

# Technical Journal



TITLE:

Oil consumption, “Low oil Level” or “Oil level low” in DIM

REF NO:  
TJ 24643

ISSUING DEPARTMENT:  
Technical Service

CAR MARKET:  
United States and Canada

PARTNER:  
3 US 7510 Volvo Cars North America

ISSUE DATE:  
YEAR MONTH DAY  
2013 05 15

FUNC GROUP:  
2100

FUNC DESC:  
Engine

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**“Fixed Right — First Time”**

## Attachment

File Name	File Size
Attachment TJ 24643 v7.pdf	1.3035 MB
Attachment TJ 24643 Instruction v7.pdf	11.194 MB

## Vehicle Type

Type	Eng	Eng Desc	Sales	Body	Gear	Steer	Model Year	Plant	Chassis range	Struc Week Range
124	90	B6304T4					2011-9999		-	0-0
124	94	B6324S4					2011-9999		-	0-0
124	95	B6324S5					2011-9999		-	0-0
124	96	B6324S2					2010-2010		-	0-0
124	98	B6324S					2007-2010		-	0-0
124	99	B6304T2					2008-2010		-	0-0
134	90	B6304T4					2011-9999		-	0-0
135	96	B6324S2					2010-2010		-	0-0
135	98	B6324S					2008-2010		-	0-0
136	90	B6304T4					2011-9999		-	0-0
136	94	B6324S4					2011-9999		-	0-0
136	95	B6324S5					2011-9999		-	0-0
136	96	B6324S2					2010-2010		-	0-0
136	98	B6324S					2008-2010		-	0-0
136	99	B6304T2					2008-2010		-	0-0
156	90	B6304T4					2011-9999		-	0-0
156	94	B6324S4					2011-9999		-	0-0
156	95	B6324S5					2011-9999		-	0-0



Type	Eng	Eng Desc	Sales	Body	Gear	Steer	Model Year	Plant	Chassis range	Struc Week Range
156	96	B6324S2					2010-2010		-	0-0
156	98	B6324S					2010-2010		-	0-0
156	99	B6304T2					2010-2010		-	0-0
275	95	B6324S5					2011-9999		-	0-0
275	98	B6324S					2007-2010		-	0-0

## CSC Customer Symptom Codes

Code	Description
AZ	Lubrication and oil system/Excessive oil consumption
BU	Lubrication and oil system/Incorrect fluid level

## DTC Diagnostic Trouble Codes

### Text

**DIM = Driver Information Module**

**PZEV = Partial Zero Emissions Vehicle**

**ECM = Engine Control Module**

**Note! If using a printed copy of this Technical Journal (TJ), first check for the latest online version.**

**NOTE! THIS DOCUMENT SUPERSEDES TECHNICAL JOURNAL 24643 dated 2012-12-19. The TJ has been reorganized to prevent incorrect diagnosis. Part numbers have been added to the parts list for piston replacement. Checking the oil trap has been added to diagnostic process. PLEASE UPDATE YOUR FILES.**

### DESCRIPTION:

This TJ describes the measures to be taken if a customer complains about low oil level, excessive oil consumption, white smoke from the exhaust, oil smell, or the yellow warning symbol and the “Engine oil level low” text message in the Driver Information Module (DIM) on a vehicle with the Short Inline 6-cylinder (Si6) engine. The chassis range is not tied to any specific symptom or product modification and is left open-ended for this TJ since the diagnostic information is useful for all vehicles with the Si6 engine.

**With this TJ, Volvo Cars of North America is applying its prior approval process for any claims submitted during the diagnosis of a low oil level warning message on any Si6 engine. The Prior Approval Department must be contacted for all warranty engine and cylinder head replacements, piston replacements, oil level sensor replacements, and cam cover reseals for the Si6 engine. This applies to all Si6 engines (engine codes 90, 94, 95, 96, 98, 99).**



**The Prior Approval Department must be contacted for authorization codes for the following operation numbers:**

**21110-0  
21014-0  
21144-2  
21040-2  
98431-2  
21102-2  
38626-2  
08284**

**This includes cam cover reseal, cylinder head replacement, piston replacement, short block replacement, oil level sensor replacement, engine replacement, and oil consumption diagnosis. If any questions arise contact the prior approval department.**

Authorization codes for the labor operation codes above will only be available via the Prior Approval Dept. Prior Authorization is not required for customer pay repairs and/or diagnosis related to this TJ, however this TJ offers fault tracing information for these cases. The technician should refer to the Prior Approval application on VRC2.

**Technicians who need to claim the labor operation above to make a repair on the vehicles in the TJ header should contact the Prior Approval Dept before making any repairs by submitting the online form on VRC2.**

**This is not a parts restriction process. Parts availability questions should be directed to the Parts Retailer Services Department.**

There are two attachments to this TJ:

Attachment TJ 24643 is the guideline

Attachment TJ 24643 Instruction is the piston replacement procedure (if needed) which will be in VIDA 2013B.



## **VOLVO STANDARD TIMES GUIDE (VSTG) INFO:**

Operation number 25702 - Crankcase ventilation, check - See VSTG

Operation number 08284- Oil consumption diagnostics - 2.0 hrs\*

\*Claim this labor operation number if diagnosis is completed according to this TJ, including the prior approval form. Do not claim 21003-2 with 08284.

Operation number 98431-2 - Pistons replace acc to TJ 24643 - 14.4 hrs

Operation number 21110-0 - Cylinder head replace - See VSTG\*\*

\*\*Do not claim 21110-0 with 98431-2.

Operation number 28106-2 - Spark plugs kit replacing - See VSTG

Operation number 36004-2 - Software, control module downloading - See VSTG

Operation number 25706-2 - Oil trap replace - See VSTG

Operation number 99400-2 - General check/adjust acc. to TJ -0.1 hrs\*\*\*

\*\*\*Claim this labor operation number if the cam cover is removed for inspection. Do not use 99400-2 together with 21110-0.

Operation number 21144-2 - Gasket valve cover replace - See VSTG\*\*\*\*

\*\*\*\*Do not use 21144-2 with 21110-0.

- Claims may be submitted under the new car warranty when there is a documented customer complaint using claim type: 01
- Labor times are valid at the time of release and are subject to change.

**To view TJ attachments continue to next page: This TJ has 2 attachments.**



Volvo Car Customer Service			
		TJ Instruction	
		TJ No 24643	
			Date May-13 Issue 07
Title	Excessive oil consumption, Low oil Level message in DIM		

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## Overview

**For all repairs, be sure the parts are available before beginning the repair in order to ensure customer satisfaction.**

This engine type is very sensitive to overfilling because it is hard to check the oil level with the dipstick in an easy way. This is because the engine oil needs time to settle in the oil sump. The car must be parked on level ground when measuring the oil. If the engine has been driven at normal operating temperature on the road (not idling) for 30 minutes, then the engine must then be left for 15 minutes before noting the oil level.

**When refilling the engine with oil its imperative that the correct fill amount be used.**

Before diagnosing an oil consumption complaint, always check for external leakage on and around the engine. If external leakage is present, repair instructions in VIDA shall be used but the Prior Approval Department still needs to be contacted since the low oil level warning was on. If no external leakage can be detected, proceed to follow the steps in this TJ.

If a customer complains about high oil consumption, poor idle quality, blue/white smoke from the exhaust, oil smell, and/or a DIM message "Low oil level" or "Oil level low" **AND** low oil level is confirmed on the dipstick (unless just topped up by the customer), then proceed as described below. If the "Low oil level" or "Oil level low" message is on in the DIM but the oil level on the dipstick is not low, refer to TJ 24382, but the Prior Approval Department still needs to be contacted since the low oil level warning was on.

**Gathering information from the customer and testing for oil consumption**

**VOLVO**

**Note! If the "Low oil level" or "Oil level low" message is on AND the oil level is low or the customer had to add oil (and it is now not overfilled), but there are no external oil leaks, it can be assumed that oil consumption exists without using the customer to run the full oil consumption test.**

If oil consumption is confirmed, proceed to follow the steps in this TJ.

### **Diagnostic steps and form-filling (all engines)**

#### **Step 1. Positive Crankcase Ventilation (PCV) check**

Perform a crankcase ventilation test according to VIDA. Using the tool specified in VIDA, the gauge will seem "out of range". Normal PCV vacuum at idle for the Si6 and Si6T engines is between -0.2 kPa and -1.0 kPa. The gauge only reads to -0.5 kPa, therefore do not replace components due to a seemingly out of range condition. **Note the results on the prior approval form, Question #14.**

#### **Step 2. Spark plugs**

- a.) Print out DTCs using VIDA.
- b.) If the vehicle is just pulled in from the parking lot, the spark plugs may be dark due to fuel which could cause a false indication of oil consumption. Fuel deposits from one or multiple cold starts are indicated by black carbon deposits. Oil deposits can either be indicated by ash deposits which will look like brown crust on the electrodes and the ceramic or soot deposits which will look like dark coking on the electrodes and the ceramic.
- c.) Use a marker to mark the spark plug socket or socket extension being used to remove the spark plug. The mark should face the intake valves.
- d.) Once the plugs are removed, transfer that mark to the plug. This is to indicate what side of the plug was facing the intake valves when the photo of the spark plugs is submitted to Prior Approval. Take the photo with the markings facing the camera. See Photo 1.



- e.) **Spark plug soot/ash level for Prior Approval:** Level of soot/ash on plugs (0 = no soot/ash, 5 = excessive soot/ash), see Photo 1 for reference. In the example shown in Photo 1, cylinders 1-4 would have a rating of 0, cylinder 5 would have a rating of 1, and cylinder 6 would have a rating of 3. A rating of "0" would correspond to a brand new spark plug. **You will be asked to provide this information and a picture of the spark plugs when submitting the online form**

**to the Prior Approval Department.** The picture should be of the side of the plugs that face the intake manifold. You will be asked to provide this information and a picture of the spark plugs when submitting the online form to the Prior Approval Department. Include a placard with all photos so we don't mix-up photo files by accident. Use the back side of a business card to display the 4 digit dealer code and the 6 digit chassis number.

### Step 3. Leakdown test.

Perform a cylinder leakage test according to VIDA. Note large amounts of carbon in a cylinder can cause a valve to hang open and create high cylinder leakage. Note your results on the form. **Add results to form.**

### Step 4. PCV (or breather) channel

Remove the PCV box and photograph the channel on the intake side of the diaphragm, shown in Photo 2 below. **This photo will be requested by the Prior Approval department.** Also include your dealer and the vehicle's chassis number in the photo.



Include a placard with all photos so we don't mix-up photo files by accident. Use the back side of a business card to display the 4 digit dealer code and the 6 digit chassis number. No other details or labels are needed on the placard. Place the placard in the area of the photo subject, not on top of it.

Frame the photo so the cavity closest to the vacuum source (next to the exhaust cam position sensor) is completely visible. It is best to position your camera directly above this area looking straight down instead of taking the shot from an angle so the bottom of the cavity is clearly seen in the photo.

**Photo 2. Intake side of PCV diaphragm**

Oil in the small breather channel can be the result of multiple issues such as the engine being overfilled with oil, a defective breather box, excessive crankcase pressure or other. Oil in the small breather channel will be vented into the cylinders causing carbon/ash build-up in the cylinders starting with cylinder #6.



**Photo 3. Oil in the breather channel indicating a possible PCV box (oil trap) failure**



### Step 5. Valve guides

**Note! It is very important to realize that there may be the presence of engine oil in the intake ports without an actual valve guide leakage. Using Automatic Transmission Fluid (ATF) for color differentiation is an effective way to verify if there is or if there is not a leak between the valve guide and the cylinder head. Cylinder head replacements should NOT be based on assumptions.**

Valve guide leakage has been seen on vehicles with an engine build date before 120512B01272 (DDMMYYxxxxx). Valve guide leakage is most commonly found when a customer complains of excessive blue/white smoke from the exhaust. However, these tests should be performed on all engines with plugs that share a pattern with Photo 4. These tests check if there is oil leakage between the cylinder head casting and the inlet valve guides. **Note the results on the prior approval form, Question #14.**

Look at the spark plugs in Photo 4 below. If the valve guide is leaking in a cylinder, the corresponding spark plug will have more soot/ash than the others. In the example in Photo 4, cylinder 2 is consuming oil.

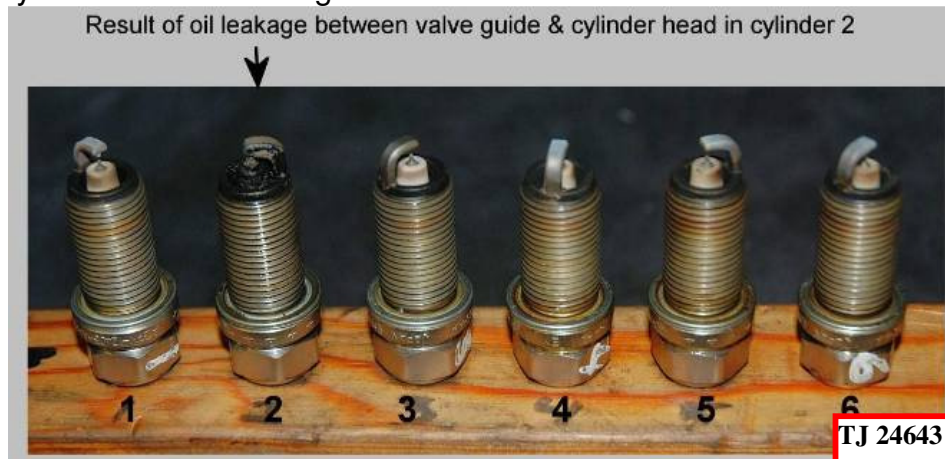
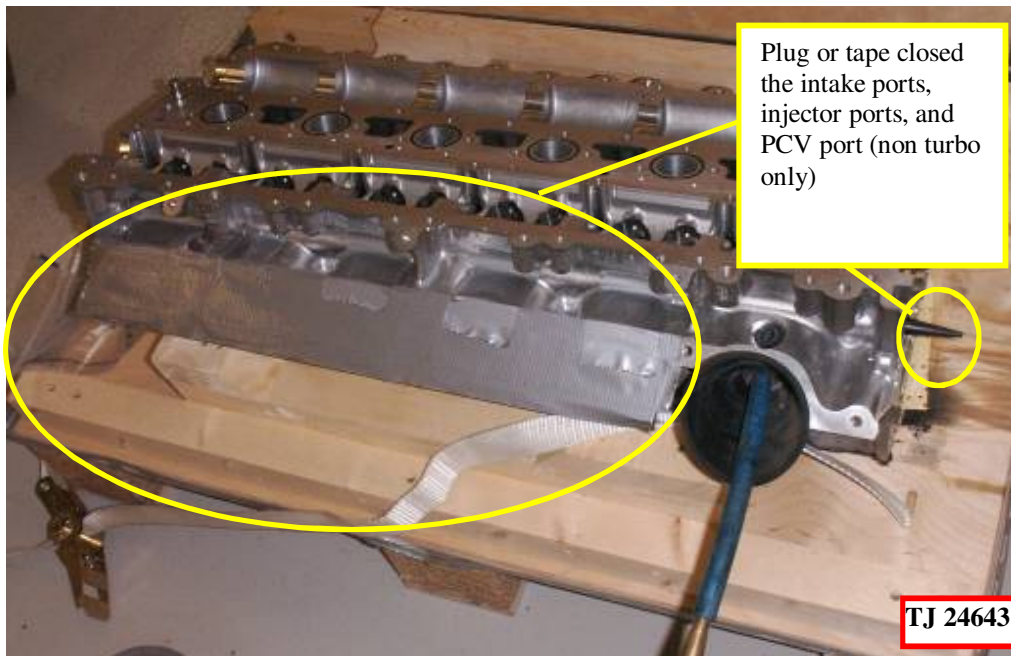


Photo 4

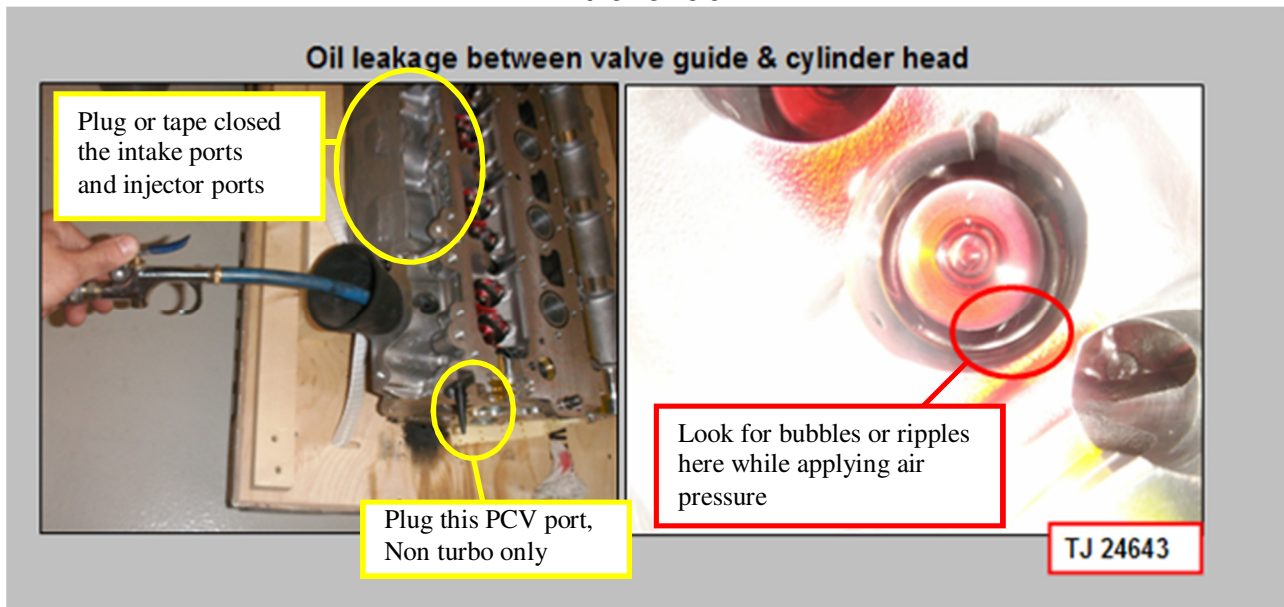
Remove the cam cover and test each valve guide using ATF. The test below should be performed:

**Note! Use safety glasses!** Remove the valve tappets. Plug all but one intake port, all injector ports, and the PCV inlet. On a turbo engine, the PCV inlet will have a check valve. If air is coming from that valve in the test, block it with tape. Starting with the intake port that corresponds to the spark plug with the most soot/ash, apply air pressure to one intake port at a time using a plug similar to those found on emissions testers. See Photos 5 and 6. Look at the base of the valve spring and check for ripples or bubbling in the ATF as you apply light air pressure.

Note that this test is only for the intake valve guides. If valve guide leakage is suspected and there is excessive white/blue smoke from the exhaust, then there is a possibility that the exhaust valve guide is leaking. In that case, the exhaust manifold should be removed and the exhaust port should be checked for excessive oil deposits. The head must be removed for the exhaust valve guide check if using the air pressure method. Only do this if it is clear that one spark plug has more soot/ash than the others as shown in Photo 4.



**Photo 5.** Note that the cylinder head is removed in this photo but this test should be performed on the vehicle.



**Photo 6**

### **Step 6. Engine 99/90 (MY2008- Si6 Turbo) only. Inspecting turbo hoses**

Inspect the intake hose to the turbo, the red/orange colored seals on the resonator, and the hose from the oil trap to the intake hose for damage/tears/improper fit/leaks which will disrupt the airflow and cause the oil trap not to function properly. Photograph any damaged or suspect parts. Replace all damaged parts. Please mention whether the inside of the hoses are oil soaked or dry. Also inspect the inside of the charge air pipe between the turbo and the intercooler for oil collecting. **Note the results on the prior approval form, Question #14.**

### **Step 7. Cam cover**

If spark plugs in cylinder 6 & 5 have more soot than the other plugs and the engine is built before engine production date 15041000001 (DDMMYYxxxxx), then remove the cam cover and inspect the sealing surface. Refer to Photos 7 and 8 below.

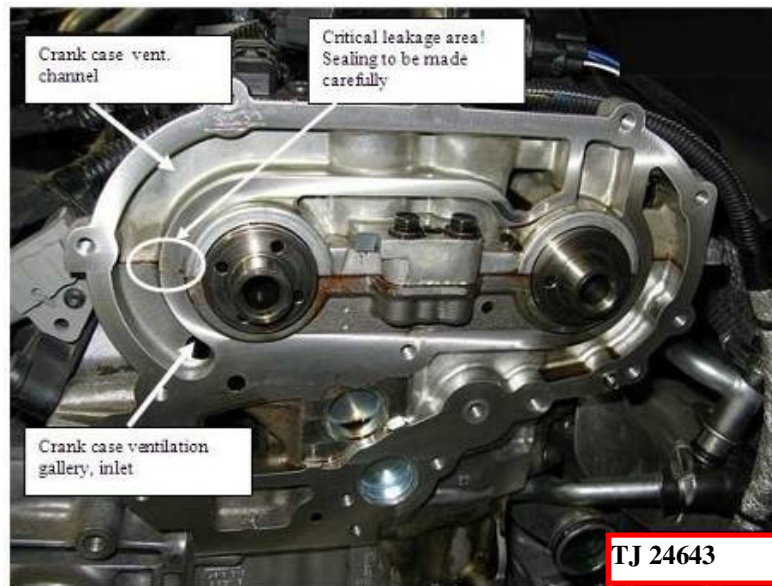


Photo 7. For reference only, not a valid check

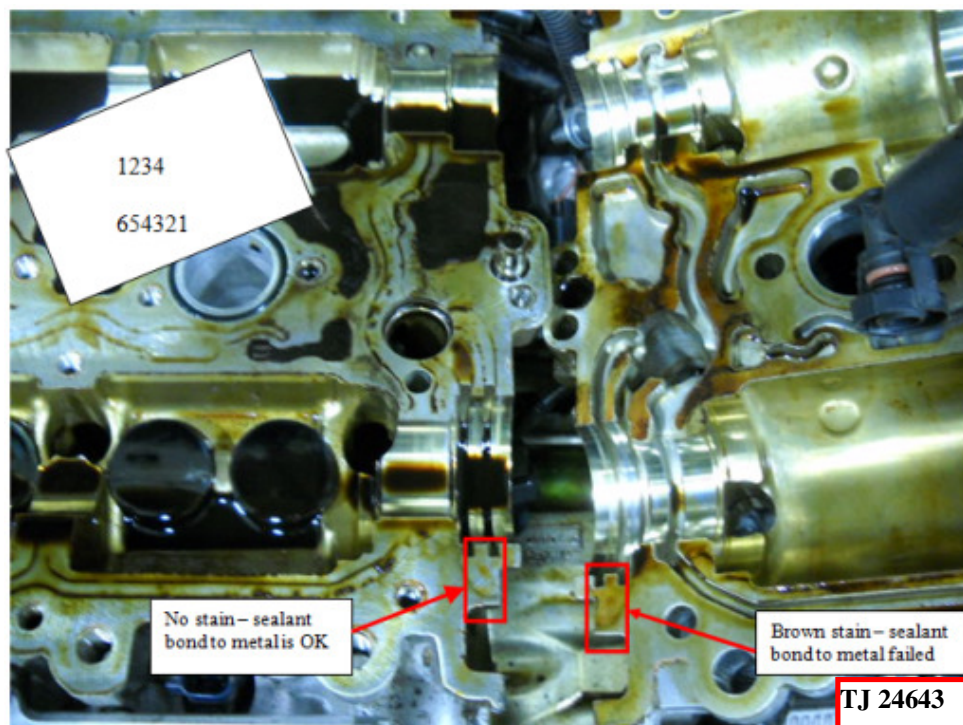


Photo 8. Check method for cam cover sealing surface. Note the placard with retailer number and chassis number is required upon submission of this photo to prior approval.

The cam cover seal was improved at engine production date 15041000001 (DDMMYYxxxxx). The production date, in this case is April 15, 2010. The engine serial number can be found using VIDA "Vehicle Details".

**If the discolored sealing surface is found on engines built after the engine production date, please inform the Prior Approval Department when you contact them for claim approval. Make sure you have the engine serial number when contacting prior approval.**



Using pages 1-7, you should now continue to pages 8-11 depending on engine type and decide what the best repair is before calling prior approval.

### **Engine 96/94 (MY 2010- Si6 non turbo PZEV)**

#### **Results from Step 1:**

If PCV pressure/vacuum is out of specification, replace the oil trap and continue to review the results from Step 2 & 4. If PCV pressure/vacuum is within specification, review the results from Steps 2 & 4. Step 3 is used for reference by the Prior Approval dept.

#### **Results from Steps 2 & 4:**

If the spark plug from cylinder # 6 does not have more soot/ash than the others, but there is another single plug that has more soot/ash than others, continue to review the results from Step 5.

If the spark plug from cylinder #6 has more soot/ash than the others and the oil galley looks like that shown in Photo 2 (clean), then the cam cover is most likely at fault.

Review the results from Step 7.

If the spark plugs are all equally dark (see Photo 9 below), then the oil control rings are at fault. See “Information on piston rings” below.

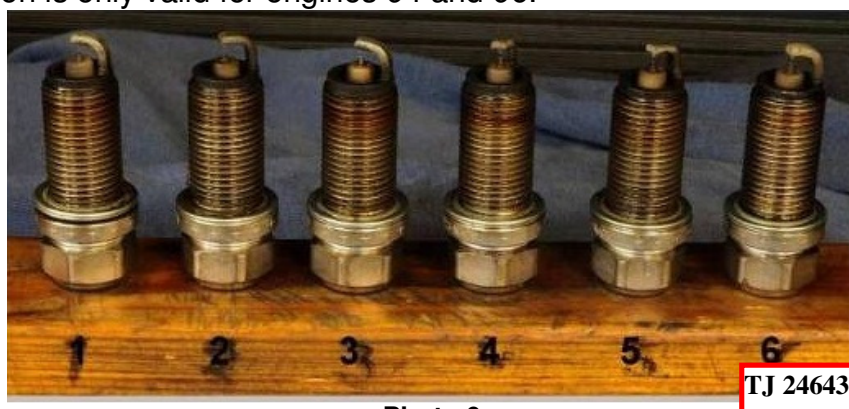
If oil is found in the galley shown in Photo 5 on an engine code other than 90, then mention this on the prior approval form and the response from prior approval will specify what to do next.

#### **Results from Step 5:**

If leakage is found on the intake or exhaust valve guides, then replace the cylinder head and add to the repair any faults found in previous steps.

#### **Information on piston rings:**

This information is only valid for engines 94 and 96.



**Photo 9**

A new piston and oil control ring were introduced into production at engine date 301011B21530 (DDMMYYxxxxx). Follow the steps below for the service solution for engines built up to this date.

A new piston kit has been created to be used as a service fix. The new piston kit uses a new oil control ring which will not fit in the original piston ring land. Replace the pistons and piston rings according to VIDA and add to the repair any faults found in previous steps.

Engine 94 only - Regardless of what the plugs look like, the latest ECM/TCM Upgrade should be performed (after the proper repair is carried out, i.e. piston replacement) before releasing the vehicle to the customer. Note that after this download the customer may notice a slight difference in transmission shifting. **This should never be the only repair!**

Note! A thorough cleaning and inspection of the cylinder walls must be performed. If any marks or scores in the cylinder walls are found and can be felt with your fingernail, then the short block (block with crank, bearings, pistons, and rods, but no head) must be replaced.

Results from Step 7:

If the sealing surface is discolored by oil as shown in the photos, it is most likely that there is a leak between the cam cover and the cylinder head. If this is the case, reseal the cam cover and add to the repair any faults found in previous steps. Be sure to check the expiration date of the sealant bottle before use.

If the sealing surface is not discolored by oil as shown in the photos, continue diagnosis elsewhere in the engine, by rechecking the previous steps. If another repair requires the removal of the cam cover, the cam cover should be resealed according to VIDA prior to re-installation, as long as the same cam cover and cylinder head will be re-installed.



## Engine 99/90 (MY2008- Si6 Turbo)

### Results from Step 1:

If PCV pressure/vacuum is out of specification, replace the oil trap and continue to review the results from Steps 2 & 4. If PCV pressure/vacuum is within specification, review the results from Steps 2 & 4. Step 3 is used for reference by the Prior Approval dept.

### Results from Steps 2 & 4:

If the spark plug from cylinder # 6 does not have more soot/ash than the others, but there is another single plug that has more soot/ash than others, continue to review the results from Step 5.

If the spark plug from cylinder #6 has more soot/ash than the others and the oil galley looks like that shown in Photo 2 (clean), then the cam cover is most likely at fault.

Review the results from Step 7.

MY2011-2014 with Engine code 90: If the spark plug from cylinder #6 has more soot/ash than the others and the oil galley looks like that shown in Photo 3, then the oil trap is most likely at fault. Replace the oil trap, but still review the results from Steps 5 - 7. If the results from steps 5 - 7 are OK, then only replace the oil trap.\*

\*If oil is found in the galley shown in Photo 5 on an engine code other than 90, then mention this on the prior approval form and the response from prior approval will specify what to do next.

### Results from Step 5:

If leakage is found on the intake or exhaust valve guides, then replace the cylinder head and add to the repair any faults found in previous steps. The results from Step 6 should still be reviewed, but step 7 can be skipped.

If no leakage is found, review the results of Step 6 & 7.

### Results from Step 6:

If any damage/tears/improper fit/leaks are found with any of the hoses, remedy as necessary and add to the repair any faults found in previous steps.

If no issues are found with the hoses and:

- there is oil in the intercooler hose but no other signs of oil consumption: replace the turbo and add to the repair any faults found in previous steps.

- there is no oil in the intercooler hose, repair any faults found in previous steps and continue to Step 7.

### Results from Step 7:

If the sealing surface is discolored by oil as shown in the photos, it is most likely that there is a leak between the cam cover and the cylinder head. If this is the case, reseal the cam cover and add to the repair any faults found in previous steps. Be sure to check the expiration date of the sealant bottle before use.

If the sealing surface is not discolored by oil as shown in the photos, continue diagnosis elsewhere in the engine, by rechecking the previous steps. If another repair requires the removal of the cam cover, the cam cover should be resealed according to VIDA prior to re-installation, as long as the same cam cover and cylinder head will be re-installed.

## **Engine 98/95 (Si6 non turbo ULEV)**

### **Results from Step 1:**

If PCV pressure/vacuum is out of specification, replace the oil trap and continue to review the results from Step 2 & 4. If PCV pressure/vacuum is within specification, review the results from Step 2 & 4. Step 3 is used for reference by the Prior Approval dept.

### **Results from Steps 2 and 4:**

If the spark plug from cylinder # 6 does not have more soot/ash than the others, but there is another single plug that has more soot/ash than others, continue to review the results from Step 5.

If the spark plug from cylinder #6 has more soot/ash than the others and the oil galley looks like that shown in Photo 2 (clean), then the cam cover is most likely at fault.

Review the results from Step 7.

\*If oil is found in the galley shown in Photo 3 on an engine code other than 90, then mention this on the prior approval form and the response from prior approval will specify what to do next.

### **Results from Step 5:**

If leakage is found on the intake or exhaust valve guides, then replace the cylinder head and add to the repair any faults found in previous steps. Step 7 can be skipped.

If no leakage is found, review the results of Step 7.

### **Results from Step 7:**

If the sealing surface is discolored by oil as shown in the photos, it is most likely that there is a leak between the cam cover and the cylinder head. If this is the case, reseal the cam cover and add to the repair any faults found in previous steps. Be sure to check the expiration date of the sealant bottle before use.

If the sealing surface is not discolored by oil as shown in the photos, continue diagnosis elsewhere in the engine, by rechecking the previous steps. If another repair requires the removal of the cam cover, the cam cover should be resealed according to VIDA prior to re-installation, as long as the same cam cover and cylinder head will be re-installed.

<b>Volvo Car Customer Service</b>			
		<b>TJ Instruction</b>	
		<b>TJ No 24643</b>	
			Date <del>August</del> æ -13 Issue 07
Title	Oil consumption, "Low oil Level" or "Oil level low" in DIM		

Instructions apply to engines 94 and 96.

**Materials** (Part numbers valid at the time if TJ Release)

Materials	Qty.	Part No.	Notes
Cleaning agent	0.8	1161721	
Gasket solution	0.8	1161847	
Chemical gasket	0.5	1161059	
Chemical gasket	1.0	1161771	
Screw	14.0	30637891	
Sealing plug	2.0	31251117	
Gasket	1.0	31251150	
Gasket	1.0	977751	
O-ring	1.0	8692089	
Sealing ring	1.0	30637865	
O-ring	2.0	30637867	
Sealing ring	6.0	30677907	
Filter insert	1.0	30750013	
Gasket	2.0	31251635	
Six point socket screw	2.0	988589	
O-ring	1.0	8642736	
Gasket	1.0	8692941	
Sealing plug	1.0	30637986	
Gasket	6.0	30650729	
O-ring	1.0	30677807	
O-ring	1.0	30696265	
Gasket	1.0	30711315	
Lip seal	1.0	30711317	
O-ring kit	6.0	30731807	
Cover	1.0	30777012	
O-ring	1.0	30777094	
Screw	12.0	31216106	
Gasket	1.0	31251345	
Engine oil	7.4	31316299	
Anti-freeze	1.0	31338284	
O-ring	1.0	30750703	
O-ring	1.0	976045	
O-ring	1.0	975667	
O-ring	1.0	982292	

### Special tools

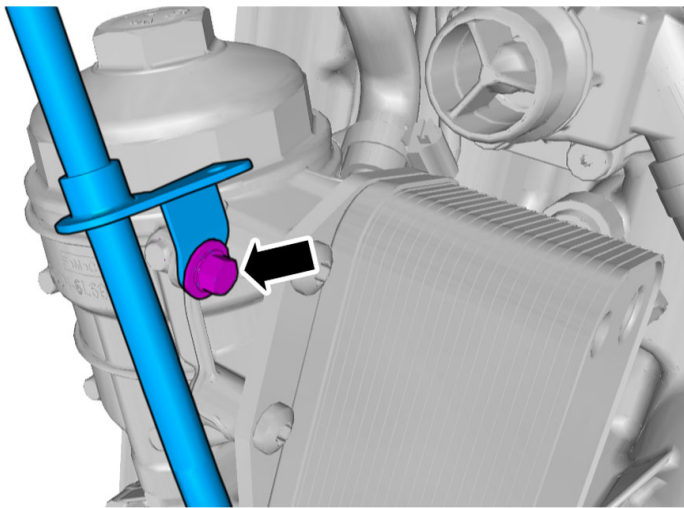
Description	Part No.
Support	999 7271
Wrench	999 7257
Socket NV-22 (heated oxygen sensor)	999 5543
Counterhold (rem/inst/freewheel gener.)Bosch,Denso	999 5760
Bit torx 50	951 2926
Counterhold	999 7264
Counterhold	999 7263
TORX 60	999 7272
PRESS TOOL (2) (CYLINDER HEAD) B6304/B5254	999 5454
Holder (remov.piston/connecting rod) B 200-B 6304	999 5746
Spanner	999 7300
Roller (Applying liquid gasket) B234,5234,6304	951 2767
Position sensor	999 7261
Guide pin	999 7269
Installation tool	999 7376
Template	999 7270
Guide pin	999 7273
Position sensor	999 7266
Position sensor	999 7267
Drift	999 7265

### Equipment

Designation	Part No.
Box wrench 19 mm	
Pin 3 mm	
Suction cup	
Piston ring compressor	

## Removal

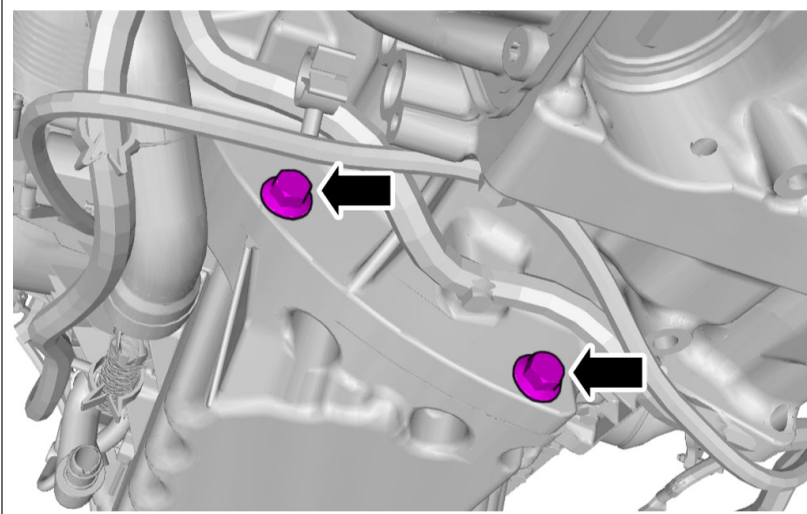
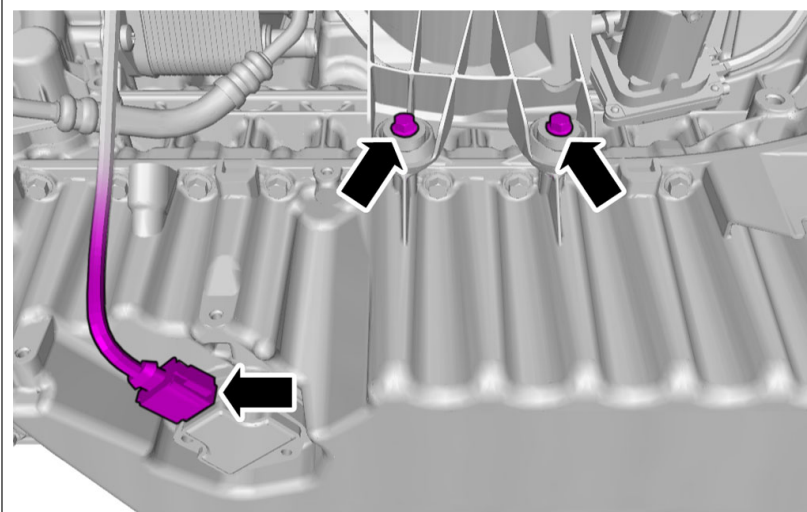
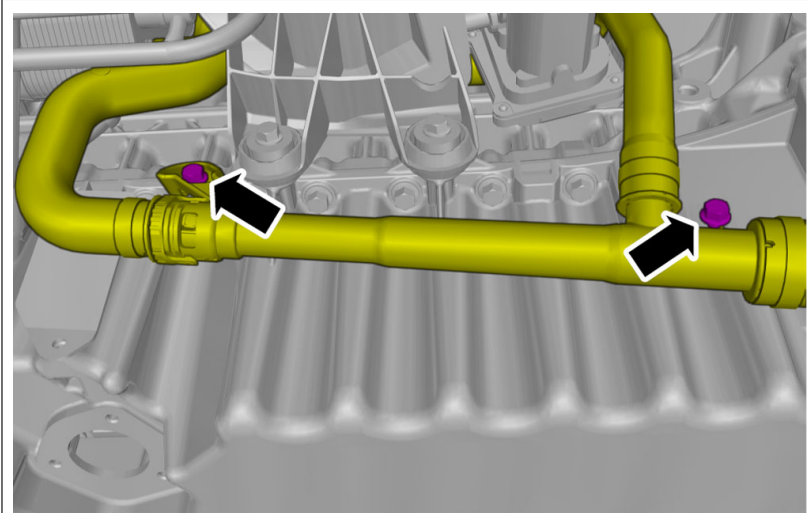
Perform depressurizing fuel system, refer to:  
Cleaning, Inspection and Adjustment  
2 - Engine with mountings and equipment  
23 - Fuel system  
234 - fuel tank, fuel lines, evaporator system

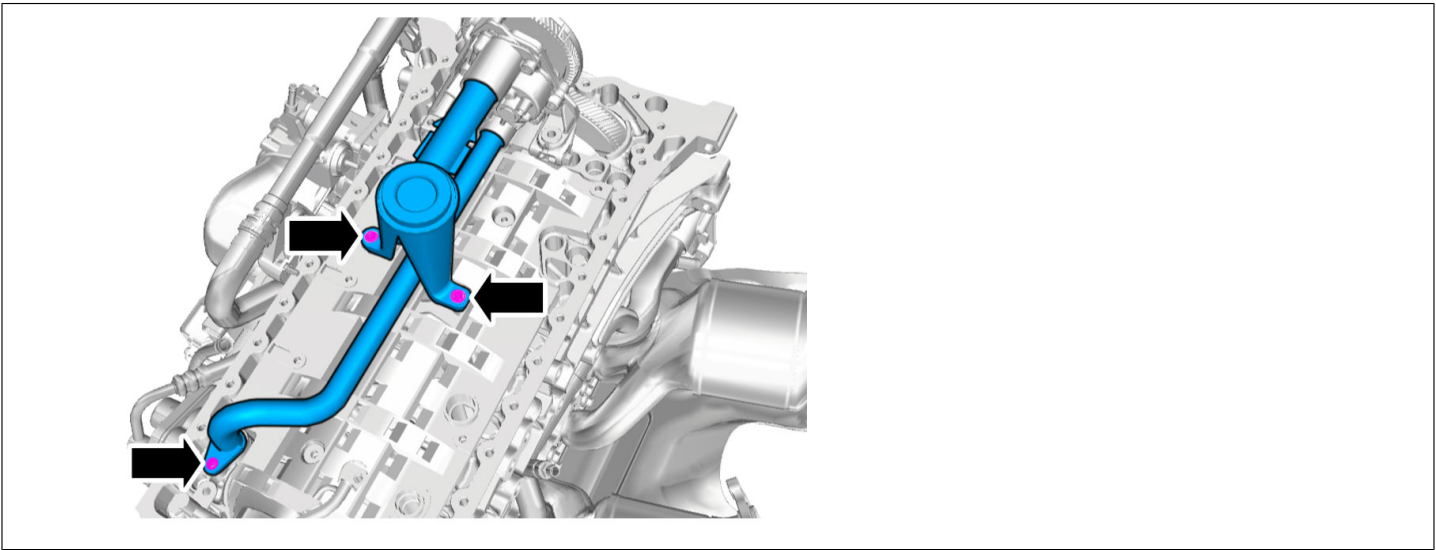
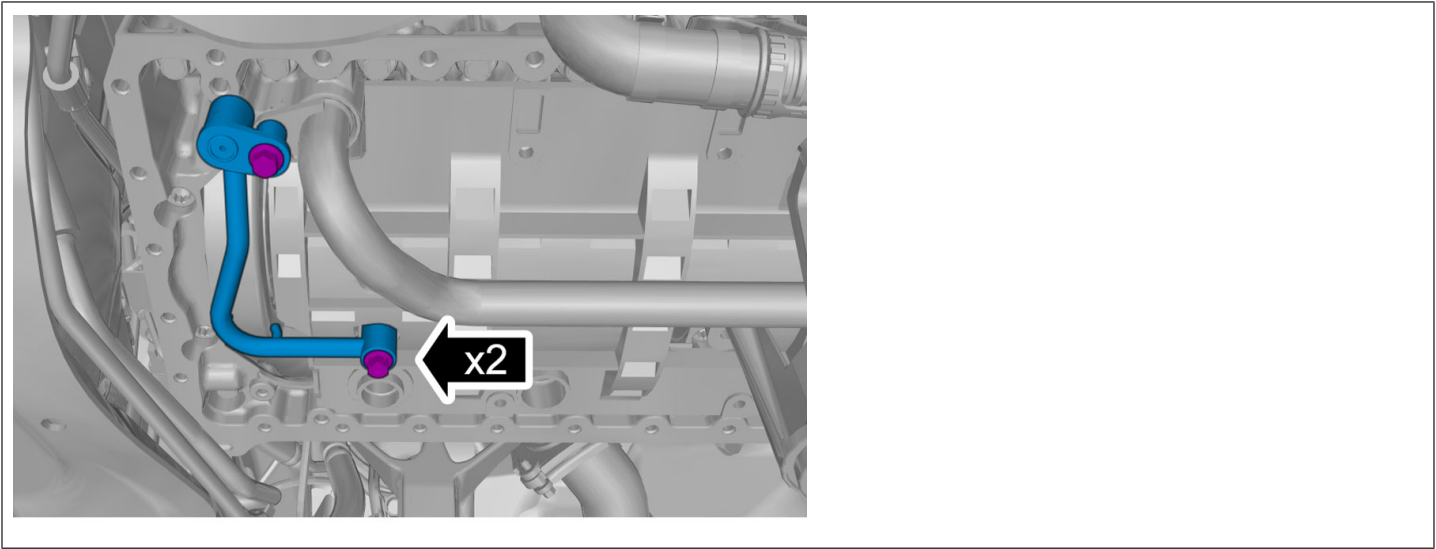
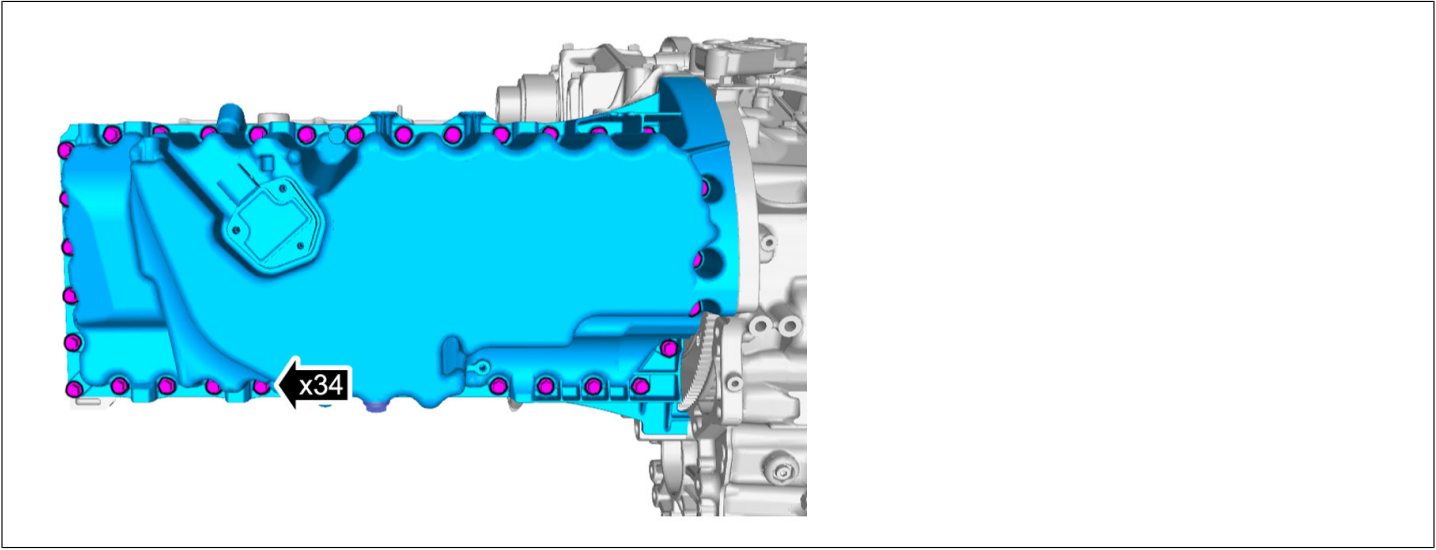


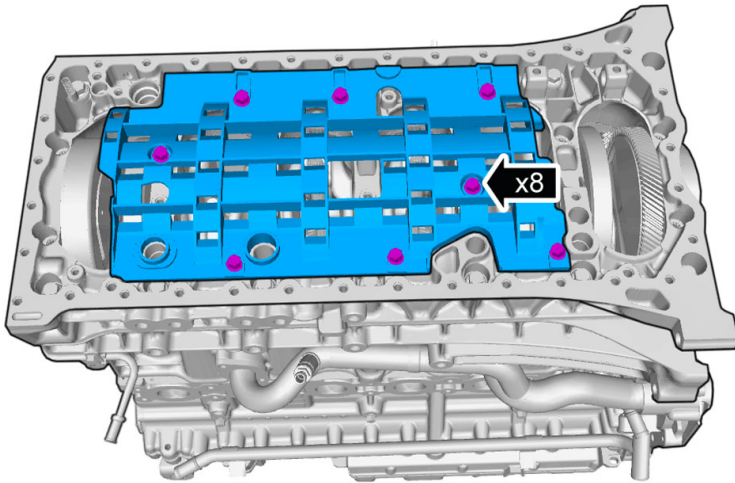
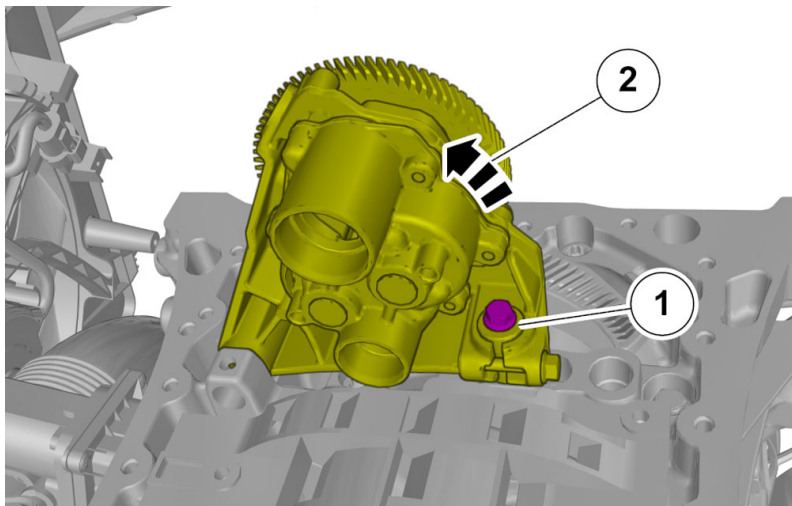
Drain engine oil, refer to:  
Removal, replacement and installation  
2 - Engine with mountings and equipment  
22 - Lubricating and oil system  
220 - general

Drain cooling system, draining, filling, and bleeding, refer to:  
Cleaning, Inspection and Adjustment  
2 - Engine with mountings and equipment  
26 - Cooling system  
261 - radiator and connections

Remove the starter motor, refer to:  
Removal, replacement and installation  
3 - Electrical system  
33 - Starting system  
331 - starter motor

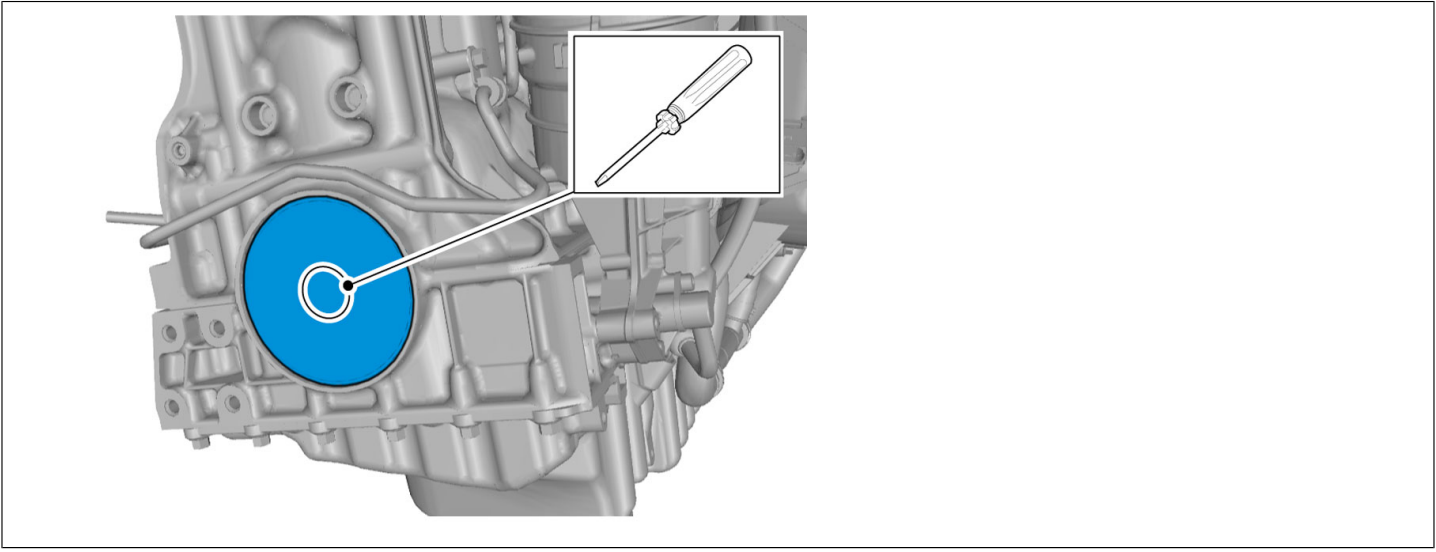
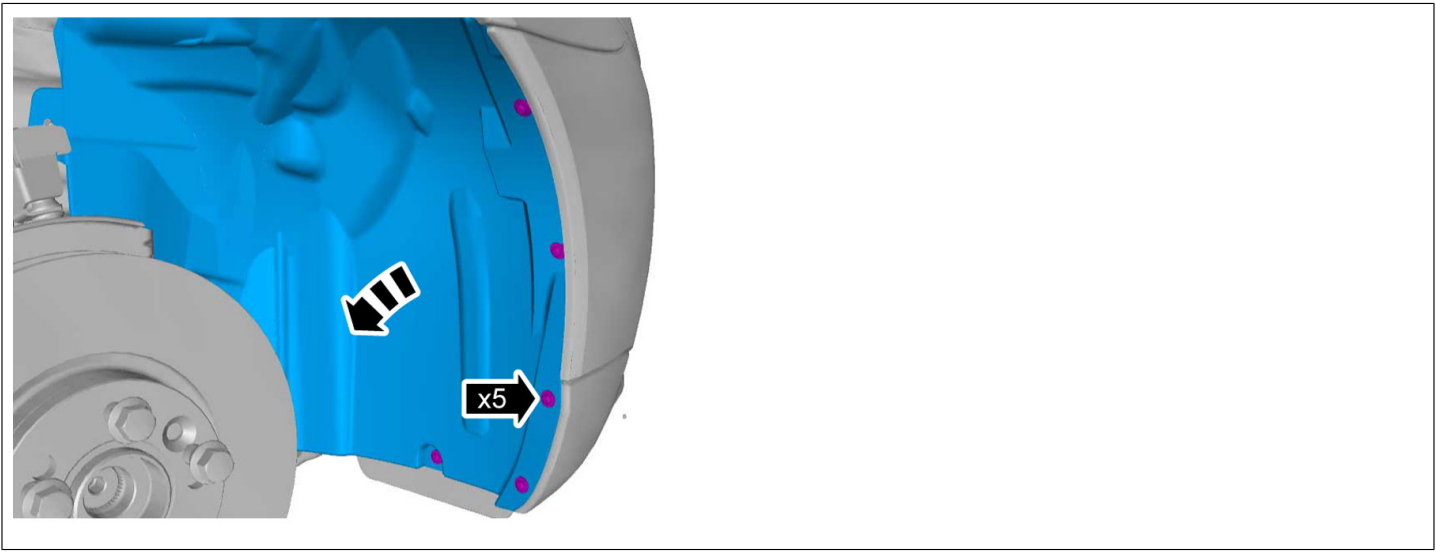


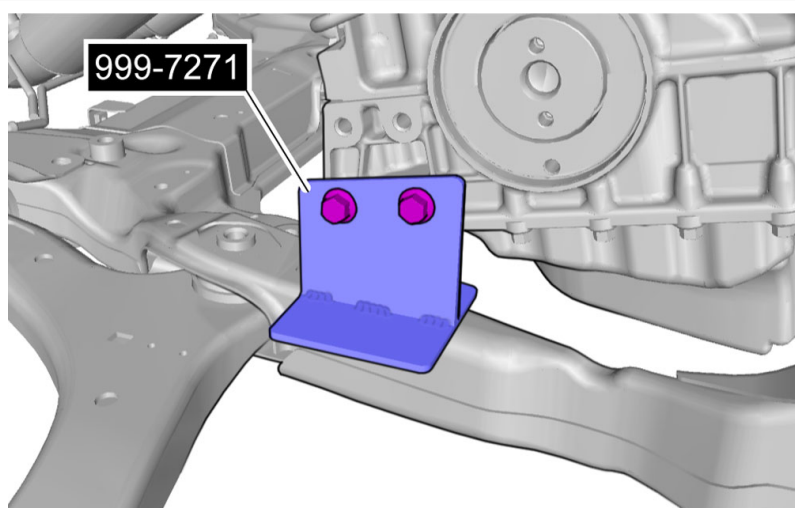




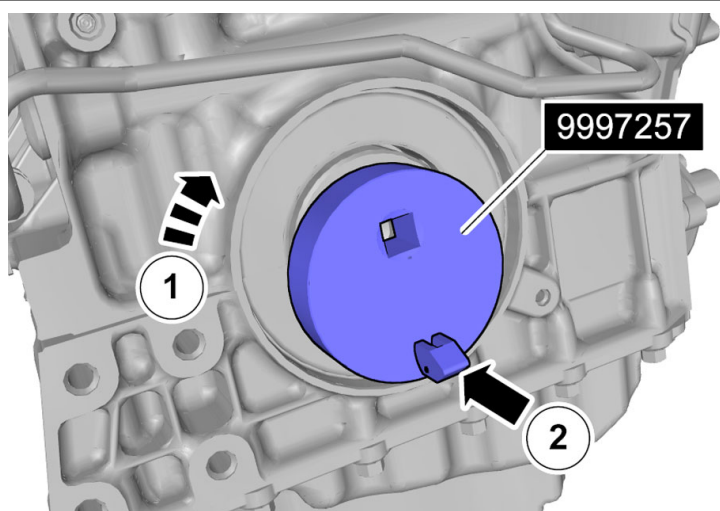
Remove right front wheel, refer to:  
Removal, replacement and installation  
7 - Springs and wheels  
77 - Wheels, tyres, hubs  
771 - wheel and wheel trim





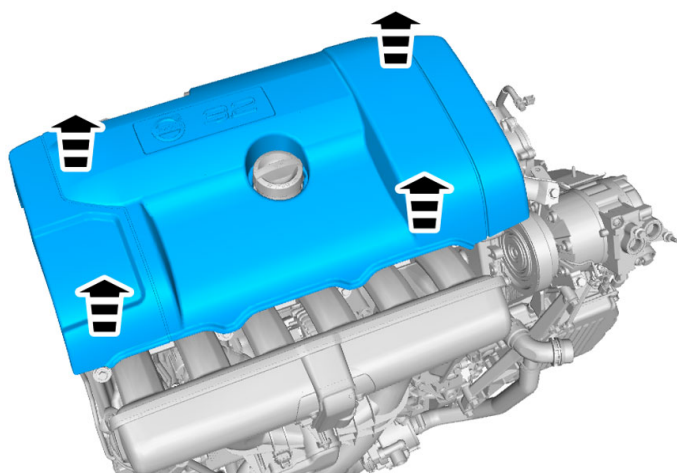


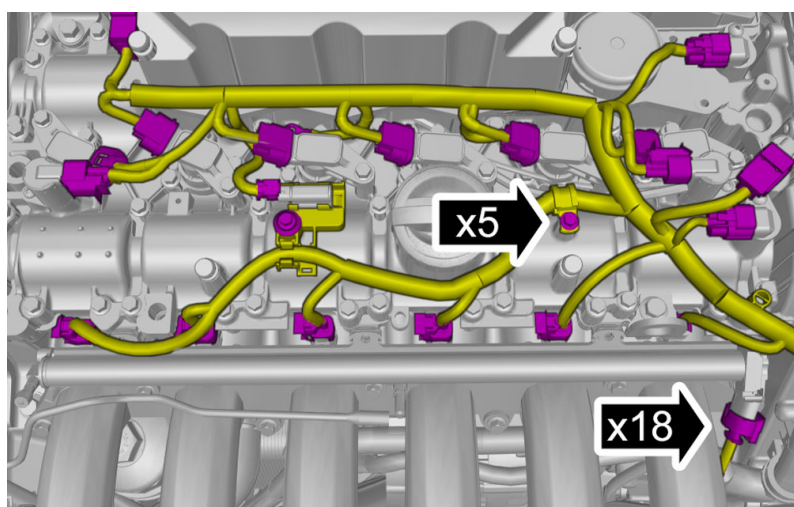
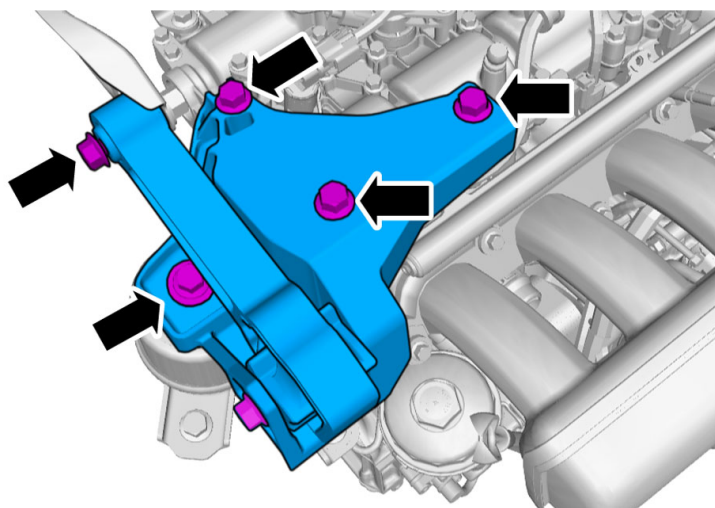
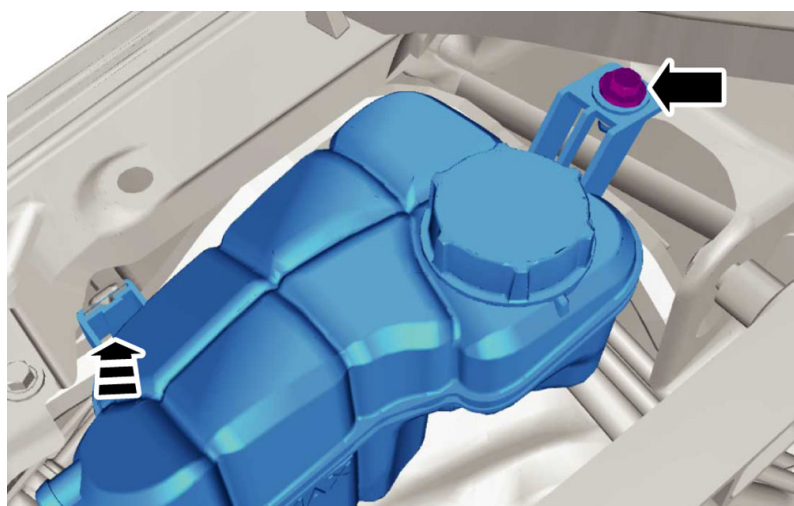
Special Tool: T9997271, Support

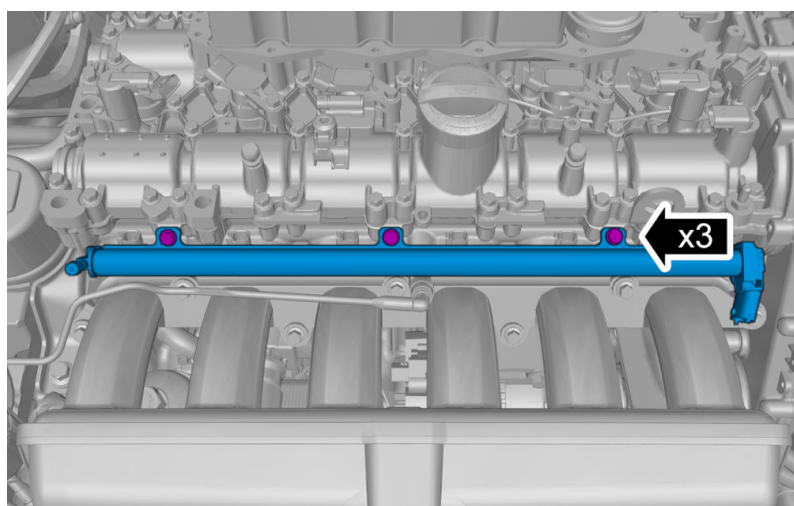


Rotate the crankshaft until piston No. 1 is at top dead center (TDC).

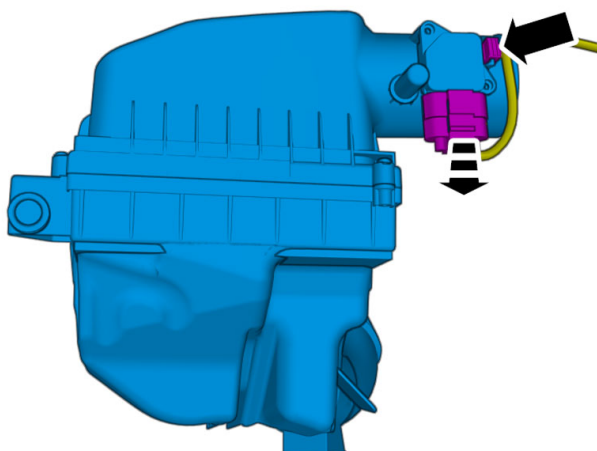
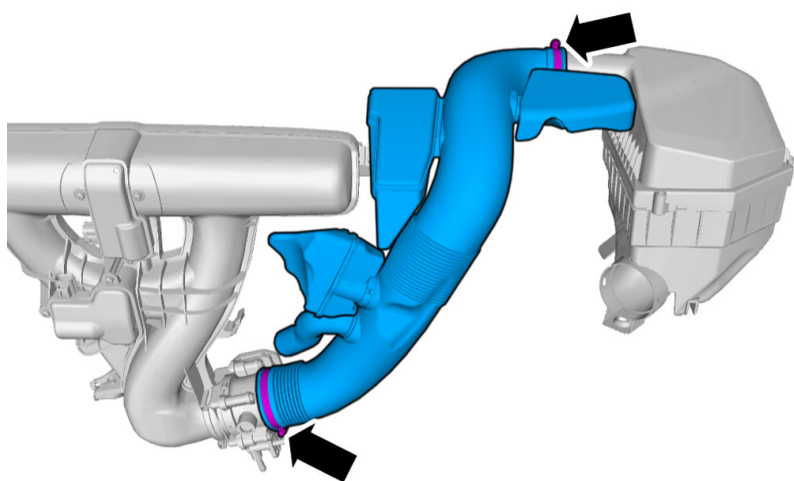
Special Tool: T9997257, Wrench



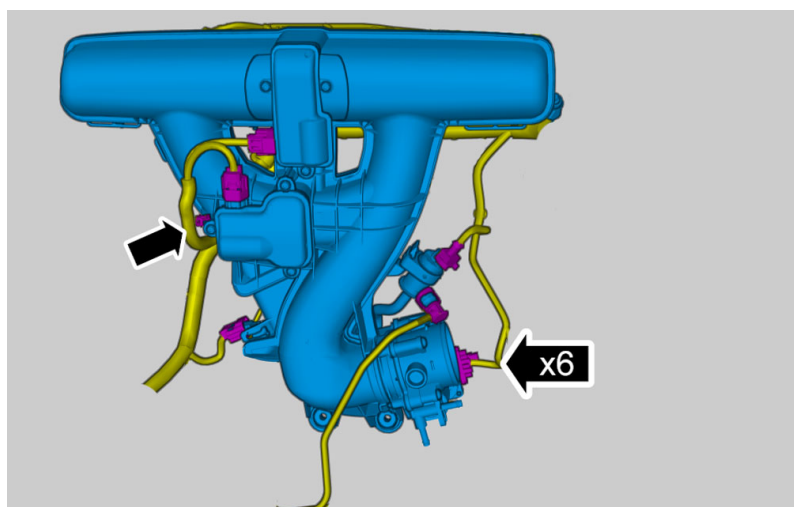
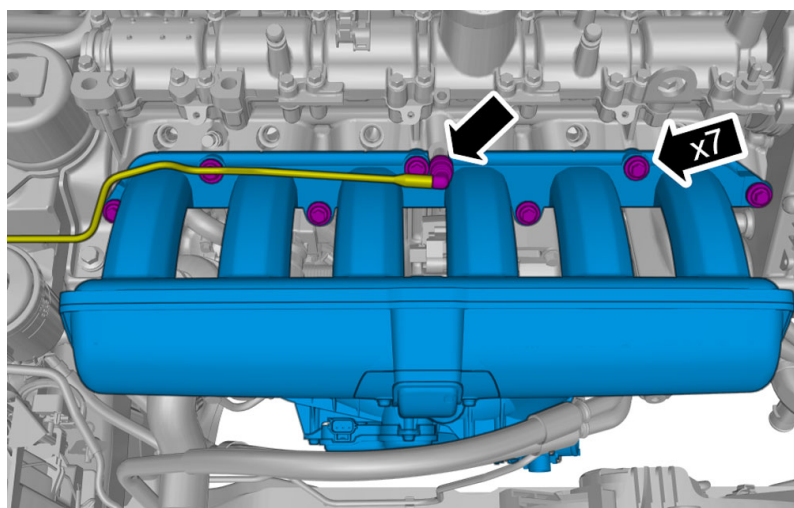
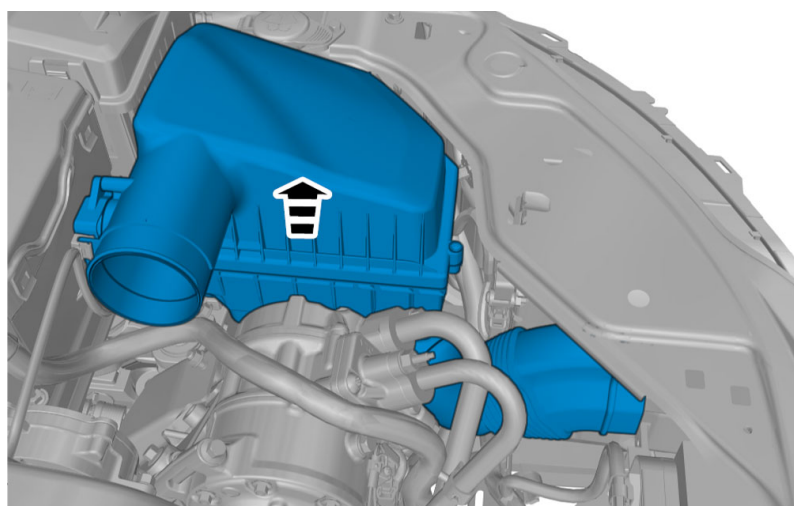


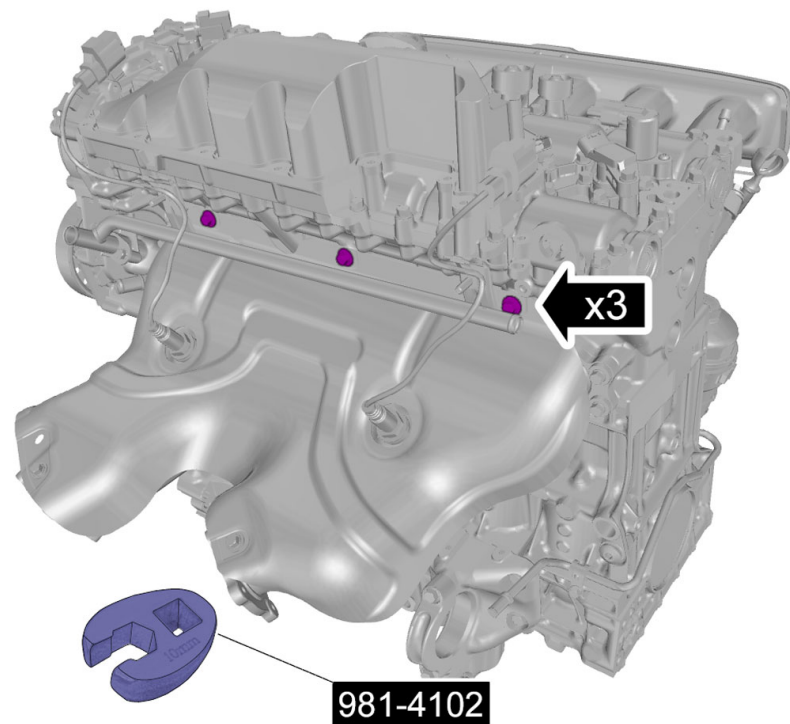
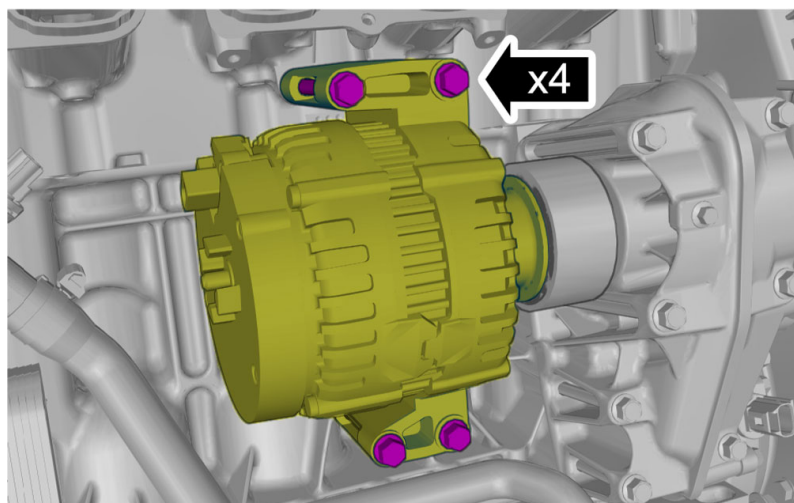


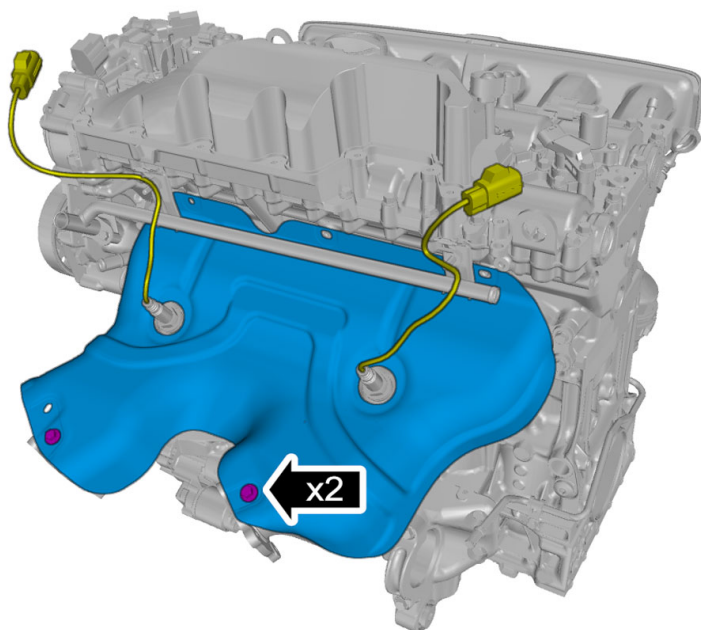
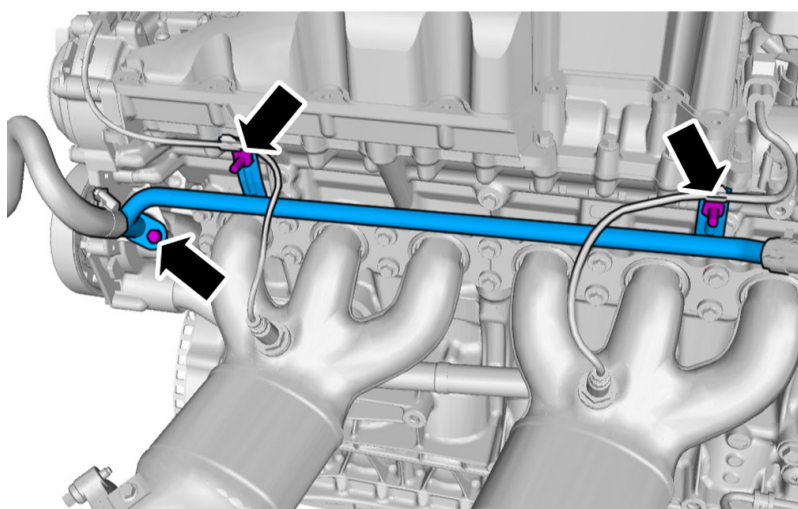
**Warning!** Be prepared to collect escaping fluid.

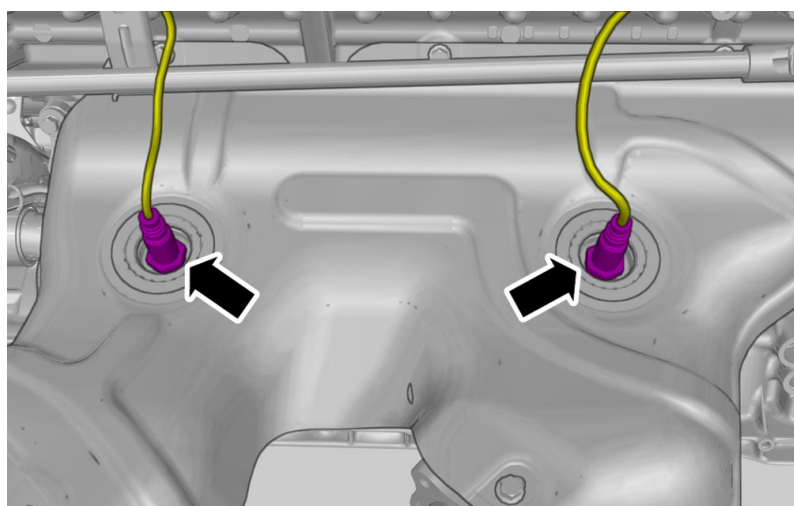




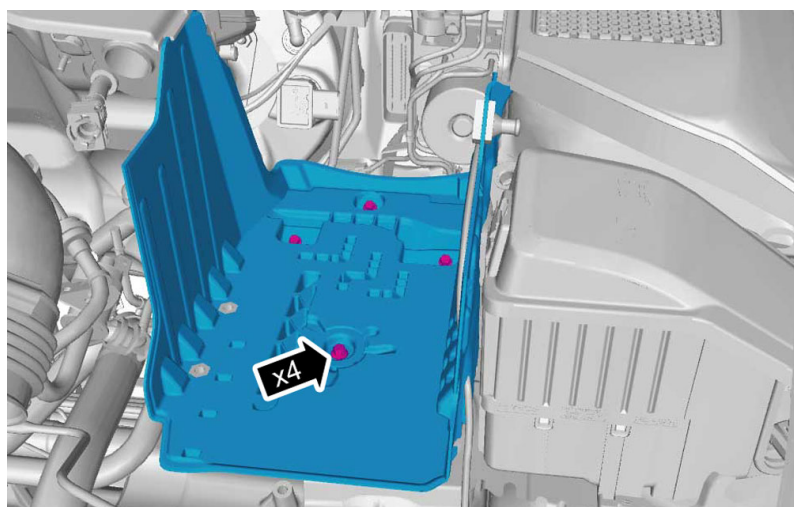
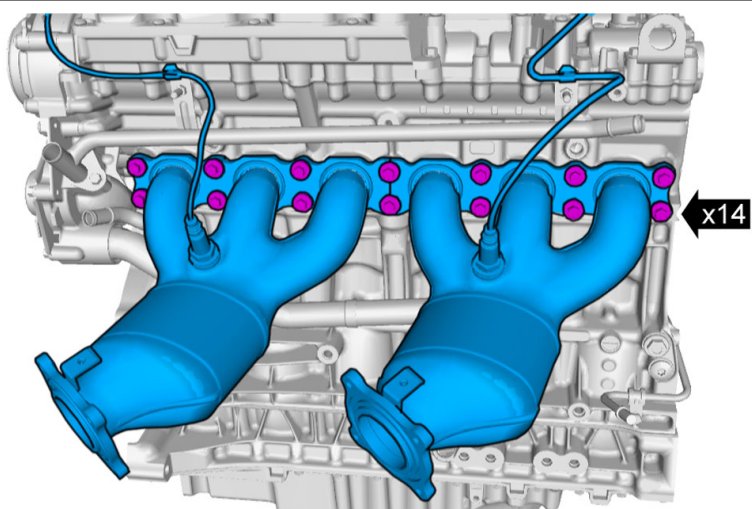




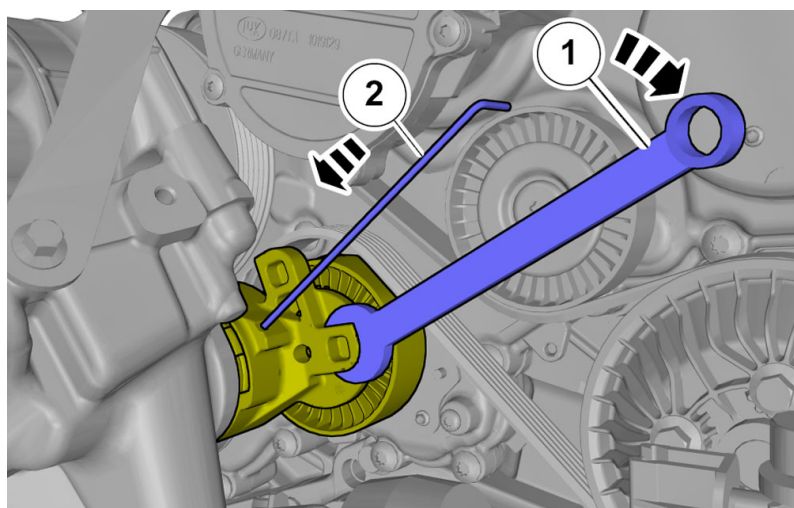
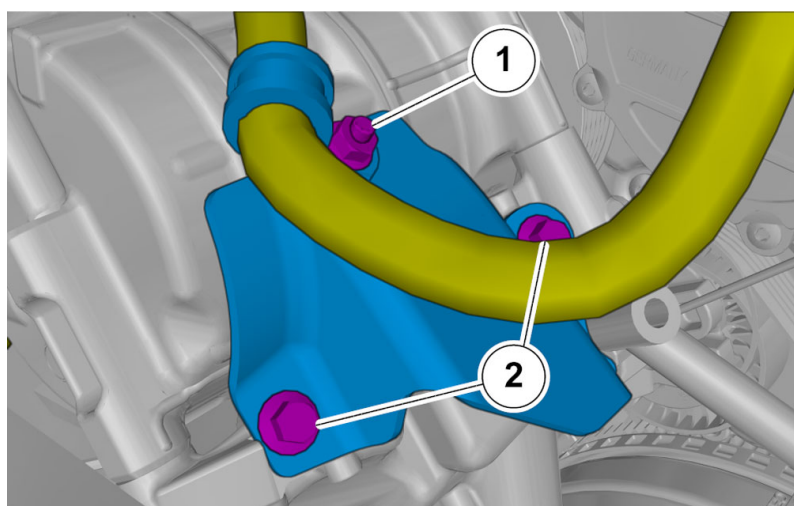




Special Tool: T9995543, Socket NV-22 (heated oxygen sensor)

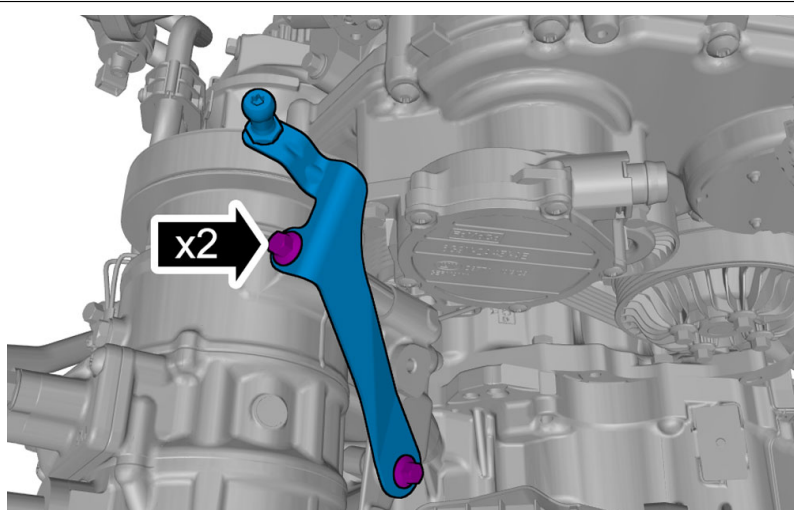


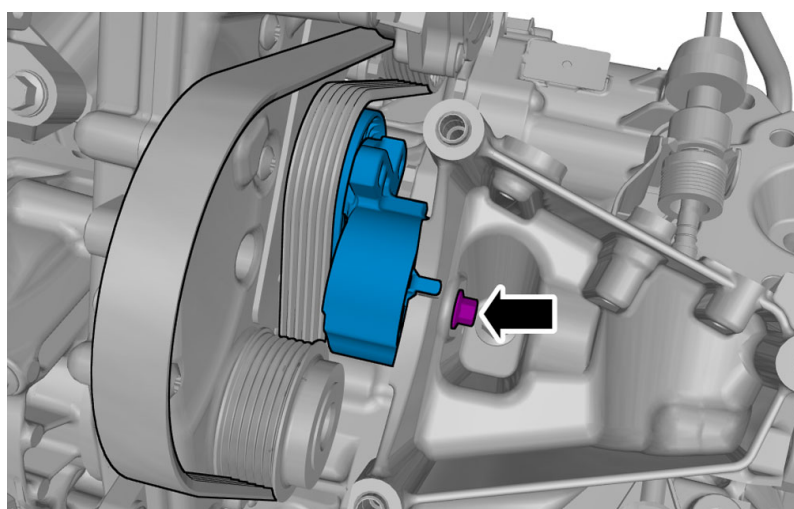
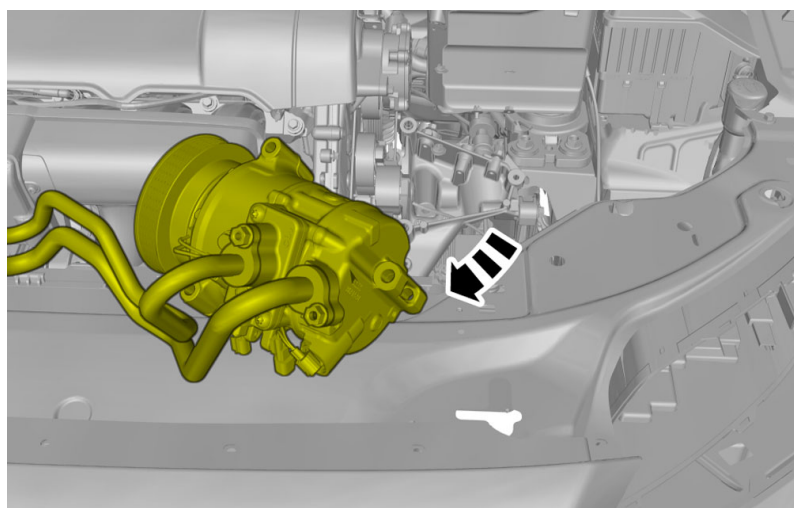
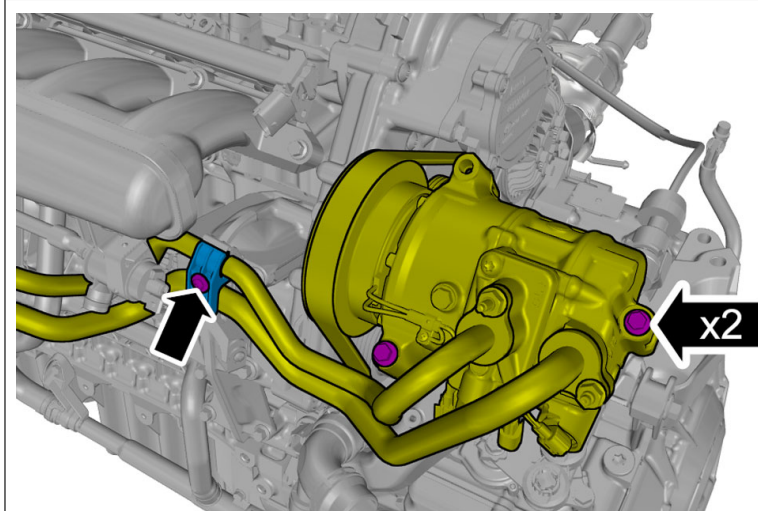


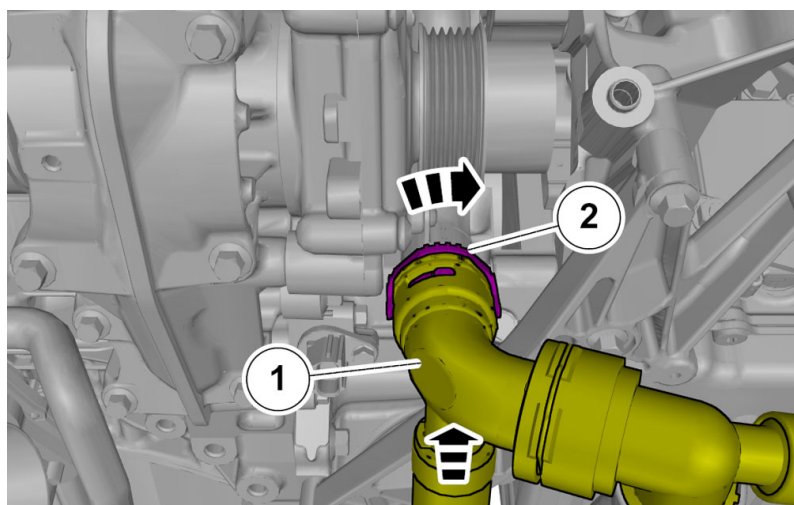
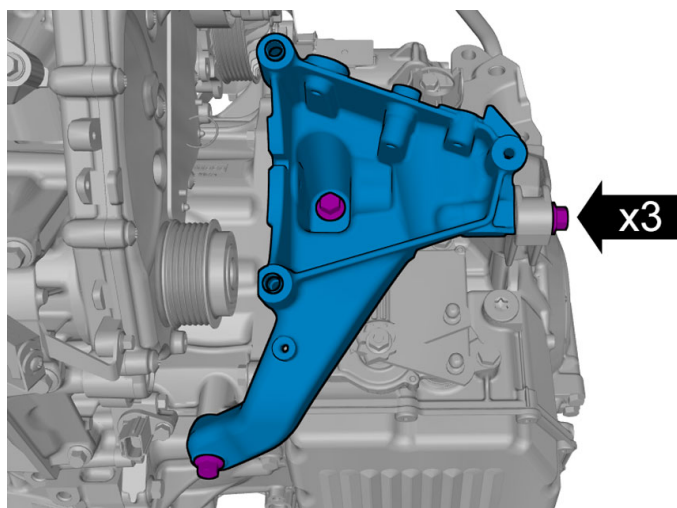
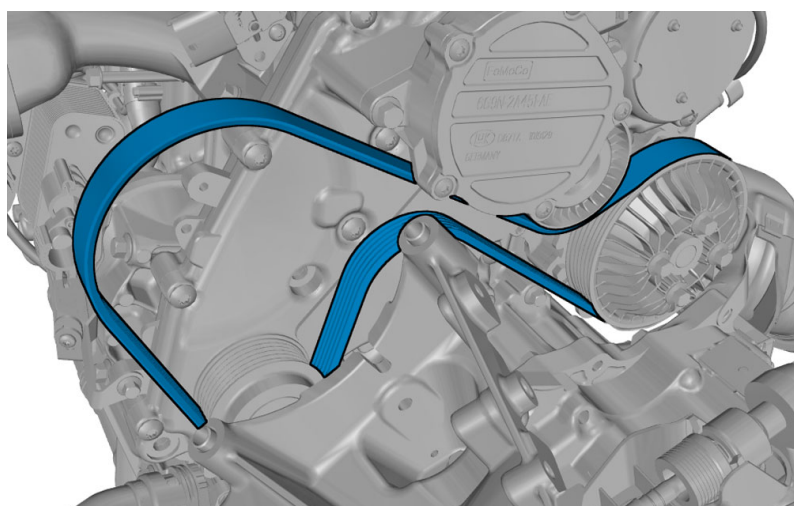


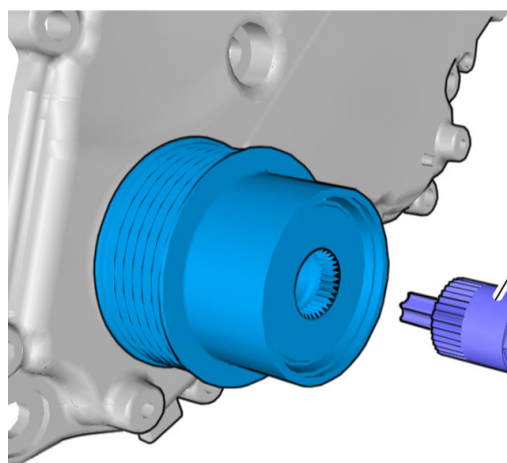
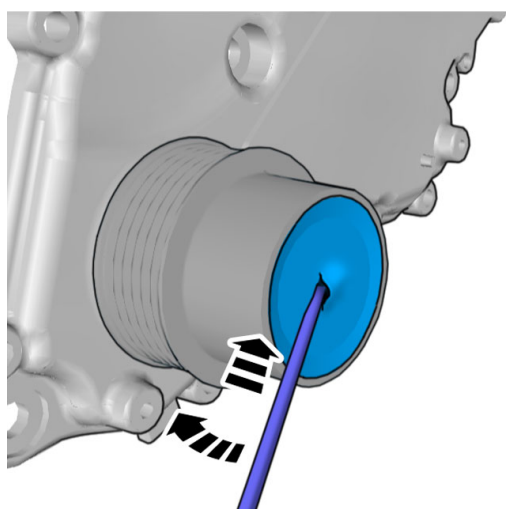
**Use:** Box wrench 19 mm

**Use:** Pin 3 mm







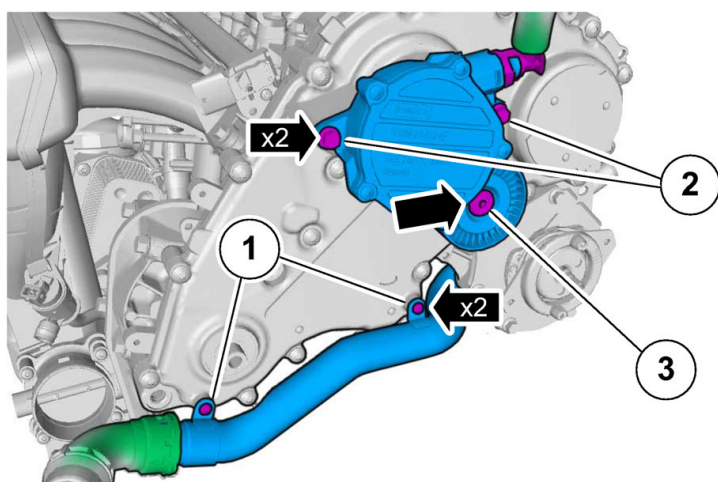


999 5760

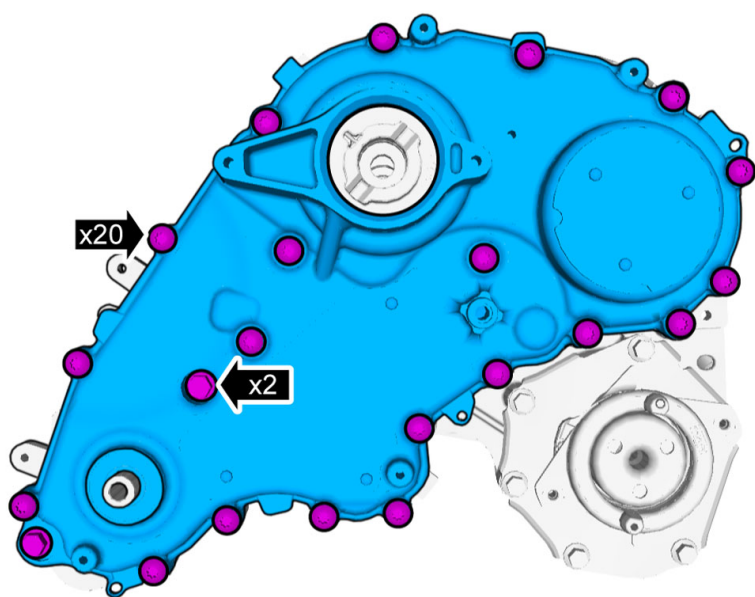
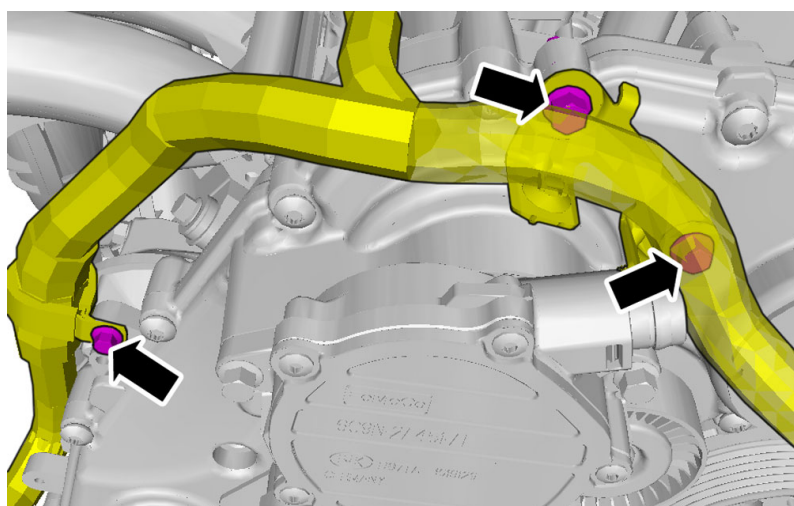
951 2926

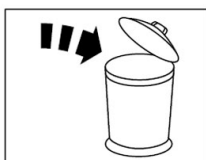
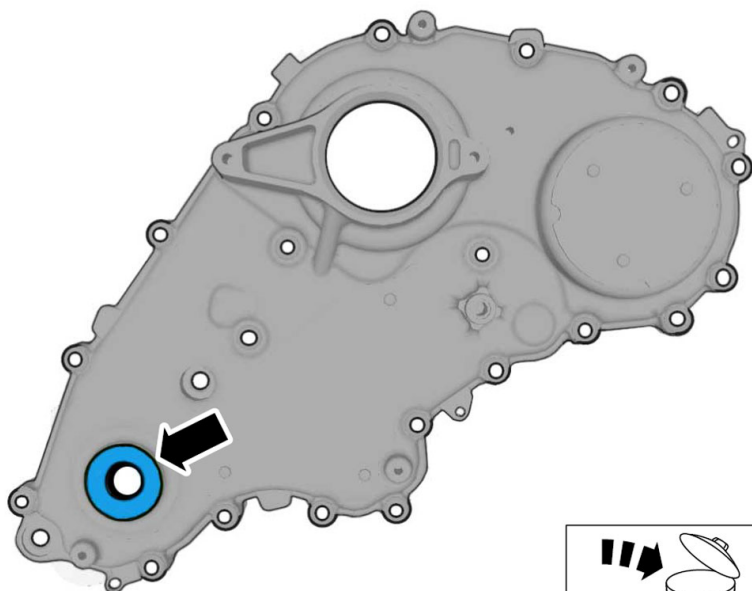
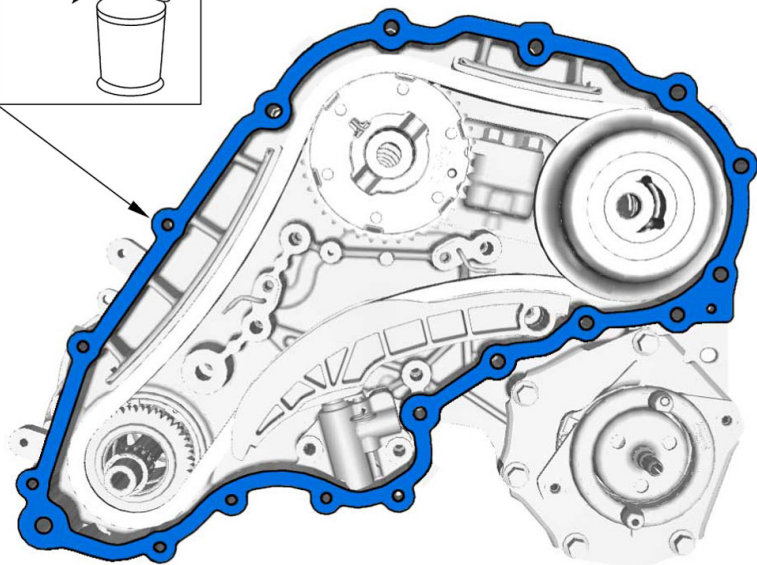
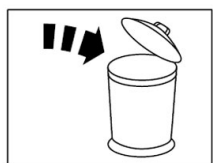
Special Tool: T9995760, Counterhold (rem/inst/  
freewheel gener.)Bosch,Denso

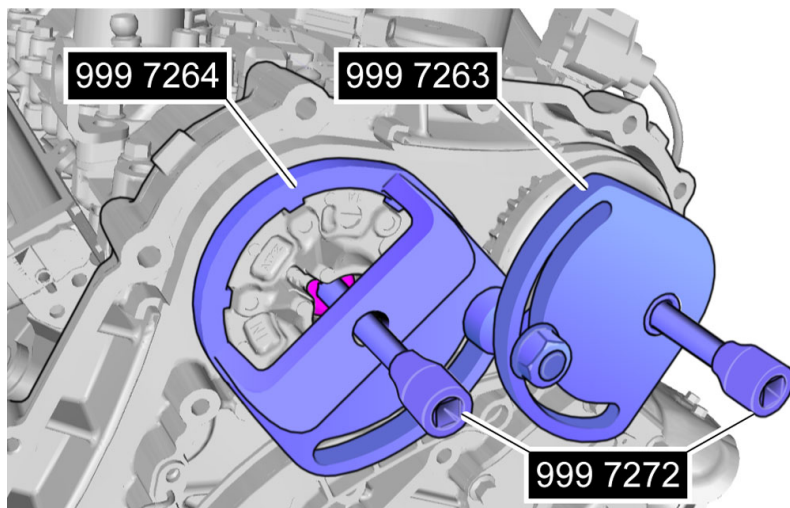
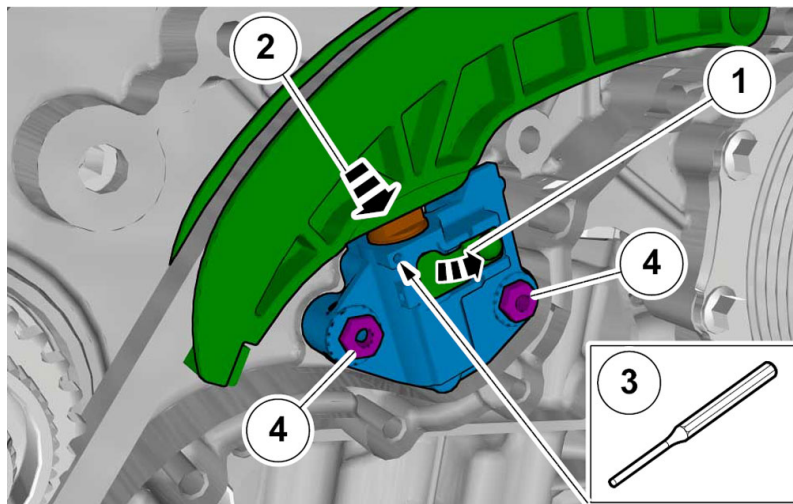
Special Tool: T9512926, Bit torx 50







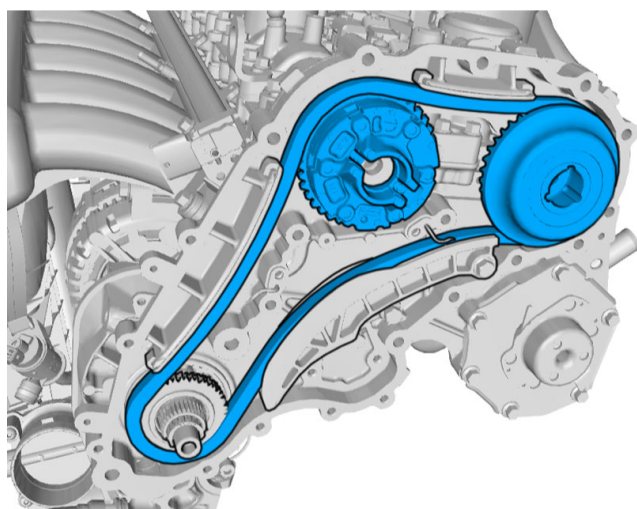




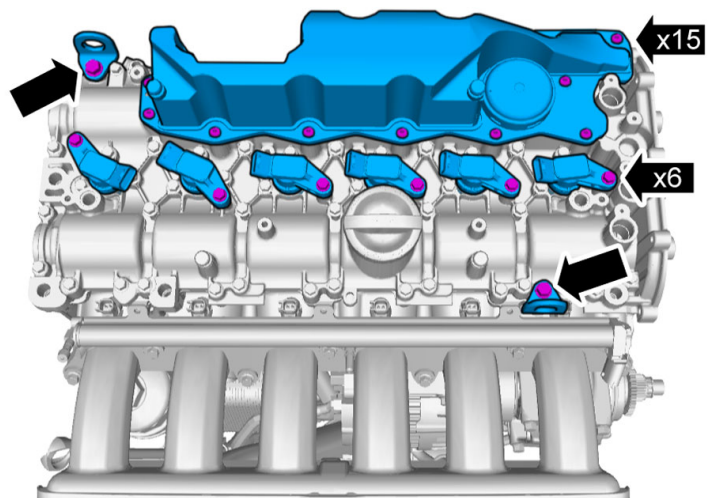
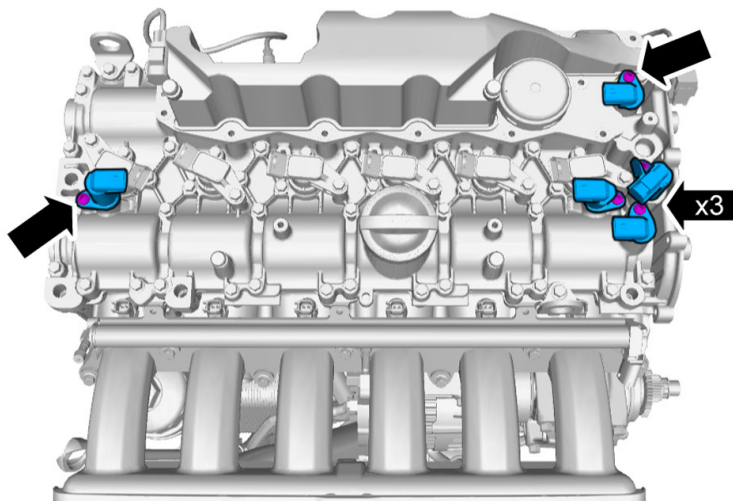
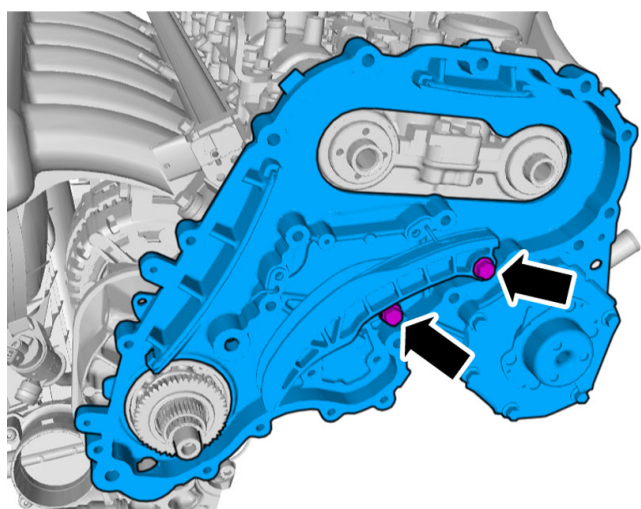
Special Tool: T9997264, Counterhold

Special Tool: T9997263, Counterhold

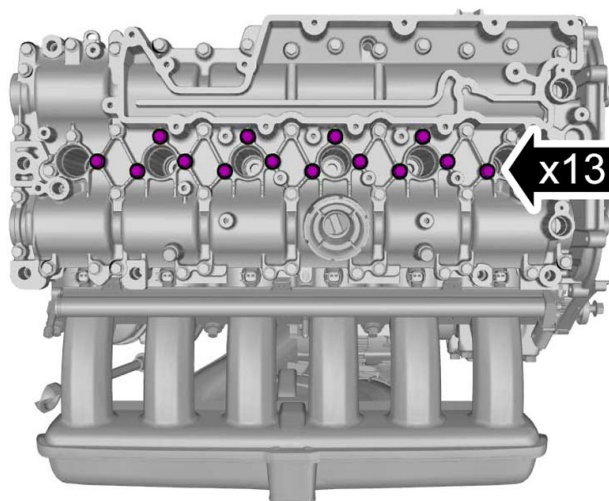
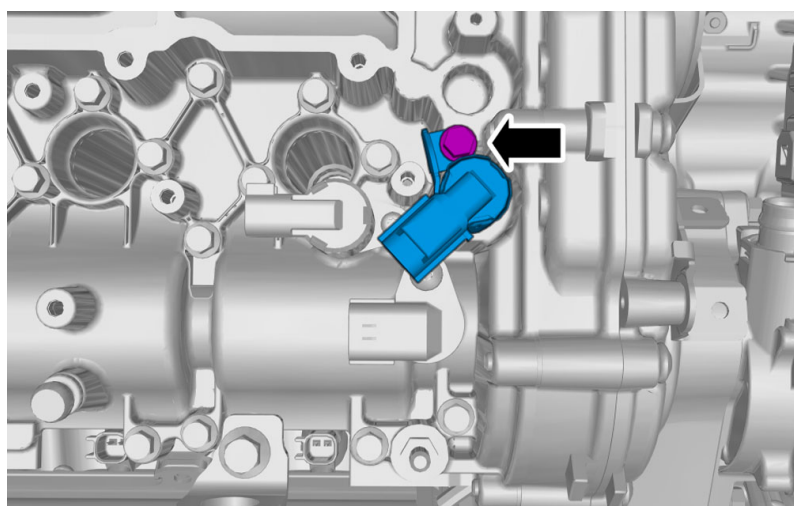
Special Tool: T9997272, TORX 60



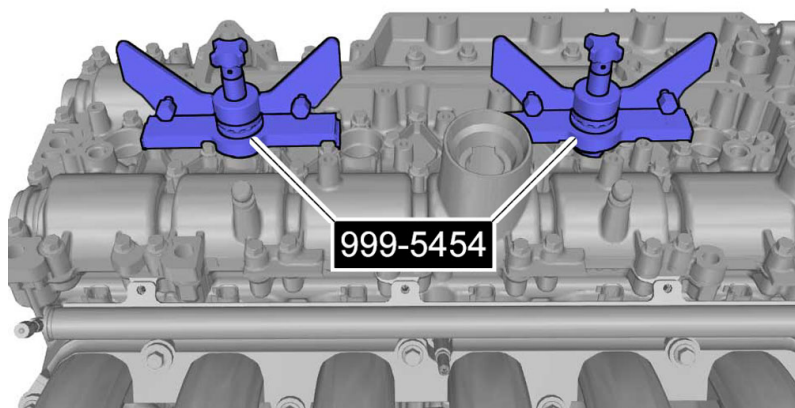
**Note! Note the position of each component before removal.**

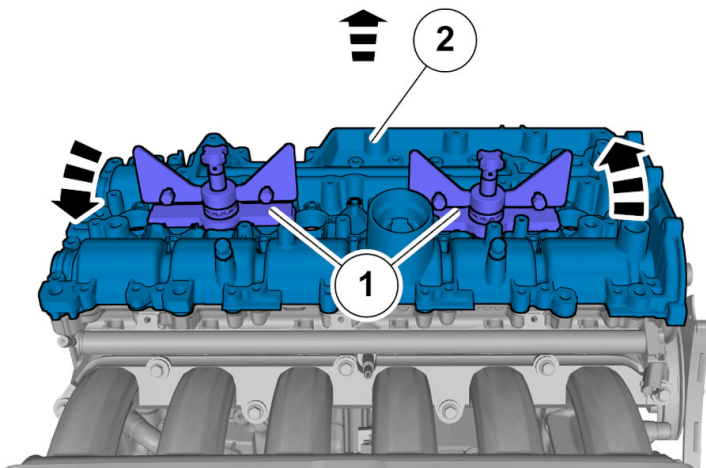
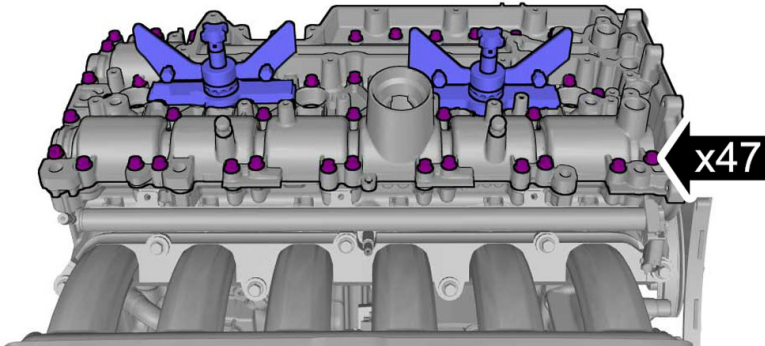




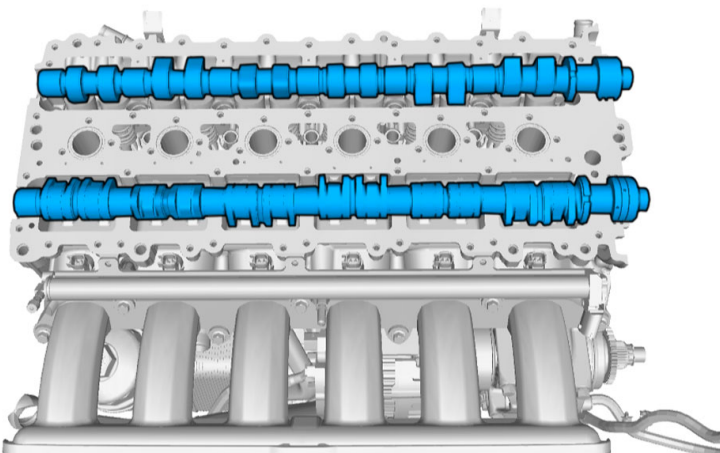


Special Tool: T9995454, PRESS TOOL (2)  
(CYLINDER HEAD) B6304/B5254

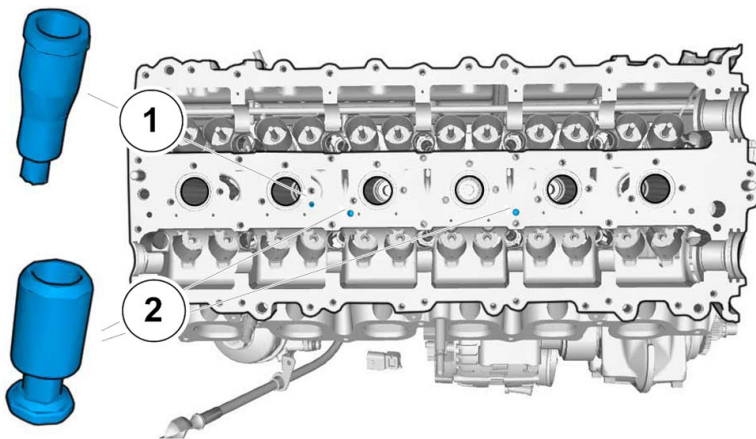




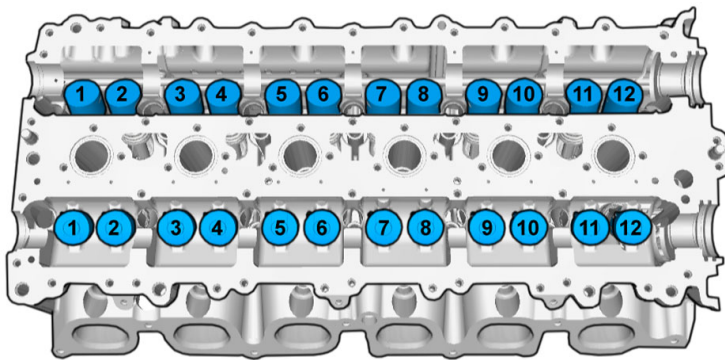
1. Note! Only use moderate force.
2. Caution! Take extra care not to damage the mating faces.



**Note! Note the position of each component before removal.**

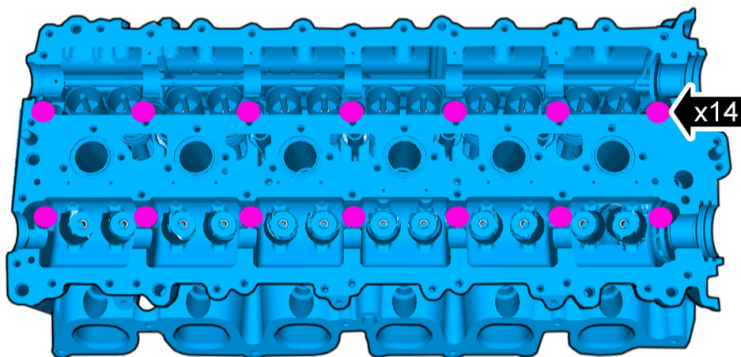


**Note!** Note the position of each component before removal.

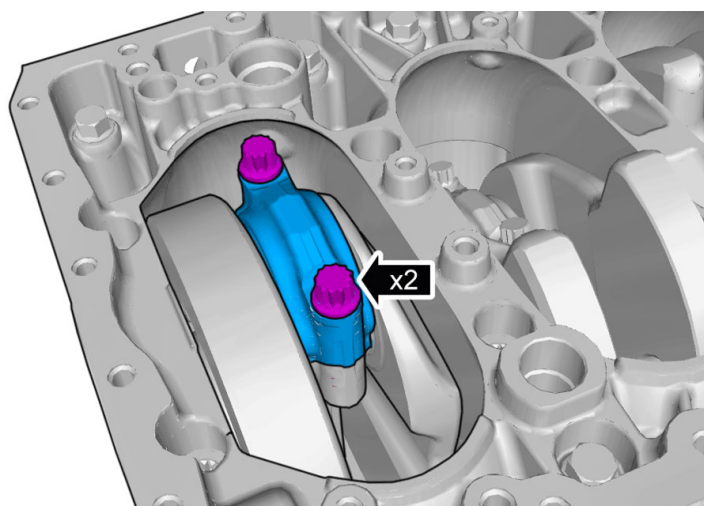


**Note!** Note the position of each component before removal.

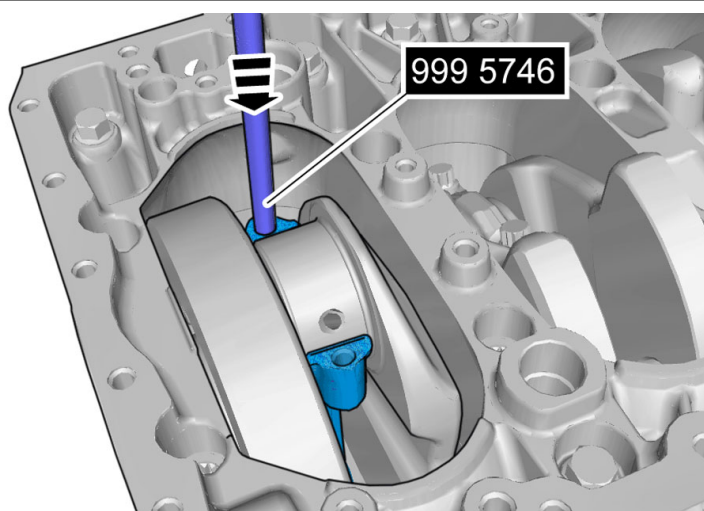
**Use:** Suction cup



**Caution!** Take extra care not to damage the mating faces.



**Note! Note the position of each component before removal.**

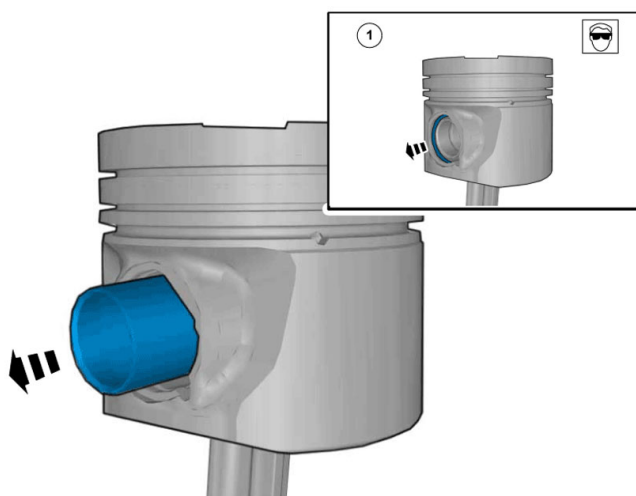


**Caution! Take extra care when handling the component.**

**Note! Note the position of the component before removal.**

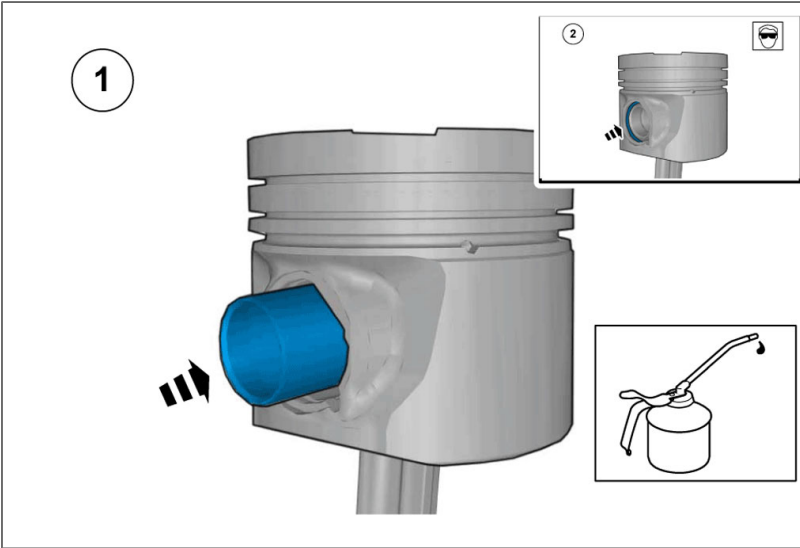
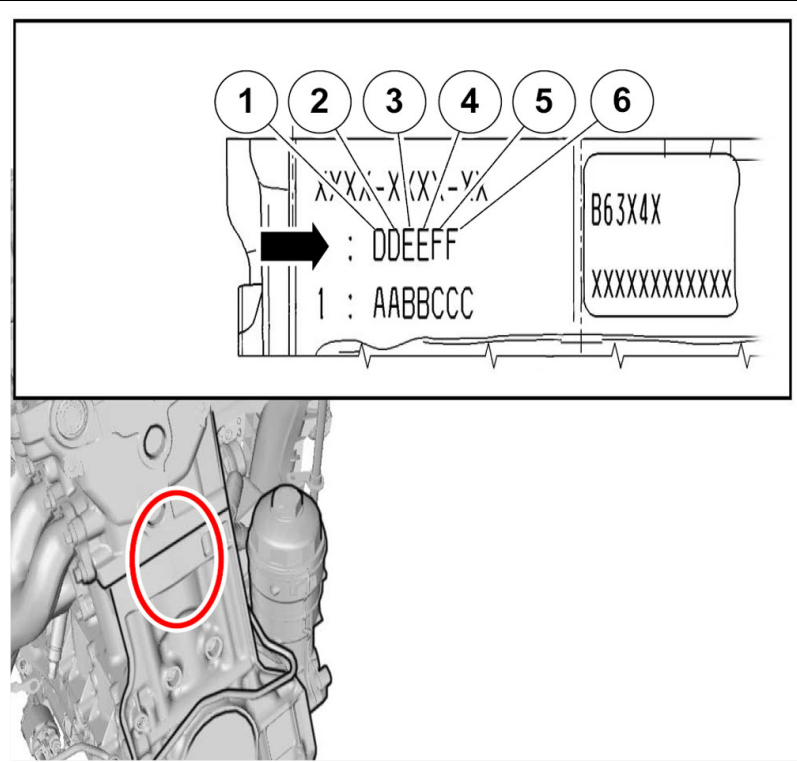
Special Tool: T9995746, Holder (remov.piston/ connecting rod) B 200-B 6304

2



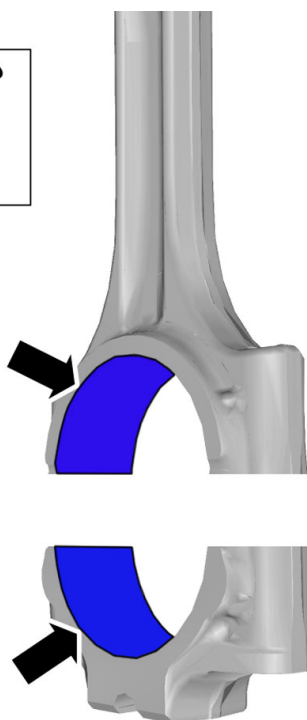
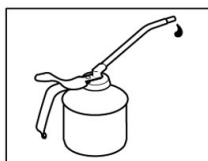
Installation

See information about engine, refer to:  
Specifications, mechanical  
2 - Engine with mountings and equipment  
21 - Engine  
210 - general

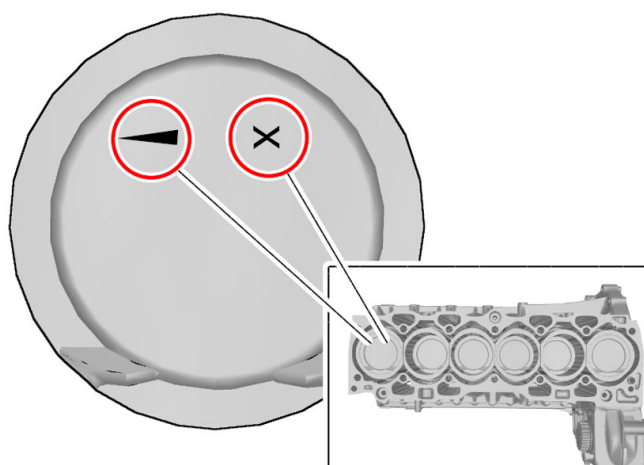


**Note! Make sure that the classification of the components correspond with each other.**

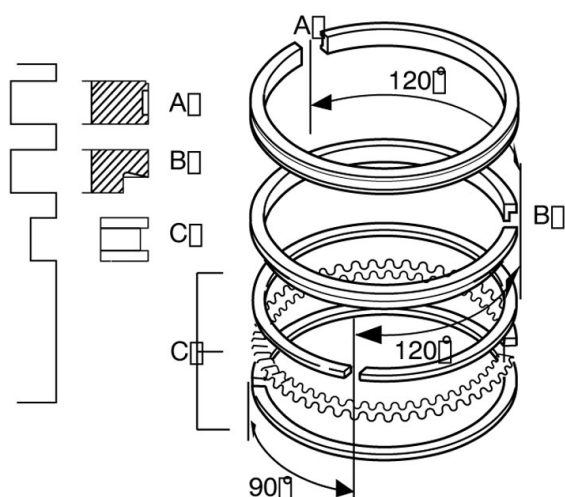




**Note!** Make sure that the classification of the components correspond with each other.

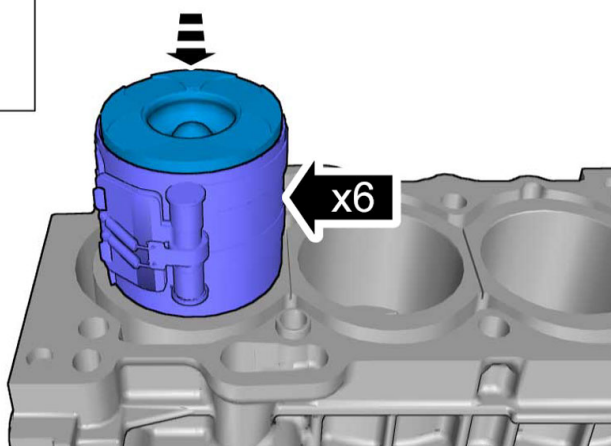


**Note!** Make sure that the direction arrow points towards the front of the engine.



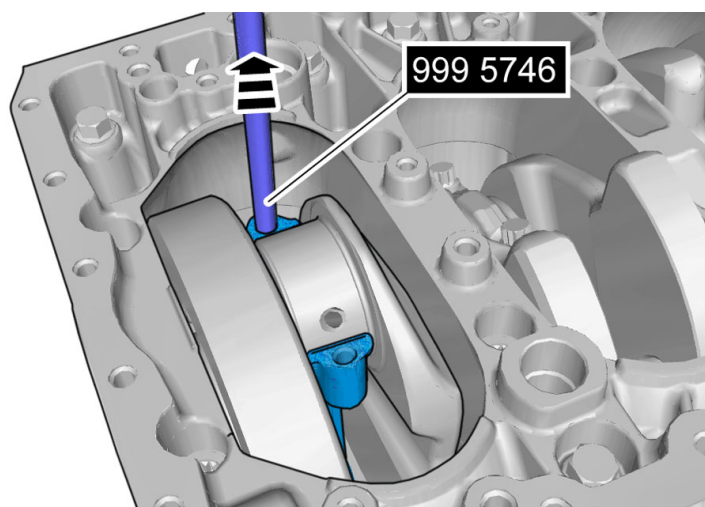
**Note! The text on piston ring A must be face up.**

**Use:** Piston ring pliers

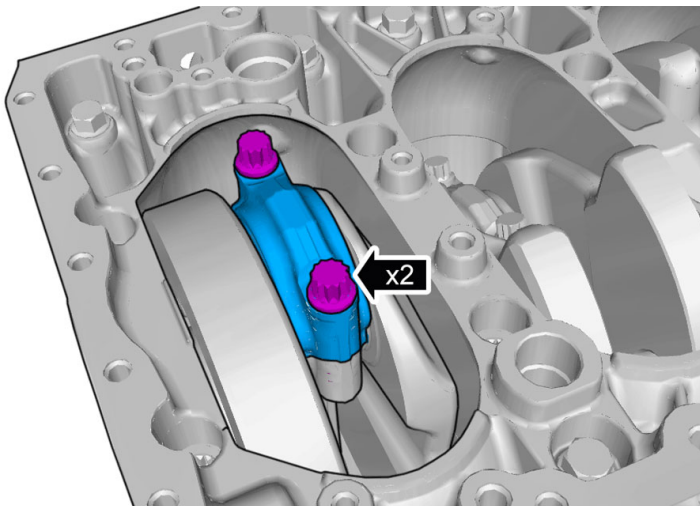


**Caution! Take extra care when handling the components.**

**Use:** Piston ring compressor



**Special Tool:** T9995746, Holder (remov.piston/ connecting rod) B 200-B 6304

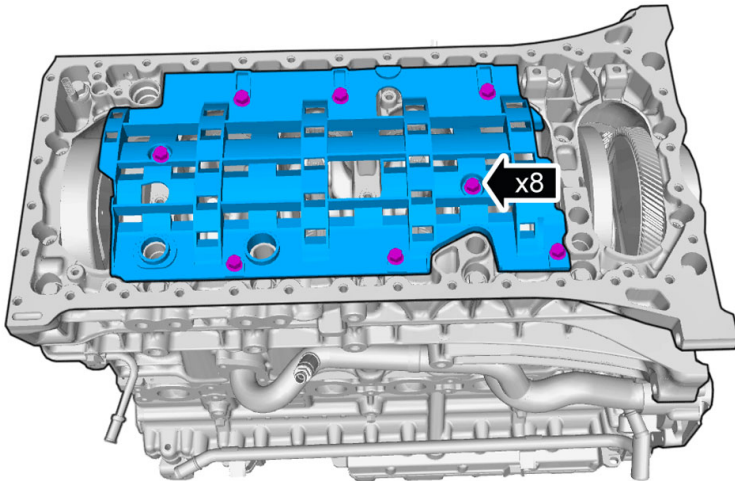


**Caution!** Make sure that new bolts are installed.

**Note!** Make sure that the classification of the components correspond with each other.

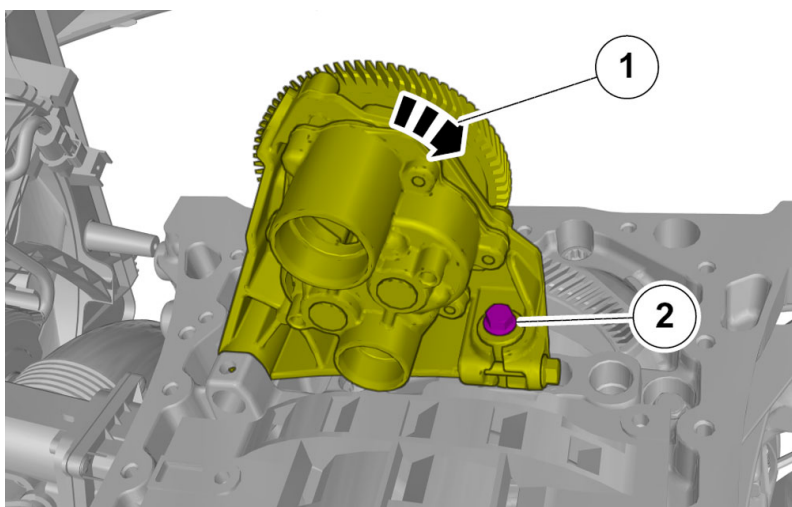
**Torque:**

- Stage 1: Cap connecting rod, 12 Nm  
(106 lbf-in or 8.9 lbf-ft)
- Stage 2: Cap connecting rod, 20 Nm  
(177 lbf-in or 14.8 lbf-ft)
- Stage 3: Cap connecting rod, 90°



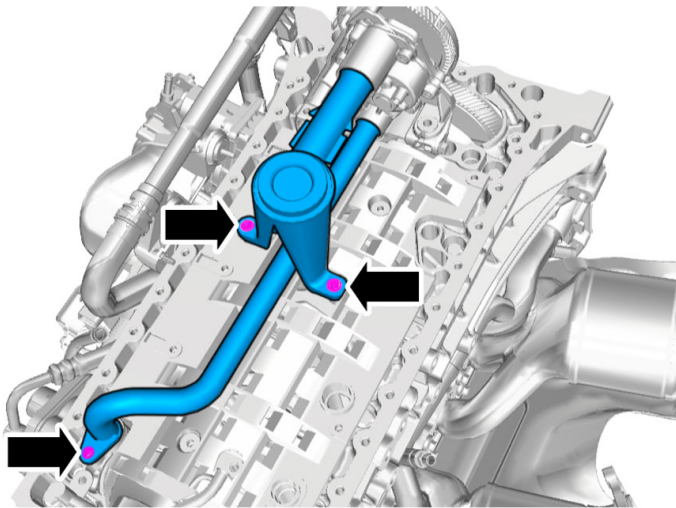
**Torque:**

M6, 10 Nm (88.5 lbf-in or 7.4 lbf-ft)

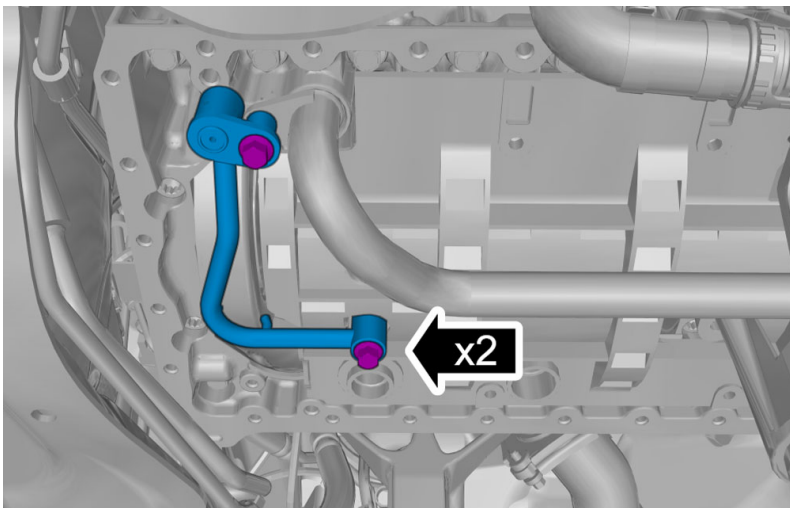


**Torque:**

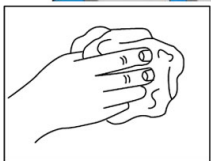
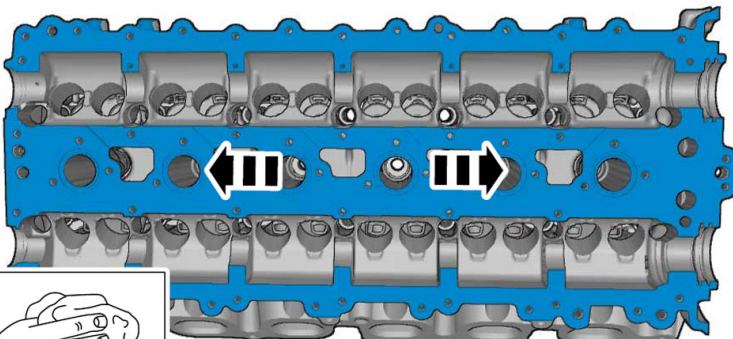
M7, 17 Nm (150.5 lbf-in or 12.5 lbf-ft)

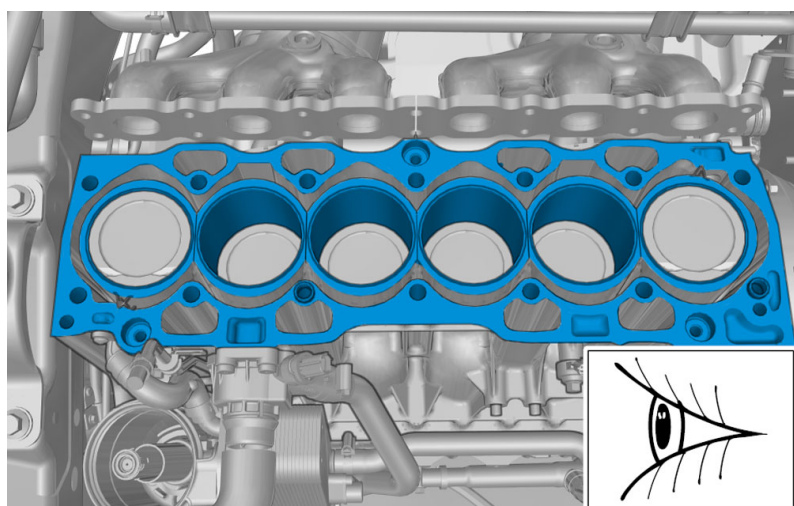
**Torque:**

M7, 17 Nm (150.5 lbf-in or 12.5 lbf-ft)

**Torque:**

M7, 17 Nm (150.5 lbf-in or 12.5 lbf-ft)

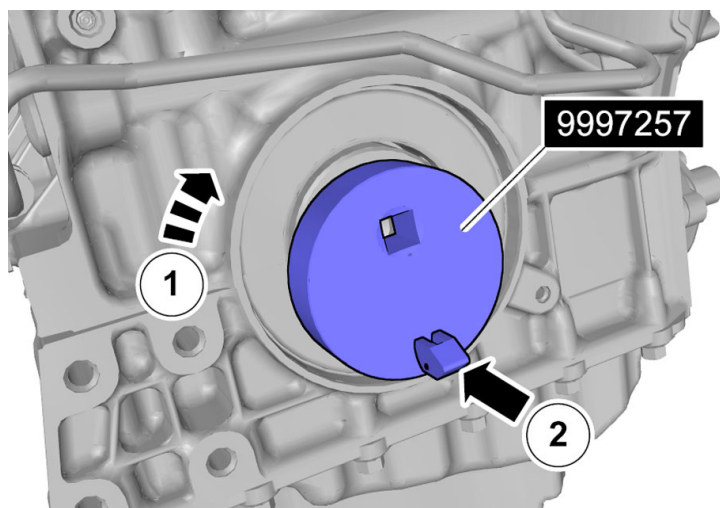
**Caution! Make sure that the surface is clean and free of foreign material.****Use:** Cleaning agent, 1161721**Use:** Gasket solution, 1161847



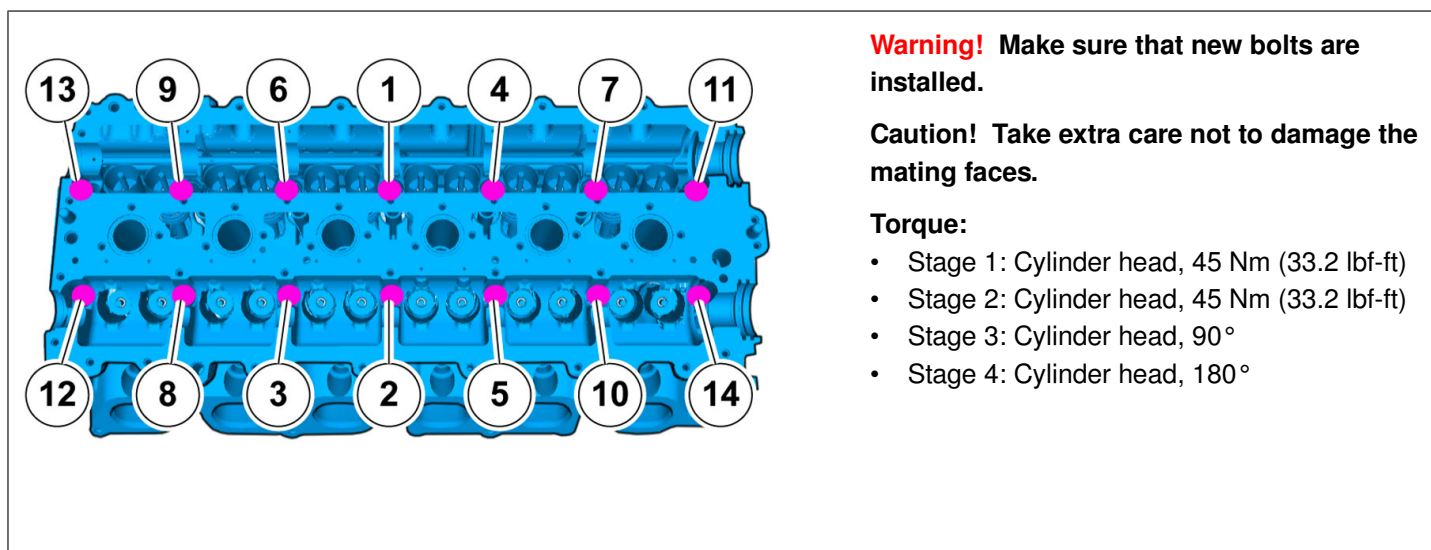
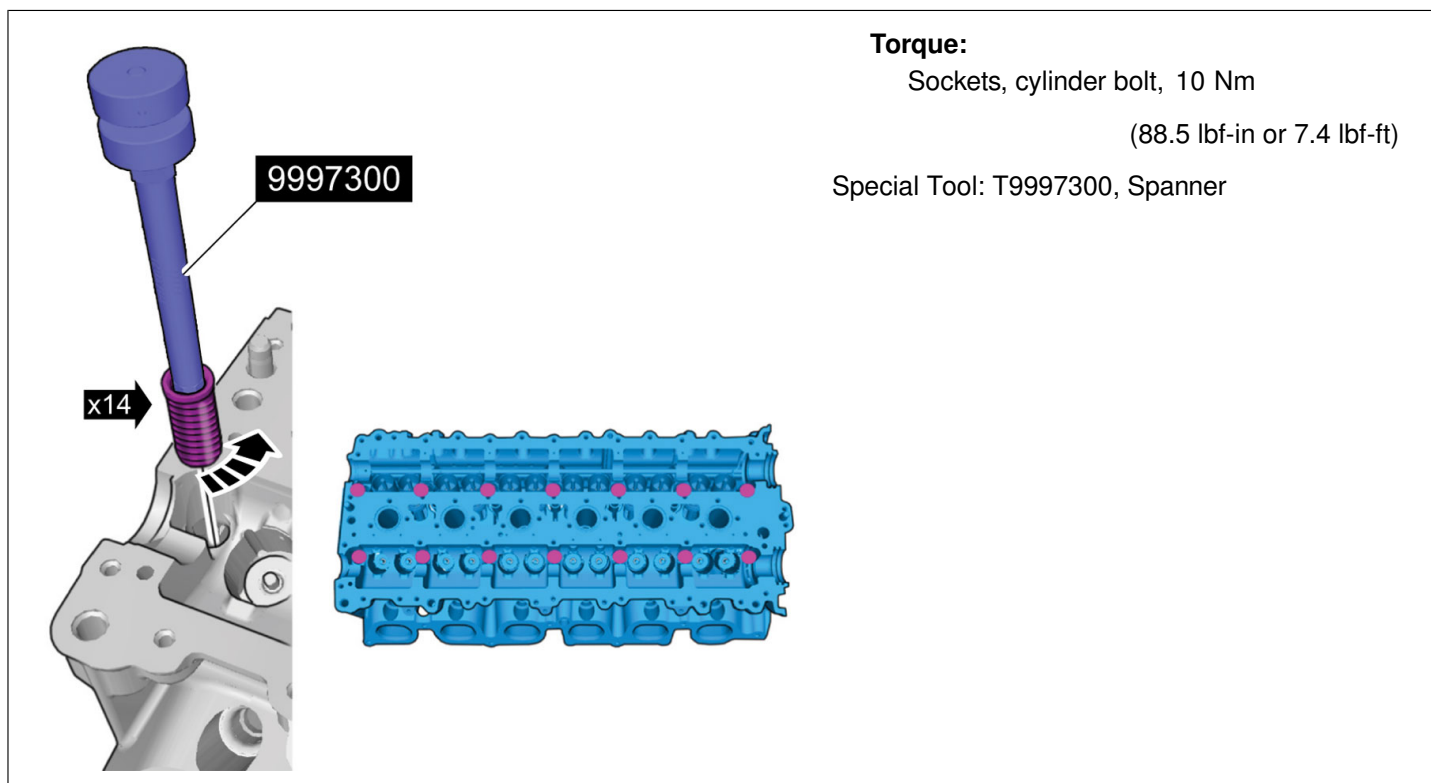
**Caution!** Make sure that the surface is clean and free of foreign material.

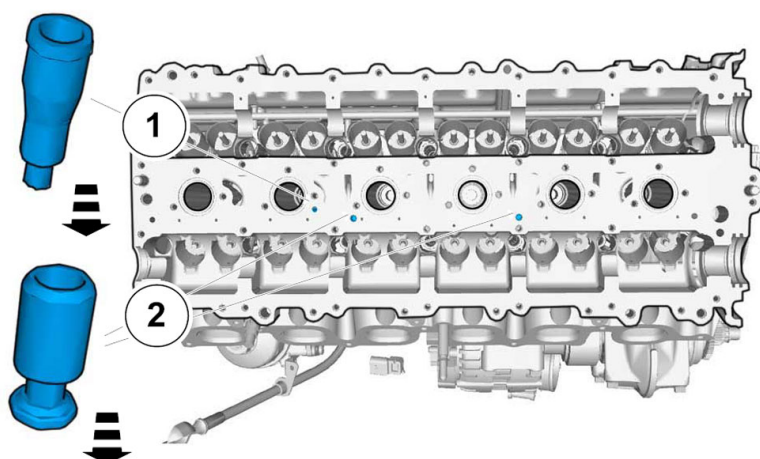
**Use:** Cleaning agent, 1161721

**Use:** Gasket solution, 1161847

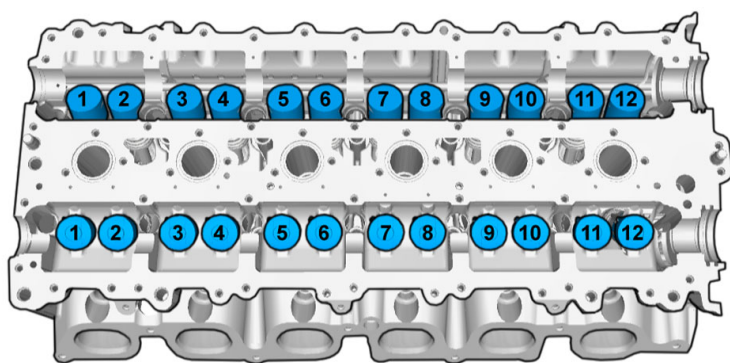






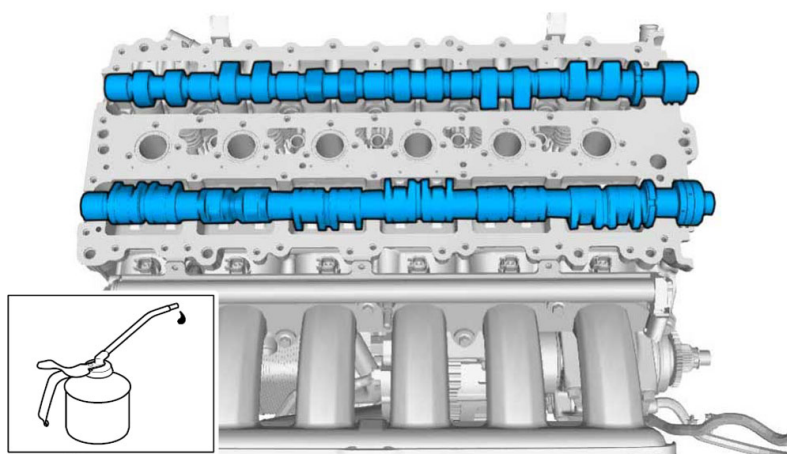


**Note! Make sure that these components are installed to the noted removal position.**



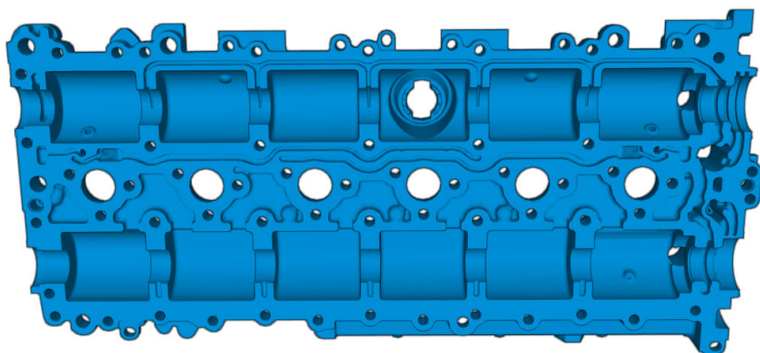
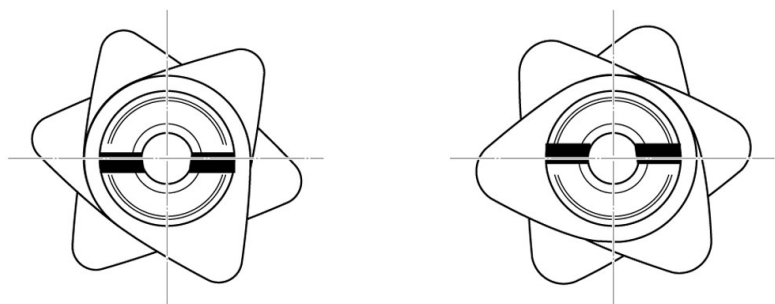
**Note! Make sure that these components are installed to the noted removal position.**

Rotate the crankshaft until piston No. 1 is at top dead center (TDC).



**Note! Make sure that these components are installed to the noted removal position.**

**Note!** Make sure that the installation marks are aligned.

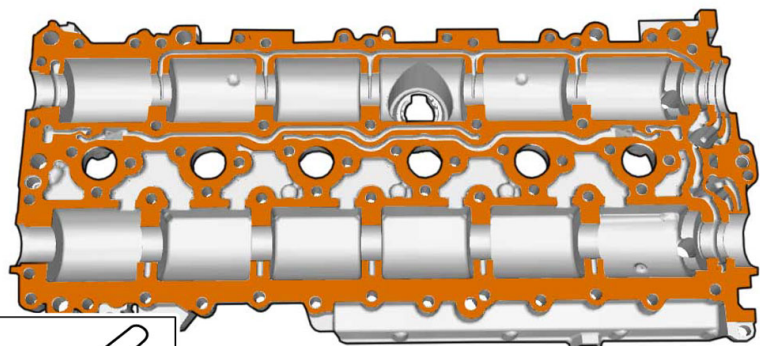


**Caution!** Make sure that the oil galleries are clean and free of foreign material.

**Caution!** Make sure that the surface is clean and free of foreign material.

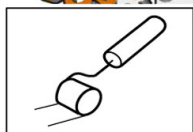
**Use:** Gasket solution, 1161847

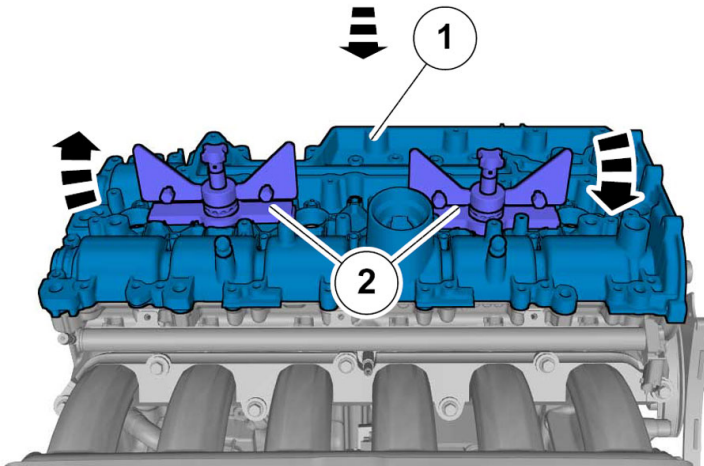
**Use:** Cleaning agent, 1161721



**Use:** Chemical gasket, 1161059

**Special Tool:** T9512767, Roller (Applying liquid gasket) B234,5234,6304





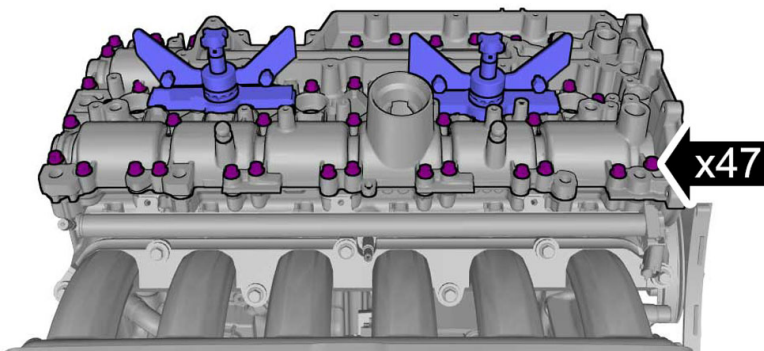
1. **Caution!** Take extra care not to damage the mating faces.

2. **Note!** Only use moderate force.

Special Tool: T9995454, PRESS TOOL (2)  
(CYLINDER HEAD) B6304/B5254

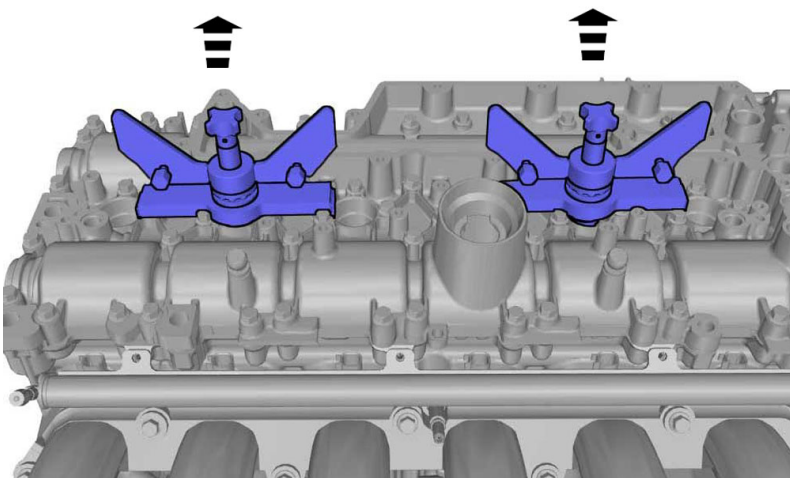
**Torque:**

M7, 17 Nm (150.5 lbf-in or 12.5 lbf-ft)

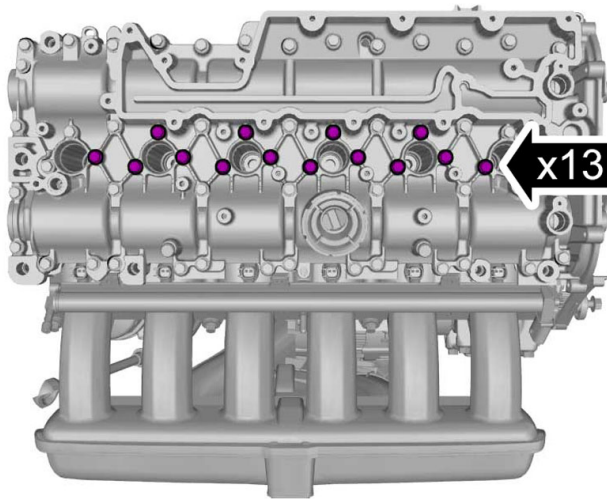


**Torque:**

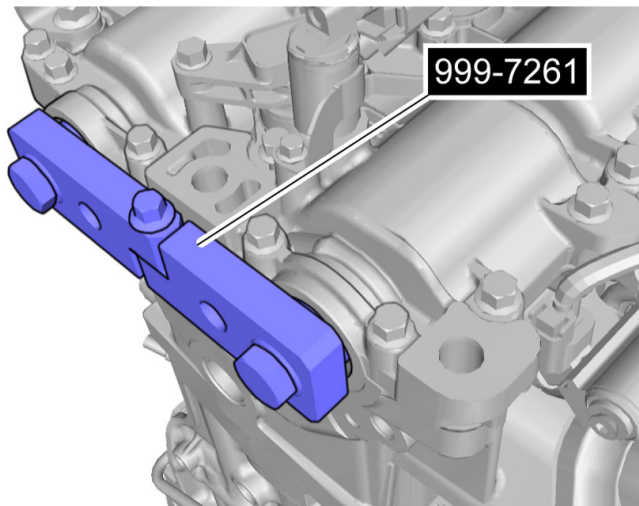
Spark plug, 28 Nm (20.7 lbf-ft)



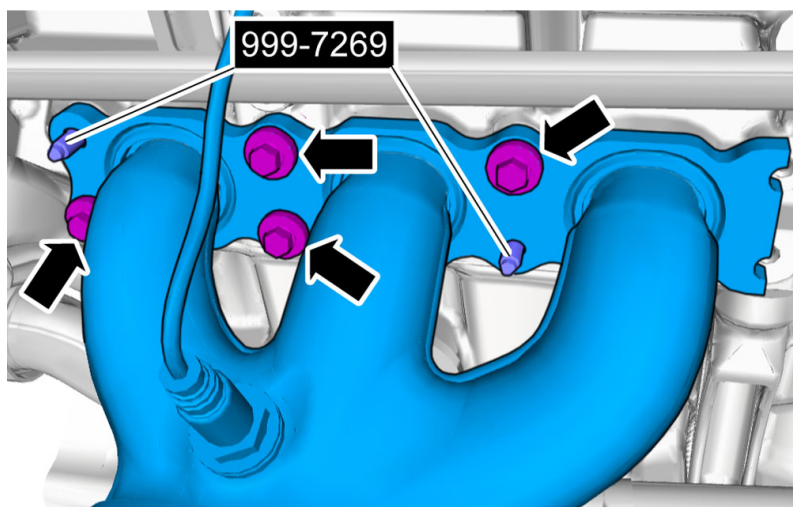


**Torque:**

M7, 17 Nm (150.5 lbf-in or 12.5 lbf-ft)



Special Tool: T9997261, Position sensor

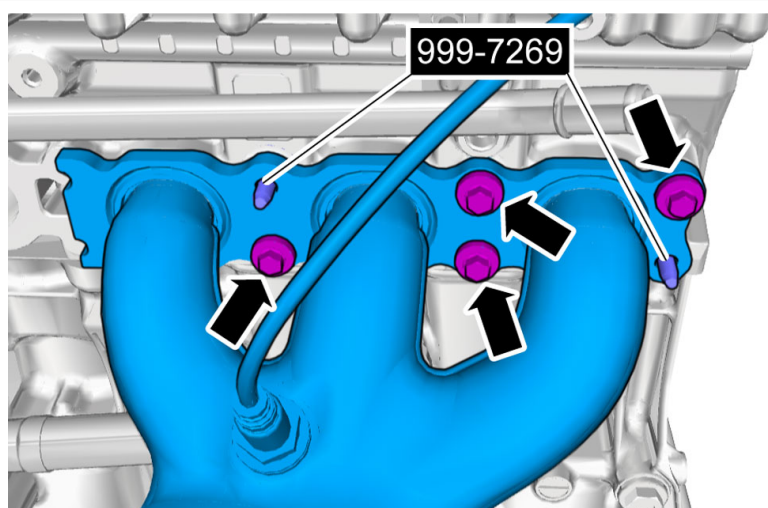
**Caution! Make sure that the gaskets are correctly located.**

Special Tool: T9997269, Guide pin

**Torque:**

M8, 24 Nm (17.7 lbf-ft)



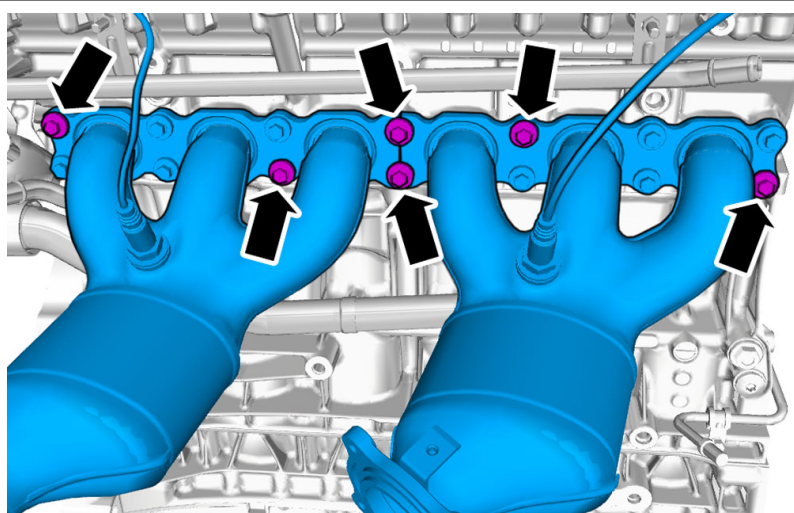


**Caution! Make sure that the gaskets are correctly located.**

**Torque:**

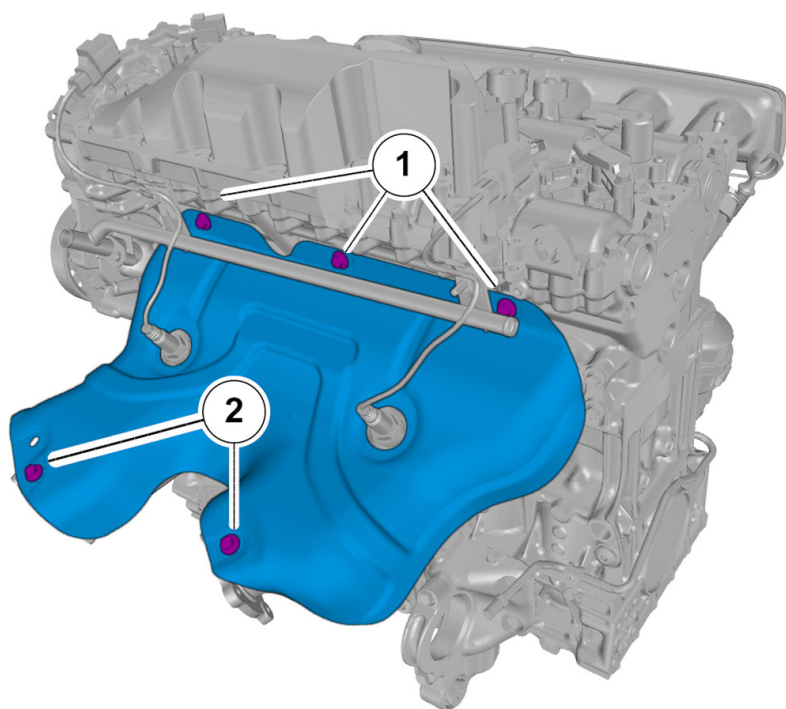
M8, 24 Nm (17.7 lbf-ft)

Special Tool: T9997269, Guide pin

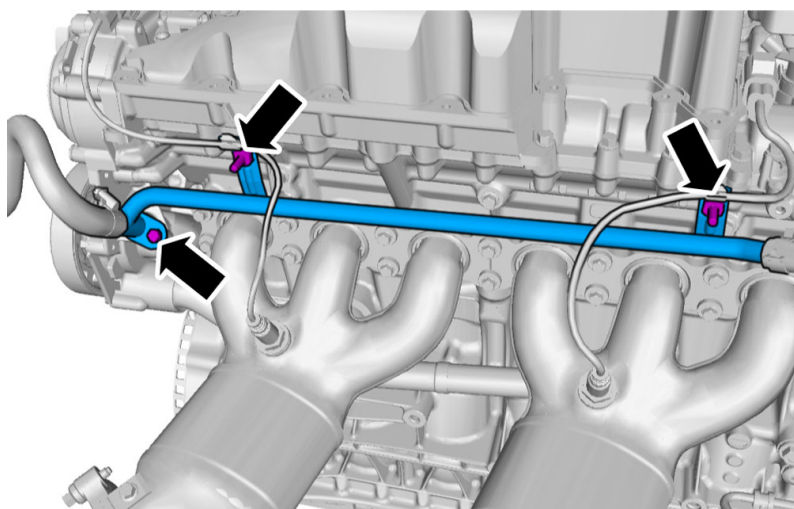


**Torque:**

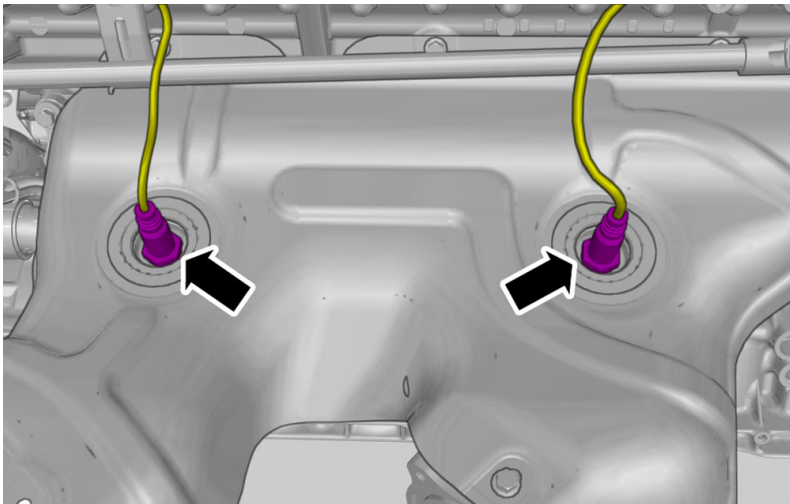
M8, 24 Nm (17.7 lbf-ft)



1. **Torque:**  
M8, 24 Nm (17.7 lbf-ft)
2. **Torque:**  
M6, 10 Nm (88.5 lbf-in or 7.4 lbf-ft)



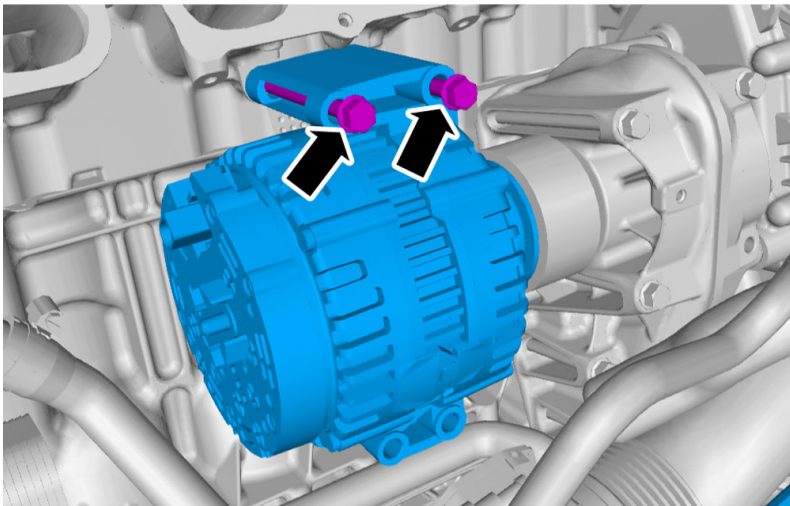
- Torque:**  
M6, 10 Nm (88.5 lbf-in or 7.4 lbf-ft)



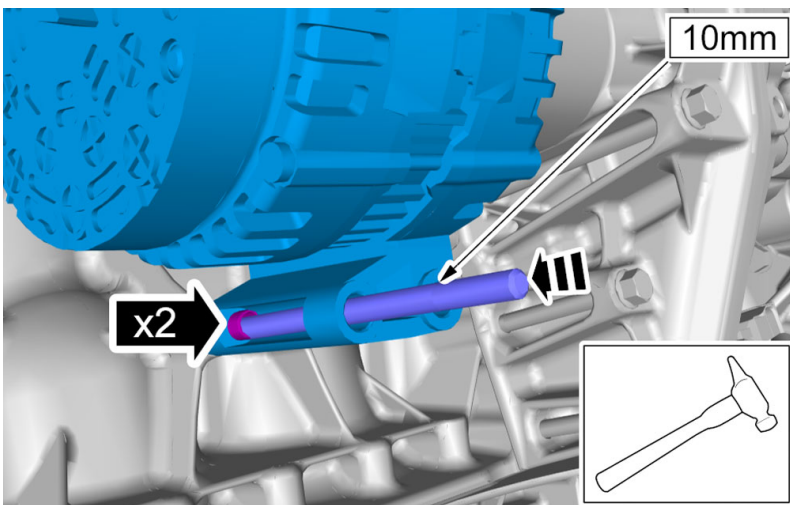
Special Tool: T9995543, Socket NV-22 (heated oxygen sensor)

**Torque:**

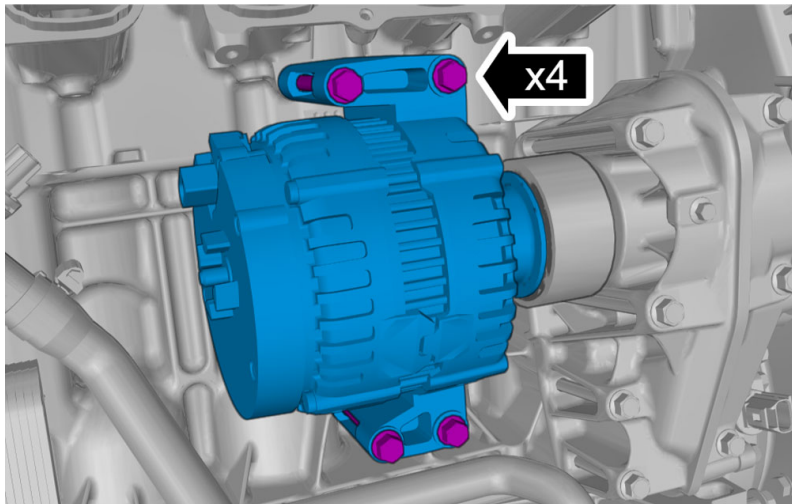
Catalyst monitor sensor, 45 Nm (33.2 lbf-ft)



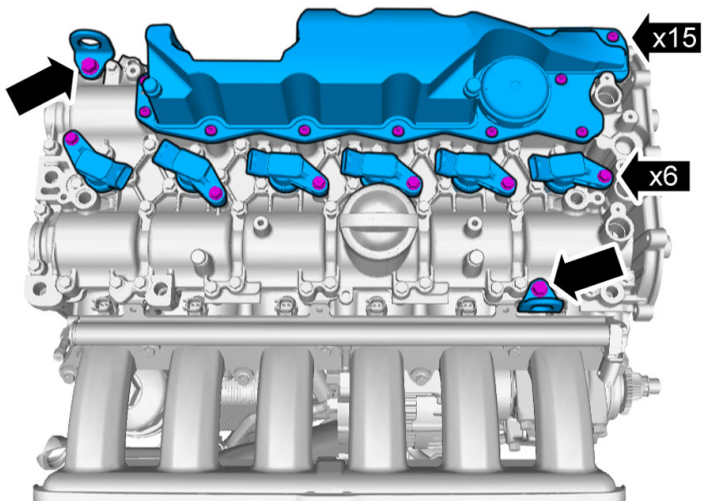
**Note!** Only tighten the bolts finger tight at this stage.



**Caution!** Make sure that the component is correctly located on the locating dowels.

**Torque:**

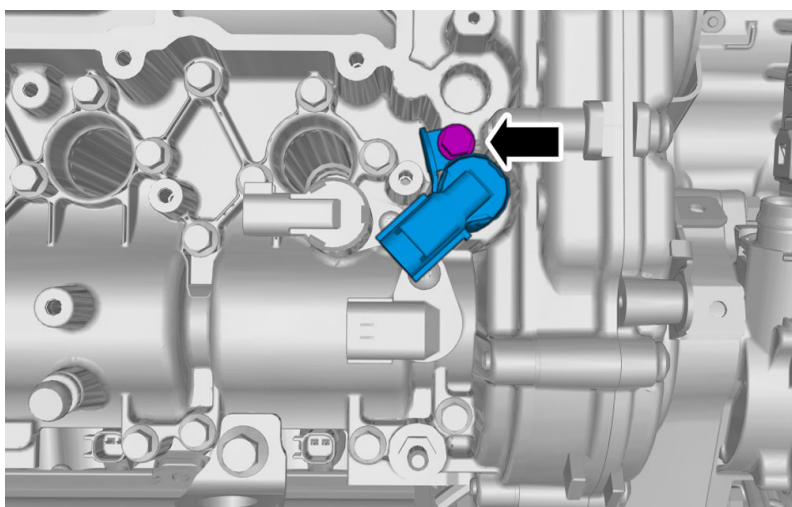
M8, 24 Nm (17.7 lbf-ft)

**1. Torque:**

M6, 10 Nm (88.5 lbf-in or 7.4 lbf-ft)

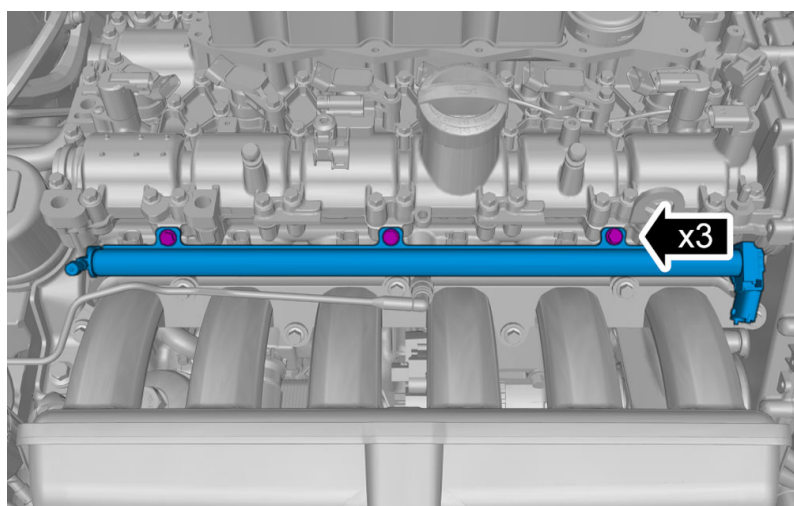
**2. Torque:**

M10, 50 Nm (36.9 lbf-ft)

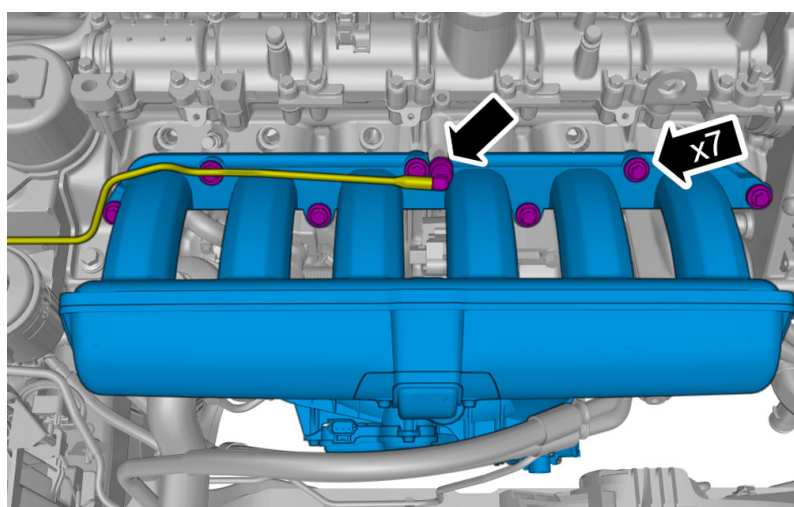
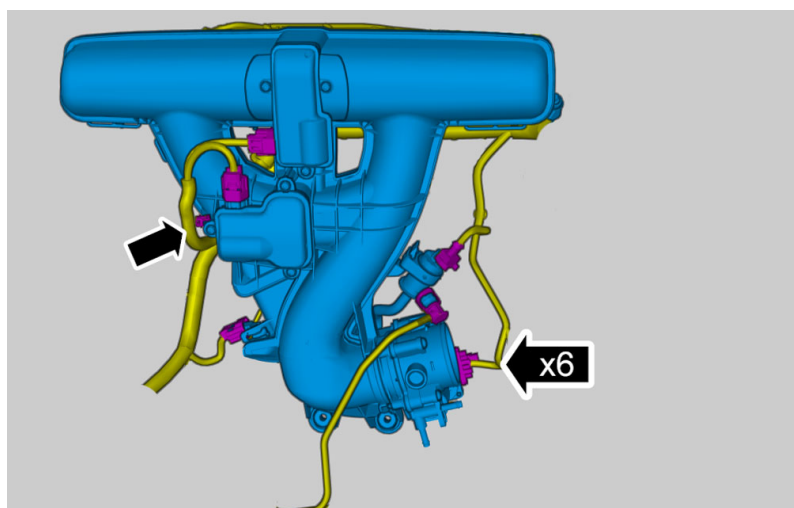
**Torque:**

M6, 10 Nm (88.5 lbf-in or 7.4 lbf-ft)



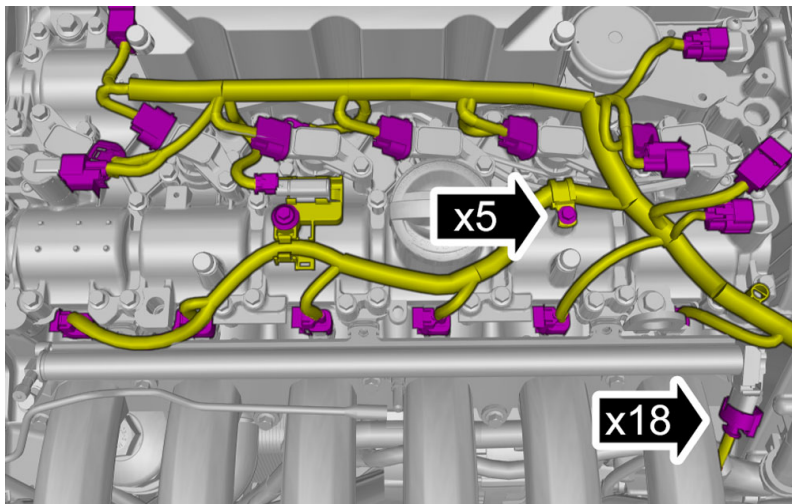
**Torque:**

M6, 10 Nm (88.5 lbf-in or 7.4 lbf-ft)

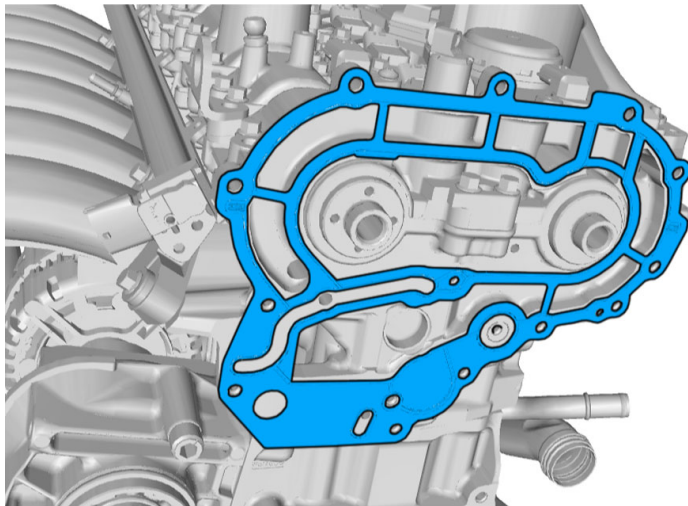
**Torque:**

M7, 17 Nm (150.5 lbf-in or 12.5 lbf-ft)



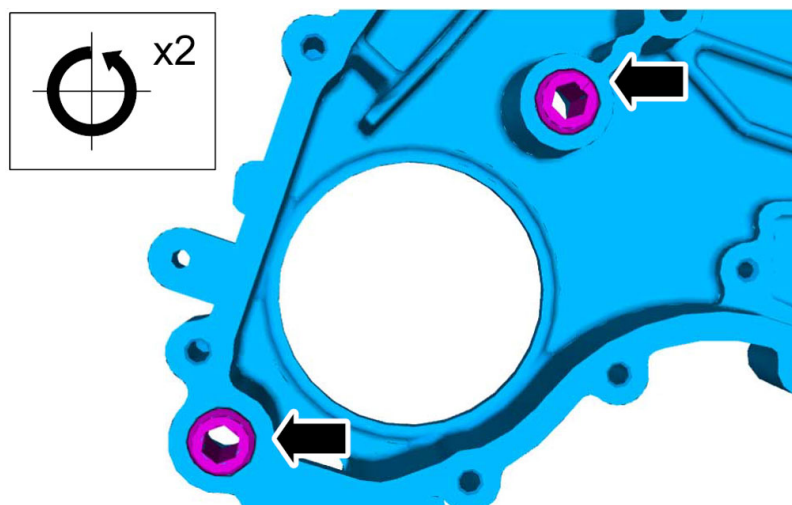
**Torque:**

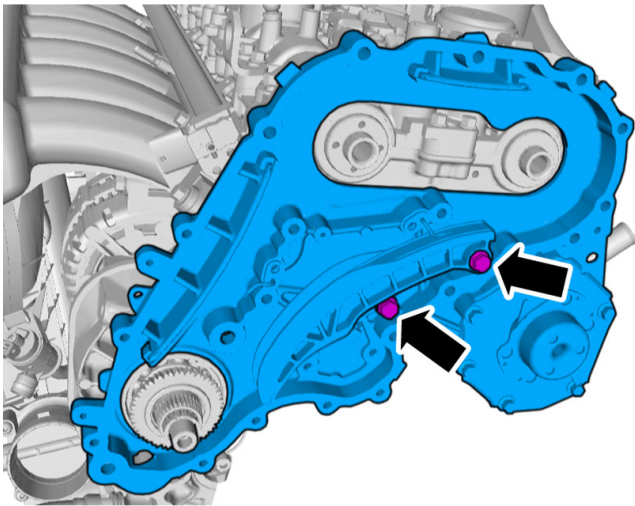
M6, 10 Nm (88.5 lbf-in or 7.4 lbf-ft)



**Caution!** Make sure that the surface is clean and free of foreign material.

**Note!** Use a new seal.

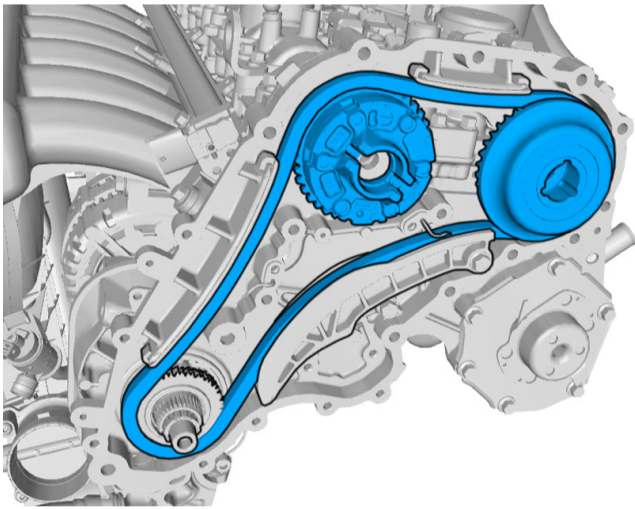




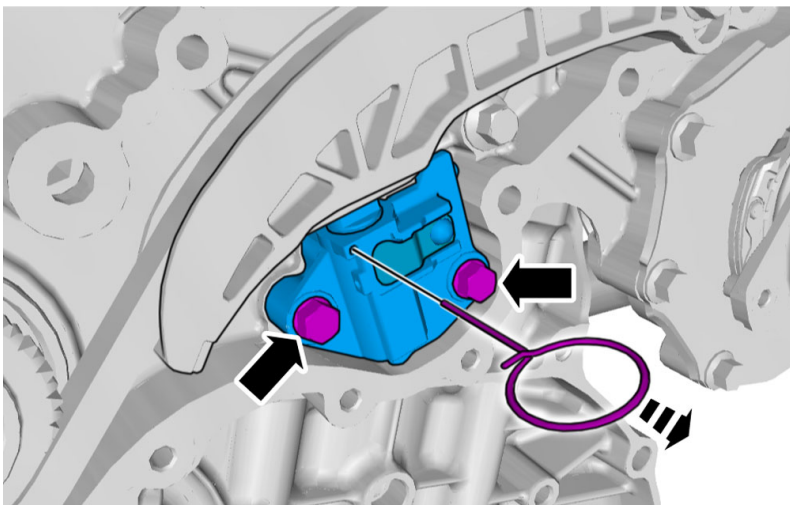
**Caution!** Make sure that the gaskets are correctly located.

**Torque:**

M7, 17 Nm (150.5 lbf-in or 12.5 lbf-ft)



**Note!** Make sure that these components are installed to the noted removal position.



**Torque:**

M6, 10 Nm (88.5 lbf-in or 7.4 lbf-ft)



Special Tool: T9997263, Counterhold

Special Tool: T9997264, Counterhold

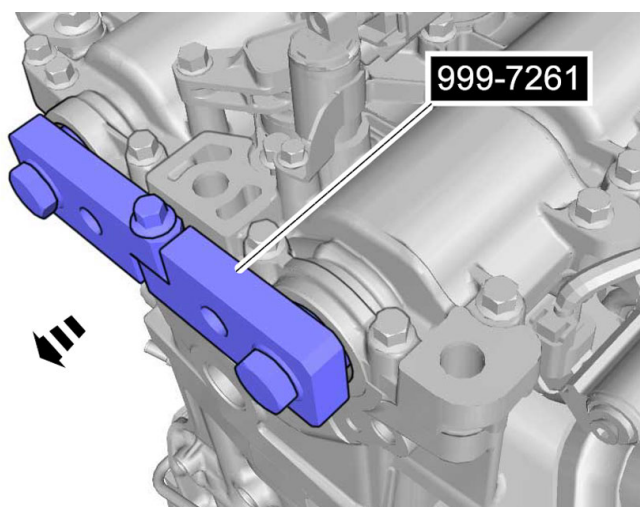
Special Tool: T9997272, TORX 60

1. **Torque:**

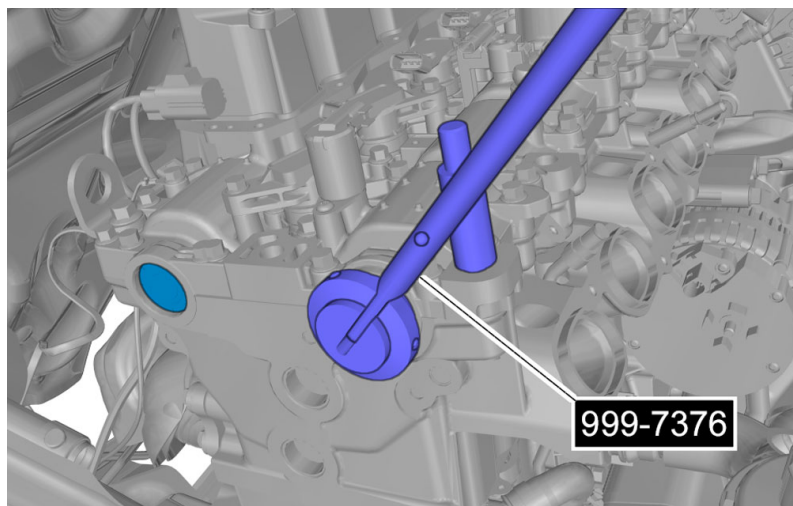
- Stage 1: Centre bolt, exhaust camshaft, 75 Nm (55.3 lbf-ft)
- Stage 2: Centre bolt, exhaust camshaft, 90°

2. **Torque:**

Centre bolt, intake camshaft, 110 Nm  
(81.1 lbf-ft)

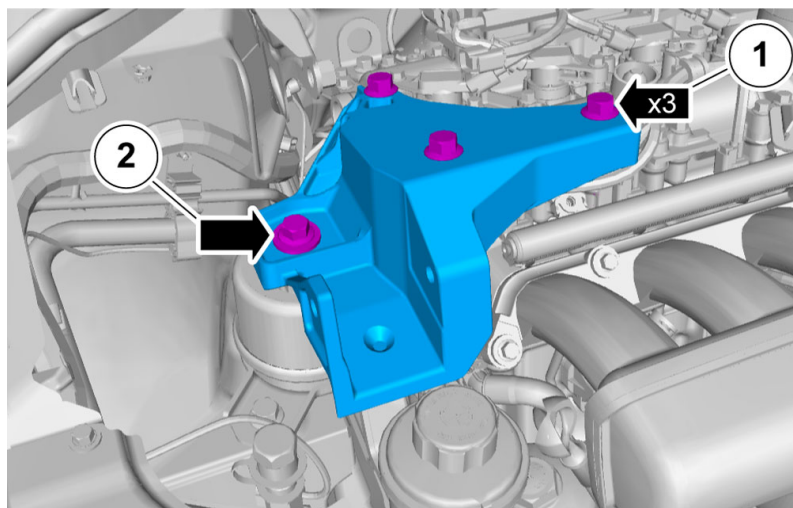






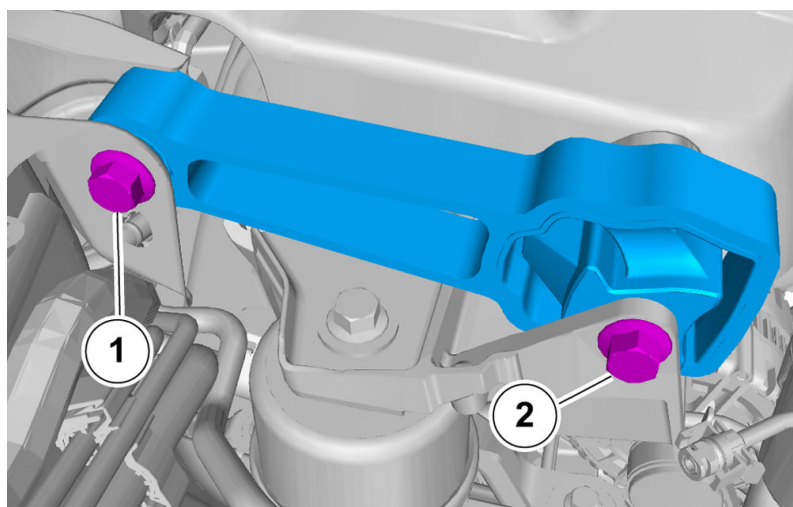
**Caution! Make sure that the gaskets are correctly located.**

Special Tool: T9997376, Installation tool

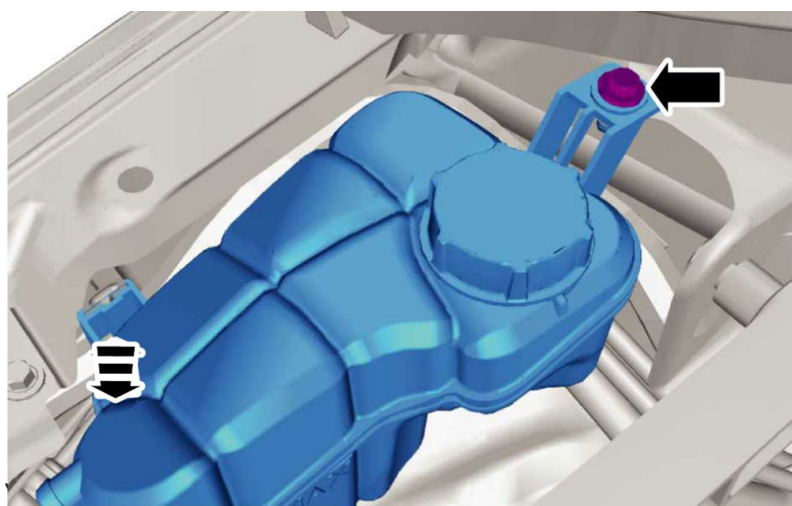


Connect the following items:

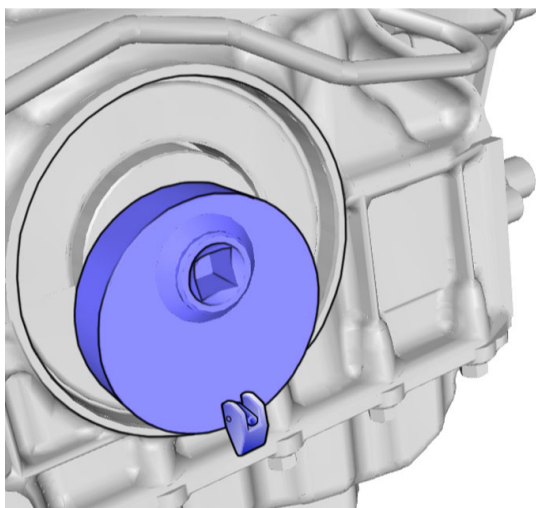
1. **Torque:**  
Bracket engine mounting to cylinder head, 80 Nm (59 lbf-ft)
2. **Torque:**  
M12, 80 Nm (59 lbf-ft)



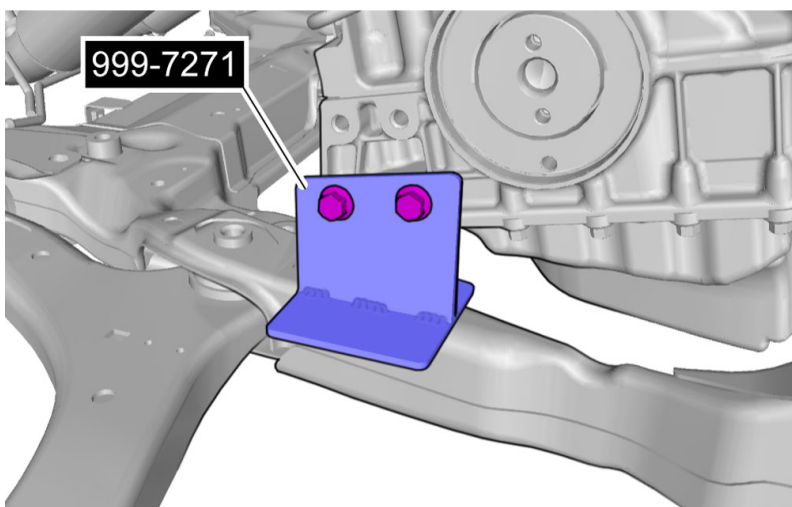
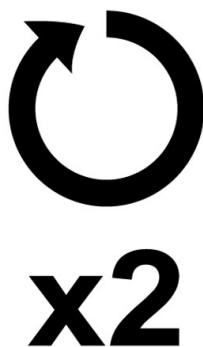
1. **Torque:**  
Upper torque rod to spring strut turret, 110 Nm (81.1 lbf-ft)
2. **Torque:**  
Upper torque rod to engine mount bracket, 110 Nm (81.1 lbf-ft)

**Torque:**

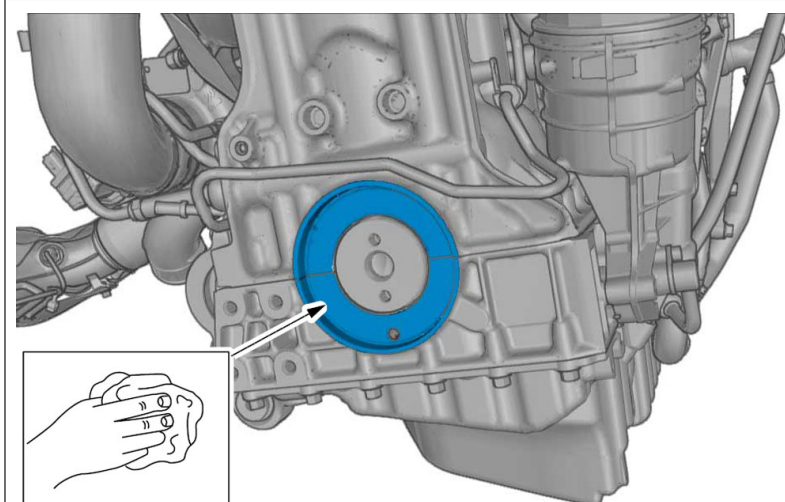
M6, 10 Nm (88.5 lbf-in or 7.4 lbf-ft)



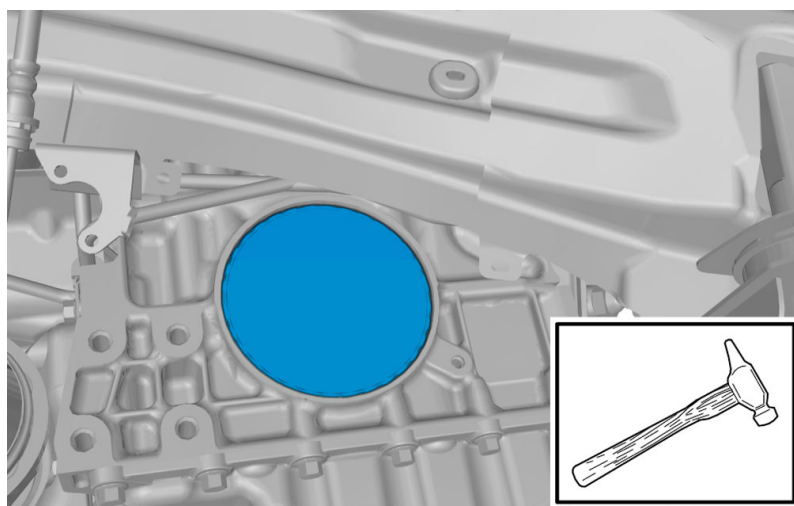
**Caution! Only rotate the crankshaft clockwise.**



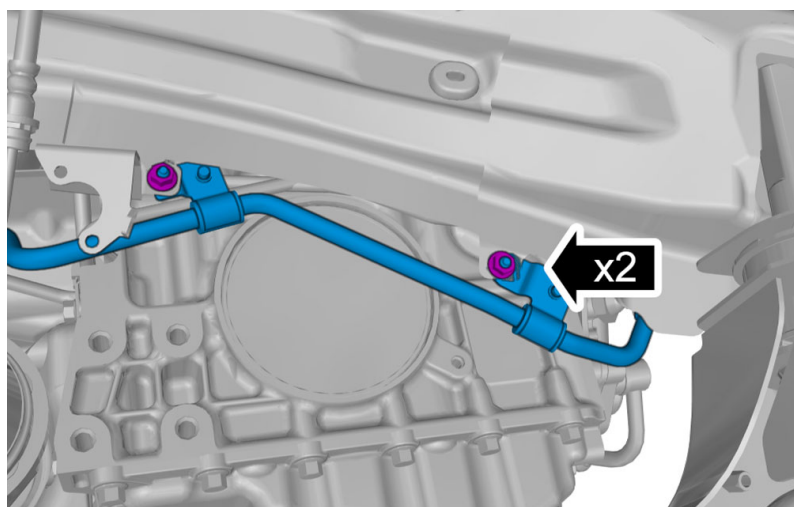


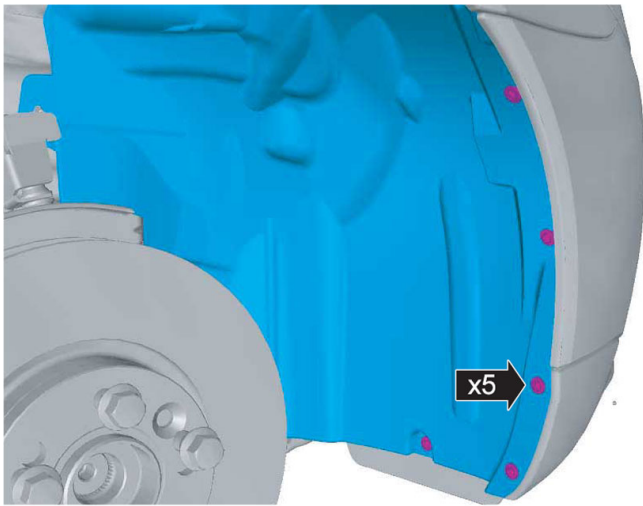


**Caution!** Make sure that the gaskets are correctly located.

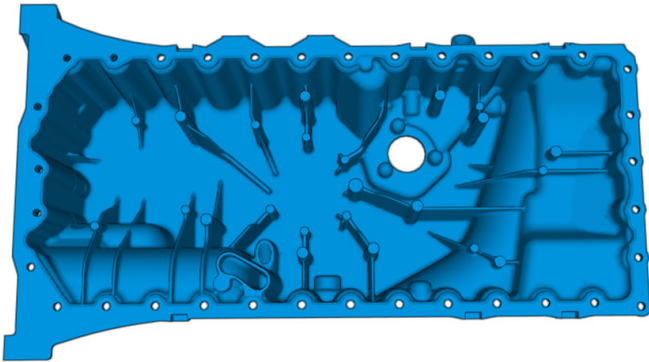


**Torque:**  
M6, 10 Nm (88.5 lbf-in or 7.4 lbf-ft)





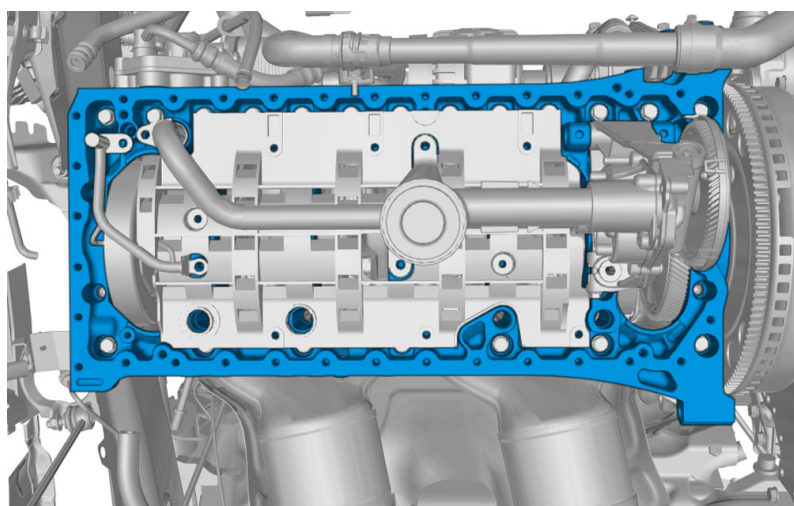
Install the right hand front wheel, refer to:  
Removal, replacement and installation  
7 - Springs and wheels  
77 - Wheels, tyres, hubs  
771 - wheel and wheel trim



**Caution! Make sure that the surface is clean and free of foreign material.**

**Use:** Gasket solution, 1161847

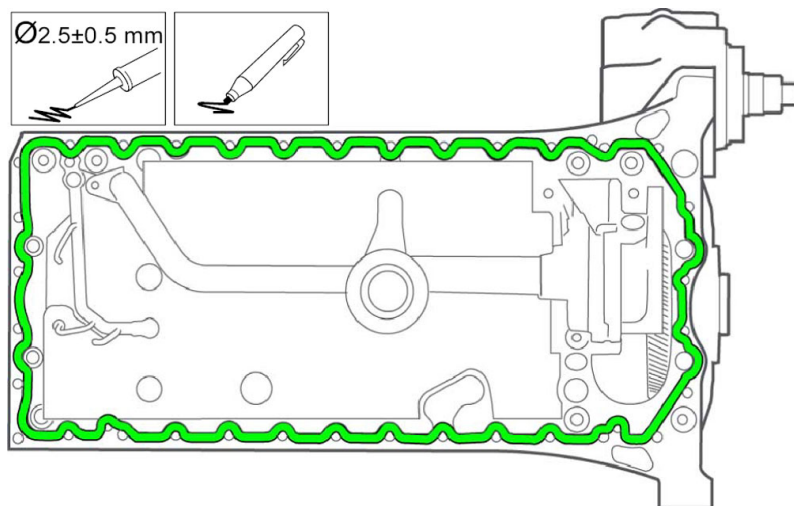
**Use:** Cleaning agent, 1161721



**Caution! Make sure that the surface is clean and free of foreign material.**

**Use:** Gasket solution, 1161847

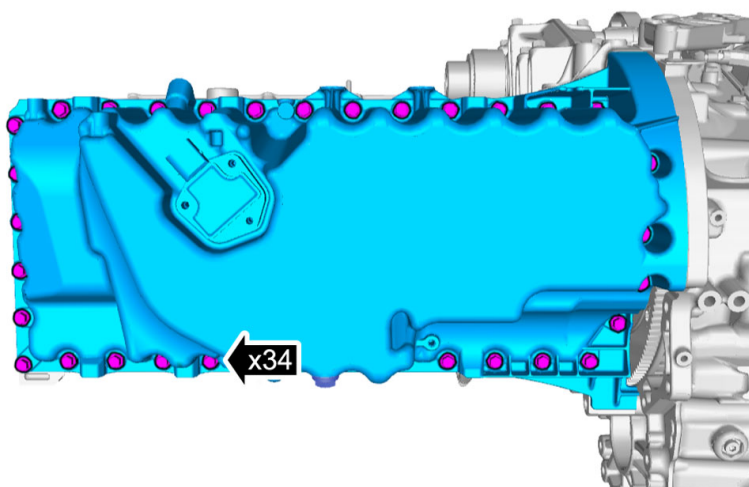
**Use:** Cleaning agent, 1161721



**Note! The component must be installed within 5 minutes of applying the sealant.**

Special Tool: T9997270, Template

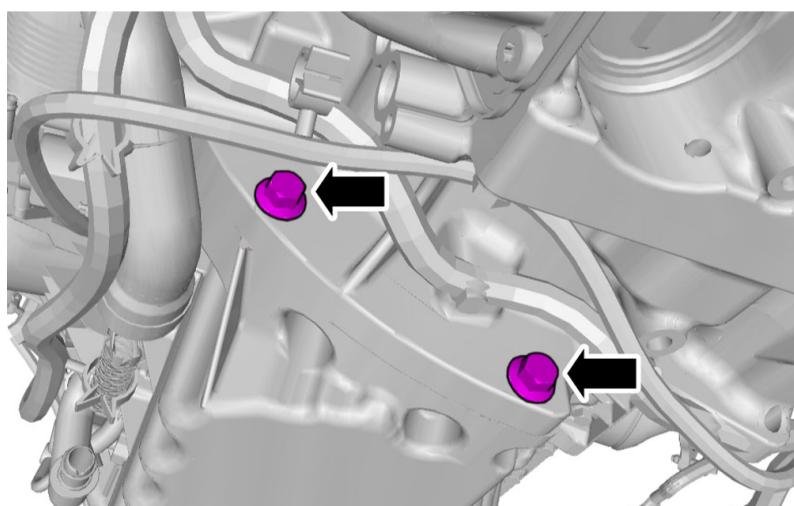
**Use:** Chemical gasket, 1161771



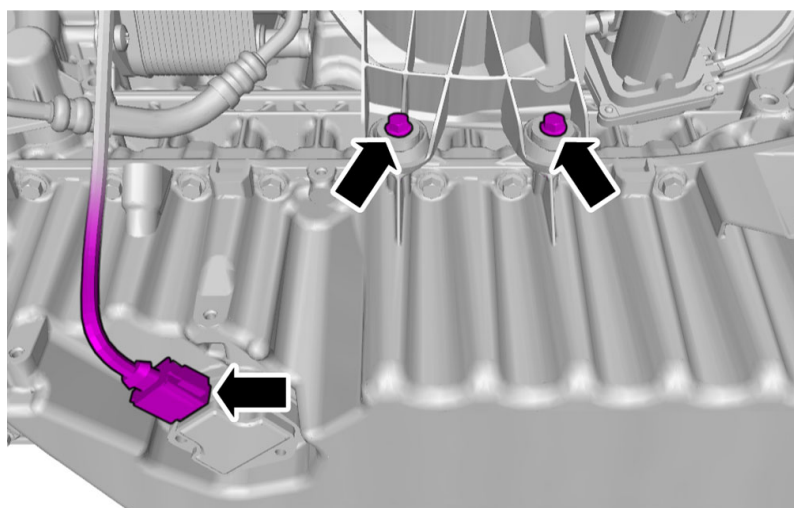
**Torque:**

M7, 17 Nm (150.5 lbf-in or 12.5 lbf-ft)

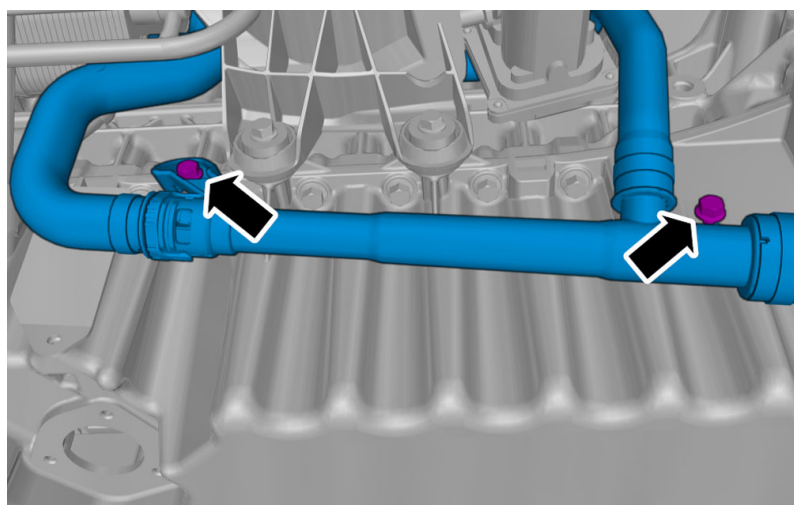
Special Tool: T9997273, Guide pin

**Torque:**

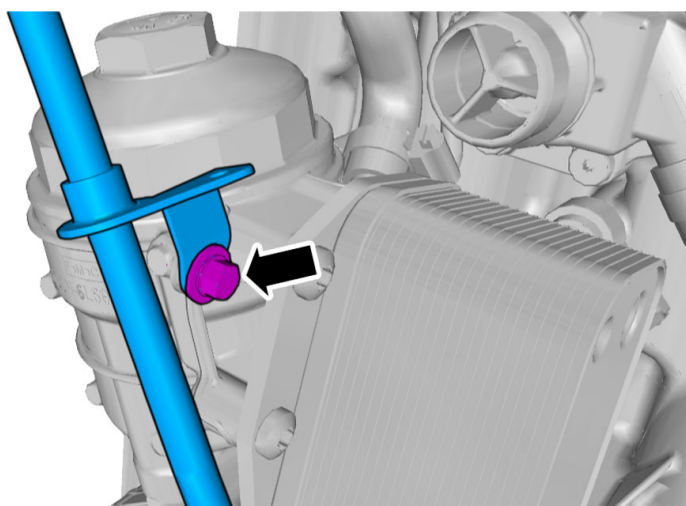
M10, 50 Nm (36.9 lbf-ft)

**Torque:**

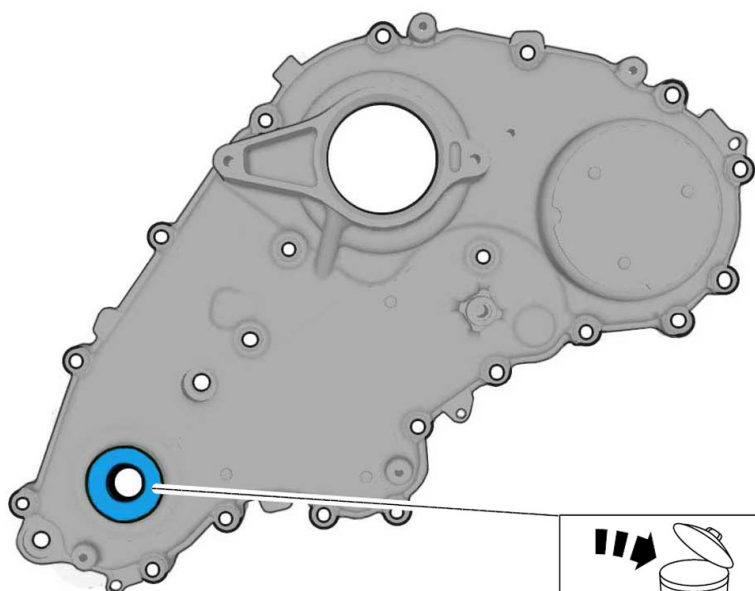
M6, 10 Nm (88.5 lbf-in or 7.4 lbf-ft)

**Torque:**

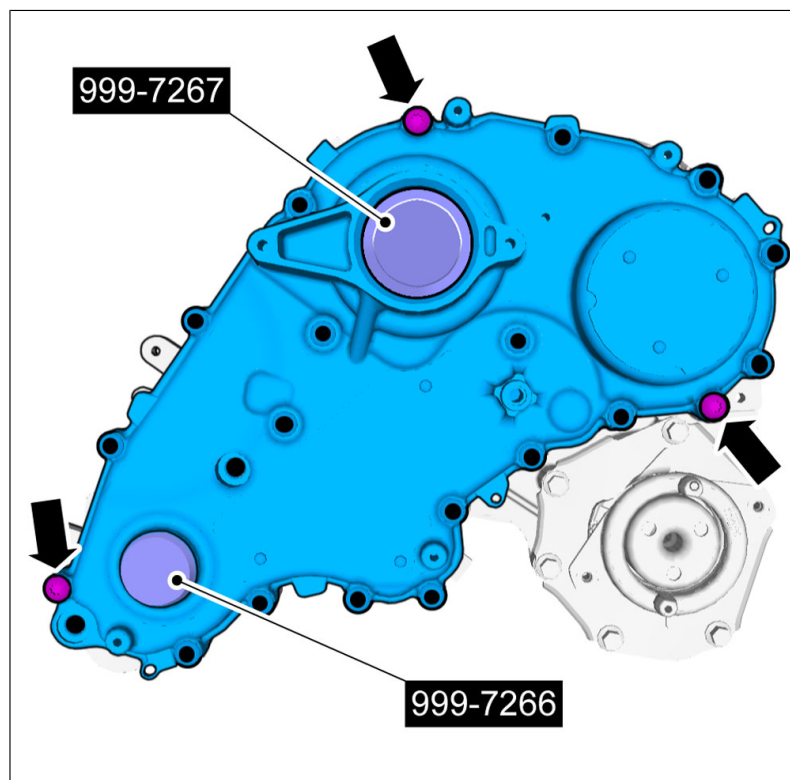
M6, 10 Nm (88.5 lbf-in or 7.4 lbf-ft)

**Torque:**

M6, 10 Nm (88.5 lbf-in or 7.4 lbf-ft)



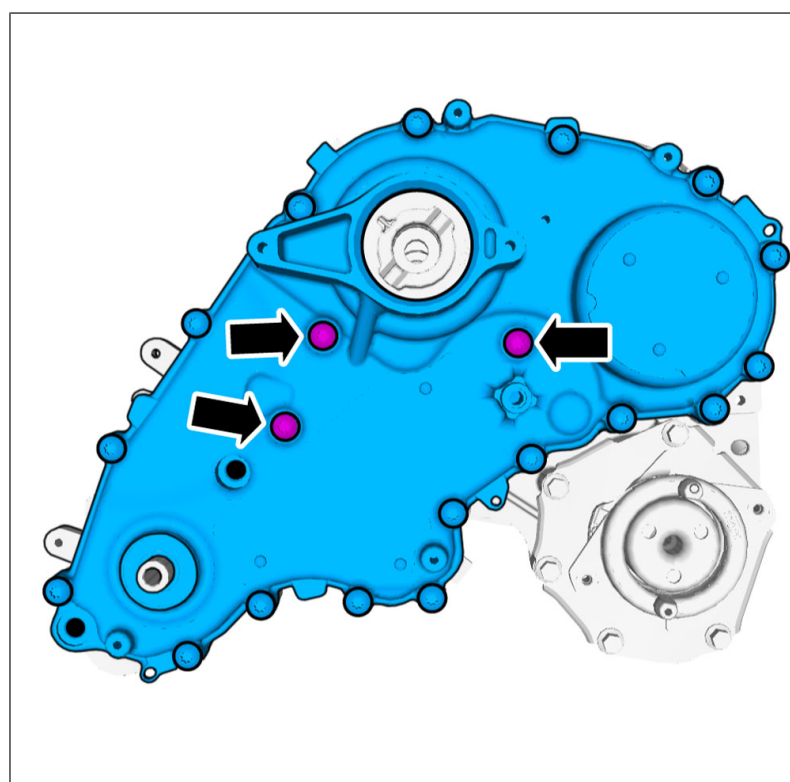




**Note! Only tighten the nut and bolts finger tight at this stage.**

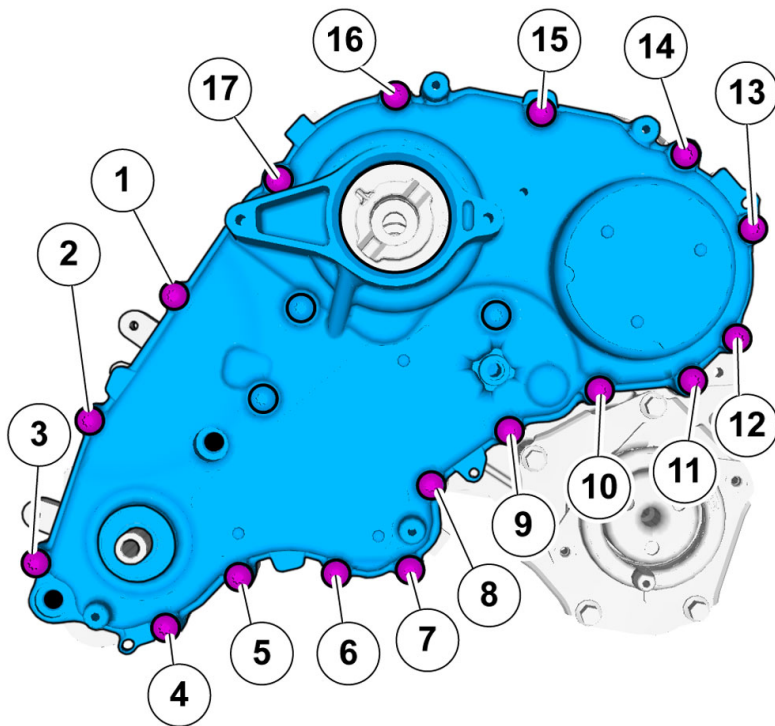
Special Tool: T9997266, Position sensor

Special Tool: T9997267, Position sensor

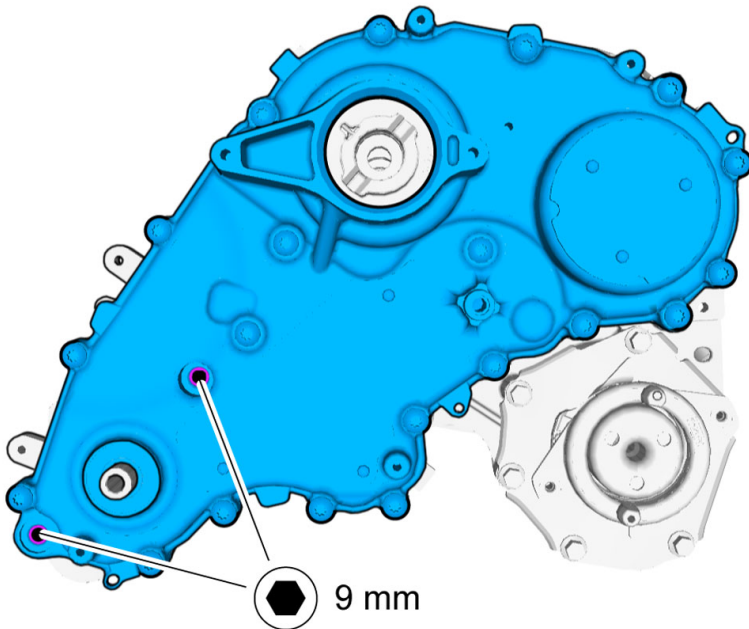


**Torque:**

M7, 17 Nm (150.5 lbf-in or 12.5 lbf-ft)

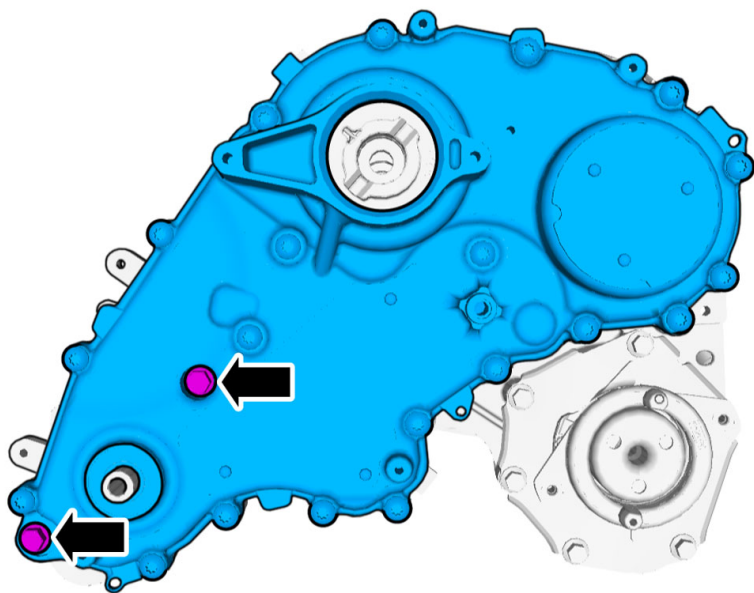
**Torque:**

M7, 17 Nm (150.5 lbf-in or 12.5 lbf-ft)

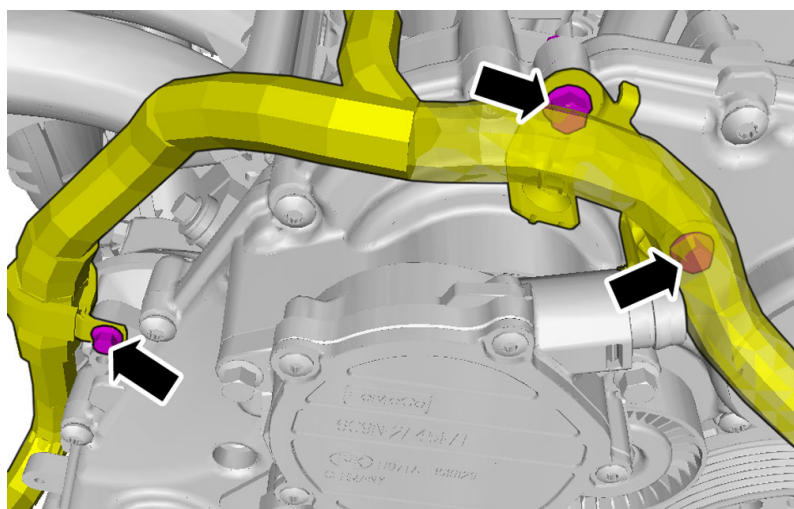
**Torque:**Inner timing cover, adjuster screw, 3 Nm  
(26.6 lbf-in or 2.2 lbf-ft)

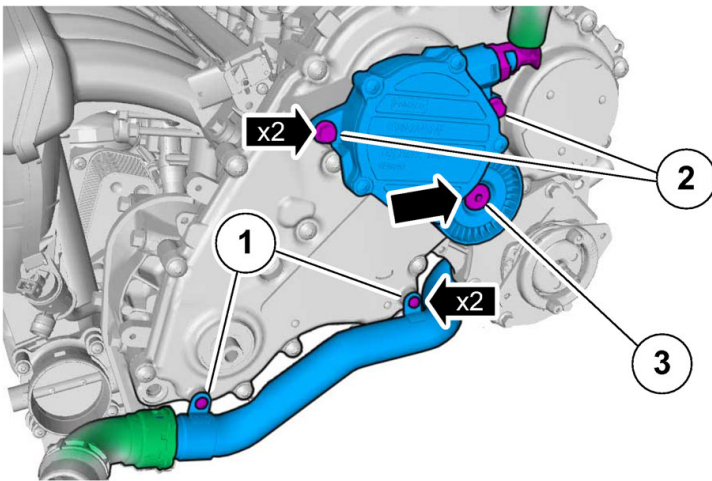
**Torque:**

M8, 24 Nm (17.7 lbf-ft)

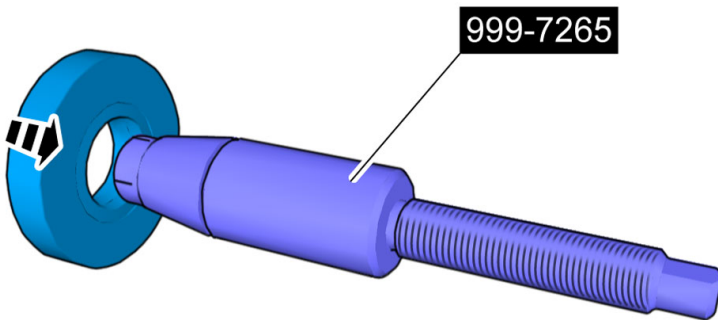
**Torque:**

M6, 10 Nm (88.5 lbf-in or 7.4 lbf-ft)

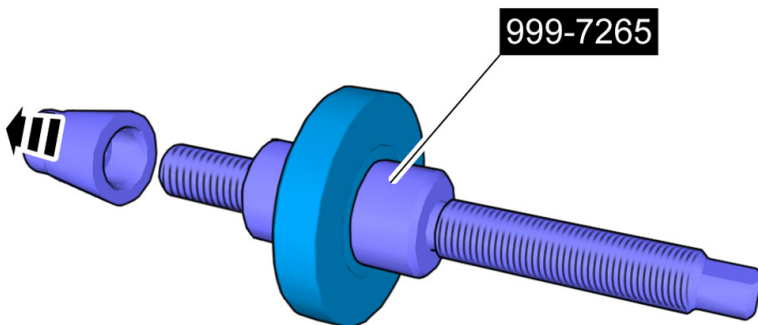


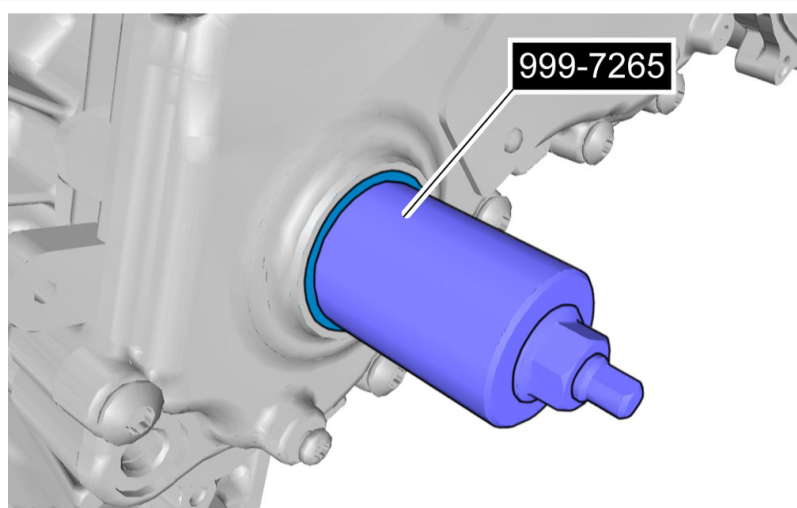


1. **Torque:**  
M6, 10 Nm (88.5 lbf-in or 7.4 lbf-ft)
2. **Torque:**  
M7, 17 Nm (150.5 lbf-in or 12.5 lbf-ft)
3. **Torque:**  
M8, 24 Nm (17.7 lbf-ft)

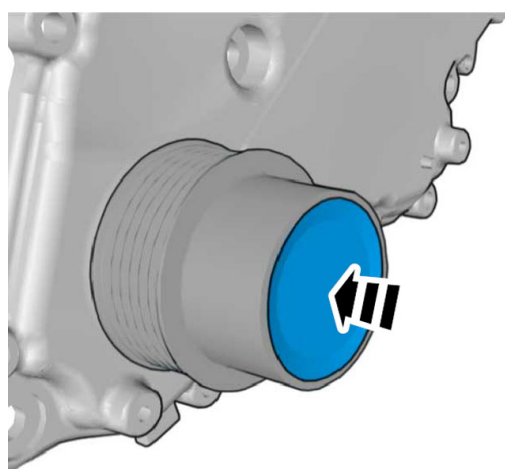
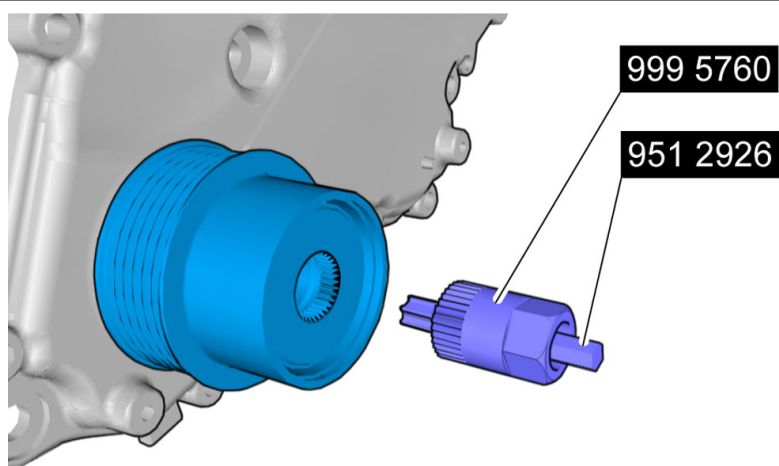


Special Tool: T9997265, Drift

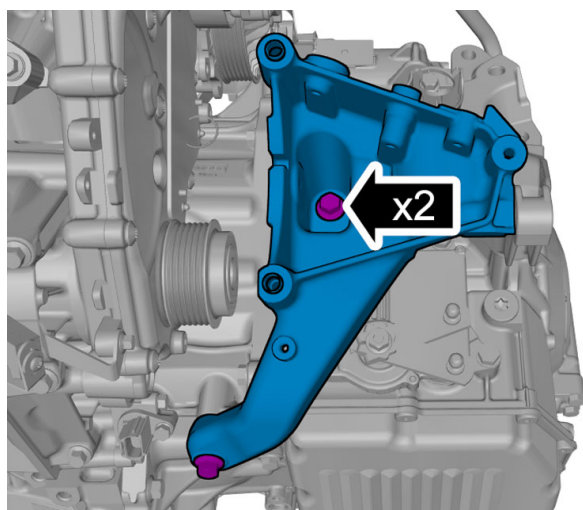
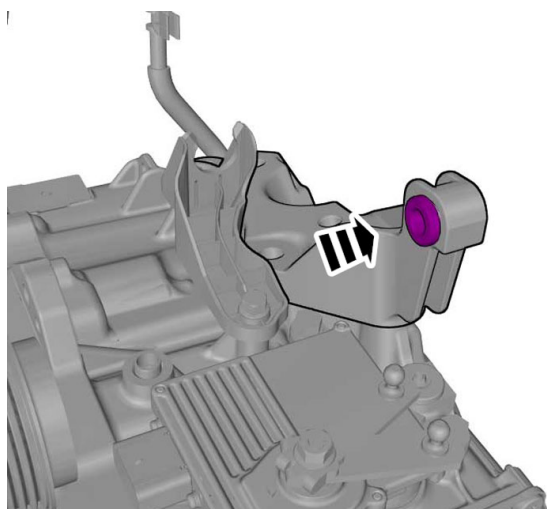




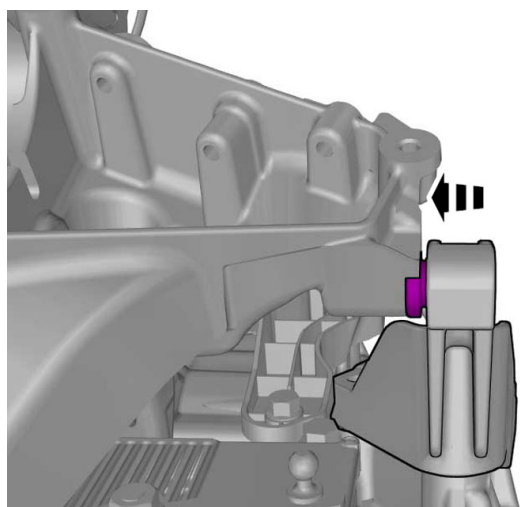
**Note!** Make sure that the seal is correctly located.





**Torque:**

M10, 50 Nm (36.9 lbf-ft)



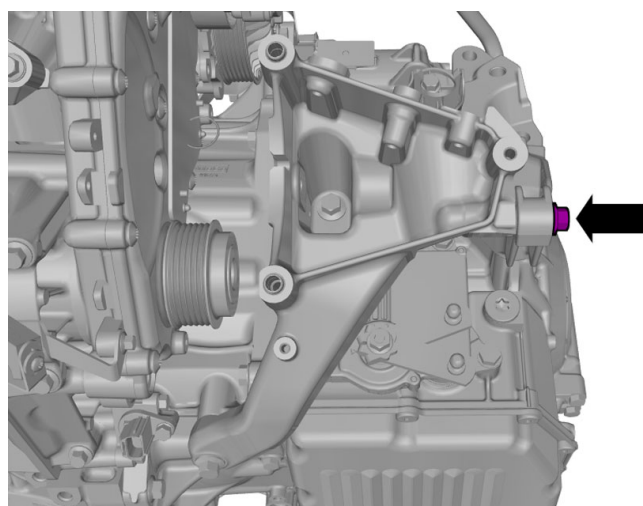
**Torque:** 2010 XC60 B6324S2, 2010 XC70 (08-)  
B6324S2, 2010 S80 (07-) B6324S2

Accessory Drive Component, adjusting  
screw, 4 Nm (35.4 lbf-in or 3.0 lbf-ft)

**Torque:** 2011 S80 (07-) B6324S4, 2011 XC70  
(08-) B6324S4, 2011 XC60 B6324S4

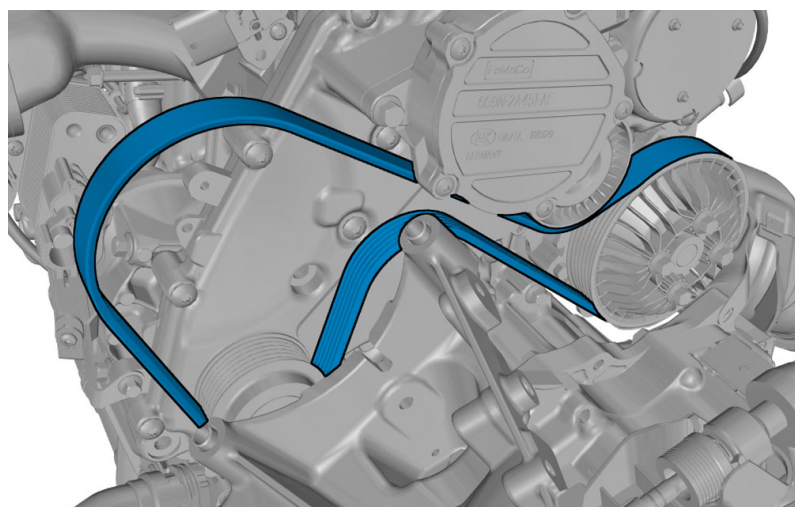
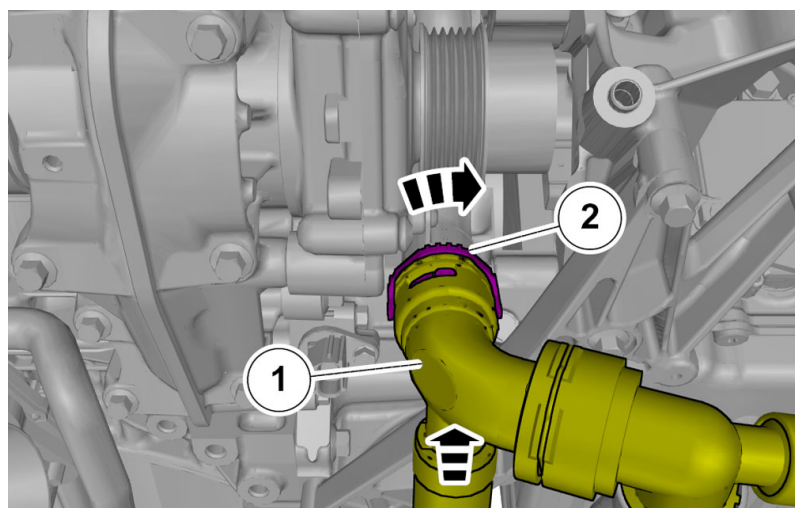
Accessory Drive Component, adjusting  
screw, 1 Nm (8.9 lbf-in)

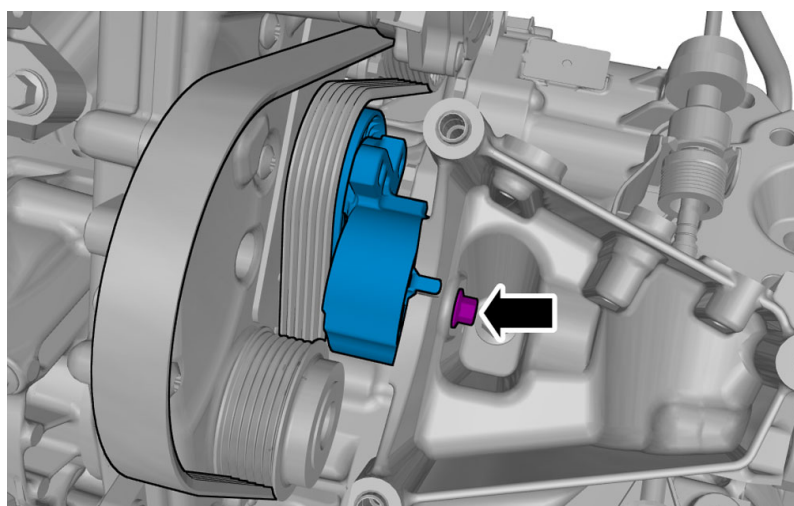
12



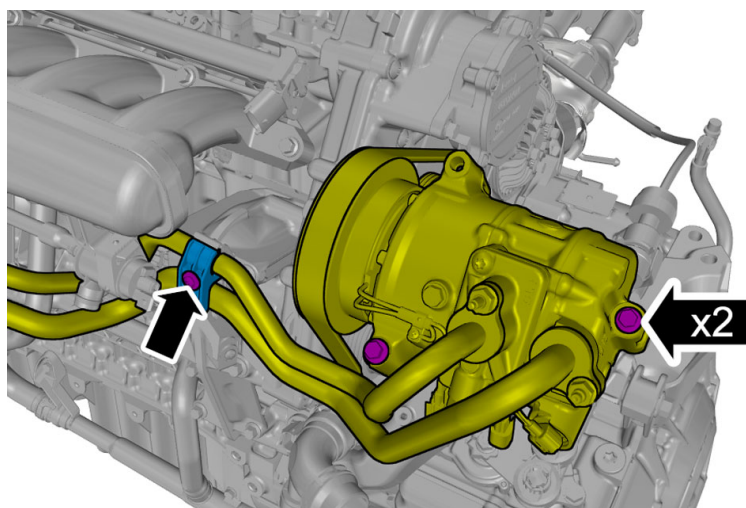
**Torque:**

M10, 50 Nm (36.9 lbf-ft)

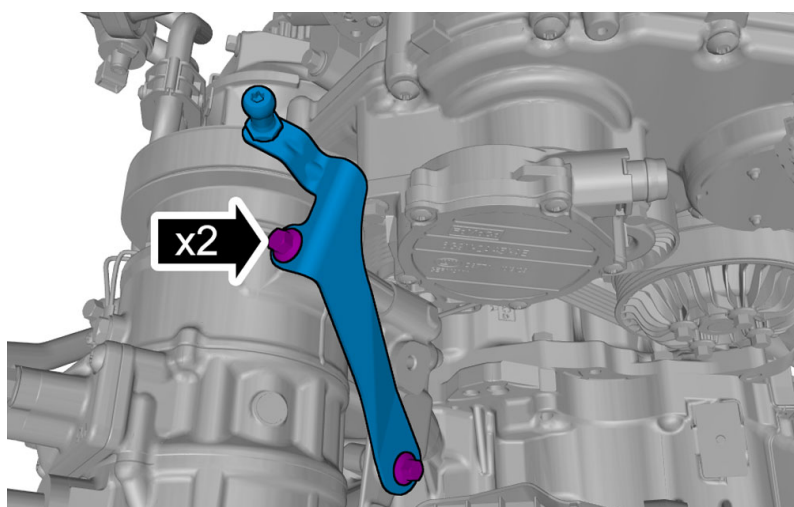


**Torque:**

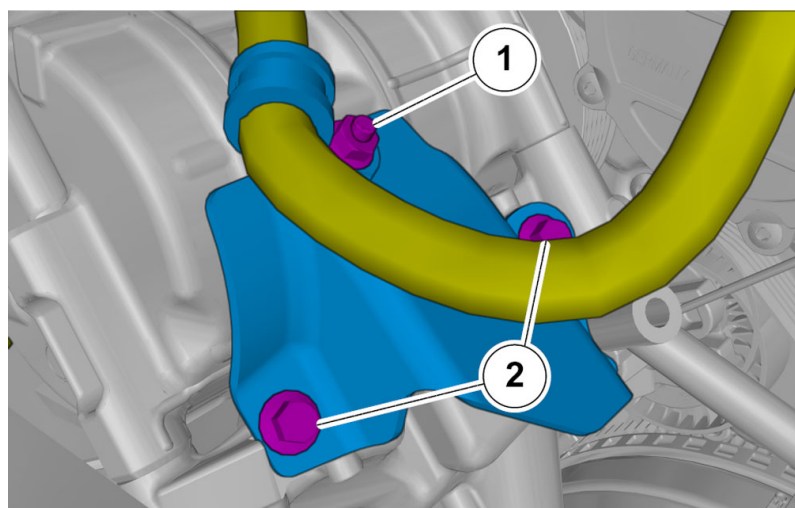
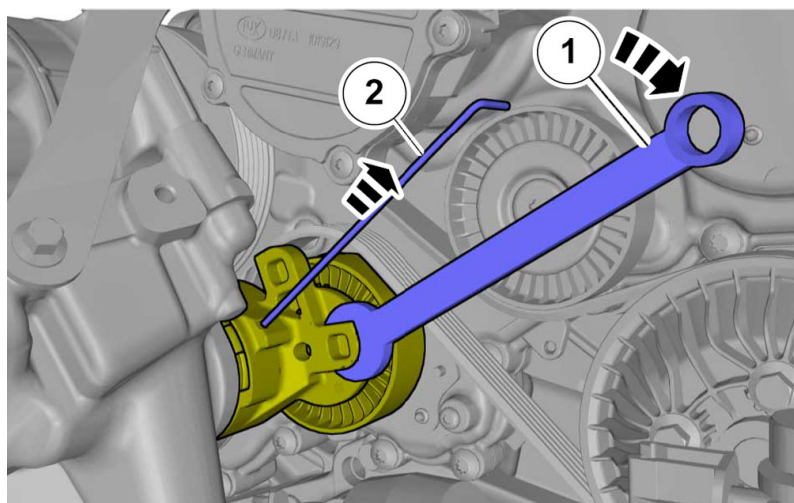
M8, 24 Nm (17.7 lbf-ft)

**Torque:**

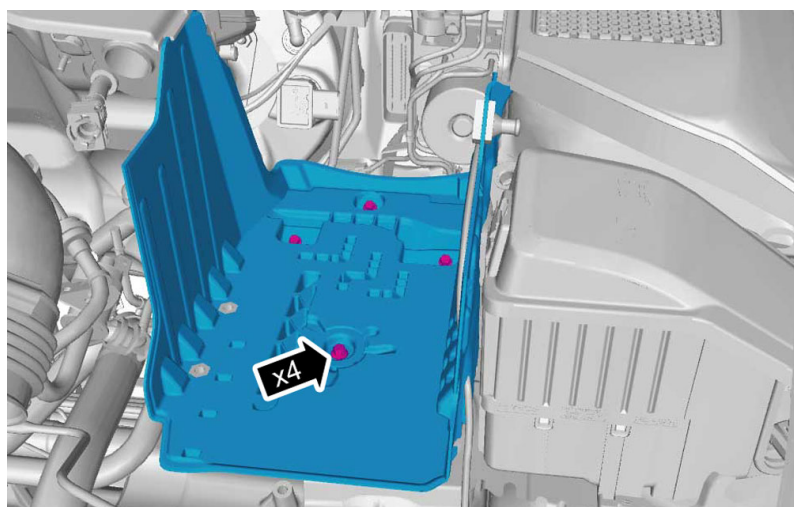
M8, 24 Nm (17.7 lbf-ft)

**Torque:**

M8, 24 Nm (17.7 lbf-ft)



1. **Torque:**  
M6, 10 Nm (88.5 lbf-in or 7.4 lbf-ft)
2. **Torque:**  
M8, 24 Nm (17.7 lbf-ft)





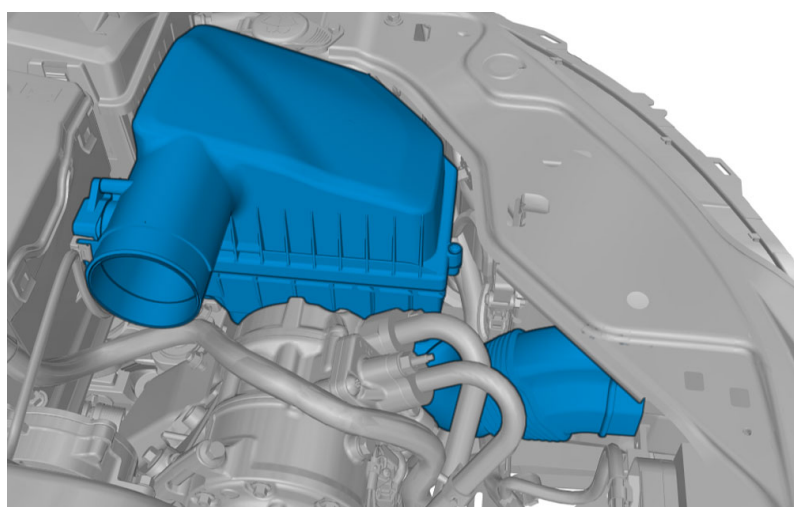
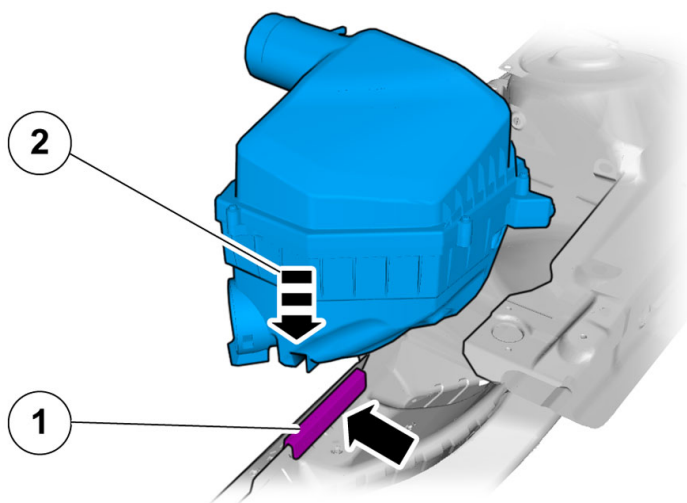
Install battery, refer to:

Removal, replacement and installation

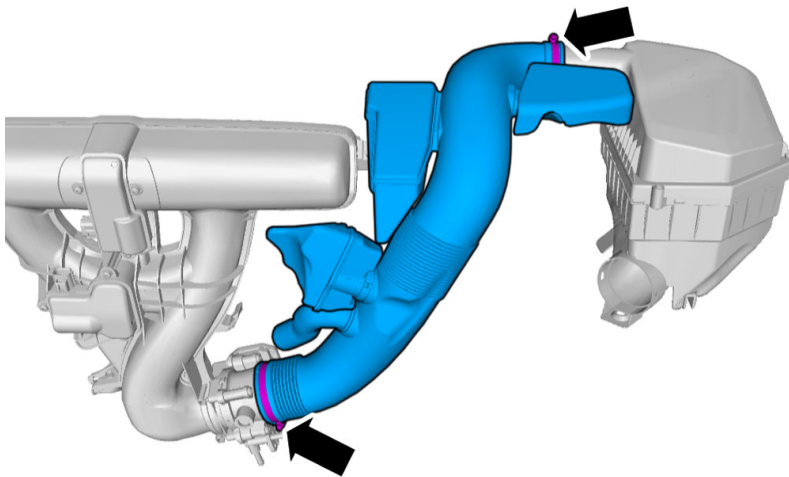
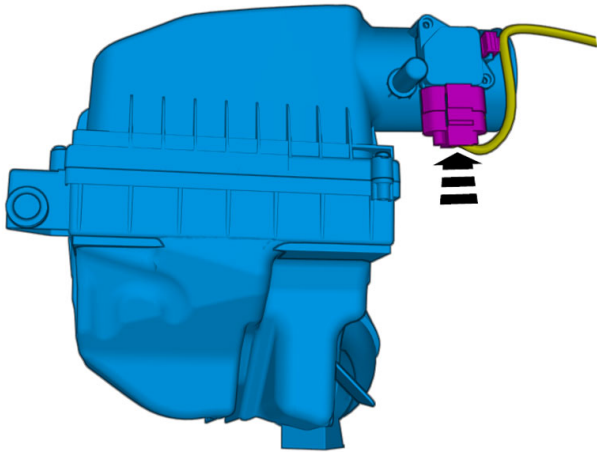
3 - Electrical system

31 - Battery and mounting

311 - battery







Fill cooling system, draining, filling, and bleeding, refer to:  
Cleaning, Inspection and Adjustment  
2 - Engine with mountings and equipment  
26 - Cooling system  
261 - radiator and connections

Top up the engine oil, refer to:  
Removal, replacement and installation  
2 - Engine with mountings and equipment  
22 - Lubricating and oil system  
220 - general