

Audi 100 1991 ➤

5-cyl Diesel Engine, Mechanical Components (2.5 l Engine)

Engine ID	AAT	ABP	AEL						
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Edition 04.2002



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List of Workshop Manual Repair GroupsList of Workshop Manual Repair Groups

Audi 100 1991 ➤

5-cyl Diesel Engine, Mechanical Components (2.5 l Engine)

Repair Group

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

26 - Exhaust system

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

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Audi 100 1991 ➤

5-cyl Diesel Engine, Mechanical Components (2.5 l Engine) - Edition 04.2002



Audi

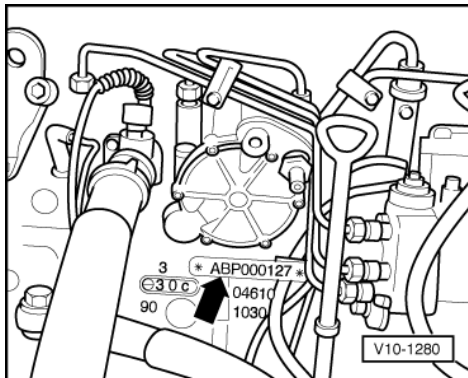
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00 - Technical data

1 - Technical data

1.1 - Technical data

1.2 - Engine number

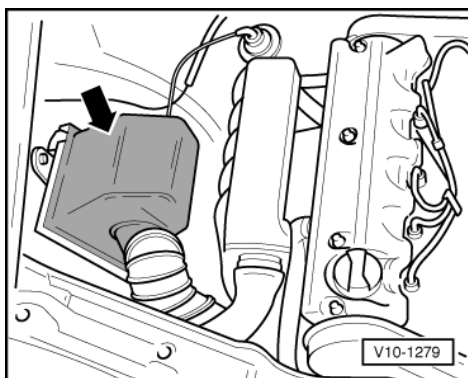


-> The engine number ("Engine code" and "Serial number") can be found on the left of the cylinder block - arrow-.

There is also a sticker on the toothed belt guard or cylinder head cover showing the engine code and serial number.

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

1.3 - Changes during the production period

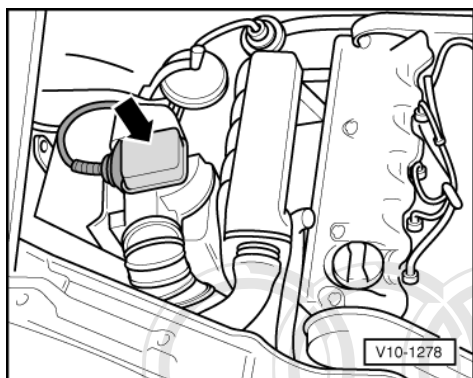


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Distinguishing features

Vehicles with engine codes ABP:

-> Identification:
 Air cleaner housing without air flow meter -arrow-.



Vehicles with engine codes AAT, AEL:

-> Identification:

Air cleaner housing with air flow meter -arrow-.

1.4 - Engine data

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Code		ABP	AAT	AEL
Capacity	l	2.5	2.5	2.5
Output	kW at rpm	85/4000	85/4000	103/4000
Torque	Nm at rpm	265/2250	265/2250 1)	290/1900
Bore	ø in mm	81.0	81.0	81.0
Stroke	mm	95.5	95.5	95.5
Compression		20.5	20.5	20.5
CN	min.	45	45	45
Firing order		1-2-4-5-3	1-2-4-5-3	1-2-4-5-3
Catalytic converter		no	yes	yes
Exhaust gas recirculation system		no	yes	yes
Turbocharging		yes	yes	yes
Charge air cooler		yes	yes	yes

1) from 05.94: 265 Nm at 1900 rpm

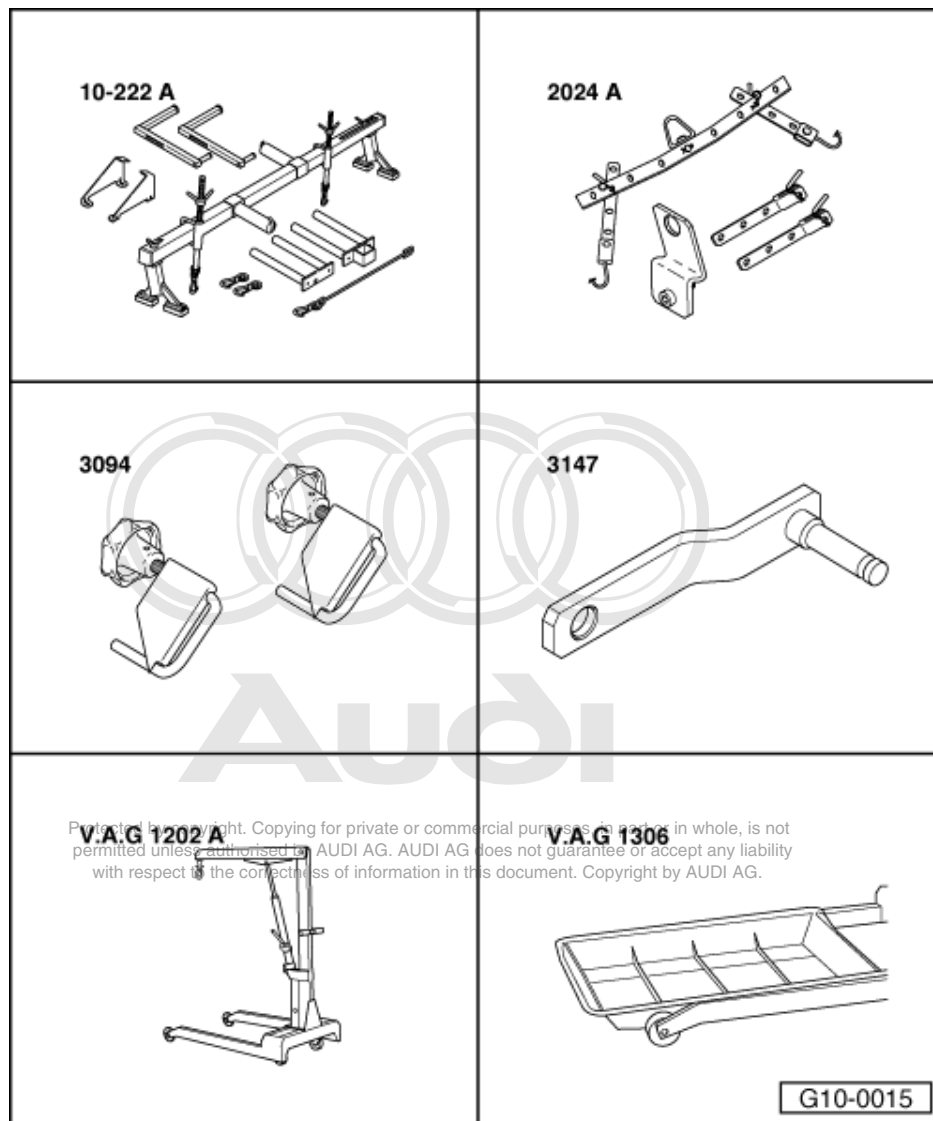
Code	ABP	AAT	AEL
Valve timing 2)			
Inlet opens after TDC	8°	8°	8°
Inlet closes after BDC	28°	28°	28°
Exhaust opens before BDC	37°	37°	37°
Exhaust closes before TDC	10°	10°	10°

2) with 1 mm valve lift and 0 mm valve play

10 - Removing and installing engine

1 - Removing and installing engine

1.1 - Removing and installing engine



Special tools and workshop equipment required

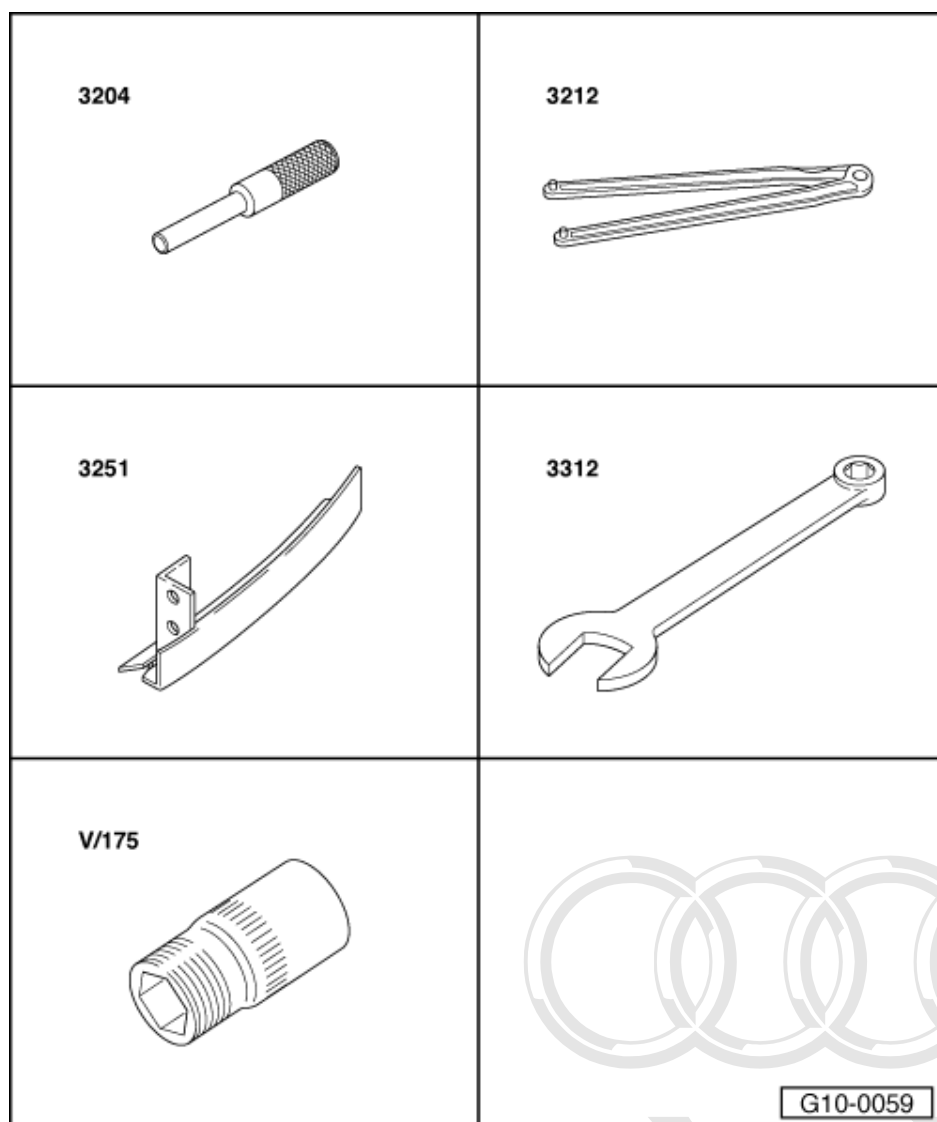
- ◆ Support bar 10-222A
- ◆ Lifting tackle 2024 A
- ◆ Hose clamps 3094
- ◆ Gearbox support 3147
- ◆ V.A.G 1202 A

or

- ◆ Workshop crane VAS 6100



- ♦ Drip tray V.A.G 1306



- ♦ Mandrel 3204
- ♦ Pin wrench 3212
- ♦ Support 3251
- ♦ Open-ended spanner 3312
- ♦ 15 mm socket insert Matra V/175 (on vehicles with automatic gearbox)

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1.2 - Removing

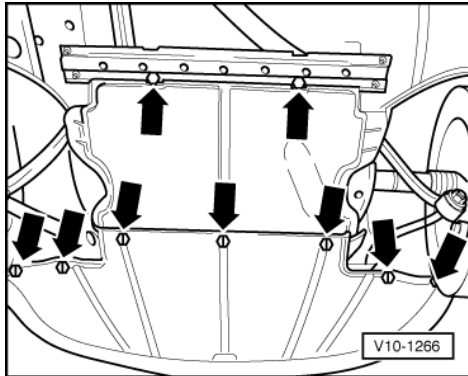
Notes:

- ♦ Remove engine upwards without gearbox.
- ♦ Collect drained coolant in a clean container for re use or disposal.
- ♦ Renew all cut and defective cable ties. Refit cable ties in the same position when installing the engine.
- Observe or obtain radio code on vehicles with coded radio.
- Disconnect earthing strap at battery with ignition switched off.

Important

Hot steam or hot coolant can escape when opening expansion tank. Cover cap with a cloth and open carefully.

- Open the cover of the coolant expansion tank



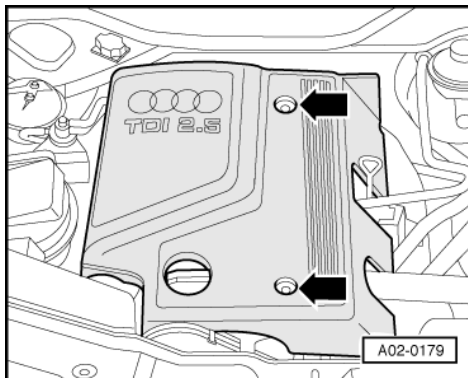
- -> Remove the noise insulation -arrows-.
- Remove the front bumper:

=> General Body Assembly; Repair group 63; Front bumper Front bumper

- Remove lock carrier:

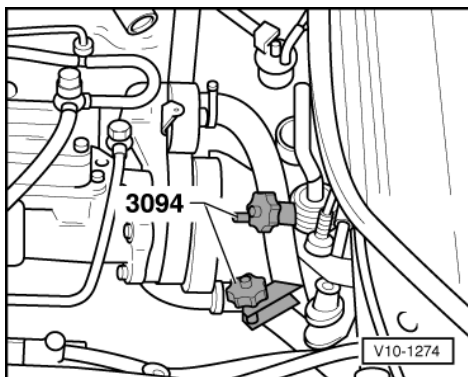
=> General Body Assembly; Repair group 50; Front body Front body

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Audi A6:

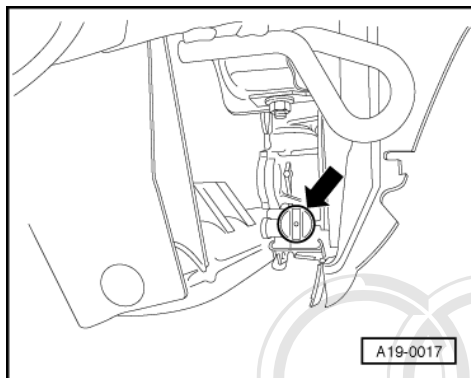
- -> Remove engine cover-arrows-.



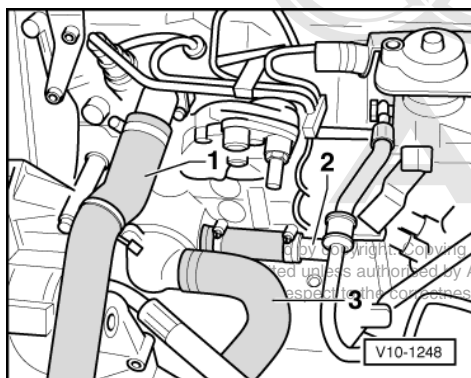


All models:

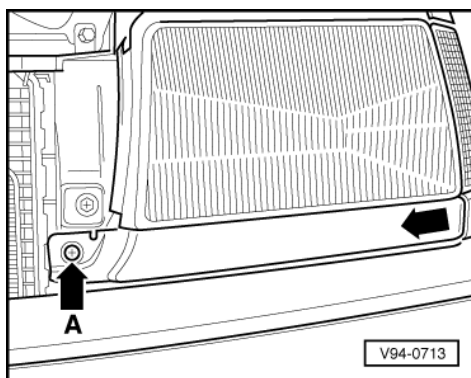
- Remove the toothed belt guard for injection pump drive.
- -> Clamp off coolant hoses to heater with hose clamps 3094.
- Place drip tray V.A.G 1306 below engine.
- Detach coolant hoses for heater at engine.



- -> Turn drain plug -arrow- on radiator anti-clockwise. If necessary, fit drain hose on connection.

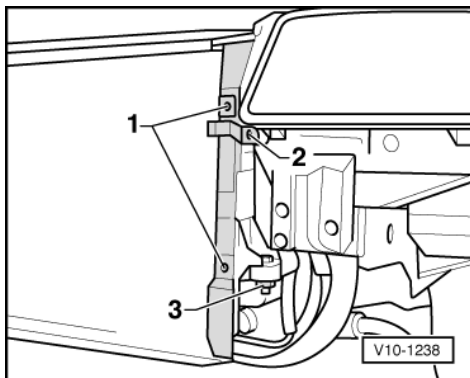


- -> Unscrew securing bolt for coolant pipe -2- (engine/gearbox flange).
- Release cable tie on coolant pipe.
- Detach coolant hose of coolant pipe -2-.
- Detach coolant hoses -1- and -3-.



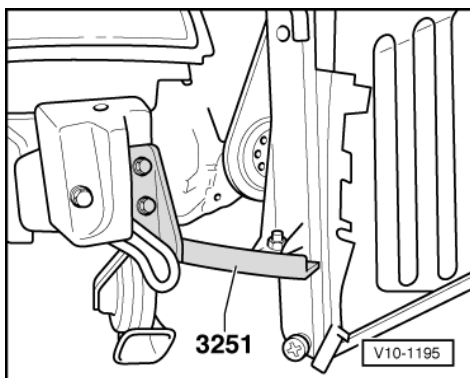
Audi A6:

- -> Remove securing bolt -arrow A- and pull out headlight trim in direction of arrow.

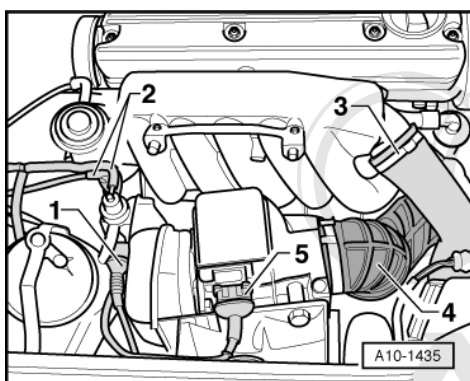


All models:

- -> Unscrew bolt -2- of retaining clip of trim on right headlight.
- Unscrew bolts -1- of air duct on left of radiator and remove air duct.
- Loosen bolts -3- on left and right of radiator.
- Unscrew air duct to air cleaner at radiator.



- -> Secure support 3251 on right bumper mounting and swing radiator forwards.



Vehicles with engine codes AAT, AEL:

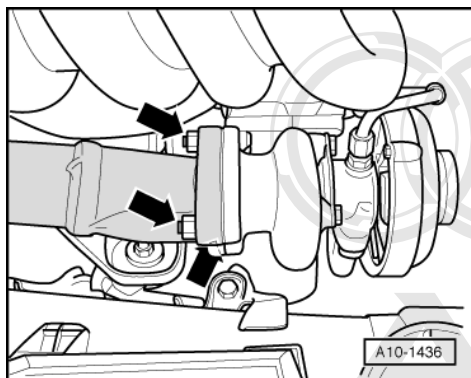
- -> Detach connector -5- from the exhaust gas recirculation valve.
- Detach connector -1- from the exhaust gas recirculation valve.
- Detach the hoses -2- from the exhaust gas recirculation valve.

All models:

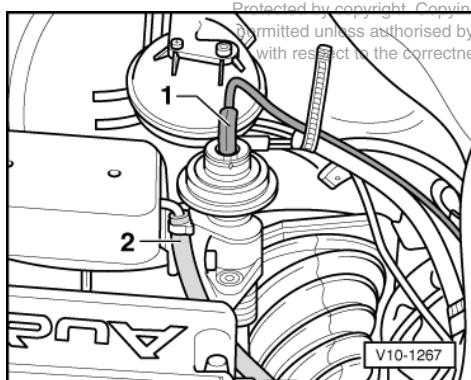
- Remove air intake pipe -3- between charge air cooler and intake manifold.
- Remove the air duct hose -4- to turbocharger with the hose for crankcase venting.



- Remove the upper section of the air cleaner housing.



- -> Unbolt front exhaust pipe from turbocharger connection -arrows-.



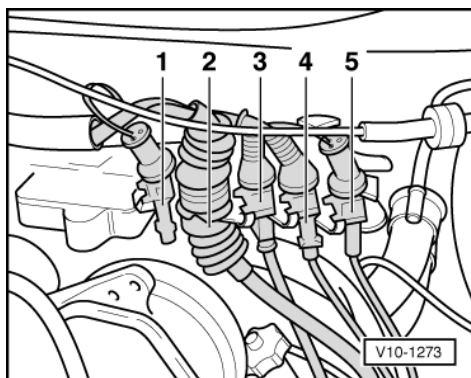
- -> Disconnect hose -2- at rear from intake manifold.

Vehicles with engine codes AAT, AEL:

- Disconnect vacuum hose -1- at mechanical exhaust gas recirculation valve.

All models:

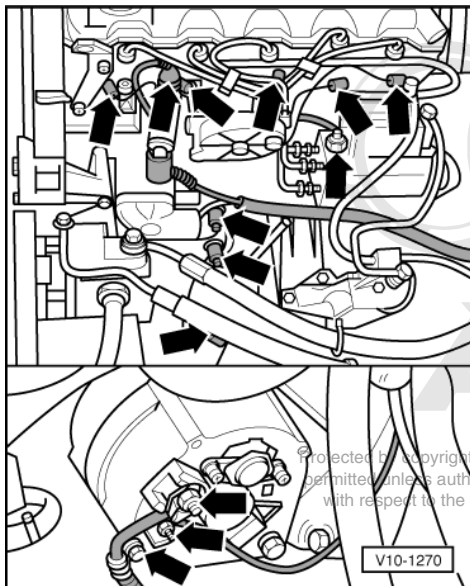
- Detach the cover for the connectors to the front.



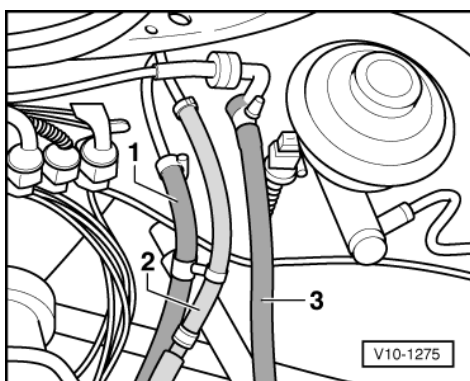
- -> Remove the following connectors from the centre of the bulkhead:

- 1 - Connector for valve for commencement of injection -N108 (white)
- 2 - Connector for injection pump
- 3 - Connector for engine speed sender -G28 (grey)
- 4 - Connector for needle lift sender -G80 (brown)

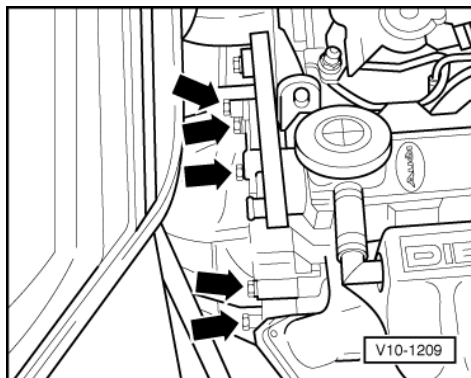
- 5 - Connector for water separator sender -G63 (black), if fitted
- Remove connectors -1...5- out of the bracket and lay the wiring aside.



- -> Disconnect the following electrical connections -arrows- at engine.
 - Glow plugs
 - Shut-off device
 - Coolant temperature senders
 - Oil pressure switch
 - Engine mount on left
- Unscrew wiring -arrows- at alternator.
 - B+ wire
 - D+ wire
 - Retainer for wiring
- Release cable tie and lay wiring aside.



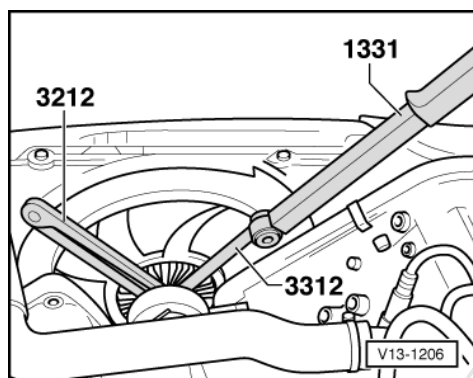
- -> Disconnect fuel supply and return lines -1- and -2-.
- Detach vacuum line -3- to brake servo at vacuum pump.



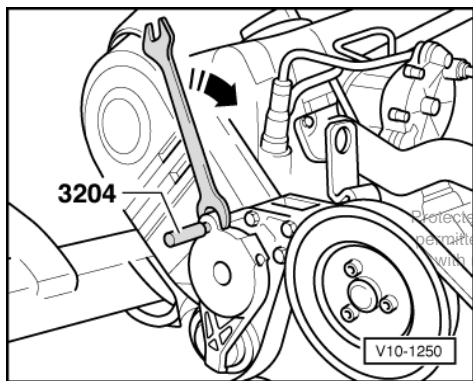
- -> Unscrew engine/gearbox connecting bolts accessible from above -arrows-. Leave one bolt in place (hand tight).

Note:

On removal, note the bolt lengths and assignment for re-installation.



- Remove the ribbed belt guard.
- -> Counterhold pulley for viscous fan with 2-hole pin wrench 3212 and unscrew viscous fan with wrench 3312 (left-hand thread).
- Remove the viscous fan.



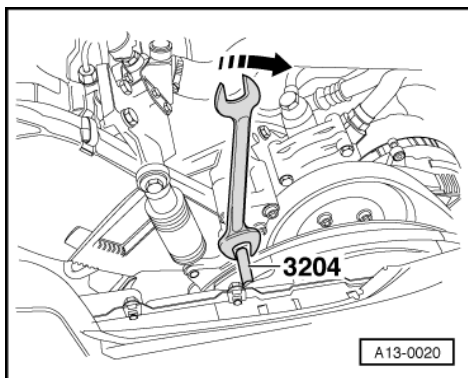
Note:

Mark the running direction with chalk or a felt-tipped pen before removing the ribbed belt. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

Audi 100:

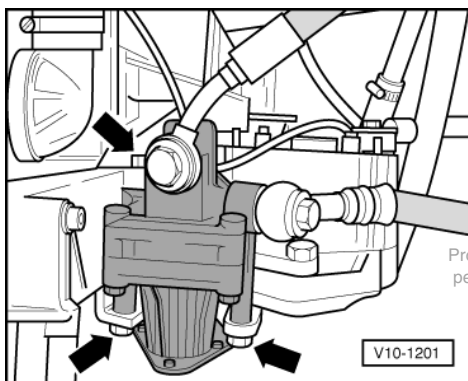
- -> To slacken ribbed belt, turn tensioner in direction of arrow.
- Secure tensioner in position with pin 3204.

- Remove ribbed belt and release tensioner.



Audi A6:

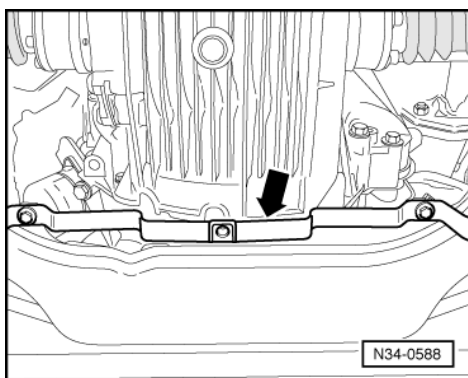
- -> To slacken ribbed belt, turn tensioner in direction of arrow.
- Secure tensioner in position with pin 3204.
- Remove ribbed belt and release tensioner.



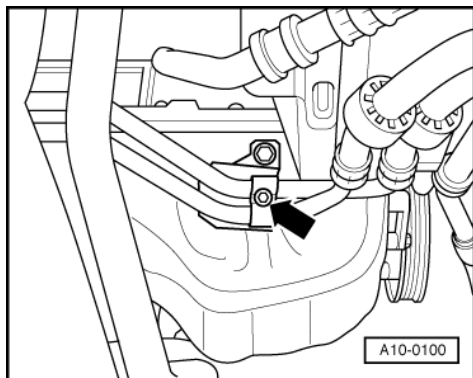
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All models:

- Unbolt pulley from vane pump for power steering.
- -> Unscrew the power steering vane pump -arrows- and place to one side. Do not detach hydraulic connections.



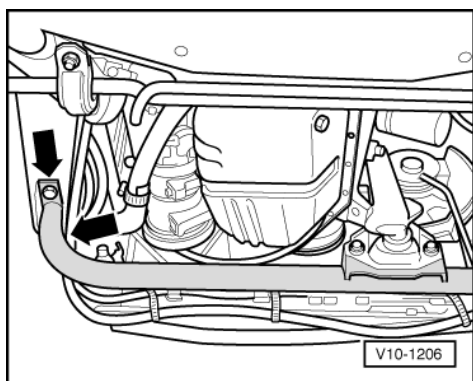
- -> Unbolt bracket for noise insulation -arrow-.



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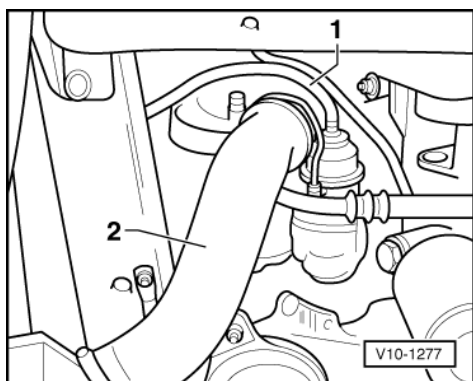
Vehicles with automatic gearbox:

- -> Unbolt bracket for ATF lines from engine -arrow-.

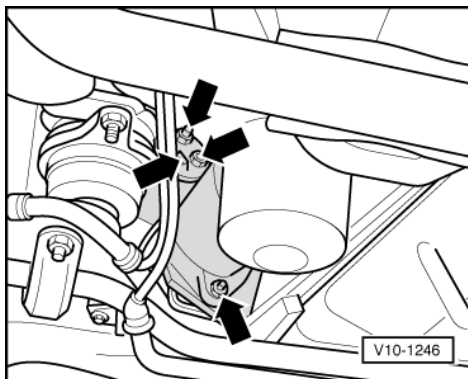


All models:

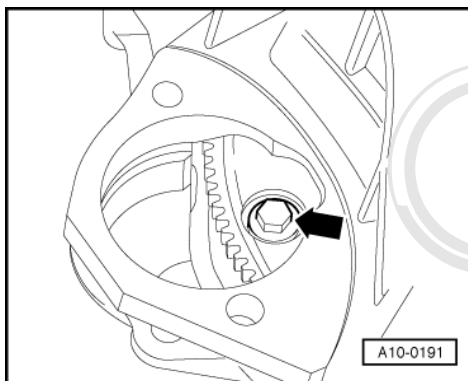
- -> Unscrew cross member -arrows- and limit stop for torque reaction support.



- -> Detach vacuum hose -1- from turbocharger boost pressure valve.
- Remove the air duct hose -2- from the charge air cooler to the turbocharger.



- -> Remove starter -arrows-.

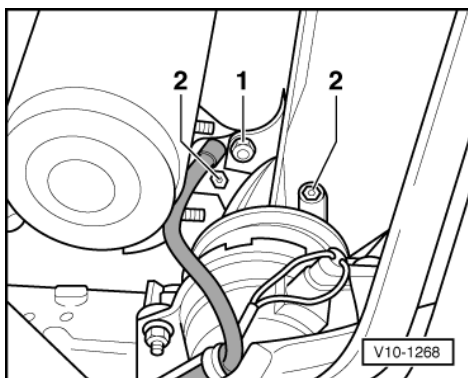


Vehicles with automatic gearbox:

- -> Use 15 mm wrench socket Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted. All rights reserved. Audi AG, Ingolstadt, Germany. No part of this document may be reproduced without the written permission of Audi AG. Information in this document. Copyright by AUDI AG. Matra V/175 to screw out 3 bolts of torque converter in opening in removed starter (give crankshaft 1/3 of a turn in each case).

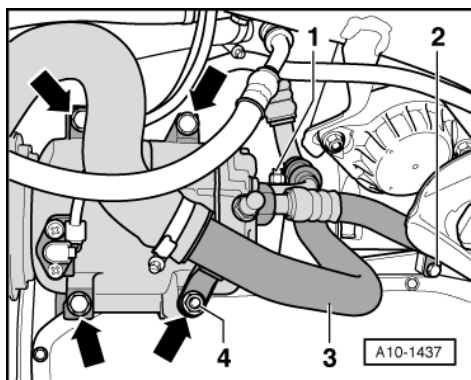
Note:

When loosening torque converter bolts, counterhold crankshaft by applying spanner to central bolt on vibration damper.



All models:

- -> Unscrew the nuts -2- for the heat shield for engine mount on right from below.
- Unscrew the nut -1- for ground lead at the right engine support.



Vehicles with air conditioner:

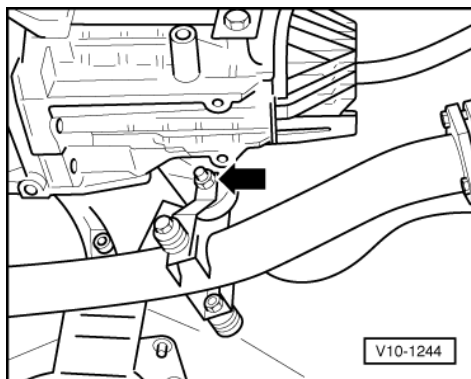
- -> Unscrew nuts -1- and -4-.
- Remove coolant pipe -2-.

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Important

The air conditioner refrigerant circuit must not be opened.

- Unscrew bolt -2-.
- Unscrew the A/C compressor from the bracket -arrows-.
- Attach air conditioner compressor onto longitudinal member, leaving lines connected.

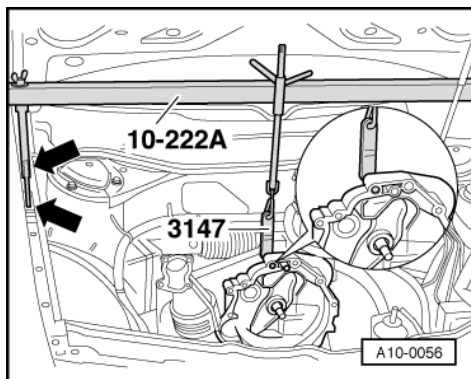


All models:

- -> Unbolt exhaust system at bracket -arrow-.
- Detach the exhaust pipe with the catalytic converter from the turbocharger.
- Unscrew engine/gearbox securing bolts accessible from below.

Note:

On removal, note the bolt lengths and assignment for re-installation.



- -> Fit support bar 10-222 A onto bolt connection edge of wing -arrows-.

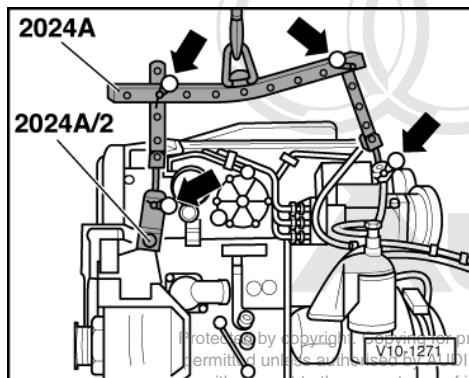
Note:

Position support bar in front of gas-filled strut of bonnet with spindle pointing to rear.

- Engage gearbox support 3147 in the top right bolt hole on the bell housing as shown in the illustration.

Notes:

- ◆ Height of gearbox can be adjusted using wing nut of attachment hook.
- ◆ Do not apply too much initial tension as the steering box could be damaged.
- ◆ Shown in illustration with engine removed.



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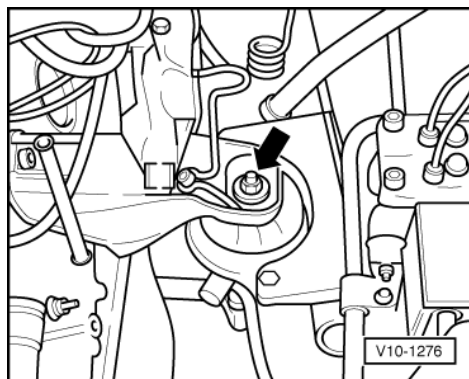
- -> Screw lug 2024 A/2 onto the engine.
- Engage lifting tackle 2024 A at the engine and at workshop crane VAS 6100 or 1202 A, as shown in the illustration.

Note:

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

Important

The hooks and locating pins of the lifting tackle must be secured with locking pins -arrows in illustration-.



- -> Unscrew nuts -arrow- at top right and left of engine mounts.

Note:

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

- Lift engine over studs of engine mounts.
- Tighten spindle of support bar 10-222 A.
- Unscrew last engine/gearbox securing bolt.

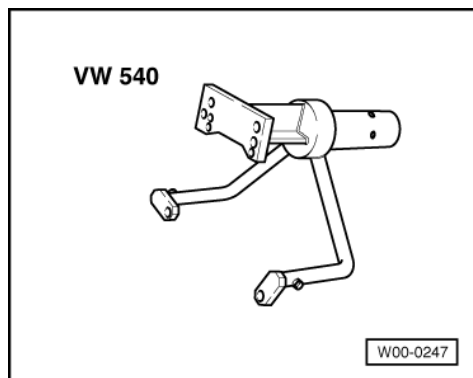


- Detach engine from gearbox and lift forward out of engine compartment.

Vehicles with automatic gearbox:

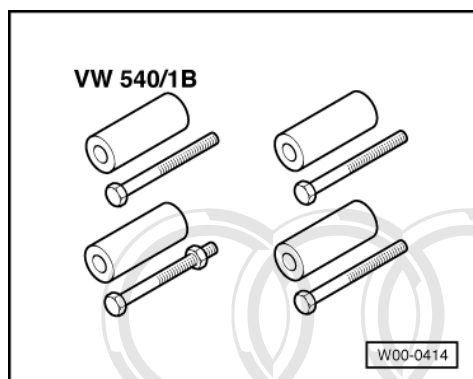
- Secure torque converter in gearbox to prevent it falling out.

1.3 - Attaching engine to repair stand

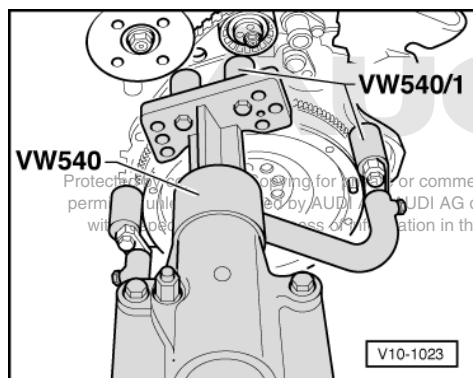


Special tools and workshop equipment required

- ♦ Engine and gearbox support VW 540



- ♦ Supplementary kit VW 540/1 B



Procedure

Note:

Before securing the engine on the engine mount, remove dowel sleeves from cylinder block at engine/gearbox flange.

- -> For work on the engine, attach engine to repair stand using engine/gearbox support VW 540 and supplementary kit VW 540/1 B.

1.4 - Installing

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

Notes:

- ◆ When performing repairs, replace seals, gaskets, self-locking nuts and bolts which have a specified tightening angle.
- ◆ Secure all hose connections with the correct hose clamps (same as original equipment):

=> Parts List

- ◆ Hose connections and hoses for charge air system must be free of oil and grease before assembly. Lubricants must never be used.

Vehicles with manual gearbox:

- Check clutch release bearing for wear, renew if necessary.
- Lightly lubricate splines on gearbox input shaft with G 000 100. Do not lubricate guide sleeve for release bearing.
- If necessary, check that clutch plate is properly centred.
- A needle bearing must be fitted in the flywheel on vehicles with manual gearbox. Install needle bearing if necessary => Page 64 .

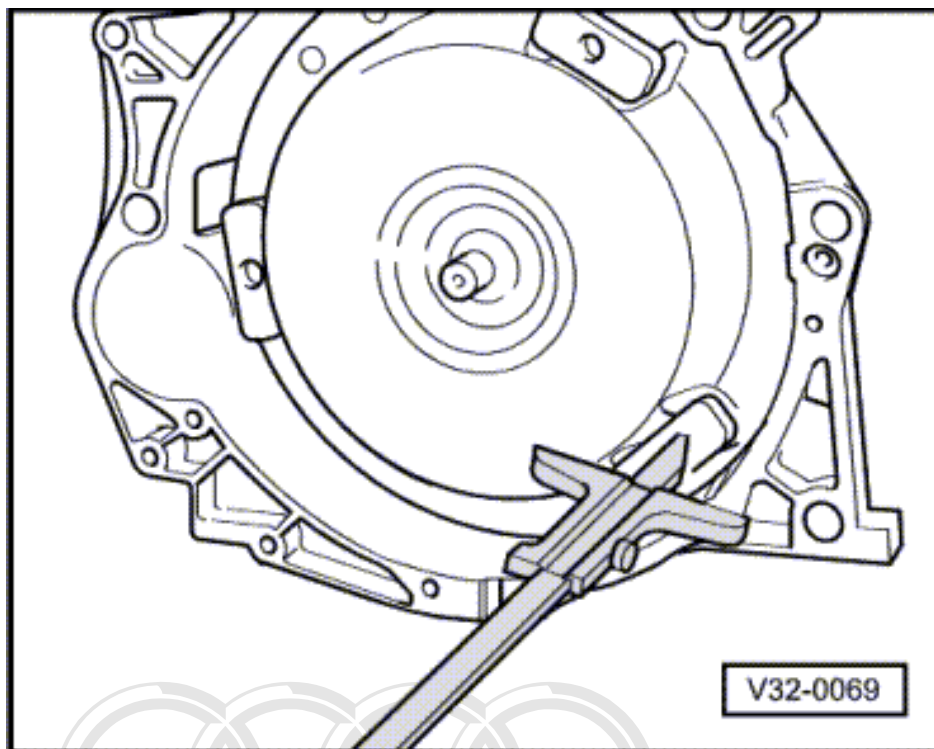
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Vehicles with automatic gearbox:

- Short engines are supplied without bushes in the crankshaft. Before installing the drive plate drive in the bush => Fig. 60
- To secure torque converter on drive plate. only use correct bolts as specified in parts catalogue (same as original equipment).

=> Parts List

- Use 15 mm wrench socket (Matra V/175) to fasten nuts of torque converter.
- Before installing engine, rotate torque converter and drive plate so that one hole and one stud are level with the aperture for the starter motor.



Checking position of torque converter

-> When the torque converter is correctly inserted, the distance between the surface of the securing eyes and the surface of the torque converter bell housing is at least 19 mm.

If the torque converter is not inserted correctly, this distance is approximately 14 mm and the freewheel support is not fully seated.

Important

If the torque converter is not installed correctly, the torque converter drive plate or the ATF pump will be seriously damaged when the gearbox is joined to the engine.

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All models:

- Installing engine mounts free of stress. Ensure that engine mounts are free of stress by shaking engine to align it before tightening engine mounts.
- Install A/C compressor and power steering vane pump.
- Install ribbed belt =>Page 29
- Install viscous fan => Page 144
- Adjusting limit stop for torque reaction support. Allow limit stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten bolts to 40 Nm.
- Installing lock carrier with attachments:

=> General Body Assembly; Repair group 50; Front body Front body

- Install the front bumper:

=> General Body Assembly; Repair group 63; Front bumper Front bumper

- Installation and stress-free alignment of exhaust system =>Page 201
- Top up coolant => Page 141

Notes:

- ♦ Drained 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.

- Electrical connections and routing:

=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

Note:

When the battery is reconnected make sure that the vehicle equipment (radio, clock, electrical window lifter) is activated according to the operating instructions.

Important
Do not use charging unit for boost starting. There is danger of damaging the vehicle control units.

- Check oil level before starting engine.
- To interrogate fault memory:

=> Diesel Direct Injection and Glow Plug System (TDI 5-cylinder); Repair group 01; Interrogating and erasing fault memory Interrogating and erasing fault memory

Note:

Faults will have been recorded in the fault memory because the connectors have been unplugged. Therefore interrogate and erase fault memory after installing engine.

1.5 - Tightening torques

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.
- ♦ Tightening torque tolerance $\pm 15\%$.

Component	Nm
Bolts/nuts	M6 10
	M8 20
	M10 45
	M12 65
Except for the following:	
Engine mounting to engine support	40
Drive plate to Torque converter M10 x 1	85
Front exhaust pipe to turbocharger	30
Front exhaust pipe to gearbox	25
A/C compressor to bracket	25
Brackets for ATF lines	10
Cross member with limit stop for torque reaction support to body	40
Vane pump to bracket	20
Belt pulley to vane pump	20
Radiator to front	20
Hose clamps for coolant hoses	2



Hose clamps for air duct hoses	3.5
Noise insulation bracket	10

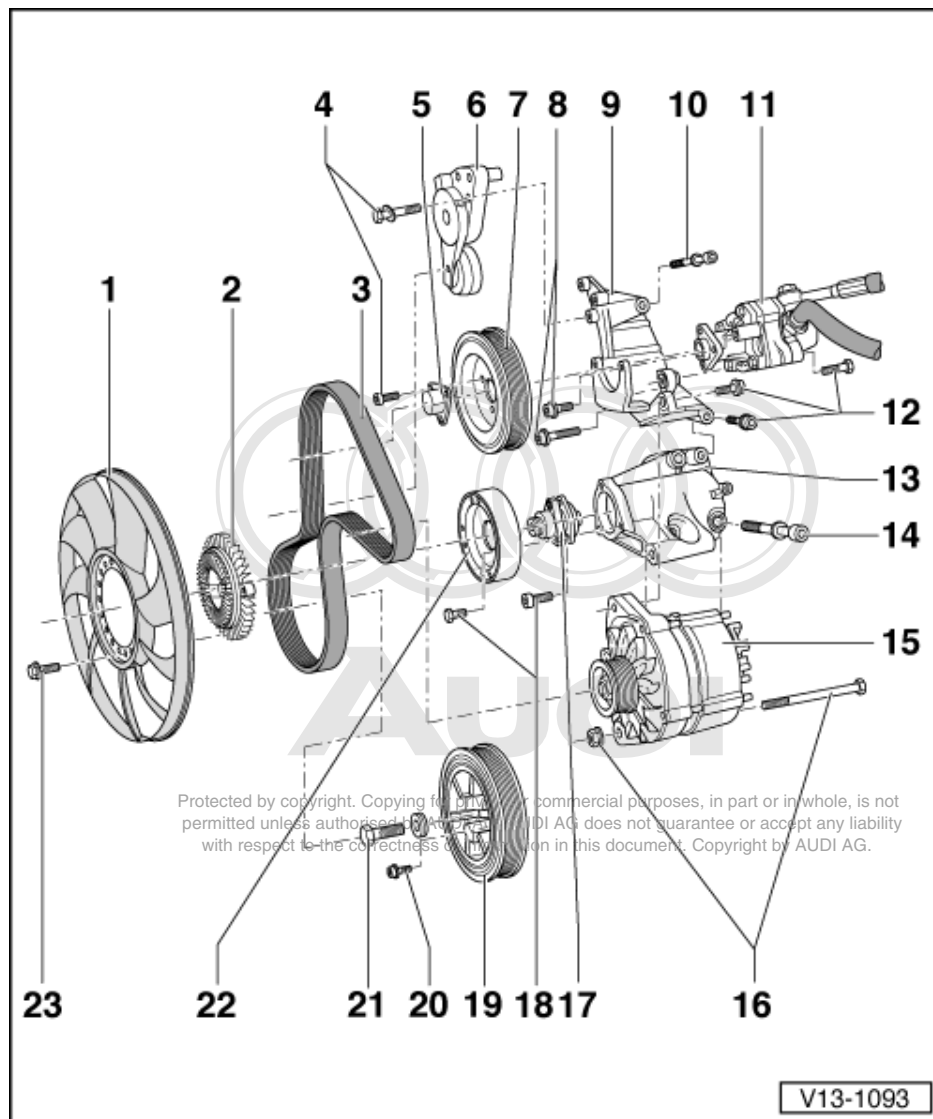


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13 - Crankshaft group

1 - Dismantling and assembling engine

1.1 - Dismantling and assembling engine



1.2 - Ribbed belt drive for vane pump, alternator and viscous fan

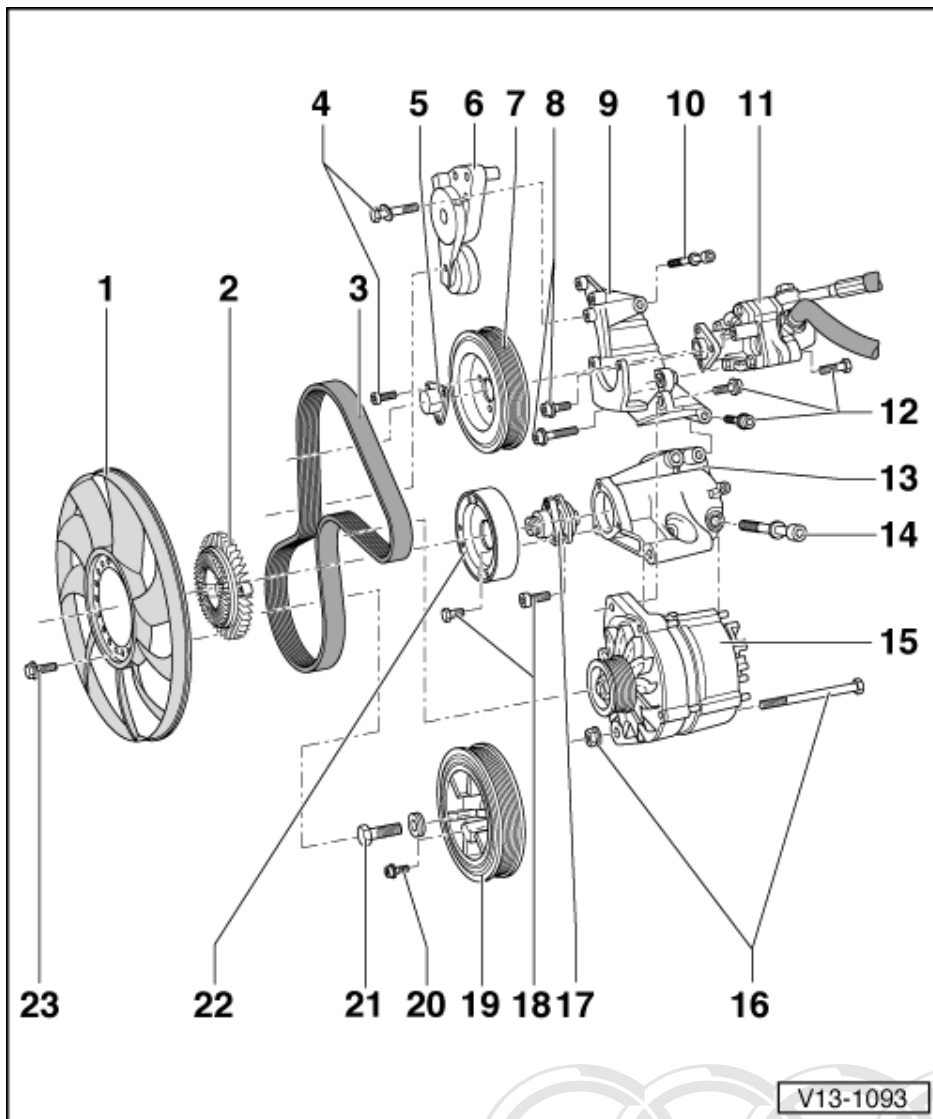
Note:

Mark the running direction with chalk or felt pen before removing the ribbed belt. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

1 Fan wheel

- ◆ For viscous fan
- ◆ "FRONT" marked on outer race must point in direction of travel

- ♦ Removing and installing =>Page 144



2 Viscous coupling

- ♦ Switching temperature: 72...80°C ambient temperature at the viscous coupling
- ♦ Checking => Page 146
- ♦ Removing and installing =>Page 144

3 Ribbed belt

- ♦ Check for wear
- ♦ Do not kink
- ♦ Removing and installing =>Page 27
- ♦ Routing of ribbed belt=>Fig. 27
- ♦ Ribbed belt on vehicles with air conditioner=>Fig. 27

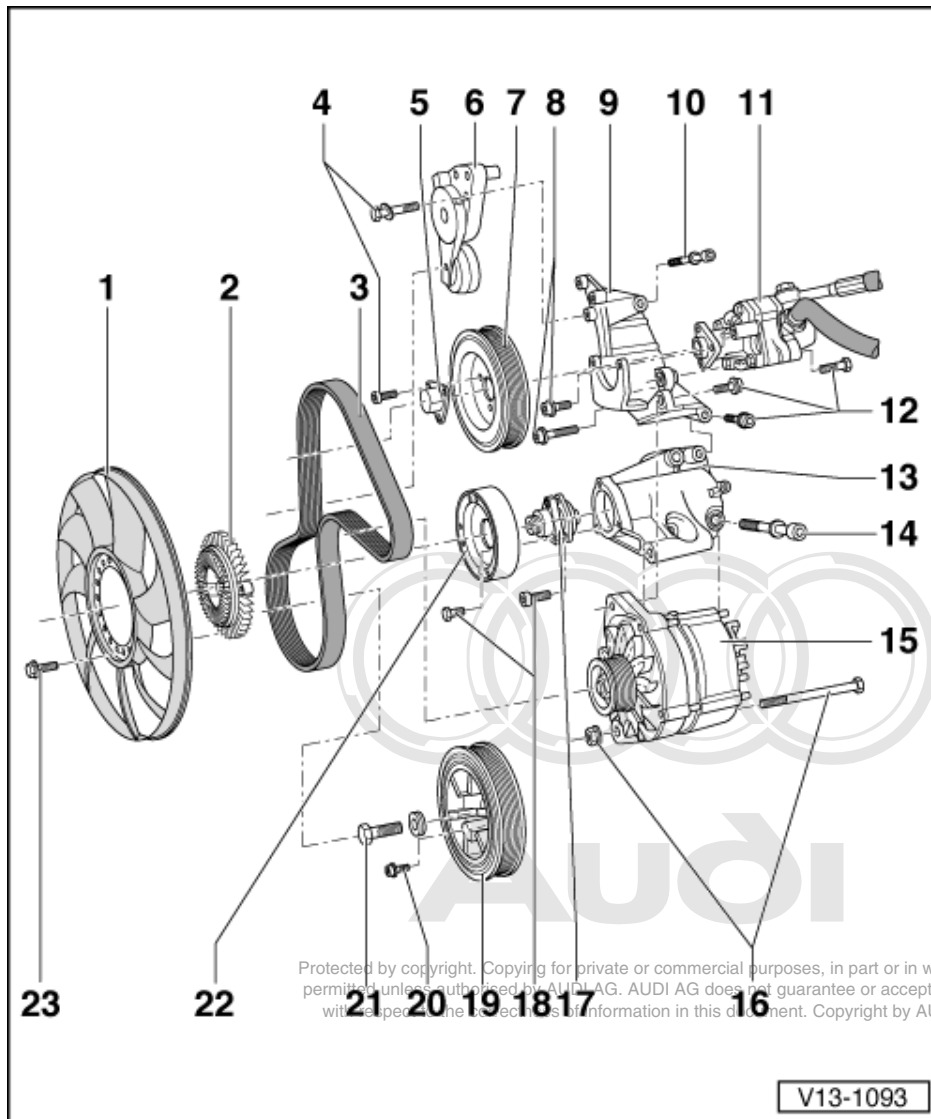
4 20 Nm

- ♦ To release and pick up pulley counterhold with oil filter strap wrench if necessary.

5 Hexagon flange

- ♦ For turning the engine by hand using wrench 32 A/F

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6 Tensioner for ribbed belt

- ♦ Swivel with open-ended spanner to slacken ribbed belt => Page 28
- ♦ Secure in position with mandrel 3204

7 Belt pulley

- ♦ For vane pump

8 20 Nm

9 Bracket

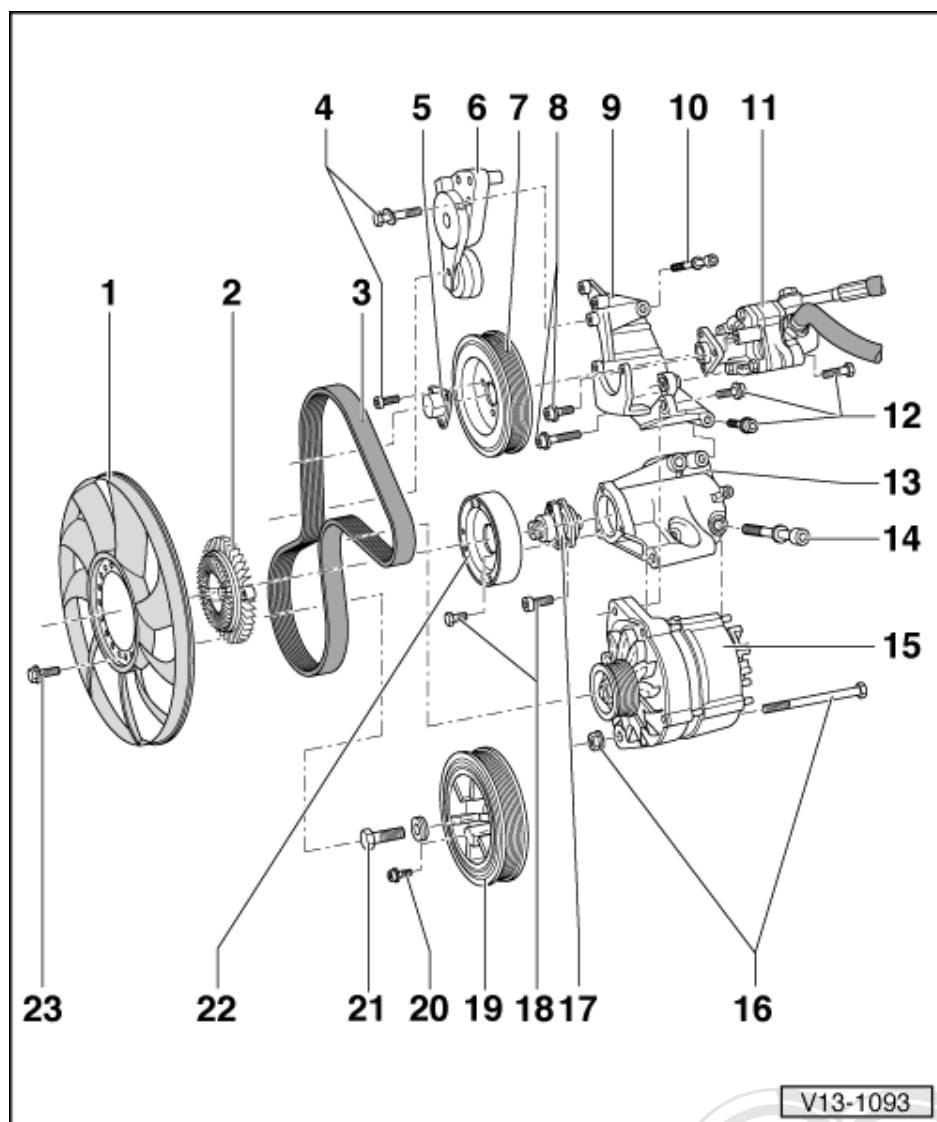
- ♦ For vane pump

10 20 Nm

11 Vane pump

- ♦ For power steering
- ♦ Removing and installing:

=> FWD and 4WD Running Gear; Repair group 48; Exploded view: Vane pumps Exploded view: Vane pumps



V13-1093

12 20 Nm

13 Bracket

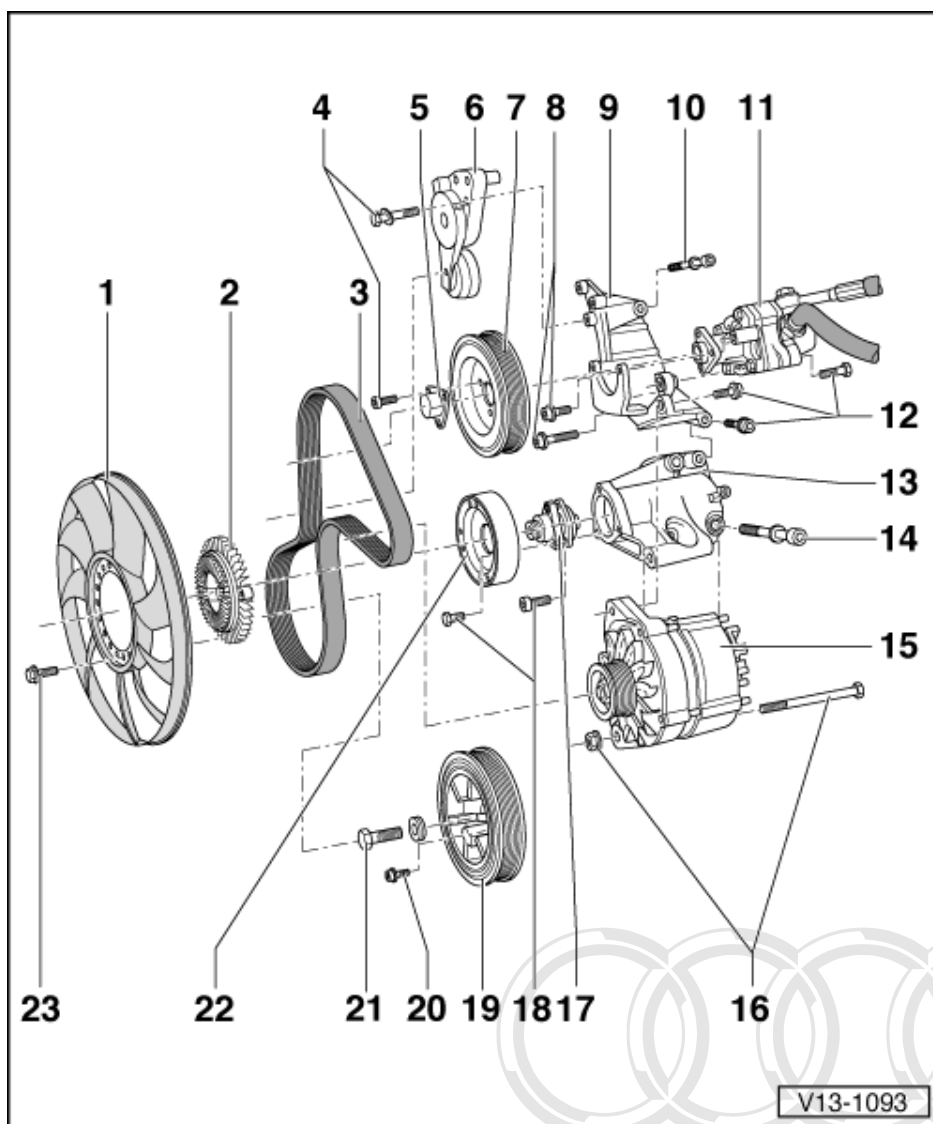
- ◆ For alternator

14 45 Nm

15 Alternator

- ◆ Removing:
 - Disconnect battery earth strap
 - Removing ribbed belt =>Page 27
 - Disconnect wiring from alternator
 - Unplug connector, lay the wiring aside.
 - Unscrew bolts from top and bottom from bracket.
 - Remove alternator
- ◆ To facilitate attachment of the alternator drive back bush for lower securing bolt slightly at bracket

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16 45 Nm

17 Mounting

- ♦ For viscous fan
- ♦ Check for ease of movement
- ♦ Removing and installing =>Page 144

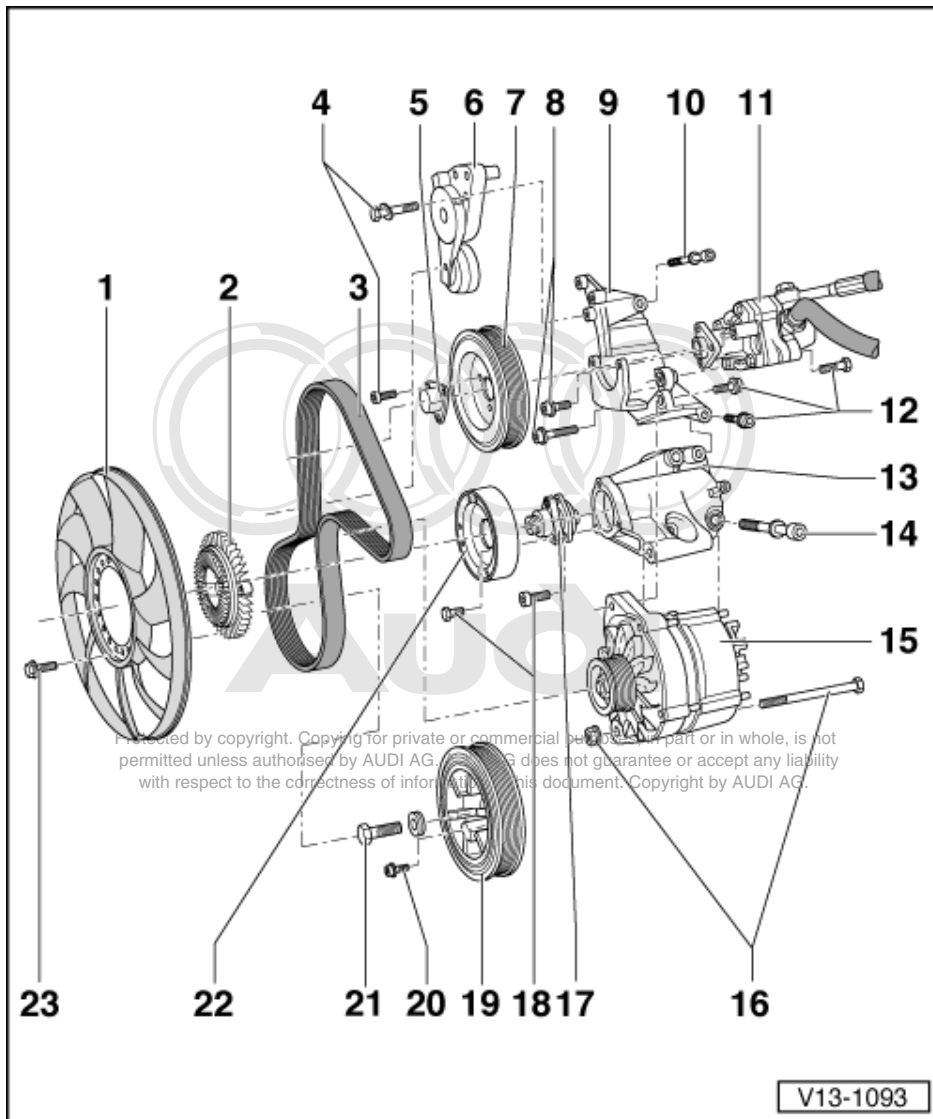
18 10 Nm

19 Vibration damper

- ♦ Assembly on the sprocket/crankshaft only possible in one position. The lug on the sprocket must engage in the bore of the belt pulley
- ♦ Removing and installing=>Page 29

20 20 Nm

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21 Central bolt

- ◆ Replace
- ◆ Coat thread and contact surface of bolt head with sealing paste
- ◆ Sealing paste

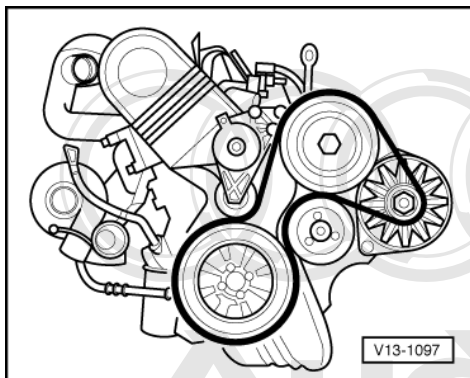
=> Parts List

- ◆ Counter hold with 3256 to loosen and tighten
- ◆ Tightening torque 200 Nm + 270° (3/4 turn)
- ◆ Removing and installing=>Page 29

22 Belt pulley

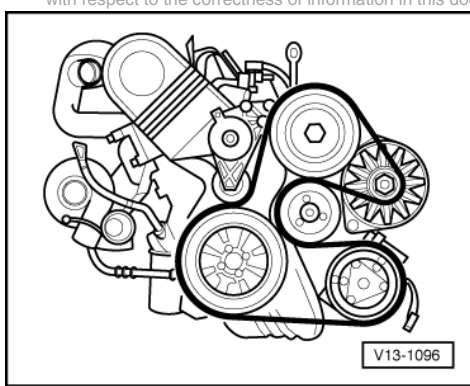
- ◆ For viscous fan
- ◆ Removing and installing =>Page 144

23 10 Nm



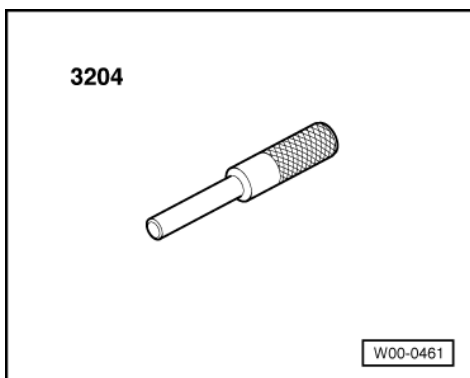
-> Fig.1 Ribbed belt routing on vehicles without air conditioner

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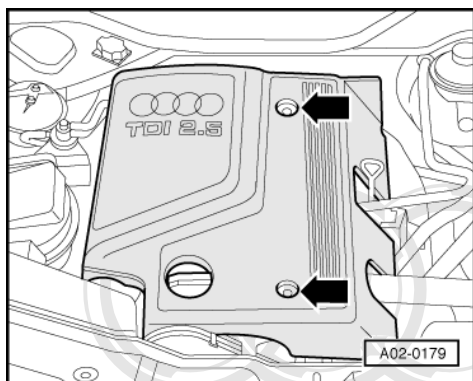
-> Fig.2 Ribbed belt routing on vehicles with air conditioner

1.3 - Removing and installing ribbed belt



Special tools and workshop equipment required

- ◆ Mandrel 3204



Removing

- Remove lock carrier:

=> General Body Assembly; Repair group 50; Front body Front body

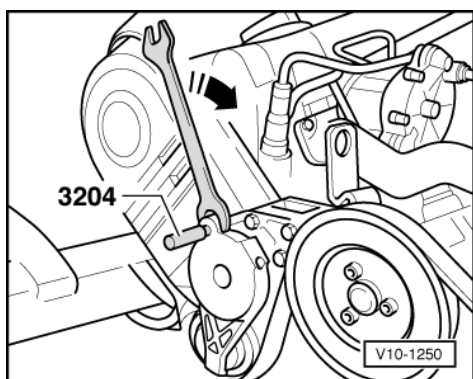
Audi A6

- ➤ ~~Remove engine cover arrows~~ - 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:

Note:

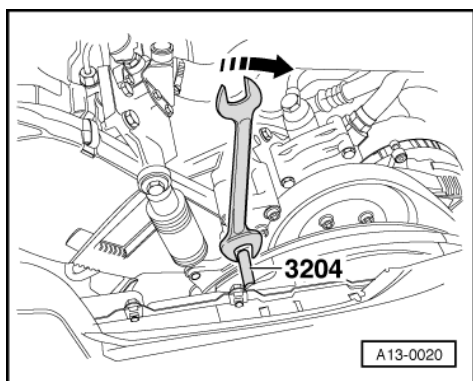
Mark the running direction with chalk or a felt-tipped pen before removing the ribbed belt. If the belt runs in the opposite direction when it is refitted, this can cause breakage.



- Remove the ribbed belt guard.

Audi 100:

- -> To slacken ribbed belt, turn tensioner in direction of arrow.
- Secure tensioner in position with pin 3204.
- Remove ribbed belt and release tensioner.



Audi A6:

- -> To slacken ribbed belt, turn tensioner in direction of arrow.
- Secure tensioner in position with pin 3204.
- Remove ribbed belt and release tensioner.

All models:

- Remove ribbed belt tensioner.
- Remove ribbed belt.

Installing

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

Note:

Ensure that the ribbed belt is properly seated on the pulleys when installing.

- Insert ribbed belt.
- Install ribbed belt tensioner.
- Fit ribbed belt.
- Check that ribbed belt is properly seated.

Vehicles without air conditioner:

- Routing of ribbed belt => Fig. 27

Vehicles with air conditioner:

- Routing of ribbed belt => Fig. 27
- Tension ribbed belt by removing pin 3204.
- Start engine and check belt running.

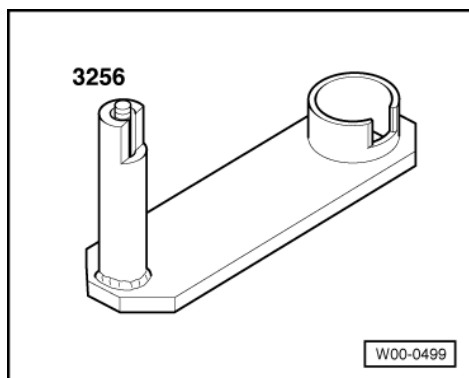
- Installing lock carrier with attachments:

=> General Body Assembly; Repair group 50; Front body Front body

Tightening torque

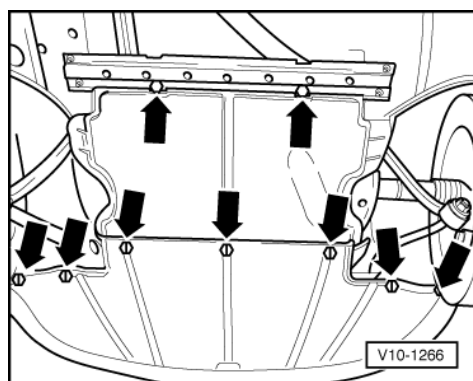
Component	Nm
Ribbed belt tensioner to engine	20
Cover for ribbed belt	10

1.4 - Removing and installing vibration damper



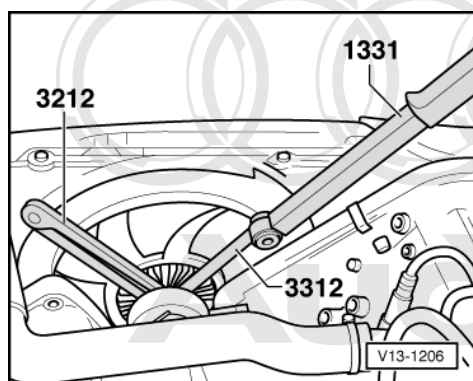
Special tools and workshop equipment required

- ♦ Counterhold for vibration damper 3256

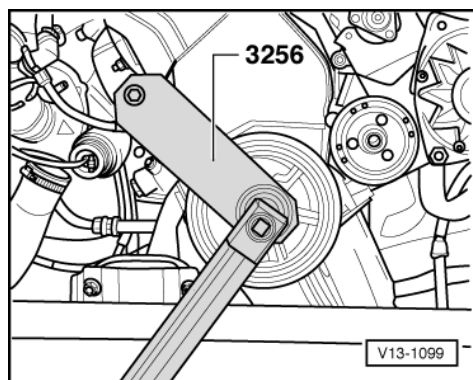


Removing

- -> Remove the noise insulation -arrows-.
- Remove ribbed belt => Page 27
- Unscrew air duct to air cleaner at radiator.



- ➤ Counterhold pulley for viscous fan with 2-hole pin wrench 3312 and unscrew viscous fan with wrench 3312 (left-hand thread).
- Remove viscous fan from mounting and put in front of radiator cowl.
- If necessary, unclip wiring harness at bottom on radiator cowl.
- Unscrew radiator cowl from radiator and remove it and the viscous fan from above.
- Unscrew radiator cowl with electric fan motor from radiator and remove it upwards.



- -> Insert vibration damper counterhold 3256 as illustrated, and unscrew central bolt.

Note:

Before securing the counterhold 3256, in vehicles with engine codes AAT and AEL, first the two bolts for the oil separator bracket must be unscrewed.

- Unscrew the 4 securing bolts (M8) for vibration damper and remove vibration damper.

Installing

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

- Tighten central bolt of vibration damper (use counterhold 3256):
 - Tightening torque: 200 Nm + 270° (3/4 turn)
- Install ribbed belt =>Page 29
- Install viscous fan => Page 144

Tightening torques

Component	Nm
Vibration damper with toothed belt to crankshaft 1)	200 + 270°2)
Vibration damper to toothed belt sprocket (M8)	20

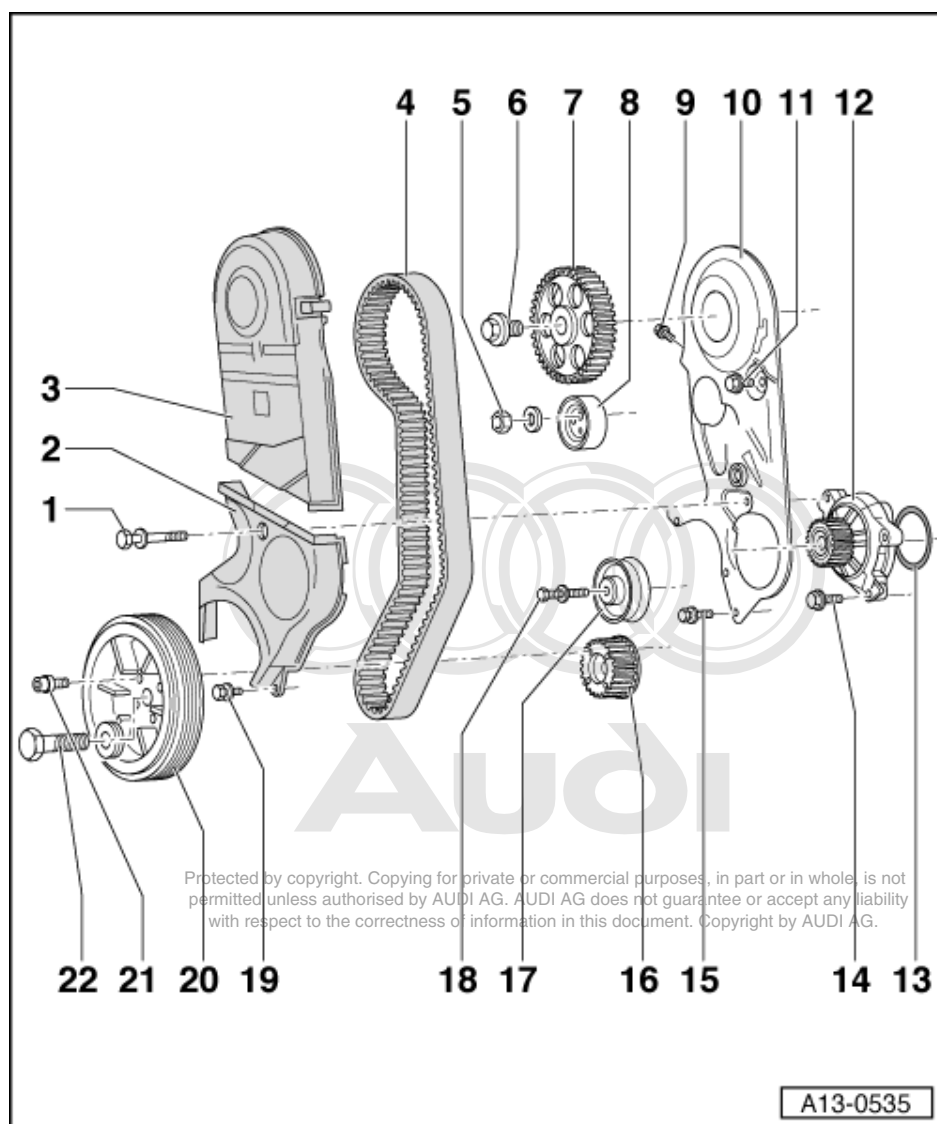
- 1) Always replace central bolt
- 2) 270°corresponds to 3/4 turn



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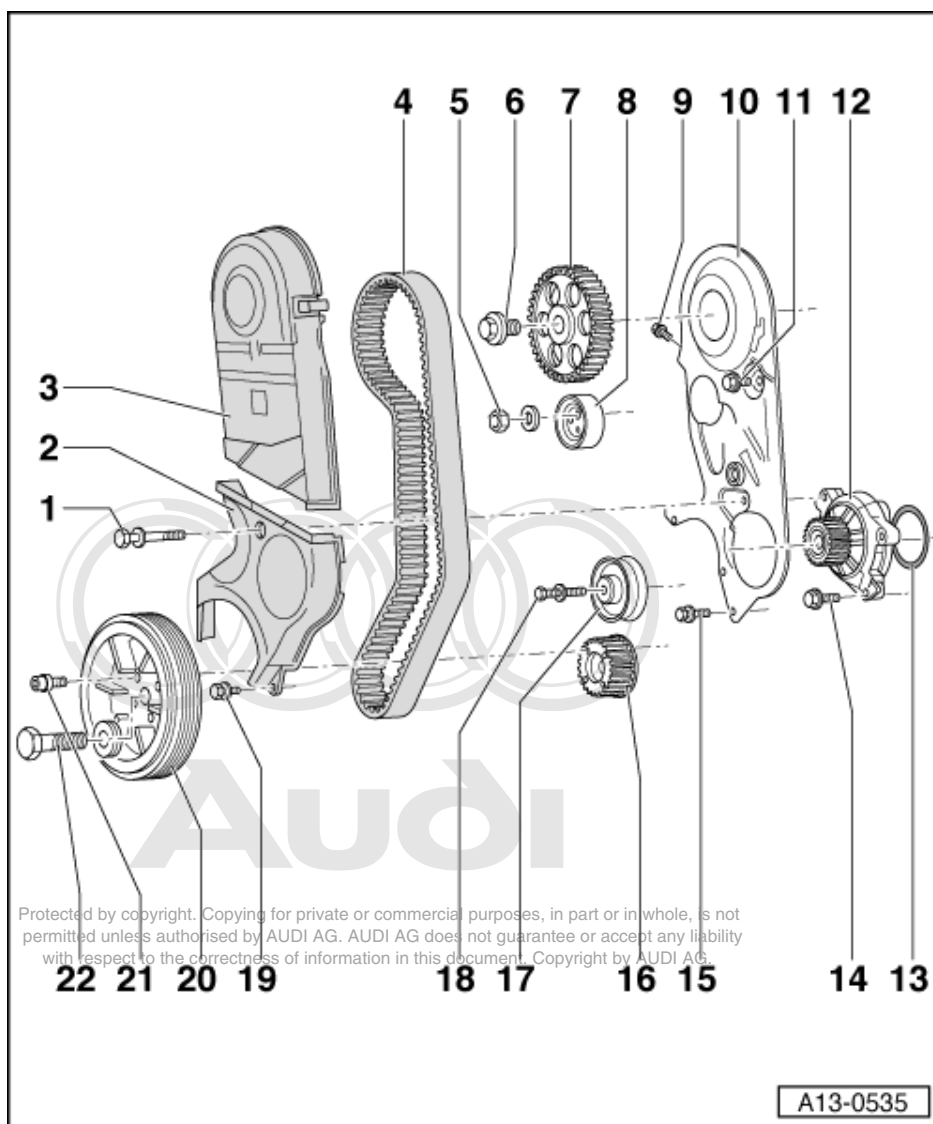
1.5 - Toothed belt drive for camshafts



Note:

Mark the running direction with chalk or felt pen before removing the toothed belt. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

- 1 20 Nm
- 2 **Toothed belt guard - lower**
 - ♦ To remove, unbolt vibration damper
- 3 **Toothed belt guard - upper**
 - ♦ When installing, engage carefully in lower toothed belt guard.



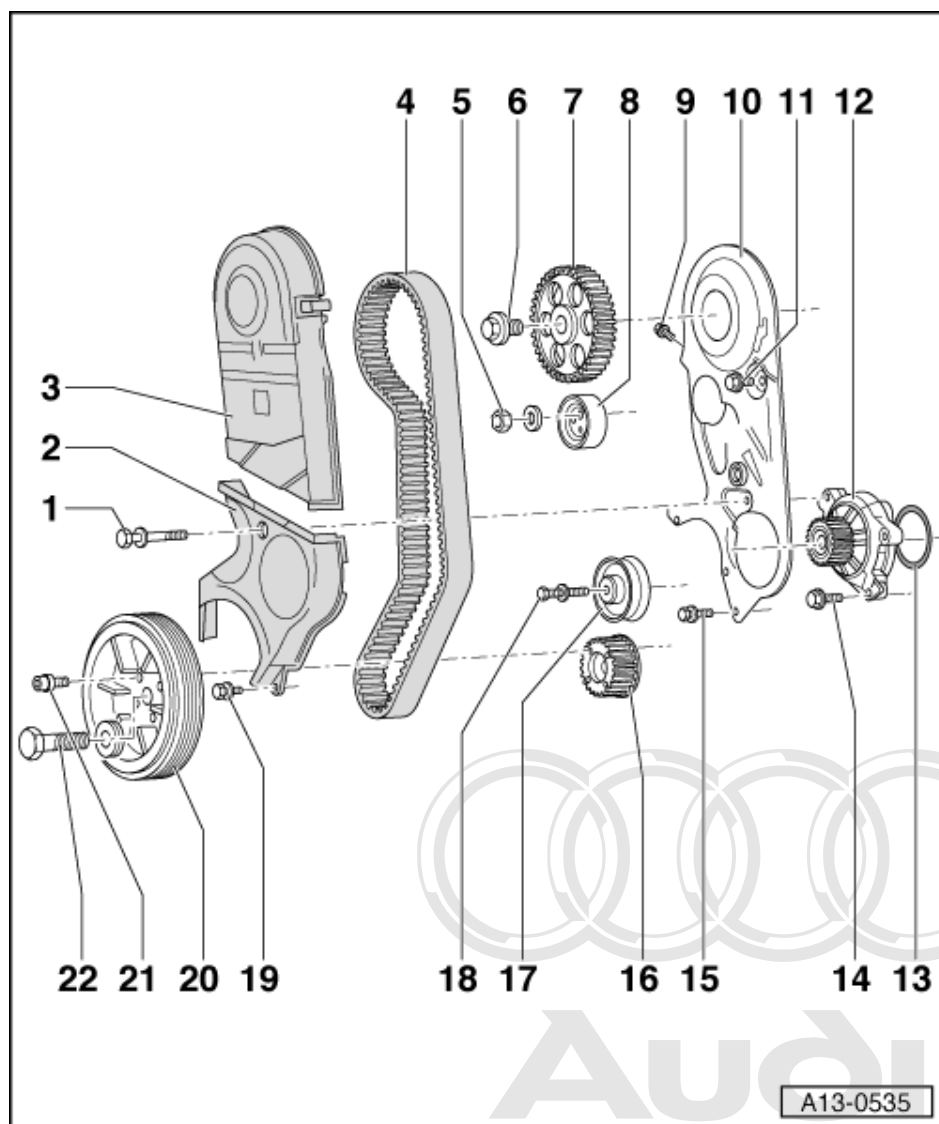
4 Toothed belts

- ♦ Always adjust toothed belt tension with cold engine
- ♦ Mark running direction with chalk or felt pen before removing
- ♦ Check for wear
- ♦ Do not kink
- ♦ Removing => Page 38
- ♦ Install (adjust valve timing) => Page 40

5 M8 - 22 Nm M10 - 45 Nm

6 Bolt for camshaft sprocket

- ♦ Counter hold with 3036 to loosen and tighten
- ♦ Tightening torque:
tighten 30 Nm + 90° (1/4 turn)

**7 Camshaft sprocket**

- ◆ Release from camshaft taper by tapping pin through hole on toothed belt guard using hammer

8 Tensioning roller**9 10 Nm****10 Toothed belt guard - rear****11 10 Nm**

- ◆ Install using locking compound
- ◆ Locking compound

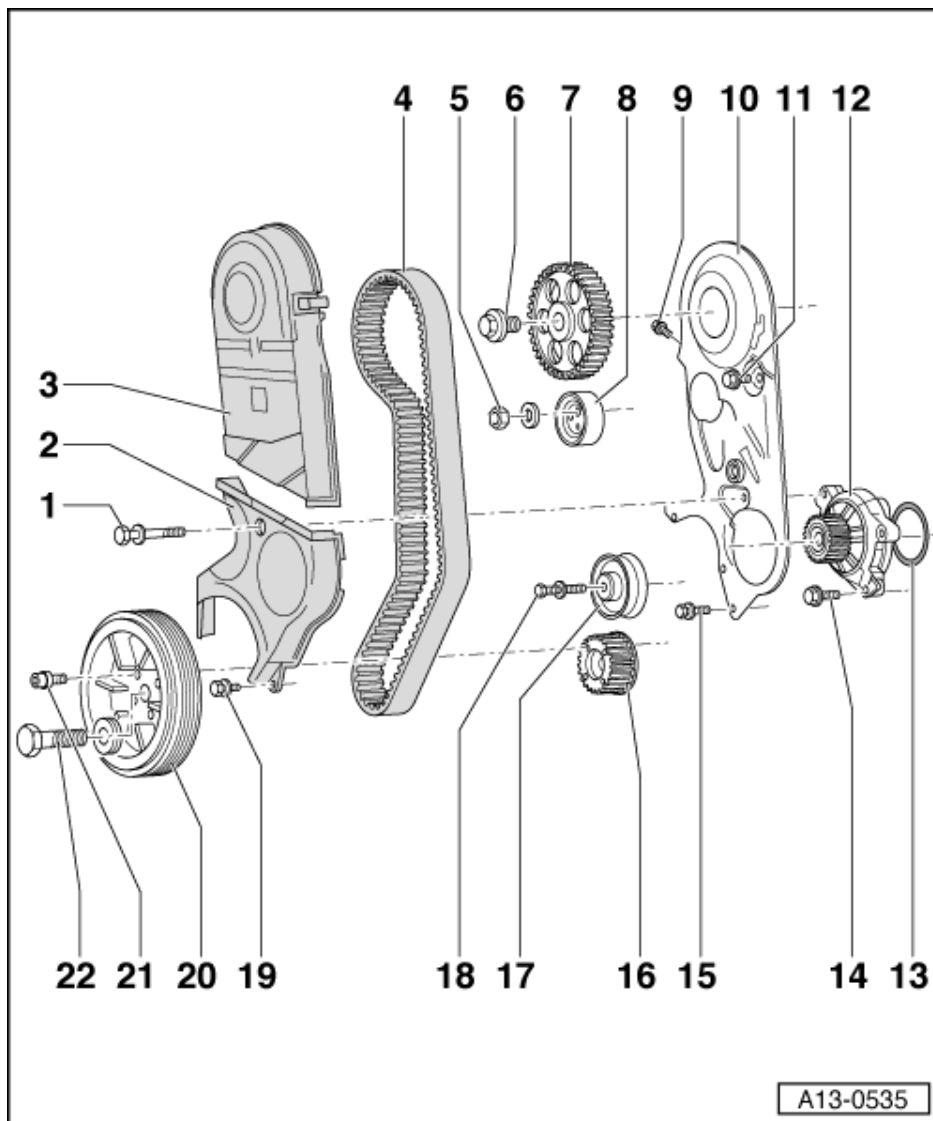
=> Parts List

12 Coolant pump

- ◆ Check for ease of movement
- ◆ Removing and installing => Page 143

13 O-ring

- ◆ Replace



14 20 Nm

15 10 Nm

- ♦ Install using locking compound
- ♦ Locking compound

=> Parts List

16 Crankshaft sprocket

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

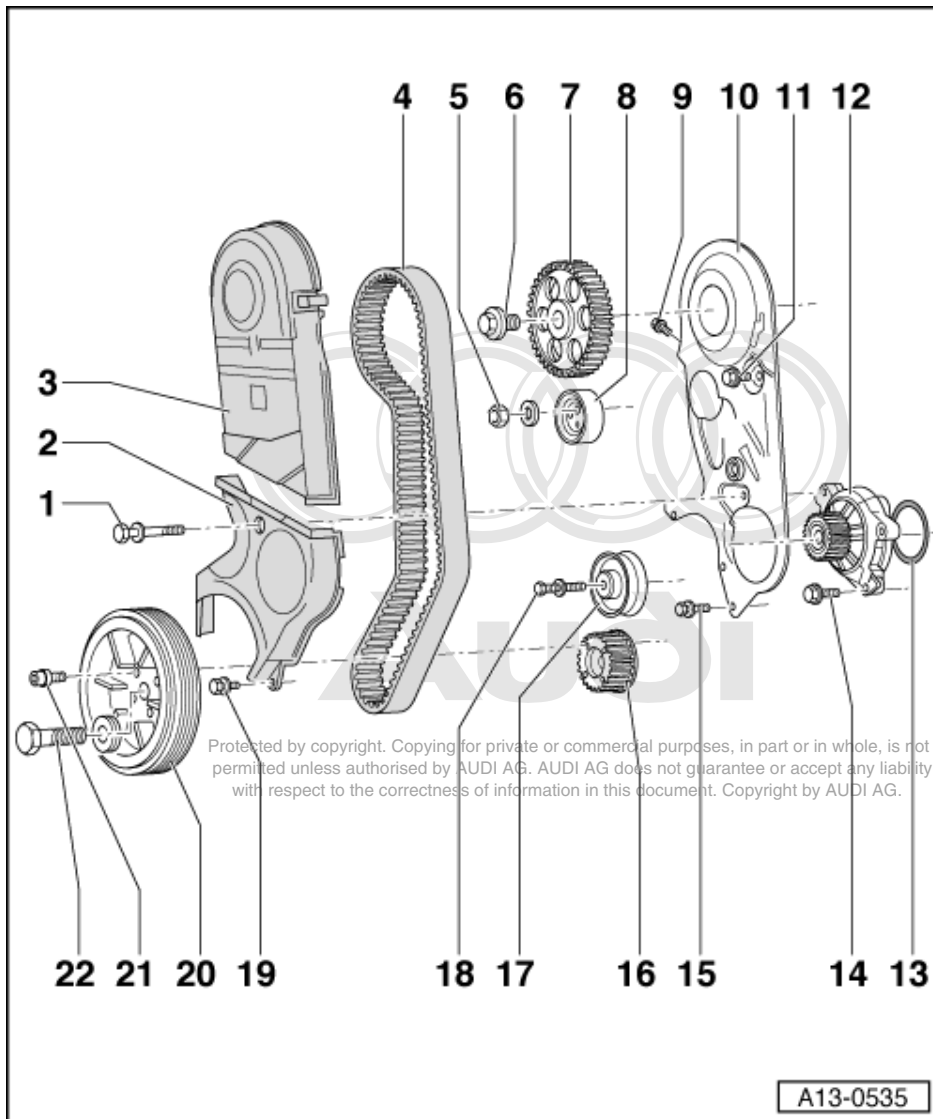
17 Idler roller

- ♦ Removing => Fig. 37

18 10 Nm

19 10 Nm

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20 Vibration damper

- ♦ Assembly on the sprocket/crankshaft only possible in one position: The lug on the sprocket must engage in the bore of the belt pulley
- ♦ Removing and installing=>Page 29

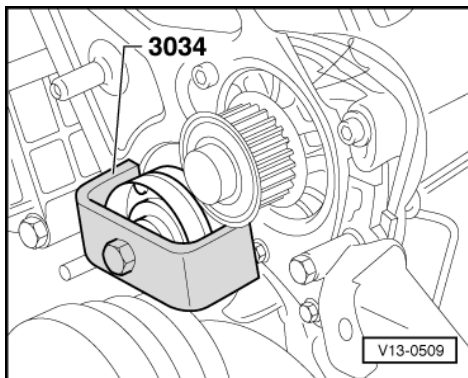
21 20 Nm

22 Central bolt

- ♦ Replace
- ♦ Coat thread and contact surface of bolt head with sealing paste
- ♦ Sealing paste

=> Parts List

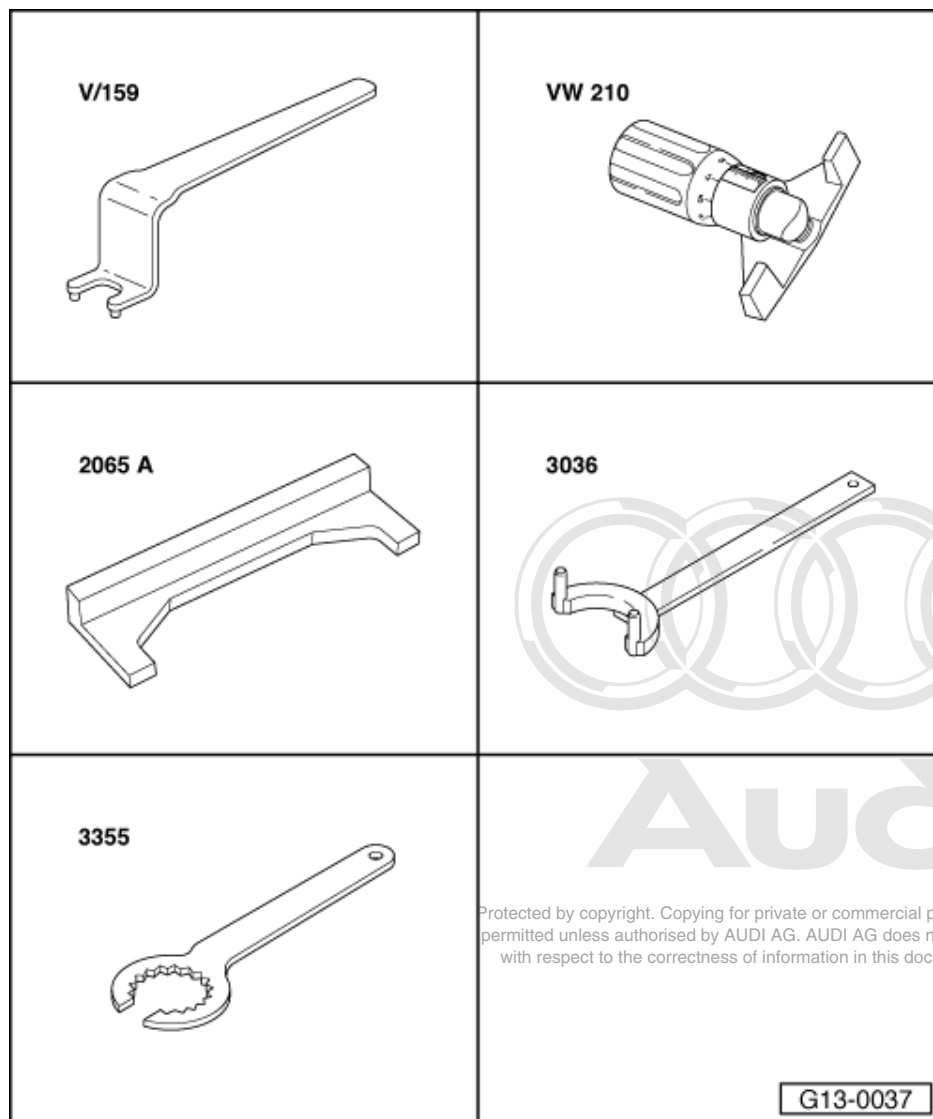
- ♦ Counter hold with 3248 to loosen and tighten
- ♦ Tightening torque 200 Nm + 270°(3/4 turn)
- ♦ Removing and installing=>Page 29 .



-> Fig.1 Removing idler wheel

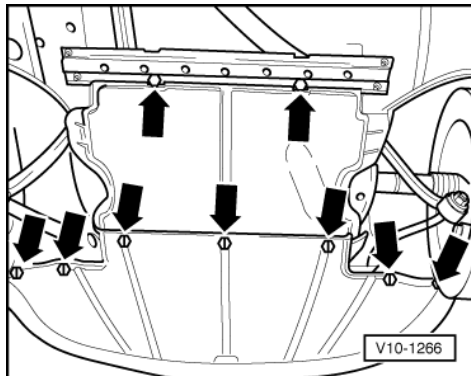
- Remove idler wheel using puller 3034.

1.6 - Removing and installing camshaft toothed belt



Special tools and workshop equipment required

- ♦ Pin wrench Matra V/159
- ♦ V-belt and toothed belt test unit VW 210
- ♦ Setting bar 2065 A
- ♦ Counterhold 3036
- ♦ Ring spanner 3355

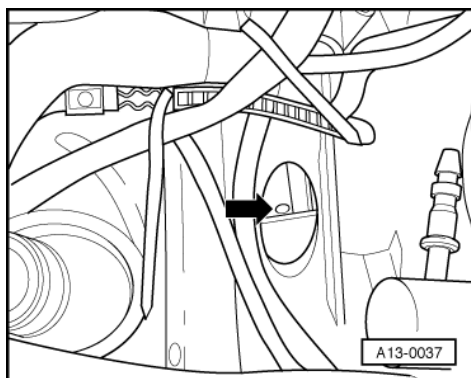


Removing

- -> Remove the noise insulation -arrows-.
- Remove lock carrier:

=> General Body Assembly; Repair group 50; Front body Front body

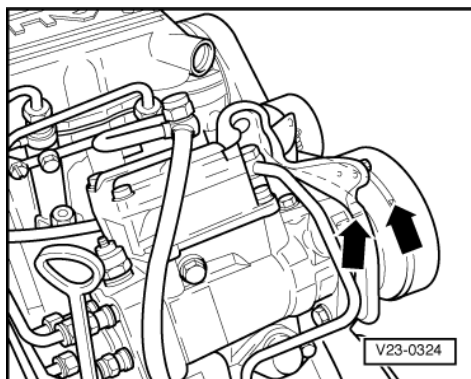
- Remove ribbed belt => Page 27
- Remove the viscous fan => Page 144
- Remove the toothed belt guard for injection pump drive.



Note:

The engine can be turned using the hexagon attachment (32 mm A/F) located at the hydraulic pump.

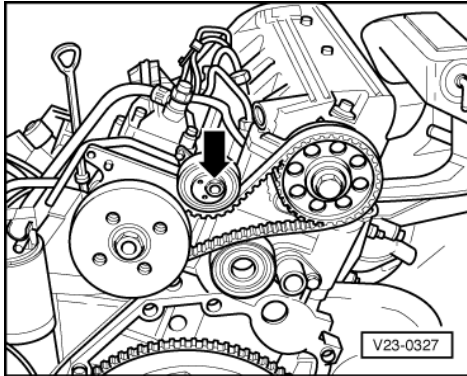
- -> Turn the crankshaft to cylinder 1° TDC -arrow-.
- The -O- mark on the flywheel must be located under the edge of the inspection hole...



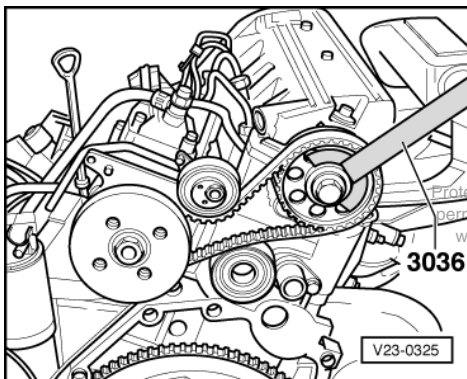
- -> ...at the same time, the marks on the injection pump sprocket and the injection pump must align - arrows-.

Notes:

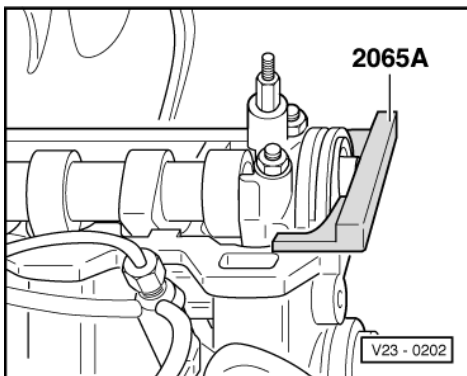
- ◆ If the marks do not align, give the crankshaft another turn.
- ◆ Position crankshaft to TDC for cylinder 1 with engine removed=> Page 52



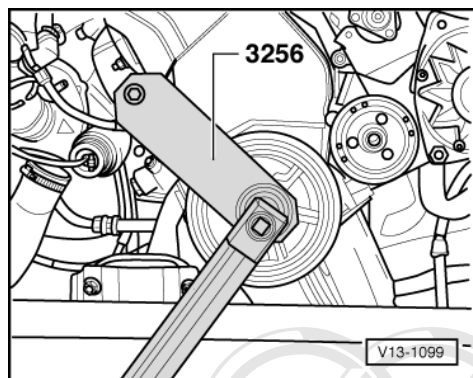
- -> Loosen the tensioning roller nut -arrow- by approx. 1 turn.



- -> Unscrew retaining bolt of injection pump input gear at camshaft using counterhold 3036.
- Mark direction of rotation of toothed belt with chalk or felt pen.
- Remove the drive wheel and toothed belt from the camshaft.



- Remove cylinder head cover => Page 80
- -> Lock the camshaft with setting bar 2065 A.
- Remove the toothed belt guard for camshaft drive.
- Release nut of toothed belt tensioning roller.
- Remove the camshaft toothed belt from the camshaft sprocket.

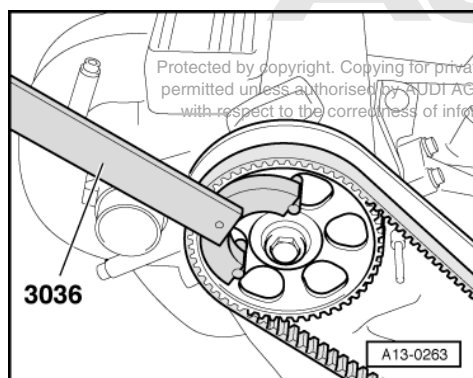


- -> Insert vibration damper counterhold 3256 as illustrated, and unscrew central bolt.

Note:

Before securing the counterhold 3256, in vehicles with engine codes AAT and AEL, first the two bolts for the oil separator bracket must be unscrewed.

- Unscrew the 4 securing bolts (M8) for vibration damper and remove vibration damper.
- Remove the lower toothed belt guard.
- Mark direction of rotation of toothed belt with chalk or felt pen.
- Remove the camshaft toothed belt from the toothed belt sprocket (crankshaft).

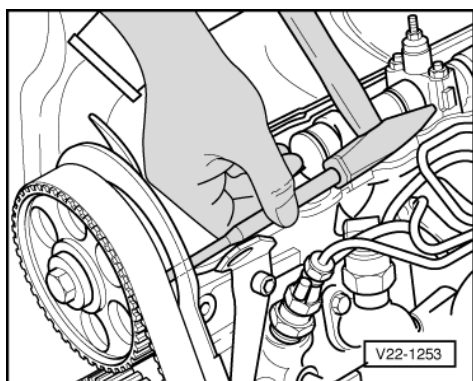


Installing (adjusting valve timing)

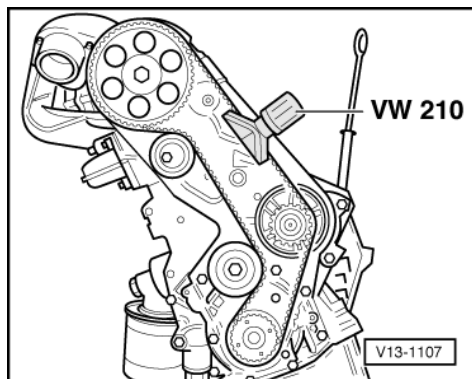
- Camshaft locked using setting bar.

Notes:

- ♦ The position of the toothed belt must be set as described below, even after repairs in which the belt is only taken off the camshaft sprocket.
- ♦ When turning the camshaft, the crankshaft must not be at TDC at any cylinder. Danger of damage to valves/piston crown.
- ♦ -> When loosening and tightening the camshaft sprocket, never use the setting bar to counterhold. Counterhold using 3036.

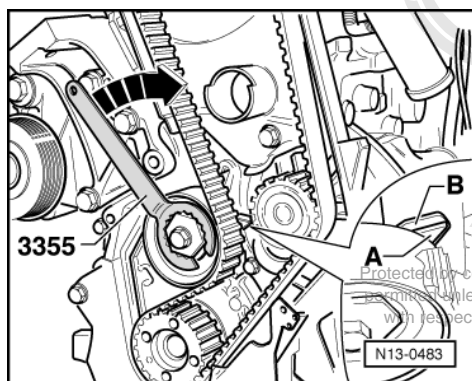


- -> Loosen the securing bolt of the camshaft sprocket 1/2 turn. Release camshaft sprocket from camshaft taper by tapping (pin through hole on rear toothed belt guard) using hammer.
- Tighten the camshaft sprocket until the sprocket can still just be turned, but does not tilt.
- Fit toothed belt (observe direction of rotation).
- Install toothed belt guard - lower part.
- Install the vibration damper => Page 29



Audi 100:

- -> Turn eccentric of tensioning roller anti-clockwise using pin wrench (e.g. Matra V/159).
- Check toothed belt tension with VW 210.
 - Scale reading: 12...13
- Tighten lock nut on tensioning roller to 22 Nm (M8) or 45 Nm (M10).

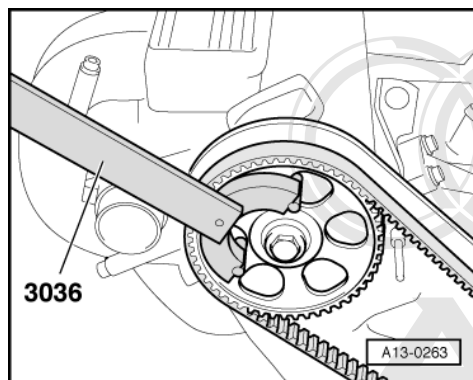


Audi A6:

- Tighten the retaining bolt of the tensioning roller initially by hand.
- -> Screw the automatic tensioning roller using ring spanner 3355 in the direction of the arrow until the right edge of pointer -A- is flush with the right edge of pointer -B-.
- Tighten the retaining bolt of the tensioning roller to 22 Nm.

Notes:

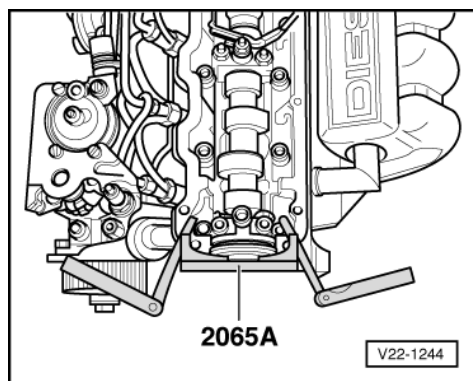
- ♦ The right edge of pointer -A- must not be turned beyond the right edge of pointer -B-, otherwise the tensioning roller may be damaged.
- ♦ If tensioning roller has been turned inadvertently too far to the right, first completely release load. Then turn the tensioning roller in the direction of the arrow to tension again.



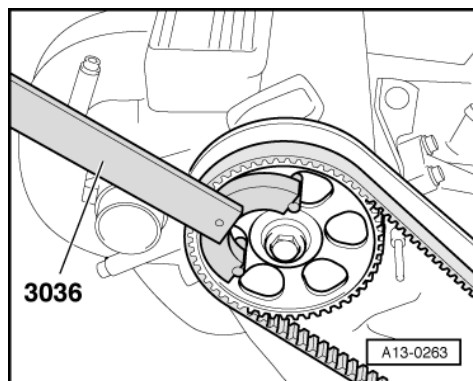
All models:

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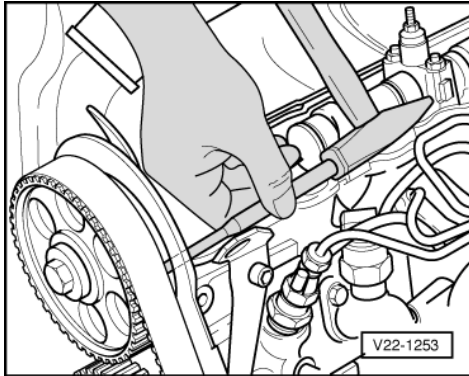
- -> Tighten the retaining bolt of the camshaft sprocket initially to 50 Nm (use counterhold 3036).



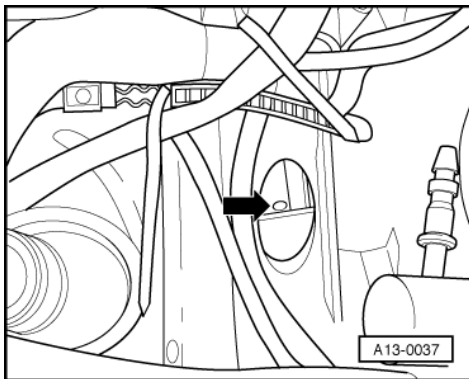
- -> Turn camshaft until one end of setting bar 2065 A contacts the cylinder head.
- Measure the play created at the opposite end using a feeler gauge.
- Insert a feeler gauge corresponding to half the play between the setting bar and the cylinder head.
- Turn camshaft until the setting bar lightly contacts the feeler gauge.
- Insert a second feeler gauge corresponding to half the play between the setting bar and the cylinder head at the other end.



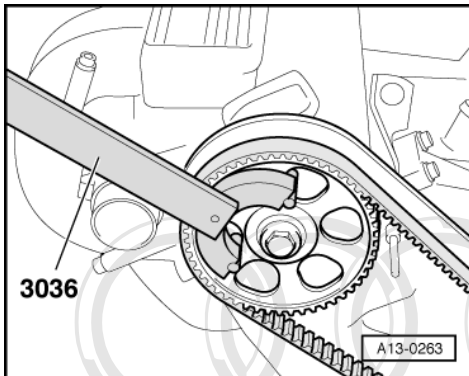
- -> Loosen bolt on camshaft sprocket using special tool 3036 to counterhold.



- -> Loosen the securing bolt of the camshaft sprocket 1/2 turn. Release camshaft sprocket from camshaft taper by tapping (pin through hole on rear toothed belt guard) using hammer.
- Tighten the camshaft sprocket until the sprocket can still just be turned, but does not tilt.

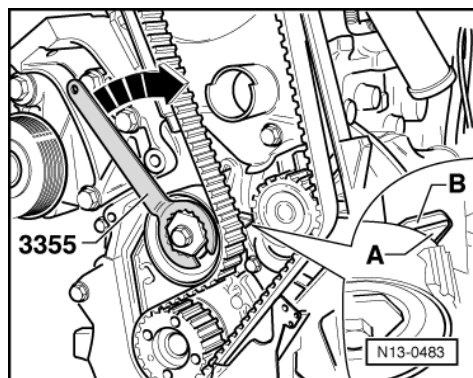


- -> Turn the crankshaft to cylinder 1 TDC -arrow-.



- -> Tighten retaining bolt of camshaft sprocket (use counterhold 3036).
- Replace bolt and tighten to 30 Nm + 90°
- Check again whether TDC mark on flywheel and reference mark are aligned.
- Remove setting bar.

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Audi A6:

- Turn the crankshaft two rotations in the direction of engine rotation until the crankshaft is set to TDC again.
- -> Check adjustment: The right edge of pointer -A- must be flush with the right edge of pointer -B-, repeat adjustment if necessary.

All models:

- Install the injection pump input gear.
- Install toothed belt for injection pump =>Page 49
- Install cylinder head cover => Page 81
- Install ribbed belt =>Page 29
- Install viscous fan => Page 144
- Installing lock carrier with attachments:

=> General Body Assembly; Repair group 50; Front body Front body

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- Check commencement of injection of injection pump:

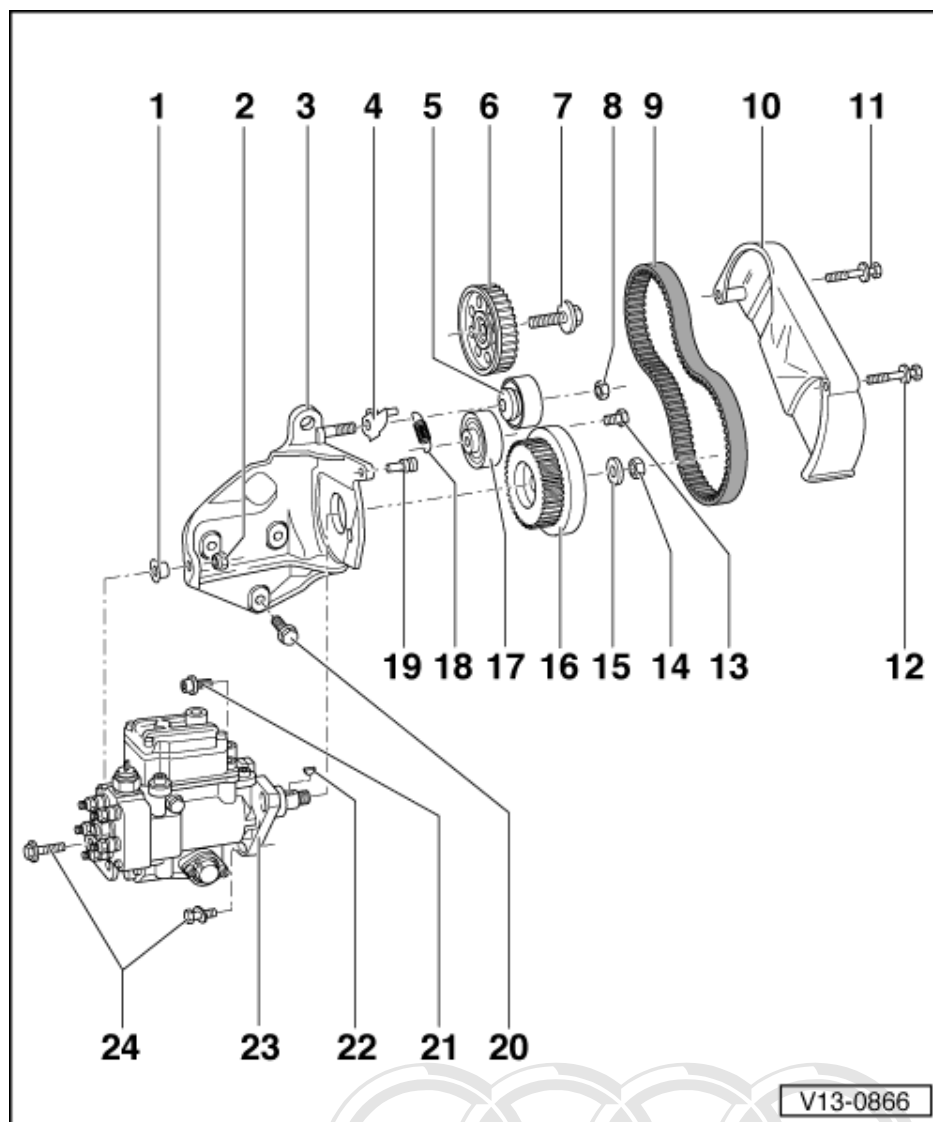
=> Diesel Direct Injection and Glow Plug System (TDI 5-cylinder); Repair group 23; Servicing diesel direct injection system Servicing diesel direct injection system

Tightening torques

Component	Nm
Toothed belt tensioning pulley M8	22
M10	45
Camshaft sprocket to camshaft	30 + 90°1)2)
Drive sprocket for injection pump to camshaft	160
Toothed belt guard M6	10
M8	20

- 1) Replace bolt
- 2) 90°corresponds to a quarter of a turn

1.7 - Toothed belt drive for injection pump

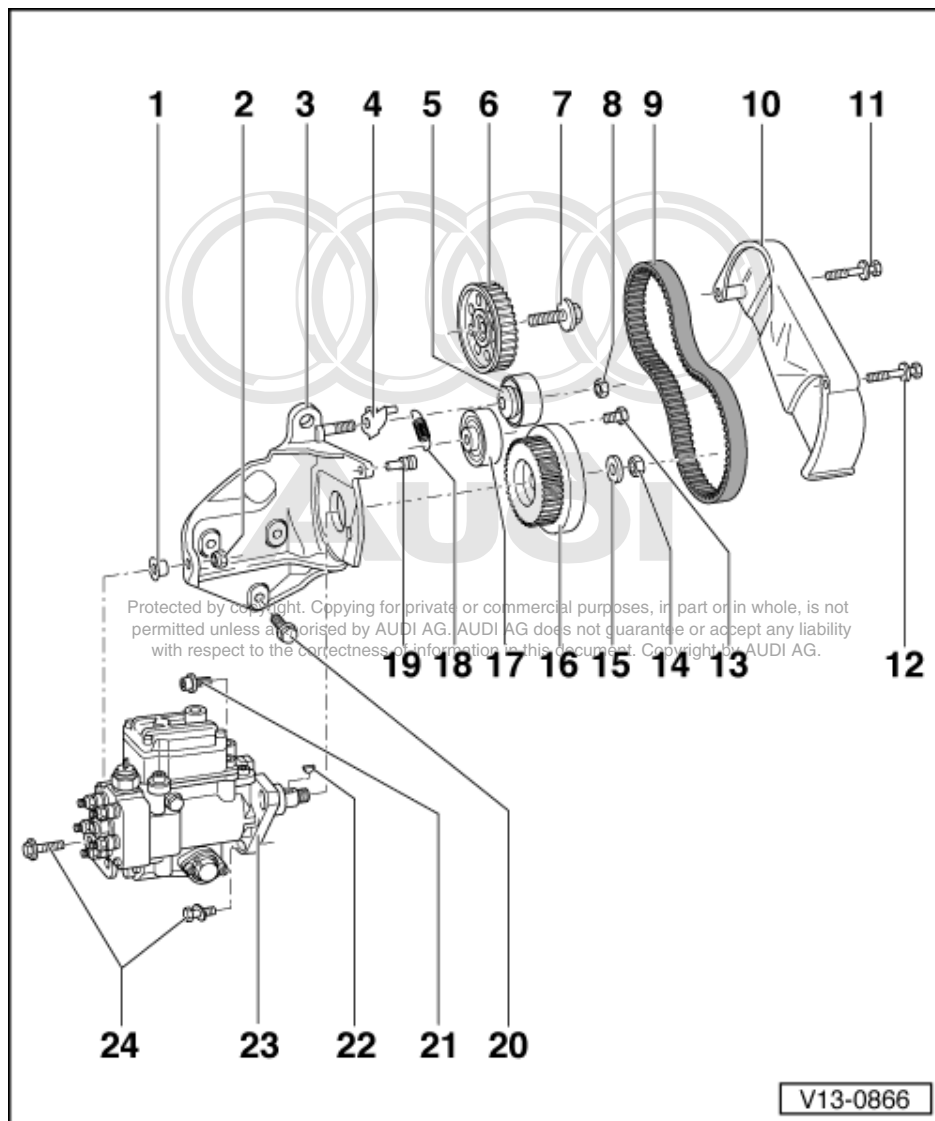


Note:

Mark the running direction with chalk or felt pen before removing the toothed belt. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

- 1 Bushing
 - ♦ With taper
- 2 Nut, 25 Nm
 - ♦ With cone
- 3 Console
 - ♦ For injection pump
- 4 Tensioning lever
 - ♦ For tensioning roller
- 5 Tensioning roller

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6 Input gear

- ♦ For injection pump
- ♦ Counter hold with 3036 to loosen and tighten

7 160 Nm

- ♦ Securely hold input gear when releasing and tightening using counterhold 3036

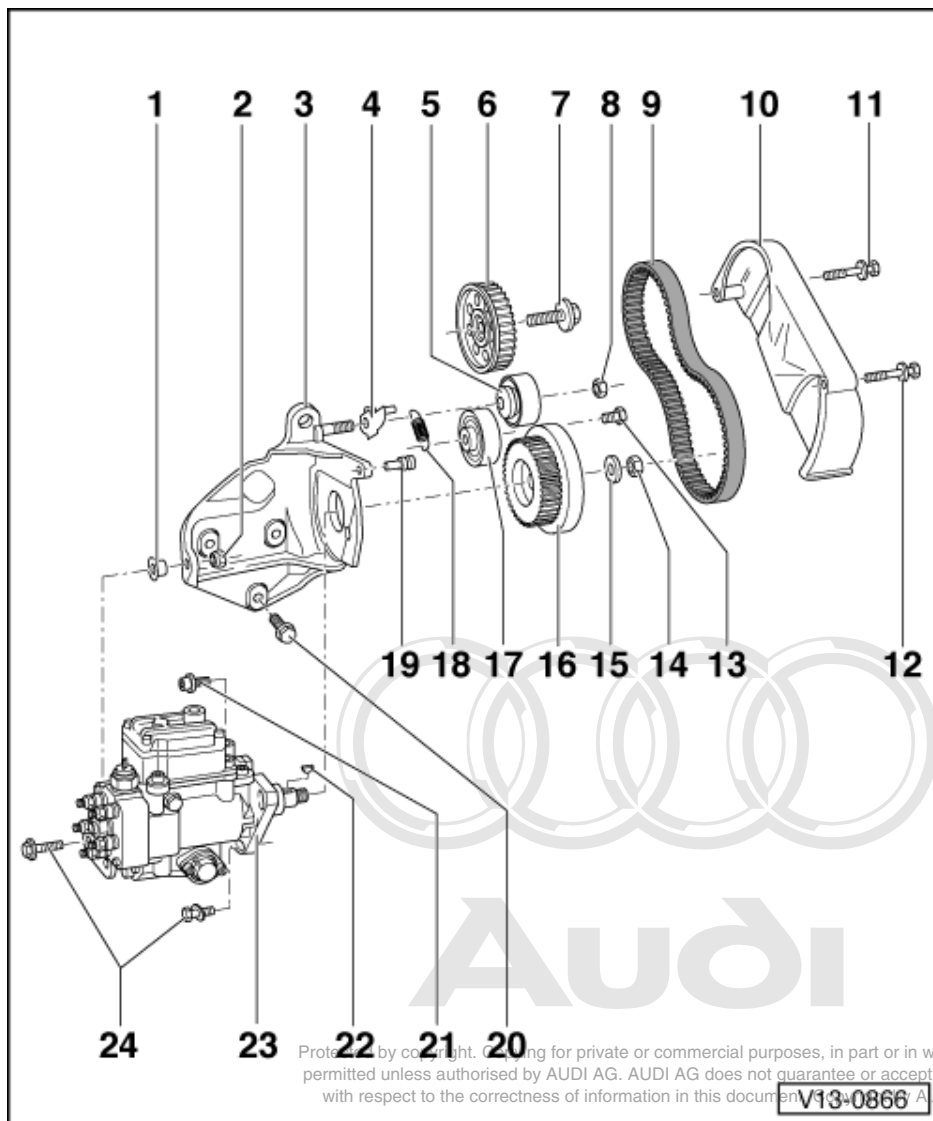
8 45 Nm

9 Toothed belts

- ♦ Mark running direction with chalk or felt pen before removing
- ♦ Do not kink
- ♦ Check for wear
- ♦ Removing => Page 49
- ♦ Installing, tensioning => Page 50

10 Toothed belt guard

- ♦ For injection pump toothed belt
- ♦ With mount for tensioning spring



11 20 Nm

12 10 Nm

13 20 Nm

14 50 Nm

15 Washer

16 Injection pump sprocket

- ♦ Removing and installing:

=> Diesel Direct Injection and Glow Plug System (TDI 5-cylinder); Repair group 23; Servicing diesel direct injection system

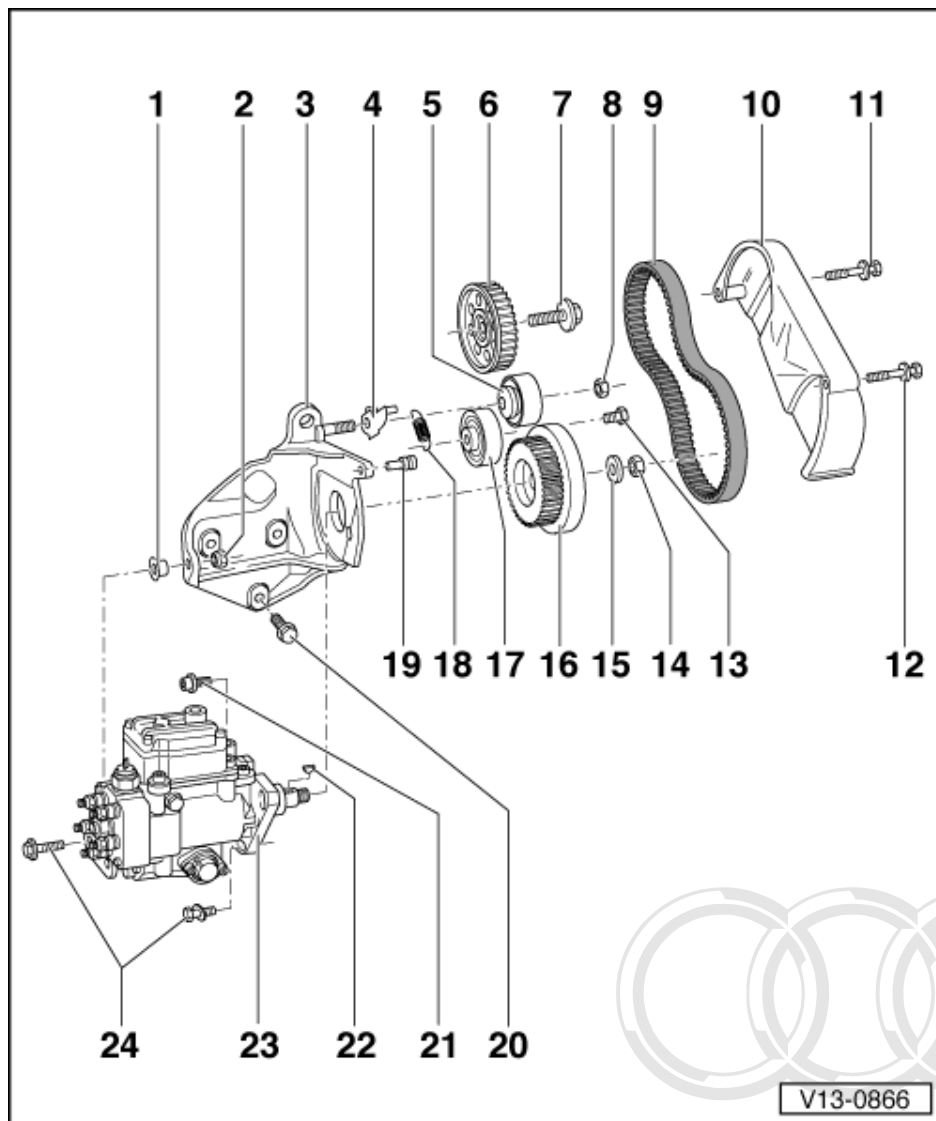
- ♦ Watch position of Woodruff key
- ♦ Can only be installed in one position

17 Idler roller

18 Not installed

19 Pin

- ♦ For tensioning spring

**20** 50 Nm**21** Cheese-head bolt, 25 Nm

- ♦ Release using socket attachment (180 mm long)

22 Woodruff key

- ♦ Ensure tight fit

23 Injection pump

- ♦ Removing and installing:

=> Diesel Direct Injection and Glow Plug System (TDI 5-cylinder); Repair group 23; Servicing diesel direct injection system

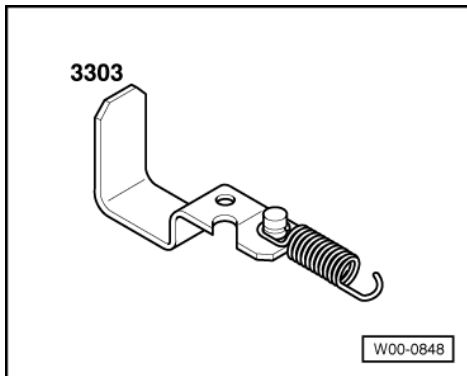
- ♦ Dynamically checking and adjusting commencement of injection.

=> Diesel Direct Injection and Glow Plug System (TDI 5-cylinder); Repair group 23; Servicing diesel direct injection system

24 25 Nm

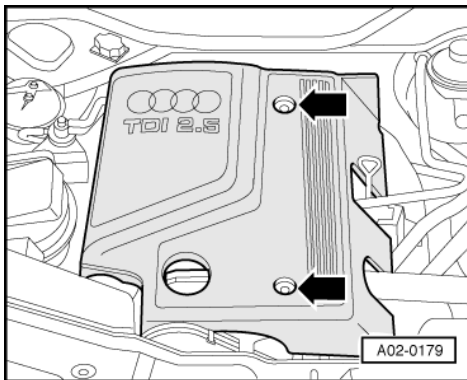
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1.8 - Removing and installing injection pump toothed belt



Special tools and workshop equipment required

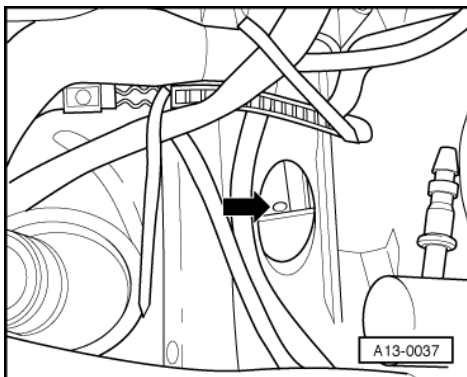
- ♦ Tensioner 3303



Removing

Audi A6:

- -> Remove engine cover -arrows-.



All models:

- Remove the toothed belt guard for injection pump drive.

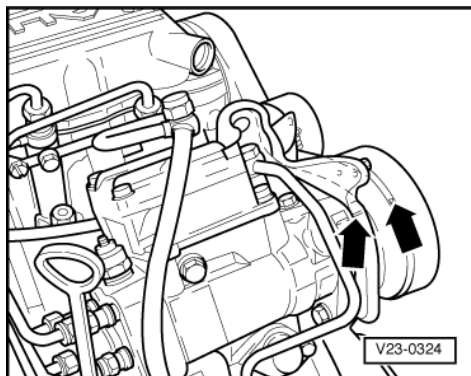


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Note:

The engine can be turned using the hexagon attachment (32 mm A/F) located at the hydraulic pump.

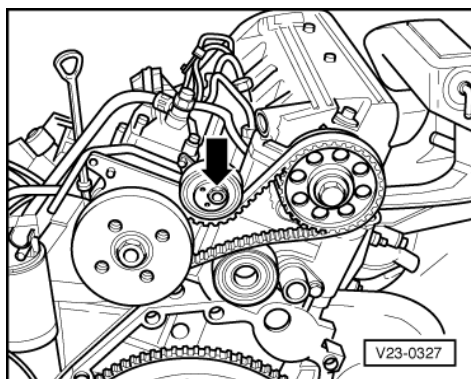
- -> Turn the crankshaft to cylinder 1 TDC -arrow-.
- The -O- mark on the flywheel must be located under the edge of the inspection hole...



- -> ...at the same time, the marks on the injection pump sprocket and the injection pump must align - arrows-.

Notes:

- ♦ If the marks do not align, give the crankshaft another turn.
- ♦ Position crankshaft to TDC for cylinder 1 with engine removed=> Page 52 .



- -> Loosen the tensioning roller nut -arrow- by approx. 1 turn.
- Mark direction of rotation of toothed belt with chalk or felt pen.
- Remove toothed belt.

Installing

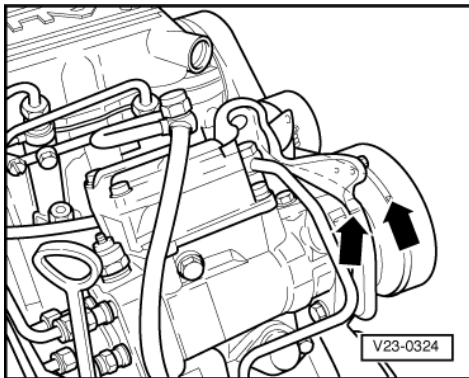
- Crankshaft in TDC-position for cylinder 1 => Page 50

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

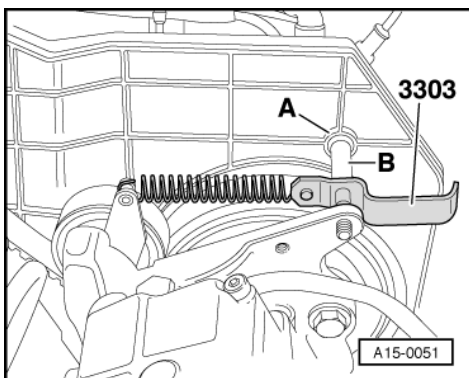
Notes:

- ♦ Ensure that before positioning the toothed belt, the eccentric of the tensioning roller is turned so that the tensioning lever, with the spring of tensioner 3303 attached, presses on the roller against the toothed belt.
- ♦ The spring of the tensioner 3303, when the tensioning roller is released, automatically sets the belt to the correct tension.

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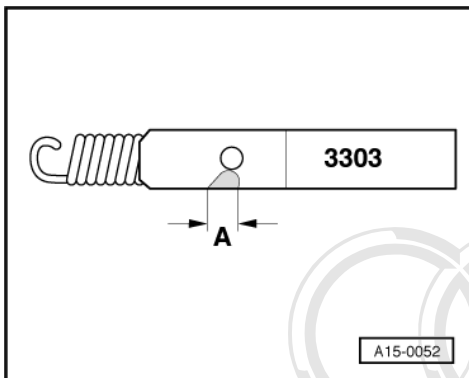


- -> Check whether the marks on the injection pump sprocket and the injection pump are aligned -arrows-.



Audi A6:

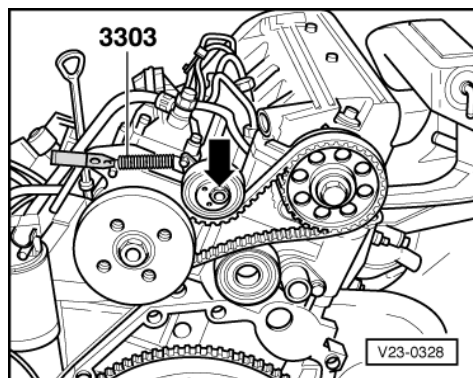
- -> Unscrew nut -A- on rear toothed belt guard for injection pump drive.
- Push toothed belt guard and sleeve -B- to rear.



Note:

-> In order to attach the tensioner for the Audi A6 without removing the stud, first file out a section of the tensioner, as shown in the illustration (shaded area).

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All models:

- ➔ Loosen the tensioning roller nut -arrow- by approx. 1 turn.
- Move the tensioning roller by hand to check that it moves easily; free the roller if necessary.
- Fit toothed belt (observe direction of rotation).
- Hook in spring of tensioner 3303.
- Turned the crankshaft approx. 1/2 turn in running direction.
- Tighten nut -arrow- on tensioning roller.
- Remove tensioner 3303.
- Check commencement of injection of injection pump:

=> Diesel Direct Injection and Glow Plug System (TDI 5-cylinder); Repair group 23; Servicing diesel direct injection system Servicing diesel direct injection system

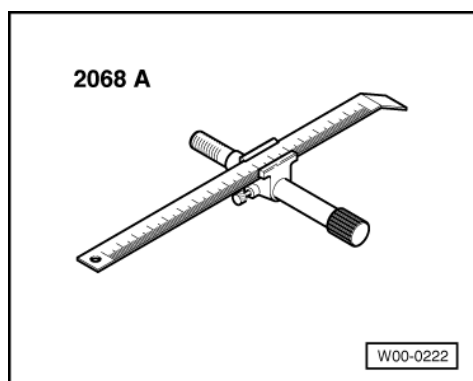
- Install toothed belt guard.

Tightening torques

Component		Nm
Nut for tensioning roller		45
Toothed belt guard	M6	10
	M8	20

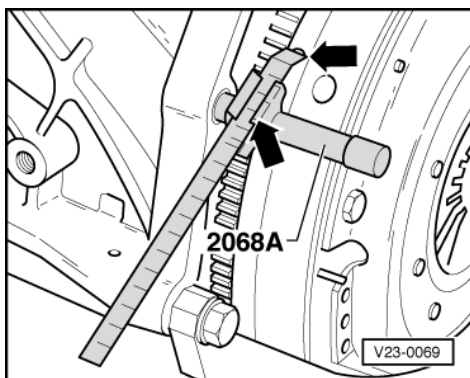
1.9 - Positioning crankshaft to TDC with engine removed

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Special tools and workshop equipment required

- ♦ TDC adjustment device 2068 A



Procedure

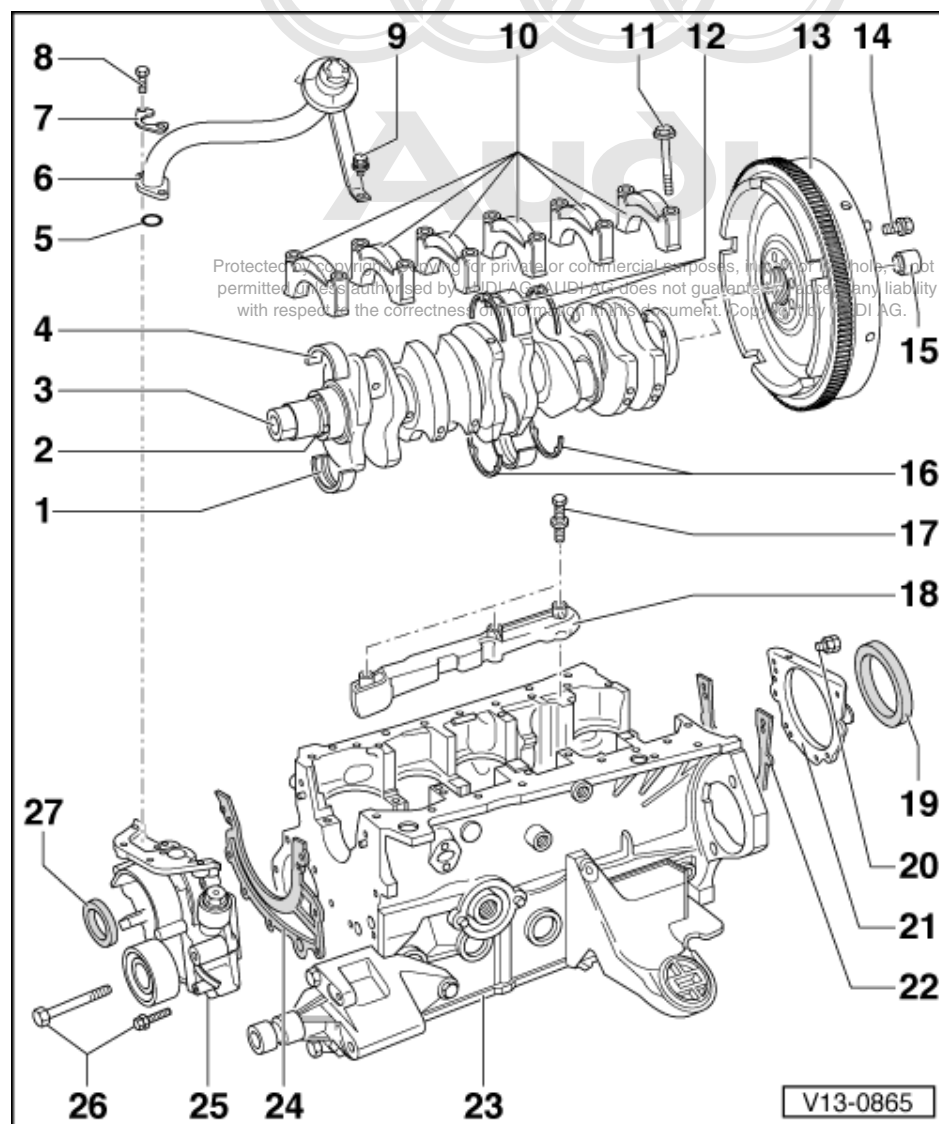
- -> Screw in TDC adjustment device 2068 A, as shown in the illustration.
- Set adjustment device to 111.5 mm (the left notch on the vernier scale -arrow A- is the reference point).
- Turn crankshaft until TDC mark "0" on flywheel aligns with edge of adjustment device.



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2 - Removing and installing crankshaft, flywheel and sealing flange

2.1 - Removing and installing crankshaft, flywheel and sealing flange



Notes:

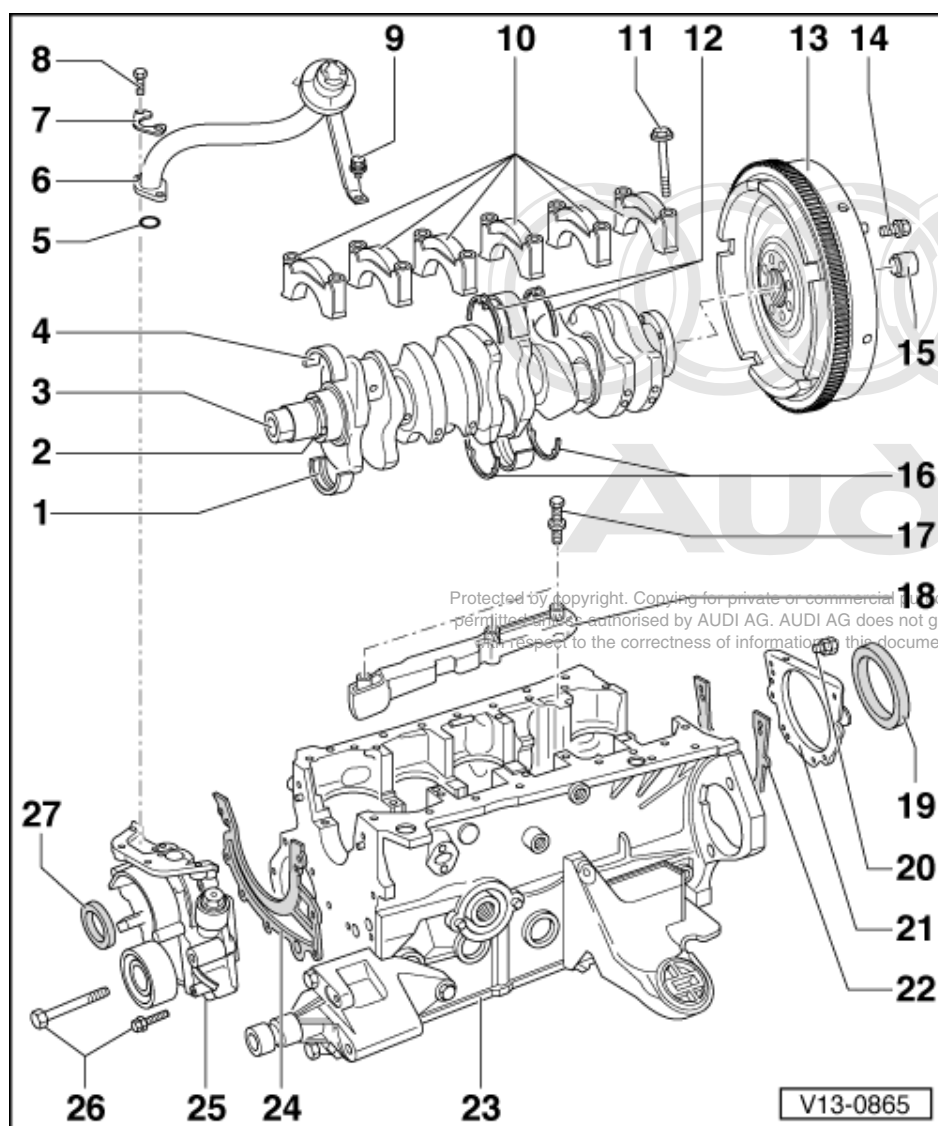
- ♦ For repairs to the clutch:

=> Manual Gearbox; Repair group 30; Servicing clutch Servicing clutch

- ♦ When working on the engine, it should be secured to the engine stand using the engine bracket VW 540.

1 Bearing shell

- ♦ For cylinder block with oil groove
- ♦ Do not interchange used bearing shells (mark with waterproof felt pen).

**2 Actuating arm**

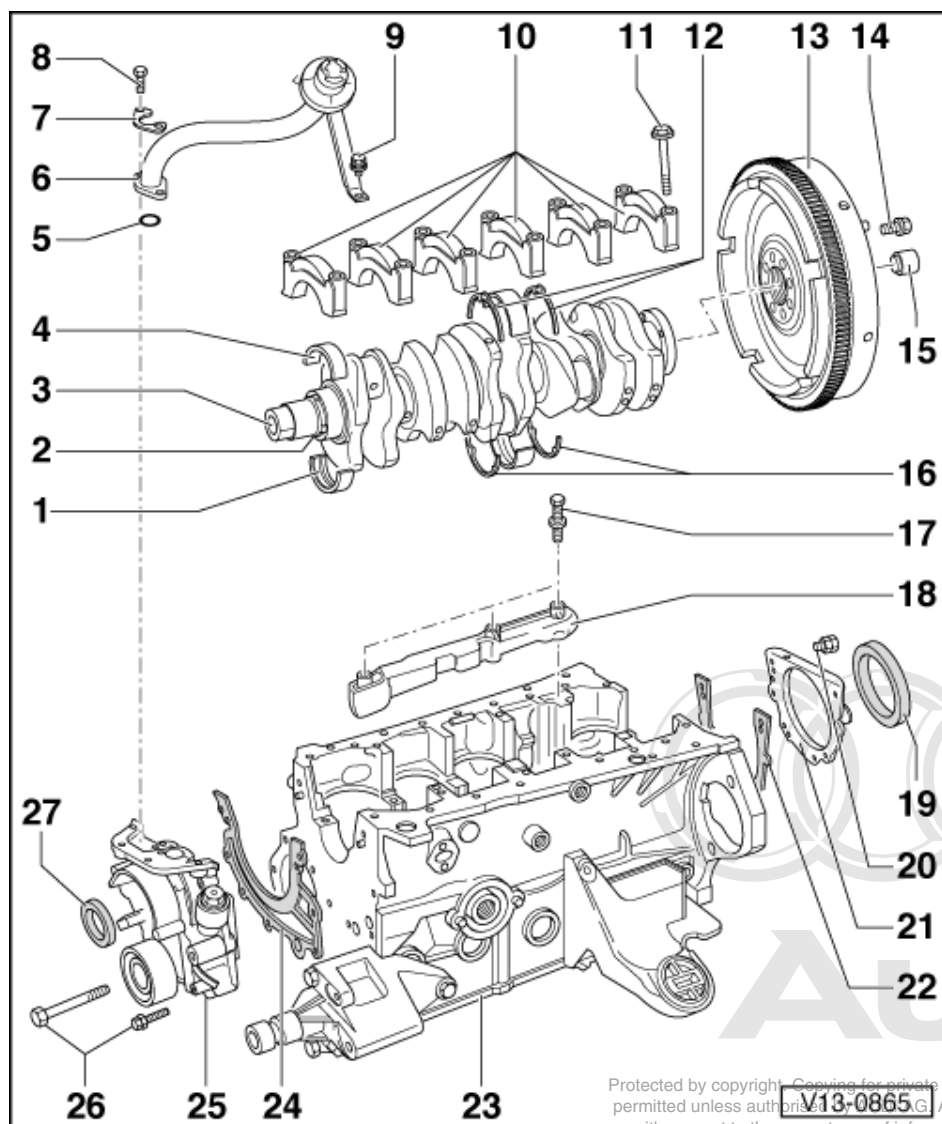
- ◆ For oil pump
- ◆ With 4 drive pins
- ◆ Lever open to remove
- ◆ To install, preheat to a maximum 200 °C

3 Crankshaft

- ◆ Axial play
New: 0.07...0.18 mm
Wear limit: 0.25 mm
- ◆ Check radial play with Plastigage
New: 0.016...0.075 mm
Wear limit: 0.16 mm
- ◆ Do not rotate the crankshaft when checking the radial play.
- ◆ Crankshaft dimensions =>Page 65

4 Bearing shell

- ◆ For bearing cap without oil groove
- ◆ Do not interchange used bearing shells (mark with waterproof felt pen).



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5 O-ring/oil seal

- ◆ Up to engine No. ABP 001 379: Seal
- ◆ Replace

6 Suction pipe

- ◆ Secure at oil pump first

7 Locking plate

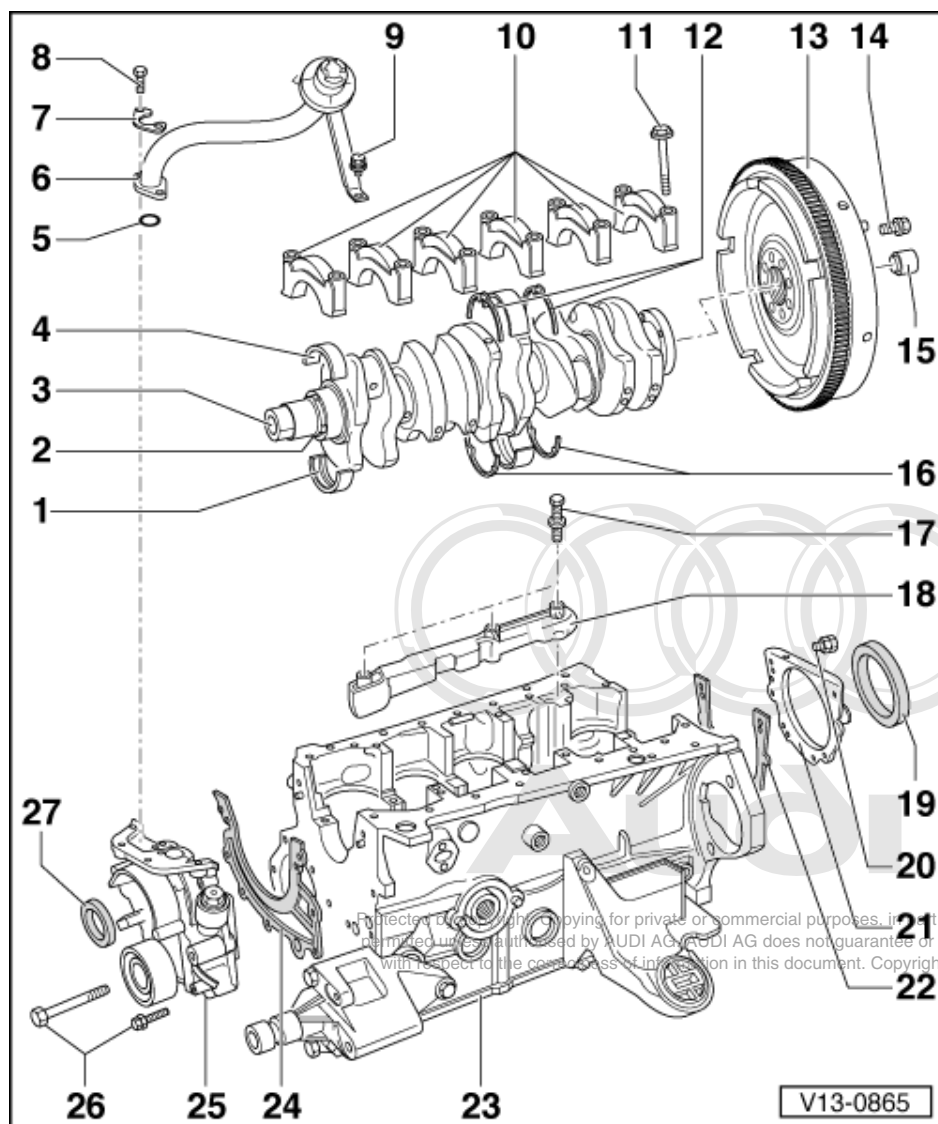
- ◆ Replace

8 10 Nm**9 10 Nm****10 Bearing cap**

- ◆ Bearing cap 1: Pulley end
- ◆ Bearing shell retaining lugs (cylinder block/bearing cap) must be on the same side.

11 30 Nm + 1/4 turn (90°) further

- ◆ Replace

**12 Thrust washers**

- ◆ For bearing cap
- ◆ Different types for cylinder block and bearing cap
- ◆ Note fixing arrangement

13 Flywheel or drive plate

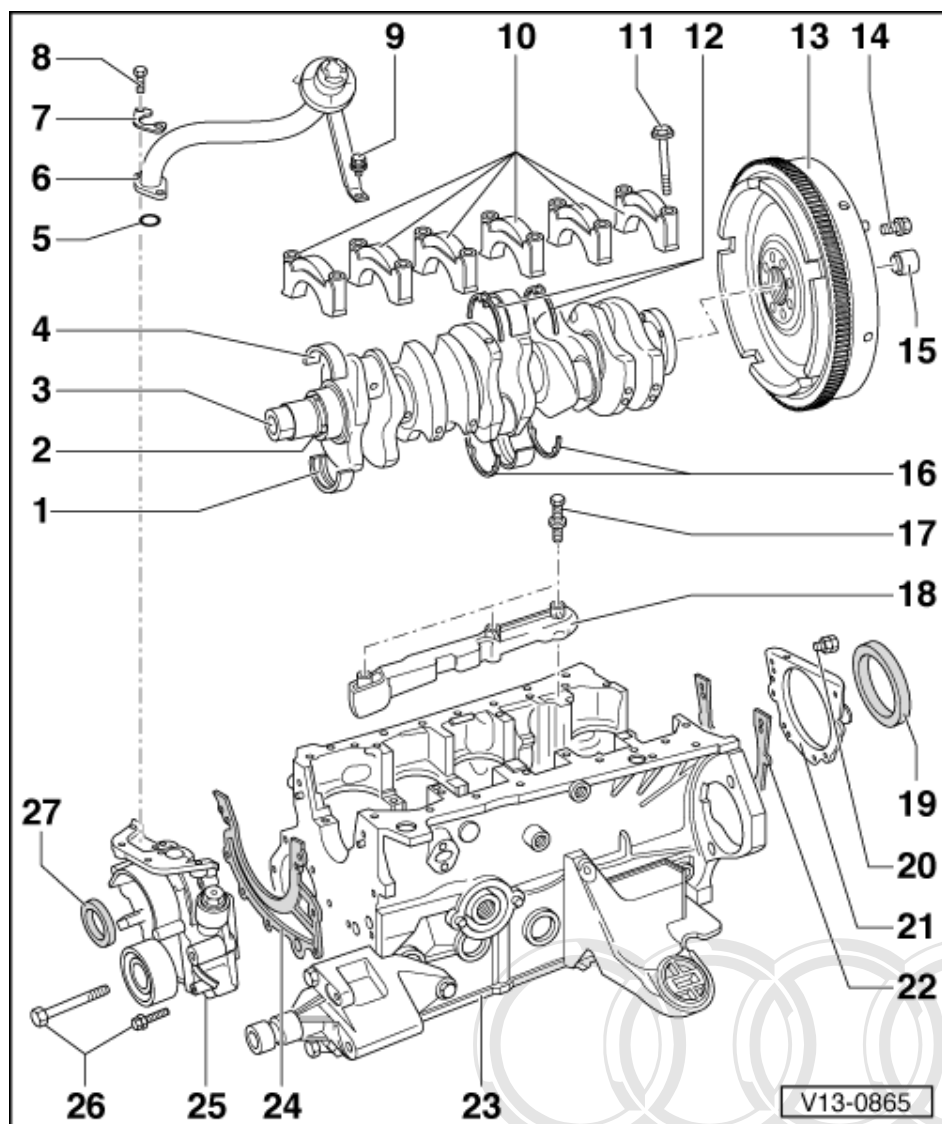
- ◆ Removing and installing flywheel => Page 62
- ◆ Removing and installing drive plate => Page 62

14 30 Nm + 1/4 turn (90 °) further

- ◆ Replace

15 Needle bearing

- ◆ Only inserted into the flywheel for vehicles with manual gearbox
- ◆ Pulling out and driving in => Page 64
- ◆ Short engines are supplied without bushes in the crankshaft. For vehicles with automatic gearbox, drive in the bush before installing the drive plate => Fig. 60

**16 Thrust washers**

- ♦ For cylinder block (without retaining lugs)
- ♦ Note fixing arrangement

17 10 Nm**18 Duct**

- ♦ For crankcase breather

19 Sealing ring

- ♦ Can only be replaced together with -item 21-

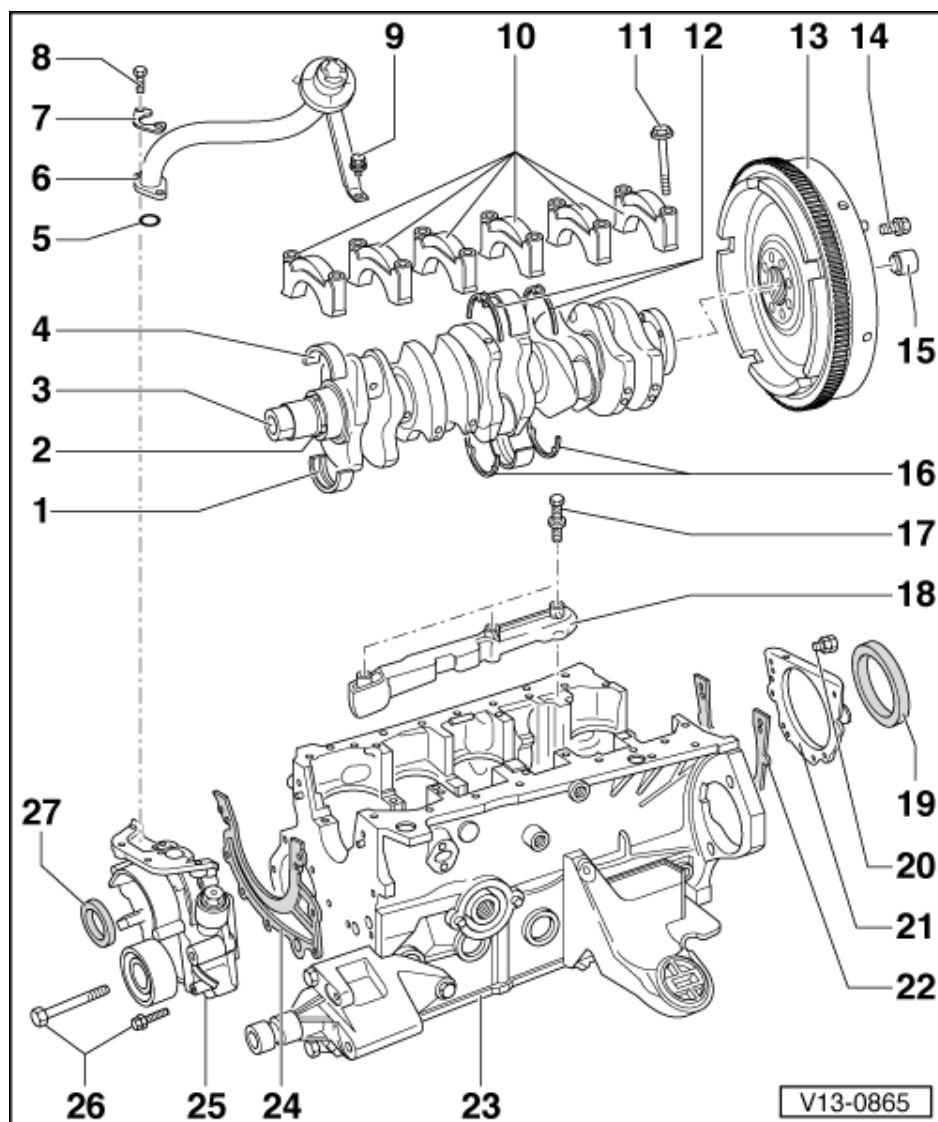
20 10 Nm**21 Rear sealing flange**

- ♦ With sealing ring
- ♦ Before fitting sump, apply a small amount of sealant to sealing points between sealing flange and cylinder block
- ♦ Sealants

=> Parts List

22 Seal

- ♦ Replace
- ♦ Only fit if the sealing flange has no sealing lip on the cylinder block side.



23 Cylinder block

24 Seal

- ◆ Replace

25 Oil pump

- ◆ Removing and installing=>Page 123
- ◆ When installing, watch position of follower at crankshaft
- ◆ Before fitting sump, apply a small amount of sealant to sealing points between sealing flange and cylinder block
- ◆ Sealants

=> Parts List

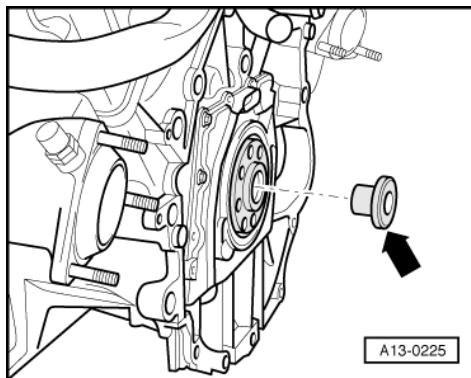
26 M6 = 10 Nm

M8 = 20 Nm

27 Sealing ring

- ◆ For crankshaft
- ◆ Replace
- ◆ Removing and installing=>Page 60

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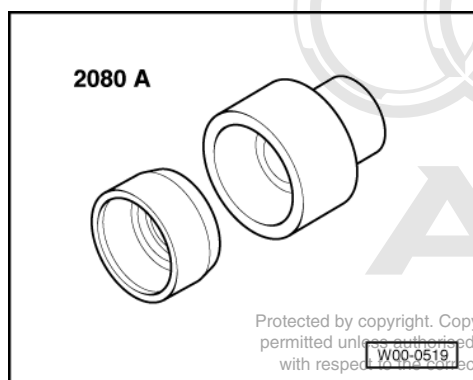


-> Fig. 1 Bearing bush for torque converter

Note:

Short-blocks and replacement engines as well as new and replacement crankshafts are supplied without a bush -arrow-. Before installing the drive plate vehicles with automatic gearboxes must have the bush fitted. For vehicles with manual gearbox, a bush must not be inserted, a needle bearing is installed in the flywheel.

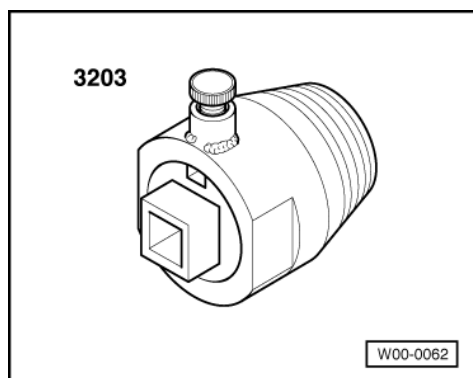
2.2 - Replacing crankshaft oil seal on pulley end



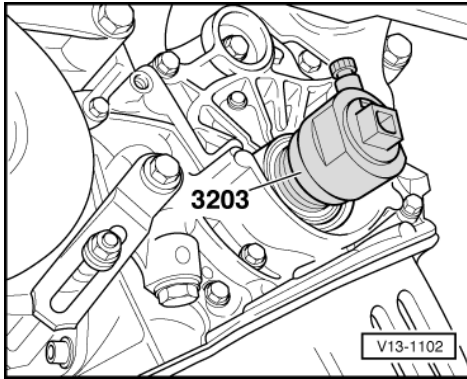
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Special tools and workshop equipment required

- ♦ Inserting ring for oil seal 2080 A

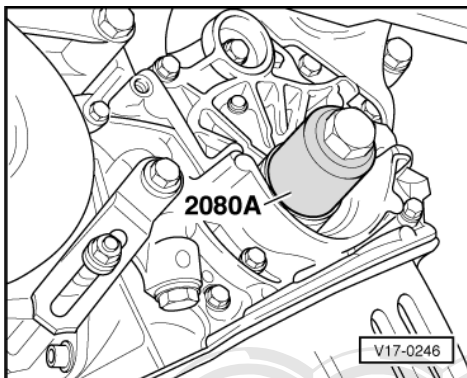


- ♦ Oil seal extractor 3203



Removing

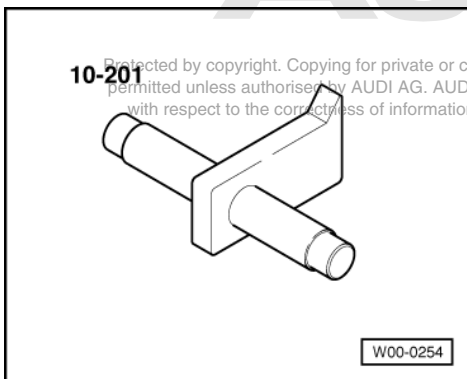
- Engine in vehicle
- Remove toothed belt => Page 38
- Unscrew inner part of oil seal extractor 3203 one turn (approx. 2 mm) from the outer part and lock in position with knurled screw.
- -> Lubricate threaded head of oil seal extractor, place it in position and exerting firm pressure, screw it into oil seal as far as possible.
- Loosen knurled screw and turn inner part against crankshaft until the sealing ring is pulled out.



Installing

- Place guide sleeve from 2080 A onto crankshaft journal.
- Carefully push oil seal over guide sleeve.
- -> Press oil seal in as far as limit stop using insertion sleeve and cleaned vibration damper bolt.
- Install toothed belt (adjust valve timing) => Page 40

2.3 - Removing and installing flywheel/drive plate

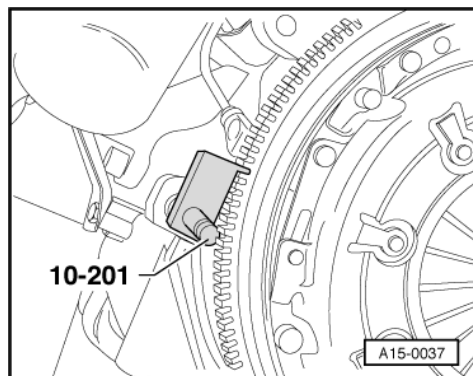


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Special tools and workshop equipment required

- ♦ Counterhold 10-201



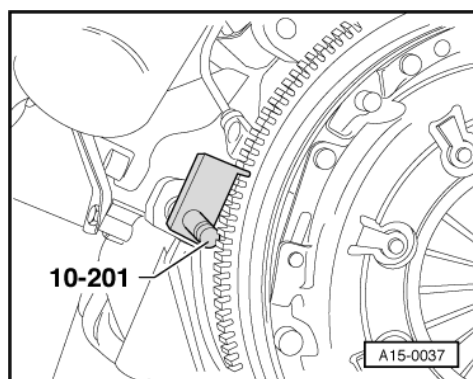
Flywheel

- -> Plug in counterhold 10-201 for loosening and tightening the bolts.
- Mark position of flywheel relative to engine.
- Only use new bolts to secure.

Tightening torque

Component	Nm
Flywheel to crankshaft	30 + 90°1)

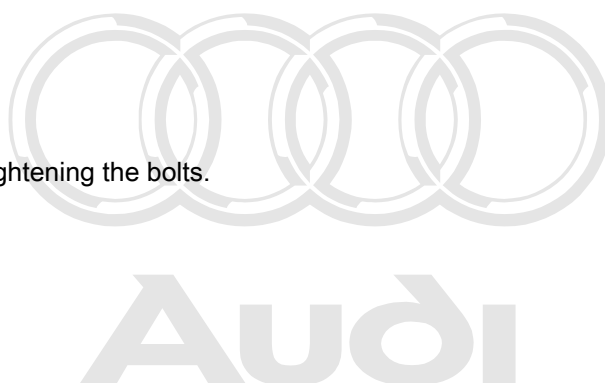
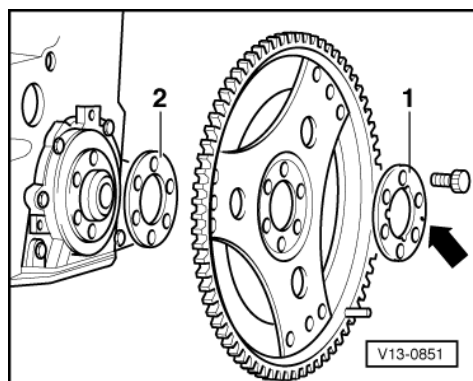
- 1) 90° corresponds to a quarter of a turn



Drive plate

Removing

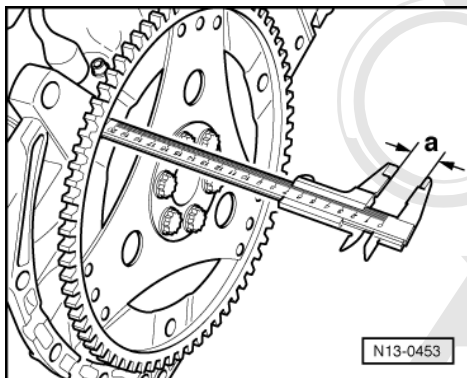
- -> Plug in counterhold 10-201 for loosening and tightening the bolts.
- Mark position of drive plate relative to engine.



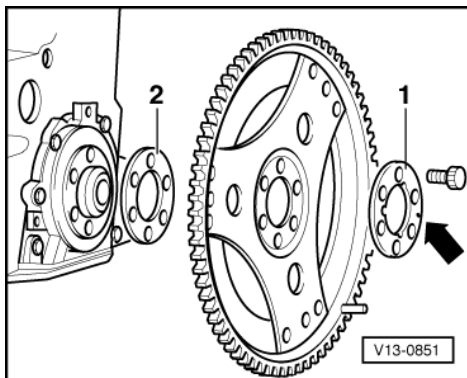
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Installing

- -> Place drive plate with shim -2- and washer -1- in position. Lug -arrow- must face towards torque converter.
- Insert at least 3 of the old securing bolts and tighten to 30 Nm.



- -> Measure dimension -a- at three points and calculate average value.
- Specification for automatic gearbox 01K front-wheel drive: 18.1 - 19.7 mm, measured from the cylinder block rear edge to the bolt-on surface for torque converter at carrier plate.



If specification is exceeded:

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

If specification is attained:

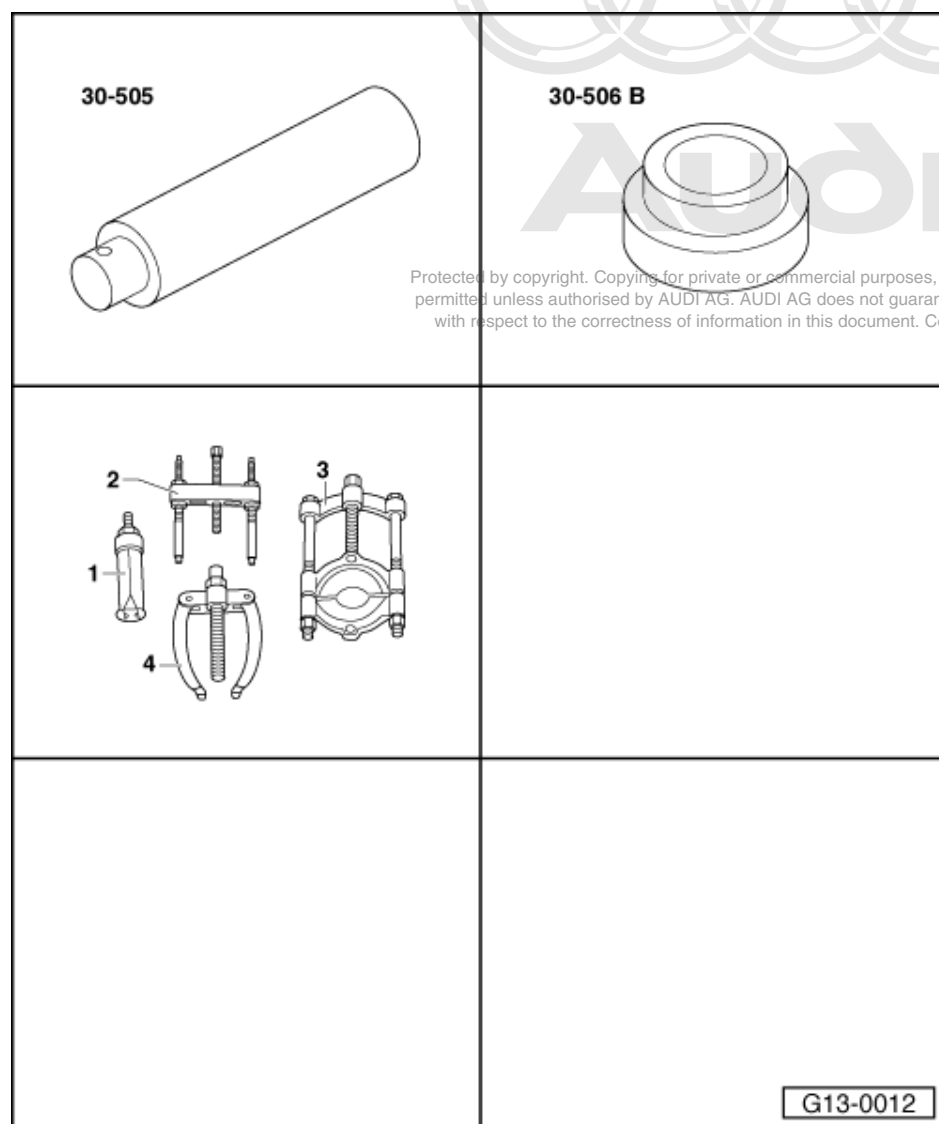
- Only use new bolts to secure.

Tightening torque

Component	Nm
Drive plate to crankshaft	30 + 90° 1)

- 1) 90° corresponds to a quarter of a turn

2.4 - Removing and installing needle bearing in flywheel

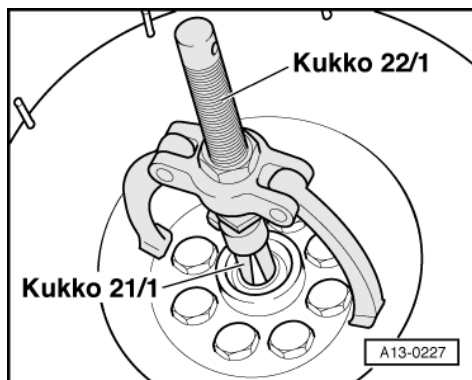


Special tools and workshop equipment required

- ♦ Mandrel 30-505
- ♦ Press tool 30-506 B
- ♦ Kukko 21/1 (Item 1) and Kukko 22/1 (Item 4) or 10-202

Notes:

- ♦ A needle bearing must be fitted in the flywheel in engines for vehicles with manual gearbox. Install needle bearing if necessary.
- ♦ Short engines are supplied without bushes in the crankshaft. Before installing the drive plate drive in the bush =>Fig. 60



Removing

- -> Pull out ball bearing with Kukko 21/1 and Kukko 22/1 or with 10-202.

Installing

- Insert ball bearing using mandrel 30-505 and insertion tool 30-506 B.

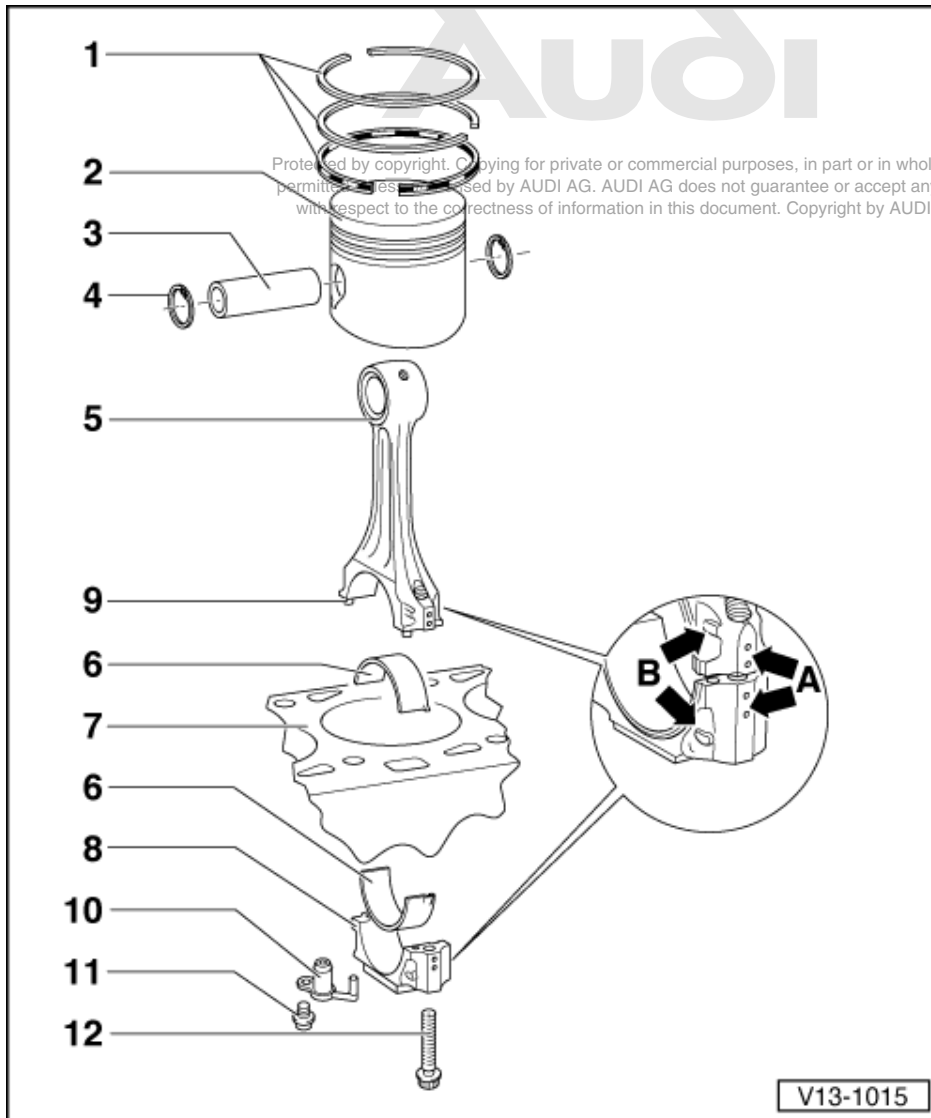
2.5 - Crankshaft dimensions

(in mm)

Honing dimension	Crankshaft bearing main journal $\varnothing$	Conrod bearing main journal $\varnothing$
Basic dimension	-0.022 58.00 -0.042	-0.022 47.80 -0.042
1st undersize	-0.022 57.75 -0.042	-0.022 47.55 -0.042
2nd undersize	-0.022 57.50 -0.042	-0.022 47.30 -0.042
3rd undersize	-0.022 57.25 -0.042	-0.022 47.05 -0.042

3 - Dismantling and assembling pistons and conrods

3.1 - Dismantling and assembling pistons and conrods

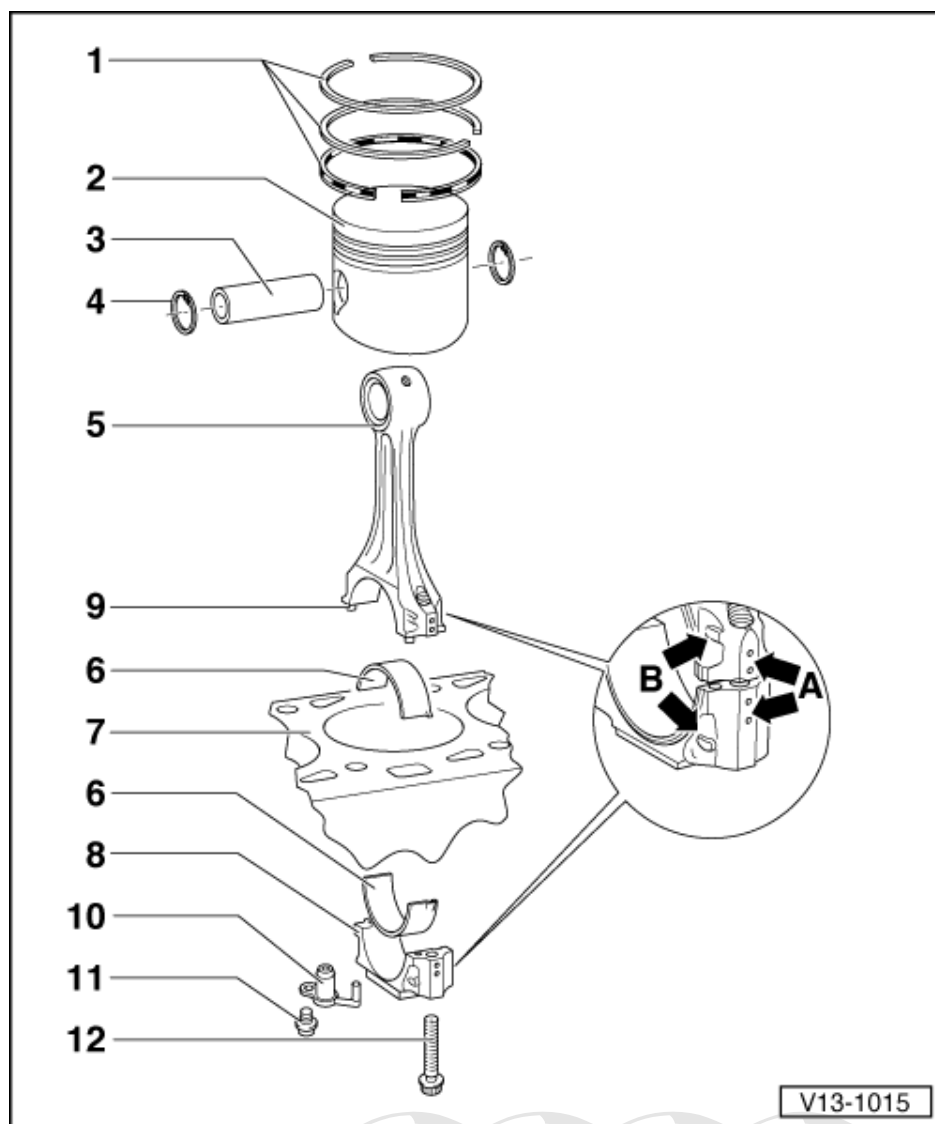


1 Piston rings

- ◆ Offset gaps by 120°
- ◆ Remove and install with piston ring pliers.
- ◆ "TOP" must face piston crown.
- ◆ Checking ring gap => Fig. 70
- ◆ Checking ring to groove play=> Fig. 70

2 Piston

- ◆ Checking => Fig. 72
- ◆ Installation position and arrangement of piston/cylinder => Fig. 71
- ◆ Location of valve reliefs for piston/cylinder => Fig. 71
- ◆ Install using piston ring clamp.
- ◆ Checking piston projection at TDC =>Page 72
- ◆ With recess for oil spray jets
- ◆ Piston and cylinder dimensions=>Page 74



3 Piston pin

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

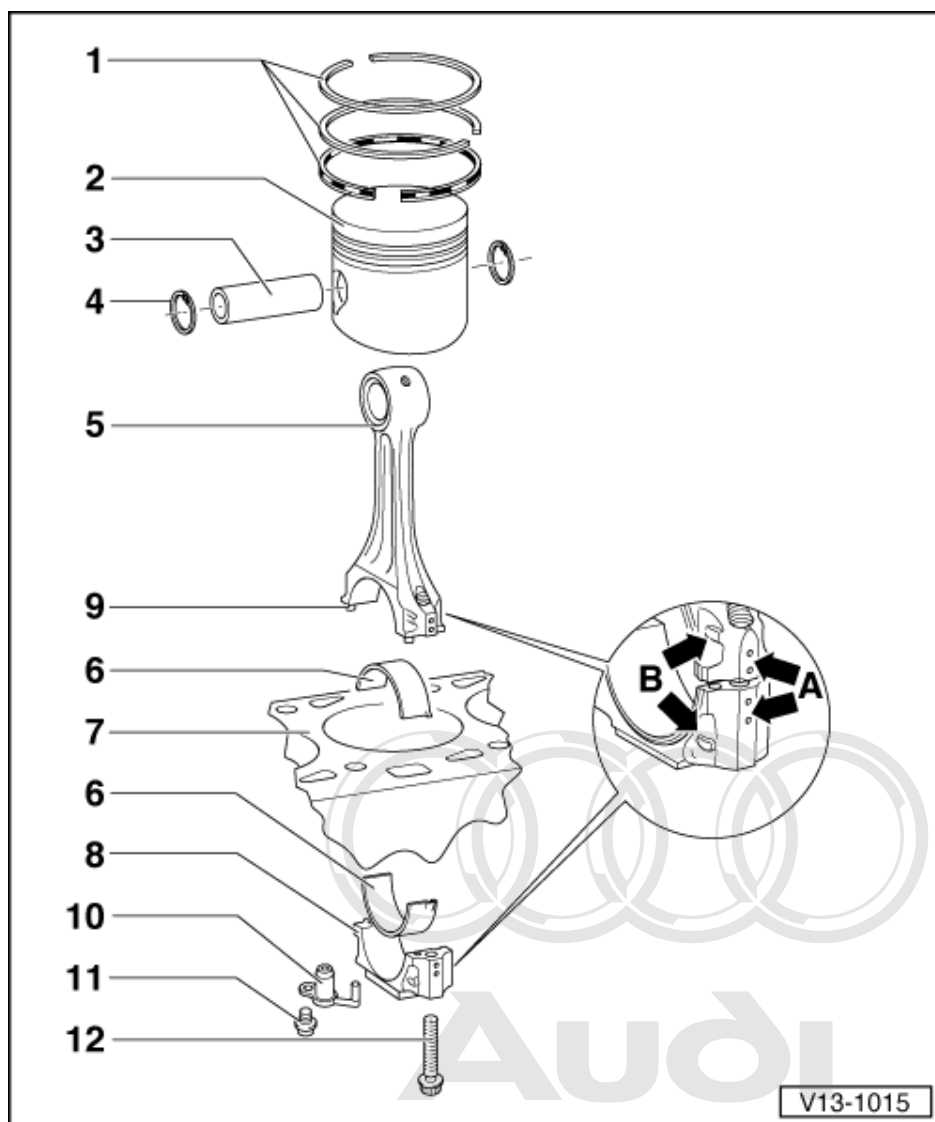
4 Circlip

- ♦ Removing and installing with circlip pliers
- ♦ Installation position: Opening pointing upwards

5 Conrod

- ♦ Only renew as a set
- ♦ Mark cylinder allocation -A-
- ♦ Installation position: Markings -B- face towards pulley side
- ♦ Guided in the piston, axial play on crankshaft is not measured

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6 Bearing shell

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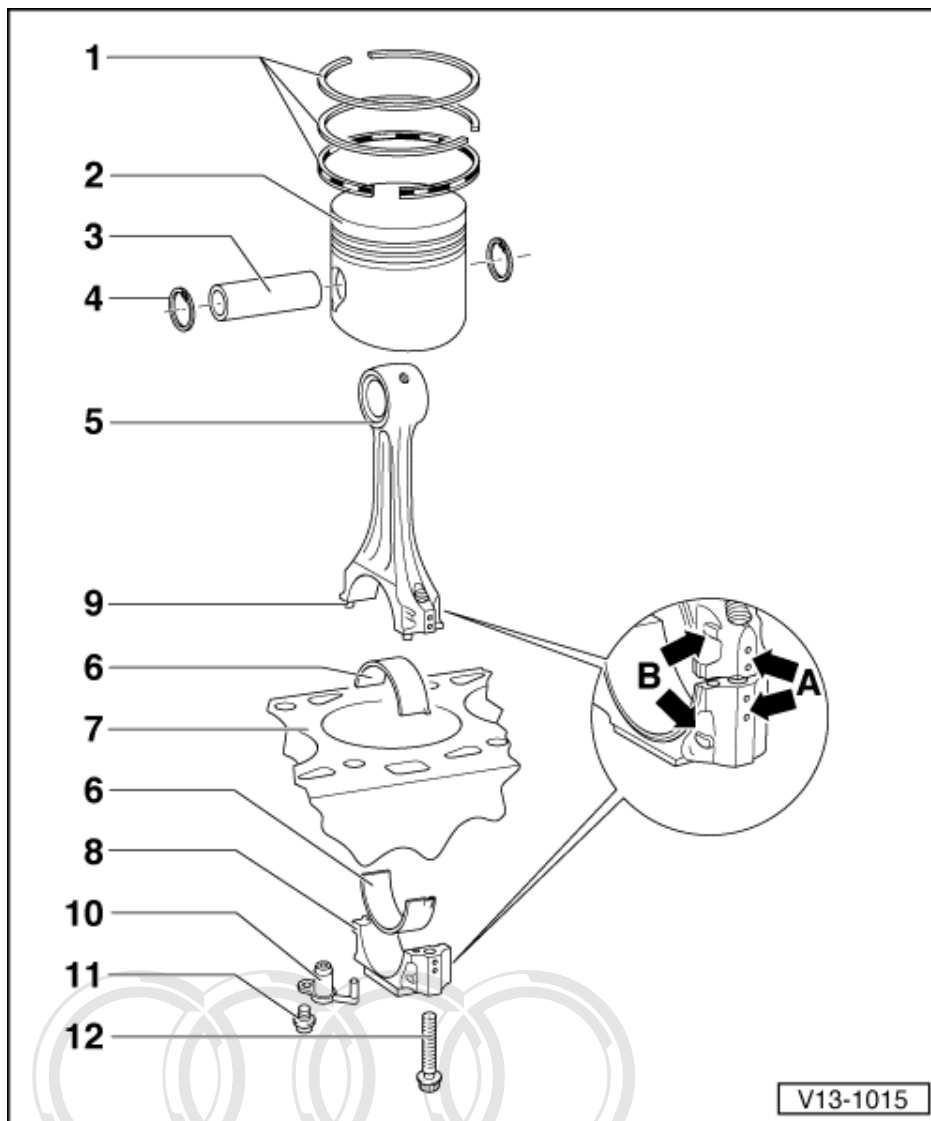
- ◆ Do not interchange used bearing shells (mark with waterproof felt pen)
- ◆ Note installation position
- ◆ Ensure retaining lugs fit tightly in recesses.
- ◆ Axial play on crankshaft is not measured, conrods are guided in the piston
- ◆ Measuring radial play=>Page 74

7 Cylinder block

- ◆ Checking cylinder bore=> Fig. 72
- ◆ Piston and cylinder dimensions=>Page 74

8 Conrod bearing cap

- ◆ Mark cylinder allocation -A-
- ◆ Installation position:
Markings -B- face towards pulley side



9 Dowel pin

- ♦ Must be firmly seated in conrod, not in conrod bearing cap

10 Oil spray jet

- ♦ For piston cooling

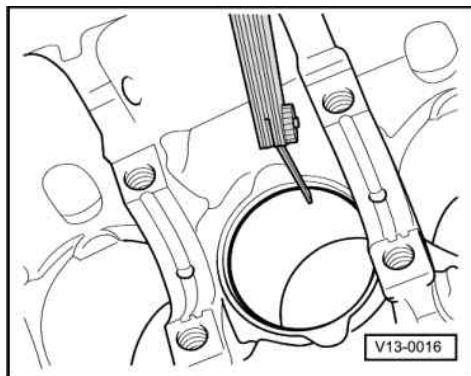
11 10 Nm

- ♦ Install using locking compound
- ♦ Locking compound

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

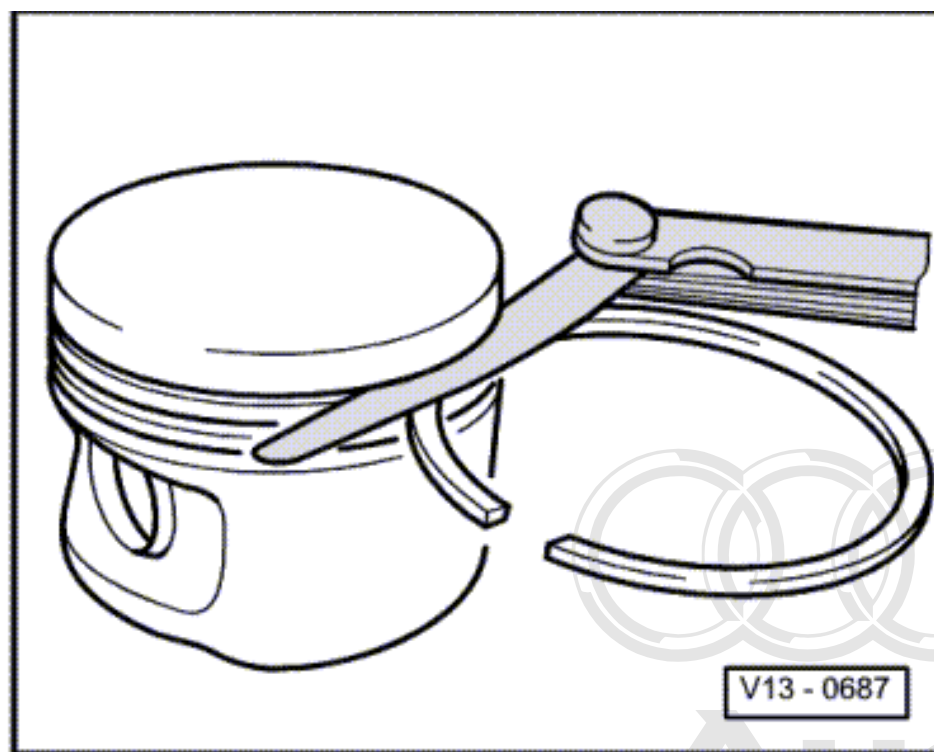
- ♦ Replace
- ♦ Oil threads and contact surface
- ♦ To measure radial play use old bolt



-> Fig.1 Checking piston ring gap

- Push ring into cylinder seated squarely on cylinder wall from top down up to approx. 15 mm before bottom edge of cylinder. Use a piston without rings.

Piston ring Dimensions in mm	New	Wear limit
1st compression ring	0.25...0.45	1.0
2nd compression ring	0.20...0.40	1.0
Oil scraper ring	0.25...0.50	1.0



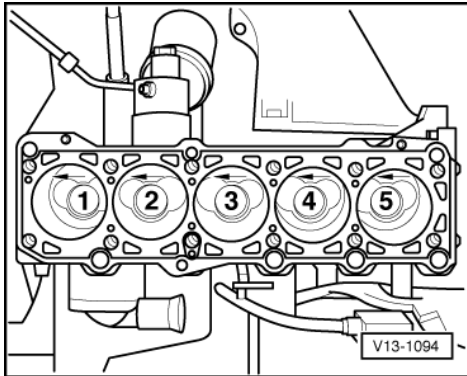
-> Fig.2 Checking ring to groove play

- Clean groove before checking play.

Piston ring Dimensions in mm	New	Wear limit
1st compression ring	0.07...0.105	0.25
2nd compression ring	0.05...0.075	0.25

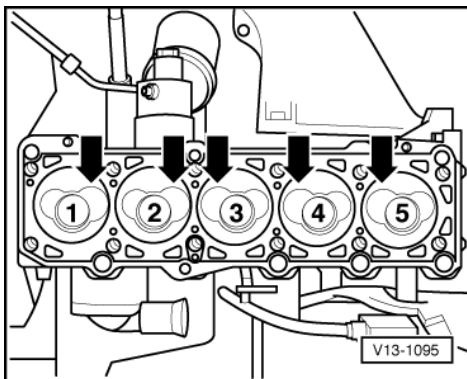
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Piston ring Dimensions in mm	New	Wear limit
Oil scraper ring	0.03...0.065	0.15



➔ Fig.3 Piston installation position and arrangement of piston/cylinder

- Mark installation position and allocation on inside of piston (not on piston crown) with electric pen or felt-tip pen.
 - Installation position:
 - Arrow on piston crown points to pulley end
- Mark piston number in relation to cylinders -1...5-.



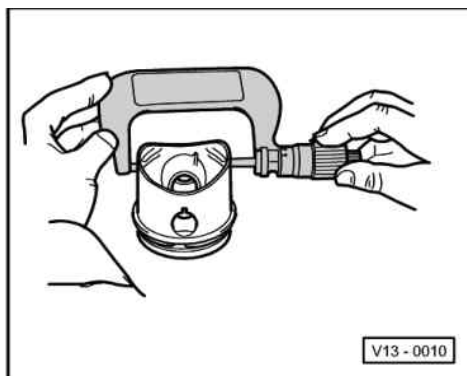
➔ Fig.4 Location of valve reliefs for piston/cylinder

- Pistons in cylinder 1 and 2: Large valve relief -arrows- for inlet valve towards flywheel side
- Pistons in cylinders 3, 4 and 5: Large valve relief -arrows- for inlet valve towards pulley side

Note:

On new pistons the cylinder numbers are marked in colour on the piston crowns.

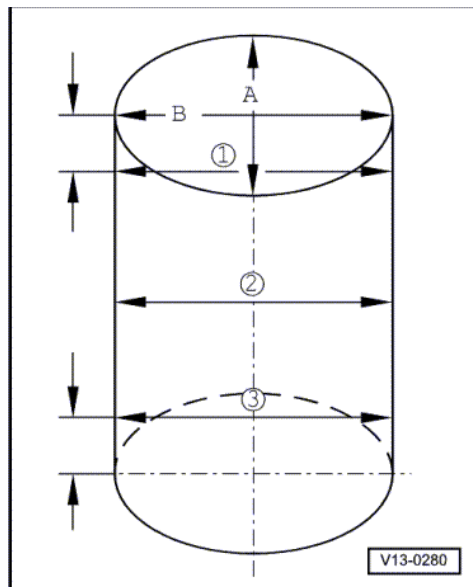
- ♦ Pistons for cylinder 1 and 2:
are marked 1/2
- ♦ Pistons for cylinders 3, 4 and 5.
are marked 3/4/5



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-> Fig.5 Checking piston

- Measure approx. 10 mm from the lower edge, offset by 90° to the piston pin axis.
- Permissible deviation from nominal dimension:
no more than 0.04 mm.



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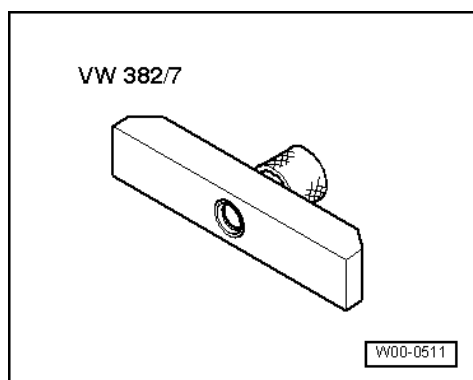
-> Fig.6 Checking cylinder bores

Special tools and workshop equipment required

- ♦ Use internal dial gauge 50...100 mm.
- Take measurements at 3 positions in both lateral direction -A- and longitudinal direction -B-.
 - Permissible deviation from nominal dimension:
no more than 0.08 mm.

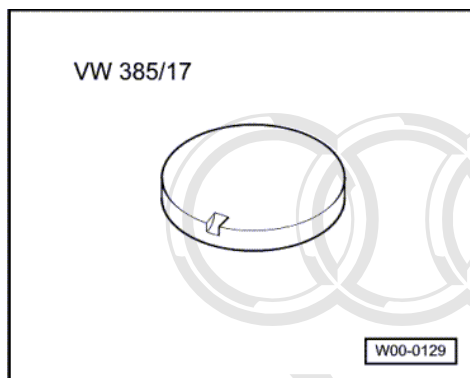
Nominal dimension => Page 74 ; Piston and cylinder dimensions

3.2 - Checking piston projection at TDC

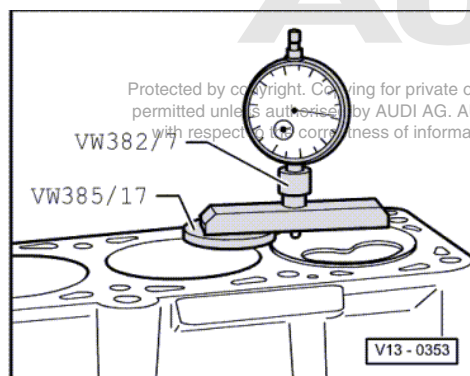


Special tools and workshop equipment required

- ♦ Special tool VW 382/7

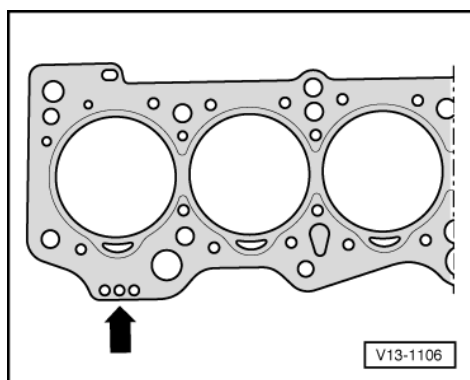


♦ Measuring plate VW 385/17



-> Piston projection at TDC must be measured when installing new pistons or a short engine. Depending on piston projection, install the corresponding cylinder head gasket according to following table:

Piston projection above top surface of cylinder block	Identification Holes or notches
0.76 mm ...1.01 mm	1
1.02 mm ...1.05 mm	2
1.06 mm ...1.13 mm	3



-> Cylinder head gasket identification

- ♦ Holes or notches = arrow

Notes:

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



- ♦ Installation position: Marking "top" or part no. must face cylinder head

3.3 - Piston and cylinder dimensions

Honing dimension		Piston $\varnothing$	Cylinder bore $\varnothing$
Basic dimension	mm	80.96	81.01
1st undersize	mm	81.21	81.26

3.4 - Checking radial play of conrods

Notes:

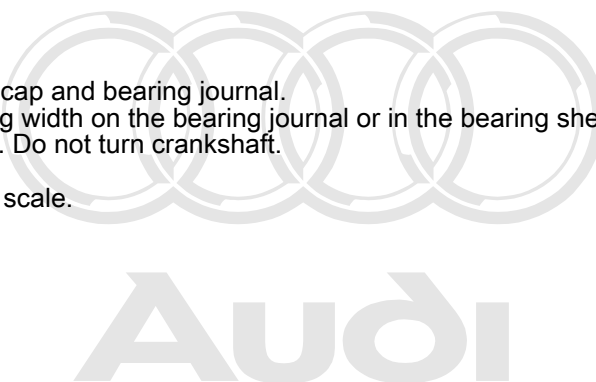
- ♦ Do not interchange used bearing shells.
- ♦ Do not turn crankshaft when measuring radial play.

Auxiliary equipment required

- ♦ Plastigage

Test sequence

- Remove conrod bearing cap. Clean bearing cap and bearing journal.
- Place a length of Plastigage of corresponding width on the bearing journal or in the bearing shells
- Fit conrod bearing cap and tighten to 30 Nm. Do not turn crankshaft.
- Remove conrod bearing cap again.
- Compare width of Plastigage with calibrated scale.
 - Wear limit: 0.08 mm



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15 - Cylinder head, Valve gear

1 - Removing and installing cylinder head

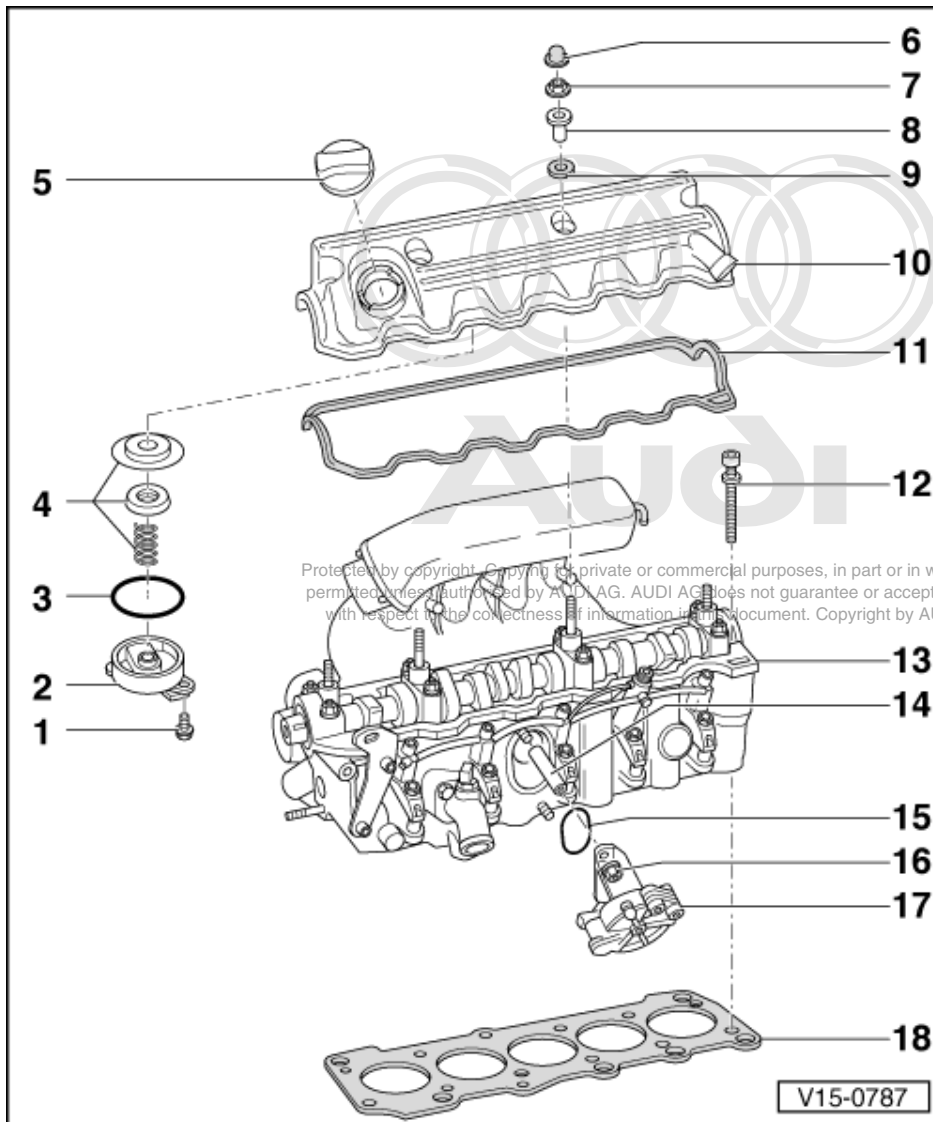
1.1 - Removing and installing cylinder head

Notes:

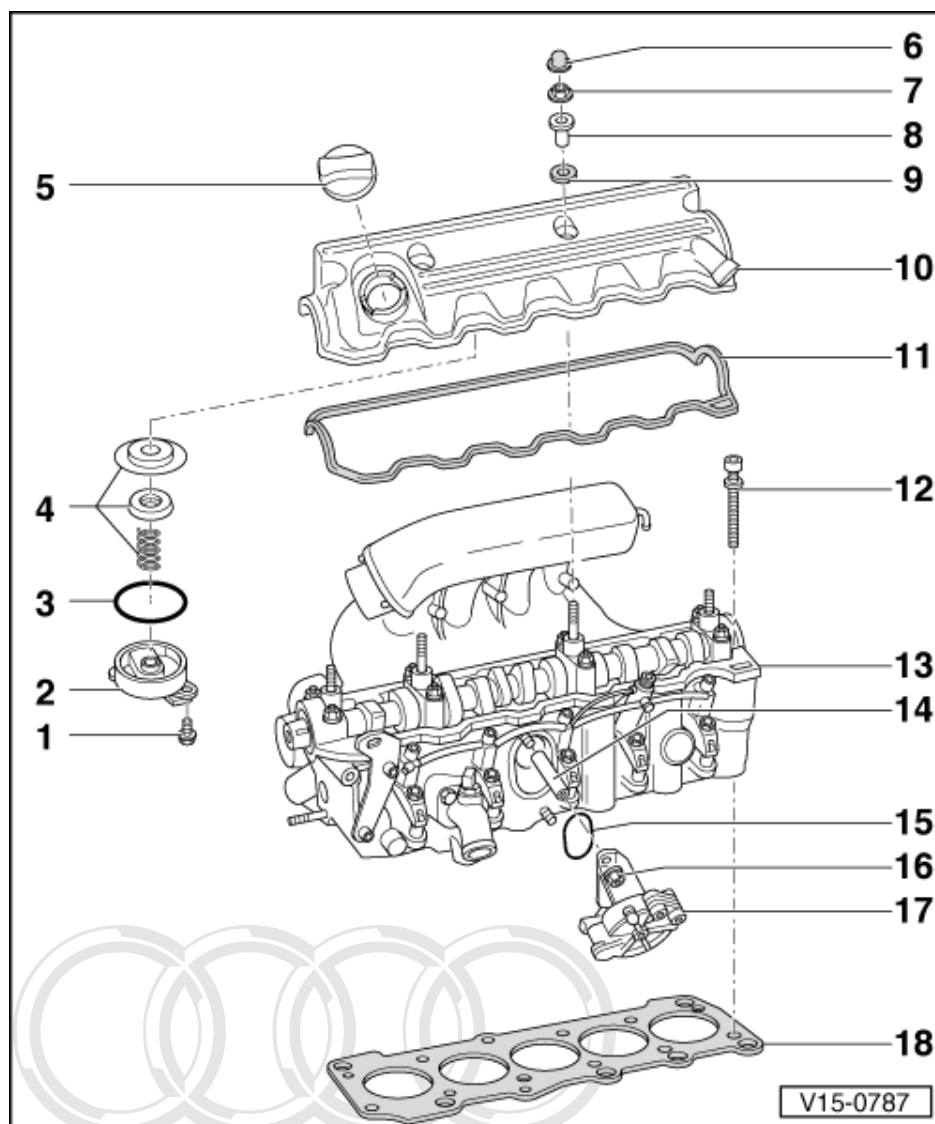
- ◆ Replace the cylinder head bolts.
- ◆ When performing installation procedures always replace self-locking nuts and bolts.
- ◆ Replace seals, gaskets, and bolts which have a specified tightening angle.
- ◆ Cylinder heads with tears can be used between the valve seats without reducing the service life if the tears are slight and at the most 0.5 mm wide.
- ◆ When fitting a new cylinder head or cylinder head gasket, drain off all the old coolant and re-fill with new coolant.
- ◆ The cylinder heads on a diesel engine must not be reworked.
- ◆ When installing an exchange cylinder head with fitted camshaft, the contact surfaces between tappets and cams must be oiled after installing the head.
- ◆ The plastic protectors fitted to protect the open valves must only be removed immediately before fitting the cylinder head.



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- 1 10 Nm
 - ♦ Replace
- 2 Cover
 - ♦ For pressure regulating valve of crankcase vent
- 3 O-ring
 - ♦ Replace
- 4 Pressure regulating valve
 - ♦ For crankcase breather
- 5 Cap
- 6 Trim cap
- 7 Nut, 10 Nm
 - ♦ With collar
- 8 Socket
 - ♦ With collar
- 9 Sealing cone
 - ♦ Replace if damaged
- 10 Cylinder head cover
 - ♦ Removing and installing =>Page 80



11 Cylinder head cover gasket

- ◆ Renew if damaged or leaking
- ◆ Removing and installing => Page 80
- ◆ Before fitting, apply sealant to sealing points => Fig. 80
- ◆ Insert in groove on cylinder head cover

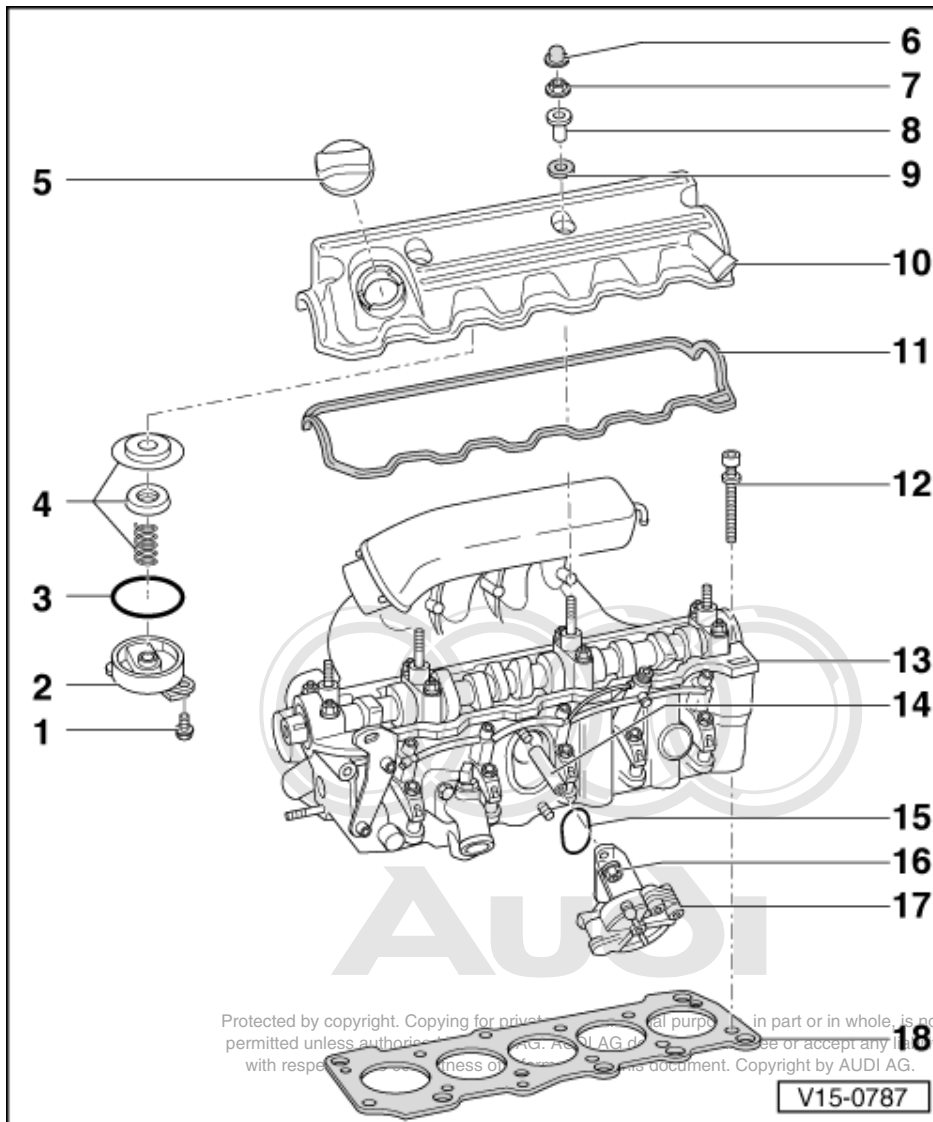
12 Cylinder head bolt

- ◆ Replace
- ◆ Note sequence when loosening => Page 88
- ◆ Note sequence when tightening => Page 90

13 Cylinder head

- ◆ Removing => Page 82
- ◆ Checking for distortion => Fig. 79
- ◆ Installing => Page 88
- ◆ After replacing, renew coolant

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14 Push rod

- ◆ For vacuum pump
- ◆ Length: 67.5 mm

15 O-ring

- ◆ Replace

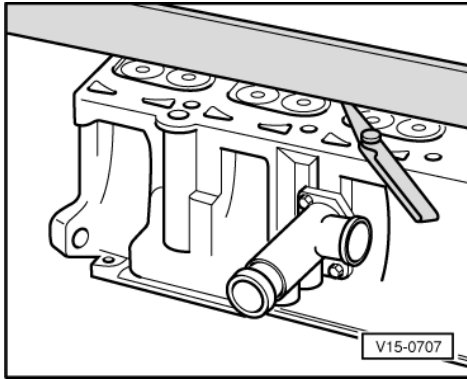
16 10 Nm

17 Vacuum pump

- ◆ For brake servo

18 Cylinder head gasket

- ◆ Renew => Removing cylinder head, Page 82
- ◆ Different thicknesses
- ◆ Observe marking => Fig. 79
- ◆ Installation position: Marking "top" or part no. must face cylinder head
- ◆ After replacing, fill with fresh coolant

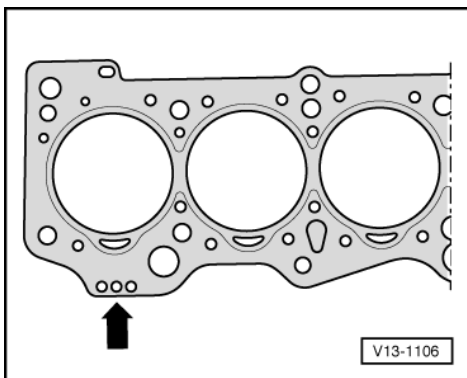


-> Fig.1 Checking cylinder head for distortion

- Use straightedge and feeler gauge to measure at several points.
- Max. permissible distortion: 0.2 mm

Note:

The cylinder heads on a diesel engine must not be reworked.

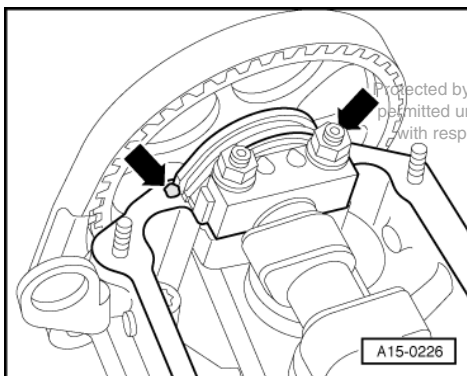


-> Fig.2 Cylinder head gasket marking

- ◆ Holes or notches = arrow

Notes:

- ◆ Cylinder head gaskets of different thicknesses are fitted depending on the amount of piston projection => Page 72 . When replacing just the gasket, the new gasket should have the same markings.
- ◆ Installation position: Marking "top" or part no. must face cylinder head



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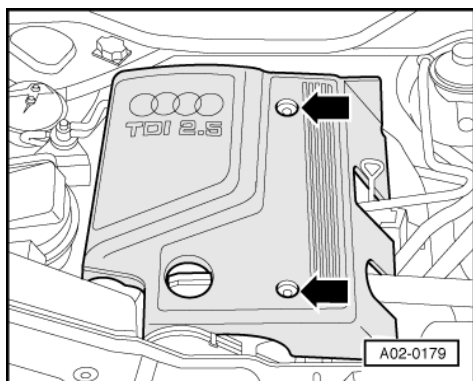


-> Fig.3 Sealing connections between bearing cap and cylinder head

- Apply a small quantity of sealing compound to sealing points -arrows- on upper sealing surface at front and rear of cylinder head.
- Sealing compound

=> Parts List

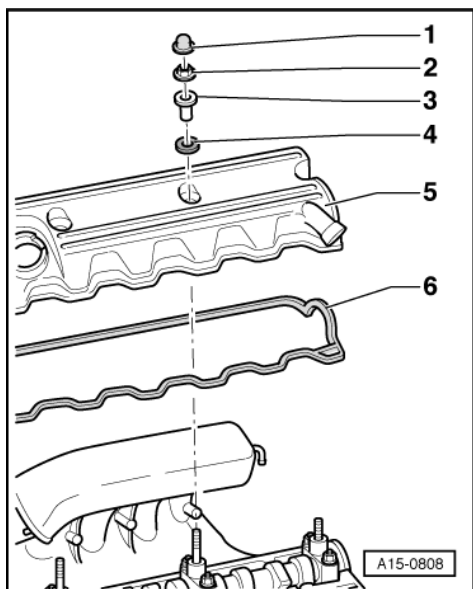
1.2 - Removing and installing cylinder head cover



Removing

Audi A6:

- -> Remove engine cover -arrows-.

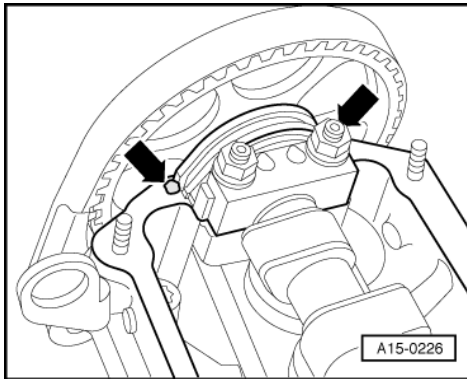


All models:

- Detach crankcase vent hoses from cylinder head cover.
- -> Remove trim caps -1-.
- Loosen nuts -2- on cylinder head cover.
- Remove the bush -3- and the sealing cone -4-.
- Remove the cylinder head cover -5-.



- Remove seal -6-.



Installing

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

Note:

Replace cylinder head cover gasket and sealing cone if damaged.

- -> Apply a small quantity of sealing compound to sealing points -arrows- on upper sealing surface on front and rear of cylinder head.
 - Sealing compound

=> Parts List

- Position cylinder head cover with parts.

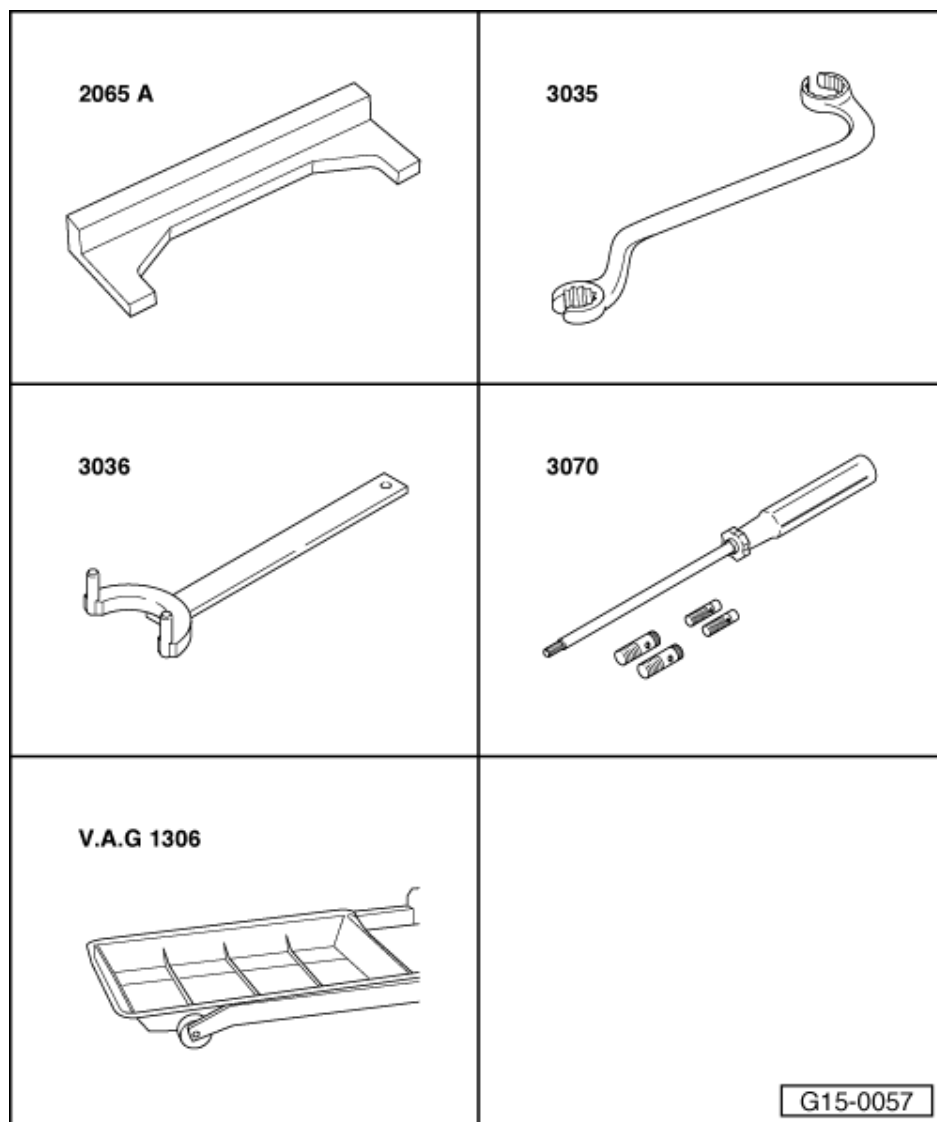
Tightening torques

Component	Nm
Cylinder head cover to cylinder head	10
Hose clamps	2

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1.3 - Removing cylinder head



Special tools and workshop equipment required

- ♦ Setting bar 2065 A
- ♦ Ring spanner 3035
- ♦ Counterhold 3036
- ♦ Guide pin 3070
- ♦ V.A.G 1306

Procedure

- Engine in vehicle

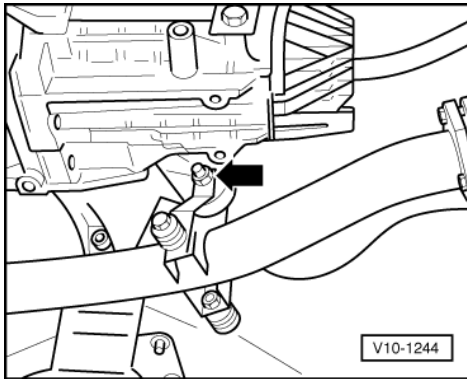
Notes:

- ♦ All cable ties which are released or cut open when removing must be fitted in the same position when installing.
- ♦ When engine oil is contaminated perform oil change.

=> Maintenance Manual

- Observe or obtain radio code on vehicles with coded radio.
- Disconnect earthing strap at battery with ignition switched off.

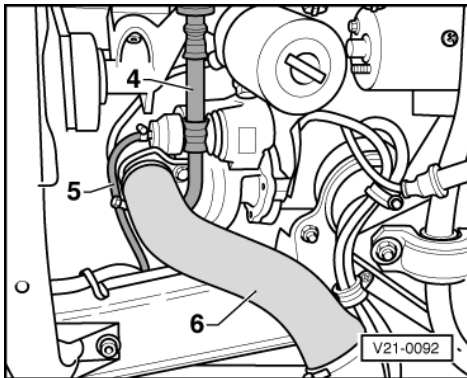
- Drain coolant => Page 139



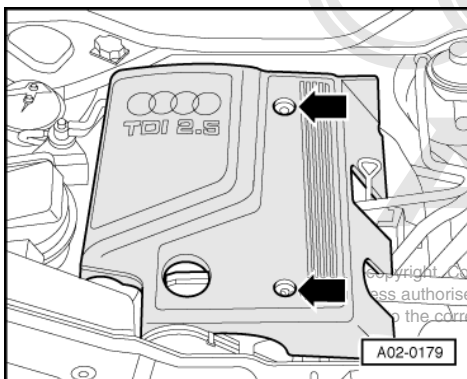
- -> Unbolt exhaust system at bracket -arrow-.

Note:

Illustration shows vehicle with automatic gearbox.



- -> Disconnect hose -5- at vacuum unit for boost pressure control of turbocharger.
- Remove the air duct hose -6- from the charge air cooler to the turbocharger.
- Place drip tray underneath.
- Unscrew the oil return pipe -4- from the turbocharger.

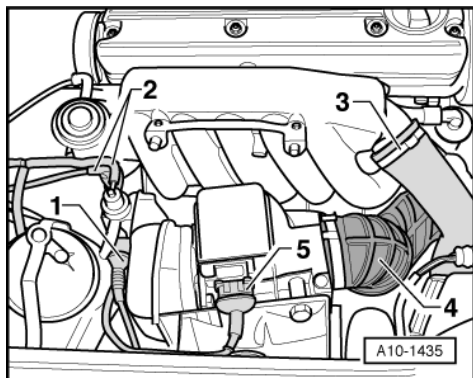


Audi A6:

- -> Remove engine cover -arrows-.

All models:

- Remove air duct to air cleaner at lock carrier.

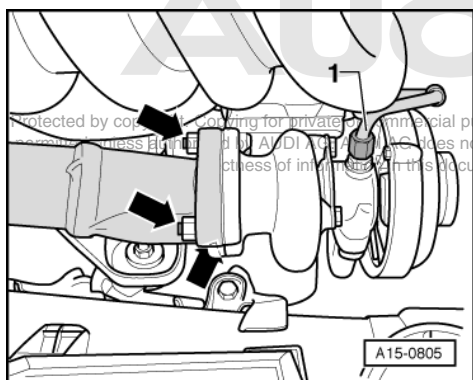


Vehicles with engine codes AAT, AEL:

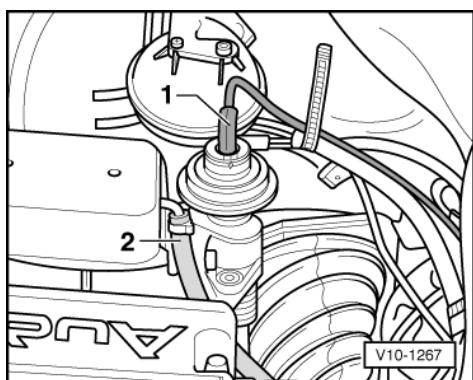
- -> Detach connector -5-.
- Detach connector-1- from the exhaust gas recirculation valve.
- Detach the hoses -2- from the exhaust gas recirculation valve.

All models:

- Remove air intake pipe -3- between charge air cooler and intake manifold.
- Remove the air duct hose -4- to turbocharger with the hose for crankcase venting.
- Remove the upper section of the air cleaner housing.



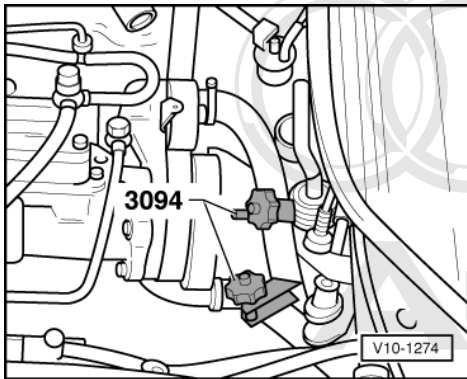
- -> Unbolt front exhaust pipe from turbocharger connection - arrows -.
- Detach front exhaust pipe from turbocharger.
- Unscrew the oil supply pipe -1- from the turbocharger.



- -> Disconnect hose -2- at rear from intake manifold.

Vehicles with engine codes AAT, AEL:

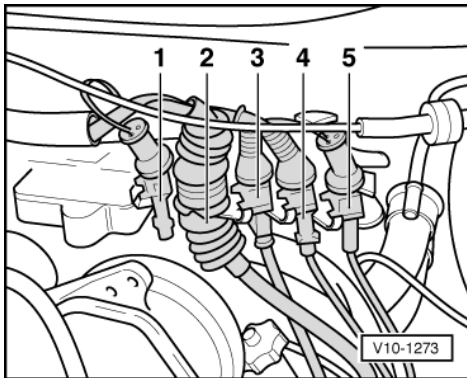
- Disconnect vacuum hose -1- at mechanical exhaust gas recirculation valve.



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All models:

- Remove the toothed belt guard for injection pump drive.
- -> Clamp off coolant hoses to heater with hose clamps 3094.
- Detach the coolant hose leading to the heater heat exchanger at the rear of the cylinder head.



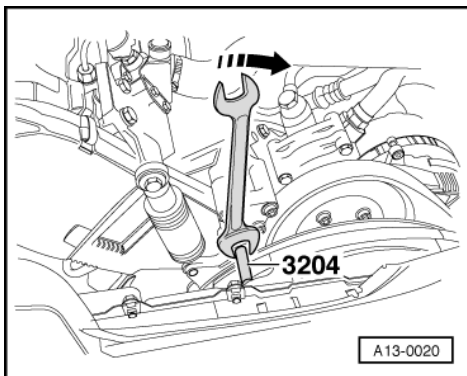
- Detach the cover for the connectors to the front.
- -> Remove the following connector from the centre of the bulkhead:

- 4 - Connector for needle lift sender -G80 (brown)

Note:

Illustration shows a vehicle with engine codes ABP or AAT up to 1st control unit version.

- Remove the connector -4- from the bracket and lay the wiring aside.

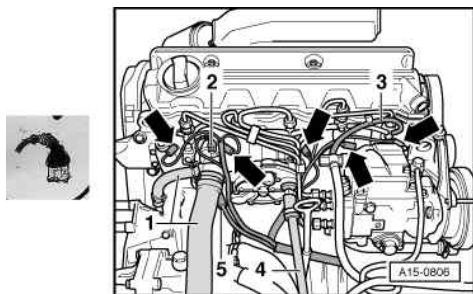


Audi A6:

Note:

Mark the running direction with chalk or a felt-tipped pen before removing the ribbed belt. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

- -> To slacken ribbed belt, turn tensioner in direction of arrow.
- Secure tensioner in position with pin 3204.
- Remove ribbed belt and release tensioner.
- Unscrew tensioner for ribbed belt from cylinder head.

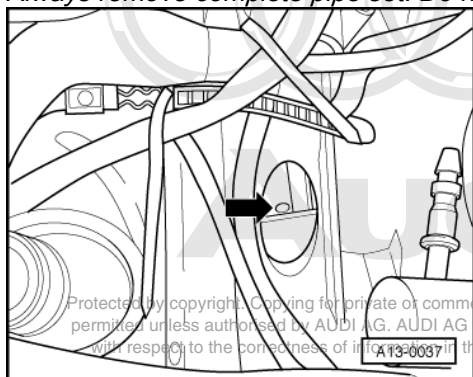


All models:

- -> Remove coolant hoses -1-.
- Detach connectors -arrows- from glow plugs.
- Detach connectors at coolant temperature sender -G62 -Item 2- and at electronic thermoswitch -F72 -Item 5-.
- Detach injector/injection pump fuel return pipe -3-.
- Detach vacuum line -4- to brake servo at vacuum pump.
- Disconnect the injector pipes using open ring spanner 3035.

Note:

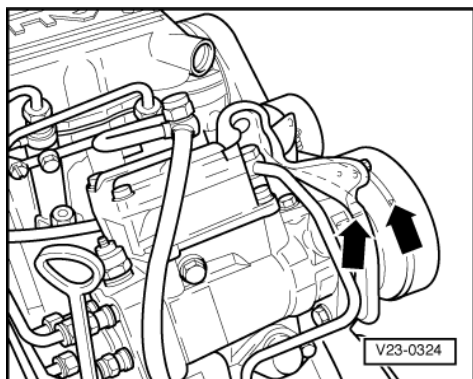
Always remove complete pipe set. Do not alter pipe shape.



Note:

The engine can be turned using the hexagon attachment (32 mm A/F) located at the hydraulic pump.

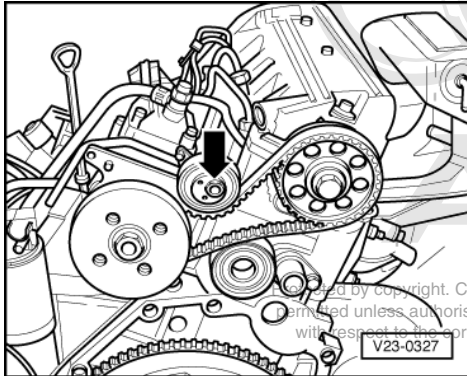
- -> Turn the crankshaft to cylinder 1 TDC -arrow-.
- The -O- mark on the flywheel must be located under the edge of the inspection hole...



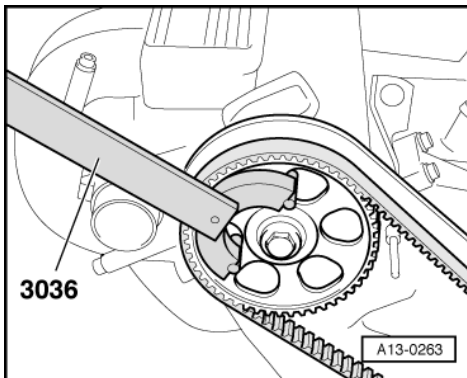
- -> ...at the same time, the marks on the injection pump sprocket and the injection pump must align - arrows-.

Notes:

- ♦ If the marks do not align, give the crankshaft another turn.
- ♦ Position crankshaft to TDC for cylinder 1 with engine removed=> Page 52



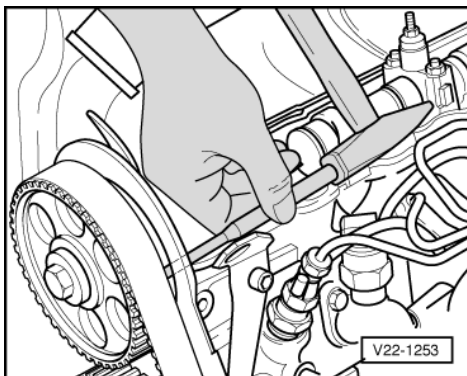
- -> Loosen the tensioning roller nut -arrow- by approx. 1 turn.
- Mark direction of rotation of toothed belt with chalk or felt pen.
- Remove toothed belt.



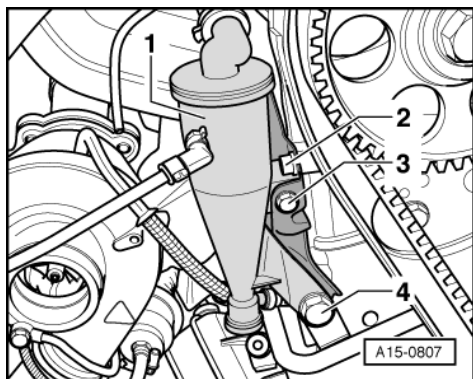
- Release nut of toothed belt tensioning roller.

Note:

-> When loosening and tightening the camshaft sprocket, never use the setting bar to counterhold. Counterhold using 3036.

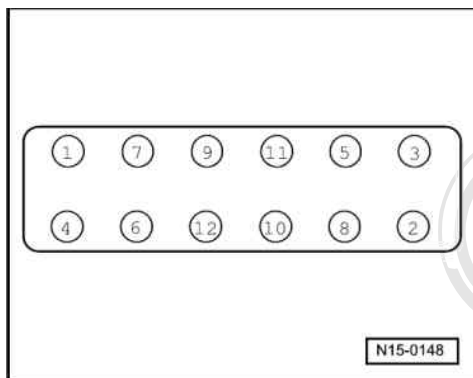


- -> Loosen the securing bolt of the camshaft sprocket 1/2 turn. Release camshaft sprocket from camshaft taper by tapping (pin through hole on rear toothed belt guard) using hammer.
- Remove the camshaft sprocket and toothed belt from the camshaft.
- Unscrew camshaft drive rear toothed belt guard from cylinder head.



Vehicles with engine codes AAT, AEL:

- -> Unscrew screws -3- and -4- and press aside oil separator -1- with hoses connected.
- Remove bolt -2- and remove bracket for oil separator.



All models:

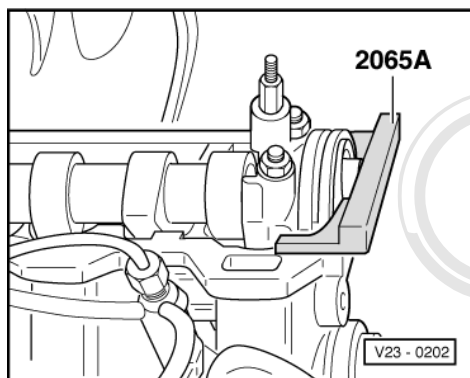
- Remove cylinder head cover => Page 80
- -> Loosen cylinder head bolts in the sequence 1...12
- Remove cylinder head with cylinder head gasket

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1.4 - Installing cylinder head

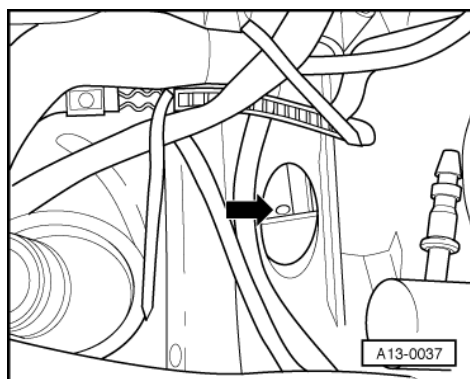
Notes:

- ♦ Replace the cylinder head bolts.
- ♦ When performing repairs, replace seals, gaskets, self-locking nuts and bolts which have a specified tightening angle.
- ♦ 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.
- ♦ No oil or coolant must be allowed to remain in the blind holes for the cylinder head bolts in the cylinder head.
- ♦ 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.
- ♦ 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.
- ♦ Hose connections and hoses for charge air system must be free of oil and grease before assembly. Lubricants must never be used.



Procedure

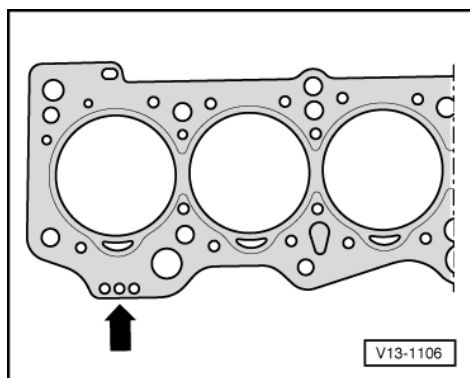
- -> Before positioning cylinder head, set crankshaft and camshaft to TDC of No. 1 cylinder. It must be possible to insert setting bar 2065 A in the camshaft.



- -> ...and the TDC mark -arrow- must be at the reference edge.

Note:

Illustration shows vehicle with manual gearbox.



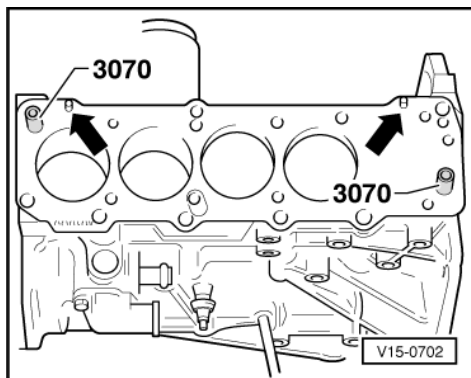
- -> Note markings on cylinder head gasket.
- ◆ Holes or notches = arrow

Notes:

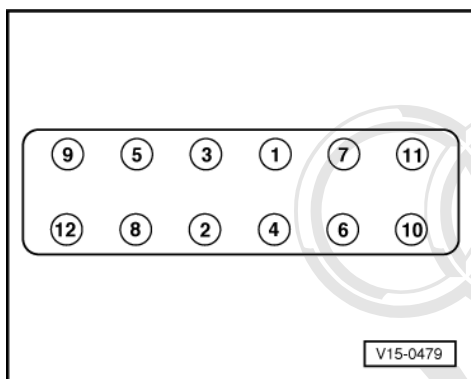
- ◆ If the cylinder head gasket or the cylinder head has been replaced, select a new gasket according to the number of holes or notches on the old gasket.



- ♦ If parts of the crank assembly have been replaced, the new cylinder head gasket must be selected by measuring the piston projection at TDC => Page 72.



- -> To centre, screw guide pins from 3070 into holes for cylinder head bolts 9 and 10.
- Place cylinder head gasket in position.
 - Note position of centralising pins in cylinder block -arrows-.
 - Check installation position of cylinder head gasket: mark "top" or the part No. must face cylinder head.
- Position cylinder head.
- Fit 10 cylinder head bolts and tighten by hand.



- Unscrew guide pins with removal tool from 3070 through bolt holes in cylinder head and install remaining cylinder head bolts.
- -> Tighten cylinder head bolts in four stages in sequence shown as follows:
- Tighten using torque wrench:
 - 1st Stage: 40 Nm
 - 2nd Stage: 60 Nm
- Tighten with rigid wrench:
 - 3rd Stage: 90° (1/4 turn) further
 - 4th Stage: 90° (1/4 turn) further

Note:

It is not necessary to retighten cylinder head bolts after repairs have been performed.

- Install toothed belt (adjust valve timing) => Page 40

Note:

Observe all instructions on removing and installing the toothed belt => from Page 38

- Install cylinder head cover => Page 81
- Install ribbed belt => Page 29
- Installation and stress-free alignment of exhaust system => Page 201
- Replace coolant => Page 141

Note:

When the battery is reconnected make sure that the vehicle equipment (radio, clock, electrical window lifter) is activated according to the operating instructions.

- Check commencement of injection of injection pump:

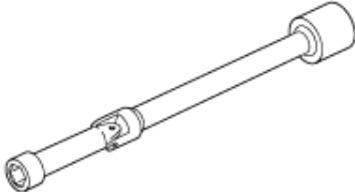
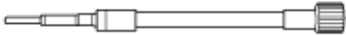
=> Diesel Direct Injection and Glow Plug System (TDI 5-cylinder); Repair group 23; Servicing diesel direct injection system

Tightening torques

Component	Nm
Front exhaust pipe to turbocharger	30
Front exhaust pipe to gearbox	25
Injector pipes to injectors/injection pump	25
Oil supply pipe to turbocharger	25
Oil return pipe to turbocharger	30
Hose clamps for coolant hoses	2
Hose clamps for air duct hoses	3.5

1.5 - Checking compression

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3220 	V.A.G 1763 
V.A.G 1381/12 	
	G15-0002

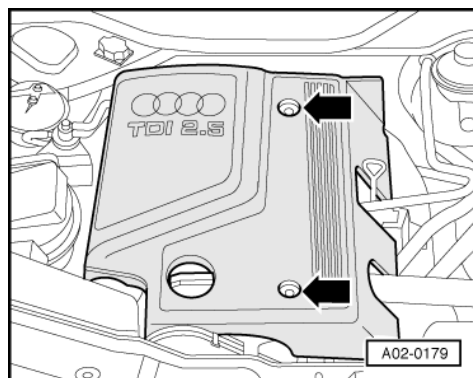
Special tools and workshop equipment required

- ♦ Special tool 3220
- ♦ V.A.G 1763
- ♦ V.A.G 1381/12

Test requirements:

- Engine oil temperature at least 30 °C
- Battery voltage at least 12.7 V

Test sequence

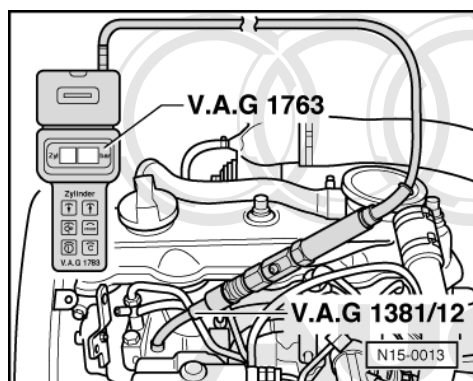


Audi A6:

- -> Remove engine cover -arrows-.

All models:

- Unscrew the electrical wiring of fuel cut-off valve at injection pump.
- Detach connector at metering control of injection pump.
- Remove all glow plugs using flexible-head spanner 3220.



- -> Screw in adapter V.A.G 1381/12 in place of glow plugs.
- Check compression with compression tester V.A.G 1381/V.A.G 1763.

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Note:

Using the compression tester

=> Operating Instructions

- Operate starter until tester shows no further pressure increase.

Compression values:

New pressure in bar	Wear limit pressure in bar	Permissible difference between cyl. pressure in bar
25...31	24	max. 5

- Install glow plugs with jointed spanner 3220 (15 Nm)
- Interrogating and erasing fault memory:

=> Diesel Direct Injection and Glow Plug System (TDI 5-cylinder); Repair group 01; Interrogating and erasing fault memory Interrogating and erasing fault memory

Note:

Faults will have been stored in the memory because connectors to injection pump have been unplugged. Interrogate and, if necessary, erase fault memory after completing the check.

Tightening torque

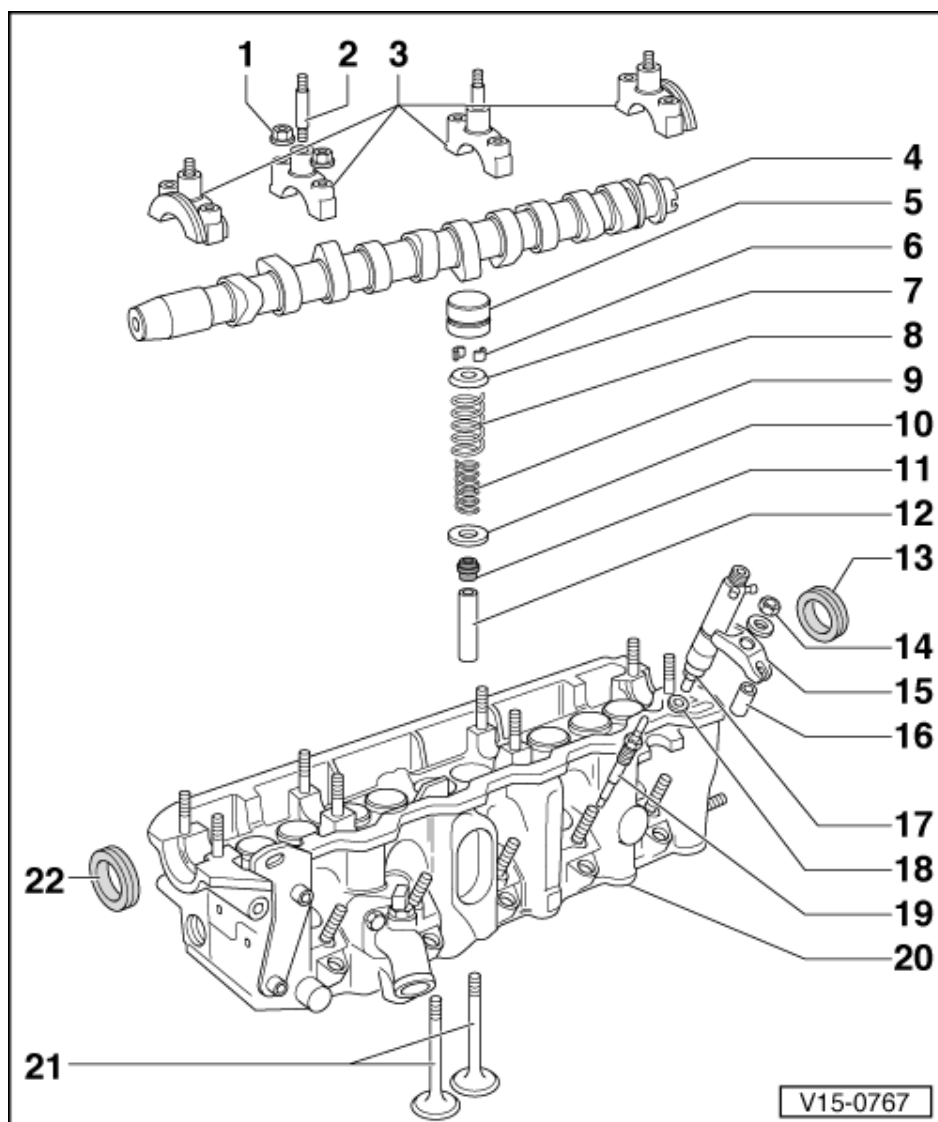
Component	Nm
Glow plugs to cylinder head	15

2 - Servicing valve gear

2.1 - Servicing valve gear

Notes:

- ◆ Cylinder heads with tears can be used between the valve seats without reducing the service life if the tears are slight and at the most 0.5 mm wide.
- ◆ After installing the camshaft, wait for about 30 minutes before starting the engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).
- ◆ After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.
- ◆ Renew all gaskets and seals.



1 20 Nm

2 5 Nm

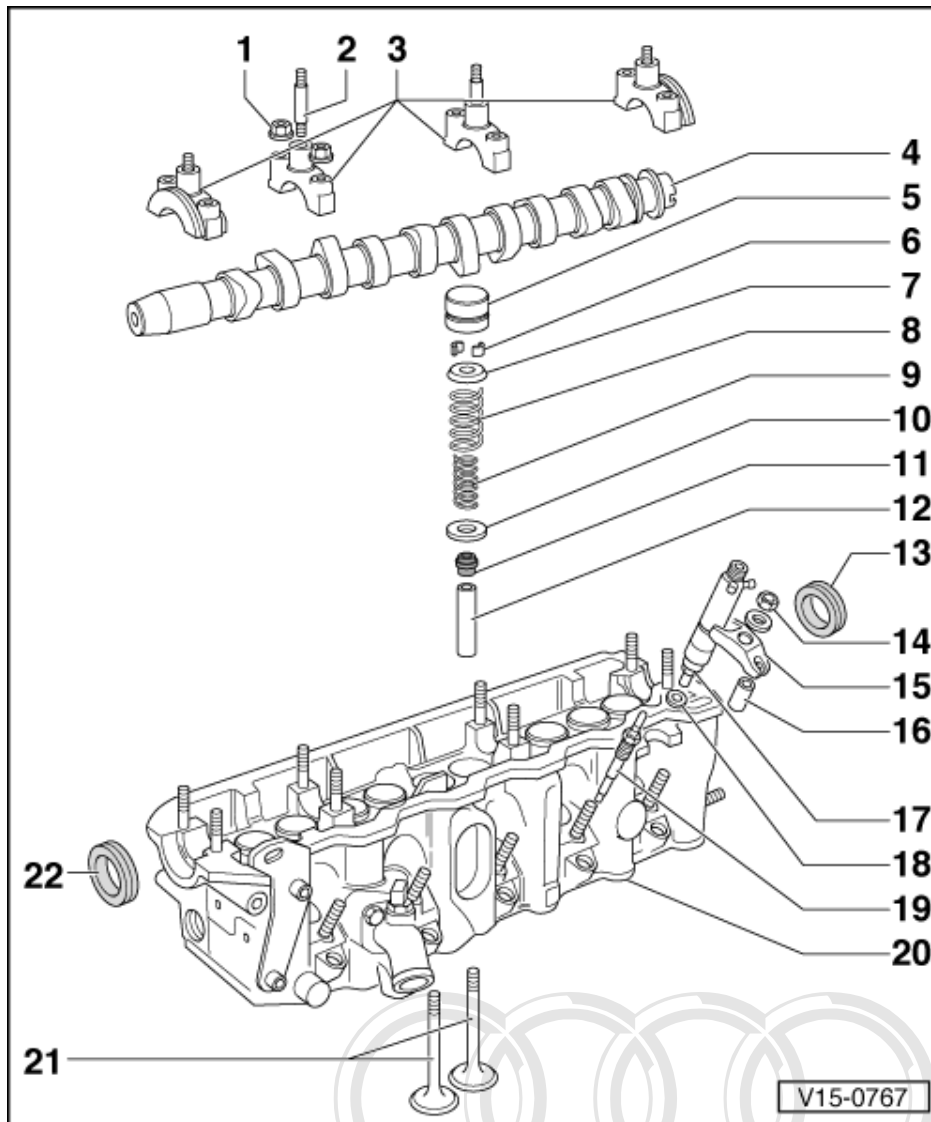
3 Bearing cap

- ◆ Identification: Cast-in numbering
- ◆ Installation position => Fig. 100
- ◆ Installation sequence=> Page 102, Removing and installing camshaft
- ◆ Before installing, apply thin coating of housing sealing compound to contact surfaces of bearing cap no. 1 (pulley side) and bearing cap no. 4 (flywheel side)
- ◆ Housing sealing compound

=> Parts List

- ♦ Applying sealant to sealing points => Fig. 100

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4 Camshaft

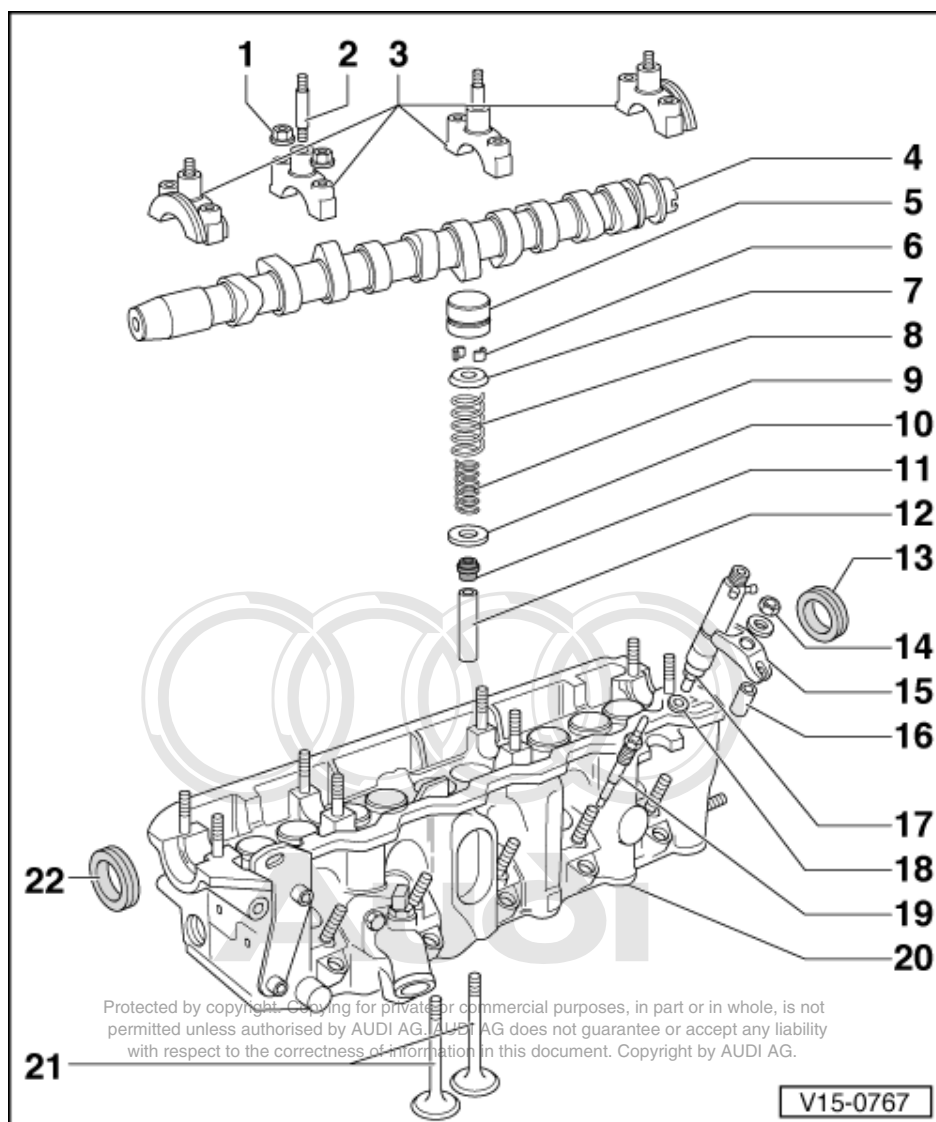
- ♦ Checking axial play=>Page 101
- ♦ Removing and installing =>Page 102
- ♦ Checking radial play with Plastigage
Wear limit: 0.11 mm
- ♦ Run-out: no more than 0.01 mm

5 Hydraulic bucket tappet

- ♦ Checking => Page 106
- ♦ Removing and installing=>Page 107
- ♦ Do not interchange
- ♦ Store with cam contact surface downwards
- ♦ Before installing check camshaft axial play=>Page 101
- ♦ Oil contact surface

6 Valve cotter

- ♦ Removing and installing:
Cylinder head
removed: with 2037
installed: =>Page 107



7 Upper valve spring bracket

- ♦ Removing and installing:
Cylinder head
removed: with 2037
installed: =>Page 107

8 Outer valve spring

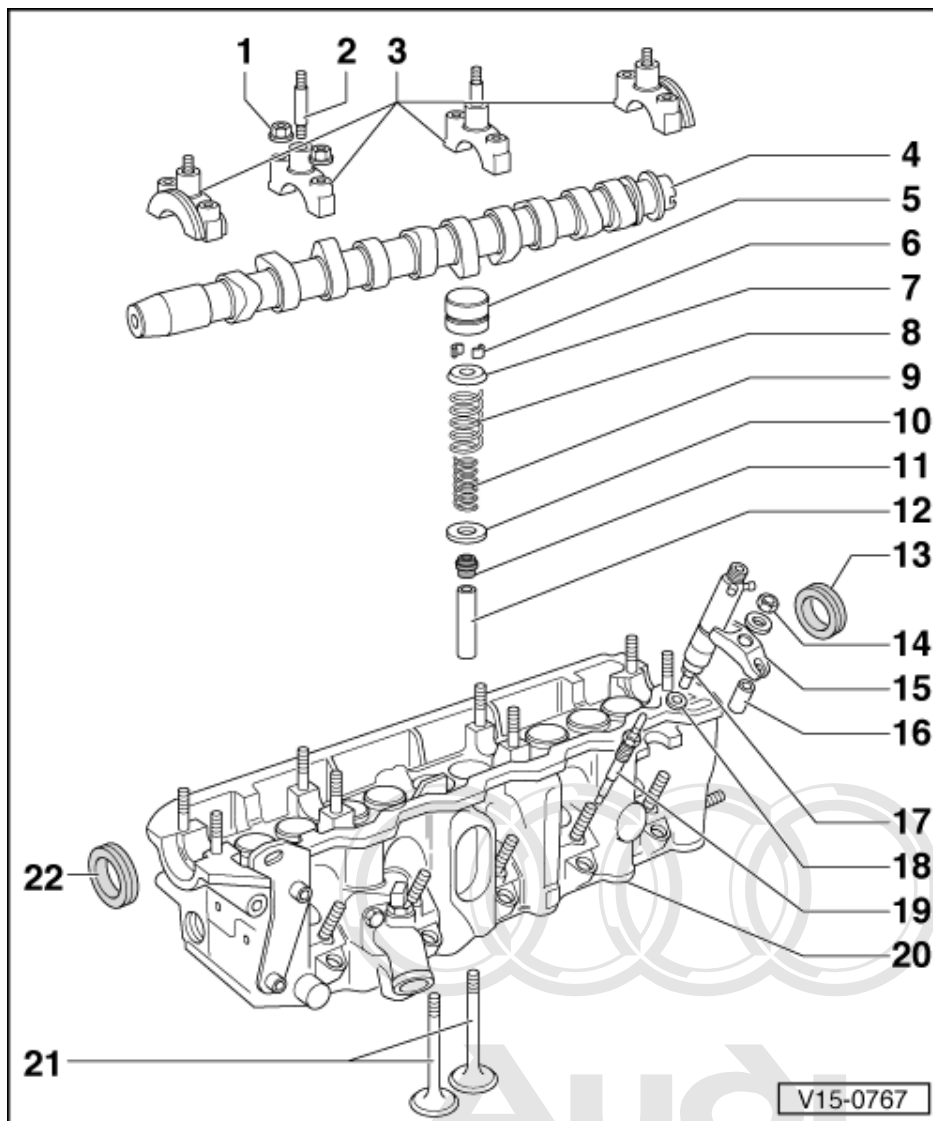
- ♦ Removing and installing:
Cylinder head
removed: with 2037
installed: =>Page 107

9 Inner valve spring

- ♦ Removing and installing:
Cylinder head
removed: with 2037
installed: =>Page 107

10 Lower valve spring retainer

- ♦ Removing and installing:
Cylinder head
removed: with 2037
installed: =>Page 107
- ♦ Can only be removed after valve stem seal -Item 11 - has been removed



11 Valve stem seal

- ♦ Replacing => Page 107

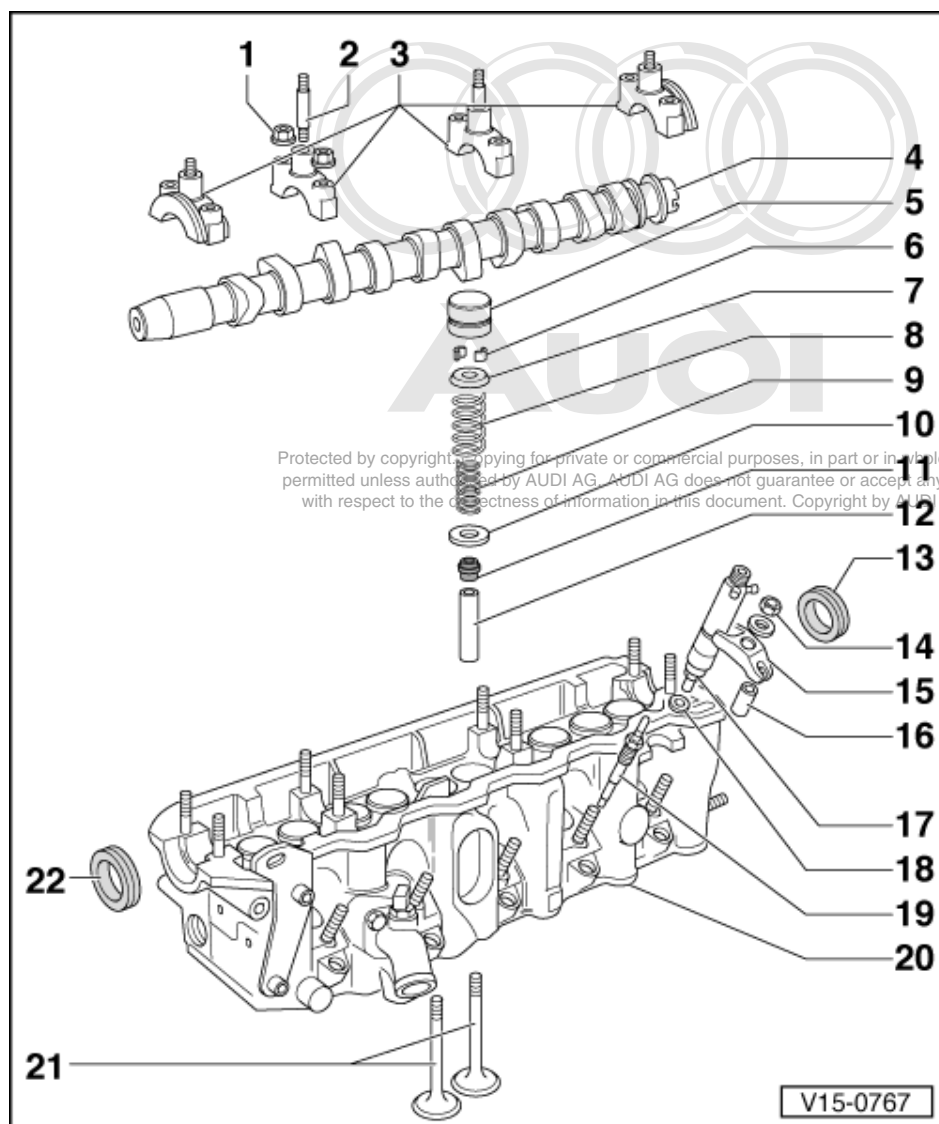
12 Valve guide

- ♦ Checking => Page 112
- ♦ Replacing => Page 113
- ♦ When exceeding wear limit replace cylinder head

13 Rear sealing ring

- ♦ To remove and install, remove bearing cap and drive wheel
- ♦ For pressing on the new sealing ring, use installer sleeve 3241/2 - the end of the camshaft has a sharp edge
- ♦ Push on to the stop
- ♦ Removing and installing injection pump toothed belt =>Page 49

14 20 Nm



15 Retainer

- ♦ For injectors

16 Bracket

17 Injector

- ♦ Removing and installing:

=> Diesel Direct Injection and Glow Plug System (TDI 5-cylinder); Repair group 23; Servicing diesel direct injection system

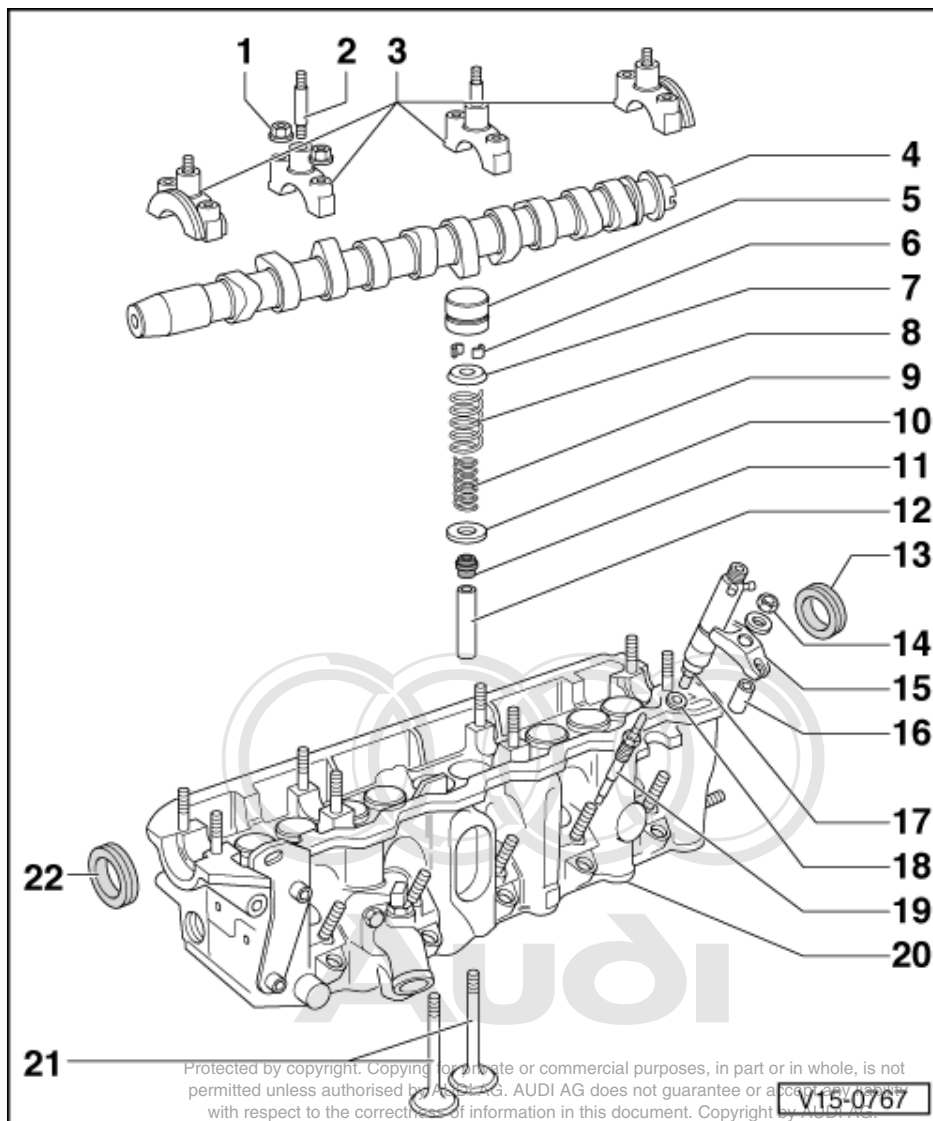
18 Heat insulation seal

- ♦ Replace

19 Glow plugs

- ♦ Removing and installing:

=> Diesel Direct Injection and Glow Plug System (TDI, 5-cylinder); Repair group 28; Checking glow plug system



20 Cylinder head

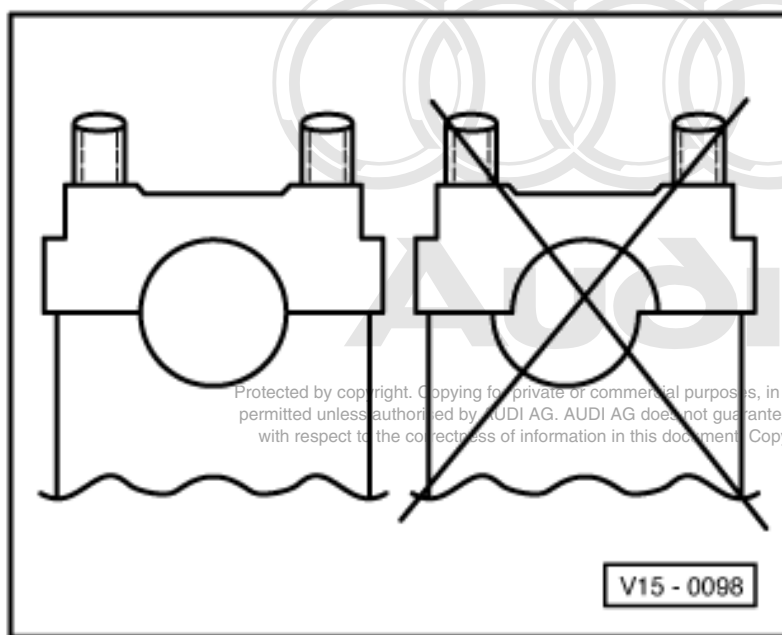
- ◆ See notes =>Page 93
- ◆ Rework valve seats =>Page 110
- ◆ Checking valve guides, grinding in valve seats =>Page 112

21 Valves

- ◆ Do not rework only grinding in is permitted
- ◆ Valve dimensions=>Fig. 101

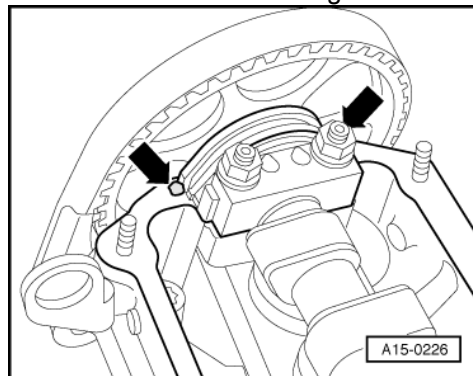
22 Front sealing ring

- ◆ To remove and install, remove bearing cap and camshaft sprocket
- ◆ Removing and installing camshaft toothed belt =>Page 38
- ◆ Push up to the stop



-> Fig.1 Installation position of camshaft bearing caps

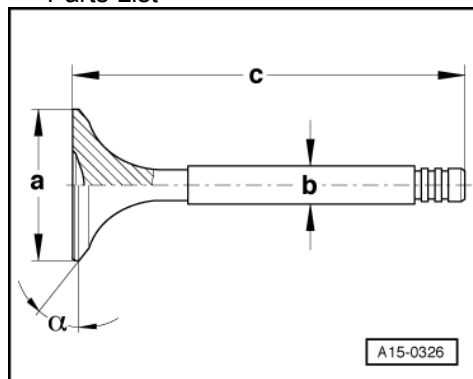
Note offset. Before installing camshaft fit bearing caps and determine installation position.



-> Fig.2 Sealing connections between bearing cap and cylinder head

- Apply a small quantity of sealing compound to sealing points -arrows- on upper sealing surface at front and rear of cylinder head.
- Sealing compound

=> Parts List



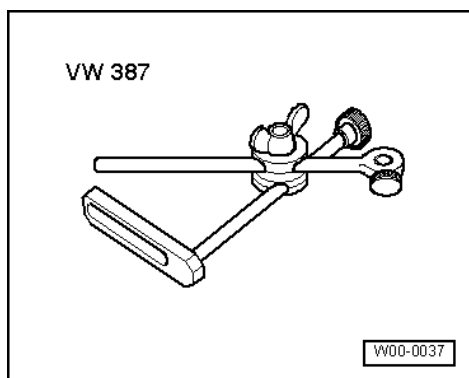
-> Fig.3 Valve dimensions

Note:

Valves must not be reworked. Only grinding in is permitted.

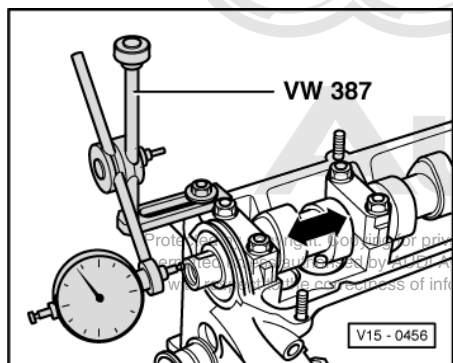
Dimension		Inlet valve	Exhaust valve
øa	mm	36.00	31.50
øb	mm	7.97	7.95
c	mm	96.85	96.85
α	°	45	45

2.2 - Checking camshaft axial play



Special tools and workshop equipment required

- ♦ Special tool VW 387
- ♦ Dial gauge

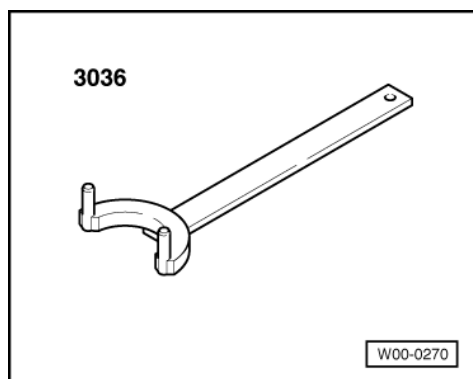


Test sequence

- -> Measure with bucket tappets removed and with first and last bearing caps fitted.
- Wear limit: no more than 0.15 mm

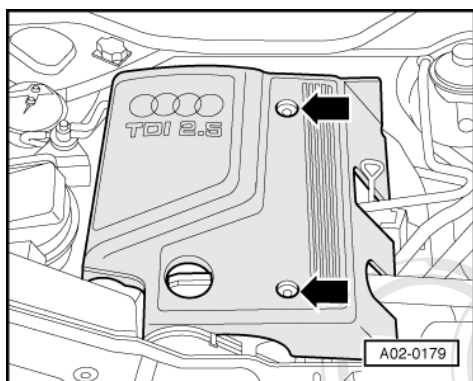


2.3 - Removing and installing camshaft



Special tools and workshop equipment required

- ♦ Counterhold 3036



Removing

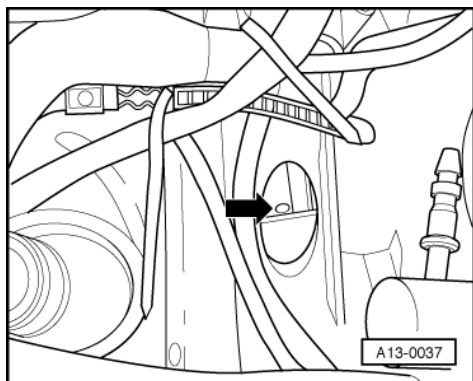
- Cylinder head installed

Audi A6:

- -> Remove engine cover -arrows-.

All models:

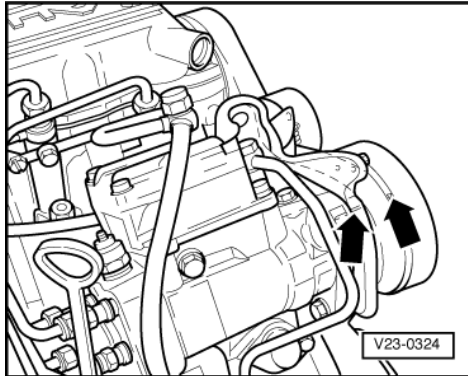
- Remove the toothed belt guard for injection pump drive.
- Remove the toothed belt guard for camshaft drive.



Note:

The engine can be turned using the hexagon attachment (32 mm A/F) located at the hydraulic pump.

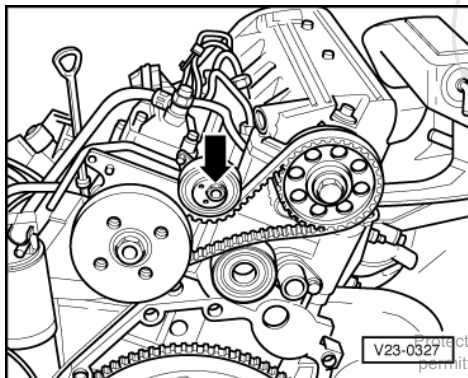
- -> Turn the crankshaft to cylinder 1 TDC -arrow-.
- The -O- mark on the flywheel must be located under the edge of the inspection hole...



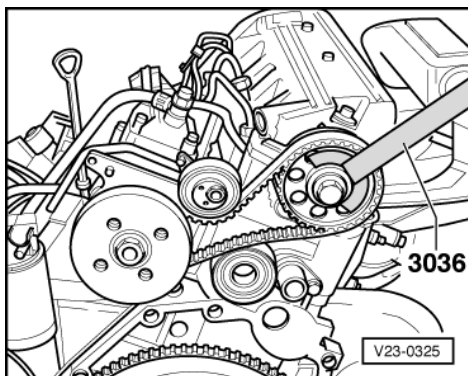
- -> ...at the same time, the marks on the injection pump sprocket and the injection pump must align - arrows-.

Note:

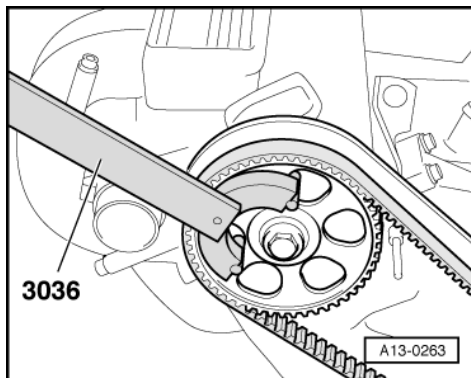
If the marks do not align, give the crankshaft another turn.



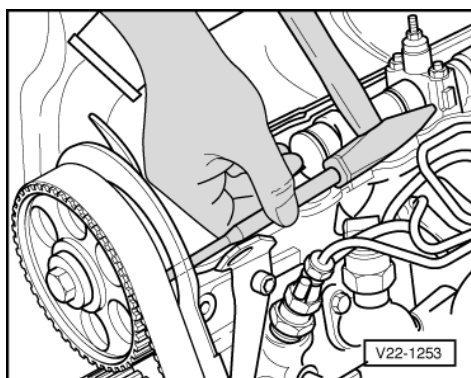
- -> Loosen the nut -arrow- for the toothed belt tensioning roller by approx. 1 turn.



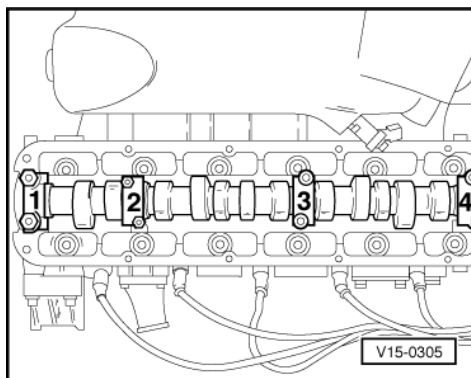
- -> Unscrew retaining bolt of injection pump input gear at camshaft using counterhold 3036.
- Mark direction of rotation of toothed belt with chalk or felt pen.
- Remove toothed belt.



- Release nut of toothed belt tensoring roller for camshaft drive.
- -> Loosen bolt on camshaft sprocket using special tool 3036 to counterhold.



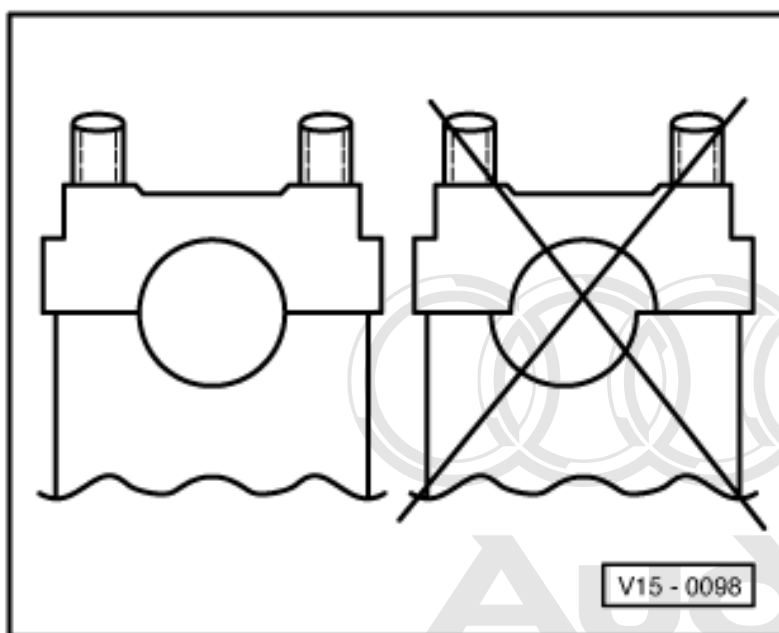
- -> Loosen the securing bolt of the camshaft sprocket 1/2 turn. Release camshaft sprocket from camshaft taper by tapping (pin through hole on rear toothed belt guard) using hammer.
- Remove the camshaft sprocket and toothed belt from the camshaft.



- Remove cylinder head cover => Page 80
- -> Loosen bearing caps 2 and 4 alternately and diagonally.
- Loosen bearing caps 1 and 3 alternately and diagonally.
- Remove camshaft.



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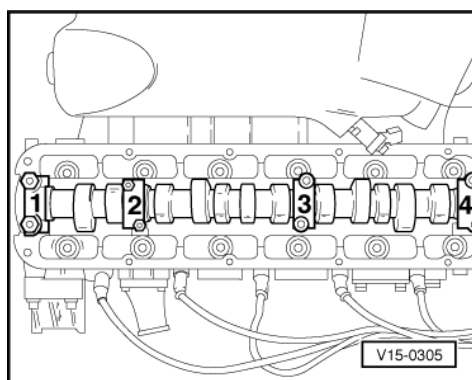
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Installing

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

Notes:

- ◆ Fit new camshaft oil seals.
- ◆ When installing the camshaft, No. 1 cylinder cams must point upwards.
- ◆ -> Before installing bearing caps, note bore offset and determine installation position.
- Oil camshaft running surfaces.



- -> Tighten bearing caps 2 and 4 alternately and diagonally to 20 Nm.
- Install bearing caps 1 and 3 and also tighten to 20 Nm.
- Install toothed belt (adjust valve timing) => Page 40

Notes:

- ◆ Observe all instructions on removing and installing the toothed belt => from Page 38
- ◆ After installing the camshaft, wait for about 30 minutes before starting the engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).

- ♦ After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.

Tightening torque

Component	Nm
Bearing cap to cylinder head	20

2.4 - Checking hydraulic bucket tappets

Special tools and workshop equipment required

- ♦ Feeler gauge
- ♦ Wood or plastic wedge

Notes:

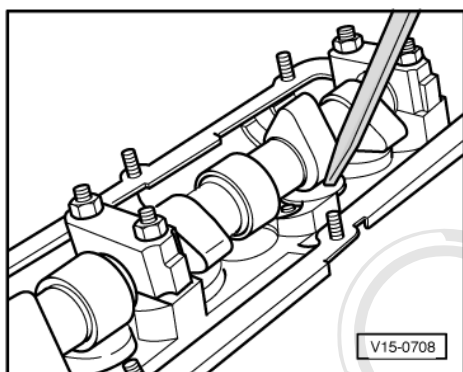
- ♦ Hydraulic tappets cannot be adjusted or repaired.
- ♦ Irregular valve noise during starting is normal.
- Start engine and leave it running until coolant temperature has reached approx. 80 °C.
- Increase engine speed to about 2500 rpm for 2 minutes (perform road test if necessary).

Note:

If the irregular valve noises stop but recur repeatedly during short journeys, a new oil retention valve must be fitted. Oil retention valve fitting location: in cylinder block => Page 118

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

- Remove cylinder head cover => Page 80
- Turn crankshaft until cams of cylinder to be checked are pointing upwards.
- Determine play between cam and tappet.



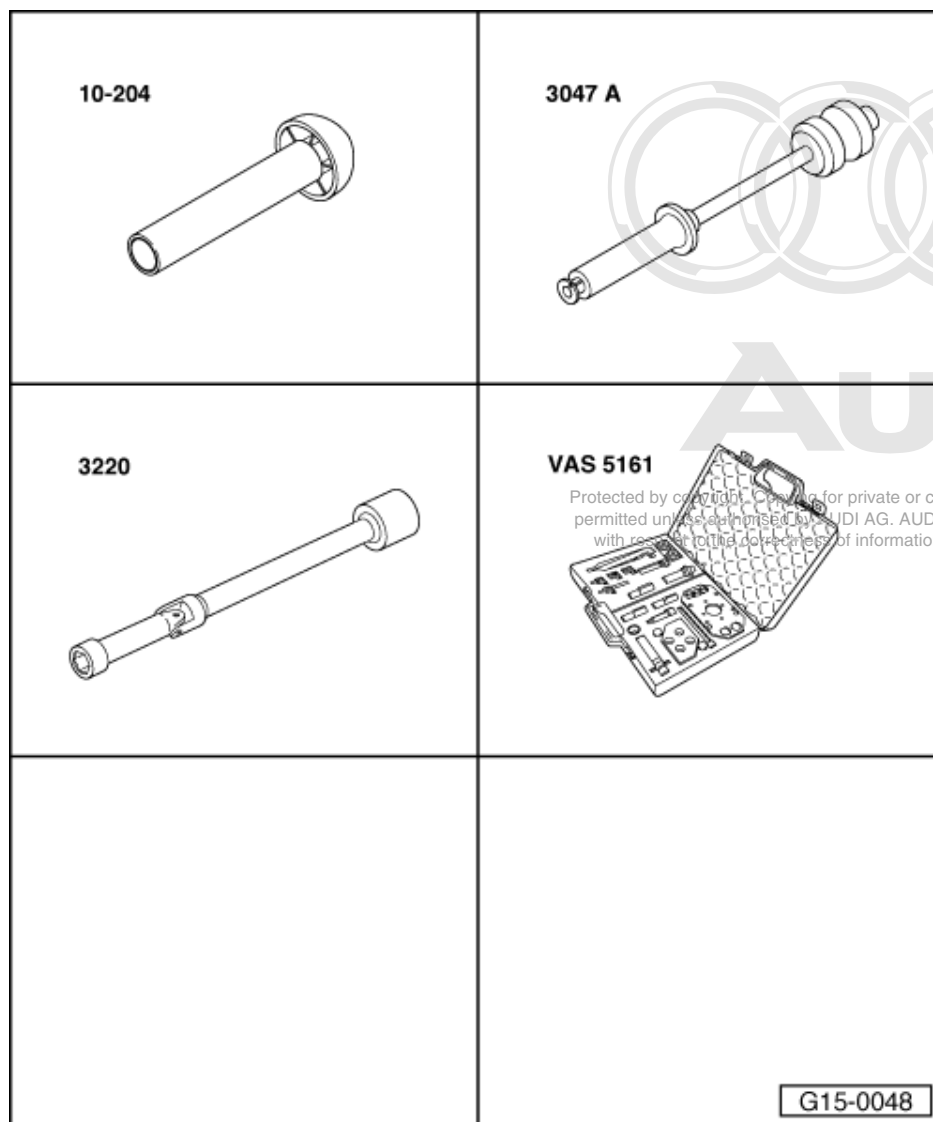
- -> Use a wooden or plastic wedge to push down bucket tappet. If an 0.20 mm feeler gauge can be inserted between camshaft and tappet, renew tappet.
- Replacing bucket tappet => Removing camshaft, Page 102

Notes:

- ♦ After installing the camshaft, wait for about 30 minutes before starting the engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).
- ♦ After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.

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2.5 - Replacing valve stem seals



Special tools and workshop equipment required

- ◆ Press-on tool 10-204
- ◆ Puller 3047 A
- ◆ Flexible-head spanner 3220
- ◆ Disassembly and assembly tool VAS 5161

Removing

- Cylinder head installed

Note:

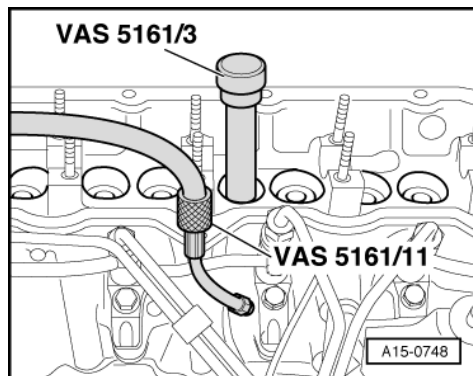
When cylinder head was removed the valve stem seals can be replaced when using special tool 2037.

- Removing camshaft => Page **102**

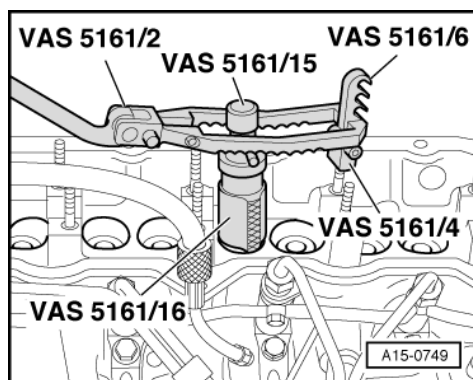
Notes:

- ◆ Make sure that the bucket tappets are not interchanged.

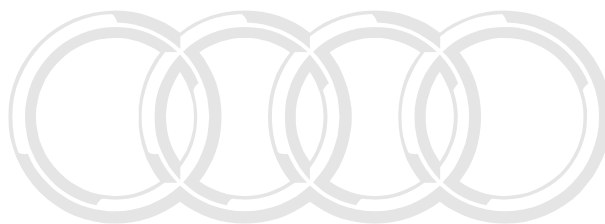
- ♦ Mark allocation of bucket tappets on rear with a waterproof felt-tip pen.
- Remove the bucket tappets from guides and put them down with the contact surface downwards.

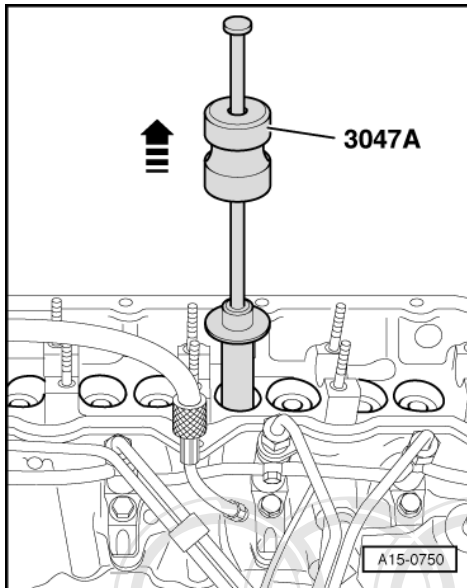


- -> Drive tightly fitting valve wedges of all valves loose using drift VAS 5161/3 and a plastic hammer.
- Unplug connectors from glow plugs.
- Remove all glow plugs using flexible-head spanner 3220.
- Set piston of appropriate cylinder to "bottom dead centre".
- Screw the adapter VAS 5161/11 hand tight into the threaded hole of the respective glow plug.
- Connect adapter VAS 5161/11 via a commercially available intermediate piece to the pressure connection.
 - Minimum pressure: 6 bar

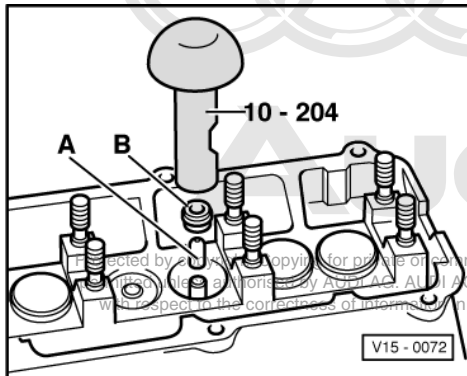


- -> Screw the catch part VAS 5161/6 with insertion fork VAS 5161/4 onto a stud on the cylinder head.
- Push guide bush VAS 5161/16 into bucket tappet guide of the valve to be removed until limit stop.
 - Installation position of guide bush: Hatched areas face driving direction
- Push assembly cartridge VAS 5161/15 into guide bush.
- Attach pressure fork VAS 5161/2 to catch part VAS 5161/6 and push assembly cartridge down.
- At the same time turn knurled screw of assembly cartridge towards the right until the tips of the valve wedges engage.
- Slightly move the knurled screw back and forth. This causes the valve wedges to be pressed apart and taken into the cartridge.
- Release the pressure fork.
- Remove assembly cartridge, guide bush, valve plate and valve springs.





- -> Use 3047 A to remove valve stem seals.

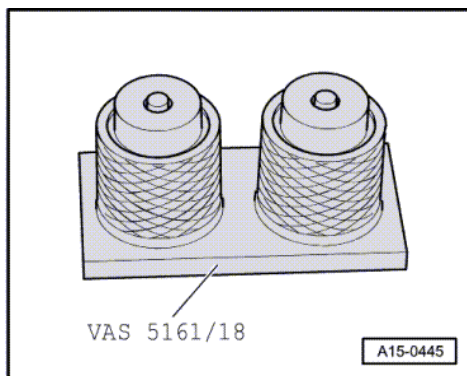


Installing

Note:

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

- -> To prevent damage to the new valve stem seals -B-, place plastic sleeve -A- on valve stem.
- Lightly lubricate sealing lip of valve stem seal.
- Push valve stem seal onto plastic sleeve.
- Carefully press the valve stem seal onto the valve guide using press-on tool 10-204.
- Remove plastic sleeve again.

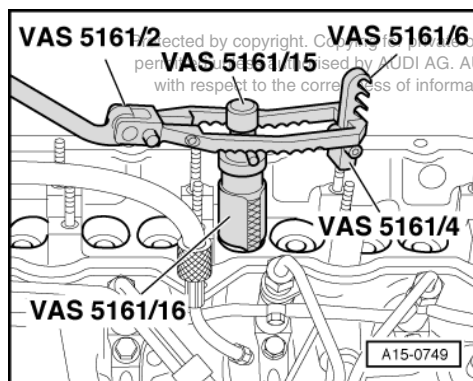


- -> If the valve wedges were taken out of the assembly cartridge they must first be inserted into the installing tool VAS 5161/18.

Notes:

The large diameter of the valve wedges points upwards.

- Push assembly cartridge VAS 5161/15 from the top onto installing tool and take up the valve wedges.



- -> Reinstall the assembly cartridge VAS 5161/15 into guide bush VAS 5161/16.
- Push pressure fork down and pull knurled screw upwards by turning to left and right - thus the valve wedges are installed.
- Take load of the pressure fork when knurled screw is still tight.
- Insert bucket tappet.
- Installing camshaft =>Page 105

Notes:

- ♦ After installing the camshaft, wait for about 30 minutes before starting the engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).
- ♦ After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.

Tightening torque

Component	Nm
Glow plugs to cylinder head	15

2.6 - Reworking valve seats

Notes:

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

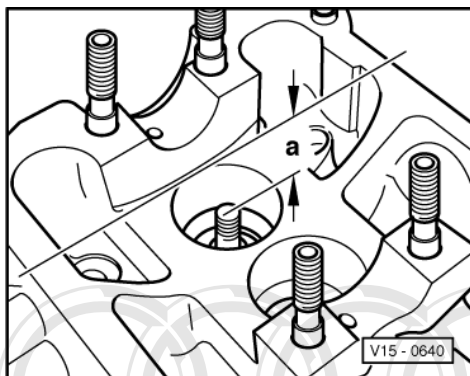
Special tools and workshop equipment required

- ♦ Depth gauge
- ♦ Valve seat machining 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 112
- ♦ Only rework the valve seats as far as is necessary to ensure a good seating pattern.
- ♦ Before starting to rework the valve seats, calculate the maximum permissible reworking dimension.

- ♦ 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.



Calculating maximum permissible reworking dimension

- Insert valve and press firmly against valve seat.

Note:

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

- -> Measure distance -a- between valve stem end and top edge of cylinder head.
- Calculate max. permissible reworking dimension from measured distance -a- and minimum dimension.

Minimum dimensions	
Inlet valve	Exhaust valve
35.8 mm	36.1 mm

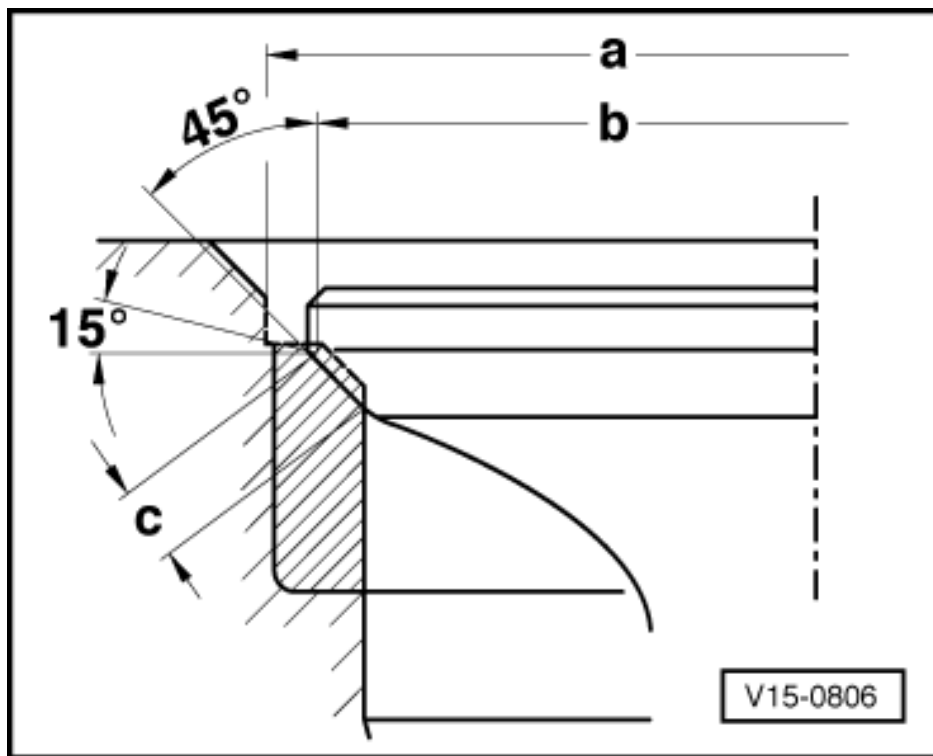
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Measured distance minus minimum dimension

= Max. permissible reworking dimension.

Example:

- Measured distance	36.5 mm
Minimum dimension	35.8 mm
= Max. permissible reworking dim.	0.7 mm



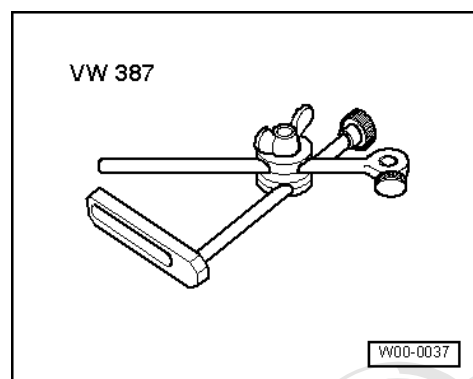
-> Rework valve seats

Inlet valve seat	
a	= $\varnothing 37.2$ mm max. 1)
b	= $\varnothing 34.8$ mm
c	= approx. 2.7 mm
45°	= Valve seat angle
15°	= Upper correction angle

Exhaust valve seat	
a	= $\varnothing 33.2$ mm max. 1)
b	= $\varnothing 30.4$ mm
c	= approx. 2.05 mm
45°	= Valve seat angle
15°	= Upper correction angle

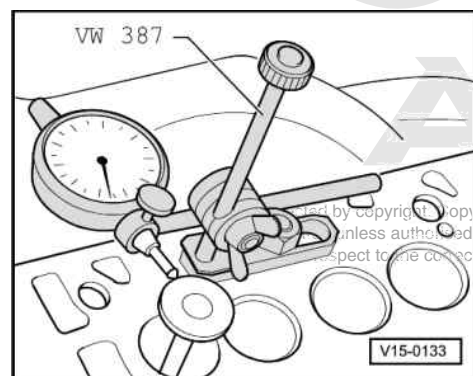
1) Max. permissible outside diameter of correction cutter

2.7 - Checking valve guides



Special tools and workshop equipment required

- ♦ Special tool VW 387
- ♦ Dial gauge



Test sequence

- -> Set valve in guide. Valve stem end must be flush with guide. Due to the slight difference in stem diameters. Ensure that only an inlet valve is used in the inlet guide and an exhaust valve in the exhaust guide.

- Determine rock.

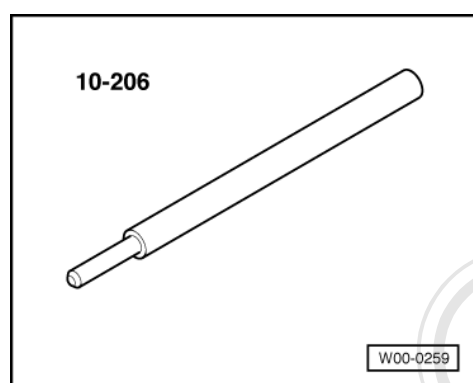
Wear limit

Inlet valve guide	Exhaust valve guide
1.30 mm	1.30 mm

Notes:

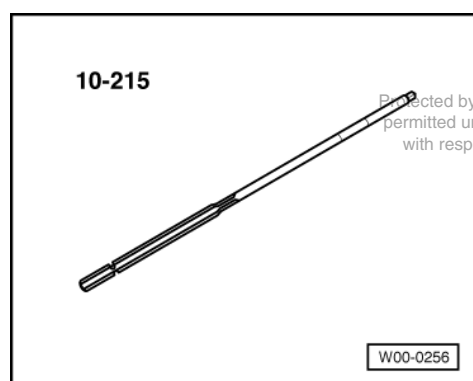
- ♦ If the wear limit is exceeded, repeat the measurement with new valves. If the wear limit is again exceeded, renew the cylinder head.
- ♦ If the valve must be renewed as part of a repair, use a new valve for the calculation.

2.8 - Replacing valve guides



Special tools and workshop equipment required

- ♦ Driver 10-206



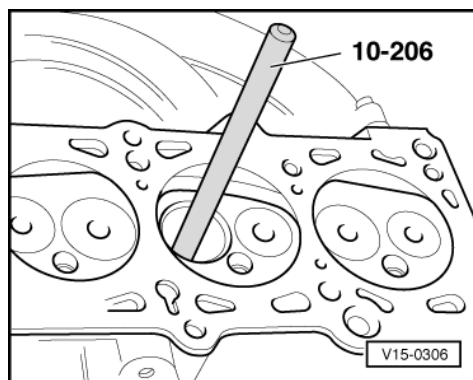
- ♦ Hand reamer 10-215 and cutting fluid

Removing

- Clean and check cylinder head. Cylinder heads in which the valve seats can no longer be reworked, or cylinder heads which have already been machined to the minimum dimension, should not have the valve guides replaced.
- Press out worn valve guides with 10-206 as follows:
 - Valve guides without collar:
 - from the camshaft end
 - Valve guides with collar (repair version):



from the combustion chamber end

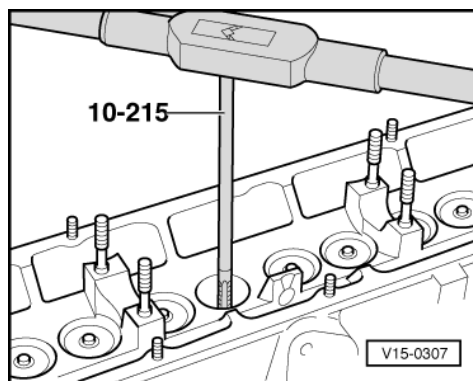


Installing

- -> Lubricate new valve guides with oil and press in with 10-206 from the camshaft end (cylinder head cold) until collar makes contact.

Note:

When the collar on the valve guide makes contact, the pressure must not exceed 10 kN (approx. 1.0 t) otherwise the collar can break off.



- -> Ream valve guide with hand reamer 10-215. Use plenty of cutting fluid.
- Reworking valve seats => Page 110
- Renewing valve stem seals => Page 107

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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 to prevent further damage occurring later.
- ◆ Refer to current information when using sealant.

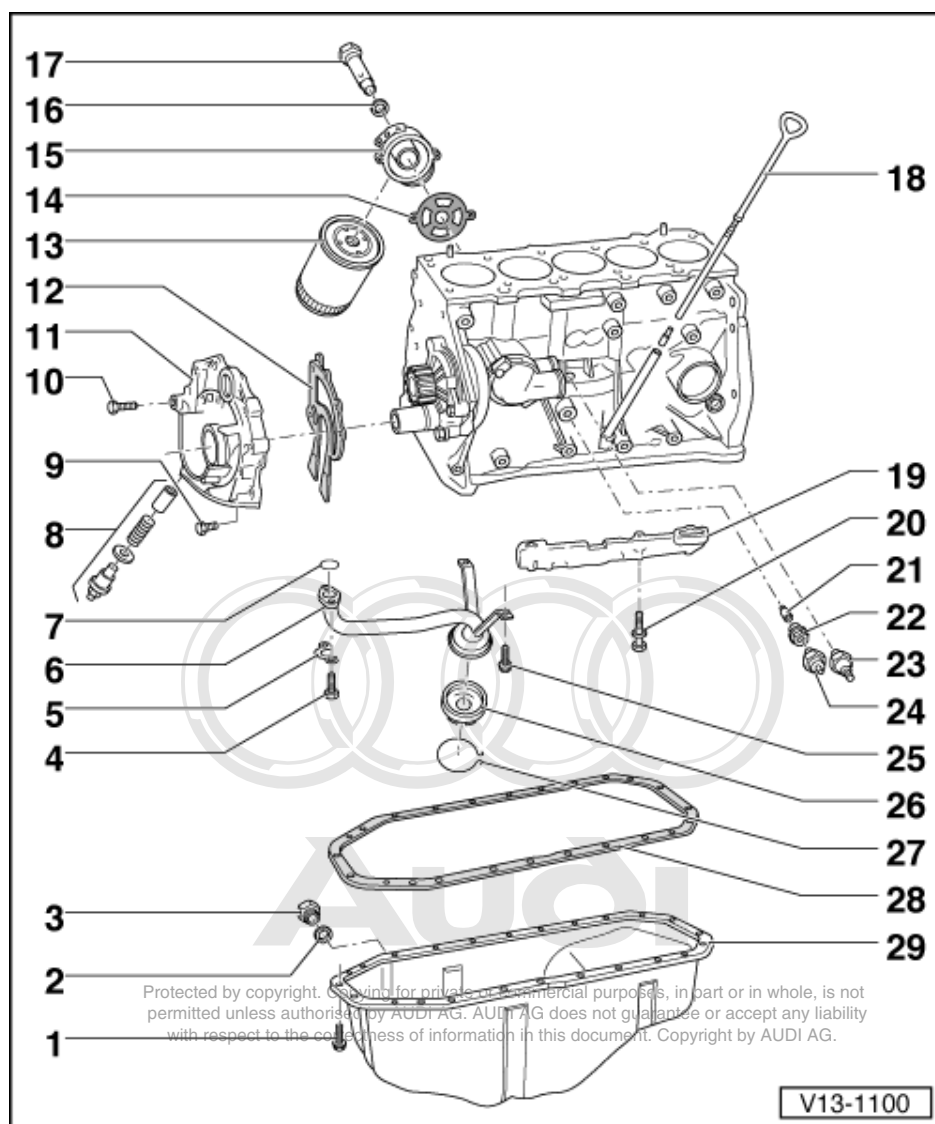
=> Parts List

Viscosity grades and oil specifications:

=> Maintenance Manual

Oil system capacity:

=> Exhaust Emission Test binder



1 Bolt (special type)

- ♦ Use only correct bolts (same as original equipment); strength rating 10.9.

=> Parts List

- ♦ Tighten in stages and in diagonal sequence
- ♦ Tighten to 20 Nm

2 Sealing ring

- ♦ Replace

3 Oil drain plug, 30 Nm

4 10 Nm

5 Locking plate

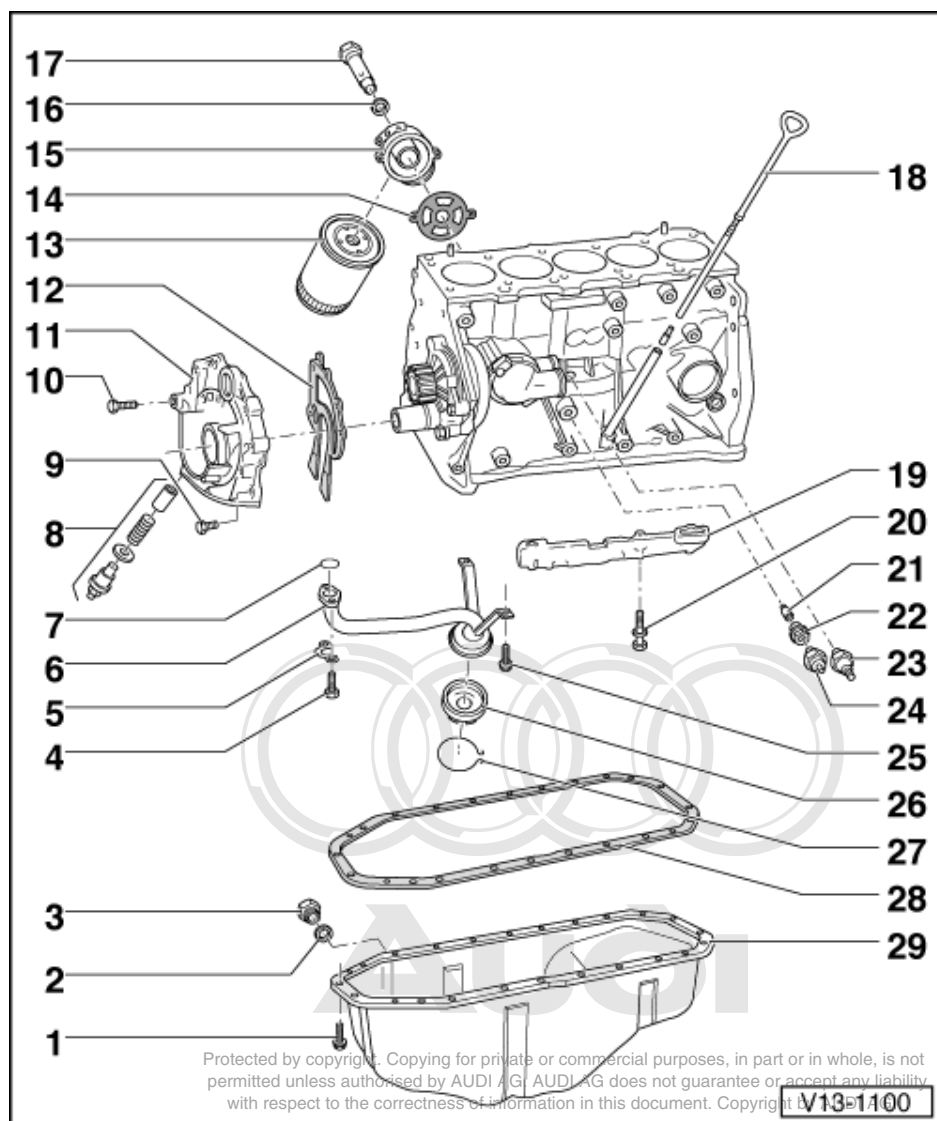
- ♦ Replace

6 Suction pipe

- ♦ Clean strainer if soiled

7 O-ring/oil seal

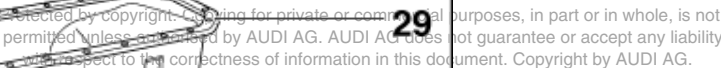
- ♦ Up to engine No. ABP 001 379: Seal
- ♦ Replace



8 Pressure relief valve

- ♦ Opening pressure: 5.3...6.3 bar
- ♦ Tighten screw plug to 40 Nm

- ◆ Replace



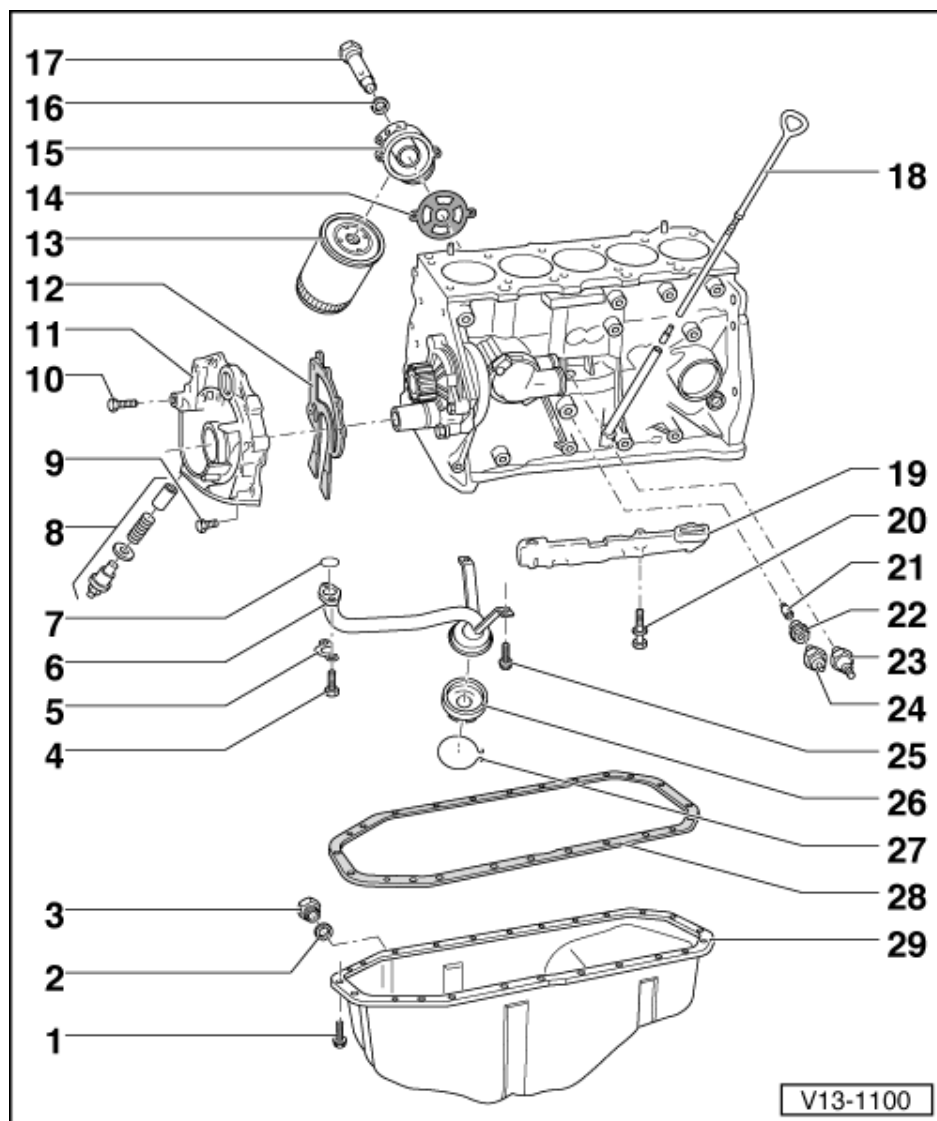
16 Sealing ring



- ♦ Replace
- 17 Banjo bolt, 50 Nm**
 - ♦ Fit new O-ring on banjo bolt
- 18 Oil dipstick**
- 19 Duct**
 - ♦ For crankcase breather
- 20 10 Nm**
- 21 Oil retention valve**
 - ♦ Removing and installing: with multi-point 8 mm socket insert
 - ♦ Install using locking compound
 - ♦ Locking compound

=> Parts List

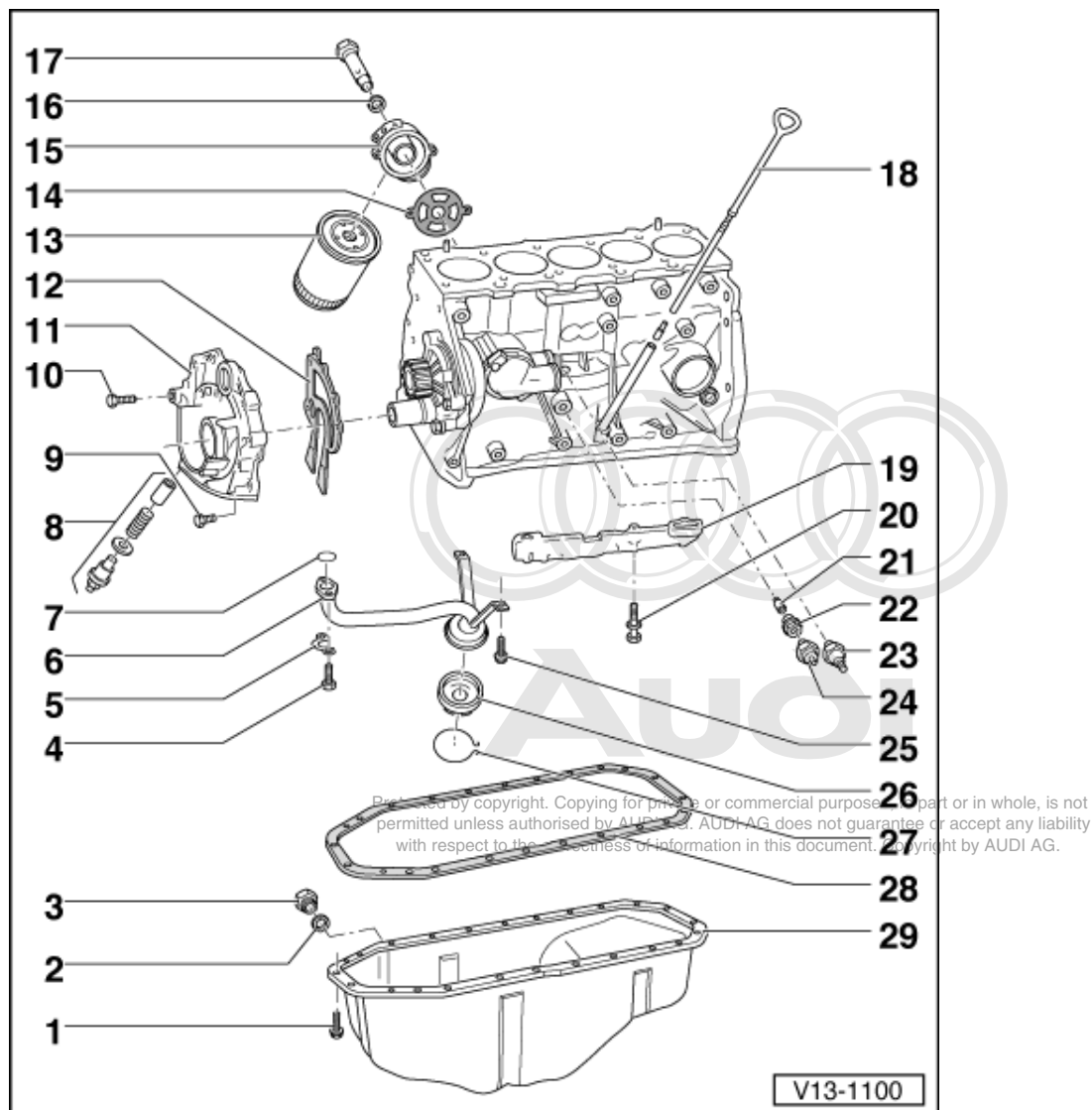
- ♦ Tighten to 6 Nm



- 22 Adapter**
 - ♦ Tighten to 50 Nm
- 23 Oil pressure switch -F1, 25 Nm**
 - ♦ 0.9 bar - grey or 1.8 bar - white (depending on production date)
 - ♦ Checking => Page 127

24 Oil pressure switch -F22, 25 Nm

- ♦ 0.25 bar - blue or 0.3 bar - brown
- ♦ As a replacement for the 0.3 bar oil pressure switch (brown) a 0.25 bar oil pressure switch (blue) is supplied.
- ♦ Checking => Page 126

25 10 Nm**26 Inlet connection****27 Retaining ring****28 Seal**

- ♦ Replace
- ♦ Install dry
- ♦ Apply thin coat of sealant to sealing points of sealing flange/cylinder block
- ♦ Sealants

=> Parts List

29 Oil pan

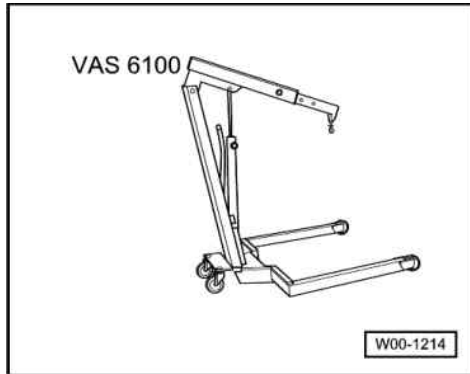
- ♦ Removing and installing=>Page 120
- ♦ Clean sealing surfaces before installing
- ♦ Before fitting sump, apply a small amount of sealant to sealing points between sealing flange and cylinder block



- ♦ Sealants

=> Parts List

1.2 - Removing and installing oil pan

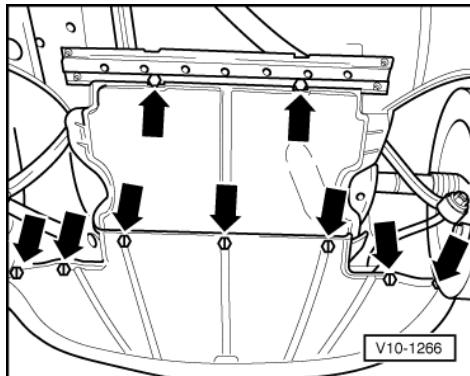


Special tools and workshop equipment required

- ♦ Workshop crane VAS 6100

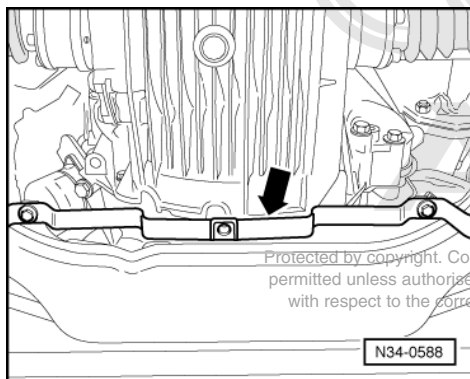
or

- ♦ Workshop crane V.A.G 1202 A



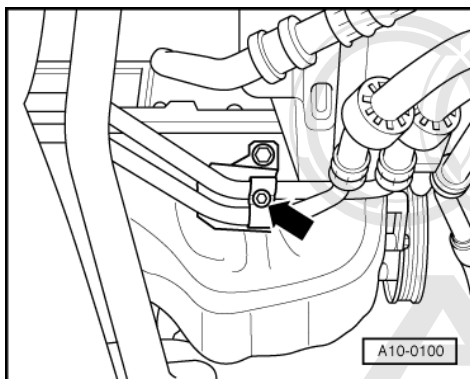
Removing

- -> Remove the noise insulation -arrows-.
- Drain engine oil.



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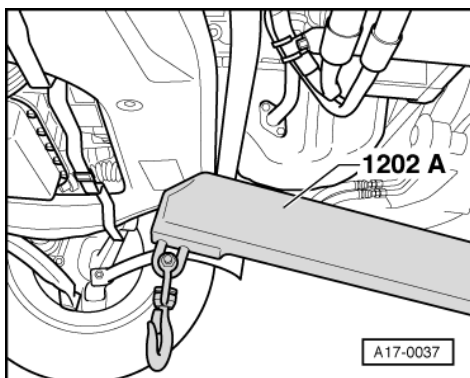
- -> Unbolt bracket for noise insulation -arrow-.



Vehicles with automatic gearbox:

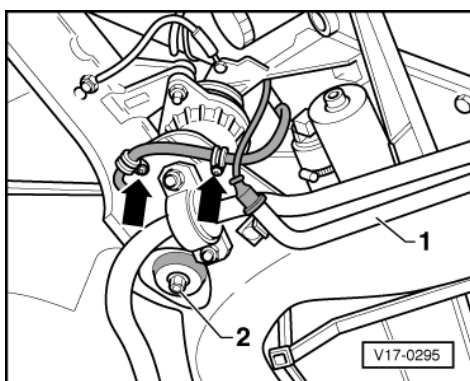
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- -> Unbolt bracket for ATF lines from engine -arrow-.



All models:

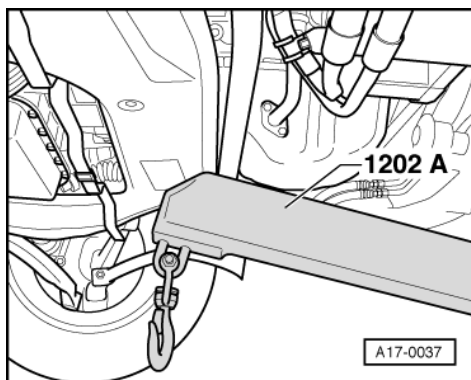
- -> Support subframe with workshop crane VAS 6100 or V.A.G 1202 A.



- -> Unbolt retaining clamps -arrows- for starter cable at subframe.
- Unbolt wire routing -1- for alternator at subframe.
- Unscrew left and right bolts -2- on front of subframe.

Note:

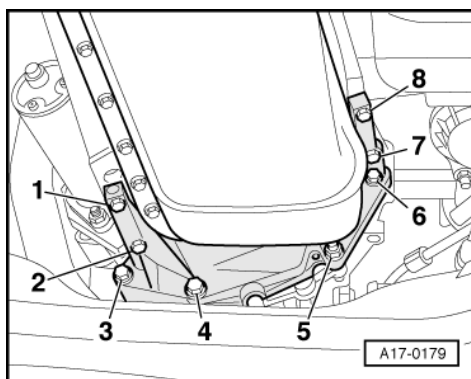
The subframe should be detached and lowered at the front only, otherwise it will be necessary to check wheel alignment.



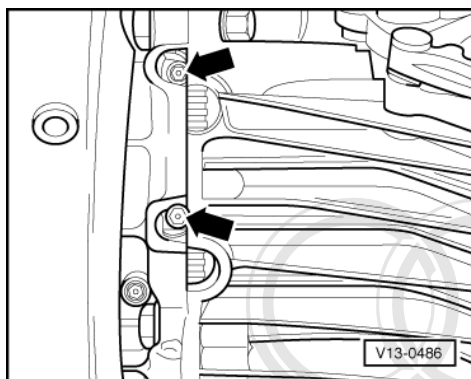
- -> Slowly lower subframe with workshop crane VAS 6100 or V.A.G 1202 A.

Important

The subframe is lowered by releasing the bolts approx. 100



- -> Unscrew bolts -1...8- for engine/gearbox support.
- Remove engine/gearbox support.



- -> Turn crankshaft until the two securing bolts -arrows- of the oil pan are visible at the recesses.
- Unscrew and remove sump, if necessary loosen it by striking lightly with a rubber hammer.

Installing

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

Notes:

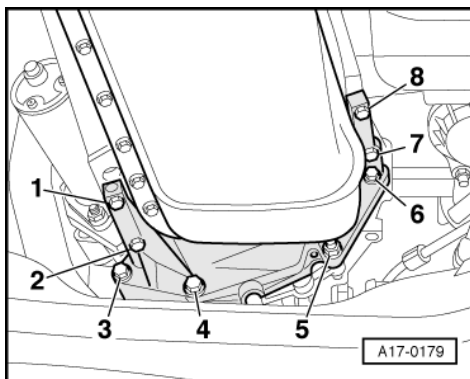
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- ♦ Replace seals and gaskets.

- ♦ When installing engine/gearbox support with engine removed, ensure that the engine/gearbox support is flush with the cylinder block on the flywheel side.
- Clean sealing surfaces before installing oil pan.
- Apply a thin coating of sealant to front and rear sealing flange/cylinder block sealing points at sealing surface to oil pan.
 - Sealants

=> Parts List

- Tighten bolts securing sump to cylinder block in two stages in diagonal sequence (final torque: 20 Nm).



- Fit engine/gearbox support as follows:
- -> Fit engine/gearbox support and tighten all bolts initially to 5 Nm in diagonal sequence.
- Tighten bolts on engine/gearbox support to gearbox.
 - Tightening torque for bolts M8: 25 Nm
 - M10 bolt tightening torque: 45 Nm
- Tighten bolts of engine/gearbox support at cylinder block in diagonal sequence to 25 Nm.
- Fitting subframe with new bolts:

=> Running Gear, FWD and 4WD; Repair group 40

- Fill up with engine oil and check oil level.

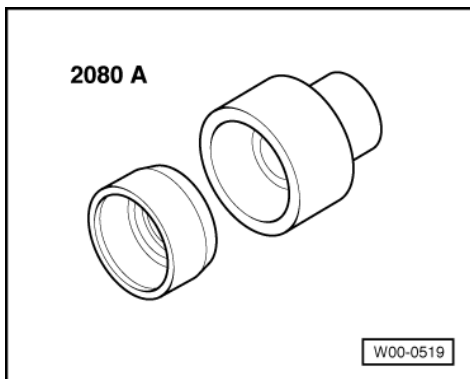
Tightening torques

Component	Nm
Sump to cylinder block 1)	20
Oil drain plug	30
Brackets for ATF lines	10
Noise insulation bracket	10

1) Special bolts, use genuine replacement bolts only

=> Parts List

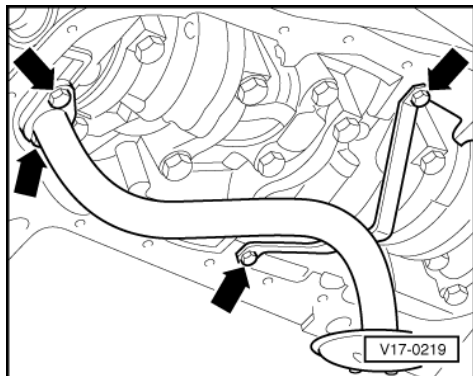
1.3 - Removing and installing oil pump





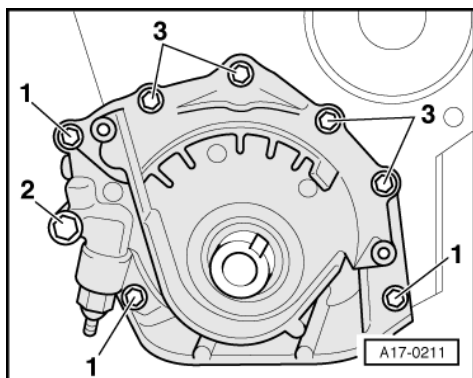
Special tools and workshop equipment required

- ♦ Inserting ring for sealing ring 2080 A



Removing

- Remove toothed belt => Page 38
- Remove oil pan => Page 120
- -> Remove oil intake pipe -arrows-.



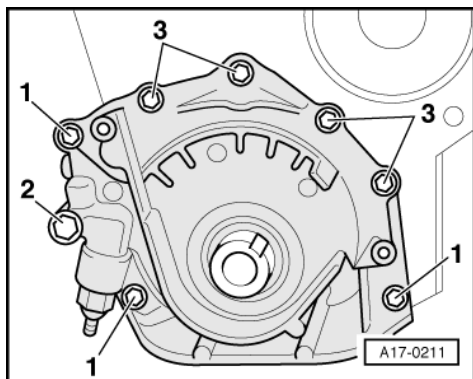
- -> Remove bolts -1-, -2- and -3-.
- Detach oil pump at front.
- Drive out sealing ring with oil pump removed.

Installing

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

Notes:

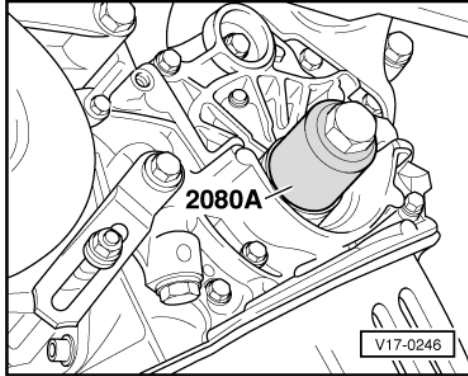
- ♦ Replace seals and gaskets.
- ♦ If the oil pump is installed with the sealing ring already fitted, place guide sleeve from 2080 A on end of crankshaft before installing oil pump.
- Clean sealing surfaces before installing oil pump.
- Set up oil pump, so that it engages in the actuating arms on the crankshaft.



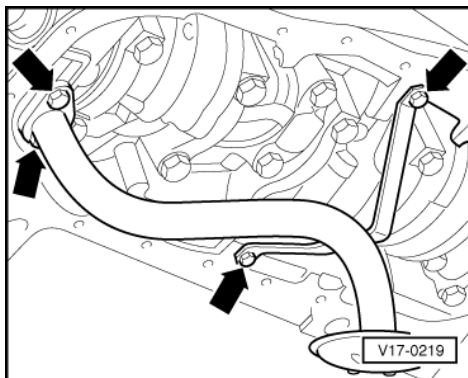
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- -> Tighten bolts -1- to 10 Nm and bolt -2- to 20 Nm.
- Insert bolts -3- with locking compound and tighten to 10 Nm.
 - Locking compound

=> Parts List



- Place guide sleeve from 2080 A onto crankshaft journal.
- Carefully push sealing ring over guide sleeve.
- -> Press sealing ring in as far as limit stop using insertion sleeve and cleaned vibration damper bolt.



- -> Install oil intake pipe -arrows-.

Notes:

- ◆ Depending on the production date, the front bolts of the oil intake pipe must be secured with a new locking plate.
- ◆ Contact surface between sprocket and crankshaft must be free of oil.

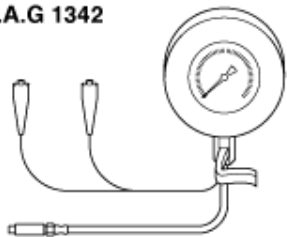
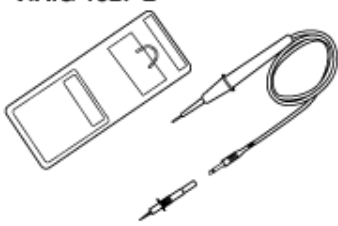
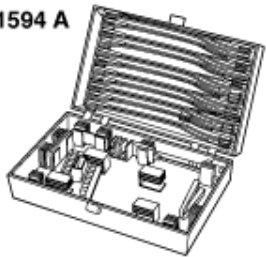
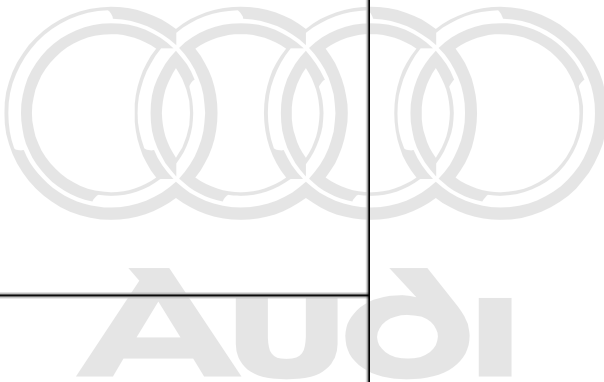
- Installing oil pan => Page 122
- Install toothed belt (adjust valve timing) => Page 40

Tightening torques

Component		Nm
Oil intake pipe to oil pump or cylinder block		10
Oil pump to cylinder block	M6	10
	M8	20

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1.4 - Checking oil pressure and oil pressure switch

V.A.G 1342 	V.A.G 1527 B 
V.A.G 1594 A 	
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Special tools and workshop equipment required

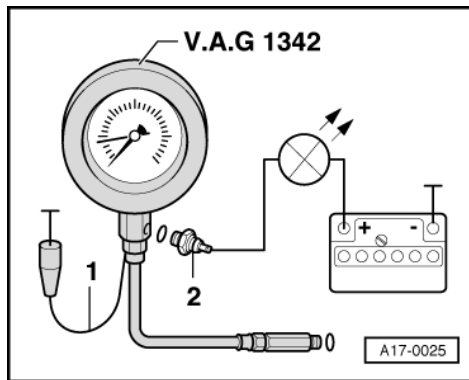
- ♦ V.A.G 1342
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A

Test requirements:

- Oil level OK.
- Oil pressure warning lamp K3 must come on when ignition is switched on.
- In vehicles with auto check system the "OK" display must appear (call up symbol).
- Engine oil temperature approx. 80 °C.

Checking warning lamp

The oil pressure warning lamp lights up when the ignition is switched on ("Terminal 15 on") with the engine not running (this does not apply to vehicles with auto check system).



Checking oil pressure switch 0.3 bar (brown) or 0.25 bar (blue)

- Disconnect wire from oil pressure switch.
- -> 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.
 - The LED should illuminate.
- If the LED does not illuminate, fit a new oil pressure switch.
- Start the engine.

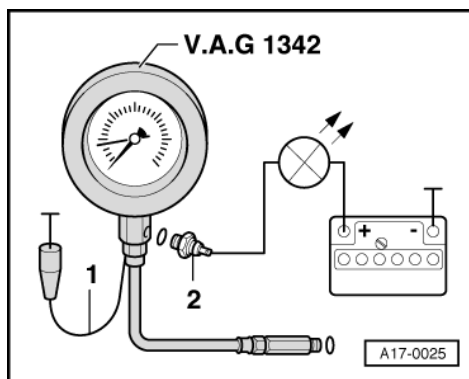
Note:

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 LED while starting the engine.

- At 0.15...0.45 bar the LED should extinguish
- If the LED does not extinguish, fit a new oil pressure switch.

Note:

As a replacement for the 0.3 bar oil pressure switch (brown) a 0.25 bar oil pressure switch (blue) is supplied.



Checking oil pressure switch 0.9 bar (grey) or 1.8 bar (white)

- Disconnect wire from oil pressure switch.
- -> 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.
 - LED should not illuminate.
- If the LED lights up, fit a new oil pressure switch.

- Start the engine.

Grey oil pressure switch:

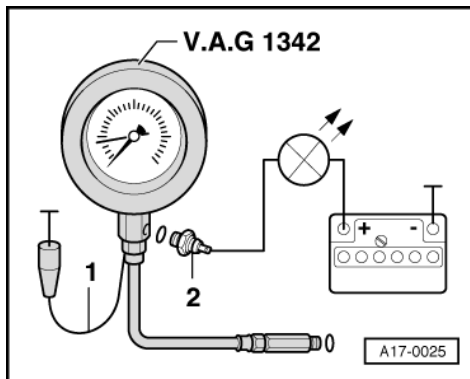
- At 0.75...1.05 bar.

White oil pressure switch:

- At 1.6...2.0 bar.

All models:

- If the LED does not illuminate, fit a new oil pressure switch.



Audi

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Checking oil pressure

- Disconnect wire from oil pressure switch.
- -> 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 approx. 80 °C).
 - Oil pressure at 2000 rpm: at least 2.0 bar
 - Oil pressure at higher engine speeds: max. 6.3 bar

If the specifications are not obtained:

- Pressure relief valve or oil pump defective, replace oil pump => Page **123**

1.5 - Engine oil

Viscosity grades and oil specifications

Viscosity grades and oil specifications:

=> Maintenance Manual

1.6 - Checking oil level

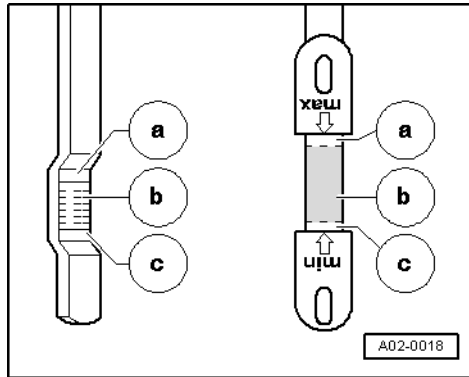
Test requirements:

- Engine oil temperature at least 60 °C
- Vehicle must be level (horizontal)

- Wait a few minutes after switching off the engine to allow the oil to flow back into the sump.

Test sequence

- Pull out the dipstick, wipe with a clean cloth and insert again to stop.
- Pull out the dipstick again and read off the oil level.



-> Markings on oil dipstick:

- a - Oil must not be topped up.
- b - Oil may be topped up. The oil level may rise as far as area -a- after topping up.
- c - Oil must be topped up. The oil level is sufficient if somewhere in area -b- (grooved area) after topping up.

Note:

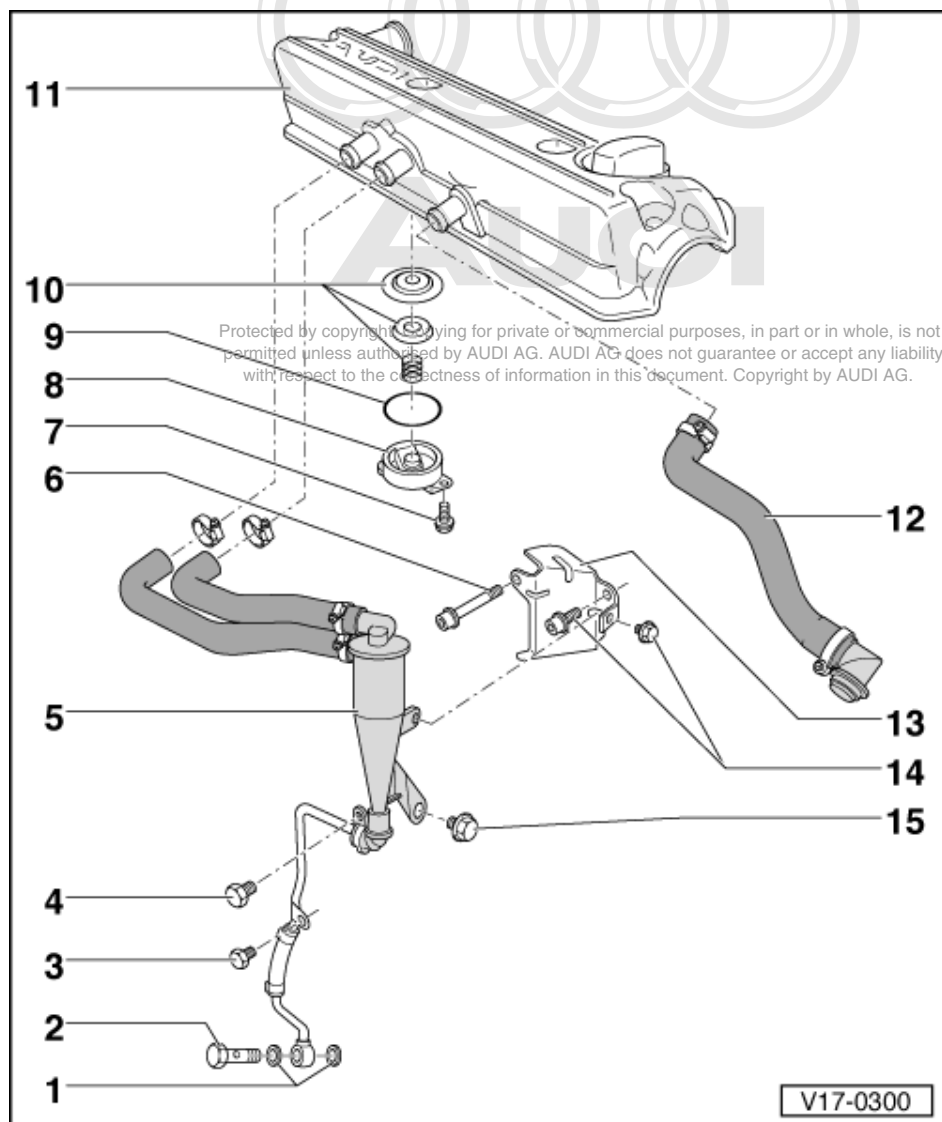
The oil level must not be above marking -a- on the dipstick.

Oil system capacity:

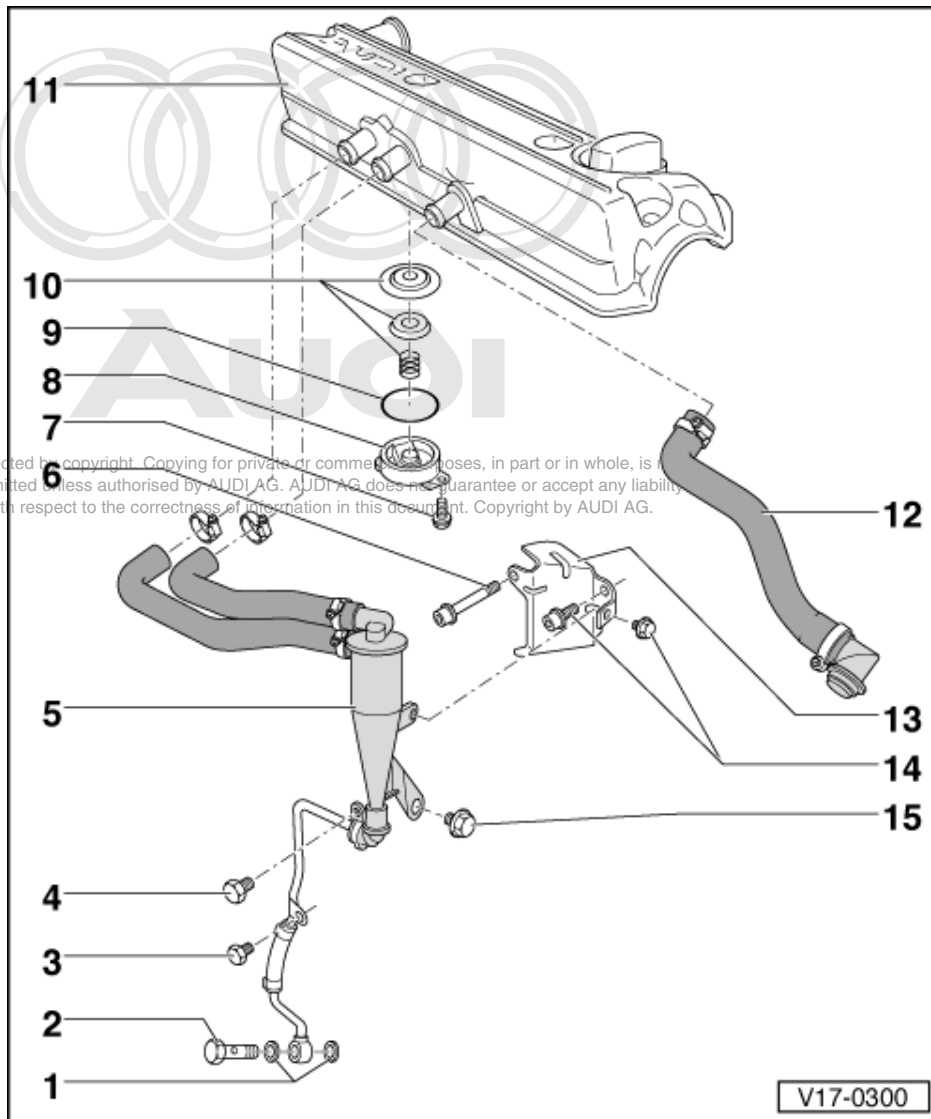
=> Exhaust Emission Test binder

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1.7 - Removing and installing parts of the crankcase vent - engine codes AAT, AEL

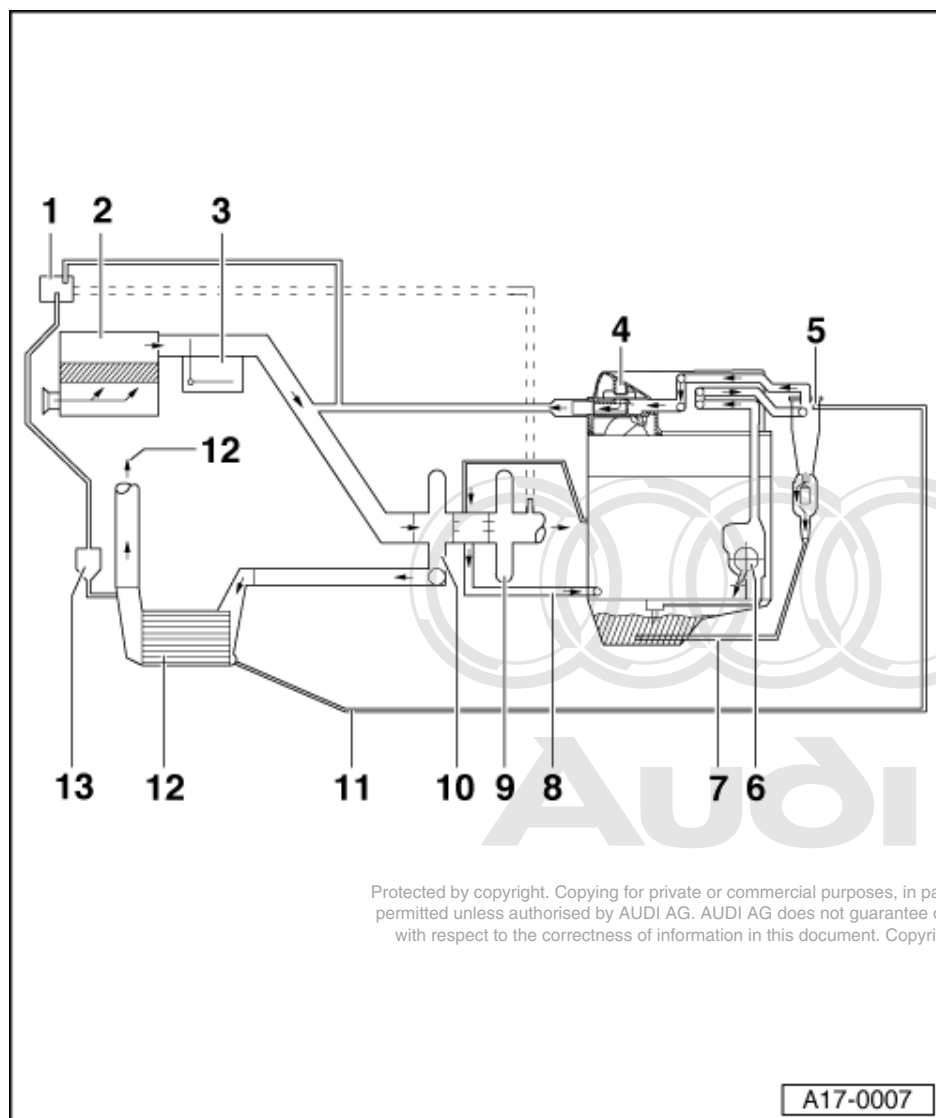


- 1 **Sealing rings**
 - ♦ Replace
- 2 **Banjo bolt - 30 Nm**
 - ♦ When tightening, securely hold oil return pipe
- 3 **20 Nm**
- 4 **45 Nm**
- 5 **Oil separator**
- 6 **20 Nm**
- 7 **10 Nm**
 - ♦ Replace
- 8 **Cover**
 - ♦ For pressure regulating valve of crankcase vent

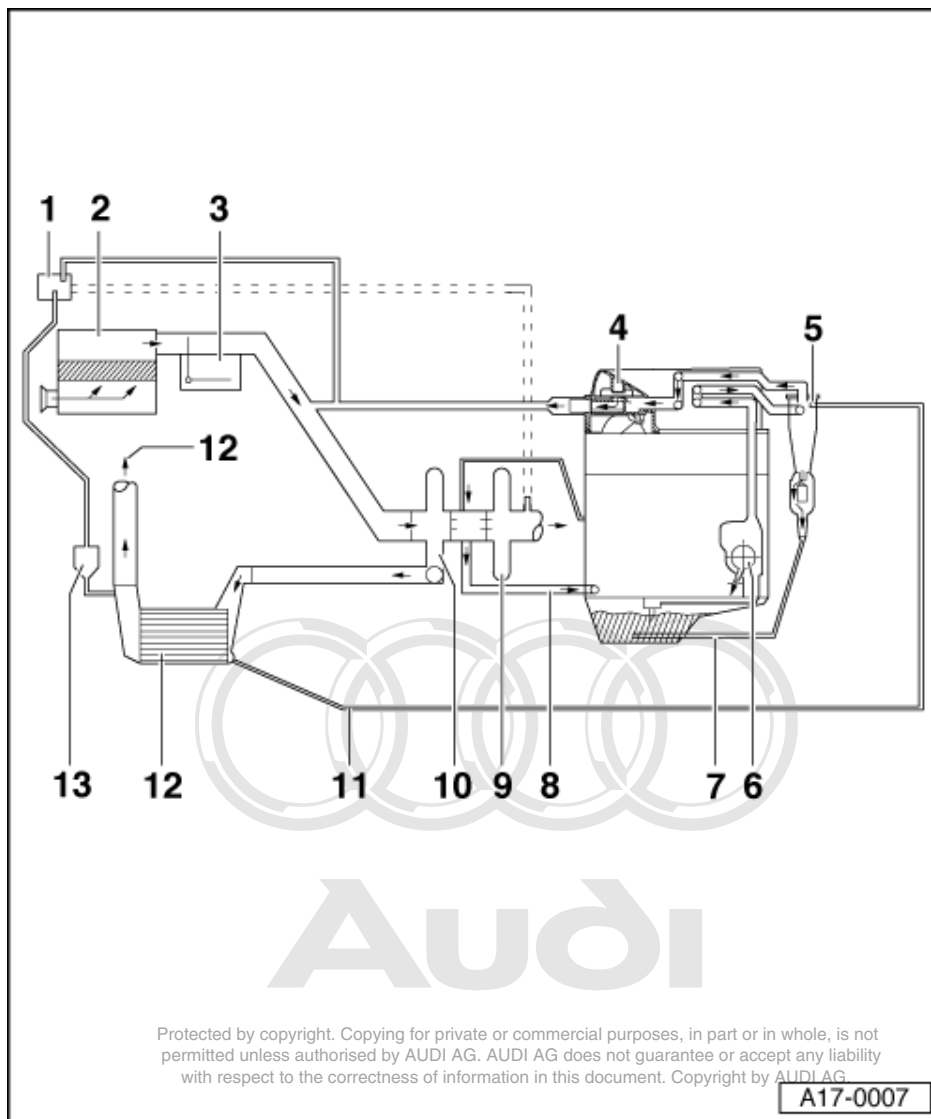


- 9 O-ring
♦ Replace
- 10 Pressure regulating valve
♦ For crankcase breather
- 11 Cylinder head cover
♦ Removing and installing =>Page 80
- 12 Hose for crankcase vent
♦ To air duct hose for air cleaner/turbocharger
- 13 Bracket
♦ For oil separator
- 14 10 Nm
- 15 45 Nm

1.8 - Diagram of connections for crankcase vent - engine codes AAT, AEL



- 1 Boost pressure control solenoid valve -N75
- 2 Air cleaner
- 3 Air flow meter -G19
- 4 Pressure regulating valve
 - ♦ In the cylinder head cover
- 5 Oil separator
 - ♦ With float valve
- 6 Crankcase breather



- 7 Oil return pipe**
 - ♦ From oil separator to oil pan
- 8 Oil supply pipe**
 - ♦ To turbocharger
- 9 Turbocharger**
 - ♦ Exhaust side
- 10 Turbocharger**
 - ♦ Charger side
- 11 Oil suction line**
- 12 Intercooler**
- 13 Damper/separator**



19 - Cooling system

1 - Removing and installing parts of the cooling system

1.1 - Removing and installing parts of the cooling system

Important

Hot steam or hot coolant can escape when opening expansion tank. Cover cap with a cloth and open 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 clamps (same as original equipment):

=> Parts List

- ♦ V.A.G 1921 pliers are recommended when installing spring clamps.
- ♦ Renew all gaskets and seals.
- ♦ The arrow markings on the coolant pipes and on the ends of the hoses must align.



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1.2 - Parts of cooling system

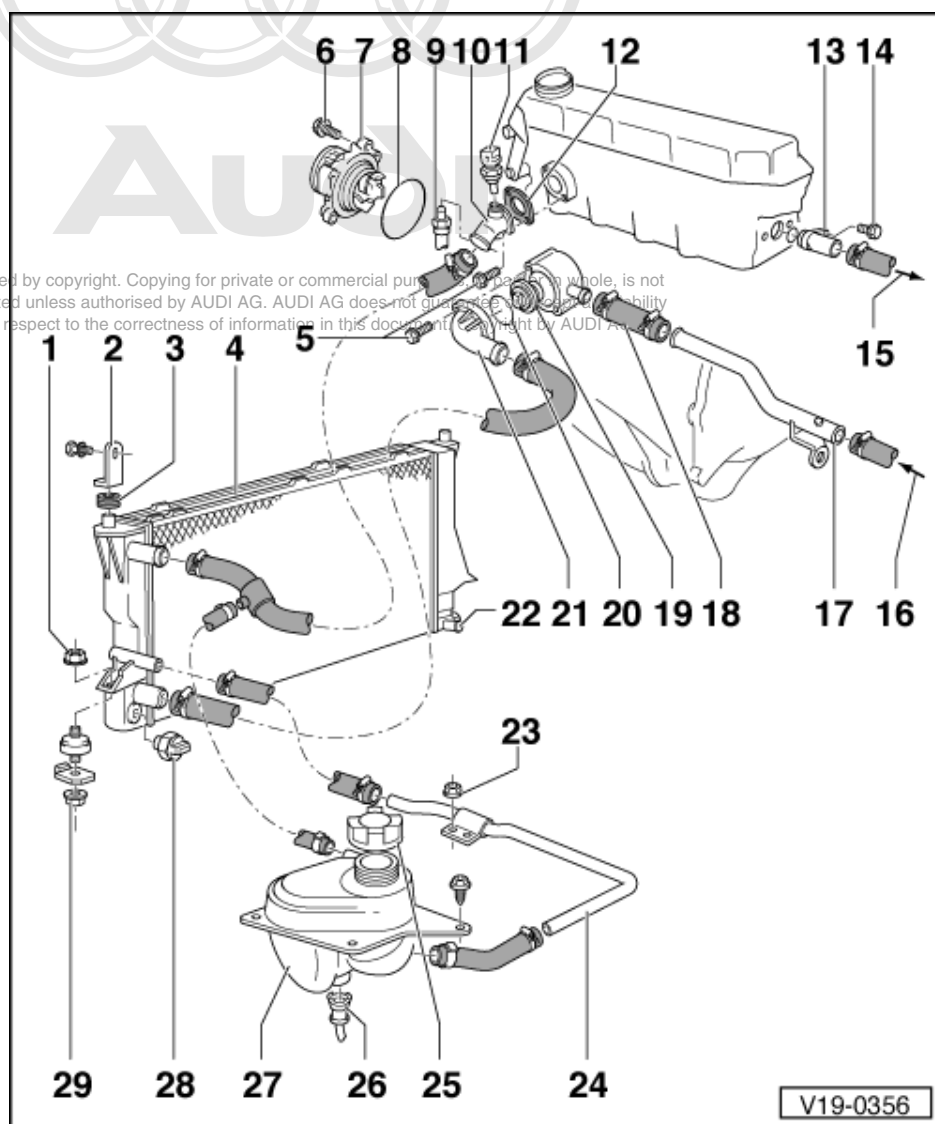
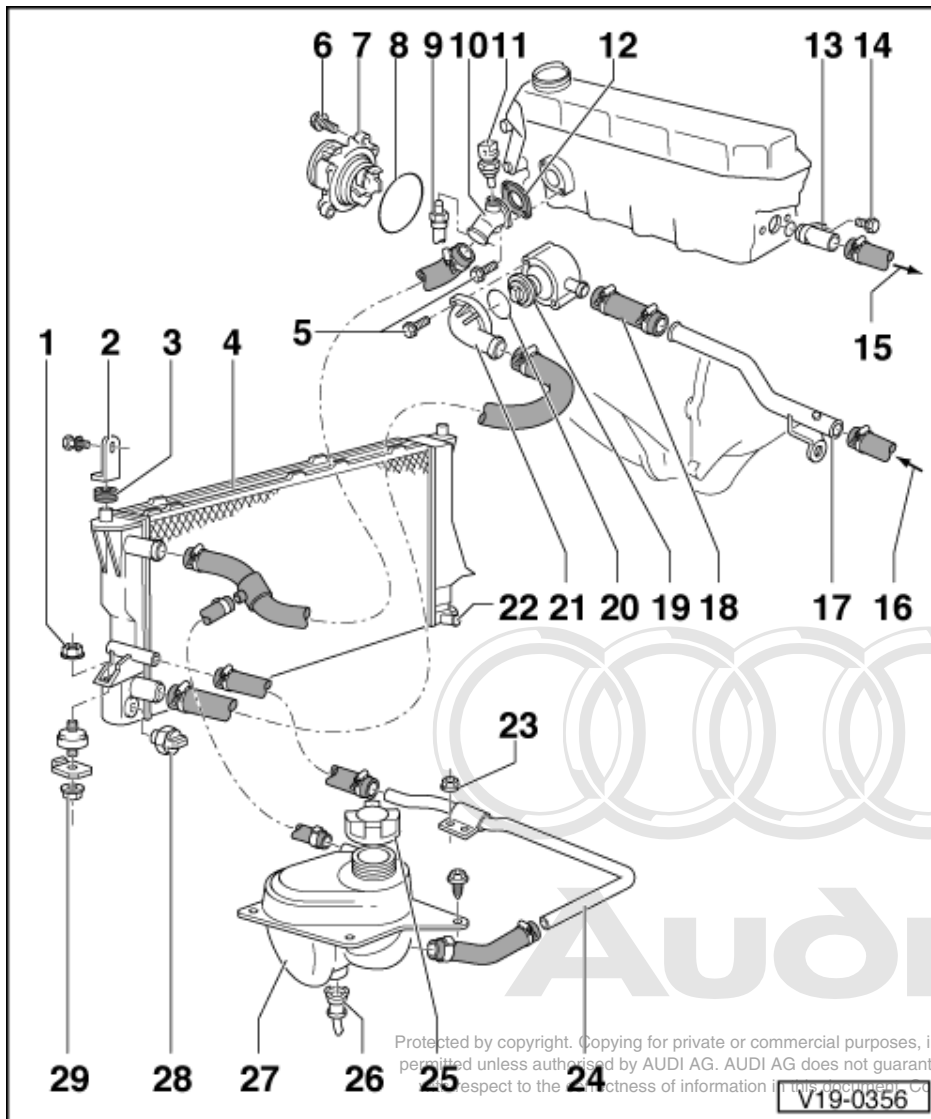


Diagram of coolant hose connections

- 1 10 Nm
- 2 Angle bracket
- 3 Rubber grommet
- 4 Radiator
 - ♦ Removing and installing =>Page 146
 - ♦ After replacing, fill with fresh coolant
 - ♦ Installation position of lower coolant hose =>Fig. 139
- 5 10 Nm
- 6 20 Nm
- 7 Coolant pump
 - ♦ Removing and installing => Page 143
 - ♦ Check for ease of movement

**8 O-ring**

- ◆ Replace
- ◆ Lubricate with coolant

9 Electronic thermostatic switch -F76

- ◆ Install with sealing ring
- ◆ Checking:

=> Electrical System; Repair group 90; Checking components of dash panel insert Checking components of dash panel insert

10 Pipe union**11 Coolant temperature sender -G62**

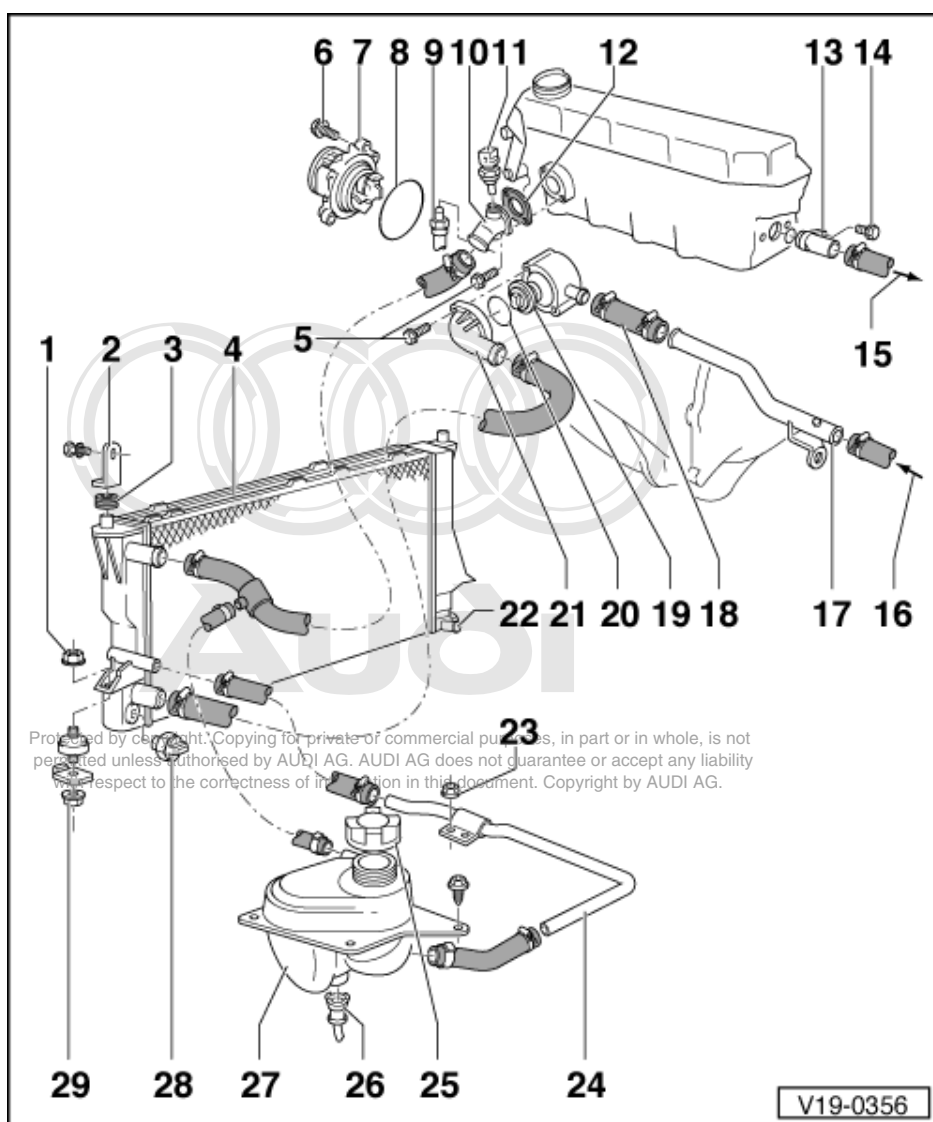
- ◆ For glow plug system
- ◆ Install with sealing ring
- ◆ Checking:

=> Electrical System; Repair group 90; Checking components of dash panel insert Checking components of dash panel insert

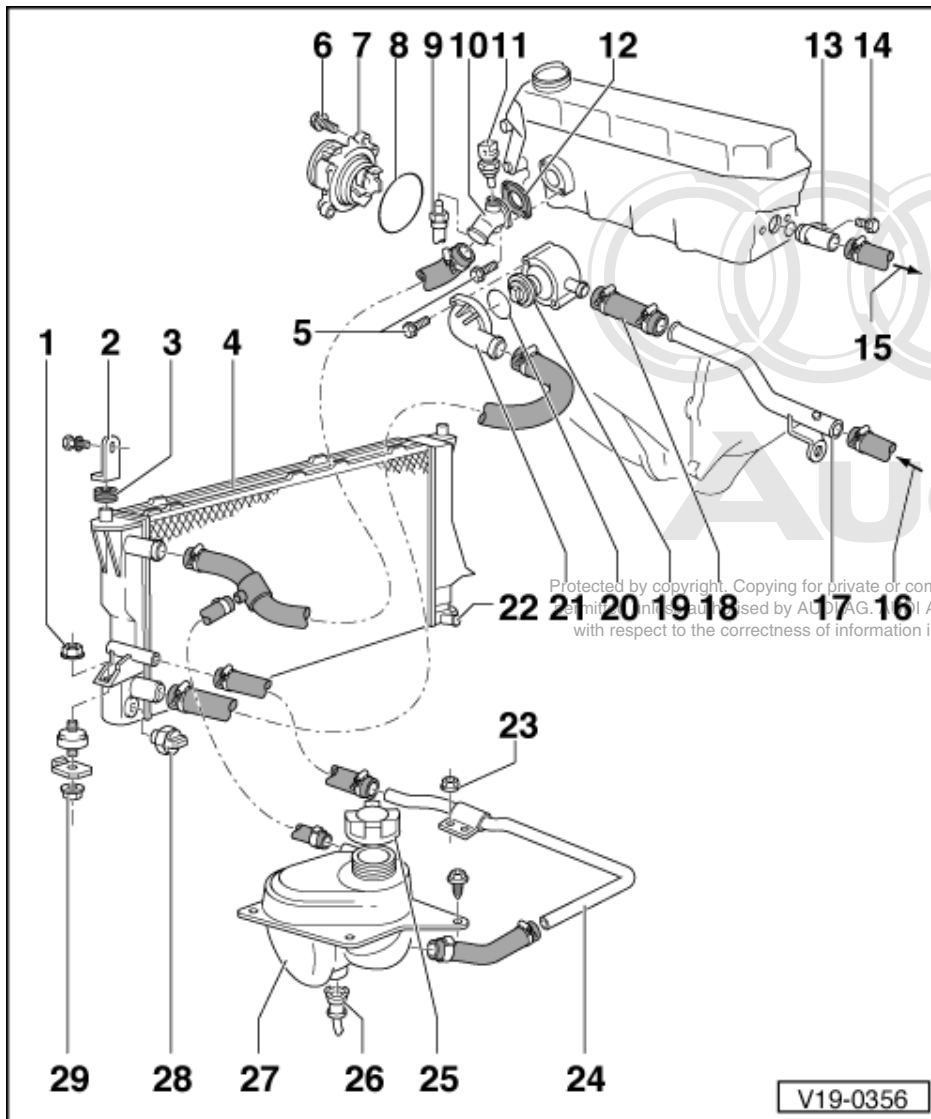
12 Seal

- ◆ Replace

13 Pipe union**14 20 Nm**



- 15 To heat exchanger
- 16 From heat exchanger
- 17 Coolant pipe
- 18 Coolant hose
 - ♦ Detach to completely drain the cooling system
- 19 Thermostat
 - ♦ Removing and installing =>Page 144
 - ♦ Checking => Page 144
- 20 O-ring
 - ♦ Replace
- 21 Pipe union
- 22 Coolant drain plug
- 23 10 Nm
- 24 Coolant pipe

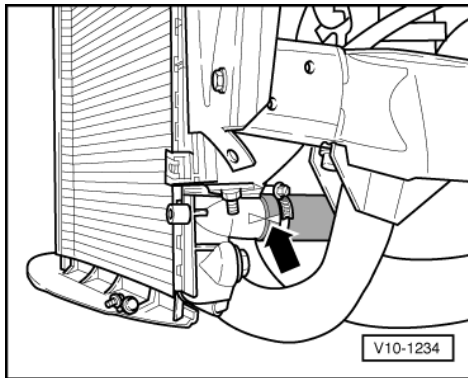
**25 Cap**

- ♦ With pressure relief valve
- ♦ Checking pressure relief valve => Page 152

26 Switch for low coolant level display -F66**27 Expansion tank****28 Thermostat for radiator fan -F18 - 25 Nm**

- ♦ Switching temperatures:
 - 1st stage
 - on: 92...97 °C
 - off: 84...91 °C
 - 2nd stage
 - on: 99...105 °C
 - off: 91...98 °C
- + = lead

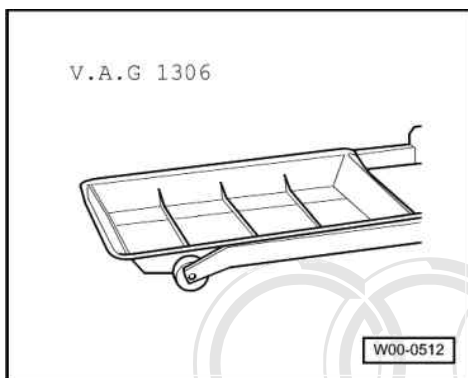
29 10 Nm



➔ Fig.1 Installation position of lower coolant hose

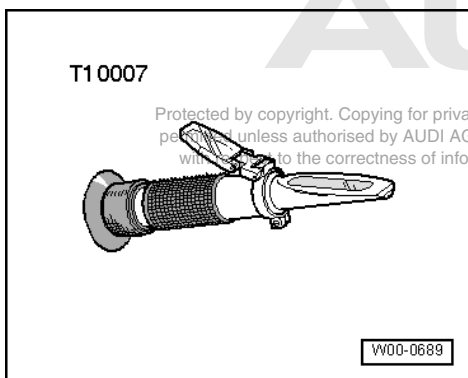
- ♦ The markings must be aligned -arrow-

1.3 - Draining and filling cooling system



Special tools and workshop equipment required

- ♦ Drip tray V.A.G 1306



- ♦ Special tool T10007 (for coolant additive G 012 A8 D)

Draining

Note:

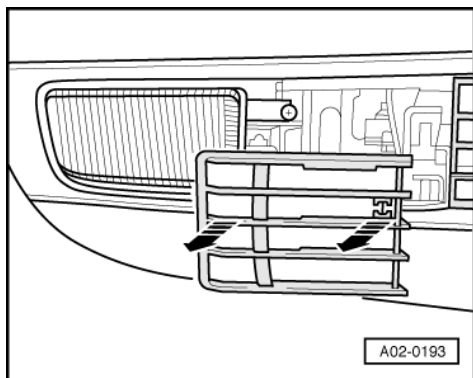
Collect drained coolant in a clean container for re use or disposal.



Important

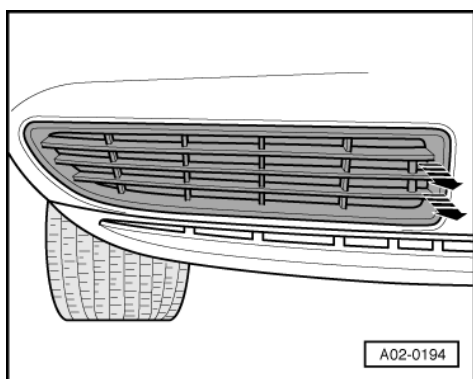
Hot steam or hot coolant can escape when opening expansion tank. Cover cap with a cloth and open carefully.

- Open the cover of the coolant expansion tank



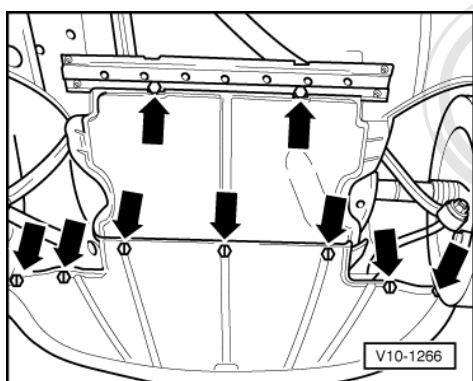
Audi 100:

- -> Unclip the air intake grille to the lower right of the bumper -arrows-.



Audi A6:

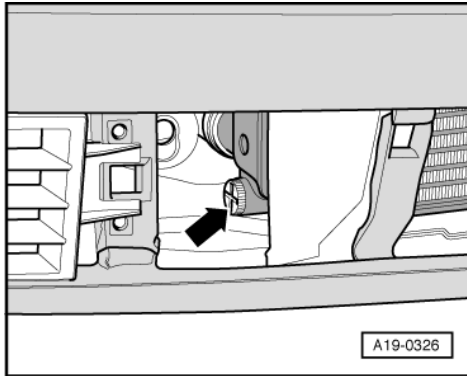
- -> Pull back retainer catch -arrows- and remove air intake grille.



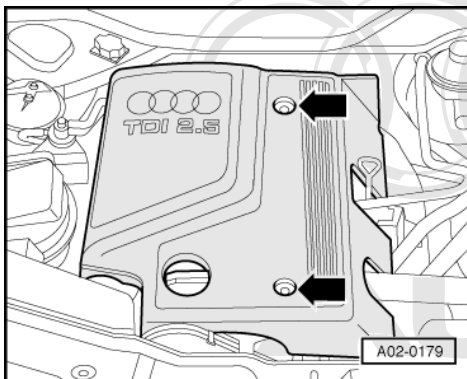
All models:

- -> Remove the noise insulation -arrows-.

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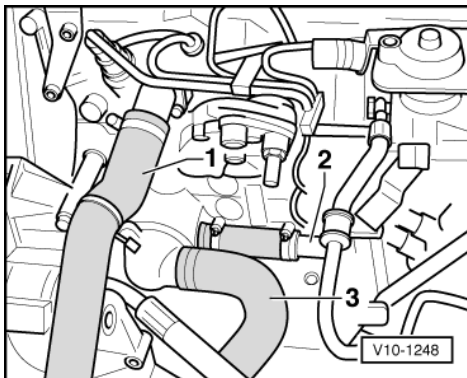
- Place drip tray V.A.G 1306 below engine.
- -> Turn drain plug -arrow- on radiator anti-clockwise. If necessary, fit drain hose on connection.



Audi A6:

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- -> Remove engine cover -arrows-.



All models:

- Remove the toothed belt guard for injection pump drive.
- -> Unscrew securing bolt for coolant pipe -2- (engine/gearbox flange).
- Release cable tie on coolant pipe.
- Detach coolant hose of coolant pipe -2-.

Filling

Notes:

- ◆ The cooling system is filled all year round with a mixture of water and antifreeze/corrosion protection agent.
- ◆ Coolant additive G 011 A8 C (green) is used in vehicles up to 06.96.



- ♦ Only coolant additive G 012 A8 D (red) is used in vehicles from 07.96 onwards.

Important

The two different coolant additives G 011 A8 C and G 012 A8 D must not be mixed together. Otherwise, this can result in serious damage to the engine.

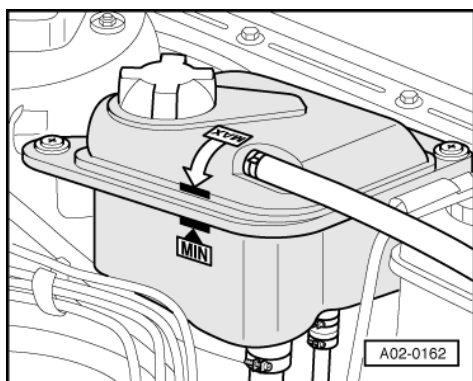
- ♦ If the fluid in the expansion tank is brown, this means G 012 A8 D has been mixed with another type of coolant. In this case, flush out the cooling system and fill with fresh coolant. To flush the system, fill it with clean water and run the engine for about 2 minutes. This should remove as much of the old coolant as possible.
- ♦ G 011 A8 C and G 012 A8 D and coolant additives marked meeting specification TL VW 774 C or 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 to about -25°C (in countries with an arctic climate to about -35°C).
- ♦ 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 to mix the coolant.
- ♦ If radiator, heat exchanger, cylinder head or cylinder head gasket is replaced, do not reuse old coolant.
- ♦ Use special tool T10007 to check frost protection of coolant additive G 012 A8 D in cooling system.

Recommended mixture ratios:

Frost protection to	Antifreeze concentration	G11/G12 1)	Water 1)
-25 °C	40 %	2.60 l	3.90 l
-35 °C	50 %	3.25 l	3.25 l

1) Coolant quantity: 6.5 litres (may vary depending upon the vehicle equipment)

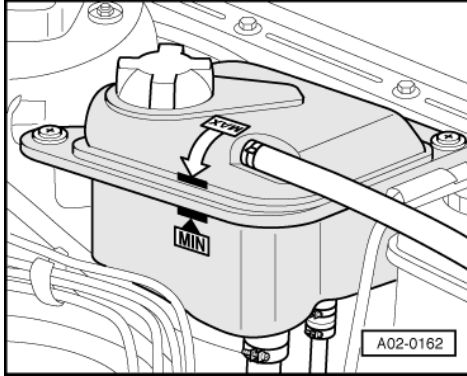
- Installing and securing coolant hoses.
- Close drain plug on radiator.



- -> Top up coolant to max. mark on expansion tank.
- Fit expansion tank cap.
- Start the engine.
- Run engine until operating temperature is attained (coolant temperature gauge reading approx. 80 °C).

Important

Hot steam or hot coolant can escape when opening expansion tank. Cover cap with a cloth and open carefully.



- -> Check the coolant level and top up if necessary. If the engine is warm, the coolant level should be at the max. mark; if cold, between the min. and max. marks.
- Stop engine.

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Tightening torque

Component	Nm
Hose clamps for coolant hoses	2

1.4 - Removing and installing coolant pump

Removing

- Drain coolant => Page 139
- Remove toothed belt => Page 38
- Remove the rear toothed belt guard.
- Unscrew remaining coolant pump bolts and detach coolant pump.

Installing

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

Note:

Fit new O-ring on coolant pump.

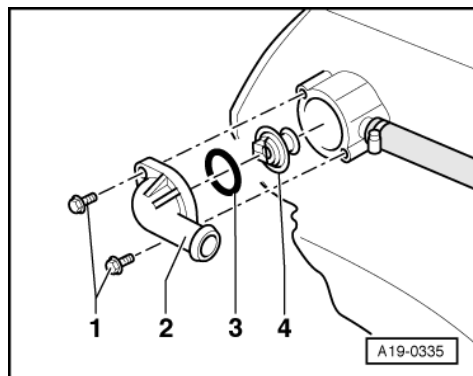
- Before installing, clean and smooth down sealing surface for O-ring.
- Lubricate new O-ring with G11/G12 and position at coolant pump.
- Install toothed belt (adjust valve timing) => Page 40
- Top up coolant => Page 141

Tightening torques

Component	Nm
Coolant pump to cylinder block	
Hexagon bolt	20
Hexagon socket-head bolt	30



1.5 - Removing, installing and checking coolant thermostat



Removing

- Drain coolant => Page 139
- -> Unscrew bolts -1- remove connection -2-, O-Ring -3- and coolant thermostat -4-.

Installing

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

Note:

Replace seals and gaskets.

- Clean and smooth down sealing surface for O-ring as required.
- Insert coolant thermostat.
 - Installation position: Cross-piece on thermostat should be vertical.
- Lubricate new O-ring with G11/G12.
- Top up coolant => Page 141

Tightening torque

Component	Nm
Connection to cylinder block	10

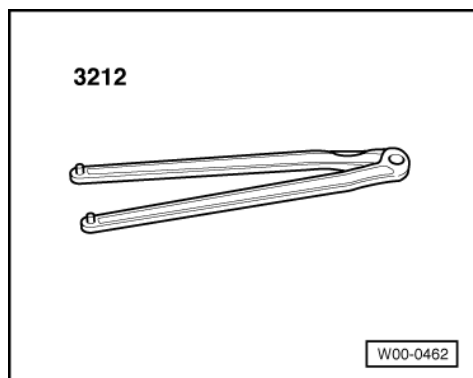
Check coolant thermostat

- Heat thermostat in water bath.

Starts to open	Fully open	Opening travel
approx. 87 °C	approx. 102 °C 1)	at least 8 mm

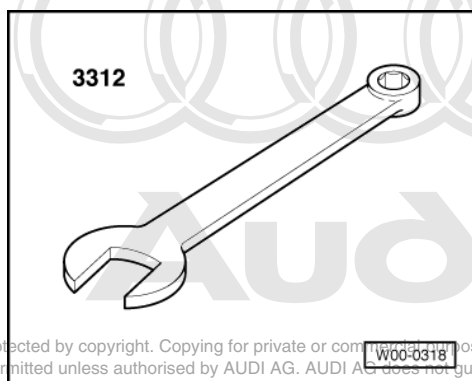
1) Cannot be tested

1.6 - Removing and installing viscous fan



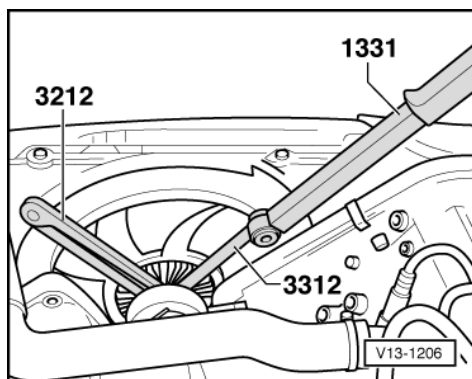
Special tools and workshop equipment required

- ♦ Pin wrench 3212



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- ♦ Open-ended spanner 3312

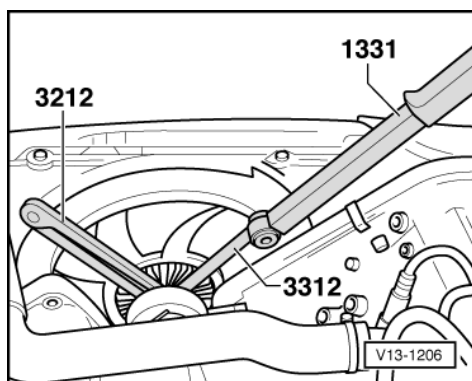


Removing

- Remove lock carrier:

=> General Body Assembly; Repair group 50; Front body Front body

- -> Counterhold pulley for viscous fan with 2-hole pin wrench 3212 and unscrew viscous fan with wrench 3312 (left-hand thread).
- Remove viscous fan from mounting and put in front of radiator cowl.
- If necessary, unclip wiring harness at bottom on radiator cowl.
- Unscrew radiator cowl from radiator and remove it and the viscous fan from above.





Installing

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

- ➔ Tighten the viscous fan with wrench 3312 and torque wrench V.A.G 1331 (left-hand thread).
- Tighten using 2-hole pin wrench 3212 as counterhold.
- Installing lock carrier with attachments:

=> General Body Assembly; Repair group 50; Front body Front body

Tightening torque for viscous fan	Nm
Torque wrench V.A.G 1331 and open-end spanner 3312	37
Torque wrench without open-end spanner 3312	70

Note:

If a torque wrench other than V.A.G 1331 is used, the tightening torque depends on the length of the torque wrench (measured from square drive to centre of handle).

220 mm = 22 Nm; 280 mm = 37 Nm;

300 mm = 39 Nm; 440 mm = 45 Nm.

1.7 - Checking viscous fan

Note:

The operation of the viscous fan clutch cannot be checked with workshop equipment.

Visual check

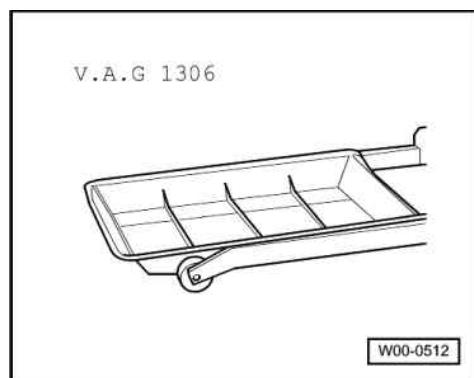
- Check viscous fan for oil leaks. The coupling housing must be clean and dry on the rear.
- Check the ease of movement of the fan when the engine is not running. It should be possible to turn the fan wheel without any appreciable resistance.

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Checking axial play

- Measure at outside circumference of fan wheel.
 - Axial play: no more than 15 mm

1.8 - Removing and installing radiator



Special tools and workshop equipment required

- ♦ Drip tray V.A.G 1306

Removing

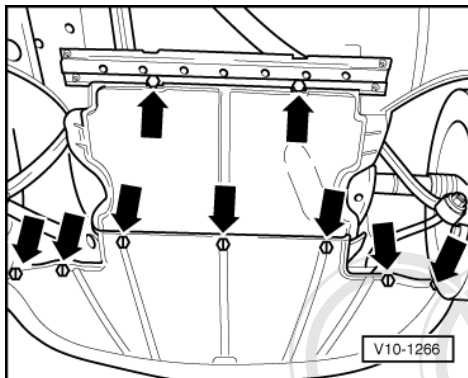
Note:

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

Important

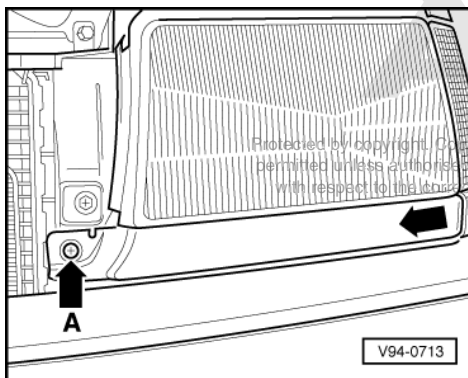
Hot steam or hot coolant can escape when opening expansion tank. Cover cap with a cloth and open carefully.

- Open the cover of the coolant expansion tank



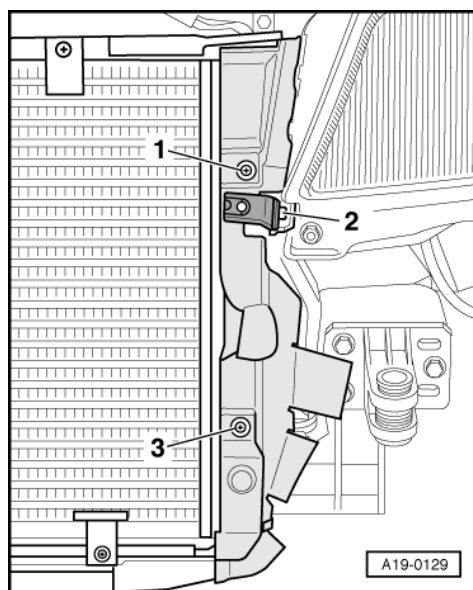
- -> Remove the noise insulation -arrows-.
- Remove the front bumper:

=> General Body Assembly; Repair group 63; Front bumper Front bumper



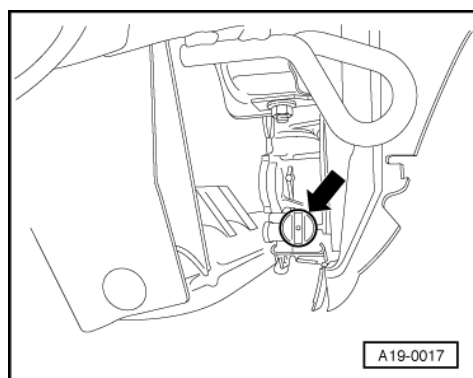
Audi A6:

- -> Remove securing bolt -arrow A- and pull out headlight trim in direction of arrow.



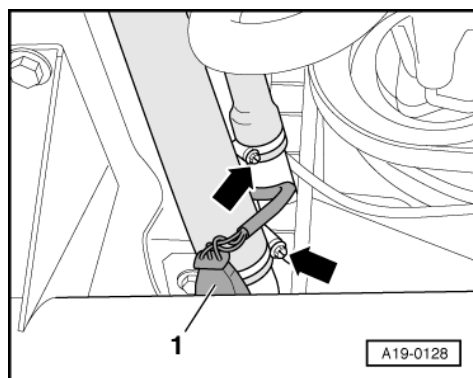
All models:

- -> Unscrew bolt -2- of retaining clip of headlight trim at housing.
- Unscrew bolts -1- and -3- of air ducts on left and right of radiator and remove air ducts.

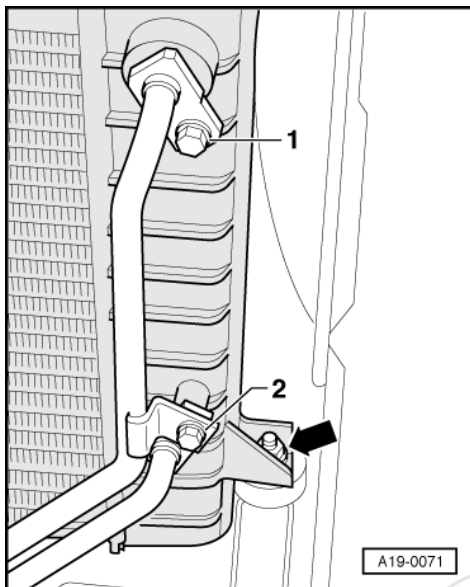


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- Place drip tray V.A.G 1306 below engine.
- -> Turn drain plug -arrow- on radiator anti-clockwise. If necessary, fit drain hose on connection.



- -> Detach both coolant hoses at bottom of radiator -arrows-.
- Unplug connector -1- at the radiator fan thermoswitch.



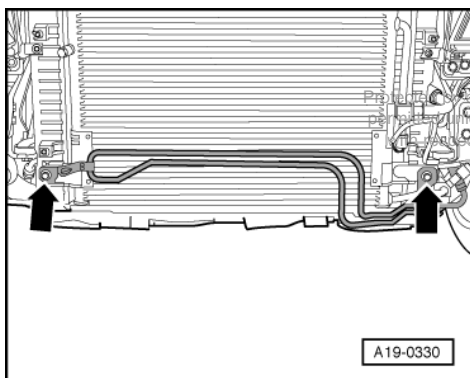
Vehicles with automatic gearbox:

- -> Detaching ATF lines from radiator (bolts -1- and -2-):

=> Automatic Gearbox 01K Front-wheel Drive; Repair group 37

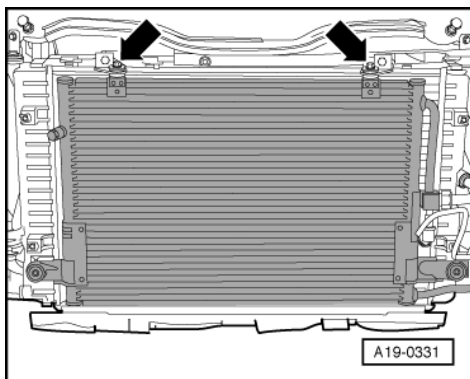
Note:

The nut -arrow- at lower right radiator fastening point must not be loosened.



All models:

- -> Detach cooling coil for power steering hydraulic fluid -arrows-.





Vehicles with air conditioner:

Important

The air conditioner refrigerant circuit must not be opened.

- -> Remove the securing bolts for the condenser.

Note:

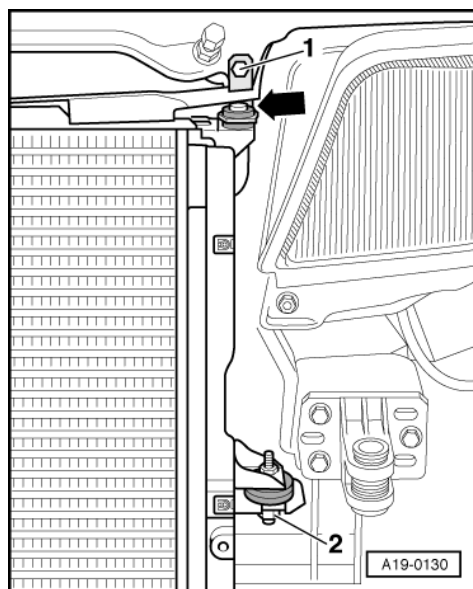
To prevent damage to the condenser and refrigerant pipes/hoses, ensure that the pipes and hoses are not stretched, kinked or bent.

- Leave condenser with connected refrigerant pipes/hoses in installation position.

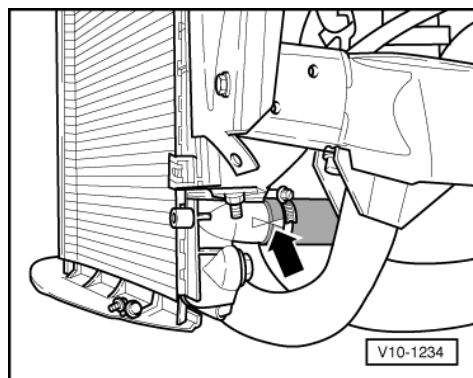
All models:

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- Unscrew air duct to air cleaner at radiator.
- Detach top left coolant hose from radiator.
- Unbolt radiator cowl at rear of radiator.
- Remove radiator cowl from brackets and tie it to lock carrier.



- -> Unscrew nuts -2- at bonded rubber mounting.
- Remove bottom of radiator from bonded rubber mounting support from front.
- Disengage upper radiator attachment -arrow- downwards (if necessary unscrew bolt -1- at radiator support).



Installing

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

- -> Install the coolant hoses in such a manner that the marks on coolant hose and connection face each other -arrow-.
- Install the front bumper:

=> General Body Assembly; Repair group 63; Front bumper Front bumper

- Top up coolant => Page **141**

Note:

All coolant must be replaced when a new radiator is fitted.

Vehicles with automatic gearbox:

- Attach ATF lines.

=> Automatic Gearbox 01K Front-wheel Drive; Repair group 37

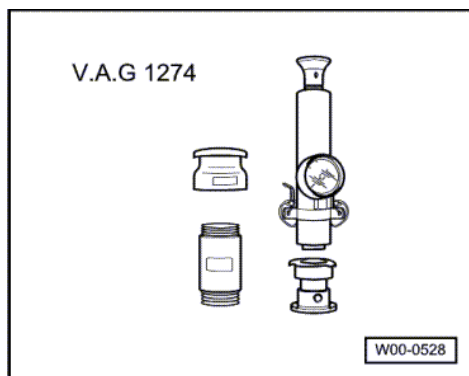
- Check ATF level:

=> Automatic Gearbox 01K Front-wheel Drive; Repair group 37

Tightening torque

Component		Nm
Radiator to front	M6	10
	M8	20
Radiator cowl to radiator		10
Condenser to radiator		10
Power steering cooling coil to radiator		10
Hose clamps for coolant hoses		2

1.9 - Checking cooling system for leaks



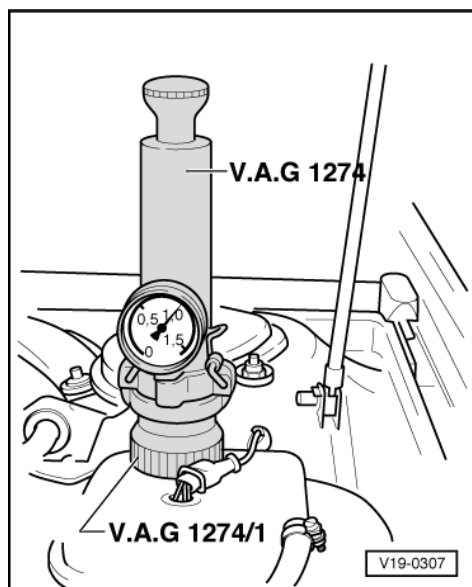
Special tools and workshop equipment required

- ♦ V.A.G 1274 with V.A.G 1274/1



Test requirements:

- Engine at operating temperature.

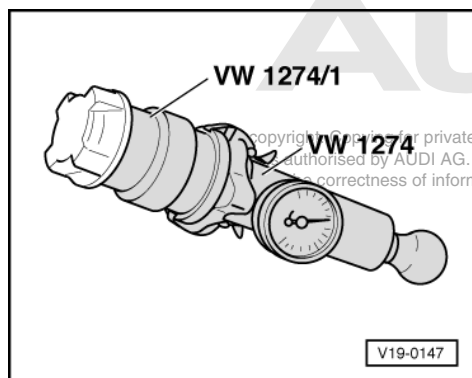


Test sequence

Important

Hot steam or hot coolant can escape when opening expansion tank. Cover cap with a cloth and open carefully.

- Open the cover of the coolant expansion tank
- -> Fit tester V.A.G 1274 with adapter V.A.G 1274/1 onto expansion tank.
- Using hand pump on tester, build up a pressure of approx. 1.0 bar.
- If this pressure is not maintained, locate and rectify leaks.



Checking pressure relief valve in filler cap

- -> Fit tester V.A.G 1274 with adapter V.A.G 1274/1 onto sealing cap.
- Operate hand pump.
 - The pressure relief valve should open at a pressure of 1.2...1.5 bar.

21 - Charging

1 - Checking charge air system with turbocharger

1.1 - Checking charge air system with turbocharger

Notes:

- ♦ For cleanliness rules, see=> Page 172
- ♦ Secure all hose connections with the correct hose clamps (same as original equipment):

=> Parts List

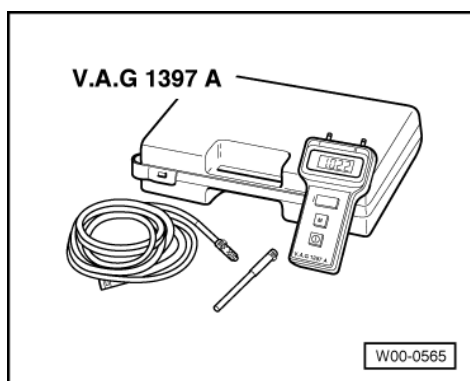
- ♦ Hose connections and hoses for charge air system must be free of oil and grease before assembly. Lubricants must never be used.

Safety precautions

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

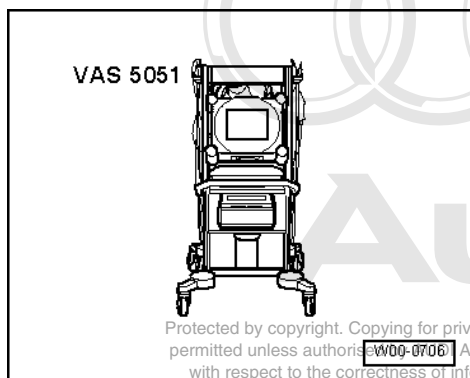
Important

- ♦ Always install testers and measuring instruments on the back seat and have a second person operate them from there.
- ♦ If test equipment is operated from the front passenger seat, the person sitting there could be injured if the front passenger airbag were triggered in the event of an accident.



Special tools and workshop equipment required

- ♦ Turbocharger tester V.A.G 1397 A





- ♦ VAS 5051 with VAS 5051/1 and VAS 5051/2

1.2 - Test requirements for checking exhaust turbocharging

1. - Coolant temperature at least 85 °C
2. - Fault memory of engine control unit interrogated.
3. - Exhaust gas recirculation OK, checking => as of Page 207

Note:

If there is a fault in the exhaust gas recirculation it is not possible to achieve reliable values when checking exhaust turbocharging.

4. - No leaks in intake or exhaust system Effects of leakages => Page 154
5. - Control hose to boost pressure regulating valve not obstructed, loose or leaking.
6. - No faults on engine or injection system, e.g. compression or injection pump or injector units, respectively.

1.3 - Effects of leaks in intake or exhaust system

A - Leaks downstream of air mass meter

Possible fault sources:

- 1 - Connection hoses between air mass meter and turbocharger
- 2 - Connection hose to crankcase vent

Effect:

- Loss of power

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B - Leaks downstream of turbocharger (intake side)

Possible fault sources:

- 1 - Connection hoses between turbocharger, charge air cooler, and intake pipe
- 2 - Intercooler
- 3 - Hose to the intake manifold pressure sender -G71/hose for solenoid valve for boost pressure limitation -N75
- 4 - Seal between intake connection and intake manifold
- 5 - Seal between intake manifold and cylinder head

Effect:

- Boost pressure too low

C - Leaks downstream of turbocharger (exhaust side)

Possible fault sources:

- 1 - Parts of exhaust gas recirculation
- 2 - Connection between turbocharger and exhaust manifold
- 3 - Connection between exhaust manifold and cylinder head

Effect:

- Boost pressure too low, possibly exhaust smell, traces of soot in engine compartment

Test requirements:

- Fault memory has been interrogated.

=> Diesel Direct Injection and Glow Plug System (TDI 5-cylinder); Repair group 01; Interrogating and erasing fault memory

- Final control diagnosis has been performed

=> Diesel Direct Injection and Glow Plug System (TDI, 5-cylinder); Repair group 01; Final control diagnosis
 Final control diagnosis

- No leaks in intake or exhaust system.
- No faults in engine or injection system, e.g. compression, injectors or commencement of injection.
- Coolant temperature at least 80 °C.

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1.4 - Test boost pressure

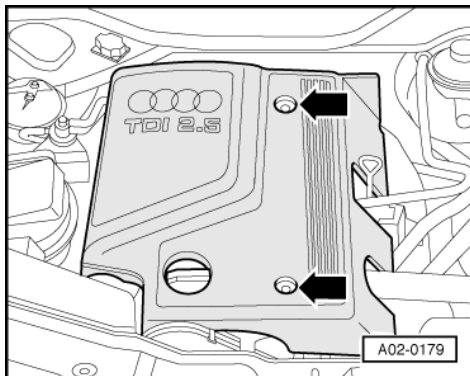
Test requirements:

- Vehicle diagnostic, testing and information system VAS 5051 connected, vehicle self-diagnosis and vehicle system "01 - Engine electronics" selected.

Important

To avoid the risk of accidents when performing measurements and test drives, please observe the safety precautions =>

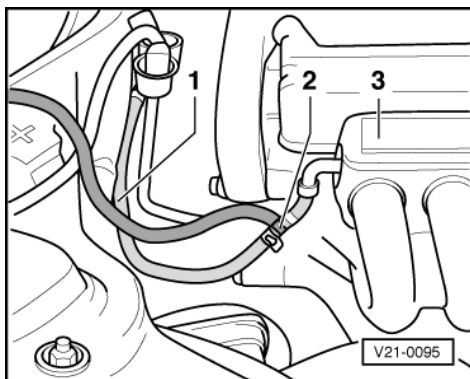
- ♦ To localise faults, the turbocharger (without boost pressure control) must be checked first, followed by the boost pressure with boost pressure control.



Test sequence

Audi A6:

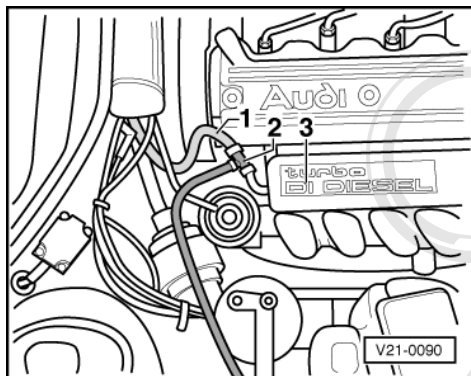
- -> Remove engine cover -arrows-.





Vehicles with engine codes ABP:

- -> Detach hose -1- to intake manifold pressure sender -G71 at intake manifold -3-.
- Connect T-piece -2- with measuring hose of turbocharger test unit V.A.G 1397 A onto front of intake pipe.

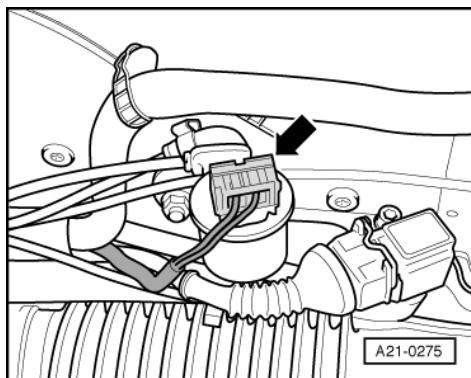


Vehicles with engine codes AAT, AEL:

- -> Detach hose -1- to intake manifold pressure sender -G71 at intake manifold -3-.
- Connect T-piece -2- with measuring hose of turbocharger test unit V.A.G 1397 A onto front of intake pipe.

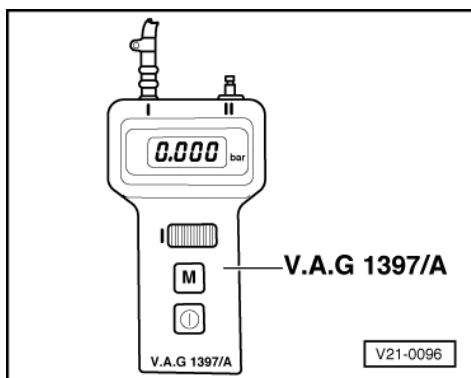
All models:

- Route measuring hose under rear edge of bonnet and into passenger compartment via right window.



Checking without boost pressure control:

- -> Disconnect the connector -arrow- from the solenoid valve for boost pressure limitation.

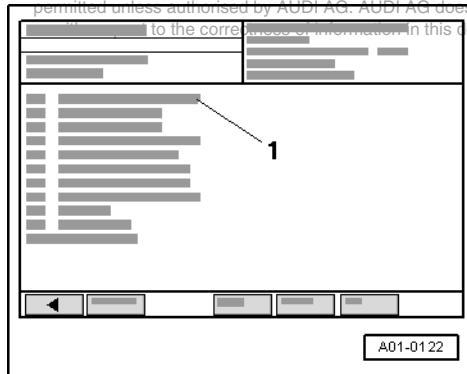


- -> Switch on turbocharger tester and set measuring range selector switch to position -I- (absolute pressure).
- Connect measuring hose to connection -I-.

Notes:

- ◆ Hose connections must be completely airtight, otherwise measurements will not be correct.
- ◆ Ensure that measuring hose is not pinched at bonnet or side window.
- ◆ Pressing memory key M on turbocharger tester will store the last measured value until memory key M is pressed again or tester is switched off.
- ◆ The decimal point in the display zone flashes to indicate that the value is being stored.
- ◆ If the battery voltage of the turbocharger tester drops below the minimum level, an arrow will appear at the top left of the display.

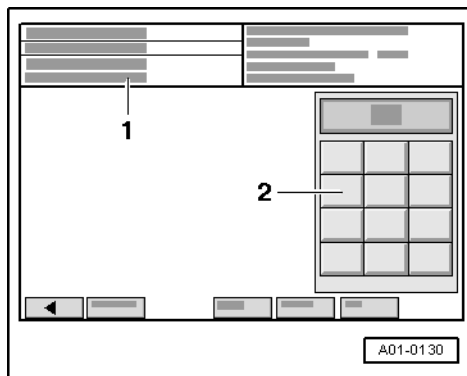
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Vehicles with engine codes AAT, AEL:

-> Display on VAS 5051:

- Under -1- select diagnostic function "08 - Read measured value block".

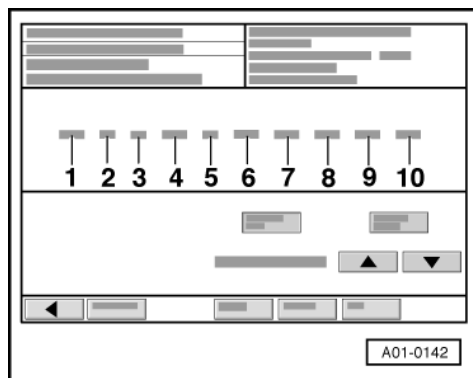


-> Display on VAS 5051:

- 1 - Enter display group
- Enter "000" for "display group number 000" in zone -2- and confirm the entry by pressing the Q key.

All models:

- Accelerate from 1500 rpm at full throttle in 4th gear (or with selector lever at position 2) and watch rev counter.
- Press "Print - Save result" key on V.A.G 5051 and memory key -M- on V.A.G 1397 A simultaneously at approx. 3000 rpm.
- Exit function "08 - Read measured value block" by pressing the ◀ key.



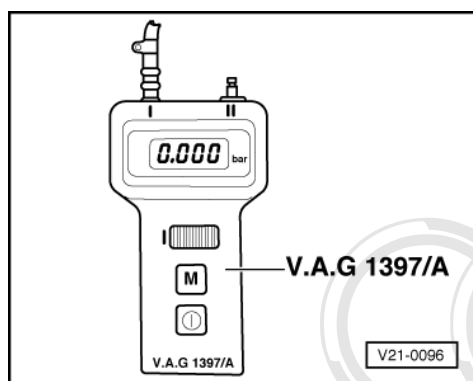
-> Display on VAS 5051:

- Check display in display zone -5-.

Engine code letters	Measured value
ABP	Ignore display
AAT up to 2nd control unit version 1)	180...200
AAT from 3rd control unit version 1), AEL	147...162

- 1) Explanation of the control unit versions

=> Diesel Direct Injection and Glow Plug System (TDI, 5-cylinder); Repair group 01; Self diagnosis Self diagnosis



-> Specified value on V.A.G 1397/A:

- ♦ 1.500...1.650 bar

Note:

The boost pressure level is measured with turbocharger tester-V.A.G 1397/A. The vehicle diagnostic, testing and information system V.A.G 5051 is used to check whether the boost pressure is being registered by the control unit in vehicles with engine codes AAT and AEL.

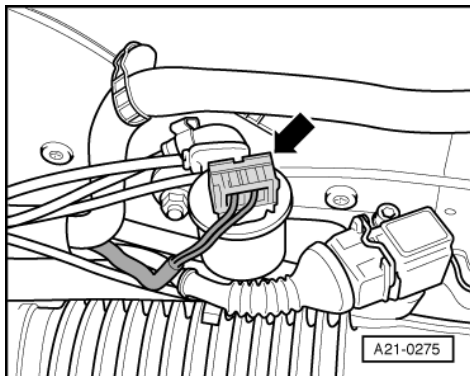
- If measured boost pressure is OK, repeat boost pressure measurement with boost pressure control => Page 159

If boost pressure is not obtained:

- ♦ Leakage between turbocharger and intake manifold => Page 154
- ♦ Turbocharger defective

If boost pressure is exceeded:

- ◆ Boost pressure control hoses fallen off, leaking or blocked.
- ◆ Boost pressure limitation solenoid valve restricted
- ◆ Bypass valve actuator (linkage, shaft) binding or stuck (bypass valve always closed)



Checking with boost pressure control:

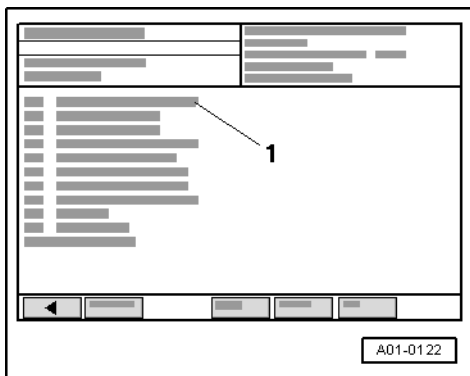
- -> Plug in the connector -arrow- to the solenoid valve for boost pressure limitation -N75.
- Erase fault memory.

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=> Diesel Direct Injection and Glow Plug System (TDI 5-cylinder); Repair group 01; Interrogating and erasing fault memory Interrogating and erasing fault memory

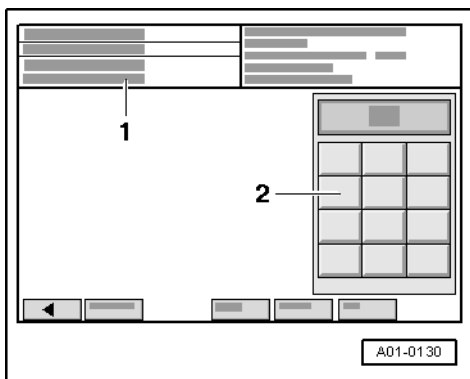
Note:

Disconnecting boost pressure limitation solenoid valve electrical connection -N75 caused a fault code to be set in the fault memory during the previous testing procedure.



Vehicles with engine codes AAT, AEL:

- > Display on VAS 5051:
- Under -1- select diagnostic function "08 - Read measured value block".





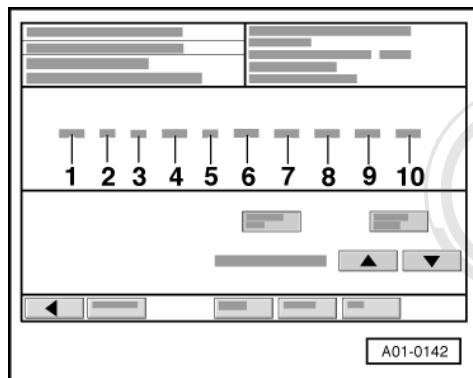
-> Display on VAS 5051:

1 - Enter display group

- Enter "000" for "display group number 000" in zone -2- and confirm the entry by pressing the Q key.

All models:

- Accelerate from 1500 rpm at full throttle in 4th gear (or with selector lever at position 2) and watch rev counter.
- Press "Print - Save result" key on V.A.G 5051 and memory key -M- on V.A.G 1397 A simultaneously at approx. 3000 rpm.
- Exit function "08 - Read measured value block" by pressing the ◀ key.



-> Display on VAS 5051:

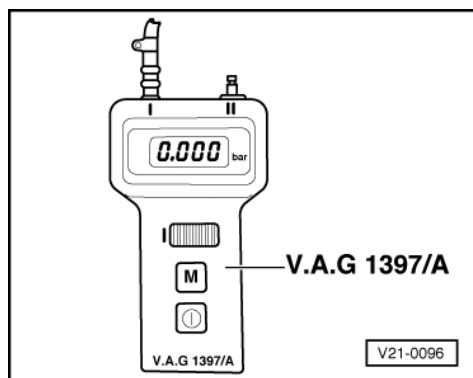
- Check display in display zone -5-

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Engine code letters	Measured value
ABP	Ignore display
AAT up to 2nd control unit version 1)	210...235
AAT from 3rd control unit version 1), AEL	168...194

1) Explanation of the control unit versions

=> Diesel Direct Injection and Glow Plug System (TDI, 5-cylinder); Repair group 01; Self diagnosis Self diagnosis



-> Specified value on V.A.G 1397/A:

- ♦ 1.720...1.920 bar

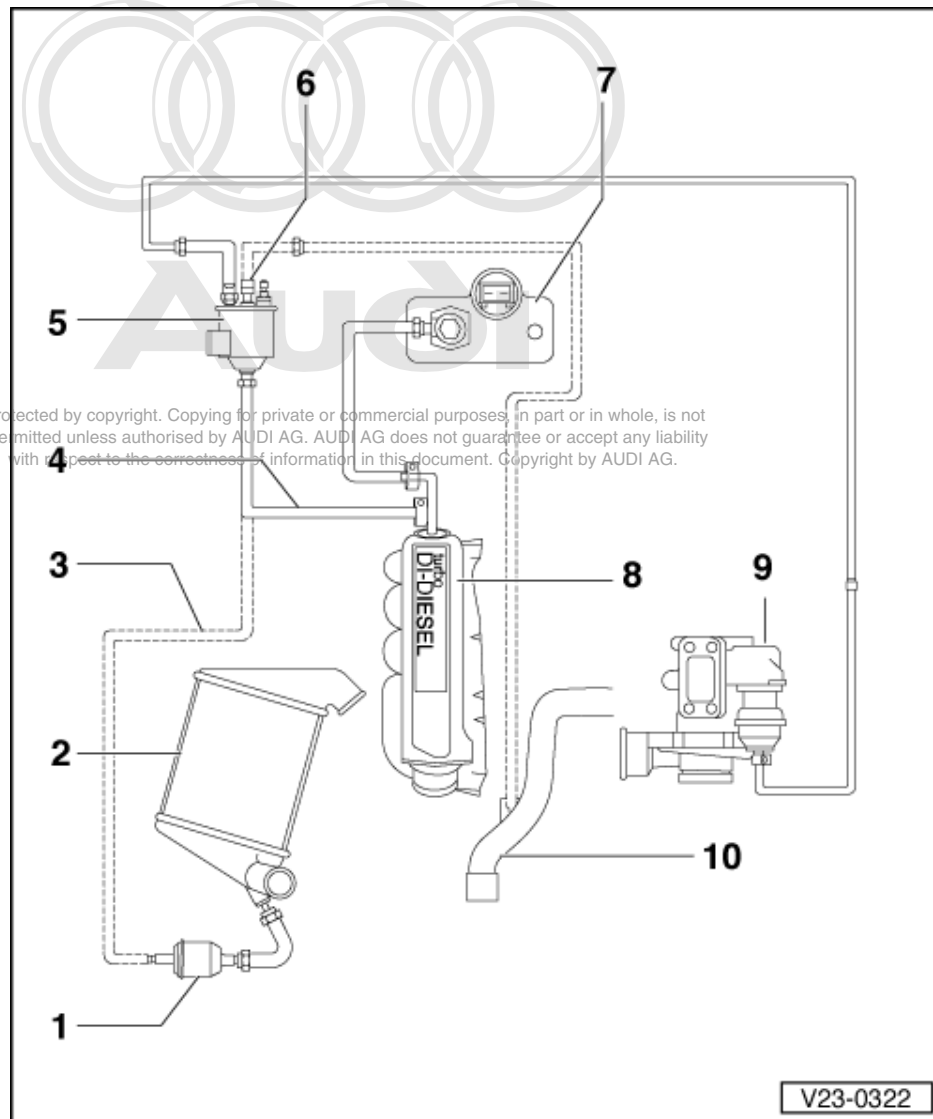
If boost pressure is not obtained:

- ◆ No electrical function of boost pressure limitation solenoid valve.
- ◆ Boost pressure limitation solenoid valve -N75 is stuck in the open position

If boost pressure is exceeded:

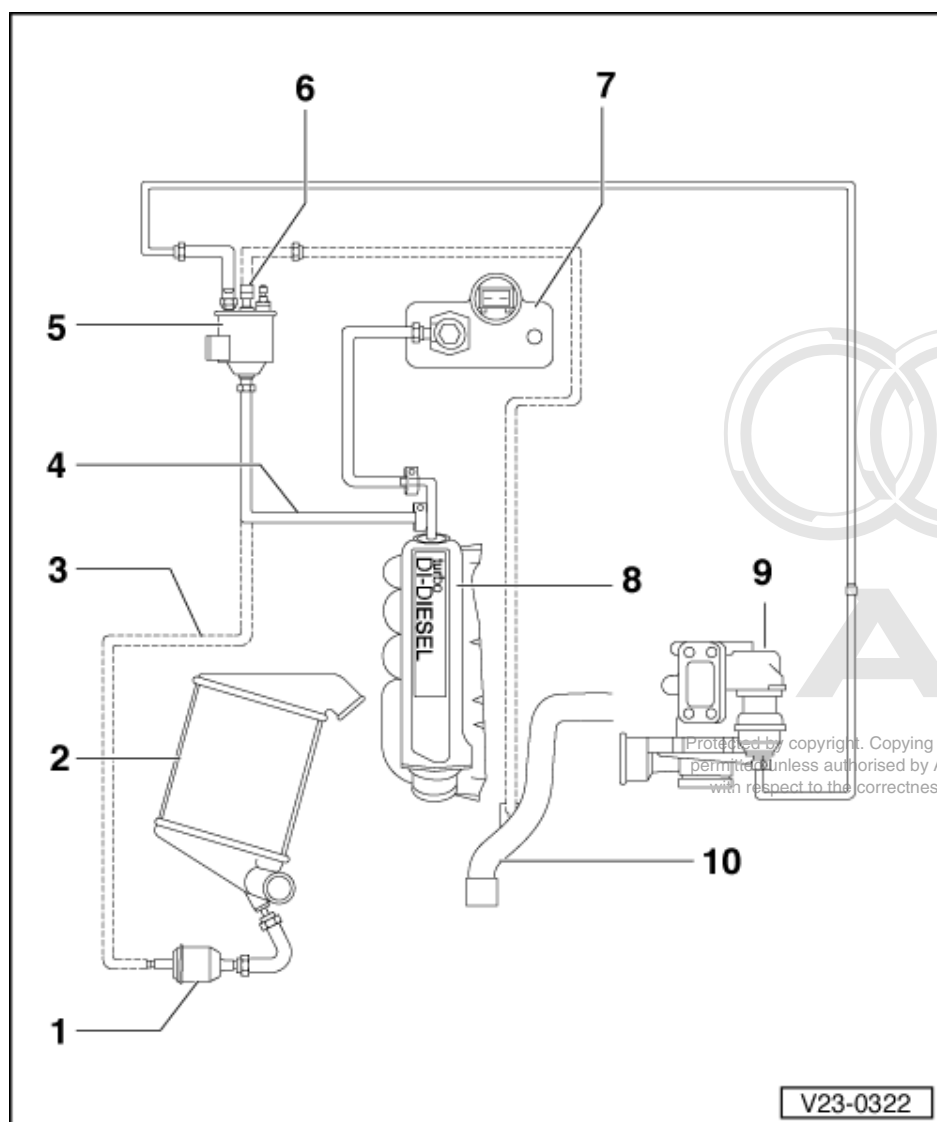
- ◆ Solenoid valve for boost pressure limitation -N75 intermittently stuck closed.
- ◆ Boost pressure increased as a result of tuning

1.5 - Diagram of connections for boost pressure control system



- 1 Separator**
 - ◆ Vehicles with engine codes AAT, AEL only
- 2 Intercooler**
- 3 Delivery connection from charge air cooler**
 - ◆ Vehicles with engine codes AAT, AEL only
- 4 Pressure connection from intake manifold**
 - ◆ Vehicles with engine code ABP only
- 5 Boost pressure control solenoid valve -N75**
 - ◆ Installation position: At the front of engine compartment, on left

♦ Checking => Page **163**



6 Ventilation connection on -N75

- ♦ With slotted cap for vehicles with engine codes ABP
- ♦ With vent line to the crankcase vent for vehicles with engine codes AAT, AEL

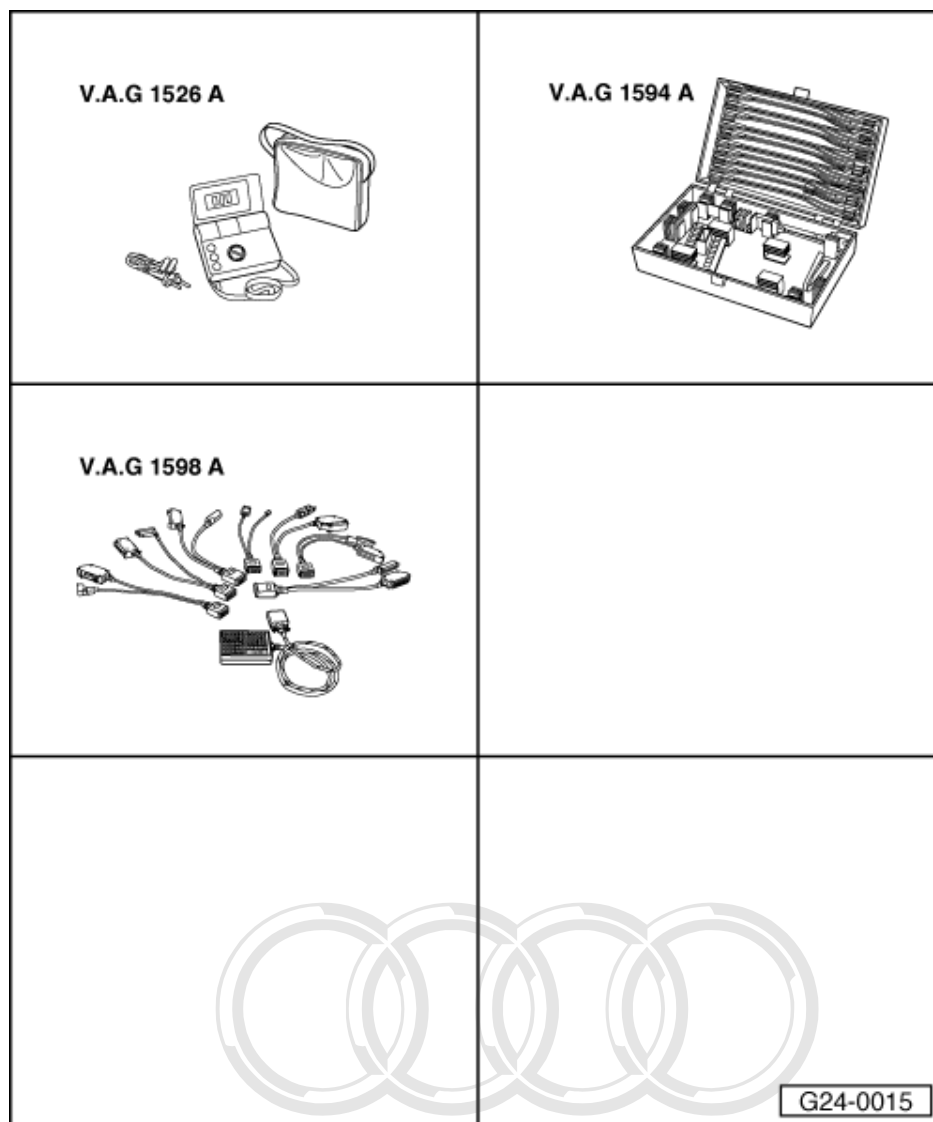
7 Intake manifold pressure sender -G71

8 Intake manifold

9 Turbocharger

10 Crankcase breather

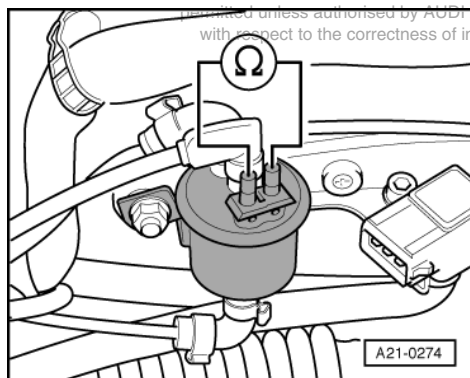
1.6 - Checking solenoid valve for boost pressure limitation -N75



Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598 A with V.A.G 1598/5

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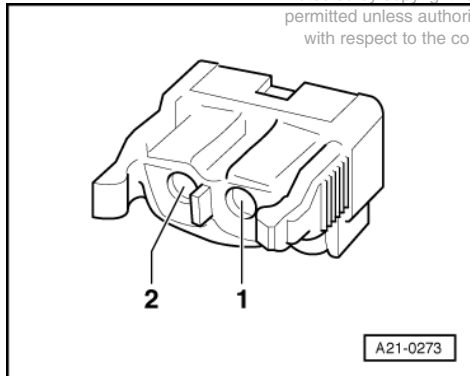
Checking internal resistance

- Switch ignition off.
- Unplug connector from solenoid valve for boost pressure limitation -N75.
- -> Connect multimeter to injector to measure resistance.
 - Specification: 20...28 Ω

If specification is not attained:

- Replace solenoid valve for boost pressure control -N75.

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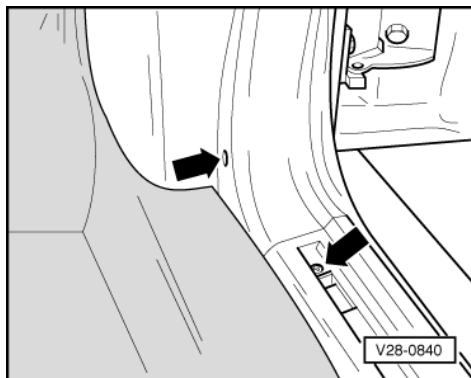
Checking power supply

- -> Connect multimeter between contact 1 and earth to measure voltage.
- Switch the ignition on.
 - Specification: approx. battery voltage

If specification is not attained:

- Test wiring for open circuit and short to positive or earth.

=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

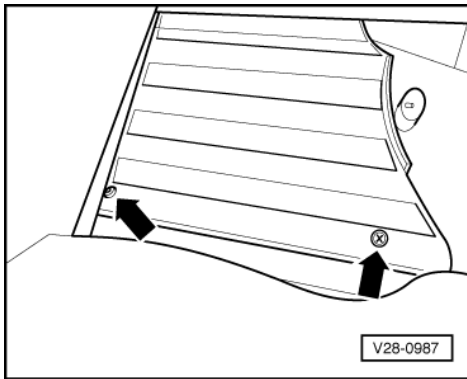


Checking control signal wiring

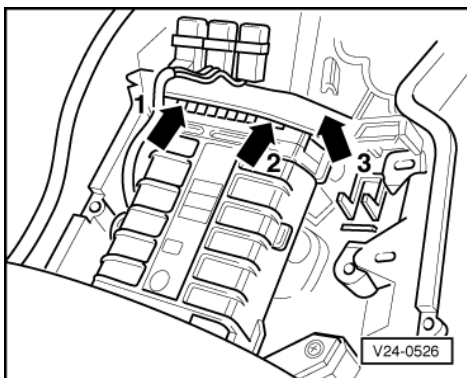
- Switch ignition off.
- -> Remove the lower part of the right A pillar trim and the front door sill panel tread strip

=> General Body Assembly; Repair group 70

- Pull back floor covering at front of right footwell. (If necessary, cut open the perforated seam on the left with a knife.)



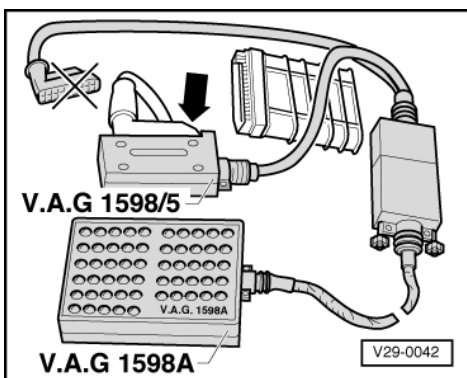
- -> Unscrew bolts -arrows- for electronics box cover.
- Carefully detach upper and lower sections of cover.



- -> Pull out cross strut -arrow 3- with attached parts.
- Screw out bolts -arrow 1- and -arrow 2-.
- Remove engine control unit.
- Disengage retaining clip and unplug control unit connector.

Note:

Always make sure that the ignition is switched off before unplugging or fitting the connector of the control unit for diesel direct injection system.

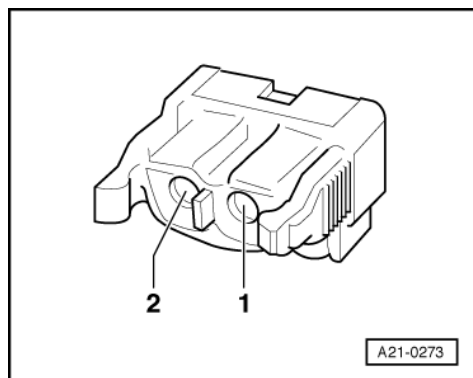


- -> With the ignition switched off, connect test box V.A.G 1598 A only to plug connection of the engine control unit (control unit remains disconnected) using adapter V.A.G 1598/5.

Important

To prevent damage to the electronic components, select appropriate measuring range before connecting the measuring cables and observe the test requirements.

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

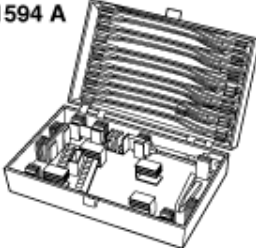
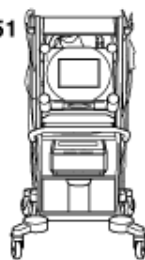
Connector Contact	Test box V.A.G 1598 A Socket
1	7

- Rectify any open/short circuit as necessary.



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1.7 - Checking intake manifold pressure sender -G71

V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598 A 	VAS 5051 
	G24-0017

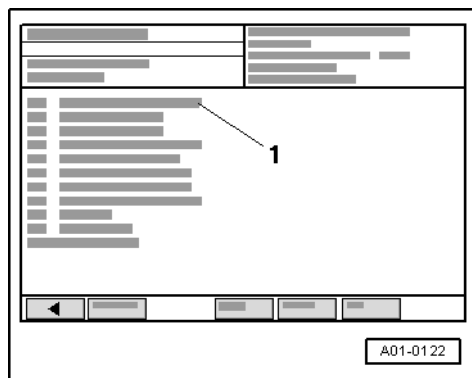
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Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598 A with V.A.G 1598/5
- ◆ VAS 5051 with VAS 5051/1 and VAS 5051/2

Test requirements:

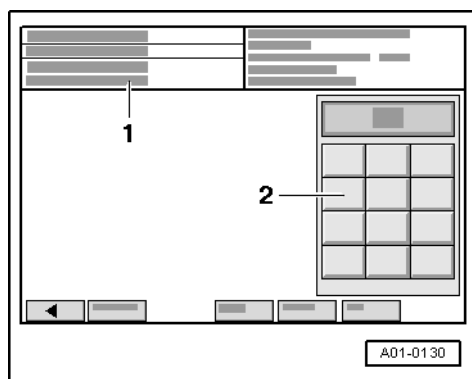
- Vehicle diagnostic, testing and information system VAS 5051 connected, vehicle self-diagnosis and vehicle system "01 - Engine electronics" selected.



Test sequence

-> Display on VAS 5051:

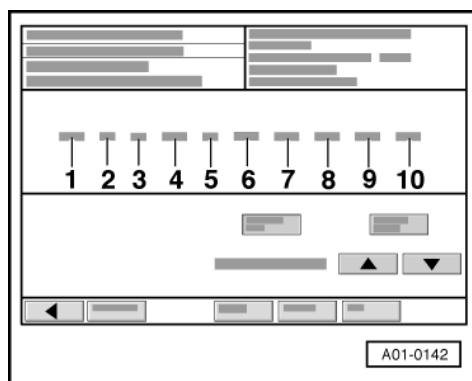
- Under -1- select diagnostic function "08 - Read measured value block".



-> Display on VAS 5051:

1 - Enter display group

- Enter "000" for "display group number 000" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check readout in display zones -5-and-6-.



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The readouts in display zones 5 and 6 should be matched as illustrated in the tables; slight deviations are permitted.

Examples for engine code ABP	
Display zone 5	Display zone 6
100	100
108	108
116	116
117	117
121	121

Examples for engine code AAT up to 2nd control unit version1)	
Display zone 5	Display zone 6
100	208
108	223
116	238
117	240
121	247

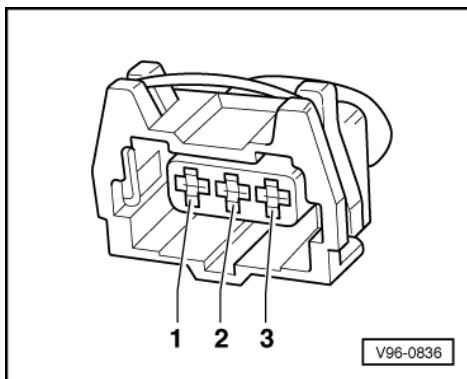
Examples for engine code AAT from 3rd control unit version1), AEL	
Display zone 5	Display zone 6
85	208
90	223
97	238
98	240
101	247

1) Explanation of the control unit versions

=> Diesel Direct Injection and Glow Plug System (TDI, 5-cylinder); Repair group 01; Self diagnosis Self diagnosis

- Start engine and run at idling speed.
 - The readout in display zone 5 goes down slightly (vacuum in intake manifold)
- Briefly increase the engine speed to approx. 3000 rpm and then release the accelerator pedal again.
 - The readout in display zone 5 increases with the boost pressure and must immediately decrease again with the engine speed.

If the readout decreases slowly or if the boost pressure is still displayed although the engine is running at idle speed again, the pressure hoses between the intake manifold and the intake manifold pressure sender are bent or blocked.



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Checking power supply

- Unplug connector at intake manifold pressure sender -G71.

Vehicles with engine codes ABP and AAT up to 2nd control unit version1):

- -> Connect multimeter between contacts 1 and 3 to measure voltage.

Vehicles with engine codes AAT from 3rd control unit version1) and AEL:

- Connect multimeter between contacts 2 and 3 to measure voltage.

1) Explanation of the control unit versions

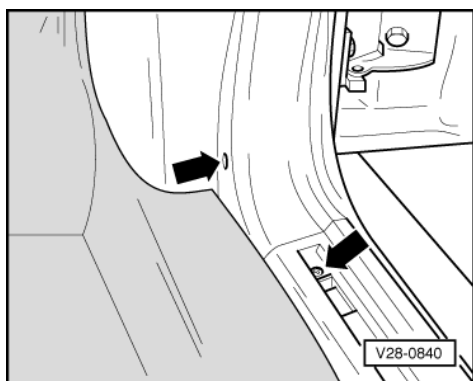
=> Diesel Direct Injection and Glow Plug System (TDI, 5-cylinder); Repair group 01; Self diagnosis Self diagnosis

All models:

- Switch the ignition on.
 - Specification: approx. 5 V

If specification is not attained:

- Test wiring for open circuit and short to positive or earth.

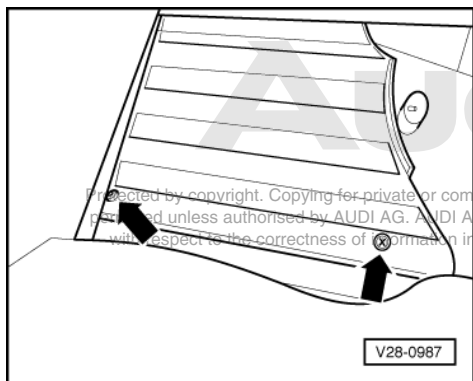


Checking control signal wiring

- Switch ignition off.
- -> Remove the lower part of the right A pillar trim and the front door sill panel tread strip

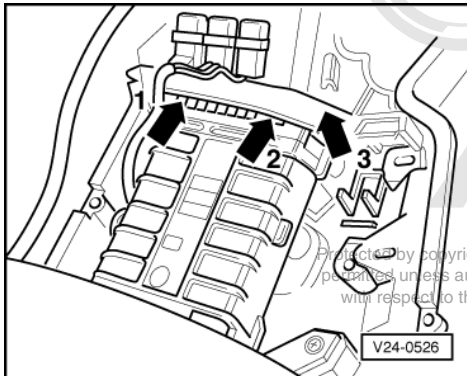
=> General Body Assembly; Repair group 70

- Pull back floor covering at front of right footwell (If necessary, cut open the perforated seam on the left with a knife).



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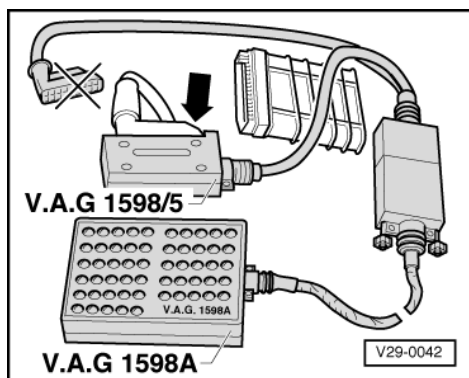
- -> Unscrew bolts -arrows- for electronics box cover.
- Carefully detach upper and lower sections of cover.



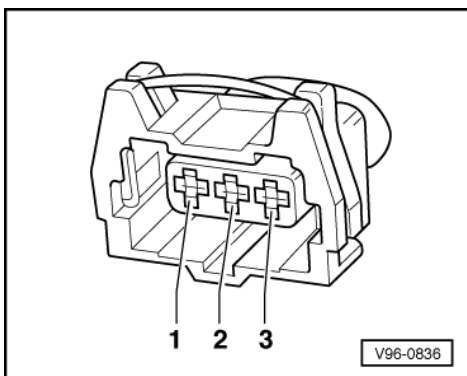
- -> Pull out cross strut -arrow 3- with attached parts.
- Screw out bolts -arrow 1- and -arrow 2-.
- Remove engine control unit.
- Disengage retaining clip and unplug control unit connector.

Note:

Always make sure that the ignition is switched off before unplugging or fitting the connector of the control unit for diesel direct injection system.



- -> With the ignition switched off, connect test box V.A.G 1598 A only to plug connection of the engine control unit (control unit remains disconnected) using adapter V.A.G 1598/5.



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



Vehicles with engine codes ABP and AAT up to 2nd control unit version1):

Connector Contact	Test box V.A.G 1598 A Socket
1	51
2	54
3	13

Vehicles with engine code AAT from 3rd control unit version1) and AEL:

Connector Contact	Test box V.A.G 1598 A Socket
1	54
2	13
3	51

1) Explanation of the control unit versions

=> Diesel Direct Injection and Glow Plug System (TDI, 5-cylinder); Repair group 01; Self diagnosis Self diagnosis

- Check for shorts between all the lines.
- Rectify any open/short circuit as necessary.
- If the wiring connection is OK, replace the engine control unit.

=> Diesel Direct Injection and Glow Plug System (TDI 5-cylinder); Repair group 23; Servicing diesel direct injection system

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2 - Servicing charge air system with turbocharger

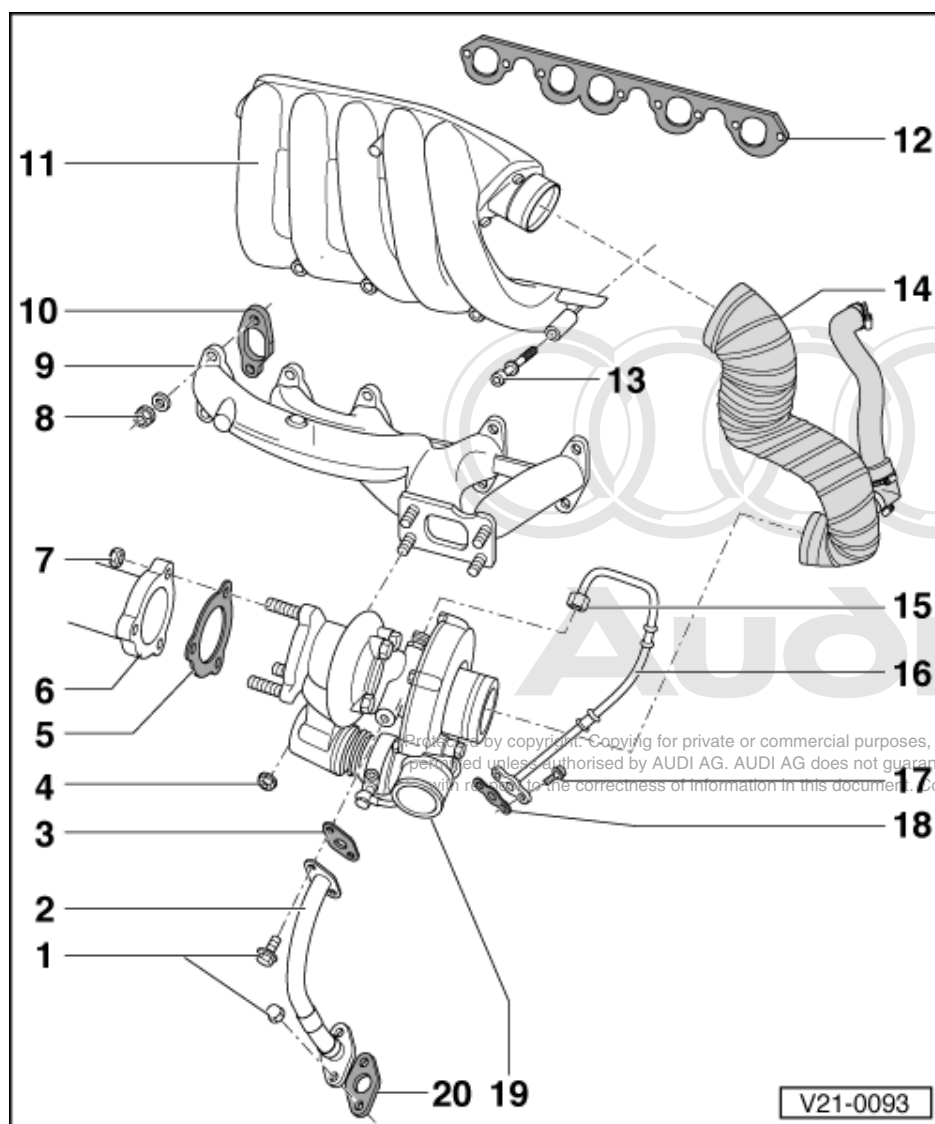
2.1 - Servicing charge air system with turbocharger

2.2 - Rules for cleanliness

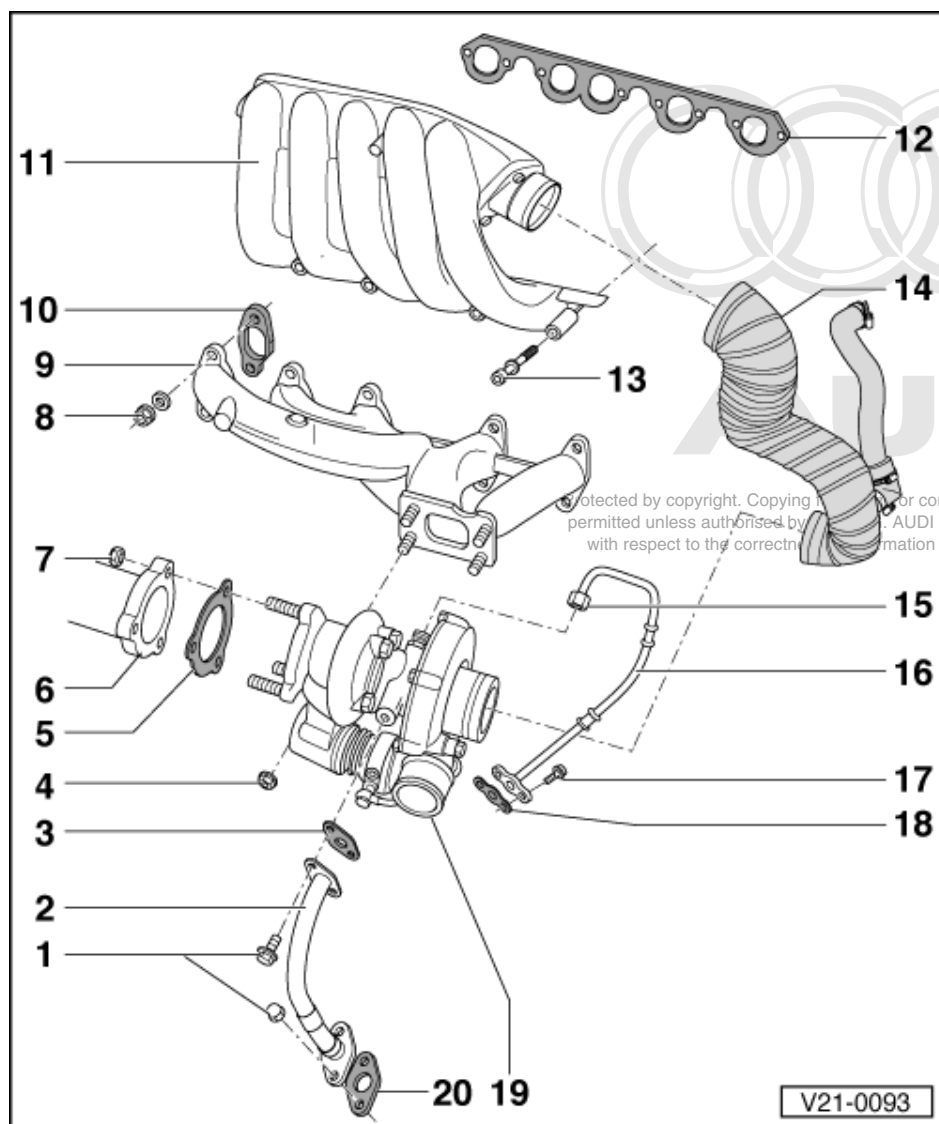
When working on the turbocharger, pay careful attention to the following "5 rules":

- ♦ Thoroughly clean all unions and the adjacent areas before disconnecting.
- ♦ Place removed parts on a clean surface and cover. Use lint-free cloths.
- ♦ Carefully cover or seal open components if repairs cannot be carried out immediately.
- ♦ Only install clean components:
Only remove replacement parts from packaging immediately prior to installation.
Do not use parts that have been stored loose (e.g. in toolboxes etc.).
- ♦ When the system is open:
Do not work with compressed air if this can be avoided.
Do not move vehicle unless absolutely necessary.

2.3 - Removing and installing turbocharger - overview



- 1 30 Nm
 - ♦ Replace
- 2 Oil return pipe
 - ♦ To cylinder block
- 3 Seal
 - ♦ Replace
- 4 60 Nm
- 5 Seal
 - ♦ Replace
- 6 Exhaust pipe
- 7 30 Nm
 - ♦ Replace



8 25 Nm

- ♦ Replace

9 Exhaust manifold

- ♦ For vehicles with engine codes AAT, AEL with connection for exhaust gas recirculation

10 Seal

- ♦ Replace
- ♦ Note installation position

11 Intake pipe

12 Seal

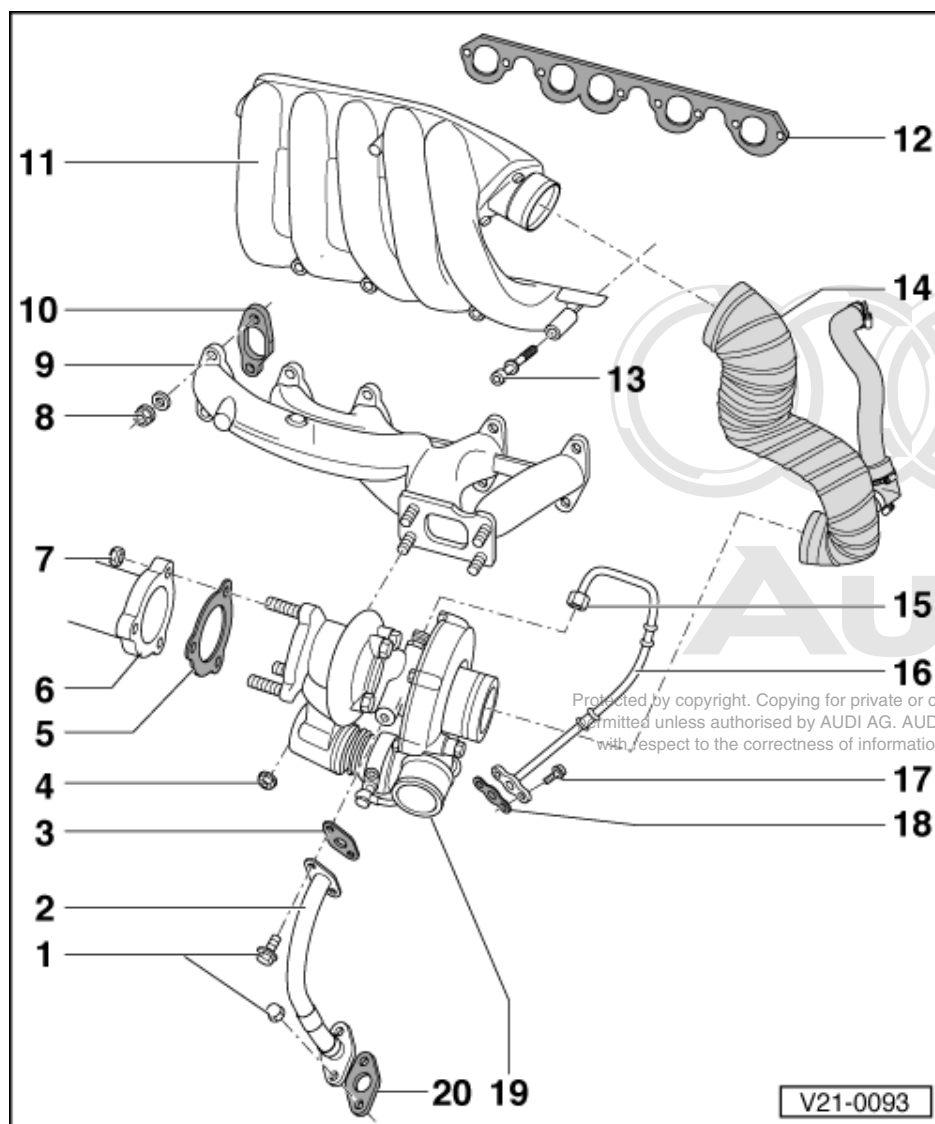
- ♦ Replace

13 20 Nm

14 Air duct hose

- ♦ Between intake manifold and charge air cooler (intercooler)

15 25 Nm



16 Oil supply pipe

- ♦ From oil filter bracket to turbocharger
- ♦ Fill with engine oil via the oil supply connection

17 10 Nm

18 Seal

- ♦ Replace

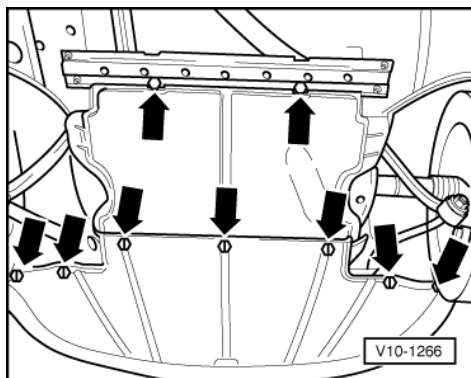
19 Turbocharger

- ♦ Checking => as of Page 153
- ♦ Removing and installing => Page 176
- ♦ Fill with engine oil via the oil supply connection

20 Seal

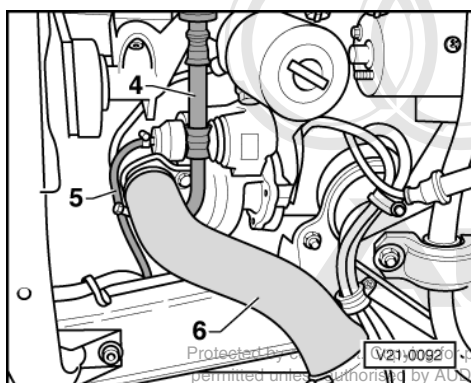
- ♦ Replace

2.4 - Removing and installing turbocharger

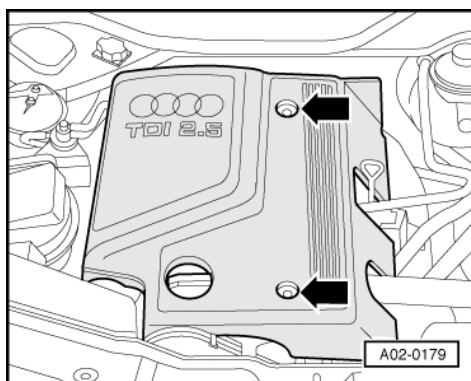


Removing

- -> Remove the noise insulation -arrows-.



- -> Disconnect hose -5- at vacuum unit for boost pressure control of turbocharger.
- Remove the air duct hose -6- from the charge air cooler to the turbocharger.
- Place drip container underneath to collect oil.
- Unscrew the oil return pipe -4- from the turbocharger.

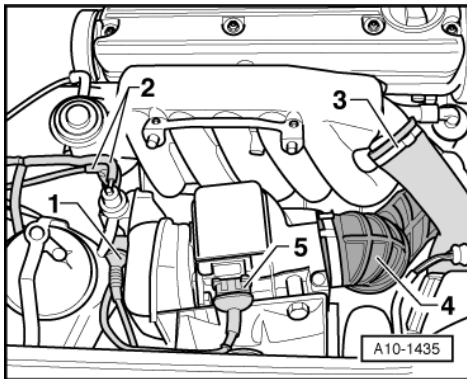


Audi A6:

- -> Remove engine cover -arrows-.

All models:

- Remove air duct to air cleaner at lock carrier.



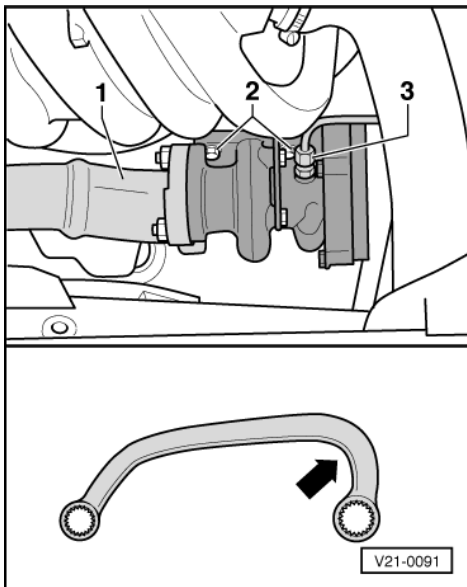
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Vehicles with engine codes AAT, AEL:

- -> Detach connector -5-.
- Detach connector -1- from the exhaust gas recirculation valve.
- Detach the hoses -2- from the exhaust gas recirculation valve.

All models:

- Remove air intake pipe -3- between charge air cooler and intake manifold.
- Remove the air duct hose -4- to turbocharger with the hose for crankcase vent.
- Remove the upper section of the air cleaner housing.



- -> Detach oil feed pipe -3- at turbocharger.
- Unbolt front exhaust pipe -1- from turbocharger connection.
- Unscrew front turbocharger/exhaust manifold nuts -2-.

Notes:

- ♦ For releasing the two rear nuts -2- on the turbocharger/exhaust manifold flange, a flat ring spanner 15 A/F must be bent to fit -arrow-.
- ♦ A flat ring spanner 15 A/F is suitable for releasing the nut at the top front.
- Remove turbocharger.



Installing

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

Notes:

- ♦ Always replace seals, gaskets and self-locking nuts.
- ♦ Coat threads and bolt head contact surface for turbocharger with high temperature lubricant. High-temperature lubricant:

=> Parts List

- ♦ Fill the turbocharger with engine oil via the oil supply connection.
- ♦ Secure all hose connections with the correct hose clamps (same as original equipment):

=> Parts List

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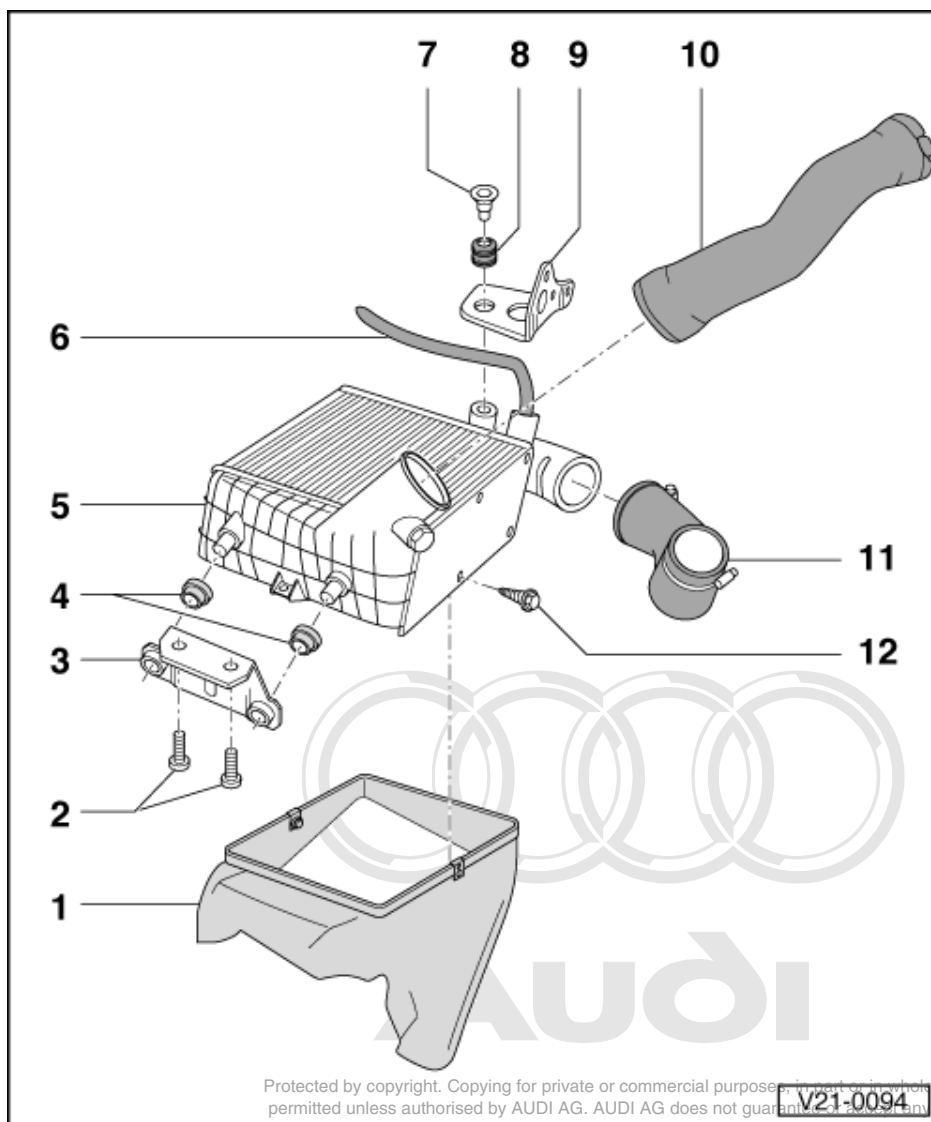
- ♦ Charge air system must be free of leaks.
- ♦ Hose connections and hoses for charge air system must be free of oil and grease before assembly. Lubricants must never be used.
- ♦ After installing the turbocharger, run engine for approx. 1 minute at idling speed; do not rev. up immediately. This ensures the turbocharger is properly lubricated.

- Check oil level => Page **128**

Tightening torques

Component	Nm
Turbocharger to exhaust manifold	60
Front exhaust pipe to turbocharger	30
Oil return pipe to turbocharger	30
Oil supply pipe to turbocharger	25
Hose clamps for air duct hoses	3.5

2.5 - Removing and installing parts of charge air cooling system





Notes:

- ◆ Secure all hose connections with the correct hose clamps (same as original equipment):

=> Parts List

- ◆ Charge air system must be free of leaks.
- ◆ Hose connections and hoses for charge air system must be free of oil and grease before assembly. Lubricants must never be used.

1 Air duct

2 20 Nm

3 Angle bracket, front

4 Rubber grommet

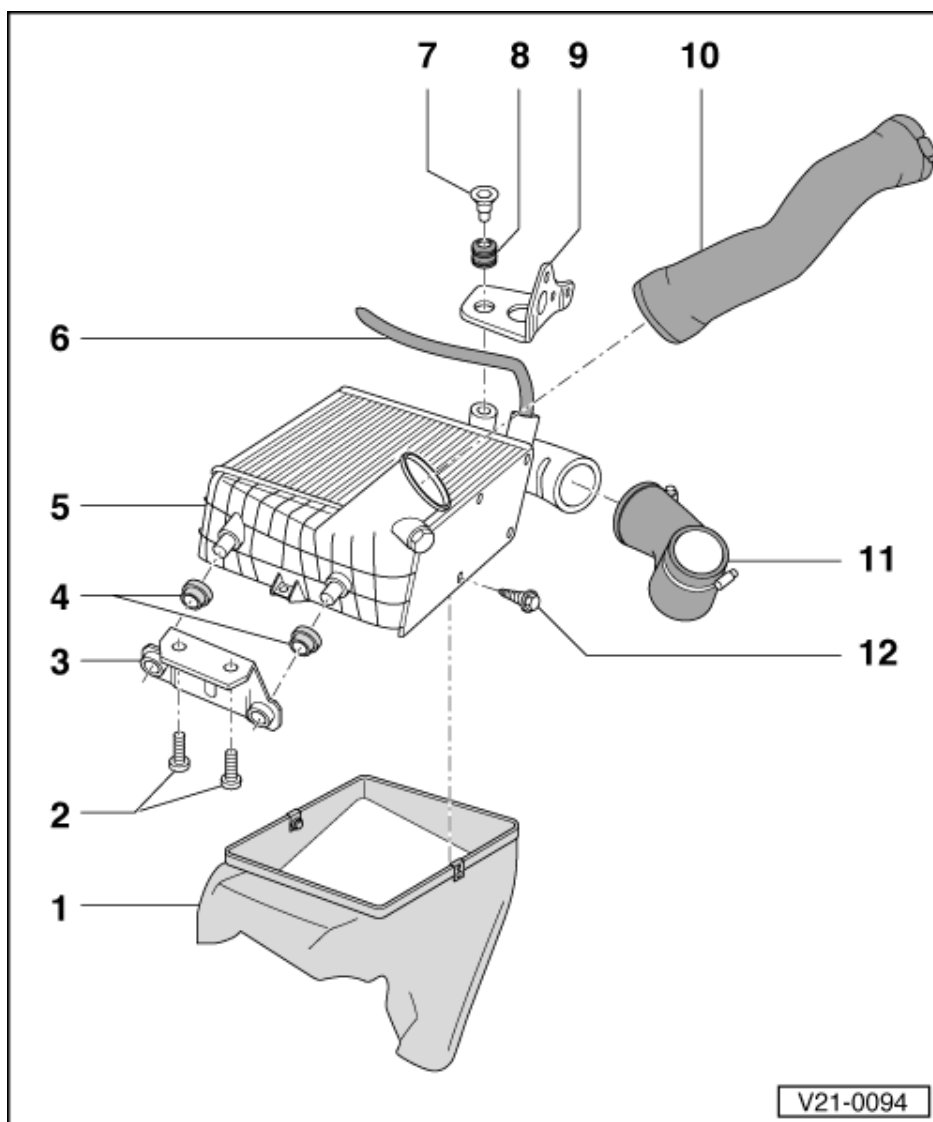
- ◆ for front angle bracket

5 Intercooler

- ◆ Removing and installing =>Page **182**



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6 Vacuum line

- ♦ For vehicles with engine codes AAT, AEL only
- ♦ Boost pressure control solenoid valve -N75



- ♦ must not be shortened or lengthened
- ♦ use same length and internal diameter when replacing:

=> Parts List

7 Cheese-head bolt, 20 Nm

- ♦ With collar

8 Rubber grommet

- ♦ For rear angle bracket

9 Angle bracket, rear

10 Air duct hose

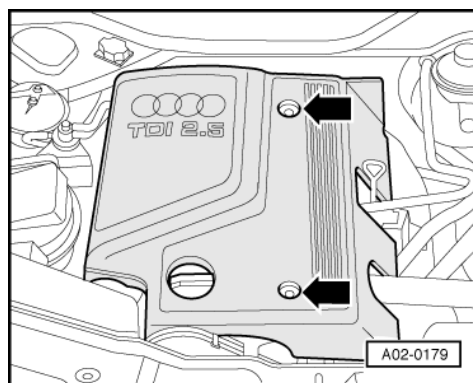
- ♦ Between intake manifold and charge air cooler (intercooler)

11 Air duct hose

- ♦ Between charge air cooler and turbocharger

12 Self-tapping screw

2.6 - Removing and installing charge air cooler (intercooler)



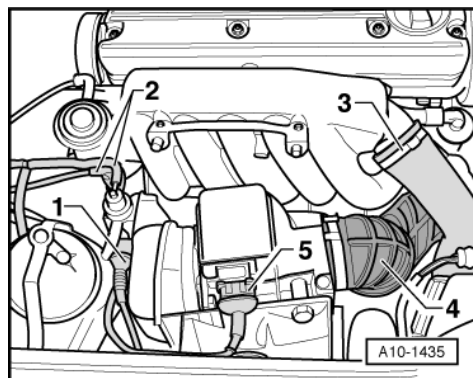
Removing

Audi A6:

- -> Remove engine cover-arrows-.

All models:

- Remove air duct to air cleaner at lock carrier.



Audi

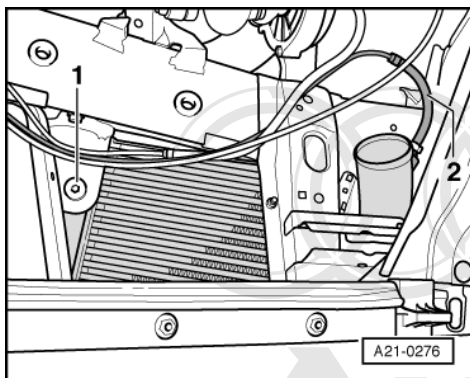
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Vehicles with engine codes AAT, AEL:

- -> Detach connector-5-
- Detach connector-1- from the exhaust gas recirculation valve.
- Detach the hoses -2- from the exhaust gas recirculation valve.

All models:

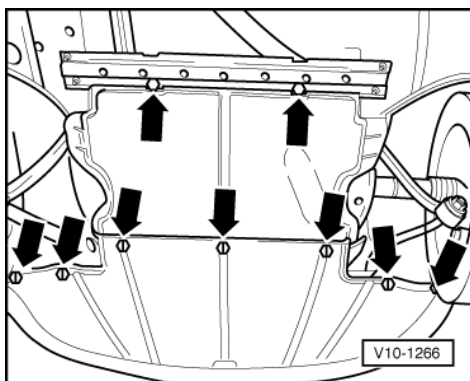
- Remove air intake pipe -3- between charge air cooler and intake manifold.
- Remove the air duct hose -4- to turbocharger with the hose for crankcase vent.
- Remove the upper and lower section of the air cleaner housing.



- -> Unscrew bolt -1-.

Vehicles with engine codes AAT, AEL:

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- Carefully detach the hose -2- from the solenoid valve for boost pressure limitation.

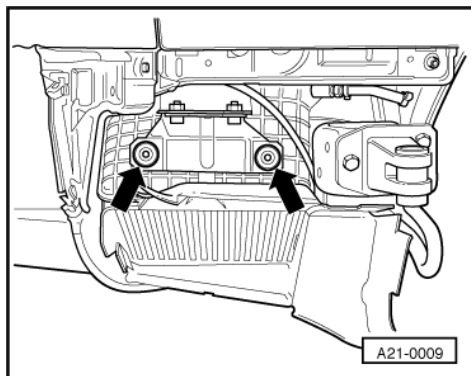


All models:

- -> Remove the front part of noise insulation -bottom arrows-.
- Remove the front bumper:

=> General Body Assembly; Repair group 63; Front bumper Front bumper

- Unscrew air duct on charge air cooler.
- Disconnect the thin hose to rear oil separator at the charge air cooler.
- Remove the air duct hose to the turbocharger at the charge air cooler.
- Lay wiring and hoses aside.



- -> Pull front charge air cooler out of rubber bearings -arrows-.
- Take out charge air cooler from underneath.

Installing

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

Notes:

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

=> Parts List

- ♦ Charge air system must be free of leaks.
- ♦ Hose connections and hoses for charge air system must be free of oil and grease before assembly. Lubricants must never be used.

Tightening torques

Component	Nm
Charge air cooler to bracket	20
Hose clamps for air duct hoses	3,5

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26 - Exhaust system

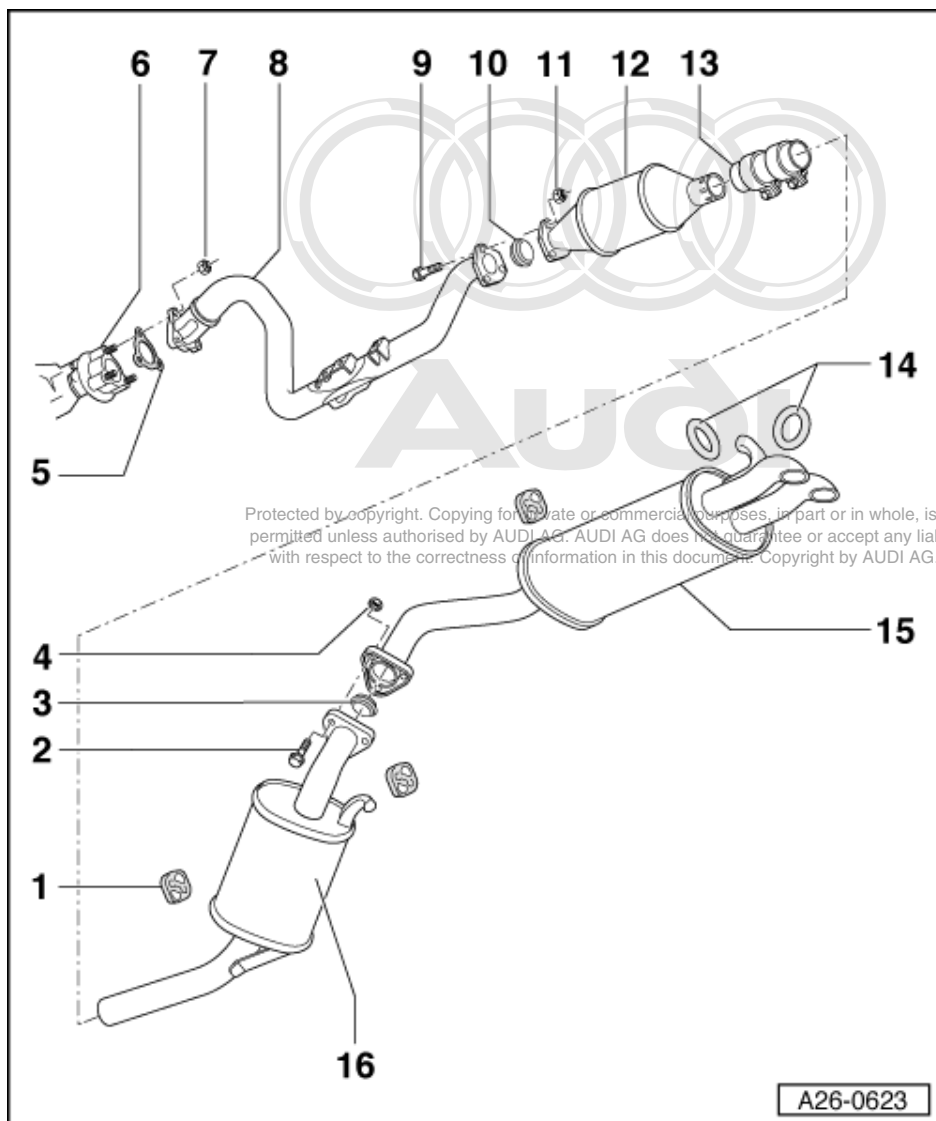
1 - Removing and installing parts of exhaust system

1.1 - Removing and installing parts of exhaust system

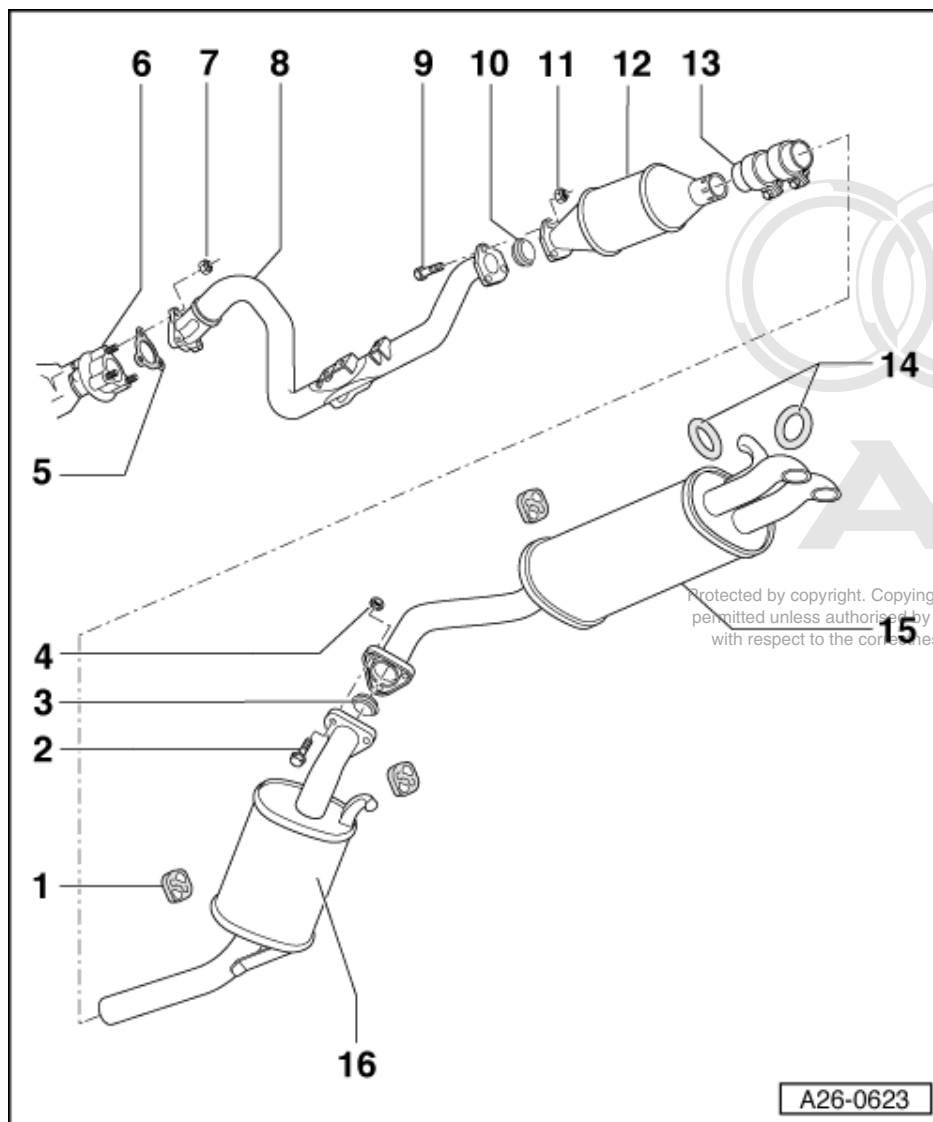
Notes:

- ◆ Always replace 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 body. If necessary, loosen clamp and align silencer and exhaust pipe so that sufficient clearance is maintained to the body at all points and the support rings are evenly loaded.
- ◆ Removing and installing floor cross member => Fig. 200

1.2 - Vehicles with front-wheel drive



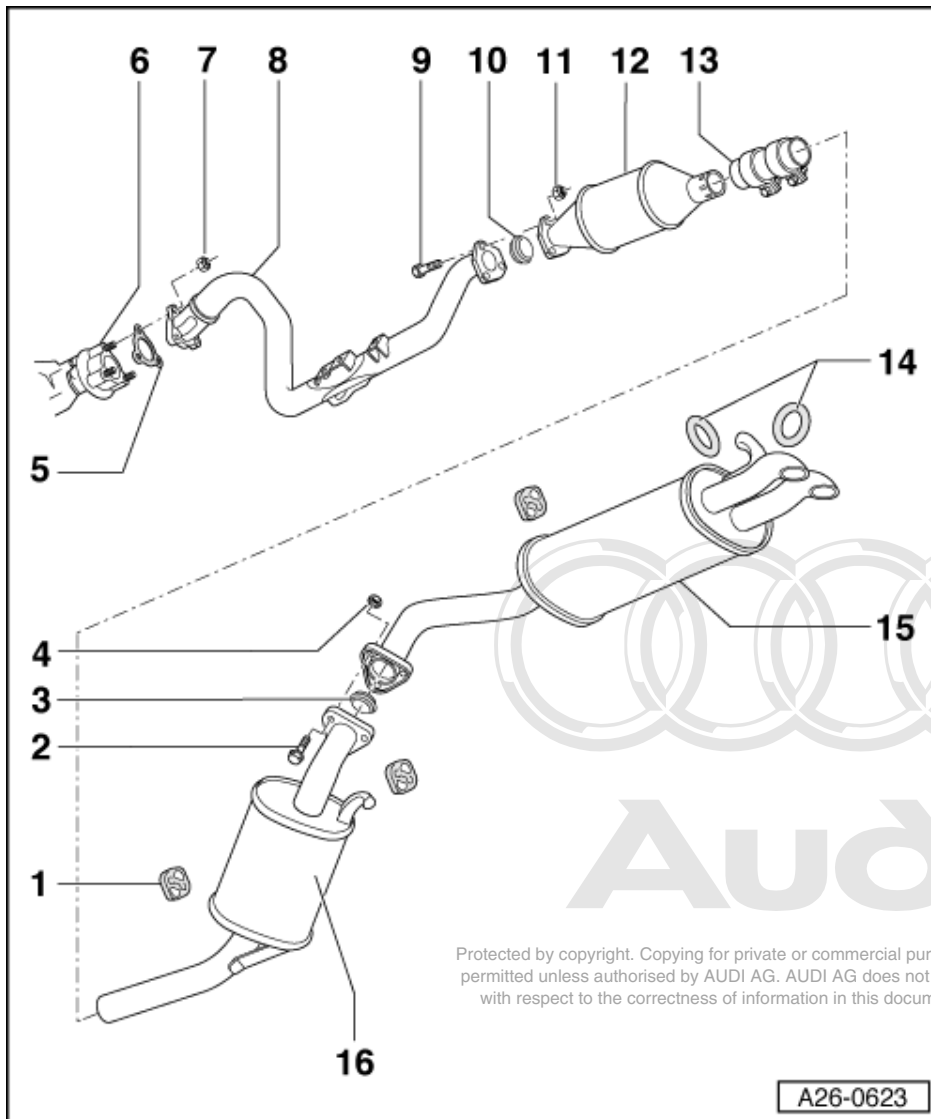
- 1 Retainer
 - ♦ Replace if damaged
 - ♦ Bending over securing tabs => Fig. 189
- 2 25 Nm
- 3 Sealing ring
 - ♦ Sensitive to impact; take care not to drop
- 4 25 Nm
 - ♦ Replace
- 5 Seal
 - ♦ Replace
- 6 Turbocharger
- 7 30 Nm
 - ♦ Replace



- 8 Front exhaust pipe
 - ♦ Different versions

=> Parts List

- ♦ For vehicles with engine codes ABP, long version
- ♦ For vehicles with engine codes AAT, AEL, short version
- ♦ Components of mounting for vehicles with manual gearbox => Fig. 190



15 Rear silencer

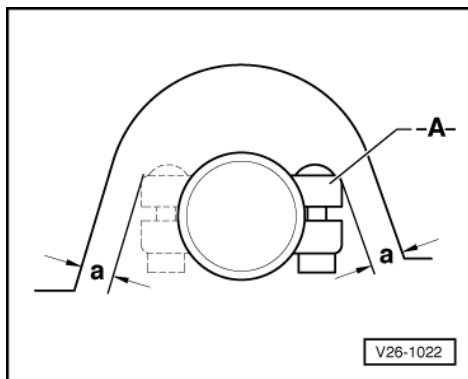
- ♦ Align exhaust system so it is free of stress before tightening clamp => Page 192

16 Centre silencer

- ♦ Different versions

=> Parts List

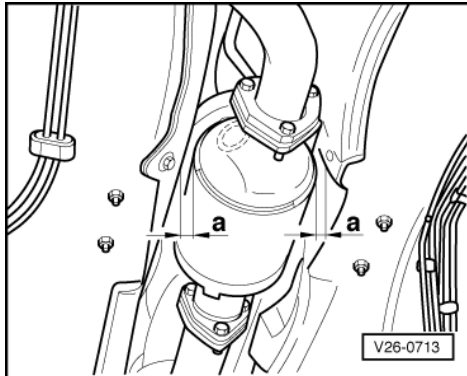
- ♦ In the case of repairs, replace centre silencer - Vehicles with engine codes AAT => Fig. 192
- ♦ Align exhaust system so it is free of stress before tightening clamp => Page 192



-> Fig.1 Installation position of the clamping sleeve

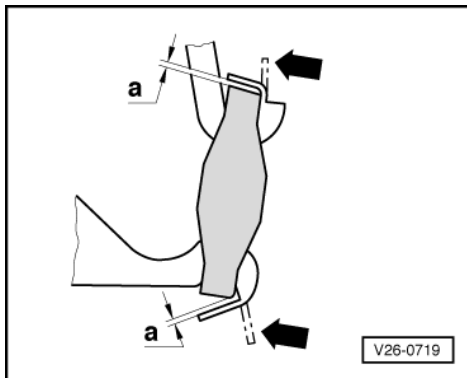
Align clamping sleeve as follows:

- Bolted connection -A- may point to the left or the right.
- Dimension a = 19...23 mm



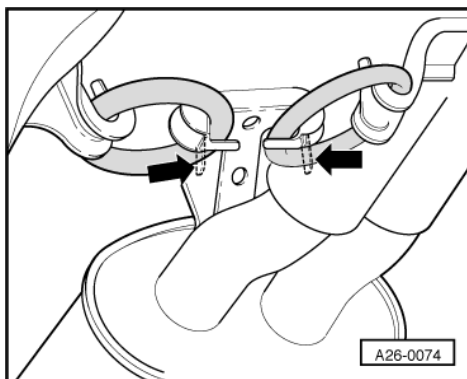
-> Fig.2 Installation position of the catalytic converter

- The arrow on the housing of the catalytic converter points to the rear.
- Align catalytic converter so that distance -a- on the left is the same as the distance -a- on the right.



-> Fig.3 Bending over securing tabs on brackets of front mounting

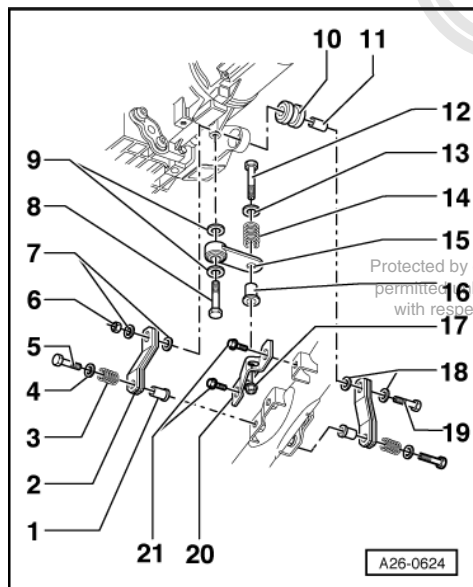
- Centre and rear silencers
- After installing the exhaust system, bend over the securing tabs -arrows- approx. 90°.
- Ensure that a distance corresponding to dimension -a- is maintained between retainer and securing tab.
 - Dimension a = 2 mm



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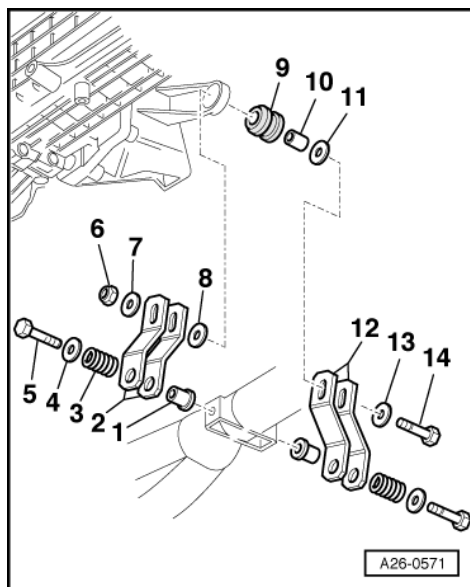
-> Fig.4 Bending over securing tabs on brackets of rear mounting

- Rear silencer
- After installing the exhaust system, bend over the securing tabs -arrows- approx. 90°.



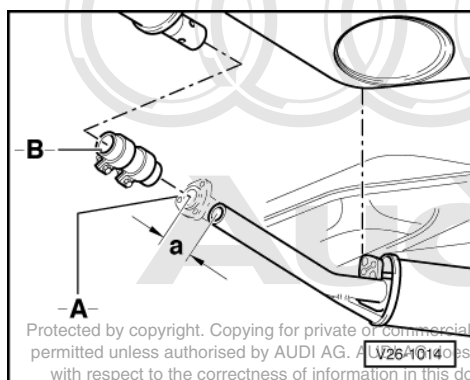
-> Fig.5 Individual parts of mounting for vehicles with manual gearbox

- 1 - Spacer
- 2 - Link
- 3 - Pressure spring
- 4 - Plate
- 5 - Bolt - 25 Nm
- 6 - Nut, self-locking - 25 Nm
- 7 - Plate
- 8 - Bolt - 25 Nm
- 9 - Plate
- 10 - Buffer
- 11 - Tubular spacer
- 12 - Bolt - 25 Nm
- 13 - Plate
- 14 - Pressure spring
- 15 - Link
- 16 - Spacer
- 17 - Nut, self-locking - 25 Nm
- 18 - Plate
- 19 - Bolt - 25 Nm
- 20 - Bracket
- 21 - Bolt - 25 Nm



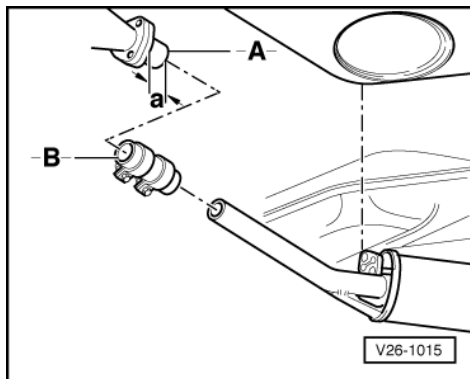
-> Fig.6 Individual parts of mounting for vehicles with automatic gearbox

- 1 - Spacer
- 2 - Retaining lugs
- 3 - Pressure spring
- 4 - Plate
- 5 - Bolt - 25 Nm
- 6 - Nut, self-locking - 25 Nm
- 7 - Plate
- 8 - Plate
- 9 - Buffer
- 10 - Tubular spacer
- 11 - Plate
- 12 - Retaining lugs
- 13 - Plate
- 14 - Bolt - 25 Nm



-> Fig.7 Replacing catalytic converter - Vehicles with engine codes AAT

- Catalytic converter new/centre silencer old
- Detach the flange -A- on the centre silencer as shown in the figure.
 - Dimension a = 102 mm
- Install the double pipe clamp -B- horizontally and tighten the nuts to 40 Nm.

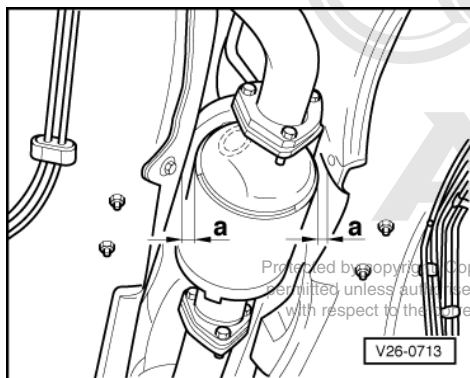


-> Fig.8 Replacing centre silencer - Vehicles with engine codes AAT

- Centre silencer new/catalytic converter old
- Fit the intermediate flange -A- on the catalytic converter as shown in the figure.
 - Plug-on dimension of double pipe clamp $a = 45 \text{ mm}$
- Install the double pipe clamp -B- horizontally and tighten the nuts to 40 Nm.

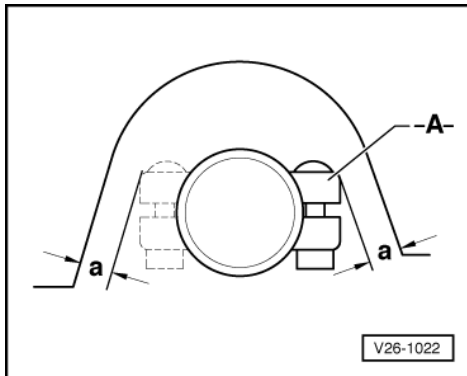
1.3 - Stress-free alignment of the exhaust system - Vehicles with front wheel drive

- Front floor cross member removed => Fig. 200
- Centre and rear silencers installed.
- Mountings for exhaust system to gearbox installed => Fig. 191
- Release the following bolted connections to the point at which the relevant exhaust system components can move in relation to each other:
 - Flange for front exhaust pipe/catalytic converter or centre silencer
 - Clamp, where applicable
 - Flange between centre and rear silencers



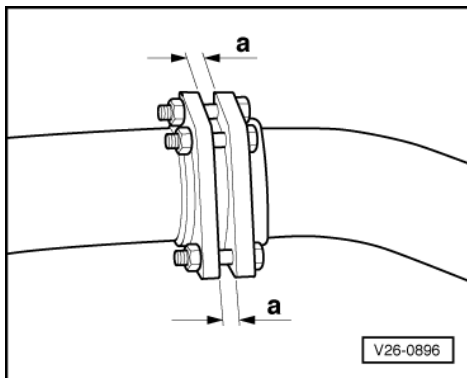
Vehicles with engine codes AAT, AEL:

- -> Align catalytic converter so that distance -a- on the left is the same as distance -a- on the right.

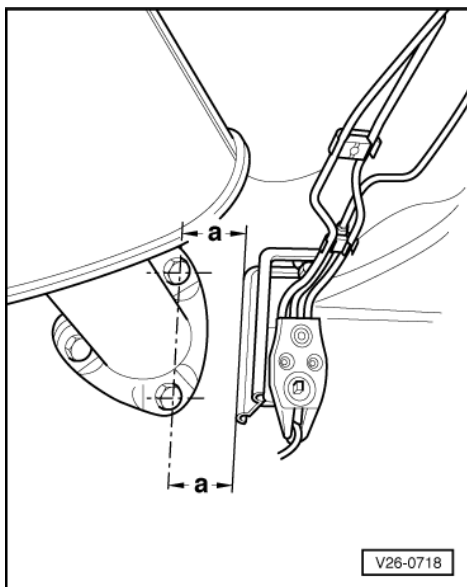


Align clamping sleeve as follows:

- -> Bolted connection -A- may point to the left or the right.
- Distance a = 19...23 mm



- -> Tighten bolted connection on front exhaust pipe/catalytic converter flange (25 Nm). The flange projections must be the same distance apart all the way round.
- Dimension a = dimension a

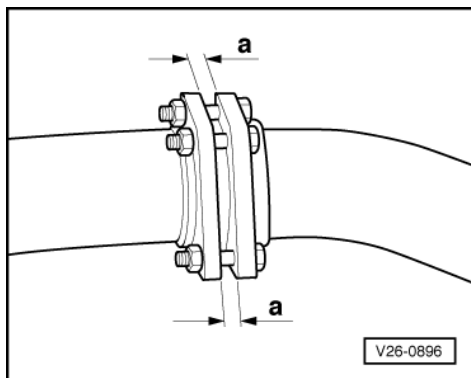


All models:

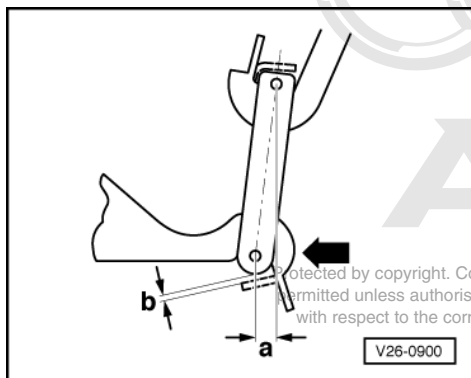
- -> Check that the bolted connections on the flange between centre and rear silencer are parallel to the brake pressure regulator bracket.



- Dimension a at bottom = dimension a at top
- Tighten bolted connections at flange between centre and rear silencers (25 Nm).



- -> Tighten the catalytic converter or front exhaust pipe/centre silencer flange connection (25 Nm). The flange projections must be the same distance apart all the way round.
- Dimension a = dimension a



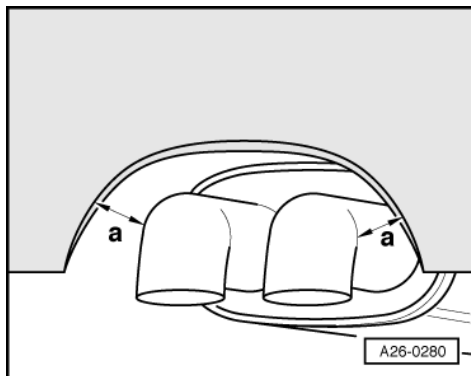
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Vehicles with engine codes AAT, AEL:

- -> Push exhaust system towards front of vehicle until rear mounting of centre silencer is preloaded by a = 7...9 mm.
- Tighten bolted connections on clamp evenly to 40 Nm.

Notes:

- ♦ The securing tabs at the brackets should be bent over about 90° after installing the retainers.
- ♦ The distance -b- between the retainer and the locking tabs should be at least 2 mm.

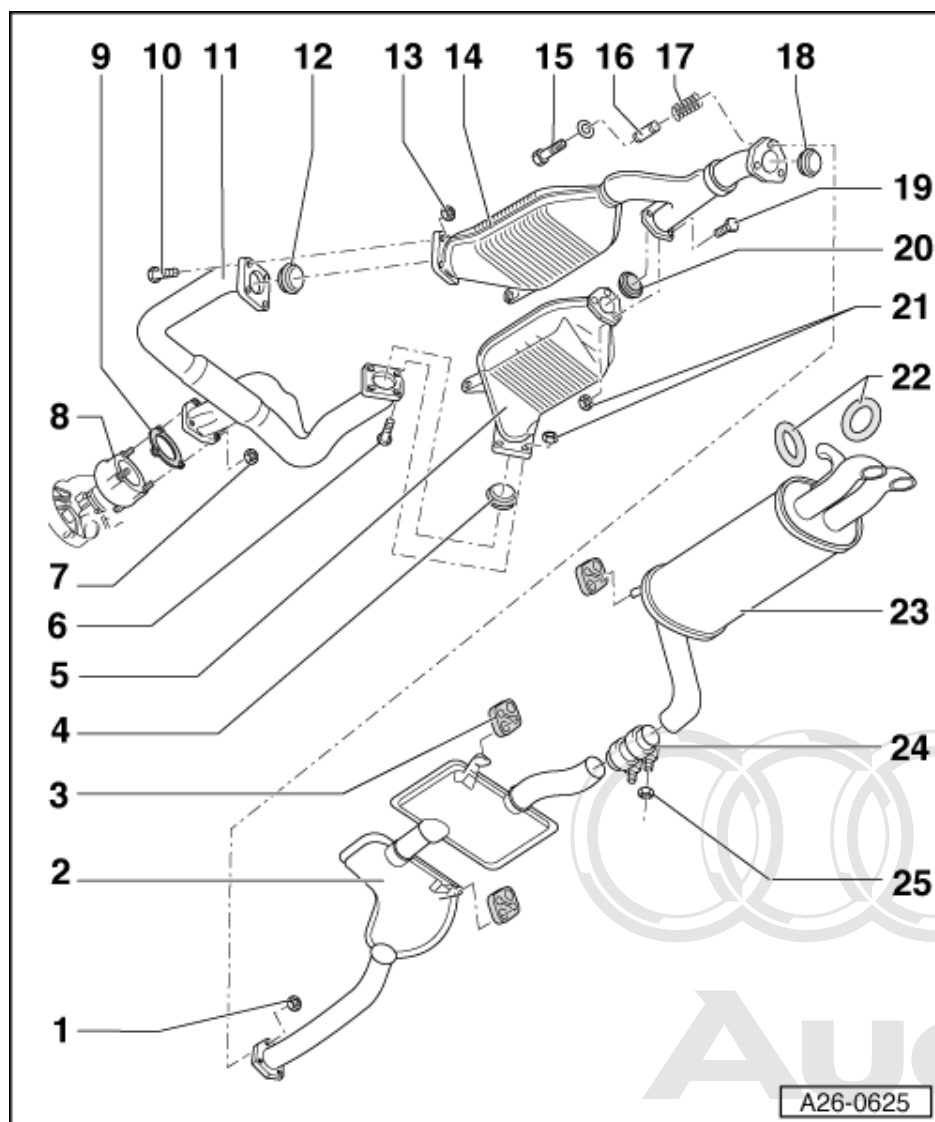


All models:

Aligning tailpipes

- -> Align tailpipes so that distance -a- is the same on both sides.

1.4 - Vehicles with four-wheel drive

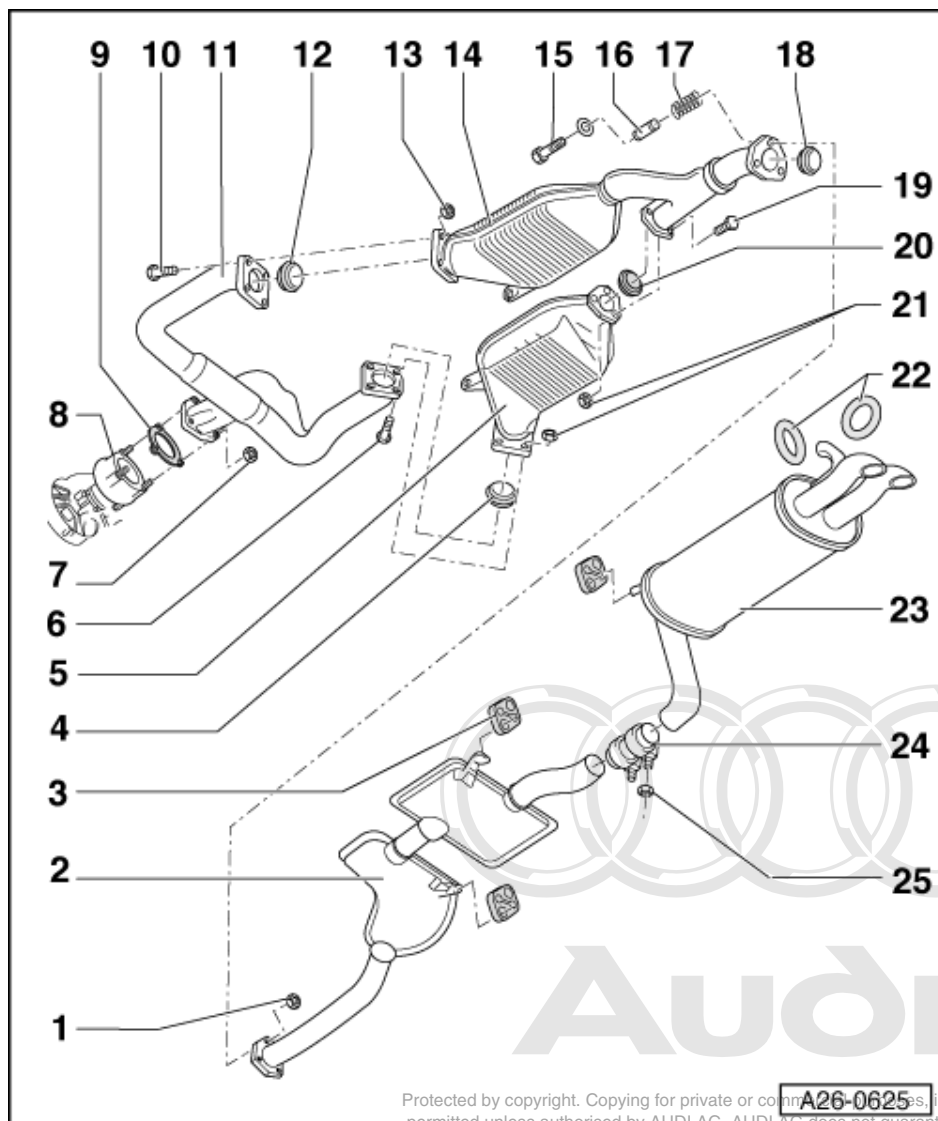


- 25 Nm**
 - ◆ Replace
- Centre silencer**
 - ◆ Centre and rear silencers are one unit as original equipment. In cases of repair renew individually
 - ◆ Cutting point => Page 200
 - ◆ Align exhaust system so it is free of stress before tightening clamp => Page 201
- Retainer**
 - ◆ Replace if damaged
 - ◆ Bending over securing tabs => Fig. 199
- Sealing ring**

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- ♦ Sensitive to impact; take care not to drop



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5 Catalytic converter

- ♦ For right side of vehicle
- ♦ Protect from damage by knocks and impact
- ♦ Components of mounting => Fig. 199
- ♦ Align exhaust system so it is free of stress before tightening clamp => Page 201

6 25 Nm

7 30 Nm

- ♦ Replace

8 Turbocharger

9 Seal

- ♦ Replace

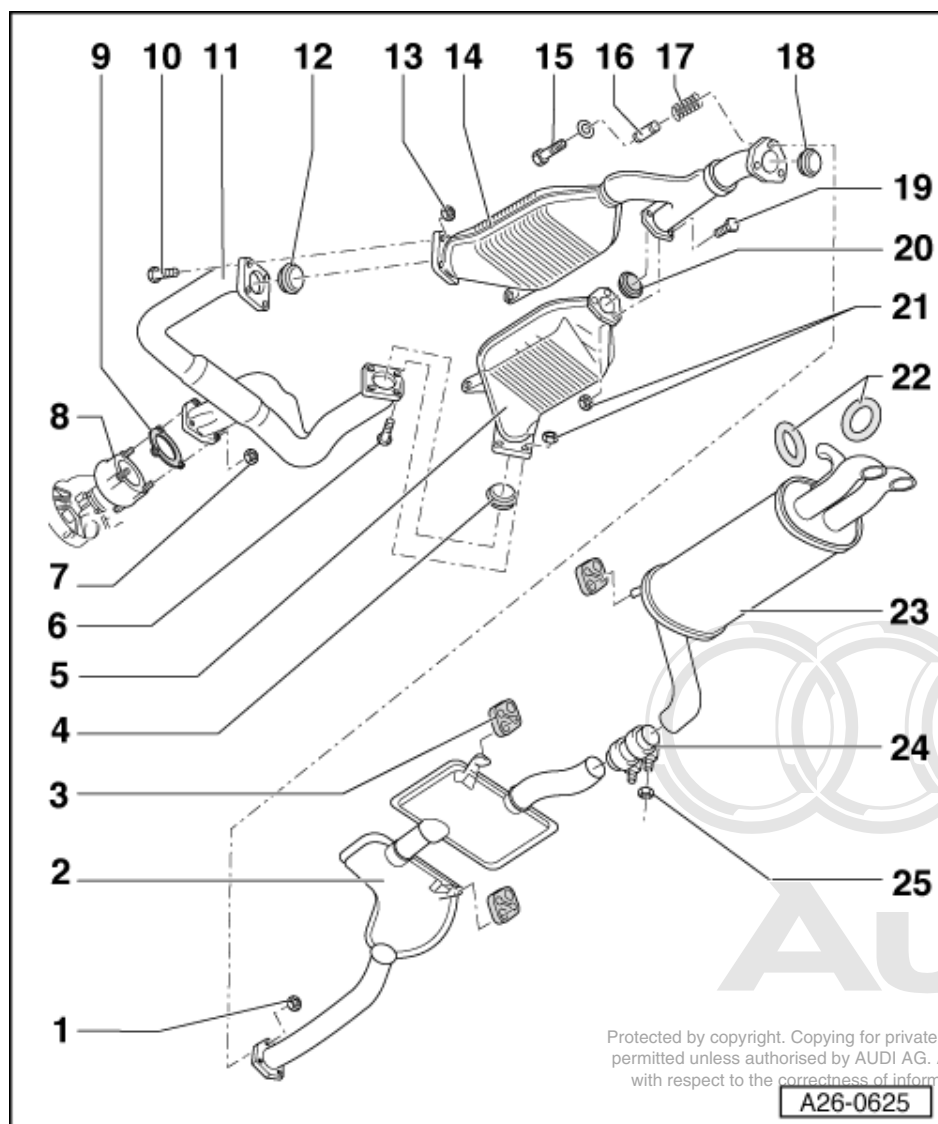
10 25 Nm

11 Front exhaust pipe

- ♦ Installation position: horizontal

12 Sealing ring

- ♦ Sensitive to impact; take care not to drop

**13 25 Nm**

- ♦ Replace

14 Catalytic converter

- ♦ for left side of vehicle
- ♦ Protect from damage by knocks and impact
- ♦ Components of mounting => Fig. 199
- ♦ Align exhaust system so it is free of stress before tightening clamp => Page 201

15 25 Nm**16 Spacer tube****17 Spring****18 Sealing ring**

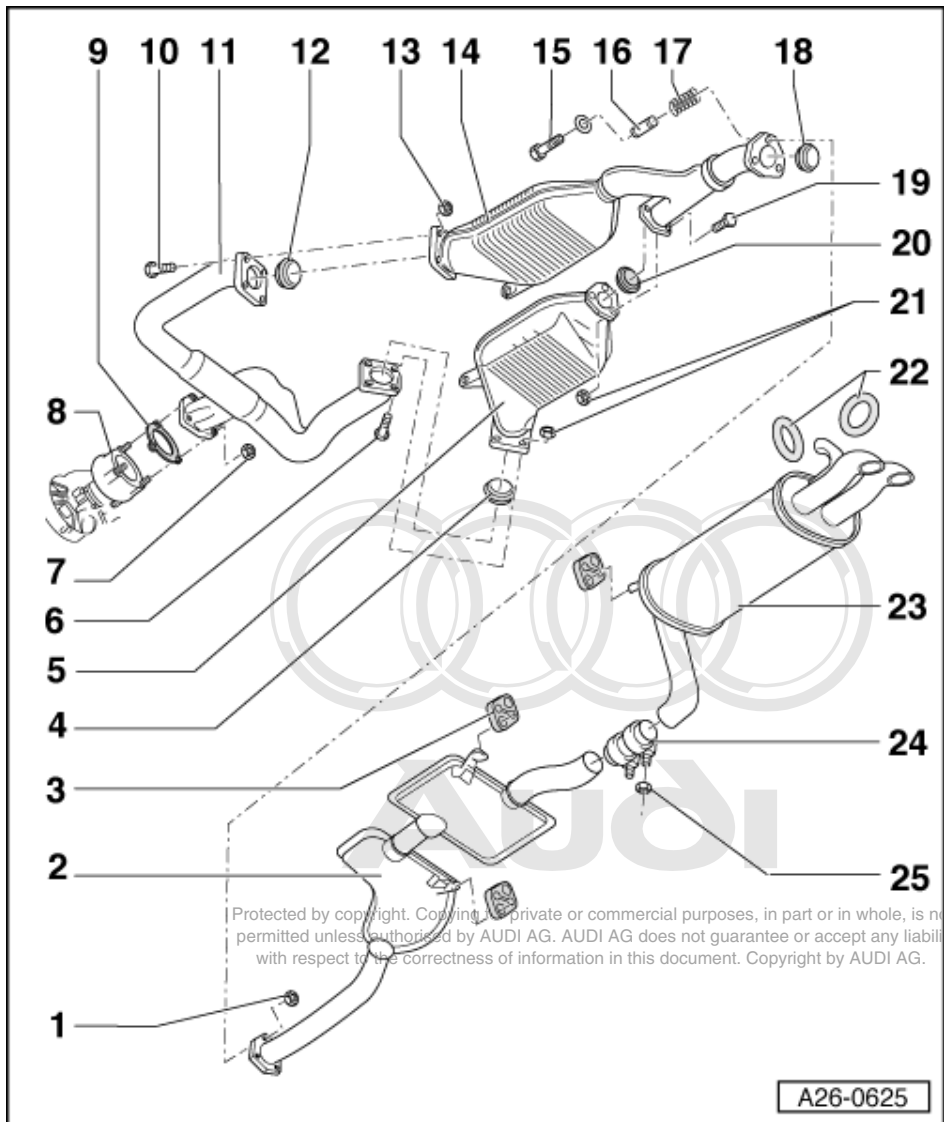
- ♦ Sensitive to impact; take care not to drop

19 25 Nm**20 Sealing ring**

- ♦ Sensitive to impact; take care not to drop

21 25 Nm

- ♦ Replace



22 Retaining ring

- ♦ Replace if damaged
- ♦ Bending over securing tabs => Fig. 200

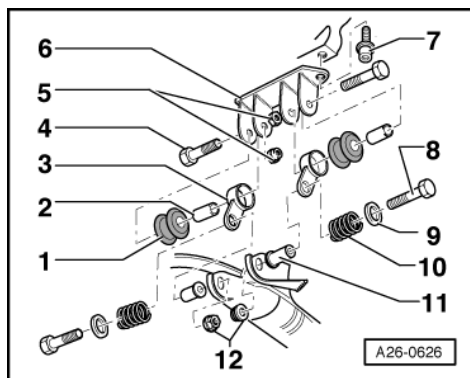
23 Rear silencer

- ♦ Rear and centre silencer are one unit as original equipment. In cases of repair renew individually
- ♦ Cutting point => Page 200
- ♦ Align exhaust system so it is free of stress before tightening clamp => Page 201

24 Rear clamping sleeve

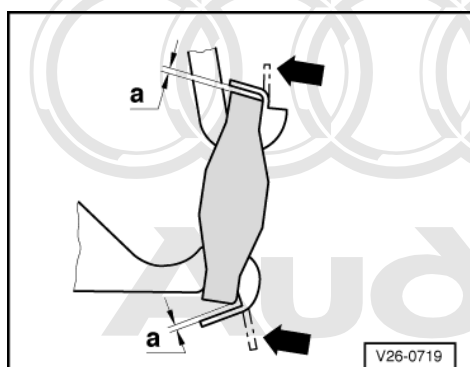
- ♦ Installation position => Page 202
- ♦ Align exhaust system so it is free of stress before tightening clamp => Page 201
- ♦ Tighten bolted connections evenly to 40 Nm

25 40 Nm



-> Fig.1 Components of front mounting for catalytic converters

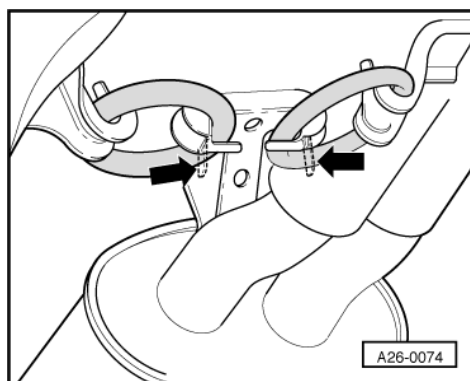
- 1 - Buffer
- 2 - Tubular spacer
- 3 - Link
- 4 - Bolt - 25 Nm
- 5 - Nut, self-locking - 25 Nm
- 6 - Bracket
- 7 - Combi screw - 25 Nm
- 8 - Bolt - 25 Nm
- 9 - Plate
- 10 - Pressure spring
- 11 - Spacer
- 12 - Nut, self-locking - 25 Nm



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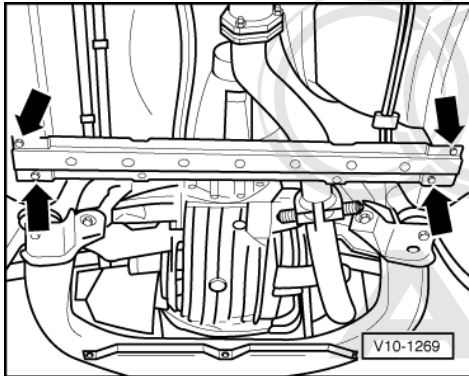
-> Fig.2 Bending over securing tabs on brackets of front mounting

- Centre and rear silencers
- After installing the exhaust system, bend over the securing tabs -arrows- approx. 90°.
- Ensure that a distance corresponding to dimension -a- is maintained between retainer and securing tab.
 - Dimension a = 2 mm



-> Fig.3 Bending over securing tabs on brackets of rear mounting

- Rear silencer
- After installing the exhaust system, bend over the securing tabs -arrows- approx. 90°.

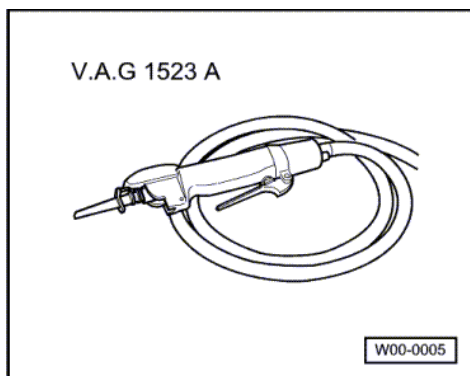


-> Fig.4 Removing and installing floor cross member

- ♦ Tightening torque: 20 Nm

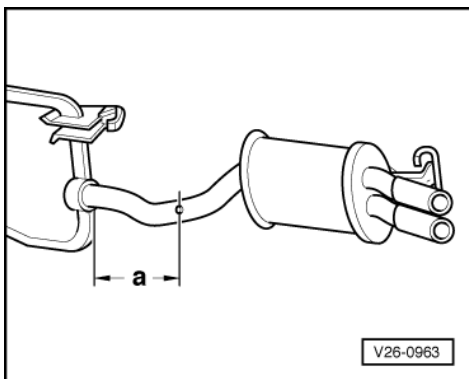
1.5 - Separating centre and rear silencers - Vehicles with four-wheel drive

- ♦ The connecting pipe can be cut through at the cutting point in order to replace 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 saw V.A.G 1523 A
- ♦ Protective goggles



Procedure

Important
Wear protective goggles.

- -> Cut through exhaust pipe at right angles at specified cutting point using body saw e.g. V.A.G 1523 A.
- ♦ The cutting point is marked with an indentation on the outside of the exhaust pipe.

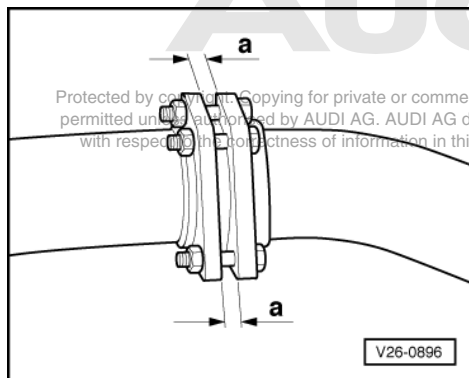
Note:

A short clamp is provided for connecting the main and rear silencers when performing repairs.

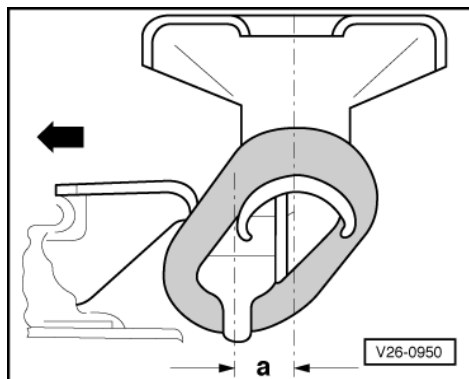
- When installing, position clamping sleeve centrally over saw cut.
 - Installation position of clamp => Page 26-26
- Stress-free alignment of exhaust system => Page 201
- Tighten bolted connections on clamp evenly to 40 Nm.

1.6 - Stress-free alignment of exhaust system - Vehicles with four-wheel drive

- Front floor cross member removed => Fig. 200
- Centre and rear silencers installed.
- Mountings for exhaust system to gearbox installed => Fig. 199
- Release the following bolted connections to the point at which the relevant exhaust system components can move in relation to each other:
 - Flange at catalytic converters and front exhaust pipe
 - Flange between catalytic converter and centre silencer
 - Clamping sleeve, where fitted



- -> Tighten flange on left and right in sequence (25 Nm). The flange projections must be the same distance apart all the way round.
 - Dimension a = dimension a



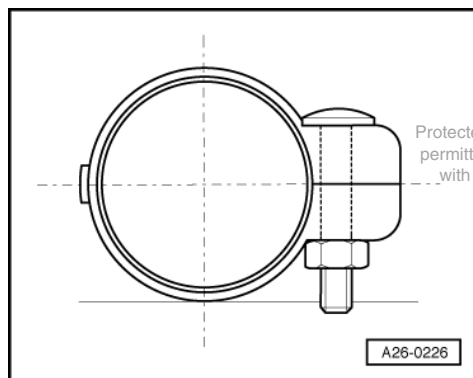


Vehicles with clamp between centre and rear silencers:

Note:

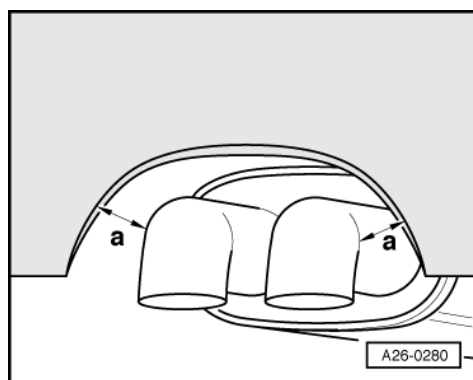
It is only necessary to additionally align the rear silencer on vehicles with a clamping sleeve between the centre silencer and the rear silencer.

- -> Push rear silencer towards front of vehicle -arrow- until rear mounting on rear silencer is preloaded by $a = 12...14$ mm.



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- -> Note installation position of clamp at rear:
 - Bolted connection faces right
- Tighten bolted connections on clamp evenly to 40 Nm.



All models:

Aligning tailpipes

- -> Align tailpipes so that distance -a- is the same on both sides.

1.7 - Check exhaust system for leaks

- Start engine and run at idling speed.
- Plug the tailpipe(s) (e. g. with rags or stoppers) and leave plugged until leak check is complete.
- Listen for noise at the connection points (cylinder head/manifold, manifold/turbocharger, turbocharger/catalytic converter, etc.) to locate any leaks.
- Rectify any leaks that are found.

2 - Exhaust gas recirculation system - engine codes AAT, AEL

2.1 - Exhaust gas recirculation system - engine codes AAT, AEL

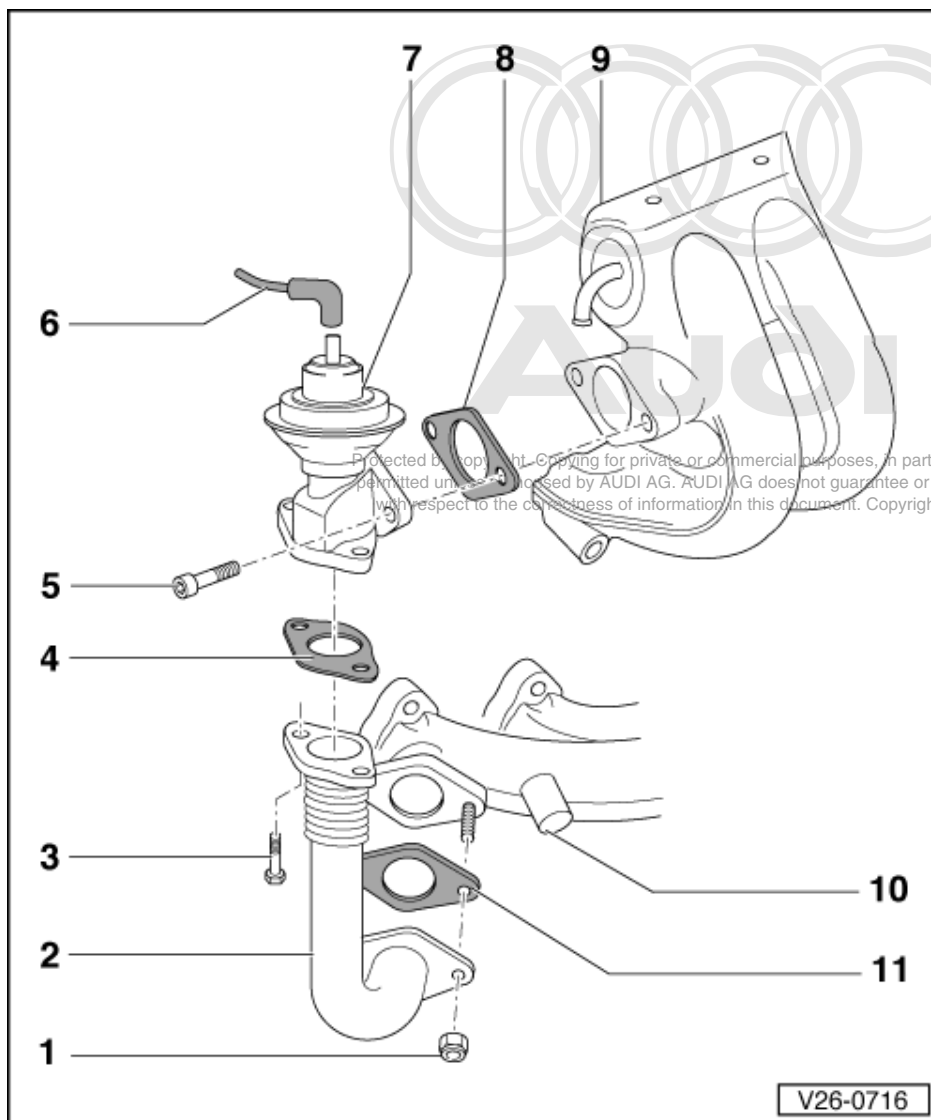
Notes:

- ◆ Actuation of the exhaust gas recirculation system is performed by diesel direct injection system control unit (-J248) via exhaust gas recirculation valve (-N18) to mechanical exhaust gas recirculation valve.
- ◆ The tapered plunger in the mechanical exhaust gas recirculation valve varies the opening cross section according to valve travel.
- ◆ Every conceivable valve position is possible through pulsed actuation.
- ◆ Secure all hose connections with the correct hose clamps (same as original equipment):

=> Parts List

- ◆ Always replace seals, gaskets and self-locking nuts.

2.2 - Removing and installing exhaust gas recirculation components



- 1 20 Nm
- ◆ Replace

2 Pipe for exhaust gas recirculation

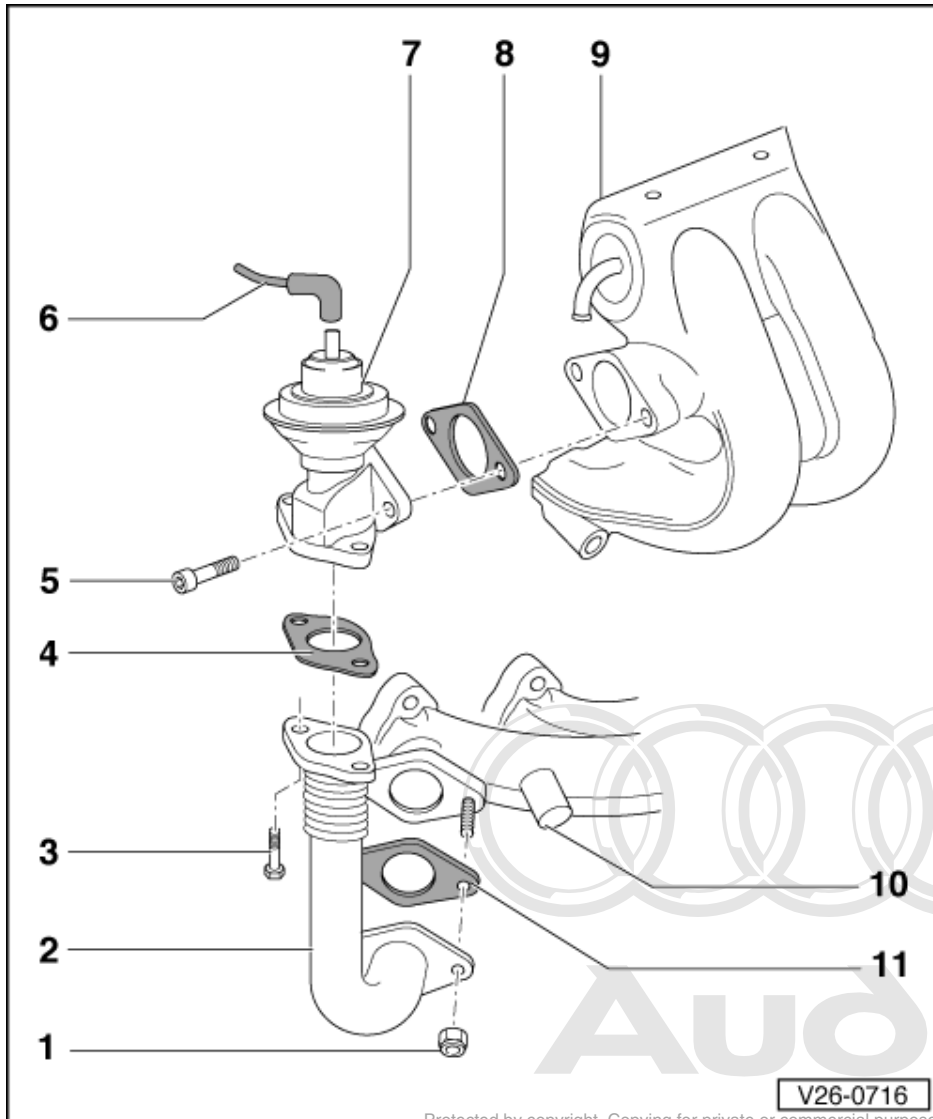
- ♦ When removing, slightly tighten all bolted connections (parts can still move freely with respect to one another). Only then tighten without tension

3 20 Nm

4 Seal

- ♦ Replace

5 20 Nm



6 Vacuum hose

- ♦ To exhaust gas recirculation valve -N18

7 Mechanical EGR valve

- ♦ Checking => Page 206

8 Seal

- ♦ Replace

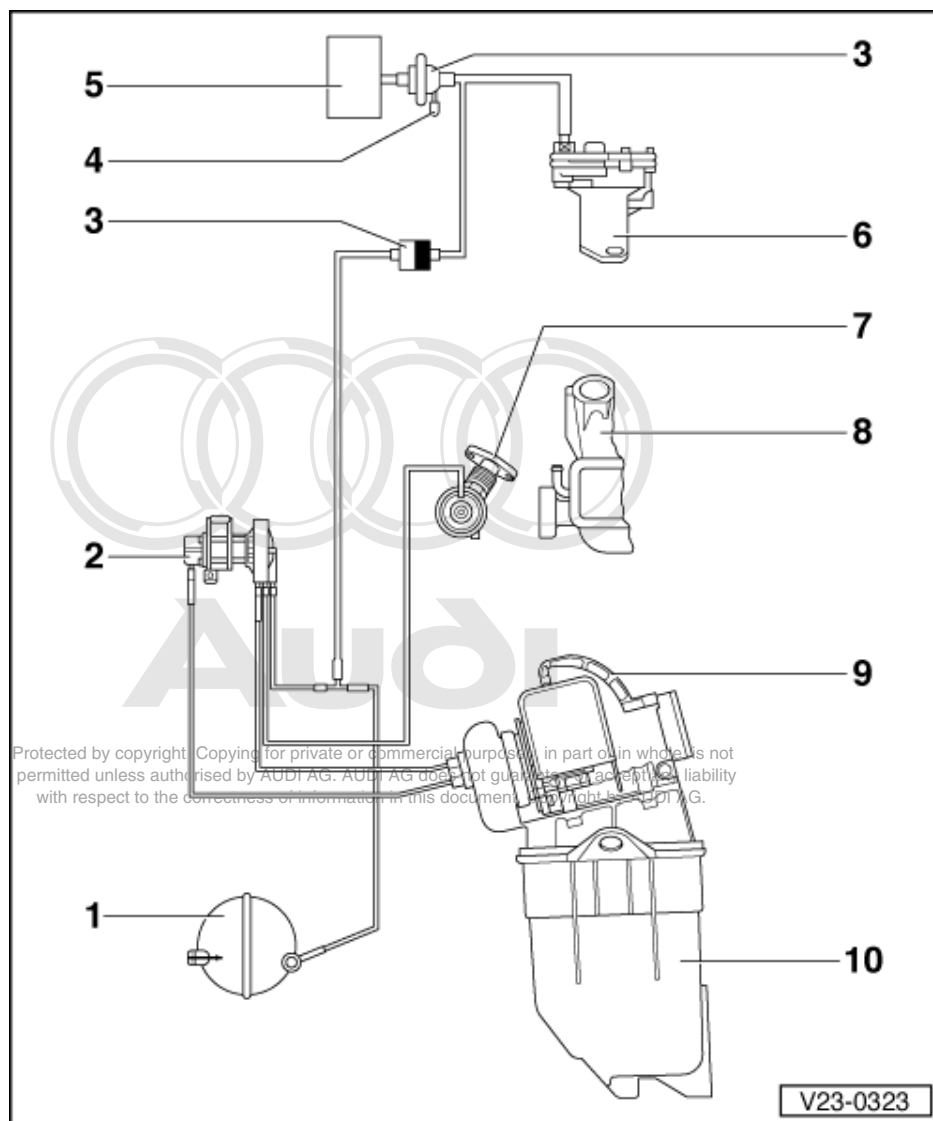
9 Intake manifold

10 Exhaust manifold

11 Seal

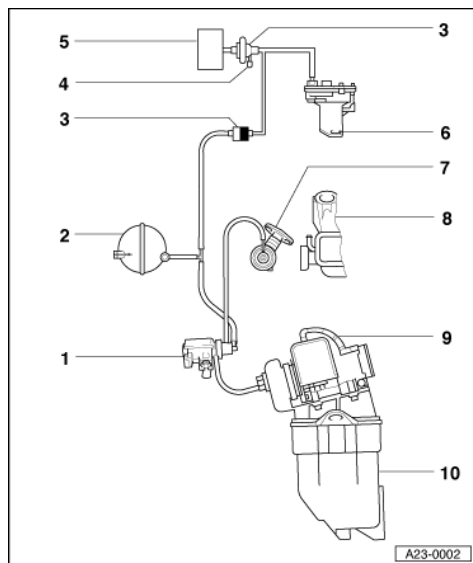
- ♦ Replace

2.3 - Diagram of exhaust gas recirculation connections with valve for old exhaust gas recirculation design



- 1 Vacuum reservoir
- 2 EGR valve -N18
 - ♦ From 02.93 at air cleaner housing
- 3 Non-return valve
- 4 Vacuum connection
 - ♦ Vehicles with air conditioner
- 5 Brake servo
- 6 Exhauster
 - ♦ For brake servo
- 7 Mechanical EGR valve
- 8 Intake manifold
- 9 Air flow meter -G19
- 10 Air cleaner

2.4 - Diagram of exhaust gas recirculation connections with valve for new exhaust gas recirculation design

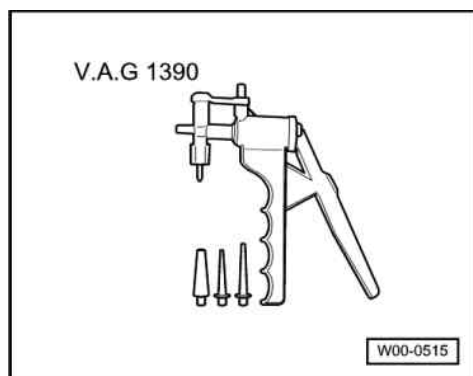


- 1 EGR valve -N18
 - ♦ From 02.93 at air cleaner housing
- 2 Vacuum reservoir
- 3 Non-return valve
- 4 Vacuum connection
 - ♦ Vehicles with air conditioner
- 5 Brake servo
- 6 Exhauster
 - ♦ For brake servo
- 7 Mechanical EGR valve
- 8 Intake manifold
- 9 Air flow meter -G19
- 10 Air cleaner



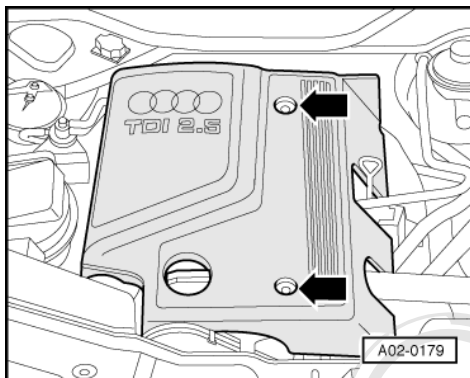
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2.5 - Checking mechanical EGR valve



Special tools and workshop equipment required

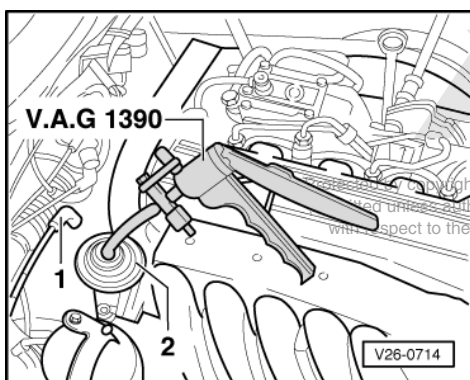
- ♦ V.A.G 1390



Test sequence

Audi A6:

- -> Remove engine cover -arrows-.

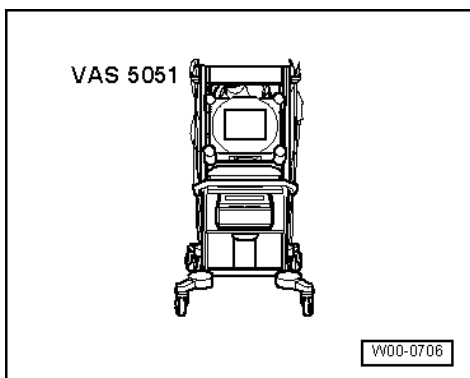


All models:

- -> Detach vacuum hose -1- from mechanical exhaust gas recirculation valve -2-.
- Connect hand vacuum pump V.A.G 1390 to valve.
- Operate pump.
- Disconnect hand vacuum pump hose from exhaust gas recirculation valve.
 - The valve must be clearly heard to close. The diaphragm rod moves towards intake manifold

2.6 - Checking EGR

The operation of the exhaust gas recirculation system is tested by measuring the intake air flow. If the exhaust gas is being recirculated, the proportion of fresh air detected by the air flow meter is lower. The larger the quantity of recirculated exhaust gas, the weaker the signal from the air flow meter.





Special tools and workshop equipment required

- ♦ VAS 5051 with VAS 5051/1 and VAS 5051/2

Test requirements:

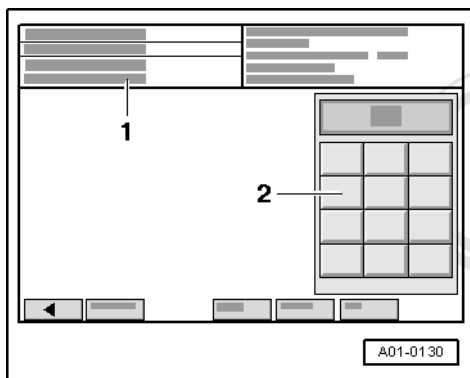
- Vehicle diagnostic, testing and information system VAS 5051 connected, vehicle self-diagnosis and vehicle system "01 - Engine electronics" selected.
- Engine running at idling speed
- Coolant temperature at least 80 °C=> display group 001, display zone 4.
- Final control diagnosis has been performed



Test sequence

-> Display on VAS 5051:

- Under -1- select diagnostic function "08 - Read measured value block".



Vehicles with engine codes AAT up to 2nd control unit version1):

- 1) Explanation of the control unit versions

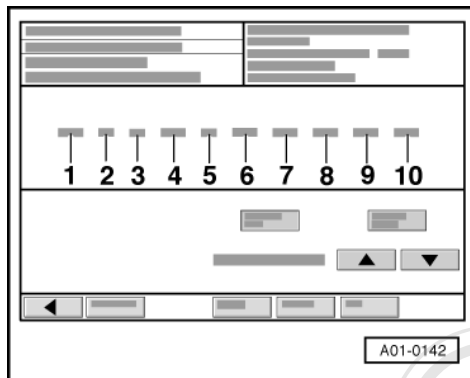
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=> Diesel Direct Injection and Glow Plug System (TDI, 5-cylinder); Repair group 01; Self diagnosis Self diagnosis

-> Display on VAS 5051:

- 1 - Enter display group

- Enter "000" for "display group number 000" in zone -2- and confirm the entry by pressing the Q key.
- Abruptly floor the accelerator pedal and release again (brief burst of throttle). 2000 rpm.



-> Display on VAS 5051:

- Increase the engine speed to approx. 1200 rpm and keep it constant.

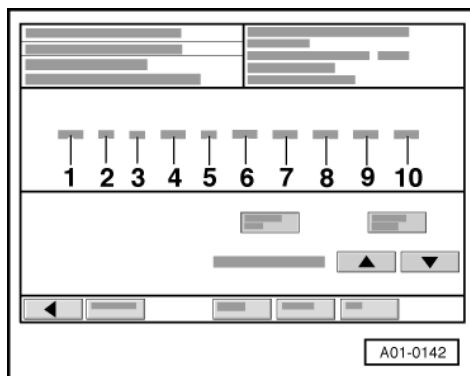
Note:

Readout in display zone -1-: 54...58.

- Check readout in display zone -10- (intake air flow).
 - Specification: 43...68

If specification is not attained: 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 zone: 10 at idle	Possible causes of fault	Fault remedy
Constant 139	- Open circuit in wiring to air flow meter	- Check air flow meter => Diesel Direct Injection and Glow Plug System (TDI, 5-cylinder); Repair group 23
	- Air flow measured not plausible	
90...120	- Engine has been running for 10 minutes at idling speed	- Briefly depress accelerator sharply
	- Insufficient exhaust gas recirculation	- Check mechanical exhaust gas recirculation valve => Page 212
	- Engine load from ancillaries	- Eliminate load (air conditioner system/ power steering/alternator)
	- Intake manifold temperature too high	- Leave to cool down, repeat measurement
Lower than 43	- Unmetered air in intake area	- Check intake area for leaks
	- Excessive exhaust gas recirculation	- Check mechanical exhaust gas recirculation valve => Page 212



-> Display on VAS 5051:



- Increase the engine speed to approx. 3500 rpm and keep it constant.

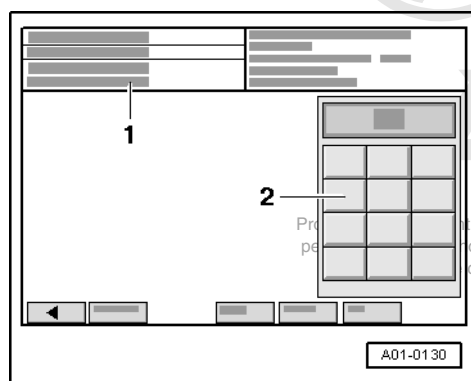
Note:

Readout in display zone -1-: 160... 170.

- Check readout in display zone -10- (intake air flow).
 - Specification: Higher than 110

If specification is not attained:

Display zone: 10 at 3500 rpm	Possible causes of fault	Fault remedy
Constant 139	- Open circuit in wiring to air flow meter - Air flow measured not plausible	- Check air flow meter => Diesel Direct Injection and Glow Plug System (TDI, 5-cylinder); Repair group 23
43...68	- Incorrect hose connections at exhaust gas recirculation valve -N18 or -N18 defective	- Check hose connections => from Page 212



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Vehicles with engine codes AAT from 3rd control unit version1) and AEL:

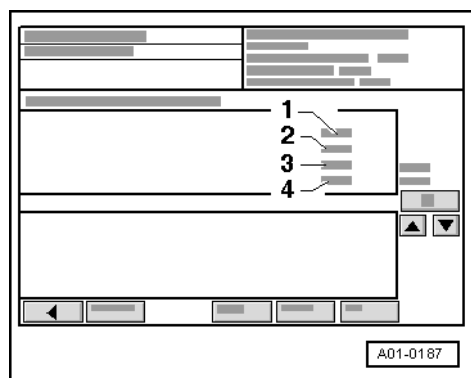
- 1) Explanation of the control unit versions

=> Diesel Direct Injection and Glow Plug System (TDI, 5-cylinder); Repair group 01; Self diagnosis Self diagnosis

-> Display on VAS 5051:

- 1 - Enter display group

- Enter "003" for "display group number 003" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check readout in display zones -2- and -3-.

	Display zones			
	1	2	3	4
Display group 003: Exhaust gas recirculation at idle				
Display	xxxx rpm	xxx mg/stroke	xxx mg/stroke	xx %
Display	Engine speed	Specified air flow	Actual air flow	Actuation of EGR valve - N18
Specification	Idling	210...370 mg/stroke	210...370 mg/stroke	14...75 %
Note:		If a value higher than 370 mg/stroke is displayed: Engine too cold => run until warm		

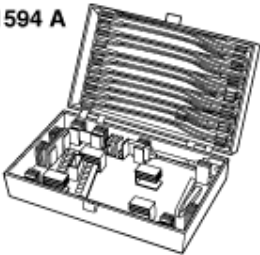
If specification not attained or exceeded:

Display zone: 3	Possible causes of fault	Fault remedy
Over 370 mg/stroke	- Engine has been running for 10 minutes at idling speed	- Briefly depress accelerator sharply
	- Insufficient exhaust gas recirculation	- Check mechanical exhaust gas recirculation valve => Page 212
	- Engine load from ancillaries	- Eliminate load (air conditioner system/power steering/alternator)
	- Intake manifold temperature too high	- Leave to cool down, repeat measurement
Less than 210 mg/stroke	- Unmetered air in intake area	- Check intake area for leaks
	- Excessive exhaust gas recirculation	- Check mechanical exhaust gas recirculation valve => Page 212

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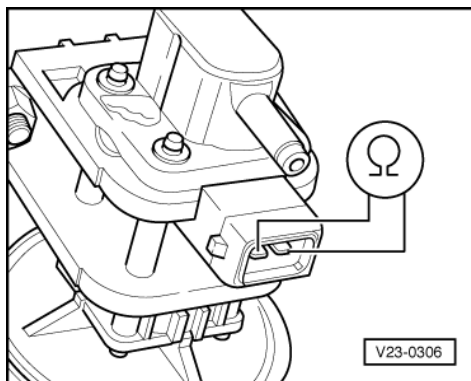
2.7 - Checking EGR valve -N18

V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598 A 	
	 G24-0015

Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598 A
- ♦ V.A.G 1598/5

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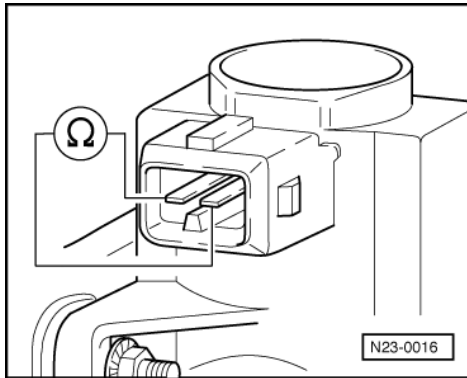


Checking internal resistance

- Switch ignition off.
- Detach connector from exhaust gas recirculation valve.

Old exhaust gas recirculation valve design:

- -> Connect multimeter to injector to measure resistance.
- Specification: 4...8 Ω

**New exhaust gas recirculation valve design:**

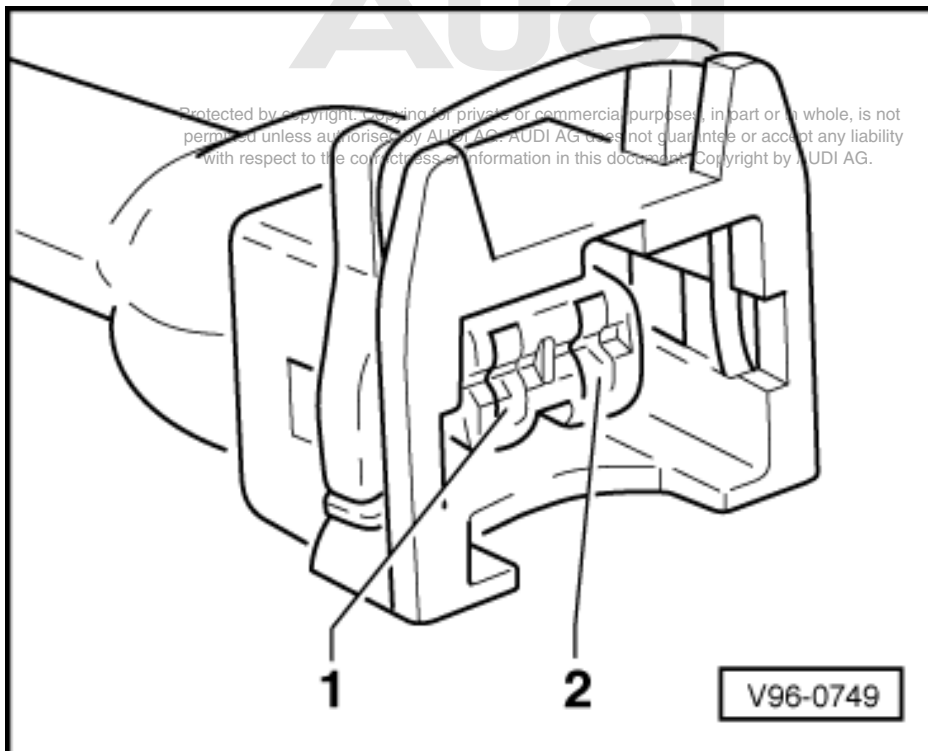
- -> Connect multimeter to injector to measure resistance.
- Specification: 14...20 Ω

All models:**Note:**

Resistance is in the lower tolerance range at room temperature and in the upper tolerance range when the engine is warm.

If specification is not attained:

- Replace the exhaust gas recirculation valve -N18.



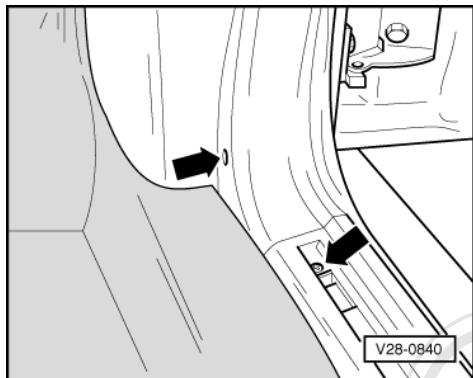
Checking power supply

- -> Connect multimeter between contact 2 and earth to measure voltage.
- Switch the ignition on.
- Specification: approx. battery voltage

If specification is not attained:

- Test wiring for open circuit and short to positive or earth.

=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

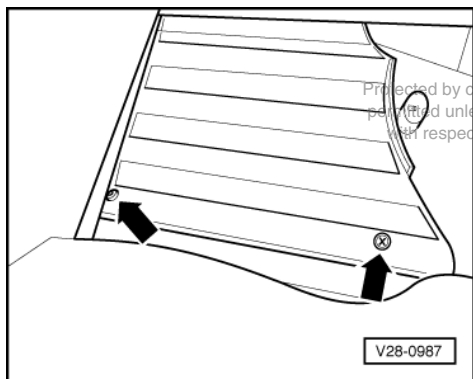


Checking control signal wiring

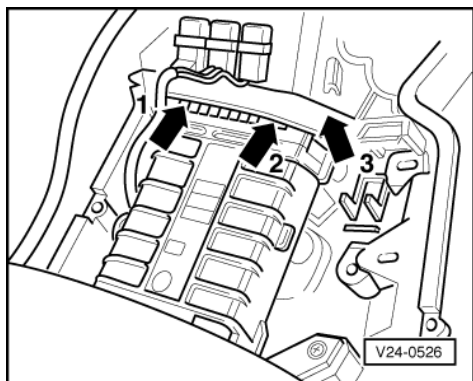
- Switch ignition off.
- -> Remove the lower part of the right A pillar trim and the front door sill panel tread strip

=> General Body Assembly; Repair group 70

- Pull back floor covering at front of right footwell. (If necessary, cut open the perforated seam on the left with a knife.)



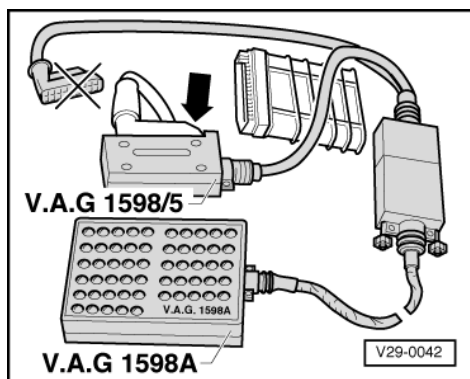
- -> Unscrew bolts -arrows- for electronics box cover.
- Carefully detach upper and lower sections of cover.



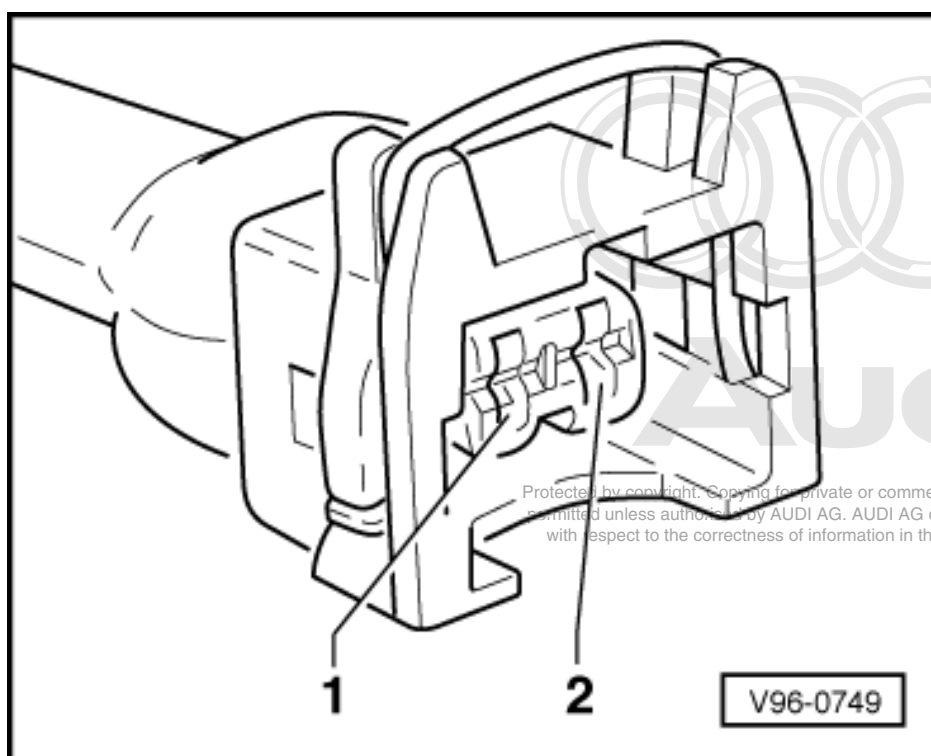
- -> Pull out cross strut -arrow 3- with attached parts.
- Screw out bolts -arrow 1- and -arrow 2-.
- Remove engine control unit.
- Disengage retaining clip and unplug control unit connector.

Note:

Always make sure that the ignition is switched off before unplugging or fitting the connector of the control unit for diesel direct injection system.



- -> With the ignition switched off, connect test box V.A.G 1598 A only to plug connection of the engine control unit (control unit remains disconnected) using adapter V.A.G 1598/5.



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

Connector Contact	Test box V.A.G 1598 A Socket
1	6

- Rectify any open/short circuit as necessary.
- If the wiring connection is OK, replace the engine control unit.



Audi 100 1991 ➤

Audi 5-cyl Diesel Engine, Mechanical Components (2.5 l Engine) - Edition 04.2002

=> Diesel Direct Injection and Glow Plug System (TDI 5-cylinder); Repair group 23; Servicing diesel direct injection system Servicing diesel direct injection system

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