

Repair Manual Audi TT 2007 ➤

Engine Mechanical							
Engine ID	CEP B						

Edition 05.2011

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List of Workshop Manual Repair Groups

Repair Group

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- 15 - Cylinder Head, Valvetrain
- 17 - Lubrication
- 19 - Cooling System
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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

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00 – General, Technical Data

1 General Information

⇒ [“1.1 Clean Working Conditions”, page 1](#)

⇒ [“1.2 Contact Corrosion”, page 1](#)

⇒ [“1.3 Coolers, Condensers and Charge Air Coolers”, page 2](#)

⇒ [“1.4 Engine Contaminants”, page 2](#)

⇒ [“1.5 Engine Number”, page 2](#)

⇒ [“1.6 Lines, Routing and Securing”, page 2](#)

⇒ [“1.7 Safety Precautions”, page 3](#)

1.1 Clean Working Conditions

Even a little contamination can lead to faults. Observe the following guidelines for cleanliness when working on the fuel system, injection system and turbocharger:

- ◆ Before loosening, connections and surrounding areas must be cleaned thoroughly with engine or brake cleaner, and then cleaned area must be dried completely.
- ◆ Seal the open lines and connections immediately with clean plugs, for example, from the engine bung set -VAS 6122- .
- ◆ Place removed parts on a clean surface and cover them with lint-free cloths.
- ◆ Carefully cover over opened components or seal, if repairs are not performed immediately.
- ◆ Only install clean components: Remove the replacement parts from their packaging just prior to installing them. Do not use parts that have been stored out of their original packaging (for example in tool boxes etc.).
- ◆ If system is open, do not work with compressed air and do not move the vehicle.
- ◆ Make sure no fuel gets onto the fuel hoses. If necessary, wipe off the fuel hoses immediately.
- ◆ Protect the disconnected connectors from dirt and moisture and only connect when they are dry.

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1.2 Contact Corrosion

Contact corrosion can occur if incorrect fasteners (bolts, nuts, washers, etc.) are used.

For this reason, only connecting elements with a special surface coating are installed.

In addition, rubber or plastic parts and adhesive are made of materials that do not conduct electricity.

If you are not sure about the suitability of parts, install new parts. Refer to the Electronic Parts Catalog (ETKA).

**Note**

- ◆ Only original replacement parts are recommended, they are checked and compatible with aluminum.
- ◆ It is recommended to use Audi accessories.
- ◆ Damage resulting from contact corrosion is not covered by the warranty.

1.3 Coolers, Condensers and Charge Air Coolers

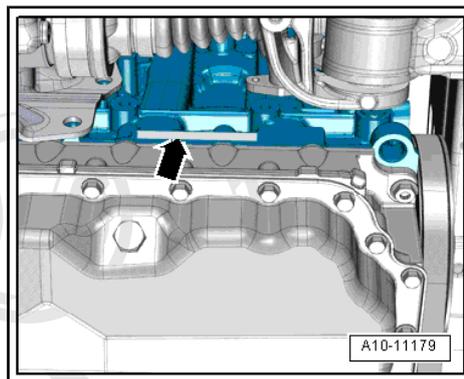
When assembled correctly, the radiator, condenser and turbocharger may have slight impressions on their fins. It is not damage. Do not replace the cooler, condenser or turbocharger because of impressions like that.

1.4 Engine Contaminants

- ◆ To prevent foreign objects from entering when working on the engine, seal open intake and exhaust channels with suitable plugs, for example from the engine bung set -VAS 6122- .

1.5 Engine Number

- ◆ The engine number ("engine codes" and "serial number") are found behind the joint for the cylinder block and upper oil pan section -arrow-.
- ◆ There is also a label located on the right timing chain cover with the "engine code" and "serial number".
- ◆ Engine codes beginning with "C" are four-digit.
- ◆ The first 3 digits of the engine code stand for displacement and the mechanical structure of the engine. They are stamped in the cylinder block, including the serial number.
- ◆ The fourth digit describes the engine output and torque and depends on the engine control module.

**Note**

- ◆ The 4-digit engine code is on the type plate, vehicle data label and Engine Control Module (ECM). protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.
- ◆ Locations of the type plate and vehicle data label. Refer to the Maintenance Procedures Rep. Gr. 03.

1.6 Lines, Routing and Securing

- ◆ Mark the individual fuel, hydraulic and vacuum lines for the EVAP canister system as well as the electrical wires before disconnecting and/or removing them. This will prevent a mix-up when reconnecting them. If necessary, draw sketches or take pictures.
- ◆ Due to the limited space inside the engine compartment, be especially careful when working near moving or hot parts. This will also prevent damaging the lines.

1.7 Safety Precautions

⇒ [“1.7.1 Before Opening High Pressure Fuel Injection System”, page 3](#)

⇒ [“1.7.2 Cooling System”, page 3](#)

⇒ [“1.7.3 Exhaust System”, page 3](#)

⇒ [“1.7.4 For Test Drives with the Use of Test and Measuring Devices”, page 4](#)

⇒ [“1.7.5 Fuel System”, page 4](#)

1.7.1 Before Opening High Pressure Fuel Injection System



WARNING

There is a risk of injury because the fuel is under very high pressure.

- ◆ *The injection system is separated into a high-pressure section (maximum approximately 140 bar) and a low-pressure section (approximately 6 bar).*
- ◆ *Before opening the high pressure area, fuel pressure must be reduced to a residual pressure of approximately 6 bar. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; General Information .*

1.7.2 Cooling System

Note the following when working on the cooling system:



WARNING

Risk of scalding due to hot steam and hot coolant.

- ◆ *The coolant system is under pressure when the engine is warm.*
- ◆ *Cover the coolant reservoir cap with a cloth and then open it slowly to release the pressure in the system.*

1.7.3 Exhaust System

Note the following when working on the exhaust system:



Caution

Danger of damaging the decoupling element.

- ◆ *Decoupling element must not be bent more than 10°.*
- ◆ *Do not load decoupling element on cable.*
- ◆ *Do not damage wire mesh at decoupling element.*

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1.7.4 For Test Drives with the Use of Test and Measuring Devices

If testing equipment must be used during a road test, observe the following:

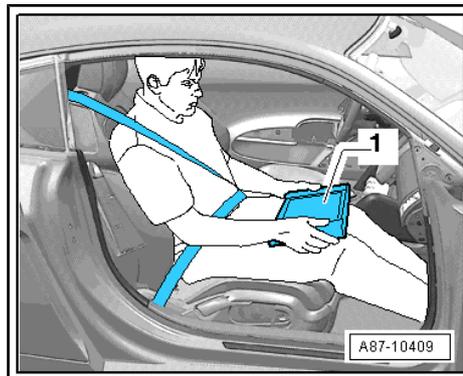


WARNING

Distraction and testing equipment that is not secured properly can cause accidents.

The passenger airbag could pose a risk if it deploys in a collision.

- *Operating testing equipment while driving causes it to shift position.*
- *There is an increased risk of injury due to unsecured testing equipment.*
- ◆ *Position passenger's seat as far back as possible.*
- ◆ *Only use the vehicle diagnosis and service system -VAS 5052 A- or diagnostic system -VAS 5053- .*
- ◆ *Testing and measuring instruments -1- must lay flat on the passenger's thighs and be operated by him or her, as shown in the illustration.*



1.7.5 Fuel System

Note the following when working on the fuel system:



WARNING

There is a risk of injury because the fuel is under very high pressure.

- ◆ *Reduce the fuel pressure down to residual pressure before opening high pressure area of the fuel injection system.*
- ◆ *To reduce remaining residual pressure, place a clean cloth around the connector and carefully loosen connector.*

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- Procedures before opening high pressure fuel injection system. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; General Information .

To prevent personal injury and damage to the injection and ignition system, observe the following:

- ◆ Turn off the ignition before disconnecting and connecting the wiring for the injection and ignition system. This includes tester cables as well.
- ◆ Only clean engine with ignition switched off.
- ◆ If any connectors were disconnected and when the engine was started, then malfunctions have been stored in the engine control module(s). "Generate readiness code" in "Guided Functions" using the vehicle diagnostic tester.



Caution

Risk of destroying electronic components when disconnecting the battery.

- ◆ ***Observe measures for disconnecting battery.***
- ◆ ***Only disconnect the battery with ignition switched off.***

- Disconnect the battery. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation .



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2 Specifications

⇒ "2.1 Engine Data", page 6

2.1 Engine Data

Identification codes	CEPB
Displacement liter	2,480
Output kW at RPM	265/5700 to 6300
Torque Nm at RPM	465/1750 to 5300
Bore diameter mm	82.5
Stroke mm	92.8
Compression ratio	10
RON at least	98 ¹⁾
Fuel injection and ignition system	Bosch Motronic
Ignition sequence	1-2-4-5-3
Exhaust gas recirculation	no
Exhaust temperature control	1 sensors
Turbocharger	Turbocharger
Knock control	2 sensors
Charge air cooler	yes
Oxygen sensor regulation	1 sensor before the catalytic converter 1 sensor after the catalytic converter
Variable valve timing	Intake Exhaust
Variable intake manifold	yes
Secondary Air Injection System	no
Valve per cylinder	4

• ¹⁾ Super unleaded RON 95 is permissible, although with reduced power.

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3 Diagnosis and Testing

⇒ ["3.1 Fuel System, Checking for Leaks", page 7](#)

⇒ ["3.2 Vacuum System, Checking", page 7](#)

3.1 Fuel System, Checking for Leaks

- Let the engine run for a few minutes at a moderate speed.
- Turn off the ignition.
- Check the entire fuel system for leaks.
- If there are leaks in spite of correct tightening specifications, the corresponding component must be replaced.
- Then perform a road test and depress the accelerator pedal all the way at least one time.
- Then check the high pressure area again for leaks.

3.2 Vacuum System, Checking

Special tools and workshop equipment required

- ◆ Hand Vacuum Pump -VAS 6213-

Procedure

- Check all vacuum lines in the vacuum system for:
 - ◆ Cracks
 - ◆ Damage caused by animals
 - ◆ Crimps
 - ◆ Leaks
- Check the vacuum line leading to and from the solenoid valve.
- If there is a fault stored in the Diagnostic Trouble Code (DTC) memory, check the vacuum lines for the named component, but also check all the vacuum lines.
- If using the -VAS 6213- does not produce any vacuum or if the vacuum drops again right away, then check the hand vacuum pump and the connection hoses for leaks.



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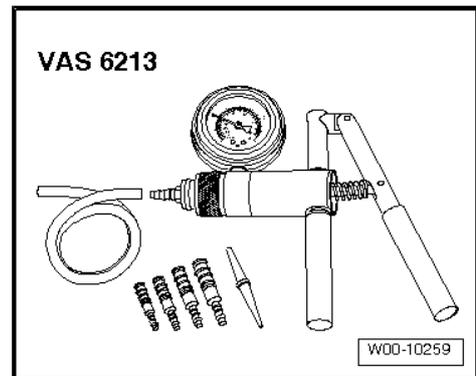
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4 Special Tools

Special tools and workshop equipment required

- ◆ Hand Vacuum Pump -VAS 6213-



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10 – Engine Assembly

1 Description and Operation

⇒ [“1.1 Subframe Overview”, page 9](#)

⇒ [“1.2 Subframe Mount, Adjusting”, page 10](#)

1.1 Subframe Overview

1 - Bolt

- Replace
- 40 Nm plus an additional 90° turn

2 - Bolt

- Replace
- 40 Nm plus an additional 90° turn

3 - Bolt

- Replace
- 40 Nm plus an additional 90° turn

4 - Bracket

- For the EVAP canister

5 - Bolt

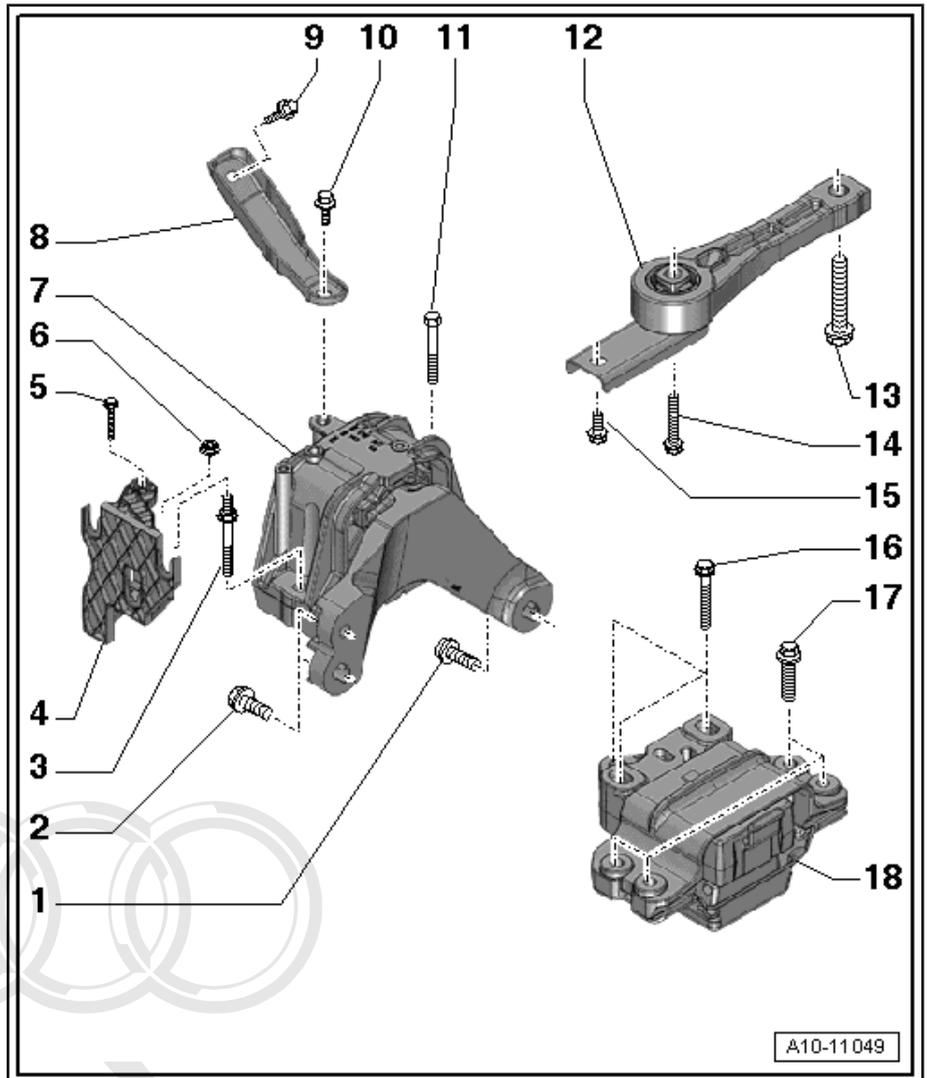
- Tightening specification
⇒ [Item 11 \(page 178\)](#)

6 - Nut

- 8 Nm

7 - Engine Mount

- Adjustment, checking, refer to
⇒ [“3.1 Subframe Mount, Checking Adjustment”, page 15](#)
- Adjusting, refer to
⇒ [“1.2 Subframe Mount, Adjusting”, page 10](#)
- Removing and installing, refer to
⇒ [“4.5 Engine Mount”, page 41](#)



8 - Bracket

9 - Bolt

- Replace
- 20 Nm plus an additional 90° turn

10 - Bolt

- Replace
- 20 Nm plus an additional 90° turn

11 - Bolt

- Replace
- 40 Nm plus an additional 90° turn

12 - Pendulum Support

- ❑ Removing and installing, refer to ⇒ Manual Transmission; Rep. Gr. 34 ; Removal and Installation

13 - Bolt

- ❑ Tightening specification, refer to ⇒ Manual Transmission; Rep. Gr. 34 ; Description and Operation

14 - Bolt

- ❑ Tightening specification, refer to ⇒ Manual Transmission; Rep. Gr. 34 ; Description and Operation

15 - Bolt

- ❑ Tightening specification, refer to ⇒ Manual Transmission; Rep. Gr. 34 ; Description and Operation

16 - Bolt

- ❑ Tightening specification, refer to ⇒ Manual Transmission; Rep. Gr. 34 ; Description and Operation

17 - Bolt

- ❑ Tightening specification, refer to ⇒ Manual Transmission; Rep. Gr. 34 ; Description and Operation

18 - Transmission Mount

- ❑ Adjustment, checking, refer to ⇒ [“3.1 Subframe Mount, Checking Adjustment”, page 15](#)
- ❑ Adjusting, refer to ⇒ [“1.2 Subframe Mount, Adjusting”, page 10](#)
- ❑ Removing and installing, refer to ⇒ Manual Transmission; Rep. Gr. 34 ; Removal and Installation

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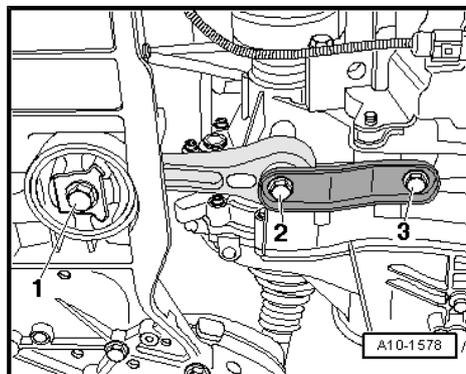
1.2 Subframe Mount, Adjusting

Special tools and workshop equipment required

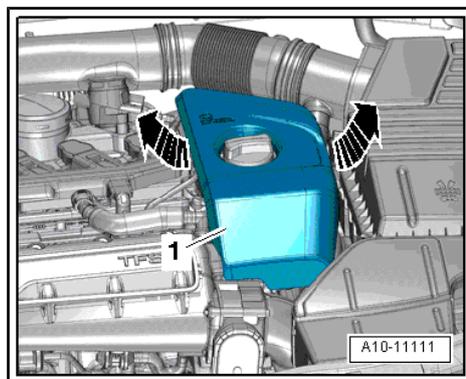
- ◆ Engine Support Bridge -10 - 222 A-
- ◆ Special Hook -10 - 222 A /20-
- ◆ Gauge -T40226-
- ◆ Spindle -10 - 222 A /11-

Procedure

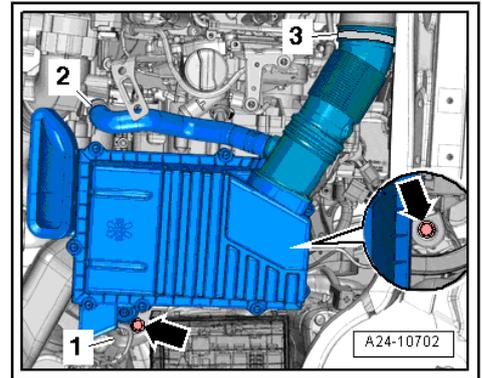
- Loosen the bolts -1, 2 and 3- for the pendulum support (about 1 turn), do not remove.



- Remove the engine cover -1- upward -arrows-.



- Remove the air filter housing, refer to => Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .

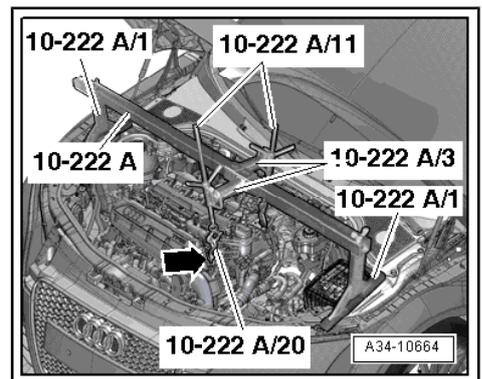


- Attach the -10 - 222 A- to the upper edge of the web plate as shown in the illustration.
- One -10 - 222 A /11- is in front, another is behind.

 **WARNING**

There is the risk of an accident.

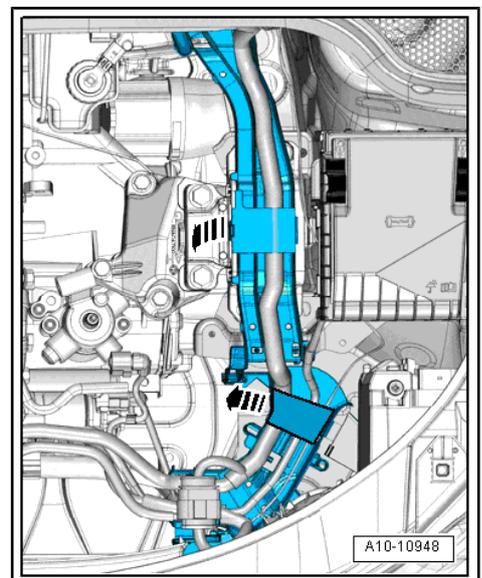
◆ *Lifting hooks and alignment pin on lifting tackle must be secured with securing pin -arrow-.*



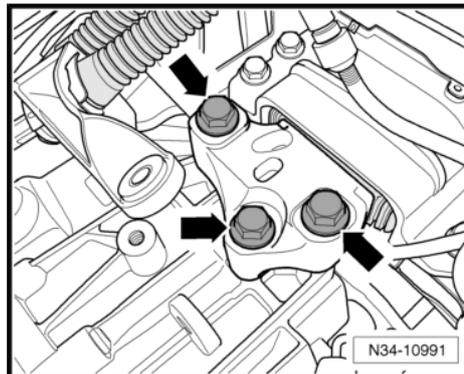
- Attach the front -10 - 222 A /11- and -10 - 222 A /20- to the front left engine lifting eye.
- Attach the rear -10 - 222 A /11- to the left engine lifting eye.
- Lightly tension spindle.
- The engine must hang in the installed position and the sub-frame mount must not be loaded.

Vehicles with a Manual Transmission:

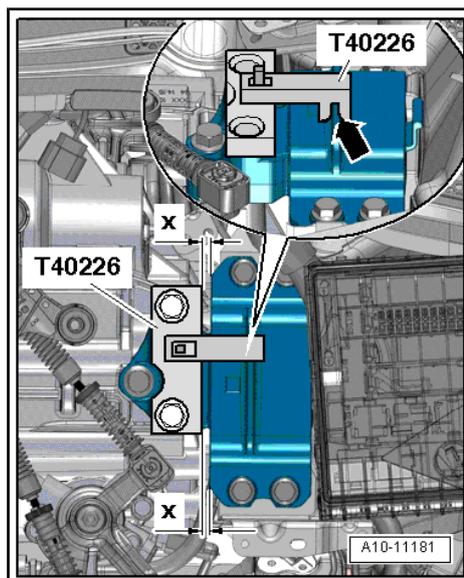
- Open wiring router bracket -arrows-.
- Cut the cable ties and push the cables aside.
- Remove the wiring guide.



- Remove the bolts -arrows- for the transmission mount.
- Replace all 3 bolts one after another and install them until they are in position.



- Attach and tighten the -T40226- to the bolt head for the left transmission mount.
- Lock the bridge for the -T40226- on the casting edge -arrow- for the transmission as shown in the illustration.
- Bring the engine/transmission sub-assembly free of tension into the installed position and shake the engine to align it.
- The gap between the socket wrench and the transmission mount must be the same distance in the front and rear.
- Dimension -x- rear = dimension -x- front (parallel) or
- Dimension -x- rear = dimension -x- front = "0" (without gap).

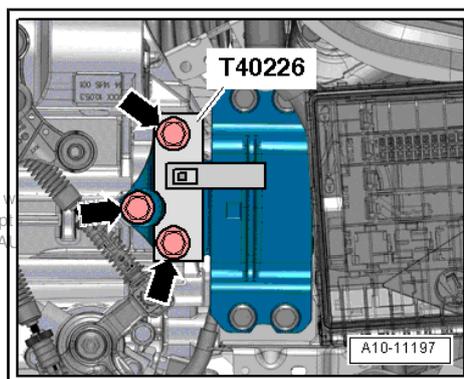
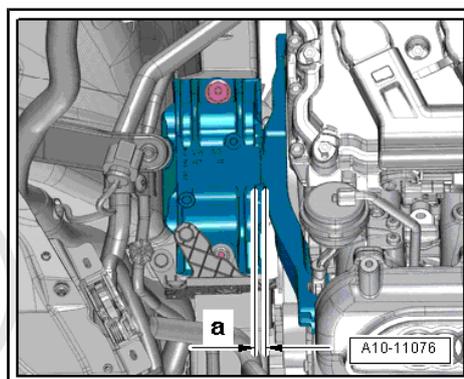


- Check the installed position on the engine mount:
- There must be a distance -a- = at least 9 mm from the support arm to the engine mount.

 **Note**

The dimension -a- can be checked for example using a 9 mm diameter drill bit.

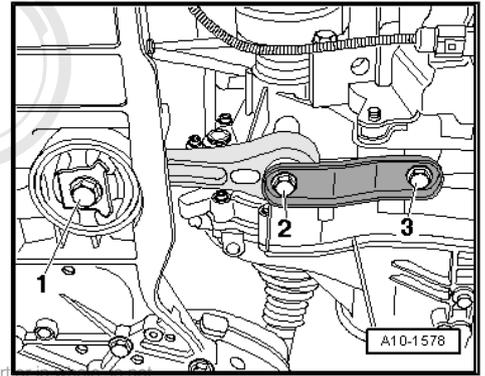
- If necessary, move the engine/transmission sub-assembly to the side.
- Tighten the bolts -arrows- for the transmission mount of the previously installed -T40226-. Refer to ⇒ Manual Transmission; Rep. Gr. 34 ; Description and Operation .



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Install in reverse order, paying attention to the following:

- Tighten bolts -1, 2 and 3- for the pendulum support. Refer to ⇒ Manual Transmission; Rep. Gr. 34 ; Description and Operation .
- Install the air filter housing. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .



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2 Specifications

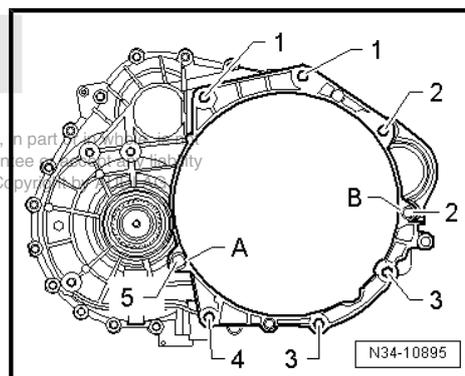
⇒ "2.1 Fastener Tightening Specifications", page 14

2.1 Fastener Tightening Specifications

Components	Fastener Size	Nm
Bracket For the EVAP Canister ¹		
-Bolt ²	-	40 + 90°
-Nut	-	8
Bracket for Engine Mount ²		
Engine Mount ²	-	40 + 90°
Bolts/nuts		
	M6	10
	M7	15
	M8	22
	M10	40
	M12	65
<ul style="list-style-type: none"> • ¹ For bolt tightening clarification, refer to ⇒ "1.1 Subframe Overview", page 9 and see items -3 and 5- • ² Replace 		

Manual Transmission on the Engine

Item	Bolt	Nm
1	M12x65	80
2	Starter securing. Refer to ⇒ Electrical Equipment, Rep. Gr. 27 Removal and Installation	
3	M10x65	40
4	M10x75	40
5 ¹⁾	M12x95	80
A, B	Alignment sleeves for centering	
<ul style="list-style-type: none"> • ¹⁾ Install in transmission from engine side. 		



3 Diagnosis and Testing

⇒ **“3.1 Subframe Mount, Checking Adjustment”, page 15**

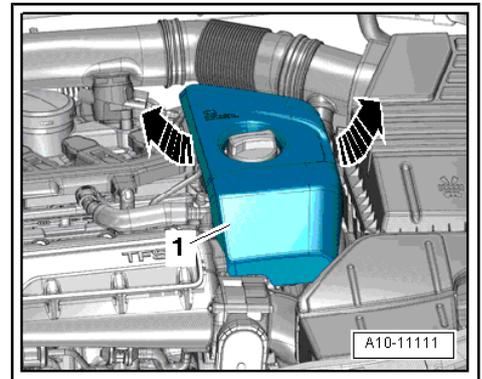
3.1 Subframe Mount, Checking Adjustment

Special tools and workshop equipment required

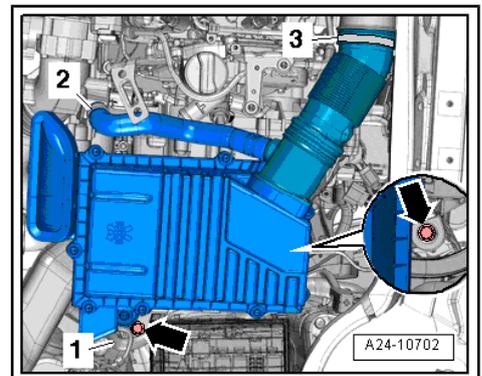
- ◆ Gauge -T40226-

Procedure

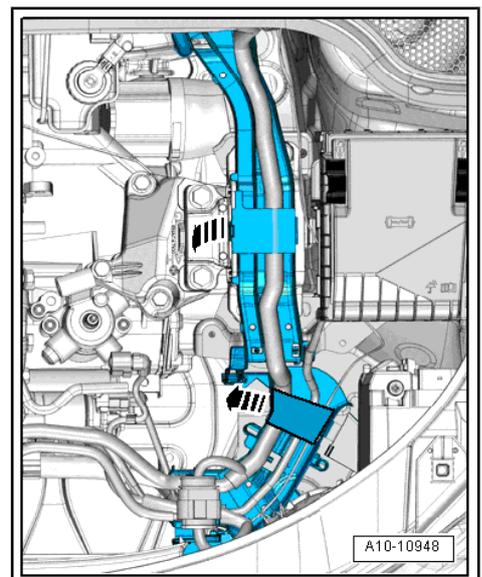
- Remove the engine cover -1- upward -arrows-.



- Remove the air filter housing, refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .



- Open wiring router bracket -arrows-.
- Cut the cable ties and push the cables aside.
- Remove the wiring guide.

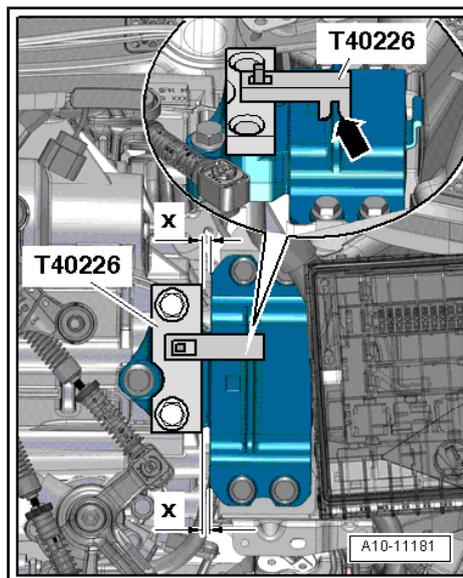


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- Attach and tighten the -T40226- to the bolt head for the left transmission mount.
- Lock the bridge for the -T40226- on the casting edge -arrow- for the transmission as shown in the illustration.
- The gap between the socket wrench and the transmission mount must be the same distance in the front and rear.
- Dimension -x- rear = dimension -x- front (parallel) or
- Dimension -x- rear = dimension -x- front = "0" (without gap).



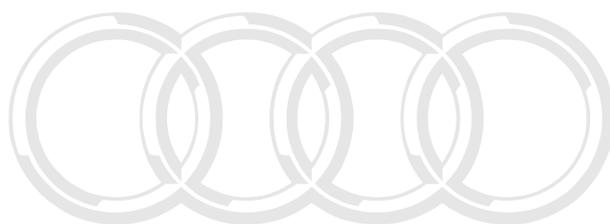
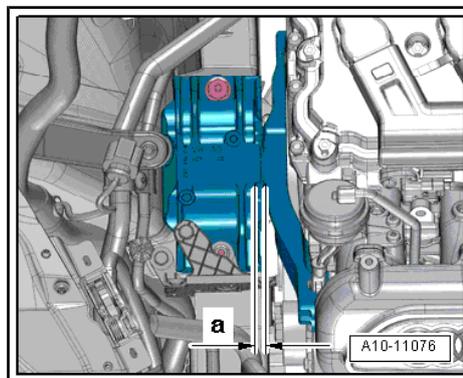
- Check the installed position on the engine mount:
- There must be a distance -a- = at least 9 mm from the support arm to the engine mount.



Note

The dimension -a- can be checked for example using a 9 mm diameter drill bit.

- If it is measured to be a smaller distance, adjust the subframe mount, refer to => ["1.2 Subframe Mount, Adjusting", page 10](#) .



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4 Removal and Installation

⇒ [“4.1 Engine, Removing”, page 17](#)

⇒ [“4.2 Engine and Manual Transmission, Separating”, page 34](#)

⇒ [“4.3 Engine, Securing to Engine and Transmission Holder”, page 36](#)

⇒ [“4.4 Engine, Installing”, page 37](#)

⇒ [“4.5 Engine Mount”, page 41](#)

4.1 Engine, Removing

Special tools and workshop equipment required

- ◆ Pry Lever - Rmv Outside Mirror -80 - 200-
- ◆ Hose Clamps Up to 25 mm Dia. -3094-
- ◆ Engine/Transmission Jack -V.A.G 1383 A-
- ◆ Step Ladder -VAS 5085-
- ◆ Engine Bung Set -VAS 6122-
- ◆ Drip Tray for VAS 6100 -VAS 6208-
- ◆ Hose Clip Pliers -VAS 6362-
- ◆ Engine Holder Bracket -T03000-

Procedure



Note

- ◆ *The engine is removed downward together with the transmission.*
- ◆ *During installation, cable ties must be installed at the same location.*
- ◆ *Wire routing and mounting in the engine compartment. Refer to ⇒ [“1.6 Lines, Routing and Securing”, page 2](#).*



WARNING

There is a risk of injury because the fuel is under very high pressure.

- ◆ *Reduce the fuel pressure down to residual pressure before opening high pressure area of the fuel injection system.*

- Reduce fuel pressure in high pressure area. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; General Information .

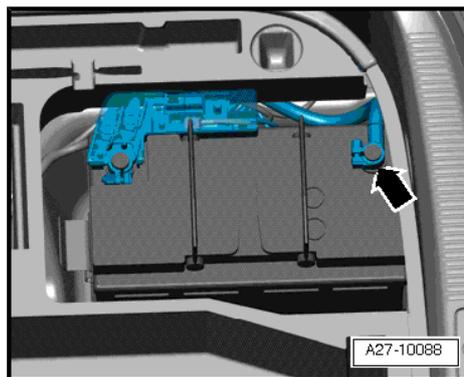


Caution

Risk of destroying electronic components when disconnecting the battery.

- ◆ *Observe measures for disconnecting battery.*

- With the ignition switched off, disconnect the battery Ground (GND) -arrow-. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation .

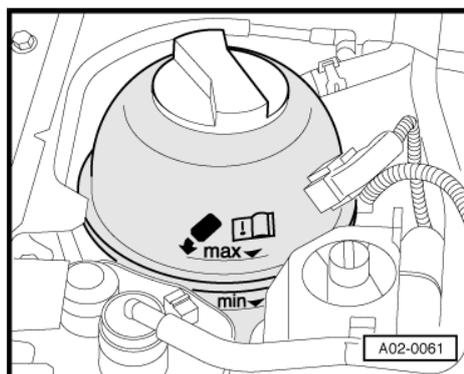


WARNING

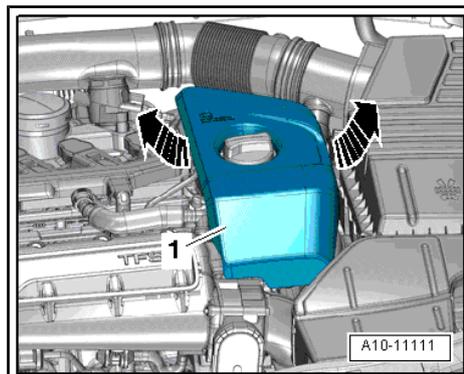
Risk of scalding due to hot steam and hot coolant.

- ◆ *The coolant system is under pressure when the engine is warm.*
- ◆ *Reduce pressure by covering coolant reservoir cap with a cloth and carefully opening.*

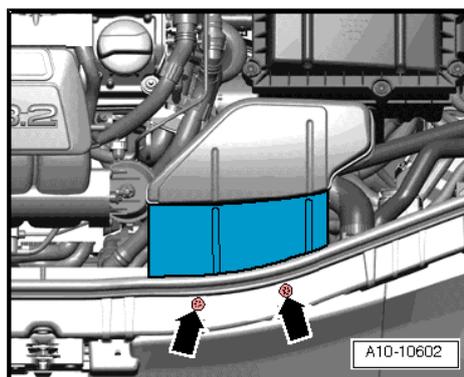
- Open the coolant reservoir cap.
- Remove the engine cover -1- upward -arrows-.



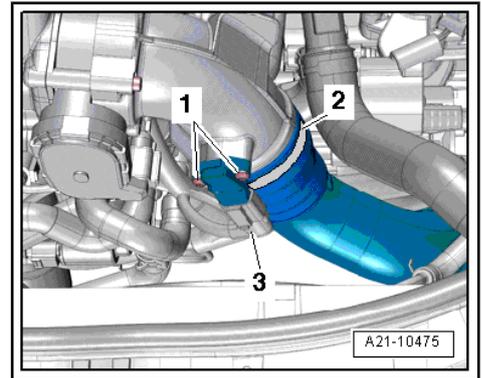
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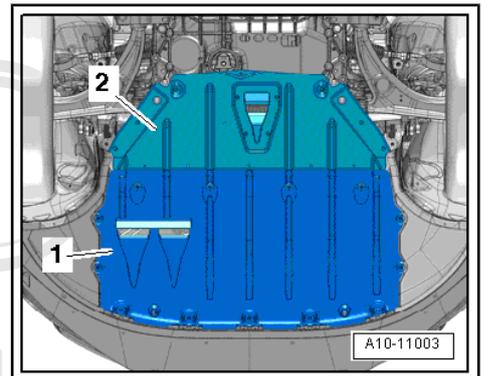
- Remove the bolts -arrows- and air guide.



- Disconnect the connector -3-.
- Remove the bolts -1-, then remove the charge air pressure sensor -G31- / Intake Air Temperature (IAT) sensor 2 -G299- .
- Loosen the hose clamp -2-.

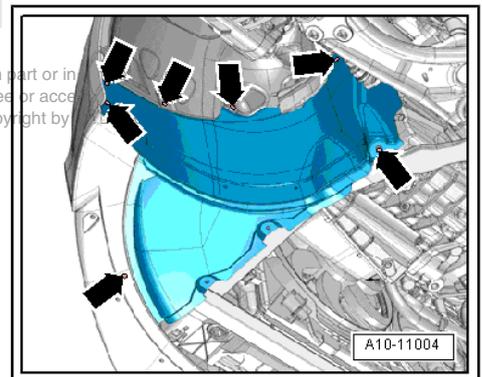


- Remove the front wheels. Refer to ⇒ Wheel and Tire Guide; Rep. Gr. 44 ; Removal and Installation .
- Remove the front noise insulation -1-. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Removal and Installation .

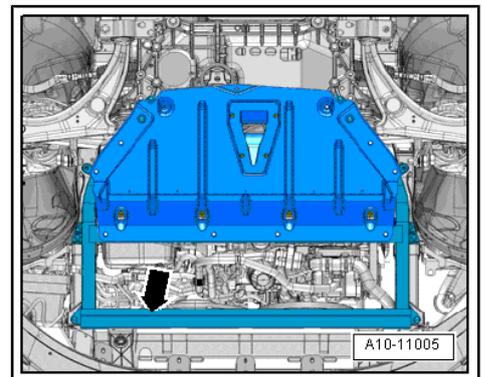


- Remove left and right lower wheel housing liners. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Removal and Installation .

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- Remove the noise insulation frame -arrow- and the rear noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 50 ; Removal and Installation .



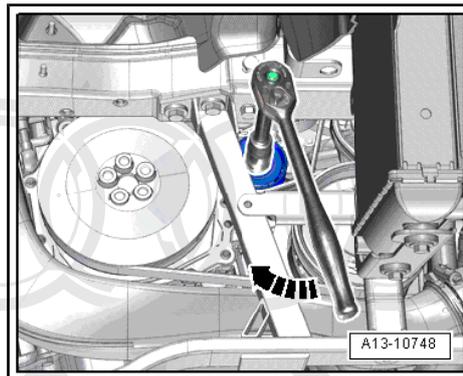


Caution

Risk of destroying due to reversed running direction on a used ribbed belt.

- ◆ *Before removing A/C compressor ribbed belt, marking running direction with chalk or felt-tip pen for reinstallation later.*

- Pivot the tensioner clockwise -arrow- to release the tension on the ribbed belt.
- Remove the A/C compressor ribbed belt, release the tensioner.

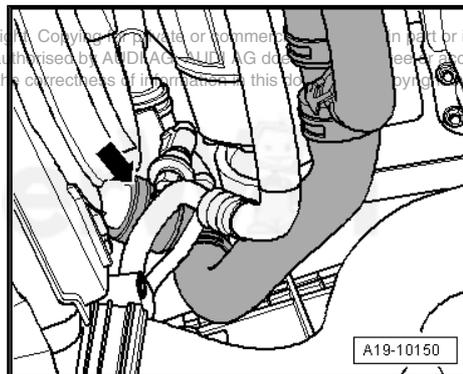


Note

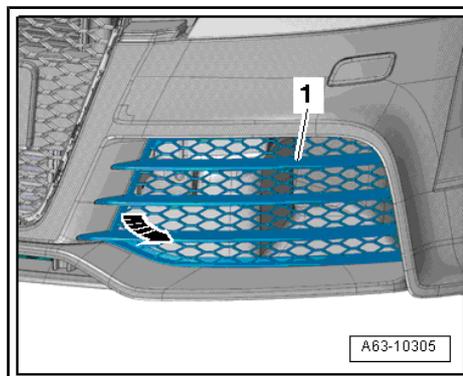
Collect escaping coolant in a clean container for disposal or reuse.

- Place the -VAS 6208- under the separating point.
- Open the clamp, drain the coolant and then remove the lower coolant hose -arrow- from the radiator.

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- Remove the air intake grille -1- from the bumper cover -arrow- and remove.

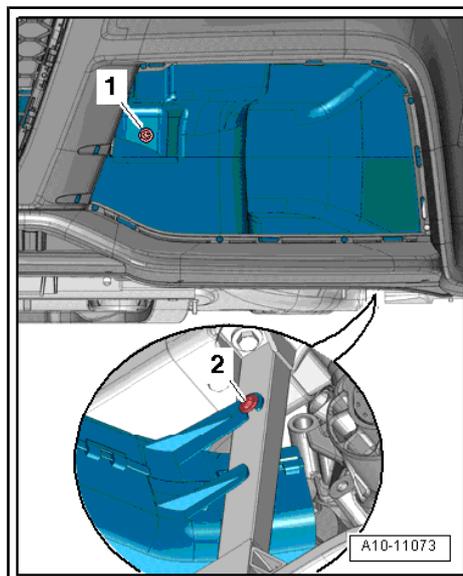


- Remove the bolt -arrows- and air guide.

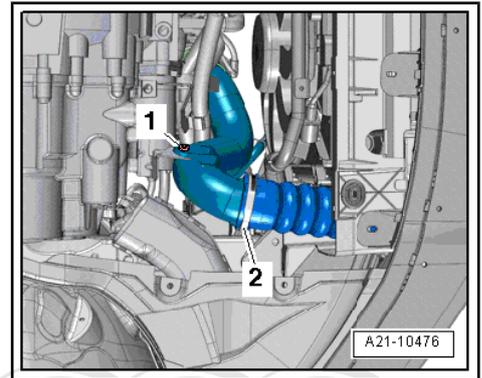


Note

Ignore -2-.



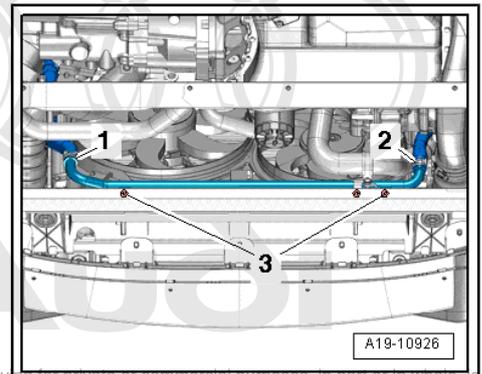
- Remove the bolt -1-.
- Remove the air guide pipe; to do this, loosen the hose clamp -2-.



- Place the -VAS 6208- under the separating point.
- Remove coolant hoses -1 and 2- in order to loosen the hose clamp, then drain the coolant.

i Note

Ignore -3-.



- Disconnect the radiator fan connector -2-.
- Remove the bolts -3-.

! WARNING

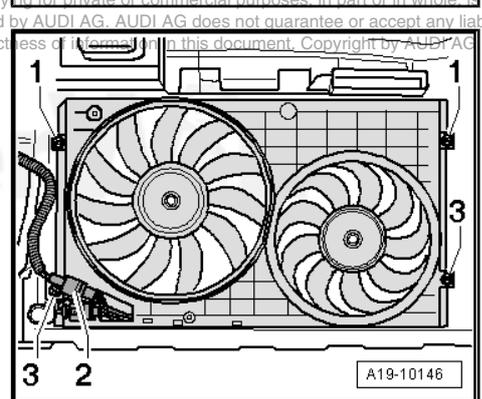
Risk of injury from fuel.

◆ *To reduce fuel pressure, lay cloths around connecting point before opening fuel system and carefully loosen.*

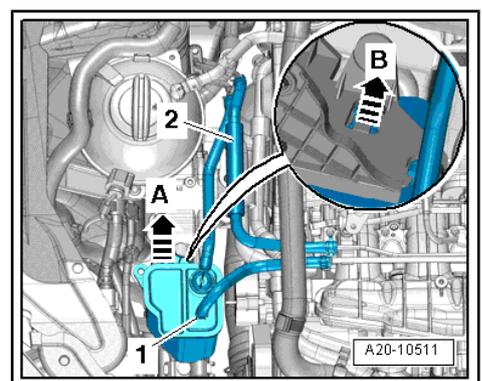
! Caution

Danger of defects caused by dirt.

◆ *Follow the guidelines for cleanliness when working on the fuel supply system. Refer to ⇒ "1.1 Clean Working Conditions", page 1 .*



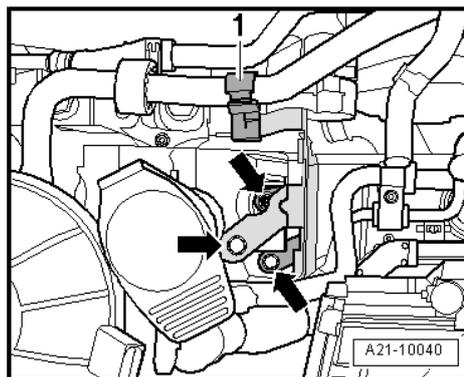
- Remove the fuel supply line mount, then remove the heat shield boot -2- from the fuel supply line at the separating point.
- Disconnect the fuel supply line in order to pull the release ring.
- Seal any open lines and connections with a clean plug from the engine bung set -VAS 6122- .
- Remove the hose -1- from the EVAP canister.
- Release the EVAP canister -B arrow-, remove it upward -A arrow- and lay it aside.



- Remove the bolts -arrows- and the EVAP canister bracket.

 **Note**

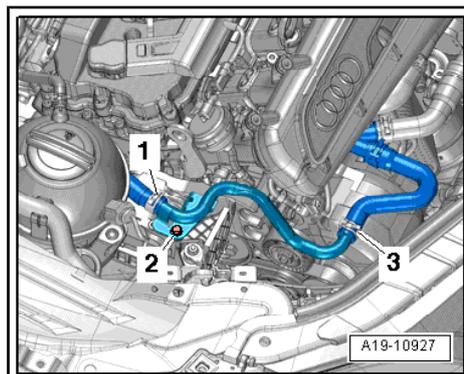
Ignore -1-.



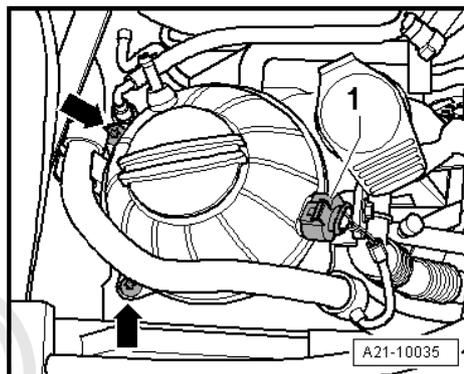
- Loosen the clamp -3- and remove the coolant hose.
- Hold the coolant hose downward and drain the coolant.

 **Note**

Ignore -1 and 2-.



- Disconnect the connector -1- for the engine coolant level warning switch -F66- .
- Remove the bolts -arrows- and set the coolant reservoir and the right coolant pipe to the side.

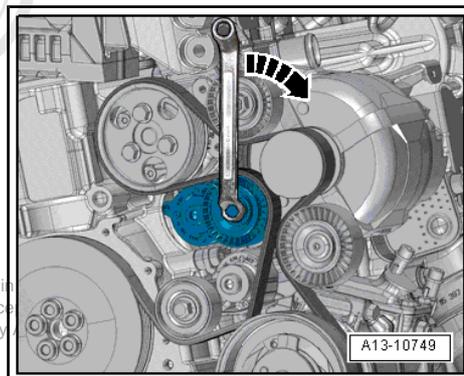


 **Caution**

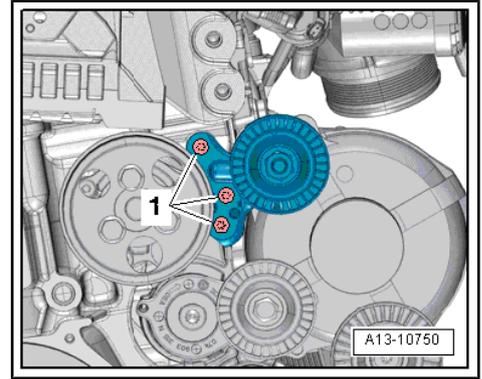
Risk of destroying due to reversed running direction on a used ribbed belt.

- ◆ **Before removing generator ribbed belt and coolant pump, mark running direction with chalk or felt-tip pen for reinstallation later.**

- Pivot the tensioner clockwise -arrow- to release the tension on the ribbed belt.
- Remove the generator ribbed belt and coolant pump and then release the tensioner.



- Remove the bolts -1- and remove the idler roller.

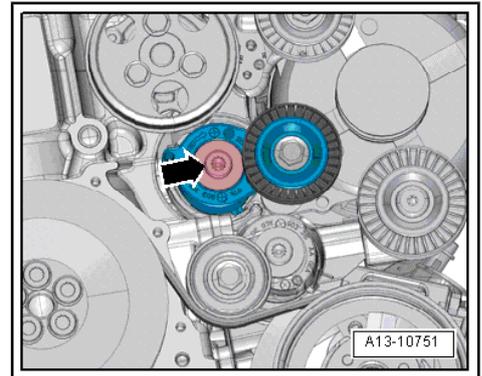


- Remove the bolt -arrow- and release the tensioner.



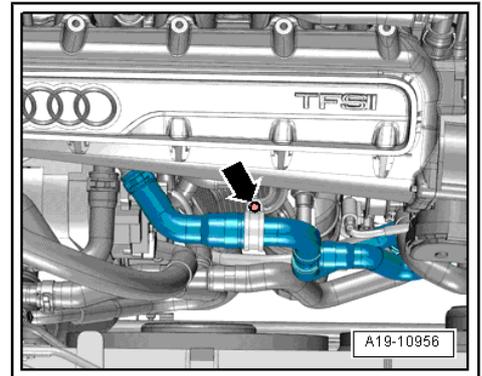
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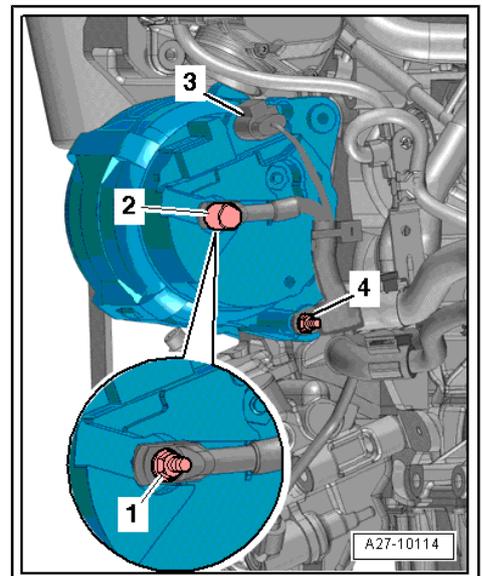


- Remove the bolt -arrow- on the retaining clamp.

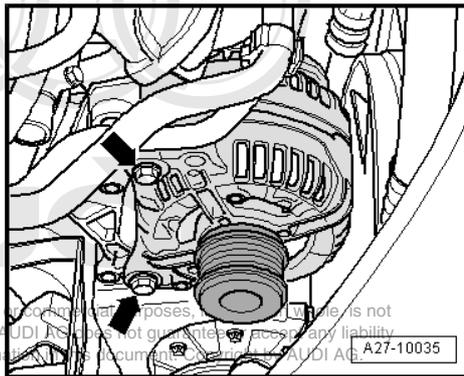
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- Disconnect the connector -3- from the generator.
- Remove the cap -2- and remove the nut -1- for the terminal 30/B+.
- Remove the nut -4- and remove the wire clamp.



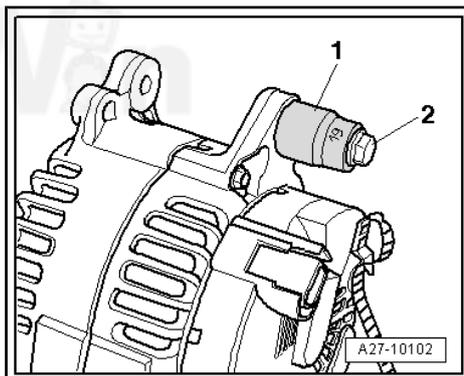
- Remove the bolts -arrows- and remove the generator upward.



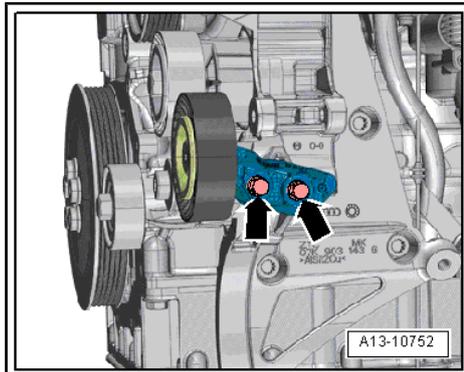
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 **Note**

- ◆ If the generator is connected to the mount, position the 1/2 14 mm socket -1- in the bushing.
- ◆ Turn the bolt M8x45 -2- in the bushing and pull the bushing from out of the generator by turning the bolt.



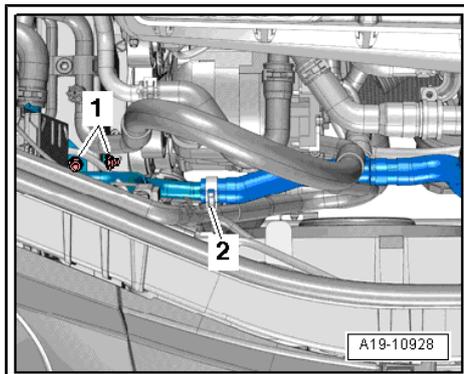
- Remove the bolts -arrows- and remove the idler roller.



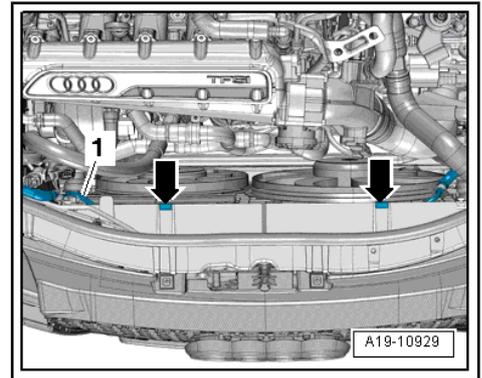
- Loosen the clamp -2- and remove the coolant hose.

 **Note**

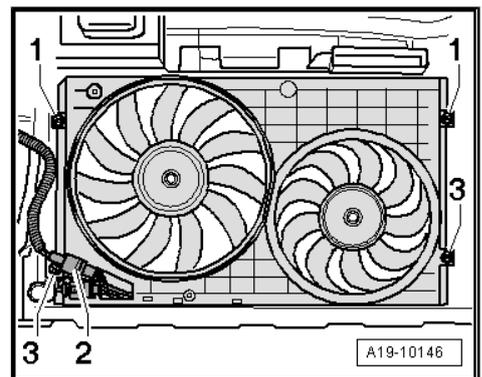
Ignore -1-.



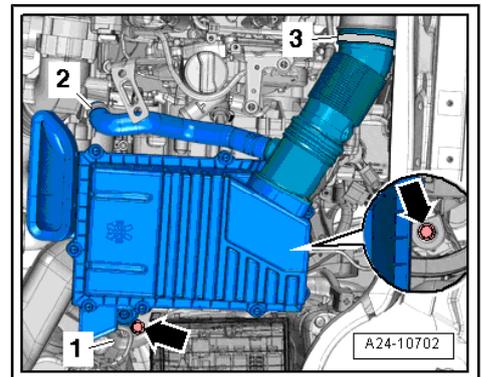
- Free up the coolant line -1- -arrows- and lay them toward the rear.



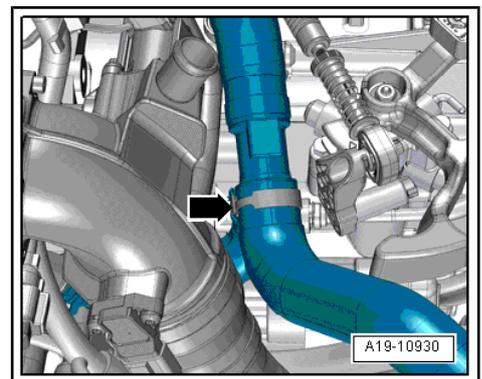
- Remove the bolts -1- and remove the fan shroud upward.



- Loosen the clamps -2 and 3- and remove the air guide hoses.
- Free up the wiring harness -1- from the air filter housing bracket.
- Remove the bolts -arrows- and remove the air filter housing.

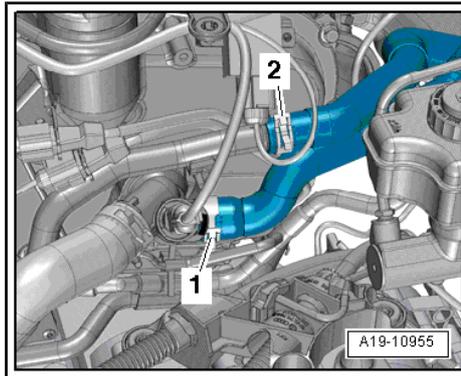


- Loosen the clamp -arrow- and remove the coolant hose.



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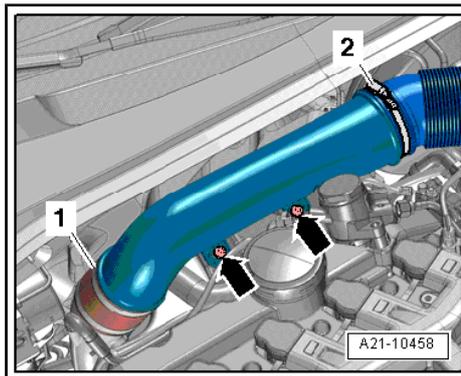
- Open the clamps -1 and 2- and remove the coolant hoses.



- Remove the bolts -arrows-.
- Remove the air guide pipe; to do this, loosen the hose clamp -1-.

 **Note**

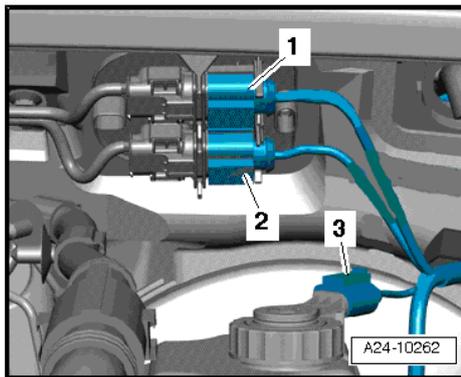
Ignore -2-.



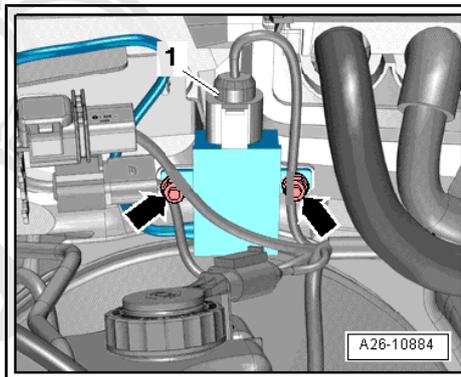
- Remove and disconnect the connector -1- for the Heated Oxygen Sensor (HO2S) -G39- .
- Free up the heated oxygen sensor wire.

 **Note**

Ignore -2 and 3-.

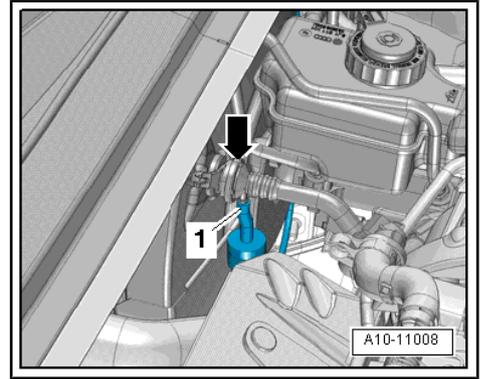


- Disconnect the connector -1-.
- Remove the bolts -arrows- and remove the exhaust gas temperature sensor 1 -G235- on the cylinder head.

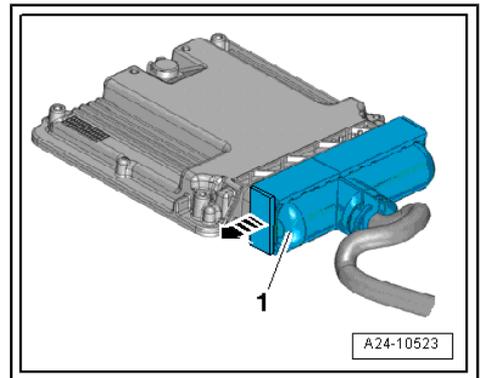


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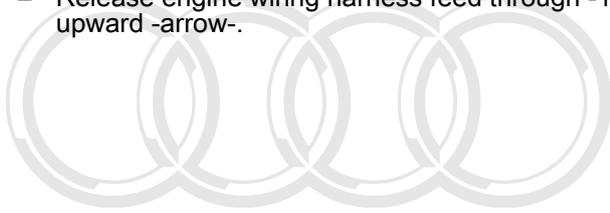
- Remove the vacuum hose -1- from the non-return valve -arrow-.
- Remove the check valve from the brake booster.



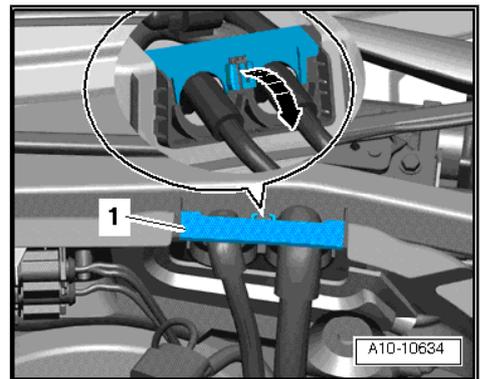
- Disconnect the connector -1- for the engine wiring harness -arrow-. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .



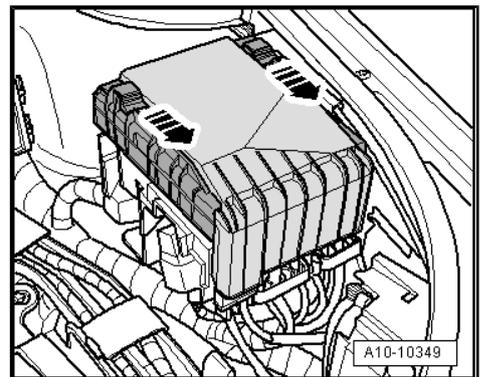
- Release engine wiring harness feed through -1- and remove upward -arrow-.



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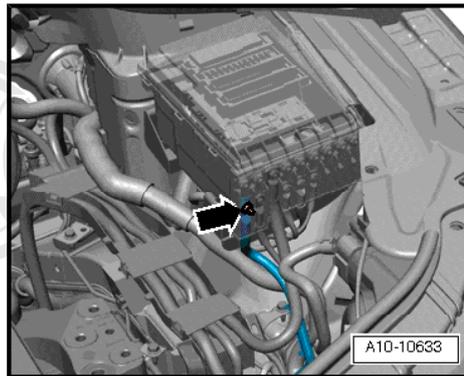


- Remove E-box cover by slide both latches in direction of -arrow-.



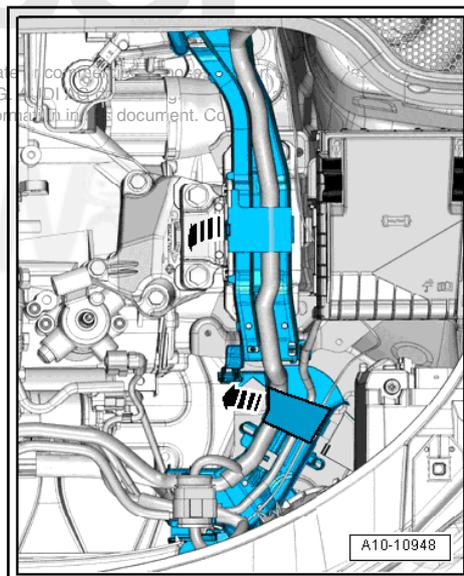
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- Remove the nut -arrow- and then remove and free up the terminal 30 wire from the engine compartment E-box.

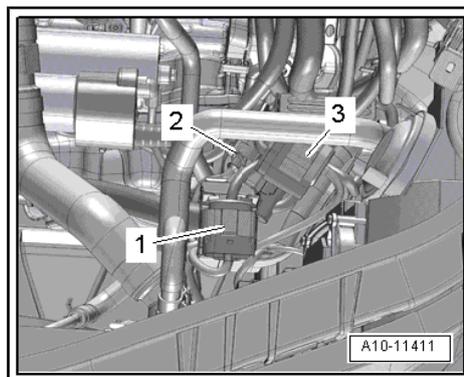


- Open wiring router bracket -arrows-.

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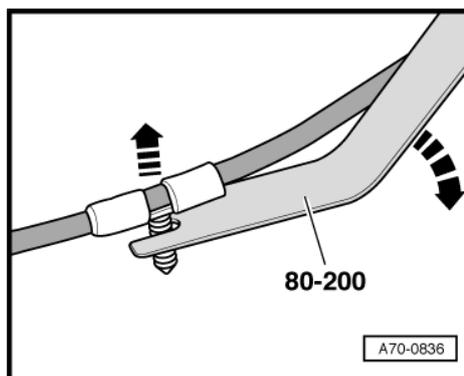


- Remove electrical harness connectors -2 and 3- from bracket and disconnect.
- Unclip electrical connector -1- from bracket and disconnect.
- Open wiring router bracket below.
- Unclip engine wiring harness to engine control module from wiring router.
- Remove the engine wiring harness from the engine.
- Secure engine control module against falling down.



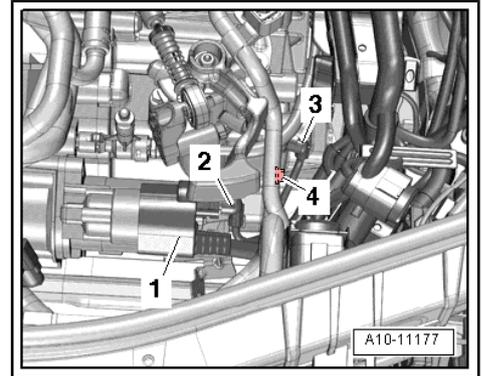
 **Note**

To unclip spiral clip, use -80 - 200- .

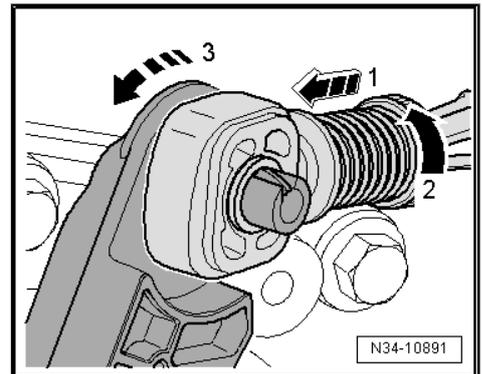


Vehicles with a Manual Transmission:

- Disconnect the starter connector -2-.
- Fold back the protective boot -1- and remove the B+ wire from the starter solenoid.
- Remove the Ground (GND) wire bolt -4-.
- Disconnect electrical connector -3- for the back-up lamp switch -F4-.

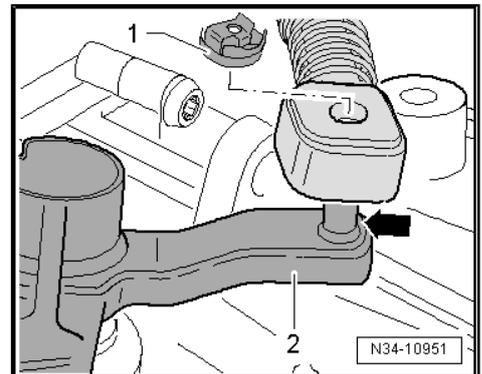


- Pull the safety mechanism all the way to the front -arrow 1- and then lock it to the left -arrow 2-.
- Push the shift relay lever forward -arrow 3- and remove the selector cable from the retainer.

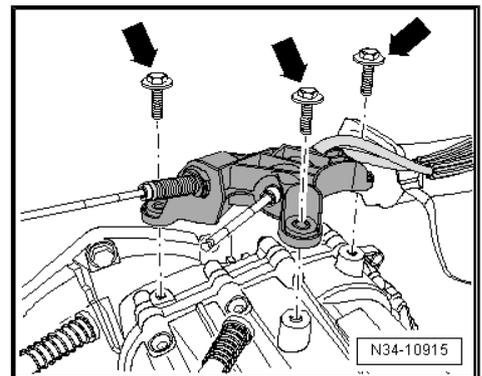


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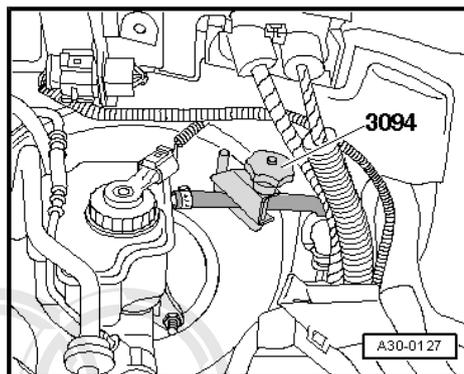
- Remove the lock washer -1- for the shift cable from the transmission selector lever -2- and remove the shift cable from the pin -arrow-.



- Remove the bolts -arrows-, then remove the cable bracket from the transmission and tie it up to the left.



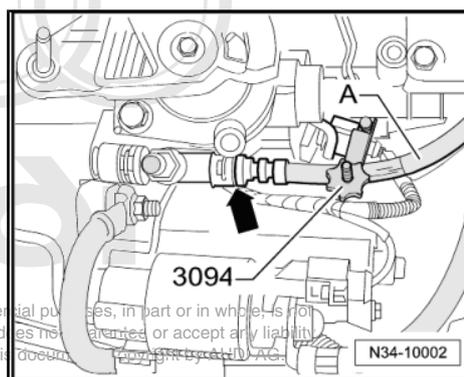
- If the plastic hose between the clutch master cylinder and the clutch slave cylinder is installed, unclamp the supply hose for the clutch master cylinder with -3094- .



- If the hose/line assembly between the clutch master cylinder and clutch slave cylinder is installed, remove hose -A- with the -3094- .

 **Note**

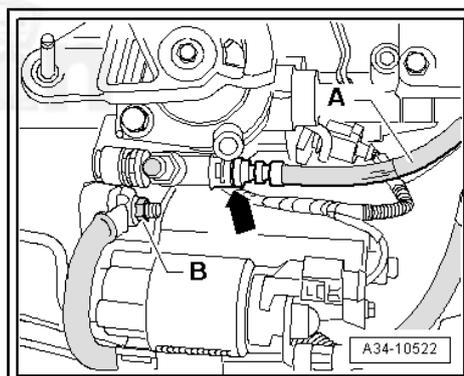
- ◆ Ignore -arrow-.
- ◆ Make sure no brake fluid gets onto the starter or on the transmission. If this happens, clean it off thoroughly.



- Pull the clamp -arrow- all the way until it stops.
- Remove the plastic hose or the hose/line assembly -A- from the bleeder/clutch slave cylinder.
- Seal any open lines and connections with a clean plug from the -VAS 6122- .

 **Note**

Ignore -B-.

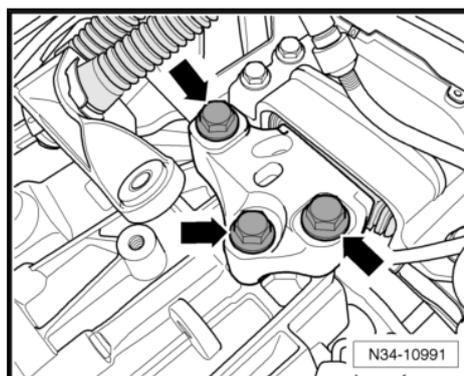


 **Caution**

Risk of contamination from escaping brake fluid.

- ◆ If the line is disconnected from the clutch slave cylinder breather, do not press clutch pedal.

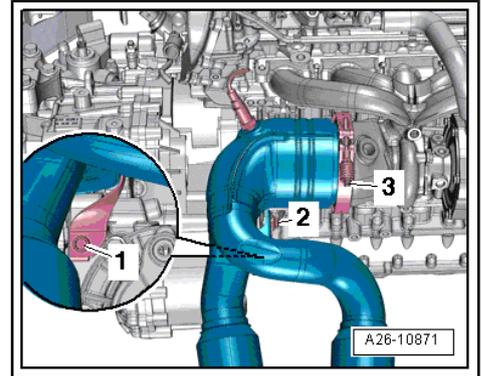
- Remove the bolts -arrows- for the transmission (about 2 turns).



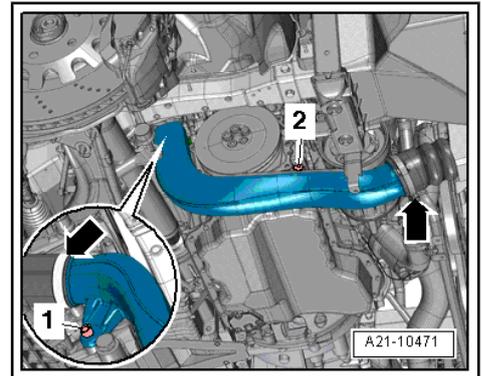
- Loosen the bolt -3- and slide the clamp onto the primary catalytic converter.
- Remove the bolt -2- and tie up the primary catalytic converter toward the rear.

 **Note**

Ignore -1-.

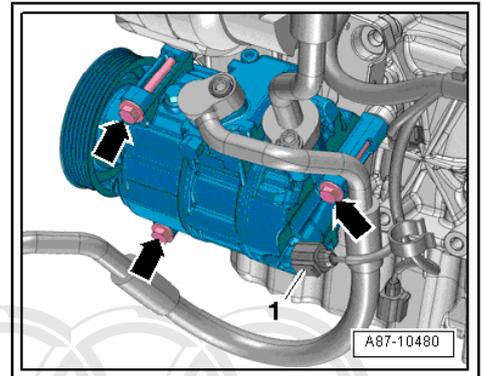


- Remove the bolts -1 and 2-.
- Remove the air guide pipe, to do so, loosen the hose clamps -arrows-.

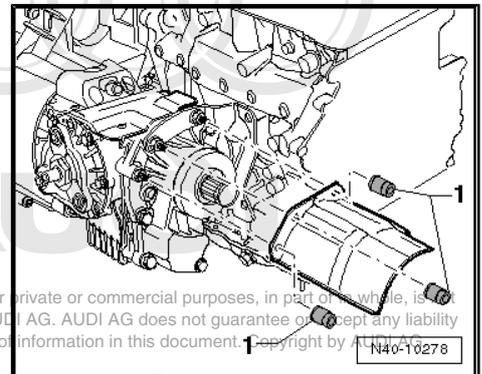


- Disconnect the connector -1- on the Air Conditioning (A/C) compressor regulator valve -N280- .

 **Caution**
Risk of damaging refrigerant lines and hoses.
 ♦ **Do not stretch, kink or bend refrigerant lines and hoses.**

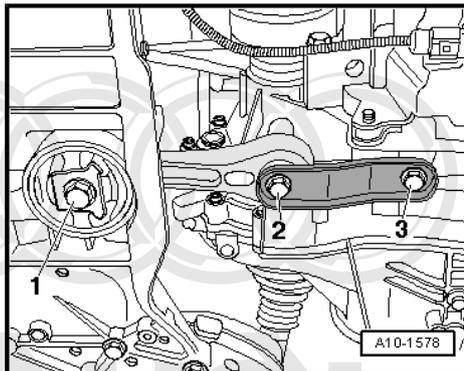


- Remove the bolts -arrows-.
- Remove the A/C compressor from the accessory assembly bracket and tie it up on the right side.
- Remove the nuts -1- and remove the right drive axle heat shield.
- Remove the left and right drive axles. Refer to => Suspension, Wheels, Steering; Rep. Gr. 40 ; Removal and Installation .

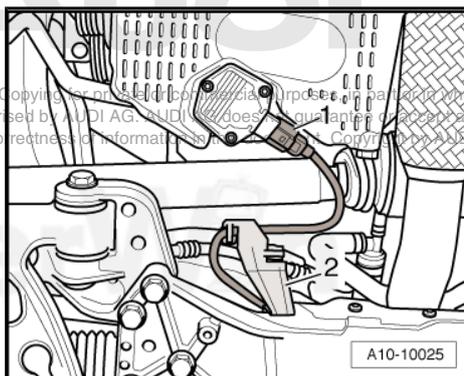


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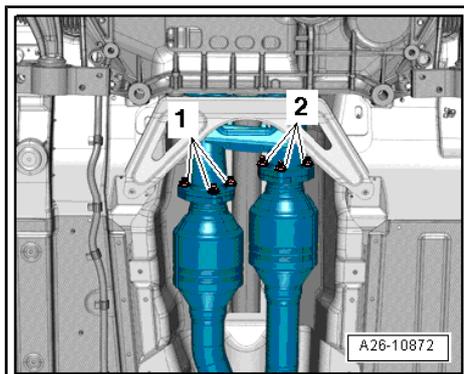
- Remove bolts -1, 2 and 3- and remove pendulum support.



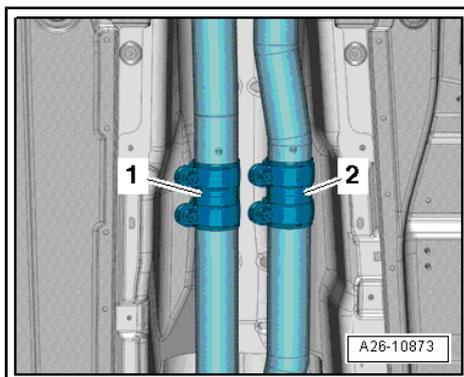
- Disconnect the connector -1- from the oil level thermal sensor -G266- .
- Unclip the mount -2- for the wire from the subframe.



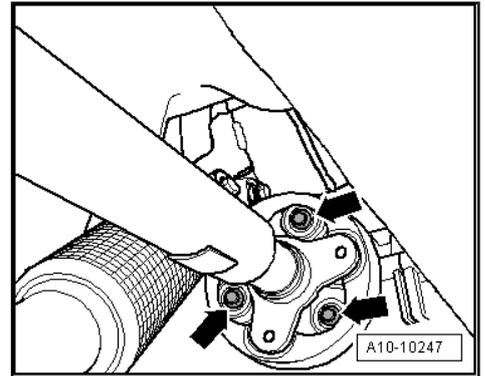
- Remove the nuts -1- and -2-.



- Loosen the clamping sleeve -1 and 2- and slide it toward the front.
- Remove the left and right catalytic converter.



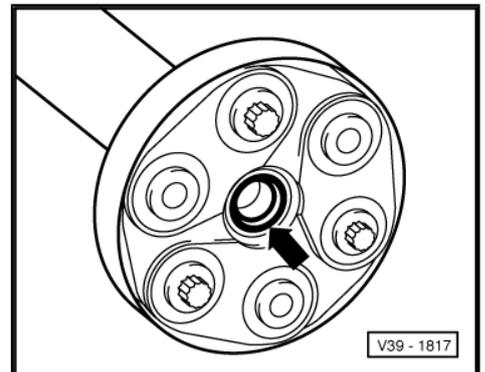
- Mark position of flexible disc to bevel box flange for reinstallation.
- Remove the bolts -arrows- for the flexible disc for the driveshaft from the bevel box, to do this, shift gear on the transmission.



 **Caution**

The shaft seal -arrow- in the driveshaft flange could be damaged.

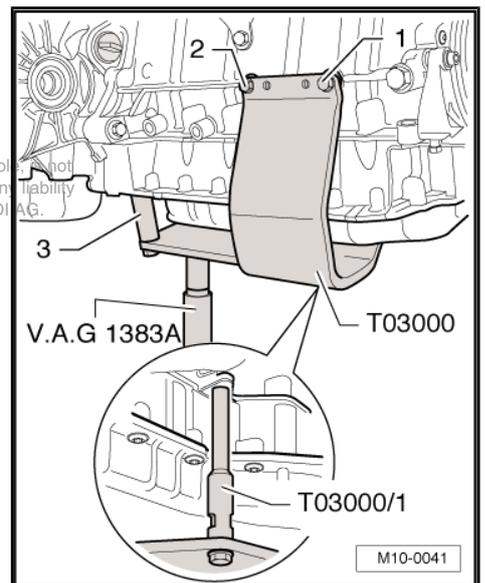
◆ *Push the driveshaft horizontally toward the rear and as far as possible.*



 **Note**

If the seal is damaged, driveshaft must be replaced.

- Remove the pin -T03000/1- from the -T03000- holding fixture.
- Install the -T03000- with fastener bolts -3- on the cylinder block and install the bolts -1 and 2- by hand until its in position.
- Install the bolts -T03000/1- on the cylinder block and tighten it to 20 Nm.
- Tight the bolts -1 and 2- to 25 Nm.
- Place -V.A.G 1383 A- on -T03000- engine bracket and raise engine/transmission subassembly slightly.



 **Note**

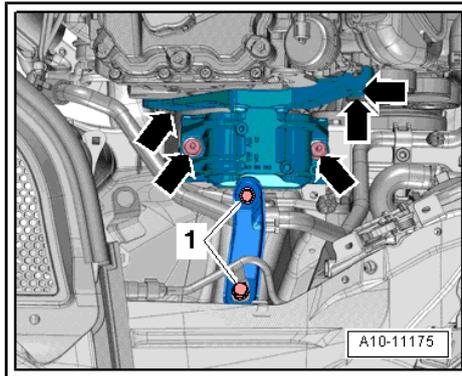
To remove subframe mounting bolts, use -VAS 5085-.

- Remove bolts -1- and -arrows- for the engine mount.

 **Note**

The bolts behind the cylinder block are accessed from the wheel housing side.

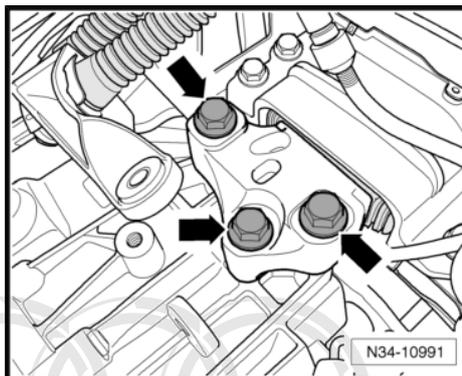
- Remove the bolts -arrows- for the transmission mount.



 **Caution**

Risk of damaging hose and wiring connections as well as engine compartment.

- ◆ *Make sure all the hoses and lines between the engine, transmission, subframe and body have been disconnected.*
- ◆ *Carefully lower and guide the engine/transmission subassembly out of the engine compartment.*
- ◆ *Make certain that there is enough clearance for the A/C compressor.*



- Move the engine/transmission subassembly forward and lower it a little more.

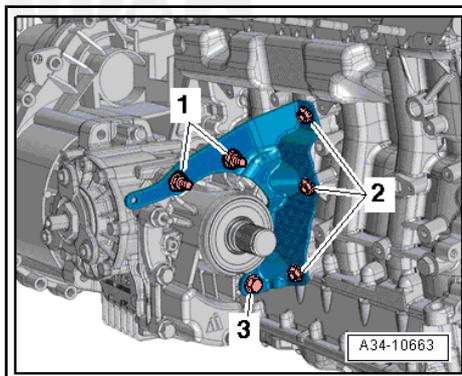
4.2 Engine and Manual Transmission, Separating

Special tools and workshop equipment required

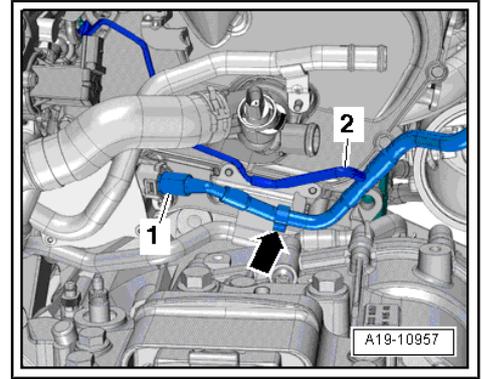
- ◆ Engine Sling -2024 A-
- ◆ Shop Crane -Load Cap=700-1200kg -VAS 6100-
- ◆ Engine Holder Bracket -T03000-

Procedure

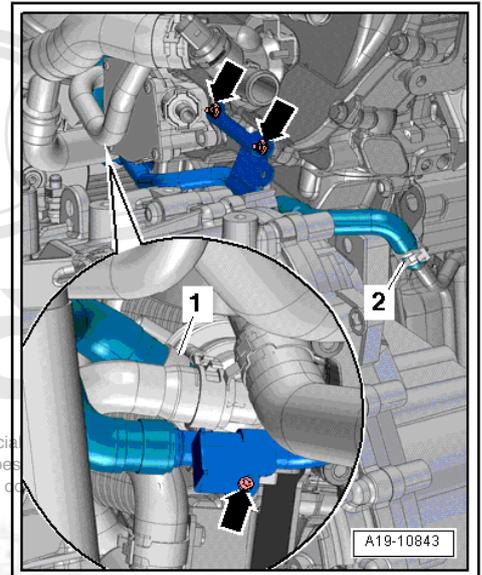
- Engine/transmission assembly removed and mounted on the -T03000-.
- Remove bolts -1, 2 and 3- and remove the mount for the bevel box.



- Disconnect vacuum hose -2-.
- Free up the vacuum hose -1-, -arrow- and remove it from the brake booster vacuum pump.

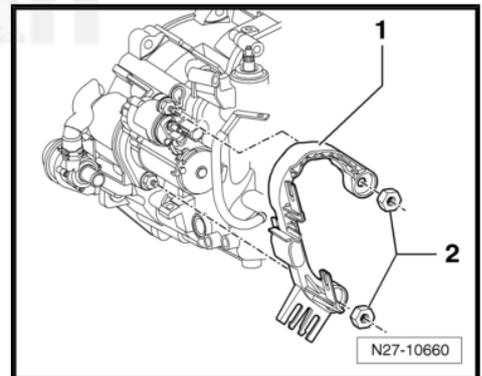


- Remove the bolts and nuts -arrows-.
- Remove the left coolant pipe, in order to loosen the hose clamps -1 and 2-.

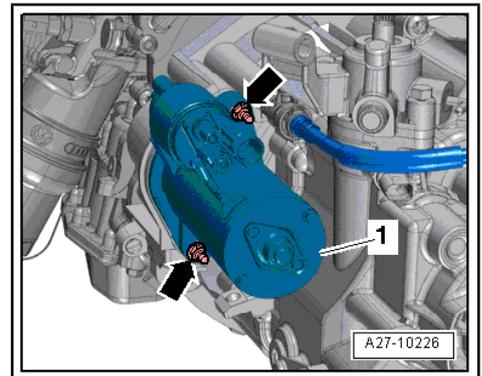


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- Remove nuts -2- and remove cable holder -1- from the starter.



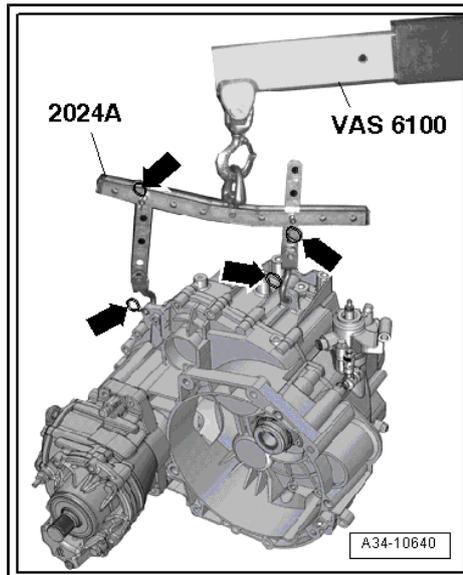
- Remove bolts -arrows- for the starter.
- Remove the starter -1- downward.



- Hook -2024 A- to the transmission and to the -VAS 6100- .

 **Note**

To be aligned to the center of gravity of the transmission, the hole rails of the lifting hook must be inserted as shown in the illustration.



 **WARNING**

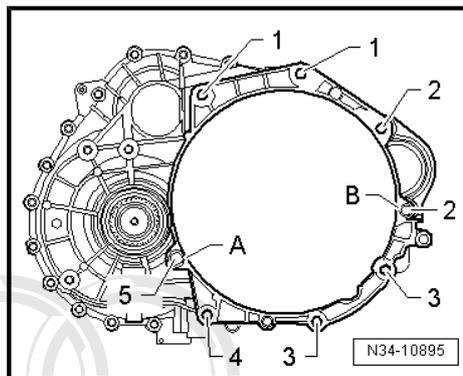
Loose engine support bridge components could cause an accident.

- ◆ Secure the mounting hooks and pins on the engine support bridge using securing pins -arrows-.

- Remove the bolts -1, 3, 4 and 5- connecting the transmission to the engine.
- Remove transmission from engine.

 **Note**

Ignore -2, A, B-.



4.3 Engine, Securing to Engine and Transmission Holder

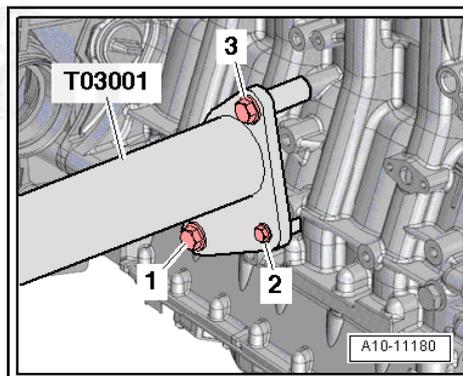
Special tools and workshop equipment required

- ◆ Engine Sling -2024 A-
- ◆ Engine and Transmission Holder -VAS 6095-
- ◆ Shop Crane -Load Cap=700-1200kg -VAS 6100-
- ◆ Engine Holder Bracket -T03000-
- ◆ Engine Lateral Bracket -T03001-

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Procedure

- Transmission separated from engine.
 - Tighten the -T03001- on the cylinder block:
- 1 - 40 Nm
 - 2 - 25 Nm
 - 3 - 40 Nm



- Hook -2024 A- to the engine and to the -VAS 6100- .

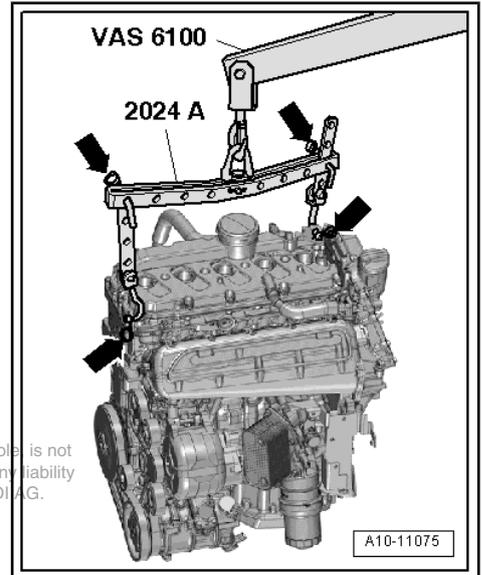
i Note

To be aligned to the center of gravity of the engine assembly, the hole rails of the lifting hook must be inserted as shown in the illustration.

! WARNING

Loose engine support bridge components could cause an accident.

◆ **Secure the mounting hooks and pins on the engine support bridge using securing pins -arrows-**



- Raise the engine from the -T03000- using the -VAS 6100- .
- Attach the engine and engine bracket with -T03001- to the -VAS 6095- .

4.4 Engine, Installing

Special tools and workshop equipment required

- ◆ Engine/Trans. Support -T10012-
- ◆ Engine Holder Bracket -T03000-

Tightening Specifications

i Note

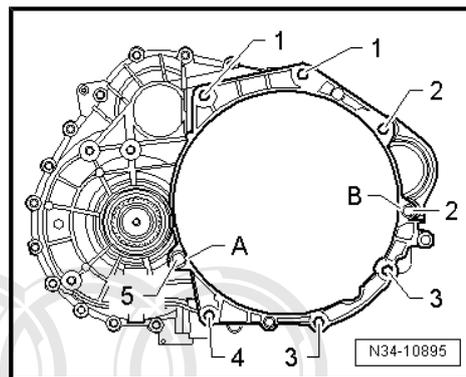
- ◆ *The tightening specifications apply only to lightly greased, oiled, phosphated or blackened nuts and bolts.*
- ◆ *Additional lubricant such as engine or transmission oil may be used, but do not use graphite lubricant.*
- ◆ *Do not use any ungreased parts.*
- ◆ *Tightening specification tolerance +/- 15%.*

Component		Nm
Bolts/nuts	M6	10
	M7	15
	M8	22
	M10	40
	M12	65

Manual Transmission on the Engine

Item	Bolt	Nm
1	M12x65	80
2	Starter, securing. Refer to → Electrical Equipment; Rep. Gr. 27 ; Removal and Installation	
3	M10x65	40
4	M10x75	40
5 1)	M12x95	80
A, B	Alignment sleeves for centering	

• 1) Install in transmission from engine side.


Procedure

- The engine/transmission subassembly is attached to the - T10012- .

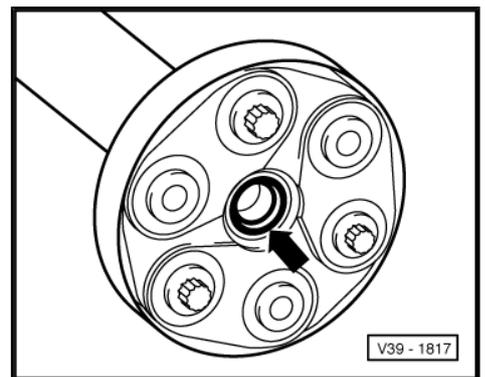
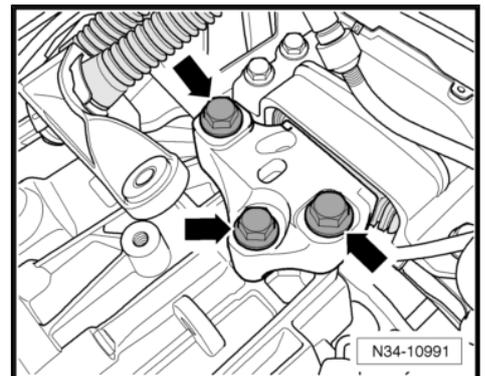
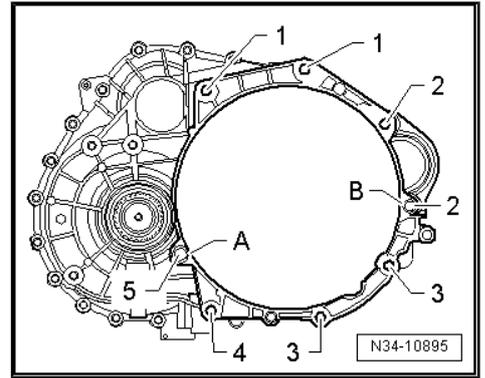

Note

- ◆ *Replace bolts that are tightened to the **specification**.*
- ◆ *Replace self-locking nuts and bolts and seals, gaskets and O-rings.*
- ◆ *The hose connections as well as the air guide pipes and hoses must be free of oil and grease before installing.*
- ◆ *Secure all hose connections with hose clamps of the same type as those equipped by the factory. Refer to the Electronic Parts Catalog (ETKA).*
- ◆ *In order to be able to securely mount the air guide hoses on their connectors, spray the screws on the previously used clamps with a rust remover.*
- ◆ *Wire routing and mounting in the engine compartment. Refer to ⇒ "1.6 Lines, Routing and Securing", page 2 .*
- ◆ *When installing, bring all cable ties back to same positions.*

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Vehicles with a Manual Transmission:

- If the alignment sleeves -A and B- for centering the engine and transmission are missing inside the cylinder block, then install the sleeves.
- If clutch release bearing is worn, replace it. Refer to ⇒ Manual Transmission; Rep. Gr. 30 ; Removal and Installation .
- Lightly lubricate transmission input shaft splines with clutch disc connection lubricating grease. Refer to the Electronic Parts Catalog (ETKA).
- Check clutch drive plate centering.
- Tighten the transmission to the engine.
- Tighten the retainer for the bevel box. Refer to ⇒ Manual Transmission; Rep. Gr. 30 ; Removal and Installation .
- Install the left coolant pipe. Refer to ⇒ ["5.11 Left Coolant Pipe", page 198](#) .
- Guide the engine/transmission subassembly into the body.
- Install the engine mount. Refer to ⇒ ["1.1 Subframe Overview", page 9](#) .
- Install the bolts -arrows- for the transmission mount by hand until its in position.
- Remove the -T03000- from the engine.
- Install the pendulum support. Refer to ⇒ Manual Transmission; Rep. Gr. 34 ; Removal and Installation .



 **Caution**

The shaft seal -arrow- in the driveshaft flange could be damaged.

◆ *Push the driveshaft horizontally toward the rear and as far as possible.*

 **Note**

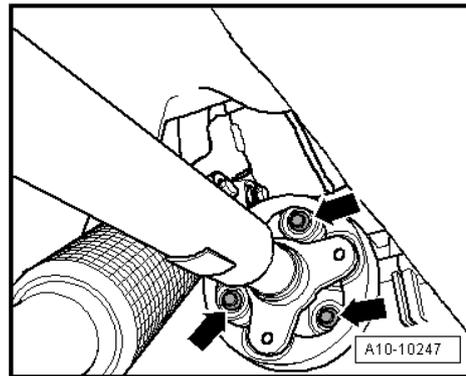
If seal is damaged, driveshaft must be replaced.

- Push the engine/transmission sub-assembly for the plenum chamber bulkhead and carefully guide the bevel box pins into the driveshaft flange.

- Tighten the driveshaft and flexible disc to the bevel box. Refer to ⇒ Rear Final Drive 02D, 0AV, 0BR and 0BY; Rep. Gr. 39; Removal and Installation .

Install in reverse order of removal paying attention to the following:

- Install the catalytic converter. Refer to ⇒ ["5.1 Catalytic Converters", page 237](#) .
- Install primary catalytic converter. Refer to ⇒ ["5.4 Primary Catalytic Converter", page 239](#) .
- Install the transverse link and the driveshaft. Refer to ⇒ Suspension, Wheels, Steering; Rep. Gr. 40; Removal and Installation .
- Install the driveshaft heat shield. Refer to ⇒ Manual Transmission; Rep. Gr. 39; Removal and Installation .
- Selector mechanism, installing and adjusting. Refer to ⇒ Manual Transmission; Rep. Gr. 34; Removal and Installation .



Caution

Risk of contamination from escaping brake fluid.

- ◆ *If hose/line assembly is not yet connected to clutch slave cylinder breather, do not press clutch cylinder.*

- Connect hose/line assembly to clutch slave cylinder breather and bleed the clutch system. Refer to ⇒ Manual Transmission; Rep. Gr. 30; General Information .
- Install the right coolant pipe. Refer to ⇒ ["2.2 Coolant Pipes Overview", page 178](#) .
- Install the radiator. Refer to ⇒ ["5.12 Radiator", page 200](#) .
- Install the air guide pipes. Refer to ⇒ ["1.1 Charge Air Cooler Overview", page 209](#) .
- Install the idler roller and ribbed belt tensioning damper. Refer to ⇒ ["1.4 Ribbed Belt Drive and Accessory Assembly Bracket Overview", page 53](#) .
- Install the generator. Refer to ⇒ Electrical Equipment; Rep. Gr. 27; Removal and Installation .
- Install the generator ribbed belt and the coolant pump. Refer to ⇒ ["4.7 Generator Ribbed Belt and Coolant Pump", page 70](#) .
- Install A/C compressor. Refer to ⇒ Heating, Ventilation and Air Conditioning; Rep. Gr. 87; Removal and Installation .
- Install the A/C compressor ribbed belt. Refer to ⇒ ["4.1 A/C Compressor Ribbed Belt", page 62](#) .
- Install the starter. Refer to ⇒ Electrical Equipment; Rep. Gr. 27; Removal and Installation .
- Install the noise insulation frame. Refer to ⇒ Body Exterior; Rep. Gr. 50; Removal and Installation .
- Install the noise insulation and the underside of the front wheel housing liner. Refer to ⇒ Body Exterior; Rep. Gr. 66; Removal and Installation .
- Install the front wheels. Refer to ⇒ Wheel and Tire Guide; Rep. Gr. 44; Removal and Installation .

- Adjust the subframe mount. Refer to ⇒ ["1.2 Subframe Mount, Adjusting", page 10](#) .
- Install the Engine Control Module (ECM) and the air filter housing. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .
- Install the charge air pressure sensor -G31- / Intake Air Temperature (IAT) sensor 2 -G299- . Refer to ⇒ ["1.2 Turbocharger Overview", page 211](#) .
- Electrical connectors and wiring routing. Refer to ⇒ Wiring diagrams, Troubleshooting & Component locations.
- Be sure to follow the procedure for connecting the battery and afterwards. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation .
- Check the oil level. Refer to the Maintenance Procedures Rep. Gr. 03.



Caution

There is a risk of destroying control modules with excess voltage.

◆ *Do not use a charger as a starting aid.*

- Fill the engine with coolant. Refer to ⇒ [page 173](#) .

 **Note**

Only reuse drained coolant if cylinder head or engine block was not replaced.

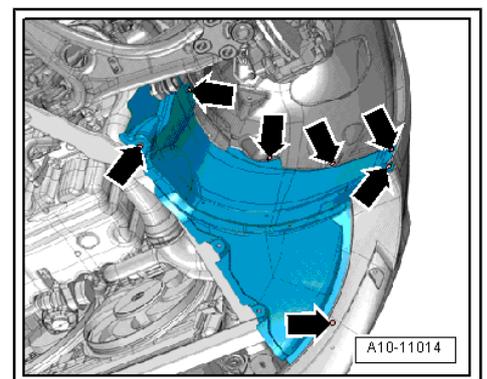
4.5 Engine Mount

Special tools and workshop equipment required

- ◆ Engine Support Bridge -10 - 222 A-
- ◆ Spindle -10 - 222 A /11-

Removing

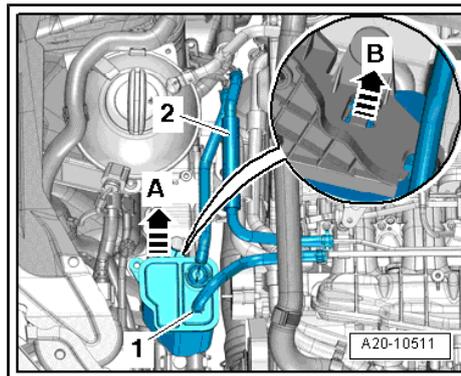
- Remove the right front wheel. Refer to ⇒ Wheel and Tire Guide; Rep. Gr. 44 ; Removal and Installation .
- Remove the right front underside of the wheel housing liner. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Removal and Installation .
- Remove the bolt for the front right upper side of the wheel housing.



- Release the Evaporative Emission (EVAP) canister -arrow B-, remove upward -arrow A- and lay it to the side along with the connected hose -1-.

 **Note**

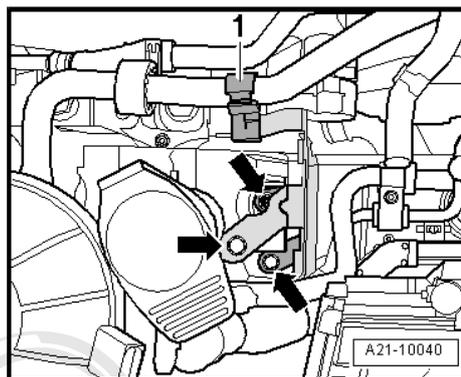
Ignore -2-.



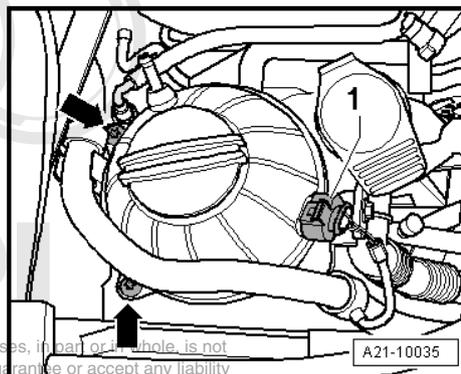
- Remove the bolts -arrows- and the EVAP canister bracket.

 **Note**

Ignore -1-.

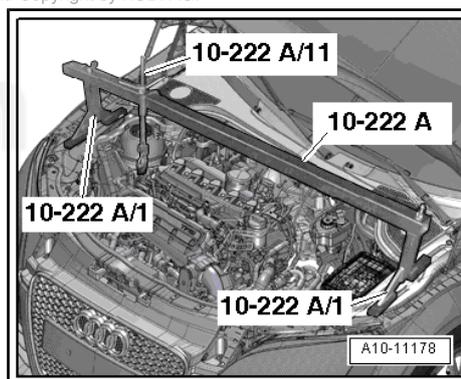


- Remove the bolts -arrows-.
- Disconnect the connector -1- for the Engine Coolant Level (ECL) warning switch -F66-, and lay the coolant reservoir and right coolant pipe aside.



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- Attach the -10 - 222 A- to the upper edge of the web plate as shown in the illustration.
- The -10 - 222 A /11- is positioned forward.
- Attach the spindle carabiner hook to the right engine lifting eye.
- Lightly tension spindle.



- Remove bolts -1- and -arrows- for the engine mount.

 **Note**

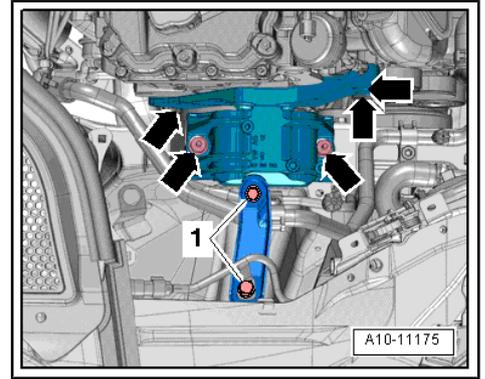
The bolts behind the cylinder block are accessed from the wheel housing side.

Installing

- For the correct tightening specifications, refer to [⇒ "1.1 Subframe Overview", page 9](#) .
- Subframe mount adjustment, checking. Refer to [⇒ "3.1 Subframe Mount, Checking Adjustment", page 15](#) .

Install in reverse order of removal paying attention to the following:

- Install the front underside of wheel housing liner. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Removal and Installation .
- Install the front wheel. Refer to ⇒ Wheel and Tire Guide; Rep. Gr. 44 ; Removal and Installation .



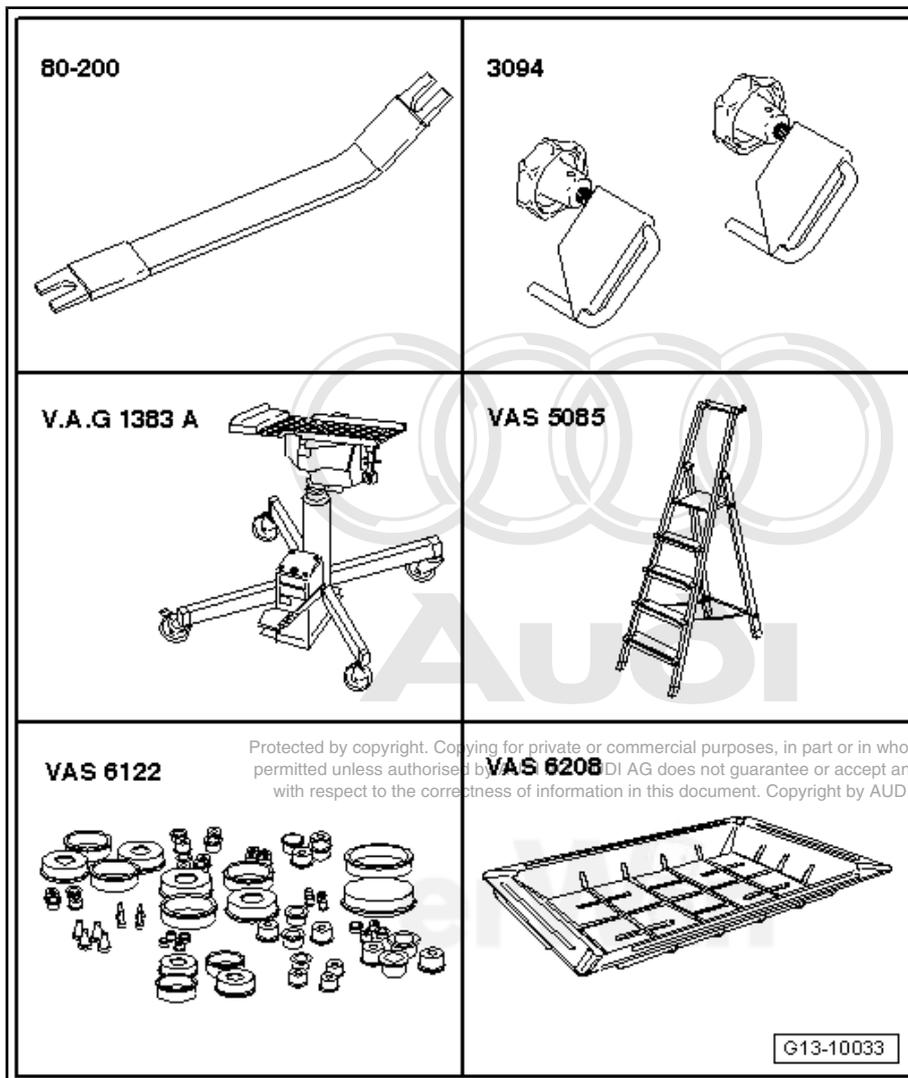
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5 Special Tools

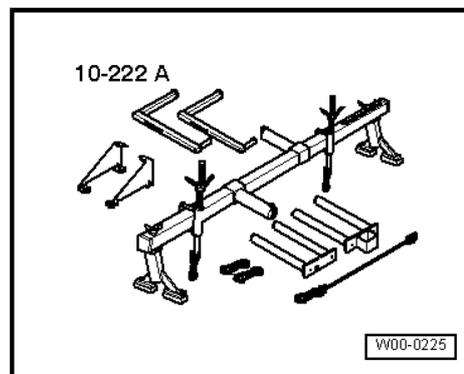
Special tools and workshop equipment required

- ◆ Pry Lever - Rmv Outside Mirror -80 - 200-
- ◆ Hose Clamps Up to 25 mm Dia. -3094-
- ◆ Engine/Transmission Jack -V.A.G 1383 A-
- ◆ Step Ladder -VAS 5085-
- ◆ Engine Bung Set -VAS 6122-
- ◆ Drip Tray for VAS 6100 - VAS 6208-

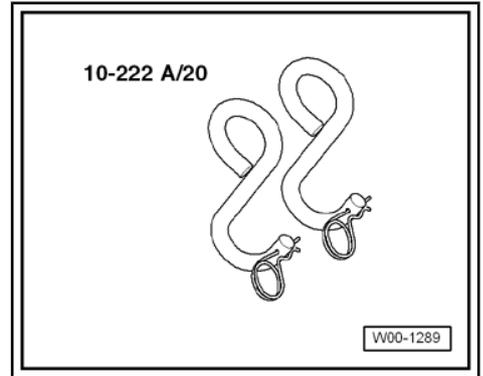


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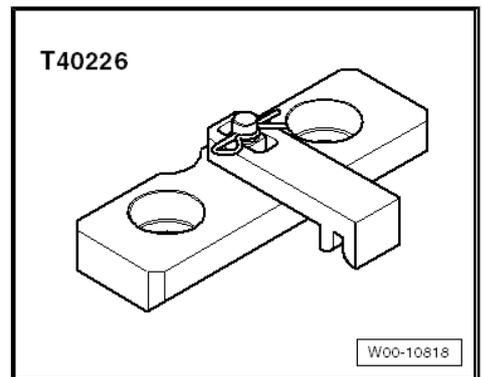
- ◆ Engine Support Bridge -10 - 222 A-



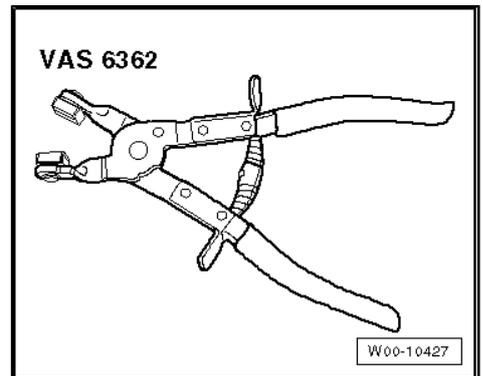
◆ Special Hook -10 - 222 A /20-



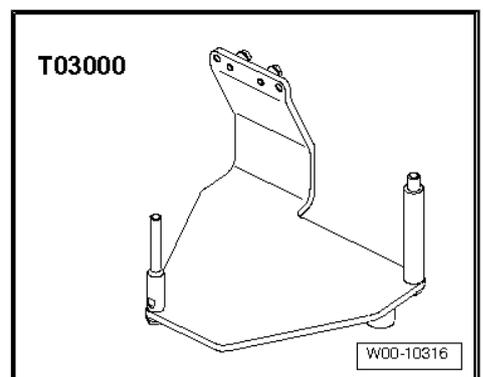
◆ Gauge -T40226-



◆ Hose Clip Pliers -VAS 6362-



◆ Engine Holder Bracket -T03000-

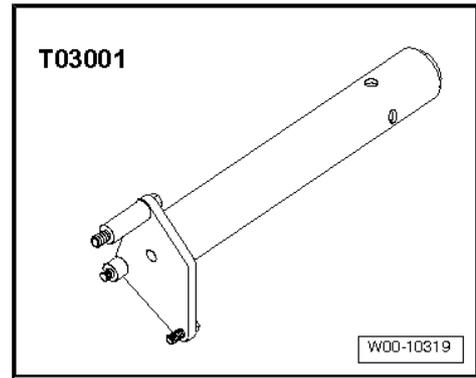


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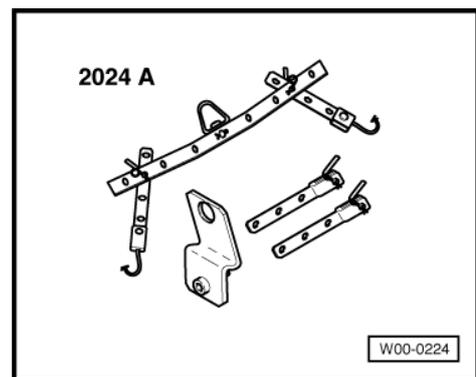




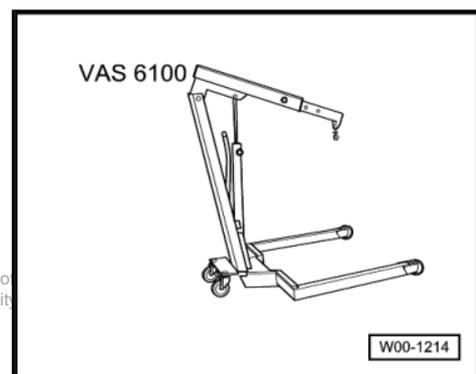
◆ Engine Lateral Bracket -T03001-



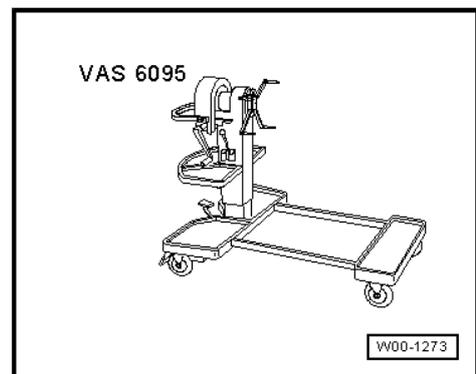
◆ Engine Sling -2024 A-



◆ Shop Crane -Load Cap=700-1200kg -VAS 6100-



◆ Engine and Transmission Holder -VAS 6095-



◆ Not illustrated:

◆ Spindle -10 - 222 A /11-

◆ Engine/Trans. Support -T10012-

13 – Crankshaft, Cylinder Block

1 Description and Operation

⇒ [“1.1 Crankshaft Overview”, page 47](#)

⇒ [“1.2 Dual Mass Flywheel Overview”, page 50](#)

⇒ [“1.3 Pistons and Connecting Rod Overview”, page 51](#)

⇒ [“1.4 Ribbed Belt Drive and Accessory Assembly Bracket Overview”, page 53](#)

⇒ [“1.5 Sealing Flange, Ribbed Belt Side Overview”, page 55](#)

1.1 Crankshaft Overview

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Note

- ◆ *For assembly work, secure the engine on the engine and transmission holder. Refer to [“4.3 Engine, Securing to Engine and Transmission Holder”, page 36](#).*
- ◆ *If large quantities of metal particles or abraded material are detected during engine repairs, it may mean the crankshaft or rod bearings are damaged. To prevent subsequent damage, the following work must be performed after the repair: Oil channels must be cleaned carefully; replace oil spray jets, engine oil cooler and oil filter.*

1 - Bolt

- Replace
- 40 Nm plus an additional 90° turn

2 - Bearing Cap

- Bearing cap 1: Belt pulley side
- Installed position: Bearing shell retaining tabs in the cylinder block and in the bearing cap must align

3 - Bearing Shell

- For bearing cap without oil groove
- Mark used bearing shells for reinstallation but not on the running surface
- Replace bearing shells that have worn down to the base layer
- Install new bearing shell with the correct color identification, refer to [⇒ Fig. "Allocation Crankshaft Bearing Shells for the Bearing Cover", page 49](#)

4 - Crankshaft

- Measuring axial play, refer to [⇒ "3.2 Crankshaft, Measuring Axial Play", page 58](#)

- Radial clearance, measuring, refer to [⇒ "3.3 Crankshaft, Measuring Radial Play", page 58](#)
- Crankshaft dimensions, refer to [⇒ "2.1 Crankshaft Dimensions", page 56](#)

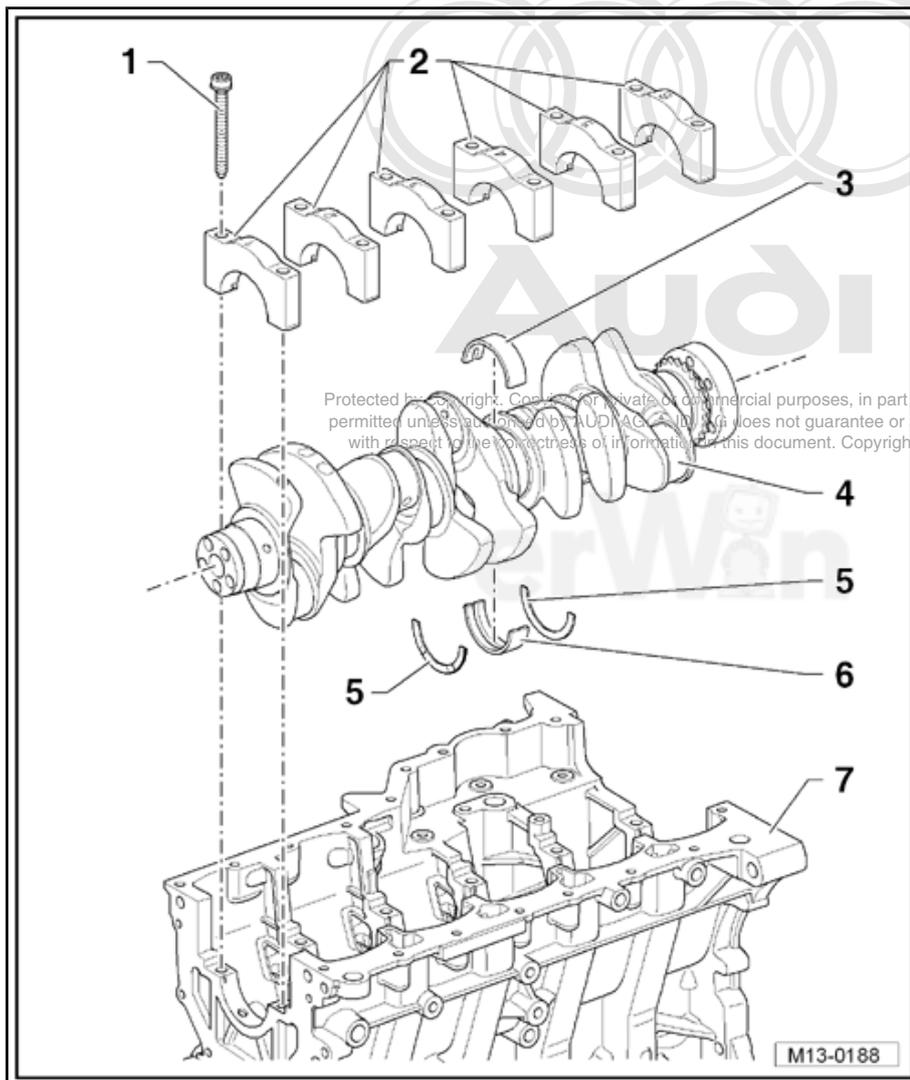
5 - Thrust Washers

- For bearing 3

6 - Bearing Shell

- For cylinder block with oil groove
- Mark used bearing shells for reinstallation but not on the running surface
- Replace bearing shells that have worn down to the base layer
- Insert new bearing shells for cylinder block with proper color marking. Refer to [⇒ Fig. "Allocation of Crankshaft Bearing Shells for Cylinder Block", page 49](#).

7 - Cylinder Block



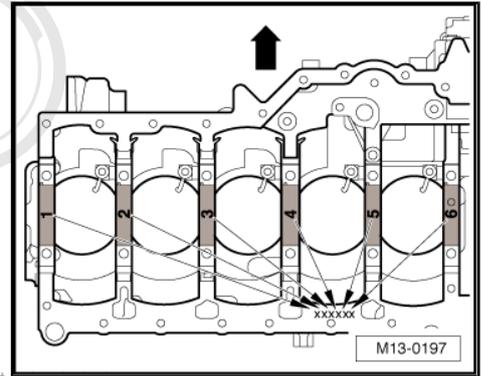
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Allocation of Crankshaft Bearing Shells for Cylinder Block

- ◆ Bearing shells with the correct thickness are allocated to the cylinder block in the factory. Colored dots on sides of bearing shells serve for identifying bearing shell thickness.
- ◆ The letters marked on the lower sealing surface of the cylinder block identify which bearing thickness must be installed in which location.

Letter on Cylinder Block	Color of Bearing
G =	Yellow
B =	Blue
W =	White

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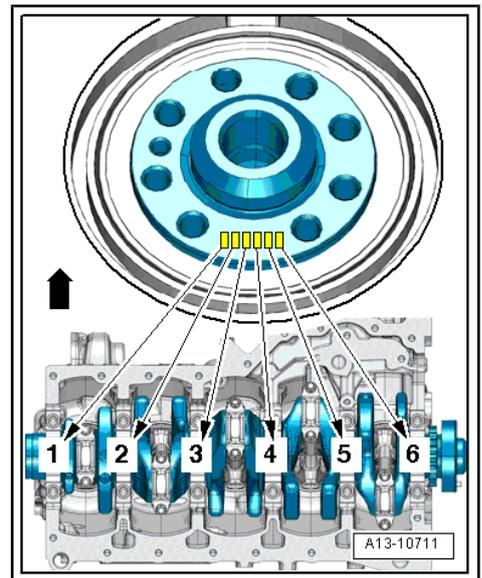
 **Note**

-Arrow- points in direction of travel.

Allocation Crankshaft Bearing Shells for the Bearing Cover

- ◆ Bearing shells with correct thickness are allocated to bearing cap at factory. Colored dots on the sides of the bearing shells serve for identifying bearing shell thickness.
- ◆ The allocation of the bearing shells for the bearing cover is identified by a series of letters on the crankshaft ribbed belt sprocket flange. The first letter of the row of letters represents bearing "1", the second letter is for bearing "2", etc.

Letter on Crankshaft	Color of Bearing
R =	Red
G =	Yellow
B =	Blue
W =	White



 **Note**

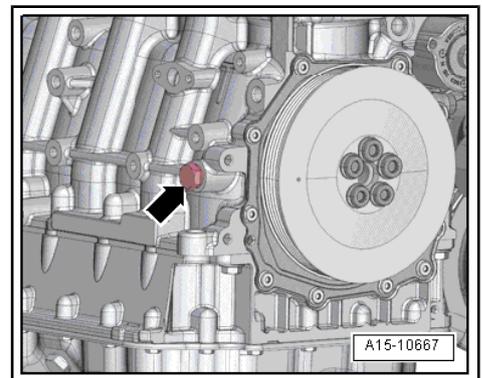
-Arrow- points in direction of travel.

"TDC" Locking Bolt- Marking- Tightening Specification

 **Note**

Replace the seal.

- Tighten the locking bolt -arrow- for "TDC"- mark to 45 Nm.



1.2 Dual Mass Flywheel Overview



Note

- ◆ For assembly work, secure the engine on the engine and transmission holder. Refer to ⇒ [“4.3 Engine, Securing to Engine and Transmission Holder”, page 36](#).
- ◆ Servicing clutch, refer to ⇒ *Manual Transmission; Rep. Gr. 30; Removal and Installation*.

1 - Bolt

- Replace
- 60 Nm plus an additional 90° turn

2 - Dual Mass Flywheel

- Different versions; allocation, refer to the Electronic Parts Catalog (ETKA)
- Removing and installing, refer to ⇒ [“4.6 Dual Mass Flywheel”, page 69](#)
- Only possible to install in one position

3 - Diamond Disc

- Replace the dual mass flywheel bolts each time that they are loosened
- Only possible to install in one position

4 - Sensor Wheel

- For the Engine Speed (RPM) sensor -G28-
- Only possible to install in one position

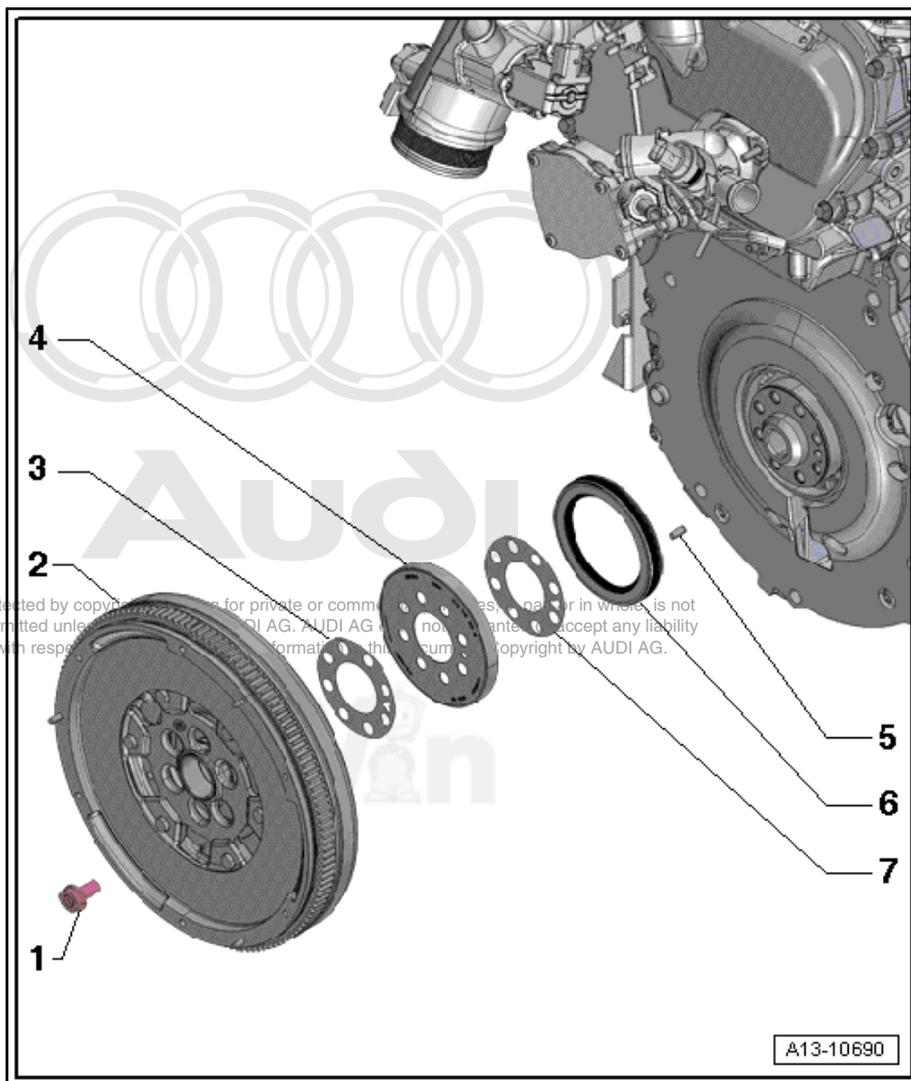
5 - Fitting Pin

6 - Crankshaft Shaft Seal, Transmission Side

- Removing and installing, refer to ⇒ [“4.5 Crankshaft Seal, Transmission Side”, page 67](#)

7 - Diamond Disc

- Replace the dual mass flywheel bolts each time that they are loosened
- Only possible to install in one position



1.3 Pistons and Connecting Rod Overview

Note

- ◆ Lubricate all bearings and running surfaces.
- ◆ Oil spray nozzle and pressure relief valve, refer to ⇒ [Fig. "Oil Spray Jet and Pressure Relief Valve"](#), page 52.

1 - Bolts

- 45 Nm plus an additional 90° turn
- Replace
- Lubricate the threads and contact surface

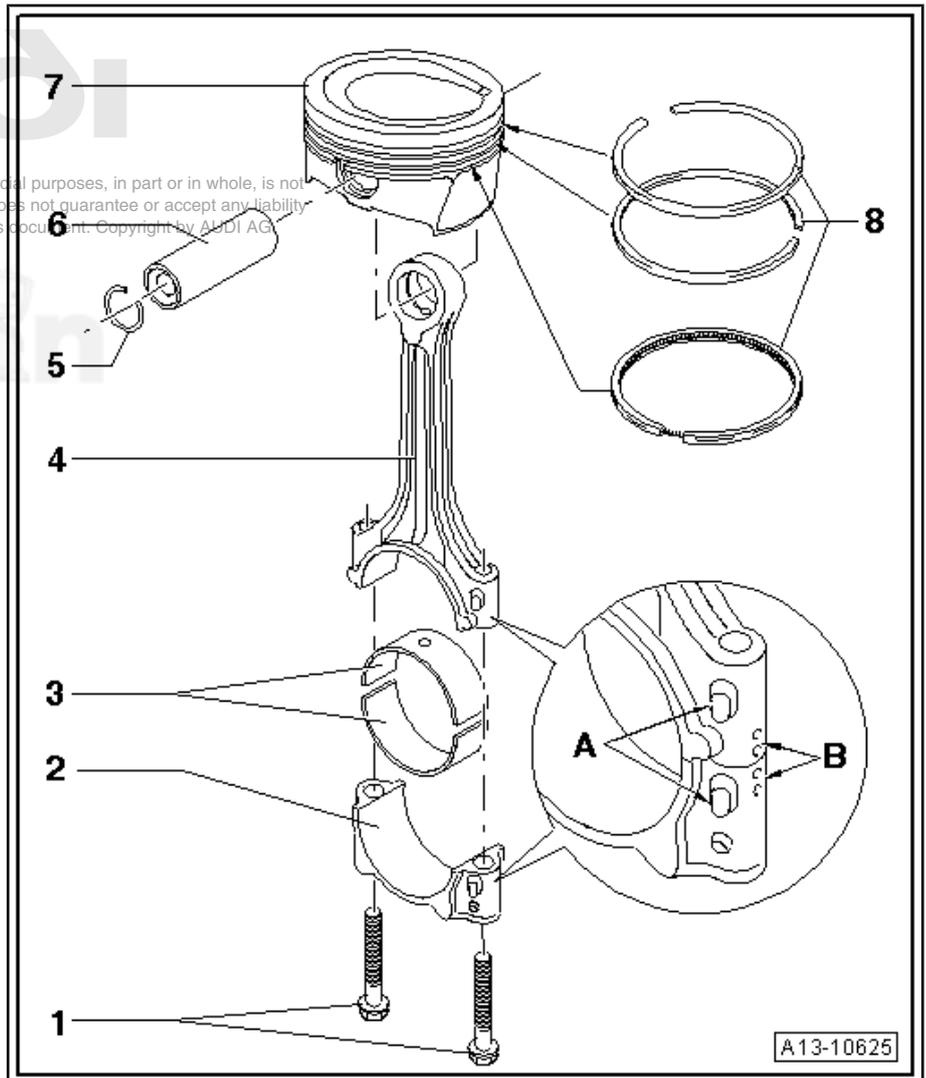
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2 - Connecting Rod Bearing Cap

- Pay attention to the installed position
- Due to the separation procedure (cracking) of the connecting rod, the cap only fits in one position and only to the corresponding connecting rod.
- Mark allocation to the cylinder with paint -B-
- Installed position: Markings -A- face the pulley side

3 - Bearing Shells

- Without oil hole
- Installed position, refer to ⇒ [Fig. "Bearing Shell Installation Position in the Connecting Rods"](#), page 52
- Mark the used bearing shells for reinstallation but not on the running surface
- Replace bearing shells that have worn down to the base layer



4 - Connecting Rod

- Only replace as set
- Mark allocation to cylinder with paint -B-
- Installed position: Markings -A- face the pulley side
- Radial clearance, measuring, refer to ⇒ ["3.1 Connecting Rod, Measuring Radial Clearance"](#), page 58
- Separate new connecting rod, refer to ⇒ ["4.8 New Connecting Rod, Separating"](#), page 71

5 - Locking Ring

- Replace

6 - Piston Pin

- ❑ Heat piston to 60 °C (140 °F) if it is difficult to move.
- ❑ Removing and installing using a pilot drift -VW 222 A-

7 - Piston

- ❑ Removing and installing, refer to ⇒ [“4.9 Piston”, page 71](#)
- ❑ Mark installed location to connecting rod and the cylinder to which it belongs
- ❑ Installed position: Arrow on the piston face points toward the belt pulley side
- ❑ Piston and cylinder bore, checking, refer to ⇒ [“3.4 Piston and Cylinder Bore, Checking”, page 59](#)

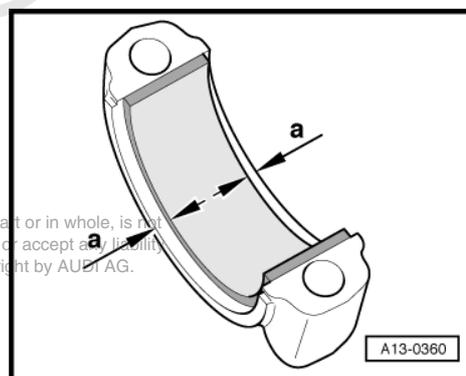
8 - Piston Rings

- ❑ Offset gaps by 120°
- ❑ Use piston ring pliers (commercially available) for removing and installing
- ❑ “TOP” faces toward piston crown
- ❑ Gap, measuring, refer to ⇒ [Fig. “Piston Ring Gap, Checking”, page 59](#)
- ❑ Measuring side clearance, refer to ⇒ [Fig. “Measuring the Ring to Groove Clearance”, page 60](#)

Bearing Shell Installation Position in the Connecting Rods

- Install the bearing shells into the center of the connecting rod or into the connecting rod bearing cap.
- Dimension -a- = approximately 1.5 mm.

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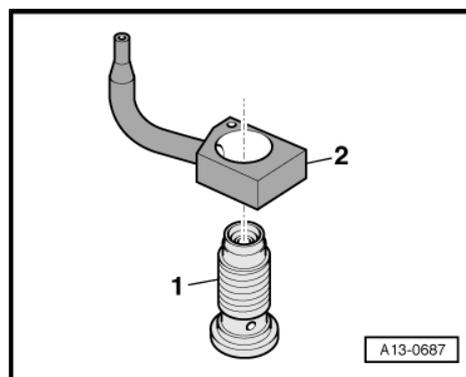
Oil Spray Jet and Pressure Relief Valve

- 1 - Bolt with pressure relief valve - 27 Nm
 - 2 - Oil spray jet (for piston cooling)
- Installed position: Align the guiding edge of the oil spray jet to the machined surface of the cylinder block.



Note

- ◆ Do not bend the oil spray nozzles.
- ◆ Replace the oil spray nozzles if they are bent.



1.4 Ribbed Belt Drive and Accessory Assembly Bracket Overview

1 - Bolt

- 35 Nm

2 - Bolt

- 50 Nm plus an additional 90° turn
- Replace

3 - Vibration Damper

- Removing and installing, refer to ⇒ ["4.11 Vibration Damper"](#), page 73
- Only possible to install in one position

4 - Ribbed Belt for A/C Compressor

- Check for wear
- Before removing, mark the direction of rotation using chalk or a felt-tip pen.
- Removing and installing, refer to ⇒ ["4.1 A/C Compressor Ribbed Belt"](#), page 62
- Do not kink
- When installing, make sure it is seated correctly on the ribbed belt pulleys

5 - Tensioning Element

- For ribbed belt for A/C compressor
- Removing and installing, refer to ⇒ ["4.2 A/C Compressor Ribbed Belt Tensioner"](#), page 63

6 - Bolt

- 35 Nm

7 - Tensioning Element

- For ribbed belt for generator and coolant pump
- Removing and installing, refer to ⇒ ["4.10 Ribbed Belt Tensioning Damper for Generator and Coolant Pump"](#), page 72

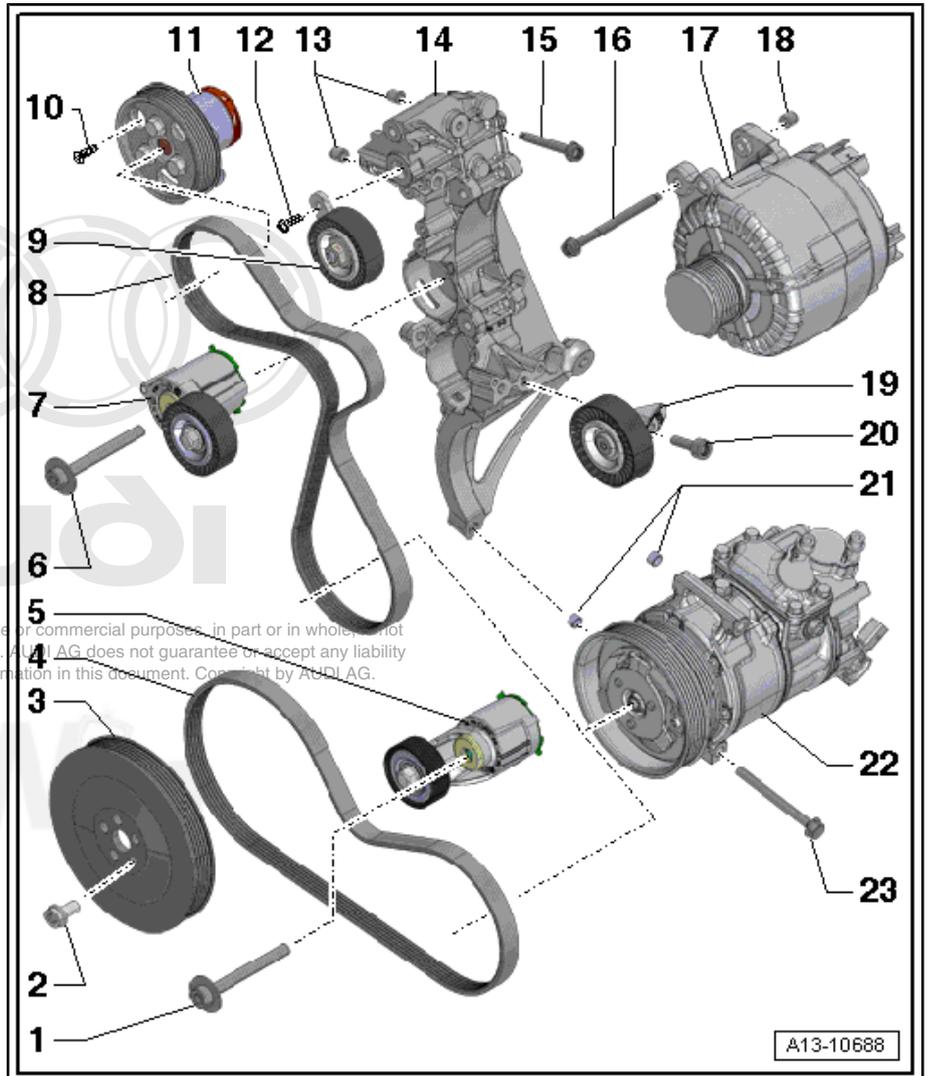
8 - Ribbed Belt for Generator and Coolant Pump

- Check for wear
- Before removing, mark the direction of rotation using chalk or a felt-tip pen.
- Removing and installing, refer to ⇒ ["4.7 Generator Ribbed Belt and Coolant Pump"](#), page 70
- Do not kink
- When installing, make sure it is seated correctly on the ribbed belt pulleys

9 - Idler Roller

10 - Bolt

- Tightening specification ⇒ [Item 2 \(page 179\)](#)



11 - Coolant Pump

- Removing and installing, refer to ⇒ [“5.4 Coolant Pump”, page 188](#)

12 - Bolt

- 8 Nm

13 - Alignment Sleeves

- For sub-assembly bracket

14 - Bracket for Assemblies

- Removing and installing, refer to ⇒ [“4.3 Accessory Assembly Bracket”, page 64](#)

15 - Bolt

- Different lengths
- Tightening specification and sequence, refer to ⇒ [Fig. “Accessory Assembly Bracket - Tightening Specifications and Tightening Sequence”](#), page 54

16 - Bolt

- For the correct tightening specification, refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Specifications

17 - Generator

- Removing and installing ⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation

18 - Slide Bushing

19 - Idler Roller

20 - Bolt

- 23 Nm

21 - Alignment Sleeves

- For air conditioning compressor

22 - A/C Compressor

- With double ribbed belt pulley
- Removing and installing, refer to ⇒ Heating, Ventilation and Air Conditioning; Rep. Gr. 87 ; Removal and Installation

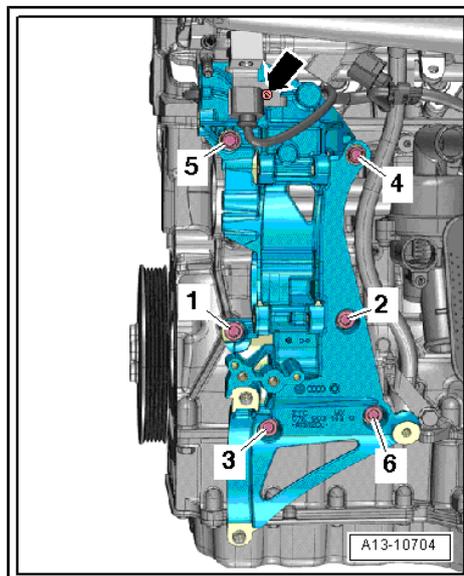
23 - Bolt

- Tightening specification ⇒ Heating, Ventilation and Air Conditioning; Rep. Gr. 87 ; Description and Operation

Accessory Assembly Bracket - Tightening Specifications and Tightening Sequence

- Replace the bolts for the auxiliary component bracket as follows:
 - ◆ Bolts -1, 2, 3, 6- M8x30.
 - ◆ Bolt -4- M8x60.
 - ◆ Bolt -5- M8x110.
- Tighten the bolts in two steps in the sequence shown:

Stage	Bolts	Tightening Specifications
1.	-1 through 6-	Install all the way in by hand.
2.	-1 through 6-	23 Nm



1.5 Sealing Flange, Ribbed Belt Side Overview

1 - Bolt

- ❑ Tightening specification
 ⇒ [Item 2 \(page 53\)](#)

2 - Vibration damper

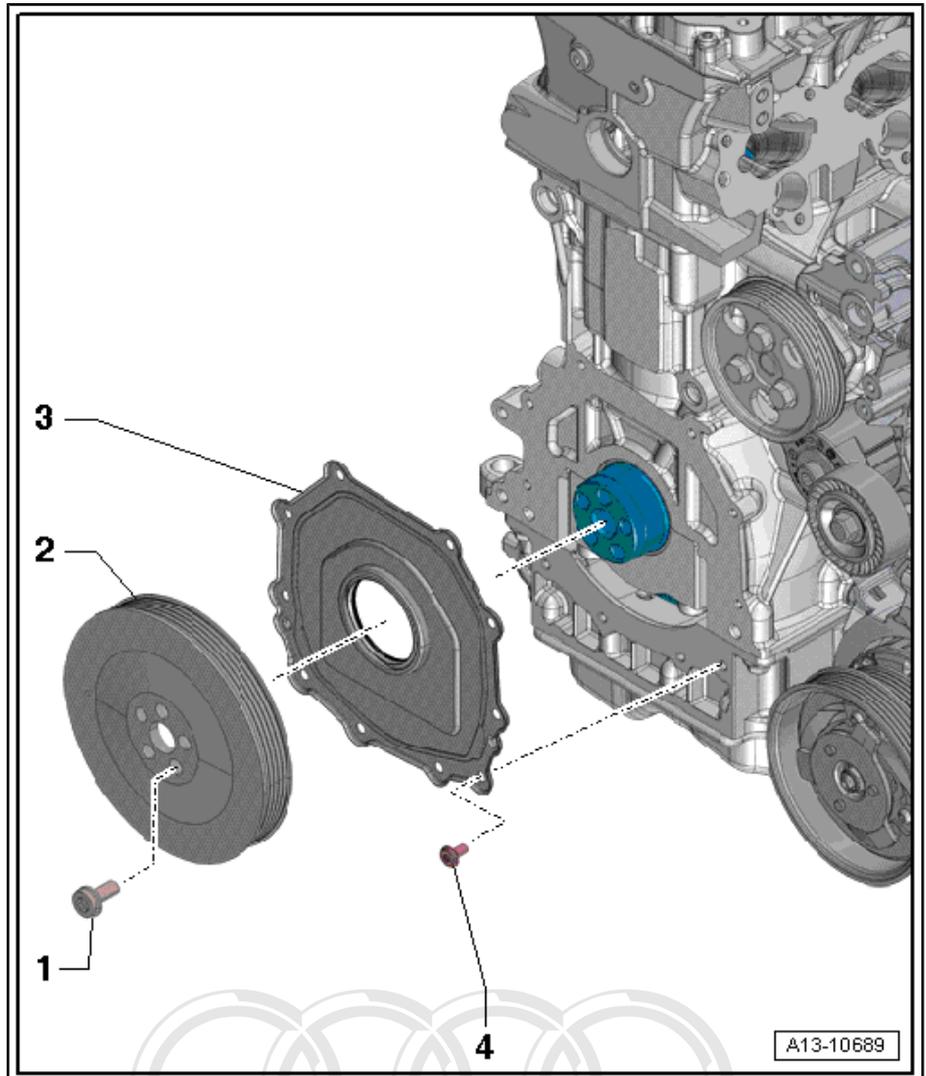
- ❑ Removing and installing, refer to
 ⇒ ["4.11 Vibration Damper", page 73](#)
- ❑ Only possible to install in one position

3 - Sealing Flange (belt pulley side)

- ❑ with centering bushing
- ❑ Removing and installing, refer to
 ⇒ ["4.4 Belt Pulley Side Sealing Flange", page 65](#)
- ❑ Install with sealant; sealant, refer to the Electronic Parts Catalog (ETKA)

4 - Bolt

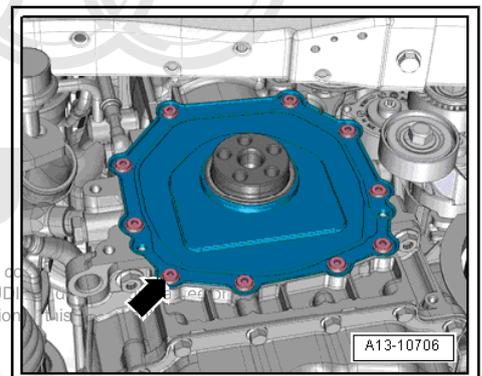
- ❑ Tightening specification and sequence, refer to
 ⇒ [Fig. "Ribbed Belt Pulley Side Sealing Flange - Tightening Specifications and Sequence", page 55](#)



Ribbed Belt Pulley Side Sealing Flange - Tightening Specifications and Sequence

– Tighten the bolt in 2 steps:

Stage	Bolts	Tightening Specifications
1.	-arrow-	Install all the way in by hand.
2.	-arrow-	Diagonally in steps at least to 9 Nm



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2 Specifications

⇒ "2.1 Crankshaft Dimensions", page 56

⇒ "2.2 Fastener Tightening Specifications", page 56

2.1 Crankshaft Dimensions

Honing Dimension	Crankshaft Bearing Pin Diameter mm	Crankshaft Connecting Rod Journal Diameter mm
Basic dimension	58.000 – 0.022 – 0.042	47.800 – 0.022 – 0.042

2.2 Fastener Tightening Specifications

Components	Fastener Size	Nm
Bearing Cap ¹	-	40 + 90°
Connecting Rod Bearing Cap ¹	-	45 + 90°
Coolant Pump	-	9
Dual Mass Flywheel ¹	-	60 + 90°
Idler Roller ²	-	8
	-	23
Oil Spray Jet	-	27
Tensioning Element for Ribbed Belt for A/C Compressor	-	35
Tensioning Element for Ribbed Belt for Generator and Coolant Pump	-	35
Vibration Damper ¹	-	50 + 90°
<ul style="list-style-type: none"> • ¹ Replace • ² For bolt tightening clarification, refer to ⇒ "1.4 Ribbed Belt Drive and Accessory Assembly Bracket Overview", page 53 and see items -12 and 20- 		

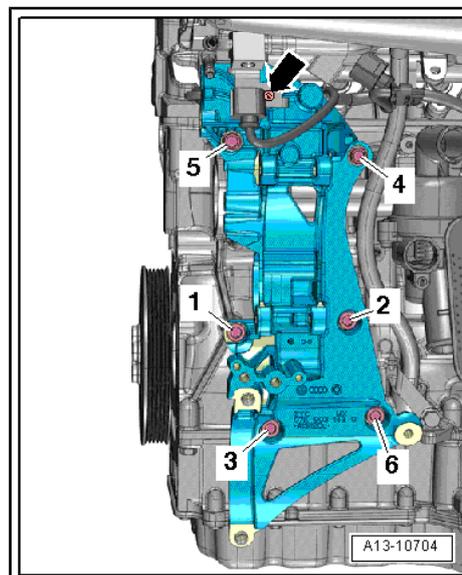
Accessory Assembly Bracket - Tightening Specifications and Tightening Sequence

– Replace the bolts for the auxiliary component bracket as follows:

- ◆ Bolts -1, 2, 3, 6- M8x30.
- ◆ Bolt -4- M8x60.
- ◆ Bolt -5- M8x110.

– Tighten the bolts in two steps in the sequence shown:

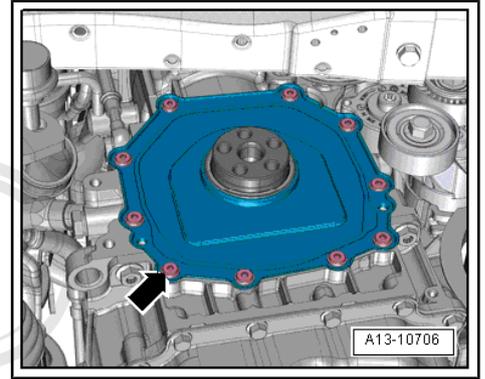
Stage	Bolts	Tightening Specifications
1.	-1 through 6-	Install all the way in by hand.
2.	-1 through 6-	23 Nm



Ribbed Belt Pulley Side Sealing Flange - Tightening Specifications and Sequence

– Tighten the bolt in 2 steps:

Stage	Bolts	Tightening Specifications
1.	-arrow-	Install all the way in by hand.
2.	-arrow-	Diagonally in steps at least to 9 Nm



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3 Diagnosis and Testing

⇒ [“3.1 Connecting Rod, Measuring Radial Clearance”, page 58](#)

⇒ [“3.2 Crankshaft, Measuring Axial Play”, page 58](#)

⇒ [“3.3 Crankshaft, Measuring Radial Play”, page 58](#)

⇒ [“3.4 Piston and Cylinder Bore, Checking”, page 59](#)

3.1 Connecting Rod, Measuring Radial Clearance

Special tools and workshop equipment required

- ◆ Plastigage

Procedure

- Remove connecting rod bearing cap. Clean the bearing cap and journal.
- Place the Plastigage over the entire width of the bearing journal or into the bearing shells.
- Plastigage must rest in the center of the bearing shell.
- Mount the connecting rod bearing cap and tighten the bolts to 45 Nm without tightening it further; do not turn the crankshaft.
- Reinstall connecting rod cover.
- Compare width of Plastigage with calibrated scale.

Radial clearance:

- New: 0.02 to 0.06 mm.
- Wear limit: 0.09 mm.
- Replace connecting rod bolts.

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3.2 Crankshaft, Measuring Axial Play

Special tools and workshop equipment required

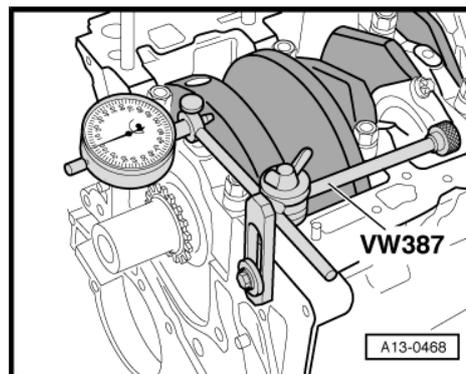
- ◆ Dial Gauge Holder -VW 387-
- ◆ Dial Gauge 0-10 mm -VAS 6079-

Procedure

- Install the -VAS 6079- with the -VW 387- on the cylinder block as shown in the illustration.
- Place the dial gauge against the crankshaft counterweight.
- Press the crankshaft against the dial gauge by hand and set the gauge to “0”.
- Press the crankshaft off the dial gauge and read the measurement.

Axial clearance:

- New: 0.07 to 0.21 mm.
- Wear limit: 0.30 mm.



3.3 Crankshaft, Measuring Radial Play

Special tools and workshop equipment required

- ◆ Plastigage

Procedure

Note

- ◆ *Marked the used bearing for installation later, but not on the running surface.*
- ◆ *Replace bearing shells that are worn down to the base layer.*
- Remove bearing cap.
- Clean bearing cap and bearing journals.
- Place the Plastigage over the entire width of the bearing journal or into the bearing shells.
- Plastigage must rest in center of bearing shell.
- Position the bearing cap and tighten the bolts to 40 Nm without rotating the crankshaft.
- Reinstall bearing cap.
- Compare width of Plastigage with calibrated scale.

Radial clearance:

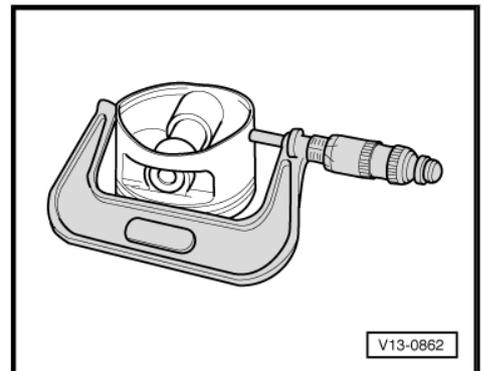
- New: 0.023 to 0.043 mm.
- Wear limit: 0.07 mm.

3.4 Piston and Cylinder Bore, Checking

Pistons, Checking

- With an external micrometer 75 ... Take measurement at 100 mm approximately 10 mm from lower edge of piston skirt and offset 90° to piston axis.
- ◆ Deviation from nominal size: max. 0.04 mm.

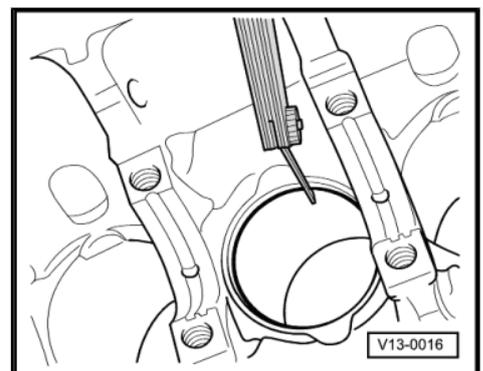
		Piston Diameter
Basic dimension	mm	82.451 ¹⁾
• ¹⁾ Measurements without graphite coating (thickness = 0.02 mm). The graphite coating wears off.		



Piston Ring Gap, Checking

- Push piston ring squarely from above down to approximately 15 mm from bottom end of the cylinder. To do this use a piston without rings.
- Measure with feeler gauge.

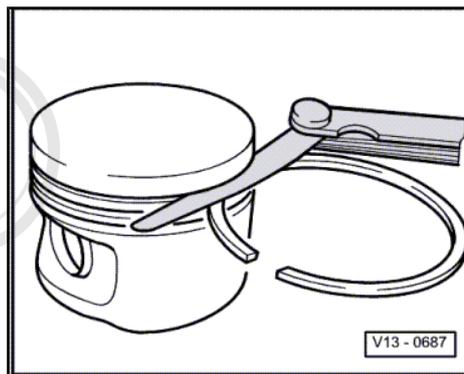
Piston Ring Dimensions in mm	New	Wear Limit
Compression ring	0.20 to 0.40	0.80
Oil scraping ring	0.25 to 0.50	0.80



Measuring the Ring to Groove Clearance

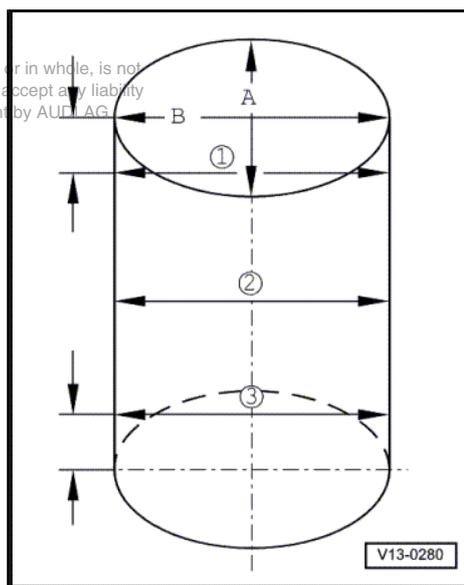
- Clean piston ring groove.
- Measure with feeler gauge.

Piston Ring	New mm	Wear Limit mm
Compression rings	0.06 to 0.09	0.20
Oil scraping ring	0.03 to 0.06	0.15



Cylinder Bore, Checking

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Special tools and workshop equipment required

- ◆ Internal dial gauge -VAS 6078- or Inside Micrometer Set 18-100 mm -US1033/S-
- ◆ Engine and Transmission Holder -VAS 6095-

Note

- ◆ *A shadow or a shiny spot on the wall of the cylinder does not mean the cylinder bore is damaged as long as the cross-grinding is still visible.*
- ◆ *Always measure the cylinder bore in 3 places laterally and longitudinally using -VAS 6078- or -US1033/S- .*
- Using a -VAS 6078- or -US1033/S- measure in a diagonal sequence at 3 positions transversely -A- and longitudinally -B-.
- ◆ Deviation from nominal size: max. 0.08 mm.

		Cylinder Bore Diameter
Basic dimension	mm	82.510



Note

Measurement of the cylinder bore may not be performed when the cylinder block is mounted in -VAS 6095-, false measurements are possible.



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4 Removal and Installation

- ⇒ ["4.1 A/C Compressor Ribbed Belt", page 62](#)
- ⇒ ["4.2 A/C Compressor Ribbed Belt Tensioner", page 63](#)
- ⇒ ["4.3 Accessory Assembly Bracket", page 64](#)
- ⇒ ["4.4 Belt Pulley Side Sealing Flange", page 65](#)
- ⇒ ["4.5 Crankshaft Seal, Transmission Side", page 67](#)
- ⇒ ["4.6 Dual Mass Flywheel", page 69](#)
- ⇒ ["4.7 Generator Ribbed Belt and Coolant Pump", page 70](#)
- ⇒ ["4.8 New Connecting Rod, Separating", page 71](#)
- ⇒ ["4.9 Piston", page 71](#)
- ⇒ ["4.10 Ribbed Belt Tensioning Damper for Generator and Coolant Pump", page 72](#)
- ⇒ ["4.11 Vibration Damper", page 73](#)

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4.1 A/C Compressor Ribbed Belt

Removing

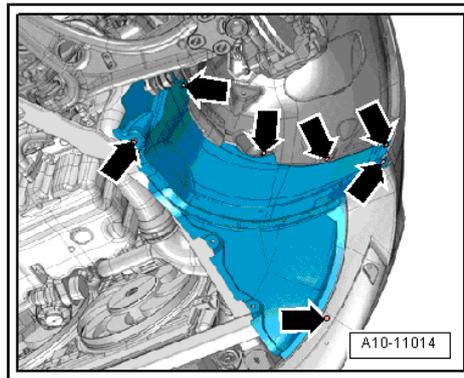
- Remove the right front wheel. Refer to ⇒ Wheel and Tire Guide; Rep. Gr. 44 ; Removal and Installation .
- Remove the right front underside of wheel housing liner. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Removal and Installation .



Caution

Risk of destroying due to reversed running direction on a used ribbed belt.

- ◆ *Before removing Air Conditioning (A/C) compressor ribbed belt, marking running direction with chalk or felt-tip pen for reinstallation later.*

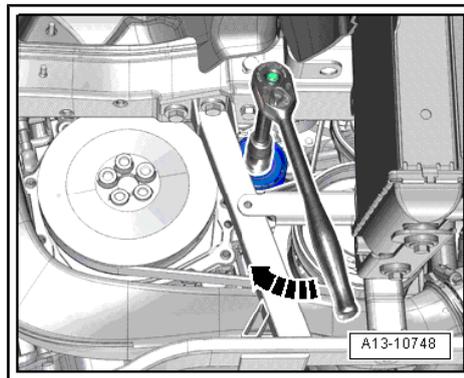


- Pivot the tensioner clockwise -arrow- to release the tension on the ribbed belt.
- Remove the A/C compressor ribbed belt, release the tensioner.

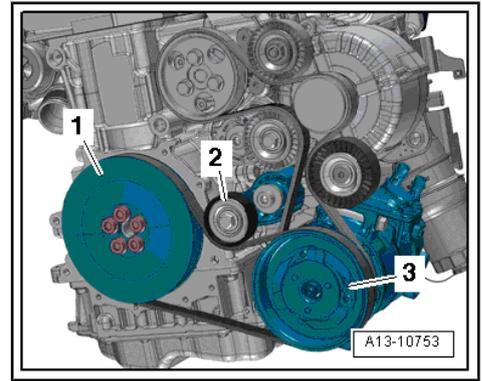
Installing

Install in reverse order, paying attention to the following:

- Move the tensioner clockwise -arrow-.



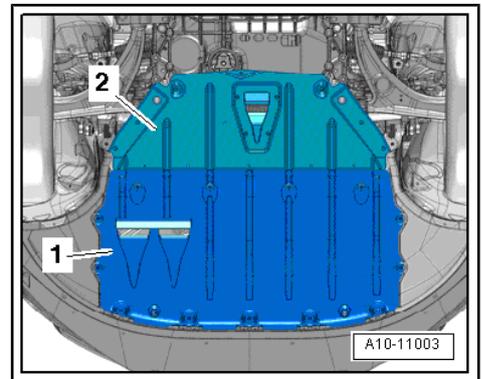
- Place the ribbed belt on the ribbed belt pulleys then place it on the A/C compressor ribbed belt pulley.
- 1 - Vibration damper
- 2 - Tensioning element
- 3 - A/C Compressor
- Release the tension on the tensioner.
- Check the ribbed belt for correct positioning.
- Start the engine and check the belt routing.
- Install the front underside of the wheel housing liner. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Removal and Installation .
- Install the front wheel. Refer to ⇒ Wheel and Tire Guide; Rep. Gr. 44 ; Removal and Installation .



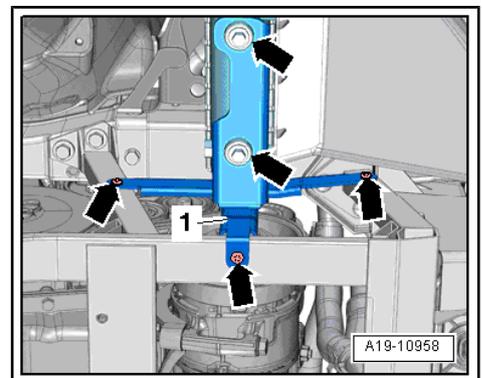
4.2 A/C Compressor Ribbed Belt Tensioner

Removing

- Remove the Air conditioning (A/C) compressor ribbed belt. Refer to ⇒ [“4.1 A/C Compressor Ribbed Belt”, page 62](#) .
- Remove the front noise insulation -1-. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Removal and Installation .



- Remove the bolts -arrows- and remove the auxiliary cooler bracket -1-.

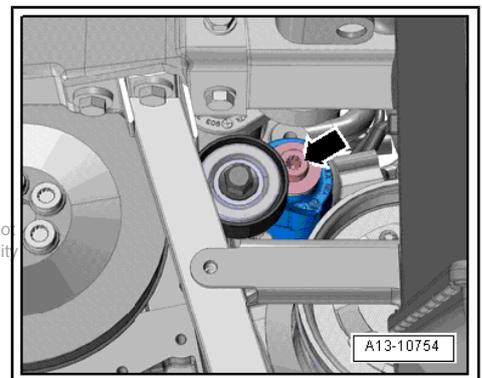


- Remove the bolt -arrow- and release the tensioner.

Installing

Install in reverse order, paying attention to the following:

- Tightening specification, refer to ⇒ [“1.4 Ribbed Belt Drive and Accessory Assembly Bracket Overview”, page 53](#) .
- Install the auxiliary cooler mount, refer to ⇒ [“2.4 Radiator and Coolant Fan Overview”, page 180](#) .
- Install the front noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Removal and Installation .
- Install the A/C compressor ribbed belt. Refer to ⇒ [“4.1 A/C Compressor Ribbed Belt”, page 62](#) .

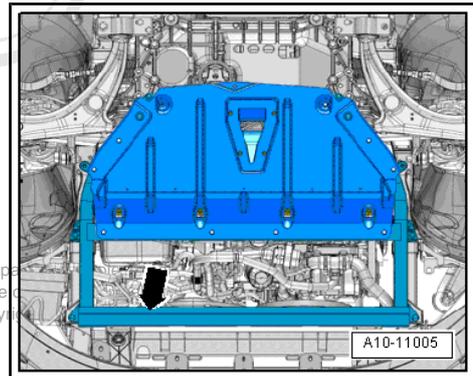


4.3 Accessory Assembly Bracket

Removing

- Remove the tensioner for the Air Conditioning (A/C) compressor ribbed belt. Refer to ⇒ [“4.2 A/C Compressor Ribbed Belt Tensioner”, page 63](#) .
- Remove the generator. Refer to ⇒ Electrical System; Rep. Gr. 27 ; Removal and Installation .
- Remove the engine bracket. Refer to ⇒ [“4.5 Engine Mount”, page 41](#) .
- Remove the noise insulation frame -arrow- and the rear noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Removal and Installation .
- Remove the fan shroud. Refer to ⇒ [“5.8 Fan Shroud”, page 193](#) .

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- Disconnect the connector -1- on the A/C compressor regulator valve -N280- .

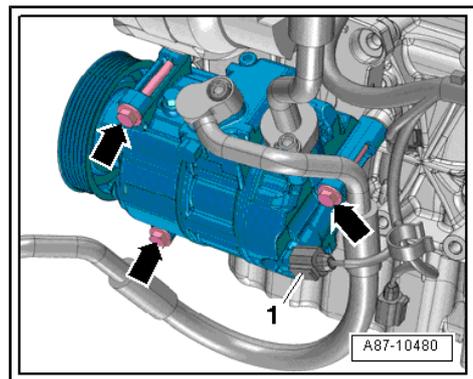


Caution

Risk of damaging refrigerant lines and hoses.

- ◆ **Do not stretch, kink or bend refrigerant lines and hoses.**

- Remove the bolts -arrows-.
- Remove the A/C compressor from the bracket and tie it to the lock carrier.

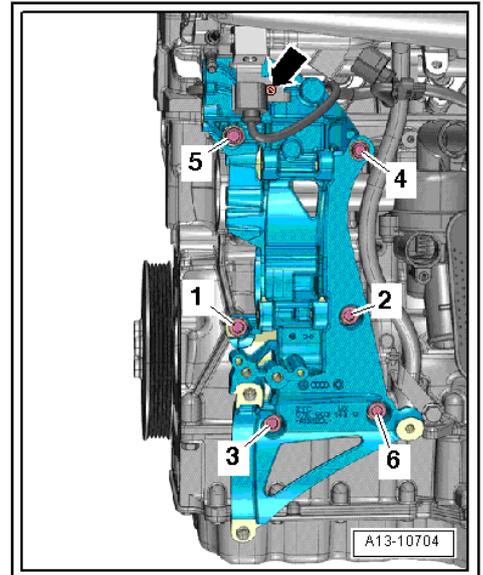


- Remove bolt -arrow-.
- Remove bolts -1 to 6- and remove accessory assembly bracket.

Installing

Install in reverse order, paying attention to the following:

- Tighten accessory assembly bracket bolts. Refer to ⇒ [Fig. "Accessory Assembly Bracket - Tightening Specifications and Tightening Sequence"](#), page 54 .
- Install A/C compressor. Refer to ⇒ Heating, Ventilation and Air Conditioning; Rep. Gr. 87 ; Removal and Installation .
- Install fan shroud. Refer to ⇒ ["5.8 Fan Shroud"](#), page 193 .
- Install the noise insulation frame. Refer to ⇒ Body Exterior; Rep. Gr. 50 ; Removal and Installation .
- Install the engine mount. Refer to ⇒ ["4.5 Engine Mount"](#), page 41 .
- Install the generator. Refer to ⇒ Electrical System; Rep. Gr. 27 ; Removal and Installation .
- Install the tensioner for the A/C compressor ribbed belt. Refer to ⇒ ["4.2 A/C Compressor Ribbed Belt Tensioner"](#), page 63 .



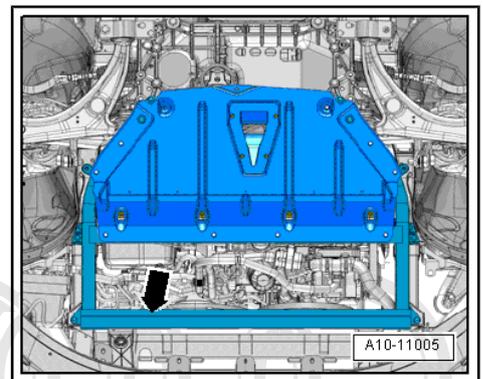
4.4 Belt Pulley Side Sealing Flange

Special tools and workshop equipment required

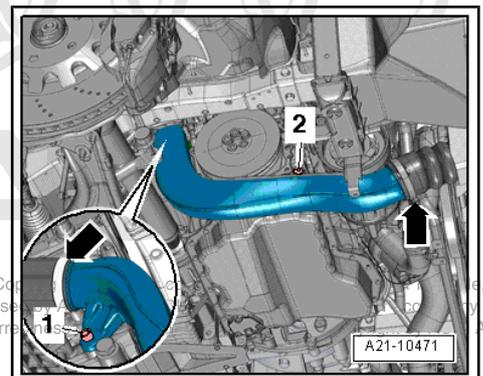
- ◆ Oil Seal Guide Sleeve -T03004-
- ◆ Hand drill with plastic brush attachment
- ◆ Protective goggles
- ◆ Sealant, refer to the Electronic Parts Catalog (ETKA)

Procedure

- Remove vibration damper. Refer to ⇒ ["4.11 Vibration Damper"](#), page 73 .
- Remove the noise insulation frame -arrow- and the rear noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 50 ; Removal and Installation .



- Remove the bolts -1 and 2-.
- Remove the air guide pipe, to do so, loosen the hose clamps -arrows-.

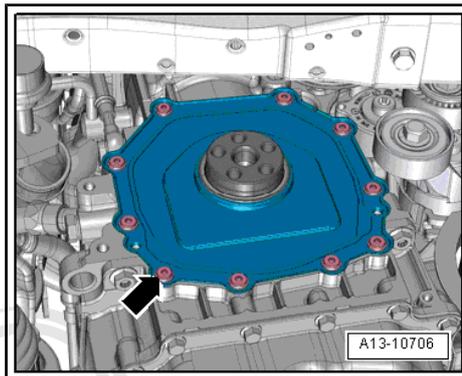


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- Remove the bolts -arrow-.
- Carefully loosen the sealing flange from the bond.

 **Note**

Replace the sealing flange.



 **Caution**

Risk of contaminating lubrication system with sealant residue.

- ◆ Seal off the open section of the cylinder block with cloth.

 **WARNING**

Danger of eye injury.

- ◆ Wear protective goggles.

- Remove sealant residue on the cylinder block, for example with a rotating plastic brush.
- Clean the sealing surfaces and crankshaft bearing pin; they must be free of oil and grease.

 **Note**

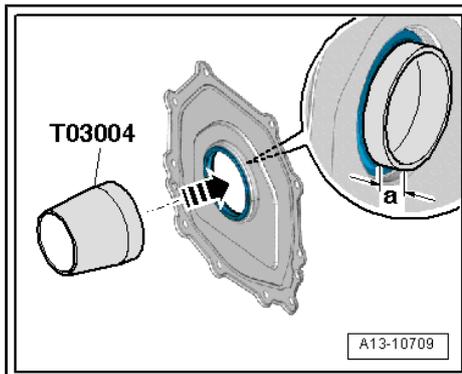
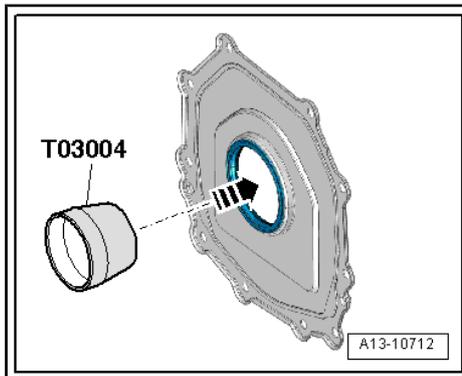
Do not use any additional grease or oil on the shaft seal sealing lip in the sealing flange.

 **Caution**

The shaft seal in the sealing flange could be damaged.

- ◆ The following preparations are necessary to prevent the shaft seal sealing lip in the sealing flange from inverting.

- Widen the shaft seal sealing lip in the sealing flange with -T03004-, as shown in the illustration.
- Smaller diameter for the shaft seal.
- Remove the -T03004- after a little time has past, and install it upside down into the shaft seal.
- Larger diameter for the shaft seal.
- The -T03004- must be at dimension -a- on the inside of the sealing flange.
- Dimension -a- = approximately 3 mm.



 **Note**

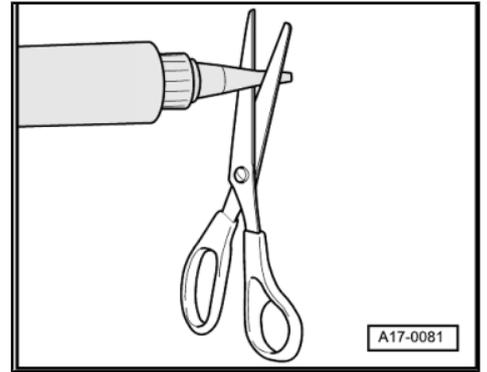
Note the expiration date of the sealing compound.

- Cut the tube nozzle at the front marking (nozzle diameter approximately 2 mm).

 **Caution**

The lubrication system could be plugged with excess sealant.

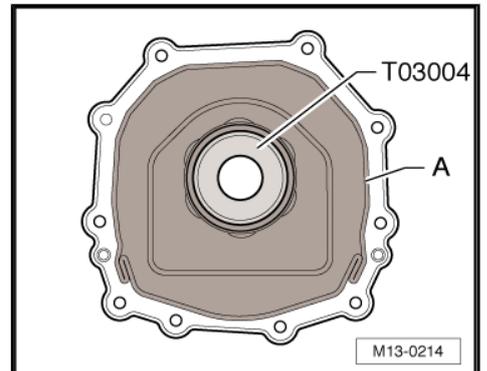
◆ *Do not apply sealant bead thicker than indicated.*



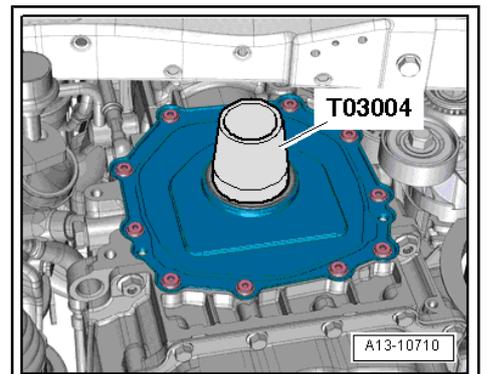
- Apply sealant bead -A- to clean sealing flange sealing surface as shown in illustration.
- Width of sealant bead: 2.5 to 3 mm.
- The sealant bead must be about 1.0 mm above the sealing surface.

 **Note**

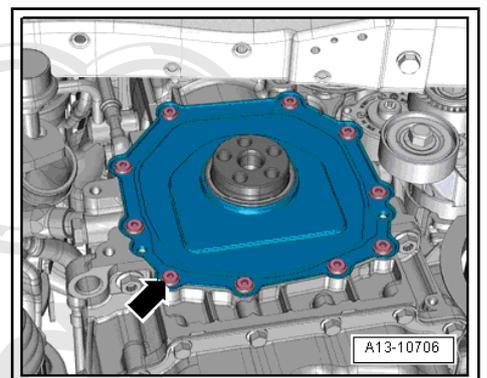
The sealing flange must be installed within 5 minutes after applying the sealant.



- Carefully remove the sealing flange and -T03004- from the crankshaft bearing pin while pressing on the cylinder block at the same time and watching the left and right of the centering bushing.



- Tighten the sealing flange. Refer to [⇒ Fig. "Ribbed Belt Pulley Side Sealing Flange - Tightening Specifications and Sequence", page 55](#).
- Install the air guide pipe. Refer to [⇒ "1.1 Charge Air Cooler Overview", page 209](#).
- Install the noise insulation frame. Refer to ⇒ Body Exterior; Rep. Gr. 50 ; Removal and Installation .
- Install vibration damper. Refer to [⇒ "4.11 Vibration Damper", page 73](#).



4.5 Crankshaft Seal, Transmission Side

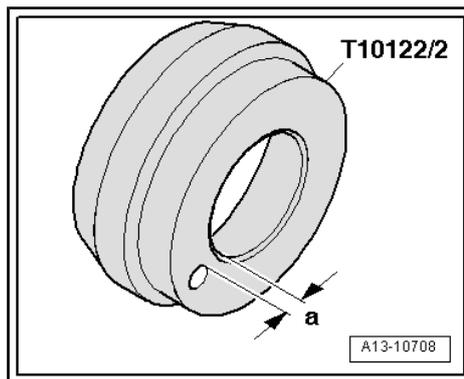
Special tools and workshop equipment required

- ◆ Assembly Tool -T10122-
- ◆ Pulling Hook -T20143/2-

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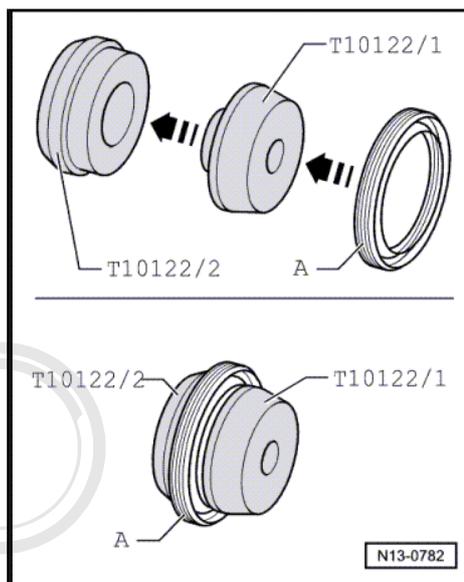
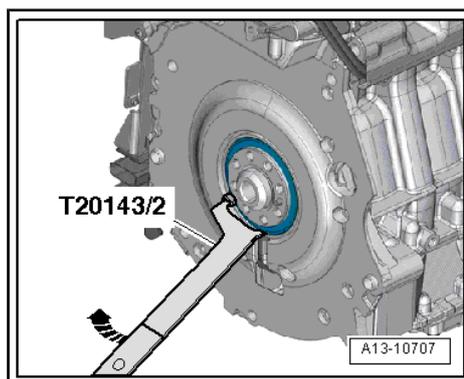
Prepare Pulling Sleeve -T10122/2- :

- Rework the alignment pin opening in the -T10122/2- until it reaches the dimension -a- = 8 mm.

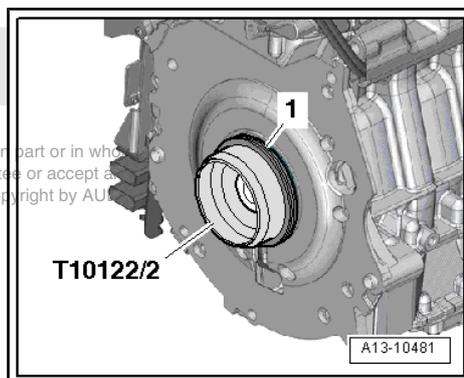


Procedure

- Transmission removed.
- Remove dual mass flywheel. Refer to [-> "4.6 Dual Mass Flywheel", page 69](#).
- Pry out the seal using -T20143/2- -arrow-.
- Clean the running and sealing surface.
- Place the assembly device -T10122/1- on the pull sleeve -T10122/2- and slide the shaft seal -A- onto the pull sleeve.
- Remove the assembly device.

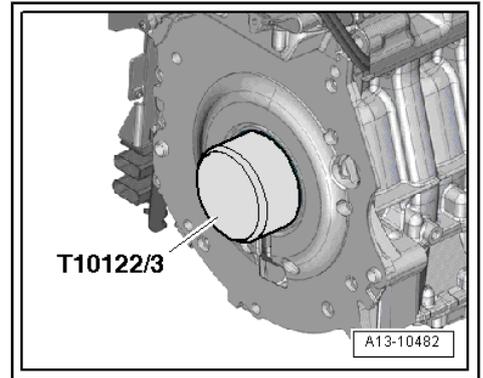


- Position the -T10122/2- with shaft seal -1- on the crankshaft.



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- Press the shaft seal in evenly all around with the thrust piece -T10122/3- until flush.
- Install dual mass flywheel. Refer to [⇒ "4.6 Dual Mass Flywheel", page 69](#) .



4.6 Dual Mass Flywheel

Special tools and workshop equipment required

- ◆ Flywheel Retainer -3067-

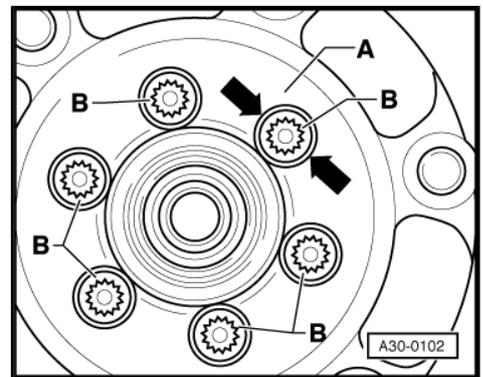
Removing

- Transmission removed.

 **Caution**

Risk of destroying dual mass flywheel.

- ◆ **Remove bolts -B- by hand, not with an air-powered or impact wrench.**
- ◆ **When removing bolts, ensure bolt head does not come in contact with dual mass flywheel.**
- ◆ **Rotate dual mass flywheel -A- so bolts -B- are centered to holes -arrows-.**



- Place the -3067- into the hole on the cylinder block -B-, then remove the dual mass flywheel bolts.

Installing

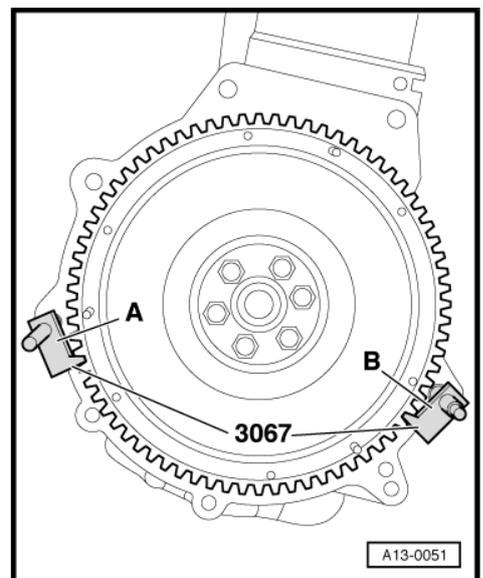
Install in reverse order, paying attention to the following:

- Tightening specification, refer to [⇒ "1.2 Dual Mass Flywheel Overview", page 50](#) .

 **Caution**

Risk of chafing.

- ◆ **Replace the diamond discs ⇒ [Item 3 \(page 50\)](#) and ⇒ [Item 7 \(page 50\)](#) after each time that the dual mass flywheel bolts are loosened.**



Note

- ◆ *Replace bolts that are tightened to the specification.*
- ◆ *The dual mass flywheel with sensor wheel and diamond discs is only able to be installed in one position.*

- Place the -3067- into the hole on the cylinder block -A-.

4.7 Generator Ribbed Belt and Coolant Pump

Removing

- Remove the Air conditioning (A/C) compressor ribbed belt. Refer to ⇒ [“4.1 A/C Compressor Ribbed Belt”, page 62](#) .
- Release the EVAP canister -arrow B-, remove upward -arrow A- and lay it to the side along with the connected hose -1-.



Note

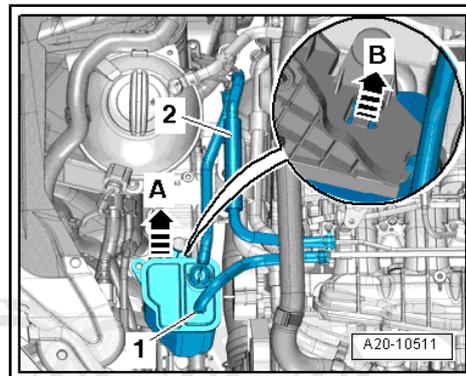
Ignore -2-.



Caution

Risk of destroying due to reversed running direction on a used ribbed belt.

- ◆ **Before removing generator ribbed belt and coolant pump, mark running direction with chalk or felt-tip pen for reinstallation later.**

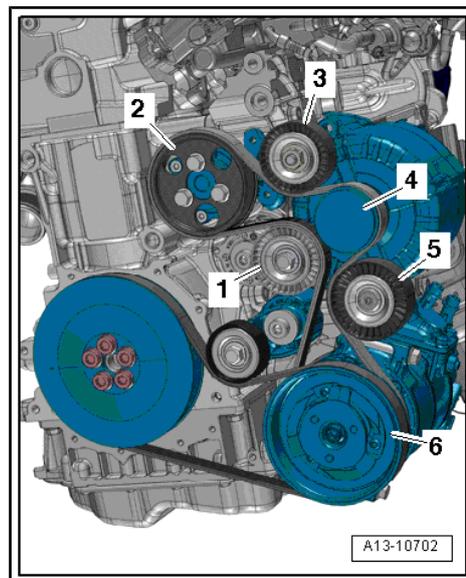
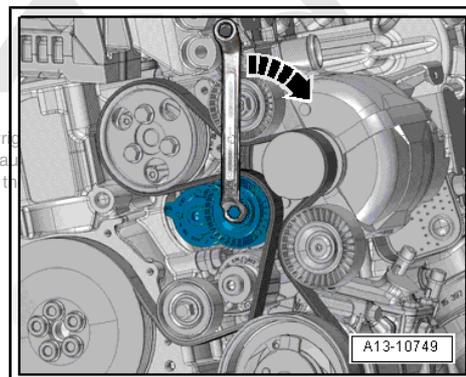


- Pivot the tensioner clockwise -arrow- to release the tension on the ribbed belt.
- Remove the generator ribbed belt and coolant pump and then release the tensioner.

Installing

Install in reverse order, paying attention to the following:

- Move the tensioner clockwise -arrow-.
 - Place the ribbed belt on the ribbed belt pulleys then place it on the generator pulley.
- 1 - Tensioning element
 - 2 - Coolant pump
 - 3 - Idler roller
 - 4 - Generator
 - 5 - Idler roller
 - 6 - A/C Compressor
- Release the tension on the tensioner.
 - Check ribbed belt for correct positioning.
 - Install the A/C compressor ribbed belt. Refer to ⇒ [“4.1 A/C Compressor Ribbed Belt”, page 62](#) .



4.8 New Connecting Rod, Separating

New connecting rods may not be separated at the location where they should be. If the connecting rod bearing cap cannot be removed by hand, proceed as follows:

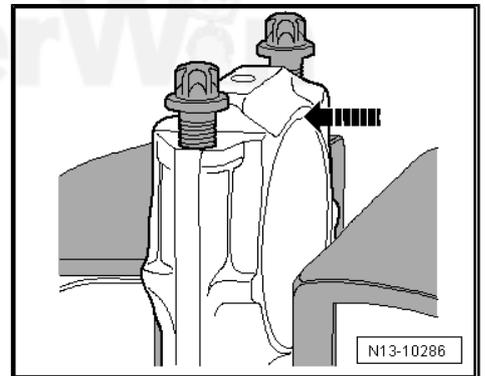
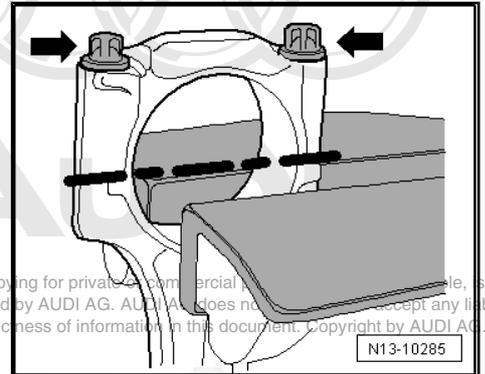
- Clamp the connecting rod in a vise, which has protectors over the grips to prevent damage.

Note

- ◆ *Only clamp the connecting rod lightly to avoid damaging it.*
- ◆ *Clamp the connecting rod below the dotted line.*

- Remove the bolts -arrows- approximately 5 turns.

- Carefully tap the connecting rod bearing cap with a plastic hammer -arrow- until it comes loose.



4.9 Piston

Special tools and workshop equipment required

- ◆ Pilot Drift -VW 222 A-
- ◆ Engine and Transmission Holder -VAS 6095-
- ◆ Pilot Drift -VW 222 A-
- ◆ Piston ring compressor, commercially available

Removing

- Removing engine. Refer to [⇒ "4.1 Engine, Removing", page 17](#) .
- Secure engine to the -VAS 6095- . Refer to [⇒ "4.3 Engine, Securing to Engine and Transmission Holder", page 36](#) .
- Cylinder head, removing, refer to [⇒ "4.5 Cylinder Head", page 110](#) .
- Remove the upper oil pan. Refer to [⇒ "5.3 Upper Oil Pan", page 152](#) .
- Mark installed position and cylinder allocation
- Mark installed position and connecting rod cylinder [⇒ Item 4 \(page 51\)](#) .
- Remove the connecting rod bearing cap and pull the piston and connecting rod upward.

 **Note**

Warm the piston to approximately 60 °C (140 °F) if it is difficult to move the piston pin.

- Remove the locking ring from the eye of the piston bolt.
- Remove the piston pin using -VW 222 A- .

Installing

Installation is carried out in the reverse order while noting the following:

- Tightening specification, refer to [⇒ "1.3 Pistons and Connecting Rod Overview", page 51](#) .

 **Note**

- ◆ Replace bolts that are tightened to the specification.
- ◆ Arrow on piston face points toward belt pulley side.
- ◆ Offset the piston ring gap by 120° .
- Coat the contact surfaces on the bearing shells with oil.
- Install the piston with a piston ring compressor. Pay attention to the installed position ⇒ [Item 7 \(page 52\)](#) .
- Install the connecting rod bearing cap. Pay attention to the installed position ⇒ [Item 2 \(page 51\)](#) .
- Installing cylinder head. Refer to [⇒ "4.5 Cylinder Head", page 110](#) .
- Install the upper oil pan. Refer to [⇒ "5.3 Upper Oil Pan", page 152](#) .

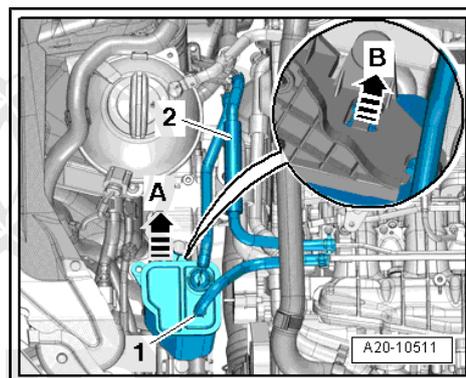
4.10 Ribbed Belt Tensioning Damper for Generator and Coolant Pump

Removing

- Release the Evaporative Emission (EVAP) canister -arrow B-, remove upward -arrow A- and lay it to the side along with the connected hose -1-.

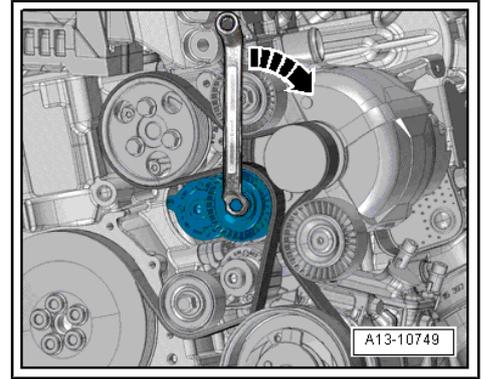
 **Note**

Ignore -2-.



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- Pivot the tensioner clockwise -arrow- to release the tension on the ribbed belt.
- Remove the ribbed belt from the generator and release the tension on the tensioning element.

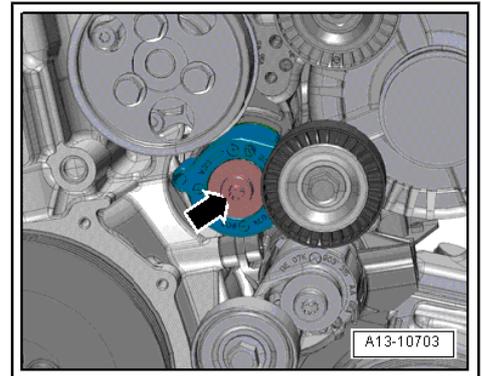


- Remove the bolt -arrow- and release the tensioner.

Installing

Install in reverse order, paying attention to the following:

- Tightening specification, refer to ⇒ ["1.4 Ribbed Belt Drive and Accessory Assembly Bracket Overview", page 53](#) .
- Install the generator ribbed belt and the coolant pump, refer to ⇒ ["4.7 Generator Ribbed Belt and Coolant Pump", page 70](#) .



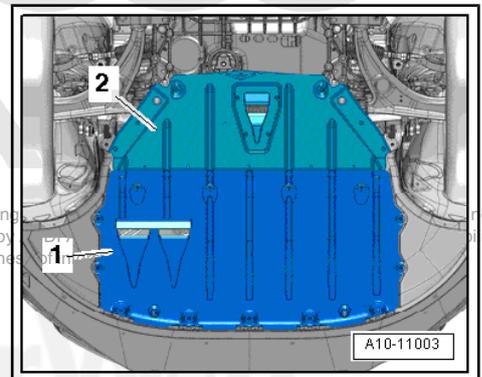
4.11 Vibration Damper

Special tools and workshop equipment required

- ◆ Crankshaft Adapter -T03003-
- ◆ Locking Pin -T40069-

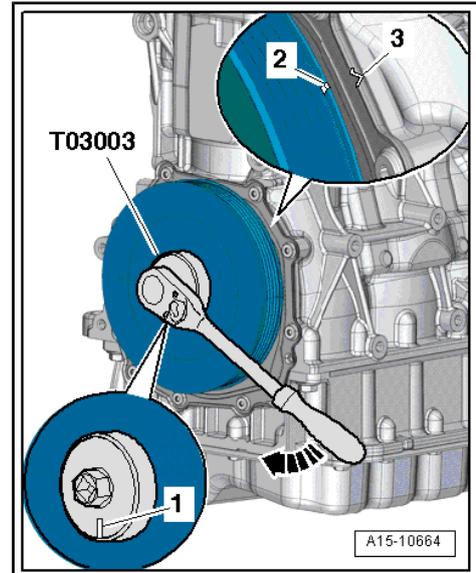
Removing

- Remove the Air Conditioning (A/C) compressor ribbed belt. Refer to ⇒ ["4.1 A/C Compressor Ribbed Belt", page 62](#) .
- Remove the noise insulation -1 and 2-. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Removal and Installation .

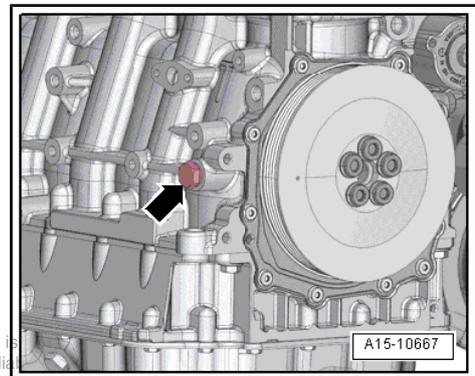


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- Turn the crankshaft in the direction of engine rotation -arrow- to "TDC" using the -T03003- .
- The notch -1- in the -T03003- is positioned vertically to the oil pan gasket.
- The marking -2- on the vibration damper is positioned opposite the marking -3- on the sealing flange.

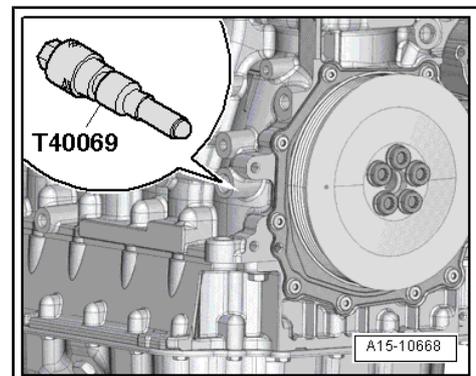


- Remove the locking bolt -arrow- for the "TDC" marking from the cylinder block.



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- Install the -T40069- in the nut and tighten to 15 Nm. If necessary, move the crankshaft back and forth slightly to center the bolt.



- Remove the bolts -arrow- and remove the vibration damper.

Installing

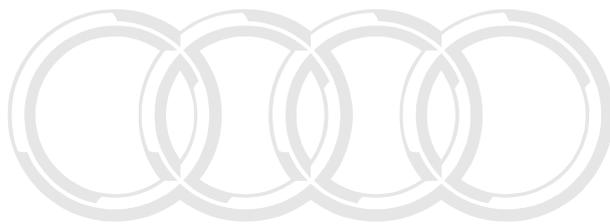
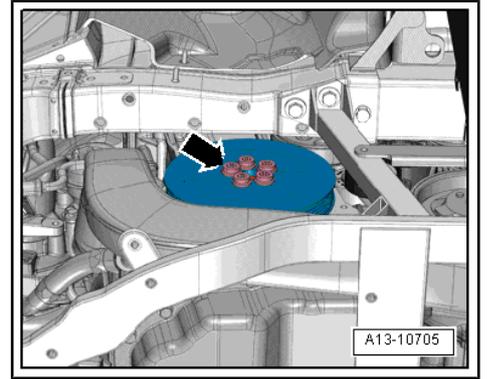
Install in reverse order, paying attention to the following:

- Tightening specification, refer to
⇒ [“1.4 Ribbed Belt Drive and Accessory Assembly Bracket Overview”, page 53](#) .

Note

- ◆ *Replace bolts that are tightened to the specification.*
- ◆ *The vibration damper can only be installed in one position.*

- Remove the -T40069- .
- Tighten the “TDC” marking locking bolt. Refer to
⇒ [Fig. ““TDC Locking Bolt- Marking- Tightening Specification””, page 49](#) .
- Install the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Removal and Installation .
- Install the Air Conditioning (A/C) compressor ribbed belt. Refer to ⇒ [“4.1 A/C Compressor Ribbed Belt”, page 62](#) .



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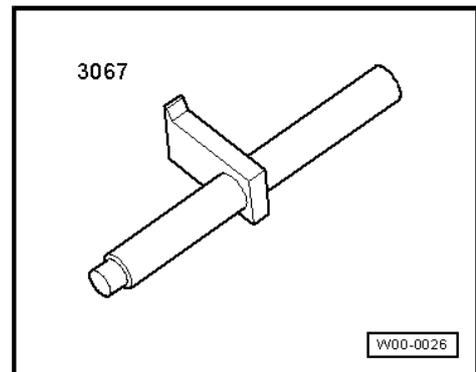
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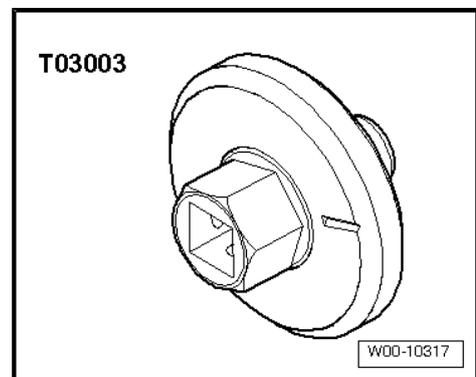
5 Special Tools

Special tools and workshop equipment required

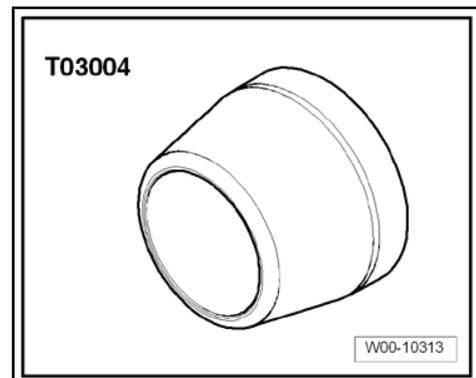
- ◆ Flywheel Retainer -3067-



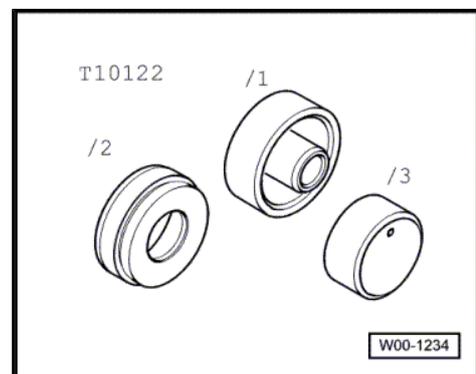
- ◆ Crankshaft Adapter -T03003-



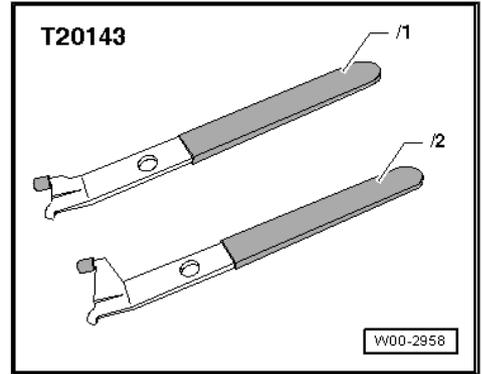
- ◆ Oil Seal Guide Sleeve -T03004-



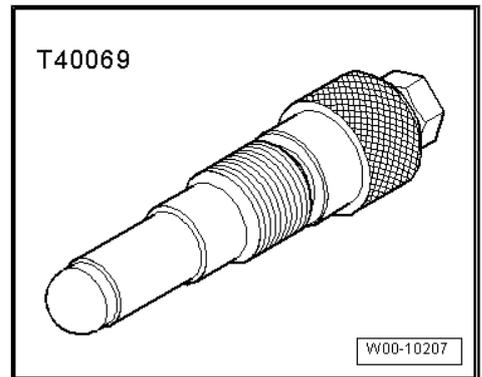
- ◆ Assembly Tool -T10122- for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



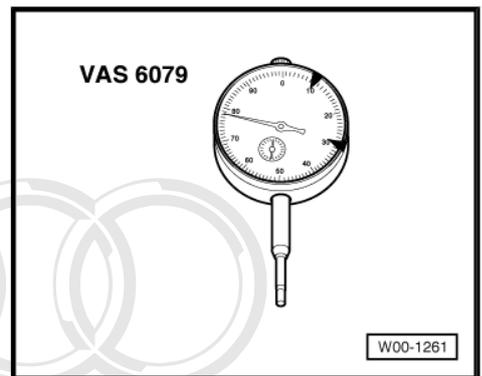
◆ Pulling Hook -T20143/2-



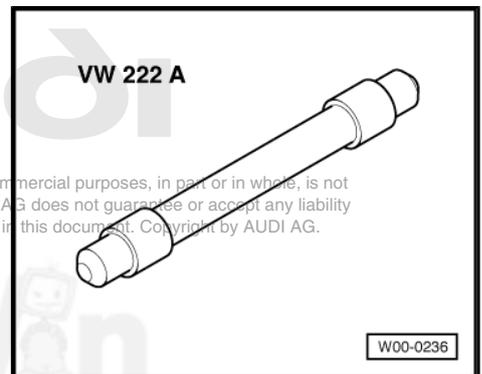
◆ Locking Pin -T40069-



◆ Dial Gauge 0-10 mm -VAS 6079-

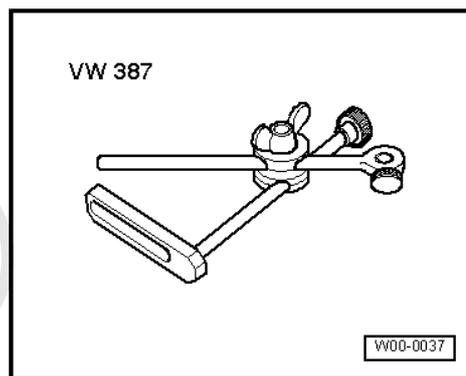
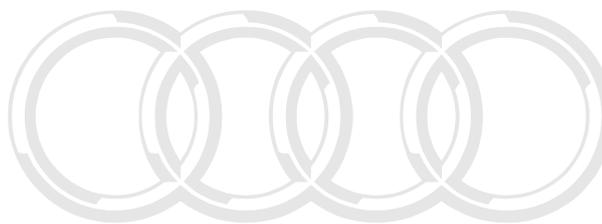


◆ Pilot Drift -VW 222 A-



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- ◆ Dial Gauge Holder -VW 387-



- ◆ Not illustrate:
- ◆ Internal dial gauge -VAS 6078- or Inside Micrometer Set 18-100 mm -US1033/S-
- ◆ Engine and Transmission Holder -VAS 6095-

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15 – Cylinder Head, Valvetrain

1 Description and Operation

- ⇒ [“1.1 Camshaft Timing Chain Overview”, page 79](#)
- ⇒ [“1.2 Cylinder Head Cover and Cylinder Head Overview”, page 80](#)
- ⇒ [“1.3 Timing Chain Covers Overview”, page 83](#)
- ⇒ [“1.4 Timing Mechanism Drive Chain Overview”, page 85](#)
- ⇒ [“1.5 Valvetrain Overview”, page 86](#)

1.1 Camshaft Timing Chain Overview

1 - Drive Chain Sprocket for the Camshaft Timing Chain

2 - Guide Rail

3 - Bolt

- 60 Nm plus an additional 90° turn
- Replace

4 - Camshaft Adjuster for Intake Camshaft

- Designation “IN”
- Removing and installing, refer to ⇒ [“4.3 Camshaft Timing Chain”, page 102](#)

5 - Bolt

- 9 Nm

6 - Camshaft Timing Chain Tensioner

7 - Oil Strainer

- Insert into the cylinder head

8 - Gasket

- Replace

9 - Camshaft Adjuster for Exhaust Camshaft

- Designation “EX”
- Removing and installing, refer to ⇒ [“4.3 Camshaft Timing Chain”, page 102](#)

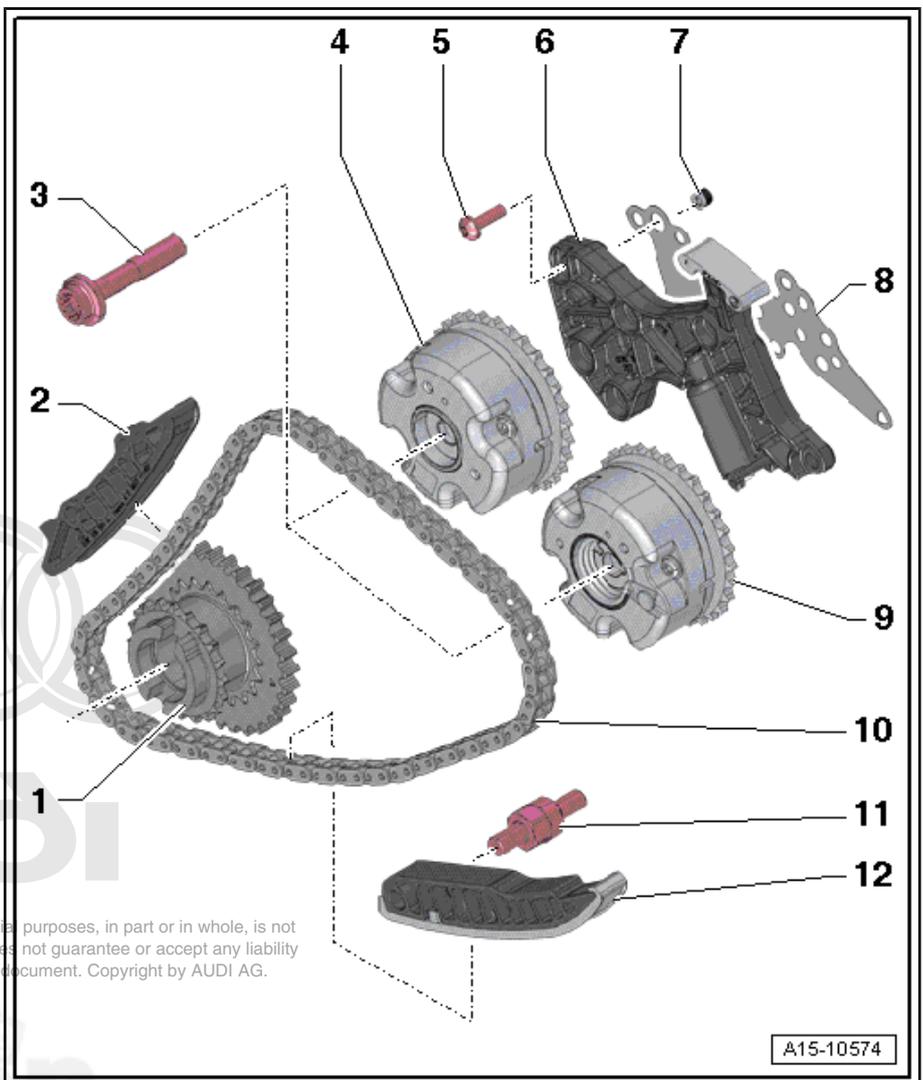
10 - Camshaft Timing Chain

- Mark the running direction with pain before removing.
- Removing and installing, refer to ⇒ [“4.3 Camshaft Timing Chain”, page 102](#)

11 - Mounting Pin

- 40 Nm

12 - Tensioning Rail



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1.2 Cylinder Head Cover and Cylinder Head Overview

1 - Cylinder Head Gasket

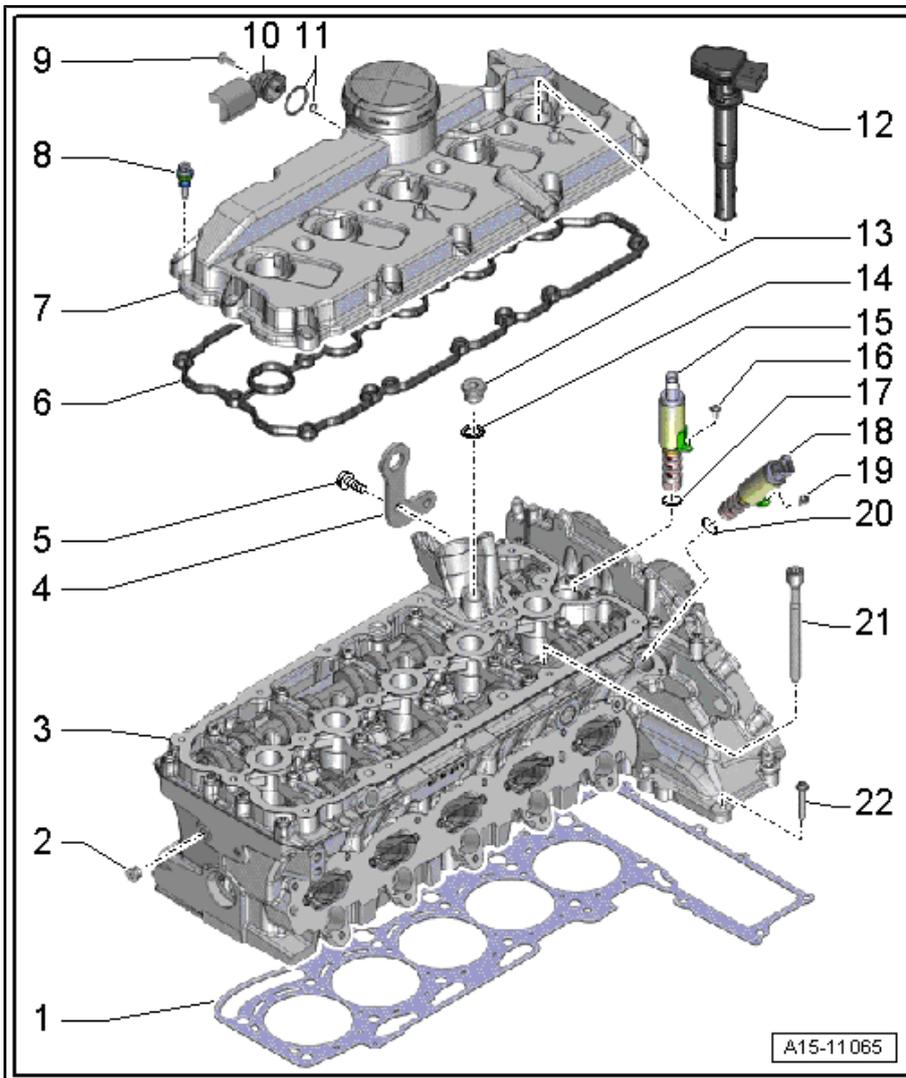
- Removing and installing, refer to [⇒ "4.5 Cylinder Head", page 110](#)
- Note installation position: The part number faces toward the cylinder head
- Install with sealant; sealant, refer to the Electronic Parts Catalog (ETKA)

2 - Drain Plug

- 15 Nm
- Replace

3 - Cylinder Head

- Removing and installing, refer to [⇒ "4.5 Cylinder Head", page 110](#)
- Must be seated on the alignment pins
- Check for distortion, refer to [⇒ Fig. "Checking Cylinder Head for Distortion", page 82](#)
- Reworking dimension, cylinder head, refer to [⇒ Fig. "Reworking Dimension, Cylinder Head", page 82](#)
- After replacing, change coolant and engine oil



4 - Engine Lifting Eye

5 - Bolt

- 22 Nm

6 - Gasket

- For cylinder head cover
- Replace if damaged or leaking

7 - Cylinder Head Cover

8 - Bolt

- Replace if the seal is damaged
- Tightening sequence, refer to [⇒ Fig. "Cylinder Head Cover, Tightening Specifications and Sequence", page 81](#)

9 - Bolt

- 3.2 Nm

10 - Housing

- For crankcase ventilation
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11 - Seals

- Replace

12 - Ignition Coil

- Removing and installing, refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 28 ; Removal and Installation

13 - Drain Plug

- 35 Nm

14 - Seal

- Replace

15 - Camshaft Adjustment Valve 1 -N205-

- Removing and installing, refer to ⇒ [“4.2 Camshaft Adjuster Valve 1 N205 / Exhaust Camshaft Adjustment Valve 1 N318 “, page 102](#)

16 - Bolt

- 2.4 Nm

17 - O-ring

- Replace

18 - Exhaust Camshaft Adjustment Valve 1 -N318-

- Removing and installing, refer to ⇒ [“4.2 Camshaft Adjuster Valve 1 N205 / Exhaust Camshaft Adjustment Valve 1 N318 “, page 102](#)
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19 - Bolt

- 2.4 Nm

20 - O-ring

- Replace

21 - Bolt

- Replace
- Follow the sequence when loosening, refer to ⇒ [page 115](#)
- Tightening specification and sequence, refer to ⇒ [Fig. ““Cylinder Head, Tightening Specifications and Sequence““ , page 82](#)

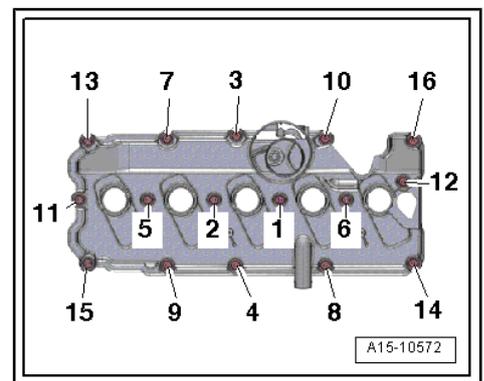
22 - Bolt

- Replace
- Follow the sequence when loosening, refer to ⇒ [page 115](#)
- Tightening specification and sequence, refer to ⇒ [Fig. ““Cylinder Head, Tightening Specifications and Sequence““ , page 82](#)

Cylinder Head Cover, Tightening Specifications and Sequence

– Tighten the bolts in two steps in the sequence shown:

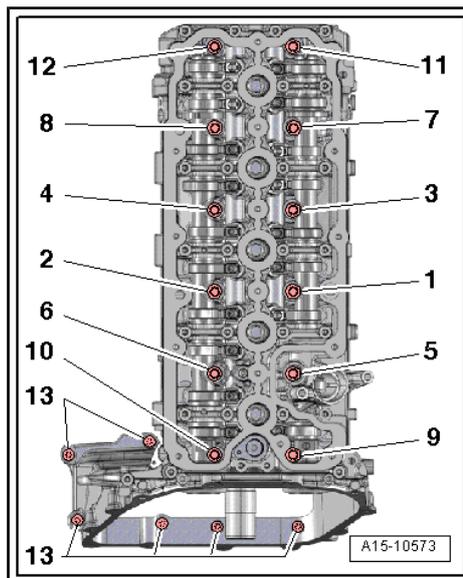
Stage	Bolt	Tightening Specifications
1.	-1 through 16-	Install all the way in by hand.
2.	-1 through 16-	10 Nm



Cylinder Head, Tightening Specifications and Sequence

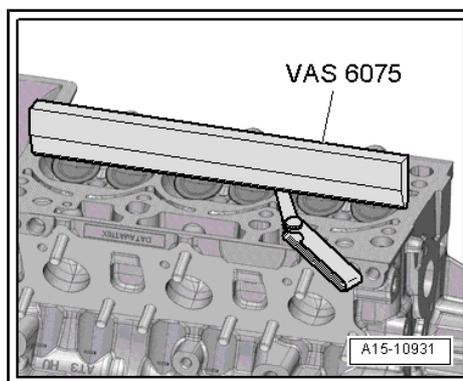
– Tighten the bolts in 6 steps in the sequence shown:

Stage	Bolts	Tighten Specifications/Angle
1.	-1 through 12-	10 Nm
2.	-1 through 12-	40 Nm
3.	-1 through 12-	Tighten 90° further
4.	-1 through 12-	Tighten 90° further
5.	-13-	8 Nm
6.	-13-	Tighten 90° further



Checking Cylinder Head for Distortion

- Check the cylinder head on several locations for distortion using a straight edge 500 mm -VAS 6075- and a feeler gauge.
- Maximum permissible distortion: 0.05 mm.

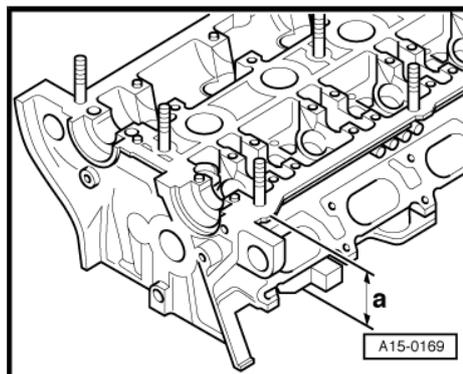


Reworking Dimension, Cylinder Head

Resurfacing the cylinder head (face grinding) is only permissible to minimum dimension -a-.

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- Minimum dimension -a- = 139.20 mm.



1.3 Timing Chain Covers Overview

1 - Engine Speed (RPM) Sensor -G28-

- Removing and installing, refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 28 ; Removal and Installation

2 - Crankshaft Shaft Seal, Transmission Side

- Removing and installing, refer to ⇒ ["4.5 Crankshaft Seal, Transmission Side", page 67](#)

3 - Alignment Bushing

4 - Bolt

- Tightening specification and sequence, refer to ⇒ [Fig. "Lower Timing Chain Cover, Tightening Specifications and Sequence", page 84](#)

5 - O-ring

- Replace

6 - Cylinder Head Gasket

7 - Double Bolt

- Tightening specification and sequence, refer to ⇒ [Fig. "Lower Timing Chain Cover, Tightening Specifications and Sequence", page 84](#)

8 - Nut

- 8 Nm

9 - Bracket

- For engine cover, high pressure line and exhaust gas temperature sensor 1 -G235-

10 - Bolt

- 8 Nm

11 - Nut

- 8 Nm

12 - Bracket

- For engine cover and connectors

13 - Double Bolt

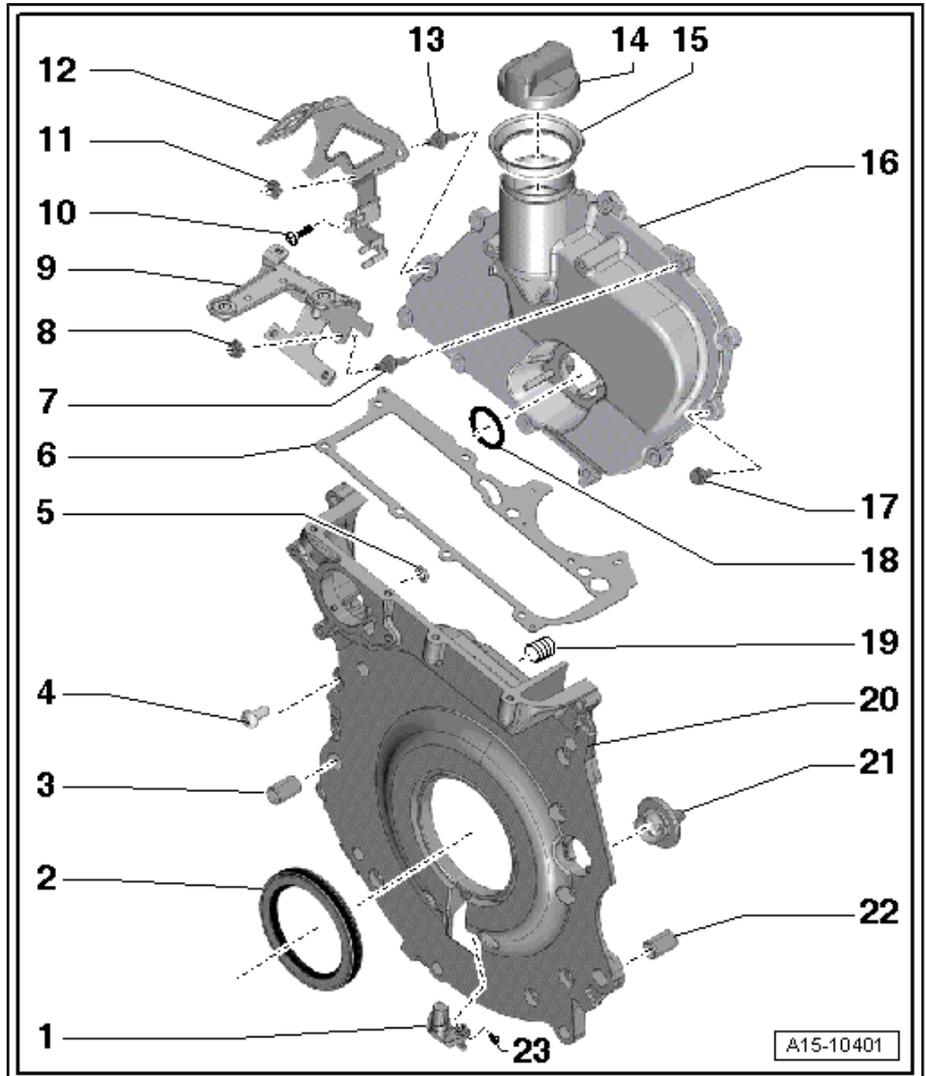
- Tightening specification and sequence, refer to ⇒ [Fig. "Lower Timing Chain Cover, Tightening Specifications and Sequence", page 84](#)

14 - Oil Filler Tube Cap

15 - Grommet

16 - Upper Timing Chain Cover

- Removing and installing, refer to ⇒ ["4.8 Upper Timing Chain Cover", page 124](#)
- Install with sealant; sealant, refer to the Electronic Parts Catalog (ETKA)



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17 - Bolt

- Tightening specification and sequence, refer to
 ⇒ [Fig. "Upper Timing Chain Cover, Tightening Specifications and Sequence", page 84](#)

18 - Seal

- Removing and installing, refer to ⇒ ["4.9 Upper Timing Chain Cover Seal", page 127](#)

19 - Sealing Sleeve

- Replace

20 - Lower Timing Chain Cover

- Removing and installing, refer to ⇒ ["4.6 Lower Timing Chain Cover", page 118](#)
- Install with sealant; sealant, refer to the Electronic Parts Catalog (ETKA)

21 - Plugs

22 - Alignment Bushing

23 - Bolt

- Tightening specification, refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 28 ; Specification

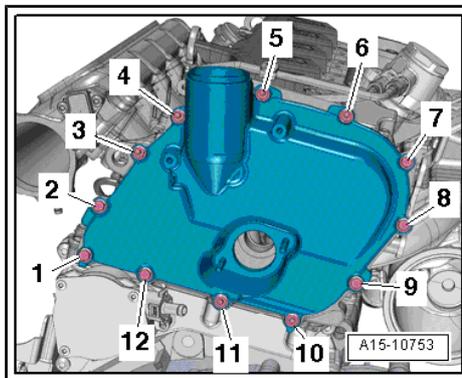
Upper Timing Chain Cover, Tightening Specifications and Sequence

 **Note**

Bolts -3, 4, 5, 6, 10 and 11- are installed like double bolts.

– Tighten the bolts in two steps in the sequence shown:

Stage	Bolts	Tightening Specifications
1.	-1 through 12-	Install all the way in by hand.
2.	-1 through 12-	9 Nm



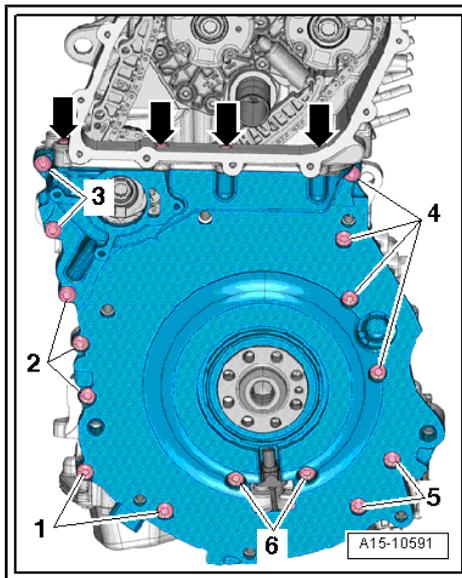
Lower Timing Chain Cover, Tightening Specifications and Sequence

 **Note**

Replace bolts that are tightened to specification.

– Tighten the bolt in 6 steps:

Stage	Bolts	Tightening Specifications
1.	-1 through 6- and -arrows-	Install all the way in by hand.
2.	-Arrows-	5 Nm
3.	-1 through 6-	in a diagonal sequence, to 8 Nm
4.	-Arrows-	8 Nm
5.	-1 through 6-	in a diagonal sequence, to 20 Nm
6.	-Arrows-	Tighten 90° further



1.4 Timing Mechanism Drive Chain Overview

1 - Bolt

- 20 Nm plus an additional 90° turn
- Replace

2 - Oil Pump Drive Sprocket

3 - Guide Rail

4 - Bolt

- 60 Nm plus an additional 90° turn
- Replace

5 - Power Take-Off Drive Chain

- Mark the running direction with paint before removing.
- Removing and installing, refer to ⇒ ["4.7 Timing Mechanism Drive Chain", page 123](#)

6 - Drive Chain Sprocket for the Camshaft Timing Chain

- To remove, remove bolts -4- and -9-, then remove the drive chain sprocket together with the pivot pin-7-.

7 - Drive Chain Sprocket Pivot Pin

8 - Axial Bearing Disc

9 - Bolt

- 9 Nm

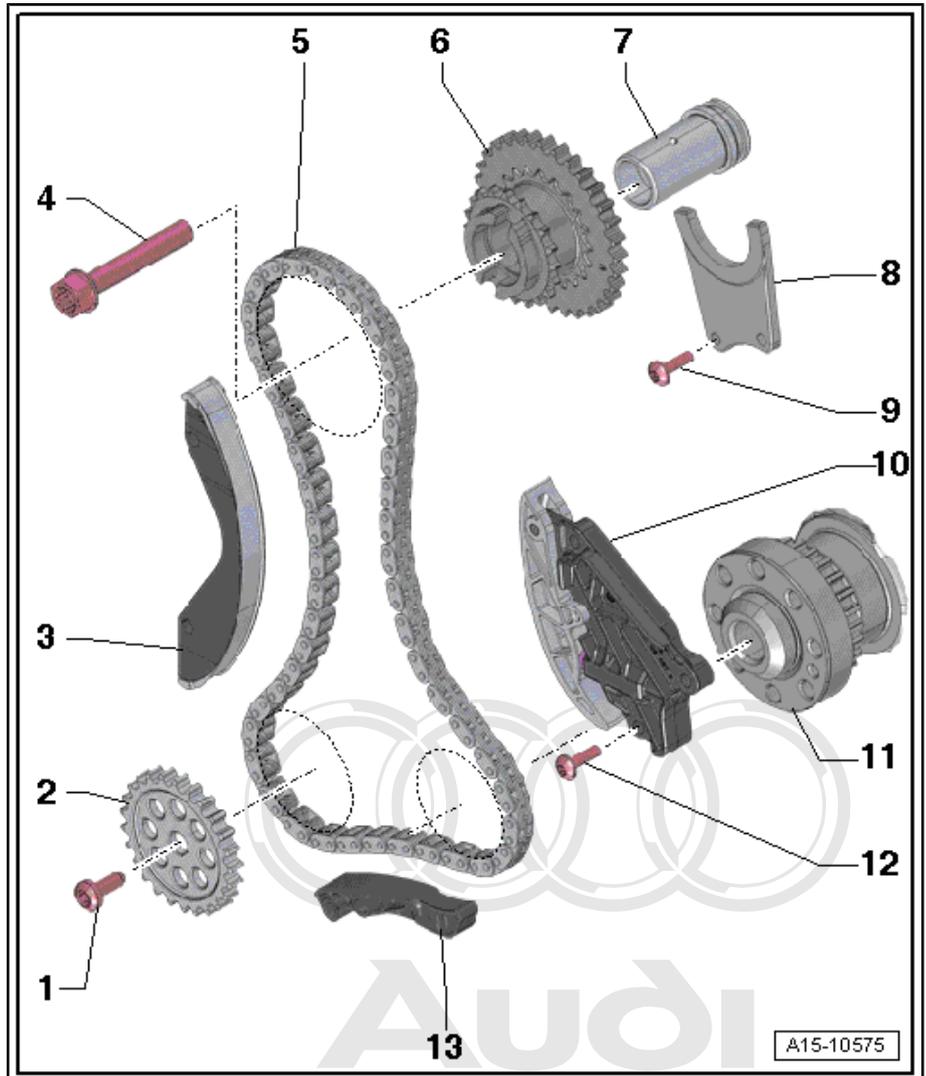
10 - Chain Tensioner

11 - Crankshaft

12 - Bolt

- 9 Nm

13 - Guide Rail



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1.5 Valvetrain Overview



Caution

Risk of damaging valves and piston heads after working on the valvetrain.

- ◆ *The motor must not be started for about 30 minutes after installing camshafts because the hydraulic equalization elements must seat themselves.*
- ◆ *To ensure valves do not strike pistons when starting, carefully rotate engine at least 2 full revolutions.*



Note

Cylinder heads with cracks between valve seats or between valve seat and spark plug thread can still be used without loss of service life if the cracks are minute (max. 0.3 mm width) or only the first four threads of a spark plug thread are cracked.

1 - Cylinder Head

- Valve guides, checking, refer to
 ⇒ ["3.6 Valve Guides, Checking", page 96](#)

2 - Alignment Pins

3 - Bolt

- Tightening specification, refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 28 ; Specification

4 - Camshaft Position (CMP) Sensor 3 -G300-

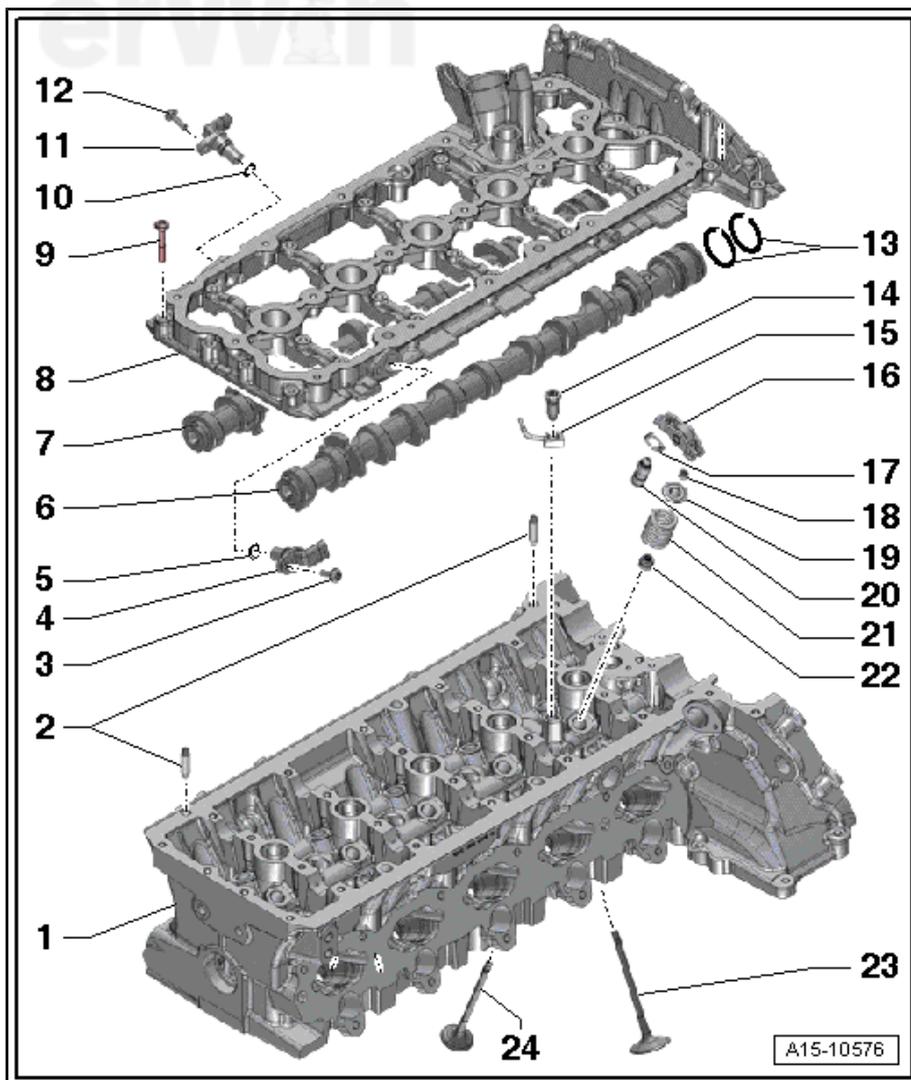
- Exhaust side
- Removing and installing, refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 28 ; Removal and Installation

5 - O-ring

- Replace

6 - Intake Camshaft

- Removing and installing, refer to
 ⇒ ["4.1 Camshafts", page 97](#)
- Measuring axial play, refer to
 ⇒ ["3.2 Camshaft, Measuring Axial Clearance", page 93](#)
- Radial clearance, measuring, refer to
 ⇒ ["3.1 Camshaft, Measuring Radial Clearance", page 93](#)



- Maximum run out: 0.04 mm

7 - Exhaust Camshaft

- With additional high pressure pump cams
- Removing and installing, refer to ⇒ [“4.1 Camshafts”, page 97](#)
- Measuring axial play, refer to ⇒ [“3.2 Camshaft, Measuring Axial Clearance”, page 93](#)
- Radial clearance, measuring, refer to ⇒ [“3.1 Camshaft, Measuring Radial Clearance”, page 93](#)
- Maximum run out: 0.04 mm

8 - Guide Frame

- With integrated camshaft bearings

9 - Bolt

- Danger of damaging the camshaft guide frame - for tightening specification and sequence, refer to ⇒ [Fig. “Camshaft Guide Frame Tightening Specifications and Sequence”, page 88](#)

10 - O-ring

- Replace

11 - Camshaft Position (CMP) Sensor -G40-

- Intake side
- Removing and installing, refer to ⇒ [Fuel Injection and Ignition; Rep. Gr. 28 ; Removal and Installation](#)

12 - Bolt

- Tightening specification, refer to ⇒ [Fuel Injection and Ignition; Rep. Gr. 28 ; Specification](#)

13 - Compression Ring

14 - Bolt

- 27 Nm
- With check-valve

15 - Oil Spray Jet

16 - Roller Rocker Lever

- Mark the installed position for installation later
- Check roller for easy movement
- Lubricate the running surfaces before installing
- To assemble, clip onto the hydraulic adjusting element -17- with securing clip -20-

17 - Clip

- Not available individually
- Make sure it is secure

18 - Valve Retainers

19 - Valve Spring Plate

20 - Hydraulic Adjusting Elements

- Clipped into roller rocker lever -16-
- Checking, refer to ⇒ [“3.4 Hydraulic Adjusting Elements, Checking”, page 94](#)
- Mark the installed position for installation later
- Lubricate the running surfaces before installing

21 - Valve Spring

- Installed position, refer to ⇒ [Fig. “Installed Position of Valve Spring”, page 88](#)

22 - Valve Stem Seal

- Replacing with the cylinder head installed, refer to ⇒ [“4.10 Valve Stem Seals, Cylinder Head Installed”, page 127](#)
- Replacing with the cylinder head removed, refer to ⇒ [“4.11 Valve Stem Seals with Cylinder Head Removed”, page 129](#)

23 - Intake Valve

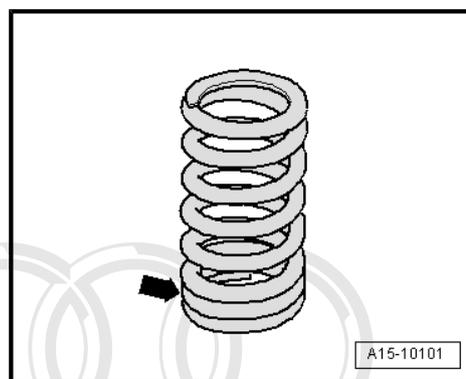
- Do not reface, only lapping is permitted
- Mark the installed position for installation later
- Checking, refer to ⇒ [“3.5 Valves, Checking”, page 96](#)
- For the correct valve dimensions, refer to ⇒ [“2.2 Valve Dimensions”, page 92](#)
- Valve guides, checking, refer to ⇒ [“3.6 Valve Guides, Checking”, page 96](#)

24 - Exhaust Valve

- Do not reface, only lapping is permitted
- Mark the installed position for installation later
- Checking, refer to ⇒ [“3.5 Valves, Checking”, page 96](#)
- For the correct valve dimensions, refer to ⇒ [“2.2 Valve Dimensions”, page 92](#)
- Valve guides, checking, refer to ⇒ [“3.6 Valve Guides, Checking”, page 96](#)

Installed Position of Valve Spring

- The tight spring coils -arrow- face toward cylinder head.



Camshaft Guide Frame Tightening Specifications and Sequence

Note

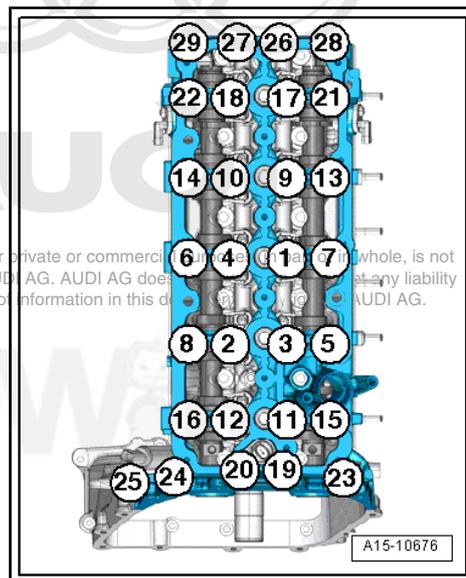
Replace bolts that are tightened to the specification.

 **Caution**

Danger of damaging the camshaft guide frame.

◆ **The guide frame bolts must only be tighten as described.**

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– Tighten the bolts in 4 steps in the sequence shown:

Stage	Bolts	Tightening Specification/Additional Turn
1.	-1 through 29-	Install by hand until the bolt heads touch the guide frame.
2.	-1 through 29-	Turn further one turn in several steps until the guide frame touches the cylinder head completely and until an 8 Nm torque is achieved.
3.	-1 through 29-	8 Nm ¹⁾
4.	-1 through 29-	Tighten 90° further

- ¹⁾ If kept constant, all of the bolts will remain tightened to 8 Nm even after the guide frame is installed.

2 Specifications

⇒ "2.1 Fastener Tightening Specifications", page 89

⇒ "2.2 Valve Dimensions", page 92

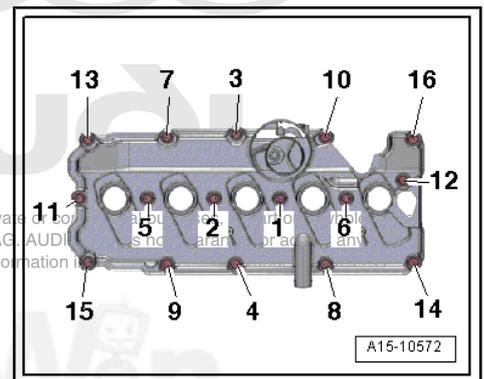
2.1 Fastener Tightening Specifications

Components	Fastener Size	Nm
Axial Bearing Disc	-	9
Bracket for engine cover and connectors, Bolt/Nut	-	8
Bracket for engine cover, high pressure line and exhaust gas temperature sensor 1	-	8
Camshaft Adjuster for Exhaust Camshaft ¹	-	60 + 90°
Camshaft Adjuster for Intake Camshaft ¹	-	60 + 90°
Camshaft Adjustment Valve 1	-	2.4
Camshaft Timing Chain Tensioner	-	9
Chain Tensioner	-	9
Drain Plug, Side of Cylinder Head ¹	-	15
Drain Plug, Top of Cylinder Head	-	35
Drive Chain Sprocket for the Camshaft Timing Chain ¹	-	60 + 90°
Engine Lifting Eye	-	22
Exhaust Camshaft Adjustment Valve 1	-	2.4
Housing for Crankcase Ventilation	-	3.2
Mounting Pin	-	40
Oil Pump Drive Sprocket ¹	-	20 + 90°
Oil spray jet, Bolt with check-valve	-	27
• ¹ Replace		

Cylinder Head Cover, Tightening Specifications and Sequence

– Tighten the bolts in two steps in the sequence shown:

Stage	Bolt	Tightening Specifications
1.	-1 through 16-	Install all the way in by hand.
2.	-1 through 16-	10 Nm

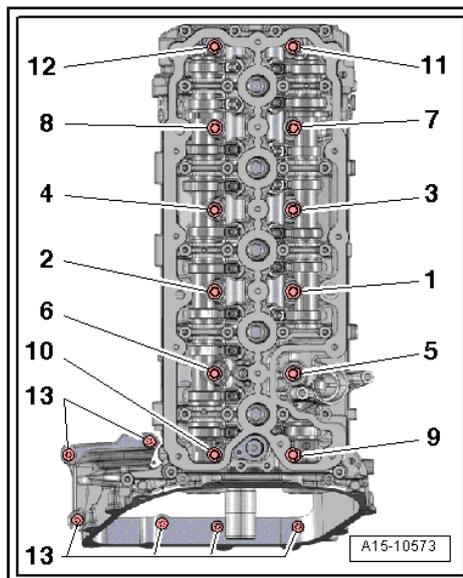


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Cylinder Head, Tightening Specifications and Sequence

– Tighten the bolts in 6 steps in the sequence shown:

Stage	Bolts	Tighten Specifications/Angle
1.	-1 through 12-	10 Nm
2.	-1 through 12-	40 Nm
3.	-1 through 12-	Tighten 90° further
4.	-1 through 12-	Tighten 90° further
5.	-13-	8 Nm
6.	-13-	Tighten 90° further



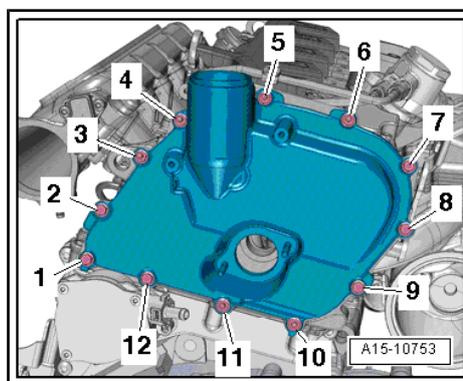
Upper Timing Chain Cover, Tightening Specifications and Sequence

i Note

Bolts -3, 4, 5, 6, 10, 11- are installed like double bolts.

– Tighten the bolts in two steps in the sequence shown:

Stage	Bolts	Tightening Specifications
1.	-1 through 12-	Install all the way in by hand.
2.	-1 through 12-	9 Nm



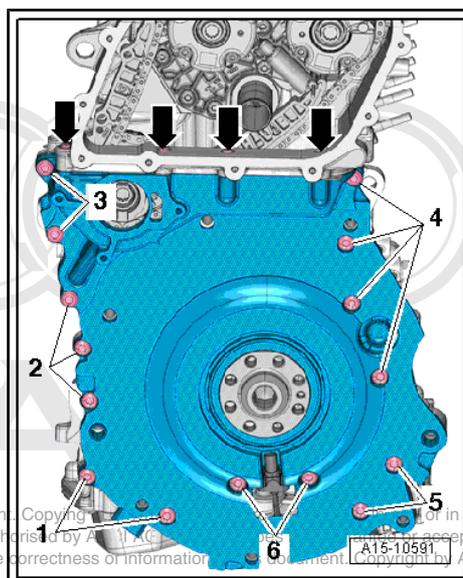
Lower Timing Chain Cover, Tightening Specifications and Sequence

i Note

Replace bolts that are tightened to the specification.

– Tighten the bolt in 6 steps:

Stage	Bolts	Tightening Specifications
1.	-1 through 6- and -arrows-	Install all the way in by hand.
2.	-Arrows-	5 Nm
3.	-1 through 6-	in a diagonal sequence, to 8 Nm
4.	-Arrows-	8 Nm
5.	-1 through 6-	in a diagonal sequence, to 20 Nm
6.	-Arrows-	Tighten 90° further



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Camshaft Guide Frame Tightening Specifications and Sequence

i Note

Replace bolts that are tightened to the specification.

! Caution

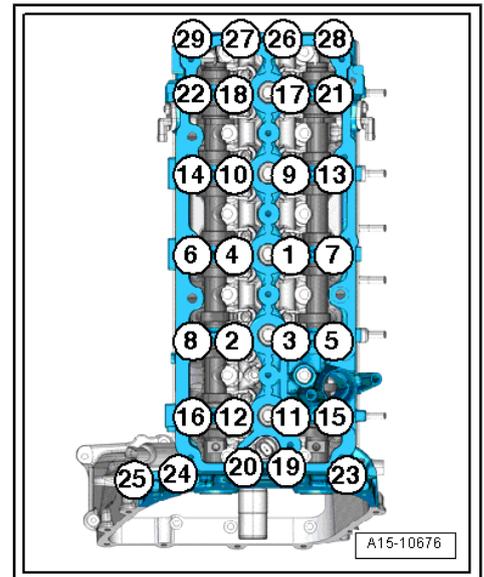
Danger of damaging the camshaft guide frame.

◆ **The guide frame bolts must only be tighten as described.**

– Tighten the bolts in 4 steps in the sequence shown:

Stage	Bolts	Tightening Specification/Additional Turn
1.	-1 through 29-	Install by hand until the bolt heads touch the guide frame.
2.	-1 through 29-	Turn further one turn in several steps until the guide frame touches the cylinder head completely and until an 8 Nm torque is achieved.
3.	-1 through 29-	8 Nm ¹⁾
4.	-1 through 29-	Tighten 90° further

- ¹⁾ If kept constant, all of the bolts will remain tightened to 8 Nm even after the guide frame is installed.



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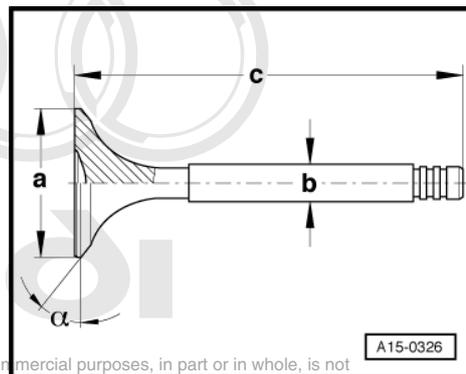


2.2 Valve Dimensions

i Note

Intake and exhaust valves must not be refaced by grinding. Only lapping is permitted.

Dimension		Intake Valve	Exhaust Valve
Diameter a	mm	33.85 ± 0.10	28.0 ± 0.1
Diameter b	mm	5.965 ± 0.005	5.955 ± 0.007
c	mm	103.97 ± 0.20	101.87 ± 0.20
α	∠°	45	45



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WARNING

Risk of injury if the exhaust valves with sodium filling are disposed of improperly.

- ◆ *Cut exhaust valve with sodium filling into 2 parts with a metal saw between shaft center and valve plate. While doing this, do not come into contact with water.*
- ◆ *Throw at the most 10 such sawed exhaust valves in a bucket filled with water and step back immediately.*
- ◆ *When there is contact with water, a sudden chemical reaction occurs which burns the sodium filling.*
- ◆ *The treated parts may then be discarded through conventional disposal channels.*

3 Diagnosis and Testing

- ⇒ [“3.2 Camshaft, Measuring Axial Clearance”, page 93](#)
- ⇒ [“3.1 Camshaft, Measuring Radial Clearance”, page 93](#)
- ⇒ [“3.3 Compression, Checking”, page 93](#)
- ⇒ [“3.4 Hydraulic Adjusting Elements, Checking”, page 94](#)
- ⇒ [“3.5 Valves, Checking”, page 96](#)
- ⇒ [“3.6 Valve Guides, Checking”, page 96](#)

3.1 Camshaft, Measuring Radial Clearance

Special tools and workshop equipment required

- ◆ Plastigage

Procedure

- Removing cam follower. Refer to [⇒ “4.1 Camshafts”, page 97](#) .
- Clean the bearing and the bearing journals.
- Place Plastigage over the entire width of bearing journal or into bearing.
- Plastigage must rest in center of bearing.
- Position the guide frame and tighten it to 8 Nm without tightening it further, do not turn the camshaft. Refer to [⇒ Fig. “Camshaft Guide Frame Tightening Specifications and Sequence” , page 88](#) .
- Install the guide frame.
- Compare width of Plastigage with calibrated scale.

Radial clearance:

- Bearing- 24 mm diameter: 0.024 to 0.066 mm.
- Bearing- 36 mm diameter: 0.050 to 0.100 mm.

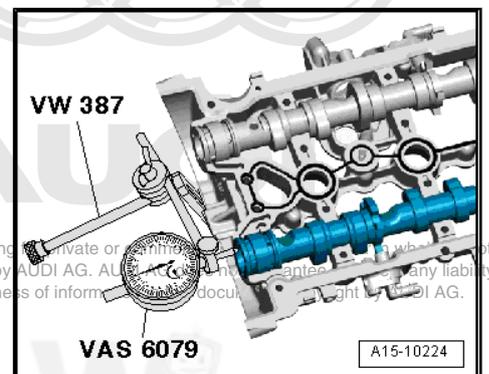
3.2 Camshaft, Measuring Axial Clearance

Special tools and workshop equipment required

- ◆ Dial Gauge Holder -VW 387-
- ◆ Dial Gauge 0-10 mm -VAS 6079-

Procedure

- Remove the guide frame. Refer to [⇒ “4.1 Camshafts”, page 97](#) .
- Place the camshaft to be checked in the guide frame.
- Secure -VAS 6079- to the guide frame with -VW 387- .
- Press camshaft against dial gauge by hand.
- Set dial gauge to “0”.
- Press camshaft off dial gauge and read the value:
- Axial clearance: 0.100 to 0.191 mm.



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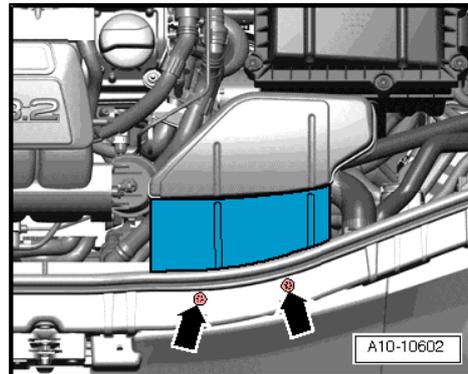
3.3 Compression, Checking

Special tools and workshop equipment required

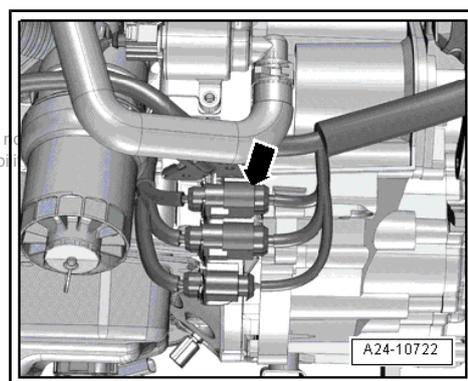
- ◆ Spark Plug Removal Tool -3122 B-
- ◆ Compression Tester -V.A.G 1763-

Procedure

- Engine oil temperature at least 30 °C (86 °F).
- Battery voltage at least 12.5 V.
- Remove the bolts -arrows- and front air guide.



- Disconnect the injector valve connector -arrow-.
- Remove the ignition coils. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 28 ; Removal and Installation .
- Remove spark plugs using 3122 B-
- Check compression pressure using V.A.G 1763- ; see operating instructions.
- Have a second technician press the accelerator pedal down all the way while operating the starter until the pressure increase is no longer displayed on the tester.
- Repeat procedure on each cylinder.



Compression Pressure	Bar Pressure
New	10.0 to 14.0
Wear limit	7,0
Maximum difference between cylinders	3,0

Assembling

Assemble in reverse order of disassembling. Note the following:

- Install the front air guide. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Description and Operation .
- Install spark plugs. Refer to the Maintenance Procedures Rep. Gr. 03.
- Install the ignition coils. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 28 ; Removal and Installation .
- If the electrical connectors were disconnected and the engine was started, then malfunctions have been stored in the engine control module. “Generate readiness code“ in “Guided Functions“ using the Vehicle diagnostic tester.

3.4 Hydraulic Adjusting Elements, Checking



Note

- ◆ *The hydraulic adjusting elements cannot be repaired.*
- ◆ *Irregular valve noises are normal while starting the engine.*

Special tools and workshop equipment required

- ◆ Crankshaft Adapter -T03003-

- ◆ Feeler gauge

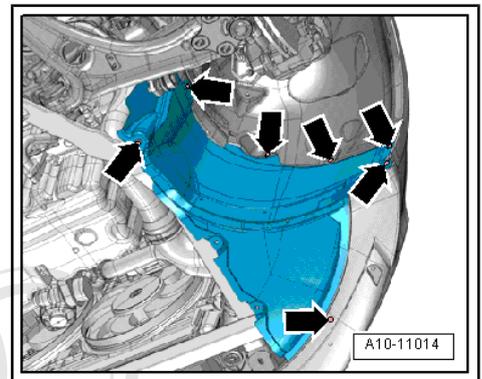
Procedure

- Start the engine and let it run until the coolant fan switches on once.
- Increase engine speed for about 2 minutes to approximately 2500 RPM, perform a road test if necessary.

Note

If the irregular valve noises disappear, but return during short drives, oil filter bracket and integrated oil check valve must be replaced.

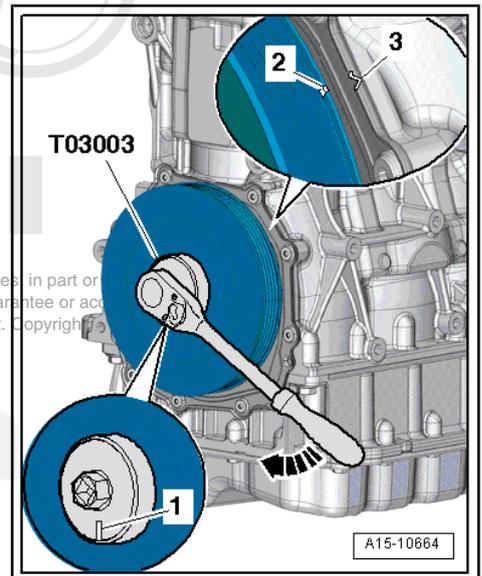
- If the hydraulic adjusting elements are still loud, determine which one is faulty as follows:
- Remove cylinder head cover. Refer to ⇒ "4.4 Cylinder Head Cover", page 108 .
- Remove the right front wheel. Refer to ⇒ Wheel and Tire Guide; Rep. Gr. 44 ; Removal and Installation .
- Remove the right front underside of wheel housing liner. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Removal and Installation .



- Turn the crankshaft using the -T03003- in direction of engine rotation -arrow- until the cam lobes on the hydraulic adjusting element to be checked face up.

Note

Ignore -1 and 2-.

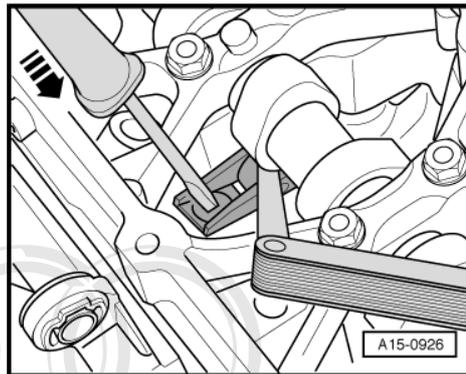


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- To determine the play between cam lobes and roller rocker lever, press lever down -arrow-.
- If a 0.20 mm feeler gauge can slide between the cam lobes and roller rocker lever, replace the hydraulic adjusting element. Refer to ⇒ ["4.1 Camshafts", page 97](#) .

Final Procedures

- Install the front underside of wheel housing liner. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Removal and Installation .
- Install the front wheel. Refer to ⇒ Wheel and Tire Guide; Rep. Gr. 44 ; Removal and Installation .
- Install the cylinder head cover. Refer to ⇒ ["4.4 Cylinder Head Cover", page 108](#) .



3.5 Valves, Checking

- Check valves at stem and seating surface for traces of wear.
- If there are clear traces of wear, replace valve.

3.6 Valve Guides, Checking

Special tools and workshop equipment required

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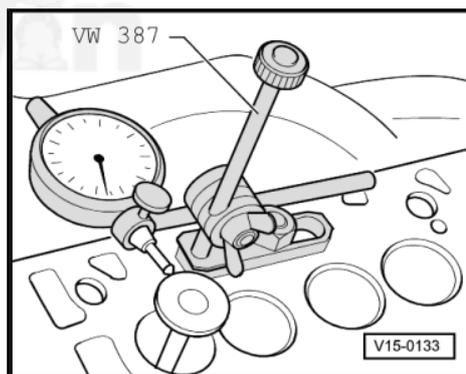
- ◆ Dial Gauge 0-10 mm -VAS 6079-
- ◆ Dial Gauge Holder -VW 387-

Procedure



Note

- ◆ *If valve is replaced during repair, use new valve for measurement.*
- ◆ *Due to different stem diameters, only use an intake valve in the intake guide and an exhaust valve in the exhaust guide.*
- Place valve in valve guide.
- Valve stem tip must seal with valve guide.
- Determine tip clearance.
- Wear limit: 0.8 mm.
- If wear limit is exceeded, measure using new valves.
- Replace the cylinder head if the wear limit is still exceeded.



Note

The valve guides cannot be replaced.

4 Removal and Installation

⇒ [“4.1 Camshafts”, page 97](#)

⇒ [“4.2 Camshaft Adjuster Valve 1 N205 / Exhaust Camshaft Adjustment Valve 1 N318”, page 102](#)

⇒ [“4.3 Camshaft Timing Chain”, page 102](#)

⇒ [“4.4 Cylinder Head Cover”, page 108](#)

⇒ [“4.5 Cylinder Head”, page 110](#)

⇒ [“4.6 Lower Timing Chain Cove”, page 118](#)

⇒ [“4.7 Timing Mechanism Drive Chain”, page 123](#)

⇒ [“4.8 Upper Timing Chain Cover”, page 124](#)

⇒ [“4.9 Upper Timing Chain Cover Seal”, page 127](#)

⇒ [“4.10 Valve Stem Seals, Cylinder Head Installed”, page 127](#)

⇒ [“4.11 Valve Stem Seals with Cylinder Head Removed”, page 129](#)

4.1 Camshafts

Special tools and workshop equipment required

- ◆ Locking Pin -T40069-
- ◆ Camshaft Clamp -T40070-
- ◆ Hand drill with plastic brush attachment
- ◆ Protective goggles
- ◆ Sealant, refer to the Electronic Parts Catalog (ETKA)

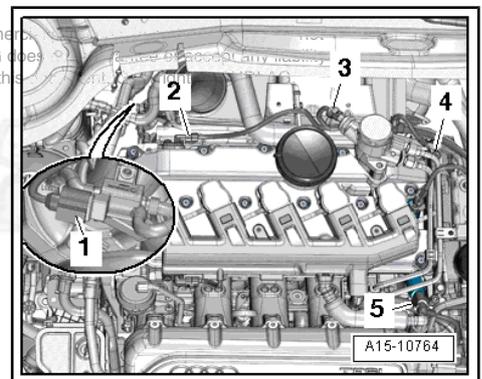
Removing

- Remove the camshaft timing chain. Refer to ⇒ [“4.3 Camshaft Timing Chain”, page 102](#) .
- Remove the bolt -4- and free up the Ground (GND) cable.
- Disconnect the connectors:
 - 2 - Camshaft Position (CMP) sensor 3 -G300-
 - 3 - Fuel metering valve -N290-

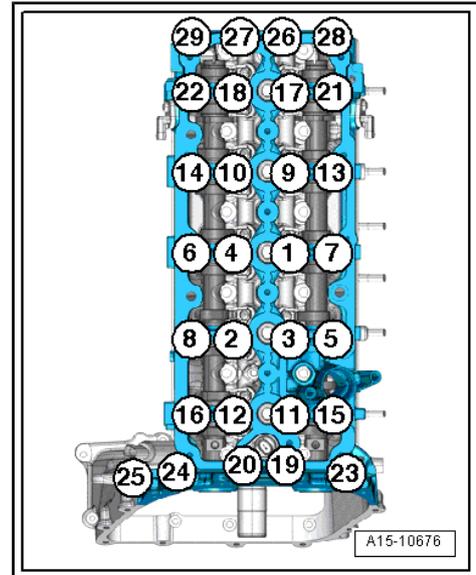
 **Note**

Ignore -1 and 5-

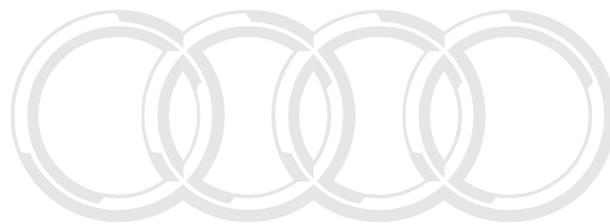
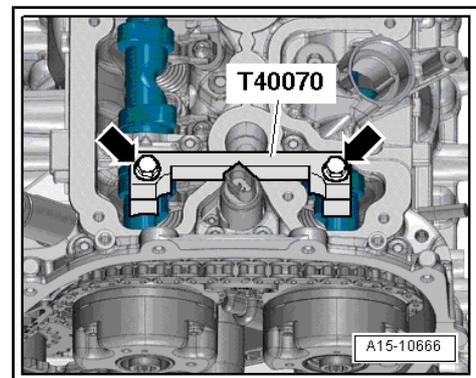
- Remove the high pressure line. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .
- Remove the high pressure pump. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .



- Loosen the guide frame bolts in the following sequence:
-29 to 1-.
- Remove the bolts, carefully loosen the guide from out of the bond and place it on a soft surface.



- Remove the -T40070- .
- Mark the camshafts and then remove them.



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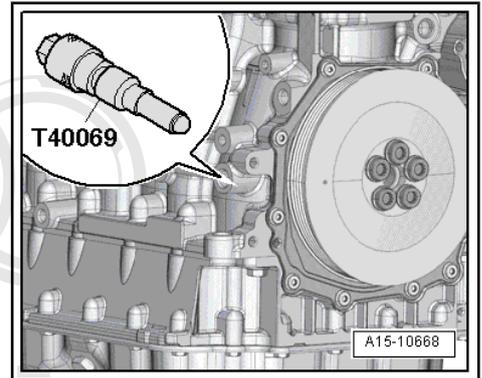


Installing

- Secure crankshaft using the -T40069- .
- The hydraulic adjusting elements and roller rocker lever are inserted.

 **Note**

Replace the seals and sealing plugs.



Caution

Risk of contaminating lubricating system and bearing.

- ◆ *Cover open parts of the engine.*

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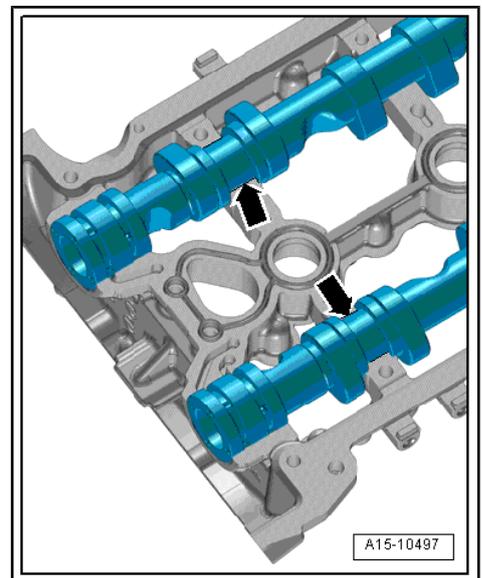


WARNING

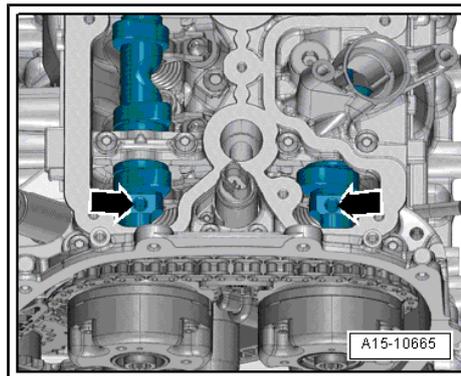
Danger of eye injury.

- ◆ *Wear protective goggles.*

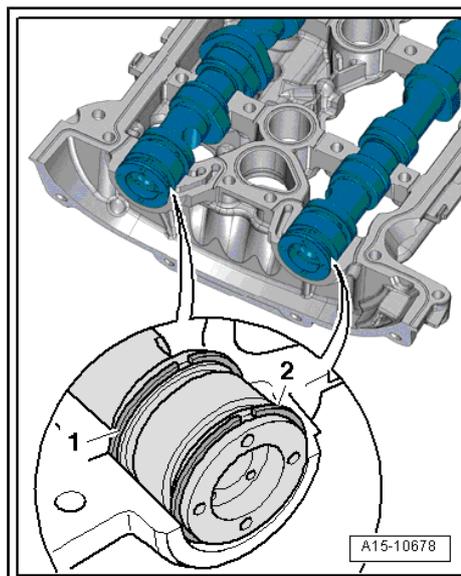
- Remove the sealant residue on the cylinder head and guide frame and the upper section of the oil pan, for example using a rotating plastic brush.
- Clean the sealing surface and grooves free from oil and grease.
- Oil running surfaces of both camshafts.
- Insert the camshafts in the guide frame.
- The exhaust camshaft contains an additional high pressure pump cam.
- The placement of the camshafts must be exactly within the axial bearings -arrows- of the guide frame.
- Rotate the guide frame with the camshafts inserted while holding them securely in the frame.



- Rotate the camshafts until the threaded holes -arrows- face upward.
- Check if the camshafts still lie in the guide frame axial bearings.



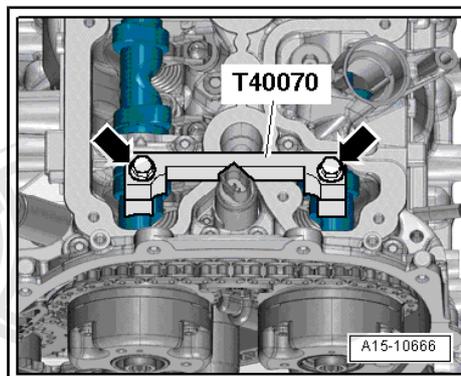
- Check the location of the compressor ring ends.
- The compression ring ends -1 and 2- must face upward or downward, and must never face sideways.



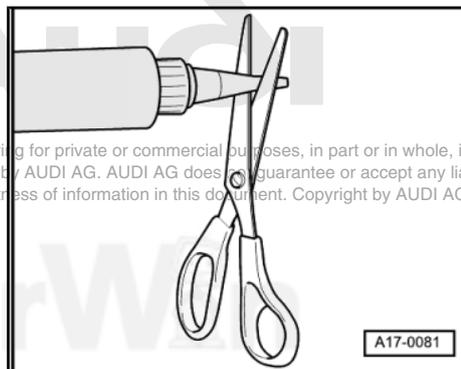
- Install the -T40070- and tighten the bolts -arrows- to 25 Nm.

**Note**

Note the expiration date of the sealing compound.



- Cut the tube nozzle at the front marking (nozzle diameter approximately 2 mm).



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- Rotate the guide frame again.

Caution

The lubrication system could be plugged with excess sealant.

◆ *Do not apply sealant beads thicker than indicated.*

- Apply at the same time an even, light sealing bead in the groove for the guide frame as shown in the illustration.
- Sealant bead width -1-: 4.0 mm.
- Sealant bead width -2, 3-: 3.0 mm.

Note

The guide frame must be installed within 5 minutes after applying the sealant.

- Place the guide frame and camshafts on the cylinder head.
- Install and tighten the camshaft guide frame bolts. Refer to ⇒ [Fig. "Camshaft Guide Frame Tightening Specifications and Sequence"](#), page 88 .

Note

After installing the guide frame, let the sealant harden for approximately 30 minutes.

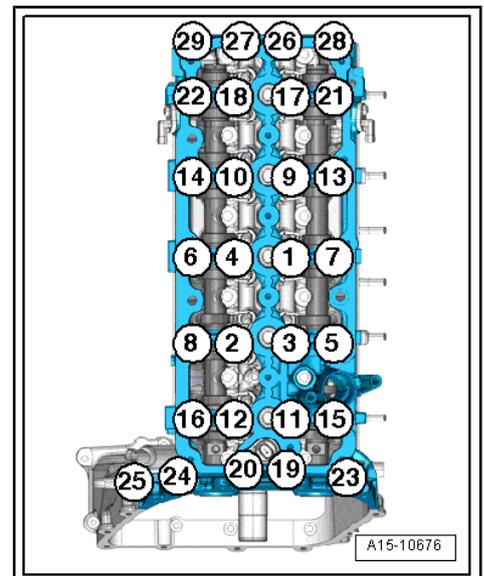
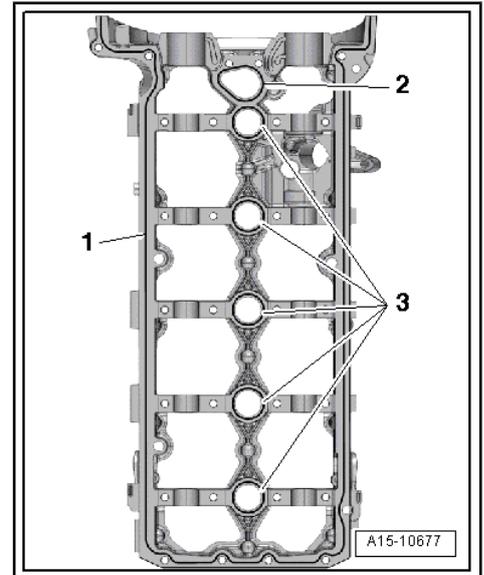
Install in reverse order of removal paying attention to the following:

- Install the high pressure pump and high pressure line. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .
- Install camshaft timing chain. Refer to ⇒ ["4.3 Camshaft Timing Chain"](#), page 102 .

Caution

Risk of damaging the valves and piston heads after working on the valve train.

◆ *To ensure valves do not strike pistons when starting, carefully rotate engine at least 2 full revolutions.*

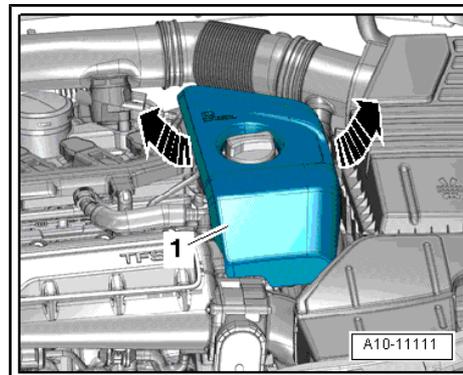


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4.2 Camshaft Adjuster Valve 1 -N205- / Exhaust Camshaft Adjustment Valve 1 - N318-

Removing

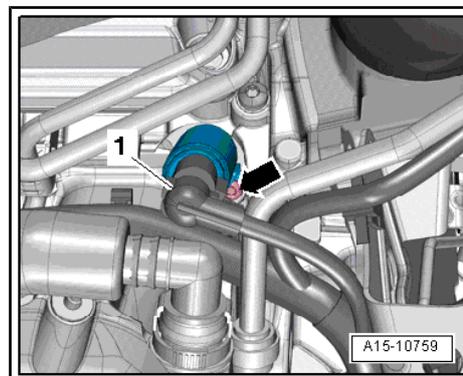
- Remove the engine cover -1- upward -arrows-.



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Camshaft Adjustment Valve 1:

- Disconnect the connector -1-.
- Remove the bolt -arrow- and remove the camshaft adjustment valve 1.



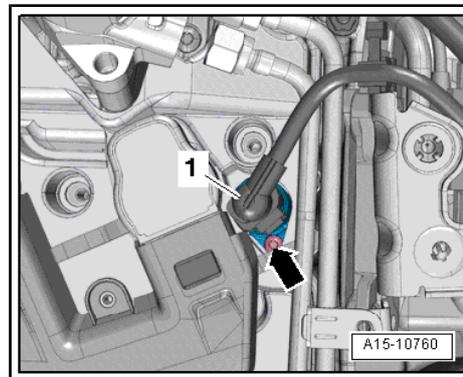
Exhaust Camshaft Adjustment Valve 1:

- Disconnect the connector -1-.
- Remove the bolt -arrow- and remove the exhaust camshaft adjustment valve 1.

Installing

Install in reverse order, paying attention to the following:

- For the correct tightening specifications, refer to ["1.2 Cylinder Head Cover and Cylinder Head Overview", page 80](#).



Note

- ◆ *Replace the O-ring.*
- ◆ *Clean the camshaft adjustment valve as well as the mount in the cylinder head free of dirt and contaminants.*
- Coat the new O-ring with engine oil.

4.3 Camshaft Timing Chain

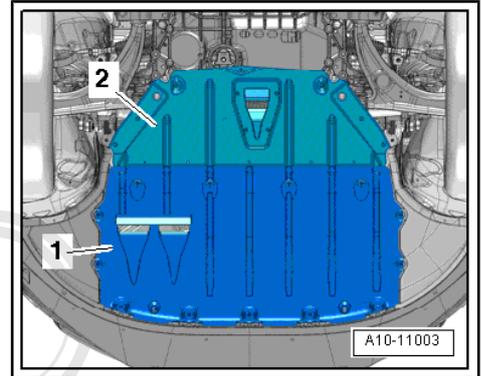
Special tools and workshop equipment required

- ◆ Torque Wrench 5-50 Nm -V.A.G 1331-
- ◆ Open Ring Spanner Insert, AF 24 mm -V.A.G 1332/9-
- ◆ Crankshaft Adapter -T03003-
- ◆ Locking Pins -T03006-

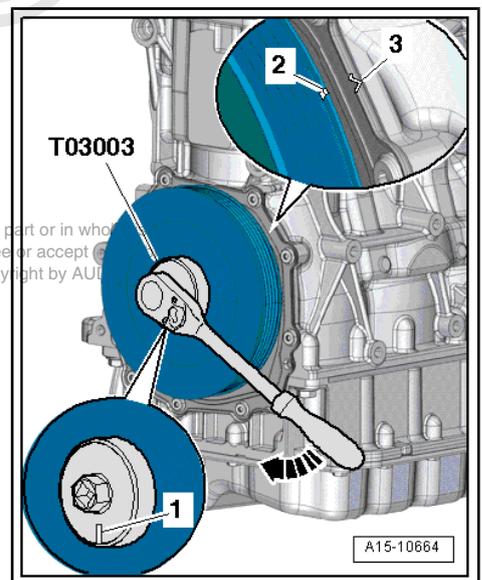
- ◆ Locking Pin -T40069- Camshaft Clamp -T40070-
- ◆ Key -T40079-

Removing

- Remove the noise insulation -1 and 2-. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Removal and Installation .
- Remove the brake booster vacuum pump. Refer to ⇒ Brake System; Rep. Gr. 47 ; Removal and Installation .
- Remove cylinder head cover. Refer to ⇒ ["4.4 Cylinder Head Cover", page 108](#) .
- Remove timing chain guard upper section. Refer to ⇒ ["4.8 Upper Timing Chain Cover", page 124](#) .



- Turn the crankshaft in the direction of engine rotation -arrow- to "TDC" using the -T03003- .
- The notch -1- in the -T03003- is positioned vertically to the oil pan gasket.
- The marking -2- on the vibration damper is positioned opposite the marking -3- on the sealing flange.

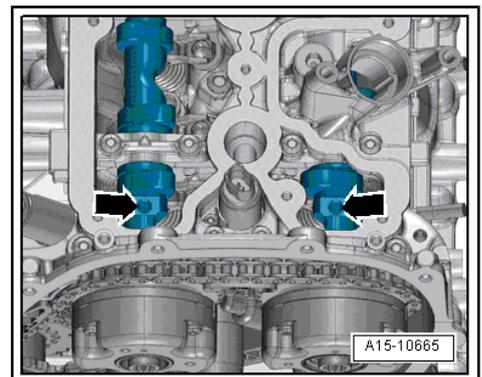


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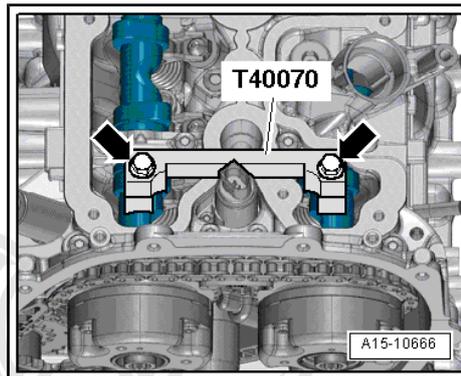
- The threaded holes -arrows- in the camshafts must face upward.

i Note

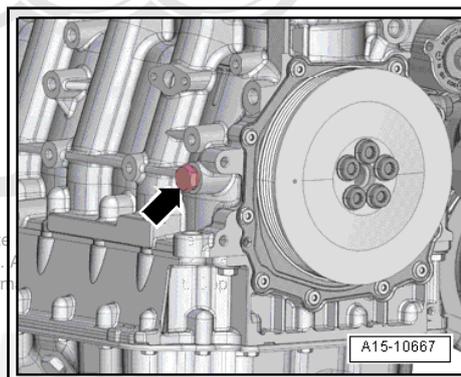
If the threaded holes are not facing upward, turn the crankshaft 360°.



- Install the -T40070- on the cylinder head and tighten the bolts -arrows- to 25 Nm.
- The -T40070- is correctly positioned when the holes for the cylinder head bolts remain free.

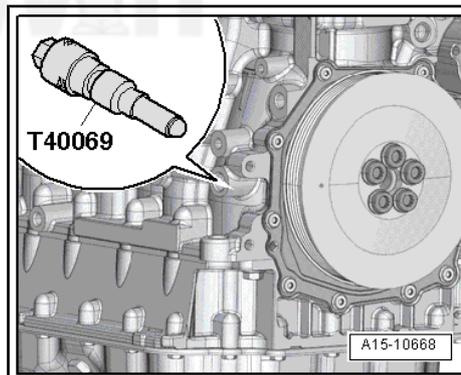


- Remove the locking bolt -arrow- for the "TDC" marking from the cylinder block.

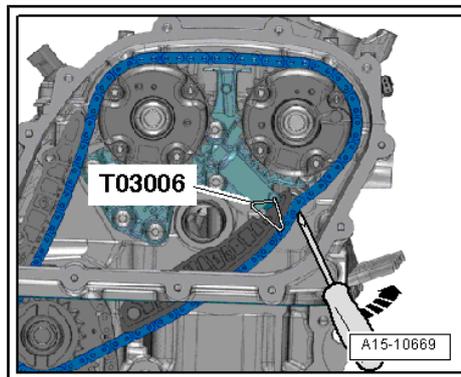


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- Install the -T40069- in the nut and tighten to 15 Nm. If necessary, move the crankshaft back and forth slightly to center the bolt.



- Push the chain tensioner glide track for the camshaft timing chain inward all the way with a screwdriver and lock the chain tensioner with the -T03006- .



Caution

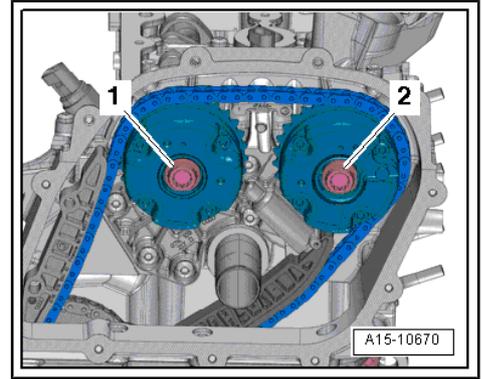
If the running direction is reversed on a used camshaft timing chain, it could be destroyed.

- ◆ *Paint arrows to mark the timing chain running direction so it can be installed again. Do not mark camshaft timing chain with punch, notch or something similar.*

The engine could be destroyed.

- ◆ *To prevent small parts from accidentally entering the engine through the opening in the timing chain compartment, seal the opening with a clean cloth.*

- Remove the bolts -1 and 2-, and remove both camshaft adjusters.



- Remove the camshaft timing chain from the drive wheel -arrow- for the camshaft timing chain.

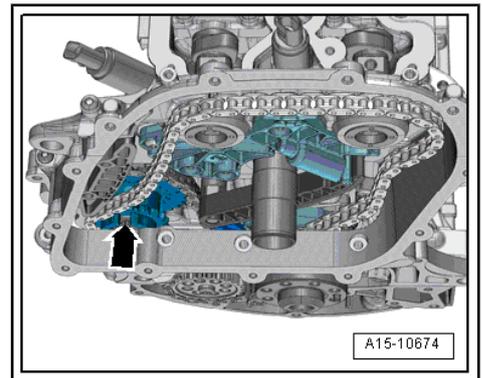
Installing

- For the correct tightening specifications, refer to [⇒ "1.1 Camshaft Timing Chain Overview", page 79](#) .



Note

Replace bolts that are tightened to the specification.

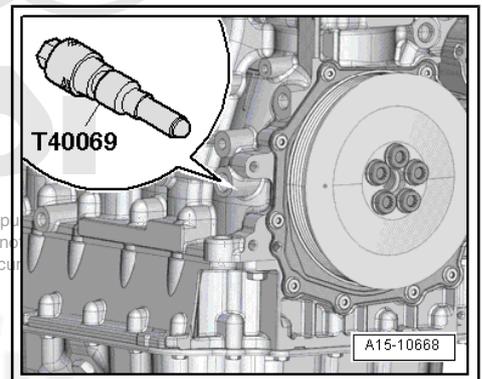


Caution

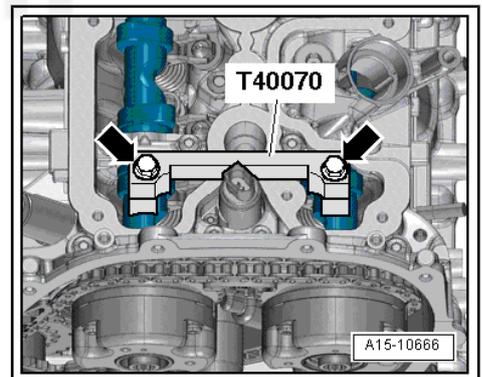
Risk of damaging valves and piston crowns.

- ◆ ***If the camshafts are rotated, crankshaft may not rest with any piston at "TDC".***

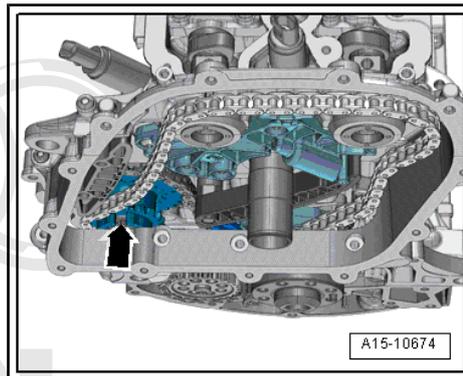
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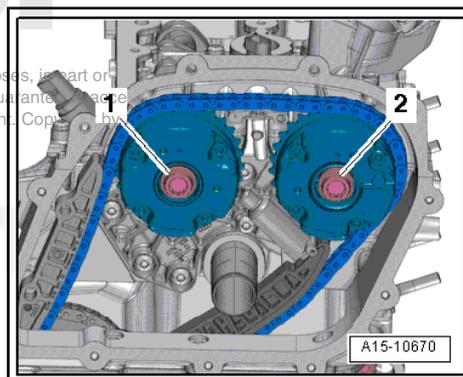
- Drive chain for timing mechanism installed. Refer to [⇒ "4.7 Timing Mechanism Drive Chain", page 123](#) .
- Secure crankshaft using -T40069- .
- Install and tighten the -T40070- to 25 Nm -arrows-.



- Install camshaft timing chain on the output wheel -arrow- for the camshaft timing chain.



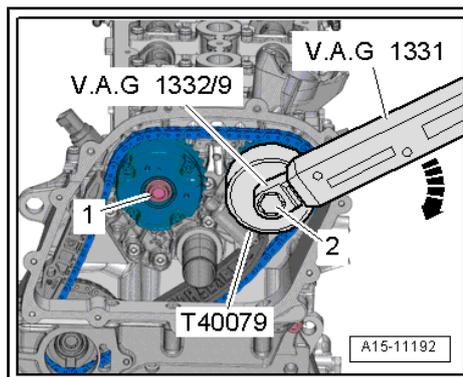
- Re-install the camshaft adjuster according to the markings => [Item 4 \(page 79\)](#) and => [Item 9 \(page 79\)](#) .
- Position the camshaft adjuster and the camshaft timing chain, then loosely install the bolts 1 and 2.
- Both camshaft adjusters must be able to still be rotated on the camshaft and must not tip.
- Remove -T03006- .



 **Note**

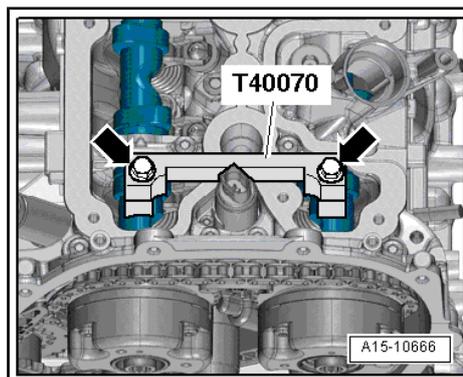
A second technician is needed for further work.

- Position the -T40079- on the camshaft adjuster for the exhaust camshaft.
- Place the -V.A.G 1331- with the -V.A.G 1332/9- on the -T40079- .
- Have a second technician pretension the camshaft adjuster clockwise to 25 Nm -arrow- and hold the tension.
- Tighten the bolts as follows while the camshaft adjuster is still held under tension.



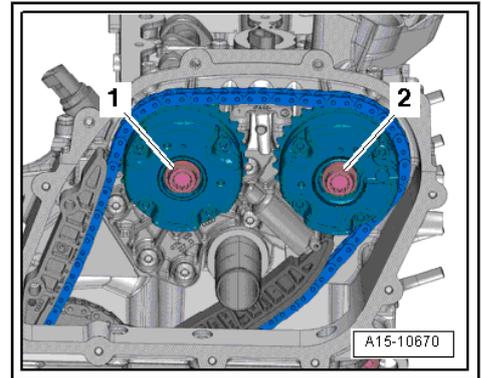
Stage	Bolt	Tightening Specifications
1.	-1-	to the intake camshaft 60 Nm
1.	-2-	to the exhaust camshaft 60 Nm

- Remove the -T40079- .
- Remove the -T40070- -arrows-.

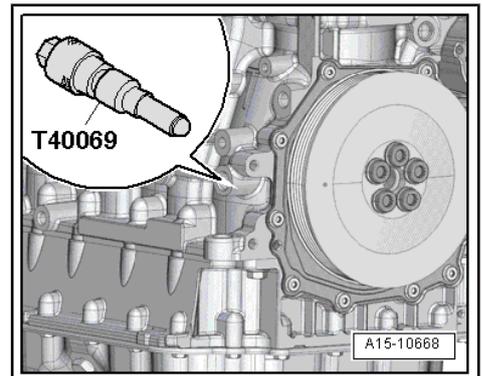


– Tighten the camshaft adjuster bolts as follows:

Stage	Bolt	Additional Turn
2.	-1-	90°
2.	-2-	90°



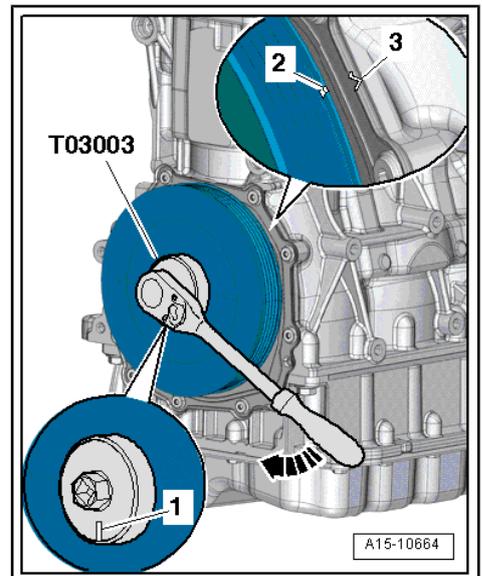
– Remove the -T40069- .



- Using the -T03003- , turn the crankshaft two turns in the direction of engine rotation -arrow- until it is back at “TDC”.
- The notch -1- in the -T03003- is positioned vertically to the oil pan gasket.
- The marking -2- on the vibration damper is positioned opposite the marking -3- on the sealing flange.

i Note

If it is accidentally rotated beyond “TDC”, rotate it back approximately 30° and set it to “TDC” again.

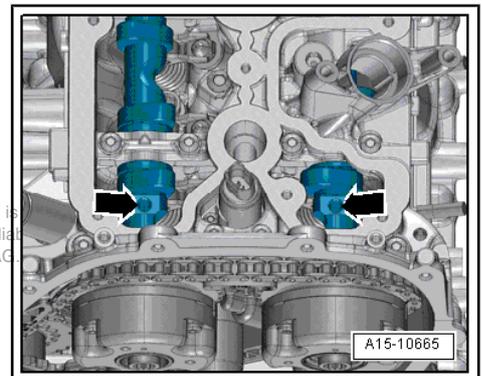


- The threaded holes -arrows- in the camshafts must face upward.

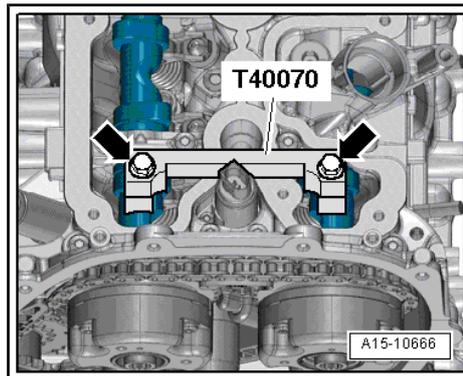
i Note

If the threaded holes are not facing upward, turn the crankshaft 360°.

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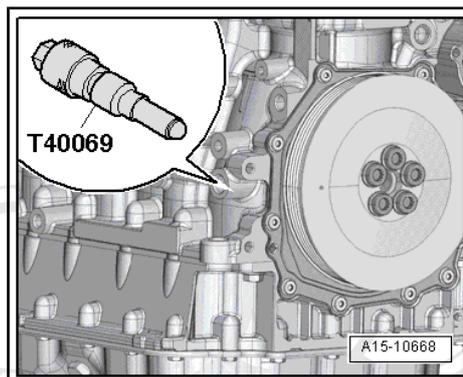
- Install the -T40070- and tighten the bolts -arrows- to 25 Nm.
- The -T40070- is correctly positioned when the holes for the cylinder head bolts remain free.



- Install the -T40069- in the nut and tighten to 15 Nm.
- The -T40069- must engage in the locating groove of the crankshaft, otherwise repeat the adjustment.
- Remove the camshaft locating tool.
- Remove the crankshaft holder.

Install in reverse order of removal paying attention to the following:

- Tighten the "TDC" marking locking bolt. Refer to => [Fig. "TDC Locking Bolt- Marking- Tightening Specification", page 49](#).
- Install timing chain guard upper section. Refer to => ["4.8 Upper Timing Chain Cover", page 124](#).
- Install cylinder head cover. Refer to => ["4.4 Cylinder Head Cover", page 108](#).
- Install the brake booster vacuum pump. Refer to => Brake System; Rep. Gr. 47 ; Removal and Installation .
- Install the noise insulation. Refer to => Body Exterior; Rep. Gr. 66 ; Removal and Installation .



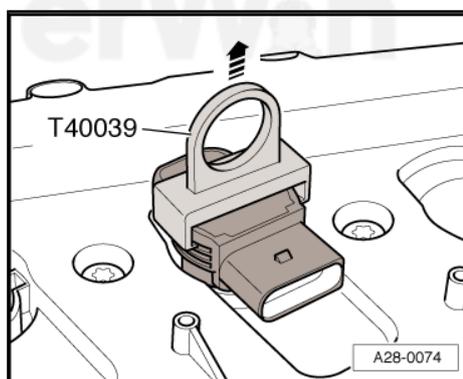
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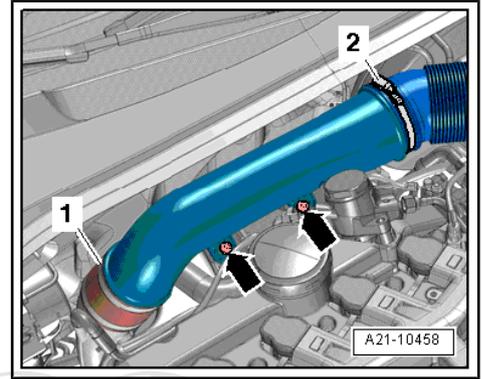
4.4 Cylinder Head Cover

Removing

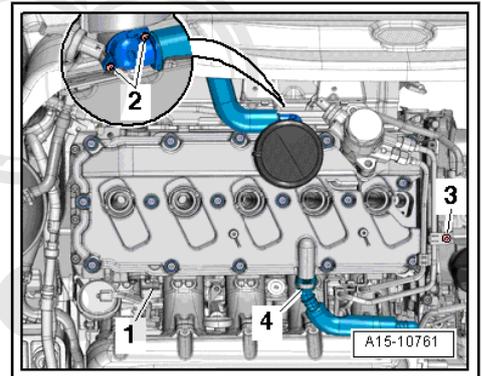
- Remove the exhaust camshaft adjustment valve 1 -N318- . Refer to => ["4.2 Camshaft Adjuster Valve 1 N205 / Exhaust Camshaft Adjustment Valve 1 N318", page 102](#) .
- Remove the ignition coils. Refer to => Fuel Injection and Ignition; Rep. Gr. 28 ; Removal and Installation .



- Remove the bolts -arrows-.
- Open the clamps -1 and 2- and remove the air guide pipe.



- Disconnect the connector -1-, set the wiring harness off to the side.
- Remove the bolts -2- and remove the crankcase housing ventilation hose.
- Remove the crankcase housing ventilation hose -4- on the opposite side in order to press the release button.
- Remove the bolt -3- and then remove the hose clamp for the fuel line.



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- Loosen the cylinder head cover bolts in the following sequence: -16 to 1-.
- Remove the bolts and the cylinder head cover.

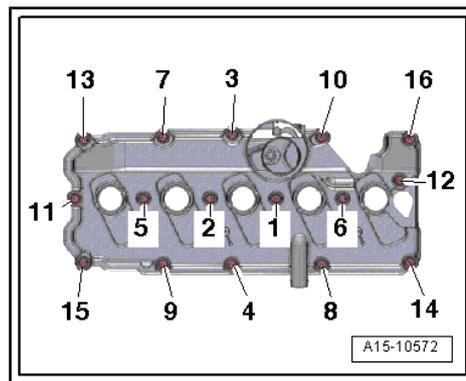
Installing

Install in reverse order, paying attention to the following:



Note

- ◆ *Replace the cylinder head seal if it is damaged.*
 - ◆ *Replace the cylinder head cover bolts when replacing the damaged seal.*
 - ◆ *Replace the O-rings.*
 - ◆ *The hose connections as well as the air guide pipes and hoses must be free of oil and grease before installing.*
 - ◆ *Secure all hose connections with hose clamps of the same type as those equipped by the factory. Refer to the Electronic Parts Catalog (ETKA).*
 - ◆ *In order to be able to securely mount the air guide hoses on their connectors, spray the screws on the previously used clamps with a rust remover.*
- Tighten cylinder head cover bolts. Refer to [⇒ Fig. "Cylinder Head Cover, Tightening Specifications and Sequence", page 81](#) .
 - Install the air guide pipe. Refer to [⇒ "1.1 Charge Air Cooler Overview", page 209](#) .
 - Install the ignition coils. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 28 ; Removal and Installation .
 - Install the exhaust camshaft adjustment valve 1. Refer to [⇒ "4.2 Camshaft Adjuster Valve 1 N205 / Exhaust Camshaft Adjustment Valve 1 N318 ", page 102](#) .



4.5 Cylinder Head

Special tools and workshop equipment required

- ◆ Engine Bung Set -VAS 6122-
- ◆ Hose Clip Pliers -VAS 6362-
- ◆ Polydrive Bit and Drive Socket -T10070- or socket XZN M12, minimum 140 mm, commercially available
- ◆ Camshaft Clamp -T40070-

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Removing



Note

When installing, bring all cable ties back to same positions.

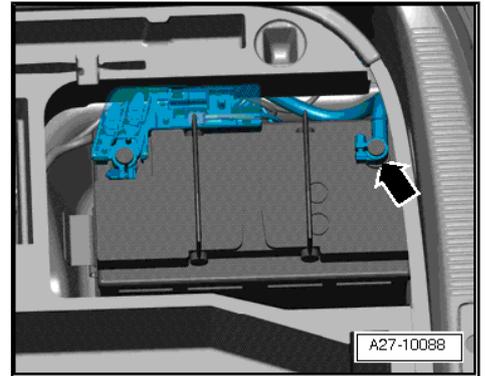


Caution

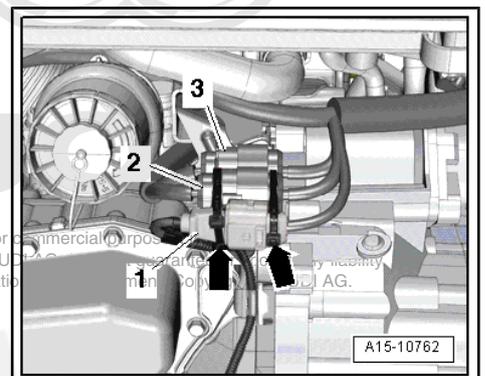
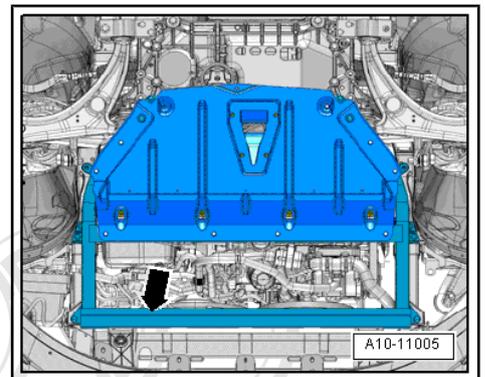
Risk of destroying electronic components when disconnecting the battery.

◆ **Observe measures for disconnecting battery.**

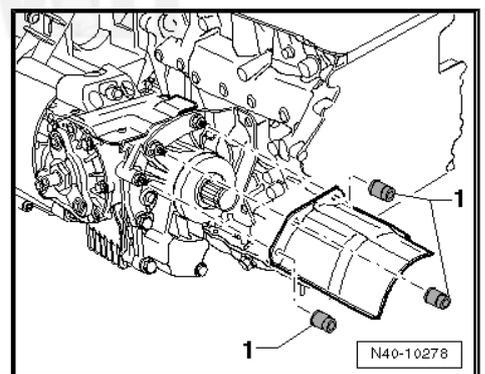
- With the ignition switched off, disconnect the battery Ground (GND) -arrow-. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation .
- Drain the coolant. Refer to ⇒ "1.1 Coolant, Draining and Filling", page 171 .
- Remove the noise insulation frame -arrow- and the rear noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 50 ; Removal and Installation .



- Disconnect the connector -1- in order to cut the cable tie -arrows-.
- Remove electrical harness connectors -2 and 3- from bracket and disconnect.
- Free up the wiring harness.

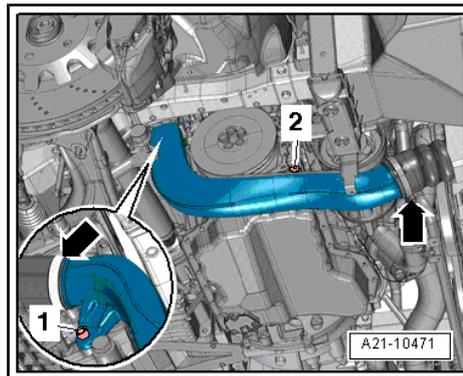


- Remove the nuts -1- and remove the right drive axle heat shield.



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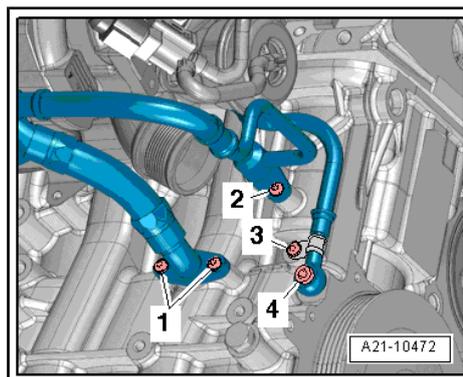
- Remove the bolts -1 and 2-
- Remove the air guide pipe, to do so, loosen the hose clamps -arrows-



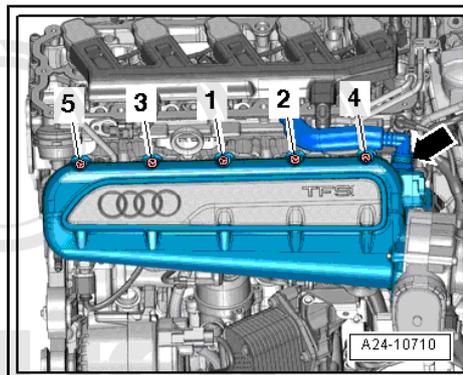
 **Note**

Lay a cloth below to catch escaping coolant and engine oil.

- Remove bolts -1, 2 and 3- and banjo bolt -4- and remove wires from the cylinder block.
- Seal any open lines and connections with a clean plug from the -VAS 6122- .



- Remove the upper section of the intake manifold. Refer to => Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .



WARNING

Risk of injury from fuel.

- ◆ *To reduce fuel pressure, lay cloths around connecting point before opening the fuel system and carefully loosen.*



Caution

Danger of defects caused by dirt.

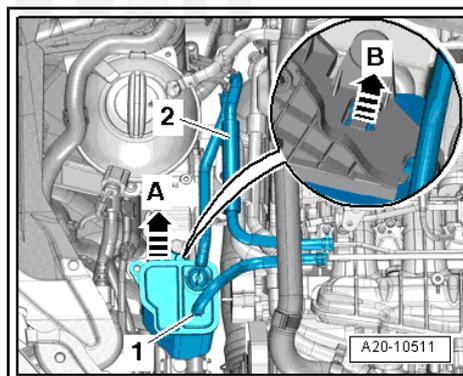
- ◆ *Follow the guidelines for cleanliness when working on the fuel supply system. Refer to => "1.1 Clean Working Conditions", page 1 .*

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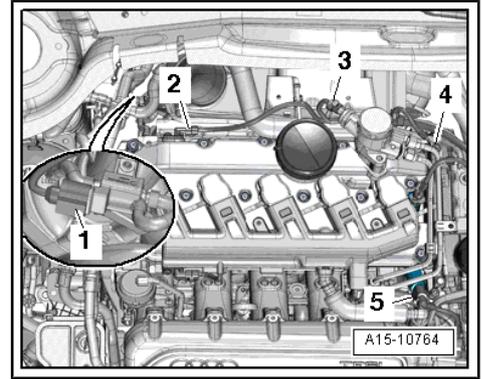
- Remove the fuel supply line mount, then remove the heat shield boot -2- from the fuel supply line at the separating point.
- Disconnect the fuel supply line in order to pull the release ring.
- Seal any open lines and connections with a clean plug from the -VAS 6122- .
- Remove the hose -1- from the EVAP canister.

 **Note**

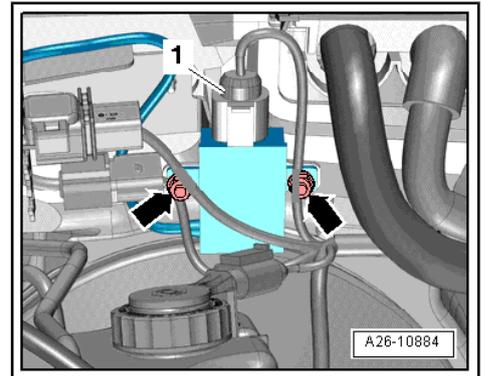
Ignore -arrows A and B-



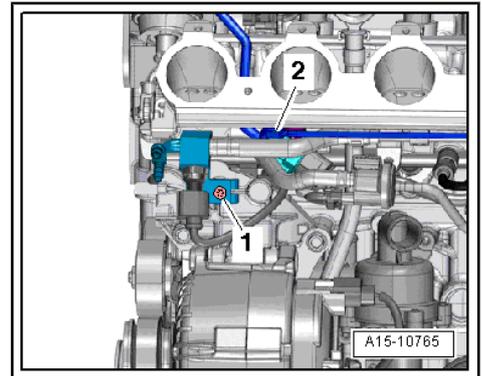
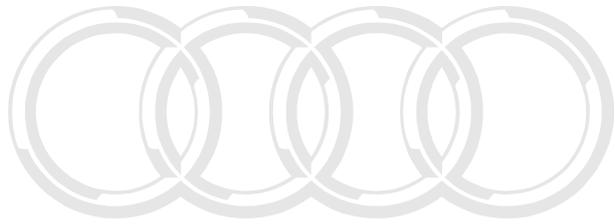
- Remove the bolt -4- and free up the Ground (GND) cable.
- Disconnect the connectors:
 - 1 - Wastegate bypass regulator valve -N75-
 - 2 - Camshaft Position (CMP) sensor 3 -G300-
 - 3 - Fuel Metering Valve -N290-
 - 5 - Camshaft adjustment valve 1 -N205-
- Free up the wiring harness.



- Disconnect the connector -1-.
- Remove the bolts -arrows- and remove the exhaust gas temperature sensor 1 -G235- on the cylinder head.



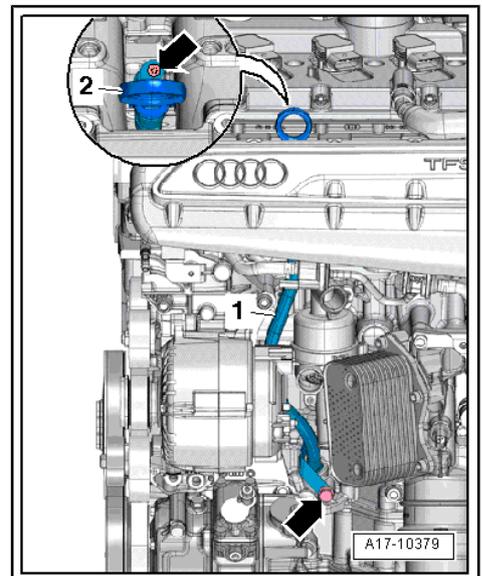
- Remove the bolt -1-.
- Disconnect the vacuum hose -2- and free it up.



- Remove the oil dipstick -2-.
- Remove the bolts -arrows-, then remove oil dipstick tube -1- upward.

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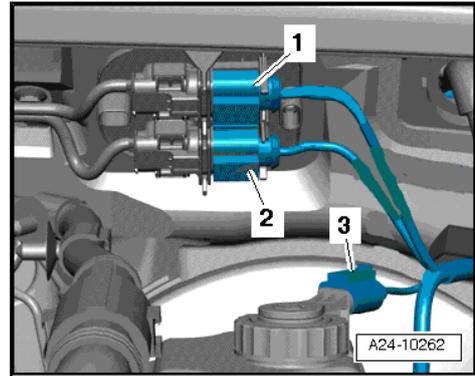
Remove the camshaft timing chain. Refer to
⇒ 4.3 Camshaft Timing Chain, page 102.



- Remove and disconnect the connector -1- for the Heated Oxygen Sensor (HO2S) -G39- .
- Free up the heated oxygen sensor wire.

 **Note**

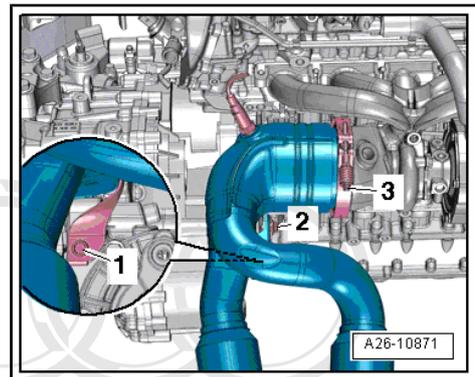
Ignore -2 and 3-.



- Loosen the bolt -3- and slide the clamp onto the primary catalytic converter.
- Remove the bolt -2- and tie up the primary catalytic converter toward the rear.

 **Note**

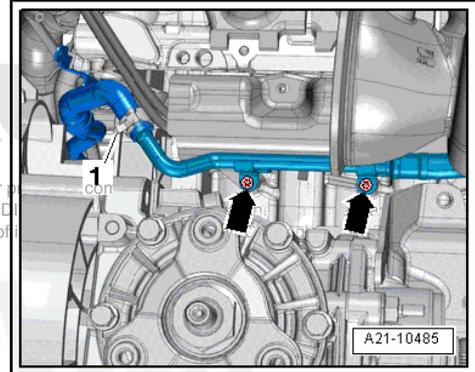
Ignore -1-.



- Remove the bolts -arrows-.

 **Note**

Ignore -1-.



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- Loosen and tighten cylinder head bolts in -13 to 1- sequence.

i Note

- ◆ If bolt -12- cannot be removed with a magnet, loosen the -T40070- bolt one turn, slide the -T40070- forward and to the right and then tighten it again.
 - ◆ A second technician is required to remove the cylinder head.
- Remove the cylinder head.



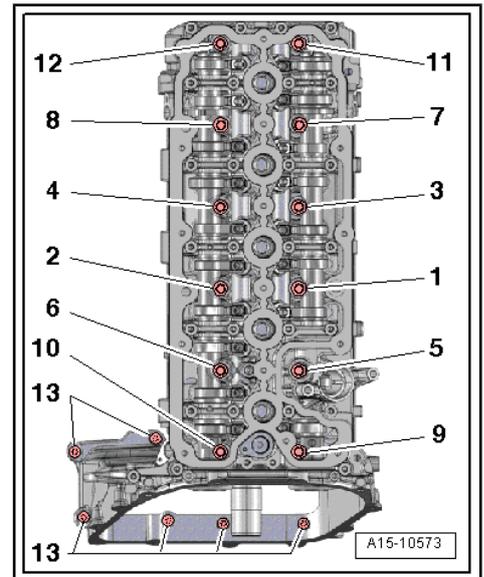
Caution

The engine could be destroyed.

- ◆ To prevent small parts from accidentally entering the engine through the opening in the timing chain compartment, seal the opening with a clean cloth.

Risk of damaging the cylinder wall.

- ◆ Stuff clean cloths into the cylinder to prevent sanding and grinding residue from getting between the cylinder wall and the pistons.



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Installing

- For the correct tightening specifications, refer to [⇒ "1.2 Cylinder Head Cover and Cylinder Head Overview", page 80](#).
- Camshafts locked using the -T40070-.



Caution

The sealing surfaces could be damaged.

- ◆ *Carefully remove sealant residue from cylinder head and cylinder block.*
- ◆ *Make sure that no long scrapes or scratches result.*

Risk of damaging cylinder block.

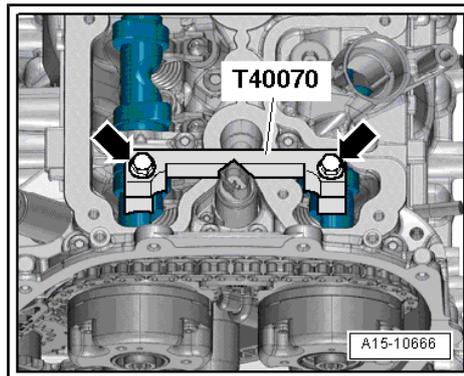
- ◆ *No oil or coolant must be in the cylinder head bolt blind holes in the cylinder block.*

Risk of leaks in cylinder head seal.

- ◆ *Carefully remove sealant residue from cylinder head and cylinder block. Make sure that no long scrapes or scratches result.*
- ◆ *Carefully remove all grinding and sanding residue.*
- ◆ *Only unpack new cylinder head gasket immediately prior to installation.*
- ◆ *To prevent cylinder head seal silicone layer and recessed area from being damaged, always handle seal extremely carefully.*

Risk of damaging open valves.

- ◆ *If a replacement cylinder is installed, only remove plastic base right before cylinder head is installed to protect open valves.*



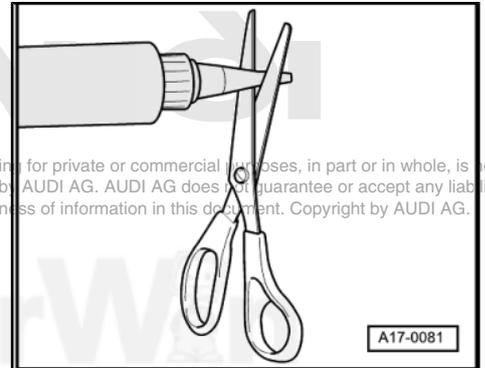
Note

- ◆ *Replace bolts that are tightened to the specification.*
 - ◆ *Replace self-locking nuts, sealing rings, seals and O-rings.*
 - ◆ *If a replacement cylinder is installed, the contact surfaces between the hydraulic adjusting elements, roller rocker levers and cam running surfaces must be lubricated before installing the cylinder head cover.*
 - ◆ *The hose connections as well as the air guide pipes and hoses must be free of oil and grease before installing.*
 - ◆ *Secure all hose connections with hose clamps of the same type as those equipped by the factory. Refer to the Electronic Parts Catalog (ETKA).*
 - ◆ *To mount the charge hoses on their connectors securely, spray the bolts on the used clamps with rust remover before installing.*
 - ◆ *The engine oil and coolant must be changed if the cylinder head or cylinder head seal are replaced.*
- Clean the sealing surfaces; they must be free of oil and grease.

i Note

Note the expiration date of the sealing compound.

- Cut the tube nozzle at the front marking (nozzle diameter approximately 2.0 mm).



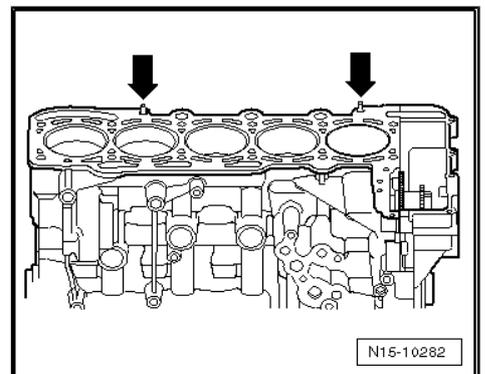
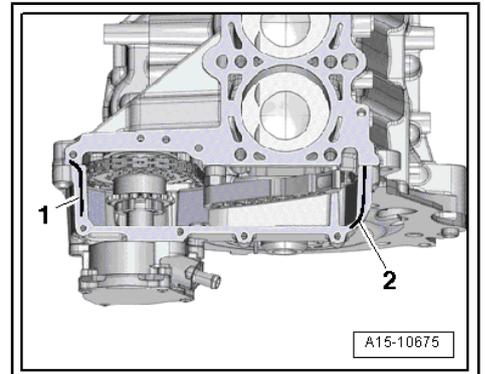
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! Caution

The lubrication system could be plugged with excess sealant.

◆ Do not apply sealant beads thicker than indicated.

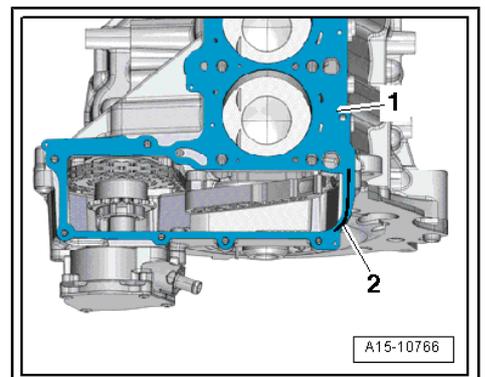
- Apply sealant beads -1 and 2- on the clean surfaces of the cylinder block as shown in the illustration.
- Thickness of sealant bead: 2.0 to 2.5 mm.
- Set cylinder head gasket in place.
- Installed position: It must be possible to read the part number.
- Pay close attention to alignment bushings in cylinder block -arrows-.



- Apply sealant bead -2- to the cylinder head gasket -1- as illustrated.

i Note

The cylinder head must be installed within 5 minutes after applying the sealant.



- Set cylinder head in place.
- Tighten the cylinder head bolts. Refer to ⇒ [Fig. "Cylinder Head, Tightening Specifications and Sequence", page 82](#).



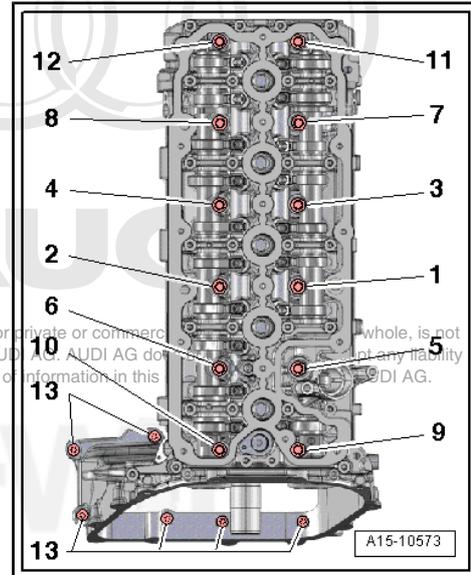
Note

Do not tighten cylinder head bolts after repairs.

- Wipe off any sealant that leaks out.

Install in reverse order of removal paying attention to the following:

- Install primary catalytic converter. Refer to ⇒ ["5.4 Primary Catalytic Converter", page 239](#).
- Install camshaft timing chain. Refer to ⇒ ["4.3 Camshaft Timing Chain", page 102](#).
- Tighten the oil dipstick guide tube. Refer to ⇒ [Fig. "Oil Dipstick Guide Tube - Tightening Specifications", page 145](#).
- Install the exhaust gas temperature sensor 1 -G235-. Refer to ⇒ ["5.2 Exhaust Gas Temperature \(EGT\) Sensor 1 G235", page 237](#).
- Install the upper section of the intake manifold. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .
- Install the turbocharger. Refer to ⇒ ["1.2 Turbocharger Overview", page 211](#).
- Install the driveshaft heat shield. Refer to ⇒ Manual Transmission; Rep. Gr. 39 ; Removal and Installation .
- Install the noise insulation frame. Refer to ⇒ Body Exterior; Rep. Gr. 50 ; Removal and Installation .
- Electrical connectors and wiring routing. Refer to ⇒ Wiring diagrams, Troubleshooting & Component locations.
- Follow measures after connecting battery. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation .
- Change engine oil. Refer to the Maintenance Procedures Rep. Gr. 03.
- Replace coolant. Refer to ⇒ ["1.1 Coolant, Draining and Filling", page 171](#).



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4.6 Lower Timing Chain Cove

Special tools and workshop equipment required

- ◆ Hand drill with plastic brush attachment
- ◆ Protective goggles
- ◆ Sealant, refer to the Electronic Parts Catalog (ETKA)

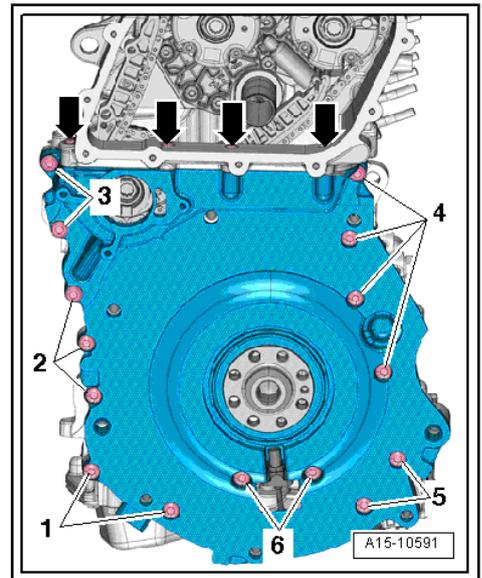
Removing

- The transmission is removed. Refer to ⇒ Manual Transmission; Rep. Gr. 34 ; Removal and Installation .

i Note

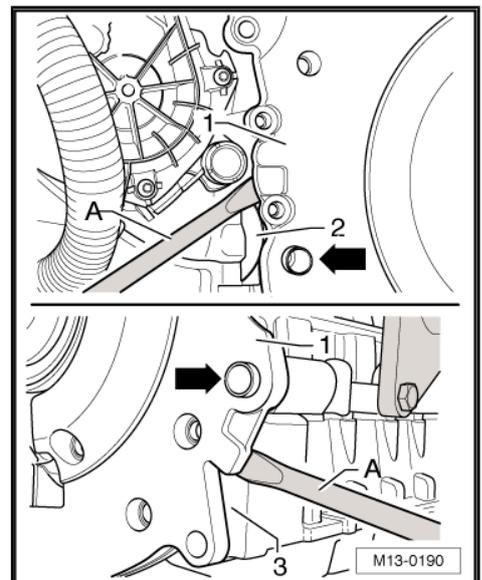
When installing, bring all cable ties back to the same positions.

- Remove dual mass flywheel. Refer to ⇒ "4.6 Dual Mass Flywheel", page 69 .
- Remove timing chain guard upper section. Refer to ⇒ "4.8 Upper Timing Chain Cover", page 124 .
- Remove the brake booster vacuum pump. Refer to ⇒ Brake System; Rep. Gr. 47 ; Removal and Installation .
- Remove Engine Speed (RPM) sensor -G28- . Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 28 ; Removal and Installation .
- Remove bolts -arrows- first, then remove bolts -1 through 6-.



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- Carefully loosen the timing chain guard lower section -1- from the bonding in order to position a screwdriver -A- on the upper and lower marked locations:
- 2 - Cylinder block
 3 - Oil pan (upper section)
- Meanwhile, begin loosening in the area of the alignment sleeve -arrows-.
 - Press the transmission side of the crankshaft shaft seal out of the lower timing chain cover.



Installing

- Drive the alignment sleeve -arrows- back into the timing chain guard lower section so far that it no longer protrudes out from the sealing surface.

i Note

Replace seals, gaskets and O-rings.

! Caution

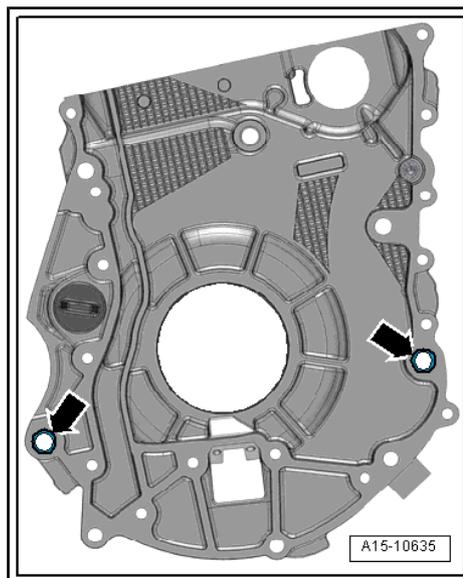
Risk of contaminating lubricating system.

- ◆ Cover open parts of engine.

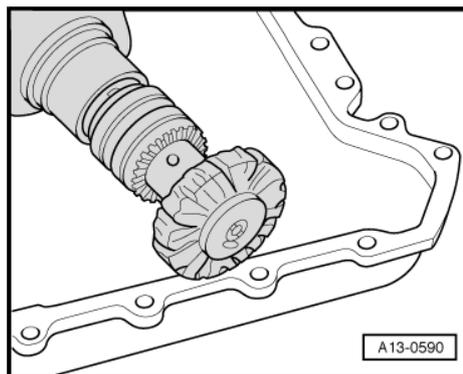
! WARNING

Danger of eye injury.

- ◆ Wear protective goggles.



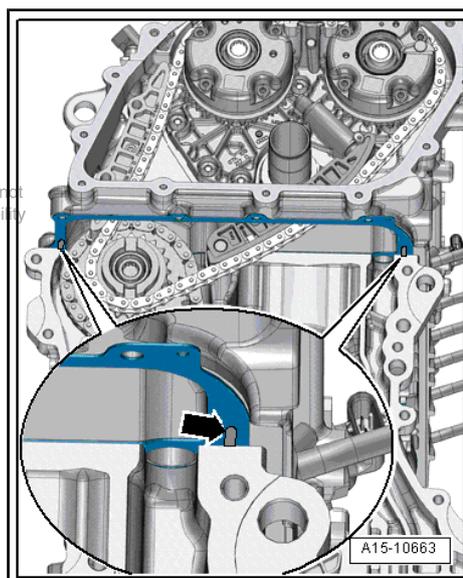
- Remove any sealant residue still on the timing chain guard lower section, cylinder block and oil pan upper section with a rotating plastic brush.
- Clean the sealing surfaces; they must be free of oil and grease.



- Clean the old sealant off the holes -arrow- in the cylinder head gasket.

i Note

With cylinder head installed, holes in cylinder head seal are only half visible.



 **Caution**
The cylinder head seal could be damaged.
 ♦ *Only bend ends of cylinder head seals slightly, do not kink.*

 **Note**

A kinked cylinder head seal must be replaced.

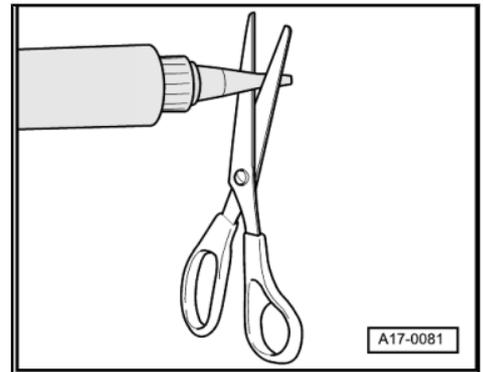
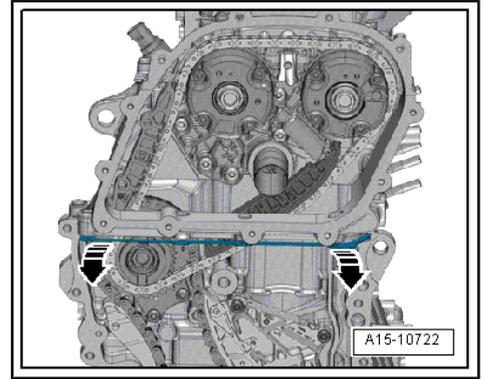
- Bend the end of the cylinder head seal down slightly -arrows- until the upper sealing surface of the seals and the cylinder head can be cleaned.
- Clean the upper and lower cylinder head gasket; they must be free from oil and grease.

 **Note**

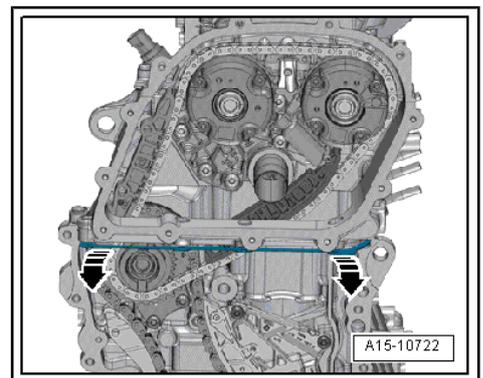
Note the expiration date of the sealing compound.

- Cut the tube nozzle at the front marking (nozzle diameter approximately 2 mm).

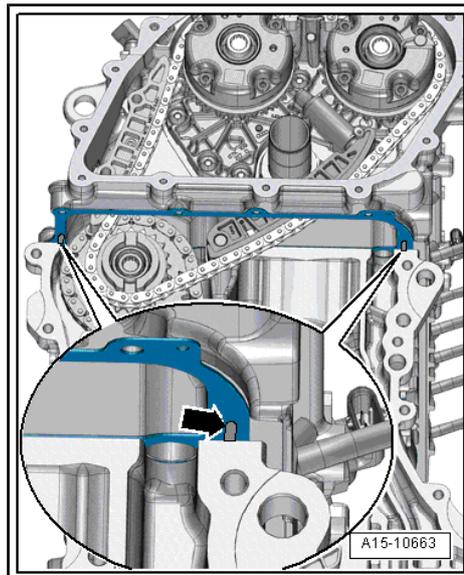
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- Lightly coat the top and bottom cylinder head seal sealing surface with lubricant by bending seal down slightly again -arrows-.
- Use a flat object such as a feeler gauge to coat the surface between the cylinder head and seal.



- Fill the cleaned cylinder head seal holes -arrow- with sealant.



Caution

The lubrication system could be plugged with excess sealant.

- ◆ *Do not apply sealant bead thicker than indicated.*

- Apply a sealant bead -arrow- to the clean sealing surface of the timing chain guard lower section as shown in the illustration.
- Thickness of sealant bead: 1.5 to 2.0 mm.

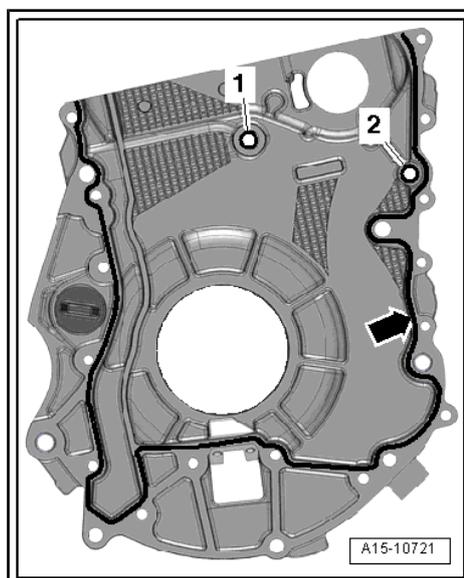


Note

The timing chain guard lower section must be installed within 5 minutes after applying the sealant.

- Install the sealing sleeve -1- and O-ring -2-.
- Position the lower timing chain cover, guiding it diagonally from below to the sealing surface on the cylinder block and cylinder head.

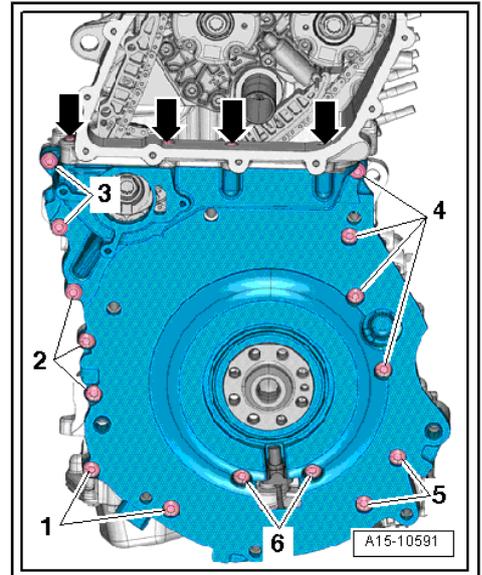
- **When positioning, ensure the cylinder head seal is not damaged.**



- Install the timing chain guard lower section bolts all the way by hand.
- Drive in the alignment sleeve on the timing chain guard lower section all the way into the cylinder block.
- Tighten the bolts for the lower timing chain cover. Refer to [⇒ Fig. "Lower Timing Chain Cover, Tightening Specifications and Sequence", page 84](#).

Install in reverse order of removal paying attention to the following:

- Install the Engine Speed (RPM) sensor -G28-. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 28 ; Removal and Installation .
- Install the brake booster vacuum pump. Refer to ⇒ Brake System; Rep. Gr. 47 ; Removal and Installation .
- Install timing chain guard upper section. Refer to [⇒ "4.8 Upper Timing Chain Cover", page 124](#) .
- Install the transmission-side crankshaft shaft seal. Refer to [⇒ "4.5 Crankshaft Seal, Transmission Side", page 67](#) .
- Install the dual mass flywheel. Refer to [⇒ "4.6 Dual Mass Flywheel", page 69](#) .



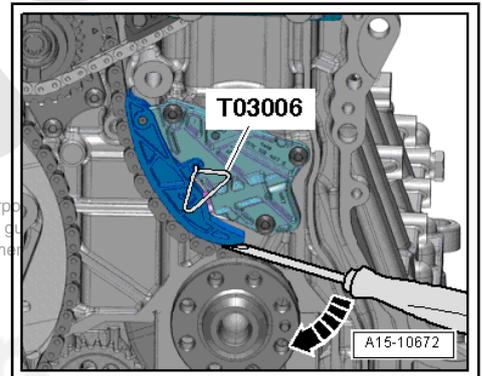
4.7 Timing Mechanism Drive Chain

Special tools and workshop equipment required

- ◆ Locking Pins -T03006-

Removing

- The transmission is removed. Refer to ⇒ Manual Transmission; Rep. Gr. 34 ; Removal and Installation .
- Remove the camshaft timing chain. Refer to [⇒ "4.3 Camshaft Timing Chain", page 102](#) .
- Remove timing chain lower cover. Refer to [⇒ "4.6 Lower Timing Chain Cover", page 118](#) .
- Press the drive chain tensioner guide rail in the direction of the -arrow- and secure the chain tensioner with a -T03006- .



Caution

Risk of destroying due to reversed running direction on a used drive chain.

- ◆ **Mark the drive chain running direction with arrows using paint for installation later. Do not mark the chain using a punch, notch or similar.**

- Remove the bolts -3- and the chain tensioner.
- Remove the glide track -1 and 2-.
- Remove the timing mechanism drive chain.

Installing

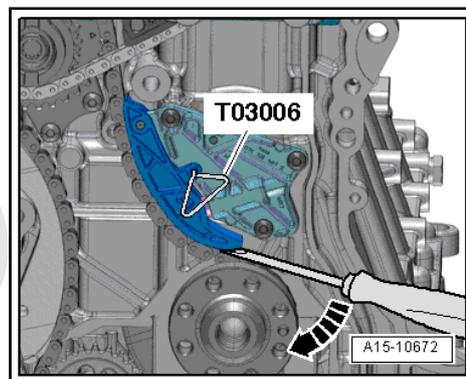
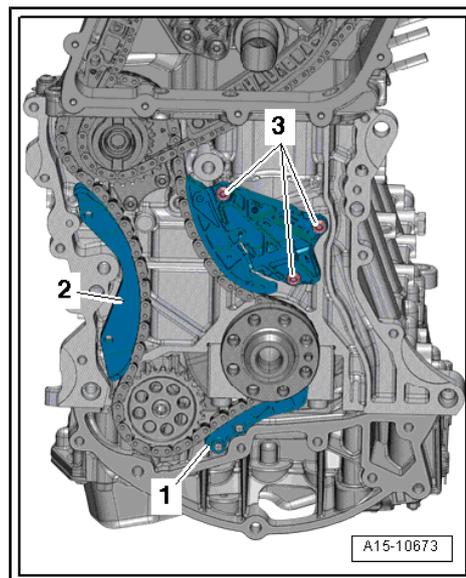
Install in reverse order, paying attention to the following:

- For the correct tightening specifications, refer to ⇒ ["1.4 Timing Mechanism Drive Chain Overview", page 85](#) .

Note

Replace bolts that are tightened to the specification.

- Position the timing mechanism drive chain according to the markings made on the drive chain sprockets during removal.
- Install the glide track -1 and 2-.
- Install the chain tensioner and tighten the bolts -3-.
- Press the drive chain tensioner guide rail in direction of -arrow- and remove the -T03006- .
- Install timing chain lower cover. Refer to ⇒ ["4.6 Lower Timing Chain Cove", page 118](#) .
- Install camshaft timing chain. Refer to ⇒ ["4.3 Camshaft Timing Chain", page 102](#) .



4.8 Upper Timing Chain Cover

Special tools and workshop equipment required

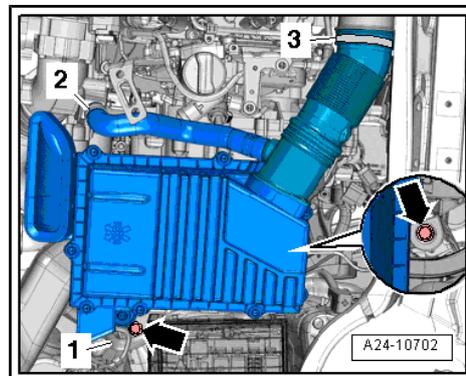
- ◆ Hose Clip Pliers -VAS 6362-
- ◆ Hand drill with plastic brush attachment
- ◆ Protective eyewear
- ◆ Sealant, refer to the Electronic Parts Catalog (ETKA)

Removing

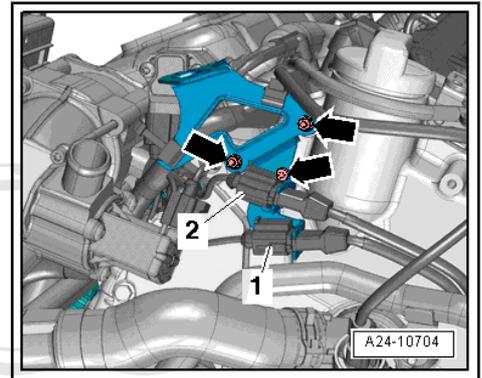
Note

Wire routing and mounting in the engine compartment. Refer to ⇒ ["1.6 Lines, Routing and Securing", page 2](#) .

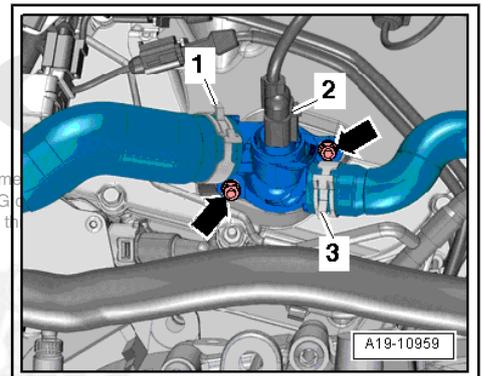
- Remove the air filter housing. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .



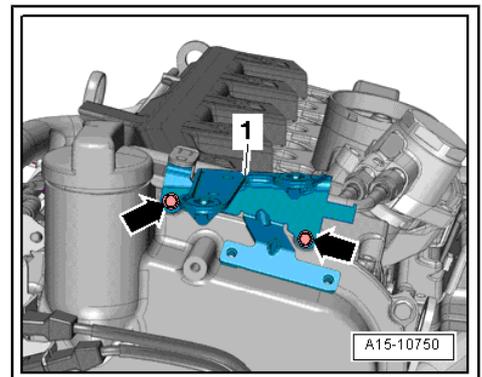
- Disconnect the connectors -1 and 2-.
- Remove the nuts and bolts -arrows- and lay the mount for the connector to the side.
- Remove the front coolant pipes. Refer to [⇒ "5.9 Front Coolant Pipes", page 195](#) .
- Remove the left coolant pipe. Refer to [⇒ "5.11 Left Coolant Pipe", page 198](#) .



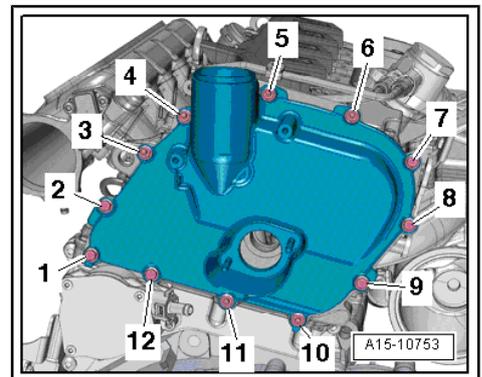
- Disconnect the connector -2- from the engine coolant temperature sensor -G62- .
- Loosen the clamp -3- and remove the coolant hose.
- Remove the nut -arrows- and lay the coolant support along with sealed coolant hose -1- off to the side.



- Remove the bolts -arrows- and remove the bracket -1-.



- Remove the bolts in descending order from -12 to 1-, then carefully loosen the timing chain guard upper section from the bonding.
- Drive out the seal from the timing chain guard upper section, refer to [⇒ "4.9 Upper Timing Chain Cover Seal", page 127](#) .



Installing

 **Caution**
Risk of contaminating lubricating system.
 ♦ *Cover open parts of engine.*

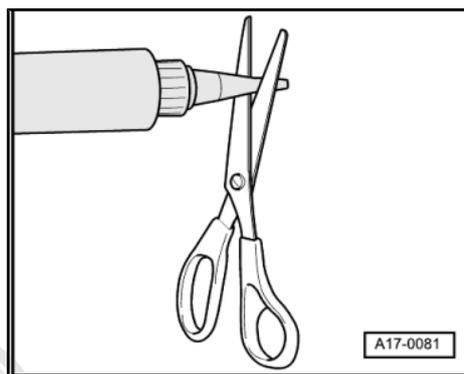
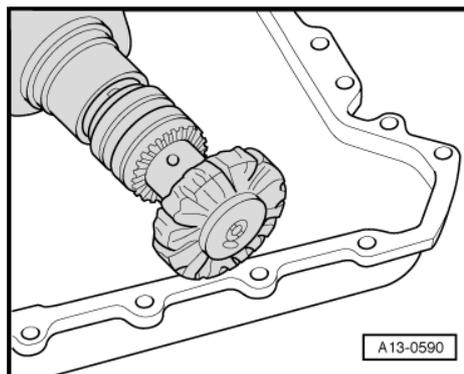
 **WARNING**
Danger of eye injury.
 ♦ *Wear protective goggles.*

- Remove any sealant residue on the timing chain cover, cylinder block and cylinder head, for example, using a rotating plastic brush.
- Press in the new seal for the timing chain guard upper section. Refer to ⇒ ["4.9 Upper Timing Chain Cover Seal", page 127](#) .
- Clean the sealing surfaces; they must be free of oil and grease.

 **Note**

Note the expiration date of the sealing compound.

- Cut the tube nozzle at the front marking (nozzle diameter approximately 1.5 mm).

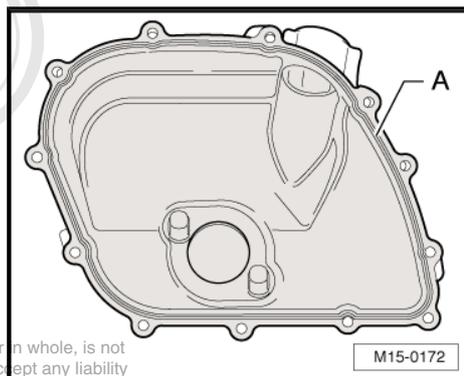


 **Caution**

The lubrication system could be plugged with excess sealant.

◆ *Do not apply sealant bead thicker than indicated.*

- Apply the sealant bead -A- to the clean sealing surfaces on the timing chain guard upper section as shown in the illustration.
- Thickness of sealant bead: 1.5 to 2.0 mm.



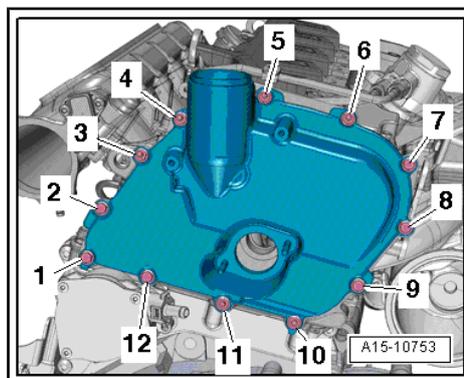
 **Note**

The timing chain guard upper section must be installed within 5 minutes after applying the sealant.

- Install the timing chain guard upper section and tighten the bolts. Refer to ⇒ ["Upper Timing Chain Cover, Tightening Specifications and Sequence", page 84](#) .

Install in reverse order of removal paying attention to the following:

- Install coolant supports. Refer to ⇒ ["2.2 Coolant Pipes Overview", page 178](#) .
- Install the left coolant pipe. Refer to ⇒ ["5.11 Left Coolant Pipe", page 198](#) .
- Install the front coolant pipes. Refer to ⇒ ["5.9 Front Coolant Pipes", page 195](#) .



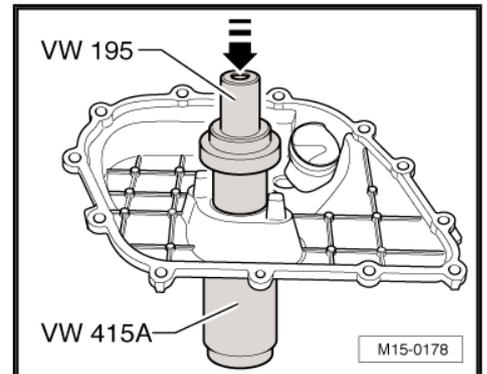
4.9 Upper Timing Chain Cover Seal

Special tools and workshop equipment required

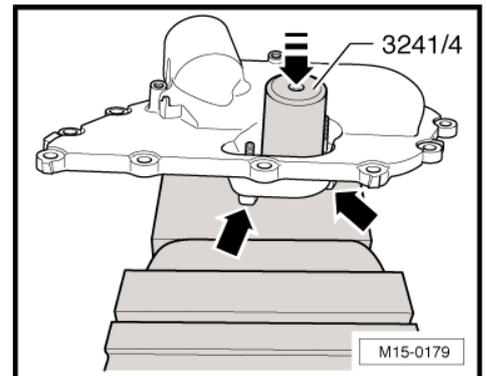
- ◆ Arbor -VW 195-
- ◆ Tube 60 mm Dia. -VW 415 A-
- ◆ Seal Installer -3241/4-

Procedure

- Remove timing chain guard upper section. Refer to [⇒ "4.8 Upper Timing Chain Cover", page 124](#) .
- Drive out the seal using the -VW 195- -arrow-.



- Support the sealant-free upper timing chain guard and with molded tabs -arrows- on a secure backing and press in the new seal all the way using the -3241/4- .
- Install timing chain guard upper section. Refer to [⇒ "4.8 Upper Timing Chain Cover", page 124](#) .



4.10 Valve Stem Seals, Cylinder Head Installed

Special tools and workshop equipment required

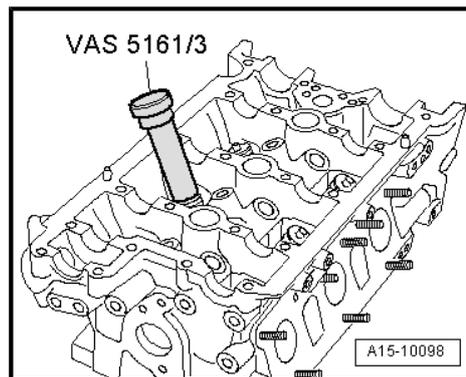
- ◆ Spark Plug Removal Tool -3122 B-
- ◆ Valve Seal Removal Tool -3364-
- ◆ Valve Stem Seal Driver -3365-
- ◆ Valve Cotters Asm/Dis-Asm Device -VAS 5161- with Guide Plate for FSI Engine -VAS 5161/19B-
- ◆ Adapter -T40012-

Removing

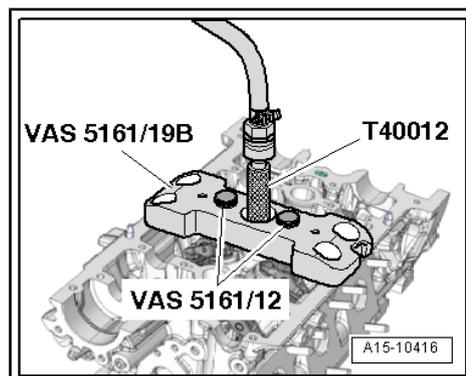
- Remove the camshafts. Refer to [⇒ "4.1 Camshafts", page 97](#) .
- Mark the allocation of the roller rocker lever and the hydraulic adjusting elements so they can be installed again.
- If necessary, remove the roller rocker levers with the hydraulic adjusting elements and place them on a clean surface.
- Remove the spark plugs using the -3122 B- .
- Move piston for respective cylinder to "Bottom Dead Center (BDC) position".

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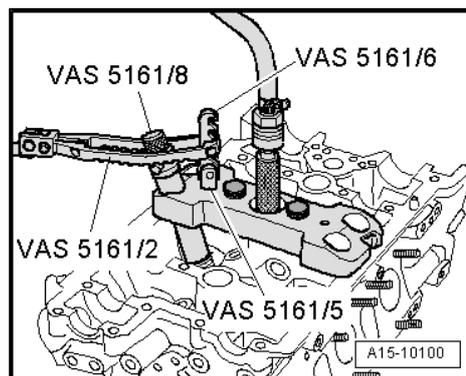
- Position the drift -VAS 5161/3- on the valve spring plate and loosen the stuck valve retainers with a plastic mallet.



- Position guide plate -VAS 5161/19B- on cylinder head.
- Secure the guide plate with the knurled screws - VAS 5161/12- .
- Install -T40012- with sealing ring in respective spark plug thread and hand tighten.
- Connect the adapter to the compressed air using a commercially available intermediate piece and give steady pressure.
- Minimum pressure: 6 bar positive pressure.

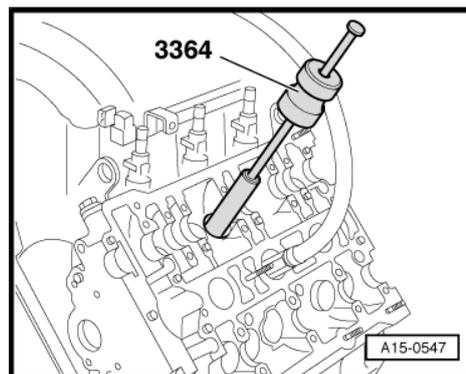


- Install engaging device -VAS 5161/6- with installation fork - VAS 5161/5- in guide plate.
- Slide installation cartridge -VAS 5161/8- in guide plate.
- Engage pressure fork -VAS 5161/2- on engaging device and press installation cartridge down.
- At the same time, rotate installation cartridge knurled screw right until points engage in valve retainers.
- Move the knurled wheel left and right slightly. This presses the valve retainers apart and captures them in the installation cartridge.
- Release the pressure fork.
- Remove installation cartridge.
- Unfasten guide plate and turn it aside.



- Pressurized air hose remains connected.
- Remove the valve spring and the valve spring plate.

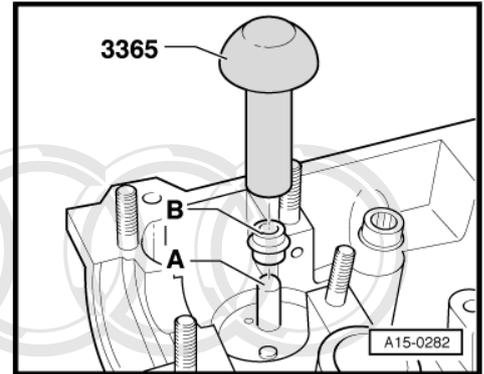
- Remove the valve stem seal with the -3364- .



 **Caution**

Risk of damage when installing valve stem seals.

- ◆ *Place plastic sleeve -A- that is attached to valve stem seals -B- on valve stem.*

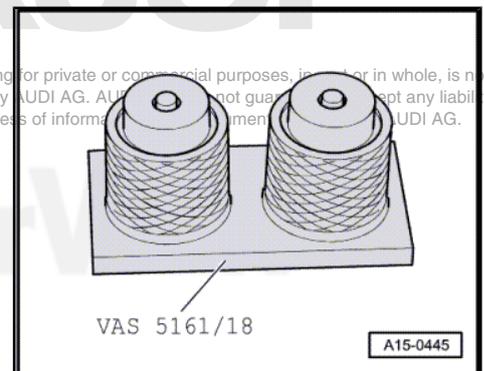


- Lightly oil valve stem seal.
- Slide valve shaft seal onto plastic sleeve.
- Carefully press valve stem seal onto valve guide using the -3365- .
- Remove plastic sleeve.

When the valve retainers were removed from the installation cartridge, they must be inserted in the valve retainer inserting tool next -VAS 5161/18- .

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- The large diameter of the valve retainers point **upward**.
- Press installation cartridge from above onto valve retainer inserting tool and capture retainers.
- Insert the valve spring and the valve spring plate. Refer to ⇒ [Fig. "Installed Position of Valve Spring"](#) , page 88 .

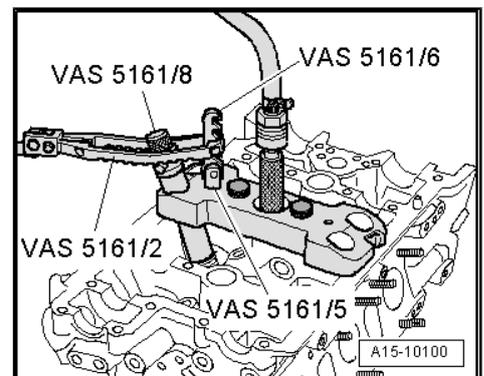


- Install the guide plate on the cylinder head.
- Insert installation cartridge in guide plate.
- Press the pressure fork down and pull the knurled screw up while turn left and right. This inserts the valve retainers.
- Release the pressure fork with the knurled screw still raised.
- Repeat the procedure on each valve.

Assembling

Assemble in reverse order of disassembling. Note the following:

- Make sure all the roller rocker levers lie on the ends of the valve stems correctly and are clipped onto the respective hydraulic adjusting elements.
- Install the camshafts. Refer to ⇒ ["4.1 Camshafts"](#) , page 97 .
- Install spark plugs. Refer to the Maintenance Procedures Rep. Gr. 03.



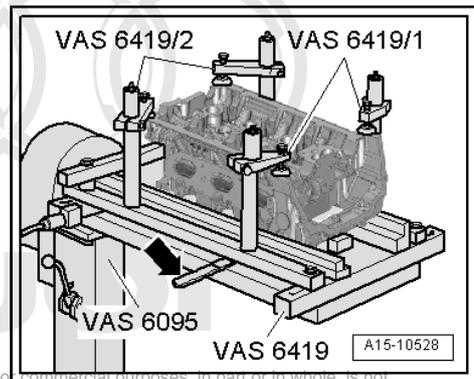
4.11 Valve Stem Seals with Cylinder Head Removed

Special tools and workshop equipment required

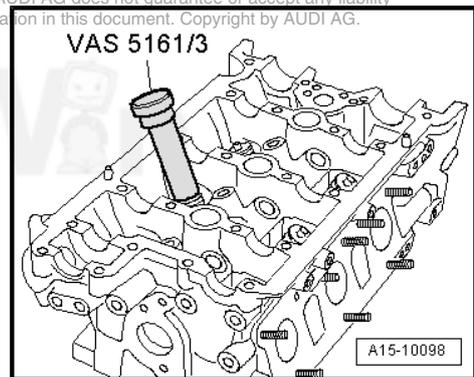
- ◆ Valve Seal Removal Tool -3364-
- ◆ Valve Stem Seal Driver -3365-
- ◆ Valve Cotters Asm/Dis-Asm Device -VAS 5161- with Guide Plate for FSI Engine -VAS 5161/19B-
- ◆ Engine and Transmission Holder -VAS 6095-
- ◆ Cylinder Head Tensioning Device -VAS 6419-

Procedure

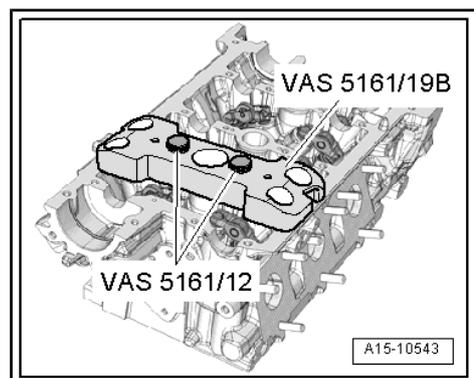
- Remove the camshafts. Refer to ["4.1 Camshafts", page 97](#) .
- Mark the allocation of the roller rocker lever and the hydraulic adjusting elements so they can be installed again.
- If necessary, remove the roller rocker levers with the hydraulic adjusting elements and place them on a clean surface.
- Mount the -VAS 6419- into the -VAS 6095- .
- Tension the cylinder head on the cylinder head tensioning device, as illustrated.
- Connect the cylinder head tensioning device to the compressed air.
- Slide the air cushion with the lever -arrow- under the combustion chamber onto the valve stem seal that will be removed.
- Let enough compressed air flow into the air cushion until it contacts the valve plate.



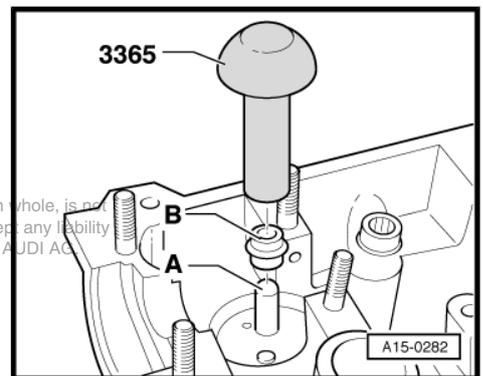
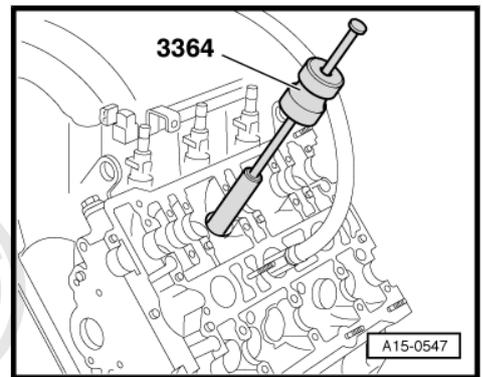
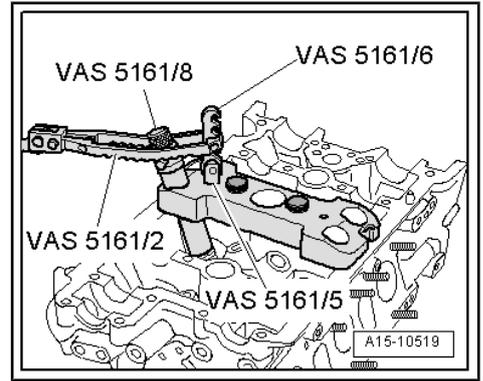
- Position the drift -VAS 5161/3- on the **valve spring plate** and loosen the stuck valve retainers with a plastic mallet.



- Position guide plate -VAS 5161/19B- on cylinder head.
- Secure the guide plate with the knurled screws -VAS 5161/12- .



- Install engaging device -VAS 5161/6- with installation fork - VAS 5161/5- in guide plate.
- Slide installation cartridge -VAS 5161/8- in guide plate.
- Engage pressure fork -VAS 5161/2- on engaging device and press installation cartridge down.
- At the same time, rotate installation cartridge knurled screw right until points engage in valve retainers.
- Move the knurled wheel left and right slightly. This presses the valve retainers apart and captures them in the installation cartridge.
- Release the pressure fork.
- Remove installation cartridge.
- Unfasten guide plate and turn it aside.
- Remove the valve spring and the valve spring plate.
- Remove the valve stem seal with the -3364- .



 **Caution**

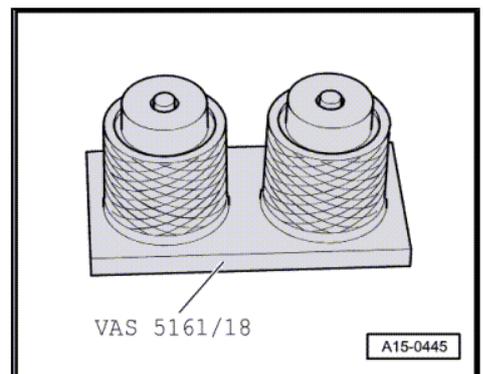
Risk of damage when installing valve stem seals.

◆ ***Place plastic sleeve -A- that is attached to valve stem seals -B- on valve stem.***

- Lightly oil valve stem seal.
- Slide valve shaft seal onto plastic sleeve.
- Carefully press valve stem seal onto valve guide with -3365- .
- Remove plastic sleeve.

When the valve retainers were removed from the installation cartridge, they must be inserted in the valve retainer inserting tool next -VAS 5161/18- .

- The large diameter of the valve retainers point upward.
- Press installation cartridge from above onto valve retainer inserting tool and capture retainers.
- Insert the valve spring and the valve spring plate. Refer to [Fig. "Installed Position of Valve Spring", page 88](#) .

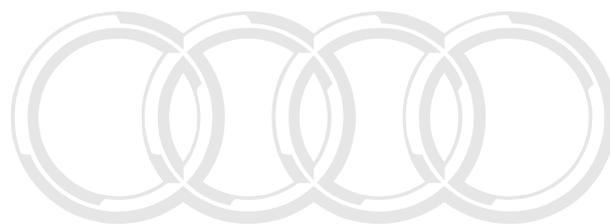
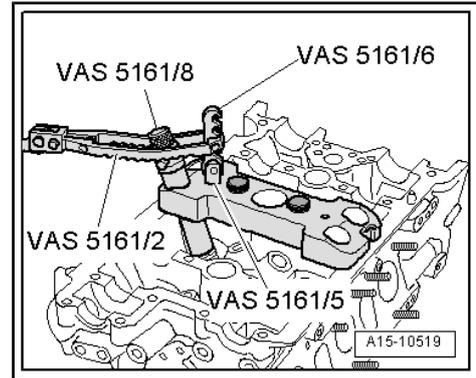


- Install the guide plate on the cylinder head.
- Insert installation cartridge in guide plate.
- Press the pressure fork down and pull the knurled screw up while turn left and right. This inserts the valve retainers.
- Release the pressure fork with the knurled screw still raised.
- Repeat the procedure on each valve.

Assembling

Assemble in reverse order of disassembling. Note the following:

- Make sure all the roller rocker levers lie on the ends of the valve stems correctly and are clipped onto the respective hydraulic adjusting elements.
- Install the camshafts. Refer to ⇒ ["4.1 Camshafts", page 97](#) .



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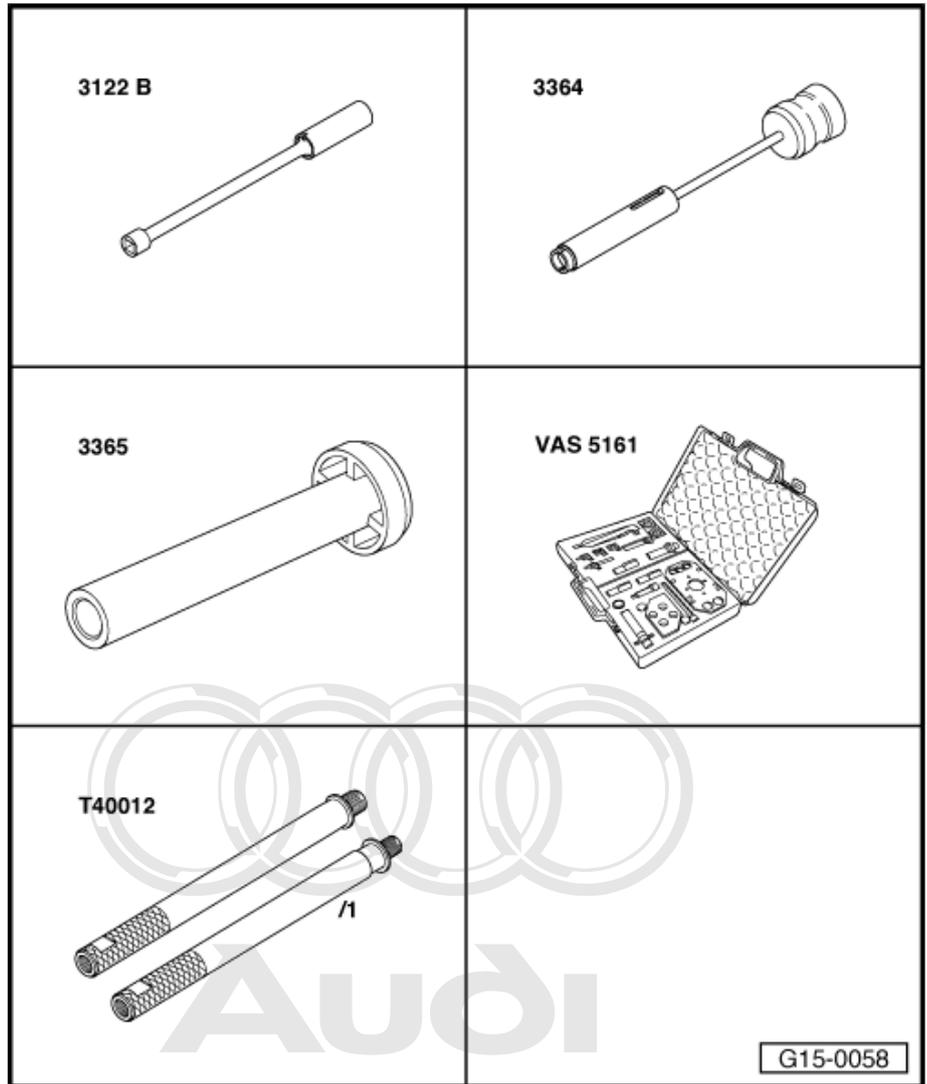
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5 Special Tools

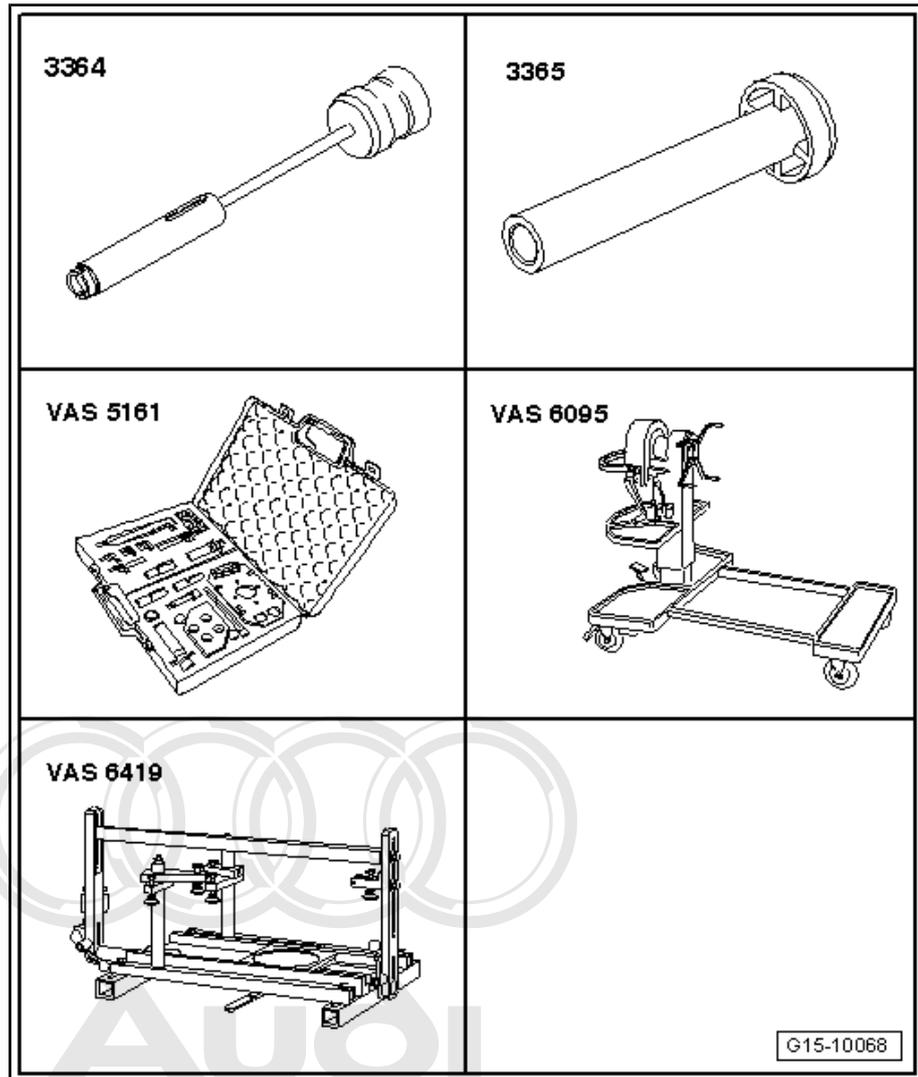
Special tools and workshop equipment required

- ◆ Spark Plug Removal Tool -3122 B-
- ◆ Valve Seal Removal Tool -3364-
- ◆ Valve Stem Seal Driver -3365-
- ◆ Valve Cotters Asm/Dis-Asm Device -VAS 5161- with Guide Plate for FSI Engine -VAS 5161/19B-
- ◆ Adapter -T40012-



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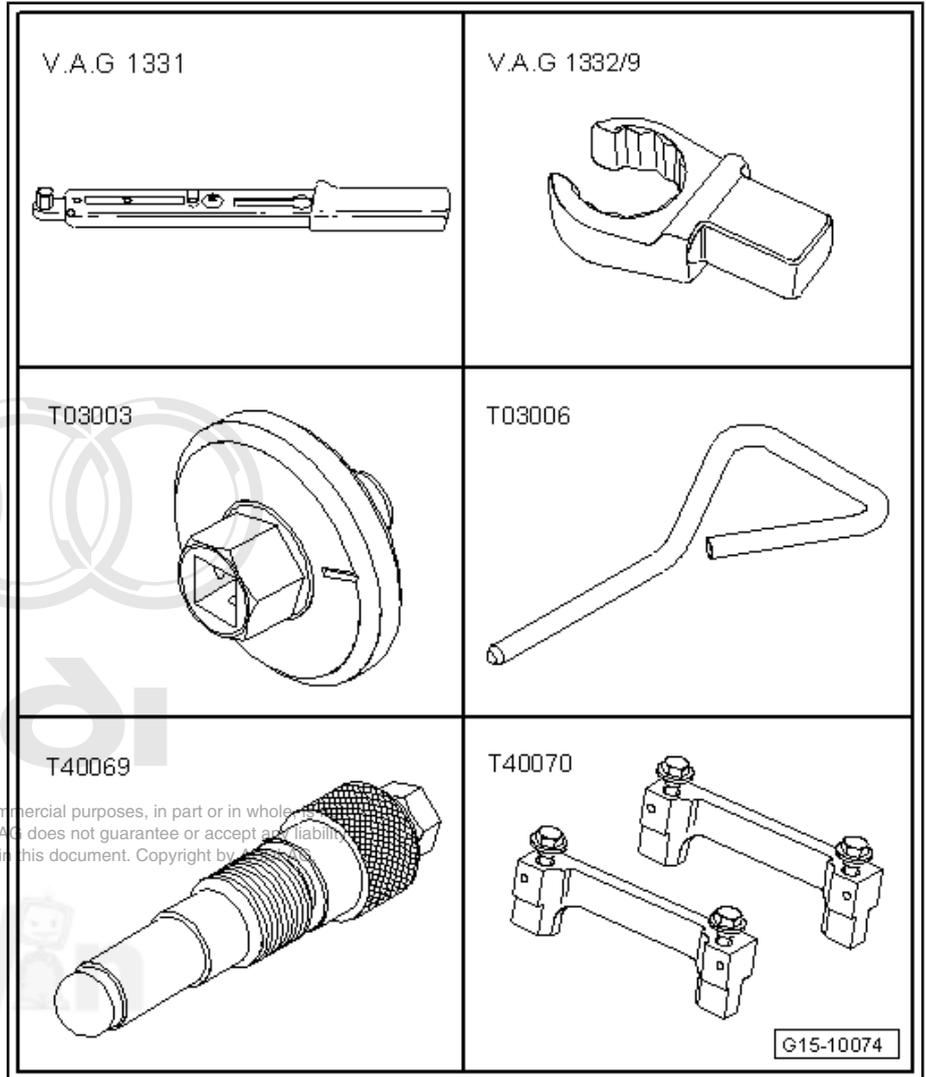
- ◆ Valve Seal Removal Tool -3364-
- ◆ Valve Stem Seal Driver -3365-
- ◆ Valve Cotters Asm/Dis-Asm Device -VAS 5161- with Guide Plate for FSI Engine -VAS 5161/19B-
- ◆ Engine and Transmission Holder -VAS 6095-
- ◆ Cylinder Head Tensioning Device -VAS 6419-



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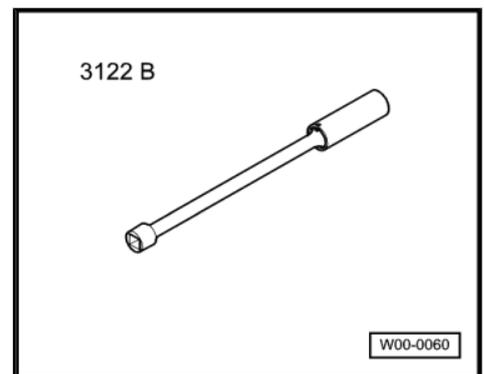
erWin

- ◆ Torque Wrench 5-50 Nm - V.A.G 1331-
- ◆ Open Ring Spanner Insert, AF 24 mm -V.A.G 1332/9-
- ◆ Crankshaft Adapter - T03003-
- ◆ Locking Pins -T03006-
- ◆ Locking Pin -T40069- Camshaft Clamp -T40070-

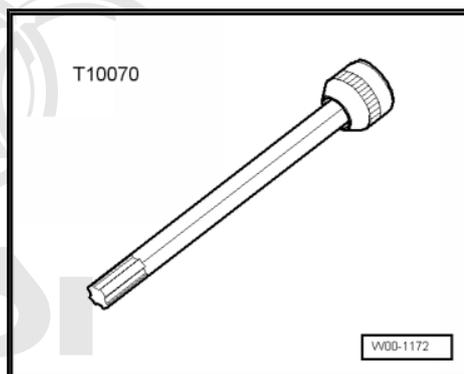


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- ◆ Spark Plug Removal Tool -3122 B-

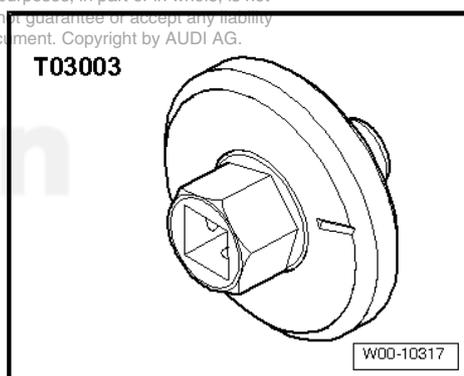


- ◆ Polydrive Bit and Drive Socket -T10070- or socket XZN M12, minimum 140 mm, commercially available

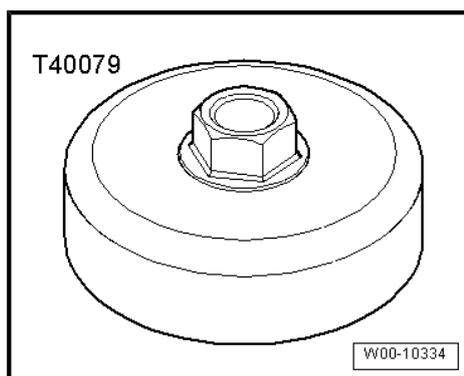


- ◆ Crankshaft Adapter -T03003-

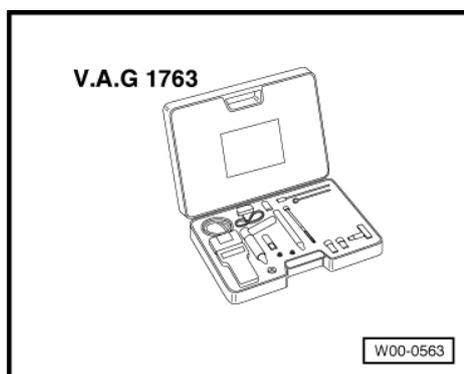
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- ◆ Key -T40079-



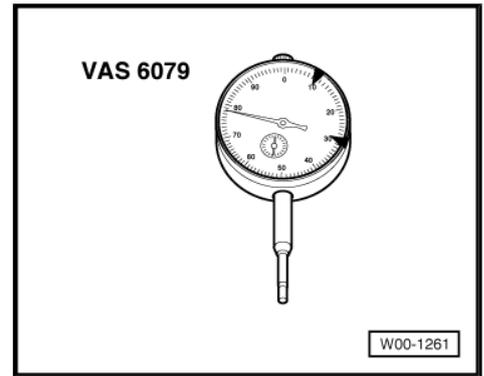
- ◆ Compression Tester -V.A.G 1763-



◆ Dial Gauge 0-10 mm -VAS 6079-

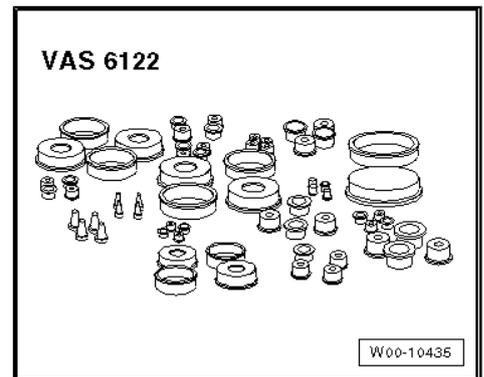
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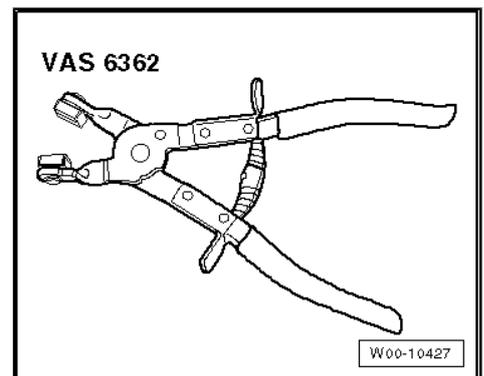


◆ Engine Bung Set -VAS 6122-

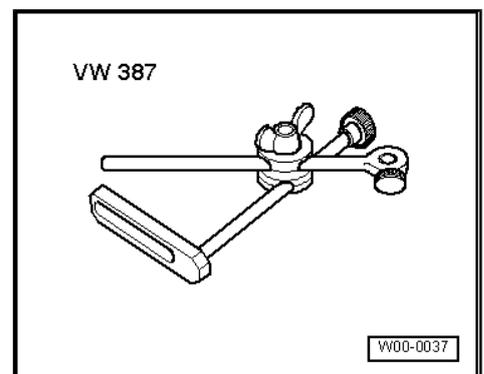
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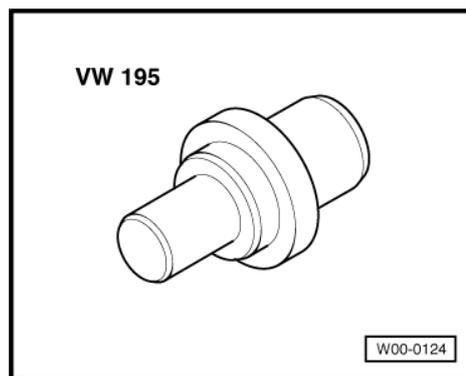
◆ Hose Clip Pliers -VAS 6362-



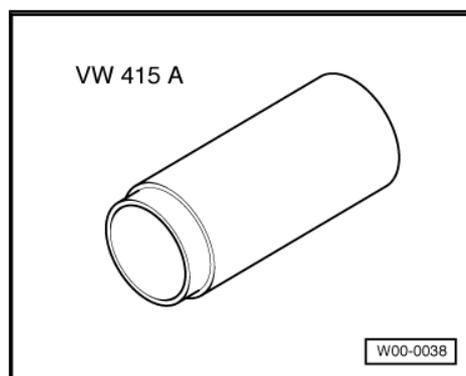
◆ Dial Gauge Holder -VW 387-



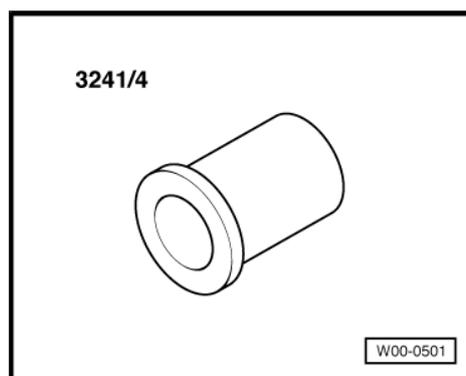
- ◆ Arbor -VW 195-



- ◆ Tube 60 mm Dia. -VW 415 A-



- ◆ Seal Installer -3241/4-



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- ◆ Not illustrated:
- ◆ Locking Pin -T40069-
- ◆ Camshaft Clamp -T40070-
- ◆ Straight Edge 500 mm -VAS 6075-

17 – Lubrication

1 General Information

⇒ ["1.1 Engine Oil", page 139](#)

1.1 Engine Oil

Oil capacities, specifications and viscosity classes refer to the Fluid Capacity Tables Rep. Gr. 03.



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12 - Bracket

13 - Cap

14 - O-ring

- Replace

15 - Oil Pressure Switch -F1- or Reduced Oil Pressure Switch -F378-

- 20 Nm
- Oil pressure switch -F1- through August 2010
- ◆ Black insulation
- ◆ Switching pressure 1.2 to 1.6 bar
 - Reduced oil pressure switch from September 2010
- ◆ Brown insulation
- ◆ Switching pressure 0.55 to 0.85 bar
 - Checking in [Guided Functions](#) using the vehicle diagnostic tester
 - Oil pressure switch / reduced oil pressure switch, removing and installing, refer to [⇒ "5.7 Oil Pressure Switch F1 / Reduced Oil Pressure Switch F378 ", page 165](#)

16 - Seal

- Replace

17 - Oil Filter Housing

- Evacuating, removing and installing, refer to. Refer to the Maintenance Procedures Rep. Gr. 03

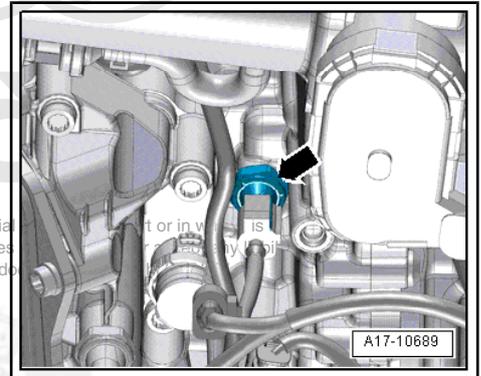
18 - Dust Cap

Oil Pressure Switch -F22- from September 2010

- ◆ Blue insulation
- ◆ Switching pressure 2.15 to 2.95 bar
- ◆ 20 Nm
- ◆ Replace seal

Checking in [Guided Functions](#) using the vehicle diagnostic tester.

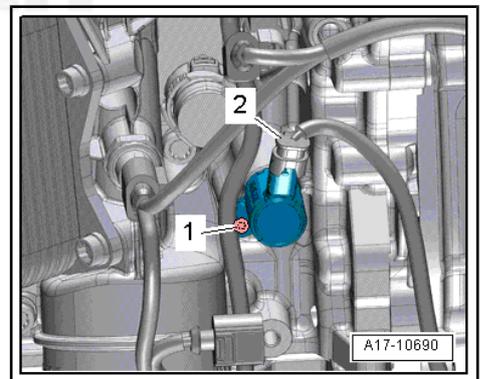
Removing and installing, refer to [⇒ "5.8 Oil Pressure Switch F22 / Oil Pressure Regulation Valve N428 from September 2010", page 165](#) .



Oil Pressure Regulation Valve -N428- from September 2010

- 1 - Bolt
- ◆ 9 Nm
- ◆ O-ring, replace
- 2 - Connector

Removing and installing, refer to [⇒ "5.8 Oil Pressure Switch F22 / Oil Pressure Regulation Valve N428 from September 2010", page 165](#) .



2.2 Oil Pan and Oil Pump Overview



Note

- ◆ *If large quantities of metal particles or abraded material are found during engine repairs, it may be an indication that the crankshaft or rod bearings are damaged. To prevent subsequent damage, the following work must be performed after the repair: Oil channels must be cleaned carefully; replace oil spray jets, engine oil cooler and oil filter*
- ◆ *Oil capacities, specifications and viscosity classes refer to the Fluid Capacity Tables Rep. Gr. 03.*



Caution

Danger of catalytic converter damage.

- ◆ ***Oil level must not exceed "max" marking.***



Note

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Oil spray nozzle and pressure relief valve, refer to
⇒ Fig. "Oil Spray Jet and Pressure Relief Valve", page 52 .

1 - Oil Pan Lower Section

- Removing and installing, refer to ⇒ ["5.2 Lower Oil Pan", page 149](#)
- Install with sealant; sealant, refer to the Electronic Parts Catalog (ETKA)

2 - Bolt

- With sleeve and rubber ring
- 9 Nm

3 - Bolt

- 9 Nm

4 - Retaining Plate

- For oil intake pipe

5 - Seal

- Replace

6 - Bolt

- Replace
- Tightening specification and sequence, refer to ⇒ [Fig. "Upper Section of Oil Pan, Tightening Specifications and Sequence", page 145](#)

7 - Oil Pan (upper section)

- Removing and installing, refer to ⇒ ["5.3 Upper Oil Pan", page 152](#)
- Install with sealant; sealant, refer to the Electronic Parts Catalog (ETKA)

8 - Bolt

- 20 Nm

9 - Oil Pump

- Do not disassemble
- Removing and installing, refer to ⇒ ["5.4 Oil Pump", page 158](#)

10 - Drive Sprocket

- For oil pump
- Installed position: Exterior label is readable

11 - Bolt

- 20 Nm plus an additional 90° turn
- Replace

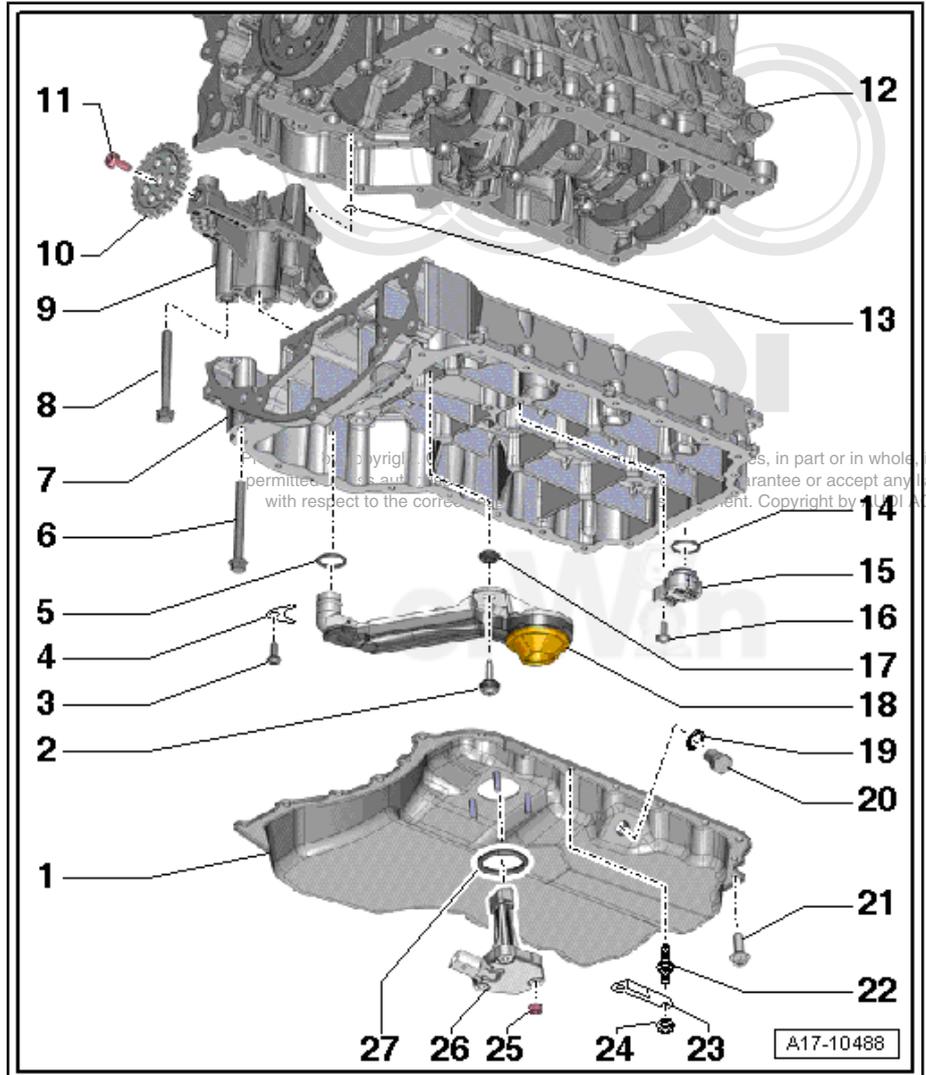
12 - Cylinder Block

13 - O-ring

- Replace

14 - O-ring

- Replace



15 - Connection

- For oil return

16 - Bolt

- 9 Nm

17 - Rubber Ring

18 - Oil Intake Pipe

19 - Seal

- Replace

20 - Oil Drain Plug

- 25 Nm

21 - Bolt

- Replace
- Tightening specification and sequence, refer to
 ⇒ [Fig. "Lower Section of Oil Pan, Tightening Specifications and Sequence", page 144](#)

22 - Double Bolt

- Tightening specification and sequence, refer to
 ⇒ [Fig. "Lower Section of Oil Pan, Tightening Specifications and Sequence", page 144](#)

23 - Bracket

24 - Nut

- 9 Nm

25 - Nut

- 9 Nm

26 - Oil Level Thermal Sensor -G266-

- Removing and installing, refer to ⇒ ["5.1 Oil Level Thermal Sensor G266", page 149](#)

27 - Seal

- Replace

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Lower Section of Oil Pan, Tightening Specifications and Sequence

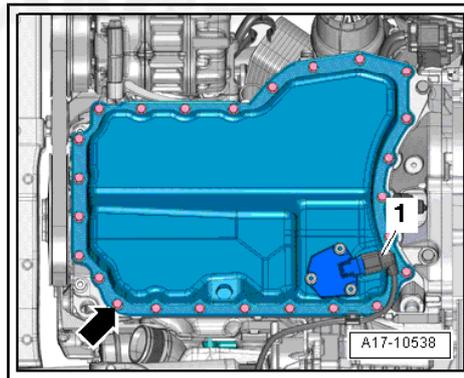


Note

Replace bolts that are tightened to the specification.

– Tighten the bolt in 3 steps:

Stage	Bolts	Tightening Specification/Additional Turn
1.	-arrow-	Install all the way in by hand.
2.	-arrow-	8 Nm in a diagonal sequence
3.	-arrow-	In a diagonal sequence, turn an additional 45°



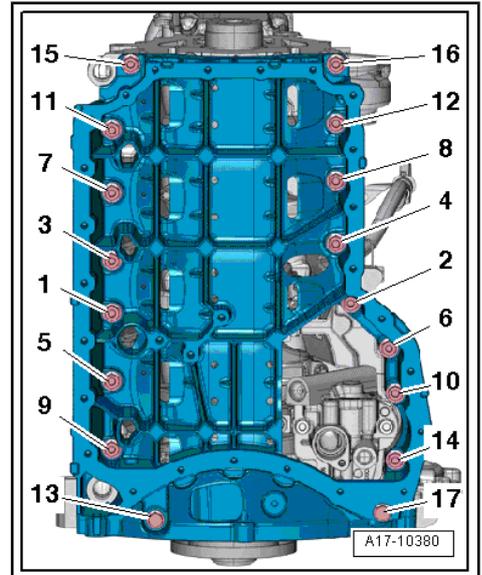
Upper Section of Oil Pan, Tightening Specifications and Sequence

i Note

Replace bolts that are tightened to the specification.

– Tighten the bolts in 3 steps in the sequence shown:

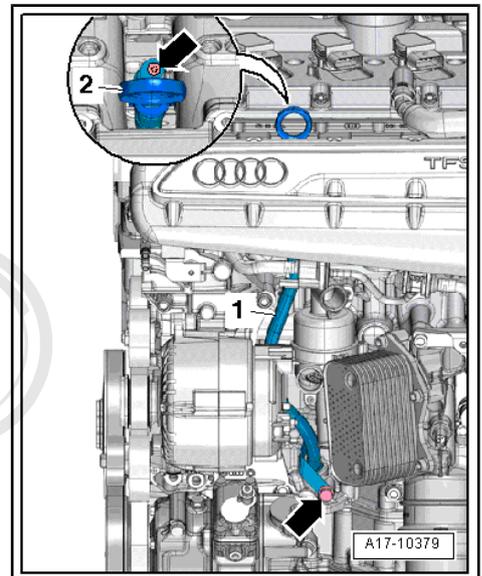
Stage	Bolts	Tightening Specification/Additional Turn
1.	-1 through 17-	Install all the way in by hand.
2.	-1 through 17-	20 Nm
3.	-1 through 17-	Tighten 90° further



Oil Dipstick Guide Tube - Tightening Specifications

– Tighten the bolts -arrows- as follows:

- ◆ M6: 9 Nm
- ◆ M8: 23 Nm



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3 Specifications

⇒ "3.1 Fastener Tightening Specifications", page 146

3.1 Fastener Tightening Specifications

Components	Fastener Size	Nm
Bracket to Lower Oil Pan, Nut	-	9
Bracket to Oil Filter Bracket	-	20
Connection for Oil Return	-	9
Drive Sprocket for Oil Pump ¹	-	20 + 90°
Engine Oil Cooler	-	20
Oil Drain Plug	-	25
Oil Intake Pipe	-	9
Oil Level Thermal Sensor, Nut	-	9
Oil Pressure Regulation Valve -N428- from September 2010	-	9
Oil Pressure Switch -F1- or Reduced Oil Pressure Switch -F378-	-	20
Oil Pressure Switch -F22- from September 2010	-	20
Oil Pump	-	20
Retaining Plate for Oil Intake Pipe	-	9
• ¹ Replace		

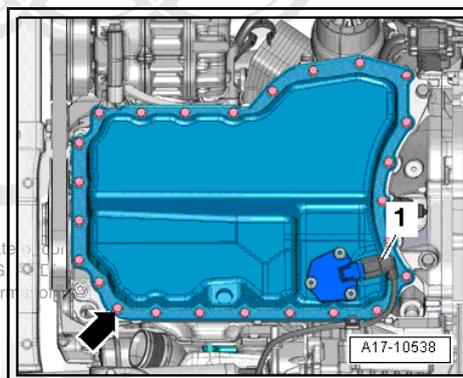
Lower Section of Oil Pan, Tightening Specifications and Sequence

i Note

Replace bolts that are tightened to the specification.

– Tighten the bolt in 3 steps:

Stage	Bolts	Tightening Specification/Additional Turn
1.	-arrow-	Install all the way in by hand.
2.	-arrow-	8 Nm in a diagonal sequence
3.	-arrow-	In a diagonal sequence, turn an additional 45°



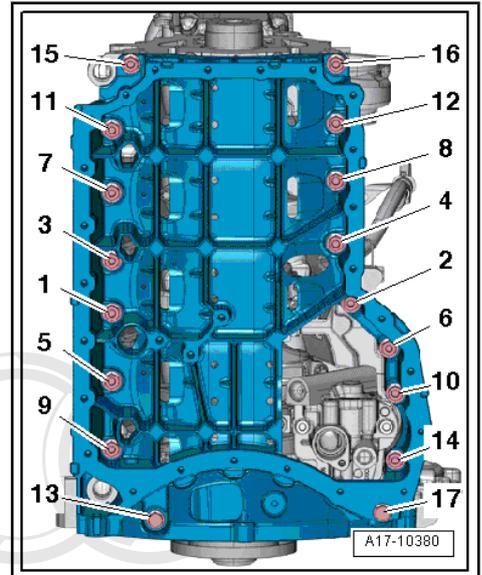
Upper Section of Oil Pan, Tightening Specifications and Sequence

i Note

Replace bolts that are tightened to the specification.

– Tighten the bolts in 3 steps in the sequence shown:

Stage	Bolts	Tightening Specification/Additional Turn
1.	-1 through 17-	Install all the way in by hand.
2.	-1 through 17-	20 Nm
3.	-1 through 17-	Tighten 90° further

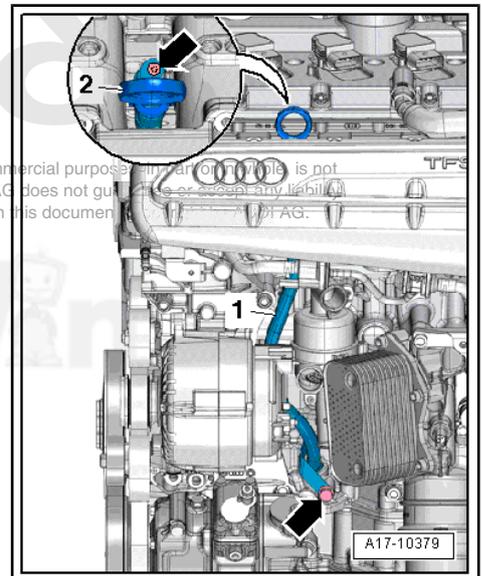


Oil Dipstick Guide Tube - Tightening Specifications

– Tighten the bolts -arrows- as follows:

- ◆ M6: 9 Nm
- ◆ M8: 23 Nm

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4 Diagnosis and Testing

⇒ ["4.1 Oil Level, Checking", page 148](#)

⇒ ["4.2 Oil Pressure, Checking", page 148](#)

⇒ ["4.3 Oil Pressure Switch F1 / Oil Pressure Switch F22 / Reduced Oil Pressure Switch F378 , Checking", page 148](#)

4.1 Oil Level, Checking

Check oil level. Refer to the Maintenance Procedures Rep. Gr. 03

4.2 Oil Pressure, Checking

Special tools and workshop equipment required

◆ Oil Pressure Gauge -V.A.G 1342-

Procedure

- Oil level OK
- Engine oil temperature approximately 80 °C (176 °F)
- Remove the oil pressure switch -F1- / reduced oil pressure switch -F378- . Refer to [⇒ "5.7 Oil Pressure Switch F1 / Reduced Oil Pressure Switch F378 ", page 165](#) .
- Attach the oil pressure switch to the -V.A.G 1342- .
- Install the -V.A.G 1342- in the hole for the oil pressure switch in the oil filter bracket.
- Start the engine.
- Oil pressure at idle at least 1.0 bar.
- Oil pressure at 2000 RPM at least 2.5 bar.
- Install the oil pressure switch/reduced oil pressure switch. Refer to [⇒ "5.7 Oil Pressure Switch F1 / Reduced Oil Pressure Switch F378 ", page 165](#) .

4.3 Oil Pressure Switch -F1- / Oil Pressure Switch -F22- / Reduced Oil Pressure Switch -F378- , Checking

Check the oil pressure switch/oil pressure switch/reduced oil pressure switch in [Guided Fault Finding](#) using the vehicle diagnostic tester.

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5 Removal and Installation

- ⇒ ["5.1 Oil Level Thermal Sensor G266", page 149](#)
- ⇒ ["5.2 Lower Oil Pan", page 149](#)
- ⇒ ["5.3 Upper Oil Pan", page 152](#)
- ⇒ ["5.4 Oil Pump", page 158](#)
- ⇒ ["5.5 Engine Oil Cooler", page 162](#)
- ⇒ ["5.6 Oil Filter Bracket with Oil Cooler", page 163](#)
- ⇒ ["5.7 Oil Pressure Switch F1 / Reduced Oil Pressure Switch F378", page 165](#)
- ⇒ ["5.8 Oil Pressure Switch F22 / Oil Pressure Regulation Valve N428 from September 2010", page 165](#)

5.1 Oil Level Thermal Sensor G266

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Removing

- Drain engine oil. Refer to the Maintenance Procedures Rep. Gr. 03.
- Disconnect the connector -3-.
- Remove the nuts -1-.
- Remove oil level thermal sensor -4- from the lower oil pan and remove the seal ring -2-.

Installing

Install in reverse order, paying attention to the following:

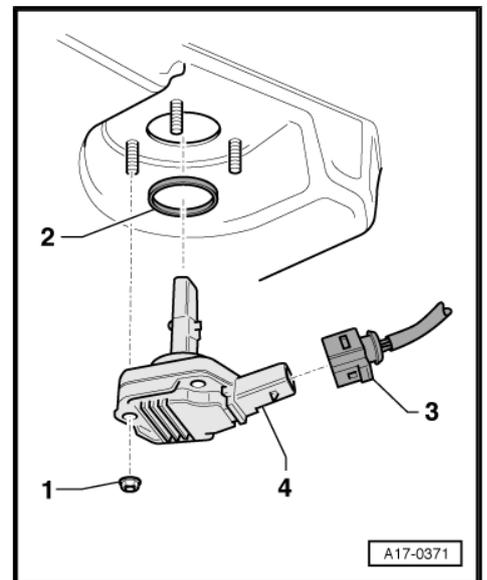
- Tightening specification, refer to ["2.2 Oil Pan and Oil Pump Overview", page 142](#).



Note

Replace the seal.

- Fill engine oil and check oil level. Refer to the Maintenance Procedures Rep. Gr. 03.



5.2 Lower Oil Pan

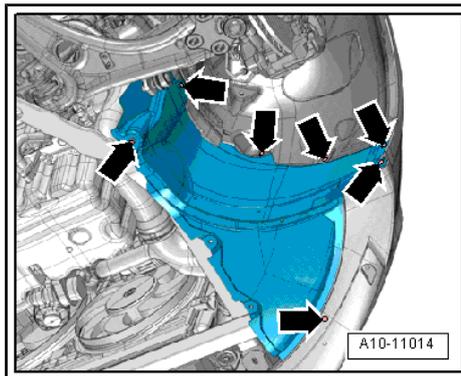
Special tools and workshop equipment required

- ◆ Hand drill with plastic brush attachment
- ◆ Protective goggles
- ◆ Sealant, refer to the Electronic Parts Catalog (ETKA)

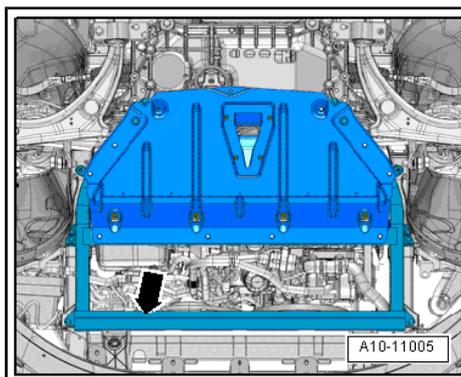
Removing

- Drain engine oil. Refer to the Maintenance Procedures Rep. Gr. 03.

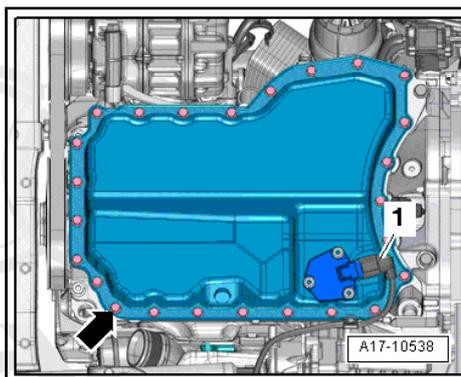
- Remove the right front underside of wheel housing liner. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Removal and Installation .



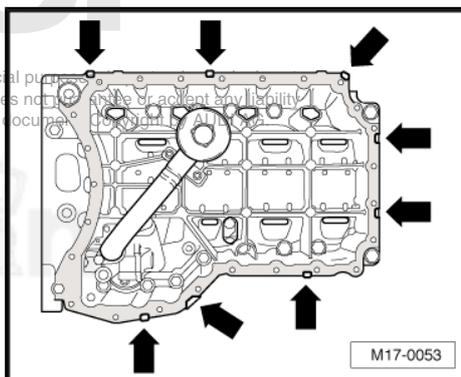
- Remove the noise insulation frame -arrow- with the rear noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 50 ; Removal and Installation .



- Disconnect the connector -1- from the oil level thermal sensor -G266- .
- Remove the lower oil pan bolts -arrow- diagonally.



- Carefully loosen the lower oil pan from the bonding in order to position the screwdriver at the lift-out pockets-arrows-.



Installing



Caution

Risk of contaminating lubricating system.

- ◆ *Cover open parts of engine.*



WARNING

Danger of eye injury.

- ◆ *Wear protective goggles.*

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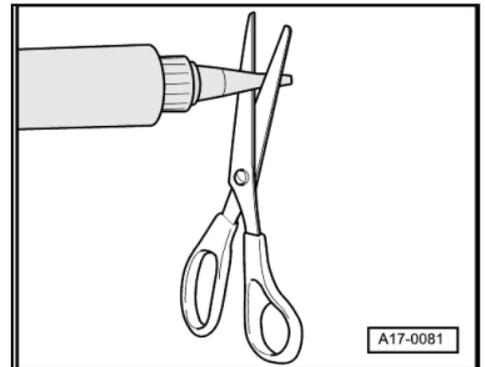
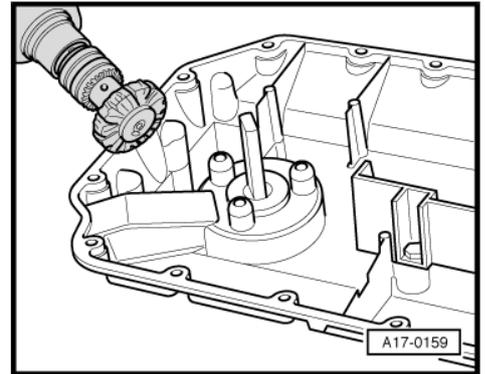
- Remove any sealant residue on the lower and upper oil pan sections using a rotating plastic brush.
- Clean the sealing surfaces; they must be free of oil and grease.

 **Note**

Note the expiration date of the sealing compound.

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- **Cut the tube nozzle at the front marking (nozzle diameter approximately 2.0 mm).**



Caution

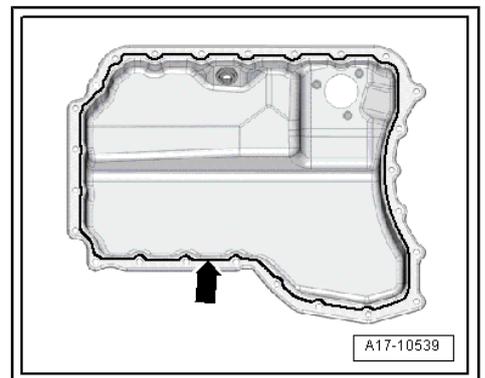
The lubrication system could be plugged with excess sealant.

- ◆ *Do not apply sealant bead thicker than indicated.*

- Apply a sealant bead -arrow- to the clean sealing surface on the lower section of the oil pan as shown in illustration.
- Thickness of sealant bead: 1.5 to 2.0 mm.

 **Note**

Install the lower the oil pan within 5 minutes of applying the sealant.



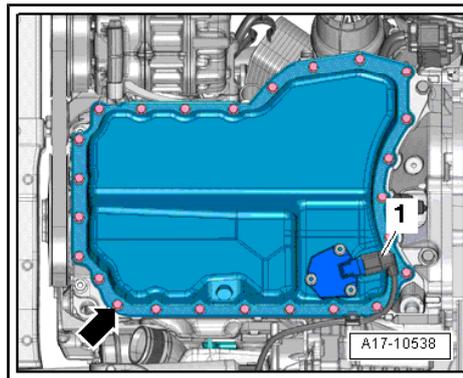
- Position the lower oil pan of the and tighten the bolts, refer to => [Fig. "Lower Section of Oil Pan, Tightening Specifications and Sequence"](#), page 144 .

 **Note**

After installing the lower oil pan, let the sealant harden for approximately 30 minutes. Only after then may the engine oil be replenished.

Install in reverse order of removal paying attention to the following:

- Install the air guide pipe. Refer to => ["1.1 Charge Air Cooler Overview"](#), page 209 .
- Install the noise insulation frame. Refer to => Body Exterior; Rep. Gr. 50 ; Removal and Installation .
- Install the front underside of wheel housing liner. Refer to => Body Exterior; Rep. Gr. 66 ; Removal and Installation .
- Fill engine oil and check oil level. Refer to the Maintenance Procedures Rep. Gr. 03.



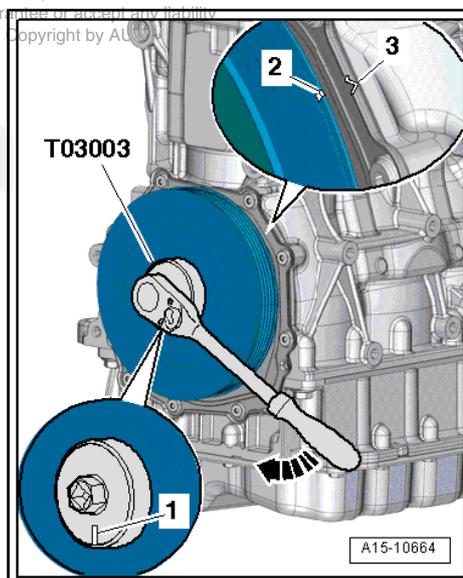
5.3 Upper Oil Pan

Special tools and workshop equipment required

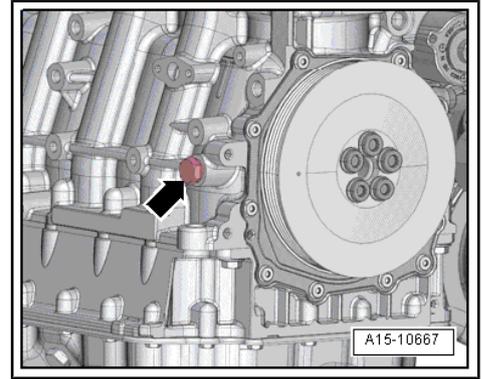
- ◆ Adapter Plates -2036/1- on the Adjustable Rod -2036-
- ◆ Counterhold Tool Touareg V10 -T10172-
- ◆ Locking Pin -T40069-
- ◆ Crankshaft Adapter -T03003-
- ◆ Locking Pin -T03006-
- ◆ Protective goggles
- ◆ Hand drill with plastic brush attachment
- ◆ Sealant, refer to the Electronic Parts Catalog (ETKA)

Removing

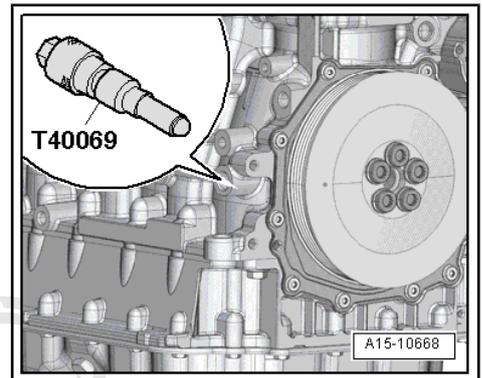
- Transmission removed.
- Turn the crankshaft in the direction of engine rotation -arrow- to "TDC" using the -T03003- .
- The notch -1- in the -T03003- is positioned vertically to the oil pan gasket.
- The marking -2- on the vibration damper is positioned opposite the marking -3- on the sealing flange.



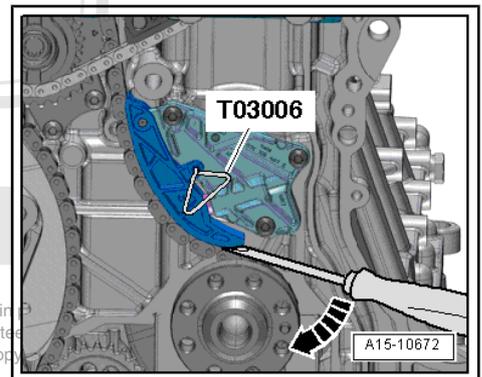
- Remove the locking bolt -arrow- for the "TDC" marking from the cylinder block.



- Install the -T40069- in the nut and tighten to 15 Nm. If necessary, move the crankshaft back and forth slightly to center the bolt.
- Remove the belt pulley side sealing flange. Refer to [⇒ "4.4 Belt Pulley Side Sealing Flange", page 65](#) .
- Remove timing chain lower cover. Refer to [⇒ "4.6 Lower Timing Chain Cove", page 118](#) .



- Press the drive chain tensioner guide rail in the direction of the -arrow- and secure the chain tensioner with a -T03006- .



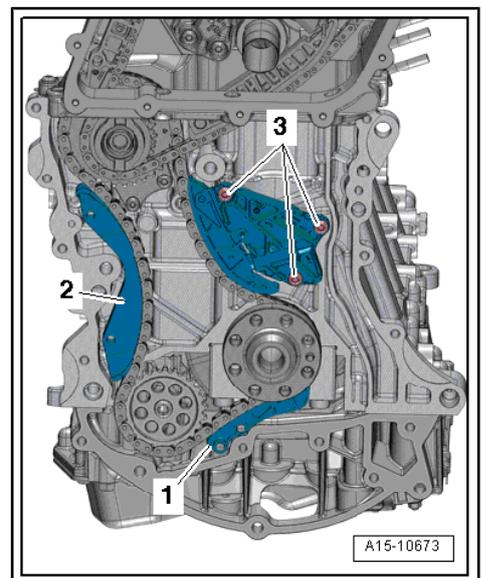
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- Remove the lower glide track -1-.

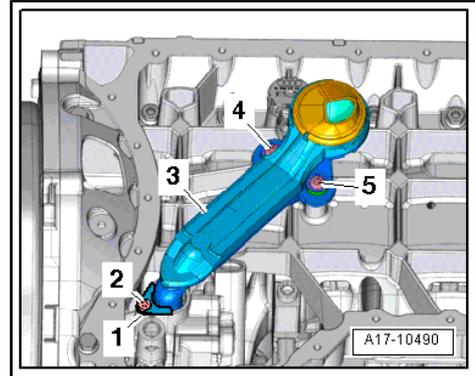


Note

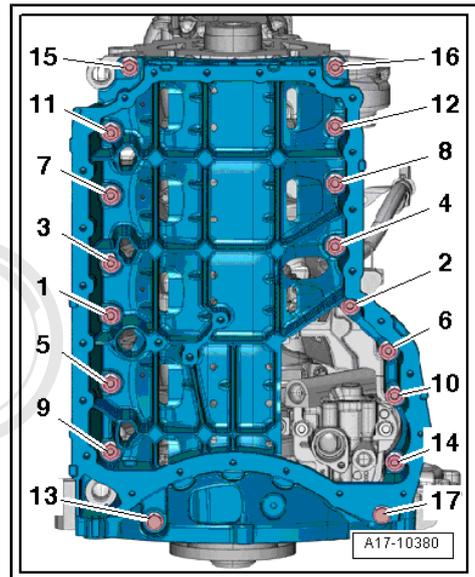
Ignore -2 and 3-.



- Remove the lower oil pan. Refer to ⇒ ["5.2 Lower Oil Pan", page 149](#) .
- Remove the bolts -2, 4 and 5-, then remove the retaining plate -1-.
- Remove the oil intake pipe -3-.



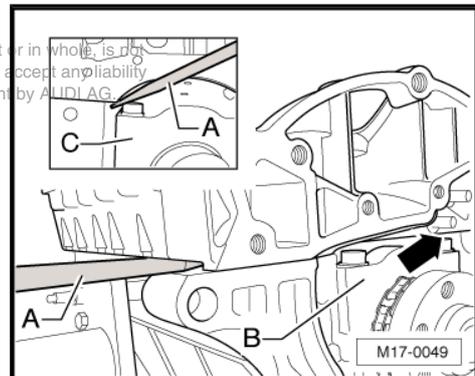
- Remove the bolts in the following sequence: -17 to 1-.



- Carefully loosen the upper oil pan from the bonding in order to position the screwdriver -A- at the points illustrated.

B - Bearing cap 6 for crankshaft

C - Bearing cap 1 for crankshaft



Installing



Replace the gaskets and O-rings.



Risk of contaminating lubricating system.

◆ *Cover open parts of engine.*



Danger of eye injury.

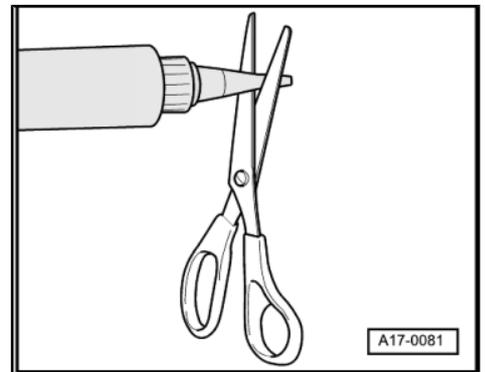
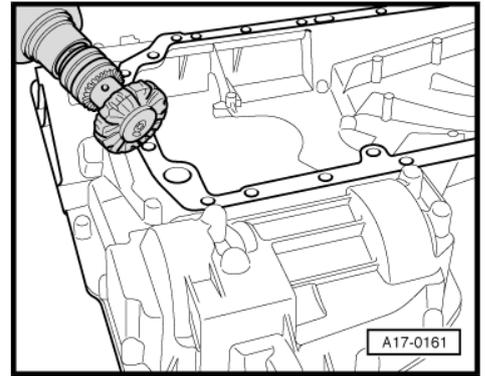
◆ *Wear protective goggles.*

- Remove the sealant residue on the cylinder block and the upper oil pan, for example using a rotating plastic brush.
- Clean the sealing surfaces; they must be free of oil and grease.



Note the expiration date of the sealing compound.

- Cut the tube nozzle at the front marking (nozzle diameter approximately 1.5 mm).



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Caution

The lubrication system could be plugged with excess sealant.

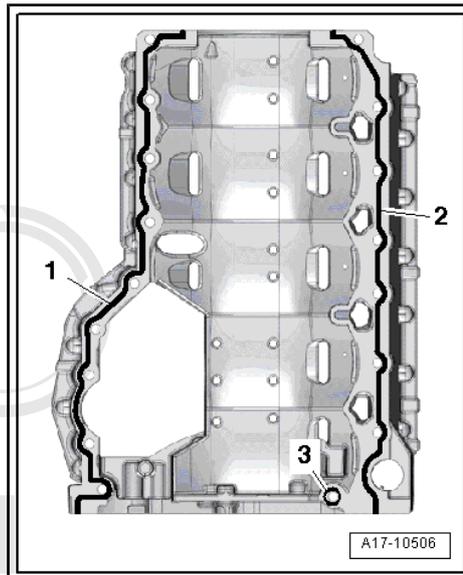
◆ *Do not apply sealant bead thicker than indicated.*

- Apply sealant beads -1, 2 and 3- to the clean sealing surface on the upper oil pan as shown in the illustration.
- Thickness of sealant bead: 1.5 to 2.0 mm.

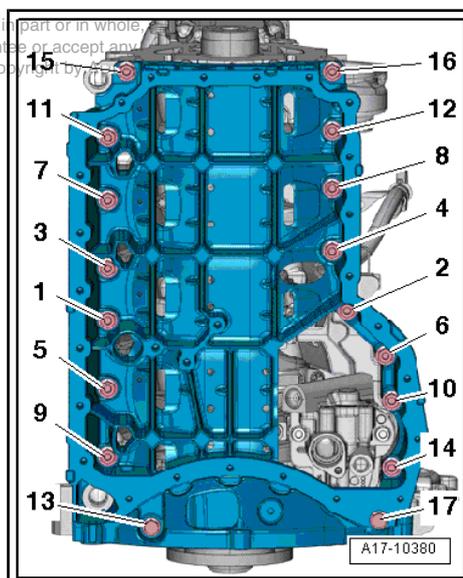


Note

Install the upper oil pan within 5 minutes of applying the sealant.



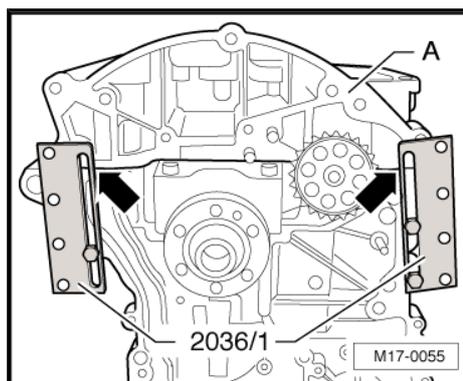
- Position the upper oil pan and install the bolts -13, 15, 16 and 17- all the way by hand.



- Wipe away any escaping sealant in the areas marked with -arrows-.
- Slightly loosen the bolts.
- Tighten the plates -2036/1- to the cylinder block to 20 Nm as shown in the illustration.
- Press the upper oil pan -A- tightly to the plates.
- Tighten the oil pan upper section bolts. Refer to => [Fig. "Upper Section of Oil Pan, Tightening Specifications and Sequence"](#), page 145 .
- The upper oil pan must continue to touch the plates.

Install in reverse order of removal paying attention to the following:

- Install lower oil pan. Refer to => ["5.2 Lower Oil Pan"](#), page 149 .



- Insert the lower glide track -1-.



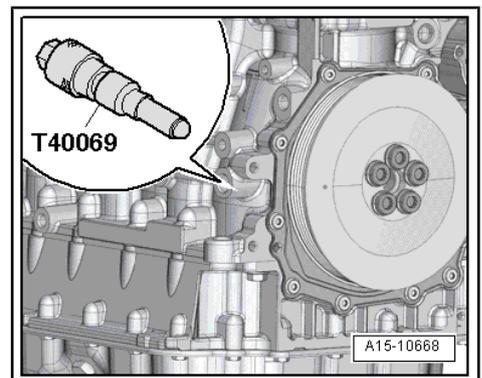
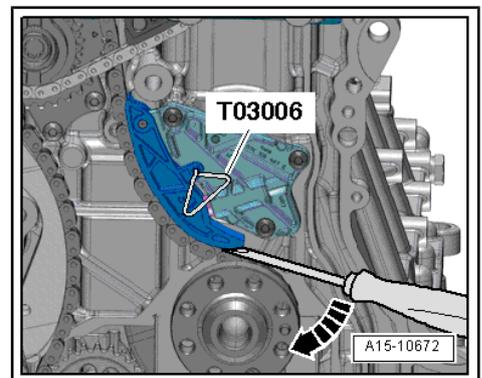
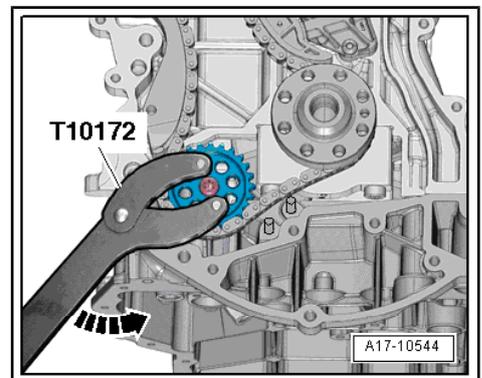
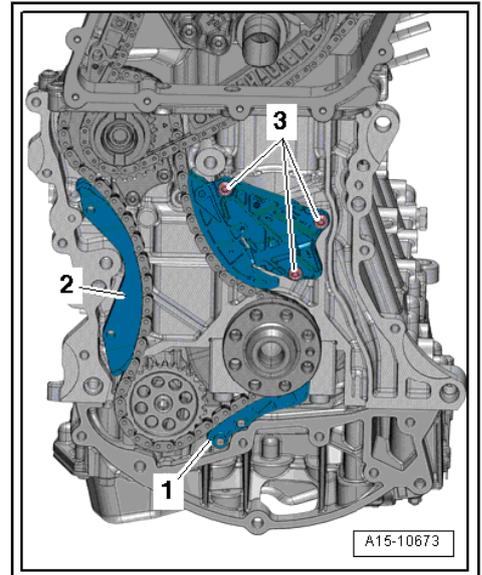
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 **Note**

If necessary, tension the timing mechanism drive chain above the output wheel for the oil pump with the -T10172- when inserting the glide track.

- Press the drive chain tensioner guide rail in direction of -arrow- and remove the -T03006- .
- Install timing chain lower cover. Refer to [⇒ "4.6 Lower Timing Chain Cove", page 118](#) .
- Install the belt pulley side sealing flange. Refer to [⇒ "4.4 Belt Pulley Side Sealing Flange", page 65](#) .

- Remove the -T40069- .
- Tighten the "TDC" marking locking bolt. Refer to [⇒ Fig. "TDC Locking Bolt- Marking- Tightening Specification", page 49](#) .



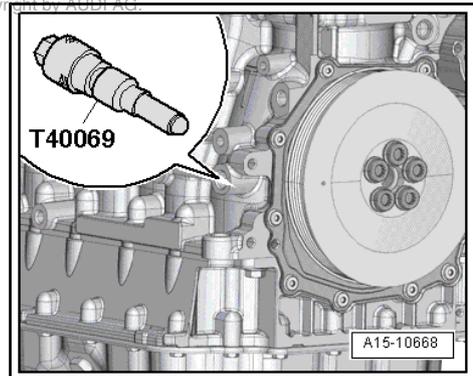
5.4 Oil Pump

Special tools and workshop equipment required

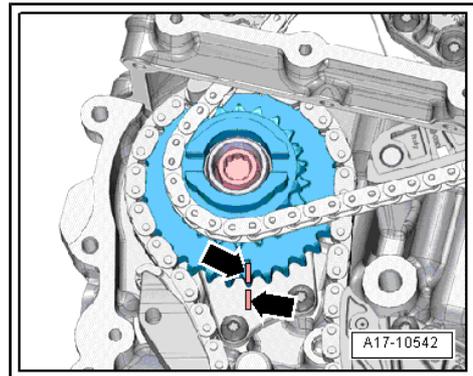
- ◆ Trim Removal Wedge -3409-
- ◆ Crankshaft Adapter -T03003-
- ◆ Oil Pump Align Plate -T03005 A-
- ◆ Counterhold Tool Touareg V10 -T10172-
- ◆ Locking Pin -T40069-

Removing

- Remove the upper oil pan. Refer to [⇒ "5.3 Upper Oil Pan", page 152](#) .
- Secure crankshaft using -T40069- .



- Mark the position with color of the drive chain sprocket for the camshaft timing chain to the axial bearing disc -arrows-.

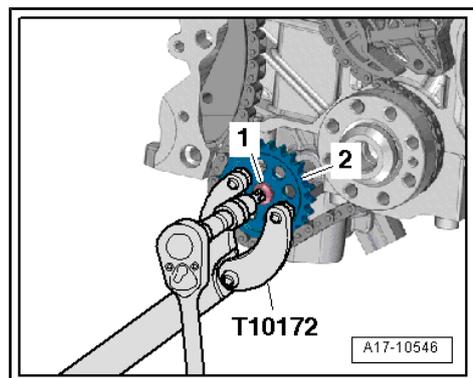


Caution

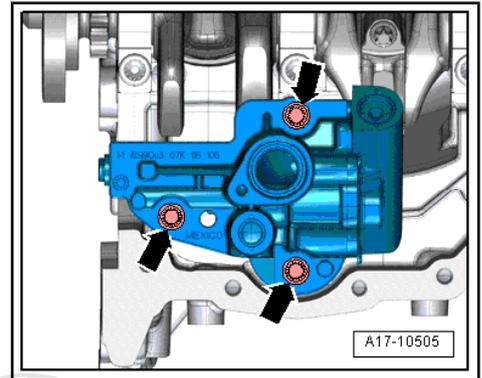
The engine could be damaged.

- ◆ *The marking serves to check the position of the drive chain sprocket for the camshaft. The position of the camshaft will change during the following procedures.*
- ◆ *If the position changes, the valve timing will need to be adjusted after finishing any work. Refer to [⇒ "4.3 Camshaft Timing Chain", page 102](#) .*

- Remove the bolt -1-, then remove the drive chain sprocket -2- with the -T10172- .



- Remove the bolts -arrows- and remove the oil pump.



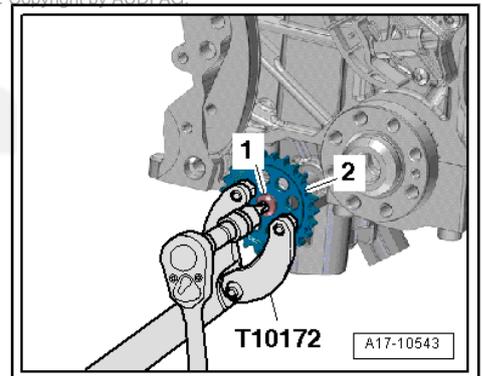
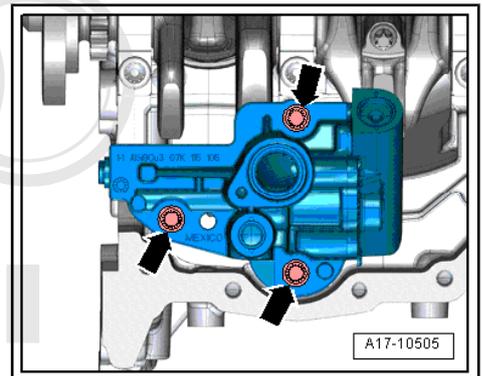
Installing

- For the correct tightening specifications, refer to ["2.2 Oil Pan and Oil Pump Overview", page 142](#).

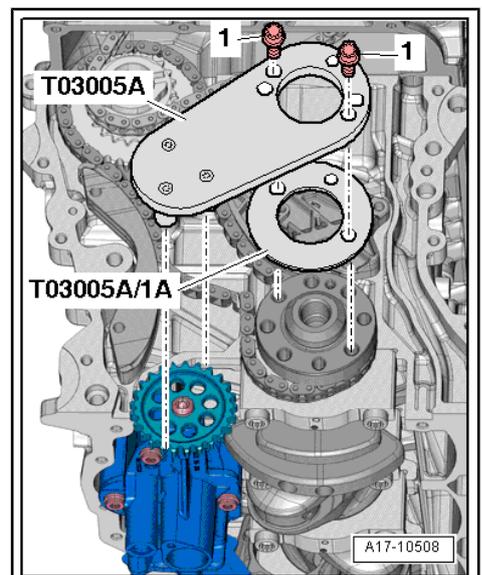
Note

Replace the O-ring.

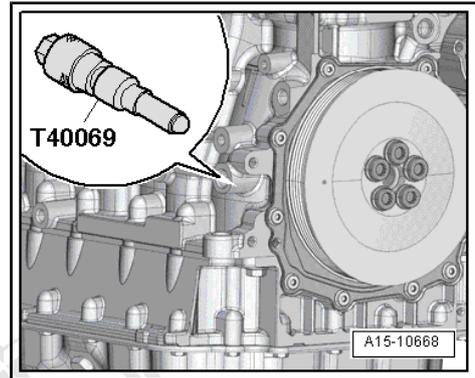
- Install the oil pump bolts -arrows- all the way by hand.
- It must still be possible to slide the oil pump by hand.
- The timing mechanism **drive chain must not be installed**.
- Position the drive chain sprocket -2- on the oil pump.
- The lettering on the drive chain sprocket must be legible.
- Tighten the bolt -1- to 20 Nm and then counter hold with the -T10172-.



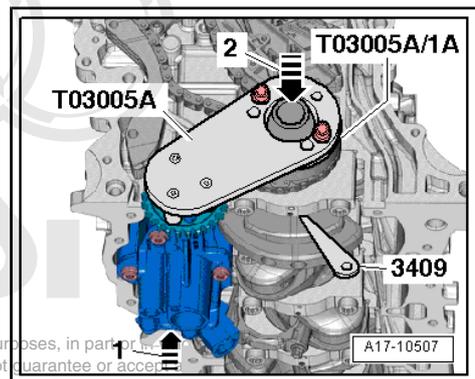
- Remove the protective shields if there are still protective shields on the -T03005 A- magnets.
- Check for metal shavings on the oil pump align plate magnets.
- The crankshaft contact surfaces, tools, and drive chain sprocket must be clean.
- Position the discs -T03005A /1A- and -T03005 A- on the crankshaft bearing pin and tighten the 2 bolts -1- for the dual mass flywheel to 30 Nm.
- Remove the oil pump from the magnets.



- Remove the -T40069- .

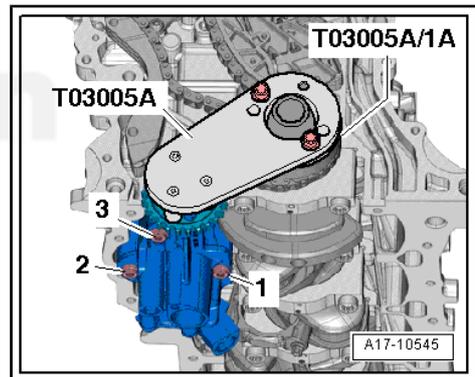


- Push the crankshaft in the axial bearing in the direction of the belt pulley side -arrow 2- and then secure it in this position with the -3409- .
- Lightly press and hold the oil pump in the axial bearing in the direction of the transmission side -arrow 1-.

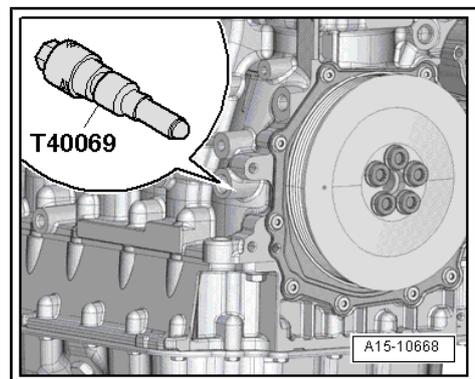


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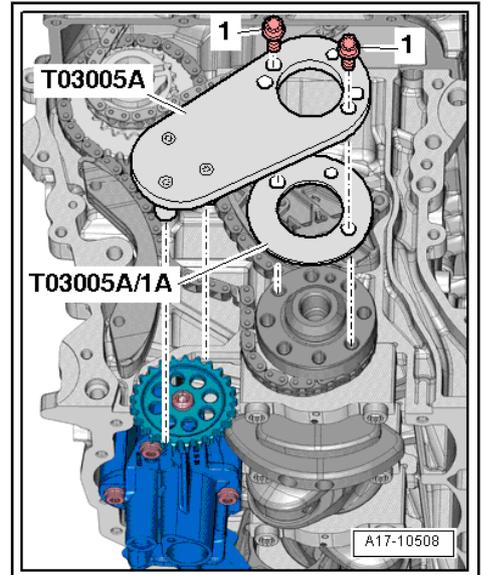
- Tighten the bolt in the following sequence: -1, 2 and 3-.



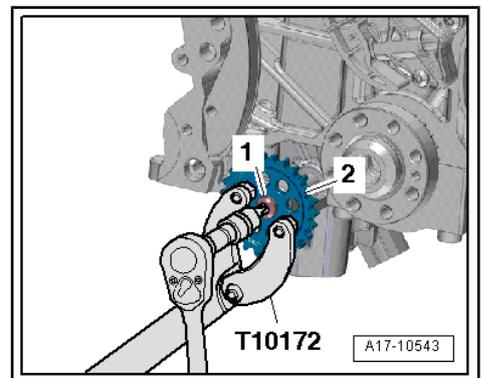
- Install the -T40069- in the nut and tighten to 15 Nm.



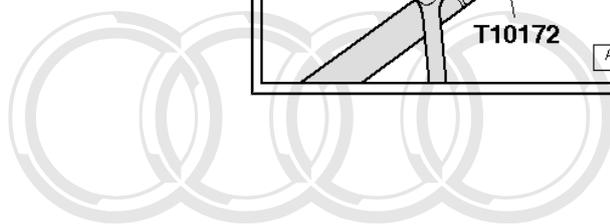
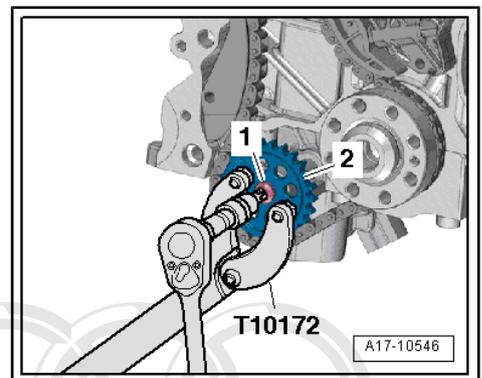
- Remove the bolts -1- and remove the -T03005 A- and plate - T03005A /1A- .
- If a new oil pump is installed, fill with a little clean engine oil above the intake channels and rotate the oil pump a few times.



- Remove the bolt -1-, then remove the drive chain sprocket -2- with the -T10172- again.



- Insert the drive chain sprocket in the drive chain, tighten the bolt -1- and counter hold with the -T10172- .
- Install the upper oil pan. Refer to [⇒ "5.3 Upper Oil Pan", page 152](#) .



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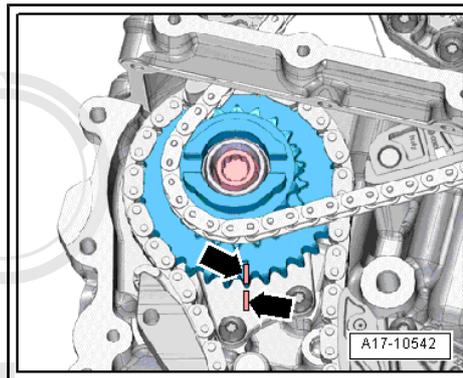
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- Check if the color markings -arrows- for the position of the drive chain sprocket for the camshaft timing chain to the axial bearing disc are still in their correct positions.
- If the color markings are in their correct positions, continue with the installation.
- If the color markings are not in their correct positions, adjust the valve timing, refer to [⇒ "4.3 Camshaft Timing Chain", page 102](#) .

Install in reverse order of removal paying attention to the following:

- Remove the -T40069- .
- Tighten the "TDC" marking locking bolt [⇒ Fig. "TDC Locking Bolt- Marking- Tightening Specification", page 49](#) .



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 **Note**

Always degrease -3409- as it is usually used for body interior work.

5.5 Engine Oil Cooler

Removing

- Remove the thermostat and housing. Refer to [⇒ "5.5 Coolant Thermostat with Housing", page 189](#) .

 **Note**

To collect escaping engine oil, place a clean cloth under oil filter housing.

- Remove the bolts -arrows-.
- Remove engine oil cooler -1-, remove coolant hose, and loosen the hose clamp -2-.

Installing

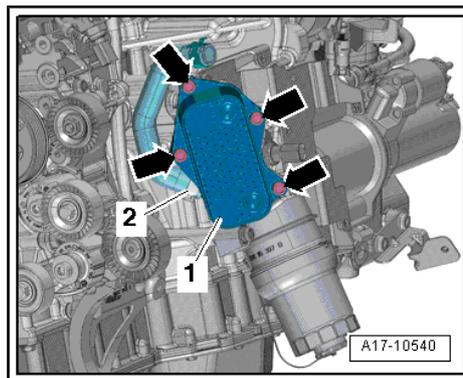
Install in reverse order, paying attention to the following:

- Tightening specification; refer to [⇒ "2.1 Oil Filter Bracket and Oil Cooler Assembly Overview", page 140](#) .

 **Note**

Replace the seals.

- Install the thermostat and its housing. Refer to [⇒ "5.5 Coolant Thermostat with Housing", page 189](#) .
- Check oil level. Refer to the Maintenance Procedures Rep. Gr. 03



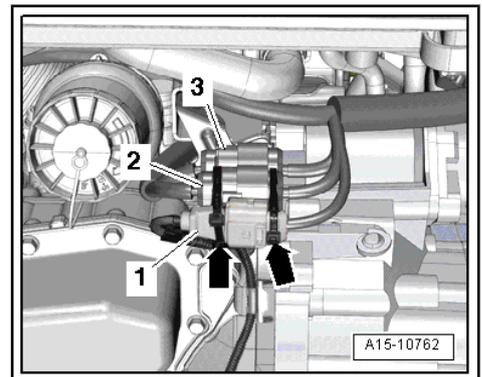
5.6 Oil Filter Bracket with Oil Cooler

Removing

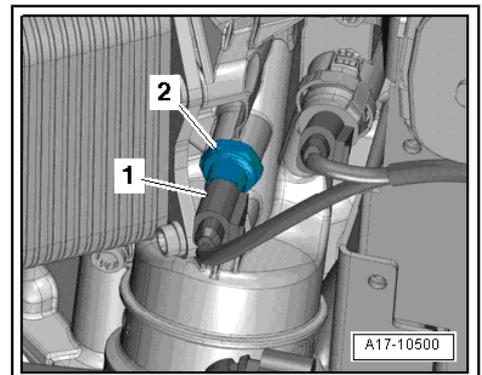
 **Note**

When installing, bring all cable ties back to the same positions.

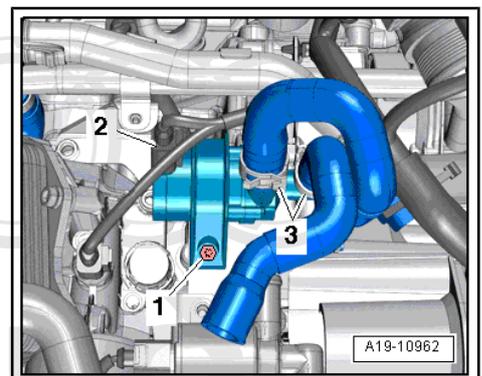
- Drain the oil filter housing. Refer to the Maintenance Procedures Rep. Gr. 03.
- Remove the front coolant pipes. Refer to [⇒ "5.9 Front Coolant Pipes", page 195](#).
- Disconnect the connector -1- in order to cut the cable tie -arrows-.
- Remove electrical harness connectors -2 and 3- from the bracket.



- Disconnect the connector -1- from the oil pressure switch-2-.

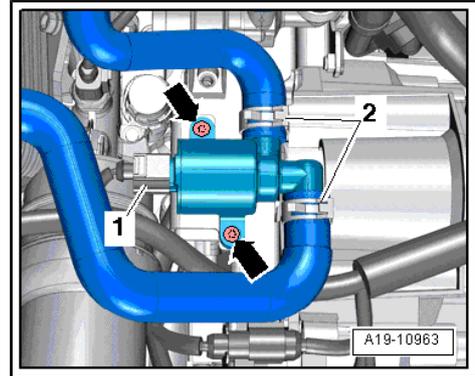


- Disconnect the connector -2-.
- Remove the bolt -1- and push the after-run coolant pump -V51- and the sealed coolant hoses -3- aside.

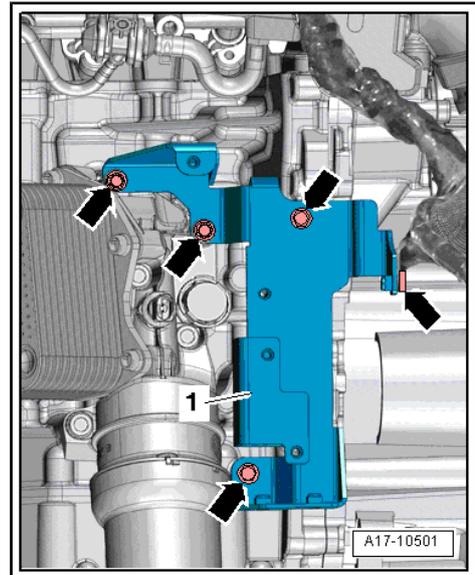


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- Disconnect the connector -1-.
- Remove the bolts -arrows-, and set the cooling circuit solenoid valve -N492- with sealed coolant hoses -2- aside.



- Remove the bolts -arrows- and the bracket -1-.



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i Note

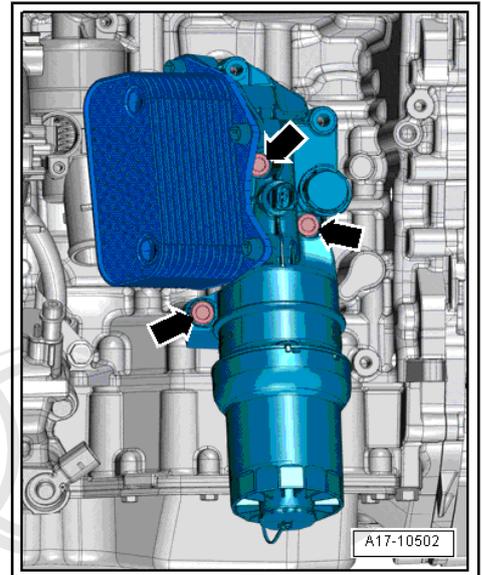
To collect escaping engine oil, place a clean cloth under oil filter housing.

- Remove bolts -arrows- and remove oil filter bracket and oil cooler.

Installing

Install in reverse order, paying attention to the following:

- For the correct tightening specifications, refer to [⇒ “2.1 Oil Filter Bracket and Oil Cooler Assembly Overview”, page 140](#).



i Note

Replace the seals

- Install the after-run coolant pump and cooling circuit solenoid valve. Refer to [⇒ “2.3 Coolant Pump and Coolant Thermostat with Housing Overview”, page 179](#).
- Install the left coolant pipe. Refer to [⇒ “5.11 Left Coolant Pipe”, page 198](#).
- Install the front coolant pipes. Refer to [⇒ “5.9 Front Coolant Pipes”, page 195](#).

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5.7 Oil Pressure Switch -F1- / Reduced Oil Pressure Switch -F378-

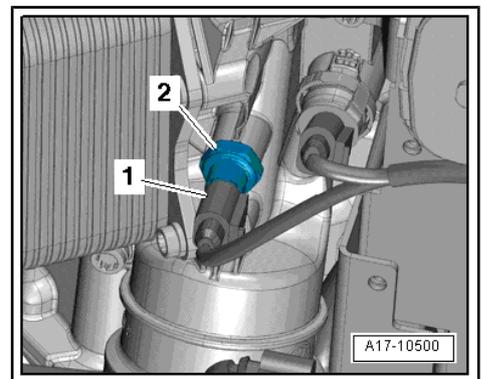
Removing

- Disconnect the connector -1-.
- Remove the oil pressure switch-2-.

Installing

Install in reverse order of removal.

- Tightening specification, refer to [⇒ “2.1 Oil Filter Bracket and Oil Cooler Assembly Overview”, page 140](#).



5.8 Oil Pressure Switch -F22- / Oil Pressure Regulation Valve -N428- from September 2010

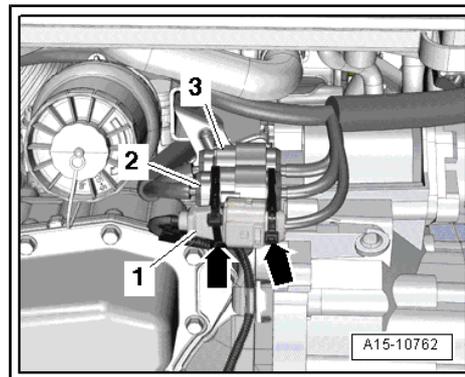
Removing

i Note

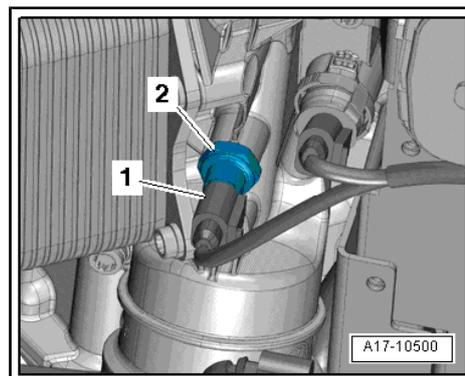
When installing, bring all cable ties back to the same positions.

- Drain the oil filter housing. Refer to the Maintenance Procedures Rep. Gr. 03.

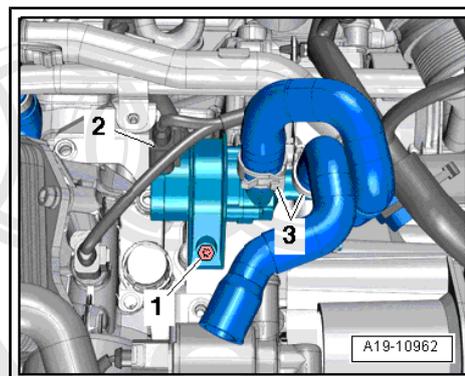
- Remove the front coolant pipes. Refer to ["5.9 Front Coolant Pipes", page 195](#) .
- Disconnect the connector -1- in order to cut the cable tie -arrows-.
- Remove electrical harness connectors -2 and 3- from the bracket.



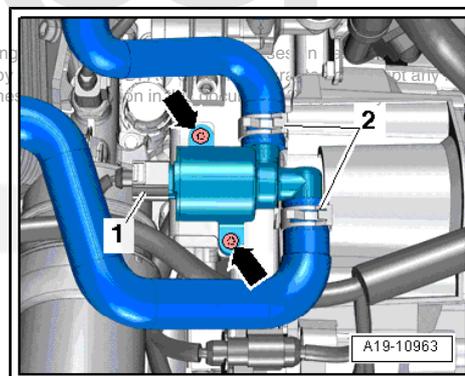
- Disconnect the connector -1- from the oil pressure switch-2-.



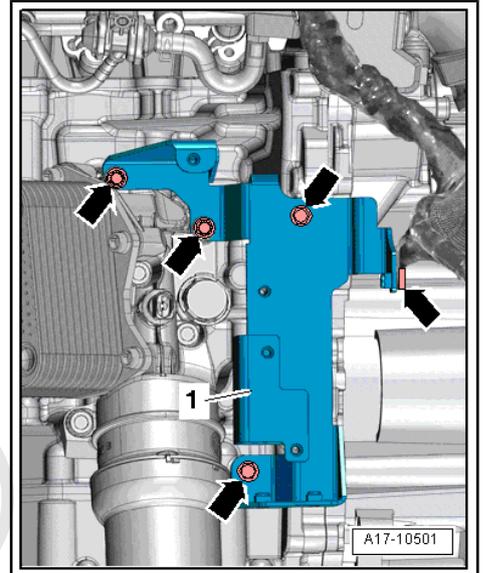
- Disconnect the connector -2-.
- Remove the bolt -1- and push the after-run coolant pump -V51- and the sealed coolant hoses -3- aside.



- Disconnect the connector -1-.
- Remove the bolts -arrows-, and set the cooling circuit solenoid valve -N492- with sealed coolant hoses -2- aside.



- Remove the bolts -arrows- and the bracket -1-.

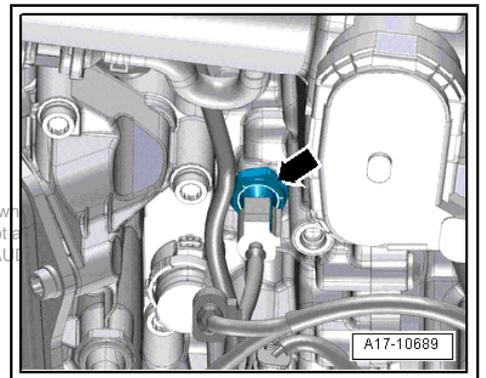


Oil Pressure Switch:



Lay a cloth below to catch the draining engine oil.

- Disconnect electrical connector -arrow-.
- Remove the oil pressure switch -F22- .



Oil Pressure Regulation Valve:



Note

Lay a cloth below to catch the draining engine oil.

- Disconnect the connector -2-.
- Remove the bolt -1- and then remove the oil pressure regulation valve.

Installing

Install in reverse order, paying attention to the following:

Tightening specifications:

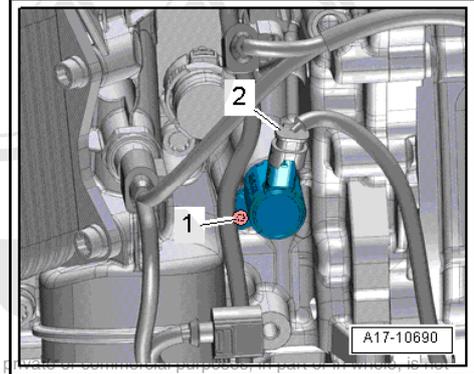
- ⇒ [Fig. "Oil Pressure Switch -F22- from September 2010", page 141](#).
- ⇒ [Fig. "Oil Pressure Regulation Valve -N428- from September 2010", page 141](#).



Note

Replace the gasket and O-ring.

- Install after-run coolant pump and cooling circuit solenoid valve. Refer to ["2.3 Coolant Pump and Coolant Thermostat with Housing Overview", page 179](#).
- Install the left coolant pipe. Refer to ["5.11 Left Coolant Pipe", page 198](#).
- Install the front coolant pipes. Refer to ["5.9 Front Coolant Pipes", page 195](#).

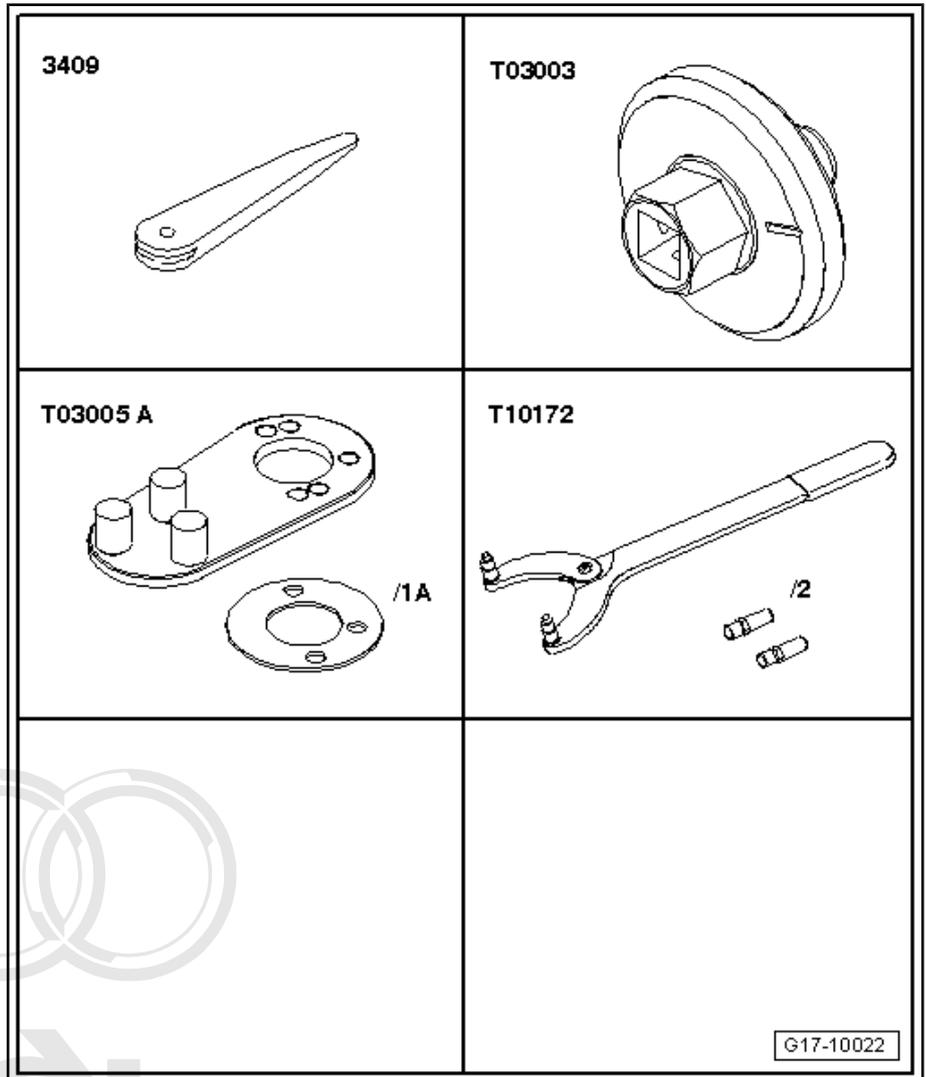


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6 Special Tools

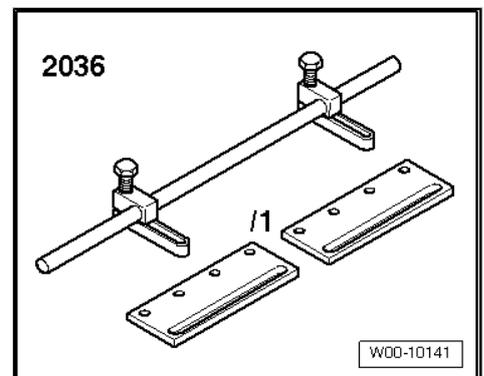
Special tools and workshop equipment required

- ◆ Trim Removal Wedge -3409-
- ◆ Crankshaft Adapter - T03003-
- ◆ Oil Pump Align Plate - T03005 A-
- ◆ Counterhold Tool Touareg V10 -T10172-

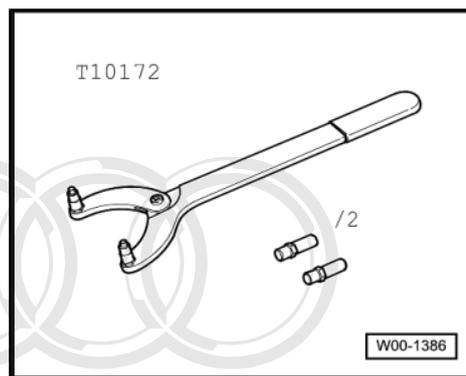


- ◆ Adapter Plates -2036/1- on the Adjustable Rod -2036-

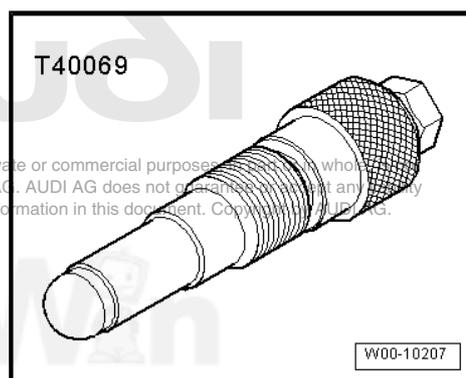
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◆ Counterhold Tool Touareg V10 -T10172-

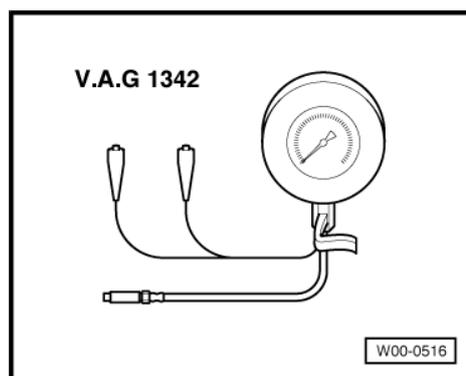


◆ Locking Pin -T40069-



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◆ Oil Pressure Gauge -V.A.G 1342-



- ◆ Not illustrated:
- ◆ Crankshaft Adapter -T03003-
- ◆ Locking Pin -T03006-

19 – Cooling System

1 General Information

⇒ “1.1 Coolant, Draining and Filling”, page 171

1.1 Coolant, Draining and Filling

Special tools and workshop equipment required

- ◆ Adapter -V.A.G 1274/8- Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability
- ◆ Cooling System Charge Unit -VAS 6096- with Replacement Reservoir -VAS 6096/1- is document. Copyright by AUDI AG.
- ◆ Drip Tray for VAS 6100 -VAS 6208-
- ◆ Hose Clip Pliers -VAS 6362-
- ◆ Refractometer -T10007-

Draining



Note

Collect escaping coolant in a clean container for disposal or re-use.

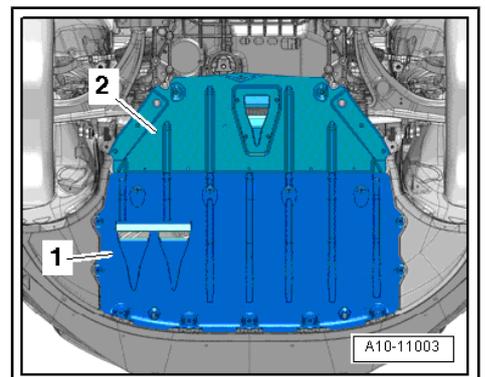
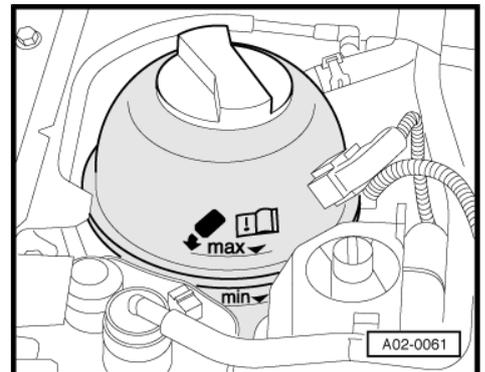


WARNING

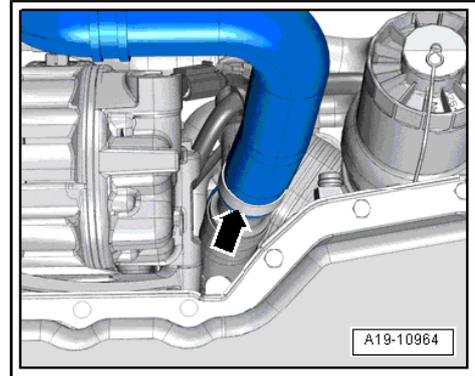
Risk of scalding due to hot steam and hot coolant.

- ◆ *The coolant system is under pressure when the engine is warm.*
- ◆ *Reduce pressure by covering coolant reservoir cap with a cloth and carefully opening.*

- Open the coolant reservoir cap.
- Remove the front noise insulation -1-. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Removal and Installation .



- Place -VAS 6208- under the engine.
- Loosen the hose clamp -arrow-, remove the coolant hose and drain the coolant.



Audi

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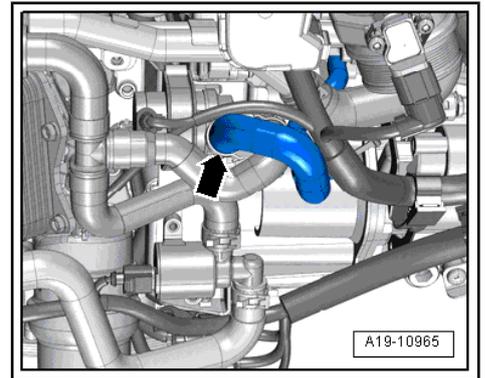


- Loosen the hose clamp -arrow-, remove the coolant hose and drain the coolant.

Filling

Note

- ◆ The cooling system is filled year-round with a mixture of water and coolant additive. Mixture ratio ⇒ [page 173](#).
- ◆ Only use coolant according to the Electronic Parts Catalog (ETKA). Other coolant additives may above all reduce the corrosion protection effect significantly. The damage resulting from this may lead to loss of coolant and consequently to severe engine damage.
- ◆ Coolant with the correct mixture ratio ⇒ [page 173](#) prevents freezing and corrosion damage and calcium deposits. They also raise the boiling point. The cooling system must be filled with coolant additive year-round.
- ◆ Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.
- ◆ Protection against frost must be assured down to approximately -25 °C (-13 °F) (in arctic climatic countries down to approximately -35 °C (-31 °F)).
- ◆ The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. Coolant additive portion must be at least 40%.
- ◆ If more freeze protection is needed due to the climate, increase the amount of coolant additive, but only up to 60% (freeze protection down to -40 °C (-40 °F)). Otherwise the freeze protection and cooling effectiveness will be reduced.
- ◆ Only use clean drinking water for mixing coolant.
- ◆ If radiator, heat exchanger, cylinder head or head seal or cylinder block were replaced, do not reuse used coolant.
- ◆ Dirty coolant may not be used again.
- ◆ Use the -T10007- to determine the level of freeze protection in the coolant system.
- ◆ Secure all hose connections with hose clamps of the same type as those equipped by the factory. Refer to the Electronic Parts Catalog (ETKA).

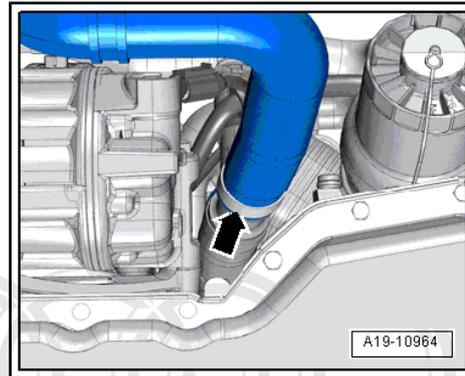


Coolant Mixture Ratio

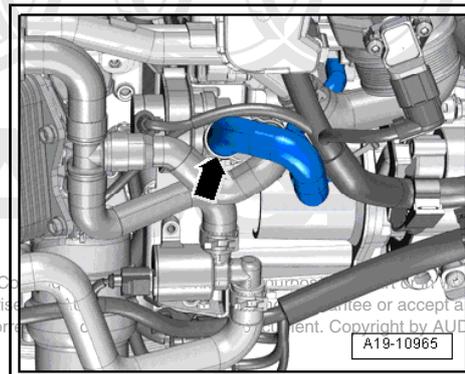
- Coolant (40%) and water (60%) for freeze protection down to -25 °C (-13 °F)
- Coolant (50%) and water (50%) for freeze protection down to -35 °C (-31 °F)
- Coolant (60%) and water (40%) for freeze protection down to -40 °C (-40 °F)
- Coolant, refer to the Electronic Parts Catalog (ETKA)

Procedure

- Connect the coolant hose -arrow-.



- Connect the coolant hose -arrow-.



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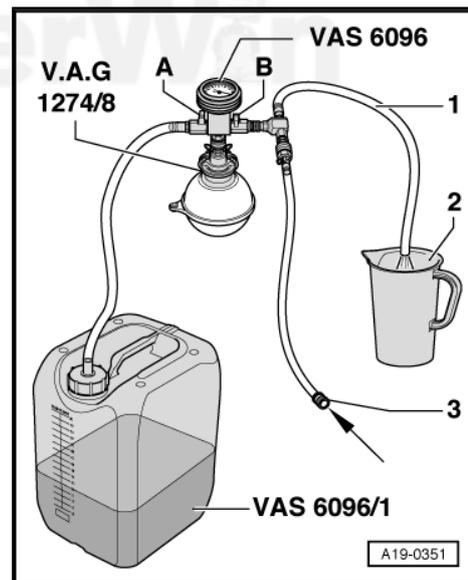
- Fill coolant reservoir on -VAS 6096- with 10 liters of premixed coolant with the proper mixture ratio, refer to [⇒ page 173](#) .
- Attach -V.A.G 1274/8- to coolant reservoir.
- Install the -VAS 6096- on -V.A.G 1274/8- .
- Place the air outlet -1- in a small container -2-.



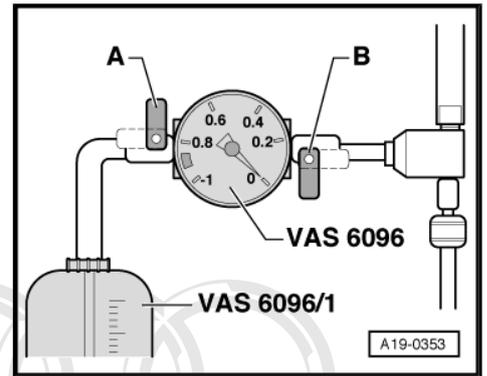
Note

A small amount of coolant which should be collected is drawn off with the discharged air.

- Close valves -A and B- by turning lever at a right angle to direction of flow.
- Connect hose -3- to compressed air.
- Pressure: 6 to 10 bar pressure.



- Open valve -B- by turning level in direction of flow.
- The suction jet pump generates pressure in the coolant system; indicator on display instrument must move into green area.
- Briefly open valve -A- by turning lever in direction of flow so that hose on -VAS 6096- coolant reservoir fills with coolant.
- Close valve -A- again.
- Leave valve -B- open another 2 minutes.
- More pressure is generated in the coolant system by the suction jet pump; indicator on display instrument must stay in green area.
- Close valve -B-.
- Needle in the display instrument must remain in the green region, then the sufficient vacuum in the cooling system is obtained for the upcoming filling.

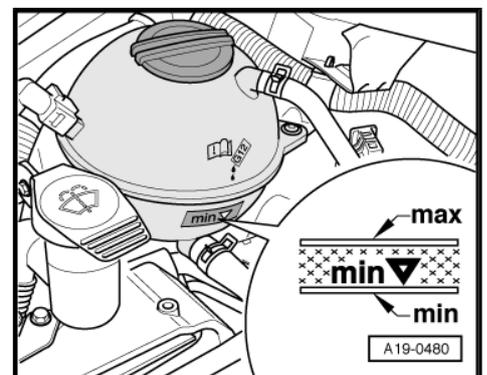


 **Note**

- ◆ *If needle stands below the green area, repeat procedure.*
- ◆ *If pressure falls, check coolant system for leaks.*

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- Remove pressurized air hose.
- Open valve -A-.
- Coolant is extracted from the -VAS 6096- coolant reservoir by pressure in the coolant system and the system is filled.
- Remove the -VAS 6096- from the coolant reservoir.
- Fill coolant up to "max" marking.
- Set the temperature at "HI".
- Press the **ECON** button to turn off the A/C compressor.
- Start the engine and run it at approximately 1500 RPM for a maximum of 2 minutes.
- With engine running, fill coolant up to overflow hole on coolant expansion tank.
- Close the cap on the coolant reservoir until it latches.
- Run the engine at idle until both large coolant hoses on the radiator are warm.
- Turn off engine and allow it to cool off.
- Install the noise insulation. Refer to => Body Exterior; Rep. Gr. 66 ; Removal and Installation .
- Check the coolant level.
- The coolant level must be between the "min" and "max" markings when the engine is cold.
- The coolant level may be at the "max" marking when the engine is warm.
- Add more coolant if necessary.



2 Description and Operation

⇒ [“2.1 Coolant Hose Connection Diagram”, page 176](#)

⇒ [“2.2 Coolant Pipes Overview”, page 178](#)

⇒ [“2.3 Coolant Pump and Coolant Thermostat with Housing Overview”, page 179](#)

⇒ [“2.4 Radiator and Coolant Fan Overview”, page 180](#)

2.1 Coolant Hose Connection Diagram



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WARNING

Risk of scalding due to hot steam and hot coolant.

- ◆ *The coolant system is under pressure when the engine is warm.*
- ◆ *Reduce pressure by covering coolant reservoir cap with a cloth and carefully open.*



Note

- ◆ *Secure all hose connections with hose clamps of the same type as those equipped by the factory. Refer to the Electronic Parts Catalog (ETKA).*
- ◆ *Arrows on coolant pipes and ends of coolant hoses must align when installing.*

Vehicles with a Manual Transmission



Note

- ◆ *Blue = large coolant circuit.*
- ◆ *Red = small coolant circuit with heating circuit.*
- ◆ *Orange = coolant circuit for turbocharger.*
- ◆ *The arrows show the coolant flow direction.*

1 - Radiator

- Change coolant after replacing

2 - Coolant Auxiliary Cooler

- Change coolant after replacing

3 - Non-Return Valve

- The arrow points in the flow direction

4 - Coolant Thermostat with Housing

5 - Coolant Pump

6 - Cylinder Head and Cylinder Block

- Change coolant after replacing

7 - Coolant Reservoir

- With cover and pressure relief valve
- Pressure relief valve, checking ⇒ [page 184](#)

8 - Heat Exchanger for Heater Unit

- Change coolant after replacing

9 - Bleeder Screw

10 - Restrictor

11 - Turbocharger

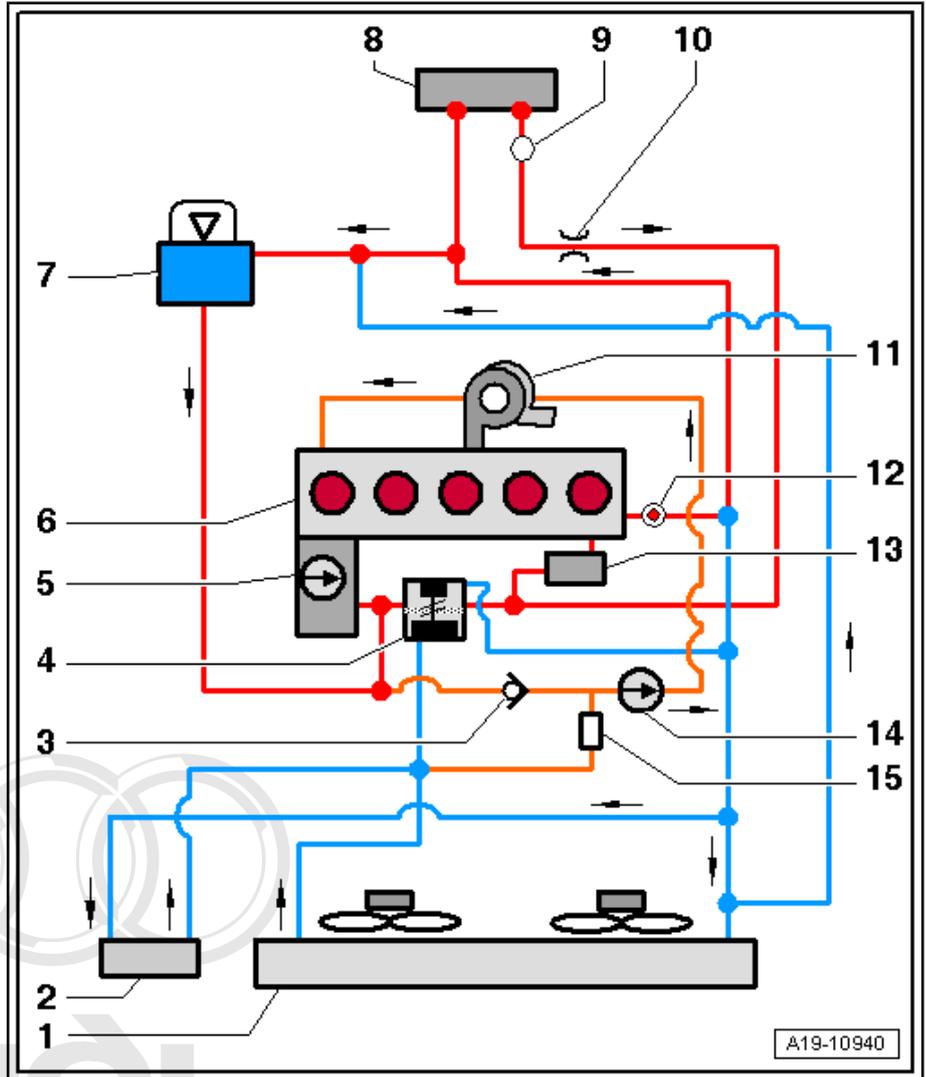
12 - Engine Coolant Temperature Sensor -G62-

13 - Engine Oil Cooler

- Change coolant after replacing

14 - After-Run Coolant Pump -V51-

15 - Coolant Circuit Solenoid Valve -N492-



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2.2 Coolant Pipes Overview

1 - Right Coolant Pipe

- Removing and installing, refer to
 ⇒ ["5.14 Right Coolant Pipe"](#), page 205

2 - Bolt

- 9 Nm

3 - O-ring

- Replace

4 - Nut

- 9 Nm

5 - Retaining Clip

6 - Coolant Temperature Sensor -G62-

- Removing and installing, refer to
 ⇒ ["5.7 Engine Coolant Temperature Sensor G62"](#), page 192

7 - O-ring

- Replace

8 - Coolant Connection

9 - Nut

- 9 Nm

10 - Left Coolant Pipe

- Removing and installing, refer to
 ⇒ ["5.11 Left Coolant Pipe"](#), page 198

11 - Bolt

- 9 Nm

12 - Front Coolant Pipes

- Removing and installing, refer to ⇒ ["5.9 Front Coolant Pipes"](#), page 195

13 - Bolt

- 9 Nm

14 - Bolt

- 9 Nm

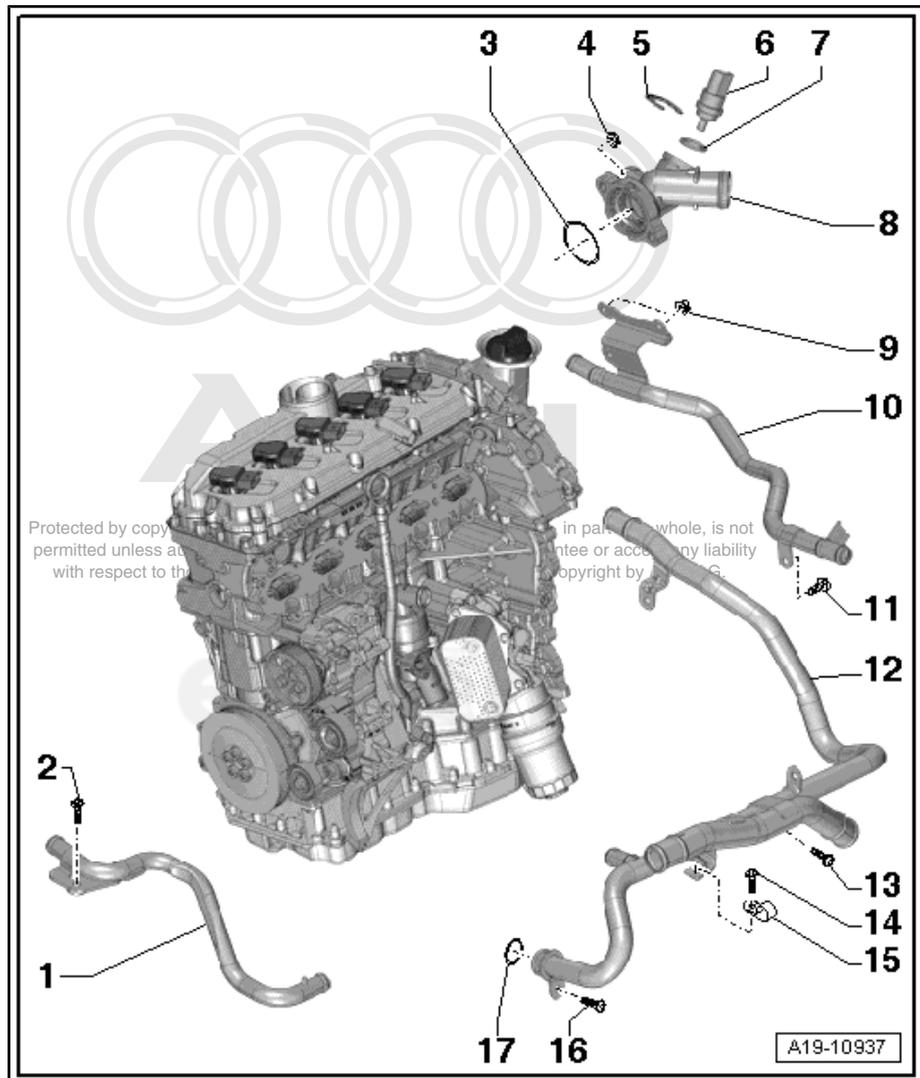
15 - Clamp

16 - Bolt

- 9 Nm

17 - O-ring

- Replace



2.3 Coolant Pump and Coolant Thermostat with Housing Overview



WARNING

Risk of scalding due to hot steam and hot coolant.

- ◆ *The coolant system is under pressure when the engine is warm.*
- ◆ *Reduce pressure by covering coolant reservoir cap with a cloth and carefully opening.*

1 - Seal

- Replace

2 - Bolt

- 9 Nm

3 - Coolant Pump

- Removing and installing, refer to
 ⇒ ["5.4 Coolant Pump", page 188](#)

4 - After-Run Coolant Pump - V51-

- Removing and installing, refer to
 ⇒ ["5.1 After-Run Coolant Pump V51", page 185](#)

5 - Bolt

- 9 Nm

6 - Coolant Circuit Solenoid Valve -N492-

- Removing and installing, refer to
 ⇒ ["5.6 Cooling Circuit Solenoid Valve N492", page 191](#)

7 - Bolt

- 9 Nm

8 - Coolant Distribution Housing

- Removing and installing, refer to
 ⇒ ["5.2 Coolant Distribution Housing", page 186](#)

9 - O-ring

- Replace

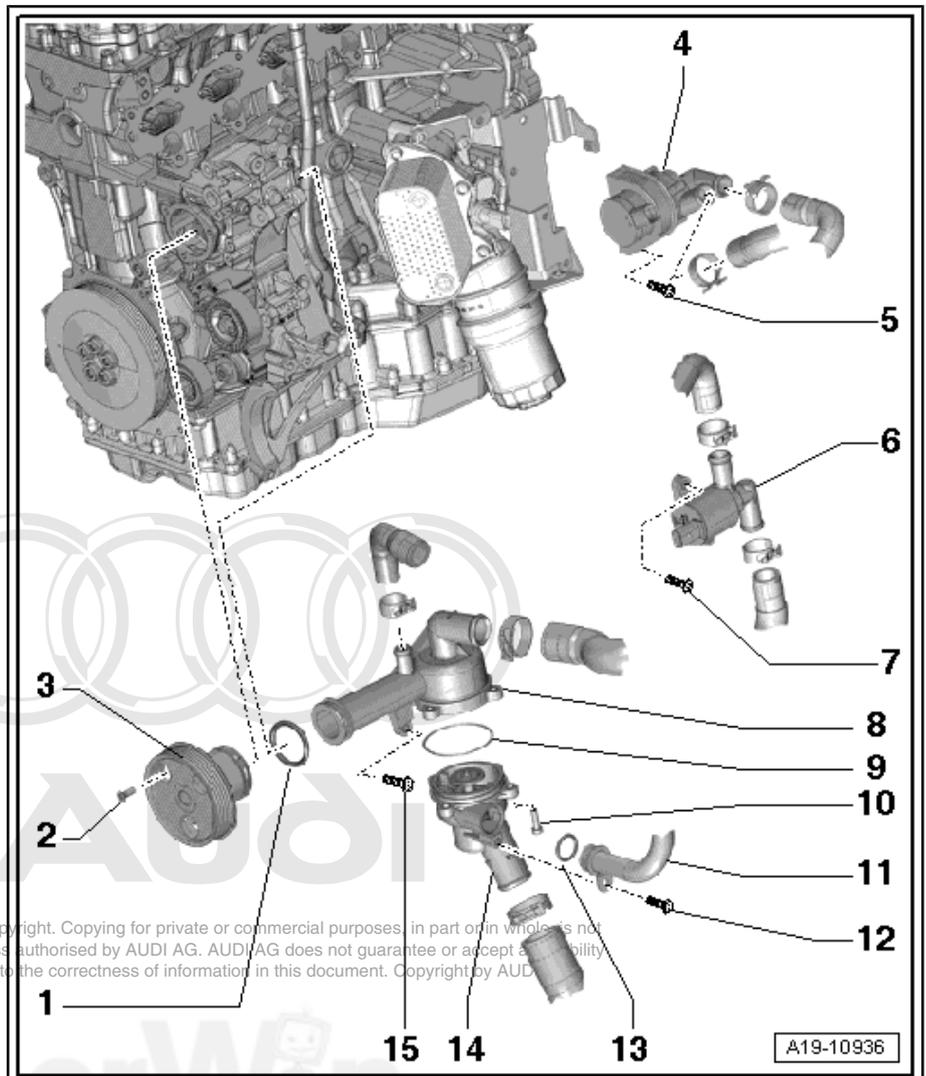
10 - Bolt

- 6 Nm

11 - Front Coolant Pipes

12 - Bolt

- 9 Nm



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13 - Nut

- 10 Nm

14 - Bolt

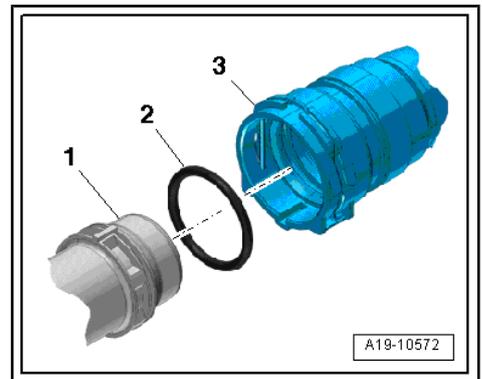
- 5 Nm

15 - Coolant Fan 2 -V177-

- Removing and installing, refer to ⇒ [“5.3 Coolant Fan V7 / Coolant Fan 2 V177”, page 187](#)

Connect the Coolant Hose with the Connector on the Radiator.

- Remove the old O-ring -2- in the coolant hose -3-.
- Coat the new O-ring with coolant and install it in the coolant hose.
- Press the coolant hose onto the radiator -1- until it engages audibly.
- Press the coolant hose on again and pull to make sure the connection is engaged correctly.



Left Auxiliary Cooler

1 - Air Guide

2 - Grommet

3 - Bolt

- 8 Nm

4 - Upper Bracket

5 - Grommet

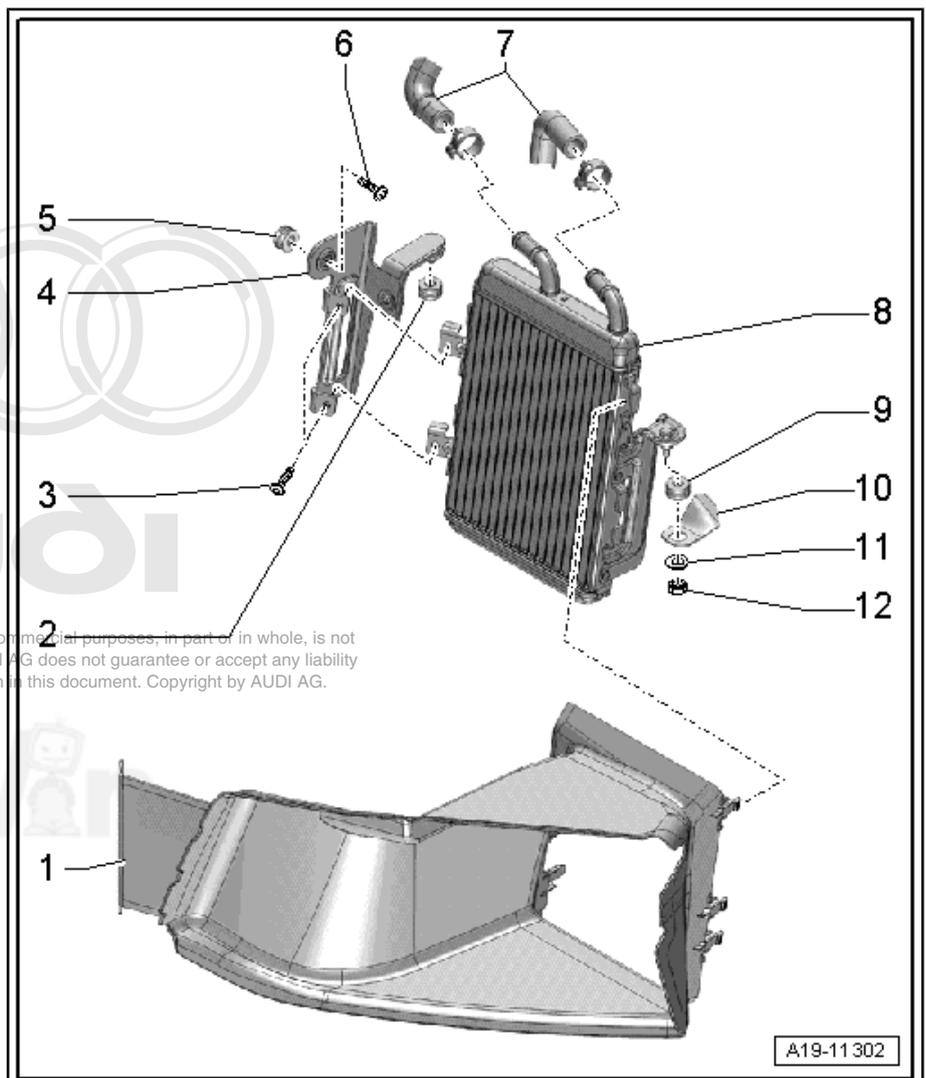
6 - Bolt

- 8 Nm

7 - Coolant Hoses

8 - Left Auxiliary Cooler

- For coolant circuit for the transmission
- Removing and installing, refer to ⇒ [“5.10 Left Auxiliary Cooler”, page 197](#)



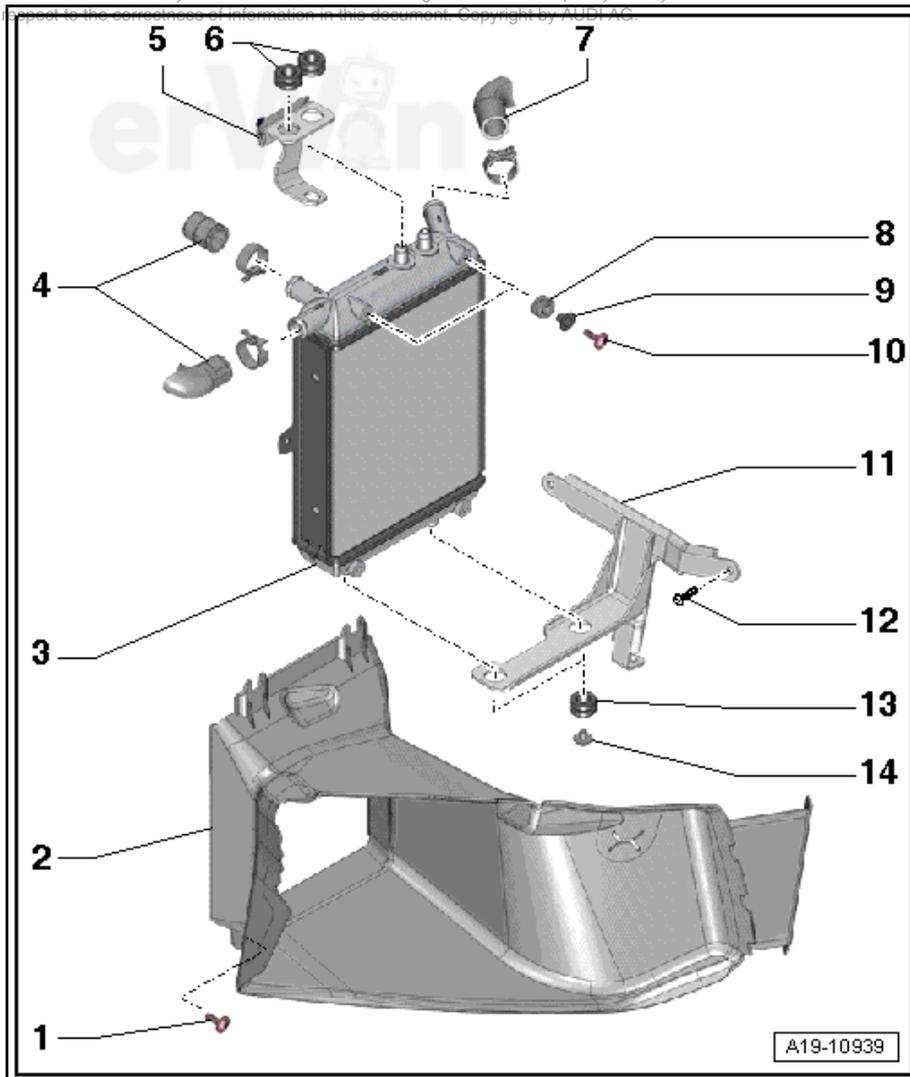
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- 9 - Grommet
- 10 - Lower Bracket
- 11 - Washer
- 12 - Nut
- 8 Nm

Right Auxiliary Cooler

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- 1 - Bolt
- 6.5 Nm
- 2 - Air Guide
- 3 - Right Auxiliary Cooler
- For coolant
- Removing and installing, refer to [⇒ "5.13 Right Auxiliary Cooler", page 203](#)
- 4 - Coolant Hoses
- 5 - Upper Bracket
- 6 - Grommets
- 7 - Coolant Hose
- 8 - Grommet
- 9 - Bushing
- 10 - Bolt
- 6.5 Nm
- 11 - Lower Bracket
- 12 - Bolt
- 8 Nm
- 13 - Grommet
- 14 - Bolt
- 6 Nm



3 Specifications

⇒ "3.1 Fastener Tightening Specifications", page 183

3.1 Fastener Tightening Specifications

Components	Fastener Size	Nm
After-Run Coolant Pump	-	9
Air Guide	-	6.5
Bracket for the Radiator	-	5
Clamp for Front Coolant Pipe	-	9
Coolant Circuit Solenoid Valve	-	9
Coolant Connection, Nut	-	9
Coolant Distribution Housing	-	9
Coolant Fan, Nut	-	10
Coolant Pump	-	9
Coolant Thermostat with Housing	-	6
Fan Shroud	-	5
Front Coolant Pipe	-	9
Left Coolant Pipe, Nut	-	9
Lower Bracket for Left Auxiliary Cooler, Nut	-	8
Lower Bracket for Right Auxiliary Cooler ¹		
	-	6
	-	8
Right Auxiliary Cooler	-	6.5
Right Coolant Pipe	-	9
Upper Bracket for Left Auxiliary Cooler	-	8
<ul style="list-style-type: none"> ¹ For bolt tightening clarification, refer to Right Auxiliary Cooler ⇒ page 182 and see items -12 and 14- 		



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4 Diagnosis and Testing

⇒ "4.1 Cooling System, Checking for Leaks", page 184

4.1 Cooling System, Checking for Leaks

Special tools and workshop equipment required

- ◆ Cooling System Tester -V.A.G 1274 B-
- ◆ Adapter -V.A.G 1274/8-
- ◆ Adapter -V.A.G 1274/9-

Procedure

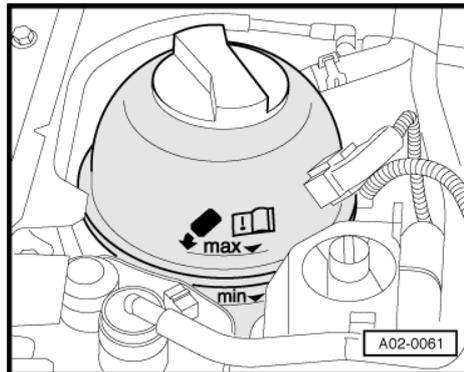
- Engine at operating temperature.



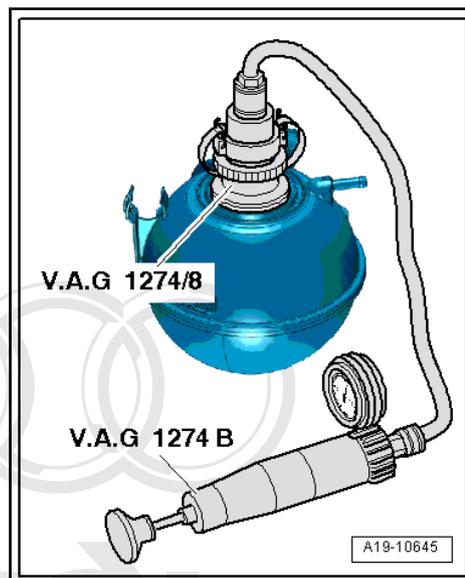
WARNING

Risk of scalding due to hot steam and hot coolant.

- ◆ *The coolant system is under pressure when the engine is warm.*
- ◆ *Reduce pressure by covering coolant reservoir cap with a cloth and carefully opening.*

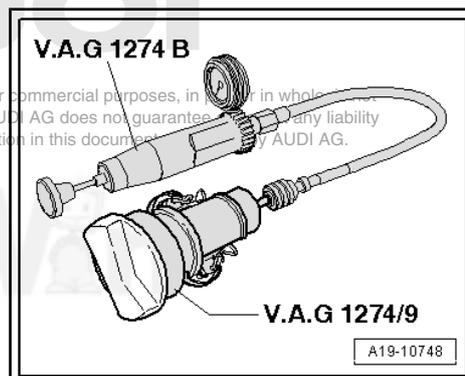


- Open the coolant reservoir cap.
- Position the -V.A.G 1274 B- with -V.A.G 1274/8- on coolant reservoir.
- Generate approximately 1 bar pressure with cooling system tester hand pump.
- If pressure falls, search for leaks and correct problem.



Pressure Relief Valve in Cap, Checking

- Attach -V.A.G 1274 B- with -V.A.G 1274/9- to sealing cap.
- Generate pressure with cooling system tester hand pump.
- The pressure release valve must open at 1.4 to 1.6 bar.
- If pressure relief valve does not open as specified, replace cap.



5 Removal and Installation

- ⇒ [“5.1 After-Run Coolant Pump V51 “, page 185](#)
- ⇒ [“5.2 Coolant Distribution Housing“, page 186](#)
- ⇒ [“5.3 Coolant Fan V7 / Coolant Fan 2 V177 “, page 187](#)
- ⇒ [“5.4 Coolant Pump“, page 188](#)
- ⇒ [“5.5 Coolant Thermostat with Housing“, page 189](#)
- ⇒ [“5.6 Cooling Circuit Solenoid Valve N492 “, page 191](#)
- ⇒ [“5.7 Engine Coolant Temperature Sensor G62 “, page 192](#)
- ⇒ [“5.8 Fan Shroud“, page 193](#)
- ⇒ [“5.9 Front Coolant Pipes“, page 195](#)
- ⇒ [“5.10 Left Auxiliary Cooler“, page 197](#)
- ⇒ [“5.11 Left Coolant Pipe“, page 198](#)
- ⇒ [“5.12 Radiator“, page 200](#)
- ⇒ [“5.13 Right Auxiliary Cooler“, page 203](#)
- ⇒ [“5.14 Right Coolant Pipe“, page 205](#)

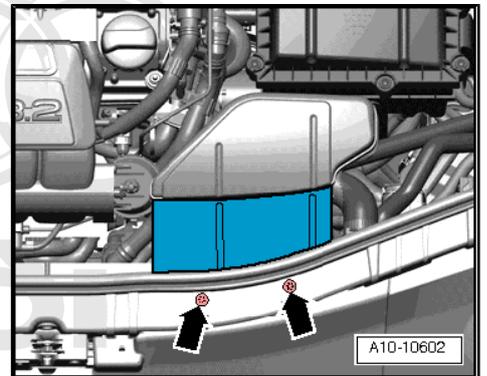
5.1 After-Run Coolant Pump -V51-

Special tools and workshop equipment required

- ◆ Hose Clamps Up to 25 mm Dia. -3094-
- ◆ Hose Clip Pliers -VAS 6362-

Removing

- Remove the bolts -arrows- and front air guide.



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 **Note**

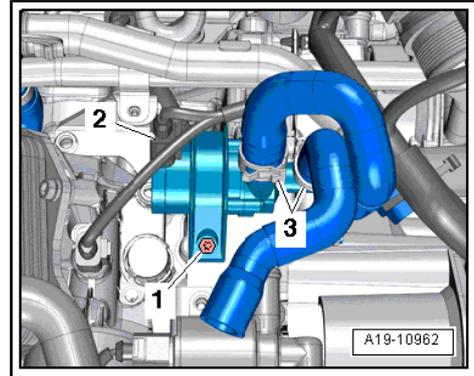
Use a cloth to catch any leaking coolant.

- Disconnect the connector -2-.
- Disconnect and remove the coolant hoses -3- using the -3094- .
- Remove the bolt -1- and the after-run coolant pump.

Installing

Install in reverse order, paying attention to the following:

- Tightening specification, refer to [⇒ "2.3 Coolant Pump and Coolant Thermostat with Housing Overview", page 179](#) .



 **Note**

Secure all hose connections with hose clamps of the same type as those equipped by the factory. Refer to the *Electronic Parts Catalog (ETKA)*.

- Install the front air guide. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Description and Operation .
- Check the coolant level. Refer to ⇒ [page 175](#) .

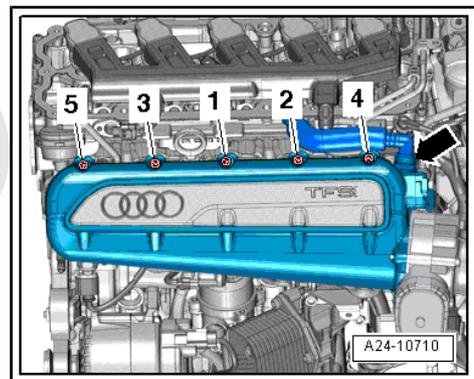
5.2 Coolant Distribution Housing

Special tools and workshop equipment required

- ◆ Hose Clip Pliers -VAS 6362-

Removing

- Remove the upper intake manifold. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .
- Remove the thermostat and housing. Refer to [⇒ "5.5 Coolant Thermostat with Housing", page 189](#) .



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- Loosen the clamp -1- and remove the coolant hose.
- Remove the bolts -arrows- and remove the coolant distribution housing -2- from the cylinder block towards the left.

Installing

Installation is carried out in the reverse order while noting the following:

- For the correct tightening specifications, refer to ⇒ ["2.3 Coolant Pump and Coolant Thermostat with Housing Overview", page 179](#).



Note

- ◆ *Replace the O-rings.*
- ◆ *Secure all hose connections with hose clamps of the same type as those equipped by the factory. Refer to the Electronic Parts Catalog (ETKA).*

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- Clean and/or smooth the sealing surfaces of the O-rings.
- Coat the O-ring with coolant and slide it onto the coolant distribution housing.
- Insert coolant distribution housing in hole at cylinder block.
- Install the thermostat and its housing. Refer to ⇒ ["5.5 Coolant Thermostat with Housing", page 189](#).
- Install the upper intake manifold. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .

5.3 Coolant Fan -V7- / Coolant Fan 2 -V177-

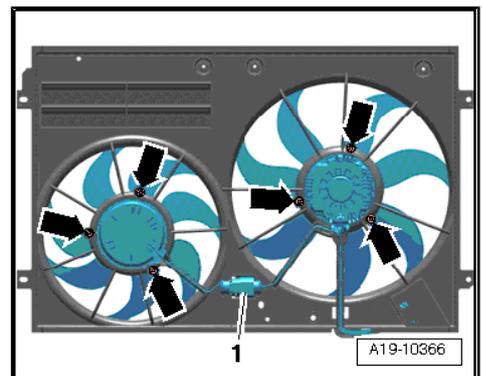
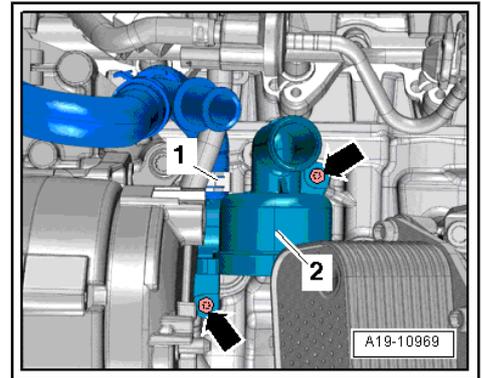
Removing

- Remove fan shroud. Refer to ⇒ ["5.8 Fan Shroud", page 193](#).
- Disconnect the connector -1-.
- Free up the wires.
- Remove nuts -arrows- and remove coolant fan.

Installing

Install in reverse order, paying attention to the following:

- Tightening specification, refer to ⇒ ["2.4 Radiator and Coolant Fan Overview", page 180](#).
- Install fan shroud. Refer to ⇒ ["5.8 Fan Shroud", page 193](#).



5.4 Coolant Pump

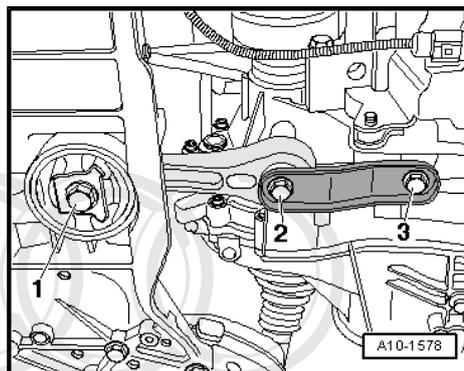
Removing

- Drain the coolant. Refer to
 ⇒ ["1.1 Coolant, Draining and Filling", page 171](#) .
- Remove the bolts -2 and 3-.



Note

Ignore -1-.

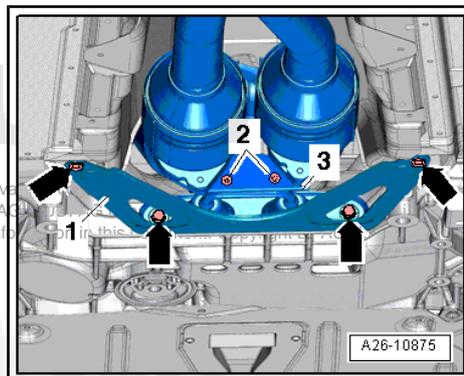


- Remove the bolts -arrows- and the cross brace -1-.



Note

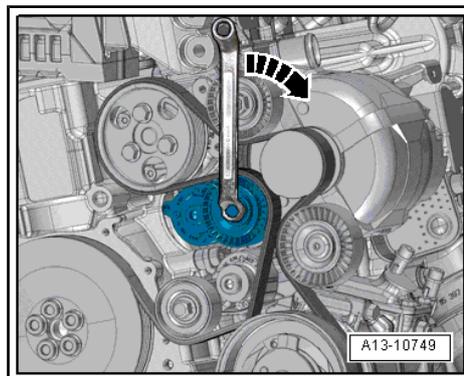
Ignore -2 and 3-.



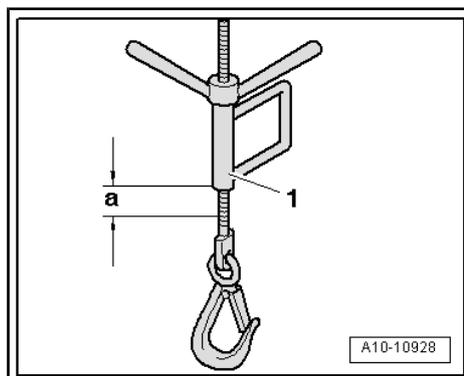
- Remove the engine bracket. Refer to
 ⇒ ["4.5 Engine Mount", page 41](#) .

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- Pivot the tensioner clockwise -arrow- to release the tension on the ribbed belt.
- Remove the ribbed belt from the generator and release the tension on the tensioning element.



- Lift the engine with the left spindle to the dimension -a-
- Dimension: -a- 55 mm.

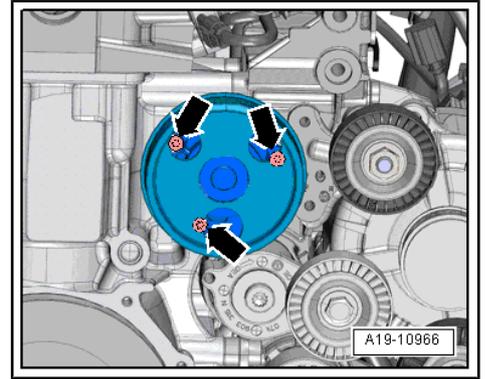


- Remove the bolts -arrows- through the holes in the ribbed belt pulley and remove the coolant pump.

Installing

Install in reverse order, paying attention to the following:

- Tightening specification, refer to [⇒ "2.3 Coolant Pump and Coolant Thermostat with Housing Overview", page 179](#) .
- Clean and smooth the sealing surface for the integrated silicon seal on the coolant pump.
- Install the engine mount. Refer to [⇒ "4.5 Engine Mount", page 41](#) .
- Install the generator ribbed belt and the coolant pump. Refer to [⇒ "4.7 Generator Ribbed Belt and Coolant Pump", page 70](#) .
- Install cross brace. Refer to [⇒ "2.1 Muffler Overview", page 232](#) .
- Install the pendulum support. Refer to ⇒ Manual Transmission; Rep. Gr. 34 ; Description and Operation .
- Fill the engine with coolant. Refer to [⇒ page 173](#) .



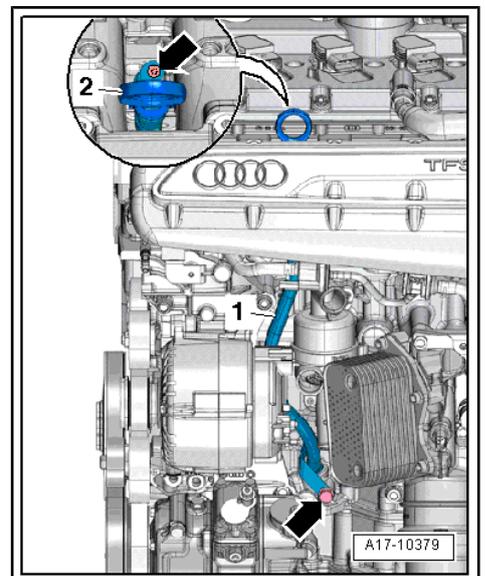
5.5 Coolant Thermostat with Housing

Special tools and workshop equipment required

- ◆ Hose Clip Pliers -VAS 6362-

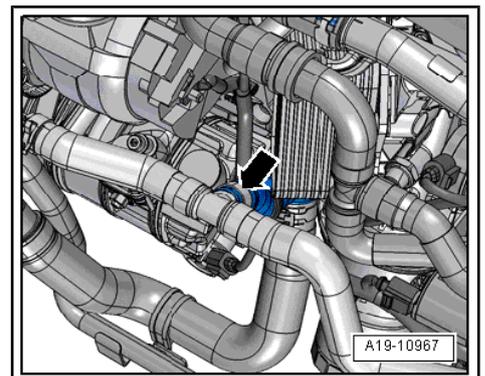
Removing

- Drain the coolant. Refer to [⇒ "1.1 Coolant, Draining and Filling", page 171](#) .
- Remove the oil dipstick -2-.
- Remove the bolts -arrows-, then remove oil dipstick tube -1- upward.

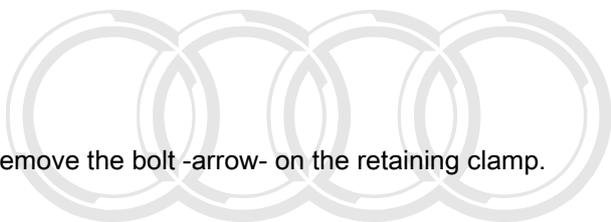


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- Remove the coolant hose from the T-connection and loosen the hose clamp -arrow-.



- Remove the air filter housing. Refer to => Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .



- Remove the bolt -arrow- on the retaining clamp.

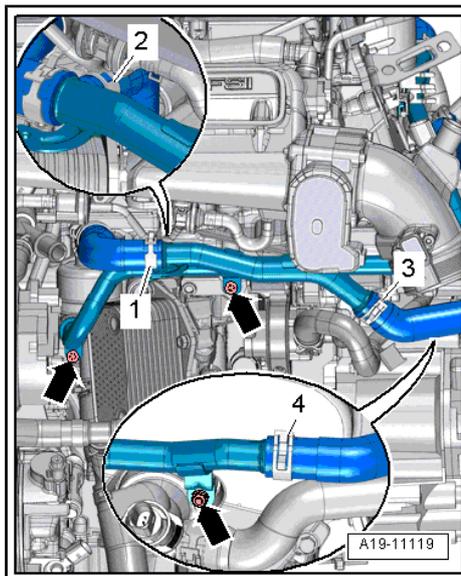
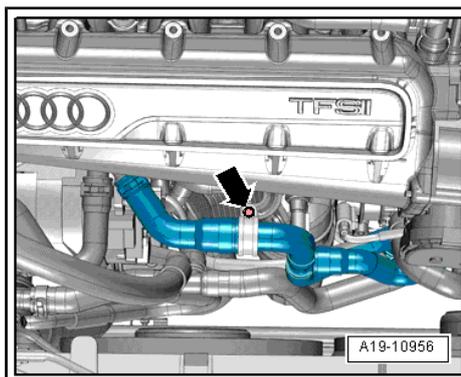
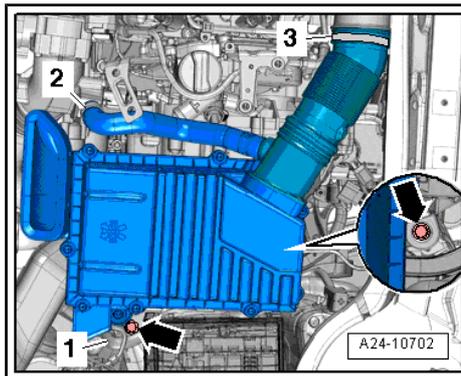


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- Loosen the clamp -1- and remove the coolant hose.
- Remove the bolts and nut -arrows- and then remove the front coolant pipe from the thermostat housing.

 **Note**

Ignore -2, 3 and 4-.



- Remove the bolts -arrows- and the coolant thermostat with the housing.

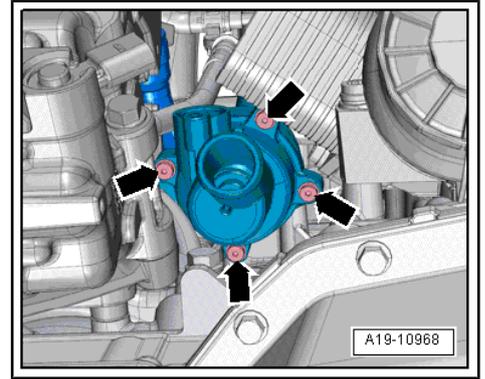
Installing

Installation is carried out in the reverse order while noting the following:

- Tightening specification, refer to ⇒ [“2.3 Coolant Pump and Coolant Thermostat with Housing Overview”, page 179](#) .

Note

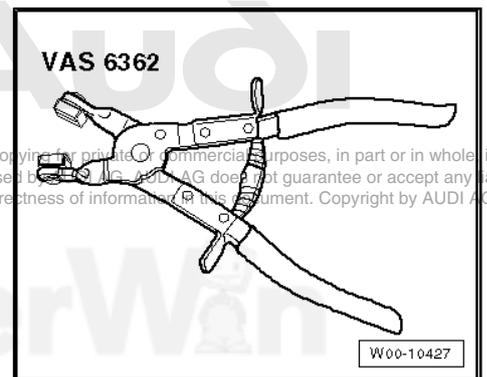
- ◆ *Replace the O-ring.*
- ◆ *Secure all hose connections with hose clamps of the same type as those equipped by the factory. Refer to the Electronic Parts Catalog (ETKA).*
- Clean and smooth the O-ring sealing surface.
- Coat the new O-ring with coolant.
- Install the front coolant pipes. Refer to ⇒ [“5.9 Front Coolant Pipes”, page 195](#) .
- Install the air filter housing. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .
- Tighten the oil dipstick guide tube. Refer to ⇒ [Fig. “Oil Dipstick Guide Tube - Tightening Specifications”](#) , page 145 .
- Fill the engine with coolant. Refer to ⇒ [page 173](#) .



5.6 Cooling Circuit Solenoid Valve -N492-

Special tools and workshop equipment required

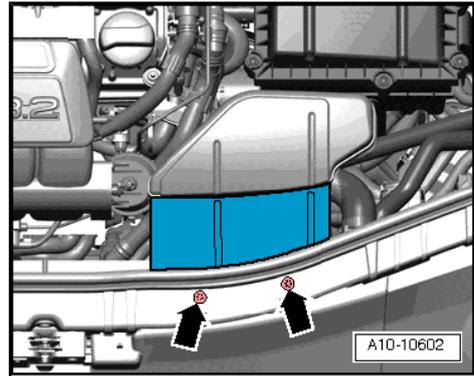
- ◆ Hose Clamps Up to 25 mm Dia. -3094-
- ◆ Hose Clip Pliers -VAS 6362-



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Removing

- Remove the bolts -arrows- and air guide.

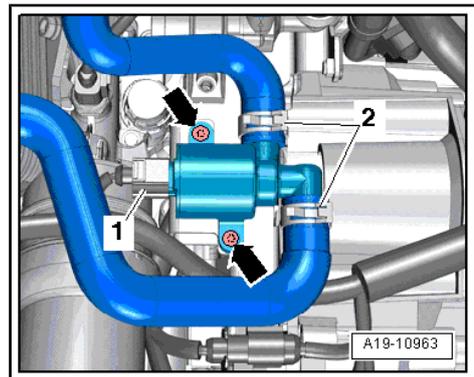


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Note

Use a cloth to catch any leaking coolant.

- Disconnect the connector -1-.
- Disconnect and remove the coolant hoses -2- using the -3094- .
- Remove the bolts -arrows- and remove the cooling circuit solenoid valve.



Installing

Install in reverse order, paying attention to the following:

- Tightening specification, refer to [⇒ "2.3 Coolant Pump and Coolant Thermostat with Housing Overview", page 179](#) .

Note

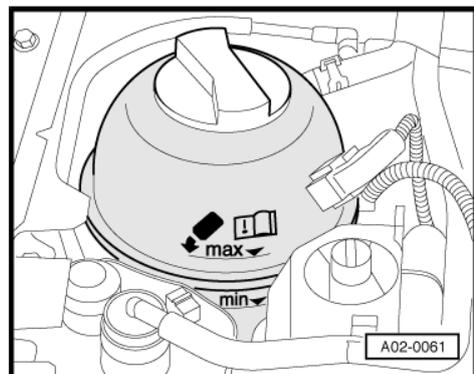
Secure all hose connections with hose clamps of the same type as those equipped by the factory. Refer to the Electronic Parts Catalog (ETKA).

- Install the front air guide. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Description and Operation .
- Check the coolant level. Refer to ⇒ [page 175](#) .

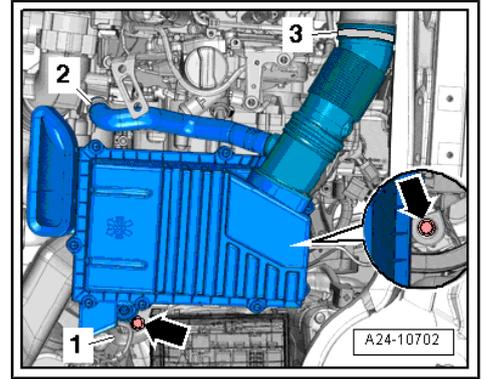
5.7 Engine Coolant Temperature Sensor - G62-

Removing

- Engine cold.
- Briefly open the coolant reservoir cap to reduce the residual pressure in the coolant system.



- Remove the air filter housing. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .



- Disconnect the connector -1-.

i Note

Use a cloth to catch any leaking coolant.

- Remove the clip -2- and then remove the Engine Coolant Temperature (ECT) sensor.

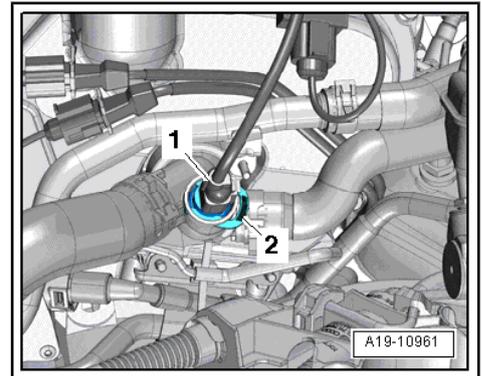
Installing

Install in reverse order, paying attention to the following:

i Note

- ◆ *Replace the O-ring.*
- ◆ *To prevent coolant loss, immediately insert new ECT sensor in support.*

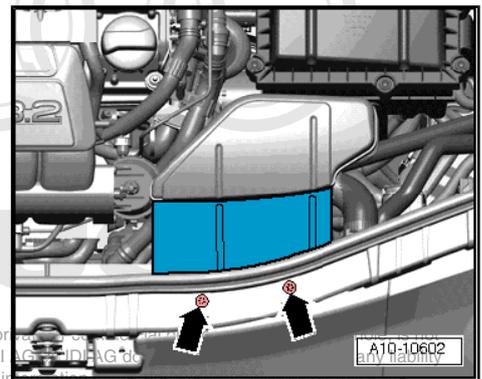
- Install the air filter housing. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .
- Check the coolant level. Refer to ⇒ [page 175](#) .



5.8 Fan Shroud

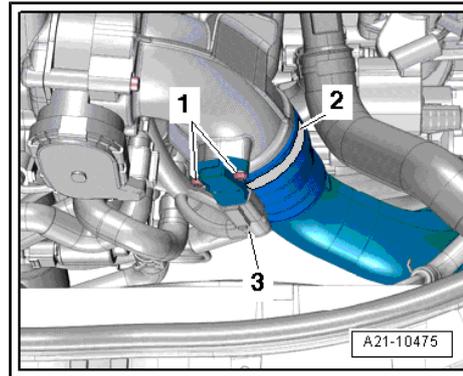
Removing

- Remove the bolts -arrows- and front air guide.

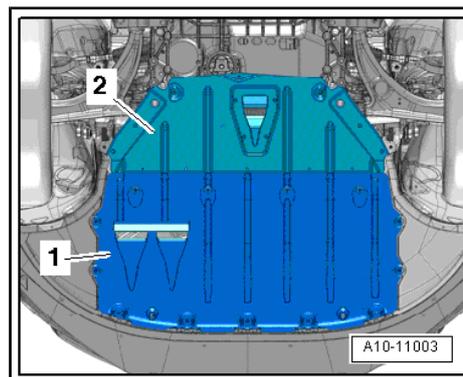


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- Remove the bolts -1-, and set the charge air pressure sensor -G31- / intake air temperature sensor 2 -G299- with attached connector -3- aside.
- Loosen the hose clamp -2-.

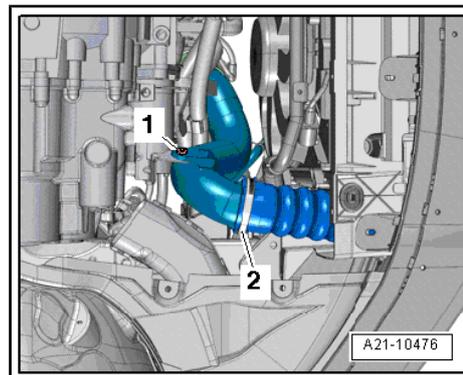


- Remove the front noise insulation -1-. Refer to => Body Exterior; Rep. Gr. 66 ; Removal and Installation .



Vehicles with a Manual Transmission:

- Remove the bolt -1-.
- Remove the air guide pipe; to do this, loosen the hose clamp -2-.

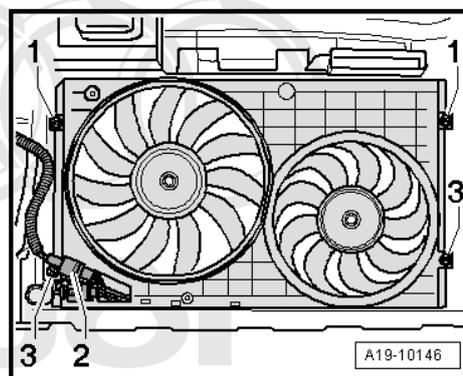


 **WARNING**

Risk of injury through fan turning on automatically.

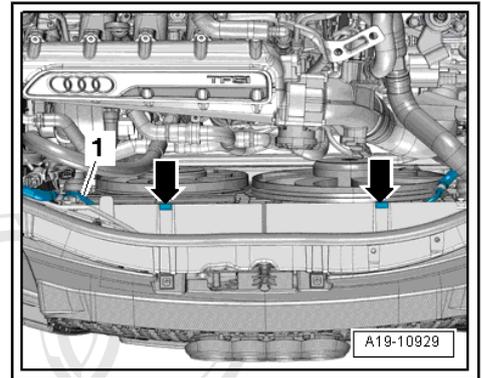
◆ *Disconnect electrical connectors before working on fan shroud.*

- Disconnect the radiator fan connector -2-.
- Remove the bolts -3-.



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- Unclip -arrows- the coolant line -1- from the lock carrier and set it towards the rear.



- Remove the bolts -1- and remove the fan shroud upward.

Installing

Install in reverse order, paying attention to the following:

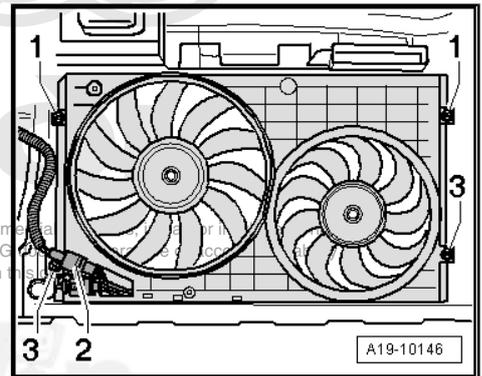
- Tightening specification, refer to [⇒ "2.4 Radiator and Coolant Fan Overview", page 180](#).



Note

Secure all hose connections with hose clamps of the same type as those equipped by the factory. Refer to the Electronic Parts Catalog (ETKA).

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- Install the air guide pipe. Refer to [⇒ "1.1 Charge Air Cooler Overview", page 209](#).
- Install the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Removal and Installation .
- Install the charge air pressure sensor / intake air temperature sensor 2. Refer to [⇒ "4.2 Charge Air Pressure Sensor G31 / and Intake Air Temperature \(IAT\) Sensor 2 G299", page 221](#) .
- Install the front air guide. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Description and Operation .

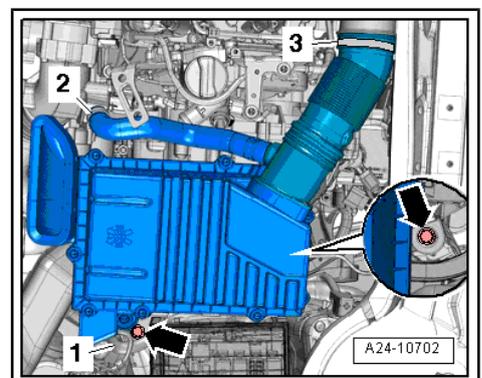
5.9 Front Coolant Pipes

Special tools and workshop equipment required

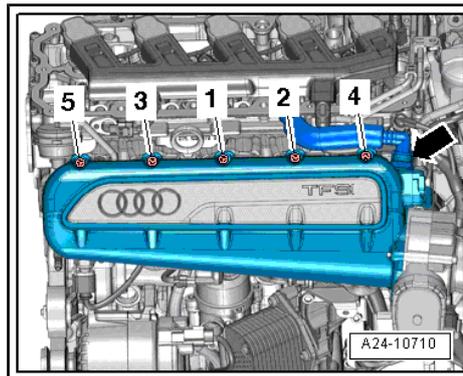
- ◆ Hose Clip Pliers -VAS 6362-

Removing

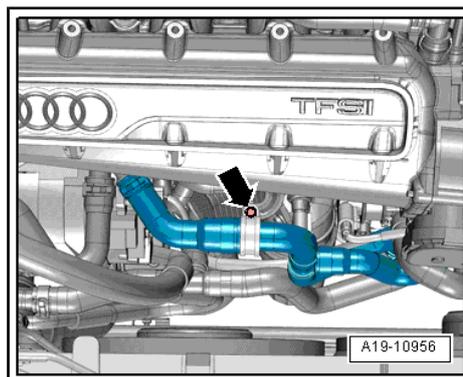
- Remove the air filter housing. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .



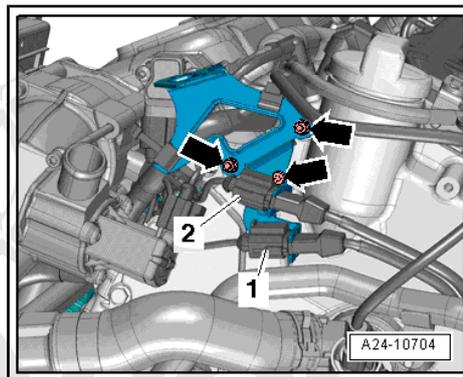
- Remove the upper intake manifold. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .
- Drain the coolant. Refer to ⇒ ["1.1 Coolant, Draining and Filling", page 171](#) .



- Remove the bolt -arrow- on the retaining clamp.



- Remove electrical harness connectors -1 and 2- from the bracket.
- Remove the nut and bolt -arrows- and then remove the mount.



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Vehicles with a Manual Transmission:

- Remove coolant hoses by loosening the hose clamps -1 to 4-
- Remove the bolts and nut -arrows- and then remove the front coolant pipe from the thermostat housing.

Installing

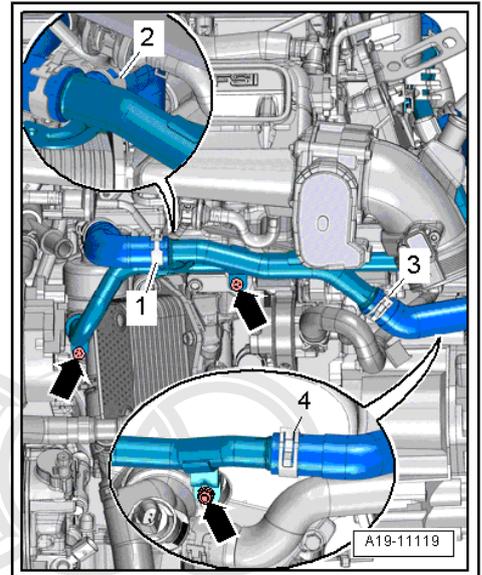
Install in reverse order, paying attention to the following:

Tightening specifications:

- => ["2.2 Coolant Pipes Overview", page 178](#) .
- => ["1.3 Timing Chain Covers Overview", page 83](#) .

 **Note**

- ◆ *Replace the O-ring.*
- ◆ *Secure all hose connections with hose clamps of the same type as those equipped by the factory. Refer to the Electronic Parts Catalog (ETKA).*
- Install the exhaust gas temperature sensor 1 -G235- . Refer to ["5.2 Exhaust Gas Temperature \(EGT\) Sensor 1 G235", page 237](#) .
- Install the intake manifold upper section and air filter housing. Refer to => Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .
- Fill the engine with coolant. Refer to => [page 173](#) .



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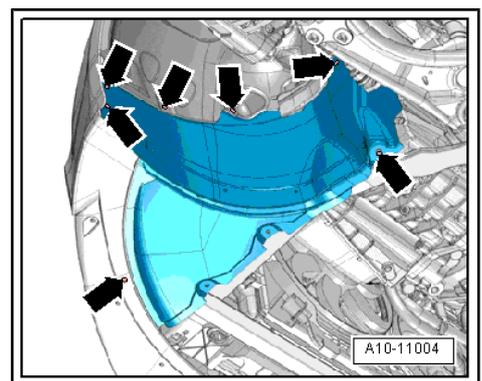
5.10 Left Auxiliary Cooler

Special tools and workshop equipment required

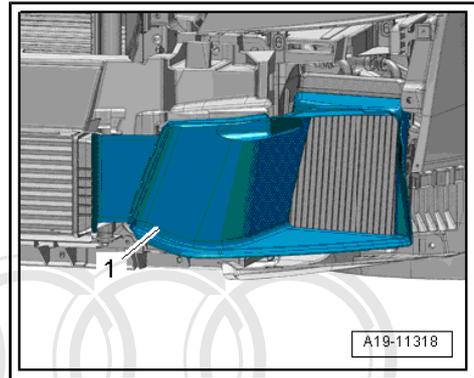
- ◆ Hose Clamps Up to 25 mm Dia. -3094-
- ◆ Hose Clip Pliers -VAS 6362-

Removing

- Remove the left front underside of wheel housing liner. Rrefer to => Body Exterior; Rep. Gr. 66 ; Removal and Installation .
- Remove the bumper cover. Refer to => Body Exterior; Rep. Gr. 63 ; Removal and Installation .



- Unclip the air guide -1- towards the front.

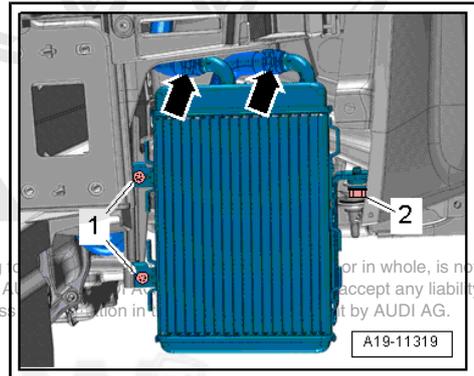


- Remove the bolts -1- and nut -2-.

 **Note**

Use a cloth to catch any leaking coolant.

- Remove the auxiliary cooler and lower it slightly.
- Disconnect and remove the coolant hoses -arrows using the -3094- .



 **Caution**

There is a risk of contamination.

- ◆ *There is still coolant in the auxiliary cooler.*

Installing

Install in reverse order, paying attention to the following:

- For the correct tightening specifications, refer to [⇒ "2.4 Radiator and Coolant Fan Overview", page 180](#) .

 **Note**

Secure all hose connections with hose clamps of the same type as those equipped by the factory. Refer to the Electronic Parts Catalog (ETKA).

- Install the bumper cover. Refer to ⇒ Body Exterior; Rep. Gr. 63 ; Removal and Installation .
- Install the front underside of wheel housing liner. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Removal and Installation .
- Fill the engine with coolant. Refer to ⇒ [page 173](#) .

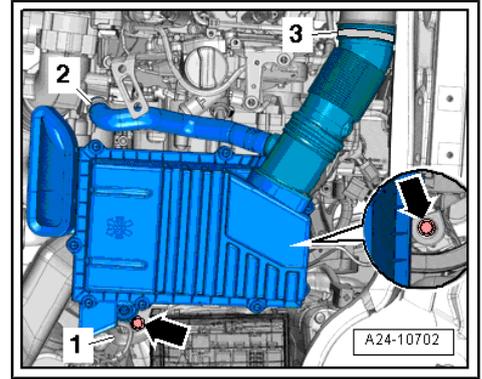
5.11 Left Coolant Pipe

Special tools and workshop equipment required

- ◆ Hose clip pliers -VAS 6362-

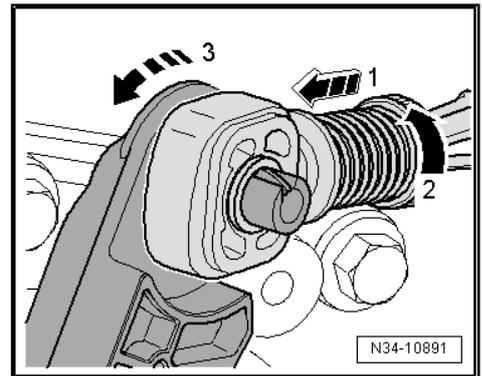
Removing

- Drain the coolant. Refer to [⇒ “1.1 Coolant, Draining and Filling”, page 171](#) .
- Remove the air filter housing. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .

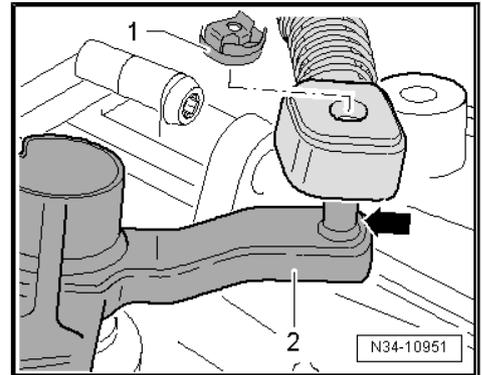


Vehicles with a Manual Transmission:

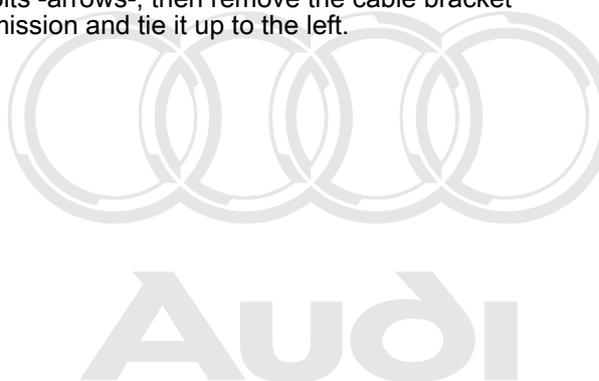
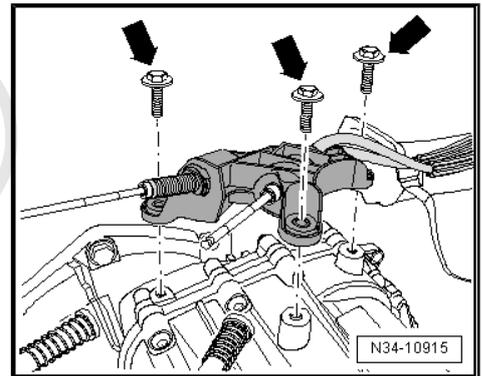
- Pull the safety mechanism all the way to the front -arrow 1- and then lock it to the left -arrow 2-.
- Push the shift relay lever forward -arrow 3- and remove the selector cable from the retainer.



- Remove the lock washer -1- for the shift cable from the transmission selector lever -2- and remove the shift cable from the pin -arrow-.



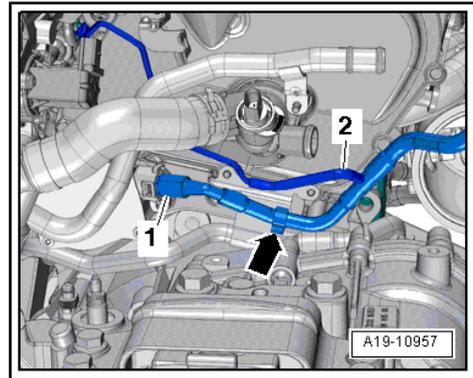
- Remove the bolts -arrows-, then remove the cable bracket from the transmission and tie it up to the left.



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- Disconnect the vacuum hose -2-.
- Free up the vacuum hose -1- -arrow- and remove it from the brake booster vacuum pump.



- Remove the bolts and nuts -arrows-.
- Remove the left coolant pipe in order to loosen the hose clamp -2-.

 **Note**

Ignore -1-.

Installing

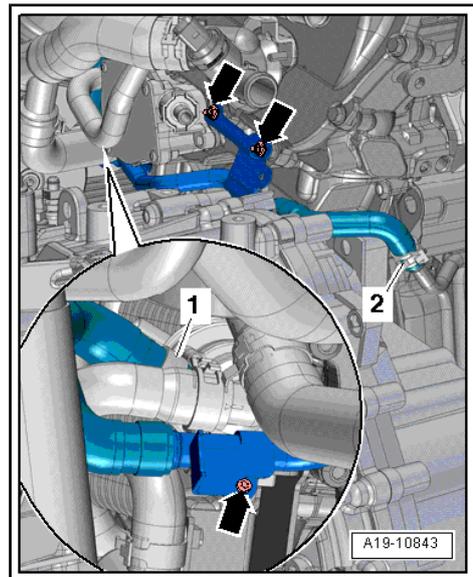
Install in reverse order, paying attention to the following:

- Tightening specification, refer to [⇒ "2.2 Coolant Pipes Overview", page 178](#) .

 **Note**

Secure all hose connections with hose clamps of the same type as those equipped by the factory. Refer to the *Electronic Parts Catalog (ETKA)*.

- Selector mechanism, installing and adjusting. Refer to ⇒ Manual Transmission; Rep. Gr. 34 ; Removal and Installation .
- Install the air filter housing. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .
- Fill the engine with coolant. Refer to ⇒ [page 173](#) .



5.12 Radiator

Special tools and workshop equipment required

- ◆ Drip Tray for VAS 6100 -VAS 6208-



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Removing



If there are small impressions on the fins. Refer to
 ⇒ ["1.3 Coolers, Condensers and Charge Air Coolers", page 2](#).

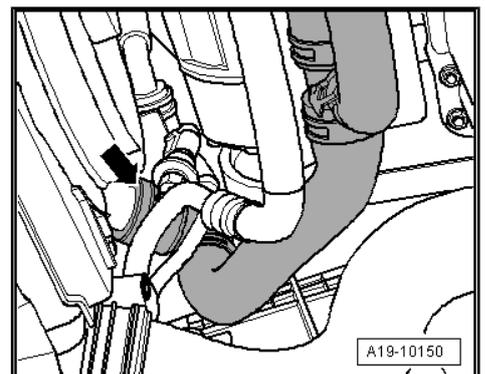
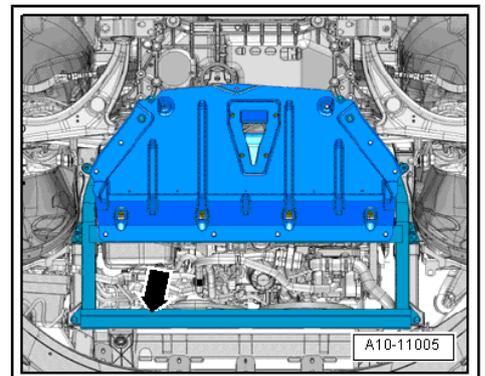
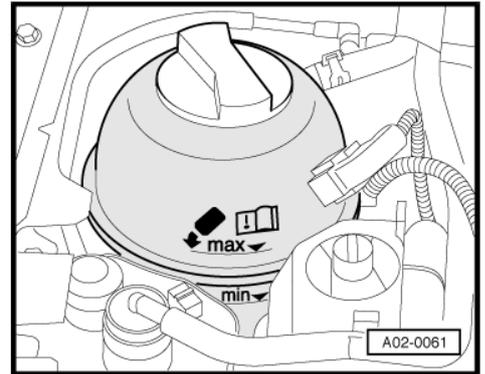


WARNING

Risk of scalding due to hot steam and hot coolant.

- ◆ *The coolant system is under pressure when the engine is warm.*
- ◆ *Cover the coolant reservoir cap with a cloth and then open it slowly to release the pressure in the system.*

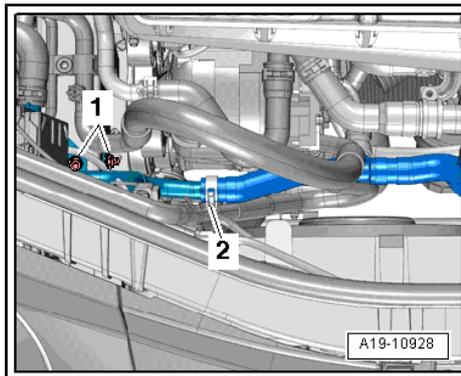
- Open the coolant reservoir cap.
- Remove the charge air cooler. Refer to
 ⇒ ["4.1 Charge Air Cooler", page 220](#).
- Remove the noise insulation frame -arrow- with the rear noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 50 ; Removal and Installation .
- Remove the fan shroud. Refer to
 ⇒ ["5.8 Fan Shroud", page 193](#).
- Place the -VAS 6208- under engine.
- Open the clamp, drain the coolant and then remove the lower coolant hose -arrow- from the radiator.



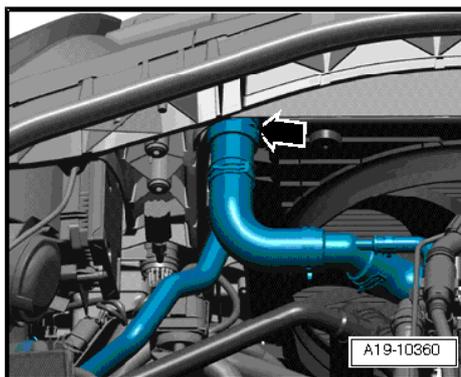
- Remove nuts -1- and push the coolant pipe toward the rear.

 **Note**

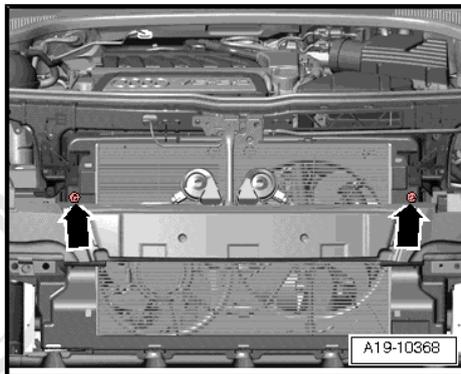
Ignore -2-.

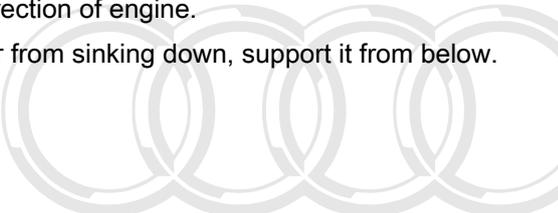


- Disconnect the coolant hose from the radiator by raising the retaining clip -arrow-.



- Remove the bolts -arrows-.
- Tip radiator back slightly at upper edge.
- Disengage radiator from lower mounting points by raising radiator.
- Slide radiator in direction of engine.
- To prevent radiator from sinking down, support it from below.




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 **WARNING**
Refrigerant can cause serious personal injury.
 ♦ *Do not open the air conditioning refrigerant circuit.*

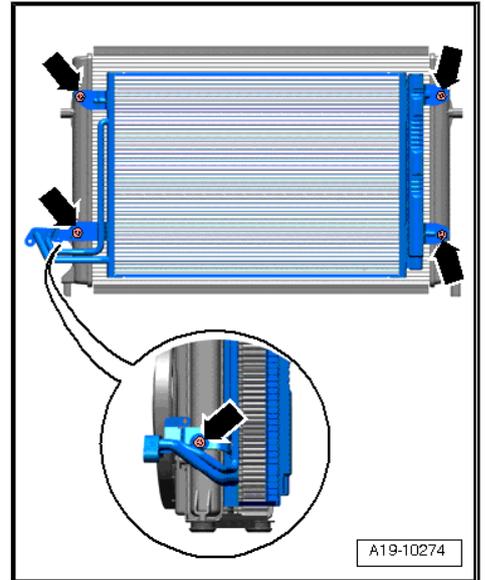
 **Caution**
Risk of damage to condenser and refrigerant lines and hoses.
 ♦ *Do not stretch, kink or bend refrigerant lines and hoses.*

- Remove the bolts -arrows-.
- Remove condenser from radiator.
- Place condenser forward in lock carrier and secure against falling down with cable ties.
- Remove radiator downward.

Installing

Install in reverse order, paying attention to the following:

- For the correct tightening specifications, refer to [⇒ "2.4 Radiator and Coolant Fan Overview", page 180](#) .
- Install condenser. Refer to ⇒ Heating, Ventilation and Air Conditioning; Rep. Gr. 87 ; Removal and Installation .
- Install fan shroud. Refer to ⇒ ["5.8 Fan Shroud", page 193](#) .
- Connect the coolant hose to the connector on the radiator. Refer to [⇒ Fig. "Connect the Coolant Hose with the Connector on the Radiator.", page 181](#) .
- Install the noise insulation frame. Refer to ⇒ Body Exterior; Rep. Gr. 50 ; Removal and Installation .
- Install the charge air cooler. Refer to [⇒ "4.1 Charge Air Cooler", page 220](#) .
- Fill the engine with coolant. Refer to [⇒ page 173](#) .



5.13 Right Auxiliary Cooler

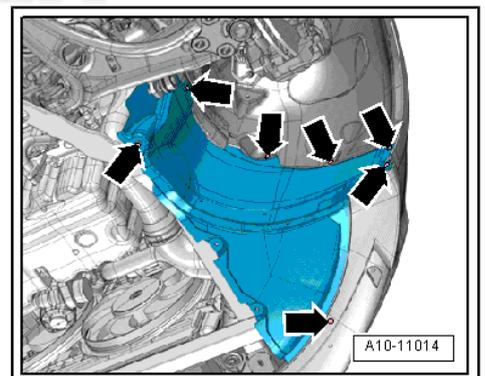
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Special tools and workshop equipment required

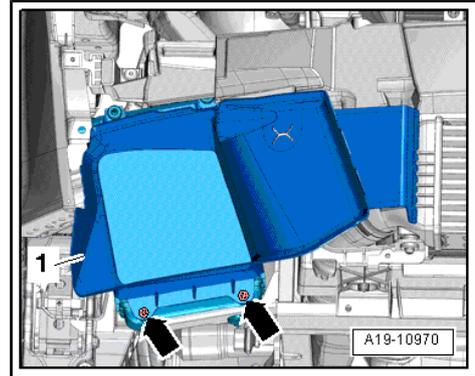
- ♦ Hose Clamps Up to 25 mm Dia. -3094-
- ♦ Hose Clip Pliers -VAS 6362-

Removing

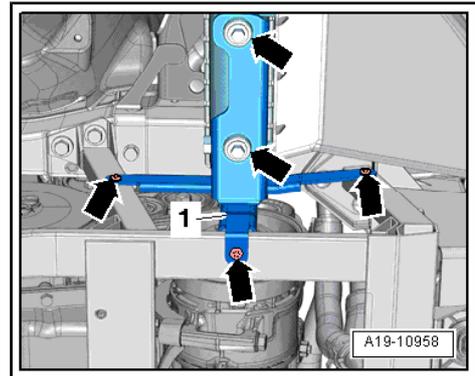
- Remove the right front underside of wheel housing liner. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Removal and Installation .
- Remove the bumper cover. Refer to ⇒ Body Exterior; Rep. Gr. 63 ; Removal and Installation .



- Remove the bolts -arrows- and remove the air guide -1- downward.



- Remove the bolts -arrows- and remove the auxiliary cooler bracket -1-.



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 **Note**

Use a cloth to catch any leaking coolant.

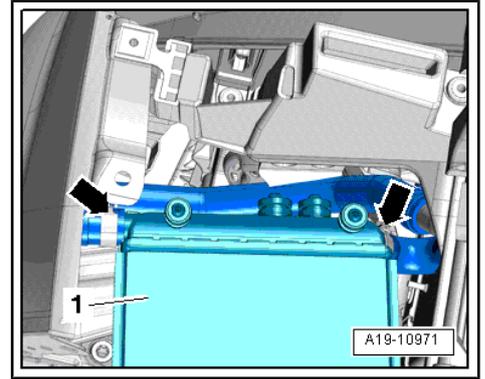
- Lower the auxiliary cooler -1- slightly.
- Disconnect and remove the coolant hoses -arrows- using the -3094- .



Caution

There is a risk of contamination.

- ◆ *There is still coolant in the auxiliary cooler.*



Installing

Install in reverse order, paying attention to the following:

- For the correct tightening specifications, refer to [⇒ "2.4 Radiator and Coolant Fan Overview", page 180](#) .

 **Note**

Secure all hose connections with hose clamps of the same type as those equipped by the factory. Refer to the Electronic Parts Catalog (ETKA).

- Install the bumper cover. Refer to ⇒ Body Exterior; Rep. Gr. 63 ; Removal and Installation .
- Install the front underside of wheel housing liner. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Removal and Installation .
- Fill the engine with coolant. Refer to [⇒ page 173](#) .

5.14 Right Coolant Pipe

Special tools and workshop equipment required

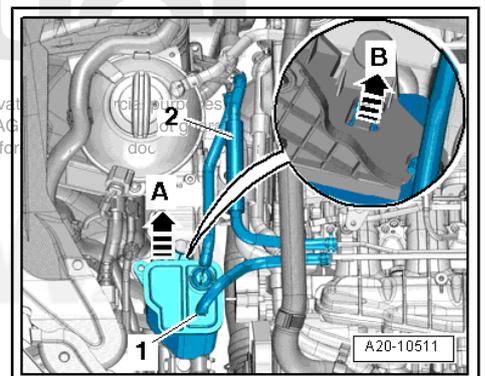
- ◆ Hose Clamps Up to 25 mm Dia. -3094-
- ◆ Hose Clip Pliers -VAS 6362-

Removing

- Release the EVAP canister -arrow B-, remove upward -arrow A- and lay it to the side along with the connected hose -1-.

 **Note**

Ignore -2-.



**Note**

Use a cloth to catch any leaking coolant.

- Disconnect the coolant hoses -1 and 3- and remove them using the -3094- .
- Remove the bolt -2- and remove the right coolant pipe.

Installing

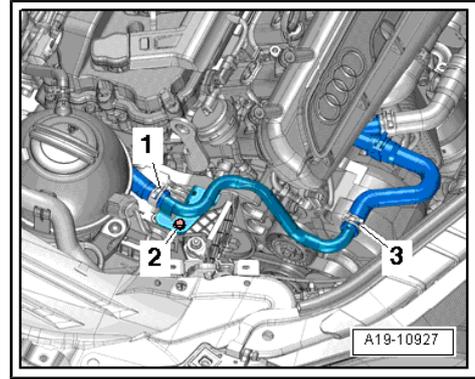
Install in reverse order, paying attention to the following:

- Tightening specification, refer to [⇒ "2.2 Coolant Pipes Overview", page 178](#) .

**Note**

Secure all hose connections with hose clamps of the same type as those equipped by the factory. Refer to the *Electronic Parts Catalog (ETKA)*.

- Check the coolant level. Refer to [⇒ page 175](#) .



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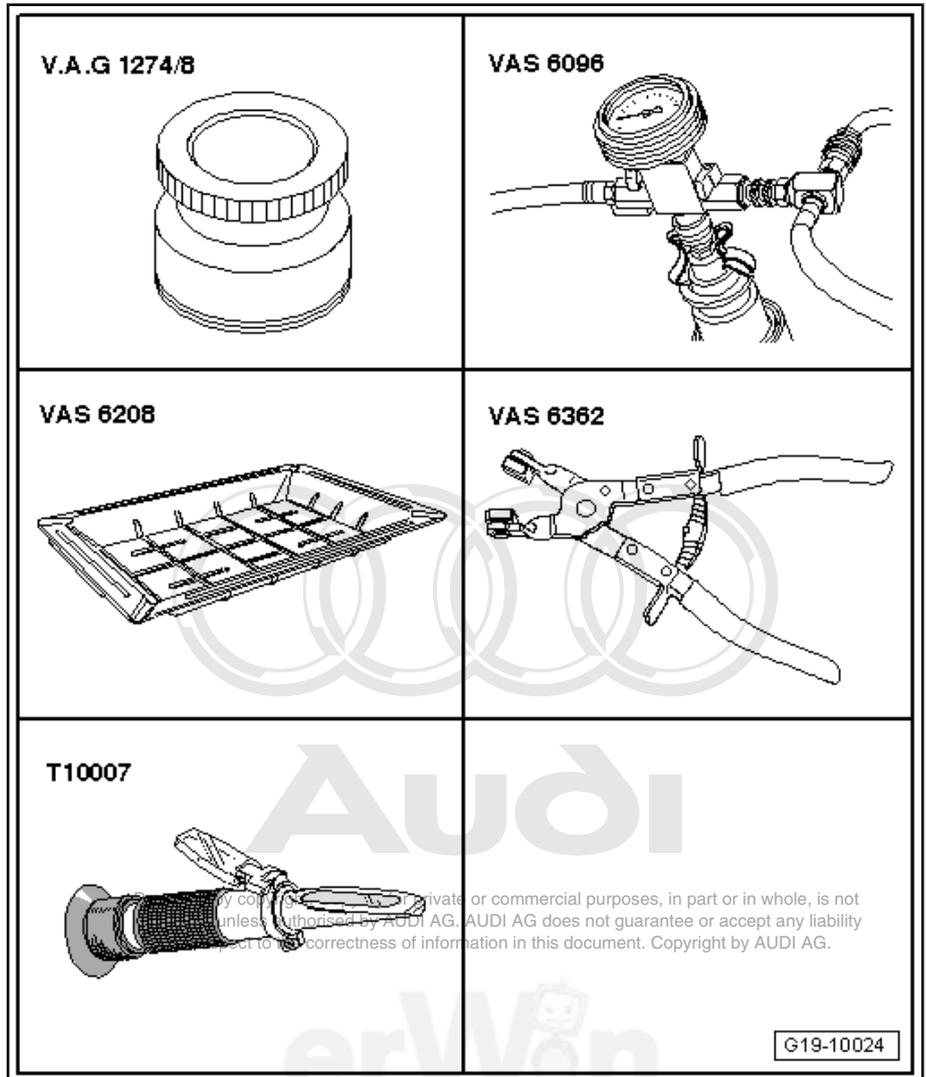
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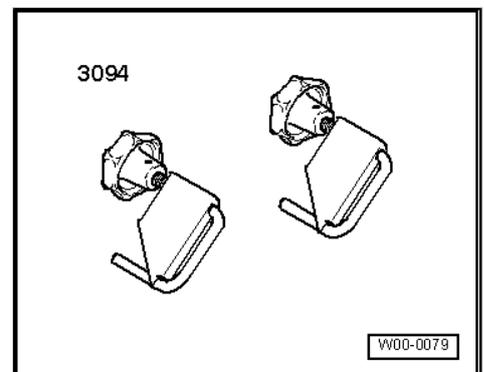
6 Special Tools

Special tools and workshop equipment required

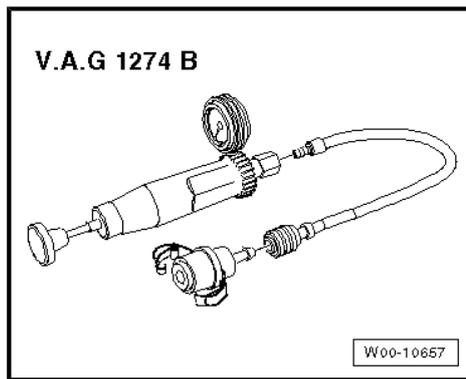
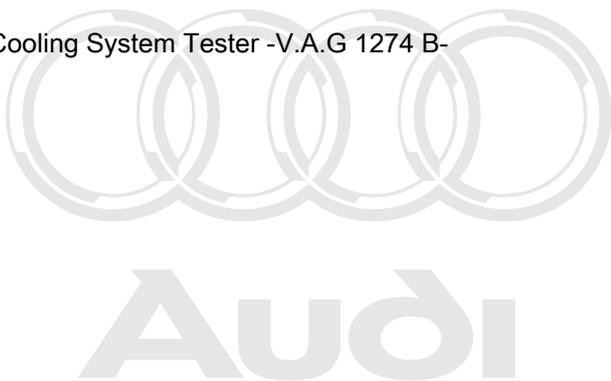
- ◆ Adapter -V.A.G 1274/8-
- ◆ Cooling System Charge Unit -VAS 6096- with Replacement Reservoir - VAS 6096/1-
- ◆ Drip Tray for VAS 6100 - VAS 6208-
- ◆ Hose Clip Pliers -VAS 6362-
- ◆ Refractometer -T10007-



- ◆ Hose Clamps Up to 25 mm Dia. -3094-

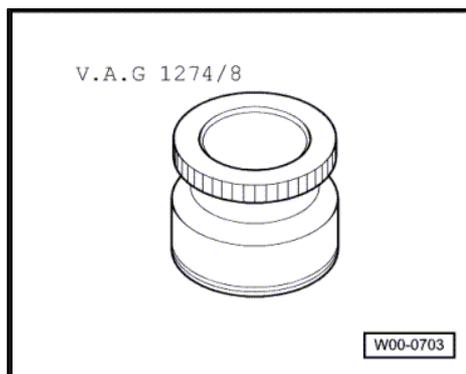


◆ Cooling System Tester -V.A.G 1274 B-



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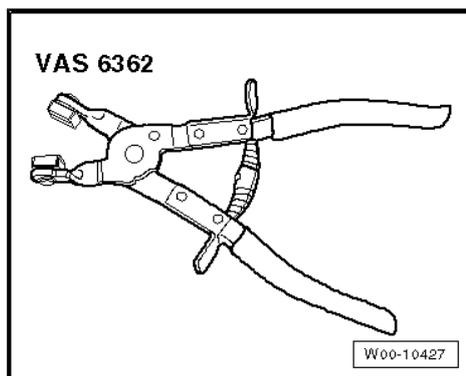
◆ Adapter -V.A.G 1274/8-



◆ Adapter -V.A.G 1274/9-



◆ Hose Clip Pliers -VAS 6362-



21 – Turbocharger, Supercharger

1 Description and Operation

⇒ [“1.1 Charge Air Cooler Overview”, page 209](#)

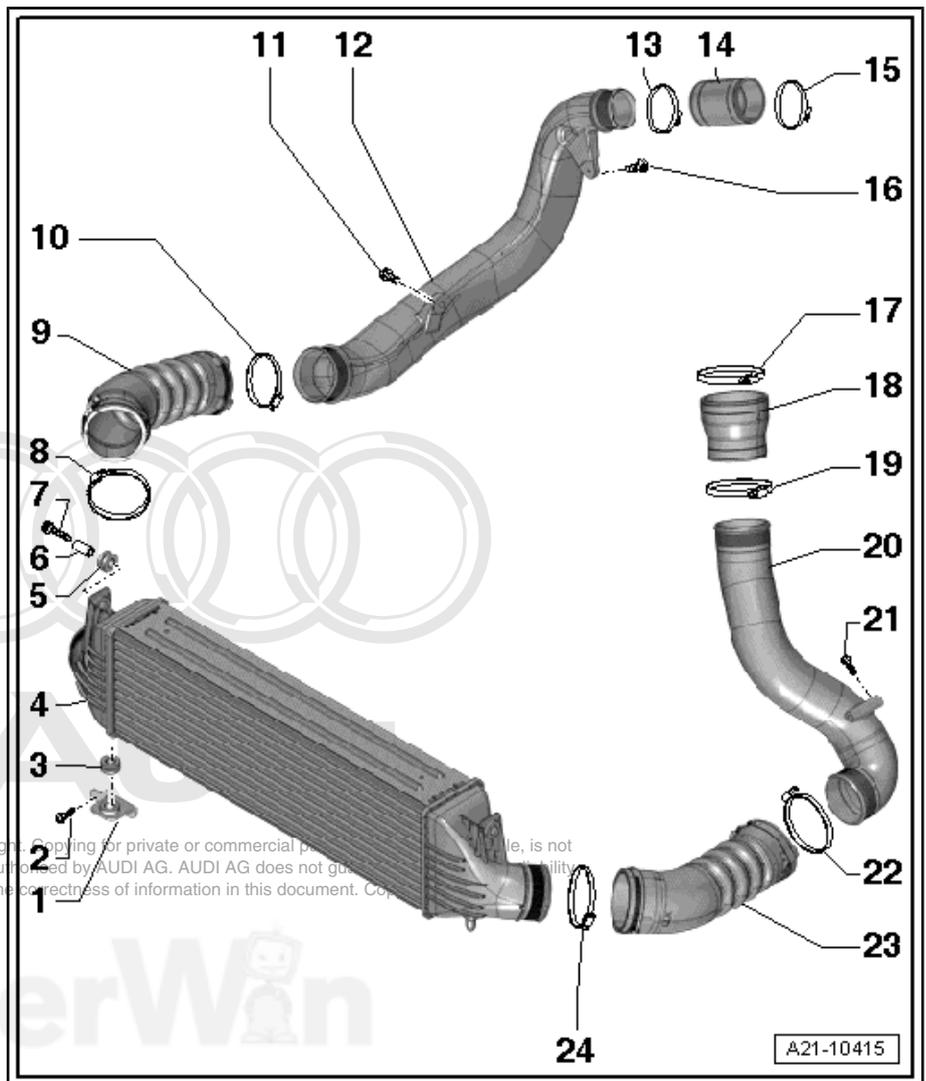
⇒ [“1.2 Turbocharger Overview”, page 211](#)

1.1 Charge Air Cooler Overview

 **Note**

- ◆ *The hose connections as well as the air guide pipes and hoses must be free of oil and grease before installing.*
- ◆ *Secure all hose connections with hose clamps of the same type as those equipped by the factory. Refer to the Electronic Parts Catalog (ETKA).*
- ◆ *To mount the charge hoses on their connectors securely, spray the bolts on the used clamps with rust remover before installing.*

- 1 - Bracket
- 2 - Bolt
 - 5 Nm
- 3 - Grommet
- 4 - Charge Air Cooler
 - Removing and installing, refer to ⇒ [“4.1 Charge Air Cooler”, page 220](#)
- 5 - Grommet
- 6 - Bushing
- 7 - Bolt
 - 5 Nm
- 8 - Hose Clamp
 - Tightening specification, refer to ⇒ [Fig. “Air Guide Hose on the Charge Air Cooler - Installed Position and Tightening Specification”, page 211](#)
- 9 - Air Guide Hose
 - Installed position, refer to ⇒ [Fig. “Air Guide Hose on the Charge Air Cooler - Installed Position and Tightening Specification”, page 211](#)
- 10 - Hose Clamp
 - Tightening specification, refer to ⇒ [Fig. “Air Guide Hose on the Charge Air Cooler - Installed Position and Tightening Specification”, page 211](#)



11 - Bolt

- 9 Nm

12 - Right Air Duct Pipe**13 - Hose Clamp**

- Tightening specification, refer to
⇒ [Fig. "Right Air Guide on the Turbocharger - Installed Position and Tightening Specification", page 211](#)

14 - Air Guide Hose

- Installed position, refer to
⇒ [Fig. "Right Air Guide on the Turbocharger - Installed Position and Tightening Specification", page 211](#)

15 - Hose Clamp

- Tightening specification, refer to
⇒ [Fig. "Right Air Guide on the Turbocharger - Installed Position and Tightening Specification", page 211](#)

16 - Bolt

- 9 Nm

17 - Hose Clamp

- Tightening specification, refer to
⇒ [Fig. "Left Air Guide on the Intake Tube - Installed Position and Tightening Specification", page 211](#)

18 - Air Guide Hose

- Installed position, refer to
⇒ [Fig. "Left Air Guide on the Intake Tube - Installed Position and Tightening Specification", page 211](#)

19 - Hose Clamp

- Tightening specification, refer to
⇒ [Fig. "Left Air Guide on the Intake Tube - Installed Position and Tightening Specification", page 211](#)

20 - Left Air Guide Pipe**21 - Bolt**

- 9 Nm

22 - Hose Clamp

- Tightening specification, refer to
⇒ [Fig. "Air Guide Hose on the Charge Air Cooler - Installed Position and Tightening Specification", page 211](#)

23 - Air Guide Hose

- Installed position, refer to
⇒ [Fig. "Air Guide Hose on the Charge Air Cooler - Installed Position and Tightening Specification", page 211](#)

24 - Hose Clamp

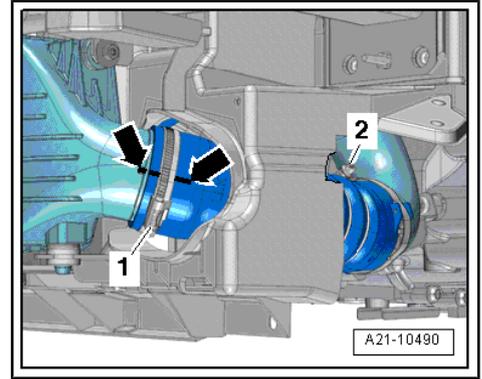
- Tightening specification, refer to
⇒ [Fig. "Air Guide Hose on the Charge Air Cooler - Installed Position and Tightening Specification", page 211](#)

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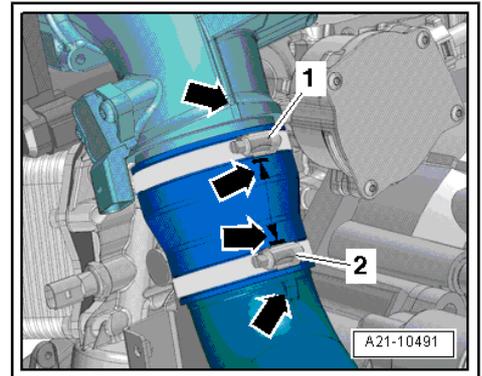
Air Guide Hose on the Charge Air Cooler - Installed Position and Tightening Specification

- The marking -arrows- must be positioned opposite each other.
- The locking bolts from the previously installed hose clamp -1 and 2- must be in the shown positions.
- Tighten hose clamps to 5.5 Nm.



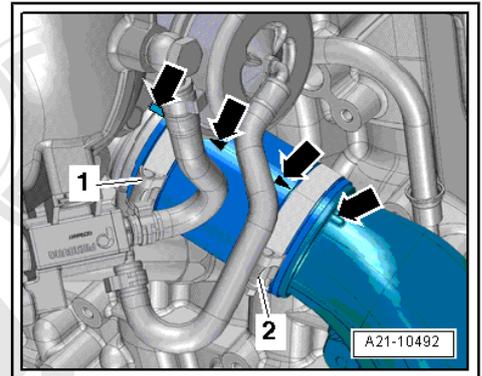
Left Air Guide on the Intake Tube - Installed Position and Tightening Specification

- The marking -arrows- must be positioned opposite each other.
- The locking bolts from the previously installed hose clamp -1 and 2- must be in the shown positions.
- Tighten hose clamps to 5.5 Nm.



Right Air Guide on the Turbocharger - Installed Position and Tightening Specification

- The marking -arrows- must be positioned opposite each other.
- The locking bolts from the previously installed hose clamp -1 and 2- must be in the shown positions.
- Tighten hose clamps to 5.5 Nm.



1.2 Turbocharger Overview

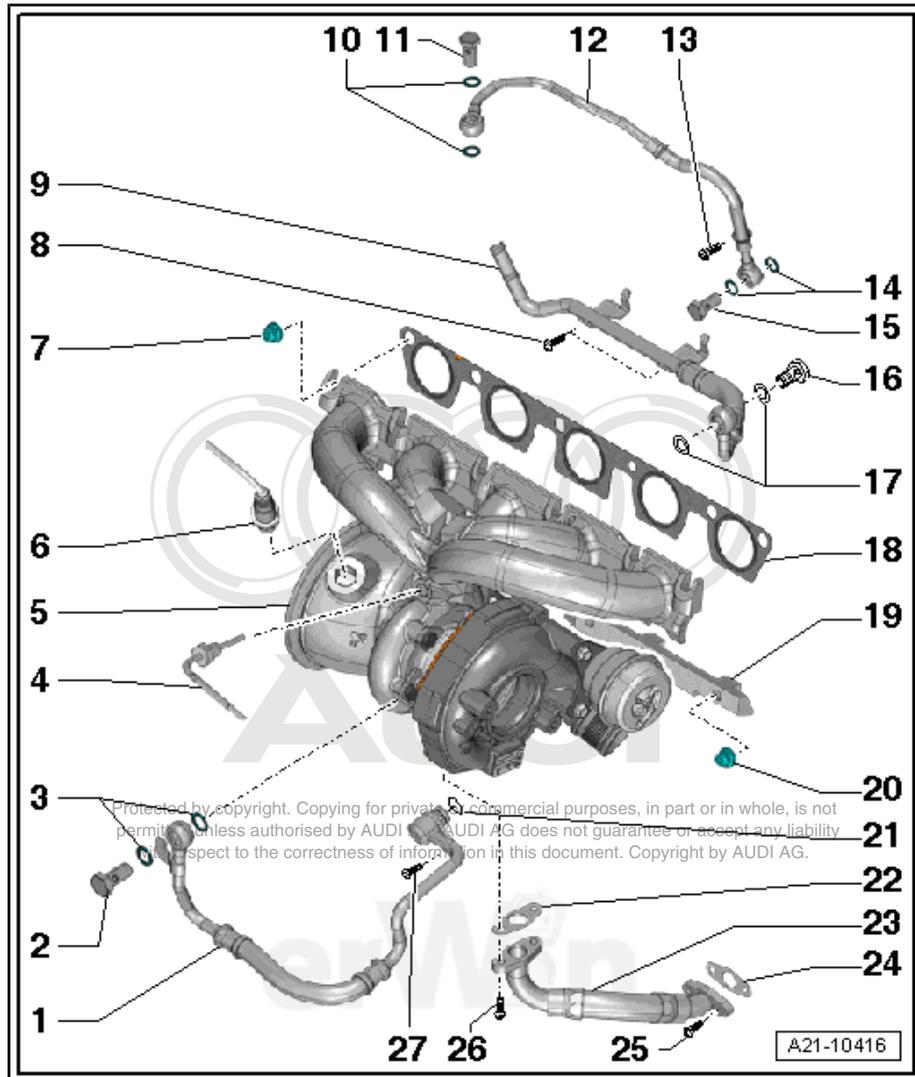
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Note

- ◆ *Follow the guidelines for cleanliness. Refer to ⇒ "1.1 Clean Working Conditions", page 1 .*
- ◆ *Before testing or performing a repair, check all air guide pipes and hoses and all vacuum lines for leaks and secure seating.*

Part 1

- 1 - Coolant Supply Pipe**
- 2 - Banjo Bolt**
 - 37.5 Nm
- 3 - Seals**
 - Replace
- 4 - Exhaust Gas Temperature (EGT) Sensor 1 -G235-**
 - Removing and installing, refer to [⇒ "5.2 Exhaust Gas Temperature \(EGT\) Sensor 1 G235", page 237](#)
- 5 - Turbocharger**
 - One unit with the exhaust manifold
 - Removing and installing, refer to [⇒ "4.4 Turbocharger", page 222](#)
- 6 - Heated Oxygen Sensor (HO2S) -G39- with Oxygen Sensor (O2S) Heater -Z19-**
 - Removing and installing, refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation
- 7 - Nut**
 - Tightening specification and sequence, refer to [⇒ Fig. "Turbocharger - Tightening Specification and Sequence", page 213](#)



- 8 - Bolt**
 - 9 Nm
- 9 - Coolant Return Pipe**
- 10 - Seals**
 - Replace
- 11 - Banjo Bolt**
 - 37.5 Nm
- 12 - Oil Supply Pipe**
- 13 - Bolt**
 - 9 Nm
- 14 - Seals**
 - Replace
- 15 - Banjo Bolt**
 - 37.5 Nm
- 16 - Banjo Bolt**
 - 37.5 Nm

17 - Seals

- Replace

18 - Gasket

- Replace

19 - Securing Strip

- Stays installed when removing turbocharger

20 - Nut

- 30 Nm
- Replace
- Tighten the center nut for the securing strip first

21 - O-ring

- Replace

22 - Gasket

- Replace

23 - Oil Return Pipe

24 - Gasket

- Replace

25 - Bolt

- 9 Nm

26 - Bolt

- 9 Nm

27 - Bolt

- 9 Nm

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Turbocharger - Tightening Specification and Sequence



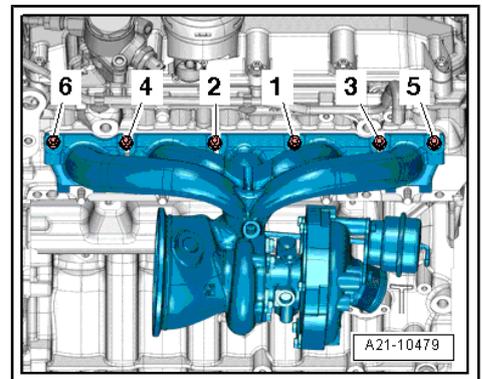
Note

Replace the nuts for the turbocharger.

– Tighten the bolts in 4 steps in the sequence shown:

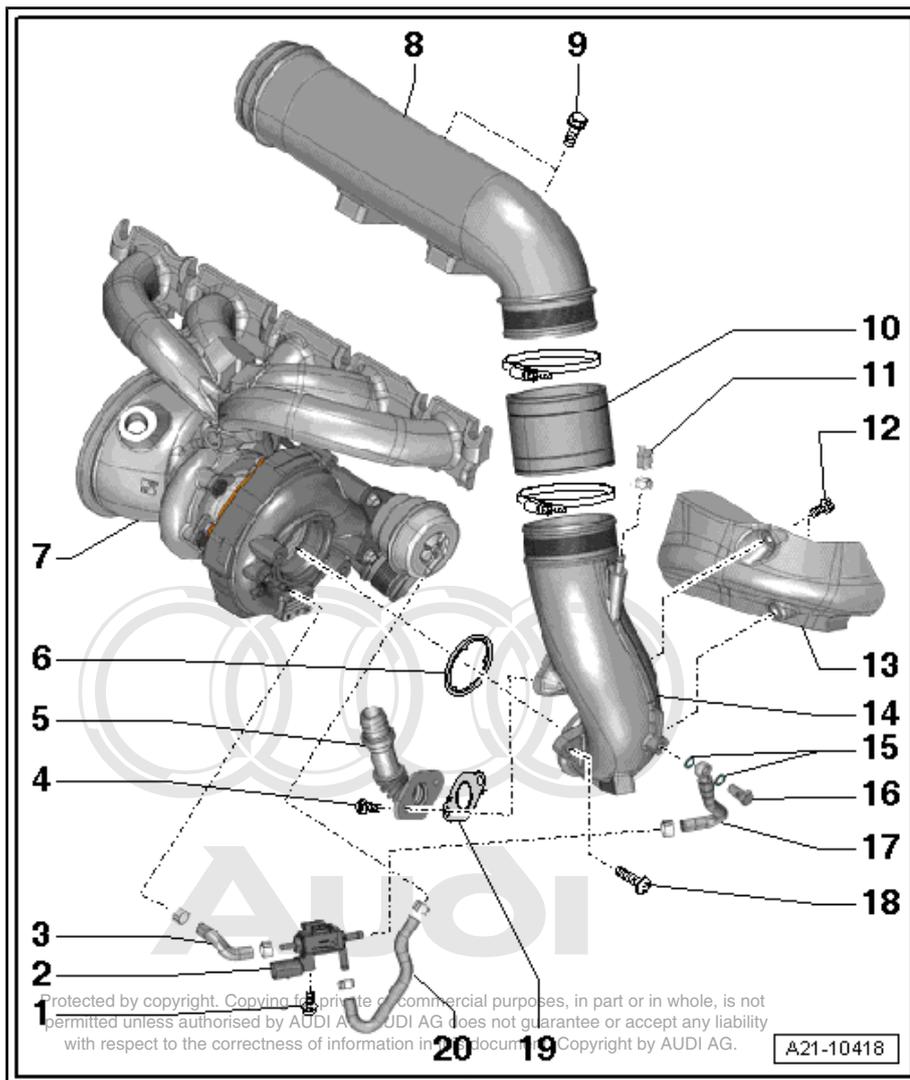
Stage	Bolts	Tightening Specifications
1.	-1 through 6-	15 Nm
2.	-1 through 6-	33 Nm
3.	-1 through 6-	33 Nm ¹⁾
4.	-1 through 6-	33 Nm ¹⁾

• ¹⁾ If kept constant, all of the bolts will remain tightened to 33 Nm after the seal for the turbocharger is installed.



Part 2

- 1 - Bolt**
 4 Nm
- 2 - Wastegate Bypass Regulator Valve -N75-**
- 3 - Hose**
- 4 - Bolt**
 9 Nm
- 5 - Connecting Piece**
 For crankcase ventilation
- 6 - Gasket**
 Replace
 Clip onto the air guide pipe
- 7 - Turbocharger**
 One unit with the exhaust manifold
 Removing and installing, refer to ["4.4 Turbocharger", page 222](#)
- 8 - Air Guide Pipe**
- 9 - Bolt**
 9 Nm
- 10 - Air Guide Hose**
- 11 - Hose**
- 12 - Bolt**
 9 Nm
- 13 - Heat Shield**
- 14 - Air Guide Pipe**
- 15 - Seals**
 Replace
- 16 - Banjo Bolt**
 15.5 Nm
- 17 - Hose**
- 18 - Bolt**
 9 Nm
- 19 - Gasket**
 Replace
 Clip onto the connection
- 20 - Hose**



Part 3

1 - O-ring

- Replace

2 - Throttle Valve Control Module -J338-

- Removing and installing, refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation

3 - Intake Tube

- Removing and installing, refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation

4 - Bolt

- Tightening specification, refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Specification

5 - Turbocharger Recirculating Valve -N249-

- Removing and installing, refer to ⇒ ["4.3 Turbocharger Recirculating Valve N249", page 222](#)

6 - Bolt

- 9 Nm

7 - O-ring

- Replace

8 - O-ring

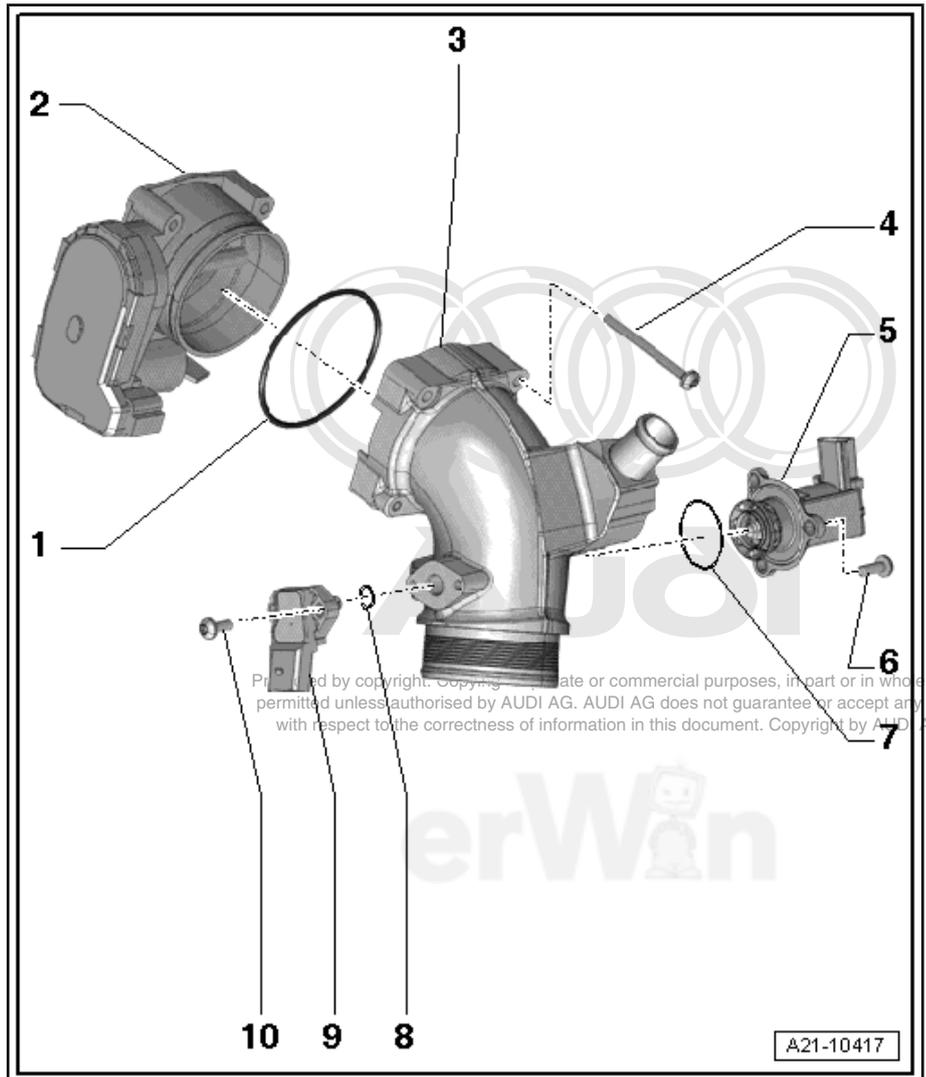
- Replace

9 - Charge Air Pressure Sensor -G31- / Intake Air Temperature Sensor 2 -G299-

- Removing and installing, refer to ⇒ ["4.2 Charge Air Pressure Sensor G31 / and Intake Air Temperature \(IAT\) Sensor 2 G299", page 221](#)

10 - Bolt

- 9 Nm



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2 Specifications

⇒ "2.1 Fastener Tightening Specifications", page 216

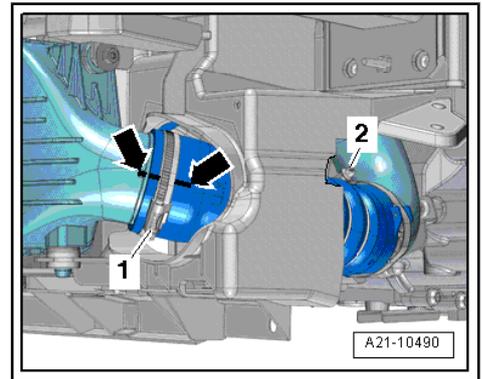
2.1 Fastener Tightening Specifications

Components	Fastener Size	Nm
Air Guide Pipe	-	9
Bracket for Charge Air Cooler	-	5
Charge Air Pressure Sensor -G31- / Intake Air Temperature Sensor 2 - G299-	-	9
Connecting Piece For crankcase ventilation	-	9
Coolant Return Pipe ²	-	
-Banjo Bolt	-	37.5
-Bolt	-	9
Coolant Supply Pipe ¹	-	
-Banjo Bolt	-	37.5
-Bolt	-	9
Hose to Air Guide Pipe, Banjo Bolt	-	15.5
Left Air Guide Pipe	-	9
Oil Return Pipe	-	9
Oil Supply Pipe ³	-	
-Banjo Bolt	-	37.5
-Bolt	-	9
Right Air Duct Pipe	-	9
Securing strip ⁴	-	30
Turbocharger Recirculating Valve	-	9
Wastegate Bypass Regulator Valve	-	4
<ul style="list-style-type: none"> • ¹ For bolt tightening clarification, refer to ⇒ "1.2 Turbocharger Overview", page 211 Part I and see items -2 and 27- • ² For bolt tightening clarification, refer to ⇒ "1.2 Turbocharger Overview", page 211 Part I and see items -9 and 16- • ³ For bolt tightening clarification, refer to ⇒ "1.2 Turbocharger Overview", page 211 Part I and see items -11, 13 and 15- • ⁴ Replace 		

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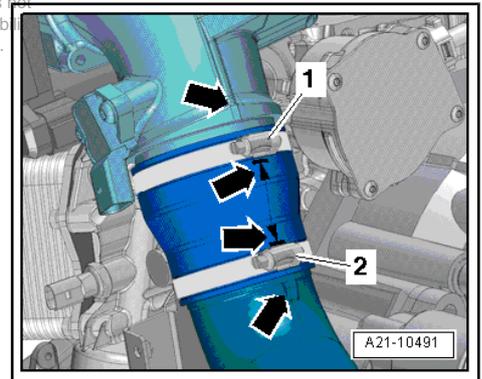
Air Guide Hose on the Charge Air Cooler - Installed Position and Tightening Specification

- The marking -arrows- must be positioned opposite each other.
- The locking bolts from the previously installed hose clamp -1 and 2- must be in the shown positions.
- Tighten hose clamps to 5.5 Nm.



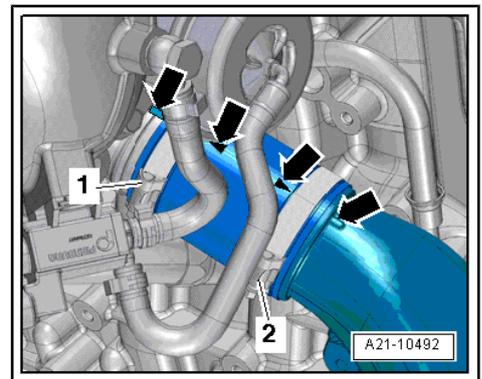
Left Air Guide on the Intake Tube - Installed Position and Tightening Specification

- The marking -arrows- must be positioned opposite each other.
- The locking bolts from the previously installed hose clamp -1 and 2- must be in the shown positions.
- Tighten hose clamps to 5.5 Nm.



Right Air Guide on the Turbocharger - Installed Position and Tightening Specification

- The marking -arrows- must be positioned opposite each other.
- The locking bolts from the previously installed hose clamp -1 and 2- must be in the shown positions.
- Tighten hose clamps to 5.5 Nm.



Turbocharger - Tightening Specification and Sequence

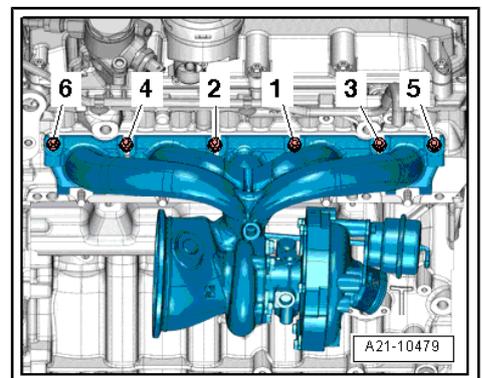
 **Note**

Replace the nuts for the turbocharger.

- Tighten the bolts in 4 steps in the sequence shown:

Stage	Bolts	Tightening Specifications
1.	-1 through 6-	15 Nm
2.	-1 through 6-	33 Nm
3.	-1 through 6-	33 Nm ¹⁾
4.	-1 through 6-	33 Nm ¹⁾

- ¹⁾ If kept constant, all of the bolts will remain tightened to 33 Nm after the seal for the turbocharger is installed.



3 Diagnosis and Testing

⇒ "3.1 Charge Air System, Checking for Leaks", page 218

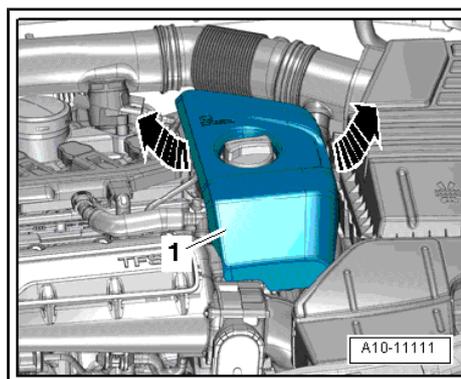
3.1 Charge Air System, Checking for Leaks

Special tools and workshop equipment required

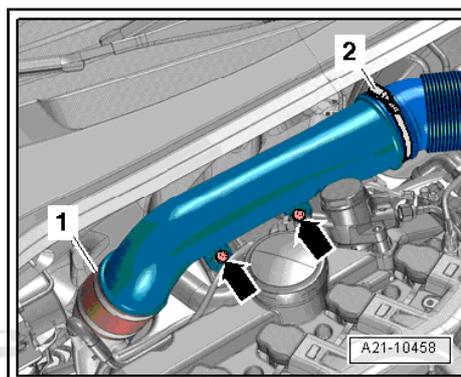
- ◆ Testing Unit for Turbocharger -V.A.G 1687-
- ◆ Adapter -V.A.G 1687/12-

Procedure

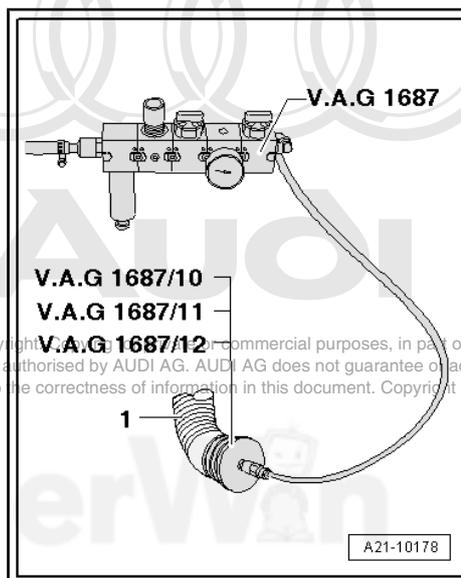
- Remove the engine cover -1- upward -arrows-.



- Remove the bolts -arrows-.
- Open the clamps -1 and 2- and remove the air guide pipe.



- Install the -1687/12- into the air guide hose -1- and secure it with a clamp.
- Connect the -V.A.G 1687- to the adapter.



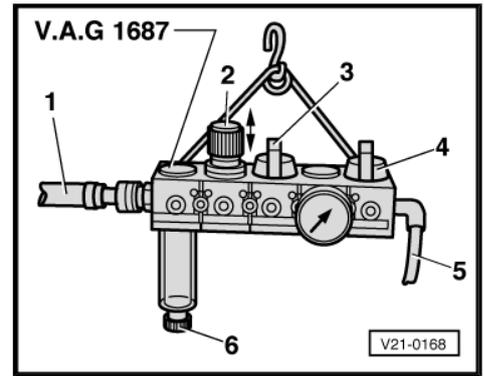
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Prepare the -V.A.G 1687- as follows:

- Remove the pressure regulator valve -2- and close valves -3 and 4-.
- The rotary knob must face upward so the pressure control valve -2- can be turned.
- Connect the -V.A.G 1687- to compressed air -1- with a commercially available adapter piece.

i Note

If there is water in the viewing glass, drain it through the drain plug -6-.



- Open the valve -3-.

! Caution

Damage could result if the pressure is set too high.

◆ *Pressure must not exceed 0.2 bar!*

- Set the pressure to 0.2 bar using the pressure control valve -2-.
- Open the valve -4- and wait until the test circuit is filled. Regulate the pressure to 0.2 bar again if necessary.
- Listen, feel and use commercially available leak detection spray or the ultrasonic tester -V.A.G 1842- to check the charge air system for leaks.

i Note

- ◆ *A small quantity of air dissipates via valves in engine. A pressure retention test is not possible for this reason.*
- ◆ *For information on using the -V.A.G 1842- , refer to the operating instructions.*
- ◆ *Release the pressure in the test circuit by pulling off the hose coupling before removing the adapter.*

Assembling

Assemble in reverse order of disassembling. Note the following:

i Note

- ◆ *The hose connections as well as the air guide pipes and hoses must be free of oil and grease before installing.*
- ◆ *Secure all hose connections with hose clamps of the same type as those equipped by the factory. Refer to the Electronic Parts Catalog (ETKA).*
- ◆ *In order to be able to securely mount the air guide hoses on their connectors, spray the screws on the previously used clamps with a rust remover.*

- Install the air guide pipe. Refer to [⇒ "1.1 Charge Air Cooler Overview", page 209](#) .

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4 Removal and Installation

⇒ "4.1 Charge Air Cooler", page 220

⇒ "4.2 Charge Air Pressure Sensor G31 / and Intake Air Temperature (IAT) Sensor 2 G299 ", page 221

⇒ "4.3 Turbocharger Recirculating Valve N249 ", page 222

⇒ "4.4 Turbocharger", page 222

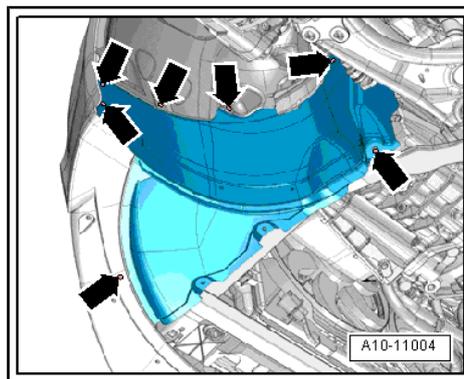
4.1 Charge Air Cooler

Special tools and workshop equipment required

- ◆ Hose Clip Pliers -VAS 6362-

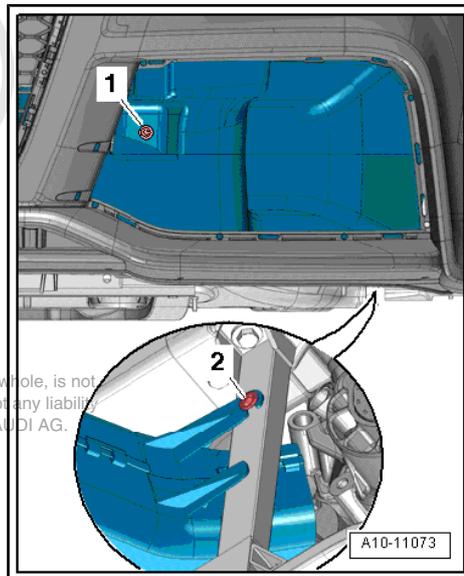
Removing

- Remove front bumper cover. Refer to ⇒ Body Exterior; Rep. Gr. 63 ; Removal and Installation .
- Remove left and right lower wheel housing liners. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Removal and Installation .



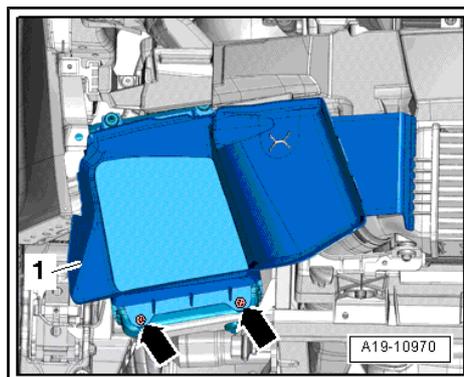
Vehicles with a Manual Transmission:

- Remove the bolts-1 and 2- and remove the air ducts.



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- Remove the bolts -arrows- and remove the air guide -1- downward.



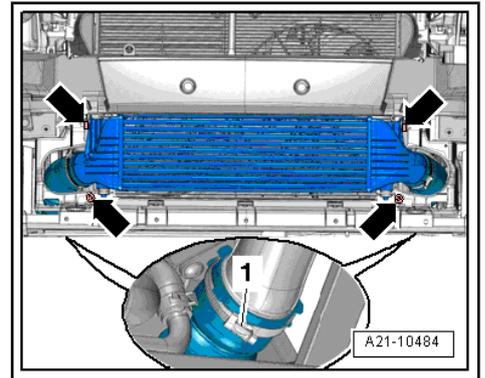
- Remove air guide hose in order to loosen the left and right hose clamps -1-.
- Remove the bolts -arrows- and remove charge air cooler.

Installing

Install in reverse order, paying attention to the following:

Tightening specifications:

- ⇒ [“1.1 Charge Air Cooler Overview”, page 209](#)
- ⇒ [“2.4 Radiator and Coolant Fan Overview”, page 180](#)



Note

- ◆ *If there are small impressions on the fins. Refer to ⇒ [“1.3 Coolers, Condensers and Charge Air Coolers”, page 2](#).*
- ◆ *Hose connections and charge air system hoses must be free of oil and grease before installing.*
- ◆ *Secure all hose connections with hose clamps of the same type as those equipped by the factory. Refer to the Electronic Parts Catalog (ETKA).*
- ◆ *To mount the charge hoses on their connectors securely, spray the bolts on the used clamps with rust remover before installing.*

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- Install the front underside of wheel housing liner. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Removal and Installation .
- Install front bumper. Refer to ⇒ Body Exterior; Rep. Gr. 63 ; Removal and Installation .

4.2 Charge Air Pressure Sensor -G31- / and Intake Air Temperature (IAT) Sensor 2 - G299-

Removing

- Disconnect the connector -3-.
- Remove the bolts -1-, then remove the charge air pressure sensor / IAT sensor 2 .

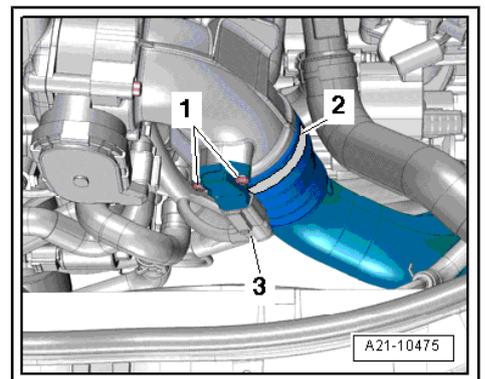
Note

Ignore -2-.

Installing

Install in reverse order, paying attention to the following:

- Tightening specification; refer to ⇒ [“1.2 Turbocharger Overview”, page 211](#) .



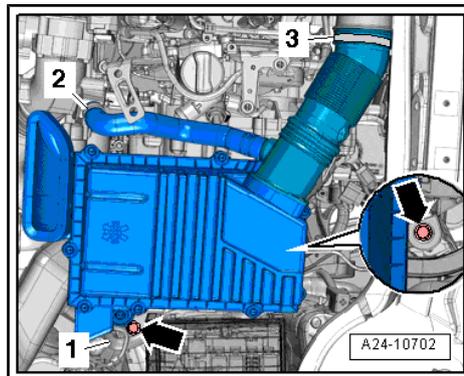
Note

Replace the O-ring.

4.3 Turbocharger Recirculating Valve - N249-

Removing

- Remove the air filter housing. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .



- Disconnect the connector -2-.
- Remove the bolts -1- and the turbocharger recirculating valve.

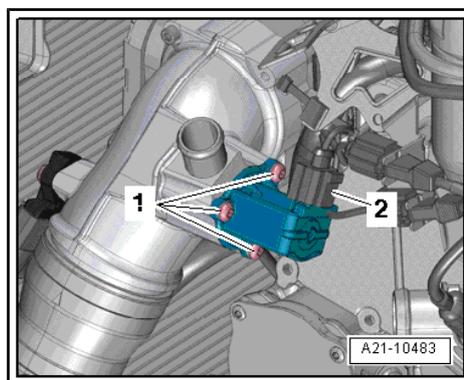
Installing

Install in reverse order, paying attention to the following:

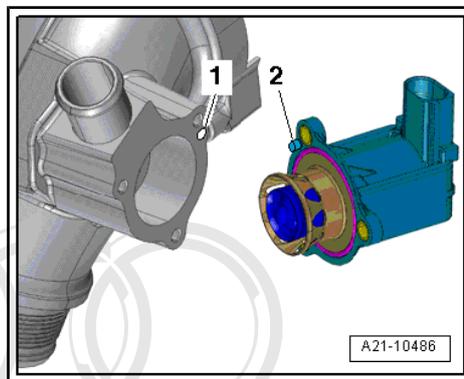
- Tightening specification, refer to ⇒ ["1.2 Turbocharger Overview", page 211](#) .

Note

Replace the O-ring.



- Installed position: The tab -2- on the turbocharger recirculation valve must be installed in the opening -1- on the intake tube.
- Install the air filter housing. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .



4.4 Turbocharger

Special tools and workshop equipment required

- ◆ Engine Bung Set -VAS 6122-
- ◆ Hose Clip Pliers -VAS 6362-

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Removing

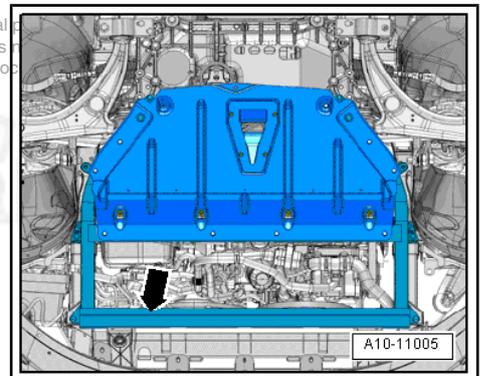


Caution

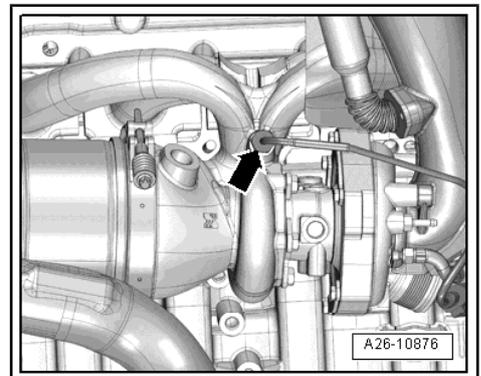
If mechanical damage (such as a destroyed compression wheel) is found on the turbocharger, just replacing the turbocharger is not enough. To avoid damage later, perform the following steps:

- ◆ *Check the air filter housing, air filter element and air guide hoses for contamination.*
- ◆ *Check the entire charge air circuit and charge air cooler for foreign objects.*
- ◆ *Clean the charge air circuit if foreign objects are found in the charge air system. Replace the charge air cooler if necessary.*

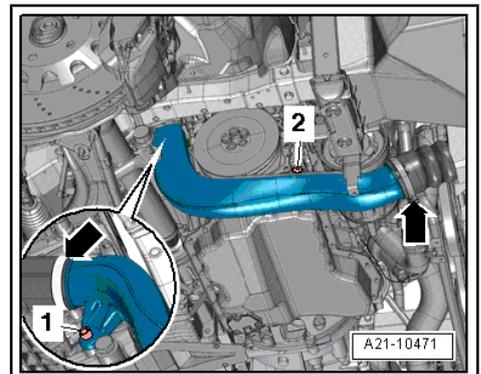
- Drain the coolant. Refer to ⇒ ["1.1 Coolant, Draining and Filling", page 171](#).
- Remove the noise insulation frame -arrow- with the rear noise insulation. Refer to ⇒ [Body Exterior; Rep. Gr. 50; Removal and Installation](#).



- Remove the temperature sensor for exhaust gas temperature sensor 1 -G235- -arrow-.
- Remove the Heated Oxygen Sensor (HO2S) -G39- . Refer to ⇒ [Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation](#) .
- Remove the high pressure pump. Refer to ⇒ [Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation](#) .



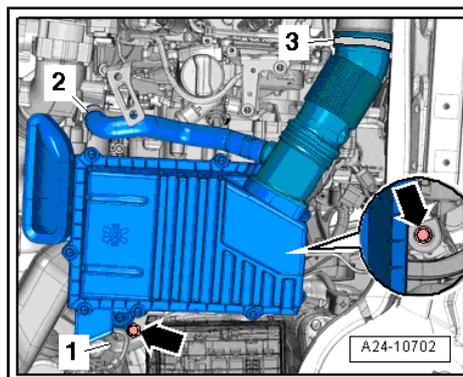
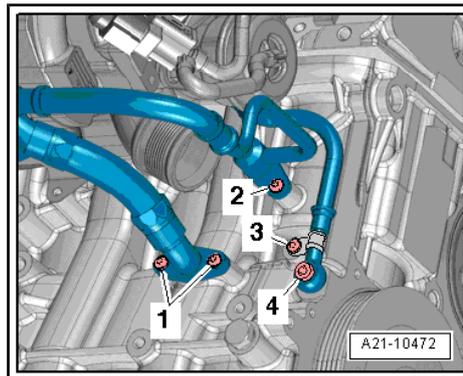
- Remove the bolts -1 and 2-.
- Remove the air guide pipe, to do this, loosen the hose clamps -arrows-.



 **Note**

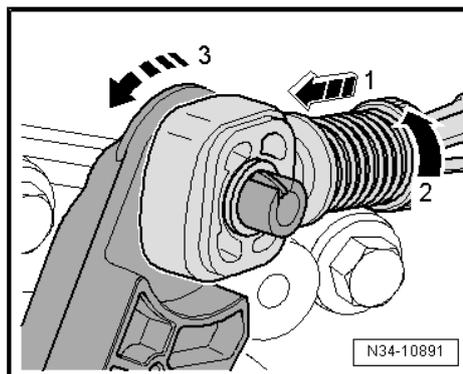
Lay a cloth below to catch escaping coolant and engine oil.

- Remove bolts -1, 2, 3- and banjo bolt -4- and remove wires from the cylinder block.
- Seal off the openings on the turbocharger and on the charge air pipe -VAS 6122- .
- Remove the air filter housing. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .

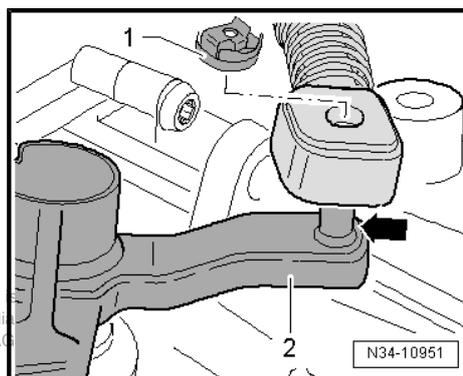


Vehicles with a Manual Transmission:

- Pull the safety mechanism all the way to the front -arrow 1- and then lock it to the left -arrow 2-.
- Push the shift relay lever forward -arrow 3- and remove the selector cable from the retainer.



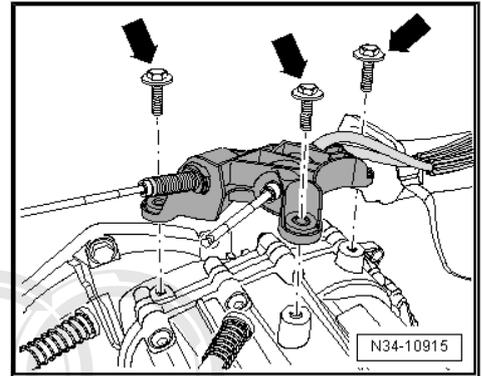
- Remove the lock washer -1- for the shift cable from the transmission selector lever -2- and remove the shift cable from the pin -arrow-.



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- Remove the bolts -arrows-, then remove the cable bracket from the transmission and tie it up to the left.

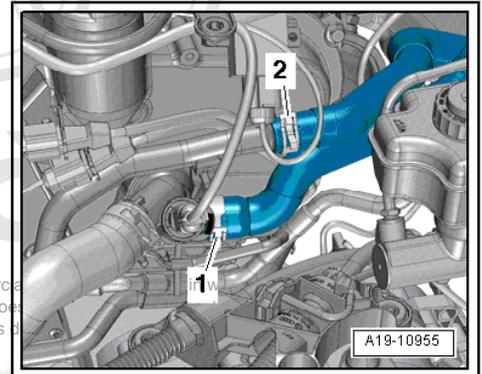


- Loosen the clamp -1- and remove the coolant hose.

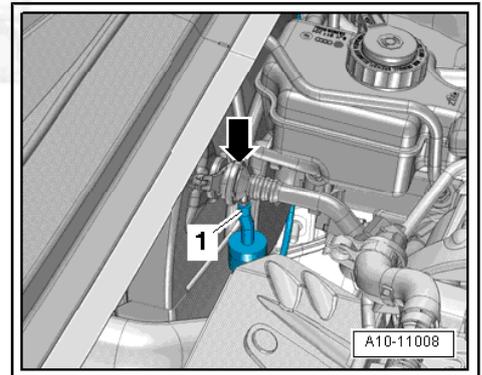
 **Note**

Ignore -2-.

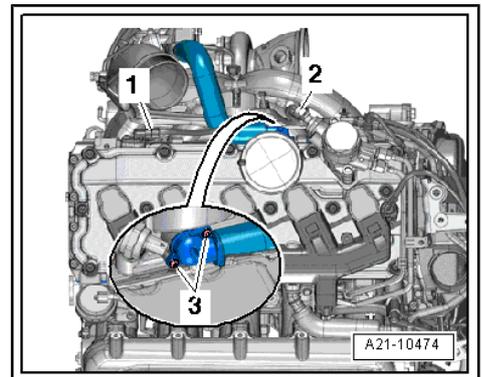
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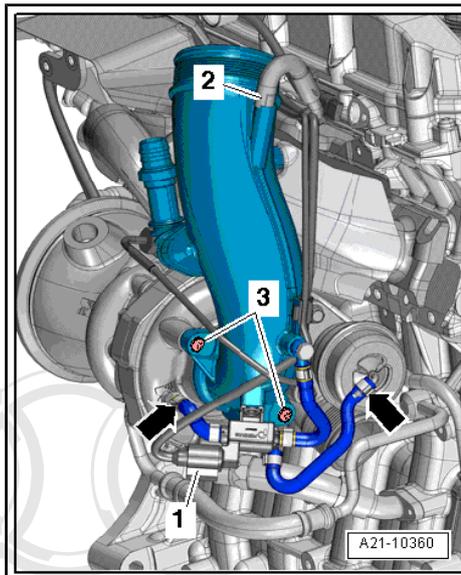
- Remove the vacuum hose -1- from the non-return valve -arrow-.
- Remove the check valve from the brake booster.



- Disconnect the connectors -1 and 2-.
- Remove the bolts -3- and remove the supports from the cylinder head cover.

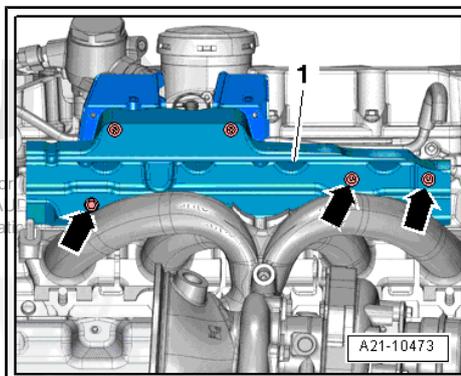


- Disconnect the connector -1- on the wastegate bypass regulator valve -N75- and free up the wire.
- Remove hose and loosen the hose clamp -arrows- and -2-.
- Remove bolts -3- and lay the intake tube toward the rear.



- Free up the wiring harness on the heat shield -1-.
- Remove bolts -arrows- and then remove the heat shield.
- Remove the intake tube.

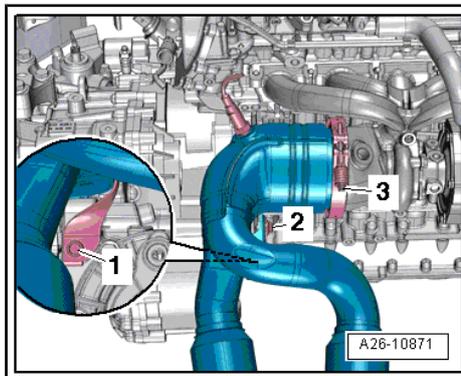
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- Loosen the bolt -3- and slide the clamp onto the primary catalytic converter.
- Remove the bolt -2- and tie up the primary catalytic converter toward the rear.

 **Note**

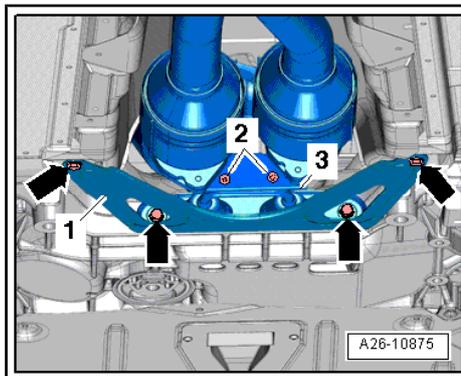
Ignore -1-.



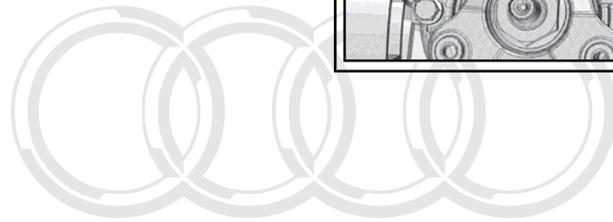
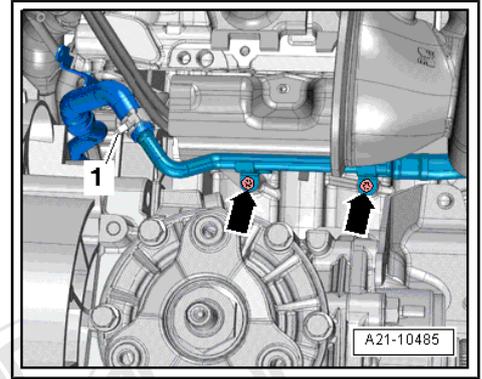
- Remove the bolts -arrows- and the cross brace -1-.

 **Note**

Ignore -2 and 3-.



- Remove the bolts -arrows-.
- Loosen the clamp -1- and remove the coolant hose.
- Remove cylinder head cover. Refer to [⇒ "4.4 Cylinder Head Cover", page 108](#).



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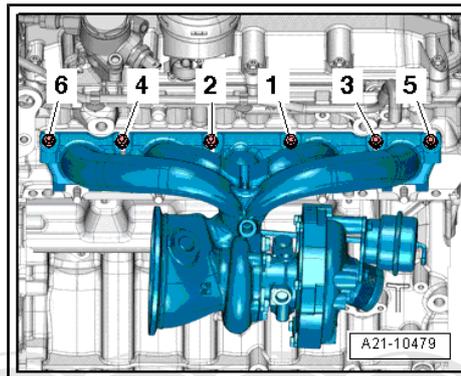
- Remove the nuts in sequence -6 to 1- and then remove the turbocharger.
- Seal any open lines and connections with a clean plug from the -VAS 6122- .

Installing

Install in reverse order, paying attention to the following:

Tightening specifications:

- ⇒ ["1.2 Turbocharger Overview", page 211](#)
- ⇒ ["1.1 Charge Air Cooler Overview", page 209](#)
- ⇒ ["1.2 Cylinder Head Cover and Cylinder Head Overview", page 80](#)



Note

- ◆ *Replace the seals and O-rings.*
- ◆ *Fill the turbocharger with engine oil at the oil supply line connection.*
- ◆ *The hose connections as well as the air guide pipes and hoses must be free of oil and grease before installing.*
- ◆ *Secure all hose connections with hose clamps of the same type as those equipped by the factory. Refer to the Electronic Parts Catalog (ETKA).*
- ◆ *To ensure the turbocharger is supplied with enough oil, let the engine run at idle for approximately 1 minute after installing the turbocharger. Do not increase the engine speed during this time.*

- Install cylinder head cover. Refer to ["4.4 Cylinder Head Cover", page 108](#) .
- Install heated oxygen sensor and high pressure pump. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .
- Install the exhaust gas temperature sensor 1 -G235- . Refer to ["5.2 Exhaust Gas Temperature \(EGT\) Sensor 1 G235 ", page 237](#) .
- Install the air guide pipes. Refer to ["1.1 Charge Air Cooler Overview", page 209](#) .
- Selector mechanism, installing and adjusting. Refer to ⇒ Manual Transmission; Rep. Gr. 34 ; Removal and Installation .
- Install the air filter housing. Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation .
- Check oil level. Refer to the Maintenance Procedures Rep. Gr. 03
- Install the noise insulation frame. Refer to ⇒ Body Exterior; Rep. Gr. 50 ; Removal and Installation .
- Fill the engine with coolant. Refer to [page 173](#) .

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 **Note**

If the turbocharger is replaced, it must be guaranteed that the auxiliary engine coolant pump relay -J496- , after-run coolant pump -V51- and cooling circuit solenoid valve -N492- are functioning properly. The after-run coolant pump is contained in the fault finding programs for the auxiliary engine coolant pump relay, there is a separate fault finding programs for the cooling circuit solenoid valve.



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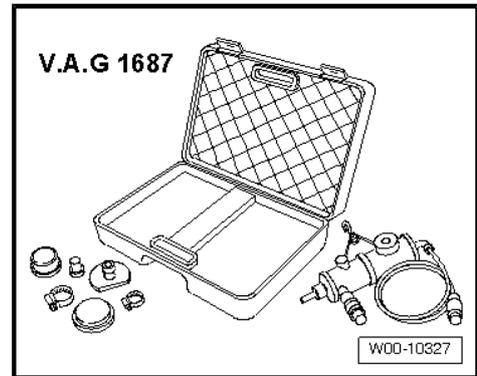
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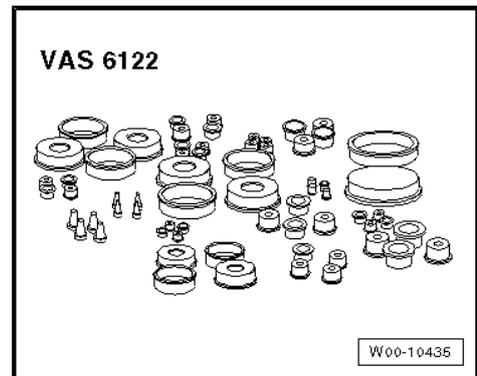
5 Special Tools

Special tools and workshop equipment required

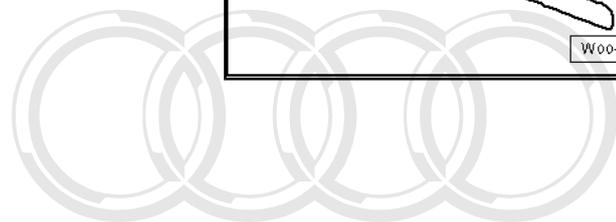
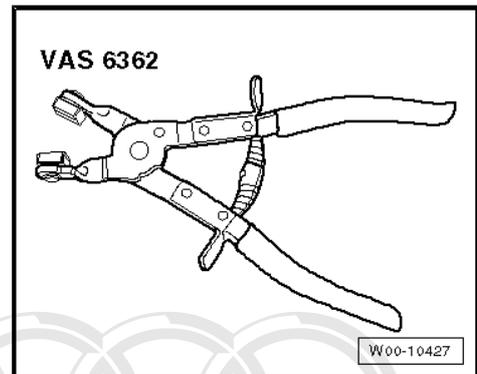
- ◆ Testing Unit for Turbocharger -V.A.G 1687-



- ◆ Adapter -V.A.G 1687/12-
- ◆ Engine Bung Set -VAS 6122-



- ◆ Hose Clip Pliers -VAS 6362-



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26 – Exhaust System, Emission Controls

1 General Information

⇒ [“1.1 Exhaust Manifold”, page 231](#)

1.1 Exhaust Manifold

The exhaust manifold and turbocharger are one unit. Removing and Installing, refer to ⇒ [“4.4 Turbocharger”, page 222](#) .



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2 Description and Operation

⇒ ["2.1 Muffler Overview", page 232](#)

⇒ ["2.2 Exhaust Temperature Control Overview", page 234](#)

2.1 Muffler Overview

1 - Retaining Loop

- Replace if damaged

2 - Center Muffler

- Unit with rear muffler
- Install exhaust system free of stress, refer to ⇒ ["5.3 Exhaust System, Installing", page 238](#)

3 - Nut

- 20 Nm

4 - Retaining Loop

- Replace if damaged

5 - Bracket for Exhaust System

6 - Bolt

- 25 Nm

7 - Bracket for Exhaust System

8 - Bolt

- 23 Nm

9 - Suspended Mount

10 - Bolt

- 23 Nm

11 - Transverse Beam

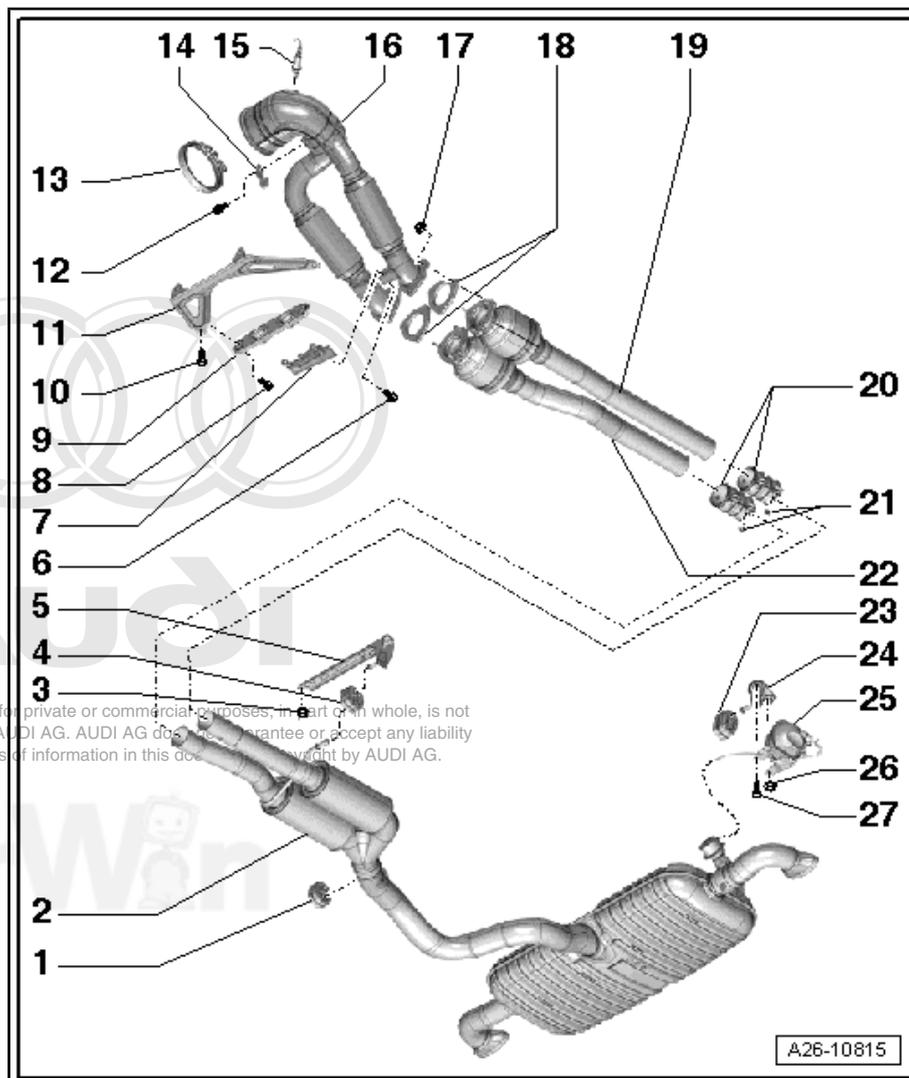
12 - Bolt

- 23 Nm

13 - Clip

- 7 Nm

14 - Bracket



15 - Oxygen Sensor (O2S) after Three Way Catalytic Converter (TWC) -G130- with Heater for Oxygen Sensor (O2S) 1 after Catalytic Converter -Z29-

- Removing and installing, refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation

16 - Primary Catalytic Converter

- With decoupling element, decoupling element must not be bent more than 10° – otherwise it may be damaged
- Do not load decoupling element on cable
- Do not damage wire mesh at decoupling element
- Protect primary catalytic converter from shocks and impact stress
- Removing and installing, refer to ⇒ ["5.4 Primary Catalytic Converter", page 239](#)
- Remove decoupling element guard on replacement part as late as possible
- Install exhaust system free of stress ⇒ ["5.3 Exhaust System, Installing", page 238](#)

17 - Nut

- Replace

- Coat the threaded pin with hot bolt paste; hot bolt paste, refer to the Electronic Parts Catalog (ETKA)
- 23 Nm

18 - Seals

- Replace

19 - Left Catalytic Converter

- Removing and installing, refer to ⇒ [“5.1 Catalytic Converters”, page 237](#)
- Install exhaust system free of stress ⇒ [“5.3 Exhaust System, Installing”, page 238](#)

20 - Clamping Sleeve

- Before tightening, align exhaust system tension-free ⇒ [“5.3 Exhaust System, Installing”, page 238](#)
- Installed position ⇒ [Fig. “Clamping Sleeve Locations”, page 233](#)
- Tighten threaded connections evenly.

21 - Nuts

- Tighten threaded connections evenly.
- 23 Nm

22 - Right Catalytic Converter

- Removing and installing, refer to ⇒ [“5.1 Catalytic Converters”, page 237](#)
- Install exhaust system free of stress ⇒ [“5.3 Exhaust System, Installing”, page 238](#)

23 - Retaining Loop

- Replace if damaged

24 - Bracket

25 - Exhaust Flap Valve -N220-

- with vacuum reservoir
- Check the exhaust flap vacuum diaphragm
⇒ [“4.1 Exhaust Flap Vacuum Diaphragm, Checking”, page 236](#)

26 - Nut

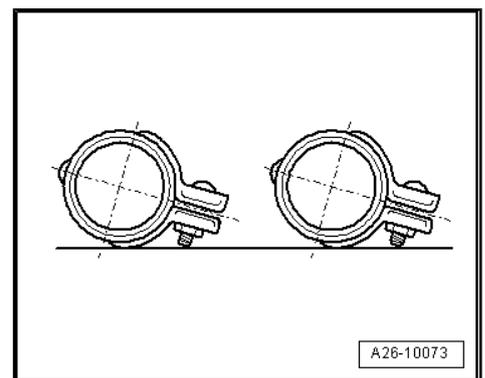
- 20 Nm

27 - Bolt

- 20 Nm
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Clamping Sleeve Locations

- Install clamping sleeves so that the bolt ends do not project over lower edge of clamping sleeves.
- The threaded connections are toward the right.



2.2 Exhaust Temperature Control Overview

1 - Exhaust Gas Temperature (EGT) Sensor 1 -G235-

- ❑ Common part with -6-
- ❑ Removing and installing, refer to ⇒ ["5.2 Exhaust Gas Temperature \(EGT\) Sensor 1 G235"](#), page 237

2 - Bolts

- ❑ 5 Nm

3 - Oxygen Sensor (O2S) after (TWC) Three Way Catalytic Converter -G130- with Heater for Oxygen Sensor (O2S 1 after Catalytic Converter -Z29-

- ❑ Removing and installing, refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation

4 - Heated Oxygen Sensor (HO2S) -G39- with Oxygen Sensor (O2S) Heater -Z19-

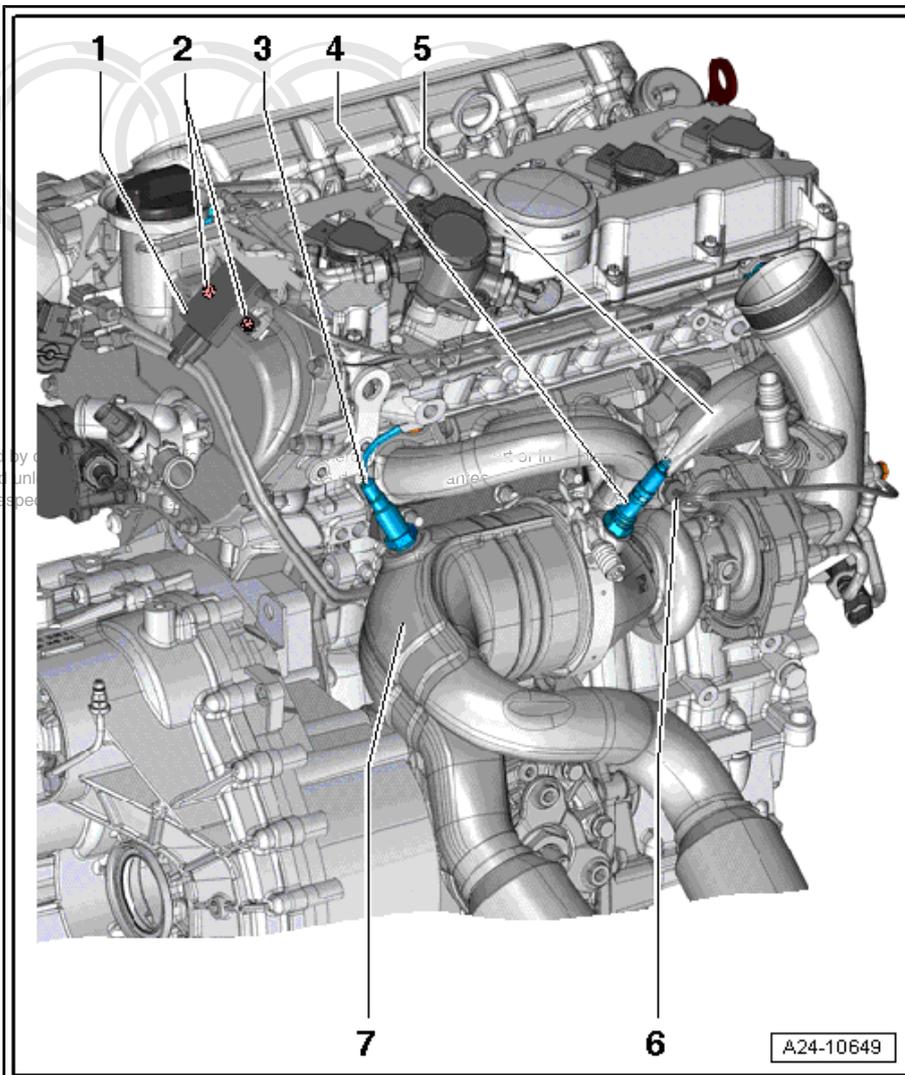
- ❑ Removing and installing, refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 24 ; Removal and Installation

5 - Turbocharger

6 - Temperature Sensor

- ❑ 45 Nm
- ❑ Coat with hot bolt paste; Hot bolt paste, refer to the Electronic Parts Catalog (ETKA)
- ❑ Common part with -1-
- ❑ For EGT Sensor 1
- ❑ Removing and installing, refer to ⇒ ["5.2 Exhaust Gas Temperature \(EGT\) Sensor 1 G235"](#), page 237

7 - Primary Catalytic Converter



3 Specifications

⇒ **“3.1 Fastener Tightening Specifications”, page 235**

3.1 Fastener Tightening Specifications

Components	Fastener Size	Nm
Bracket for Center Muffler, Nut	-	20
Bracket for Exhaust System, Nut	-	20
Bracket for Primary Catalytic Converter	-	23
Bracket for Suspended Mount	-	23
Clamping Sleeve, Nut	-	23
Exhaust Flap Valve, Bolt/Nut	-	20
Exhaust Gas Temperature (EGT) Sensor 1	-	5
Primary Catalytic Converter		
-Nut ^{1,2}	-	23
-Bolt	-	25
Suspended Mount	-	23
Temperature Sensor ²	-	45
Transverse Beam	-	23
<ul style="list-style-type: none"> • ¹ Replace • ² Coat the threaded pin with hot bolt paste 		



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4 Diagnosis and Testing

⇒ "4.1 Exhaust Flap Vacuum Diaphragm, Checking", page 236

⇒ "4.2 Exhaust System, Checking for Leaks", page 236

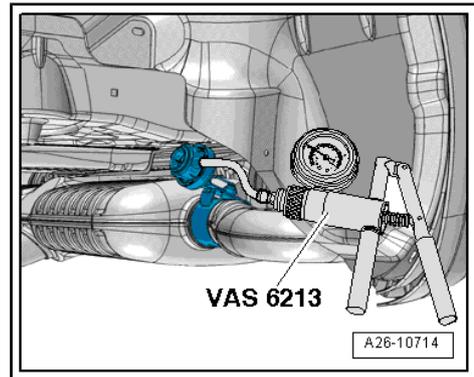
4.1 Exhaust Flap Vacuum Diaphragm, Checking

Special tools and workshop equipment required

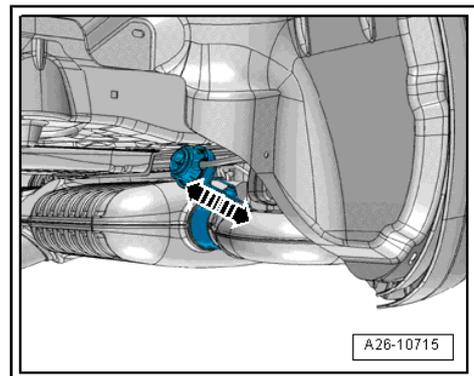
- ◆ Hand Vacuum Pump -VAS 6213-

Procedure

- Remove the hose from the exhaust flap vacuum diaphragm on the rear muffler.
- Connect the -VAS 6213- at the vacuum diaphragm.



- Operate hand vacuum pump.
 - Linkage must move upward.
- Vent hand vacuum pump.
 - Linkage must move downward.
- If the linkage does not move, make sure it is not stuck and check the vacuum diaphragm for leaks.



4.2 Exhaust System, Checking for Leaks

Procedure

- Start the engine and let it run in idle.
- Seal the tail pipes with cloths or plugs during the leak test.
- Check for leaks by listening at the connection point between the cylinder head and the exhaust manifold and turbocharger, exhaust manifold and turbocharger and primary catalytic converter etc.
- Repair detected leaks.

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5 Removal and Installation

⇒ ["5.1 Catalytic Converters", page 237](#)

⇒ ["5.2 Exhaust Gas Temperature \(EGT\) Sensor 1 G235", page 237](#)

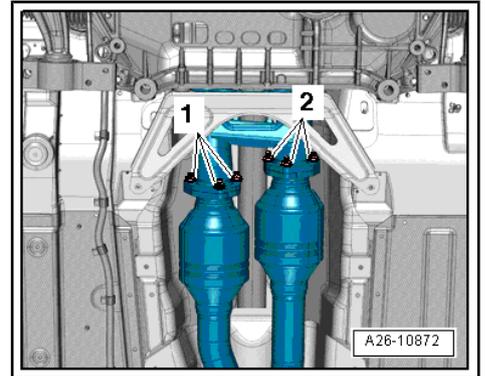
⇒ ["5.3 Exhaust System, Installing", page 238](#)

⇒ ["5.4 Primary Catalytic Converter", page 239](#)

5.1 Catalytic Converters

Removing

- Remove the nuts -1 or 2-.

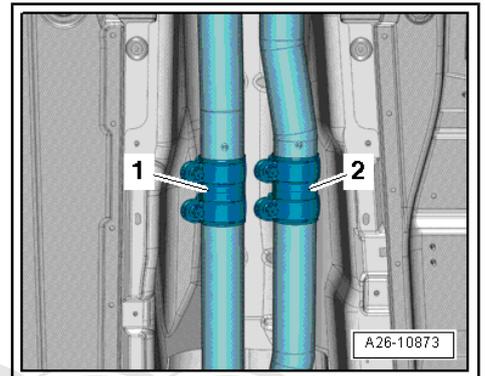


- Loosen clamping sleeve -1 or 2- and remove catalytic converter with clamping sleeve.

Installing

Installation is performed in reverse order of removal, noting the following.

- For the correct tightening specifications, refer to ⇒ ["2.1 Muffler Overview", page 232](#).



Note

Replace the seal and self-locking nuts.

5.2 Exhaust Gas Temperature (EGT) Sensor 1 -G235-

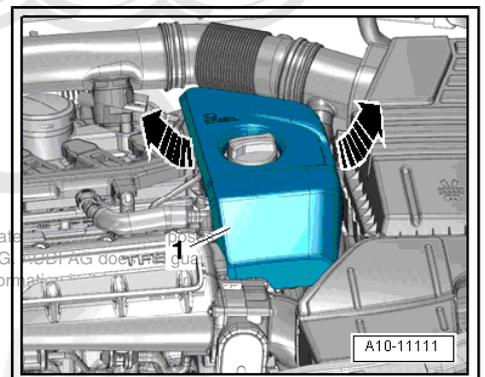
Removing



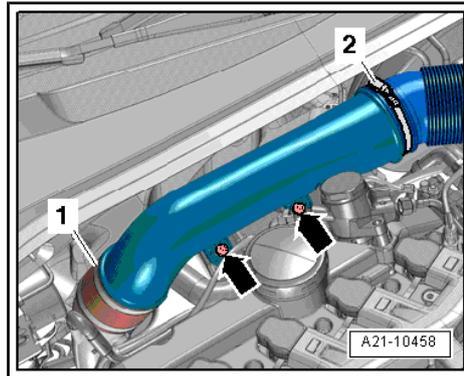
Note

When installing, bring all cable ties back to the same positions.

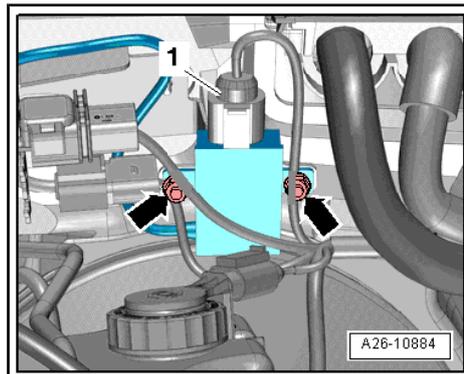
- Remove the engine cover -1- upward -arrows-



- Remove the bolts -arrows-.
- Open the clamps -1 and 2- and remove the air guide pipe.



- Disconnect the connector -1-.
- Remove the bolts -arrows-.
- Free up the wiring harness for the temperature sensor for the exhaust gas temperature sensor 1.



- Remove the temperature sensor for exhaust gas temperature sensor 1 -arrow-.

Installing

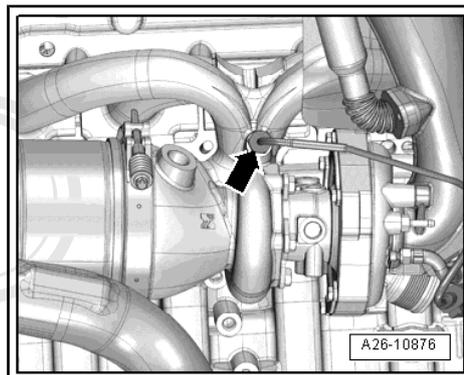
Install in reverse order, paying attention to the following:

- Tightening specification, refer to [⇒ "2.2 Exhaust Temperature Control Overview", page 234](#) .

Note

Coat the temperature sensor thread for the EGT sensor 1 with hot bolt paste. Refer to the Electronic Parts Catalog (ETKA).

- Install the air guide pipe. Refer to [⇒ "1.1 Charge Air Cooler Overview", page 209](#) .



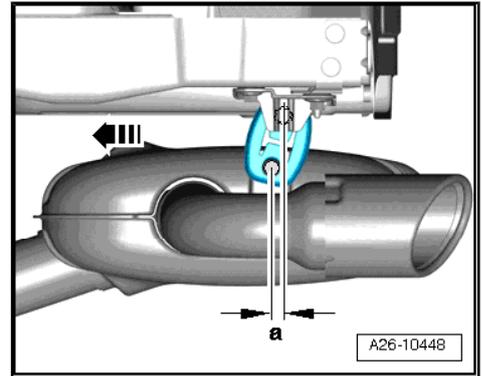
5.3 Exhaust System, Installing

Procedure

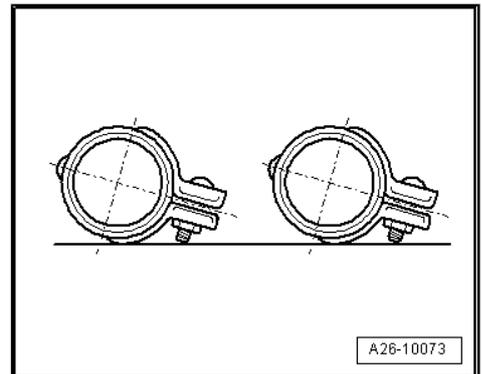
- Align exhaust system when cold.
- Tightening specification, refer to [⇒ "2.1 Muffler Overview", page 232](#) .

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- Loosen the clamping sleeve threaded connections.
- Press the rear muffler as far forward as possible -arrow- until the tension at the left retaining loop -a- = 11 to 13 mm.



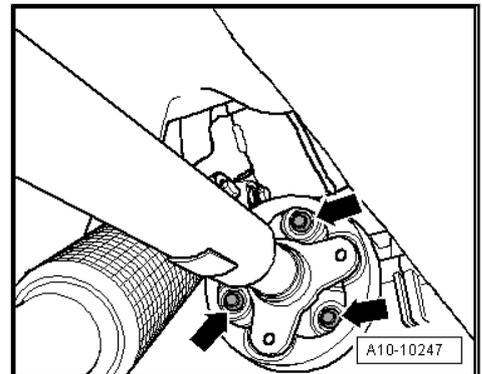
- Install clamping sleeves so that the bolt ends do not project over lower edge of clamping sleeves.
- The threaded connections are toward the right.



5.4 Primary Catalytic Converter

Removing

- Remove the driveshaft. Refer to ⇒ Rear Final Drive 02D, 0AV, 0BR and 0BY; Rep. Gr. 39 ; Removal and Installation .



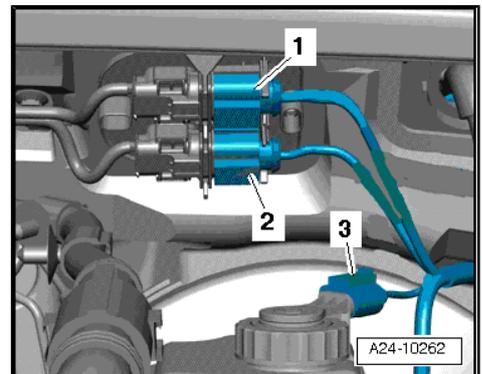
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- Remove the electrical connector -2- for the Oxygen Sensor (O2S) after (TWC) Three Way Catalytic Converter -G130- from the bracket and disconnect it.
- Free up the heated oxygen sensor wire.

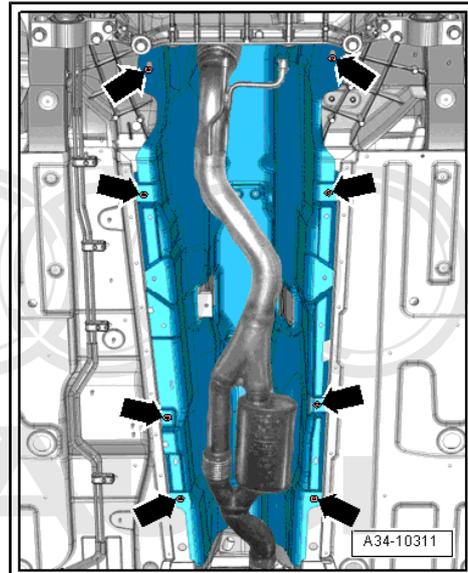


Note

Ignore -1 and 3-.



- Remove the bolts and nuts -arrows- and remove the heat shield toward the rear.



- Remove the bolts -1 and 2- and remove the primary catalytic converter mount.
- Loosen the bolt -3- and remove the clamp from the flange.
- Remove the primary catalytic converter.

Installing

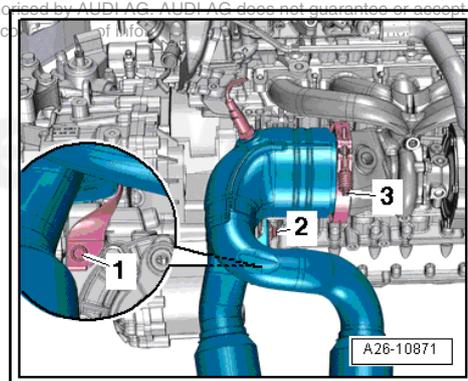
Installation is performed in reverse order of removal, noting the following.

- For the correct tightening specifications, refer to [⇒ "2.1 Muffler Overview", page 232](#) .

Note

Replace the seal and self-locking nuts.

- Install the driveshaft. Refer to ⇒ Rear Final Drive 02D, 0AV, 0BR and 0BY; Rep. Gr. 39 ; Removal and Installation .
- Install exhaust system free of stress. Refer to [⇒ "5.3 Exhaust System, Installing", page 238](#) .

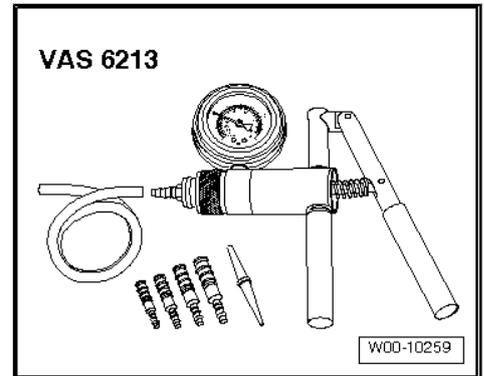


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6 Special Tools

Special tools and workshop equipment required

- ◆ Hand Vacuum Pump -VAS 6213-



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Cautions & Warnings

Please read these WARNINGS and CAUTIONS before proceeding with maintenance and repair work. You must answer that you have read and you understand these WARNINGS and CAUTIONS before you will be allowed to view this information.

- If you lack the skills, tools and equipment, or a suitable workshop for any procedure described in this manual, we suggest you leave such repairs to an authorized Audi retailer or other qualified shop. We especially urge you to consult an authorized Audi retailer before beginning repairs on any vehicle that may still be covered wholly or in part by any of the extensive warranties issued by Audi.
- Disconnect the battery negative terminal (ground strap) whenever you work on the fuel system or the electrical system. Do not smoke or work near heaters or other fire hazards. Keep an approved fire extinguisher handy.
- Audi is constantly improving its vehicles and sometimes these changes, both in parts and specifications, are made applicable to earlier models. Therefore, part numbers listed in this manual are for reference only. Always check with your authorized Audi retailer parts department for the latest information.
- Any time the battery has been disconnected on an automatic transmission vehicle, it will be necessary to reestablish Transmission Control Module (TCM) basic settings using the VAG 1551 Scan Tool (ST).
- Never work under a lifted vehicle unless it is solidly supported on stands designed for the purpose. Do not support a vehicle on cinder blocks, hollow tiles or other props that may crumble under continuous load. Never work under a vehicle that is supported solely by a jack. Never work under the vehicle while the engine is running.
- For vehicles equipped with an anti-theft radio, be sure of the correct radio activation code before disconnecting the battery or removing the radio. If the wrong code is entered when the power is restored, the radio may lock up and become inoperable, even if the correct code is used in a later attempt.
- If you are going to work under a vehicle on the ground, make sure that the ground is level. Block the wheels to keep the vehicle from rolling. Disconnect the battery negative terminal (ground strap) to prevent others from starting the vehicle while you are under it.
- Do not attempt to work on your vehicle if you do not feel well. You increase the danger of injury to yourself and others if you are tired, upset or have taken medicine or any other substances that may impair you or keep you from being fully alert.
- Never run the engine unless the work area is well ventilated. Carbon monoxide (CO) kills.
- Always observe good workshop practices. Wear goggles when you operate machine tools or work with acid. Wear goggles, gloves and other protective clothing whenever the job requires working with harmful substances.
- Tie long hair behind your head. Do not wear a necktie, a scarf, loose clothing, or a necklace when you work near machine tools or running engines. If your hair, clothing, or jewelry were to get caught in the machinery, severe injury could result.

Cautions & Warnings

- Do not re-use any fasteners that are worn or deformed in normal use. Some fasteners are designed to be used only once and are unreliable and may fail if used a second time. This includes, but is not limited to, nuts, bolts, washers, circlips and cotter pins. Always follow the recommendations in this manual - replace these fasteners with new parts where indicated, and any other time it is deemed necessary by inspection.
- Illuminate the work area adequately but safely. Use a portable safety light for working inside or under the vehicle. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.
- Friction materials such as brake pads and clutch discs may contain asbestos fibers. Do not create dust by grinding, sanding, or by cleaning with compressed air. Avoid breathing asbestos fibers and asbestos dust. Breathing asbestos can cause serious diseases such as asbestosis or cancer, and may result in death.
- Finger rings should be removed so that they cannot cause electrical shorts, get caught in running machinery, or be crushed by heavy parts.
- Before starting a job, make certain that you have all the necessary tools and parts on hand. Read all the instructions thoroughly, do not attempt shortcuts. Use tools that are appropriate to the work and use only replacement parts meeting Audi specifications. Makeshift tools, parts and procedures will not make good repairs.
- Catch draining fuel, oil or brake fluid in suitable containers. Do not use empty food or beverage containers that might mislead someone into drinking from them. Store flammable fluids away from fire hazards. Wipe up spills at once, but do not store the oily rags, which can ignite and burn spontaneously.
- Use pneumatic and electric tools only to loosen threaded parts and fasteners. Never use these tools to tighten fasteners, especially on light alloy parts. Always use a torque wrench to tighten fasteners to the tightening torque listed.
- Keep sparks, lighted matches, and open flame away from the top of the battery. If escaping hydrogen gas is ignited, it will ignite gas trapped in the cells and cause the battery to explode.
- Be mindful of the environment and ecology. Before you drain the crankcase, find out the proper way to dispose of the oil. Do not pour oil onto the ground, down a drain, or into a stream, pond, or lake. Consult local ordinances that govern the disposal of wastes.
- The air-conditioning (A/C) system is filled with a chemical refrigerant that is hazardous. The A/C system should be serviced only by trained automotive service technicians using approved refrigerant recovery/recycling equipment, trained in related safety precautions, and familiar with regulations governing the discharging and disposal of automotive chemical refrigerants.
- Before doing any electrical welding on vehicles equipped with anti-lock brakes (ABS), disconnect the battery negative terminal (ground strap) and the ABS control module connector.
- Do not expose any part of the A/C system to high temperatures such as open flame. Excessive heat will increase system pressure and may cause the system to burst.

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Cautions & Warnings

- When boost-charging the battery, first remove the fuses for the Engine Control Module (ECM), the Transmission Control Module (TCM), the ABS control module, and the trip computer. In cases where one or more of these components is not separately fused, disconnect the control module connector(s).
- Some of the vehicles covered by this manual are equipped with a supplemental restraint system (SRS), that automatically deploys an airbag in the event of a frontal impact. The airbag is operated by an explosive device. Handled improperly or without adequate safeguards, it can be accidentally activated and cause serious personal injury. To guard against personal injury or airbag system failure, only trained Audi Service technicians should test, disassemble or service the airbag system.
- Do not quick-charge the battery (for boost starting) for longer than one minute, and do not exceed 16.5 volts at the battery with the boosting cables attached. Wait at least one minute before boosting the battery a second time.
- Never use a test light to conduct electrical tests of the airbag system. The system must only be tested by trained Audi Service technicians using the VAG 1551 Scan Tool (ST) or an approved equivalent. The airbag unit must never be electrically tested while it is not installed in the vehicle.
- Some aerosol tire inflators are highly flammable. Be extremely cautious when repairing a tire that may have been inflated using an aerosol tire inflator. Keep sparks, open flame or other sources of ignition away from the tire repair area. Inflate and deflate the tire at least four times before breaking the bead from the rim. Completely remove the tire from the rim before attempting any repair.
- When driving or riding in an airbag-equipped vehicle, never hold test equipment in your hands or lap while the vehicle is in motion. Objects between you and the airbag can increase the risk of injury in an accident.

I have read and I understand these Cautions and Warnings.

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