

Workshop Manual Audi A6 2005 ➤

4-cylinder TDI unit injector engine (2.0 ltr. 4-valve),
mechanics

Engine ID	BLB	BNA	BRE	BRF	BVG				
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Edition 04.2015



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List of Workshop Manual Repair Groups

Repair Group

- 00 - Technical data
- 10 - Removing and installing engine
- 13 - Crankshaft group
- 15 - Cylinder head, valve gear
- 17 - Lubrication
- 19 - Cooling
- 21 - Turbocharging/supercharging
- 26 - Exhaust 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 – Technical data

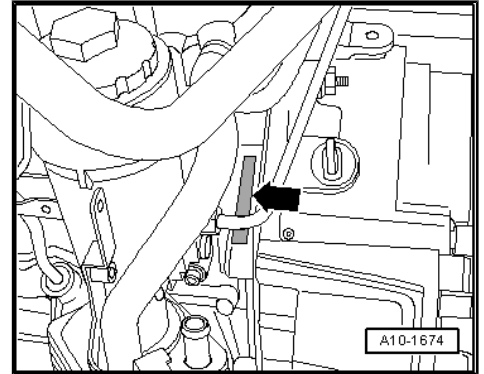
1 Engine number

(ARL004275; Edition 04.2015)

The engine number ("Engine code" and "Serial number")
-arrow- can be found at the front of the joint between engine and gearbox.

Additionally there is a sticker on the toothed belt cover showing the "engine code" and "serial number".

The engine code is also included on the vehicle data sticker.



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2 Engine data

Code letters		BLB	BNA	BRE
Capacity	ltr.	1.968	1.968	1.968
Power output	kW at rpm	103/4000	100/4000	103/4000
Torque	Nm at rpm	320/1750 ... 2500	320/1750 ... 2500	320/1750 ... 2500
Bore	Ø mm	81.0	81.0	81.0
Stroke	mm	95.5	95.5	95.5
Compression ratio		18.5	18.5	18.5
CN	at least	49	49	49
Firing order		1-3-4-2	1-3-4-2	1-3-4-2
Exhaust gas recirculation		yes	yes	yes
Turbocharging/supercharging		yes	yes	yes
Charge air cooling		yes	yes	yes
Particulate filter		no	no	yes

Code letters		BRF	BVG	
Capacity	ltr.	1.968	1.968	
Power output	kW at rpm	100/4000	89/4000	
Torque	Nm at rpm	320/1750 ... 2500	320/1750 ... 2500	
Bore	Ø mm	81.0	81.0	
Stroke	mm	95.5	95.5	
Compression ratio		18.5	18.5	
CN	at least	49	49	
Firing order		1-3-4-2	1-3-4-2	
Exhaust gas recirculation		yes	yes	
Turbocharging/supercharging		yes	yes	
Charge air cooling		yes	yes	
Particulate filter		yes	yes	

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3 Safety precautions

3.1 Working on the fuel system

When working on the fuel system note the following warnings:



WARNING

Risk of injury - fuel system operates under pressure.

- ◆ *Wrap a cloth around the connection before opening the fuel system. Then release pressure by carefully loosening the connection.*

The fuel can become extremely hot. This can cause injuries.

- ◆ *In extreme cases the temperature of the fuel lines and the fuel can be up to 100 °C after the engine is switched off. Allow the fuel to cool down before disconnecting the lines - danger of scalding.*
- ◆ *Wear protective gloves.*
- ◆ *Wear safety goggles.*

Observe the following points to prevent personal injuries and damage to the injection and glow plug system:

- ◆ Always switch off the ignition before connecting or disconnecting tester cables or electrical wiring for the injection or glow plug system.
- ◆ Always switch off ignition before washing engine.
- ◆ Faults are stored in engine control unit if electrical connectors were unplugged and the engine was started: "Interrogate event memory" in "Vehicle self-diagnosis" ⇒ Vehicle diagnostic tester .



Caution

To prevent irreparable damage to the electronic components when disconnecting the battery:

- ◆ *Observe notes on procedure for disconnecting the battery.*
- ◆ *Always switch off the ignition before disconnecting the battery.*

- Disconnect battery ⇒ Rep. gr. 27 .

3.2 Working on the cooling system

When working on the cooling system note the following warnings:



WARNING

Hot steam/hot coolant can escape - risk of scalding.

- ◆ *The cooling system is under pressure when the engine is hot.*
- ◆ *To allow pressure to dissipate, cover filler cap on coolant expansion tank with cloth and open carefully.*



Caution

Overheating can occur if the filler cap is not fitted properly.

- ◆ *The filler cap must engage positively and audibly when it is closed.*

3.3 Using testers and measuring instruments during a road test

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Note the following if testers and measuring instruments have to be used during a road test:



WARNING

Accidents can be caused if the driver is distracted by test equipment while road-testing, or if test equipment is not properly secured.

Persons sitting in the front passenger's seat could be injured if the airbag is triggered in an accident.

- *The use of test equipment while driving causes distraction.*
- *There is an increased risk of injury if test equipment is not secured.*
- ◆ *Test equipment must always be secured on the rear seat with a strap and operated from the rear seat by a second person.*

3.4 Working on the exhaust system

When working on the exhaust system please note the following:



Caution

Risk of damage to flexible joint.

- ◆ *Do not bend flexible joint more than 10°.*
- ◆ *Install flexible joint so that it is not under tension.*
- ◆ *Take care not to damage wire mesh on flexible joint.*

4 General repair instructions

4.1 Different types of glow plugs

The Audi A6 with 4-cyl. 2.0 ltr. 4-valve TDI engine is equipped with steel glow plugs or NGK ceramic glow plugs.



Note

- ◆ NGK ceramic glow plugs are colour-coded with a white, or possibly "silver-coloured" seal.
- ◆ Observe the following for NGK ceramic glow plugs.
⇒ [page 5](#)

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4.2 Handling ceramic glow plugs

Important: Note the following points regarding ceramic glow plugs:



Caution

- ◆ Due to the special properties of the material used, ceramic glow plugs are easily damaged and require extra care when handling and removing/installing. Always observe the special instructions when removing and installing ceramic glow plugs ⇒ Rep. gr. 28.
- ◆ Use only the approved type of ceramic glow plugs ⇒ Electronic parts catalogue.
- ◆ Transport and store only in original packaging or packed separately in bubble wrap.
- ◆ Do not remove new ceramic glow plugs from packaging until they are ready to be fitted.
- ◆ Ceramic glow plugs are sensitive to knocks and bending. For this reason, ceramic glow plugs which have been dropped (even from a height of only about 2 cm) must not be installed, even if no damage is apparent (hair-line cracks may not be visible).
- ◆ Always install a new ceramic glow plug if you are not sure the old one is in perfect condition.
- ◆ Damaged glow plugs (e.g. heater pin of ceramic glow plug is damaged) will invariably cause engine damage.
- ◆ If the heater pin of the glow plug is damaged, the fragments must be removed from the combustion chamber before starting the engine for the first time, otherwise this will invariably cause mechanical damage (piston seizure).
- ◆ To check compression, select function "Self-diagnosis compatible systems" in "Guided Fault Finding" ⇒ Vehicle diagnostic tester.
- ◆ The ceramic glow plugs must not be removed when checking cylinder compression.

4.3 Rules for cleanliness when working on fuel supply system, injection system and turbocharger

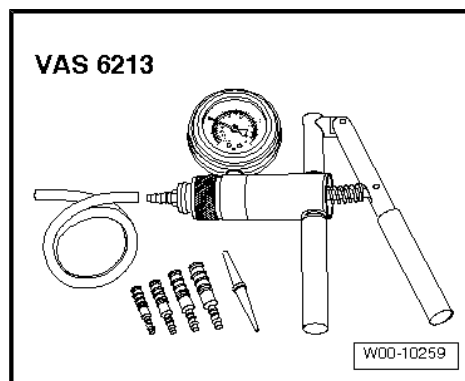
Even small amounts of dirt can cause malfunctions. For this reason, please observe the following rules when working on the fuel supply system, injection system and turbocharger:

- ◆ Carefully clean connection points and the surrounding area with engine cleaner or brake cleaner and dry thoroughly before opening.
- ◆ Seal off open pipes/lines and connections immediately with clean plugs, e.g. from engine bung set - VAS 6122- .
- ◆ Place parts that have been removed on a clean surface and cover them over. Use only lint-free cloths.
- ◆ Carefully cover or seal open components if repairs cannot be carried out immediately.
- ◆ Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have not been stored in their packing (e.g. in tool boxes etc.).
- ◆ When the system is open, do not work with compressed air and do not move the vehicle.
- ◆ Protect unplugged electrical connectors against dirt and moisture and make sure connections are dry when attaching.

4.4 Checking vacuum system

Special tools and workshop equipment required

- ◆ Hand vacuum pump - VAS 6213-



Procedure

- Check all vacuum lines in the complete vacuum system for:
 - ◆ Cracks
 - ◆ Traces of animal bites
 - ◆ Kinked or crushed lines
 - ◆ Lines porous or leaking
- Check vacuum line to solenoid valve and from solenoid valve to corresponding component.
- If a fault is stored in the memory, check the vacuum lines leading to the corresponding component and also check the remaining vacuum lines in the system.
- If it is not possible to build up pressure with the hand vacuum pump - VAS 6213- or if the pressure drops again immediately, check the hand vacuum pump and connecting hoses for leaks.

4.5 Routing and attachment of pipes, hoses and wiring

- ◆ Mark fuel lines, hydraulic lines, vacuum lines, lines for activated charcoal filter and electrical wiring etc. before removal so they can be re-installed in the original positions and correctly connected. Make sketches or take photographs if necessary.
- ◆ To prevent damaging pipes, hoses and wiring, ensure sufficient clearance from all moving or hot components in engine compartment (little space in engine compartment).

4.6 Checking fuel system for leaks

- Allow engine to run for several minutes at moderate rpm.
- Switch off ignition.
- **Check complete fuel system for leaks.**
- If leaks are found although the connections have been tightened to the correct torque, the relevant component must be renewed.
- Road-test vehicle and accelerate with full throttle at least once.
- Then inspect high-pressure section of fuel system again for leaks.

4.7 Contact corrosion!

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

For this reason, only fasteners with a special surface coating are used.

Additionally, all rubber and plastic parts and all adhesives are made of non-conductive materials.

Always install new parts if you are not sure whether used parts can be re-fitted ⇒ Electronic parts catalogue .

Note the following:

- ◆ We recommend using only genuine replacement parts; these have been tested and are compatible with aluminium.
- ◆ We recommend the use of Audi accessories.
- ◆ Damage caused by contact corrosion is not covered under warranty.

4.8 Installing radiators, condensers and charge air coolers

Even when the radiator, condenser and charge air cooler are correctly installed, slight impressions may be visible on the fins of these components. This does not mean that the components are damaged. If the fins are only very slightly distorted, this does not justify renewal of the radiator, condenser or charge air cooler.

10 – Removing and installing engine

1 Removing and installing engine

1.1 Removing engine

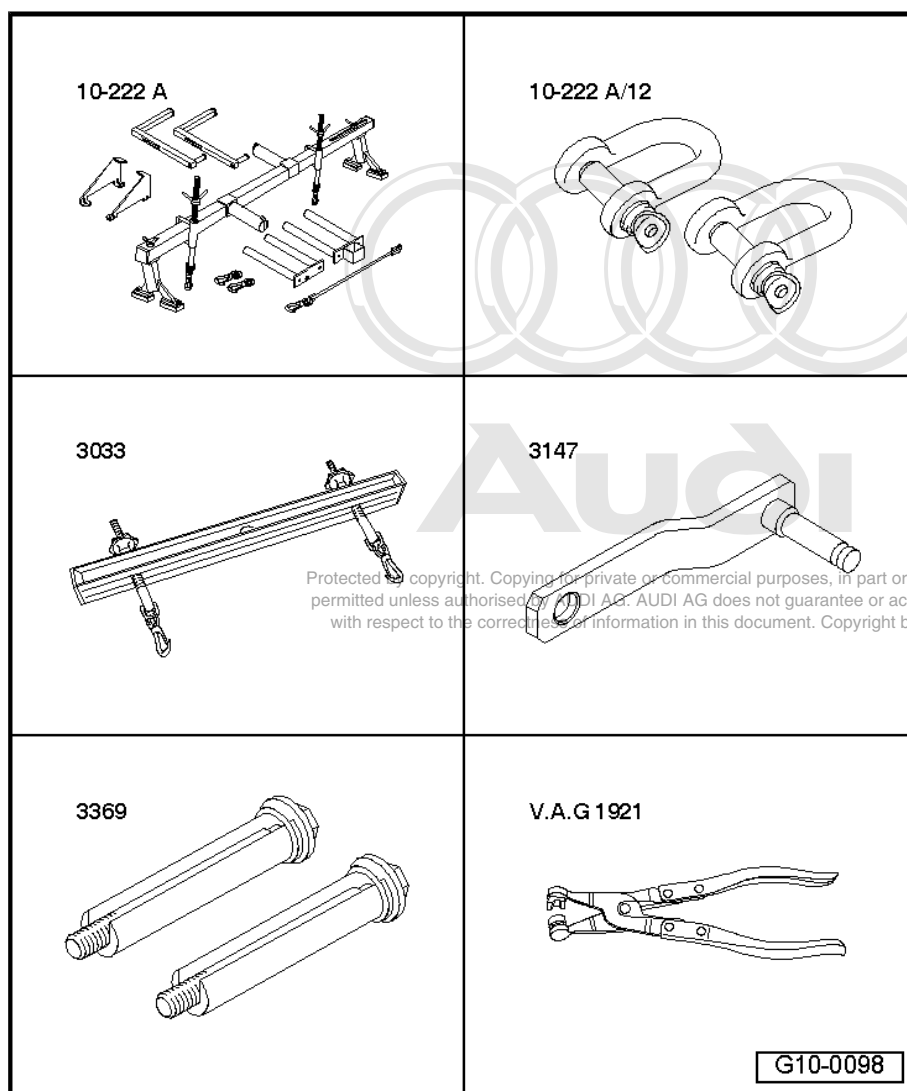


Note

- ◆ The engine is removed upwards without gearbox.
- ◆ All cable ties which are released or cut open when removing must be fitted in the same position when installing.
- ◆ Collect drained coolant in a clean container for re-use or disposal.

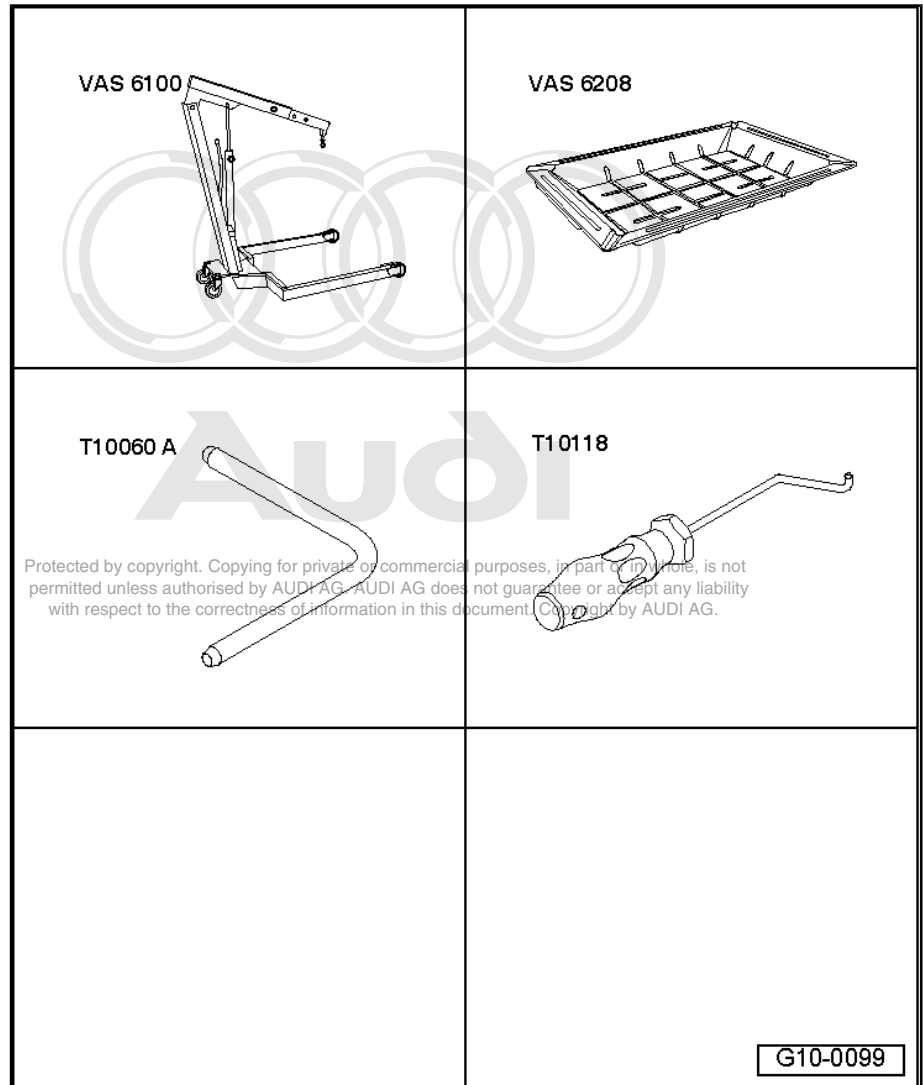
Special tools and workshop equipment required

- ◆ Support bracket - 10-222 A-
- ◆ Shackle - 10-222 A/12-
- ◆ Lifting tackle - 3033-
- ◆ Gearbox support - 3147-
- ◆ Front-end service sleeves - 3369-
- ◆ Hose clip pliers - V.A.G 1921-



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- ◆ Workshop hoist - VAS 6100-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Locking pin - T10060 A-
- ◆ Assembly tool - T10118-
- ◆ Safety goggles
- ◆ Protective gloves



Procedure



WARNING

Before removing the engine secure the vehicle against tipping over. To do so, the luggage compartment must be empty.



Caution

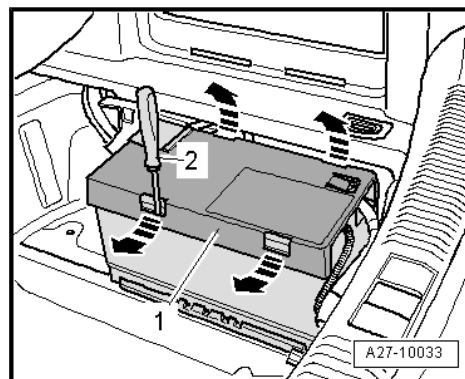
Observe notes on procedure for disconnecting the battery → Rep. gr. 27.



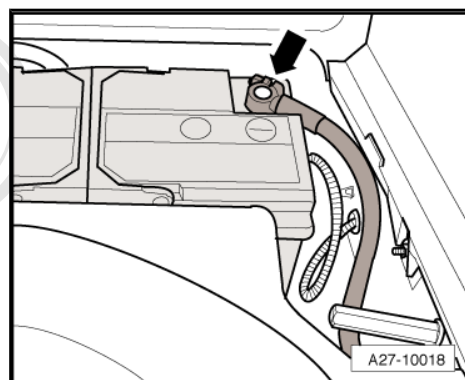
Note

To make sure you can still move the front wheels when the battery has been disconnected, only disconnect the battery with the ignition key inserted.

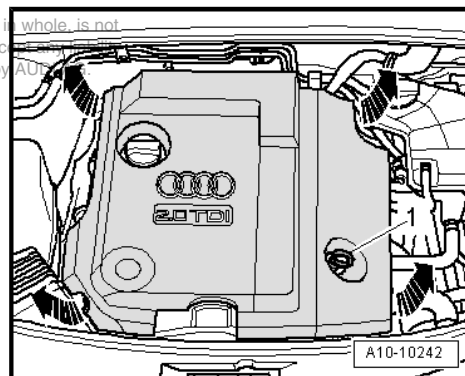
- Take out luggage compartment floor trim.
- Use screwdriver -2- to release retaining clips -arrows- and detach cover -1- for negative terminal post.



- Disconnect earth cable -arrow- at battery.

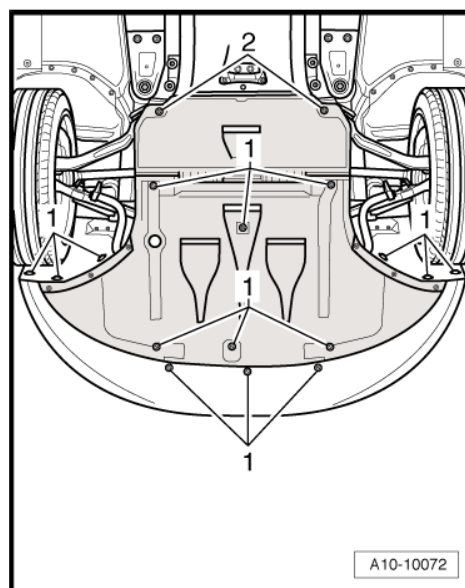


- Pull dipstick -1- out of guide tube.
- Pull off engine cover panel -arrows-.
- Re-insert dipstick in guide tube.

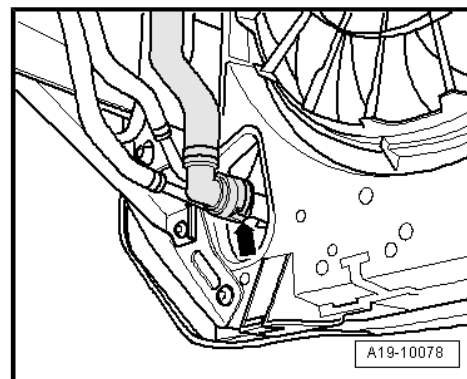

WARNING

Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

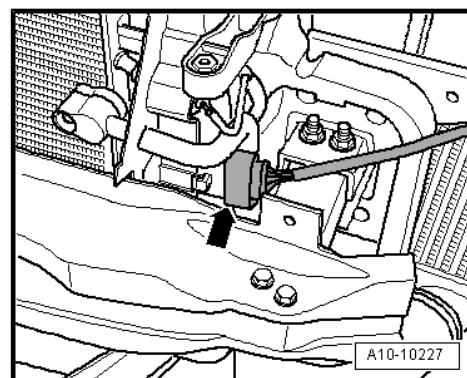
- Open filler cap on coolant expansion tank.
- Remove both front wheels.
- Release quick-release fasteners -1- and -2- and take off noise insulation panels.



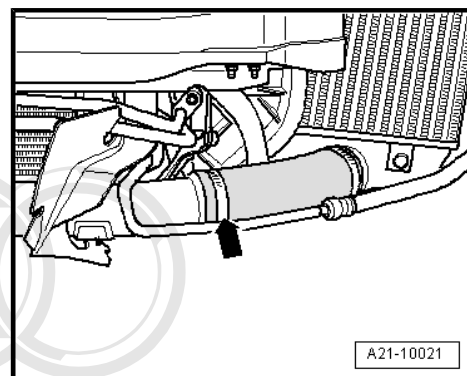
- Place drip tray for workshop hoist - VAS 6208- under engine.
- Disconnect coolant hose -arrow- at bottom left of radiator and drain off coolant.
- Remove front sections of front wheel housing liners (left and right) ⇒ Rep. gr. 66 .
- Remove bumper cover (front) ⇒ Rep. gr. 63 .
- Remove headlights (left and right) ⇒ Rep. gr. 94 .



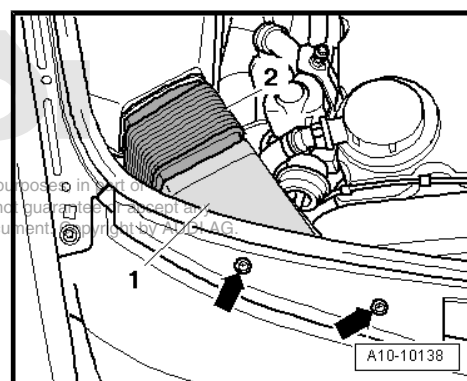
- Unplug electrical multi-pin connector -arrow-.



- Open hose clip -arrow- and disconnect air intake hose from air pipe.



- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.



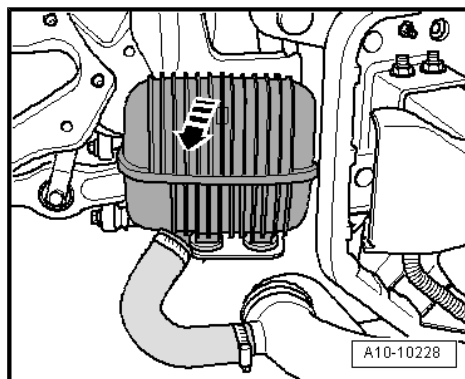
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- Detach resonator from retainer -arrow-.

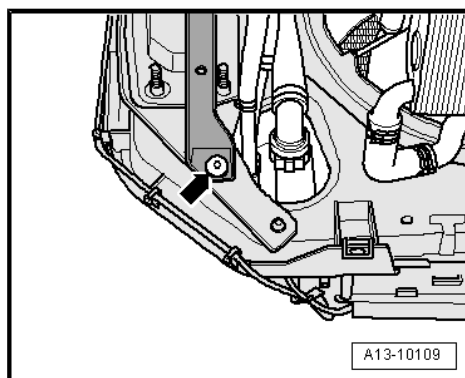


Note

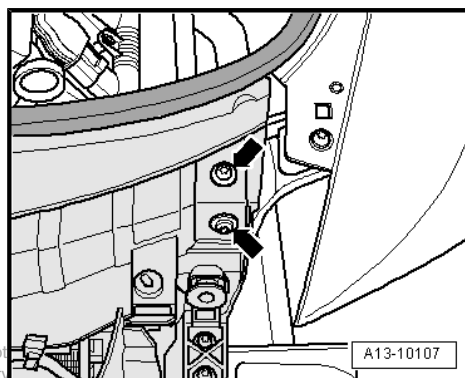
Air intake hose remains connected.



- Remove one bolt on each side at bottom of lock carrier.

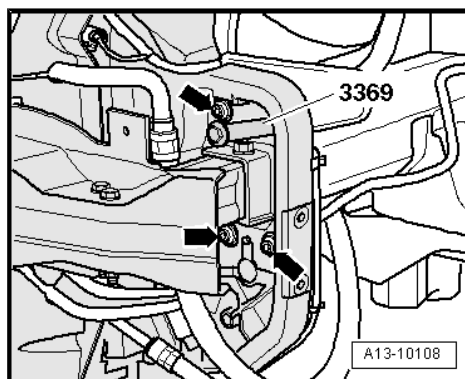


- Pull off bonnet seal at both wing panels and at lock carrier.
- Remove two bolts -arrows- on each side at top of lock carrier.



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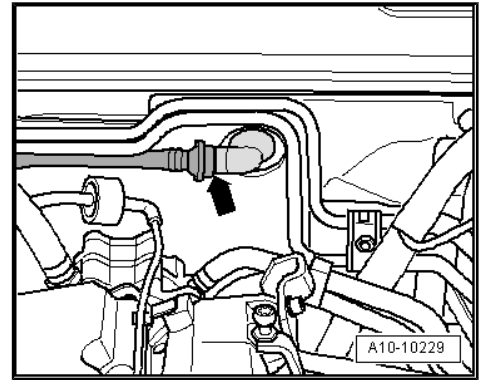
- Screw in front-end service sleeves - 3369- (left and right) at holes for lock carrier securing bolts, after removing corresponding bolts.
- Remove remaining bolts (left and right) -arrows-.
- Carefully pull the lock carrier forward.



- Disconnect vacuum hose -arrow- leading to brake servo.

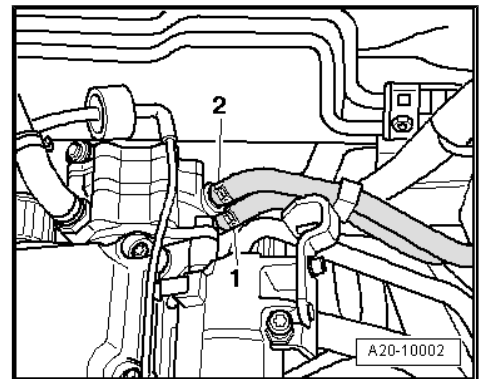
**Caution**

*Rules for cleanliness when working on the injection system
⇒ [page 6](#).*

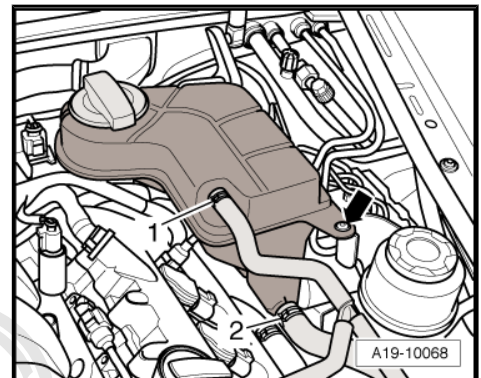
**WARNING**

- ◆ *In extreme cases the fuel lines and the fuel can reach a temperature of 100 °C on vehicles with unit injector engine. Allow the fuel to cool down before disconnecting the lines - danger of scalding.*
- ◆ *Wear protective gloves.*
- ◆ *Wear safety goggles.*

- Mark the installation position of fuel hoses.
- Disconnect fuel return line -1- and fuel supply line -2- from tandem pump.

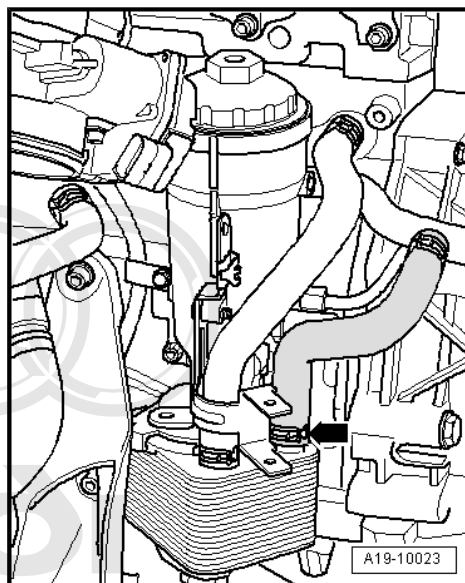


- Place drip tray for workshop hoist - VAS 6208- under engine.
- Disconnect coolant hoses -1- and -2- at coolant expansion tank.
- Unbolt coolant expansion tank -arrow-.
- Detach electrical connector at coolant shortage indicator switch - F66- on coolant expansion tank (bottom).



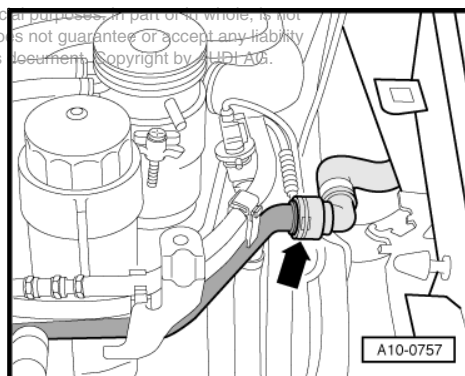
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- Disconnect rear coolant hose from oil cooler -arrow-, and drain off remaining coolant.

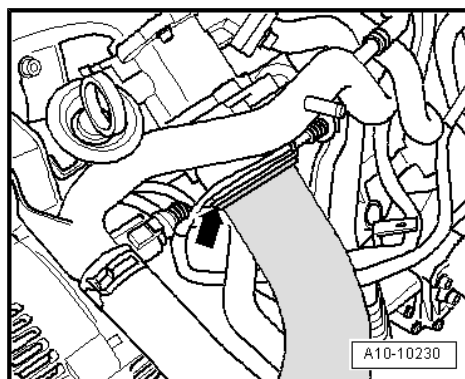


- Disconnect coolant hose -arrow- leading to heat exchanger for heater at rear of engine.

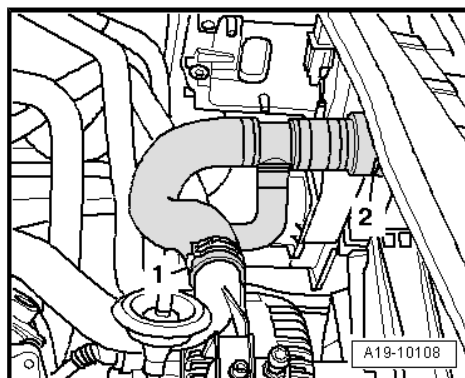
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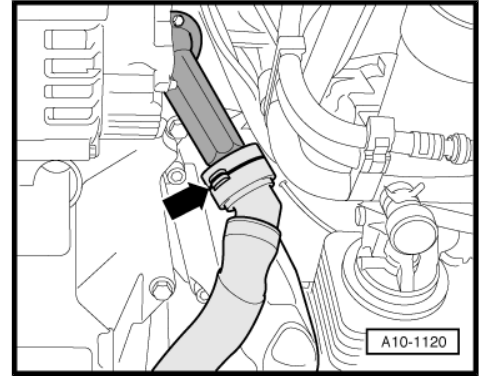
- Remove air intake hose at intake manifold flap motor - V157- by lifting retaining clip -arrow- slightly.



- Detach coolant hose at the points marked -1- and -2- and move clear to one side.



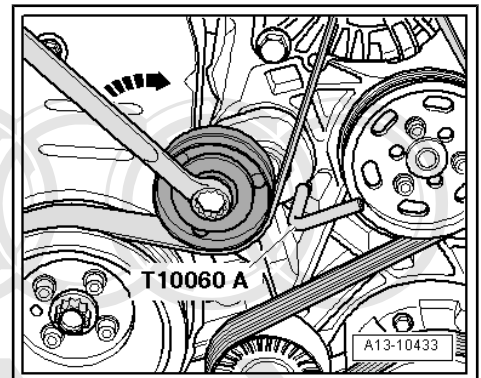
- Disconnect coolant hose from hose connection for thermostat -arrow-.



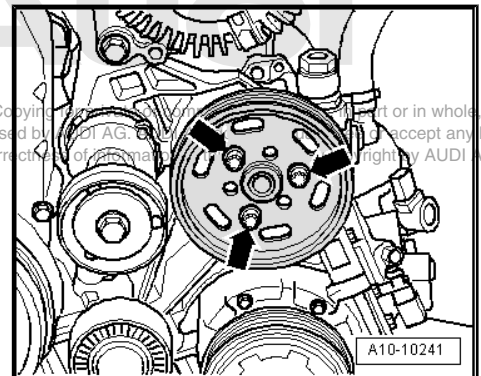
Note

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

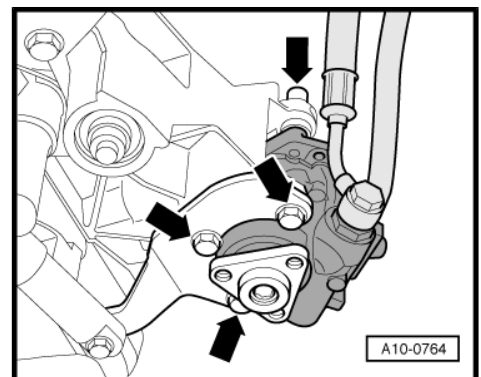
- Turn tensioner in -direction of arrow- and lock with locking pin - T10060 A- to slacken the poly V-belt.
- Remove poly V-belt.



- Counterhold power steering pump pulley with drift to unbolt pulley -arrows-.

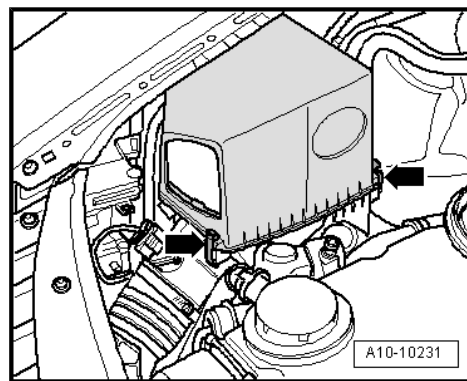


- Unbolt power steering pump -arrows- and tie up to one side; the hoses/pipes remain connected.

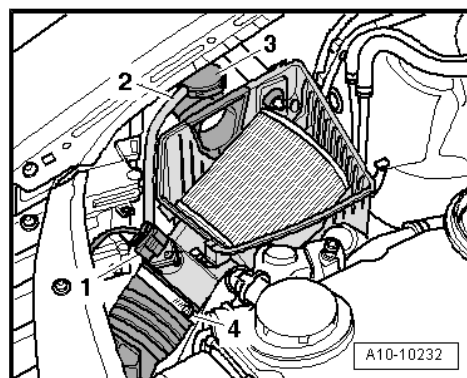


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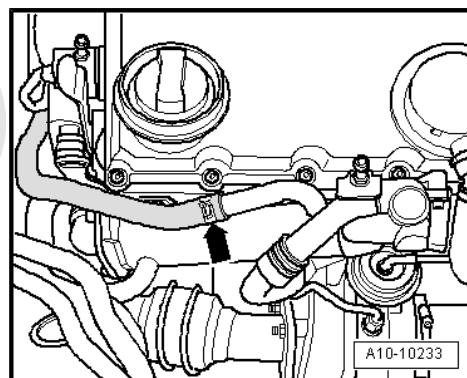
- Release two retaining clips -arrows- and detach top section of air cleaner housing.



- Unplug electrical connector -1- at air mass meter - G70- .
- Loosen hose clip -4- to remove air intake hose.
- Detach vacuum hose -2-.
- Lift off vacuum unit -3- with air flap from air cleaner housing.
- Disengage bottom section of air cleaner housing from retaining pin and remove.

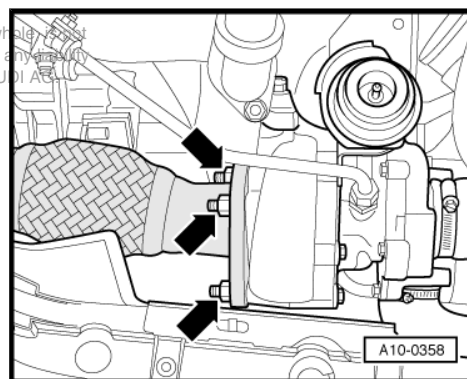


- Detach coolant hose from exhaust gas recirculation cooler -arrow-.



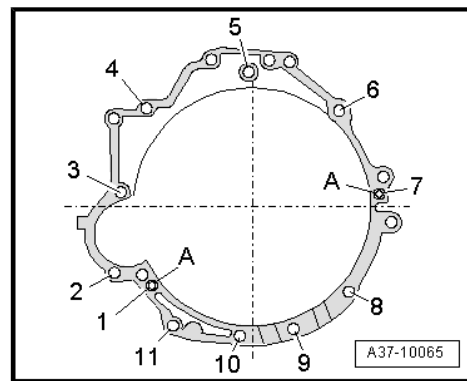
Vehicles without particulate filter:

- Unscrew nuts securing turbocharger to front exhaust pipe -arrows-.



All vehicles:

- Unscrew engine/gearbox bolts -4-, -5- and -6- (accessible from above); leave bolt -6- screwed in finger-tight.

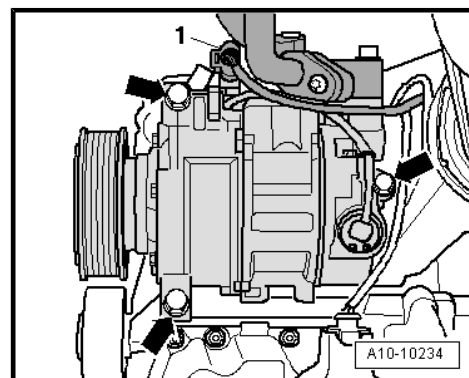


- Unplug electrical connector -1- for magnetic clutch on air conditioner compressor.

**Caution**

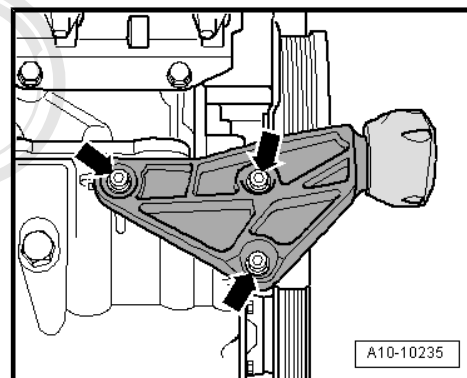
The air conditioner refrigerant circuit must not be opened.

- Unscrew air conditioner compressor from bracket -arrows-.

**Note**

To prevent damage to the refrigerant lines, ensure that the lines and hoses are not stretched, kinked or bent.

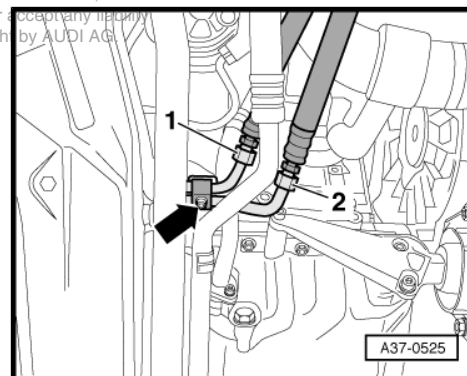
- Tie up air conditioner compressor with lines attached to left-side of vehicle.
- Unscrew bolts -arrows- and remove torque reaction support from engine.

**Vehicles with multitronic gearbox:**

- Remove bracket -arrow- for ATF lines.

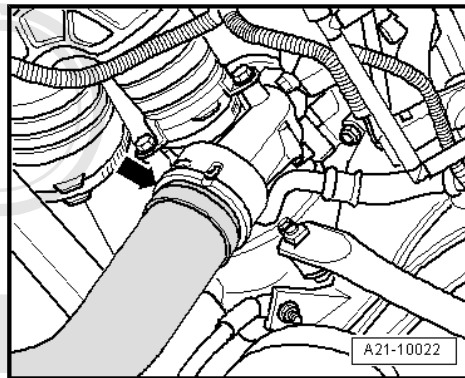
**Note**

Disregard items -1- and -2-.

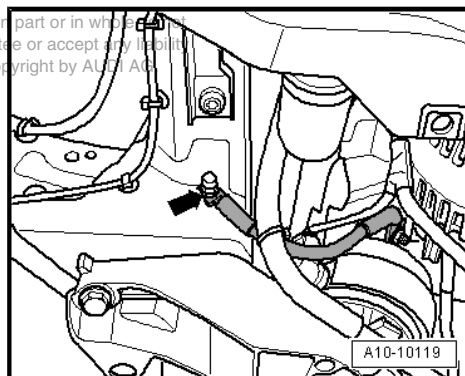


All vehicles:

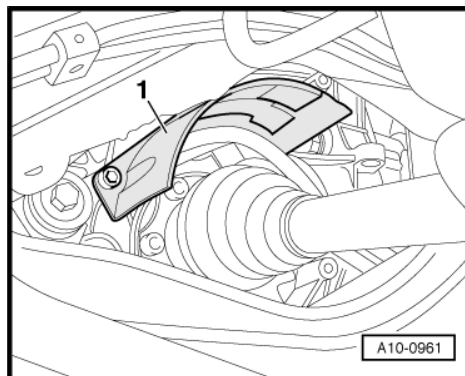
- Detach air intake hose from turbocharger by lifting retaining clip -arrow- slightly.



- Unscrew earth cable -arrow- from longitudinal member (right-side) and move cable clear.



- Unbolt heat shield -1- for drive shaft (right-side).



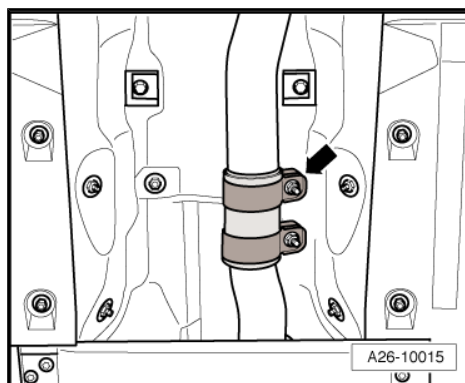
Vehicles without particulate filter:



Note

Do not bend the flexible joint (de-coupling element) in the exhaust system more than 10°, otherwise it could be damaged.

- Disconnect exhaust system at clamp -arrow- and detach front exhaust pipe from turbocharger.
- Tie up front exhaust pipe to body.

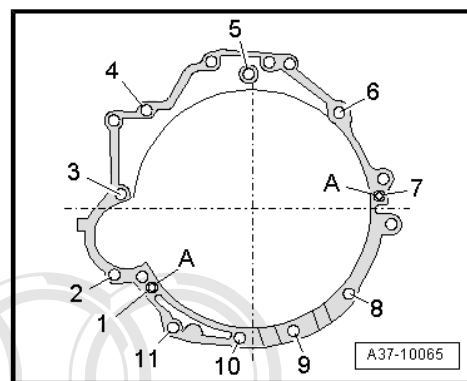


Vehicles with particulate filter:

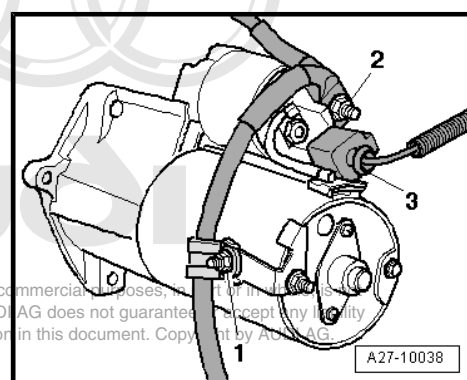
- Remove front exhaust pipe ⇒ [page 230](#) .
- Remove particulate filter ⇒ [page 232](#) .

All vehicles:

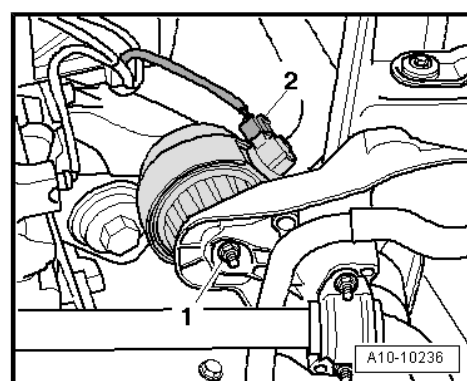
- Remove engine/gearbox bolts -1-, -3- and -7 ... 11- accessible from below.



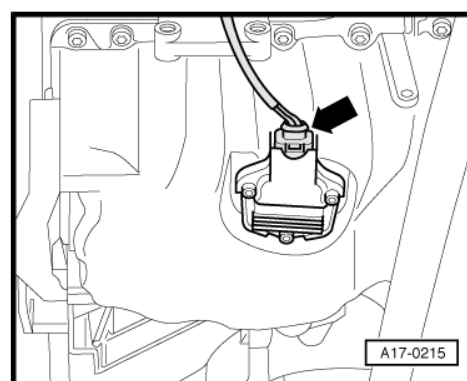
- Detach starter and swivel to one side.
- Unplug electrical connector -3-.
- Unscrew nut -1- for clamp.
- Unscrew nut -2- and detach electrical wiring.
- Detach starter.



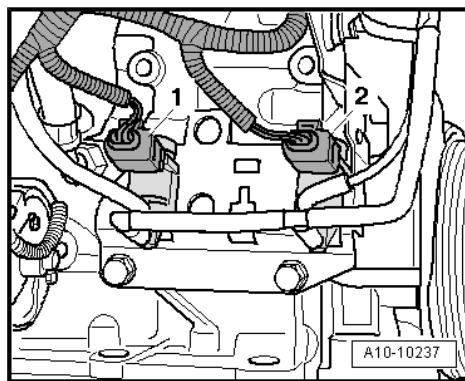
- Unplug electrical connector -2- at engine mounting.
- Unscrew nut -1- for engine mounting.
- Repeat procedure on other side of vehicle.



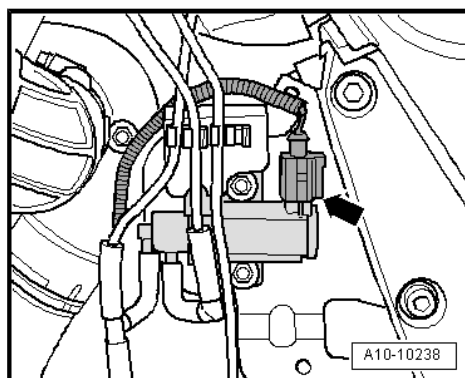
- Unplug electrical connector -arrow- at oil level and oil temperature sender - G266- .



- Unplug electrical connectors at air cleaner bypass flap valve - N275- -item 1- and at exhaust gas recirculation cooler change-over valve - N345- -item 2-.



- Unplug electrical connector at charge pressure control solenoid valve - N75- -arrow- and move wiring harness clear.

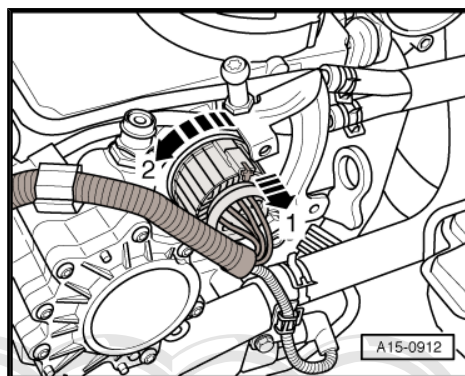


- Pull the release pin -arrow 1- and unscrew knurled nut -arrow 2-.



Note

Shown from rear for illustration purposes.

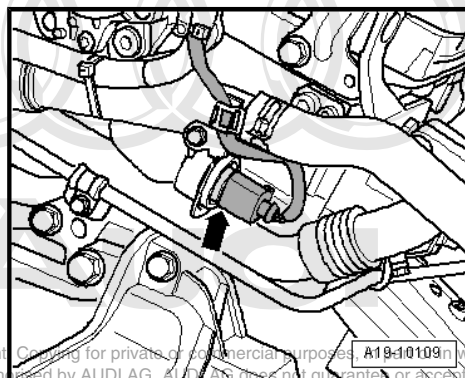


- Unplug electrical connector at coolant temperature sender - G62- -arrow- and move wiring harness clear.



Note

Shown from rear for illustration purposes.



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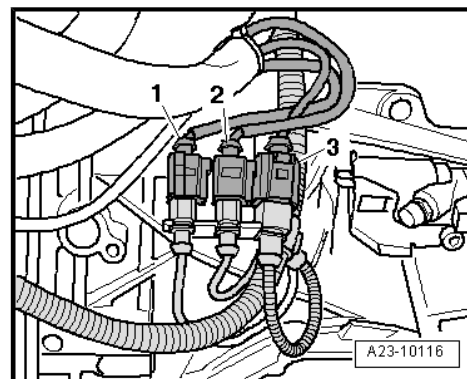
Vehicles with particulate filter:

- Take electrical connector -1- for exhaust gas temperature sender 1 - G235- out of bracket.

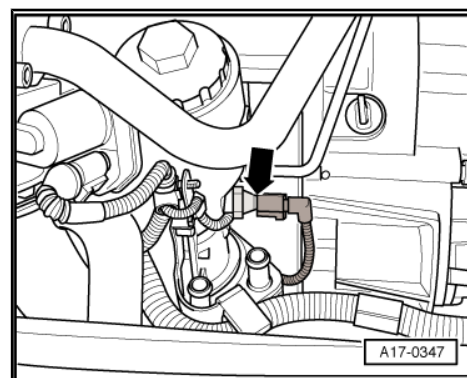
**Note**

Disregard items -2- and -3-.

- Unplug electrical connector and move wiring clear.

**All vehicles:**

- Unplug electrical connector at oil pressure switch - F1- -arrow-.

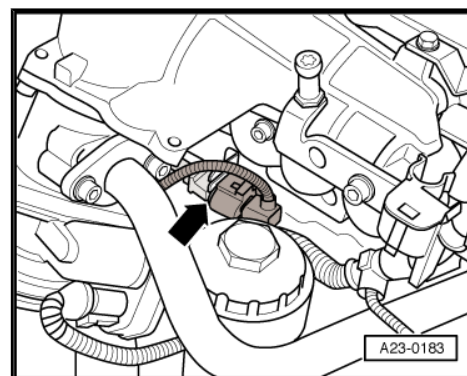
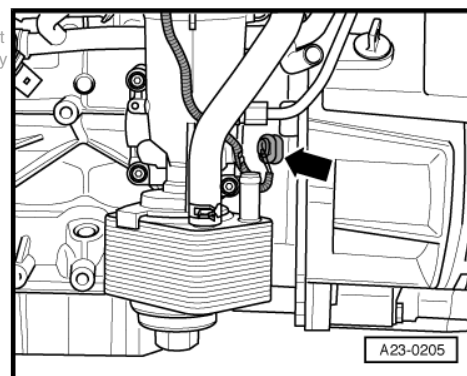


- Unplug electrical connector at engine speed sender - G28- -arrow- using assembly tool - T10118-.

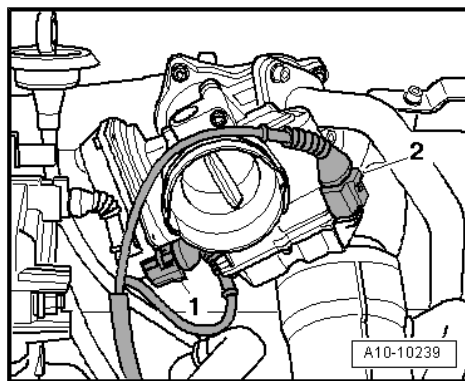
**Note**

To release electrical connector without assembly tool - T10118-, press connector on engine speed sender in with a screwdriver and at the same time lift release tab with a thin wire hook.

- Move wiring clear.
- Unplug electrical connector -arrow- at Hall sender - G40- .

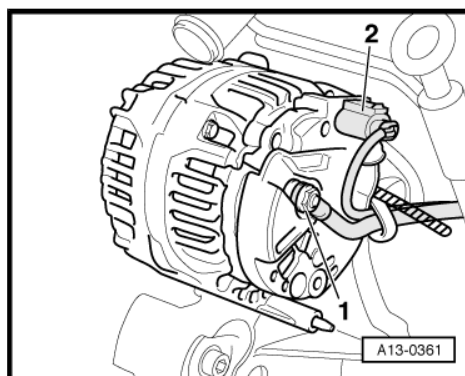


- Unplug electrical connectors at exhaust gas recirculation valve
- N18- with exhaust gas recirculation potentiometer - G212-
-item 1- and at intake manifold flap motor - V157- -item 2-.

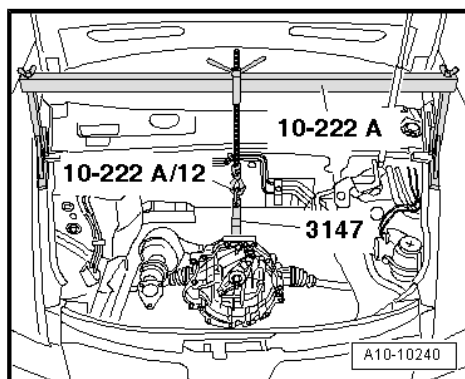


- Unplug electrical connector -2-.

- Unbolt electrical wiring -1- at alternator and move wiring harness clear.



- Set up support bracket - 10-222 A- behind gas-filled strut on wing panel flanges. The spindle is located at the front.
- Engage gearbox support - 3147- in bolt hole at top of bell housing as shown in illustration.
- Connect the gearbox support - 3147- to support bracket - 10-222 A- using shackle - 10-222 A/12- .



Note

Shown in illustration with engine removed.



Caution

***Do not apply tension to spindle of support bracket - 10-222 A- .
This can lead to deformation of the wing panel flanges.***

- Attach lifting tackle - 3033- to engine and workshop hoist - VAS 6100- as shown in illustration.
- Unscrew remaining engine/gearbox bolt.

**Note**

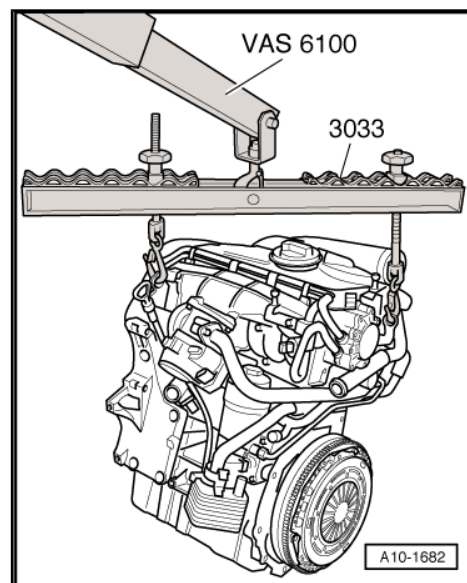
Check that all hoses and other connections between engine and body have been detached.

- Raise engine until the studs of the engine mountings are clear.
- Turn spindle of support bracket - 10-222 A- to take up slack.

**Caution**

Do not apply tension to spindle of support bracket - 10-222 A-. This can lead to deformation of the wing panel flanges.

- Detach engine from gearbox and lift engine upwards out of engine compartment.

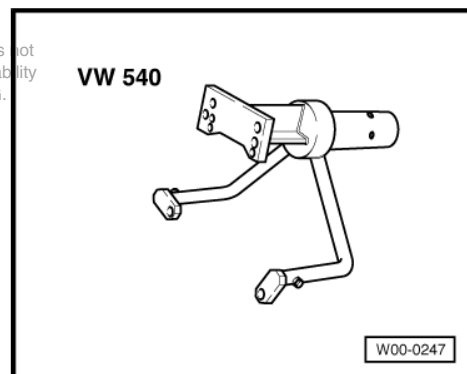


1.2 Securing engine to assembly stand

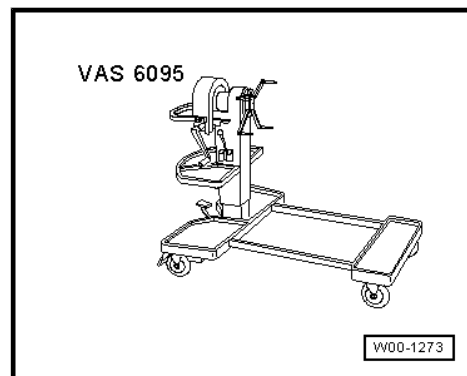
Special tools and workshop equipment required

- ◆ Engine and gearbox support - VW 540-

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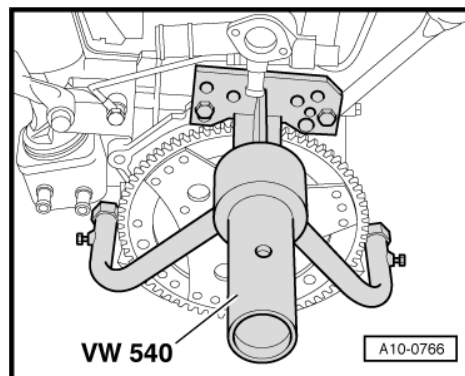


- ◆ Engine and gearbox support - VAS 6095-



Procedure

- Secure engine with engine and gearbox support - VW 540- to engine stand - VAS 6095- .



1.3 Installing engine



Note

- ◆ *Renew self-locking nuts and bolts when performing assembly work.*
- ◆ *Renew bolts which are tightened to a specified angle as well as oil seals, gaskets and O-rings.*
- ◆ *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*
- ◆ *Fit all cable ties in the original positions when installing.*

Vehicles with manual gearbox:

- When fitting a new clutch plate together with a used pressure plate (self-adjusting clutch), the adjuster ring in the pressure plate has to be reset by turning it back as far as it will go. If this is not done, the pressure plate will operate with reduced clamping force, causing clutch slip ⇒ Rep. gr. 30 .



Note

- ◆ *If the clutch plate is not being replaced, it is not necessary to reset the adjuster ring.*
- ◆ *New SAC pressure plates are already pre-set accordingly, and do not have to be reset.*
- Clean input shaft splines and (in the case of used clutch plates) the hub splines. Remove corrosion and apply only a very thin coating of grease - G 000 100- to the splines. Do not lubricate guide sleeve.
- Check that the clutch plate is properly centralised (only necessary if you have carried out other work on the clutch).
- Check clutch release bearing for wear and make sure that plastic ring is securely seated; renew clutch release bearing if necessary ⇒ Rep. gr. 30 .
- A needle bearing must be fitted in the crankshaft on vehicles with manual gearbox; install needle bearing if not already fitted ⇒ [page 78](#) .

Vehicles with multitronic gearbox:

- Clean input shaft splines and splines of damper unit on fly-wheel; remove corrosion and apply only a very thin coating of

grease - G 000 100- to the splines. Remove any excess grease.

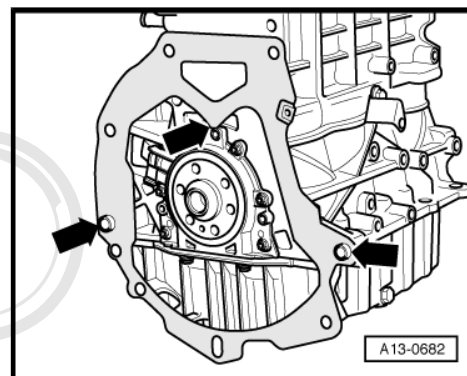
All vehicles:

- Check whether dowel sleeves for centring the engine/gearbox assembly are fitted in the cylinder block; install dowel sleeves if necessary.
- Ensure that the intermediate plate is engaged on the sealing flange and pushed onto the dowel sleeves -arrows-.
- Push intermediate plate between engine and gearbox onto dowel sleeves.
- Attach engine to gearbox and screw in one bolt finger-tight.



Caution

Release support bracket - 10-222 A- before lowering engine. Lowering the engine without releasing the support bracket can lead to deformation of the wing panel flanges.



- Release spindle of support bracket - 10-222 A- .
- Lower engine, inserting studs of engine mountings into consoles for engine mountings as you do so.



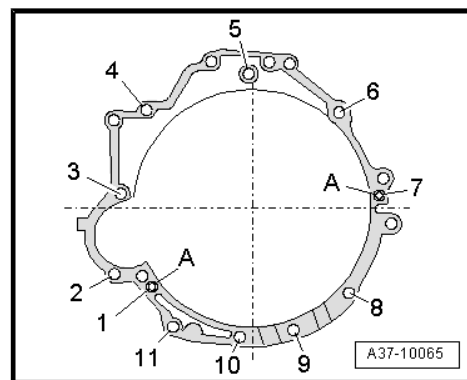
Note

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- ◆ *Tightening torques apply only to lightly greased, oiled, phosphated or black-finished nuts and bolts.*
- ◆ *Additional lubricant such as engine oil or gearbox oil may be used, but do not use lubricant containing graphite.*
- ◆ *Do not use degreased parts.*
- ◆ *Tolerance for tightening torques: $\pm 15\%$.*

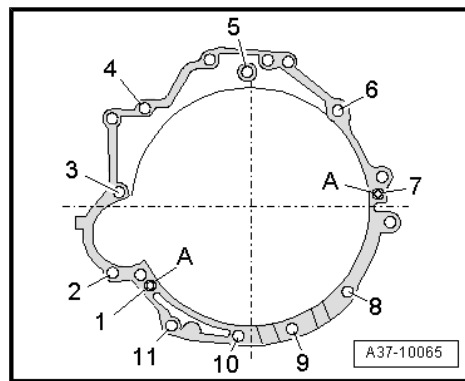
Securing engine to manual gearbox

Item	Bolt	Nm
1, 6	M12x105	65
2, 4	M12x80	65
3	M12x90	65
5, 7	M12x95	65
8	M10x50	45
9, 10, 11	M10x45	45
A	Dowel sleeves for centralising	



Securing engine to multitronic gearbox

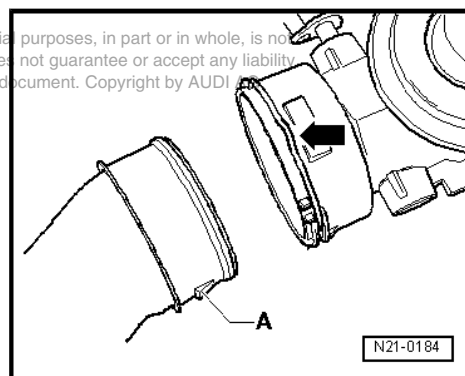
Item	Bolt	Nm
1	M12x67	65
2	M10x70	45
3, 4, 5, 7	M12x75	65
6	M12x105	65
8	M10x60	45
9, 10, 11	M10x45	45
A	Dowel sleeves for centralising	



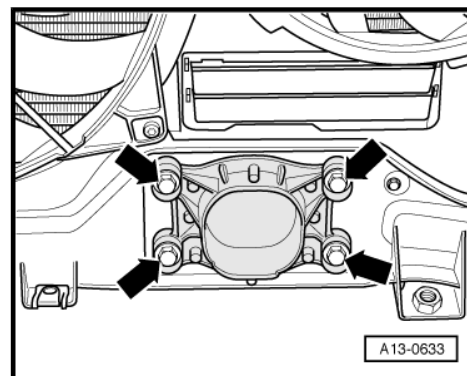
All vehicles:

Remaining installation steps are carried out in reverse sequence; note the following:

- Align exhaust system so it is free of stress: vehicles without particulate filter ⇒ [page 221](#) , vehicles with particulate filter ⇒ [page 235](#) .
- Install air conditioner compressor ⇒ Rep. gr. 87 .
- Install power steering pump ⇒ Rep. gr. 48 .
- Install poly V-belt ⇒ [page 35](#) .
- When installing air intake hoses with plug-in connectors, ensure that the securing clip -arrow- engages audibly on the retaining lug -A-.



- Install lock carrier with attachments ⇒ Rep. gr. 50 .
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten bolts -arrows-.
- Install headlights ⇒ Rep. gr. 94 .
- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Observe notes on procedures required after connecting battery ⇒ Rep. gr. 27 .

**Caution**

Do not use a battery charger to boost starting. There is danger of damaging the vehicle's control units.

- Check oil level ⇒ [page 178](#) .
- Fill cooling system ⇒ [page 185](#) .

**Note**

- ◆ *Drained-off coolant may only be used again if the original cylinder head and cylinder block are re-installed.*
- ◆ *Contaminated or dirty coolant must not be used again.*
- Check headlight adjustment ⇒ Maintenance ; Booklet 405 .

Tightening torques**Note**

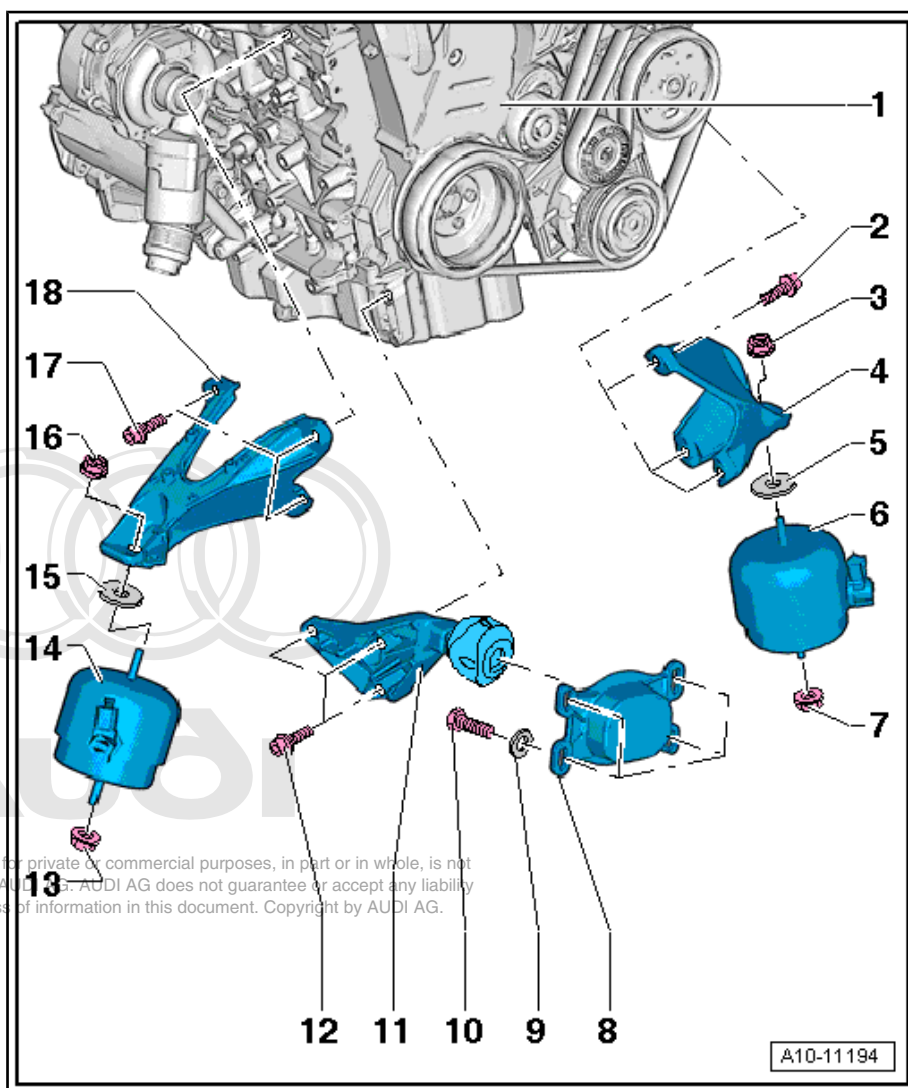
- ◆ *Tightening torques apply only to lightly greased, oiled, phosphated or black-finished nuts and bolts.*
- ◆ *Additional lubricant such as engine oil or gearbox oil may be used, but do not use lubricant containing graphite.*
- ◆ *Do not use degreased parts.*
- ◆ *Tolerance for tightening torques: ± 15 %.*

Component		Nm
Bolts/nuts	M6	9
	M8	20
	M10	40
	M12	65
Except for the following:		
Electrical wire to alternator		16
Electrical wire to starter		16
Engine mounting to engine console		40
Drive shaft heat shield to gearbox		23
Torque reaction support to engine		23
Stop for torque reaction support to lock carrier		23

2 Assembly mountings

2.1 Assembly mountings - exploded view

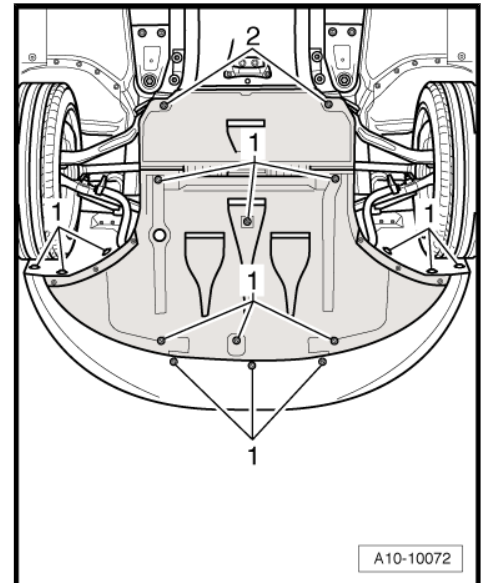
- 1 - Engine
- 2 - Bolt
 - ☐ 40 Nm
- 3 - Nut
 - ☐ 40 Nm
- 4 - Engine support
- 5 - Washer
- 6 - Engine mounting
- 7 - Nut
 - ☐ 40 Nm
- 8 - Torque reaction stop
 - ☐ Removing and installing
⇒ [page 29](#)
- 9 - Washer
- 10 - Bolt
 - ☐ 23 Nm
- 11 - Torque reaction support
 - ☐ Removing and installing
⇒ [page 29](#)
- 12 - Bolt
 - ☐ 20 Nm + 90°
- 13 - Nut
 - ☐ 40 Nm
- 14 - Engine mounting
- 15 - Washer
- 16 - Nut
 - ☐ 40 Nm
- 17 - Bolt
 - ☐ 40 Nm
- 18 - Engine support



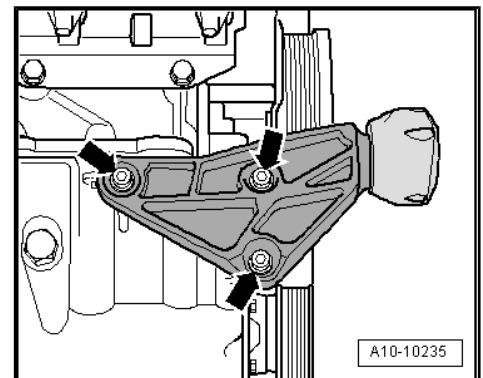
2.2 Removing and installing torque reaction support and torque reaction stop

Removing

- Release quick-release fasteners -1- and -2- and take off noise insulation panels.



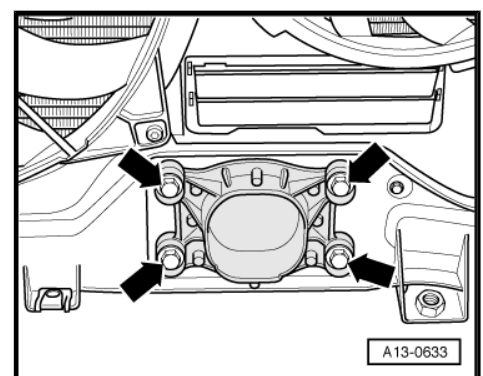
- Unscrew bolts -arrows- and remove torque reaction support from engine.



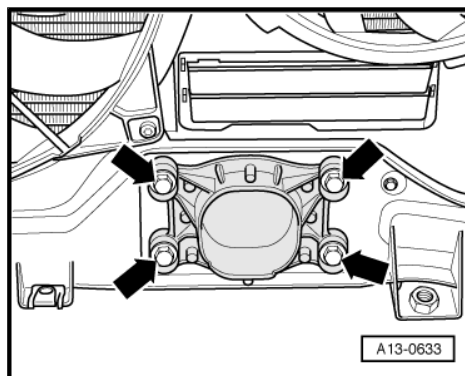
- Unscrew bolts -arrows- and remove stop for torque reaction support.

Installing

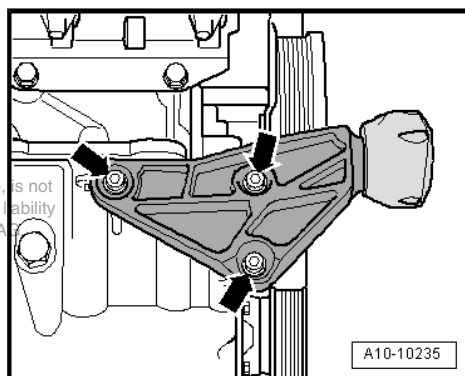
Installation is carried out in the reverse order; note the following:
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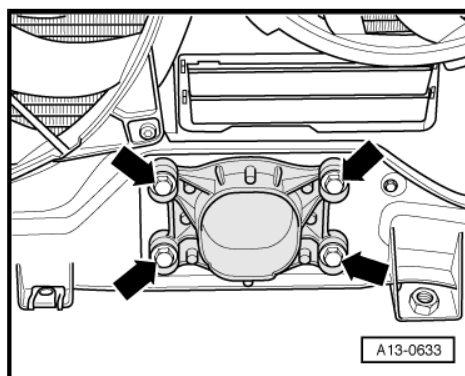
- Insert stop for torque reaction support and screw in bolts -arrows- hand-tight.



- Install torque reaction support and tighten bolts -arrows-.



- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten bolts -arrows-.



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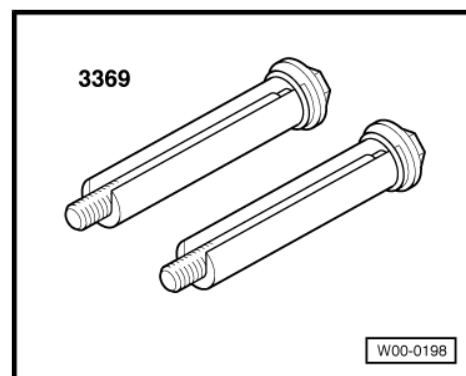
13 – Crankshaft group

1 Dismantling and assembling engine

1.1 Moving lock carrier to service position

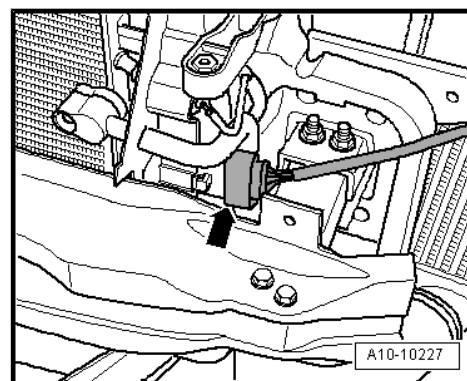
Special tools and workshop equipment required

- ◆ Front-end service sleeves - 3369-

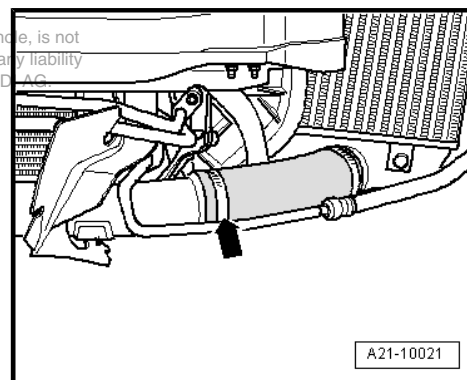


Removing

- Remove both front wheels.
- Remove front sections of front wheel housing liners (left and right) ⇒ Rep. gr. 66 .
- Remove bumper cover (front) ⇒ Rep. gr. 63 .
- Remove headlights (left and right) ⇒ Rep. gr. 94 .
- Unplug electrical multi-pin connector -arrow-.

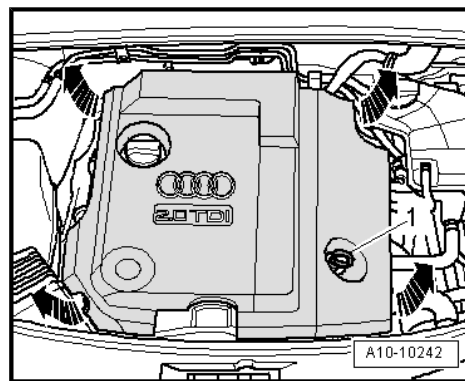


- Open hose clip -arrow- and disconnect air intake hose from air pipe.

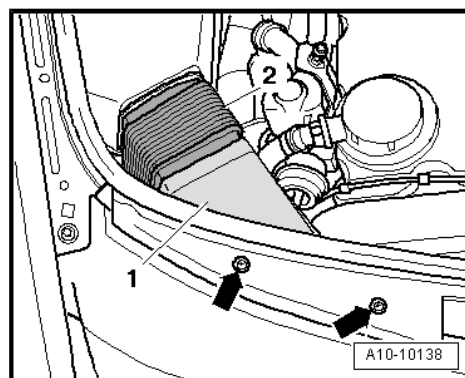


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- Pull dipstick -1- out of guide tube.
- Pull off engine cover panel -arrows-.
- Re-insert dipstick in guide tube.



- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.

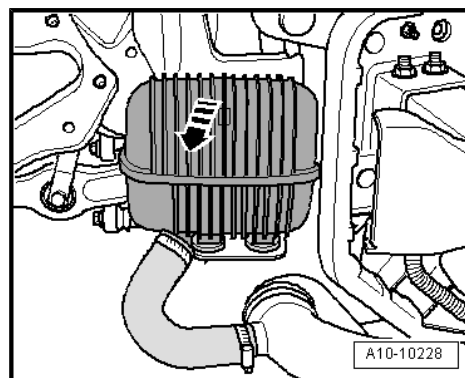


- Detach resonator from retainer -arrow-.

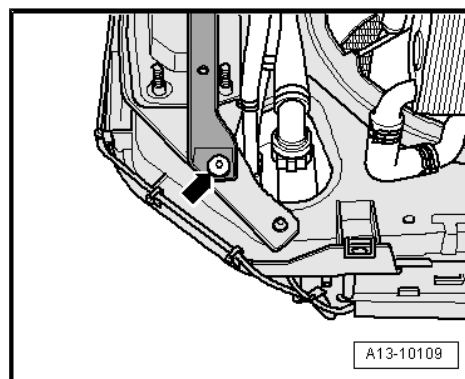


Note

Air intake hose remains connected.

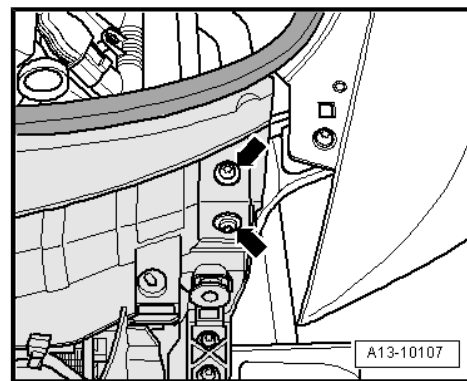


- Remove one bolt -arrow- on each side from bottom of lock carrier.

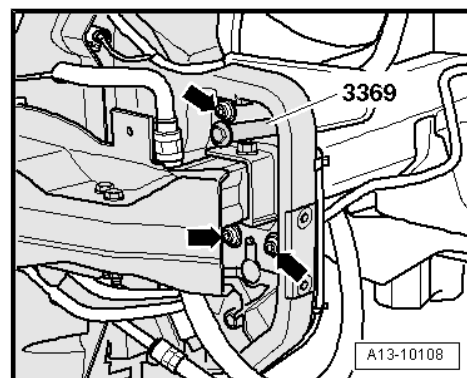


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- Pull off bonnet seal at both wing panels and at lock carrier.
- Remove two bolts -arrows- on each side at top of lock carrier.



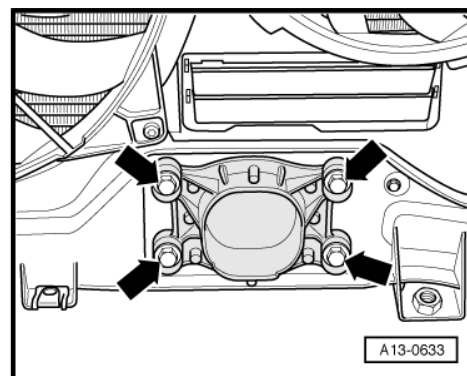
- Screw in front-end service sleeves - 3369- (left and right) at holes for lock carrier securing bolts, after removing corresponding bolts.
- Remove remaining bolts (left and right) -arrows-.
- Carefully pull the lock carrier forward.



Installing

Installation is carried out in the reverse order; note the following:

- Install lock carrier with attachments ⇒ Rep. gr. 50 .
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten bolts -arrows-.
- Install headlights ⇒ Rep. gr. 94 .
- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Check headlight adjustment ⇒ Maintenance ; Booklet 405 .



Tightening torque

Component	Nm
Stop for torque reaction support to lock carrier	23

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2 Servicing work on pulley end

2.1 Poly V-belt drive for power steering pump, alternator and air conditioner compressor - exploded view

1 - Poly V-belt

- ☐ Check for wear
- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.
- ☐ Removing and installing ⇒ [page 35](#)
- ☐ When installing, make sure it is properly seated on pulleys.

2 - Vibration damper

- ☐ With pulley for poly V-belt
- ☐ Can only be installed in one position
- ☐ Removing and installing ⇒ [page 39](#)

3 - 10 Nm + 90° (1/4 turn) further

- ☐ Renew

4 - Cover cap for vibration damper

5 - 23 Nm

6 - Pulley for power steering pump

- ☐ Counterhold with drift to unbolt

7 - Poly V-belt tensioner

- ☐ Use locking pin - T10060 A- to lock tensioner.
- ☐ Removing and installing ⇒ [page 37](#)

8 - Dowel sleeve

- ☐ Ensure correct seating in bracket

9 - 40 Nm + 90° (1/4 turn) further

- ☐ Renew

10 - Idler roller for toothed belt

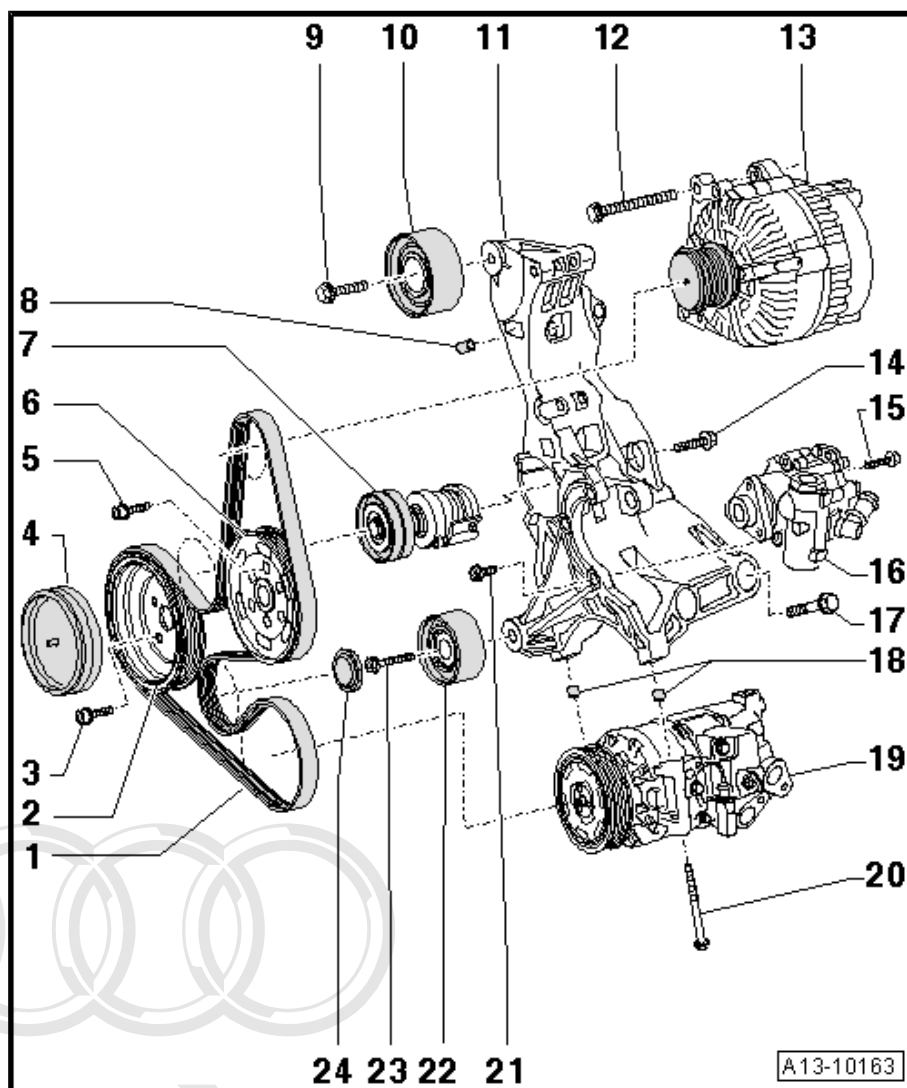
11 - Bracket for ancillaries

- ☐ Removing and installing ⇒ [page 42](#)

12 - 23 Nm

13 - Alternator

- ☐ Removing and installing ⇒ Rep. gr. 27



- ☐ To facilitate attachment of alternator, knock back threaded bushes for securing bolts slightly

14 - 23 Nm

15 - 23 Nm

16 - Power steering pump

- ☐ Removing and installing ⇒ Rep. gr. 48
- ☐ To facilitate attachment of power steering pump, knock back threaded bush for securing bolt slightly

17 - 45 Nm

18 - Dowel sleeve

- ☐ 2x
- ☐ Ensure correct seating in bracket for ancillaries

19 - Air conditioner compressor

- ☐ Do not unscrew or disconnect refrigerant hoses or pipes.
- ☐ Removing and installing ⇒ Rep. gr. 87
- ☐ Pay attention to dowel sleeves ⇒ [Item 18 \(page 35\)](#) when installing

20 - 25 Nm

21 - 23 Nm

22 - Idler roller for poly V-belt

- ☐ Note installation position

23 - 20 Nm + 90° (1/4 turn) further

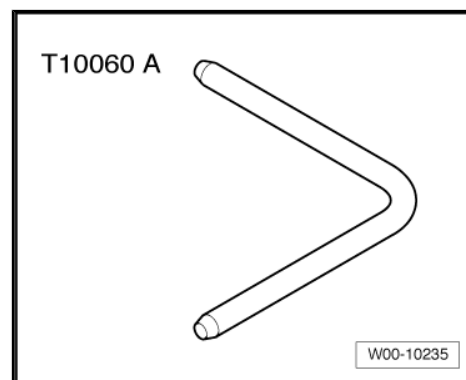
- ☐ Renew

24 - Cover cap for idler roller

2.2 Removing and installing poly V-belt

Special tools and workshop equipment required

- ◆ Locking pin - T10060 A-



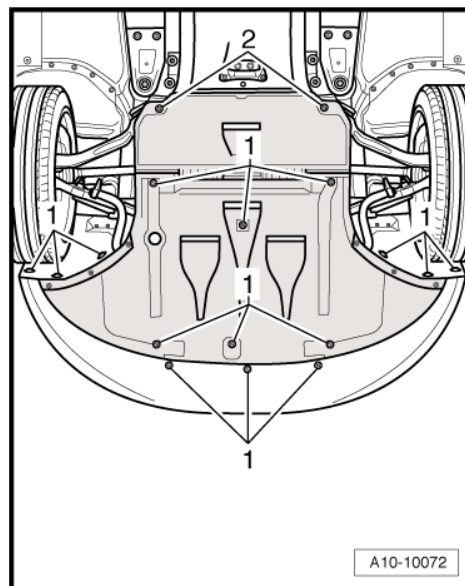
Removing



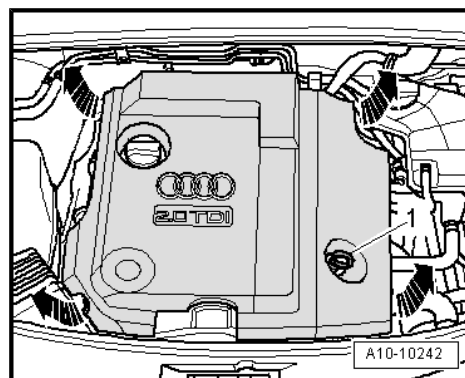
Note

To avoid the procedure of moving the lock carrier to the service position when removing and installing the poly V-belt, the belt can be fitted with the assistance of a second mechanic. The engine compartment must be accessed from top and bottom at the same time.

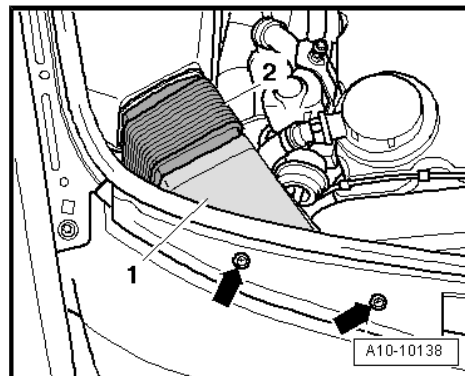
- Release quick-release fasteners -1- and -2- and take off noise insulation panels.



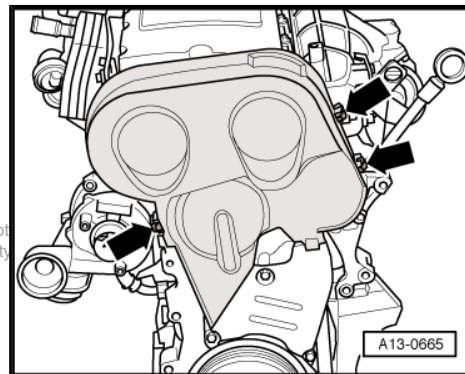
- Pull dipstick -1- out of guide tube.
- Pull off engine cover panel -arrows-.
- Re-insert dipstick in guide tube.



- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.
- Pull off bonnet seal at lock carrier.



- Remove top toothed belt cover by releasing retaining clips -arrows-.



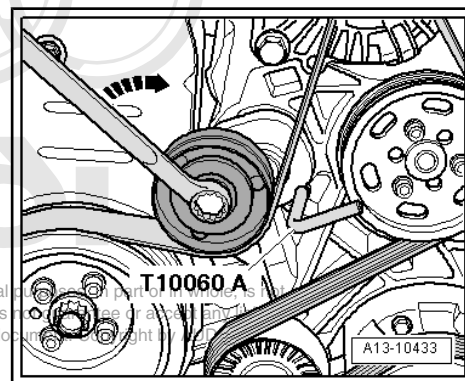
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**Note**

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

- Turn tensioner in -direction of arrow- and lock with locking pin - T10060 A- to slacken the poly V-belt.
- Remove poly V-belt.

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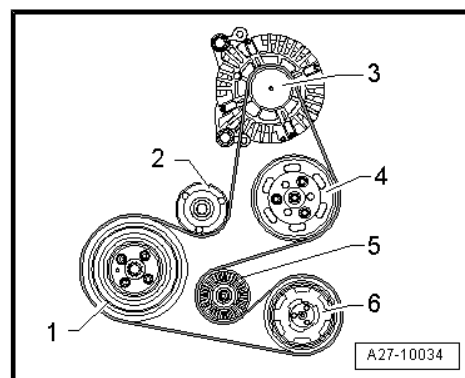
**Installing**

Installation is carried out in the reverse order; note the following:

- Fit poly V-belt on all belt pulleys.

- 1 - Vibration damper
- 2 - Tensioner
- 3 - Alternator
- 4 - Power steering pump
- 5 - Idler roller
- 6 - Air conditioner compressor

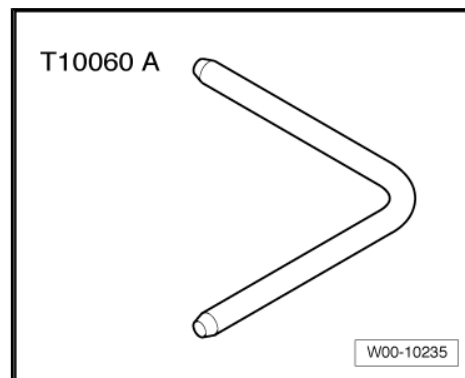
- Hold tensioner with ring spanner, pull out locking pin - T10060 A- and release pressure from tensioner.
- Check poly V-belt for proper seating.
- Start engine and check that belt runs properly.



2.3 Removing and installing tensioner for poly V-belt

Special tools and workshop equipment required

- ◆ Locking pin - T10060 A-



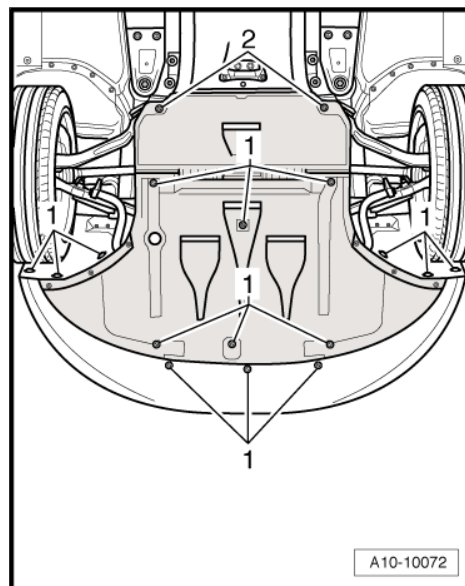
Removing



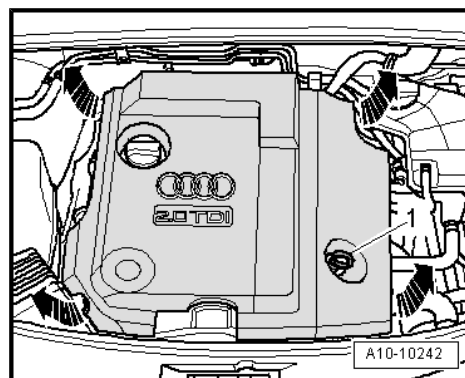
Note

To avoid the procedure of moving the lock carrier to the service position when removing and installing the poly V-belt, the belt can be fitted with the assistance of a second mechanic. The engine compartment must be accessed from top and bottom at the same time.

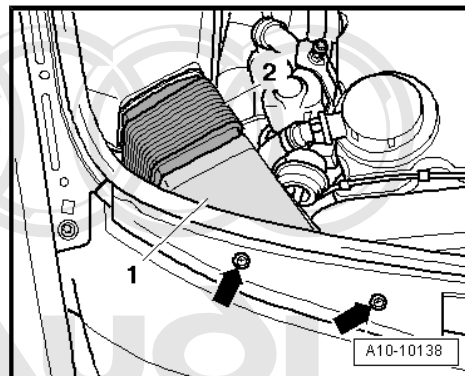
- Release quick-release fasteners -1- and -2- and take off noise insulation panels.



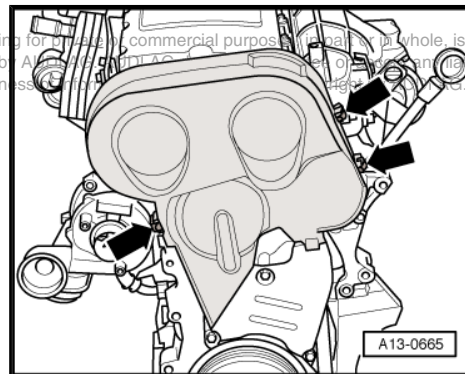
- Pull dipstick -1- out of guide tube.
- Pull off engine cover panel -arrows-.
- Re-insert dipstick in guide tube.



- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.
- Pull off bonnet seal at lock carrier.



- Remove top toothed belt cover by releasing retaining clips -arrows-.

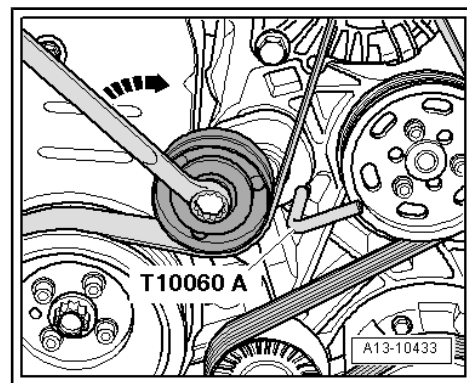


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**Note**

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

- Turn tensioner in -direction of arrow- and lock with locking pin - T10060 A- to slacken the poly V-belt.
- Remove poly V-belt.

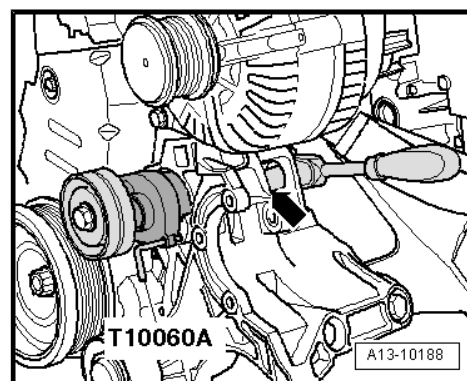


- Unscrew bolt -arrow- and remove poly V-belt tensioner.

Installing

Installation is carried out in the reverse order; note the following:

- Check tensioner for correct seating in bracket for ancillaries before securing.
- Install poly V-belt ⇒ [page 35](#).

**Tightening torque**

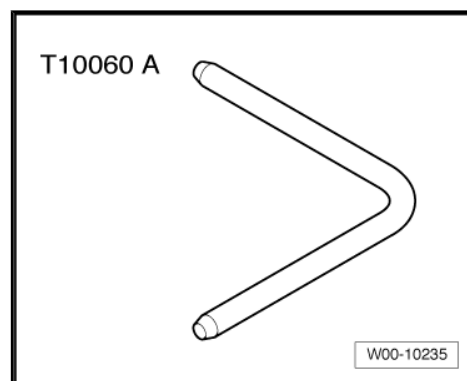
Component	Nm
Poly V-belt tensioner to bracket	25

2.4

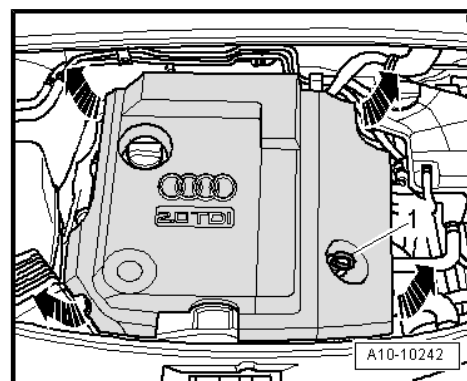
Removing and installing vibration damper

Special tools and workshop equipment required

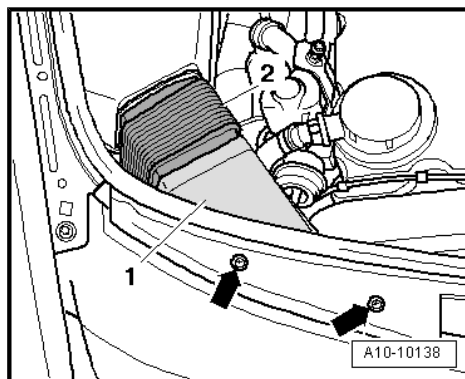
- ◆ Locking pin - T10060 A-

**Removing**

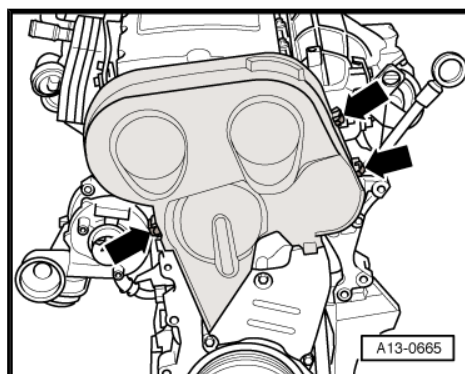
- Pull dipstick -1- out of guide tube.
- Pull off engine cover panel -arrows-.
- Re-insert dipstick in guide tube.



- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.
- Pull off bonnet seal at lock carrier.



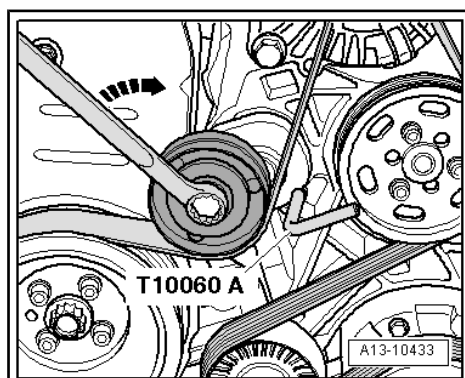
- Remove top toothed belt cover by releasing retaining clips -arrows-.



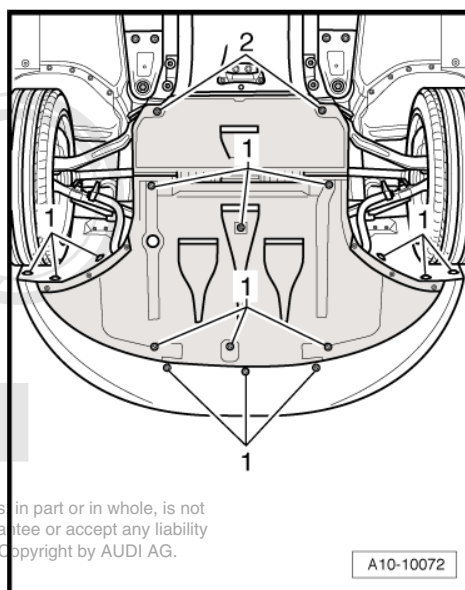
Note

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

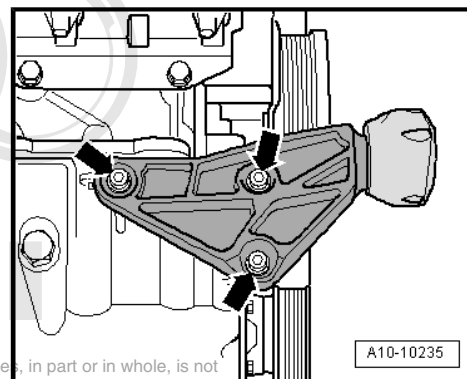
- Turn tensioner in -direction of arrow- and lock with locking pin - T10060 A- to slacken the poly V-belt.
- Remove poly V-belt.



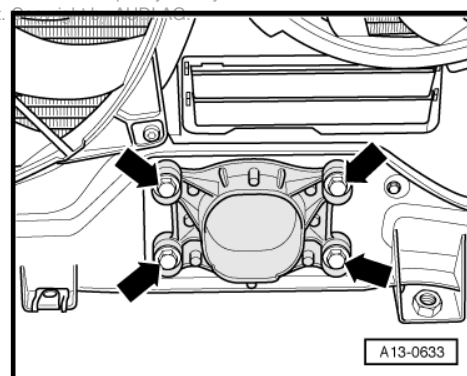
- Release quick-release fasteners -1- and -2- and take off noise insulation panels.



- Unscrew bolts -arrows- and remove torque reaction support from engine.



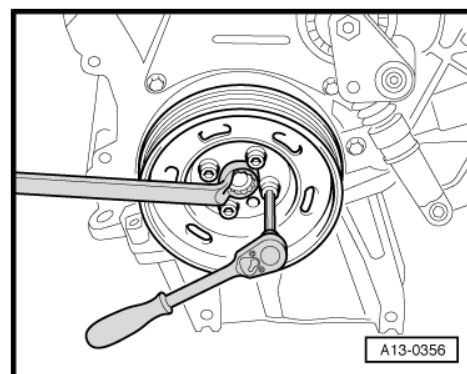
- Unscrew bolts -arrows- and remove stop for torque reaction support.



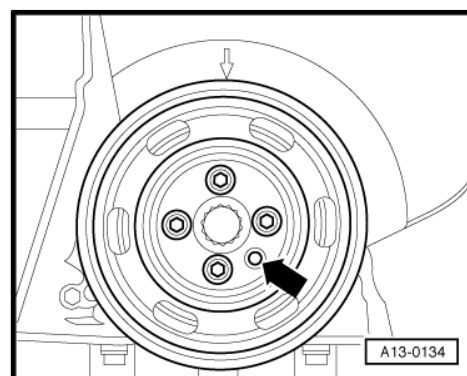
- Mark position of vibration damper for re-installation.
- Lever off cover cap from vibration damper.
- Unbolt vibration damper; counterhold on centre bolt with ring spanner.

Installing

Installation is carried out in the reverse order; note the following:



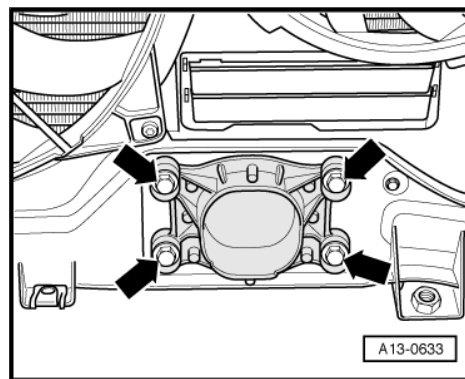
- When installing the vibration damper, use only new genuine bolts (same as original equipment) ⇒ Parts catalogue .
- The vibration damper can only be installed in one position. The hole in the vibration damper must be located over the projection on the toothed belt sprocket -arrow-.
- Install poly V-belt ⇒ [page 35](#) .



- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten bolts -arrows-.

Tightening torque

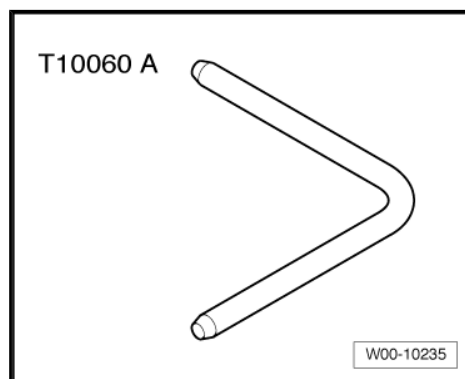
Component	Nm
Vibration damper to crankshaft	10 + 90° 1)2)
Torque reaction support to engine	23
Stop for torque reaction support to lock carrier	23
• 1) Renew bolts. • 2) 90° = one quarter turn.	



2.5 Removing and installing bracket for ancillaries

Special tools and workshop equipment required

- ◆ Locking pin - T10060 A-



Removing



Caution

Observe notes on procedure for disconnecting the battery ⇒ Rep. gr. 27.

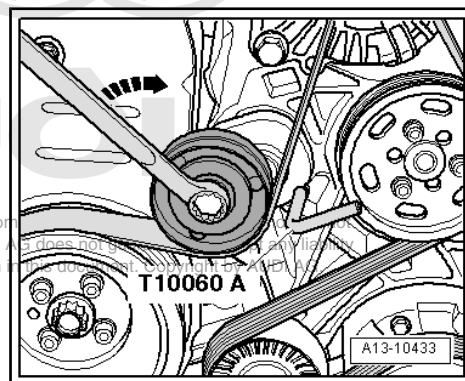
- Disconnect earth wire at battery with ignition switched off.
- Drain off coolant ⇒ [page 183](#).
- Move lock carrier to service position ⇒ [page 31](#).



Note

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

- Turn tensioner in -direction of arrow- and lock with locking pin - T10060 A- to slacken the poly V-belt.
- Remove poly V-belt.



- Unplug electrical connector -1- for magnetic clutch on air conditioner compressor.

**Caution**

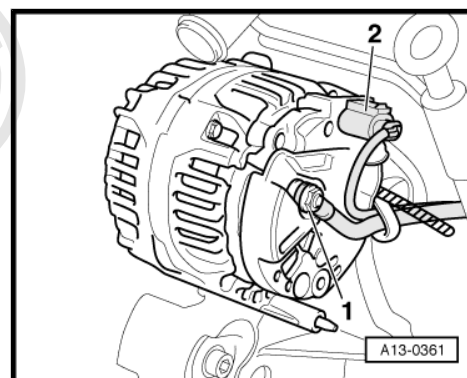
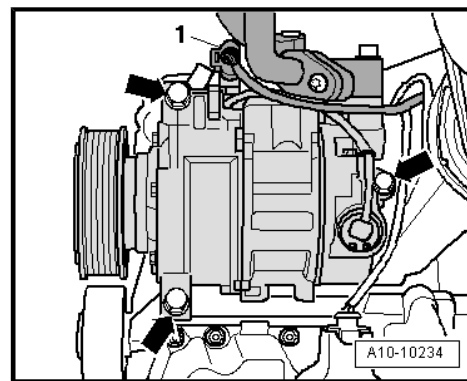
The air conditioner refrigerant circuit must not be opened.

- Unscrew air conditioner compressor from bracket -arrows-.

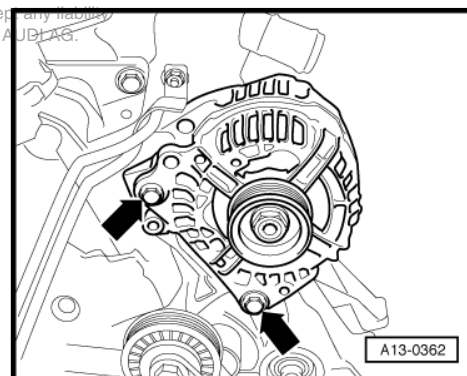
**Note**

To prevent damage to the refrigerant lines, ensure that the lines and hoses are not stretched, kinked or bent.

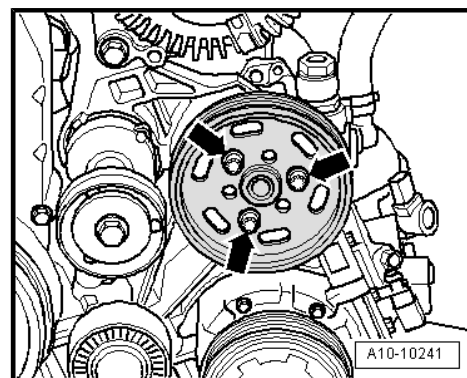
- Tie up air conditioner compressor with lines attached to left-side of vehicle.
- Unscrew wire -1- at alternator.
- Unplug electrical connector -2-.



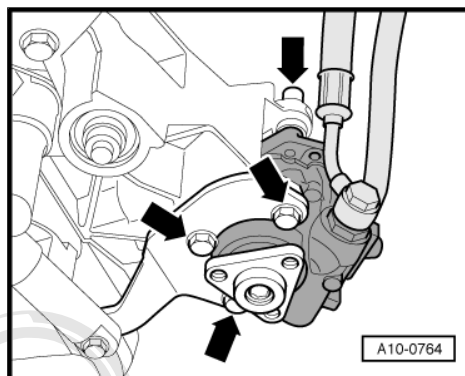
- Remove bolts -arrows-.
- Remove alternator.



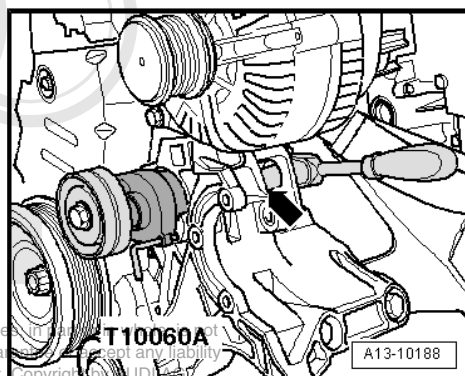
- Counterhold power steering pump pulley with drift to unbolt pulley -arrows-.



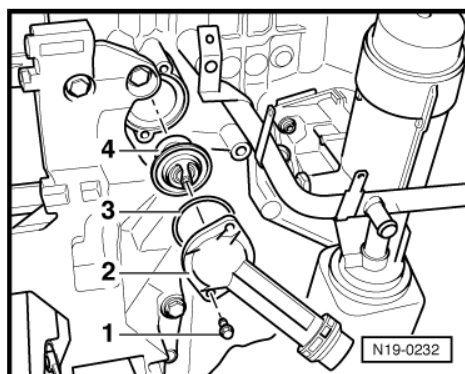
- Unbolt power steering pump -arrows- and tie up to one side; the hoses/pipes remain connected.



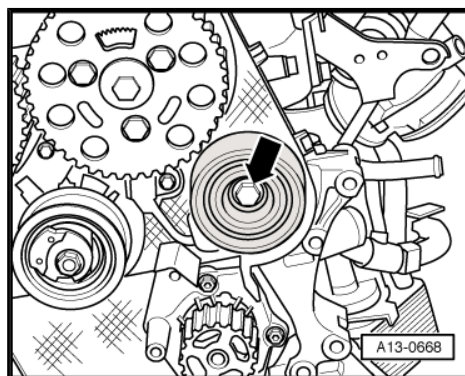
- Unscrew bolt -arrow- and remove poly V-belt tensioner.



- Detach coolant hose from hose connection -2-.
- Remove securing bolts -1- for hose connection and remove hose connection with thermostat -4- and O-ring -3-.



- Remove toothed belt ⇒ [page 48](#).
- Remove the idler roller -arrow-.



- Unscrew bolts -1 ... 6- and remove bracket for ancillaries.

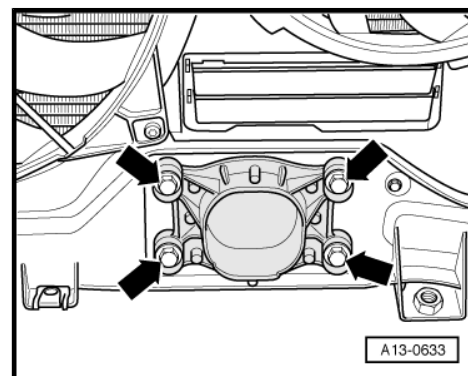
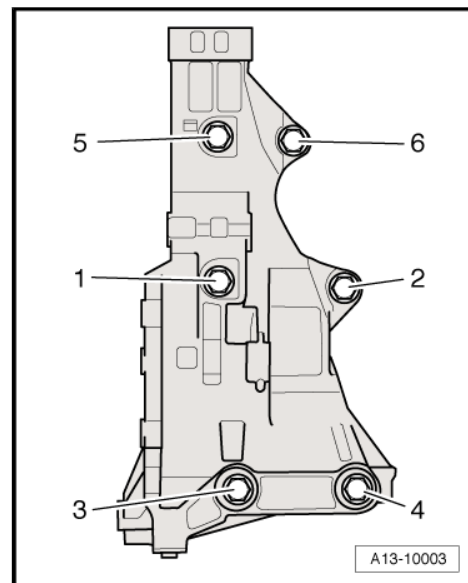
Installing

Installation is carried out in the reverse order; note the following:

- Check that dowel sleeve at top right between bracket for ancillaries and cylinder block is fitted; insert if necessary.
- First tighten bolts in the sequence -1 ... 6- hand-tight, then tighten to specified torque.
- Install toothed belt (adjust valve timing) ⇒ [page 51](#) .
- Install vibration damper ⇒ [page 39](#) .
- Install thermostat connection together with thermostat ⇒ [page 190](#) .
- Install poly V-belt tensioner ⇒ [page 37](#) .
- Install power steering pump ⇒ Rep. gr. 48 .
- Install alternator ⇒ Rep. gr. 27 .
- Install air conditioner compressor ⇒ Rep. gr. 87 .
- Install poly V-belt ⇒ [page 35](#) .
- Install lock carrier with attachments ⇒ Rep. gr. 50 .
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten bolts -arrows-.
- Install headlights ⇒ Rep. gr. 94 .
- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Connect battery. Procedures required ⇒ Rep. gr. 27 .
- Fill cooling system ⇒ [page 185](#) .
- Check headlight adjustment ⇒ Maintenance ; Booklet 405 .

Tightening torques

Component	Nm
Bracket for ancillaries to cylinder block	45
Idler roller for toothed belt to bracket for ancillary units	40 + 90° ¹⁾²⁾
Stop for torque reaction support to lock carrier	23
• ¹⁾ Renew bolts. • ²⁾ 90° = one quarter turn.	



2.6 Toothed belt drive - exploded view

Part 1

1 - Cover cap

- ☐ For vibration damper

2 - 10 Nm + 90° (1/4 turn) further

- ☐ Renew ⇒ Parts catalogue

3 - Vibration damper

- ☐ With pulley for poly V-belt
- ☐ Removing and installing ⇒ [page 39](#)

4 - 10 Nm

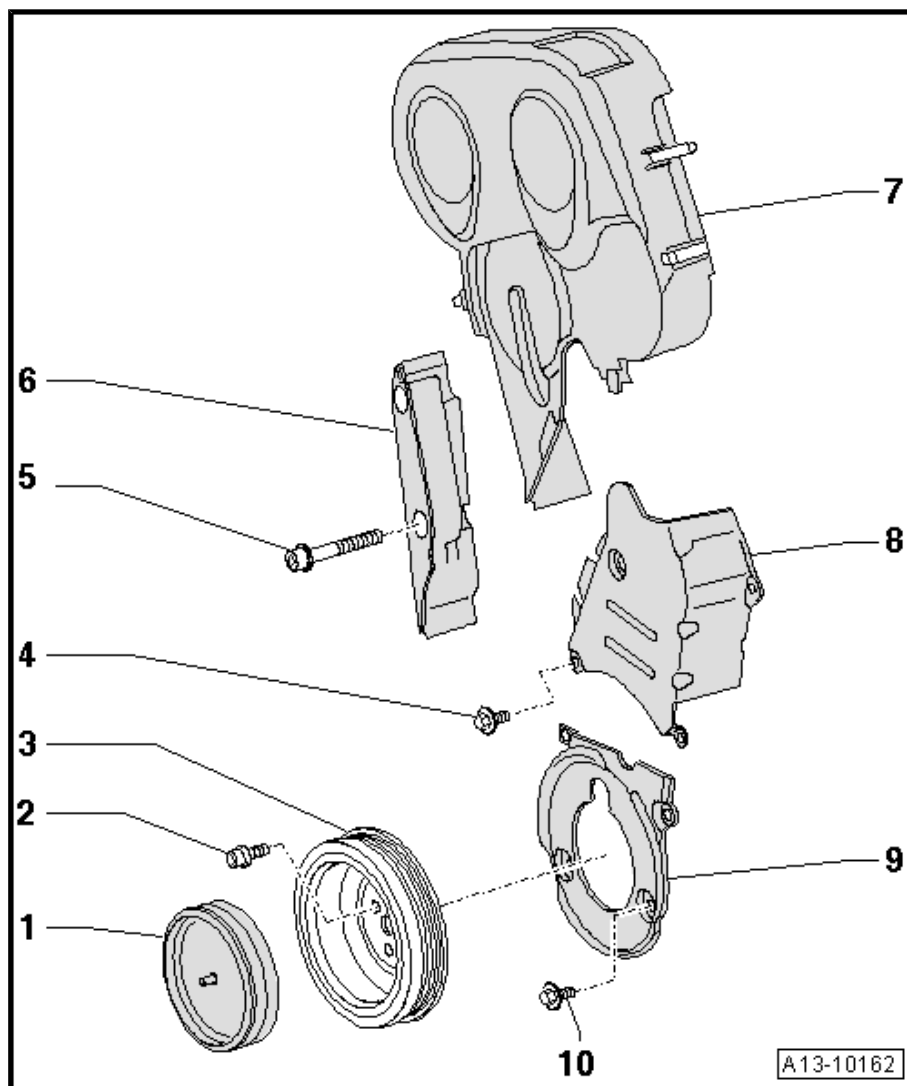
- ☐ Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue

5 - 40 Nm
6 - Toothed belt cover (side)
7 - Toothed belt cover (top)

- ☐ Engage carefully in centre toothed belt cover when installing

8 - Toothed belt cover (centre)
9 - Toothed belt cover (bottom)
10 - 10 Nm

- ☐ Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue


Part 2


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1 - 120 Nm + 90° (1/4 turn) further

- ☐ Renew
- ☐ Do not lubricate with oil
- ☐ Use counterhold tool - 3415- when loosening and tightening
⇒ [page 58](#)

2 - 20 Nm

3 - Idler roller

4 - 20 Nm + 45° (1/8 turn) further

5 - Tensioning roller

6 - Toothed belt

- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage
- ☐ Check for wear
- ☐ Removing ⇒ [page 48](#)
- ☐ Installing (adjusting valve timing)
⇒ [page 51](#)

7 - 25 Nm

8 - Camshaft sprocket for exhaust camshaft

- ☐ Mark installation position

9 - 25 Nm

10 - Camshaft sprocket for inlet camshaft

11 - 100 Nm

- ☐ Use counterhold tool - T10051- when loosening and tightening
⇒ ["3.3 Removing and installing camshafts", page 116](#)

12 - 100 Nm

- ☐ Use counterhold tool - T10051- when loosening and tightening
⇒ ["3.3 Removing and installing camshafts", page 116](#)

13 - Hub for exhaust camshaft

- ☐ To remove, use puller - T10052- ⇒ ["3.3 Removing and installing camshafts", page 116](#)

14 - Hub for inlet camshaft

- ☐ With sender wheel for Hall sender - G40-
- ☐ To remove, use puller - T10052- ⇒ ["3.3 Removing and installing camshafts", page 116](#)

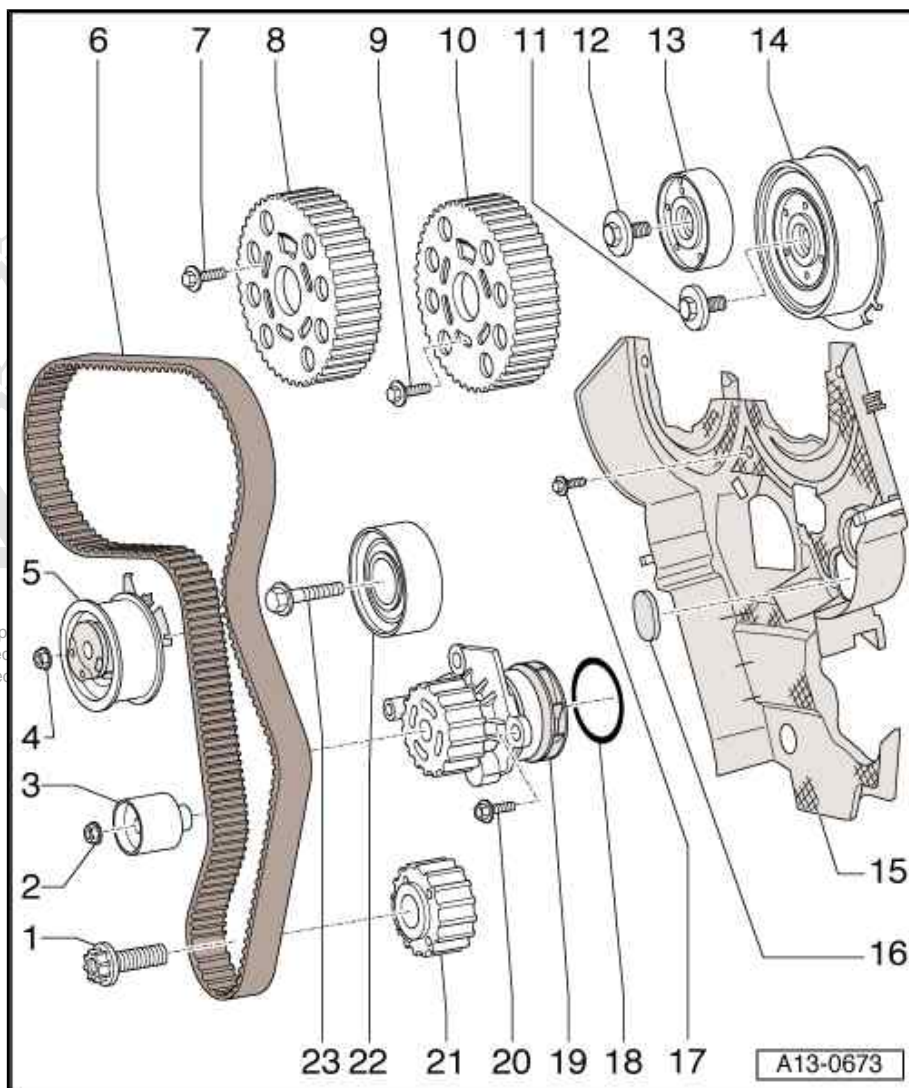
15 - Toothed belt cover (rear)

16 - Rubber grommet

- ☐ Renew if damaged

17 - 10 Nm

- ☐ Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue



18 - O-ring

- ☐ Renew

19 - Coolant pump

- ☐ Removing and installing ⇒ [page 189](#)

20 - 15 Nm

21 - Crankshaft sprocket

- ☐ Contact surface between sprocket and crankshaft must be free of oil
- ☐ Can only be installed in one position

22 - Idler roller

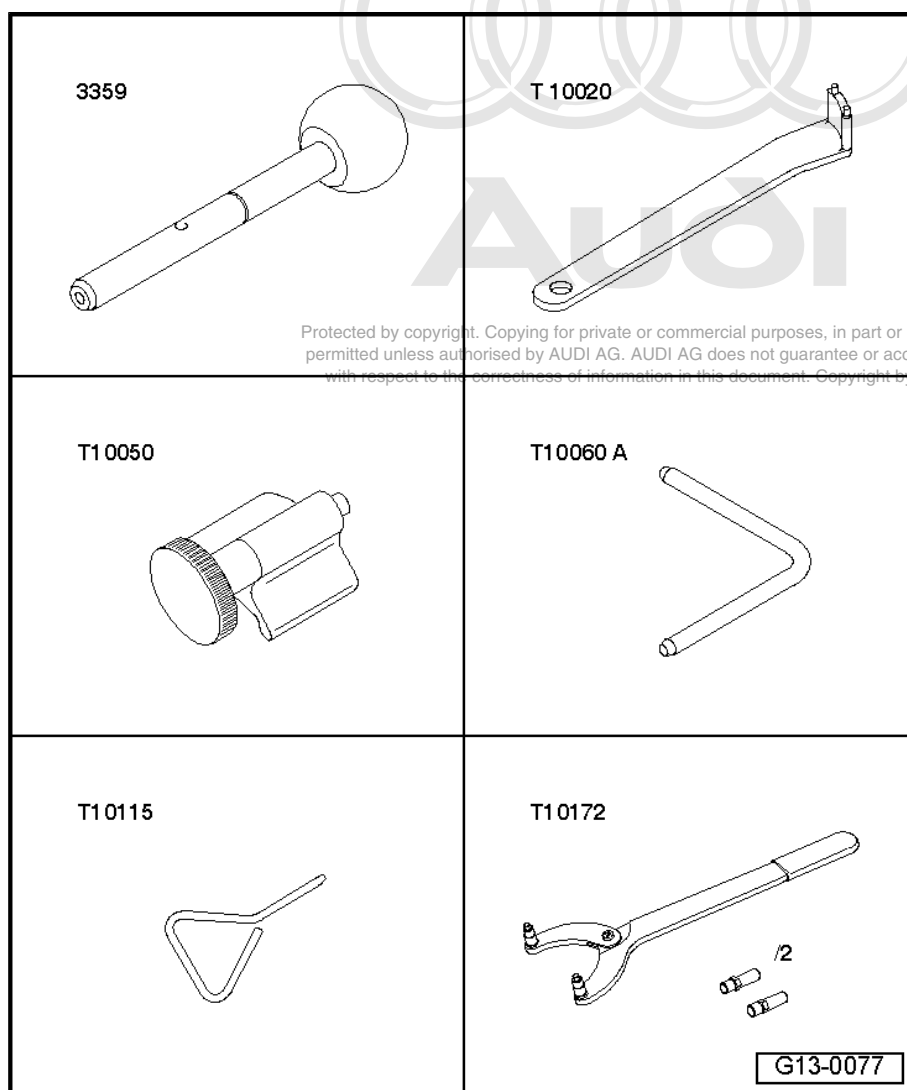
23 - 40 Nm + 90° (1/4 turn) further

- ☐ Renew

2.7 Removing and installing toothed belt

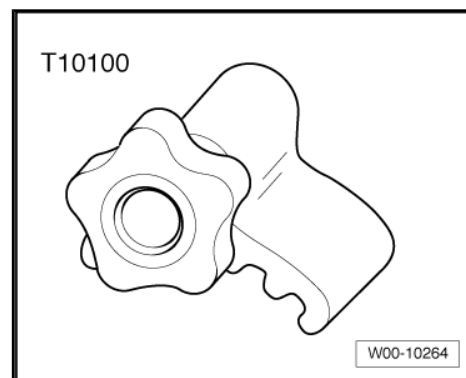
Special tools and workshop equipment required

- ◆ Diesel injection pump locking pin - 3359- (2x)
- ◆ Pin wrench - T10020-
- ◆ Crankshaft stop - T10050- for engines with circular crankshaft sprocket
- ◆ Locking pin - T10060 A-
- ◆ Locking pin - T10115-
- ◆ Counterhold tool - T10172-



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- ◆ Crankshaft stop - T10100- for engines with oval crankshaft sprocket



- ◆ Locking fluid ⇒ Parts catalogue

Removing

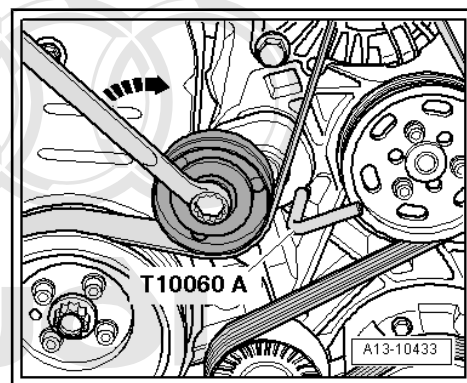
- Move lock carrier to service position ⇒ [page 31](#).



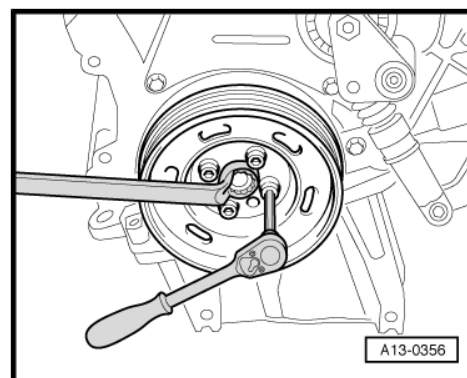
Note

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

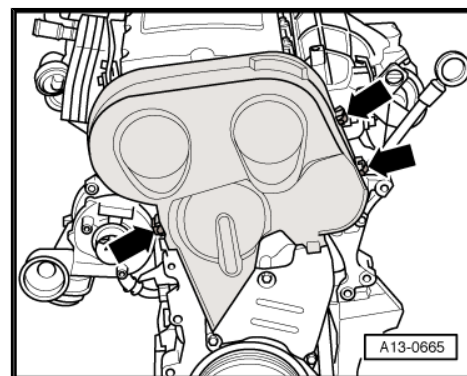
- Turn tensioner in -direction of arrow- and lock with locking pin - T10060 A- to slacken the poly V-belt.
- Remove poly V-belt.
- Release tensioner.
- Lever off cover cap from vibration damper.
- Unbolt vibration damper; counterhold on centre bolt with ring spanner.



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- Remove top toothed belt cover by releasing retaining clips -arrows-.

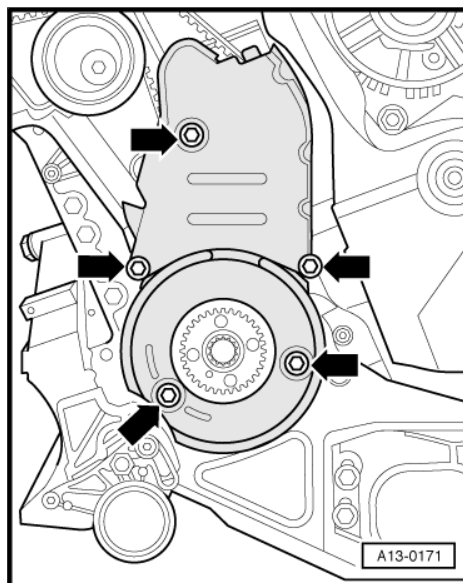


- Unbolt lower and centre toothed belt covers -arrows-.



Caution

The engine must only be turned at the crankshaft, in the direction of normal engine rotation (clockwise).



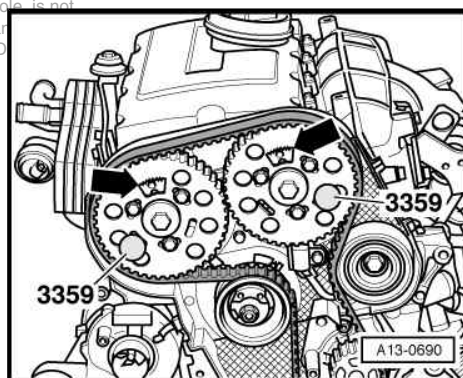
- Turn the crankshaft to TDC.



Note

At TDC position the toothed segments -arrows- face upwards.

- Lock hubs with locking pins - 3359- .



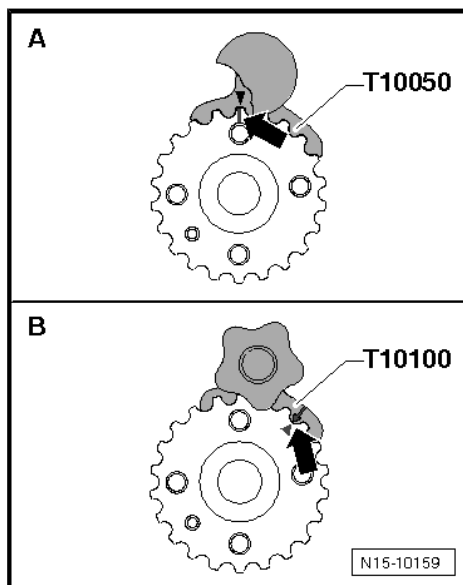
- Lock crankshaft sprocket using crankshaft stop - T10050- for engines with circular crankshaft sprocket, or crankshaft stop - T10100- for engines with oval crankshaft sprocket.
- The markings on the toothed belt sprocket and the crankshaft stop must align -arrow-. The lug of the crankshaft stop must engage in the bore in the sealing flange.



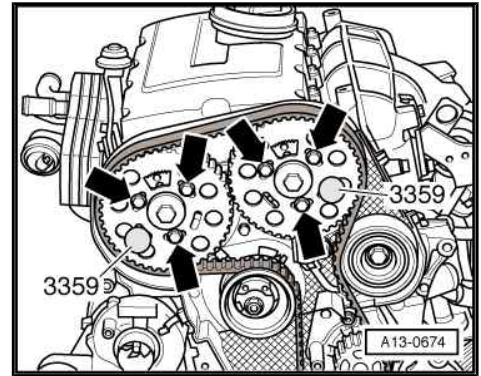
Note

The crankshaft stop can only be pushed onto the sprocket from the front face of the teeth.

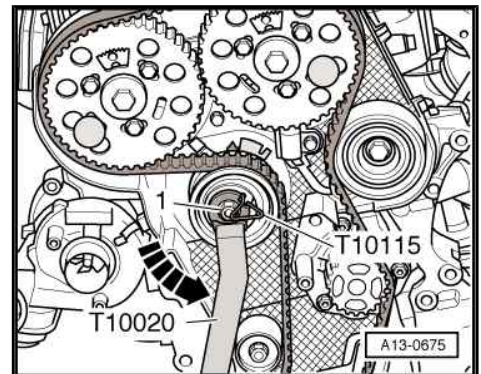
- Mark direction of rotation of toothed belt with chalk or felt-tip pen.



- Loosen the bolts -arrows- for camshaft sprockets approx. 2 turns.



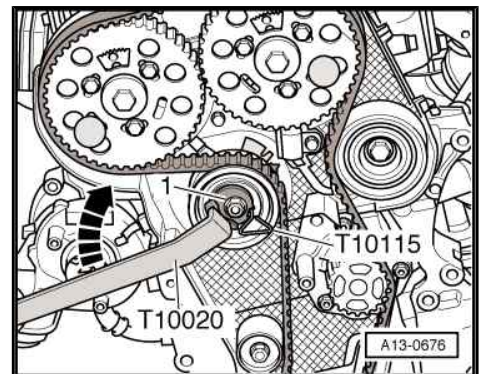
- Loosen securing nut -1- for tensioning roller.
- Using pin wrench - T10020- , turn eccentric adjuster anti-clockwise -arrow- until tensioning roller can be secured with locking pin - T10115- .



- Then turn pin wrench - T10020- clockwise -arrow- until stop and tighten securing nut -1- finger-tight.
- Take off toothed belt first from coolant pump and then from the remaining sprockets.

Installing (adjusting valve timing)

- Camshafts locked with locking pins - 3359- .
- Crankshaft is locked using crankshaft stop - T10050- for engines with circular crankshaft sprocket, or crankshaft stop - T10100- for engines with oval crankshaft sprocket.
- Tensioning roller locked with locking pin - T10115- and secured at right stop with securing nut.

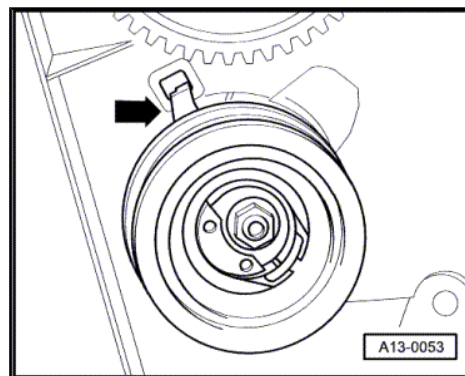


Note

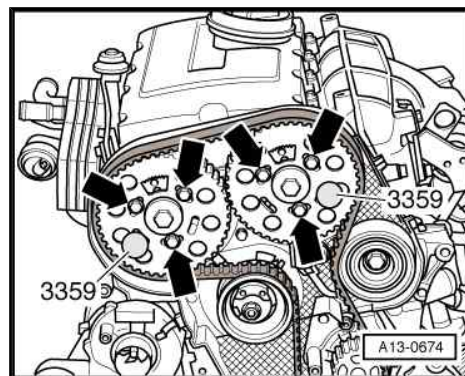
- ◆ *Toothed belt adjustment must always be performed when the engine is cold.*
- ◆ *The crankshaft must not be at TDC at any cylinder when the camshaft is turned. Otherwise, there is a risk of damage to valves and piston crowns.*

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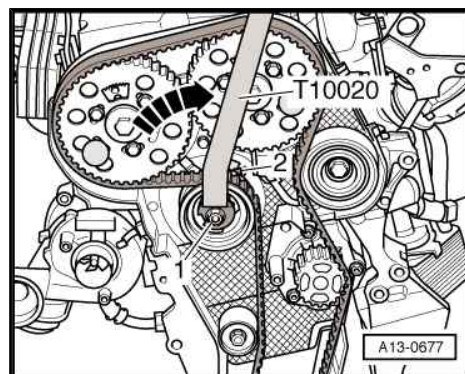
- Ensure that tensioning roller is seated properly in rear toothed belt cover -arrow-.



- Screw in bolts -arrows-, but do not tighten.
- It should just be possible to turn the camshaft sprockets on the hubs without axial movement.
- Turn the camshaft sprockets in their elongated holes clockwise until the stop.
- Fit the toothed belt to crankshaft, tensioning roller, camshaft sprockets, idler roller and finally to sprocket for coolant pump.



- Adjust toothed belt tension as follows:
- Remove locking pin - T10115- .
- Loosen securing nut -1- for tensioning roller.
- Turn eccentric adjuster of tensioning roller clockwise -arrow- using pin wrench - T10020- until pointer -2- aligns with centre of slot in base plate.



Note

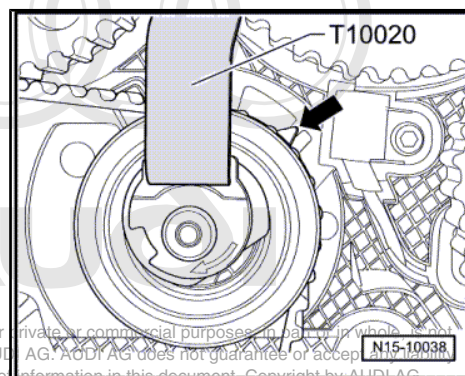
Make sure that the securing nut does not also turn.

- Hold tensioning roller in this position and tighten securing nut to 20 Nm + 45° (1/8 turn).



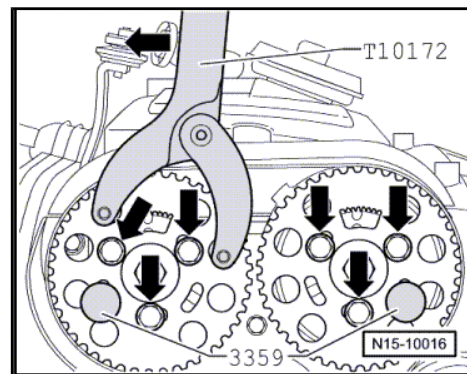
Note

When tightening the securing nut, the pointer -arrow- may move up to 5 mm (maximum) to the right of the slot in the base plate. This position must not be corrected, because the toothed belt stretches slightly when running in.



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- Insert counterhold - T10172- as shown in illustration and apply tension to camshaft sprockets by pressing in direction of -arrow-.
- Tighten camshaft sprocket securing bolts -arrows- to 25 Nm.
- Remove locking pins - 3359- and crankshaft stop.



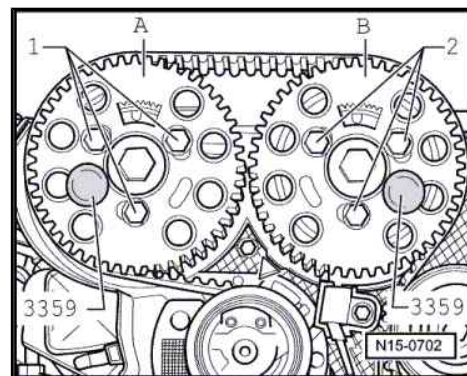
Checking valve timing:



Caution

The engine must only be turned at the crankshaft, in the direction of normal engine rotation (clockwise).

- Turn crankshaft two rotations in normal direction of rotation until the crankshaft is just before TDC again.
- Lock the hub -A- into place with the locking pin - 3359- when turning.
- Check whether:
 - ◆ The hub -B- can be locked with the locking pin - 3359- ;
 - ◆ The crankshaft can be locked with the crankshaft stop.
 - ◆ The tensioner pointer is centred or a maximum of 5 mm to the right of the slot in the base plate.



Adjusting the valve timing:

If hub -B- cannot be locked:

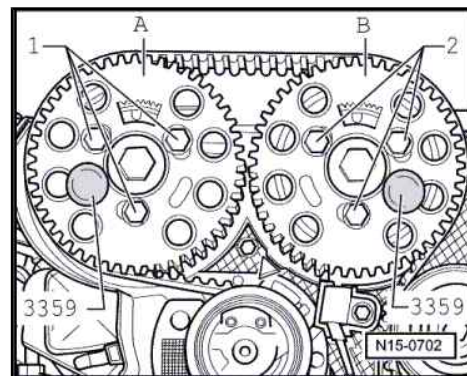
- Loosen securing bolts -2- for inlet camshaft sprocket.
- Place a ring spanner on the centre bolt for inlet camshaft.
- Turn hub until locking pin - 3359- can be inserted.
- Tighten bolts -2- for inlet camshaft sprocket to 25 Nm.
- Remove locking pins - 3359- and crankshaft stop.



Caution

The engine must only be turned at the crankshaft, in the direction of normal engine rotation (clockwise).

- Turn crankshaft two rotations in normal direction of rotation until crankshaft is at TDC again.
- Check valve timing once again ⇒ [page 53](#)



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If the crankshaft cannot be locked:

- Loosen bolts -1- and -2- for the camshaft sprockets -A- and -B-.
- Turn the crankshaft in the normal direction of rotation until it can be locked with crankshaft stop - T10050- for engines with circular crankshaft sprocket, or crankshaft stop - T10100- for engines with oval crankshaft sprocket.



Note

If the crankshaft has been rotated beyond TDC, turn it back slightly so you can then reset it to TDC by turning in the normal running direction.

- Tighten bolts -1- and -2- for camshaft sprockets -A- and -B- to 25 Nm.
- Remove locking pins - 3359- and crankshaft stop.



Caution

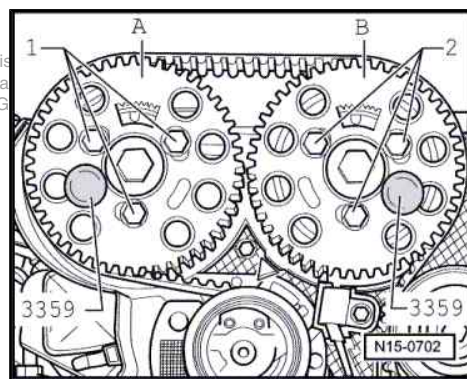
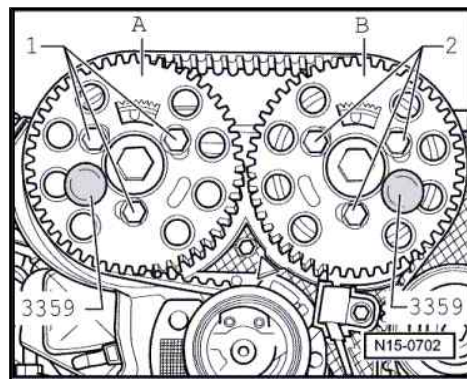
The engine must only be turned at the crankshaft, in the direction of normal engine rotation (clockwise).

- Turn crankshaft two rotations in normal direction of rotation until crankshaft is at TDC again.
- Check valve timing once again ⇒ [page 53](#) .

Assembling:

Installation is carried out in the reverse order; note the following:

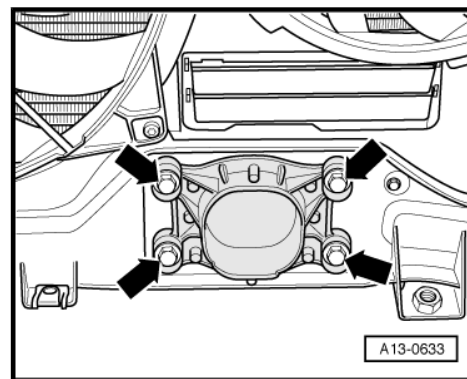
- Install toothed belt cover (bottom and centre).
- Install vibration damper ⇒ [page 39](#) .
- Install poly V-belt ⇒ [page 35](#) .
- Install lock carrier with attachments ⇒ Rep. gr. 50 .



- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten bolts -arrows-.
- Install headlights ⇒ Rep. gr. 94 .
- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Check headlight adjustment ⇒ Maintenance ; Booklet 405 .

Tightening torques

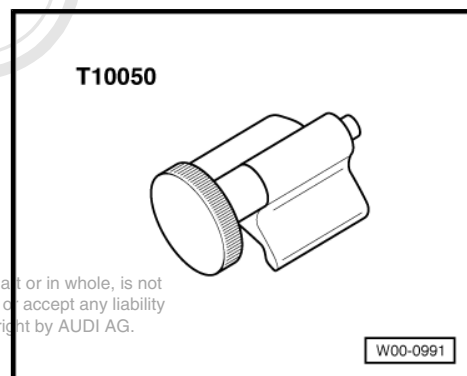
Component	Nm
Tensioning roller for toothed belt to cylinder head	20 + 45° ¹⁾
Camshaft sprocket to hub	25
Toothed belt cover (bottom) to cylinder block	10 ²⁾
Toothed belt cover (centre) to cylinder block	10 ²⁾
Stop for torque reaction support to lock carrier	23
• ¹⁾ 45° = one eighth turn. • ²⁾ Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue .	



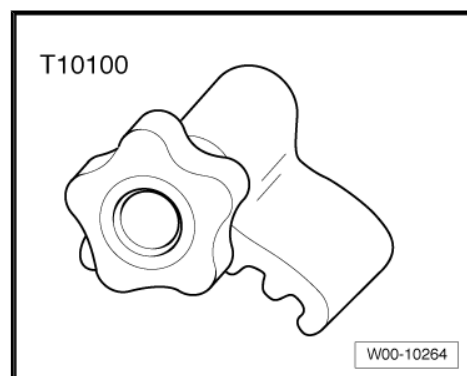
2.8 Rotating crankshaft to TDC

Special tools and workshop equipment required

- ◆ Crankshaft stop - T10050- for engines with circular crankshaft sprocket



- ◆ Crankshaft stop - T10100- for engines with oval crankshaft sprocket



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Procedure

- Remove poly V-belt ⇒ [page 35](#) .
- Remove vibration damper ⇒ [page 39](#) .
- Unscrew bolts -arrows- for toothed belt cover (centre and bottom); slacken top bolt -arrow at top- only approx. two turns.



Caution

The engine must only be turned at the crankshaft, in the direction of normal engine rotation (clockwise).

- Turn the crankshaft to TDC.
- Lock crankshaft sprocket using crankshaft stop - T10050- for engines with circular crankshaft sprocket, or crankshaft stop - T10100- for engines with oval crankshaft sprocket.
- The markings on the toothed belt sprocket and the crankshaft stop must align -arrow-. The lug of the crankshaft stop must engage in the bore in the sealing flange.



Note

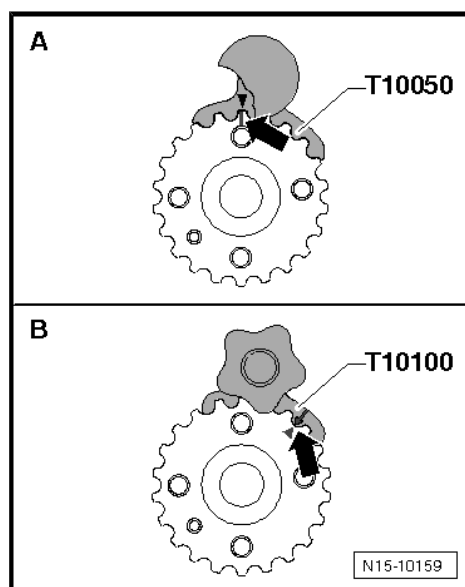
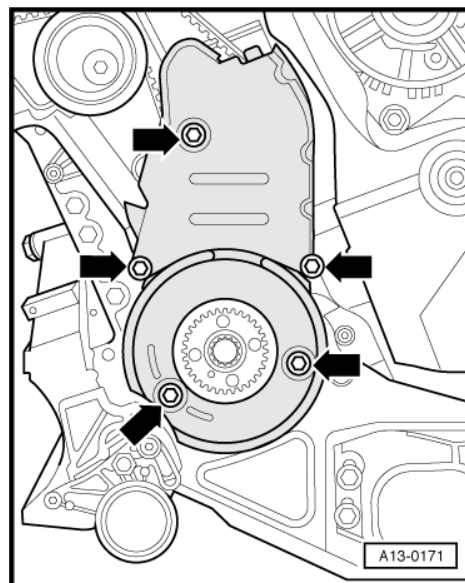
The crankshaft stop can only be pushed onto the sprocket from the front face of the teeth.

Installation is carried out in the reverse order; note the following:

- Install vibration damper ⇒ [page 39](#) .
- Install poly V-belt ⇒ [page 35](#) .

Tightening torques

Component	Nm
Toothed belt cover (bottom) to cylinder block	10 ¹⁾
Toothed belt cover (centre) to cylinder block	10 ¹⁾
• ¹⁾ Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue .	



3 Removing and installing sealing flanges and flywheel



Note

Servicing clutch ⇒ Rep. gr. 30

3.1 Sealing flanges and flywheel - exploded view

1 - Engine speed sender - G28-

- ☐ Removing and installing
⇒ ["3.6 Renewing rear sealing flange", page 69](#)

2 - 4.5 Nm

3 - 15 Nm

4 - Oil seal

- ☐ Renewing ⇒ [page 58](#)

5 - Sealing flange (front)

- ☐ Must be positioned on dowel sleeves
- ☐ Install using sealant; sealant ⇒ Parts catalogue
- ☐ Removing and installing
⇒ [page 61](#)

6 - 15 Nm

- ☐ Tighten in stages and in diagonal sequence

7 - Sump

- ☐ Removing and installing
⇒ [page 135](#)

8 - Cylinder block

- ☐ Removing and installing crankshaft ⇒ [page 77](#)
- ☐ Dismantling and assembling pistons and con-rods ⇒ [page 85](#)

9 - Flywheel/dual-mass flywheel

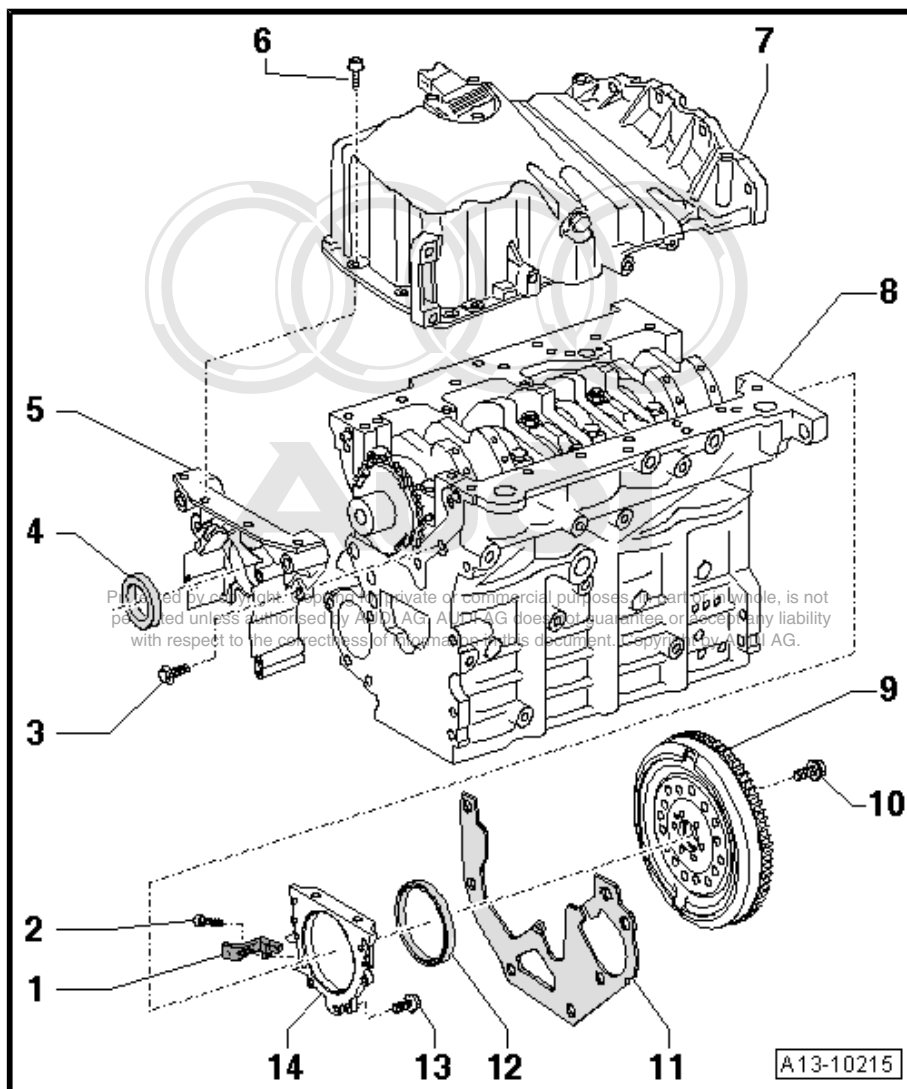
- ☐ Removing and installing dual-mass flywheel on vehicles with manual gearbox ⇒ [page 65](#)
- ☐ Removing and installing flywheel on vehicles with multitronic gearbox ⇒ [page 67](#)

10 - Securing bolt for flywheel/dual-mass flywheel

- ☐ Renew
- ☐ Tightening torque ⇒ [page 67](#)

11 - Intermediate plate

- ☐ Must be positioned on dowel sleeves
- ☐ Do not damage/bend when assembling
- ☐ Is fitted onto sealing flange ⇒ [page 58](#)



12 - Sender wheel

- ☐ For engine speed sender - G28-
- ☐ Removing and installing ⇒ ["3.6 Renewing rear sealing flange", page 69](#)

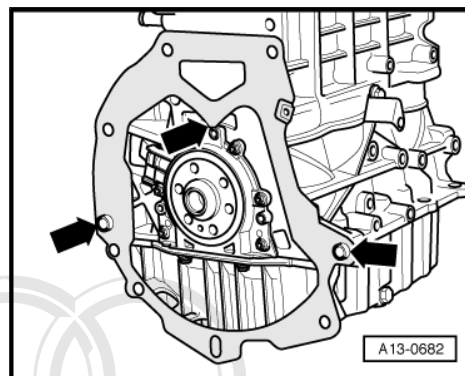
13 - 15 Nm

14 - Sealing flange (rear) with oil seal

- ☐ Renewing ⇒ [page 69](#)

Installing intermediate plate

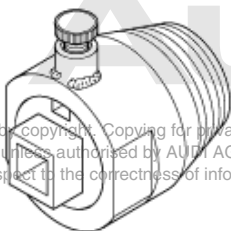
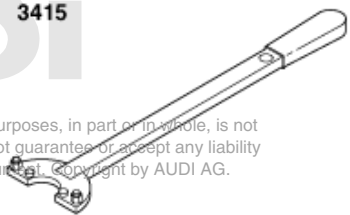
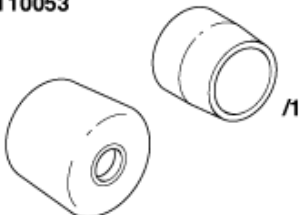
- Fit intermediate plate on sealing flange and push onto dowel sleeves -arrows-.



3.2 Renewing crankshaft oil seal (pulley end)

Special tools and workshop equipment required

- ◆ Oil seal extractor - 3203-
- ◆ Counterhold tool - 3415-

3203 	3415 
T10053 	
	G13-0017

- ◆ Assembly tool - T10053-

Procedure

- Move lock carrier to service position ⇒ [page 31](#) .
- Remove poly V-belt ⇒ [page 35](#) .



Note

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Remove air conditioner compressor and tie up to one side so that it is possible to pull out lock carrier as far as it will go.

- Unplug electrical connector -1- for magnetic clutch on air conditioner compressor.



Caution

The air conditioner refrigerant circuit must not be opened.

- Unscrew air conditioner compressor from bracket -arrows-.

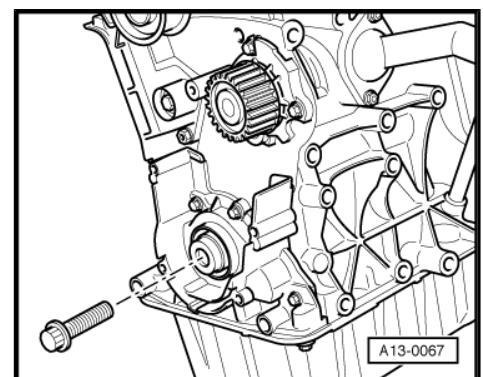
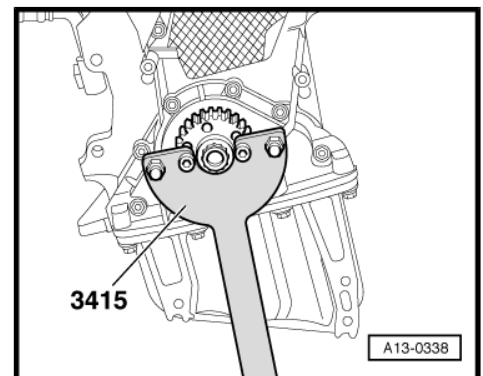
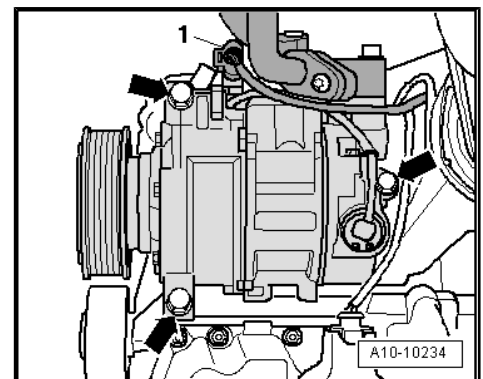


Note

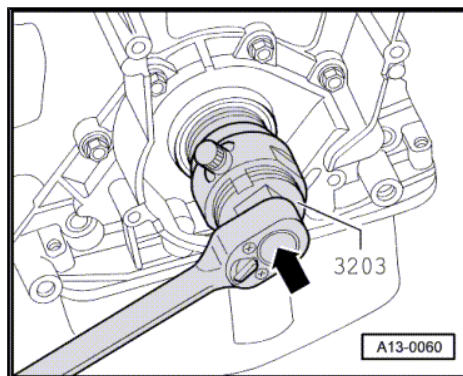
To prevent damage to the refrigerant lines, ensure that the lines and hoses are not stretched, kinked or bent.

- Tie up air conditioner compressor with lines attached to left-side of vehicle.
- Remove toothed belt ⇒ [page 48](#) .
- Remove crankshaft sprocket; use counterhold tool - 3415- to lock sprocket in place.

- Before fitting oil seal extractor, fully screw in centre bolt for sprocket into crankshaft.



- Unscrew inner section of oil seal extractor - 3203- 8 turns out of outer section and lock with knurled screw.
- Lubricate threaded head of oil seal extractor, place it in position and, exerting firm pressure -arrow-, screw it into oil seal as far as possible.
- Loosen knurled screw and turn inner part against crankshaft until the oil seal is pulled out.
- Clamp flats of oil seal extractor in vice.
- Remove oil seal with pliers.
- Clean running surface and sealing surface.

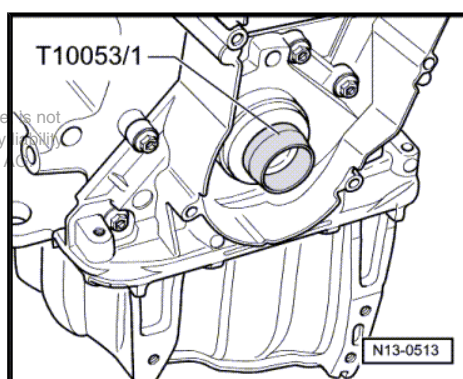


Note

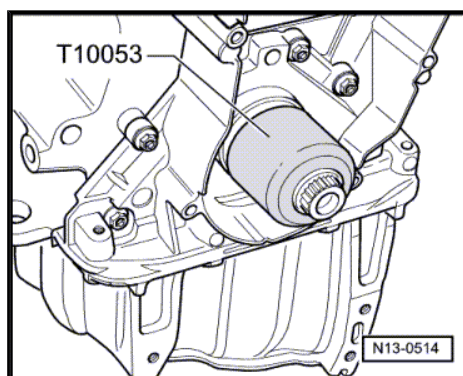
Do not lubricate sealing lip and outer rim of oil seal before pressing in.

- Place guide sleeve - T10053/1- onto crankshaft journal.
- Slide oil seal over guide sleeve.

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- Press in oil seal until flush using the centre bolt and assembly tool - T10053- .



- Renew centre bolt for toothed belt sprocket.
- Contact surface between toothed belt sprocket and crankshaft must be free of oil.
- Do not lubricate bolt for crankshaft sprocket.
- Install crankshaft sprocket; use counterhold tool - 3415- to lock sprocket in place.

Remaining installation steps are carried out in reverse sequence; note the following:

- Install toothed belt (adjust valve timing) ⇒ [page 51](#) .
- Install vibration damper ⇒ [page 39](#) .
- Install air conditioner compressor ⇒ Rep. gr. 87 .
- Install poly V-belt ⇒ [page 35](#) .
- Install lock carrier with attachments ⇒ Rep. gr. 50 .
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten bolts -arrows-.
- Install headlights ⇒ Rep. gr. 94 .
- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Check headlight adjustment ⇒ Maintenance ; Booklet 405 .

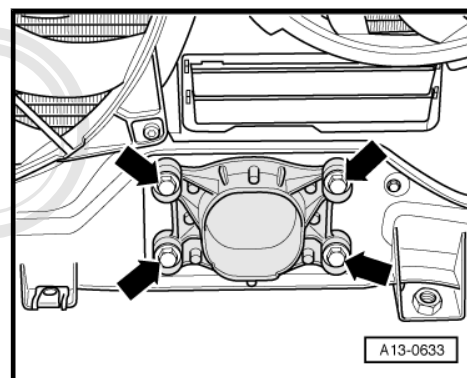
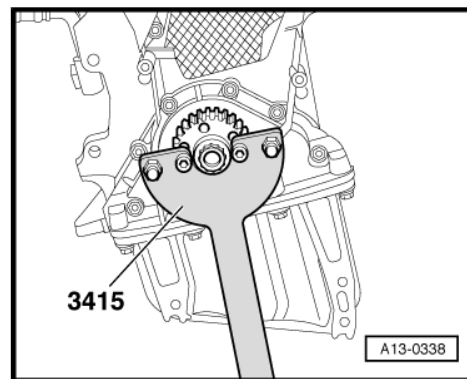
Tightening torques

Component	Nm
Toothed belt sprocket to crankshaft	120 + 90° 1)2)
Stop for torque reaction support to lock carrier	23

- 1) Renew bolts.

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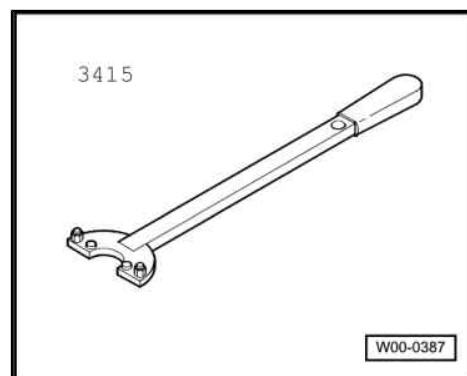
- 2) 90° = one quarter turn.



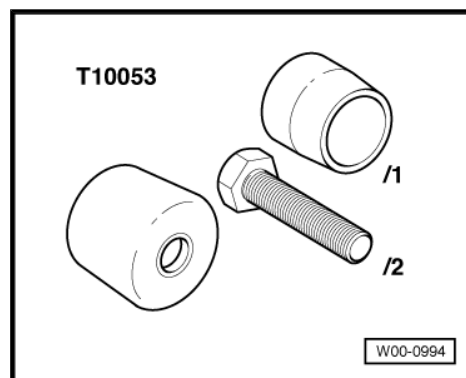
3.3 Removing and installing sealing flange (front)

Special tools and workshop equipment required

- ◆ Counterhold tool - 3415-



- ◆ Assembly tool - T10053-



- ◆ Electric drill with plastic brush attachment
- ◆ Safety goggles
- ◆ Sealant ⇒ Parts catalogue

Removing

- Move lock carrier to service position ⇒ [page 31](#) .
- Remove poly V-belt ⇒ [page 35](#) .



Note

Remove air conditioner compressor and tie up to one side so that it is possible to pull out lock carrier as far as it will go.

- Unplug electrical connector -1- for magnetic clutch on air conditioner compressor.



Caution

The air conditioner refrigerant circuit must not be opened.

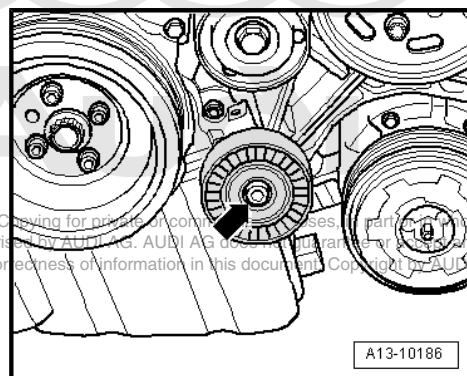
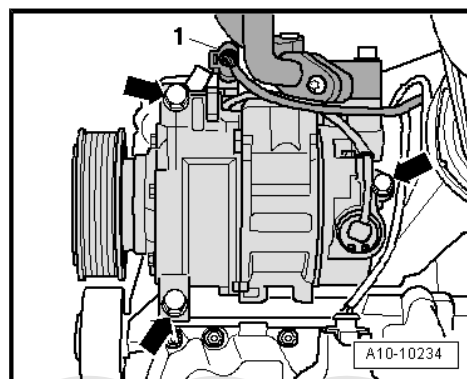
- Unscrew air conditioner compressor from bracket -arrows-.



Note

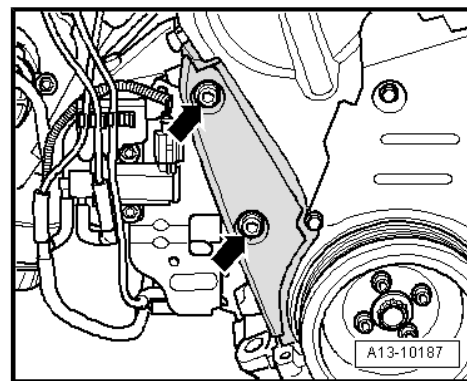
To prevent damage to the refrigerant lines, ensure that the lines and hoses are not stretched, kinked or bent.

- Tie up air conditioner compressor with lines attached to left-side of vehicle.
- Pry off cover from idler roller for poly V-belt.
- Unscrew bolt -arrow- and remove idler roller for poly V-belt.

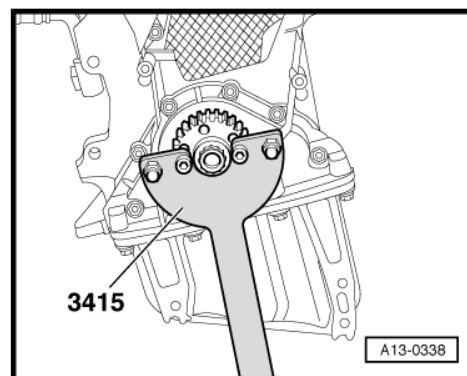


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- Unscrew bolts -arrows- and remove cover.



- Remove toothed belt ⇒ [page 48](#) .
- Remove crankshaft sprocket; use counterhold tool - 3415- to lock sprocket in place.



- Remove bolts -1 ... 10-.
- Pull off sealing flange (front).
- Drive out oil seal with flange removed.

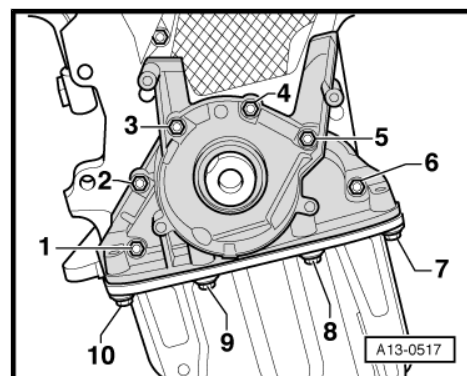
Installing



Note

Place a cloth over the exposed section of the sump.

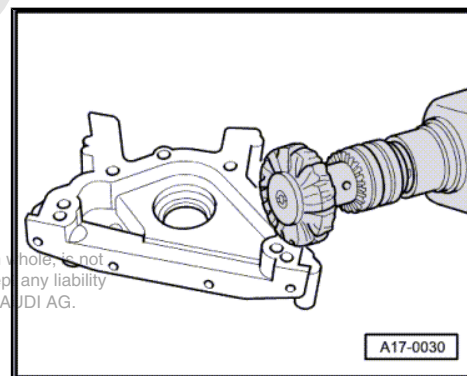
- Carefully remove any sealant residue on the cylinder block and sump.



WARNING

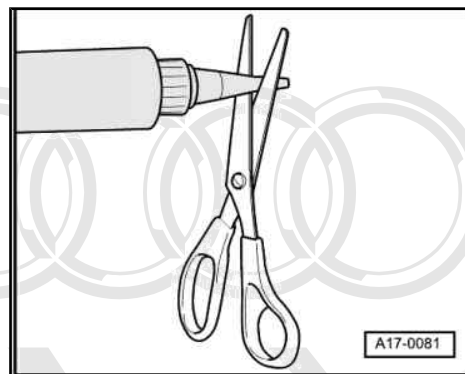
Wear safety goggles.

- Remove sealant residue from sealing flange with rotating plastic brush or similar.
- Clean sealing surfaces; they must be free of oil and grease.

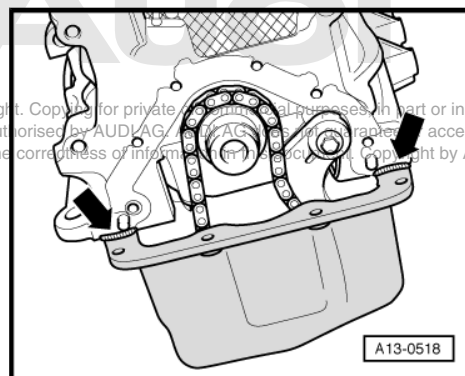


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- Cut off tube nozzle at front marking (diameter of nozzle approx. 2 mm).



- Apply a thin bead of sealant at the edge of the joint between the cylinder block and the sump -arrows-.



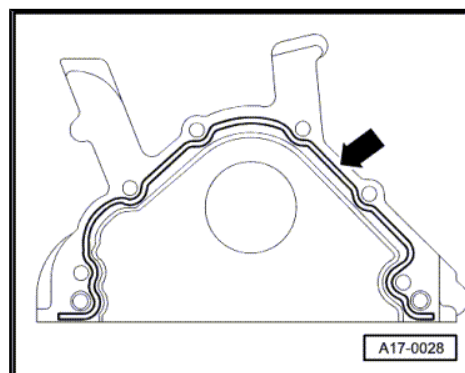
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- Apply the bead of sealant onto the clean sealing surface of the sealing flange as illustrated -arrow-.
- Thickness of sealant bead: 2 ... 3 mm



Note

The sealant bead must not be thicker than specified, otherwise excess sealant could enter the sump and clog the strainer in the oil pump.



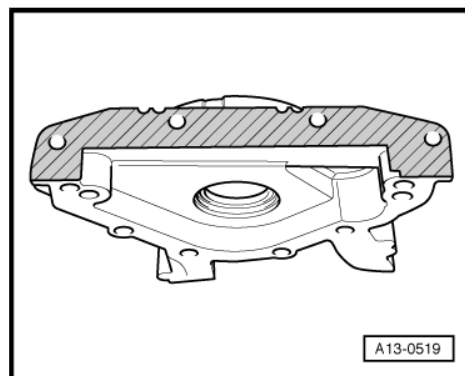
- Coat the lower sealing surface on the sealing flange lightly with sealant -hatched area-.



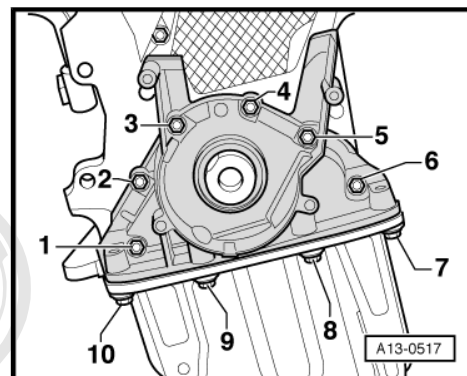
Note

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

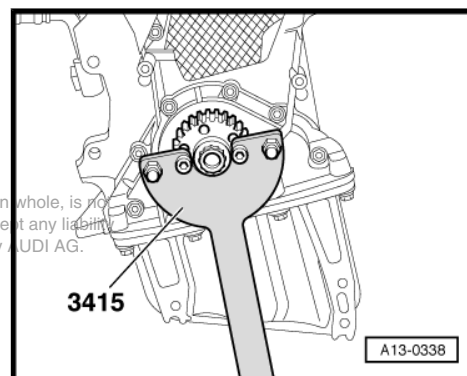
- Carefully push the sealing flange onto the dowel sleeves on the engine block.



- Tighten bolts in the specified sequence:
 1. Tighten bolts -1 ... 6-.
 2. Tighten bolts -7 ... 10-.
- Install crankshaft oil seal (pulley end) ⇒ [page 60](#) .

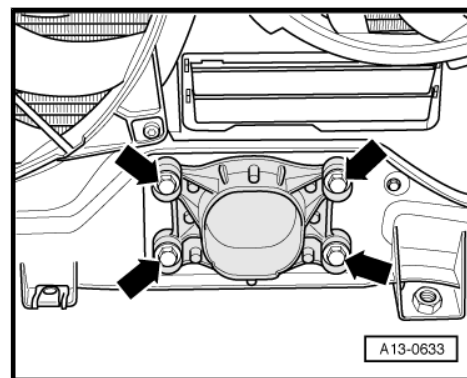


- Renew centre bolt for toothed belt sprocket.
- Contact surface between toothed belt sprocket and crankshaft must be free of oil.
- Do not lubricate bolt for crankshaft sprocket.
- Install crankshaft sprocket; use counterhold tool - 3415- to lock sprocket in place.



Remaining installation steps are carried out in reverse sequence, note the following:

- Install toothed belt (adjust valve timing) ⇒ [page 51](#) .
- Install vibration damper ⇒ [page 39](#) .
- Install air conditioner compressor ⇒ Rep. gr. 87 .
- Install poly V-belt ⇒ [page 35](#) .
- Install lock carrier with attachments ⇒ Rep. gr. 50 .
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten bolts -arrows-.
- Install headlights ⇒ Rep. gr. 94 .
- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Check headlight adjustment ⇒ Maintenance ; Booklet 405 .



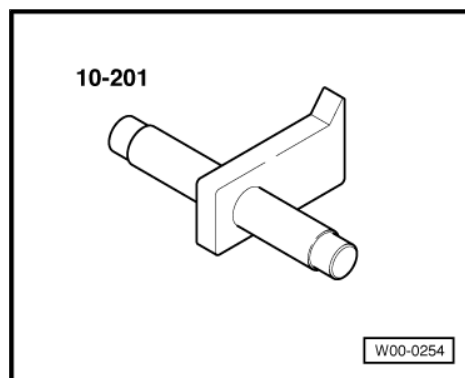
Tightening torques

Component	Nm
Sealing flange to cylinder block	15
Stop for torque reaction support to lock carrier	23
Toothed belt sprocket to crankshaft	120 + 90° 1)2)
• 1) Renew bolts. • 2) 90° = one quarter turn.	

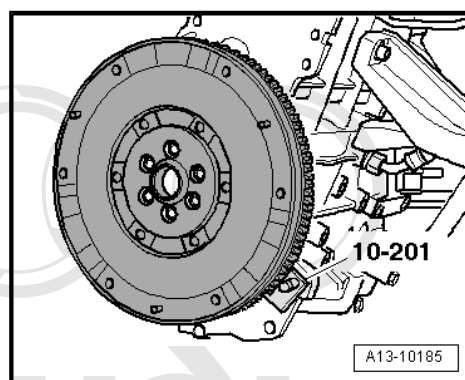
3.4 Removing and installing dual-mass fly-wheel - vehicles with manual gearbox

Special tools and workshop equipment required

◆ Counterhold tool - 10-201-

**Removing**

- Engine or gearbox removed.
- Remove clutch pressure plate ⇒ Rep. gr. 30 .
- Mark installation position of dual-mass flywheel on crankshaft.
- Attach counterhold tool - 10-201- in order to loosen bolts.

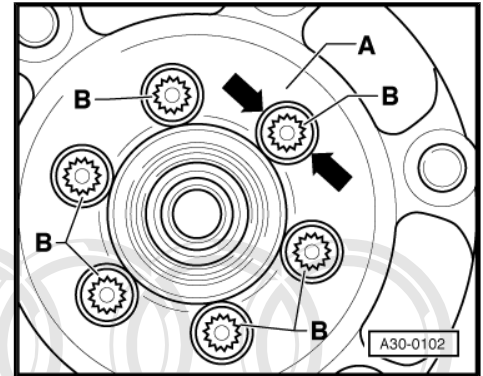


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 Note

To prevent damage to the dual-mass flywheel when removing, the bolts -B- must not be removed with an impact wrench or similar. The bolts may only be removed by hand using conventional tools.

- Rotate the dual-mass flywheel -A- so that the bolts align with the holes -arrows-.
- When unscrewing the bolts, make sure that the bolt heads do not come into contact with the dual-mass flywheel; the flywheel will otherwise be damaged as the bolts are screwed out.



Installing

Installation is carried out in the reverse order; note the following:

- Use new securing bolts.
- Reverse position of counterhold tool - 10-201- in order to tighten bolts.
- Install clutch pressure plate ⇒ Rep. gr. 30 .

Tightening torque

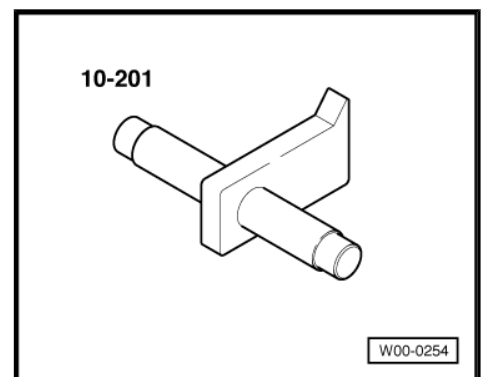
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Component	Nm
Dual-mass flywheel to crankshaft	
Bolt length 22.5 mm	60 + 90° ¹⁾²⁾
35.0 mm	60 + 180° ¹⁾³⁾
43.0 mm	60 + 180° ¹⁾³⁾
• ¹⁾ Renew bolts. • ²⁾ 90° = one quarter turn. • ³⁾ 180° = one half turn.	

3.5 Removing and installing flywheel - vehicles with multitronic gearbox

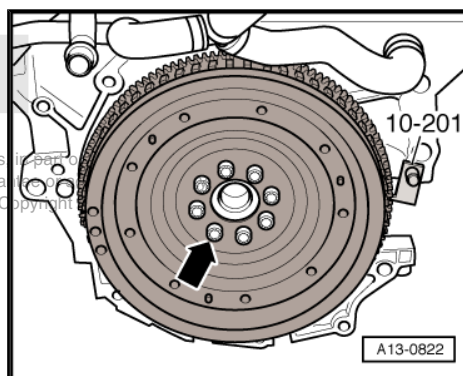
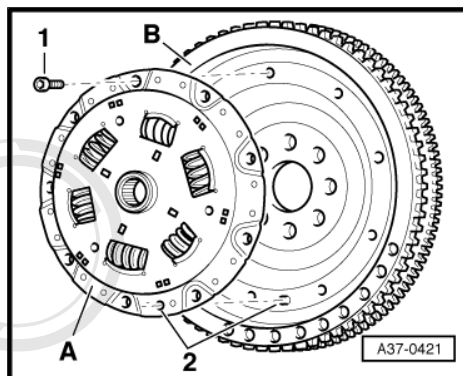
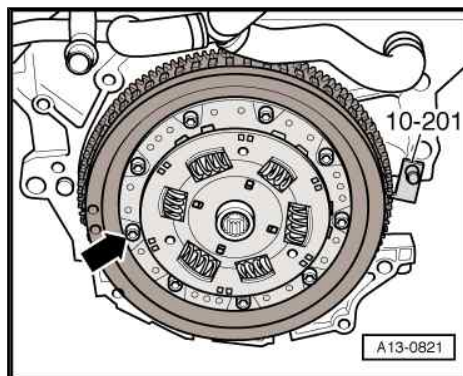
Special tools and workshop equipment required

- ◆ Counterhold tool - 10-201-



Removing

- Engine or gearbox removed.
- Attach counterhold tool - 10-201- in order to loosen bolts -arrows-.
- Unscrew bolts -1- and remove damper unit -A- from flywheel -B-.
- Mark installation position of flywheel -arrow- on crankshaft.
- Attach counterhold tool - 10-201- in order to loosen bolts.
- Unbolt flywheel.



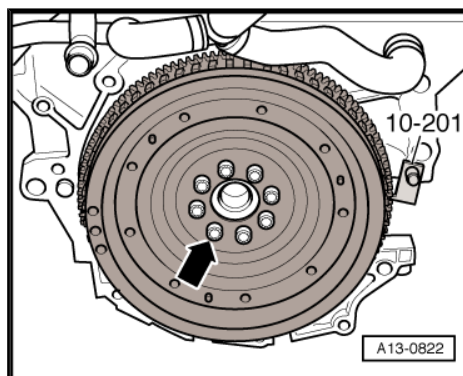
Installing

Installation is carried out in the reverse order, note the following.



Note

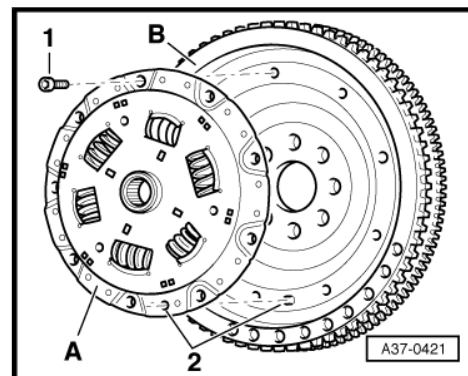
- ◆ Reverse position of counterhold tool - 10-201- in order to tighten bolts.
- ◆ The part number of the damper unit is assigned to the gearbox code letters; for correct allocation refer to ⇒ Parts catalogue .
- Fit flywheel and tighten to coincide with markings made previously.



- Align the damper unit -A- and flywheel -B-.
- The two lugs -2- must align.
- Fit bolts -1- hand-tight and tighten in diagonal sequence.

Tightening torque

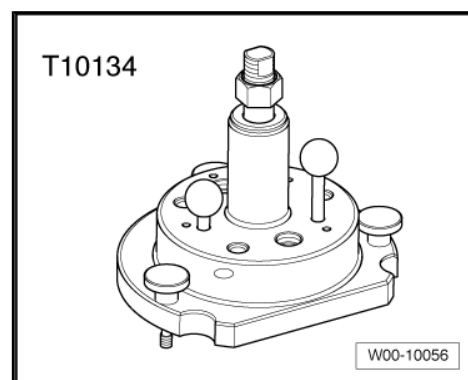
Component	Nm
Flywheel to crankshaft	
Bolt length 22.5 mm	60 + 90° 1)2)
Damper unit to flywheel	25
• 1) Renew bolts. • 2) 90° = a quarter of a turn.	



3.6 Renewing rear sealing flange

Special tools and workshop equipment required

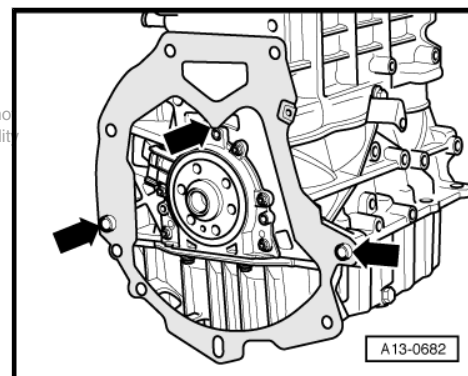
- ◆ Assembly tool - T10134-



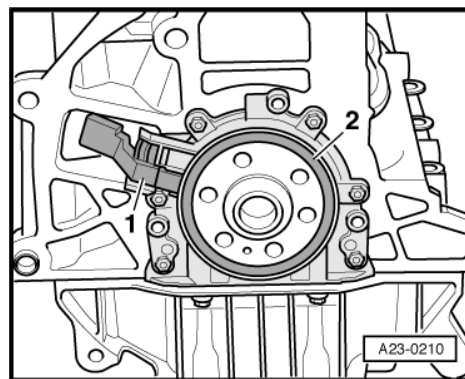
- ◆ Depth gauge
- ◆ Bolt M6x35 (3x)
- ◆ Bolt M7x35 (2x)

Pressing out sealing flange with sender wheel

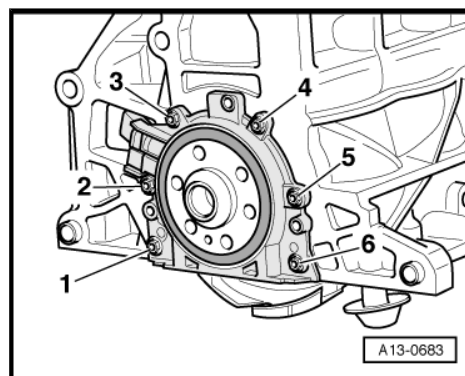
- Gearbox removed
- Remove dual-mass flywheel (vehicles with manual gearbox) ⇒ [page 65](#).
- Remove flywheel (on a vehicle with multitronic gearbox ⇒ [page 67](#)).
- Detach intermediate plate at sealing flange and dowel sleeves -arrows-.
- Remove sump ⇒ [page 135](#).
- Turn the crankshaft to TDC ⇒ [page 55](#).



- Remove engine speed sender - G28- -item 1- using a standard ball head hexagon key.



- Unscrew securing bolts -1 ... 6- for sealing flange.

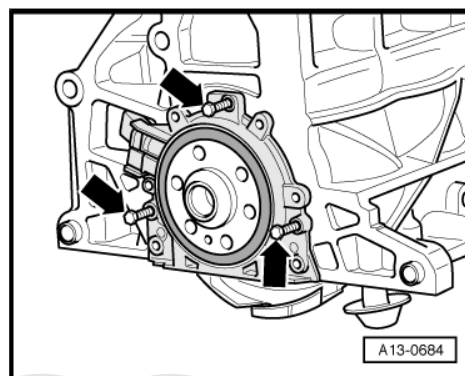


Note

The sealing flange is pressed off the crankshaft together with the sender wheel.

- To press out, screw in 3 bolts M6x35 -arrows- alternately into sealing flange not more than $\frac{1}{2}$ turn at a time.
- Remove sealing flange together with the sender wheel.

Pressing in sealing flange with sender wheel



Note

- ◆ The sealing flange with PTFE oil seal is fitted with a sealing lip support ring. This support ring acts as an assembly sleeve and must not be removed before installation.
- ◆ The sealing flange and sender wheel must not be separated or twisted after removal from the replacement parts packaging.
- ◆ The sender wheel is held in its installation position by a locating pin on the assembly tool - T10134- .
- ◆ The sealing flange and oil seal are a single unit and must only be replaced together with the sender wheel.
- ◆ The assembly tool - T10134- is held in its installation position for the crankshaft by a guide pin which is inserted into a hole on the crankshaft.

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Construction of assembly tool - T10134-

A - Tightening flats

B - Hexagon nut

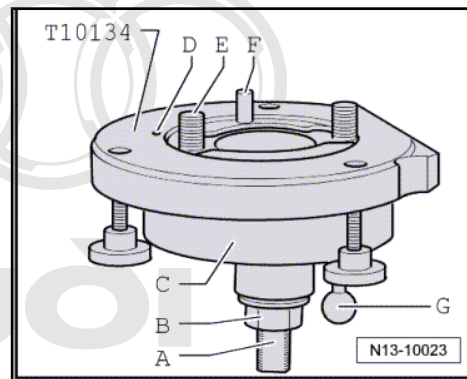
C - Assembly housing

D - Locating pin

E - Hexagon socket-head bolt

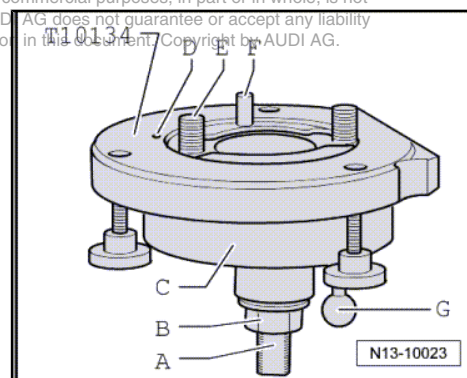
F - Guide pin for diesel engines (black handle)

G - Guide pin for petrol engines (red handle)



A - Fitting sealing flange with sender wheel onto assembly tool - T10134- :

- Turn hexagon nut -B- until it is just in front of flats -A- on threaded spindle.

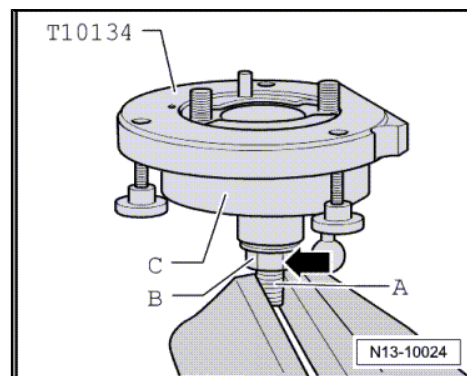


- Clamp assembly tool - T10134- in a vice on tightening flats -A- of threaded spindle.
- Press the assembly housing -C- downwards so that it lies on the hexagon nut -B- -arrow-.



Note

Inner part of assembly device and assembly housing must align (be level) with each other.

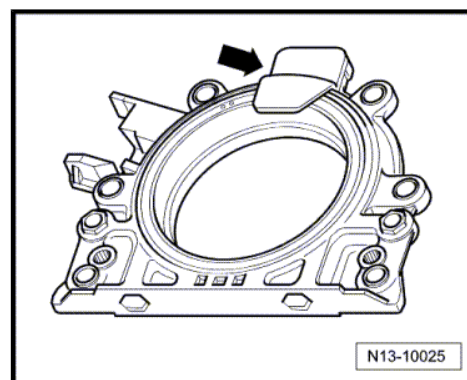


- Remove the securing clip -arrow- from new sealing flange.

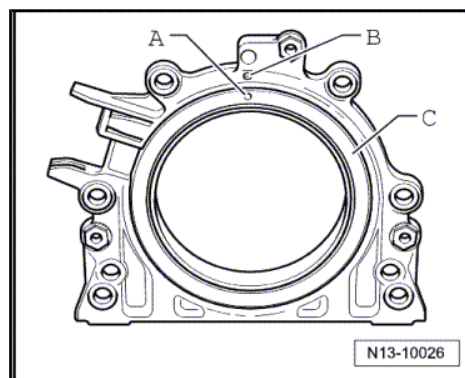


Note

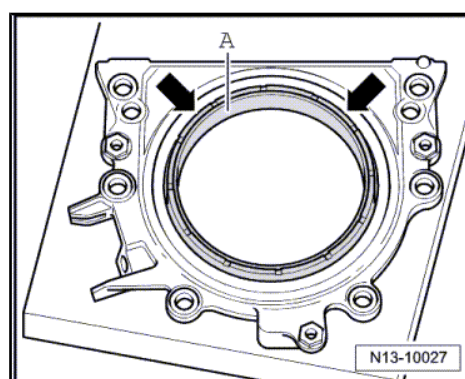
The sender wheel must not be removed from the sealing flange or twisted.



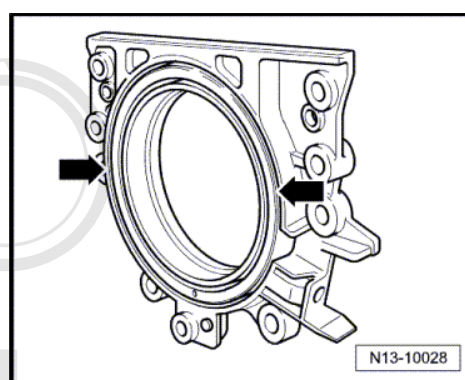
- The locating hole -A- on the sender wheel -C- must align with the marking -B- on the sealing flange.
- Place the sealing flange (with the front side downwards) on a clean flat surface.



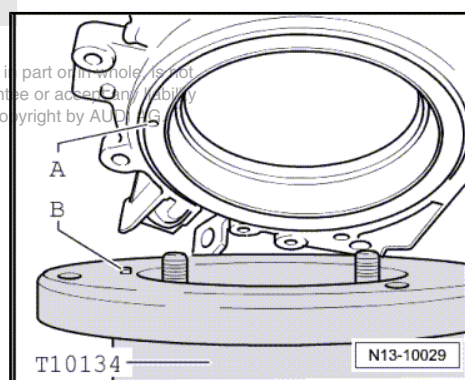
- Press the sealing lip support ring -A- downwards in direction of -arrows- until it lies against the flat surface.



- The upper edge of the sender wheel and the front edge of the sealing flange must align -arrows-.



- Place the sealing flange with the front side on the assembly tool - T10134- , so that the locating pin -B- can be inserted in the sender wheel hole -A-.



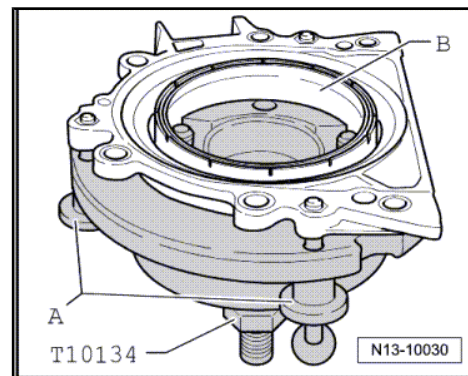
Note

Ensure the sealing flange lies flat on the assembly tool.

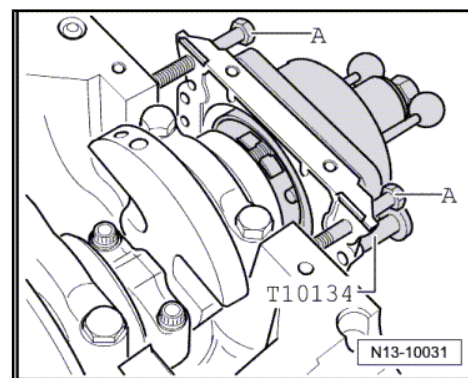
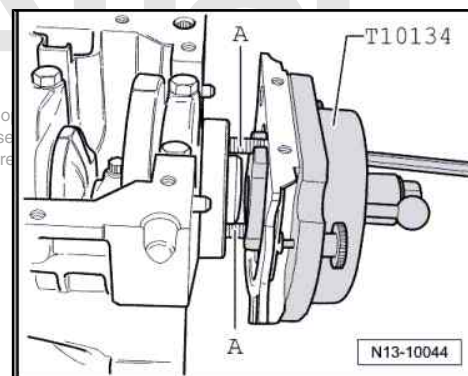
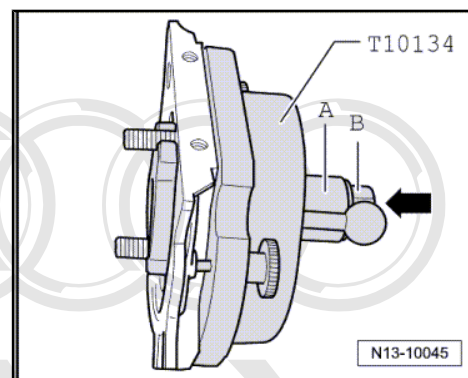
- Press the sealing flange and sealing lip support ring -B- onto the surface of the assembly tool - T10134- while tightening the three knurled screws -A- so that the locating pin will not slip out of the hole in the sender wheel.

**Note**

Ensure the sender wheel remains fixed on the assembly tool when installing the sealing flange.

**B - Installing assembly tool - T10134- with sealing flange on crankshaft flange:**

- Crankshaft flange free of oil and grease.
- Engine positioned at TDC (cylinder 1).
- Screw hexagon nut -B- to end of threaded spindle.
- Press the threaded spindle of assembly tool - T10134- in direction of -arrow- until the hexagon nut -B- lies on the assembly housing -A-.
- Position flat edge of assembly housing towards sealing surface for sump on cylinder block.
- Secure assembly tool - T10134- to crankshaft flange by screwing hexagon socket head bolts -A- approx. 5 threads into crankshaft flange.
- Screw two bolts M7×35 mm -A- into cylinder block to guide sealing flange.



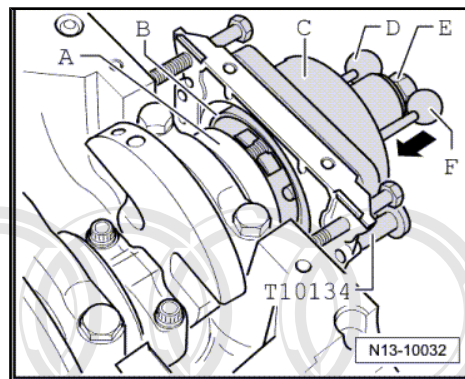
C - Securing assembly tool - T10134- onto crankshaft flange:

- Press the assembly housing -C- by hand in the direction of the -arrow- until the sealing lip support ring -B- lies on the surface of the crankshaft flange -A-.
- Press the guide pin for diesel engines (black handle) -D- into hole of crankshaft. This ensures that the sender wheel is in its final installation position.



Note

The guide pin for PETROL engines (red handle) -F- MUST NOT be inserted into the threaded hole in the crankshaft.



- Tighten both hexagon socket head bolts on assembly tool finger-tight.
- Screw hexagon nut -E- onto threaded spindle by hand until it lies against the assembly housing -C-.

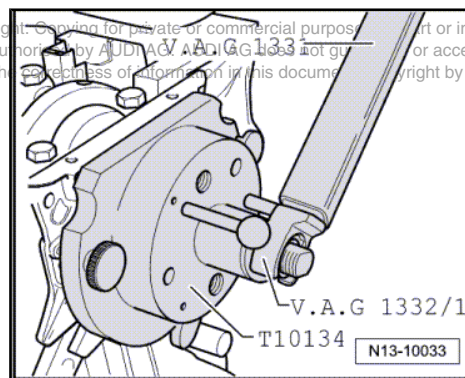
D - Pressing sender wheel onto crankshaft flange with assembly tool - T10134- :

- Tighten hexagon nut of assembly tool - T10134- to 35 Nm.



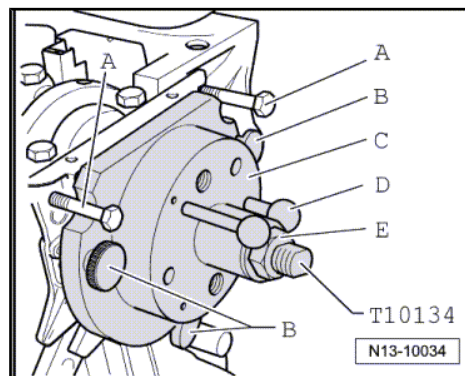
Note

A small air gap must be present between cylinder block and sealing flange after tightening hexagon nut to 35 Nm.

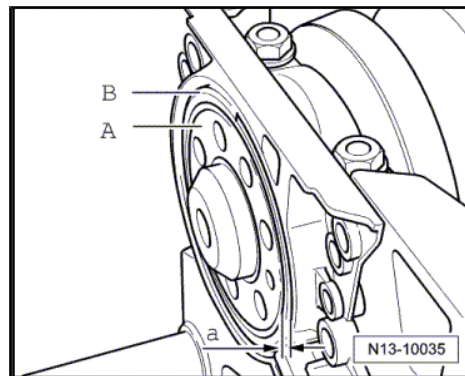


E - Checking sender wheel installation position on crankshaft:

- Screw hexagon nut -E- to end of threaded spindle.
- Unscrew the 2 bolts -A- out of cylinder block.
- Unscrew the three knurled screws -B- from sealing flange.
- Remove assembly tool - T10134- .
- Remove sealing lip support ring.



- The sender wheel is positioned correctly on the crankshaft if the distance -a- between the crankshaft flange -A- and sender wheel -B- is 0.5 mm.



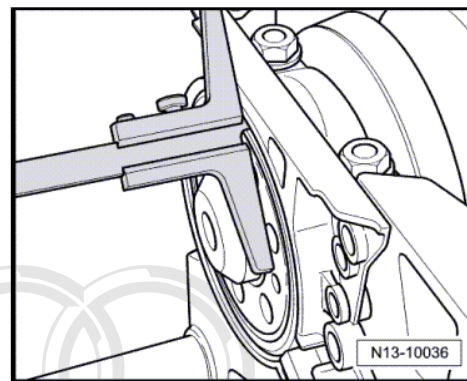
- Apply a depth gauge on the crankshaft flange.
- Measure the distance “a” between crankshaft flange and sender wheel.

If dimension “a” is too small:

- Press in the sender wheel further ⇒ [page 75](#) .

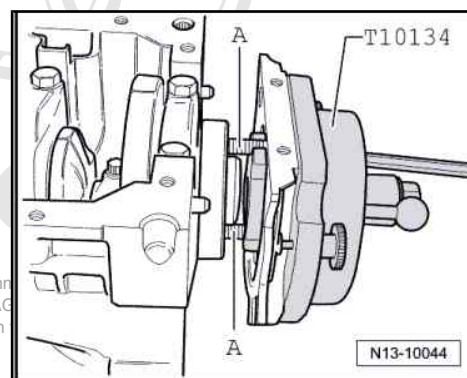
When dimension “a” is achieved:

- Continue with assembly ⇒ [page 76](#) .



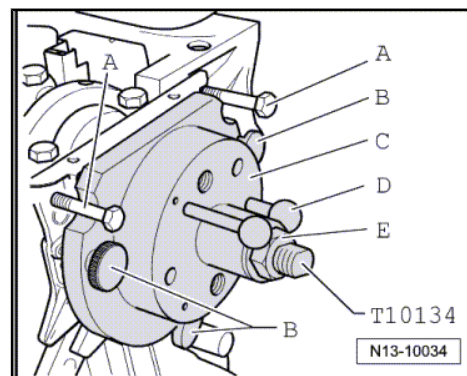
F - Pressing sender wheel in further:

- Secure the assembly tool - T10134- -A- to crankshaft flange by tightening hexagon socket head bolts finger-tight.
- Press the assembly tool - T10134- towards the sealing flange by hand.



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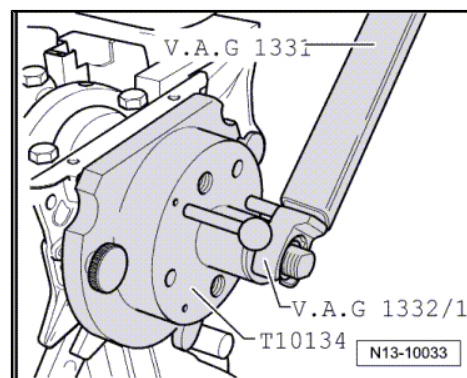
- Screw hexagon nut -E- onto threaded spindle by hand until it lies against the assembly housing -C-.



- Tighten hexagon nut of assembly tool - T10134- to 40 Nm.
- Check installation position of sender wheel on crankshaft again ⇒ [page 74](#) .

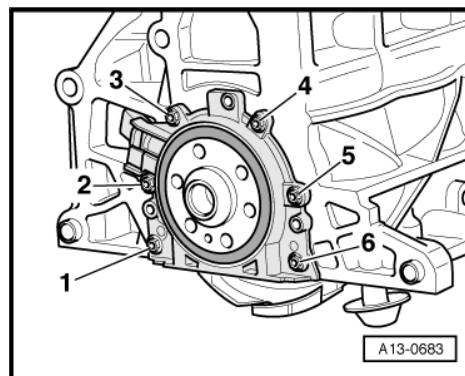
If dimension “a” is too small again:

- Tighten hexagon nut of assembly tool - T10134- to 45 Nm.
- Check installation position of sender wheel on crankshaft again ⇒ [page 74](#) .

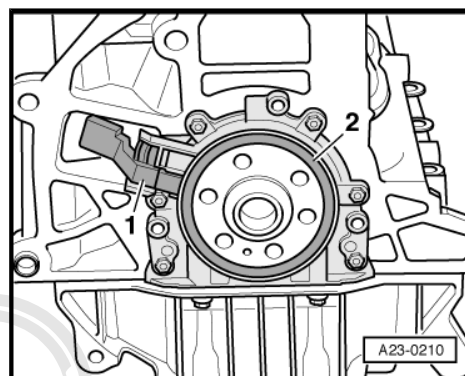


Assembling:

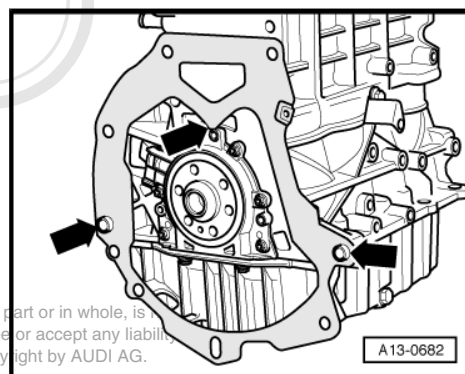
- Tighten new securing bolts for sealing flange -1 ... 6- in diagonal sequence.



- Secure engine speed sender - G28- -item 1-.
- Install sump ⇒ [page 135](#) .



- Fit intermediate plate on sealing flange and push onto dowel sleeves -arrows-.
- Install dual-mass flywheel (on a vehicle with manual gearbox ⇒ [page 65](#)).
- Install flywheel (on a vehicle with multitronic gearbox ⇒ [page 67](#)).



Tightening torques

Component	Nm
Sealing flange to cylinder block	15 1)
Engine speed sender - G28- to cylinder block	5
• 1) Tighten bolts in diagonal sequence	

4 Removing and installing crankshaft



Note

When carrying out repairs, secure engine to assembly stand with engine and gearbox support - VW 540- ⇒ [page 23](#).

4.1 Crankshaft - exploded view

1 - Bearing shell

- ☐ For cylinder block (with oil groove)
- ☐ Do not interchange used bearing shells (mark positions)

2 - Drive gear/ sprocket

- ☐ For balance shaft assembly
- ☐ Depending on version: chain sprocket or spur gear
- ☐ Converting balance shaft assembly to spur gear drive ⇒ [page 79](#)
- ☐ Pulling spur gear off crankshaft and shrinking new spur gear ⇒ [page 81](#)

3 - Bearing shell

- ☐ For bearing cap (without oil groove)
- ☐ Do not interchange used bearing shells (mark positions)

4 - Thrust washers

- ☐ For bearing No. 3
- ☐ Different types for cylinder block and bearing cap
- ☐ Note location

5 - 65 Nm + 90° (1/4 turn) further

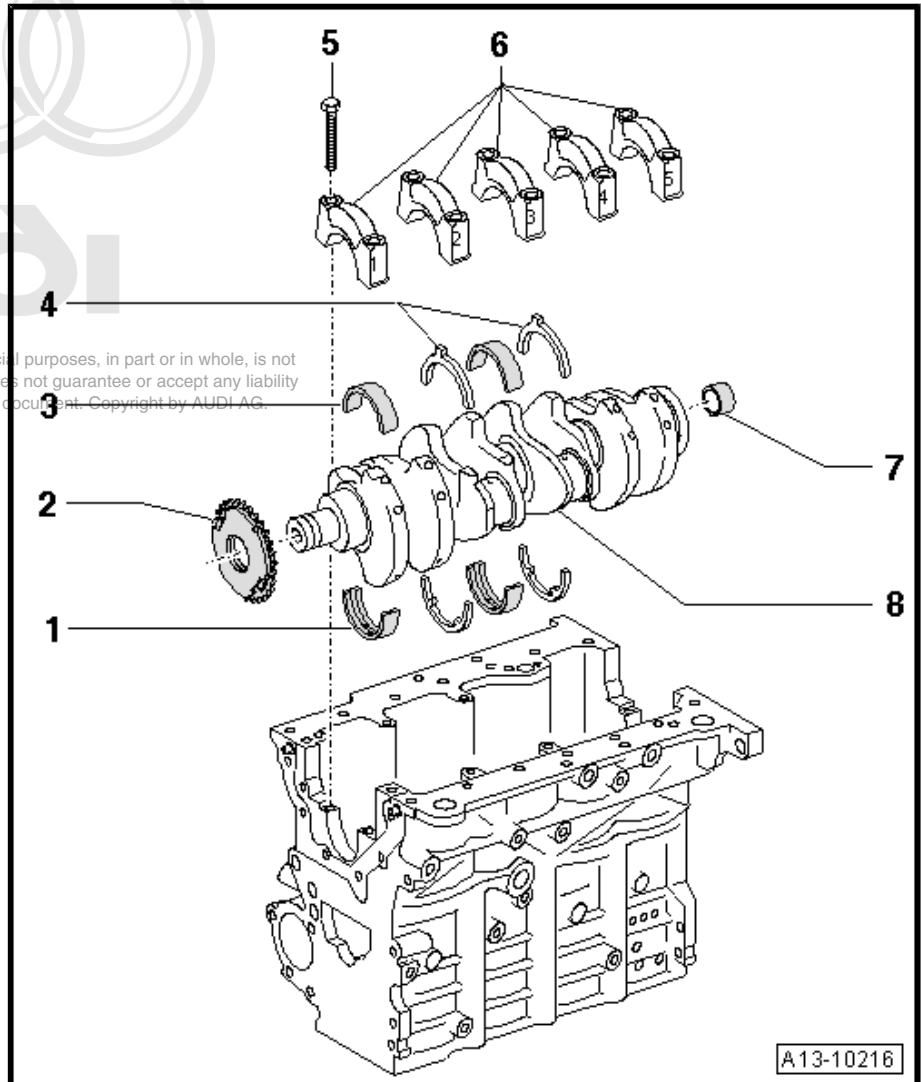
- ☐ Renew
- ☐ For measuring radial clearance of crankshaft tighten to 65 Nm, but not further

6 - Bearing cap

- ☐ Bearing cap 1: Pulley end
- ☐ Bearing cap 3 with recesses for thrust washers
- ☐ Bearing shell retaining lugs (cylinder block/bearing cap) must be on the same side

7 - Needle bearing

- ☐ For vehicles with manual gearbox
- ☐ Extracting and driving in ⇒ [page 78](#)



8 - Crankshaft

- ☐ Axial clearance when new: 0.07 ... 0.17 mm; wear limit: 0.37 mm
- ☐ Check radial clearance with Plastigage
- ☐ Radial clearance when new: 0.03 ... 0.08 mm; wear limit 0.17 mm
- ☐ Do not rotate the crankshaft when checking the radial clearance
- ☐ Crankshaft dimensions ⇒ [page 79](#)

4.2 Extracting and driving in needle bearing for crankshaft

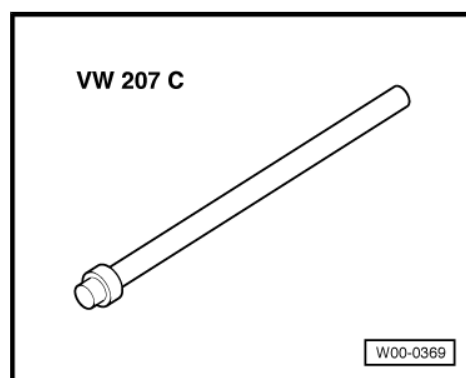


Note

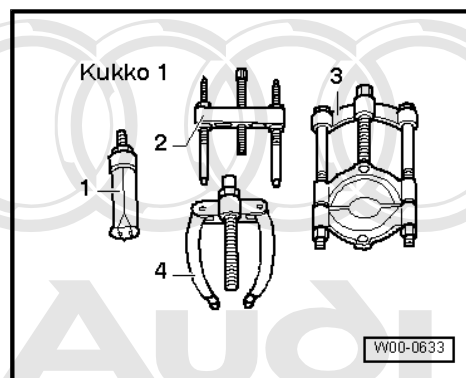
A needle bearing must be fitted in the crankshaft on vehicles with manual gearbox; insert needle bearing if not yet fitted.

Special tools and workshop equipment required

- ◆ Drift - VW 207 C- or centring mandrel - 3176-



- ◆ -1- Internal puller - Kukko 21/1-

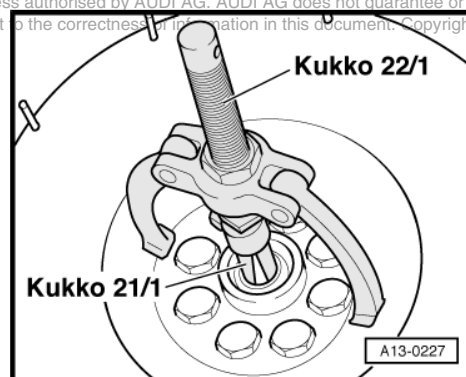


- ◆ -4- Counter-support - Kukko 22/1-

Pulling out

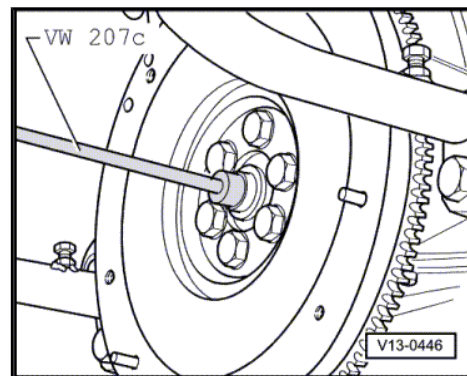
- Remove needle bearing using internal puller - Kukko 21/1- and counter-support - Kukko 22/1- .

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Driving in

- Drive in needle bearing until flush using drift - VW 207 C- or centring drift - 3176- .
- The lettering on the needle bearing must be visible when installed.



4.3 Crankshaft dimensions

Honing dimension (in mm)	Crankshaft main bearing journal Ø	Conrod bearing journal Ø
Basic dimension	54.00 -0.022 -0.042	50.90 -0.022 -0.042

4.4 Converting balance shaft assembly to spur gear drive

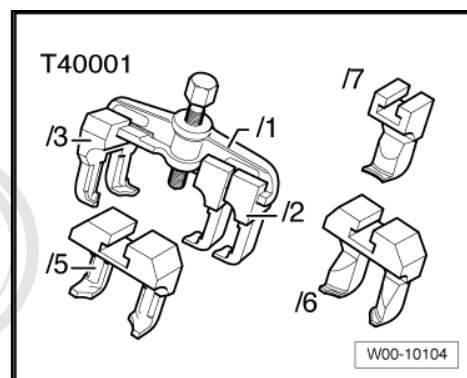


Note

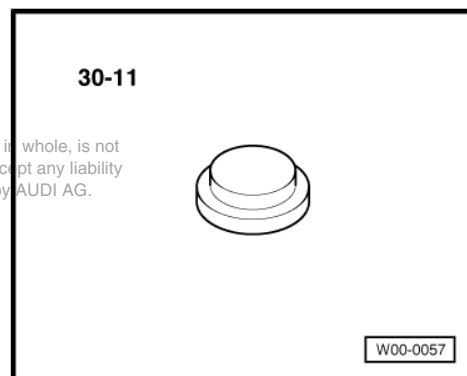
If the chain drive of the balance shaft assembly is worn or defective, the chain drive must be converted to spur gear drive. The balance shaft assembly with chain drive is no longer supplied.

Special tools and workshop equipment required

- ◆ Two-arm puller - T40001- with claw - T40001/5- and claw - T40001/3-

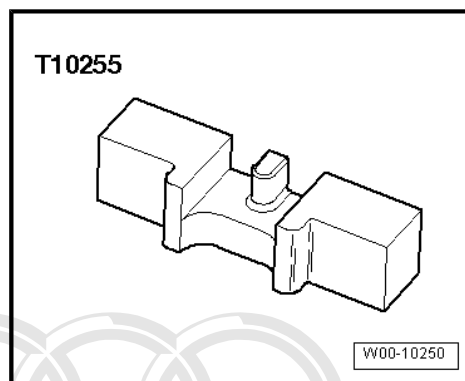


- ◆ Thrust plate - 30 - 11-



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- ◆ Locking tool - T10255-



- ◆ Hotplate (commercially available)



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- ◆ Temperature gauge -VAS 6519-

Procedure

- Remove noise insulation tray ⇒ General body repairs, exterior; Rep. gr. 50 ; Body - front, exploded view .
- Remove balance shaft assembly ⇒ [page 142](#) .
- Remove front sealing flange ⇒ [page 61](#) .
- Apply two-arm puller - T40001- with thrust plate - 30 - 11- to chain sprocket on end of crankshaft as illustrated.



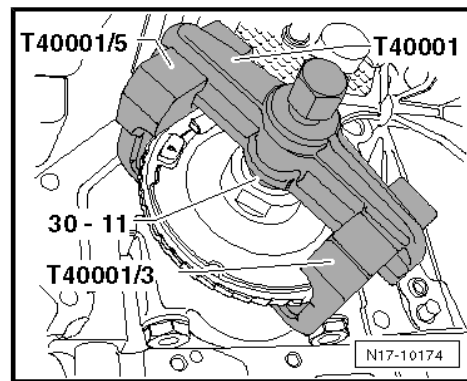
Caution

Make sure that the puller is applied correctly. Otherwise the crankshaft can be irreparably damaged if the sprocket is not pulled off straight.

- Pull chain sprocket off crankshaft.

**Note**

- ◆ While heating up the new spur gear, monitor the temperature with the temperature gauge -VAS 6519- .
- ◆ When the temperature reaches 200°C, you have approx. 4 seconds to fit the spur gear on the crankshaft.
- ◆ A higher temperature increases the amount of time available (220°C = approx. 6 seconds).
- ◆ Make sure the end of the crankshaft is clean.

**Caution**

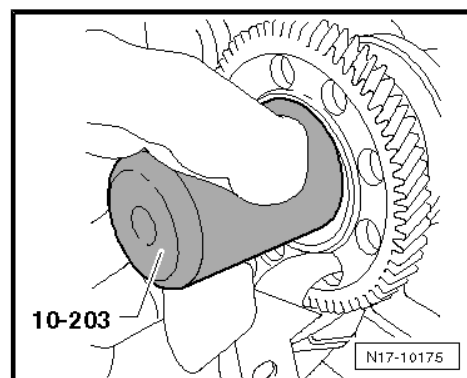
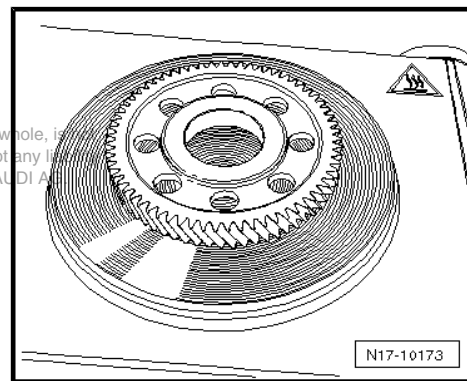
Do not exceed a maximum temperature of 240°C; otherwise the spur gear can become discoloured and distorted.

- Place the new spur gear flat on a commercially available hot-plate and heat it up to at least 200°C, but not more than 240°C. The lettering must face upwards.

**WARNING**

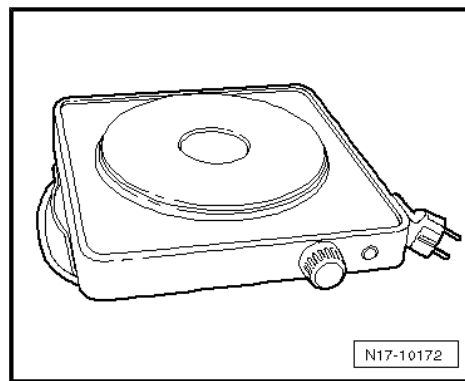
Risk of burns. Use suitable protective gloves for the following steps.

- When the required temperature has been reached, take up the new spur gear with pliers. Take care not to damage the gear teeth.
- Slide the gear without delay onto the end of the crankshaft as far as the stop, taking care to keep it straight. Use fitting tool - 10 - 203- .
- Allow the spur gear to cool for a few minutes and then install the new balance shaft assembly ➔ [page 166](#) .

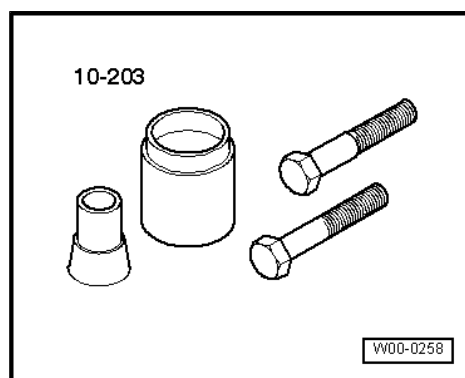


4.5 Pulling spur gear off crankshaft and shrink-fitting new spur gear

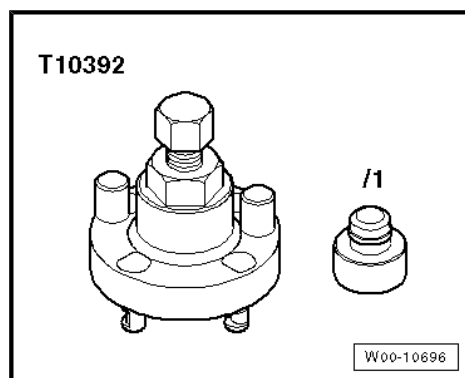
- ◆ Hotplate (commercially available)



- ◆ Fitting tool - 10 - 203-



- ◆ Puller -T10392-



- ◆ Thrust piece -T10392/1-
- ◆ Temperature gauge -VAS 6519-
- Remove front sealing flange ⇒ [page 61](#) .
- Remove sump ⇒ [page 135](#) .



Note

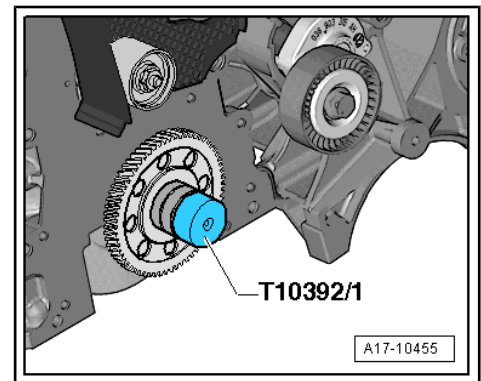
It is sufficient to detach idler gear if balance shaft assembly does not need to be renewed.

- Remove balance shaft assembly ⇒ [page 142](#) .

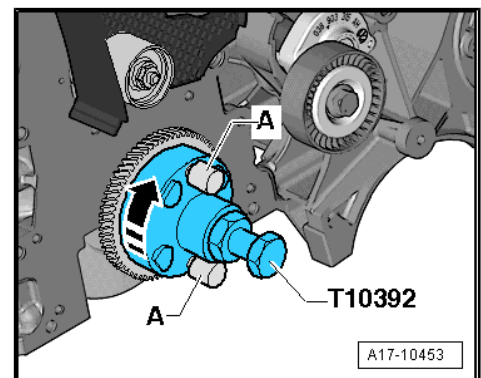
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Pulling off spur gear

- Insert thrust piece -T10392/1- in end of crankshaft.



- Insert puller -T10392- in holes in spur gear, turn clockwise -arrow- and screw in locking pins -A-.



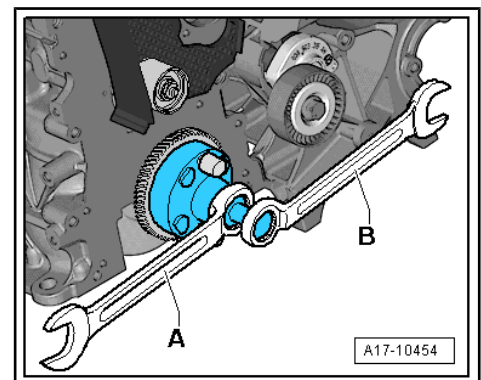
- Counterhold crankshaft with ring spanner -A- and pull spur gear off end of crankshaft by screwing in spindle with ring spanner -B-.

Shrink-fitting spur gear



Note

- ◆ While heating up the new spur gear, monitor the temperature with the temperature gauge -VAS 6519-.
- ◆ When the temperature reaches 200°C, you have approx. 4 seconds to fit the spur gear on the crankshaft.
- ◆ A higher temperature increases the amount of time available (220°C = approx. 6 seconds).
- ◆ Make sure the end of the crankshaft is clean.



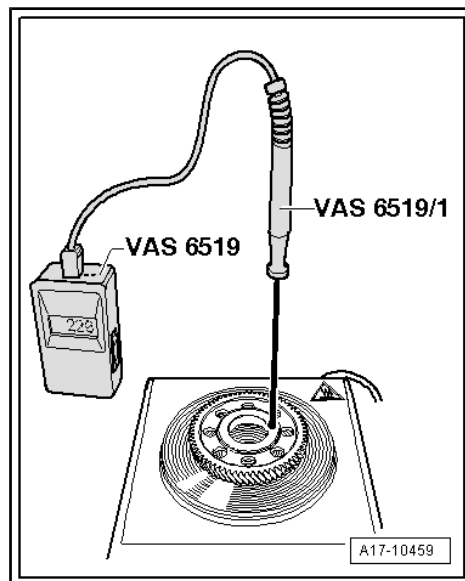
Caution

Do not exceed a maximum temperature of 240°C; otherwise the spur gear can become discoloured and distorted.

- Place the new spur gear flat on a commercially available hot-plate and heat it up to at least 200°C, but not more than 240°C. The lettering must face upwards.
- Set temperature gauge -VAS 6519- to measuring range 2.
- Position temperature sensor -VAS 6519/1- on collar of spur gear (as shown) and read off temperature at temperature gauge.


WARNING

Risk of burns. Use suitable protective gloves for the following steps.

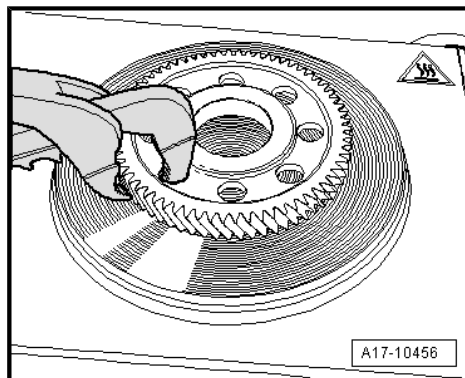


- When the required temperature has been reached, pick up the spur gear with pliers as illustrated.

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Note

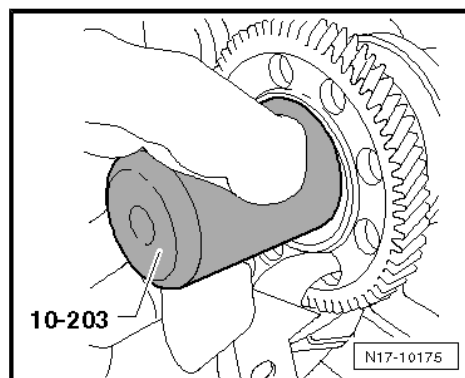
Take care not to damage the teeth of the spur gear.



- With the aid of fitting tool - 10 - 203- , slide spur gear by hand onto end of crankshaft as far as stop. This must be done without delay, taking care to keep the gear straight.
- Wait a few minutes to allow the spur gear to cool down, and then install the balance shaft assembly.

⇒ ["2.5 Installing a new balance shaft assembly", page 166](#)

⇒ ["2.6 Re-installing the "old" balance shaft assembly", page 170](#)



5 Dismantling and assembling pistons and conrods



Oil spray jet and pressure relief valve ⇒ [page 88](#)

5.1 Pistons and conrods - exploded view

1 - Conrod bolt, 30 Nm + 90° (1/4 turn) further

- ☐ Renew
- ☐ Lubricate threads and contact surface
- ☐ Use old bolts when measuring radial clearance

2 - Conrod bearing cap

- ☐ Mark cylinder number -B-
- ☐ Installation position: Markings -A- face towards pulley end

3 - Bearing shell

- ☐ Installation position ⇒ [page 87](#)
- ☐ Do not interchange used bearing shells (mark positions)
- ☐ Note type: upper bearing shell (closest to piston) is made of more wear-resistant material. Distinguishing feature on new bearing shells: black marking on bearing surface near joint
- ☐ Check that it is securely seated
- ☐ Axial clearance: wear limit: 0.37 mm
- ☐ Measuring radial clearance ⇒ [page 89](#)
- ☐ Do not rotate crankshaft when checking radial clearance
- ☐ Radial clearance: wear limit: 0.08 mm

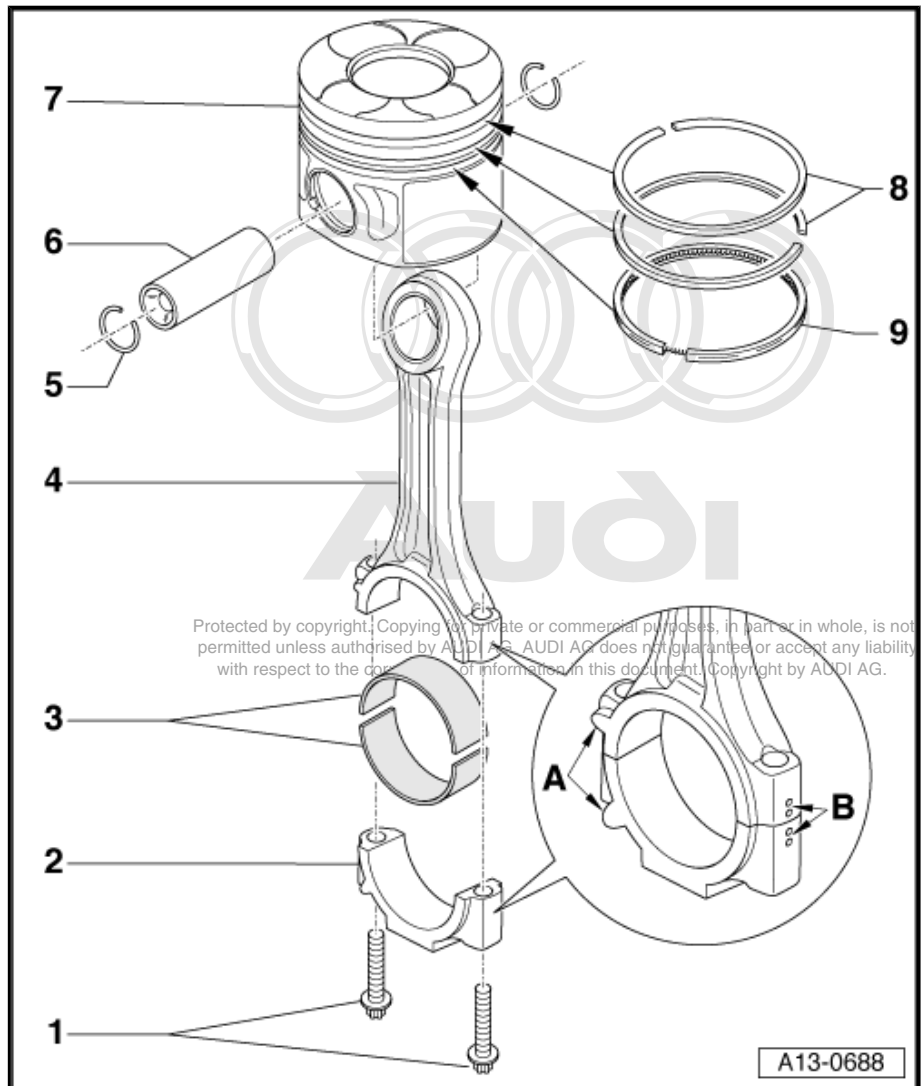
4 - Conrod

- ☐ Only renew as a complete set
- ☐ Mark cylinder number -B-
- ☐ Installation position: Markings -A- face towards pulley end

5 - Circlip

6 - Piston pin

- ☐ If difficult to move, heat piston to approx. 60 °C



- ☐ Remove and install using drift - VW 222 A-

7 - Piston

- ☐ With combustion chamber
- ☐ Mark installation position and cylinder number
- ☐ Installation position and allocation of piston/cylinder ⇒ [page 87](#)
- ☐ Arrow on piston crown points to pulley end
- ☐ If cracking is visible on piston skirt, renew piston
- ☐ Checking piston ⇒ [page 87](#)
- ☐ Piston and cylinder dimensions ⇒ [page 89](#)
- ☐ Checking cylinder bore ⇒ [page 87](#)
- ☐ Install using piston ring clamp
- ☐ Checking piston projection at TDC ⇒ [page 88](#)

8 - Piston rings

- ☐ Compression rings
- ☐ Offset gaps by 120°
- ☐ Use piston ring pliers to remove and install
- ☐ Marking "TOP" or inscription must face piston crown.
- ☐ Checking ring gap ⇒ [page 86](#)
- ☐ Checking ring-to-groove clearance ⇒ [page 86](#)

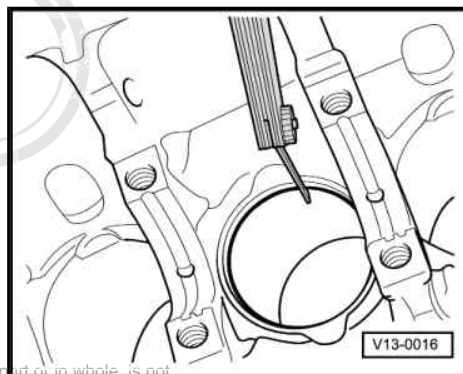
9 - Piston ring

- ☐ Oil scraper ring
- ☐ Offset gap 120° from bottom compression ring
- ☐ Use piston ring pliers to remove and install
- ☐ Checking ring gap ⇒ [page 86](#)
- ☐ Checking ring-to-groove clearance ⇒ [page 86](#)

Checking piston ring gap

- Insert ring at right angle to cylinder wall from above and push down into lower cylinder opening approx. 15 mm from bottom of cylinder. Use a piston without rings to push ring into bore.

Piston ring Dimensions in mm	New	Wear limit
1st compression ring	0.25 ... 0.40	1.00
2nd compression ring	0.25 ... 0.40	1.00
Oil scraper ring	0.25 ... 0.50	1.00

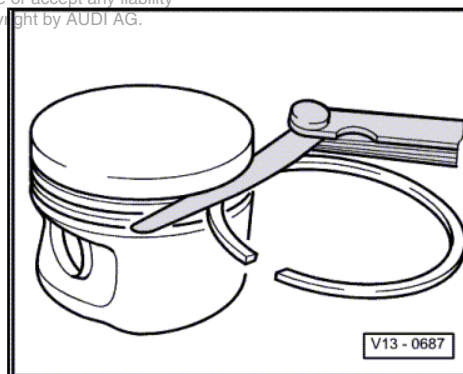


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Checking ring-to-groove clearance

- Clean groove in piston before checking clearance.

Piston ring Dimensions in mm	New	Wear limit
1st compression ring	0.06 ... 0.09	0.25
2nd compression ring	0.05 ... 0.08	0.25
Oil scraper ring	0.03 ... 0.06	0.15

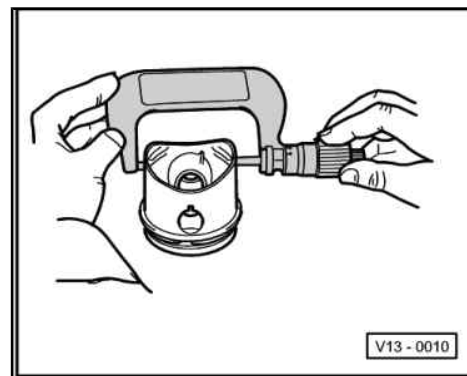


Checking piston

- Measure approx. 10 mm from the bottom edge, perpendicular to the piston pin axis.
- Maximum deviation from nominal dimension: 0.04 mm.

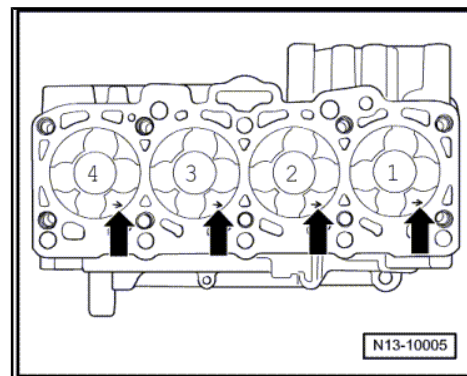
Nominal dimension

⇒ [“5.3 Piston and cylinder dimensions”, page 89](#) .



Piston installation position and piston/cylinder allocation

- Arrow on piston crown points to pulley end -arrows-.

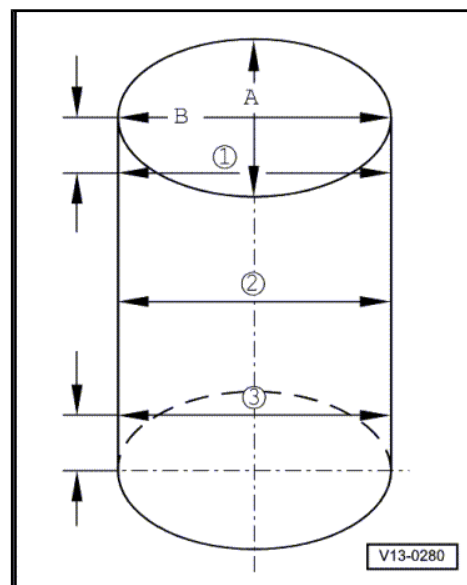


Checking cylinder bore

- Use 50 ... 100 mm internal dial gauge to take measurements at 3 points in transverse direction -A- and longitudinal direction -B-.
- Maximum deviation from nominal dimension: 0.10 mm.

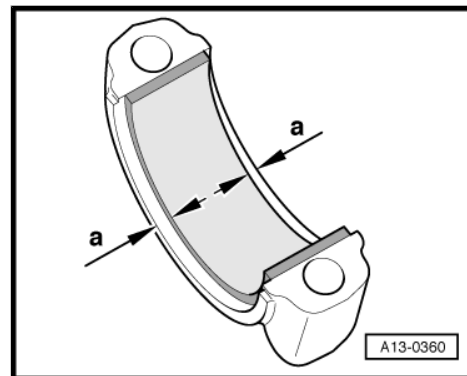
Nominal dimension

⇒ [“5.3 Piston and cylinder dimensions”, page 89](#) .



Installation position of bearing shells in conrods

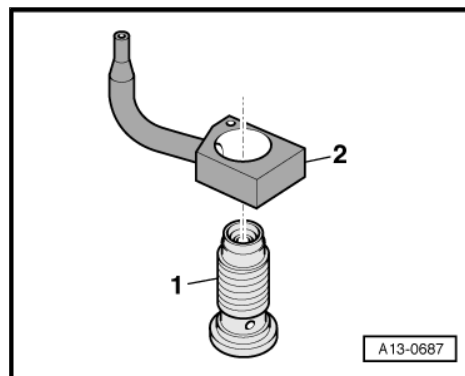
- Insert bearing shells centrally in conrod/conrod bearing cap.
- Dimension -a- = 2.5 mm



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Oil spray jet and pressure relief valve

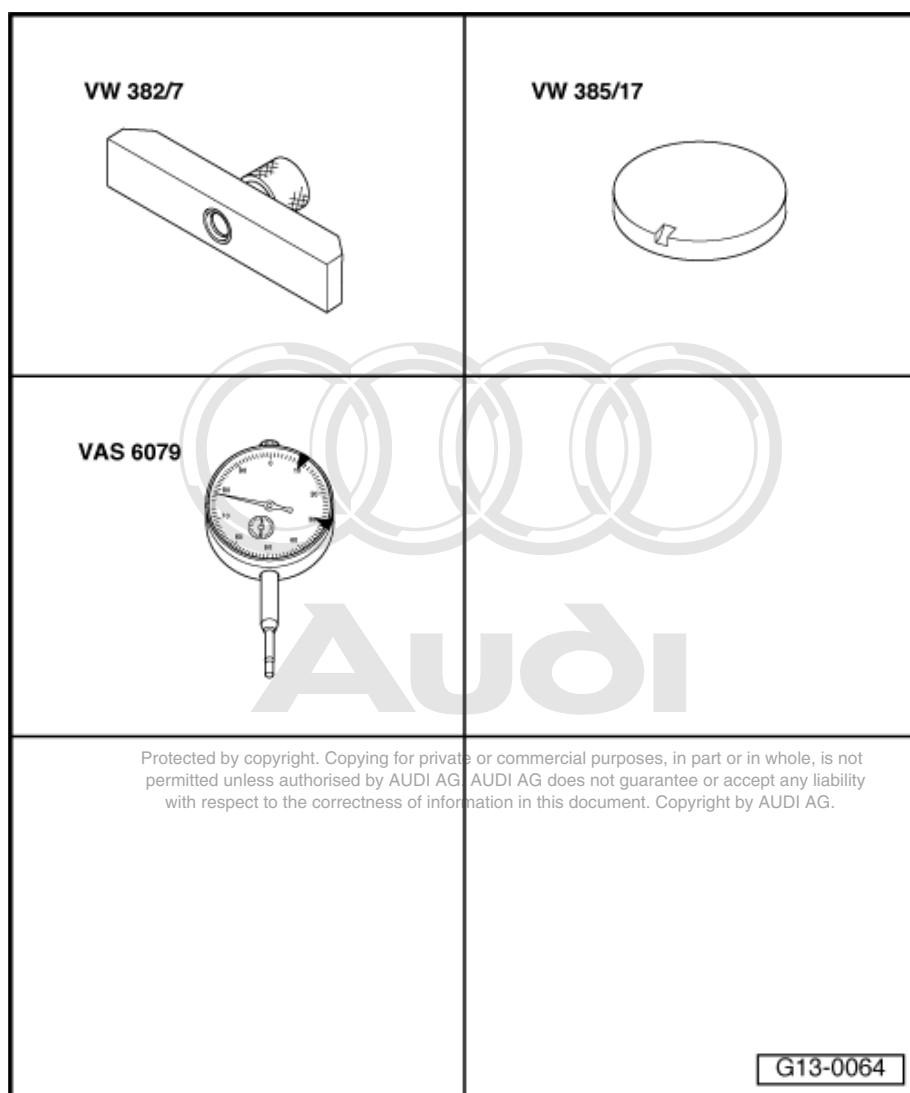
- 1 - Bolt with pressure relief valve, 27 Nm
- 2 - Oil spray jet (for cooling of pistons)



5.2 Checking piston projection at TDC

Special tools and workshop equipment required

- ◆ -VW 382/7- from measuring tool - VW 382-
- ◆ -VW 385/17- from universal measuring tool - VW 385-
- ◆ Dial gauge - VAS 6079-

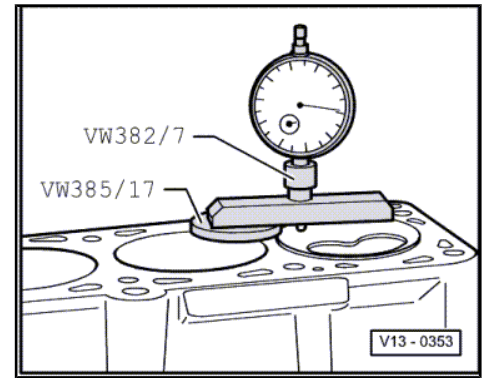


Test sequence

Piston projection at TDC must be measured when installing new pistons or a short engine.

Depending upon piston projection, install the corresponding cylinder head gasket according to following table:

Piston projection above top surface of cylinder block	Identification (No. of holes)
0.91 ... 1.00 mm	1
1.01 ... 1.10 mm	2
1.11 ... 1.20 mm	3



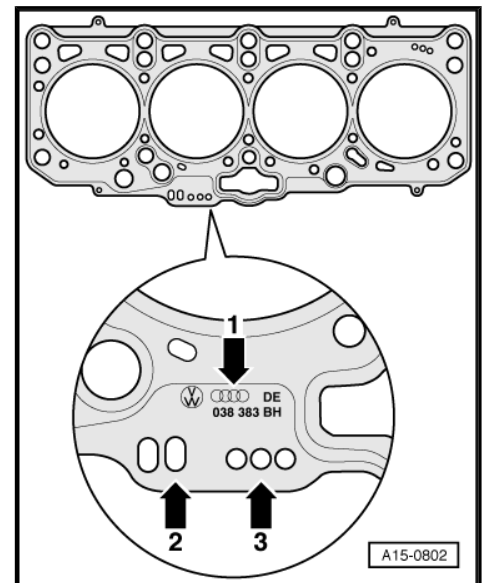
Identification of cylinder head gasket

- 1 - Part No.
- 2 - Production code (can be disregarded)
- 3 - Holes



Note

If the measured values for piston projection are not the same for all pistons, use the highest value to determine the correct gasket size.



5.3 Piston and cylinder dimensions

Honing dimension	Piston Ø	Cylinder bore Ø
Basic dimension mm	80.96	81.01

5.4 Measuring radial clearance of conrods

Special tools and workshop equipment required

- ◆ Plastigage

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- Remove conrod bearing caps.
- Clean bearing caps and bearing journals.
- Place Plastigage onto bearing journal or into bearing shells corresponding to width of bearing.
- Fit conrod bearing caps and tighten to 30 Nm without rotating crankshaft.
- Remove conrod bearing caps once more.
- Compare width of Plastigage with measurement scale:
 - Radial clearance (wear limit): 0.08 mm
- Renew conrod bolts.

15 – Cylinder head, valve gear

1 Handling glow plugs

1.1 Different types of glow plugs

Two different types of glow plugs are installed in the 4-cylinder 2.0 ltr. 4-valve TDI engine in Audi A6 vehicles.

Engine code letters BLB, BNA

- ◆ These engines are fitted exclusively with metal glow plugs.

Engine code letters BRE, BRF, BVG

- ◆ These engines are fitted exclusively with NGK ceramic glow plugs.



Note

NGK ceramic glow plugs are colour-coded with a white, or possibly "silver-coloured" seal.

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1.2 Handling ceramic glow plugs

Important: Note the following points regarding ceramic glow plugs:



Caution

- ◆ *Due to the special properties of the material used, ceramic glow plugs are easily damaged and require extra care when handling and removing/installing. Always observe the special instructions when removing and installing ceramic glow plugs → Rep. gr. 28 .*
- ◆ *Use only the approved type of ceramic glow plugs → Parts catalogue .*
- ◆ *Transport and store only in original packaging or packed separately in bubble wrap.*
- ◆ *Do not remove new ceramic glow plugs from packaging until they are ready to be fitted.*
- ◆ *Ceramic glow plugs are sensitive to knocks and bending. For this reason, ceramic glow plugs which have been dropped (even from a height of only about 2 cm) must not be installed, even if no damage is apparent (hair-line cracks may not be visible).*
- ◆ *Always install a new ceramic glow plug if you are not sure the old one is in perfect condition.*
- ◆ *Damaged glow plugs (e.g. heater pin of the glow plug is damaged) will invariably cause engine damage.*
- ◆ *If the heater pin of the glow plug is damaged, the fragments must be removed from the combustion chamber before starting the engine for the first time, otherwise this will invariably cause mechanical damage (piston seizure).*
- ◆ *To check compression, select function "Self-diagnosis compatible systems" in "Guided Fault Finding" → Vehicle diagnostic tester.*
- ◆ *The ceramic glow plugs must not be removed when checking cylinder compression.*



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2 Removing and installing cylinder head

1 - Toothed belt cover (rear)

2 - Rubber grommet

- ☐ Renew if damaged

3 - Threaded pin, 15 Nm

4 - Hub for inlet camshaft

- ☐ With sender wheel for Hall sender - G40-
- ☐ To remove, use puller - T10052- ⇒ [page 102](#)

5 - 100 Nm

- ☐ Use counterhold tool - T10051- when loosening and tightening
⇒ ["3.3 Removing and installing camshafts", page 116](#)

6 - Hub for exhaust camshaft

- ☐ To remove, use puller - T10052-
⇒ ["3.3 Removing and installing camshafts", page 116](#)

7 - 10 Nm

- ☐ Install using locking fluid; for locking fluid refer to ⇒ [Parts catalogue](#)

8 - Rocker arm shaft

- ☐ Mark allocation of rocker arms
- ☐ Do not interchange
- ☐ Removing and installing
⇒ ["2.2 Removing and installing cylinder head", page 96](#)

- ☐ Before installing, check that all ball studs and O-rings are inserted in the unit injectors ⇒ [page 94](#)

9 - Bolt for rocker arm shaft

- ☐ Renew
- ☐ Note correct sequence when loosening ⇒ [page 103](#)
- ☐ Note correct sequence when tightening ⇒ [page 107](#)

10 - Gasket for cylinder head cover

- ☐ Renew if damaged or leaking
- ☐ Engage in spacer sleeves of ⇒ [Item 16 \(page 93\)](#)

11 - Cylinder head cover

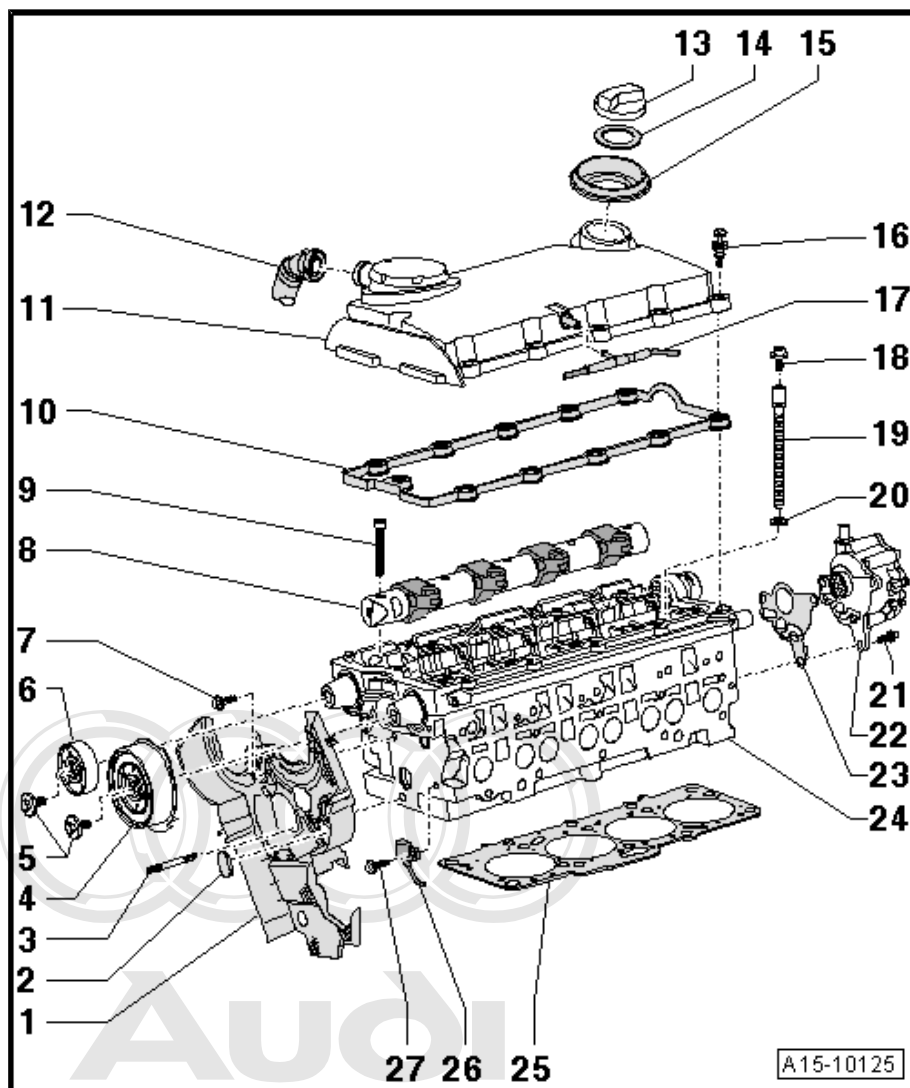
- ☐ Removing and installing ⇒ [page 95](#)

12 - Crankcase breather hose

13 - Filler cap

14 - Seal

- ☐ Renew if damaged or leaking



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15 - Cap

16 - Special bolt, 10 Nm

- ☐ Renew if damaged or leaking
- ☐ Note correct sequence for loosening and tightening
⇒ [“2.1 Removing and installing cylinder head cover”, page 95](#)

17 - Vacuum hose

18 - 20 Nm

19 - Cylinder head bolt

- ☐ Renew
- ☐ Note correct sequence when loosening ⇒ [page 104](#)
- ☐ Note correct sequence when tightening ⇒ [page 106](#)

20 - Washer

- ☐ When cylinder head is removed, fit washer in cylinder head before installing bearing frame

21 - 20 Nm

22 - Tandem pump

- ☐ Removing and installing ⇒ Rep. gr. 20

23 - Gasket

- ☐ Renew

24 - Cylinder head

- ☐ Removing and installing ⇒ [page 96](#)

 **Caution**

Vehicles with ceramic glow plugs: The ceramic glow plugs are very easily damaged and project slightly beyond the cylinder head gasket surface, so do NOT lay the cylinder head down on the gasket side while the glow plugs are still installed.

Handling ceramic glow plugs ⇒ [page 5](#).

- ☐ Checking for distortion ⇒ [page 94](#)
- ☐ If renewed, change engine oil and coolant

25 - Cylinder head gasket

- ☐ Renewing ⇒ [“2.2 Removing and installing cylinder head”, page 96](#)
- ☐ Note marking ⇒ [page 94](#)
- ☐ If renewed, change engine oil and coolant

26 - Hall sender - G40-

- ☐ For camshaft position

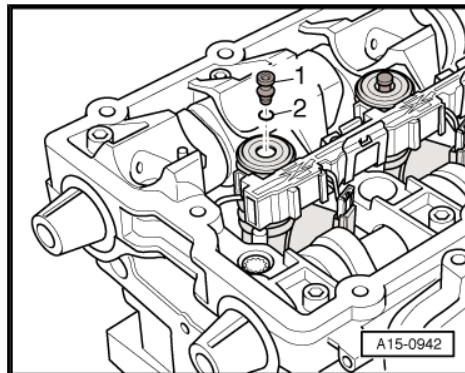
27 - 10 Nm

- ☐ Install using locking fluid; for locking fluid refer to ⇒ [Parts catalogue](#)

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Ball stud for rocker arm shaft

- Before installing rocker arm shaft, check that all ball studs -1- and O-rings -2- are fitted in unit injectors.



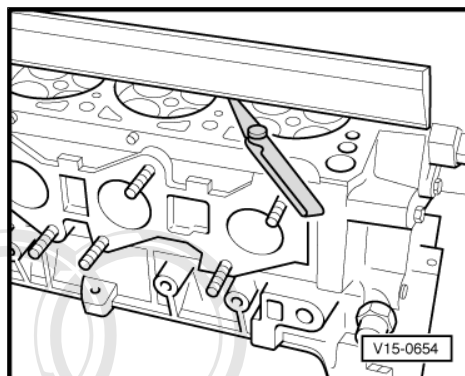
Checking cylinder head for distortion

- Use straight edge and feeler gauge to measure for distortion at several points.
- Maximum permissible distortion: 0.1 mm.



Note

The cylinder heads of diesel engines must not be machined.



Identification of cylinder head gasket

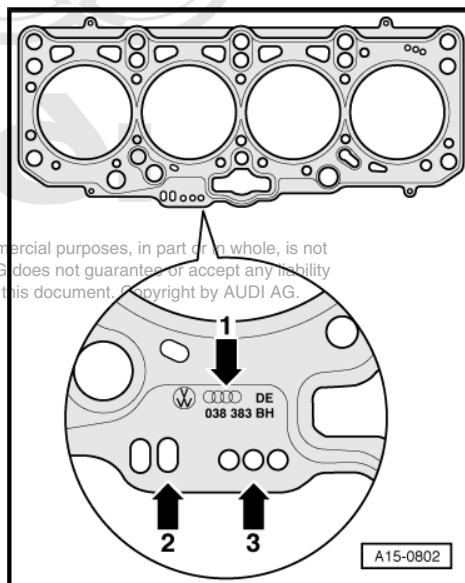
- 1 - Part No.
- 2 - Production code (can be disregarded)
- 3 - Holes



Note

Cylinder head gaskets of different thicknesses are fitted depending on the amount of piston projection ⇒ [page 88](#). When renewing just the cylinder head gasket, the new gasket should have the same identification as the old one.

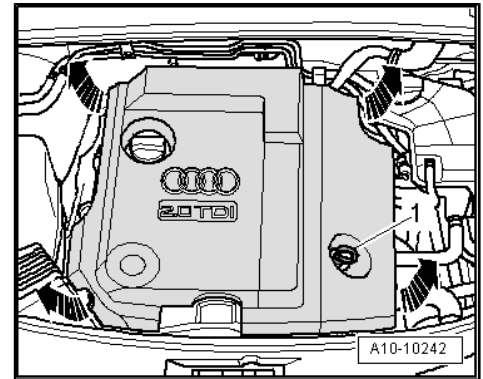
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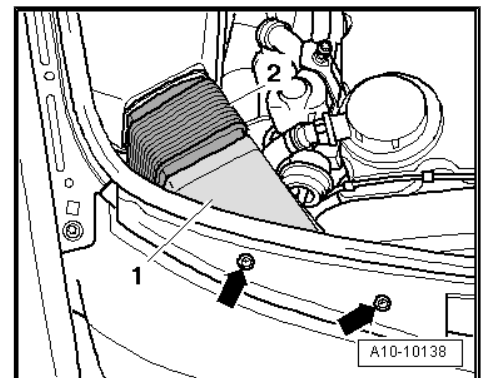
2.1 Removing and installing cylinder head cover

Removing

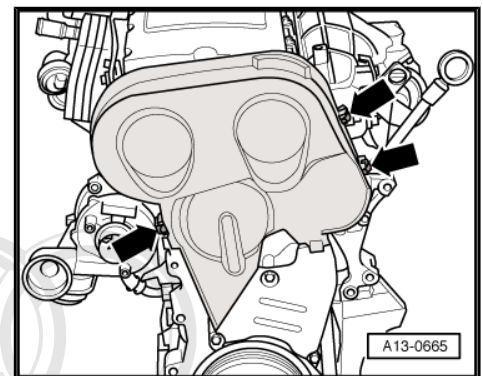
- Pull dipstick -1- out of guide tube.
- Pull off engine cover panel -arrows-.
- Re-insert dipstick in guide tube.



- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.



- Remove top toothed belt cover by releasing retaining clips -arrows-.



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- Detach crankcase breather hose and vacuum hose from cylinder head cover -arrows-.
- Remove cylinder head cover bolts in the sequence -11 ... 1-.
- Remove cylinder head cover.

Installing

Installation is carried out in the reverse order; note the following:



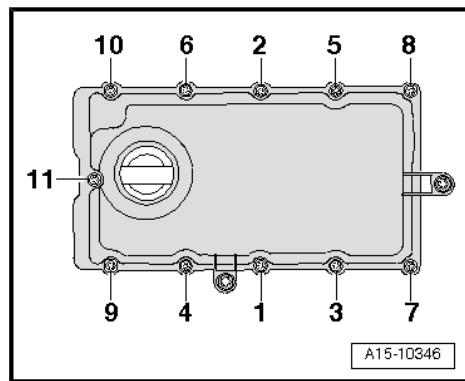
Note

Renew gasket for cylinder head cover and bolts if damaged.

- Tighten bolts for cylinder head cover to final setting in the sequence -1 ... 11-.

Tightening torque

Component	Nm
Cylinder head cover to cylinder head	10

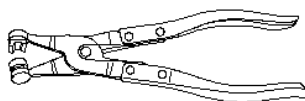


2.2 Removing and installing cylinder head

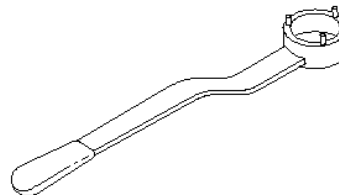
Special tools and workshop equipment required

- ◆ Hose clip pliers - V.A.G 1921-
- ◆ Counterhold tool - T10051-
- ◆ Puller - T10052-
- ◆ Safety goggles
- ◆ Protective gloves

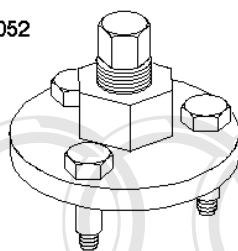
V.A.G 1921



T10051



T10052



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G13-0078

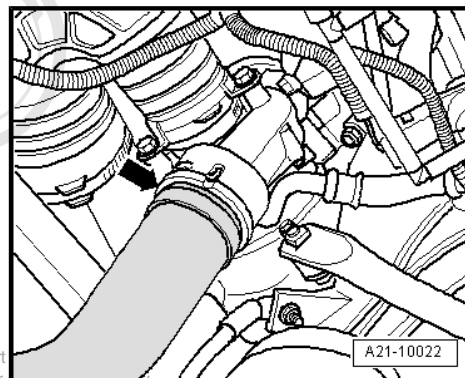
Removing



Caution

Observe notes on procedure for disconnecting the battery → Rep. gr. 27.

- Disconnect earth wire at battery with ignition switched off.
- Drain off coolant → [page 183](#).
- Move lock carrier to service position → [page 31](#).
- Detach air intake hose from turbocharger by lifting retaining clip -arrow- slightly.



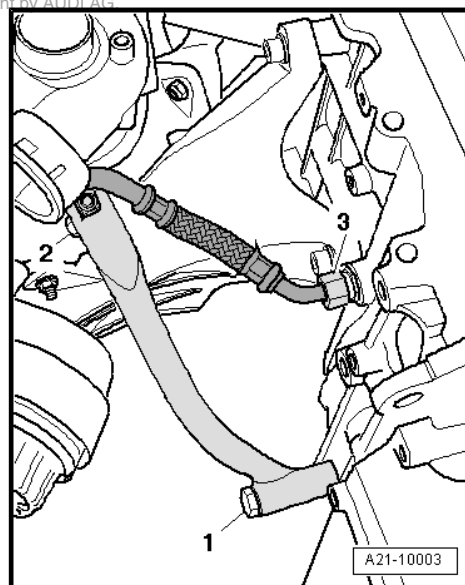
- Remove bolts -1- and -2- and detach support for turbocharger.



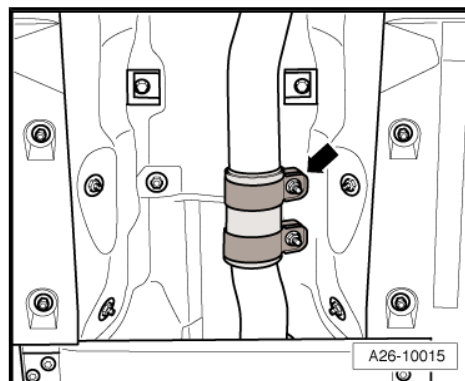
Note

Place a cloth underneath to catch any escaping oil.

- Remove oil return line -3- at cylinder block.



- Disconnect exhaust system at clamp -arrow- and push clamp back.

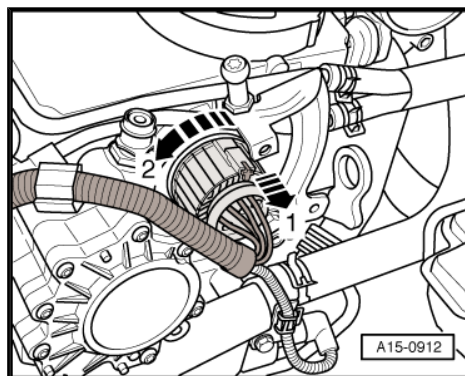


- Pull the release pin -arrow 1- and unscrew knurled nut -arrow 2-.



Note

Shown from rear for illustration purposes.

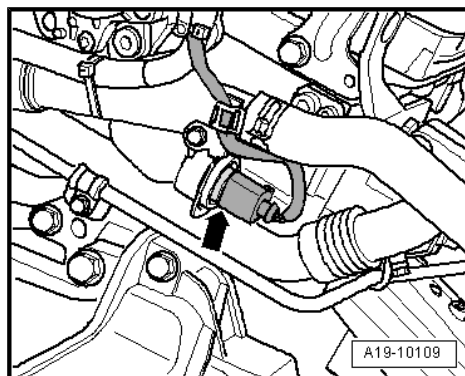


- Unplug electrical connector -arrow- at coolant temperature sender - G62- and move wiring harness clear.



Note

Shown from rear for illustration purposes.



- Disconnect vacuum hose -arrow- leading to brake servo.



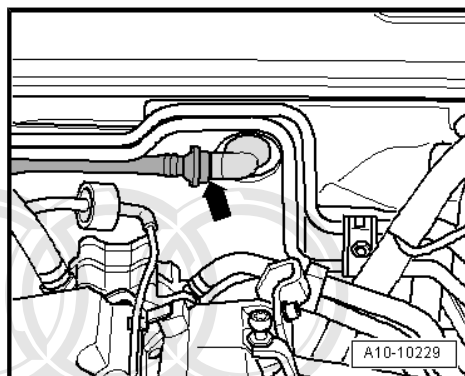
Caution

Rules for cleanliness when working on the injection system
⇒ **page 6**.



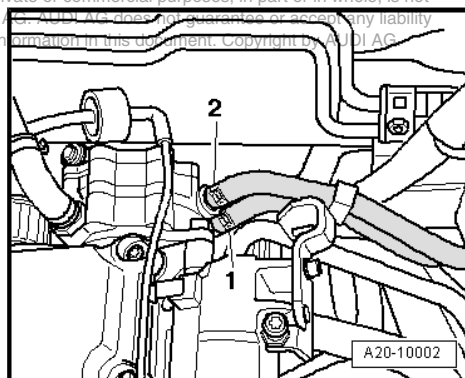
WARNING

- ◆ **In extreme cases the fuel lines and the fuel can reach a temperature of 100 °C on vehicles with unit injector engine. Allow the fuel to cool down before disconnecting the lines - danger of scalding.**
- ◆ **Wear protective gloves.**
- ◆ **Wear safety goggles.**

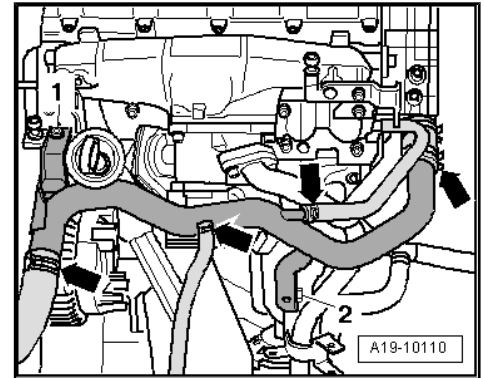


- Mark the installation position of fuel hoses.
- Disconnect fuel return line -1- and fuel supply line -2- from tandem pump.

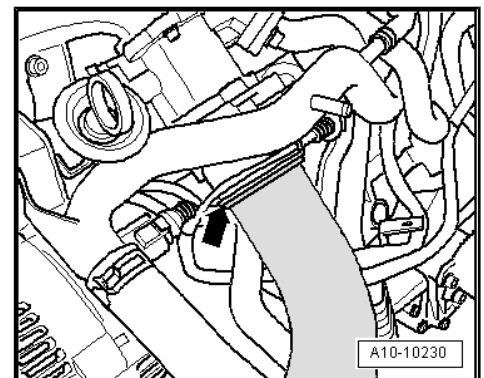
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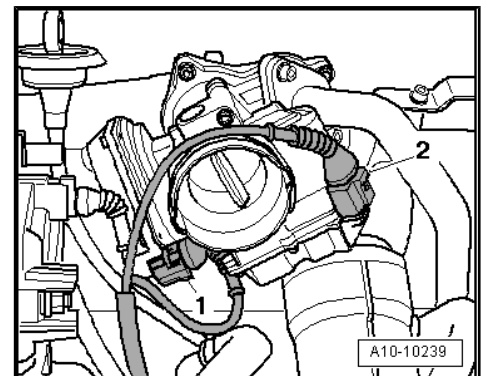
- Unscrew bolts -1- and -2- and detach top coolant pipe from coolant hoses -arrows-.



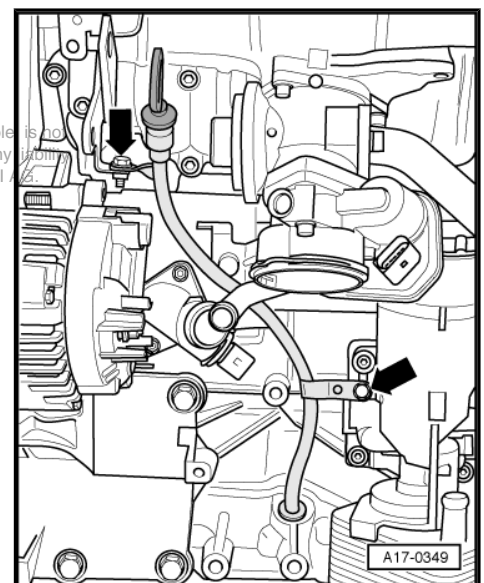
- Remove air intake hose at intake manifold flap motor - V157- by lifting retaining clip -arrow- slightly.



- Unplug electrical connectors at exhaust gas recirculation valve - N18- with exhaust gas recirculation potentiometer - G212- -item 1- and at intake manifold flap motor - V157- -item 2-.

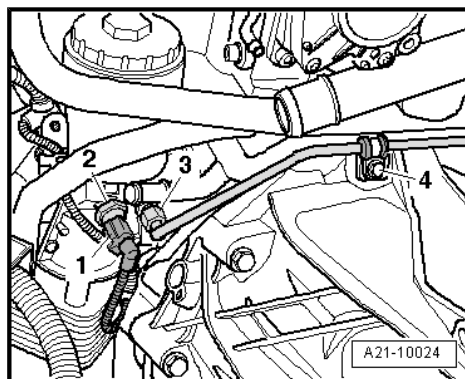


- Remove bolts -arrows-.
- Pull guide tube for oil dipstick upwards out of the cylinder block and swing towards front to remove.

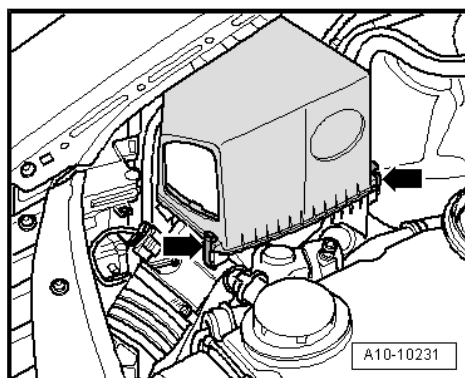


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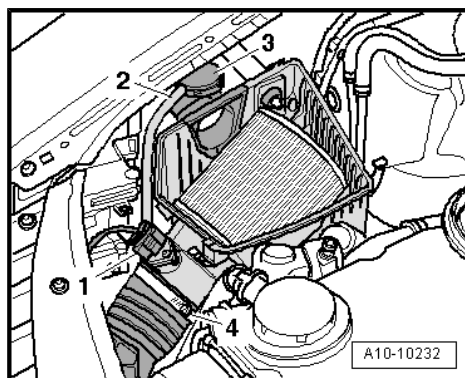
- Unplug electrical connector -1- at oil pressure switch - F1- .
- Unscrew oil pressure switch - F1- -item 2-.
- Detach oil supply line at oil filter bracket -3- and at connecting pipe for exhaust gas recirculation -4-.



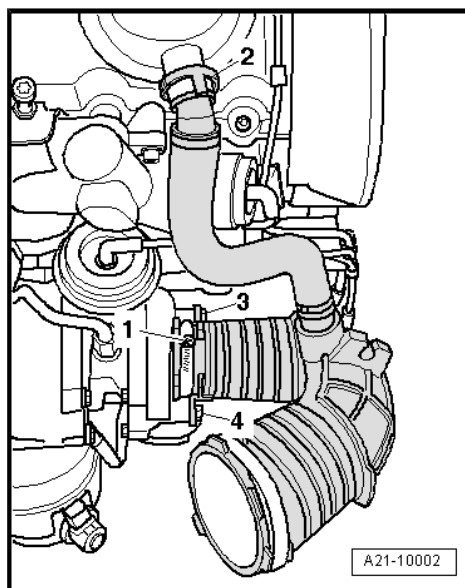
- Release two retaining clips -arrows- and detach top section of air cleaner housing.



- Unplug electrical connector -1- at air mass meter - G70- .
- Loosen hose clip -4- to remove air intake hose.
- Detach vacuum hose -2-.
- Lift off vacuum unit -3- with air flap from air cleaner housing.
- Disengage bottom section of air cleaner housing from retaining pin and remove.

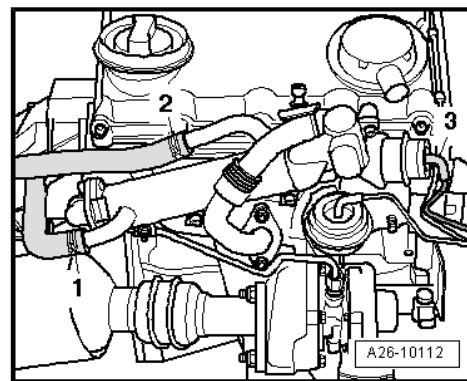


- Detach crankcase breather hose -2- from cylinder head cover.
- Remove bolts -3- and -4-.
- Detach air hose -1- from turbocharger.

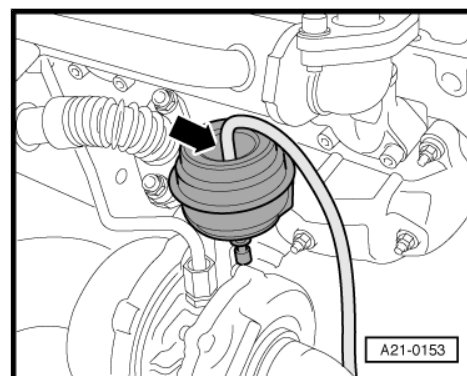


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- Disconnect coolant hoses -1- and -2- at exhaust gas recirculation cooler.
- Detach vacuum hose -3- at exhaust gas recirculation cooler.

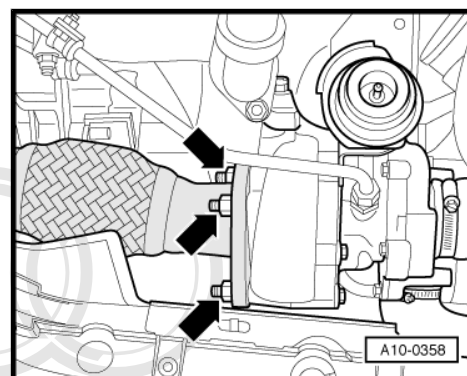


- Disconnect hose -arrow- from vacuum unit for charge pressure control.
- Move vacuum hoses at cylinder head clear.

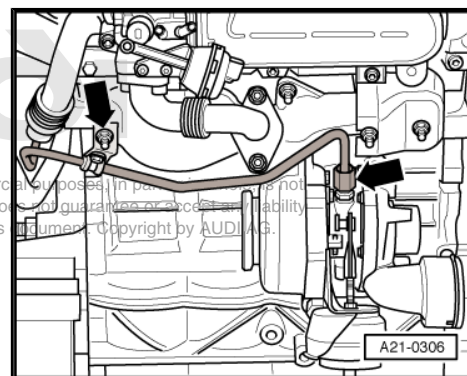
**Note**

To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.

- Unscrew nuts on turbocharger -arrows-.
- Disconnect front exhaust pipe / particulate filter from turbocharger.

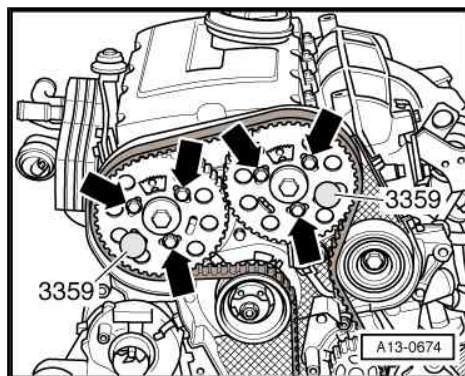


- Unscrew oil supply line at turbocharger and exhaust manifold -arrows-.

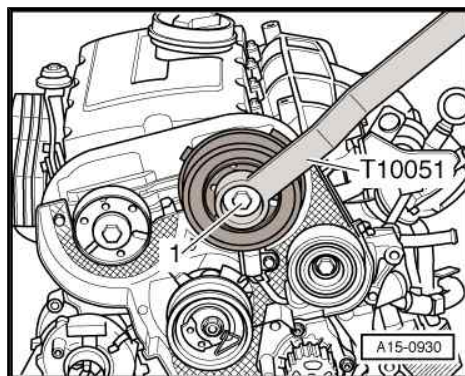


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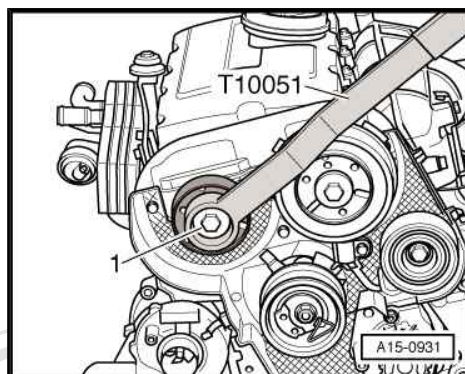
- Remove toothed belt ⇒ [page 48](#) .
- Remove locking pins - 3359- .
- Remove securing bolts -arrows- for camshaft sprockets.
- Remove the camshaft sprockets from hubs.



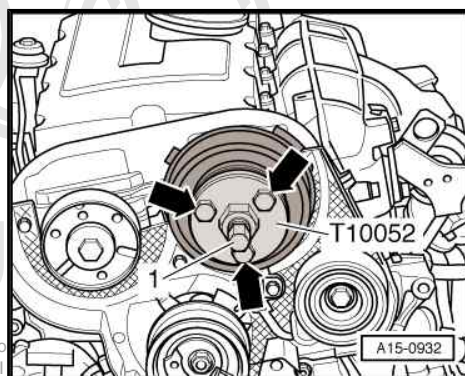
- Loosen securing bolt -1- for hub on inlet camshaft; use counterhold tool - T10051- .



- Loosen securing bolt -1- for hub on exhaust camshaft; use counterhold tool - T10051- .
- Unscrew securing bolts of hubs approx. 2 turns.

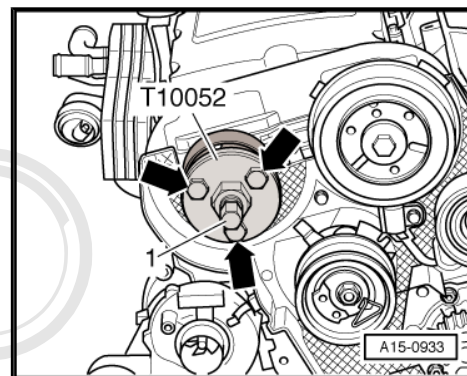


- Fit puller - T10052- on hub of inlet camshaft and screw in bolts -arrows- into hub.
- Remove hub by screwing in bolt -1- while counterholding at hexagon flats (30 mm) of puller.



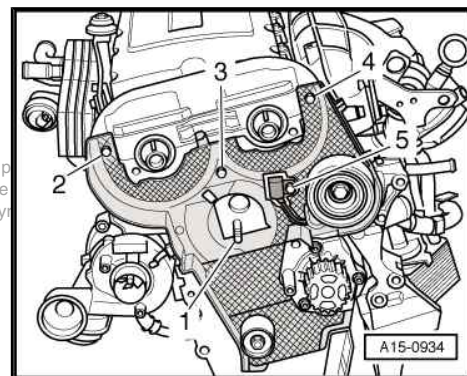
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- Fit puller - T10052- on hub of exhaust camshaft and screw bolts -arrows- into hub.
- Remove hub by screwing in bolt -1- while counterholding at hexagon flats (30 mm) of puller.
- Remove toothed belt tensioning roller.

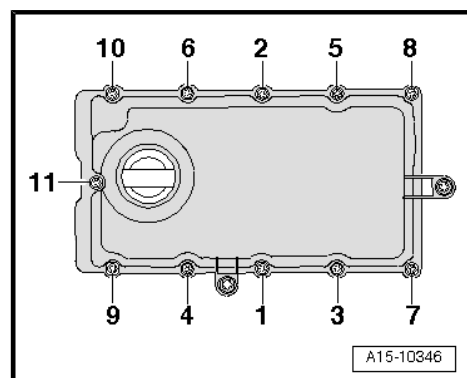


- Remove bolts -2 ... 4-.
- Unscrew bolt -5- and remove Hall sender - G40- from cylinder head.
- Unscrew stud -1- using two M8 lock nuts.

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- Detach vacuum hose at cylinder head cover -arrow at bottom-.
- Remove cylinder head cover bolts in the sequence -11 ... 1-.
- Remove cylinder head cover.



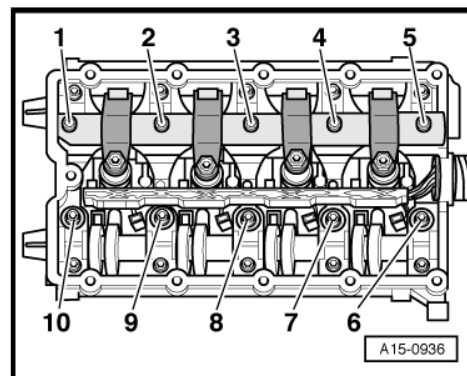
- Remove bolts -1-, -3- and -5-.
- Unscrew bolts -2- and -4- alternately in several stages.



Note

Do not pull bolts out of rocker arm shaft so that components remain attached to shaft. If necessary mark position on rocker arm.

- Detach rocker arm shaft.
- Remove bolts -6 ... 10-.



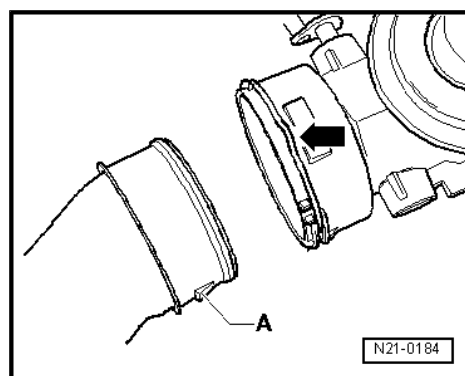
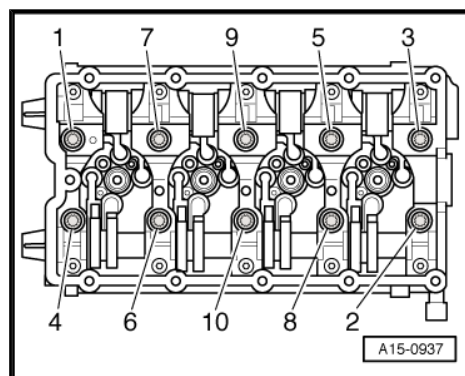
- Remove cylinder head bolts in the sequence: -1 ... 10-.
- Remove the cylinder head with the assistance of a 2nd mechanic.

Installing

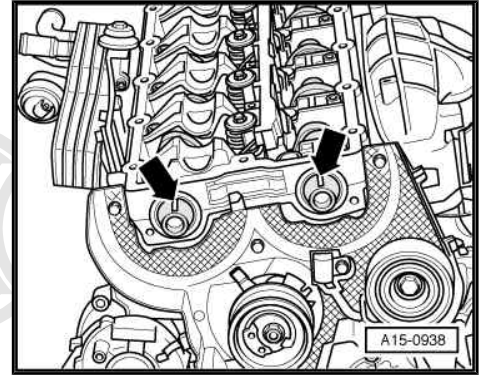


Note

- ◆ Carefully remove any sealant residue from the cylinder head and cylinder block. Ensure that no long scores or scratches are made on the surfaces.
- ◆ Carefully remove any remaining emery and abrasive material.
- ◆ No oil or coolant must be allowed to remain in the blind holes for the cylinder head bolts in the cylinder block.
- ◆ Cylinder heads with cracks between the valve seats may be used without reducing engine life, provided the cracks are small and not more than 0.5 mm wide.
- ◆ The cylinder heads of diesel engines must not be machined.
- ◆ Renew the cylinder head bolts.
- ◆ Renew self-locking nuts and bolts when performing assembly work.
- ◆ Renew bolts which are tightened to a specified angle as well as oil seals, gaskets and O-rings.
- ◆ Do not remove new cylinder head gasket from packaging until it is ready to be fitted.
- ◆ **Handle gasket very carefully. Damage to the silicone coating or the indented area will lead to leaks.**
- ◆ When installing an exchange cylinder head with fitted camshafts, the contact surfaces between roller rocker fingers and cams must be oiled after installing the head.
- ◆ The plastic protectors fitted to protect the open valves should not be removed until the cylinder head is ready to be fitted.
- ◆ Hose connections and hoses for charge air system must be free of oil and grease before assembly. Do NOT use lubricant.
- ◆ When installing air intake hoses with plug-in connectors, ensure that the securing clip -arrow- engages audibly on the retaining lug -A-.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .
- ◆ After fitting a new cylinder head or cylinder head gasket, change the engine oil and refill the complete cooling system with fresh coolant.



- Check whether both the camshafts and the crankshaft are positioned at TDC:
- The grooves -arrows- for the hubs must face upwards.

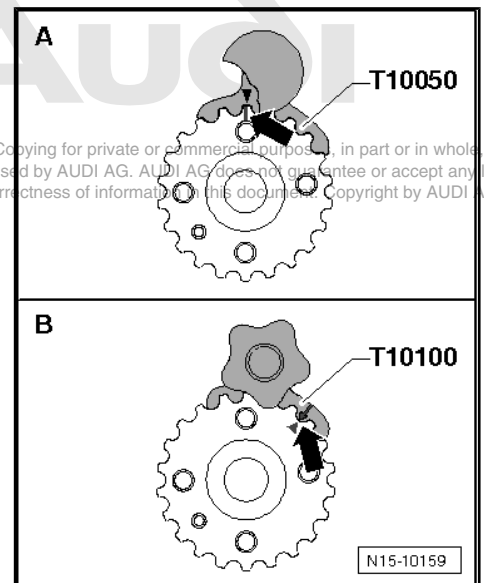


- The crankshaft sprocket must be locked using crankshaft stop - T10050- for engines with circular crankshaft sprocket, or crankshaft stop - T10100- for engines with oval crankshaft sprocket.

**Note**

The markings on the toothed belt sprocket and the crankshaft stop must align -arrow-.

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- Check whether there is a slit dowel sleeve inserted between cylinders 1 and 2 -arrow A-; insert if necessary.
- Check which type of dowel sleeve is inserted between cylinders 3 and 4 -arrow B-:

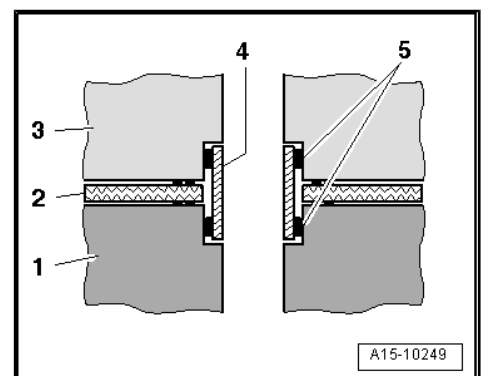
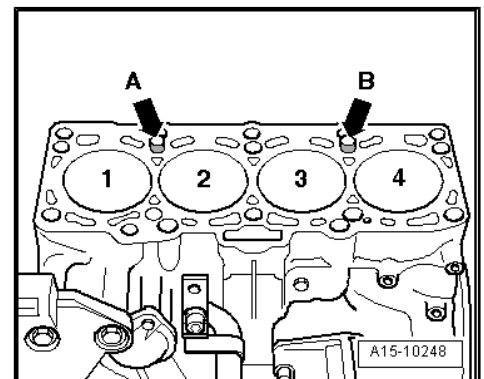
Vehicles with slit dowel sleeve -arrow B-:

- A slit dowel sleeve remains installed.

Vehicles with closed dowel sleeve -arrow B-:

- A closed dowel sleeve must be coated with new sealant as described in the following.
- Pull closed dowel sleeve -arrow B- out of cylinder block and remove any remaining sealant.
- Blow out drilled holes for dowel sleeve in cylinder block -1- and in cylinder head -3- with compressed air.
- Clean and degrease each drilled hole down to a depth of 10 mm.
- Allow holes to dry for 3 minutes and then coat drilled holes in cylinder block and cylinder head all around with sealant - D 154 103 A1- .
- Insert closed dowel sleeve -4-.

2 - Cylinder head gasket



All vehicles:

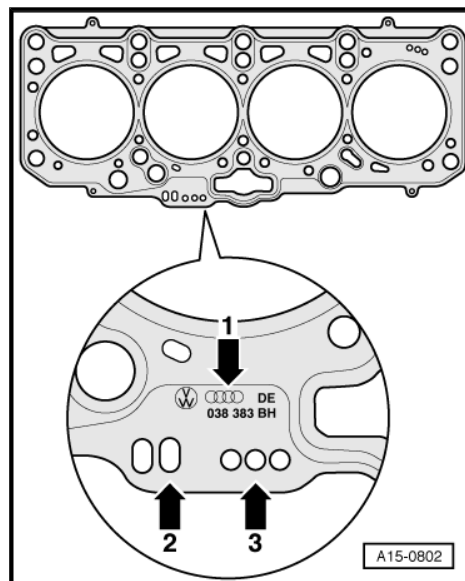
- Note identification markings on cylinder head gasket.

- 1 - Part No.
- 2 - Production code (can be disregarded)
- 3 - Holes

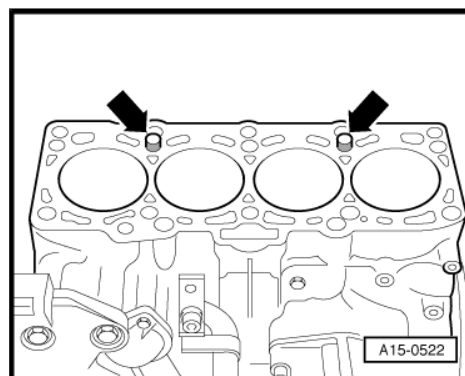


Note

- ◆ If the cylinder head gasket or cylinder head is renewed, be sure to install a gasket with the same identification.
- ◆ If parts of the crankshaft drive have been renewed, the new cylinder head gasket must be selected by measuring the piston projection at TDC ⇒ [page 88](#).

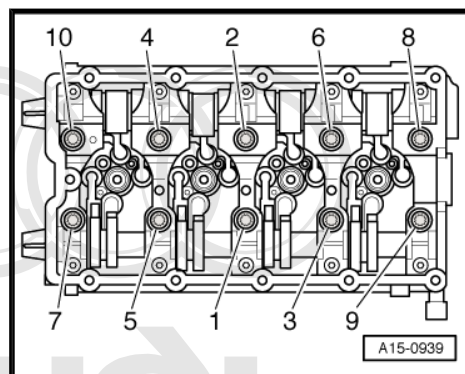


- Fit cylinder head gasket.
- Pay attention to dowel sleeves -arrows- in cylinder block.
- Check installation position of cylinder head gasket: the word "oben" (top) or the Part No. should face towards the cylinder head.
- Fit cylinder head.



- Insert and hand-tighten cylinder head bolts.
- Tighten cylinder head bolts in 4 stages in the sequence shown:

 1. Tighten with torque wrench to 40 Nm.
 2. Tighten with torque wrench to 60 Nm.
 3. Turn 90° (1/4 turn) further using a rigid wrench.
 4. Turn 90° (1/4 turn) further using a rigid wrench.

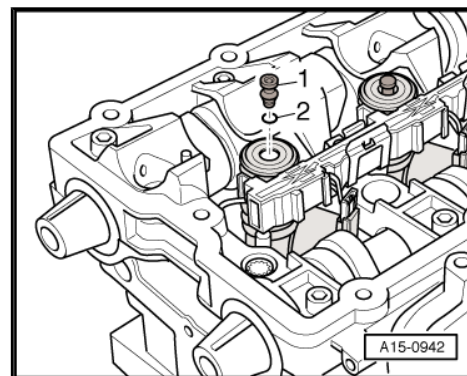


Note

Cylinder head bolts do not have to be torqued down again later after repair work.

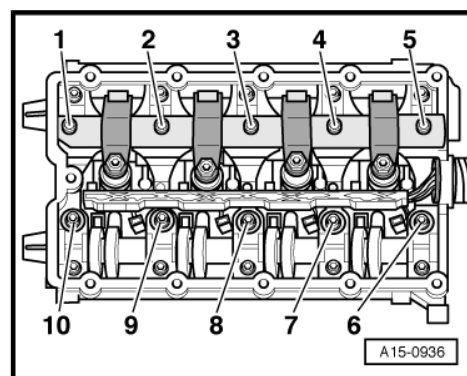
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- Before installing rocker arm shaft, check that all ball studs -1- and O-rings -2- are fitted in unit injectors.

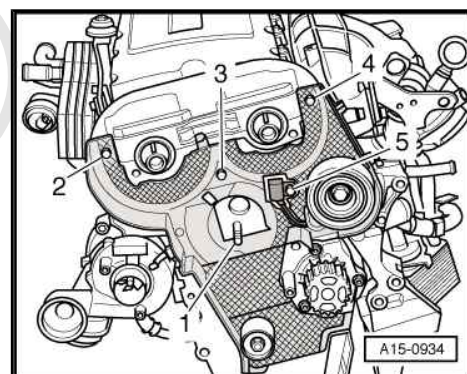


- Secure the rocker arm shaft as follows:

1. Tighten bolts -2- and -4- alternately in several stages until rocker arm shaft lies on bearing frame.
2. Tighten bolts -1-, -3- and -5- to 20 Nm + 90° (1/4 turn).
3. Tighten bolts -2- and -4- to 20 Nm + 90° (1/4 turn).
4. Tighten bolts -6 ... 10- to 20 Nm.

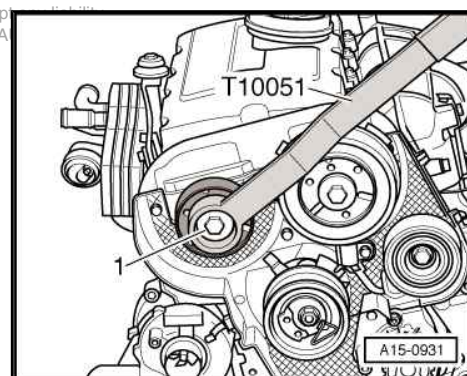


- Apply locking fluid to bolts -2 ... 5- and tighten; for locking fluid refer to ⇒ Parts catalogue .
- Screw in stud -1-.

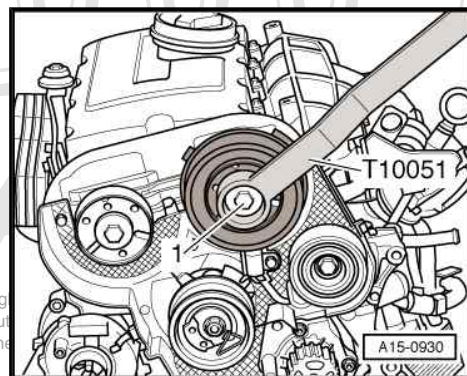


- Attach hub to exhaust camshaft.

- Tighten securing bolt -1- to 100 Nm (use counterhold tool - T10051-).



- Attach hub to inlet camshaft.
- Tighten securing bolt -1- to 100 Nm (use counterhold tool - T10051-).



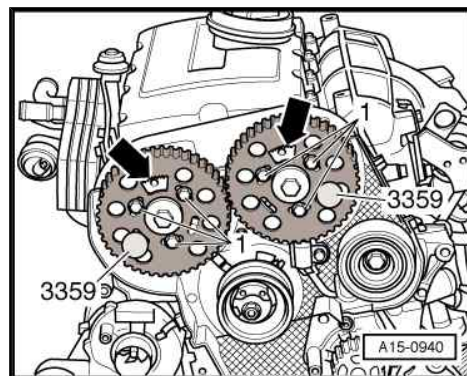
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- Push camshaft sprockets onto hubs.
- The toothed segments -arrows- in the camshaft sprockets must both face upwards.
- Screw in bolts -1- finger-tight.
- Lock hubs with locking pins - 3359- .

Remaining installation steps are carried out in reverse sequence; note the following:

- Install cylinder head cover ⇒ [page 95](#) .
- Install toothed belt (adjust valve timing) ⇒ [page 51](#) .
- Install vibration damper ⇒ [page 39](#) .
- Install poly V-belt ⇒ [page 35](#) .



Vehicles without particulate filter:

- Install front exhaust pipe together with catalytic converter ⇒ [page 219](#) .
- Align exhaust system so it is free of stress ⇒ [page 221](#) .

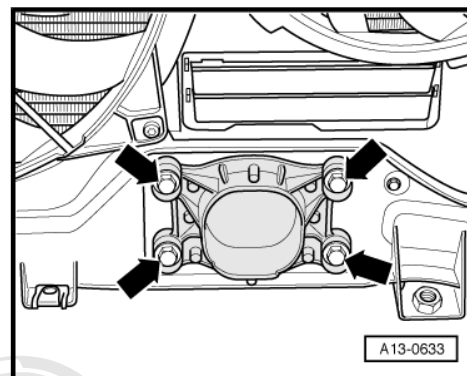
Vehicles with particulate filter:

- Install front exhaust pipe ⇒ [page 230](#) .
- Align exhaust system so it is free of stress ⇒ [page 235](#) .

All vehicles:

- Install coolant pipe (top) ⇒ [page 192](#) .
- Install lock carrier with attachments ⇒ Rep. gr. 50 .

- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten bolts -arrows-.
- Install headlights ⇒ Rep. gr. 94 .
- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Connect battery. Procedures required ⇒ Rep. gr. 27 .
- Change engine oil ⇒ Maintenance ; Booklet 405 .
- Fill cooling system with fresh coolant ⇒ [page 185](#) .
- Check headlight adjustment ⇒ Maintenance ; Booklet 405 .



Tightening torques

Component	Nm
Rocker arm shaft to cylinder head	20 + 90° 1)2)
Rear toothed belt cover to cylinder head	10 3)
Hall sender to cylinder head	10 3)
Stud to cylinder head	15
Hub to camshaft	100
Oil supply line to turbocharger	22
Bracket for oil supply line to exhaust manifold	22
Oil supply line to oil filter bracket	22
Oil pressure switch to oil filter bracket	20
Oil return line to cylinder block	30
Guide tube for oil dipstick to:	
Engine lifting eye	10
Oil filter bracket	10
Bracket for turbocharger to:	
Turbocharger	20
Cylinder block	40
Stop for torque reaction support to lock carrier	23
• 1) Renew bolts. • 2) 90° = one quarter turn. • 3) Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue .	

2.3 Checking compression

Checking of compression is carried out using the Guided Fault Finding function of the vehicle diagnosis, testing and information system - VAS 5051 A- under "Repair group 15; Cylinder head, valve gear; Subsystem, background conditions; Diagnosis object: compression pressure poor".

3 Servicing valve gear



Note

- ◆ After installing camshafts, wait for approx. 30 minutes before starting engine. The hydraulic tappets have to settle (otherwise valves will strike pistons).
- ◆ After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.
- ◆ Renew gaskets, seals and O-rings.
- ◆ Removing and installing tandem pump ⇒ Rep. gr. 20.

1 - Bracket for wiring -10 Nm-

2 - 20 Nm

- ☐ Note correct sequence for loosening and tightening
⇒ ["3.3 Removing and installing camshafts", page 116](#)

3 - Rocker arm shaft

4 - Bolt for rocker arm shaft

- ☐ Renew
- ☐ Note correct sequence when loosening
⇒ [page 103](#)
- ☐ Note correct sequence when tightening
⇒ [page 107](#)

5 - Cylinder head bolt

- ☐ Renew
- ☐ Note correct sequence when loosening
⇒ [page 104](#)
- ☐ Note correct sequence when tightening
⇒ [page 106](#)

6 - Washer

- ☐ For cylinder head bolts
- ☐ Insert in cylinder head before installing bearing frame

7 - Cotters

8 - Valve spring plate

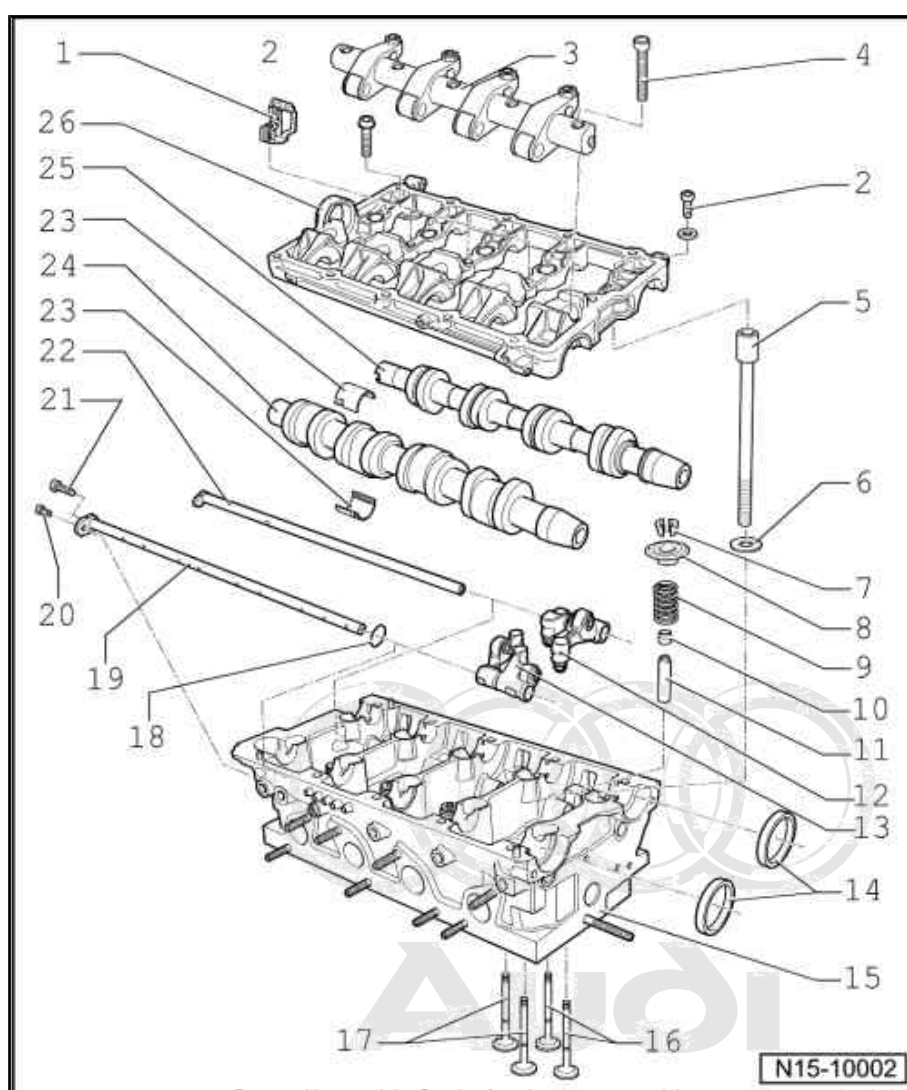
9 - Valve spring

10 - Valve stem oil seal

- ☐ Renewing ⇒ [page 125](#)

11 - Valve guide

- ☐ Checking ⇒ [page 130](#)



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12 - Roller rocker finger

- ☐ Inlet side
- ☐ With pressed-in hydraulic tappet
- ☐ Removing and installing ⇒ [page 124](#)
- ☐ Do not interchange used roller rocker fingers (mark)
- ☐ Check roller bearing for play and ease of movement

13 - Roller rocker finger

- ☐ Exhaust side
- ☐ With pressed-in hydraulic tappet
- ☐ Removing and installing ⇒ [page 124](#)
- ☐ Do not interchange used roller rocker fingers (mark)
- ☐ Check roller bearing for play and ease of movement

14 - Oil seals

- ☐ Renewing ⇒ [page 112](#)

15 - Cylinder head

16 - Inlet valves

- ☐ Checking valves ⇒ [page 131](#)
- ☐ Valve dimensions ⇒ [page 130](#)

17 - Exhaust valves

- ☐ Checking valves ⇒ [page 131](#)
- ☐ Valve dimensions ⇒ [page 130](#)

18 - O-ring

- ☐ Renew

19 - Shaft

- ☐ For roller rocker fingers
- ☐ Removing and installing ⇒ ["3.4 Removing and installing roller rocker fingers", page 124](#)

20 - 10 Nm

21 - Screw plug, 10 Nm

- ☐ Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue

22 - Shaft

- ☐ For roller rocker fingers
- ☐ Removing and installing ⇒ ["3.4 Removing and installing roller rocker fingers", page 124](#)

23 - Bearing shell

- ☐ Do not interchange used bearing shells (mark positions)
- ☐ Make sure that the retaining lugs are correctly seated in the bearing caps and the cylinder head

24 - Exhaust camshaft

- ☐ Checking axial clearance ⇒ [page 112](#)
- ☐ Removing and installing ⇒ [page 116](#)

25 - Inlet camshaft

- ☐ Checking axial clearance ⇒ [page 112](#)
- ☐ Removing and installing ⇒ [page 116](#)

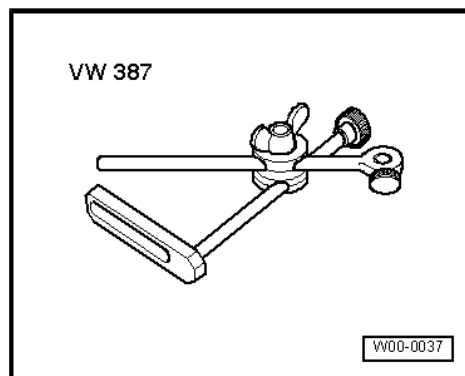
26 - Bearing frame

- ☐ Note correct sequence for loosening and tightening
⇒ ["3.3 Removing and installing camshafts", page 116](#)

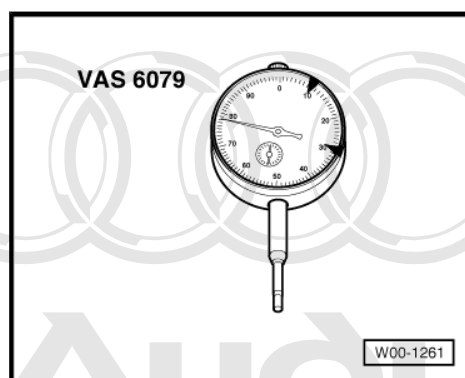
3.1 Checking axial clearance of camshafts

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-

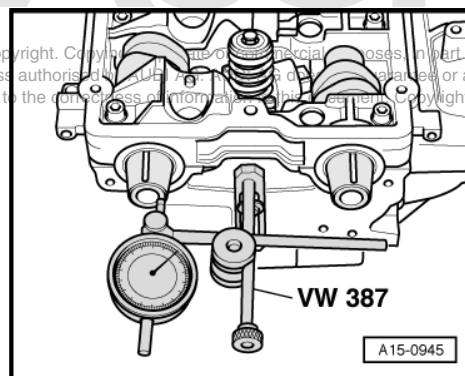


- ◆ Dial gauge - VAS 6079-



Test sequence

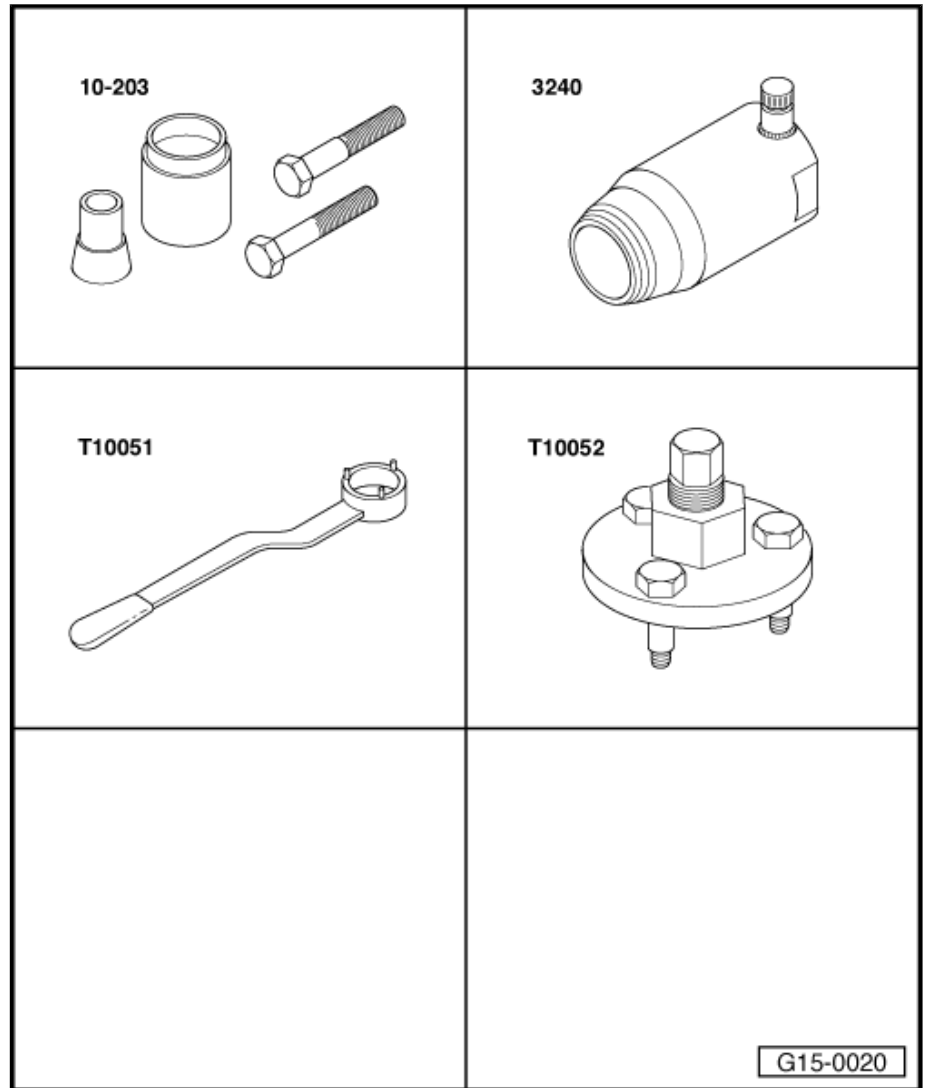
- Carry out procedure with roller rocker fingers removed and bearing frame installed.
- Wear limit: 0.15 mm.



3.2 Renewing camshaft oil seals

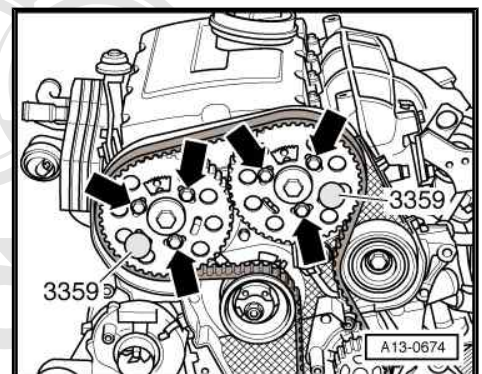
Special tools and workshop equipment required

- ◆ Fitting tool - 10 - 203-
- ◆ Oil seal extractor - 3240-
- ◆ Counterhold tool - T10051-
- ◆ Puller - T10052-
- ◆ Bolt M12x60



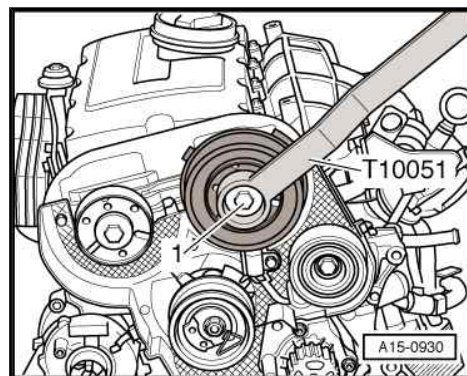
Procedure

- Move lock carrier to service position ⇒ [page 31](#) .
- Remove toothed belt ⇒ [page 48](#) .
- Remove locking pins - 3359- .
- Remove securing bolts -arrows- for camshaft sprockets.
- Remove the camshaft sprockets from hubs.

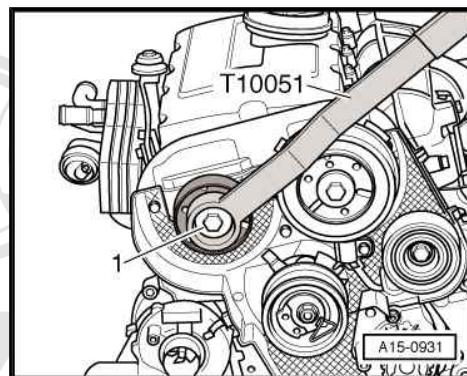


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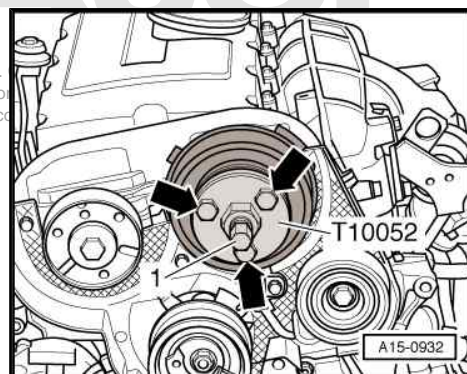
- Loosen securing bolt -1- for hub on inlet camshaft; use counterhold tool - T10051- .



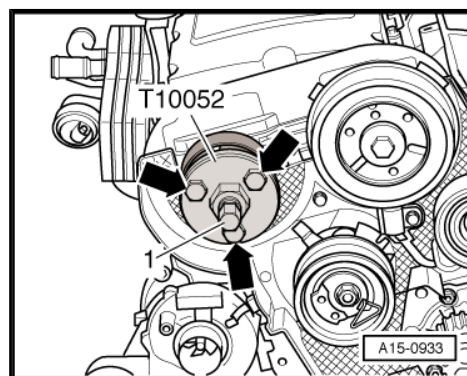
- Loosen securing bolt -1- for hub on exhaust camshaft; use counterhold tool - T10051- .
- Unscrew securing bolts of hubs approx. 2 turns.



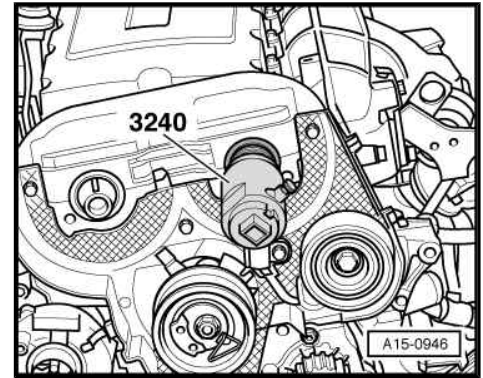
- Fit puller - T10052- on hub of inlet camshaft and screw bolts -arrows- into hub.
- Remove hub by screwing in bolt -1- while counterholding at hexagon flats (30 mm) of puller.



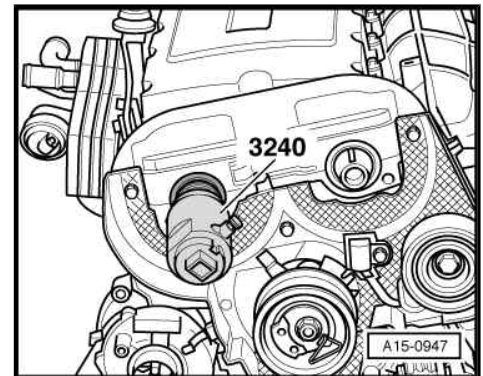
- Fit puller - T10052- on hub of exhaust camshaft and screw bolts -arrows- into hub.
- Remove hub by screwing in bolt -1- while counterholding at hexagon flats (30 mm) of puller.



- Adjust inner part of oil seal extractor - 3240- so it is level with the outer part and lock in position with knurled screw.
- Lubricate threaded head of oil seal extractor, place it in position and exerting firm pressure, screw it into oil seal of inlet camshaft as far as possible.
- Loosen knurled screw and turn inner section against camshaft until oil seal is pulled out.
- Clamp flats of oil seal extractor in vice. Remove oil seal with pliers.

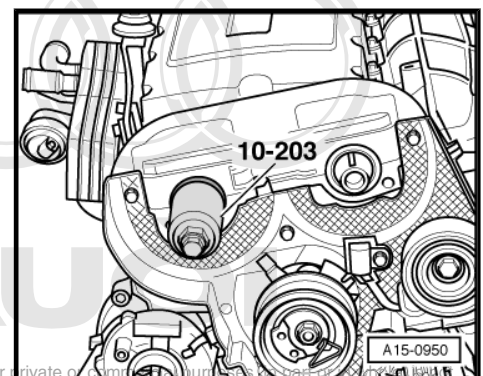
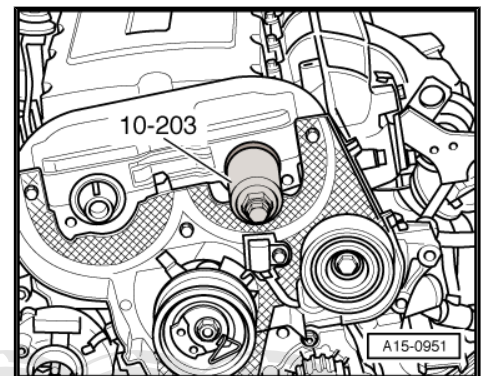


- Adjust inner part of oil seal extractor - 3240- so it is level with the outer part and lock in position with knurled screw.
- Lubricate threaded head of oil seal extractor, place it in position and exerting firm pressure, screw it into oil seal of exhaust camshaft as far as possible.
- Loosen knurled screw and turn inner section against camshaft until oil seal is pulled out.
- Clamp flats of oil seal extractor in vice. Remove oil seal with pliers.
- Clean running surface and sealing surface.
- Use a clean cloth to wipe off oil residue on camshaft journal.
- Tape off groove on taper of both camshafts with adhesive tape.

**Note**

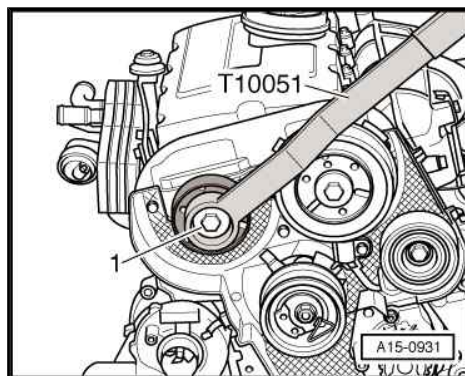
Do not additionally lubricate or grease sealing lips of oil seals.

- Carefully position oil seal on inlet camshaft.
- Press in oil seal with press piece of fitting tool - 10 - 203- and bolt M12×60 as far as the stop.
- Carefully position oil seal on exhaust camshaft.

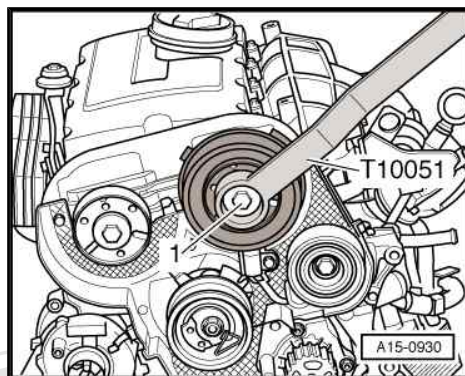


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- Attach hub to exhaust camshaft.
- Press in oil seal with press piece of fitting tool - 10 - 203- and bolt M12×60 as far as the stop.
- Tighten securing bolt -1- to 100 Nm (use counterhold tool - T10051-).



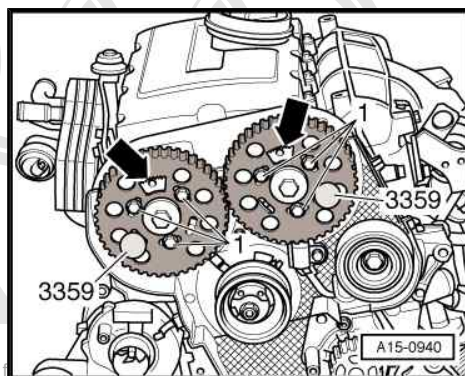
- Attach hub to inlet camshaft.
- Tighten securing bolt -1- to 100 Nm (use counterhold tool - T10051-).



- Push camshaft sprockets onto hubs.
- The toothed segments -arrows- in the camshaft sprockets must both face upwards.
- Screw in bolts -1- finger-tight.
- Lock hubs with locking pins - 3359- .

Remaining installation steps are carried out in reverse sequence; note the following:

- Install toothed belt (adjust valve timing) ⇒ [page 51](#) .
- Install vibration damper ⇒ [page 39](#) .
- Install poly V-belt ⇒ [page 35](#) .
- Install lock carrier with attachments ⇒ Rep. gr. 50 .

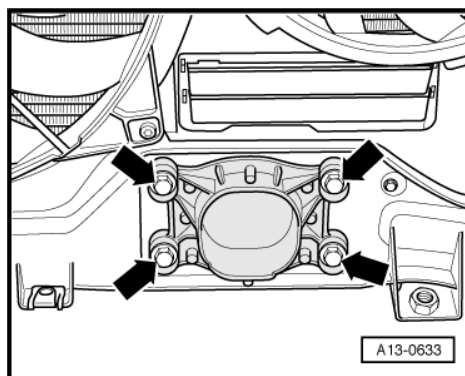


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- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten bolts -arrows-.
- Install headlights ⇒ Rep. gr. 94 .
- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Check headlight adjustment ⇒ Maintenance ; Booklet 405 .

Tightening torque

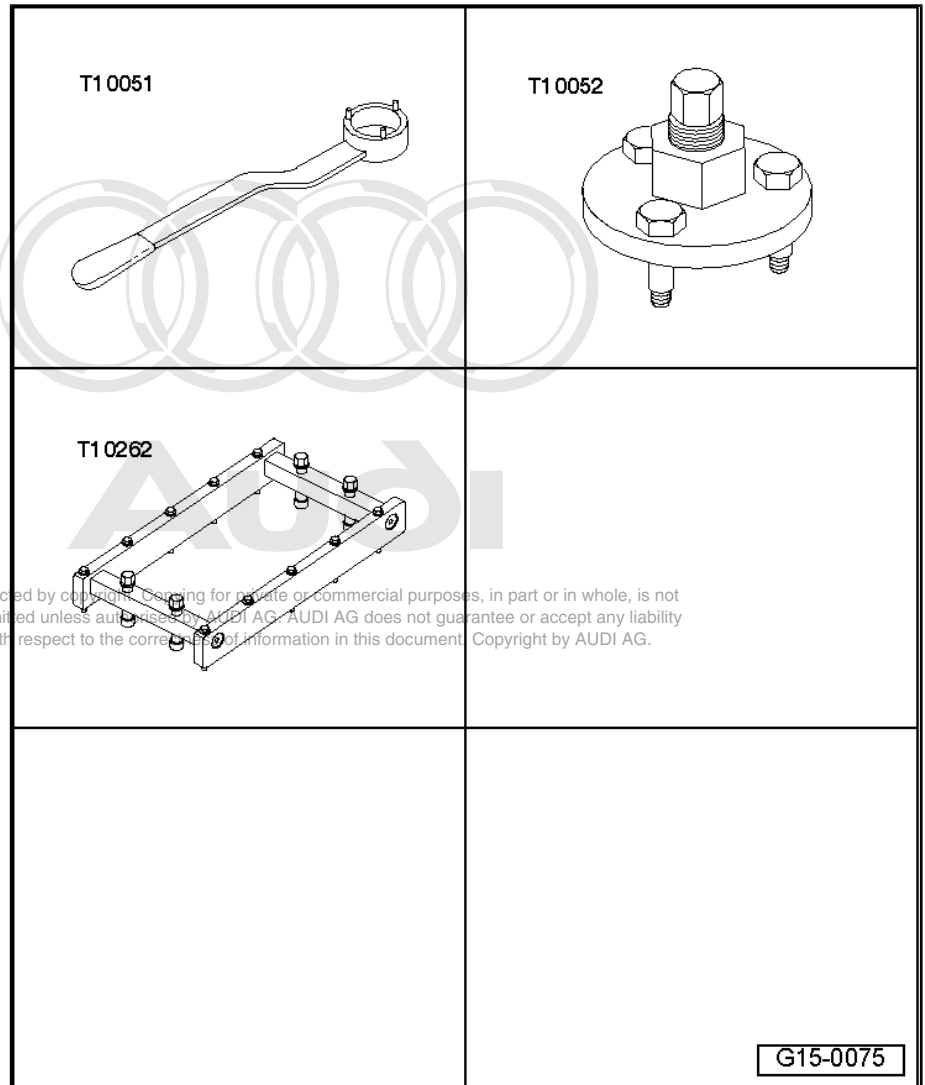
Component	Nm
Stop for torque reaction support to lock carrier	23



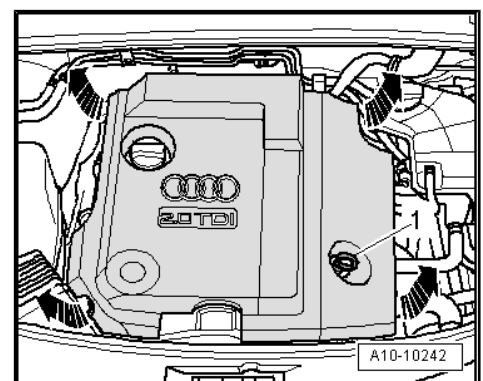
3.3 Removing and installing camshafts

Special tools and workshop equipment required

- ◆ Counterhold tool - T10051-
- ◆ Puller - T10052-
- ◆ Rack - T10262-
- ◆ Safety goggles
- ◆ Sealant ⇒ Parts catalogue

**Removing**

- Pull dipstick -1- out of guide tube.
- Pull off engine cover panel -arrows-.
- Re-insert dipstick in guide tube.

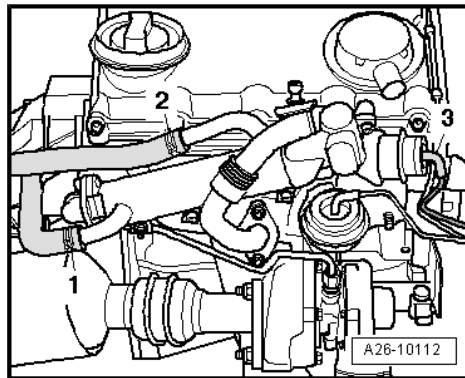


- Detach vacuum line -3-.

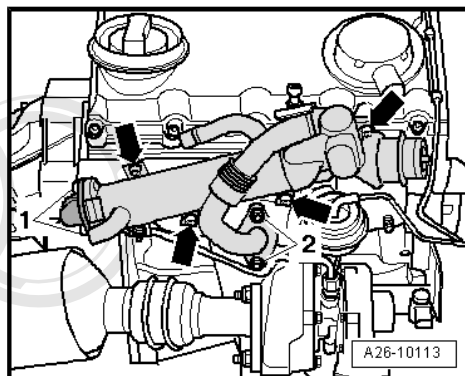


Note

Coolant hoses -1- and -2- remain connected.

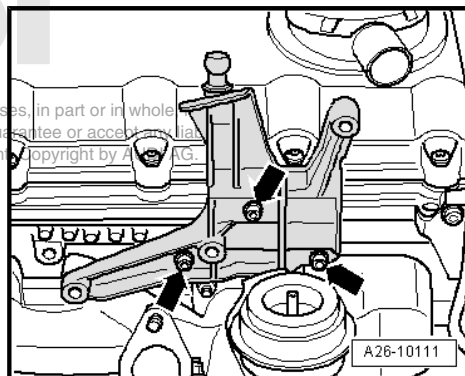


- Unscrew bolts -1- and nuts -2-.
- Remove bolts -arrows-.
- Remove exhaust gas recirculation cooler and lay it aside with coolant hoses connected.

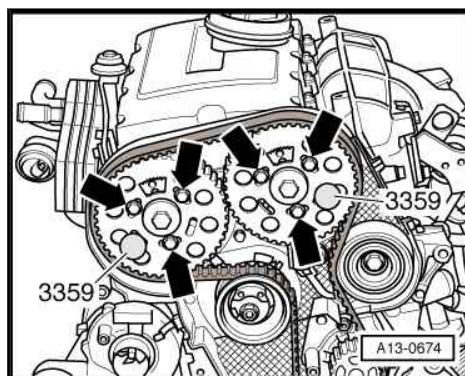


- Detach bracket for exhaust gas recirculation cooler from cylinder head -arrows-.
- Remove toothed belt ⇒ [page 48](#).

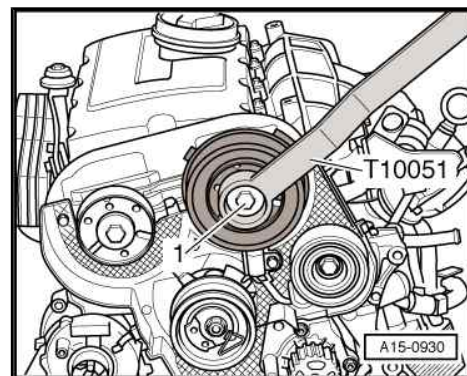
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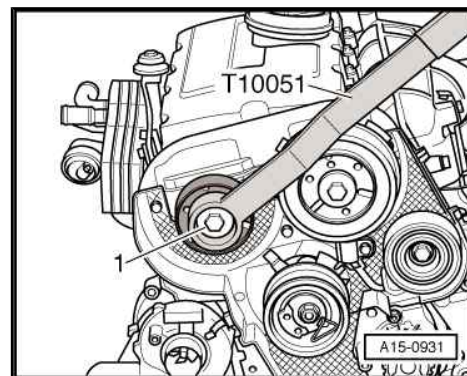
- Remove locking pins - 3359- .
- Remove securing bolts -arrows- for camshaft sprockets.
- Remove the camshaft sprockets from hubs.



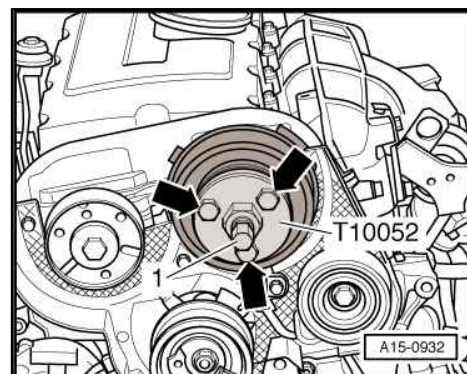
- Loosen securing bolt -1- for hub on inlet camshaft; use counterhold tool - T10051- .



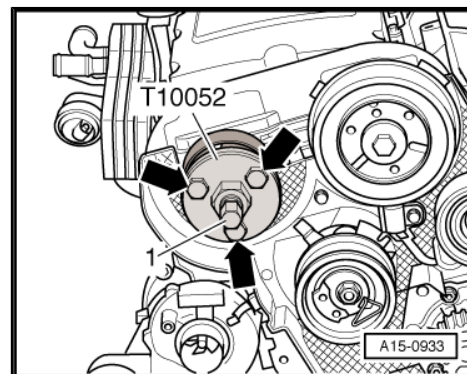
- Loosen securing bolt -1- for hub on exhaust camshaft; use counterhold tool - T10051- .
- Unscrew securing bolts of hubs approx. 2 turns.



- Fit puller - T10052- on hub of inlet camshaft and screw bolts -arrows- into hub.
- Remove hub by screwing in bolt -1- while counterholding at hexagon flats (30 mm) of puller.



- Fit puller - T10052- on hub of exhaust camshaft and screw bolts -arrows- into hub.
- Remove hub by screwing in bolt -1- while counterholding at hexagon flats (30 mm) of puller.

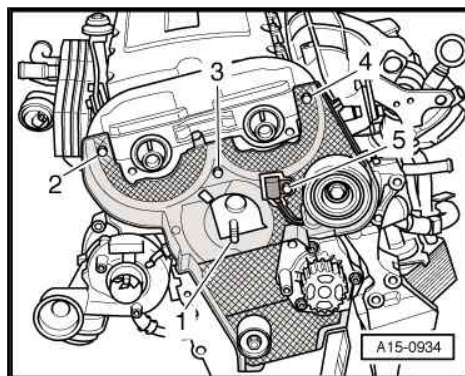


- Remove bolts -2- and -4-.

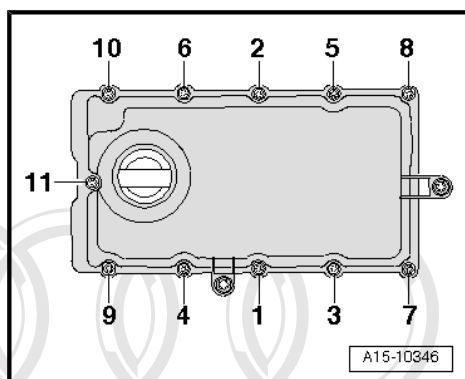


Note

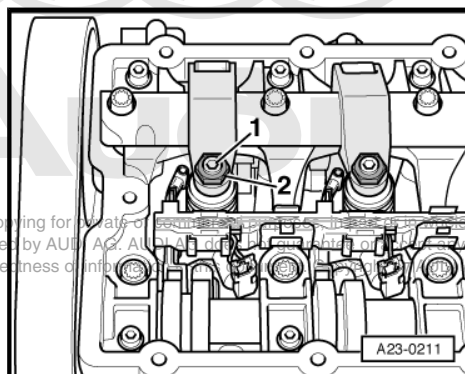
The bolts -1-, -3- and -5- remain tightened.



- Detach crankcase breather hose and vacuum hose from cylinder head cover -arrows-.
- Remove cylinder head cover bolts in the sequence -11 ... 1-.
- Remove cylinder head cover.



- Loosen the lock nuts -2- of the adjuster screws -1- on all unit injectors.
- Unscrew the adjuster screws until each rocker arm touches the tappet spring of the unit injector.



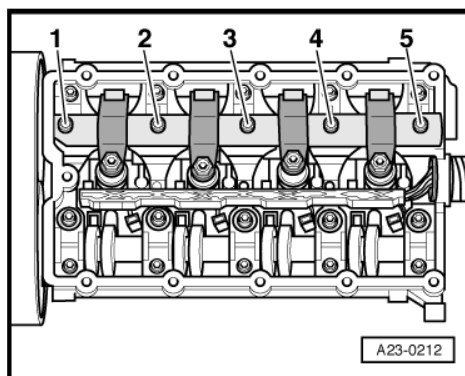
- Remove bolts -1-, -3- and -5-.
- Unscrew bolts -2- and -4- alternately in several stages.



Note

Do not pull bolts out of rocker arm shaft so that components remain attached to shaft. If necessary mark position on rocker arm.

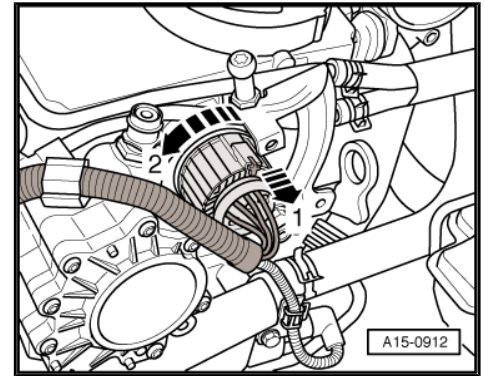
- Detach rocker arm shaft.
- Remove tandem pump ⇒ Rep. gr. 20 .



Note

The hoses can remain attached to the tandem pump.

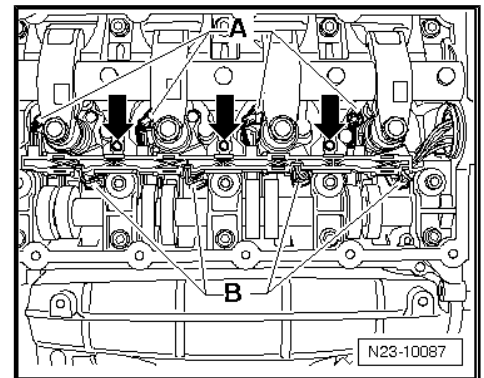
- Pull the release pin -arrow 1- and unscrew knurled nut -arrow 2-.
- Detach main connector for unit injectors and glow plugs.



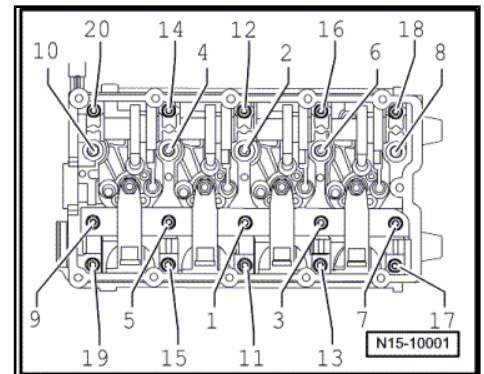
- Detach electrical connectors from glow plugs -A- and from unit injectors -B-.

**Caution**

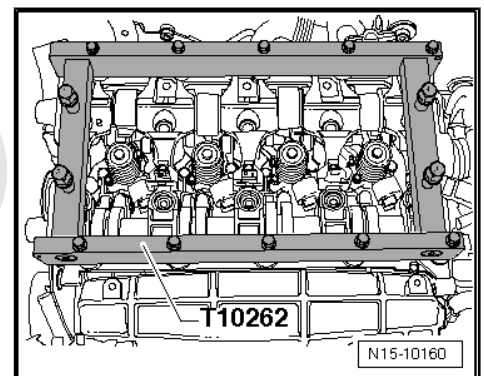
Only slacken or tighten the bolts at the retaining clips when removing the electrical wiring harness. If the electrical wiring harness is released at the retaining clips, the clips will become bent and this may lead to a break in the wiring because of the increased amount of play.



- Remove bolts -arrows- at retaining clips and move entire electrical wiring harness clear to one side.
- Unscrew remaining 15 bolts for bearing frame evenly, working from the outside inwards.



- Unscrew the 15 mm pressing-out bolts on the rack - T10262- anti-clockwise by hand as far as the stop.
- Position the rack - T10262- on the bearing frame as illustrated and tighten the 10 mm securing bolts to 10 Nm.
- Screw in the pressing-out bolts clockwise by hand until they make contact with the cylinder head bolts.
- Now tighten the pressing-out bolts evenly in the sequence 1 ... 4 (numbers are inscribed on the bolt heads) until the bearing frame detaches from the cylinder head.
- Remove the bearing frame.

**Note**

Mark allocation of camshaft bearing shells on rear with a water-proof felt-tip pen.

- Take out camshafts.

Installing



Note

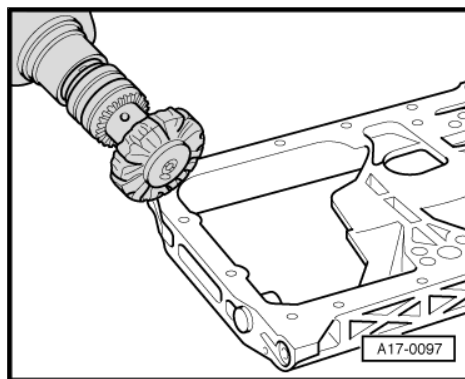
Renew the bolts tightened with specified tightening angle.

- Remove sealant residue from bearing frame and cylinder block with rotating plastic brush or similar.



WARNING

Wear safety goggles.

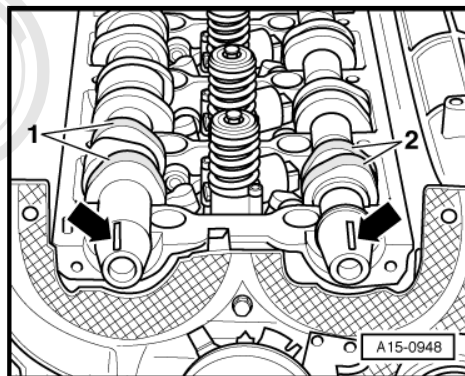


- Clean sealing surfaces; they must be free of oil and grease.
- Check whether the crankshaft is positioned at TDC.
- The crankshaft sprocket must be locked at cylinder 1 TDC using crankshaft stop - T10050- for engines with circular crankshaft sprocket, or crankshaft stop - T10100- for engines with oval crankshaft sprocket.

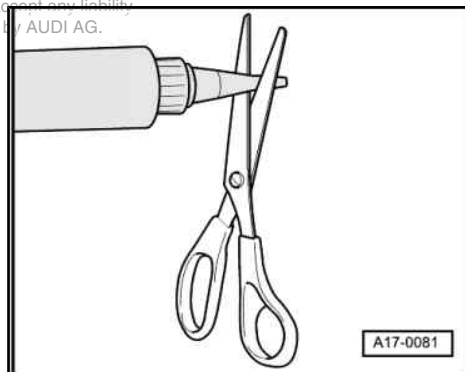


Note

- ◆ *Make sure that the camshaft bearing shells are not interchanged.*
- ◆ *When installing the camshaft, make sure that the retaining lugs on the bearing shells are correctly seated in the bearing caps and the cylinder head.*
- Lubricate running surfaces of camshafts.
- Install camshafts in TDC position for cylinder 1:
- On both camshafts, the cams -1- and -2- for cylinder 1 must face upwards.
- The grooves -arrows- also face upwards.



- Cut off tube nozzle at front marking (diameter of nozzle approx. 2 mm).

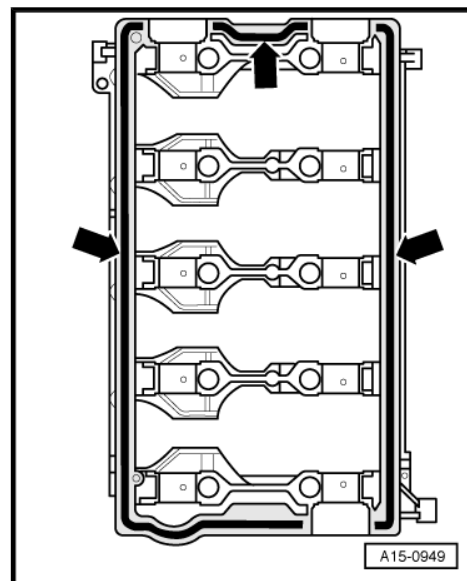


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- Apply sealant onto the clean sealing surfaces of the bearing frame -arrows-.
- Width of sealant bead: 2 mm.

**Note**

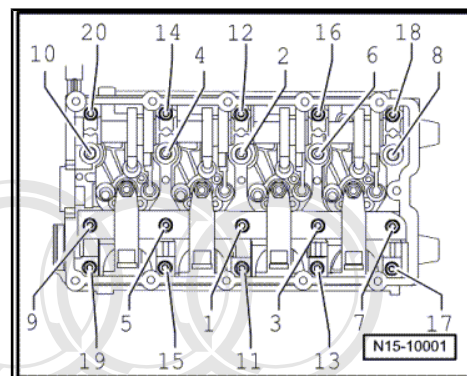
The bearing frame must be installed within 5 minutes after applying sealant.



- Tighten the bolts -1 ... 20- evenly from the inside outwards.
- Turn bolts -1-, -3-, -5-, -7- and -9- of rocker arm shaft 90° (1/4 turn) further.

Remaining installation steps are carried out in reverse sequence; note the following:

- Connect main connector for unit injectors and glow plugs.
- Adjust unit injectors ⇒ Rep. gr. 23 .
- Install tandem pump ⇒ Rep. gr. 20 .
- Install cylinder head cover ⇒ [page 95](#) .
- Install oil seals for camshafts ⇒ [page 115](#) .
- Install toothed belt (adjust valve timing) ⇒ [page 51](#) .
- Install vibration damper ⇒ [page 39](#) .
- Install poly V-belt ⇒ [page 35](#) .
- Install exhaust gas recirculation cooler ⇒ [page 249](#) .
- Install lock carrier with attachments ⇒ Rep. gr. 50 .



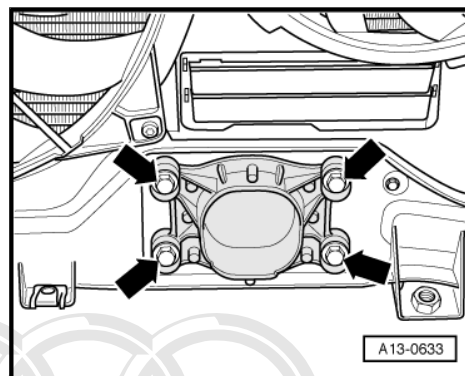
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- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten nuts -arrows-.
- Install headlights ⇒ Rep. gr. 94 .
- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Check headlight adjustment ⇒ Maintenance ; Booklet 405 .



Note

- ◆ After installing camshafts, wait for approx. 30 minutes before starting engine. The hydraulic tappets have to settle (otherwise valves will strike pistons).
- ◆ After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.



Tightening torques

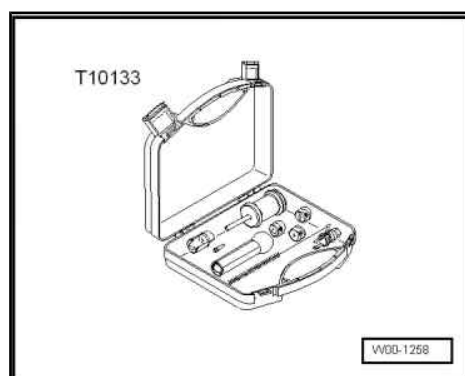
Component	Nm
Bearing frame to cylinder head	20
Rocker arm shaft to cylinder head	20 + 90° 1)2)
Bracket for exhaust gas recirculation cooler to cylinder head	10
Toothed belt cover (rear) to bearing frame	10 3)
Stop for torque reaction support to lock carrier	23

- 1) Renew bolts.
- 2) 90° = one quarter turn.
- 3) Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue .

3.4 Removing and installing roller rocker fingers

Special tools and workshop equipment required

- ◆ Puller - T10133-



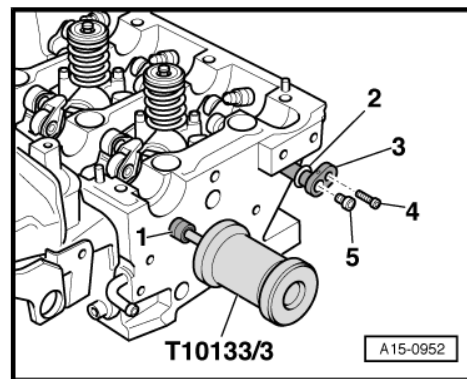
Removing

- Cylinder head removed.
- Camshafts removed.

- To aid assembly, mark the allocation of the roller rocker fingers and the shafts for the fingers.
- Pull shaft for roller rocker fingers -1- (inlet side) out of cylinder head using puller - T10133/3- .
- Remove roller rocker fingers.
- Remove bolts -4- and -5-.
- Pull shaft -3- for roller rocker fingers (exhaust side) out of cylinder head.

Installing

Installation is carried out in the reverse order; note the following:



Note

Fit new O-rings -2-.

- Lubricate the bearings of the roller rocker fingers before installing.

Tightening torques

Component	Nm
Shaft for roller rocker fingers to cylinder head	10
Screw plug for shaft (for roller rocker fingers) to cylinder head	10 ¹⁾
• ¹⁾ Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue .	

3.5 Renewing valve stem oil seals



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Special tools and workshop equipment required

- ◆ Valve stem seal puller - 3364-
- ◆ Valve stem seal fitting tool - 3365-
- ◆ Removal and installation device for valve cotter - VAS 5161-
- ◆ Guide plate for 2.0 ltr. TDI engine - VAS 5161/21-
- ◆ Socket - T50001- (use only if cylinder head is removed)

3364	3365
VAS 5161	VAS 5161/21
T 50001	G15-0074

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Procedure

- Remove camshafts ⇒ [page 116](#) .
- Remove unit injectors ⇒ Rep. gr. 23 .

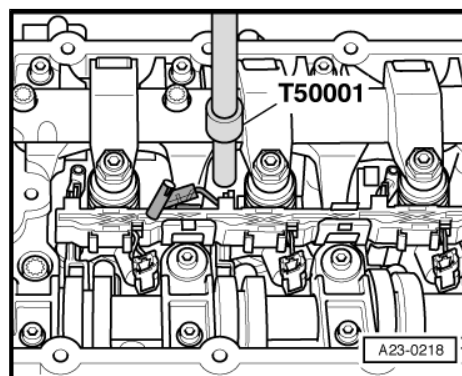
Cylinder head removed:



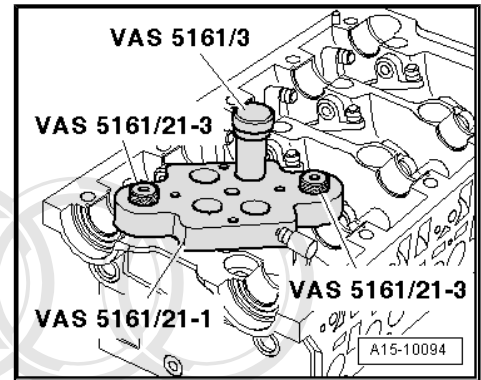
Caution

Due to the special properties of the material used, ceramic glow plugs (fitted on vehicles with diesel particulate filter) are easily damaged and require extra care when handling and removing/installing ⇒ Rep. gr. 28 .

- Remove glow plugs using socket - T50001- .

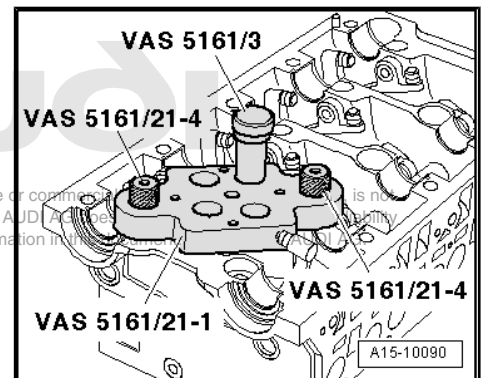


- Lay cylinder head aside onto workbench, on a soft surface.
- Fit guide plate - VAS 5161/21-1- onto cylinder head.
- Secure guide plate using the knurled screws - VAS 5161/21-3- .
- Insert drift - VAS 5161/3- into guide plate and knock valve cotters loose using a plastic hammer.



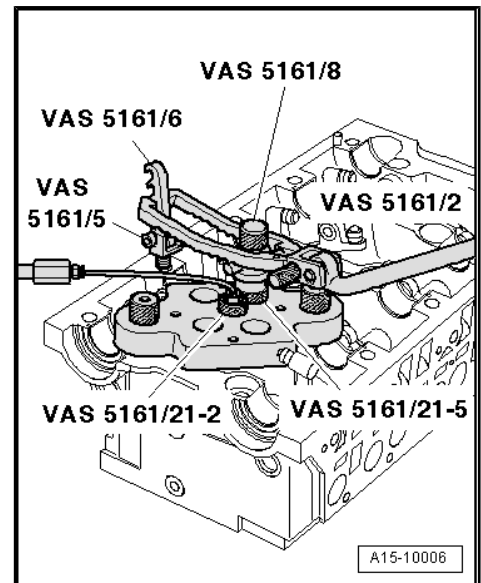
Cylinder head installed:

- Set piston of the respective cylinder to "bottom dead centre".
- Fit guide plate - VAS 5161/21-1- onto cylinder head.
- Secure guide plate using the knurled screws - VAS 5161/21-4- .
- Insert drift - VAS 5161/3- into guide plate and knock valve cotters loose using a plastic hammer.
- Screw adapter - VAS 5161/21-2- finger-tight into guide plate.

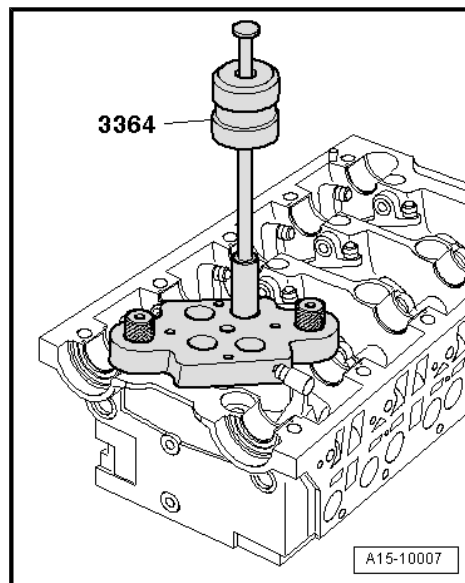


Continued (same procedure if cylinder head remains installed or if it is removed):

- Secure snap-in device - VAS 5161/6- with engaging forks - VAS 5161/5- to cylinder head.
- Slide knurled spacer ring - VAS 5161/21-5- onto assembly cartridge - VAS 5161/8- .
- Insert assembly cartridge into guide plate.
- With cylinder head installed, connect the adapter - VAS 5161/21-2- to compressed air line using a commercially available connection piece, and apply constant air pressure.
 - Minimum pressure: 6 bar
- Attach pressure fork - VAS 5161/2- to snap-in device and push assembly cartridge down.
- At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.
- Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the assembly cartridge.
- Release pressure fork.
- Take out assembly cartridge with knurled spacer ring, valve spring plate and valve spring.



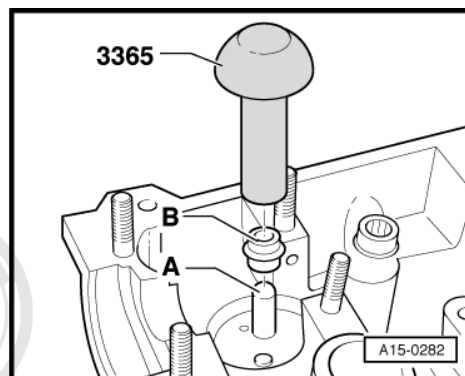
- Remove valve stem oil seals using the valve stem seal puller - 3364- .



Note

A plastic sleeve -A- is included with the new valve stem oil seals.

- Fit plastic sleeve -A- onto the valve stem to prevent damage to the new valve stem oil seal -B-.
- Lightly lubricate sealing lip of valve stem oil seal.
- Slip valve stem oil seal over plastic sleeve.
- Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool - 3365- .
- Remove plastic sleeve.
- If valve cotter pins have been removed from assembly cartridge - VAS 5161/8- , they need to be put into valve insertion device - VAS 5161/18- first.

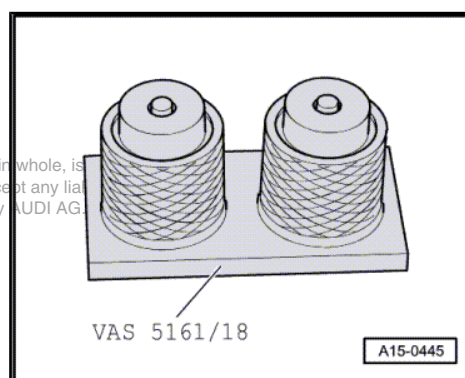


Note

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Larger diameter of valve cotter pins faces upwards.

- Press assembly cartridge onto insertion device from above and take up valve cotter pins.



- Insert assembly cartridge into guide plate.
- Press down pressure fork and pull up knurled screw, thus inserting the valve cotters.
- Release pressure fork with knurled screw still in pulled position.

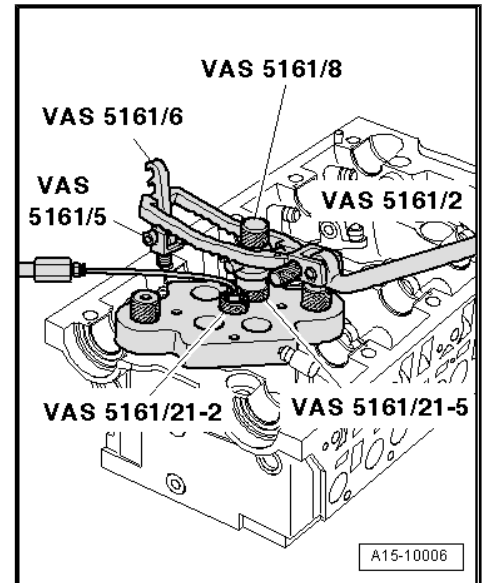
Installation is carried out in the reverse order; note the following:

- Install unit injectors ⇒ Rep. gr. 23 .
- Install camshafts ⇒ [page 116](#) .
- Install glow plugs ⇒ Rep. gr. 28 .



Note

- ♦ *Engine is not to be rotated for approx. 30 minutes after installing camshafts. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).*
- ♦ *After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.*



3.6 Checking hydraulic tappets

Special tools and workshop equipment required

- ♦ Feeler gauge



Note

- ♦ *The hydraulic tappets that are pressed into the roller rocker fingers cannot be serviced.*
- ♦ *Irregular valve noises when starting engine are normal.*

Test sequence

- Start engine and let it run until the radiator fan has switched on once.
- Increase engine speed to approx. 2500 rpm for 2 minutes (perform road test if necessary).



Note

If the irregular valve noise stops but repeatedly re-occurs when driving short distances, then the oil retention valve is defective. Fitting location: in oil filter bracket ⇒ [Item 7 \(page 172\)](#) . The oil retention valve cannot be renewed separately.

If the hydraulic tappets are still noisy, locate defective tappet as follows:

- Remove cylinder head cover ⇒ [page 95](#) .
- Rotate crankshaft until cam of hydraulic tappet to be checked faces upwards. Procedure on
- ♦ Vehicles with manual gearbox: push vehicle forwards with 4th gear engaged and ignition switched off.
- ♦ Vehicles with multitronic gearbox: remove noise insulation, lever off cover cap from vibration damper and rotate crank-

shaft in clockwise direction via central bolt for vibration damper.

- Determine clearance between cam and roller rocker finger.
- Press roller rocker finger down -arrow- using a screwdriver.

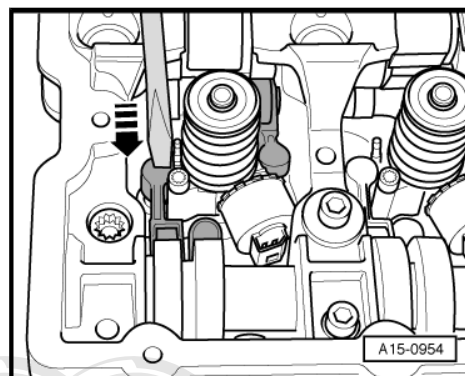
If it is possible to insert a feeler gauge of 0.20 mm between camshaft and roller rocker finger:

- Renew hydraulic tappet; to do so, remove roller rocker finger
⇒ [“3.3 Removing and installing camshafts”, page 116](#).



Note

- ◆ After installing camshafts, wait for approx. 30 minutes before starting engine. The hydraulic tappets have to settle (otherwise valves will strike pistons).
- ◆ After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.



3.7 Valve dimensions

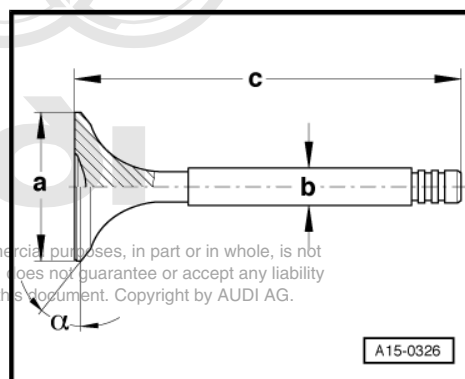
Dimension		Inlet valve	Exhaust valve
Ø a	mm	29.40	25.50
Ø b	mm	5.980	5.965
c	mm	88.50	88.20
α	°	45	45

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Note

Valves must not be machined. Only grinding is permitted.



3.8 Machining valve seats



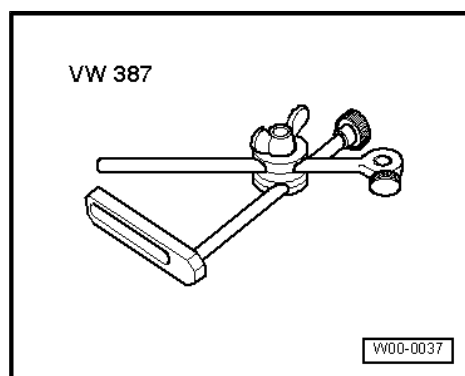
Note

Valve seats may not be machined due to the very small tolerances.

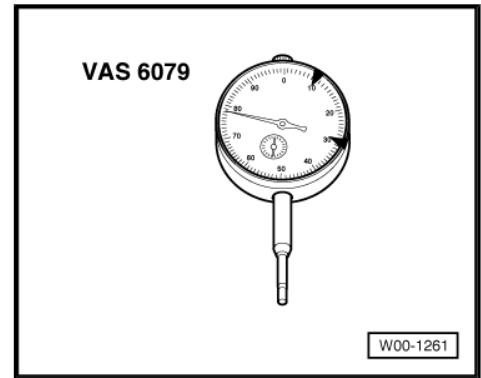
3.9 Checking valve guides

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-



◆ Dial gauge - VAS 6079-



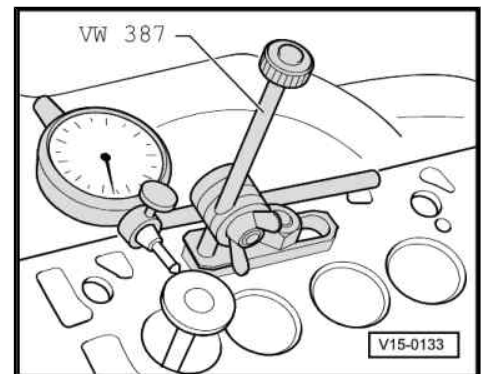
Test sequence

- Insert valve into valve guide.
- End of valve stem must be flush with guide.
- Determine amount of sideways play.
- Wear limit (sideways play): 0.8 mm.



Note

- ◆ *If the wear limit is exceeded, repeat the measurement with new valves. Renew cylinder head if wear limit is still exceeded. Valve guides cannot be renewed.*
- ◆ *If the valve has to be renewed as part of a repair, use a new valve for the measurement.*



3.10 Checking valves

- Visually inspect for scoring on valve stem and on seating surface.
- Renew valves with significant score marks.

17 – Lubrication

1 Servicing sump, oil pump and balance shaft assembly with chain drive



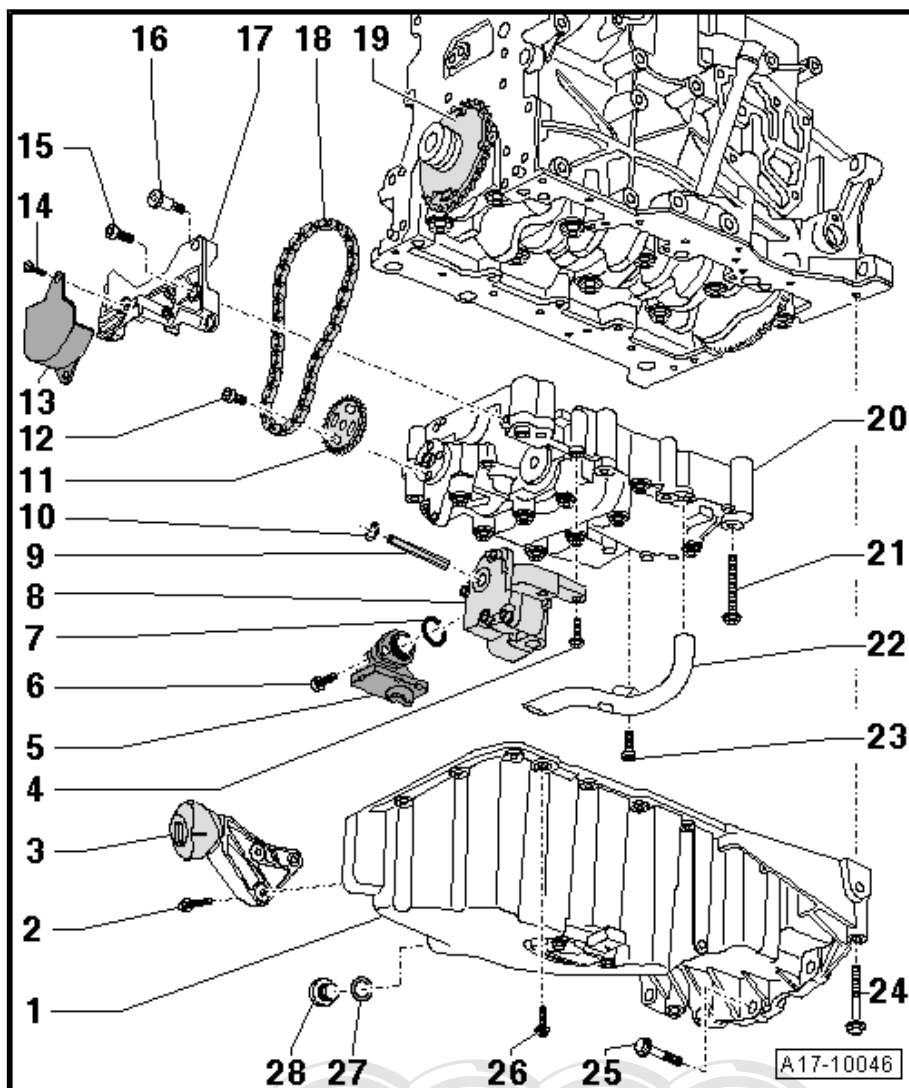
Note

- ◆ *If large quantities of metal particles are found in the engine oil when repairing the engine, the oil passages must be cleaned carefully, and the oil cooler renewed in order to prevent further damage.*
- ◆ *The oil level must not be above max. mark on dipstick – danger of damage to catalytic converter.*
- ◆ *Oil spray jet and pressure relief valve → [page 134](#)*
- ◆ *Removing and installing oil level and oil temperature sender - G266- → [page 134](#) .*
- ◆ *Refer to → Maintenance tables for engine oil capacity, viscosity grades and oil specifications.*

1.1 Sump, oil pump, balance shaft assembly with chain drive - exploded view

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- ❏ Removing and installing ⇒ page 142



20 - Balance shaft assembly

- ☐ Removing and installing ⇒ [page 142](#)
- ☐ Before installing, check that the two dowel sleeves for centring balance shaft assembly are fitted onto cylinder block.

21 - M7 = 13 Nm + 90° (1/4 turn) further; M8 = 20 Nm + 90° (1/4 turn) further

- ☐ Renew
- ☐ Observe correct tightening sequence ⇒ [page 148](#)

22 - Oil intake pipe

23 - 10 Nm

24 - 40 Nm

- ☐ Observe correct tightening sequence ⇒ [page 135](#)

25 - 45 Nm

- ☐ Observe correct tightening sequence ⇒ [page 135](#)

26 - 15 Nm

- ☐ Tighten in stages and in diagonal sequence
- ☐ Observe correct tightening sequence ⇒ [page 142](#)

27 - Seal

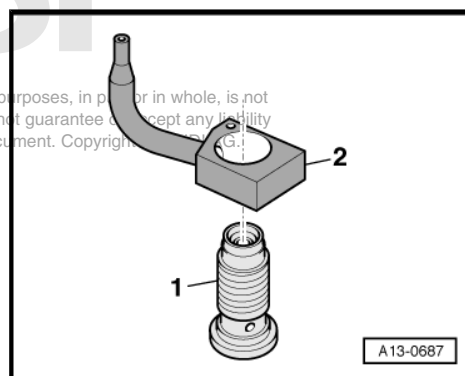
- ☐ Renew

28 - Oil drain plug, 30 Nm

Oil spray jet and pressure relief valve

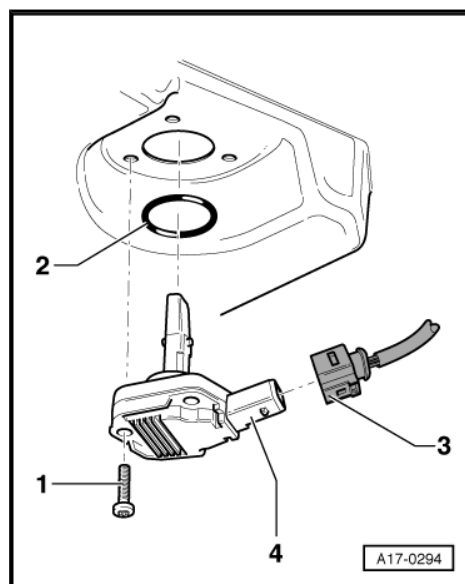
- 1 - Bolt with pressure relief valve, 27 Nm
- 2 - Oil spray jet (for cooling of pistons)

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Removing and installing oil level and oil temperature sender - G266-

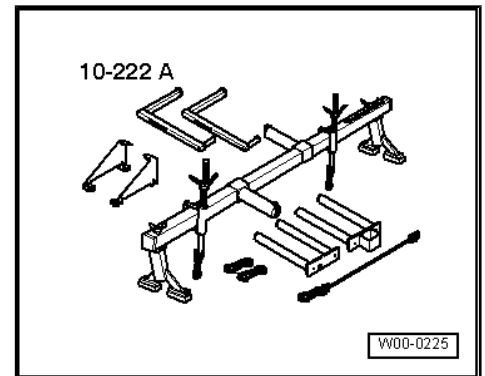
- 1 - Bolt, 10 Nm (self-locking); renew
- 2 - Seal; renew
- 3 - Electrical connector
- 4 - Oil level and oil temperature sender - G266-



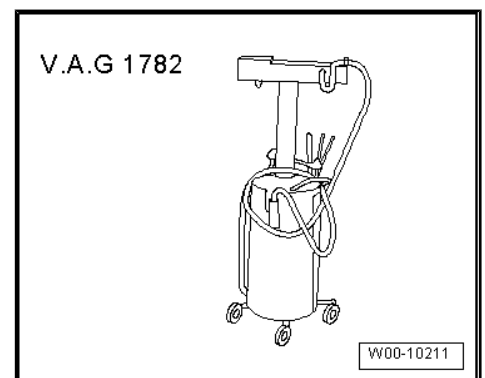
1.2 Removing and installing sump

Special tools and workshop equipment required

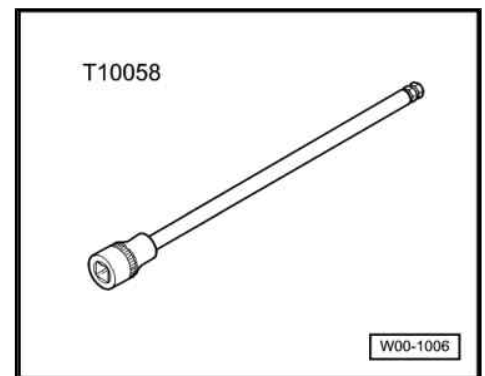
- ◆ Support bracket - 10 - 222 A-



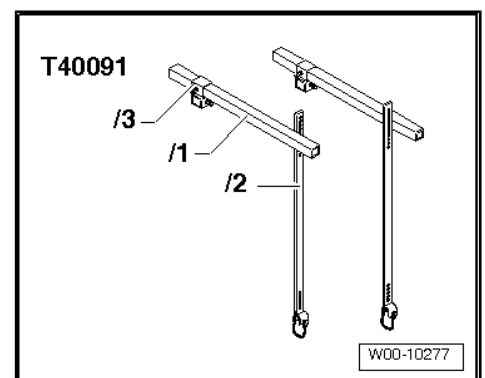
- ◆ Used oil collection and extraction unit - V.A.G 1782-



- ◆ Allen key, long reach - T10058-

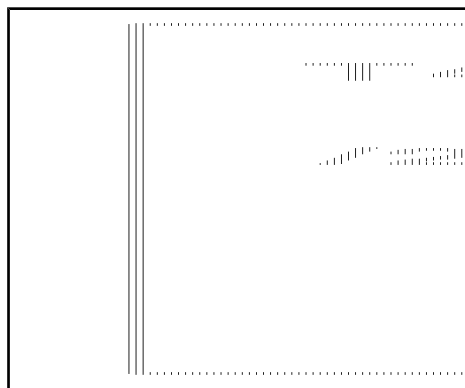


- ◆ Engine support bracket (basic set) - T40091-



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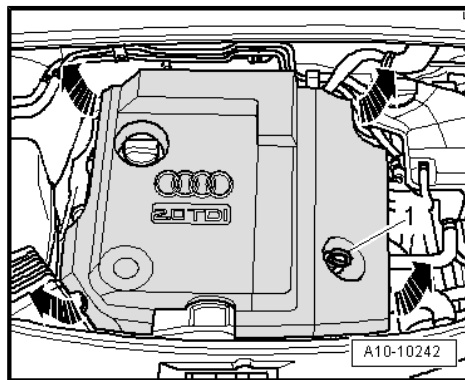
◆ Engine support bracket (supplementary set) - T40093-



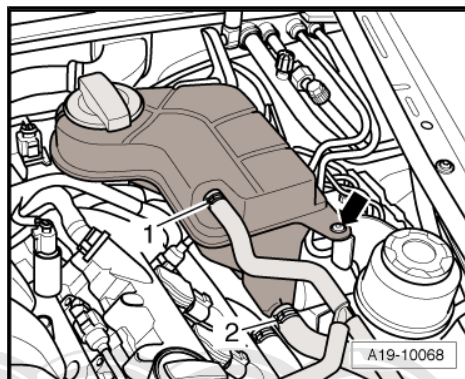
- ◆ Electric drill with plastic brush attachment
- ◆ Safety goggles
- ◆ Sealant ⇒ Parts catalogue

Removing

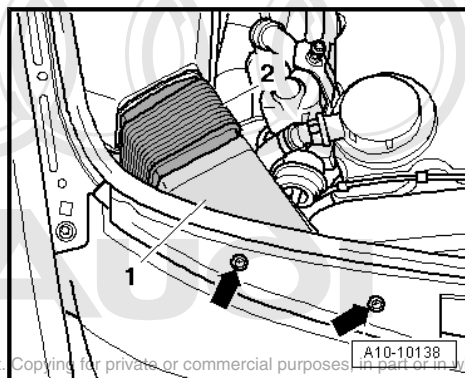
- Pull dipstick -1- out of guide tube.
- Pull off engine cover panel -arrows-.
- Re-insert dipstick in guide tube.



- Unbolt coolant expansion tank -arrow-.
- Unplug electrical connector for coolant shortage indicator switch - F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -2- attached.

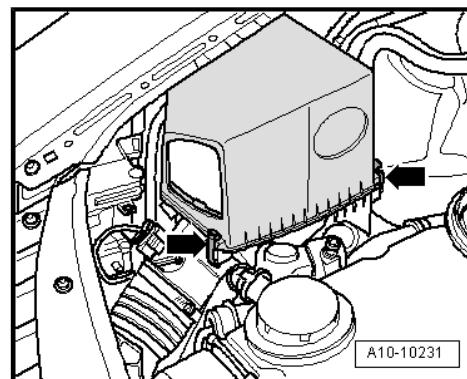


- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.

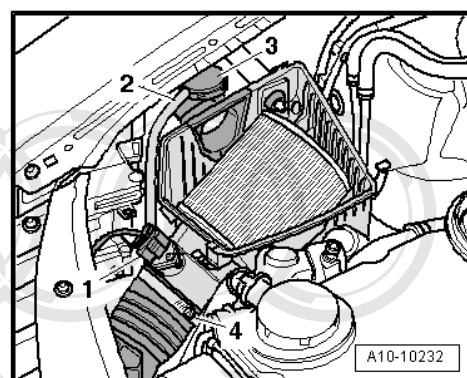


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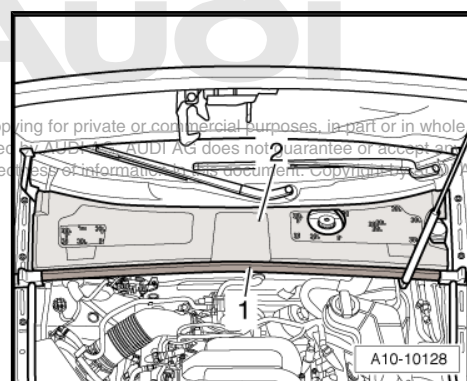
- Release two retaining clips -arrows- and detach top section of air cleaner housing.



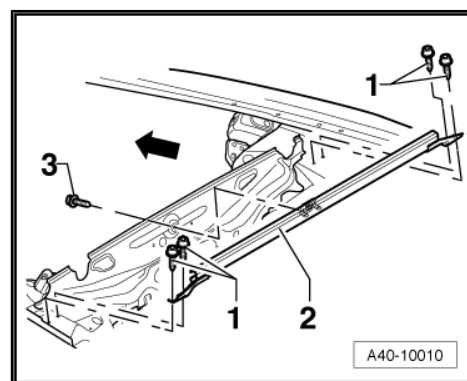
- Unplug electrical connector -1- at air mass meter - G70- .
- Loosen hose clip -4- to remove air intake hose.
- Detach vacuum hose -2-.
- Lift off vacuum unit -3- with air flap from air cleaner housing.
- Disengage bottom section of air cleaner housing from retaining pin and remove.



- Pull off rubber seal -1- on plenum chamber cover.
- Detach plenum chamber cover -2-.

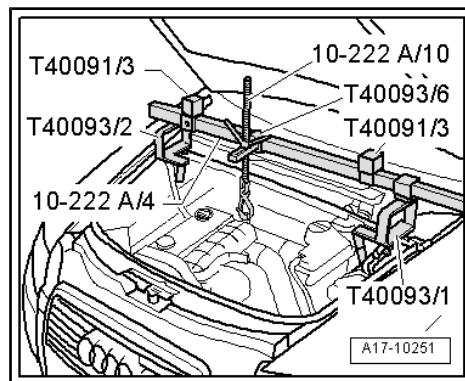


- If fitted, unscrew bolts -1- and -3- and remove body brace -2-.

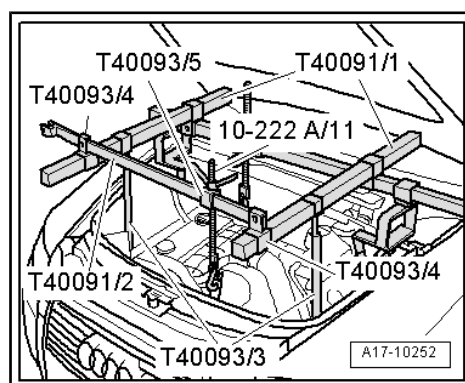


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- Attach adapter - 10 - 222 A /4- with connecting pieces - T40091/3- , adapter -T40093/6- , hook - 10 - 222 A /10- and brackets -T40093/1- and -T40093/2- to suspension turrets.
- The brackets are marked for left and right-side of vehicle.
- Attach hook - 10 - 222 A /10- to engine lifting eye (rear).



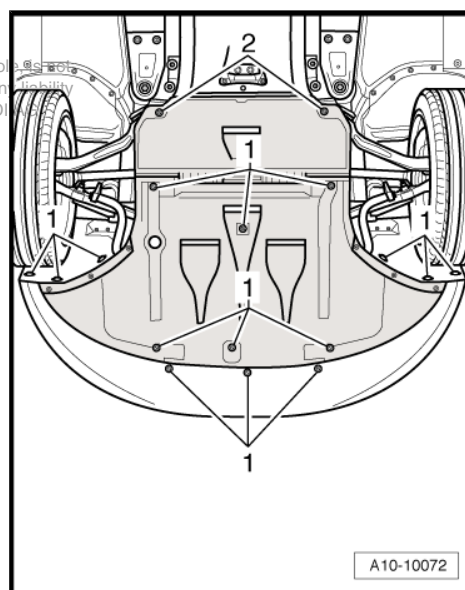
- Set up further components of support bracket as shown in illustration. Position supports -T40093/3- onto flanges of longitudinal members.
- Push support -T40091/2- with sliding support -T40093/5- and the two connecting pieces -T40093/4- onto square-section pipes -T40091/1- .
- Attach spindle - 10 - 222 A /11- to engine lifting eye (front).


WARNING

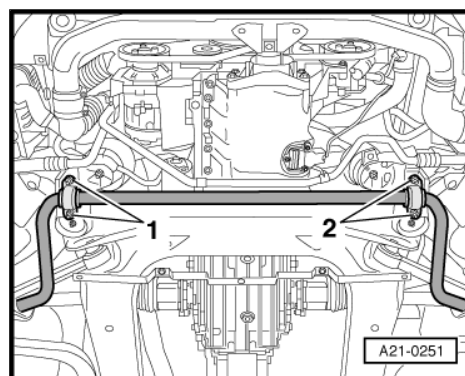
Secure support -T40091/2- with pins and split pins of connecting pieces -T40093/4- .

- Release quick-release fasteners -1- and -2- and take off noise insulation panels.

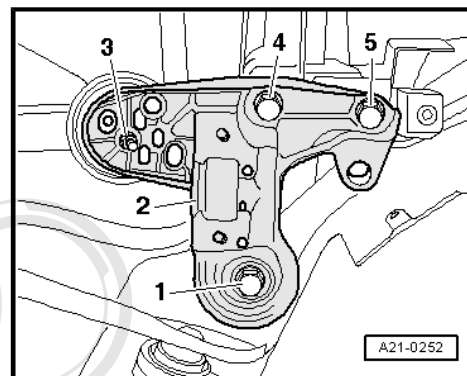
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- Unbolt anti-roll bar mountings -1- and -2-.



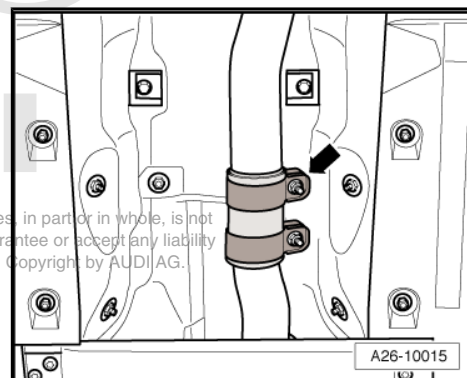
- Unscrew nut -3- at bottom of engine mounting.
- Unscrew bolts -4- and -5- on console for engine mounting.
- Unscrew bolt -1- (front) for subframe and remove console for engine mounting -2-.
- Repeat procedure on other side of vehicle.
- Lift engine.

**Note**

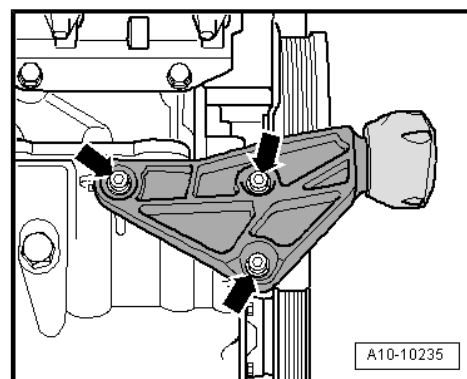
Do not bend the flexible joint (de-coupling element) in the exhaust system more than 10°, otherwise it could be damaged.

- Disconnect exhaust system at clamp -arrow- and push clamp back.

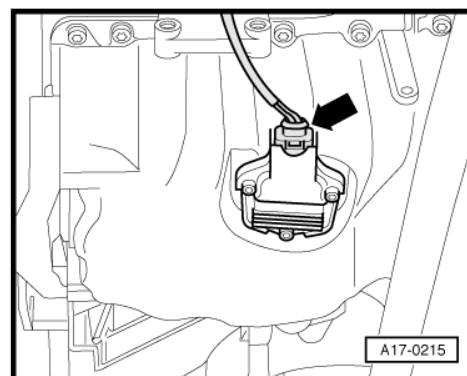
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- Unscrew bolts -arrows- and remove torque reaction support from engine.
- Lift the engine evenly a short distance with both spindles.
- Place used oil collection and extraction unit - V.A.G 1782- under engine and drain engine oil.



- Unplug electrical connector at oil level and oil temperature sender - G266- -arrow-.



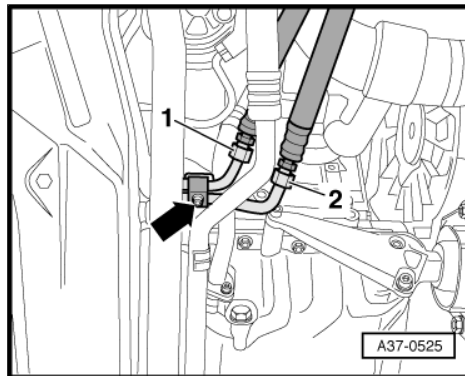
Vehicles with multitronic gearbox:

- Unbolt bracket -arrow- for ATF lines at sump.



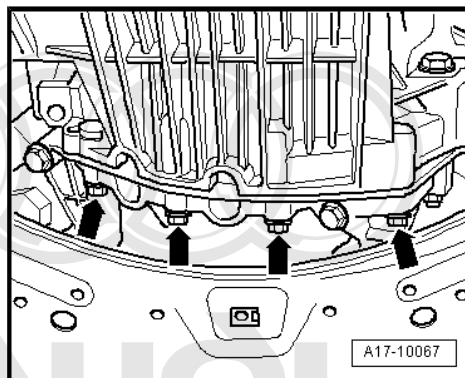
Note

Disregard items -1- and -2-.



All vehicles:

- Unscrew gearbox/sump bolts -arrows-.



- Unscrew M10 bolts -arrows-.
- Slacken bolts -1 ... 18- in diagonal sequence.



Note

- ◆ Bolts -17- and -18- can only be unscrewed using Allen key (long reach) - T10058-.
- ◆ When unscrewing bolts -17- and -18- they come into contact with flywheel. However, this does not damage bolts and tapped holes.
- Take off sump; if necessary loosen it by striking lightly with a rubber hammer.

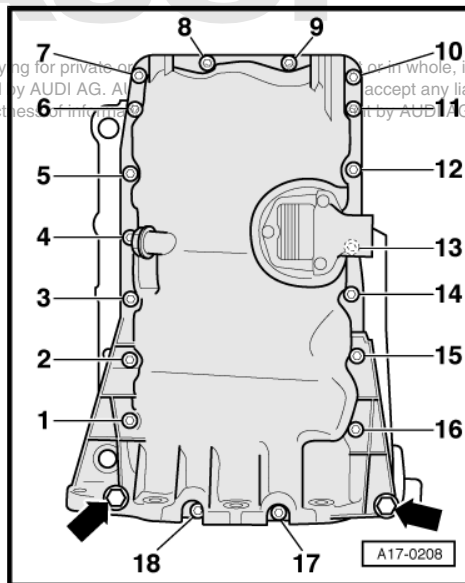
Installing

Installation is carried out in the reverse order; note the following:



Note

Renew seal.



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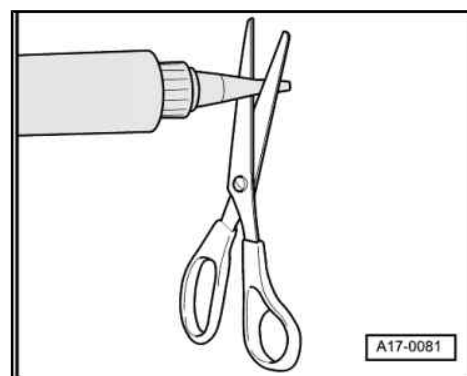
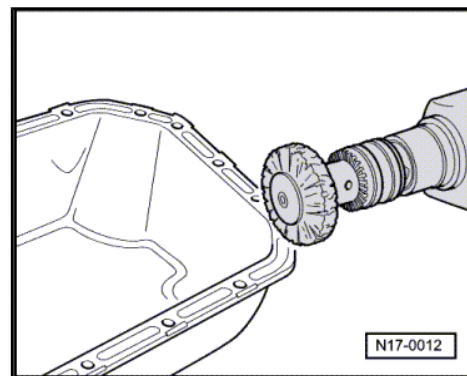
- Remove sealant residue from sump and cylinder block with rotating plastic brush or similar.

**WARNING**

Wear safety goggles.

- Clean sealing surfaces; they must be free of oil and grease.
- Cut off tube nozzle at front marking (diameter of nozzle approx. 2 mm).

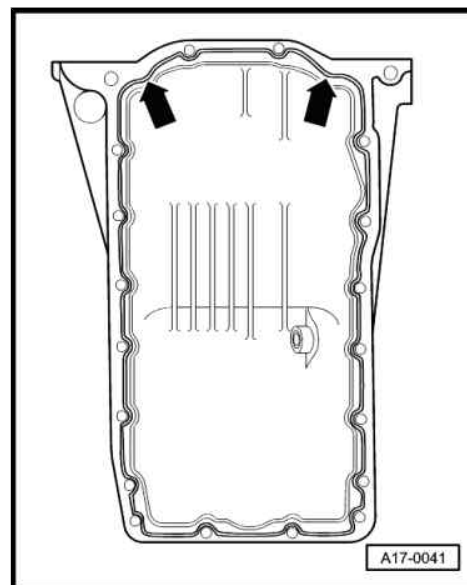
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- Apply bead of sealant onto the clean sealing surface of the sump as shown in the illustration.
- Thickness of sealant bead: 2 ... 3 mm

**Note**

- ◆ *Sealant bead must not be wider than 3 mm, otherwise excess sealant could ingress into sump and clog strainer in oil intake pipe.*
- ◆ *Take particular care when applying sealant bead in area of rear sealing flange -arrows-.*
- ◆ *The sump must be installed within 5 minutes after applying sealant.*



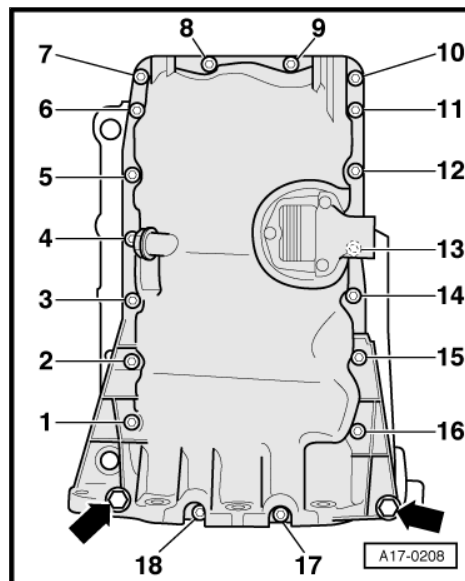
– Immediately install sump and tighten bolts in the sequence indicated:

1. Pre-tighten bolts -1 ... 18- to 5 Nm in diagonal sequence.
2. Tighten bolts securing sump to gearbox to 45 Nm.
3. Tighten bolts M10 -arrows- to 40 Nm.
4. Tighten bolts -1 ... 18- to 15 Nm in diagonal sequence.



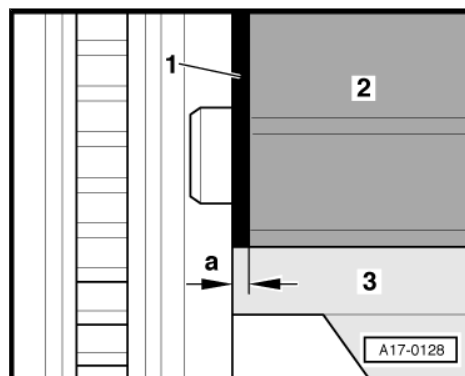
Note

- ◆ Bolts -17- and -18- can only be screwed in using Allen key (long reach) - T10058- .
- ◆ When screwing in bolts -17- and -18- they come into contact with flywheel. However, this does not damage bolts and tapped holes.



Note

- ◆ When installing the sump -3- with the engine removed from the vehicle, make sure that it is positioned flush with the intermediate plate -1- at the flywheel end. In other words, the sump should protrude by 0.8 mm (distance -a-) from cylinder block -2-.
- ◆ After fitting sump assembly, the sealant must dry for approx. 30 minutes. Then (and only then) fill the engine with engine oil.



- Install subframe ⇒ Rep. gr. 40 .
- Install anti-roll bar ⇒ Rep. gr. 40 .
- Align exhaust system so it is free of stress: vehicles without particulate filter ⇒ [page 221](#) , vehicles with particulate filter ⇒ [page 235](#) .
- Fill up with engine oil and check oil level ⇒ [page 178](#) .

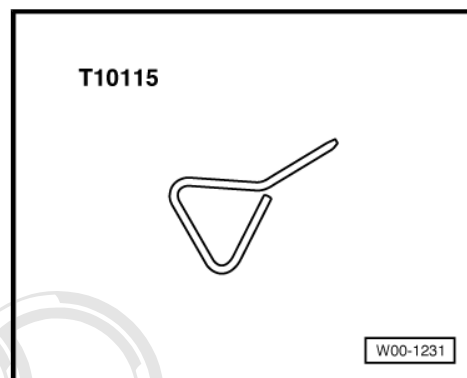
Tightening torques

Component		Nm
Sump to:	M7	15
Cylinder block	M10	40
Sump to gearbox		45
Engine mounting to console for engine mounting		40
Console for engine mounting to longitudinal member		75
Torque reaction support to lock carrier		23
Oil drain plug		30

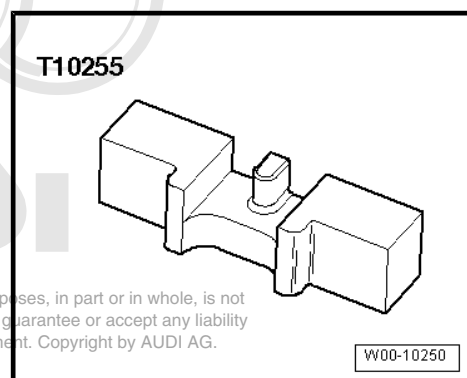
1.3 Removing and installing balance shaft assembly

Special tools and workshop equipment required

◆ Locking pin - T10115-



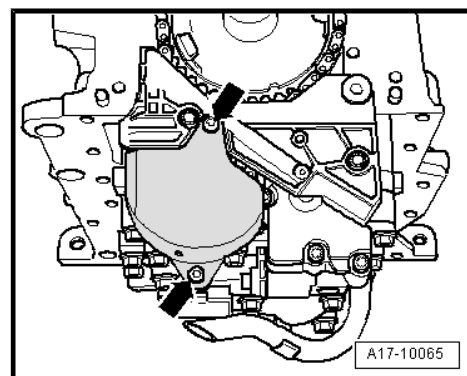
◆ Locking tool - T10255-



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Removing

- Remove sump ⇒ [page 135](#) .
- Rotate crankshaft to TDC ⇒ [page 55](#) and lock crankshaft using crankshaft stop - T10050- for engines with circular crankshaft sprocket, or crankshaft stop - T10100- for engines with oval crankshaft sprocket.
- Unscrew bolts -arrows- and detach chain sprocket cover.



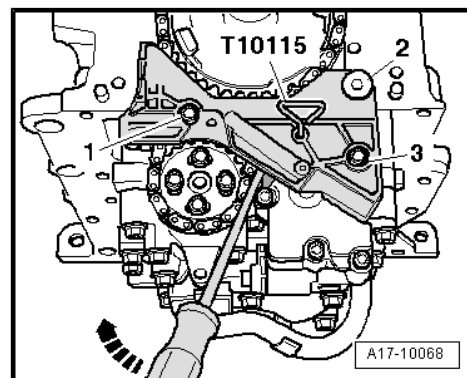
- Press guide rail for chain tensioner in -direction of arrow- using a screwdriver and lock chain tensioner with locking pin - T10115- .

Remove bolts -1- and -3-.

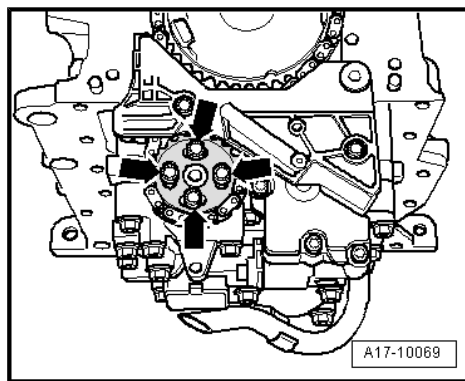


Note

Disregard -item 2-.



- Unscrew bolts -arrows- and detach chain sprocket from balance shaft.



- Unscrew bolts in the sequence -8 ... 1- and remove balance shaft assembly with oil pump.

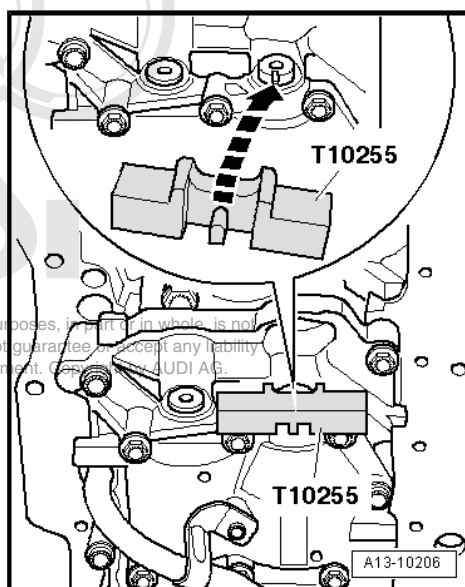
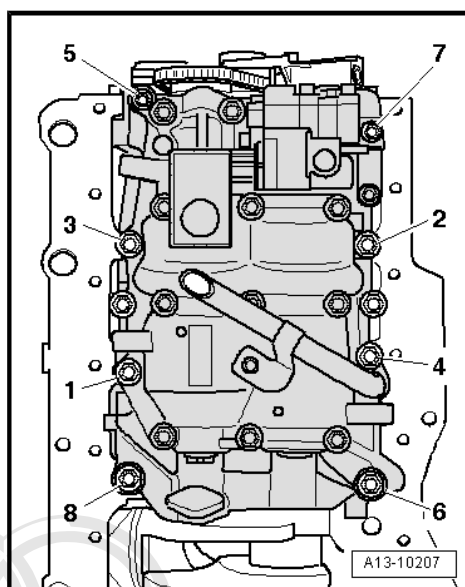
Installing



Note

Renew the bolts tightened with specified tightening angle.

- Crankshaft is locked at TDC using crankshaft stop - T10050- for engines with circular crankshaft sprocket, or crankshaft stop - T10100- for engines with oval crankshaft sprocket.
- Chain sprocket fitted into drive chain for balance shaft.
- Make sure both dowel sleeves are in place before installing balance shaft assembly.
- Initially screw bolts -1 ... 8- in finger-tight.
- Lock balance shaft with locking tool - T10255- .
- The lug of the locking tool must engage in the groove of the balance shaft.

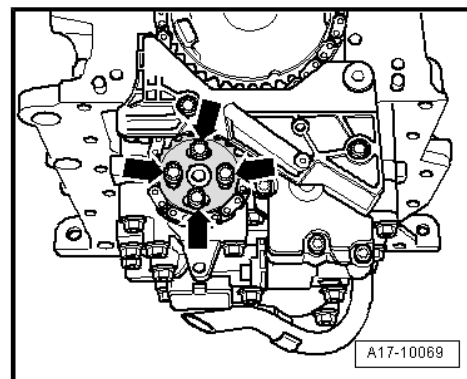


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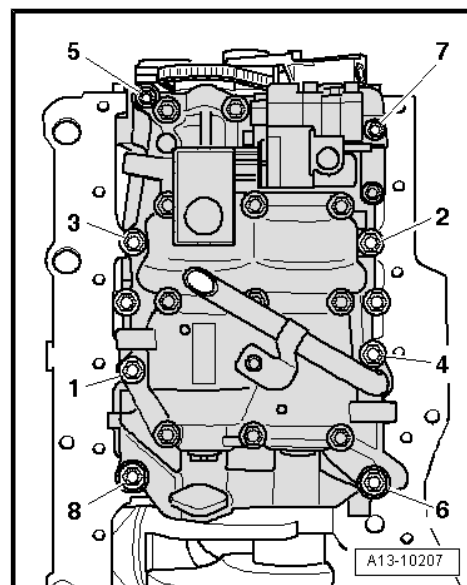
- Bolt on chain sprocket for balance shaft loosely -arrows-.
- It must still be possible to move the chain sprocket back and forth in the elongated holes.

**Note**

If it is not possible to align the elongated holes in the chain sprocket with the threaded holes, the chain sprocket must be moved one tooth further in the drive chain. The balance shaft assembly must be removed again for this procedure.



- Tighten bolts securing balance shaft assembly as follows:
 1. Pre-tighten bolts in the sequence -1 ... 8- to 6 Nm.
 2. Tighten bolts -5- and -7- to 13 Nm.
 3. Turn bolts -5- and -7- 90° further ($\frac{1}{4}$ turn) using a rigid wrench.
 4. Tighten bolts -1 ... 4-, -6- and -8- to 20 Nm.
 5. Turn bolts -1 ... 4-, -6- and -8- 90° further ($\frac{1}{4}$ turn) using a rigid wrench.

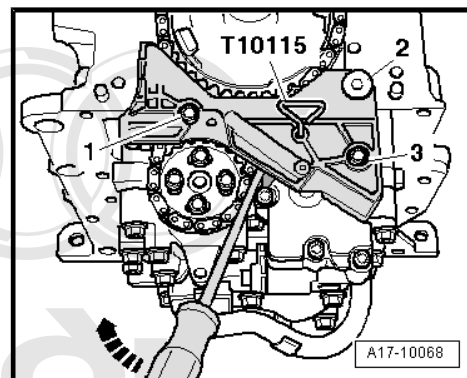


- Tighten bolts -1- and -3-.

**Note**

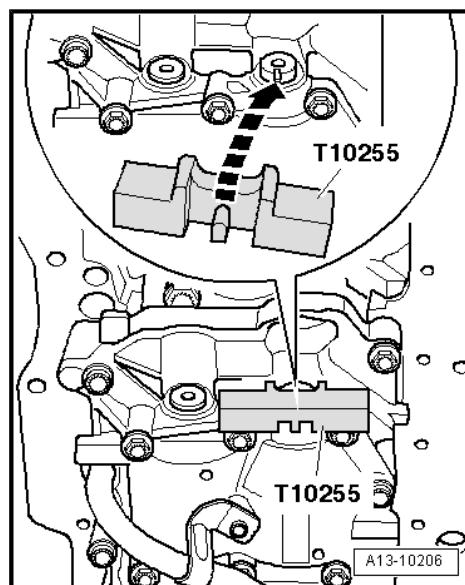
Disregard -item 2- and -arrow-.

- Remove locking pin - T10115- from chain tensioner.

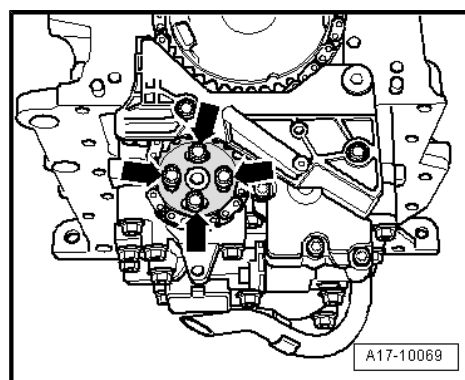


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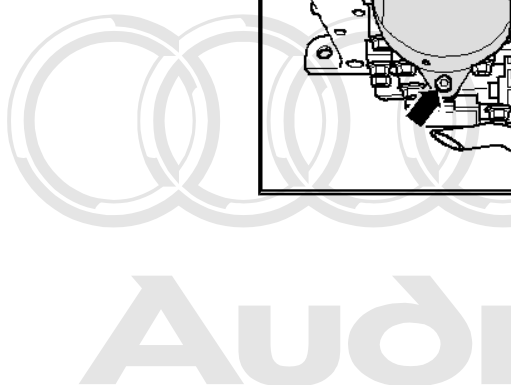
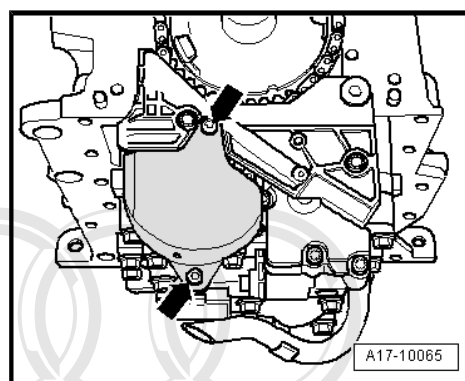
- Insert locking tool - T10255- in balance shaft again to secure chain sprocket.
- The lug of the locking tool must engage in the groove of the balance shaft.



- Tighten bolts -arrows-.
- Remove locking tool - T10255- .



- Fit chain tensioner cover -arrows-.
- Detach crankshaft stop.



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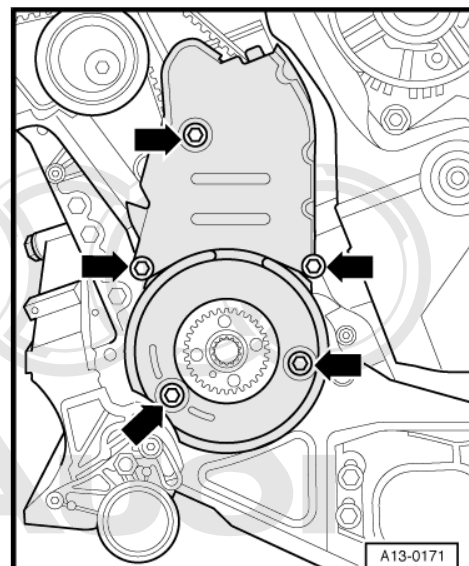
- Secure bottom section of toothed belt cover -arrows-.

Remaining installation steps are carried out in reverse sequence; note the following:

- Install sump ⇒ [page 135](#) .
- Install vibration damper ⇒ [page 39](#) .

Tightening torques

Component		Nm
Balance shaft assembly to cylinder block	M7	13 + 90° 1)2)
	M8	20 + 90° 1)2)
Chain tensioner to balance shaft assembly		9
Chain sprocket to balance shaft		10 + 90° 1)2)
Cover for chain sprocket to:	Chain tensioner	5 3)
	Oil pump	5 3)
Toothed belt cover to engine		10 3)
• 1) Renew bolts. • 2) 90° = one quarter turn. • 3) Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue .		



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1.4 Removing and installing oil pump

Removing

- Remove sump ⇒ [page 135](#) .
- Remove balance shaft assembly ⇒ [page 142](#) .

- Remove circlip -1- with circlip pliers.
- Screw in an M3 screw -2- and pull drive shaft out of oil pump -arrow-.
- Unscrew bolt -4- and detach intake connecting pipe from oil pump.
- Unscrew bolts -3- and -5- and remove oil pump.

Installing

Installation is carried out in the reverse order; note the following:

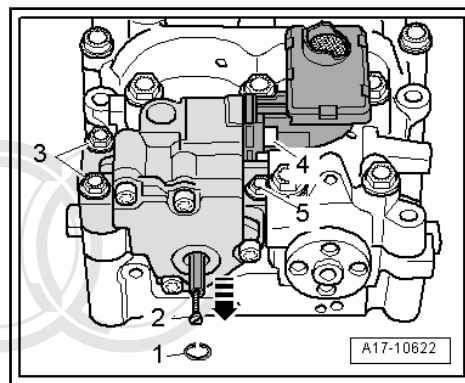


Note

- ◆ *Renew O-ring.*
- ◆ *Renew circlip if damaged or stretched.*
- ◆ *Circlip must fit securely in groove.*
- Make sure both dowel sleeves are in place before installing oil pump.
- Install balance shaft assembly ⇒ [page 142](#) .
- Install sump ⇒ [page 135](#) .

Tightening torques

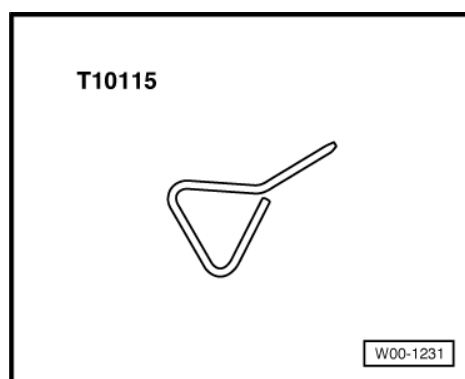
Component	Nm
Oil pump to balance shaft assembly	10
Intake connecting pipe to oil pump	10
Tightening torques and tightening sequence for balance shaft assembly	⇒ page 145



1.5 Removing and installing chain tensioner for balance shaft assembly

Special tools and workshop equipment required

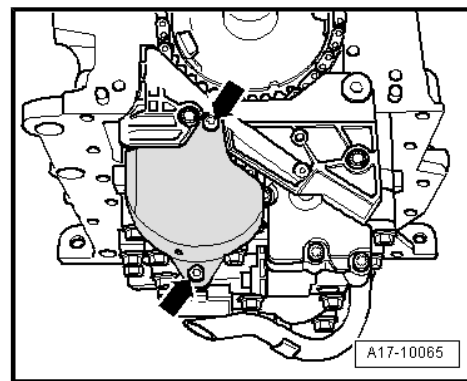
- ◆ Locking pin - T10115-



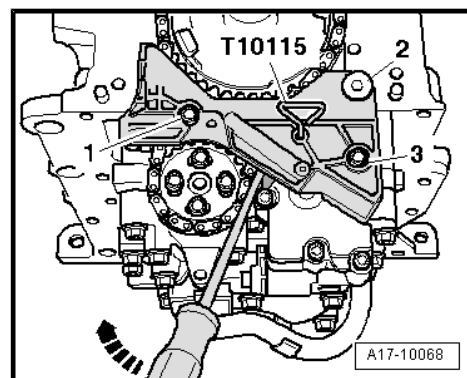
Removing

- Move lock carrier to service position ⇒ [page 31](#) .
- Remove toothed belt ⇒ [page 48](#) .
- Remove sump ⇒ [page 135](#) .
- Remove sealing flange (front) ⇒ [page 61](#) .

- Unscrew bolts -arrows- and detach chain sprocket cover.



- Press guide rail for chain tensioner in -direction of arrow- using a screwdriver and lock chain tensioner with locking pin - T10115- .
- Remove bolts -1- and -3-.
- Then unscrew bolt -2- and remove chain tensioner.



Installing



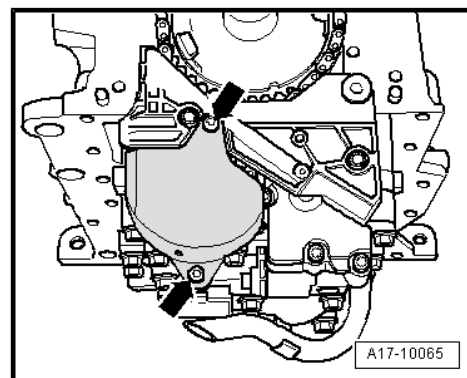
Note

Renew the bolts tightened with specified tightening angle.

- Initially bolt chain tensioner (locking pin inserted) onto cylinder block with fitted bolt -2-.
- Then tighten bolts -1- and -3-.
- Remove locking pin - T10115- from chain tensioner.
- Fit chain tensioner cover -arrows-.

Remaining installation steps are carried out in reverse sequence; note the following:

- Install sealing flange (front) ⇒ [page 61](#) .
- Install sump ⇒ [page 135](#) .
- Install toothed belt (adjust valve timing) ⇒ [page 51](#) .
- Install vibration damper ⇒ [page 39](#) .
- Install poly V-belt ⇒ [page 35](#) .
- Install lock carrier with attachments ⇒ Rep. gr. 50 .

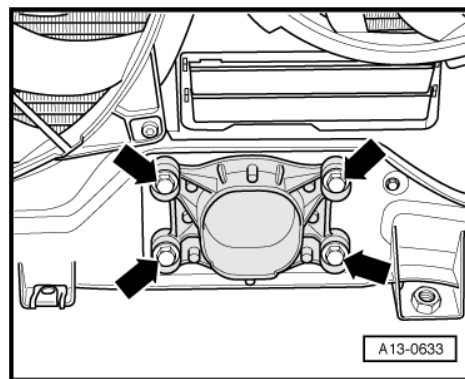




- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten bolts -arrows-.
- Install headlights ⇒ Rep. gr. 94 .
- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Check headlight adjustment ⇒ Maintenance ; Booklet 405 .

Tightening torques

Component	Nm
Chain tensioner to: Cylinder block	20
Balance shaft assembly	9
Drive chain cover to: Chain tensioner	5 ¹⁾
Oil pump	5 ¹⁾
Stop for torque reaction support to lock carrier	23
• ¹⁾ Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue .	



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2 Servicing sump, oil pump and balance shaft assembly with spur gear drive



Note

- ◆ *If large quantities of metal shavings or particles are found in the engine oil when repairing the engine, the oil passages must be cleaned carefully, and the oil cooler must be renewed in order to prevent further damage occurring later.*
- ◆ *The oil level must not be above max. mark on dipstick – danger of damage to catalytic converter.*
- ◆ *Oil spray jet and pressure relief valve ⇒ [page 154](#)*
- ◆ *Removing and installing oil level and oil temperature sender - G266- ⇒ [page 155](#).*
- ◆ *Refer to ⇒ Maintenance tables for engine oil capacity, viscosity grades and oil specifications.*

2.1 Sump, oil pump, balance shaft assembly with spur gear drive - exploded view



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1 - Sump

- ☐ With oil level and oil temperature sender - G266-
- ☐ Removing and installing sump ⇒ [page 155](#)

2 - 23 Nm

3 - Torque reaction support

4 - 10 Nm

5 - Intake connecting pipe

- ☐ Clean strainer if dirty

6 - 10 Nm

7 - O-ring

- ☐ Renew

8 - Oil pump

- ☐ Removing and installing ⇒ [page 164](#)
- ☐ Before installing, check that the two dowel sleeves for centring oil pump are fitted onto balance shaft assembly.

9 - Oil pump drive shaft

10 - Circlip

- ☐ Must fit securely in groove
- ☐ Renew circlip if damaged or stretched

11 - Spur gear for balance shaft

12 - 20 Nm + turn 90° further

- ☐ Renew

13 - Hub

- ☐ For idler gear

14 - 90 Nm + turn 90° further

- ☐ Renew

15 - Thrust washer

- ☐ For idler gear
- ☐ Renew
- ☐ Installation position ⇒ [page 154](#)

16 - Idler gear

- ☐ Renew
- ☐ To achieve the correct backlash a suitably thick coating is already applied to the new idler gear
- ☐ Installing ⇒ [page 166](#)

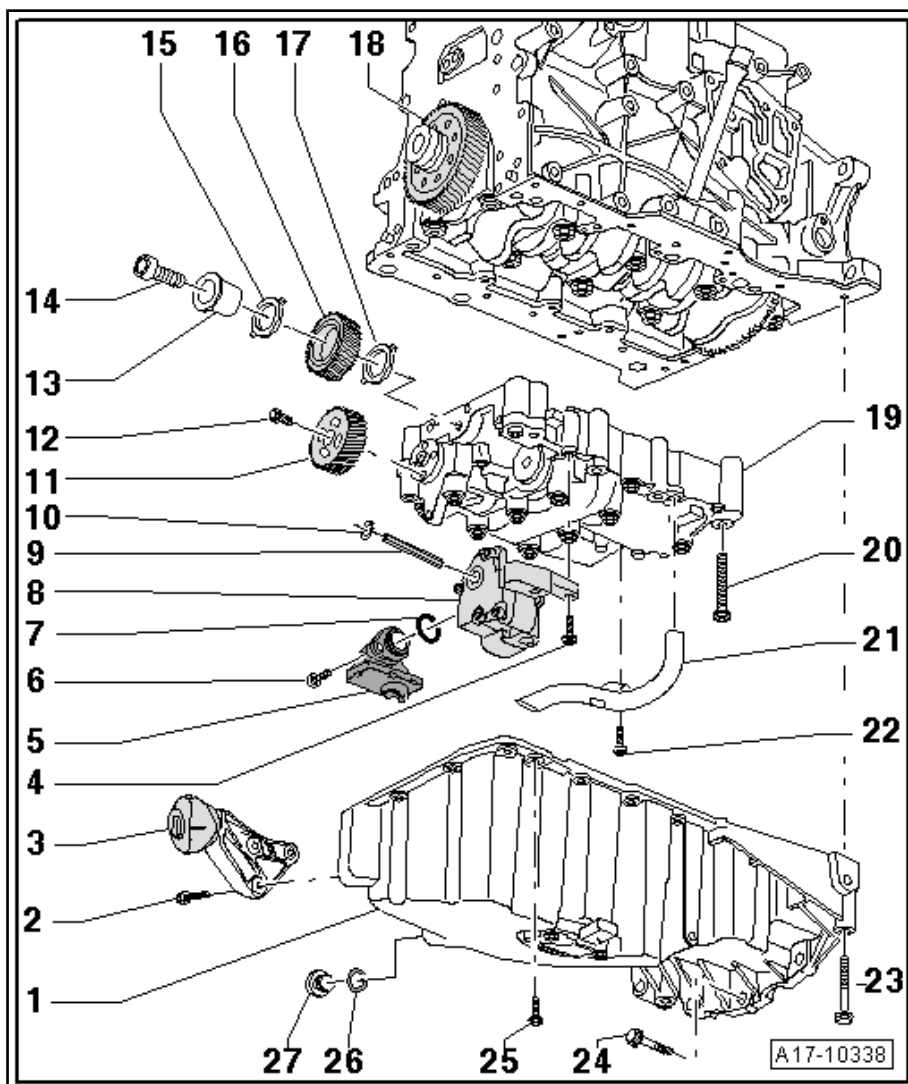
17 - Thrust washer

- ☐ For idler gear

18 - Spur gear

19 - Balance shaft assembly

- ☐ Removing ⇒ [page 164](#)



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- ☐ Installing new balance shaft assembly ⇒ [page 166](#)
- ☐ Re-installing "old" balance shaft assembly ⇒ [page 170](#)
- ☐ Before installing, check that the two dowel sleeves for centring balance shaft assembly are fitted onto cylinder block.

20 - Bolt

- ☐ Renew
- ☐ Tightening torque and sequence with eight attachment points ⇒ [page 153](#)
- ☐ Tightening torque and sequence with six attachment points ⇒ [page 154](#)

21 - Oil intake pipe**22 - 10 Nm****23 - 40 Nm**

- ☐ Observe correct tightening sequence ⇒ [page 162](#)

24 - 45 Nm

- ☐ Observe correct tightening sequence ⇒ [page 162](#)

25 - 15 Nm

- ☐ Tighten in stages and in diagonal sequence
- ☐ Observe correct tightening sequence ⇒ [page 162](#)

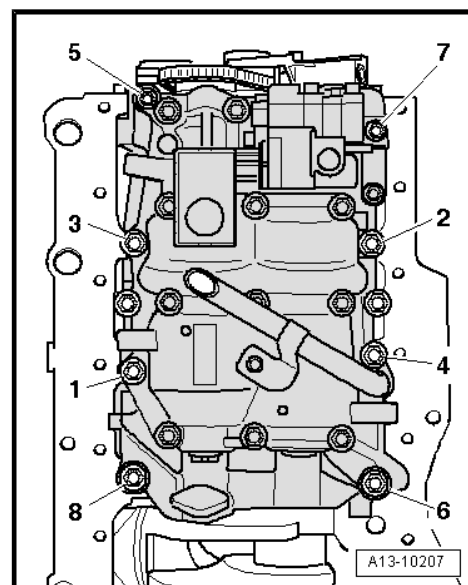
26 - Seal

- ☐ Renew

27 - Oil drain plug, 30 Nm**Balance shaft assembly with eight attachment points - tightening torque and sequence**

- Tighten bolts in 8 stages in the sequence shown:

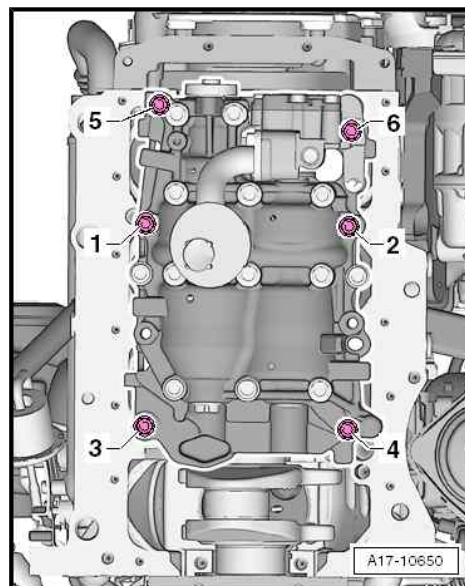
Stage	Bolts	Tightening torque/angle specification
1.	-1 ... 8-	hand-tighten
2.	-1 ... 8-	6 Nm
3.	-1 ... 4-	20 Nm
4.	-5-	13 Nm
5.	-6-	20 Nm
6.	-7-	13 Nm
7.	-8-	20 Nm
8.	-1 ... 8-	Turn 90° further



Balance shaft assembly with six attachment points - tightening torque and sequence

– Tighten bolts in 8 stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-1 ... 6-	hand-tighten
2.	-1 ... 6-	6 Nm
3.	-1 ... 4-	20 Nm
4.	-5, 6-	13 Nm
5.	-1 ... 6-	Turn 90° further

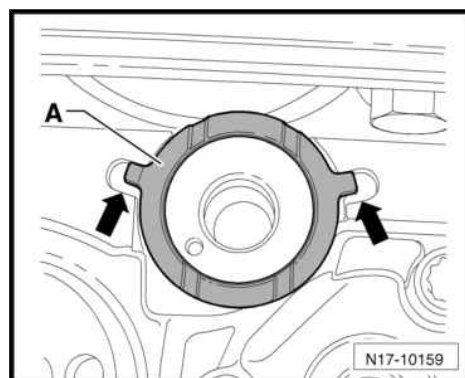


Installation position of thrust washer



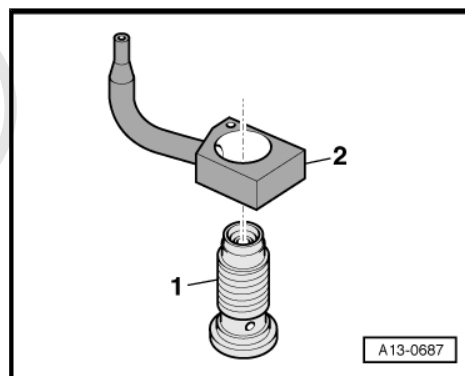
Caution

Make sure that the thrust washer -A- does not slip out of the recesses in the balance shaft assembly -arrows- when fitting the idler gear. If this is neglected, the thrust washer can become stuck. If necessary, apply grease to the thrust washer and attach it to the balance shaft assembly.



Oil spray jet and pressure relief valve

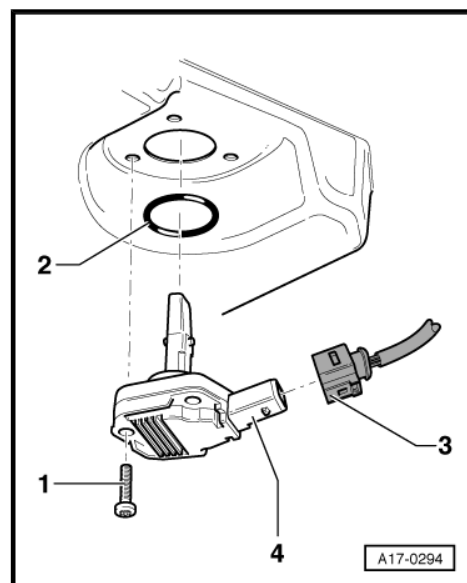
- 1 - Bolt with pressure relief valve, 27 Nm
- 2 - Oil spray jet (for cooling of pistons)



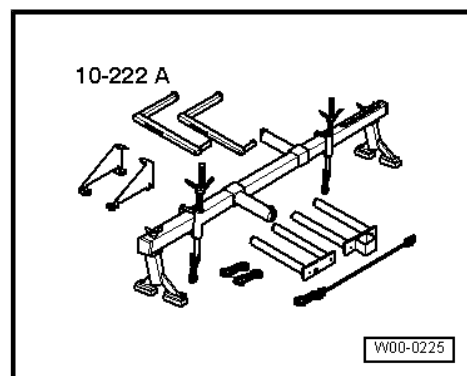
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Removing and installing oil level and oil temperature sender - G266-

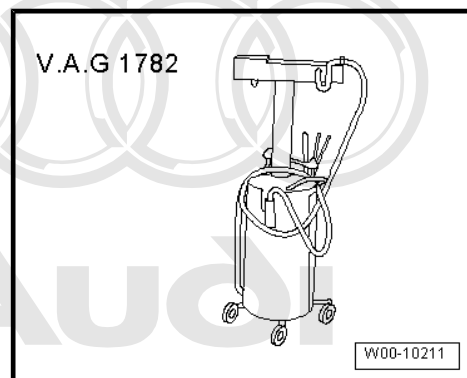
- 1 - Bolt, 10 Nm (self-locking); renew
- 2 - Seal; renew
- 3 - Electrical connector
- 4 - Oil level and oil temperature sender - G266-

**2.2 Removing and installing sump****Special tools and workshop equipment required**

- ◆ Support bracket - 10 - 222 A-

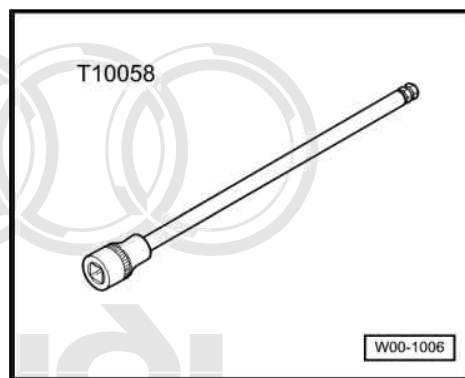


- ◆ Used oil collection and extraction unit - V.A.G 1782-



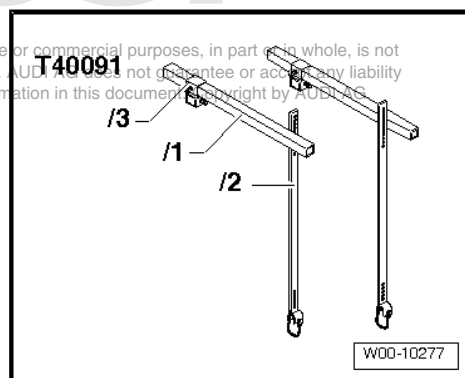
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- ◆ Allen key, long reach - T10058-

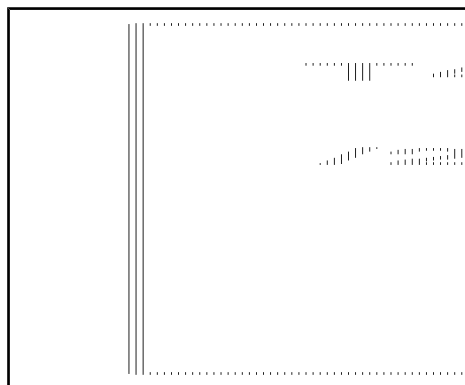


- ◆ Engine support bracket (basic set) - T40091-

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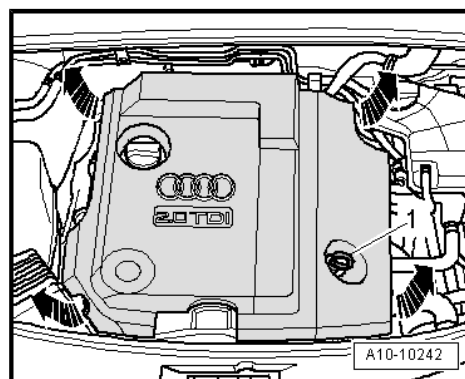
- ◆ Engine support bracket (supplementary set) - T40093-



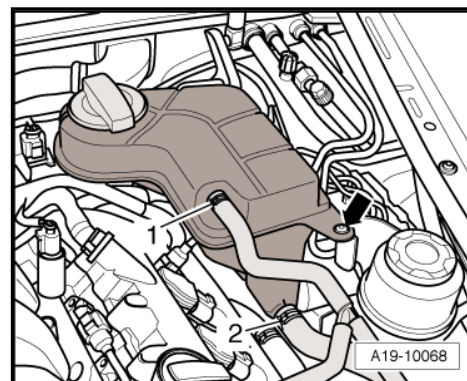
- ◆ Electric drill with plastic brush attachment
- ◆ Safety goggles
- ◆ Sealant ⇒ Parts catalogue

Removing

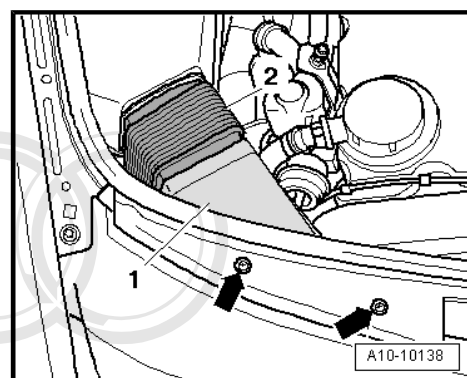
- Pull dipstick -1- out of guide tube.
- Pull off engine cover panel -arrows-.
- Re-insert dipstick in guide tube.



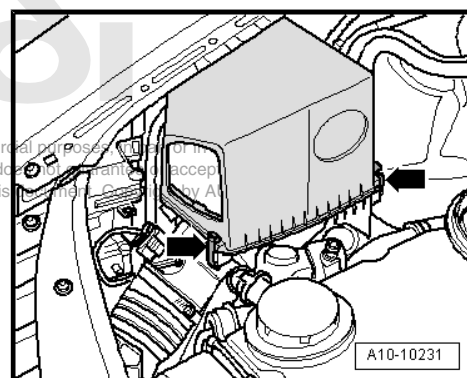
- Unbolt coolant expansion tank -arrow-.
- Unplug electrical connector for coolant shortage indicator switch - F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -2- attached.



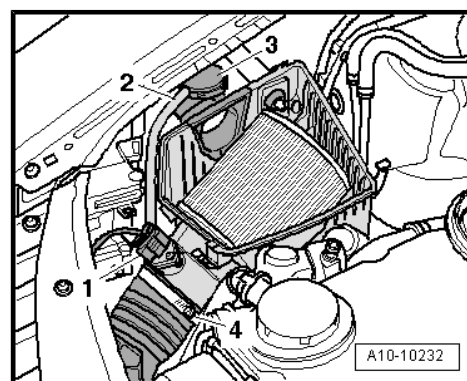
- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.



- Release two retaining clips -arrows- and detach top section of air cleaner housing.

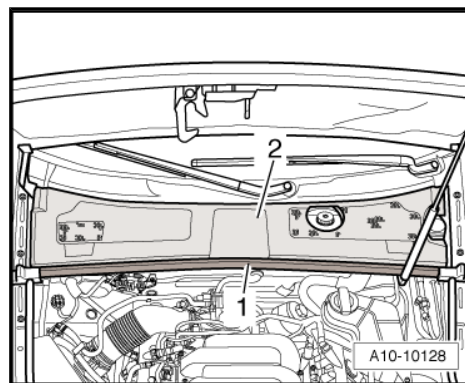


- Unplug electrical connector -1- at air mass meter - G70- .
- Loosen hose clip -4- to remove air intake hose.
- Detach vacuum hose -2-.
- Lift off vacuum unit -3- with air flap from air cleaner housing.
- Disengage bottom section of air cleaner housing from retaining pin and remove.

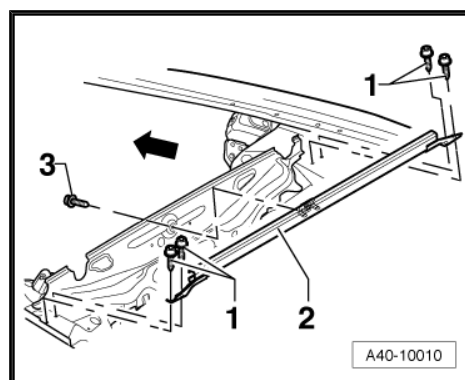


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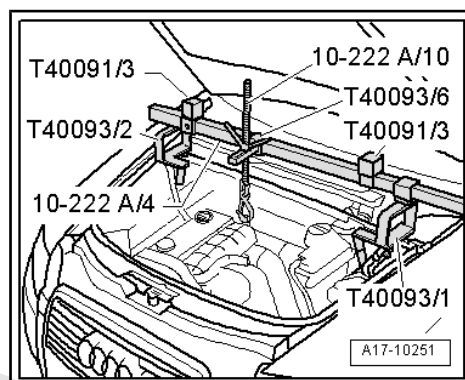
- Pull off rubber seal -1- on plenum chamber cover.
- Detach plenum chamber cover -2-.



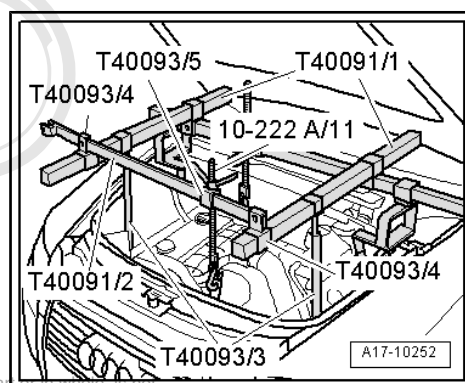
- If fitted, unscrew bolts -1- and -3- and remove body brace -2-.



- Attach adapter - 10 - 222 A /4- with connecting pieces - T40091/3- , adapter -T40093/6- , hook - 10 - 222 A /10- and brackets -T40093/1- and -T40093/2- to suspension turrets.
- The brackets are marked for left and right-side of vehicle.
- Attach hook - 10 - 222 A /10- to engine lifting eye (rear).



- Set up further components of support bracket as shown in illustration. Position supports -T40093/3- onto flanges of longitudinal members.
- Push support -T40091/2- with sliding support -T40093/5- and the two connecting pieces -T40093/4- onto square-section pipes -T40091/1- .
- Attach spindle - 10 - 222 A /11- to engine lifting eye (front).

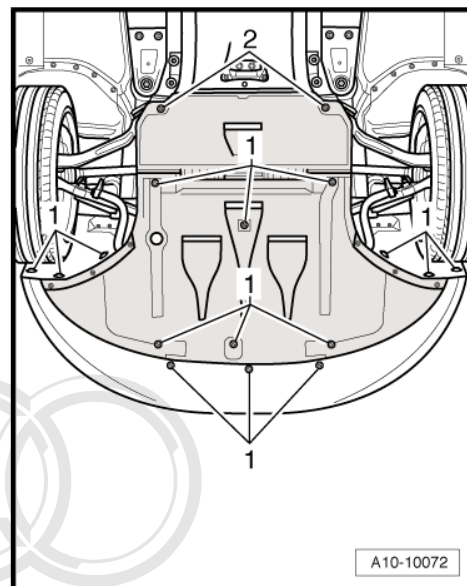


WARNING

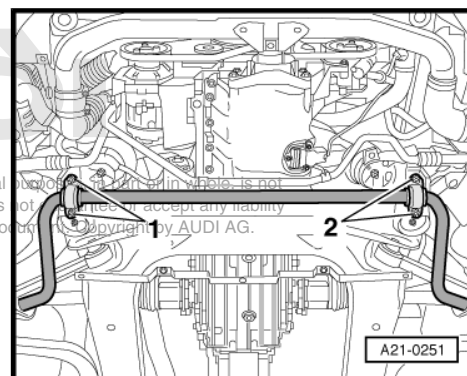
Secure support -T40091/2- with pins and split pins of connecting pieces -T40093/4-

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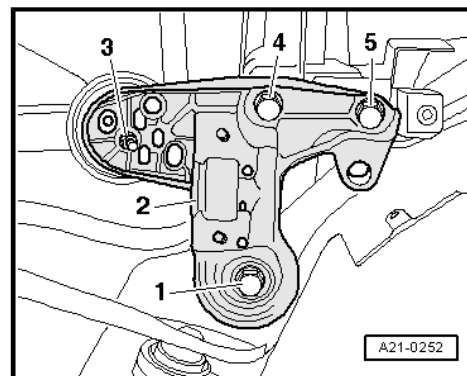
- Release quick-release fasteners -1- and -2- and take off noise insulation panels.



- Unbolt anti-roll bar mountings -1- and -2-.



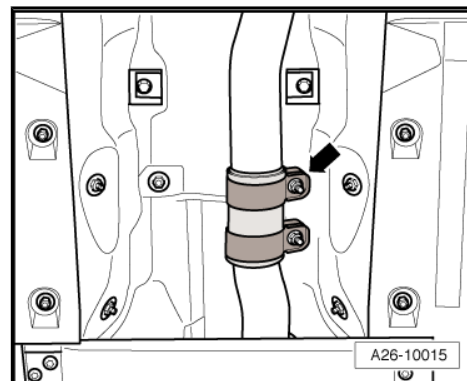
- Unscrew nut -3- at bottom of engine mounting.
- Unscrew bolts -4- and -5- on console for engine mounting.
- Unscrew bolt -1- (front) for subframe and remove console for engine mounting -2-.
- Repeat procedure on other side of vehicle.
- Lift engine.



Note

Do not bend the flexible joint (de-coupling element) in the exhaust system more than 10°, otherwise it could be damaged.

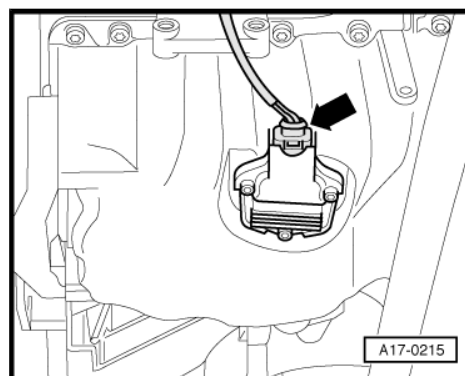
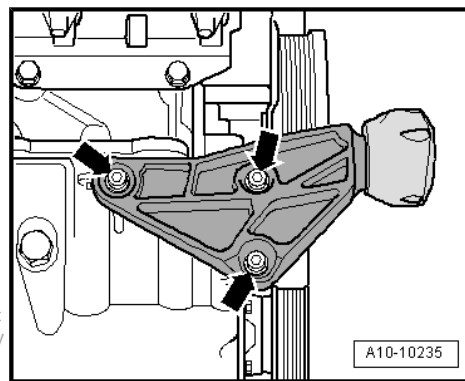
- Disconnect exhaust system at clamp -arrow- and push clamp back.



- Unscrew bolts -arrows- and remove torque reaction support from engine.
- Lift the engine evenly a short distance with both spindles.
- Place used oil collection and extraction unit - V.A.G 1782- under engine and drain engine oil.

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- Unplug electrical connector at oil level and oil temperature sender - G266- -arrow-.



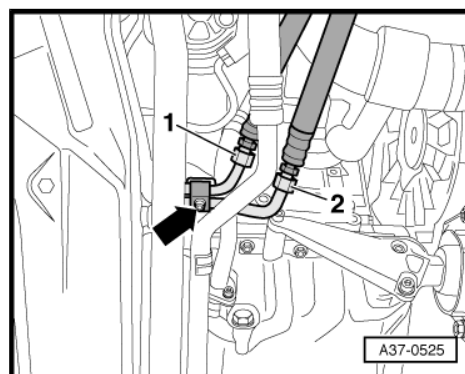
Vehicles with multitronic gearbox:

- Unbolt bracket -arrow- for ATF lines at sump.



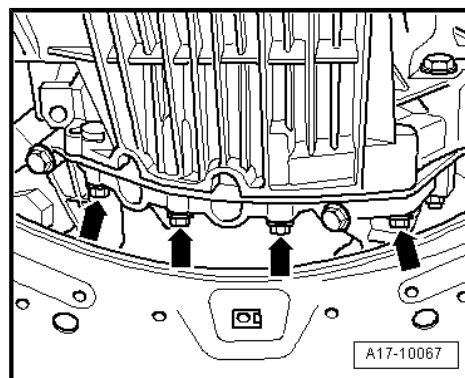
Note

Disregard items -1- and -2-.



All vehicles:

- Unscrew gearbox/sump bolts -arrows-.



- Unscrew M10 bolts -arrows-.
- Slacken bolts -1 ... 18- in diagonal sequence.

 Note

- ◆ *Bolts -17- and -18- can only be unscrewed using Allen key (long reach) - T10058- .*
- ◆ *When unscrewing bolts -17- and -18- they come into contact with flywheel. However, this does not damage bolts and tapped holes.*
- Take off sump; if necessary loosen it by striking lightly with a rubber hammer.

Installing

Installation is carried out in the reverse order; note the following:

 Note

Renew seal.

- Remove sealant residue from sump and cylinder block with rotating plastic brush or similar.

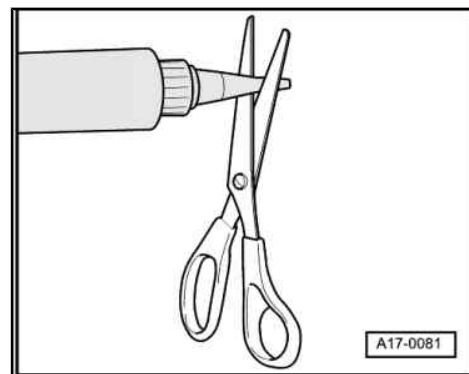
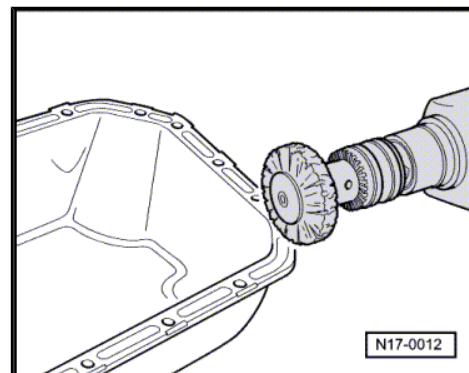
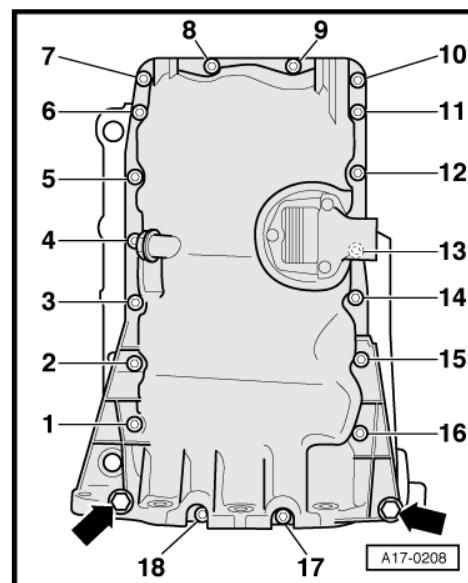


WARNING

Wear safety goggles.

- Clean sealing surfaces; they must be free of oil and grease.
- Cut off tube nozzle at front marking (diameter of nozzle approx. 2 mm).

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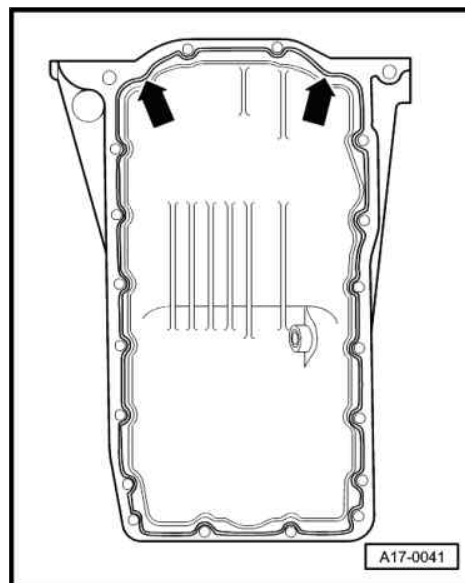


- Apply bead of sealant onto the clean sealing surface of the sump as shown in the illustration.
- Thickness of sealant bead: 2 ... 3 mm



Note

- ◆ Sealant bead must not be wider than 3 mm, otherwise excess sealant could ingress into sump and clog strainer in oil intake pipe.
- ◆ Take particular care when applying sealant bead in area of rear sealing flange -arrows-.
- ◆ The sump must be installed within 5 minutes after applying sealant.

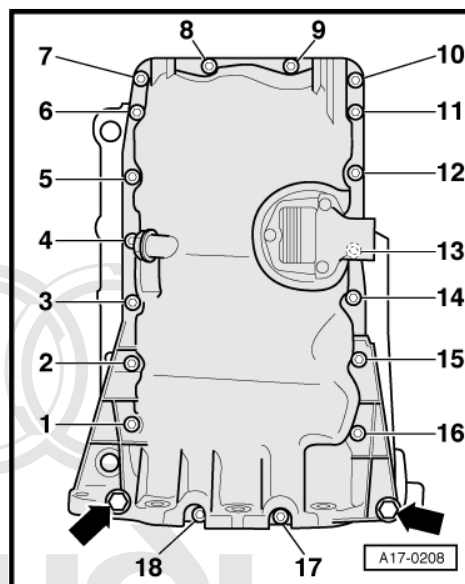


- Immediately install sump and tighten bolts in the sequence indicated:
1. Pre-tighten bolts -1 ... 18- to 5 Nm in diagonal sequence.
 2. Tighten bolts securing sump to gearbox to 45 Nm.
 3. Tighten bolts M10 -arrows- to 40 Nm.
 4. Tighten bolts -1 ... 18- to 15 Nm in diagonal sequence.



Note

- ◆ Bolts -17- and -18- can only be screwed in using Allen key (long reach) - T10058- .
- ◆ When screwing in bolts -17- and -18- they come into contact with flywheel. However, this does not damage bolts and tapped holes.

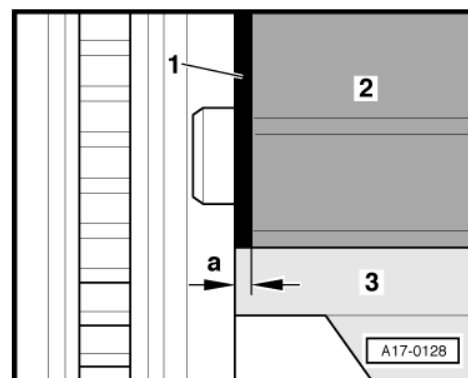


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Note

- ◆ *When installing the sump -3- with the engine removed from the vehicle, make sure that it is positioned flush with the intermediate plate -1- at the flywheel end. In other words, the sump should protrude by 0.8 mm (distance -a-) from cylinder block -2-.*
- ◆ *After fitting sump assembly, the sealant must dry for approx. 30 minutes. Then (and only then) fill the engine with engine oil.*
- Install subframe ⇒ Rep. gr. 40 .
- Install anti-roll bar ⇒ Rep. gr. 40 .
- Align exhaust system so it is free of stress: vehicles without particulate filter ⇒ [page 221](#) , vehicles with particulate filter ⇒ [page 235](#) .
- Fill up with engine oil and check oil level ⇒ [page 178](#) .



Tightening torques

Component		Nm
Sump to:	M7	15
Cylinder block	M10	40
Sump to gearbox		45
Engine mounting to console for engine mounting		40
Console for engine mounting to longitudinal member		75
Torque reaction support to lock carrier		23
Oil drain plug		30

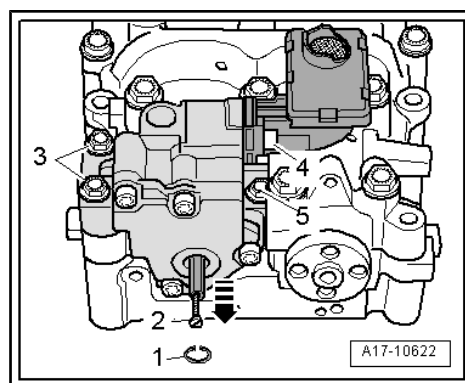


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2.3 Removing and installing oil pump

Removing

- Remove sump ⇒ [page 155](#) .
- Remove circlip -1- with circlip pliers.
- Screw in an M3 screw -2- and pull drive shaft out of oil pump -arrow-.
- Unscrew bolt -4- and detach intake connecting pipe from oil pump.
- Unscrew bolts -3- and -5- and remove oil pump.



Note

Shown in illustration with balance shaft assembly removed.



Caution

The bolt on the idler gear must NOT be loosened.

Installing

Installation is carried out in the reverse order; note the following:



Note

- ◆ Renew O-ring.
- ◆ Renew circlip if damaged or stretched.
- ◆ Circlip must fit securely in groove.
- Make sure both dowel sleeves are in place before installing oil pump.
- Install sump ⇒ [page 155](#) .

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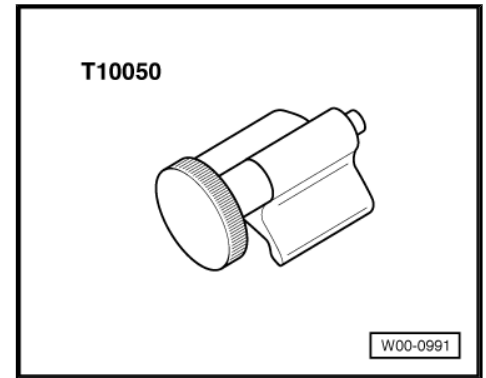
Tightening torques

Component	Nm
Oil pump to balance shaft assembly	10
Intake connecting pipe to oil pump	10

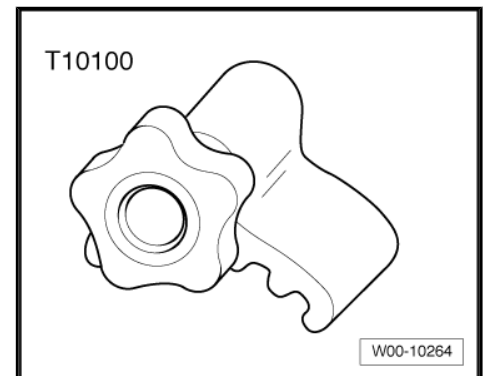
2.4 Removing balance shaft assembly

Special tools and workshop equipment required

- ◆ Crankshaft stop - T10050- for engines with circular crankshaft sprocket

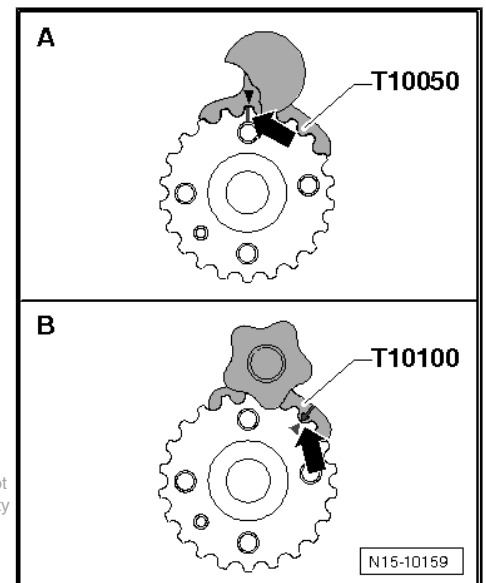


- ◆ Crankshaft stop - T10100- for engines with oval crankshaft sprocket



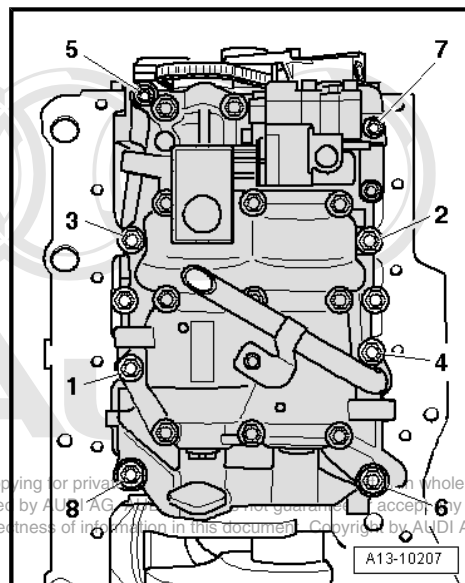
Procedure

- Remove sump ⇒ [page 155](#) .
- Rotate crankshaft to TDC ⇒ [page 55](#) and lock crankshaft using crankshaft stop - T10050- for engines with circular crankshaft sprocket, or crankshaft stop - T10100- for engines with oval crankshaft sprocket.
- Unscrew bolts in the sequence shown by the numbers and remove balance shaft assembly with oil pump:



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- ◆ Balance shaft assembly with eight attachment points.



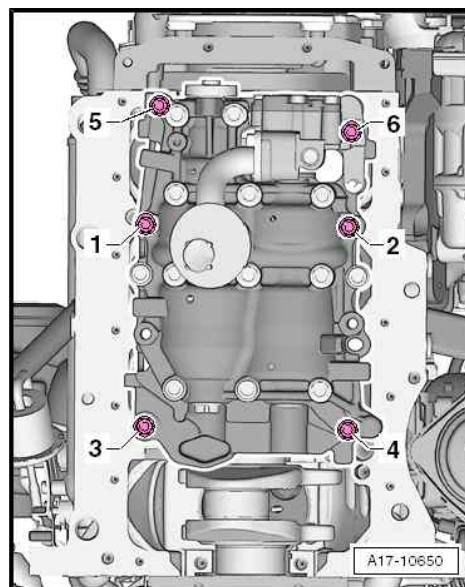
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- ◆ Balance shaft assembly with six attachment points.



Note

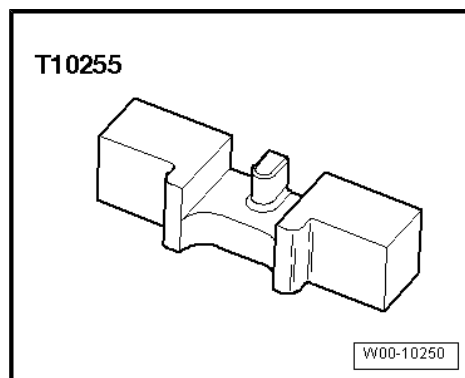
- ◆ Installing a new balance shaft assembly ⇒ [page 166](#).
- ◆ Re-installing the "old" balance shaft assembly ⇒ [page 170](#).



2.5 Installing a new balance shaft assembly

Special tools and workshop equipment required

- ◆ Locking tool - T10255-

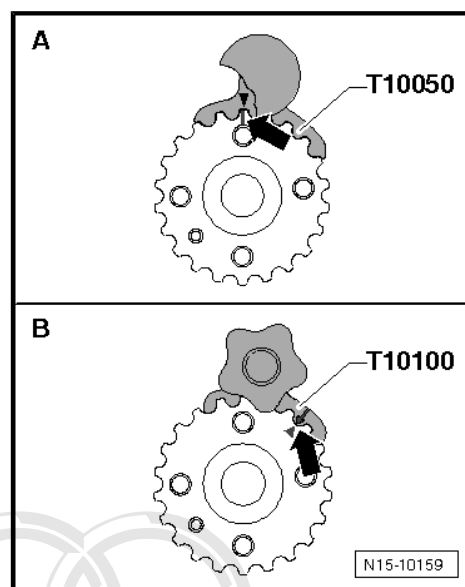


Procedure

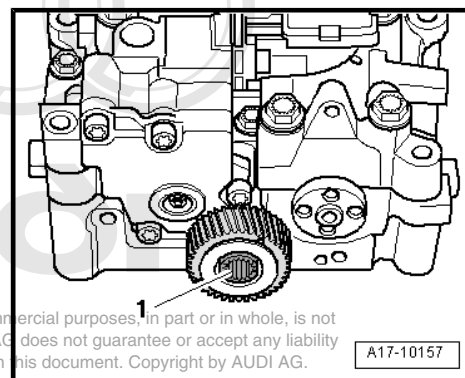


Note

- ◆ *The spur gear drive of the balance shaft assembly must be installed with a backlash of 0.038 ... 0.072 mm.*
- ◆ *To achieve the correct backlash, a suitably thick coating is already applied to the new idler gear. The coating is applied to the teeth on parts of the circumference.*
- ◆ *The coating is worn down rapidly and the backlash is then correct.*
- ◆ *A new balance shaft assembly must always be installed in conjunction with a new idler gear which has the correct coating.*
- ◆ *A white dot on the idler gear indicates the correct installation position.*
- ◆ *Idler gears not marked with a white dot are coated all round. They can be installed in any position.*
- ◆ *Renew the bolts tightened with specified tightening angle.*
- Crankshaft sprocket is locked using crankshaft stop - T10050- for engines with circular crankshaft sprocket, or crankshaft stop - T10100- for engines with oval crankshaft sprocket.



- Before positioning balance shaft assembly on cylinder block slacken off bolt -1- for idler gear approx. $\frac{1}{4}$ turn.
- Check that two dowel sleeves are in place, to ensure that balance shaft assembly is located correctly on cylinder block.



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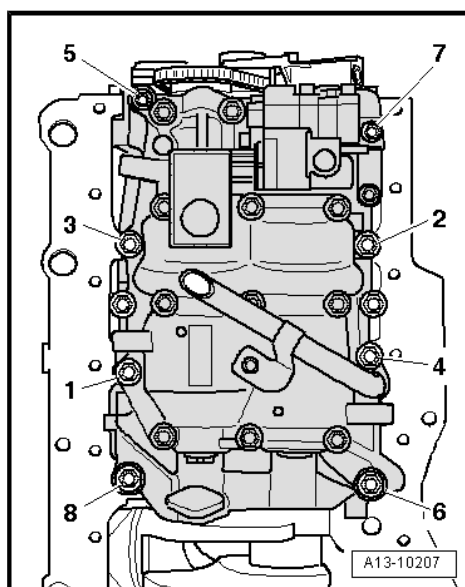
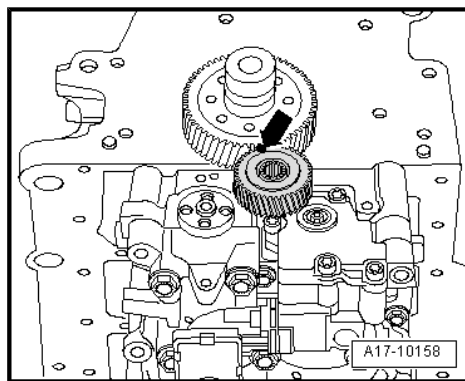
- Position balance shaft assembly on cylinder block, making sure idler gear is in correct position:
- White dot -arrow- on idler gear must be aligned centrally with crankshaft.
- Idler gears not marked with a white dot can be installed in any position.



Note

Take care not to damage coating on idler gear.

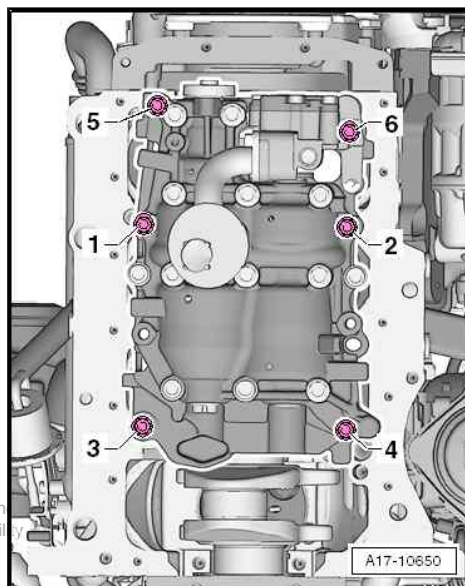
- ◆ Balance shaft assembly with eight attachment points: tighten bolts ⇒ [page 153](#) .



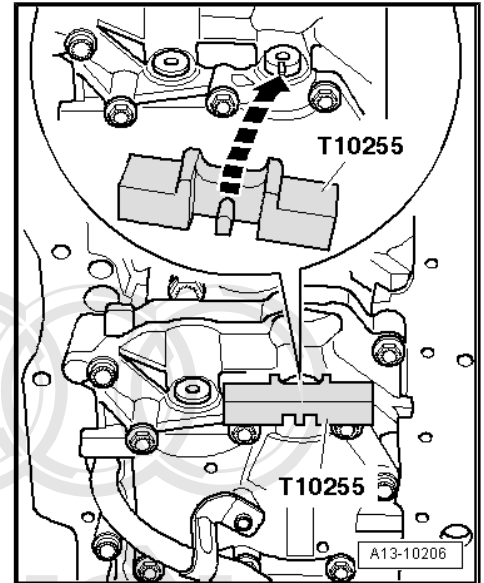
- ◆ Balance shaft assembly with six attachment points: tighten bolts ⇒ [page 154](#) .



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- Lock balance shaft with locking tool - T10255- ; turn balance shaft to do so, if necessary.
- The lug of the locking tool must engage in the groove of the balance shaft.



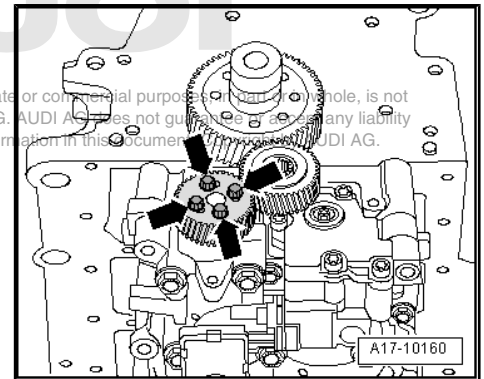
- Carefully fit balance shaft gear onto balance shaft; to do so, push idler gear slightly to one side.

i Note

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- ◆ Take care not to damage coating on idler gear.
- ◆ If it is not possible to align the elongated holes in the balance shaft gear with the threaded holes, you must turn the gear some teeth further as required and then fit it again.

- Secure balance shaft gear -arrows-.
- Remove locking tool - T10255- .

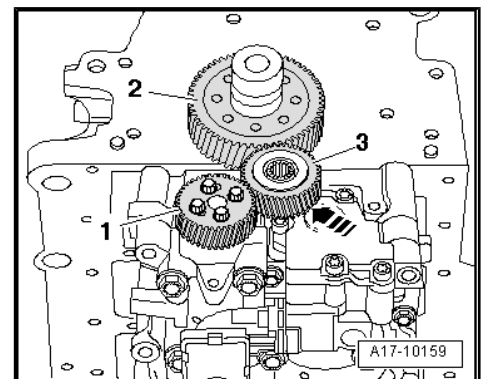


The following three steps have to be performed simultaneously (a second mechanic is therefore required):

- Push idler gear -3- firmly in direction of -arrow- into teeth on drive gear -2- and balance shaft gear -1-. If necessary use a wooden rod to do so.
- At the same time, turn balance shaft gear slightly in anti-clockwise direction.
- Tighten bolt for idler gear.
- Detach crankshaft stop.

i Note

After installation the idler gear must have no backlash. This can be checked by exerting light pressure by hand.



Remaining installation steps are carried out in reverse sequence; note the following:

- Install sump ➔ [page 155](#) .
- Install vibration damper ➔ [page 39](#) .

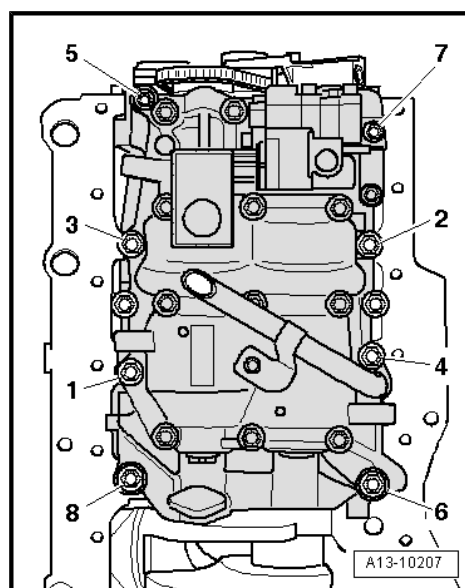
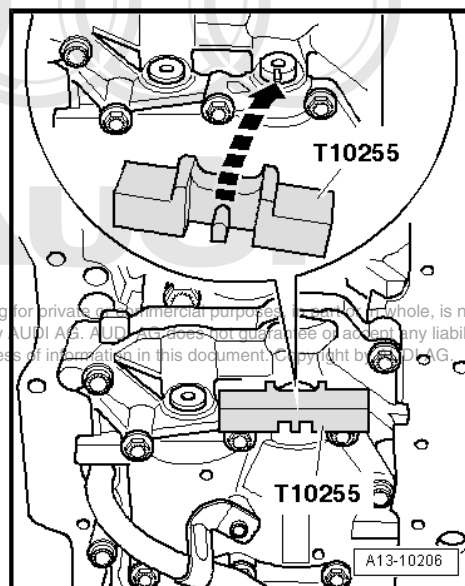
2.6 Re-installing the "old" balance shaft assembly



Note

- ◆ If re-installing the "old" balance shaft assembly and neither the drive gear on the crankshaft nor the crankshaft itself have been renewed, proceed as described in the following. It is also essential that the idler gear has NOT been slackened.
- ◆ If the bolt for the idler gear has been slackened or the drive gear on the crankshaft or the crankshaft itself have been renewed you must install a new idler gear with the appropriate coating. Procedure for installation ⇒ "2.5 Installing a new balance shaft assembly", page 166 .
- ◆ Renew the bolts tightened with specified tightening angle.
- Lock balance shaft with locking tool - T10255- ; turn balance shaft to do so, if necessary.
- The lug of the locking tool must engage in the groove of the balance shaft.
- Check that two dowel sleeves are in place, to ensure that balance shaft assembly is located correctly on cylinder block.
- Attach balance shaft assembly to cylinder block.
- When balance shaft is locked in position, idler gear must engage in drive gear on crankshaft.
- Idler gear must have noticeable backlash.
- Detach crankshaft stop.

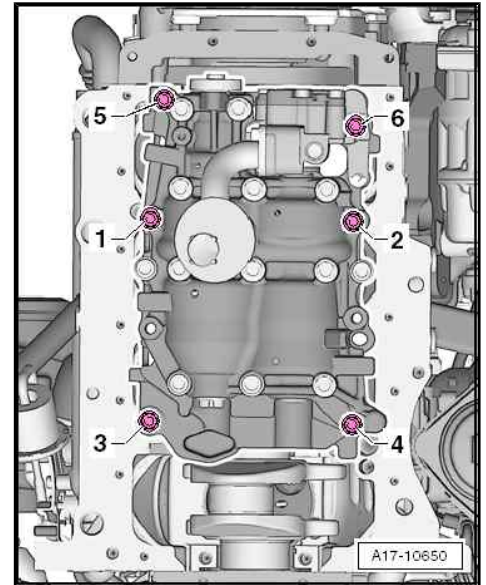
- ◆ Balance shaft assembly with eight attachment points: tighten bolts ⇒ [page 153](#) .



- ◆ Balance shaft assembly with six attachment points: tighten bolts [⇒ page 154](#) .

Remaining installation steps are carried out in reverse sequence; note the following:

- Install sump [⇒ page 155](#) .
- Install vibration damper [⇒ page 39](#) .

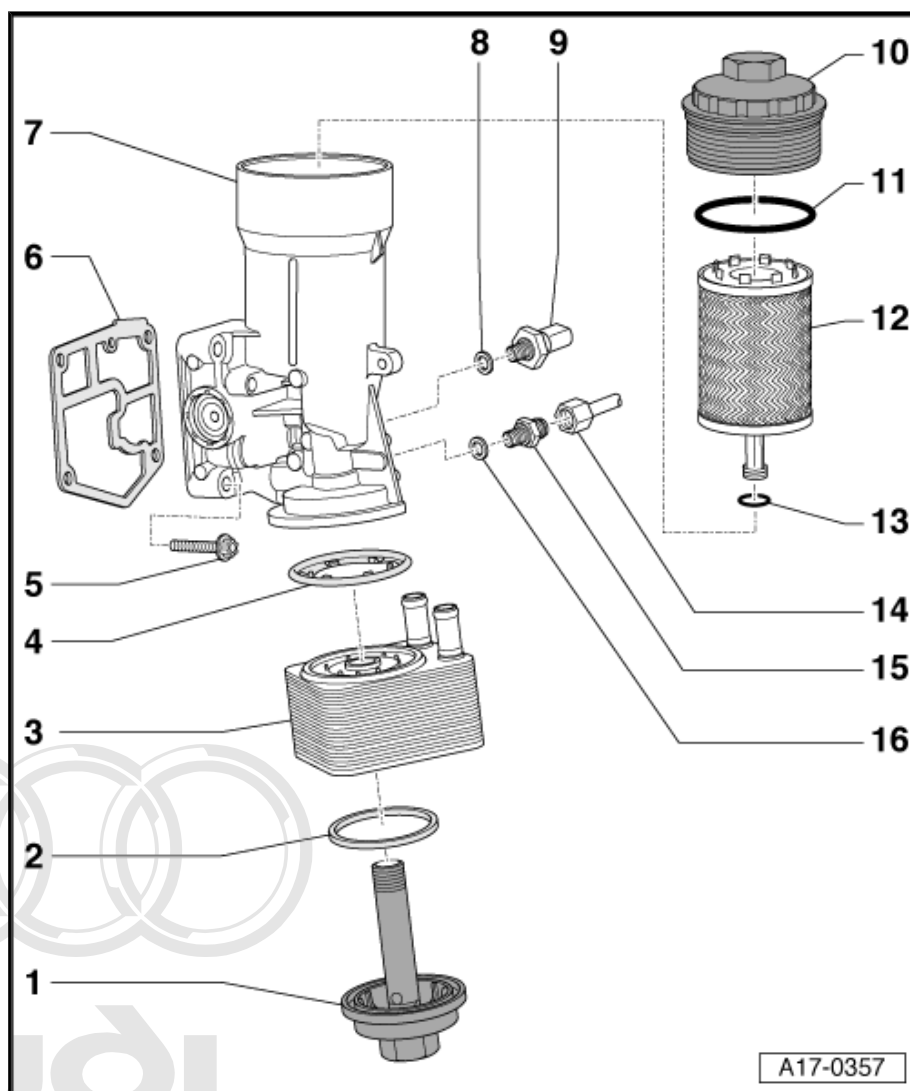


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3 Servicing oil filter bracket with oil cooler

3.1 Oil filter bracket with oil cooler - exploded view

- 1 - Screw plug, 25 Nm
- 2 - Seal
 - ☐ Renew
- 3 - Oil cooler
 - ☐ See note ⇒ [page 132](#)
 - ☐ Connection diagram - coolant hoses ⇒ [page 180](#)
- 4 - Gasket
 - ☐ Renew
 - ☐ Installation position ⇒ [page 173](#)
- 5 - 14 Nm + 90° (1/4 turn) further
 - ☐ Renew
 - ☐ Tighten in diagonal sequence
- 6 - Gasket
 - ☐ Renew
- 7 - Oil filter bracket
 - ☐ With oil retention valve
 - ☐ The oil retention valve cannot be renewed separately
- 8 - Seal
 - ☐ Renew
- 9 - Oil pressure switch - F1-, 20 Nm
 - ☐ 0.7 bar - brown
 - ☐ Checking ⇒ [page 176](#)
- 10 - Sealing cap, 25 Nm
- 11 - O-ring
 - ☐ Renew
- 12 - Oil filter element
 - ☐ Detach from sealing cap ⇒ [Item 10 \(page 172\)](#)
 - ☐ When changing filter, renew O-rings ⇒ [Item 11 \(page 172\)](#) and ⇒ [Item 13 \(page 172\)](#)
 - ☐ Note installation position
 - ☐ Observe change intervals ⇒ Maintenance ; Booklet 405
- 13 - O-ring
 - ☐ Renew
- 14 - Oil supply line
 - ☐ Tighten to 22 Nm



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- ☐ To turbocharger
- ☐ Note installation sequence:
 - First attach both ends of pipe loosely.
 - Then tighten connections to final torque.
 - Tighten clip for oil supply line last.

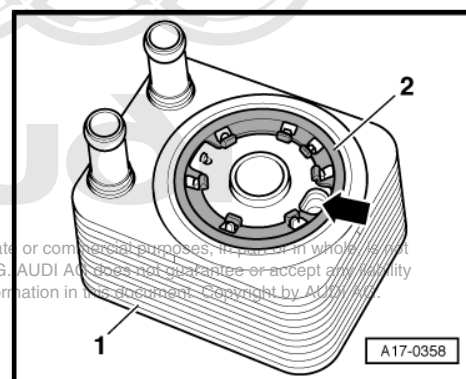
15 - Connection

16 - Seal

- ☐ Renew

Installation position of seal for oil cooler

- Insert the seal -2- so that it can be attached to all tabs on the oil cooler -1-.
- The oil drilling -arrow- must not be covered by the seal.

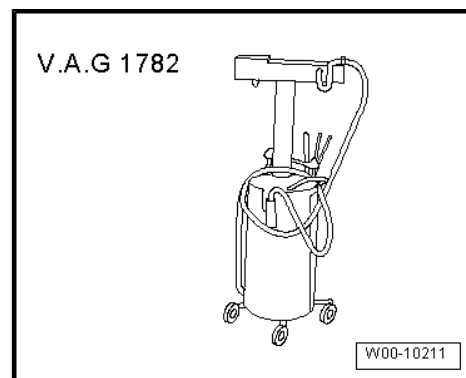


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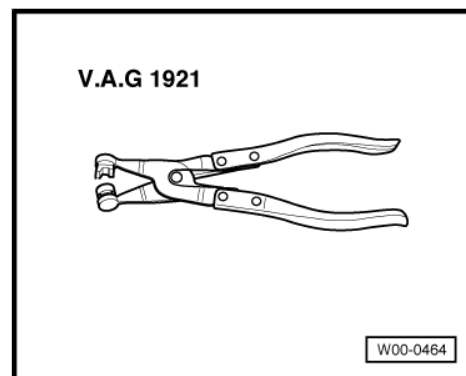
3.2 Removing and installing oil filter bracket with oil cooler

Special tools and workshop equipment required

- ◆ Used oil collection and extraction unit - V.A.G 1782-

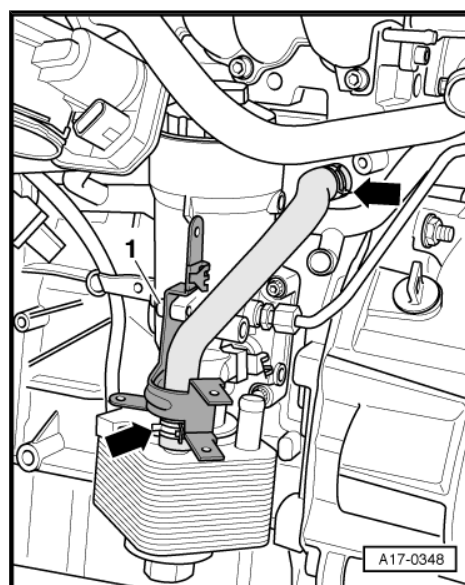
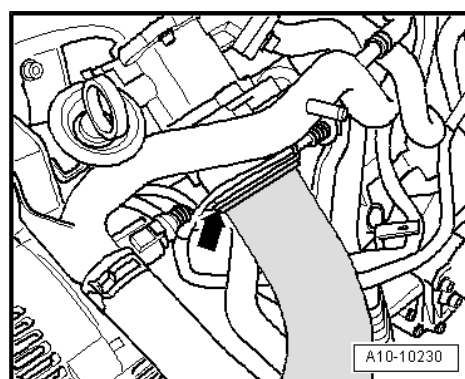
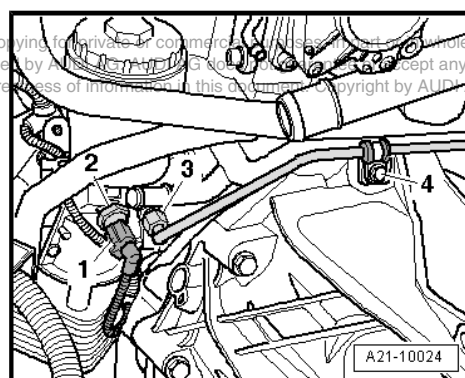
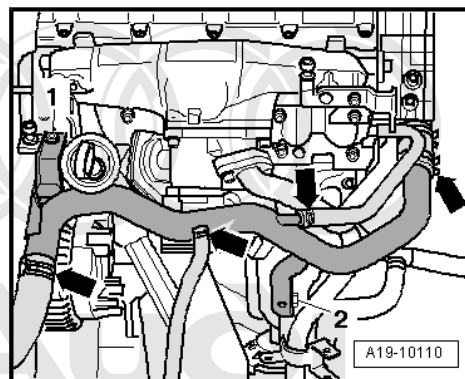


- ◆ Hose clip pliers - V.A.G 1921-

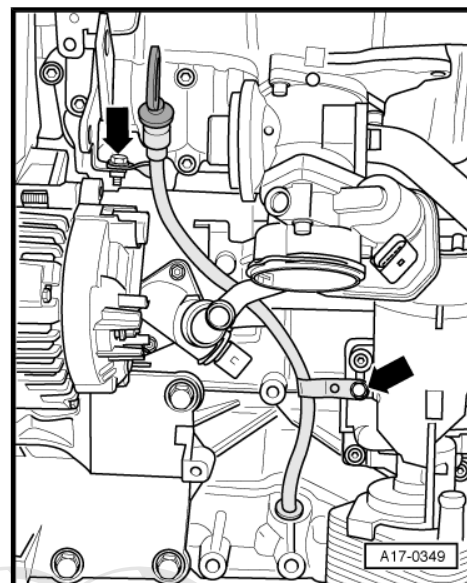


Removing

- Drain off coolant ⇒ [page 183](#) .
- Unscrew bolts -1- and -2- and detach top coolant pipe from coolant hoses -arrows-.
- Unplug electrical connector -1- at oil pressure switch - F1- .
- Unscrew oil pressure switch - F1- -item 2-.
- Detach oil supply line at oil filter bracket -3- and at connecting pipe for exhaust gas recirculation -4-.
- Remove air intake hose at intake manifold flap motor - V157- by lifting retaining clip -arrow- slightly.
- Move wiring harness at bracket clear.
- Unscrew bolt -1- and remove bracket for wiring harness.
- Disconnect coolant hose -arrows- and remove.



- Remove bolts -arrows-.
- Pull guide tube for oil dipstick upwards out of the cylinder block and swing towards front to remove.



- Place used oil collection and extraction unit - V.A.G 1782- under engine.
- Remove bolts -arrows-.
- Remove oil filter bracket.

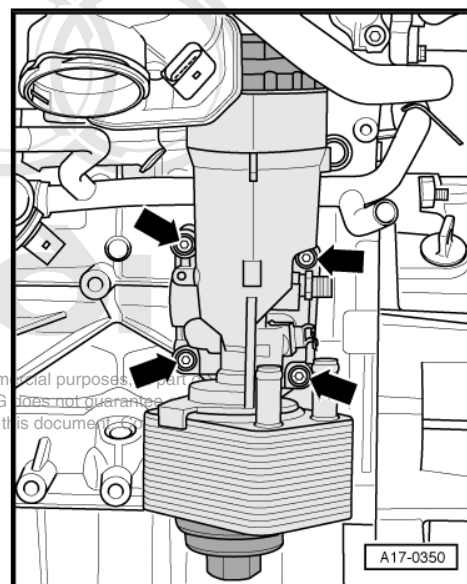
Installing

Installation is carried out in the reverse order; note the following:



Note

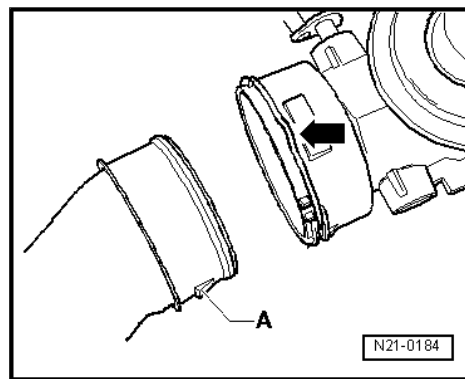
- ◆ *Renew gaskets, seals and O-rings*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*



- When installing air intake hoses with plug-in connectors, ensure that the securing clip -arrow- engages audibly on the retaining lug -A-.
- Install coolant pipe (top) ⇒ [page 192](#) .
- Fill up cooling system (or change coolant if the oil cooler has been renewed) ⇒ [page 185](#) .
- Fill up with engine oil and check oil level ⇒ [page 178](#) .

Tightening torques

Component	Nm
Oil filter bracket to cylinder block	14 + 90° 1)2)
Guide tube for oil dipstick to:	
Engine lifting eye	10
Oil filter bracket	10
Bracket for wiring harness to oil filter bracket	10
Oil supply line to:	
Oil filter bracket	22
Connecting pipe for exhaust gas recirculation	10
Oil pressure switch to oil filter bracket	20
• 1) Renew bolts. • 2) 90° = one quarter turn.	

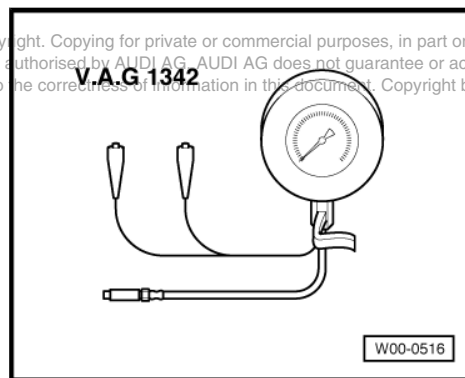


3.3 Checking oil pressure and oil pressure switch

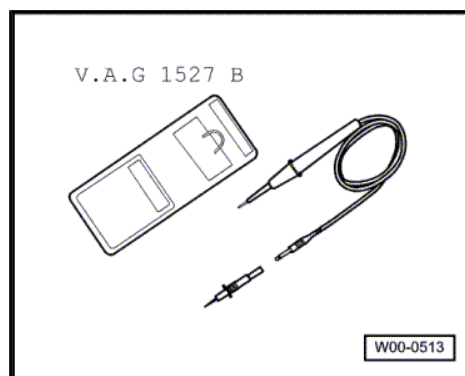
Special tools and workshop equipment required

- ◆ Oil pressure tester - V.A.G 1342-

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- ◆ Voltage tester - V.A.G 1527B-



◆ Auxiliary measuring set - V.A.G 1594C-

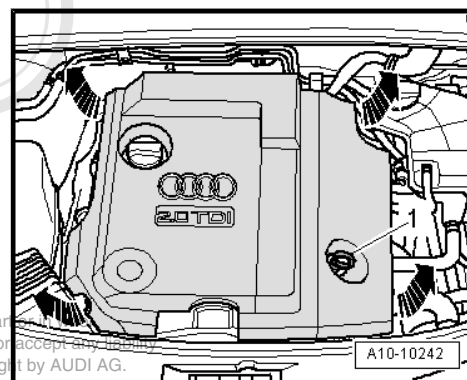


Test conditions

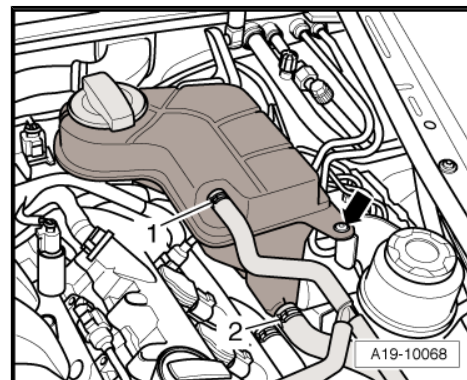
- Oil level OK
- Engine oil temperature approx. 80 °C

Preparation for test

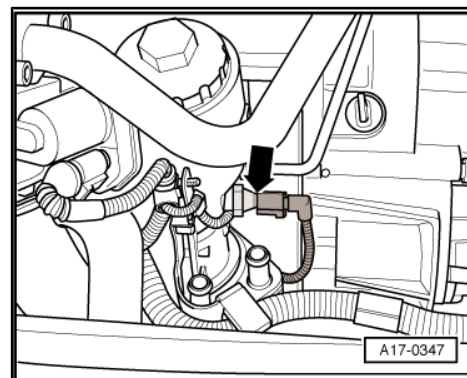
- Pull dipstick -1- out of guide tube.
- Pull off engine cover panel -arrows-.
- Re-insert dipstick in guide tube.



- Unbolt coolant expansion tank -arrow-.
- Unplug electrical connector for coolant shortage indicator switch - F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -2- attached.



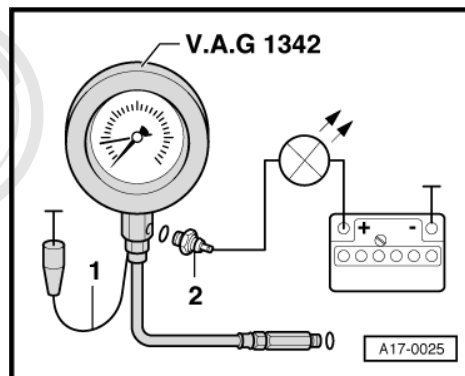
- Unplug electrical connector -arrow- at oil pressure switch - F1- .
- Place a cloth under oil pressure switch - F1- .
- Unscrew oil pressure switch - F1- .



- Connect oil pressure tester - V.A.G 1342- to threaded hole for oil pressure switch.
- Screw oil pressure switch -2- into oil pressure tester - V.A.G 1342- .

Checking oil pressure switch

- Connect brown wire -1- of oil pressure tester to earth (-).
- Connect voltage tester - V.A.G 1527 B- with test leads from auxiliary measuring set - V.A.G 1594 C- to oil pressure switch and battery positive (+).
- LED should not light up.



If the LED lights up:

- Renew oil pressure switch

- Start engine.



Note

Observe tester and LED while starting, as switching point of oil pressure switch may already be exceeded when starting.

- LED should light up at 0.55 ... 0.85 bar.

If LED does not light up:

- Renew oil pressure switch.

Checking oil pressure

- Start engine.
- Minimum oil pressure at idling speed: 0.8 bar.
- Minimum oil pressure at 2000 rpm: 2.0 bar.

3.4 Engine oil

Refer to ⇒ Maintenance tables for engine oil capacity, viscosity grades and oil specifications.

3.5 Checking oil level

Test conditions

- Engine oil temperature at least 60 °C.
- Vehicle must be level (horizontal)
- Wait a few minutes after switching off the engine to allow the oil to flow back into the sump.

Test sequence

- Pull out the dipstick, wipe off with a clean cloth and insert it again as far as it will go.
- Pull out the dipstick again and read off the oil level.

Markings on oil dipstick:

a - Oil must be topped up. It is sufficient if the oil level is somewhere in area -b- after topping up.

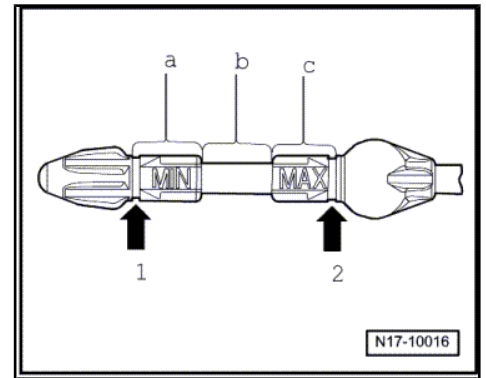
b - Oil may be topped up.

c - Do not top up oil.



Note

The oil level must not be above the MAX marking -arrow 2- and not below the MIN marking -arrow 1-.



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19 – Cooling

1 Removing and installing parts of cooling system



WARNING

Hot steam can escape when opening cap on expansion tank; cover filler cap with a cloth and open carefully.



Note

- ◆ *The cooling system is under pressure when the engine is hot. If necessary, relieve pressure before commencing repair work.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*
- ◆ *Renew gaskets, seals and O-rings.*
- ◆ *The arrow markings on coolant pipes and on ends of hoses must align.*

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1.1 Parts of cooling system

Connection diagram - coolant hoses, vehicles without auxiliary heater

1 - Radiator

- ☐ Removing and installing
⇒ [page 194](#)
- ☐ If renewed, refill system
with fresh coolant

2 - Thermostat

- ☐ Removing and installing
⇒ [page 190](#)
- ☐ Checking ⇒ [page 192](#)

3 - Coolant pump

- ☐ Removing and installing
⇒ [page 189](#)

4 - Cylinder head/cylinder block

- ☐ If renewed, refill system
with fresh coolant

5 - Exhaust gas recirculation cooler

- ☐ If renewed, refill system
with fresh coolant
- ☐ Removing and installing
⇒ [page 249](#)

6 - Connection**7 - Coolant temperature sender - G2- / coolant temperature sender - G62-****8 - Heat exchanger**

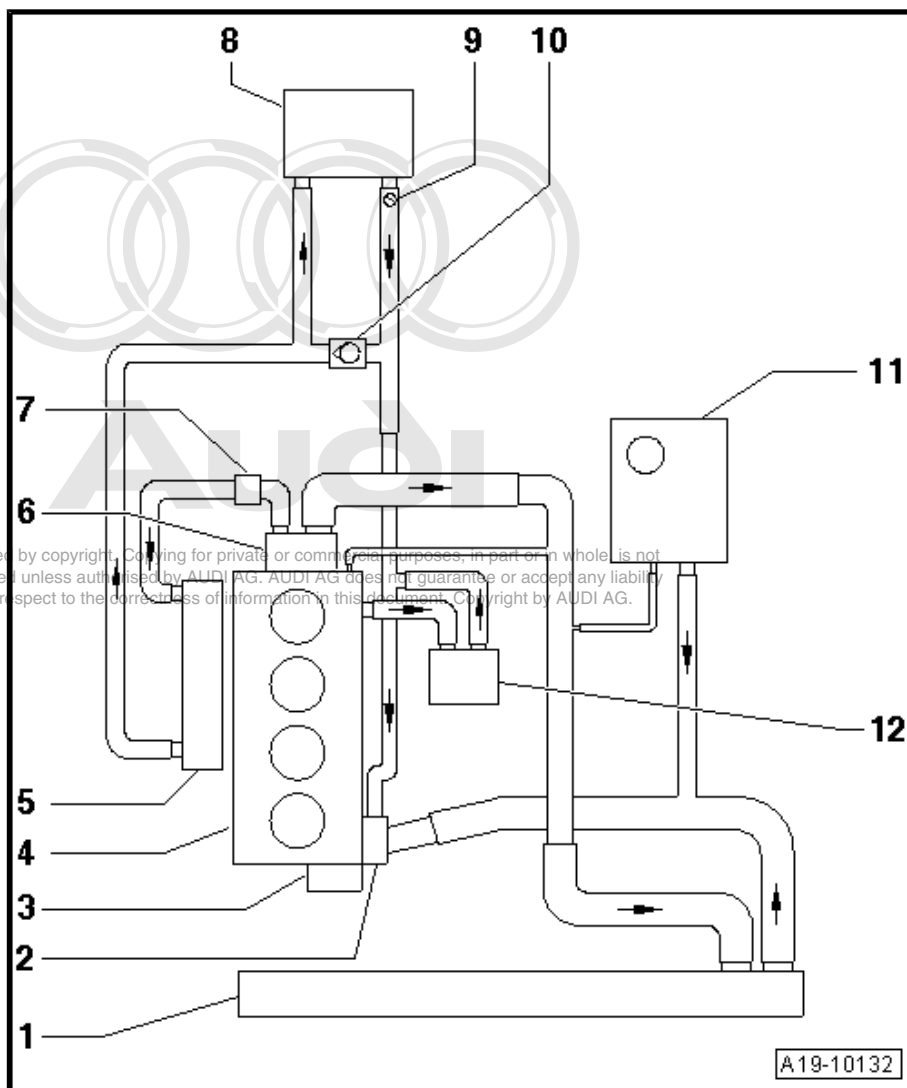
- ☐ If renewed, refill system
with fresh coolant

9 - Bleeder screw**10 - Non-return valve****11 - Expansion tank**

- ☐ With filler cap
- ☐ Checking pressure relief valve in filler cap ⇒ [page 200](#)

12 - Oil cooler

- ☐ If renewed, refill system with fresh coolant
- ☐ Removing and installing ⇒ [“3.2 Removing and installing oil filter bracket with oil cooler”, page 173](#)



Connection diagram - coolant hoses, vehicles with auxiliary heater

1 - Radiator

- ☐ Removing and installing
⇒ [page 194](#)
- ☐ If renewed, refill system with fresh coolant

2 - Thermostat

- ☐ Removing and installing
⇒ [page 190](#)
- ☐ Checking ⇒ [page 192](#)

3 - Coolant pump

- ☐ Removing and installing
⇒ [page 189](#)

4 - Cylinder head/cylinder block

- ☐ If renewed, refill system with fresh coolant

5 - Exhaust gas recirculation cooler

- ☐ If renewed, refill system with fresh coolant
- ☐ Removing and installing
⇒ [page 249](#)

6 - Connection

7 - Coolant temperature sender - G2- / coolant temperature sender - G62-

8 - Heat exchanger

- ☐ If renewed, refill system with fresh coolant

9 - Bleeder screw

10 - Expansion tank

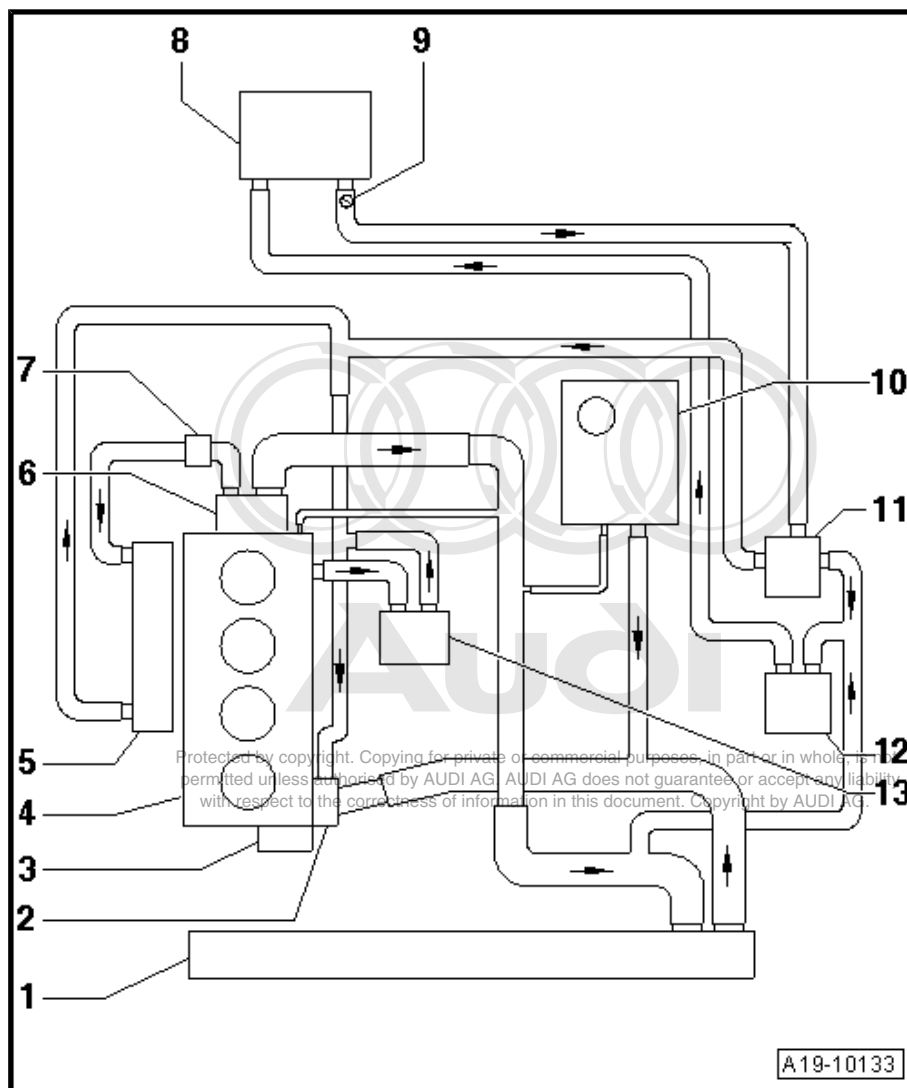
- ☐ With filler cap
- ☐ Checking pressure relief valve in filler cap ⇒ [page 200](#)

11 - Heater coolant shut-off valve - N279-

12 - Auxiliary heater

13 - Oil cooler

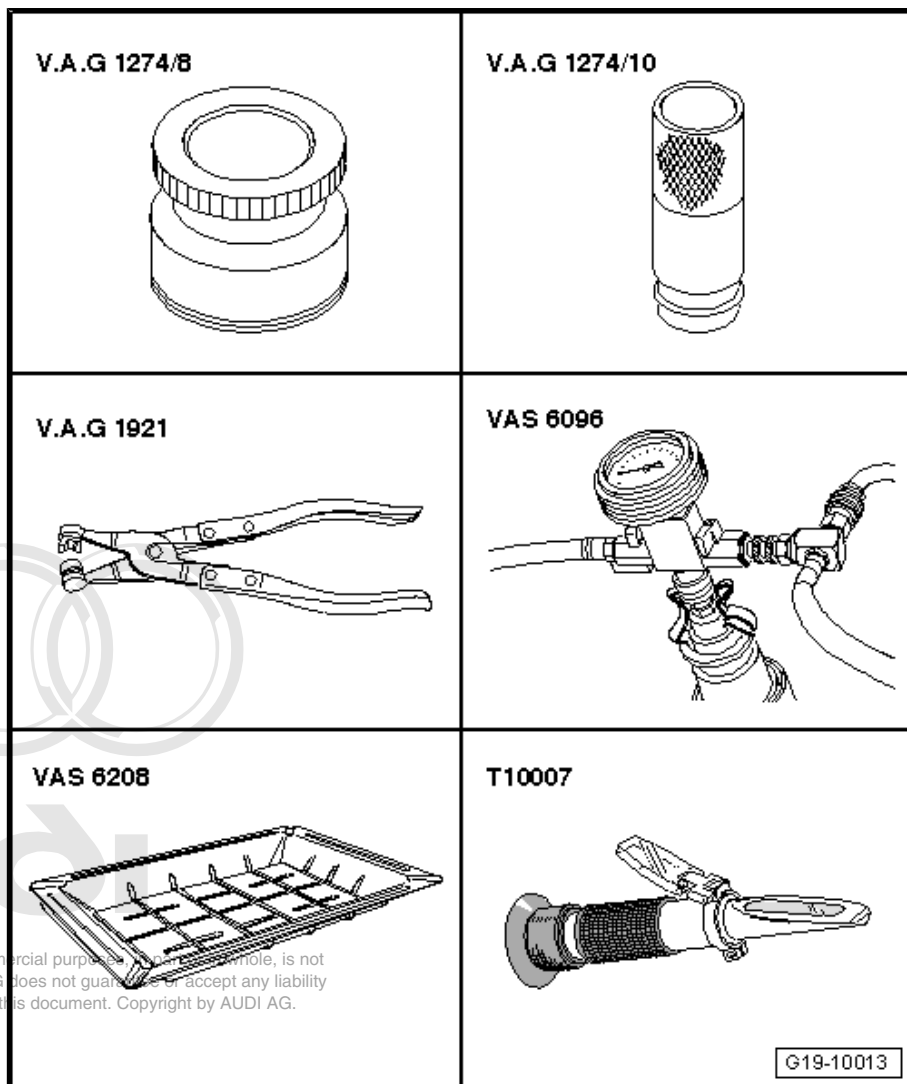
- ☐ If renewed, refill system with fresh coolant
- ☐ Removing and installing ⇒ ["3.2 Removing and installing oil filter bracket with oil cooler", page 173](#)



1.2 Draining and filling cooling system

Special tools and workshop equipment required

- ◆ Adapter - V.A.G 1274/8-
- ◆ Pipe - V.A.G 1274/10-
- ◆ Hose clip pliers - V.A.G 1921-
- ◆ Cooling system charge unit - VAS 6096-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Refractometer - T10007 A-



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Draining



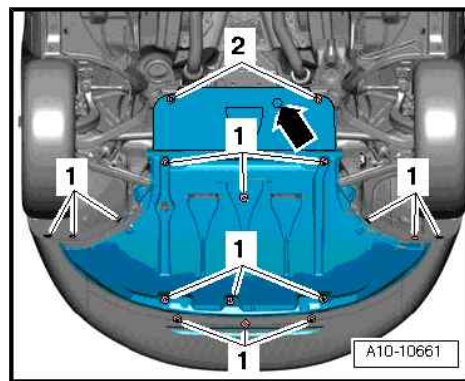
WARNING

Hot steam/hot coolant can escape - risk of scalding.

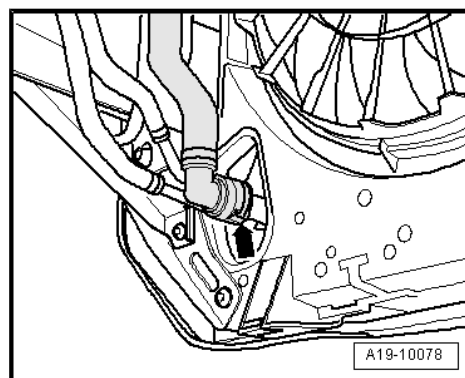
- ◆ *The cooling system is under pressure when the engine is hot.*
- ◆ *To allow pressure to dissipate, cover filler cap on coolant expansion tank with cloth and open carefully.*

- Open filler cap on coolant expansion tank.

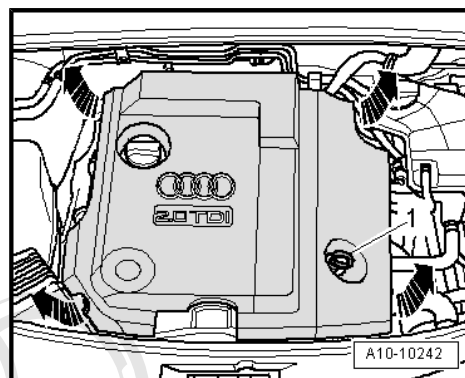
- Remove noise insulation panels ⇒ Rep. gr. 50 .



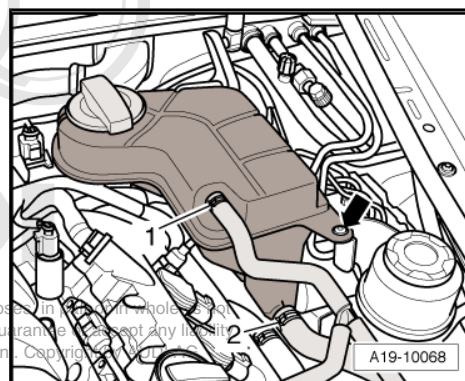
- Place drip tray for workshop hoist - VAS 6208- under engine.
- Detach coolant hose -arrow- at bottom left of radiator.



- Pull dipstick -1- out of guide tube.
- Pull off engine cover panel -arrows-.
- Re-insert dipstick in guide tube.



- Unbolt coolant expansion tank -arrow-.
- Unplug electrical connector for coolant shortage indicator switch - F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -2- attached.



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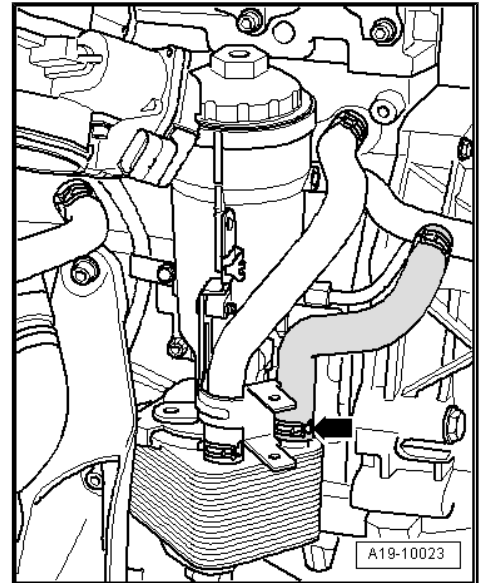
- Disconnect rear coolant hose from oil cooler -arrow-, and drain off remaining coolant.

Filling



Caution

Always use distilled water for mixing coolant additives as this ensures optimum corrosion protection.

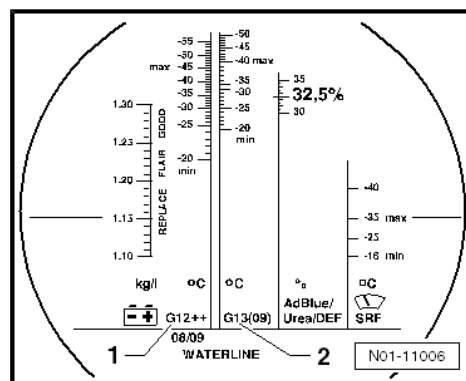


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Note

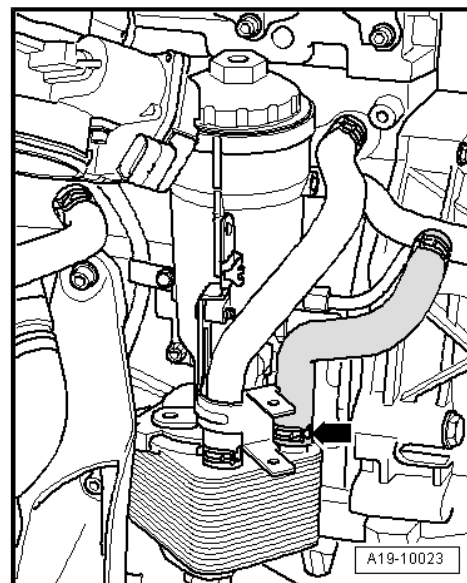
- ◆ *The effectiveness of the coolant is greatly influenced by the quality of the water with which it is mixed. Because water may contain different substances depending on the country or even the region, the water quality to be used for cooling systems has been specified. Distilled water meets all the requirements and is therefore recommended for use when topping up or filling up with coolant.*
- ◆ *Use only coolant additives listed in the ⇒ Electronic parts catalogue (ETKA) . Other coolant additives could seriously impair in particular the anti-corrosion properties. The resulting damage could lead to loss of coolant and consequently to serious engine damage.*
- ◆ *Coolant with the recommended mixture ratio prevents frost and corrosion damage and stops scaling. At the same time it raises the boiling point of the fluid in the system. For this reason the cooling system must be filled all year round with the correct coolant additive.*
- ◆ *Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.*
- ◆ *The refractometer - T10007A- MUST be used to determine the current level of frost protection.*
- ◆ *The mixture must guarantee frost protection down to at least -25 °C (in countries with arctic climate: down to -36 °C). The amount of antifreeze should only be increased if greater frost protection is required in very cold climates. This must only be down to -48 °C, however, as otherwise the cooling efficiency of the coolant is impaired.*
- ◆ *The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. Frost protection must be provided to at least -25 °C.*
- ◆ *Read off the level of frost protection on the scale for the relevant coolant additive.*
- ◆ *The temperature indicated on the refractometer - T10007A- corresponds to the temperature at which the first ice crystals can form in the coolant.*
- ◆ *Do not reuse coolant.*
- ◆ *Only use water/coolant additive as a lubricant for coolant hoses.*



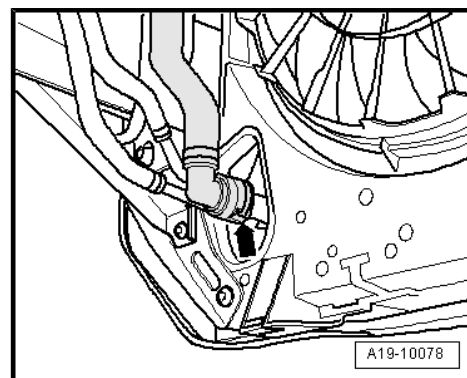
Recommended mixture ratio for coolant

- Coolant additive (40 %) and distilled water (60 %) for frost protection to -25 °C
- Coolant additive (50 %) and distilled water (50 %) for frost protection to -36 °C
- Coolant additive: ⇒ Electronic parts catalogue (ETKA)

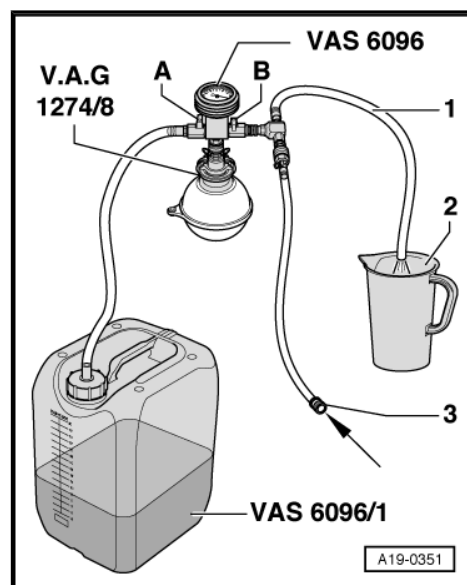
- Connect coolant hose to oil cooler -arrow-.



- Connect coolant hose to lower part of radiator -arrow-.



- Fill reservoir - VAS 6096/1- with at least 9 litres of premixed coolant (based on recommended ratio):
- Run vent hose -1- into a small container -2-. (The vented air draws along a small amount of coolant, which should be collected.)
- Close the two valves -A- and -B- by setting lever at right angle to direction of flow.
- Connect hose -3- to compressed air.
- Pressure: 6 ... 10 bar.



- Open valve -B- by setting lever in direction of flow.

The suction jet pump generates a partial vacuum in the cooling system.

- The needle on the gauge should move into the green zone.
- Also briefly open valve -A- (turn lever in direction of flow) so that hose on reservoir - VAS 6096/1- can fill with coolant.
- Close valve -A- again.
- Leave valve -B- open for another 2 minutes.
- The suction jet pump will continue generating a vacuum in the cooling system.
- The needle on the gauge should remain in the green zone.
- Close valve -B-.
- The needle on the gauge should stop in the green zone. The vacuum level in the cooling system is then sufficient for subsequent filling.

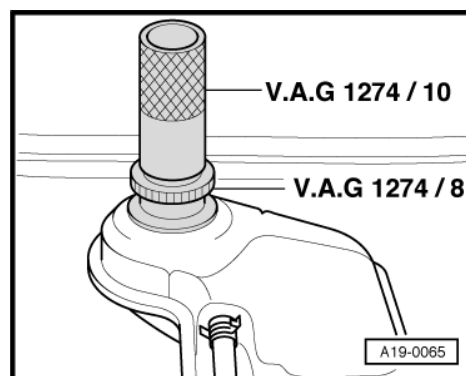
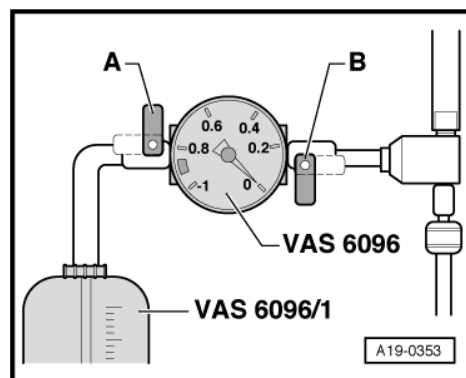
If the needle does not reach the green zone, repeat the process.

If the vacuum level drops, there is a leak in the cooling system.

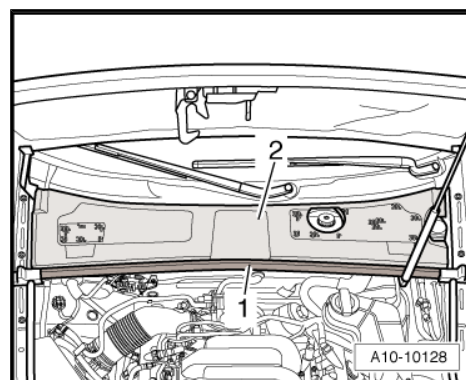
- Detach compressed air hose.
- Open valve -A-.

The partial vacuum in the cooling system causes the coolant to be drawn up out of the reservoir - VAS 6096/1- ; the cooling system is then filled.

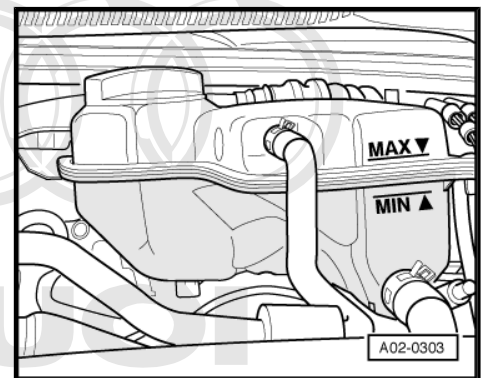
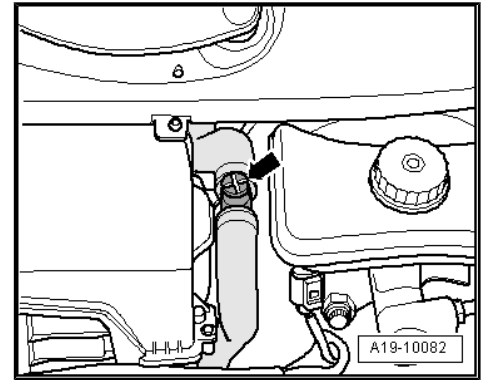
- Detach cooling system charge unit - VAS 6096- from expansion tank.
- Fit pipe - V.A.G 1274/10- onto adapter - V.A.G 1274/8- .



- Pull off rubber seal -1- on plenum chamber cover.
- Detach plenum chamber cover -2-.



- Open bleeder screw -arrow-.
- Fill up with coolant until it flows out at bleeder hole in coolant hose.
- Close bleeder screw.
- On vehicles with auxiliary heater, switch heater on (for about 30 seconds) and then off again.
- Tighten filler cap on expansion tank.
- Start engine.
- Set heater/air conditioner on both sides to "HI".
- Run the engine for 3 minutes at 2000 rpm.
- Allow the engine to run at idling speed until the two large coolant hoses at main radiator become warm.
- Run the engine for 1 minute at 2000 rpm.
- Switch off ignition and allow engine to cool down.
- Check coolant level.
- The coolant level must be at the MAX marking when the engine is cold.
- The coolant level can be above the MAX marking when the engine is warm.



1.3 Removing and installing coolant pump

Removing

- Drain off coolant ⇒ [page 183](#) .
- Move lock carrier to service position ⇒ [page 31](#) .
- Remove toothed belt ⇒ [page 48](#) .

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- Unscrew bolts -1- for coolant pump and remove coolant pump -2-.
- Remove O-ring -3-.

Installing

Installation is carried out in the reverse order; note the following:



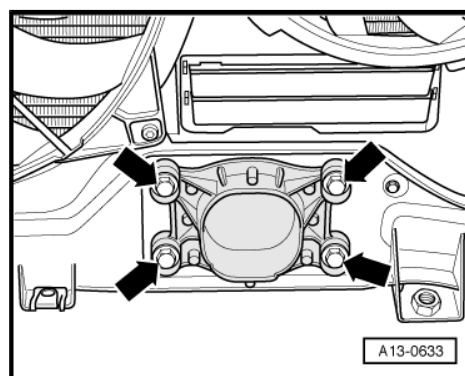
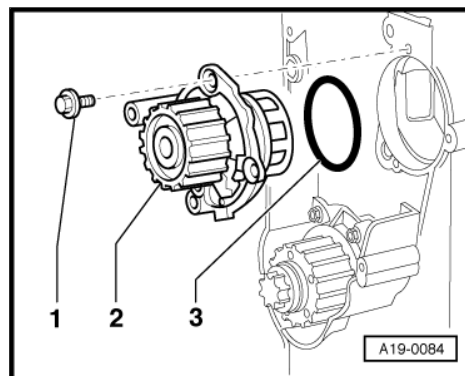
Note

Renew O-ring.

- Clean and smoothen sealing surface for O-ring as required.
- Lubricate new O-ring -3- with coolant additive »G12+«.
- Fit coolant pump -2-.
- Installation position: Sealing plug in housing faces downwards.
- Tighten bolts -1- for coolant pump.
- Install toothed belt (adjust valve timing) ⇒ [page 51](#) .
- Install vibration damper ⇒ [page 39](#) .
- Install poly V-belt ⇒ [page 35](#) .
- Install lock carrier with attachments ⇒ Rep. gr. 50 .
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten bolts -arrows-.
- Install headlights ⇒ Rep. gr. 94 .
- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Fill cooling system ⇒ [page 185](#) .
- Check headlight adjustment ⇒ Maintenance ; Booklet 405 .

Tightening torques

Component	Nm
Coolant pump to cylinder block	15
Stop for torque reaction support to lock carrier	23



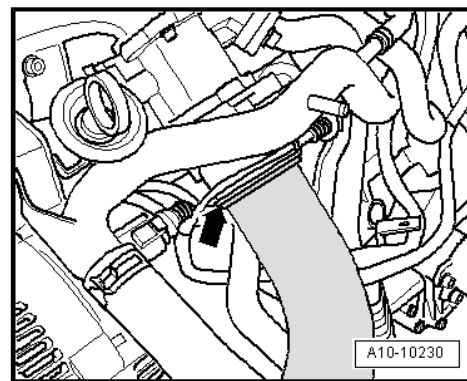
1.4 Removing, installing and checking thermostat

Removing

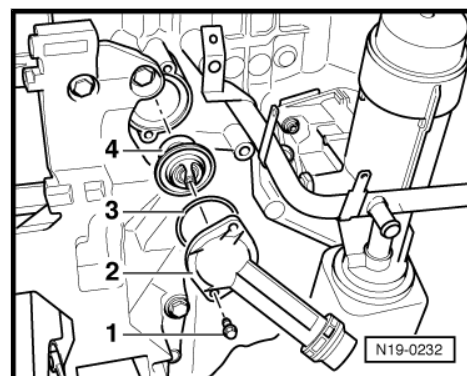
- Drain off coolant ⇒ [page 183](#) .

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- Remove air intake hose at intake manifold flap motor - V157- by lifting retaining clip -arrow- slightly.



- Disconnect bottom coolant hose from hose connection -2-.
- Remove securing bolts -1- for hose connection and remove hose connection with thermostat -4- and O-ring -3-.



- Turn thermostat -item 2- approx. 90° (1/4 turn) anti-clockwise -arrow- and remove it from hose connection.
- Remove O-ring -1-.

Installing

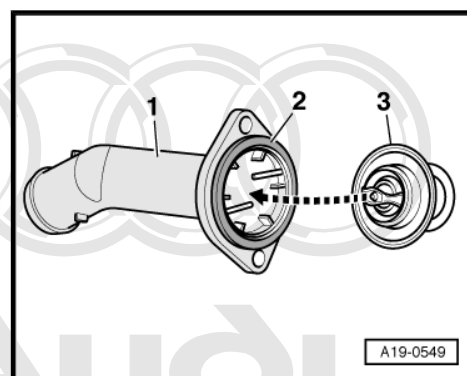
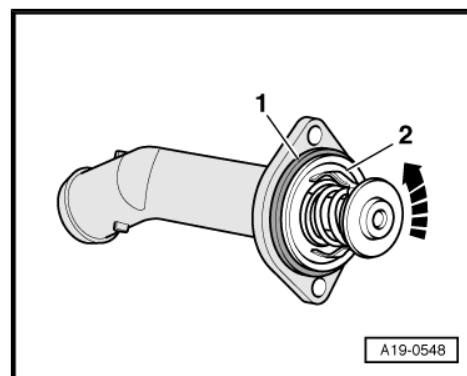
Installation is carried out in the reverse order; note the following:



Note

Renew O-ring.

- Clean and smoothen sealing surface for O-ring as required.
- Insert thermostat -3- with new O-ring -2- into hose connection -1-.
- When inserting, the cross-piece on the thermostat should be horizontal as shown in the illustration.
- Then turn thermostat 90° (1/4 of a turn) clockwise.
- Lubricate new O-ring with coolant additive »G12+«.



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- When installing air intake hoses with plug-in connectors, ensure that the securing clip -arrow- engages audibly on the retaining lug -A-.
- Fill cooling system ⇒ [page 185](#) .

Tightening torque

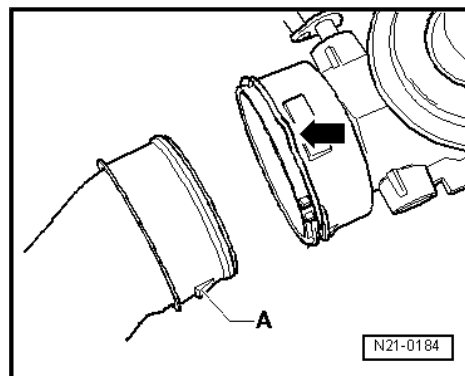
Component	Nm
Connection to cylinder block	13

Checking thermostat

- Heat up the thermostat in hot water.

Starts to open	Fully open	Opening travel
approx. 87 °C	approx. 102 °C ¹⁾	at least 8 mm

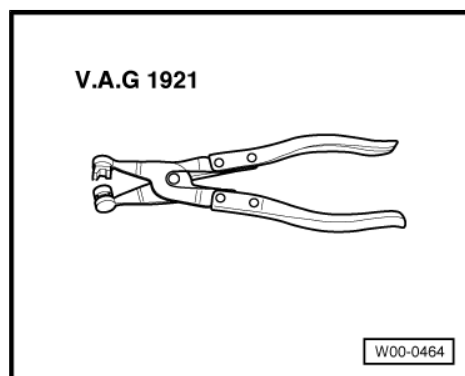
1) Cannot be tested.



1.5 Removing and installing coolant pipe (top)

Special tools and workshop equipment required

- ◆ Hose clip pliers - V.A.G 1921-



Removing

- Drain off coolant ⇒ [page 183](#) .
- Unscrew bolts -1- and -2- and detach top coolant pipe from coolant hoses -arrows-.

Installing

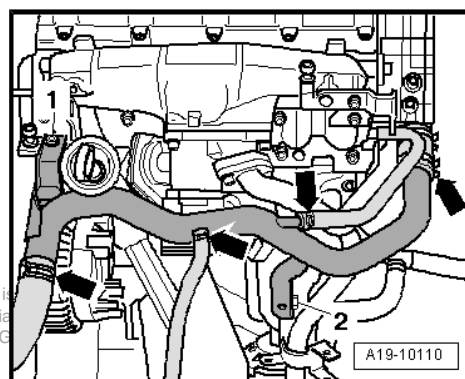
Installation is carried out in the reverse order; note the following:



Note

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Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ *Parts catalogue* .



- Fill cooling system ⇒ [page 185](#) .

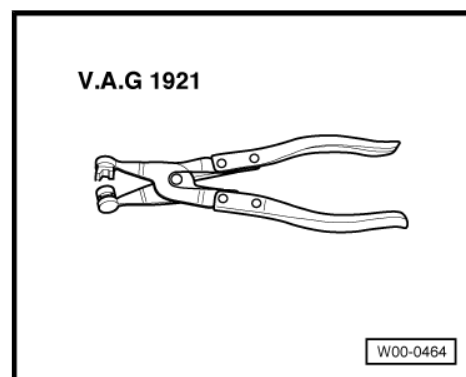
Tightening torques

Component	Nm
Coolant pipe (top) to: Engine lifting eye	10
Oil filter bracket	10

1.6 Removing and installing coolant pipe (bottom)

Special tools and workshop equipment required

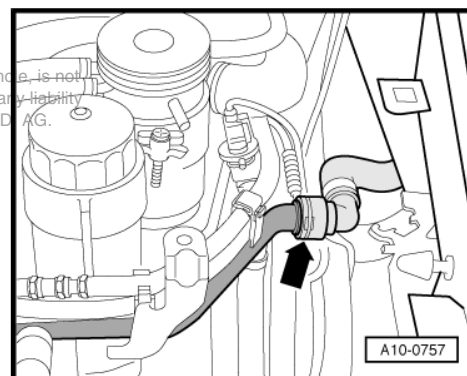
- ◆ Hose clip pliers - V.A.G 1921-



Removing

- Drain off coolant ⇒ [page 183](#) .
- Remove coolant pipe (top) ⇒ [page 192](#) .
- Remove oil filter bracket ⇒ [page 173](#) .
- Disconnect coolant hose -arrow- (leading to heat exchanger) from coolant pipe (bottom).

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- Unscrew securing bolt -1- on coolant pipe.
- Pull coolant pipe out of cylinder block -arrow-.

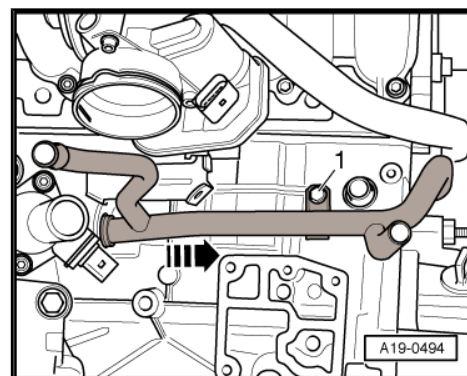
Installing

Installation is carried out in the reverse order; note the following:



Note

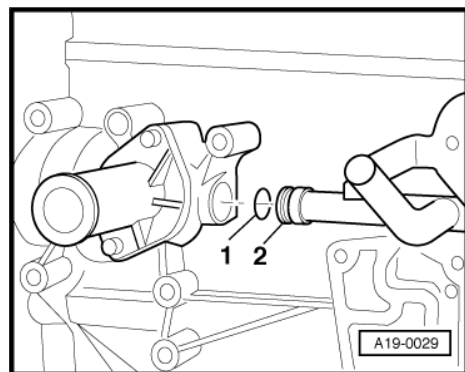
- ◆ *Renew seals.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*
- Clean and smoothen contact surface for seal.



- Lubricate new seal -1- with »G 12+« and push onto coolant pipe -2-.
- Push coolant pipe into bore on cylinder block.
- Install oil filter bracket ⇒ [page 173](#) .
- Install coolant pipe (top) ⇒ [page 192](#) .
- Fill up with engine oil and check oil level ⇒ [page 178](#) .
- Fill cooling system ⇒ [page 185](#) .

Tightening torque

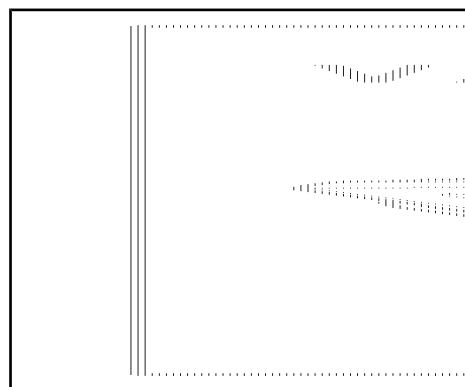
Component	Nm
Coolant pipe to cylinder block	15



1.7 Removing and installing radiator

Special tools and workshop equipment required

- ♦ Drip tray for workshop hoist - VAS 6208-

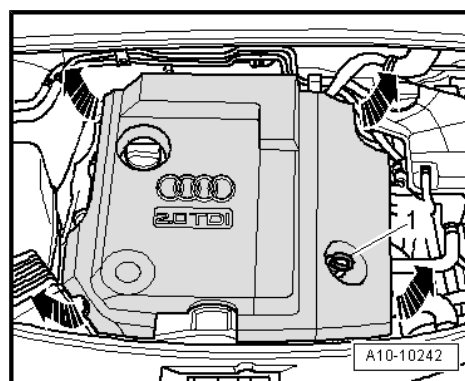


Removing



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

- Pull dipstick -1- out of guide tube.
- Pull off engine cover panel -arrows-.
- Re-insert dipstick in guide tube.
- Unscrew bolts -2- and -3- at brackets for refrigerant pipes.

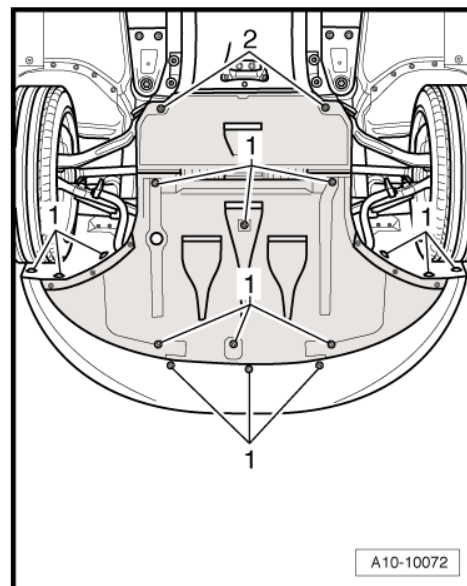


WARNING

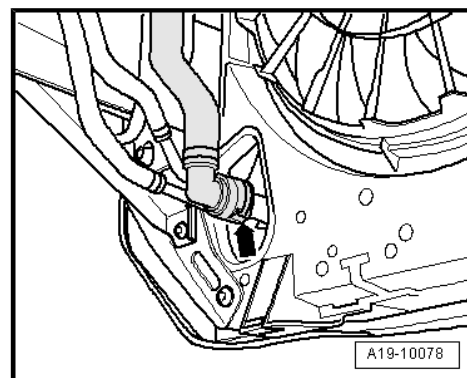
Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

- Open filler cap on coolant expansion tank.
- Remove both front wheels.

- Open quick-release fasteners -1- and remove noise insulation (front).
- Remove front sections of front wheel housing liners (left and right) ⇒ Rep. gr. 66 .
- Remove bumper cover (front) ⇒ Rep. gr. 63 .



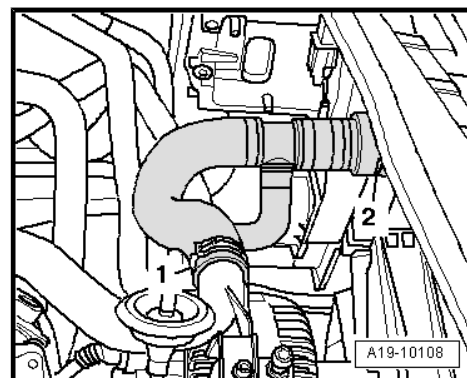
- Place drip tray for workshop hoist - VAS 6208- under engine.
- Disconnect coolant hose -arrow- at bottom left of radiator and drain off coolant.



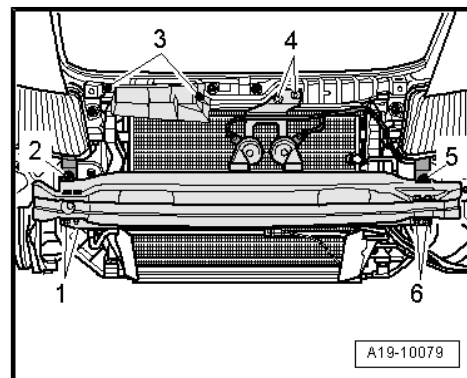
- Detach coolant hose at top left of radiator -2-.

**Note**

Disregard -item 1-.

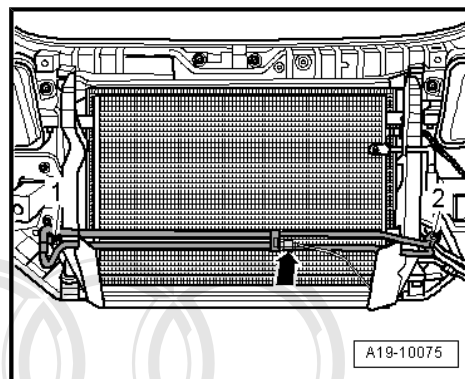


- Unscrew bolts -3- and detach air duct.
- Unscrew bolts -4- and remove bracket for horns; electrical wiring remains attached.
- Unbolt brackets -2- and -5- for headlights.
- Unscrew nuts -1- and -6- and remove bumper.



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- Unclip ambient temperature sensor - G17- -arrow- from bracket.
- Unscrew bolts -1- and -2- for power steering cooling pipe; the hydraulic hoses remain attached.



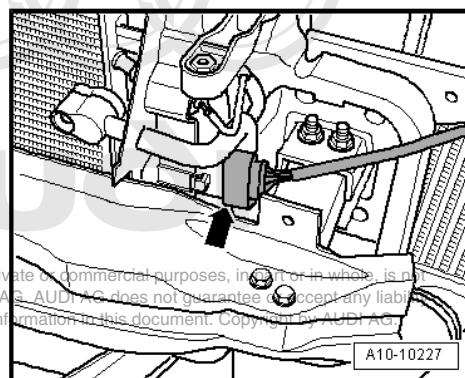
- Unplug electrical multi-pin connector -arrow-.
- Detach air ducts (left and right) from radiator.



Caution

The air conditioner refrigerant circuit must not be opened.

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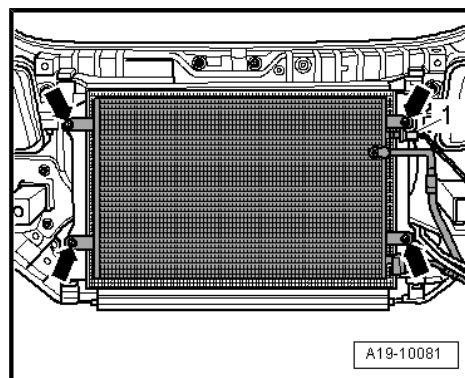
- Unplug electrical connector -1-.
- Remove bolts -arrows-.



Note

To prevent damage to the air conditioner compressor and refrigerant pipes/hoses, ensure that the pipes and hoses are not stretched, kinked or bent.

- Pivot condenser downwards with pipes/hoses attached.



- Release two retaining pins for radiator and pull out upwards -arrows-.
- Swivel radiator forwards and lift off.

Installing

Installation is carried out in the reverse order; note the following:



Note

Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .

- Install front bumper ⇒ Rep. gr. 63 .
- Install front wheel housing liners (right and left) ⇒ Rep. gr. 66 .
- Fill cooling system ⇒ [page 185](#) .



Note

The coolant in the entire system must be changed if the radiator is renewed.

Tightening torques

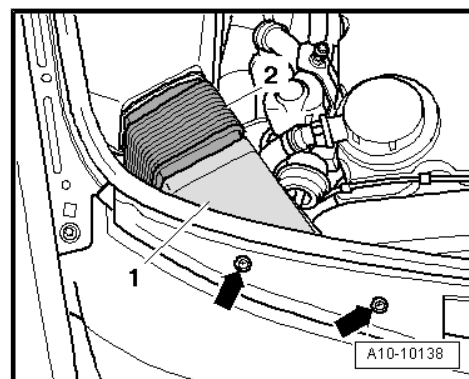
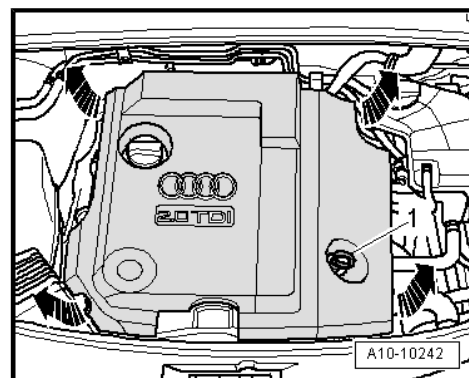
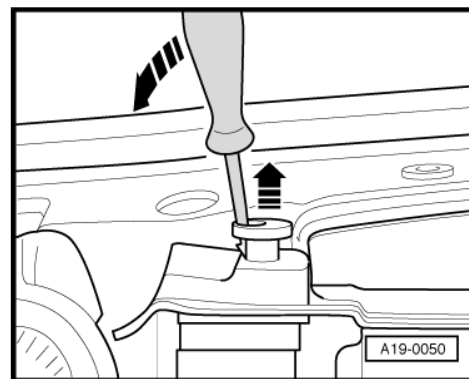
Component	Nm
Condenser to lock carrier	6
Power steering cooling pipe to condenser	9
Bracket for horns to lock carrier	8

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1.8 Removing and installing radiator cowl

Removing

- Move lock carrier to service position ⇒ [page 31](#) .
- Pull dipstick -1- out of guide tube.
- Pull off engine cover panel -arrows-.
- Re-insert dipstick in guide tube.
- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.



- Unplug electrical connector -1- for radiator fan.
- Unscrew bolts -arrows- and lift out radiator cowl.

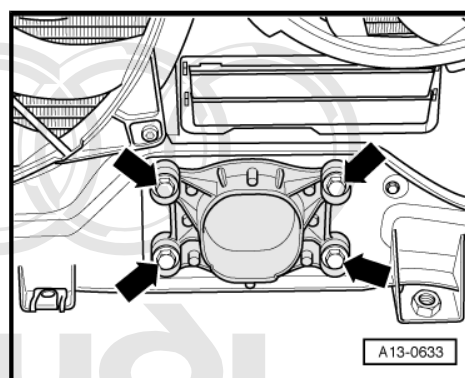
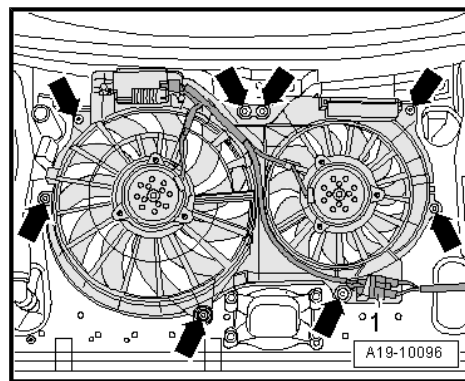
Installing

Installation is carried out in the reverse order; note the following:

- Install lock carrier with attachments ⇒ Rep. gr. 50 .
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten bolts -arrows-.
- Install headlights ⇒ Rep. gr. 94 .
- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Check headlight adjustment ⇒ Maintenance ; Booklet 405 .

Tightening torques

Component		Nm
Radiator cowl to	M6	11
Lock carrier	Panel bolt	2
Stop for torque reaction support to lock carrier		23



1.9 Removing and installing radiator fan

Removing

- Remove radiator cowl ⇒ [page 197](#) .
- Move wiring clear.
- Remove bolts -1 ... 8-.
- Remove radiator fan with control unit.

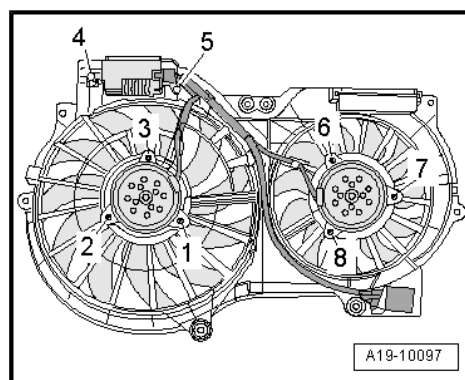
Installing

Installation is carried out in the reverse order; note the following:

- Install radiator cowl ⇒ [page 197](#) .

Tightening torque

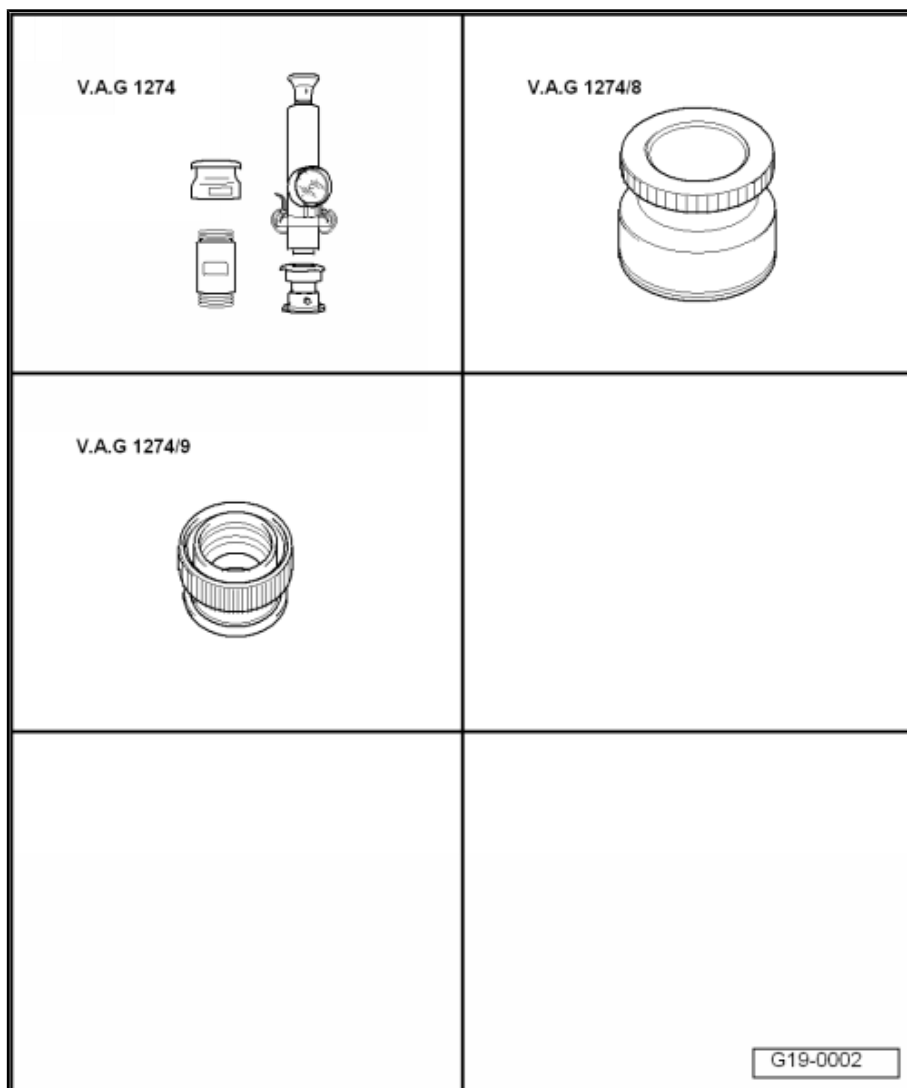
Component		Nm
Radiator fan	Single fan	3
to radiator cowl	Dual fan	4.5



1.10 Checking cooling system for leaks

Special tools and workshop equipment required

- ◆ Cooling system tester - V.A.G 1274-
- ◆ Adapter for cooling system tester - V.A.G 1274/8-
- ◆ Adapter for cooling system tester - V.A.G 1274/9-

**Test condition**

- Engine must be warm.

Test sequence**WARNING**

Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

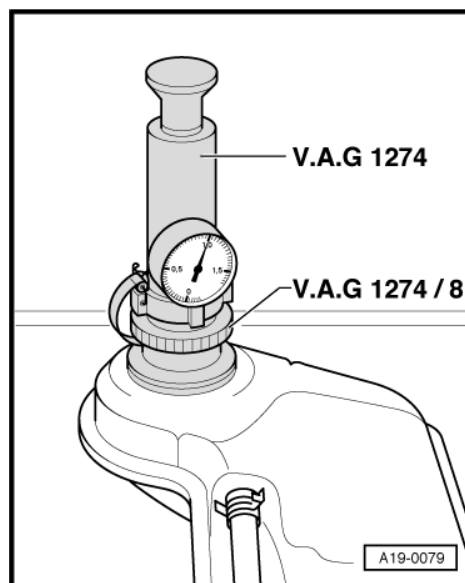
- Open filler cap on coolant expansion tank.

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- Attach cooling system tester - V.A.G 1274- with adapter - V.A.G 1274/8- to expansion tank.
- Use hand pump on cooling system tester to create a pressure of approx. 1.0 bar.

If the pressure drops:

- Trace leak and repair.

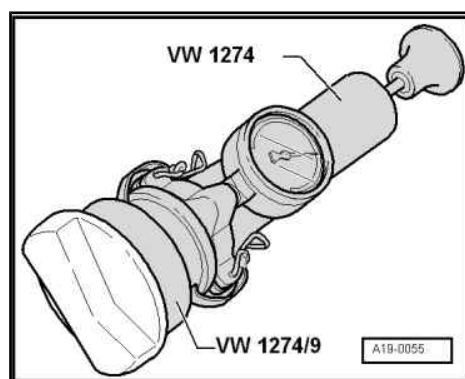


Checking pressure relief valve in filler cap

- Attach cooling system tester - V.A.G 1274- with adapter - V.A.G 1274/9- to filler cap.
- Use hand pump on cooling system tester to create pressure.
- The pressure relief valve should open at a pressure of 1.4 ... 1.6 bar.

If the pressure relief valve does not open as described:

- Renew filler cap.



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21 – Turbocharging/supercharging

1 Servicing charge air system with turbocharger

1.1 Rules for cleanliness

When working on the turbocharger, pay careful attention to the following “5 rules”:

- ◆ Thoroughly clean all unions and surrounding areas before disconnecting.
- ◆ Place parts that have been removed on a clean surface and cover them over. Do not use fluffy cloths.
- ◆ Carefully cover or seal open components if repairs cannot be carried out immediately.
- ◆ Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have been previously unpacked and stored away loose (e.g. in toolboxes, etc.).
- ◆ When the system is open: Do not work with compressed air if this can be avoided. Do not move the vehicle unless absolutely necessary.

1.2 Turbocharger - exploded view

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1 - 15 Nm

- ☐ Property class 10.9; use only genuine bolts (same as original equipment) ⇒ Parts catalogue

2 - Oil return line

- ☐ To cylinder block
- ☐ Tighten union nut to 40 Nm

3 - Gasket

- ☐ Renew

4 - Connection, 40 Nm

5 - Seal

- ☐ Renew

6 - 20 Nm

7 - Gasket

- ☐ Renew

8 - Front exhaust pipe with catalytic converter

- ☐ Removing and installing ⇒ [page 219](#)

9 - 23 Nm

- ☐ Renew

10 - Seal

- ☐ Renew

11 - Connection, 30 Nm

12 - 10 Nm

13 - To oil filter bracket

14 - Oil supply line

- ☐ Tighten union nut to 22 Nm

15 - Vacuum hose

- ☐ From charge pressure control solenoid valve - N75-

16 - 25 Nm

- ☐ Renew

- ☐ Coat with high-temperature lubricant; for high-temperature lubricant refer to ⇒ Parts catalogue

17 - Turbocharger

- ☐ Removing and installing ⇒ [page 203](#)

18 - Hose clip, 3.5 Nm

19 - Crankcase breather hose

20 - 8 Nm

21 - Air hose

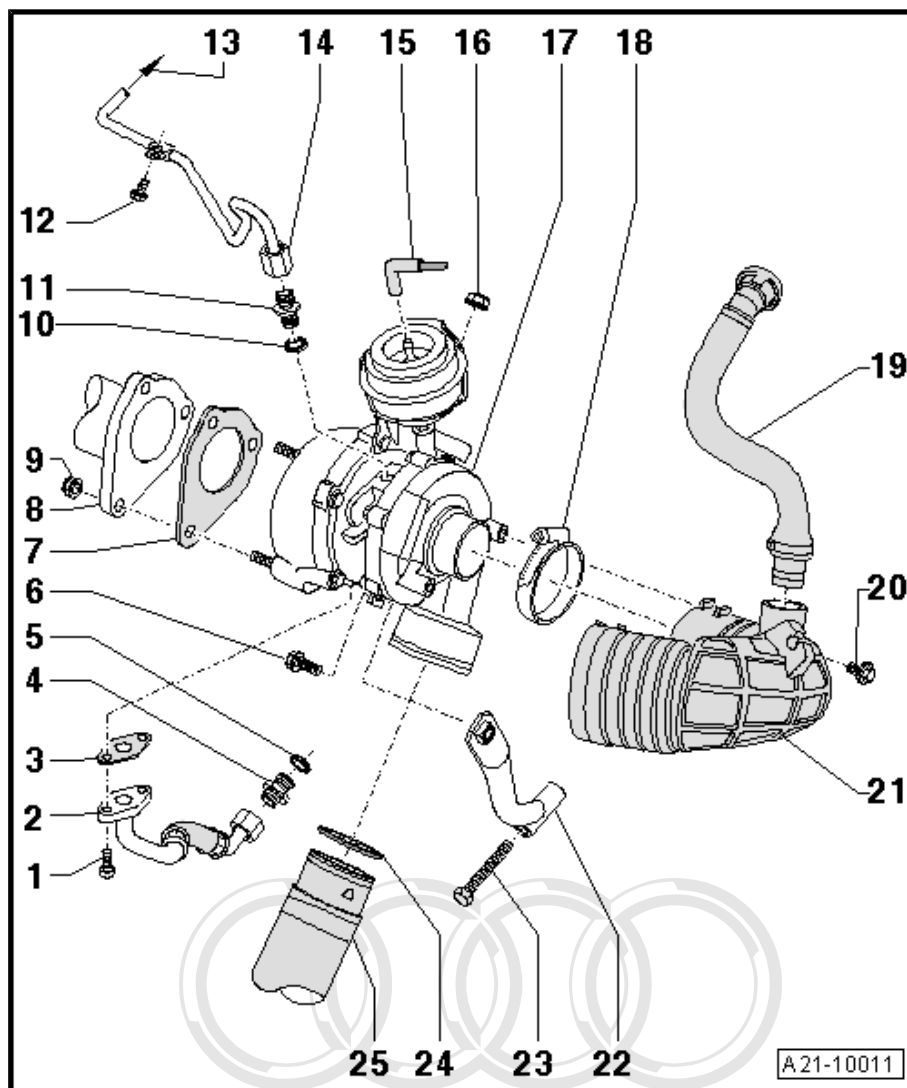
- ☐ To air cleaner housing

22 - Support

23 - 40 Nm

24 - Seal

- ☐ Renew if damaged or leaking



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25 - Air intake hose to charge air cooler

1.3 Removing and installing turbocharger

Removing



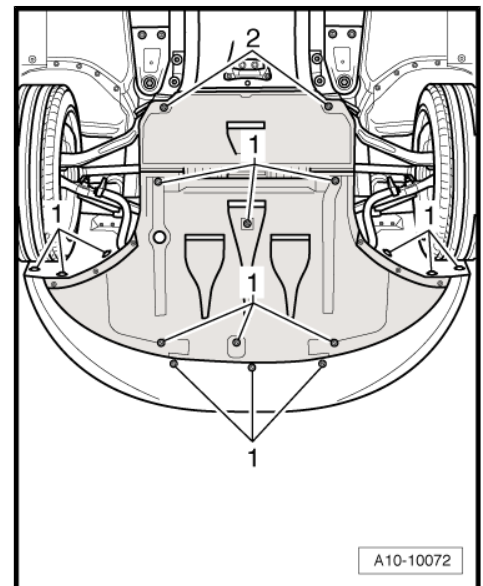
Caution

If the turbocharger has suffered mechanical damage (e.g. damaged compressor wheel), it is not sufficient merely to fit a new turbocharger. The following work must be performed in order to avoid further damage:

- ◆ *Check air cleaner housing, air filter element and air hoses for dirt and foreign particles.*
- ◆ *Check the entire charge air system (including the charge air cooler) for foreign matter.*
- ◆ *If foreign matter is found in the charge air system, clean all relevant ducts and hoses and renew charge air cooler if necessary.*

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- Release quick-release fasteners -1- and -2- and take off noise insulation panels.

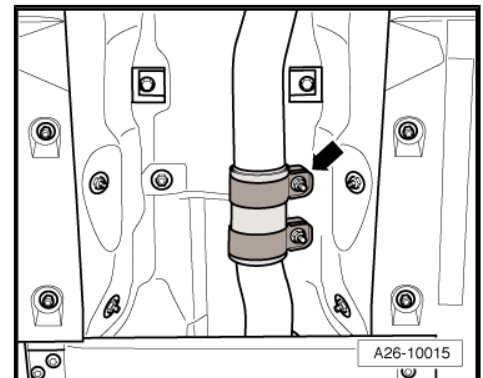


Vehicles without particulate filter:

- Disconnect exhaust system at clamp -arrow- and push clamp back.

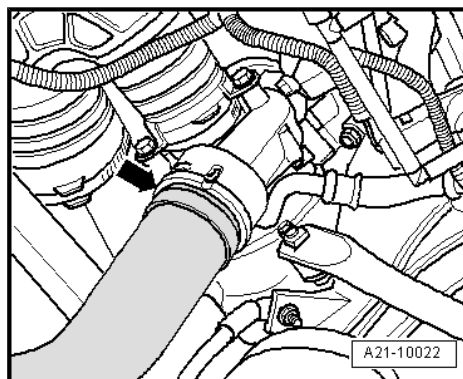
Vehicles with particulate filter:

- Remove front exhaust pipe ⇒ [page 217](#) .



All vehicles:

- Detach air intake hose from turbocharger by lifting retaining clip -arrow- slightly.



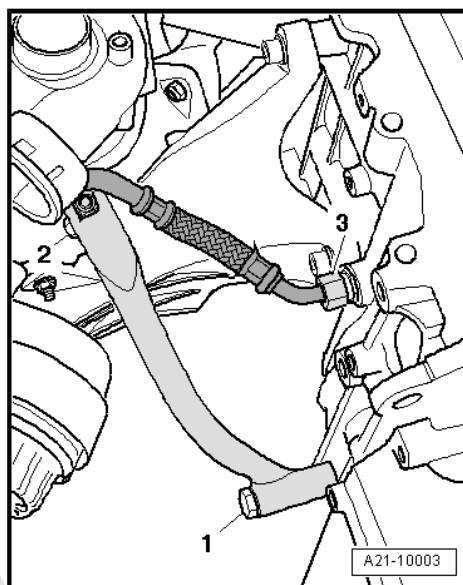
- Remove bolts -1- and -2- and detach support for turbocharger.



Note

Place a cloth underneath to catch any escaping oil.

- Remove oil return line -3- at cylinder block.

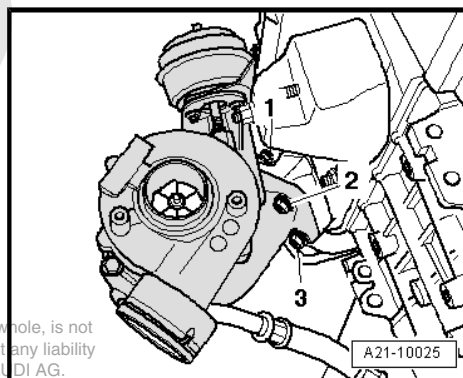


- Unscrew nuts -2- and -3- (accessible from below) connecting turbocharger to exhaust manifold.

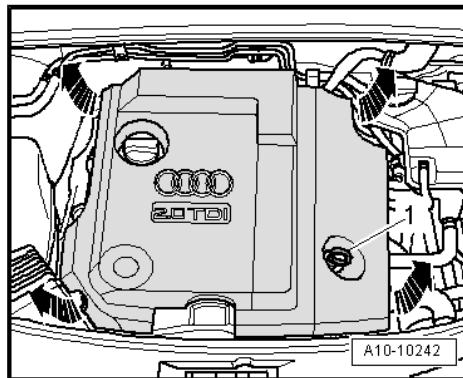


Note

Disregard -item 1-.



- Pull dipstick -1- out of guide tube.
- Pull off engine cover panel -arrows-.
- Re-insert dipstick in guide tube.



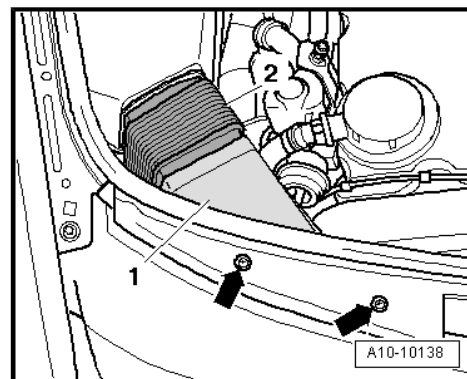
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- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.

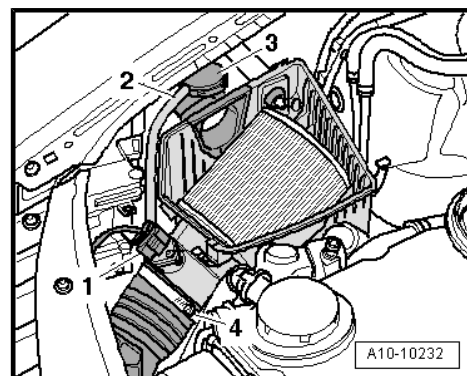
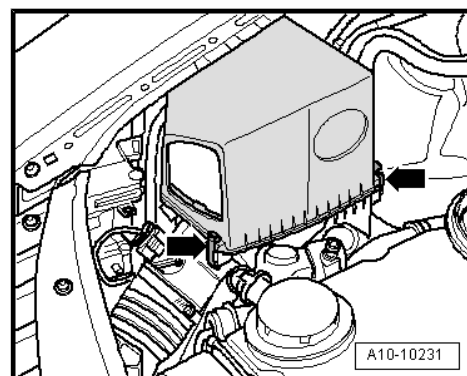
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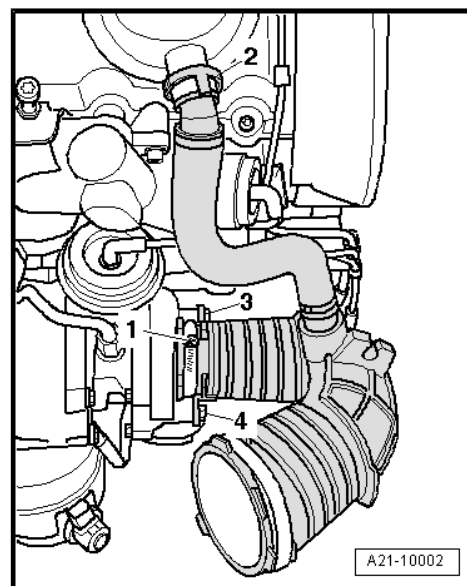
- Release two retaining clips -arrows- and detach top section of air cleaner housing.



- Unplug electrical connector -1- at air mass meter - G70- .
- Loosen hose clip -4- to remove air intake hose.
- Detach vacuum hose -2-.
- Lift off vacuum unit -3- with air flap from air cleaner housing.
- Disengage bottom section of air cleaner housing from retaining pin and remove.



- Detach crankcase breather hose -2- from cylinder head cover.
- Remove bolts -3- and -4-.
- Detach hose -1- between charge air cooler and turbocharger.



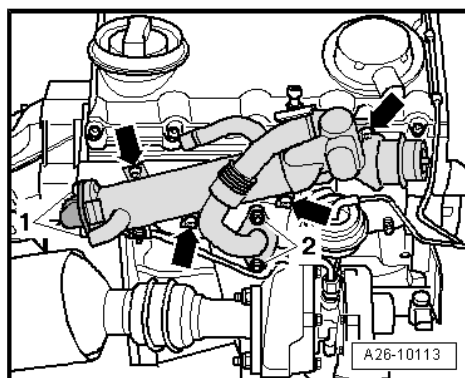
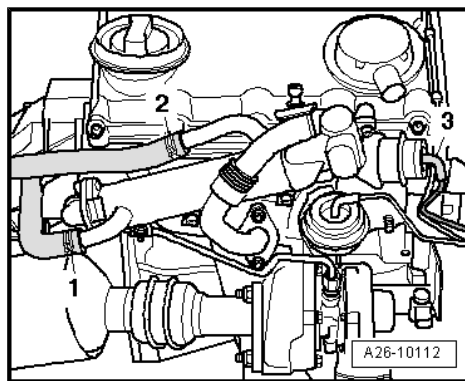
- Detach vacuum line -3-.



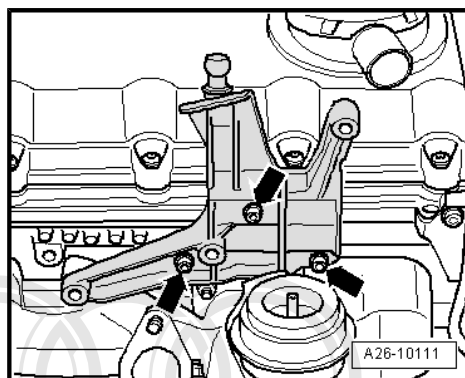
Note

Coolant hoses -1- and -2- remain connected.

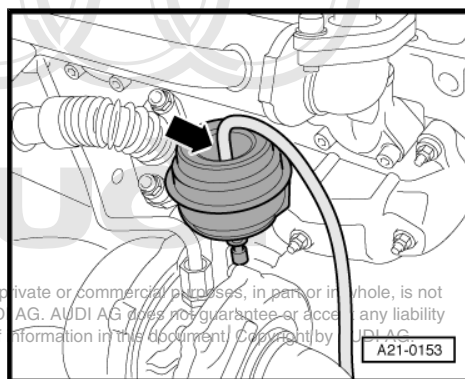
- Unscrew bolts -1- and nuts -2-.
- Remove bolts -arrows-.
- Remove exhaust gas recirculation cooler and lay it aside with coolant hoses connected.



- Detach bracket for exhaust gas recirculation cooler from cylinder head -arrows-.



- Disconnect hose -arrow- from vacuum unit for charge pressure control.



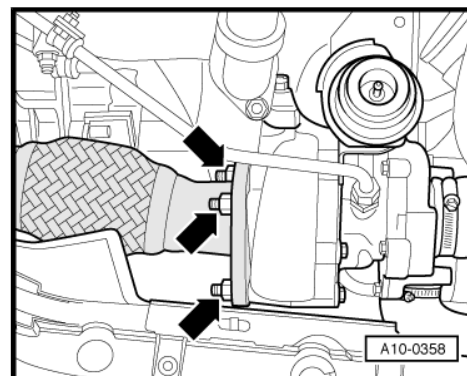
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Vehicles without particulate filter:

Note

To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.

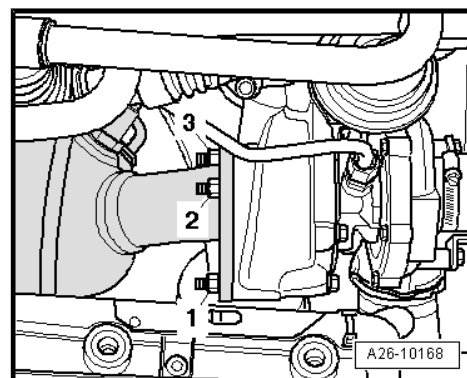
- Unscrew securing nuts connecting turbocharger to catalytic converter -arrows- and detach front exhaust pipe from turbocharger.


Vehicles with particulate filter:

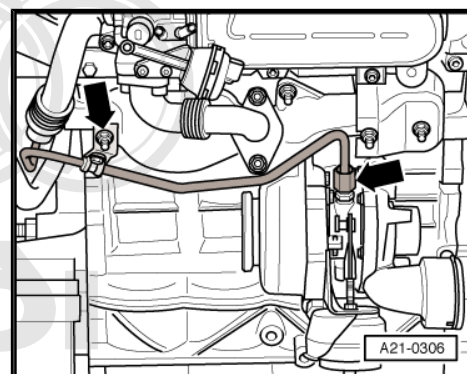
- Unscrew securing nuts connecting turbocharger to particulate filter -1 ... 3- and push particulate filter slightly towards the rear.


Note

The particulate filter remains in the vehicle.


All vehicles:

- Unscrew oil supply line at turbocharger and exhaust manifold -arrows-.



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- Unscrew securing nut accessible from above -1- connecting turbocharger to exhaust manifold and remove turbocharger.



Note

Disregard items -2- and -3-.

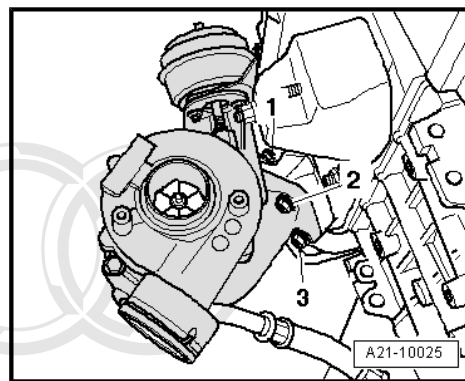
Installing

Installation is carried out in the reverse order; note the following:



Note

- ◆ Renew gaskets, seals and self-locking nuts.
- ◆ Fill turbocharger with engine oil at connection for oil supply line.
- ◆ Charge air system must be free of leaks!
- ◆ Hose connections and hoses for charge air system must be free of oil and grease before assembly.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .



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- When installing air intake hoses with plug-in connectors, ensure that the securing clip -arrow- engages audibly on the retaining lug -A-.
- Install exhaust gas recirculation cooler ⇒ [page 249](#) .

Vehicles without particulate filter:

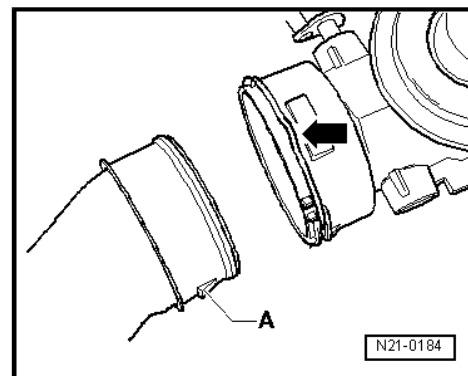
- Install front exhaust pipe together with catalytic converter ⇒ [page 219](#) .
- Align exhaust system so it is free of stress ⇒ [page 221](#) .

Vehicles with particulate filter:

- Install front exhaust pipe ⇒ [page 230](#) .
- Align exhaust system so it is free of stress ⇒ [page 235](#) .

All vehicles:

- Check oil level ⇒ [page 178](#) .



Note

After installing turbocharger, allow engine to idle for approx. 1 minute and do not rev up immediately to ensure turbocharger is supplied with oil.

Tightening torques

Component	Nm
Turbocharger to exhaust manifold	25 ¹⁾²⁾
Support for turbocharger to turbocharger	20
Support for turbocharger to cylinder block	40
Oil return line to cylinder block	40
Oil supply line to turbocharger	22
Bracket for oil supply line to exhaust manifold	22
Bracket for exhaust gas recirculation cooler to cylinder head	10
Air intake hose to turbocharger	8
Hose clips (9 mm wide)	3.5
Hose clips (13 mm wide)	5.5
• ¹⁾ Renew nuts. • ²⁾ Coat threads and contact surface of bolt heads with high-temperature paste; for high-temperature paste refer to ⇒ Parts catalogue .	

1.4 Charge air cooling - exploded view

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Note

Illustration shows left-side charge air cooler.

1 - Air hose

- ☐ To turbocharger
- ☐ Must be free of oil and grease when installing

2 - Charge air cooler

- ☐ Removing and installing
⇒ [page 210](#)

3 - Hose clip (reinforced), 5.5 Nm

4 - Air hose

- ☐ To intake manifold
- ☐ Must be free of oil and grease when installing

5 - Seal

- ☐ Renew if damaged or leaking

6 - O-ring

- ☐ Renew

7 - Charge pressure sender - G31- / intake air temperature sender - G42-

- ☐ Removing and installing
⇒ [page 211](#)

8 - 5 Nm

9 - Retainer

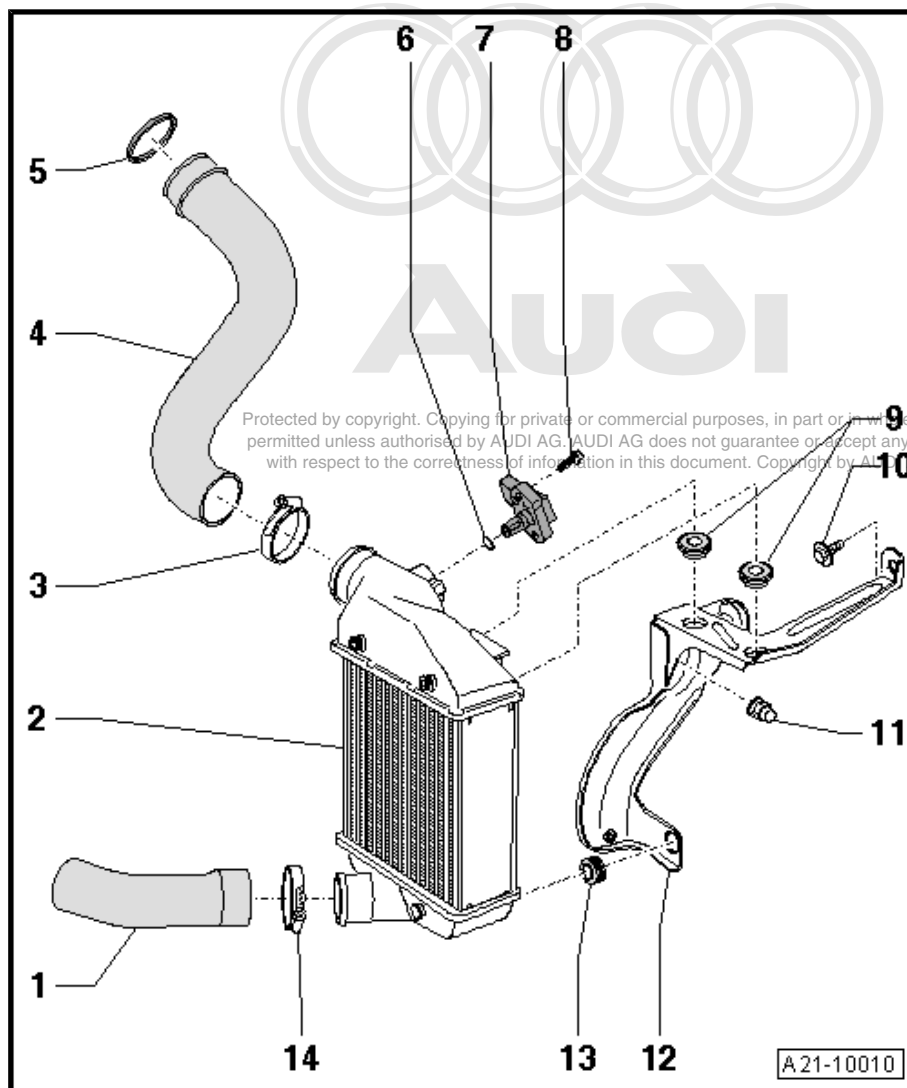
10 - 22 Nm

11 - 22 Nm

12 - Bracket for charge air cooler

13 - Rubber grommet

14 - Hose clip (reinforced), 5.5 Nm



1.5 Removing and installing charge air cooler



Note

Check all hoses and pipes for correct fitting and leakage before carrying out tests or repairs.

Removing

- Remove bumper cover (front) ⇒ Rep. gr. 63 .
- Remove left headlight ⇒ Rep. gr. 94 .

- Unplug electrical connector -1- at charge pressure sender - G31- / intake air temperature sender - G42- .
- Open hose clips -arrows- and disconnect air intake hoses.
- Detach charge air cooler by pulling upwards.

Installing

Installation is carried out in the reverse order; note the following:



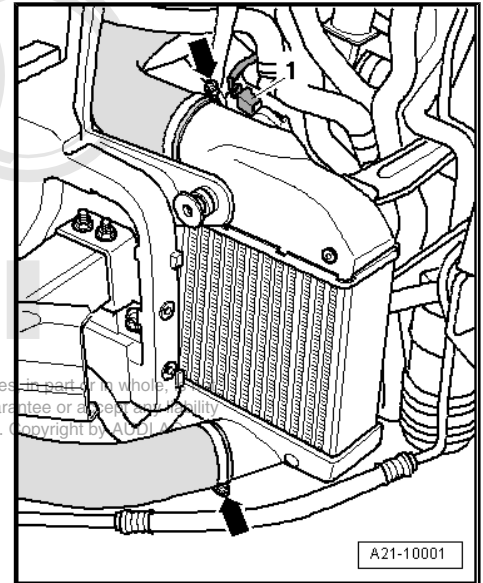
Note

- ◆ *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*

- Install headlight ⇒ Rep. gr. 94 .
- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Check headlight adjustment ⇒ Maintenance ; Booklet 405 .

Tightening torque

Component	Nm
Hose clips (13 mm wide)	5.5



1.6 Removing and installing charge pressure sender - G31- / intake air temperature sender - G42-

Removing

- Remove bumper cover (front) ⇒ Rep. gr. 63 .
- Remove left headlight ⇒ Rep. gr. 94 .
- Unplug electrical connector -1- at charge pressure sender - G31- / intake air temperature sender - G42- .
- Remove bolts -2- and pull charge pressure sender - G31- / intake air temperature sender - G42- out of charge air cooler.

Installing

Installation is carried out in the reverse order; note the following:



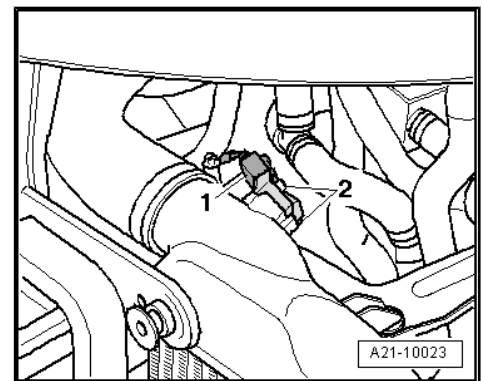
Note

Renew O-ring.

- Install headlight ⇒ Rep. gr. 94 .
- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Check headlight adjustment ⇒ Maintenance ; Booklet 405 .

Tightening torque

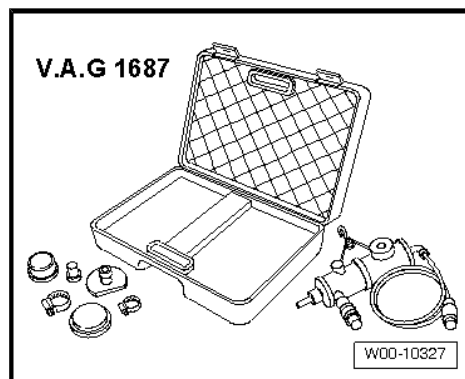
Component	Nm
Charge pressure sender - G31- / intake air temperature sender - G42- to charge air cooler	5



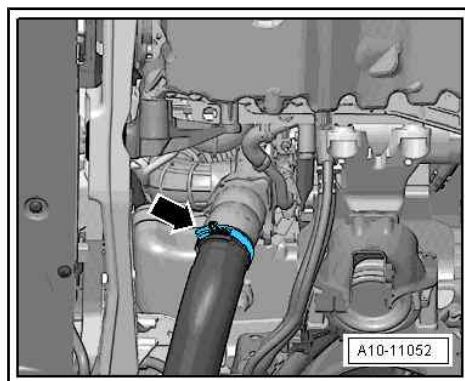
1.7 Checking charge air system for leaks

Special tools and workshop equipment required

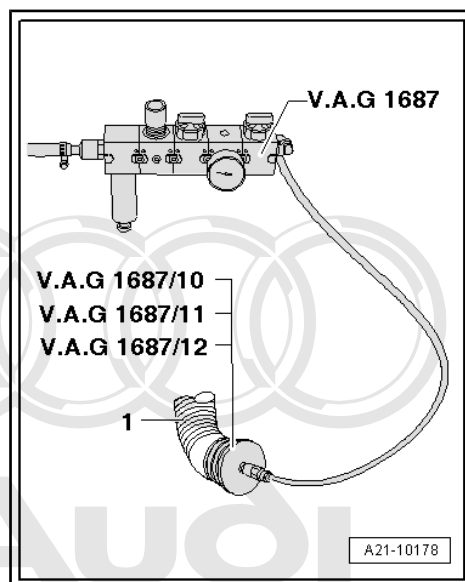
- ◆ Charge air system tester - V.A.G 1687-



- Remove noise insulation ⇒ Rep. gr. 50 .
- Open hose clip -arrow-, detach air hose and swivel to side.



- Depending on hose diameter, insert adapter - 1687/10- , -1687/11- or -1687/12- into air hose -1- and secure with hose clip.
- Connect charge air system tester - V.A.G 1687- as shown on illustration.



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Prepare charge air system tester - V.A.G 1687- as follows:

- Unscrew pressure control valve -2- completely and close valves -3- and -4-.



Note

Make sure knob is pulled out before turning pressure control valve -2-.

- Using a commercially available connection piece, connect charge air system tester - V.A.G 1687- to compressed air -1-.



Note

If there is water in sight glass, remove drain plug -6- and drain water.

- Open valve -3-.



Caution

Risk of damage if pressure is set too high.

- ◆ ***The pressure must not exceed 0.5 bar.***

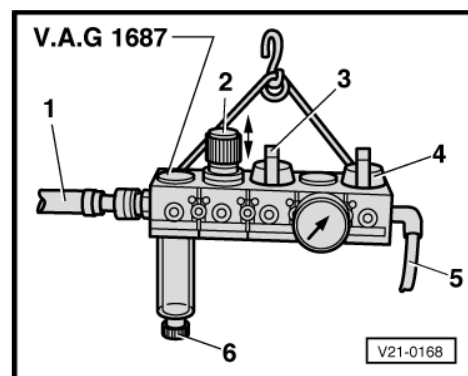
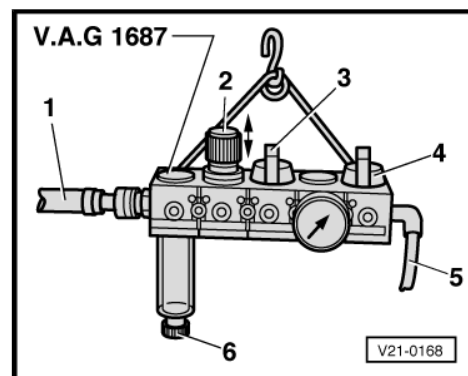
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- Adjust pressure to 0.5 bar via pressure control valve -2-.
- Open valve -4- and wait until test system is pressurised. If necessary, adjust pressure to 0.5 bar again.
- Check charge air system for audible leaks or leaks that can be felt with the hand; apply commercially available leak detecting spray or use ultrasonic tester - V.A.G 1842- .



Note

- ◆ *A small amount of air escapes through the valves and enters the engine. Therefore it is not possible to perform a pressure retention test.*
- ◆ *Operation of ultrasonic tester - V.A.G 1842- ⇒ Operating instructions .*
- ◆ *Release pressure in test circuit by detaching coupling from adapter before removing adapter.*
- ◆ *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *To ensure that the air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*



26 – Exhaust system

1 Removing and installing parts of exhaust system (vehicles without particulate filter)



Note

- ◆ Renew gaskets and self-locking nuts.
- ◆ After working on the exhaust system, ensure that the system is not under stress and that it has sufficient clearance from the body. If necessary, loosen clamps and align silencers and exhaust pipes so that sufficient clearance is maintained to the body at all points and the mountings are evenly loaded.
- ◆ To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.

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1.1 Exhaust system - exploded view

1 - Y-pipe

- ☐ With centre silencers
- ☐ Combined in one unit with rear silencers as original equipment. Can be renewed individually for repair purposes
- ☐ Cutting point
⇒ [page 216](#)
- ☐ Align exhaust system so it is free of stress
⇒ [page 221](#)

2 - 23 Nm

- ☐ Renew
- ☐ Coat with high-temperature lubricant; for high-temperature lubricant refer to ⇒ Parts catalogue

3 - Turbocharger

4 - Gasket

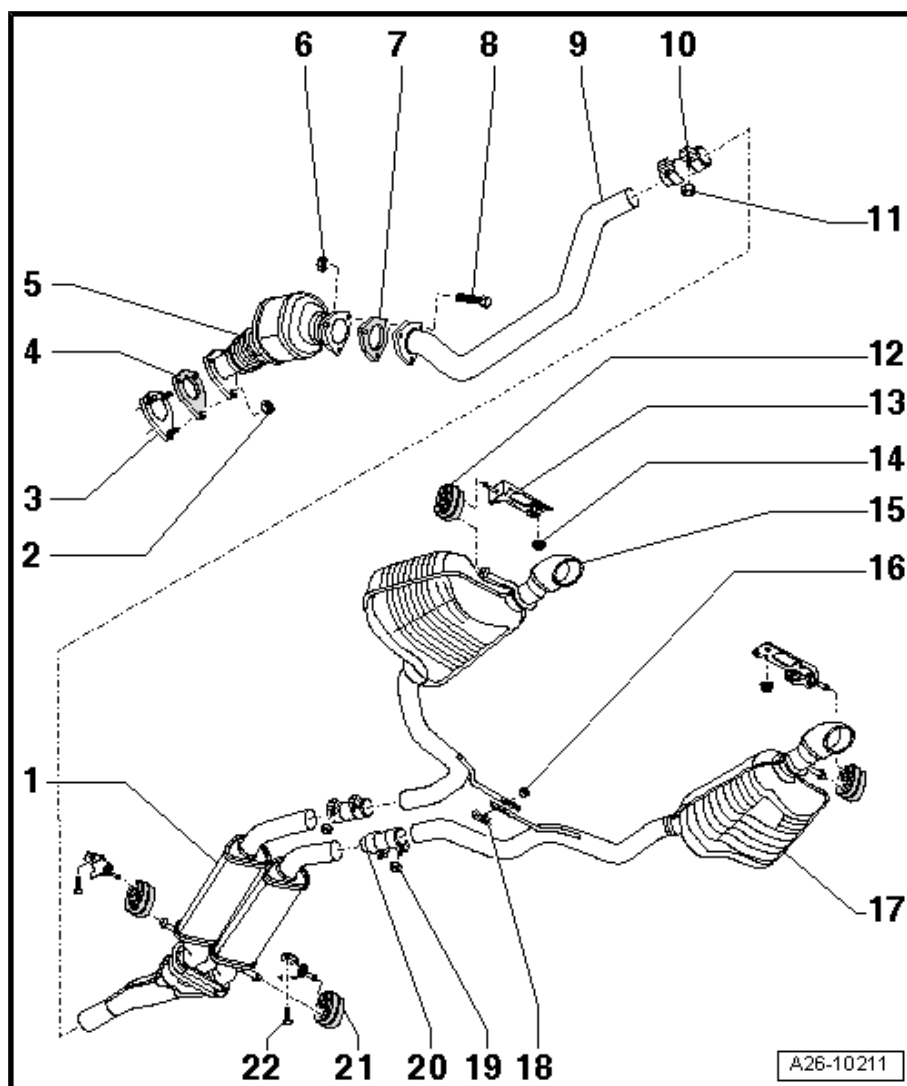
- ☐ Renew

5 - Catalytic converter

- ☐ With flexible joint
- ☐ Do not bend flexible joint more than 10° – otherwise it can be damaged
- ☐ Protect against knocks and impact
- ☐ Removing and installing
⇒ [page 219](#)

6 - 23 Nm

- ☐ Renew



- ☐ Coat with high-temperature lubricant; for high-temperature lubricant refer to ⇒ Parts catalogue

7 - Gasket

- ☐ Renew

8 - Bolt

9 - Front exhaust pipe

- ☐ Removing and installing ⇒ [page 217](#)

10 - Clamp (front)

- ☐ Installation position of bolts ⇒ [page 216](#)
- ☐ Before tightening, align exhaust system so it is free of stress ⇒ [page 221](#)
- ☐ Tighten bolted connections evenly

11 - 23 Nm

12 - Rubber mounting

- ☐ Renew if damaged
- ☐ Check preload ⇒ ["1.5 Stress-free alignment of exhaust system", page 221](#)

13 - Mounting

14 - 23 Nm

15 - Rear silencer

- ☐ For left side of vehicle
- ☐ Combined with Y-pipe in one unit as original equipment. Can be renewed individually for repair purposes
- ☐ Cutting point ⇒ [page 216](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 221](#)

16 - 23 Nm

- ☐ Renew

17 - Rear silencer

- ☐ For right side of vehicle
- ☐ Combined in one unit with centre silencer as original equipment. Can be renewed individually for repair purposes
- ☐ Cutting point ⇒ [page 216](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 221](#)

18 - Connecting bracket

19 - Clamp (rear)

- ☐ For separate replacement of Y-pipe and rear silencers
- ☐ Before tightening, align exhaust system so it is free of stress ⇒ [page 221](#)
- ☐ Installation position ⇒ [page 216](#)
- ☐ Tighten bolted connections evenly

20 - 23 Nm

21 - Rubber mounting

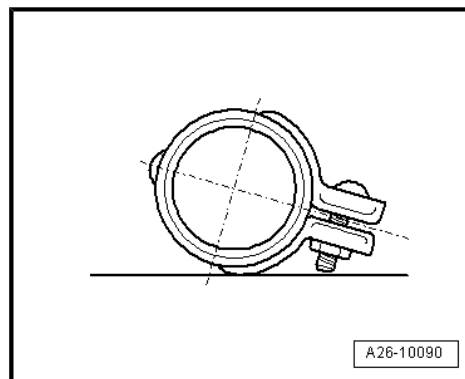
- ☐ Renew if damaged
- ☐ Check preload ⇒ ["1.5 Stress-free alignment of exhaust system", page 221](#)

22 - 23 Nm

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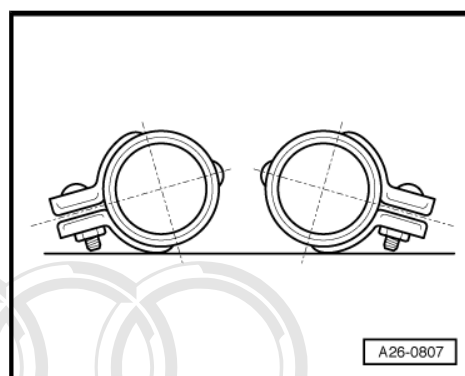
Installation position of front clamp

- Install clamp so that ends of bolts do not protrude beyond bottom of clamp.
- Bolt connection faces to right.



Installation position of rear clamps

- Install clamps so that the bolt ends do not protrude beyond bottom of clamp.
- Bolt connections face outwards.



1.2 Separating Y-pipe and rear silencers

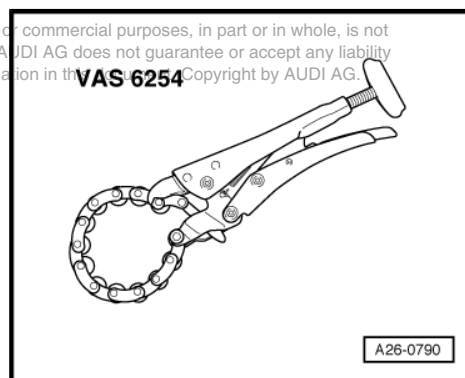
- ◆ The connecting pipe can be cut through at the point marked in order to renew the Y-pipe or rear silencer(s) separately.
- ◆ The cutting point is marked by an indentation on the circumference of the exhaust pipe.

Special tools and workshop equipment required

- ◆ Chain pipe cutter - VAS 6254-

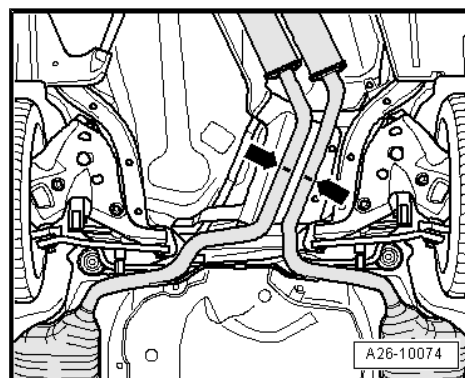
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VAS 6254



Procedure

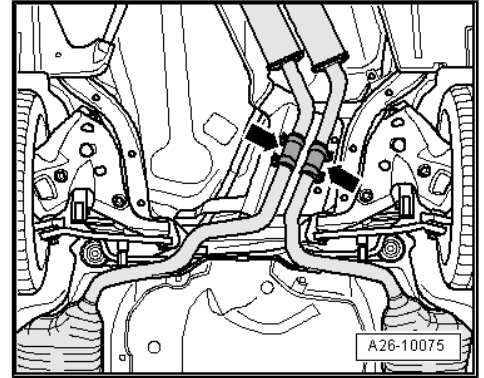
- Cut through exhaust pipes at a right angle at cutting point -arrows- using chain pipe cutter - VAS 6254- .



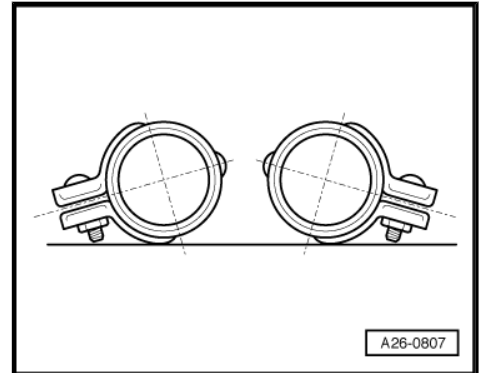
- When reassembling, position the clamps -arrows- centrally over the cutting points.

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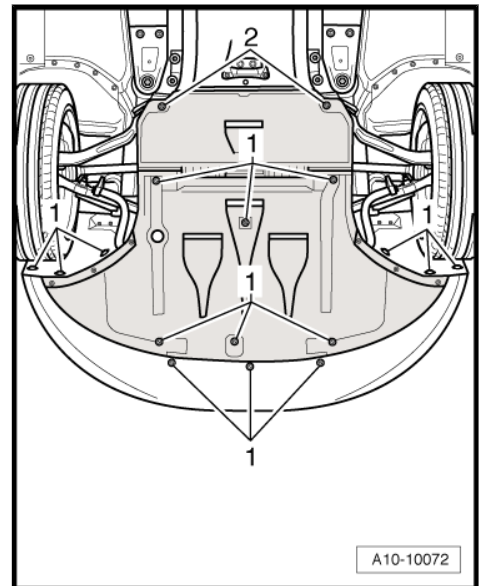
- Fit clamps so that ends of bolts do not protrude beyond bottom of clamp.
- Bolt connections face outwards.
- Align exhaust system so it is free of stress ⇒ [page 221](#) .



1.3 Removing and installing front exhaust pipe

Removing

- Release quick-release fasteners -1- and -2- and take off front and rear noise insulation.

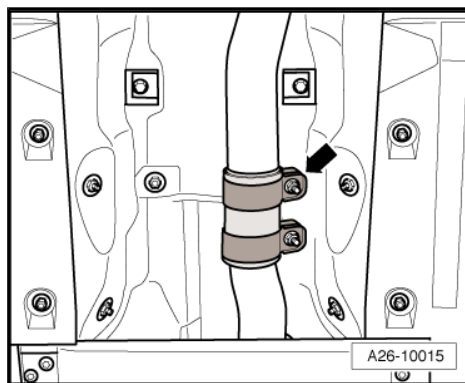




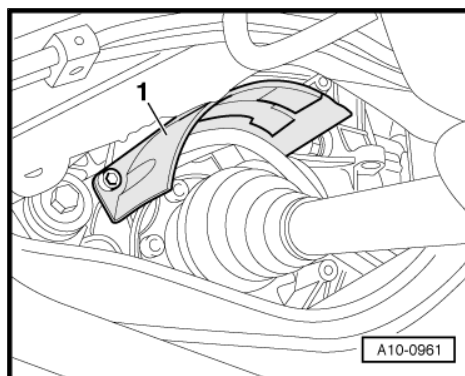
Note

To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.

- Disconnect exhaust system at clamp -arrow-.



- Unbolt heat shield -1- for drive shaft (right-side).



- Unscrew securing nuts connecting front exhaust pipe to catalytic converter -arrows- and detach front exhaust pipe from catalytic converter.

Installing

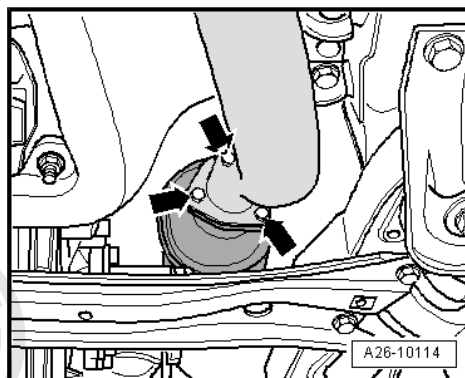
Installation is carried out in the reverse order; note the following:



Note

Renew gaskets and self-locking nuts.

- Align exhaust system so it is free of stress ⇒ [page 221](#).



Tightening torques

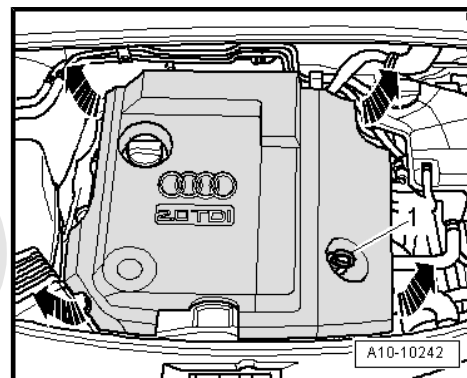
Component	Nm
Front exhaust pipe to catalytic converter	23 ¹⁾²⁾
Drive shaft heat shield to gearbox	23
• 1) Renew nuts. • 2) Coat with high-temperature paste; refer to ⇒ Parts catalogue.	

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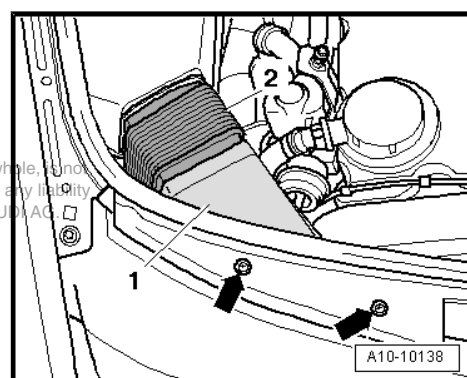
1.4 Removing and installing front exhaust pipe with catalytic converter

Removing

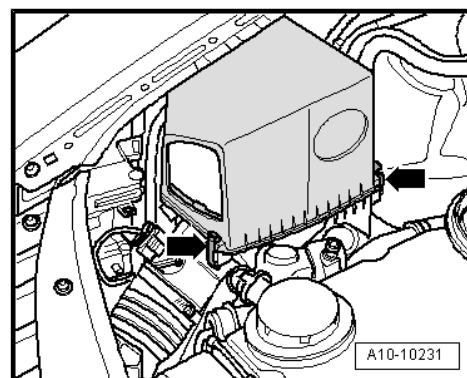
- Pull dipstick -1- out of guide tube.
- Pull off engine cover panel -arrows-.
- Re-insert dipstick in guide tube.



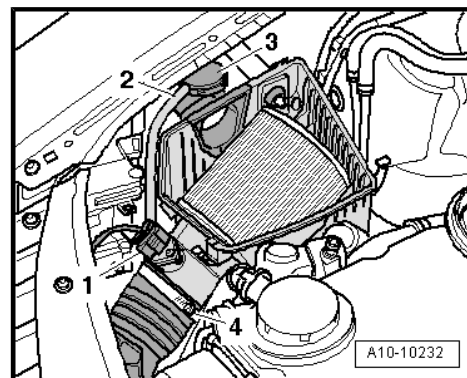
- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.



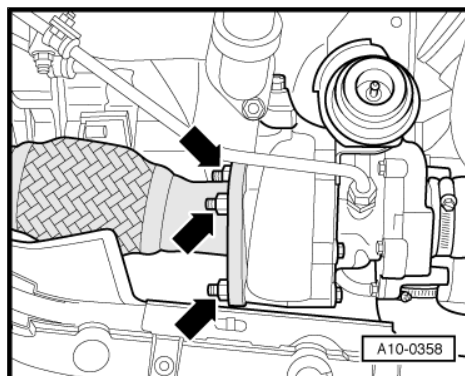
- Release two retaining clips -arrows- and detach top section of air cleaner housing.



- Unplug electrical connector -1- at air mass meter - G70- .
- Loosen hose clip -4- to remove air intake hose.
- Detach vacuum hose -2-.
- Lift off vacuum unit -3- with air flap from air cleaner housing.
- Disengage bottom section of air cleaner housing from retaining pin and remove.

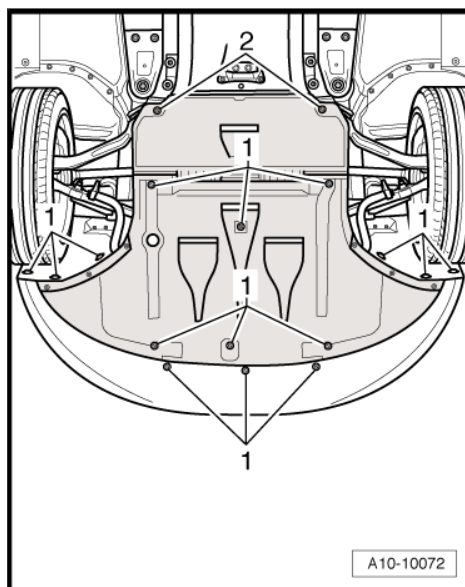


- Unscrew nuts securing turbocharger to catalytic converter -arrows-.

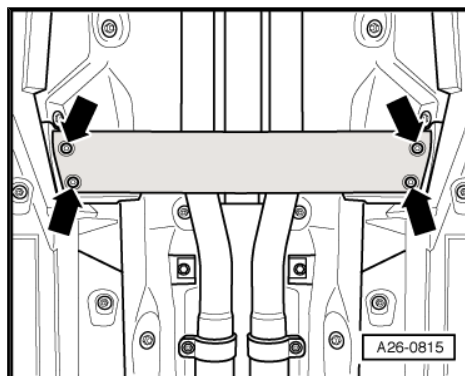


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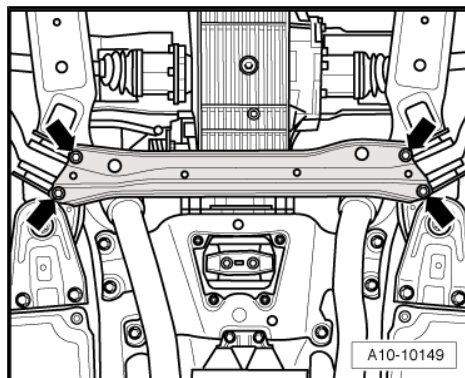
- Release quick-release fasteners -1- and -2- and take off front and rear noise insulation.



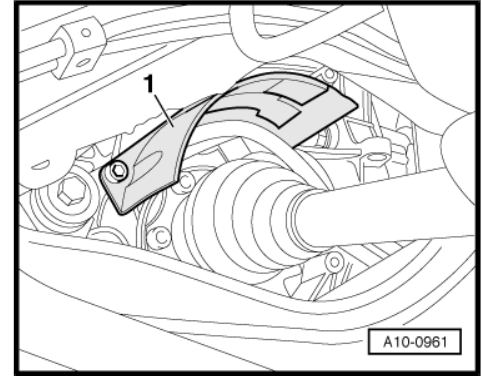
- Remove front cross piece -arrows-.



- Unbolt cross piece from subframe -arrows-.



- Unbolt heat shield -1- for drive shaft (right-side).



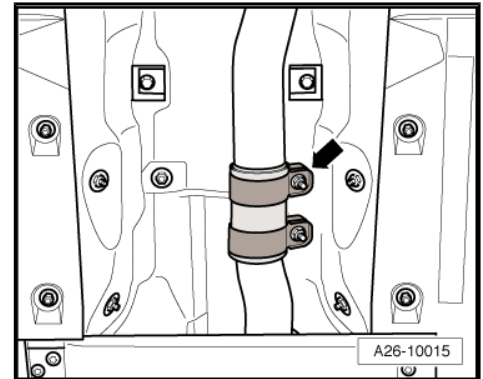
 Note

To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.

- Disconnect exhaust system at clamp -arrow-.
- Detach front exhaust pipe with catalytic converter.

Installing

Installation is carried out in the reverse order; note the following:



 Note

- ◆ *Renew gaskets and self-locking nuts.*
- ◆ *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*

- Install cross piece on subframe ⇒ Rep. gr. 40 .
- Install cross piece (front) ⇒ Rep. gr. 50 .
- Align exhaust system so it is free of stress ⇒ [page 221](#) .

Tightening torques

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Component	Nm
Front exhaust pipe to catalytic converter	23 ¹⁾
Catalytic converter to turbocharger	23 ¹⁾²⁾
Drive shaft heat shield to gearbox	23
• ¹⁾ Renew nuts. • ²⁾ Coat with high-temperature paste; refer to ⇒ Parts catalogue .	

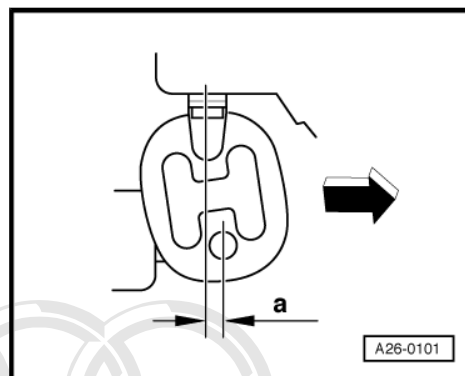
1.5 Stress-free alignment of exhaust system

 Note

The exhaust system must be aligned when it is cool.

Vehicles without clamps between Y-pipe and rear silencer

- Loosen bolt connections of front clamp
⇒ [Item 10 \(page 215\)](#) .
- Push exhaust system towards front of vehicle -arrow- so that rear rubber mountings for rear silencers are preloaded by -a- = 9 ... 13 mm.
- Tighten clamp evenly to 23 Nm.
- Align tailpipes ⇒ [page 222](#) .



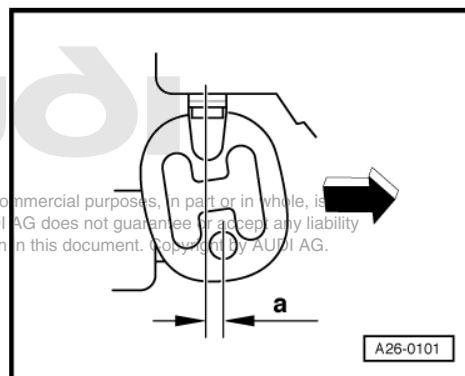
Vehicles with clamps between Y-pipe and rear silencer



Note

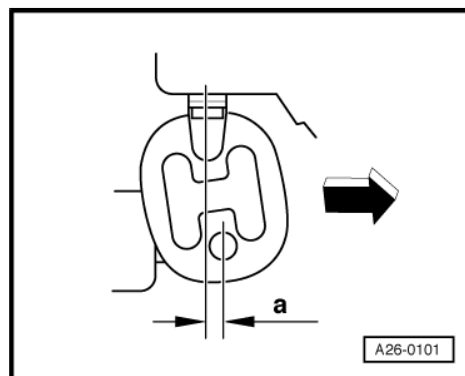
On a vehicle with clamps fitted between Y-pipe and rear silencer, it is also necessary to align the Y-pipe.

- Loosen bolts on clamps ⇒ [Item 10 \(page 215\)](#) and
⇒ [Item 19 \(page 215\)](#) .
- Push front section of exhaust system towards front of vehicle -arrow-, so that mountings for Y-pipe are preloaded by -a- = 9 ... 13 mm.
- Tighten bolts on front clamp ⇒ [Item 10 \(page 215\)](#) evenly to 23 Nm.



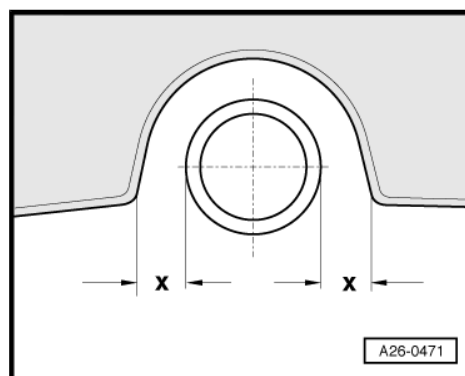
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- Push rear section of exhaust system towards front of vehicle -arrow-, so that mountings (rear) for rear silencers are preloaded by -a- = 13 ... 17 mm.
- Align rear silencers so they are horizontal.
- Tighten bolts on rear clamps ⇒ [Item 19 \(page 215\)](#) evenly to 23 Nm.
- Align tailpipes ⇒ [page 222](#) .



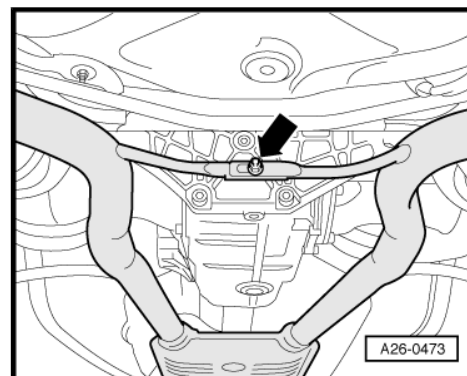
1.6 Aligning tailpipes

- Check clearance between tailpipes and bumper on both sides.
- Dimension -x- (left-side) = dimension -x- (right-side)

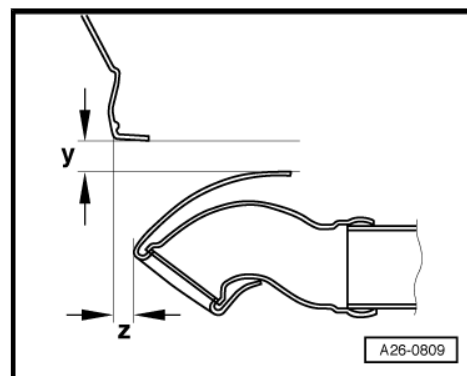


If necessary, correct dimension -x- as follows:

- Slacken bolt connection -arrow- on brace between exhaust pipes.
- Adjust the distance between the rear silencers.
- Tighten bolt connection to 23 Nm.



- Check clearance -y- between tailpipes and bumper:
 - Dimension -y- = 37 ... 43 mm.
 - Dimension -z- = 12 ... 17 mm.
- If necessary, check whether the exhaust system is aligned free of stress ⇒ [page 221](#) .



1.7 Checking exhaust system for leaks

- Start engine and run at idling speed.
- Plug tailpipes during leak test (e.g. with cloth or plug).
- Listen for leaks at connection points between cylinder head/ exhaust manifold, exhaust manifold/turbocharger and turbocharger/catalytic converter etc.
- Repair any leaks that are found.



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2 Removing and installing parts of exhaust system (vehicles with particulate filter)



Note

- ◆ *Renew gaskets and self-locking nuts.*
- ◆ *After working on the exhaust system, ensure that the system is not under stress and that it has sufficient clearance from the body. If necessary, loosen clamps and align silencers and exhaust pipes so that sufficient clearance is maintained to the body at all points and the mountings are evenly loaded.*
- ◆ *To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.*

2.1 Exhaust system - exploded view

1 - 23 Nm

2 - Rubber mounting

- ☐ Renew if damaged
- ☐ Check preload
⇒ ["2.7 Stress-free alignment of exhaust system", page 235](#)

3 - Y-pipe

- ☐ With centre silencers
- ☐ Combined in one unit with rear silencers as original equipment. Can be renewed **individually** for repair purposes
- ☐ Cutting point
⇒ [page 227](#)
- ☐ Align exhaust system so it is free of stress
⇒ [page 235](#)

4 - Gasket

- ☐ Renew

5 - 23 Nm

- ☐ Renew
- ☐ Coat with high-temperature lubricant; for high-temperature lubricant refer to ⇒ [Parts catalogue](#)

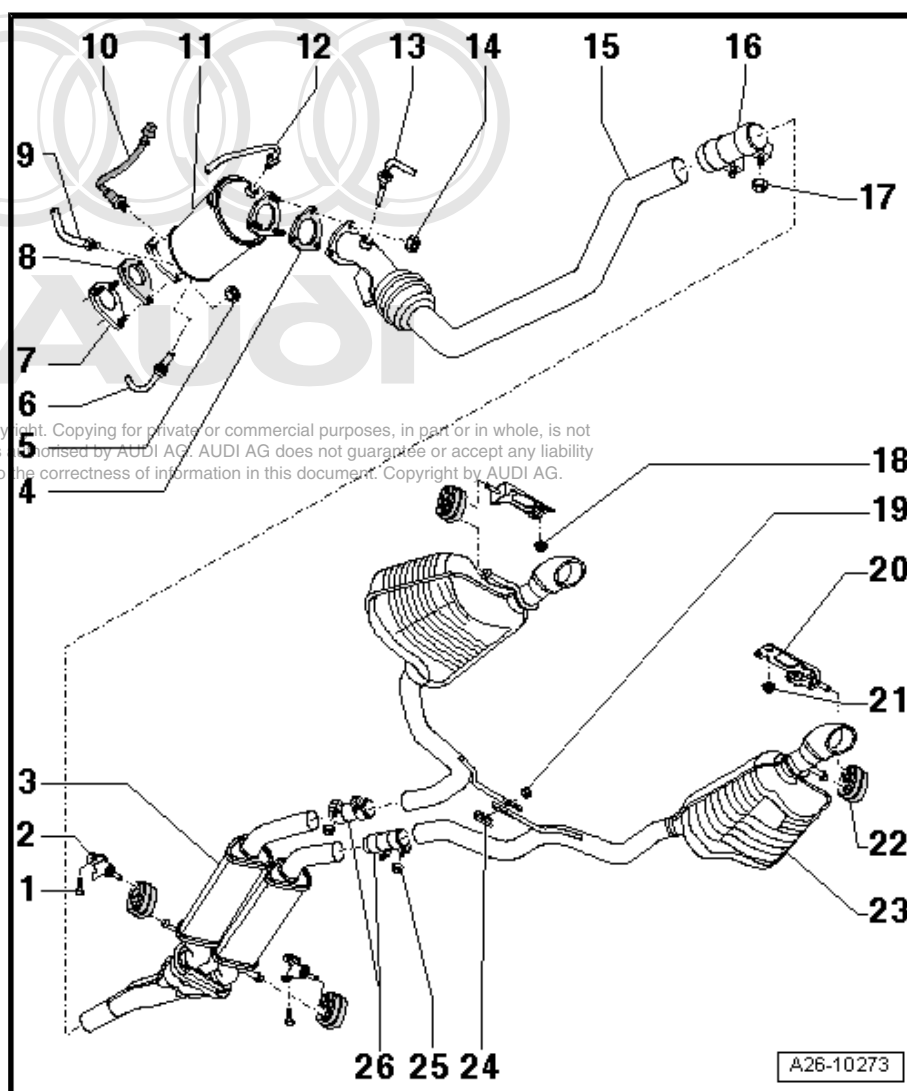
6 - Temperature sender before particulate filter - G506-

- ☐ Removing and installing
⇒ [page 242](#)
- ☐ Tighten to 45 Nm

7 - Turbocharger

8 - Gasket

- ☐ Renew



9 - Pressure line

- ☐ Tighten union nuts to 45 Nm.

10 - Lambda probe - G39-

- ☐ Threads of new Lambda probes are already greased with assembly paste; the paste must not get into the slots on the probe body
- ☐ When re-using the old Lambda probe, grease thread with high-temperature paste lubricant; the paste must not get into the slots of the probe body. High-temperature paste ⇒ Parts catalogue
- ☐ Remove and install using ring spanner for Lambda probe - 3337- ⇒ Rep. gr. 23
- ☐ Tighten to 55 Nm

11 - Particulate filter

- ☐ Removing and installing ⇒ [page 232](#)
- ☐ Protect against knocks and impact
- ☐ Mounting components ⇒ [page 227](#)
- ☐ After renewing particulate filter perform adaption in "Guided Fault Finding" ⇒ Vehicle diagnostic tester

12 - Pressure line

- ☐ Tighten union nuts to 45 Nm.

13 - Temperature sender after particulate filter - G527-

- ☐ Tighten to 45 Nm
- ☐ Removing and installing ⇒ [page 245](#)

14 - 23 Nm

- ☐ Renew
- ☐ Coat with high-temperature lubricant; for high-temperature lubricant refer to ⇒ Parts catalogue

15 - Front exhaust pipe

- ☐ With flexible joint
- ☐ Do not bend flexible joint more than 10° – otherwise it can be damaged
- ☐ Removing and installing ⇒ [page 230](#)
- ☐ Mounting components ⇒ [page 227](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 235](#)

16 - Clamp (front)

- ☐ Installation position of bolts ⇒ [page 226](#)
- ☐ Before tightening, align exhaust system so it is free of stress ⇒ [page 235](#)
- ☐ Tighten bolted connections evenly

17 - 23 Nm

18 - Rear silencer

- ☐ For left side of vehicle
- ☐ Combined with Y-pipe in one unit as original equipment. Can be renewed individually for repair purposes
- ☐ Cutting point ⇒ [page 227](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 235](#)

19 - 23 Nm

- ☐ Renew

20 - Mounting

21 - 23 Nm

22 - Rubber mounting

- ☐ Renew if damaged
- ☐ Check preload ⇒ ["2.7 Stress-free alignment of exhaust system", page 235](#)

23 - Rear silencer

- ☐ For right side of vehicle

- ☐ Combined in one unit with centre silencer as original equipment. Can be renewed individually for repair purposes
- ☐ Cutting point ⇒ [page 227](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 235](#)

24 - Connecting bracket

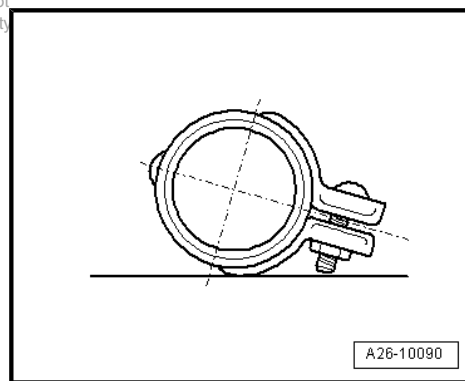
25 - 23 Nm

26 - Clamp (rear)

- ☐ For separate replacement of Y-pipe and rear silencers
- ☐ Before tightening, align exhaust system so it is free of stress ⇒ [page 235](#)
- ☐ Installation position ⇒ [page 226](#)
- ☐ Tighten bolted connections evenly

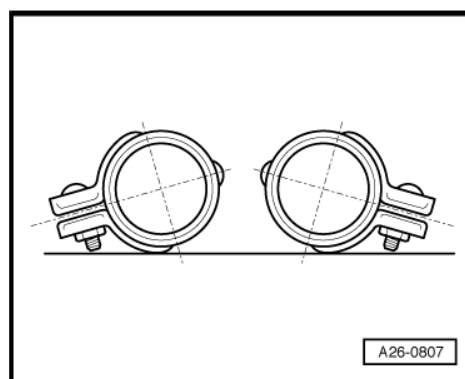
Installation position of front clamp

- Install clamp so that ends of bolts do not protrude beyond bottom of clamp.
- Bolt connection faces to right.



Installation position of rear clamps

- Install clamps so that the bolt ends do not protrude beyond bottom of clamp.
- Bolt connections face outwards.

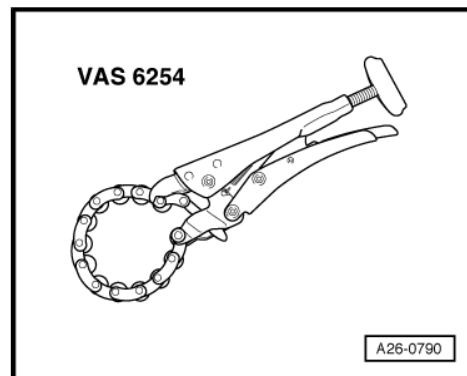


2.2 Separating Y-pipe and rear silencers

- ◆ The connecting pipe can be cut through at the point marked in order to renew the Y-pipe or rear silencer(s) separately.
- ◆ The cutting point is marked by an indentation on the circumference of the exhaust pipe.

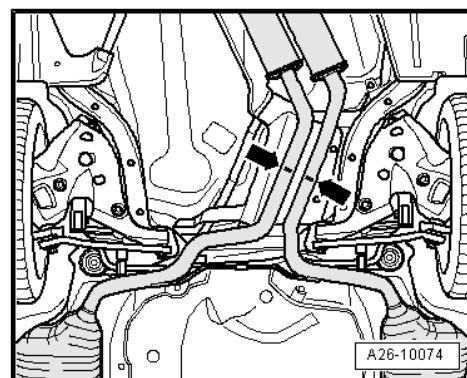
Special tools and workshop equipment required

◆ Chain pipe cutter - VAS 6254-

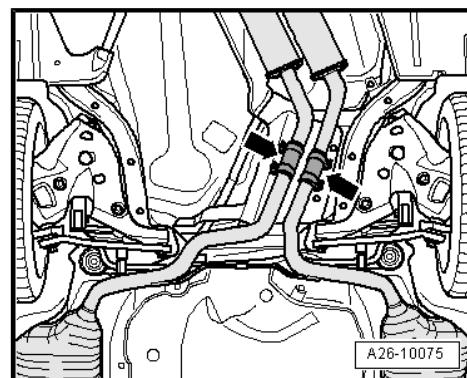


Procedure

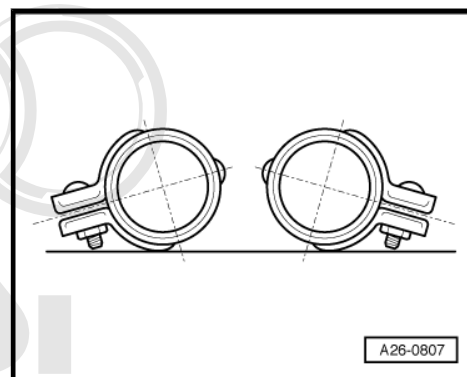
- Cut through exhaust pipes at a right angle at cutting point -arrows- using chain pipe cutter - VAS 6254- .



- When reassembling, position the clamps -arrows- centrally over the cutting points.



- Fit clamps so that ends of bolts do not protrude beyond bottom of clamp.
- Bolt connections face outwards.
- Align exhaust system so it is free of stress ⇒ [page 235](#) .



2.3

Front exhaust pipe with mountings on vehicles with manual gearbox - exploded view

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1 - Front exhaust pipe

- ☐ With flexible joint
- ☐ Do not bend flexible joint more than 10° – otherwise it can be damaged

2 - Spacer sleeve

3 - Bracket

4 - Buffer

5 - Spacer sleeve

6 - Bolt, 25 Nm

7 - Bolt, 25 Nm

8 - Washer

9 - Compression spring

10 - Spacer sleeve

11 - Bracket (front)

12 - Nut, 25 Nm

13 - Bolt, 25 Nm

14 - Nut, 25 Nm

15 - Spacer sleeve

16 - Buffer

17 - Spacer sleeve

18 - Bolt, 25 Nm

19 - Bolt, 25 Nm

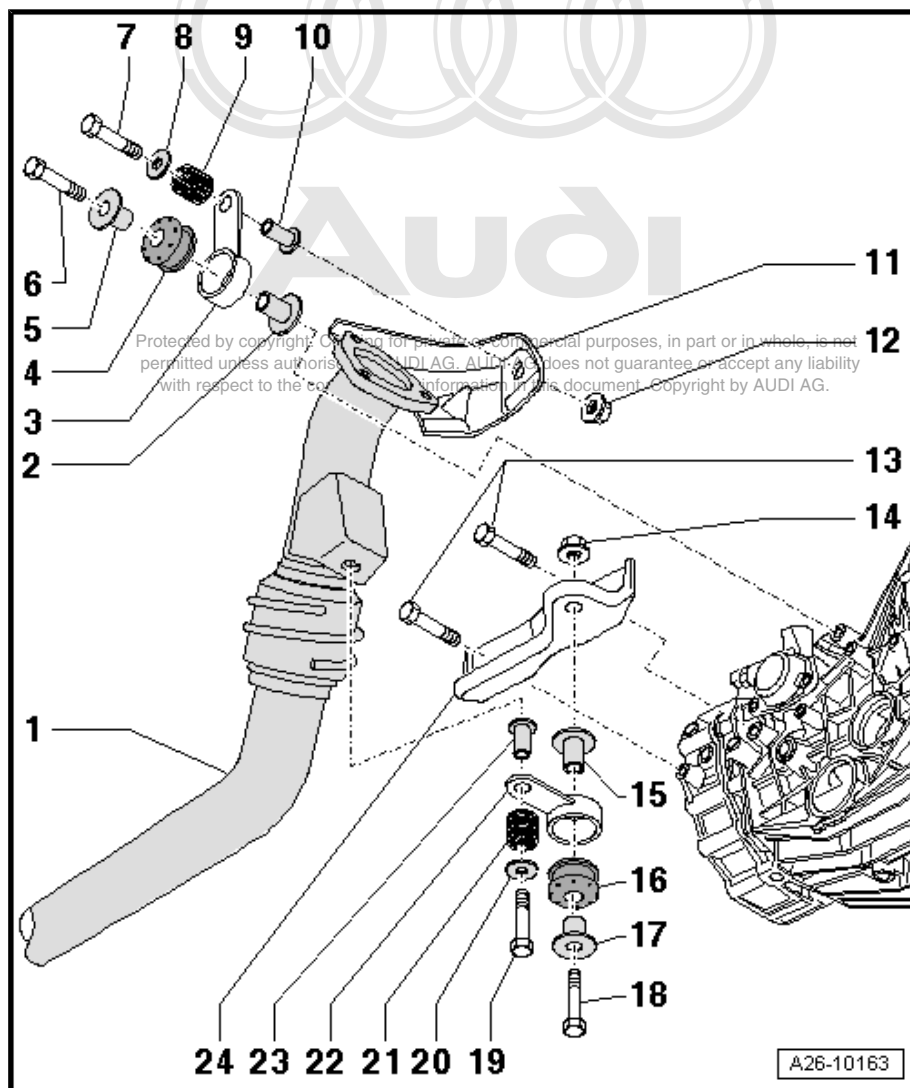
20 - Washer

21 - Compression spring

22 - Bracket

23 - Spacer sleeve

24 - Bracket (rear)



2.4 Front exhaust pipe with mountings on vehicles with multitronic gearbox - exploded view

1 - Front exhaust pipe

- ☐ With flexible joint
- ☐ Do not bend flexible joint more than 10° – otherwise it can be damaged

2 - Spacer sleeve

3 - Bracket

4 - Buffer

5 - Spacer sleeve

6 - Bolt, 25 Nm

7 - Bolt, 25 Nm

8 - Washer

9 - Compression spring

10 - Spacer sleeve

11 - Nut, 25 Nm

12 - Bolt, 25 Nm

13 - Bracket (rear)

14 - Bolt, 25 Nm

15 - Spacer sleeve

16 - Buffer

17 - Spacer sleeve

18 - Bolt, 25 Nm

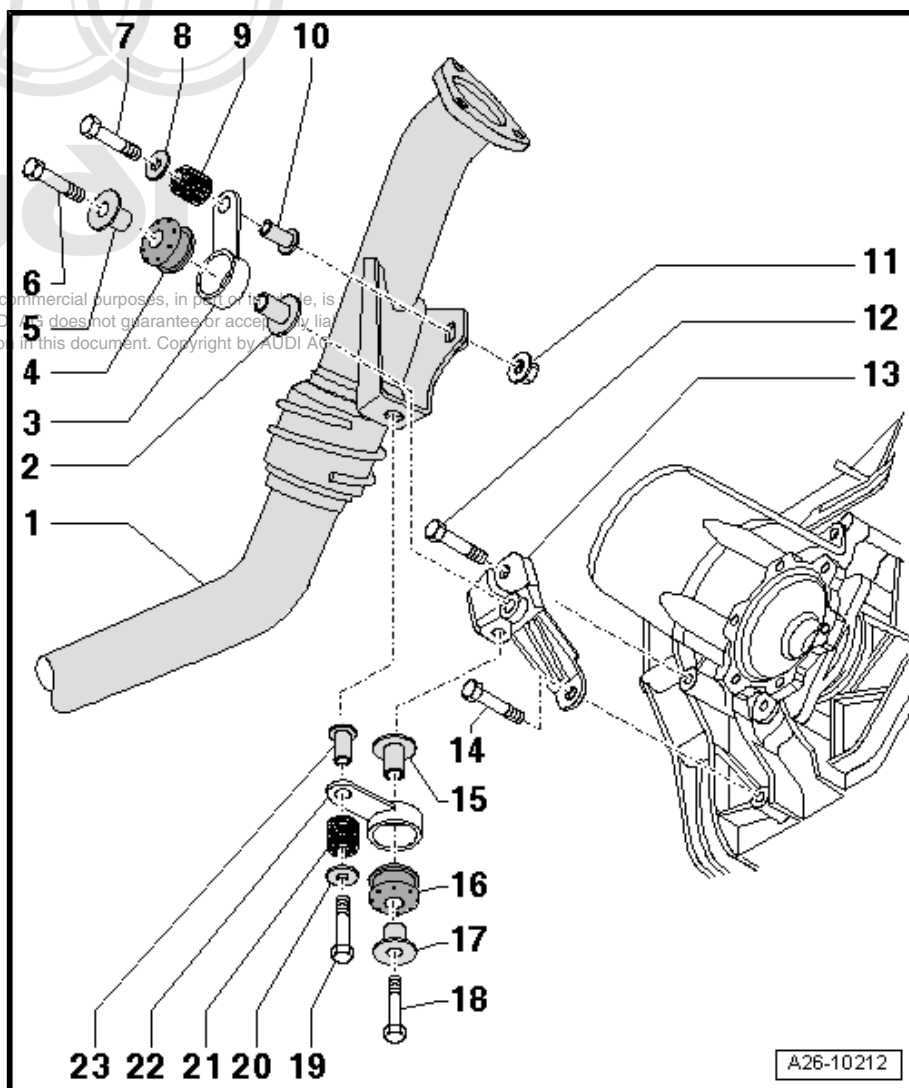
19 - Bolt, 25 Nm

20 - Washer

21 - Compression spring

22 - Bracket

23 - Spacer sleeve



A26-10212

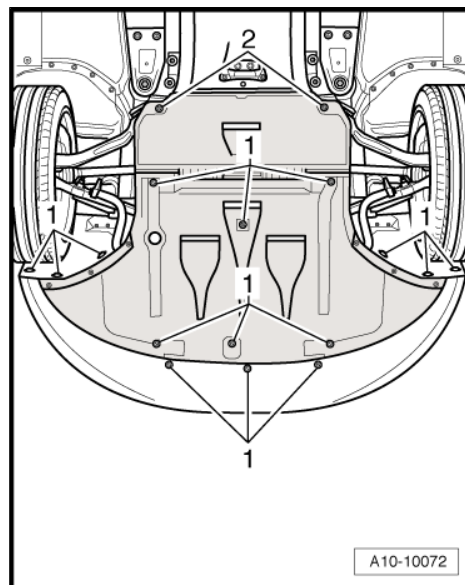
2.5 Removing and installing front exhaust pipe

Removing

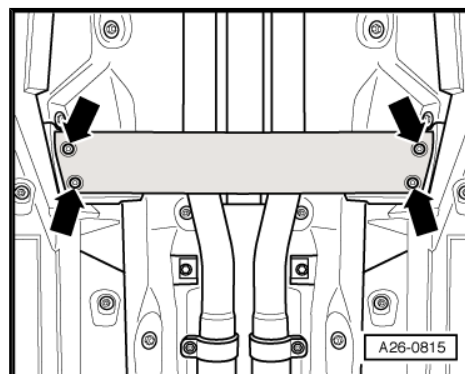


Note

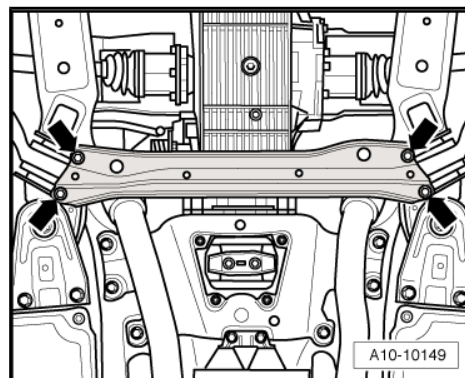
- ◆ *The following procedure applies to vehicles with a manual gearbox.*
- ◆ *All cable ties which are released or cut open when removing must be fitted in the same position when installing.*
- Release quick-release fasteners -1- and -2- and take off front and rear noise insulation.



- Remove front cross piece -arrows-.

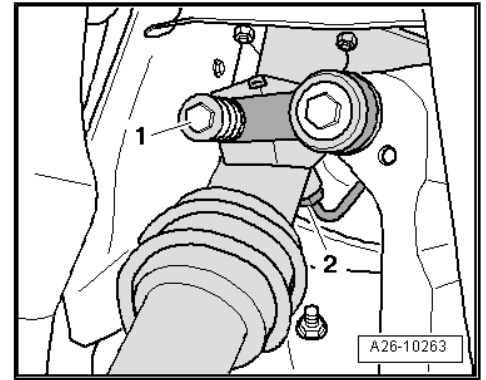


- Unbolt cross piece from subframe -arrows-.

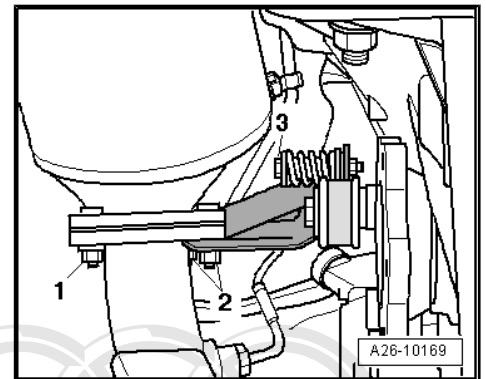


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- Remove bolt -1- and pivot bracket for front exhaust pipe forwards.
- Unscrew temperature sender after particulate filter - G527-
-item 2-.



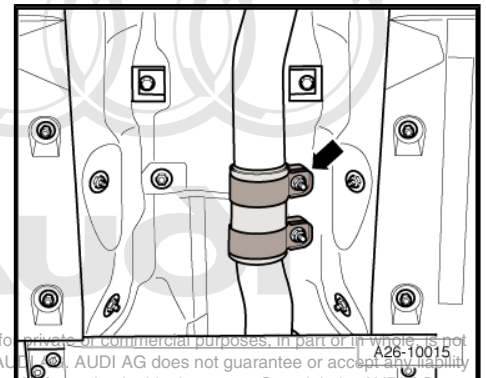
- Unscrew bolts -1 ... 3- and remove bracket (front) for front exhaust pipe.



 Note

To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.

- Loosen clamp -arrow- and push towards rear.
- Remove front exhaust pipe.



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Installing

Installation is carried out in the reverse order; note the following:



Note

- ◆ *Renew gaskets and self-locking nuts.*
- ◆ *Fit all cable ties in the original positions when installing.*
- When installing, make sure that temperature sender after particulate filter - G527- is fitted at angle α -.
 - Angle α = 40°
- Align exhaust system so it is free of stress ⇒ [page 235](#) .

Tightening torques

Component	Nm
Temperature sender after particulate filter - G527- to front exhaust pipe	45
Front exhaust pipe to particulate filter	23 ¹⁾
Mounting plate to:	
Bracket	25
Front exhaust pipe	25

- ¹⁾ Renew nuts.

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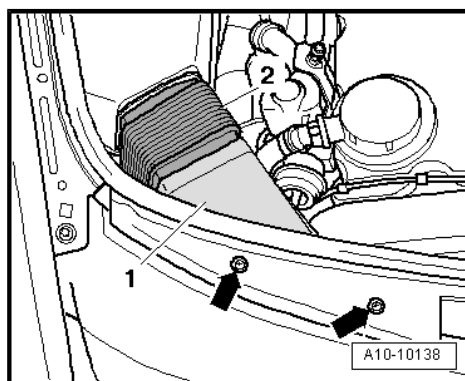
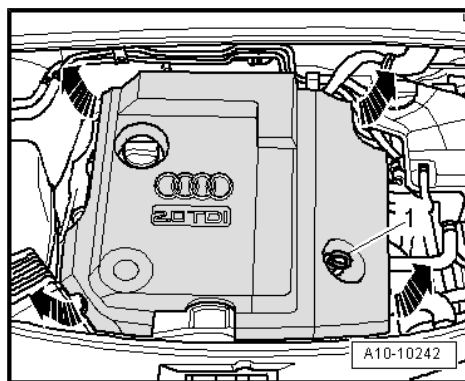
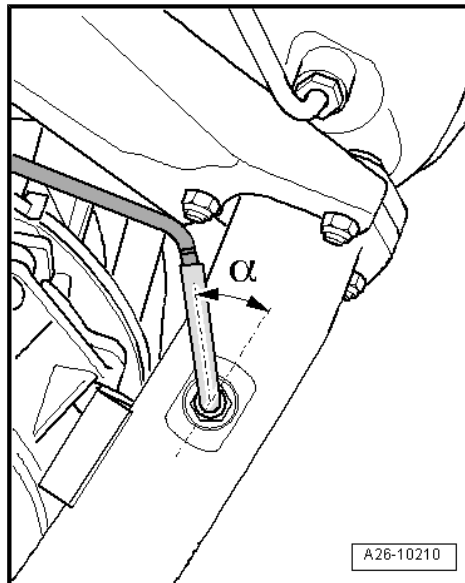
2.6 Removing and installing particulate filter

Removing

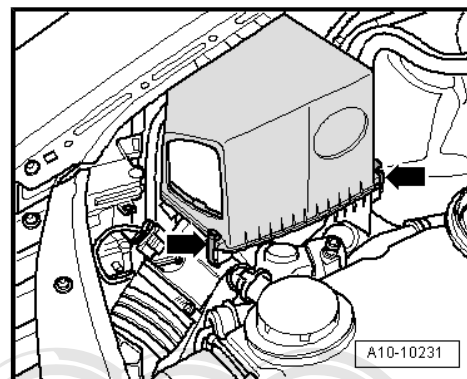


Note

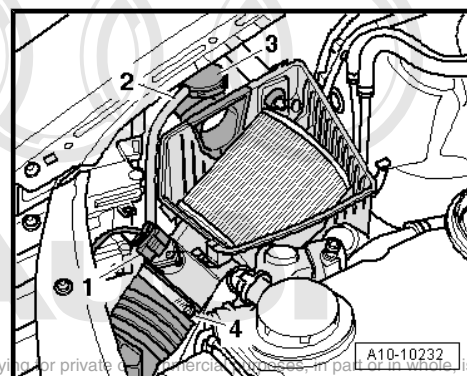
- ◆ *The following procedure applies to vehicles with a manual gearbox.*
- ◆ *Fit all heat insulation sleeves in the original position when installing.*
- ◆ *All cable ties which are released or cut open when removing must be fitted in the same position when installing.*
- Pull dipstick -1- out of guide tube.
- Pull off engine cover panel -arrows-.
- Re-insert dipstick in guide tube.
- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.



- Release two retaining clips -arrows- and detach top section of air cleaner housing.



- Unplug electrical connector -1- at air mass meter - G70- .
- Loosen hose clip -4- to remove air intake hose.
- If fitted, disconnect vacuum hose -2- and lift vacuum unit -3- together with air flap off air cleaner housing.
- Disengage bottom section of air cleaner housing from retaining pin and remove.



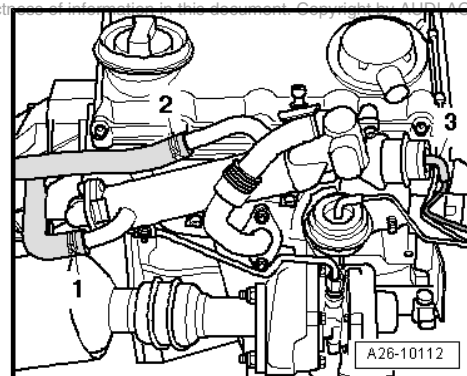
Vehicles with multitronic gearbox

- Detach vacuum hose -3- from vacuum unit for change-over flap for exhaust gas recirculation.



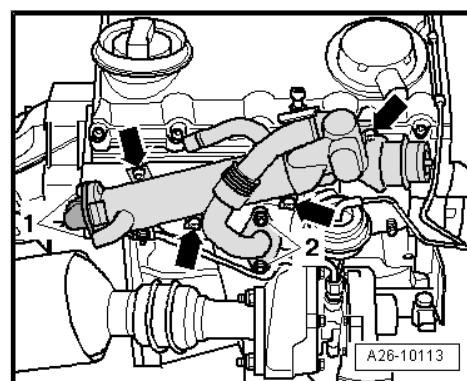
Note

Coolant hoses -1- and -2- must not be detached.

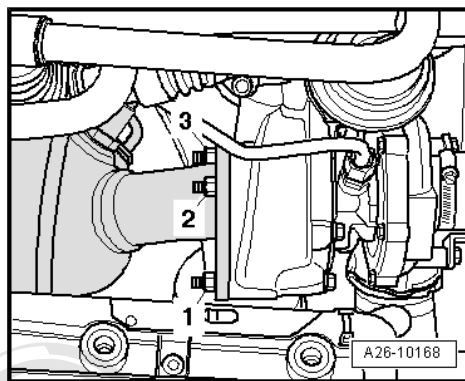


- Unscrew bolts -1- and nuts -2-.
- Remove bolts -arrows- and tie up exhaust gas recirculation cooler.

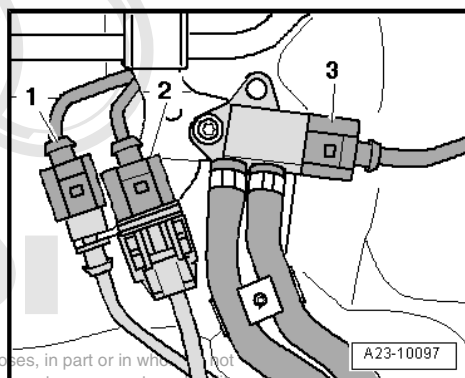
All vehicles



- Unscrew nuts securing turbocharger to particulate filter
-1 ... 3-.

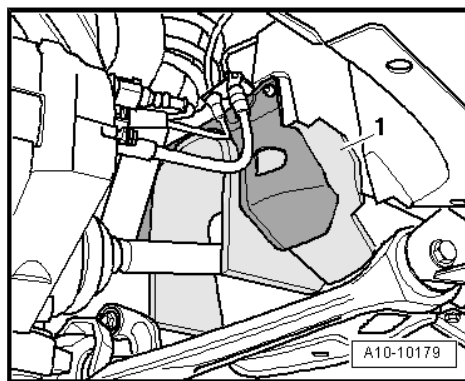


- Remove electrical connector -1- for temperature sender before particulate filter - G506- and electrical connector -2- for Lambda probe - G39- from bracket.
- Unplug electrical connectors and move wiring clear.
- Unplug electrical wiring at exhaust gas pressure sensor 1 - G450- -item 3-.
- Unscrew nut and detach -G450- from bracket.
- Leave hoses connected and move -G450- clear towards bottom of vehicle.

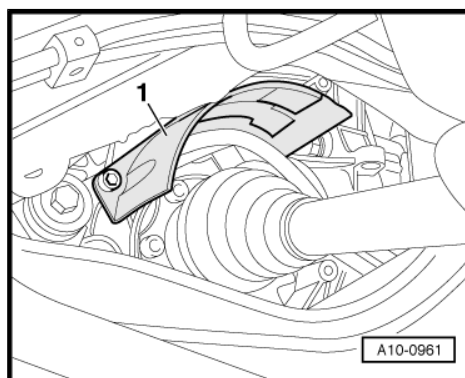


- Remove front exhaust pipe [page 230](#)
- Remove front right wheel.

- Remove noise insulation -1- in wheel housing (right-side).



- Unbolt heat shield -1- for drive shaft (right-side).



- Unscrew bolts -arrows- and remove bracket for front exhaust pipe.
- Detach particulate filter.

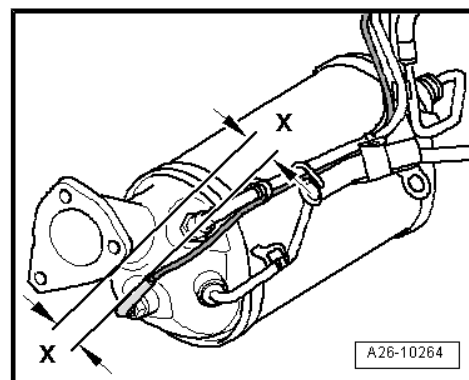
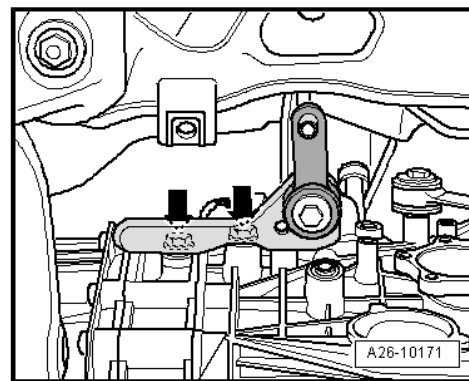
Installing

Installation is carried out in the reverse order; note the following:



Note

- ◆ *Renew gaskets and self-locking nuts.*
 - ◆ *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
 - ◆ *Fit all heat insulation sleeves in the original position when installing.*
 - ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*
 - ◆ *Fit all cable ties in the original positions when installing.*
- When installing, make sure that temperature sender before particulate filter G506 is positioned parallel to flange area of particulate filter.
- Dimension -x- = dimension -x-.
- Install front exhaust pipe ⇒ [page 230](#) .
- Align exhaust system so it is free of stress ⇒ [page 235](#) .
- After renewing particulate filter perform adaption in “Guided Fault Finding” ⇒ Vehicle diagnostic tester.



Tightening torques

Component	Nm
Particulate filter to turbocharger	23 ¹⁾²⁾
Bracket for front exhaust pipe to gearbox	25
Hose clips (9 mm wide)	3
Hose clips (13 mm wide)	5.5
• ¹⁾ Renew nuts. • ²⁾ Coat threads and contact surface of bolt heads with high-temperature paste; for high-temperature paste refer to ⇒ Parts catalogue .	

2.7 Stress-free alignment of exhaust system



Note

The exhaust system must be aligned when it is cool.

Vehicles without clamps between Y-pipe and rear silencer

- Loosen bolt connections of front clamp
⇒ [Item 16 \(page 225\)](#) .

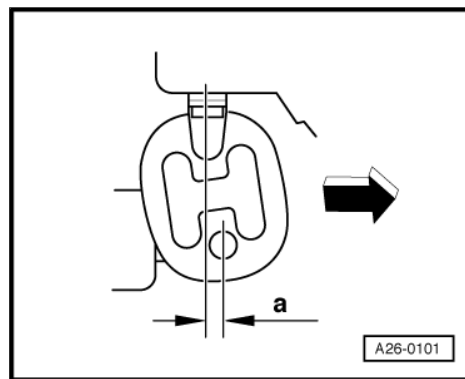
- Push exhaust system towards front of vehicle -arrow- so that rear rubber mountings for rear silencers are preloaded by -a- = 9 ... 13 mm.
- Tighten clamp evenly to 23 Nm.
- Align tailpipes ⇒ [page 222](#) .

Vehicles with clamps between Y-pipe and rear silencer

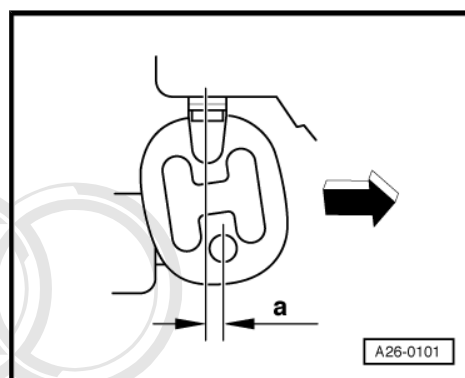


Note

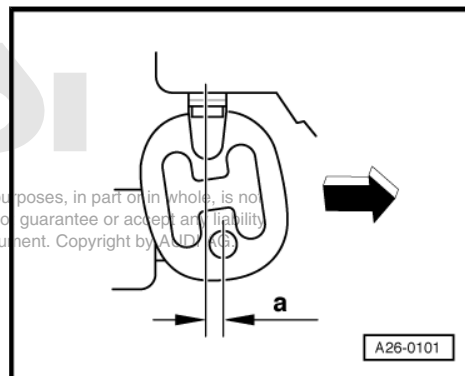
On a vehicle with clamps fitted between Y-pipe and rear silencer, it is also necessary to align the Y-pipe.



- Loosen bolts on clamps ⇒ [Item 16 \(page 225\)](#) and ⇒ [Item 26 \(page 226\)](#) .
- Push front section of exhaust system towards front of vehicle -arrow-, so that mountings for Y-pipe are preloaded by -a- = 9 ... 13 mm.
- Tighten bolts on front clamp ⇒ [Item 16 \(page 225\)](#) evenly to 23 Nm.

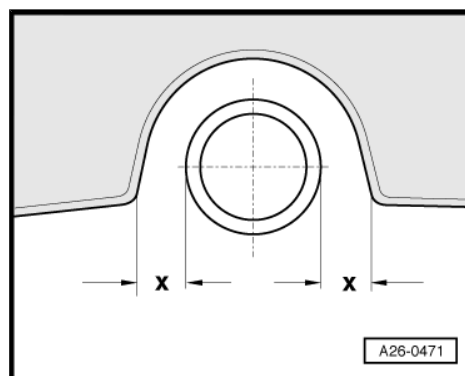


- Push rear section of exhaust system towards front of vehicle -arrow-, so that mountings (rear) for rear silencers are preloaded by -a- = 13 ... 17 mm.
- Align rear silencers so they are horizontal.
- Tighten bolts on rear clamps ⇒ [Item 26 \(page 226\)](#) evenly to 23 Nm.
- Align tailpipes ⇒ [page 236](#) .



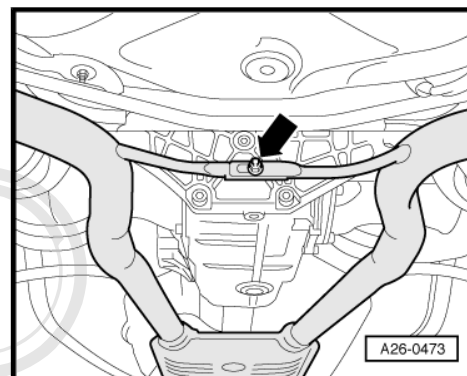
2.8 Aligning tailpipes

- Check clearance between tailpipes and bumper on both sides.
- Dimension -x- (left-side) = dimension -x- (right-side)

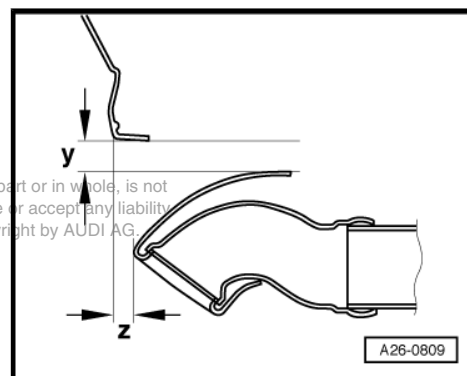


If necessary, correct dimension -x- as follows:

- Slacken bolt connection -arrow- on brace between exhaust pipes.
- Adjust the distance between the rear silencers.
- Tighten bolt connection to 23 Nm.



- Check clearance -y- between tailpipes and bumper:
 - Dimension -y- = 37 ... 43 mm.
 - Dimension -z- = 12 ... 17 mm.
- If necessary, check whether the exhaust system is aligned free of stress ⇒ [page 235](#)



2.9 Checking exhaust system for leaks

- Start engine and run at idling speed.
- Plug tailpipes during leak test (e.g. with cloth or plug).
- Listen for leaks at joints between cylinder head/exhaust manifold, exhaust manifold/turbocharger, turbocharger/particulate filter etc.
- Repair any leaks that are found.

3 Removing and installing exhaust manifold

3.1 Exhaust manifold - exploded view

1 - Bracket

2 - 25 Nm

3 - Exhaust manifold

- ☐ Removing and installing
⇒ [page 239](#)

4 - Gasket

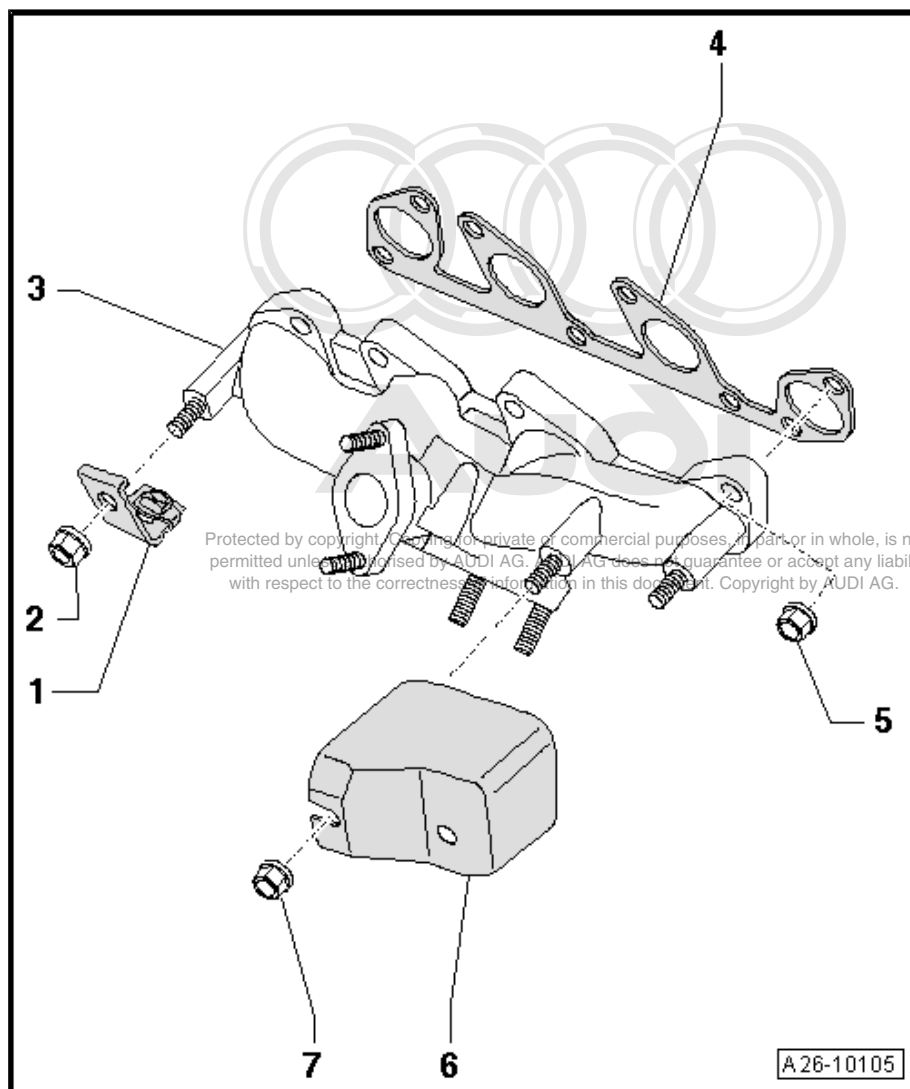
- ☐ Renew

5 - 25 Nm

- ☐ Renew
- ☐ Coat with high-temperature lubricant; for high-temperature lubricant refer to ⇒ Parts catalogue

6 - Heat shield

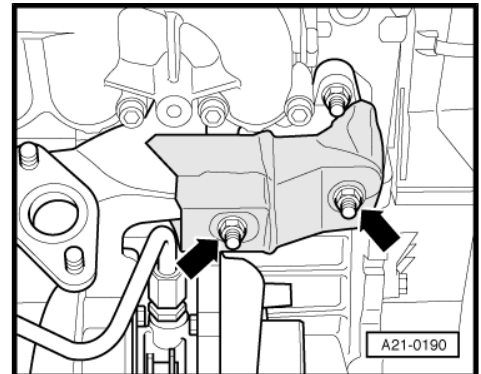
7 - 25 Nm



3.2 Removing and installing exhaust manifold

Removing

- Remove turbocharger ➔ [page 203](#) .
- Detach heat shield from exhaust manifold -arrows-.



- Unscrew all nuts -arrows- on exhaust manifold.
- Detach exhaust manifold.

Installing

Installation is carried out in the reverse order; note the following:



Renew gaskets and self-locking nuts.

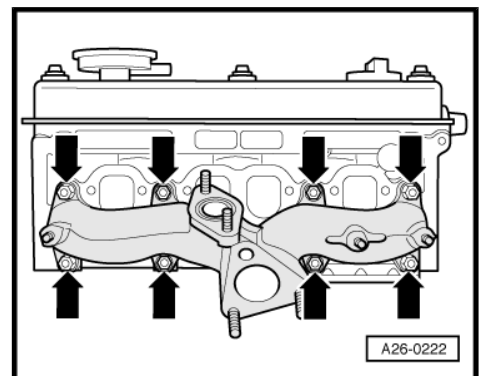
- Install turbocharger ➔ [page 203](#) .

Vehicles without particulate filter:

- Install front exhaust pipe together with catalytic converter ➔ [page 219](#) .
- Align exhaust system so it is free of stress ➔ [page 221](#) .

Vehicles with particulate filter:

- Install front exhaust pipe ➔ [page 230](#) .
- Align exhaust system so it is free of stress ➔ [page 235](#) .



Tightening torques

Component	Nm
Exhaust manifold to cylinder head	25 ¹⁾²⁾
Heat shield to exhaust manifold	25
Bracket for oil supply line to exhaust manifold	25
• ¹⁾ Renew nuts. • ²⁾ Coat with high-temperature paste; refer to ➔ Parts catalogue .	

4 Removing and installing exhaust gas temperature sender

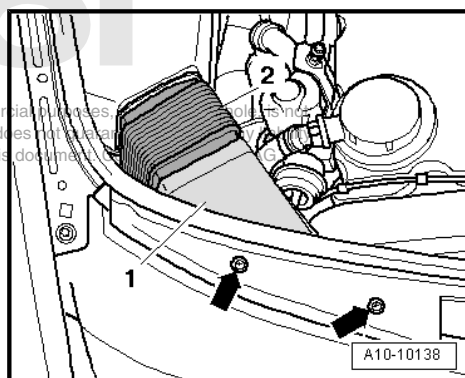
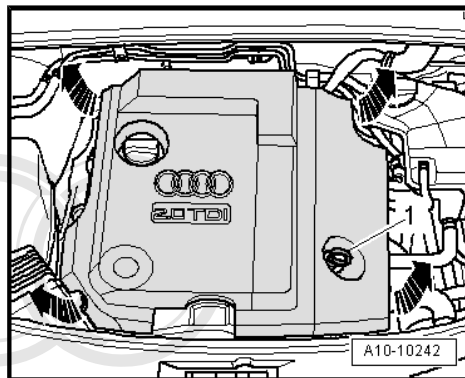
4.1 Removing and installing exhaust gas temperature sender 1 - G235-

Removing

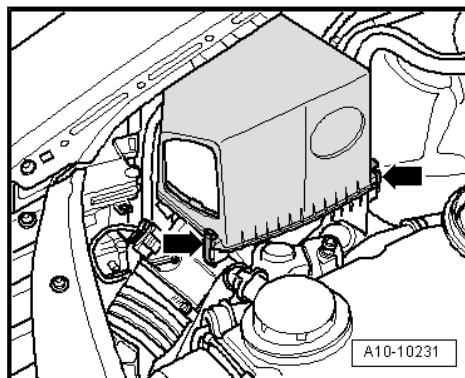


Note

- ◆ *Fit all heat insulation sleeves in the original position when installing.*
- ◆ *All cable ties which are released or cut open when removing must be fitted in the same position when installing.*
- Pull dipstick -1- out of guide tube.
- Pull off engine cover panel -arrows-.
- Re-insert dipstick in guide tube.
- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.

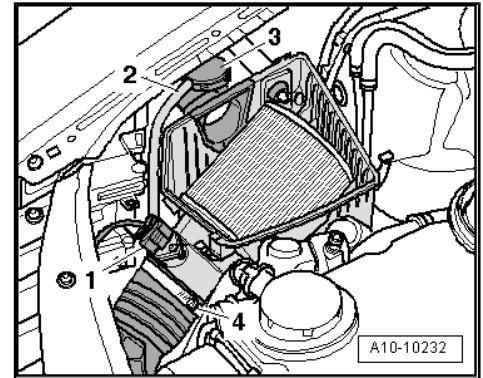


- Release two retaining clips -arrows- and detach top section of air cleaner housing.

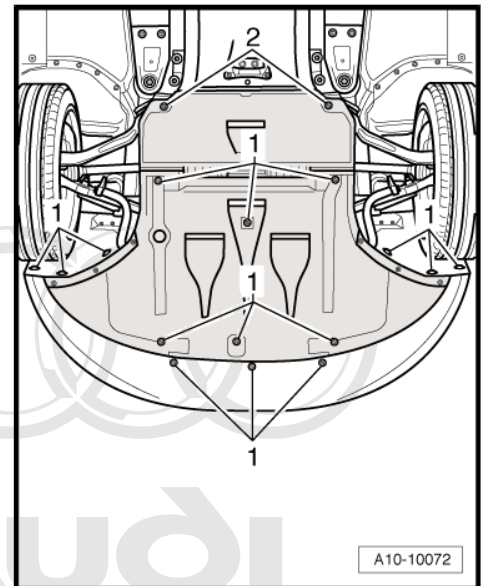


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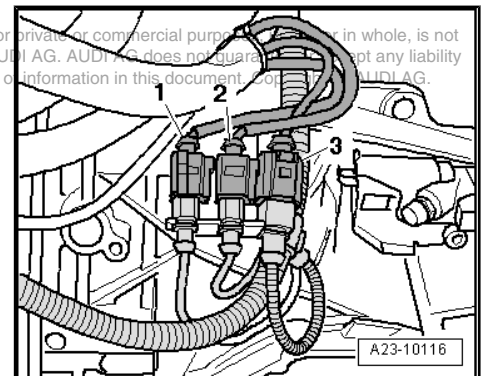
- Unplug electrical connector -1- at air mass meter - G70- .
- Loosen hose clip -4- to remove air intake hose.
- If fitted, disconnect vacuum hose -2- and lift vacuum unit -3- together with air flap off air cleaner housing.
- Disengage bottom section of air cleaner housing from retaining pin and remove.



- Open quick-release fasteners -2- and remove rear noise insulation.



- Take electrical connector -1- for exhaust gas temperature sender 1 - G235- out of bracket on left side of gearbox.
- Unplug electrical connector and move wiring clear towards bottom of vehicle.



- Unscrew exhaust gas temperature sender 1 - G235- -arrow- from turbocharger using an open ring spanner.

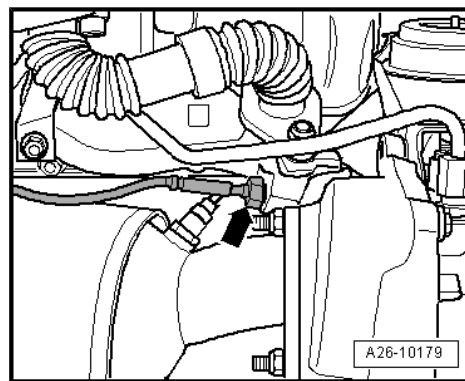
Installing

Installation is carried out in the reverse order; note the following:



Note

- ◆ *Fit all heat insulation sleeves in the original position when installing.*
- ◆ *Fit all cable ties in the original positions when installing.*



Tightening torques

Component	Nm
Exhaust gas temperature sender 1 - G235- to turbocharger	45
Hose clips (9 mm wide)	3
Hose clips (13 mm wide)	5.5

4.2 Removing and installing temperature sender before particulate filter - G506-

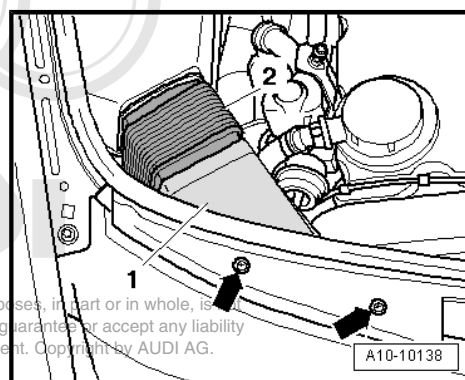
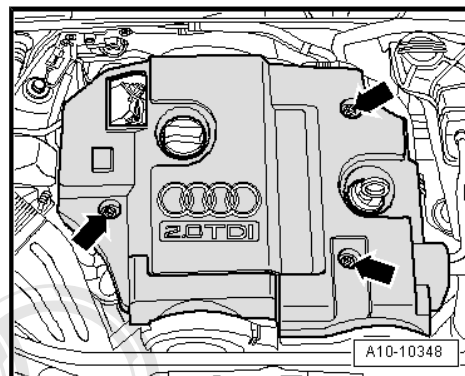
Removing



Note

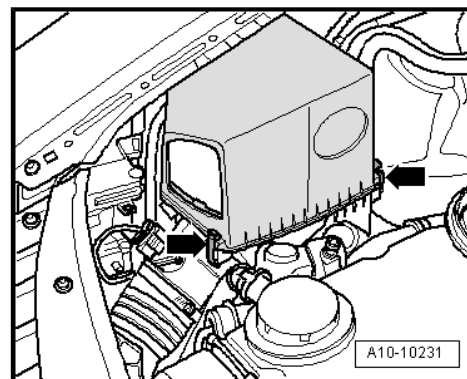
All cable ties which are released or cut open when removing must be fitted in the same position when installing.

- Pull dipstick -1- out of guide tube.
- Pull off engine cover panel -arrows-.
- Re-insert dipstick in guide tube.
- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.

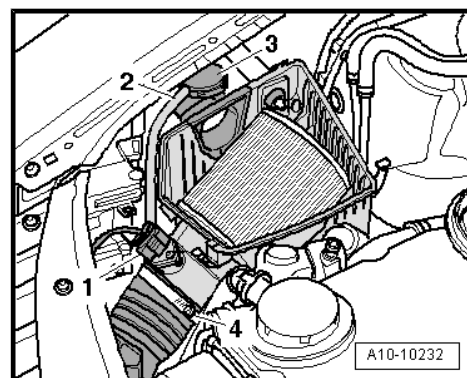


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- Release two retaining clips -arrows- and detach top section of air cleaner housing.



- Unplug electrical connector -1- at air mass meter - G70- .
- Loosen hose clip -4- to remove air intake hose.
- If fitted, disconnect vacuum hose -2- and lift vacuum unit -3- together with air flap off air cleaner housing.
- Disengage bottom section of air cleaner housing from retaining pin and remove.

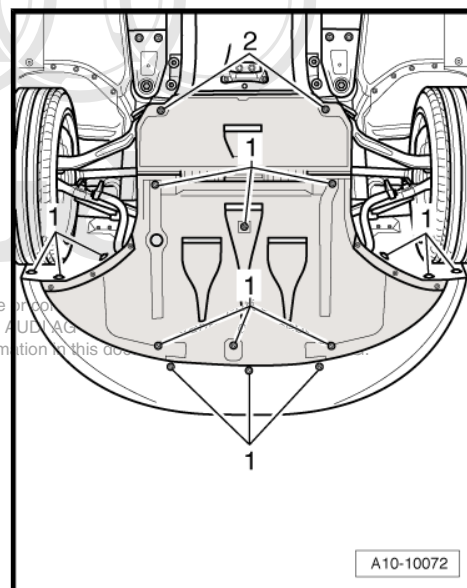
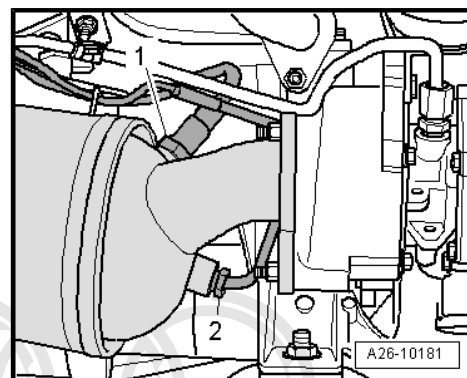


- Slacken temperature sender before particulate filter - G506- -item 2-.



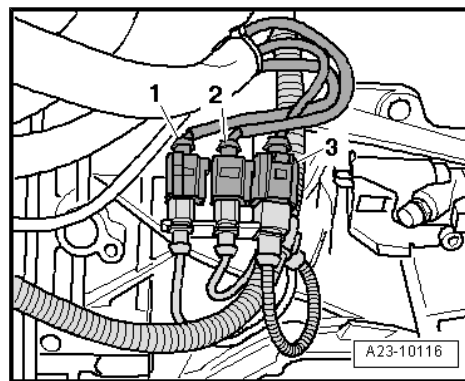
Note

- ◆ *The temperature sender before particulate filter - G506- is removed LATER.*
- ◆ *Disregard -item 1-.*
- Remove front exhaust pipe ⇒ [page 230](#) .
- Open quick-release fasteners -2- and remove rear noise insulation.

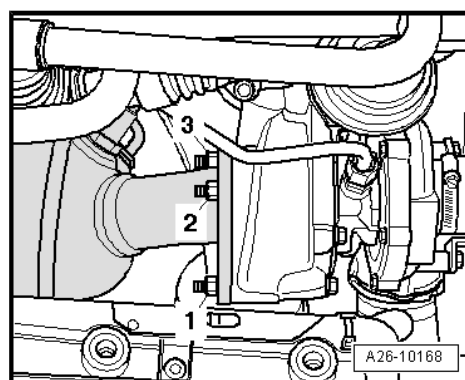


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- Take electrical connector -2- for temperature sender before particulate filter - G506- out of bracket.
- Unplug electrical connector and move wiring clear.



- Unscrew securing nuts connecting turbocharger to particulate filter -1 ... 3- and push particulate filter slightly towards the rear.
- Detach temperature sender before particulate filter - G506- .



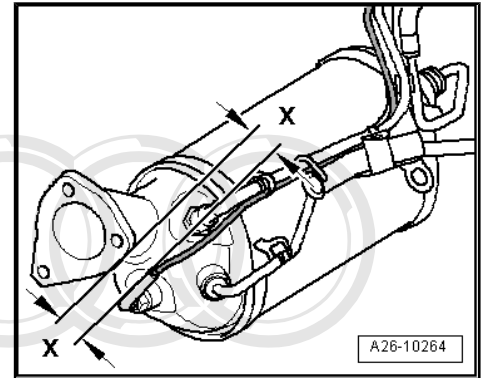
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Installing

Installation is carried out in the reverse order; note the following:

Note

- ◆ *Renew gaskets and self-locking nuts.*
- ◆ *Fit all heat insulation sleeves in the original position when installing.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*
- ◆ *Fit all cable ties in the original positions when installing.*
- When installing, make sure that temperature sender before particulate filter - G506- is positioned parallel to flange area of particulate filter.
- Dimension -x- = dimension -x-.
- Install front exhaust pipe ⇒ [page 230](#) .
- Align exhaust system so it is free of stress ⇒ [page 235](#) .



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Tightening torques

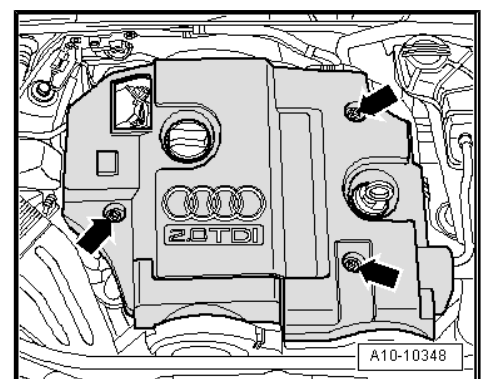
Component	Nm
Temperature sender before particulate filter - G506- to particulate filter	45
Particulate filter to turbocharger	23 ¹⁾²⁾
Hose clips (9 mm wide)	3
Hose clips (13 mm wide)	5.5
• ¹⁾ Renew nuts. • ²⁾ Coat threads and contact surface of bolt heads with high-temperature paste; for high-temperature paste refer to ⇒ Parts catalogue .	

4.3 Removing and installing temperature sender after particulate filter - G527-

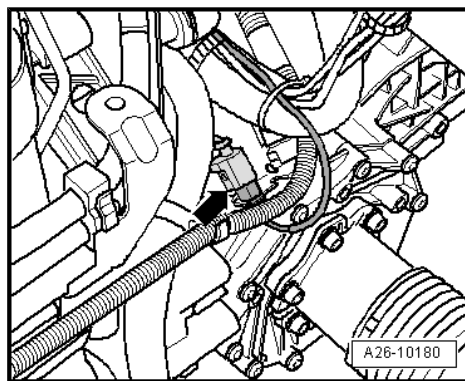
Removing

Note

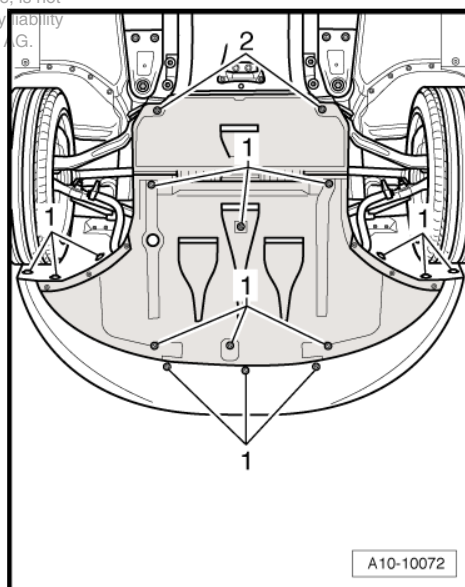
- ◆ *Fit all heat insulation sleeves in the original position when installing.*
- ◆ *All cable ties which are released or cut open when removing must be fitted in the same position when installing.*
- Pull dipstick -1- out of guide tube.
- Pull off engine cover panel -arrows-.
- Re-insert dipstick in guide tube.



- Take electrical connector -arrow- for temperature sender after particulate filter - G527- out of bracket.
- Unplug electrical connector and move wiring clear.



- Release quick-release fasteners -1- and -2- and take off front and rear noise insulation.

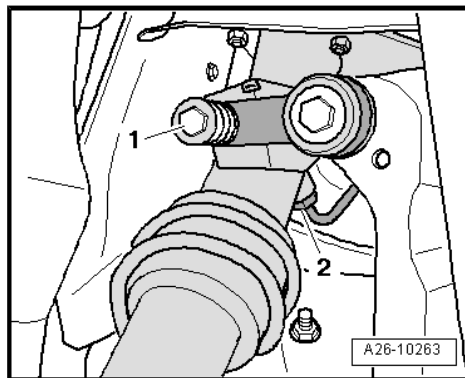


- Unscrew temperature sender after particulate filter - G527- -item 2-.



Note

Disregard -item 1-.



Installing

Installation is carried out in the reverse order; note the following:



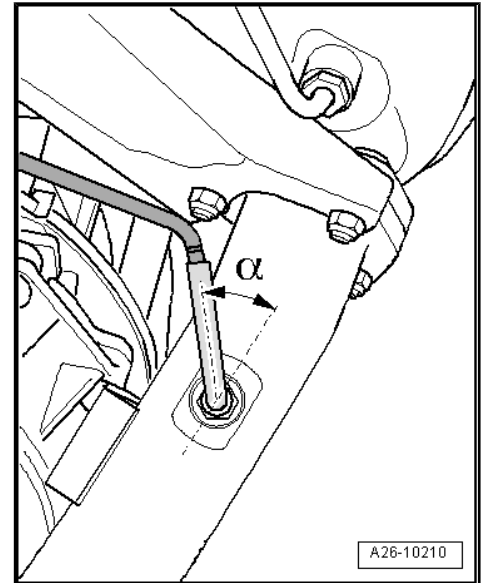
Note

Fit all cable ties in the original positions when installing.

- When installing, make sure that temperature sender after particulate filter - G527- is fitted at angle $-\alpha$.
- Angle $-\alpha = 40^\circ$

Tightening torques

Component	Nm
Temperature sender after particulate filter - G527- to front exhaust pipe	45



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5 Exhaust gas recirculation system

5.1 Exhaust gas recirculation system - exploded view

1 - Gasket

- ☐ Renew

2 - 25 Nm

3 - Connecting pipe for exhaust gas recirculation

- ☐ Tightening sequence

4 - Coolant hoses

5 - Exhaust gas recirculation cooler

- ☐ Removing and installing
⇒ [page 249](#)

6 - Bracket

7 - Retaining pin for engine cover panel

8 - 9 Nm

9 - Gasket

10 - Vacuum unit

- ☐ Removing and installing
⇒ [page 250](#)

11 - Vacuum hose

- ☐ From exhaust gas recirculation cooler change-over valve - N345-

12 - 7 Nm

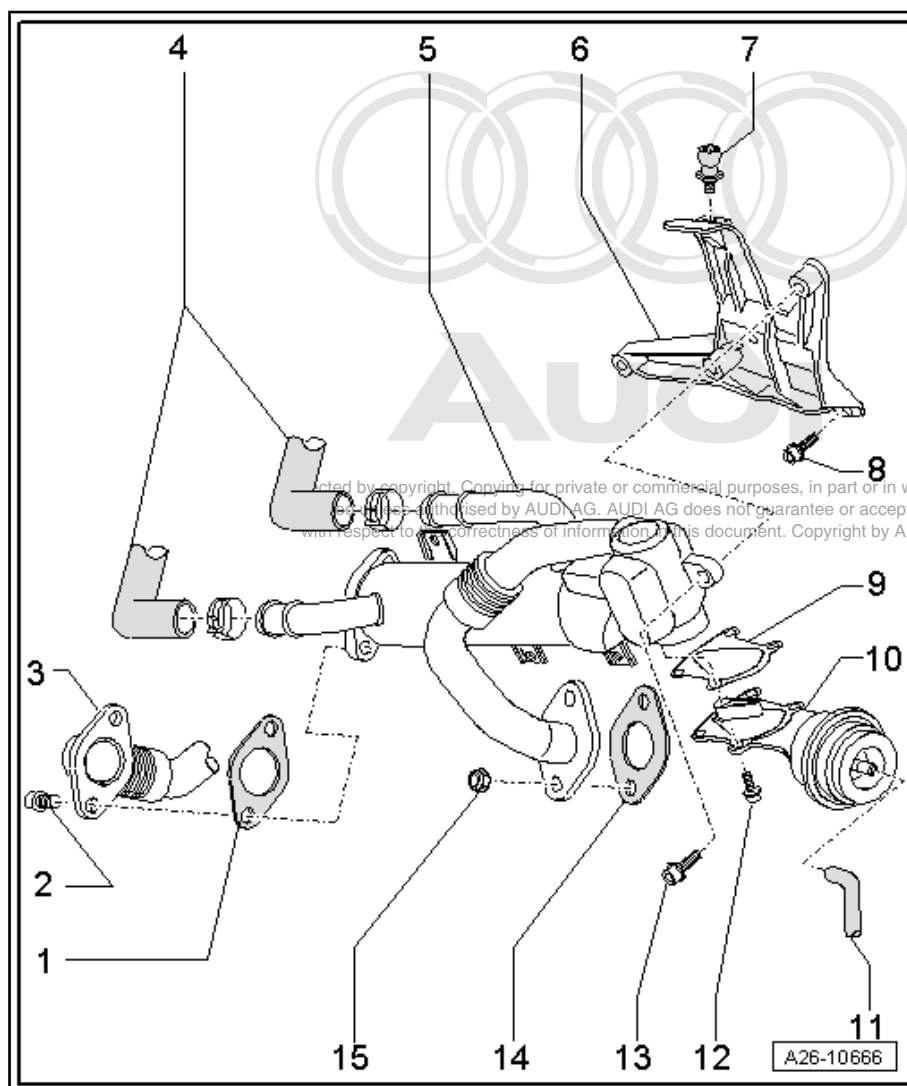
13 - 9 Nm

14 - Gasket

- ☐ Renew

15 - 25 Nm

- ☐ Renew



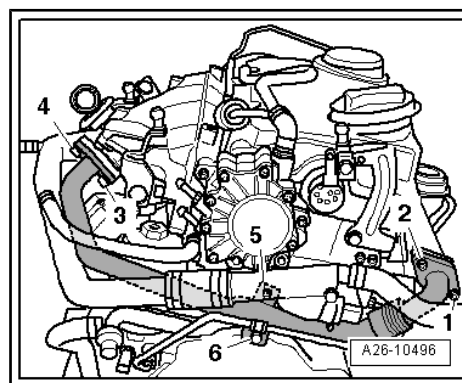
Tightening sequence: connecting pipe for exhaust gas recirculation



Note

The connecting pipe for exhaust gas recirculation must be installed free of stress as described below:

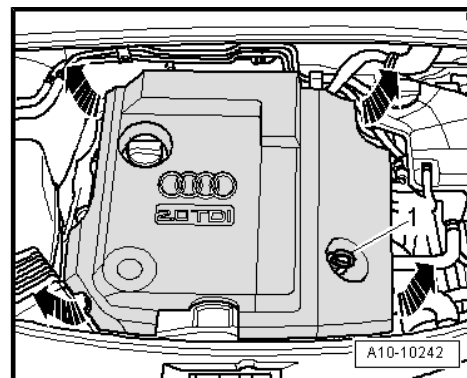
1. Tighten bolt connections -1 ... 6- for connecting pipe for exhaust gas recirculation hand-tight.
2. Tighten bolt connections for connecting pipe for exhaust gas recirculation to specified torque in the sequence -1 ... 6-.



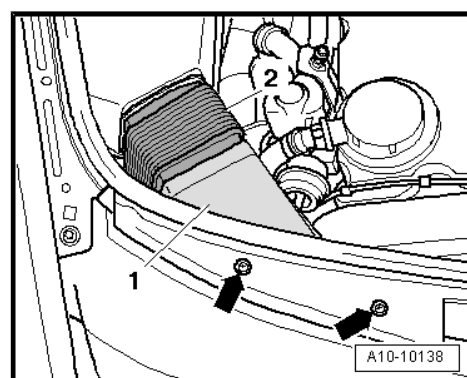
5.2 Removing and installing exhaust gas recirculation cooler

Removing

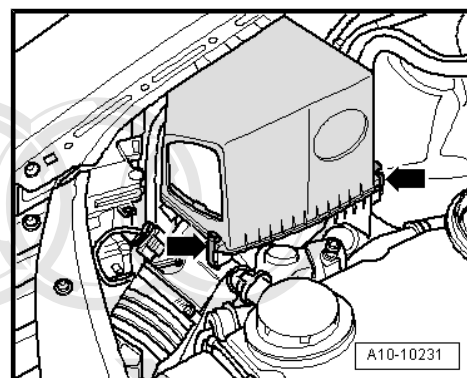
- Pull dipstick -1- out of guide tube.
- Pull off engine cover panel -arrows-.
- Re-insert dipstick in guide tube.
- Drain off coolant ⇒ [page 183](#) .



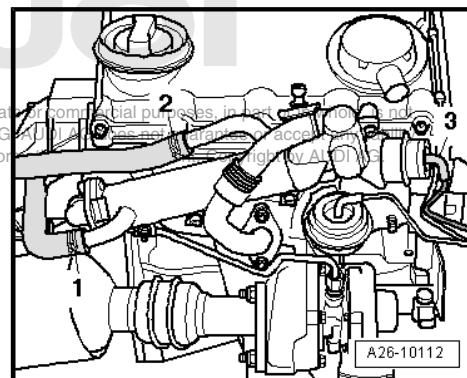
- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.



- Release two retaining clips -arrows- and detach top section of air cleaner housing.
- Remove crankcase breather hose from cylinder head cover.



- Detach vacuum hose -3- from vacuum unit for change-over flap for exhaust gas recirculation.
- Disconnect coolant hoses -1- and -2- at exhaust gas recirculation cooler.



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- Unscrew bolts -1- and nuts -2-.
- Remove bolts -arrows-.
- Remove exhaust gas recirculation cooler.

Installing

Installation is carried out in the reverse order; note the following:



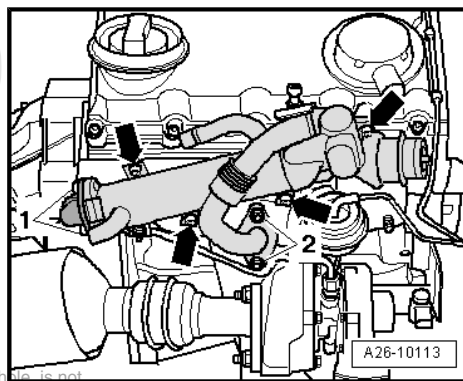
Note

- ◆ Renew gaskets and self-locking nuts.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ *Parts catalogue*.

- Fill cooling system ⇒ [page 185](#).

Tightening torques

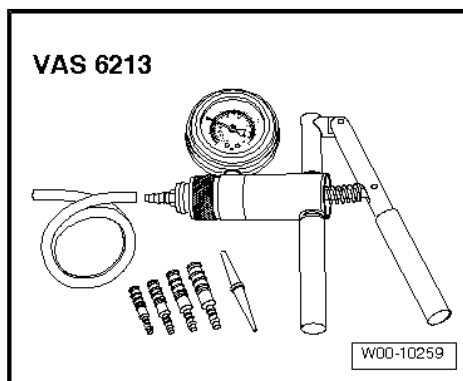
Component	Nm
Exhaust gas recirculation cooler to bracket	9
EGR connecting pipe to exhaust manifold	25 ¹⁾²⁾
EGR connecting pipe to exhaust gas recirculation cooler	25 ²⁾
• 1) Renew nuts. • 2) Tightening sequence ⇒ page 248	



5.3 Removing and installing vacuum unit for exhaust gas recirculation cooler

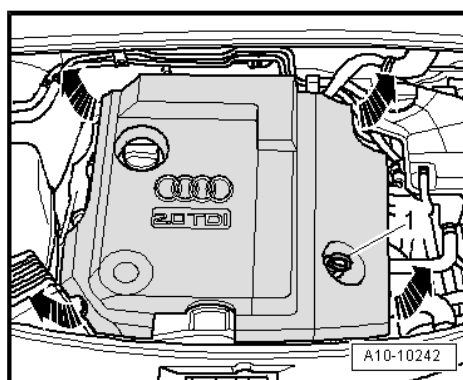
Special tools and workshop equipment required

- ◆ Hand vacuum pump - VAS 6213-

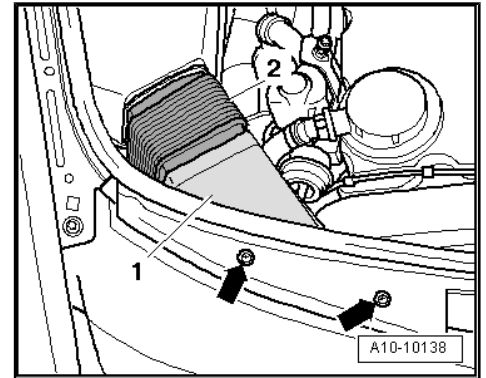


Removing

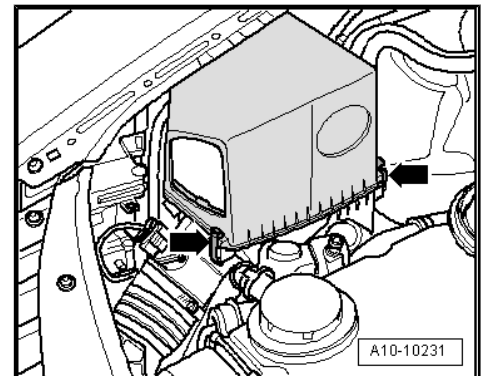
- Pull dipstick -1- out of guide tube.
- Pull off engine cover panel -arrows-.
- Re-insert dipstick in guide tube.



- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.



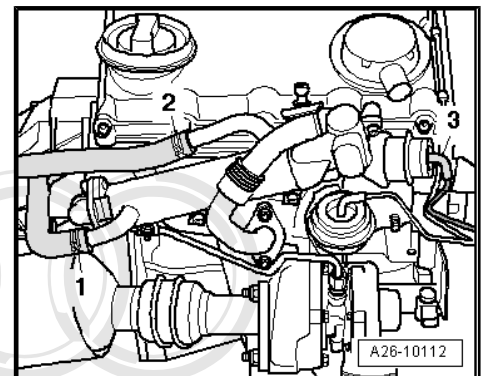
- Release two retaining clips -arrows- and detach top section of air cleaner housing.
- Remove crankcase breather hose from cylinder head cover.



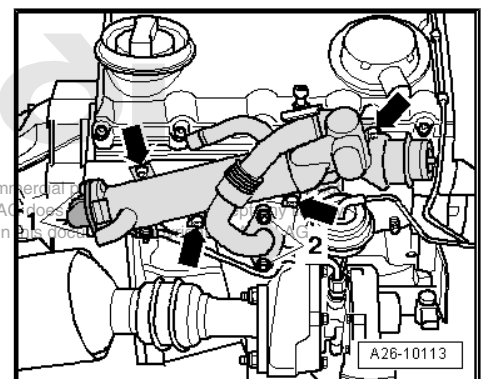
- Detach vacuum hose -3- from vacuum unit for change-over flap for exhaust gas recirculation.

i Note

Coolant hoses -1- and -2- must not be detached.



- Unscrew bolts -1- and nuts -2-.
- Remove bolts -arrows-.
- Move exhaust gas recirculation cooler to one side with coolant hoses attached.



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- Remove bolts -1- to -4- and detach vacuum unit with gasket.



Note

Disregard hand vacuum pump - VAS 6213- .

Installing

Installation is carried out in the reverse order; note the following:

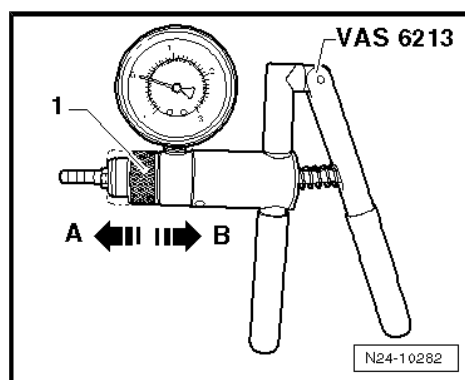
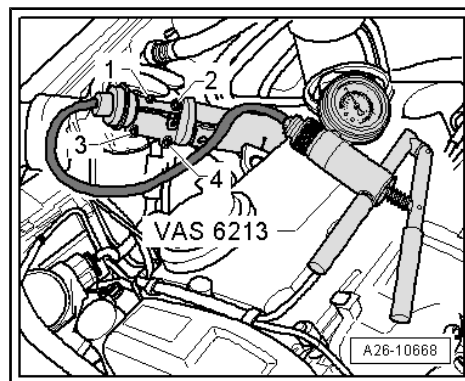
Tightening torques ⇒ [page 248](#)



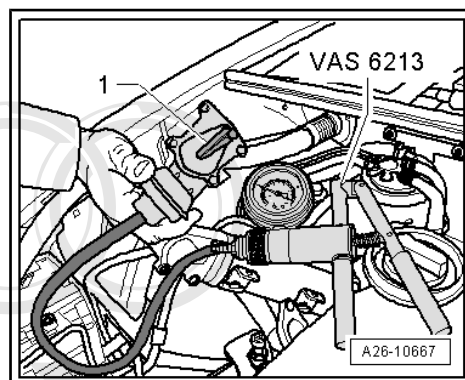
Note

- ◆ Renew gaskets and self-locking nuts.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ *Parts catalogue* .

- Set sliding ring -1- to position -A- for vacuum function.



- Set change-over flap -1- as shown in illustration using hand vacuum pump - VAS 6213- .
- Install vacuum unit with gasket and secure in position.



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