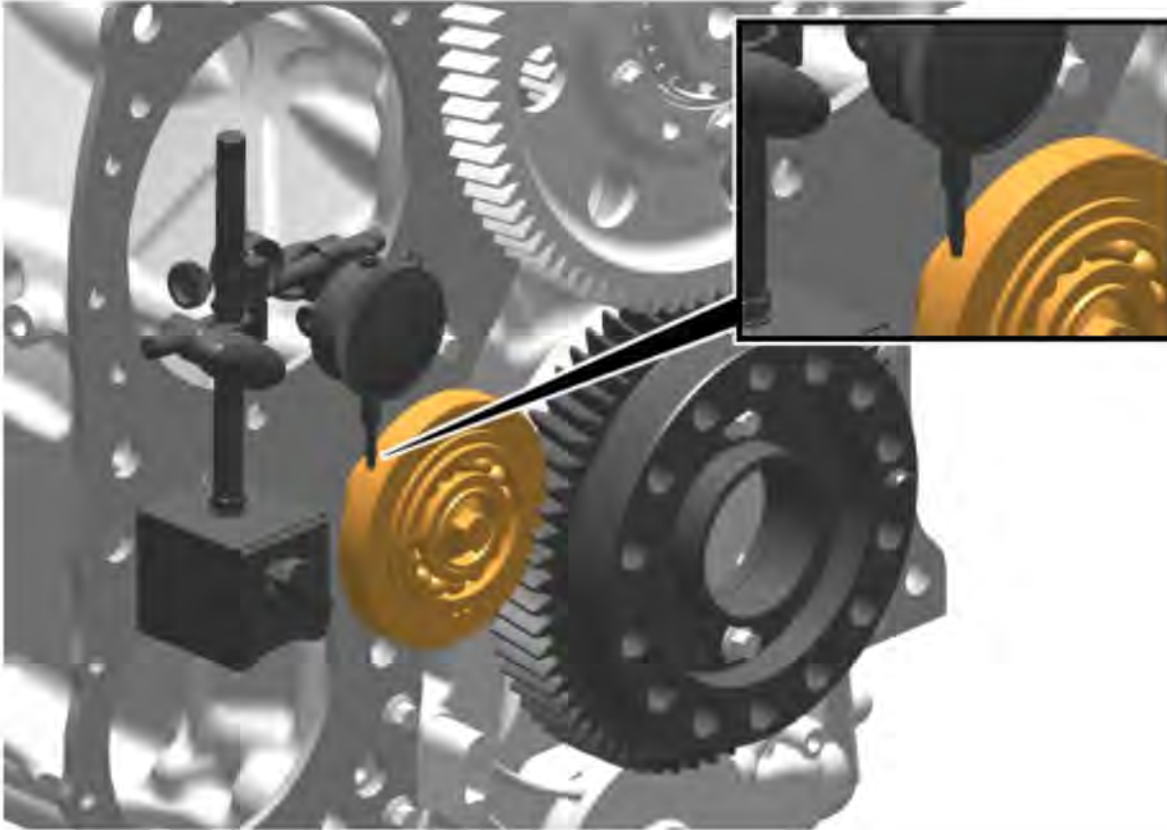
**i** **Note**  
Use caution that the timing plate seal is not damaged.



**Note**

Ensure that the probe tip touches the gear tooth.

205 Set the dial to zero.



206 Turn the idler gear by hand.

207 Read and record the amount of backlash.

**Tech data**

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

208 Perform this procedure when the condition below is met.

**Conditions**

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

209 Install the tools.

**Required material**

ROCKER_INDICATOR	<a href="#">9999683</a>
MAGNETIC STAND	<a href="#">9999696</a>





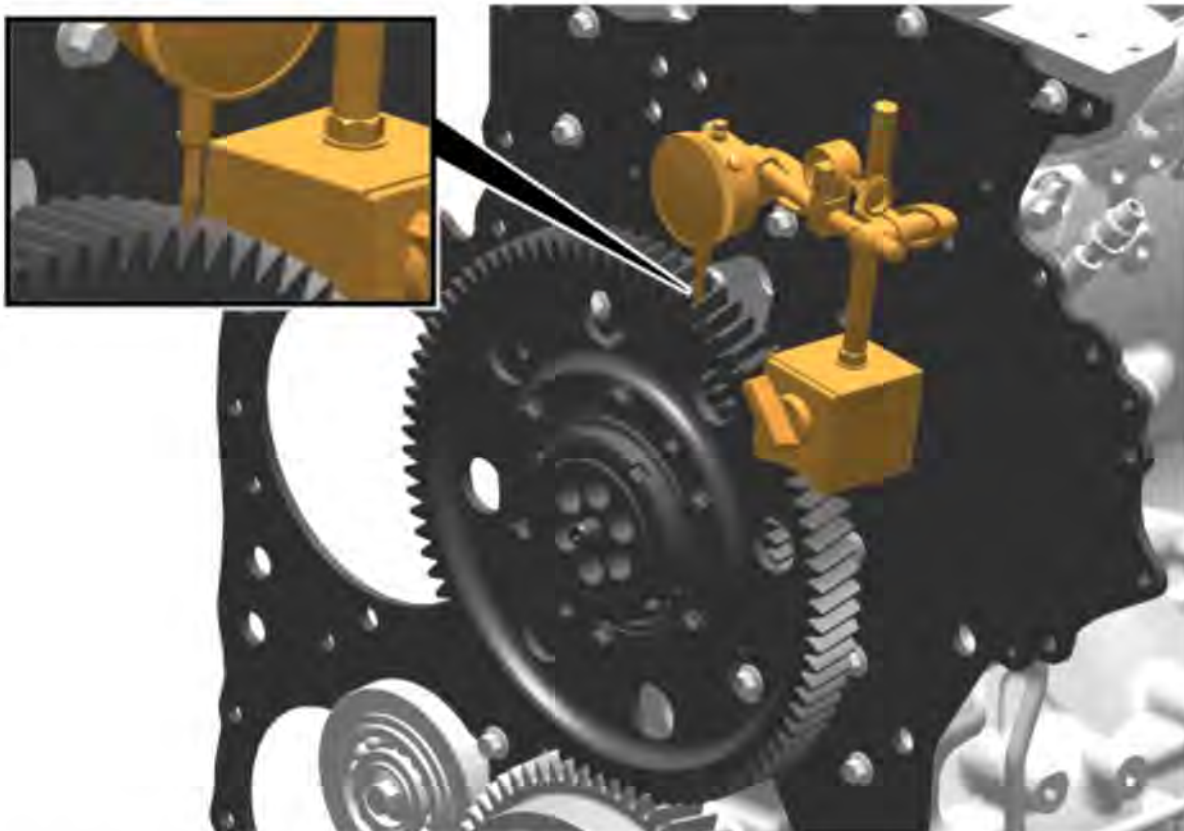
**Note**

Ensure that the probe tip touches the gear tooth.

210 Check the backlash.

**Tech data**

Gear, backlash	0.05 – 0.17 mm (0.002 – 0.0067 in)
----------------	---------------------------------------



211 Perform this procedure when the condition below is met.

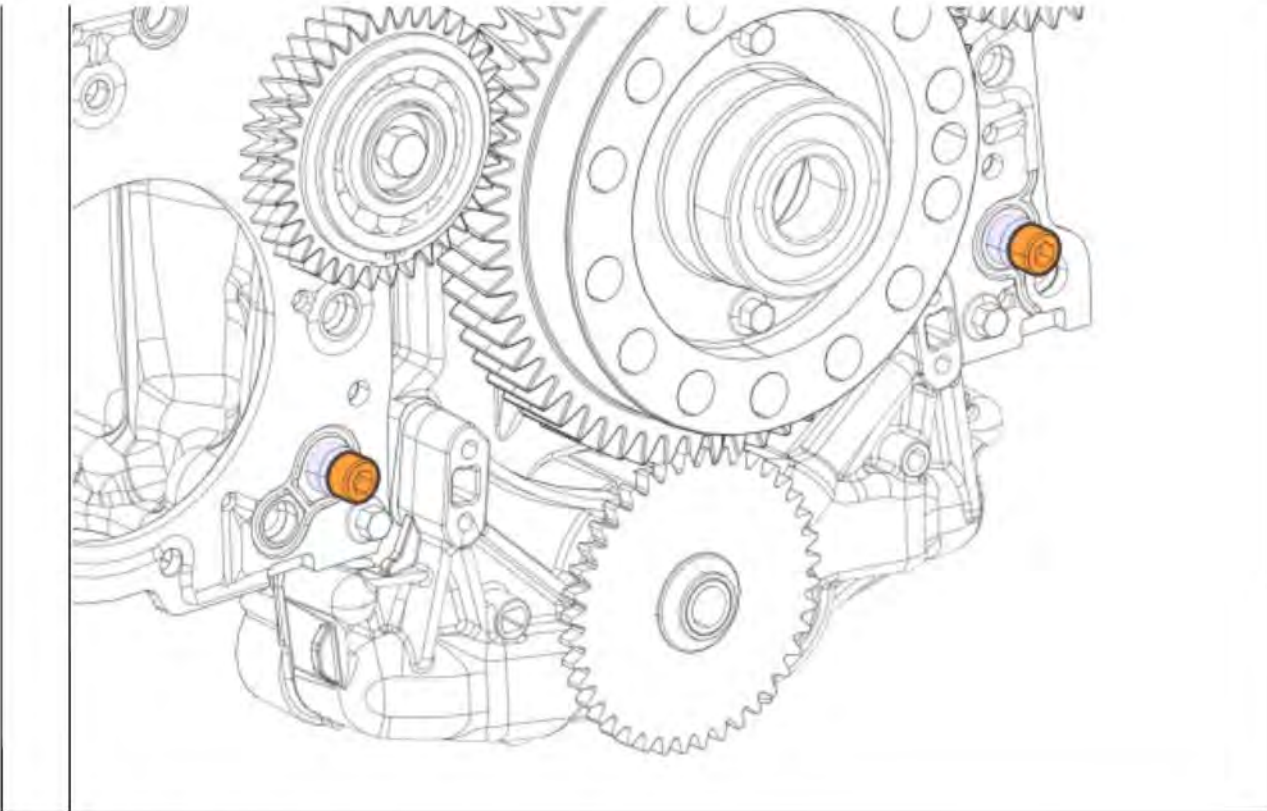
**Conditions**

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

212 Perform this procedure when the condition below is met.

**Conditions**

- If all of the clearances are within the specifications
- ▶ Tighten the screws.



213	Remove the screws.
-----	--------------------

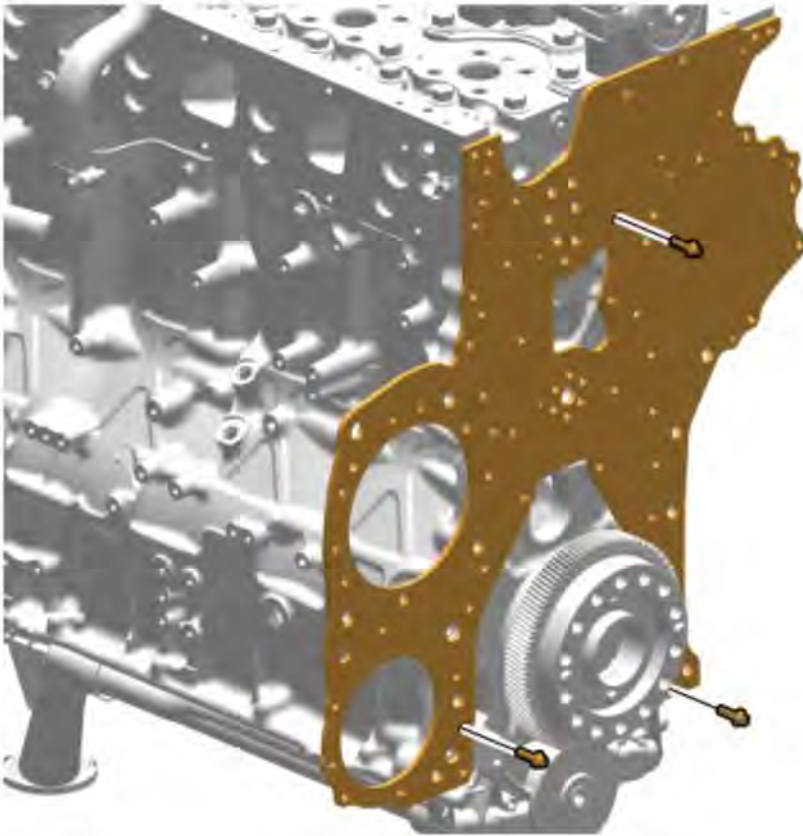
214	Remove the gears.
-----	-------------------



215	Remove the screws.
-----	--------------------

216	Remove the timing gear plate.
-----	-------------------------------





217 Clean the contact surfaces carefully.






**Note**

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

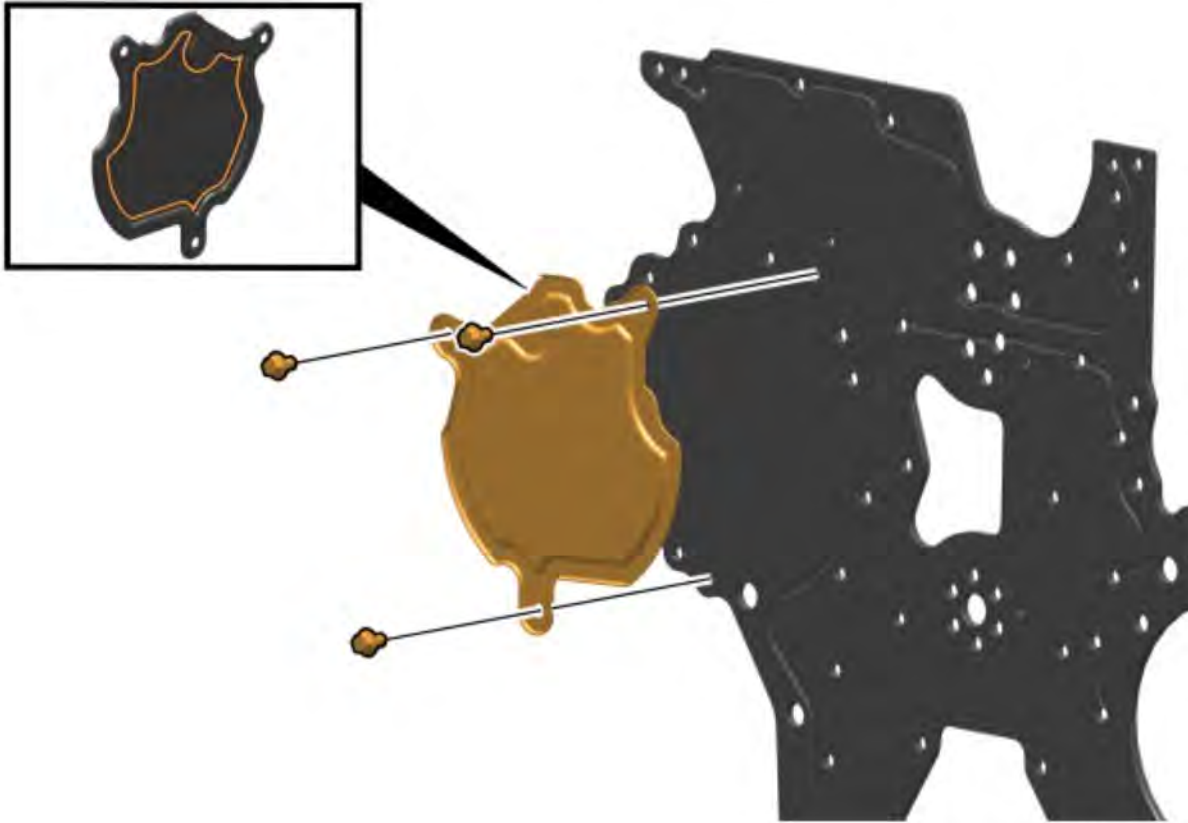
218 Inspect the sealing strip surfaces on both side of the timing gear plate.

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

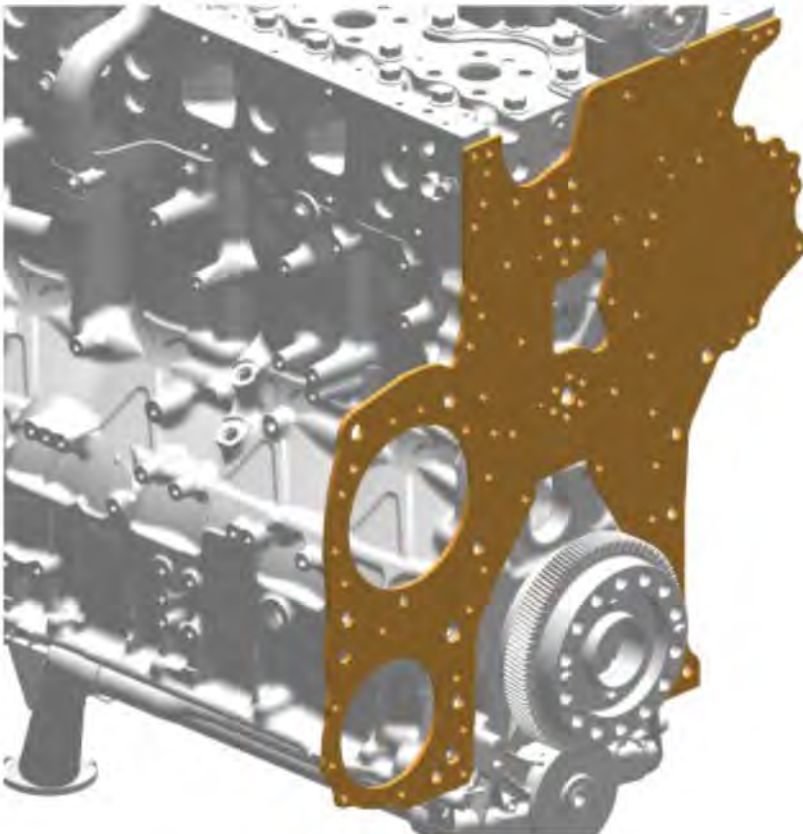


<b>220</b>	Apply the sealant.
<b>Tech data</b>	
Sealant, bead thickness	2 mm (0.08 in)
	<b>Note</b> Use recommended sealant.
	<b>Note</b> Ensure that the surfaces are completely clean of oil and grease.
<b>221</b>	Install the noise shield.
	<b>Note</b> Install the noise shield within 20 minutes of applying the sealant.
<b>222</b>	Install the screws.





223 Install the timing gear plate.



224 Install the screws.



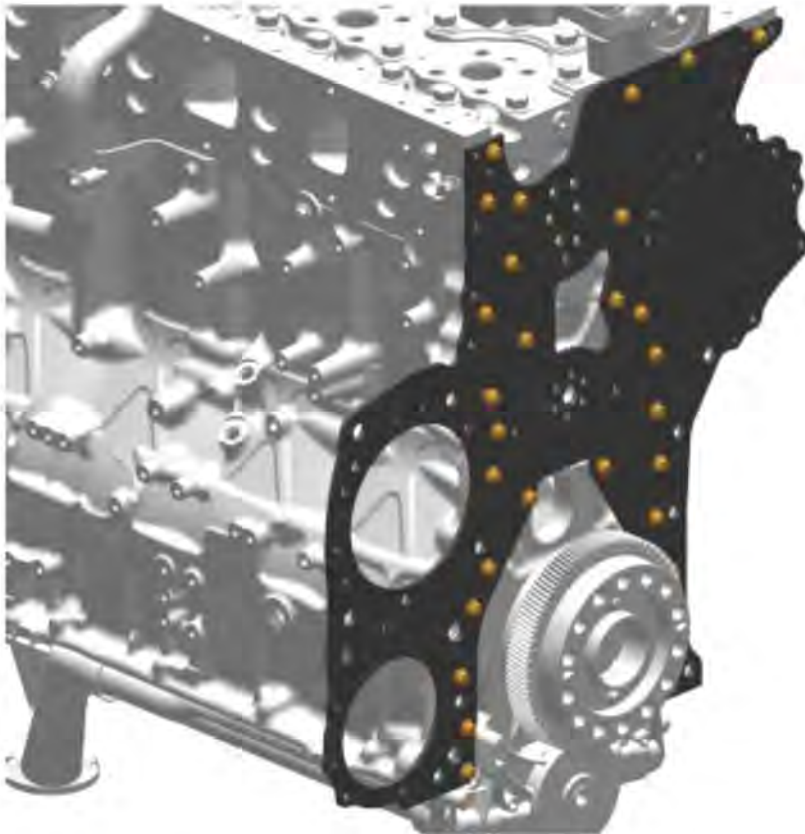
**Note**

Use new parts.



**Note**

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



225 Lubricate the O-ring.



**Note**

Use a new part.



**Note**

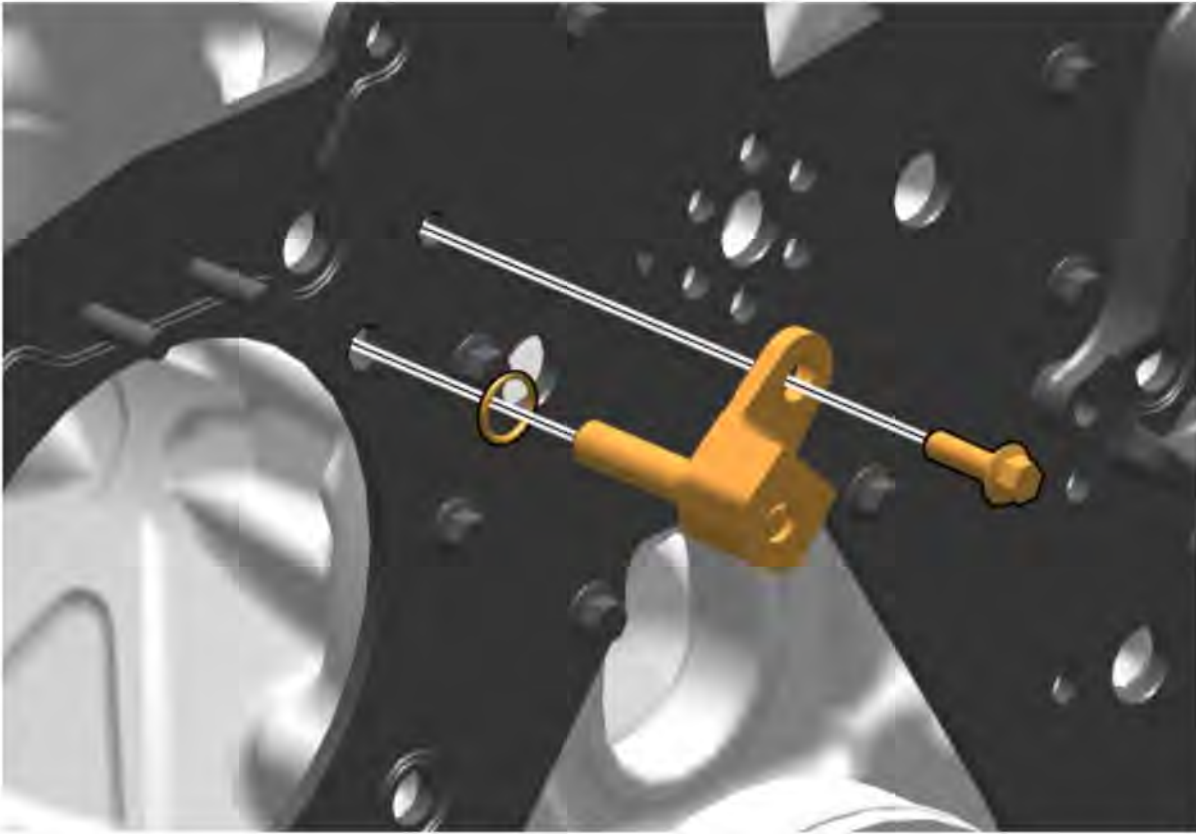
Use recommended oil.

226 Install the O-ring.

227 Install the bracket.

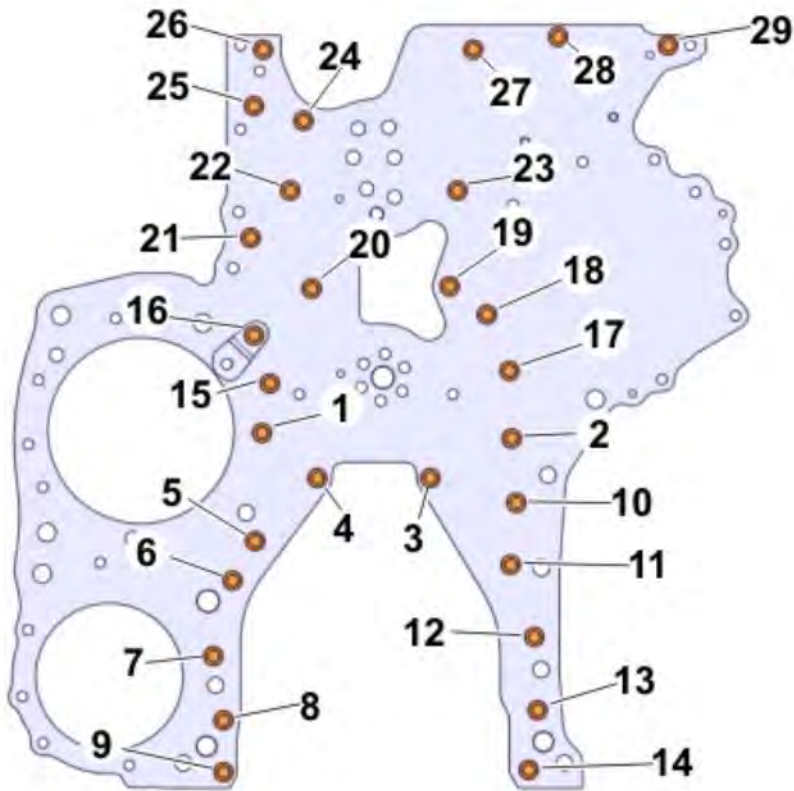
228 Install the screw.



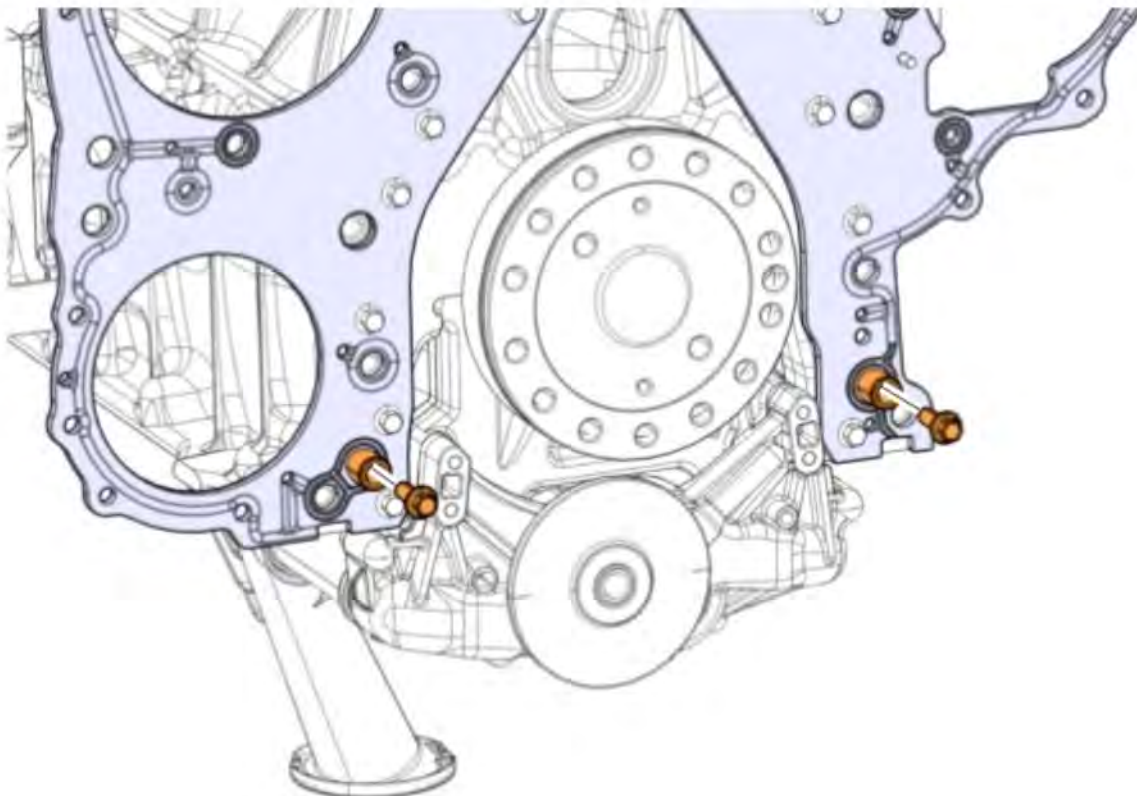


<b>229</b>	Torque tighten the screws.
------------	----------------------------

<b>Tightening torque</b>	
Timing gear plate, screw	Tightening sequence: 1 - 28
	28 ±4 Nm
	(21 ±3 lb <sub>f</sub> ·ft)



<b>230</b>	Remove the tools.
------------	-------------------



<b>231</b>	Clean the timing gear plate.
------------	------------------------------

<b>232</b>	Install the thrust washer.
------------	----------------------------

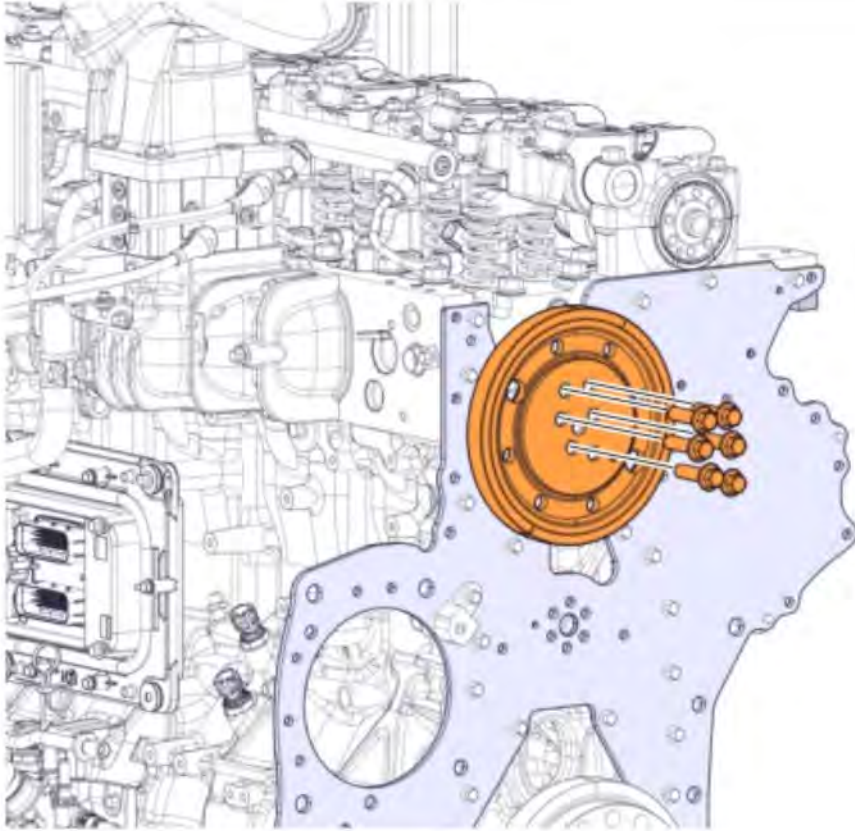


233	Install the gear.
-----	-------------------

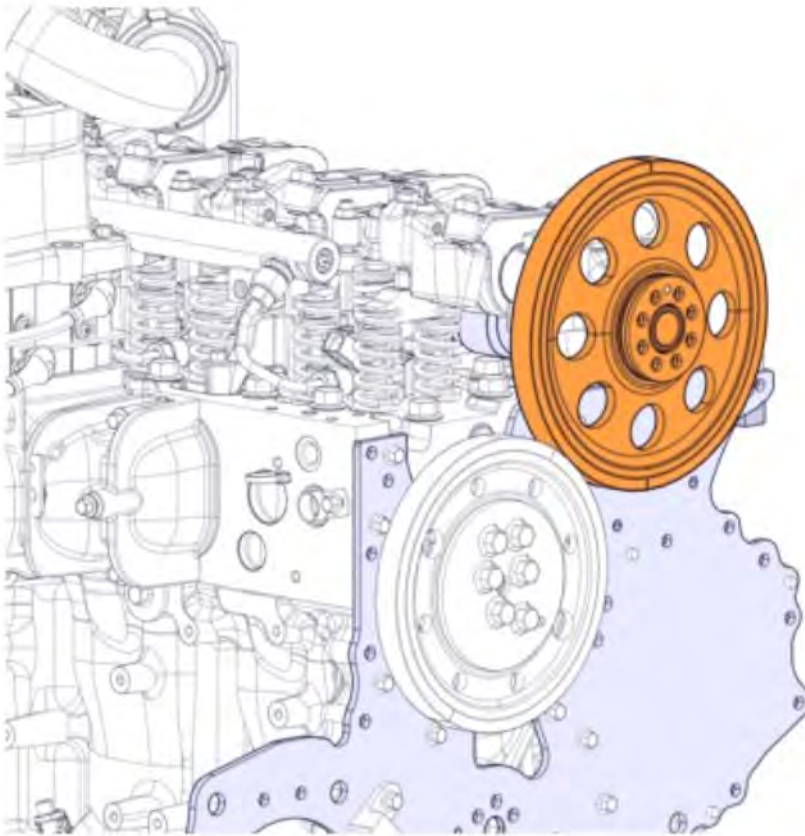
234	Install the screws.
-----	---------------------

**Note**

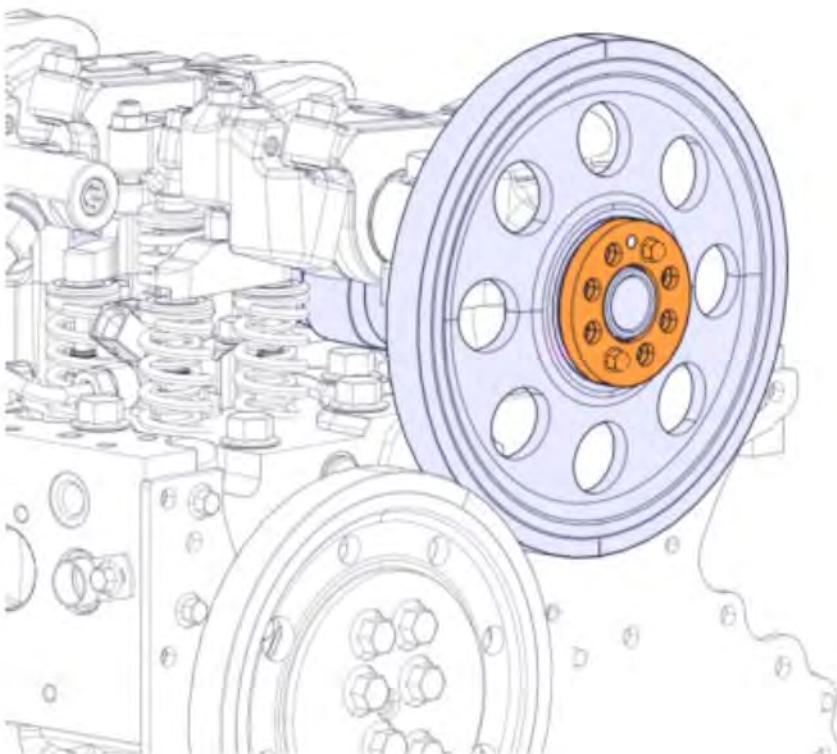
Hand tighten the screws.



235	Install the gear.
-----	-------------------

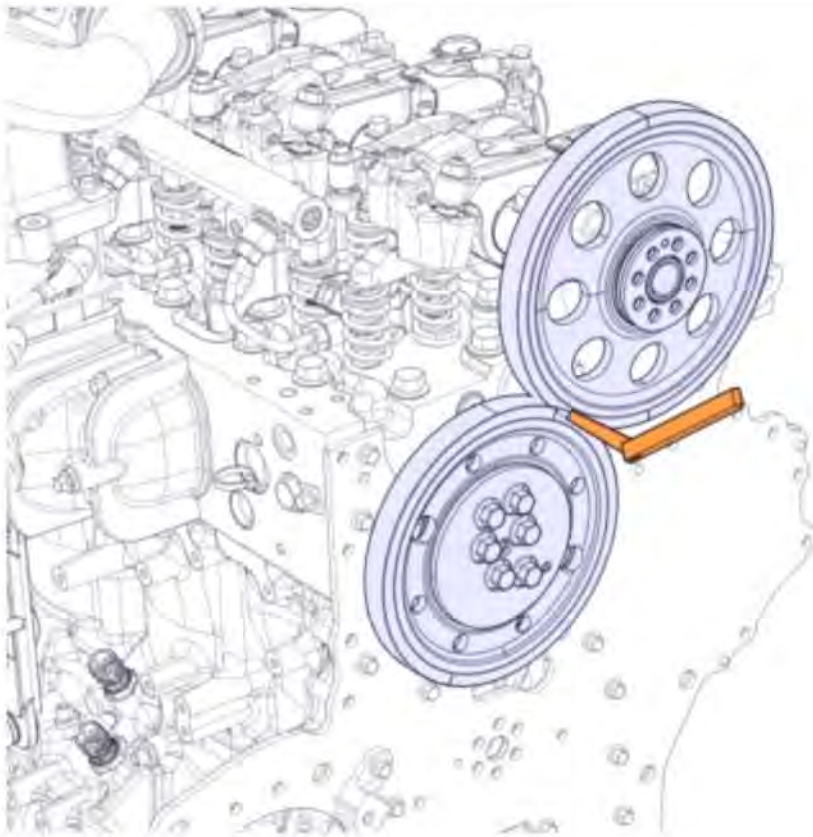


<b>236</b>	Install the tool.	
	<b>Required material</b>	
	KIT	<a href="#">J-44514B</a>



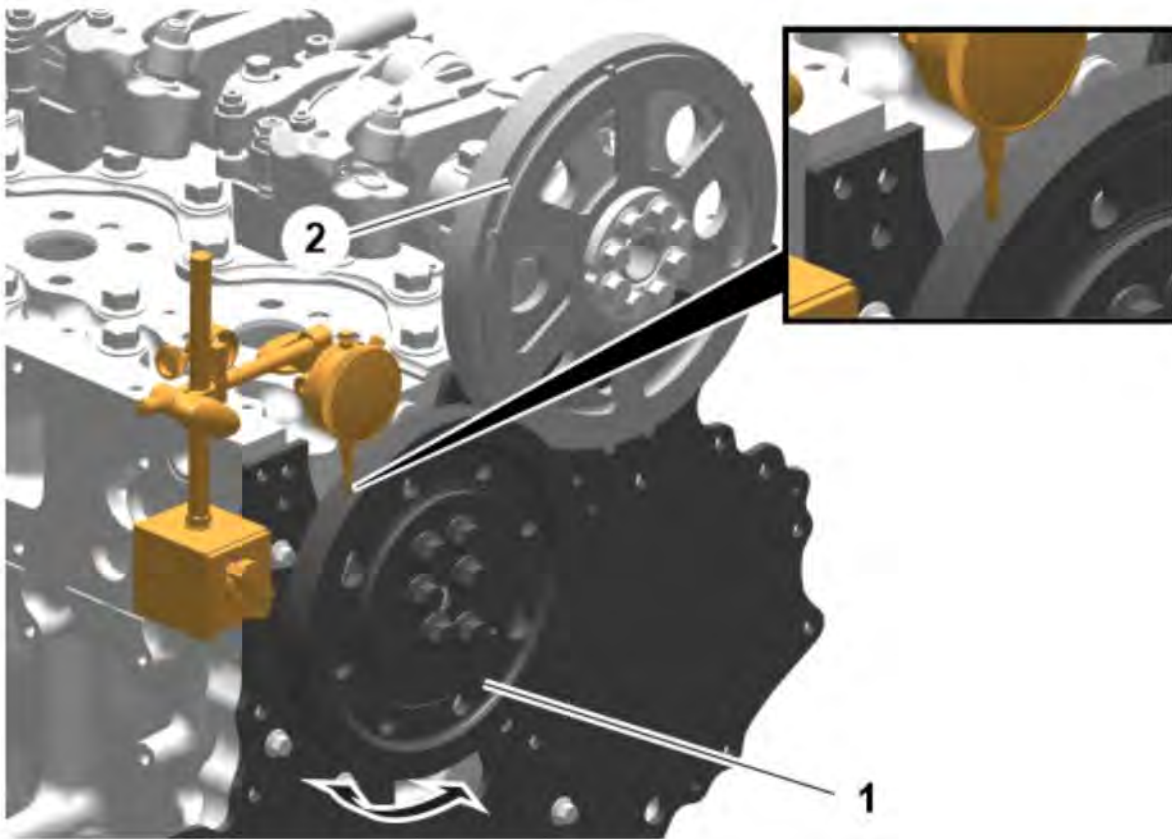


<b>237</b>	Install the feeler gauge.	
	<b>Tech data</b>	
	Feeler gauge, thickness	0.1 mm (0.004 in)

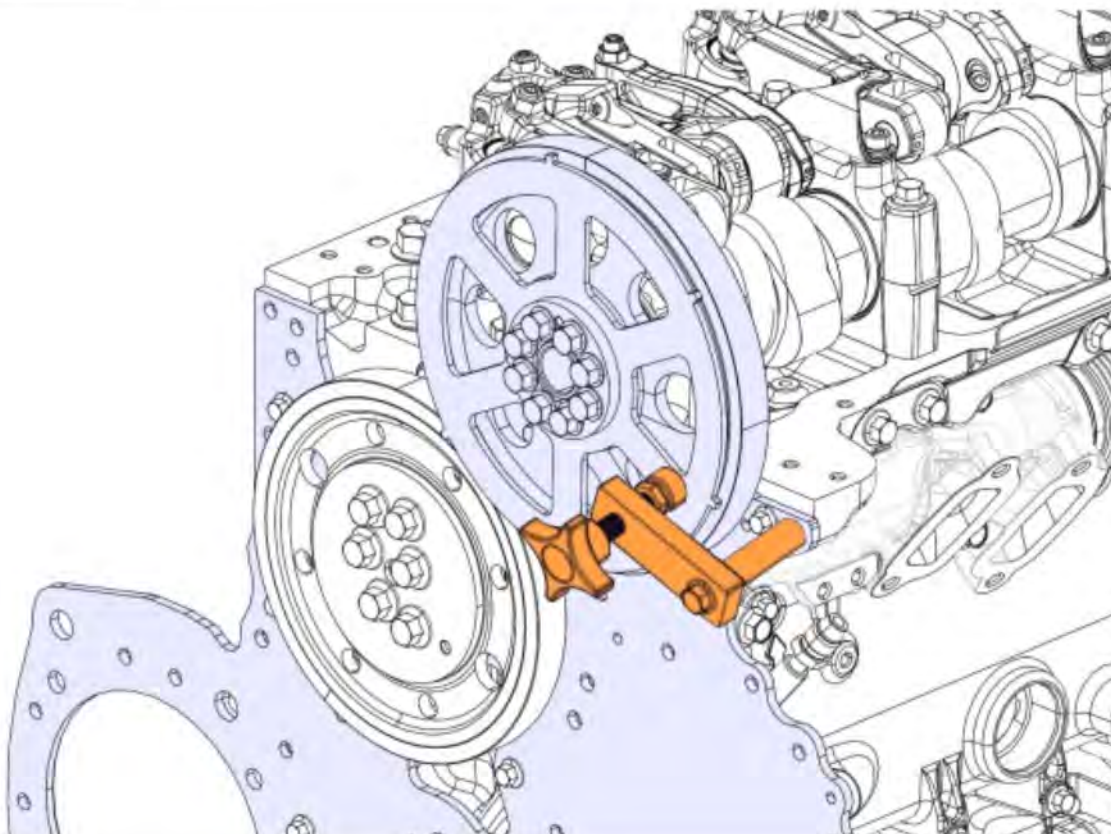


<b>238</b>	Adjust the clearance.	
	<b>i</b>	<b>Note</b> Adjust the idler gear to adjust the clearance.
<b>i</b>	<b>Note</b> Ensure that a feeler gauge inserted between the teeth is difficult to move.	

<b>239</b>	Install the tools.	
	<b>Required material</b>	
	MAGNETIC STAND	<a href="#">9999696</a>
	ROCKER_INDICATOR	<a href="#">9999683</a>
<b>i</b>	<b>Note</b> Ensure that the probe tip touches the gear tooth.	



240	Install the tool.
	<b>Required material</b>
	KIT <a href="#">J-44514B</a>

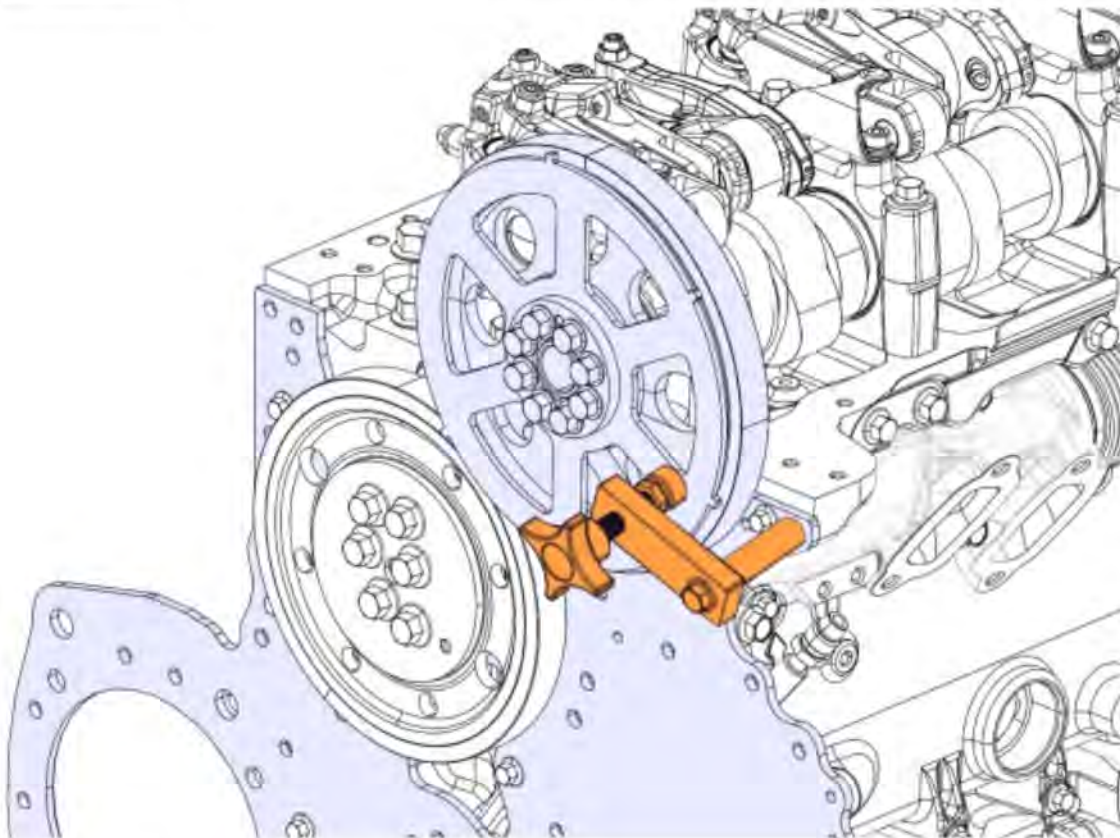




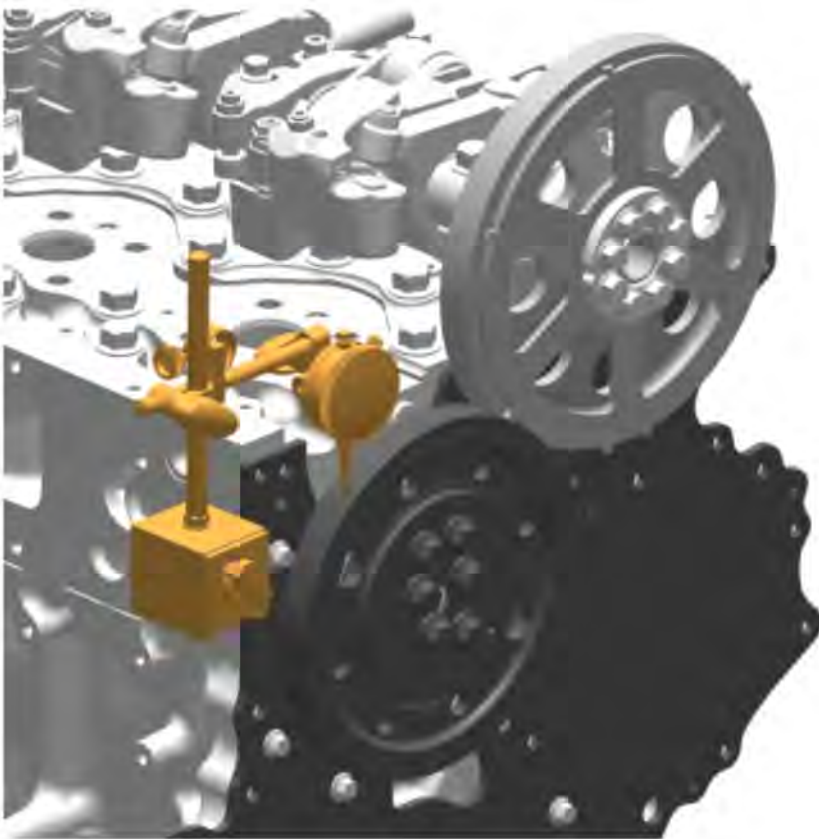
<b>241</b>	Check the backlash between gears 1 and 2.	
<b>Tech data</b>		
Backlash clearance		0.1 ±0.05 mm (0.004 ±0.002 in)

<b>242</b>	Perform this procedure when the condition below is met.			
<b>Conditions</b>				
<ul style="list-style-type: none"> <li>• If the backlash is not within specified value.</li> </ul>				
<ul style="list-style-type: none"> <li>▶ Readjust the gears.</li> </ul>				
<table border="1" style="width: 100%;"> <tr> <td style="width: 10%; text-align: center;"><b>i</b></td> <td><b>Note</b> The tool must be removed to readjust the gears.</td> </tr> </table>			<b>i</b>	<b>Note</b> The tool must be removed to readjust the gears.
<b>i</b>	<b>Note</b> The tool must be removed to readjust the gears.			

<b>243</b>	Remove the tool.
------------	------------------



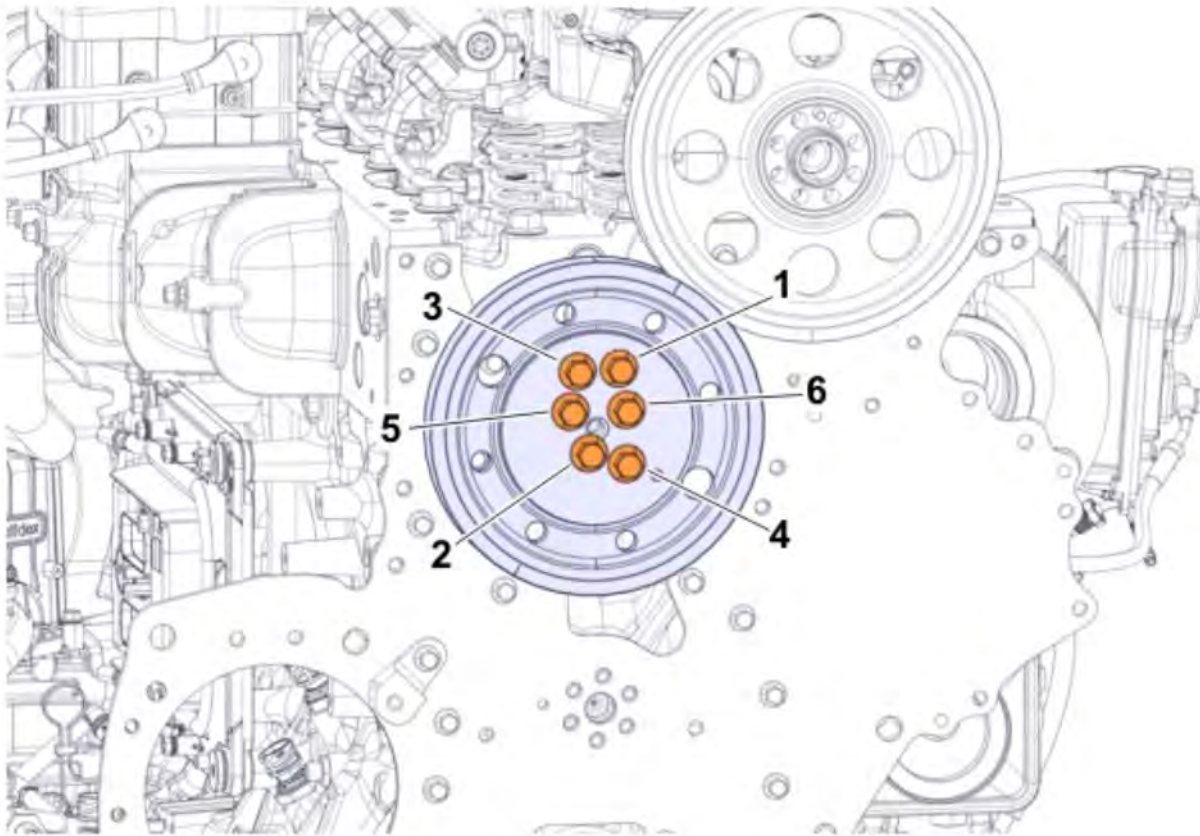
<b>244</b>	Remove the tools.
------------	-------------------



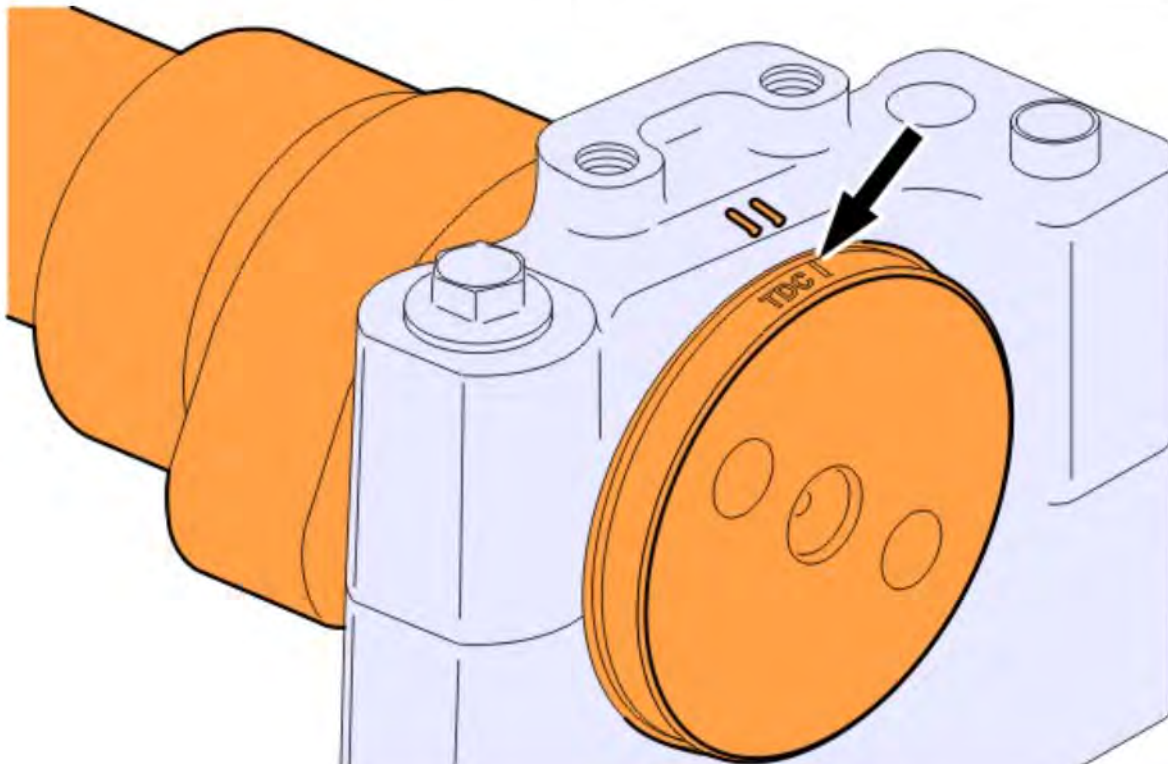
245	Torque tighten the screws.
-----	----------------------------

Tightening torque		
Idler gear, screw	1.	Tightening sequence: 1-6
		35 ±4 Nm (26 ±3 lb <sub>f</sub> -ft)
	2.	Tightening sequence: 1-6
		120 ±5°

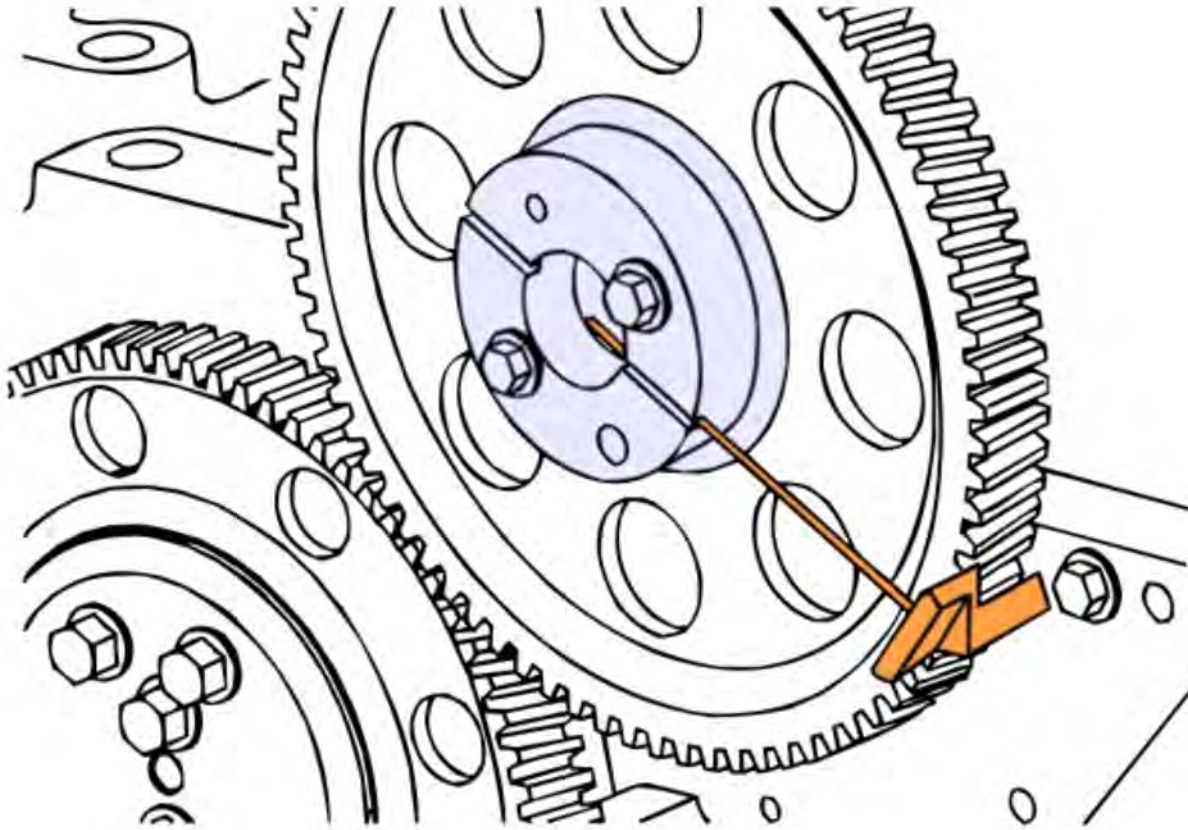




246 Verify that the camshaft position markings are at (TDC).



<b>247</b>	Install the cam gear aligner.	
	<b>Required material</b>	
	KIT	<a href="#">J-44514B</a>



248 Install the gears.



**Note**

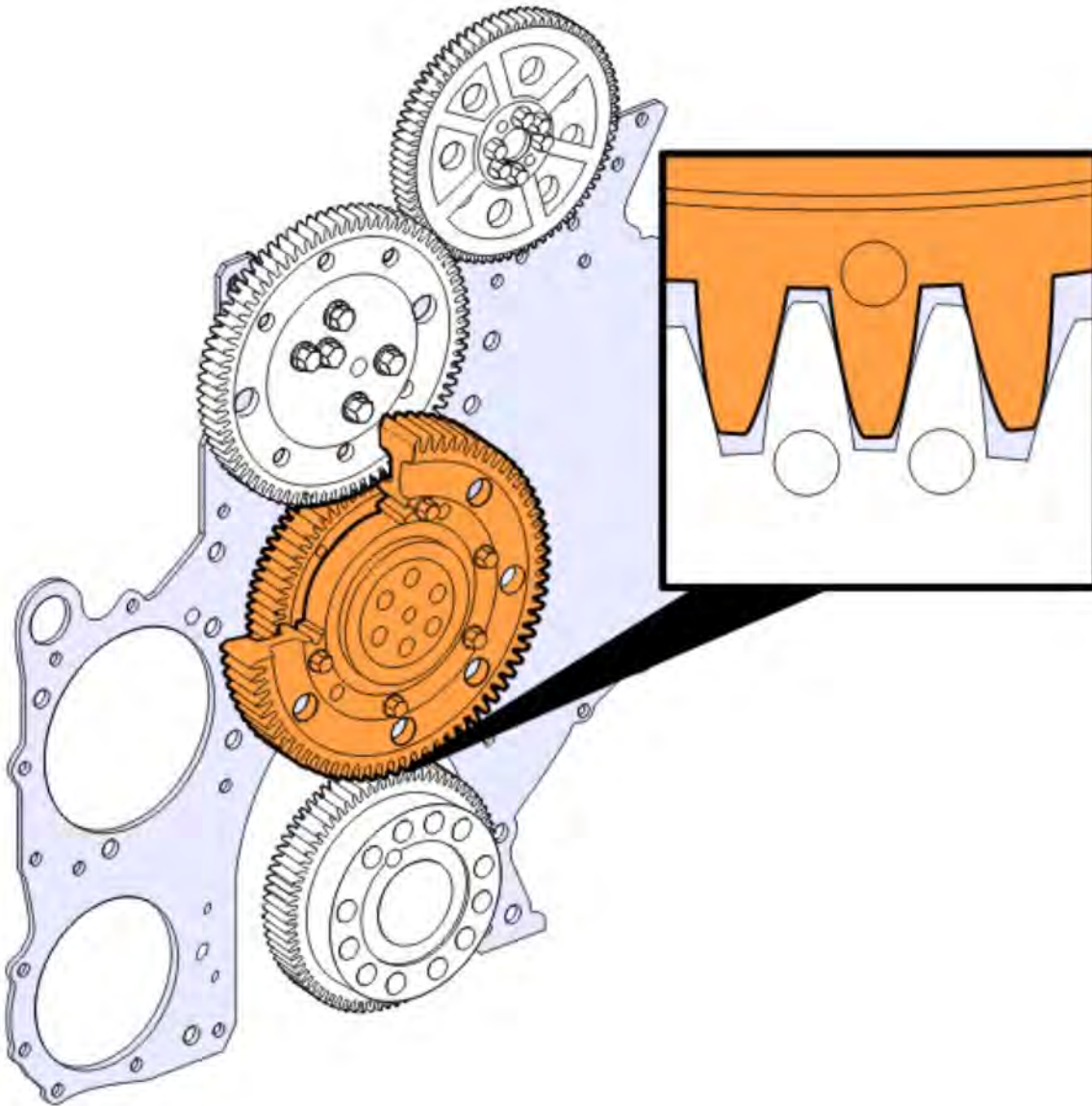
Ensure the markings correctly align.



**Note**

Remove the cam gear aligner.

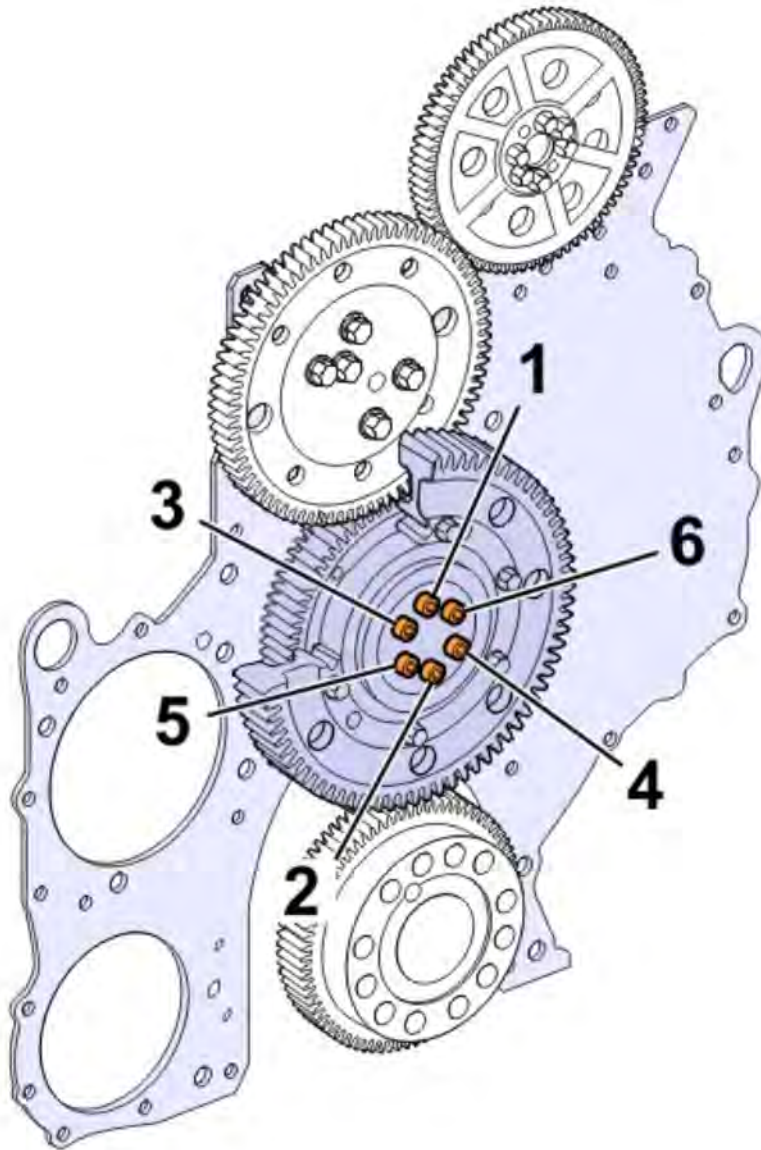




<b>249</b>	Install the screws.				
	<table border="1" style="width: 100%;"> <tr> <td style="text-align: center;"><b>i</b></td> <td><b>Note</b></td> </tr> <tr> <td></td> <td>Use new parts.</td> </tr> </table>	<b>i</b>	<b>Note</b>		Use new parts.
<b>i</b>	<b>Note</b>				
	Use new parts.				

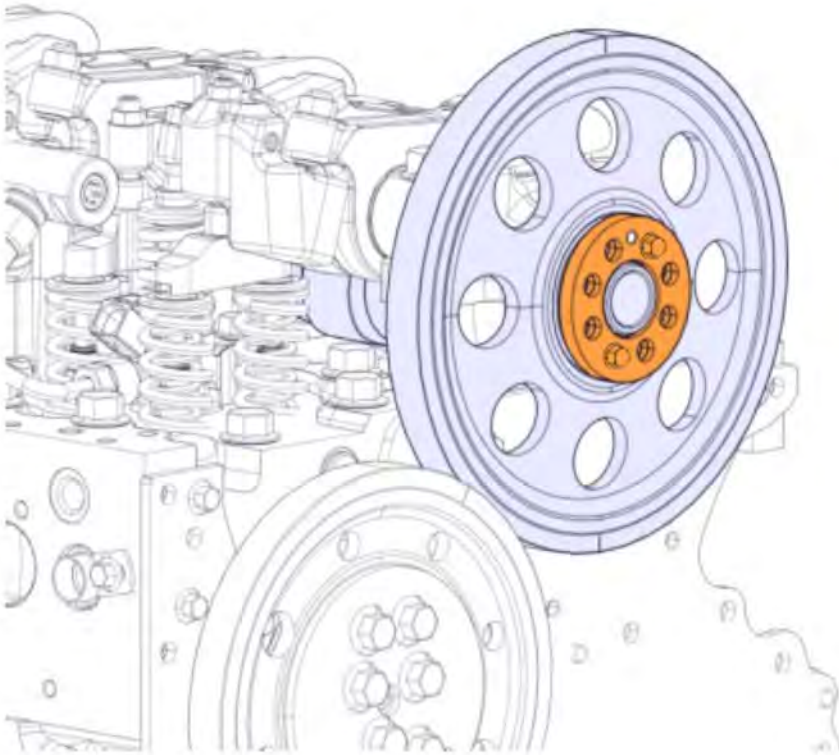
<b>250</b>	Torque tighten the screws.
------------	----------------------------

<b>Tightening torque</b>		
Double idler gear, screw	1.	Tightening sequence: 1-6
		25 ±3 Nm
		(18 ±2 lb <sub>f</sub> -ft)
	2.	Tightening sequence: 1-6
		110 ±5°



251	Remove the tool.
-----	------------------



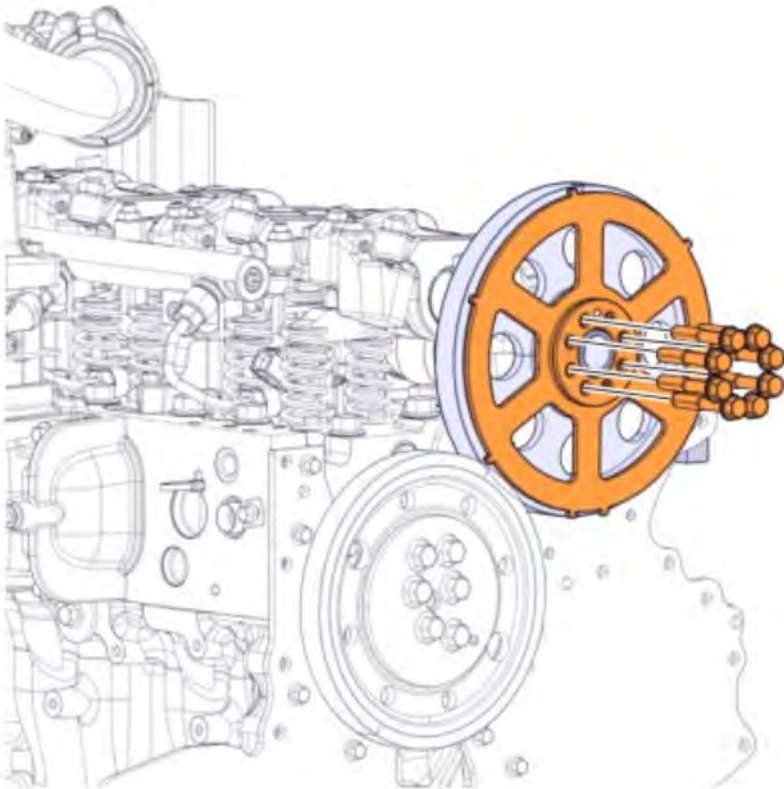


252 Install the tone wheel and screws.



**Note**

Use new screws.

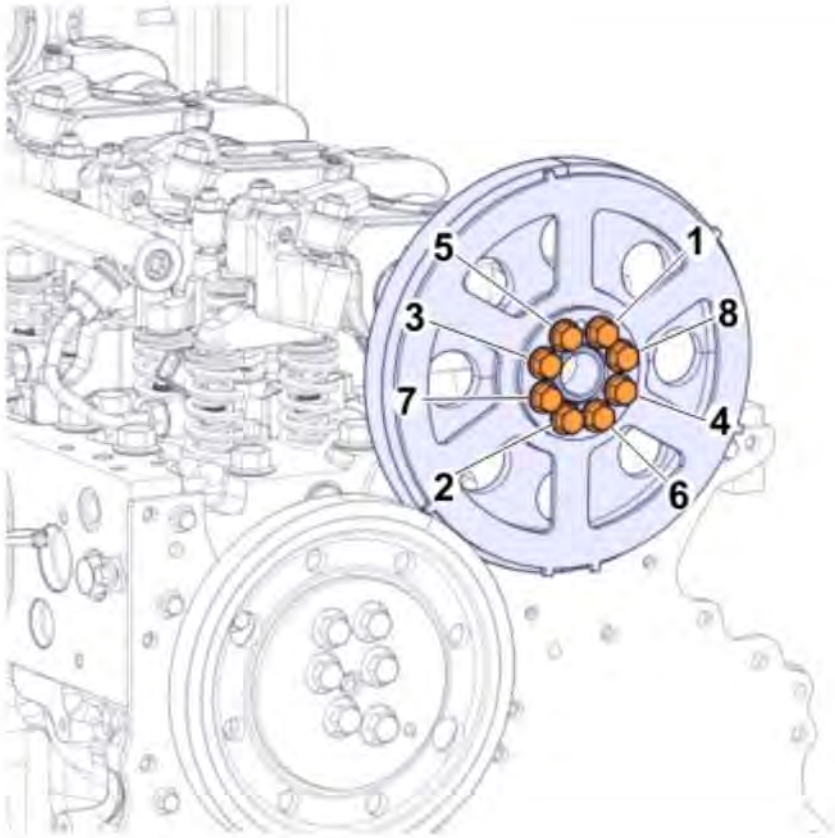


253 Torque tighten the screws.

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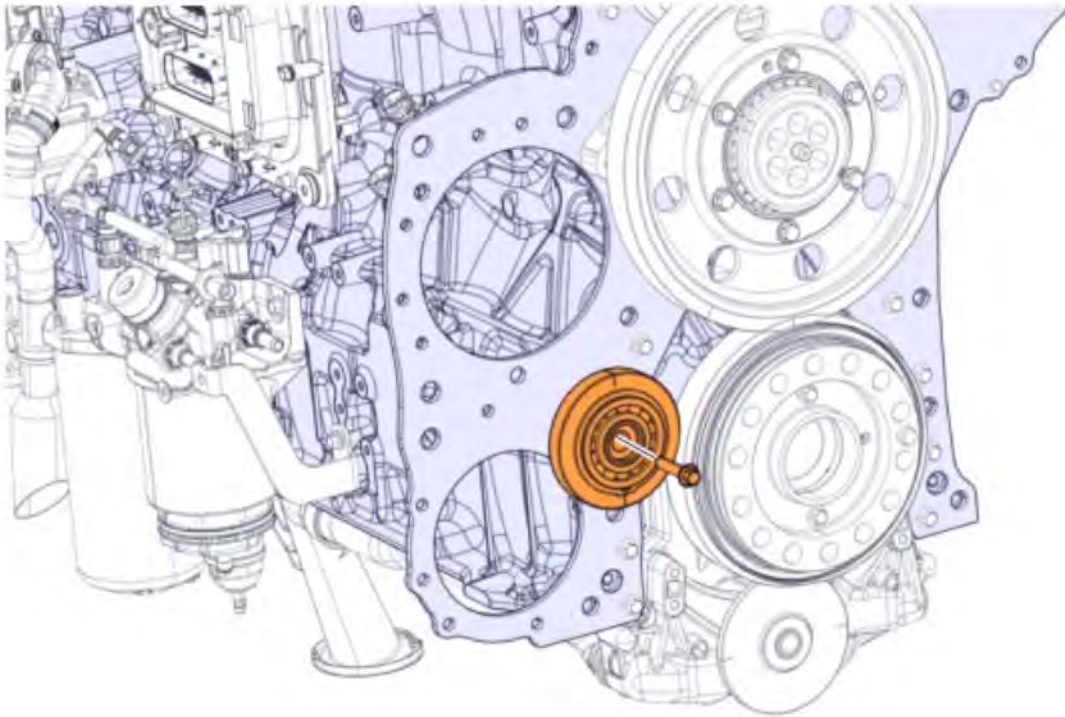
The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.

Tightening torque		
Camshaft gear, screw	1.	Tightening sequence: 1-8
		45 ±5 Nm (33 ±4 lb <sub>f</sub> .ft)
	2.	Tightening sequence: 1-8
		90 ±5°

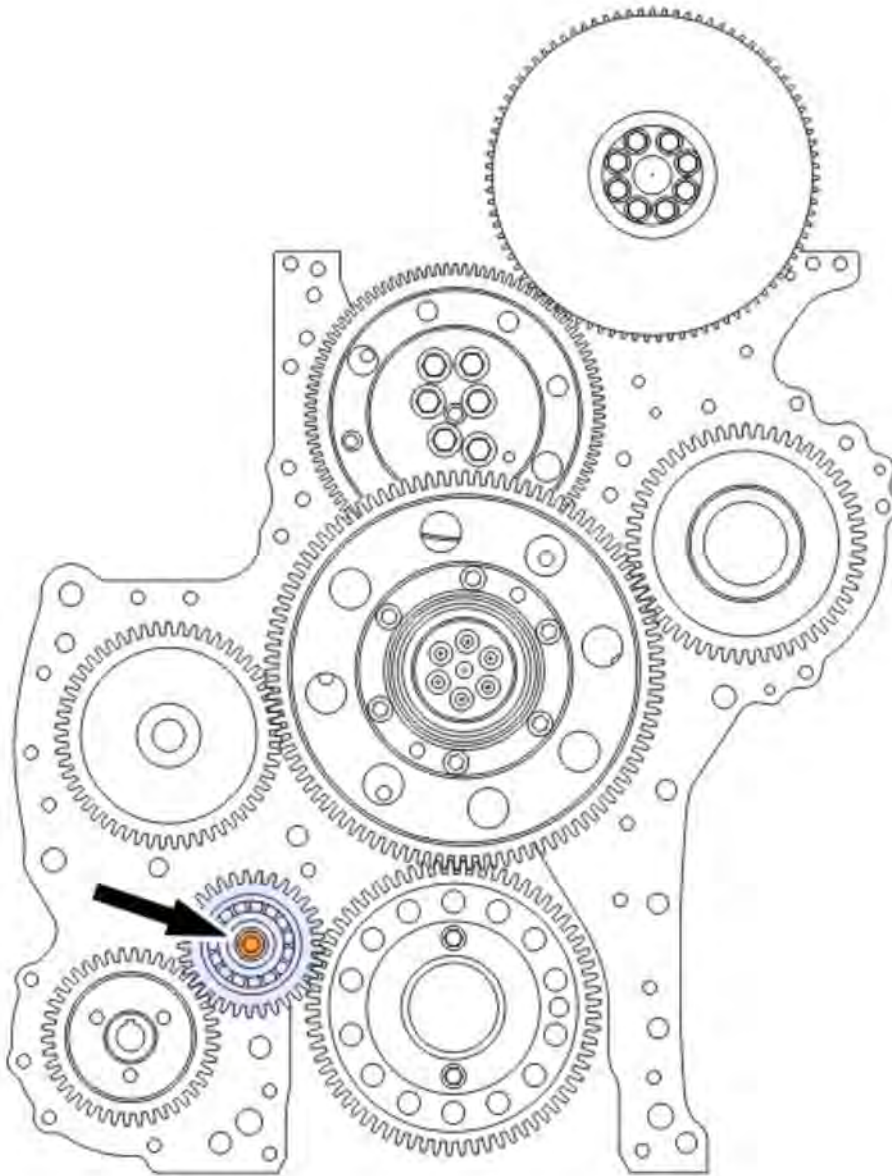


- 254 Install the gear.
- 255 Install the screw.
- 256 Torque tighten the screw.





Tightening torque	
Idler gear, servo pump, screw	140 ±10 Nm (103 ±7 lb <sub>f</sub> ·ft)



257 Clean the contact surfaces carefully.



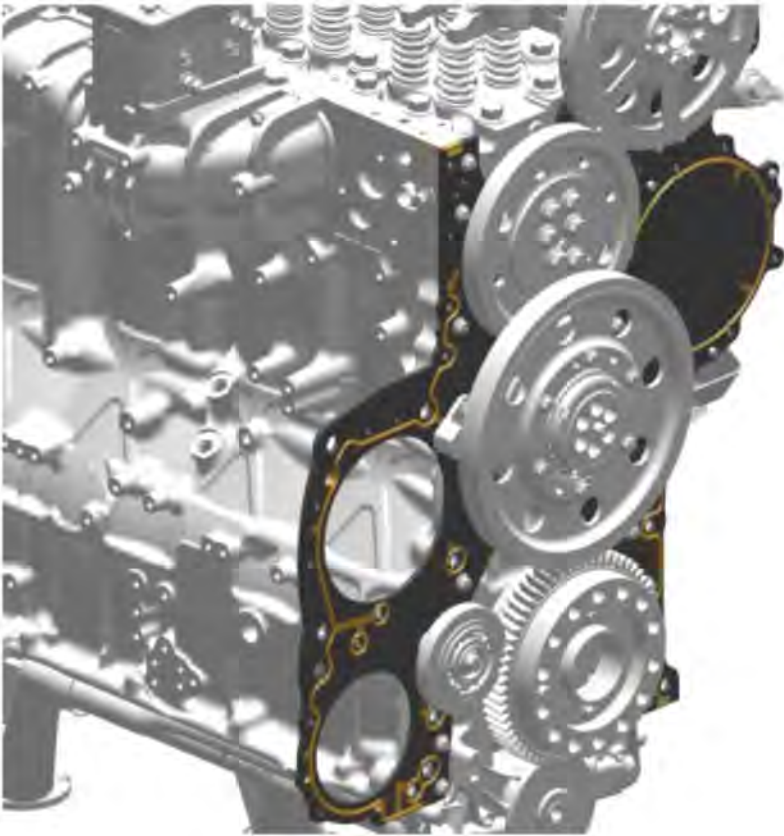
**Note**

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

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

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

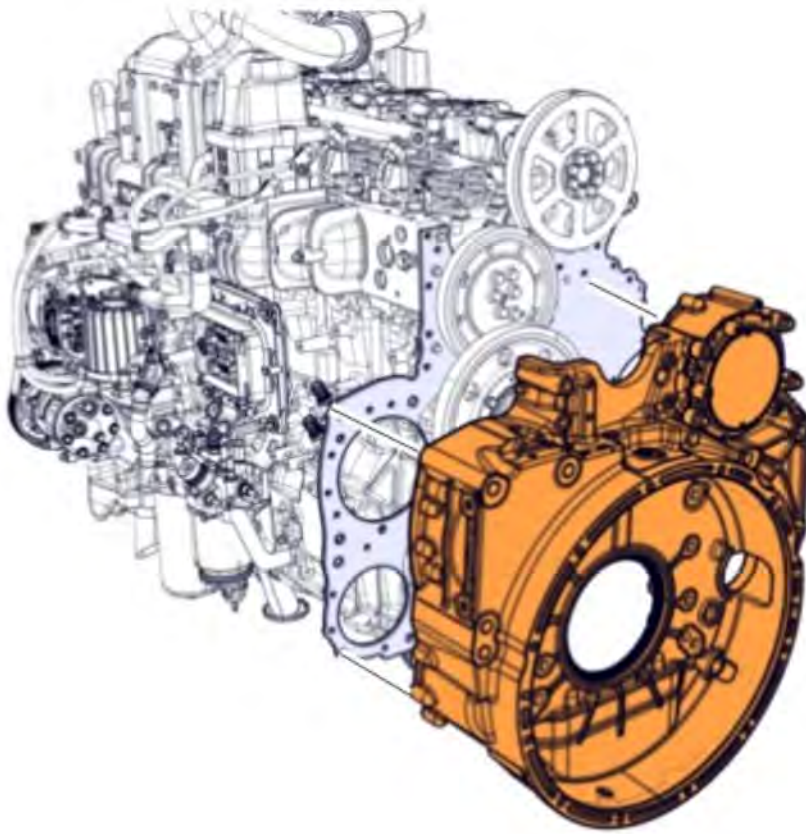


**CAUTION****Risk of serious injury.**

Heavy component.

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

**260** Install the flywheel housing.



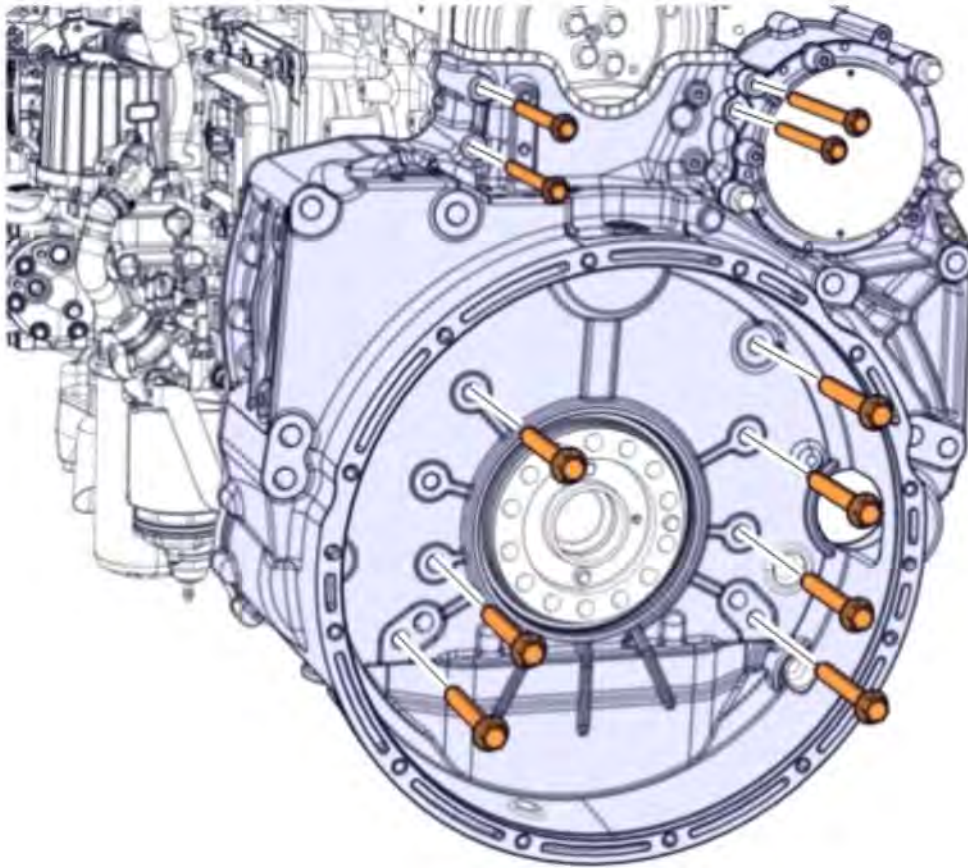
261 Install the screws.



**Note**

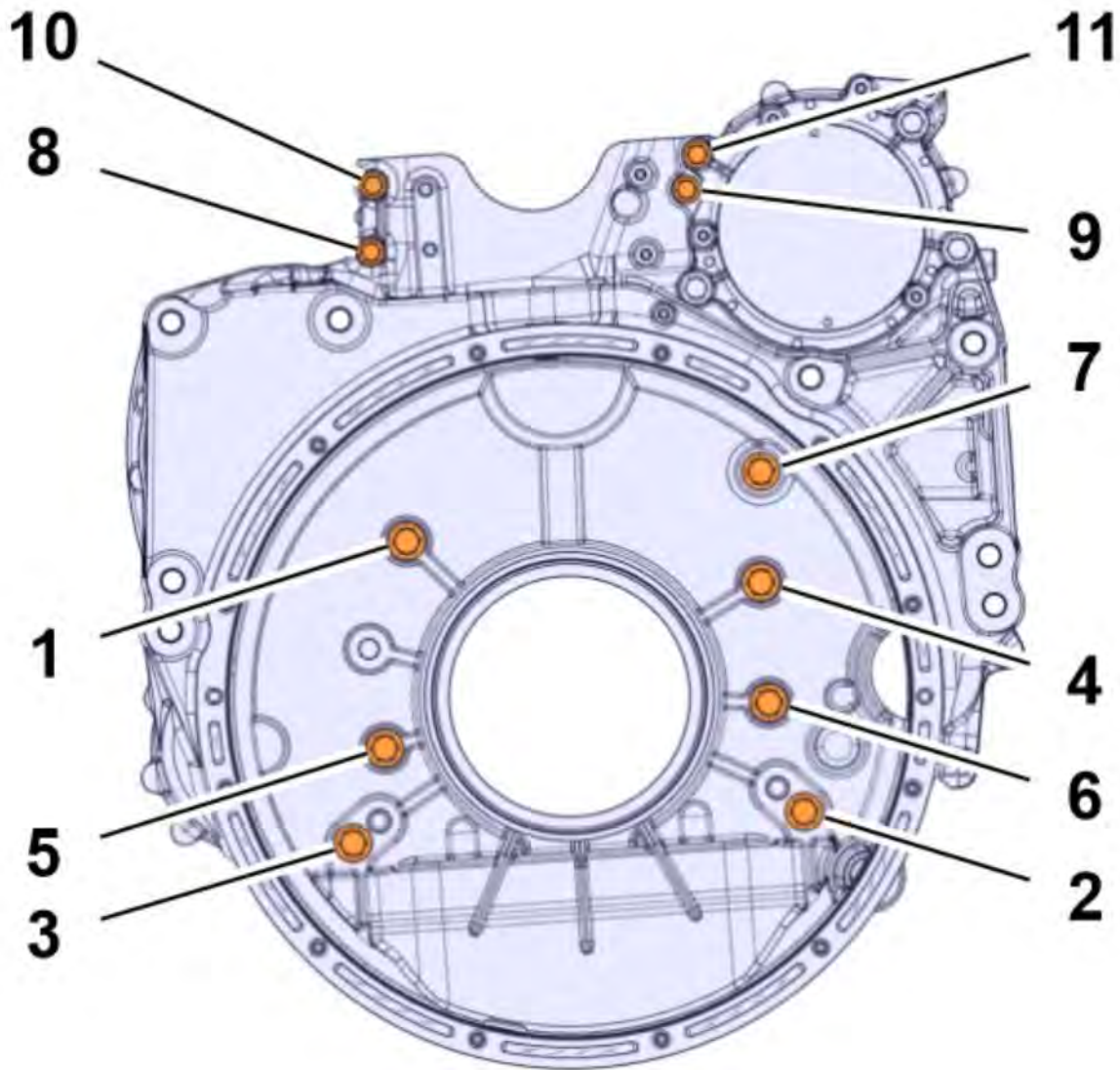
Remove the alignment dowels.





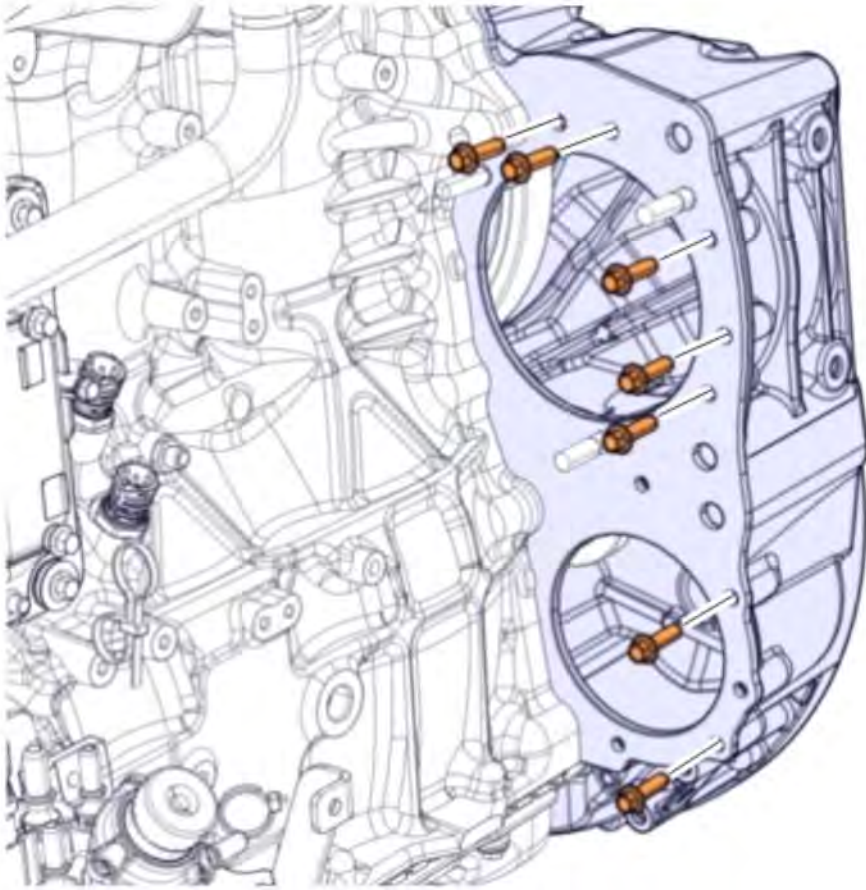
262 Torque tighten the screws.

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



<b>263</b>	Install the screws.		
	<table border="1" style="width: 100%;"> <tr> <td style="width: 20px; text-align: center;"><b>i</b></td> <td><b>Note</b> Some housings may not include all the screws shown.</td> </tr> </table>	<b>i</b>	<b>Note</b> Some housings may not include all the screws shown.
<b>i</b>	<b>Note</b> Some housings may not include all the screws shown.		

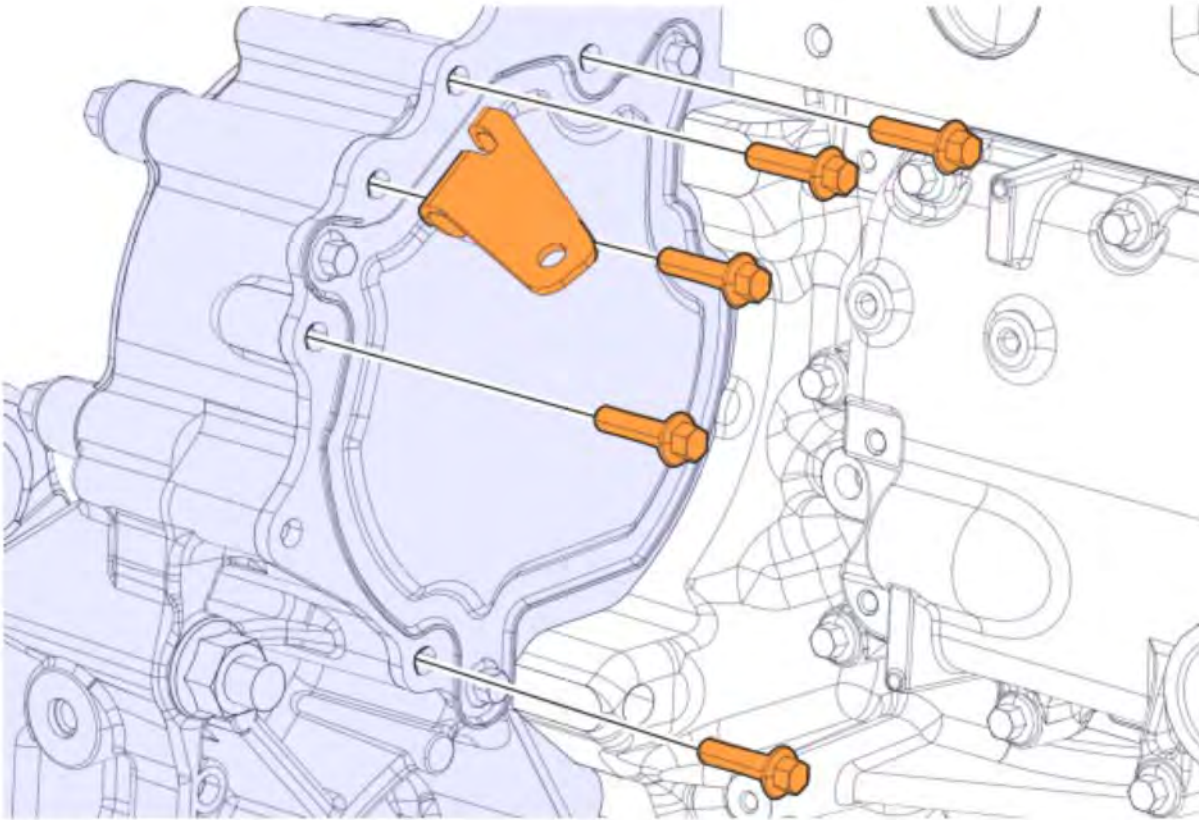
<b>264</b>	Torque tighten the screws.	
	<b>Tightening torque</b>	
	Screw	M8
		24 ±4 Nm
		(18 ±3 lb <sub>f</sub> -ft)



265	Install the bracket and the screws.
-----	-------------------------------------

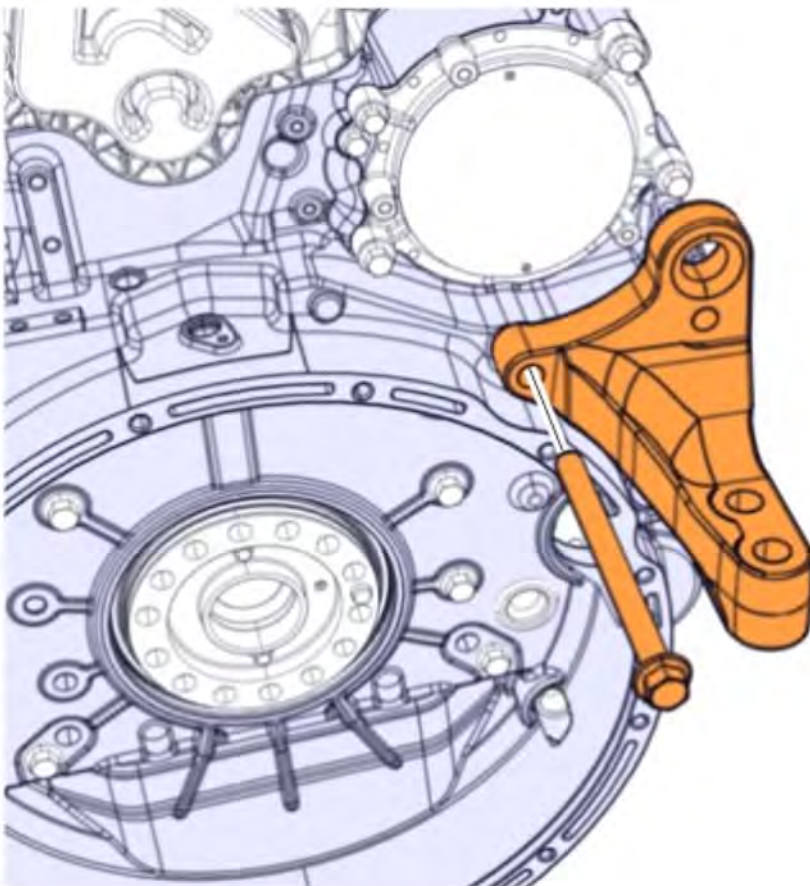
266	Torque tighten the screws.	
	<b>Tightening torque</b>	
	Screw	M8
		24 ±4 Nm
		(18 ±3 lb <sub>f</sub> -ft)





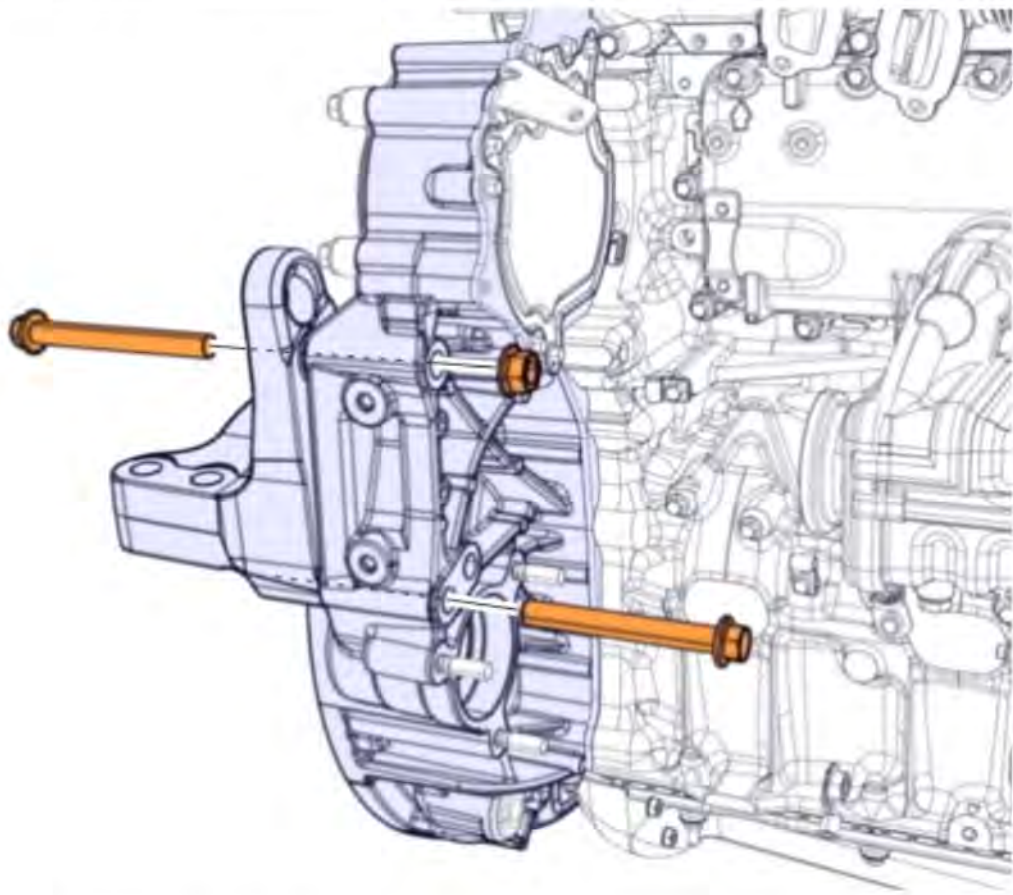
<b>267</b>	Install the bracket.
------------	----------------------

<b>268</b>	Install the screw.
------------	--------------------



<b>269</b>	Install the screw.
------------	--------------------

270 Install the screw and nut.

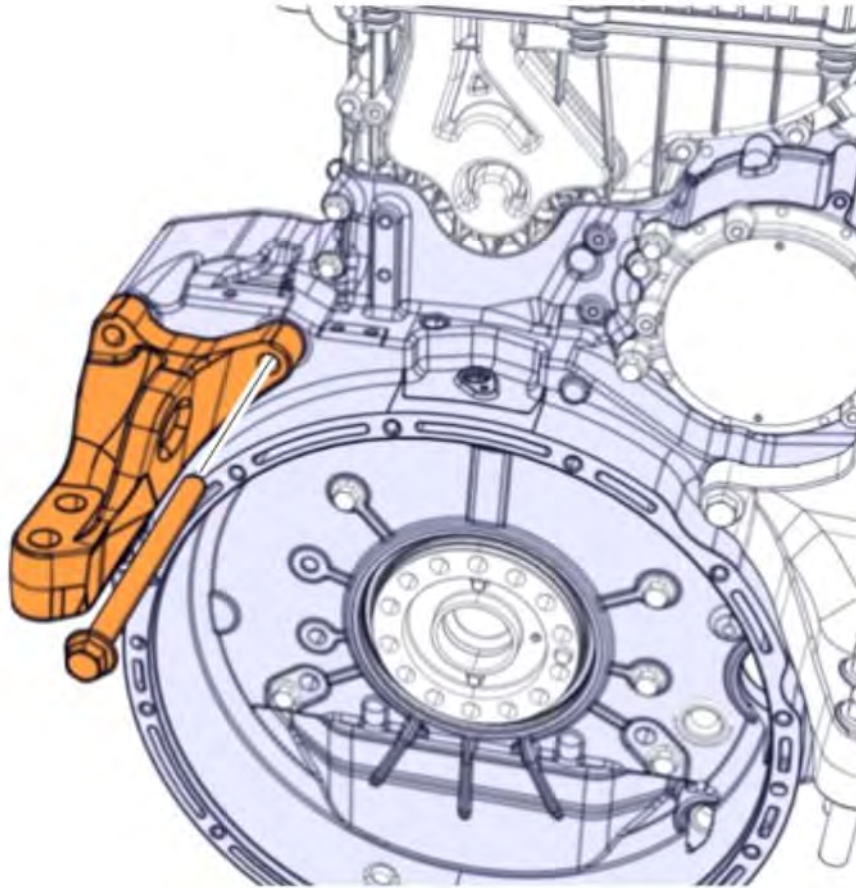


271	Torque tighten the screws and nut.	
	<b>Tightening torque</b>	
	Engine bracket, flywheel housing, rear, screw	275 ±45 Nm (203 ±33 lb <sub>f</sub> -ft)

272 Install the bracket.

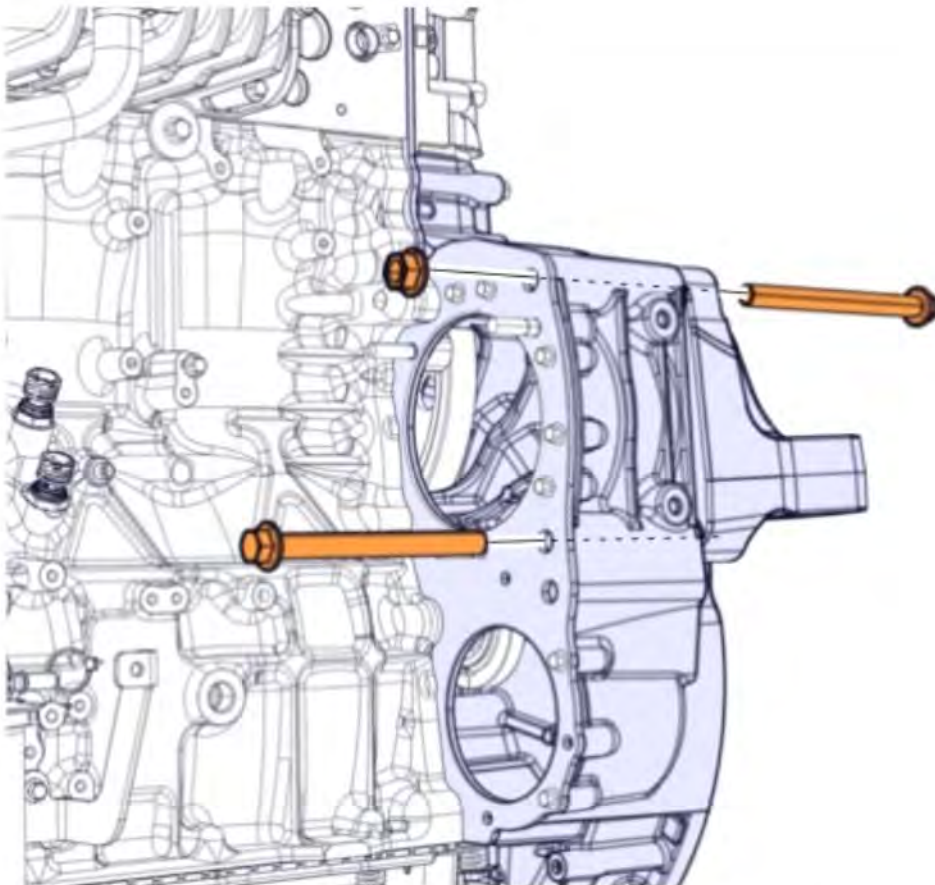
273 Install the screw.





274	Install the screw.
-----	--------------------

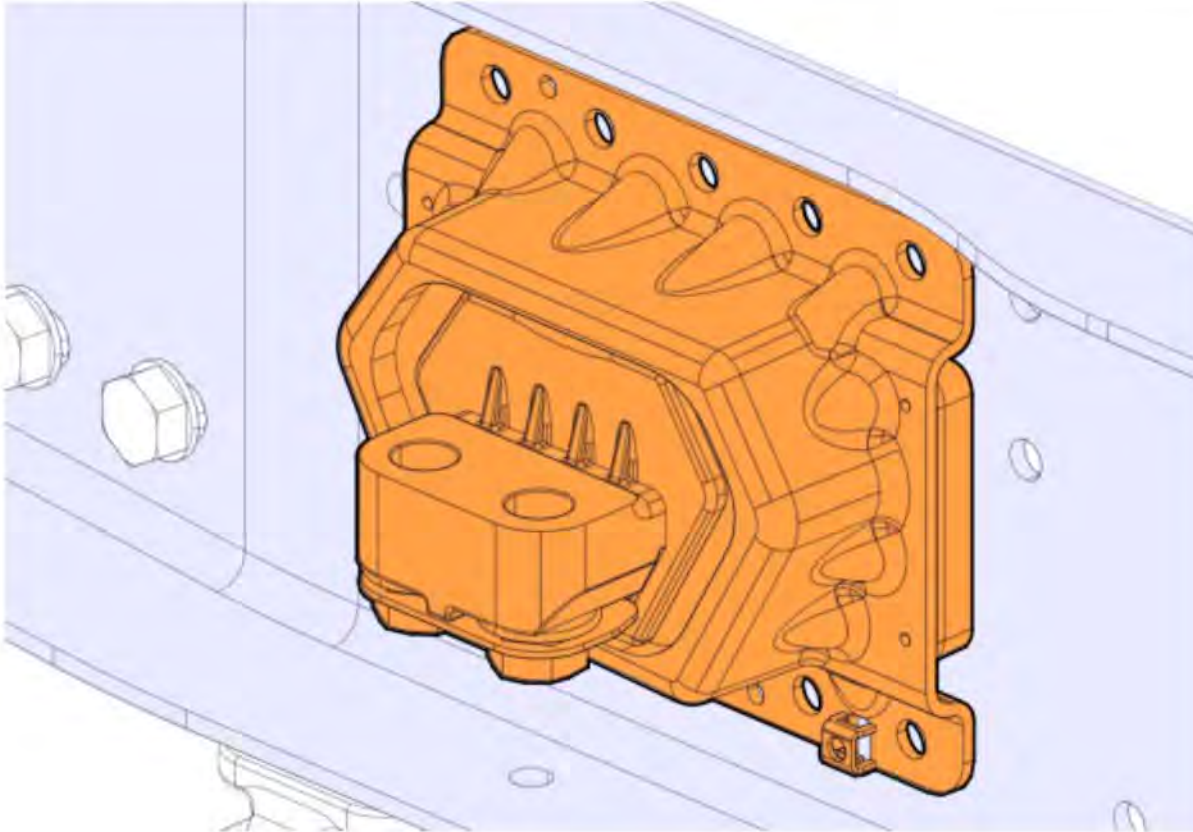
275	Install the screw and nut.
-----	----------------------------



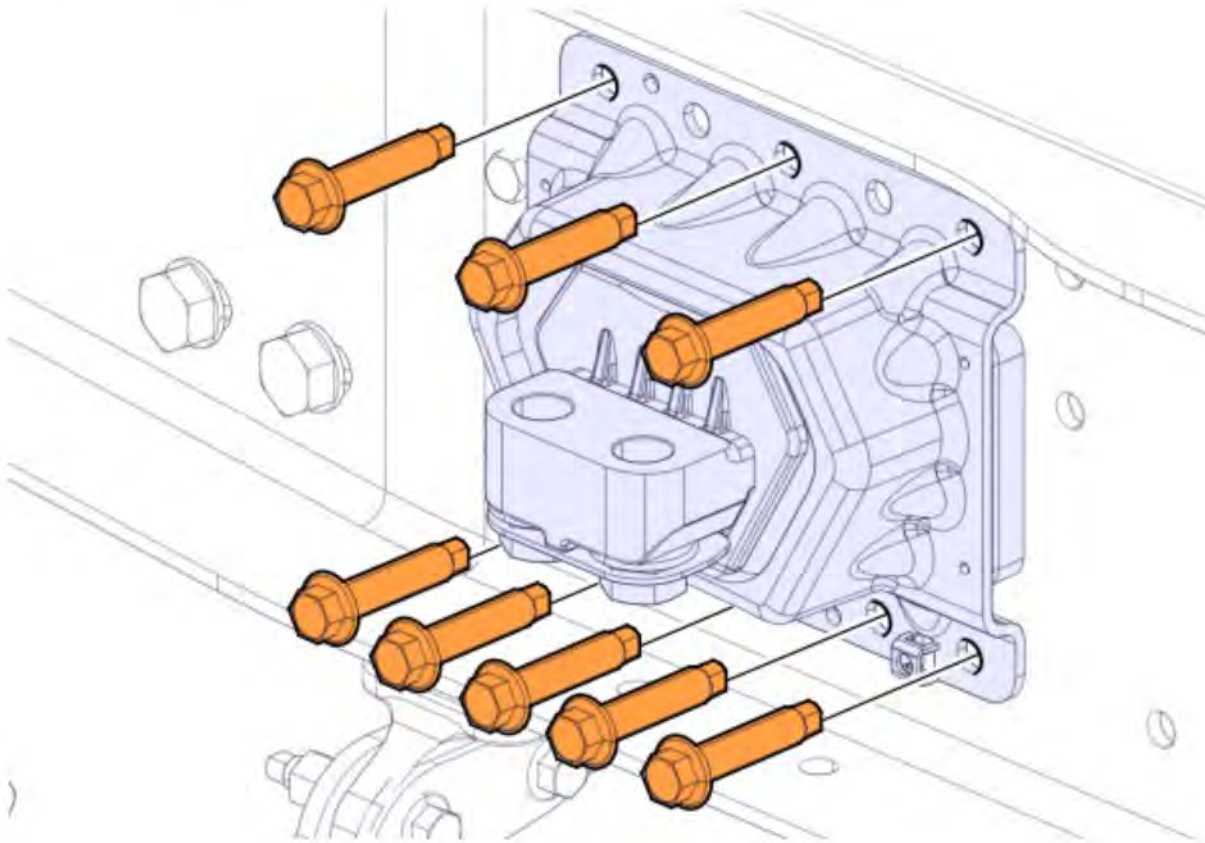


276	Torque tighten the screws and nut.	
	<b>Tightening torque</b>	
	Engine bracket, flywheel housing, rear, screw	275 ±45 Nm (203 ±33 lb <sub>f</sub> ·ft)

277	Install the rubber cushion.
-----	-----------------------------

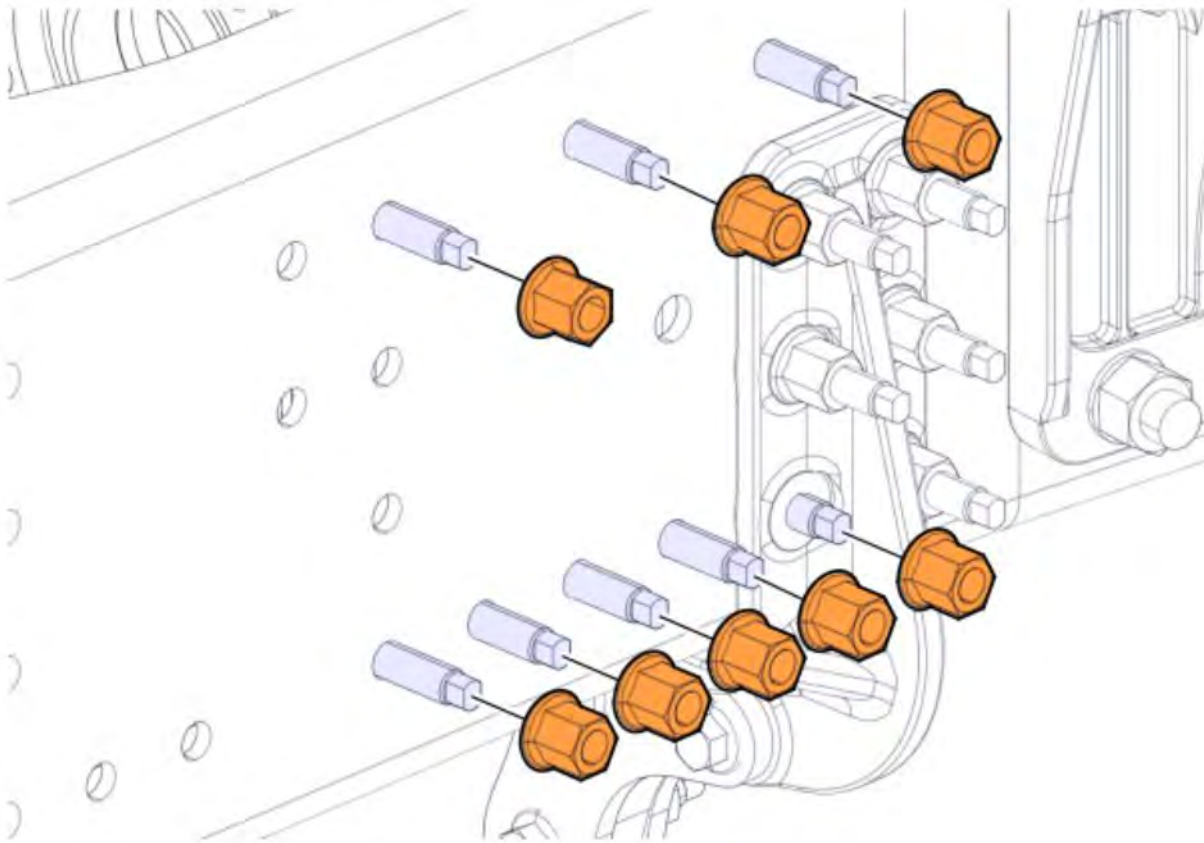


278	Install the screws.
-----	---------------------

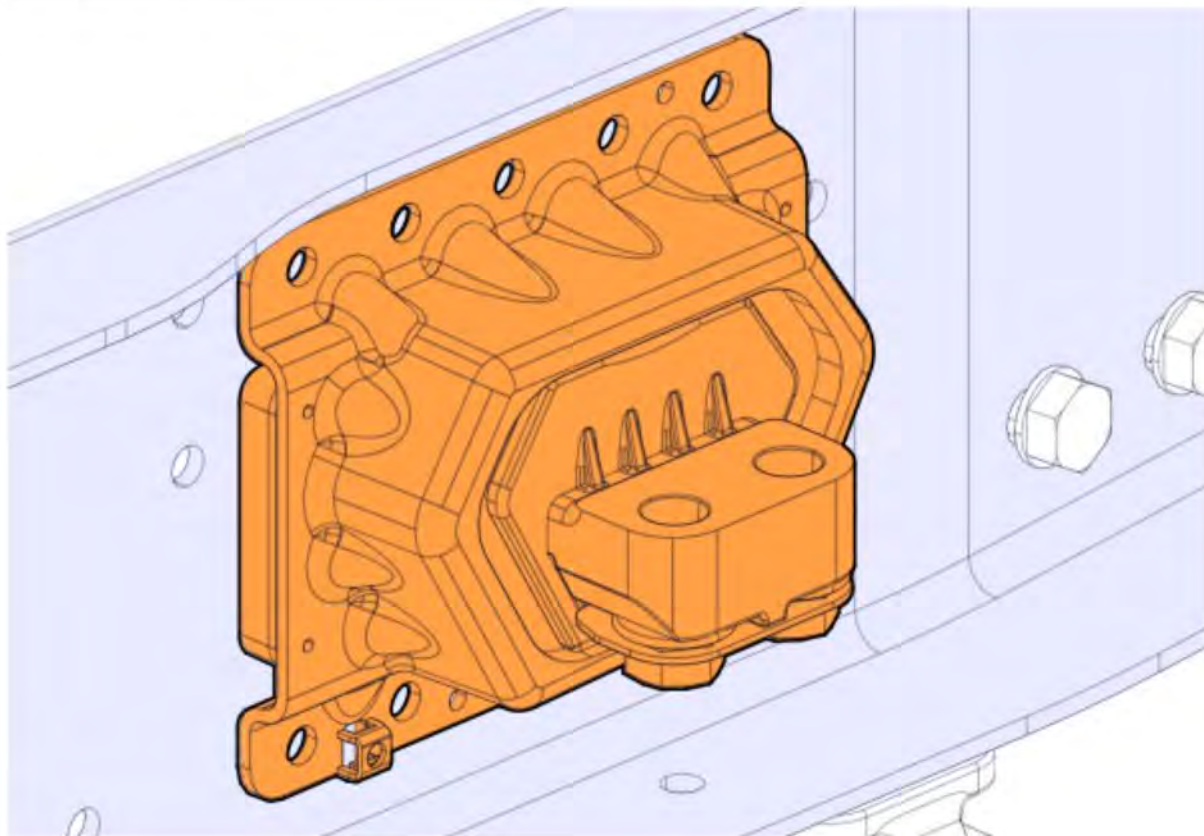


279	Install the nuts.	
280	Torque tighten the nuts.	
	<b>Tightening torque</b>	
	Rear cushion, screw	140 ±25 Nm (103 ±18 lb <sub>f</sub> -ft)

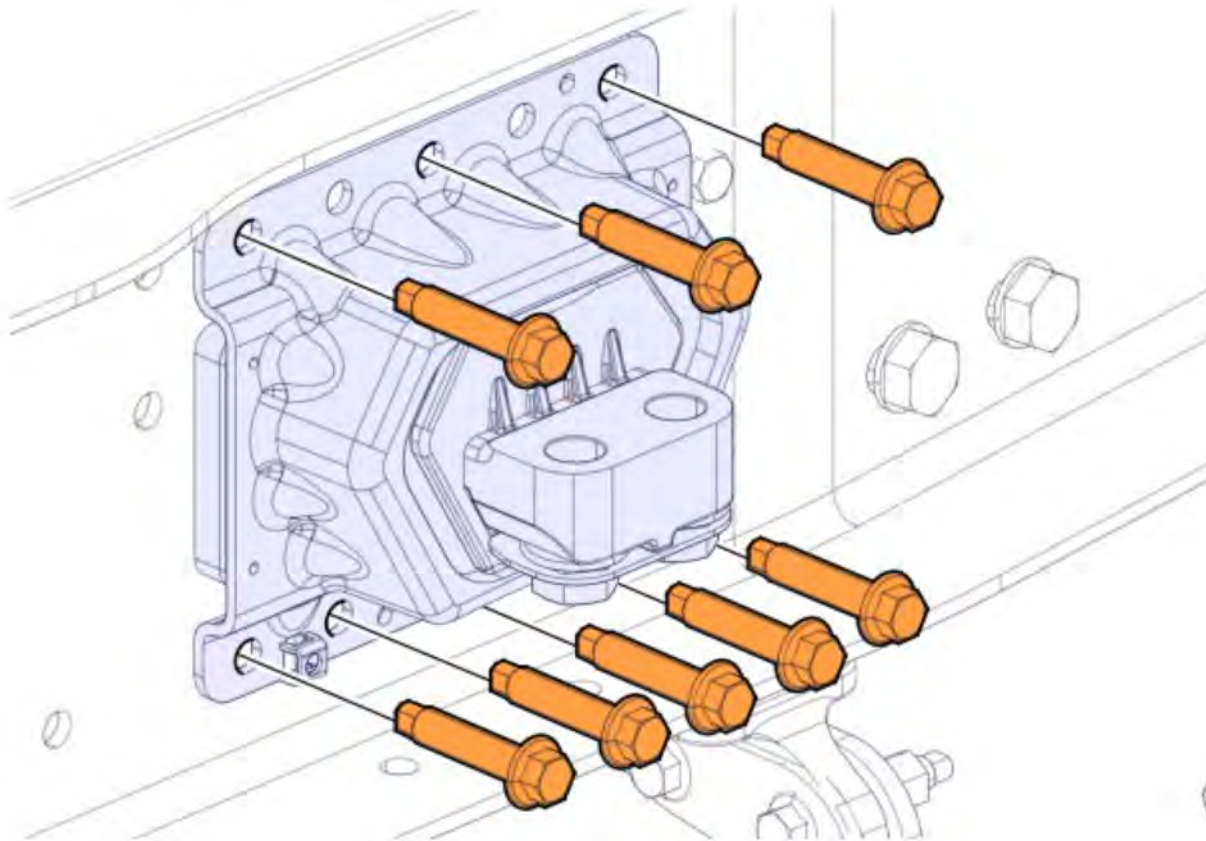




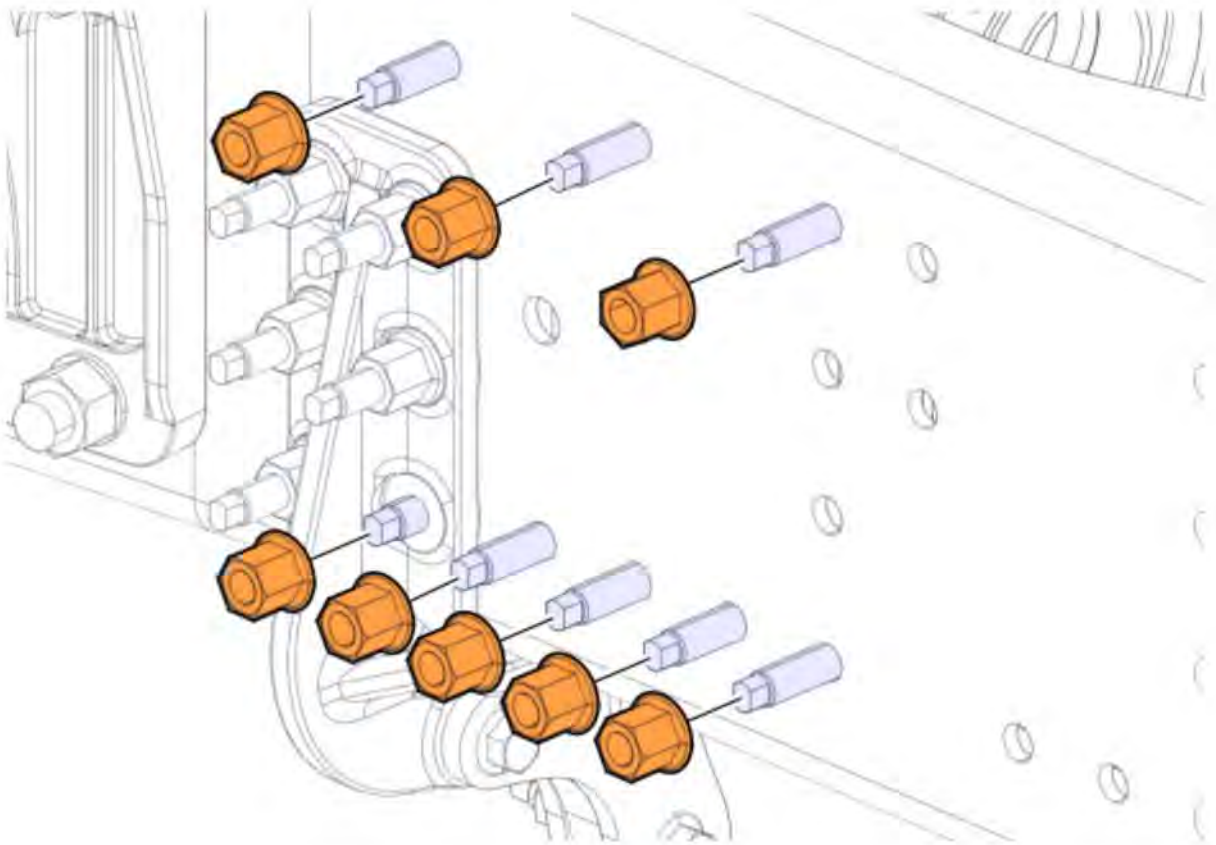
**281** Install the rubber cushion.



**282** Install the screws.

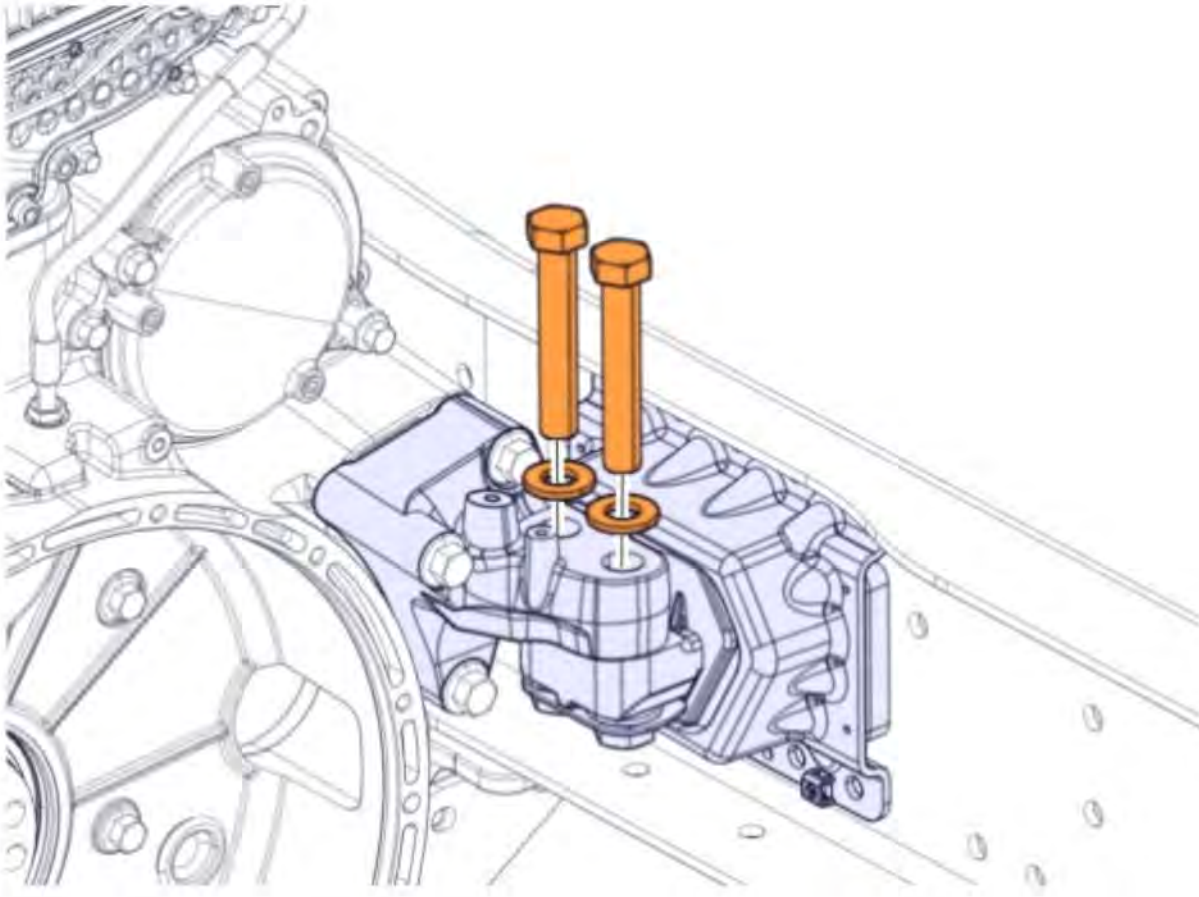


283	Install the nuts.	
284	Torque tighten the nuts.	
	<b>Tightening torque</b>	
	Rear cushion, screw	140 ±25 Nm (103 ±18 lb <sub>f</sub> -ft)



285	Lower the engine onto the rubber cushions.	
286	Install the screws and washers.	
287	Torque tighten the screws.	
	<b>Tightening torque</b>	
	Engine bracket, rubber cushion, screw	540 ±90 Nm (398 ±66 lb <sub>f</sub> ·ft)



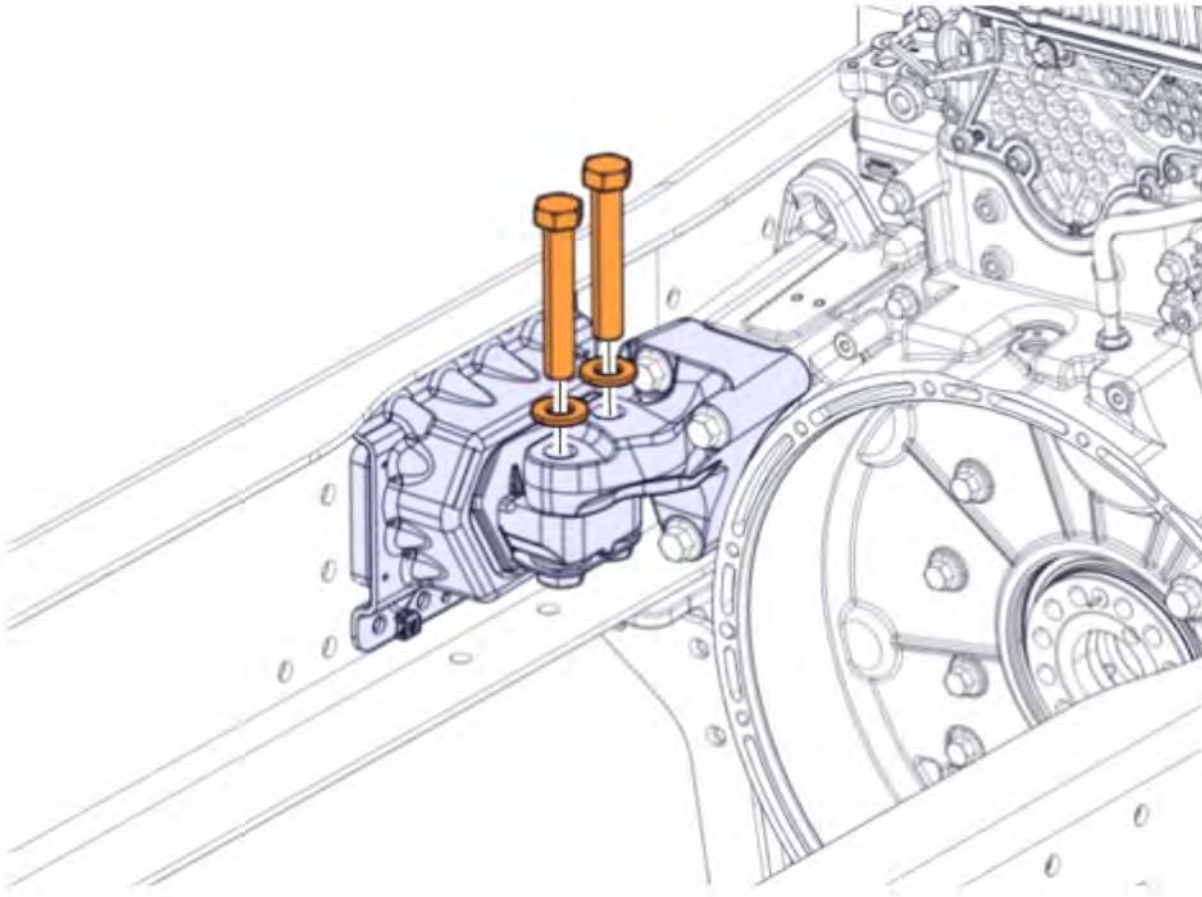


288	Install the screws and washers.
-----	---------------------------------

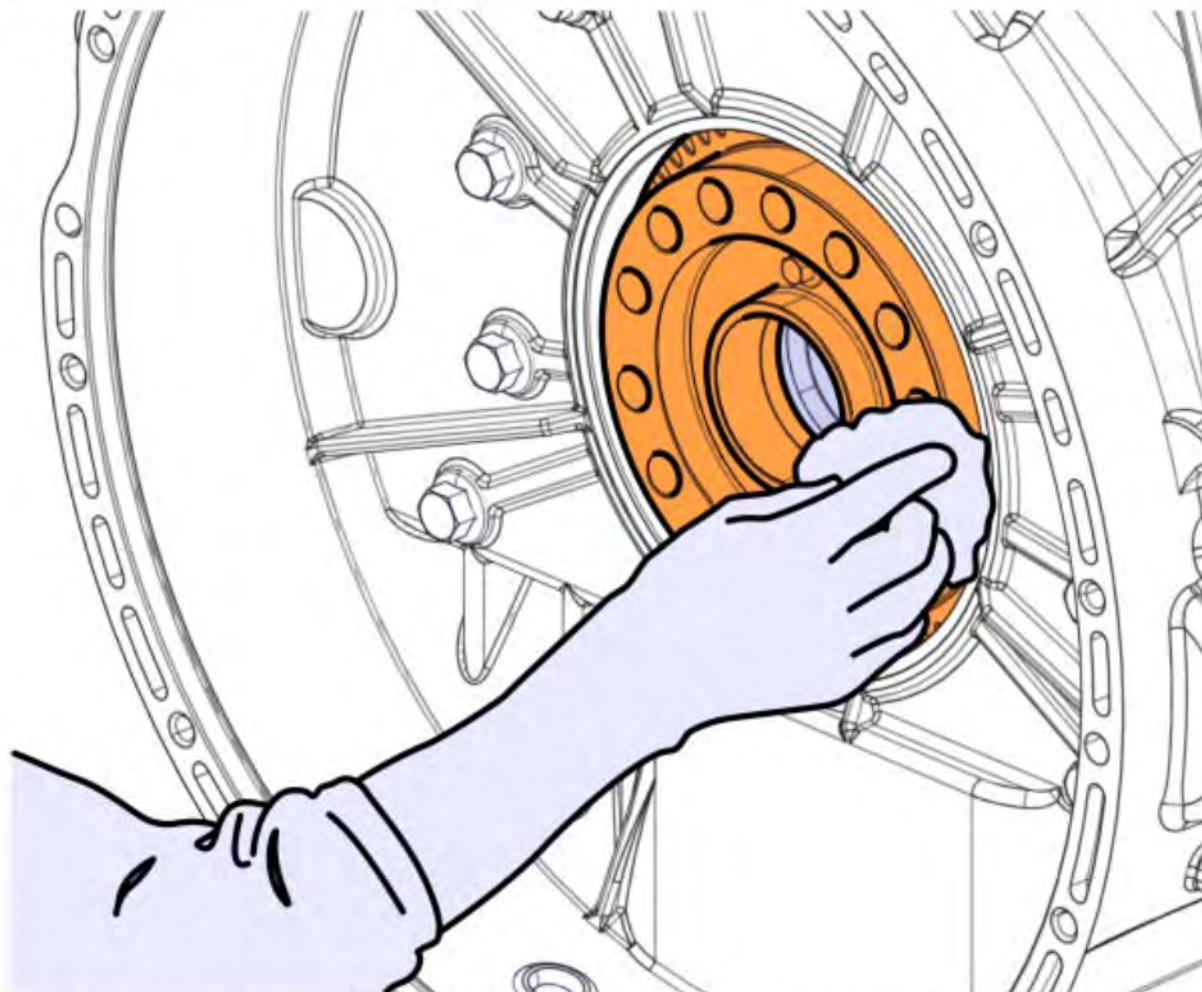
289	Torque tighten the screws.
-----	----------------------------

<b>Tightening torque</b>	
--------------------------	--

Engine bracket, rubber cushion, screw	540 ±90 Nm (398 ±66 lb <sub>f</sub> ·ft)
---------------------------------------	---




290 Clean the contact surfaces.

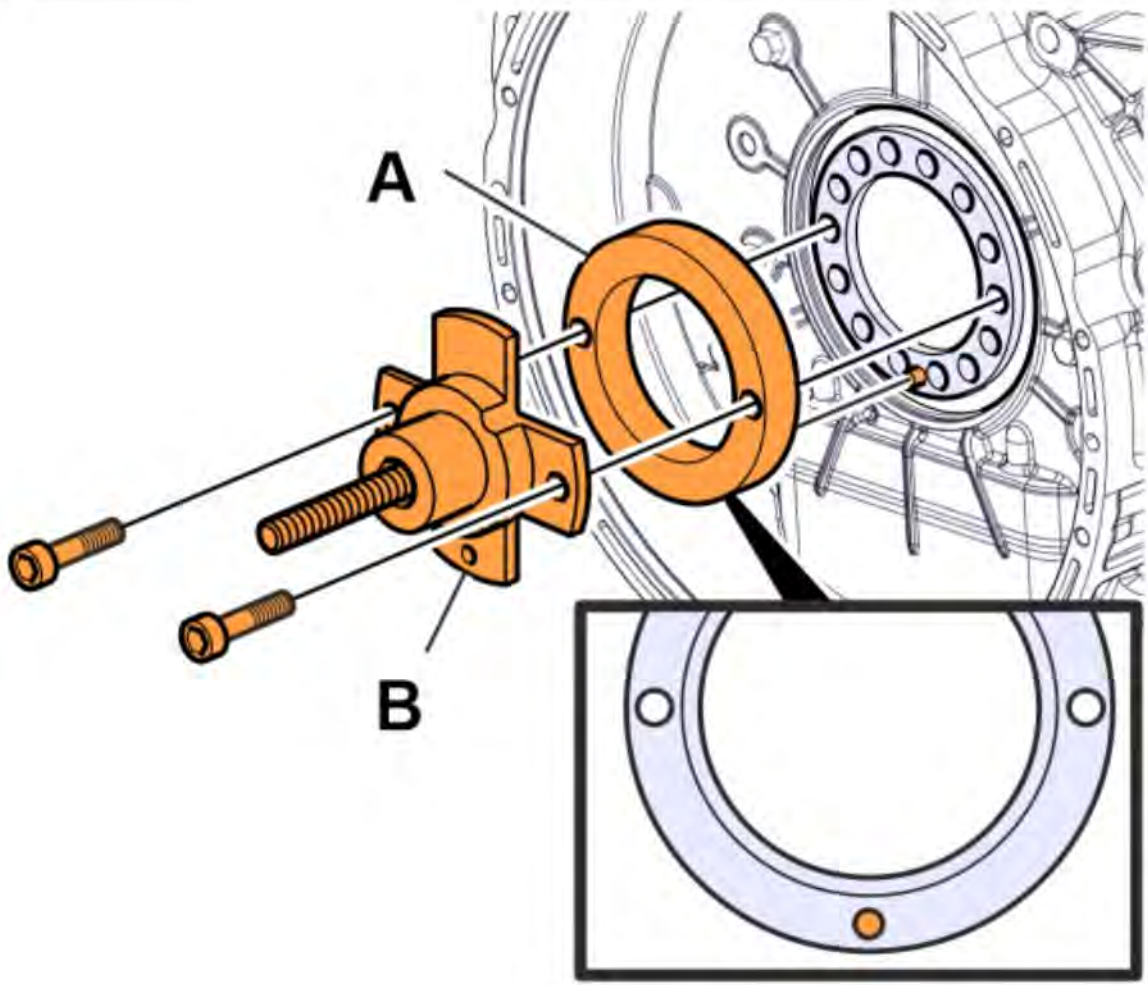





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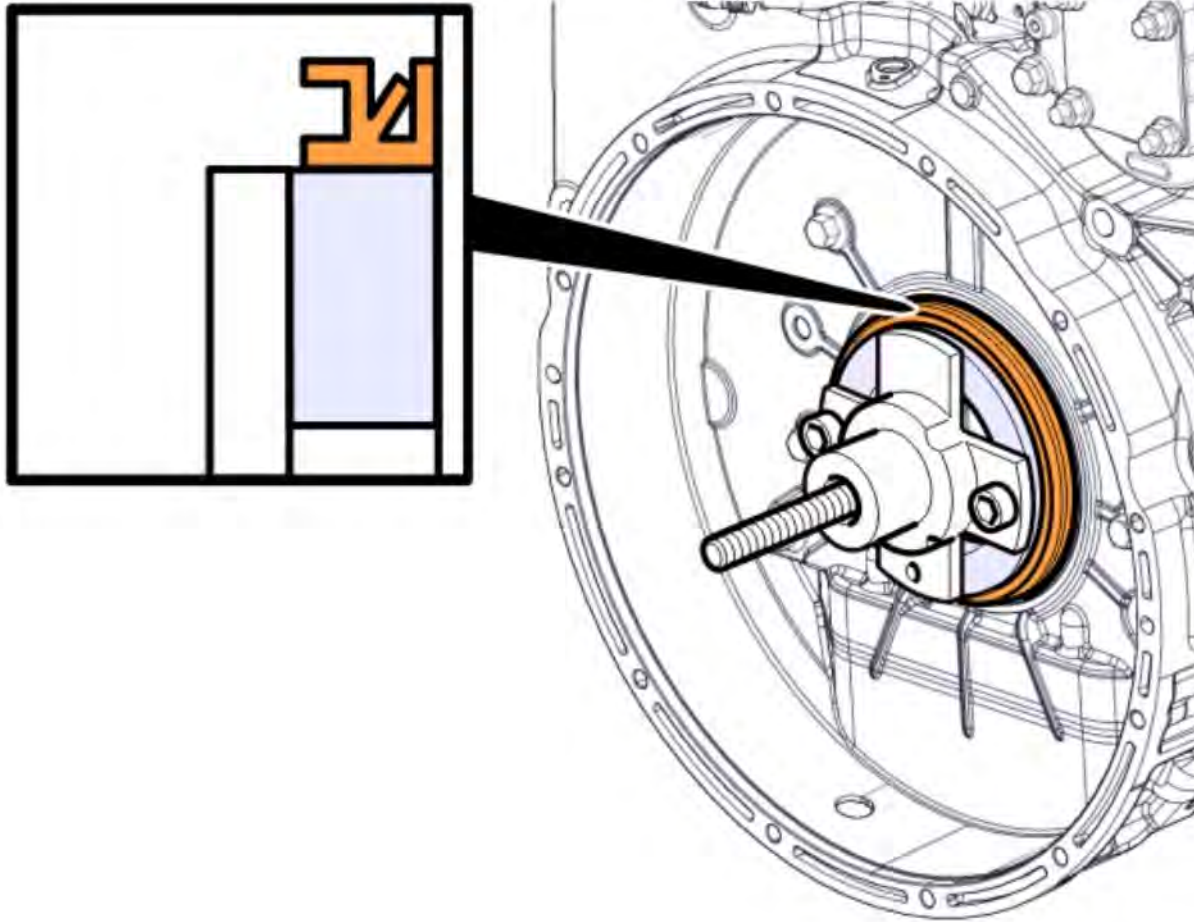


291	Install the spacer and the tool on the crankshaft.		
292	Install the screws.		
	<b>Required material</b>		
	A	ASSEMBLY TOOL	<a href="#">88800619</a>
	B	ASSEMBLY TOOL	<a href="#">9990166</a>
	 <b>Service hint</b> Ensure that the spacer and the tool are properly positioned on the crankshaft's internal guide and are flat against the crankshaft before tightening the screws.		

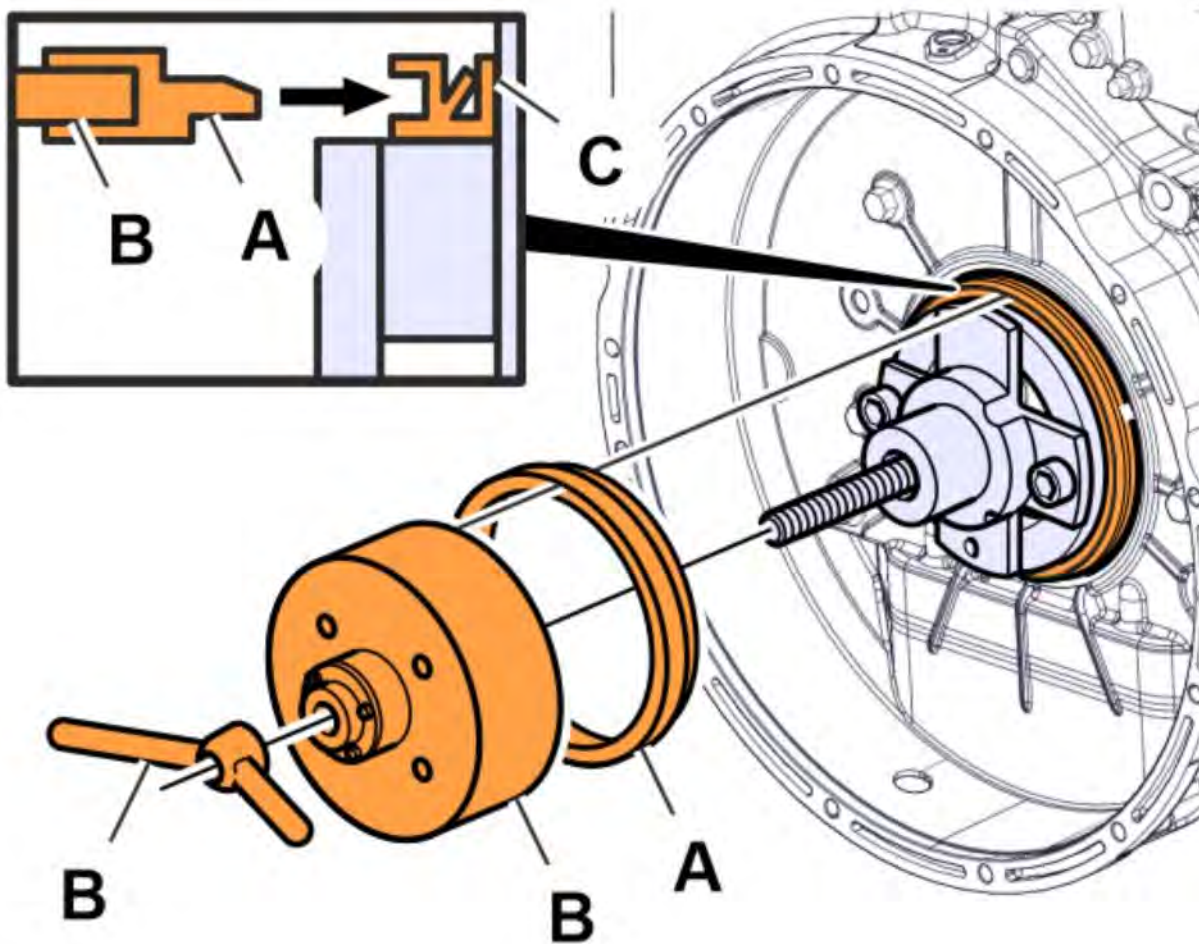


293	Position the seal.		
 <b>Note</b> Always use a new type of seal.			
 <b>Note</b> Lubricate the seal to facilitate installation.			
 <b>Service hint</b> The text on the seal must be turned away from the engine.			





<b>294</b>	Install the installation tool.	
	<b>Required material</b>	
	A	ASSEMBLY TOOL <a href="#">88800619</a>
	B	ASSEMBLY TOOL <a href="#">9990166</a>
	C	Seal

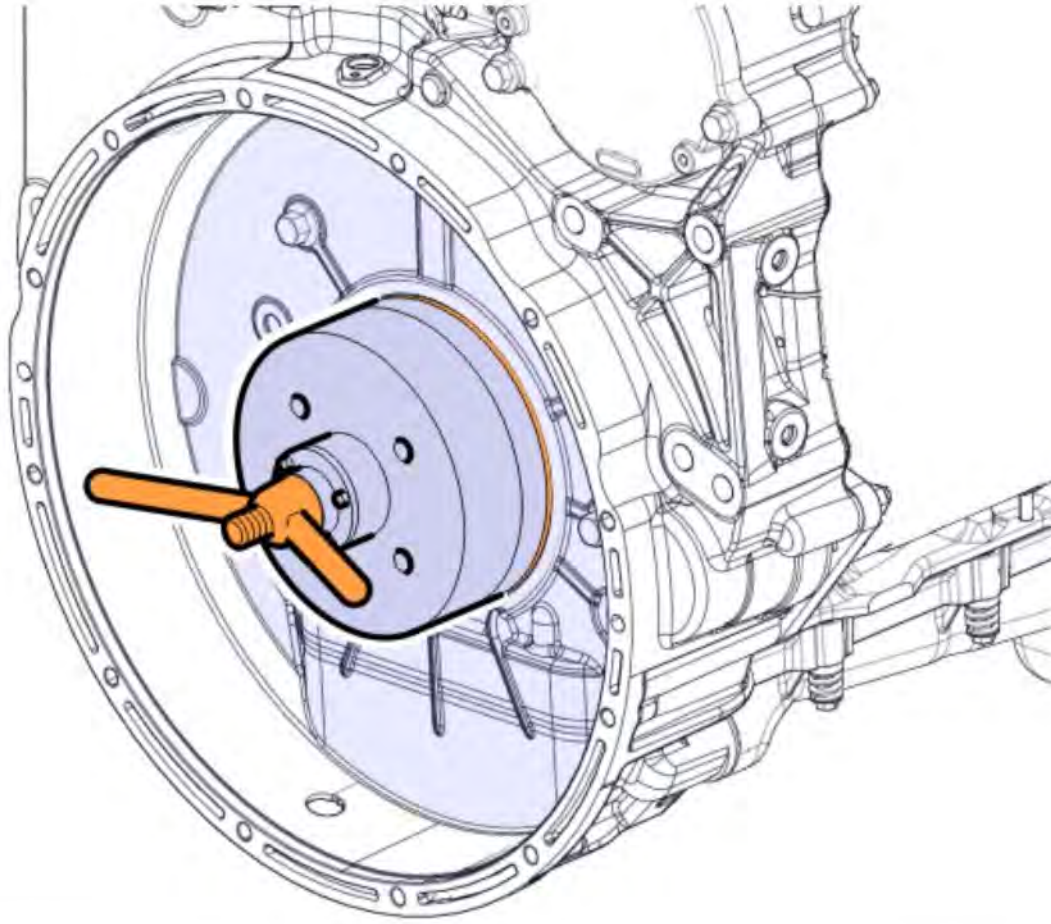


295 Press the cassette seal into place by turning the handle.



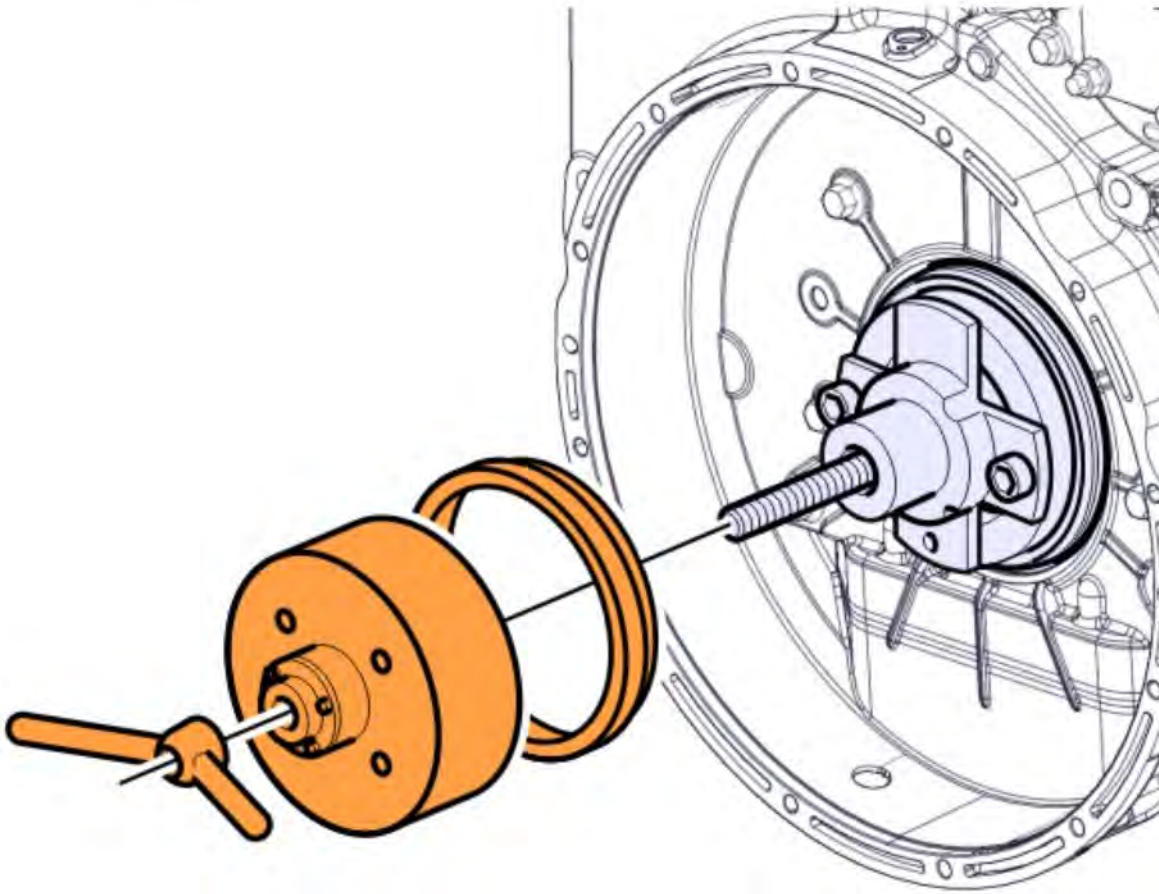
**Note**

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

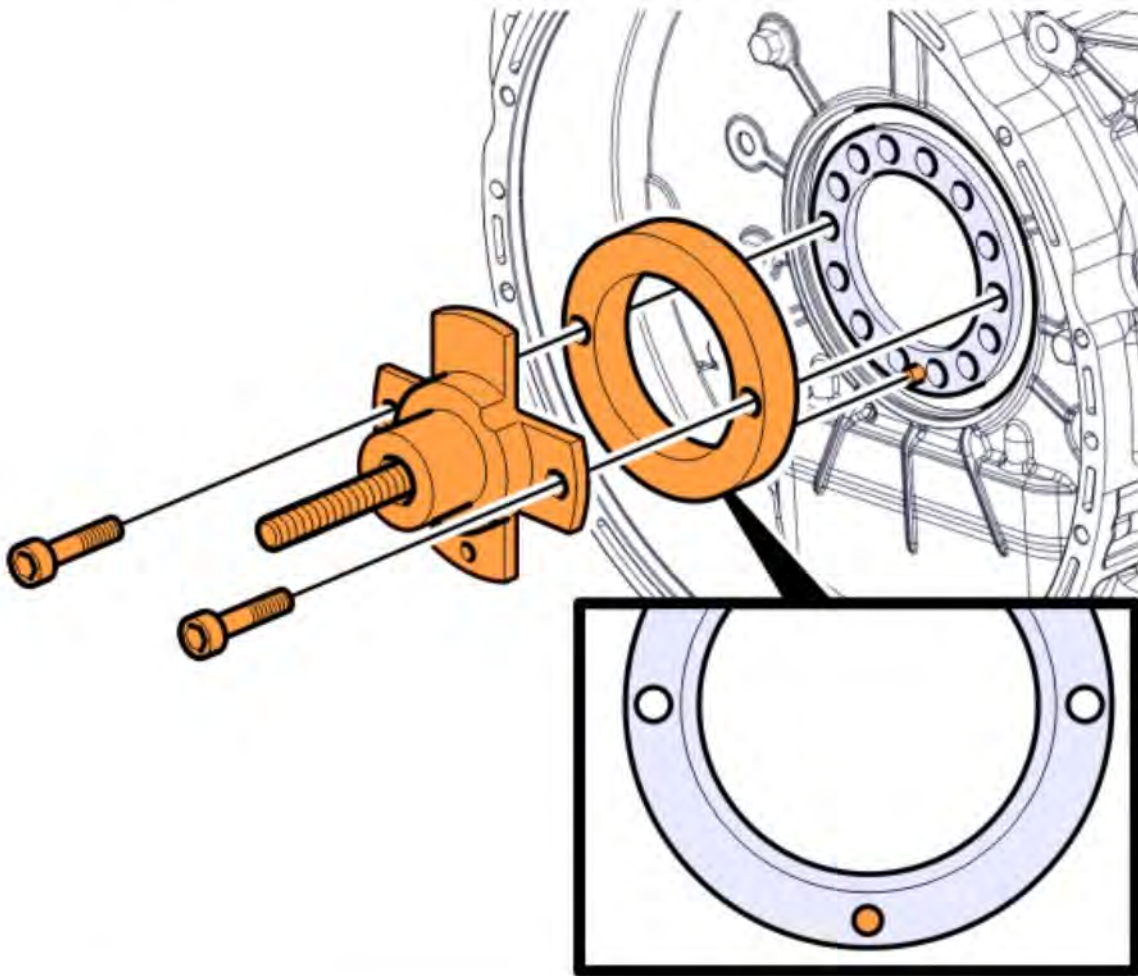


296	Remove the adapter and cover.
-----	-------------------------------





297	Remove the tool and the spacer.
-----	---------------------------------

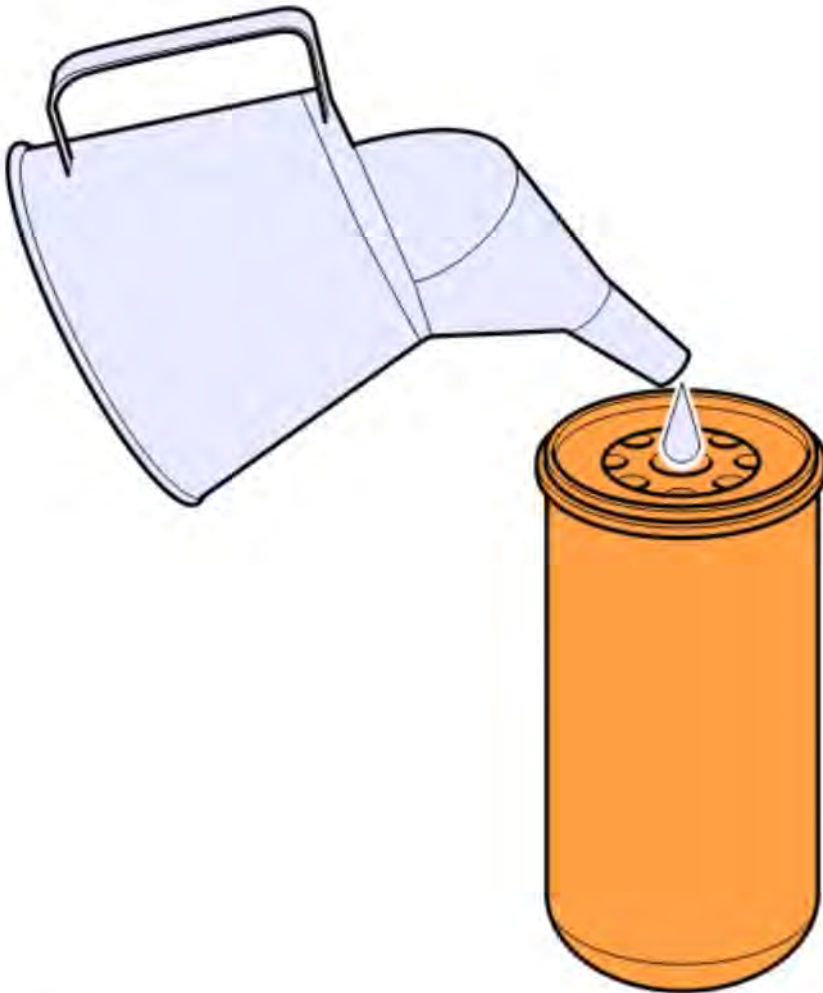


298 Fill the filters with engine oil.



**Note**

Use new filters.



299 Apply engine oil to the gasket.



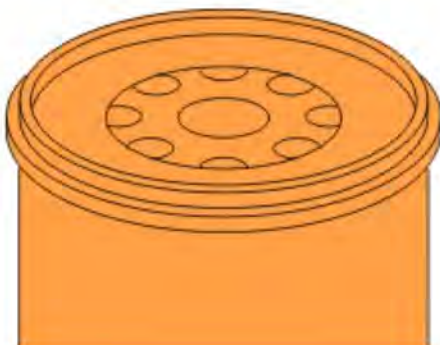
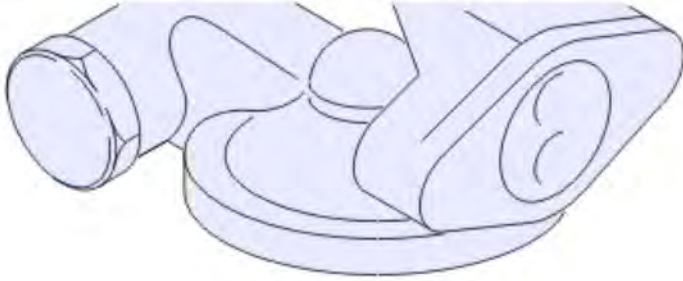
**Note**

Use recommended oil.





300 Install the filters.



**⚠ DANGER**

**Risk of material damage, serious personal injury or death.**

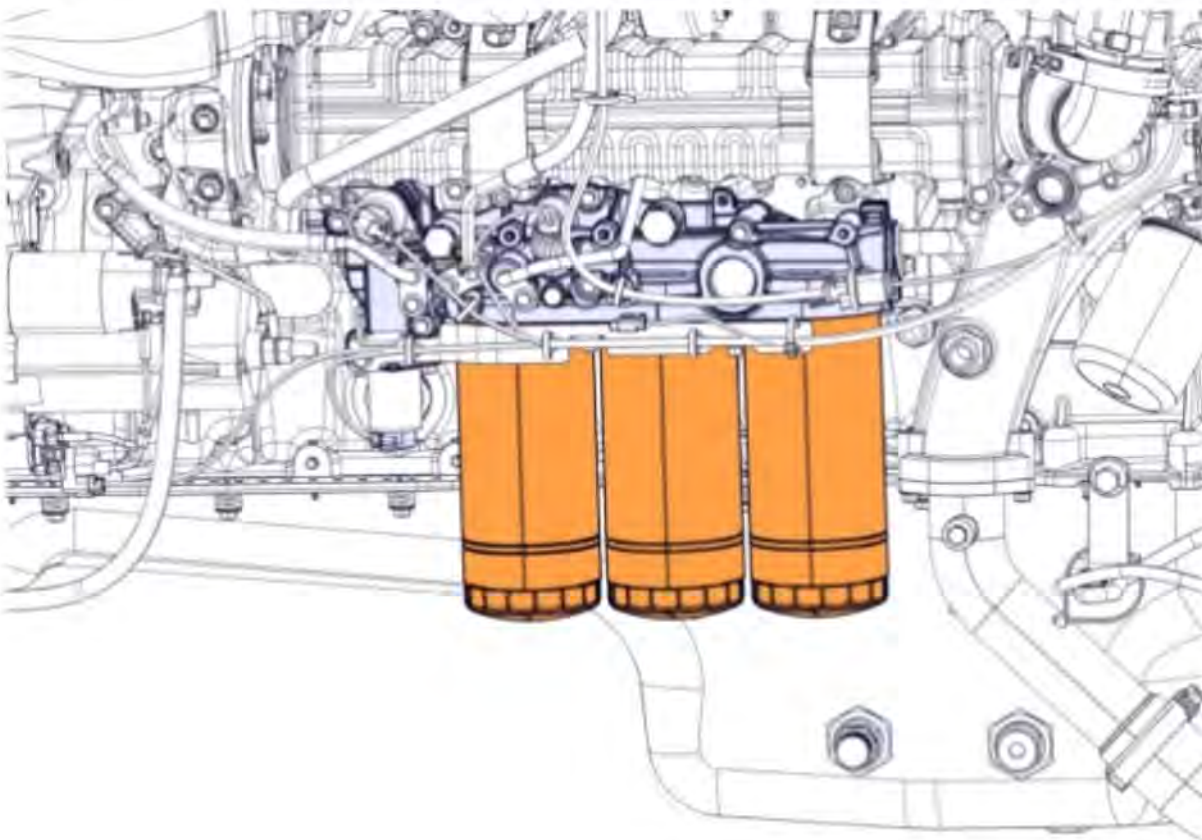
Connections that are not tightened in accordance with specified tightening torques may cause leakage.

- ▶ Tighten connections according to service information.

**301** Torque-tighten the filters.

**Tightening torque**

Oil filter	25 ±5 Nm (18 ±4 lb <sub>f</sub> .ft)
------------	---



**302** Clean the contact surfaces.



**Note**

Ensure that the surfaces are completely clean of oil and grease

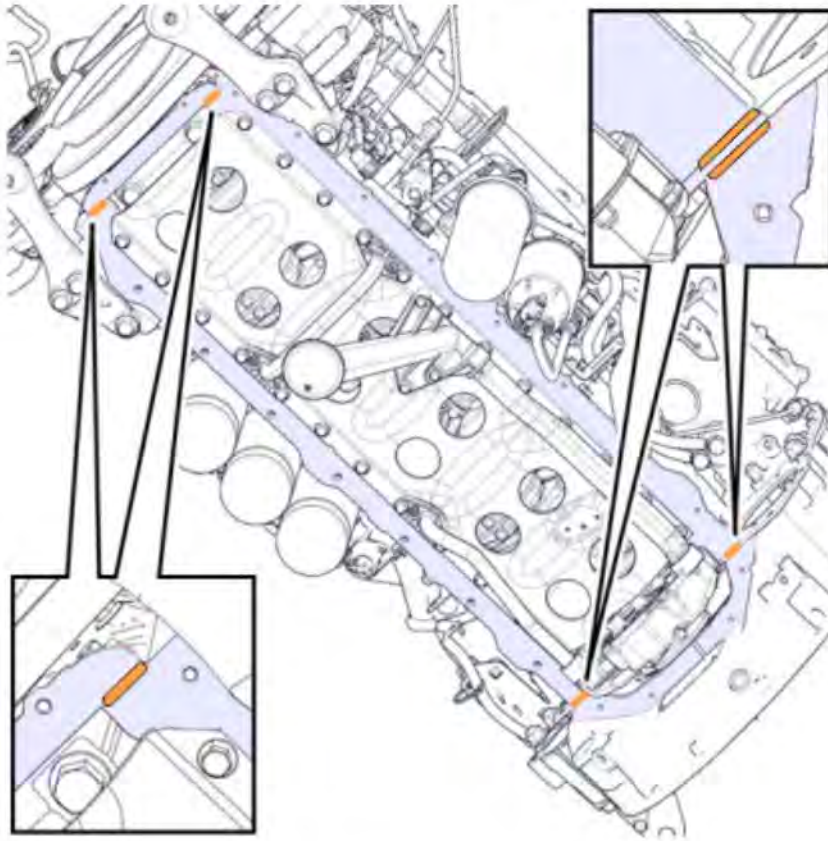
**303** Remove hardened sealant.

**304** Apply recommended sealant as illustrated.

**Tech data**

Sealant, bead thickness	2 mm
-------------------------	------

(0.08 in)



305 Install the gasket.

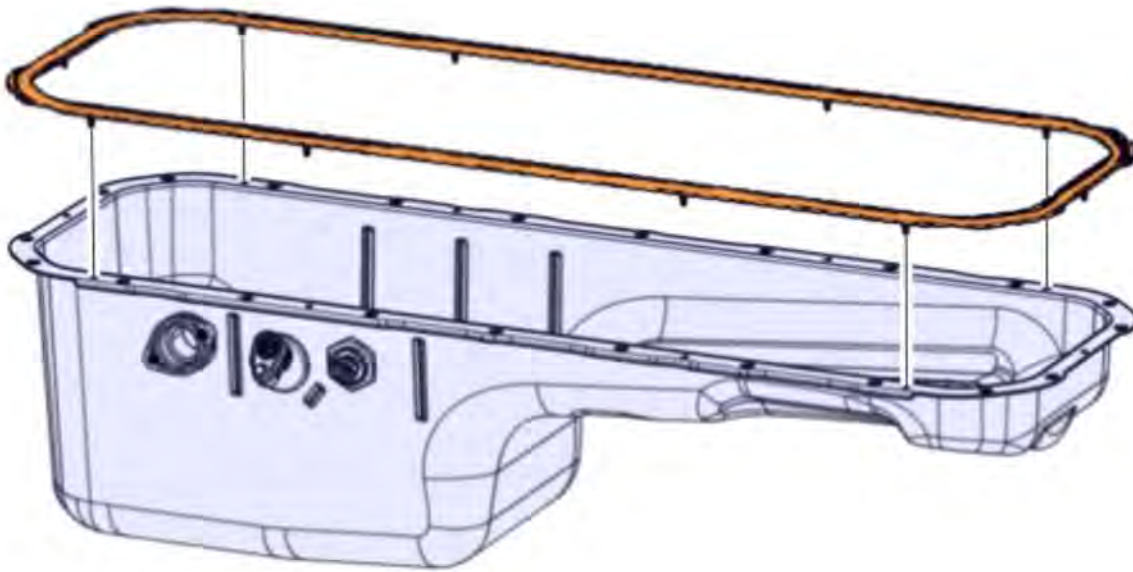
**Note**

Use a new part.

**Note**

Install the gasket within 20 minutes of sealant application.



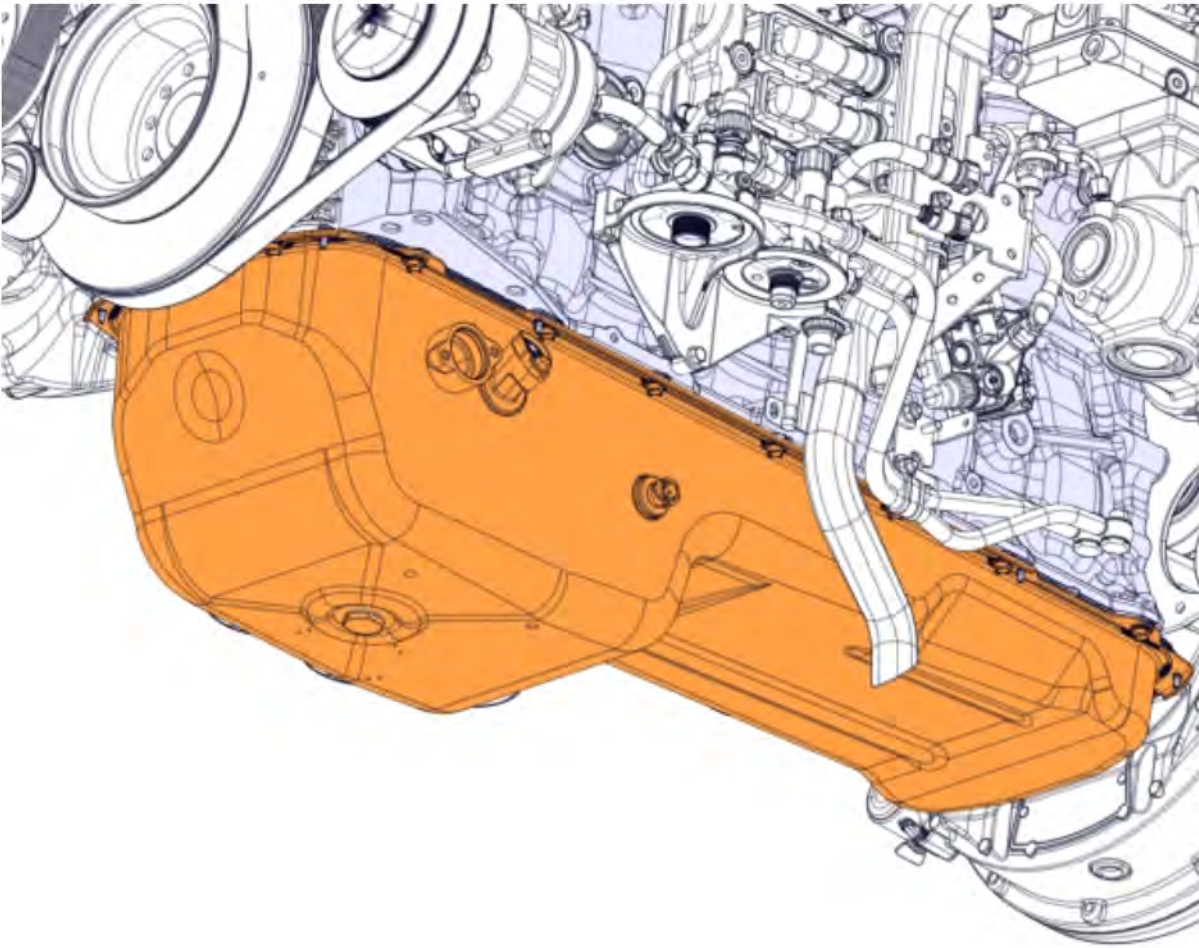


306 Install the oil pan.



**Note**

Assistance may be required.



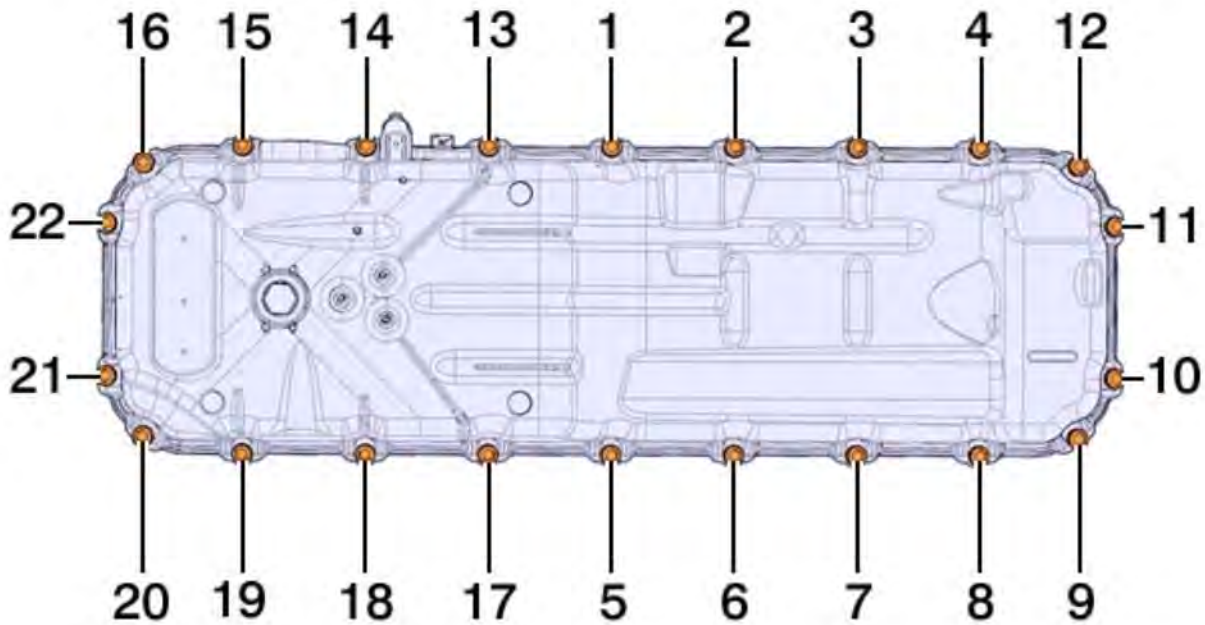
307	Install the screws.
-----	---------------------



**308** Torque tighten the screws.

Tightening torque	
Oil pan, screw	Tightening sequence: 1-22
	24 ±4 Nm (18 ±3 lb <sub>f</sub> ·ft)





309 Install the seal.

<b>i</b>	<b>Note</b> Use a new part.
----------	--------------------------------

310 Install the pipe (A).

311 Install the outer casing (B).

<b>i</b>	<b>Note</b> Check the outer casing for correct position.
----------	---

312 Connect the connector (C).



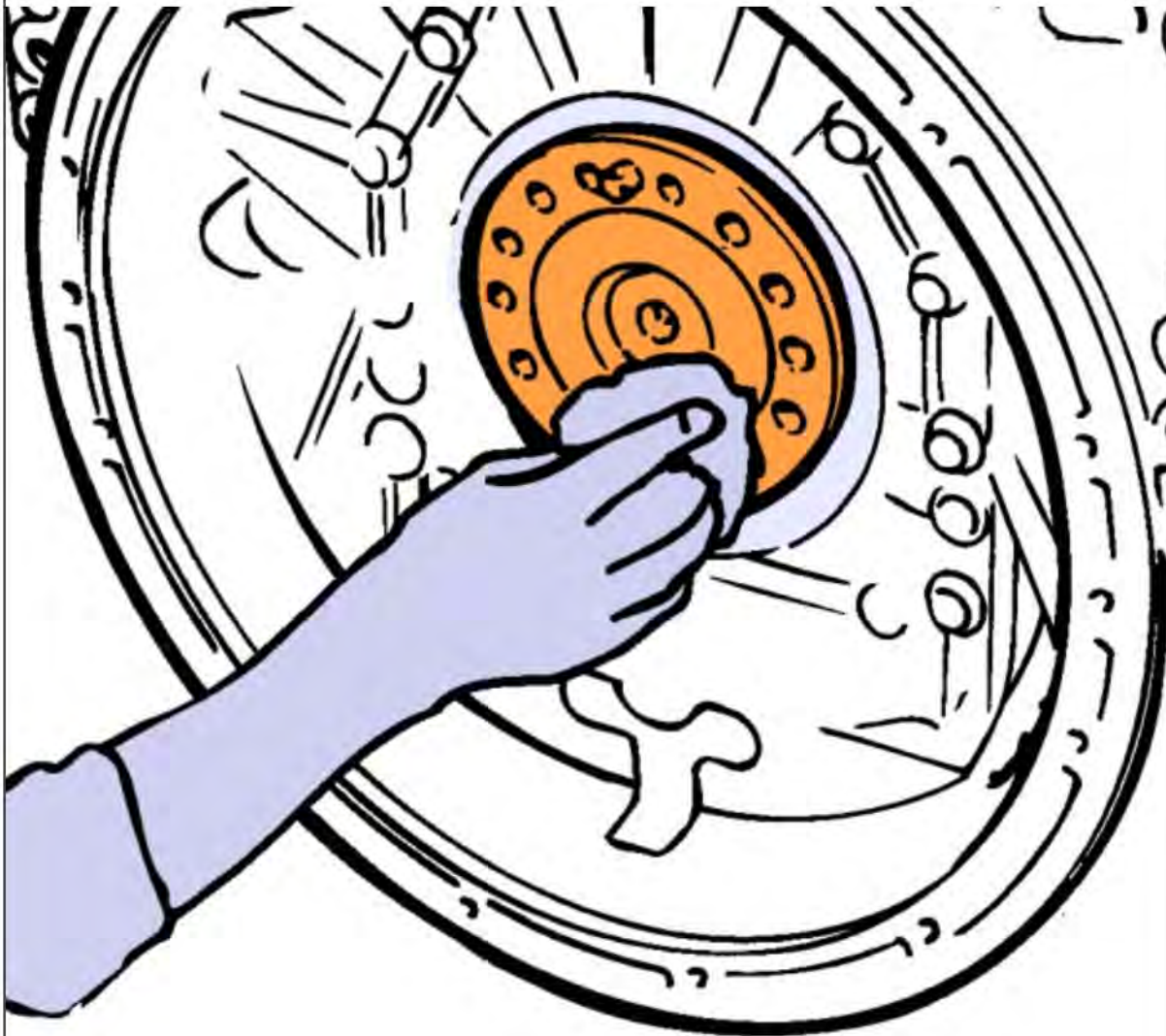
313 This step contains 2 alternatives.

Select one of the valid alternatives below.

**Alternative 1 / 2**

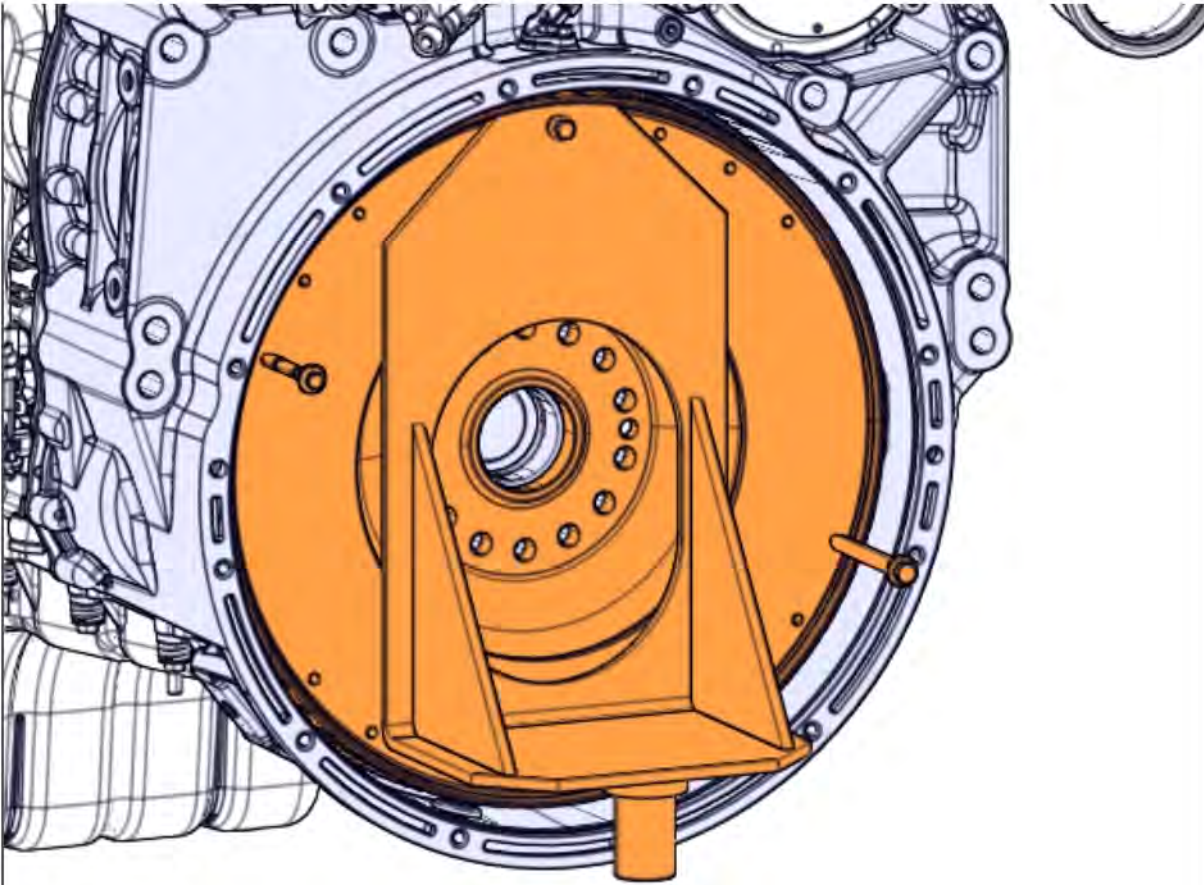
▶ Clean the crankshaft flange.

▶ Check the crankshaft seal.



▶ Install the flywheel.



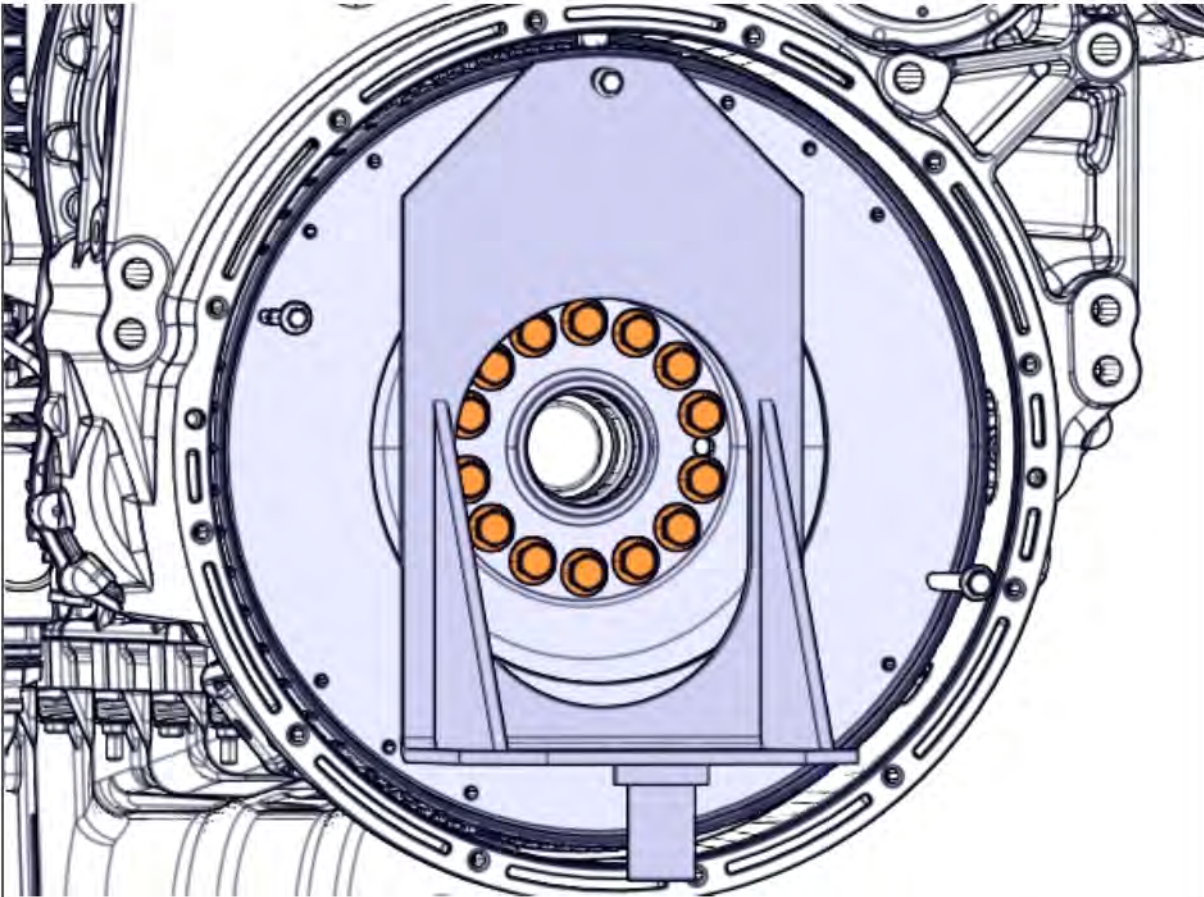


- ▶ Install the screws.

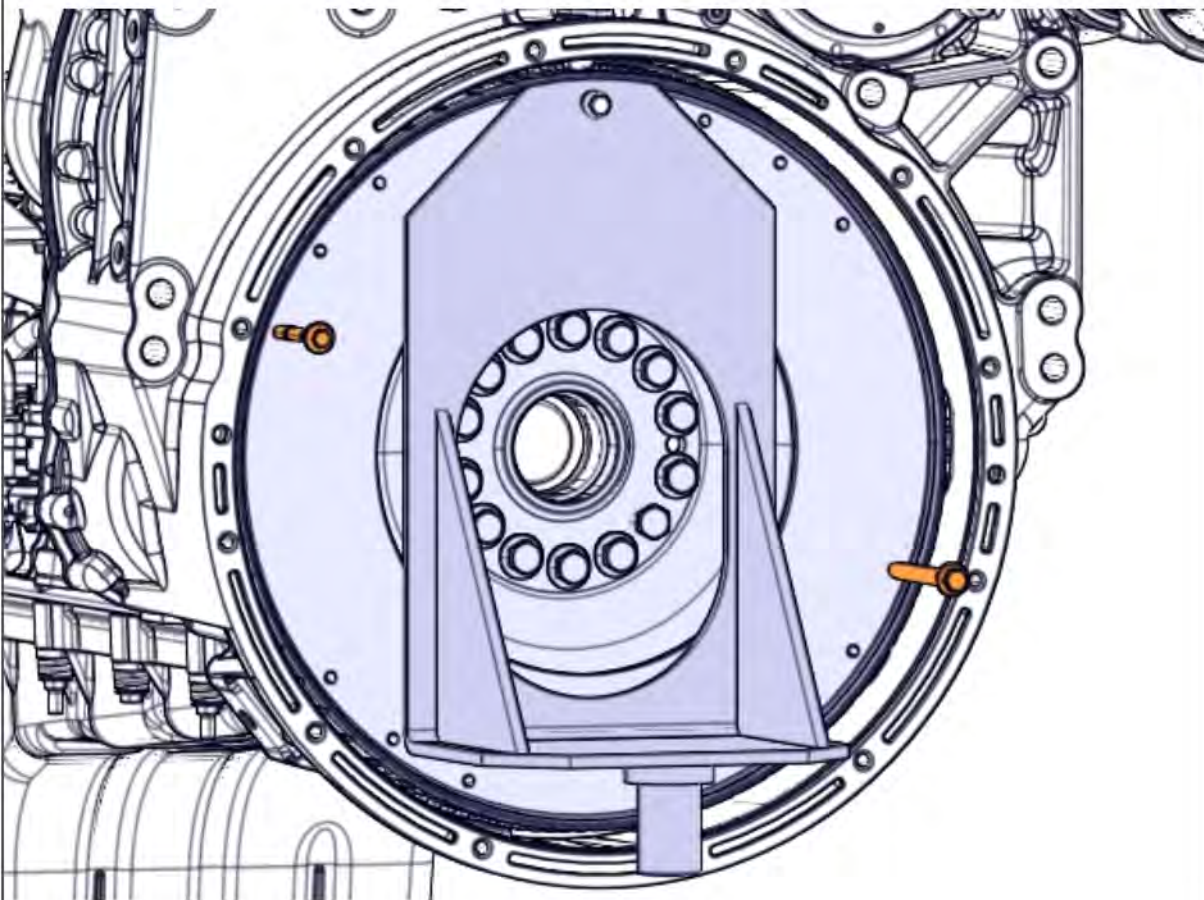
**Note**

Hand tighten the screws.





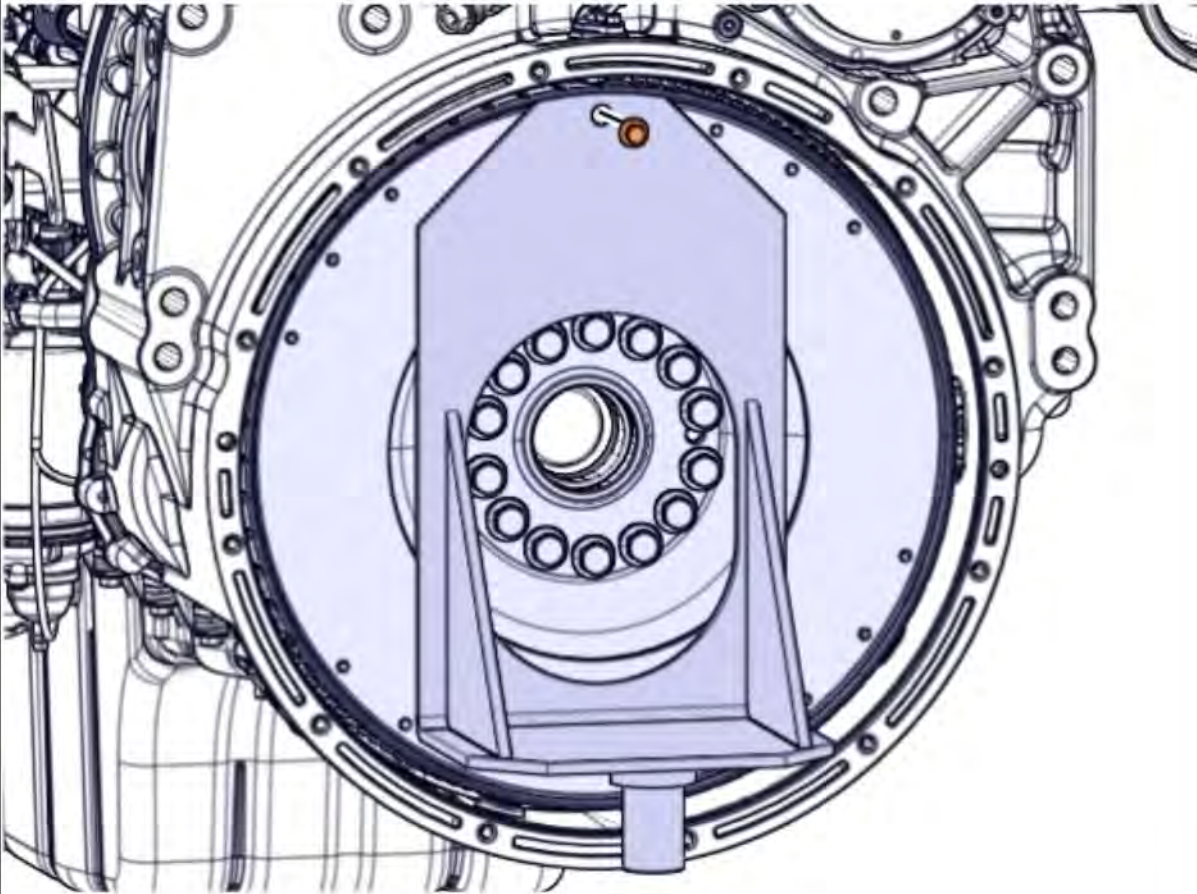
► Remove the screws.



► Remove the screw.



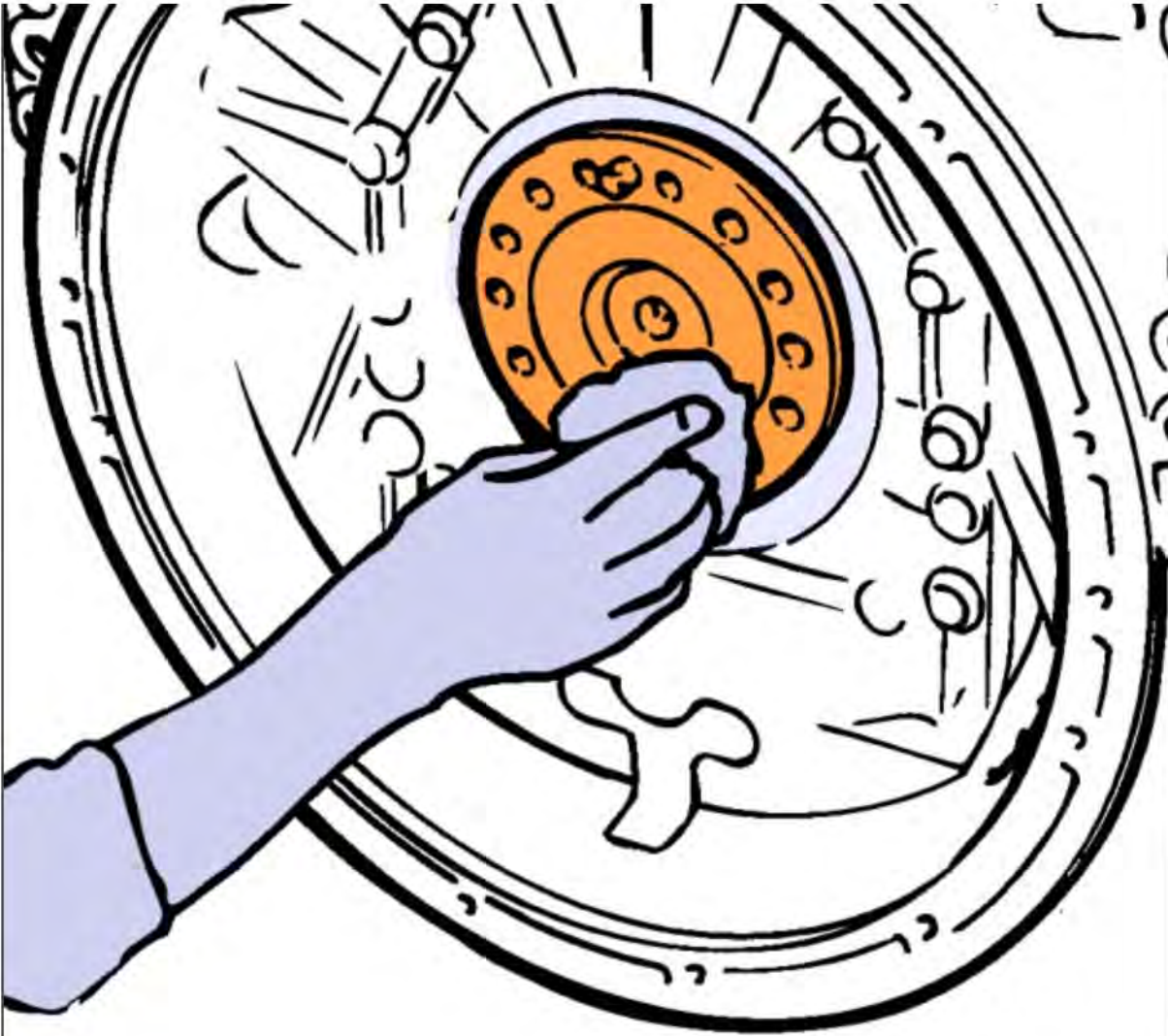
▶ Remove the tool.



#### Alternative 2 / 2

▶ Clean the crankshaft flange.

▶ Check the crankshaft seal.



▶ Install the flywheel.

▶ Install the flexplate.

▶ Install the thrust plate.

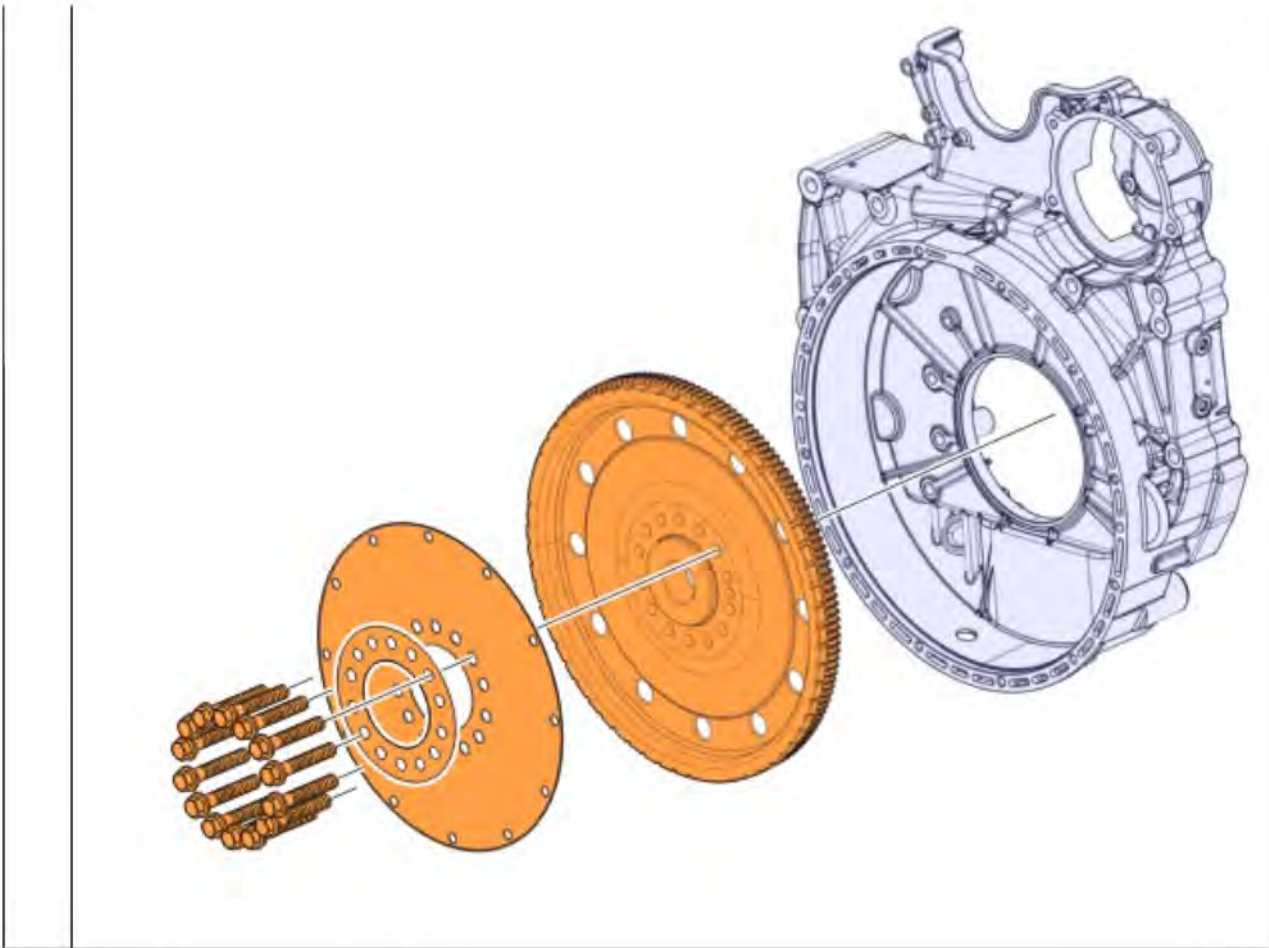
▶ Install the screws.



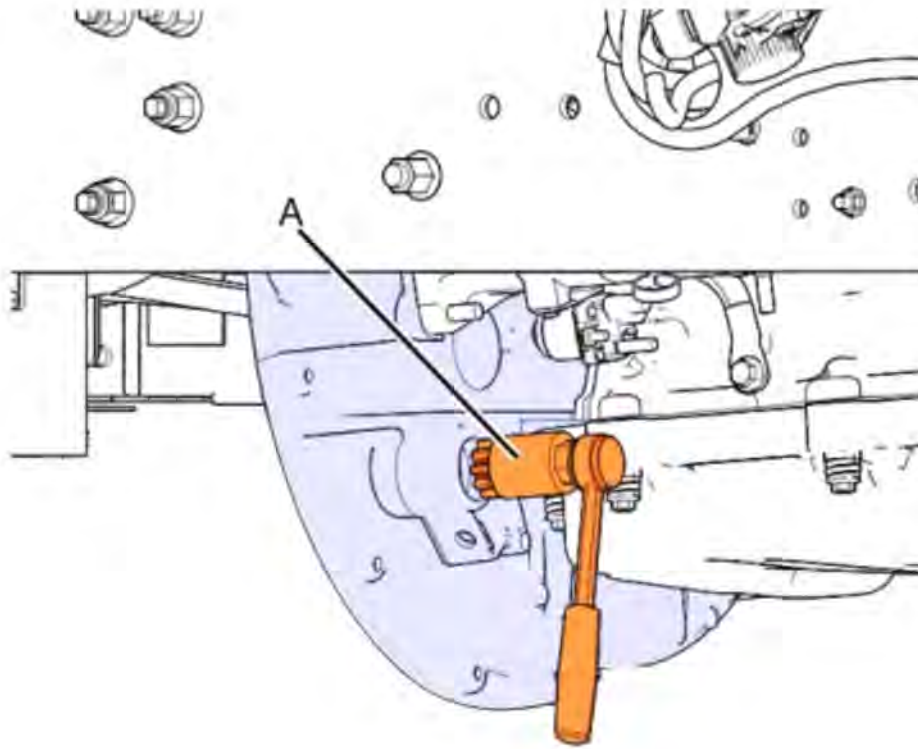
**Note**

Hand tighten.



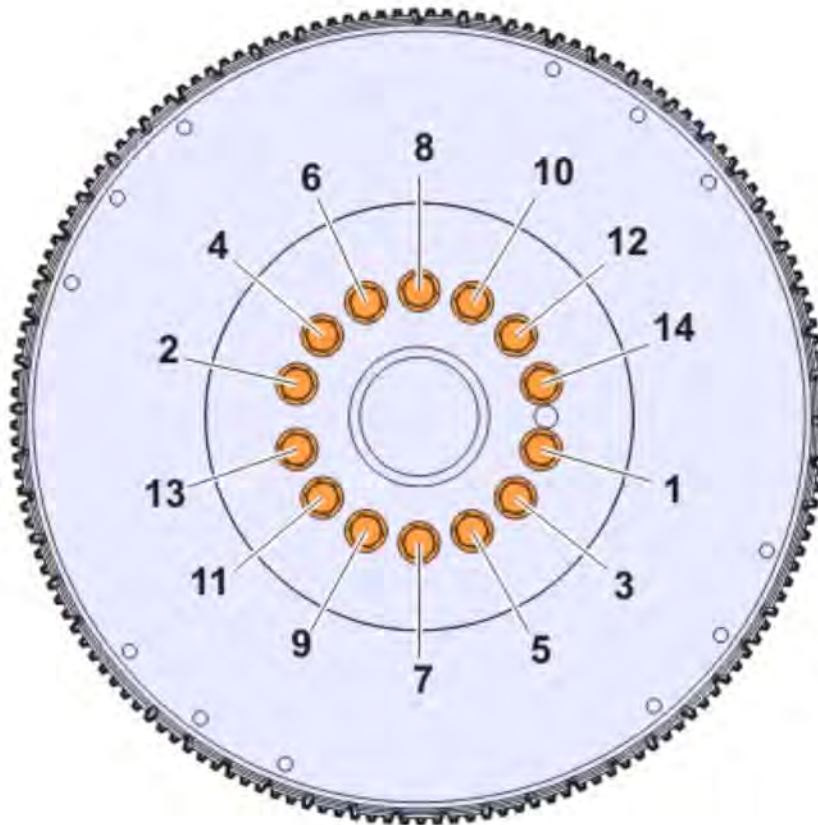


<b>314</b>	Install the cranking tool (A).	
	<b>Required material</b>	
	CRANKING TOOL	<a href="#">88840317</a>



**315** Torque tighten the screws.

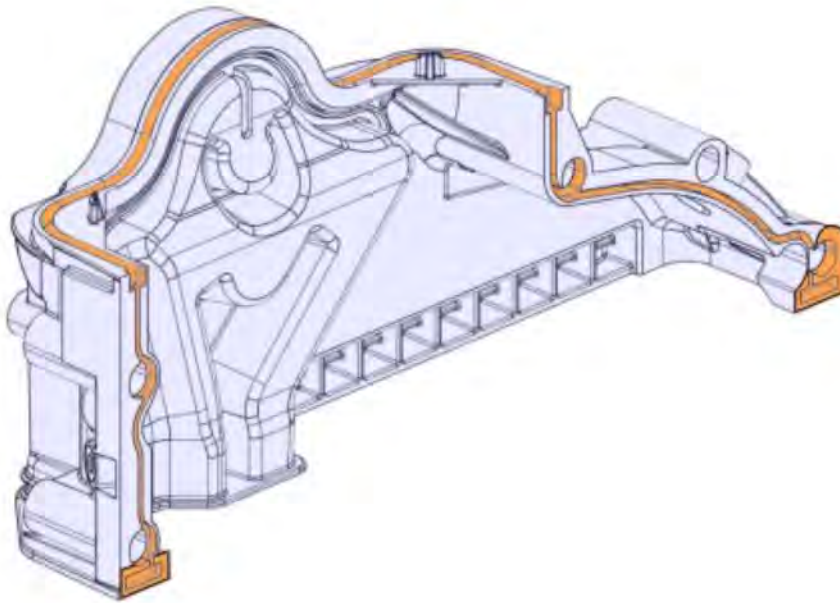
Tightening torque		
Flywheel, screw	1.	Tightening sequence: 1-14
		60 ±5 Nm (44 ±4 lb <sub>f</sub> -ft)
	2.	Tightening sequence: 1-14
		120 ±10°

**Note**

Use the cranking tool with a drawbar handle as counterhold.

**316** Clean the contact surfaces.



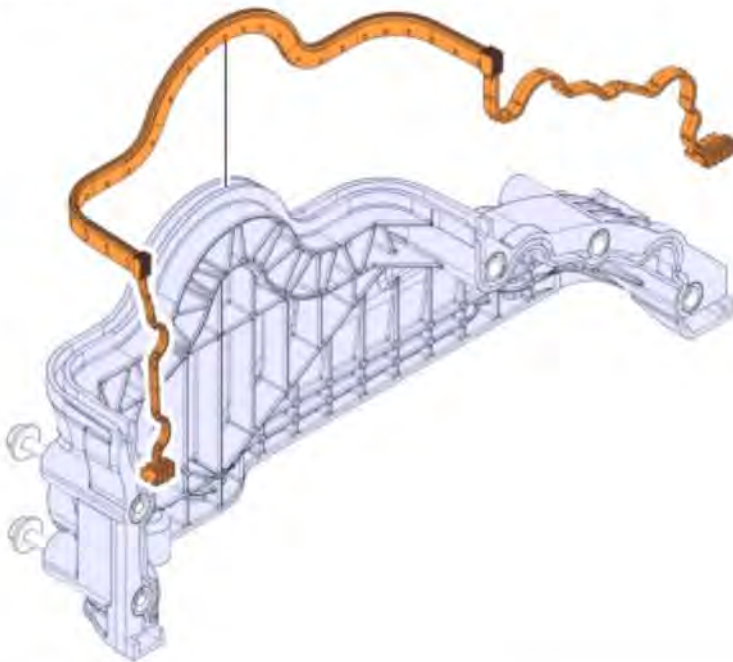


317 Install the gasket.



**Note**

Use a new part.



318 Clean the contact surfaces carefully.

319 Install the timing gear cover.



**Note**

Take care not to damage the gasket.

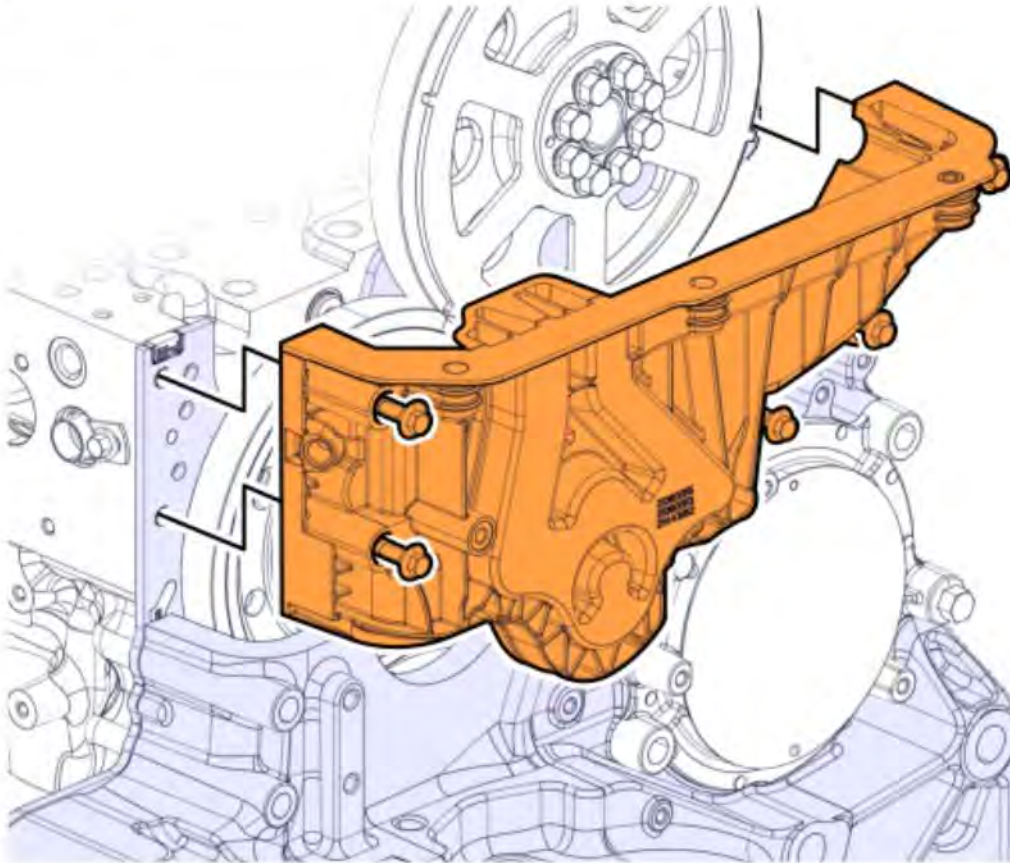
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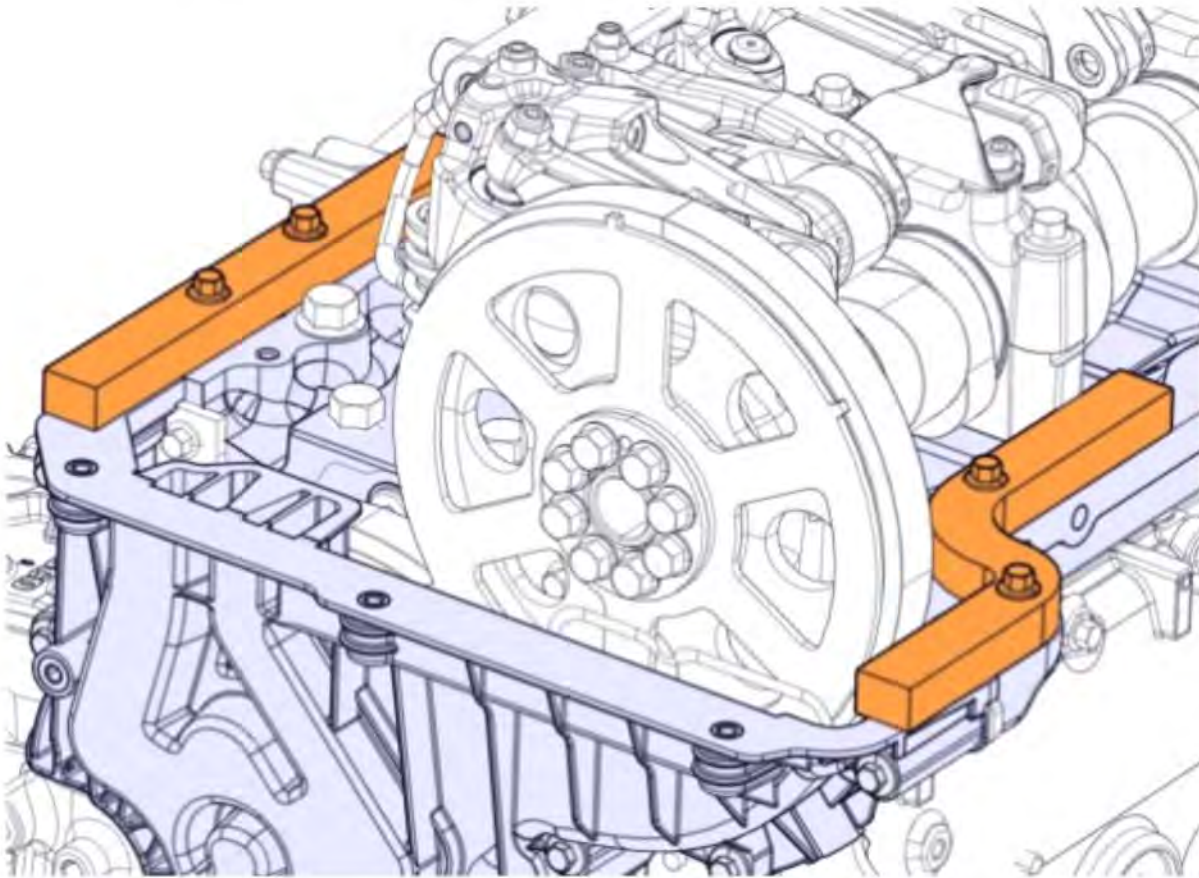
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Check that the gasket is correctly located in the groove.



<b>320</b>	Install the tools.
	<b>Required material</b>
	ALIGN TOOL <span style="float: right;"><a href="#">85111422</a></span>



321 Gently tighten the timing gear cover screws.



**Note**

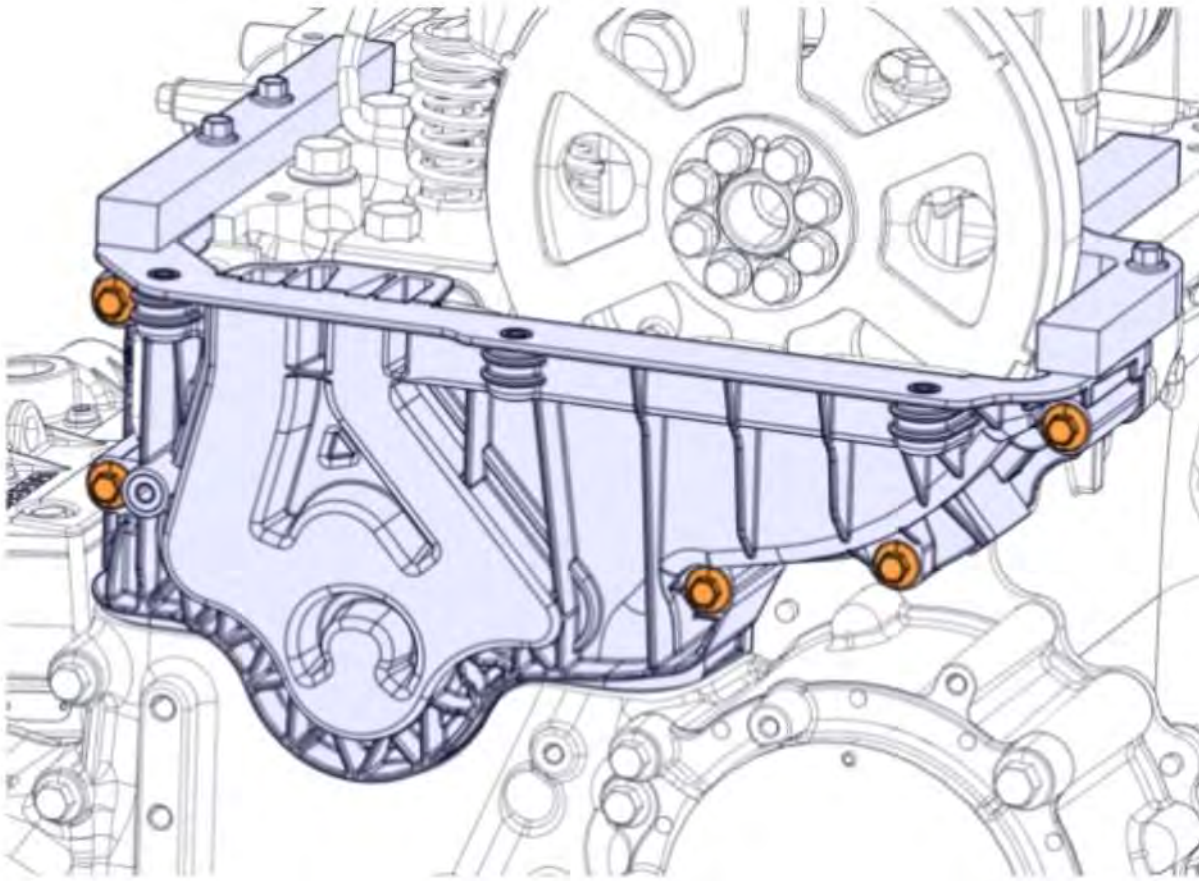
Ensure that the timing gear cover aligns with the cylinder head on both sides.



**Note**

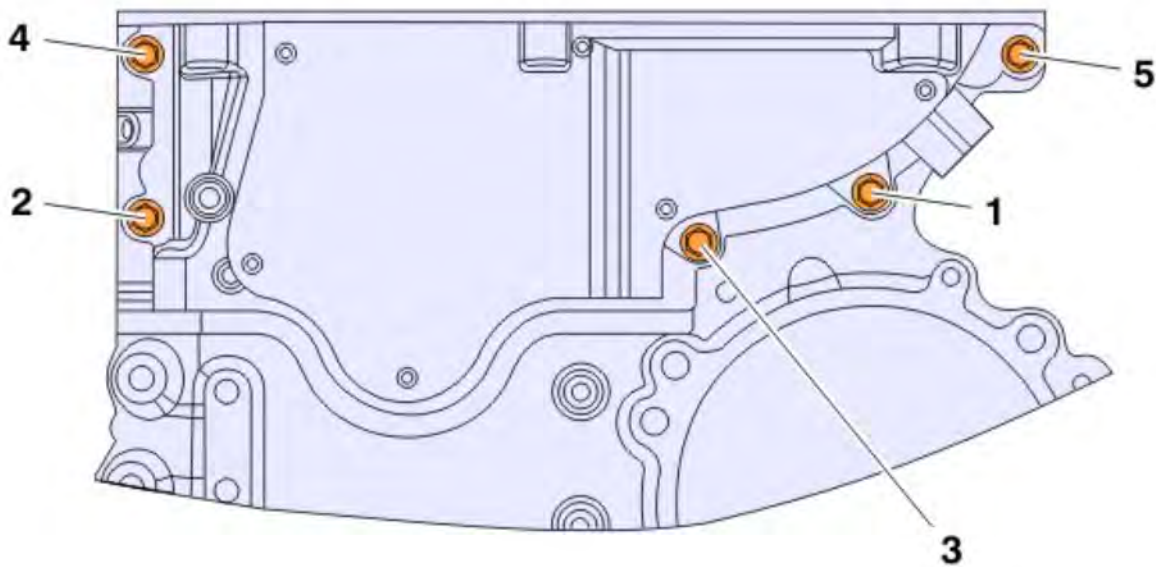
Ensure that the timing gear cover is in contact with the timing gear plate.





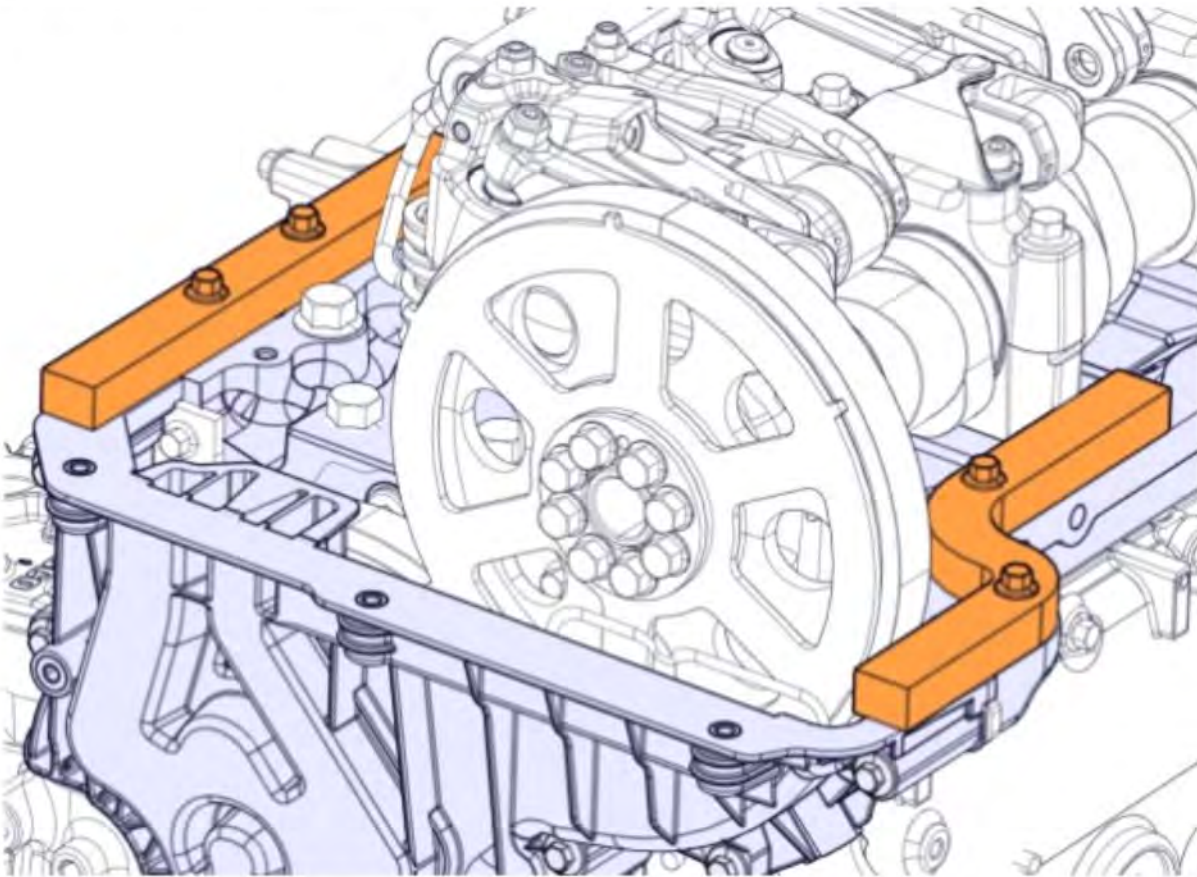
**322** Torque tighten the screws.

Tightening torque	
Upper timing gear casing, screw	Tightening sequence: 1-5 27 ±3 Nm (20 ±2 lb <sub>f</sub> ·ft)

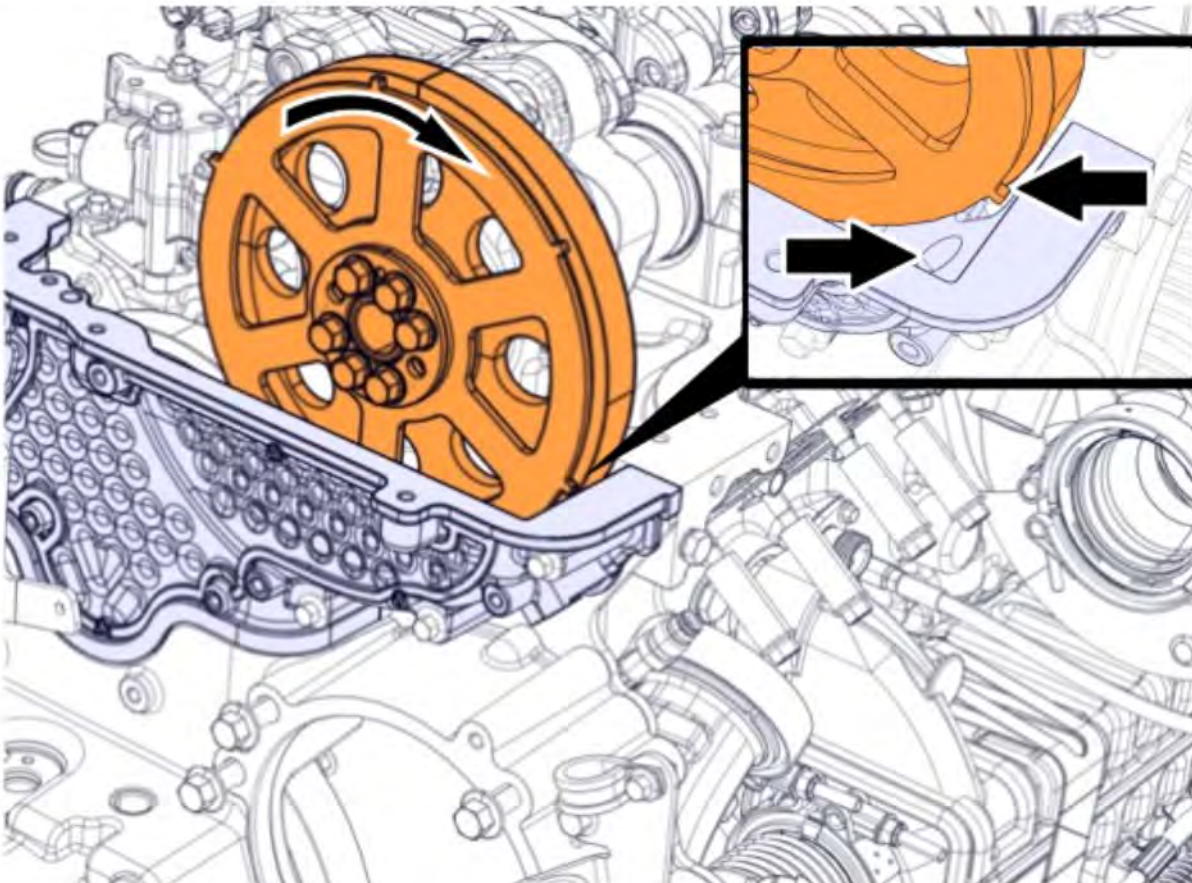




323 Remove the tools.

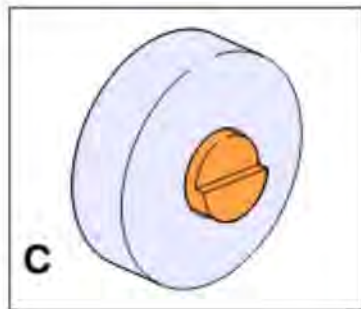
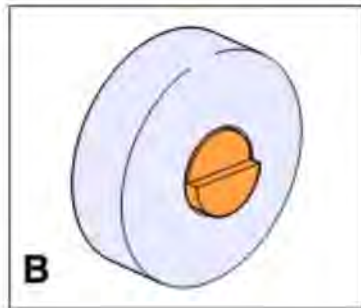
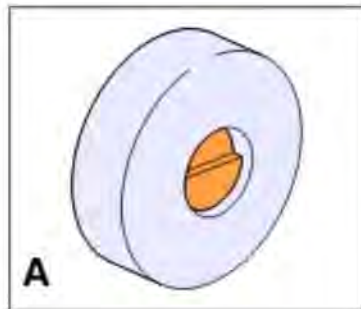
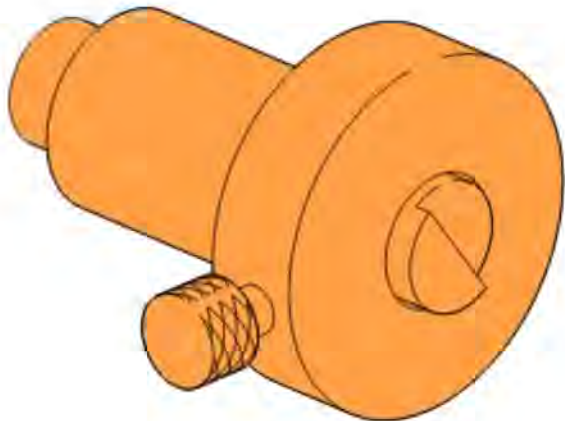


324 Rotate the gear so that a tooth on the sensor wheel aligns with the sensor location.



325	Install the setting tool.	
	<b>Required material</b>	
	SETTING TOOL	<a href="#">88800031</a>

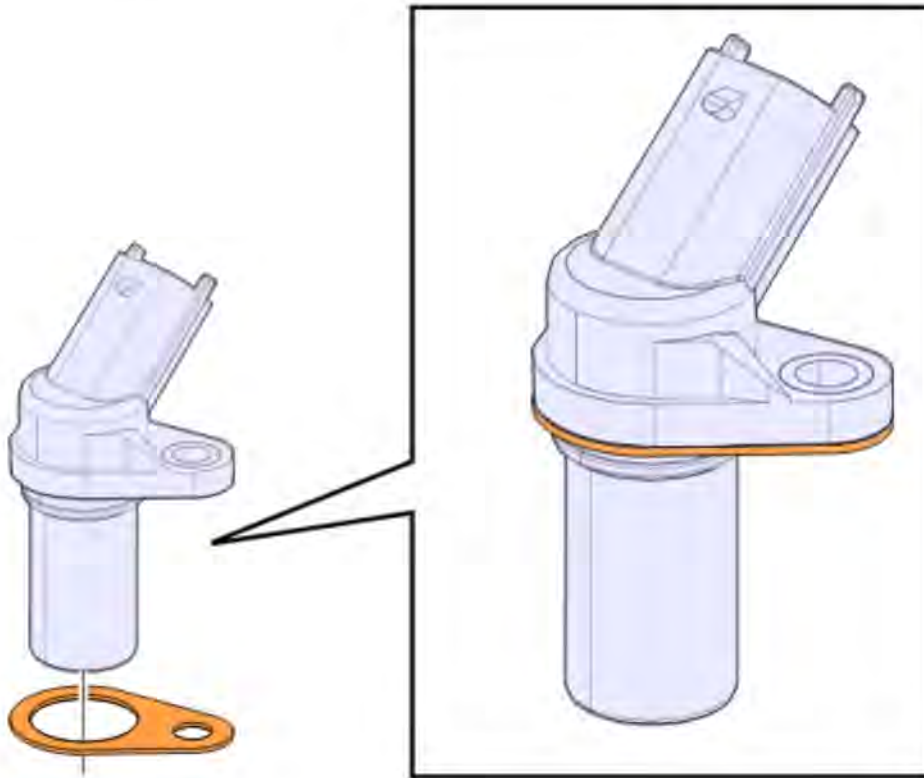
326	Read off the setting tool.	
	<b>Impulse sensor, number of shims</b>	
	Conditions: A: No edge outside the tool.	0 pcs
	Conditions: B: One edge outside the tool.	1 pc
	Conditions: C: Two edges outside the tool.	2 pcs



327	Remove the setting tool.
-----	--------------------------

328	Install the shims as needed.
-----	------------------------------





329 Remove the old sealant from the contact surfaces (A).



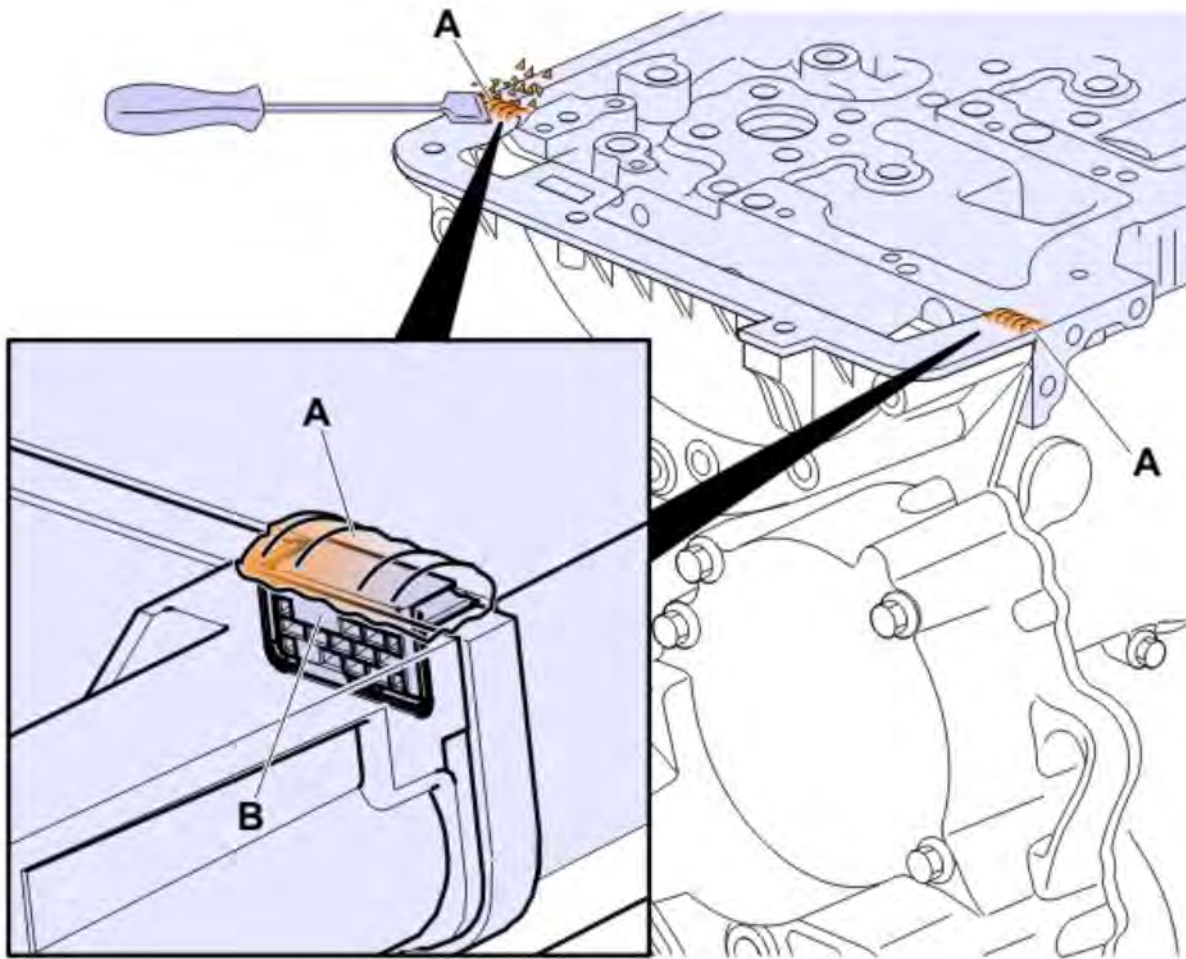
**Note**

Ensure that the surfaces are completely clean from sealant.

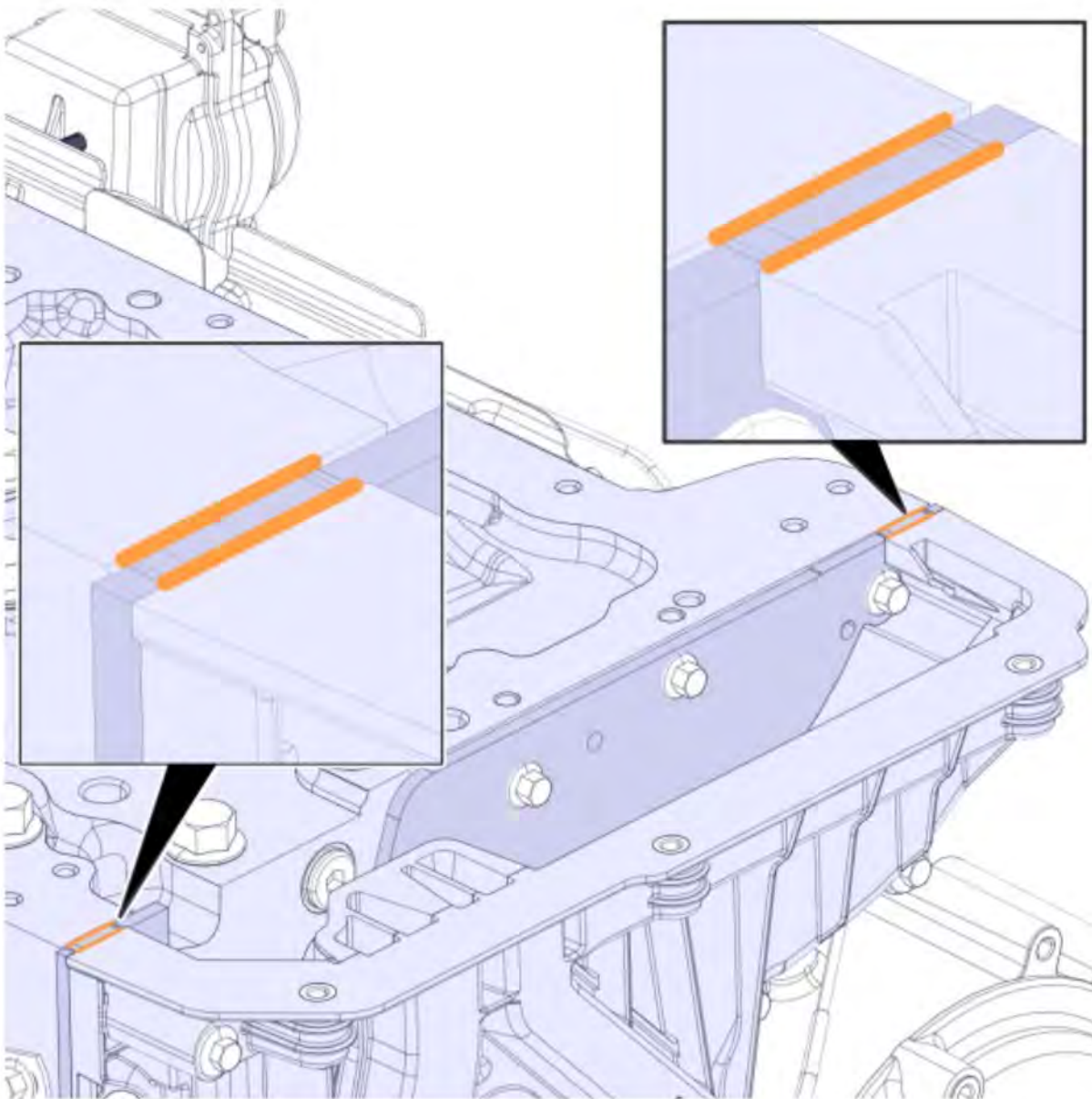


**Note**

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



330	Apply sealant.					
<b>Tech data</b>						
Sealant, bead thickness		2 mm (0.08 in)				
<table border="1" style="width: 100%;"> <tr> <td style="width: 20px; text-align: center;"><b>i</b></td> <td><b>Note</b> Use recommended sealant.</td> </tr> <tr> <td style="width: 20px; text-align: center;"><b>i</b></td> <td><b>Note</b> Install the valve cover within 20 minutes of applying the sealant.</td> </tr> </table>			<b>i</b>	<b>Note</b> Use recommended sealant.	<b>i</b>	<b>Note</b> Install the valve cover within 20 minutes of applying the sealant.
<b>i</b>	<b>Note</b> Use recommended sealant.					
<b>i</b>	<b>Note</b> Install the valve cover within 20 minutes of applying the sealant.					



331 Clean the contact surfaces carefully.

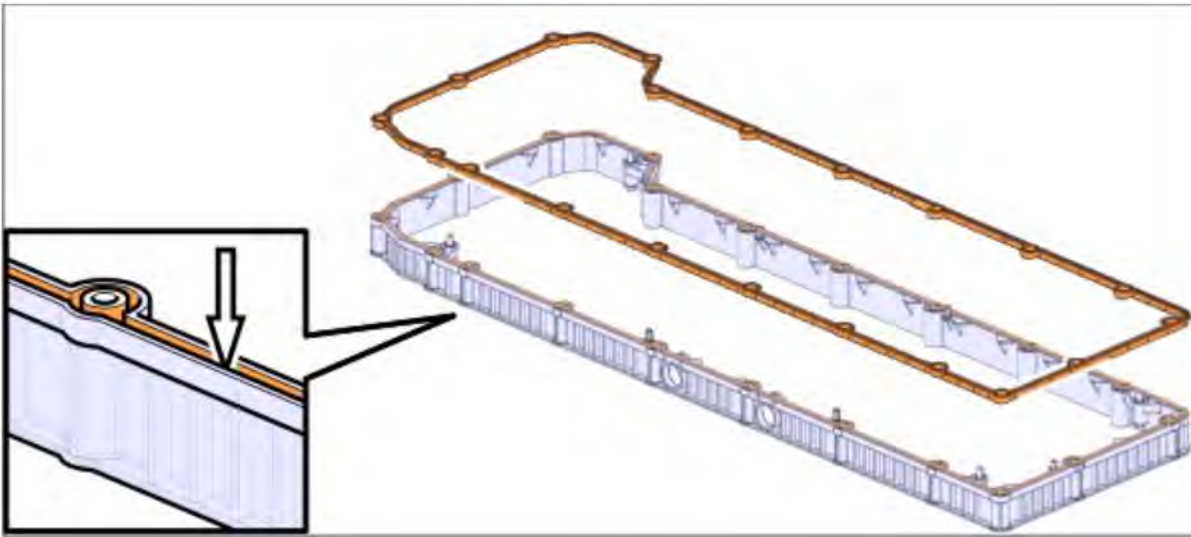
332 Clean the groove.

**i** **Note**  
Ensure that the surfaces are completely clean of oil and grease.

333 Install the gasket.

**i** **Note**  
Use a new part.

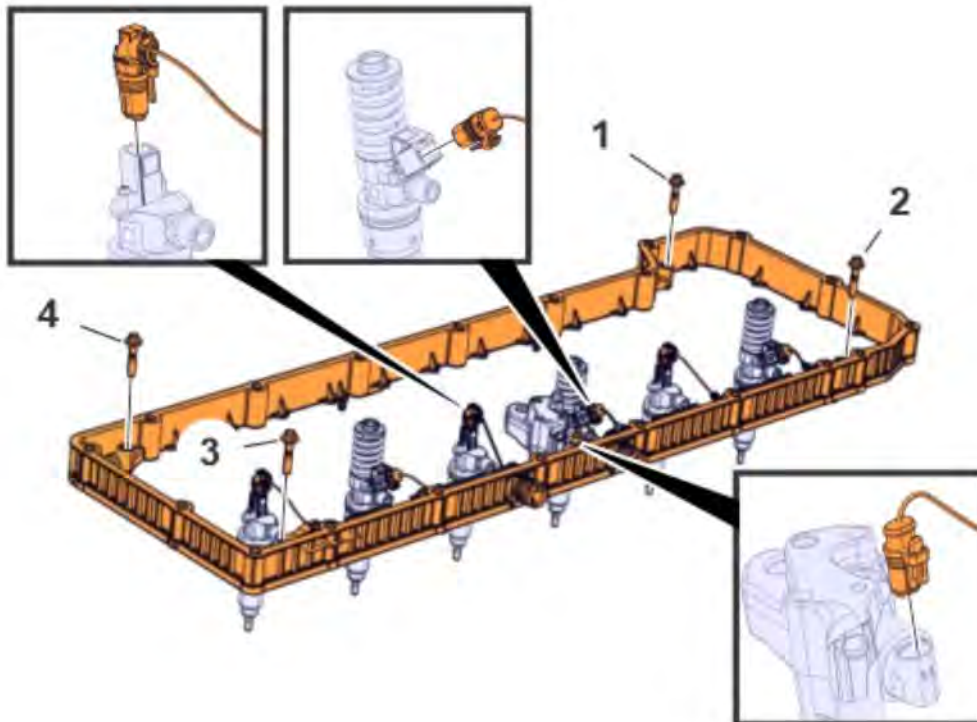




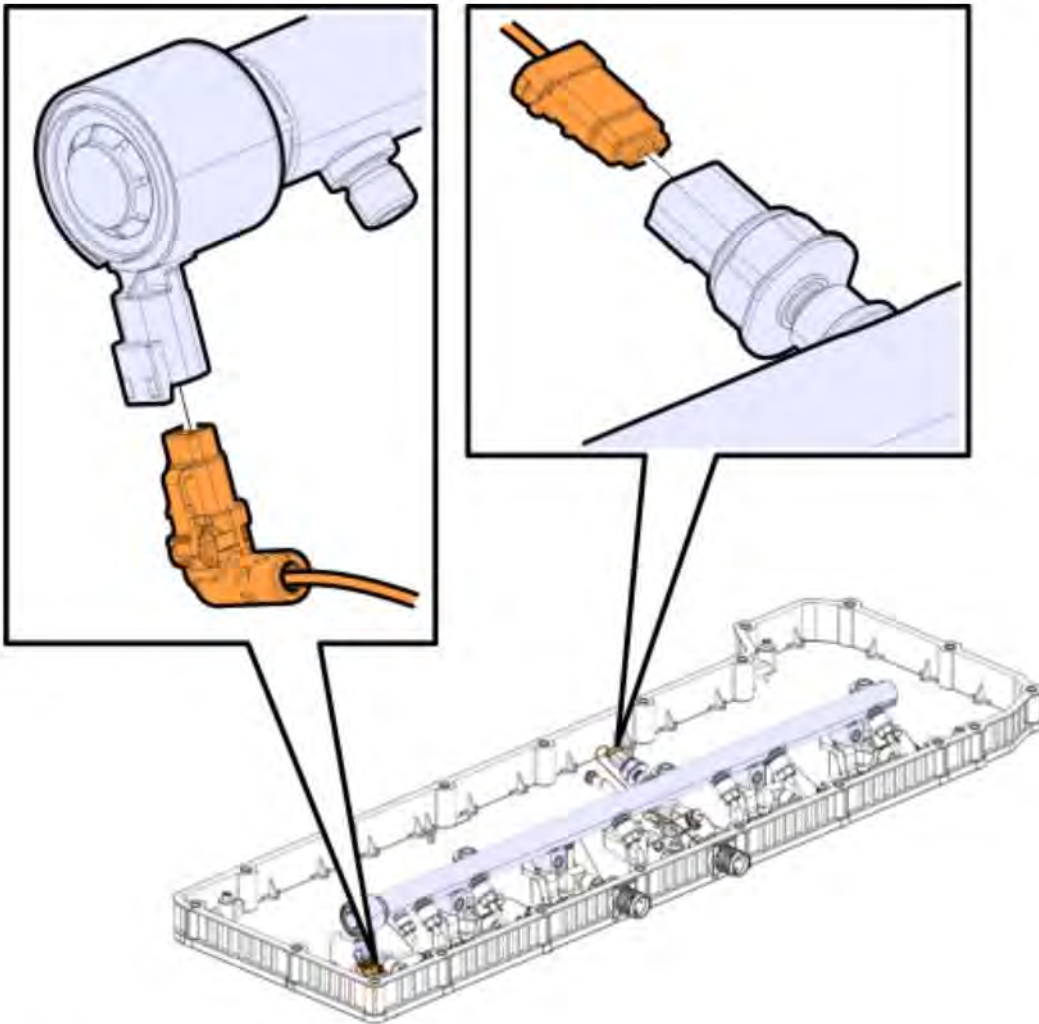
334 Install the frame.

335	Torque tighten the screws.	
	<b>Tightening torque</b>	
	Lower valve cover, screw	Tightening sequence: 1-4 $24 \pm 4 \text{ Nm}$ $(18 \pm 3 \text{ lb}_f\text{-ft})$

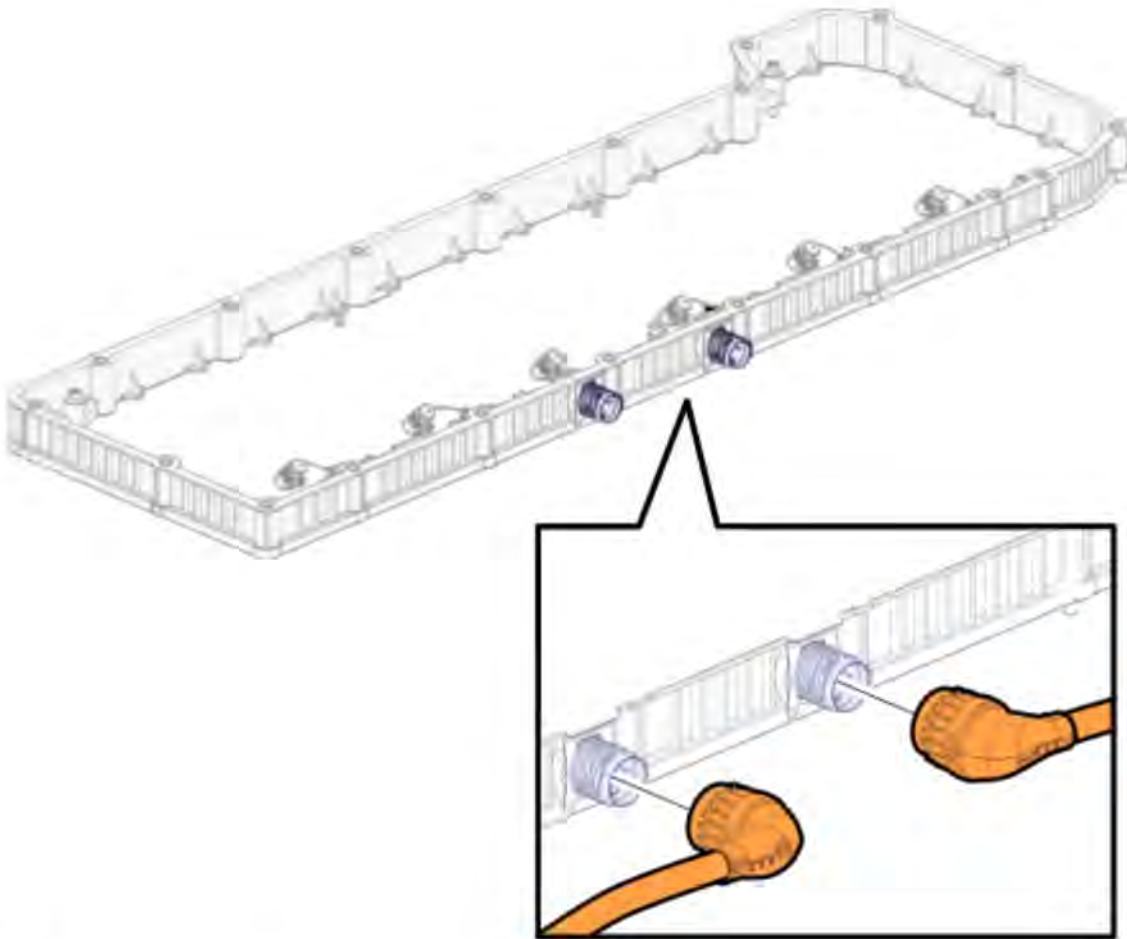
336 Connect the connectors.



337 Connect the connectors.



**338** Connect the connectors.



339 Position the screws.



**Note**

Inspect the gasket, replace as needed.

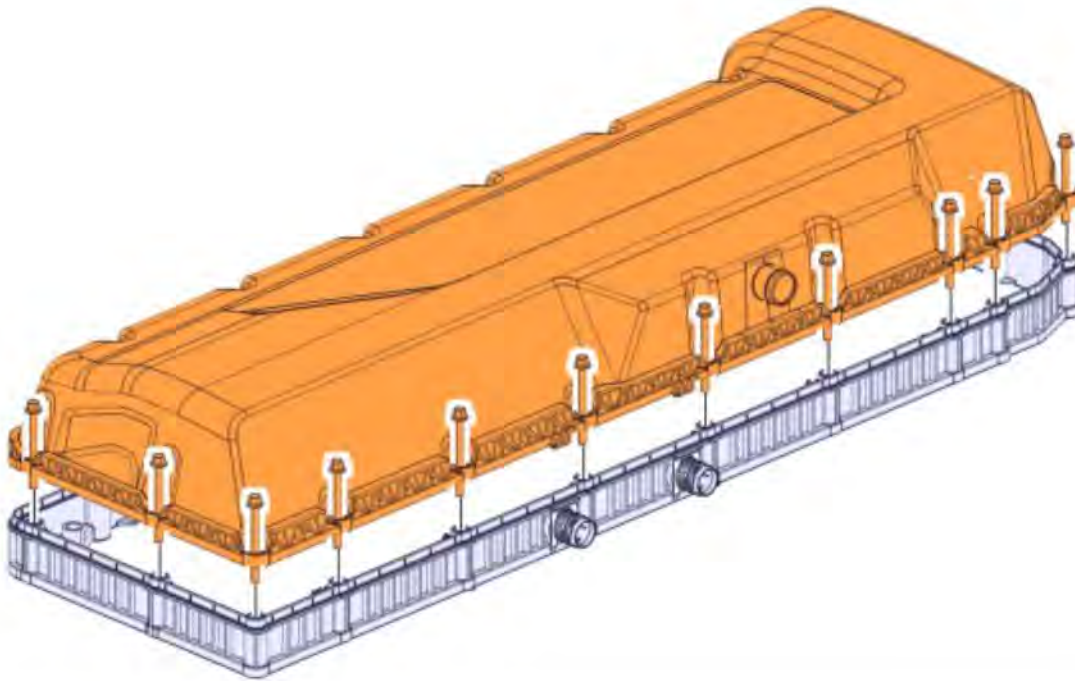


**Service hint**

Temporarily securing the screws at the rear of the cover in the uppermost position will aid in installation

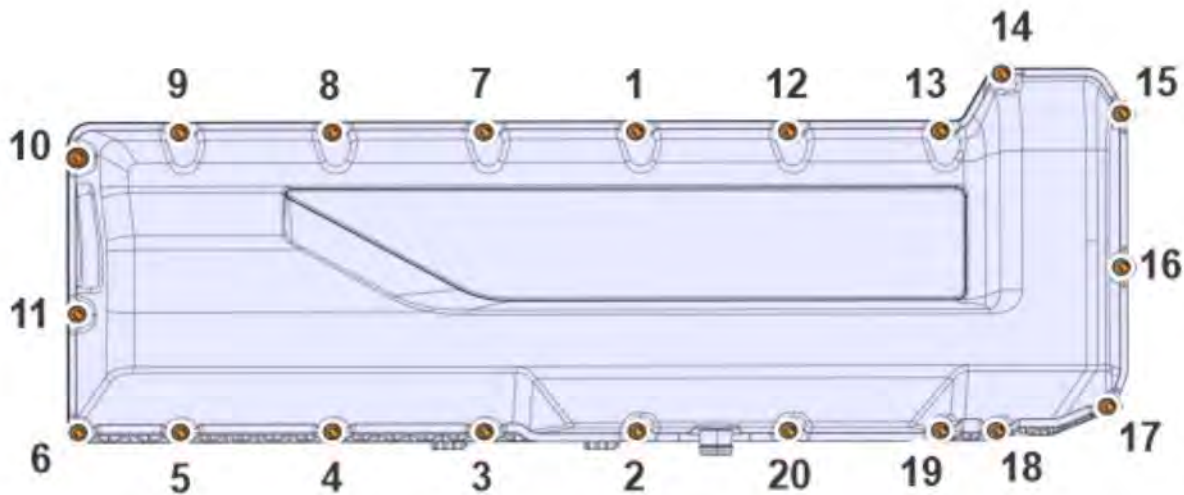
340 Install the valve cover.





**341** Tighten the screws to torque.

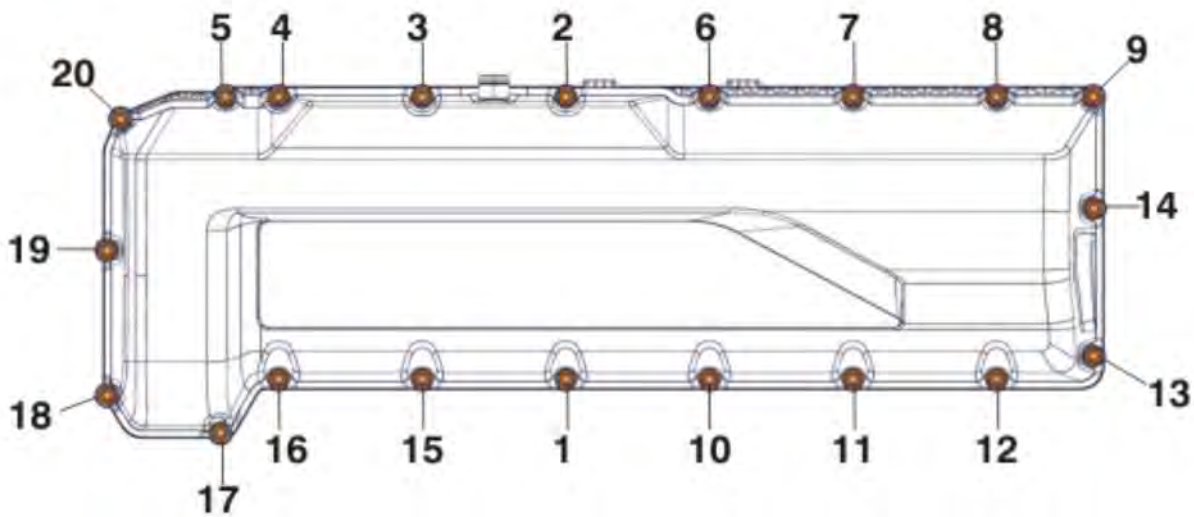
Tightening torque	
Valve cover, screw	Tightening sequence: 1-20
	24 ±4 Nm (18 ±3 lb <sub>f</sub> -ft)



Tightening torque	
Valve cover, screw	Tightening sequence: 1-20
	24 ±4 Nm (18 ±3 lb <sub>f</sub> -ft)

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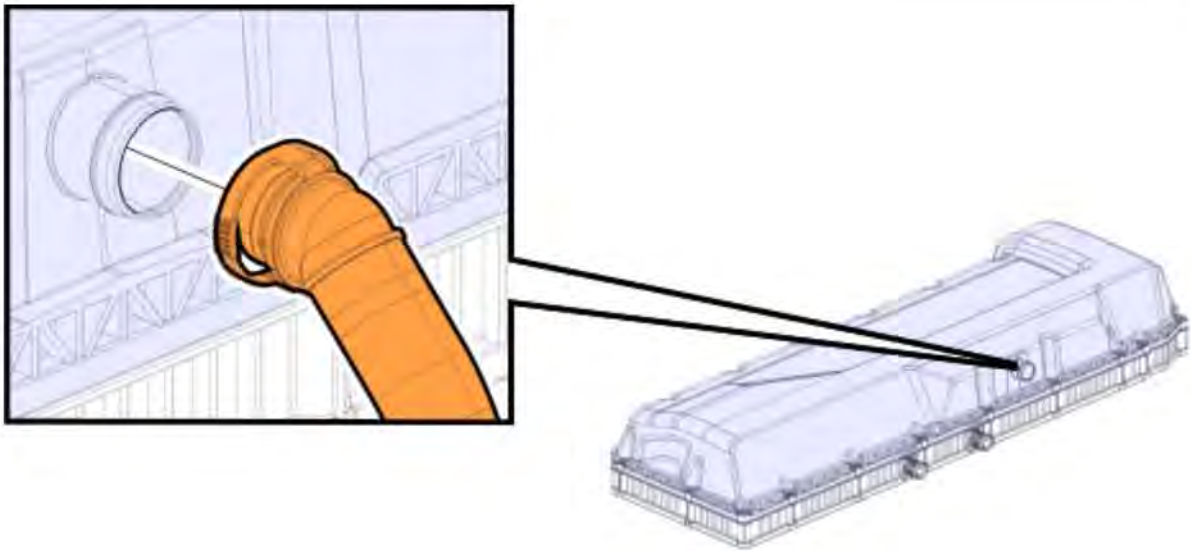
The information contained herein is current at the time of its original distribution, but is subject to change. The reader is advised that printed copies are uncontrolled.



**342** Install the pipe.

**i** **Note**  
If not previously installed.

**i** **Note**  
Inspect the internal sealing ring.

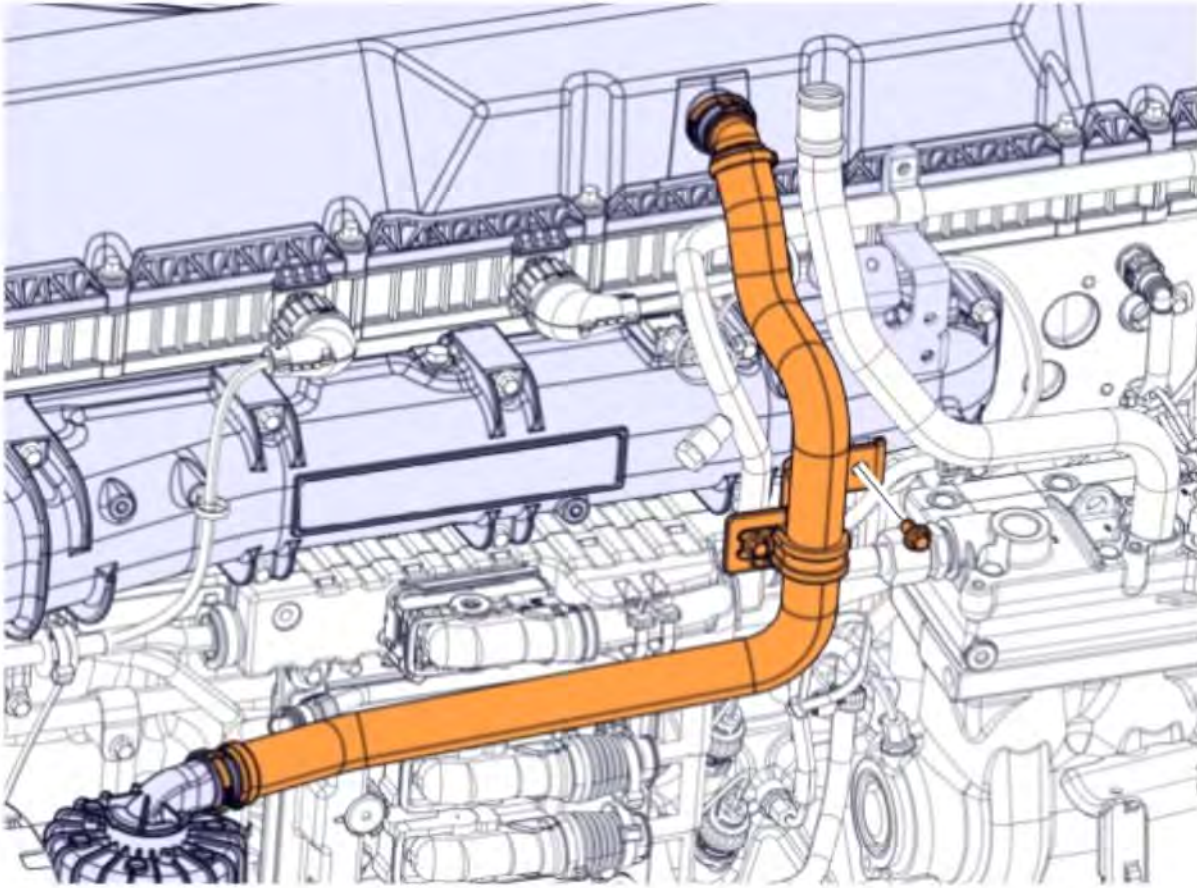


**343** Install the pipe.

**344** Install the screw.

**345** Torque-tighten the screw.

Tightening torque	
Screw	M8
	24 ±4 Nm
	(18 ±3 lb <sub>f</sub> ·ft)



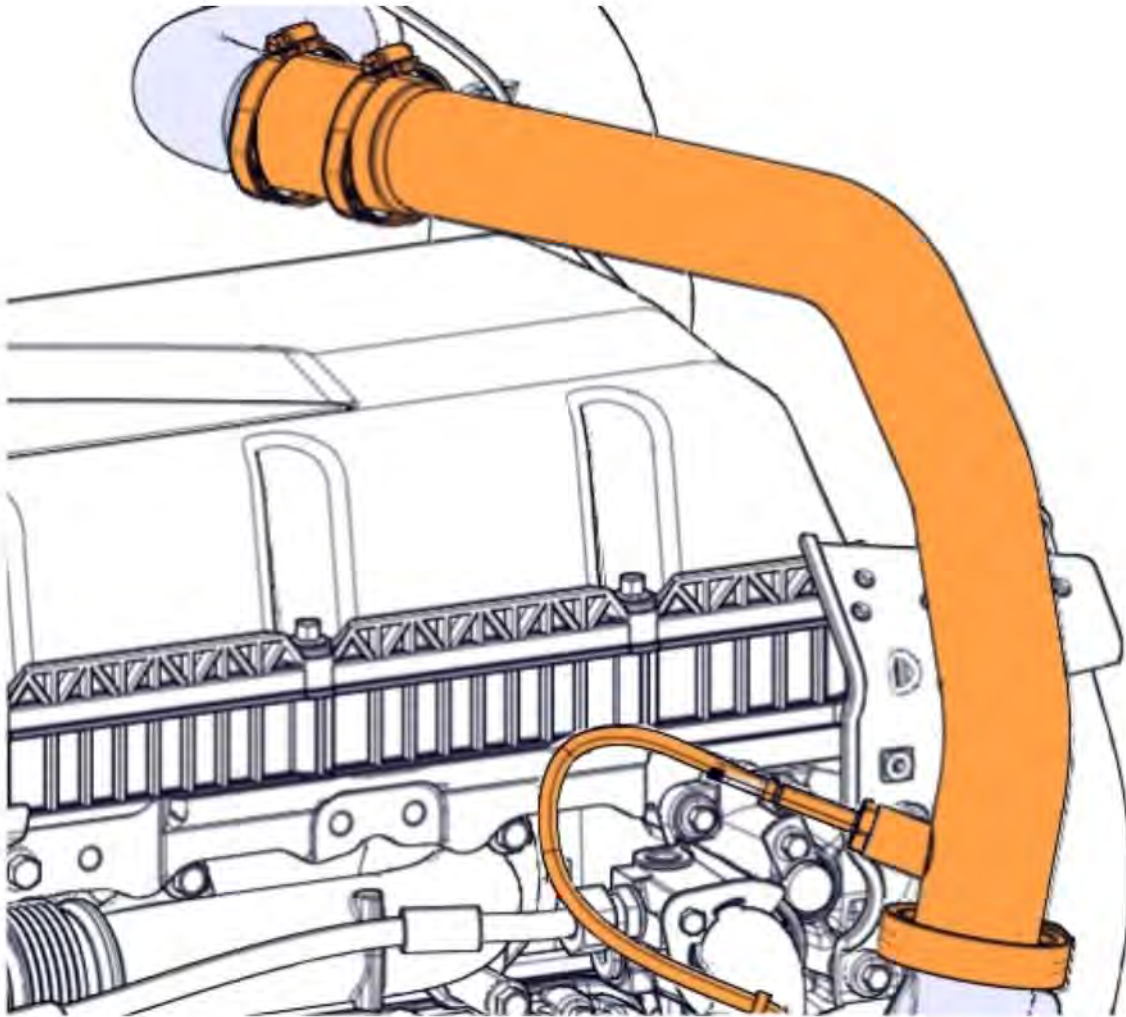
346 Install the pipe.



**Note**

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



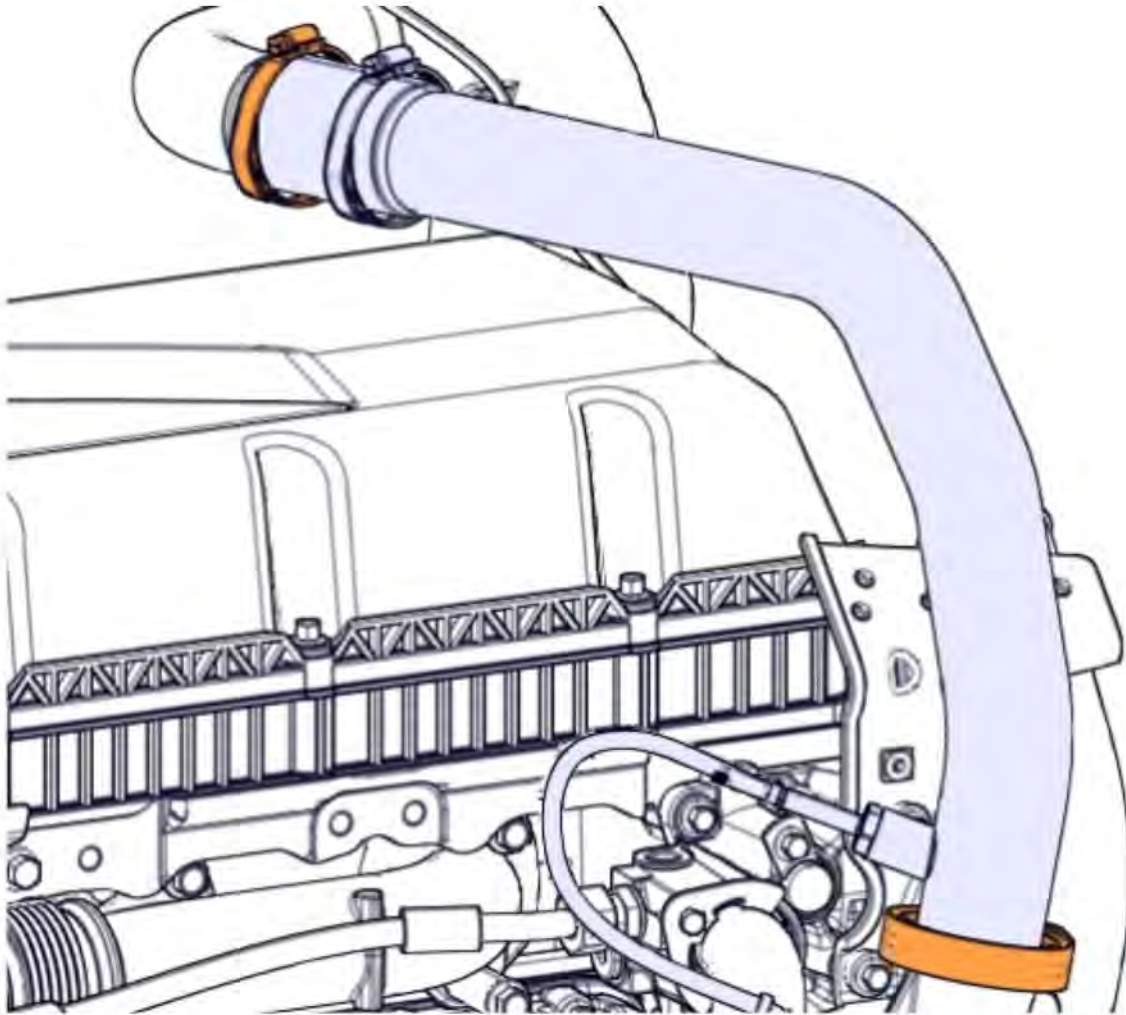


**347** Position the clamps.

<b>i</b>	<b>Note</b> As noted.
----------	--------------------------

**348** Tighten the clamps to torque.

<b>Tightening torque</b>	
V band clamp screw	10.2 ±1 Nm (90 ±9 lb <sub>f</sub> ·in)
<b>Tightening torque</b>	
Hose clamp	11.9 ±2 Nm (105 ±18 lb <sub>f</sub> ·in)

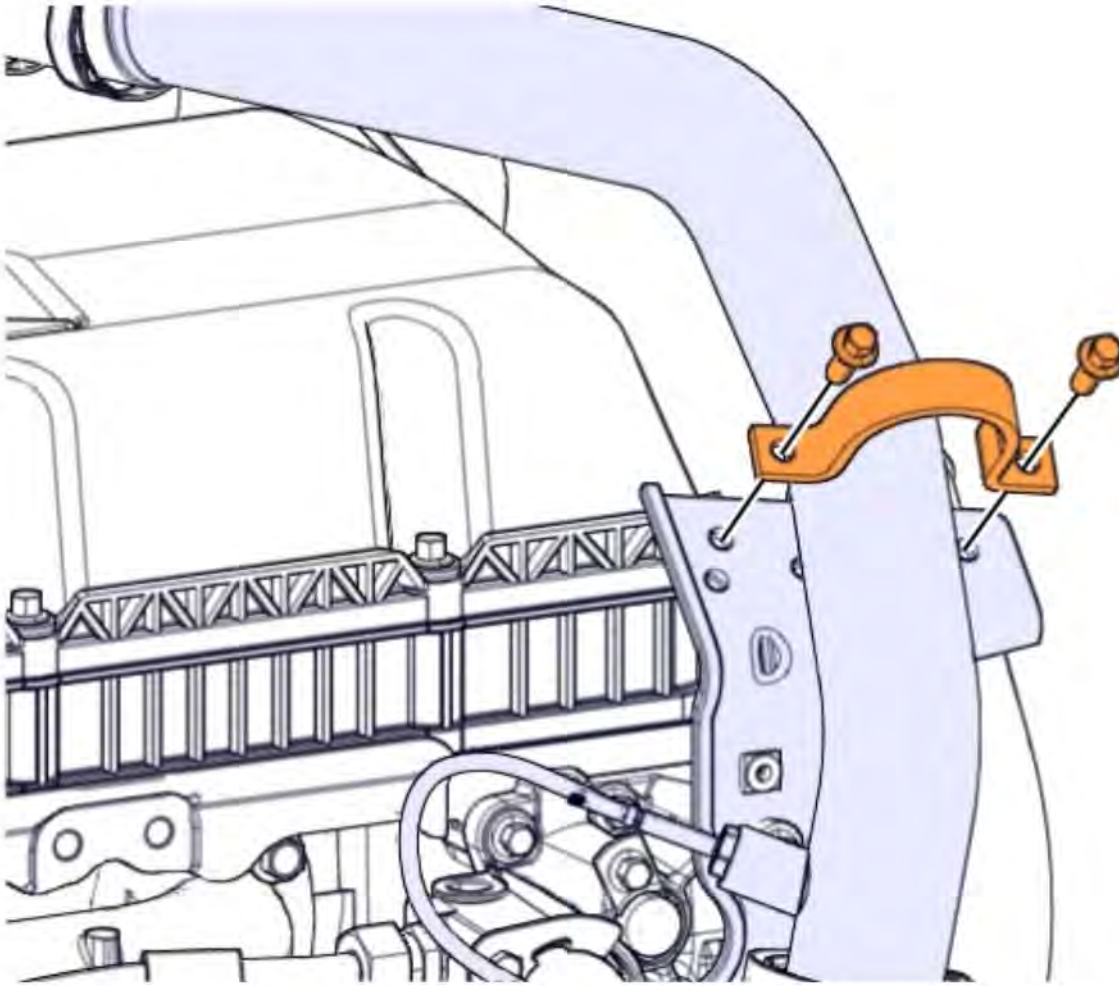


349 Install the clamp.

350 Torque tighten the screws.

**Tightening torque**

Screw	M8
	24 ±4 Nm
	(18 ±3 lb <sub>f</sub> .ft)



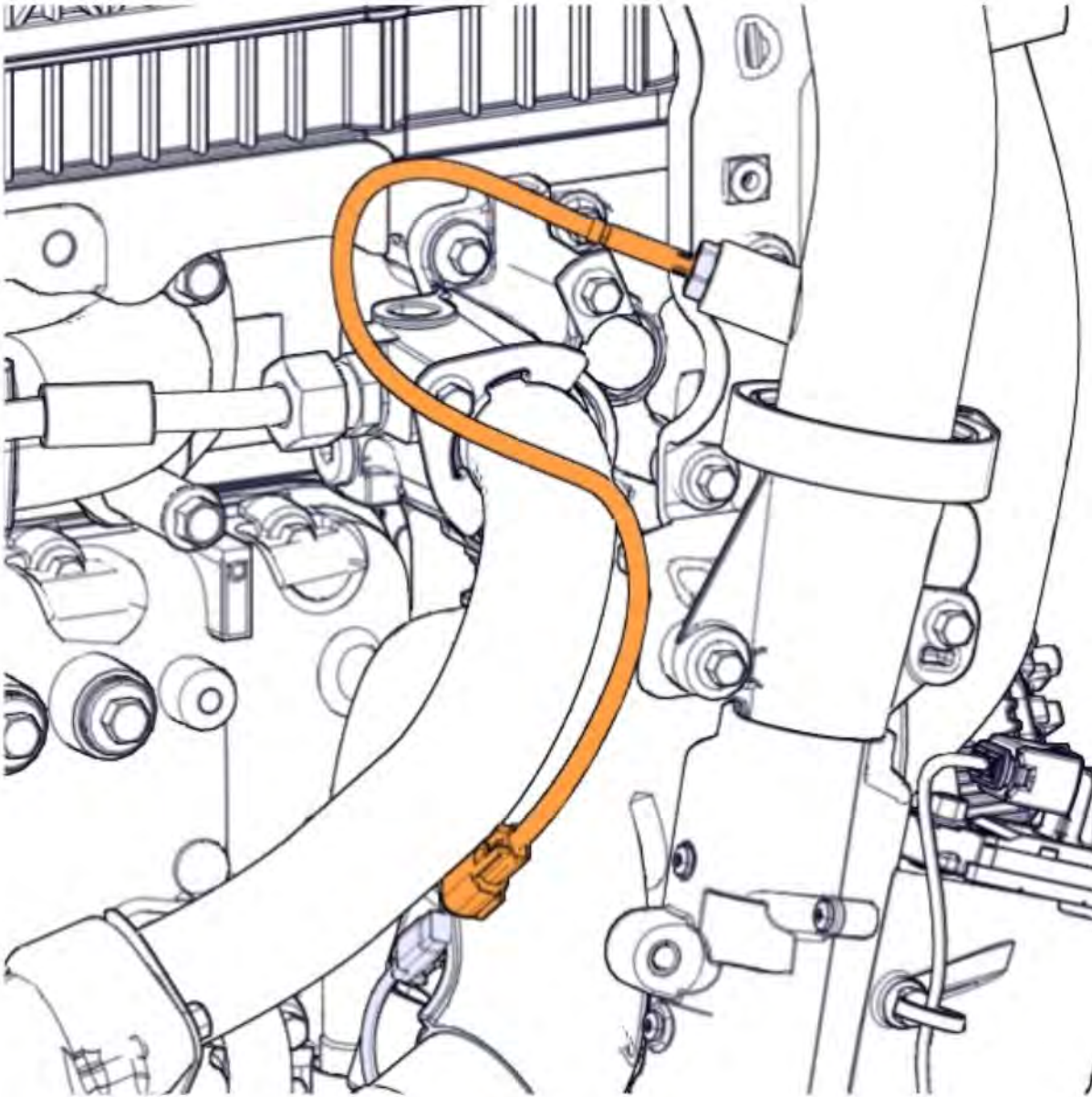
351	Connect the connector.
-----	------------------------

352	Install the cable tie.
-----	------------------------

**Note**

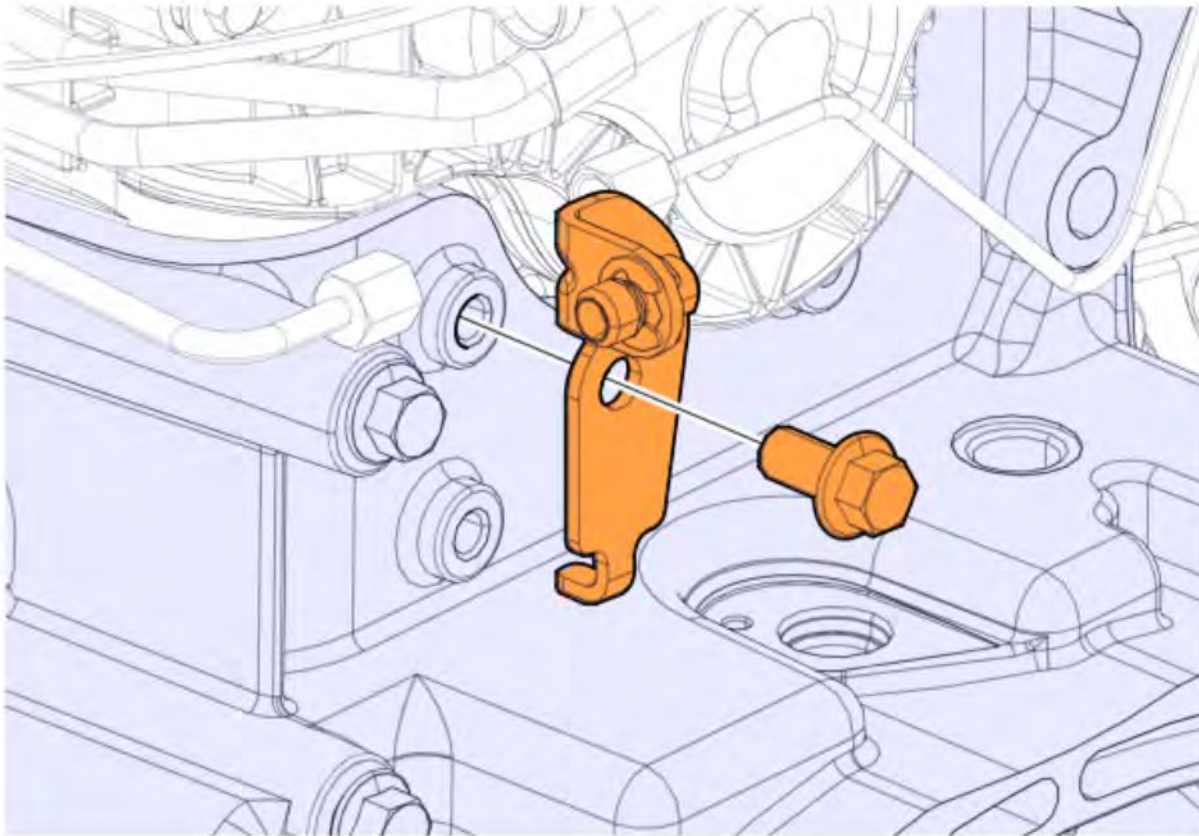
Use a new part.





353	Install the bracket.
-----	----------------------

354	Install the screw.
-----	--------------------

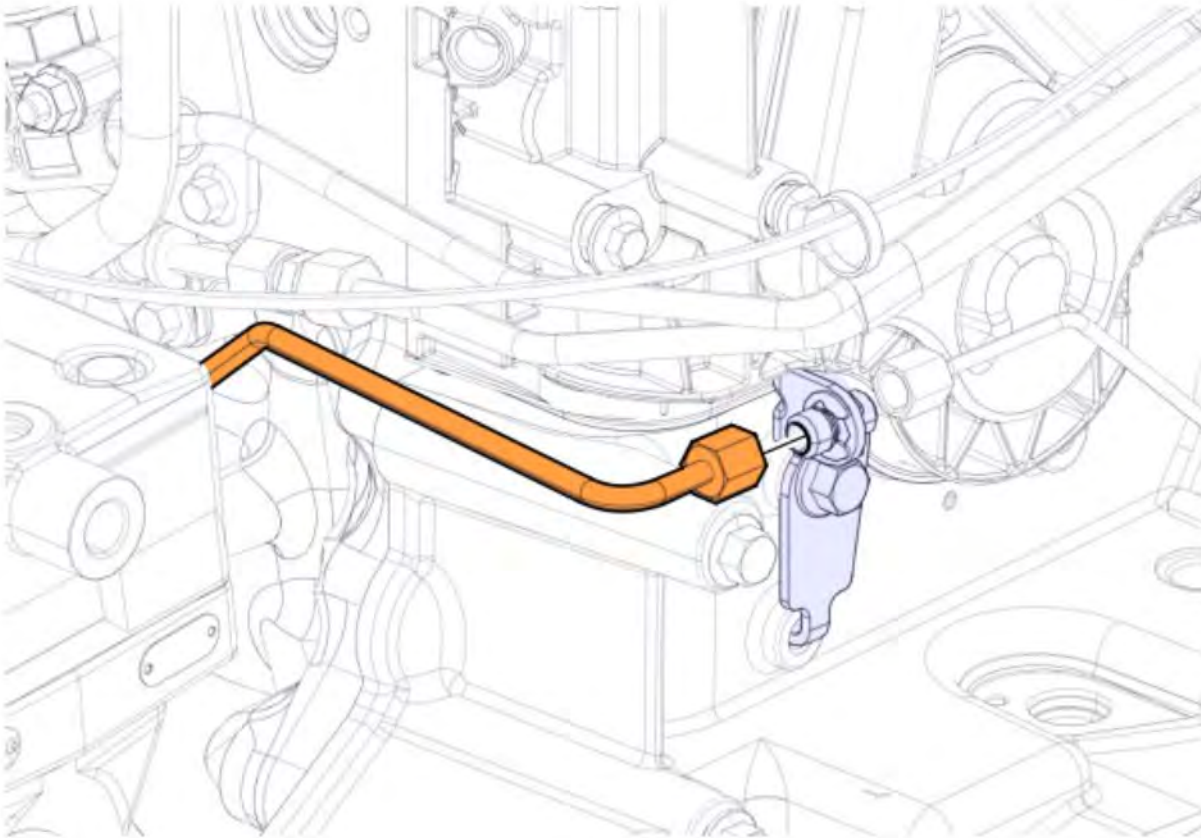


<b>355</b>	Install the nut.
------------	------------------

<b>356</b>	Torque tighten the nut.
------------	-------------------------

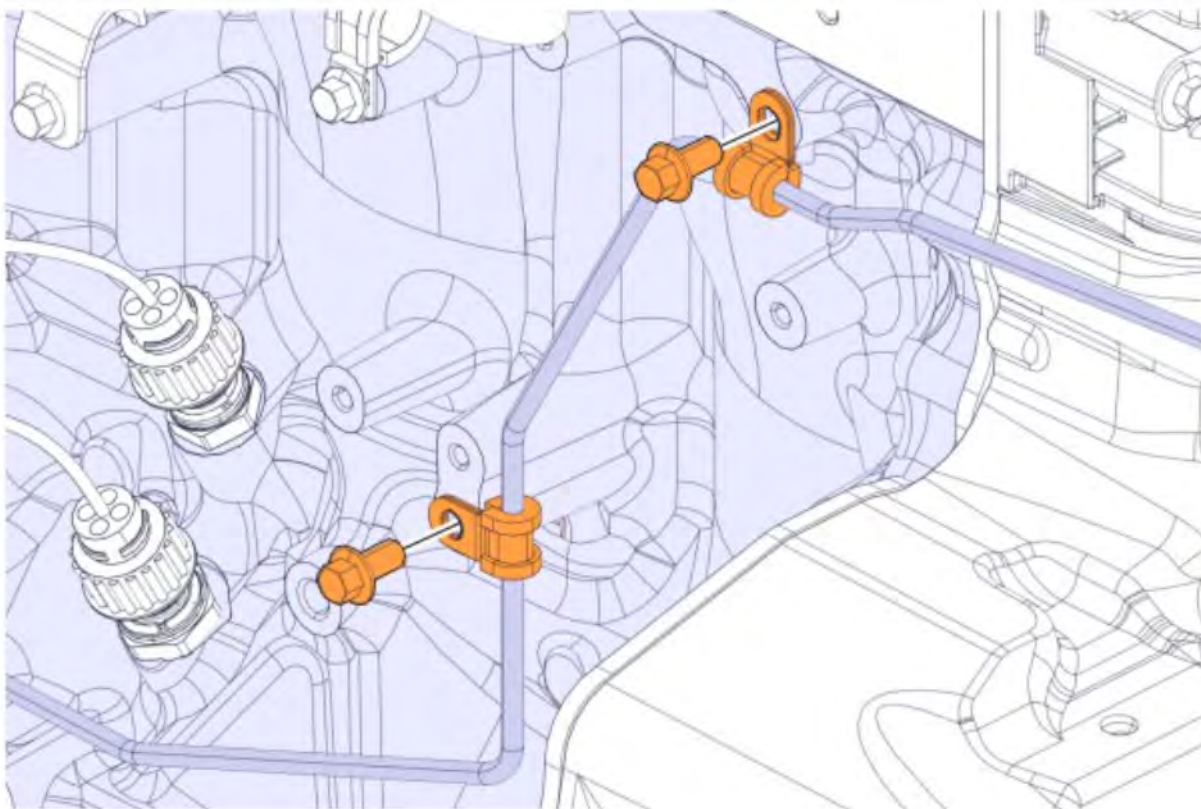
Tightening torque	
Fitting	#4
	15 ±1 Nm (11 ±1 lb <sub>f</sub> .ft)





<b>357</b>	Install the clamps.
------------	---------------------

<b>358</b>	Install the screws.
------------	---------------------



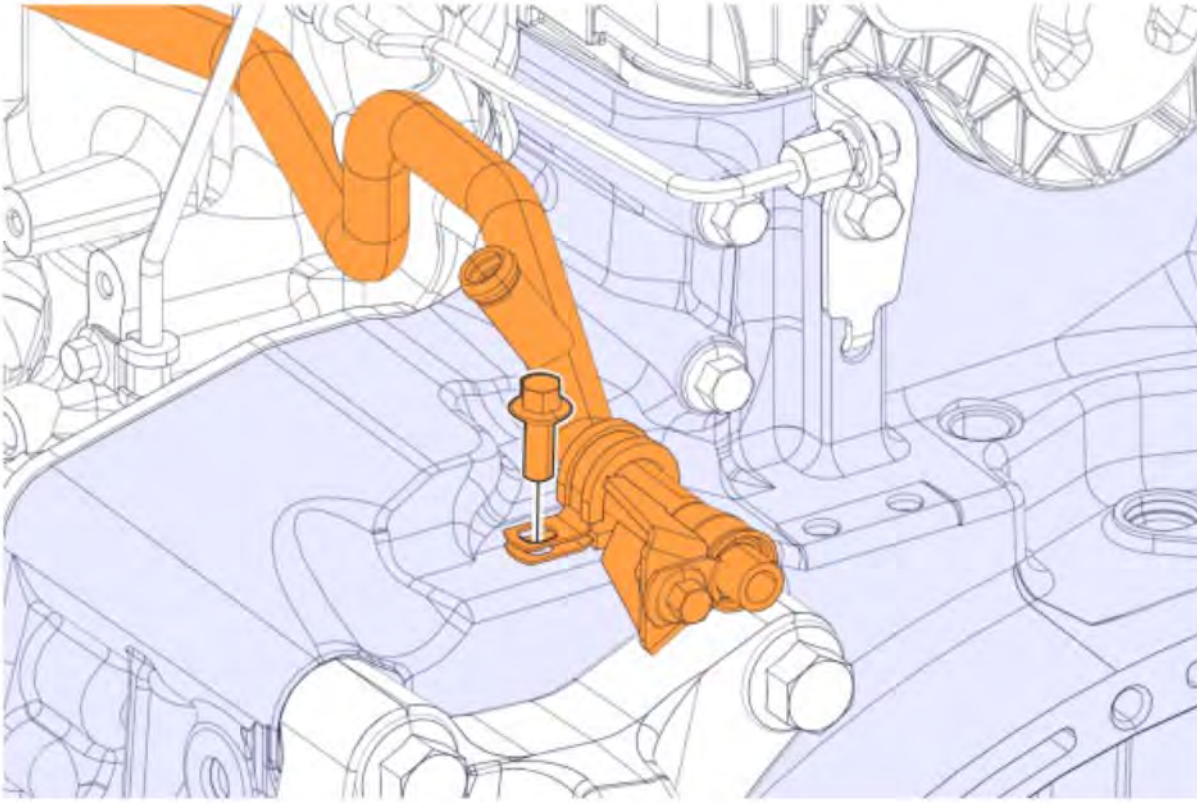
<b>359</b>	Position the pipe.
------------	--------------------

<b>360</b>	Install the screw.
------------	--------------------

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**361** Lubricate the O-ring.



**Note**

Use a new part.



**Note**

Use recommended oil.

**362** Install the O-ring.



**⚠ CAUTION**

**Risk of serious injury.**  
 Heavy component.

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

**363** Install the compressor.

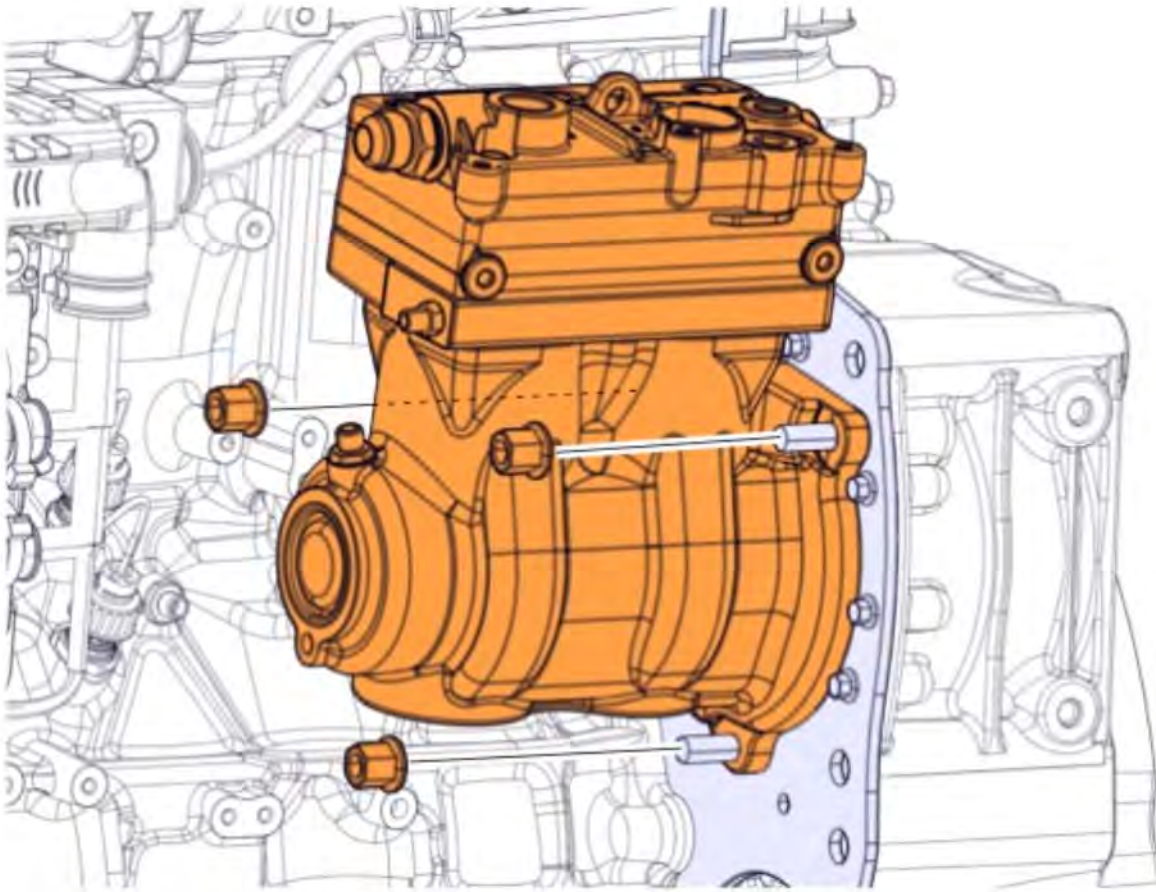
<b>i</b>	<b>Note</b> Take care not to damage surrounding components.
----------	--

**364** Install the nuts.

**365** Torque tighten the nuts diagonally.

Tightening torque	
Compressor, mounting nut	85 ±15 Nm (63 ±11 lb <sub>f</sub> -ft)

**366** Repeat the operation a second time.



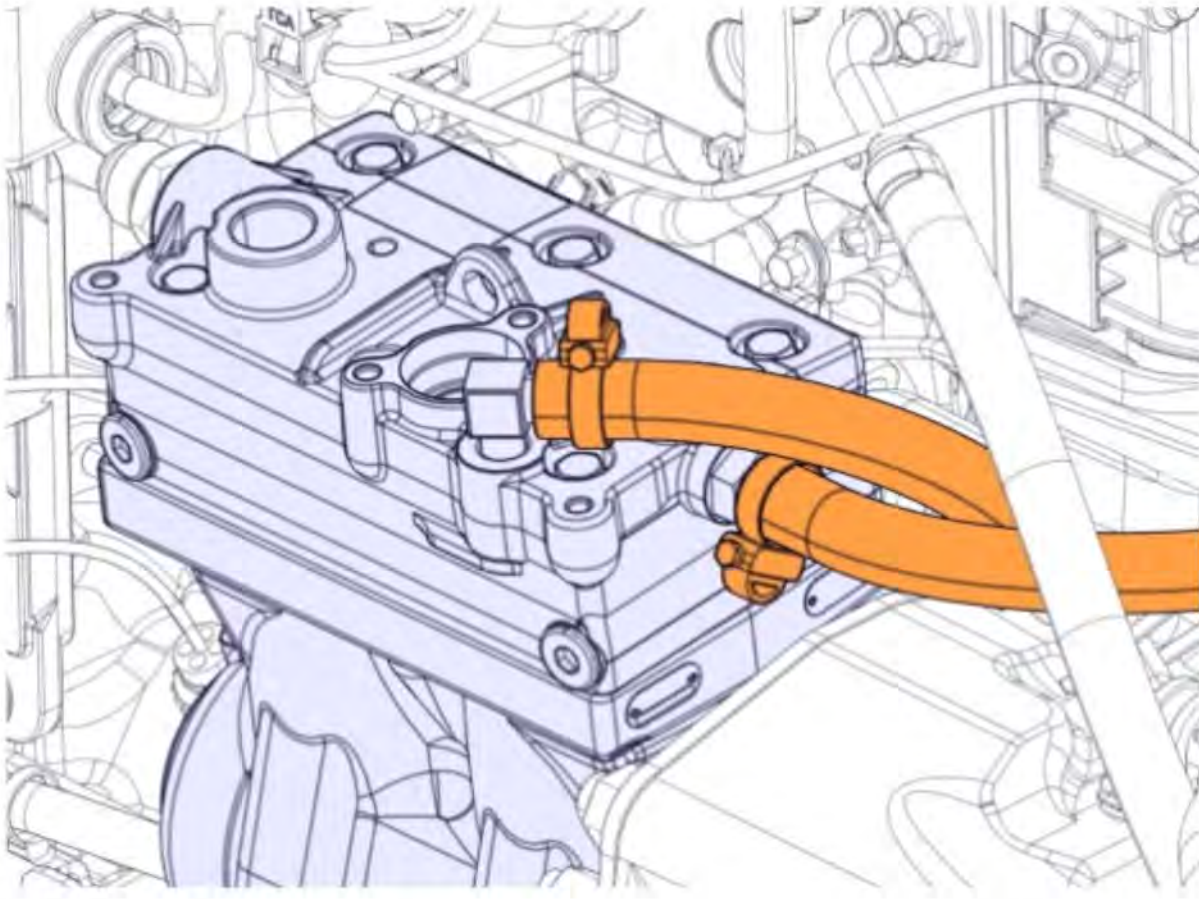
<b>367</b>	Connect the hoses.
------------	--------------------

<b>368</b>	Torque tighten the clamps.
------------	----------------------------

<b>Tightening torque</b>	
--------------------------	--

Compressor, coolant hose, clamp	$3 \pm 0.5 \text{ Nm}$ $(2 \pm 0.4 \text{ lb}_f\text{-ft})$
---------------------------------	--





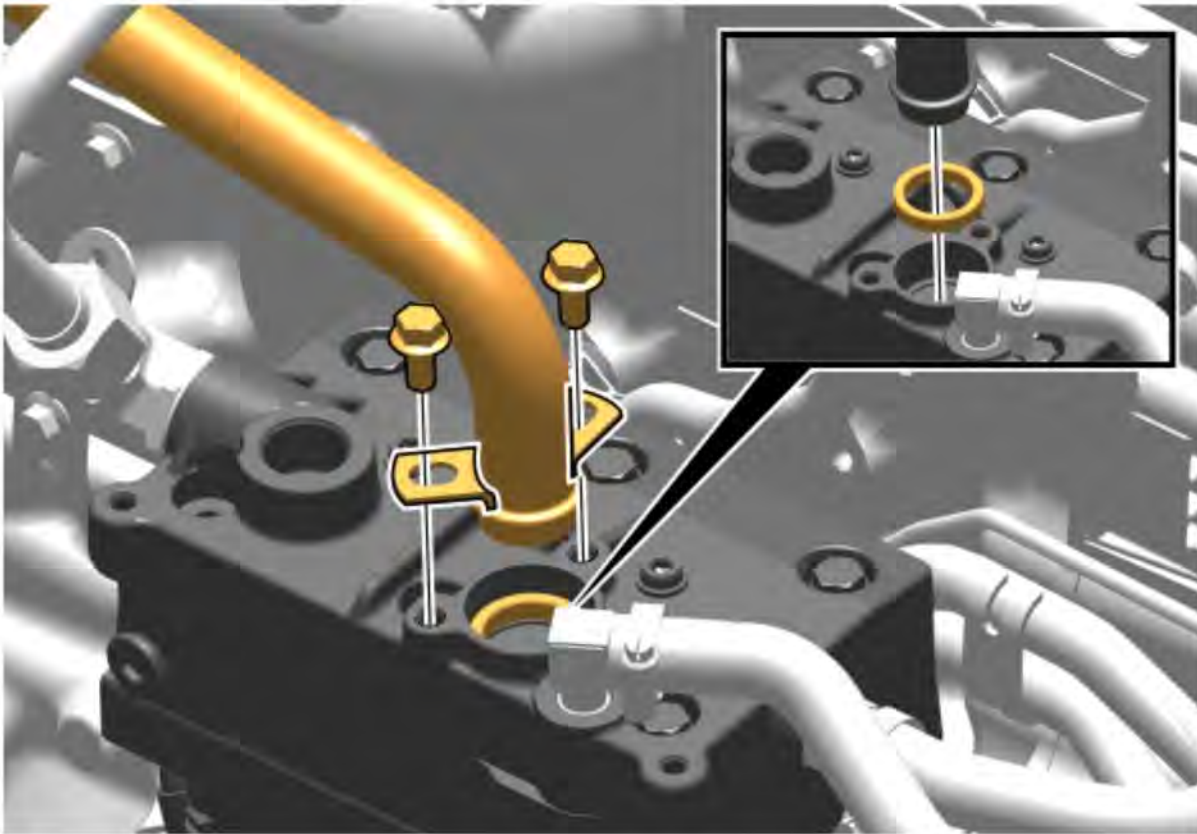
<b>369</b>	Lubricate the sealing ring.		
	<table border="1" style="width: 100%;"> <tr> <td style="width: 10%; text-align: center;"><b>i</b></td> <td><b>Note</b> Use recommended oil.</td> </tr> </table>	<b>i</b>	<b>Note</b> Use recommended oil.
<b>i</b>	<b>Note</b> Use recommended oil.		

<b>370</b>	Install the sealing ring.		
	<table border="1" style="width: 100%;"> <tr> <td style="width: 10%; text-align: center;"><b>i</b></td> <td><b>Note</b> Use a new part.</td> </tr> </table>	<b>i</b>	<b>Note</b> Use a new part.
<b>i</b>	<b>Note</b> Use a new part.		

<b>371</b>	Install the pipe along with the lock braces.
------------	--

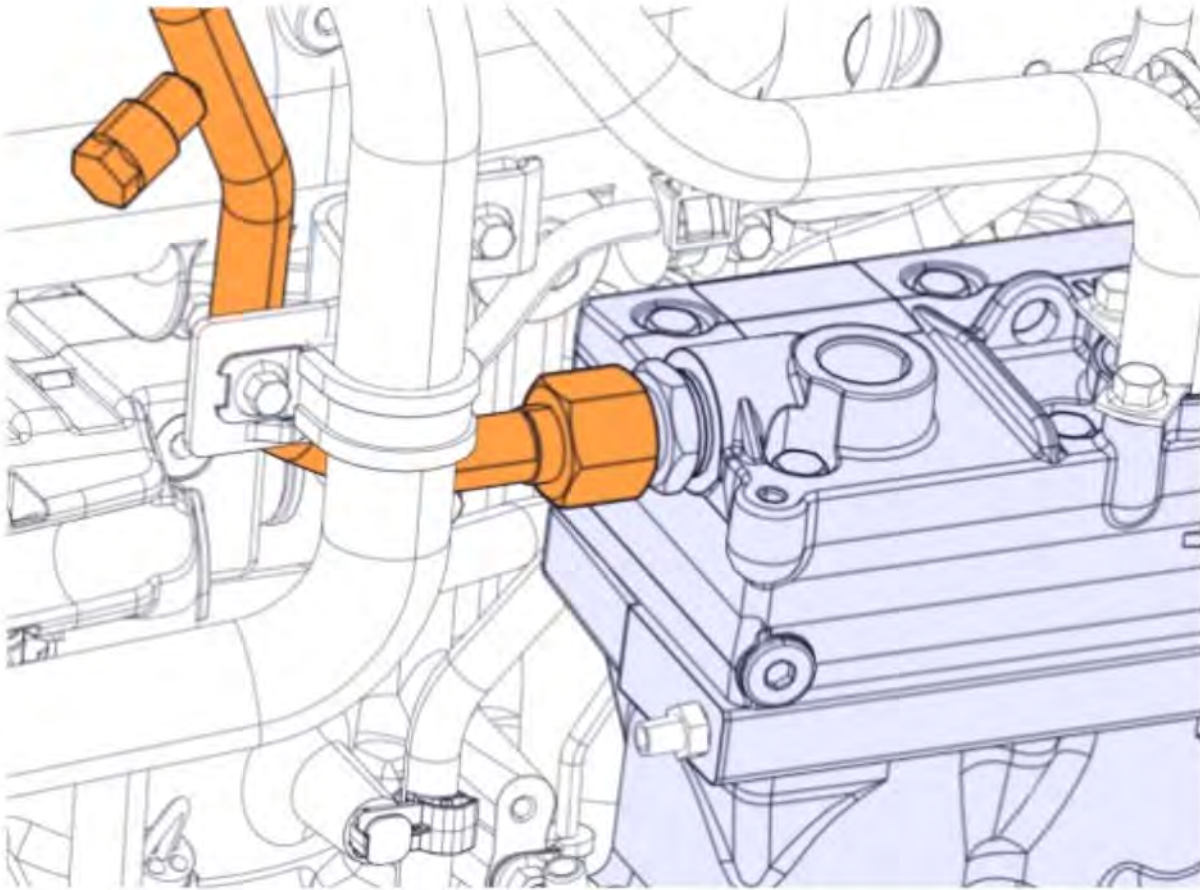
<b>372</b>	Install the screws.
------------	---------------------

<b>373</b>	Torque tighten the screws.						
	<b>Tightening torque</b>						
	<table border="1" style="width: 100%;"> <tr> <td style="width: 50%;">Lock brace, screw</td> <td>M8</td> </tr> <tr> <td></td> <td>24 ±4 Nm</td> </tr> <tr> <td></td> <td>(18 ±3 lb<sub>f</sub>·ft)</td> </tr> </table>	Lock brace, screw	M8		24 ±4 Nm		(18 ±3 lb <sub>f</sub> ·ft)
Lock brace, screw	M8						
	24 ±4 Nm						
	(18 ±3 lb <sub>f</sub> ·ft)						



<b>374</b>	Install the pipe.
------------	-------------------

<b>375</b>	Torque tighten the nut.	
	<b>Tightening torque</b>	
	Compressor, air outlet, nut	130 ±20 Nm (96 ±15 lb <sub>f</sub> -ft)



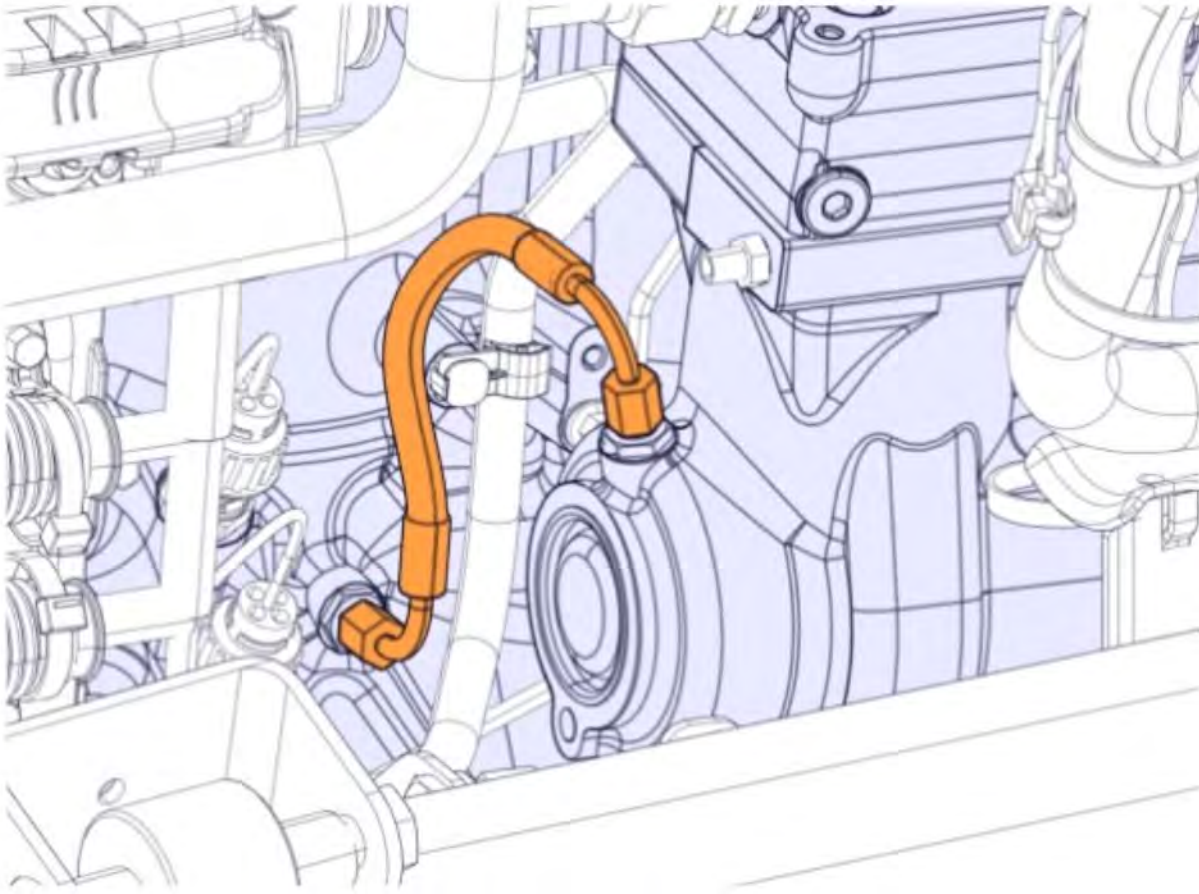
<b>376</b>	Install the oil hose.
------------	-----------------------

<b>377</b>	Torque tighten the fitting nuts.
------------	----------------------------------

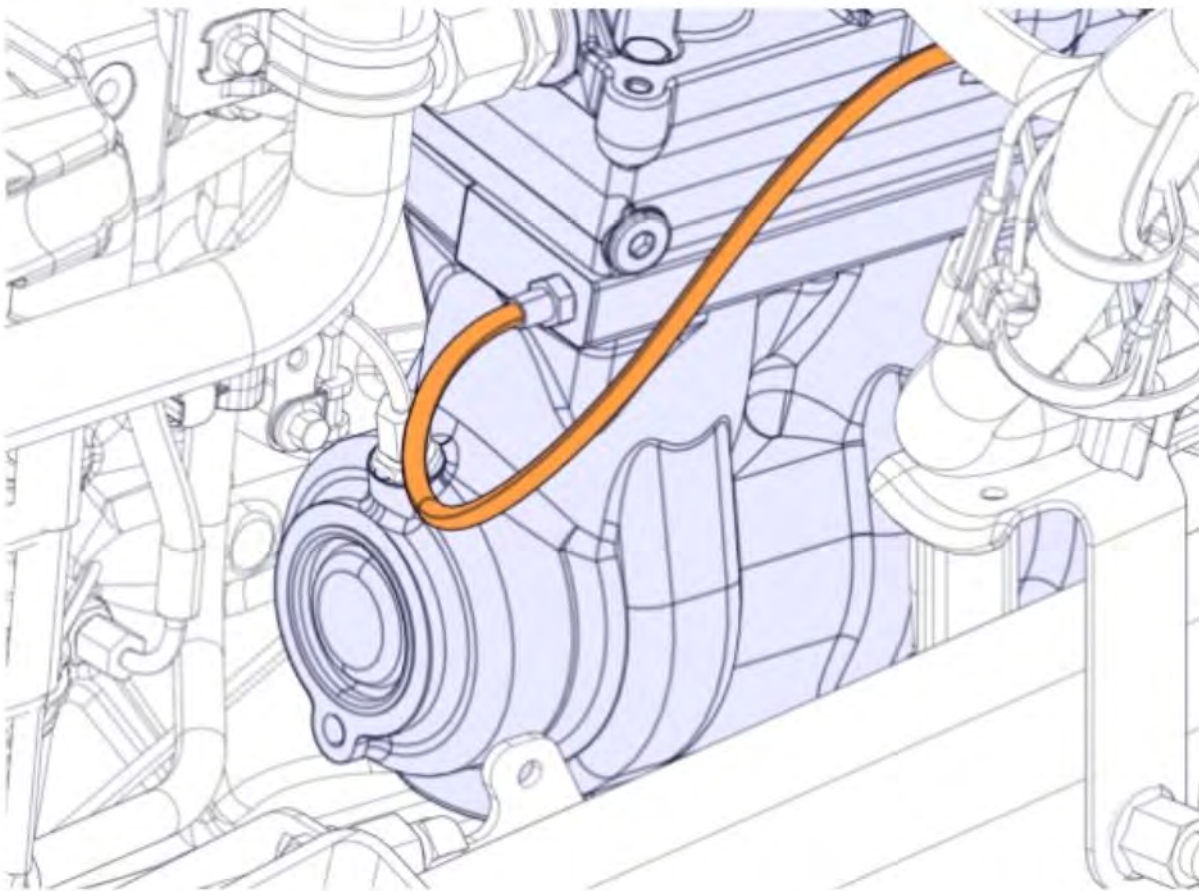
<b>Tightening torque</b>	
--------------------------	--

Compressor, oil hose, fitting	15 ±3 Nm (11 ±2 lb <sub>f</sub> ·ft)
-------------------------------	---





**378** Connect the air line.

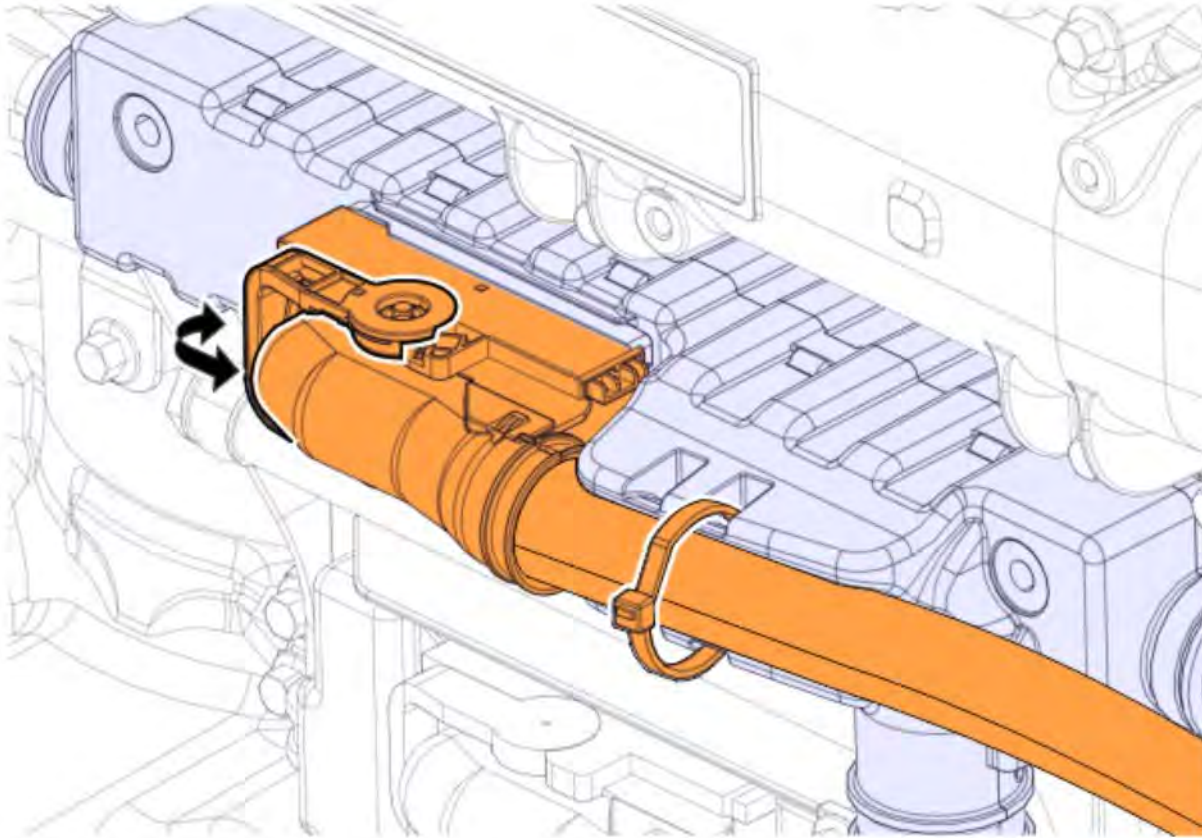


**379** Connect the connector.

380 Install the cable ties.

**i** **Note**  
Use new parts.

**i** **Note**  
As noted.



381 Lubricate the seal.

382 Install the seal.

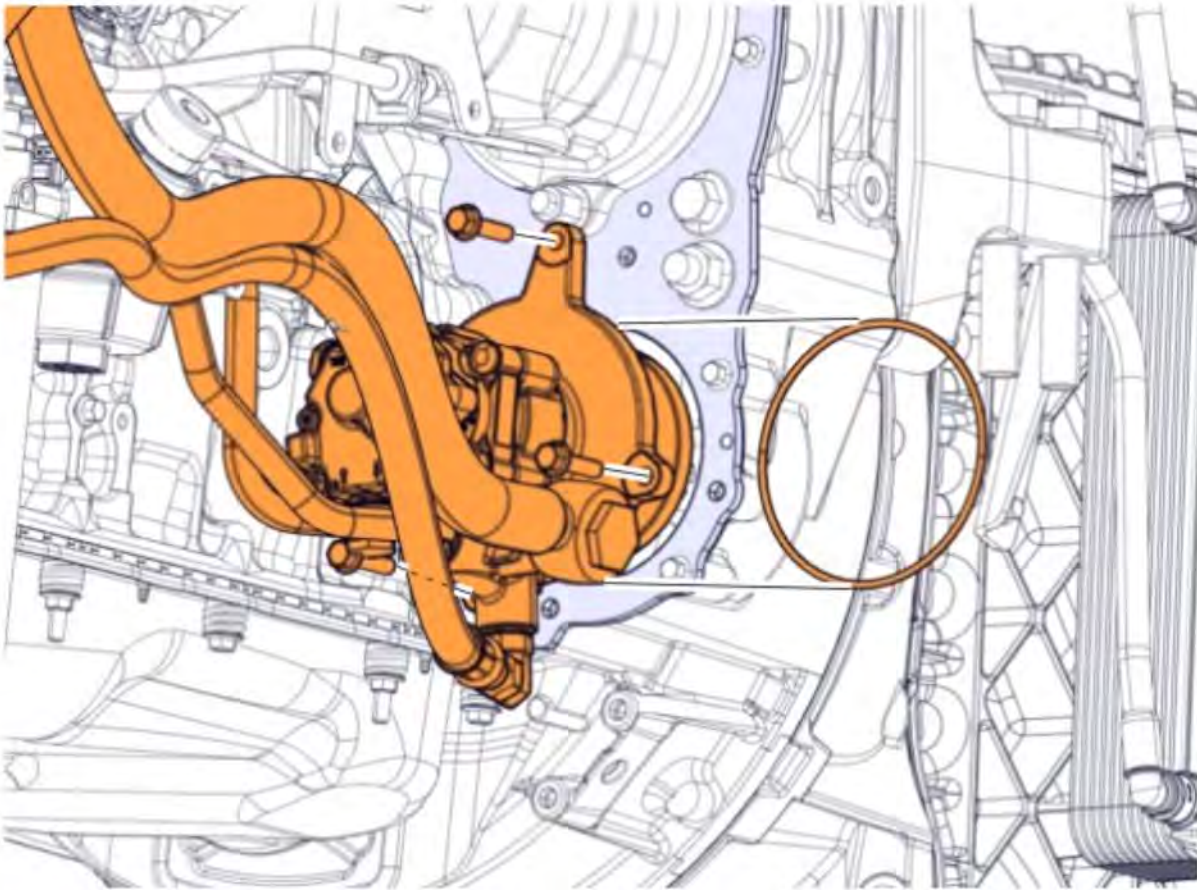
**i** **Note**  
Use a new part

**i** **Note**  
Use recommended oil.

383 Install the pump.

384 Install the screws.



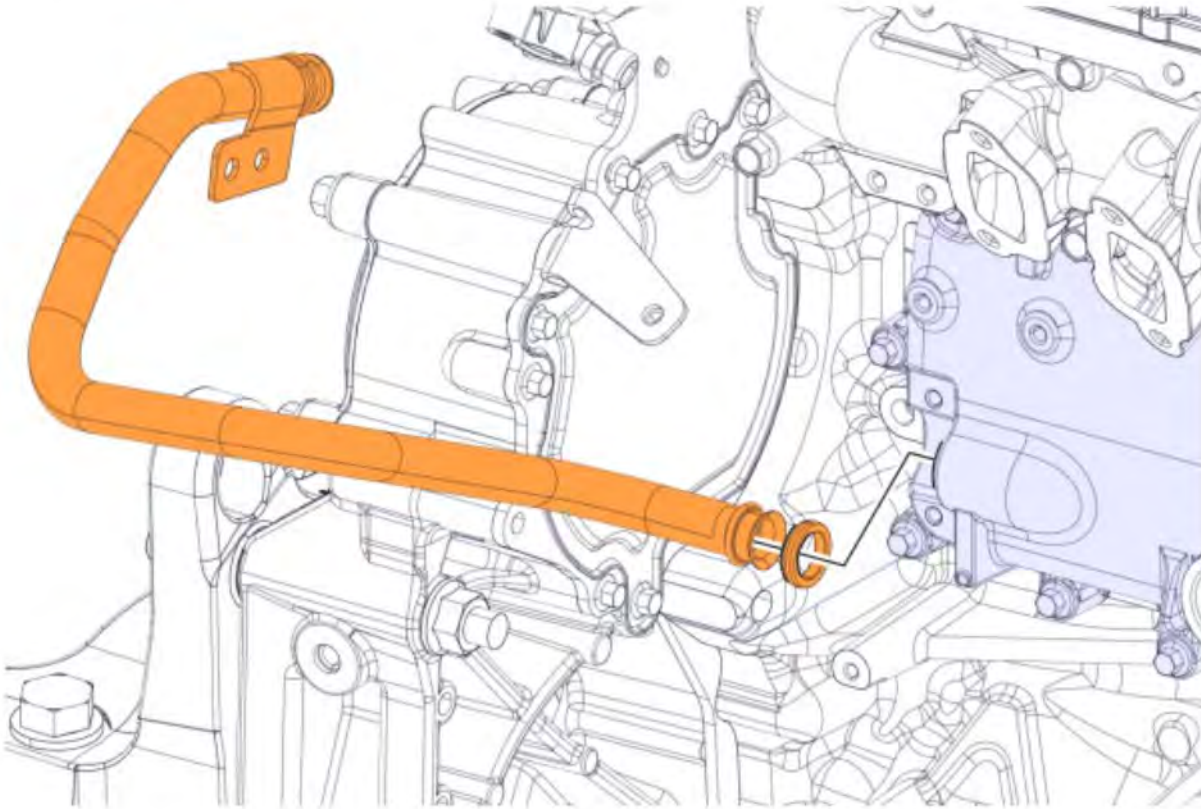


<b>385</b>	Torque tighten the screws.	
	<b>Tightening torque</b>	
	Screw	M8
		24 ±4 Nm (18 ±3 lb <sub>f</sub> .ft)

<b>386</b>	Install the seal.	
	<b>i</b>	<b>Note</b> Use a new part.

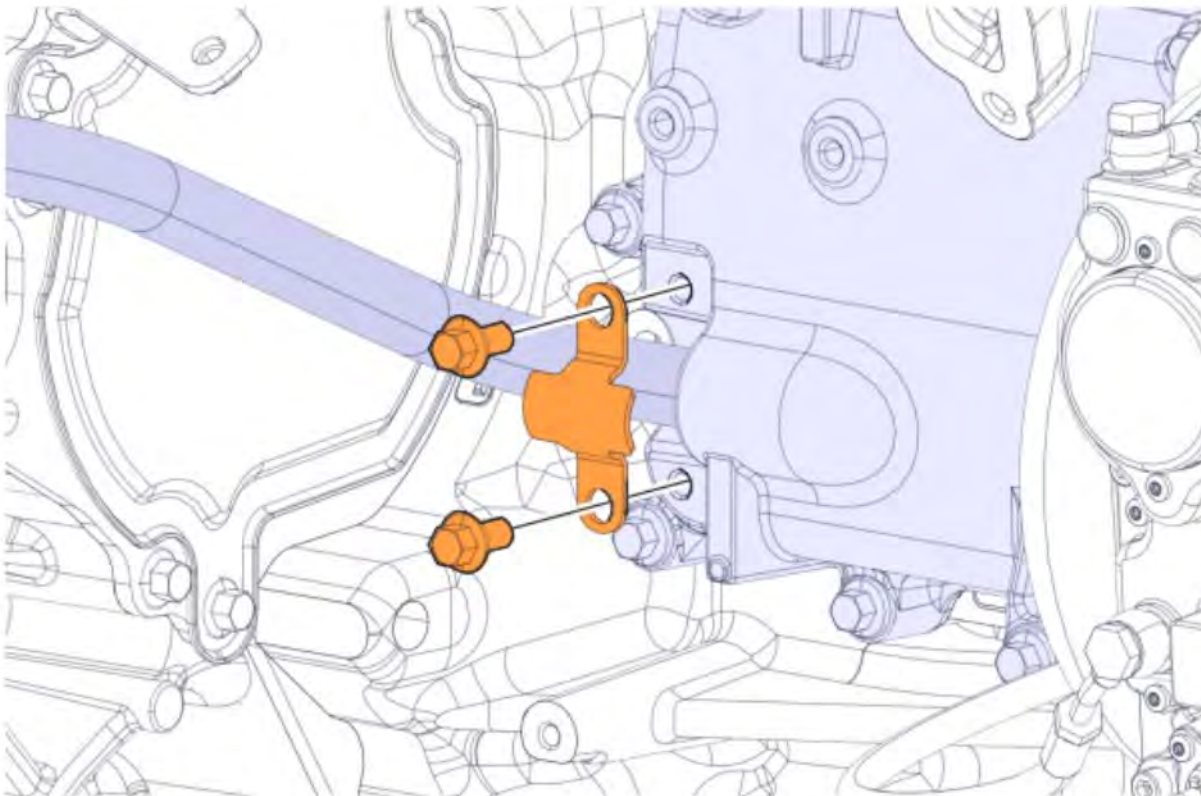
<b>387</b>	Install the pipe.
------------	-------------------





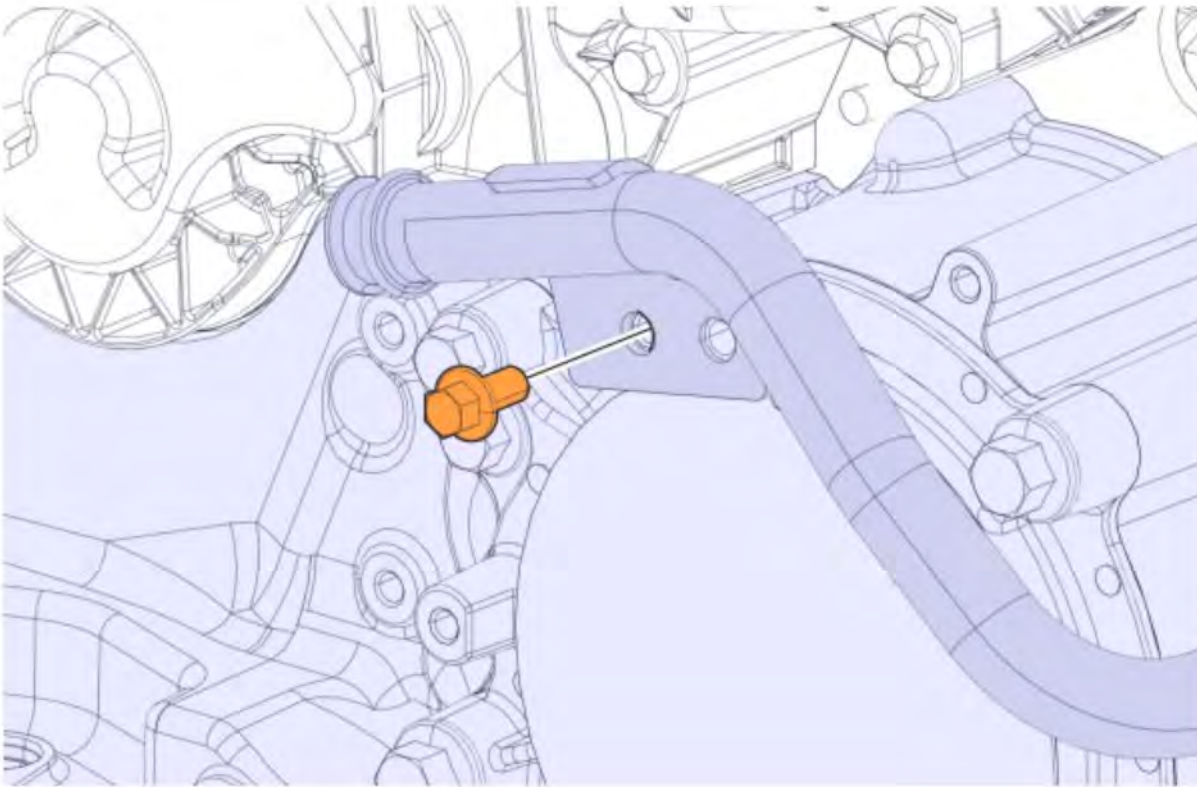
<b>388</b>	Install the clamp.
------------	--------------------

<b>389</b>	Install the screws.
------------	---------------------



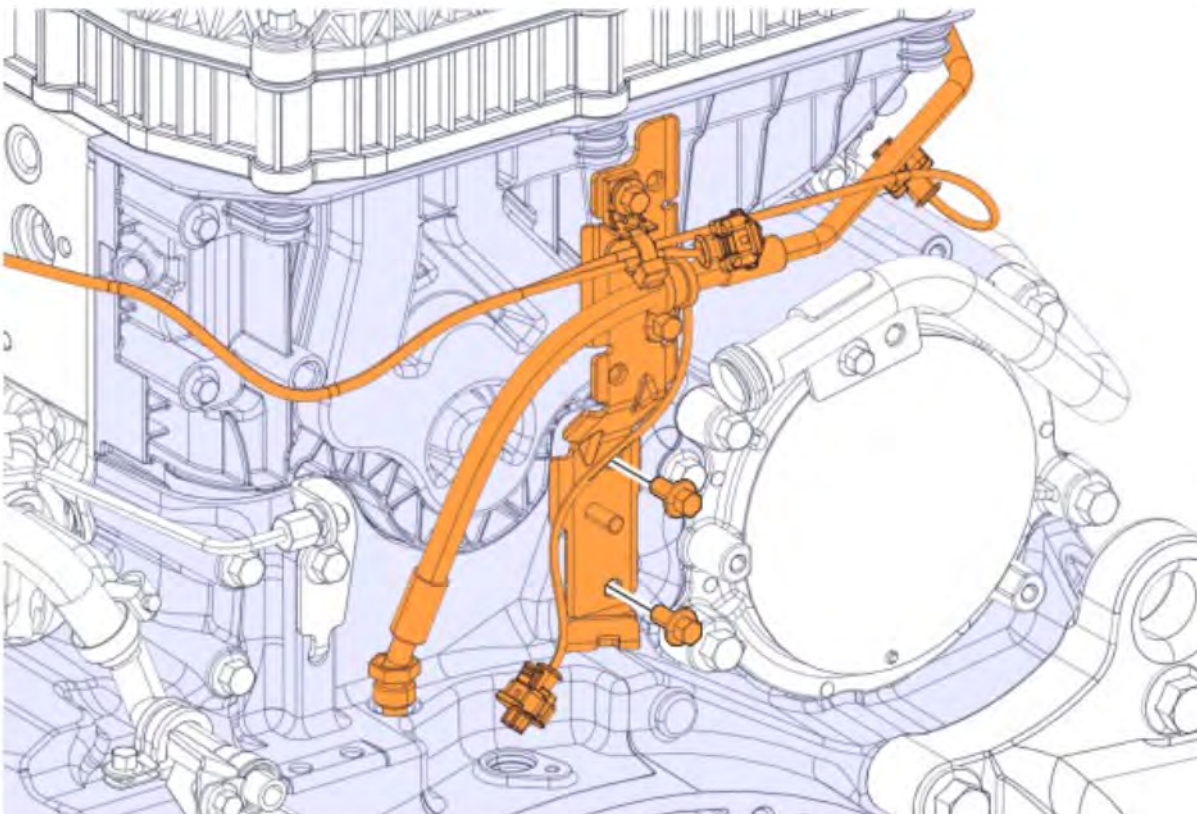
<b>390</b>	Install the screw.
------------	--------------------





**391** Position the assembly.

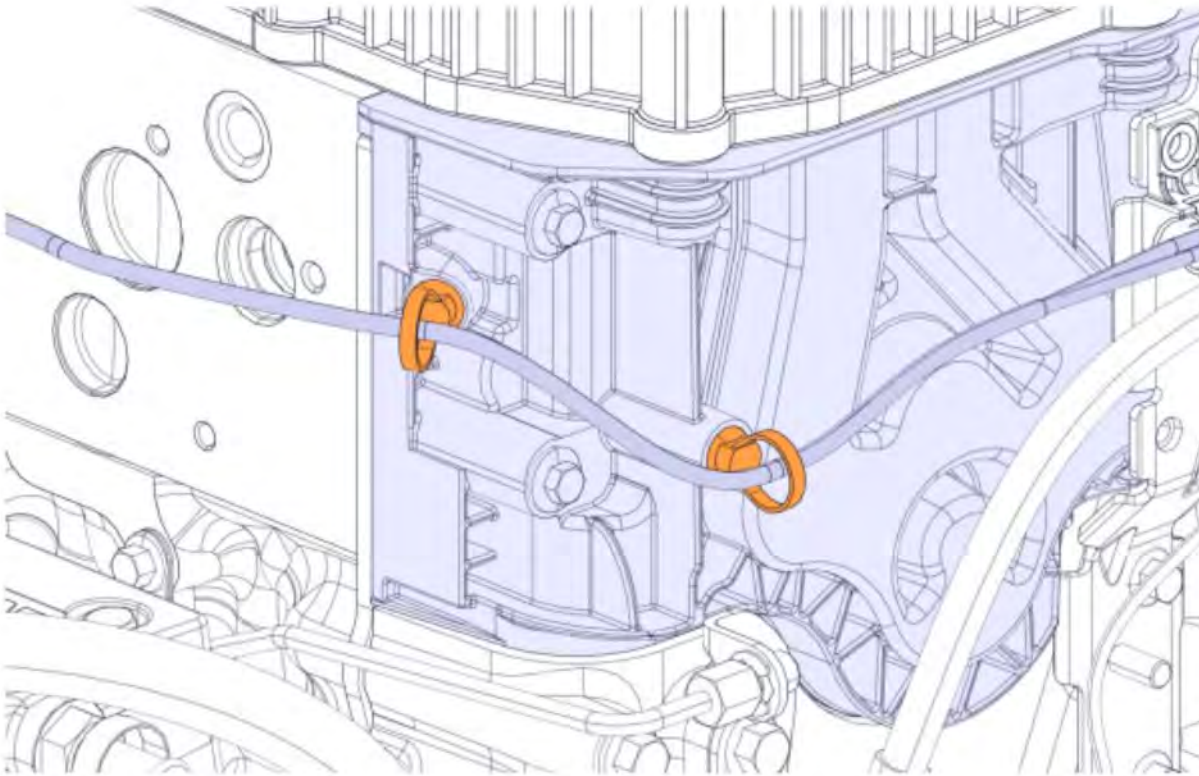
**392** Install the screws.



**393** Install the cable ties.

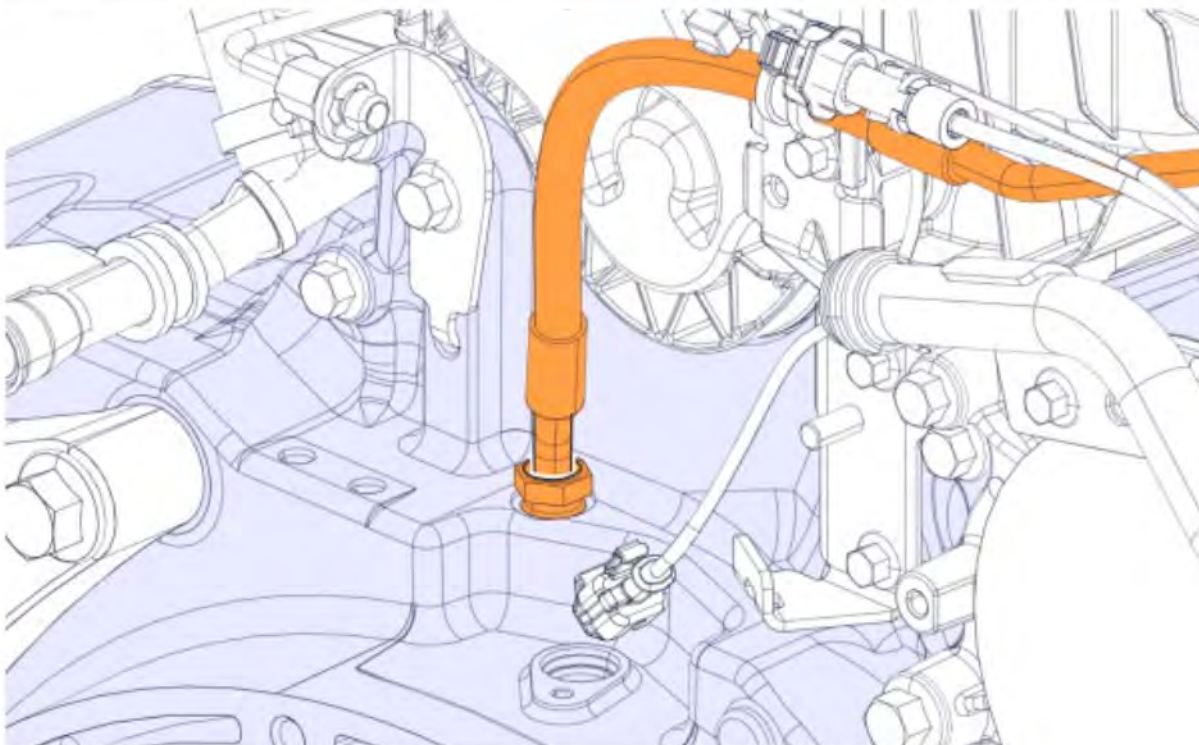
**i** **Note**  
Use new parts.





<b>394</b>	Install the hose.
------------	-------------------

<b>395</b>	Tighten the nut.
------------	------------------

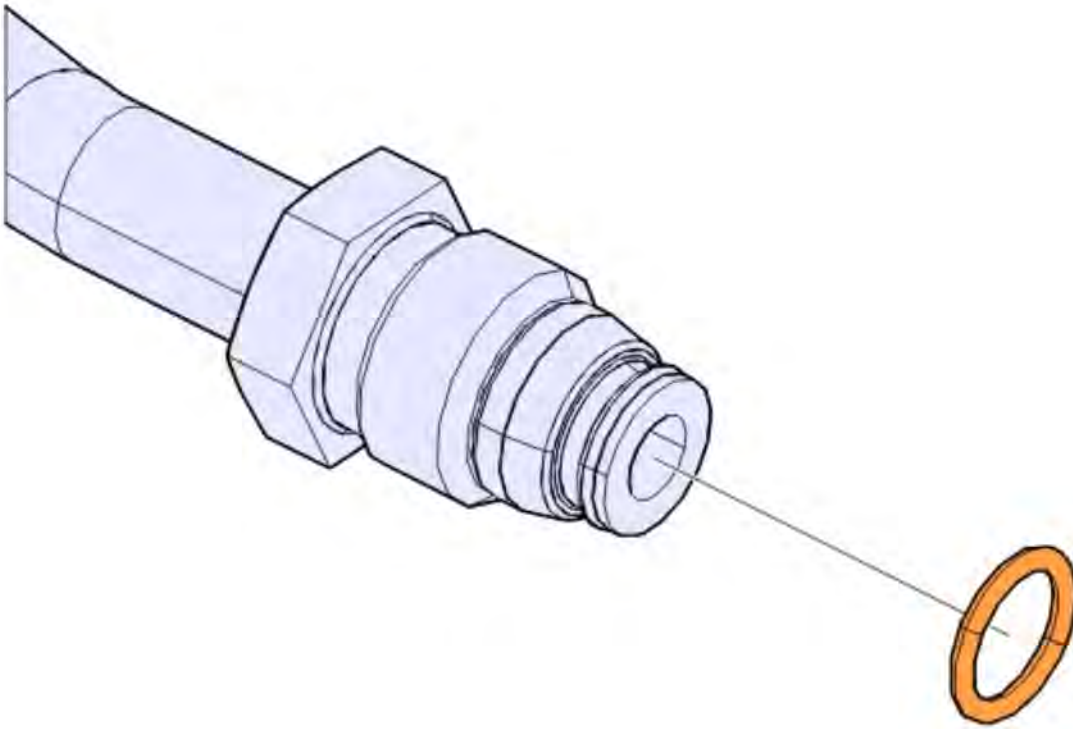


<b>396</b>	Clean the contact surface.
------------	----------------------------

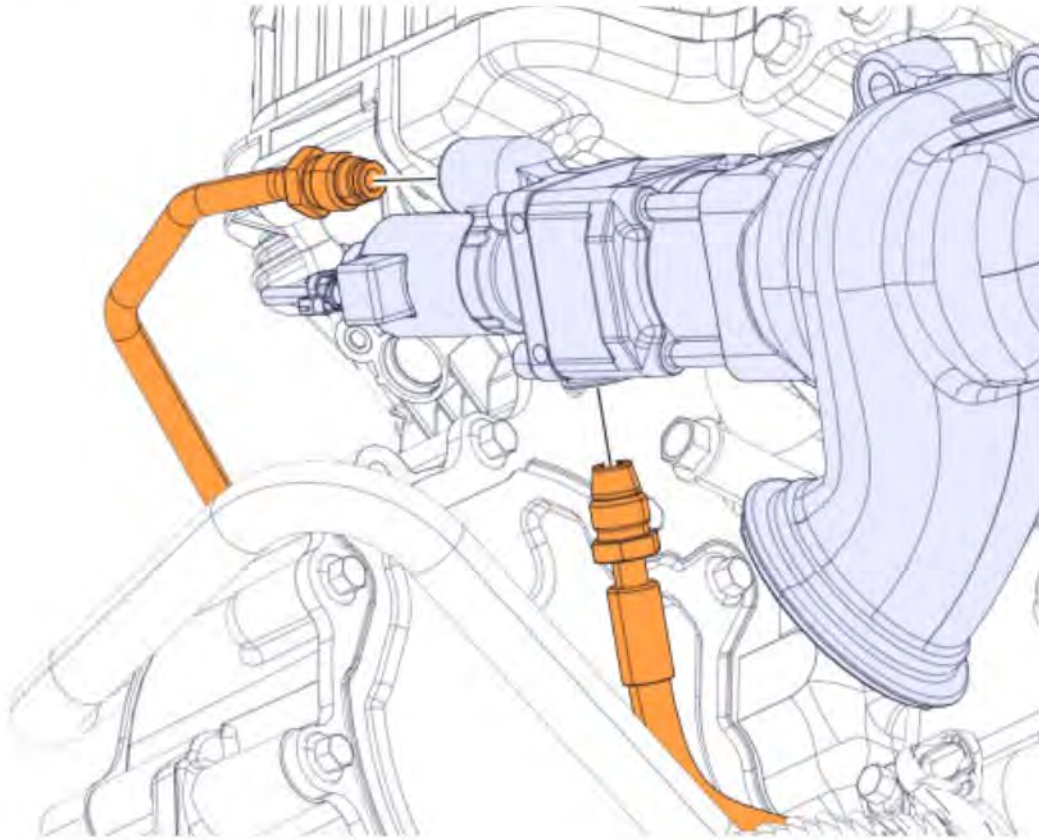
<b>397</b>	Install the seal.
------------	-------------------

<b>i</b>	<b>Note</b> Use a new part.
----------	--------------------------------





<b>398</b>	Install the pipes.
------------	--------------------



399 Install the gasket.



**Note**

Use a new part.

400 Position the valve.

401 Install the spacers.

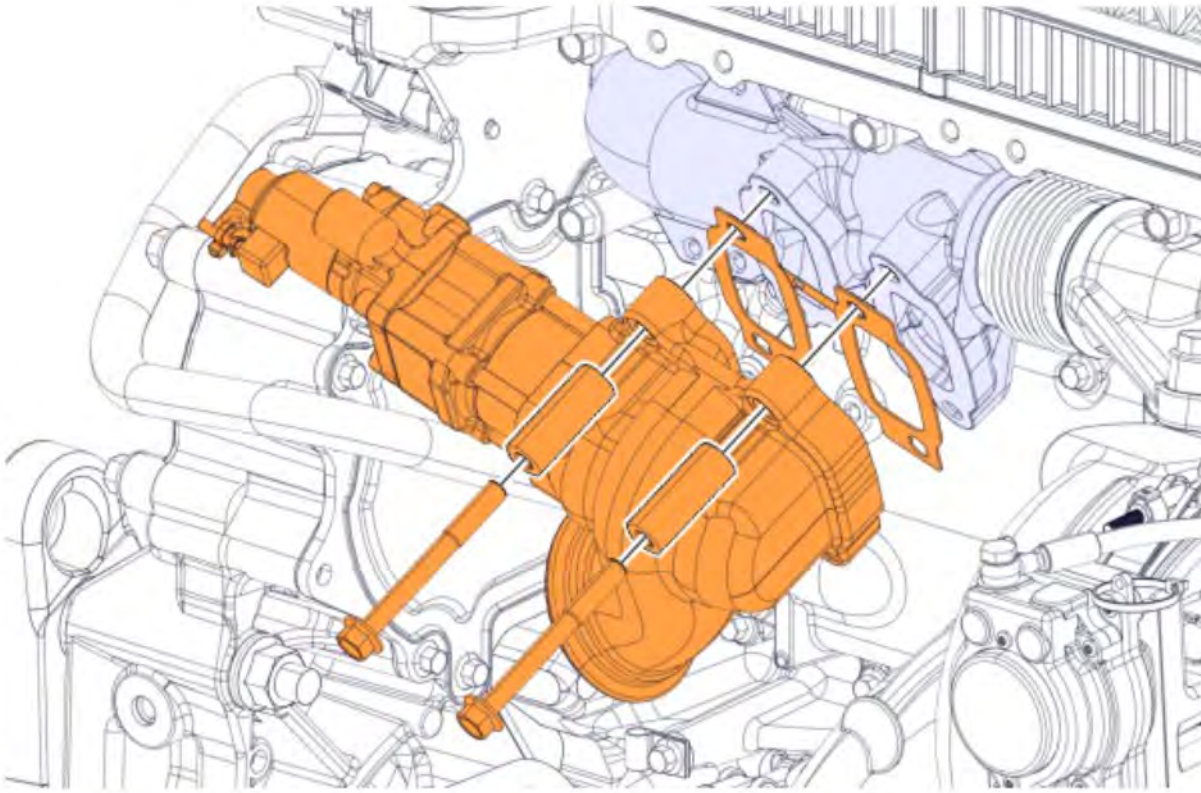
402 Install the screws.



**Note**

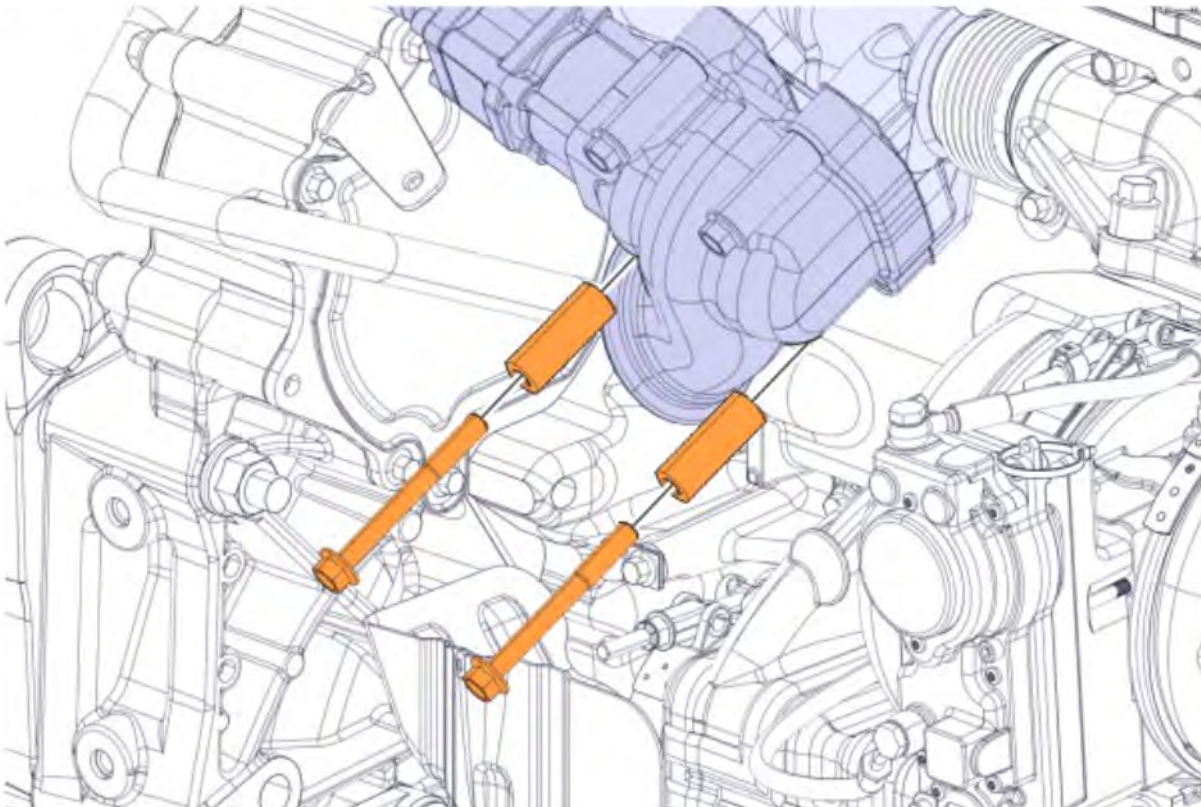
Use the two upper fasteners to hold the gasket in place.





<b>403</b>	Install the spacers.
------------	----------------------

<b>404</b>	Install the screws.
------------	---------------------



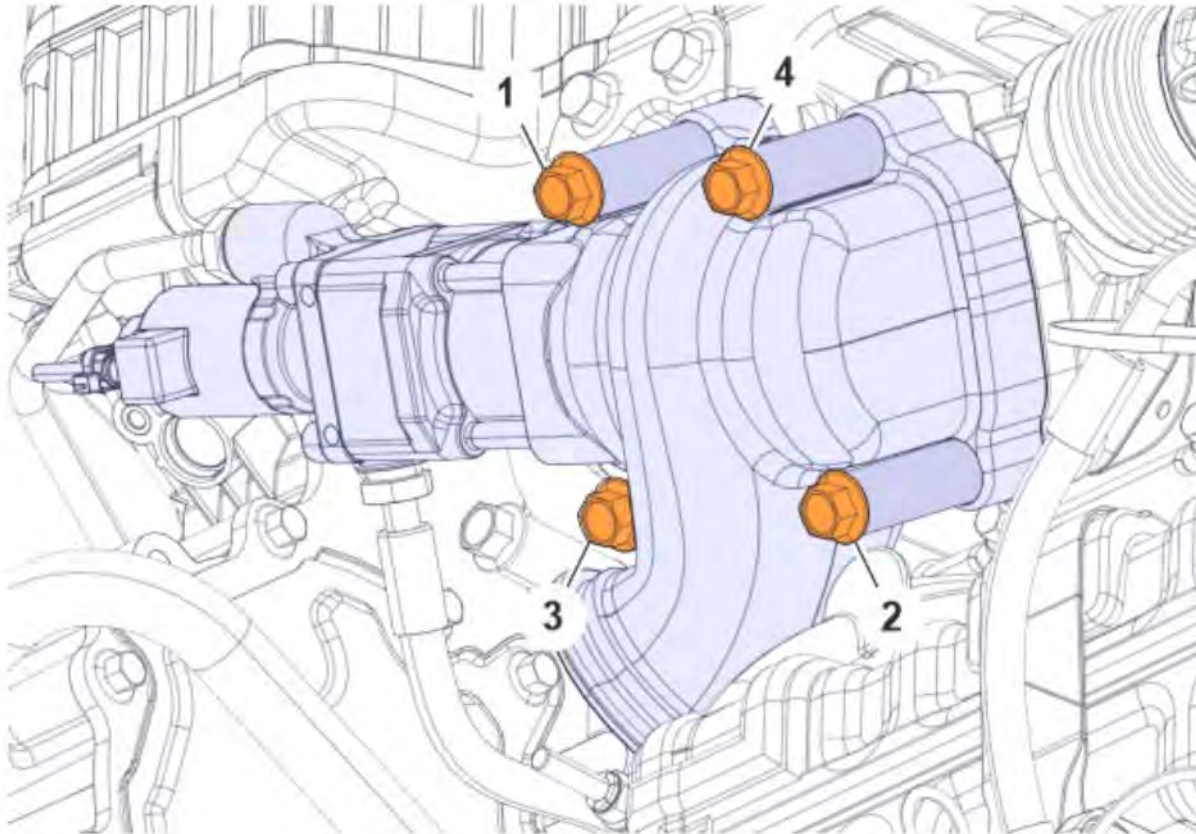
<b>405</b>	Torque tighten the screws.
------------	----------------------------

<b>Tightening torque</b>	
--------------------------	--

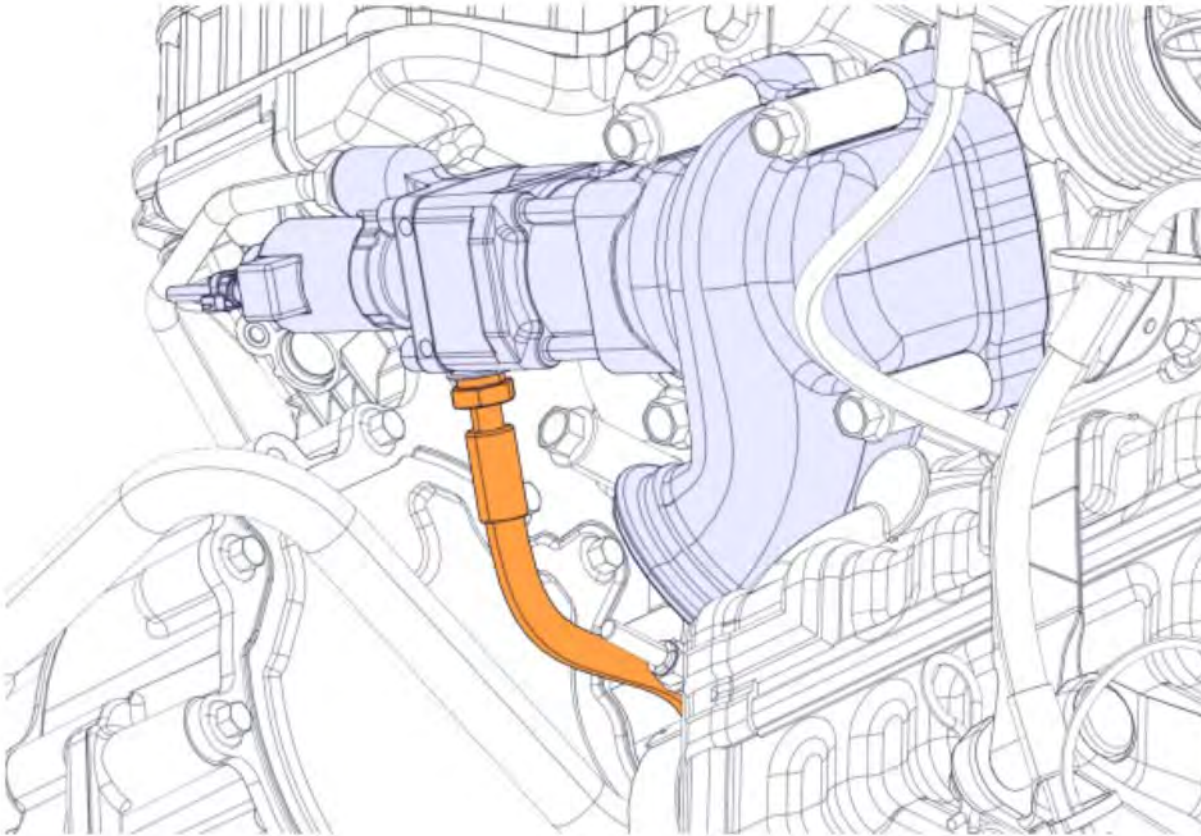
EGR valve, screw	1.	Tightening sequence: 1-4
------------------	----	--------------------------



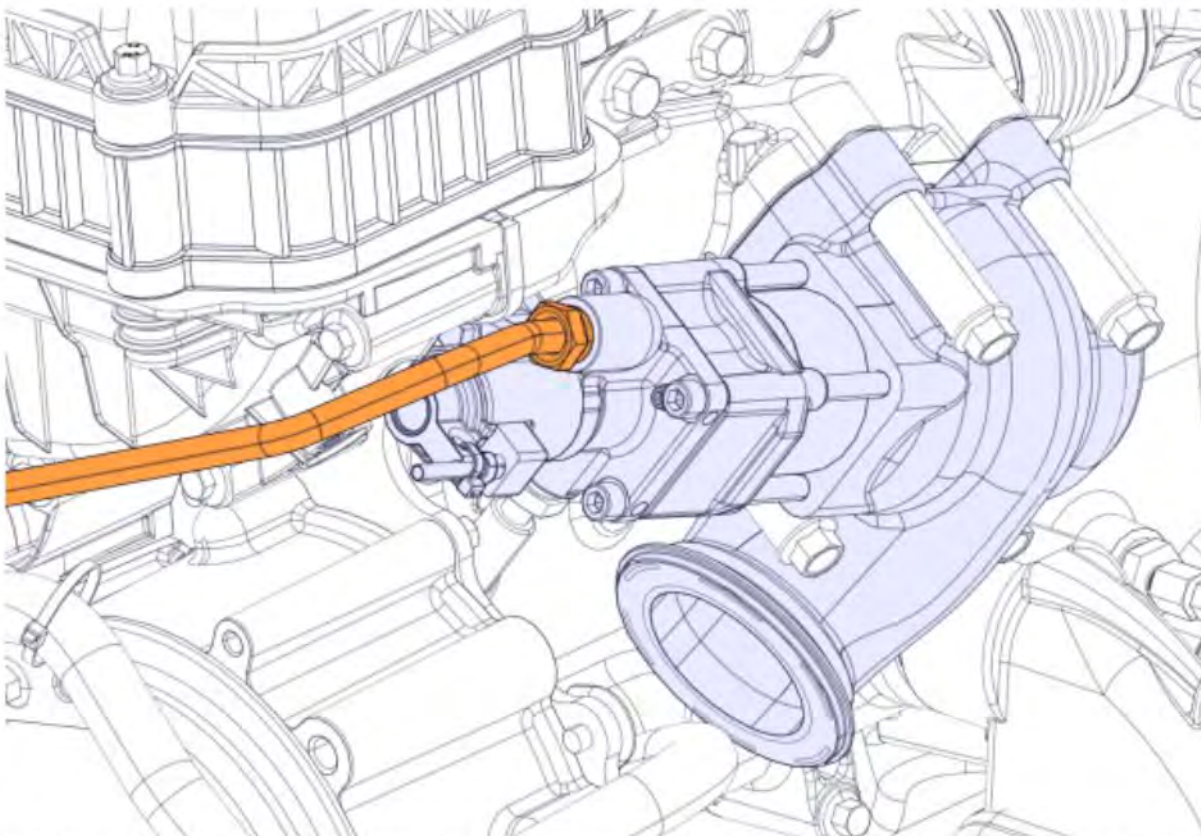
		20 ±4 Nm (15 ±3 lb <sub>f</sub> .ft)
	2.	Tightening sequence: 1-4
		52 ±4 Nm (38 ±3 lb <sub>f</sub> .ft)



406	Torque tighten the pipe.	
	<b>Tightening torque</b>	
	EGR valve, nipple	25 ±4 Nm (18 ±3 lb <sub>f</sub> .ft)



<b>407</b>	Torque tighten the pipe.	
	<b>Tightening torque</b>	
	EGR valve, nipple	25 ±4 Nm (18 ±3 lb <sub>f</sub> ·ft)



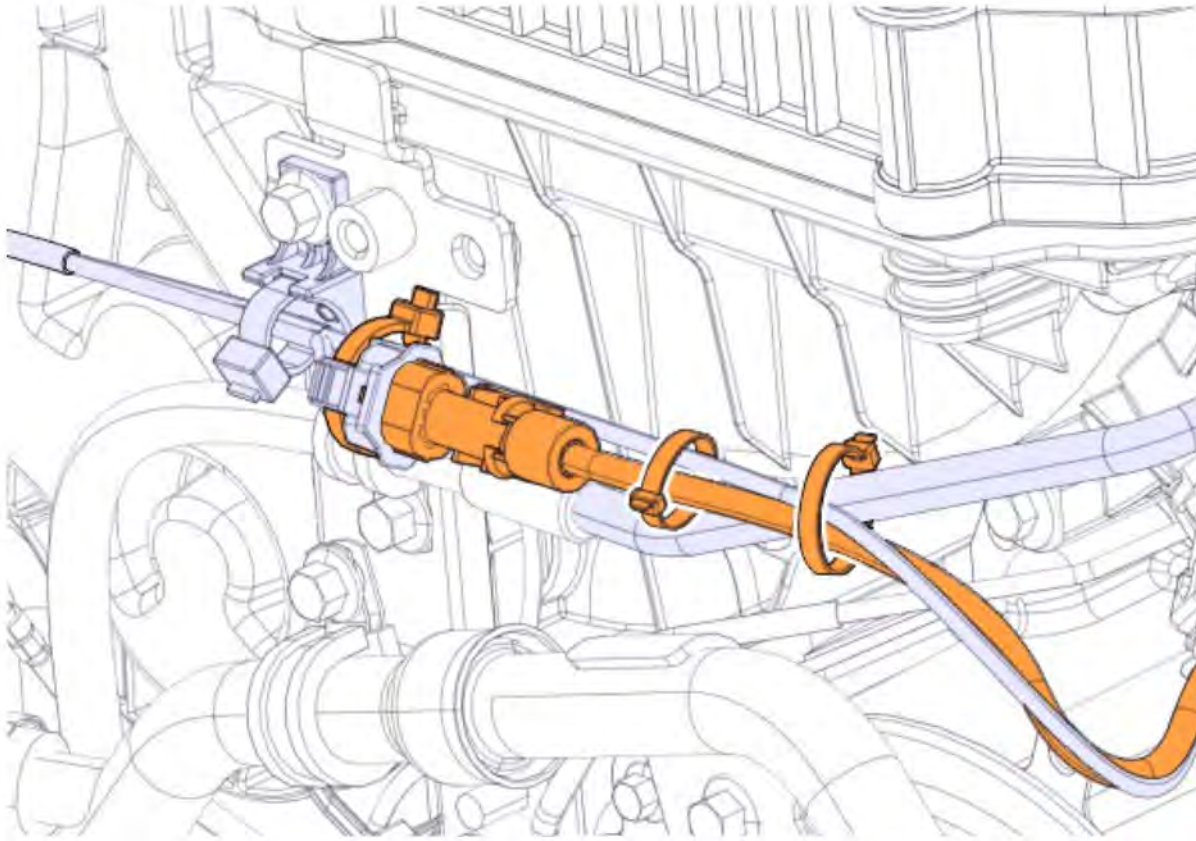


408	Position the cable.
-----	---------------------

409	Connect the connector.
-----	------------------------

410	Install the cable ties.
-----	-------------------------

<b>i</b>	<b>Note</b> Use new parts.
----------	-------------------------------



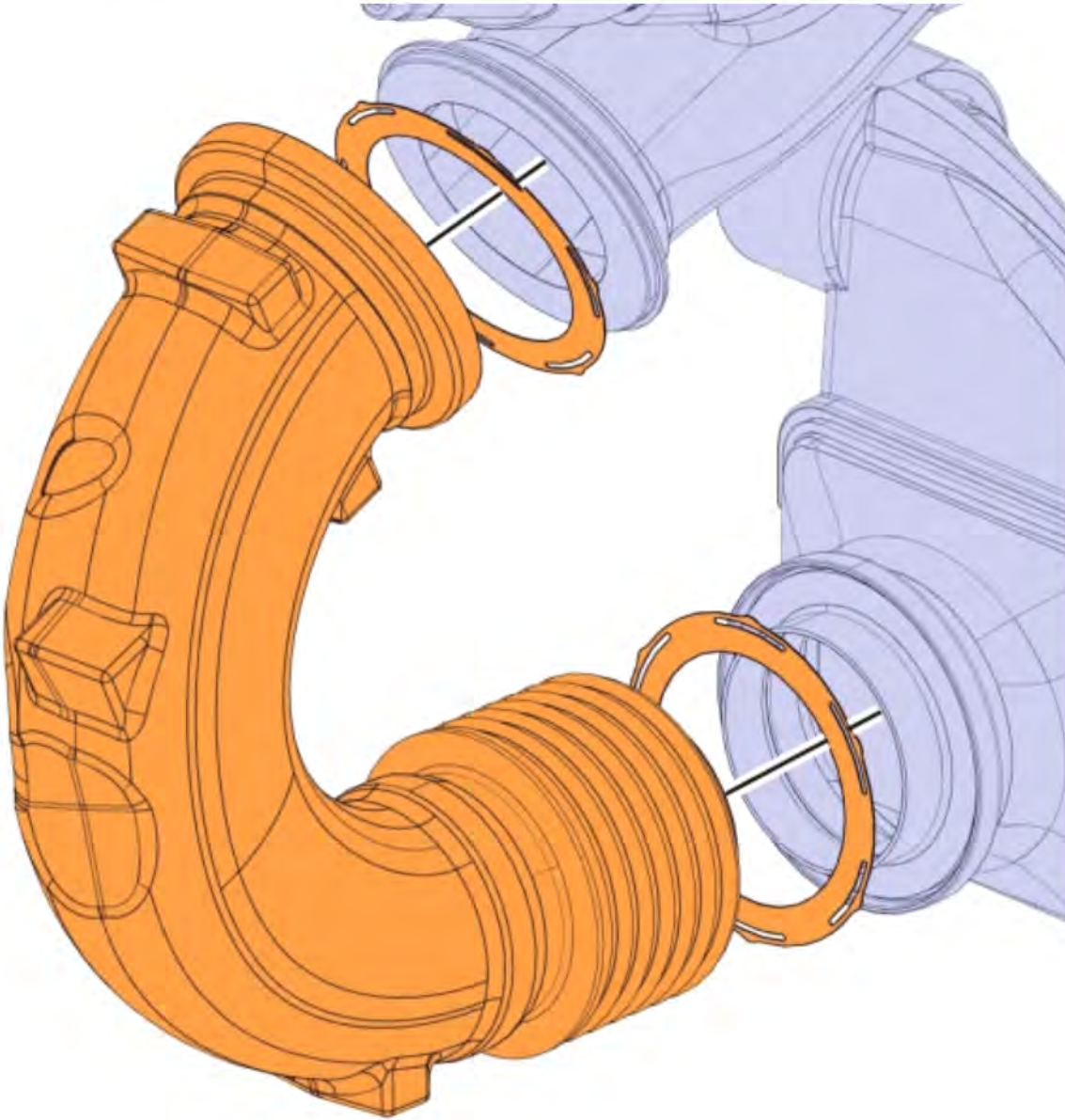
411	Clean the contact surfaces.
-----	-----------------------------

412	Install the gaskets.
-----	----------------------

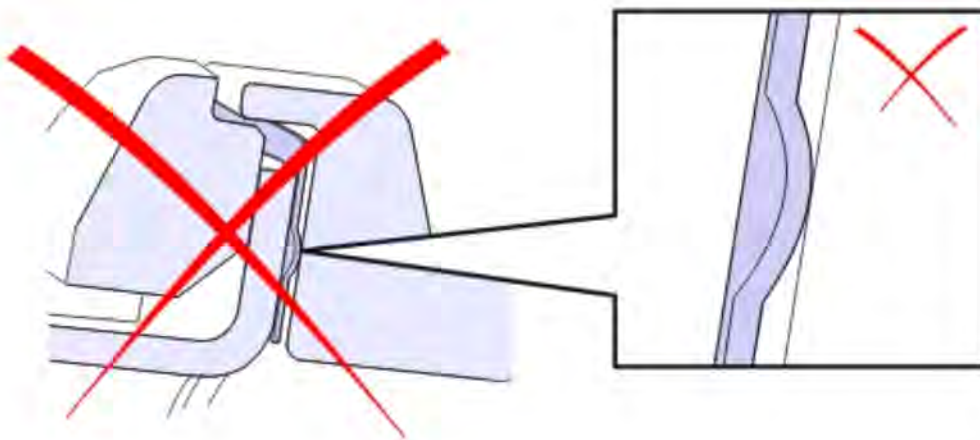
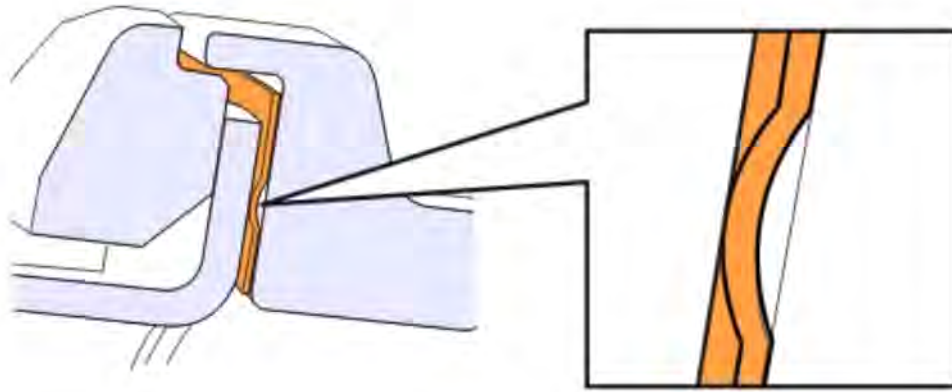
<b>i</b>	<b>Note</b> Use new parts.
----------	-------------------------------

413	Install the pipe.
-----	-------------------



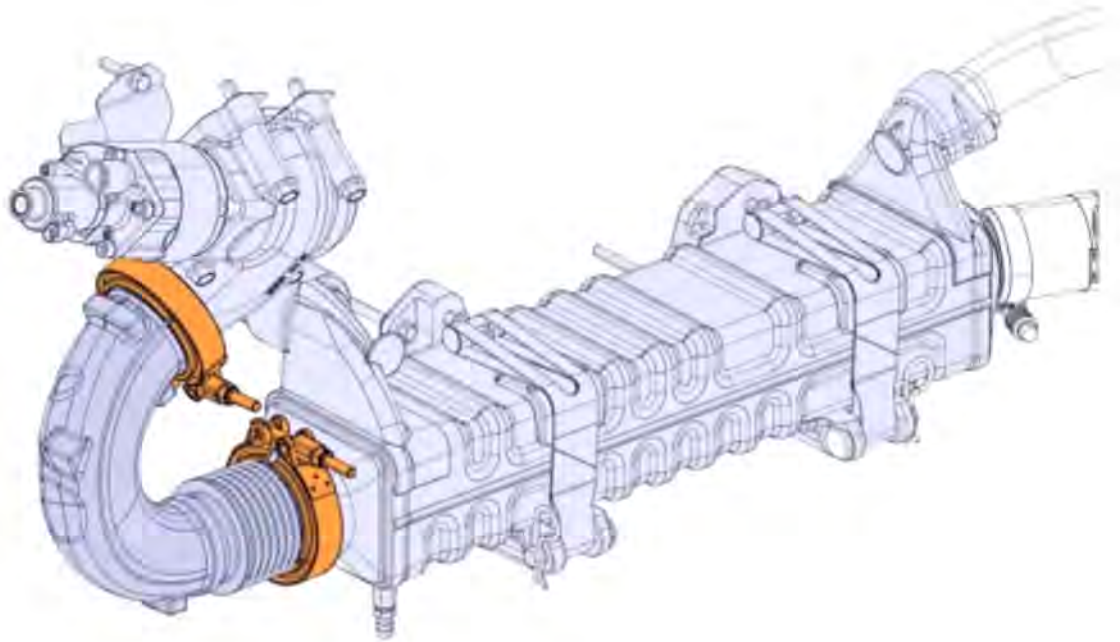


414	Check that the gaskets are positioned correctly.
-----	--



<b>415</b>	<p>Install the V-clamps.</p> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;"> <p><b>i</b> <b>Note</b> Install as marked.</p> </div> <div style="border: 1px solid black; padding: 2px;"> <p><b>i</b> <b>Note</b> Use new parts.</p> </div>
------------	--

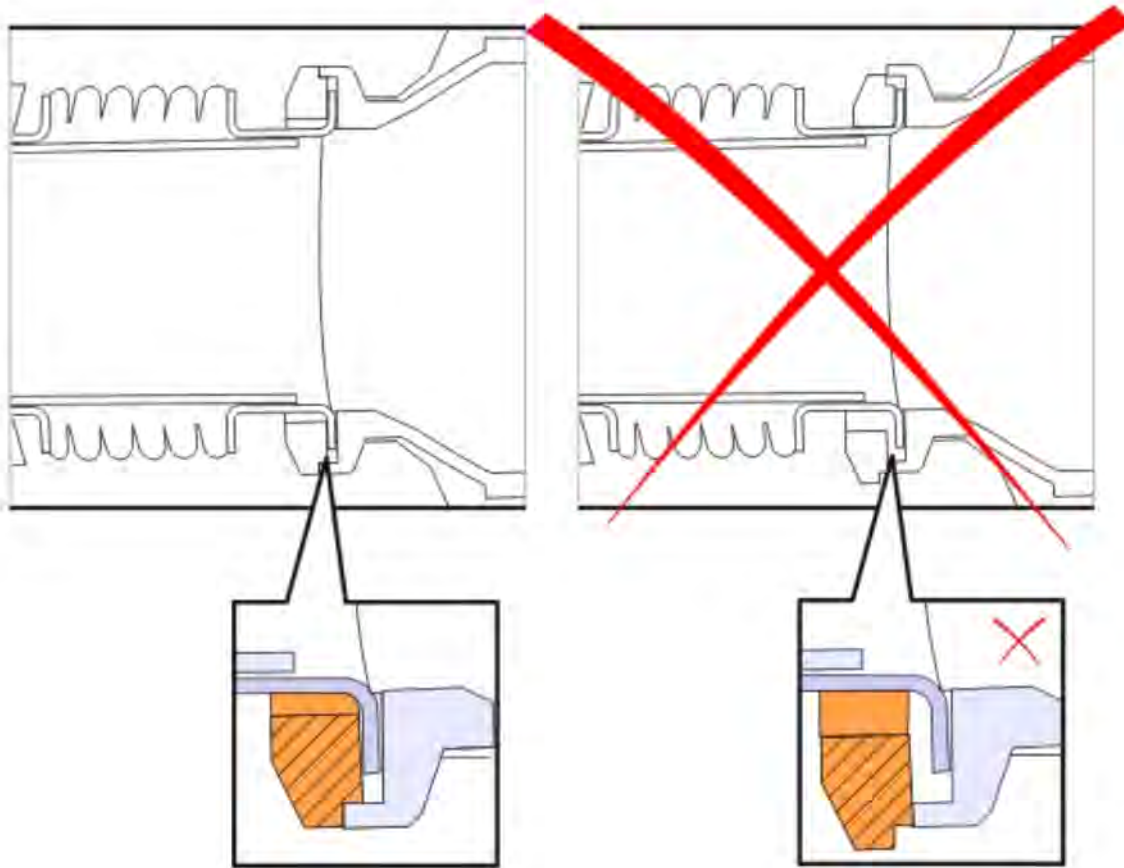


**CAUTION****Risk of material damage.**

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.

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

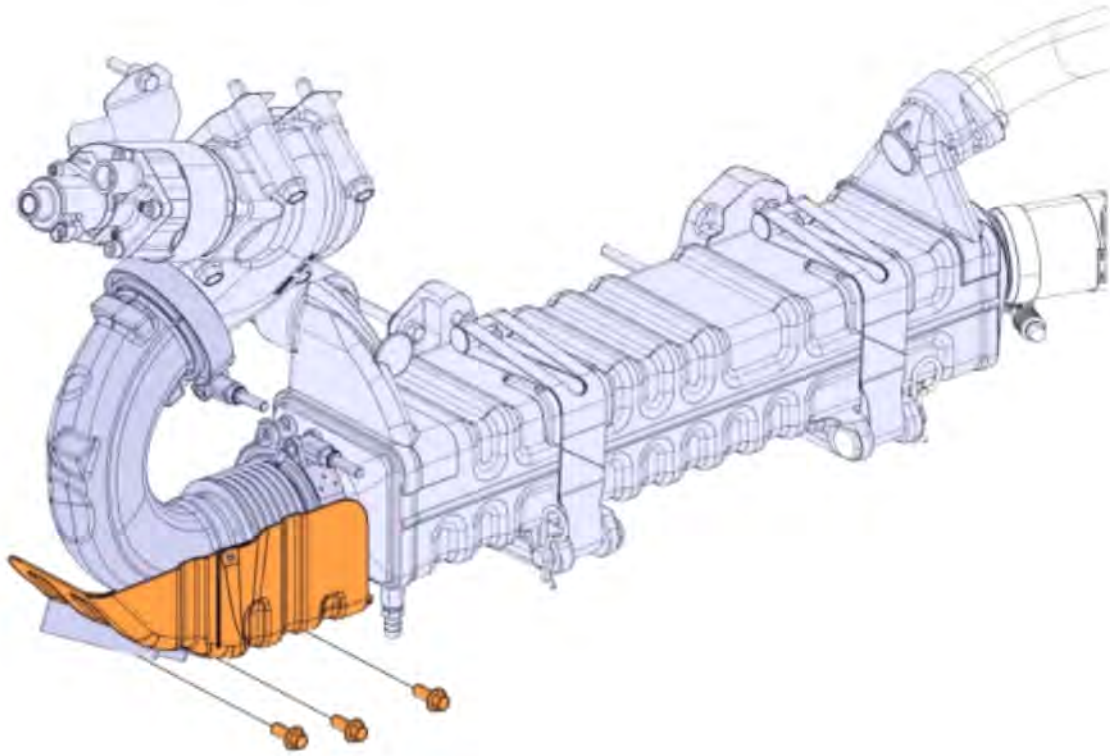





<b>417</b>	Torque tighten the V-clamps.			
	<b>Tightening torque</b>			
	V-clamp, screw	20 ±4 Nm (15 ±3 lb <sub>f</sub> -ft)		
<table border="1" style="width: 100%;"> <tr> <td style="text-align: center;"><b>i</b></td> <td><b>Note</b> After tightening, check the position of the V-clamps.</td> </tr> </table>			<b>i</b>	<b>Note</b> After tightening, check the position of the V-clamps.
<b>i</b>	<b>Note</b> After tightening, check the position of the V-clamps.			

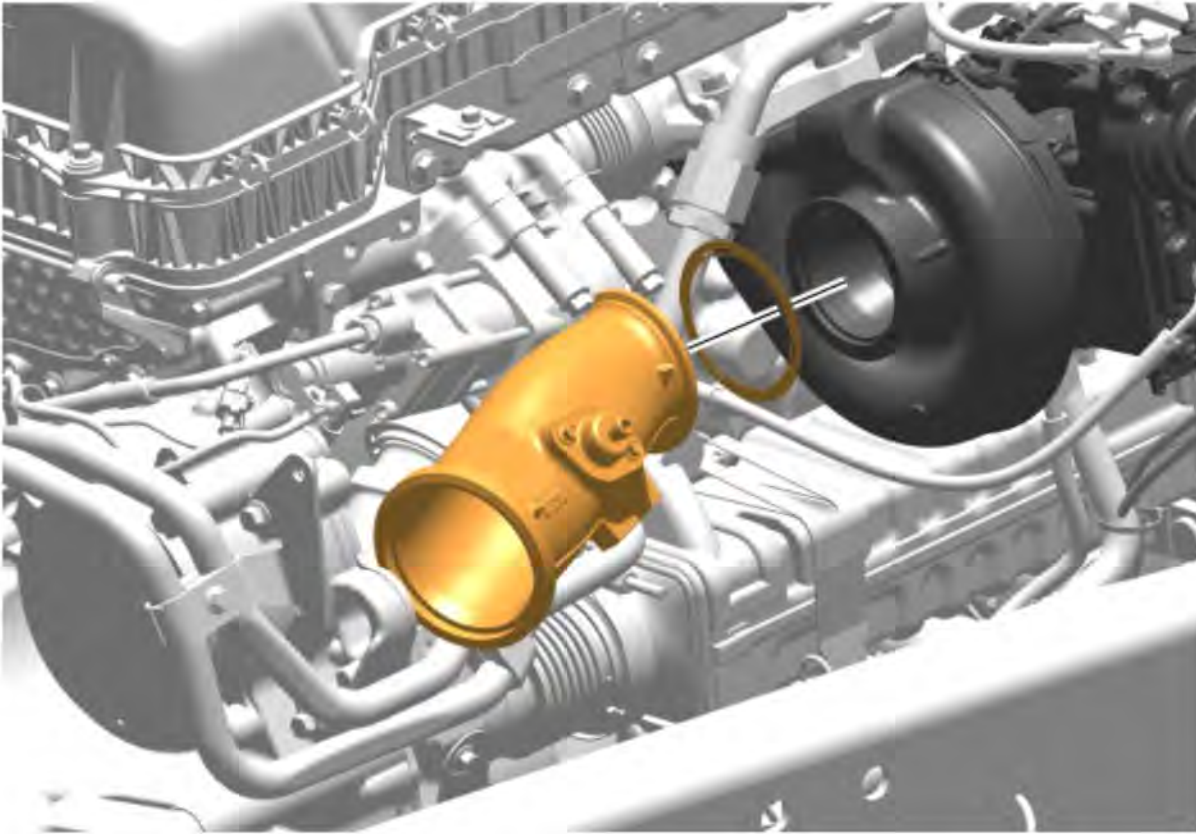
<b>418</b>	Install the heat shield.
------------	--------------------------

<b>419</b>	Install the screws.
------------	---------------------





420	Clean the mating surfaces.		
421	Install the gasket. <table border="1" data-bbox="159 1093 427 1196"><tr><td data-bbox="159 1093 236 1160"></td><td data-bbox="236 1093 427 1196"><b>Note</b> Use a new part.</td></tr></table>		<b>Note</b> Use a new part.
	<b>Note</b> Use a new part.		
422	Install the diffuser.		



423 Install the clamp.



**Note**

Use a new part.



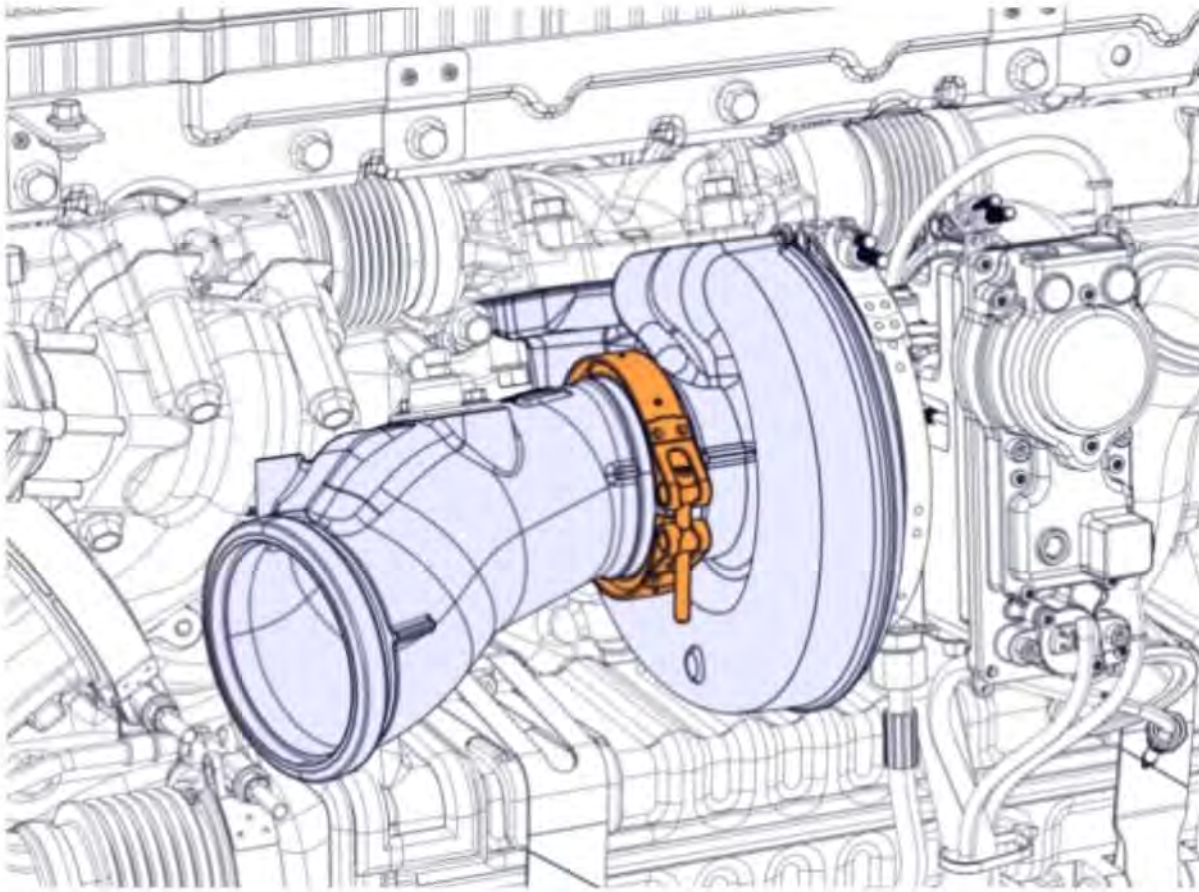
**Note**

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.

<b>424</b>	Torque tighten the clamp in sequence.	
	<b>Tightening torque</b>	
	V-clamp, pre-torque	7 Nm (5 lb <sub>f</sub> ·ft)

<b>425</b>	Seat the clamp by tapping it into place between tightening sequences.	
	<b>Tightening torque</b>	
	V-clamp, final torque	14 ±2 Nm (10 ±1 lb <sub>f</sub> ·ft)

**426** This step contains 2 alternatives.  
Select one of the valid alternatives below.

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**Alternative 1 / 2****Conditions**

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



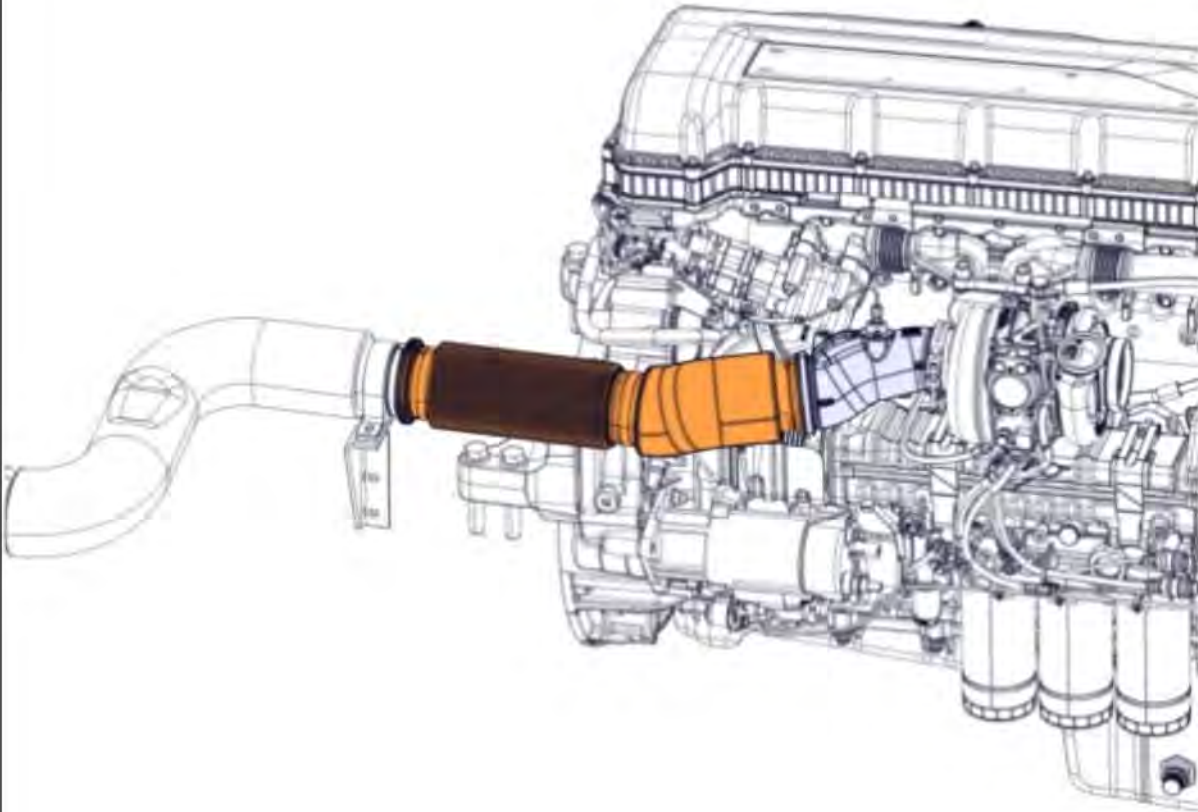
**Note**  
Use new parts.



- ▶ Install the pipe.



**Note**  
As noted.



▶ Install the clamps.



**Note**  
Use new parts.

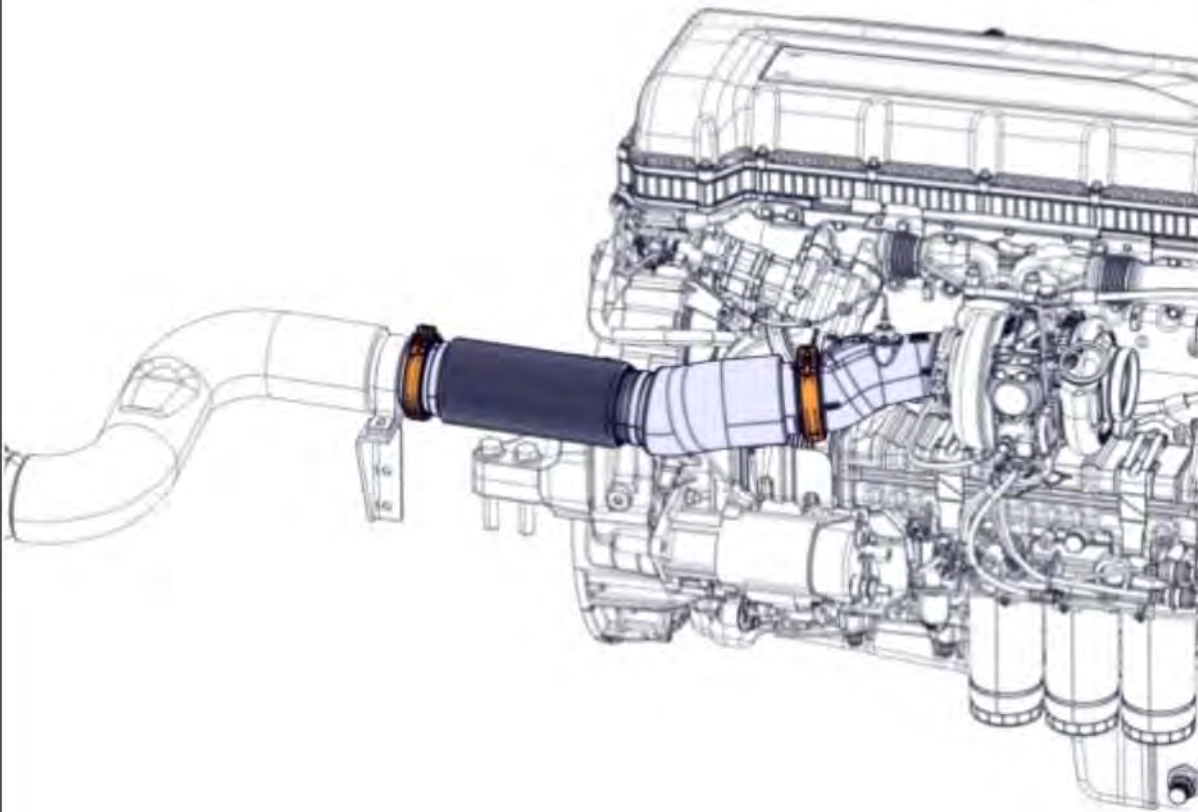


**Note**  
As noted.

▶ Torque tighten the clamps.

**Tightening torque**

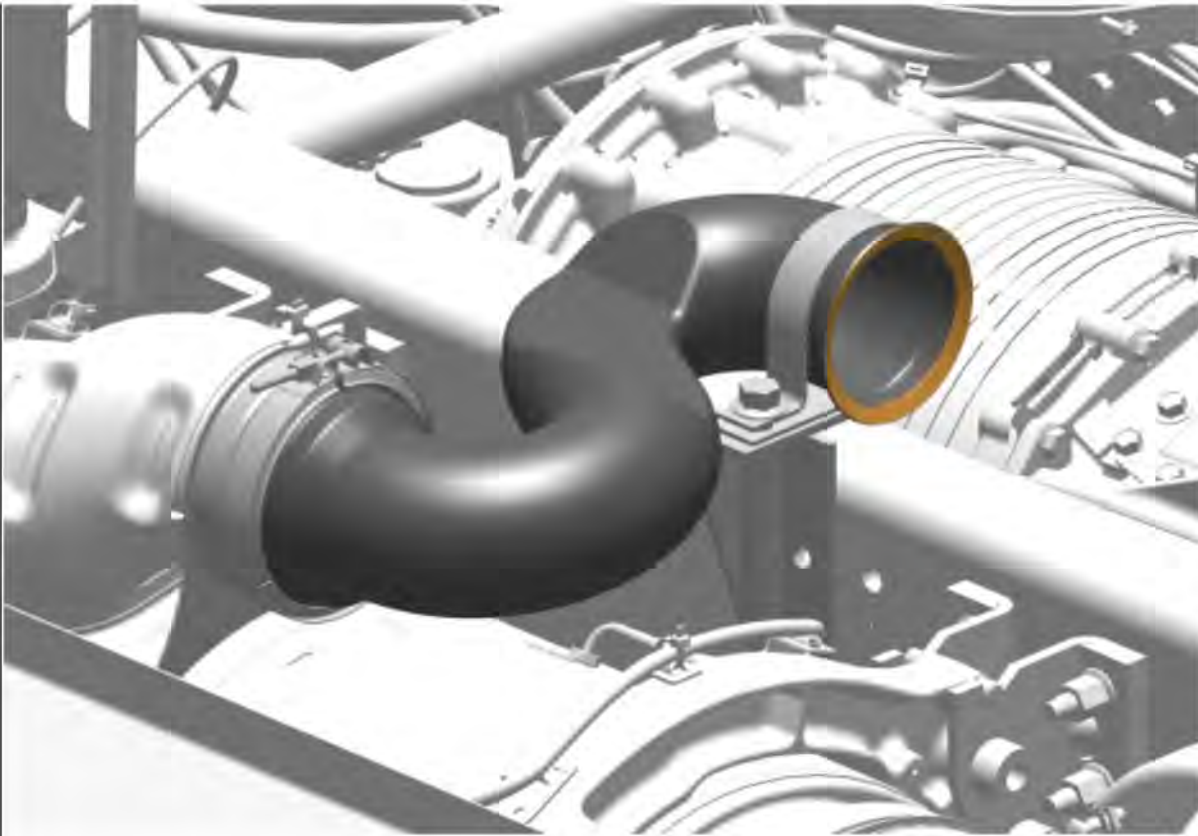
Pipe, clamp	5.6 Nm (4 lb <sub>f</sub> ·ft)
-------------	-----------------------------------

**Alternative 2 / 2****Conditions**

- If the pipe is replaced

- ▶ Clean the surface.





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

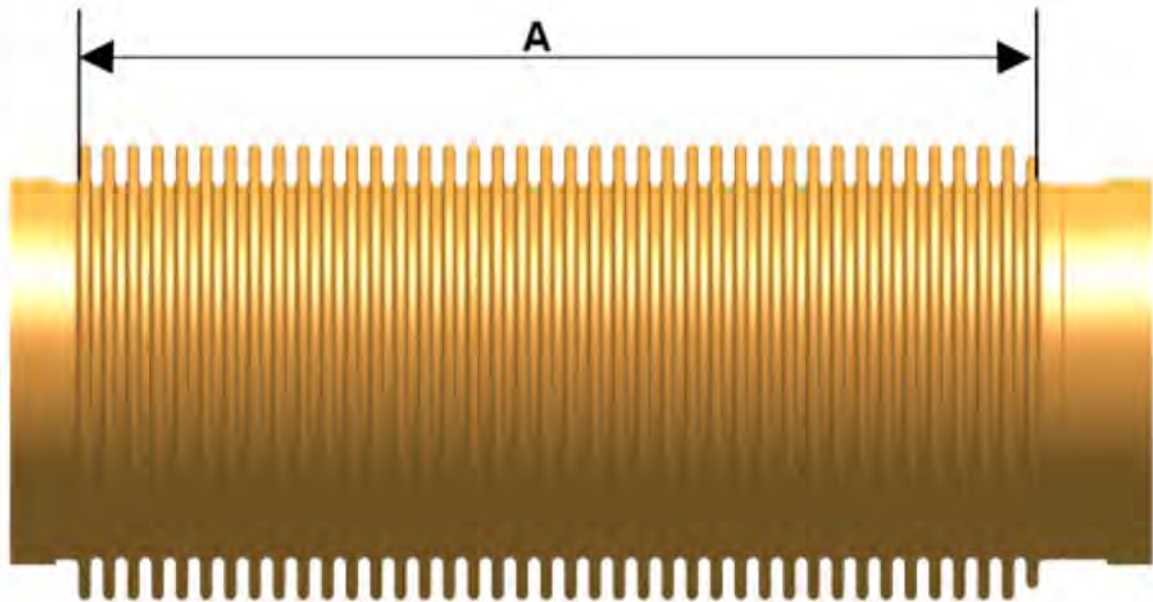
**Tech data**

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**

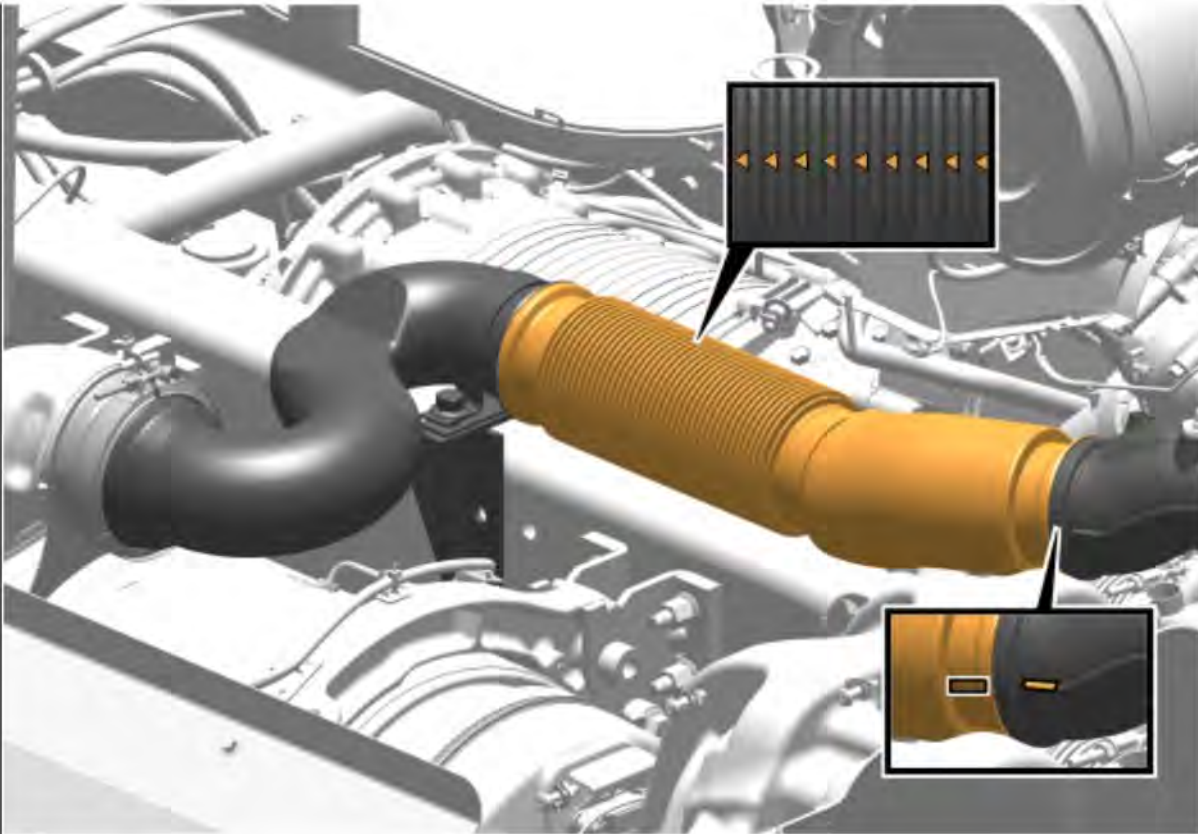
Ensure that flexible hose is not twisted or bent more than the specification.



**Service hint**

Ensure that 11 L engines are aligned with Red line.

Ensure that 13 L engines are aligned with Black line.



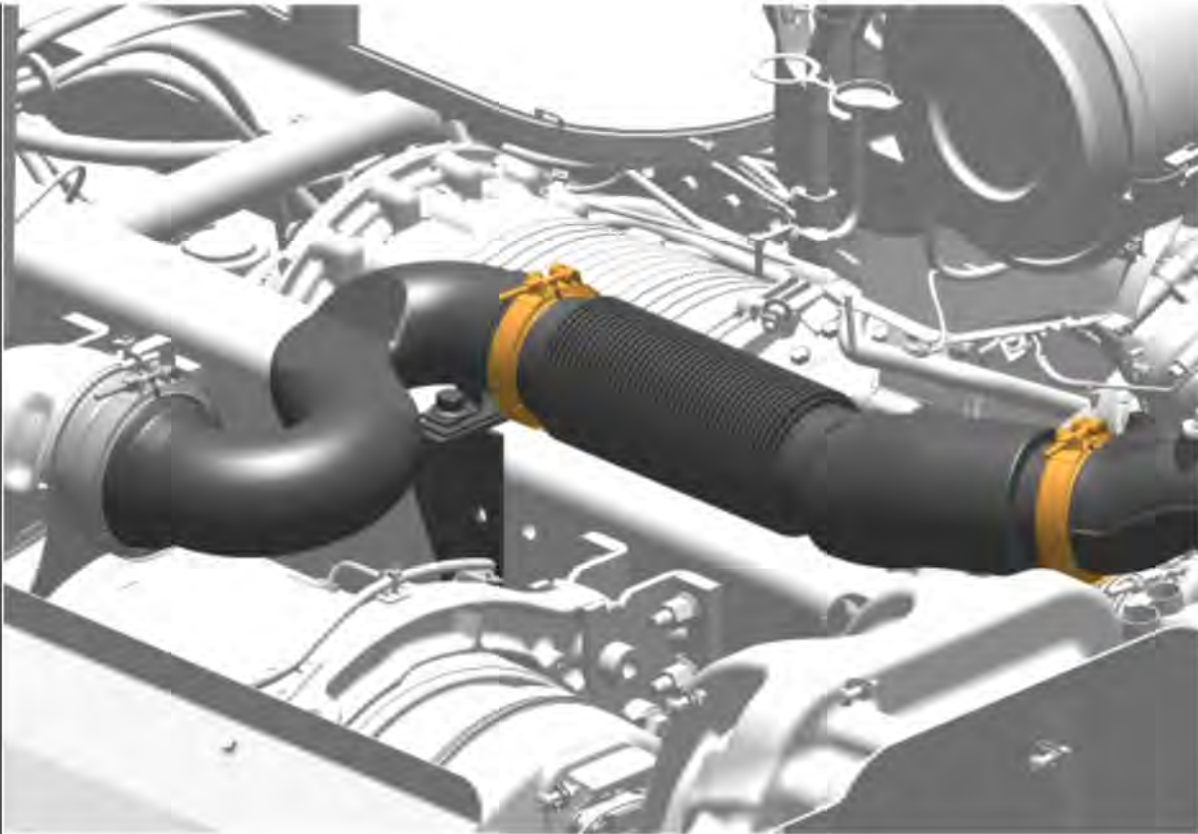
▶ Install the V-clamps.

**i** **Note**  
Use new parts.

**i** **Note**  
As noted.

**i** **Note**  
Do not torque tighten the V-clamps.





- ▶ Check the alignment of the flexible hose.

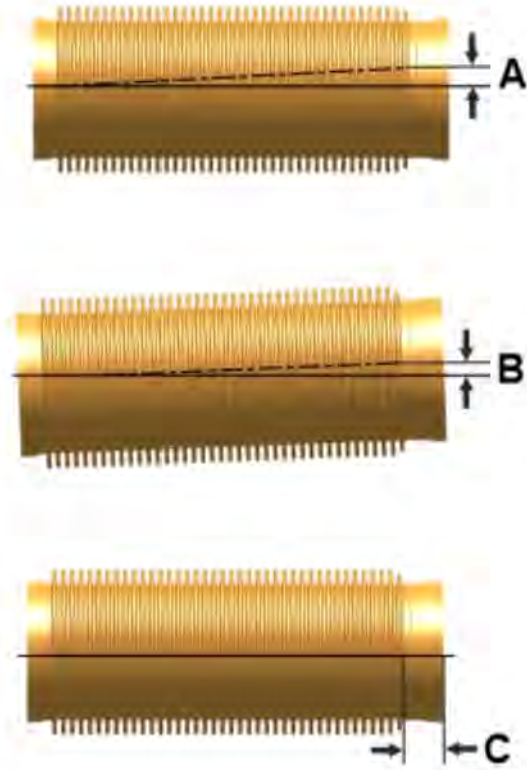
**Tech data**

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)



**Note**

Ensure that the flexible hose is aligned according to specifications.



► Perform this procedure when the condition below is met.

**Conditions**

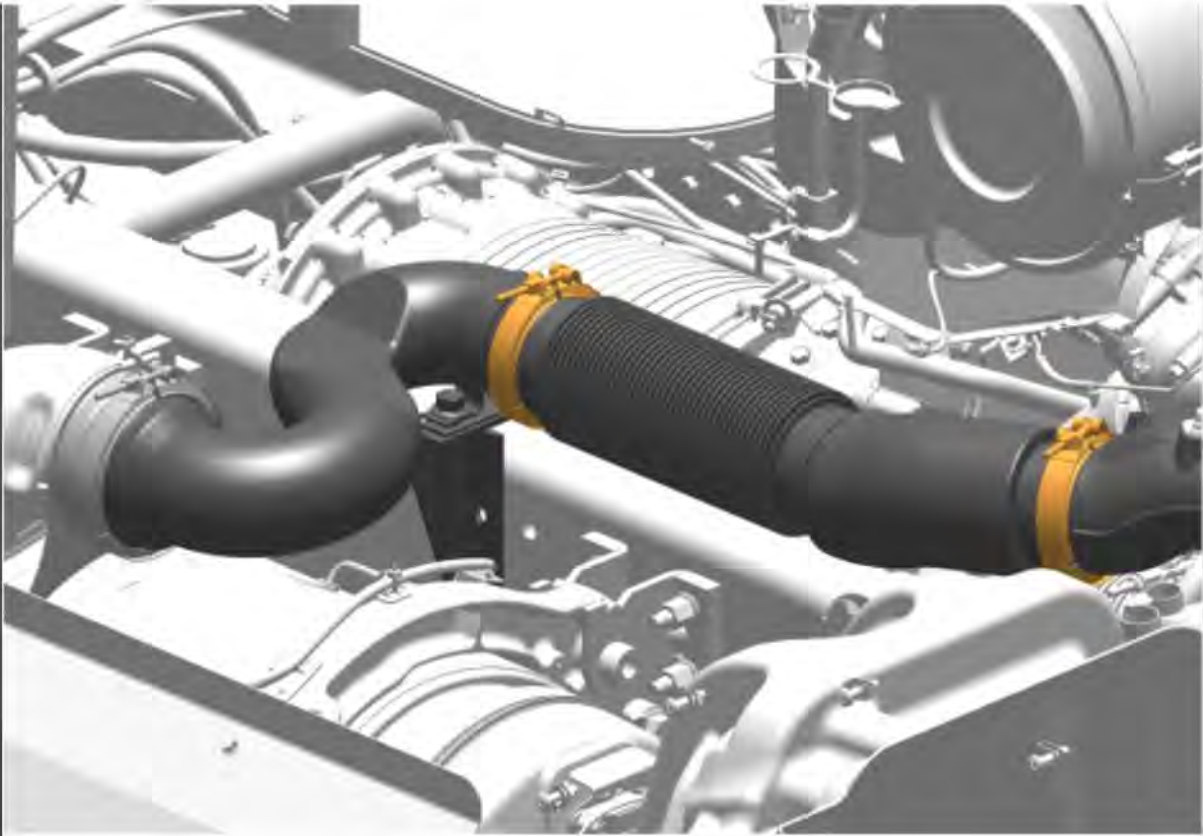
- If the flexible hose length and alignment is not according to the specification

► 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 <sub>f</sub> ·ft)
-------------	-----------------------------------



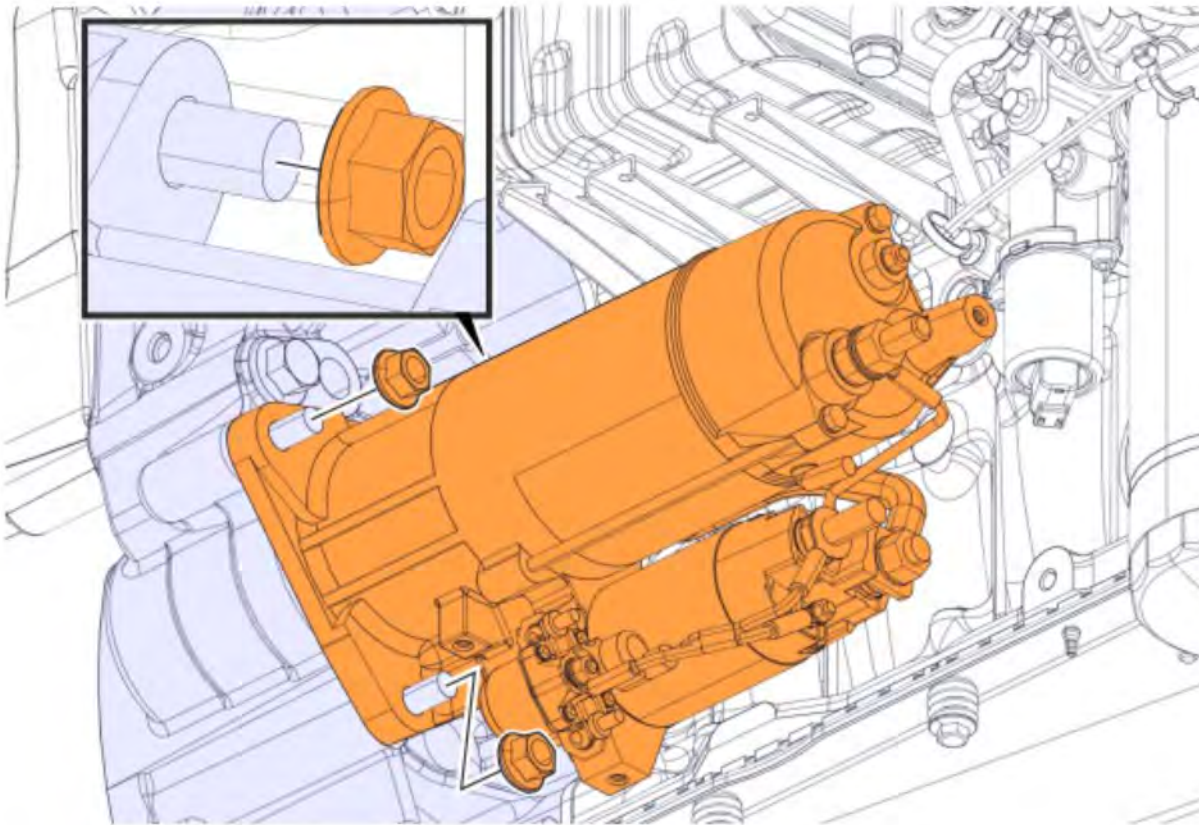
427 Install the starter motor.

428 Install the nuts.

429 Tighten the nuts to torque.

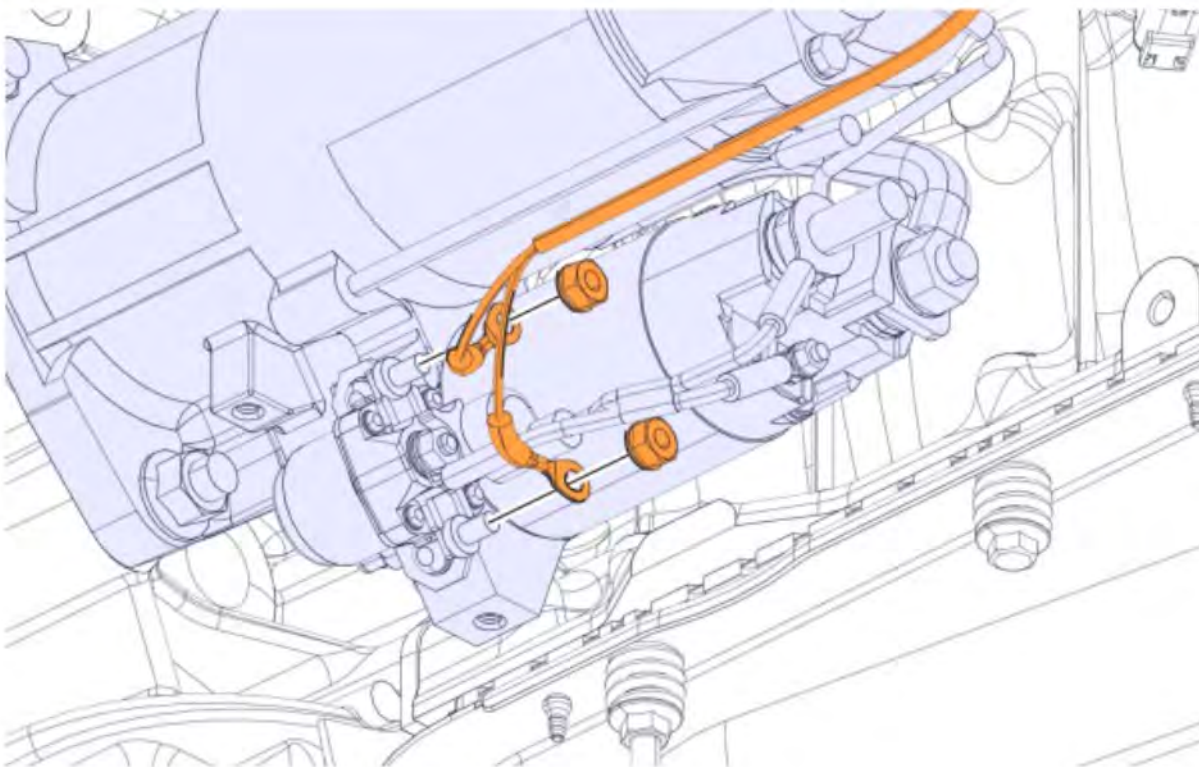
Tightening torque	
Starter motor, nut	48 ±8 Nm (35 ±6 lb <sub>f</sub> .ft)





<b>430</b>	Install the cable terminals.
------------	------------------------------

<b>431</b>	Install the nuts.
------------	-------------------

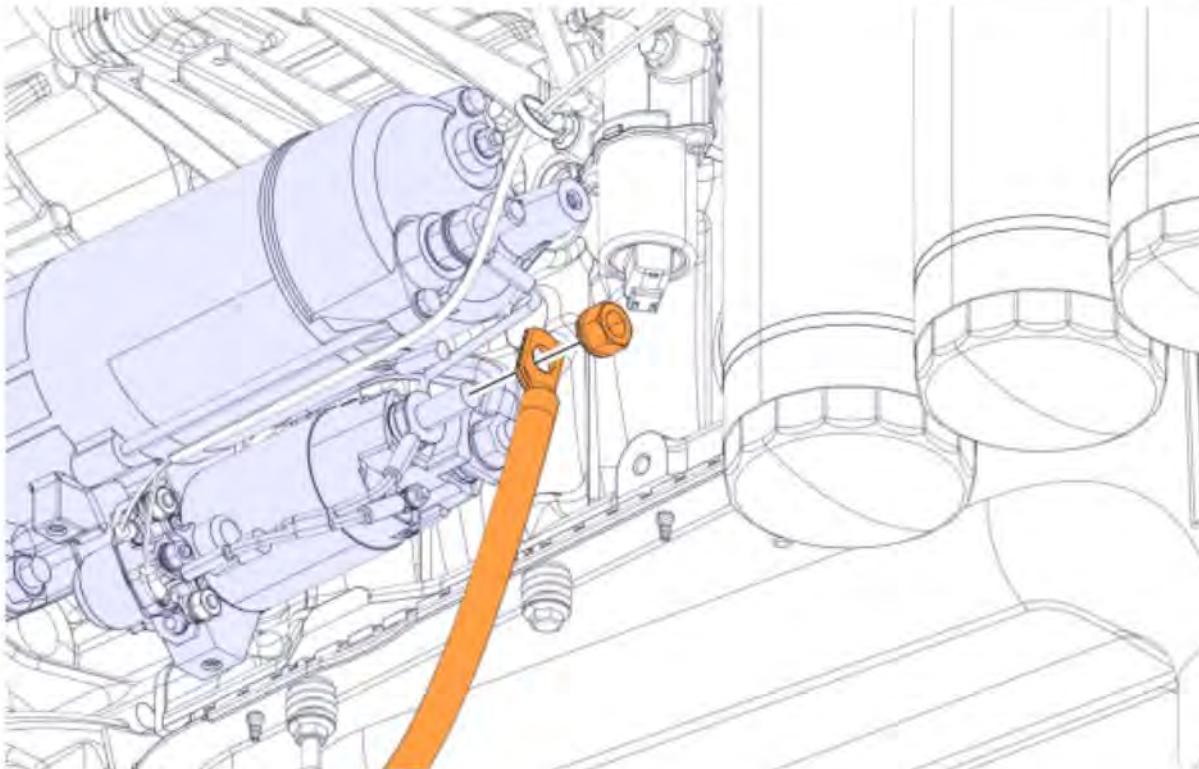


<b>432</b>	Install the cable terminal.
------------	-----------------------------

<b>433</b>	Install the nut.
------------	------------------

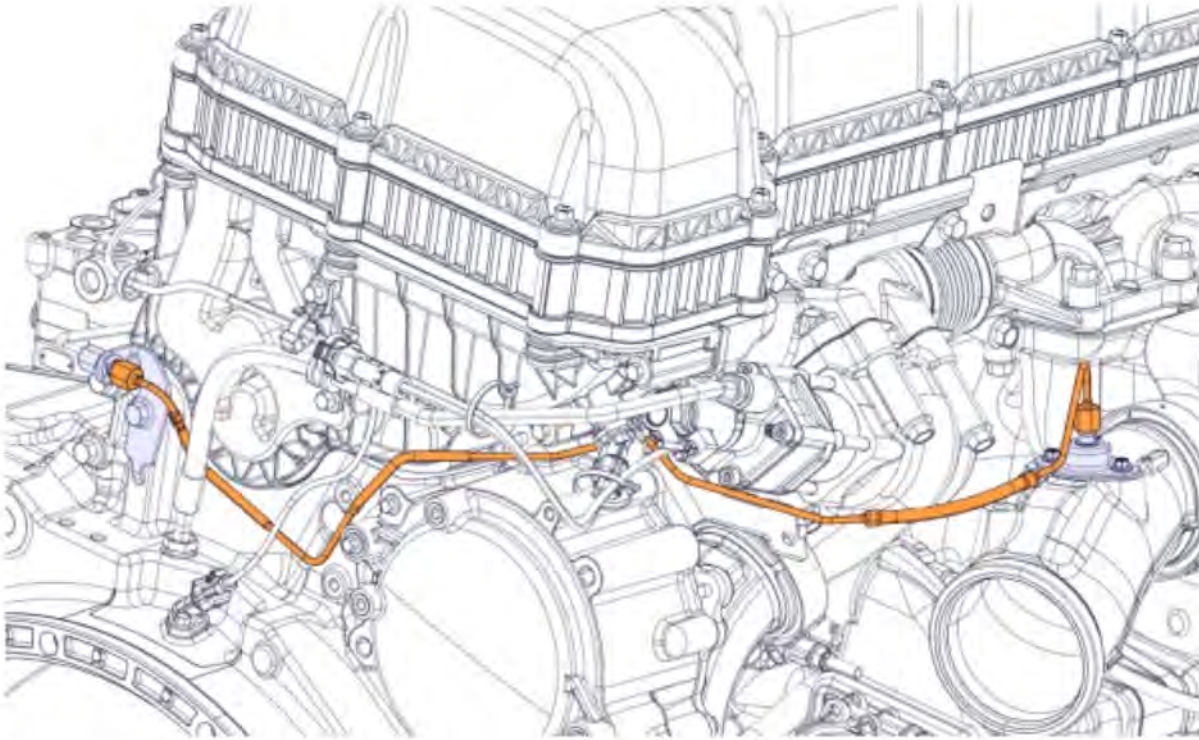
<b>434</b>	Torque tighten the nut.
------------	-------------------------

Tightening torque	
Starter solenoid, terminal, nut	M10
	18 ±3.6 Nm (13 ±3 lb <sub>f</sub> .ft)
Tightening torque	
Starter solenoid, terminal, nut	M12
	25 ±5 Nm (18 ±4 lb <sub>f</sub> .ft)



<b>435</b>	<p>Position the pipe.</p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p><b>i</b> <b>Note</b> The pipe can be reused only a limited number of times.</p> </div> <div style="border: 1px solid black; padding: 5px;"> <p><b>i</b> <b>Note</b> If there are no clips, replace the pipe.</p> </div>
------------	--

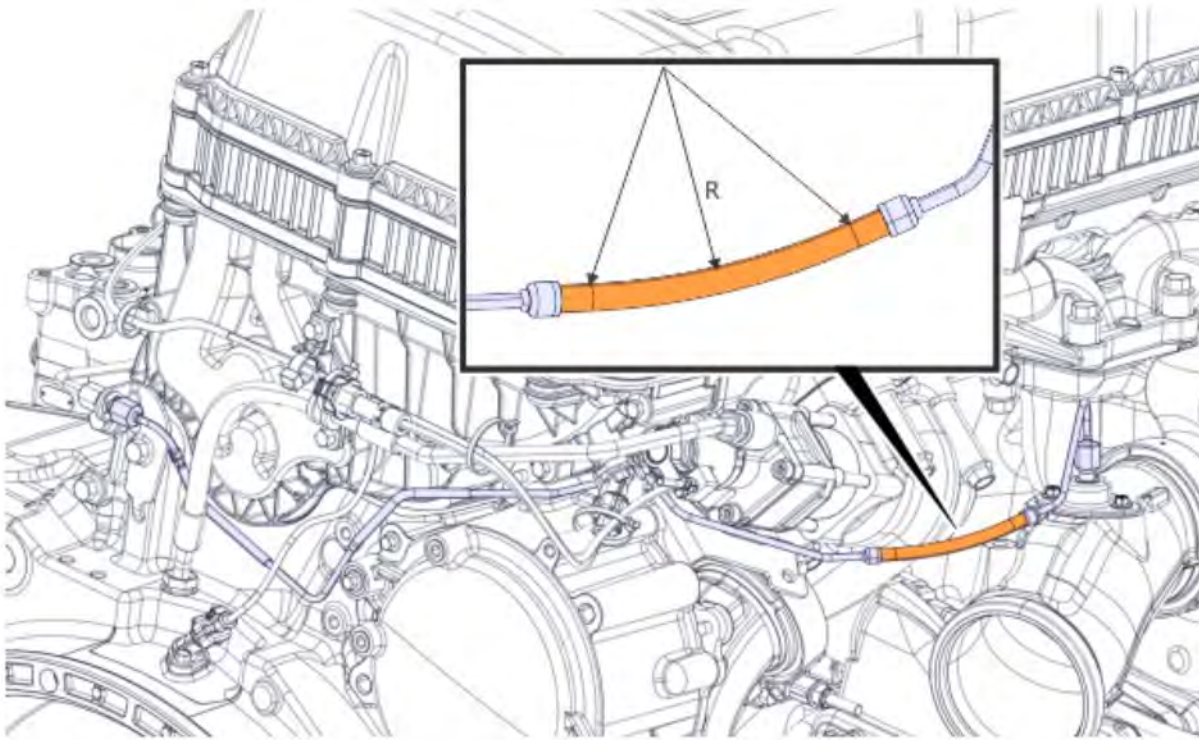




<b>436</b>	<p>Perform this procedure when the condition below is met.</p> <p><b>Conditions</b></p> <ul style="list-style-type: none"> <li>• If the pipe is reused, remove a clip.</li> <li>▶ If there are no clips, replace the pipe.</li> <li>▶ When installing new pipe, do not remove any clips.</li> </ul> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>i</b> <b>Note</b> If the pipe has been disconnected on either end for service, this counts as reuse.</p> </div>
------------	--

<b>437</b>	<p>Ensure that the tube is not bent at the crimp.</p> <table border="1" style="width: 100%; margin-top: 10px;"> <tr> <th colspan="2" style="background-color: #e0e0e0;">Tech data</th> </tr> <tr> <td style="width: 60%;">Fuel pipe, radius (R)</td> <td style="text-align: right;">≥50 mm (≥1.97 in)</td> </tr> </table> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>i</b> <b>Note</b> The minimum bend radius is 50 mm at the flexible line.</p> </div> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>i</b> <b>Note</b> Do not twist the tube and crimp.</p> </div>	Tech data		Fuel pipe, radius (R)	≥50 mm (≥1.97 in)
Tech data					
Fuel pipe, radius (R)	≥50 mm (≥1.97 in)				





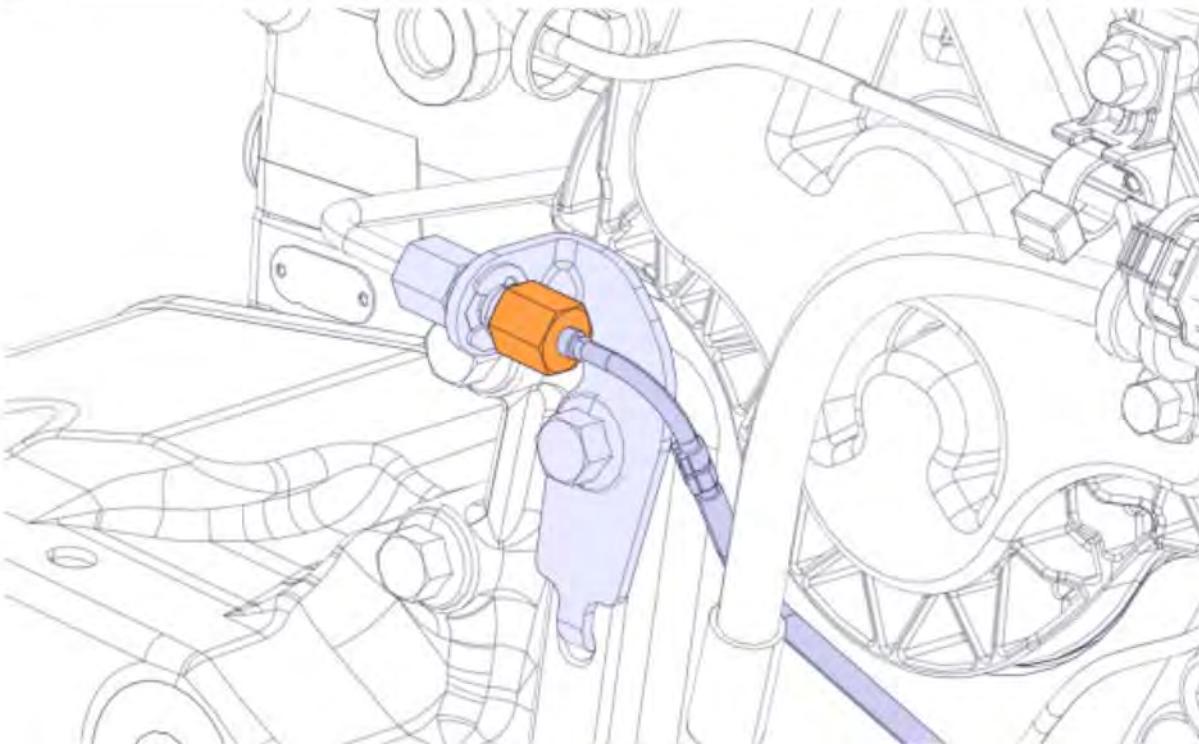
**438** Install the nut.

**439** Torque tighten the nut.

**Tightening torque**

Fuel pipe, nut

15 ±2 Nm  
(11 ±1 lb<sub>f</sub>-ft)



**440** Install the nut.

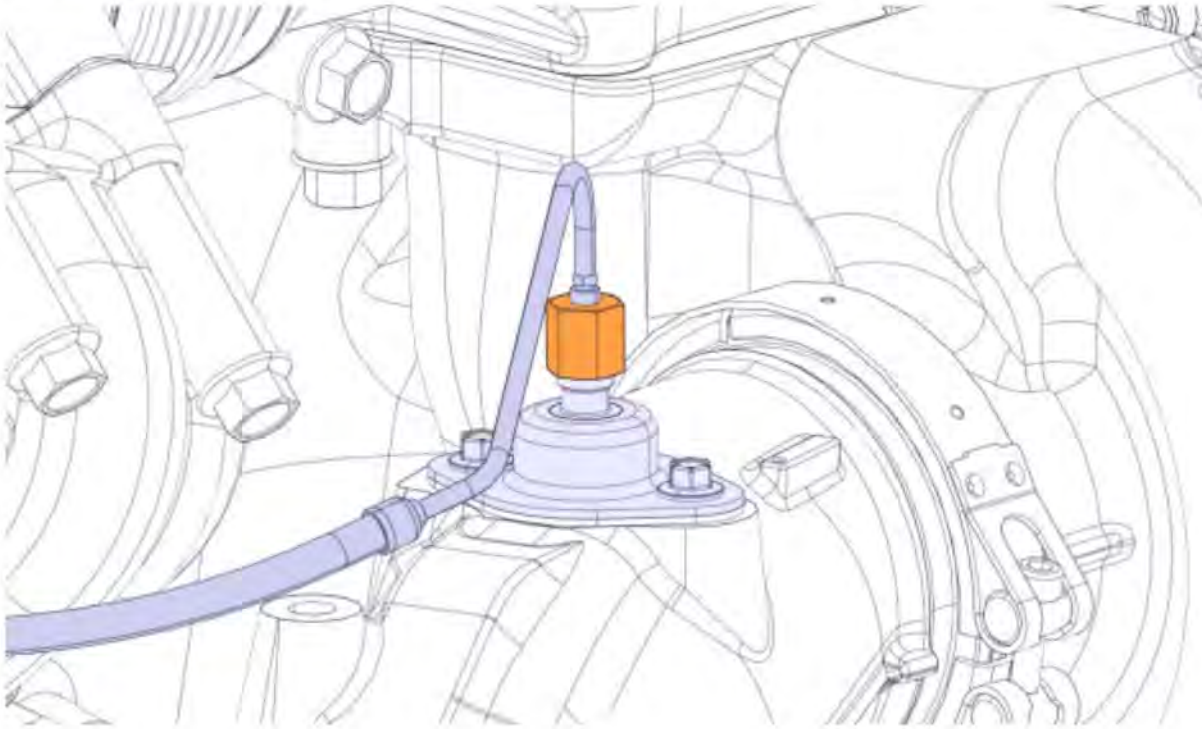
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Hand tighten the nut.

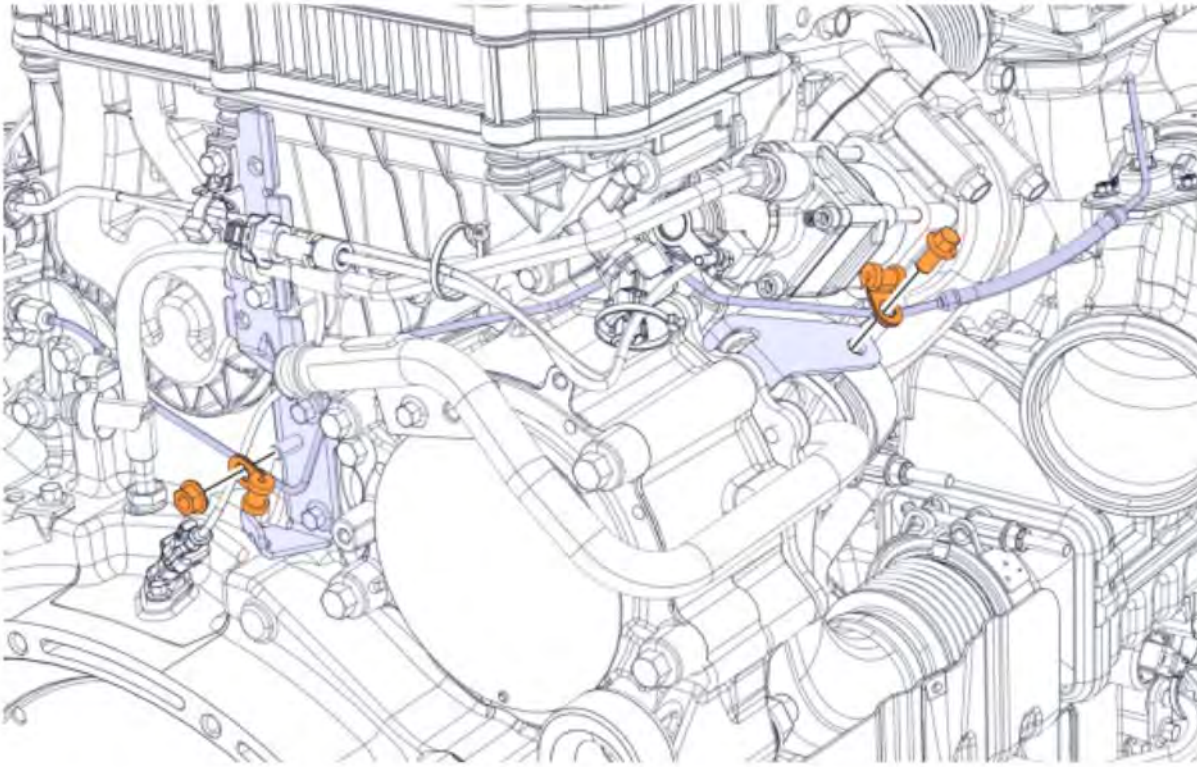


**441** Install the clamp along with the screw and nut.

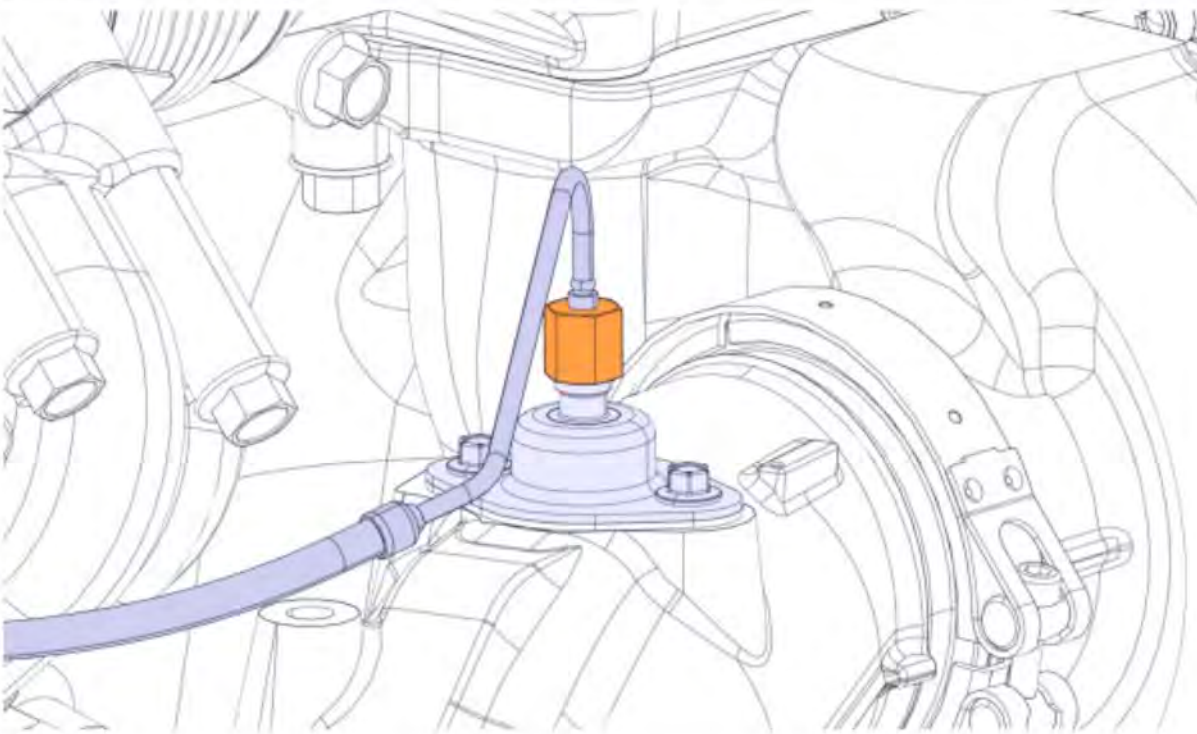
<b>442</b>	Torque tighten the screw.	
	<b>Tightening torque</b>	
	Fuel pipe, screw	24 ±4 Nm (18 ±3 lb <sub>f</sub> .ft)

<b>443</b>	Torque tighten the nut.	
	<b>Tightening torque</b>	
	Fuel pipe, nut	24 ±4 Nm (18 ±3 lb <sub>f</sub> .ft)





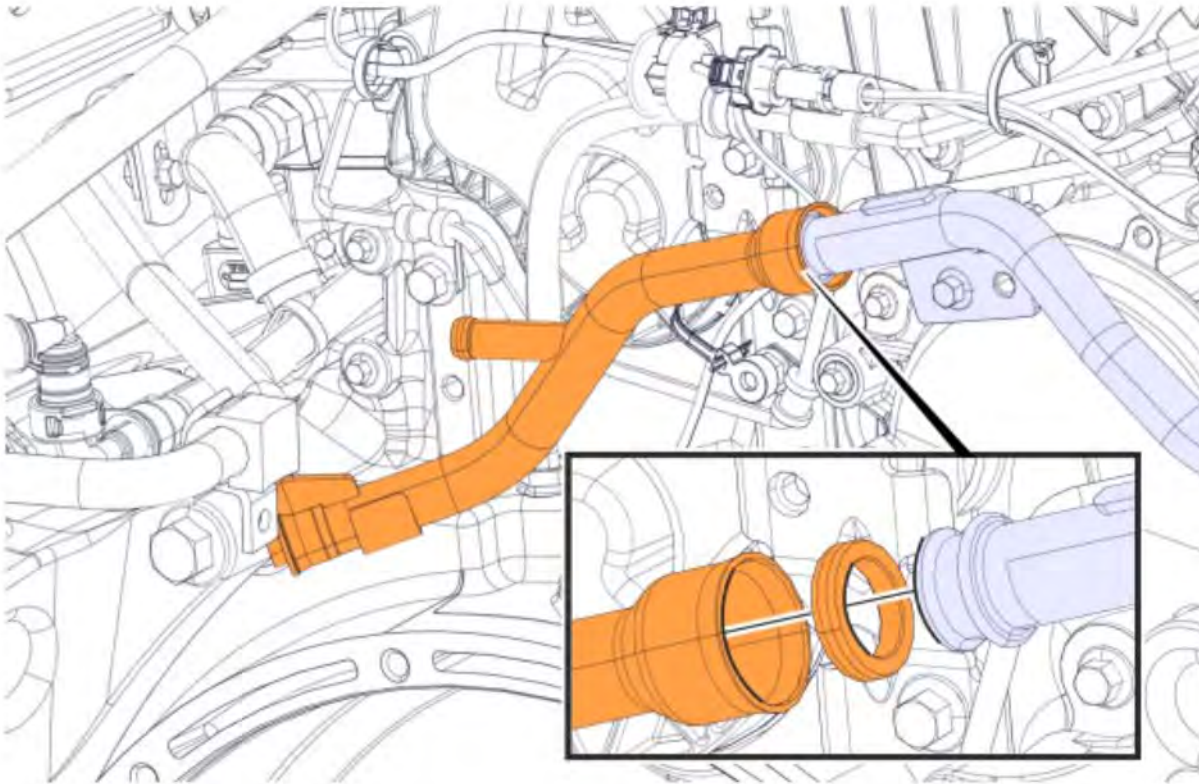
<b>444</b>	Torque tighten the nut.	
	<b>Tightening torque</b>	
	Injector pipe, nut	25 ±6 Nm (18 ±4 lb <sub>f</sub> .ft)



**445** Install the seal.

**446** Install the pipe.



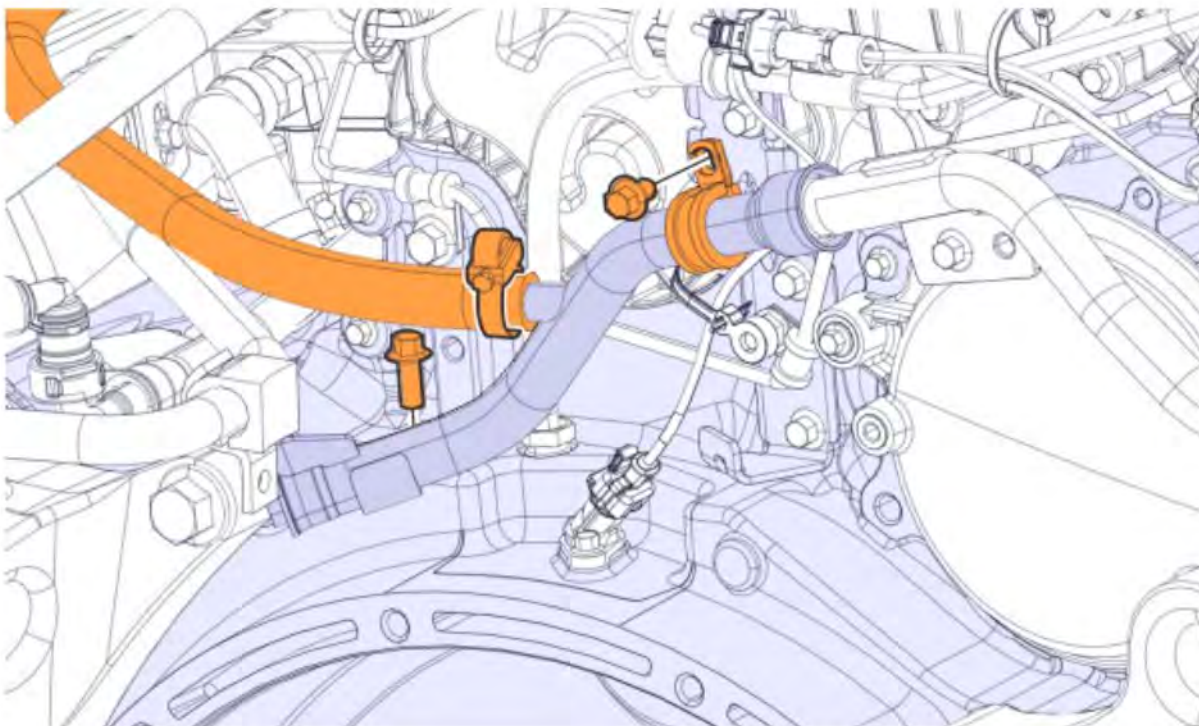


447 Install the clamp.

448 Install the screws.

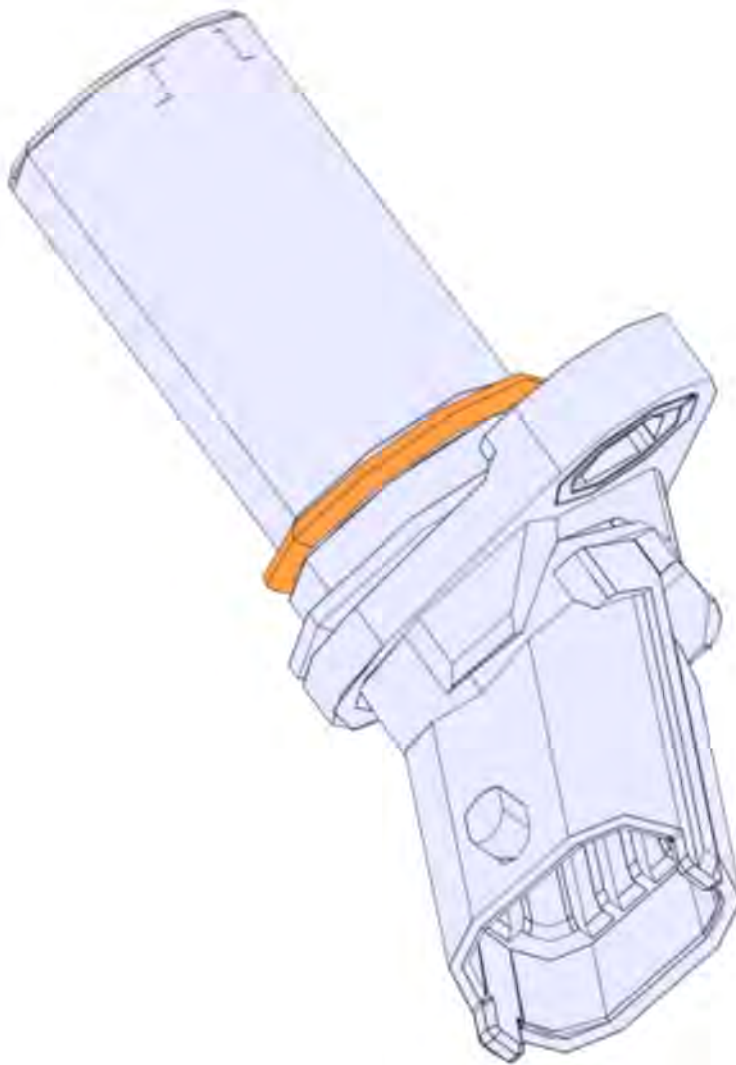
449 Install the hose.

450 Tighten the clamp.



451 Install the o-ring.

**i** **Note**  
Use a new part.



<b>452</b>	Install the sensor (4).		
	<table border="1" style="width: 100%;"> <tr> <td style="width: 10%; text-align: center;"></td> <td><b>Service hint</b> Install the sensor and shims previously recorded.</td> </tr> </table>		<b>Service hint</b> Install the sensor and shims previously recorded.
	<b>Service hint</b> Install the sensor and shims previously recorded.		

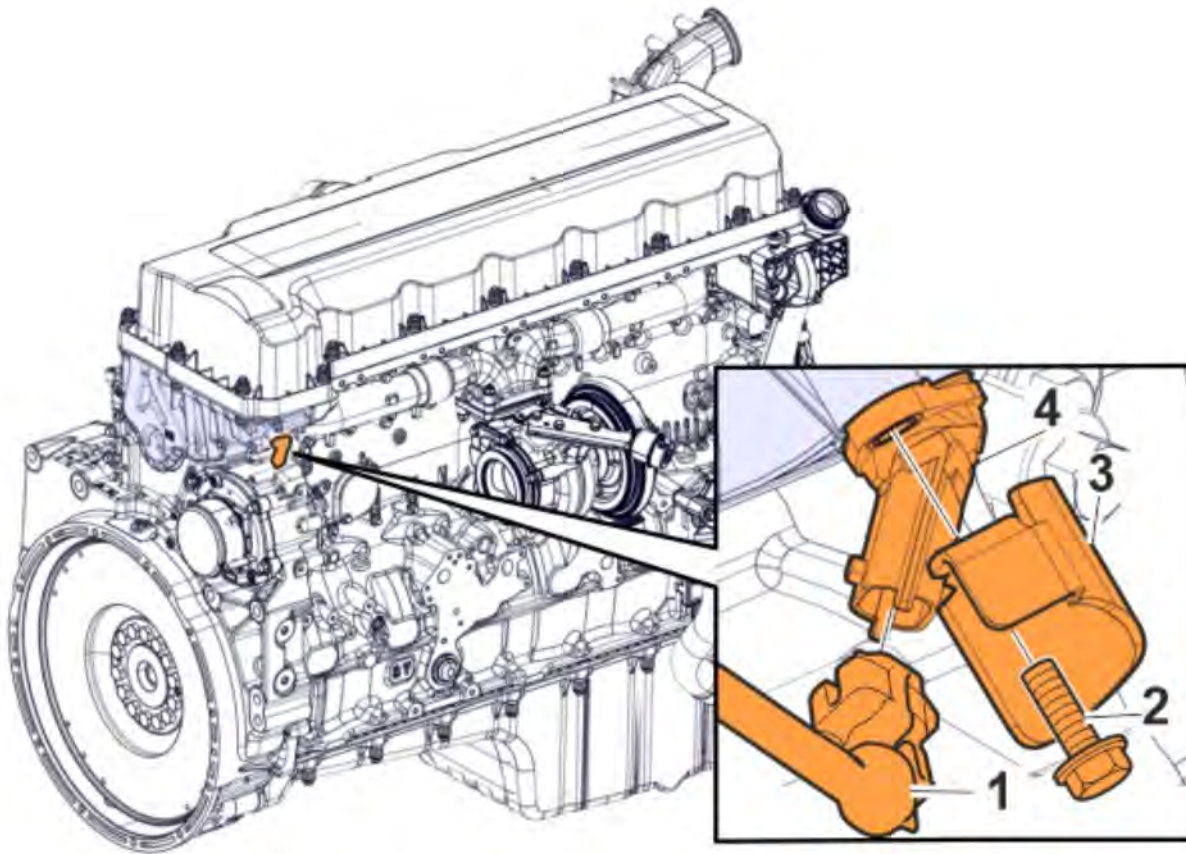
<b>453</b>	Install the heat shield (3).
------------	------------------------------

<b>454</b>	Install the screw (2).
------------	------------------------

<b>455</b>	Tighten the screw to torque.		
	<b>Tightening torque</b>		
	<table border="1" style="width: 100%;"> <tr> <td style="width: 50%;">Camshaft speed sensor, screw</td> <td style="text-align: center;">8 ±2 Nm (6 ±1 lb<sub>f</sub>-ft)</td> </tr> </table>	Camshaft speed sensor, screw	8 ±2 Nm (6 ±1 lb <sub>f</sub> -ft)
Camshaft speed sensor, screw	8 ±2 Nm (6 ±1 lb <sub>f</sub> -ft)		

<b>456</b>	Connect the connector (1).
------------	----------------------------





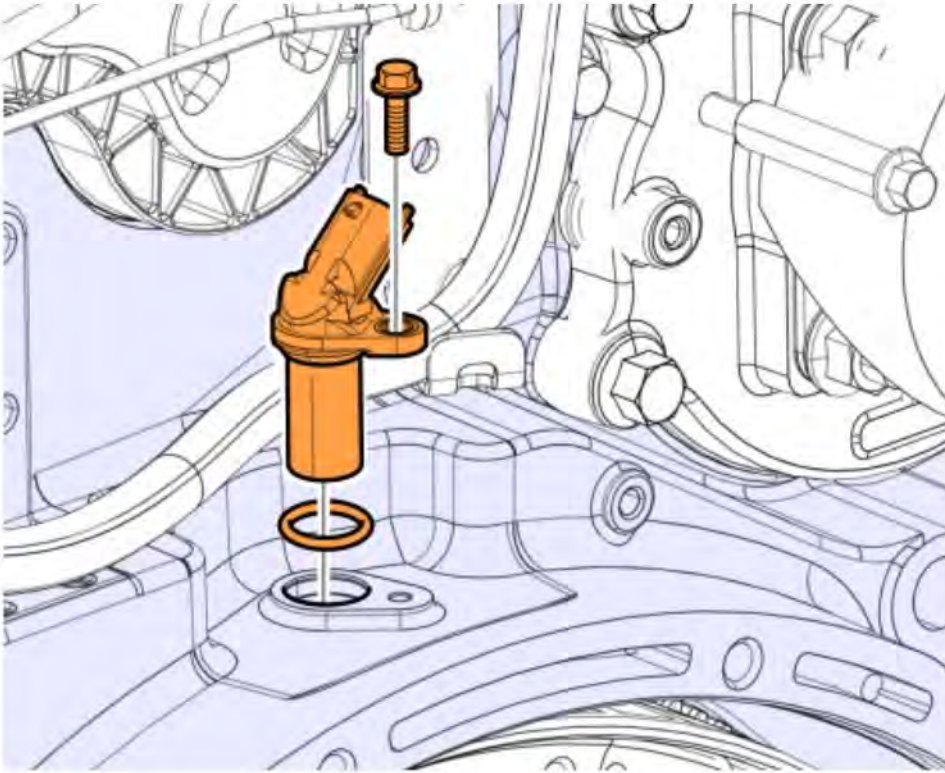
<b>457</b>	Install the o-ring.				
	<table border="1" style="border-collapse: collapse; width: 100%;"> <tr> <td style="text-align: center; width: 20px;"><b>i</b></td> <td style="padding: 2px;"><b>Note</b></td> </tr> <tr> <td colspan="2" style="padding: 2px;">Use a new part.</td> </tr> </table>	<b>i</b>	<b>Note</b>	Use a new part.	
<b>i</b>	<b>Note</b>				
Use a new part.					

<b>458</b>	Install the sensor.
------------	---------------------

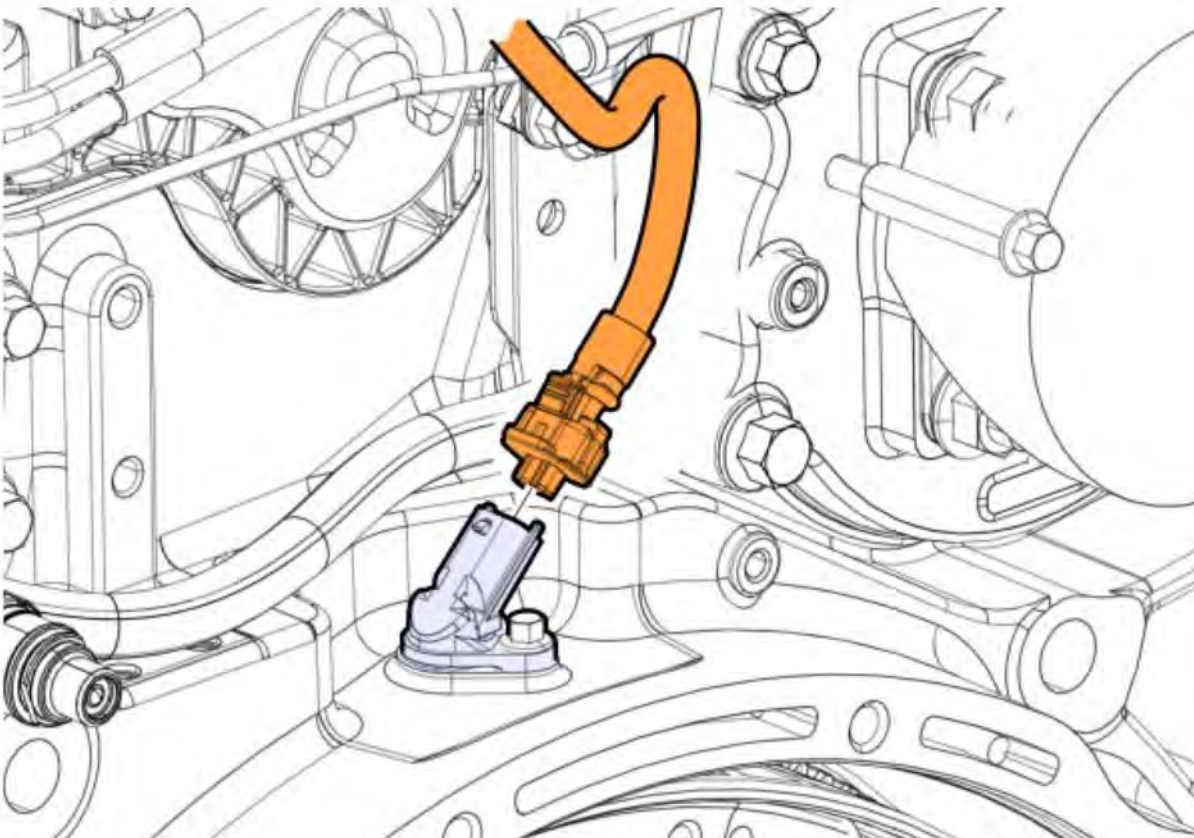
<b>459</b>	Install the screw.
------------	--------------------

<b>460</b>	Tighten the screw to torque.
<b>Tightening torque</b>	
Camshaft speed sensor, screw	$8 \pm 2 \text{ Nm}$ $(6 \pm 1 \text{ lb}_f\text{-ft})$

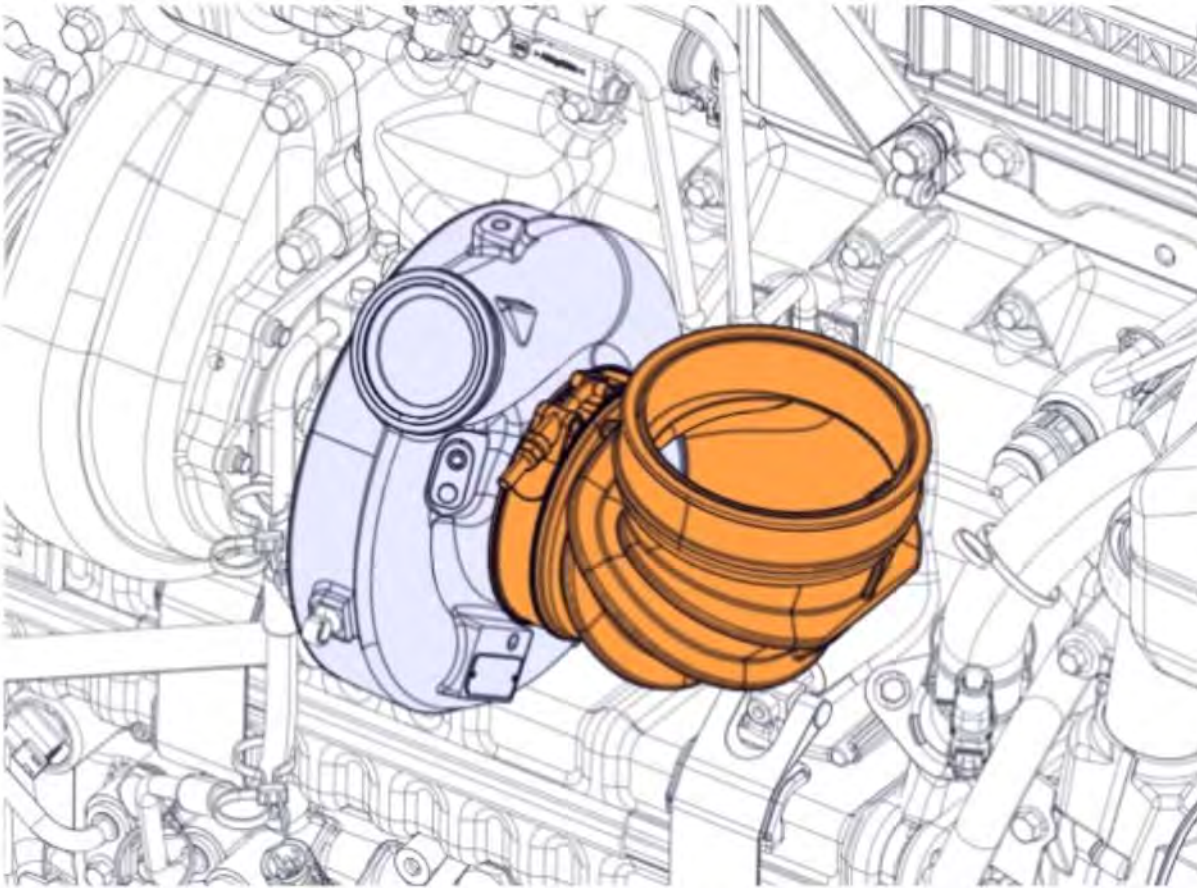




**461** Connect the connector.

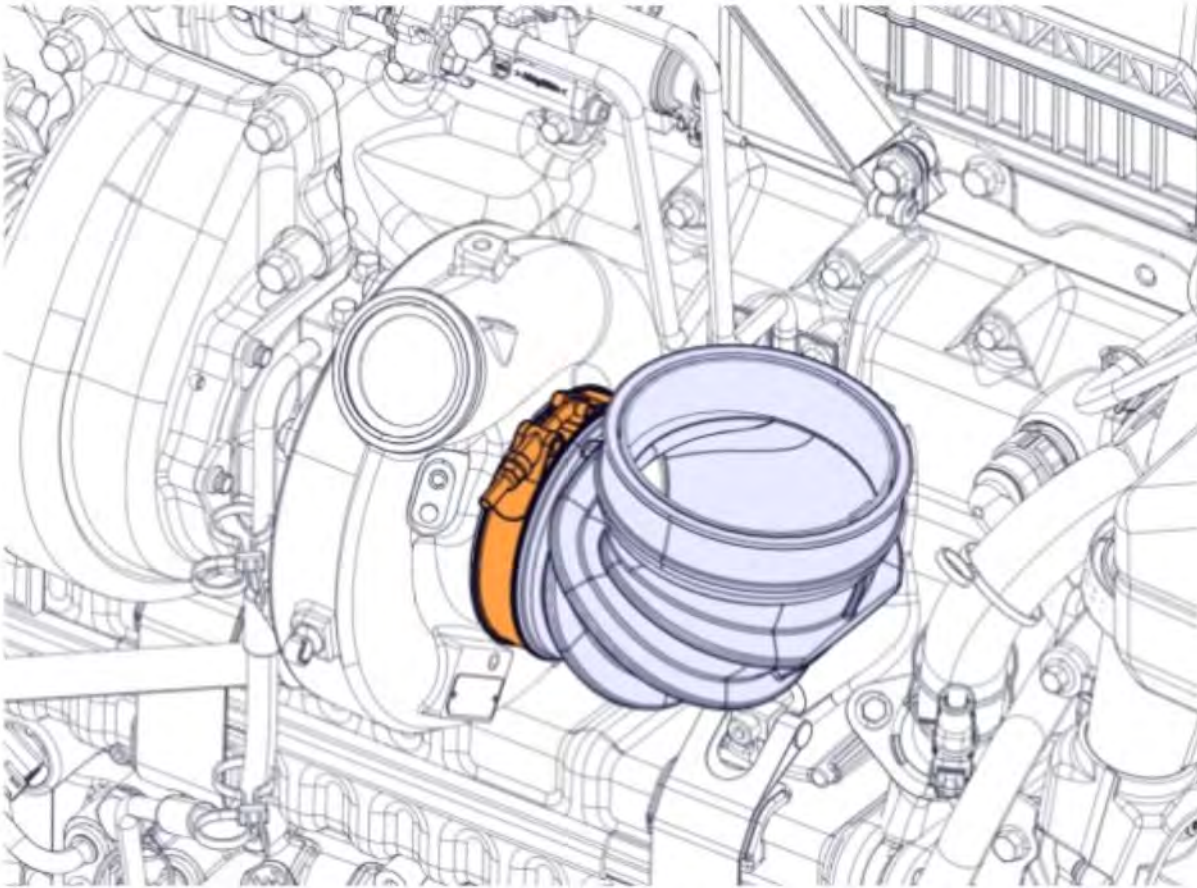


**462** Install the duct.

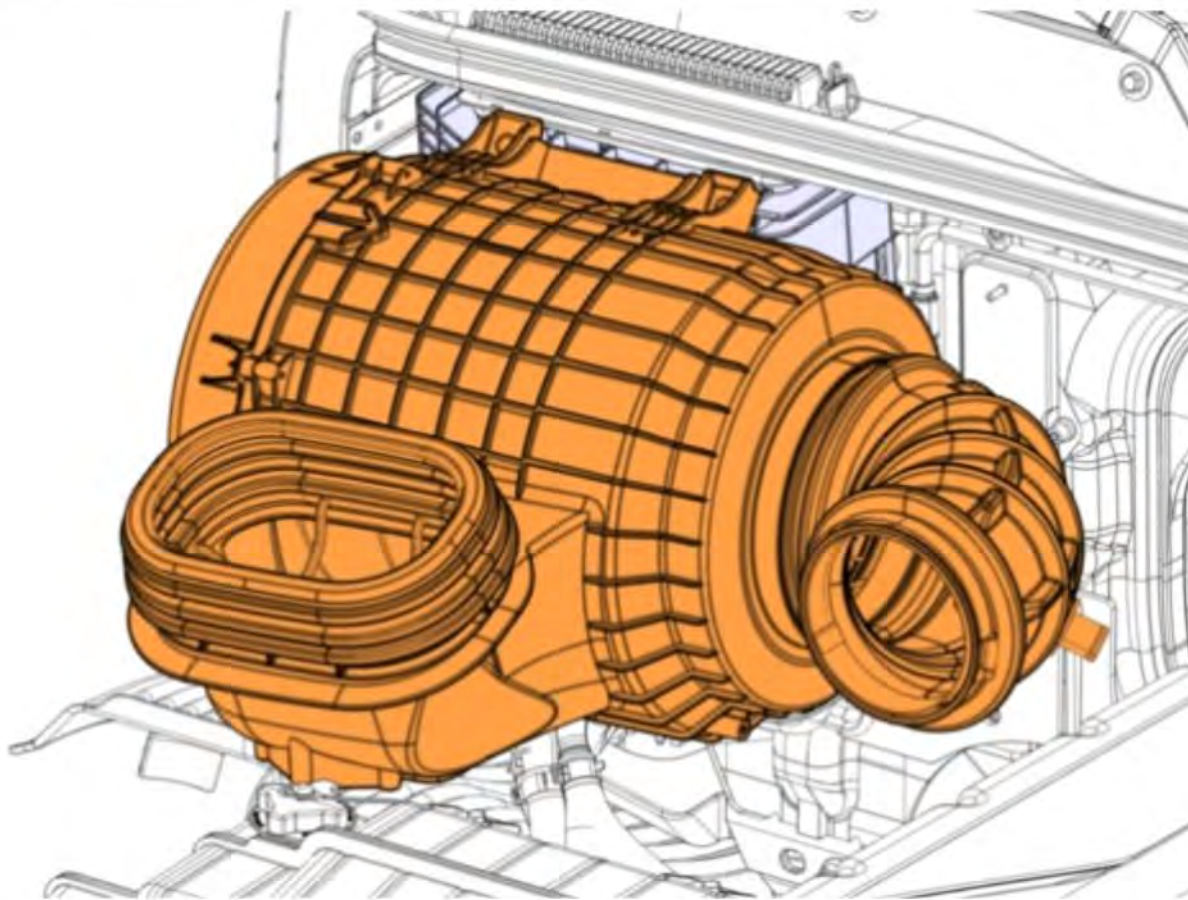


<b>463</b>	Torque-tighten the clamp.	
	<b>Tightening torque</b>	
	Air duct, clamp	$9 \pm 1 \text{ Nm}$ $(80 \pm 9 \text{ lb}_f\text{-in})$





**464** Install the air filter housing.



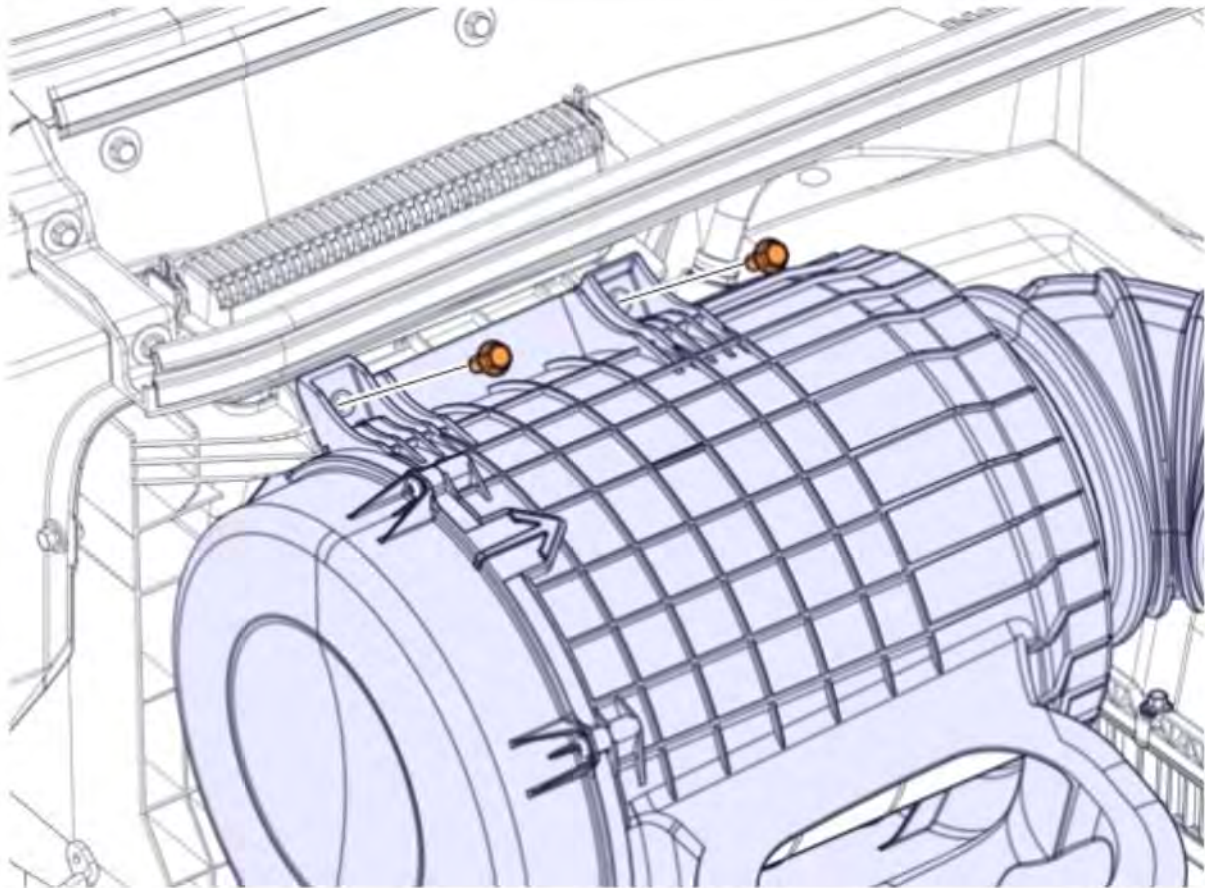
**465** Install the screws.

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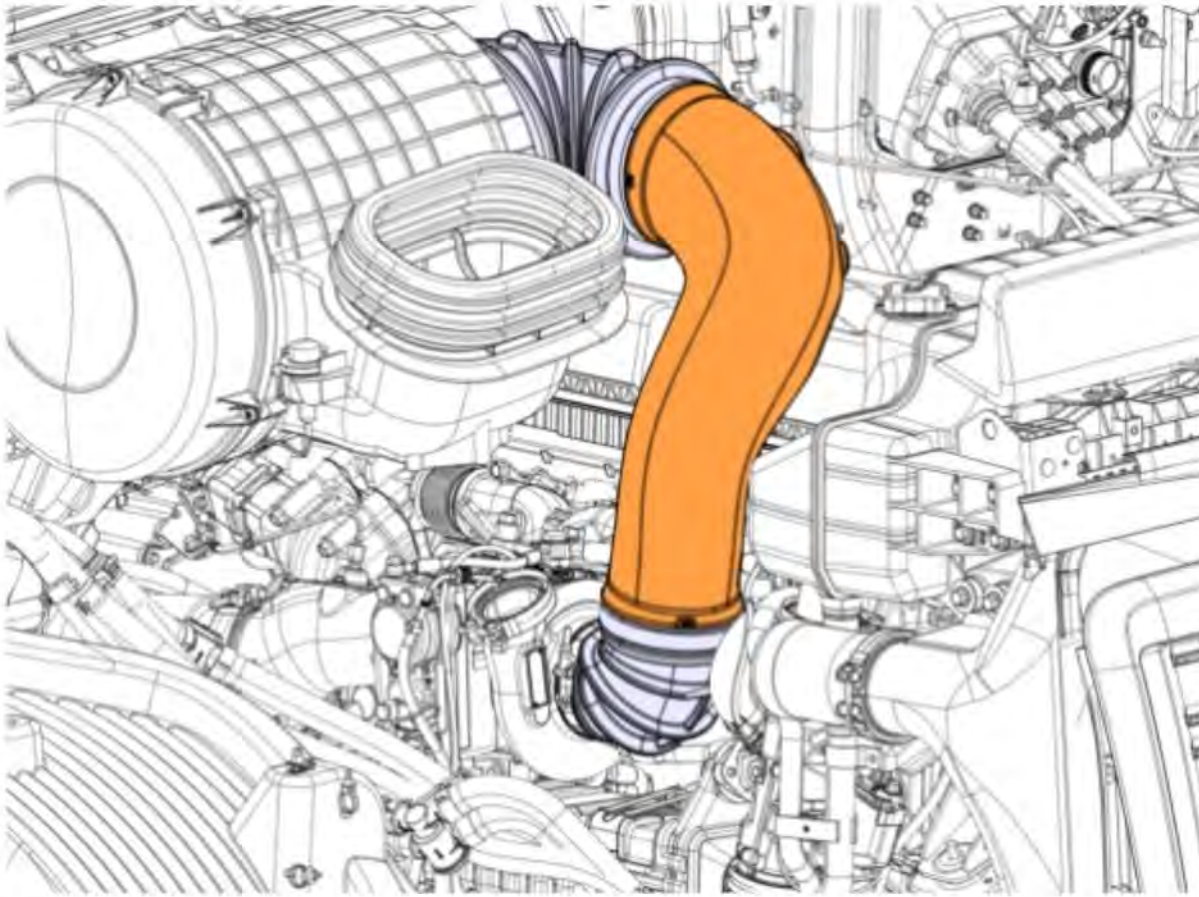
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466	Torque tighten the screws.	
<b>Tightening torque</b>		
Screw	M10	
	48 ±8 Nm	
	(35 ±6 lb <sub>f</sub> .ft)	

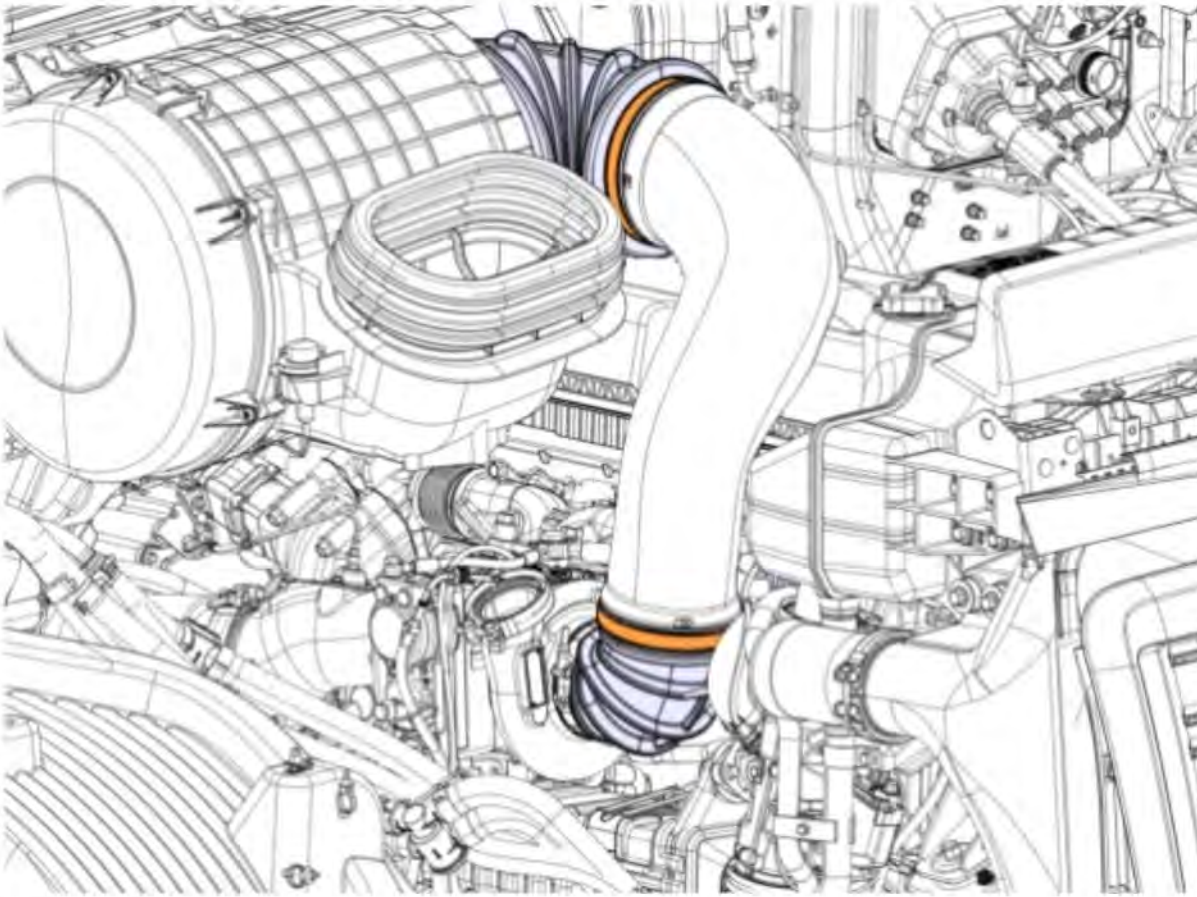


467	Install the air duct.	
-----	-----------------------	--



<b>468</b>	Torque tighten the clamps.				
	<b>Tightening torque</b>				
	Air duct, clamp	$9 \pm 1 \text{ Nm}$ $(80 \pm 9 \text{ lb}_f \cdot \text{in})$			
	<table border="1" style="border-collapse: collapse;"> <tr> <td style="text-align: center; width: 20px;"><b>i</b></td> <td style="padding: 2px;"><b>Note</b></td> </tr> <tr> <td colspan="2" style="padding: 2px;">As noted.</td> </tr> </table>	<b>i</b>	<b>Note</b>	As noted.	
<b>i</b>	<b>Note</b>				
As noted.					





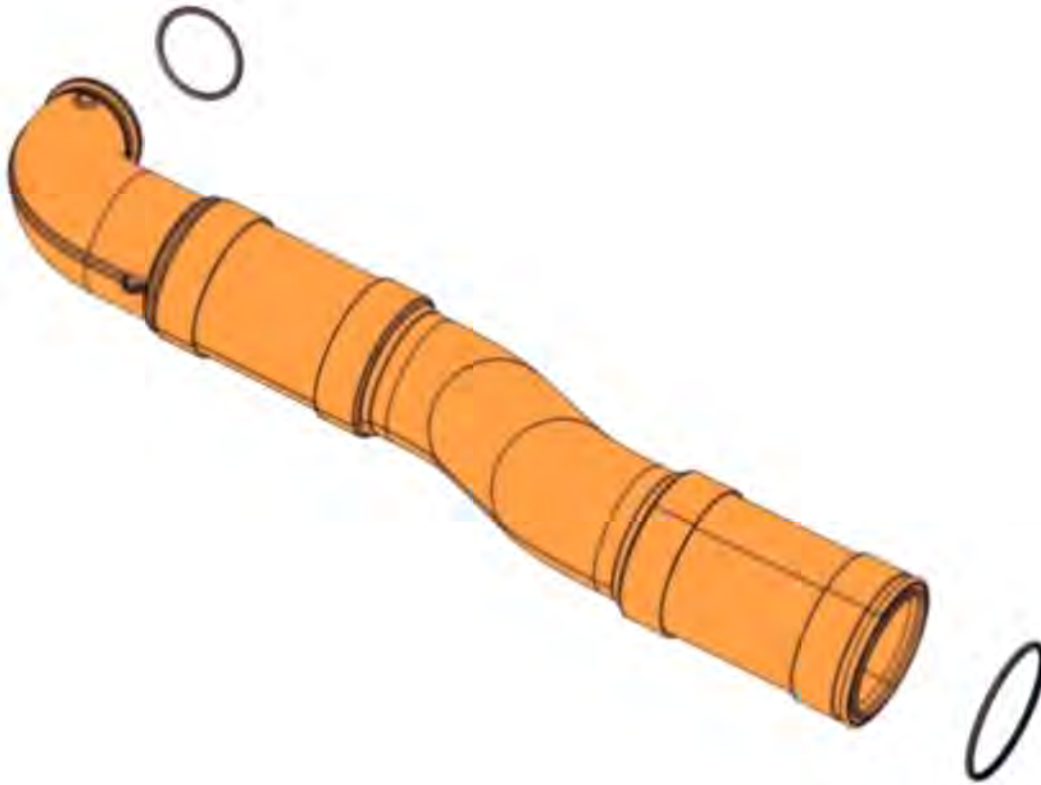
469 Install the seals.



**Note**

Inspect the seals, replace as needed.

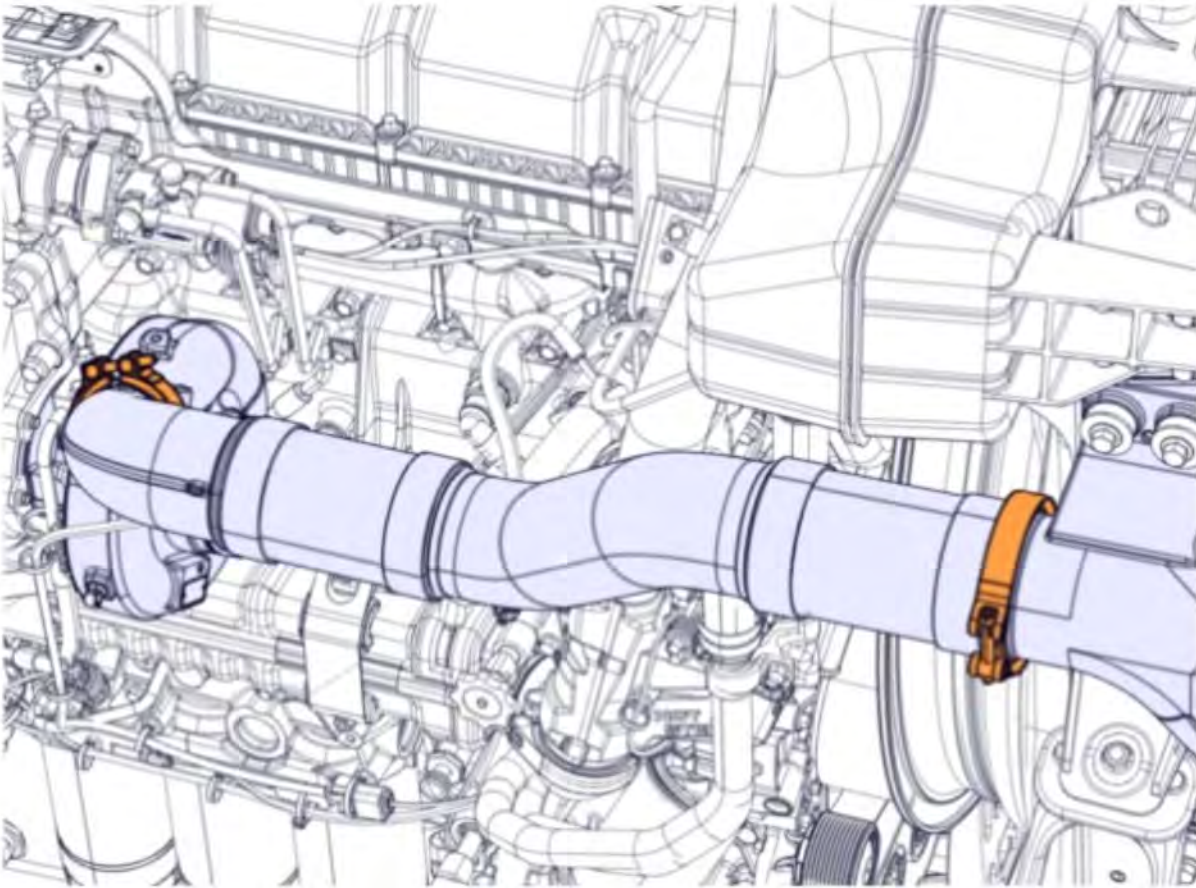
470 Install the charge air pipe.



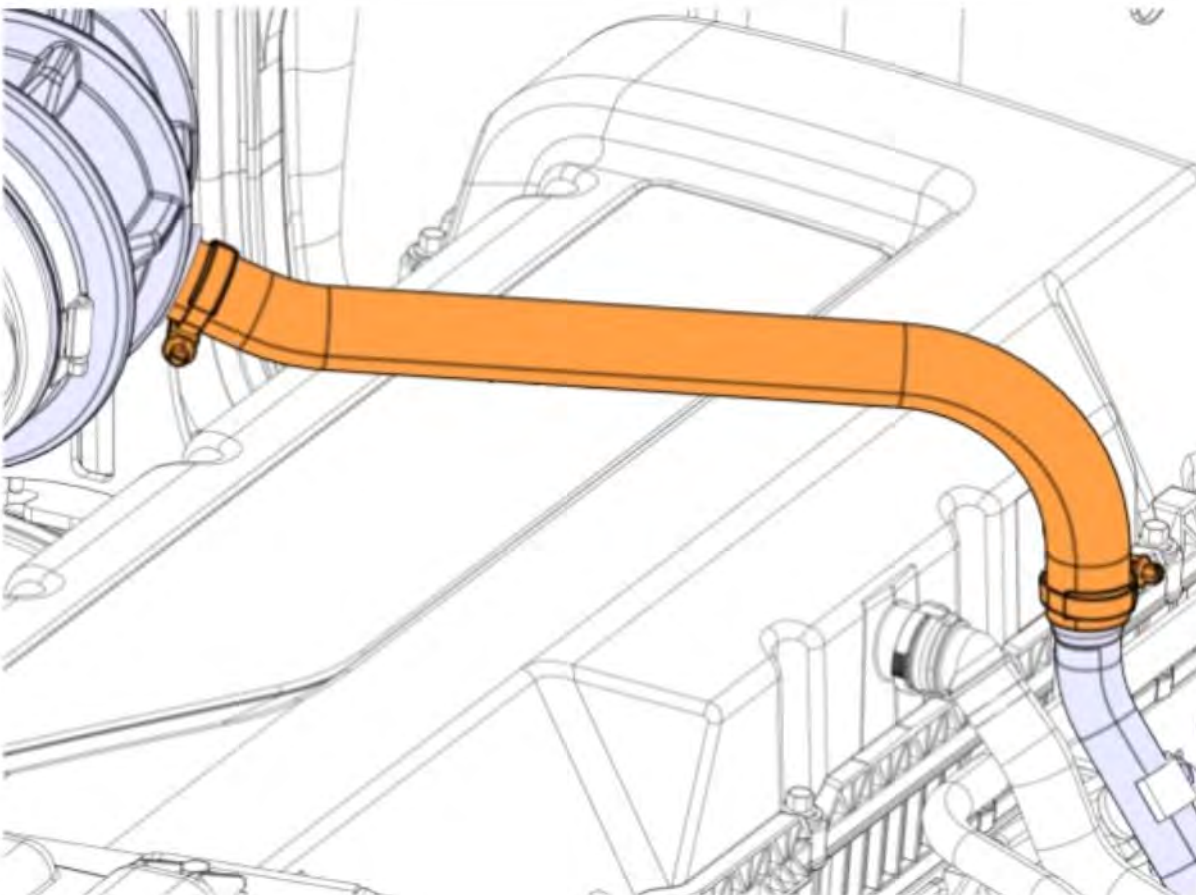
<b>471</b>	Install the V-clamps.		
	<table border="1" style="border-collapse: collapse;"> <tr> <td style="width: 20px; text-align: center;"><b>i</b></td> <td><b>Note</b> Note the orientation.</td> </tr> </table>	<b>i</b>	<b>Note</b> Note the orientation.
<b>i</b>	<b>Note</b> Note the orientation.		

<b>472</b>	Tighten the V-clamps to torque.	
	<b>Tightening torque</b>	
	V-clamp, screw	7 ±1 Nm (5 ±1 lb <sub>f</sub> .ft)





473 Install the hose.



474 Position the clamps.

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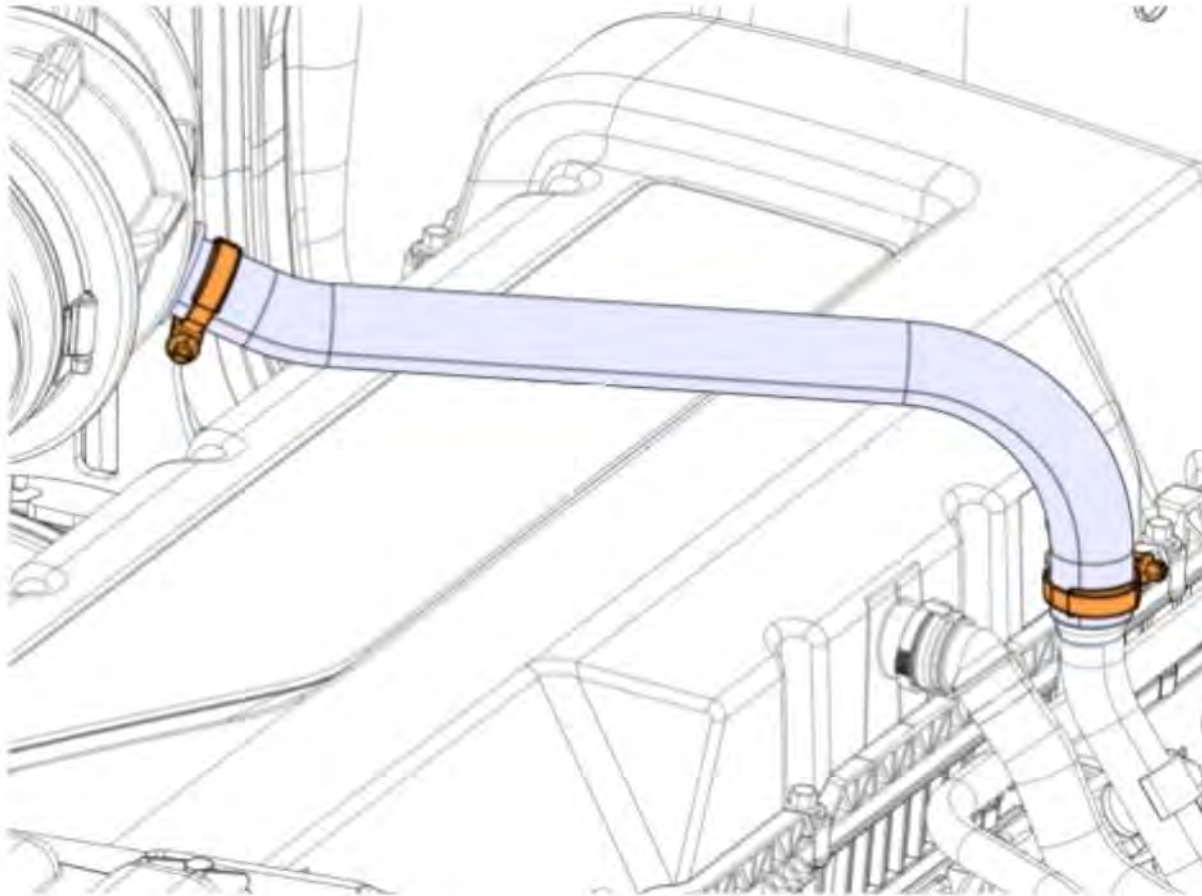


**Note**  
As noted.

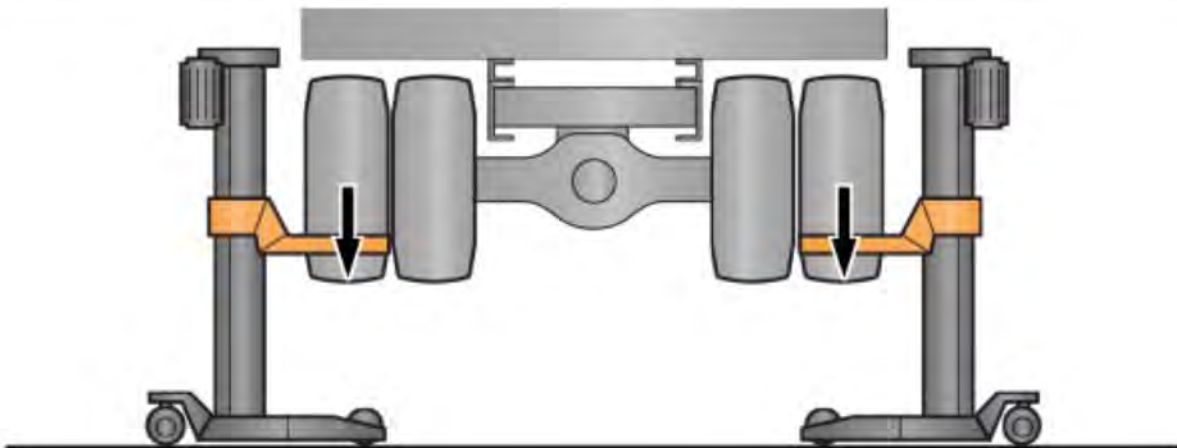
**475** Tighten the clamps to torque.

**Tightening torque**

Clamp, screw	3.95 ±0.6 Nm (35.0 ±5 lb <sub>f</sub> ·in)
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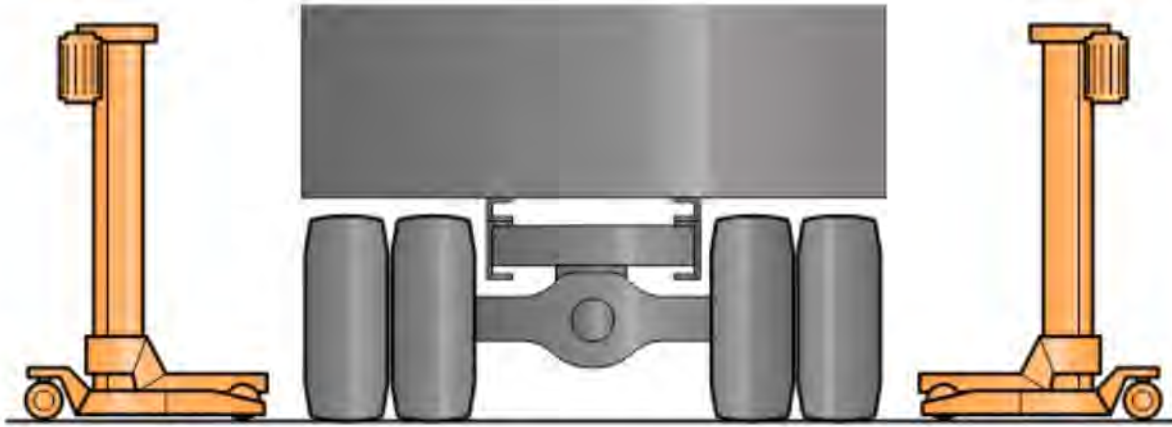
**476** Lower the vehicle.



**477** Remove the column lifts.

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478 Perform this procedure when the condition below is met.

**Conditions**

- If all of the coolant connections have been made, fill the coolant system.

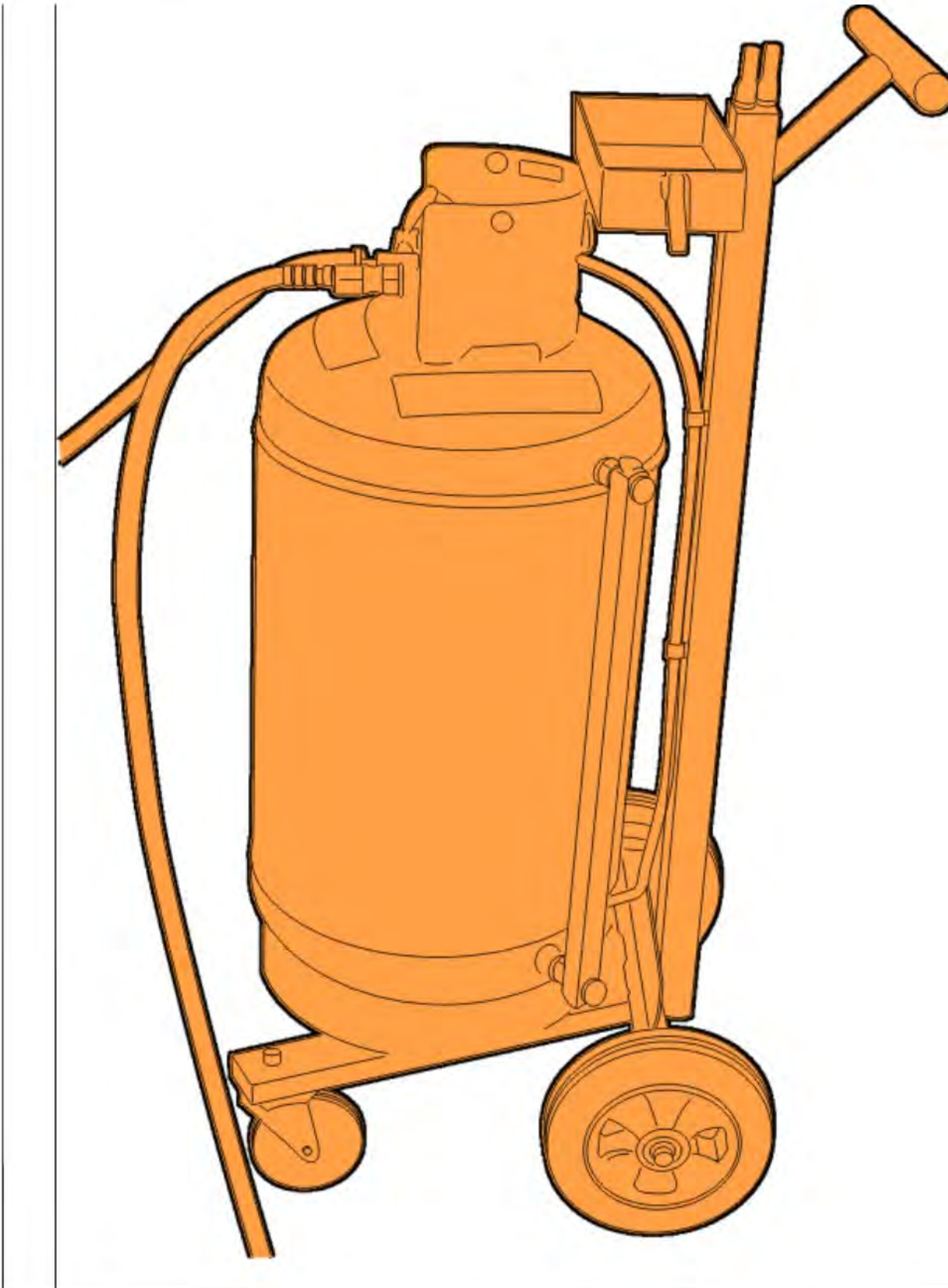
► Fill the cooling system.



**Note**

Use approved coolant.





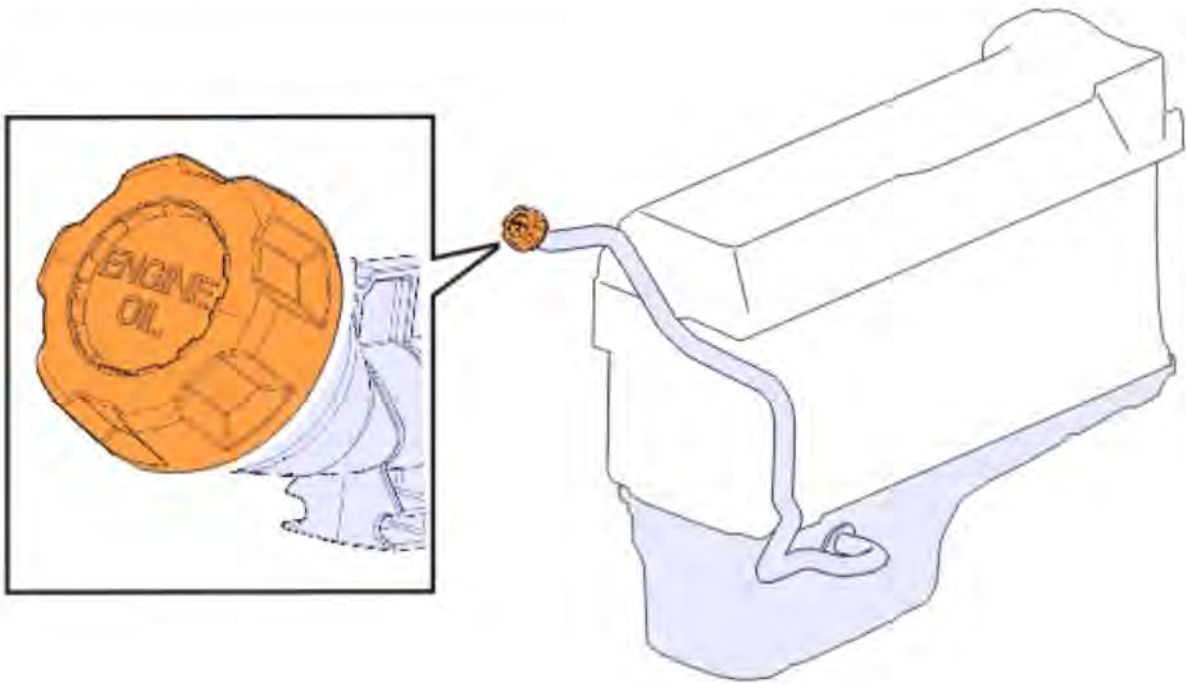
<b>479</b>	Perform this procedure when the condition below is met.
	<b>Conditions</b>
	<ul style="list-style-type: none"> <li>• If the end cap is removed</li> </ul>
	<ul style="list-style-type: none"> <li>▶ Install the end cap.</li> </ul>

**480** Fill with engine oil.

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	<b>Note</b> Use recommended oil.
---	-------------------------------------



<b>481</b>	Perform this procedure when the condition below is met.
	<b>Conditions</b>
	<ul style="list-style-type: none"> <li>• If the engine cover was removed for service</li> </ul>
	<ul style="list-style-type: none"> <li>▶ Install the engine cover.</li> </ul>

<b>482</b>	Install the lower left side splash shield.
------------	--

<b>483</b>	Install the lower right side splash shield.
------------	---

<b>484</b>	Lower the hood.
	<b>Note</b> Ensure that the hood is latched.



## 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:** Volvo Essential Tool Shipment

The tools listed below will be shipped **automatically** to all Volvo dealers (full-line, parts & service, and satellite locations) from the PDC. Each dealer will be invoiced on **ET1201V**. **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 Technical 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. 2-3 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.

# VOLVO TRUCKS UPTIME



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

[TC Bracket Volvo 1 - YouTube](#)



# Timing Gear Plate, Inspection

V-212-001

(December 2022)

## Valid for

All Volvo Powered Trucks 2017 to current

## Case description

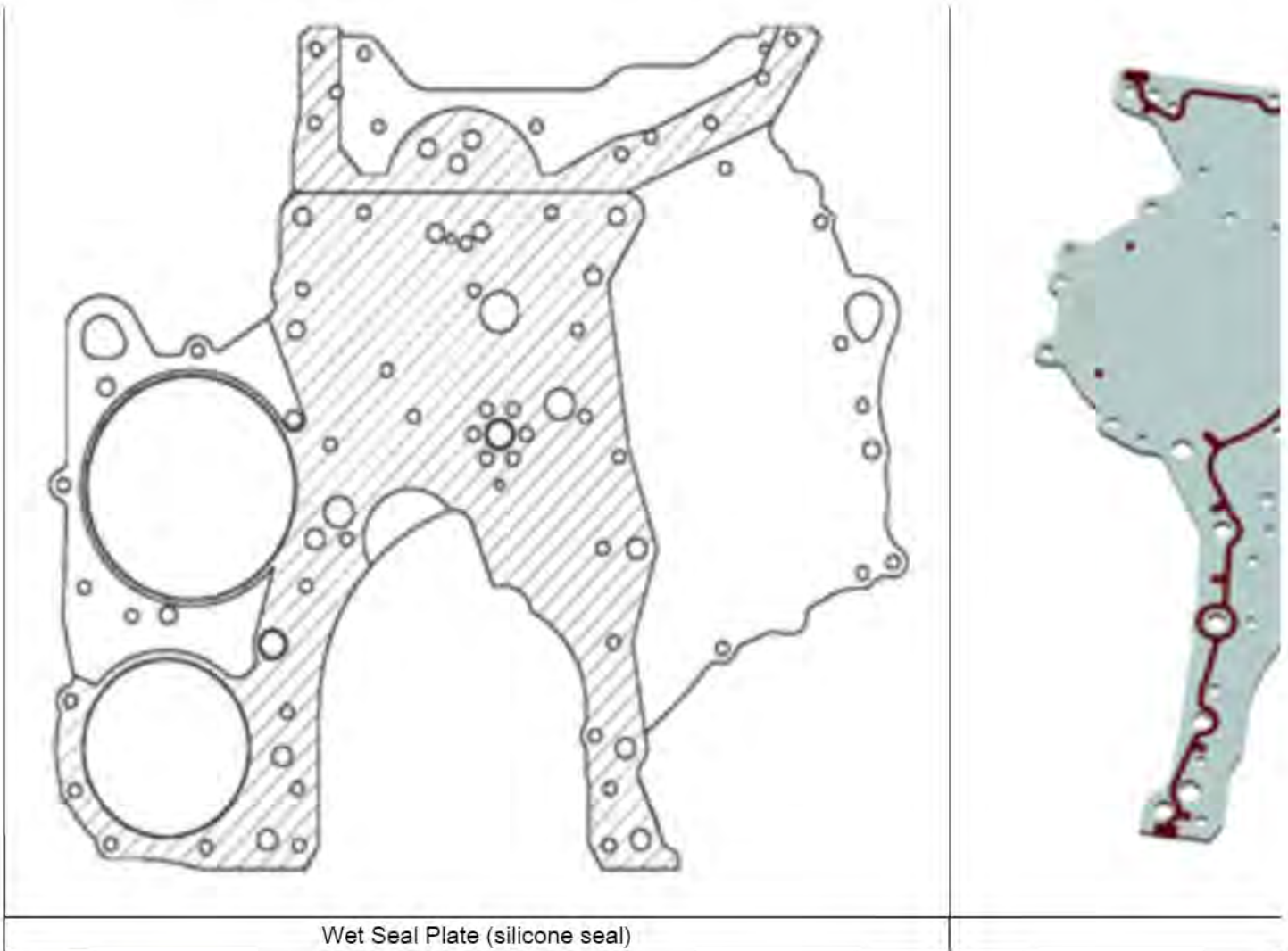
Volvo Trucks with an 11L and 13L engine utilize two types of timing gear plates. In some instances, the timing gear plates may show evidence of an oil leak or oil weep. The information in this publication describes the differences between the two types of timing gear plates used, the inspection criteria 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.

## 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 <a href="#">TPI 212-031, Timing Gear Plate</a> 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.*

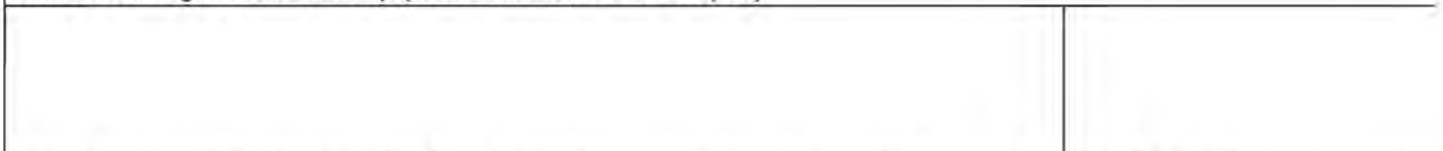
**Oil Leak** is determined by the identification of oil actively accumulating on the exterior of a part. The area will be visibly saturated, can be seen actively accumulating and running from the area.

*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.

*Note: If an integrated seal plate is leaking or if damage is found to the seal, it must be replaced with a new one. It cannot be repaired using silicone.*

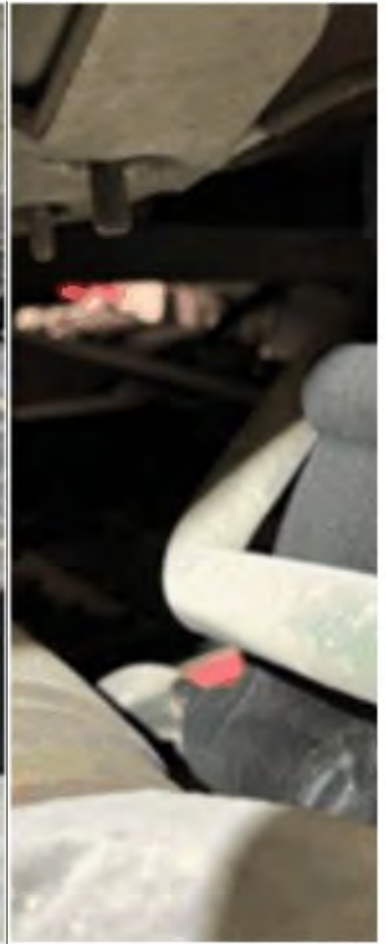
### Reference images of an oil weep (not a valid warrantable repair)





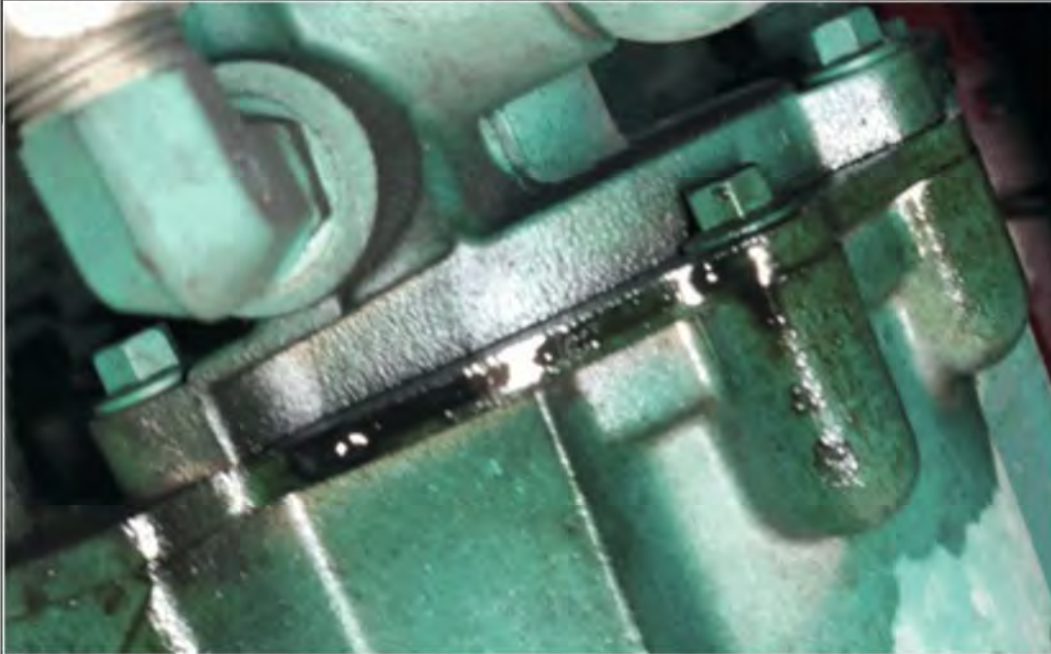


Dark spot or stain



Colle

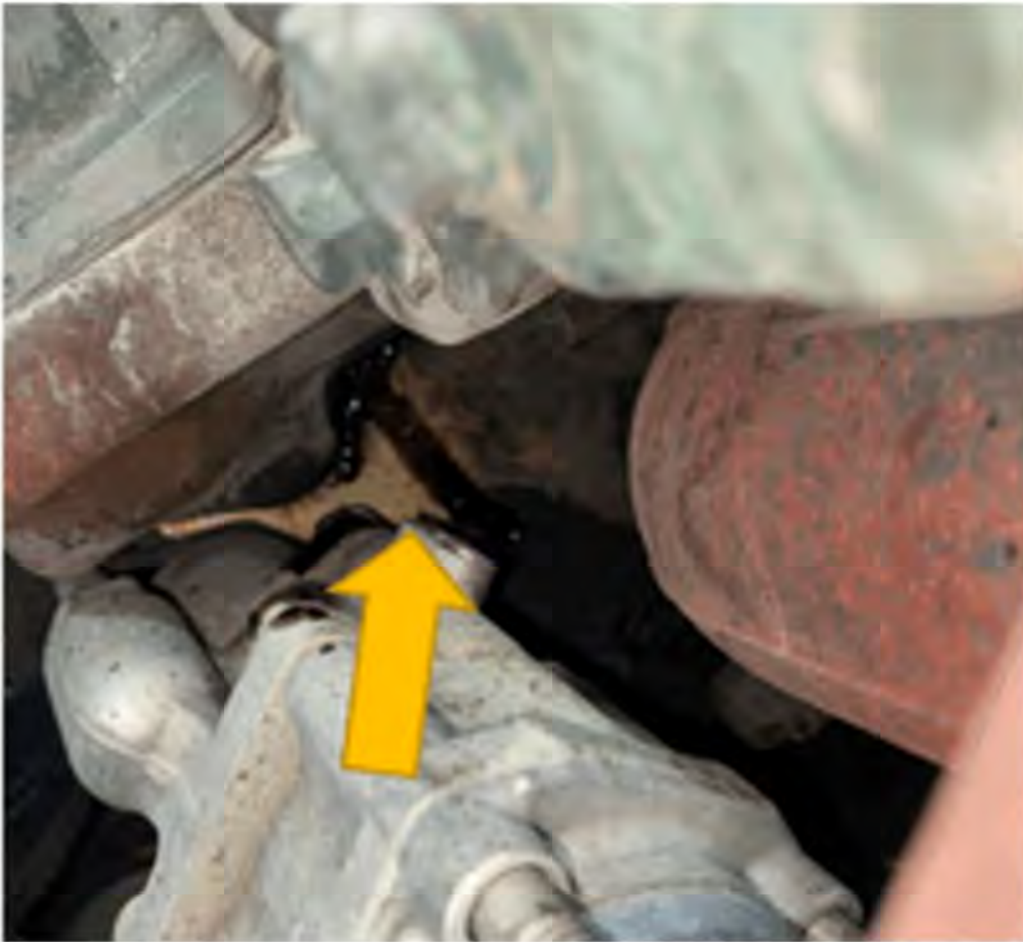
Reference images for an oil leak (valid warrantable repair)







Oil actively leaking

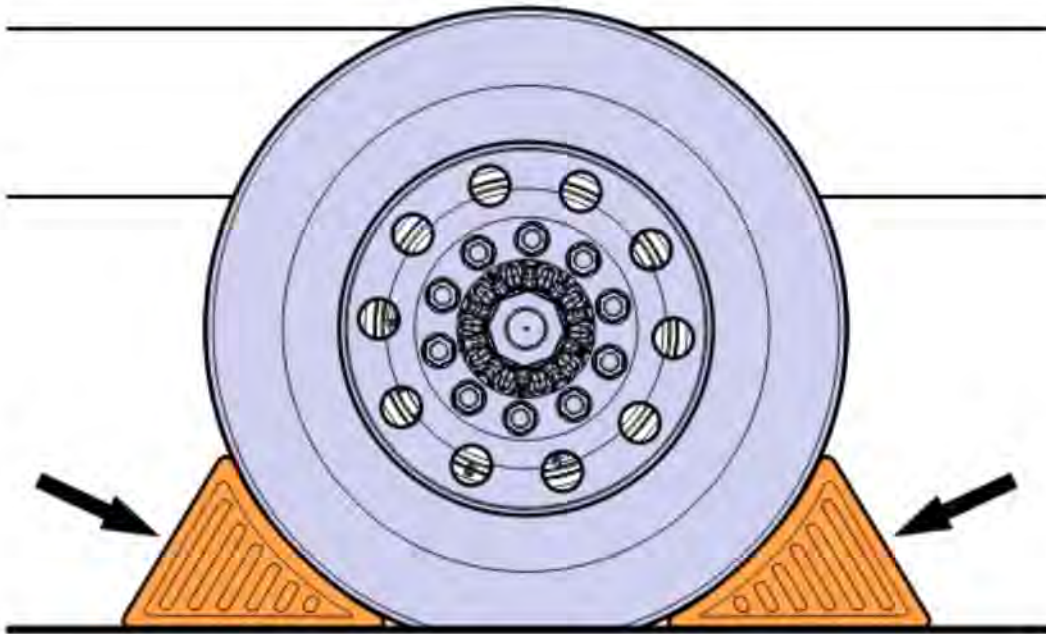


Oil actively running down joint

## 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.*

- . Park the vehicle on a level surface.
- . Apply the parking brake.
- . Place the gear lever in neutral.
- . Install the wheel chocks.



- . Unlatch and raise the hood.
- . Visually inspect the Timing Gear Plate (TGP) for an active leak.
- . If a **weep** is found (dark stain/dust and dirt) no further diagnostics is needed. Release truck back into service.
- . 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.

<b>Important Note</b>
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If further assistance is needed determining a leak request support using the normal process.
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- . Once a leak is determined and documented with pictures, follow Impact repair instruction in function group 2152.

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## Recommended Engine Oils

V-183-001A

(Aug 2022)

### Valid for

All Volvo Powered Vehicles

### Case description

This is to inform all North American and Canadian Dealers to utilize the below recommended VDS 4.5 10w30 Oil List if Volvo Genuine oil is not available.

This list is being put together to help guide towards other VDS 4.5 10w30 oils that provide the best optimum performance with Volvo D11 & D13 engines. This list will be continually reviewed and updated as future formulations are evaluated.

Brand	Label	Viscosity	Volvo
Shell	ROTELLA® T4	10w30	VDS 4.5
Chevron	Delo 400 SDE SAE	10w30	VDS 4.5
Chevron	Delo® 400 XLE SAE	10w30	VDS 4.5
ExxonMobil	Delvac™ 1300 Super	10w30	VDS 4.5
ExxonMobil	Delvac™ HDEO	10w30	VDS 4.5
ExxonMobil	Delvac Extreme	10w30	VDS 4.5
Valvoline	Premium Blue One Gen2	10w30	VDS 4.5
Valvoline	All-Terrain	10w30	VDS 4.5
Petro-Canada	Duron SHP	10w30	VDS 4.5
Phillips 66	Guardol Fleet EC	10w30	VDS 4.5

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# Warranty Operations Manual

Canada, United States, Latin America

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## - TIMING GEAR PLATE - Clean Claim Template



### Documents

Timing Gear Plate

### **RO'S OPEN MARCH 6, 2023 AND AFTER:**

#### **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 212-001 - 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 212-001 Timing Gear Plate, Inspection.

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

### **ALL RO'S OPENED PRIOR TO 3/6/2023 FOLLOW INSTRUCTIONS BELOW:**

Quick Reference guide to CBR documents and Bulletins (more info can be found in Impact and CBR):

- FSB 215-003, Timing Plate Flange Screw- When replacing a timing gear plate, the bolts must be replaced.

File claims using the recommended labor code:

- 2152-03-02-04 Timing Gear Plate, Replacement (Includes labor for R/R of the transmission, clutch, flywheel, flywheel housing, etc.)

**PARTS:**

Impact FG 215

**NOTES:**

All diagnostic time and related test must be claimed under labor code **1700-16-03-01** Diagnostic Time

If the timing gear plate needs to be resealed, warranty claim may be submitted if the vehicle has coverage that lists the following items "**Gaskets, Seals, O Rings, and Silicon Sealant**".

A warranty claim may be filed if there is fretting or material defect on the timing plate that will keep the plate from sealing under major component coverage. For this example, a clear picture of the fretting must be attached to the claim.

Effective with RO's opened November 28, 2022, all timing gear plate repairs require pre-authorization to be considered for Warranty reimbursement.

To request pre-authorization, please open a Warranty Argus Case:

- Enter "Timing Gear Plate" in the Description field
- Use Function Group 2153
- Describe symptoms
- Attach pictures clearly illustrating the issue

**NON-WARRANTABLE FAILURES**

If the plate needs to be resealed the repair is only covered under standard coverage and purchased coverage that contains the following items "Gaskets, Seals, O Rings, and Silicon Sealant". This type of repair not covered under major component coverage.

Timing Gear Plate claims submitted without pre-authorization are not eligible for warranty reimbursement.

*All information for internal use only*