

Audi A3 1997 ➤

4-Cylinder engine (5-valve), Mechanics

Engine ID	AGN	APG						
-----------	-----	-----	--	--	--	--	--	--

Edition 09.2001



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

List of Workshop Manual Repair GroupsList of Workshop Manual Repair Groups

Audi A3 1997 ➤

4-Cylinder engine (5-valve), Mechanics

Repair Group

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

- 00 - Technical data
- 10 - Removing and installing engine
- 13 - Crankshaft group
- 15 - Cylinder head, Valve gear
- 17 - Lubrication
- 19 - Cooling system
- 26 - Exhaust system

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.

All rights reserved.
No reproduction without prior agreement from publisher.

Contents

00 - Technical data	1
1 Technical data	1
1.1 Technical data	1
1.2 Engine number	1
1.3 Engine data	1
10 - Removing and installing engine	3
1 Removing and installing engine	3
1.1 Removing and installing engine	3
1.2 Removing	4
1.3 Separating gearbox from engine	21
1.4 Attaching engine to engine stand	25
1.5 Installing	26
2 Adjusting engine mountings	32
2.1 Adjusting engine mountings	32
13 - Crankshaft group	37
1 Dismantling and assembling engine	37
1.1 Dismantling and assembling engine	37
1.2 Removing and installing ribbed belt	37
1.3 Removing and installing vibration damper	41
1.4 Removing and installing ribbed belt	43
1.5 Removing and installing bracket for auxiliary drives	44
1.6 Removing and installing toothed belt	48
1.7 Removing, replacing and installing toothed belt	54
1.8 Removing toothed belt from camshaft sprocket	60
1.9 Turning crankshaft to TDC of No. 1 cylinder with engine installed	62
1.10 Turning crankshaft to TDC of No. 1 cylinder with engine removed	65
2 Removing and installing sealing flanges and flywheel/drive plate	66
2.1 Removing and installing sealing flanges and flywheel/drive plate	66
2.2 Renewing crankshaft oil seal - pulley end -	70
2.3 Removing and installing front sealing flange	73
2.4 Removing and installing dual mass flywheel/ drive plate	76
3 Removing and installing crankshaft	80
3.1 Removing and installing crankshaft	80
3.2 Crankshaft dimensions - vehicles up to approx. 02/97	85
3.3 Crankshaft dimensions - vehicles as of approx. 03/97	85
3.4 Removing and installing chain sprocket	86
4 Dismantling and assembling pistons and conrods	87
4.1 Dismantling and assembling pistons and conrods	87
4.2 Different conrod versions with different conrod bolts	87
4.3 Sawn conrods	88
4.4 Cracked-steel conrods	93
4.5 Piston and cylinder dimensions	99
15 - Cylinder head, Valve gear	100
1 Removing and installing cylinder head	100
1.1 Removing and installing cylinder head	100
1.2 Removing and installing upper section of intake manifold	108
1.3 Removing and installing lower section of intake manifold	112
1.4 Removing and installing cylinder head cover	115
1.5 Removing cylinder head	117
1.6 Installing cylinder head	120



1.7	Checking compressions	123
2	Servicing valve gear	125
2.1	Servicing valve gear	125
2.2	Checking camshaft axial clearance	131
2.3	Renewing oil seal of exhaust camshaft	133
2.4	Renewing oil seal of inlet camshaft	136
2.5	Removing and installing camshafts and camshaft adjuster	139
2.6	Checking hydraulic bucket tappets	146
2.7	Renewing valve stem seals	147
2.8	Checking valve guides	151
2.9	Checking valves	152
2.10	Reworking valve seats	152
3	Testing camshaft timing control	154
3.1	Testing camshaft timing control	154
3.2	Testing system: engines with engine code letters APG	154
3.3	Checking solenoid valve for camshaft timing control -N205	156
17	Lubrication	162
1	Removing and installing parts of the lubrication system	162
1.1	Removing and installing parts of the lubrication system	162
1.2	Part I	163
1.3	Part II	167
1.4	Removing and installing sump	170
1.5	Removing and installing oil pump	173
1.6	Testing oil pressure and oil pressure switch	174
1.7	Engine oil	177
1.8	Checking oil level	177
19	Cooling system	178
1	Removing and installing parts of cooling system	178
1.1	Removing and installing parts of cooling system	178
1.2	Parts of cooling system	179
1.3	Draining and filling cooling system	181
1.4	Removing and installing coolant pump	184
1.5	Removing and installing coolant thermostat	186
1.6	Radiator and radiator fan - Exploded view	188
1.7	Removing and installing radiator	190
1.8	Checking cooling system for leaks	194
26	Exhaust system	196
1	Removing and installing parts of exhaust system	196
1.1	Removing and installing parts of exhaust system	196
1.2	Separating centre and rear silencers	202
1.3	Removing and installing exhaust manifold	203
1.4	Removing and installing front exhaust pipe with catalytic converter	205
1.5	Stress-free alignment of exhaust system	208
1.6	Checking exhaust system for leaks	210
2	Exhaust gas recirculation system - vehicles with engine letter code APG	210
2.1	Exhaust gas recirculation system - vehicles with engine letter code APG	210
2.2	Removing and installing parts of exhaust gas recirculation system	211
2.3	Electrical check of exhaust gas recirculation valve -N18 and potentiometer for exhaust gas recirculation -G212	214
2.4	Removing and installing exhaust gas recirculation valve -N18 with potentiometer for exhaust gas recirculation -G212	220
3	Secondary air system - vehicles with engine code letters APG	222
3.1	Secondary air system - vehicles with engine code letters APG	222
3.2	Testing secondary air inlet valve -N112	226

3.3	Testing secondary air pump relay -J299 and activation	.231
3.4	Checking function of combination valve for secondary air system; checking for leaks . . .	.237
3.5	Removing and installing combination valve for secondary air system	.238
3.6	Removing and installing secondary air pump	.240



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



Audi A3 1997 ➤

Audi 4-Cylinder engine (5-valve), Mechanics - Edition 09.2001



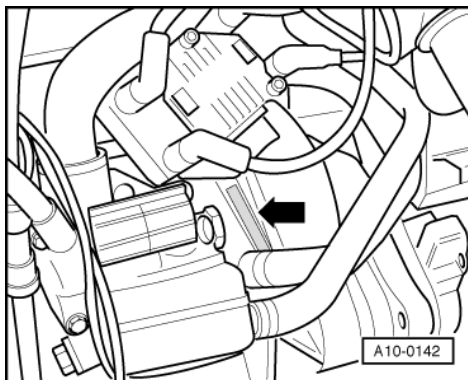
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

00 - Technical data

1 - Technical data

1.1 - Technical data

1.2 - Engine number



-> The engine number ("Engine code" and "Serial number") can be found at the front next to the join between engine and gearbox

Additionally there is a sticker on the toothed belt guard with "Engine code" and "Serial number".

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

1.3 - Engine data

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

Code letters		AGN	AGN	APG
Manufactured		up to 07.97	08.97 up to 07.00	from 08.00
Displacement	l	1.781	1.781	1.781
Output	kW at rpm	92/6000	92/6000	92/6000
Torque	Nm at rpm	173/4100	170/3500 ... 4000	170/3500 ... 4000
Bore	mm	81.0	81.0	81.0
Stroke	mm	86.4	86.4	86.4
Compression ratio		9.5	9.5	9.5
RON	min.	95 1)	95 1)	95 1)
Injection/ignition system		Motronic	Motronic	Motronic
Firing order		1-4-3-2	1-4-3-2	1-4-3-2
Knock control		yes	yes	yes
Secondary air system		no	no	yes
Exhaust gas recirculation system		no	no	yes
Intake manifold changeover function		no	yes	yes



Code letters	AGN	AGN	APG
Camshaft adjustment	yes	yes	yes

- 1) Unleaded regular RON 91 also acceptable, however with loss of performance.

Code letters	AGN	AGN	APG
Valve timing 2)			
Inlet opens after TDC	12.0°	18.0°	18.0°
Inlet closes after BDC	34.0°	40.0°	40.0°
Exhaust opens before BDC	38.0°	38.0°	38.0°
Exhaust closes before TDC	8.0°	8.0°	8.0°

- 2) with 1 mm valve lift and 0 mm valve clearance

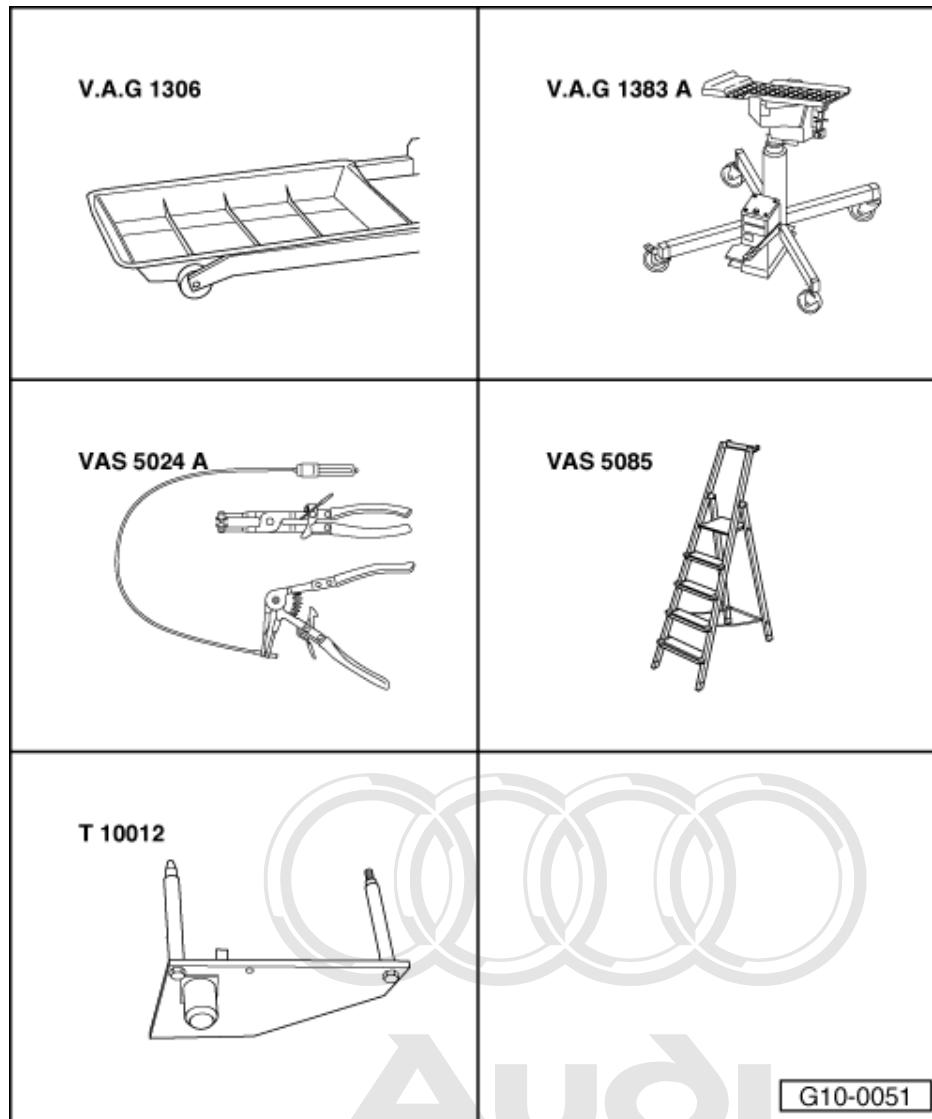


Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

10 - Removing and installing engine

1 - Removing and installing engine

1.1 - Removing and installing engine



Special tools and workshop equipment required

- ♦ V.A.G 1306
- ♦ V.A.G 1383 A
- ♦ VAS 5024
- ♦ VAS 5085
- ♦ Engine bracket T10012

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



1.2 - Removing

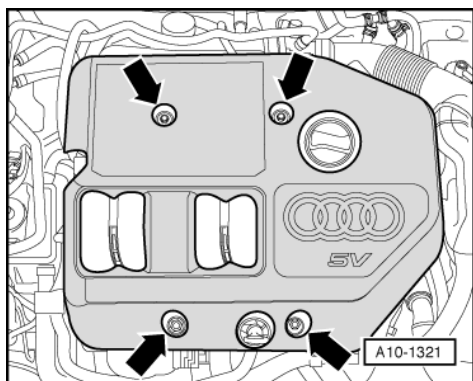
Notes:

- ♦ The following procedures are described for vehicles with electronic throttle, secondary air system and exhaust gas recirculation system. The procedures for older vehicles without these features are the same, except that some of the steps will not be required.
- ♦ The engine is removed from underneath together with the gearbox.
- ♦ All cable ties which are opened or cut open when removing the engine must be replaced in the same position when installing the engine.
- ♦ Catch drained-off coolant in a clean container for re-use or disposal.

Caution!

On vehicles equipped with telematics the telematics control unit must be switched to service mode before the battery terminals are disconnected. => Radio, telephone and navigation system; Repair group 91

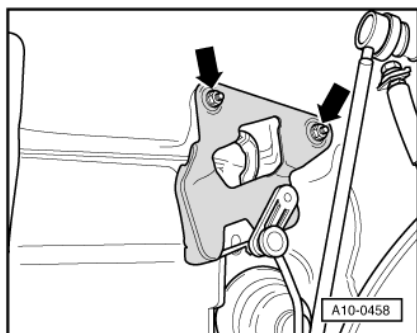
- Obtain code on vehicles with coded radio/integrated radio and navigation system.
- With ignition switched off disconnect battery earth strap.



Warning!

Hot steam or hot coolant can escape when the cap on the expansion tank is opened. Cover the cap with a cloth, and open it carefully.

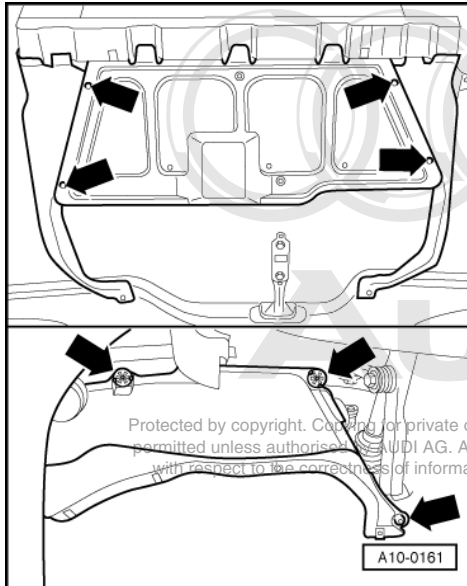
- Open cap on coolant expansion tank.
- -> Remove engine cover panel -arrows-.



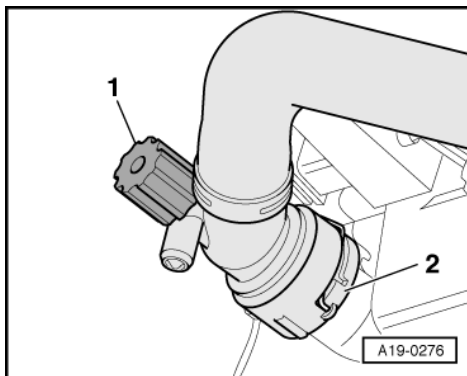
- -> On vehicles with automatic headlight range control, unbolt bracket for headlight range control at top of left wheelhousing -arrows-.



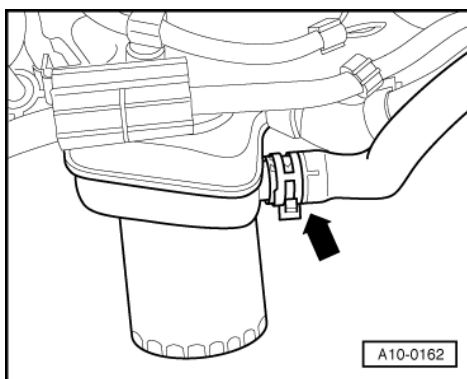
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



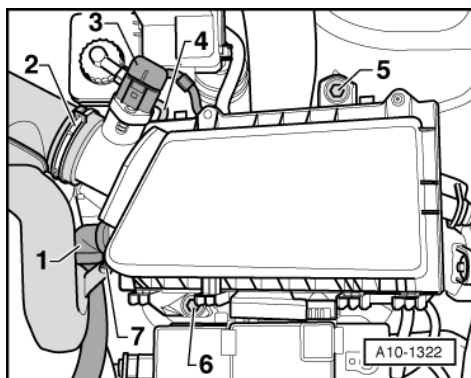
- -> Remove noise insulation in the centre and on left and right sides -arrows-.



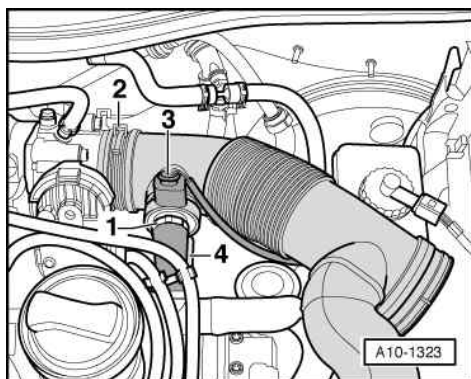
- Place drip tray V.A.G 1306 below engine.
- -> Turn drain screw -1- on radiator anti-clockwise, if necessary fit drain hose to connection and drain coolant at radiator.
- Pull off bottom coolant hose retaining clip -2- and remove coolant hose from radiator.



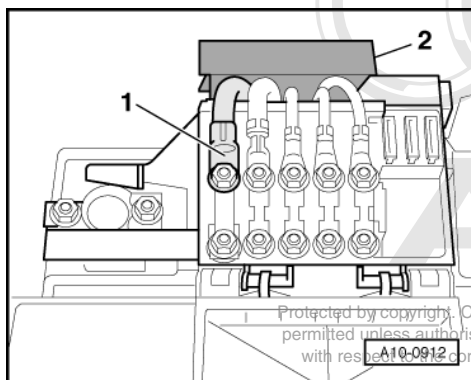
- -> In addition, detach coolant hose from bottom of oil cooler -arrow- and drain off remaining coolant.



- -> Disconnect secondary air pump intake hose -1- from air cleaner housing.
- Unscrew bolt -7-.
- Disconnect air hose -2- from air mass meter.
- Unplug electrical connector -3- from air mass meter.
- Unscrew bolts -5- and -6-.
- Remove air cleaner housing and pull off vent hose -4- from behind.

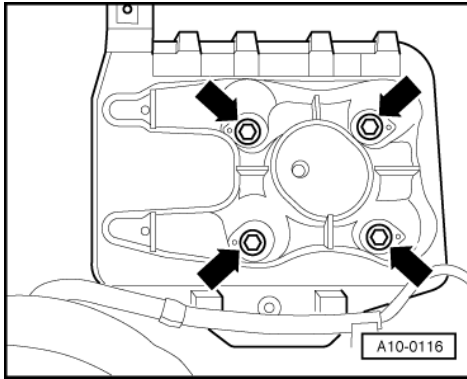


- -> Unplug electrical connector -3-.
- Disconnect hoses -1- and -4-.
- Remove air duct by releasing hose clip -2-.

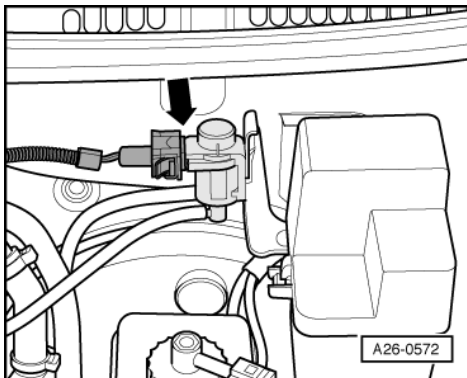


Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

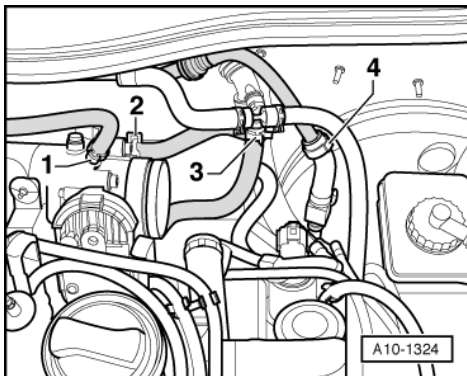
- Open lid of main fuse box towards front of vehicle.
- -> Remove protective cover -2- for wires.
- Unscrew black wire -1- from fuse bar.
- Remove battery.



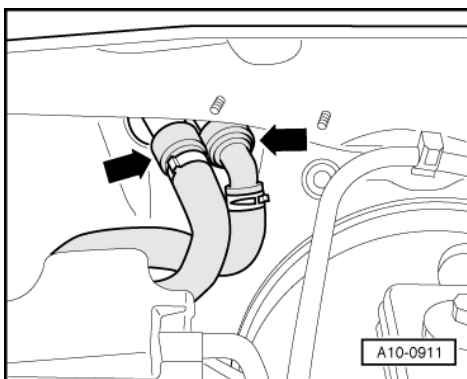
- -> Remove battery platform -arrows-.



- -> Detach secondary air inlet valve -N112 from bracket on bulkhead -arrow-.



- -> Disconnect hoses -1 ... 4-.

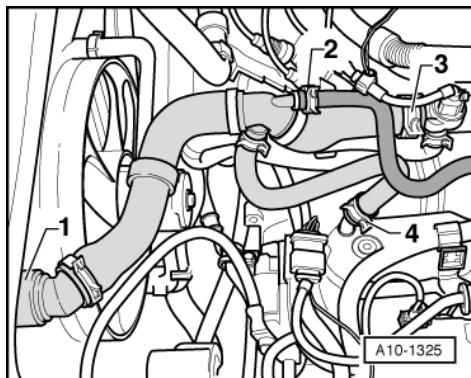


- -> Disconnect coolant hoses (going to heat exchanger) at bulkhead -arrows- by releasing clips.



Audi

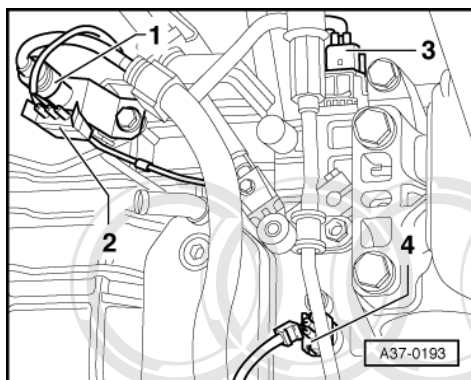
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



- -> Disconnect and remove the coolant hoses at the shown points -1 ... 4-.

Note:

In the picture shown on vehicle with automatic gearbox.



Vehicles with automatic gearbox

- -> Unplug electrical connections:

1 - for solenoid valves (10-pin connector)

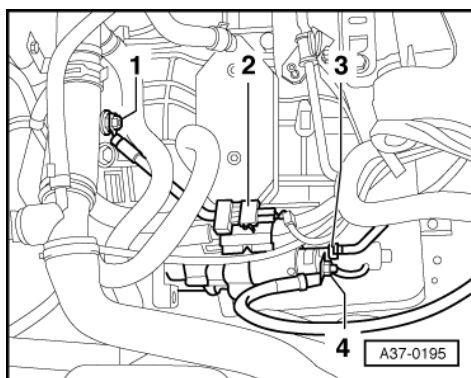
2 - for road speed sender -G68

3 - at multi-function switch -F125

4 - at gearbox speed sender -G38

Protected by copyright. Reproduction or use in any form or for any purposes, in part or in whole, is not permitted unless expressly permitted by Audi AG. Audi AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- Disengage wiring harness from retainers and move to one side.



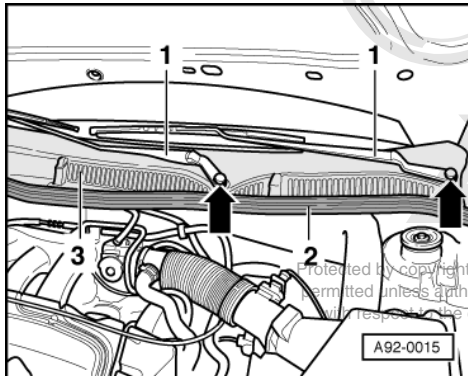
All models

- -> Unbolt earth wire -1- on engine/gearbox flange.
- Disconnect wires -3- and -4- from starter.

- Unplug connector -2- and pull out of retainer.
- Disengage wires from retainer on starter and move wires to one side.

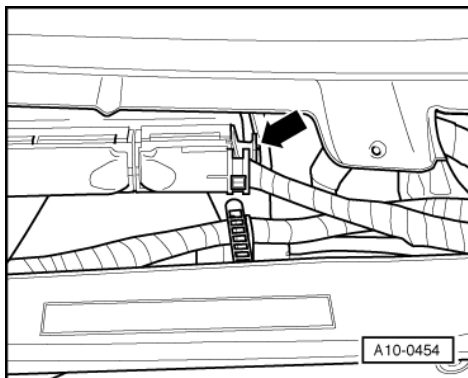
Vehicles with manual gearbox:

- Unplug connector for reversing light switch on gearbox.

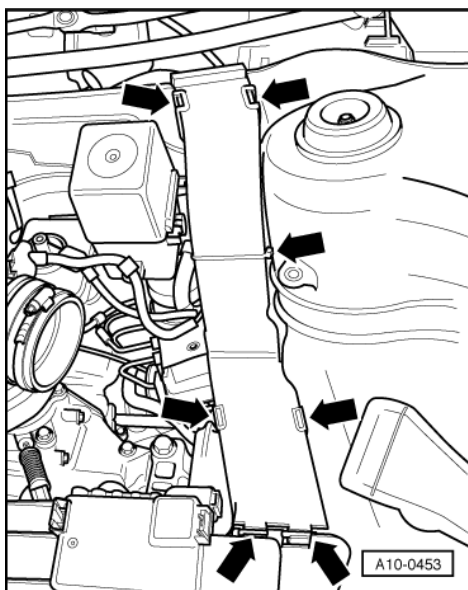


All models

- -> Lever off cover caps -arrows- from wiper arms with a screwdriver. Loosen the hex nuts several turns.
- Loosen wiper arms -1- by moving them around gently on the wiper shafts.
- Remove hexagon nuts completely and take off wiper arms.
- Pull rubber seal -2- off plenum chamber cover.
- Detach cover from plenum chamber -3- and move clear towards windscreen.

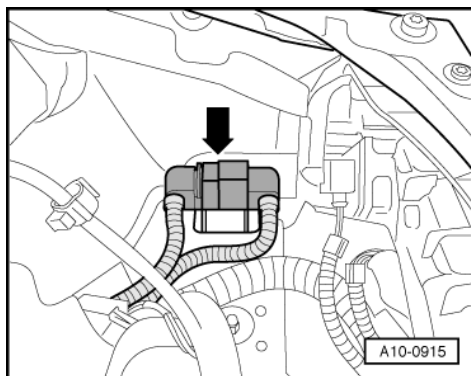


- -> Release left retainer catch -arrow- and unplug control unit connector.

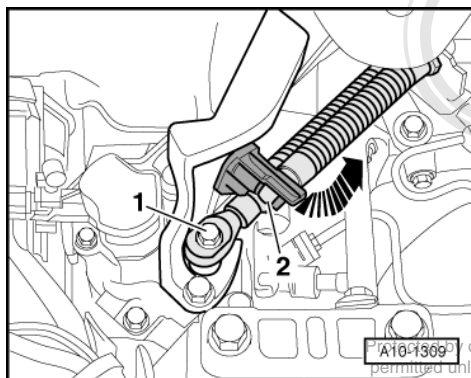




- -> Open cable duct on left side of engine compartment -arrows-.
- Unplug connector in cable duct



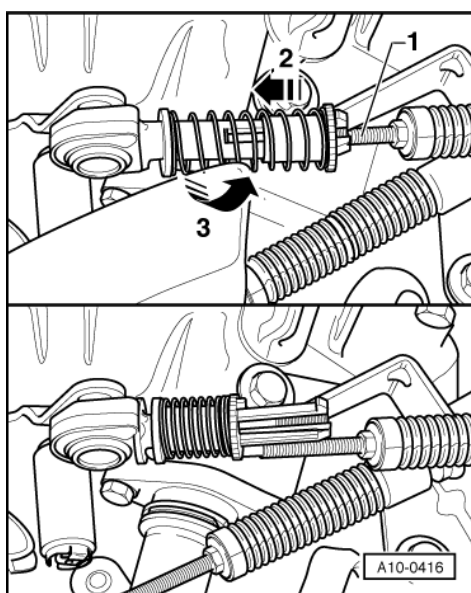
- -> Take electric connector out of retaining clip and disconnect -arrow-.
- Release control unit wiring harness as far as engine.



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

Vehicles with manual gearbox (until approx. 07/98):

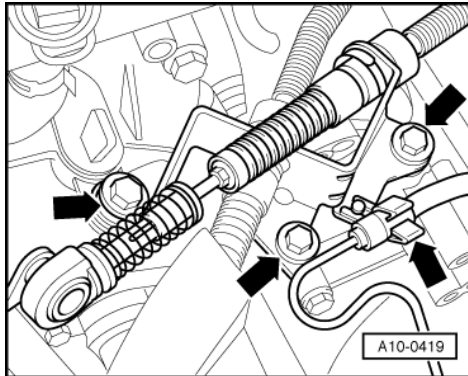
- -> Pull the clip upwards -arrow- and press down the selector cable -2-.
- Detach gear selector cable -1-.



Vehicles with manual gearbox (from approx. 08/98):

Disconnect both selector cables at gearbox as follows:

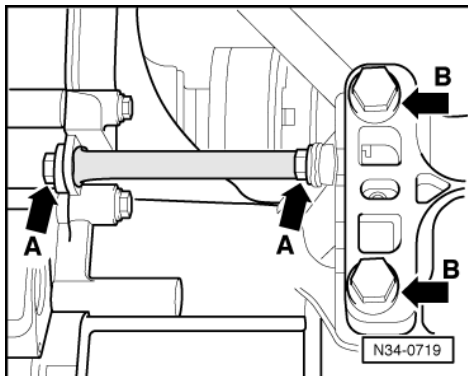
- -> Mark position of both selector cables on threaded rods -1-. Use waterproof felt-tip pen.
- Pull threaded collar in direction of arrow -2- (towards ball joint) to compress spring, then turn collar clockwise (arrow -3-) to lock in position.
- Disengage both selector cables.



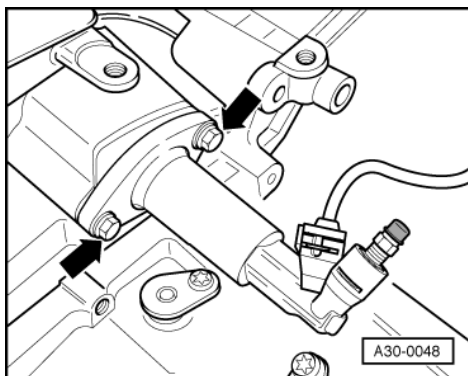
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

All vehicles with manual gearbox:

- -> Unclip clutch slave cylinder hose from selector cable support bracket.
- Remove selector cable support bracket from gearbox and place to one side -arrow-.



- -> Remove the gearbox brace -arrow A- from the gearbox.

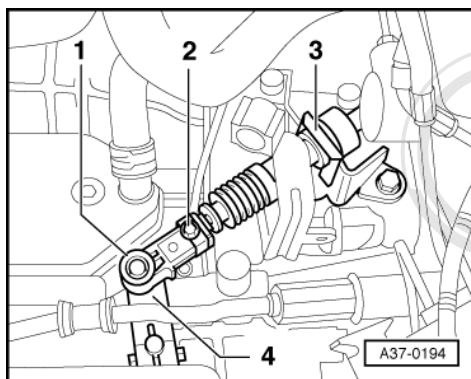


- -> Remove clutch slave cylinder -arrows- and secure with wire; do not disconnect pipe.



Note:

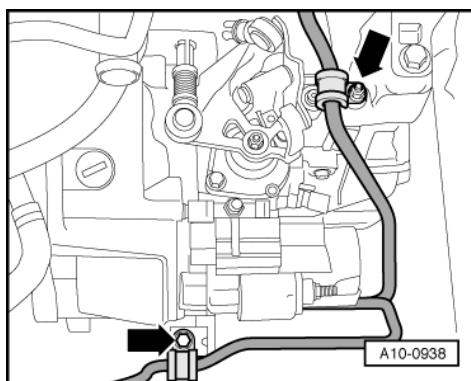
Do not depress clutch pedal after removing slave cylinder.



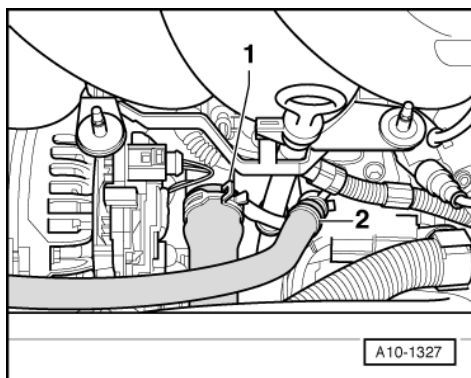
Vehicles with automatic gearbox

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

- -> Using a screwdriver, press selector cable -1- off selector lever on gearbox -4-, and pull retainer clip -3- off support bracket.
- Detach selector cable and move to one side.
- Unbolt bracket for power steering pressure pipe from gearbox support.

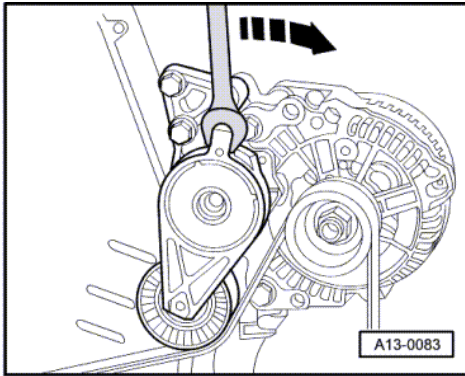


- -> Detach power steering pipe from gearbox -arrows-.



All models

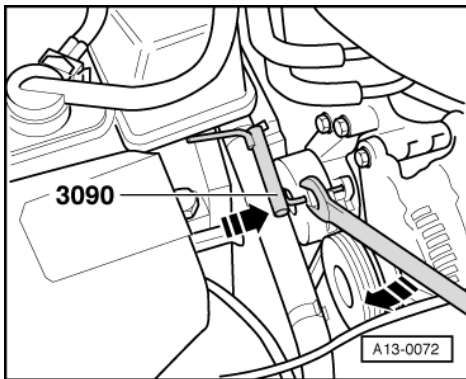
- -> Disconnect coolant hoses -1- and -2-.



Note:

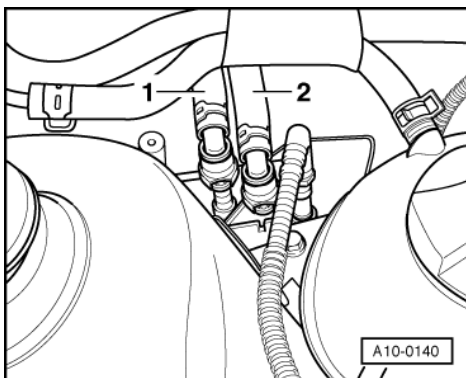
Before removing the ribbed belt, mark the direction of rotation with chalk or a felt pen. If a used belt rotates in the wrong direction when refitted, it can break.

- -> To slacken ribbed belt, turn belt tensioner in direction of arrow.
- Remove ribbed belt.



Note:

-> The tensioning element must be secured with a suitable pin or mandrel of 4.5 mm dia. and about 55 mm long. On vehicles without headlight washer system conrod support 3090 may also be used.

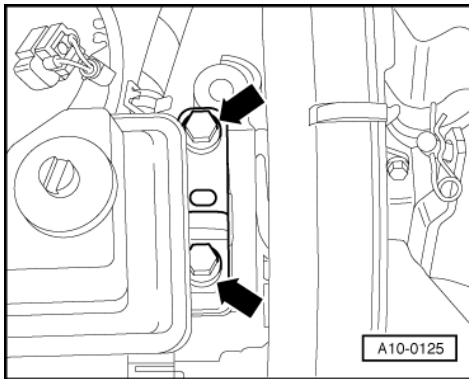


Warning

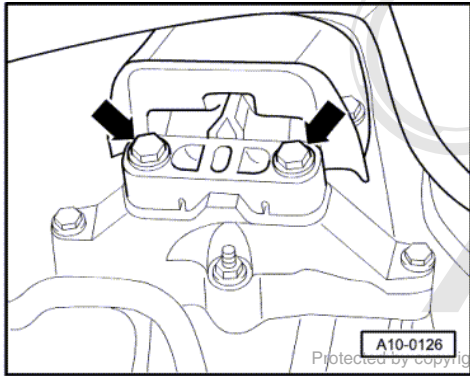
Fuel system is under pressure. Before opening the system place a cloth around the connection. Then release pressure by carefully loosening the connection.

- -> Press release catches and disconnect fuel supply line -1- and fuel return line -2-.

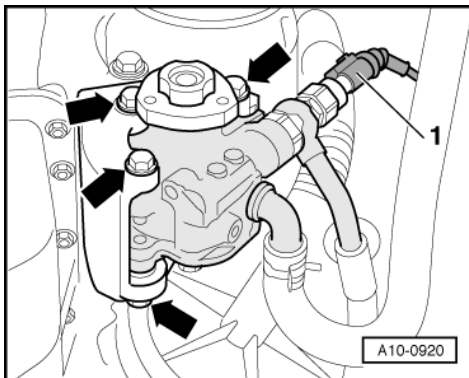
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



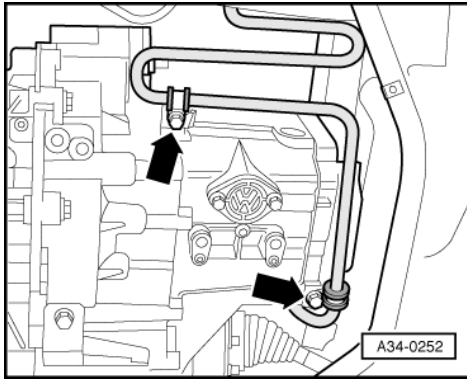
- -> Loosen the bolts -arrows- on the engine mounting ...



- -> ... and the bolts on the gearbox (about 2 turns only).
- Unscrew fan cowl securing bolts accessible from above.

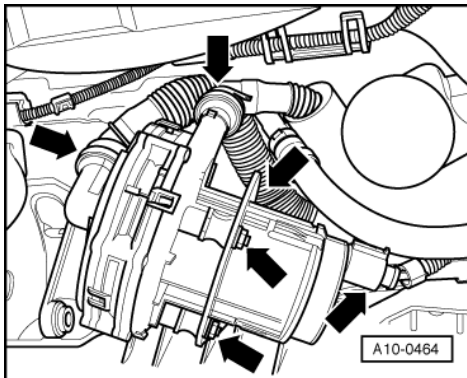


- Detach pulley from power steering pump using a mandrel as a brace.
- -> Unplug connector -1- at power steering pressure switch -F88.
- Unbolt power steering pump -arrows-. Do not disconnect pipes/hoses.



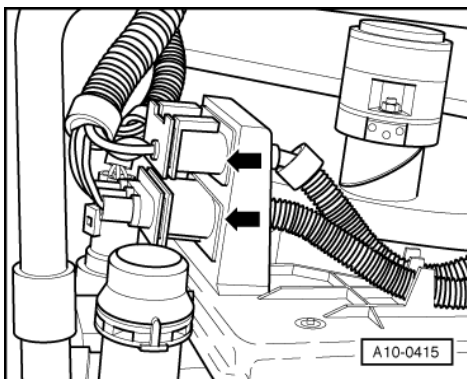
Vehicles with manual gearbox

- -> Detach power steering pipe from gearbox -arrows-.



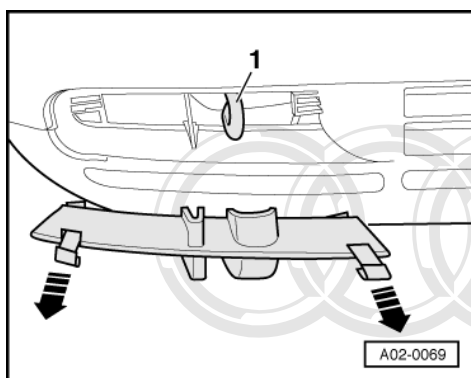
All models

- -> Disconnect hoses and connector from secondary air pump. Remove secondary air pump -arrows-.

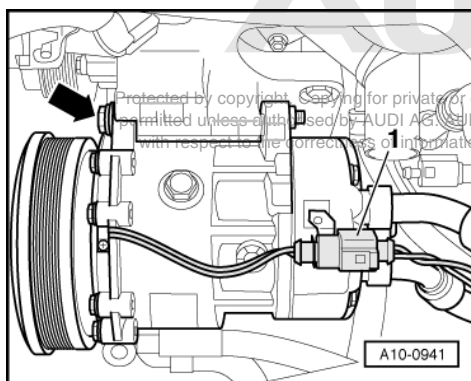


- -> Unplug both radiator fan connectors on fan cowl (bottom left).
- Reach in from beneath and unscrew bolts on fan cowl.
- Detach cowl together with the two fans and remove by pulling out from below.
- Tie up power steering pump with pipe on lock carrier panel

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



- -> Pull retainer lugs -arrows- to disengage grille panel, then remove grille.



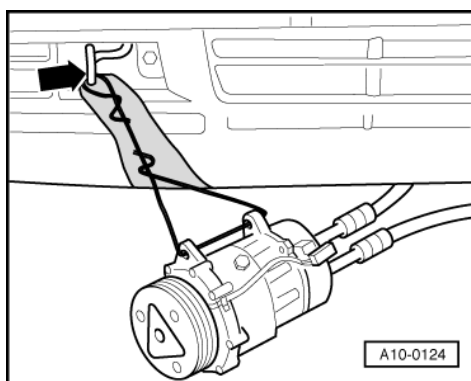
Vehicles with air conditioner:

- -> Disconnect magnetic clutch connector -1- from A/C compressor.

Warning!

The air conditioning system refrigerant circuit must not be opened.

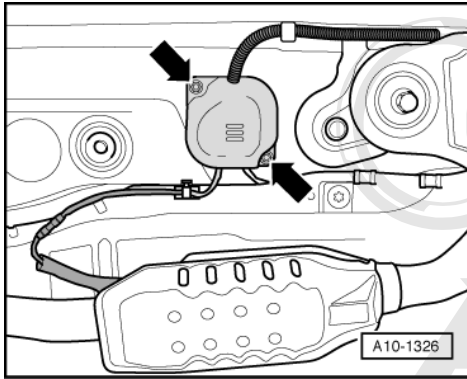
- Unscrew bolts -arrow- for A/C compressor.



- -> Unscrew air conditioner compressor mountings, lower out compressor with refrigerant hoses connected, and secure compressor to towline anchorage -arrow- with wire.

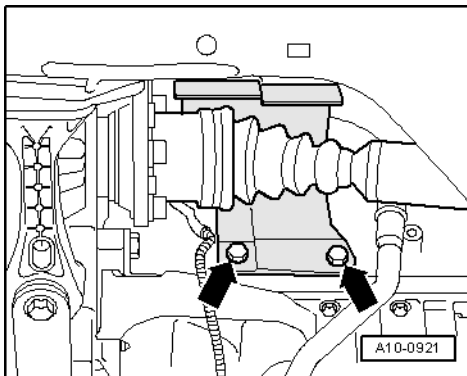
Note:

Use adhesive tape to prevent scratching bumper.

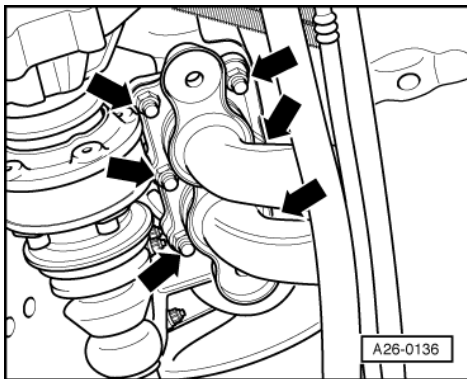


- -> Unbolt connector cover -1- (-arrows-).
- Unplug electrical connectors and move clear wiring for lambda probes.

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



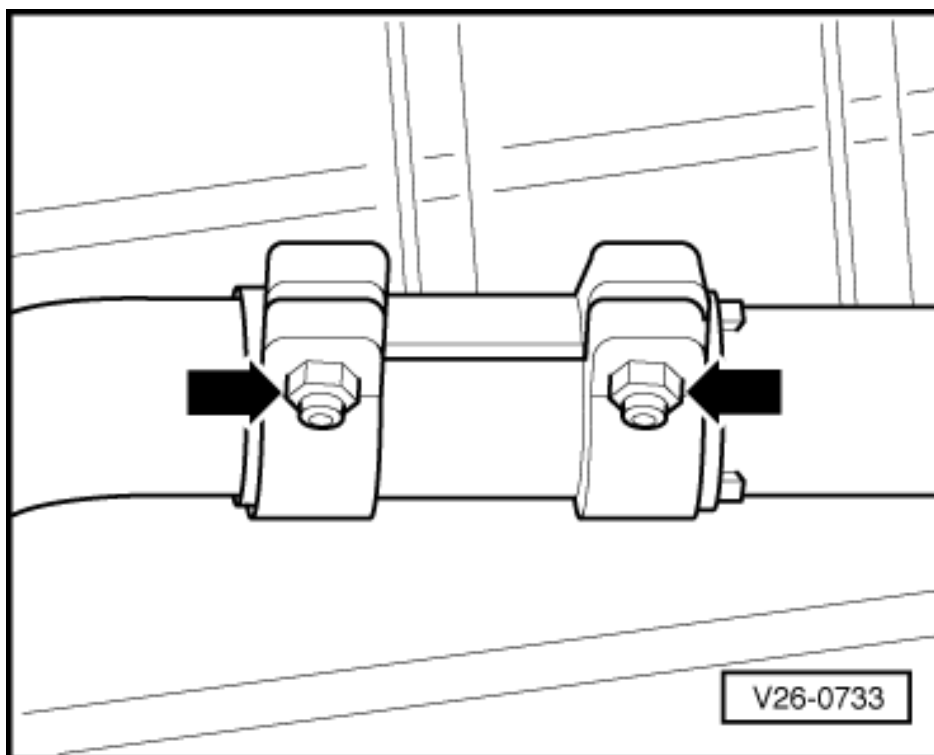
- -> Remove heat shield for right drive shaft -arrows-.



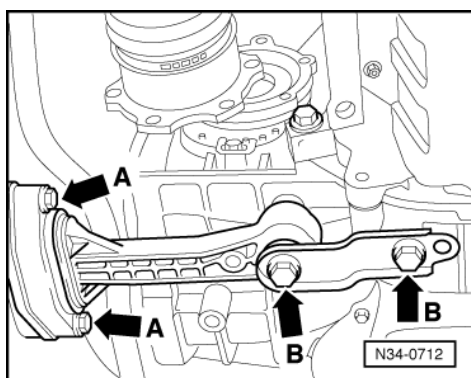
Note:

The flexible pipe connection (de-coupling element) on the front exhaust pipe must not be bent more than 10 ° otherwise it can be damaged.

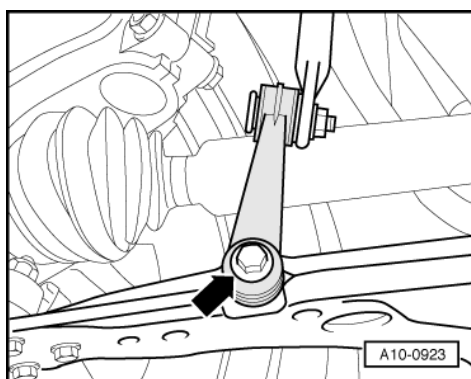
- -> Unscrew retaining nuts -arrows- for front exhaust pipe/exhaust manifold.



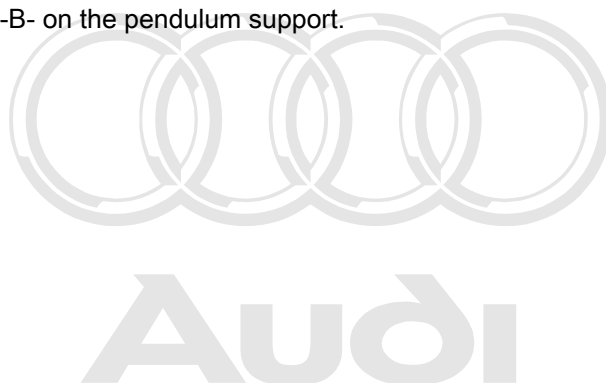
- -> Slacken clamp -arrows- on exhaust system and disconnect exhaust pipe.
- Pivot front exhaust pipe 180° and detach.



- -> First remove bolts -A-, then remove bolts -B- on the pendulum support.
- Remove pendulum support.



- -> Unbolt connecting link at right wishbone -arrow-.



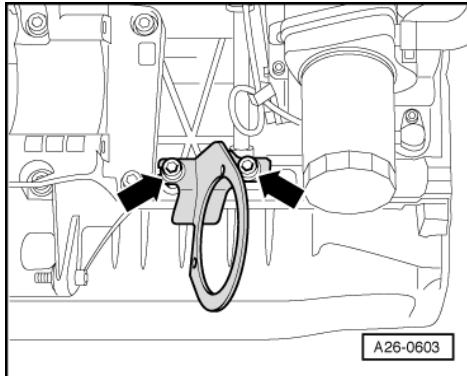
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- Unbolt left and right-hand drive shafts from gearbox flange.

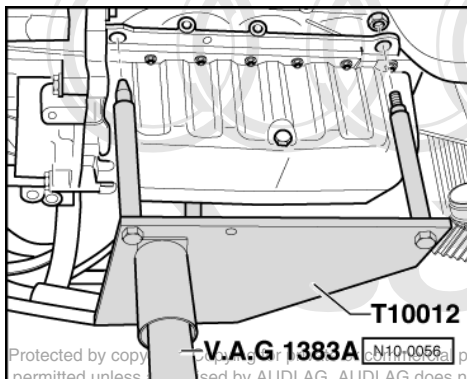
Note:

Use adhesive tape to prevent scratching bumper.

- Turn the front wheels to the right.
- Press the engine forwards, at the same time swing the right drive shaft forwards.
- Tie up right drive shaft on towline anchorage with a loop of wire.
- Move left-hand drive shaft towards rear of vehicle.



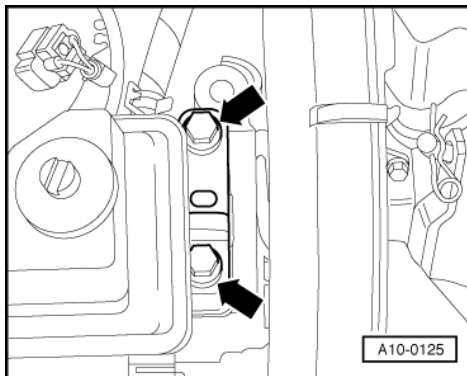
- -> Remove support bracket for secondary air pump -arrows-.



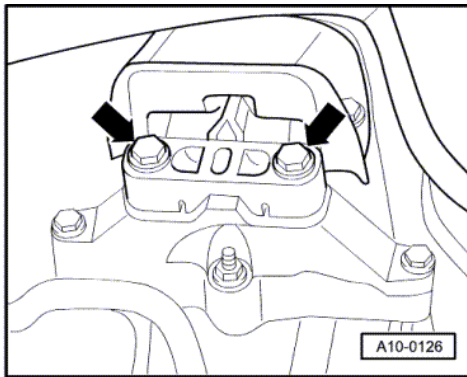
- -> Bolt engine bracket T10012 to cylinder block with securing nut and bolt. Tighten to about 20 Nm.
- Fit engine/gearbox jack V.A.G 1383 A to engine bracket T10012 and raise engine/gearbox slightly.

Note:

Use step ladder VAS 5085 for access to engine compartment from above.



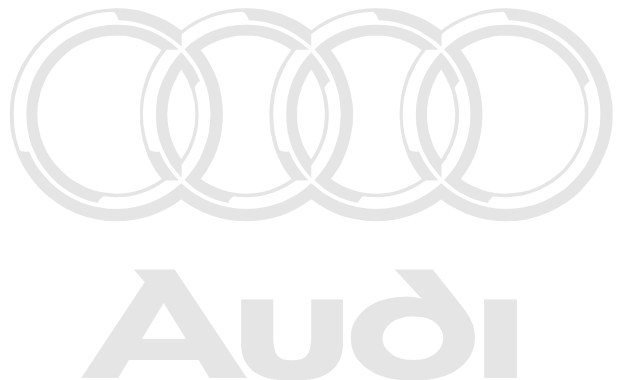
- -> Remove engine/gearbox assembly mounting bolts on engine side -arrows-



- -> ...and likewise on gearbox side.

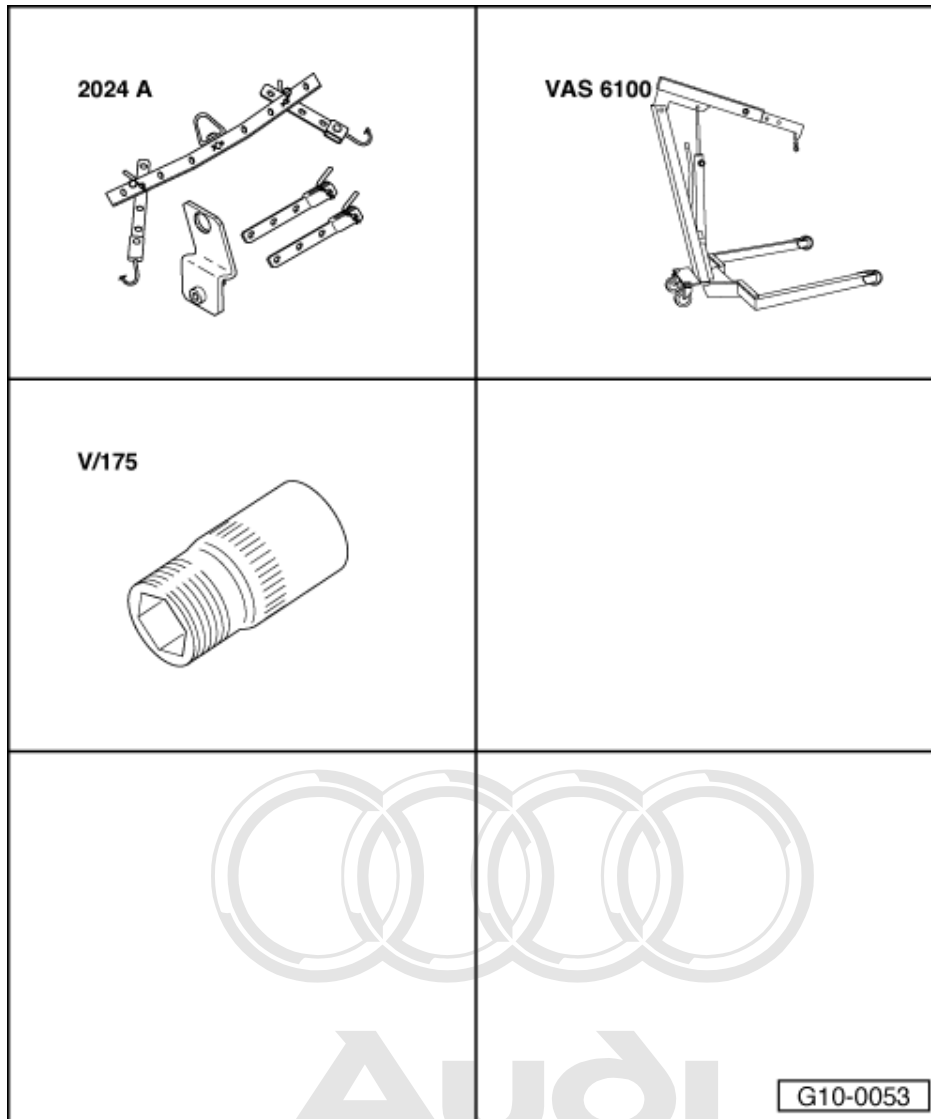
Notes:

- ♦ Make sure that all hoses, pipes and wiring between engine, gearbox and body have been disconnected.
- ♦ The engine/gearbox assembly must be carefully guided while it is being lowered to avoid any damage.
- Pull engine/gearbox assembly as far forward as possible, and lower gradually.



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

1.3 - Separating gearbox from engine

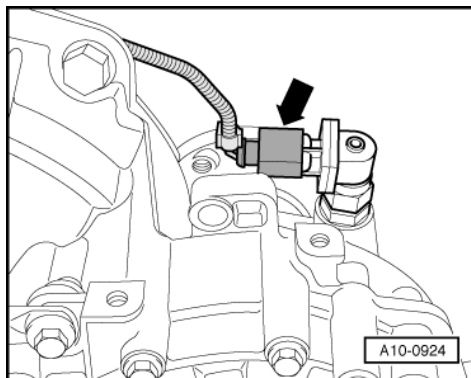


Special tools and workshop equipment required

- ◆ Lifting tackle 2024 A
- ◆ VAS 6100

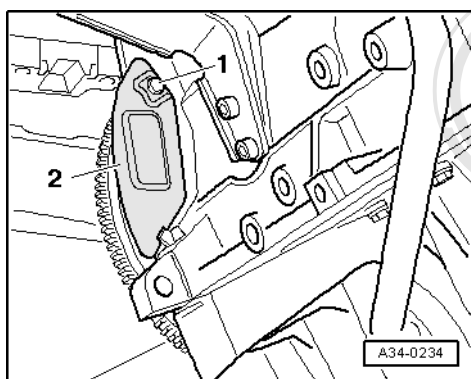
or

- ◆ Workshop crane V.A.G 1202 A
- ◆ Socket attachment 15 mm A/F: Matra V/175 (on vehicles with automatic gearbox)



Work sequence

- Engine/gearbox assembly removed and mounted on engine bracket T10012.
- Unplug connector -arrow- from speedometer sender -G22 on gearbox, and move wire clear.



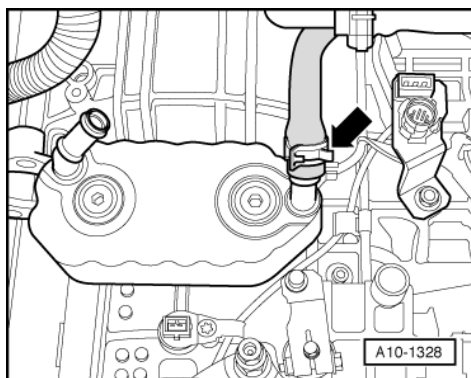
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Vehicles with manual gearbox

- -> Unscrew bolt -1- with gearbox still installed.
- Pull out cover plate -2- towards the top.

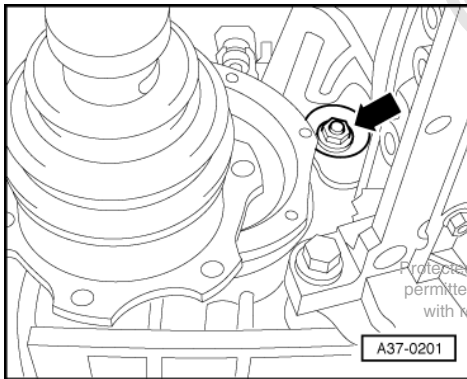
Note:

Shown in illustration with gearbox removed.



Vehicles with automatic gearbox

- -> Disconnect the coolant hose -arrow- from the ATF cooler.

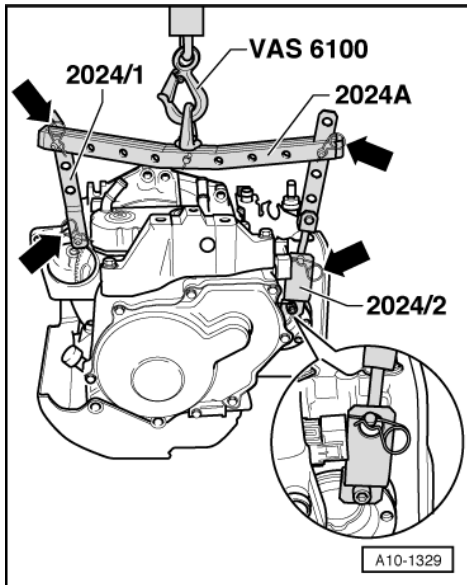


Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- Remove plug from hole in torque converter cover plate.
- -> Unscrew 3 torque converter nuts -arrow- using Matra V/175 15 mm socket attachment (turn crankshaft 1/3 turn each time).

Note:

To prevent engine from turning when loosening torque converter nuts, counterhold central bolt on vibration damper.

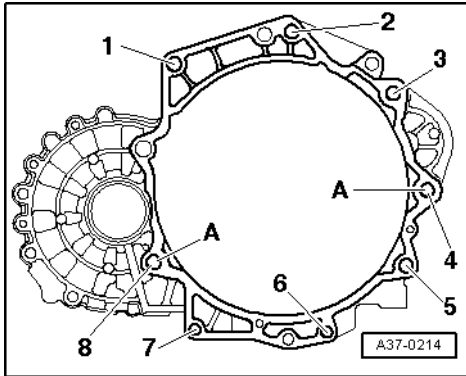


- Remove the starter.
- -> Attach lifting tackle 2024 A to automatic gearbox and hook onto workshop crane VAS 6100 or V.A.G 1202 A.

Note:

To balance the centre of gravity, position the hook attachments as shown in the illustration.

Warning
The hook attachments and locating pins on the lifting tackle must be secured with locking pins (arrows in illustration).



All models

- -> Remove bolts -1- to -8- on engine/gearbox flange.
- Remove the starter.

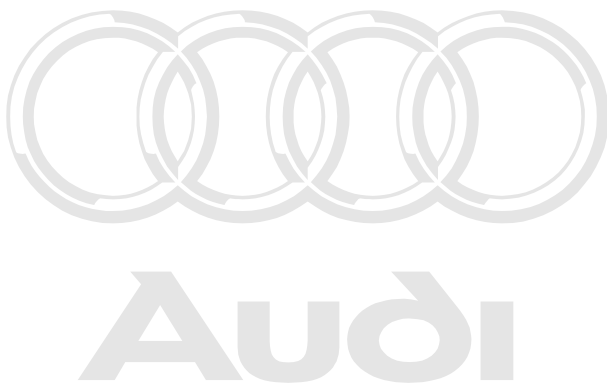
Note:

The manual gearbox can be removed without a crane, however the assistance of a second mechanic is required.

- Pull gearbox off engine.

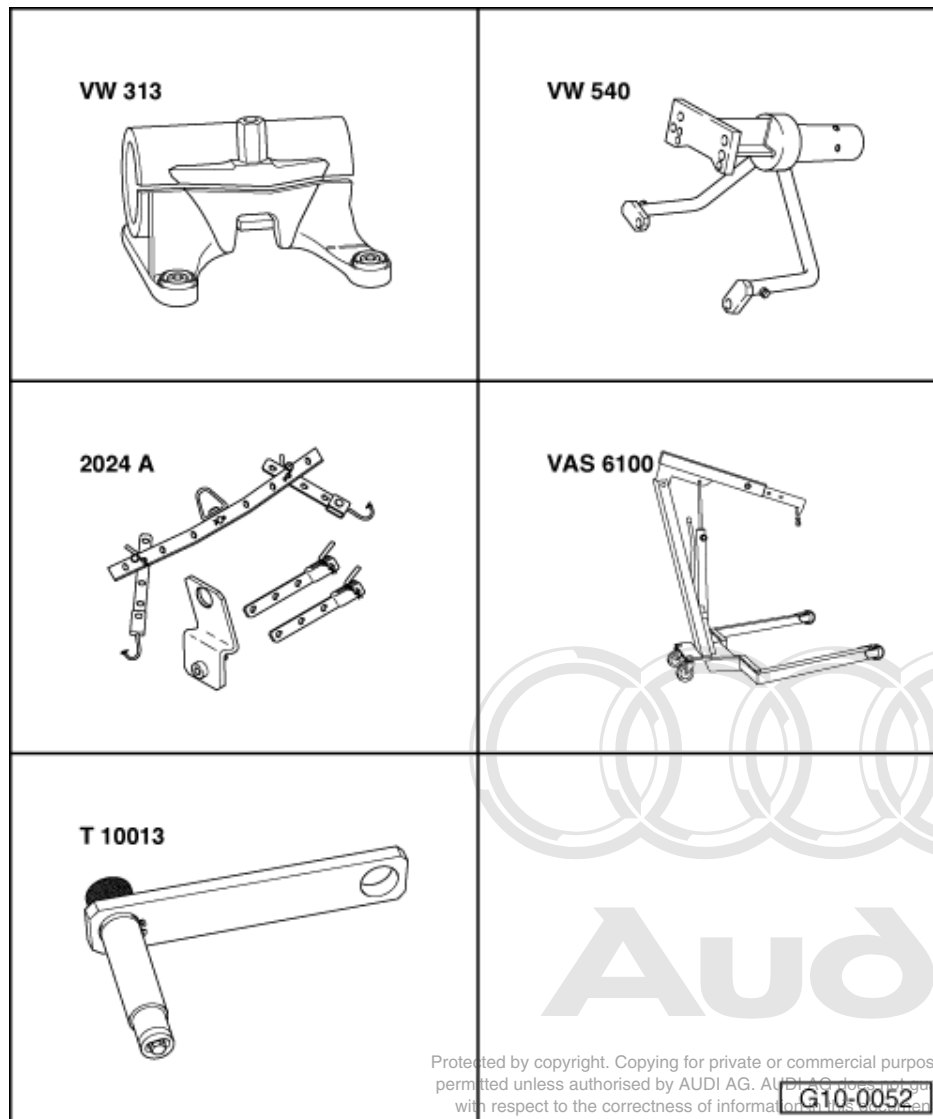
Vehicles with automatic gearbox

- If necessary, secure torque converter in gearbox with wire to prevent it falling out.



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

1.4 - Attaching engine to engine stand



Special tools and workshop equipment required

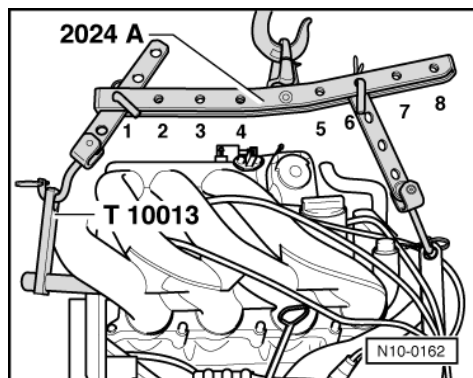
- ◆ Support clamp VW 313
- ◆ Engine and gearbox support VW 540
- ◆ Lifting tackle 2024 A
- ◆ VAS 6100

or

- ◆ Workshop crane V.A.G 1202 A
- ◆ Retainer T10013

Work sequence

- Gearbox separated from engine
- Insert the retainer T10013 in the right side lifting eye on the engine and slide the securing washer off centre to lock in place.



- -> Attach lifting tackle 2024 A to engine and hook onto workshop crane VAS 6100 or V.A.G 1202 A.

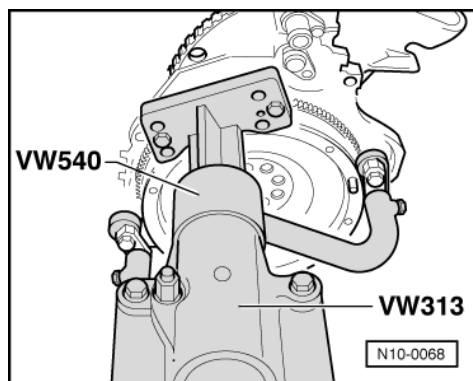
Note:

To balance the centre of gravity of the engine, position the hook attachments as shown in the illustration.

Warning

The hook attachments and locating pins on the lifting tackle must be secured with locking pins

- Lower the engine with workshop crane VAS 6100 or V.A.G 1202 A from engine bracket T10012.



- > When working on the engine, secure it to the engine stand using engine bracket VW 540.

Note:

To remove the retainer T10013, the securing washer must be raised with a screwdriver.

1.5 - Installing

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

Special tools and workshop equipment required

- ♦ Depth gauge (for vehicles with automatic gearbox)

Work sequence

- Engine mounted on engine bracket T10012.

Installation is carried out in the reverse sequence, when doing this note the following:

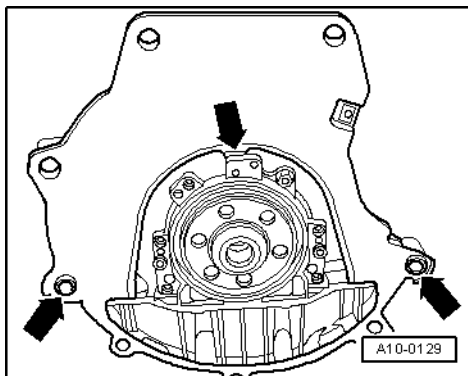
Notes:

- ♦ All cable ties which are opened or cut open on removal must be replaced in the same position when installing.

- ♦ Secure all hose connections with the correct hose clips (same as original equipment)

=> Parts catalogue

- ♦ When performing repairs, renew self-locking nuts and bolts.
- ♦ Renew self-locking nuts and bolts which have a specified tightening angle as well as seals and gaskets.
- Check whether the dowel sleeves for centralising engine/gearbox are in the cylinder block, install if necessary.



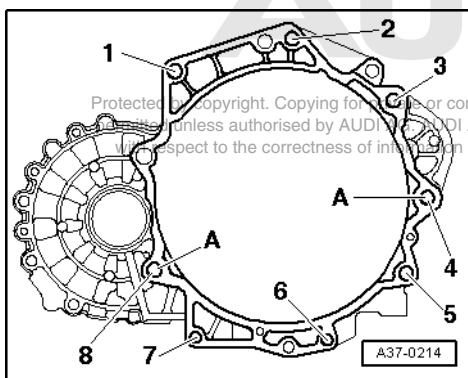
- -> Engage intermediate plate on sealing flange, and press onto dowel sleeves -arrows-.

Vehicles with manual gearbox

- Make sure that clutch plate is properly centred.
- Check clutch release bearing for wear, renew if necessary.
- Lightly grease clutch release bearing, release bearing guide sleeve and splines on input shaft with G 000 100.
- Secure gearbox to engine.

Notes:

- ♦ The tightening torques listed on this page apply only to lightly greased, oiled, phosphated, or black-finished nuts and bolts.
- ♦ Additional lubricant such as engine or gearbox oil may be used, but do not use graphite lubricant.
- ♦ Do not use degreased parts.
- ♦ Tolerance for tightening torques is $\pm 15\%$.



-> Engine/gearbox mountings (manual gearbox)

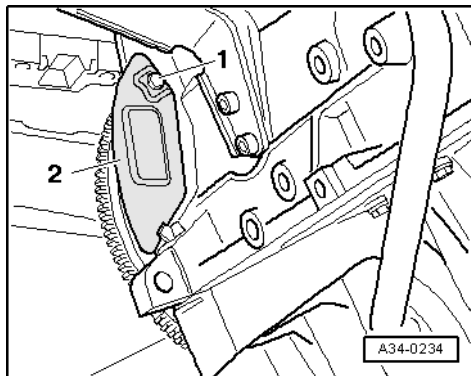
Item	Bolt	Nm
1, 2 1), 8	M12 x 55	80
3 1), 4	M12 x 150	80



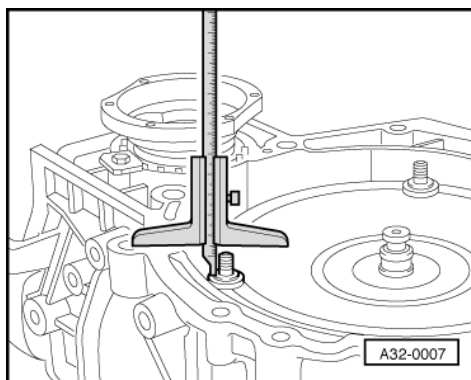
Item	Bolt	Nm
5 ... 7	M10 x 50	45

1) Bolt with M8 stud

A: centering sleeves



- -> Slide in cover plate -2- so that bottom lug engages on cylinder block, and secure at the top with bolt -1-.



Vehicles with automatic gearbox

- To secure the torque converter on the drive plate only use the correct nuts as specified in the parts catalogue.

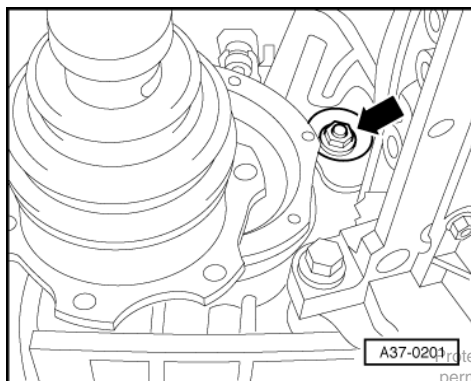
=> Parts catalogue

-> If the torque converter is correctly installed, the depth between the contact faces at the bottom of the studs on the torque converter and the contact surface of the torque converter bell housing is about 22 mm.

If the torque converter is not fully inserted, this distance is about 10 mm.

Important!

If the torque converter is incorrectly inserted, the driver of the torque converter or the ATF pump will be severely damaged when the gearbox is attached to the engine.

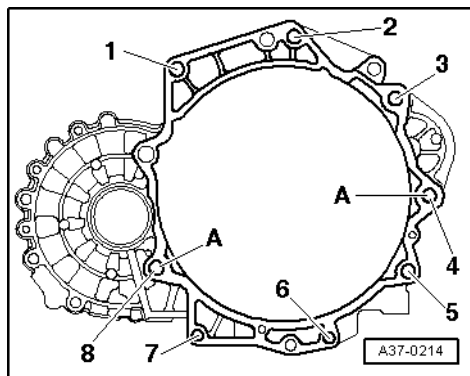


protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- -> Before installing engine, rotate torque converter and drive plate so that one hole and one stud are level with the opening in the torque converter cover.
- Bolt gearbox to engine.
- Tighten torque converter nuts with special tool Matra V/175.

Notes:

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

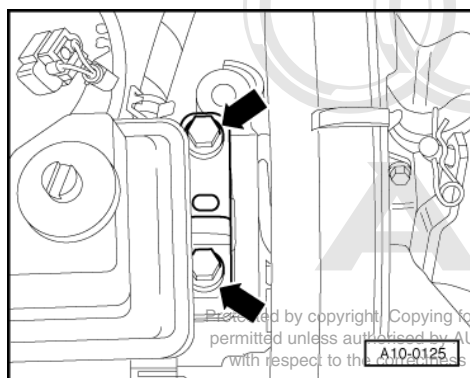


-> Engine/gearbox mountings (automatics)

Item	Bolt	Nm
1, 2 1)	M12 x 65	80
3 1), 4 1)	M12 x 180	80
5 ... 7	M10 x 50	45
8	M12 x 80	80

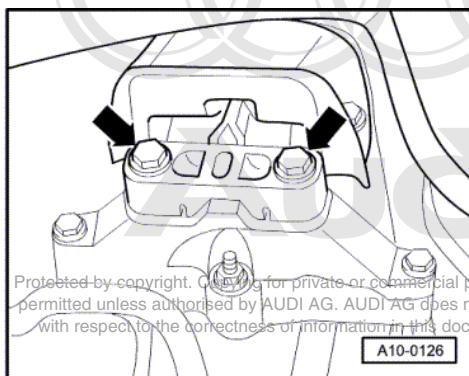
1) Bolt with M8 stud

A: centering sleeves



All models

- Guide engine/gearbox assembly into engine compartment.
- -> Screw in and hand-tighten the bolts -arrows- connecting the engine support with the engine console ...



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

- -> ... and the bolts connecting the gearbox support with the gearbox console.
- Use new bolts for securing.

Note:

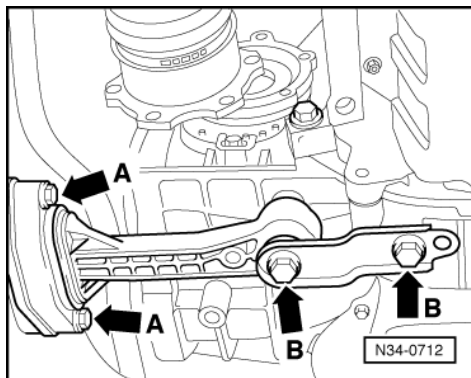
The bolts are only tightened to their final specified torque settings when the engine mountings are adjusted => Page 32.

- Remove engine bracket T10012 from the engine.
- Install drive shafts:

=> Running gear, Front-wheel drive and four-wheel drive; Repair group 40

Note:

The drive shafts must be installed before doing any more assembly work.

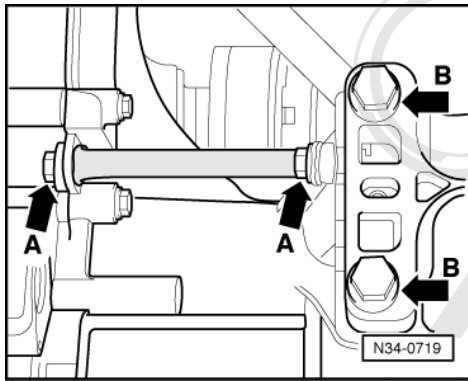


- -> Secure pendulum support -arrow B- first to the gearbox and then to the subframe -arrow A-.
- Use new bolts for securing.
- Install the exhaust system and align it stress-free => Page 208.
- To ease the installation of the vane pump and the air conditioner compressor, knock back the sleeves for the holding bolts slightly.
- Install the vane pump and the air conditioner compressor => Page 39.

Vehicles with manual gearbox

- Install hydraulic clutch slave cylinder:

=> 5-Speed manual gearbox 02J; Repair group 30; Servicing clutch release mechanism Servicing clutch release mechanism



- -> Fit gearbox brace (arrows -A-) to gearbox.
- Attach selector cables to gearbox and adjust.

=> 5-Speed manual gearbox 02J; Repair group 34; Servicing selector mechanism; Removing and installing selector cables
Servicing selector mechanism
Removing and installing selector cables

All vehicles:

The remaining installation steps are carried out in the reverse sequence.

- Install ribbed belt =>Page 44 .
- Adjust engine mountings => Page 32 .

Vehicles with throttle cable:

- Adjust throttle cable:

=> Fuel supply system - Petrol engines; Repair group 20; Servicing accelerator mechanism - Vehicles with mechanical throttle cable. Servicing accelerator mechanism - Vehicles with mechanical throttle cable.

All models

- Electrical connections and routing:

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

Notes:

- ◆ When the battery is reconnected, re-activate electrical equipment (radio, combined radio/navigation system, clock, electric windows) as described in the Owner's Manual.
- ◆ De-activate service mode in telematics control unit.

=> Radio, telephone and navigation system; Repair group 91

- ◆ Further procedures after reconnecting the voltage supply:

=> Motronic injection and ignition system; Repair group 24

- Check oil level => Page 177 .
- Fill up with coolant=> Page 182 .

Notes:

- ◆ Drained-off coolant may only be used again if the original cylinder head and cylinder block are re-installed.
- ◆ Coolant must not be used again if it is dirty.

Warning

Do not use a battery charger to start the engine. Otherwise the electronic control units can be damaged.



Tightening torques

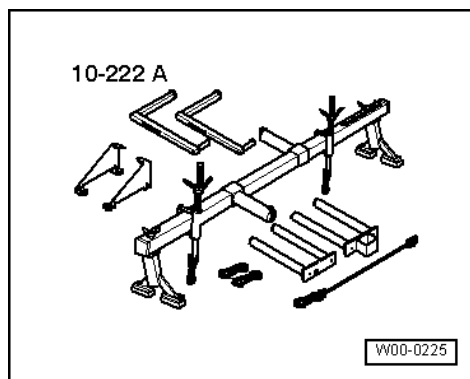
Component		Nm
Bolts/nuts	M6	10
	M8	20
	M10	45
	M12	65
Except for the following:		
Drive plate to torque converter	M10 x1	85
Support bracket for secondary air pump to cylinder block		25
Connecting link to wishbone		15 + 90° 1)2)
Pendulum support to gearbox		40 + 90° 1)2)
Pendulum support to subframe		20 + 90° 1)2)
AC-compressor to bracket for auxiliary drives		45
Gearbox brace		25
Wiper arm on linkage		16
Cable connector to battery terminal		6

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

- 1) 90° = 1/4 turn
- 2) Replace nuts or bolts

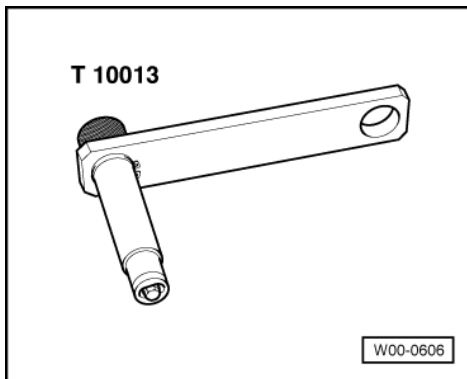
2 - Adjusting engine mountings

2.1 - Adjusting engine mountings

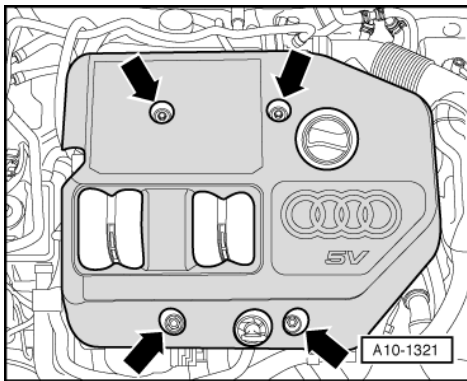


Special tools and workshop equipment required

- ♦ 10-222 A engine support

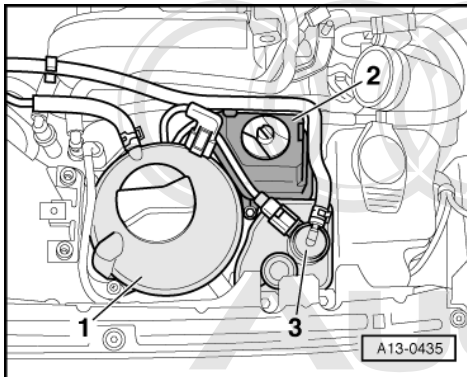


♦ Retainer T10013



Checking adjustment

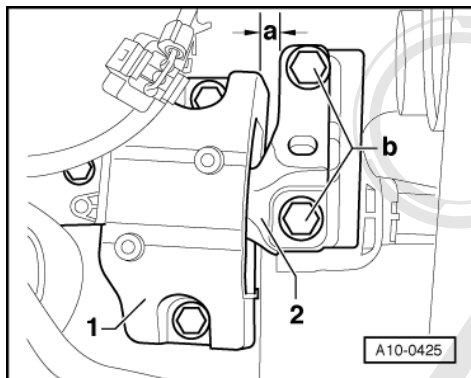
- -> Remove engine cover panel -arrows-.



- -> Disconnect coolant expansion tank -1- and fluid reservoir for power steering -2-. The hoses remain connected.

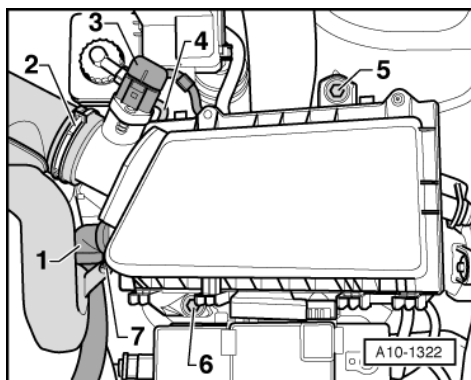
Note:

The ACF container -3- does not have to be removed.



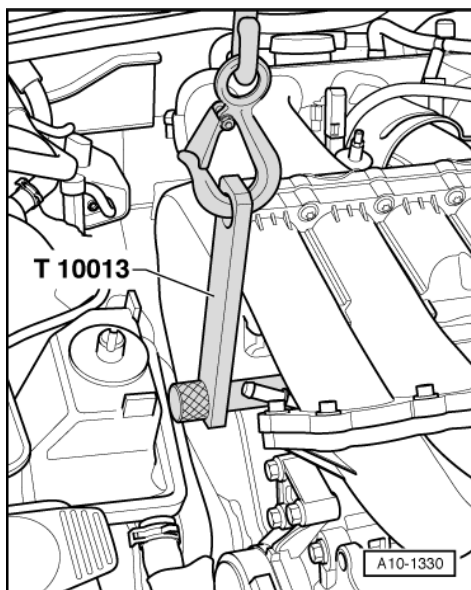
- -> Both bolt-heads -b- must align flush with edge of support arm -2-.
- Distance -a- between engine console -1- and support arm -2- of right engine mount should be 13 mm. Check distance -a- by inserting a 12 mm flat iron bar (alternatively, use special tool 2011). It should slide in easily.

with respect to the correctness of information in this document. Copyright by AUDI AG.

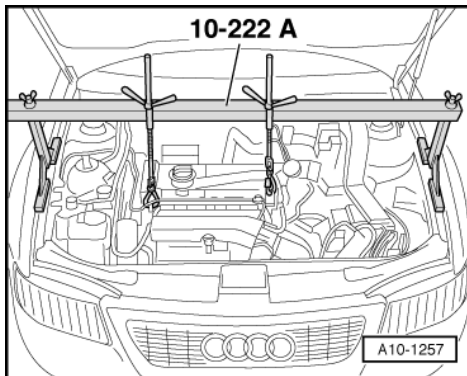


If the gap is too narrow or too wide, proceed as follows:

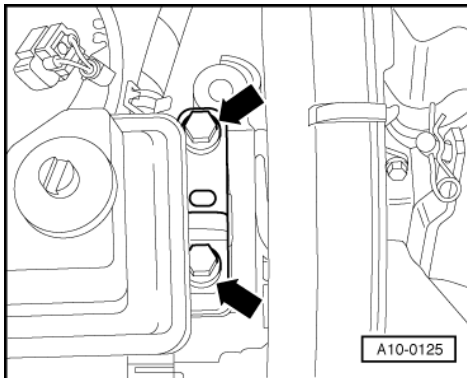
- -> Disconnect secondary air pump intake hose -1- from air cleaner housing.
- Unscrew bolt -7-.
- Disconnect air hose -2- from air mass meter.
- Unplug connector -3- from air mass meter.
- Unscrew bolts -5- and -6-.
- Remove air cleaner housing and pull off vent hose -4- from behind.



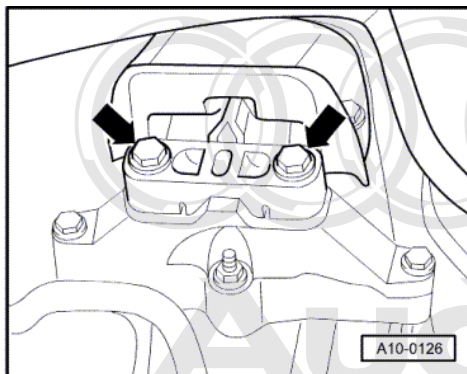
- -> Insert the retainer T10013 in the lifting eye (right side) and lock into place by positioning the washer off centre.



- -> Set up engine support bracket 10-222 A in front of gas strut on bolted flanges of wing panels with spindles at front.
- Engage spindle hooks into respective lifting eye or retainer T10013.
- Raise the engine slightly, taking up the weight evenly on both spindles.

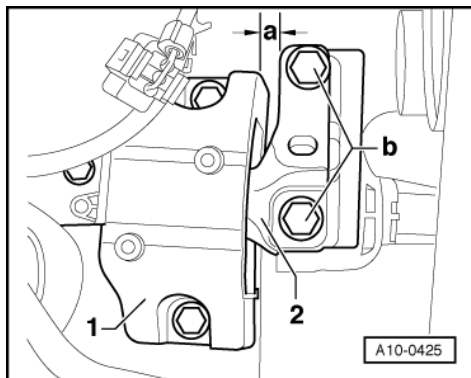


- -> Unscrew the bolts -arrows- in the support arm at the engine...

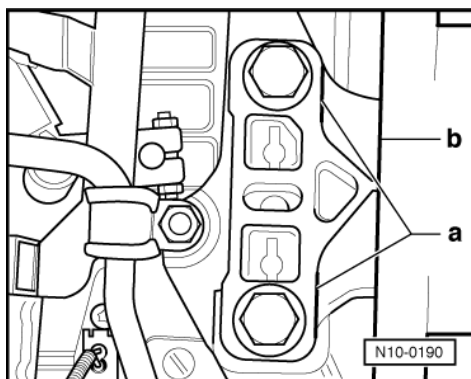


- -> ... and on the gearbox. Replace all 4 bolts (if not already done so when installing engine) and tighten by hand.

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



- -> Slacken bolts -b- on left and right-hand support arms by about two turns each.
- Insert an iron bar between engine console -1- and support arm -2-, then move engine until gap -a- measures 13 mm.
 - a 12 mm flat iron bar (alternatively special tool 2011) should slide in easily.
 - both bolt-heads -b- should align flush with edge of support arm.
- Tighten bolts -b- in support arm at engine to 60 Nm + 90°.



- -> Make sure that the edges of the support arm -a- and the gearbox console -b- align parallel.
- Tighten bolts in support arm at gearbox to 60 Nm + 90°.

Install in reverse sequence; note the following points:

Note:

To remove the retainer T10013 the securing washer must be raised with a screwdriver.

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

13 - Crankshaft group

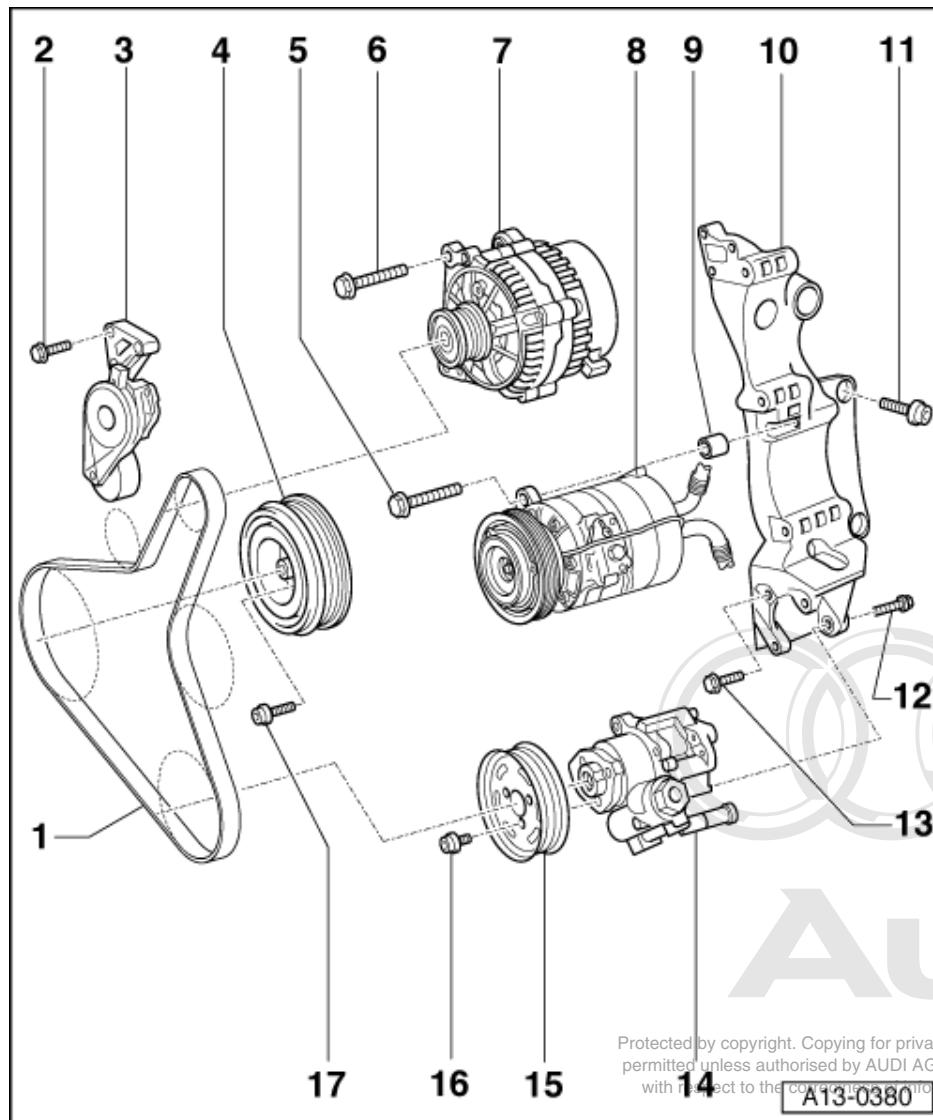
1 - Dismantling and assembling engine

1.1 - Dismantling and assembling engine

1.2 - Removing and installing ribbed belt

Notes:

- ◆ Before removing the ribbed belt, mark the direction of rotation using chalk or a felt marker pen. If the belt rotates in the wrong direction when it is refitted, this can cause breakage. Ensure that the belt is properly seated in the pulleys when installing.
- ◆ The following illustration shows the belt drive on vehicles equipped with air conditioner.



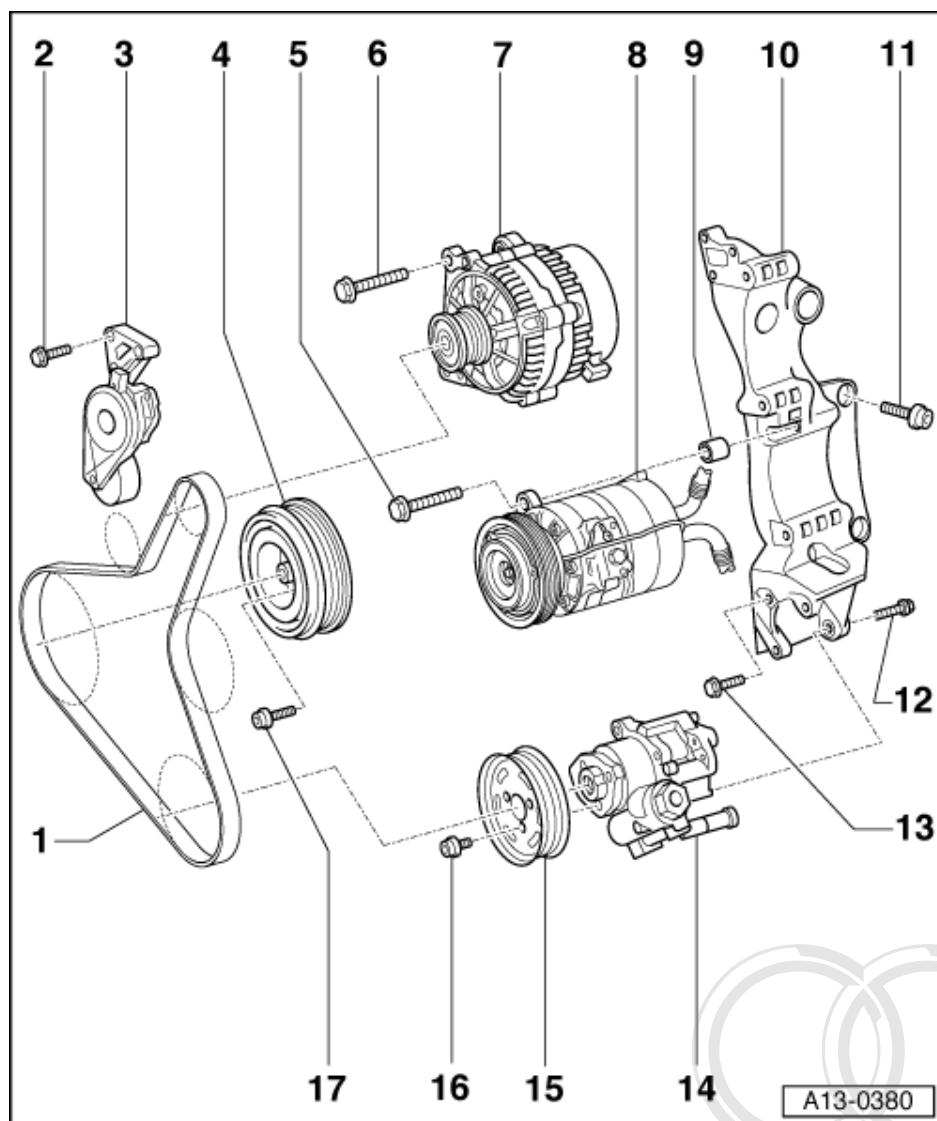
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

A13-0380

1 Ribbed belt

- ◆ Ribbed belt routing on vehicles without air conditioner=>Fig. 41
 - ◆ Ribbed belt routing on vehicles with air conditioner=>Fig. 41
 - ◆ A double ribbed belt is fitted on engines with A/C compressor
 - ◆ Check for wear
 - ◆ Do not kink
 - ◆ Removing and installing
- => Page 43

2 23 Nm



3 Tensioning element for ribbed belt

- ◆ Turn with open-end spanner to slacken ribbed belt => Page 43

4 Vibration damper

- ◆ With pulley for ribbed belt
- ◆ Removing and installing
=> Page 42

5 45 Nm

6 23 Nm

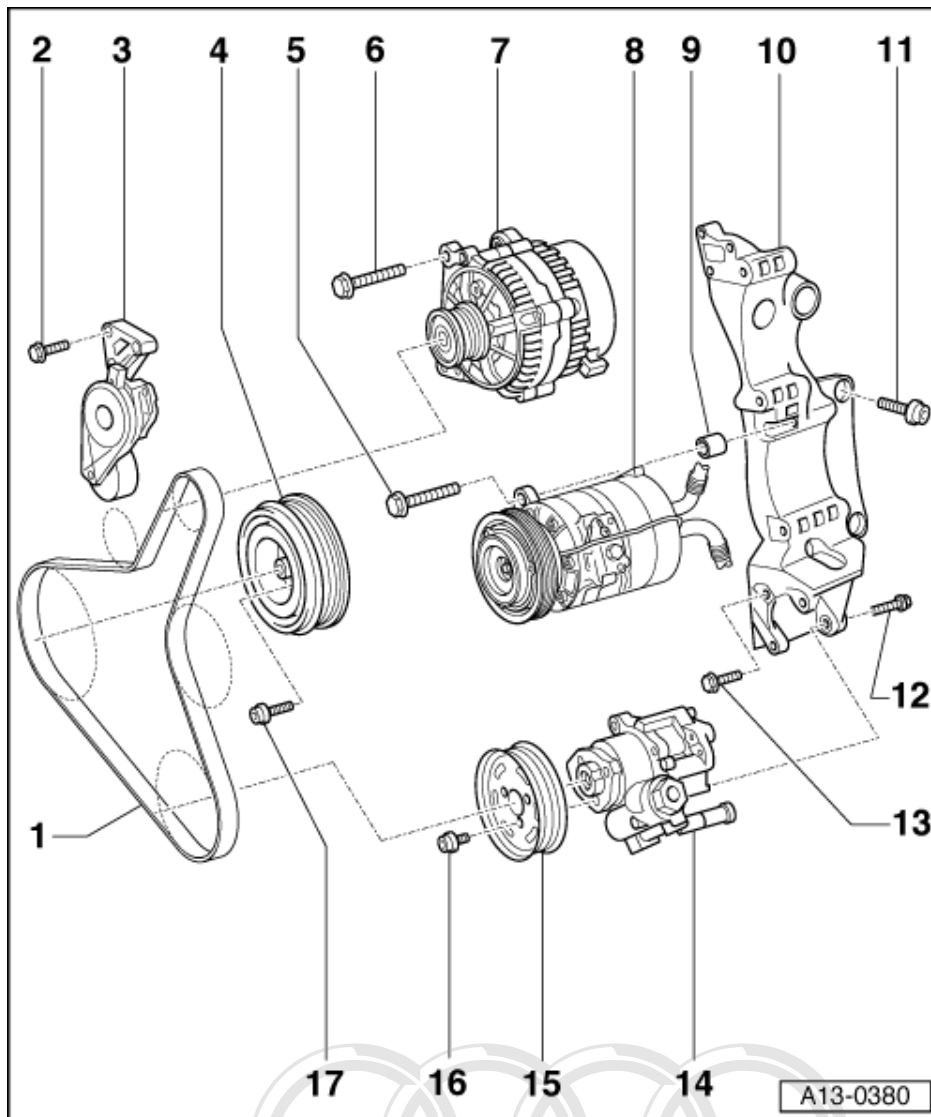
7 Alternator

- ◆ Removing and installing:

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

=> Electrical system; Repair group 27

- ♦ To facilitate positioning of alternator on bracket, knock back threaded bushes for retaining bolts slightly



8 A/C compressor

- ♦ After removing compressor from mountings, secure it to bonnet lock carrier with wire or similar. Do not leave it suspended on refrigerant hoses.
- ♦ Do not unscrew or disconnect refrigerant hoses or pipes.
- ♦ To facilitate positioning of AC- compressor on bracket, knock back threaded bushes for retaining bolts slightly

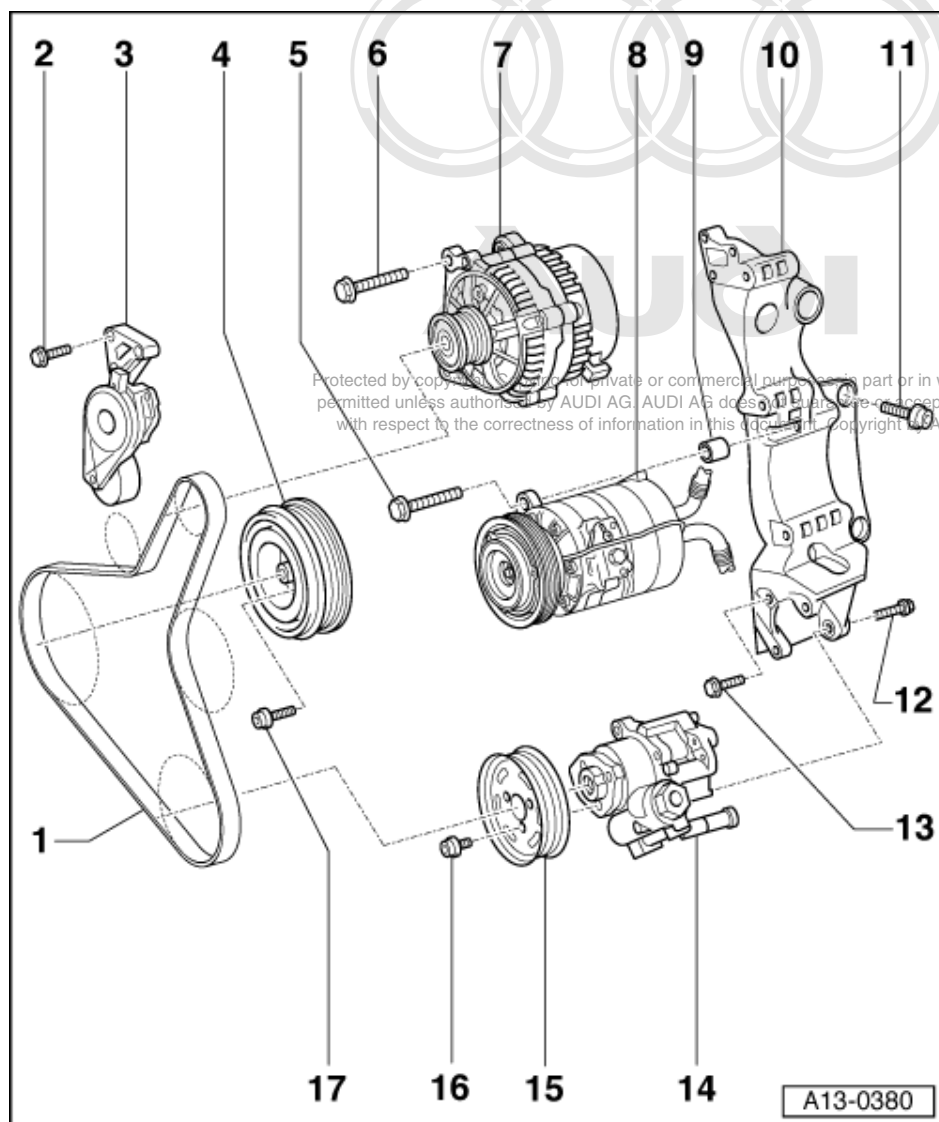
9 Spacer bush

10 Bracket for auxiliary drives

11 45 Nm

12 23 Nm

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



13 23 Nm

14 Vane pump

- ♦ For power steering
- ♦ Removing and installing:

=> Running gear, Front-wheel drive and four-wheel drive; Repair group 48

- ♦ To facilitate positioning of vane pump on bracket, knock threaded bush for retaining bolt back somewhat

15 Pulley

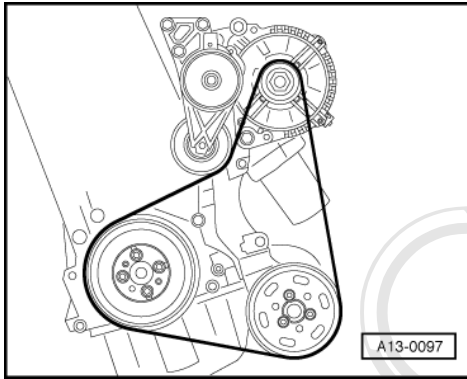
- ♦ For vane pump

16 23 Nm

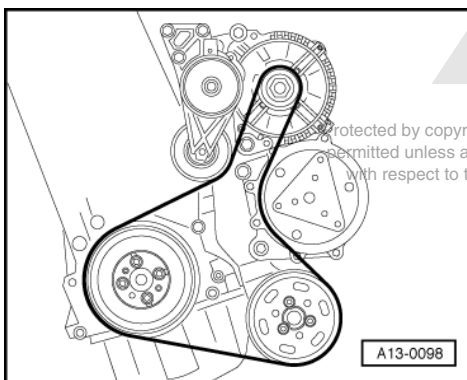
17 Bolt (special type)

=> Parts catalogue

- ♦ For bolt of strength grade 8.8: replace and tighten to 10 Nm + 90°
- ♦ For bolt of strength grade 10.9: tighten to 40 Nm



-> Fig.1 Ribbed belt on vehicles without air conditioner

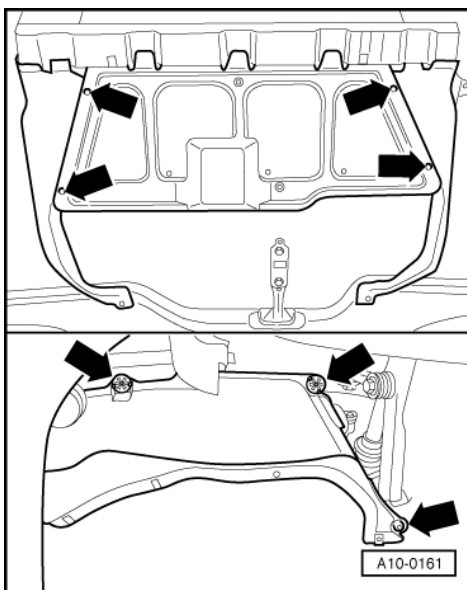


-> Fig.2 Ribbed belt on vehicles with air conditioner

Note:

Engines with an air conditioner compressor are fitted with a double ribbed belt.

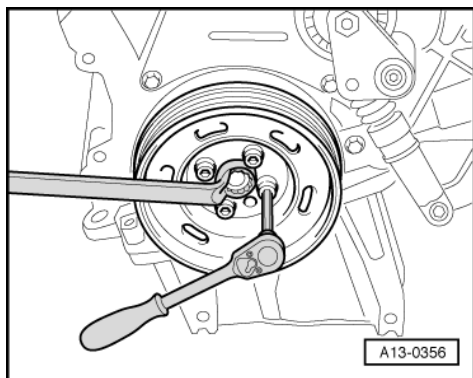
1.3 - Removing and installing vibration damper





Removing

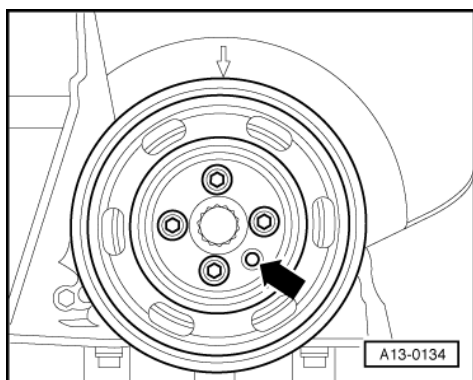
- Ribbed belt must be removed => Page 43 .
- -> Remove noise insulation panels (centre and right side) -arrows-.



- -> Unbolt vibration damper.

Note:

When loosening and tightening the bolts securing the vibration damper, counter-hold central bolt with a ring spanner.



Installing

Install in reverse sequence; note the following points:

- Use new bolts for securing.
- -> When installing the vibration damper, use only genuine spare bolts:

=> Parts catalogue

- The vibration damper can only be installed in one position. The hole -arrow- in the vibration damper must fit over the projection on the toothed belt sprocket.

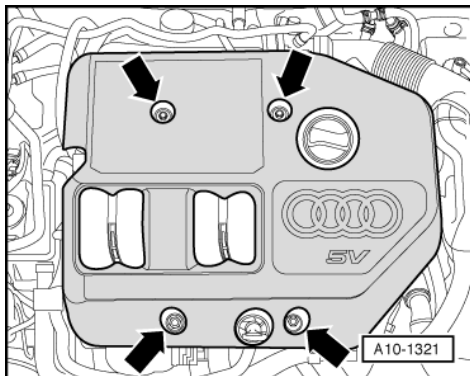
Tighten vibration damper bolts as follows:

- For bolts installed of strength grade 8.8: replace and tighten to 10 Nm + 90°
- For bolts installed of strength grade 10.9: tighten to 40 Nm



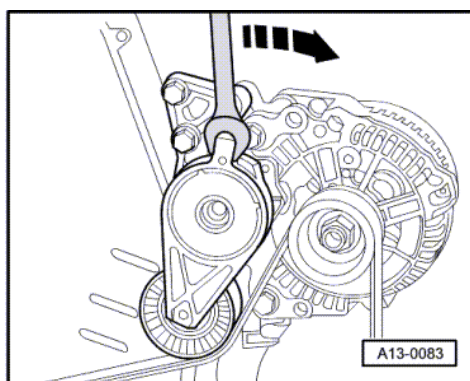
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

1.4 - Removing and installing ribbed belt



Removing

- -> Remove engine cover panel -arrows-.

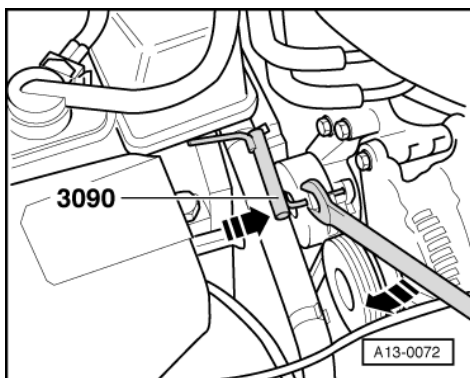


Note:

Before removing the ribbed belt, mark the direction of rotation with chalk or a felt pen. If a used belt rotates in the wrong direction when refitted, it can break.

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

- -> To slacken ribbed belt, turn tensioning element in direction of arrow.
- Remove ribbed belt.





Note:

-> The tensioning element can be secured with a suitable pin or mandrel of 4.5 mm dia. and about 55 mm long. On vehicles without headlight washer system conrod support 3090 may also be used.

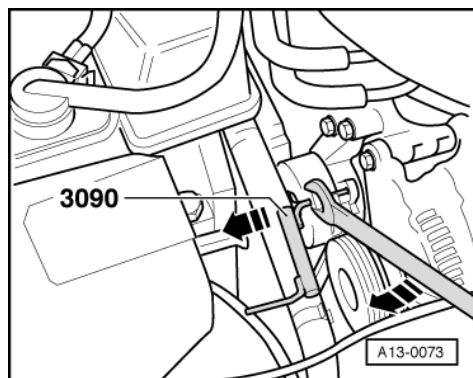
Installing

Install in reverse sequence; note the following points:

Note:

Before fitting the ribbed belt ensure that all sub-assemblies (alternator, air conditioner compressor, vane pump) are tight.

- Fit ribbed belt over crankshaft pulley and vane pump pulley. If necessary, pull the belt upwards using a suitable tool.
- Fit ribbed belt over alternator pulley last. Release tensioning element.



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

- -> Slacken tensioning element for ribbed belt. Pull out punch or conrod support 3090 -arrows-.
- Check that ribbed belt is properly seated.

Vehicles without air conditioner:

- Routing of ribbed belt => Fig. 1, Page 41

Vehicles with air conditioner:

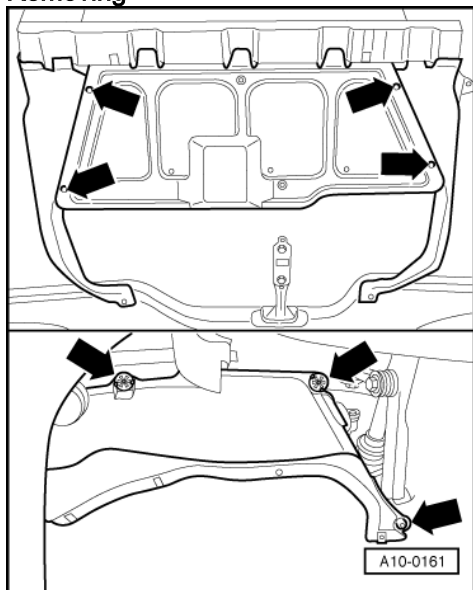
- Routing of ribbed belt => Fig. 2, Page 41

All models

- Start engine and check that belt runs properly.

1.5 - Removing and installing bracket for auxiliary drives

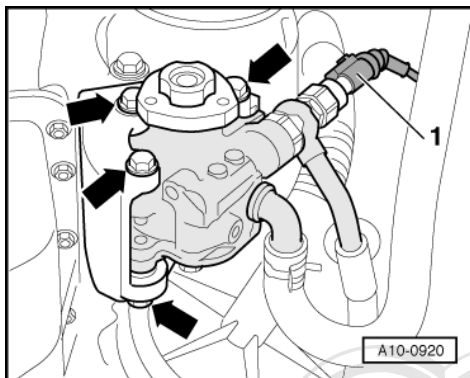
Removing



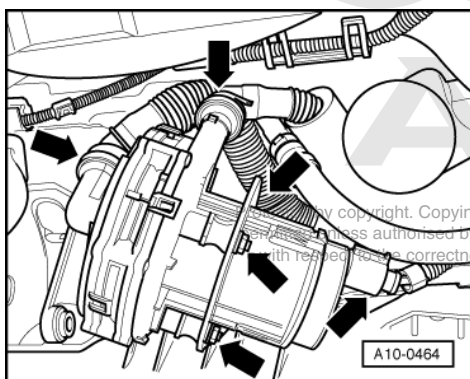
Caution!

On vehicles equipped with telematics the telematics control unit must be switched to service mode before the battery terminals are disconnected. => Radio, telephone and navigation system; Repair group 91

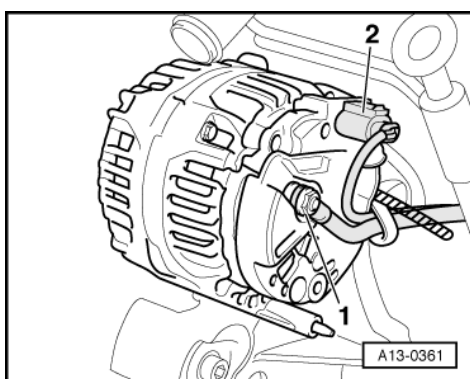
- Obtain code on vehicles with coded radio/integrated radio and navigation system.
- With ignition switched off disconnect battery earth strap.
- Remove ribbed belt => Page 43 .
- -> Remove noise insulation panels (centre and right side) -arrows-.



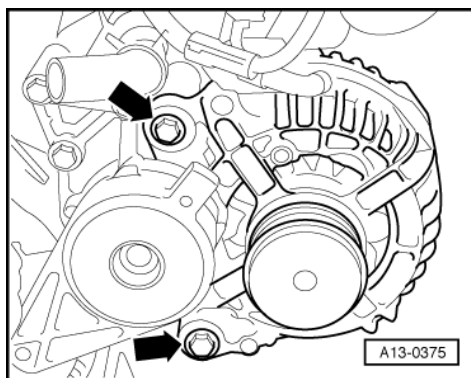
- Detach pulley from power steering pump using mandrel for leverage.
- -> Unplug connector -1- from pressure switch for power steering -F88.
- Unbolt power steering pump -arrows-, move clear towards the side and tie in place. Do not open hydraulic connections.



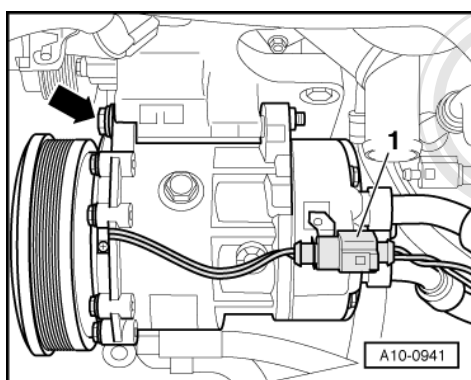
- -> Disconnect hoses and connector from secondary air pump, remove air pump -arrows-.



- -> Unplug electrical connector -2-
- Unscrew and disconnect cable -1- at alternator.
- Unscrew cable clamp and move wiring clear.



- -> Remove bolts -arrows-.
- Detach alternator and guide out of engine compartment from right side.



Vehicles with air conditioner:

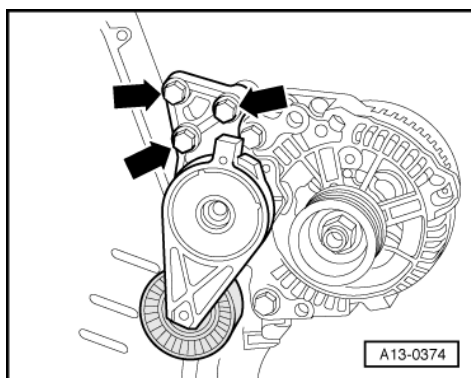
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- Unbolt fan on right side of fan cowl. Lower it clear and tie it to the body. All wiring remains attached.
- -> Disconnect electrical connector -1- for magnetic clutch on air conditioner compressor.

Warning!

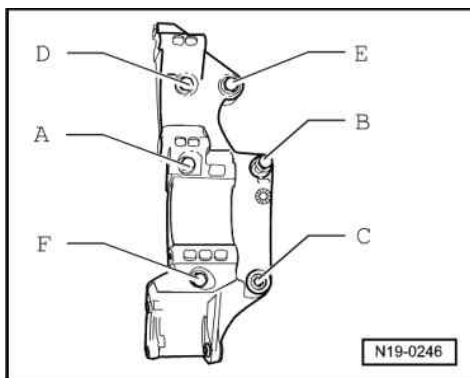
The air conditioning system refrigerant circuit must not be opened.

- Unscrew bolts -arrow- for air conditioner compressor.
- Drop the compressor down and secure to lock carrier with wire.

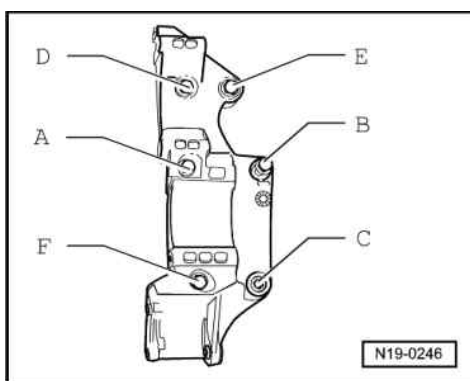


All models

- -> Remove ribbed belt tensioning element -arrows-.



- -> Unbolt bracket for auxiliary drives - bolts A ... F.
- Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted without express authorisation by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



Installing

Install in reverse sequence; note the following points:

- -> Tighten bolts in alphabetical sequence to 45 Nm -A ... F- .
- Install the alternator, power steering pump and air conditioning compressor=>from Page 38 .
- Install ribbed belt =>Page 44 .

Notes:

- ◆ When the battery is reconnected, re-activate electrical equipment (radio, combined radio/navigation system, clock, electric windows) as described in the Owner's Manual.
- ◆ De-activate service mode in telematics control unit.

=> Radio, telephone and navigation system; Repair group 91

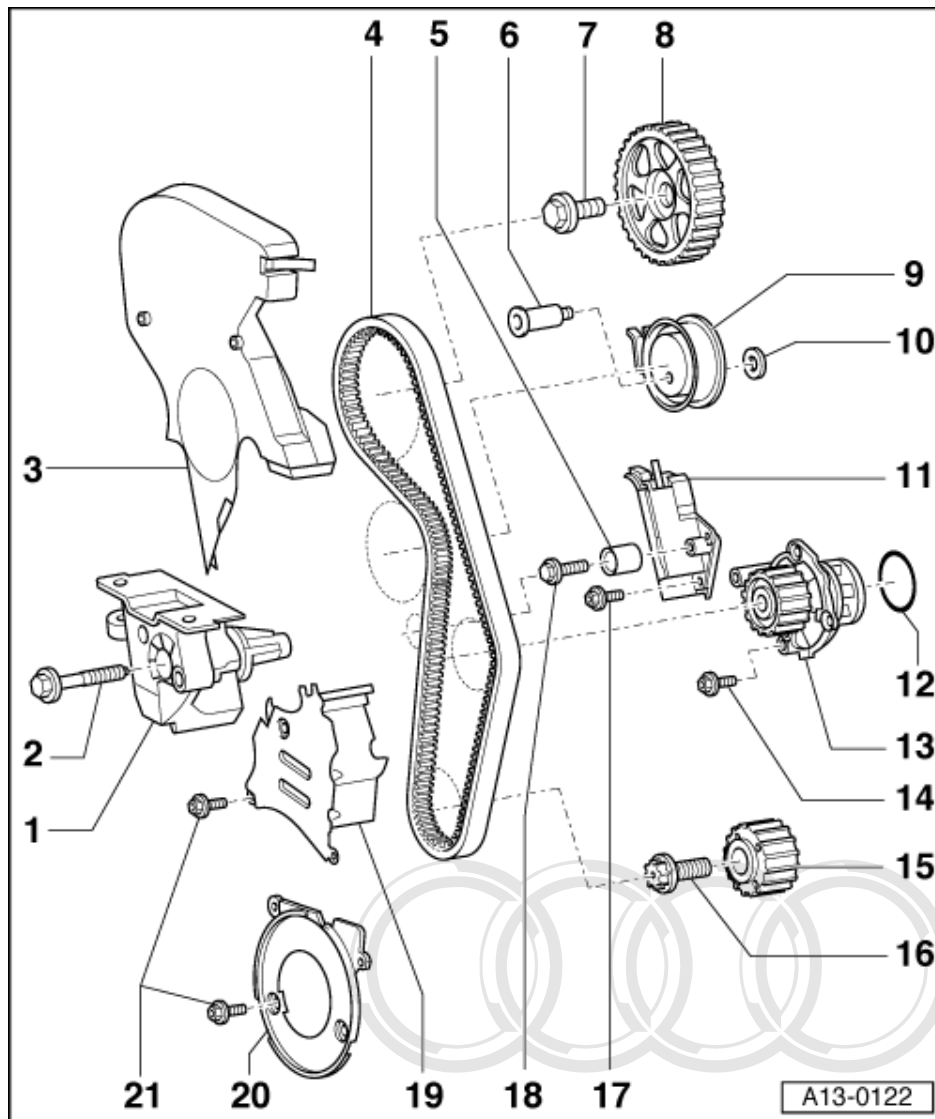
- ◆ Further procedures after reconnecting the voltage supply:

=> Motronic injection and ignition system; Repair group 24

Tightening torques

Component	Nm
Support bracket for auxiliary units to cylinder block	45
Tensioner for ribbed belt to support bracket for auxiliary units	23

1.6 - Removing and installing toothed belt



Note:

Mark the direction of rotation with chalk or felt pen before removing the toothed belt. If a used belt rotates in the wrong direction when refitted, this can result in breakage.

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

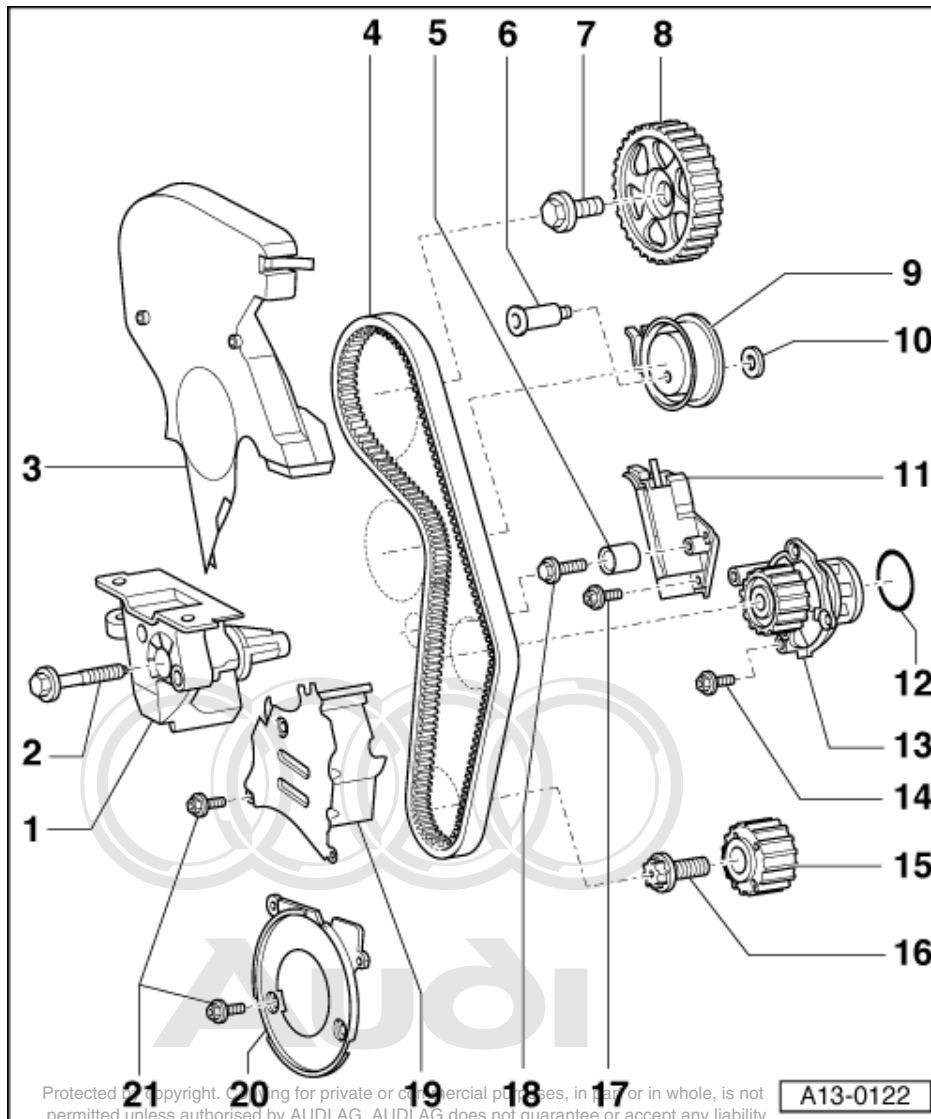
1 Engine support

- ♦ Installing
=> Fig. 53

2 45 Nm

3 Toothed belt guard - top

- ♦ Carefully engage in centre section of toothed belt guard when installing



4 Toothed belt

- ◆ Mark direction of rotation with chalk or felt pen before removing
- ◆ Check for wear
- ◆ Removing => Page 54
- ◆ Installing (adjusting valve timing)
=> Page 58

5 Idler roller

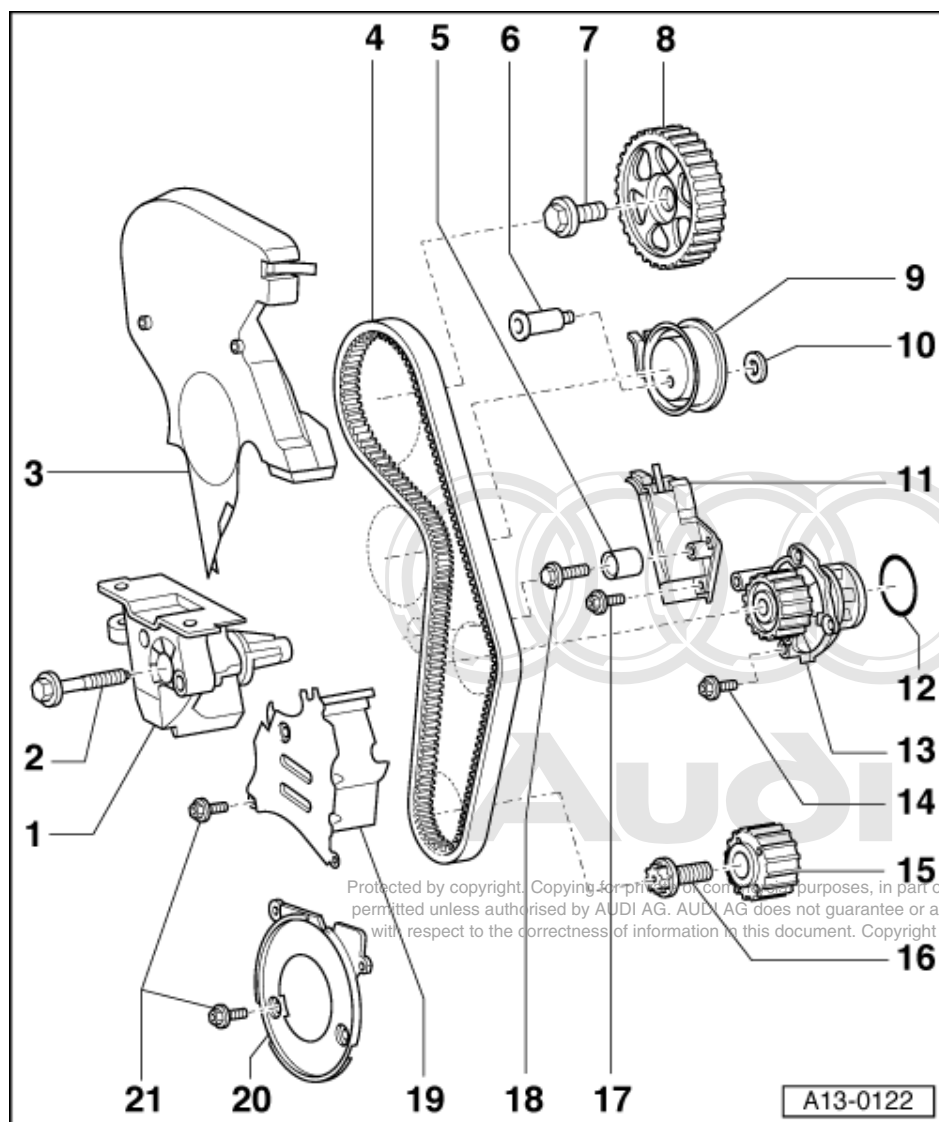
6 27 Nm

7 65 Nm

- ◆ Use counter-hold 3036 to loosen and tighten => Fig. 52

8 Camshaft sprocket

- ◆ For exhaust camshaft
- ◆ To remove and install, first remove toothed belt => Page 54
- ◆ Installation position
=> Fig. 52



9 Tensioning roller

10 Washer

11 Tensioning device for toothed belt

12 O-ring

- ◆ Renew
- ◆ Lightly coat with coolant G 012 A8 D before installing

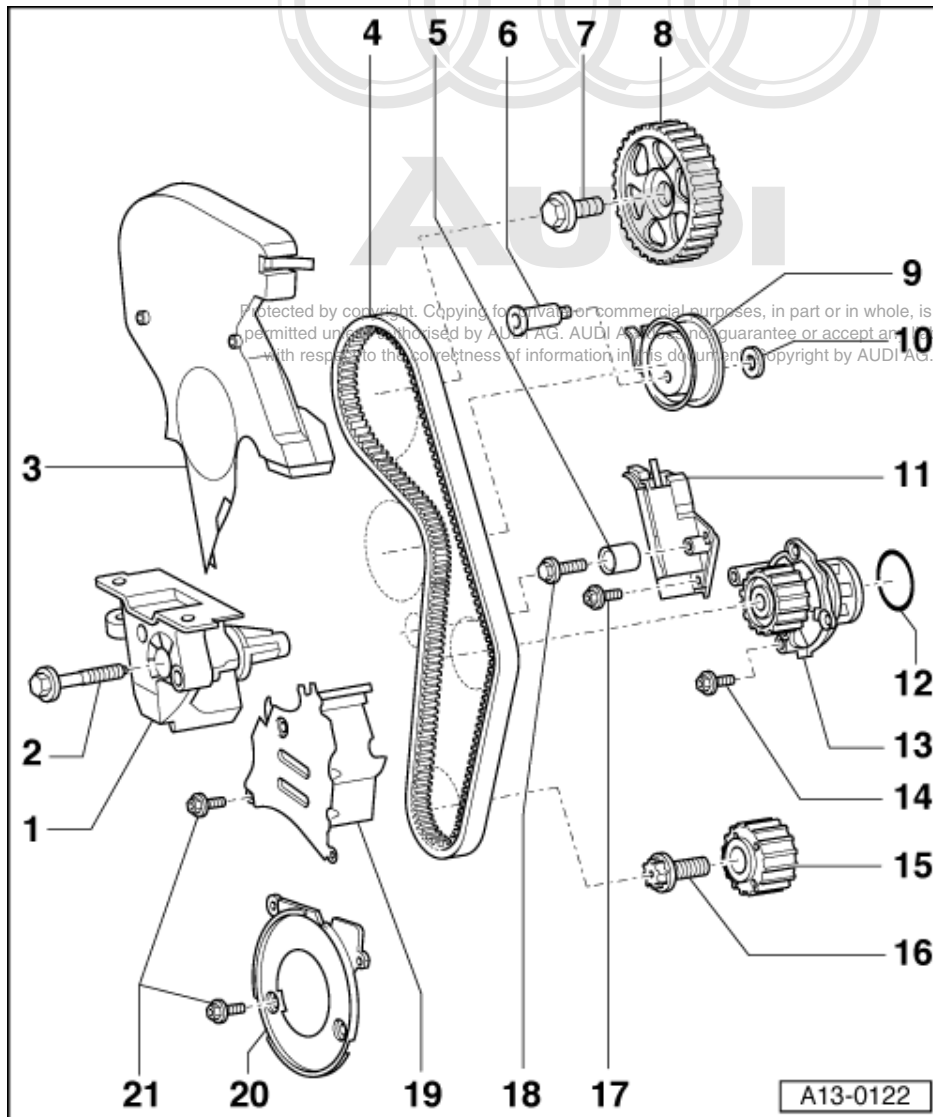
13 Coolant pump

- ◆ Removing and installing
=> Page 184

14 15 Nm

15 Crankshaft sprocket

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



16 90 Nm + 1/4 turn (90 °) further

- ◆ Renew
- ◆ Do not use oil
- ◆ Use counter-hold tool 3415 when loosening and tightening
- ◆ Bolting on counter-hold tool 3415
=> Fig. 52

17 15 Nm

18 25 Nm

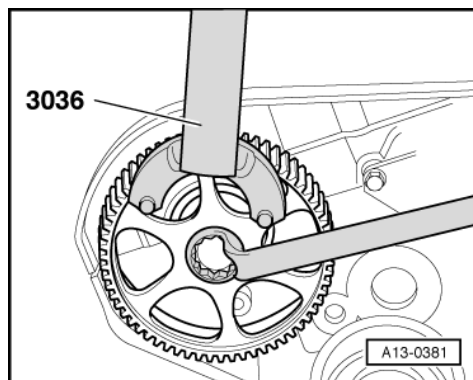
19 Toothed belt guard - centre

20 Toothed belt guard - bottom

21 10 Nm

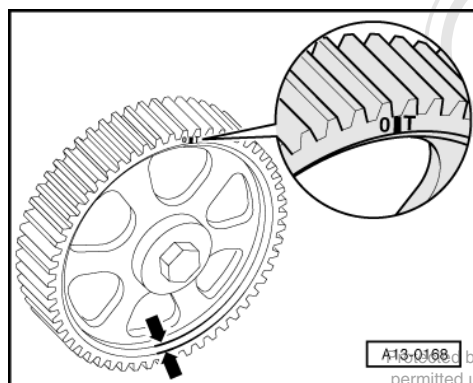
- ◆ Apply locking fluid before installing
- ◆ For required locking fluid:

=> Parts List



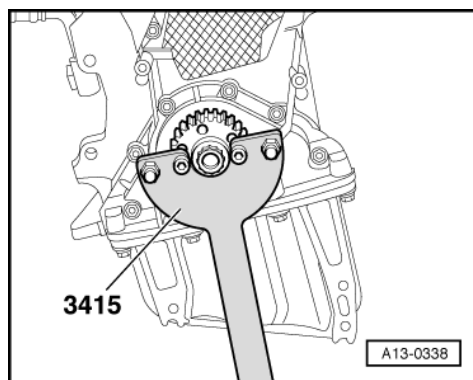
-> Fig1 Unbolting camshaft sprocket

- Use counter-hold tool 3036 when loosening and tightening central bolt.



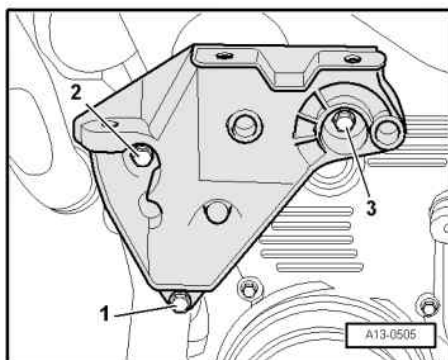
-> Fig.2 Installation position of camshaft sprocket

- ♦ Narrow rim flange on camshaft sprocket faces outwards -arrows- and marking for TDC of No. 1 cylinder is visible from front.



-> Fig3 Removing and installing crankshaft sprocket

- Use counter-hold tool 3415 to loosen and tighten the central bolt.



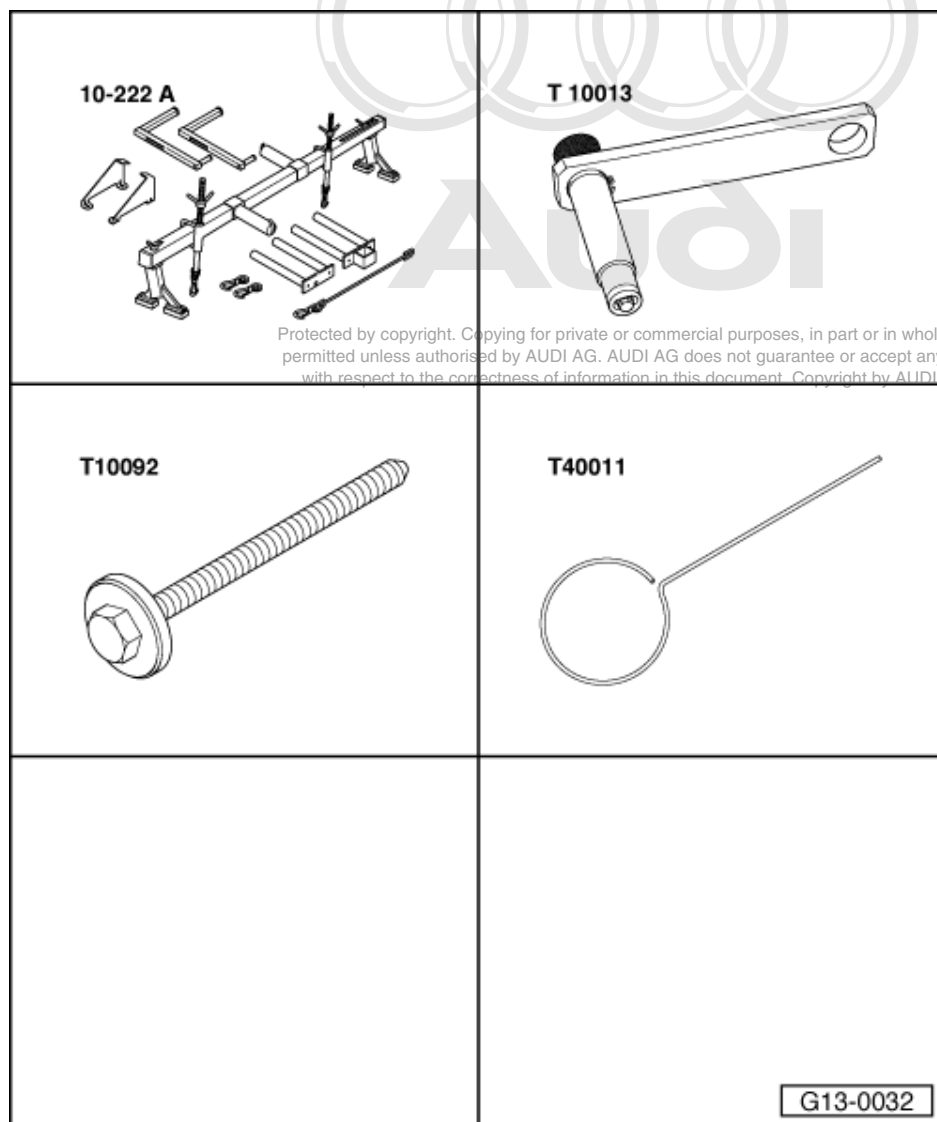
-> Fig.4 Installing engine support

- Screw in bolts -1 ... 3- hand tight.
- Then tighten the bolts -1 ... 3- to 45 Nm.

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

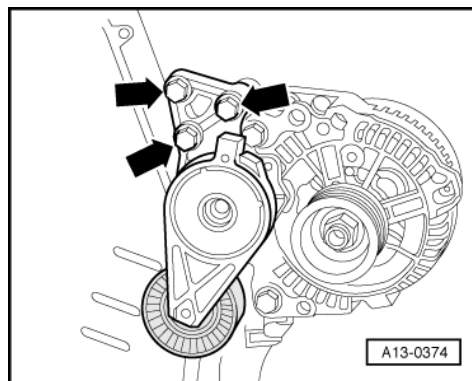


1.7 - Removing, replacing and installing toothed belt



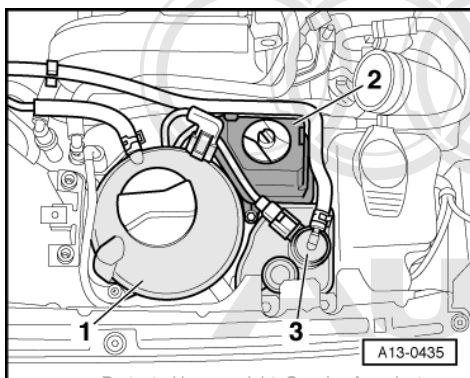
Special tools and workshop equipment required

- ♦ Engine support bracket 10-222 A
- ♦ Retainer T10013
- ♦ Tensioning bolt T10092
- ♦ Locking pin T40011

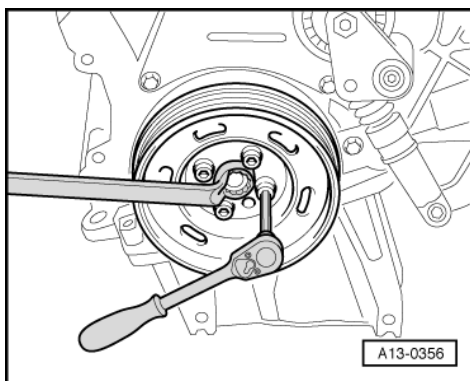


Removing

- Remove ribbed belt => Page 43 .
- -> Remove tensioning element for ribbed belt -arrows-.



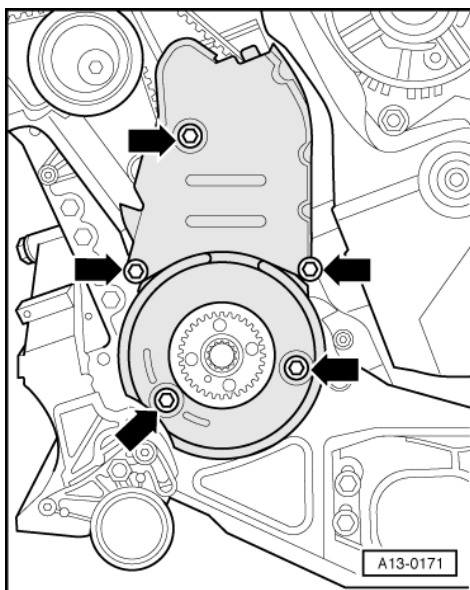
- -> Disconnect the coolant expansion tank -1-, the power steering fluid reservoir -2- and the ACF filter -3-. The hoses remain connected.



- Turn crankshaft to TDC position of No. 1 cylinder with engine installed => Page 62 .
- Turn crankshaft to TDC position of No. 1 cylinder with engine removed => Page 65 .
- -> Unbolt vibration damper.

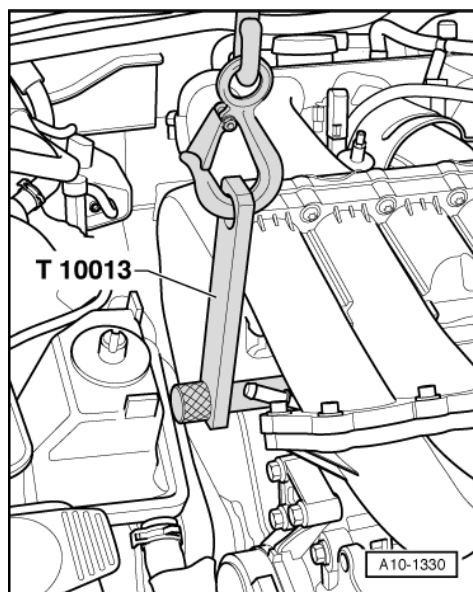
Note:

When loosening and tightening the bolts securing the vibration damper, counter-hold central bolt with a ring spanner.

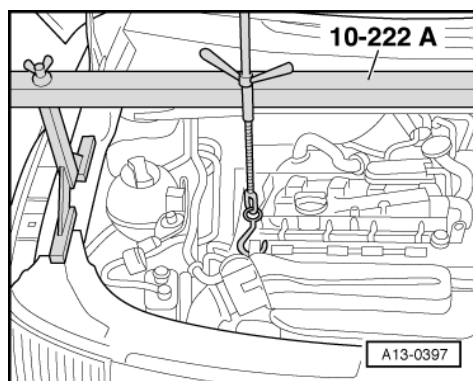




- -> Unbolt bottom and centre sections of toothed belt guard -arrows-.



- -> Insert the retainer T10013 in the lifting eye (right side) and lock into place by positioning the washer off centre.

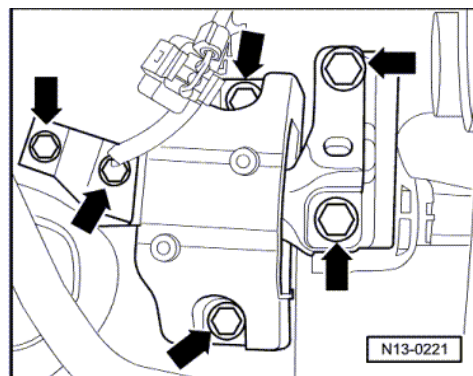


Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

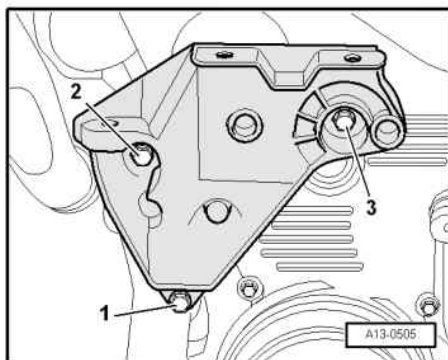
Note:

Insert suitable plastic or wooden packing between the bolted wing flange and the side panel to prevent deformation of the wing panel.

- -> Set up engine support bracket 10-222 A in front of gas strut on bolted flanges of wing panels with spindles at front.
- Engage hooks at spindle ends in the retainer T10013.
- Lift engine slightly with spindle of engine support bracket 10-222 A.



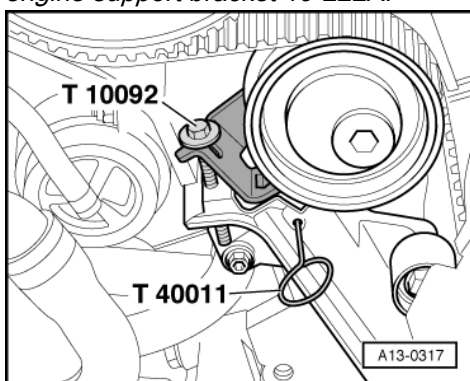
- -> Unbolt connecting piece between engine console and body -arrows-.
- Unbolt engine console from engine support and from body -arrows-.
- Take out engine console.



- -> Unscrew the engine support bolts -1 ... 3- and swing engine support to the rear slightly.

Note:

To remove the bolts for the engine support, raise or lower the engine slightly as necessary via the spindles on engine support bracket 10-222A.

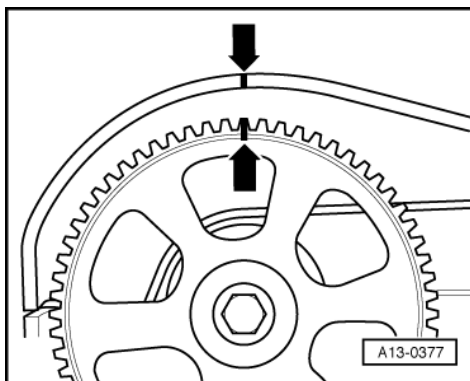


- -> Screw tensioning bolt T10092 into tensioning element for toothed belt.
- Only compress the piston of the tensioning element as far as is necessary to insert locking pin T40011.

Note:

The locking pin T40011 will be easier to insert if it is turned about 90° first.

- Mark direction of rotation of belt with chalk or felt pen.
- Pull out toothed belt through space between engine support and cylinder block.



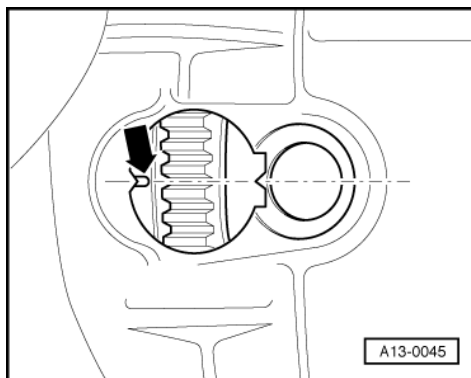


Installing (adjusting valve timing)

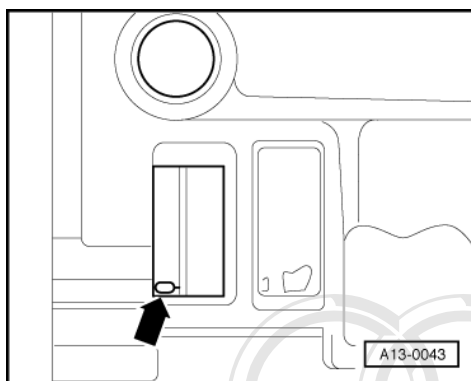
Note:

When turning the camshaft the crankshaft must not be at TDC. Danger of damage to valves/piston crown.

- -> Align marking on camshaft sprocket with marking on cylinder head cover -arrows-.



- Check again whether the crankshaft is positioned at TDC for cylinder 1:
 - -> Vehicles with manual gearbox

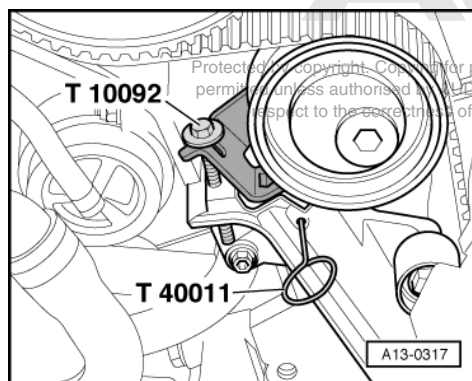


- -> Vehicles with automatic gearbox

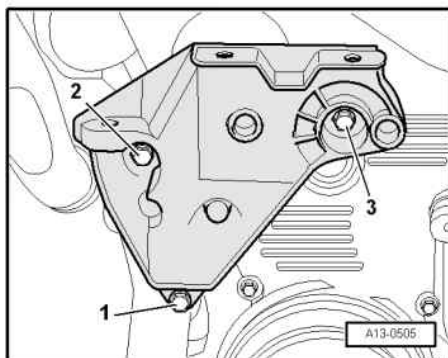
Note:

Turning crankshaft to TDC No. 1 cylinder with engine removed

=> Page **65**.



- Place toothed belt on crankshaft sprocket (observe DOR).
- Fit toothed belt onto coolant pump, then tensioning roller, and finally camshaft sprocket.
- -> Unscrew tensioning bolt T10092.
- Pull locking pin T40011 out of tensioning element.
 - piston of toothed belt tensioning element relaxes
- Turn crankshaft two full turns in direction of rotation (by turning central bolt on crankshaft sprocket). Check that marks on the camshaft and the crankshaft align with their respective reference points.
- Install toothed belt guard.



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

The remaining installation steps are carried out in the reverse sequence - note the following points:

-> Tighten the engine support as follows:

- Tighten bolts -1 ... 3- hand tight.
- Then tighten the bolts -1 ... 3- to 45 Nm.
- Install the engine console.
- Install vibration damper
=> Page 42 .
- Readjust engine mountings => Page 32 .
- Install ribbed belt =>Page 44 .
- Install and secure coolant expansion tank, power steering fluid reservoir and ACF filter.

Tightening torques

Component	Nm
Bottom section of toothed belt guard to cylinder block	10 1)
Centre section of toothed belt guard to cylinder block	10 1)
Engine support to cylinder block	45
Engine console to body	40 + 90°2)3)
Connecting piece to body/ engine console	25
Ribbed belt tensioner to bracket for auxiliary units	25

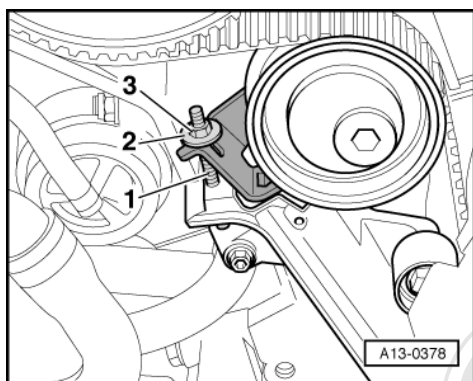
- 1) Insert with thread-locking adhesive;
thread-locker

=> Parts catalogue

- 2) Renew bolts
- 3) 90° is a quarter turn

1.8 - Removing toothed belt from camshaft sprocket

- Turn crankshaft to TDC position of No. 1 cylinder with engine installed => Page 62 .
- Turn crankshaft to TDC position of No. 1 cylinder with engine removed => Page 65 .



- -> Screw M5 x 55 stud -1- into toothed belt tensioning element. Fit a large washer -2- and screw hexagonal nut -3- onto the stud.
- Carefully compress piston of tensioning element just as far as necessary to take toothed belt off camshaft sprocket -arrow-.

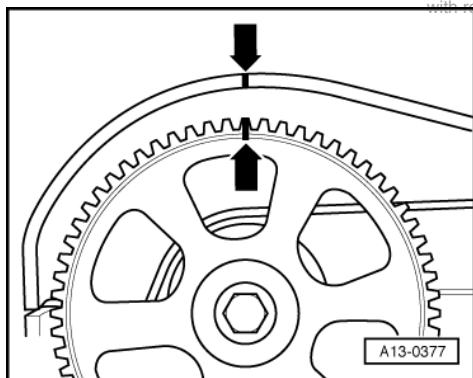
Note:

Take care not to compress tensioning element too much.

- Take toothed belt off camshaft sprocket.

Installing (adjusting valve timing)

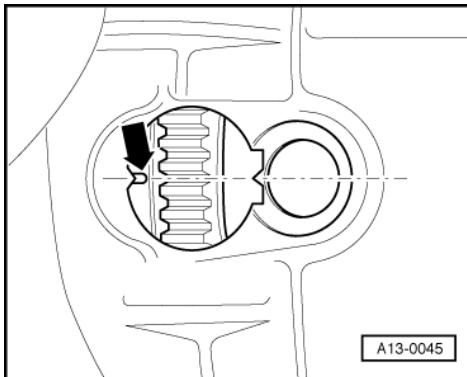
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



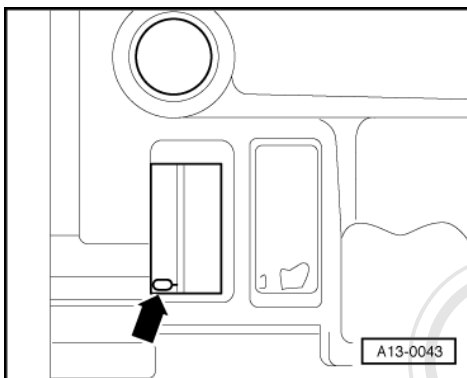
Note:

When turning the camshaft the crankshaft must not be at TDC. Danger of damage to valves/piston crown.

- -> Align marking on camshaft sprocket with marking on cylinder head cover -arrows-.



- Check again whether the crankshaft is positioned at TDC for cylinder 1:
 - -> Vehicles with manual gearbox

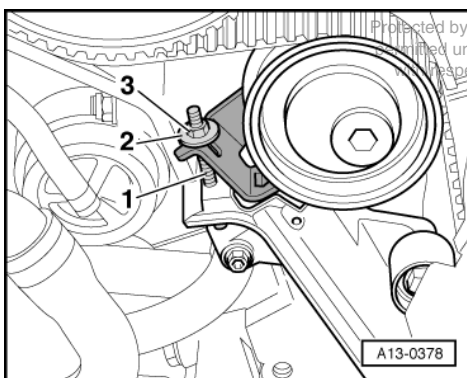


- -> Vehicles with automatic gearbox

Note:

Turning crankshaft to TDC No. 1 cylinder with engine removed

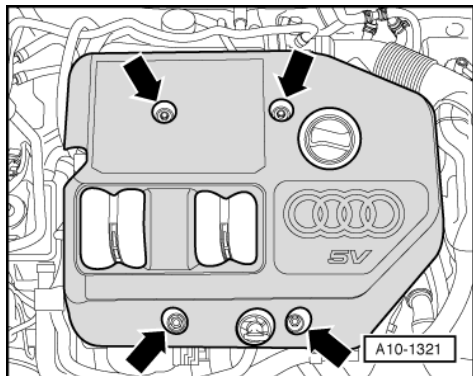
=> page 65.



- Place toothed belt on camshaft sprocket.
- -> Release piston of toothed belt tensioning element. Unscrew stud -1-.
- Turn crankshaft two full turns in direction of rotation (by turning central bolt on crankshaft sprocket). Check that marks on the camshaft and the crankshaft align with their respective reference points.

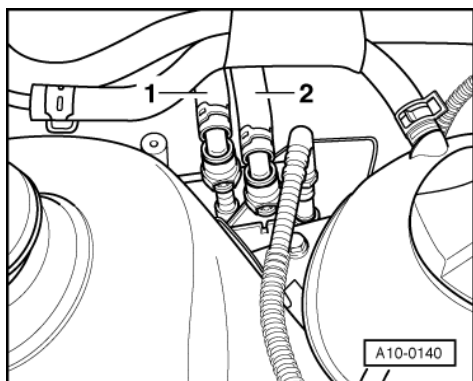


1.9 - Turning crankshaft to TDC of No. 1 cylinder with engine installed



Work sequence

- -> Remove engine cover panel -arrows-.

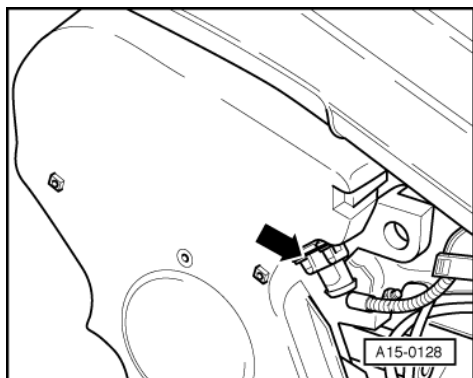


Warning

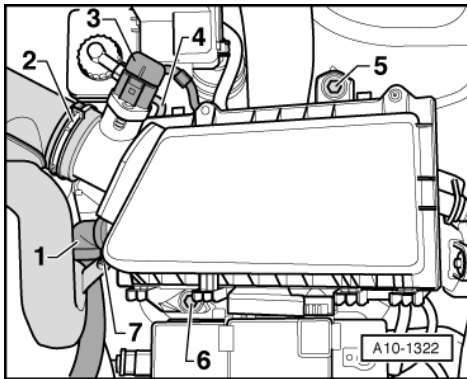
Fuel system is under pressure. Before opening the system place a cloth around the connection. Then release pressure by carefully loosening the connection.

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted without the express written consent of the copyright holder. The copyright holder assumes no liability with respect to the correctness of information in this document. Copyright by AUDI AG.

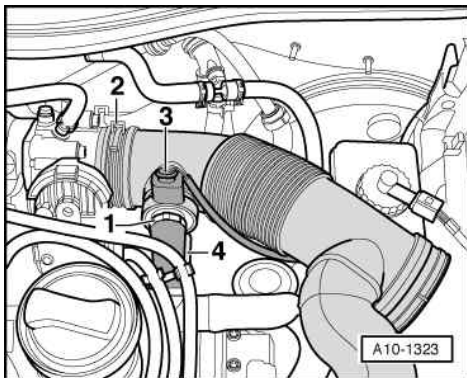
- -> Press release catches and disconnect fuel supply line -1- and fuel return line -2.



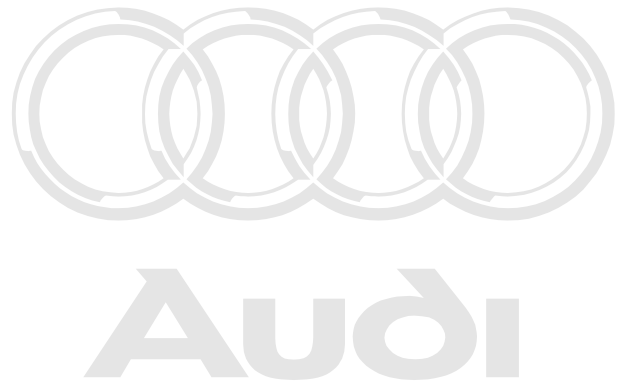
- -> Pull connector off Hall sender -G40 -arrow-.
- Remove toothed belt guard (top).



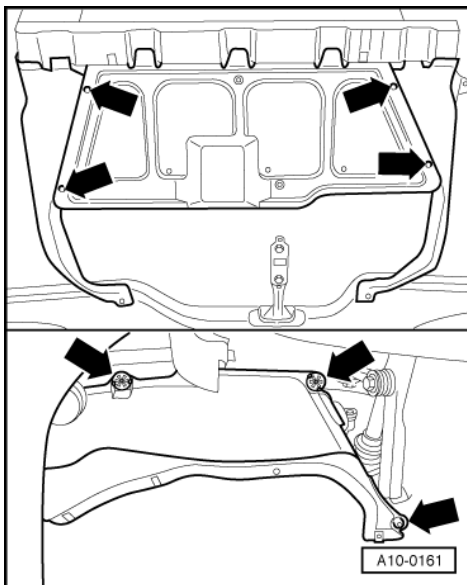
- -> Disconnect secondary air pump intake hose -1- from air cleaner housing.
- Unscrew bolt -7-.
- Disconnect air hose -2- from air mass meter.
- Unplug electrical connector -3- from air mass meter.
- Unscrew bolts -5- and -6-.
- Remove air cleaner housing and detach vent hose -4- from the rear.



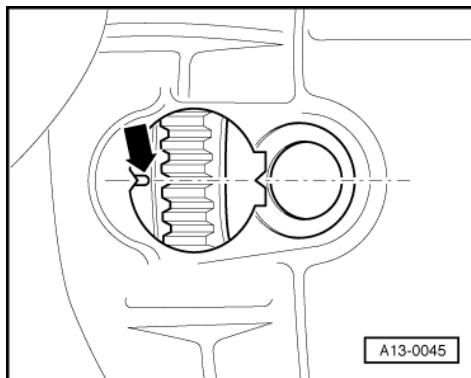
- -> Unplug electrical connector -3-.
- Disconnect hoses -1- and -4-.
- Remove air duct by releasing hose clip -2-.



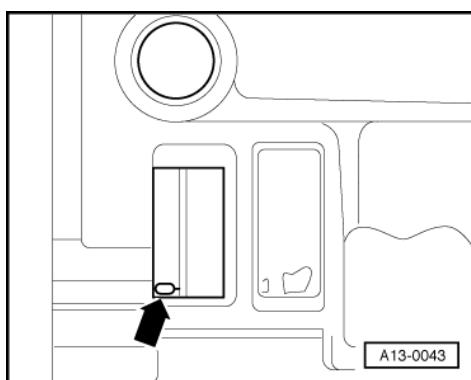
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



- -> Remove noise insulation panels (centre and right side) -arrows-.



- -> Set crankshaft to mark for TDC of No. 1 cylinder by turning central bolt on crankshaft sprocket in direction of engine rotation
- -> Vehicles with manual gearbox

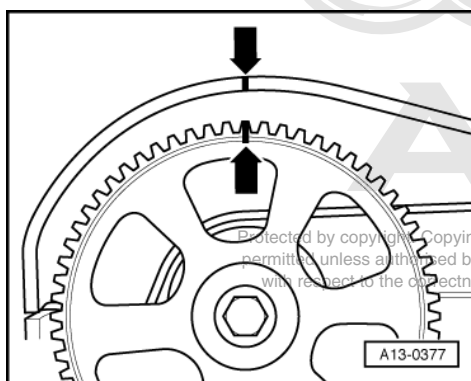


- -> Vehicles with automatic gearbox

Note:

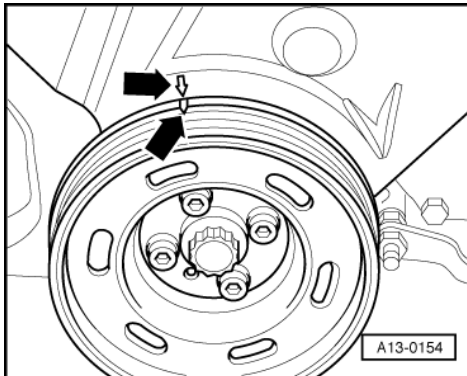
Turning crankshaft to TDC No. 1 cylinder with engine removed

=> Page 65 .

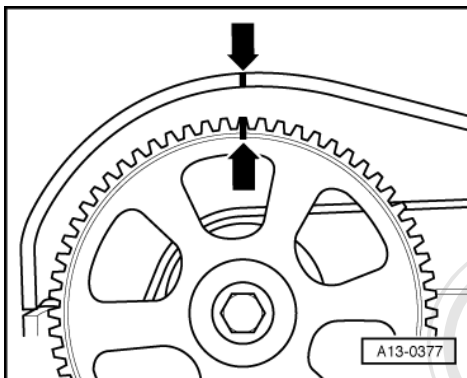


- -> ... and at the same time check that mark on face of camshaft sprocket is aligned with mark on rear toothed belt guard -arrows-. If necessary, turn crankshaft 1 turn further.

1.10 - Turning crankshaft to TDC of No. 1 cylinder with engine removed



- Toothed belt guard top part removed
- -> Set crankshaft to mark for TDC of No. 1 cylinder -arrows- by turning central bolt on crankshaft sprocket in direction of rotation



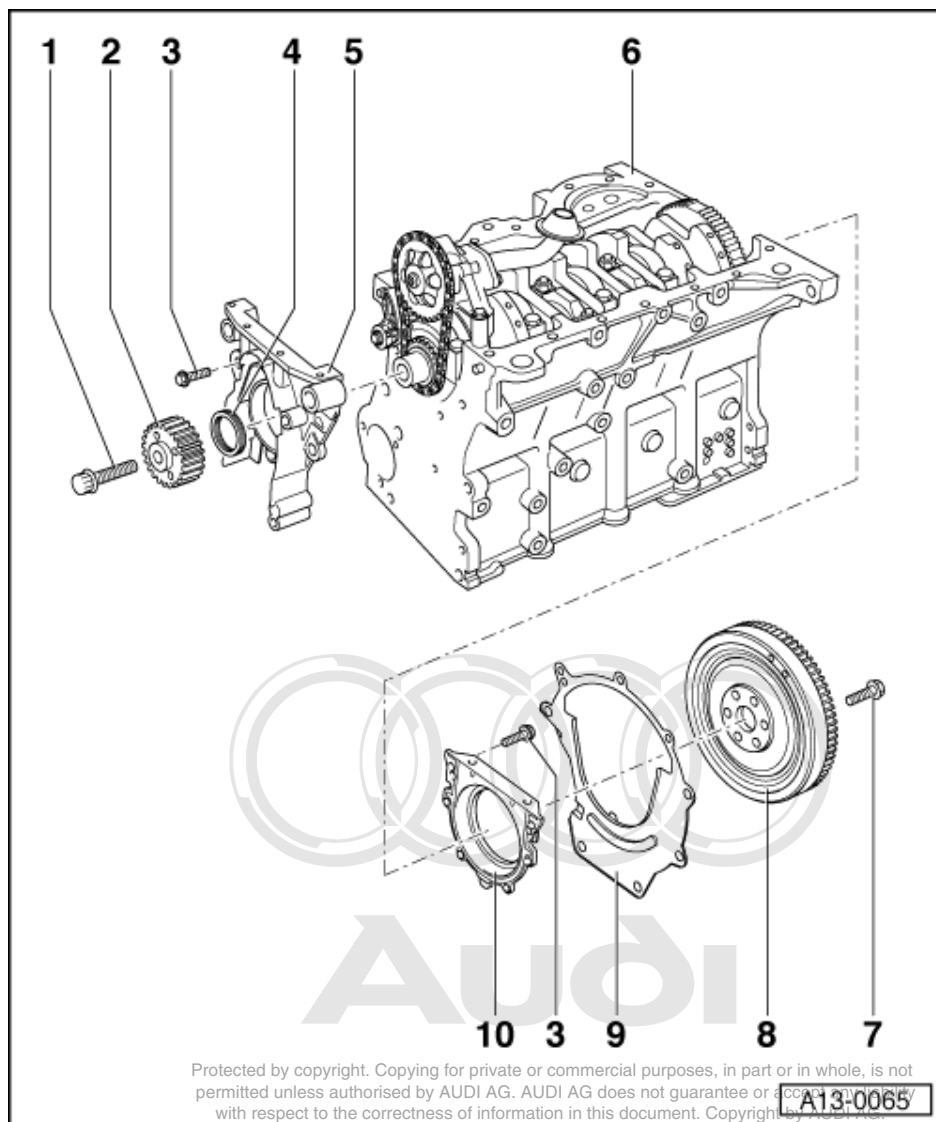
- -> ... and at the same time check that mark on camshaft sprocket is aligned with mark on rear toothed belt guard. If necessary, turn crankshaft 1 turn further.

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



2 - Removing and installing sealing flanges and flywheel/drive plate

2.1 - Removing and installing sealing flanges and flywheel/drive plate



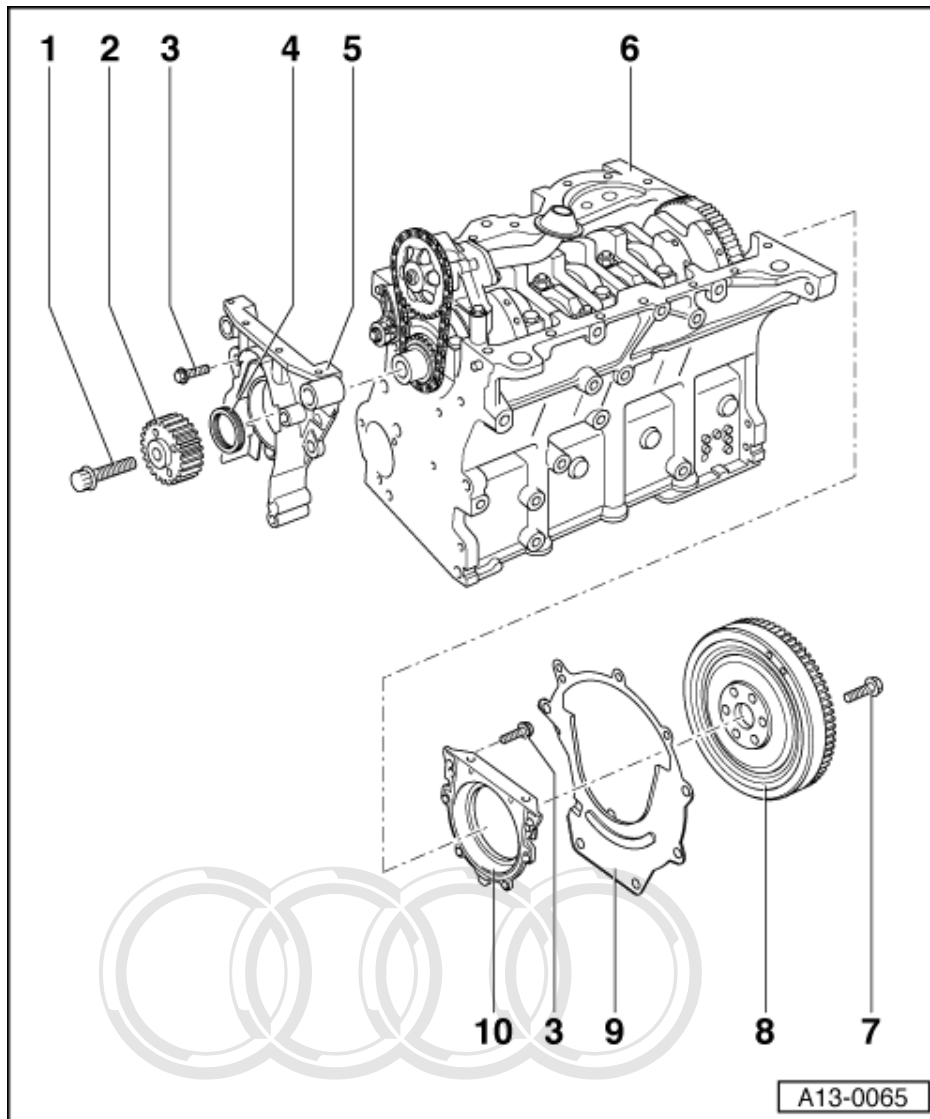
Note:

For repairs to the clutch:

=> 5-Speed manual gearbox 02J; Repair group 30; servicing clutch servicing clutch

1 90 Nm + 90°(1/4 turn) further

- ◆ Renew
 - ◆ Do not use oil
 - ◆ Use counter-hold tool 3415 when loosening and tightening
 - ◆ Bolting on counter-hold tool 3415
- => Fig. 52



2 Crankshaft sprocket

- ◆ Contact surface between sprocket and crankshaft must be free of oil.
- ◆ Can only be installed in one position.
- ◆ Removing and installing

=> Page 71

3 15 Nm

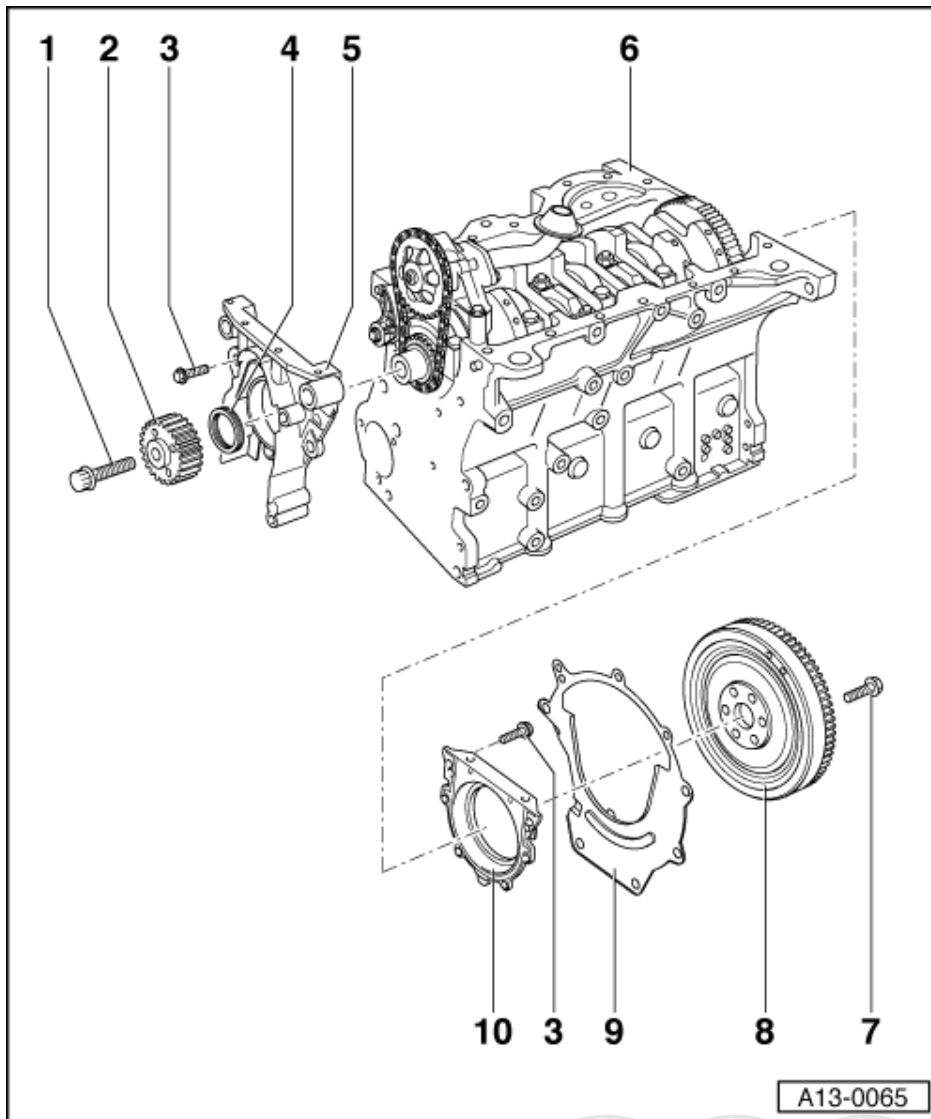
4 Oil seal

- ◆ Renewing => Page 71
- ◆ Do not use oil

5 Sealing flange - front

- ◆ Must be located on dowel sleeves
- ◆ Removing and installing

=> Page 73



6 Cylinder block

- ♦ Removing and installing crankshaft => Page 80
- ♦ Dismantling and assembling pistons and conrods
=> Page 87

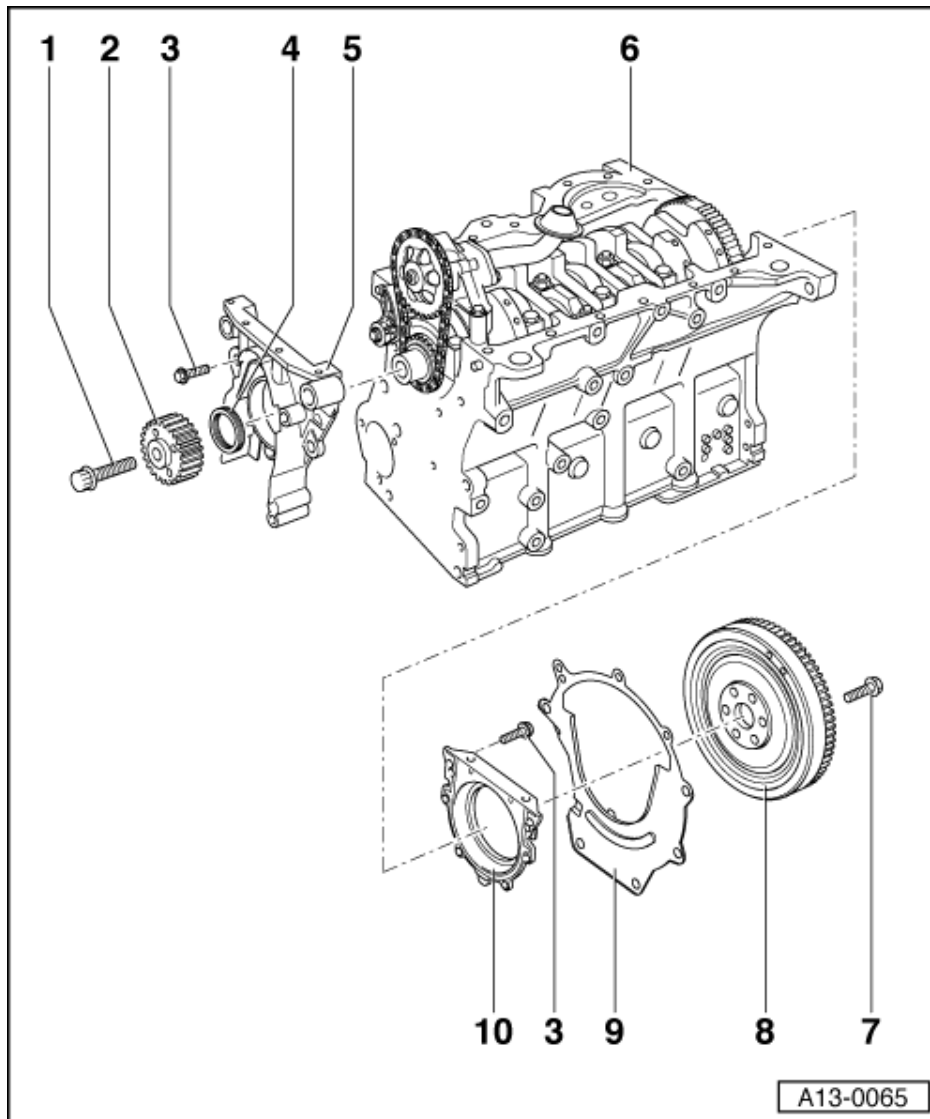
7 60 Nm + 90°(1/4 turn) further

- ♦ Renew

8 Dual-mass flywheel/drive plate

- ♦ Removing and installing dual-mass flywheel =>Page 76
- ♦ Removing and installing drive plate =>Page 77
- ♦ Can only be installed in one position. Holes are off-set

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

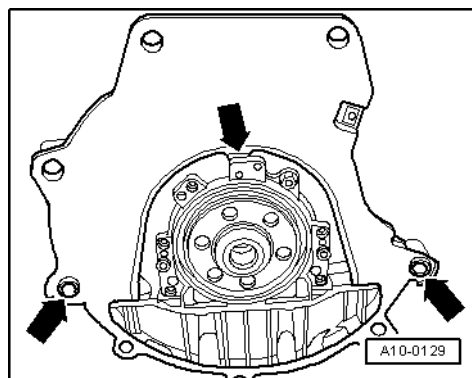


9 Intermediate plate

- ◆ Must be located on dowel sleeves
- ◆ Do not damage/bend when assembling
- ◆ Is engaged on sealing flange
=> Fig. 70

10 Rear sealing flange with oil seal

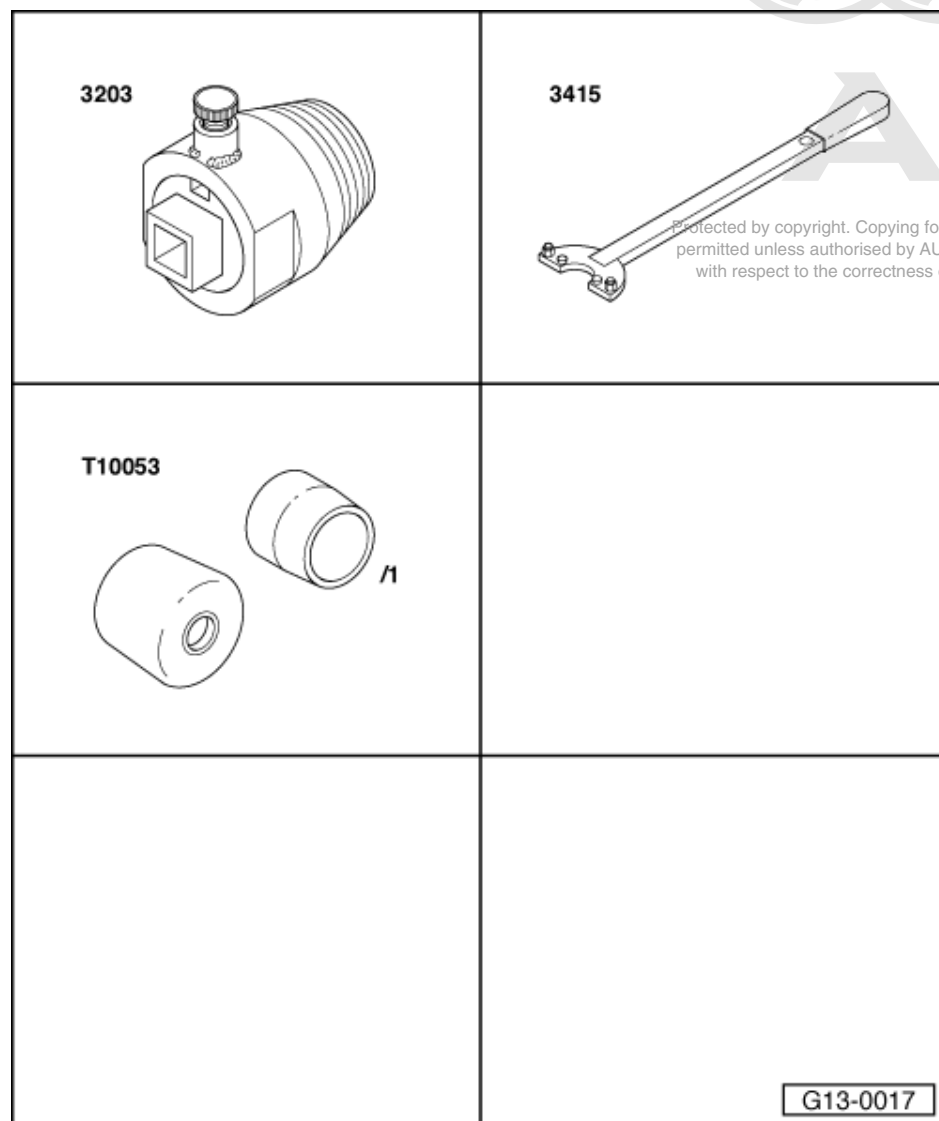
- ◆ With gasket for cylinder block
- ◆ Do not use oil
- ◆ Make sure that the sealing ring lip is not twisted or damaged when fitting the flange
- ◆ Remove sump in order to remove and install => Page 170 .
- ◆ When installing, push guide sleeve from repair kit onto crankshaft.



-> Fig.1 Installing intermediate plate

- Engage intermediate plate on sealing flange and press onto dowel sleeves -arrows-.

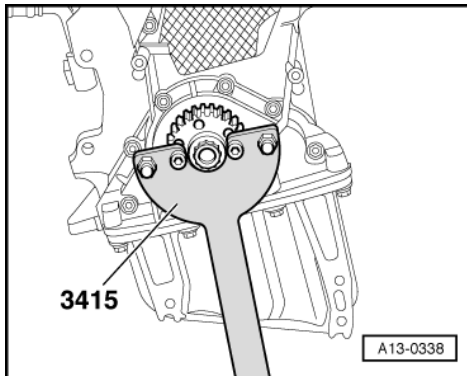
2.2 - Renewing crankshaft oil seal - pulley end -



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

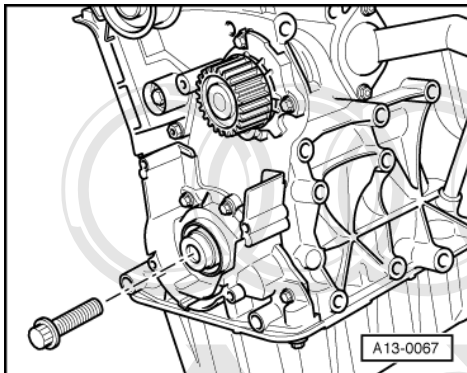
Special tools and workshop equipment required

- ◆ Oil seal extractor 3203
- ◆ Retainer 3415
- ◆ Guide sleeve T10053

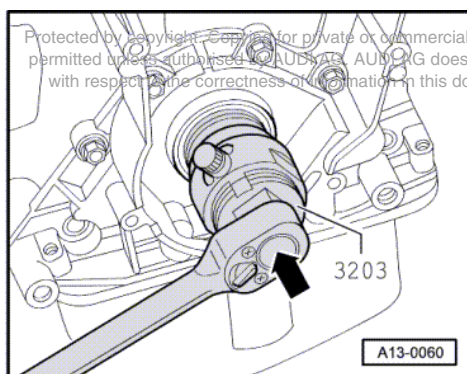


Removing

- Engine in vehicle
- Remove toothed belt => Page 54 .
- -> Remove toothed belt sprocket from crankshaft. To do this, hold sprocket in position with counter-hold tool 3415.



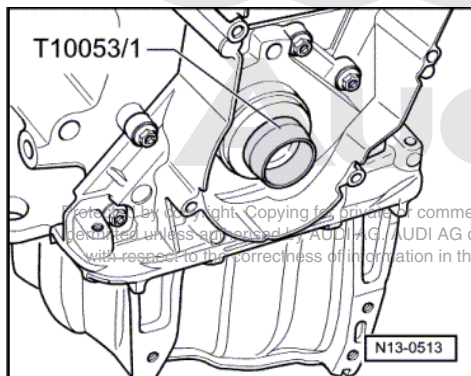
- -> Before applying oil seal extractor, screw central bolt for toothed belt sprocket into crankshaft as far as it will go.



- Unscrew the inner part of the oil seal extractor 3203 one turn out of the outer part and lock with knurled screw.
- -> Lubricate threaded head of oil seal extractor, place it in position and exerting firm pressure screw it as far as possible into oil seal.
- Loosen knurled screw and turn inner part against crankshaft until oil seal is pulled out.

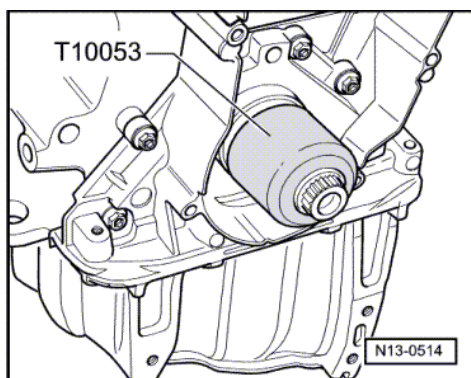


- Clamp flats of oil seal extractor in vice. Remove oil seal with pliers.
- Clean contact surface and sealing surface.

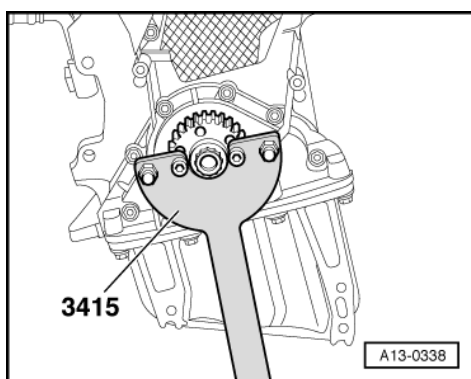


Installing

- Do not lubricate sealing lip or outer circumference of seal before pressing in.
- -> Fit guide sleeve T10053/1 onto crankshaft journal.
- Slide oil seal over guide sleeve.



- -> Press oil seal in until flush using central bolt for toothed belt sprocket and press sleeve T10053.



- Renew central bolt for toothed belt sprocket.
- -> Remove crankshaft sprocket. To do this counter-hold crankshaft sprocket with counter-hold tool 3415.

Notes:

- ◆ Contact surface between toothed belt sprocket and crankshaft must be free of oil.
- ◆ Do not oil bolt for crankshaft sprocket.

- Install toothed belt (adjust valve timing) => Page 58 .

Note:

Follow all instructions for removing and installing toothed belt

=>Page 54 .

- Install ribbed belt =>Page 44 .

Tightening torque

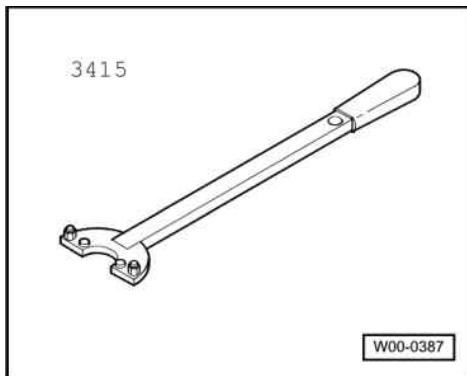
Component	Nm
Toothed belt sprocket to crankshaft	90 + 90°1)2)

Protection of the rights of Audi AG in the form of trademarks and logos is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

1) Renew bolt

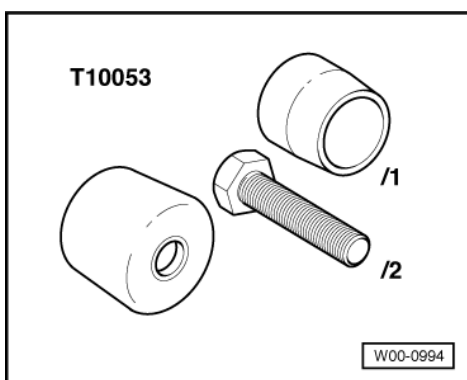
2) 90° is a quarter turn

2.3 - Removing and installing front sealing flange



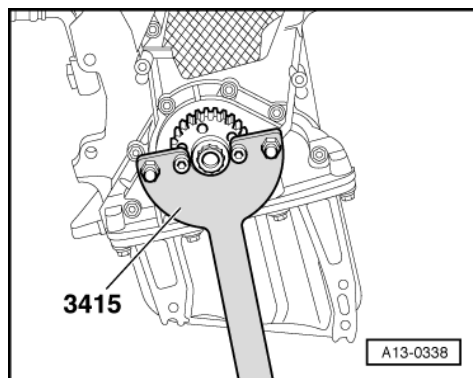
Special tools, workshop equipment and auxiliary items

- ◆ Counter-hold tool 3415



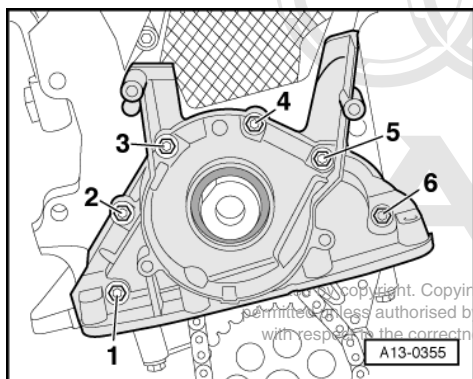
- ◆ Guide sleeve T10053
- ◆ Electric drill with plastic brush attachment
- ◆ Protective goggles
- ◆ Silicone sealant

=> Parts catalogue

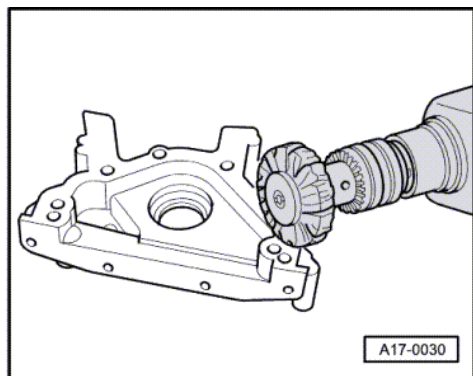


Removing

- Engine in vehicle
- Remove toothed belt => Page 54 .
- -> Remove toothed belt sprocket from crankshaft. To do this, hold sprocket in position with counter-hold tool 3415.
- Remove sump => Page 170 .

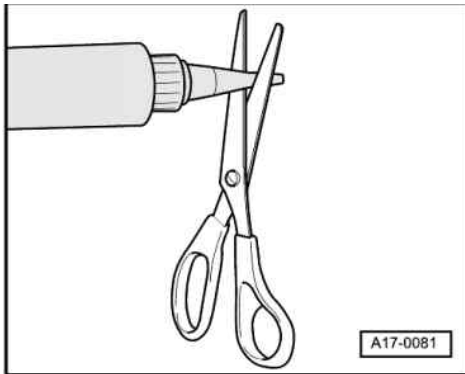


- -> Unscrew bolts -1...6-.
- Prise off sealing flange and remove.
- Carefully remove sealant remaining on cylinder block.



Warning!
Wear eye protection

- -> Remove sealant remaining on sealing flange (with rotating plastic brush or similar).
- Clean sealing surfaces: they must be free of oil and grease.

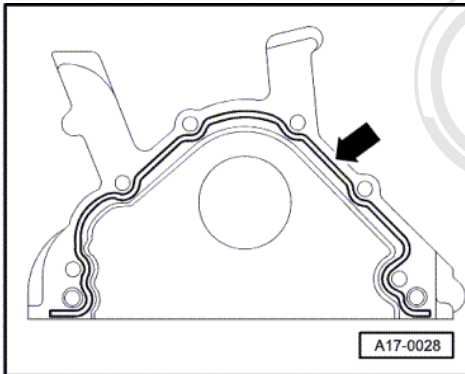


Installing

Note:

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

- -> Cut off nozzle of tube at front marking (nozzle dia. approx. 3 mm).



- -> Apply the bead of silicone 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 exceed this thickness, excess sealant could enter the sump and clog the filter in the oil intake pipe.

- Fit the sealing flange immediately, and tighten all bolts lightly.

Note:

Use guide sleeve T10053/1 to fit sealing flange with the oil seal already installed.

- Tighten sealing flange bolts in diagonal sequence.
- Install sump => Page 172 .

Note:

After installing, the sealant must be allowed to dry for about 30 minutes before putting in engine oil.

- Install crankshaft oil seal (pulley end) => Page 72 .
- Install toothed belt (adjust valve timing) => Page 58 .

Note:

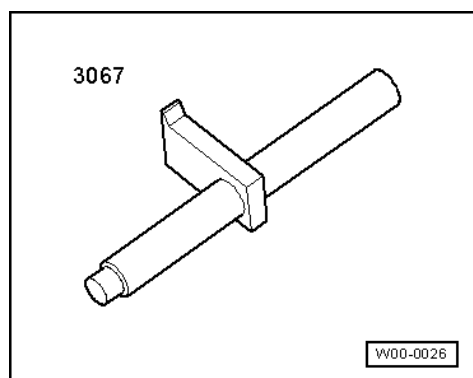
Follow all instructions for removing and installing toothed belt

=>Page 54.

Tightening torque

Component	Nm
Sealing flange to cylinder block	15

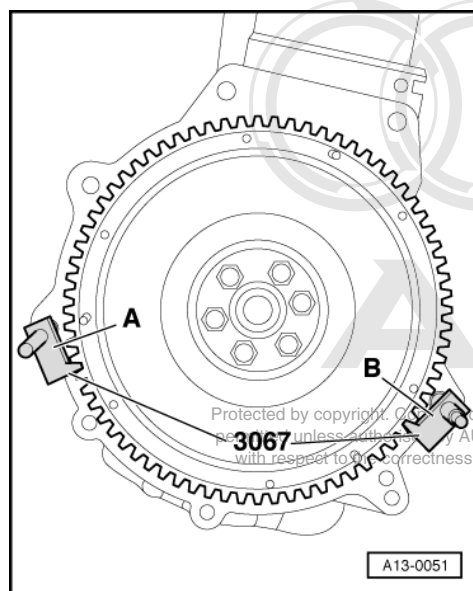
2.4 - Removing and installing dual mass flywheel/ drive plate



Dual-mass flywheel

Special tools and workshop equipment required

- ♦ Counter-hold tool 3067



Removing

- Clutch removed
- -> Insert counter-hold tool 3067 in drilling in cylinder block, and engage on flywheel.
- Insertion position for counter-hold tool:
 - A - To tighten

- B - To loosen
- Mark position of flywheel relative to engine.
- Unbolt flywheel.

Installing

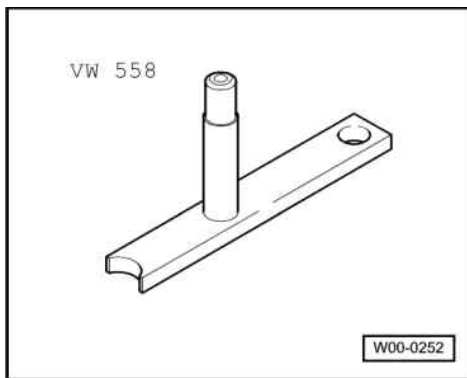
Install in reverse sequence; note the following points:

- Use new bolts for securing.

Tightening torque

Component	Nm
Dual-mass flywheel to crankshaft	60 + 90°1)

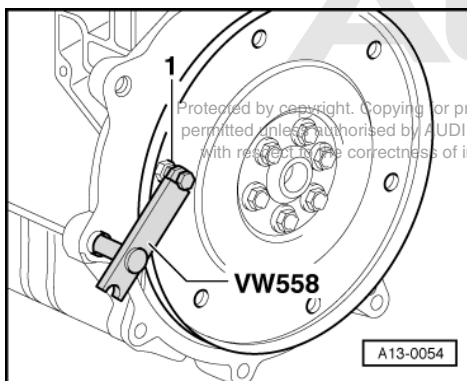
1) 90° = 1/4 turn



Drive plate

Special tools and workshop equipment required

- ◆ Counter-hold tool VW 558
- ◆ Hexagon bolt M8 x 45 and two M10 hexagon nuts
- ◆ Vernier caliper or depth gauge

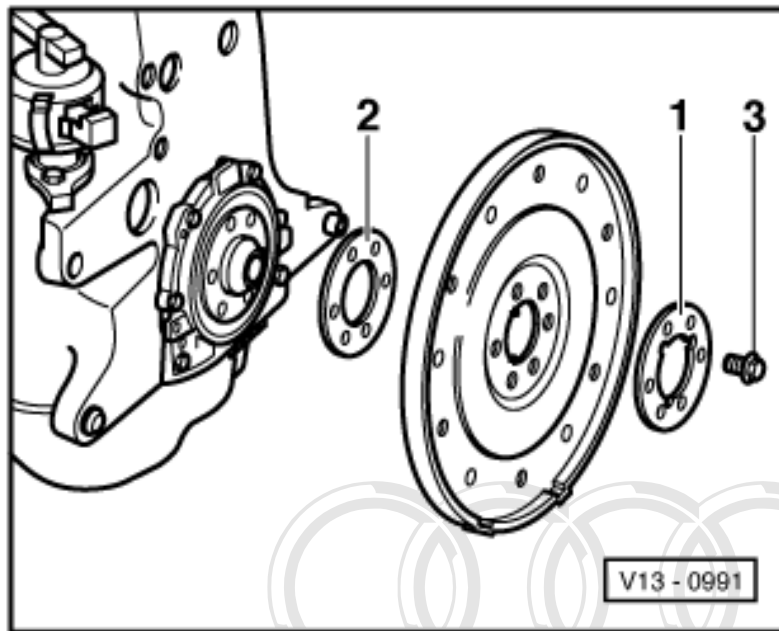


Removing

- -> Secure counter-hold tool VW 558 to the drive plate with a hexagon bolt M8x45. Place two M10 hexagon nuts -1- between counter-hold tool and drive plate.
- Mark position of drive plate relative to engine.



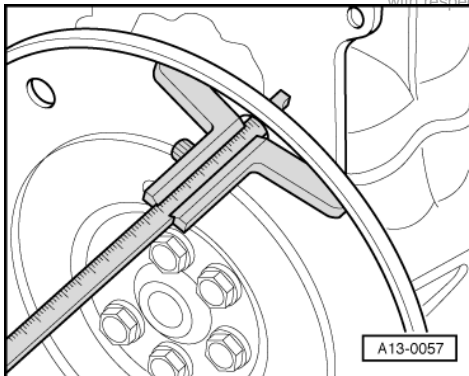
- Unbolt drive plate.



Installing

- -> Locate drive plate with shim -2- and packing plate -1-.
- Insert at least 3 of the old securing bolts -3- and tighten to 30 Nm.

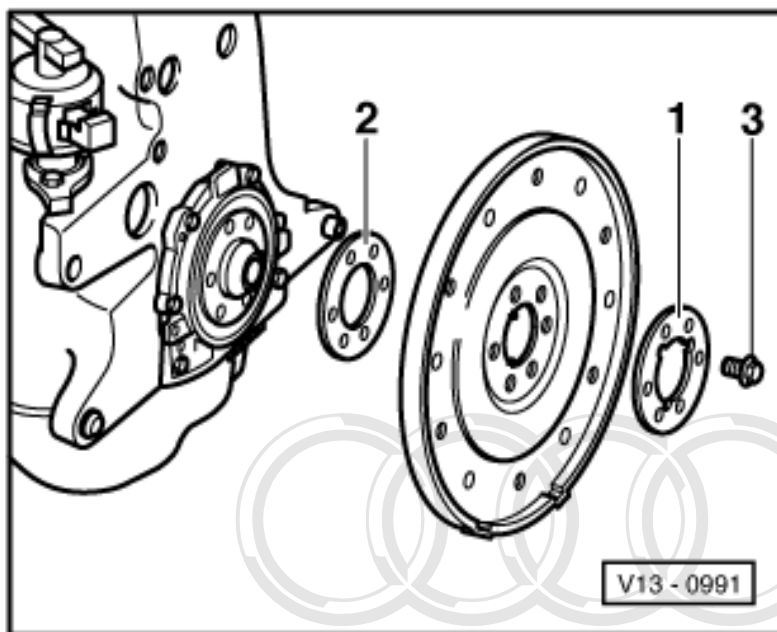
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



- -> Check installation position of drive plate by measuring at three points and calculate average.
- Specification: 19.5...21.1 mm

Note:

Measurement is taken through the hole in the drive plate to the machined surface of the cylinder block.



If the specification is exceeded:

- -> Remove drive plate again and install without shim 2. Tighten bolts to 30 Nm again.
- Measure distance again.

If the specification is obtained:

- Fit new bolts and tighten.

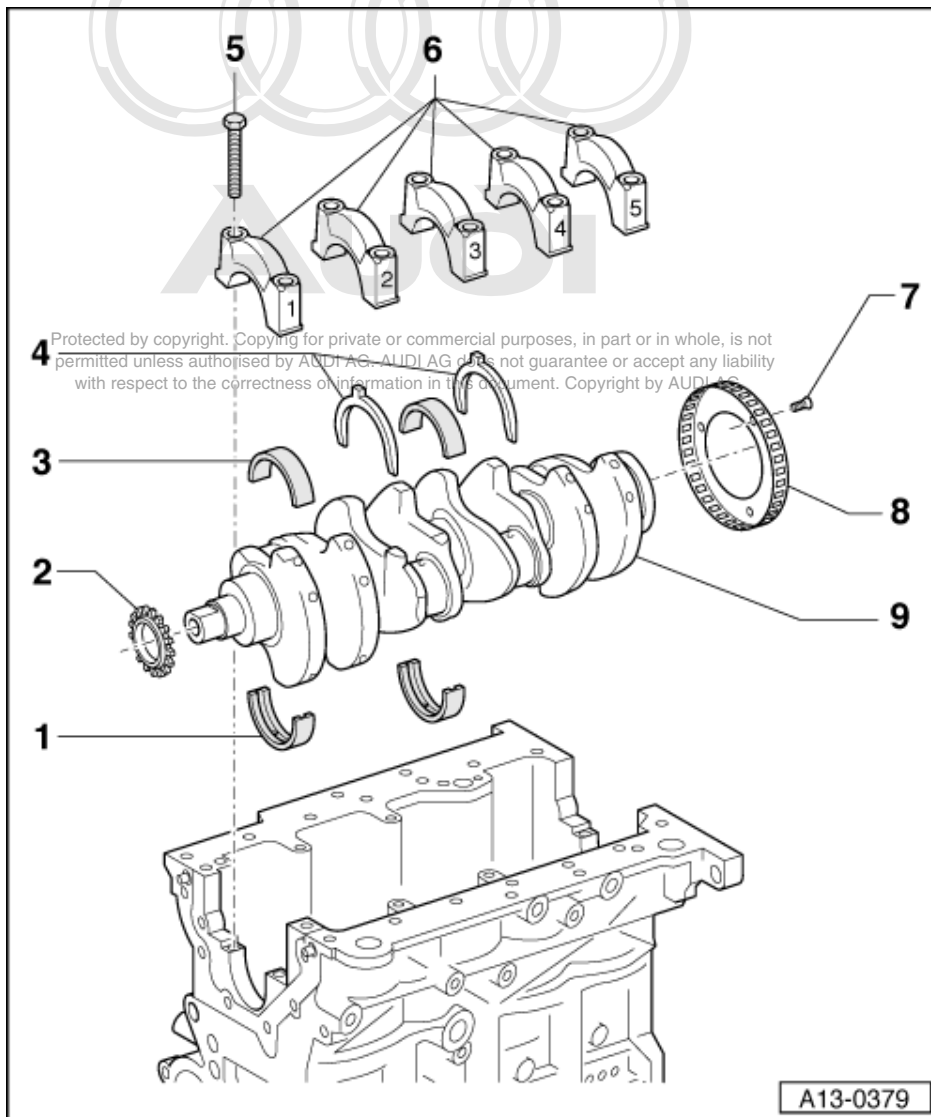
Tightening torque

Component	Nm
Drive plate to crankshaft	60 + 90°1)

1) 90°= 1/4turn

3 - Removing and installing crankshaft

3.1 - Removing and installing crankshaft

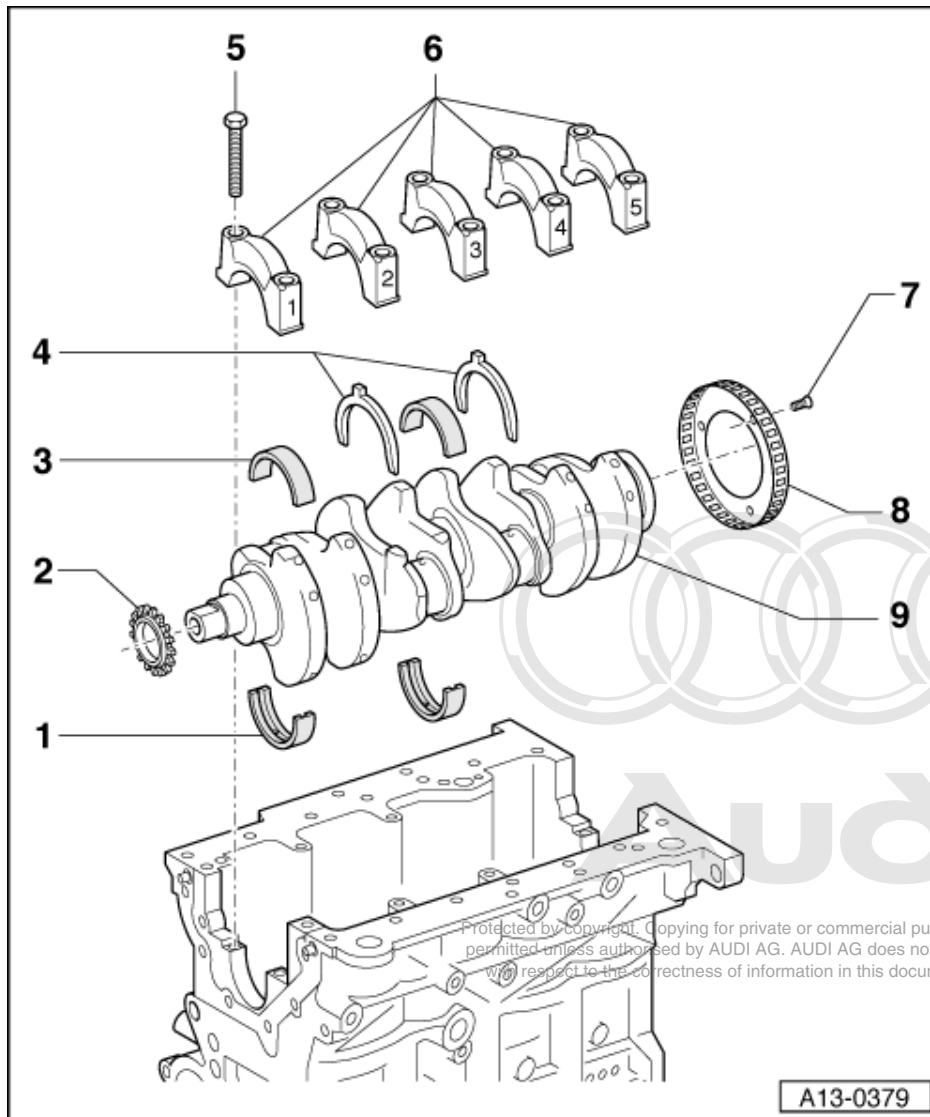


Notes:

- ♦ As of approx. 03/97 bearing shells are assigned to specific cylinder block positions according to thickness. Shell thicknesses are identified by coloured dots.
- ♦ For removal and installation mount the engine with engine support VW 540 to the assembly stand => Page 25 .

1 Bearing shell

- ♦ For cylinder block with oil groove
- ♦ Do not interchange used bearing shells (mark)
- ♦ As of approx. 03/97: insert new bearing shells for cylinder block with the proper colour code => Fig. 85



2 Chain sprocket

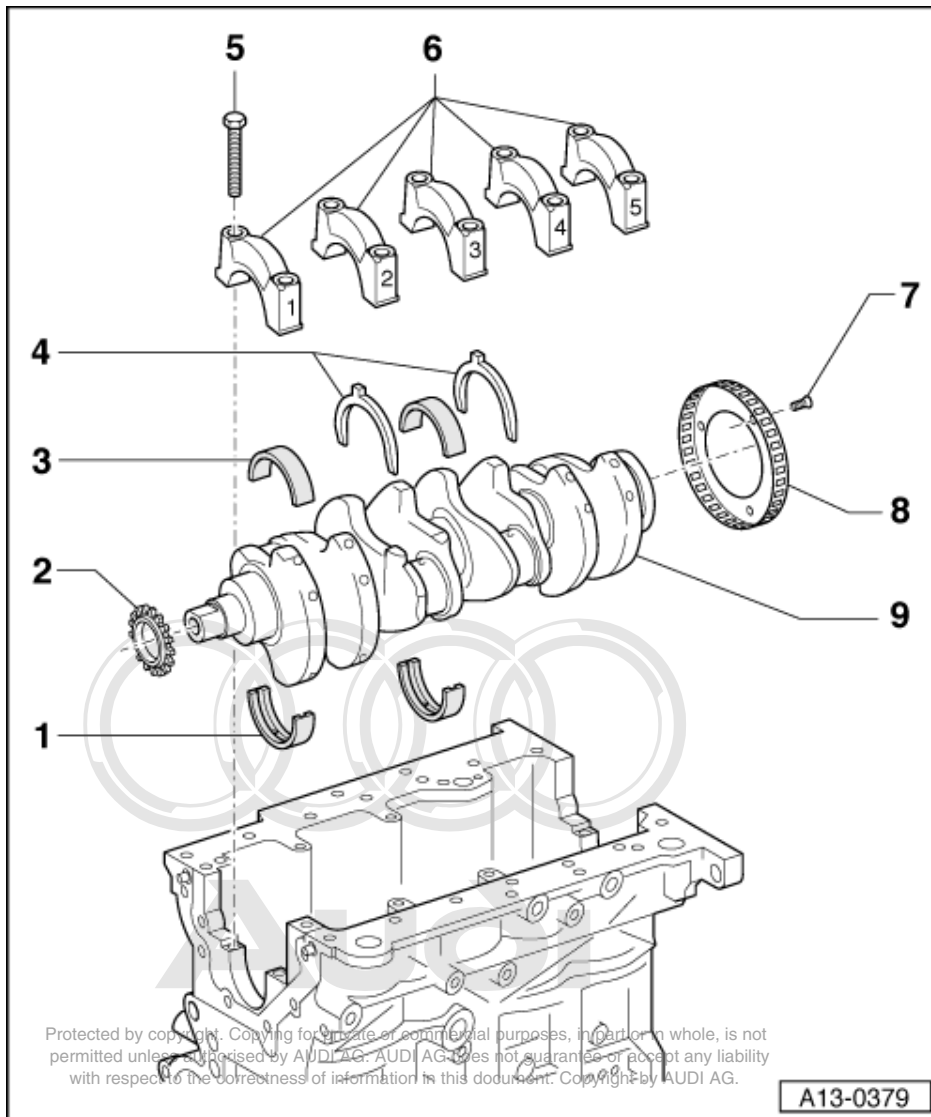
- ♦ For oil pump drive chain
- ♦ Renewing => Page 86

3 Bearing shell

- ♦ For bearing cap without oil groove
- ♦ Do not interchange used bearing shells (mark)
- ♦ As of approx. 03/97: the replacement crankshaft bearing shells inside the bearing caps are supplied with yellow colour code only.

4 Thrust washer

- ♦ For bearing 3
- ♦ Note fixing arrangement



5 65 Nm + tighten 90°(1/4turn) further

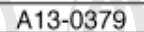
- ◆ Renew
- ◆ When measuring radial clearance of crankshaft, tighten to 65 Nm but do not turn further

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

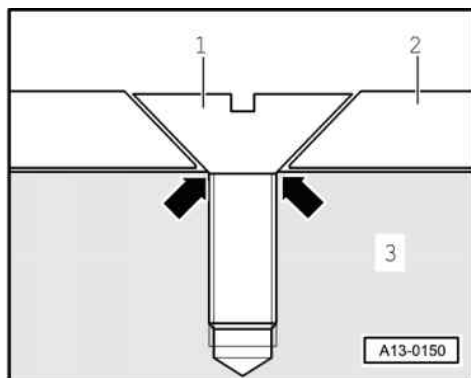
7 10 Nm + tighten 90°(1/4turn) further

- ◆ Renew
- ◆ Always renew sender wheel if bolts have been unscrewed
=> Fig. 84



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

- ### 3.1 - Removing and installing crankshaft 83



-> Fig.1 Removing and installing sender wheel

- Always renew sender wheel -2- if securing bolts -1- have been unscrewed.

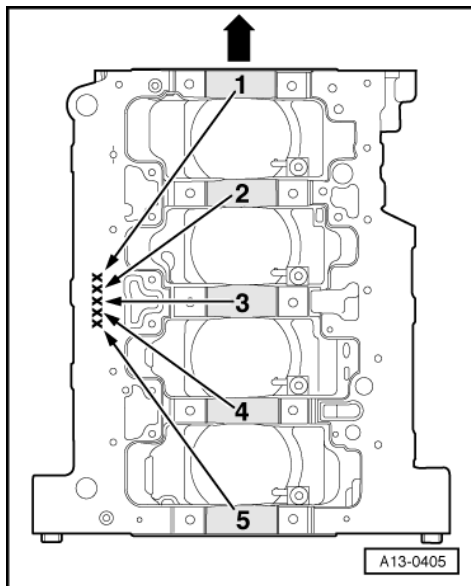
Notes:

- ♦ If the securing bolts are tightened a second time, the seats for the countersunk bolt heads in the sender wheel will be distorted to such an extent that the bolt heads will come into direct contact with the crankshaft -3- (-arrows-) and the sender wheel will only fit loosely under the bolts.
- ♦ The mounting holes are asymmetrically spaced, so it is only possible to install the sender wheel in one position.

Tightening torque

Component	Nm
Sender wheel to crankshaft	10 + 90° 1)2)

- 1) Renew bolts
- 2) 90° is a quarter turn



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

-> Fig.2 As of approx. 03/97: assignment of crankshaft bearing shells to cylinder block positions

As of approx. 03/97 cylinder blocks are assigned bearing shells with the proper thickness. Shell thicknesses are identified by coloured dots.

Note:

Arrow points in direction of travel.

Letters on the bottom sealing surface of the cylinder block indicate the proper bearing shell thicknesses for the different positions.

Letter on cylinder block		Bearing colour code
S	=	black
R	=	red
G	=	yellow

Note:

The replacement bearing shells to go inside the bearing caps are supplied with yellow colour code only.

3.2 - Crankshaft dimensions - vehicles up to approx. 02/97

(in mm)

Honing dimension	Main journal dia.	Conrod journal dia.
Basic dimension	-0.022	-0.022
	54.00	47.80
	-0.042	-0.042
1st undersize	-0.022	-0.022
	53.75	47.55
	-0.042	-0.042
2nd undersize	-0.022	-0.022
	53.50	47.30
	-0.042	-0.042
3rd undersize	-0.022	-0.022
	53.25	47.05
	-0.042	-0.042

3.3 - Crankshaft dimensions - vehicles as of approx. 03/97

(in mm)

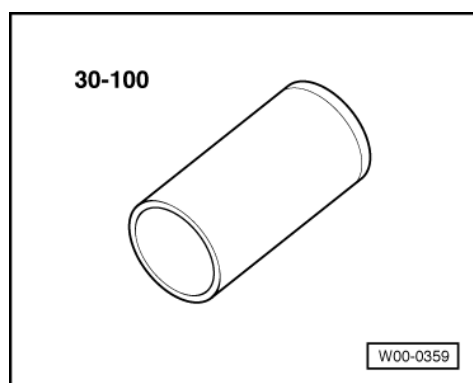
Honing dimension	Main journal dia.	Conrod journal dia.
Basic dimension	-0.017	-0.022
	54.00	47.80
	-0.037	-0.042

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



Honing dimension	Main journal dia.	Conrod journal dia.
1st undersize	-0.017	-0.022
	53.75	47.55
	-0.037	-0.042
2nd undersize	-0.017	-0.022
	53.50	47.30
	-0.037	-0.042
3rd undersize	-0.017	-0.022
	53.25	47.05
	-0.037	-0.042

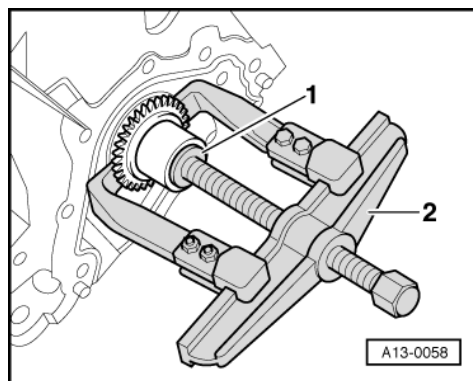
3.4 - Removing and installing chain sprocket



Special tools and workshop equipment required

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

- ♦ Drift sleeve 30-100
- ♦ Two-arm puller (normal commercial type)
- ♦ Protective gloves



Removing

- Remove sump => Page 170 .
- Remove front sealing flange => Page 73 .
- Remove oil pump chain sprocket, chain tensioner and chain
=> -Item 163 .
- -> Pull chain sprocket off crankshaft with puller -2- : use a suitable washer -1- to protect end of crankshaft.

Installing

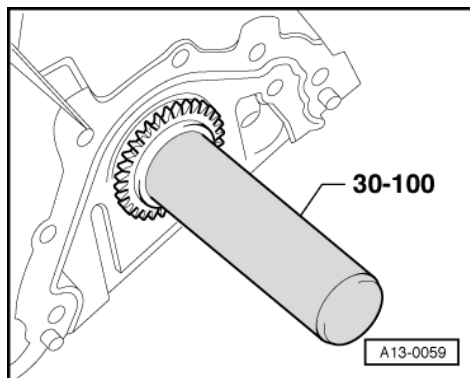
Install in reverse sequence; note the following points:

Caution
 Wear protective gloves.

- Heat chain sprocket in oven for approx. 15 minutes to 220°C.

Note:

Fitting location: Large shoulder of chain sprocket points to engine.



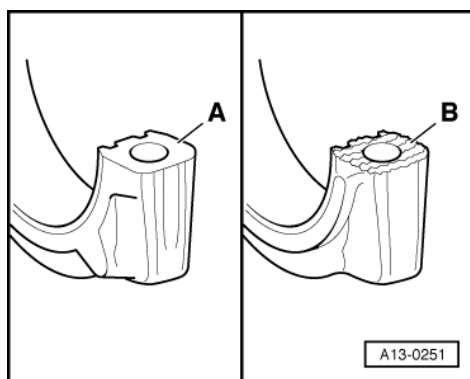
- -> Fit chain sprocket on end of crankshaft using pliers, and press onto crankshaft until fully seated using sleeve 30-100.

4 - Dismantling and assembling pistons and conrods

4.1 - Dismantling and assembling pistons and conrods

4.2 - Different conrod versions with different conrod bolts

- ◆ Depending on manufacture date cracked steel conrods are used in place of sawn conrods.
- ◆ Identification of sawn conrods and cracked-steel conrods:

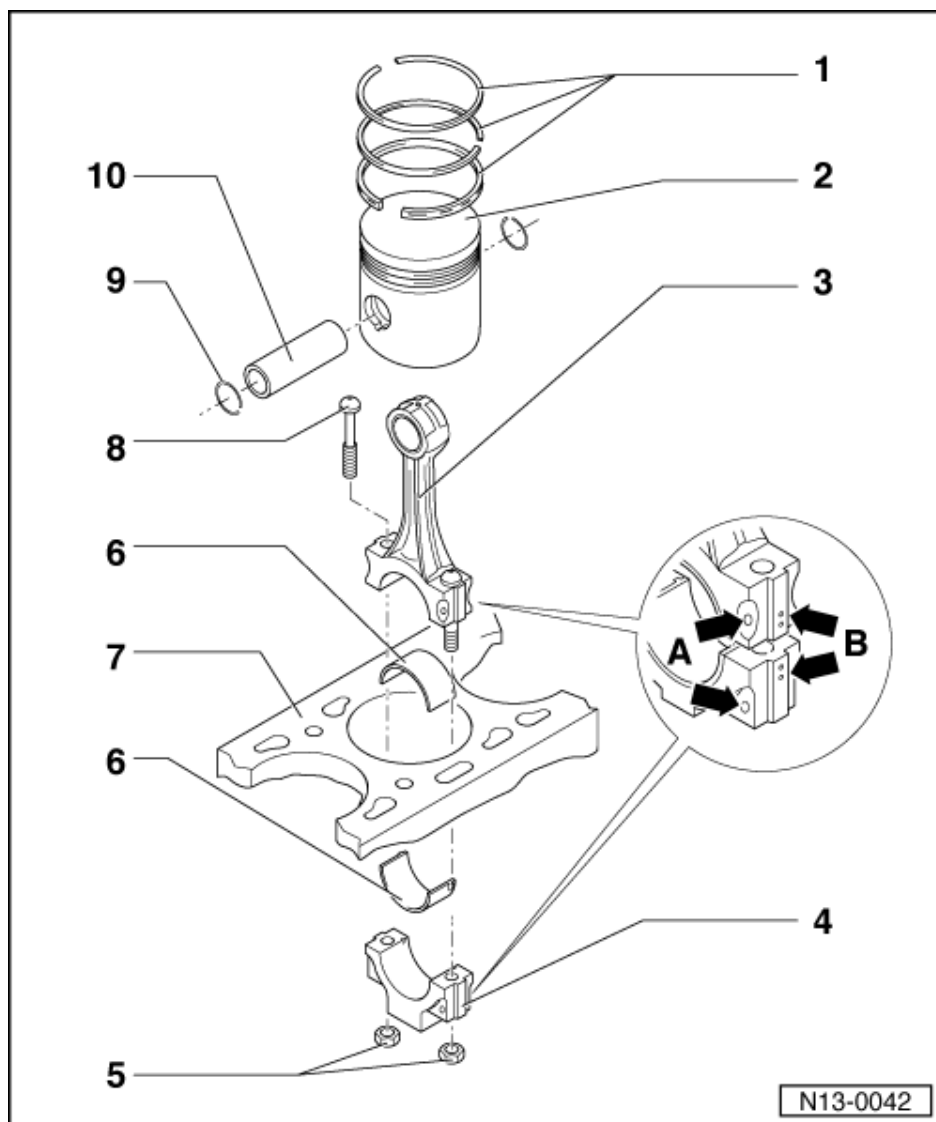


- A - -> Sawn conrods = smooth joint surface
 B - Cracked-steel conrods¹⁾ = rough joint surface

- 1) broken into two sections by cracking

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

4.3 - Sawn conrods



Note:

Oil spray jet and pressure relief valve

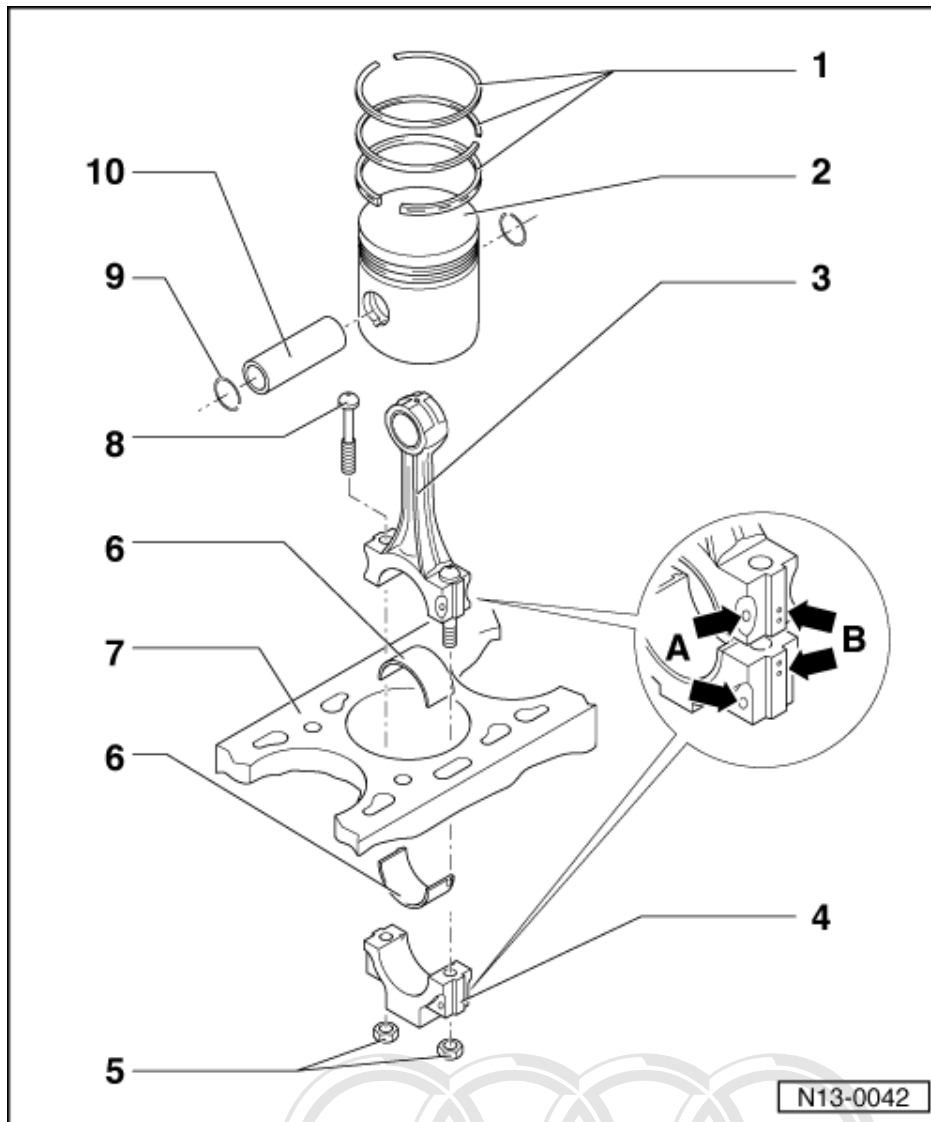
=>Fig. 99.

1 Piston ring

- ◆ Offset gaps by 120 °
- ◆ Remove and install with piston ring pliers
- ◆ "TOP" faces towards piston crown
- ◆ Checking ring gap
=> Fig. 97
- ◆ Checking ring to groove clearance
=> Fig. 97



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



2 Piston

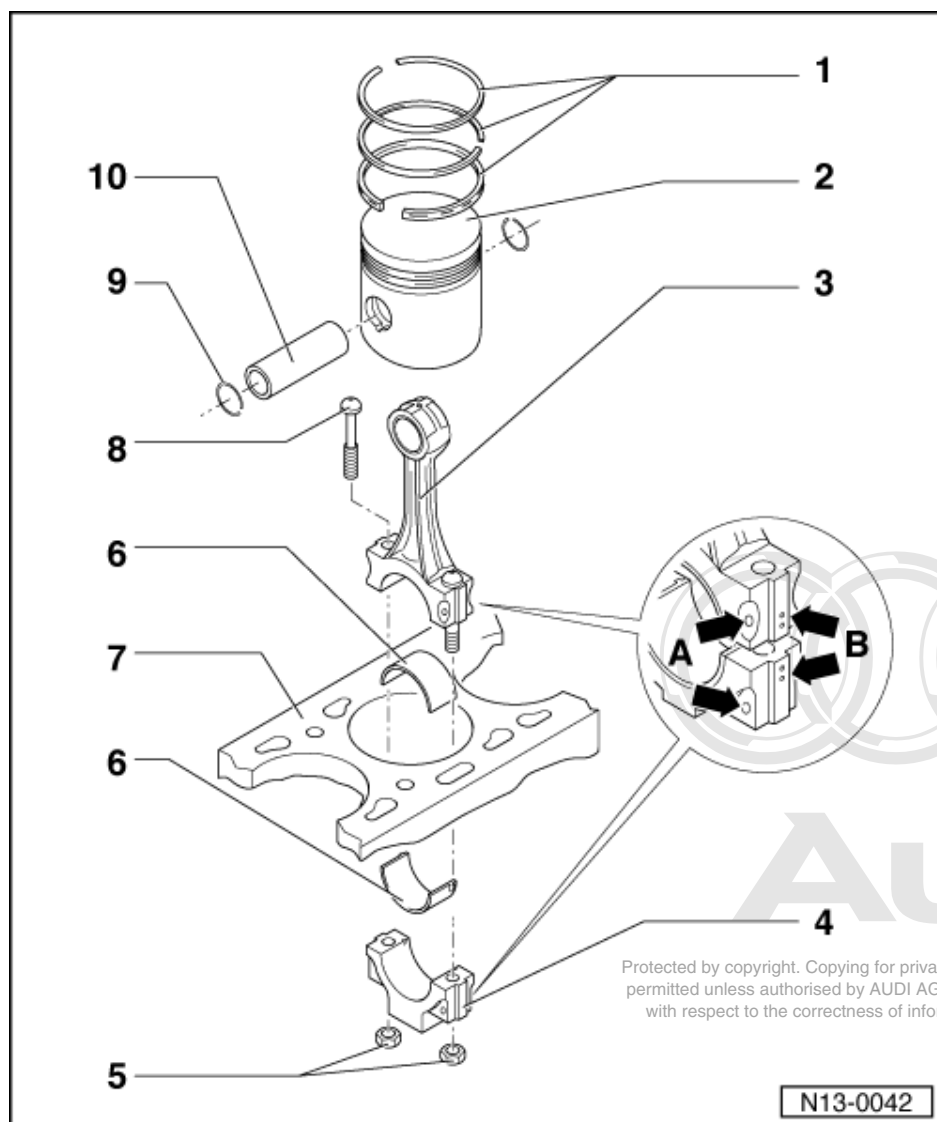
- ◆ Checking => Fig. 98
- ◆ Mark installation position and cylinder number
- ◆ Arrow on piston crown points to pulley end
- ◆ Install using piston ring clamp
- ◆ Piston and cylinder dimensions

=>Page 99

3 Conrod

- ◆ Only renew as a set
- ◆ Mark cylinder number -B-
- ◆ Installation position:
Marking -A- faces towards pulley end
- ◆ With oil drilling for piston pin lubrication

This document is not to be used for private or commercial purposes, in part or in whole, is not to be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage and retrieval system. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

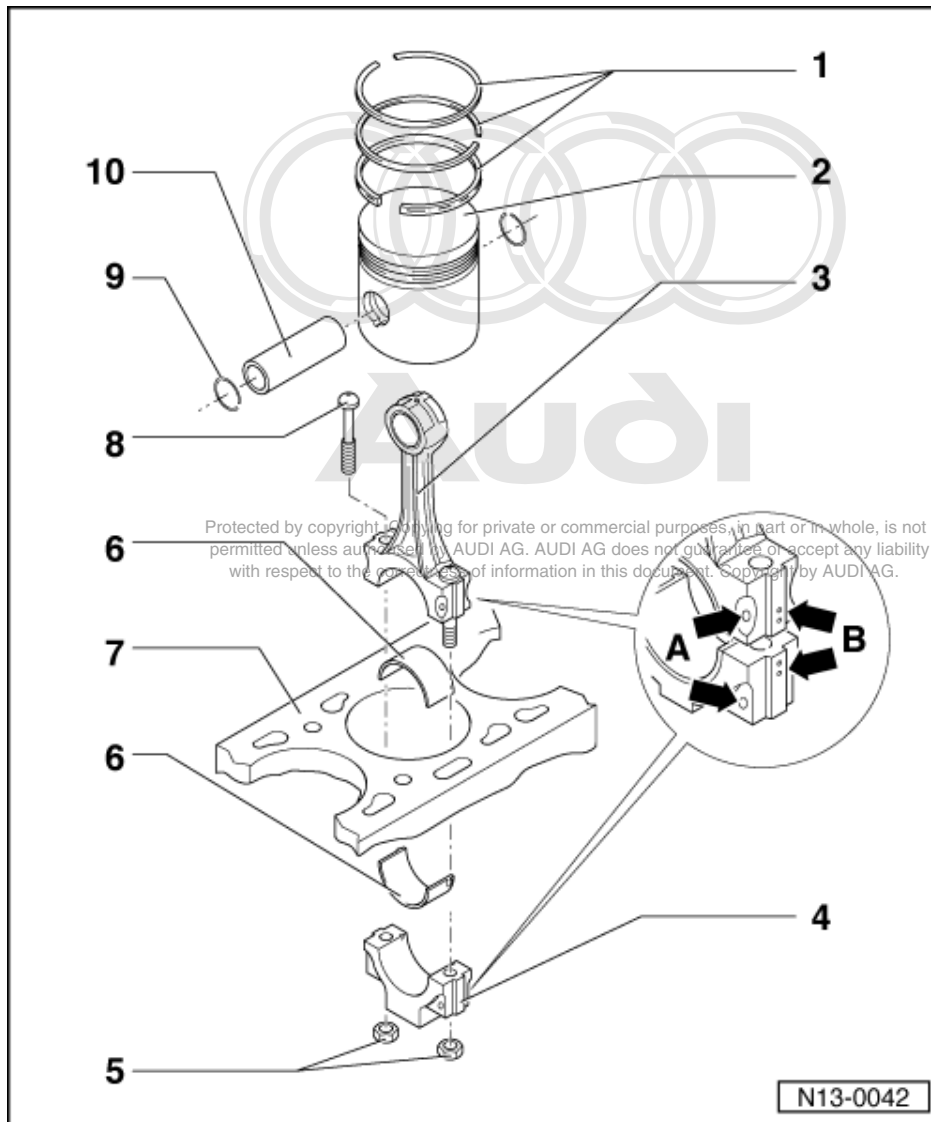


4 Conrod bearing cap

- ◆ Mark cylinder number -B-
- ◆ Installation position:
Marking -A- faces towards pulley end

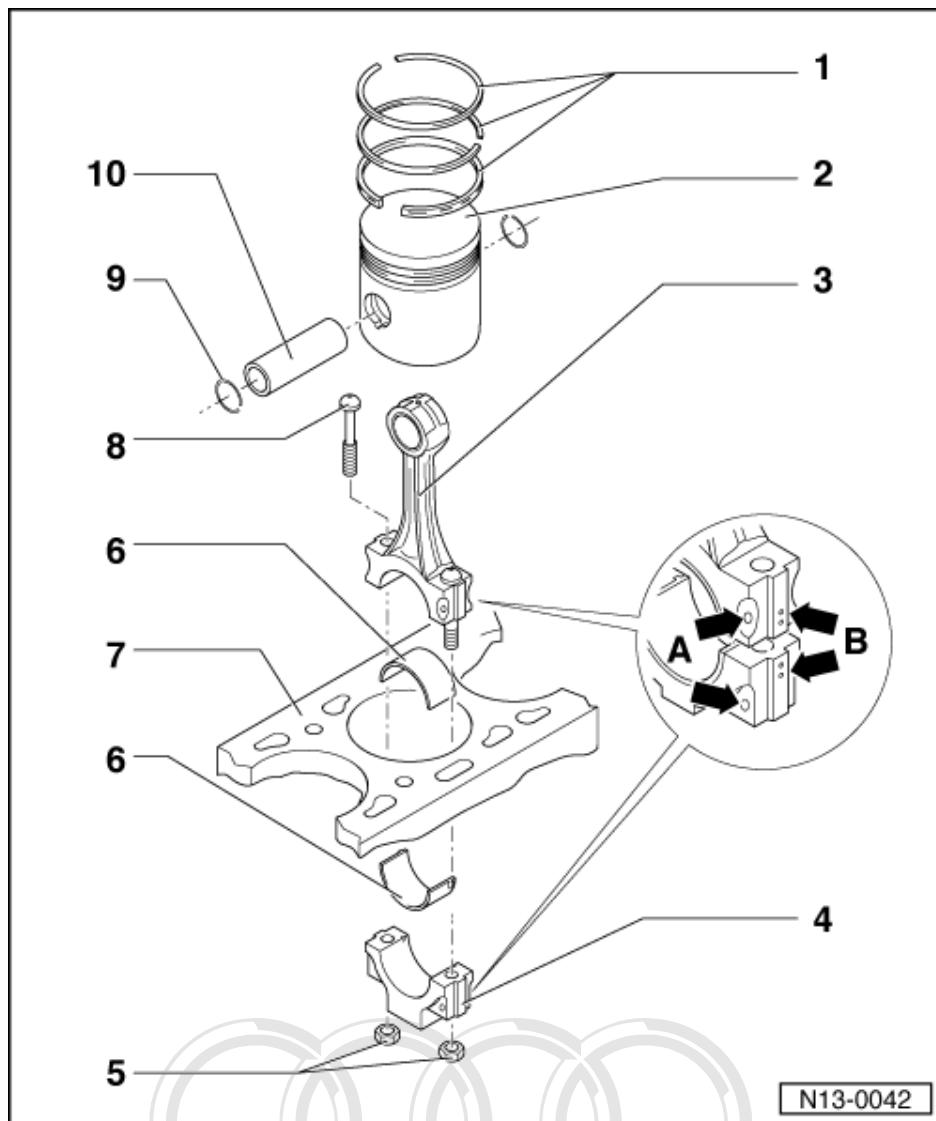
5 30 Nm + tighten 90° (1/4 turn) further

- ◆ Renew conrod bolts (Item 8)
- ◆ Oil threads and contact surface
- ◆ To measure radial clearance tighten to 30 Nm but not further



6 Bearing shell

- ◆ Upper bearing shell with oil drilling for piston pin lubrication
- ◆ Note installation position
- ◆ Do not interchange used bearing shells (mark)
- ◆ Ensure retaining lugs fit tightly in recesses
- ◆ Axial clearance
New: 0.10...0.35 mm
Wear limit: 0.40 mm
- ◆ Check radial clearance with Plastigage:
New: 0.01...0.05 mm
Wear limit: 0.12 mm
Do not rotate crankshaft when checking radial clearance



7 Cylinder block

- ♦ Checking cylinder bores
=>Fig. 98
- ♦ Piston and cylinder dimensions
=>Page 99

8 Conrod bolt

- ♦ Renew

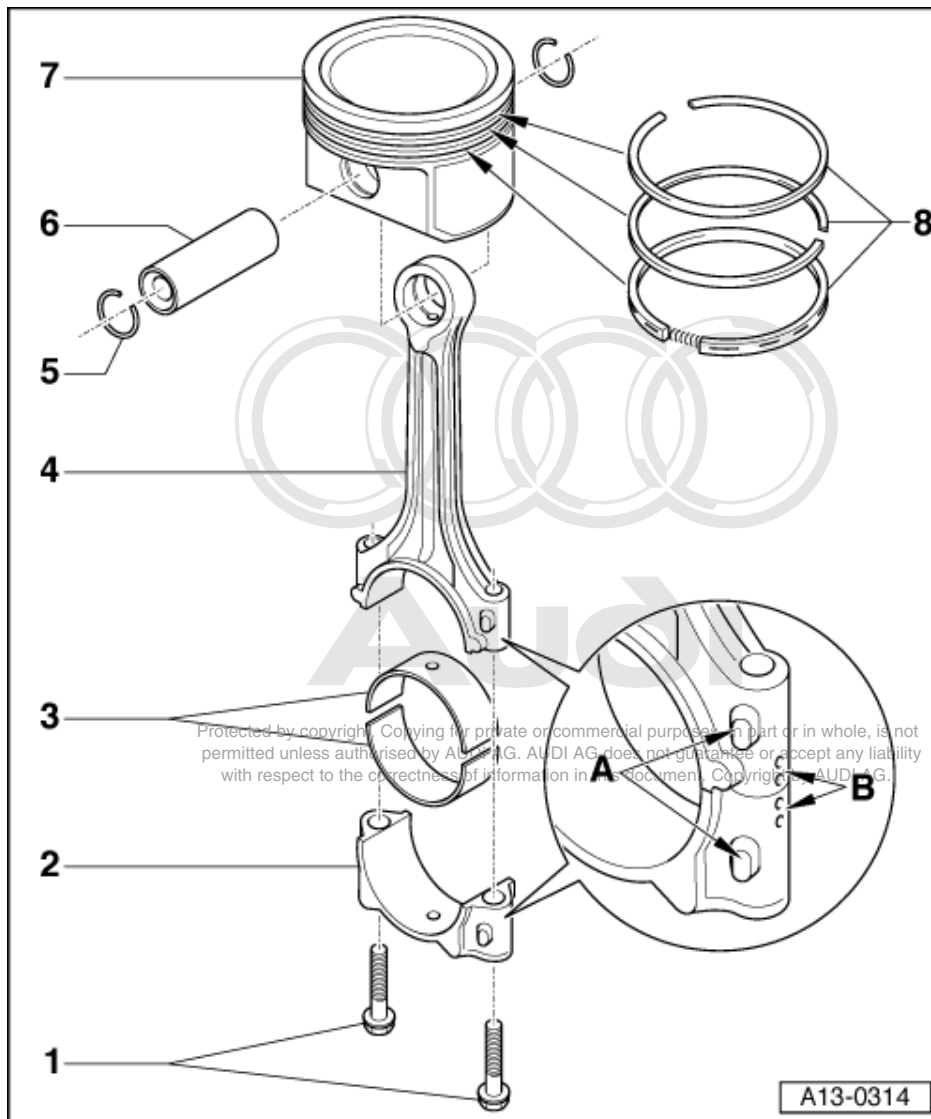
9 Circlip

10 Piston pin

- ♦ If difficult to move heat piston to approx. 60 °C
- ♦ Remove and install with VW 222a

This document, in part or in whole, is not to be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage and retrieval system. Audi AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

4.4 - Cracked-steel conrods



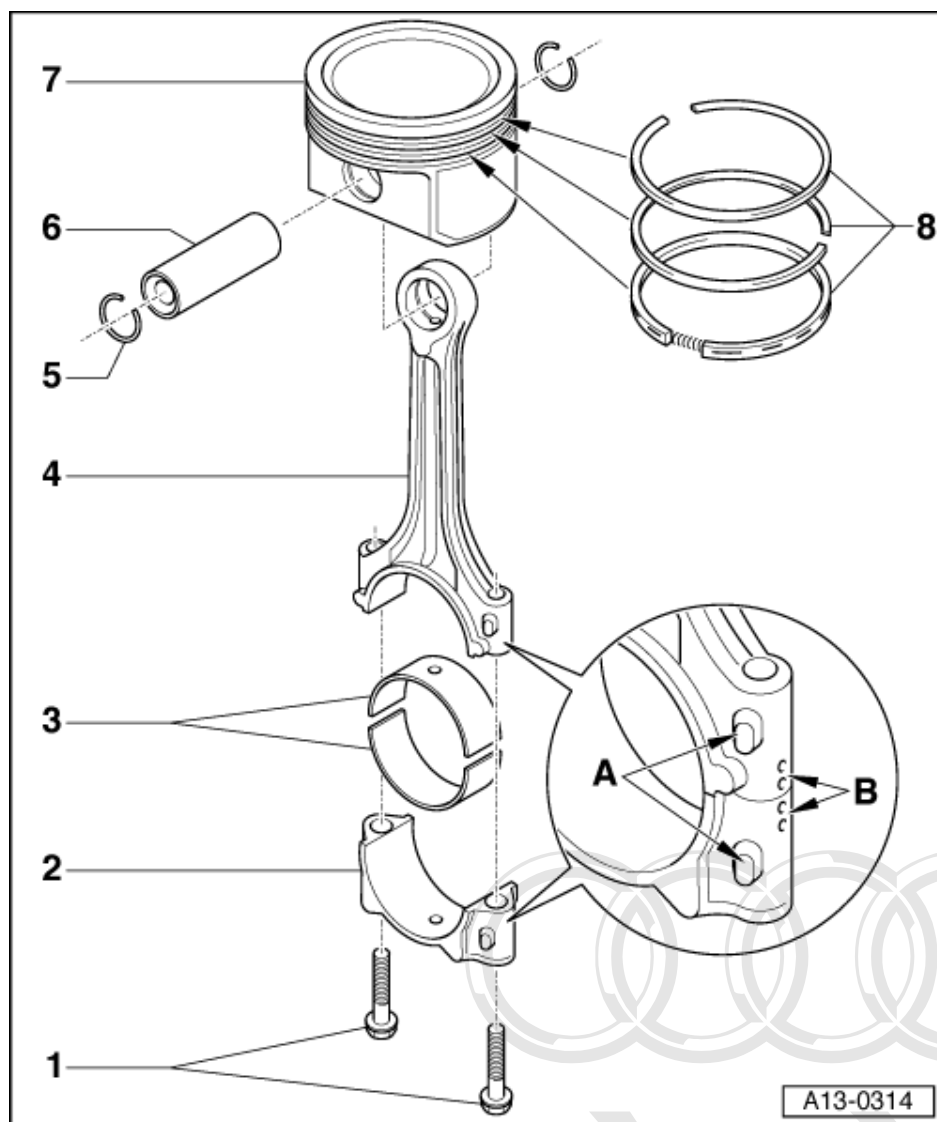
Note:

Oil spray jet and oil pressure relief valve

=> Fig. 99

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

- ◆ Renew
- ◆ Oil threads and contact surface
- ◆ To measure radial clearance use old bolts
- ◆ To measure radial clearance tighten to 30 Nm but not further



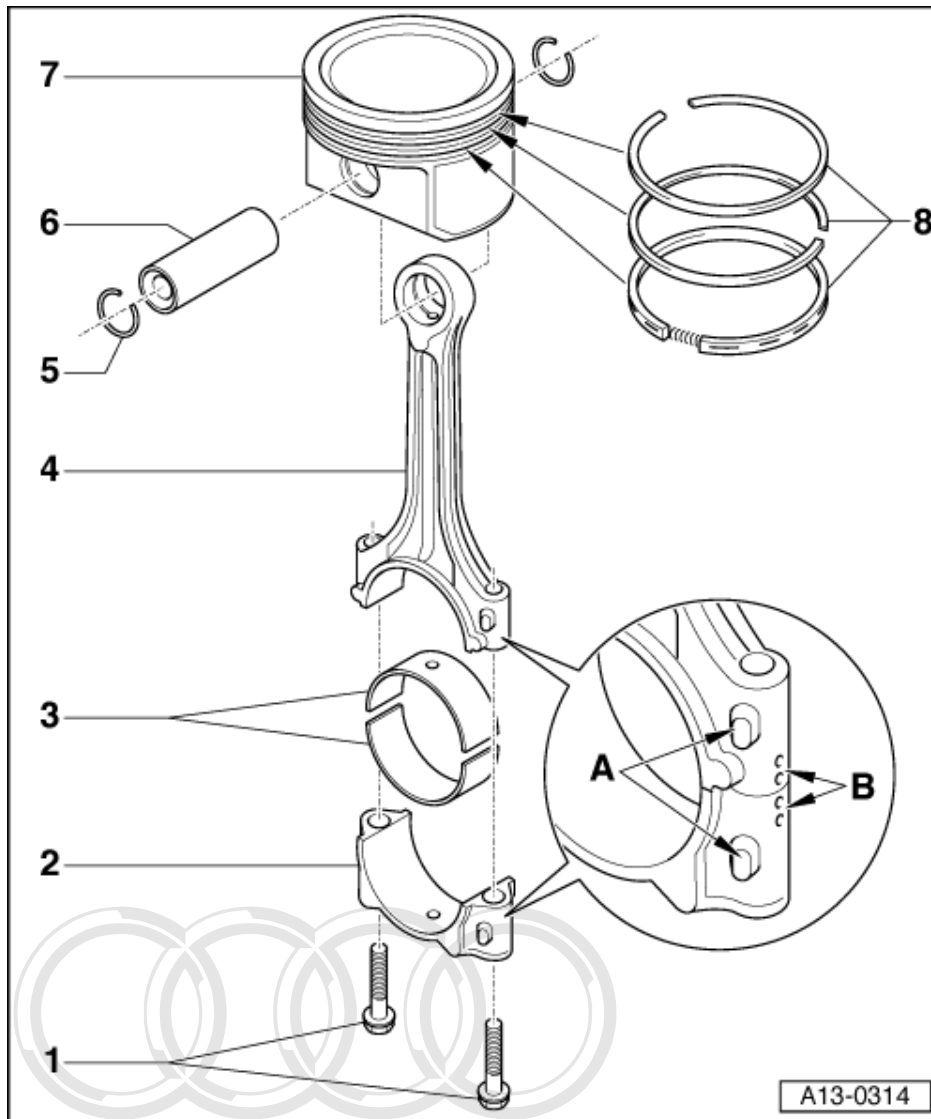
2 Conrod bearing cap

- ♦ Mark cylinder number -B-
- ♦ Installation position:
Marking -A- faces towards pulley end

3 Bearing shells

- ♦ Upper bearing shell with oil drilling for piston pin lubrication
- ♦ Note installation position
=>Fig. 99
- ♦ Do not interchange used bearing shells (mark)
- ♦ Axial clearance
New: 0.10...0.35 mm
Wear limit: 0.40 mm
- ♦ Check radial clearance with Plastigage:
New: 0.01...0.05 mm
Wear limit: 0.12 mm
Do not rotate crankshaft when checking radial clearance

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability for errors or omissions in this document. Copyright by AUDI AG.



4 Conrod

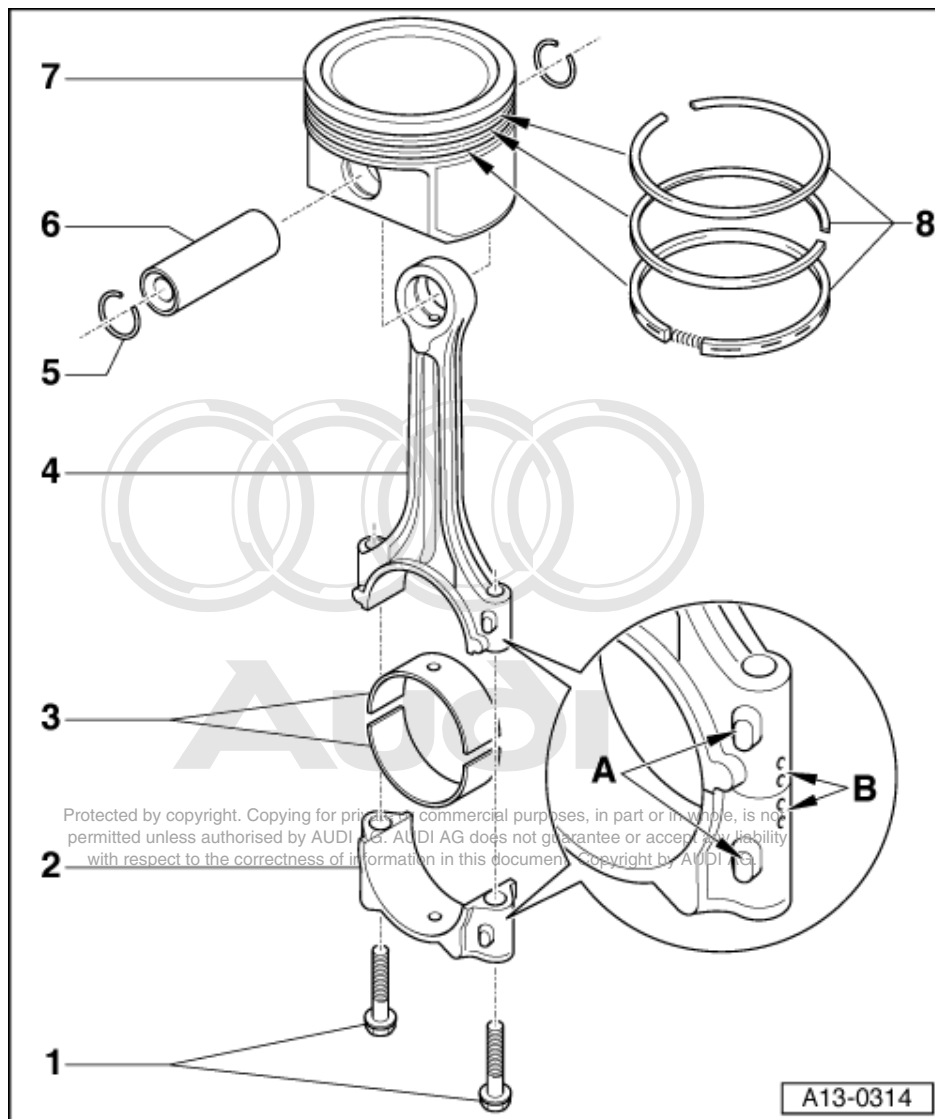
- ◆ Only renew as a set
- ◆ Mark cylinder number -B-
- ◆ Installation position:
Marking -A- faces towards pulley end
- ◆ With oil drilling for piston pin lubrication

5 Circlip

6 Piston pin

- ◆ If difficult to move, heat piston to approx. 60 °C
- ◆ Remove and install with VW 222a

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

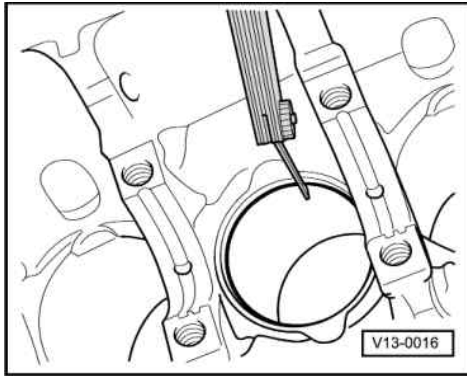


7 Piston

- ♦ Checking => Fig. 98
 - ♦ Mark installation position and cylinder number
 - ♦ Arrow on piston crown points to pulley end
 - ♦ Install using piston ring clamp
 - ♦ Piston and cylinder dimensions
- =>Page 99

8 Piston rings

- ♦ Offset gaps by 120 °
 - ♦ Remove and install with piston ring pliers
 - ♦ "TOP" must face towards piston crown
 - ♦ Checking ring gap
- => Fig. 97
- ♦ Checking ring to groove clearance
- => Fig. 97

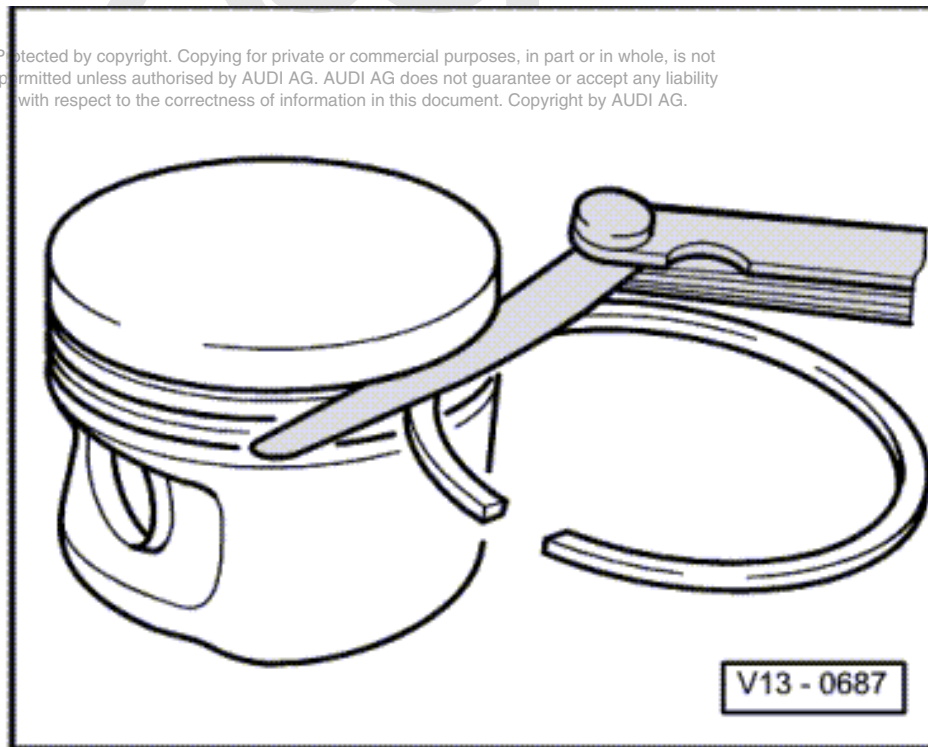


-> Fig. 1 Checking piston ring gap

- Push ring squarely from above down to approx. 15 mm from bottom end of cylinder. To do this use a piston without rings.

Piston ring Dimension in mm	New	Wear limit
1st compression ring	0.20...0.40	0.8
2nd compression ring	0.20...0.40	0.8
Oil scraper ring	0.25...0.50	0.8

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



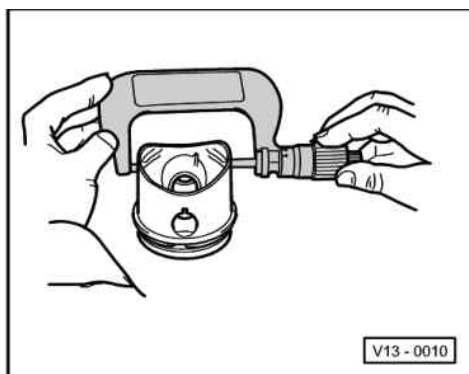
-> Fig. 2 Checking ring to groove clearance

- Clean groove before checking clearance.

Piston ring Dimension in mm	New	Wear limit
1st compression ring	0.06...0.09	0.20
2nd compression ring	0.05...0.08	0.20

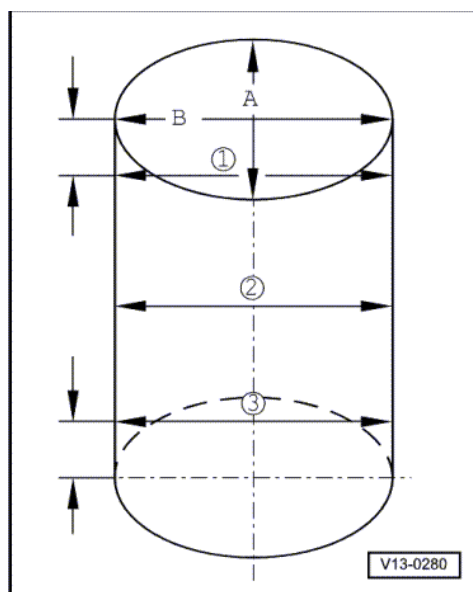


Piston ring Dimension in mm	New	Wear limit
Oil scraper ring	0.03...0.06	0.15



-> Fig. 3 Checking piston

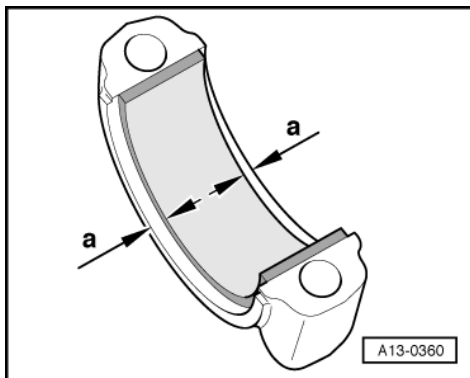
- Measure pistons approx. 10 mm from lower edge of skirt, at 90° to the piston pin axis.
 - Deviation from nominal dimension not more than 0.04 mm



-> Fig. 4 Checking cylinder bores

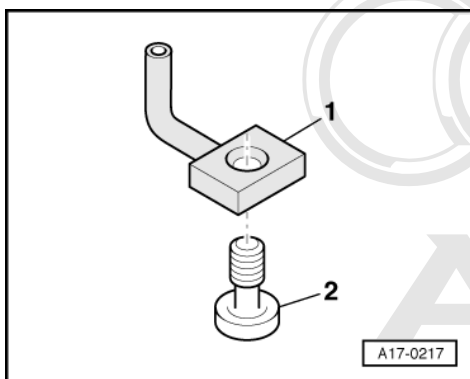
Special tools and workshop equipment required

- ♦ Internal dial gauge 50...100 mm
- Take measurements at 3 positions in both lateral -A- and longitudinal -B- directions.
 - Deviation from nominal dimension not more than 0.08 mm



-> Fig.5 Bearing shell installation position with cracked-steel conrods

- Insert bearing shell centrally in conrod or conrod bearing cap.
- Dimension a = 3.0 mm



-> Fig.6 Oil spray jet and pressure relief valve

- 1 - Oil spray jet (for piston cooling)
- 2 - Bolt with pressure relief valve - 27 Nm
- Engines with sawn conrods:
Opening pressure 2.5 ... 3.2 bar
- Engines with cracked-steel conrods:
Opening pressure 1.3 ... 1.6 bar

4.5 - Piston and cylinder dimensions

Honing dimension		Piston dia.	Cylinder bore dia.
Basic dimension	mm	80.9651)	81.01
Oversize	mm	81.465 1)	81.51

- 1) Dimension without graphite coating (thickness 0.02 mm).
The graphite coating wears away.



15 - Cylinder head, Valve gear

1 - Removing and installing cylinder head

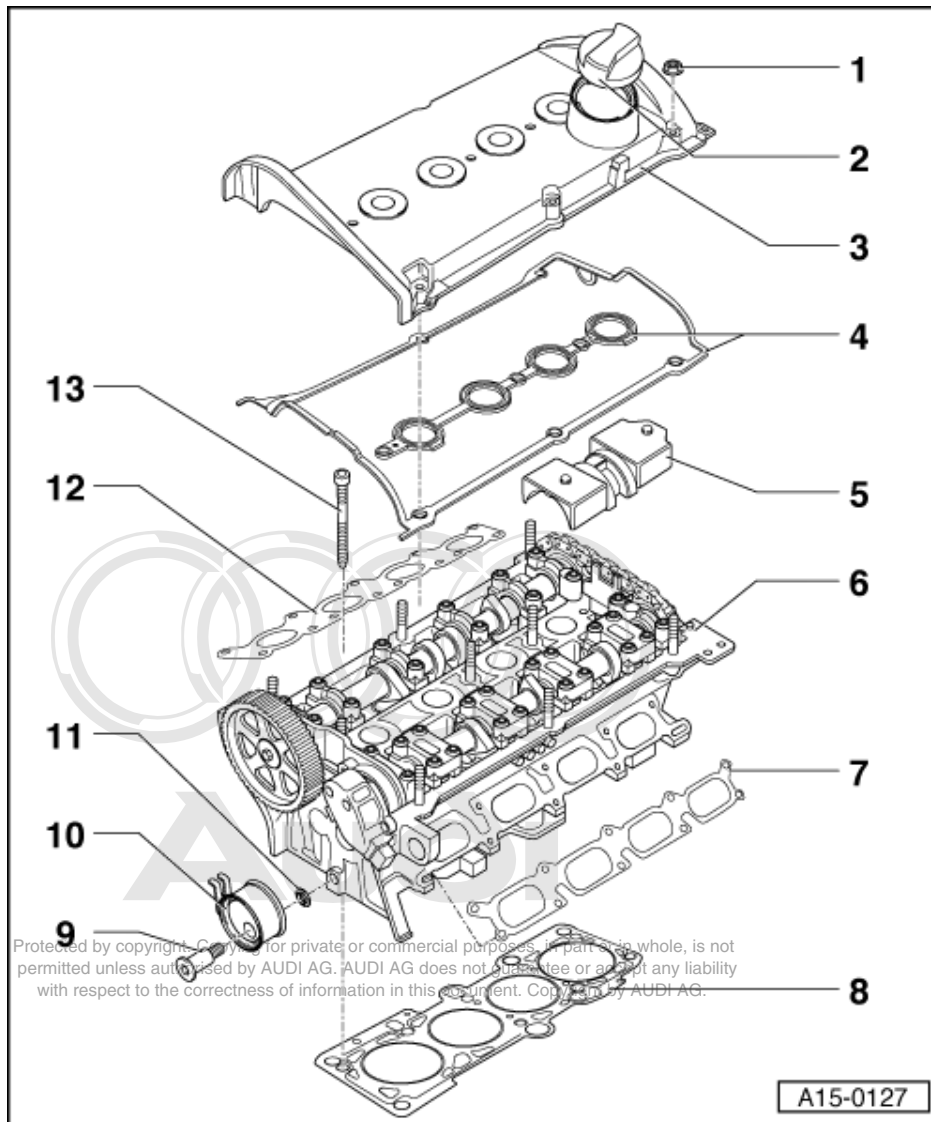
1.1 - Removing and installing cylinder head

Notes:

- ♦ The following procedures are described for vehicles with electronic throttle, secondary air system and exhaust gas recirculation system. The procedures for older vehicles without these features are the same, except that some of the steps will not be required.
- ♦ Renew the cylinder head bolts.
- ♦ When performing repairs, renew seals, gaskets, self-locking nuts and bolts which have a specified tightening angle.
- ♦ When installing an exchange cylinder head with the camshafts fitted, the contact surfaces between bucket tappet and cam running surface must be oiled after installation of the cylinder head.
- ♦ The plastic protectors fitted to protect the open valves must only be removed immediately before fitting the cylinder head.
- ♦ When fitting a new cylinder head or cylinder head gasket, drain off all the old coolant and re-fill with new coolant.
- ♦ Cylinder heads which have cracks between the valve seats or between valve seat inserts and the spark plug thread can be used further without reducing service life, provided the cracks do not exceed a maximum of 0.3 mm in width, or when no more than the first 4 turns of the spark plug threads are cracked.



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



Part I

1 10 Nm

- ◆ Start with inner nuts
- ◆ Tighten outer nuts crosswise diagonally

2 Filler cap

- ◆ Renew seal if damaged

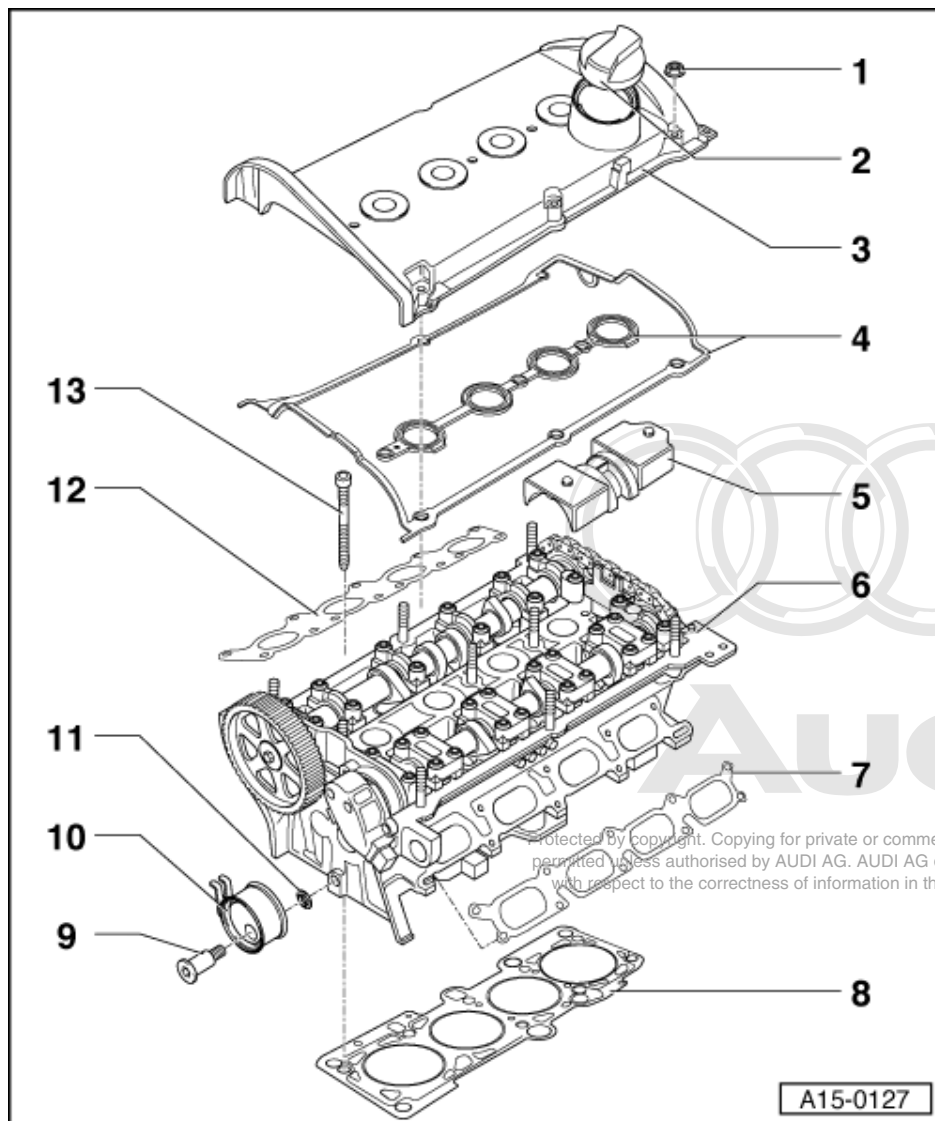
3 Cylinder head cover

- ◆ Removing and installing
=> Page **115**

4 Cylinder head cover gasket

- ◆ Renew if damaged or leaking
- ◆ Before fitting gasket apply sealant compound to corner locations of flange
=> Figs. **107**
- ◆ Liquid sealant

=> Parts List



5 Oil deflector

- ♦ Note installation position

6 Cylinder head

- ♦ Removing => Page 117
- ♦ Check for distortion
=> Fig. 107
- ♦ Reworking limit
=> Fig. 107
- ♦ Installing => Page 120
- ♦ After replacing, fill with fresh coolant

7 Gasket

- ♦ For lower section of intake manifold
- ♦ Different versions possible

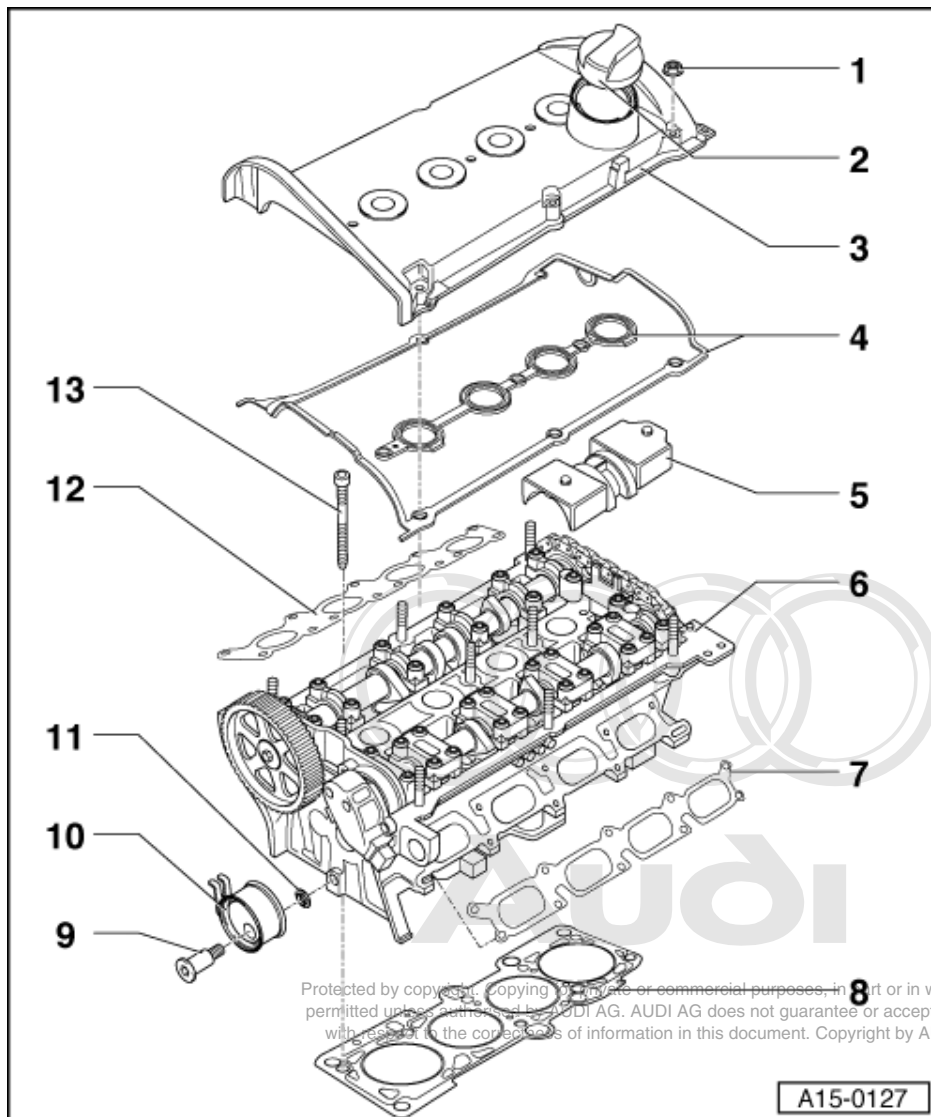
=> Parts List

- ♦ Renew

8 Cylinder head gasket

- ♦ Renew => Removing cylinder head, Page 117
- ♦ Installation position: part No. faces cylinder head and must be legible from inlet side

- ♦ After replacing, fill with fresh coolant



9 45 Nm

10 Tensioner

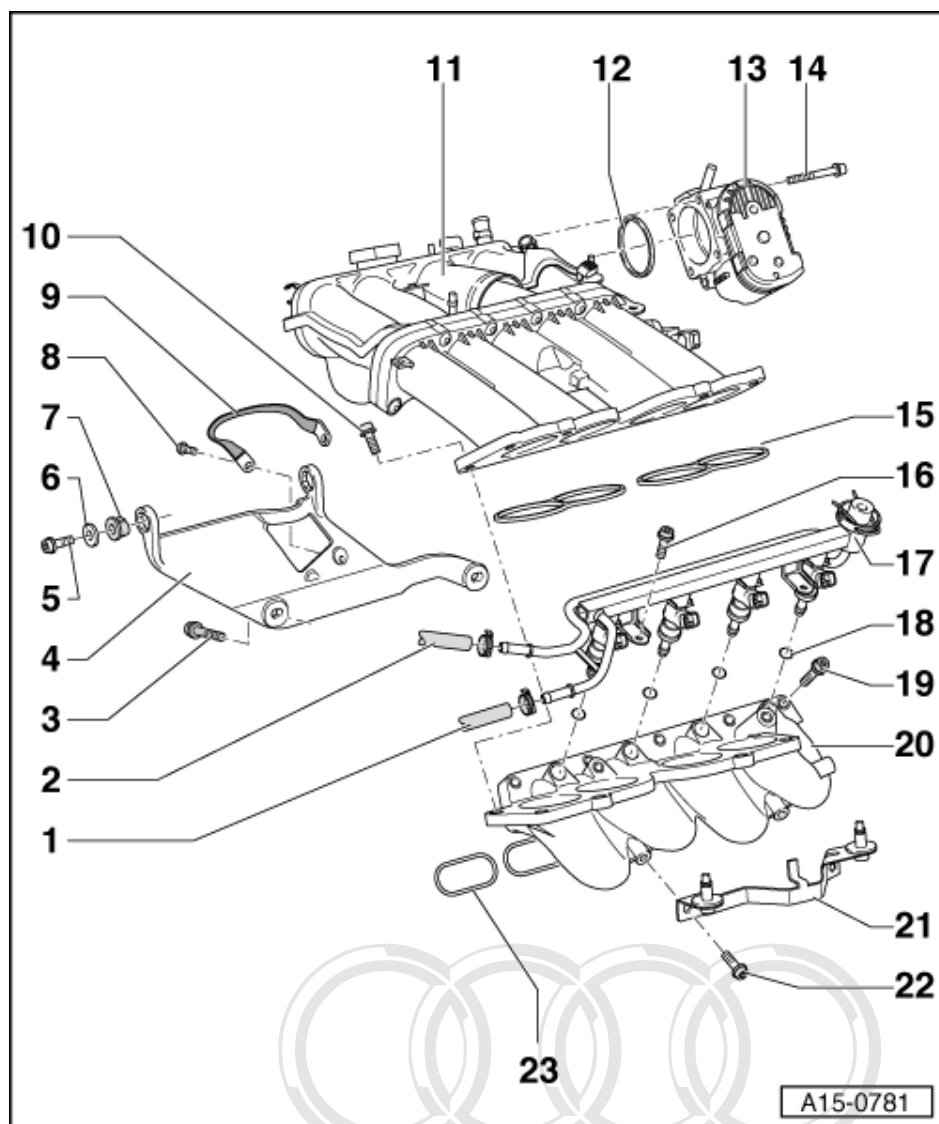
11 Washer

12 Gasket

- ♦ For exhaust manifold
- ♦ Note installation position
- ♦ Renew

13 Cylinder head bolt

- ♦ Renew
- ♦ Note sequence when loosening
=> Page 120
- ♦ Note sequence when tightening
=> Page 122

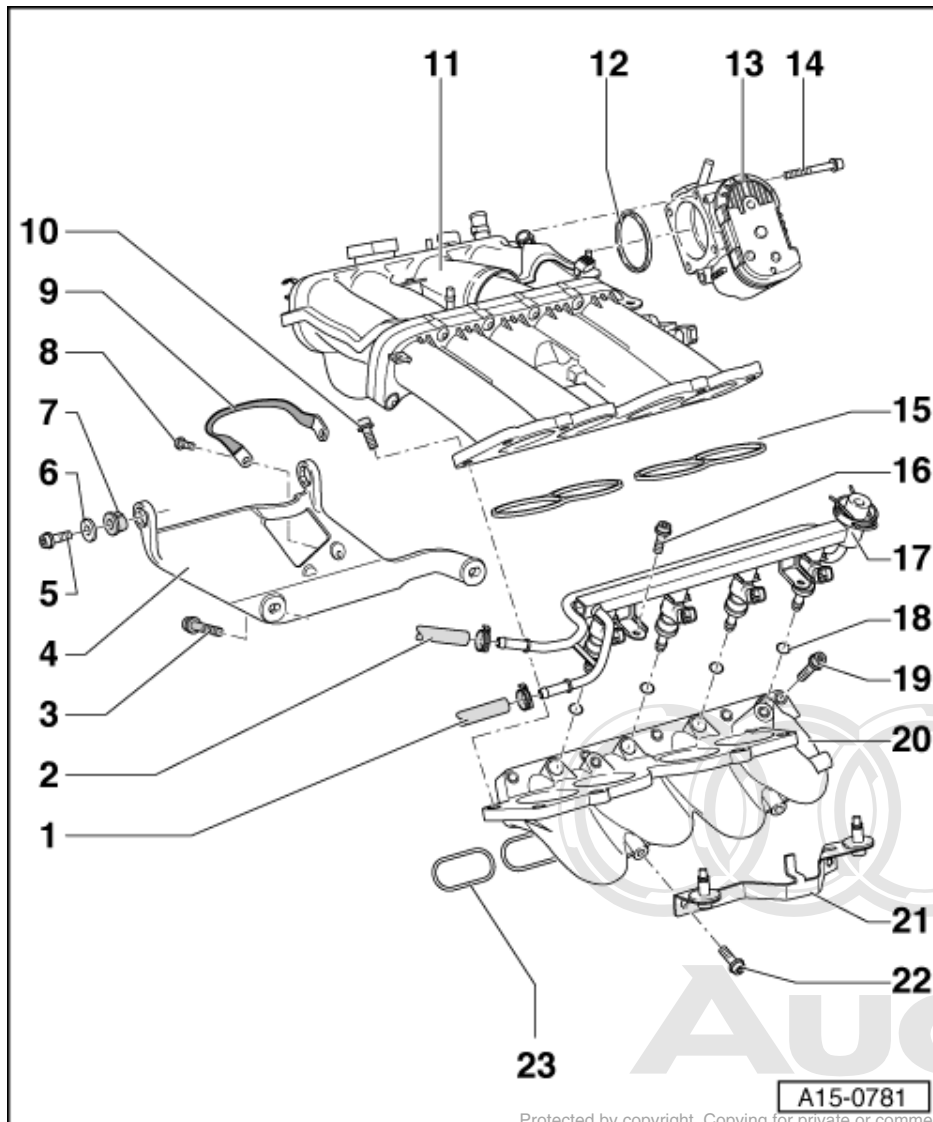


Part II

Note:

The figure shows the intake manifold version fitted as from 08.97.

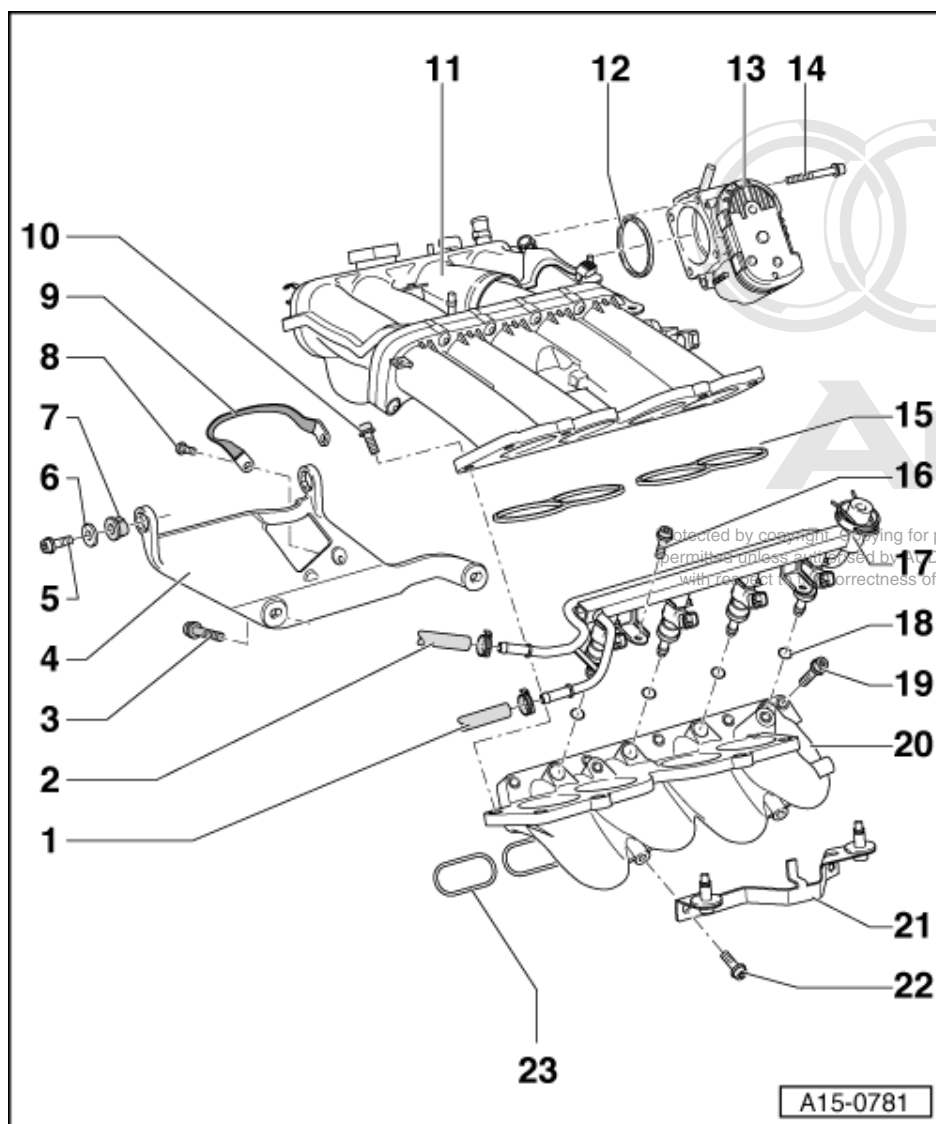
- 1 **Fuel supply pipe**
 - ♦ Mark pipe before disconnecting
- 2 **Fuel return pipe**
 - ♦ Mark pipe before disconnecting
- 3 **22 Nm**
- 4 **Support**
 - ♦ For upper section of intake manifold
- 5 **10 Nm**
- 6 **Washer**
- 7 **Rubber bush**



A15-0781

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

- 8 10 Nm
- 9 Earth wire
- 10 10 Nm
- 11 Intake manifold - upper section
 - ♦ Removing and installing
=> Page 108
- 12 Seal
 - ♦ Renew
- 13 Throttle valve housing
- 14 10 Nm
- 15 Gasket
 - ♦ Renew
- 16 10 Nm
- 17 Fuel rail
 - ♦ With fuel injectors



18 O-ring

- ♦ For injectors
- ♦ Renew
- ♦ Lubricate with clean engine oil

19 10 Nm

20 Intake manifold - lower section

- ♦ Removing and installing
=> Page 112

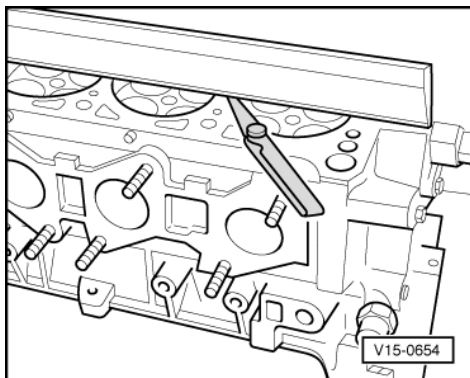
21 Bracket

- ♦ For oil dipstick guide tube

22 10 Nm

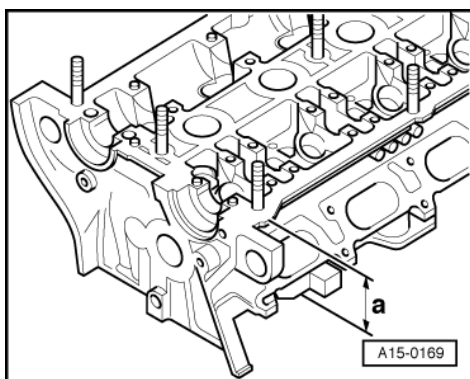
23 Gasket

- ♦ Renew



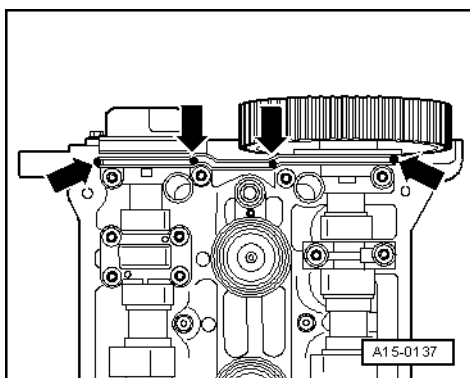
-> Fig. 1 Checking cylinder head for distortion

- Use knife-edge straightedge and feeler gauge to measure at several points.
 - Max. permissible distortion: 0.1 mm



-> Fig.2 Cylinder head reworking limit

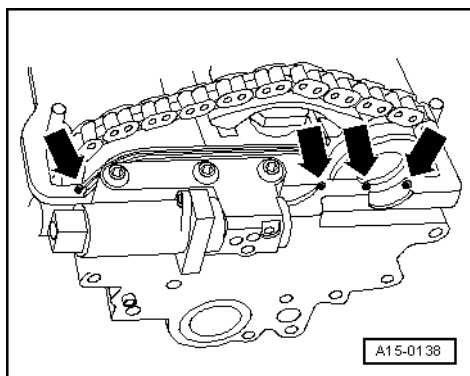
- Reworking the cylinder head (skimming) is only permitted down to minimum dimension a.
 - Minimum dimension a = 139.20 mm



-> Fig. 3 Sealing transition points between double bearing cap and cylinder head

- Apply a small quantity of sealant to flange corner points -arrows- on upper sealing surface of cylinder head.
 - Sealant

=> Parts catalogue



-> Fig. 4 Sealing points for camshaft adjuster / cylinder head

- Apply a small quantity of sealant to flange corner points -arrows- on upper sealing surface of cylinder head.
- Sealant

=> Parts catalogue

1.2 - Removing and installing upper section of intake manifold

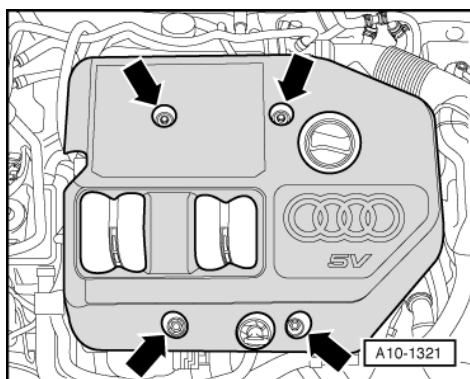
Note:

The following description of removal and installation relates to vehicles with electronic throttle, secondary air system and exhaust gas recirculation. Some procedures do not apply for vehicles with older components.

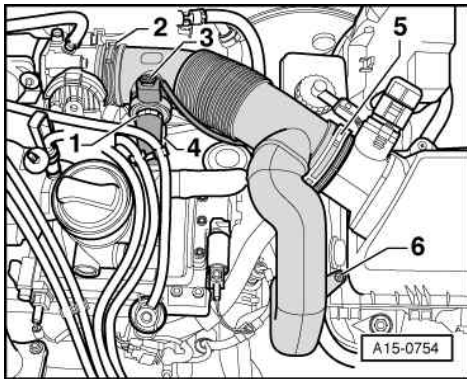
Caution!

On vehicles equipped with telematics the telematics control unit must be switched to service mode before the battery terminals are disconnected.=>Radio, telephone and navigation system; Repair group 91

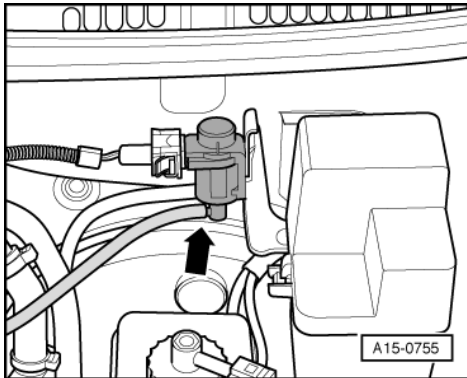
- Obtain code on vehicles with coded radio/integrated radio and navigation system.
- With ignition switched off disconnect battery earth strap.
- Drain cooling system=> Page **181** .



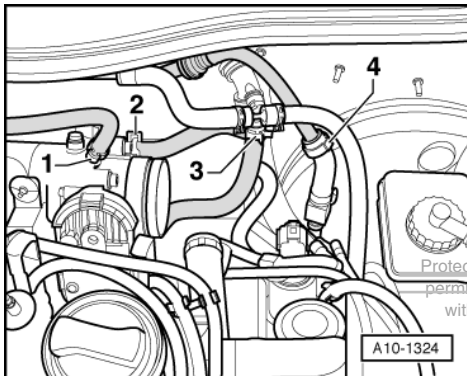
- -> Remove engine cover panel -arrows-.



- -> Unplug electrical connector -3-.
- Disconnect hoses -1- and -4-.
- Remove bolt -6-.
- Remove air duct by releasing spring clamps -2- and -5-.

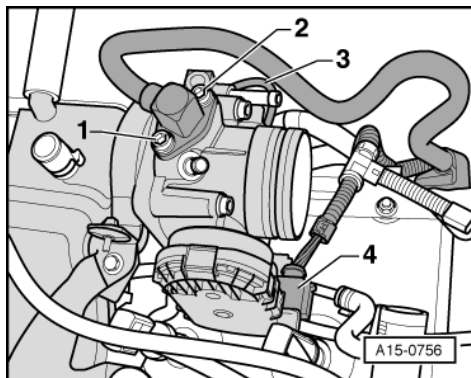


- -> Disconnect hose -arrow- on secondary air inlet valve -N112.

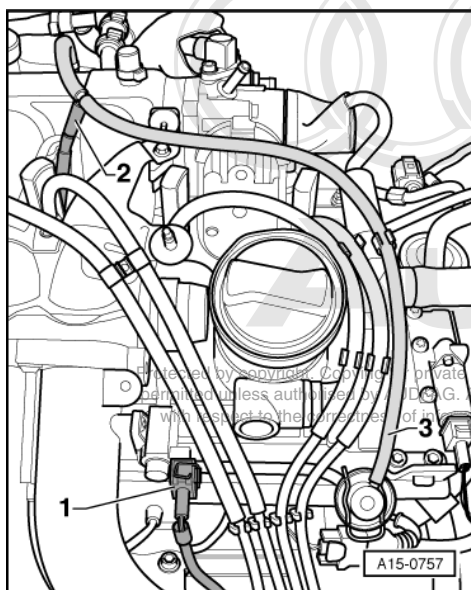


- -> Disconnect hoses -1 ... 4-.

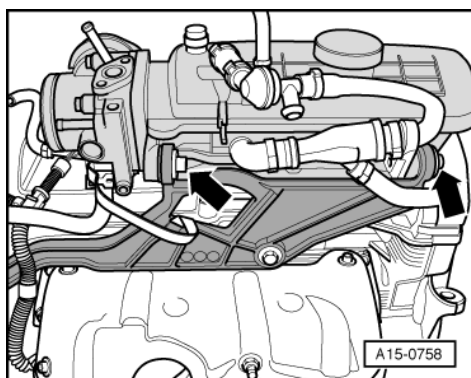
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



- -> Unplug electrical connector -4- from throttle valve control part -J338.
- Remove earth wire -3-.
- Remove bolts -1- and -2- and disconnect exhaust gas recirculation pipe from top of throttle valve housing.



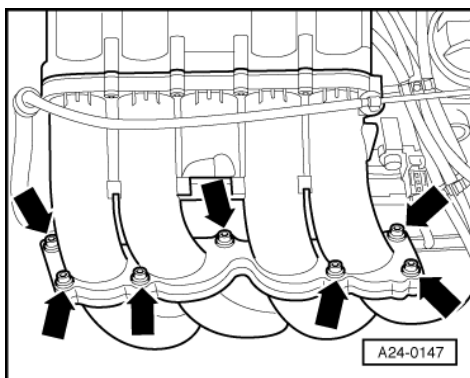
- -> Unplug connector -1- from intake manifold changeover valve - N156.
- Disconnect vacuum hoses -2- and -3-.
- Disconnect spark plug connectors.



- -> Unscrew upper section of intake manifold from rear support bracket -arrows-.

Note:

Shown in illustration with engine removed.



- -> Unscrew bolts -arrows- and remove upper section of intake manifold.

Note:

Plug inlet passages of lower section of intake manifold with clean cloths.

Installing

Install in reverse sequence; note the following points:

Vehicles with throttle cable:

- Adjust throttle cable:

=> Fuel supply system - Petrol engines; Repair group 20; Servicing accelerator mechanism - Vehicles with mechanical throttle cable. Servicing accelerator mechanism - Vehicles with mechanical throttle cable.

All models

Notes:

- ◆ Renew gaskets.
- ◆ When the battery is reconnected, re-activate electrical equipment (radio, combined radio/navigation system, clock, electric windows) as described in the Owner's Manual.
- ◆ De-activate service mode in telematics control unit.

=> Radio, telephone and navigation system; Repair group 91

- ◆ Further procedures after reconnecting the voltage supply:

=> Motronic injection and ignition system; Repair group 24

- Fill up with coolant=> Page 182 .

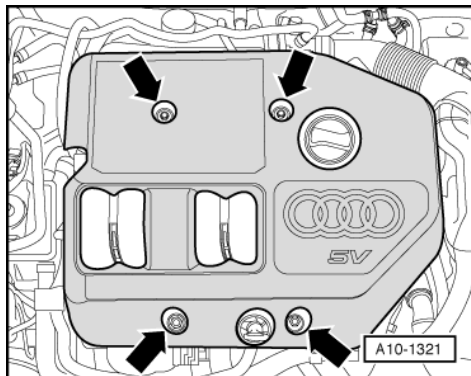
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Tightening torques

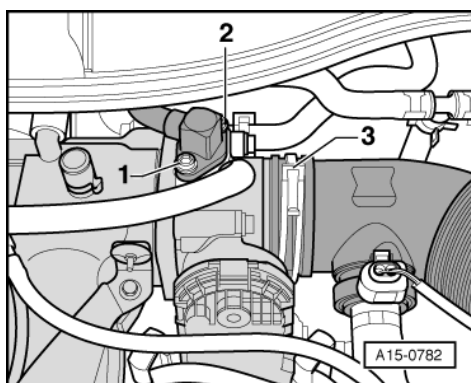
Component	Nm
Upper section of intake manifold to lower section of intake manifold	10
Upper section of intake manifold to support bracket	10
Earth connection to throttle valve control part	10



1.3 - Removing and installing lower section of intake manifold



- -> Remove engine cover panel -arrows-.



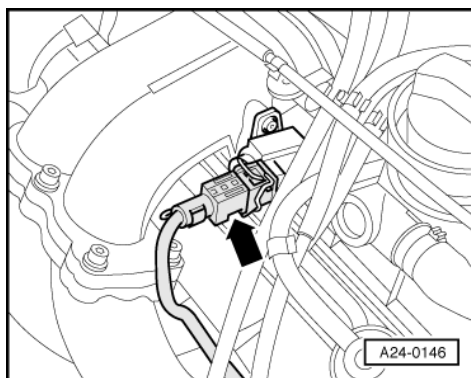
- -> Release spring clamp -3- and push back on air hose.

Vehicles with exhaust gas recirculation:

- Remove bolts -1- and -2- and disconnect exhaust gas recirculation pipe from top of throttle valve housing.

All models

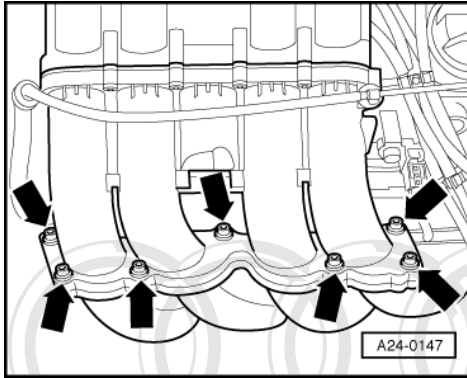
- Disconnect spark plug connectors.



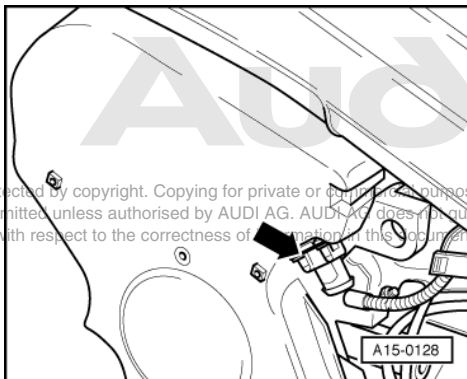
- -> Unplug connector -arrow- on intake manifold changeover valve -N156.



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

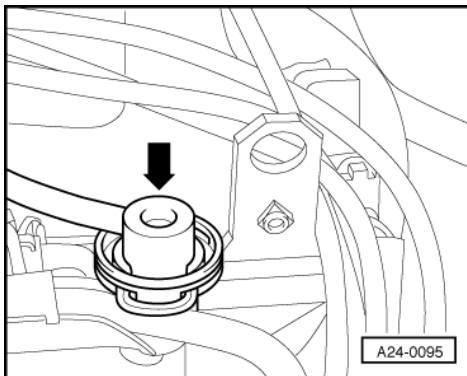


- -> Unscrew bolts -arrows- for upper section of intake manifold.
- Pivot up upper section of intake manifold.

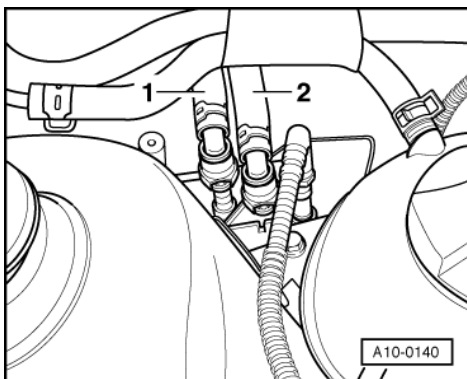


Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- -> Pull connector off Hall sender -G40 -arrow-.
- Unplug connectors from injectors.



- -> Disconnect vacuum hose from fuel pressure regulator -arrow-.

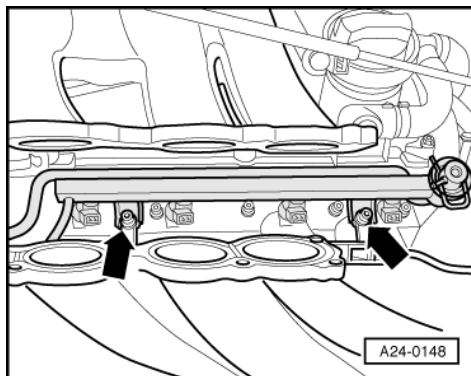




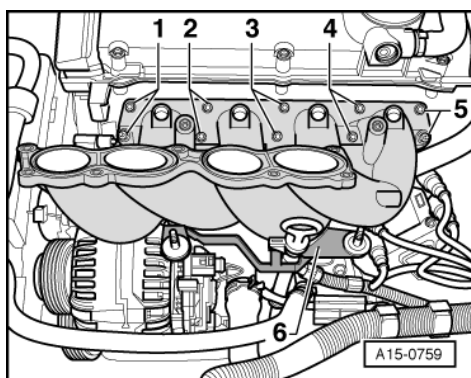
Warning

Fuel system is under pressure. Before opening the system place a cloth around the connection. Then release pressure by carefully loosening the connection.

- -> Press release catches and disconnect fuel supply line -1- and fuel return line -2.



- -> Unscrew bolts -arrows- securing fuel rail to lower section of intake manifold and separate upwards from lower section of intake manifold with injectors in place.



- -> Unscrew bracket -6- for oil dipstick guide tube from lower section of intake manifold.
- Unscrew bolts -1 ... 5- and remove lower section of intake manifold.

Note:

Plug intake ports on cylinder head with clean cloths.

Installing

Install in reverse sequence; note the following points:

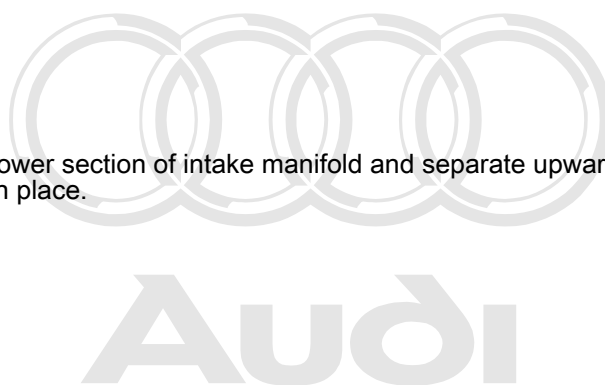
Note:

Replace gaskets and seals.

- Install upper section of intake manifold => Page 111 .

Tightening torques

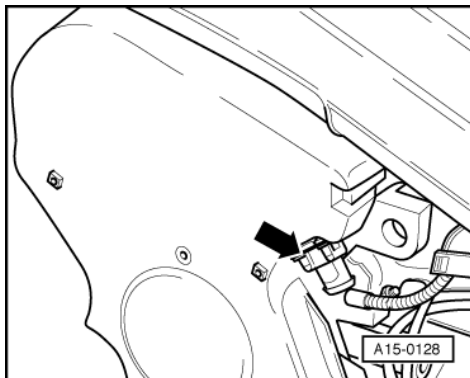
Component	Nm
Intake manifold (lower section) to cylinder head	10
Bracket to intake manifold (lower section)	10



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

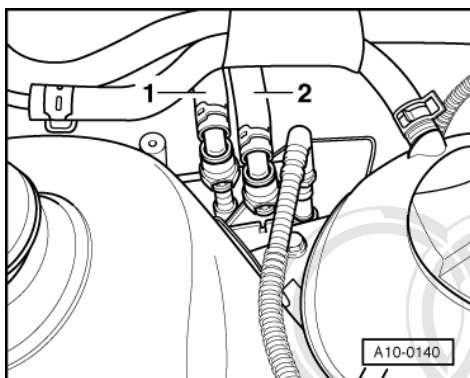
Fuel rail to intake manifold (lower section)	10
---	----

1.4 - Removing and installing cylinder head cover



Removing

- Remove upper section of intake manifold => Page 108 .
- -> Pull connector off Hall sender -G40 -arrow-.

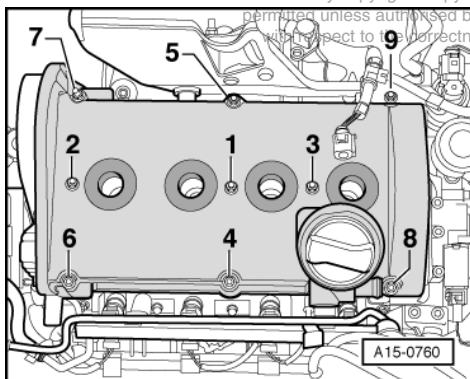


Warning

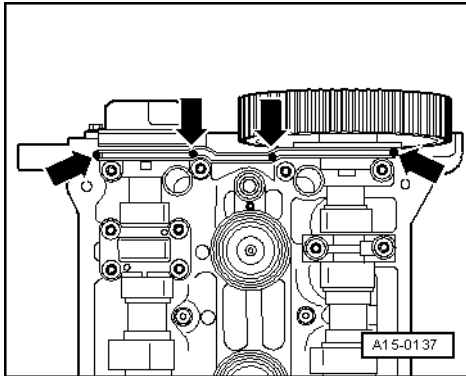
Fuel system is under pressure. Before opening the system place a cloth around the connection. Then release pressure by carefully loosening the connection.

- -> Press release catches and disconnect fuel supply line -1- and fuel return line -2-.
- Remove toothed belt guard (top).

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorized by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



- Disconnect crankcase breather hose from cylinder head cover.
- -> Unscrew nuts on cylinder head cover in order -9 ... 1-.



Installing

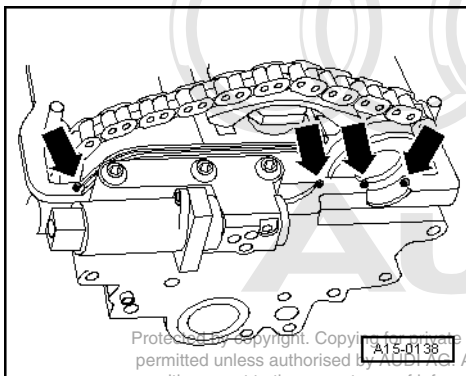
Install in reverse sequence; note the following points:

Note:

Replace cylinder head cover gaskets if damaged.

- -> Apply a small quantity of sealant to flange corner points -arrows- on upper sealing surface of cylinder head.
- Sealant

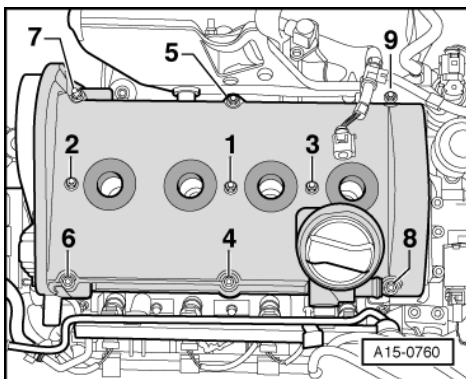
=> Parts catalogue



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

- -> Apply a small quantity of sealant to flange corner points -arrows- on upper sealing surface of cylinder head.
- Sealant

=> Parts catalogue



- -> Tighten bolts for cylinder head cover in order -1 ... 9-.
- Make sure that upper toothed belt guard is seated correctly.
- Install upper section of intake manifold => Page 111 .

Tightening torques

Component	Nm
Cylinder head cover to cylinder head	10
Bracket for electrical wire to cylinder head cover	10

1.5 - Removing cylinder head

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted without the prior written permission of AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- Engine in vehicle

Notes:

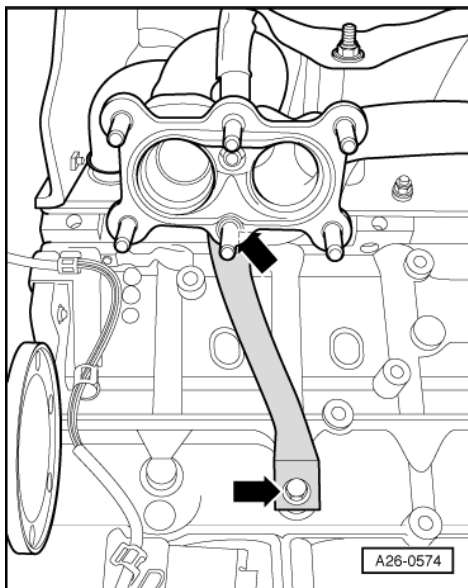
- ♦ All cable ties which are opened or cut open on removal must be replaced in the same position when installing.
- ♦ Change the engine oil if there are particles or other impurities in the oil:

=> Maintenance booklet

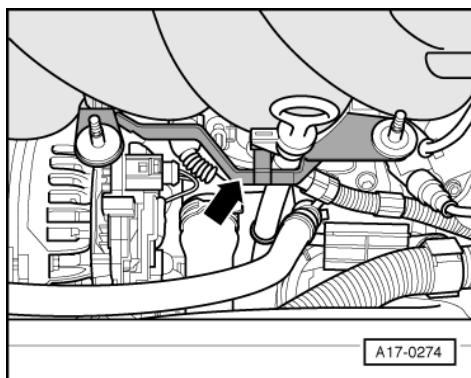
- ♦ Before applying sealant, check updated information:

=> Parts catalogue

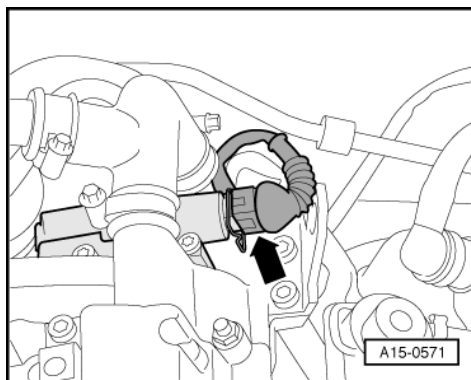
- Drain cooling system=> Page 181 .
- Remove front exhaust pipe with catalytic converter => Page 205 .



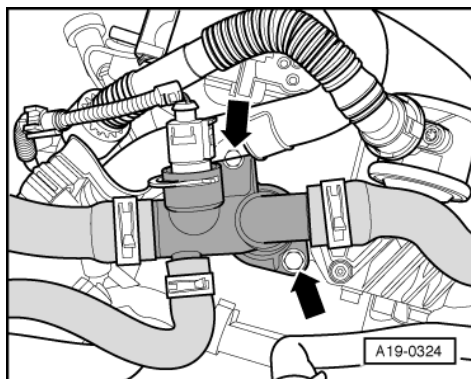
- -> Remove support for exhaust manifold -arrows-.
- Remove upper section of intake manifold => Page 108 .



- -> Detach bracket -arrow- for oil dipstick guide tube from lower section of intake manifold.
- Turn crankshaft to TDC position of No. 1 cylinder with engine installed => Page 62 .
- Turn crankshaft to TDC position of No. 1 cylinder with engine removed => Page 65 .
- Take toothed belt off camshaft sprocket => Page 60 .



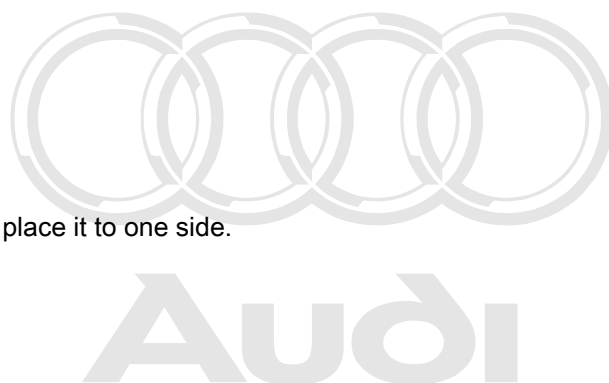
- -> Unplug electrical connector -arrow- from camshaft adjuster.



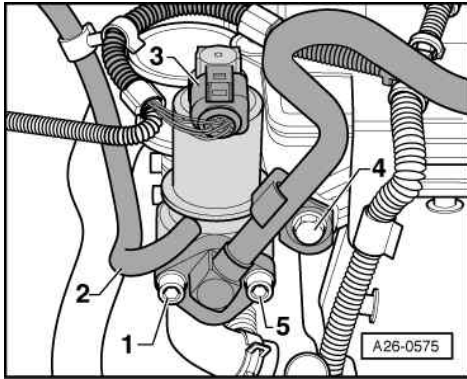
- -> Unbolt coolant pipe flange from cylinder head (left) and place it to one side.

Note:

Leave coolant hoses connected.



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

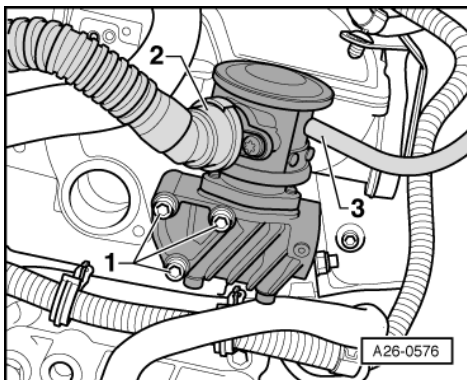


Vehicles with exhaust gas recirculation

- -> Unplug electrical connector -3-.
- Disconnect vent hose -2-.
- Unscrew bolts -1-, -4- and -5- and detach exhaust gas recirculation valve -N18.

Note:

Shown in illustration with engine removed.

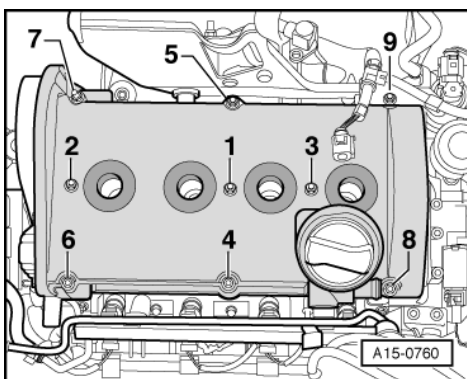


Vehicles with secondary air system

- -> Disconnect hoses -2- and -3-.

Note:

The combination valve -1- for the secondary air system can remain installed.

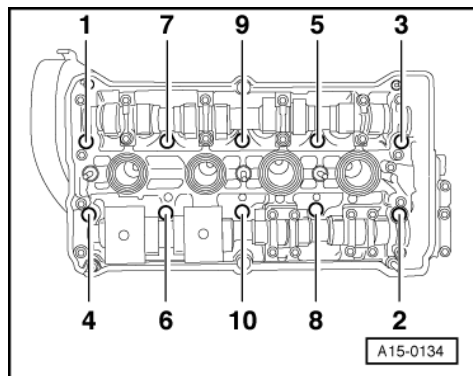


Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



All models

- Disconnect crankcase breather hose from cylinder head cover.
- -> Unscrew nuts on cylinder head cover in order -9 ... 1-.



- -> Loosen cylinder head bolts in the sequence indicated: 1 ... 10.
- Remove cylinder head.

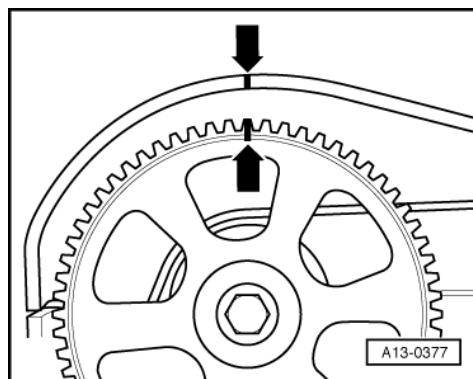
1.6 - Installing cylinder head

Notes:

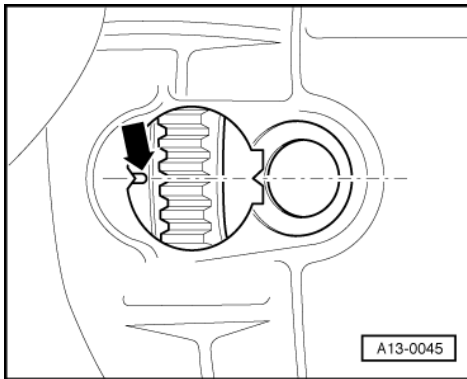
- ♦ Always renew cylinder head bolts when assembling.
- ♦ When performing repairs, renew self-locking nuts and bolts.
- ♦ Renew self-locking nuts and bolts which have a specified tightening angle as well as seals and gaskets.
- ♦ Secure all hose connections with the correct hose clips (same as original equipment)

=> Parts catalogue

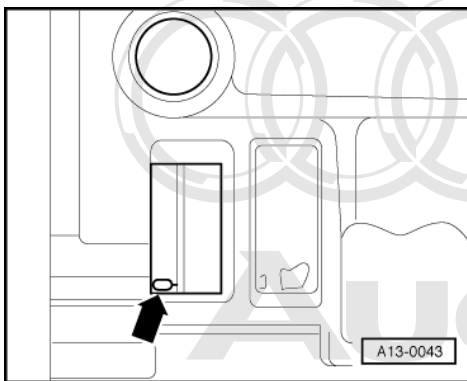
- ♦ If repairing, carefully remove any remains of gasket material from the cylinder head and cylinder block. Make sure that no long scores or scratches are made on the surfaces.
- ♦ Carefully remove any remaining emery and abrasive material.
- ♦ Remove new cylinder head gasket from packaging, just before installation.
- ♦ Handle gasket extremely carefully. Damaging the silicone layer or the indented area will lead to leaks.
- ♦ No oil or coolant must be allowed to remain in the blind holes for the cylinder head bolts in the cylinder block.



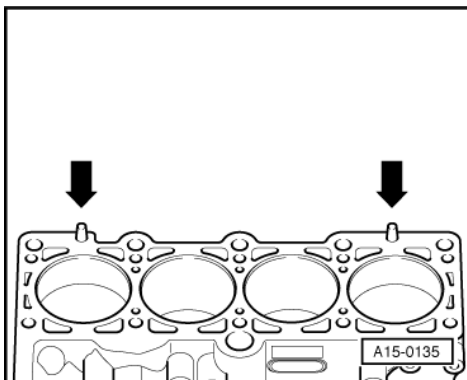
- -> Align marking on camshaft sprocket with marking on cylinder head cover -arrows-.



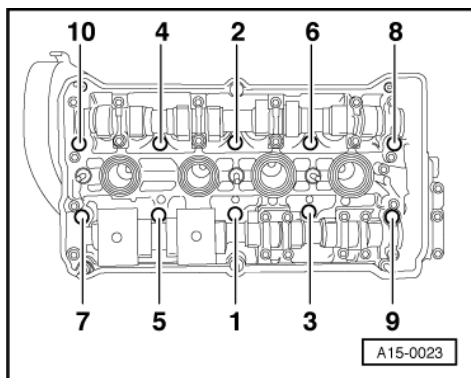
- Check again whether the crankshaft is positioned at TDC for cylinder 1:
 - -> Vehicles with manual gearbox



- **-> Vehicles with automatic gearbox**
- For legal purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



- -> Place cylinder head gasket in position.
 - Note position of centralizing pins in cylinder block -arrows-.
 - Check installation position of cylinder head gasket. The part No. faces towards cylinder head and should be legible from inlet side.
- Place cylinder head on.



- Insert cylinder head bolts and tighten by hand.
- ➔ Tighten cylinder head bolts in two stages in the sequence shown as follows:
- Tighten using torque wrench:
 - 1st stage: 40 Nm
- Tighten with normal fixed wrench:
 - 2nd stage: turn an additional 180° (1/2 turn)
(alternatively 2 x 90° is possible)

Note:

It is not necessary to re-tighten cylinder head bolts later after repairs have been performed.

- Install cylinder head cover => Page 116 .
- Install toothed belt (adjust valve timing) => Page 60
- Install upper section of intake manifold => Page 111 .
- Check oil level => Page 177 .

Note:

Change engine oil if dirty:

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

=> Maintenance booklet

- Install support for exhaust manifold.
- Install front exhaust pipe => Page 207 .
- Aligning exhaust system free of stress => Page 208 .
- Fill up with coolant=> Page 182 .

Notes:

- ♦ When the battery is reconnected, re-activate electrical equipment (radio, combined radio/navigation system, clock, electric windows) as described in the Owner's Manual.
- ♦ De-activate service mode in telematics control unit.

=> Radio, telephone and navigation system; Repair group 91

- ♦ Further procedures after reconnecting the voltage supply:

=> Motronic injection and ignition system; Repair group 24

Tightening torques

Component	Nm
Combination valve for secondary air system to cylinder head	10
Coolant pipe flange to cylinder head	10
Support for cylinder block	25

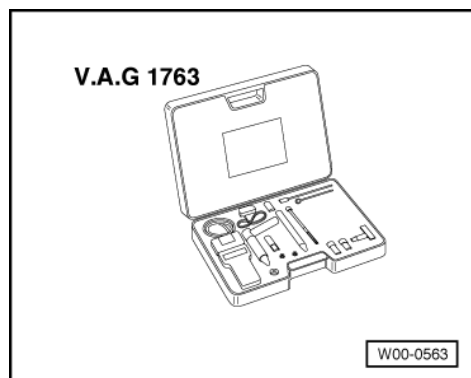
Component	Nm
exhaust manifold to exhaust manifold	25

1.7 - Checking compressions

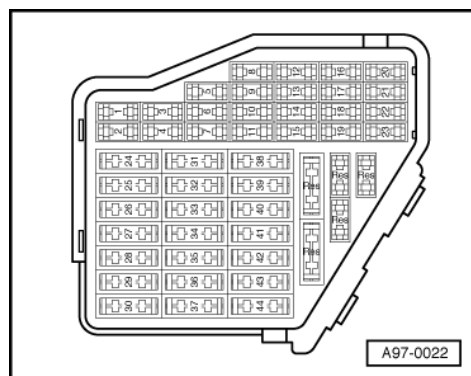


Special tools and workshop equipment required

- ♦ Spark plug spanner 3122 B



- ♦ Compression tester V.A.G 1381 or V.A.G 1763



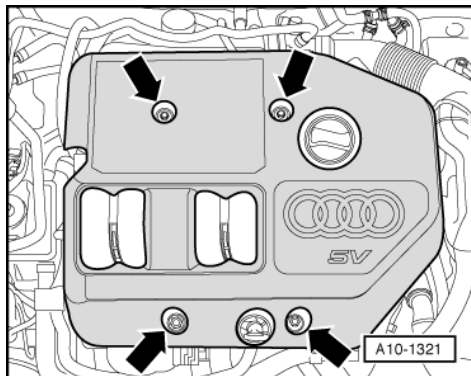
Requirements for test:

- Engine oil temperature not less than 30 °C
- Battery voltage not less than 12.7 V



Test sequence

- Switch off ignition.
- -> Remove fuses for ignition coil and fuel injectors from sockets "10" and "29".



- -> Remove engine cover panel -arrows-.
- Disconnect spark plug connectors.
- Remove spark plugs with spark plug spanner 3122B.
- Fully open throttle valve.
- Check compressions with compression tester V.A.G 1381 or V.A.G 1763.

Note:

Using the compression tester

=> Operating instructions

- Operate starter until tester shows no further pressure increase.

Compression pressure:

New bar	Wear limit bar	Difference between cylinders bar
10.0 ... 13.0	7.0	max. 3.0

- Install spark plugs.
- Interrogate and erase fault memory:

=> Motronic injection and ignition system; Repair group 24

Note:

Faults will be stored in the memory when fuses are removed. Interrogate and if necessary erase fault memory after completing test.

Tightening torque

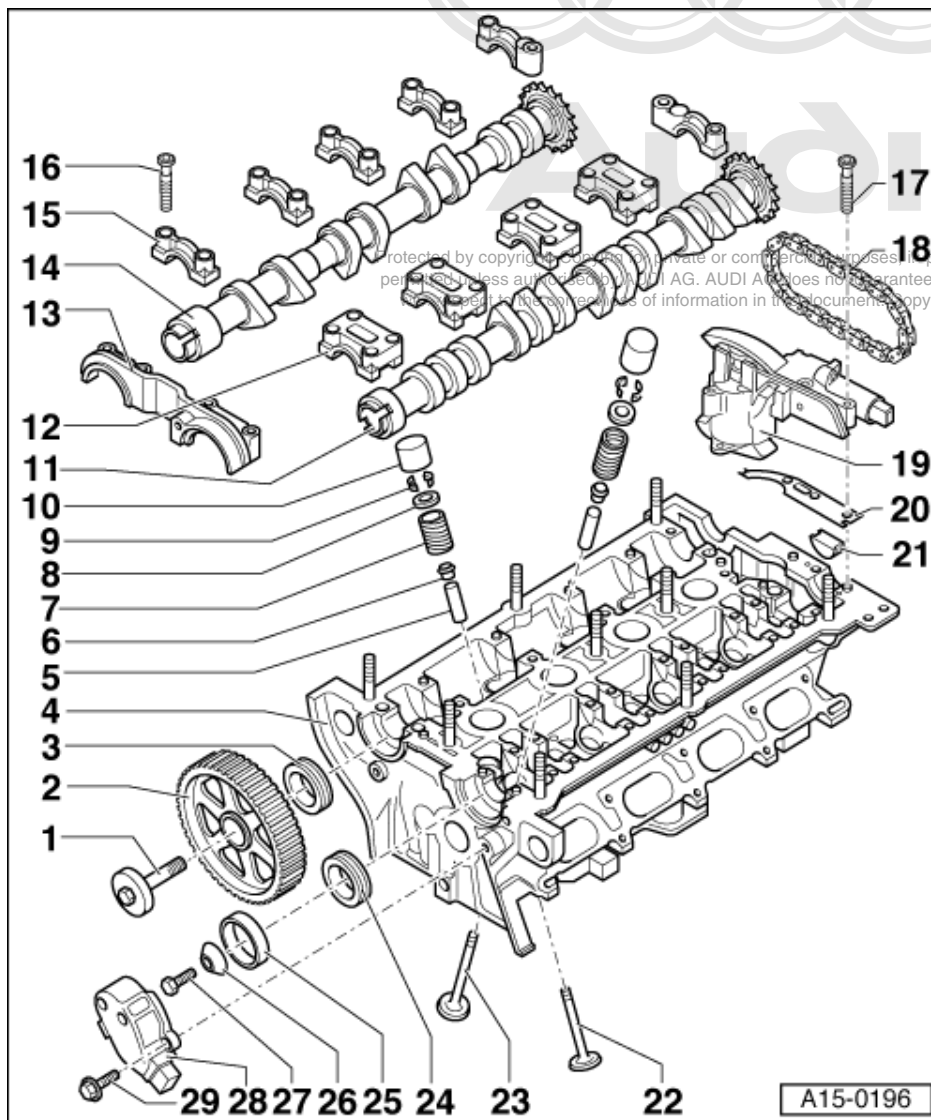
Component	Nm
Spark plugs in cylinder head	30

2 - Servicing valve gear

2.1 - Servicing valve gear

Notes:

- ♦ Cylinder heads which have cracks between the valve seats or between valve seat inserts and the spark plug thread can be used further without reducing service life, provided the cracks do not exceed a maximum of 0.3 mm in width, or when no more than the first 4 turns of the spark plug threads are cracked.
- ♦ After installing the camshaft, wait for about 30 minutes before starting the engine. The hydraulic tappets must be allowed to settle, otherwise the valves will contact the 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 seals and gaskets.



1 65 Nm

- ♦ Use counter-hold 3036 to loosen and tighten =>Fig. 52

2 Camshaft sprocket

- ♦ For exhaust camshaft
- ♦ Note installation position:
narrow rim flange facing forward and TDC marking for cylinder 1 visible from the front =>Page 135

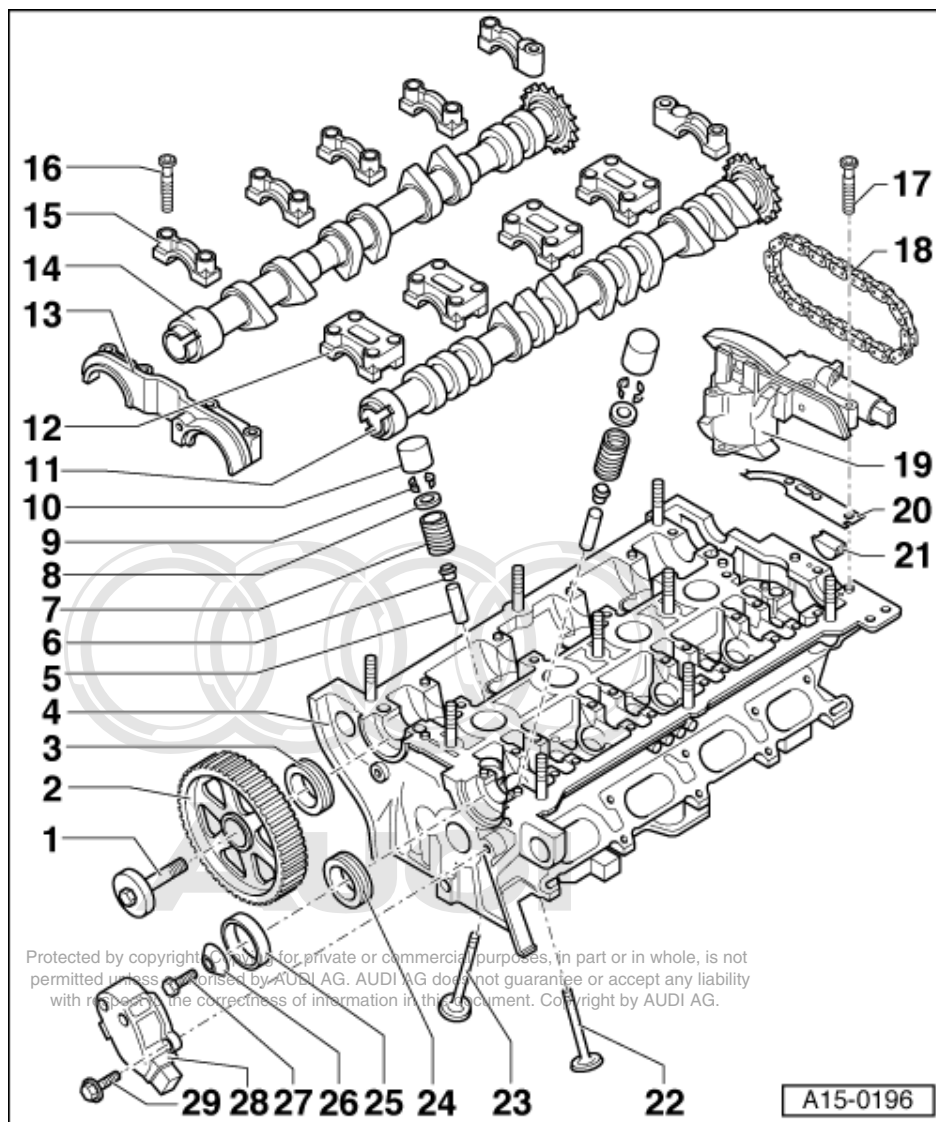
3 Oil seal

- ♦ For exhaust camshaft

- ♦ Renewing=> Page 133

4 Cylinder head

- ♦ See note
=> Page 125
- ♦ Checking valve guides
=> Page 151
- ♦ Reworking valve seats
=> Page 152
- ♦ Dowel sleeves for bearing caps must be located in cylinder head



5 Valve guide

- ♦ Checking => Page 151

6 Valve stem seal

- ♦ Renewing=> Page 147

7 Valve springs

- ♦ Removing and installing
=> Page 147

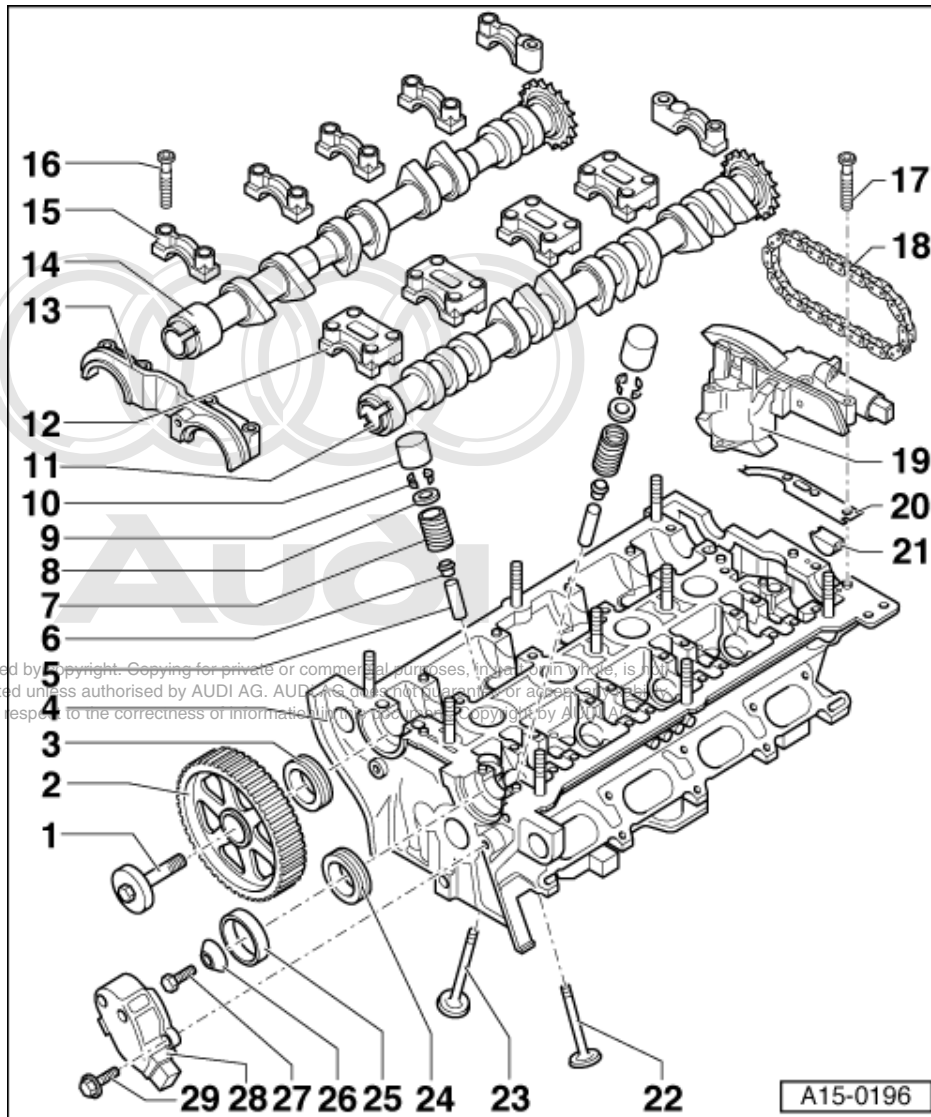
8 Valve spring plate

9 Valve cotter pins

10 Hydraulic bucket tappet

- ♦ Checking => Page 146
- ♦ Removing and installing
=> Page 147
- ♦ Do not interchange

- ♦ Store with cam lobe contact surface downwards
- ♦ Before installing check camshaft axial clearance => Page 131
- ♦ Oil contact surface



11 Inlet camshaft

- ♦ Check radial clearance with Plastigage (bucket tappets not installed)
Wear limit: 0.1 mm
- ♦ Run-out: max. 0.035 mm
- ♦ Checking axial clearance
=> Page 131
- ♦ Removing and installing camshafts
=> Page 139

12 Bearing cap for inlet camshaft

- ♦ Must be located on dowel sleeves
- ♦ Dowel sleeves must be located in cylinder head
- ♦ Note installation position
- ♦ Installation sequence
=> Page 142

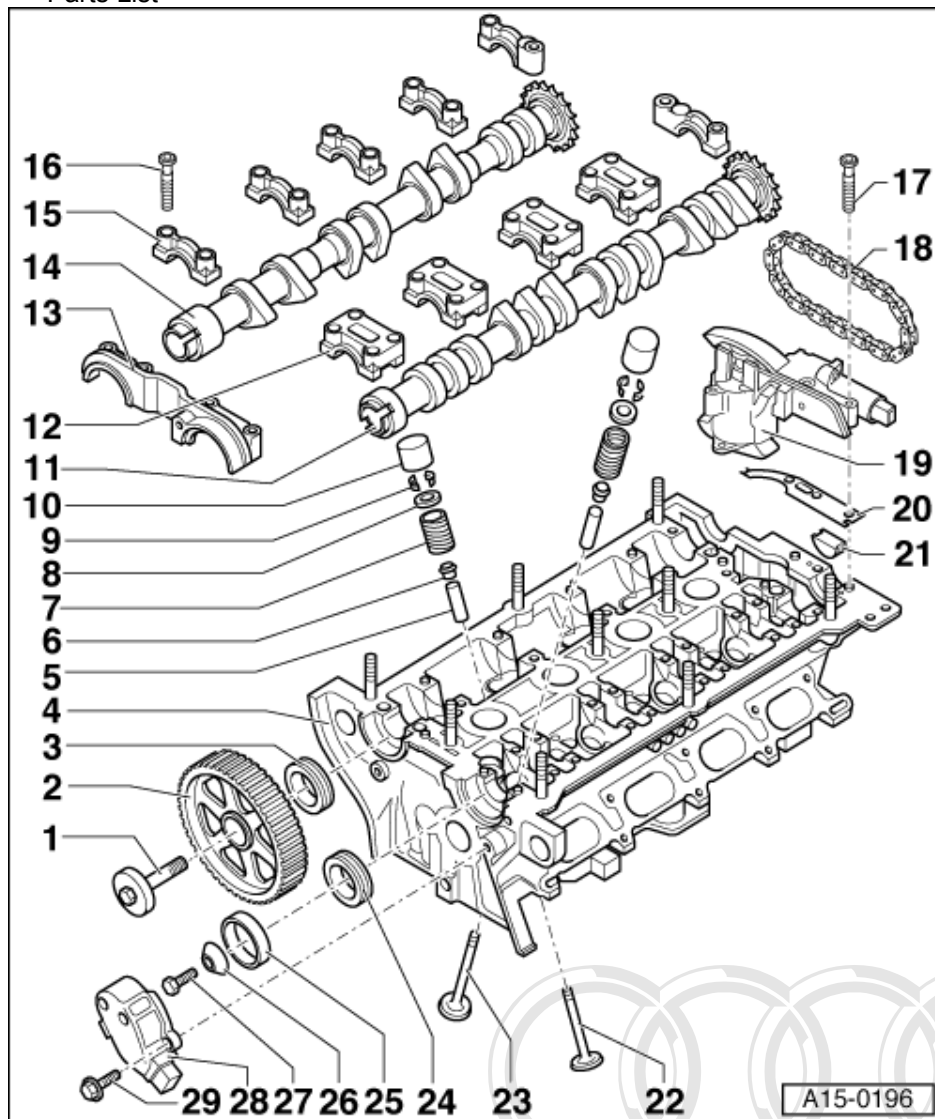
13 Double bearing cap

- ♦ Must be located on dowel sleeves
- ♦ Dowel sleeves must be located in cylinder head
- ♦ Apply a small amount of sealant to sealing surface before installation
=> Page 144



- ♦ Liquid sealant

=> Parts List



14 Exhaust camshaft

- ♦ Check radial clearance with Plastigage (bucket tappets not installed)
Wear limit: 0.1 mm
- ♦ Run-out: max. 0.035 mm
- ♦ Checking axial clearance
=> Page 131
- ♦ Removing and installing camshafts
=> Page 139

15 Bearing cap for exhaust camshaft

- ♦ Must be located on dowel sleeves
- ♦ Dowel sleeves must be located in cylinder head
- ♦ Note installation position
- ♦ Installation sequence
=> Page 142

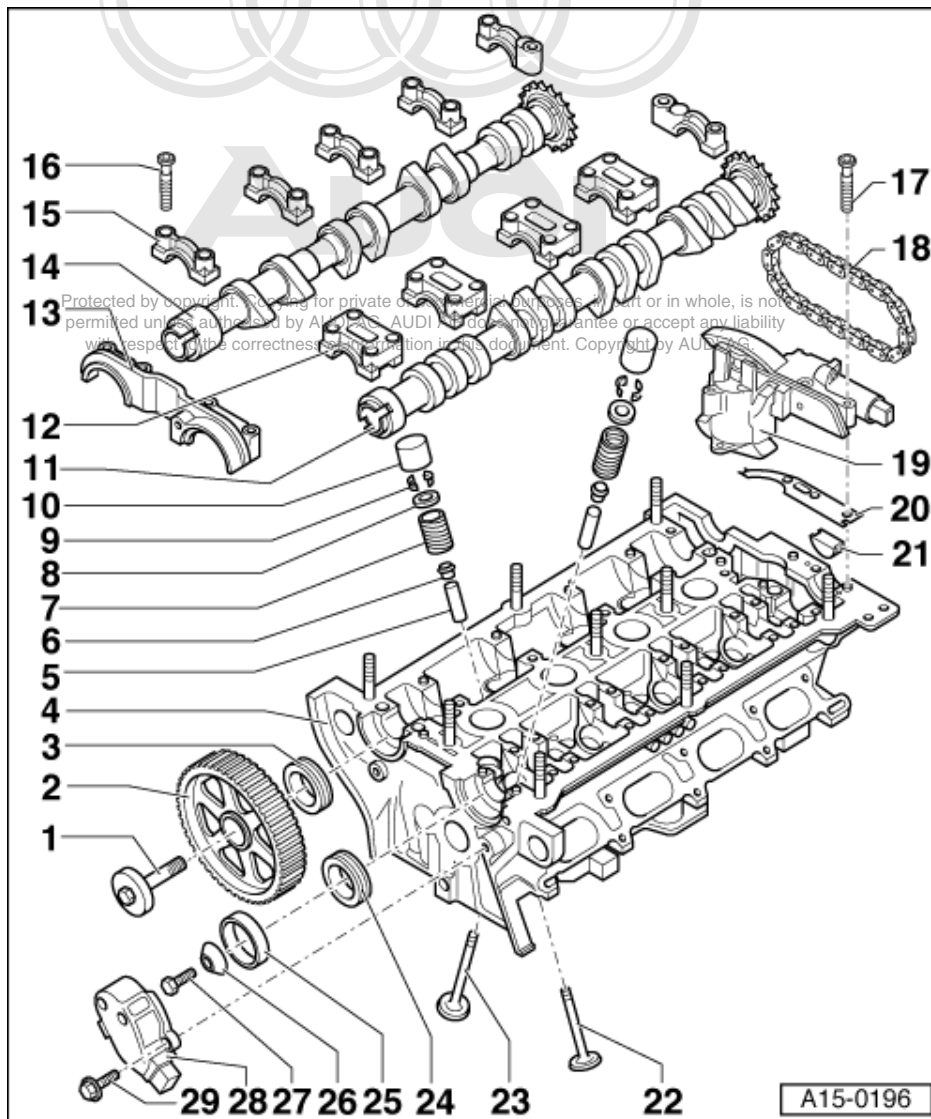
16 10 Nm

17 10 Nm

18 Drive chain

- ♦ Check for wear
- ♦ Mark position of chain before removing=> Page 141
- ♦ Removing and installing:
=> "Removing and installing"

camshaft," Page 139



19 Camshaft adjuster

- ♦ With solenoid valve for camshaft adjustment -N205
- ♦ Checking =>Page 154
- ♦ Hold in position with retainer for chain tensioner 3366 before removing
- ♦ Removing and installing
=> Page 139

20 Metal/rubber gasket

- ♦ Coat with sealant before installing
=> Page 142
- ♦ Liquid sealant

=> Parts List

21 Gasket

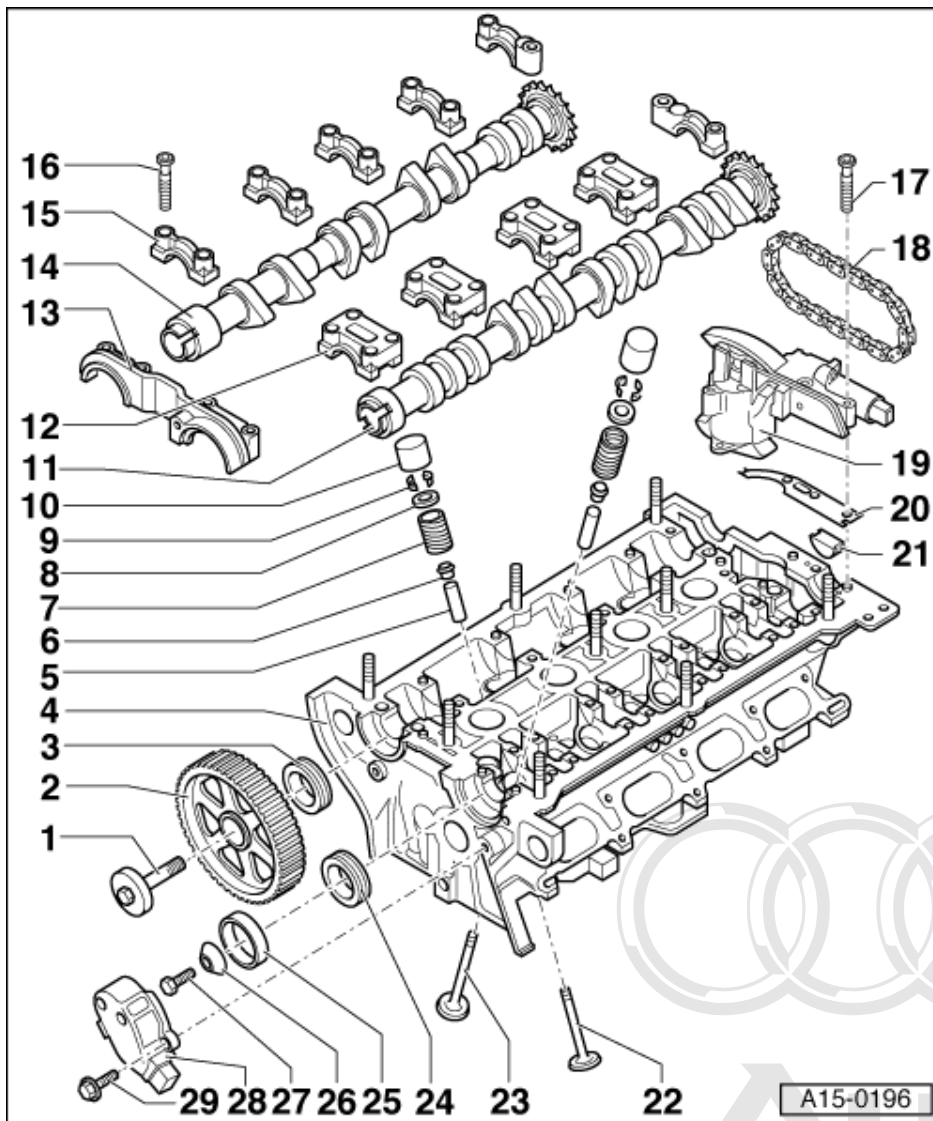
- ♦ Renew

22 Exhaust valve

- ♦ With sodium filling
- ♦ Note instructions on scrapping valves with a sodium filling => Page 131
- ♦ Do not rework, only grinding-in is permitted
- ♦ Valve dimensions
=> Fig. 131
- ♦ Checking valve guides
=> Page 151



- ♦ Reworking valve seats
=> Page 152

**23 Inlet valve**

- ♦ Do not rework, only grinding-in is permitted
- ♦ Valve dimensions
=> Fig. 131
- ♦ Checking valve guides
=> Page 151
- ♦ Reworking valve seats
=> Page 152

24 Oil seal

- ♦ For inlet camshaft
- ♦ Renewing=> Page 136

25 Hall sender rotor

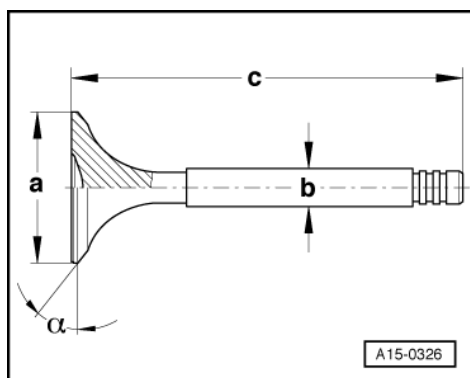
- ♦ Note installation position:
locate lug in notch on camshaft

26 Washer

- ♦ Conical
- ♦ Note installation position

27 25 Nm**28 Housing for Hall sender -G40****29 10 Nm**

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



-> Fig. 1 Valve dimensions

Note:

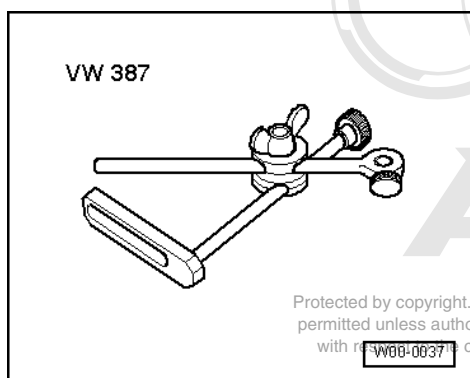
Inlet and exhaust valves must not be reworked. Only grinding-in is permitted.

Dimension	Inlet valve	Exhaust valve
dia. a mm	26.80 ... 27.00	29.80 ... 30.00
dia. b mm	5.95 ... 5.97	5.94 ... 5.95
c mm	104.84 ... 105.34	103.64 ... 104.14
α °	45	45

Caution

- ◆ Worn exhaust valves with sodium filling must not be disposed of until they have been treated as follows:
- ◆ The valves must be sawn into two sections with a metal saw at a point between the centre of the shaft and the valve head. They must not come into contact with water when this is done. Then throw the valves into a bucket of water (not more than ten at time). Then step back because a chemical reaction occurs when the sodium filling burns.
- ◆ After this treatment the valves can be disposed of in the normal way.

2.2 - Checking camshaft axial clearance



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with regard to the correctness of information in this document. Copyright by AUDI AG.

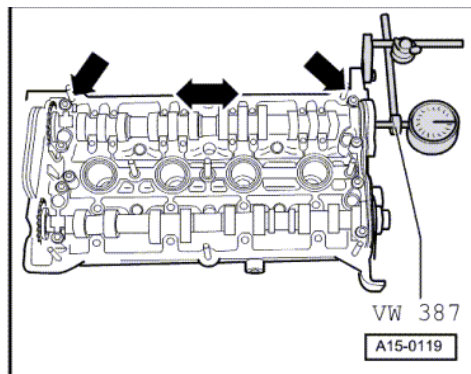
Special tools and workshop equipment required

- ◆ Universal dial gauge bracket VW 387



- ♦ Dial gauge

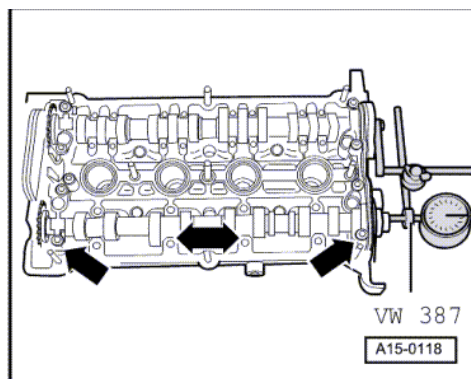
Test sequence



Perform measurement with bucket tappets removed and with bearing cap at chain sprocket end and double bearing cap at camshaft sprocket end installed.

- Attach dial gauge with universal dial gauge holder VW 387 to cylinder head:

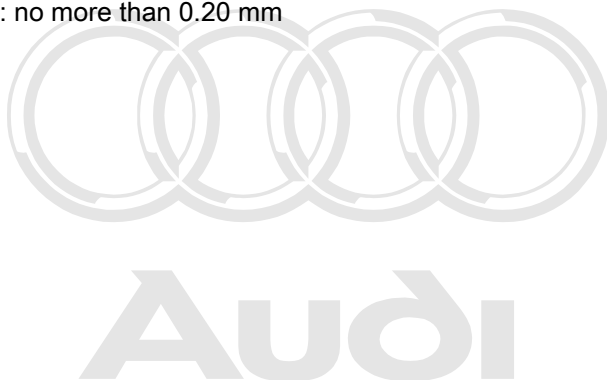
-> Inlet camshaft



-> Exhaust camshaft

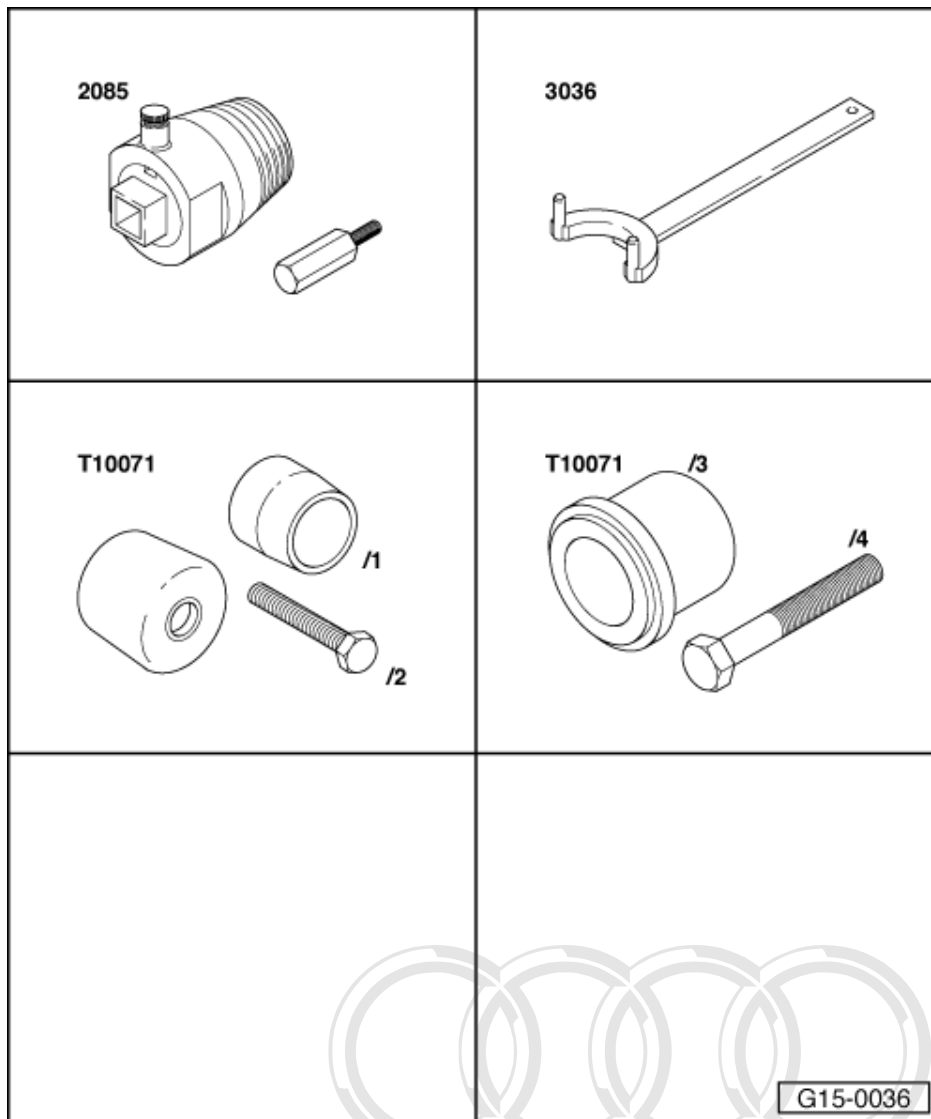
Wear limit for inlet and exhaust camshaft.

- ♦ Axial play: no more than 0.20 mm



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

2.3 - Renewing oil seal of exhaust camshaft

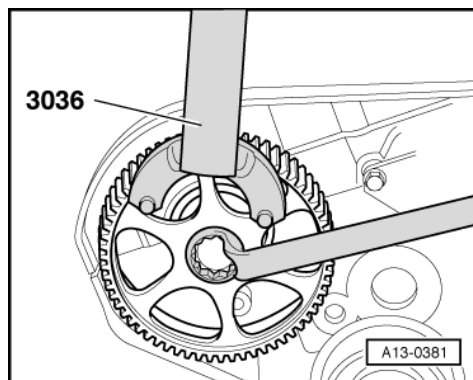


Special tools and workshop equipment required

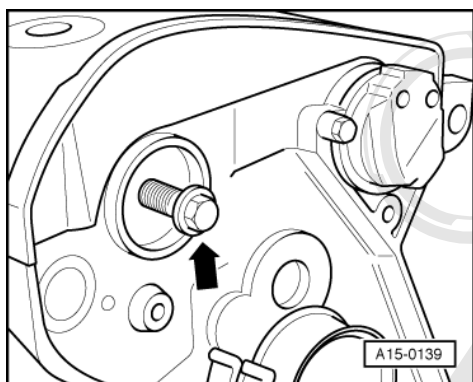
- ◆ Oil seal extractor 2085
- ◆ Retainer 3036
- ◆ Assembly tool T10071

Removing

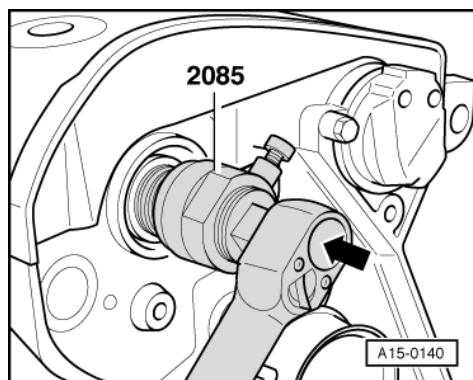
- Cylinder head installed
- Turn crankshaft to TDC position of No. 1 cylinder with engine installed => Page 62 .
- Turn crankshaft to TDC position of No. 1 cylinder with engine removed => Page 65 .
- Take toothed belt off camshaft sprocket => Page 60 .



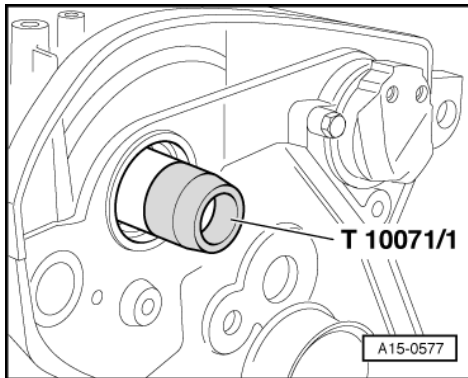
- -> Loosen camshaft sprocket (counter-hold with 3036).
- Pull off camshaft sprocket.



- -> To guide oil seal extractor, screw securing bolt for camshaft sprocket -arrow- into camshaft as far as it will go by hand.
- Unscrew inner part of oil seal extractor 2085 two turns (approx. 3 mm) out of the outer part and lock in position with knurled screw.

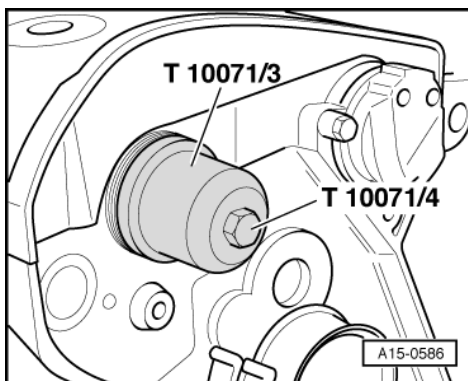


- -> Lubricate threaded head of oil seal extractor 2085, place it in position and, exerting firm pressure, screw it into oil seal as far as possible.
- Loosen knurled screw and turn inner part against camshaft until oil seal has been extracted.
- Clamp flats of oil seal extractor in vice. Remove oil seal with pliers.

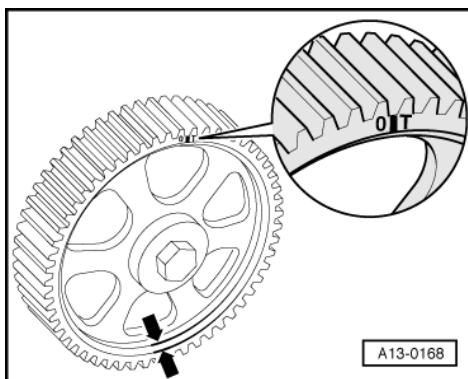


Installing

- Do NOT apply oil to sealing lip of oil seal.
- -> Fit guide sleeve T10071/1 onto camshaft journal.
- Slide oil seal over guide sleeve and onto camshaft journal.
- Remove guide sleeve.



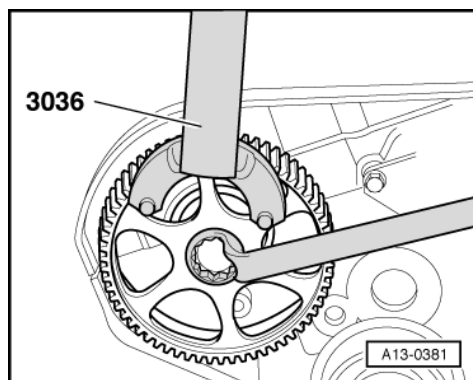
- -> Use press-sleeve T10071/3 and bolt T10071/4 to drive oil seal all the way down to stop.



- -> Install camshaft sprocket.
- Check installation position:
The narrow rim flange on the camshaft sprocket faces outwards -arrows- and the marking for No. 1 cylinder TDC is visible.



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability for errors or omissions. Copyright © 2001 AUDI AG.



- -> Screw in securing bolt for camshaft sprocket.
Use counter-hold tool 3036.

Note:

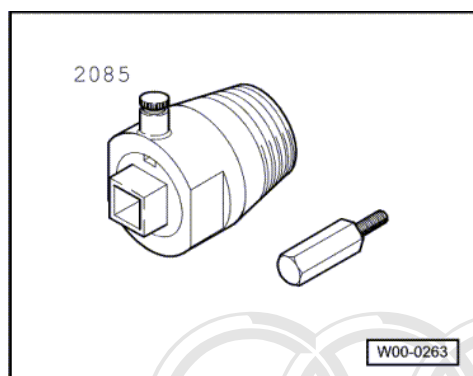
If a piston is at TDC the valves could strike the piston when turning the camshaft. To avoid damage to valves and pistons the pistons must not be at TDC.

- Install toothed belt (adjust valve timing) => Page 60

Tightening torque

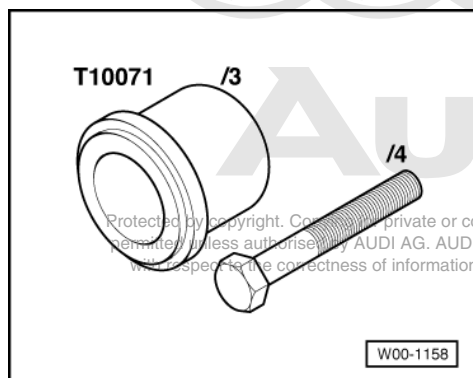
Component	Nm
Camshaft sprocket to camshaft	65

2.4 - Renewing oil seal of inlet camshaft

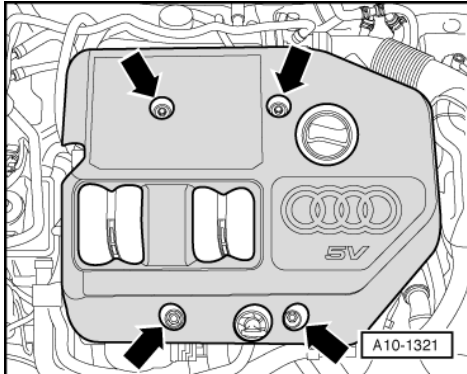


Special tools and workshop equipment required

- ♦ Oil seal extractor 2085

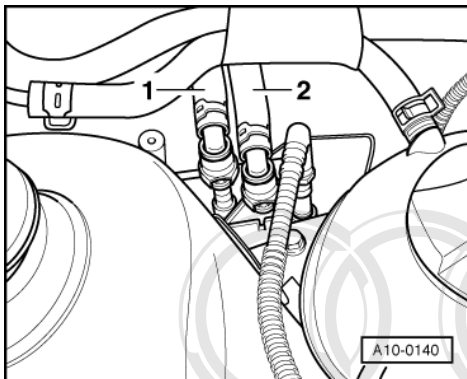


- ◆ Press sleeve T10071/3
- ◆ Guide sleeve T10071/5
- ◆ Bolt M8 x 60



Removing

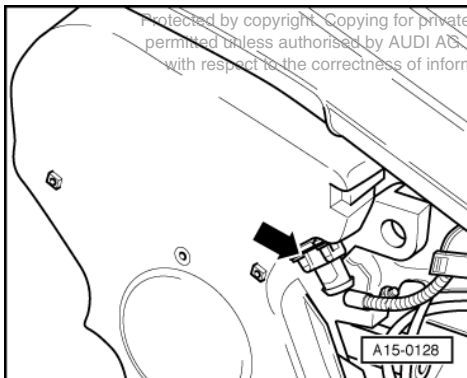
- Cylinder head installed
- -> Remove engine cover panel -arrows-.



Warning

Fuel system is under pressure. Before opening the system place a cloth around the connection. Then release pressure by carefully loosening the connection.

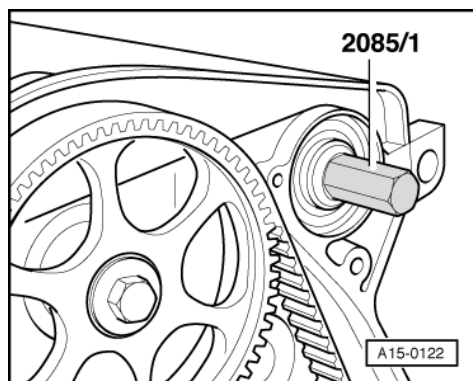
- -> Press release catches and disconnect fuel supply line -1- and fuel return line -2.



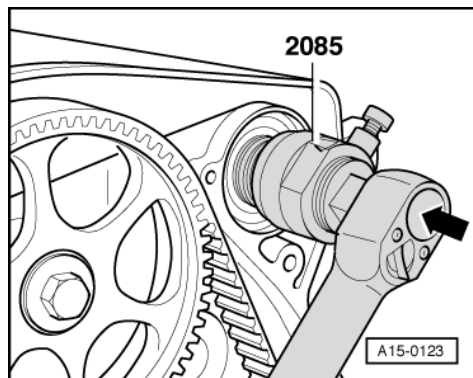
- -> Pull connector off Hall sender -G40 -arrow-.
- Remove toothed belt guard (top).
- Remove Hall sender housing.



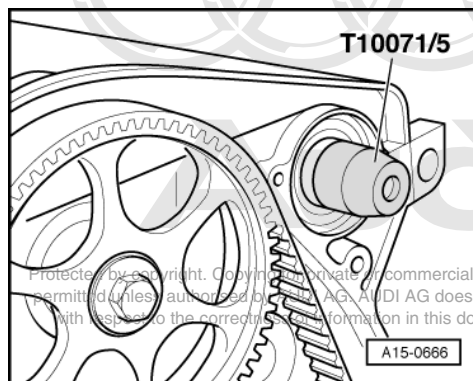
- Remove Hall sender rotor and washer.



- -> To guide oil seal extractor, screw bolt 2085/1 by hand into camshaft as far as it will go.
- Unscrew inner part of oil seal extractor 2085 two turns (approx. 3 mm) out of the outer part and lock in position with knurled screw.

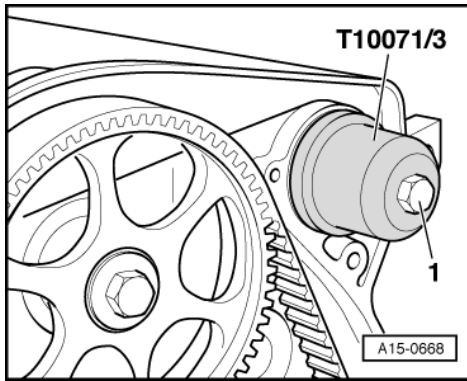


- -> Lubricate threaded head of oil seal extractor 2085, place it in position and, exerting firm pressure, screw it into oil seal as far as possible.
- Loosen knurled screw and turn inner part against camshaft until oil seal has been extracted.



Installing

- Do NOT apply oil to sealing lip of oil seal.
- -> Fit guide sleeve T10071/5 onto camshaft journal.
- Slide oil seal over guide sleeve and onto camshaft journal.
- Remove guide sleeve.



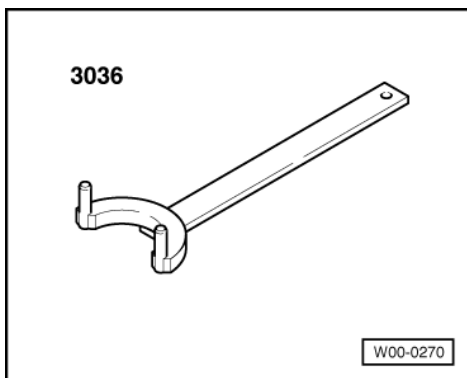
- -> Press oil seal all the way down to stop with press-sleeve T10071/3 and bolt M8 x 60.
- Install Hall sender =>Page 130 .
- Install toothed belt guard (upper section).

Tightening torques

Component	Nm
Hall sender rotor to camshaft	25
Hall sender housing to cylinder head	10

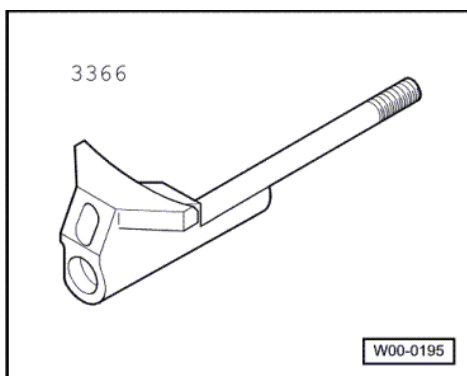
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

2.5 - Removing and installing camshafts and camshaft adjuster



Special tools and workshop equipment required

- ♦ Counter-hold tool 3036



- ♦ Retainer for chain tensioner 3366

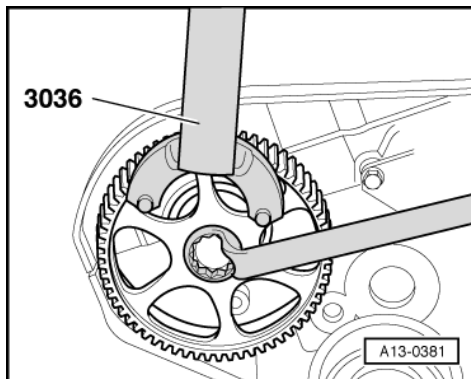


- ♦ Sealant

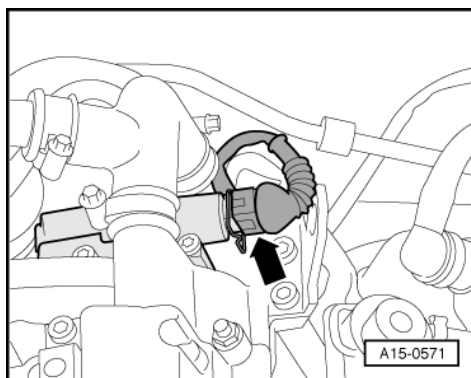
=> Parts catalogue

Removing

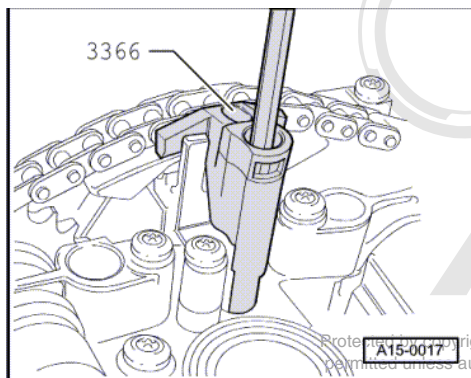
- Cylinder head installed



- Turn crankshaft to TDC for cylinder No. 1 (with engine installed) => Page 62 .
- Turn crankshaft to TDC for cylinder No. 1 (with engine removed) => Page 65 .
- Take toothed belt off camshaft sprocket => Page 60 .
- -> Loosen camshaft sprocket (counter-hold with 3036).
- Pull off camshaft sprocket.



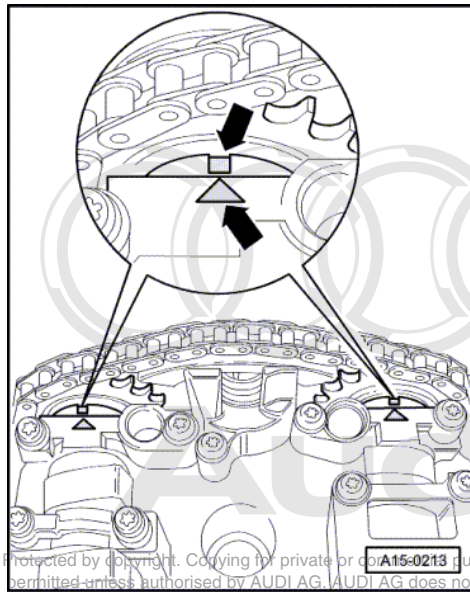
- -> Unplug electrical connector -arrow- from camshaft adjuster.
- Remove cylinder head cover =>Page 115 .
- Remove both oil deflectors.
- Remove Hall sender (complete).



- -> Hold camshaft adjuster in position with retainer for chain tensioner 3366.

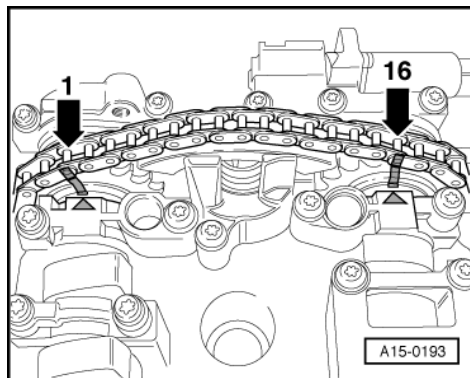
Note:

If the retainer for chain tensioner is tightened excessively, this can damage the camshaft adjuster.



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

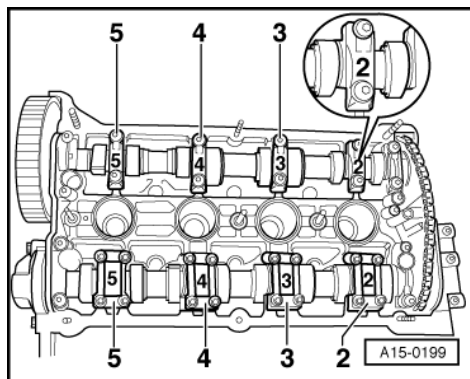
- > Re-check TDC position of camshafts.
- The marks on the two camshafts must be in line with the arrows on the bearing caps.



- Clean chain and camshaft sprockets opposite the two arrows on the bearing caps and mark installation position with coloured marks.
- -> The distance between the two arrows (and thus between the coloured markings) is 16 rollers on the chain.
- The notch on the exhaust camshaft is offset slightly towards the inside in relation to chain roller -1-.

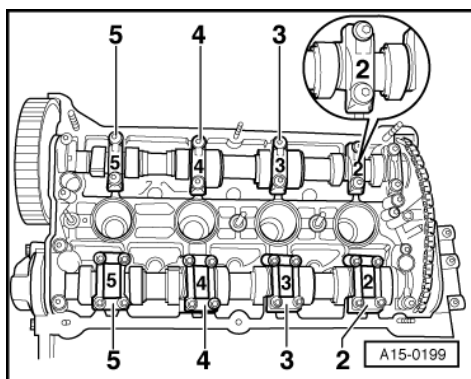
Note:

Do not mark chain with a centre punch or by making a notch or similar.



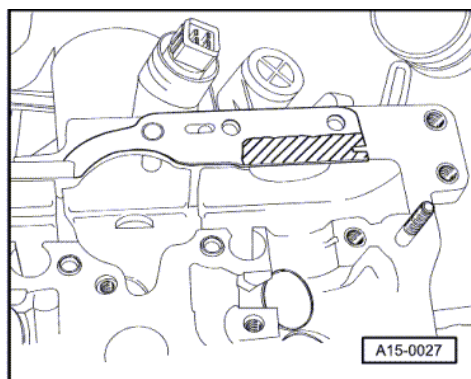


- -> First remove bearing caps 3 and 5 on inlet and exhaust camshafts.
- Remove double bearing cap.
- Remove both bearing caps next to inlet and exhaust camshaft chain sprockets.
- Unscrew bolts securing camshaft adjuster.



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

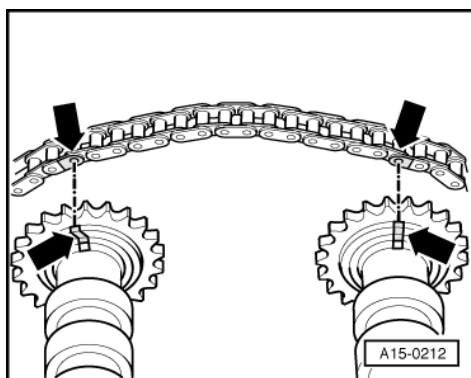
- -> Loosen bearing caps 2 and 4 of inlet and exhaust camshafts in alternating and diagonal sequence and remove.
- Remove inlet and exhaust camshafts together with camshaft adjuster.



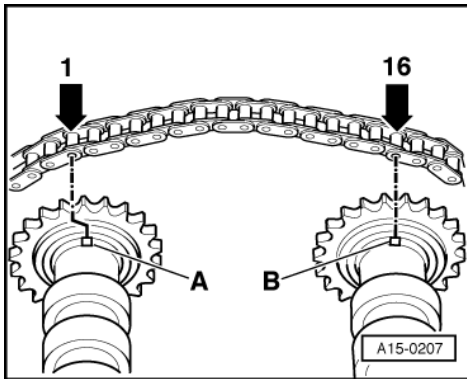
Installing

- -> Renew rubber/ metal gasket for camshaft adjuster and apply a thin coat of sealant to the shaded area.
- Sealant

=> Parts catalogue



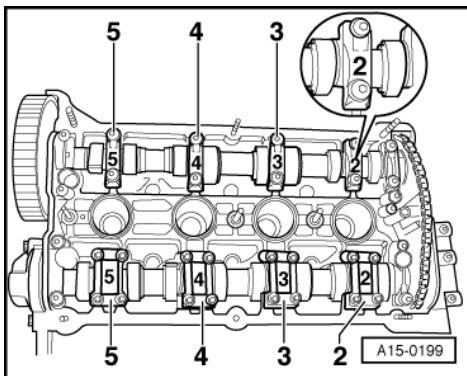
- Fit drive chain on camshaft sprockets as follows:
 - -> When the old chain is being re-installed, fit the chain so that the coloured markings are in line -arrows-.



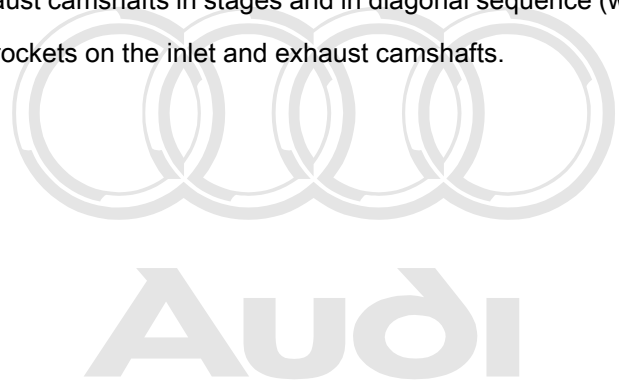
- -> When a new chain is being installed, the distance between the notches -A- and -B- on the camshafts must be 16 rollers on the chain. The illustration shows the exact positions of the 1st and 16th rollers on the sprockets.
- Notch -A- is offset slightly towards the inside in relation to chain roller -1-.
- Slide the camshaft adjuster into the drive chain (second person required).
- Locate camshafts together with drive chain and camshaft adjuster on cylinder head.
- Oil running surfaces of both camshafts.

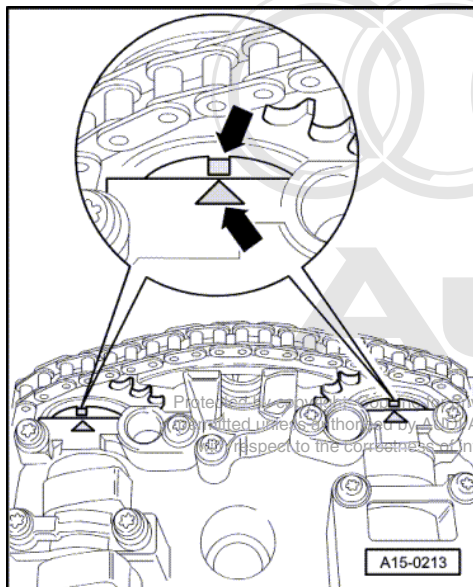
Notes:

- ◆ Dowel sleeves for bearing caps and camshaft adjuster must be fitted in cylinder head.
- ◆ When installing bearing caps ensure that the identification mark is readable from the inlet side of cylinder head.
- Tighten mountings of camshaft adjuster (watch position of dowel sleeves).

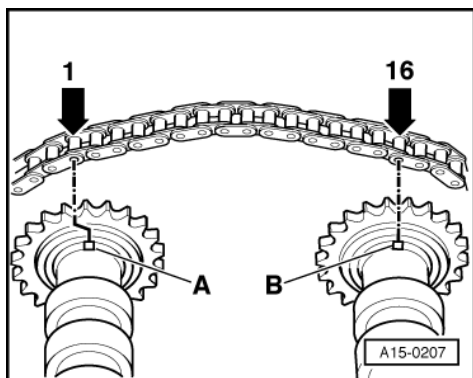


- -> Tighten bearing caps 2 and 4 of inlet and exhaust camshafts in stages and in diagonal sequence (watch position of dowel sleeves).
- Install the two bearing caps next to the chain sprockets on the inlet and exhaust camshafts.

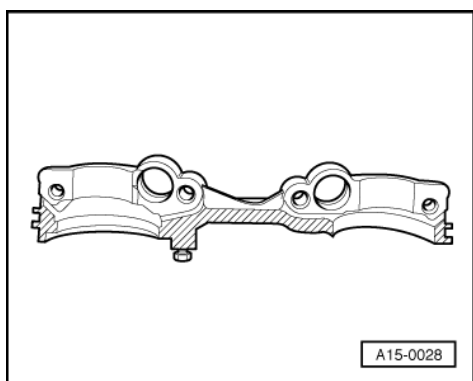




- Check correct setting of camshafts:
 - -> The two markings on the camshafts must be in line with the two arrows on the bearing caps -arrows-.



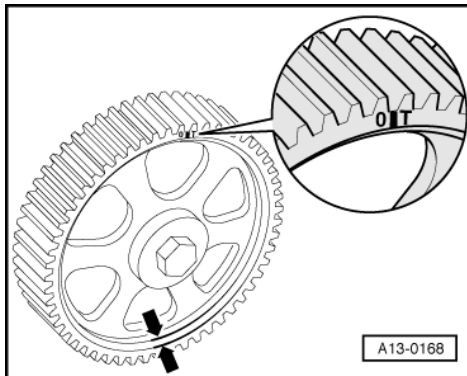
- -> The distance between the two arrows on the bearing caps (or between the coloured markings) is 16 rollers on the chain.
- The notch on the exhaust camshaft is offset slightly towards the inside in relation to chain roller -1-.



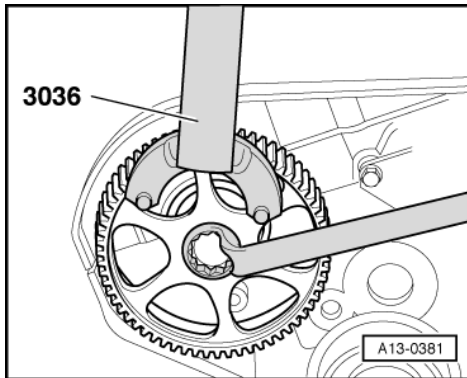
- Remove holder for chain tensioner 3366.
- -> Apply a thin coat of sealant to shaded area on double bearing cap and install bearing cap (watch position of dowel sleeves).
- Sealant

=> Parts catalogue

- Install remaining bearing caps (watch position of dowel sleeves).
- Renew oil seals for inlet and exhaust camshafts
=> starting on Page 133 .



- -> Install camshaft sprocket.
- Check installation position:
The narrow rim flange on the camshaft sprocket faces outwards -arrows- and the marking for No. 1 cylinder TDC is visible.



- -> Fit securing bolt for camshaft sprocket (use counter-hold tool 3036).
- Install Hall sender =>Page 130 .
- Install cylinder head cover =>Page 116 .

Note:

If a piston is at TDC the valves could strike the piston when turning the camshaft. To avoid damage to valves and pistons the pistons must not be at TDC.

- Install toothed belt (adjust valve timing) => Page 60 .

Notes:

- ♦ Wait about 30 minutes after installing the camshafts before starting the engine. The hydraulic valve compensating elements must settle (otherwise the valves will strike the 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 caps to cylinder head	10
Camshaft adjuster to cylinder head	10
Hall sender rotor to camshaft	25
Hall sender housing to cylinder head	10

Camshaft sprocket to camshaft	65
-------------------------------	----

2.6 - Checking hydraulic bucket tappets

Special tools and workshop equipment required

- ♦ Feeler gauge
- ♦ Wood or plastic wedge

Notes:

- ♦ Hydraulic tappets cannot be adjusted or repaired.
- ♦ Irregular valve noises when starting engine are normal.

Test sequence

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

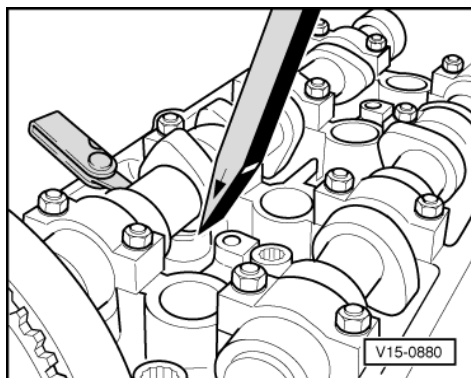
Note:

If the irregular valve noises stop but recur repeatedly during short trips, the oil retention valve must be replaced. The oil retention valve is located in the oil filter bracket => -Item 168.

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

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

- Remove cylinder head cover =>Page 115 .
- Rotate crankshaft until the cams of the tappets to be checked are pointing upwards:
 - Vehicles with manual gearbox push: vehicle forwards with 4th gear engaged and ignition off.
 - Vehicle with automatic gearbox: remove centre and right noise insulation panels.
 - Turn crankshaft clockwise with centre bolt on crankshaft sprocket.
- Determine play between cam and bucket tappet.

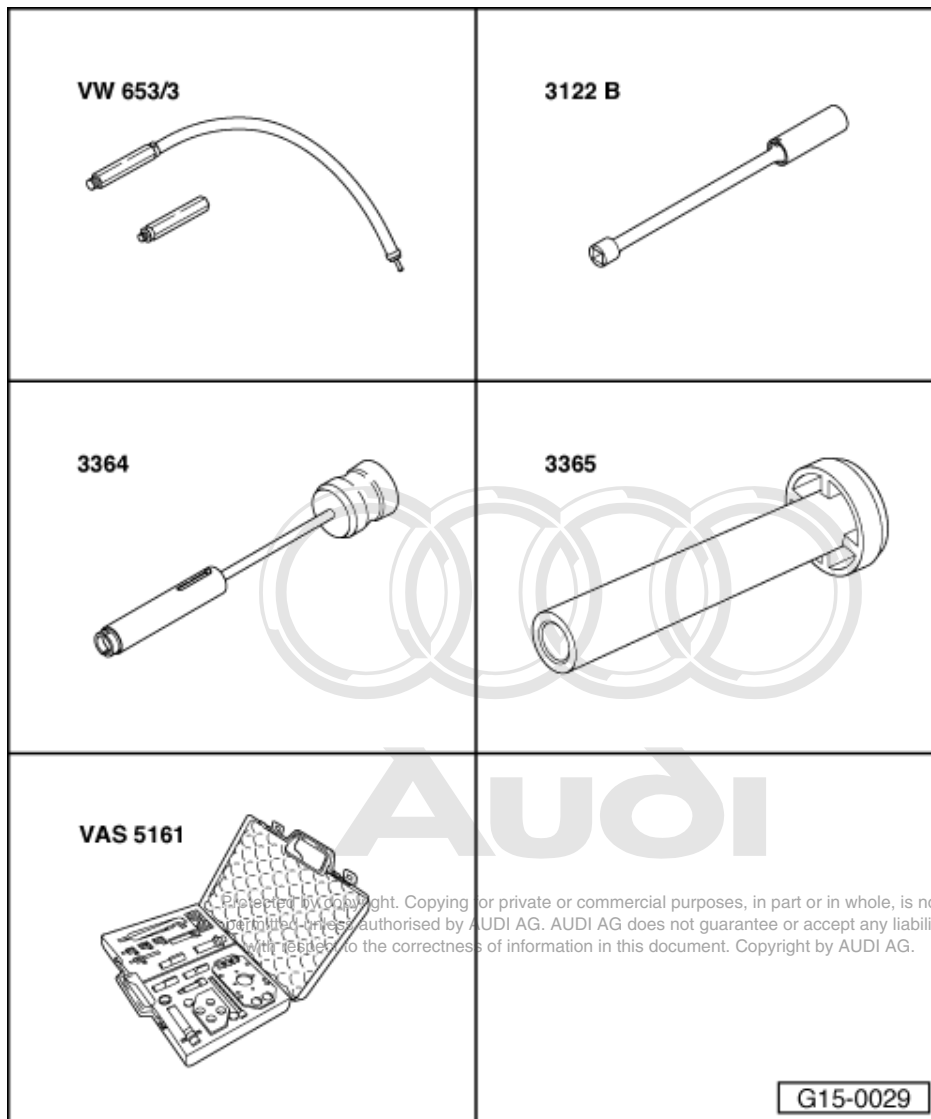


- -> Press tappet down with a wooden or plastic wedge. If an 0.20 mm feeler gauge can be inserted between camshaft and tappet, renew tappet.
- Renewing tappet =>Removing and installing camshafts and camshaft adjuster, Page 139 .

Notes:

- ♦ After installing the camshaft, wait for about 30 minutes before starting the engine. The hydraulic tappets must be allowed to settle, otherwise the valves will contact the 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.

2.7 - Renewing valve stem seals



Special tools and workshop equipment required

- ◆ Pressure hose VW 653/3
- ◆ Spark plug socket and extension 3122 B
- ◆ Puller 3364
- ◆ Fitting tool 3365
- ◆ Removal and installing tool VAS 5161

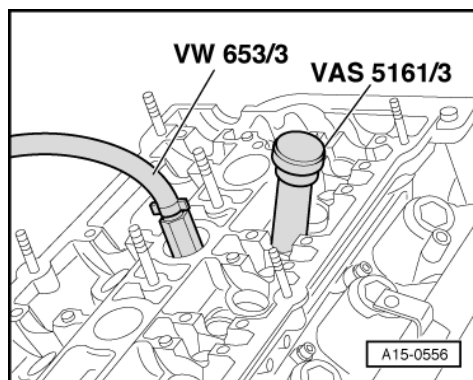
Removing

- Cylinder head installed
- Remove camshafts and camshaft adjuster
=> Page 139 .

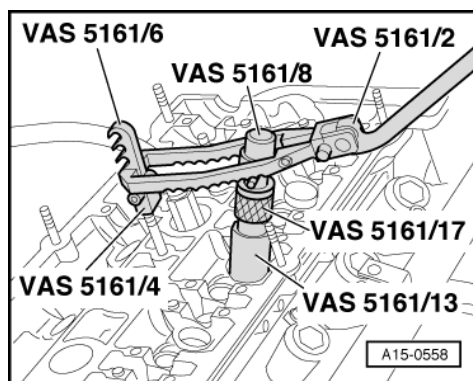
Notes:

- ◆ Ensure that bucket tappets are not interchanged.
- ◆ Mark installation position on back of tappets with water-proof felt pen.
- Remove the bucket tappets from guides and put them down with the contact surface downwards.

- Remove spark plugs with spark plug spanner 3122B.

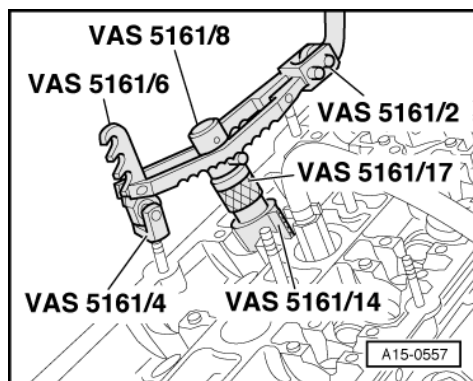


- Set piston of appropriate cylinder to "bottom dead centre".
- -> Screw compressed air hose VW 653/3 into spark plug thread and apply a continuous pressure of at least 6 bar.
- Insert punch VAS 5161/3 in bucket tappet guide.
- Knock sticking valve cotter on all valves loose using a plastic-tip hammer.



Inlet side

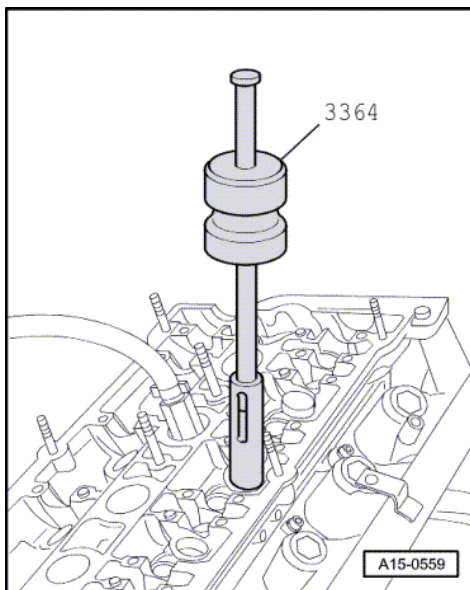
- -> Screw retainer VAS 5161/6 with guide fork VAS 5161/4 onto threaded stud on cylinder head.
- Insert guide sleeve VAS 5161/13 all the way into bucket tappet guide of the valve to be removed.
- Mounting position: knurled surfaces have to align transversely to direction of travel.
- Slide knurled spacer ring 5161/17 onto cartridge VAS 5161/8.
- Insert cartridge into guide bush.
- Hook pressure fork VAS 5161/2 into retainer VAS 5161/6 and press cartridge downwards.
- While doing this turn knurled screw of cartridge clockwise until the ends engage in the valve cotter.
- Turn knurled screw back and forth slightly to press valve cotter apart so they are taken up by the cartridge.
- Release pressure fork.
- Remove cartridge with knurled spacer ring, guide bush, valve spring plate and valve spring.



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

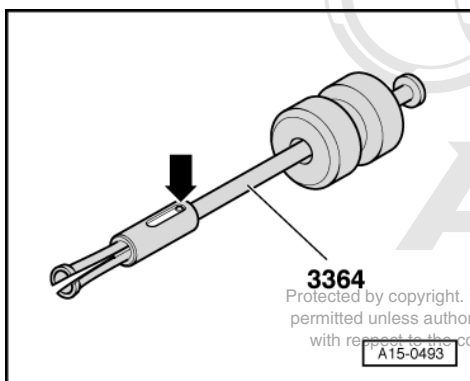
Exhaust side

- -> Screw retainer VAS 5161/6 with guide fork VAS 5161/4 onto a stud on the cylinder head.
- Insert guide bush VAS 5161/14 all the way into bucket tappet guide of the valve to be removed.
 - Mounting position: knurled surfaces have to align transversely to direction of travel.
- Slide knurled spacer ring 5161/17 onto cartridge VAS 5161/8.
- Insert cartridge into guide bush.
- Hook pressure fork VAS 5161/2 into retainer VAS 5161/6 and press cartridge downwards.
- While doing this turn knurled screw of cartridge clockwise until the ends engage in the valve cotters.
- Turn knurled screw back and forth slightly to press valve cotters apart so they are taken up by the cartridge.
- Release pressure fork.
- Remove cartridge with knurled spacer ring, guide bush, valve spring plate and valve spring.



All models

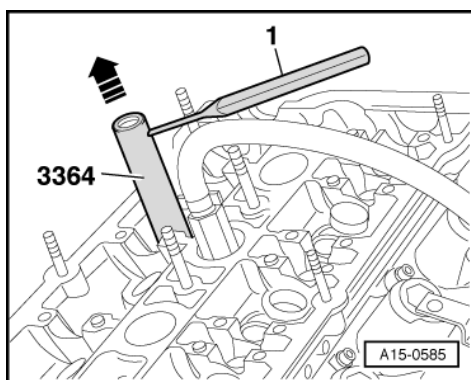
- -> Pull off valve stem seals with 3364.



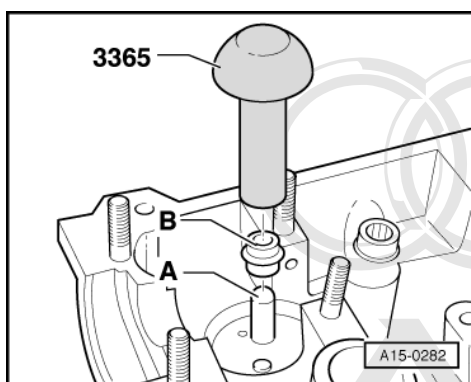
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

If the space is not sufficient to pull off individual valve stem seals with puller 3364, proceed as described below:

- -> Knock pin -arrow- of puller 3364 out using a drift and remove the extractor attachment.



- -> Place bottom part of puller 3364 on valve stem seal.
- Secure the puller with a drift or punch -1- as shown in the illustration.
- Apply a suitable lever to puller 3364 and pull out valve stem seal -arrow-.



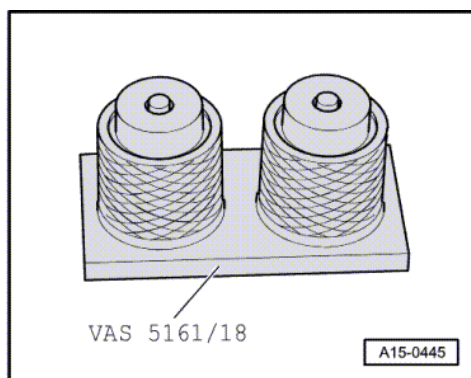
Installing

Note:

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

New valve stem seals come with a plastic sleeve -A-.

- -> To prevent damage to the new valve stem seals -B-, place plastic sleeve -A- on valve stem.
- Lightly oil sealing lip of valve stem seal.
- Slide valve stem seal over plastic sleeve.
- Carefully press valve stem seal with fitting tool 3365 down onto valve guide.
- Remove plastic sleeve.

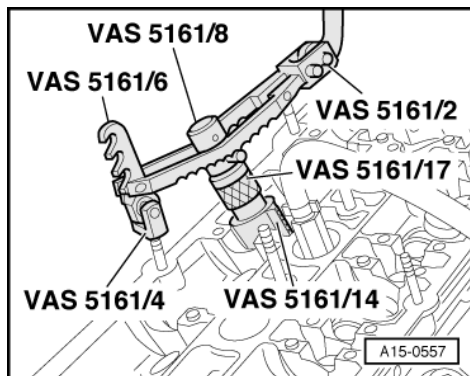


- -> If valve cotter pins had been removed from assembly cartridge they need to be put into insertion device VAS 5161/18 first.

Note:

The larger diameter of the valve cotters points upwards.

- Press cartridge VAS 5161/8 onto insertion device from above and take up valve cotters.

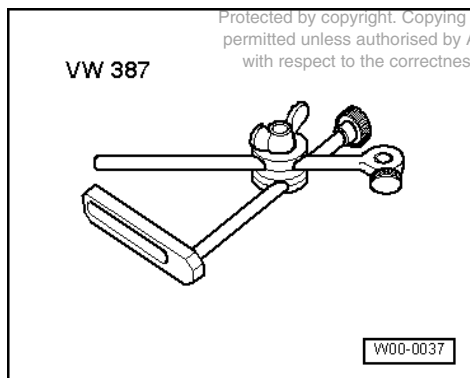


- -> Re-insert cartridge VAS 5161/8 into guide bush VAS 5161/13 or VAS 5161/14.
- To install valve cotters, press down pressure fork and pull knurled screw upwards, turning it back and forth.
- Release pressure fork with knurled screw still pulled upwards.
- Insert tappets.
- Install camshafts and camshaft adjuster
=> Page 142 .

Notes:

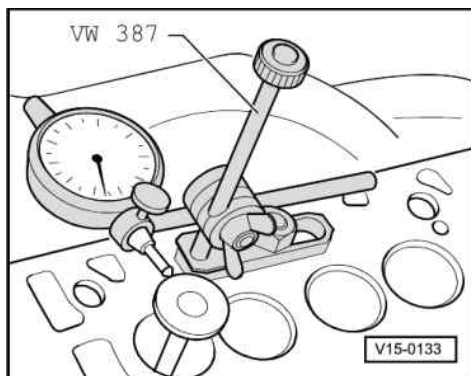
- ♦ Wait about 30 minutes after installing the camshafts before starting the engine. The hydraulic valve compensating elements must settle (otherwise the valves will strike the pistons).
- ♦ After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.

2.8 - Checking valve guides



Special tools and workshop equipment required

- ♦ Universal dial gauge bracket VW 387
- ♦ Dial gauge



Test sequence

- -> Insert valve into valve guide until end of valve stem is flush with end of guide.
- Measure the amount of sideways play (lateral play).

Wear limit

Inlet valve guide	Exhaust valve guide
0.80 mm	0.80 mm

Notes:

- ♦ If the wear limit is exceeded, repeat the measurement with new valves. If the wear limit is again exceeded, renew the cylinder head. The valve guides cannot be replaced.
- ♦ If the valve is to be renewed as part of a repair, use a new valve for the calculation.

2.9 - Checking valves

- Visual inspection for scoring on valve stems and valve seat surfaces. Renew valves if severe scoring is visible.

2.10 - Reworking valve seats

Note:

If a good seating pattern cannot be obtained by grinding the valve seats (lapping), they must be refaced (re-worked):

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

Special tools and workshop equipment required

- ♦ Depth gauge
- ♦ Valve seat refacing tool

Notes:

- ♦ When repairing engines with leaking valves, it is not sufficient to reface the valve seats and renew the valves. The valve guides must also be checked for wear. This is particularly important on high mileage engines =>Page 151 .
- ♦ The valve seats should only be reworked just enough to produce a perfect seating pattern.
- ♦ Calculate the maximum permissible reworking dimension before reworking.

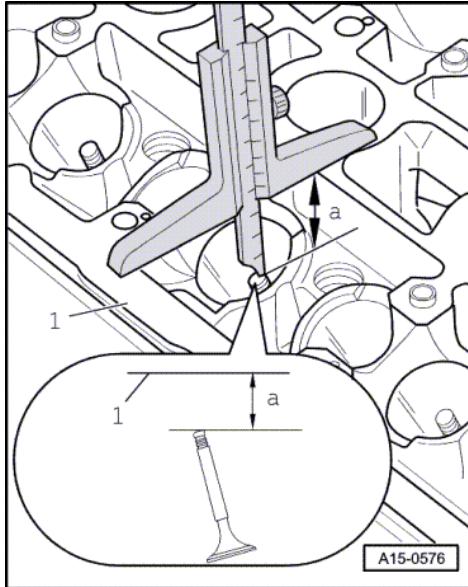
- ♦ If the reworking dimension is exceeded, the function of the hydraulic tappets can no longer be guaranteed and the cylinder head should be renewed.

Calculating maximum permissible reworking dimension

- Insert valve and press it firmly against valve seat.

Note:

If the valve is to be renewed as part of a repair, use a new valve for the calculation.



- -> Measure distance -a- between end of valve stem (upper edge) and top surface of cylinder head using a depth gauge.
- Calculate max. permissible reworking dimension from measured distance and minimum dimension.

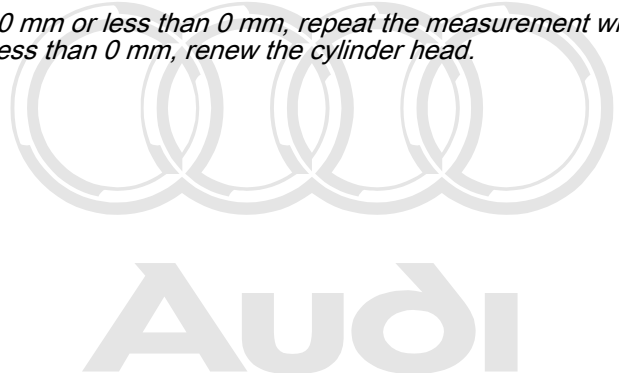
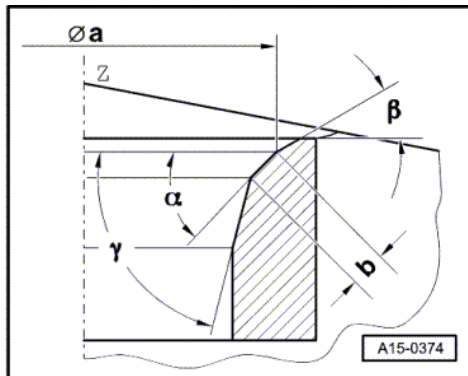
Minimum dimensions		
Outer inlet valves	Centre inlet valve	Exhaust valves
31.0 mm	32.2 mm	31.9 mm

Measured distance minus minimum dimension
= max. permissible reworking dimension.

Example (for outer inlet valve):	
Measured distance	31.4 mm
- Minimum dimension	- 31.0 mm
= Maximum permissible reworking dimension	= 0.4 mm

Note:

If the maximum permissible reworking dimension is 0 mm or less than 0 mm, repeat the measurement with a new valve. If the measured result is again 0 mm or less than 0 mm, renew the cylinder head.



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

**-> Reworking valve seats**

Dimension		Inlet valve seat
dia. a	mm	26.2
b	mm	1.5 ... 1.8
Z		Cylinder head lower edge
α	45°	Valve seat angle
β	30°	Upper correction angle
γ	60°	Lower correction angle

Dimension		Exhaust valve seat
dia. a	mm	29.0
b	mm	1.8
Z		Cylinder head lower edge
α	45°	Valve seat angle
β	30°	Upper correction angle
γ	60°	Lower correction angle

3 - Testing camshaft timing control

3.1 - Testing camshaft timing control

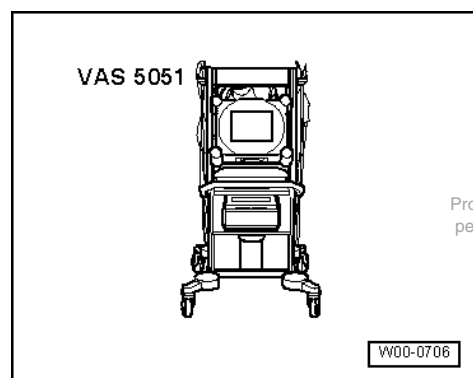
By altering the valve timing the engine control unit varies the cylinder charge to suit the current engine load and rpm.

The timing of the inlet camshaft is controlled according to engine load and engine speed. The electrically operated solenoid valve for camshaft adjustment transmits oil pressure to the mechanical camshaft adjuster as required.

Note:

The camshaft timing control only becomes active 25 seconds after the engine is started.

3.2 - Testing system: engines with engine code letters APG



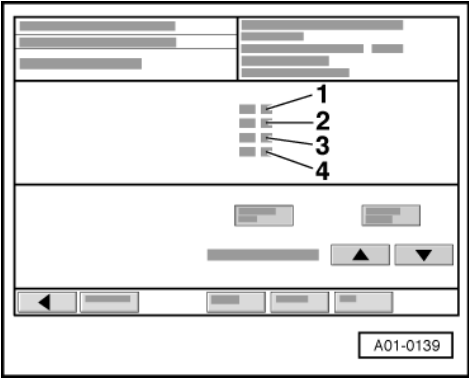
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Special tools and workshop equipment required

- ♦ VAS 5051 and VAS 5051/1

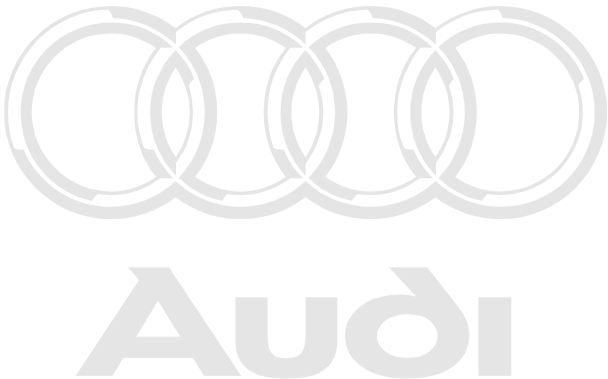
Requirements for test:

- Connect vehicle diagnosis, testing and information system VAS 5051, select "Vehicle self-diagnosis" and vehicle system "01 - Engine electronics".
- Engine idling.



Test sequence

- Start basic settings, Display Group 094.
- > Display on VAS 5051:
- Check specification in display zone -3-.

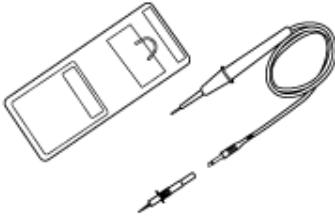
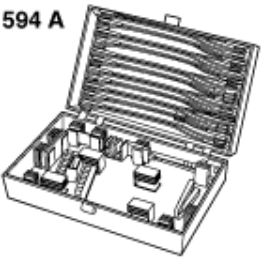
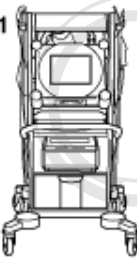


Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

	Display zones			
	1	2	3	4
Display Group 094: Camshaft timing control				
Display	xxxx/min	---	---	
Indicates	Engine speed, rpm	Camshaft timing control	Diagnostic status	
Operating range		CS-ctrlOFF CS-ctrlON	Test OFF Test ON Syst. OK Syst.n.OK	
Specification	660...860 rpm	CS-ctrlOFF	Syst. OK	
Note			If display shows "Syst.n.OK": interrogate fault memory	



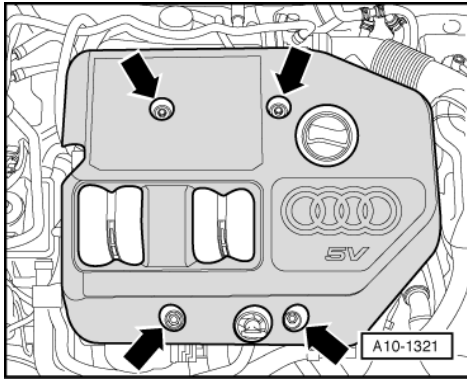
3.3 - Checking solenoid valve for camshaft timing control -N205

V.A.G 1526 A 	V.A.G 1527 B 
V.A.G 1594 A 	V.A.G 1598/22 
V.A.G 1598/31 	VAS 5051  G20-0010

Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/22
(vehicles with engine code letters AGN)
- ♦ V.A.G 1598/31
(vehicles with engine code letters APG)
- ♦ VAS 5051 with VAS 5051/1

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

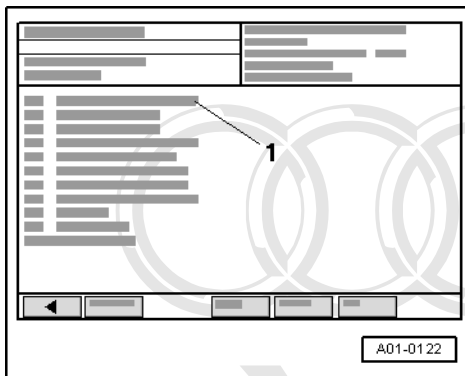


Test requirement:

- Connect vehicle diagnosis, testing and information system VAS 5051, select "Vehicle self-diagnosis" and vehicle system "01 - Engine electronics".

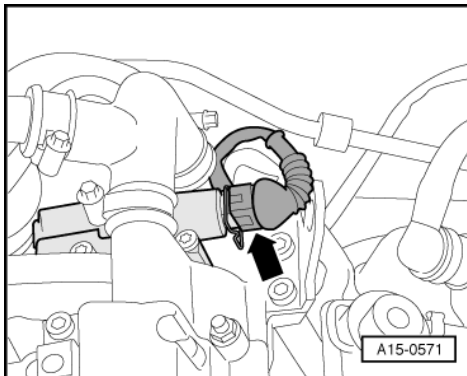
Test sequence

- -> Remove engine cover panel -arrows-.



-> Display on VAS 5051:

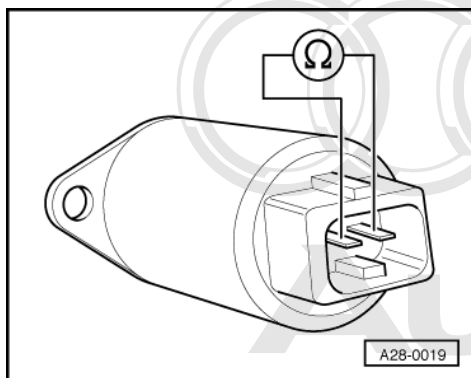
- Select diagnosis function "03 - Final control diagnosis" from the menu -1-
- **Activate solenoid valve for camshaft adjuster.**
- ◆ This valve is activated for about 1 minute (clicks when activated) unless the test programme is deliberately advanced to the next control element by pressing the ► - key.
- Press the ◀ button to exit from function "03 - Final control diagnosis".
- Select diagnosis function "06 - End output".



If the valve is not actuated (does not click):

Testing internal resistance

- Switch off ignition.
- -> Unplug electrical connector -arrow- from camshaft adjuster.



- -> Connect multimeter to valve (resistance measurement range)
- Specification: 10 ~ 18 Ω

If the specification is not attained:

- Fit a new valve.

If the specification is obtained:

Testing voltage supply

Requirements for test:

- Fuse for solenoid valve for camshaft timing control OK

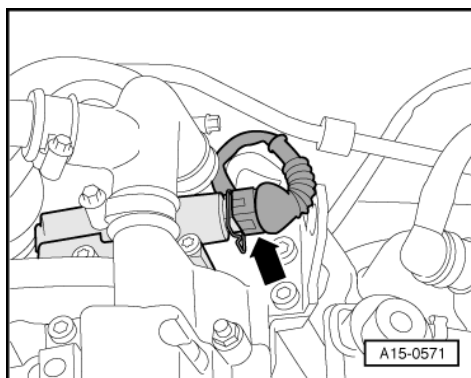
=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- Fuel pump relay OK

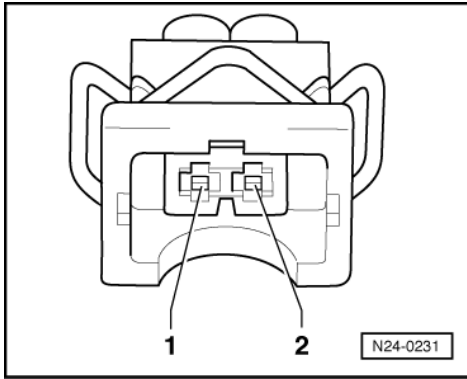
=> Motronic injection and ignition system; Repair group 24

Note:

The solenoid valve for camshaft timing control receives its power supply via the fuel pump relay.



- -> Unplug electrical connector -arrow- from camshaft adjuster.



- -> Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure against
1	Engine earth

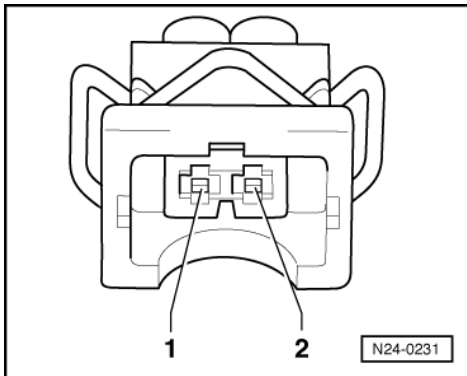
- Operate starter briefly.
- The LED should light up.

If the LED does not light up:

- Test for open circuit in wiring connection between fuel pump relay and contact 1 on connector via fuse:

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

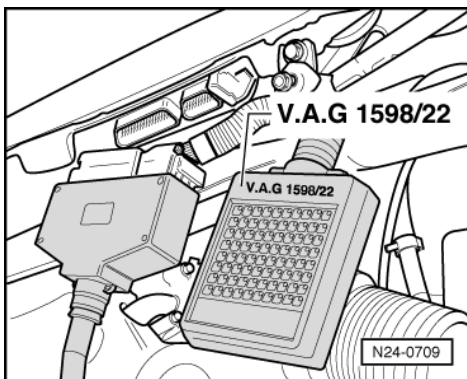
- Rectify any open circuits.



If the LED lights up:

Testing activation

- -> Connect voltage tester V.A.G 1527 B to contact 1 (positive) and contact 2 of the connector.
- Start final control diagnosis and select solenoid valve for camshaft timing control:
- The LED should flash.



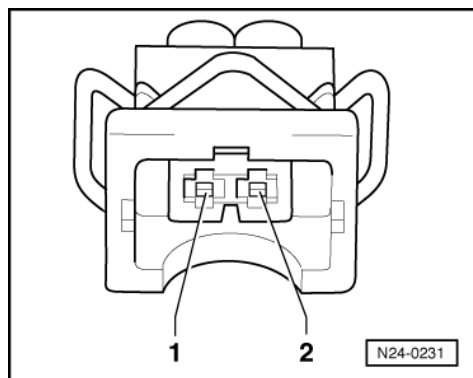


Models with engine code letters AGN:

If the LED lamp does not flash or if it lights up continuously:

- -> Connect test box V.A.G 1598/22 to wiring harness connector. Do not connect engine control unit.

=> Motronic injection and ignition system; Repair group 24



- -> Test for open circuit and short to positive or earth in the following wiring connections:

Connector Contact	Test box V.A.G 1598/22 Socket
2	55

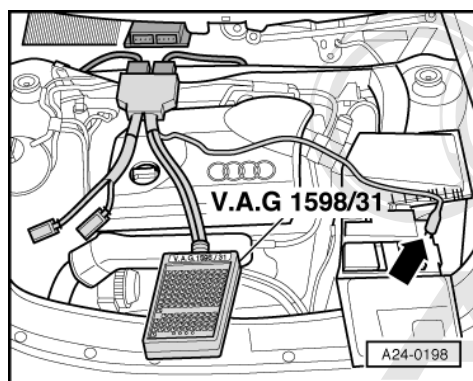
- Rectify any open/short circuit as necessary.

If the wiring is OK:

- Install a new engine control unit:

If no fault is found:

- Install a new mechanical camshaft adjuster => Page 139 .



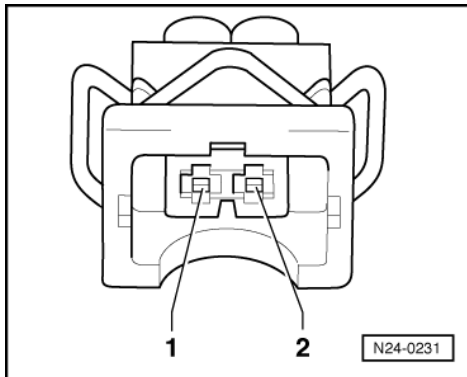
Models with engine code letters APG:

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

If the LED lamp does not flash or if it lights up continuously:

- -> Connect test box V.A.G 1598/31 to wiring harness connectors. The engine control unit itself does not need to be connected to the test box. Connect earth clamp on test box to earth -arrow-.

=> Motronic injection and ignition system; Repair group 24



- -> Test for open circuit and short to positive or earth in the following wiring connections:

Connector Contact	Test box V.A.G 1598/31 Socket
2	115

- Rectify any short circuits to earth or open circuits if found.

If the wiring is OK:

- Install a new engine control unit:

If no fault is found:

- Install a new mechanical camshaft adjuster => Page 139 .

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



17 - Lubrication

1 - Removing and installing parts of the lubrication system

1.1 - Removing and installing parts of the lubrication system

Notes:

- ♦ 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 renewed in order to prevent further damage occurring later.
- ♦ The oil level must not be above the max. mark - danger of damage to catalytic converter.
- ♦ Oil spray jet and pressure relief valve
=> Fig. 167

Viscosity grades and oil specifications:

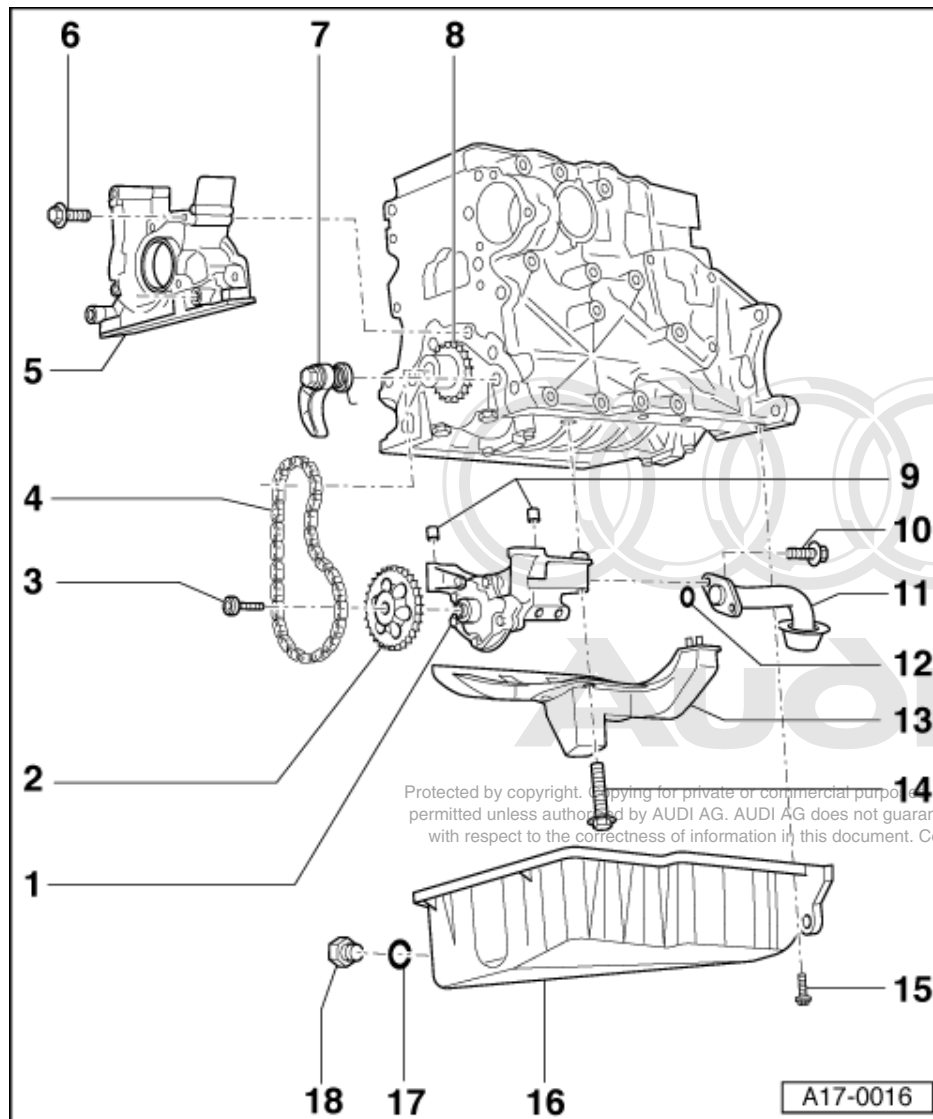
=> Maintenance booklet

Oil system capacity:

=> Exhaust emissions test binder

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

1.2 - Part I



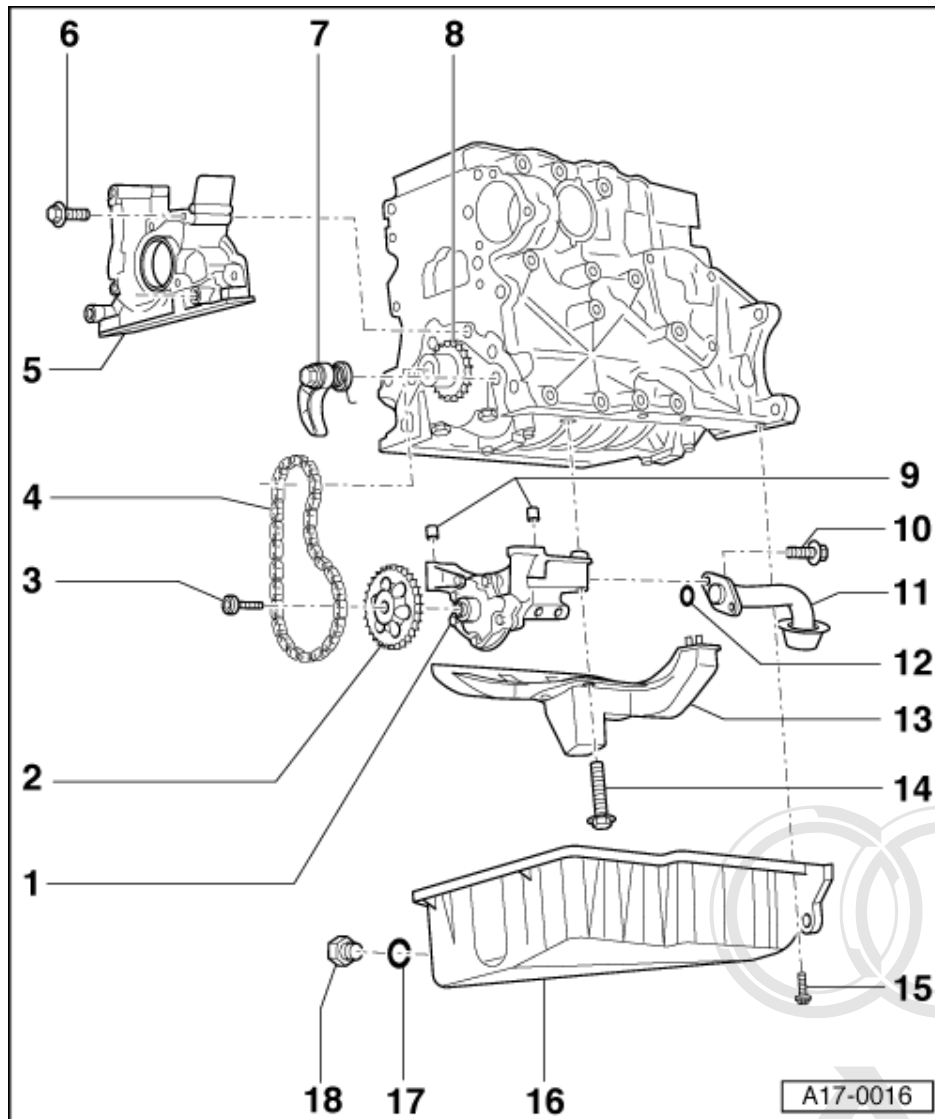
1 Oil pump

- ♦ With pressure relief valve (12 bar)
- ♦ Removing and installing
=> Page 173
- ♦ Before installing, check that the two dowel sleeves -Item 9 - for centring oil pump/cylinder block are fitted.
- ♦ Renew pump if there is scoring on moving surfaces and gear teeth.
- ♦ Tightening torque for oil pump cover to oil pump housing: 10 Nm

2 Oil pump sprocket

- ♦ Sprocket can only be fitted on oil pump shaft in one position.

3 22 Nm

**4 Drive chain for oil pump**

- ◆ Mark D.O.R. before removing
- ◆ Check for wear

5 Front sealing flange

- ◆ Apply silicone sealant before installing => Page 73
- ◆ Sealing compound

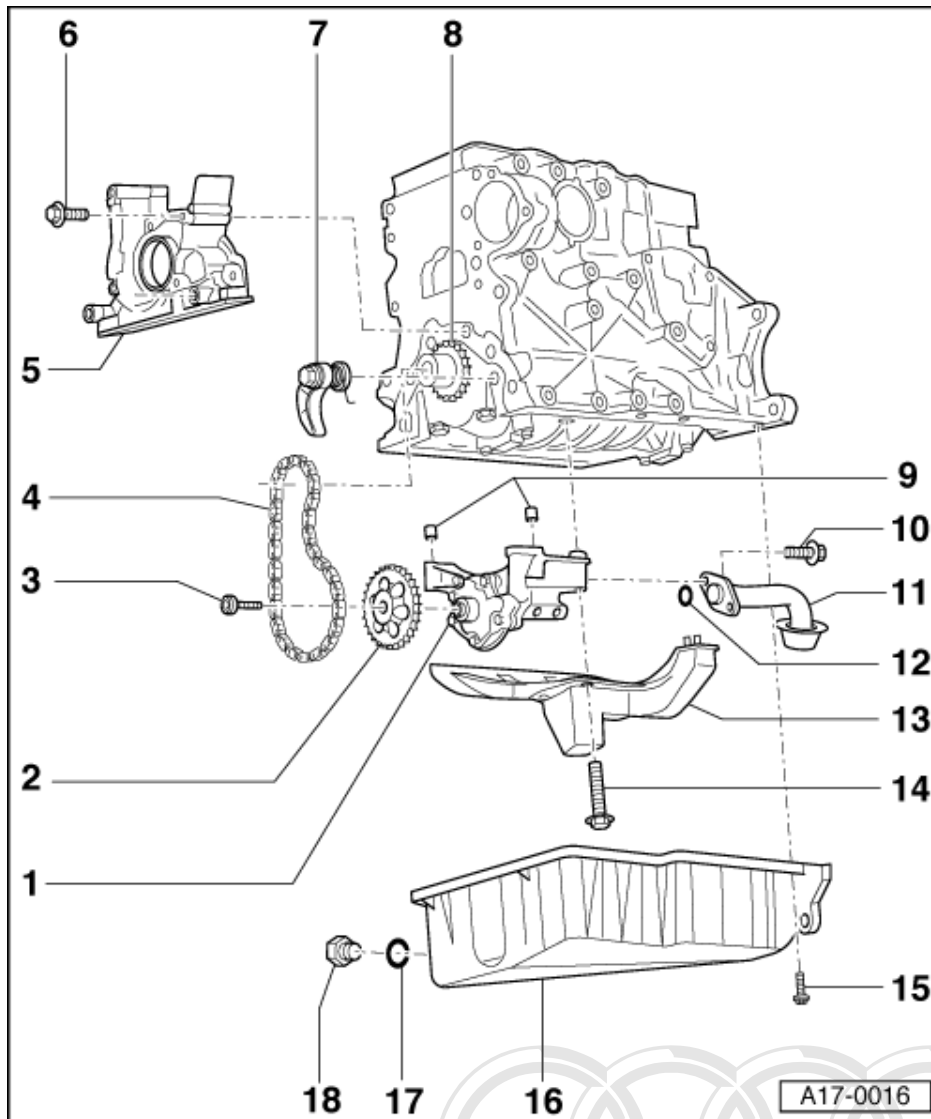
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

=> Parts List

- ◆ Renewing crankshaft oil seal at pulley end => Page 71

6 15 Nm**7 Chain tensioner**

- ◆ Tighten to 16 Nm
- ◆ Do not dismantle
- ◆ Note fitting position
- ◆ Pre-tension spring and engage before installing



8 Oil pump sprocket

- ♦ Removing and installing
=> Page 86

9 Dowel sleeves

- ♦ Qty. 2

10 15 Nm

11 Suction pipe

- ♦ Clean strainer if soiled

12 O-ring

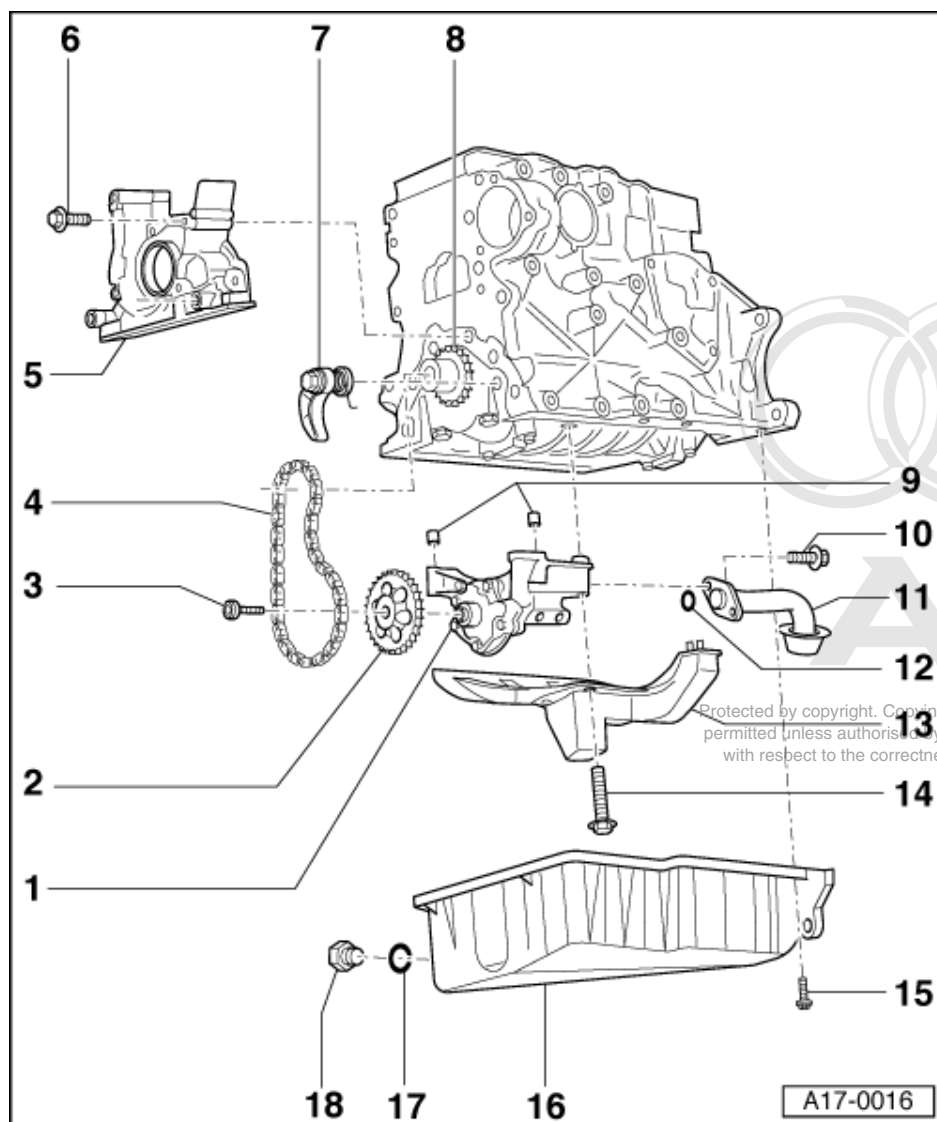
- ♦ Renew

13 Baffle plate

14 16 Nm

15 15 Nm

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



16 Sump

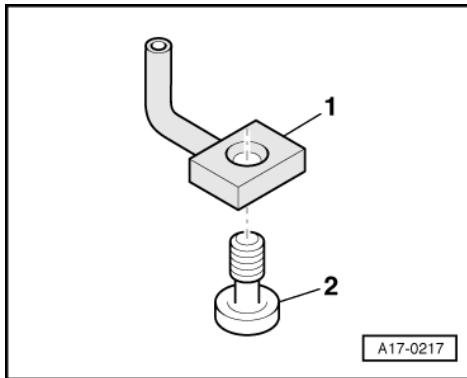
- ♦ Removing and installing
=> Page 170
- ♦ Apply silicone sealant before installing
- ♦ Sealing compound

=> Parts List

17 Seal

- ♦ Renew

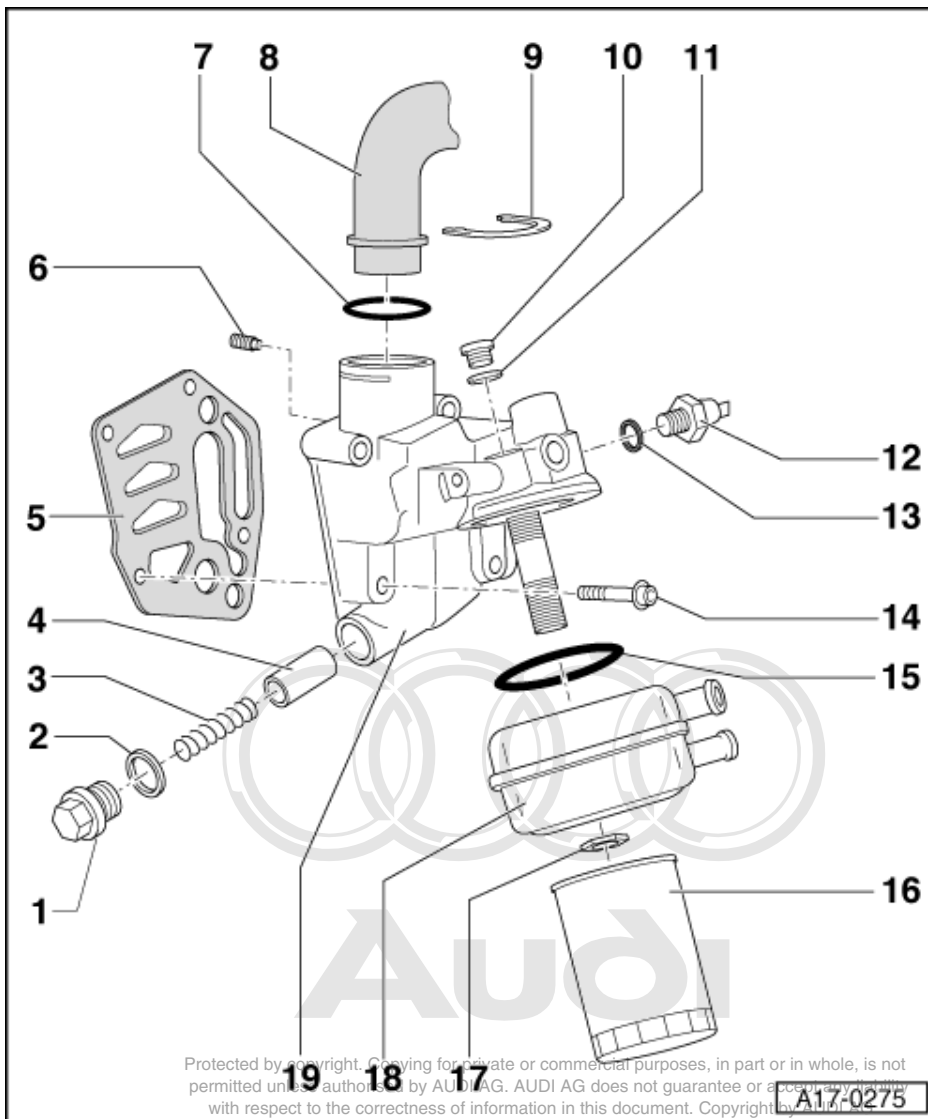
18 Oil drain plug - 30 Nm



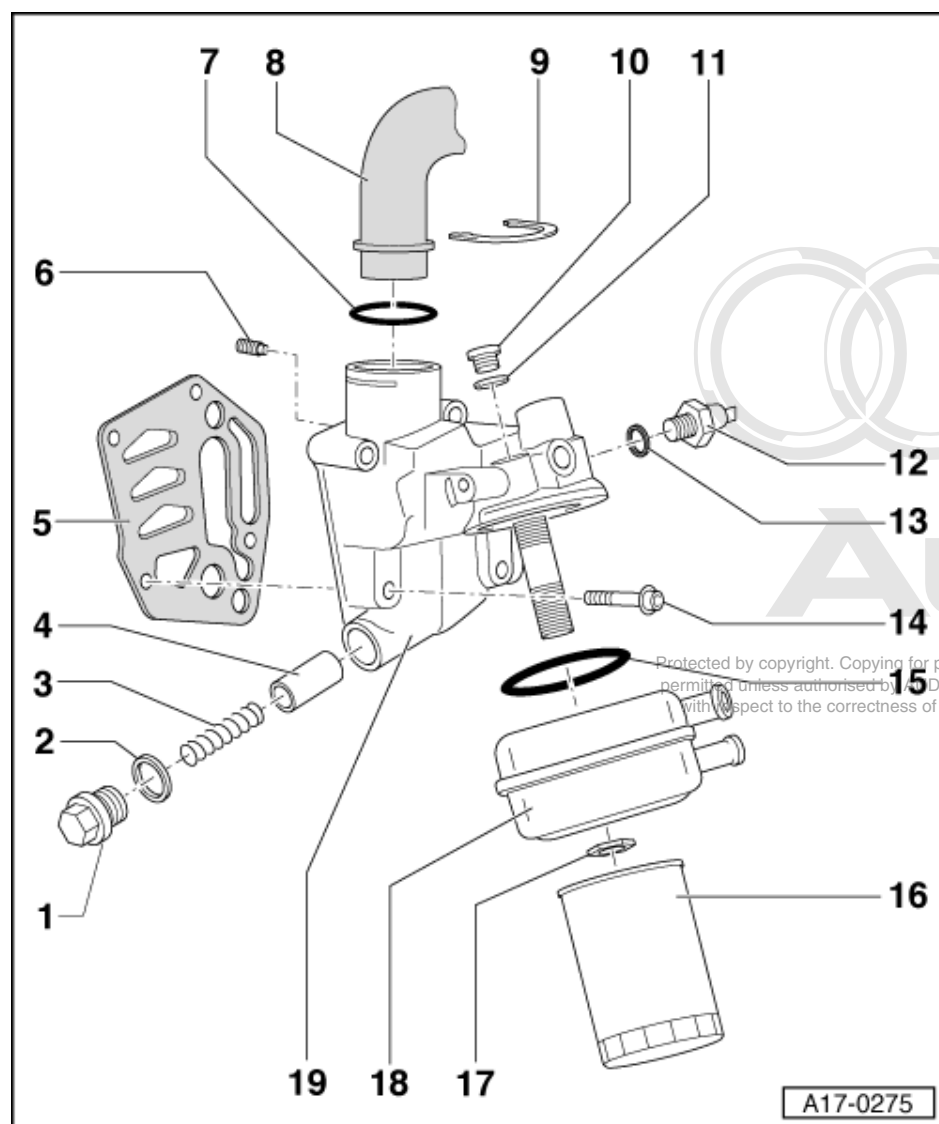
-> Fig. 1 Oil spray jet and pressure relief valve

- 1 - Oil spray jet (for piston cooling)
- 2 - Bolt with pressure relief valve - 27 Nm
- Valve release pressure 2.5 ... 3.2 bar

1.3 - Part II



- 1 Plug - 40 Nm
- 2 Gasket
 - ♦ Renew
- 3 Spring
 - ♦ For pressure relief valve, approx. 4 bar
- 4 Piston
 - ♦ For pressure relief valve, approx. 4 bar
- 5 Gasket
 - ♦ Renew
- 6 Oil retention valve
 - ♦ Tighten to 8 Nm
 - ♦ Built into oil filter bracket
- 7 O-ring
 - ♦ Renew
 - ♦ Slide on until flush with collar on pipe -Item 8 -



- 8 Pipe
 - ♦ For crankcase breather
- 9 Retaining clip
- 10 Screw plug - 15 Nm

- ◆ If seal is leaking, cut open and renew.

**12 Oil pressure switch -F1, 1.4 bar
-25 Nm**

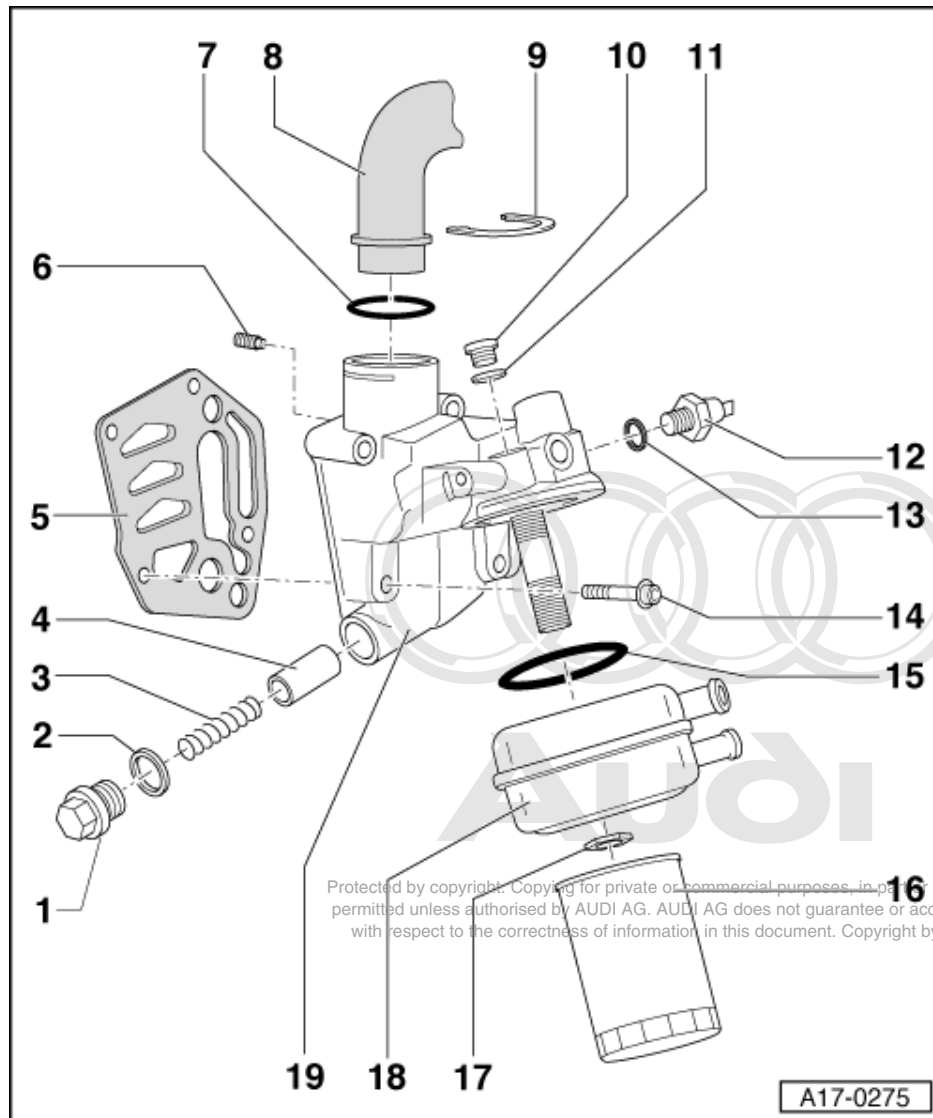
- ◆ Black insulation
- ◆ Checking => Page 175

13 Seal

- ◆ If seal is leaking, cut open and renew.

14 15 Nm + 90 ° (1/4 turn) further

- ◆ Renew



15 Gasket

- ◆ Renew
- ◆ Engage in projections on oil cooler

16 Oil filter

- ◆ Observe change intervals

=> Maintenance

- ◆ Observe installation instructions on oil filter



- ♦ Tighten to 20 Nm

17 25 Nm

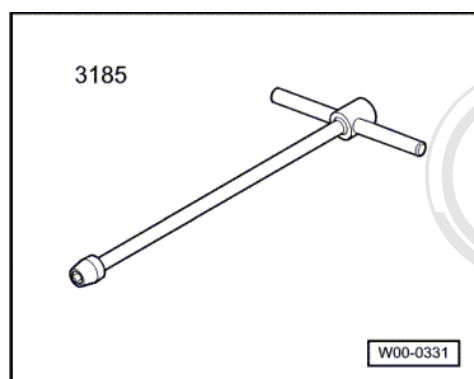
18 Oil cooler

- ♦ See note
=> Page 162
- ♦ Ensure clearance to adjacent components
- ♦ Coolant hose connection diagram => Page 179

19 Oil filter bracket

- ♦ With pressure relief valve (approx. 4 bar)

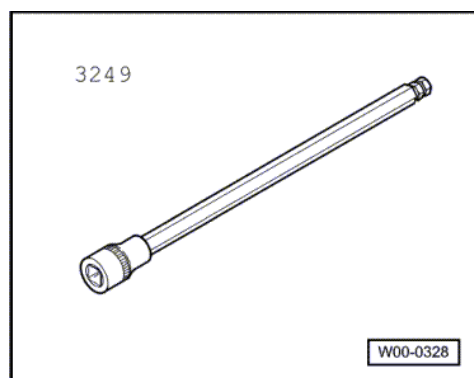
1.4 - Removing and installing sump



Special tools, workshop equipment and auxiliary items

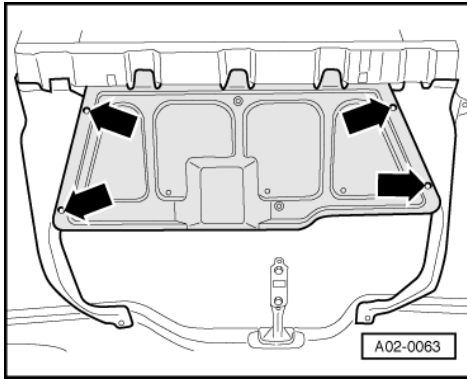
- ♦ T-bar and socket 3185

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



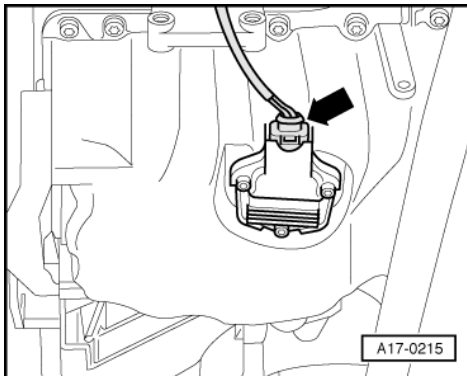
- ♦ Socket 3249
- ♦ Electric drill with plastic brush attachment
- ♦ Protective goggles
- ♦ Sealant

=> Parts catalogue

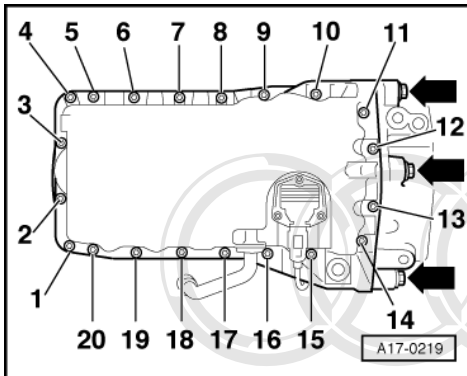


Removing

- -> Remove noise insulation centre panel -arrows-.
- Drain engine oil.



- -> If equipped, unplug electrical connector -arrow- at oil level sender.

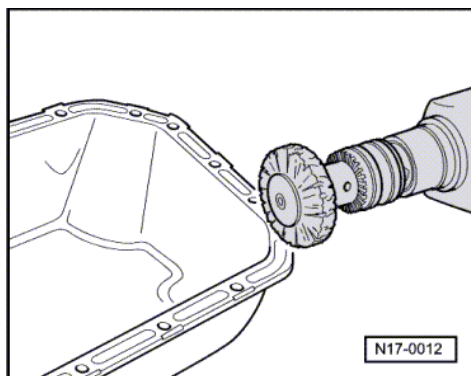


- -> Unscrew bolts from sump/gearbox -arrows-.
- Slacken bolts -1 ... 20- in diagonal sequence using T-bar and socket 3185.

Note:

Unscrew oil sump mounting bolts with socket 3249.

- Take off sump; if necessary loosen it by striking lightly with a rubber hammer.

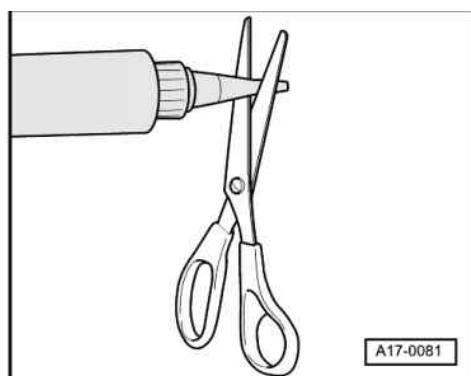


- Remove baffle plate and carefully remove any remains of sealant from cylinder block.

Warning!

Wear eye protection

- -> Remove remaining sealant from sump (with rotating plastic brush or similar).
- Clean sealing surfaces: they must be free of oil and grease.



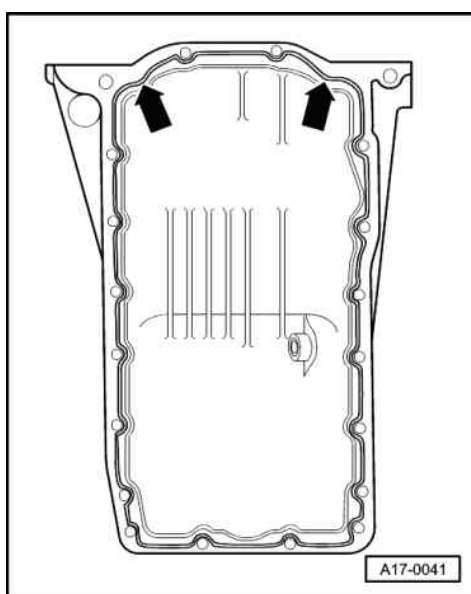
Installing

Install in reverse sequence; note the following points:

Note:

Replace gaskets and seals.

- -> Cut off nozzle on tube at front marking (nozzle dia. approx. 3 mm).

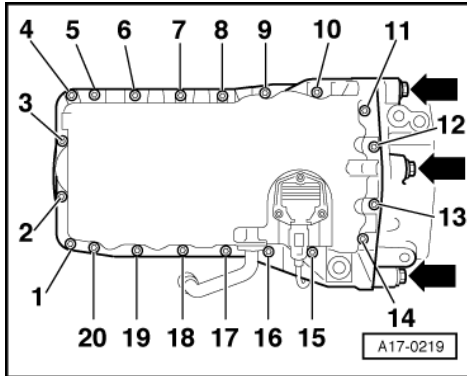


Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- -> Apply silicone sealant to the clean sealing surface on the sump as illustrated.
- Thickness of sealant bead: 2 ... 3 mm

Notes:

- ◆ The sump must be installed within 5 minutes after applying silicone sealant.
- ◆ The bead of sealant must not be thicker than indicated. Excess sealant can otherwise enter the sump and obstruct the filter screen in the oil intake pipe.
- ◆ Apply sealant bead with care around the rear sealing flange -arrows in illustration-.



- Fit sump immediately and tighten bolts in the sequence shown:
 - -> Tighten bolts -1 ... 20- to an initial torque of 5 Nm in diagonal sequence.
 - Tighten bolts securing sump/gearbox to 45 Nm.
 - Tighten bolts -1 ... 20- to 15 Nm in diagonal sequence.

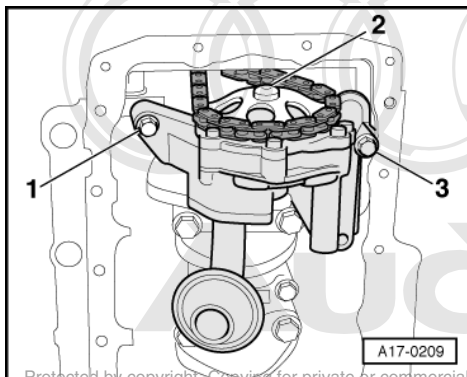
Notes:

- ◆ When installing the sump with the engine out of the vehicle, ensure that the sump is flush with the cylinder block at the flywheel end.
- ◆ After installing the sump, wait for about 30 minutes for the sealant to dry before putting in engine oil.
- Fill up with engine oil and check oil level.

Tightening torques

Component	Nm
Sump to cylinder block	15
Sump to gearbox	45
Oil drain plug	30

1.5 - Removing and installing oil pump



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



Removing

- Remove sump and baffle plate
=> Page **170**.
- -> Unscrew bolt -2-.
- Detach sprocket from oil pump shaft.
- Unscrew bolts -1- and -3- and remove oil pump.

Installing

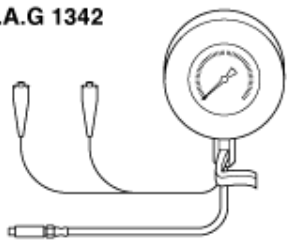
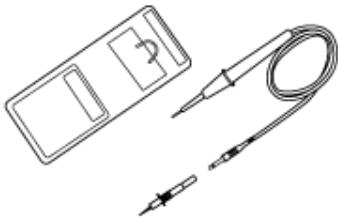
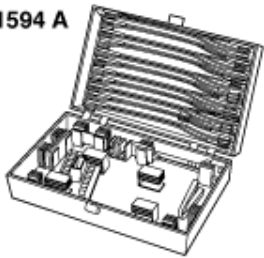
Install in reverse sequence; note the following points:

- Fit dowel sleeves -Item **165** on top of oil pump.
 - Chain sprocket can only be fitted in one position on oil pump shaft.
- Install sump => Page **172**.

Tightening torques

Component	Nm
Chain sprocket to oil pump shaft	22
Oil pump to cylinder block	16

1.6 - Testing oil pressure and oil pressure switch

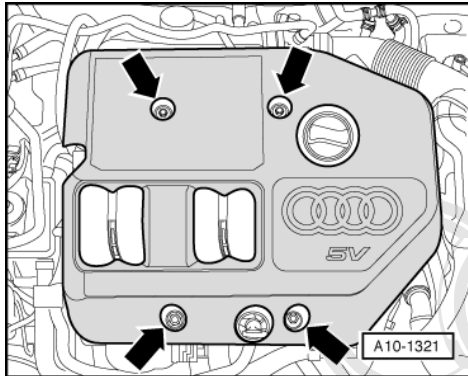
V.A.G 1342 	Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG. V.A.G 1527 B 
V.A.G 1594 A 	
	G17-0001

Special tools and workshop equipment required

- ◆ V.A.G 1342
- ◆ V.A.G 1527 B
- ◆ V.A.G 1594 A

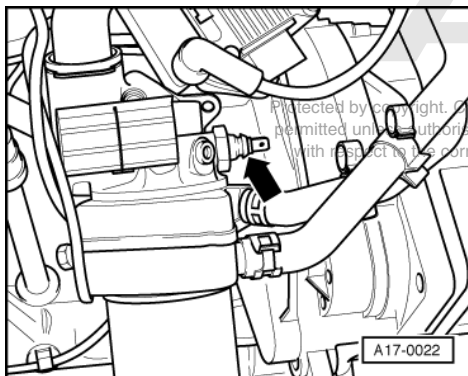
Requirements for test:

- Oil level ok.
- Engine oil temperature approx. 80 °C
- Oil pressure warning lamp -K3 must come on when ignition is switched on.
- In vehicles with Driver information system the "OK" must appear in the display.



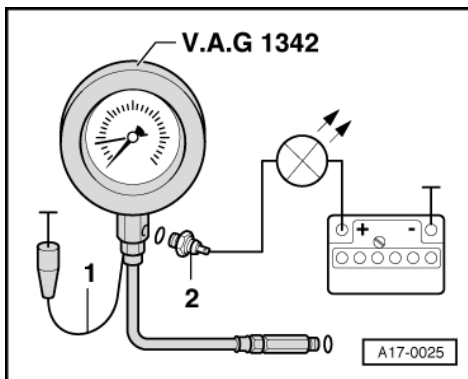
Test sequence

- -> Remove engine cover panel -arrows-.



Testing oil pressure switch

- -> Disconnect wire from oil pressure switch -arrow-.





- -> Unscrew oil pressure switch and screw in oil pressure tester V.A.G 1342.
- Screw oil pressure switch -2- into V.A.G 1342.
- Connect brown wire -1- of tester to earth (-).
- Connect voltage tester V.A.G 1527 B to oil pressure switch and positive side of battery (+) using test leads from V.A.G 1594 A.
- Test lamp should not light up.
- If the test lamp lights up, fit a new oil pressure switch.
- Start the engine.

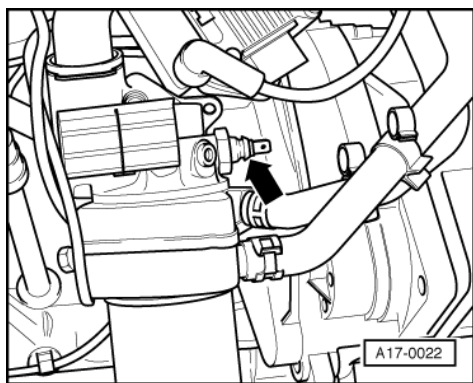
Note:

The switching point of the oil pressure switch can be reached when the engine is cranked on the starter motor, so watch the tester and the test lamp while starting the engine.

Black oil pressure switch:

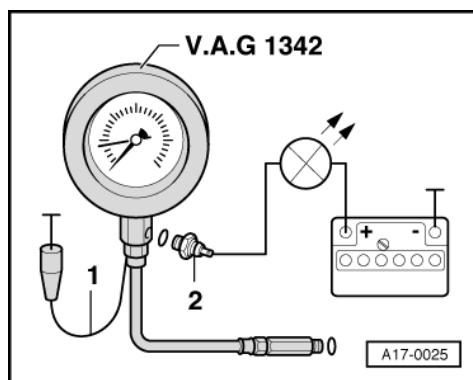
... for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- Test lamp should light up at 1.2...1.6 bar.
- If the test lamp does not light up, fit a new oil pressure switch.



Testing oil pressure

- -> Disconnect wire from oil pressure switch -arrow-.



- -> Unscrew oil pressure switch and screw in oil pressure tester V.A.G 1342.
- Screw oil pressure switch -2- into V.A.G 1342.
- Start engine (engine oil temperature at least 80°C).
- Oil pressure at idling speed: at least 1.3 bar
- Oil pressure at 2000 rpm: between 3.5 and 4.5 bar

If the specifications are not obtained:

- Pressure relief valve or oil pump defective; renew oil pump => Page 173 .

1.7 - Engine oil

Viscosity grades and oil specifications

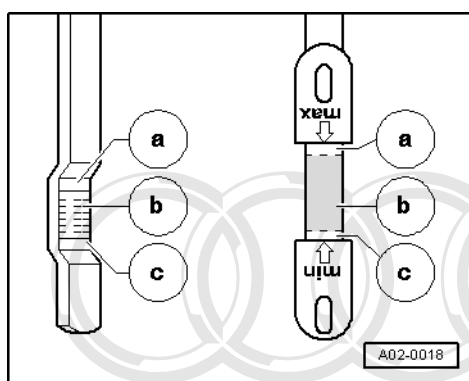
Viscosity grades and oil specifications:

=> Maintenance booklet

1.8 - Checking oil level

Requirements for test:

- Engine oil temperature at least 60 °C
 - Vehicle must be level (horizontal)
 - After switching off the engine, wait a few minutes to allow the oil to flow back into the sump.
- 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 - Do not top up oil.
- b - Oil can be topped up. The oil level may rise as far as area -a- after topping up.
- c - Oil must be topped up. It is sufficient if the oil level is somewhere in area -b- (grooved area on dipstick) after topping up.

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability

Note: respect to the correctness of information in this document. Copyright by AUDI AG.

The oil level must not be above marking -a- on the dipstick.



19 - Cooling system

1 - Removing and installing parts of cooling system

1.1 - Removing and installing parts of cooling system

Warning!

Hot steam or hot coolant can escape when the cap on the expansion tank is opened. Cover the cap with a cloth, and open it carefully.

Notes:

- ♦ When the engine is warm the cooling system is under pressure. If necessary release pressure before commencing repair work.
- ♦ Secure all hose connections with the correct hose clips (same as original equipment)

=> Parts catalogue

- ♦ V.A.G 1921 or VAS 5024 A hose clip pliers are recommended when installing spring-type clips.
- ♦ Renew seals and gaskets.
- ♦ The arrow markings on the coolant pipes and on the ends of the hoses must be aligned with each other.

1.2 - Parts of cooling system

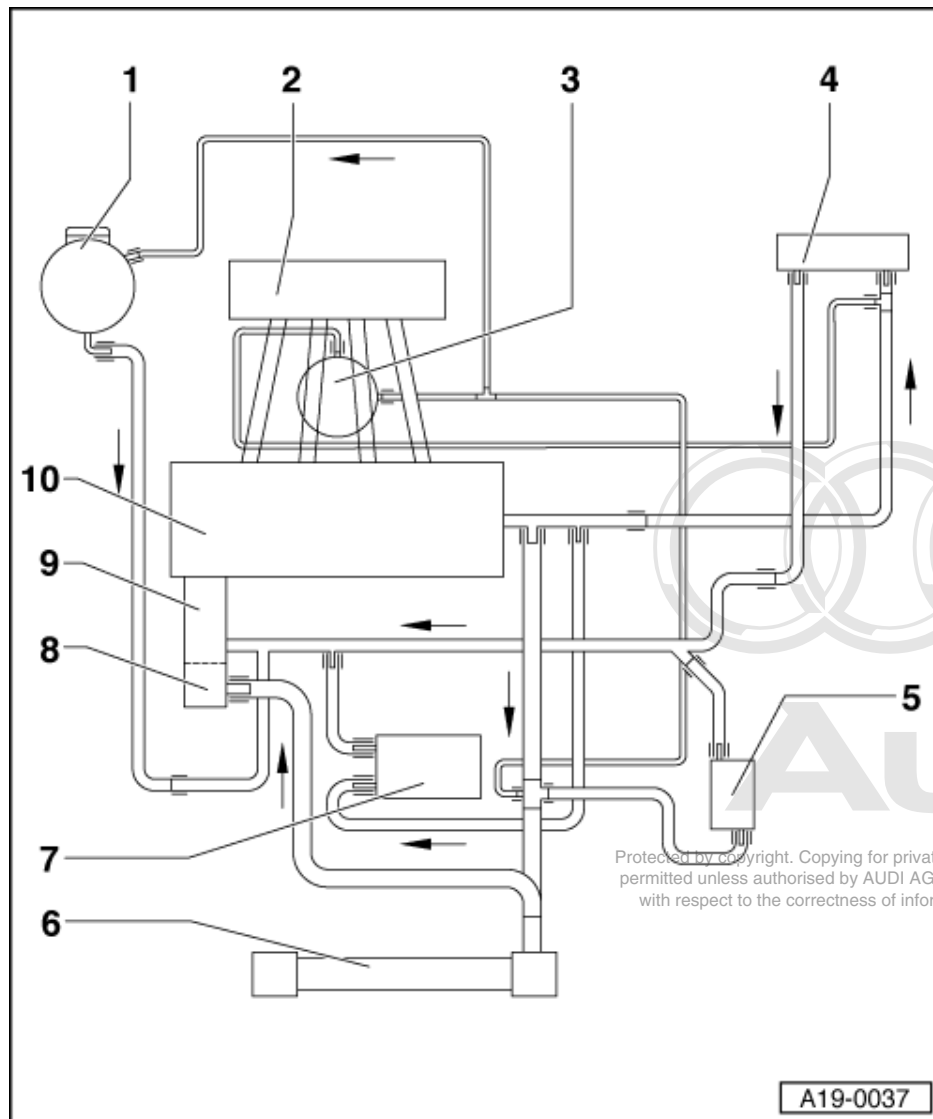
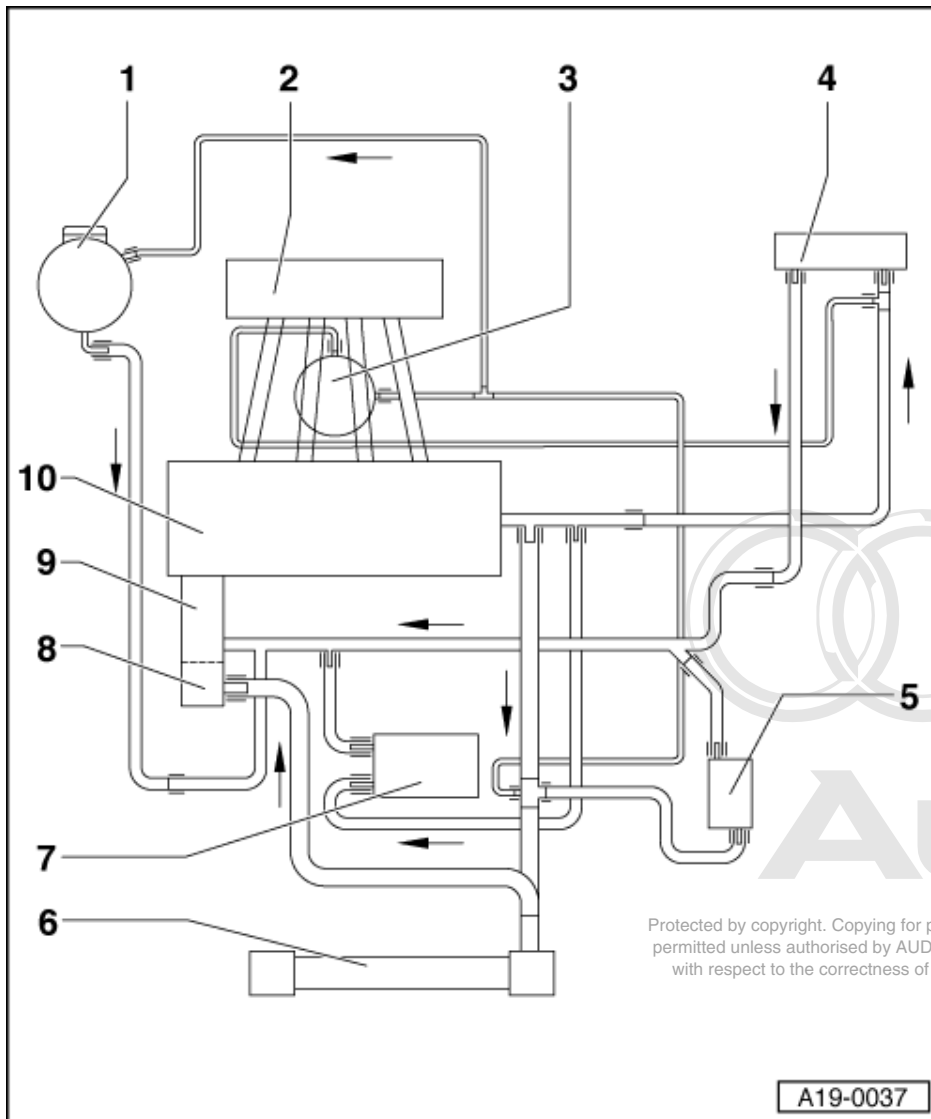


Diagram of coolant hose connections

- 1 Expansion tank
 - ♦ With filler cap
 - ♦ Testing pressure relief valve in filler cap => Page 195
- 2 Intake manifold
- 3 Connecting pipe on throttle valve control part
- 4 To heat exchanger
 - ♦ After replacing, fill system with fresh coolant
- 5 Gearbox ATF cooler
 - ♦ for ATF in automatic gearbox
 - ♦ For vehicles with automatic gearbox



6 Radiator

- ♦ Removing and installing
=> Page 190
- ♦ After replacing, fill system with fresh coolant

7 Oil cooler

- ♦ Removing and installing
=> Page 170 , item 18

8 Coolant thermostat

- ♦ Removing and installing
=> Page 186
- ♦ Checking => Page 187

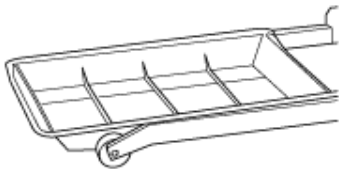
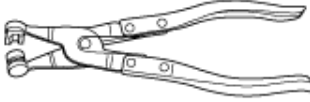
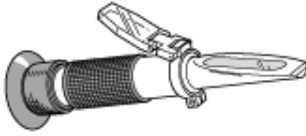
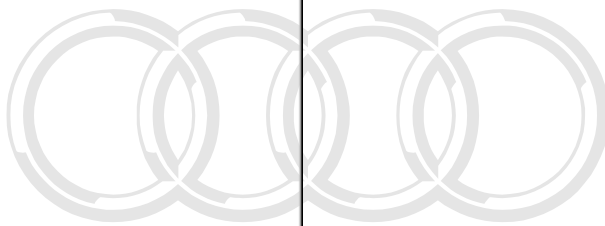
9 Coolant pump

- ♦ Removing and installing
=> Page 184
- ♦ Check for ease of movement

10 Cylinder head/cylinder block

- ♦ After replacing, fill system with fresh coolant

1.3 - Draining and filling cooling system

V.A.G 1306 	V.A.G 1921 
T10007 	
	Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG. G19-0008

Special tools and workshop equipment required

- ◆ V.A.G 1306
- ◆ V.A.G 1921
- ◆ Refractometer T10007

Draining

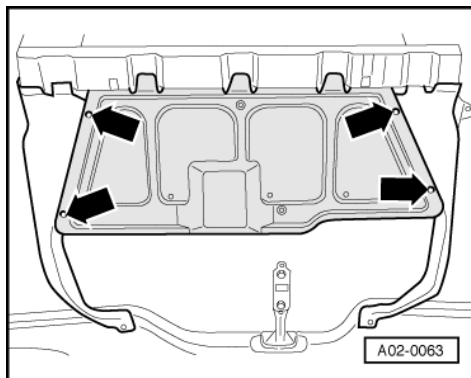
Note:

Catch drained-off coolant in a clean container for re-use or disposal.

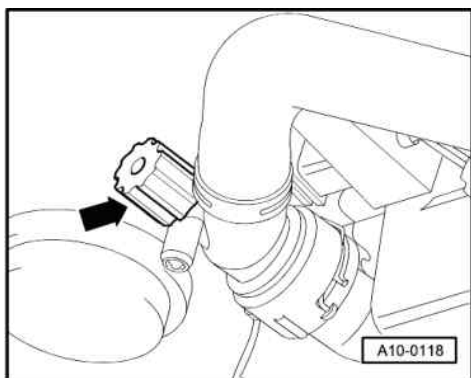
Warning!

Hot steam or hot coolant can escape when the cap on the expansion tank is opened. Cover the cap with a cloth, and open it carefully.

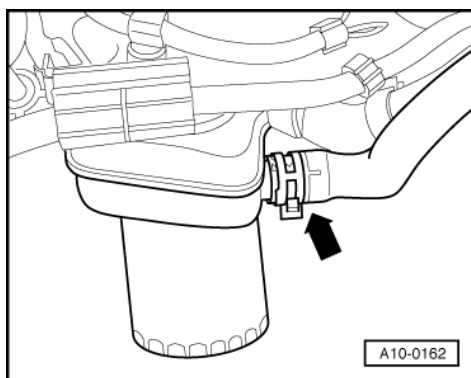
- Open cap on coolant expansion tank.



- -> Remove noise insulation centre panel -arrows-.



- Place drip tray V.A.G 1306 below engine.
- -> Turn drain screw -arrow- on radiator anti-clockwise, fit an extension hose to the connection if necessary.



- -> In addition, disconnect coolant hose at bottom of oil cooler -arrow-, and drain off remaining coolant.

Filling

Notes:

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

- ♦ The cooling system is filled all year round with a mixture of water and coolant additive (combined anti-freeze and corrosion protection agent).
- ♦ Only use coolant additive G 012 A8 D - meeting specification TL VW 774 D. Identifiable by red colour

Caution

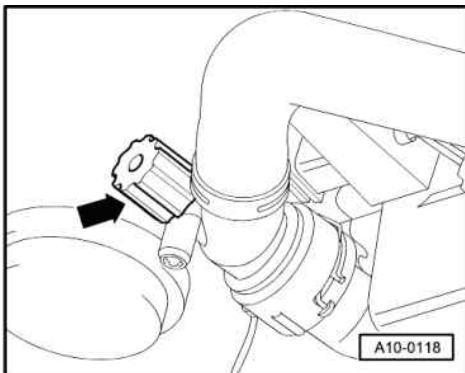
The coolant additive G 012 A8 D be mixed with any other coolant additive. This can result in serious damage to the engine.

- ♦ If the fluid in the expansion tank is brown, this means G 012 A8 D has been mixed with another type of coolant. In this case, flush out the cooling system and put in fresh coolant. To flush the system, fill it with clean water and run the engine for about 2 minutes. This should remove very nearly all of the old coolant.
- ♦ G 012 A8 D (and coolant additives marked "meeting specification TL VW 774 D") prevent frost and corrosion damage, stop scaling and at the same time raise the boiling point of the coolant. For these reasons the cooling system must be filled all year round with the correct anti-freeze and anti-corrosion additive.
- ♦ Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.
- ♦ Protection against frost must be assured down to about -25 °C (or down to about -35 °C in countries with arctic climate).
- ♦ The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The anti-freeze ratio must be at least 40 %.
- ♦ If greater frost protection is required in very cold climates, the amount of G 012 A8 D can be increased, but only up to 60 % (this gives frost protection to about -40 °C), as otherwise frost protection is reduced again and cooling effectiveness is also reduced.
- ♦ Only use clean drinking water for mixing coolant.
- ♦ If radiator, heat exchanger, cylinder head or cylinder head gasket is replaced, do not reuse old coolant.
- ♦ Special tool T10007 must be used for testing the anti-freeze concentration if the cooling system contains coolant additive G012 A8 D.

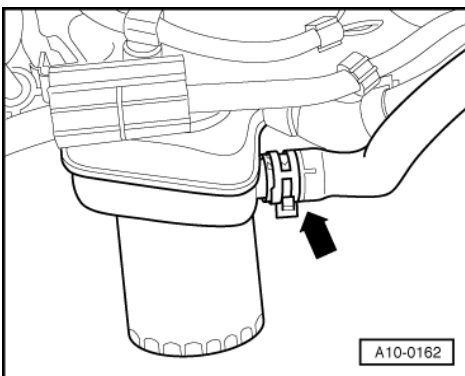
Recommended mixture ratios:

Frost protection to	Anti-freeze concentration	Quantity of G 012A8 D 1)	Quantity of water1)
-25 °C	40 %	2.0 ltr.	3.0 ltr.
-35 °C	50 %	2.5 ltr.	2.5 ltr.

- 1) Coolant quantity: 5.0 litres (may vary depending upon the vehicle equipment)



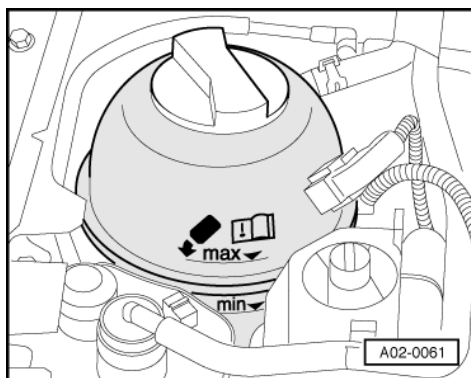
- -> Turn drain screw -arrow- on radiator clockwise.



- -> Connect coolant hose to oil cooler -arrow-.



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



- -> Top up coolant to max. mark on expansion tank.
- Start engine and run at approx. 1500 rpm for max. 2 minutes and at the same time fill with coolant up to over-flow hole on expansion tank.
- Fit expansion tank cap.
- Run engine until radiator fan cuts in.

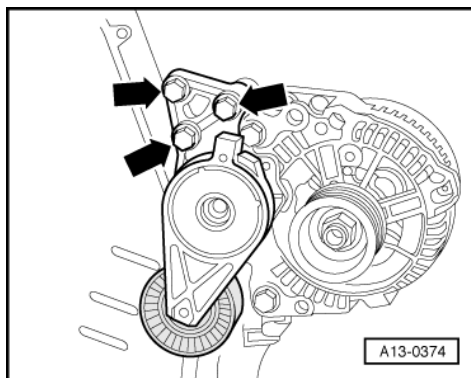
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability for the use of the information in this manual. Copyright © 2001 AUDI AG.

Warning!

Hot steam or hot coolant can escape when the cap on the expansion tank is opened. Cover the cap with a cloth, and open it carefully.

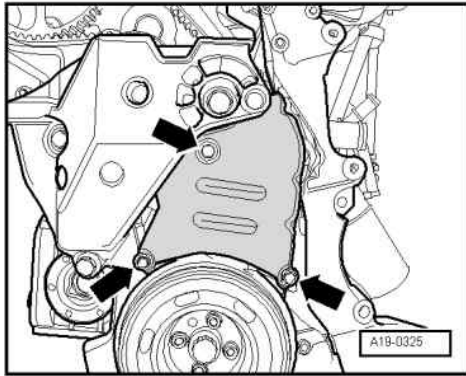
- Check coolant level and replenish as necessary. When the engine is at normal operating temperature, the coolant level must be on the max. mark, when the engine is cold, between the min. and max. marks.
- Stop engine.

1.4 - Removing and installing coolant pump



Removing

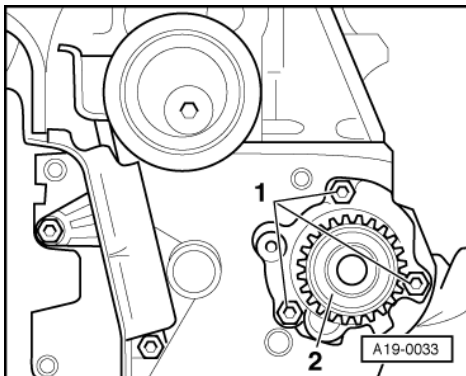
- Remove ribbed belt => Page 43 .
- Remove tensioning element for ribbed belt -arrows-.
- Drain cooling system=> Page 181 .
- Turn crankshaft to TDC position of No. 1 cylinder with engine installed => Page 62 .
- Turn crankshaft to TDC position of No. 1 cylinder with engine removed => Page 65 .
- Take toothed belt off camshaft sprocket => Page 60 .



- -> Remove centre section of toothed belt guard -arrows-.

Notes:

- ◆ The vibration damper and bottom toothed belt guard do not have to be removed.
- ◆ The toothed belt should be left in position on the crankshaft sprocket.
- ◆ Before removing the coolant pump cover the toothed belt with a rag to protect it from coolant spills.



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

- -> Unscrew coolant pump securing bolts -1- and remove coolant pump -2-.

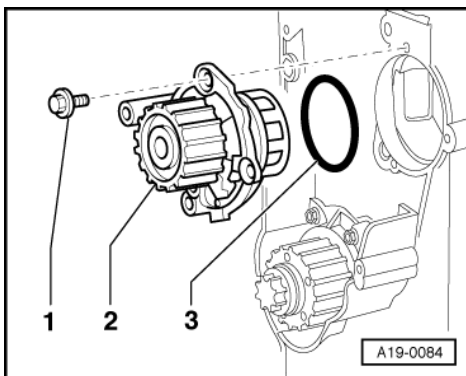
Installing

Install in reverse sequence; note the following points:

Notes:

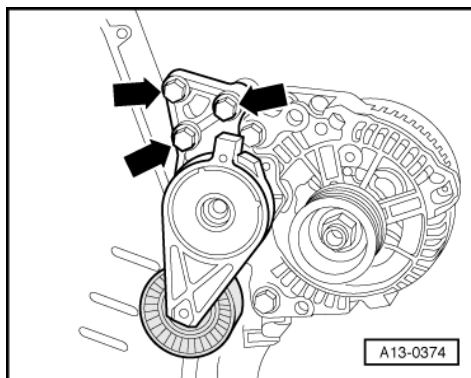
- ◆ When performing repairs, renew seals, gaskets and stretch bolts which have a specified tightening angle.
- ◆ Secure all hose connections with the correct hose clips (same as original equipment)

=> Parts catalogue





- -> Lightly coat new O-ring -3- with coolant G 012 A8 D.
- Fit coolant pump -2-.
- Installation position: sealing plug in housing faces downwards.
- Tighten bolts -1- for coolant pump to 15 Nm.
- Install toothed belt (adjust valve timing) => Page 60



- -> Install tensioning element for ribbed belt => -arrows-.
- Install ribbed belt => Page 44 .
- Fill up with coolant => Page 182 .

Tightening torques

Component	Nm
Coolant pump to cylinder block	15
Centre section of toothed belt guard to cylinder block	10 1)
Ribbed belt tensioning element to cylinder block	23

- 1) Insert with thread-locking adhesive;
thread-locker

=> Parts catalogue

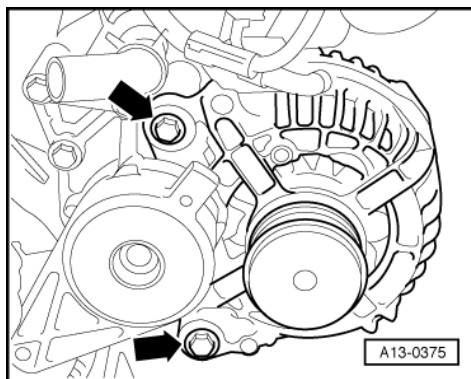
1.5 - Removing and installing coolant thermostat

Removing

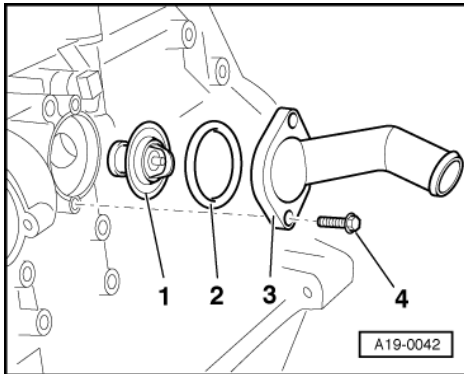
Caution!

On vehicles equipped with telematics the telematics control unit must be switched to service mode before the battery terminals are disconnected => Radio, telephone and navigation system; Repair group 91

- Obtain code on vehicles with coded radio/integrated radio and navigation system.
- With ignition switched off disconnect battery earth strap.
- Drain cooling system => Page 181
- Remove ribbed belt => Page 43 .



- -> Unscrew bolts for alternator -arrows- and lay alternator forward. The wires remain connected.



- -> Disconnect coolant hose from connection -3-.
- Unscrew bolts -4- and remove connection, O-ring -2- and coolant thermostat -1-.

Installing

Install in reverse sequence; note the following points:

Note:

Replace O-ring.

- Clean and smooth down sealing surface for O-ring as required.
- Insert coolant thermostat.
 - Installation position: cross-piece on thermostat should be vertical.
- Moisten new O ring with coolant G 012 A8 D.
- Install ribbed belt =>Page **44** .
- Fill up with coolant=> Page **182** .

Notes:

- ◆ When the battery is reconnected, re-activate electrical equipment (radio, combined radio/navigation system, clock, electric windows) as described in the Owner's Manual.
- ◆ De-activate service mode in telematics control unit.

=> Radio, telephone and navigation system; Repair group 91

- ◆ Further procedures after reconnecting the voltage supply:

=> Motronic injection and ignition system; Repair group 24

Tightening torque

Component	Nm
Connection to cylinder block	15
Alternator to auxiliary drive mounting bracket	23

For more information on the correct use of this document, please refer to the Audi AG website. In part or whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

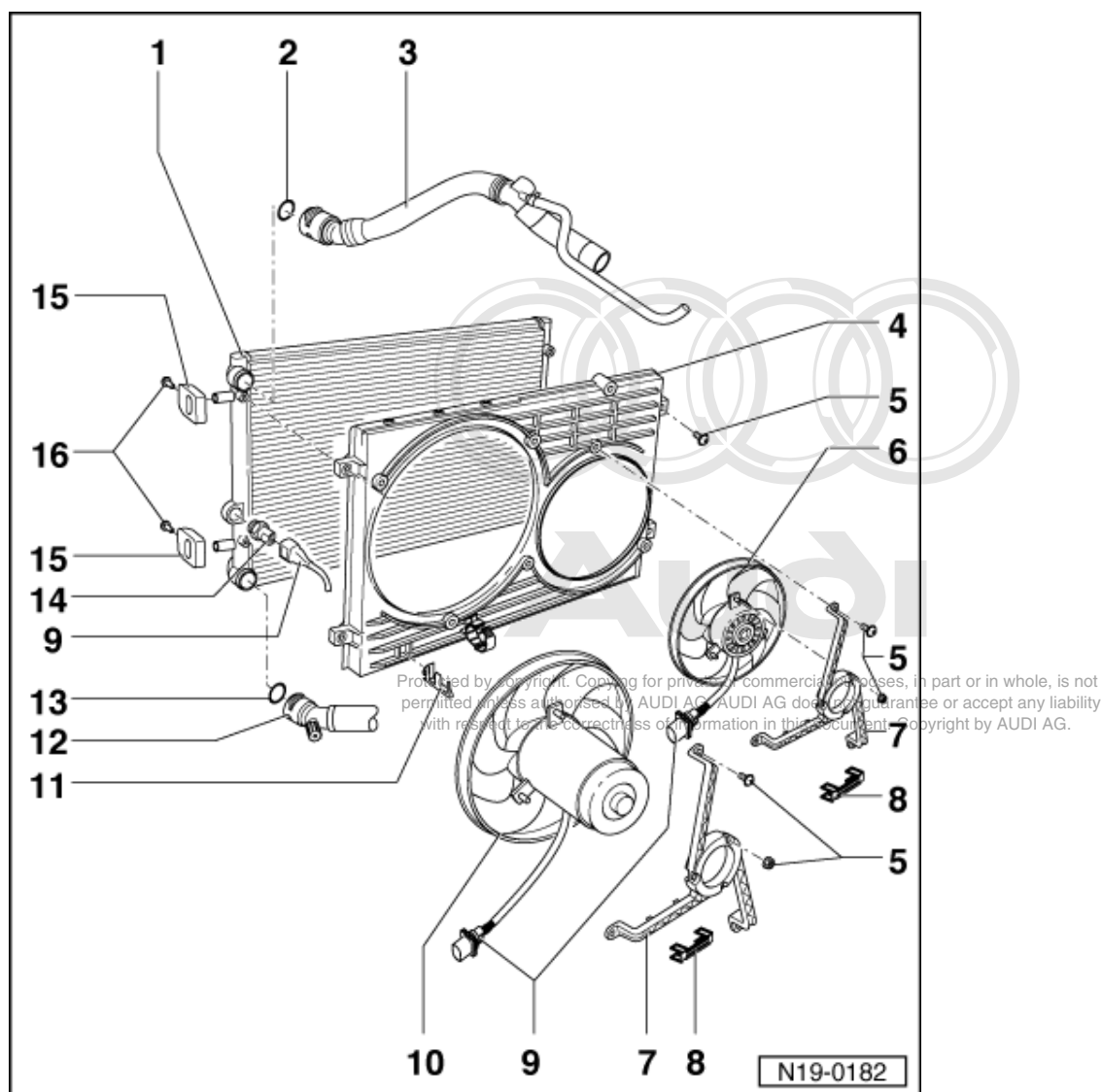
Testing coolant thermostat

- Heat thermostat in water bath.

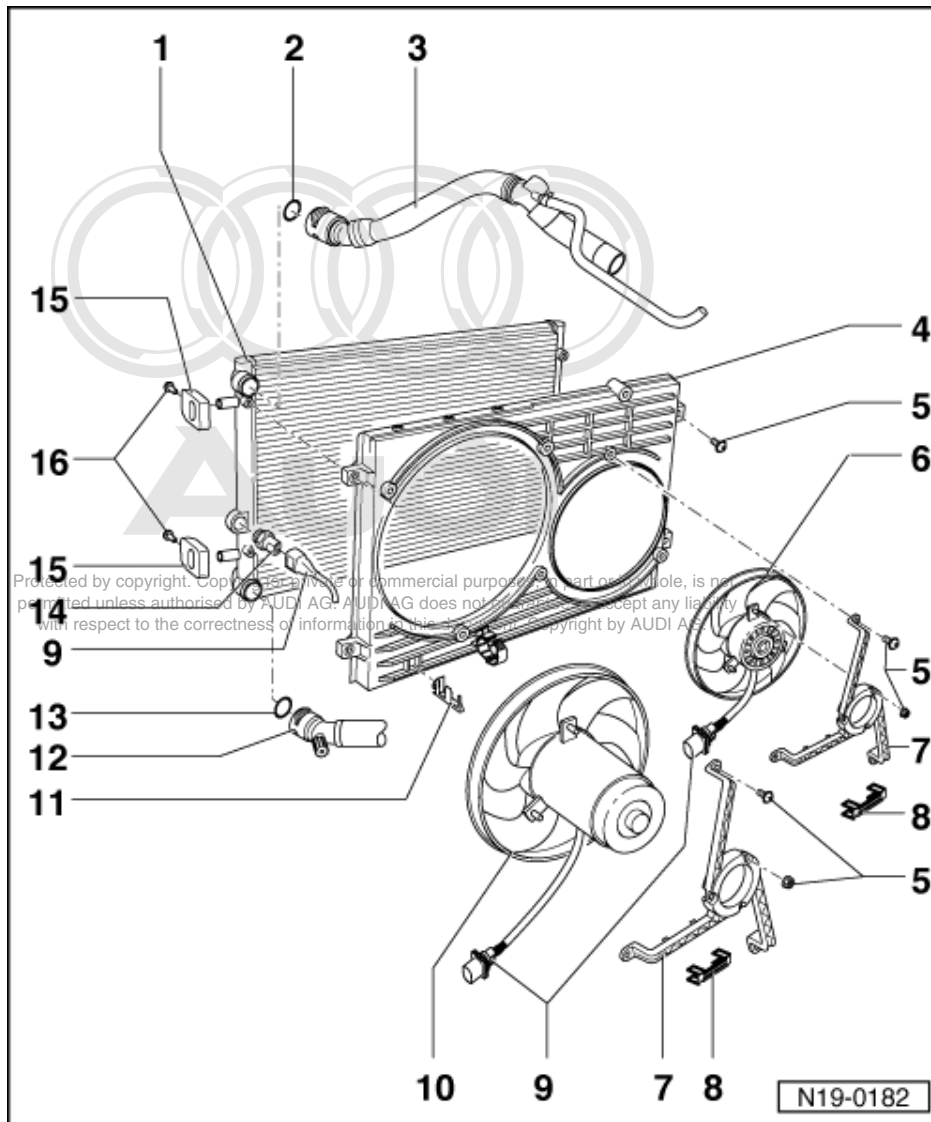
Opening temperature	Closing temperature	Travel
approx. 87°C	approx. 102°C 1)	at least 7 mm

- 1) cannot be tested

1.6 - Radiator and radiator fan - Exploded view



- 1 Radiator
 - ◆ Removing and installing
=> Page 190
 - ◆ After replacing renew entire coolant
- 2 O-ring
 - ◆ Renew
- 3 Upper coolant hose
- 4 Fan cowl
- 5 10 Nm
- 6 Additional fan
 - ◆ if equipped
- 7 Fan ring
- 8 Retaining clip
- 9 Connector



10 Radiator fan -V7

11 Bracket

- ♦ For connector

12 Lower coolant hose

- ♦ To connection for thermostat

13 O-ring

- ♦ Renew

14 Radiator fan thermo switch -F18/-F54 - 35 Nm

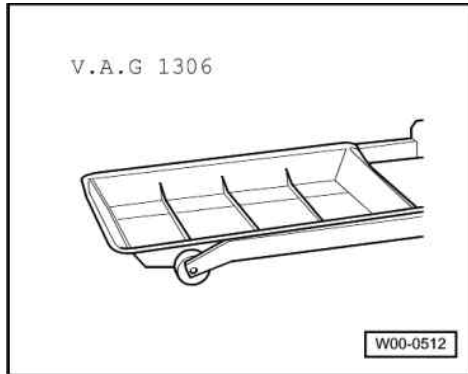
- ♦ Switching temperatures:
Stage 1
on: 92...97 °C
off: 84...91 °C
Stage 2
on: 99...105 °C
off: 91...98 °C

15 Bracket

- ♦ For radiator
- ♦ Note installation position

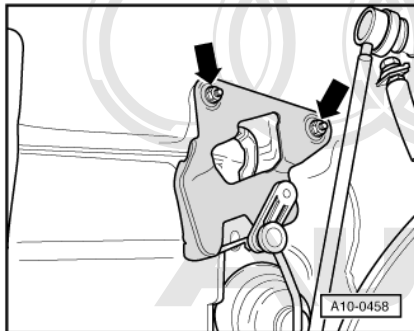
16 15 Nm

1.7 - Removing and installing radiator



Special tools and workshop equipment required

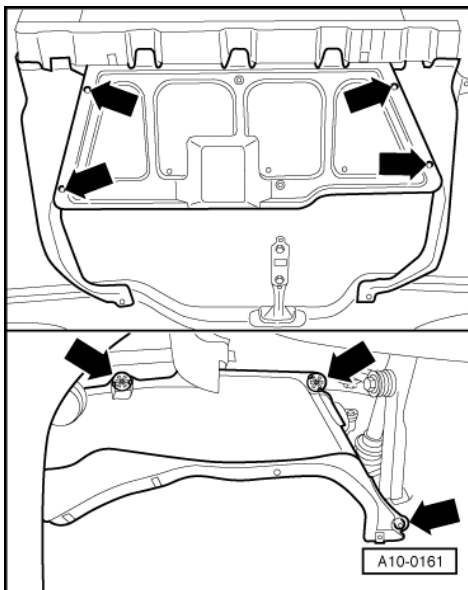
- ♦ Drip tray V.A.G 1306



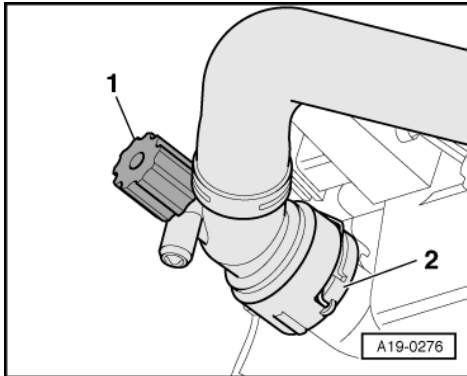
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Removing

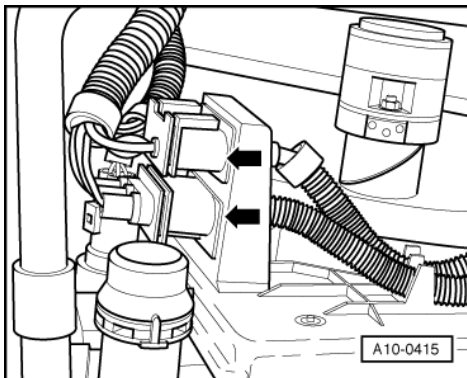
- -> On vehicles with automatic headlight range control, unbolt bracket for headlight range control at top of left wheelhousing -arrows-.



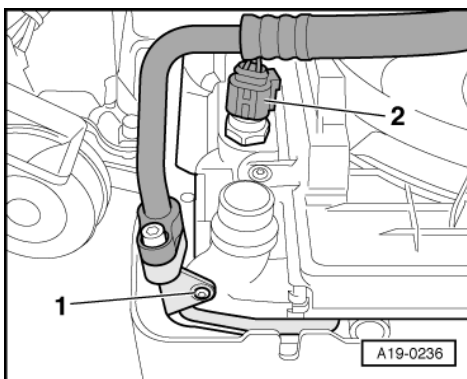
- -> Remove noise insulation in the centre and on left and right sides -arrows-.



- Place drip tray V.A.G 1306 below engine.
- -> Turn drain screw -1- on radiator anti-clockwise, if necessary fit drain hose to connection and drain coolant at radiator.
- Pull off bottom coolant hose retaining clip -2- and remove coolant hose from radiator.



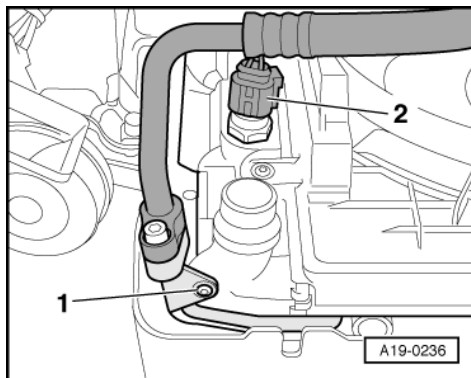
- -> Unplug the two radiator fan connectors -arrows- on the fan cowl (bottom left).



- -> Unplug connector -2- from thermoswitch -F18.



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



Vehicles with air conditioner:

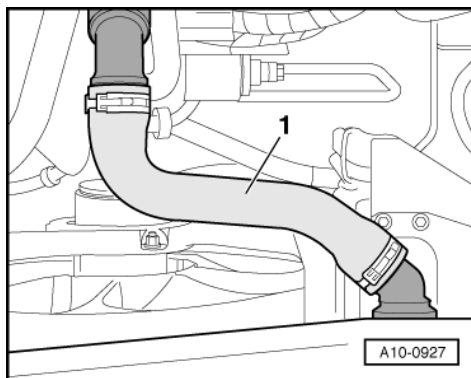
Warning!

The air conditioning system refrigerant circuit must not be opened.

Note:

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

- -> Unscrew refrigerant pipe -1- from radiator.



All models

- -> Disconnect top coolant hose -1- from radiator.
- Remove front bumper cover panel:

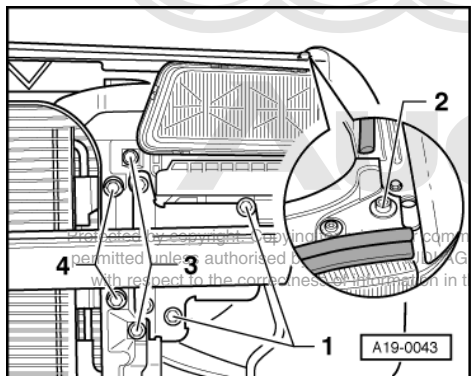
=> General body repairs, Exterior; Repair group 63; Front bumper; Removing and installing front bumper Front bumper Removing and installing front bumper

Vehicles with air conditioner:

Warning!

The air conditioning system refrigerant circuit must not be opened.

Note:

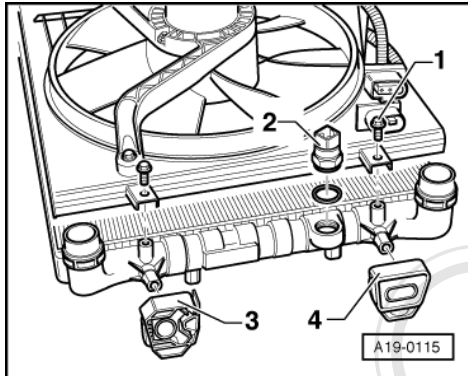


To prevent damage to the condenser and refrigerant pipes/hoses, ensure that the pipes and hoses are not stretched, kinked or bent.

- -> Remove securing bolts -4- for condenser.
- Tie condenser to lock carrier with wire.

All models

- Unscrew bolts -3- for radiator.
- Unscrew bolts -1- for lock carrier.
- Loosen bolts -2- two turns.
- Pull lock carrier carefully forward as far as possible (the help of a 2nd mechanic is required) and lower radiator and fan out of vehicle.



Installing

Install in reverse sequence; note the following points:

- -> Fit mountings -3- and -4- on radiator as illustrated.
- Fit radiator securing bolts (the help of a 2nd mechanic is required).
- Installing lock carrier with attachments:

=> General body repairs, Exterior; Repair group 50; Body, front; Removing and installing lock carrier with bolted-on parts Body, front Removing and installing lock carrier with bolted-on parts

- Install front bumper cover:

=> General body repairs, Exterior; Repair group 63; Front bumper; Removing and installing front bumper Front bumper Removing and installing front bumper

- Fill up with coolant=> Page 182 .
- Adjust headlight settings:

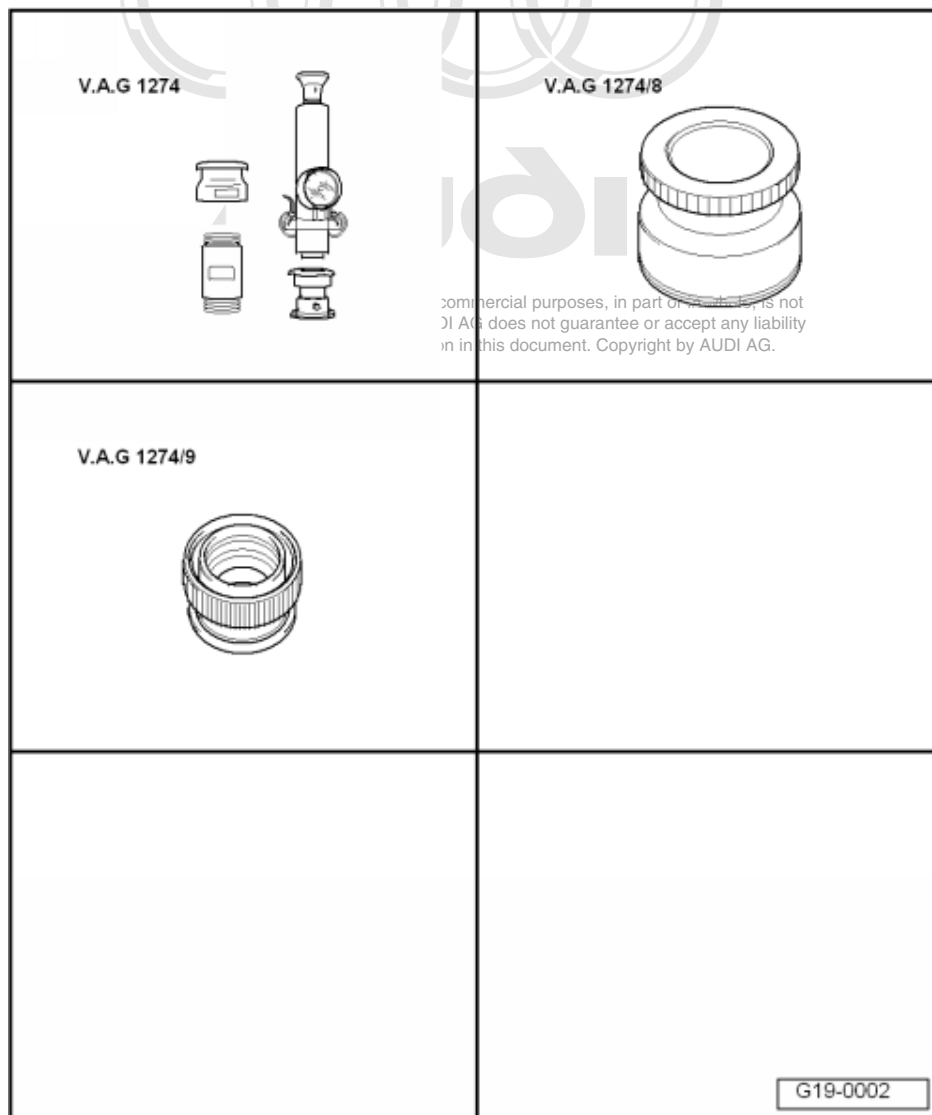
=> Electrical system; Repair group 94; Servicing headlights Servicing headlights

Tightening torques

Component	Nm
Radiator cowl to radiator	10
Thermoswitch in radiator	35
Refrigerant pipe to radiator	10
Condenser to radiator	10
Radiator to lock carrier	15



1.8 - Checking cooling system for leaks



Special tools and workshop equipment required

- ♦ V.A.G 1274
- ♦ V.A.G 1274/8
- ♦ V.A.G 1274/9

Test requirement:

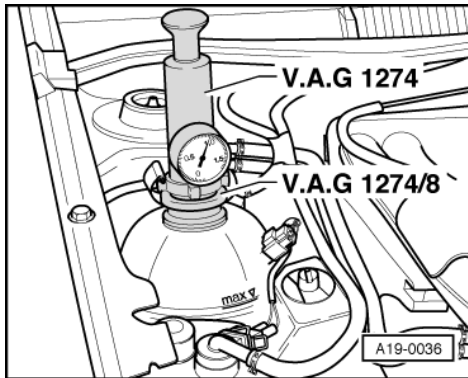
- Engine at operating temperature.

Test sequence

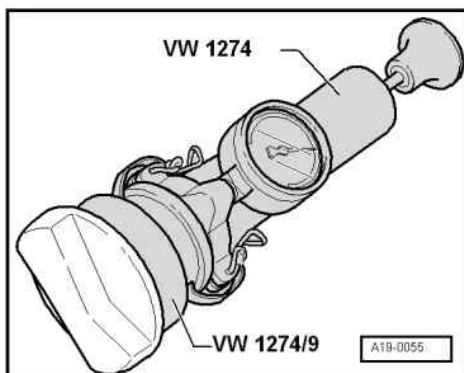
Warning!

Hot steam or hot coolant can escape when the cap on the expansion tank is opened. Cover the cap with a cloth, and open it carefully.

- Open cap on coolant expansion tank.



- -> Fit tester V.A.G 1274 with adapter V.A.G 1274/8 onto expansion tank.
- Using hand pump on tester, build up a pressure of approx. 1.0 bar.
- If pressure is not maintained, trace leak and rectify fault.



Testing pressure relief valve in filler cap.

- -> Fit tester V.A.G 1274 with adapter V.A.G 1274/9 onto filler cap.
- Operate hand pump.
- Pressure relief valve should open at 1.4 ... 1.6 bar.

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

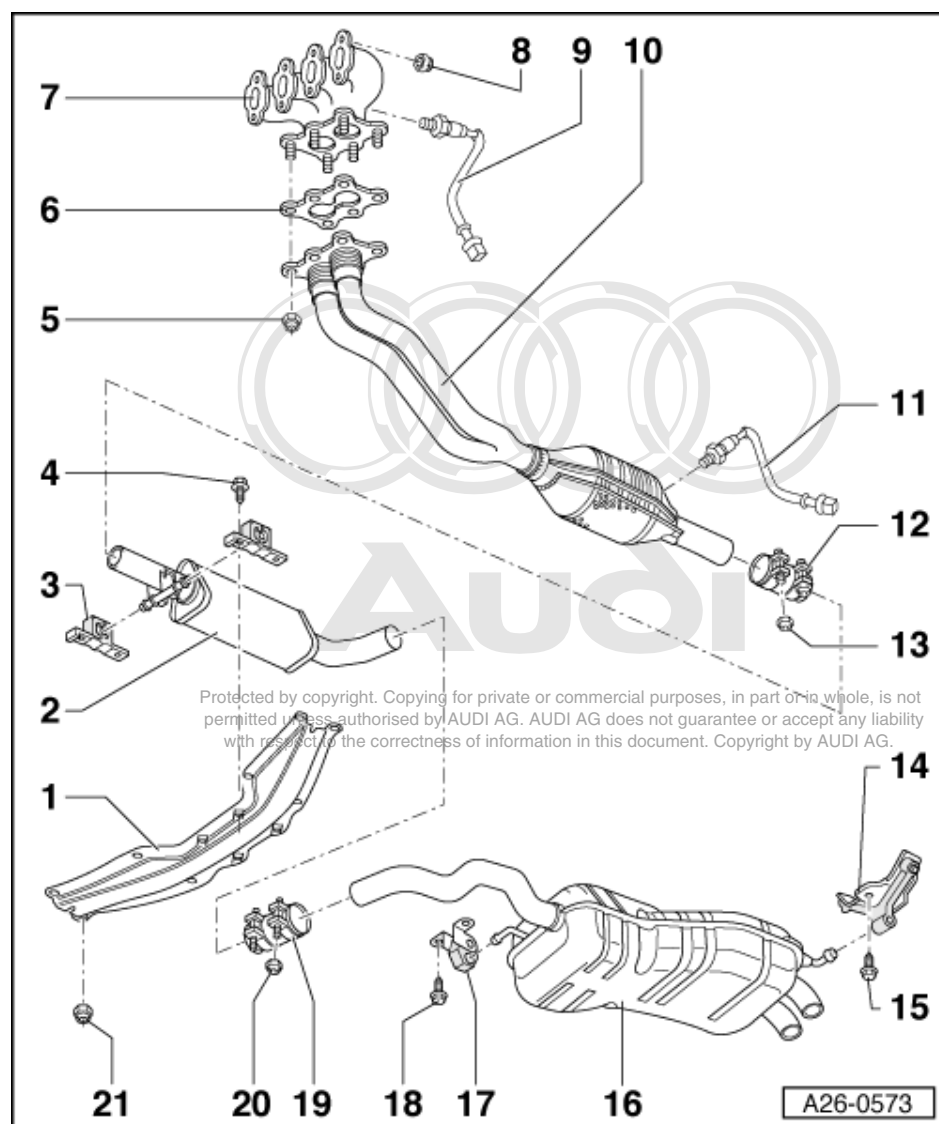
26 - Exhaust system

1 - Removing and installing parts of exhaust system

1.1 - Removing and installing parts of exhaust system

Notes:

- ♦ Always renew seals, 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 bodywork. If necessary, loosen clamp and align silencers and exhaust pipe so that sufficient clearance is maintained to the bodywork at all points and the mountings are evenly loaded.
- ♦ Slacken and tighten clamping plates for heat shields with a screwdriver.
Tightening torque: 2 Nm



1 Tunnel cross-piece

- ♦ With drilling for aligning exhaust system => Page 208

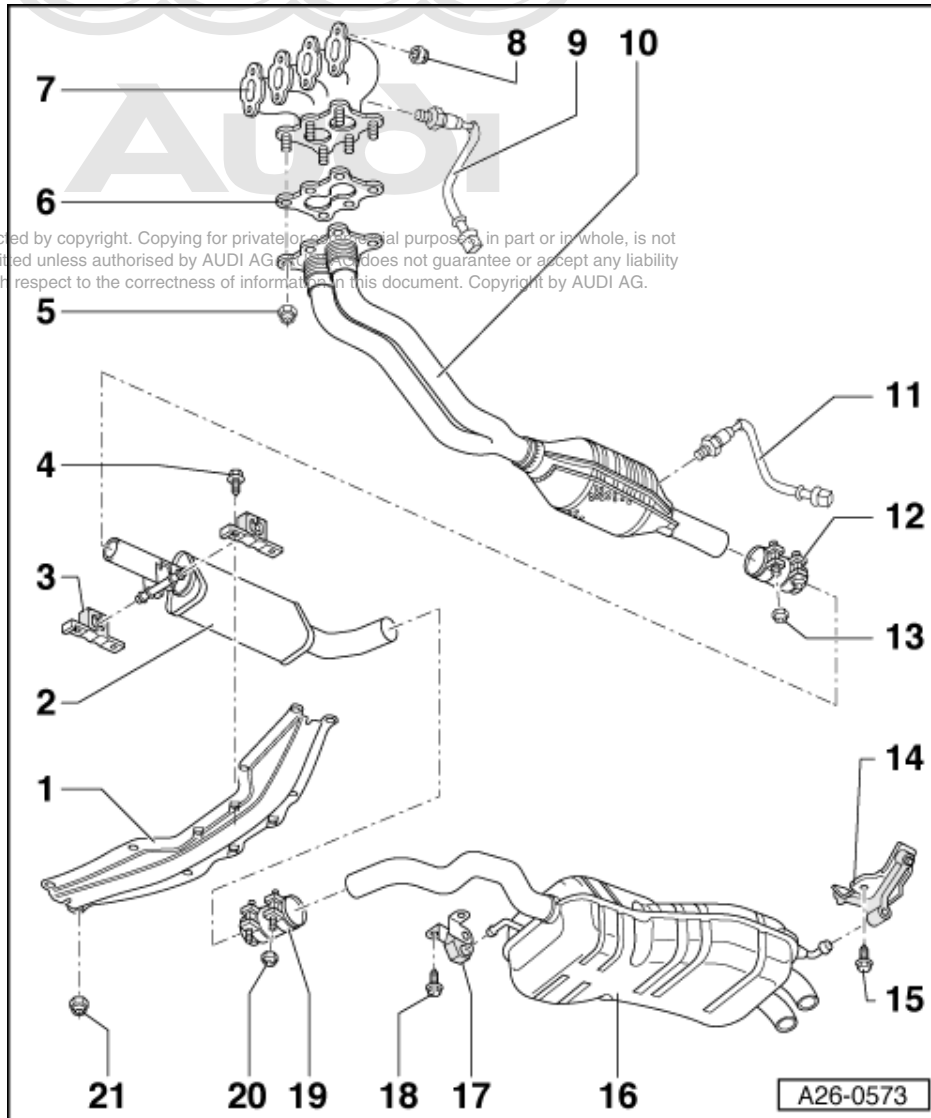
2 Centre silencer

- ♦ Centre silencer and rear silencer are one unit as original equipment, but can be renewed separately for repair purposes
- ♦ Cutting point => Page 203
- ♦ Aligning exhaust system free of stress => Page 208

3 Mounting

- ♦ Installation position => Fig. 3, Page 202
- ♦ Renew if damaged

4 23 Nm



5 40 Nm

- ♦ Renew
- ♦ Coat studs on exhaust manifold with high-temperature paste
- ♦ High-temperature paste

=> Parts List

- ♦ Note tightening order => Page 207

6 Gasket

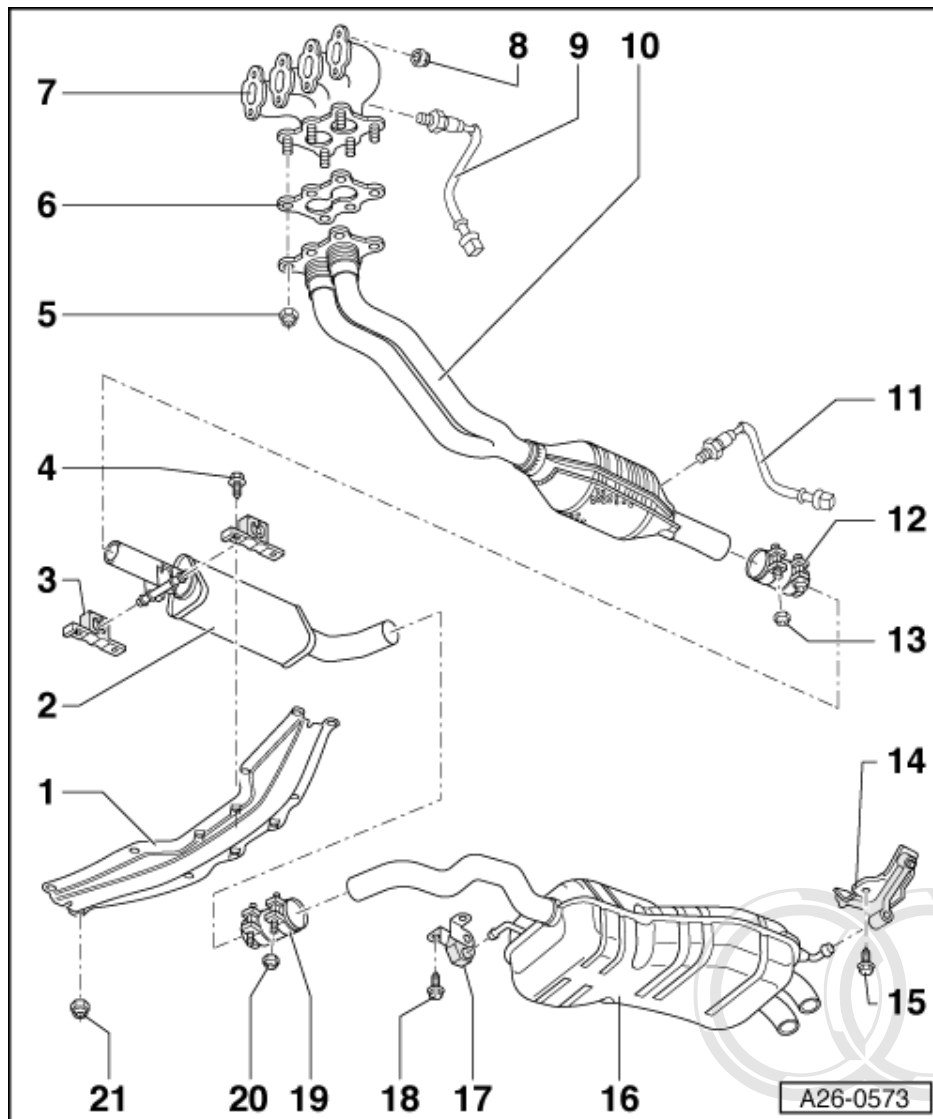
- ♦ Renew
- ♦ Installation position on vehicles with engine code letters APG:
Notch on flange of gasket points to rear (towards lambda probe)

7 Exhaust manifold

- ♦ Removing and installing



=> Page 203



8 25 Nm

9 Lambda probe - 55 Nm

- ◆ Before catalytic converter
- ◆ Grease only the threads with high-temperature lubricant. Lubricant must not get into the slots on the probe body.
- ◆ High-temperature lubricant

=> Parts List

- ◆ Checking:

=> Motronic injection and ignition system; Repair group 24

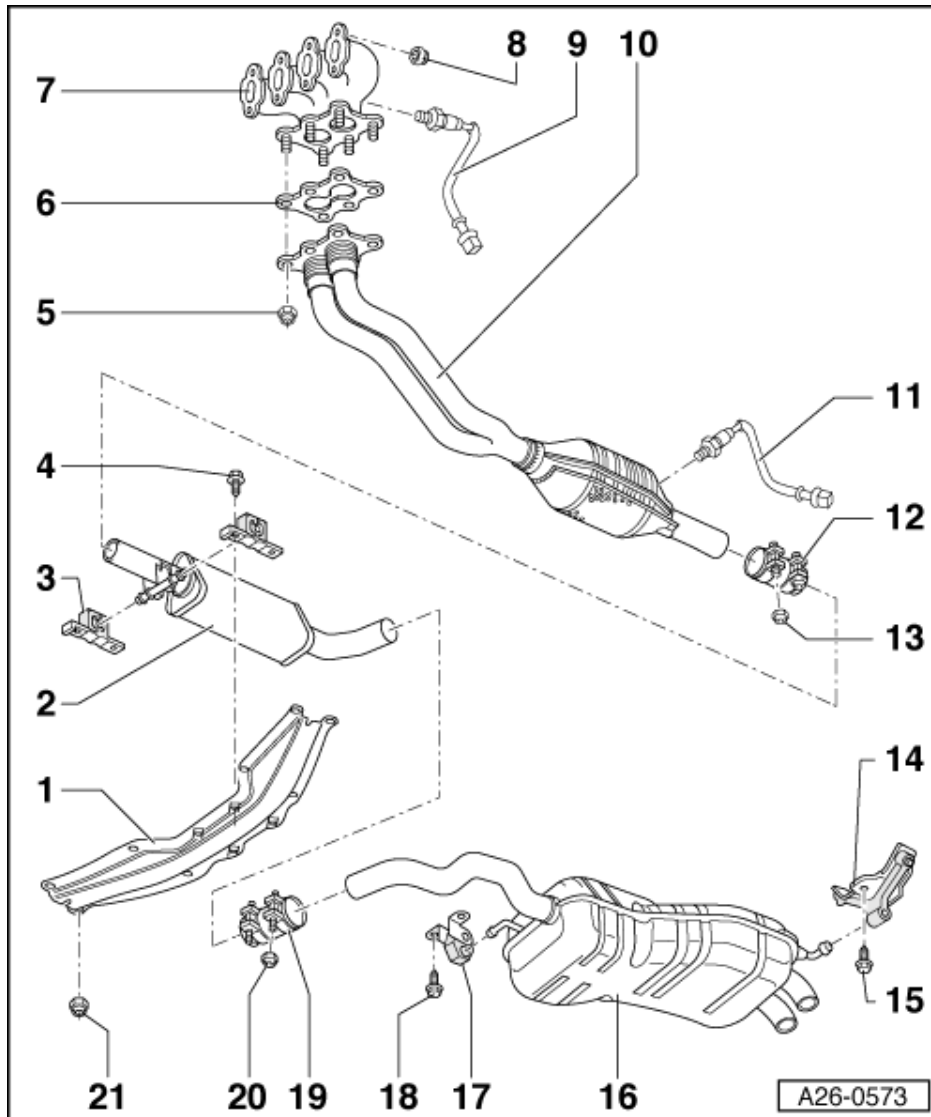
- ◆ Lambda probe connector located under a protective cover
=> Page 205

10 Front exhaust pipe

- ◆ With catalytic converter
- ◆ Protect from damage by knocks and impact
- ◆ Removing and installing
=> Page 205

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

- ♦ Aligning exhaust system free of stress => Page 208



11 Lambda probe - 55 Nm

- ♦ After catalytic converter
- ♦ Grease only the threads with high-temperature lubricant. Lubricant must not get into the slots on the probe body.
- ♦ High-temperature lubricant

=> Parts List

- ♦ Checking:

=> Motronic injection and ignition system; Repair group 24

- ♦ Lambda probe connector located under a protective cover
=> Page 205

12 Front clamp

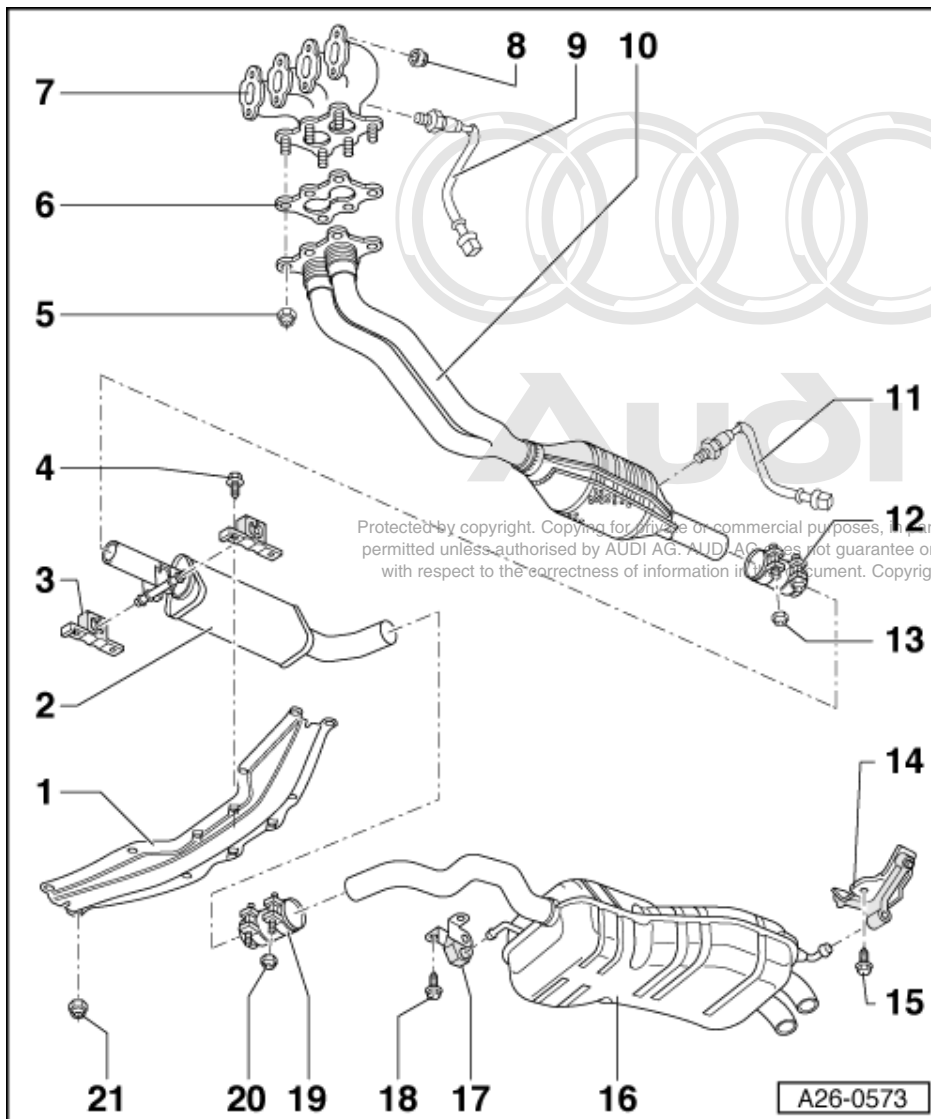
- ♦ Align exhaust system so it is free of stress before tightening clamp => Page 208 .
- ♦ Installation position => Fig 201
- ♦ Tighten bolted connections evenly.

13 40 Nm

14 Mounting



- ♦ Renew if damaged



15 23 Nm

16 Rear silencer

- ♦ Rear silencer and centre silencer are one unit as original equipment, but can be renewed separately for repair purposes
- ♦ Cutting point => Page 203
- ♦ Aligning exhaust system free of stress => Page 208

17 Mounting

- ♦ Renew if damaged

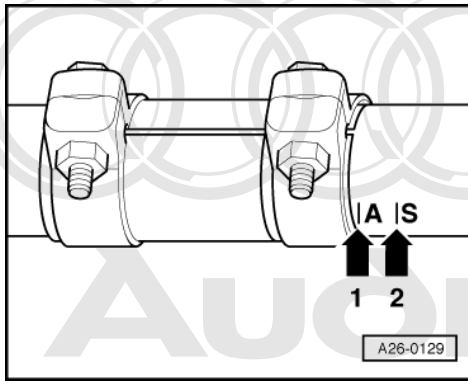
18 23 Nm

19 Rear clamp

- ♦ For separate replacement of centre and rear silencers
- ♦ Installation position
=> Fig. 201
- ♦ Tighten bolted connections evenly.

20 40 Nm

21 23 Nm



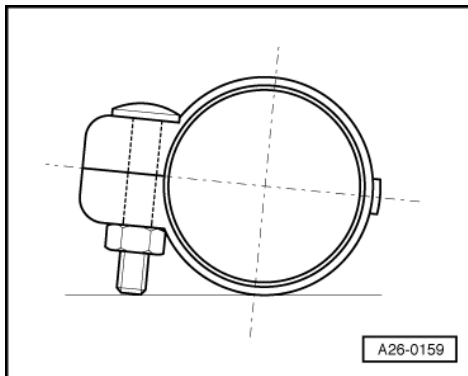
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted without the prior written consent of AUDI AG. AUDI AG does not accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

-> Fig.1 Installation position of front clamp

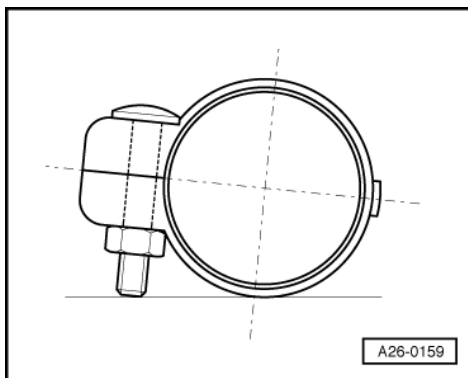
- Position clamp about 5 mm away from the respective marking line "A" -arrow 1- and tighten to 40 Nm.

Note:

Disregard mark "S" -arrow 2-.

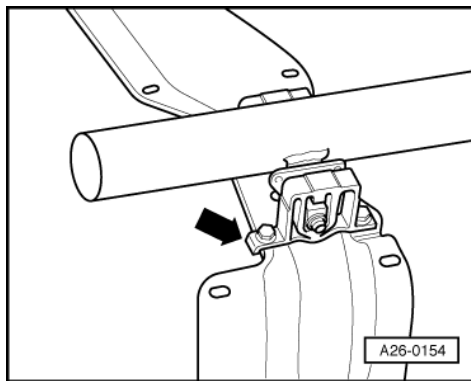


- -> Fit clamp so that end of bolt does not project beyond lower part of clamp circumference.
- Bolted connection on left



-> Fig.2 Installation position of rear clamp

- Install clamp so that ends of bolts are not below bottom circumference of clamp.
- Bolted connection points forward

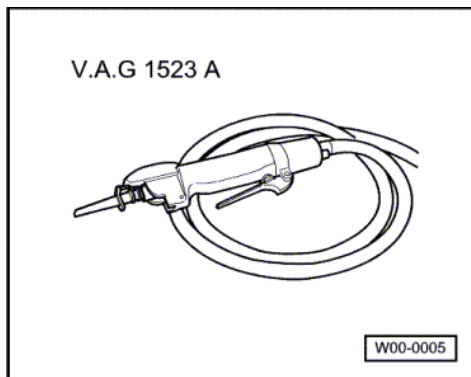


→ Fig.3 Installation position of mounting

Angled end of base of mounting -arrow- faces in direction of travel.

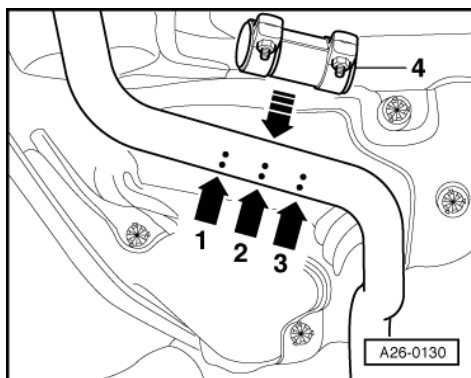
1.2 - Separating centre and rear silencers

- ♦ The connecting pipe can be cut through at the point marked in order to renew the centre and rear silencers separately.
- ♦ The cutting point is marked with an indentation on the outside of the exhaust pipe.



Special tools and workshop equipment required

- ♦ Body repair saw V.A.G 1523 A
- ♦ Protective goggles

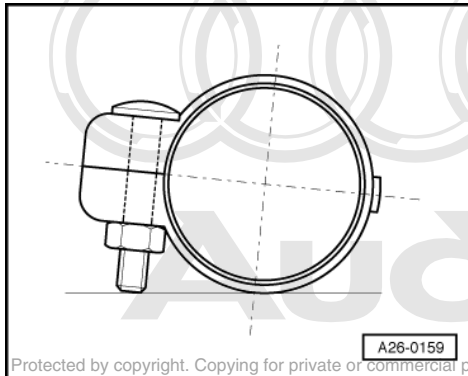


Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Work sequence

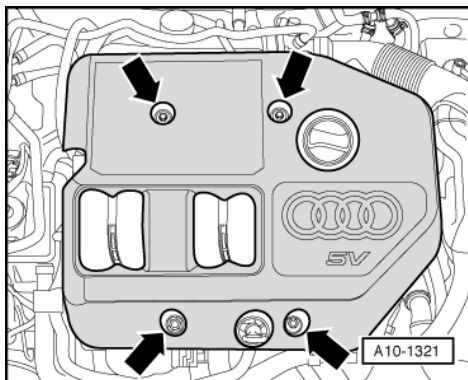
Warning!
Wear eye protection

- ➔ Cut through exhaust pipe at right angles at -arrow 2- with pneumatic jigsaw (e.g. V.A.G 1523 A).
- Position clamp -4- between side markings -arrows 1 and 3- when installing.



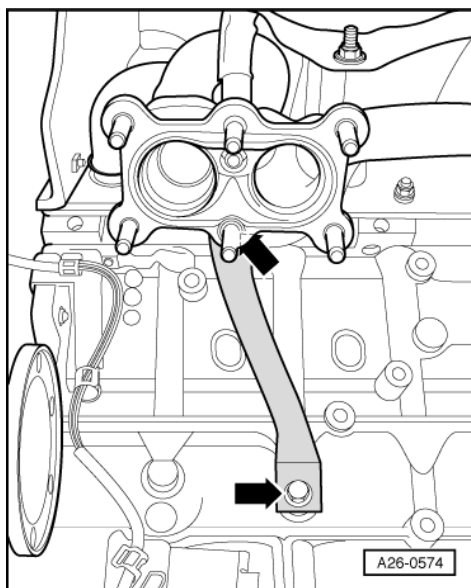
- Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by Audi AG. Audi AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by V.A.G AG.
- ➔ **Fit clamp so that end of bolt does not project beyond lower part of clamp circumference.**
 - Bolted connection points forward
 - Aligning exhaust system free of stress =>
Page **208**.

1.3 - Removing and installing exhaust manifold

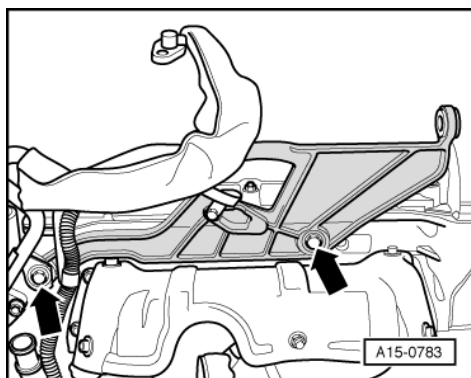


Removing

- ➔ Remove engine cover panel -arrows-.
- Remove front exhaust pipe with catalytic converter => Page **205**.



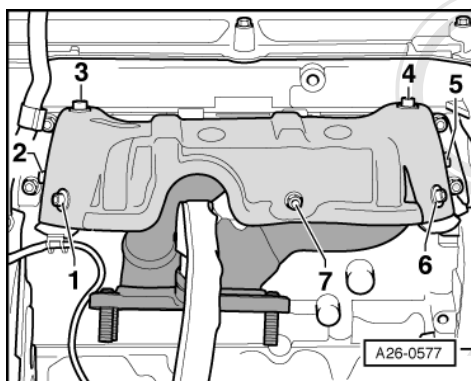
- -> Remove support for exhaust manifold -arrows-.



- Remove upper section of intake manifold => Page 108 .
- -> Remove support for upper section of intake manifold -arrows-.

Note:

Shown in illustration with engine removed.

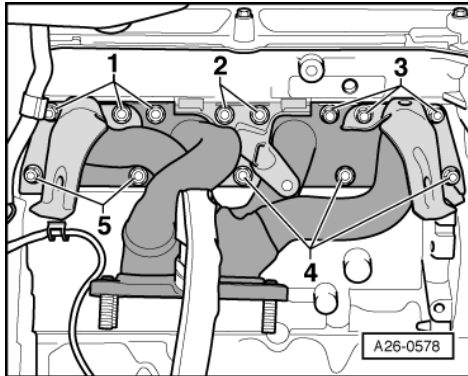


- -> Unscrew bolts -1 ... 7- and remove heat shield.

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

Note:

Shown in illustration with engine removed.



- -> Remove all nuts -arrows- on exhaust manifold (nuts can be reached from above).
- Remove bracket for heat shield and exhaust manifold.

Note:

Shown in illustration with engine removed.

Installing

Install in reverse sequence; note the following points:

Note:

Install new gaskets and self-locking nuts.

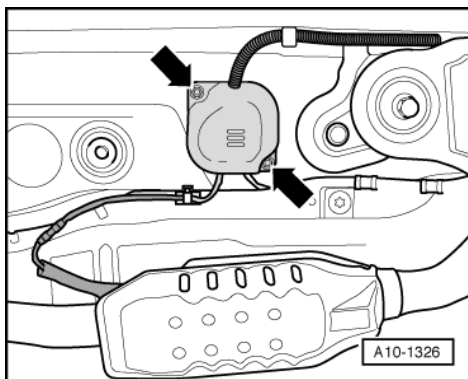
- Install upper section of intake manifold => Page 111 .
- Install front exhaust pipe => Page 207 .
- Aligning exhaust system free of stress => Page 208 .

Tightening torques

Component	Nm
Exhaust manifold to cylinder head	25
Heat shield to bracket M6	10
M8	23
Support for upper section of intake manifold to cylinder head	22
Bracket for exhaust manifold to exhaust manifold	25
Exhaust manifold bracket to cylinder block	25

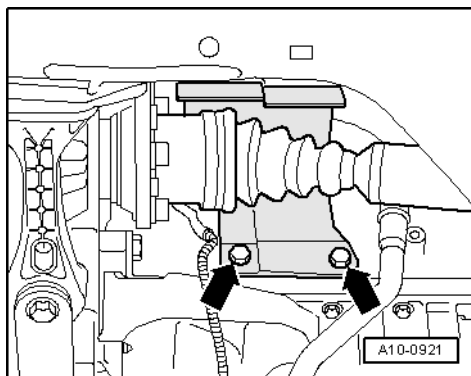
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

1.4 - Removing and installing front exhaust pipe with catalytic converter

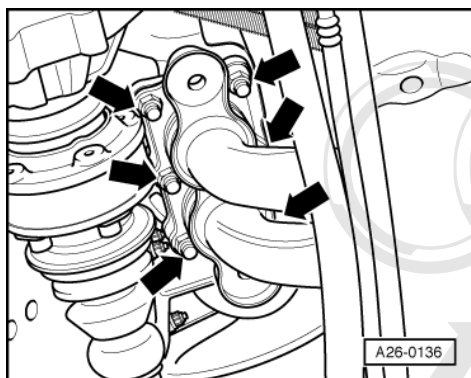


Removing

- -> Unbolt connector cover -1- (-arrows-).
- Unplug electrical connectors and move clear wiring for lambda probes.



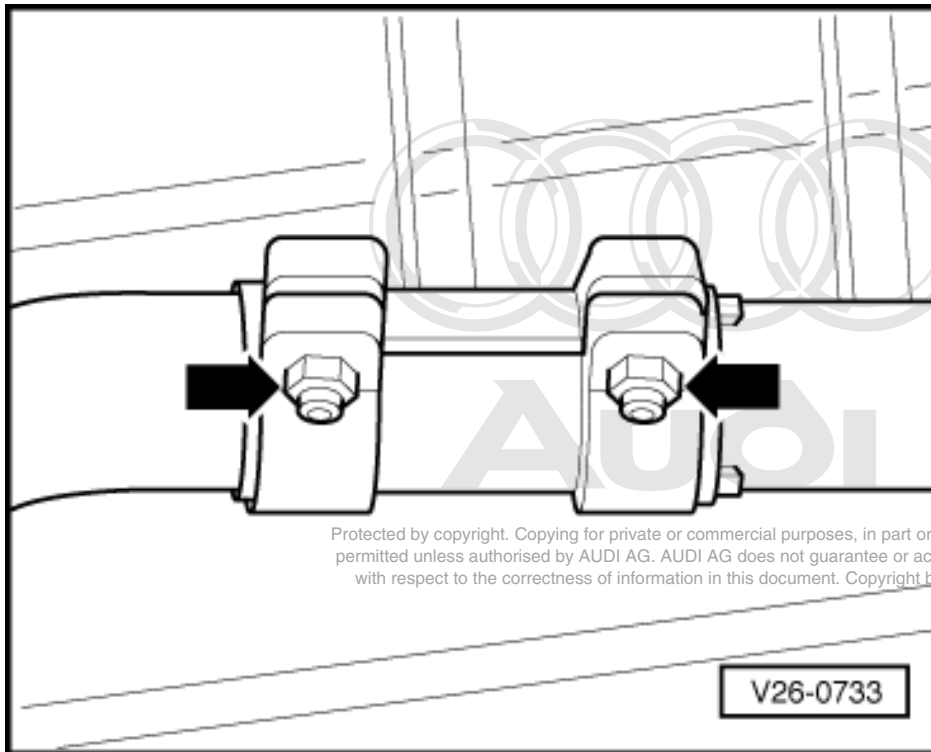
- -> Remove heat shield for right drive shaft -arrows-.



Note:

The flexible pipe connection (de-coupling element) on the front exhaust pipe must not be bent more than 10 ° - otherwise it can be damaged.

- -> Unscrew retaining nuts -arrows- for front exhaust pipe/exhaust manifold.



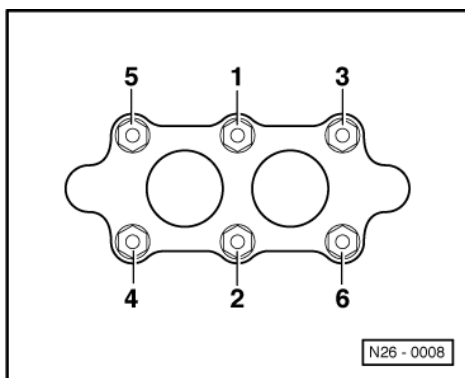
- -> Slacken clamp -arrows- on exhaust system and disconnect exhaust pipe.
- Pivot front exhaust pipe 180° and detach.

Installing

Install in reverse sequence; note the following points:

Notes:

- ♦ Always renew seals, gaskets and self-locking nuts.
- ♦ On vehicles with engine code letters APG, note the installation position of the gasket between exhaust manifold and front exhaust pipe: the notch on gasket flange points to rear (towards lambda probe)



- -> Tighten nuts securing front exhaust pipe to exhaust manifold in sequence shown in illustration.
- Aligning exhaust system free of stress => Page 208 .

Tightening torque

Component	Nm
-----------	----

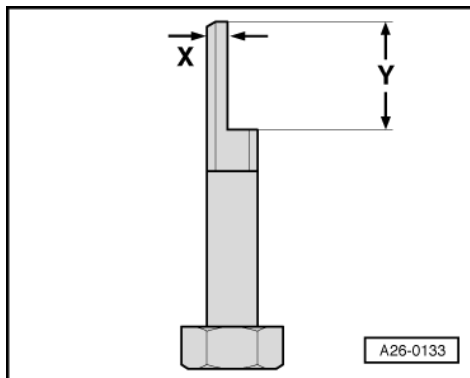
Front exhaust pipe to exhaust manifold	40 1)
--	-------

- 1) Coat studs on exhaust manifold with high-temperature paste;
for high temperature paste refer to:

=> Parts catalogue

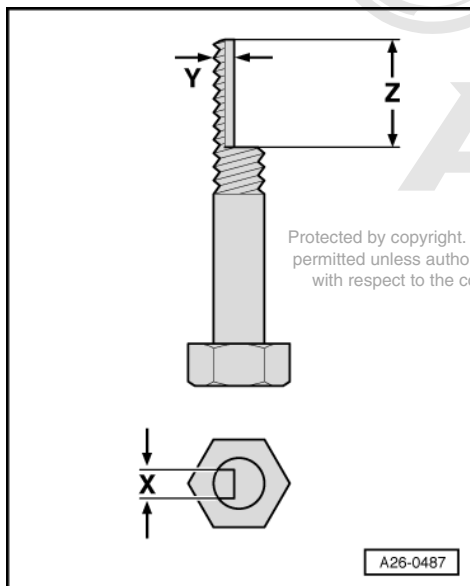
1.5 - Stress-free alignment of exhaust system

- Depending on vehicle version, a special tool, consisting of an M10 or M14 bolt, must be made up for proper alignment of exhaust system.
- The exhaust system must be aligned when cold.



Vehicles with 10.5 mm dia. hole in rear tunnel cross-piece:

- > As a tool for aligning the exhaust system, modify an M10 bolt according to the dimensions given.
- Dimension X = 4 mm
- Dimension Y = 25 mm

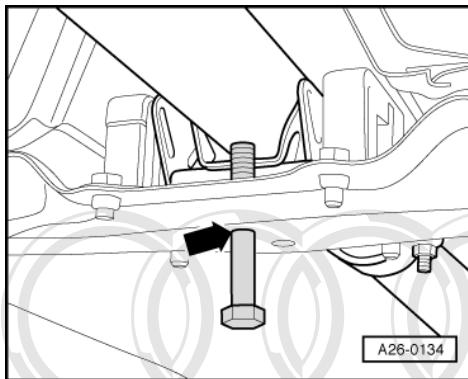


Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Vehicles with 14.5 mm dia. hole in rear tunnel cross-piece

- > As a tool for aligning the exhaust system, modify a M14 bolt according to the dimensions given.
- Dimension X = 10 mm
- Dimension Y = 6 mm

- Dimension Z = 25 mm



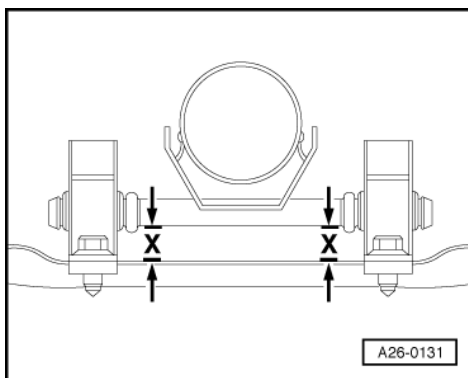
All models

- Slacken bolted connections on front clamp -Item 199 .
- -> Insert modified bolt (aligning tool) through rear drilling -arrow- in tunnel cross-piece, with flat part of bolt facing towards mounting pin on exhaust system.

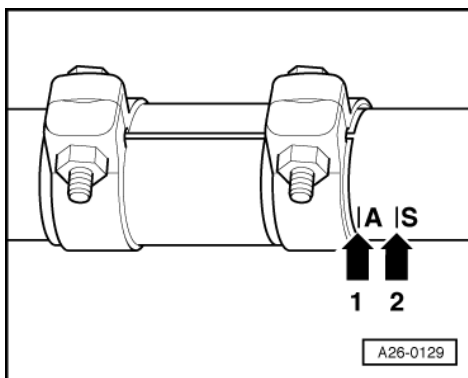
Note:

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

With bolt inserted, exhaust system is pre-tensioned in the direction of travel.



- Align front and rear silencers horizontally:
 - -> Mounting pin on exhaust pipe must be parallel to tunnel cross-piece (dimension x must be the same on left and right).



- -> Position clamp horizontally approx. 5 mm away from line marked "A" -arrow 1-.



Note:

Disregard mark "S" -arrow 2-

- ♦ Installation position of clamp =>Fig., Page 201
- Align rear silencer so it is horizontal.
- Tighten bolted connections on clamp evenly to 40 Nm.

1.6 - Checking exhaust system for leaks

- Start engine and run at idling speed.
- Plug tailpipes (e.g. with rags or stoppers) until check is completed.
- Listen for noise at the connection points (cylinder head/manifold, manifold/front exhaust pipe etc.) to determine whether there are any leaks.
- Rectify any leaks that are found.

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

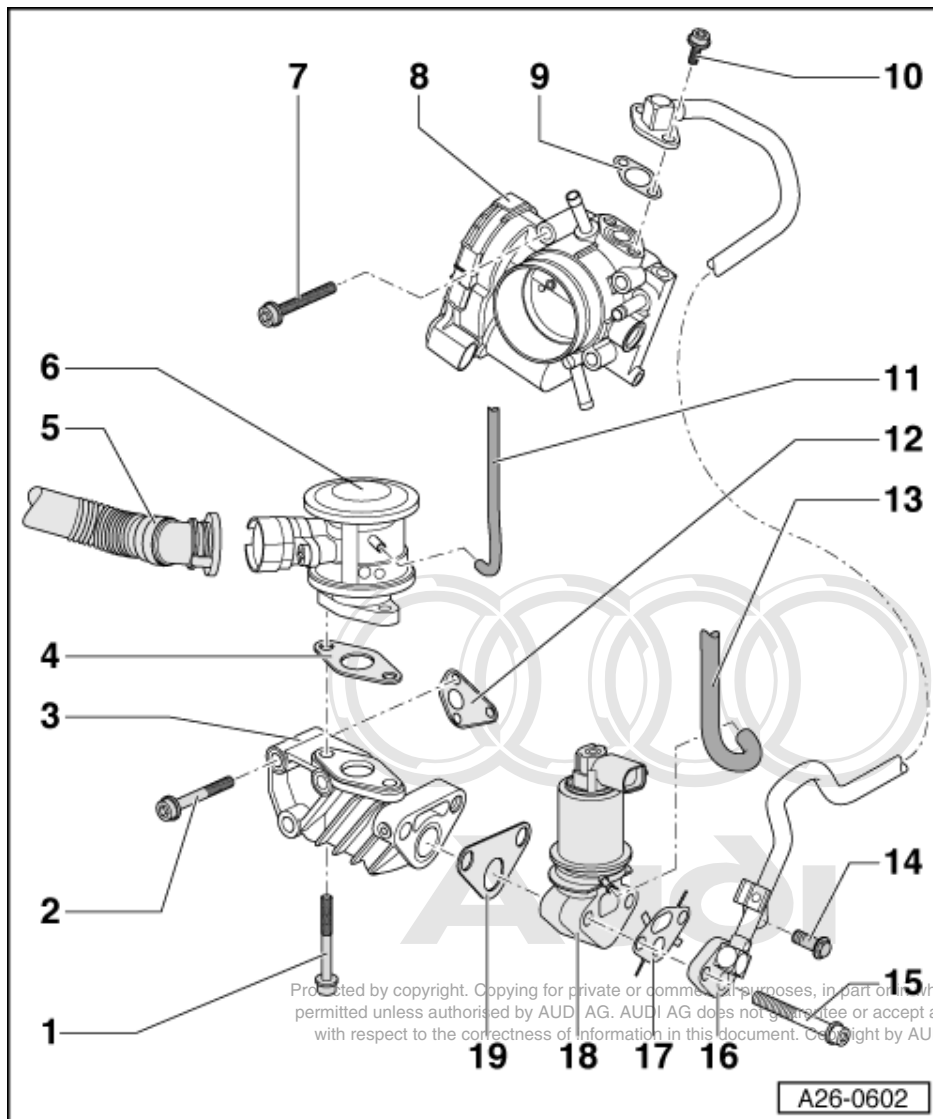
2 - Exhaust gas recirculation system - vehicles with engine letter code APG

2.1 - Exhaust gas recirculation system - vehicles with engine letter code APG

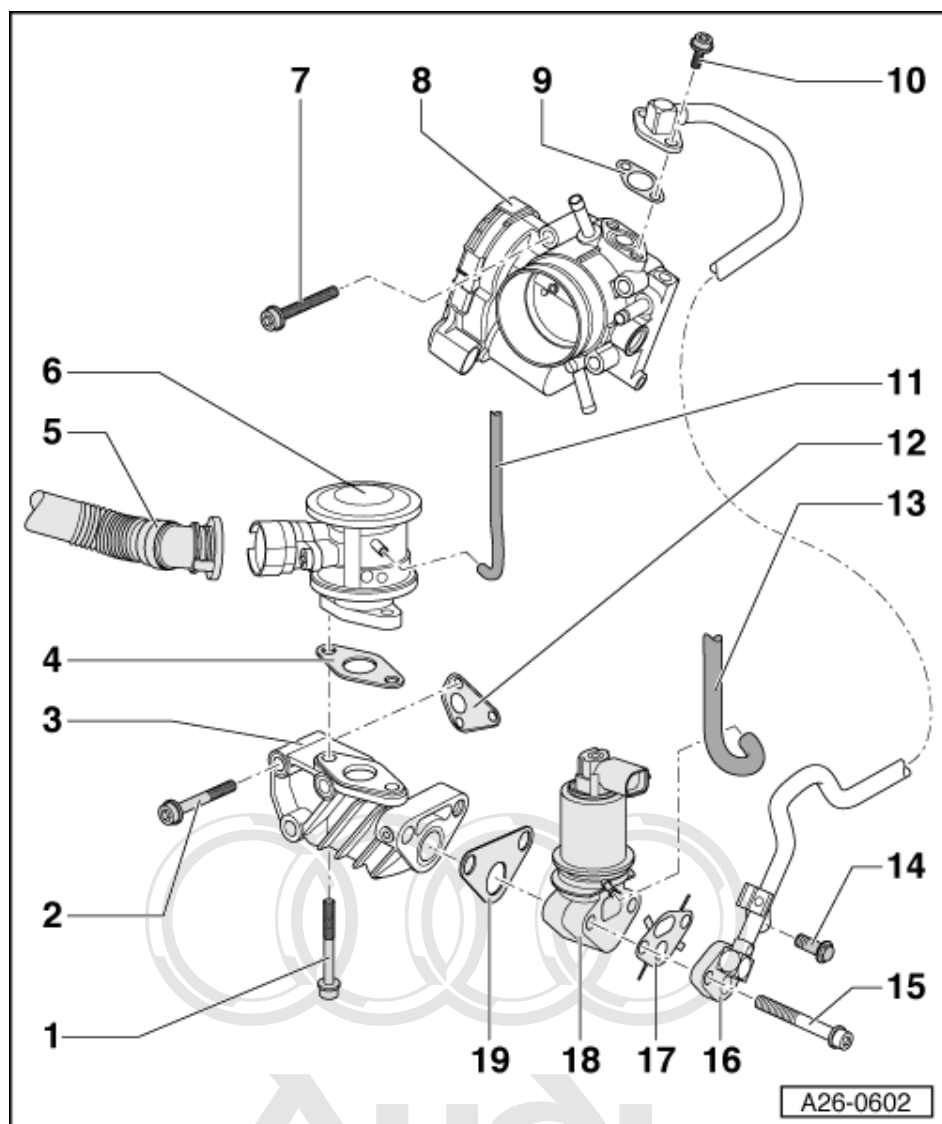
Notes:

- ♦ Under certain operating conditions exhaust gas is recirculated into the intake air via the exhaust gas recirculation valve -N18. This mixture results in a reduction of combustion chamber temperature and thereby better exhaust gas emissions.
- ♦ The exhaust gas recirculation system is controlled and activated by the engine control unit via the exhaust gas recirculation valve -N18.
- ♦ Pulsed control makes it possible to obtain any required valve position.
- ♦ The position of the exhaust gas recirculation valve -N18 is given to the engine control unit via the potentiometer for exhaust gas recirculation -G212. The valve and potentiometer are located in the same component.
- ♦ A blocked exhaust gas recirculation valve -N18 in opened position is evident when poor idling occurs.

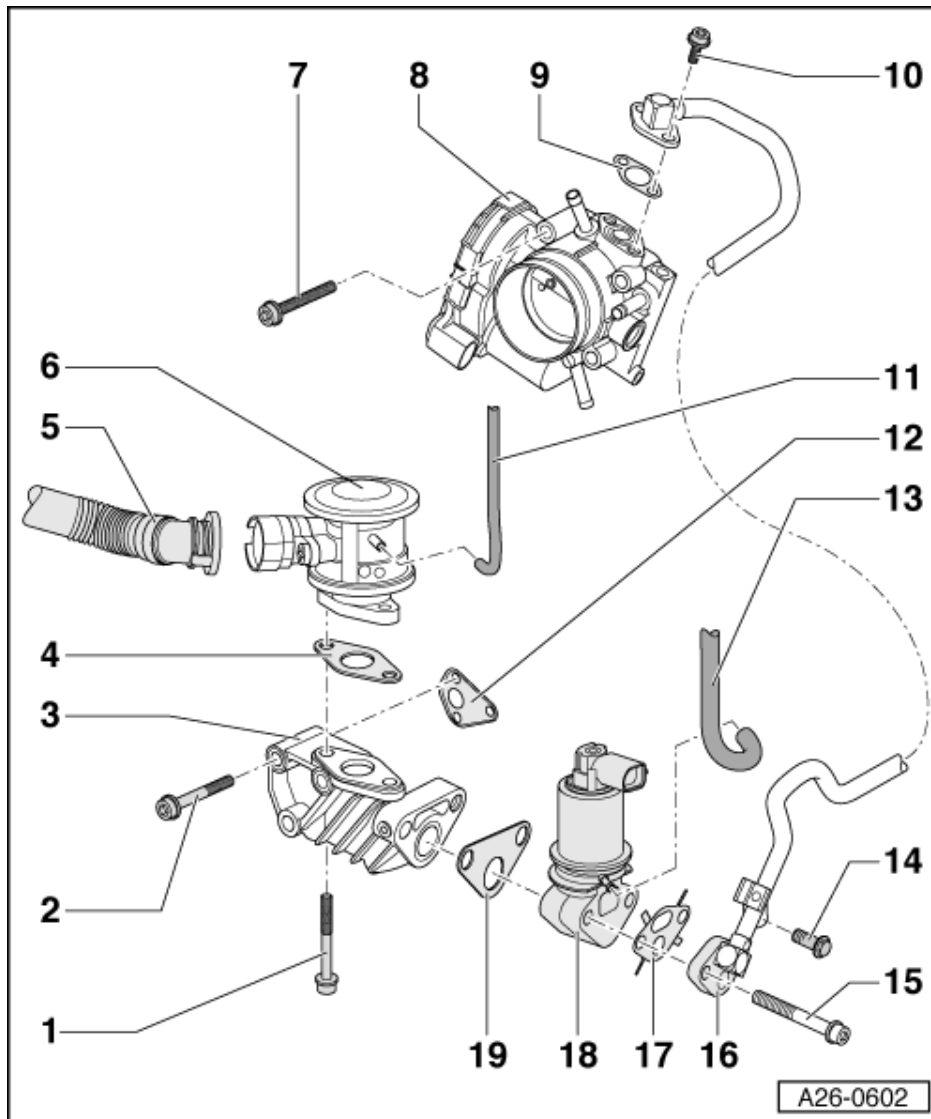
2.2 - Removing and installing parts of exhaust gas recirculation system



- 1 10 Nm
- 2 10 Nm
- 3 Connector flange
- 4 Gasket
 - ♦ Renew
- 5 Air hose
 - ♦ From secondary air pump
- 6 Combination valve for secondary air system
 - ♦ Location => Fig. 226
 - ♦ Testing =>Page 237
 - ♦ Removing and installing
=> Page 238



- 7 10 Nm
- 8 Throttle valve control part -J338
- 9 Gasket
- ♦ Renew
- 10 10 Nm
- 11 Vacuum pipe
- ♦ From secondary air inlet valve -N112
- 12 Gasket
- ♦ Renew
- 13 Vent pipe
- ♦ To air cleaner housing
- 14 22 Nm
- 15 22 Nm



16 Connecting pipe

- ♦ From exhaust gas recirculation valve to throttle valve control part

17 Gasket

- ♦ Renew

18 Exhaust gas recirculation valve -N18 with potentiometer for exhaust gas recirculation -G212

- ♦ Electrical check =>Page [214](#)
- ♦ Perform adaption to engine control unit after replacing:

=> Motronic injection and ignition system; Repair group 24

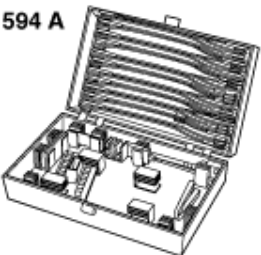
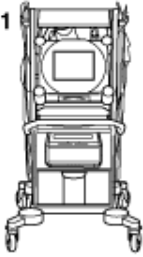
19 Gasket

- ♦ Renew

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

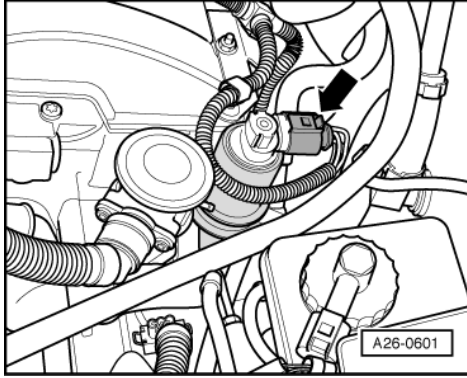


2.3 - Electrical check of exhaust gas recirculation valve -N18 and potentiometer for exhaust gas recirculation -G212

V.A.G 1526 A 	V.A.G 1527 B 
V.A.G 1594 A 	V.A.G 1598/31 
VAS 5051 	G24-0023

Special tools and workshop equipment required

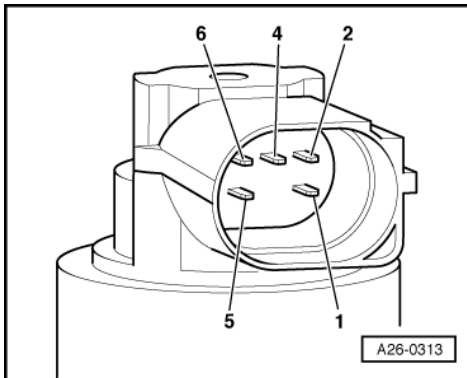
- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/31
- ♦ VAS 5051 with VAS 5051/1



Testing internal resistance

- -> Disconnect connector -arrow-.

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



- -> Connect multimeter (resistance measurement range) as follows:

Component	Connector contact	Specification at room temperature
Exhaust gas recirculation valve - N18	1 + 5	7.5 ... 8.5 ω
Potentiometer for exhaust gas recirculation -G212	2 + 4 2 + 6	2.6 ... 4.8 ω 0.5 ... 6.3 ω

If the specifications are not obtained:

- Replace exhaust gas recirculation valve -N18 and potentiometer for exhaust gas recirculation -G212 => Page 220 .

If the specifications are obtained:

Checking voltage supply for exhaust gas recirculation valve -N18

Test requirement:

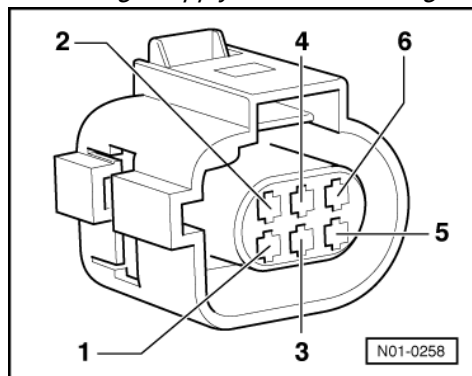
- Voltage supply relay for Motronic OK; test.

=> Motronic injection and ignition system; Repair group 28



Note:

The voltage supply for the exhaust gas recirculation valve is supplied via the Motronic voltage supply relay.



- -> Connect voltage tester V.A.G 1527 B as follows:

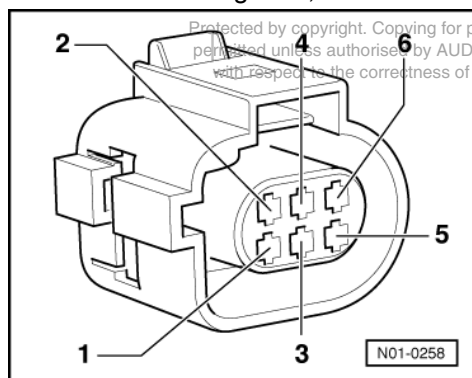
Connector Contact	Measure against
1	Engine earth

- Switch on ignition.
- The LED should light up.

If the LED does not light up:

- Check for open circuit in wiring from connector contact 1 through fuse to voltage supply relay for Motronic:

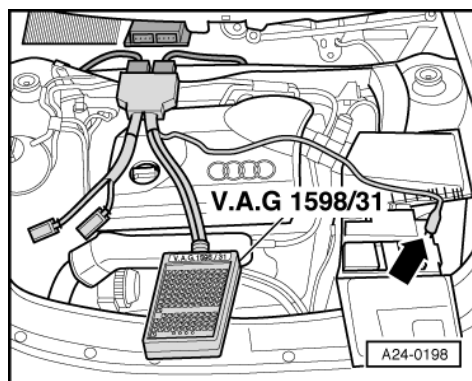
=> Current flow diagrams, Electrical fault finding and Fitting locations binder



If the LED lights up:

Checking voltage supply for potentiometer for exhaust gas recirculation -G212

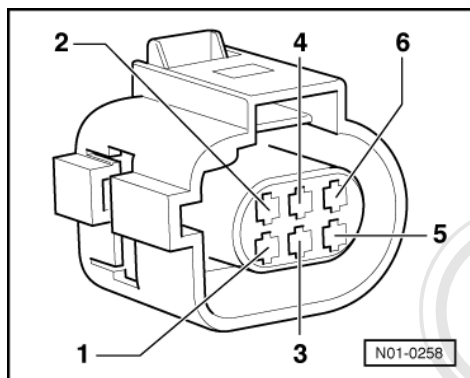
- -> Connect multimeter (voltage measurement range) between contacts 2 and 4 of connector.
- Switch on ignition.
- Specification: approx. 4.5 ... 5.5 V



If the specification is not attained:

- -> Connect test box V.A.G 1598/31 to wiring harness connectors. The engine control unit itself does not need to be connected to the test box. Connect earth clamp on test box to earth -arrow-.

=> Motronic injection and ignition system; Repair group 24



- -> Test for open circuit and short to positive or earth in the following wiring connections:

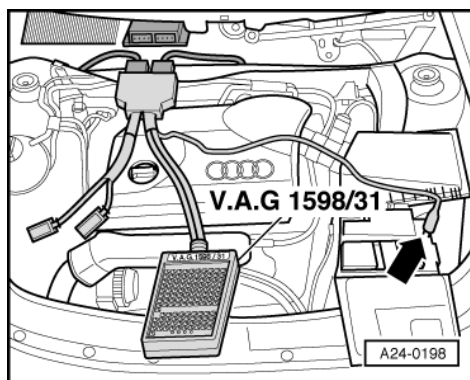
Connector Contact	Test box V.A.G 1598/31 Socket
2	98
4	108

- Rectify any open/short circuit as necessary.

Unauthorized copying or reuse of any part of this page is illegal. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

If the wiring is OK:

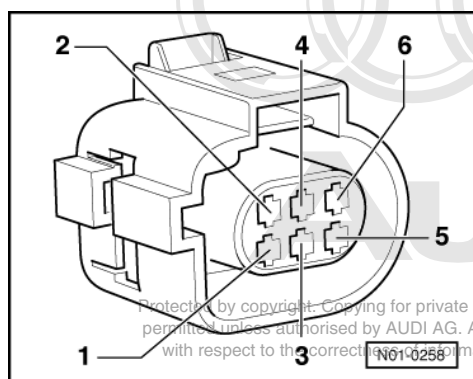
- Replace engine control unit.



Checking signal wiring from potentiometer for exhaust gas recirculation -G212 to engine control unit.

- -> Connect test box V.A.G 1598/31 to wiring harness connectors. The engine control unit itself does not need to be connected to the test box. Connect earth clamp on test box to earth -arrow-.

=> Motronic injection and ignition system; Repair group 24

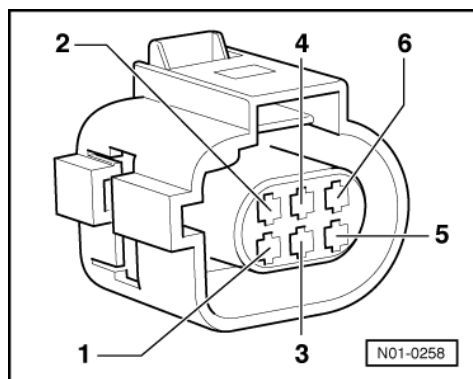


Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of the information in this document. Copyright by AUDI AG.

- -> Test for open circuit and short to positive or earth in the following wiring connections:

Connector Contact	Test box V.A.G 1598/31 Socket
6	100

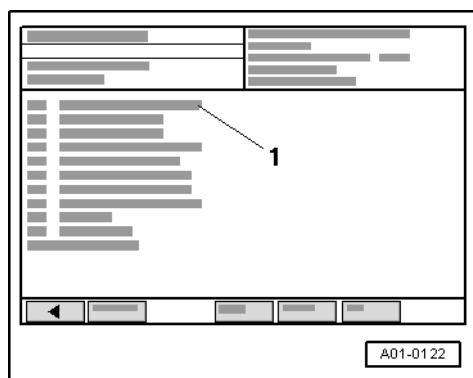
- Rectify any open/short circuit as necessary.



Testing activation of exhaust gas recirculation valve -N18

Requirements for test:

- Voltage supply OK
 - Connect vehicle diagnosis, testing and information system VAS 5051, select "Vehicle self-diagnosis" and vehicle system "01 - Engine electronics".
- -> Connect diode test lamp V.A.G 1527 B to contacts 1 and 5 of connector.



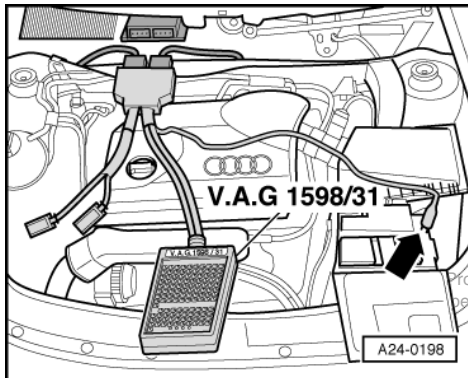
-> Display on VAS 5051:

- Select diagnosis function "03 - Final control diagnosis" from the menu -1-
- Activate exhaust gas recirculation valve -N18.
 - The LED should flash slowly.

Note:

The LEDs on voltage testers with a low current draw continue to glow faintly between impulses from the engine control unit (rather than going out completely) and become much brighter when receiving an impulse.

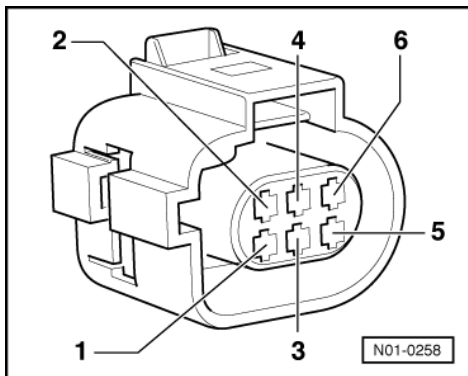
- Press the **•** button to exit from function "03 - Final control diagnosis".
- Select diagnosis function "06 - End output".



If the LED does not flash:

- -> Connect test box V.A.G 1598/31 to wiring harness connectors. The engine control unit itself does not need to be connected to the test box. Connect earth clamp on test box to earth -arrow-.

=> Motronic injection and ignition system; Repair group 24



- -> Test for open circuit and short to positive or earth in the following wiring connections:

Connector Contact	Test box V.A.G 1598/31 Socket
5	114

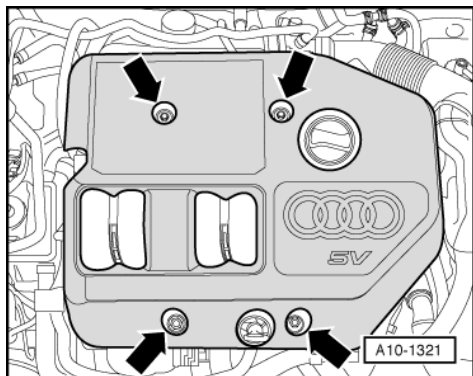
- Rectify any open/short circuit as necessary.

If the wiring is OK:

- Install new engine control unit.

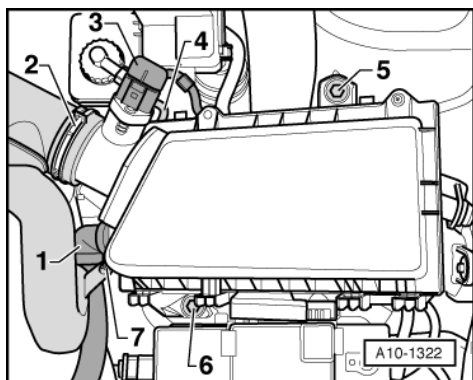


2.4 - Removing and installing exhaust gas recirculation valve -N18 with potentiometer for exhaust gas recirculation -G212

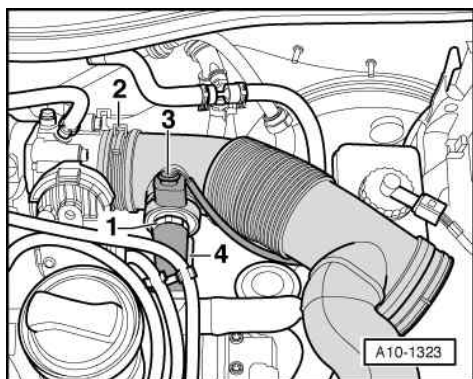


Removing

- -> Remove engine cover panel -arrows-.



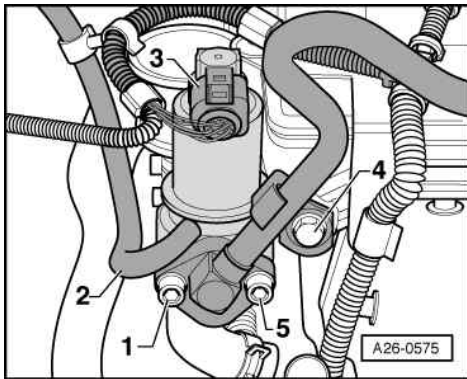
- -> Disconnect secondary air pump intake hose -1- from air cleaner housing.
- Unscrew bolt -7-.
- Disconnect air hose -2- from air mass meter.
- Unplug electrical connector -3- from air mass meter.
- Unscrew bolts -5- and -6-.
- Remove air cleaner housing and pull off vent hose -4- from behind.



- -> Unplug electrical connector -3-.
- Disconnect hoses -1- and -4-.
- Remove air duct by releasing hose clip -2-.



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



- -> Unplug electrical connector -3-.
- Disconnect vent hose -2-.
- Unscrew bolts -1-, -4- and -5- and detach exhaust gas recirculation valve -N18.

Note:

Shown in illustration with engine removed.

Installing

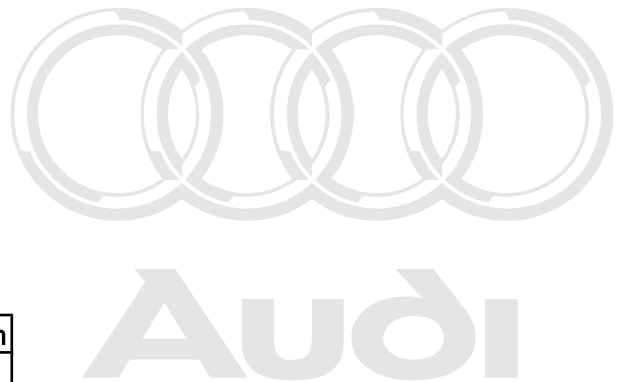
Install in reverse sequence; note the following points:

Note:

Replace gaskets and seals.

Tightening torques

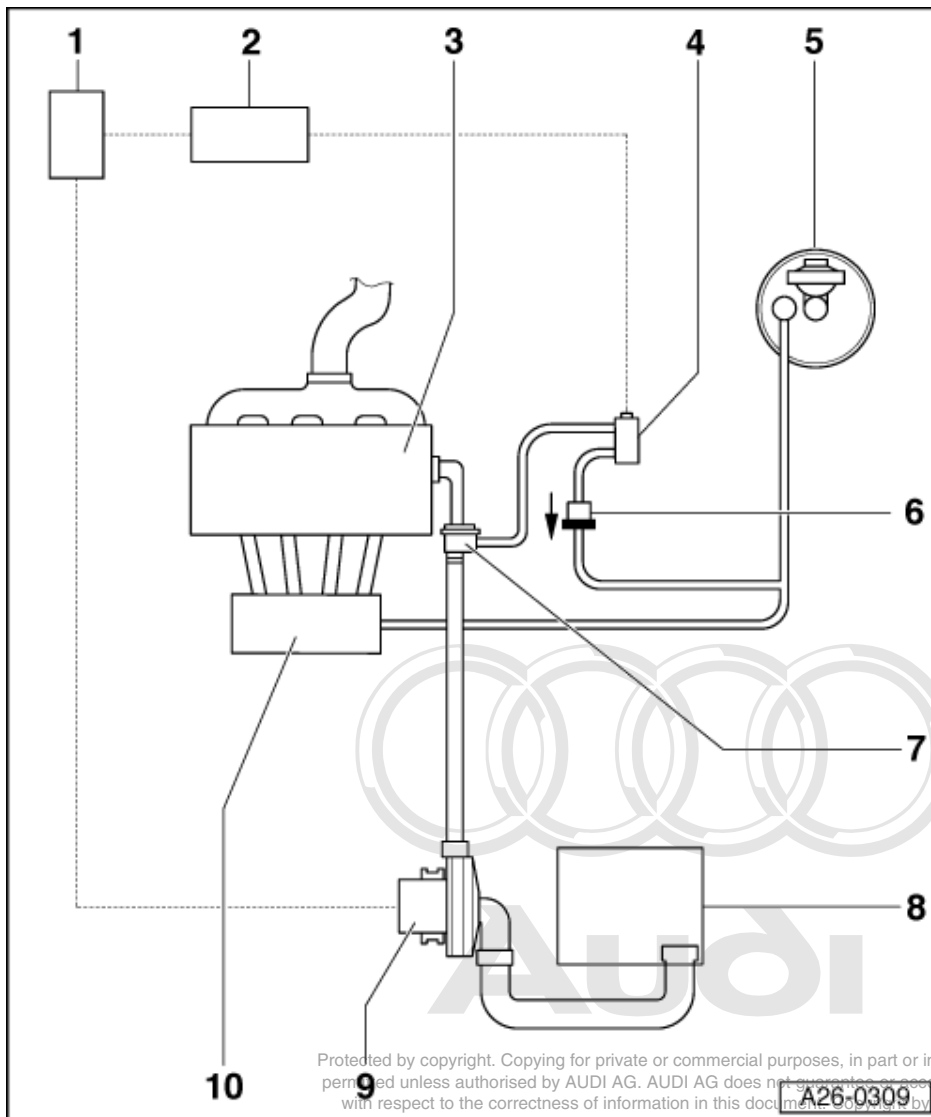
Component	Nm
Connecting pipe for exhaust gas recirculation with -N18 to secondary air valve	22
Connecting pipe for exhaust gas recirculation to support for upper section of intake manifold	22



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

3 - Secondary air system - vehicles with engine code letters APG

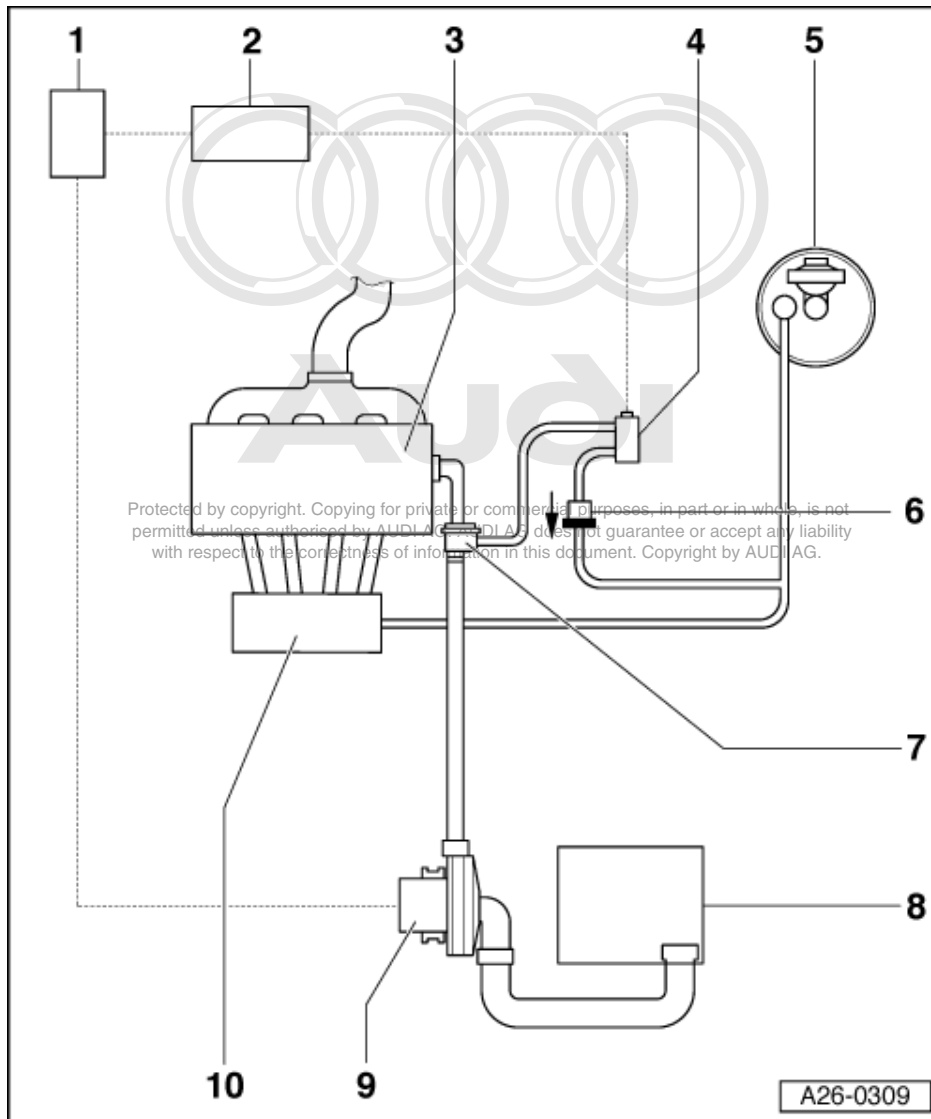
3.1 - Secondary air system - vehicles with engine code letters APG



The secondary air system is designed to enable the catalytic converter to heat up and reach its operating temperature more quickly after a cold start.

Principle of operation

Due to the extra mixture enrichment during the cold-start phase, an increased amount of unburnt hydrocarbons is carried in the exhaust gas. The secondary air system improves the afterburning (oxidation) process in the catalytic converter, and in this way reduces toxic emissions. The heat generated by oxidation accelerates the "light off" of the catalytic converter and significantly improves exhaust gas quality during warm-up.



1 Secondary air pump relay -J299

- ♦ Location => Fig. 225

2 Engine control unit -J220

3 Cylinder head

4 Secondary air inlet valve -N112

- ♦ Location => Fig. 225

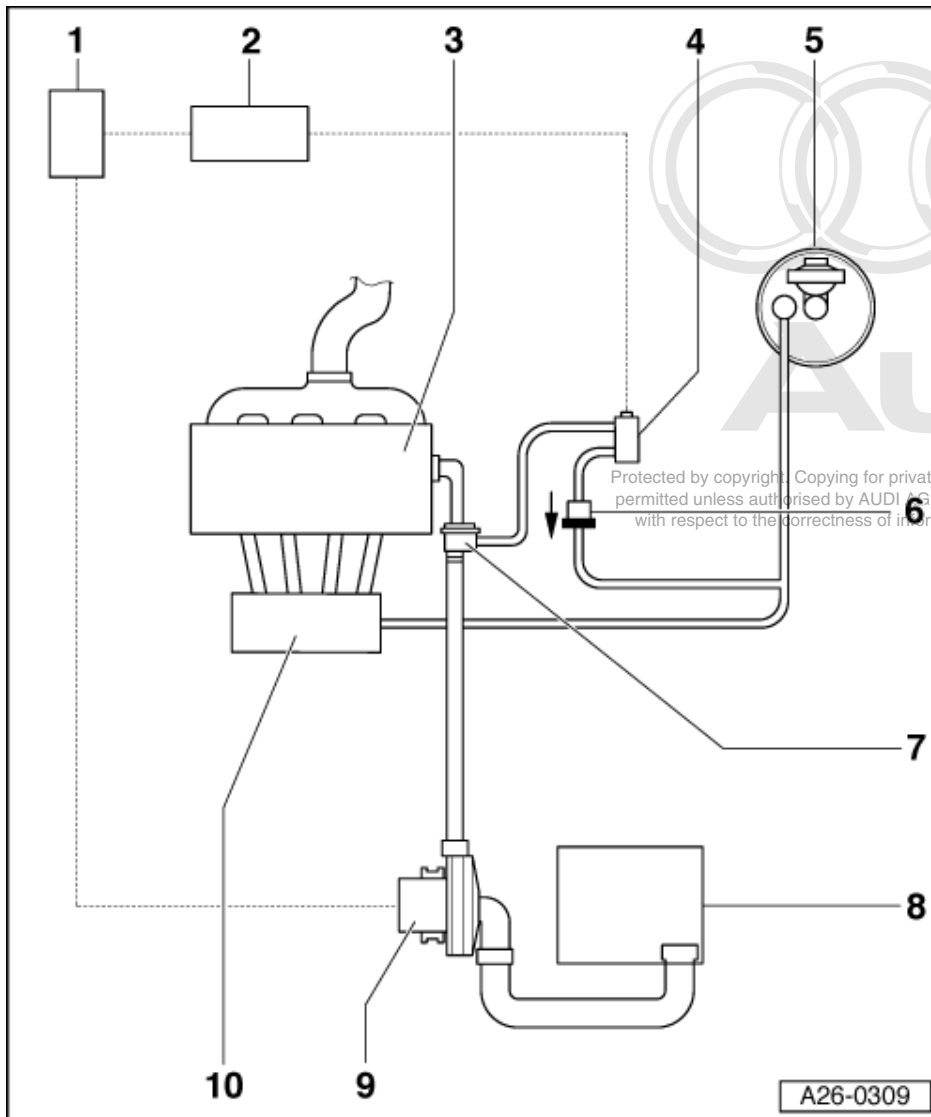
5 Brake servo

6 Non-return valve

- ♦ Installation position (light side/ dark side) as shown in illustration. Arrow indicates direction of flow

7 Combination valve for secondary air system

- ♦ Location => Fig. 226
- ♦ Removing and installing
=> Page 238

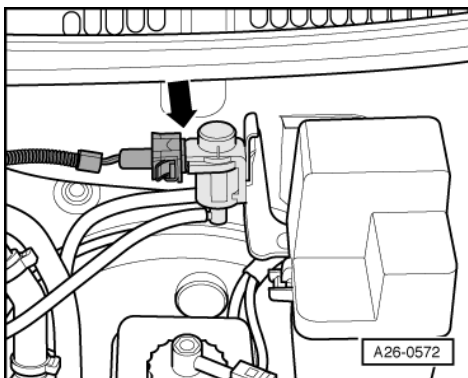


8 Air cleaner

9 Secondary air pump motor -V101

♦ Location => Fig. 225

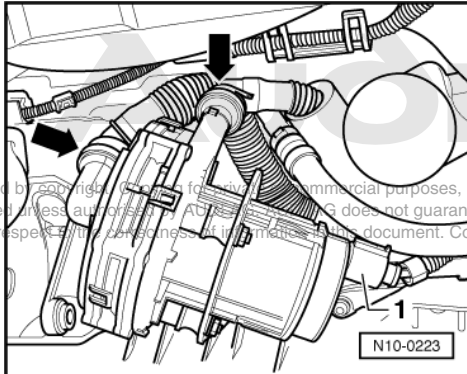
10 Intake manifold



-> Fig.1 Location of secondary air inlet valve

-N112

- ◆ Installation location: rear left side on bulkhead -arrow-.

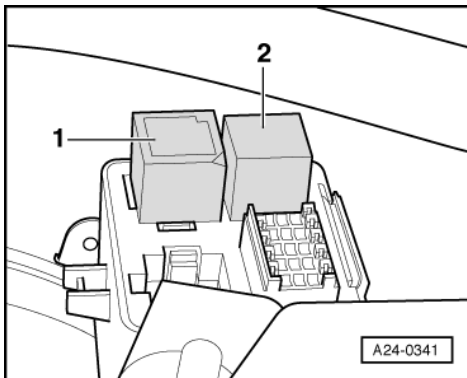


Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorized by Audi AG. Audi AG does not guarantee or accept any liability with respect to the correctness of the information in this document. Copyright by AUDI AG.

-> Fig.2 Location of secondary air pump motor

-V101

- ◆ Fitting location: front right of engine compartment below alternator or A/C compressor

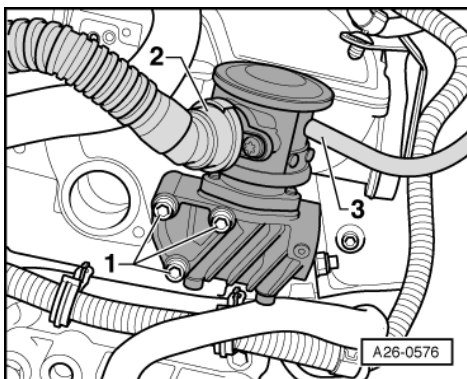


-> Fig.3 Location of secondary air pump relay

-J299

- ◆ Fitting location: under cover on left side of bulkhead

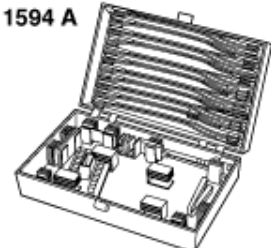
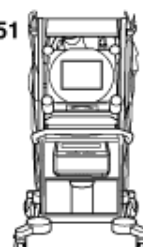
- 1 - Relay for secondary air pump -J299
- 2 - Voltage supply relay for Motronic -J271



-> Fig4 Location of combination valve for secondary air system

- ♦ Installation location: left on cylinder head

3.2 - Testing secondary air inlet valve -N112

V.A.G 1526 A 	V.A.G 1527 B 
V.A.G 1594 A 	V.A.G 1598/31 
VAS 5051 	G24-0023

Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/31
- ♦ VAS 5051 with VAS 5051/1

Test requirement:

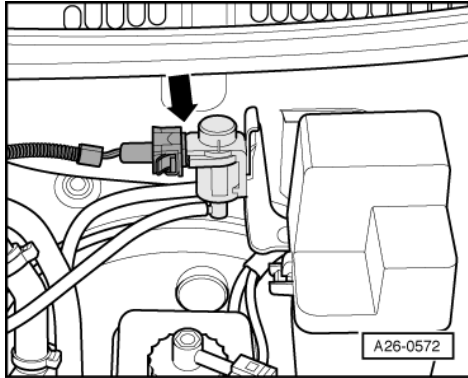
- Connect vehicle diagnosis, testing and information system VAS 5051, select "Vehicle self-diagnosis" and vehicle system "01 - Engine electronics".

Test sequence

Note:

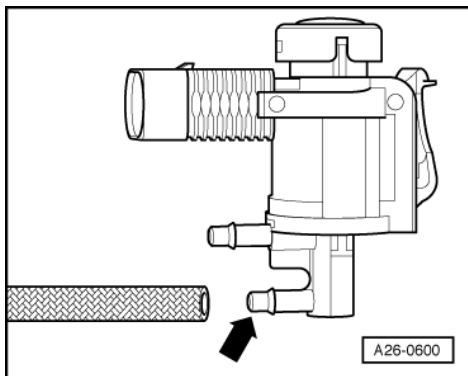
Secondary air inlet valve -N112 and associated wiring are monitored by engine control unit.

- Interrogate fault memory of engine control unit.

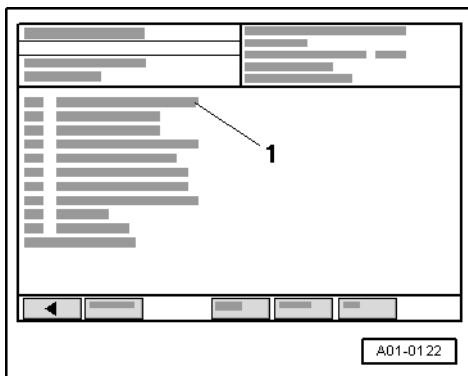


If the display shows a fault relating to secondary air inlet valve -N112:

- -> Disconnect secondary air inlet valve -N112 -arrow- from bracket.
- Disconnect hoses from secondary air inlet valve; electrical connector remains connected.



- -> Connect test hose to connection on valve indicated by arrow.



-> Display on VAS 5051:

- Select diagnosis function "03 - Final control diagnosis" from the menu -1-

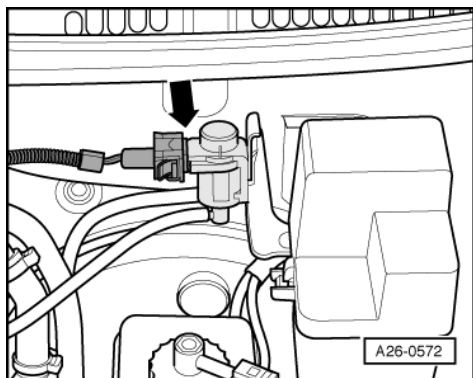
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



- Activate secondary air inlet valve -N112:
 - ♦ The valve should click...
 - ♦ ...and open and close (can be checked by blowing into test hose).

If the valve does not open and close properly:

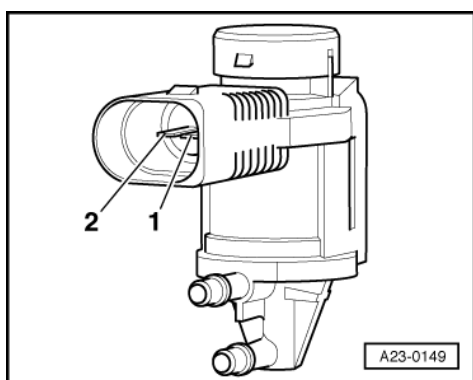
- Renew secondary air inlet valve -N112.



If valve does not click during final control diagnosis:

Testing internal resistance

- Switch off ignition.
- -> Unplug connector from secondary air inlet valve -N112 -arrow-.



- -> Connect multimeter between contacts 1 and 2 of valve (resistance measurement range).
- Specification: 52.5 ... 62.5 Ω at room temperature

If the specification is not attained:

- Renew secondary air inlet valve -N112.

If the specification is obtained:

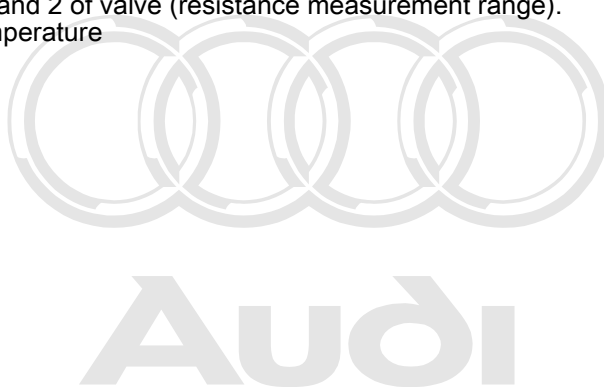
Checking voltage supply

Requirements for test:

- Fuse for secondary air inlet valve OK.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

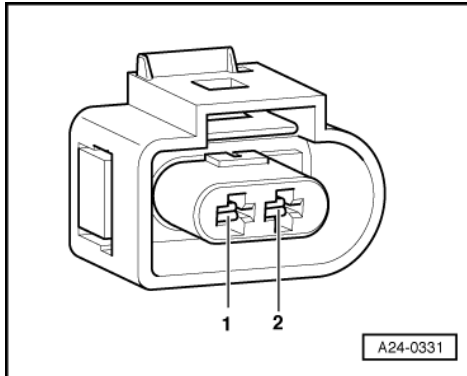
- Fuel pump relay OK



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

Note:

The secondary air inlet valve -N112 receives its power supply via the fuel pump relay.



- -> Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure against
1	Engine earth

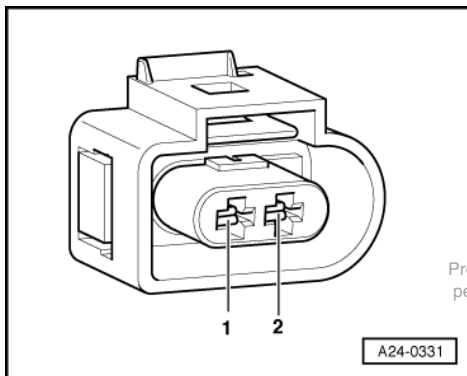
- Operate starter briefly.
- The LED should light up.

If the LED does not light up:

- Test for open circuit in wiring connection between fuel pump relay and contact 1 on connector via fuse:

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- Rectify any open circuits.

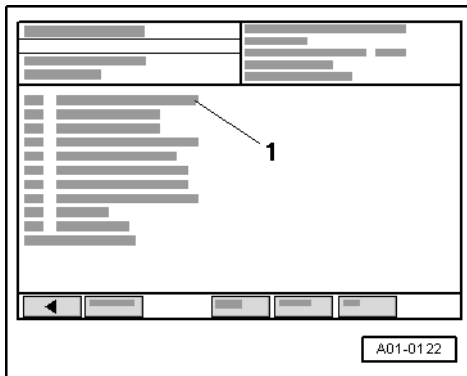


Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

If the LED lights up:

Checking activation

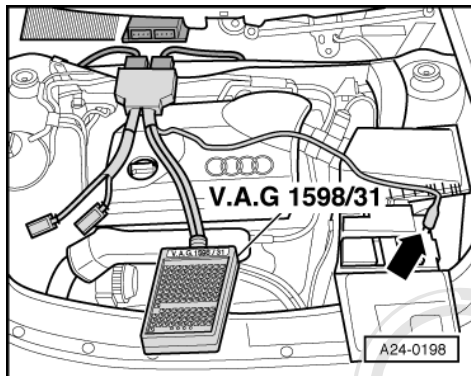
- -> Connect voltage tester V.A.G 1527 B to contact 1 (positive) and contact 2 of the connector.





-> Display on VAS 5051:

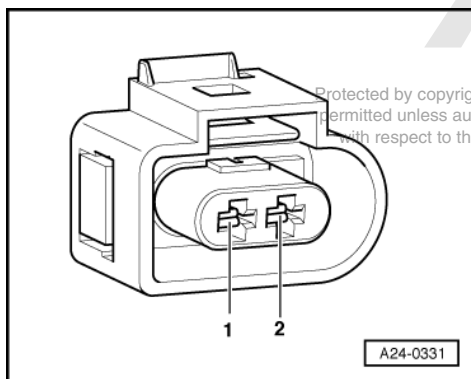
- Select diagnosis function "03 - Final control diagnosis" from the menu -1-
- Activate secondary air inlet valve -N112:
 - The LED should flash slowly.



If the LED lamp does not flash or if it lights up continuously:

- -> Connect test box V.A.G 1598/31 to wiring harness connectors. The engine control unit itself does not need to be connected to the test box. Connect earth clamp on test box to earth -arrow-.

=> Motronic injection and ignition system; Repair group 24



- Test for open circuit and short to positive or earth in the following wiring connection:

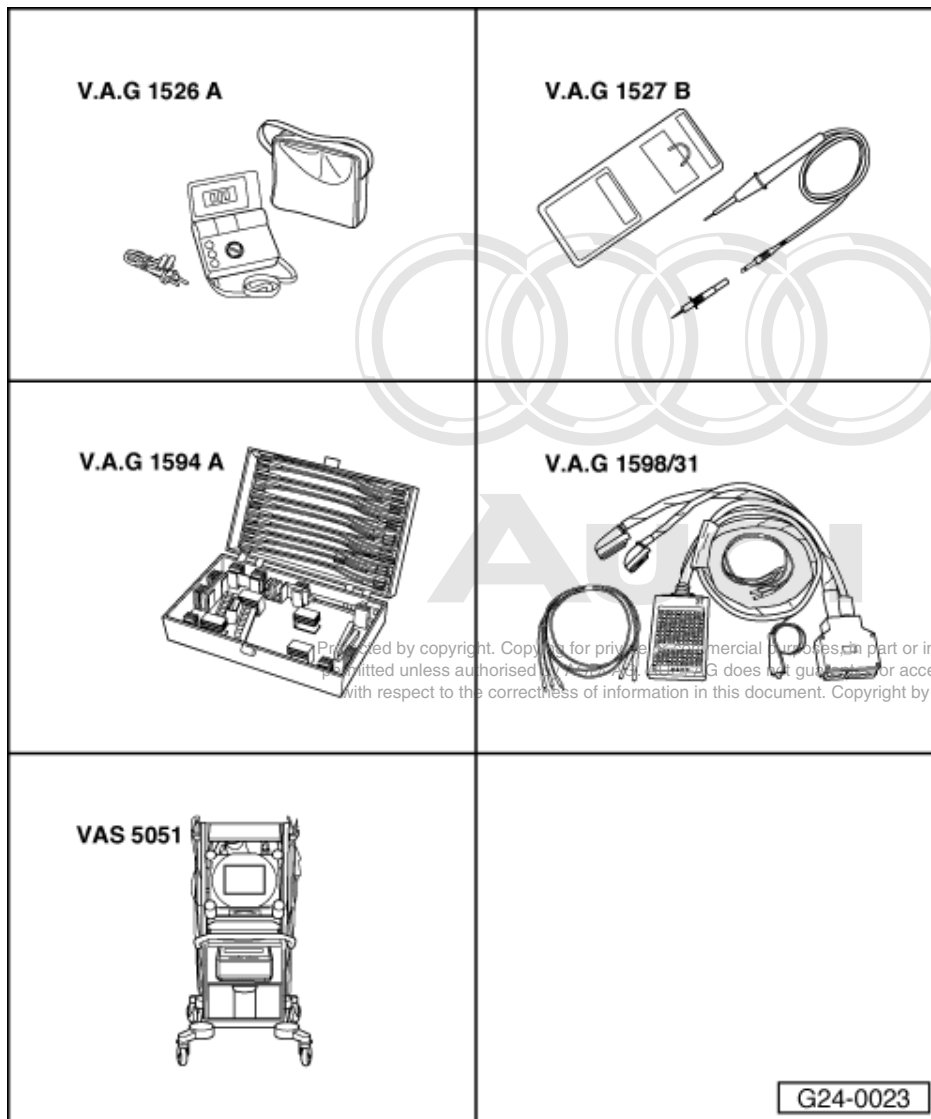
Connector Contact	Test box V.A.G 1598/31 Socket
2	105

- Rectify any open/short circuit as necessary.

If the wiring is OK:

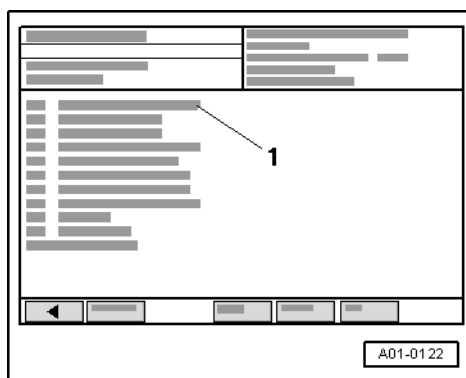
- Install a new engine control unit:

3.3 - Testing secondary air pump relay -J299 and activation



Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1527 B
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31
- ◆ VAS 5051 with VAS 5051/1





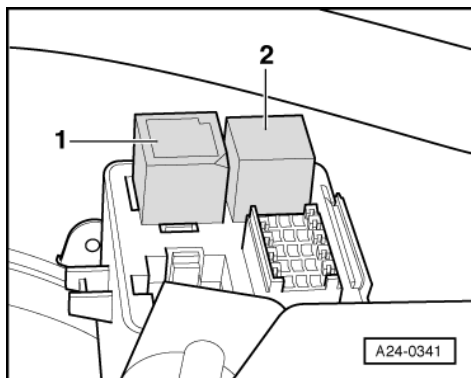
Test requirement:

- Connect vehicle diagnosis, testing and information system VAS 5051, select "Vehicle self-diagnosis" and vehicle system "01 - Engine electronics".

Test sequence

-> Display on VAS 5051:

- Select diagnosis function "03 - Final control diagnosis" from the menu -1-
- Activate secondary air pump relay -J299.



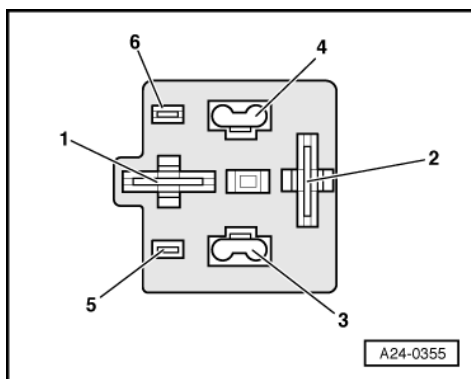
- -> Secondary air pump relay -1- should pick up and secondary air pump motor -V101 should run in intervals. (The relay is located under a cover on the left of the bulkhead).

A - If the relay does not pick up:

- Test voltage supply of secondary air pump relay => Page 232 .
- Test activation of secondary air pump relay => Page 234 .

B - If the relay picks up but the secondary air pump motor does not run:

- Test voltage supply of secondary air pump motor =>Page 236 .



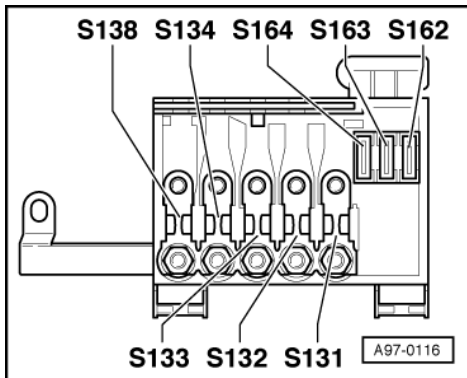
Testing voltage supply of secondary air pump relay

- Switch off ignition.
- Disconnect secondary air pump relay.
- -> Connect multimeter (voltage measurement range) as follows:

Relay carrier below cover on left side of bulkhead Contact	Measure against
1	Engine earth

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability to the correctness of information in this document. Copyright by AUDI AG.

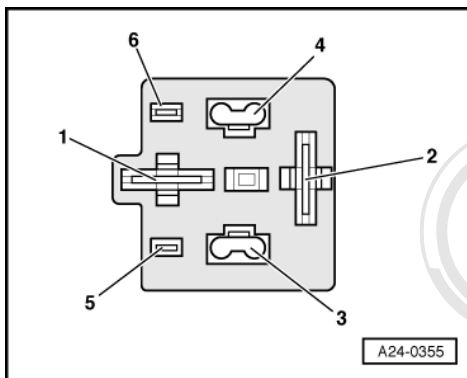
- Specification: approx. battery voltage



If the specification is not obtained:

- Carry out the following tests (marked with dots):
- -> Check fuse S130 (40 A) or S131 (50A) in main fuse box/battery.
- Test for open circuit in wiring from battery + (terminal 30) via fuse S131 to secondary air pump relay -J299 (below cover on left side of bulkhead):

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

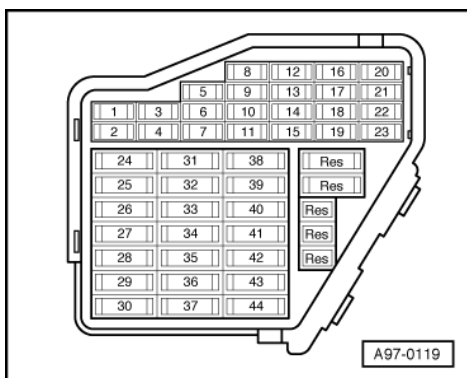


- -> Connect multimeter (voltage measurement range) as follows:

Relay carrier below cover on left side of bulkhead	Measure against
Contact	
3	Engine earth

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted without the prior written permission of AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

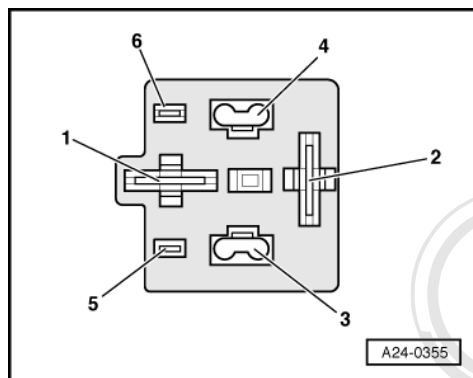
- Operate starter briefly.
- Specification: approx. battery voltage



If the specification is not obtained:

- Carry out the following tests (marked with dots):
- -> Check fuse S243 (fuse position 43 in fuse holder).
- Test for open circuit in wiring from secondary air pump relay -J299 (below cover on left side of bulkhead) to fuel pump relay via fuse S243 (fuse position 43 in fuse holder):

=> Current flow diagrams, Electrical fault finding and Fitting locations binder



Testing activation of secondary air pump relay

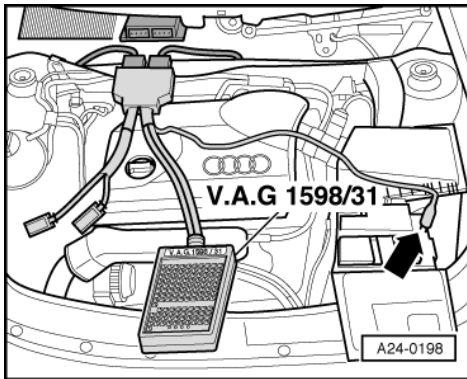
- Switch off ignition.
- Disconnect secondary air pump relay.
- -> Connect voltage tester V.A.G 1527 B as follows:

Relay carrier below cover on left side of bulkhead	Measure against
4	Battery positive



-> Display on VAS 5051:

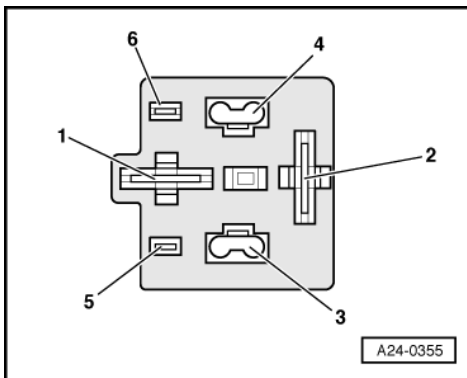
- Select diagnosis function "03 - Final control diagnosis" from the menu -1-
- Activate secondary air pump relay -J299.
 - The LED should flash.



If the LED does not flash:

- Switch off ignition.
- -> Connect test box V.A.G 1598/31 to wiring harness connectors. The engine control unit itself does not need to be connected to the test box. Connect earth clamp on test box to earth -arrow-.

=> Motronic injection and ignition system; Repair group 24



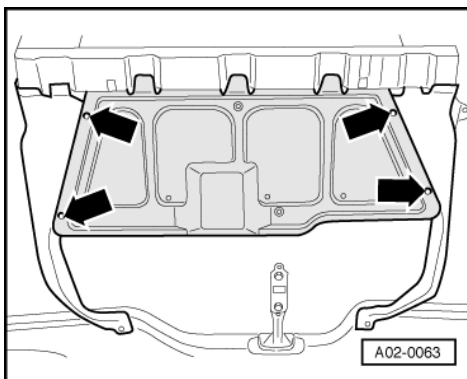
- -> Test for open circuit and short to positive or earth in the following wiring connections:

Relay carrier below cover on left side of bulkhead Contact	Test box V.A.G 1598/31 Socket
4	9

- Rectify any open/short circuit as necessary.

If no fault is found:

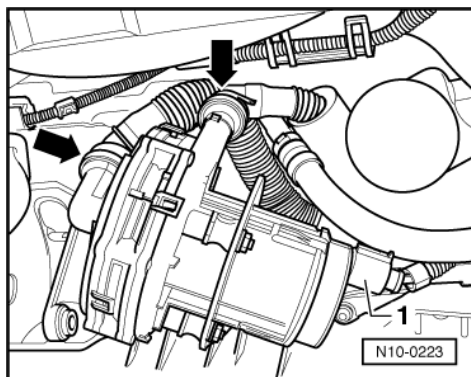
- Fit a new secondary air pump relay -J299.



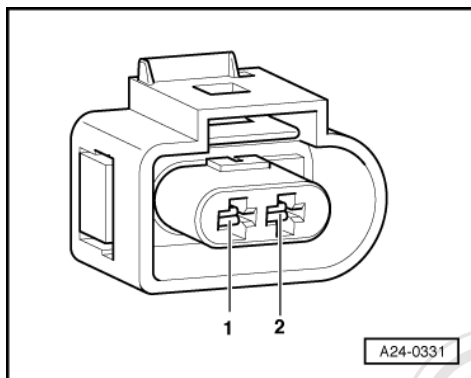
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Testing voltage supply to secondary air pump motor

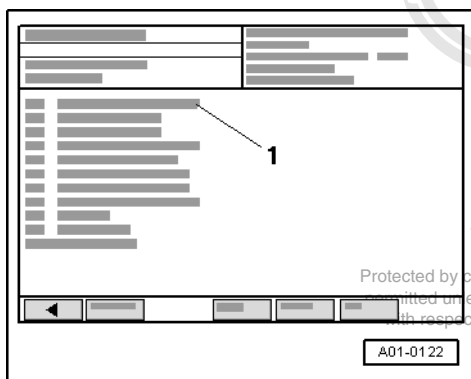
- -> Remove noise insulation centre panel -arrows-.



- -> Unplug connector -1- from secondary air pump motor -V101.



- -> Connect voltage tester V.A.G 1527 B between contacts 1 and 2.



-> Display on VAS 5051:

- Select diagnosis function "03 - Final control diagnosis" from the menu -1-
- Activate secondary air pump relay -J299.
 - The LED should flash.

If the LED does not flash:

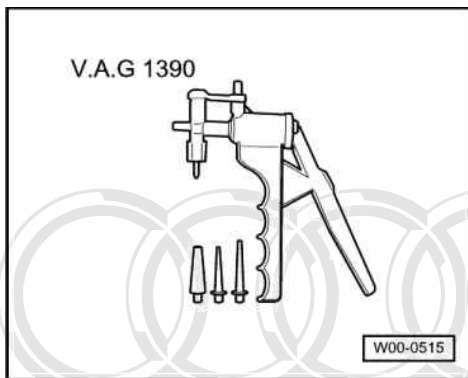
- Carry out the following tests (marked with dots):
 - Test for open circuit in wiring from connector on secondary air pump motor -V101 to secondary air pump relay -J299 (in relay carrier below cover on left side of bulkhead):

=> Current flow diagrams, Electrical fault finding and Fitting locations binder
 • Test for open circuit in wiring from contact 1 of connector to earth:

=> Current flow diagrams, Electrical fault finding and Fitting locations binder
 If no fault is found:

- Replace secondary air pump => Page **240** .

3.4 - Checking function of combination valve for secondary air system; checking for leaks



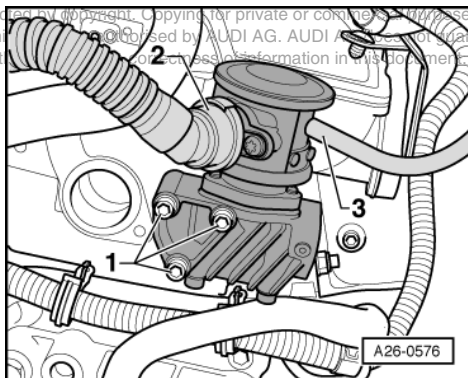
Special tools and workshop equipment required

- ♦ Hand vacuum pump V.A.G 1390

Requirements for test:

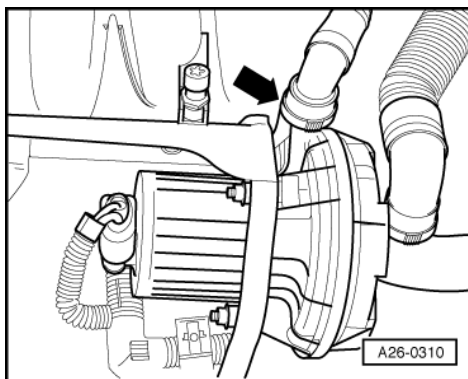
- No leaks in vacuum hoses and hose connections
- No obstructions in vacuum hoses

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted without the written consent of AUDI AG. AUDI AG does not guarantee or accept any liability for errors or omissions in this document. Copyright by AUDI AG.



Test sequence

- -> Disconnect vacuum hose -3- on combination valve.
- Connect hand vacuum pump V.A.G 1390 to vacuum connection on combination valve.





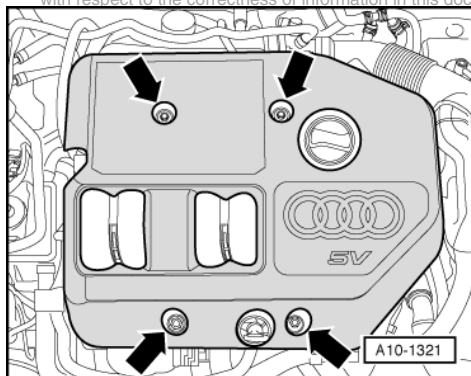
- -> Disconnect pressure hose -arrow- on secondary air pump.
- Blow lightly into pipe (do not use compressed air).
 - The combination valve should be closed; it should not be possible to blow through the hose.
- Operate hand vacuum pump.
 - The combination valve should open; it should now be possible to blow through the hose.

If the combination valve does not open:

- Renew combination valve => Page 26-63.

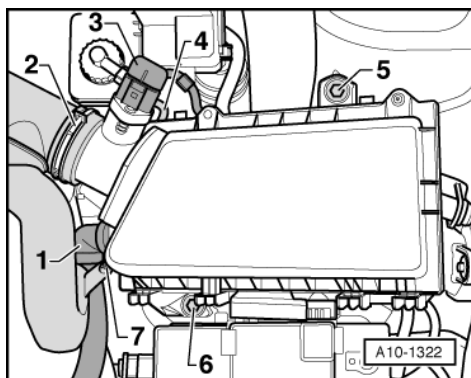
3.5 Removing and installing combination valve for secondary air system

permitted unless authorized by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

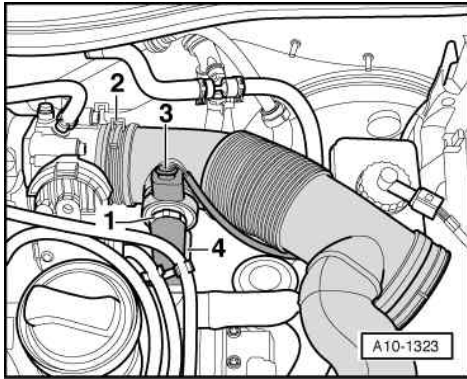


Removing

- Drain cooling system=> Page 181
- -> Remove engine cover panel -arrows-.

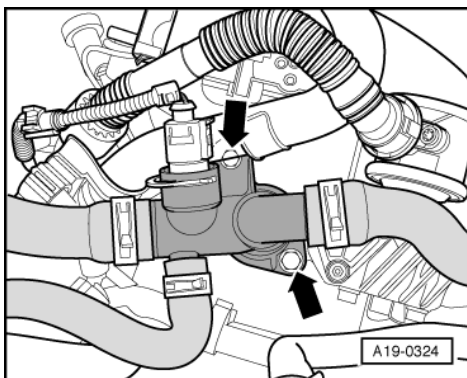


- -> Disconnect secondary air pump intake hose -1- from air cleaner housing.
- Unscrew bolt -7-.
- Disconnect air hose -2- from air mass meter.
- Unplug electrical connector -3- from air mass meter.
- Unscrew bolts -5- and -6-.
- Remove air cleaner housing and pull off vent hose -4- from behind.



- -> Unplug electrical connector -3-.
- Disconnect hoses -1- and -4-.
- Remove air duct by releasing hose clip -2-.

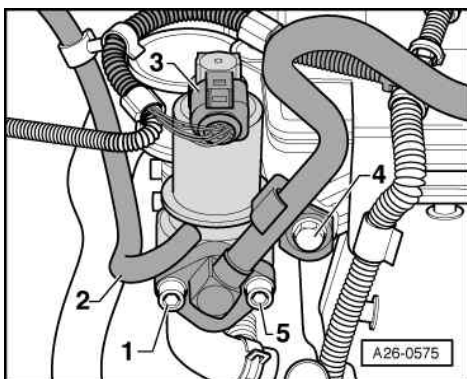
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



- -> Unbolt coolant flange from cylinder head (left) -arrows- and place it to one side.

Note:

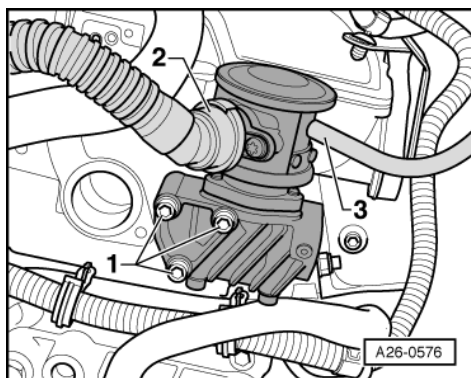
Leave coolant hoses connected.



- -> Unplug electrical connector -3-.
- Disconnect vent hose -2-.
- Unscrew bolts -1-, -4- and -5- and detach exhaust gas recirculation valve -N18.

Note:

Shown in illustration with engine removed.



- -> Disconnect hoses -2- and -3-.
- Unscrew bolts -1- and remove combination valve for secondary air system.

Installing

Install in reverse sequence; note the following points:

Note:

Replace gaskets and seals.

Tightening torques

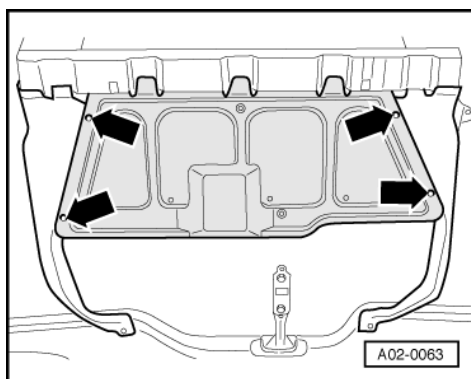
Component	Nm
Combination valve for secondary air system to cylinder head	10
Connecting pipe for exhaust gas recirculation with -N18 to secondary air valve	22
EGR pipe to support for upper section of intake manifold	22
Coolant pipe flange to cylinder head	10



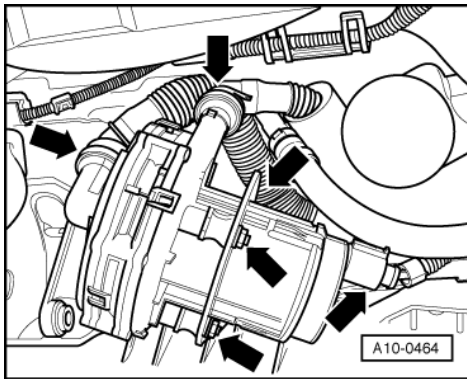
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

3.6 - Removing and installing secondary air pump

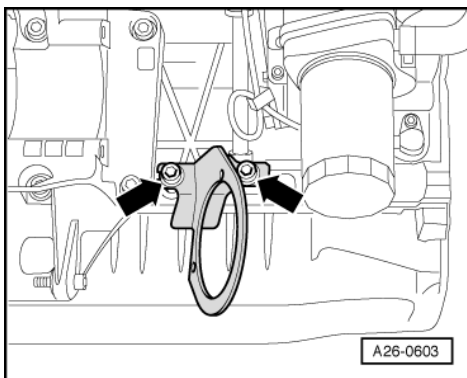
Removing



- -> Remove noise insulation centre panel -arrows-.



- -> Disconnect hoses and connector from secondary air pump; remove nuts -arrows-.
- Swing secondary air pump out slightly to side.



- -> Unscrew bolts -arrows- on bracket for secondary air pump.

Note:

For illustration purposes the bracket is shown with the secondary air pump removed.

- Remove secondary air pump and bracket.

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

Installing

Installation is performed in the reverse order.

Tightening torques

Component	Nm
Bracket for secondary air pump to cylinder block	25
Secondary air pump to bracket	10