

Audi A3 1997 ➤

4-cyl TDI®-Engine, Mechanical Components								
Engine ID	ASZ	ATD	AXR					

Edition 12.2001



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List of Workshop Manual Repair GroupsList of Workshop Manual Repair Groups Audi A3 1997 ➤

4-cyl TDI®-Engine, Mechanical Components

Repair Group

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

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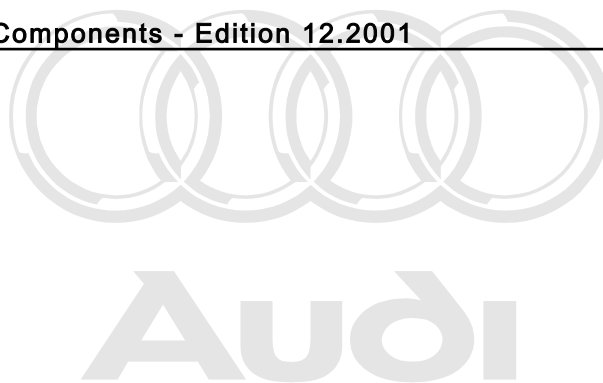
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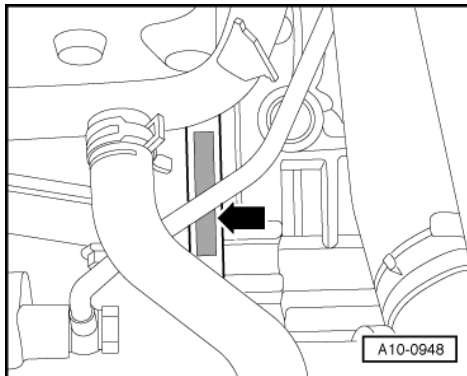
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00 - Technical data

1 - Technical data

1.1 - Technical data

1.2 - Engine number



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

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

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

1.3 - Engine data

Code letters		ASZ	ATD	AXR
Capacity	l	1.9	1.9	1.9
Output	kW at rpm	96/4000	74/4000	74/4000
Torque	Nm at rpm	310/1900	240/1800...2400	240/1800...2400
Bore	ø in mm	79.5	79.5	79.5
Stroke	mm	95.5	95.5	95.5
Compression		19.0	19.0	19.0
CN		49	49	49
Firing order		1-3-4-2	1-3-4-2	1-3-4-2
Catalytic converter		yes	yes	yes
Exhaust gas recirculation system		yes	yes	yes
Turbocharging		yes	yes	yes
Charge air cooler		yes	yes	yes

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Code letters	ASZ	ATD	AXR
Valve timing 1)			
Inlet opens after TDC	15.8°	15.8°	15.8°
Inlet closes after BDC	25.3°	25.3°	25.3°
Exhaust opens before BDC	28.2°	28.2°	28.2°
Exhaust closes before TDC	8°	8°	8°

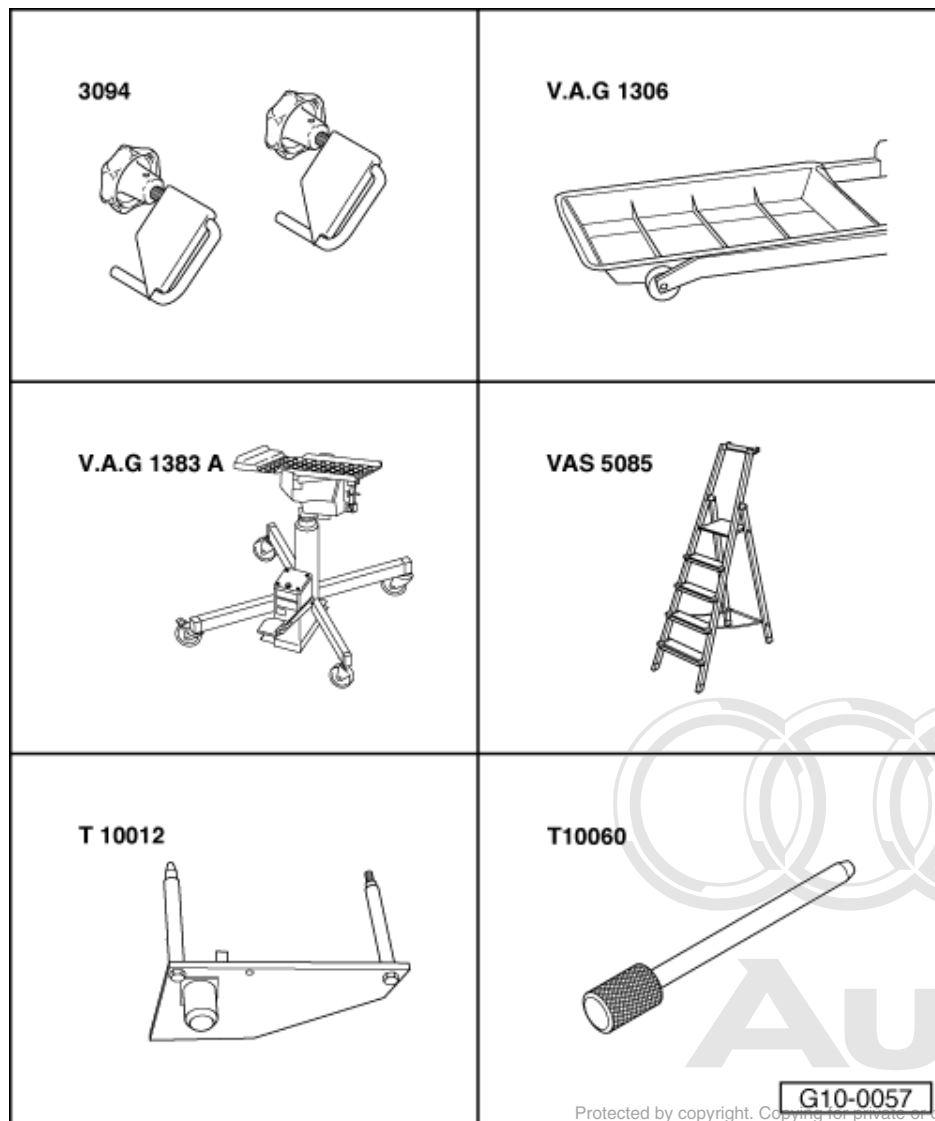
1) with 1 mm valve lift and 0 mm valve play

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10 - Removing and installing engine

1 - Removing and installing engine - Vehicles with front-wheel drive

1.1 - Removing and installing engine - Vehicles with front-wheel drive



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Special tools and workshop equipment required

- ◆ Hose clamps 3094
- ◆ Drip tray V.A.G 1306
- ◆ Engine/gearbox lifter V.A.G 1383 A
- ◆ Stepladder VAS 5085
- ◆ Engine mounting T10012
- ◆ Mandrel T10060



1.2 - Removing

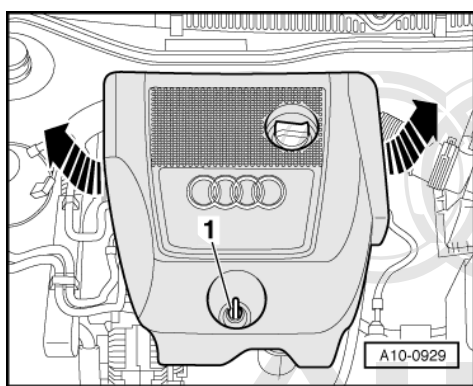
Notes:

- ♦ The engine is removed from underneath together with the gearbox.
- ♦ Collect drained coolant in a clean container for re use or disposal.

Important

- ♦ Measures to be taken prior to disconnecting the battery: =>Electrical System; Repair group 27
- ♦ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.

- Refer to coding on vehicles with encoded radio/radio navigation system (RNS); if necessary, interrogate.
- With the ignition switched off disconnect the battery earth strap.



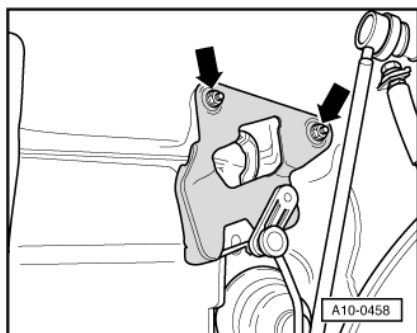
- -> Remove oil dipstick -1- from guide tube.
- Remove engine cover -arrows-.
- Reinsert dipstick in guide tube.

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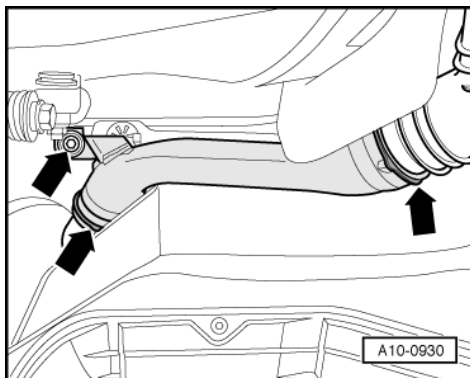
Important

Hot steam can escape when opening cap on expansion tank: Cover cap with a cloth and open carefully.

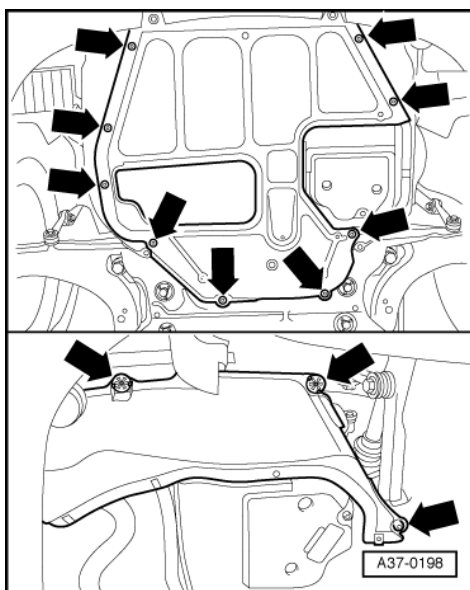
- Open the cover of the coolant expansion tank



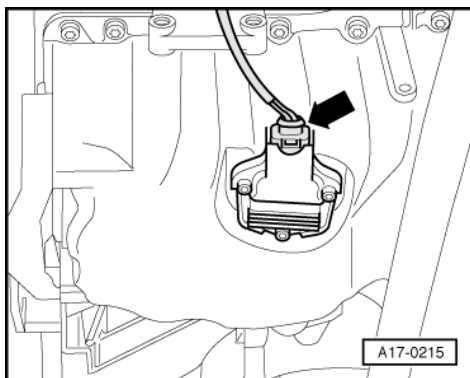
- -> If installed, remove the headlight range control bracket in top right of wheel housing -arrows-.



- -> Remove air duct pipe from right longitudinal member -arrows-.



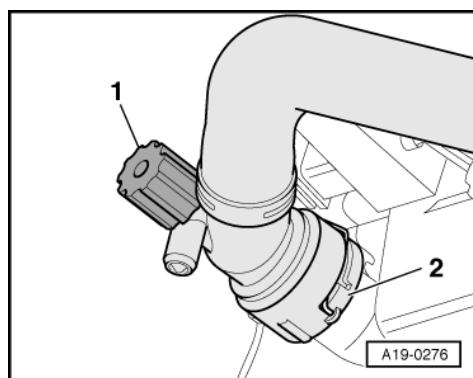
- -> Remove noise insulation from centre, left and right sides -arrows-



- -> Detach electrical connector from oil level sender -arrow-.
- Move wiring to the top.



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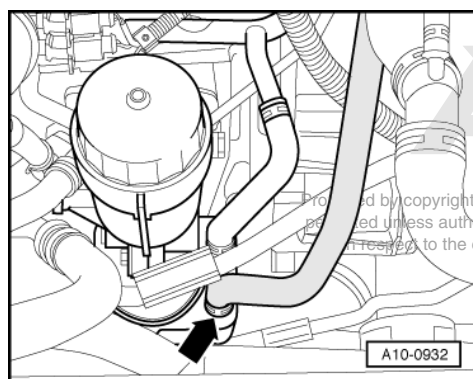
- Place drip tray V.A.G 1306 below engine.

Vehicles with drain plug:

- -> Turn drain plug -1- on radiator anti-clockwise, fit auxiliary hose to connection if necessary.

All models:

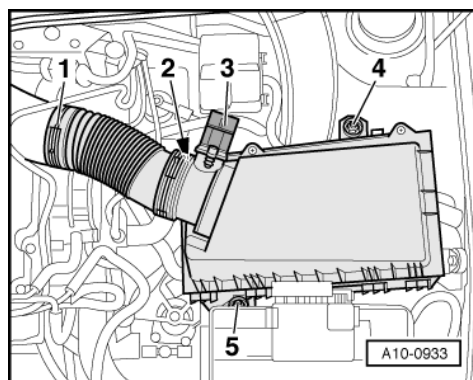
- Pull off retaining clip -2- for bottom coolant hose and detach coolant hose from radiator.



- -> Also disconnect coolant hose on oil cooler -arrow-, and drain off remaining coolant.

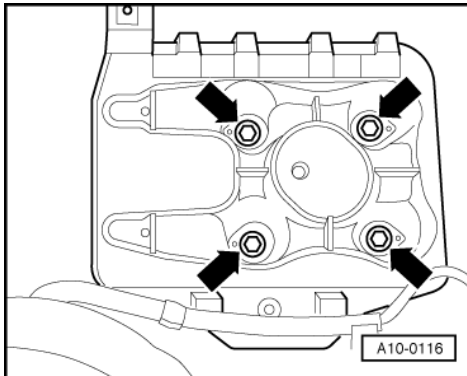
Note:

Illustration shows an engine with code ASZ.

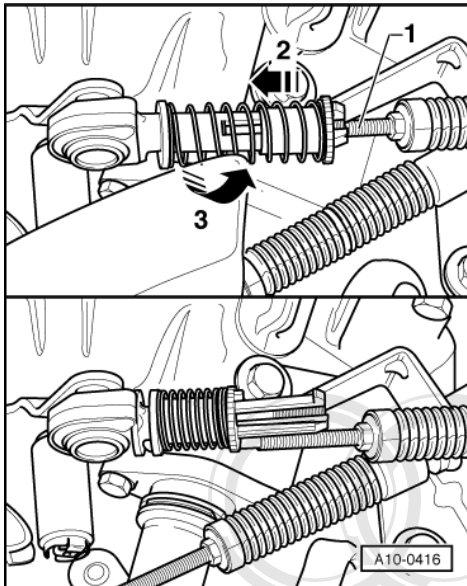


- -> Remove air duct hose -1- from air duct pipe.
- Detach connector of air mass meter -3-.
- Unscrew bolts -4- and -5-.
- Remove vent hose -2- off air cleaner housing.

- Remove air cleaner housing.



- Remove the battery.
- -> Remove battery carrier -arrows-.

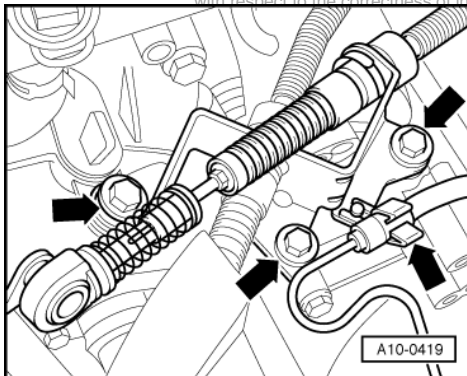


Vehicles with manual gearbox:

Detach both gear selector cables from gearbox as follows:

- -> Mark installation position of threaded rods -1- of both gear selector cables with a waterproof felt-tip pen.
- Pull the spring with the knurled piece in direction of arrow -2- towards spherical joint and then turn knurled piece clockwise to secure in engaged position -arrow 3-.
- Detach both gear selector cables.

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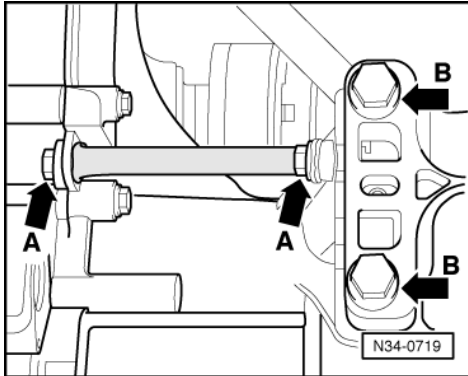




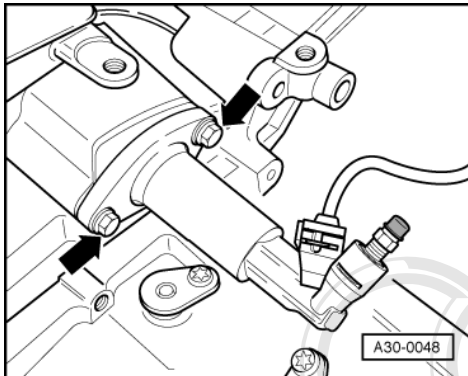
- -> Remove cable counterhold from gearbox and place to one side
-arrows-

Vehicles with engine code ATD, AXR:

- Unclip the clutch slave cylinder hose at the cable support bracket.



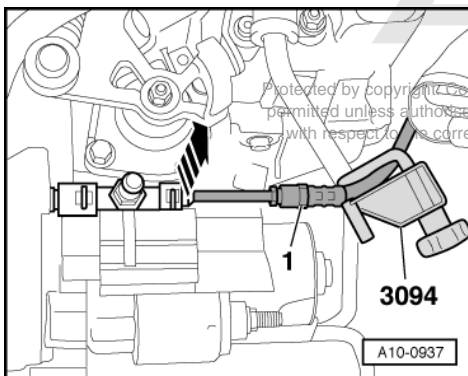
- -> Remove gearbox strut -arrows A- from gearbox.



- -> Remove clutch slave cylinder -arrows- and secure with wire, do not open cable system.

Important

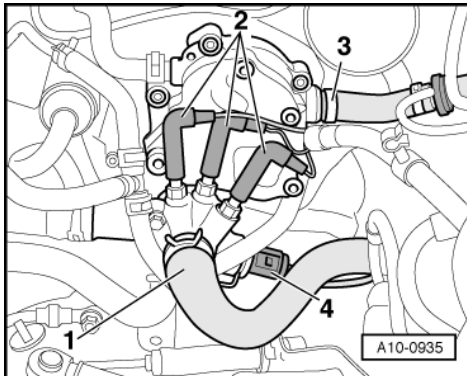
Do not depress clutch pedal after removing slave cylinder.



Vehicles with engine code ASZ:

- -> Clamp off pressure line to clutch slave cylinder using a hose clamp 3094.
- Pull retainer upwards -arrow- and disconnect pressure line from hose connector -1-.

Important
Do not depress clutch pedal after removing slave cylinder.

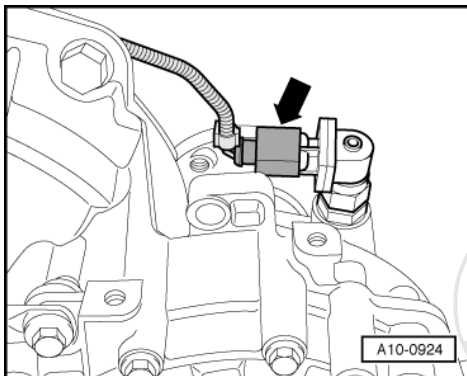


Vehicles with engine code ASZ, ATD:

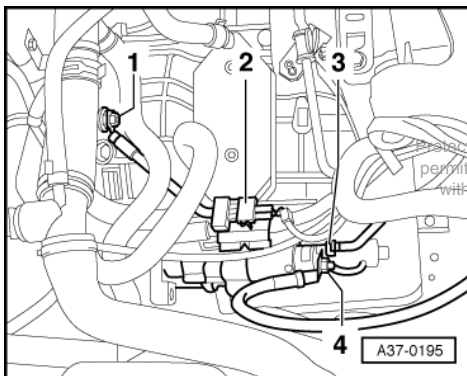
- -> Detach coolant hose -1- from engine.

All models:

- Detach connectors from glow plugs (coolant) -Q7 -Item 2-.
- Disconnect vacuum line -3- from tandem pump.
- Unplug connector -4- at coolant temperature sender -G62.
- Disconnect coolant hose to radiator heat exchanger from coolant pipe (rear of engine).



- Detach the heat protection sleeve at the speedometer sender -G22.
- -> Detach connector -arrow- from speedometer sender -G22 from gearbox, lay wiring aside.

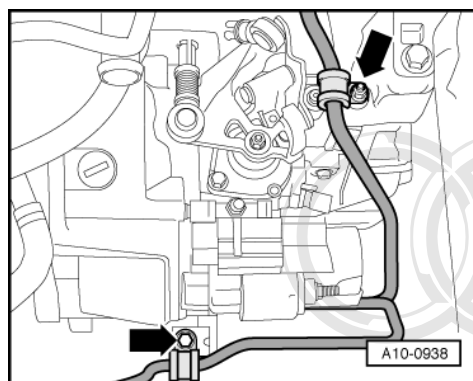


- -> Unscrew earth wire -1- from flange engine/gearbox.
- Disconnect leads -3- and -4- to the starter.
- Take connector -2- out of bracket.
- Detach wiring from starter bracket.

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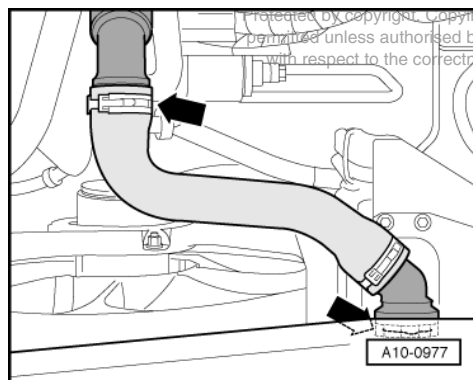


- Unplug connector for reversing light switch on gearbox.



Vehicles with engine code ASZ:

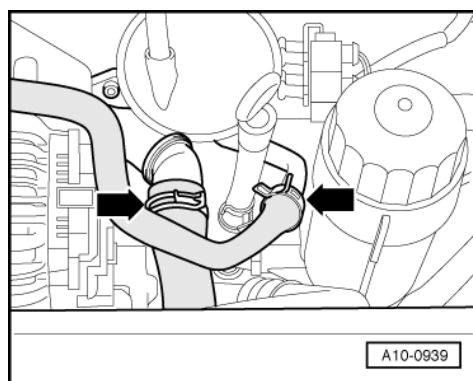
- -> Detach power steering line from gearbox -arrows-.



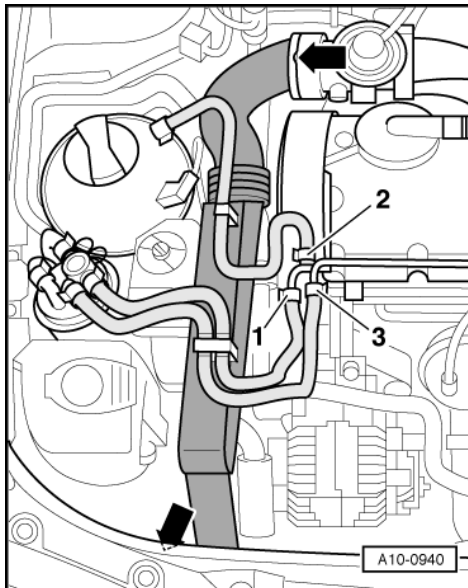
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All models:

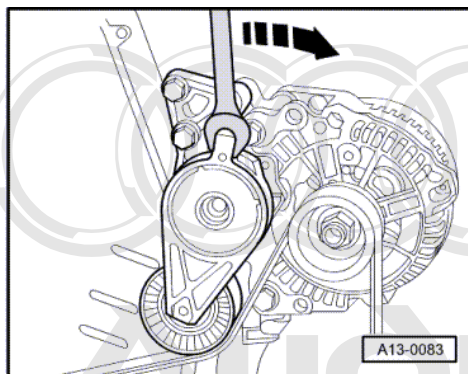
- -> Detach coolant hose between engine and radiator -arrows-.



- -> Detach coolant hoses -arrows- from front of engine.



- -> Remove coolant hose -2- and set aside.
- Separate fuel feed pipe -3- and fuel return pipe -1- and set aside.
- Lay aside wiring at air duct hose.
- Where necessary, detach the housing cover at rear of right headlamp.
- Remove air duct pipe -arrows-.

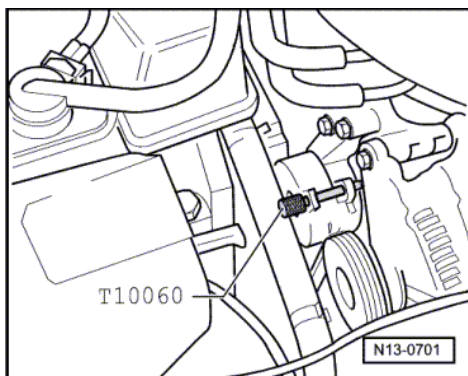


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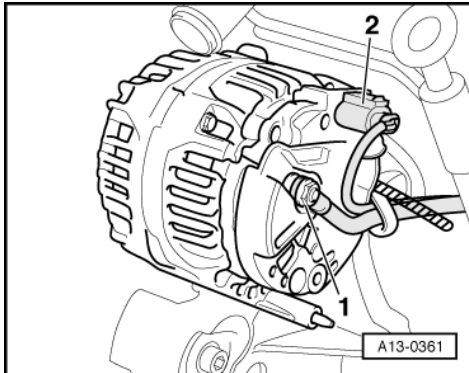
Mark the running direction with chalk or a felt-tipped pen before removing the ribbed belt. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

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



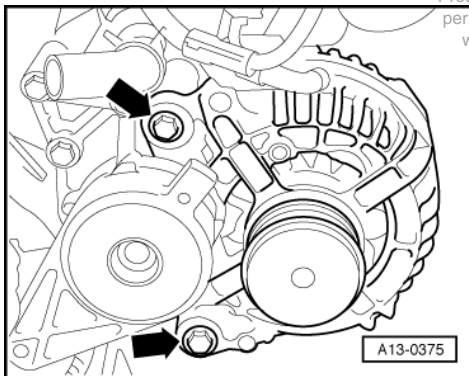


- -> Lock ribbed belt tensioner using mandrel T10060.
- Remove ribbed belt.

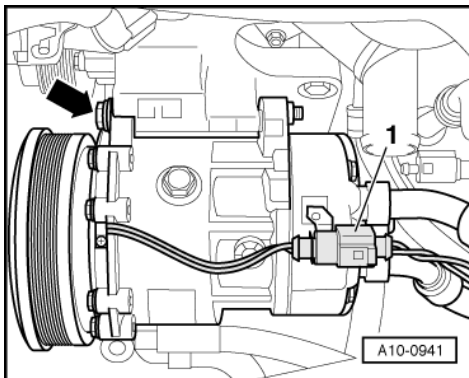


- -> Detach connector -2-.
- Unscrew wire -1- from alternator.
- Unbolt wiring clamp.

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- -> Unscrew the bolts -arrows- and remove alternator.



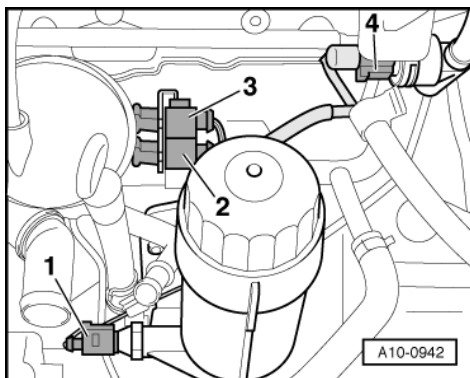
Vehicles with air conditioner:

- -> Detach electrical connector -1- for solenoid clutch on air conditioner compressor.

Important
The air conditioner refrigerant circuit must not be opened.

- Screw out bolts -arrow- for air conditioner compressor.

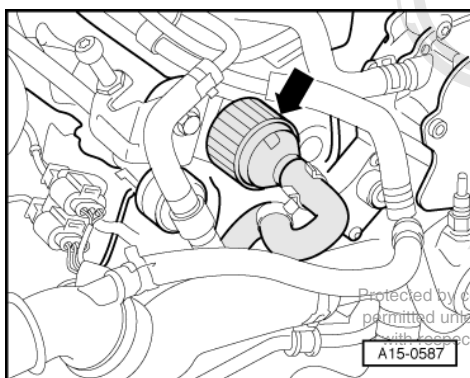
- Suspend air conditioner compressor together with connected coolant hoses from engine bonnet lock.



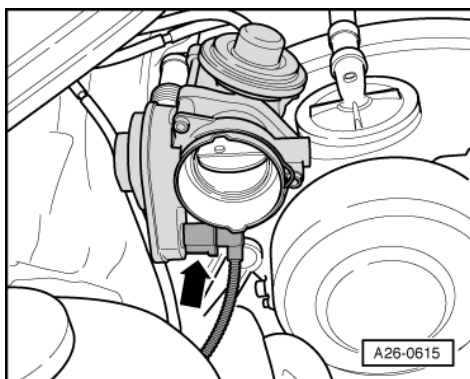
All models:

- Unplug connector console from glow plugs.
- -> Detach the following connectors:

- 1 - Oil pressure switch -F1
- 2 - Hall sender -G40
- 3 - Engine speed sender -G28
- 4 - Fuel temperature sender -G81

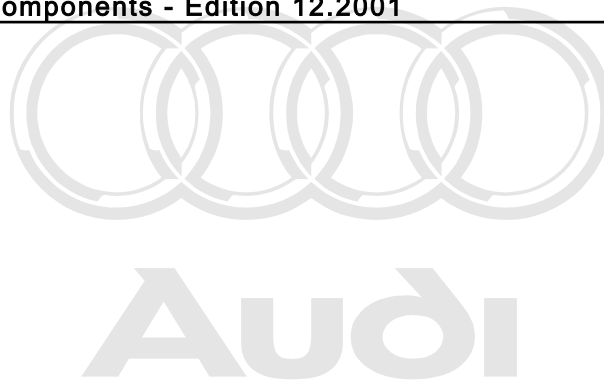
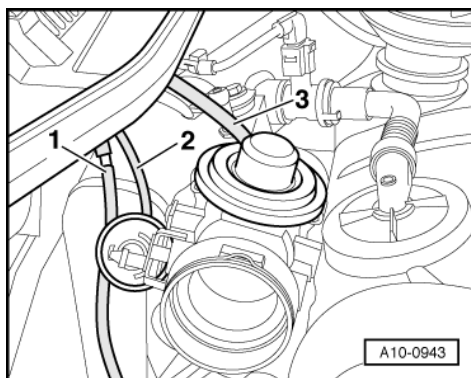


- -> Open the knurled nut -arrow- and unplug central connector.
- Lay wiring aside.



Vehicles with engine code AXR:

- -> Detach connector -arrow- at intake manifold flap motor.



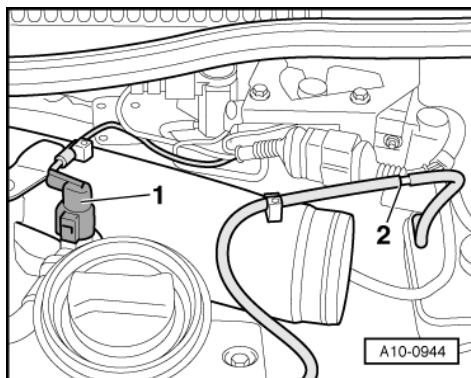
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All models:

- -> Disconnect vacuum hoses -1 ... 3- at rear of intake manifold.

Note:

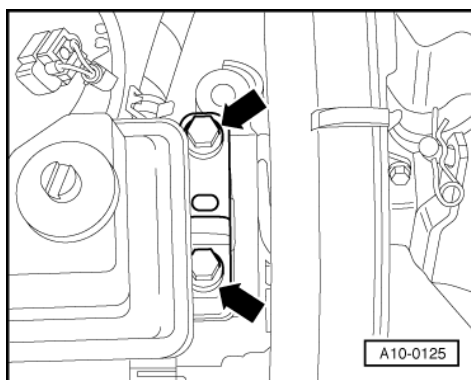
Illustration shows an engine with code ASZ, ATD.



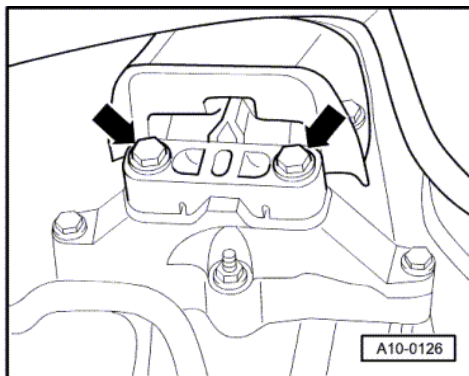
- -> If installed, detach connector for heating resistor (crankcase venting) -N79 -Item 1-.
- Detach vacuum hose -2- to solenoid valves.

Note:

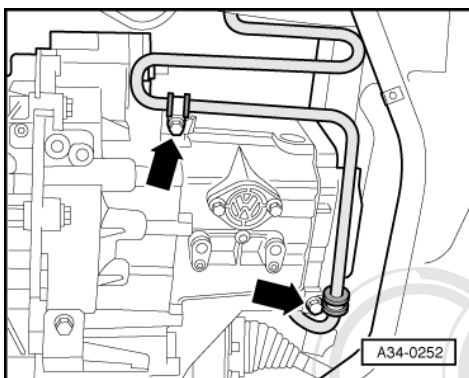
Illustration shows an engine with code ASZ, ATD.



- -> Loosen bolts -arrows- of assembly mounting on engine by 2 turns.

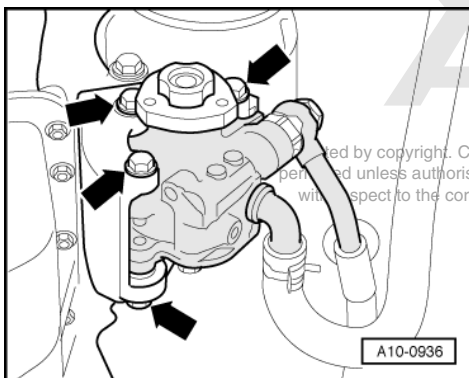


- -> Loosen bolts -arrows- of assembly mounting on gearbox by 2 turns.



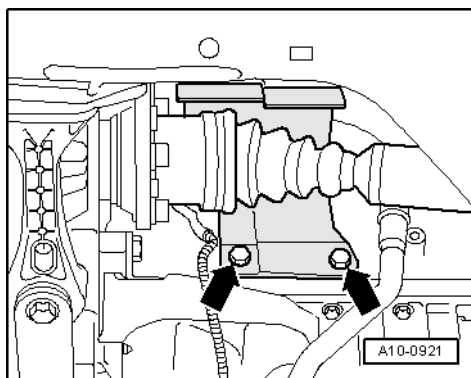
Vehicles with engine code ATD, AXR:

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

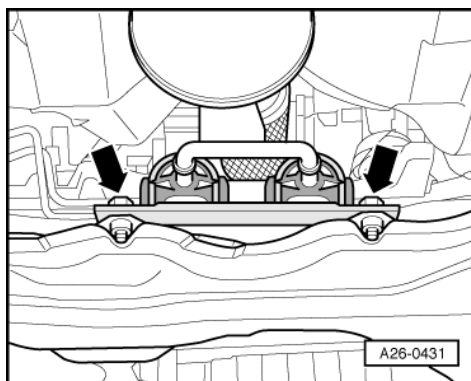


All models:

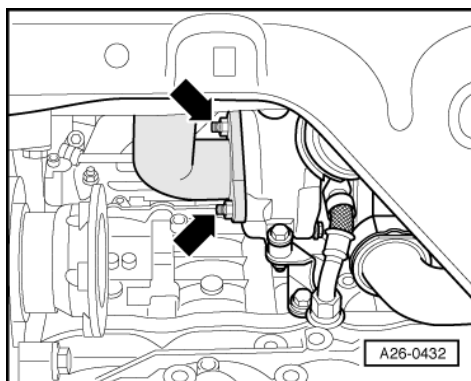
- Detach pulley from power steering vane pump.
- -> Detach vane pump for power steering -arrows-. Do not open hydraulic connections.
- Suspend vane pump for power steering from lock carrier.



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



- -> Unbolt bracket for exhaust system from assembly mounting -arrows-.



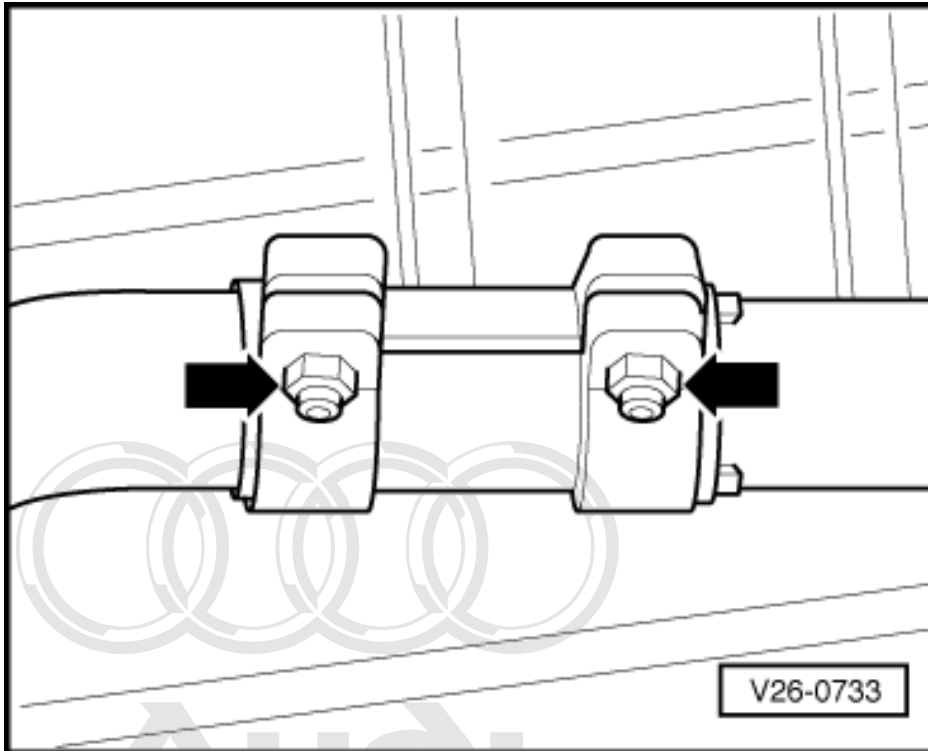
Note:

The isolating element in front exhaust pipe must not be deflected more than 10 °to avoid damage.

- -> Unscrew securing bolts -arrows- of front exhaust pipe/turbocharger.

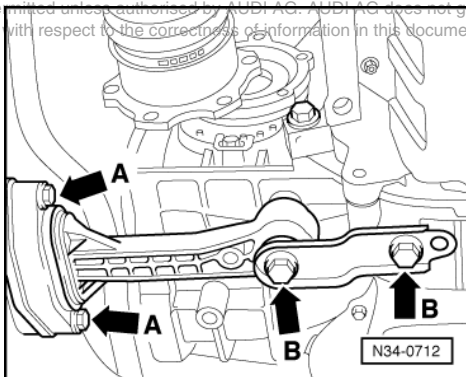


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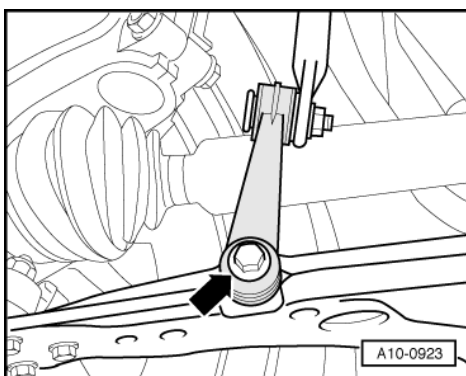


- -> Detach the exhaust system at the clamping sleeve -arrows-.
- Remove the front exhaust pipe.

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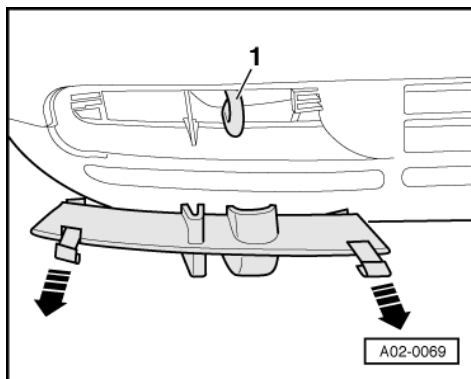
- -> First remove bolts-A- and then bolts -B- from pendulum support.
- Detach pendulum support.



- -> Unbolt right connecting rod at wishbone -arrows-.
- Unscrew drive shaft on left and right from gearbox flange.



- Push engine forward and at the same time swivel right drive shaft towards front.

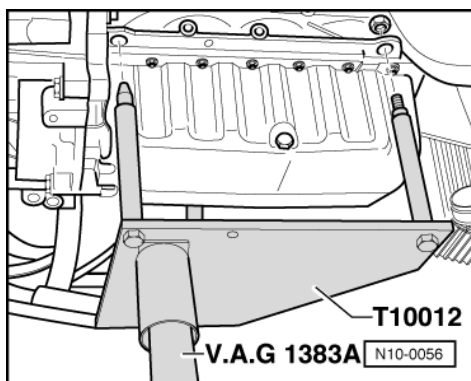


- -> Pull release tabs -arrows- and remove air intake grille.
- Suspend right drive shaft at towing eye -1- using a wire loop.

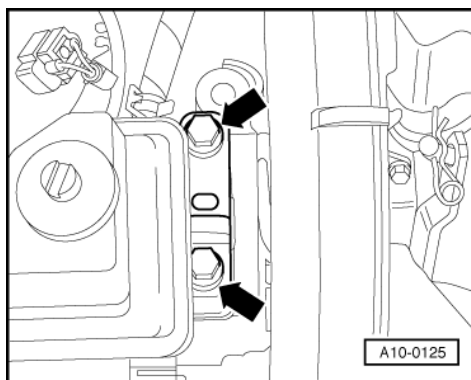
Note:

Protect bumper from scratches by using an adhesive tape.

- Move left drive shaft towards rear and attach to anti-roll bar using a wire loop.



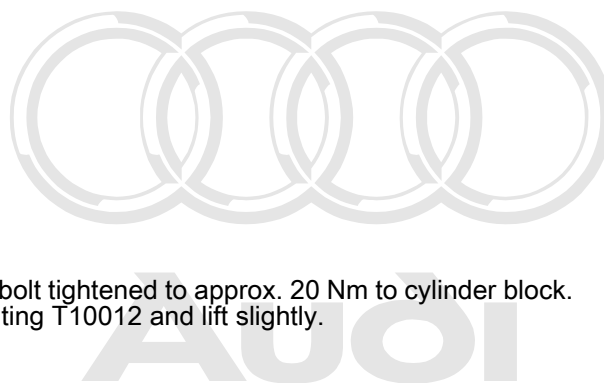
- -> Attach engine mounting T10012 with securing nut and bolt tightened to approx. 20 Nm to cylinder block.
- Insert engine/gearbox lifter V.A.G 1383 A in engine mounting T10012 and lift slightly.



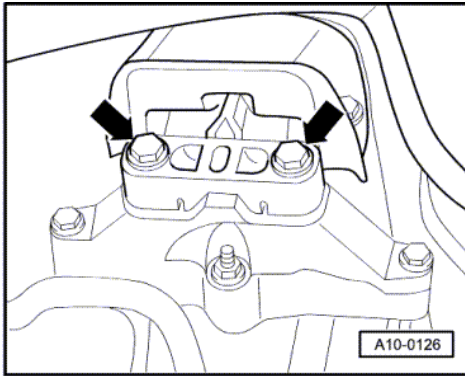
Note:

To unscrew bolts for assembly mounting use stepladder VAS 5085.

- -> Loosen bolts -arrows- of assembly mounting on engine...



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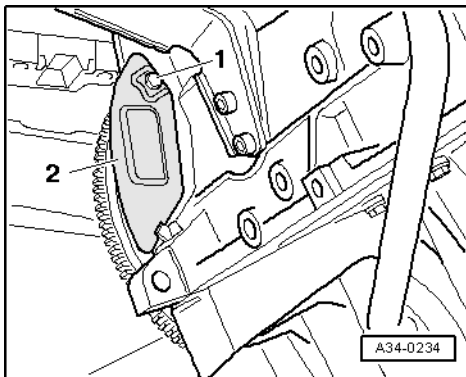


- -> ...and from gearbox.

Notes:

- ◆ Check that all hoses and wiring connections between engine, gearbox and body have been detached.
 - ◆ Carefully guide engine/gearbox assembly when lowering to avoid damages.
 - ◆ Make especially sure that there is free movement to vacuum unit of turbocharger.
- Pull engine/gearbox assembly as far forward as possible, and lower gradually.

1.3 - Separating engine from gearbox - vehicles with manual gearbox



Procedure

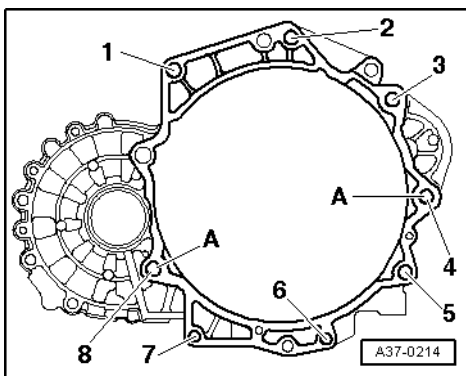
- Engine/gearbox assembly removed and attached to engine mounting T10012.

- -> Unscrew bolt -1- with gearbox installed.
- Pull up splash plate -2-.

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Note:

Shown in illustration with gearbox removed.





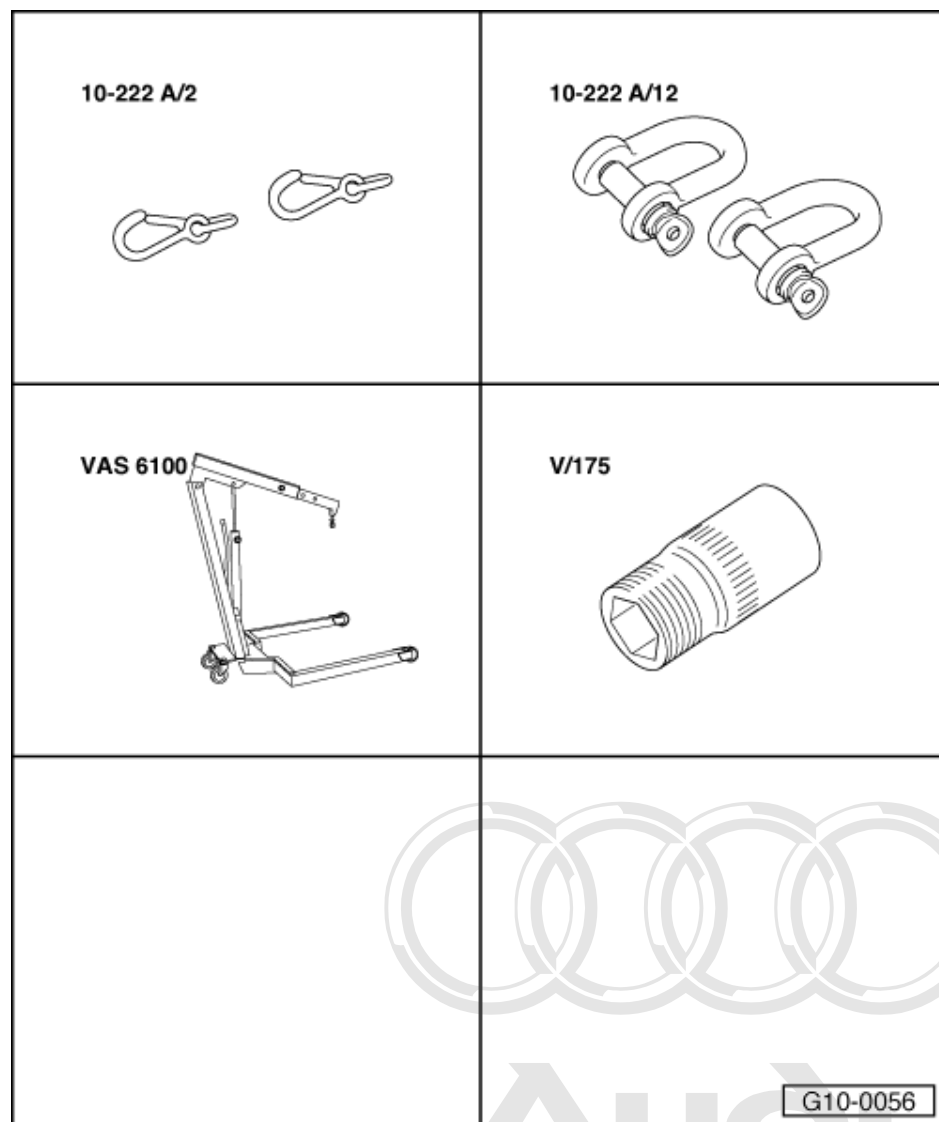
- -> Unscrew bolts -1 ... 8- at engine/gearbox flange.
- Take off starter.

Note:

A 2. mechanic is required to separate engine/gearbox assembly.

- Remove gearbox from engine.

1.4 - Detaching engine from gearbox - vehicles with automatic gearbox



Special tools and workshop equipment required

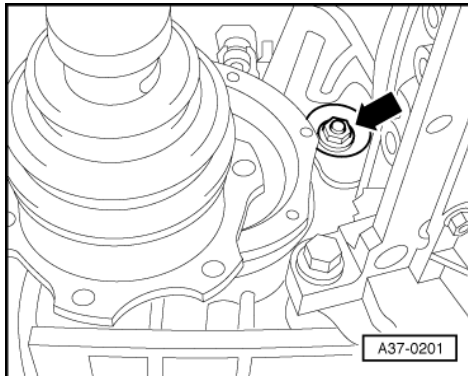
- ♦ Auxiliary hook 10-222 A/2
- ♦ Shackle 10-222 A/12
- ♦ Workshop crane VAS 6100

or

- ♦ Workshop crane V.A.G 1202 A

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- ♦ 15 mm socket insert Matra V/175

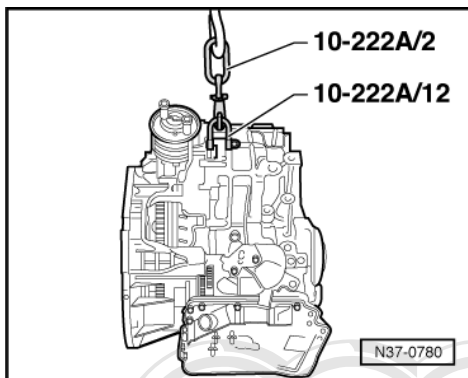


Procedure

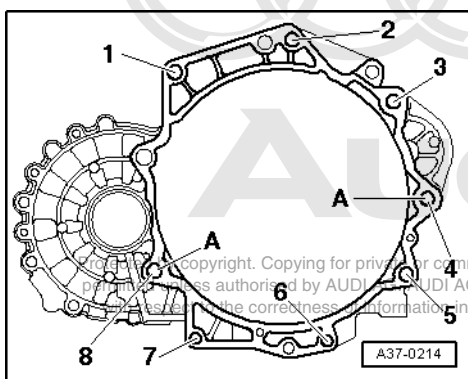
- Engine/gearbox assembly removed and attached to engine mounting T10012.
- -> Screw out 3 nuts of torque converter -arrow- with 15 mm socket insert, Matra V/175 (turn crankshaft 1/3 of a turn each time).

Note:

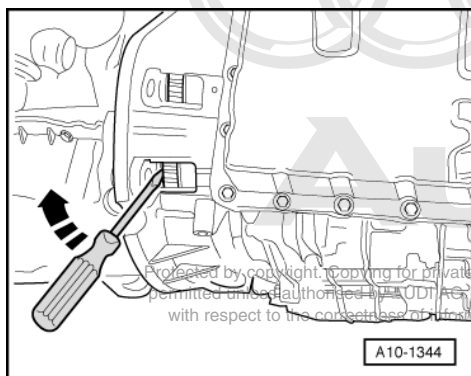
To prevent engine from turning when loosening torque converter nuts, counterhold central bolt on vibration damper.



- -> Fasten the shackle 10-222 A/12 to the gearbox housing and connect the shackle by means of auxiliary hook 10-222 A/2.
- Fasten the auxiliary hook 10-222 A/2 to workshop crane VAS 6100 or 1202 A as shown in the illustration.

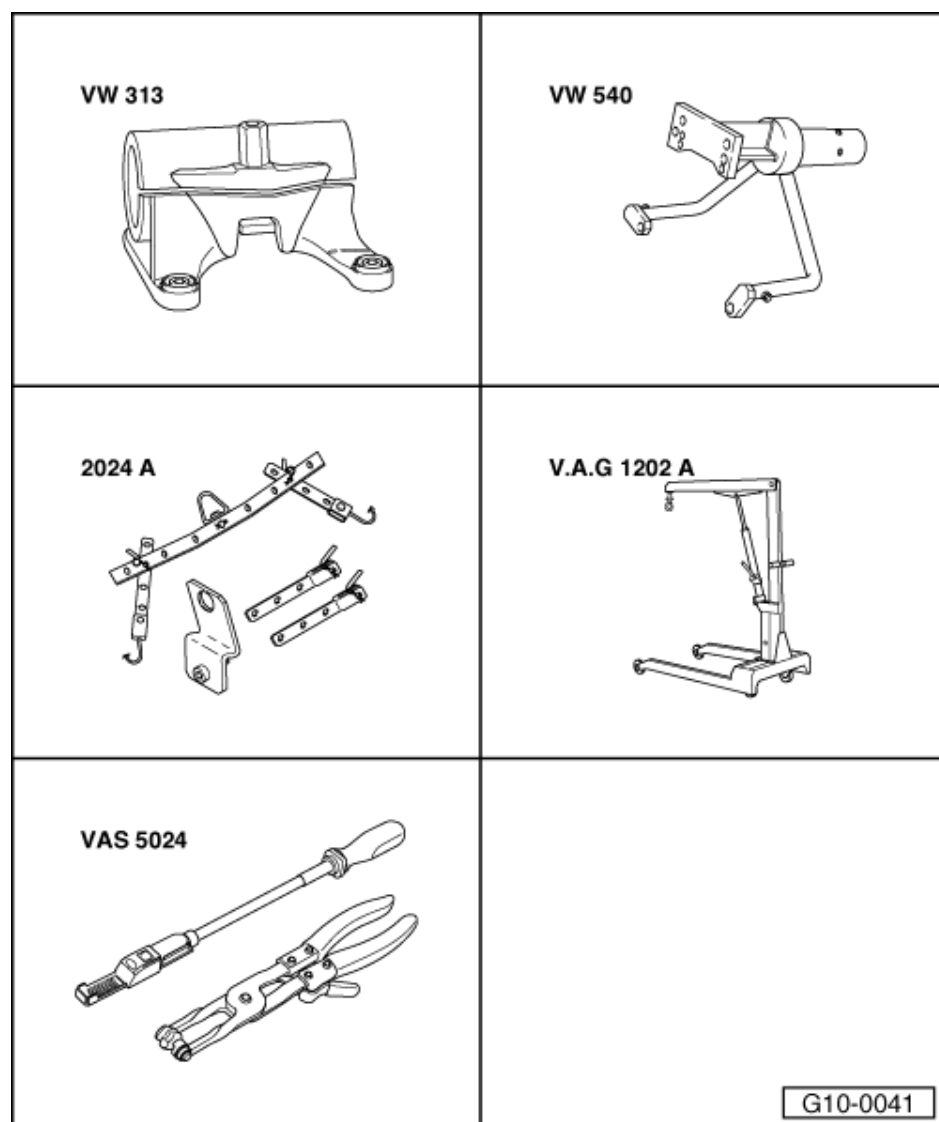


- -> Unscrew bolts -1 ... 8- at engine/gearbox flange.
- Take off starter.



- -> Push gearbox off engine. At the same time, push torque converter off the drive plate.
- If necessary, secure torque converter in gearbox with wire to prevent it falling out.

1.5 - Attaching engine to repair stand



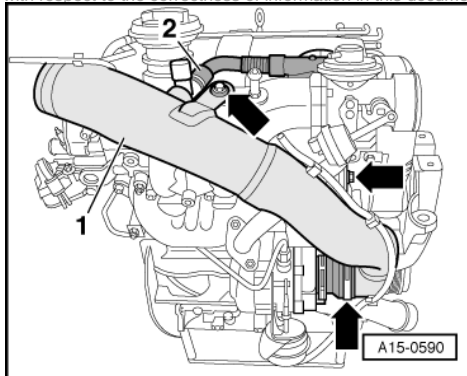
Special tools and workshop equipment required

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

or

- ◆ Workshop crane V.A.G 1202 A
- ◆ VAS 5024 A

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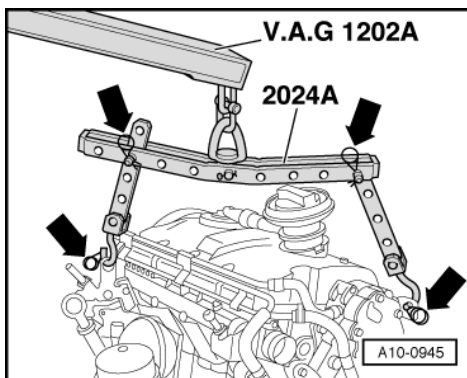


Procedure

- -> Detach crankcase vent pipe -2- from air duct hose.
- Set aside vacuum units to air duct hose.
- Remove air duct pipe -arrows-.

Note:

Illustration shows an engine with code ASZ, ATD.



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

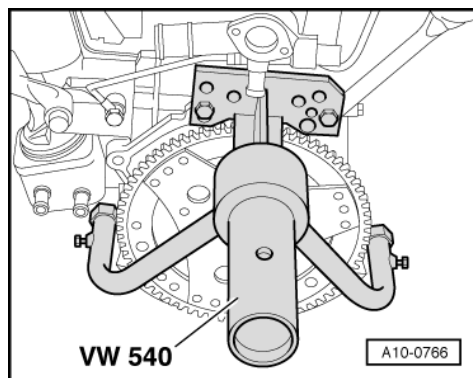
Note:

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

Important

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

- Lift engine off engine bracket T10012 using workshop crane VAS 6100 or V.A.G 1202 A.



-> When working on the engine, it should be secured to the repair stand using the engine mounting VW 540.

1.6 - Installing

Special tools and workshop equipment required

- ♦ Depth measurement (vehicles with automatic gearbox)

Procedure

- Engine installed on engine bracket T10012.

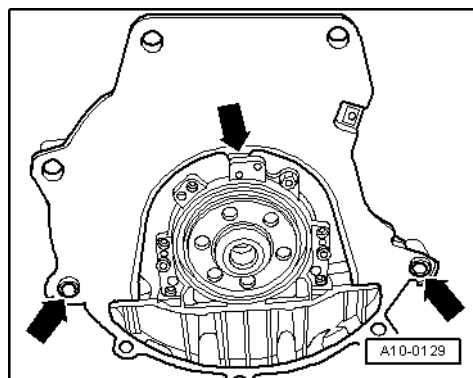
Installation is carried out in the reverse order; note the following:

Notes:

- ♦ When performing installation procedures always replace self-locking nuts and bolts.
- ♦ Replace seals, gaskets, and bolts which have a specified tightening angle.
- ♦ Hose connections and hoses for charge air system must be free of oil and grease before assembly.
- ♦ Secure all hose connections with the correct hose clamps (same as original equipment):

=> Parts List

- Check whether the dowel sleeves for centralising engine/gearbox are in the cylinder block, install if necessary.



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

Vehicles with manual gearbox:

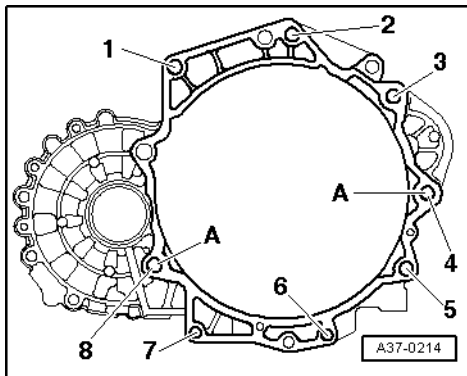
- If necessary, check that clutch plate is properly centred.
- Check clutch release bearing for wear, renew if necessary.

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- Lightly lubricate clutch release bearing, release bearing guide sleeve and splines on input shaft with G 000 100.
- Bolt the gearbox to the engine, use new bolts for vehicles with gearbox 02M.

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 $\pm 15\%$.



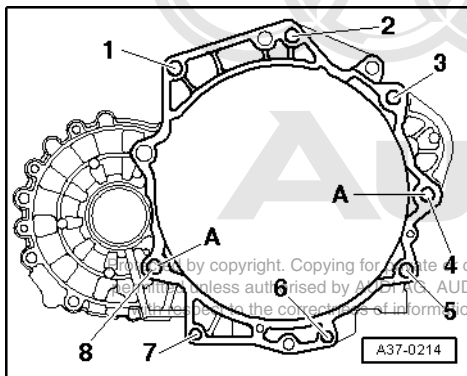
Vehicles with manual gearbox 02J:

-> Fasten engine to gearbox

Item	Bolt	Nm
1, 2 1), 8	M12 x 55	80
3 1), 4 1)	M12 x 150	80
5 ... 7	M10 x 50	45

1) Bolt with threaded pin M8

A: Centring sleeves



Vehicles with manual gearbox 02M:

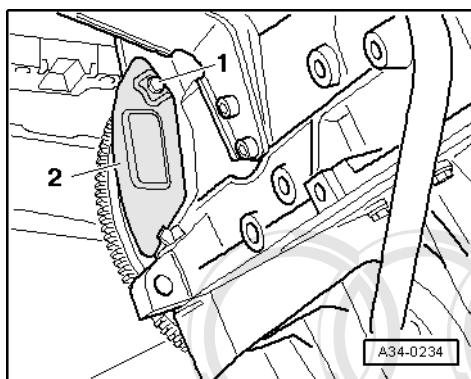
-> Fastening engine to gearbox

Item	Bolt	Nm
1, 2 1)	M12 x 55	80 2)
3 1), 4 1)	M12 x 165	80 2)
5	M10 x 105	45 2)

Item	Bolt	Nm
6, 7	M10 x 50	45 2)
8	M12 x 70	80 2)

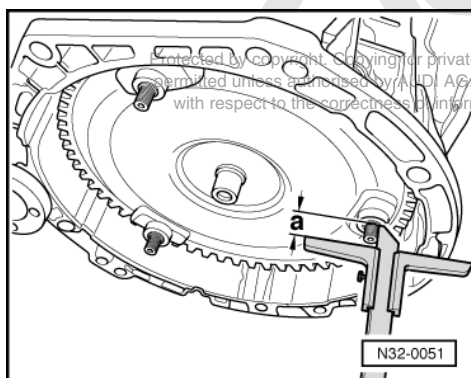
- 1) Bolt with threaded pin M8
- 2) Replace bolts

A: Centring sleeves



Vehicles with manual gearbox:

- -> Push in splash plate -2- in such a way that the lower lug engages into the cylinder block and secure on top with bolt -1-.



Vehicles with automatic gearbox:

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

=> Parts List

- Press the torque converter by hand into the torque converter bell housing, while rotating it so that the torque converter hub engages in the recesses of the inner wheel of the ATF pump and the torque converter is felt to slide in.

-> If the torque converter is correctly installed, the depth between the contact surfaces at the bottom of the studs on the torque converter and the contact surface of the torque converter bell housing is about 21 mm.

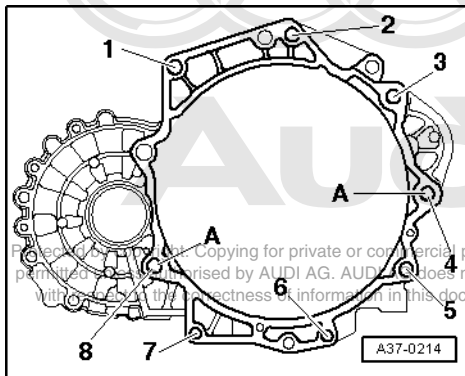
Important

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.

- Attach gearbox to engine.
- Secure nuts of torque converter with special tool Matra V/175.

Notes:

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

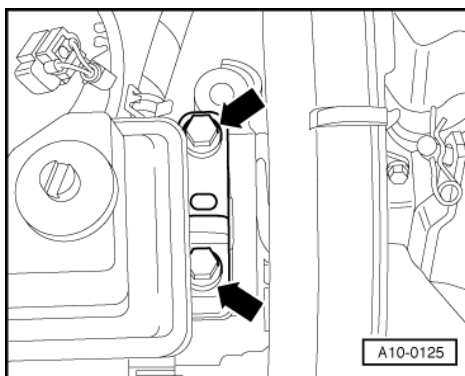


-> Fastening engine to gearbox in vehicles with automatic gearbox

Item	Bolt	Nm
1, 3 1), 4 1)	M12 x 60	80
2	M12 x 40	80
5, 6	M10 x 55	45
7	M10 x 70	45
8	M12 x 70	80

1) Bolt with threaded pin M8

A: Centring sleeves

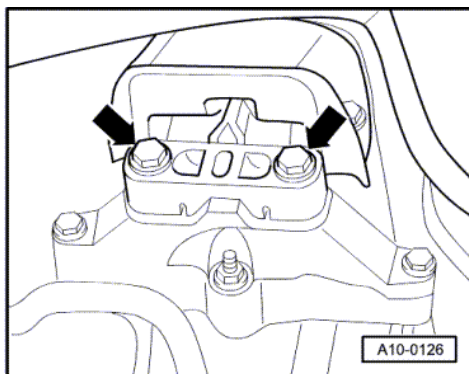


All models:

- Guide engine/gearbox assembly into the chassis.



- -> Unscrew bolts -arrows- engine mounting from engine console...



- -> ...and gearbox mounting on gearbox console hand tight.
- Only use new bolts to secure.

Note:

The bolts are tightened to final torque only after adjusting the engine mounting => Page 10-85.

- Remove engine mounting T10012 from engine.
- Install drive shafts.

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

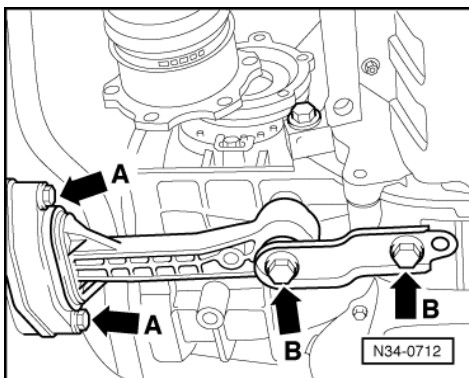
Note:

Before further assembly carry out the installation of the drive shafts.

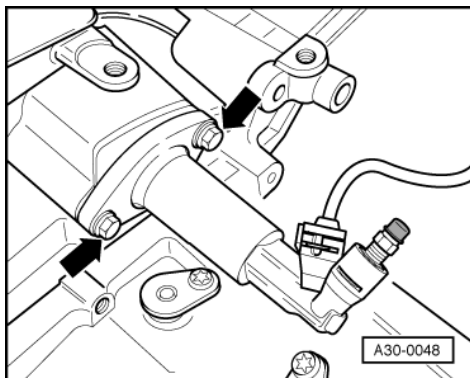
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- Install the connecting rod.

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



- -> First attach pendulum support to gearbox -arrows B- and then to subframe -arrows A-.
- Only use new bolts to secure.
- Install exhaust system and align it stress-free => Page 26-13.
- To facilitate the attachment of the alternator, vane pump and air conditioner slightly push back the bush for the securing bolt.

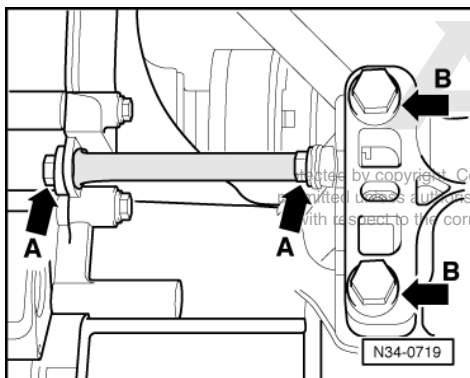


Vehicles with engine code ATD, AXR:

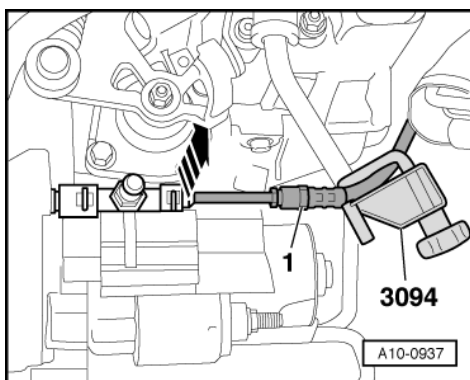
- -> Remove clutch slave cylinder -arrows-.

Important

Do not operate clutch pedal before the slave cylinder has been installed.



- -> Remove gearbox strut -arrows A- from gearbox.



Vehicles with engine code ASZ:

- -> Push the pressure line -1- into the hose connector and lock it with the catch -arrow-.

Important

The clutch pedal must not be operated before the clutch system has been bled.

- Remove hose clamp -3094-.



- Bleeding clutch hydraulic system:

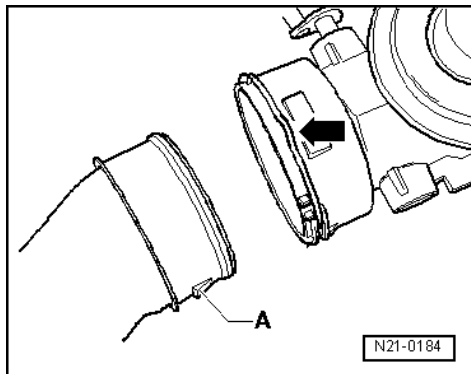
=> 6-speed Manual Gearbox 02M Front-wheel Drive; Repair group 30; Servicing clutch mechanism Servicing clutch mechanism

All models:

- Attach selector cables to gearbox and adjust:

=> Manual Gearbox; Repair group 34

- Install ribbed belt =>Page 13-12.
- Adjust engine mounting => Page 10-85.



- -> When installing air duct pipes with connectors, ensure that the securing clip -arrow- engages audibly in the retaining lug -A-.
- Install vacuum hoses =>as of Page 21-21.
- Electrical connections and routing:

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

Notes:

- ♦ If the battery is reconnected, please ensure that the vehicle equipment (radio, radio/navigation system, clock, electric window lifters) is activated as described in the operating instructions.
- ♦ Deactivate the service mode of the telematics control unit.

=> Radio, Telephone and Navigation System; Repair group 91

- Check oil level => Page 17-23.

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Important

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

- Top up coolant => Page 19-10.

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.

Tightening torques

Component		Nm
Bolts/nuts	M6	10
	M8	20
	M10	45
	M12	65

Component	Nm
Except for the following:	
Drive plate to torque converter M10 x1	57
Pendulum support to gearbox	40 + 90° 1)2)
Pendulum support to subframe	20 + 90°1)2)
Front exhaust pipe on turbocharger	253)

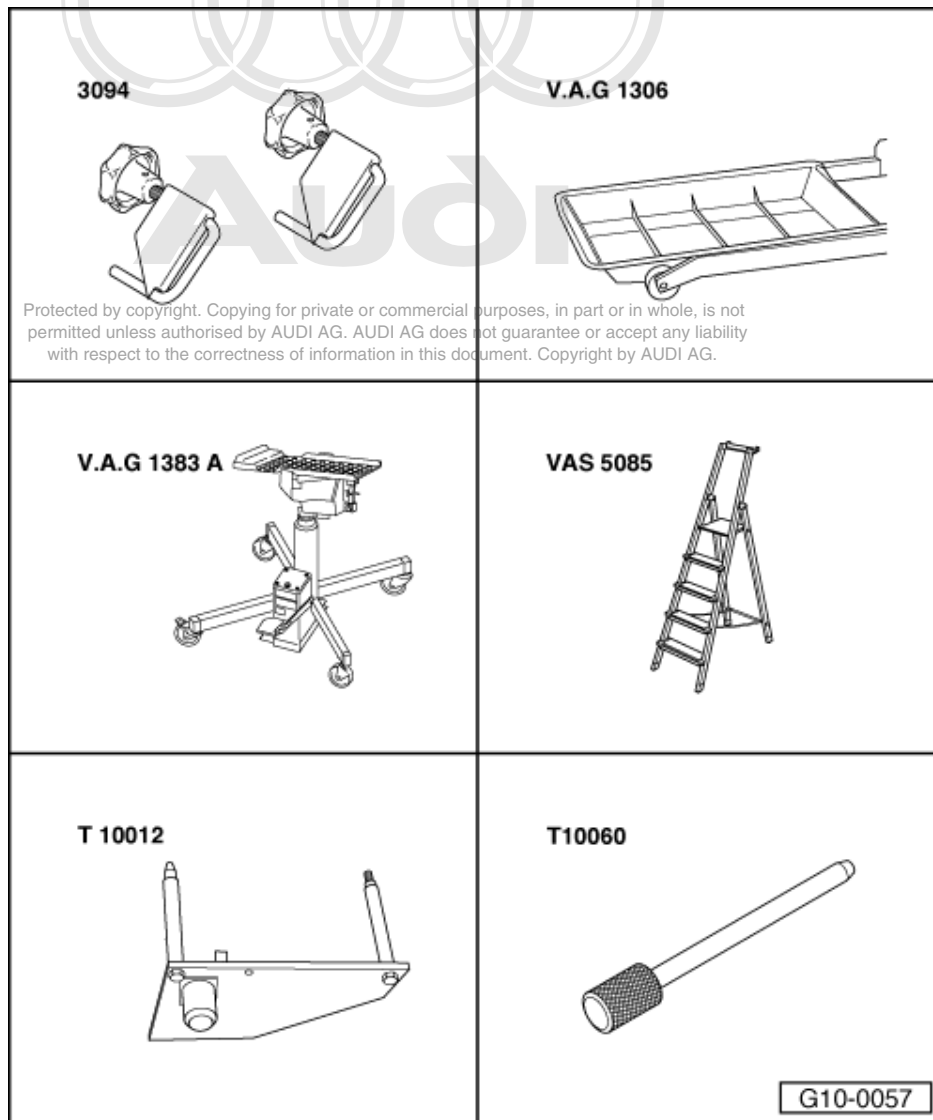
- 1) Stretch bolts, replace
- 2) 90° corresponds to a quarter of a turn
- 3) Replace the nuts.

Component	Nm
Drive shaft heat shield to cylinder block	35
Vane pump for power steering pump to bracket for auxiliary assemblies	23
Air conditioner compressor to bracket for auxiliary mechanical units	45
Alternator to bracket for auxiliary mechanical units	23
Clutch slave cylinder to gearbox	25
Gear strut	25
Selector cable support bracket to gearbox	23

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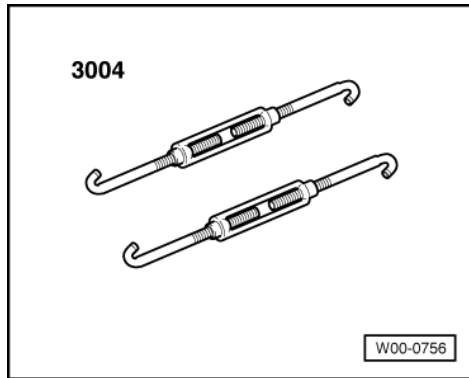
2 - Removing and installing engine -vehicles with four-wheel drive-

2.1 - Removing and installing engine -vehicles with four-wheel drive-

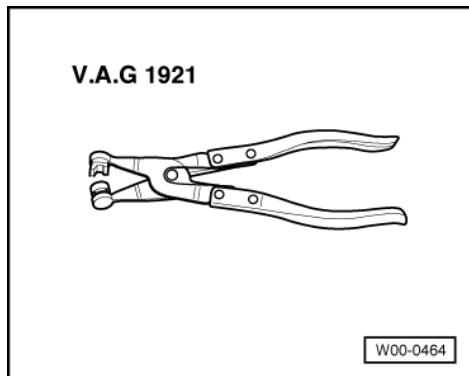


Special tools and workshop equipment required

- ♦ Hose clamps 3094
- ♦ Drip tray V.A.G 1306
- ♦ Engine/gearbox lifter V.A.G 1383 A
- ♦ Stepladder VAS 5085
- ♦ Engine mounting T10012
- ♦ Mandrel T10060



♦ Hook 3004



♦ Hose clamp pliers V.A.G 1921

2.2 - Removing

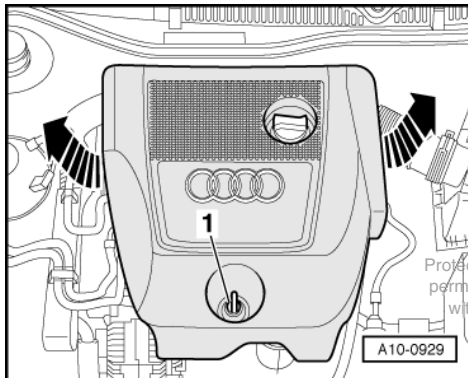
Notes:

- ♦ The engine is removed from underneath together with the gearbox.
- ♦ Collect drained coolant in a clean container for re use or disposal.

Important

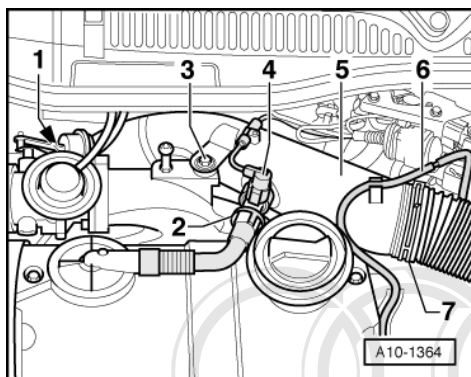
- ♦ **Measures to be taken prior to disconnecting the battery:** =>Electrical System; Repair group 27
- ♦ **Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.**

- Refer to coding on vehicles with encoded radio/radio navigation system (RNS); if necessary, interrogate.
- With the ignition switched off disconnect the battery earth strap.

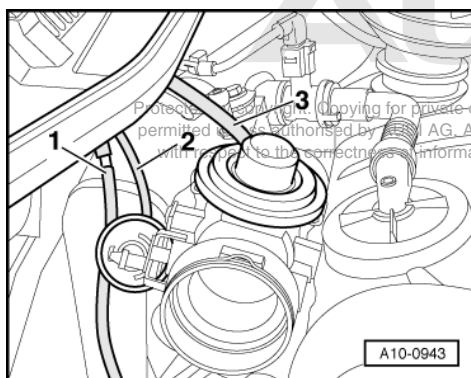


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- -> Remove oil dipstick -1- from guide tube.
- Remove engine cover -arrows-.
- Reinsert dipstick in guide tube.



- -> Disconnect hose -7- to air cleaner housing.
- Disconnect crankcase vent pipe -2- from air duct hose.
- If installed, detach connector for heating resistor (crankcase venting) -N79 -Item 4-.
- Detach vacuum hose -6- to solenoid valves.
- Set aside the vacuum hoses.
- Unscrew bolts -1- and -3-.

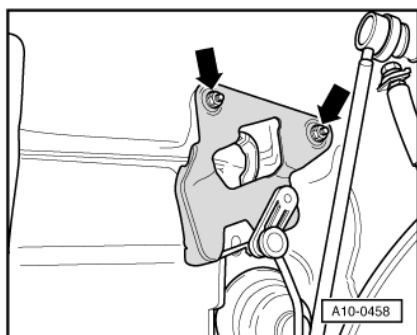


- -> Disconnect vacuum hoses -1 ... 3- at rear of intake manifold.

Important

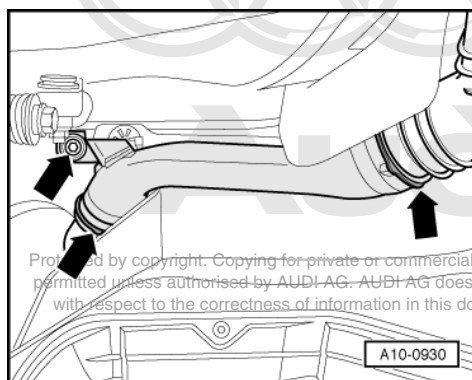
Hot steam can escape when opening cap on expansion tank: Cover cap with a cloth and open carefully.

- Open the cover of the coolant expansion tank

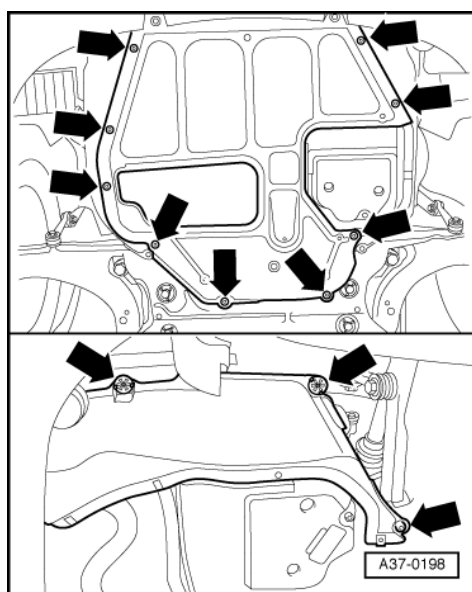


- -> If installed, remove the headlight range control bracket in top right of wheel housing -arrows-.

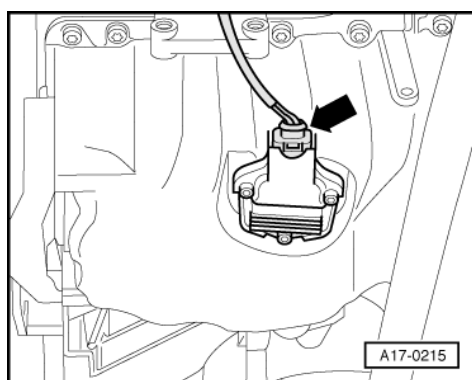
- Detach linkage for headlight range control from the wishbone and unplug connector.



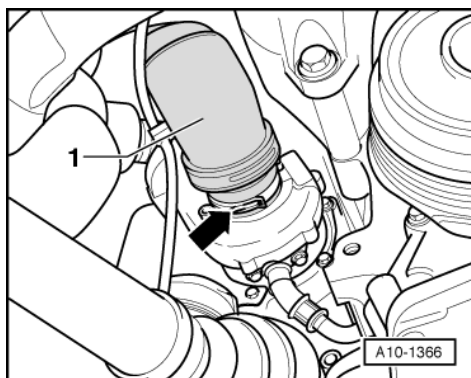
- -> Remove air duct pipe from right longitudinal member -arrows-.



- -> Remove noise insulation from centre, left and right sides -arrows-



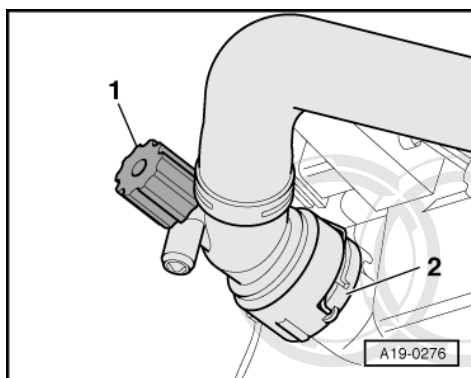
- -> Detach electrical connector from oil level sender -arrow-.
- Move wiring to the top.



- -> Release spring clamp -arrow- at turbocharger using hose clamp pliers V.A.G 1921 and disconnect the air duct pipe -1- from turbocharger.

Note:

The air duct pipe is removed from above at a later point.



- Place drip tray V.A.G 1306 below engine.

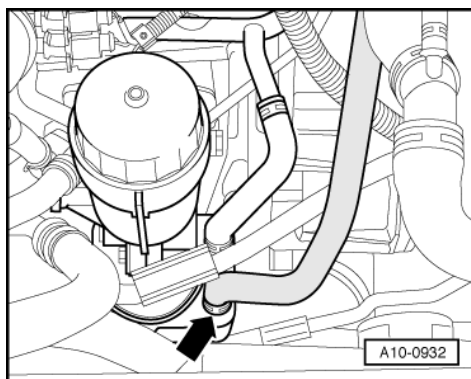
Vehicles with drain plug:

- -> Turn drain plug-1- on radiator anti-clockwise, fit auxiliary hose to connection if necessary.

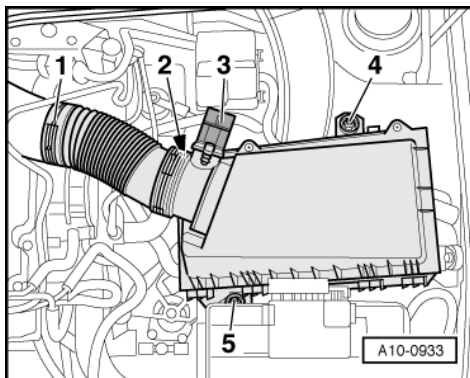
All models:

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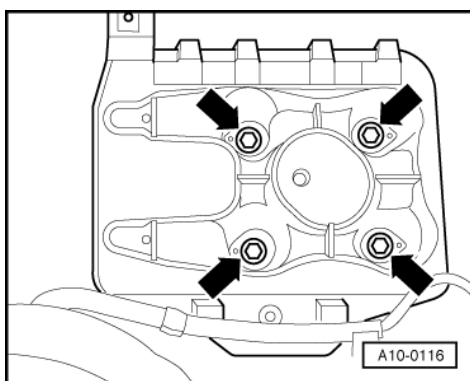
- Detach retaining clip -2- for bottom coolant hose and detach coolant hose from radiator.



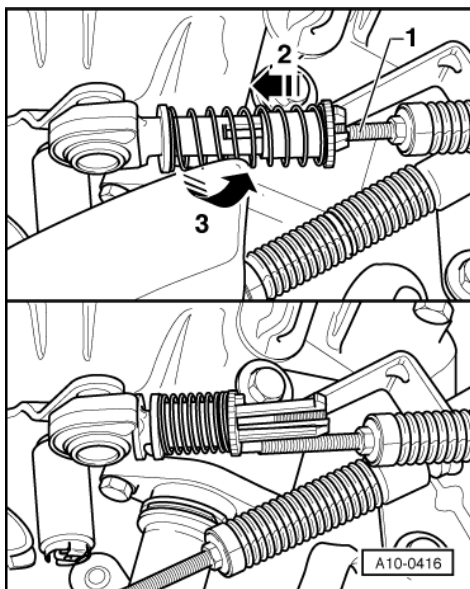
- -> Also disconnect coolant hose on oil cooler -arrow-, and drain off remaining coolant.
- Lift out the air duct pipe upwards.



- -> Unplug connectors for air mass meter -3-.
- Unscrew bolts -4- and -5-.
- Remove vent hose -2- off air cleaner housing.
- Remove air cleaner housing.



- Remove the battery.
- -> Remove battery carrier -arrows-.

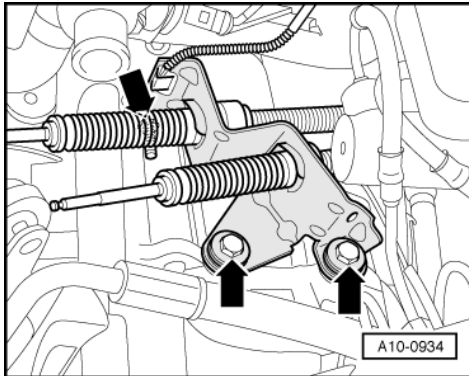


Detach both gear selector cables from gearbox as follows:

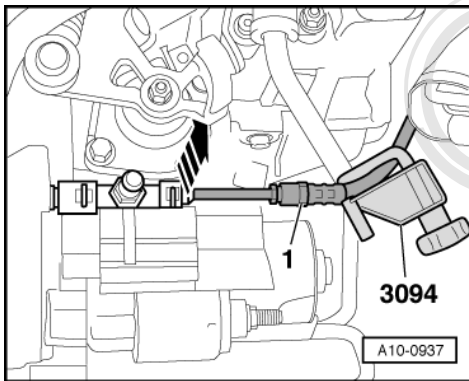
- -> Mark installation position of thread rods -1- of both gear selector cables with a waterproof felt-tip pen.
- Pull the spring with the knurled piece in direction of arrow 2 towards spherical joint and then turn knurled piece clockwise to secure in engaged position -arrow 3-.

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- Detach both gear selector cables.



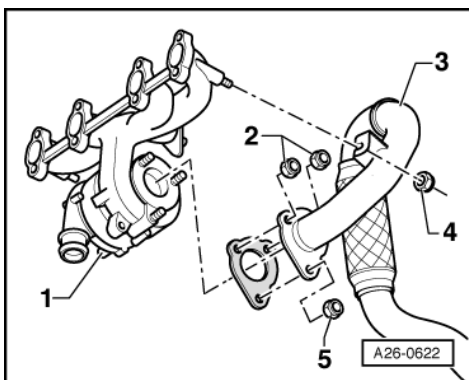
- -> Remove cable counterhold from gearbox and place to one side -arrows-.



- -> Clamp off pressure line to clutch slave cylinder using a hose clamp 3094.
- Pull retainer upwards -arrow- and detach pressure line from hose connector -1-.

Important

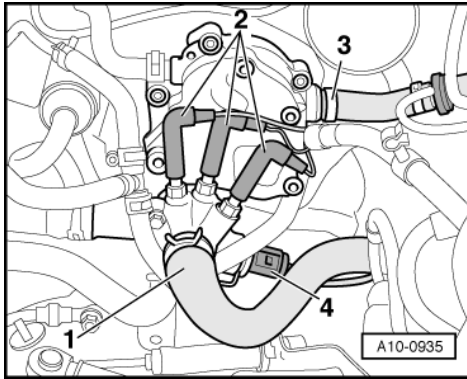
Do not depress clutch pedal after removing slave cylinder.



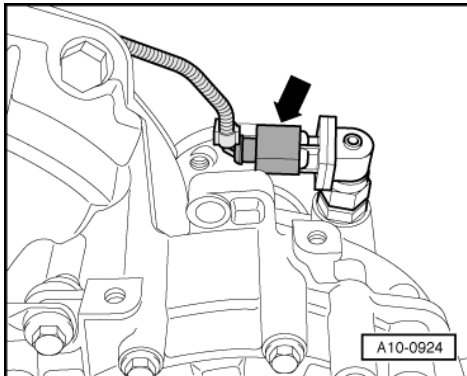
- -> Unscrew nuts -2-, -4- and -5-.

Note:

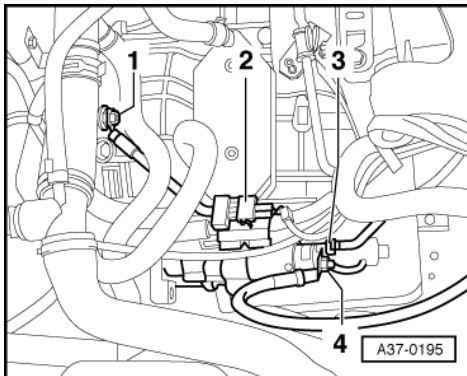
The front exhaust pipe -1- remains connected to the turbocharger -3-.



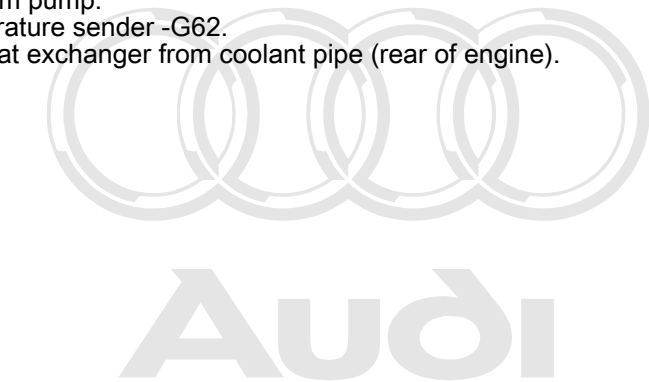
- -> Detach coolant hose -1- from engine.
- Detach connectors from glow plugs (coolant) -Q7 -Item 2-.
- Disconnect vacuum line -3- from tandem pump.
- Unplug connector -4- at coolant temperature sender -G62.
- Disconnect coolant hose to radiator heat exchanger from coolant pipe (rear of engine).



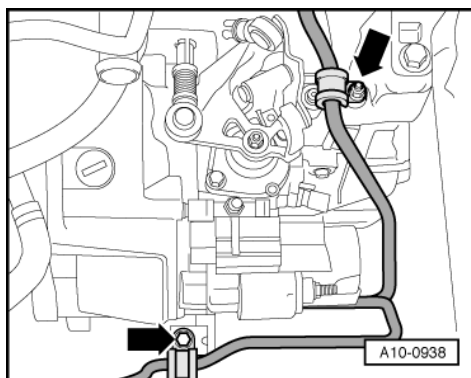
- Detach the heat protection sleeve at the speedometer sender -G22.
- -> Detach connector -arrow- from speedometer sender -G22 from gearbox, lay wiring aside.



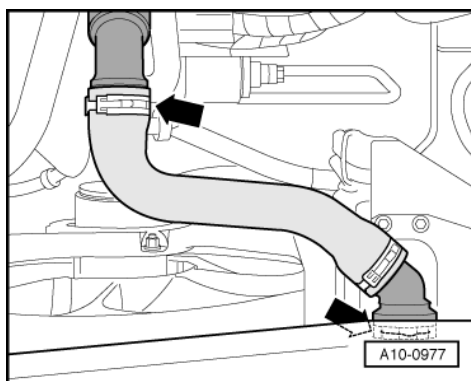
- -> Unscrew earth wiring -1- from flange engine/gearbox.
- Disconnect leads -3- and -4- to the starter.
- Take connector -2- out of bracket.
- Detach wiring from starter bracket.
- Unplug connector for reversing light switch on gearbox.



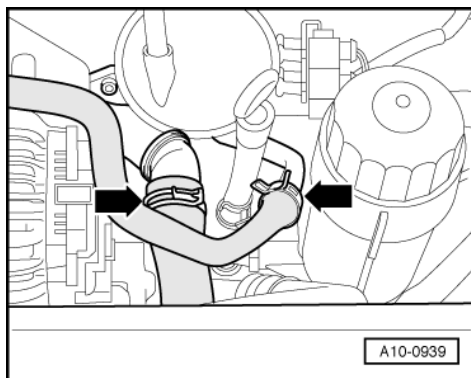
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- -> Detach power steering line from gearbox -arrows-.



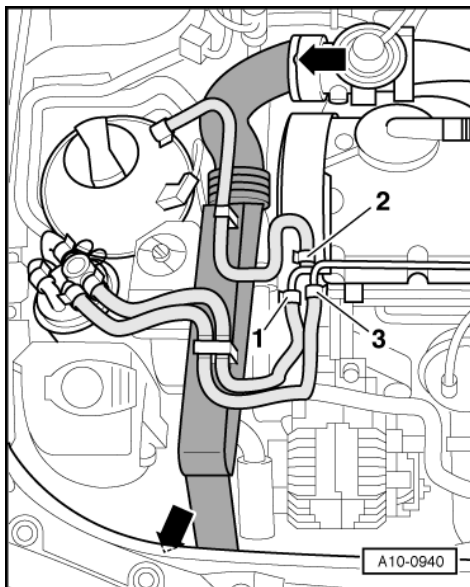
- -> Detach coolant hose between engine and radiator -arrows-.



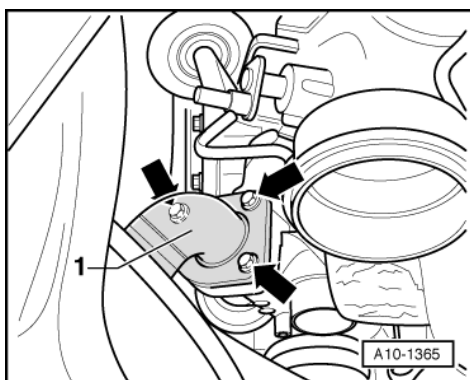
- -> Detach coolant hoses -arrows- from front of engine.



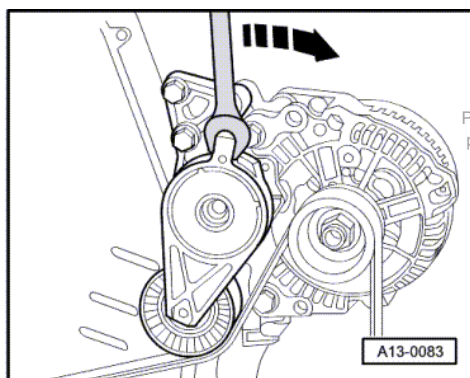
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- -> Remove coolant hose -2- and set aside.
- Detach fuel feed pipe -3- and fuel return pipe -1- and set aside.
- Lay aside wiring at air duct hose.
- Where necessary, detach the housing cover at rear of right headlamp.
- Remove air duct pipe -arrows-.



- -> Remove bolts -arrows- and remove resonator -1-.

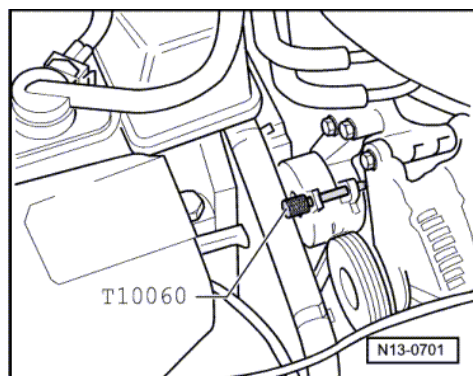


Note:

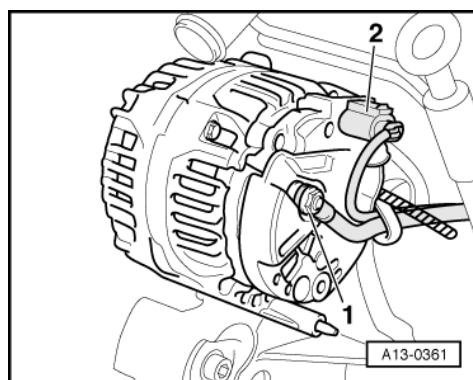
Mark the running direction with chalk or a felt-tipped pen before removing the ribbed belt. If the belt runs in the opposite direction when it is refitted, this can cause breakage.



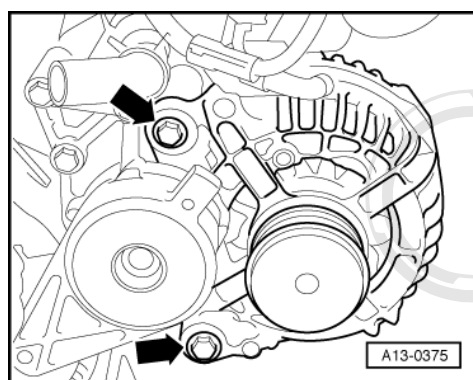
- -> To slacken ribbed belt, turn tensioner in direction of arrow.



- -> Lock ribbed belt tensioner using mandrel T10060.
- Remove ribbed belt.

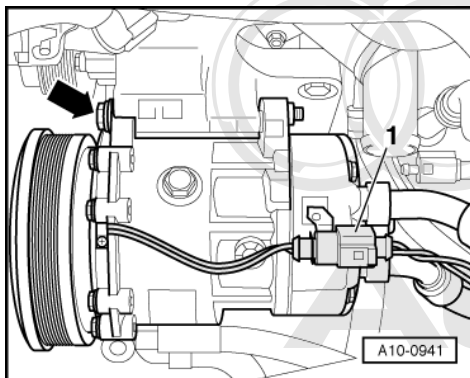


- -> Disconnect the connector -2-.
- Unscrew wire -1- from alternator.
- Unbolt wiring clamp.



- -> Unscrew the bolts -arrows- and remove alternator.

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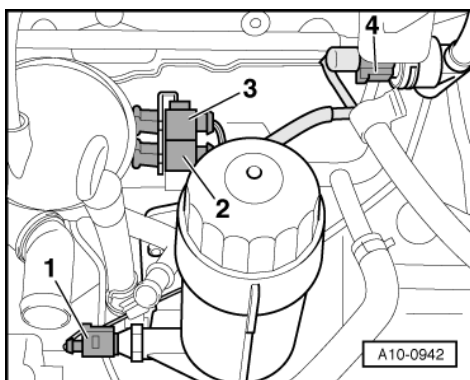
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Vehicles with air conditioner:

- -> Detach electrical connector -1- for solenoid clutch on air conditioner compressor.

Important
The air conditioner refrigerant circuit must not be opened.

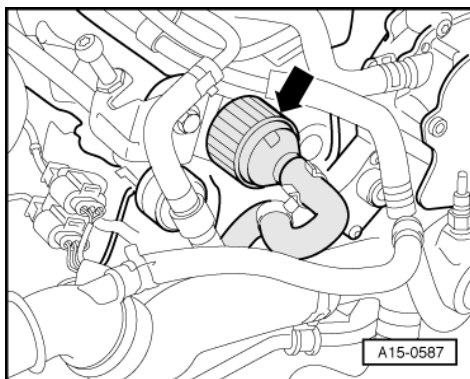
- Screw out bolts -arrow- for air conditioner compressor.
- Suspend air conditioner compressor together with connected coolant hoses from engine bonnet lock.



All models:

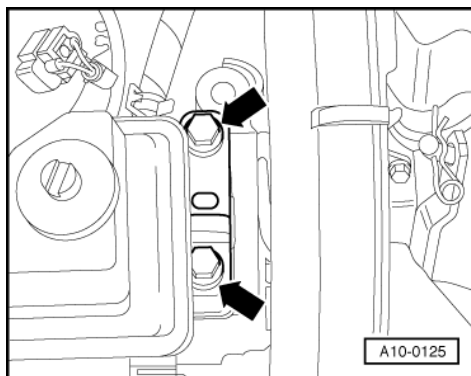
- Unplug connector console from glow plugs.
- -> Detach the following connectors:

- 1 - Oil pressure switch -F1
- 2 - Hall sender -G40
- 3 - Engine speed sender -G28
- 4 - Fuel temperature sender -G81

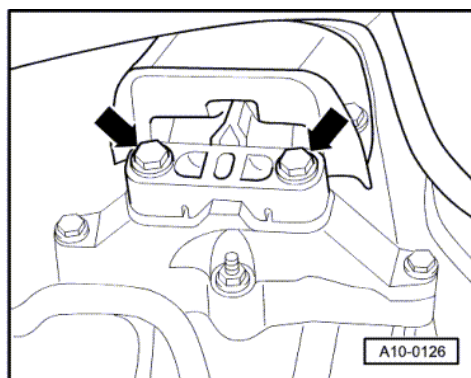




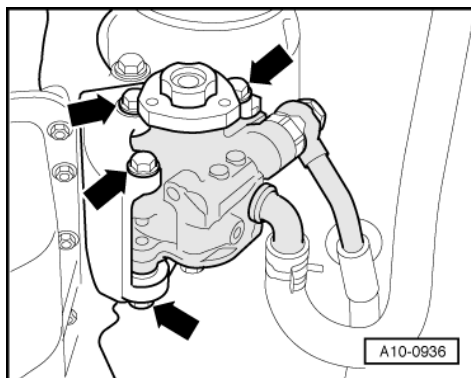
- -> Open the knurled nut -arrow- and unplug central connector.
- Lay wiring aside.



- -> Loosen bolts -arrows- of assembly mounting on engine by 2 turns.



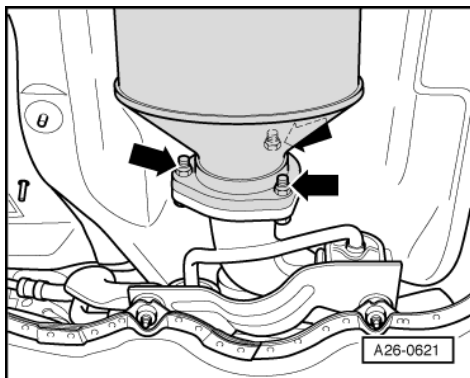
- -> Loosen bolts -arrows- of assembly mounting on gearbox by 2 turns.



- Detach pulley from power steering vane pump.
- -> Detach vane pump for power steering -arrows-. Do not open hydraulic connections.
- Suspend vane pump for power steering from lock carrier.



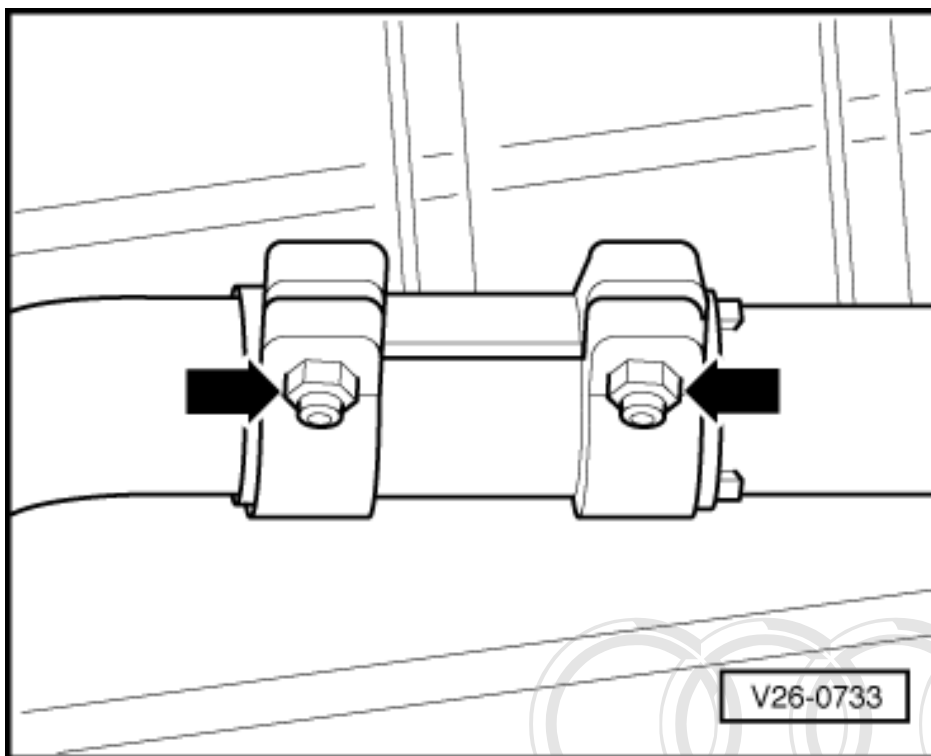
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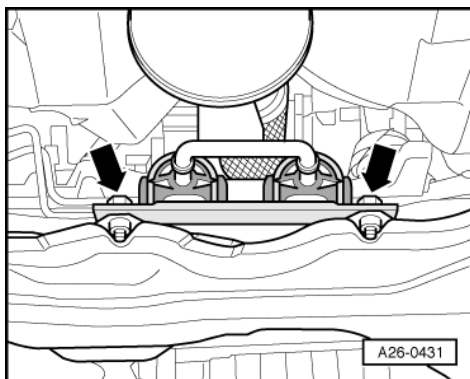
Note:

The isolating element in front exhaust pipe must not be deflected more than 10 °to avoid damage.

- -> Remove bolts -arrows- at the front exhaust pipe/catalytic converter flange.

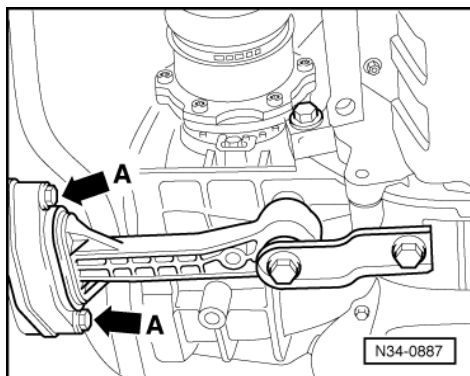


- -> Detach the exhaust system at the clamping sleeve -arrows-.
- Remove catalytic converter.

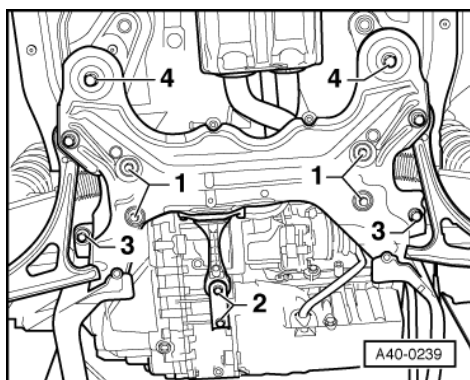


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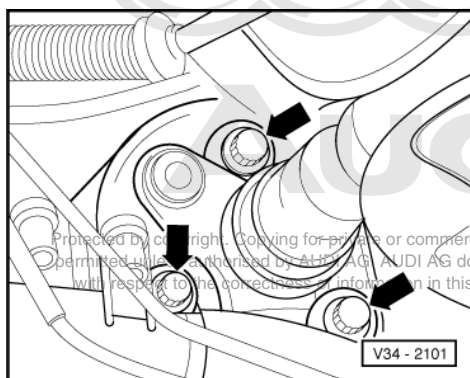
- -> Unbolt bracket for exhaust system from assembly mounting
-arrows-.



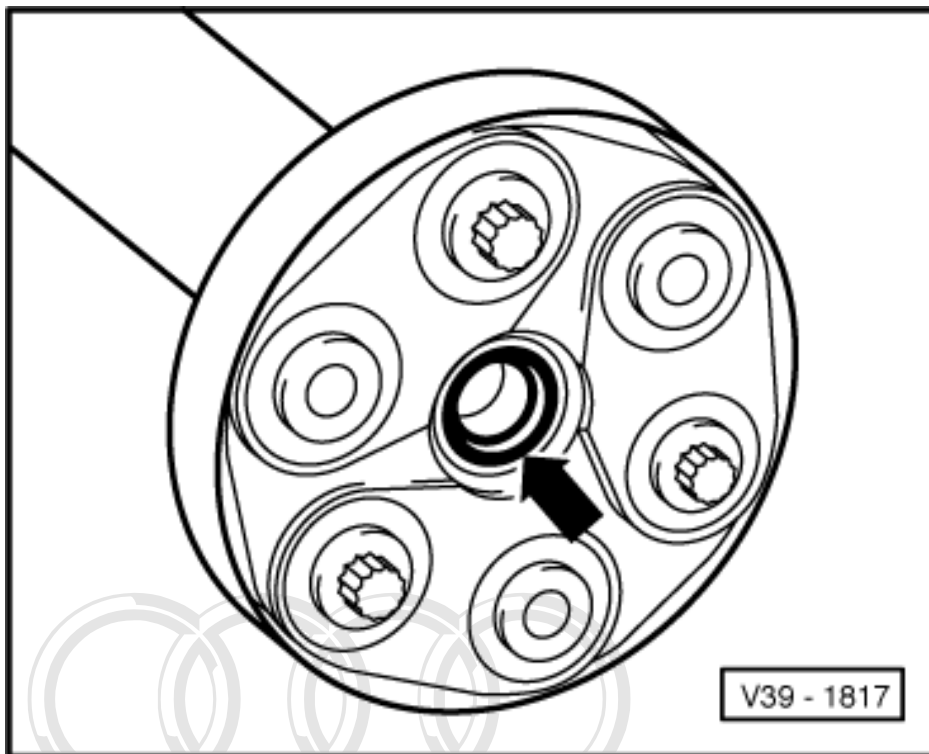
- -> Remove bolts -A- of pendulum support.



- -> Remove bolts -2- of pendulum support.
- Detach pendulum support.
- Remove bolts -2- for steering box.
- Lever steering box off subframe (dowel sleeve) and detach power-steering pressure line at subframe.
- Position gearbox lifter V.A.G 1383 A with universal mount 1359/2 underneath subframe.
- Unscrew bolts -3- and -4- for subframe.
- Carefully lower subframe, leave attached at the wishbones and connecting rods, while pressing steering box upwards.
- Remove front exhaust pipe.
- Suspend the steering box upwards.
- Mark position of gear disc and angle drive flange in relation to each other.



- -> Unbolt propshaft with gear disc at angle drive -arrows-.
- Press front propshaft tube as far as possible towards the rear.

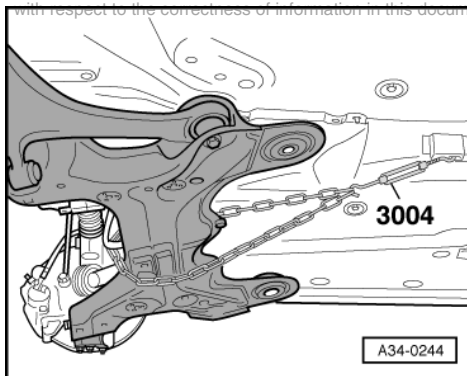


Important

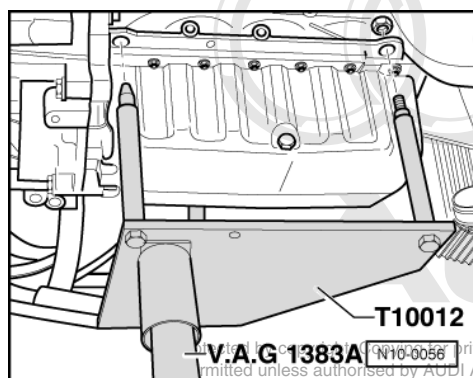
The sealing ring -arrow- in the flange of the propshaft may not be damaged when removing and installing the mechanical units of the engine/gearbox. If sealing ring is damaged propshaft must be replaced.

- -> Carefully push the engine/gearbox-assembly forwards so that the guide pins at the gearbox flange can be pulled out of the propshaft.

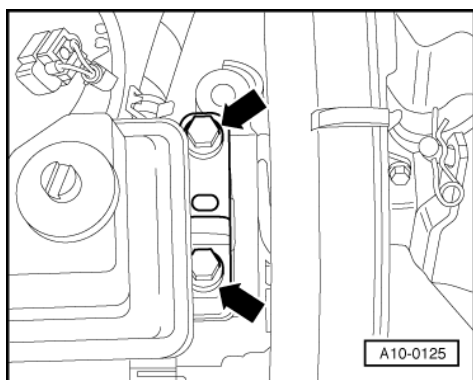
Unbolt the left and right drive shafts from the gearbox flange and place drive shafts on the subframe.
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- -> Tie the subframe towards the rear by means of a chain. Engage hook 3004 in an aperture in the vehicle floor for this purpose (remove plug if necessary).



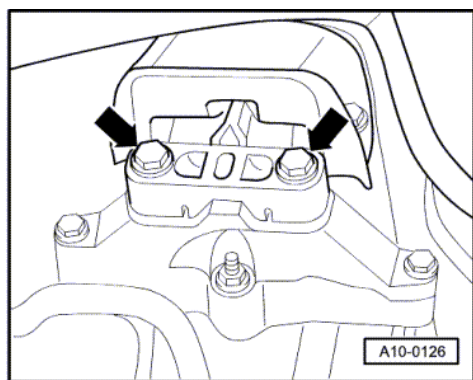
- -> Attach engine mounting T10012 with securing nut and bolt with approx. 20 Nm to cylinder block.
- Insert engine/gearbox lifter V.A.G 1383 A in engine mounting T10012 and lift slightly.



Note:

To unscrew bolts for assembly mounting use stepladder VAS 5085.

- -> Loosen bolts -arrows- of assembly mounting on engine...

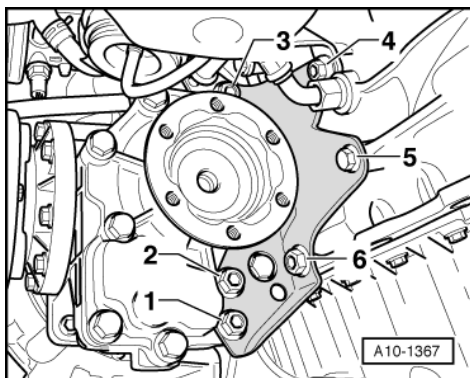


- -> ...and from gearbox.

Notes:

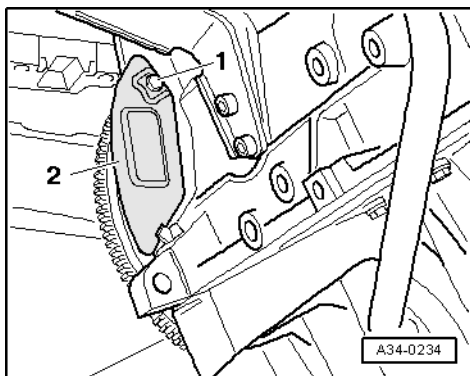
- ♦ Check that all hoses and wiring connections between engine, gearbox and body have been detached.
- ♦ Carefully guide engine/gearbox assembly when lowering to avoid damage.
- ♦ Make especially sure that there is free movement to vacuum unit of turbocharger.
- Pull engine/gearbox assembly as far forward as possible, and lower gradually.

2.3 - Detaching engine from gearbox.



Procedure

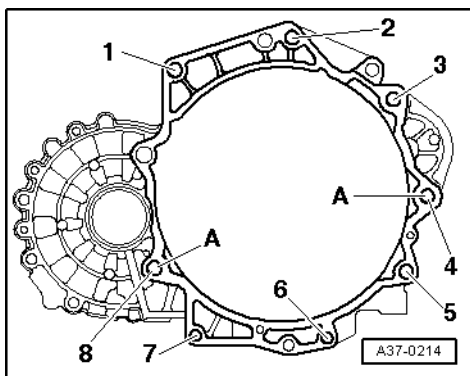
- Engine/gearbox assembly removed and attached to engine mounting T10012.
- -> Remove bolts -1 ... 6- from angle drive mounting.



- -> Unscrew bolt -1- with gearbox installed.
- Pull up splash plate -2-.

Note:

Shown in illustration with gearbox removed.



- -> Unscrew bolts -1 ... 8- at engine/gearbox flange.
- Take off starter.


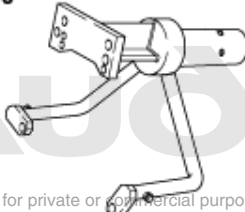
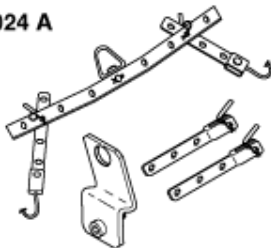



Note:

A 2. mechanic is required to separate engine/gearbox assembly.

- Remove gearbox from engine.

2.4 - Attaching engine to repair stand

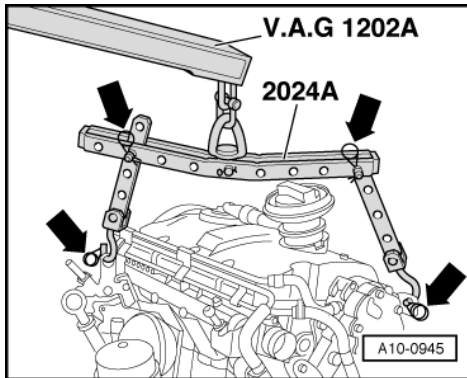
VW 313 	VW 540 
2024 A 	V.A.G 1202 A 
	<div>G10-0037</div>

Special tools and workshop equipment required

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

or

- ♦ Workshop crane V.A.G 1202 A



Procedure

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

Note:

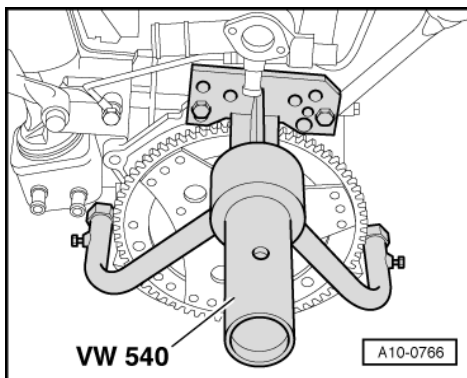
To balance the centre of gravity of the engine, position the hook attachments as shown in the illustration.

Important

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

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- Lift engine off engine bracket T10012 using workshop crane VAS 6100 or V.A.G 1202 A.



-> When working on the engine, it should be secured to the repair stand using the engine mounting VW 540.

2.5 - Installing

Procedure

- Engine installed on engine bracket T10012.

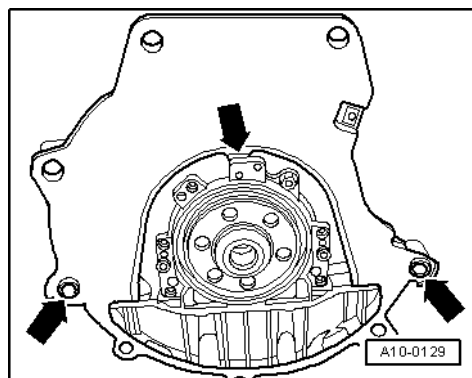
Installation is carried out in the reverse order; note the following:

Notes:

- ◆ When performing installation procedures always replace self-locking nuts and bolts.
- ◆ Replace seals, gaskets, and bolts which have a specified tightening angle.
- ◆ Hose connections and hoses for charge air system must be free of oil and grease before assembly.
- ◆ Secure all hose connections with the correct hose clamps (same as original equipment):

=> Parts List

- Check whether the dowel sleeves for centralising engine/gearbox are in the cylinder block, install if necessary.

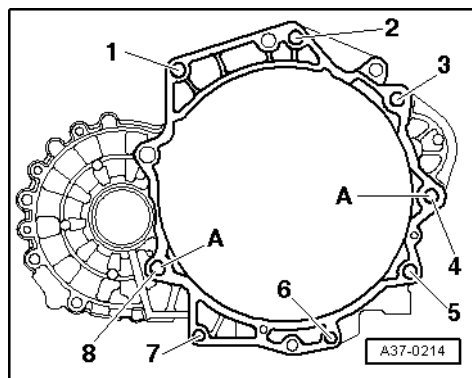


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- -> Engage intermediate plate on sealing flange and push onto dowel sleeves -arrows-.
- If necessary, check that clutch plate is properly centred.
- Check clutch release bearing for wear, renew if necessary.
- Lightly lubricate clutch release bearing, release bearing guide sleeve and splines on input shaft with G 000 100.
- Bolt gearbox to engine, use new bolts to fasten.

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 $\pm 15\%$.



Vehicles with manual gearbox 02M:

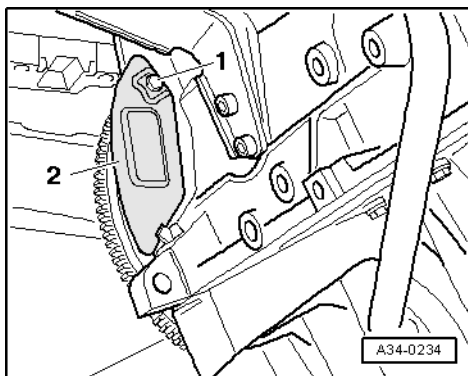
-> Fastening engine to gearbox

Item	Bolt	Nm
1, 2 1)	M12 x 55	80 2)
3 1), 4 1)	M12 x 165	80 2)
5	M10 x 105	45 2)
6, 7	M10 x 50	45 2)
8	M12 x 70	80 2)

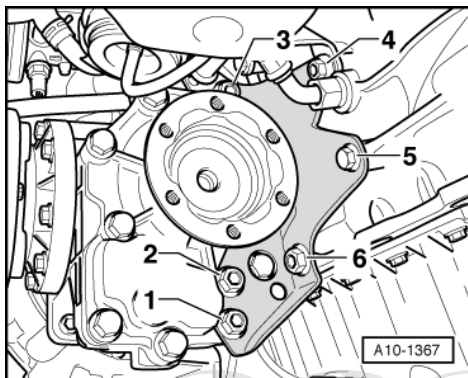
1) Bolt with threaded pin M8

2) Replace bolts

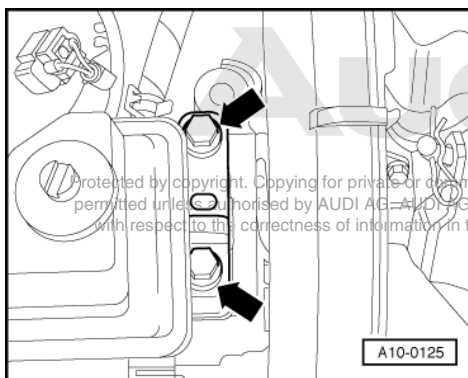
A: Centring sleeves



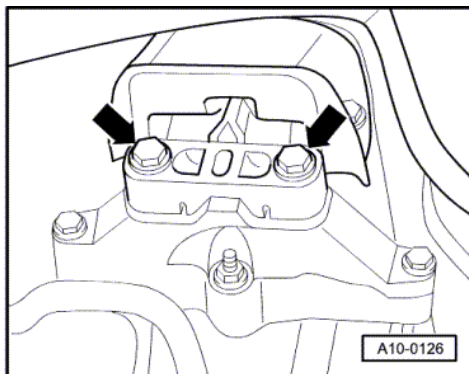
- -> Push in splash plate -2- in such a way that the lower lug engages into the cylinder block and secure on top with bolt -1-.



- -> Install angle drive mounting, observe the following installation sequence:
 - Fit bolts -4 ... 6- loosely.
 - Initially tighten bolts -1 ... 3- to 3 Nm.
 - Then tighten bolts -4- and -6- to 45 Nm.
 - Tighten bolt -5- to 22 Nm.
 - Tighten bolts -1 ... 3- to 45 Nm.



- Guide engine/gearbox assembly into the chassis.
- -> Unscrew bolts -arrows- engine mounting from engine console...

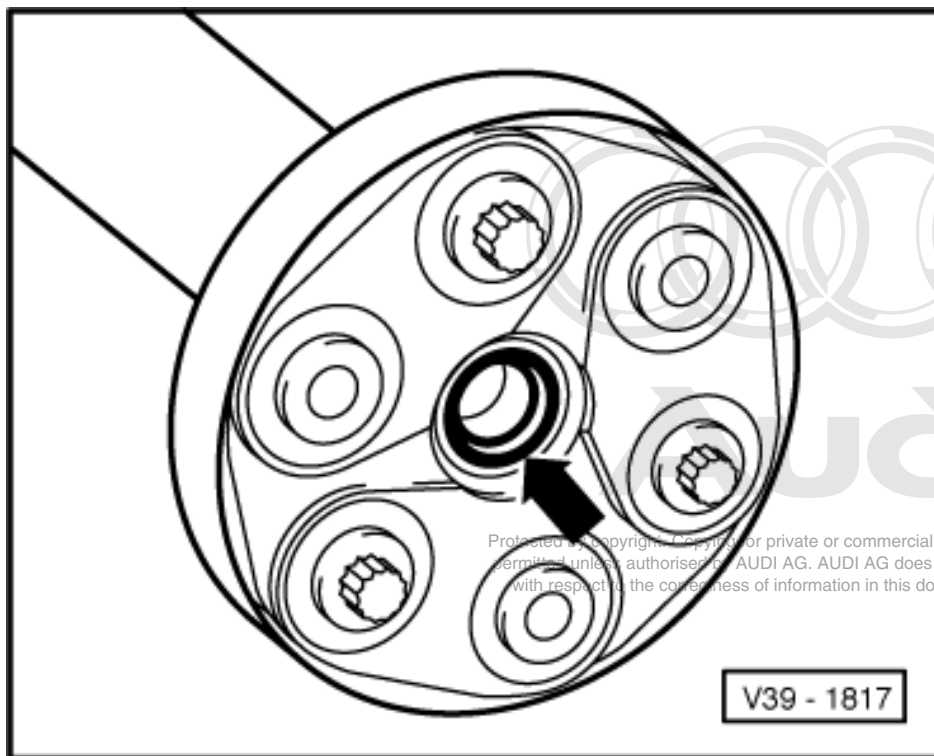


- -> ...and gearbox mounting on gearbox console hand tight.
- Only use new bolts to secure.

Note:

The bolts are tightened to final torque only after adjusting the engine mounting => Page 10-85.

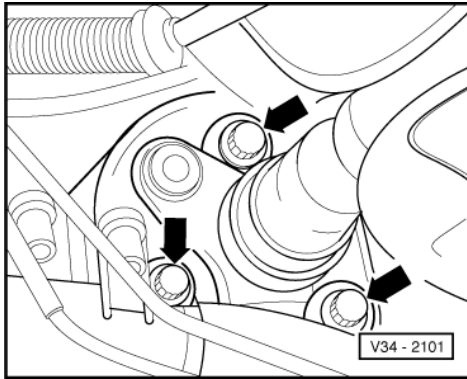
- Remove engine mounting T10012 from engine.



- -> Push mechanical engine/gearbox units against bulkhead; the lug of the angle drive must be inserted horizontally and carefully into the flange of the propshaft.

Important

The sealing ring -arrow- in the flange of the propshaft may not be damaged when removing and installing the mechanical units of the engine/gearbox. If sealing ring is damaged propshaft must be replaced.

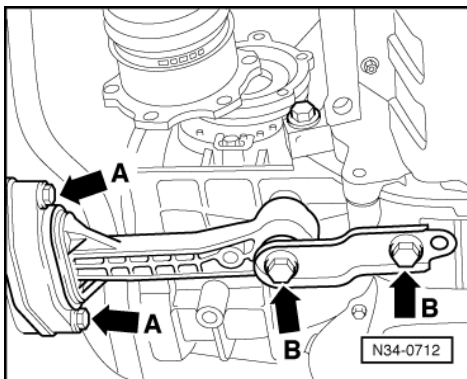


- -> Bolt on propshaft with drive disc to the flange of the angle drive -arrows-. Tightening torques:

=> 5 and 6-speed Manual Gearbox-02M Four-wheel Drive/Final Drives; Repair group 39

- Fit front exhaust pipe to turbocharger and secure with nut.
- Installing subframe

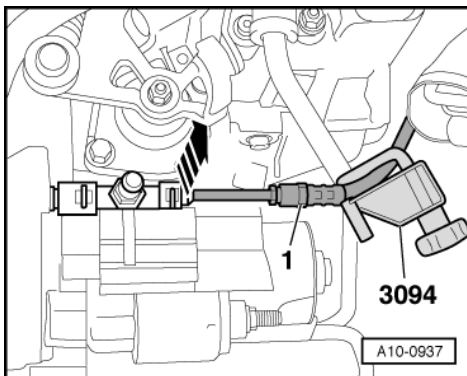
=> Running Gear, FWD and 4WD; Repair group 40



- -> First attach pendulum support to gearbox -arrows B- and then to subframe -arrows A-.
- Only use new bolts to secure.
- Install drive shafts.

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

- To facilitate the attachment of the alternator, vane pump and air conditioner slightly push back the bush for the securing bolt.



- -> Push the pressure line -1- into the hose connector and lock it with the catch.

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Important

The clutch pedal must not be operated before the clutch system has been bled.

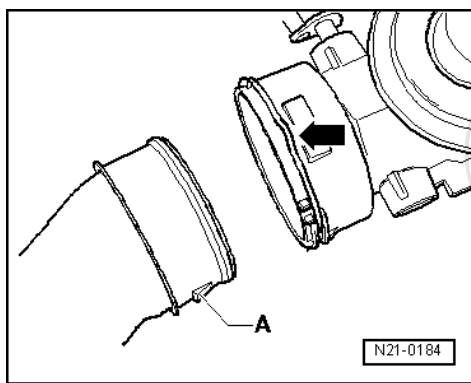
- Remove hose clamp -3094-.
- Bleeding clutch hydraulic system:

=> 5 and 6-speed Manual Gearbox 02M Four-wheel Drive/Gearbox; Repair group 30; Servicing clutch mechanism Servicing clutch mechanism

- Attach selector cables to gearbox and adjust:

=> 5 and 6-speed Manual Gearbox 02M Four-wheel Drive/Gearbox; Repair group 34; Servicing clutch mechanism Servicing clutch mechanism

- Install exhaust system and align it stress-free => Page 26-35.
- Install ribbed belt =>Page 13-12.
- Adjust engine mounting => Page 10-85.



- -> When installing air duct pipes with connectors, ensure that the securing clip -arrow- engages audibly in the retaining lug -A-.
- Install vacuum hoses =>as of Page 21-21.
- Electrical connections and routing:

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

Notes:

- ♦ If the battery is reconnected, please ensure that the vehicle equipment (radio, radio/navigation system, clock, electric window lifters) is activated as described in the operating instructions.
- ♦ Deactivate the service mode of the telematics control unit.

=> Radio, Telephone and Navigation System; Repair group 91

- Check oil level => Page 17-23.

Important

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

- Top up coolant => Page 19-10.

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.

Tightening torques

Component		Nm
Bolts/nuts	M6	10
	M8	20
	M10	45
	M12	65
Except for the following:		
Pendulum support to gearbox		40 + 90° 1)2)
Pendulum support to subframe		20 + 90°1)2)
Vane pump for power steering pump to bracket for auxiliary assemblies		23

1) Stretch bolts, replace

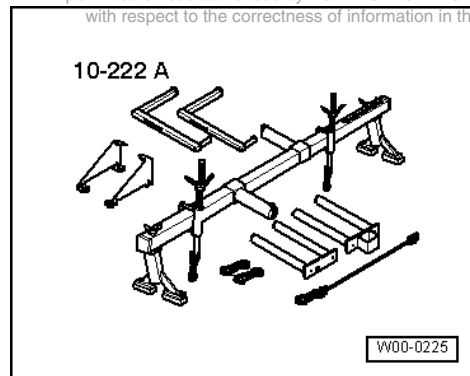
2) 90° corresponds to a quarter of a turn

Component	Nm
Air conditioner compressor to bracket for auxiliary mechanical units	45
Alternator to bracket for auxiliary mechanical units	23
Resonator to turbocharger	9
Selector cable support bracket to gearbox	23

3 - Adjusting engine mounting

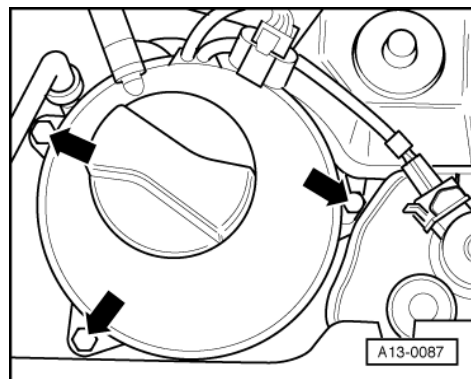
3.1 - Adjusting engine mounting

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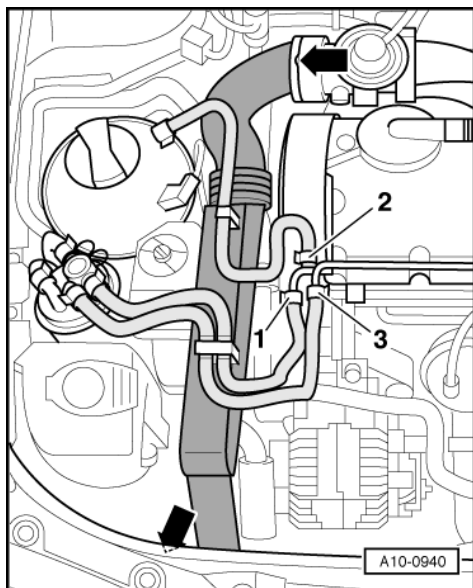
Special tools and workshop equipment required

- ♦ Support bar 10-222A



Checking adjustment

- -> Unscrew coolant expansion tank and refill reservoir for power steering -arrows-.

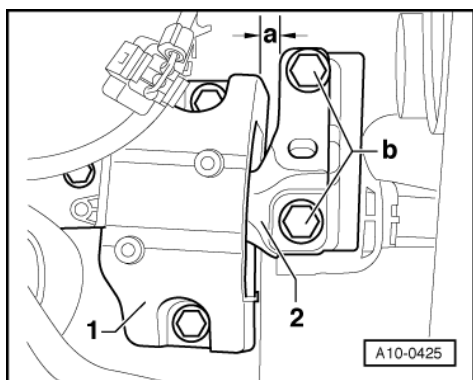


- -> Lay aside wiring at air duct hose.
- Where necessary, detach the housing cover at rear of right headlamp.
- Remove air duct pipe -arrows-.

Note:

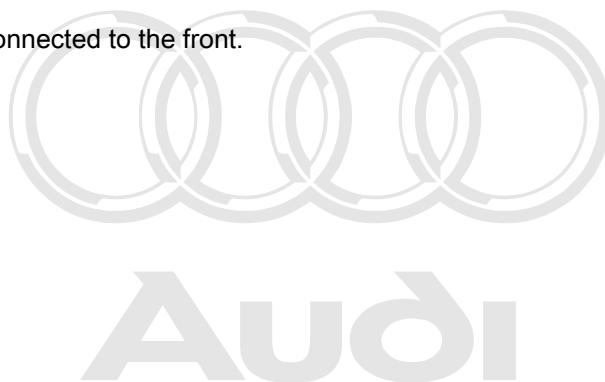
The coolant hose -2- and fuel lines -1- and -3- remain connected.

- Move coolant expansion tank with lines connected to the front.

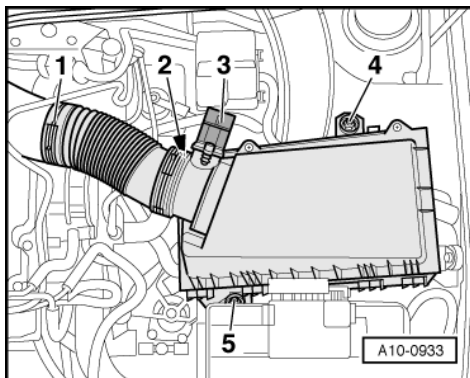


- -> Both bolt heads -b- must be flush with the edge of the support arm -2-.
- Between engine console -1- and support arm -2- of the right engine mounting must be a distance $a = 13$ mm.

Use a 12 mm flat iron (if necessary, use special tool 2011) to check distance -a-. It must be easy to insert the flat iron.



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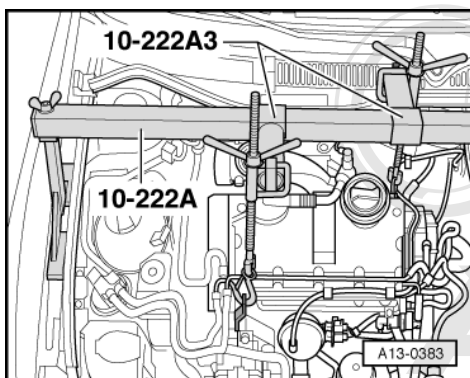
Adjusting

If the distance measured is too small or great, proceed as follows:

- -> Remove air duct hose -1- from air duct pipe.
- Detach connector of air mass meter -3-.
- Unscrew bolts -4- and -5-.
- Remove vent hose -2- off air cleaner housing.
- Remove air cleaner housing.

Vehicles with engine code ASZ, ATD:

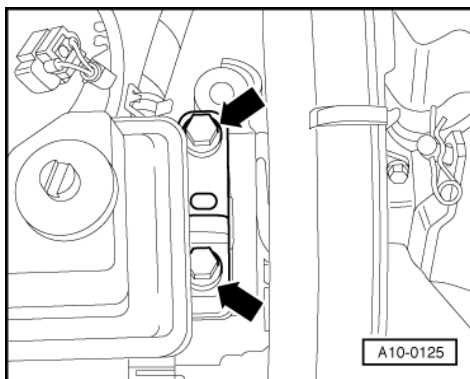
- Unscrew 2 bolts of the air duct hose from intake manifold and push air duct pipe forwards.



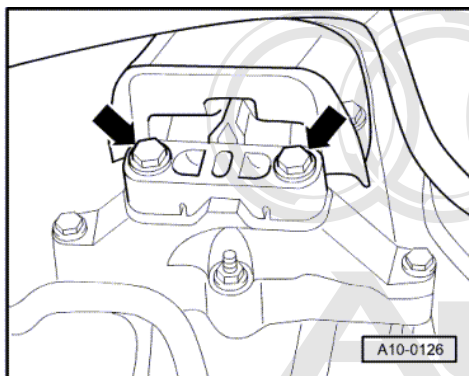
All models:

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- -> Set up support bar 10-222 A on wing panel flanges using adapters 10-222 A3.
- Attach spindles in both lifting eyes.
- Lift engine with both spindles evenly and slightly.

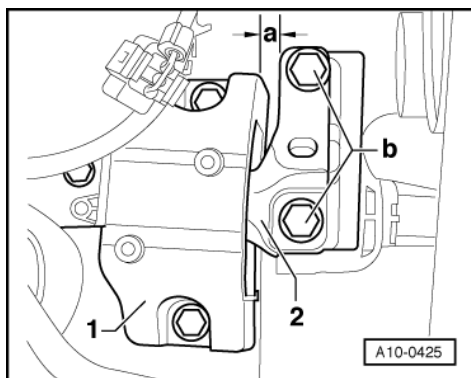


- -> Loosen bolts -arrows- of assembly mounting on engine...

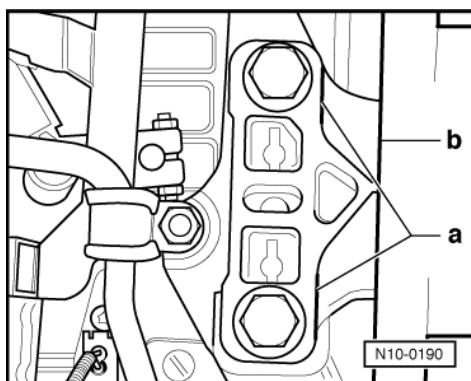


- -> ...and from gearbox. Replace all 4 bolts one by one (if not already replaced when engine was installed) and hand-tighten them.

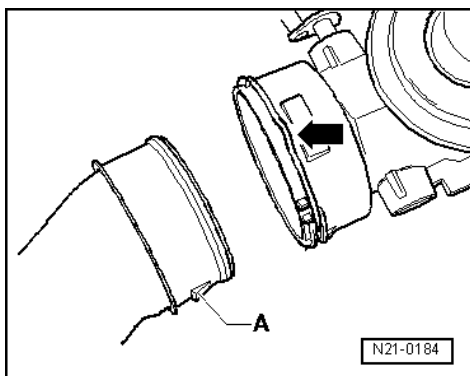
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- -> Loosen bolts -b- of support arms on left and right approx. two turns.
- Using an assembly iron displace engine between engine console -1- and support arm -2- until the distance on engine side is $a = 13 \text{ mm}$.
 - It must be easy to insert a 12 mm flat iron (or special tool 2011).
 - Both bolt heads -b- must be flush with the edge of the support arm.
- Tighten the bolts -b- to 100 Nm on assembly bracket on engine side.



- -> Ensure that the edges on the load arm on the gearbox side -a- and gearbox console -b- are parallel.
- Tighten the bolts for assembly bracket on gearbox side to 100 Nm.



- -> When installing air duct pipes with connectors, ensure that the securing clip -arrow- engages audibly in the retaining lug -A-.

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



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13 - Crankshaft group

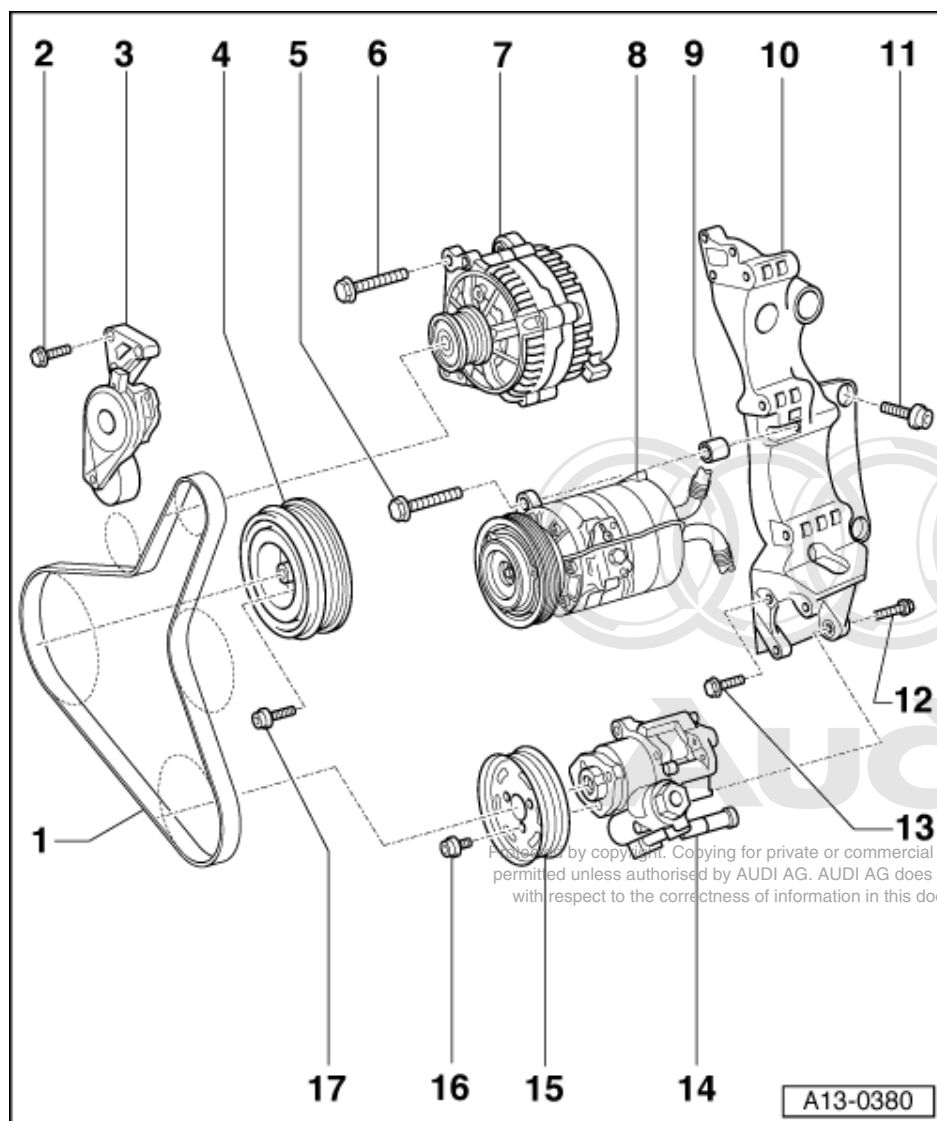
1 - Dismantling and assembling engine

1.1 - Dismantling and assembling engine

1.2 - Removing and installing ribbed belt

Notes:

- ♦ 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. Ensure that the belt is correctly seated in the pulleys when installing.
- ♦ The following illustration shows the belt drive on vehicles with air conditioner.



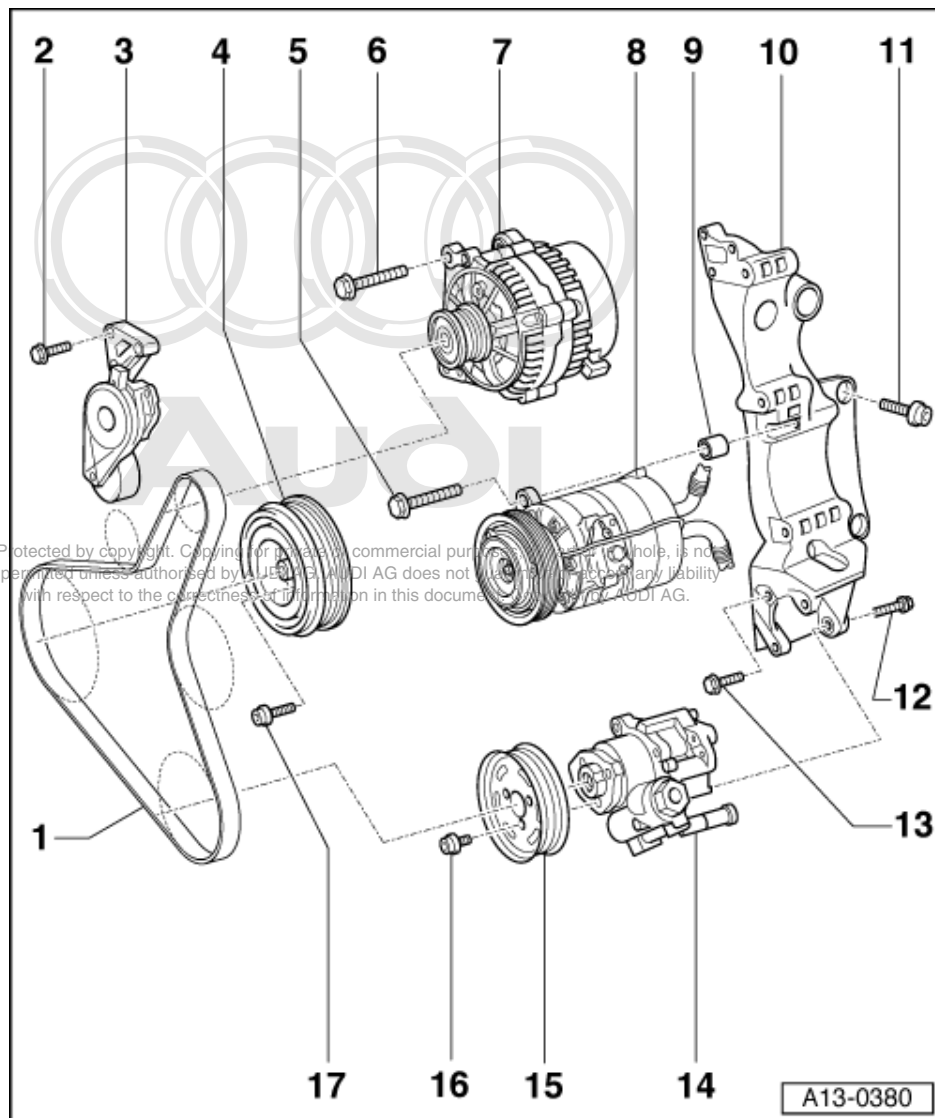
1 Ribbed belt

- ♦ Ribbed belt on vehicles without air conditioner=>Fig.13-6
- ♦ Ribbed belt on vehicles with air conditioner=>Fig.13-6
- ♦ A double ribbed belt is fitted on engines with AC compressor
- ♦ Check for wear
- ♦ Do not kink
- ♦ Removing and installing
=>Page 13-10

2 23 Nm

3 Tensioner for ribbed belt

- ♦ Swivel with open-ended spanner to slacken ribbed belt.
- ♦ Secure tensioner in position using mandrel T10060



4 Vibration damper

- ♦ With pulley for ribbed belt
- ♦ Removing and installing
=>Page 13-7

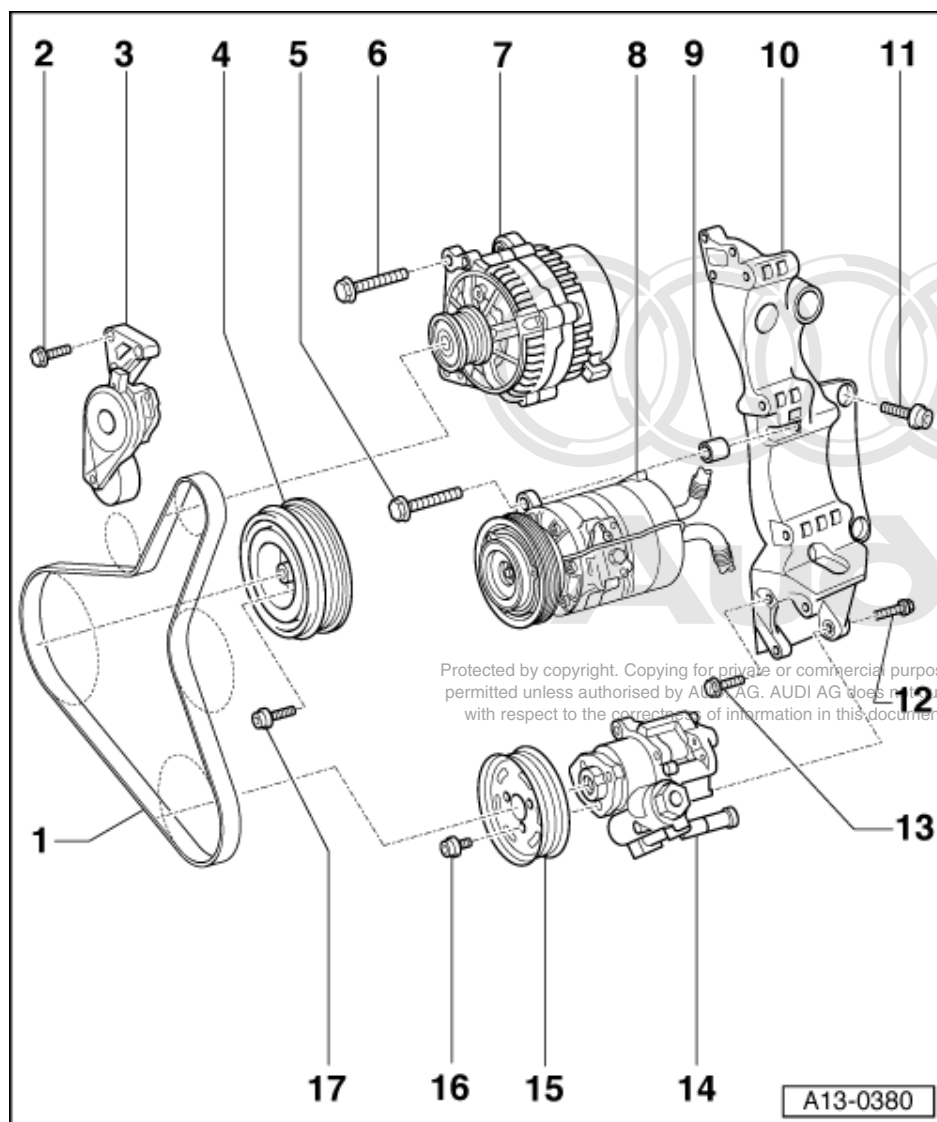
5 45 Nm

6 23 Nm

7 Alternator

- ♦ Removing:
 - Detach battery earth strap.
 - Remove engine cover.
 - Slacken ribbed belt and take belt off alternator => Page 13-10.

- Disconnect wiring from alternator
- Detach connector.
- Unscrew bolts from top and bottom from bracket.
- Remove alternator
- ♦ To facilitate the positioning of alternator knock back bushes for retaining bolts slightly.



8 Air conditioner compressor

- ♦ After removing compressor secure to lock carrier with wire. Do not leave compressor suspended on refrigerant hoses.
- ♦ Do not unscrew or disconnect refrigerant hoses or pipes.
- ♦ To facilitate the positioning of air conditioner knock back bushes for retaining bolts slightly.

9 Spacer bush

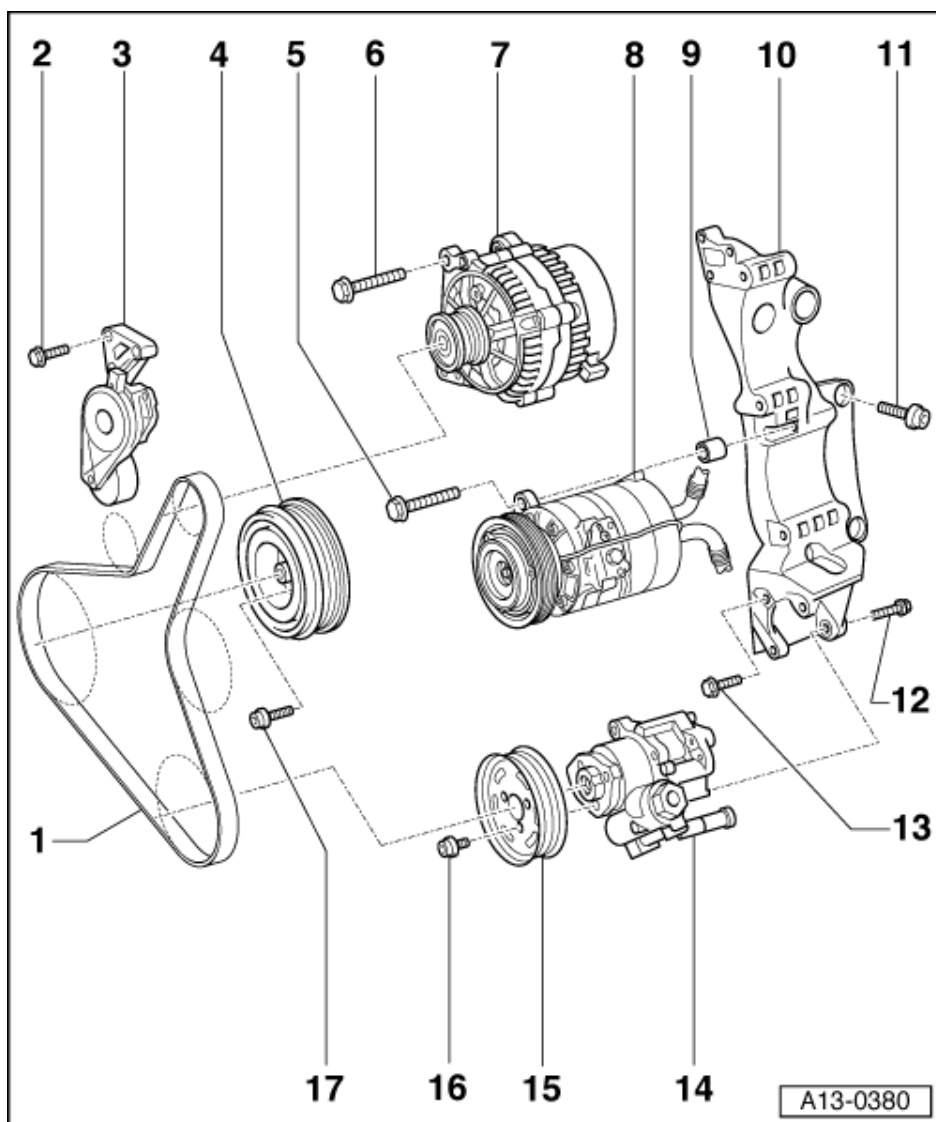
- ♦ Not fitted on all versions

10 Bracket for auxiliary assembly

- ♦ Removing and installing
=>Page 13-14

11 45 Nm

- ♦ Observe the tightening sequence =>Page 13-14



12 23 Nm

13 23 Nm

14 Vane pump

- ♦ For power steering
- ♦ Removing and installing:

=> Running Gear, FWD and 4WD; Repair group 48

- ♦ To facilitate the positioning of vane pump knock back bushes for retaining bolts slightly.

15 Belt pulley

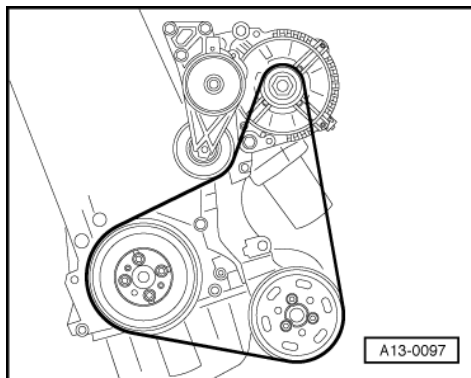
- ♦ For vane pump

16 23 Nm

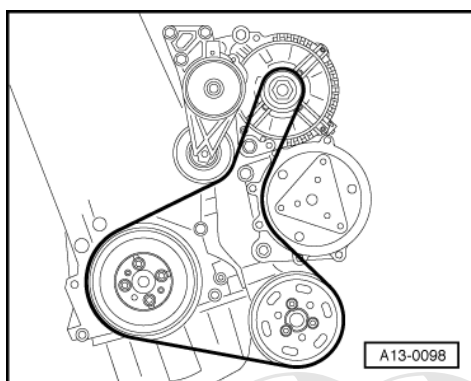
17 10 Nm + 90° (1/4 turn) further

- ♦ Replacing

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



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

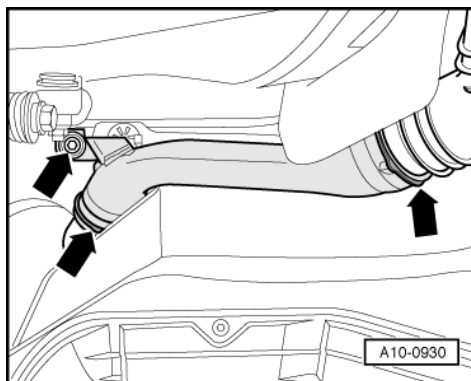
Note:

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

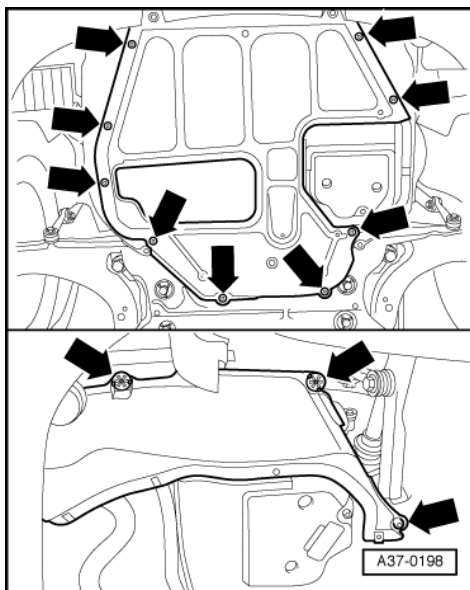
1.3 - Removing and installing vibration damper

Removing

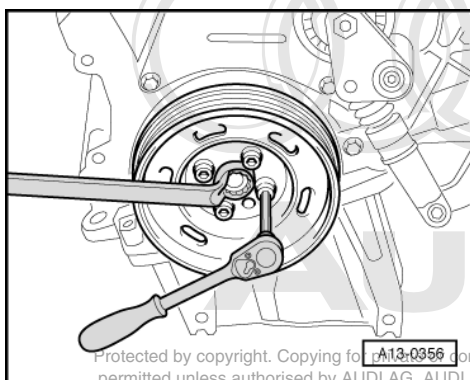
- Ribbed belt must be removed =>Page 13-10.



- -> Remove air duct pipe from right longitudinal member -arrows-.



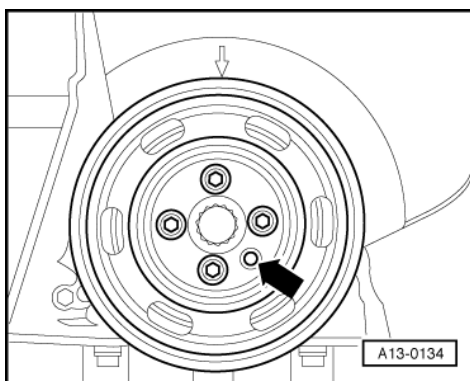
- -> Remove noise insulation in centre and on right -arrows-.



- -> Unbolt vibration damper.

Note:

To loosen and tighten the vibration damper counterhold with ring spanner on central bolt.





Installing

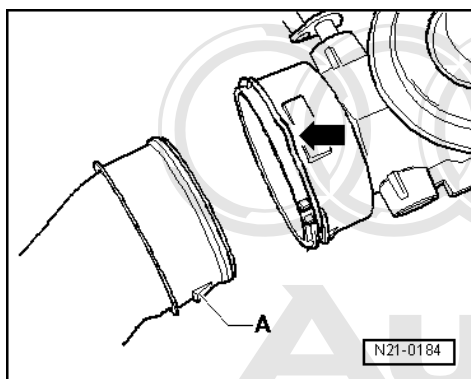
Installation is carried out in the reverse order; note the following:

- Only use new bolts to secure.
- -> When installing vibration damper, use only original bolts:

=> Parts List

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

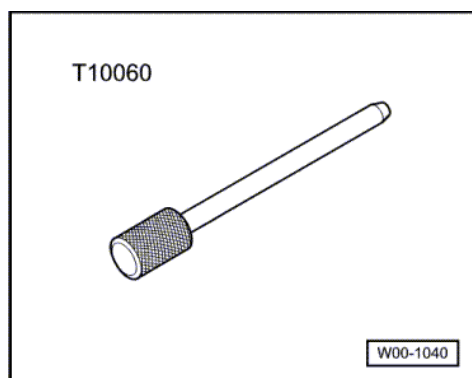
Tighten bolts of vibration damper to 10 Nm + 90° (1/4 turn).



- -> When installing air duct pipes with connectors, ensure that the securing clip -arrow- engages audibly in the retaining lug -A-.

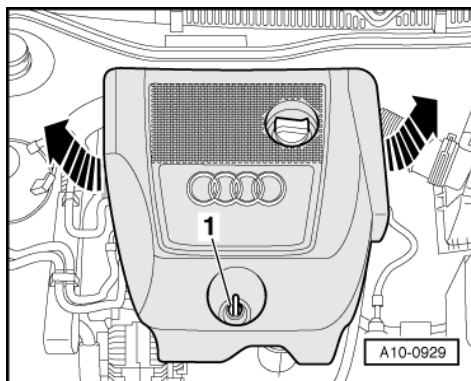
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1.4 - Removing and installing ribbed belt



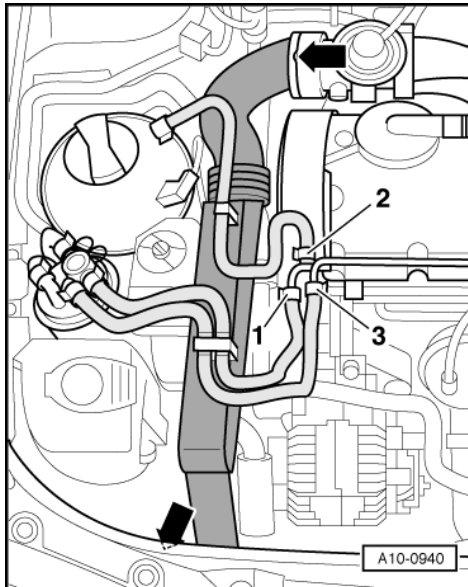
Special tools and workshop equipment required

- ♦ Mandrel T10060



Removing

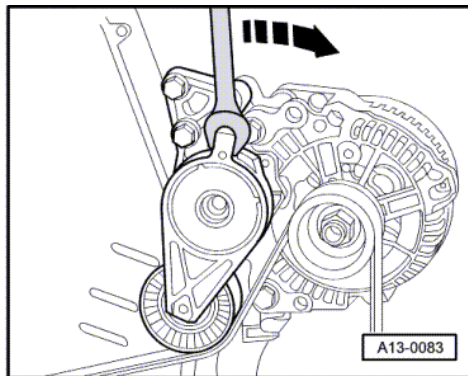
- -> Remove oil dipstick -1- from guide tube.
- Remove engine cover -arrows-.
- Reinsert dipstick in guide tube.



- -> Lay aside wiring at air duct hose.
- Where necessary, detach the housing cover at rear of right headlamp.
- Remove air duct pipe -arrows-.

Note:

The coolant hose -2- and fuel lines -1- and -3- remain connected.

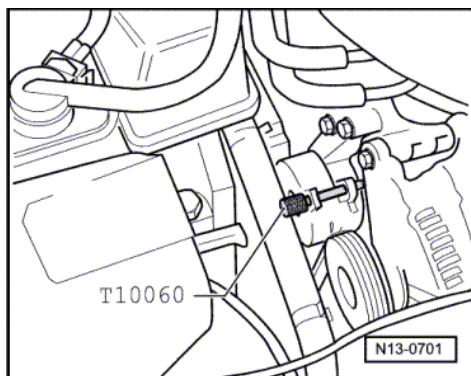


Note:

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.

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- -> Lock ribbed belt tensioner using mandrel T10060.
- Remove ribbed belt.

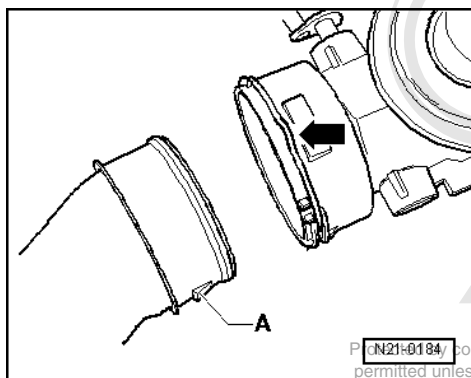
Installing

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

Note:

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

- Fit ribbed belt over crankshaft pulley and vane pump pulley. If necessary, pull the belt upwards using an auxiliary tool.
- Fit ribbed belt over alternator pulley last. Release tensioner.
- Check that ribbed belt is properly seated.
 - Ribbed belt routing => Fig.13-6



- -> When installing air duct pipes with connectors, ensure that the securing clip -arrow- engages audibly in the retaining lug -A-.
- Start engine and check belt running.

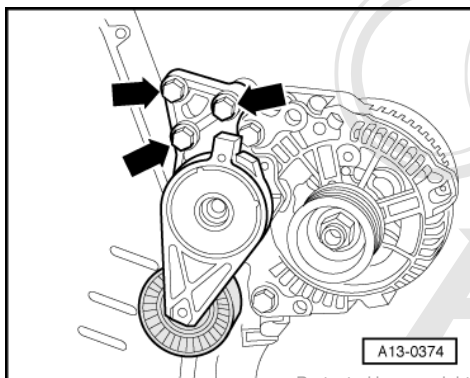
1.5 - Removing and installing bracket for auxiliary assemblies

Removing

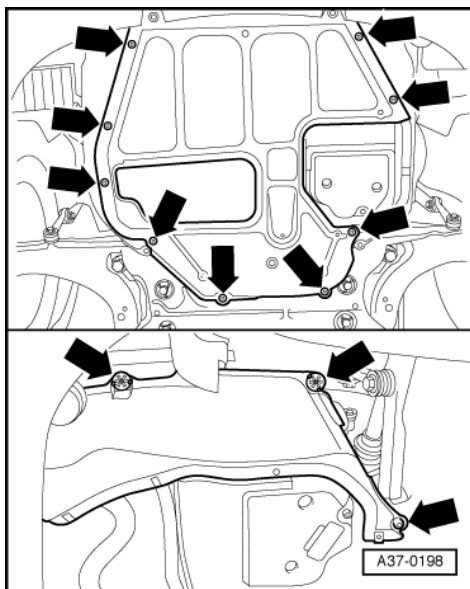
Important

- ♦ Measures to be taken prior to disconnecting the battery: =>Electrical System; Repair group 27
- ♦ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.

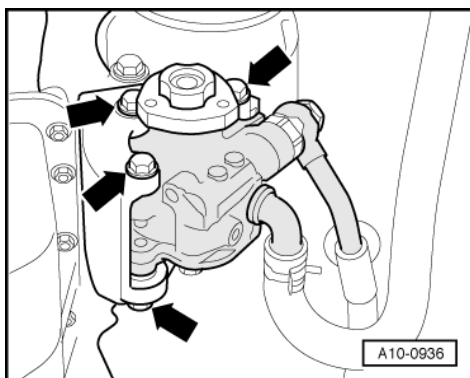
- Refer to coding on vehicles with encoded radio/radio navigation system (RNS); if necessary, interrogate.
- With the ignition switched off disconnect the battery earth strap.



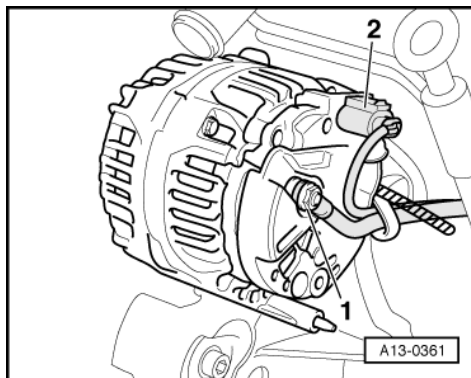
- Remove ribbed belt => Page 13-10
- -> Remove tensioner for ribbed belt cover -arrows-



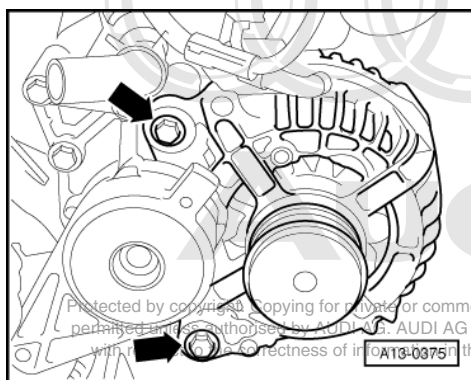
- -> Remove noise insulation in centre and on right -arrows-



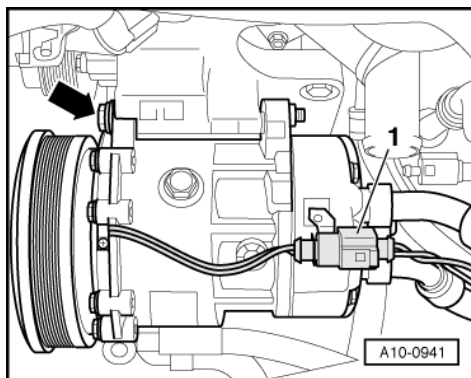
- Detach pulley from power steering vane pump.
- -> Unbolt power steering vane pump -arrows-, lay to one side and tie in place. Do not detach hydraulic connections.



- -> Disconnect the connector -2-.
- Unscrew wire -1- from alternator.
- Unscrew wire clip and lay wiring aside.



- -> Unscrew the bolts -arrows- and remove alternator.



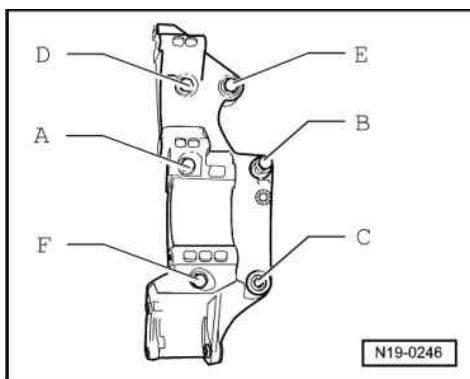
Vehicles with air conditioner:

- -> Detach electrical connector -1- for solenoid clutch on air conditioner compressor.

Important

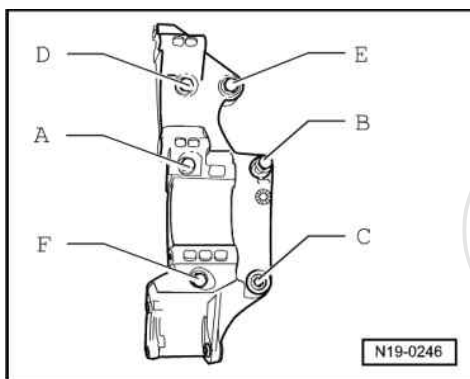
The air conditioner refrigerant circuit must not be opened.

- Screw out bolts -arrow- for air conditioner compressor.
- Lower air conditioner and suspend from lock carrier with wire.



All models:

- -> Unbolt bracket for auxiliary assemblies -bolts A ... F-



Installing

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

- -> Tighten bolts in sequence -A ... F to 45 Nm.
- Drive bush for bottom securing bolt back slightly to facilitate positioning of alternator, vane pump and air conditioner compressor.
- Install ribbed belt =>Page 13-12.

Notes:

- ♦ If the battery is reconnected, please ensure that the vehicle equipment (radio, radio/navigation system, clock, electric window lifters) is activated as described in the operating instructions.
- ♦ Deactivate the service mode of the telematics control unit.

=> Radio, Telephone and Navigation System; Repair group 91

Tightening torques

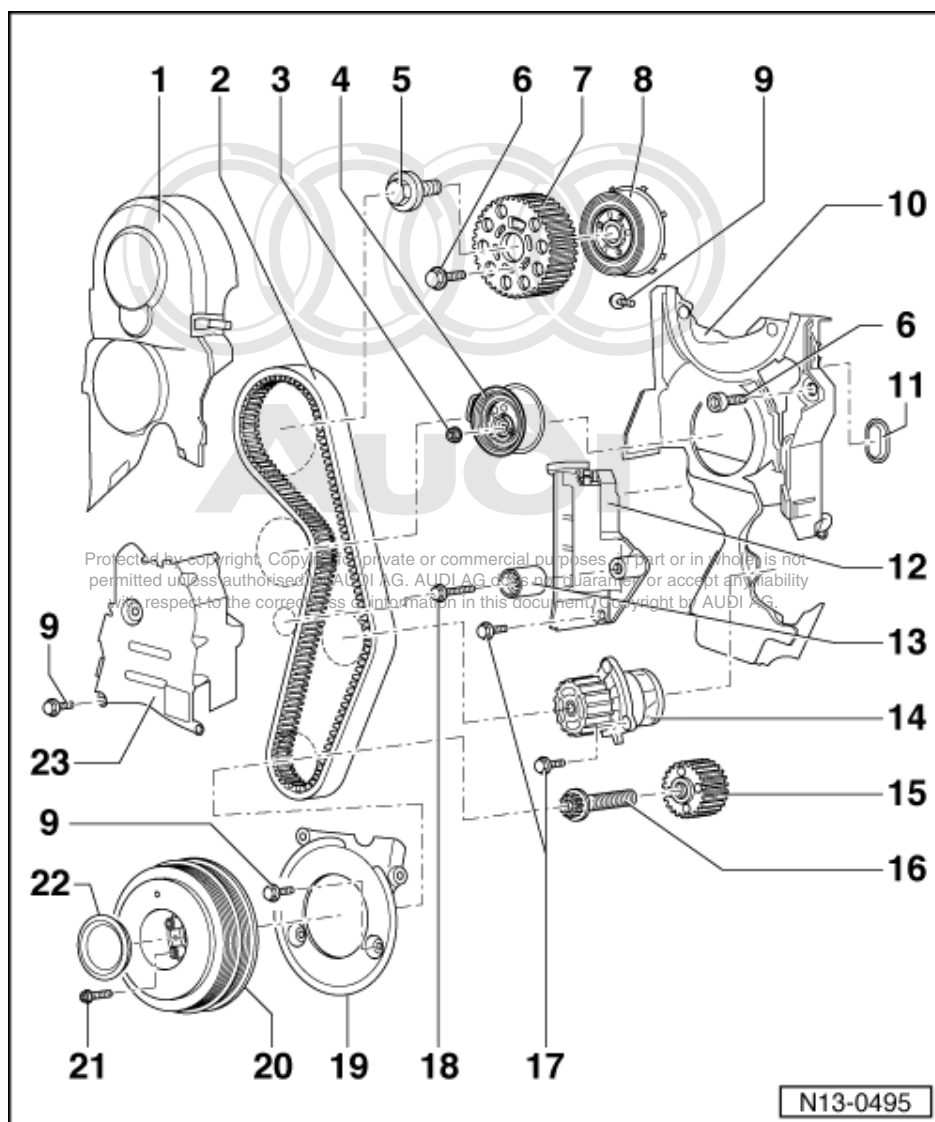
Component	Nm
Bracket for auxiliary mechanical units to cylinder block	45
Air conditioner compressor to bracket for auxiliary mechanical units	45
Alternator to bracket for auxiliary mechanical units	23
Vane pump to bracket for auxiliary mechanical units	23
Belt pulley to vane pump	23



Tensioner for ribbed belt tensioner to bracket for auxiliary mechanical units	23
---	----

2 - Toothed belt drive with hydraulically damped tensioning roller - Assembly overview

2.1 - Toothed belt drive with hydraulically damped tensioning roller - Assembly overview

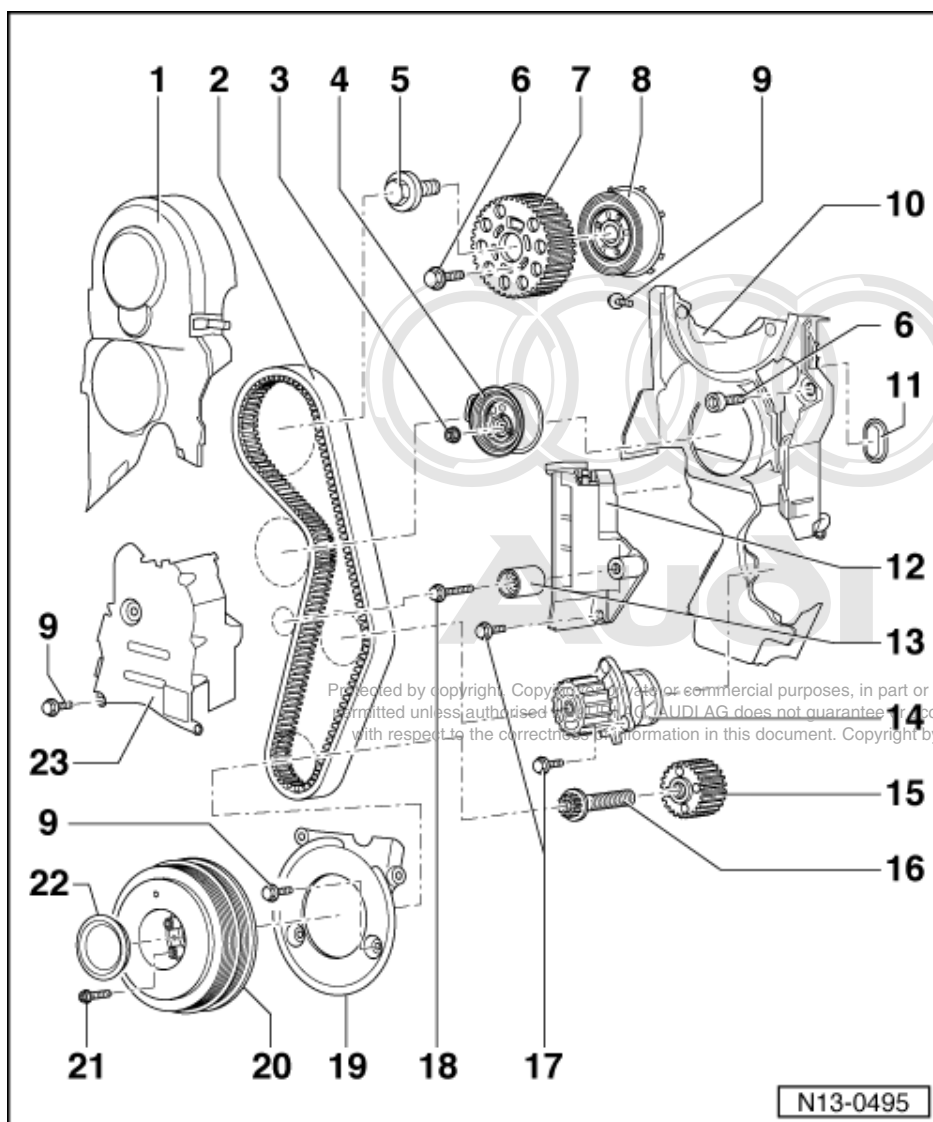


Note:

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 Toothed belt guard - top

- ♦ For removal remove right air duct pipe
- ♦ When installing, engage carefully in centre toothed belt guard.



2 Toothed belts

- ◆ Mark running direction with chalk or felt pen before removing
- ◆ Check for wear
- ◆ Removing => Page 13-26
- ◆ Install (adjust valve timing) => Page 13-36.

3 20 Nm + 45° (1/8 turn) further

4 Tensioning roller

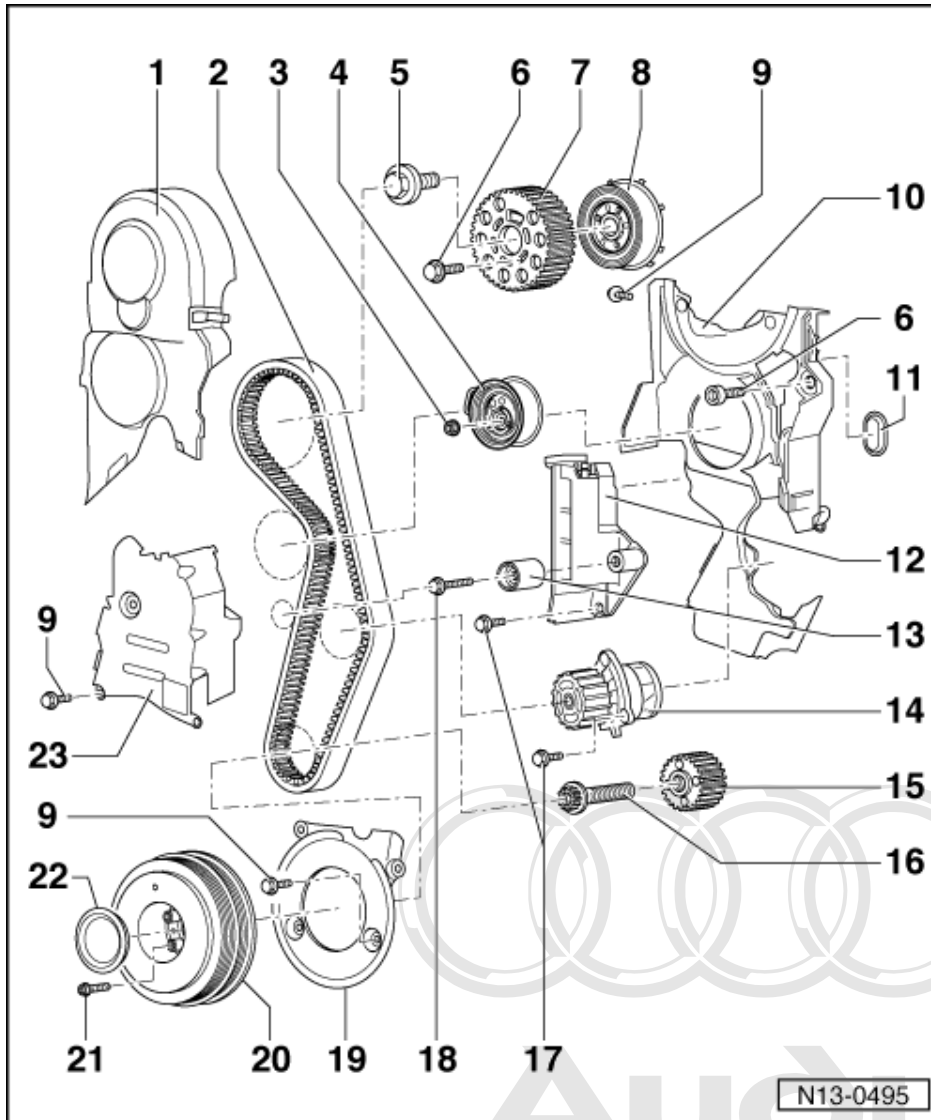
5 100 Nm

- ◆ To loosen and tighten use counterhold T10051

6 25 Nm

7 Camshaft sprocket

- ◆ Mark installation position



8 Hub

- ♦ with sender wheel for Hall sender -G40
- ♦ To loosen and tighten use counterhold T10051
- ♦ For removal use puller T10052
- ♦ Detaching => Page 15-28

9 10 Nm

- ♦ Install using locking compound
- ♦ Locking compound

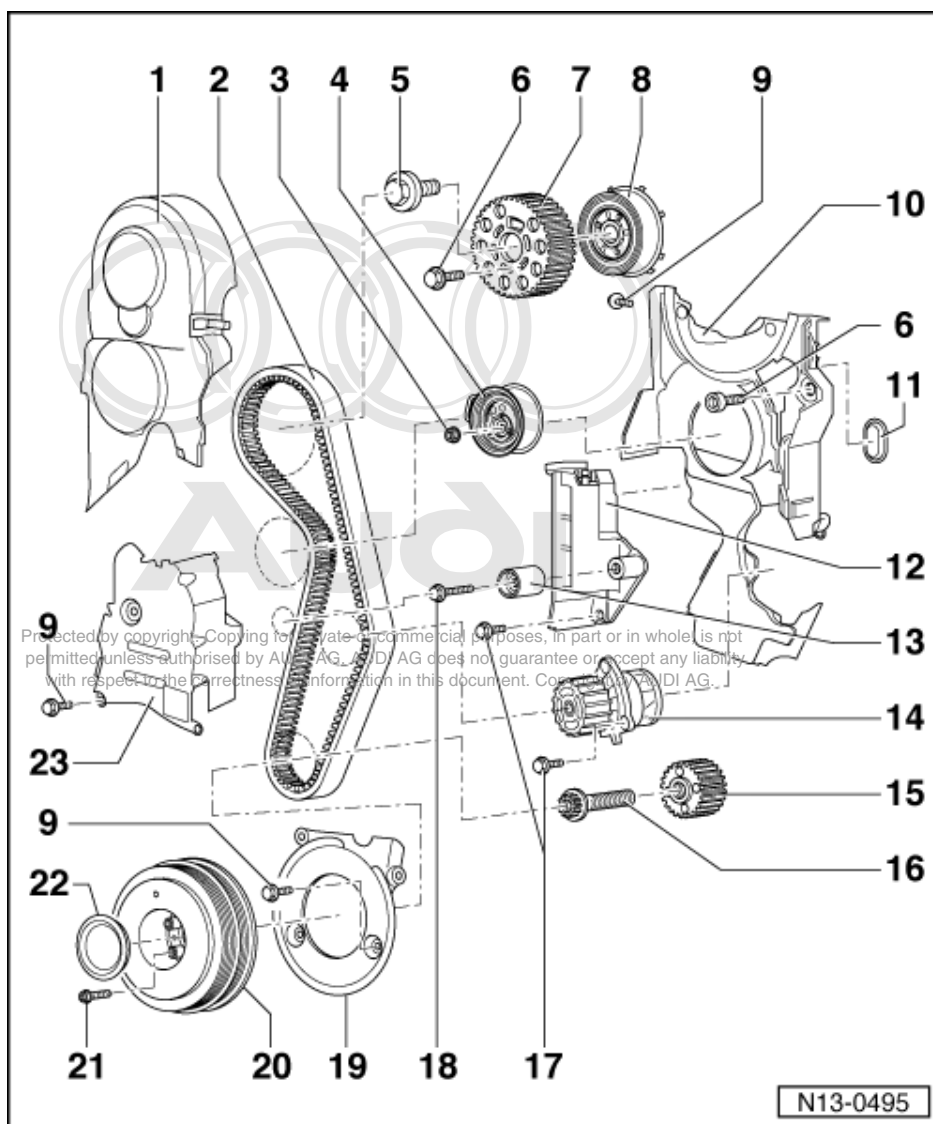
=> Parts List

10 Toothed belt guard - rear

11 Rubber grommet

- ♦ Replace if damaged

12 Tensioner for toothed belt



13 Idler roller

14 Coolant pump

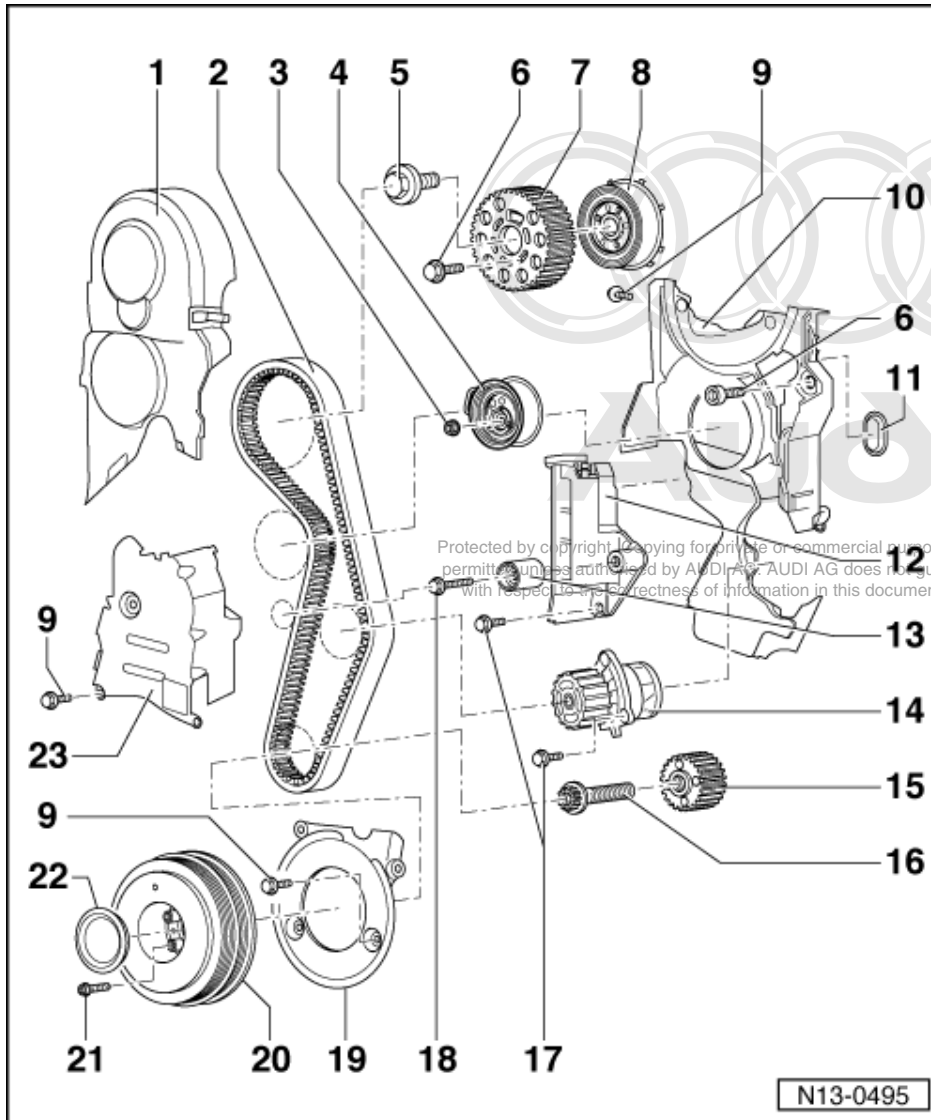
- ◆ Removing and installing
=>Page 19-15

15 Crankshaft sprocket

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

16 120 Nm + 90° (1/4 turn) further

- ◆ Replacing
- ◆ Do not use oil
- ◆ To loosen and tighten use counterhold 3415
=> Fig.13-25



17 13 Nm

18 20 Nm

19 Toothed belt guard - lower

20 Vibration damper

- ◆ With pulley for ribbed belt
- ◆ Can only be installed in one position. Holes are off set

21 10 Nm + 90° (1/4 turn) further

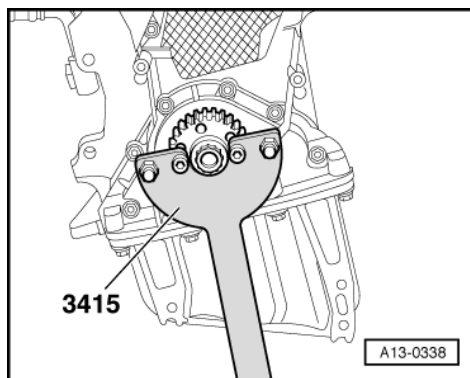
- ◆ Replacing

22 Cover

- ◆ Not fitted on all versions

23 Toothed belt guard - centre

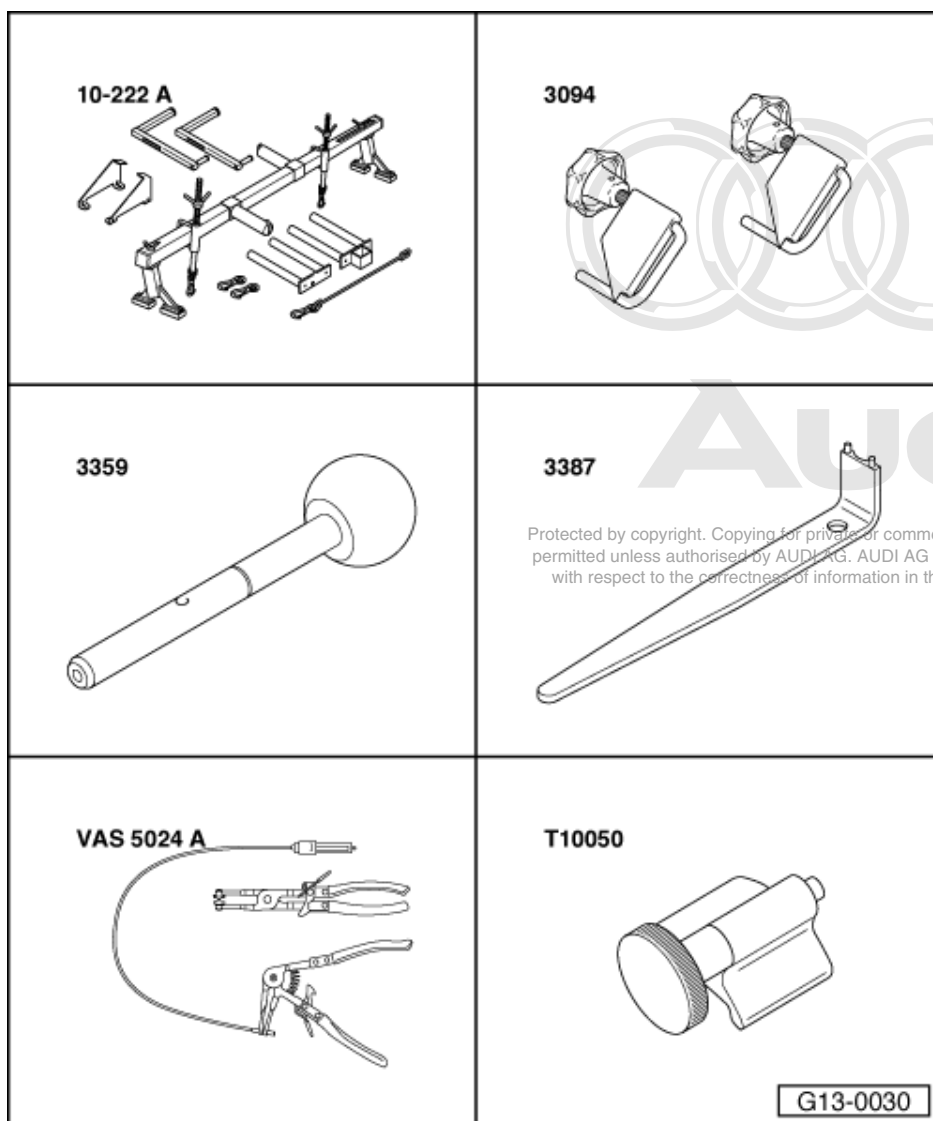
- ◆ For removal remove upper toothed belt guard and unscrew tensioner for ribbed belt



-> Fig.1 Removing and installing crankshaft sprocket

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

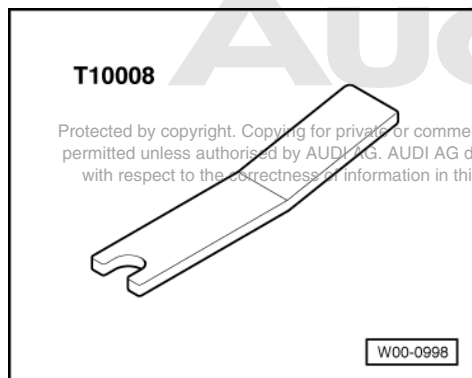
2.2 - Removing and installing toothed belt





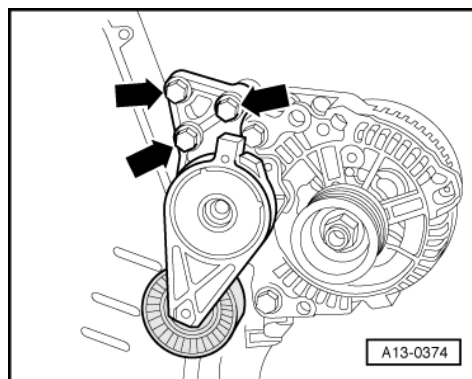
Special tools and workshop equipment required

- ♦ Support bar 10-222A
- ♦ Hose clamps 3094
- ♦ Mandrel 3359
- ♦ Pin wrench 3387
- ♦ VAS 5024 A
- ♦ Crankshaft stop T10050



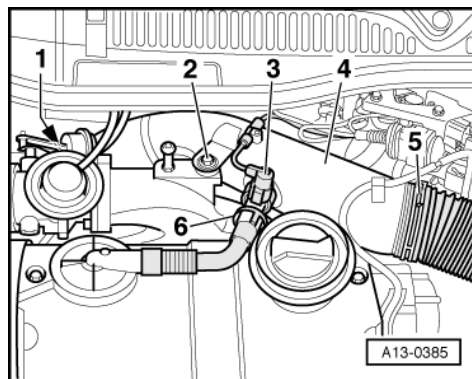
- ♦ Securing plate T10008
- ♦ Drill, $\varnothing 4$ mm
- ♦ Locking compound

=> Parts List



Removing

- Engine in vehicle
- Remove ribbed belt => Page 13-10
- -> Remove tensioner for ribbed belt cover -arrows-.

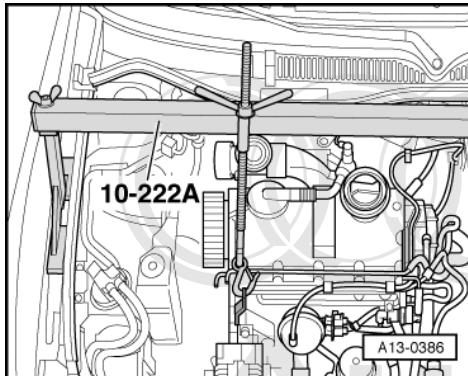


- -> Disconnect hose -5- to air cleaner housing.
- Disconnect crankcase vent pipe -6- from air duct hose.
- If installed, detach connector for heating resistor (crankcase venting) -N79 -Item 3-.
- Release spring clamp on turbocharger using VAS 5024 A.

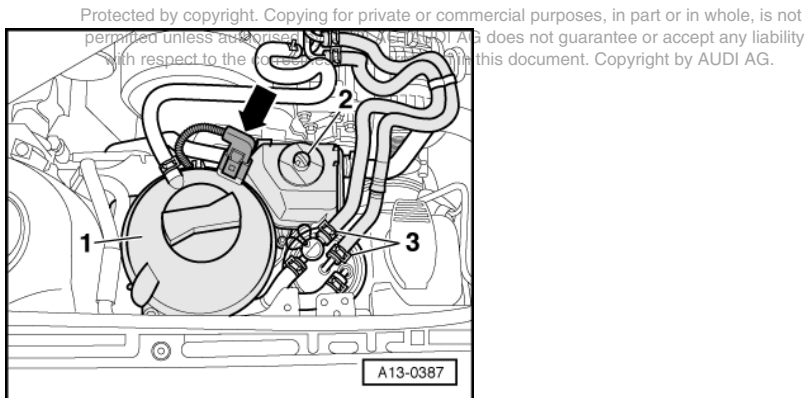
Note:

For vehicles with four-wheel drive, the spring clamp is not accessible from above. To release the spring clamp, remove the air duct pipe from the right longitudinal member and the centre and right noise insulation.

- Set aside the vacuum hoses.
- Unscrew bolts -1- and -2- and remove air duct pipe -4-.



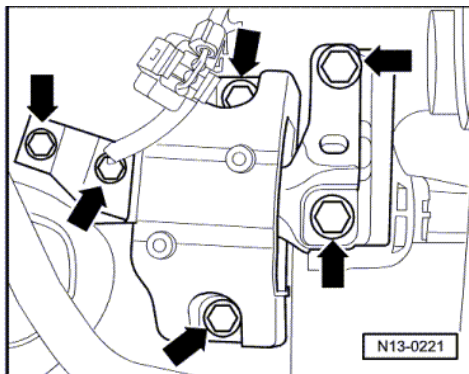
- -> Attach support bar 10-222 A onto screwed edge of wing and attach spindle in right engine lifting eye.
- Lift engine slightly with spindle of engine support bracket 10-222 A.



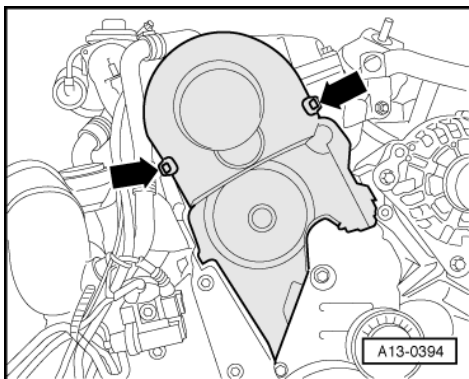
- -> Mark fuel feed pipe and fuel return pipe -3- and remove from fuel filter.
- Unplug connector -arrow-.
- Unbolt coolant expansion tank -1- for coolant. Do not detach hoses.
- Unscrew refill reservoir -2- for power steering.
- Clamp off hose to steering box using hose clamp 3094.
- Detach refill reservoir line.

Note:

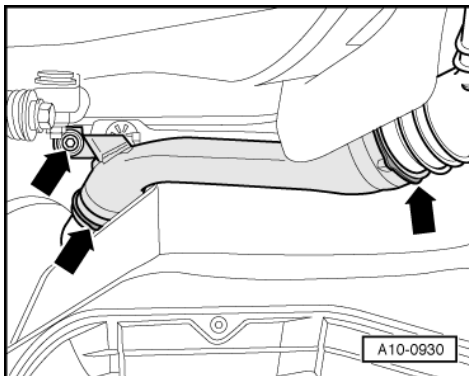
Close opening at refill reservoir with plug.



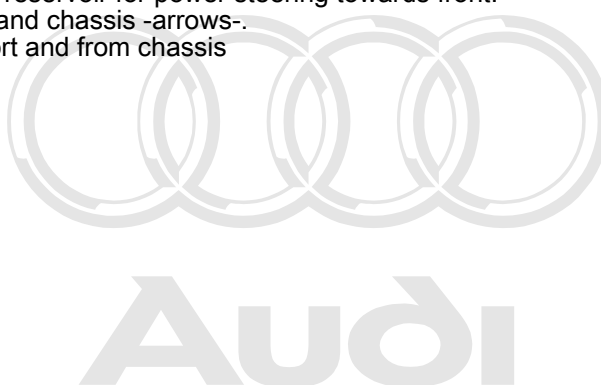
- Remove coolant expansion tank and refill reservoir for power steering towards front.
- -> Unbolt brace between engine console and chassis -arrows-.
- Unbolt engine console from engine support and from chassis -arrows-.
- Take out engine console.



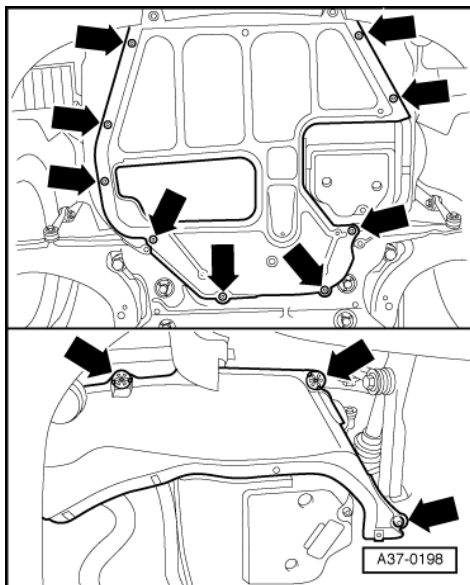
- -> Remove the upper toothed belt guard -arrows-.



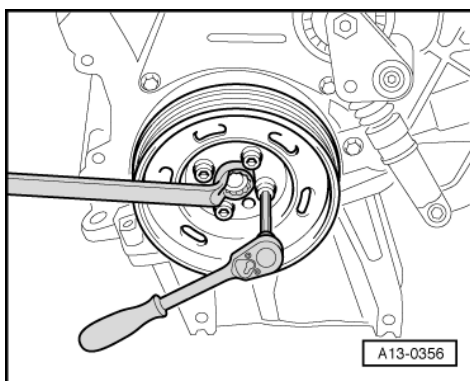
- -> Remove air duct pipe from right longitudinal member -arrows-.



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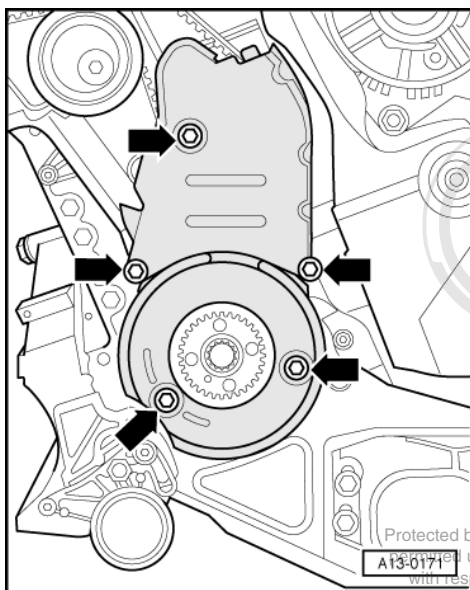
- -> Remove noise insulation in centre and on right -arrows-.



- -> Unbolt vibration damper.

Note:

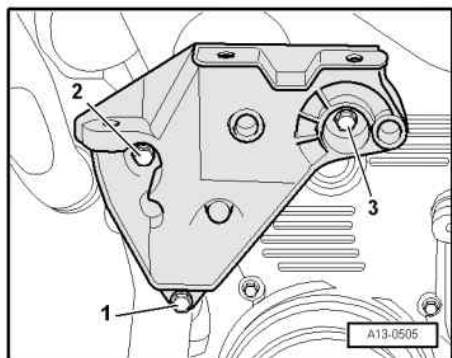
To loosen and tighten the vibration damper counterhold with ring spanner on central bolt.



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

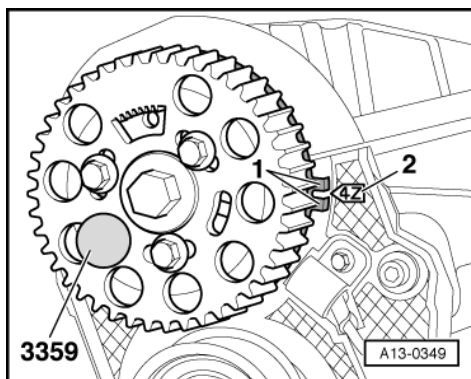


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- -> Remove bolts for engine support -1 ... 3- and swivel engine support slightly to the rear.

Note:

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



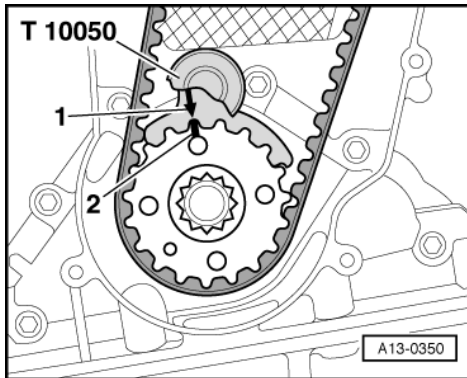
Important

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

- Set the crankshaft to TDC for cylinder No. 1.

Notes:

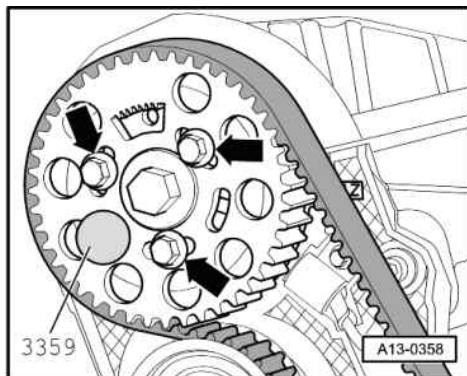
- ♦ -> The space between the two lugs -1- on sender wheel of camshaft must align with marking "4Z" -Item 2- on rear toothed belt guard.
- ♦ The illustration shows the toothed belt camshaft sprocket without toothed belt.
- Lock the hub with mandrel 3359.



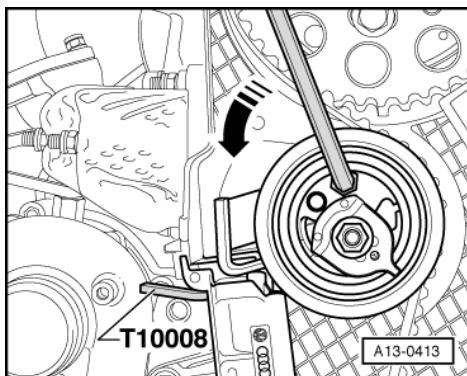
- -> Lock the crankshaft toothed belt sprocket with crankshaft stop T10050.

Notes:

- ◆ The markings on the toothed belt sprocket -2- and crankshaft stop -1- must align. The journal of the crankshaft stop must engage in the bore of the sealing flange.
- ◆ The crankshaft stop can only be pushed from the front onto the toothed belt sprocket due to the splines.



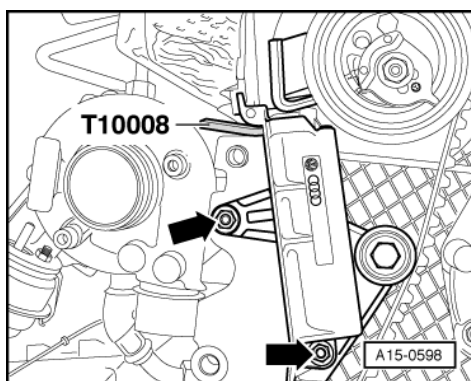
- Mark running direction of belt with chalk or felt pen.
- -> Loosen the bolts -arrows- at the camshaft sprocket.



- -> Insert an Allen key into hexagon until limit stop and thus push the tensioning roller anti-clockwise -direction of arrow- until the tensioner of the toothed belt can be locked with the connecting pin T10008.

Notes:

- ◆ Insert Allen key until limit stop to avoid damage.
- ◆ The toothed belt tensioner is oil damped, and can only be compressed slowly by applying continuous pressure.



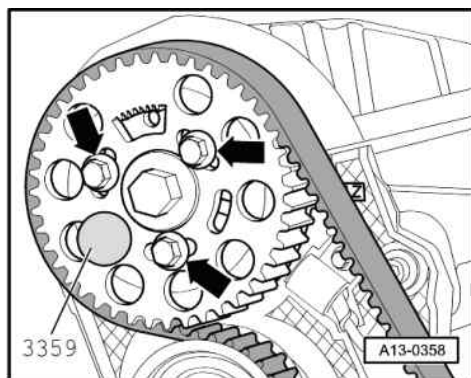
- Loosen securing nut of tensioner.
- -> Unscrew bolts -arrows- of toothed belt tensioner and remove.
- Remove toothed belt first from coolant pump and then from the remaining gears.

Installing (adjusting valve timing)

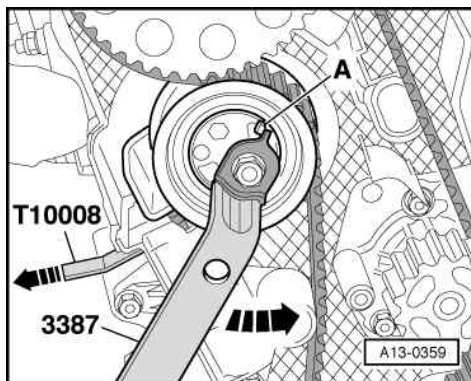
- Camshaft locked with mandrel 3359.
- Crankshaft locked with crankshaft stop T10050.
- Toothed belt tensioner is locked with securing plate T10008.

Notes:

- ♦ Adjustments to the toothed belt may only be performed when engine is cold.
- ♦ When turning the camshaft, the crankshaft must not be at TDC for any piston. Danger of damage to valves/ piston crown.



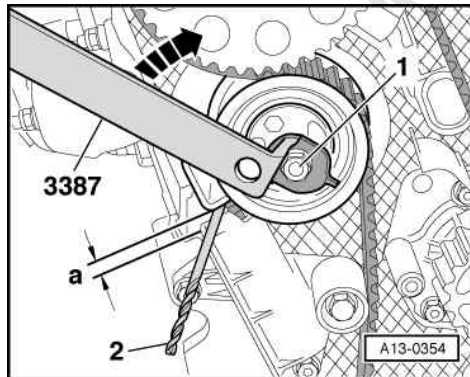
- -> Loosely secure the bolts -arrow-.
- The camshaft sprocket should be just able to turn on the hub and must not tilt.
- Turn the camshaft sprocket in its longitudinal holes clockwise, as far as possible.
- Attach toothed belt to camshaft sprocket, tensioning roller, toothed belt sprocket crankshaft and finally to toothed belt sprocket coolant pump.
- Install tensioner for toothed belt.



- Adjust toothed belt tension as follows:
- -> Turn the cam anti-clockwise until limit stop -A- with pin wrench 3387.
- Remove securing plate T10008.

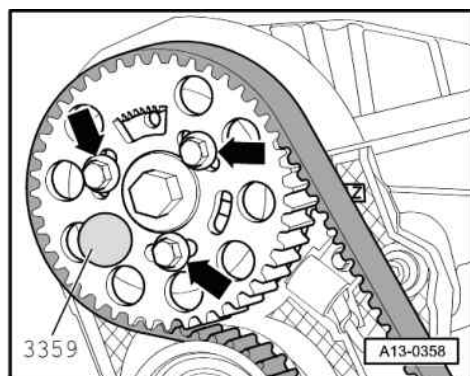
Note:

Special tool Matra V/159 may be used in place of pin wrench 3387.

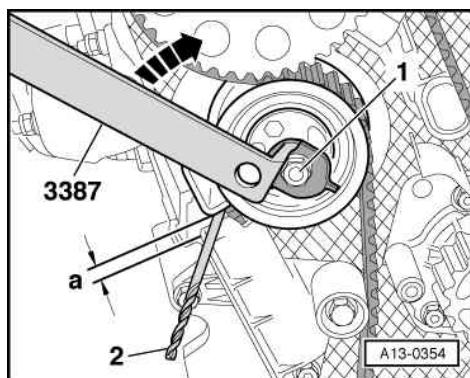


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- -> Slowly release pressure on tensioner clockwise until a $\varnothing 4.0$ mm drill with -Item 2- can be easily inserted between tensioning lever and tensioner housing.
- Dimension $a = 4.0 \pm 1.0$ mm
- Hold the tensioning roller in this position and tighten tensioning roller nut -1- to 20 Nm + 45° (1/8 turn).

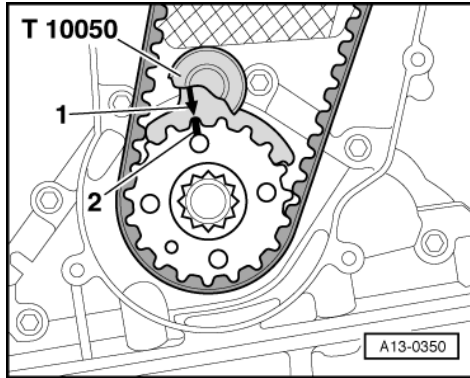


- -> Tighten the camshaft sprocket bolts -arrows- to 25 Nm.
- Remove mandrel 3359 and crankshaft stop T10050.



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

- Turn the crankshaft two rotations in the direction of engine rotation until the crankshaft is set to TDC again.
- > Check again whether dimension -a- is achieved between tensioning lever and tensioner housing.
 - Dimension a = 4.0 ± 1.0 mm
- If dimension -a- is not achieved, readjust tensioning roller as follows:
- Counterhold tensioning roller with pin wrench 3387, loosen nut -1- and slacken counterforce of tensioner - arrow-, until measure -a- has been reached.
 - Dimension a = 4.0 ± 1.0 mm
- Hold the tensioning roller in this position and tighten tensioning roller nut -1- to 20 Nm + 45° (1/8 turn).

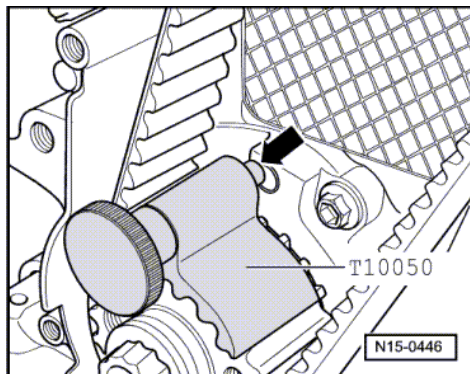


Checking the valve timing

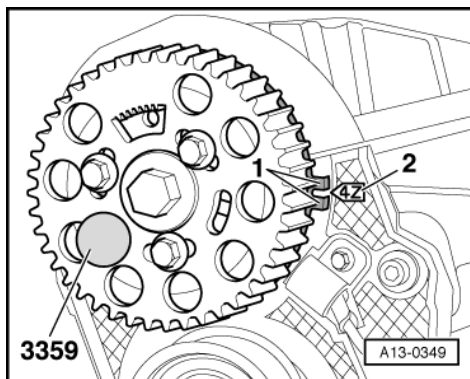
- > For checking purposes, lock the crankshaft toothed belt sprocket again using crankshaft stop T10050.

Notes:

- ♦ The markings on the toothed belt sprocket -2- and crankshaft stop -1- must align. The journal of the crankshaft stop must engage in the bore of the sealing flange.



- ♦ -> The pin of the crankshaft stop must engage into the bore of the sealing flange when rotated -arrow-.
- ♦ If the crankshaft was turned over TDC for cylinder 1, then turn back crankshaft 1/4 turn to position it again to TDC for cylinder 1 in direction of engine rotation.
- ♦ Corrections against the rotation direction of the engine to adjust the crankshaft stop are not permitted.

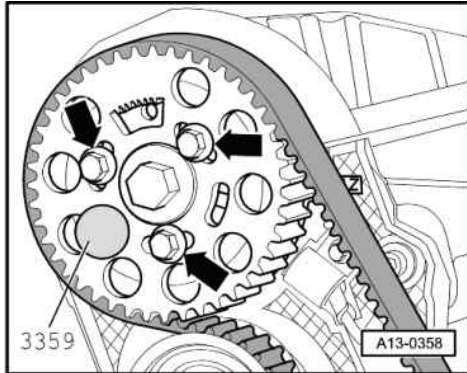


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- -> Check with mandrel 3359 whether hub can be locked.

Notes:

- ♦ The space between the two lugs -1- on sender wheel of camshaft must align with marking "4Z" -Item 2- on rear toothed belt guard.
- ♦ The illustration shows the toothed belt camshaft sprocket without toothed belt.



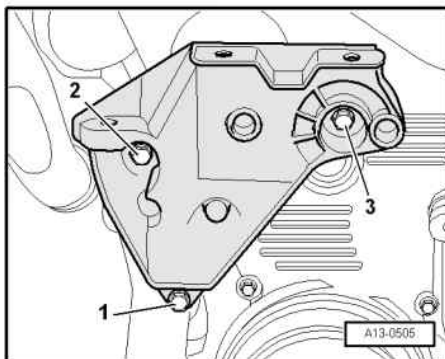
If hub cannot be locked:

- -> Loosen the securing bolts -arrows- on the camshaft sprocket.
- Apply a ring spanner to centre bolt of camshaft.
- Turn hub until the mandrel 3359 can be inserted.
- Tighten the bolts -arrows- of camshaft sprocket to 25 Nm.
- Remove mandrel 3359 and crankshaft stop T10050.

Important

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

- Turn the crankshaft two rotations in the direction of engine rotation until the crankshaft is set to TDC again.
- Repeat valve timing checks =>Page 13-38.
- Install toothed belt guard (bottom and centre sections).
- Install toothed belt guard (top section).



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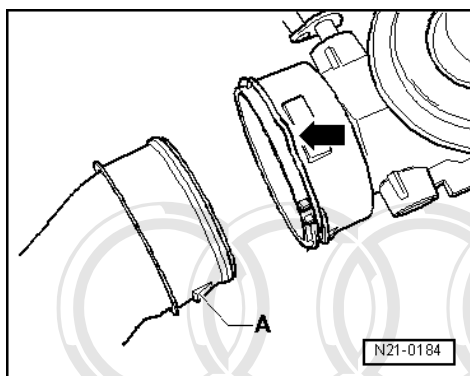
The remaining installation steps are carried out in the reverse sequence - note the following points:

-> Secure the engine support as follows:

- Remove bolts -1 ... 3-.
- Then tighten the bolts -1 ... 3- to 45 Nm.



- Install engine console.
- Install the vibration damper => Page 13-7.
- Adjust engine mounting => Page 10-85.
- Install ribbed belt =>Page 13-12.



- -> When installing air duct pipes with connectors, ensure that the securing clip -arrow- engages audibly in the retaining lug -A-.
- Install and secure coolant expansion tank and power assisted steering reservoir.

Tightening torques

Component	Nm
Toothed belt tensioning roller to cylinder head	20 + 45° 1)
Camshaft sprocket to hub	25
Lower section of toothed belt guard to cylinder block	10 2)
Toothed belt tensioner to cylinder block	13
Centre section of toothed belt guard to cylinder block	10 2)
Vibration damper to crankshaft sprocket	10 + 90° 3) 4)
Engine support to cylinder block	45
Engine console to chassis	50
Engine support to engine console	100 3) 5)

- 1) 45° corresponds to an eighth of a turn
- 2) install using locking compound;
locking compound

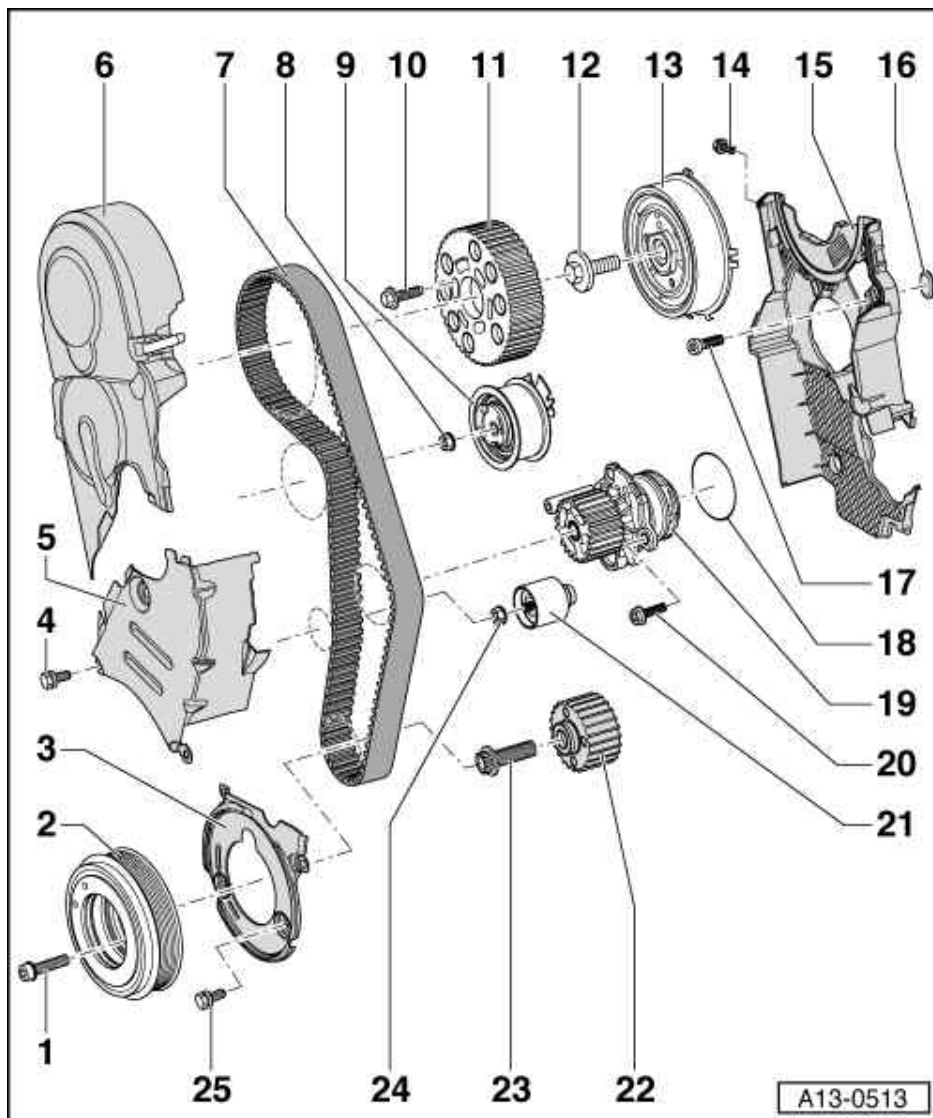
=> Parts List

- 3) Replace bolts
- 4) 90° corresponds to a quarter of a turn
- 5) Only tighten to final torque after adjusting the engine mounting=> Page 10-85

Component	Nm
Brace to engine console/chassis	25
Tensioner for ribbed belt tensioner to bracket for auxiliary mechanical units	23
Rear air duct pipe to intake manifold	10

3 - Toothed belt drive with friction-absorbing tensioning roller - Assembly overview

3.1 - Toothed belt drive with friction-absorbing tensioning roller - Assembly overview

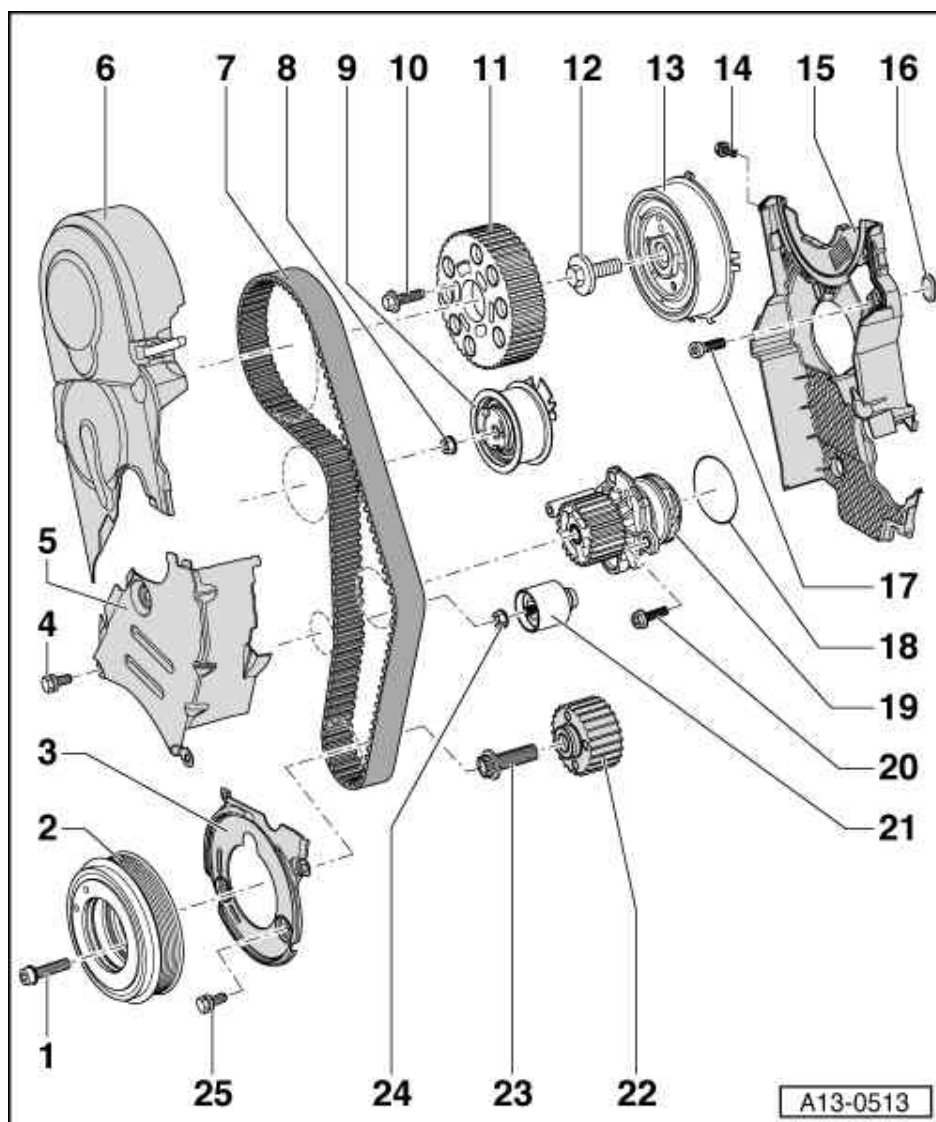


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Note:

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 10 Nm + 90° (1/4 turn) further
 - ♦ Replacing
- 2 Vibration damper
 - ♦ With pulley for ribbed belt
 - ♦ Can only be installed in one position. Holes are off set
- 3 Toothed belt guard - lower



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4 10 Nm

- ◆ Install using locking compound
- ◆ Locking compound

=> Parts List

5 Toothed belt guard - centre

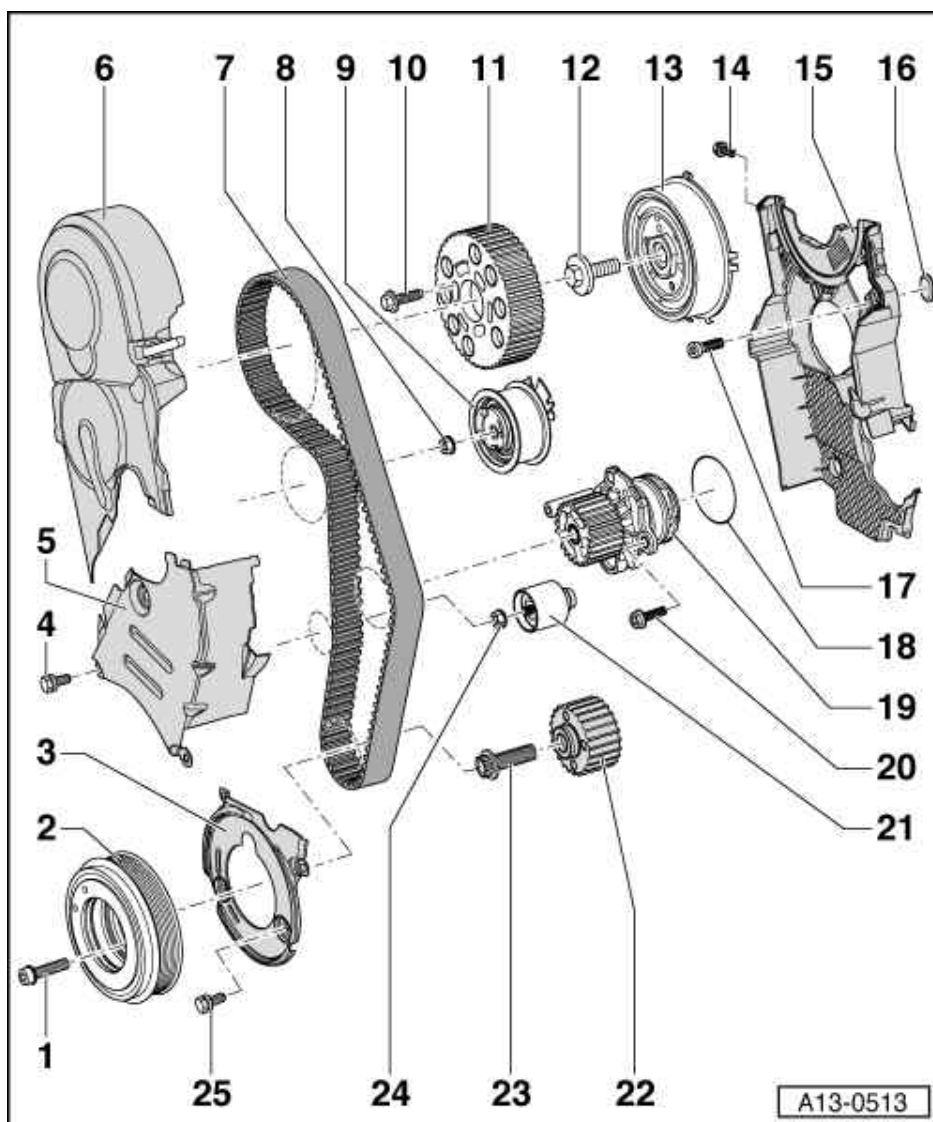
- ◆ For removal remove upper toothed belt guard and unscrew tensioner for ribbed belt

6 Toothed belt guard - top

- ◆ For removal remove right air duct pipe
- ◆ When installing, engage carefully in centre toothed belt guard.

7 Toothed belts

- ◆ Mark running direction with chalk or felt pen before removing
- ◆ Check for wear
- ◆ Removing => Page 13-51
- ◆ Install (adjust valve timing) => Page 13-62.



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8 20 Nm + 45° (1/8 turn) further

9 Tensioning roller

10 25 Nm

11 Camshaft sprocket

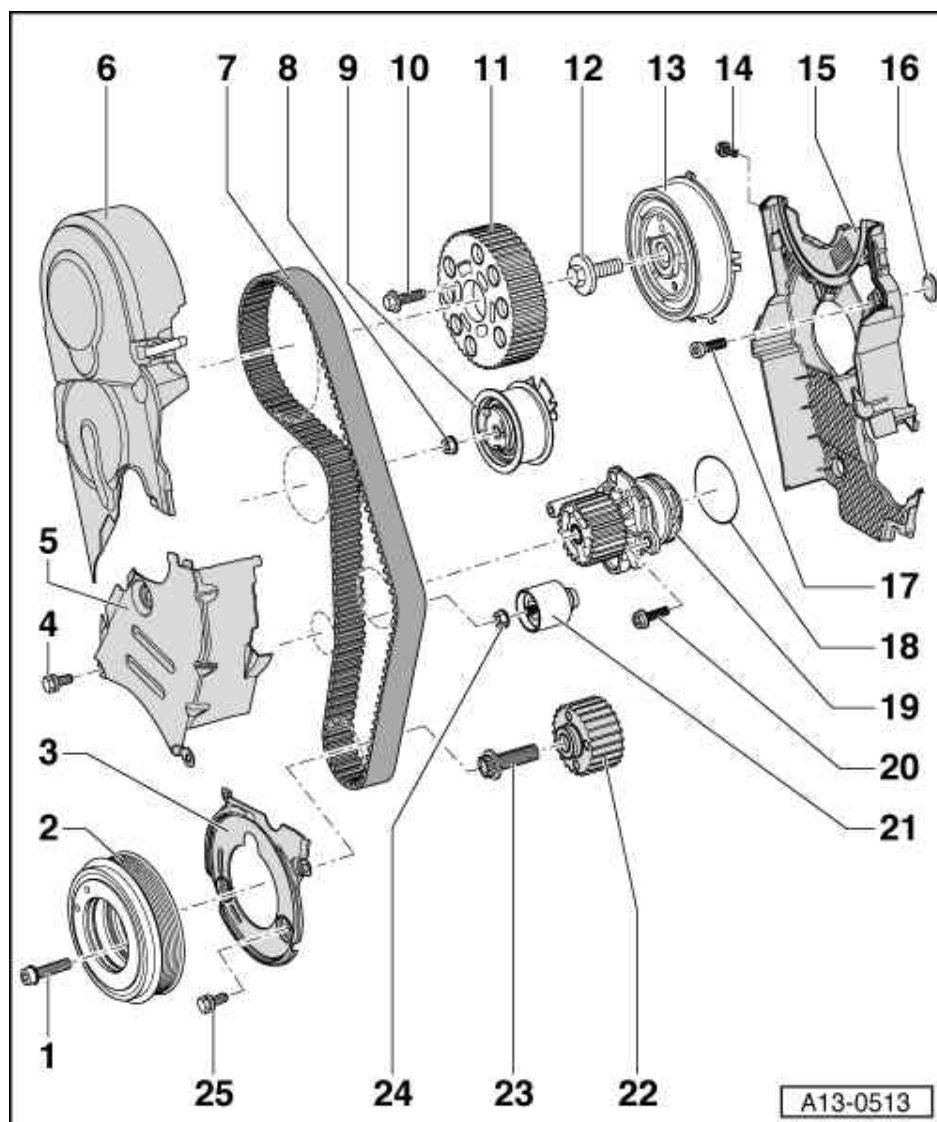
- ♦ Mark installation position

12 100 Nm

- ♦ To loosen and tighten use counterhold T10051

13 Hub

- ♦ With sender wheel for Hall sender -G40
- ♦ To loosen and tighten use counterhold T10051
- ♦ For removal use puller T10052
- ♦ Detaching => Page 15-28



14 10 Nm

- ◆ Install using locking compound
- ◆ Locking compound

=> Parts List

15 Toothed belt guard - rear

- ◆ For removal, remove coolant pump
- ◆ When installing, engage carefully in front sealing flange

16 Rubber grommet

- ◆ Replace if damaged

17 25 Nm

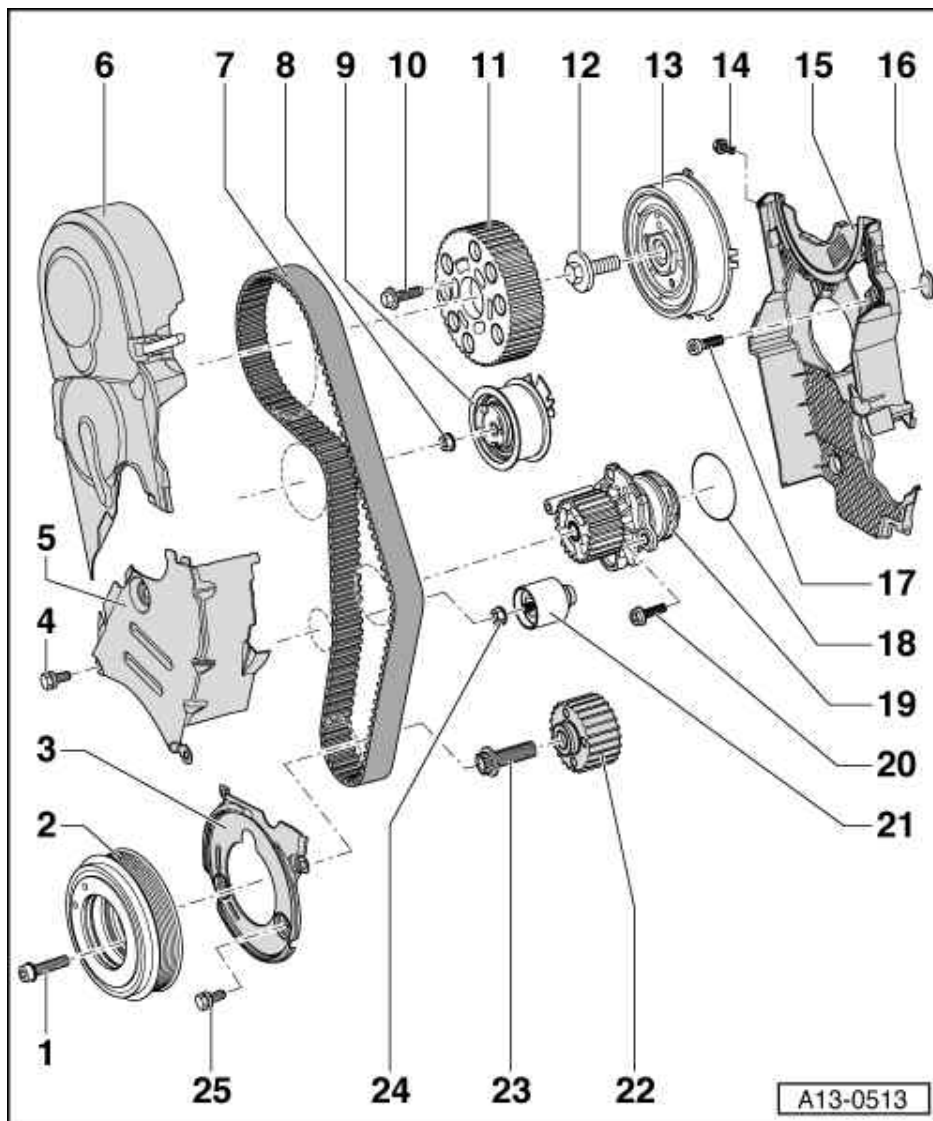
18 O-ring

- ◆ Replacing

19 Coolant pump

- ◆ Removing and installing

=>Page 19-15



20 13 Nm

21 Idler roller

22 Crankshaft sprocket

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

23 120 Nm + 90° (1/4 turn) further

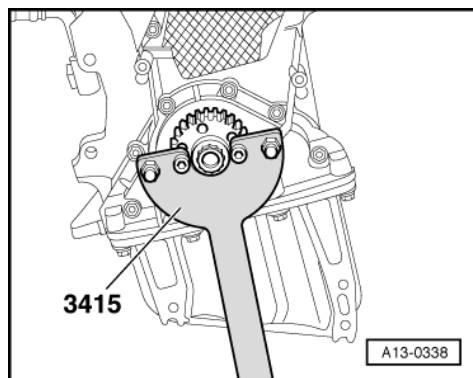
- ◆ Replacing
- ◆ Do not use oil
- ◆ To loosen and tighten use counterhold 3415
=> Fig. 13-50

24 22 Nm

25 10 Nm

- ◆ Install using locking compound
- ◆ Locking compound

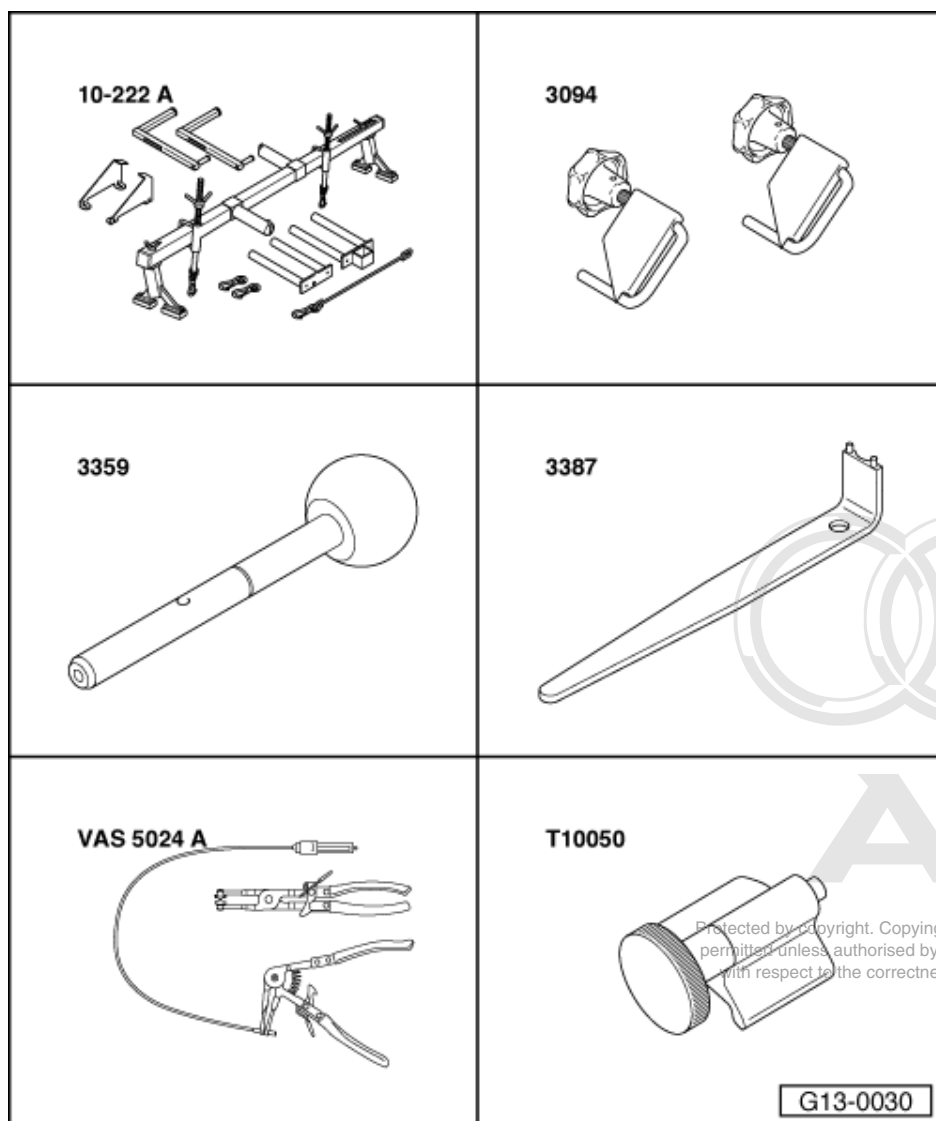
=> Parts List



-> Fig.1 Removing and installing crankshaft sprocket

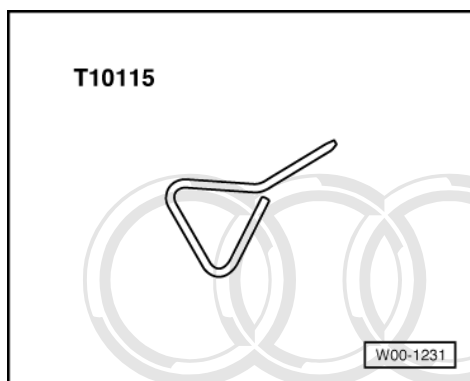
- Use counter-hold tool 3415 to loosen and tighten the central bolt.

3.2 - Removing and installing toothed belt



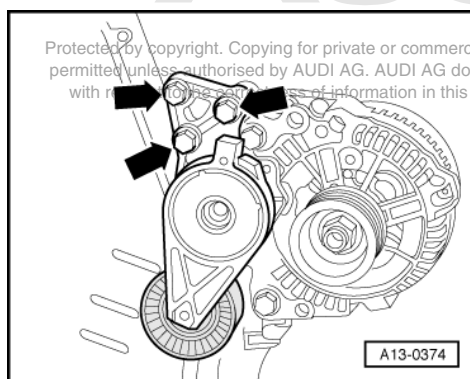
Special tools and workshop equipment required

- ♦ Support bar 10-222A
- ♦ Hose clamps 3094
- ♦ Mandrel 3359
- ♦ Pin wrench 3387
- ♦ VAS 5024 A
- ♦ Crankshaft stop T10050



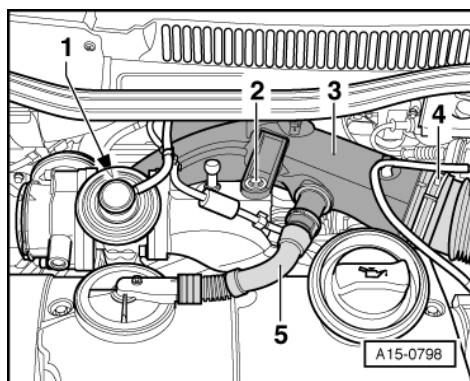
- ♦ Pin T10115
- ♦ Locking compound

=> Parts List



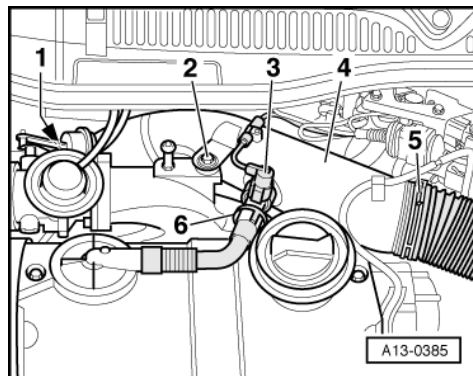
Removing

- Engine in vehicle
- Remove ribbed belt => Page 13-10
- -> Remove tensioner for ribbed belt cover -arrows-.



Vehicles with engine code AXR:

- -> Detach the crankcase vent pipe -5- from air duct pipe.
- Release spring clamp on turbocharger using VAS 5024 A.
- Set aside the vacuum hoses.
- Unscrew bolts -1- and -2- and remove air duct pipe -3-.

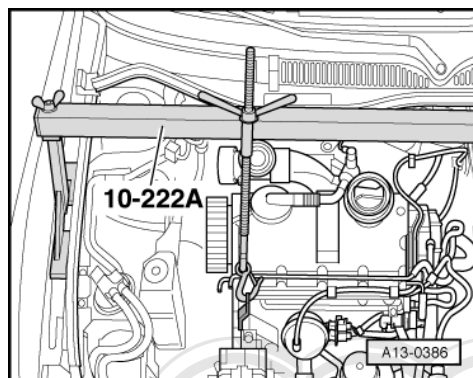

Vehicles with engine code ASZ, ATD:

- -> Disconnect hose -5- to air cleaner housing.
- Disconnect crankcase vent pipe -6- from air duct hose.
- If installed, detach connector for heating resistor (crankcase venting) -N79 -Item 3-.
- Release spring clamp on turbocharger using VAS 5024 A.

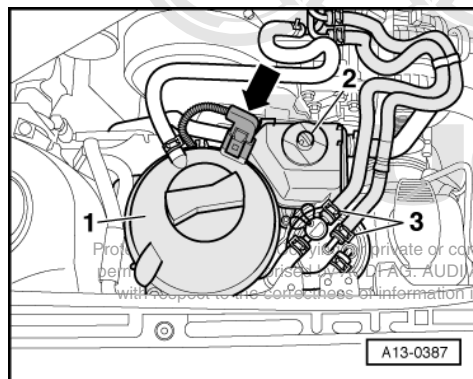
Note:

For vehicles with four-wheel drive, the spring clamp is not accessible from above. To release the spring clamp, remove the air duct pipe from the right longitudinal member and the centre and right noise insulation.

- Set aside the vacuum hoses.
- Unscrew bolts -1- and -2-.


All models:

- -> Attach support bar 10-222 A onto screwed edge of wing and attach spindle in right engine lifting eye.
- Lift engine slightly with spindle of engine support bracket 10 222 A.

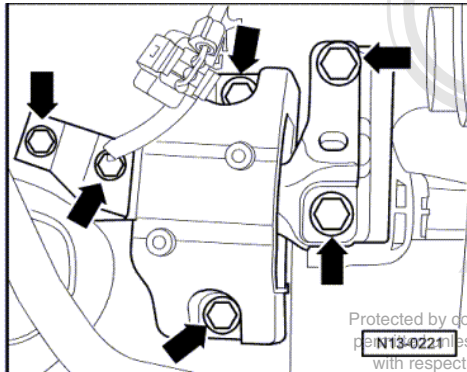


- -> Mark fuel feed pipe and fuel return pipe -3- and remove from fuel filter.
- Detach connector -arrow-.
- Unbolt coolant expansion tank -1- for coolant. Do not detach hoses.
- Unscrew refill reservoir -2- for power steering.
- Clamp off hose to steering box using hose clamp 3094.
- Detach refill reservoir line.

Note:

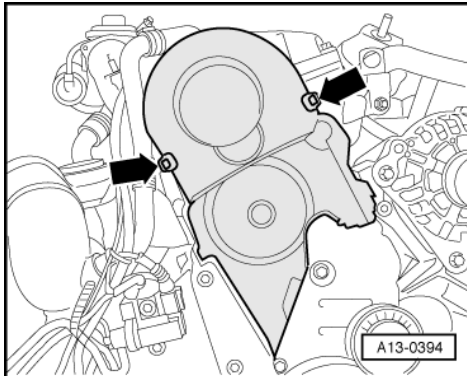
Close opening at refill reservoir with plug.

- Remove coolant expansion tank and refill reservoir for power steering towards front.

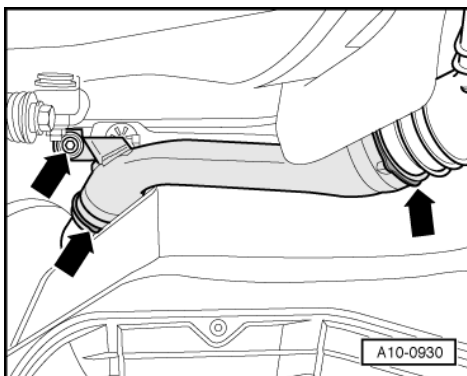


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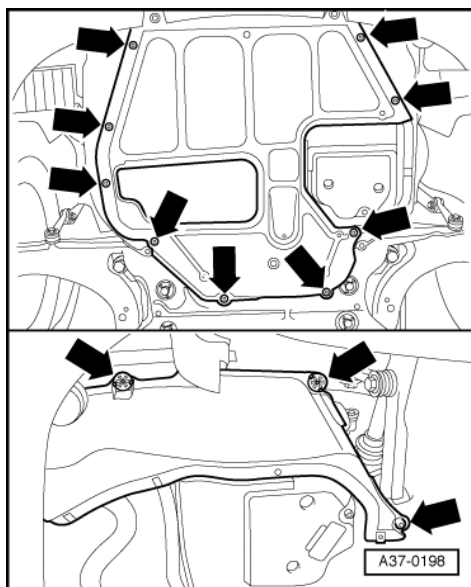
- -> Unbolt brace between engine console and chassis -arrows-.
- Unbolt engine console from engine support and from chassis -arrows-.
- Take out engine console.



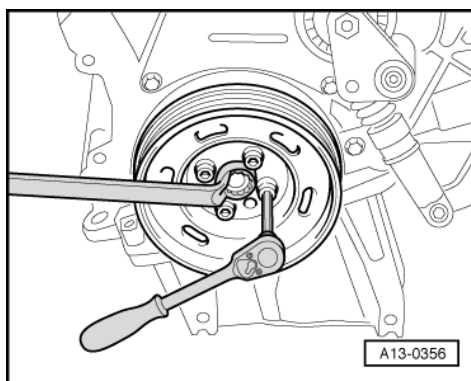
- -> Remove the upper toothed belt guard -arrows-.



- -> Remove air duct pipe from right longitudinal member -arrows-.



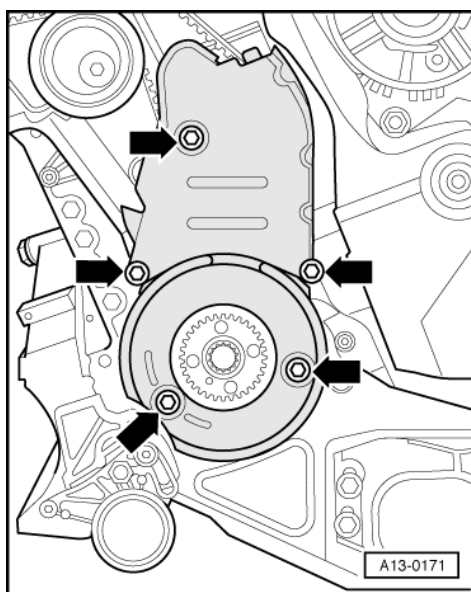
- -> Remove noise insulation in centre and on right -arrows-.



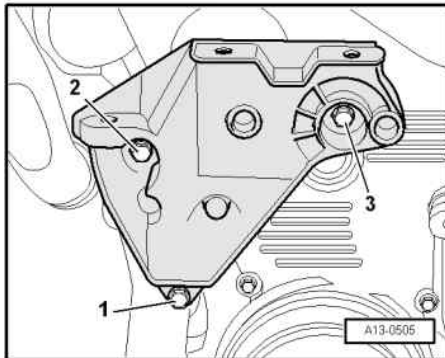
- -> Unbolt vibration damper.

Note:

To loosen and tighten the vibration damper counterhold with ring spanner on central bolt.



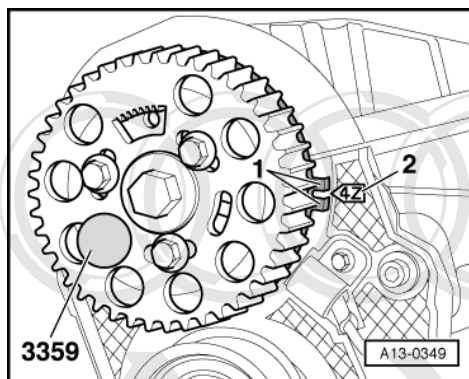
- -> Unbolt bottom and centre section of toothed belt guard -arrows-.



- -> Remove bolts for engine support -1 ... 3- and swivel engine support slightly to the rear.

Note:

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



Important

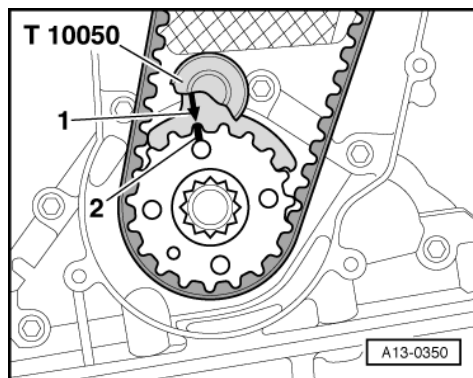
The engine must only be turned at the crankshaft, in the direction of engine rotation (clockwise).

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Set the crankshaft to TDC for cylinder No. 1.

Notes:

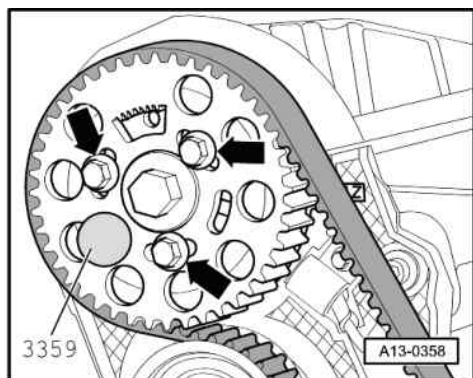
- ♦ -> The space between the two lugs -1- on sender wheel of camshaft must align with marking "4Z" -Item 2- on rear toothed belt guard.
- ♦ The illustration shows the toothed belt camshaft sprocket without toothed belt.
- Lock the hub with mandrel 3359.



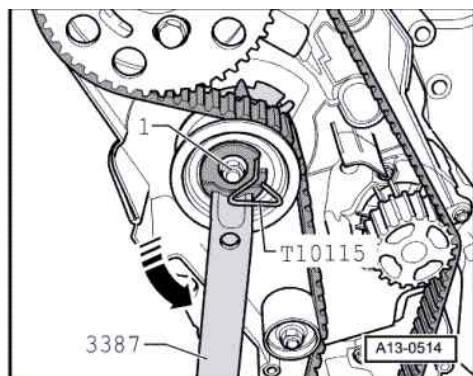
- -> Lock the crankshaft toothed belt sprocket with crankshaft stop T 10050.

Notes:

- ♦ The markings on the toothed belt sprocket -2- and crankshaft stop -1- must align. The journal of the crankshaft stop must engage in the bore of the sealing flange.
- ♦ The crankshaft stop can only be pushed from the front onto the toothed belt sprocket due to the splines.



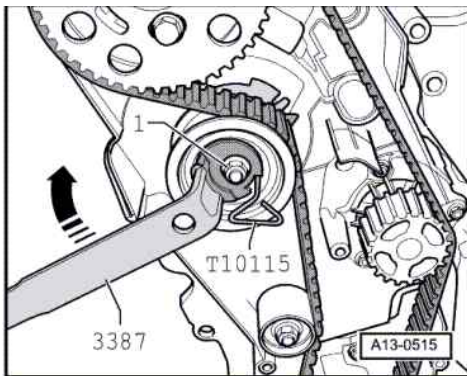
- Mark running direction of belt with chalk or felt pen.
- -> Loosen the bolts -arrows- at the camshaft sprocket.



- Loosen securing nut -1- of tensioning roller.
- -> With pin wrench 3387 turn the cam of the tensioning roller anticlockwise, until the tensioning roller can be locked with pin T10115.

Note:

Special tool Matra V/159 may be used in place of pin wrench 3387.



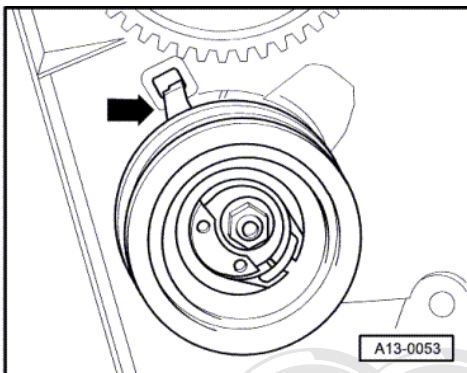
- -> Now turn pin wrench 3387 clockwise until limit stop and hand-tighten securing nut -1-.
- Remove toothed belt first from coolant pump and then from the remaining gears.

Installing (adjusting valve timing)

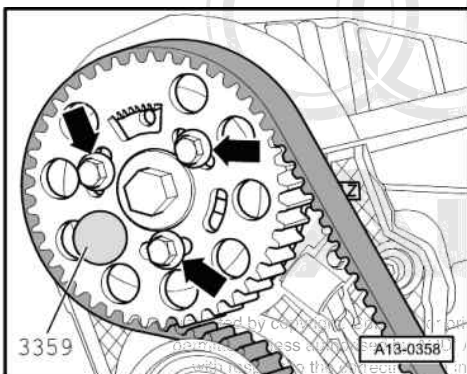
- Camshaft locked with mandrel 3359.
- Crankshaft locked with crankshaft stop T10050.
- Tensioning roller is locked with pin T10115 and secured with securing nut to right limit stop.

Notes:

- ♦ Adjustments to the toothed belt may only be performed when engine is cold.
- ♦ When turning the camshaft, the crankshaft must not be at TDC for any piston. Danger of damage to valves/ piston crown.

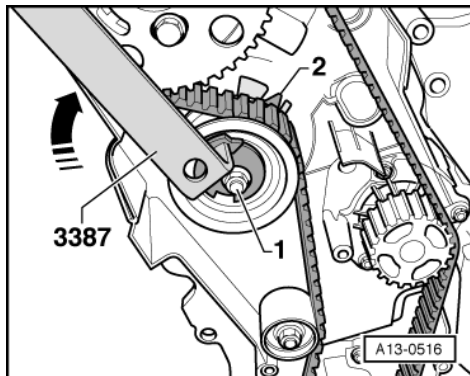


- -> Ensure the tensioning roller is correctly seated in the rear toothed belt guard -arrow-.

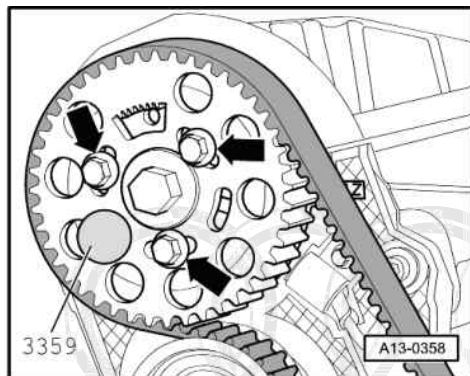


- -> Loosely secure the bolts -arrow-.
- The camshaft sprocket should be just able to turn on the hub and must not tilt.
- Turn the camshaft sprocket in its longitudinal holes to the centre position.

- Attach toothed belt to camshaft sprocket, tensioning roller, toothed belt sprocket crankshaft and finally to toothed belt sprocket coolant pump.



- Adjust toothed belt tension as follows:
- Remove pin T10115.
- -> Loosen securing nut -1- of tensioning roller.
- Turn the cam of the tensioning roller clockwise with pin wrench 3387, until pointer -2- is central to the gap in the base plate.
- Hold the tensioning roller in this position and tighten tensioning roller nut to 20 Nm + 45° (1/8 turn).



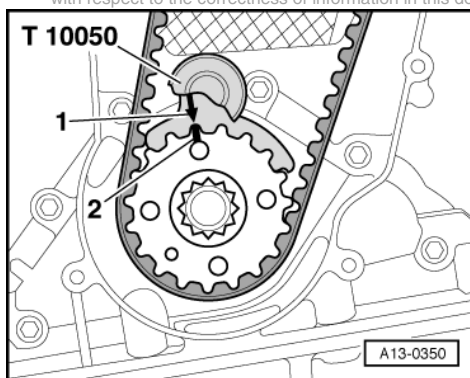
- -> Tighten the camshaft sprocket bolts -arrows- to 25 Nm.
- Remove mandrel 3359 and crankshaft stop T10050.

Important

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

- Turn the crankshaft two rotations in the direction of engine rotation until the crankshaft is set to TDC again.

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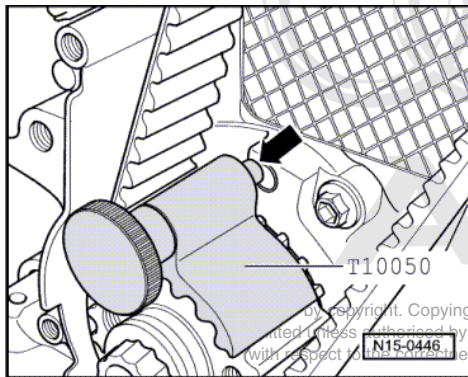


Checking the valve timing

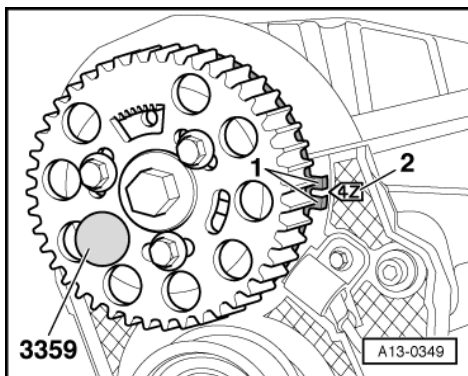
- -> For checking purposes, lock the crankshaft toothed belt sprocket again using crankshaft stop T10050.

Notes:

- ♦ The markings on the toothed belt sprocket -2- and crankshaft stop -1- must align. The journal of the crankshaft stop must engage in the bore of the sealing flange.



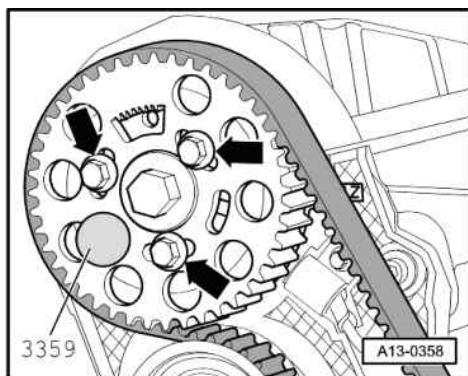
- ♦ -> The pin of the crankshaft stop must engage into the bore of the sealing flange when rotated -arrow-.
- ♦ If the crankshaft was turned over TDC for cylinder 1, then turn back crankshaft 1/4 turn to position it again to TDC for cylinder 1 in direction of engine rotation.
- ♦ Corrections against the rotation direction of the engine to adjust the crankshaft stop are not permitted.



- -> Check with mandrel 3359 whether hub can be locked.

Notes:

- ♦ The space between the two lugs -1- on sender wheel of camshaft must align with marking "4Z" -Item 2 - on rear toothed belt guard.
- ♦ The illustration shows the toothed belt camshaft sprocket without toothed belt.



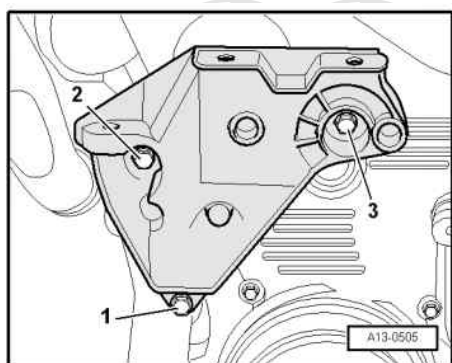
If hub cannot be locked:

- -> Loosen the securing bolts -arrows- on the camshaft sprocket.
- Apply a ring spanner to centre bolt of camshaft.
- Turn hub until the mandrel 3359 can be inserted.
- Tighten the bolts -arrows- of camshaft sprocket to 25 Nm.
- Remove mandrel 3359 and crankshaft stop T10050.

Important

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

- Turn the crankshaft two rotations in the direction of engine rotation until the crankshaft is set to TDC again.
- Repeat valve timing checks =>Page 13-38.
- Install toothed belt guard (bottom and centre sections).
- Install toothed belt guard (top section).

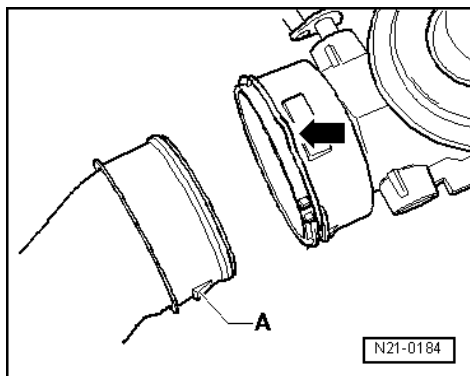


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The remaining installation steps are carried out in the reverse sequence - note the following points:

-> Secure the engine support as follows:

- Remove bolts -1 ... 3-.
- Then tighten the bolts -1 ... 3- to 45 Nm.
- Install engine console.
- Install the vibration damper => Page 13-7.
- Adjust engine mounting => Page 10-85.
- Install ribbed belt =>Page 13-12.



- -> When installing air duct pipes with connectors, ensure that the securing clip -arrow- engages audibly in the retaining lug -A-.

- Install and secure coolant expansion tank and power assisted steering reservoir.

Tightening torques

Component	Nm
Toothed belt tensioning roller to cylinder head	20 + 45° 1)
Camshaft sprocket to hub	25
Lower section of toothed belt guard to cylinder block	10 2)
Centre section of toothed belt guard to cylinder block	10 2)
Vibration damper to crankshaft sprocket	10 + 90°3)4)
Engine support to cylinder block	45
Engine console to chassis	50
Engine support to engine console	100 3)5)

1) 45° corresponds to an eighth of a turn

2) install using locking compound;
locking compound

=> Parts List

3) Replace bolts

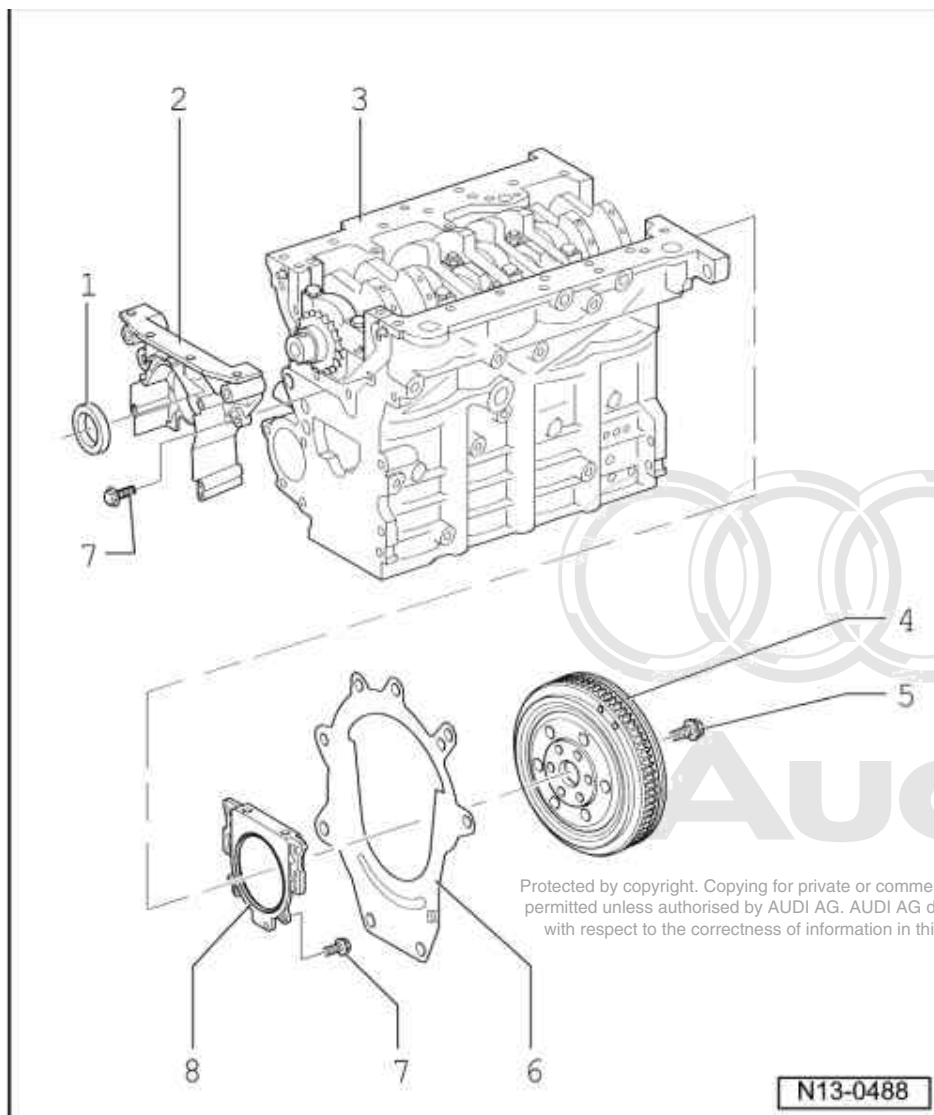
4) 90° corresponds to a quarter of a turn

5) Only tighten to final torque after adjusting the engine mounting=> Page 10-85

Component	Nm
Brace to engine console/chassis	25
Tensioner for ribbed belt tensioner to bracket for auxiliary mechanical units	23

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

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



Note:

For repairs to the clutch:

=> 5-speed Manual Gearbox 02J; Repair group 30; Servicing clutch Servicing clutch

=> 6-speed Manual Gearbox 02M Front-wheel Drive; Repair group 30; Servicing clutch Servicing clutch

=> 5 and 6-speed Manual Gearbox 02M Four-wheel drive/Gearbox; Repair group 30; Servicing clutch Servicing clutch

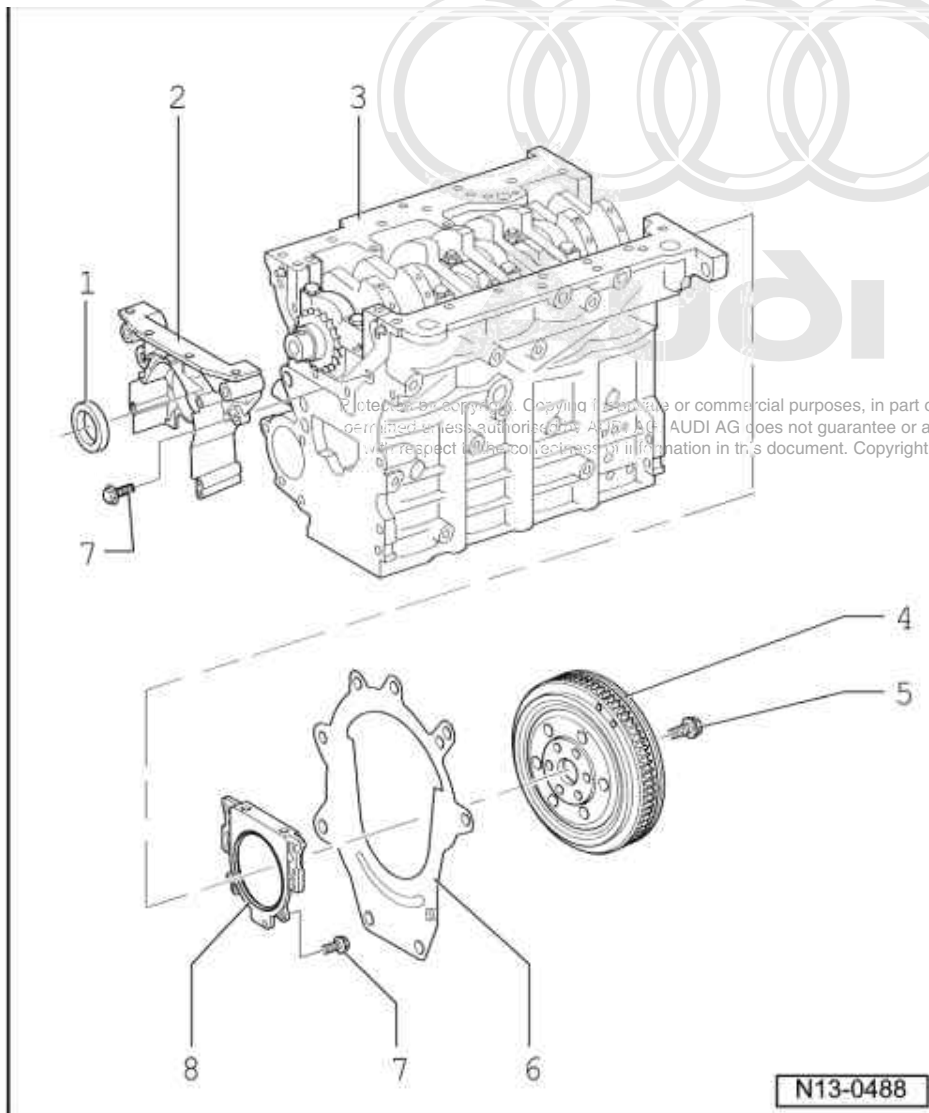
1 Sealing ring

- ◆ Replacing => Page 13-74.
- ◆ Do not use oil

2 Sealing flange - front

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

=>Page 13-79



3 Cylinder block

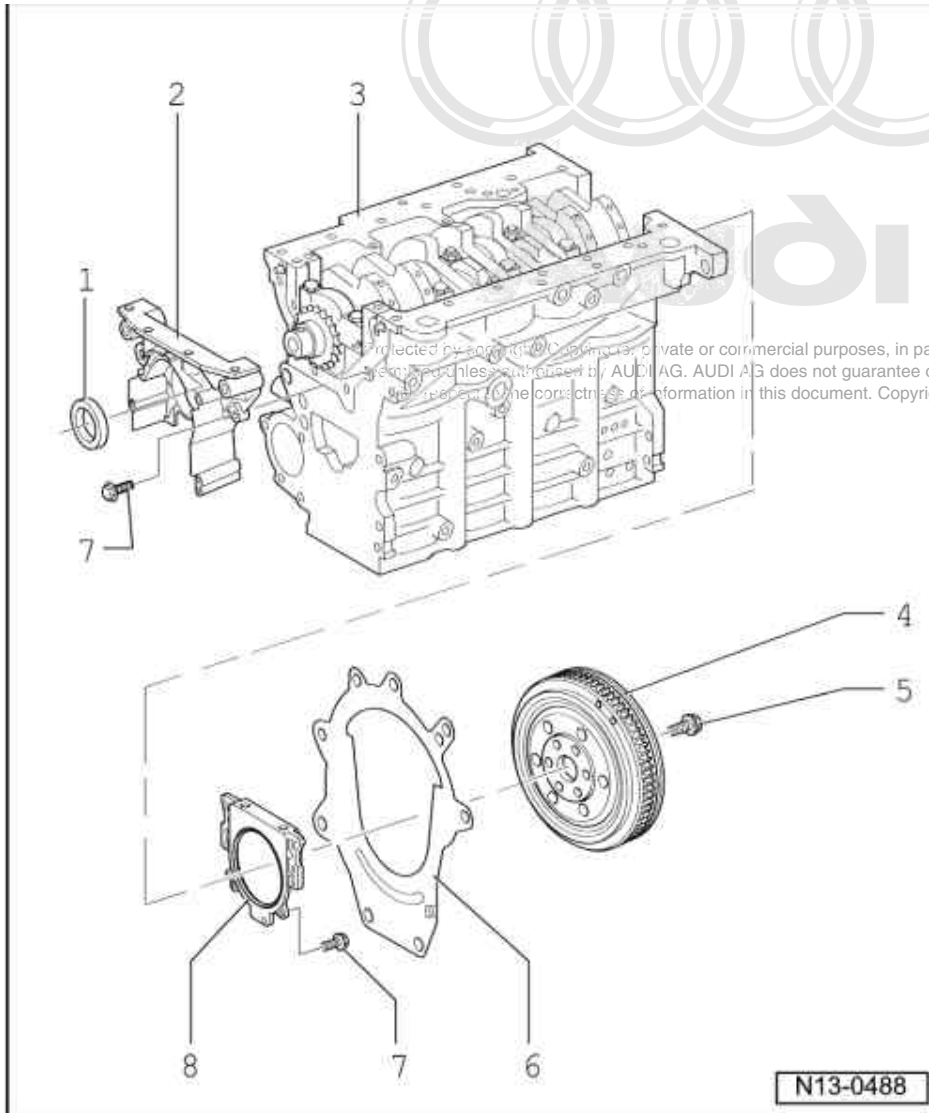
- ♦ Removing and installing crankshaft=> Page 13-94
- ♦ Dismantling and assembling pistons and conrods => Page 13-103

4 Dual-mass flywheel/drive plate

- ♦ Removing and installing dual mass flywheel=> Page 13-89
- ♦ Removing and installing drive plate => Page 13-91
- ♦ Can only be installed in one position. Holes are off set

5 60 Nm + 90° (1/4 turn) further

- ♦ Replacing



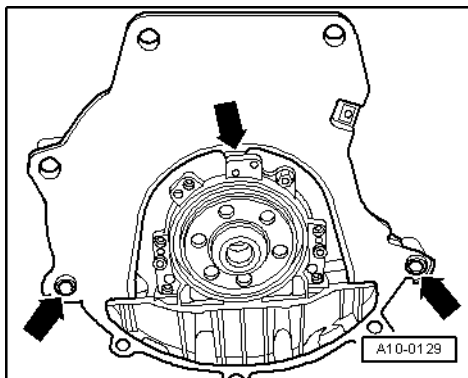
6 Intermediate plate

- ◆ Must be located on dowel sleeves
- ◆ Do not damage/bend when assembling.
- ◆ Attached to sealing flange => Fig.13-73

7 15 Nm

8 Rear sealing flange

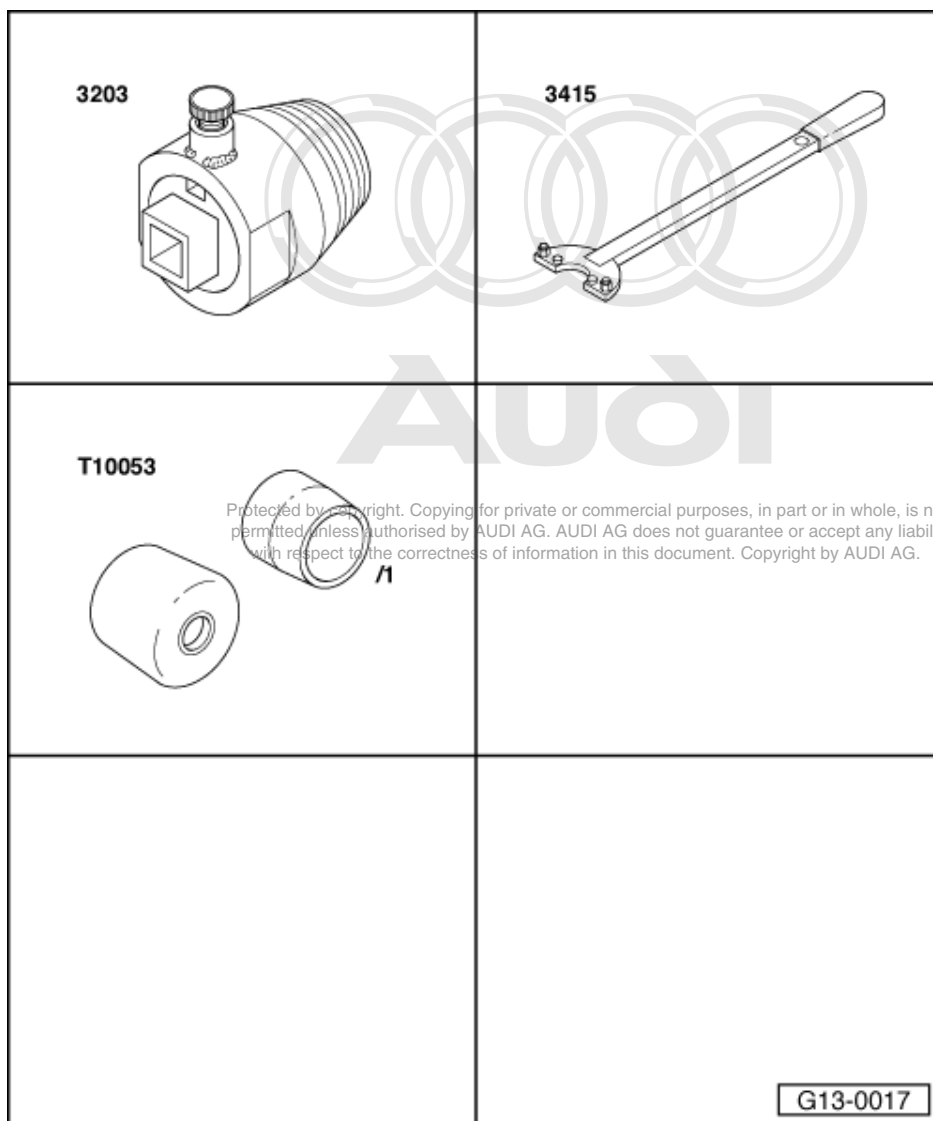
- ◆ With sealing ring
- ◆ Removing and installing
=>Page 13-85



-> Fig.1 Installing intermediate plate

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

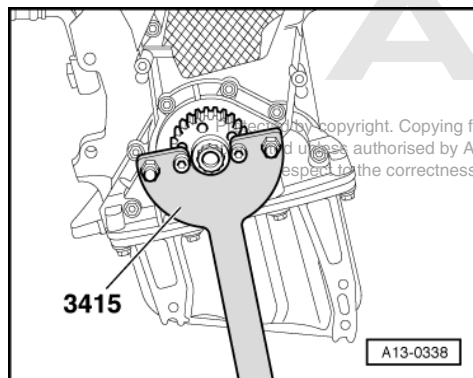
4.2 - Replacing crankshaft oil seal on pulley end





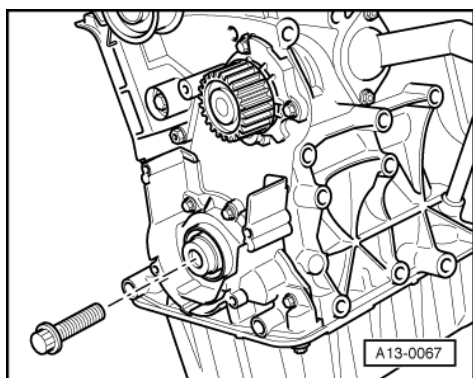
Special tools and workshop equipment required

- ♦ Oil seal extractor 3203
- ♦ Holding tool 3415
- ♦ Assembly tool T10053

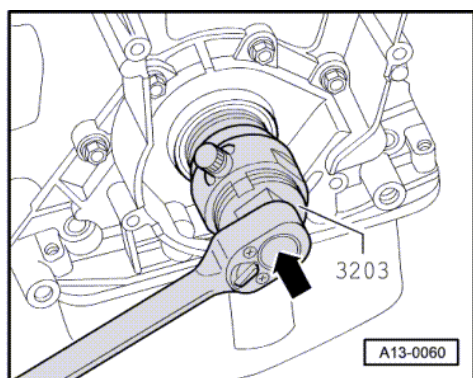


Removing

- Engine in vehicle
- Removing toothed belt => Page 13-51.
- -> Remove crankshaft toothed belt sprocket. Counter hold sprocket with 3415.

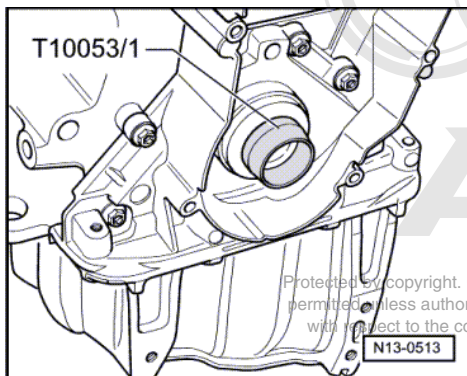


- -> Before applying oil seal extractor, screw central bolt for toothed belt sprocket into crankshaft until limit stop.



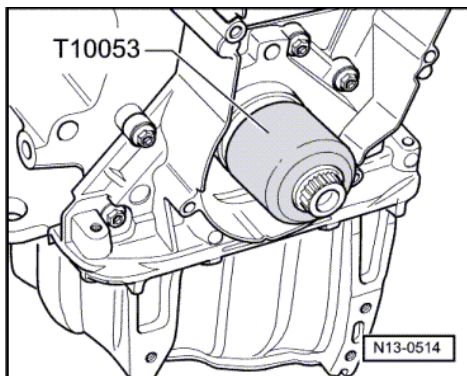
- Unscrew inner section of oil seal extractor 3203 eight turns out of outer section and lock with knurled screw.
- -> Lubricate threaded head of oil seal extractor, place it in position and exerting firm pressure, screw it into oil seal as far as possible.
- Loosen knurled screw and turn inner part against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

- Clean contact surface and sealing surface.

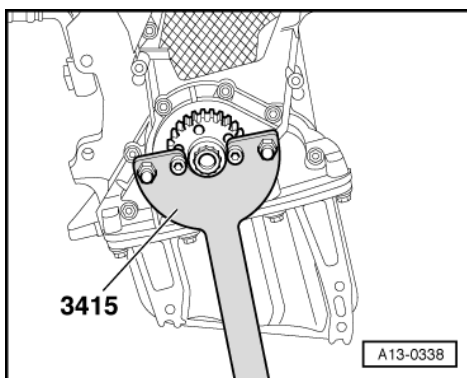


Installing

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



- -> Press in sealing ring with central bolt of toothed belt sprocket and press sleeve of T10053 until flush.



- Replace bolt for crankshaft sprocket.
- -> Install toothed belt crankshaft sprocket. Counter hold toothed belt sprocket with counterhold 3415.

Notes:

- ◆ Contact surface between sprocket and crankshaft must be free of oil.
- ◆ Do not oil bolt for crankshaft sprocket.
- Install toothed belt (adjust valve timing) => Page 13-62.
- Install ribbed belt => Page 13-12.

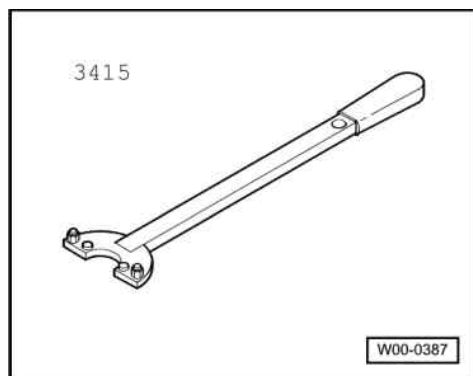


Tightening torque

Component	Nm
Toothed belt sprocket to crankshaft	120 + 90°1)2)

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

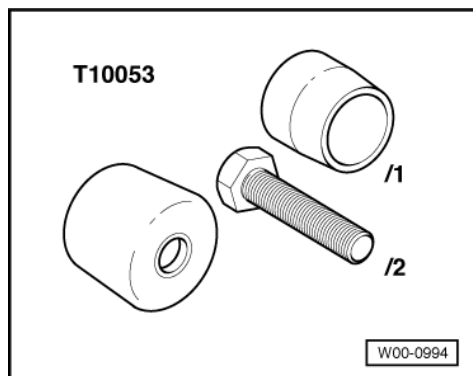
4.3 - Removing and installing front sealing flange



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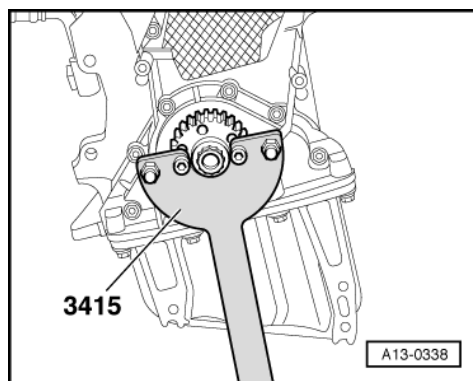
Special tools and workshop equipment required

- ♦ Counterhold 3415



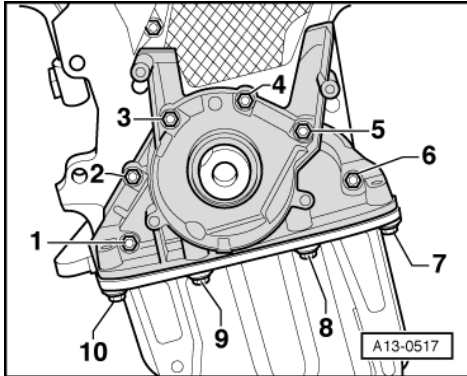
- ♦ Assembly tool T10053
- ♦ Electric drill with plastic brush attachment
- ♦ Protective goggles
- ♦ Silicone sealant

=> Parts List



Removing

- Engine in vehicle
- Removing toothed belt => Page 13-51.
- -> Remove crankshaft toothed belt sprocket. Counter hold sprocket with 3415.



- -> Unscrew bolts -1 ... 10-.
- Lever off sealing flange and remove.
- Drive out oil seal with flange removed.

Installing

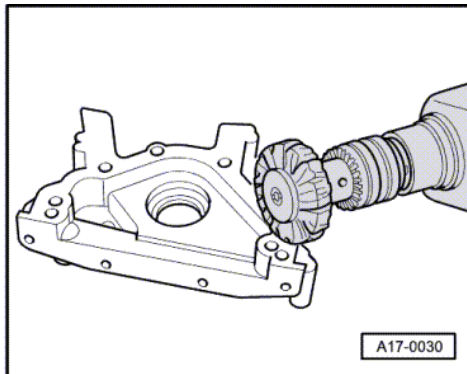
Installation is carried out in the reverse order; note the following:

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Place a cloth over the open part of the oil pan.

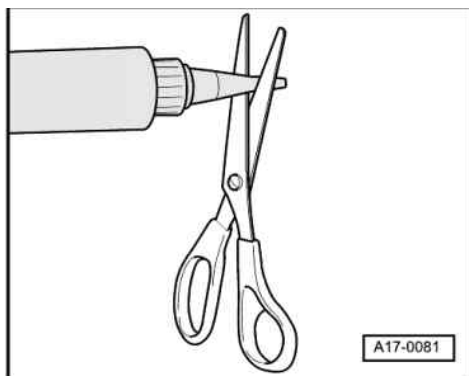
- Carefully remove any residual sealant from cylinder block and oil pan.



- -> Remove sealant residues from sealing flange, e.g. with rotating plastic brush or similar.

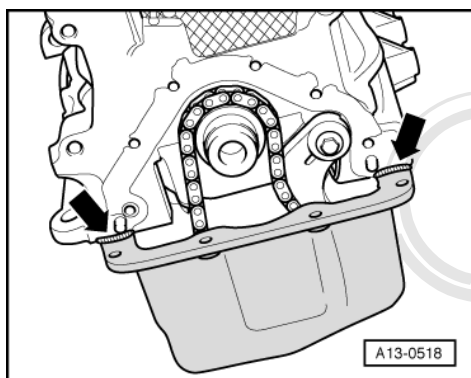
Important
Wear protective goggles.

- Clean sealing surfaces: they must be free of oil and grease.

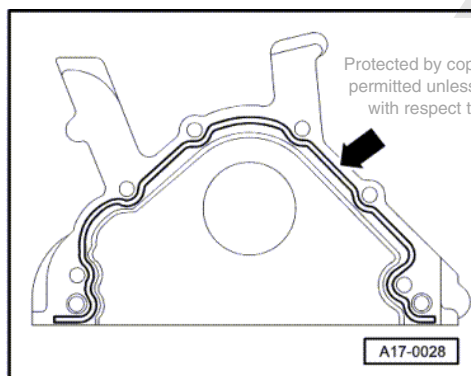

Note:

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

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



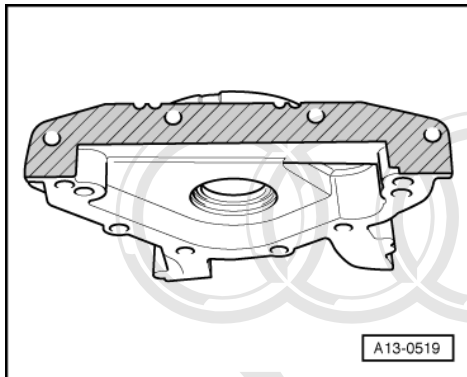
- -> Apply a thin bead of silicone sealant at the edge between the cylinder block and the oil pan -arrows-.



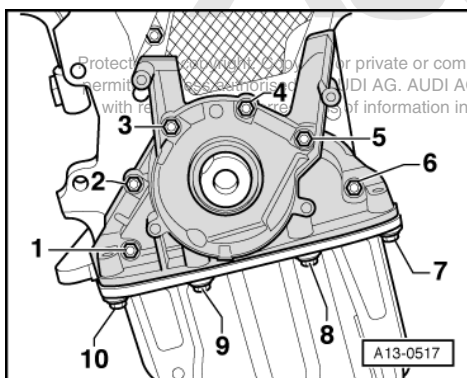
- -> Apply the bead of silicone sealant -arrow- onto the clean sealing surface of the sealing flange, as illustrated (arrow).
- Sealant bead width - arrow-: 2 ... 3 mm

Note:

The bead of sealant must not be thicker than 3 mm, as otherwise excess sealant will enter the sump and obstruct the strainer in the oil intake manifold.



- -> Coat the lower sealing surface at the sealing flange lightly with silicone sealant -hatched area-.
- Carefully push the sealing flange onto the dowel pins at the engine block.



- Tighten bolts in the specified sequence:
 - -> Unscrew bolts -1 ... 6-.
 - Tighten bolts -7 ... 10-.
- Install crankshaft oil seal => Page 13-76.
- Install toothed belt (adjust valve timing) => Page 13-62.

Tightening torque

Component	Nm
Sealing flange to cylinder block	15

4.4 - Removing and installing rear sealing flange

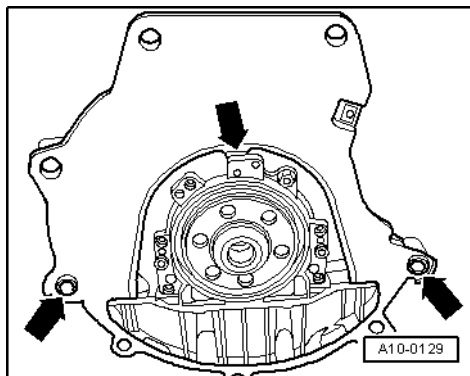
Special tools and workshop equipment required

- ♦ Electric drill with plastic brush attachment
- ♦ Protective goggles
- ♦ Silicone sealant

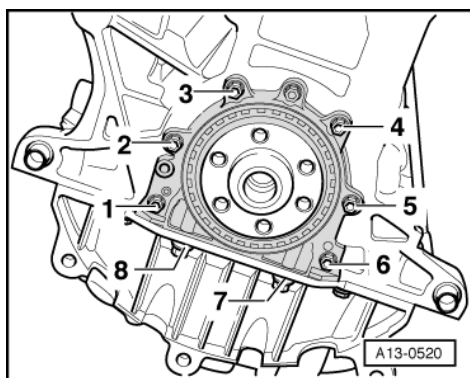
=> Parts List

Removing

- Gearbox removed
- Remove dual-mass flywheel/drive plate => Page 13-91.



- -> Detach intermediate plate at sealing flange and dowel sleeves -arrows-.



- -> Unscrew bolts -1 ... 8-.
- Lever off rear sealing flange and remove.

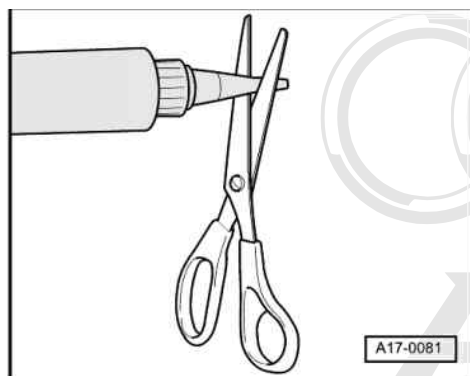
Installing

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

Note:

Place a cloth over the open part of the oil pan.

- Carefully remove residual sealant at the oil pan and bottom of sealing flange.
- Clean sealing surfaces: they must be free of oil and grease.

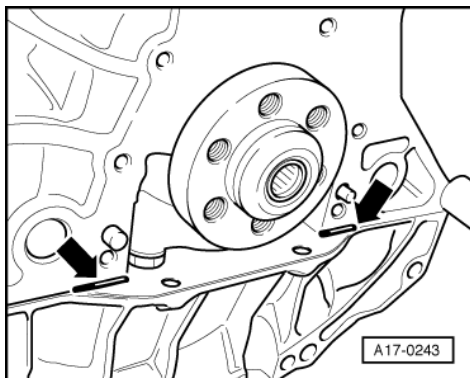


Note:

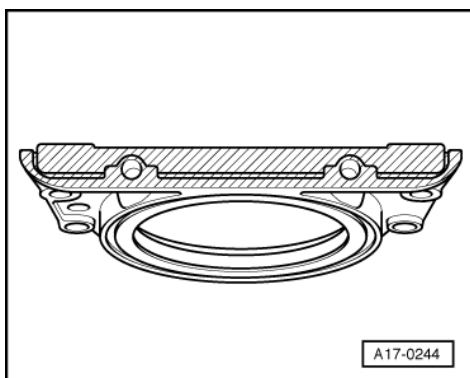
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The sealing flange must be installed within 5 minutes after applying silicone sealant.

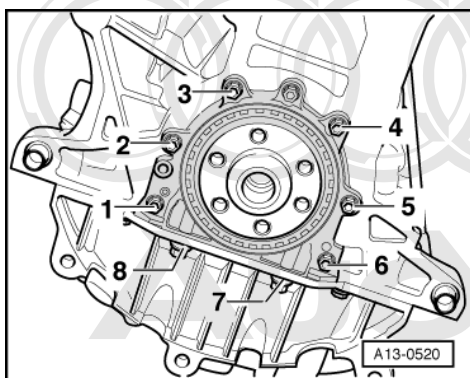
- -> Cut off nozzle of tube at front marking (ø of nozzle approx. 3 mm).



- -> Apply a thin bead of silicone sealant at the edge between the cylinder block and the oil pan -arrows-.



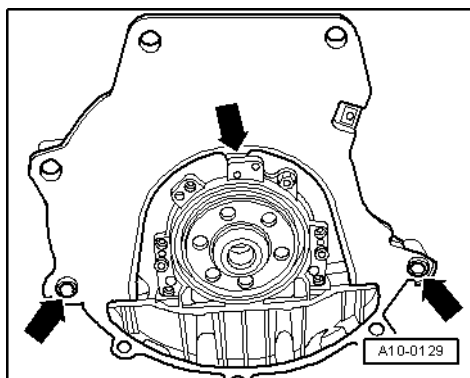
- -> Coat the lower sealing surface at the sealing flange lightly with silicone sealant -hatched area-.
- When installing, push guide sleeve from installation kit onto crankshaft.
- Carefully push the sealing flange onto the dowel pins at the engine block.



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Tighten bolts in the specified sequence:

- > Unscrew bolts -1... 6-.
- Tighten bolts -7- and -8-.



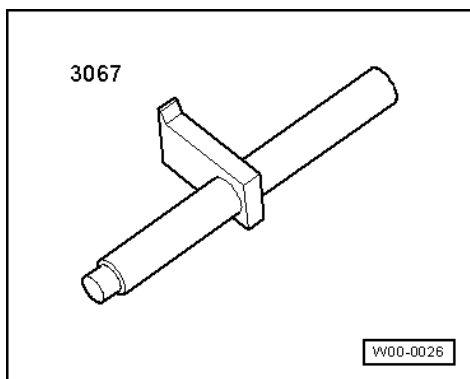
- -> Engage intermediate plate on sealing flange and push onto dowel sleeves -arrows-.
- Install dual-mass flywheel/drive plate => Page 13-92.

Tightening torque

Component	Nm
Sealing flange to cylinder block	15

4.5 - Removing and installing dual mass flywheel/drive plate

Dual-mass flywheel

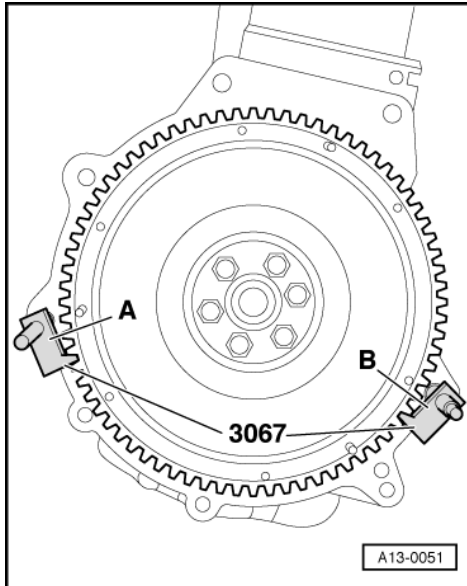


Special tools and workshop equipment required

- ♦ Holding tool 3067



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Removing

- -> Insert counter hold tool 3067 into bore of cylinder block, and engage on dual mass flywheel.
- Installation position for counter hold tool:
 - A - To tighten
 - B - To slacken
- Mark position of dual mass flywheel relative to engine.
- Unbolt dual mass flywheel.

Installing

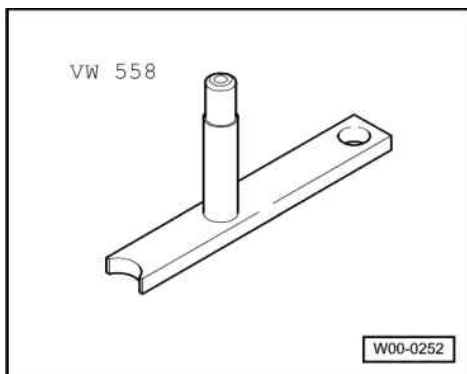
Installation is carried out in the reverse order; note the following:

- Replace bolts.

Tightening torque

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

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



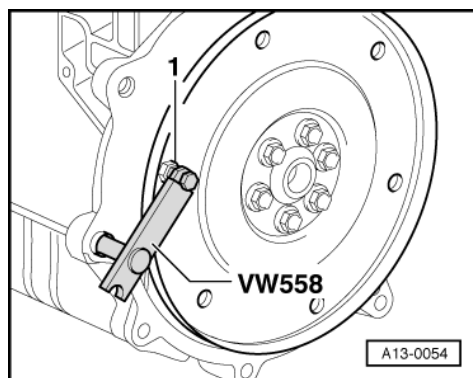
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Drive plate

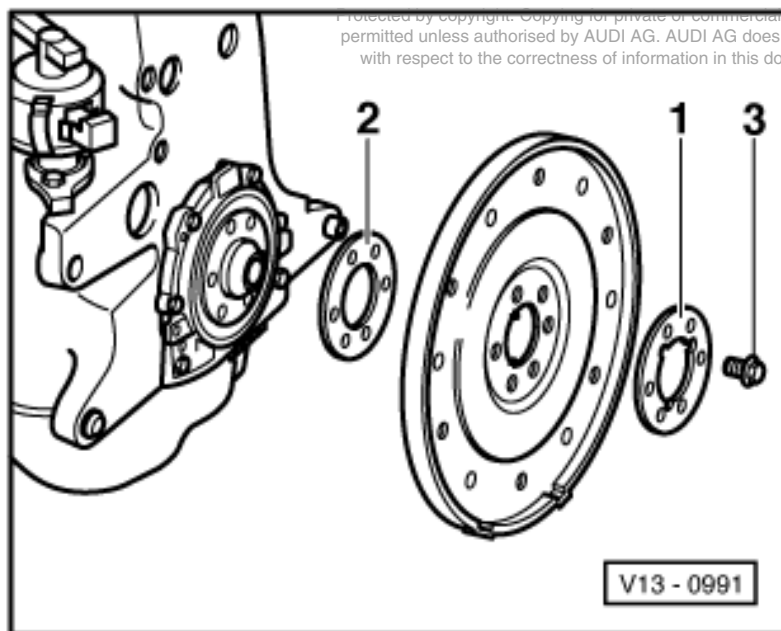
Special tools and workshop equipment required

- ♦ Counterhold VW 558
- ♦ Hexagon bolt M8 x 45 and two M10 hexagon nuts
- ♦ Caliper gauge or depth gauge



Removing

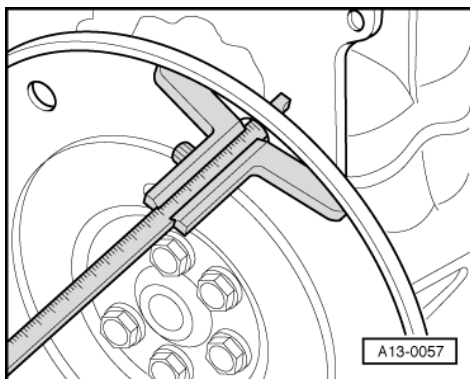
- -> Secure counterhold VW 558 to the drive plate with a hexagon bolt M8x45. Place two M10 hexagon nuts between counter hold tool and drive plate.
- Mark position of drive plate relative to engine.
- Unbolt drive plate.



Installing

- -> Place drive plate with shim -2- and washer -1- in position.

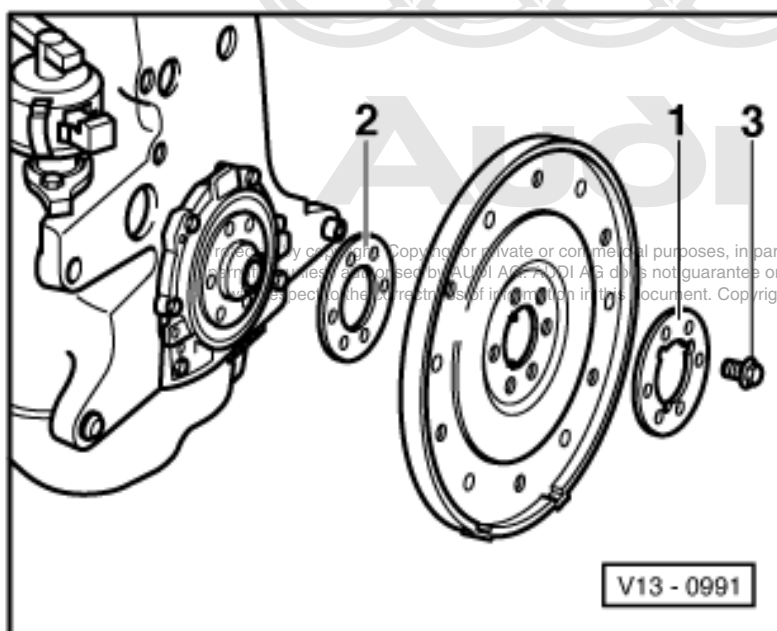
- Insert at least 3 of the old securing bolts -3- and tighten to 30 Nm.



- -> Check fitting location of drive plate by measuring at three points and calculate average.
- Specified value: 19.5...21.1 mm

Note:

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



If nominal value is exceeded:

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

If specified value is attained:

- Fit new bolts and tighten.

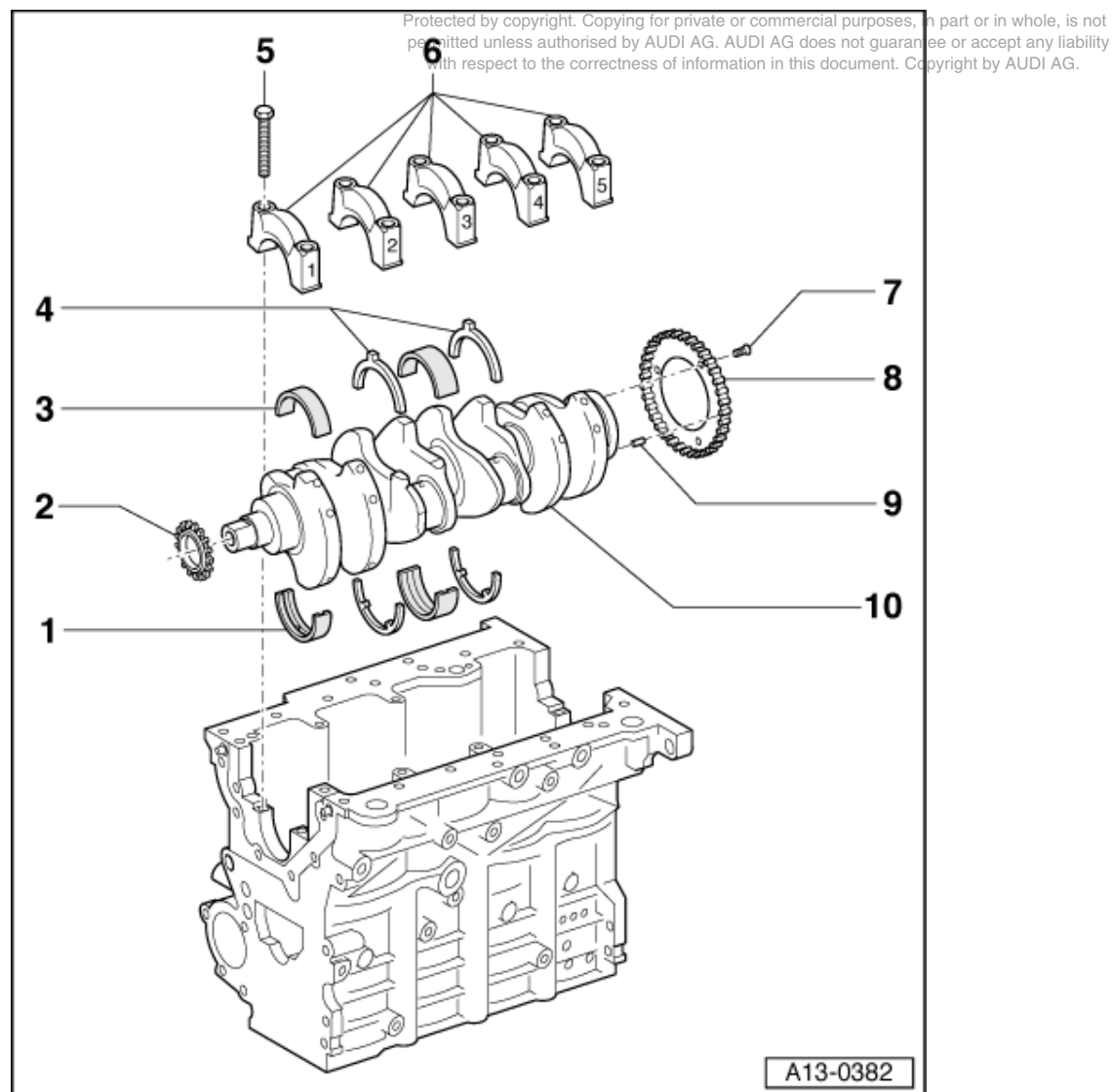
Tightening torque

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

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

5 - Removing and installing crankshaft

5.1 - Removing and installing crankshaft



Note:

When working on the engine, it should be secured to the repair stand using engine bracket VW 540 => Page 10-73.

1 Bearing shell

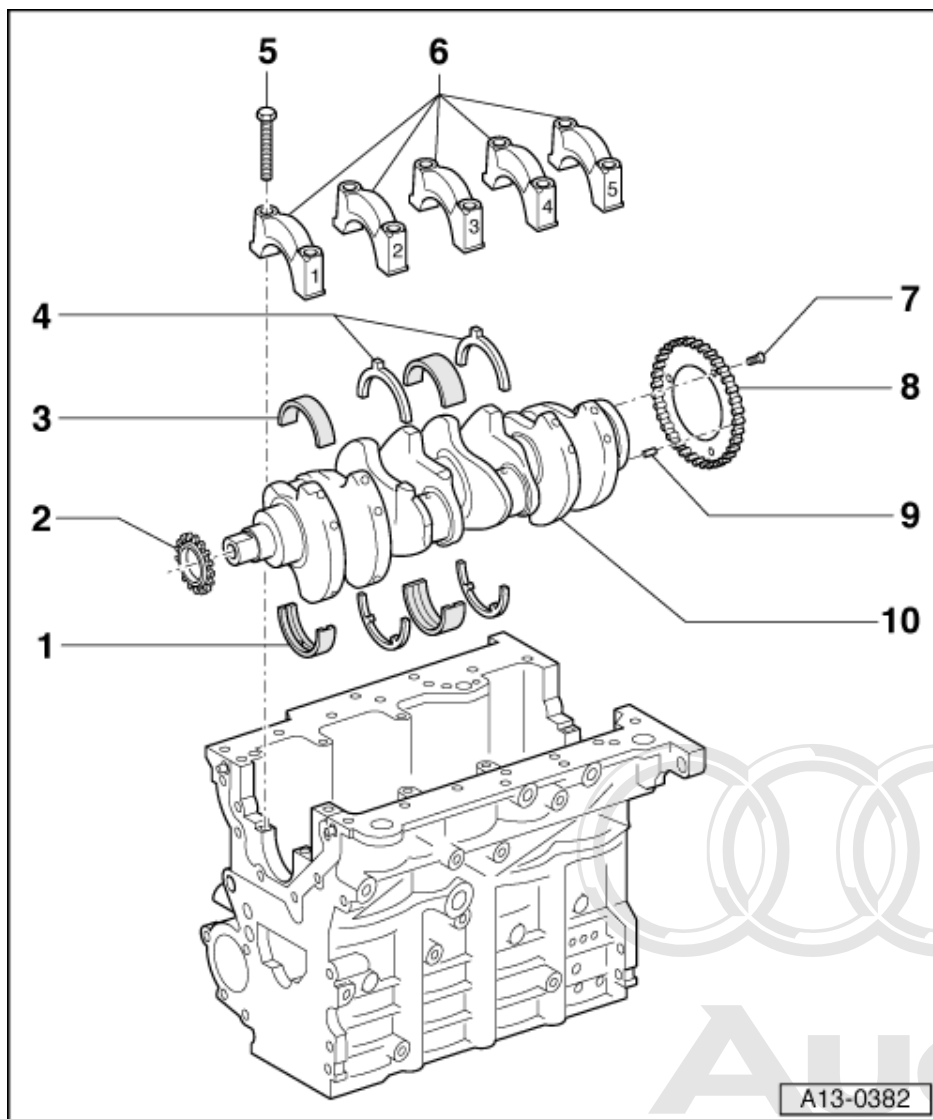
- ♦ For cylinder block with oil groove
- ♦ Do not interchange used bearing shells (mark).

2 Chain sprocket

- ♦ For oil pump drive chain
- ♦ Replacing => Page 13-101.

3 Bearing shell

- ♦ For bearing cap without oil groove
- ♦ Do not interchange used bearing shells (mark).



4 Thrust washers

- ♦ For mounting 3
- ♦ Different types for cylinder block and bearing cap
- ♦ Note fixing arrangement

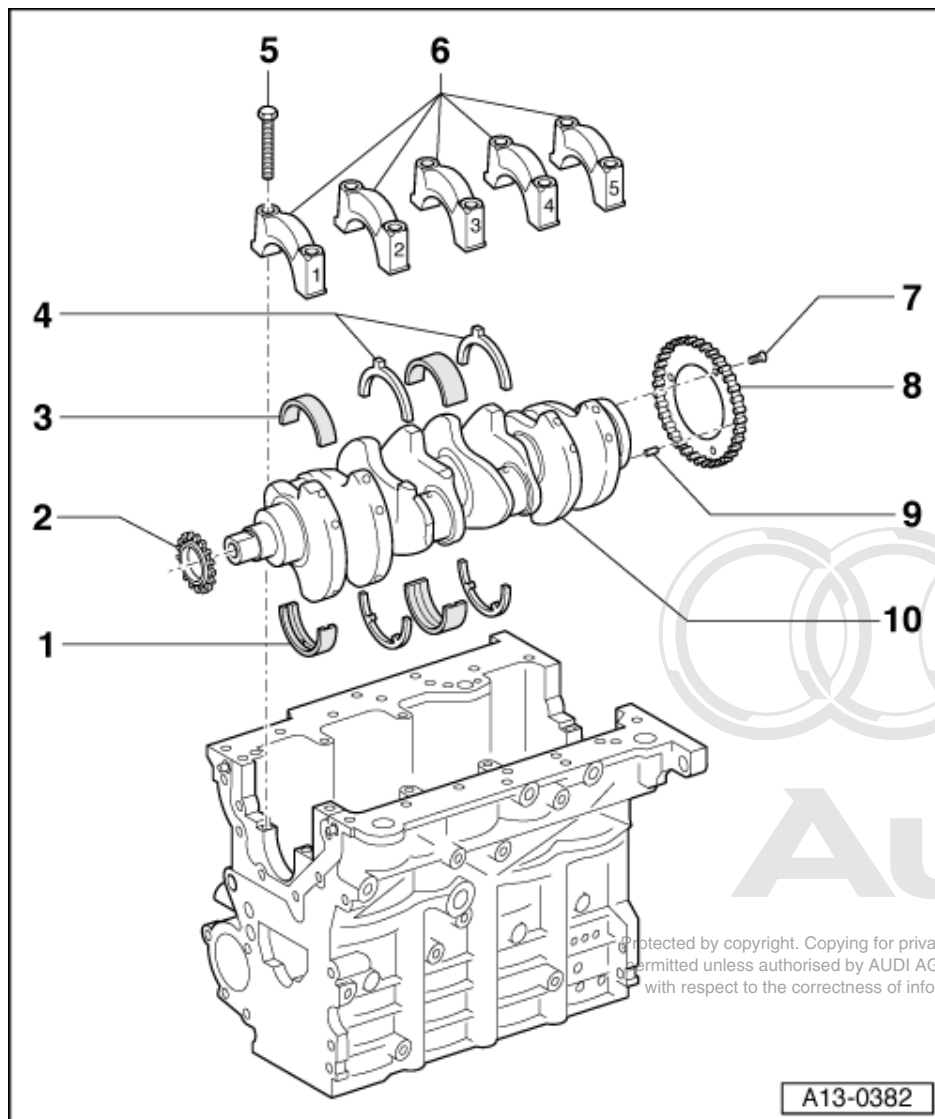
5 65 Nm + 90° (1/4 turn) further

- ♦ Replacing
- ♦ When measuring radial play of crankshaft, tighten to 65 Nm but do not turn further.

6 Bearing cap

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

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7 10 Nm + 90° (1/4 turn) further

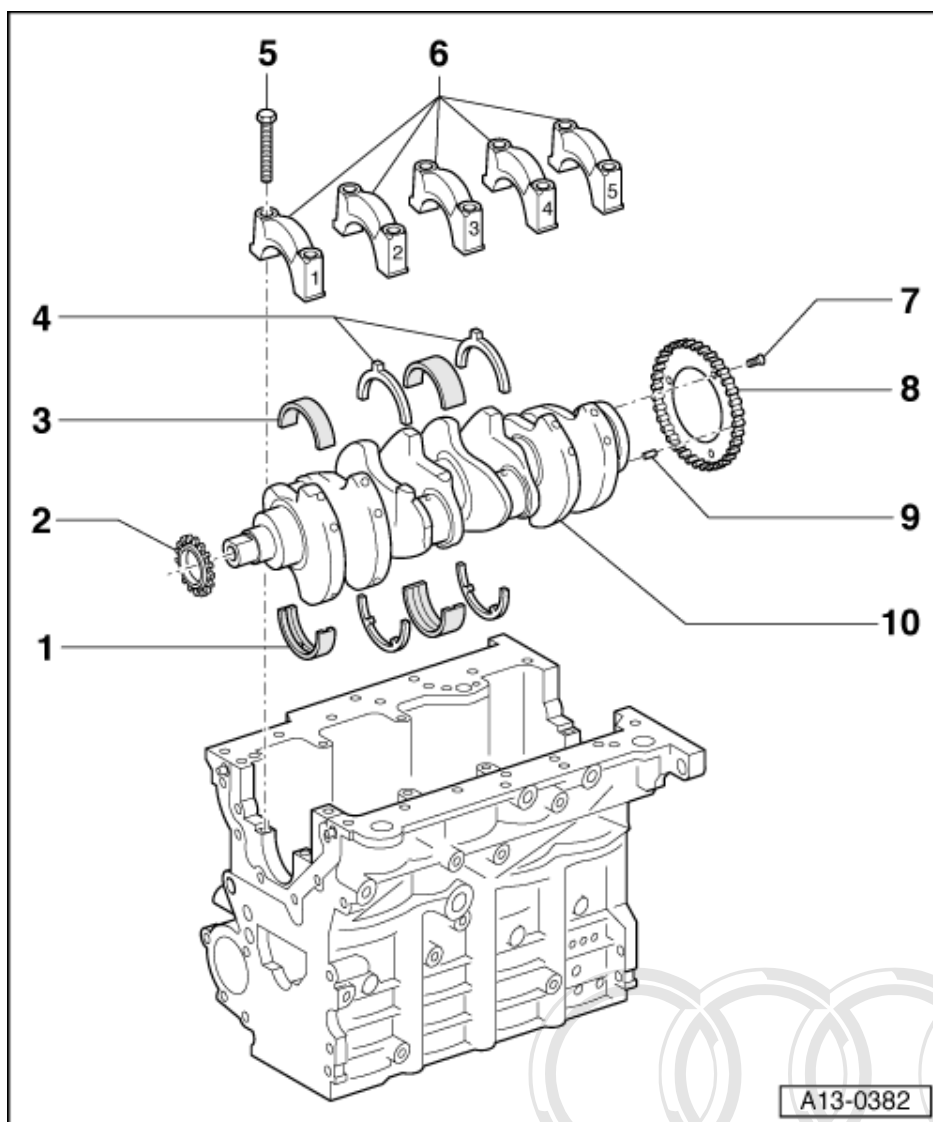
- ◆ Replacing
- ◆ After each loosening of bolts replace sender wheel
=> Fig.13-98

8 Sender wheel

- ◆ For engine speed sender -G28
- ◆ Can only be installed in one position. Holes are off set
- ◆ Always renew sender wheel if securing bolts have been unscrewed.
- ◆ Removing and installing
=> Fig.13-98

9 Dowel pin

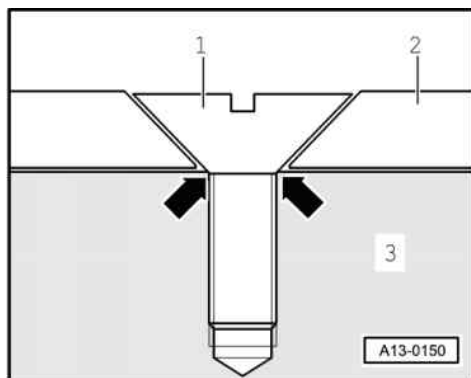
- ◆ Check projection from crankshaft => Fig.13-99



10 Crankshaft

- ♦ Axial play new: 0.07 ... 0.23 mm
Wear limit: 0.30 mm
- ♦ Check radial play with Plastigage
New: 0.02 ... 0.04 mm
Wear limit: 0.15 mm
- ♦ Do not rotate the crankshaft when checking the radial play.
- ♦ Crankshaft dimensions
=>Page 13-100

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➔ Fig.1 Removing and installing sender wheel

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

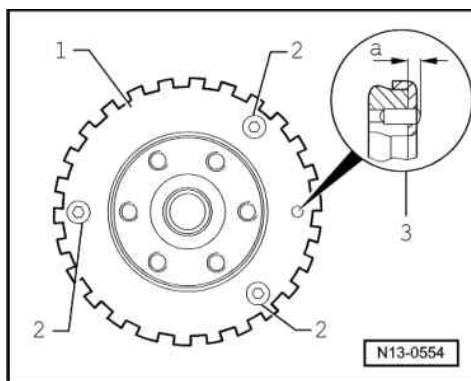
Notes:

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

Tightening torque

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

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



➔ Fig. 2 Checking projection of dowel sleeve from crankshaft

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Projection of dowel sleeve -3- from crankshaft

- ♦ $a = 2.5 \dots 3.0 \text{ mm}$

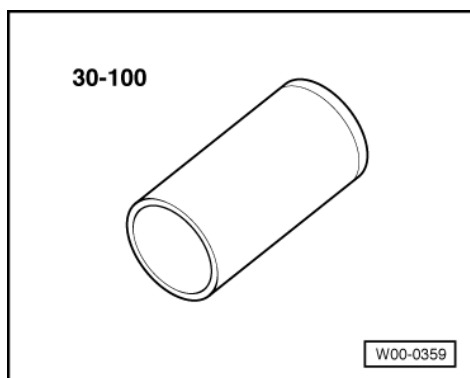
5.2 - Crankshaft dimensions

(in mm)

Honing dimension	Crankshaft bearing main journal \varnothing	Conrod bearing main journal \varnothing
Basic dimension	-0.022	-0.022
	54.00	50.90
	-0.042	-0.042
1st undersize	-0.022	-0.022
	53.75	50.65
	-0.042	-0.042
2nd undersize	-0.022	-0.022
	53.50	50.40
	-0.042	-0.042
3rd undersize	-0.022	-0.022
	53.25	50.15
	-0.042	-0.042

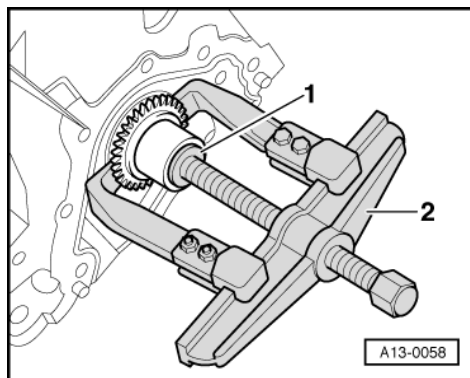
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5.3 - Removing and installing chain sprocket



Special tools and workshop equipment required

- ◆ Sleeve 30-100
- ◆ Two-arm puller, commercially available.
- ◆ Protective gloves





Removing

- Remove oil pan => Page 17-11.
- Removing front sealing flange => Page 13-79.
- Remove chain wheel of oil pump, chain tensioner and chain => -Item 17-2.
- -> Detach chain sprocket from crankshaft with puller 2 : use a suitable washer 1 to protect end of crankshaft.

Installing

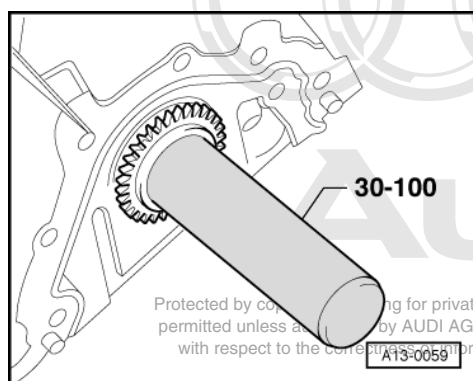
Installation is carried out in the reverse order; note the following:

Important
Wear protective gloves.

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

Note:

Installation position: wide collar on sprocket facing towards engine,



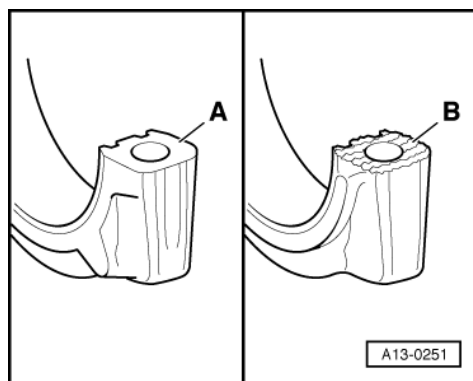
- -> Fit chain sprocket on end of crankshaft using pliers and push onto seat on crankshaft with drift sleeve 30-100.

6 - Dismantling and assembling pistons and conrods

6.1 - Dismantling and assembling pistons and conrods

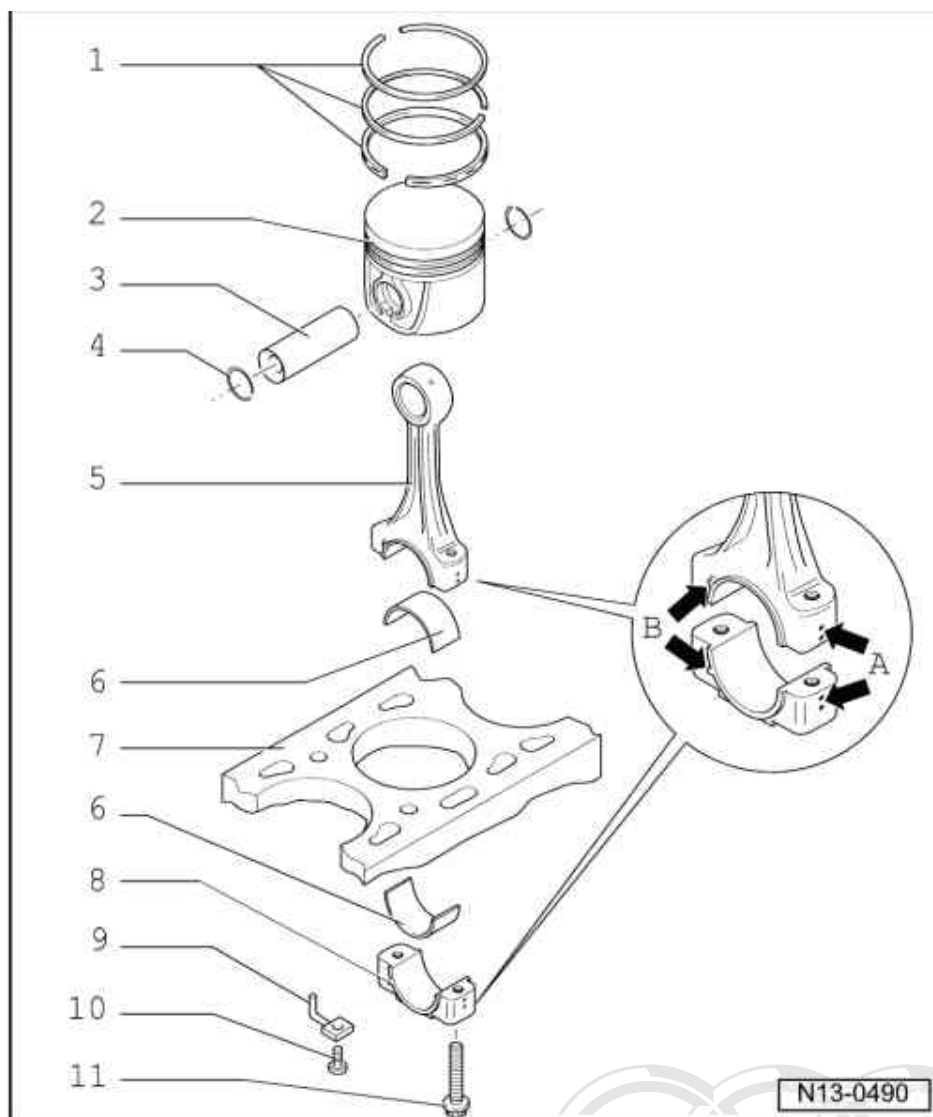
6.2 - Different conrods

- ♦ For engines with codes ATD and AXR, only cracked conrods are used.
- ♦ For engines with code ASZ, reinforced sawn and cracked conrod versions are installed as optional.



♦ Characteristics of sawn and cracked conrods

- A - -> sawn conrod = smooth separation surface
- B - cracked conrod = rough separation surface

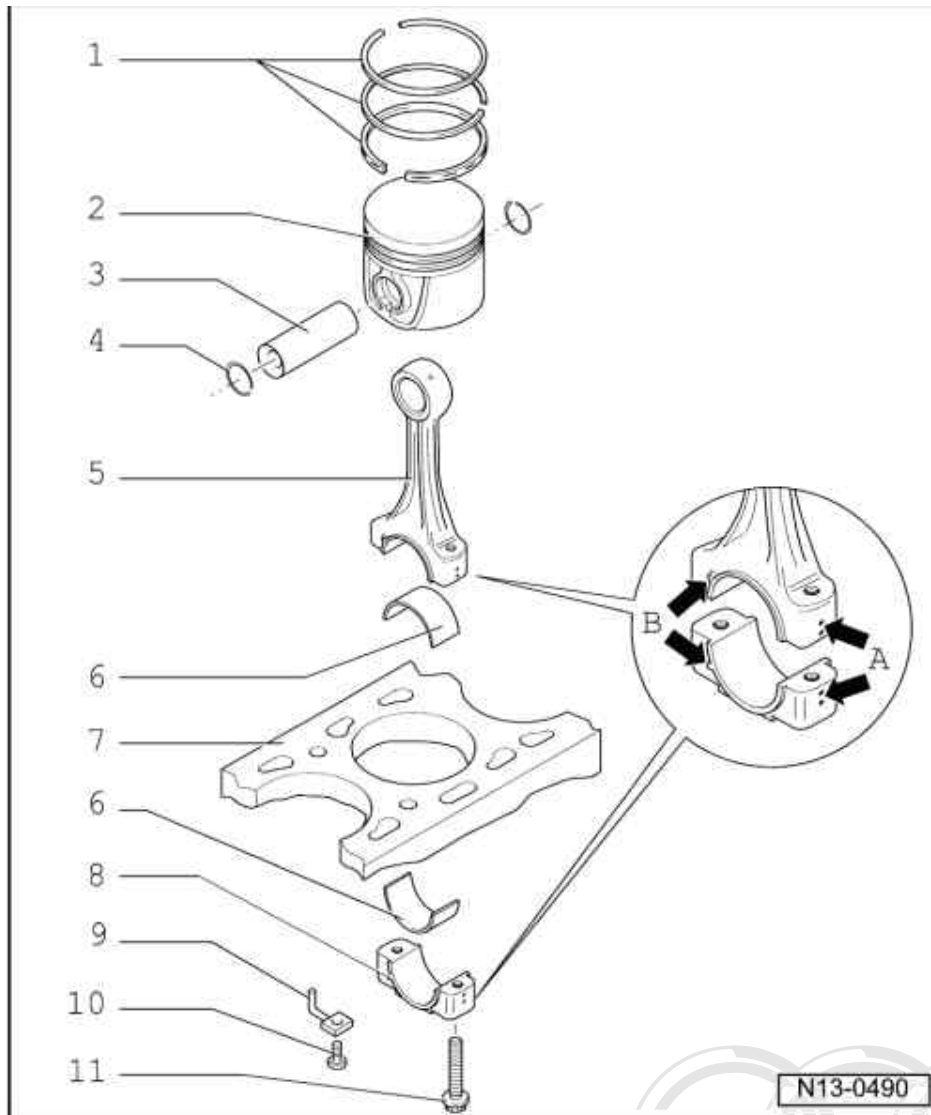
6.3 - Cracked conrods**1 Piston rings**

- ♦ Offset gaps by 120°
- ♦ Remove and install with piston ring pliers.
- ♦ Marking "TOP" or inscription must face piston crown.
- ♦ Checking ring gap
=> Fig.13-113
- ♦ Checking ring to groove play
=> Fig.13-113

2 Piston

- ♦ With combustion chamber
- ♦ Mark installation position and cylinder number.
- ♦ Installation position and arrangement of piston/cylinder
=> Fig.13-114

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- ◆ If cracking is visible on piston skirt, replace piston
- ◆ Arrow on piston crown points to pulley end.
- ◆ Install using piston ring clamp.
- ◆ Checking piston projection at TDC =>Page 13-117
- ◆ Piston and cylinder dimensions
=>Page 13-119
- ◆ Checking => Fig.13-115

3 Piston pin

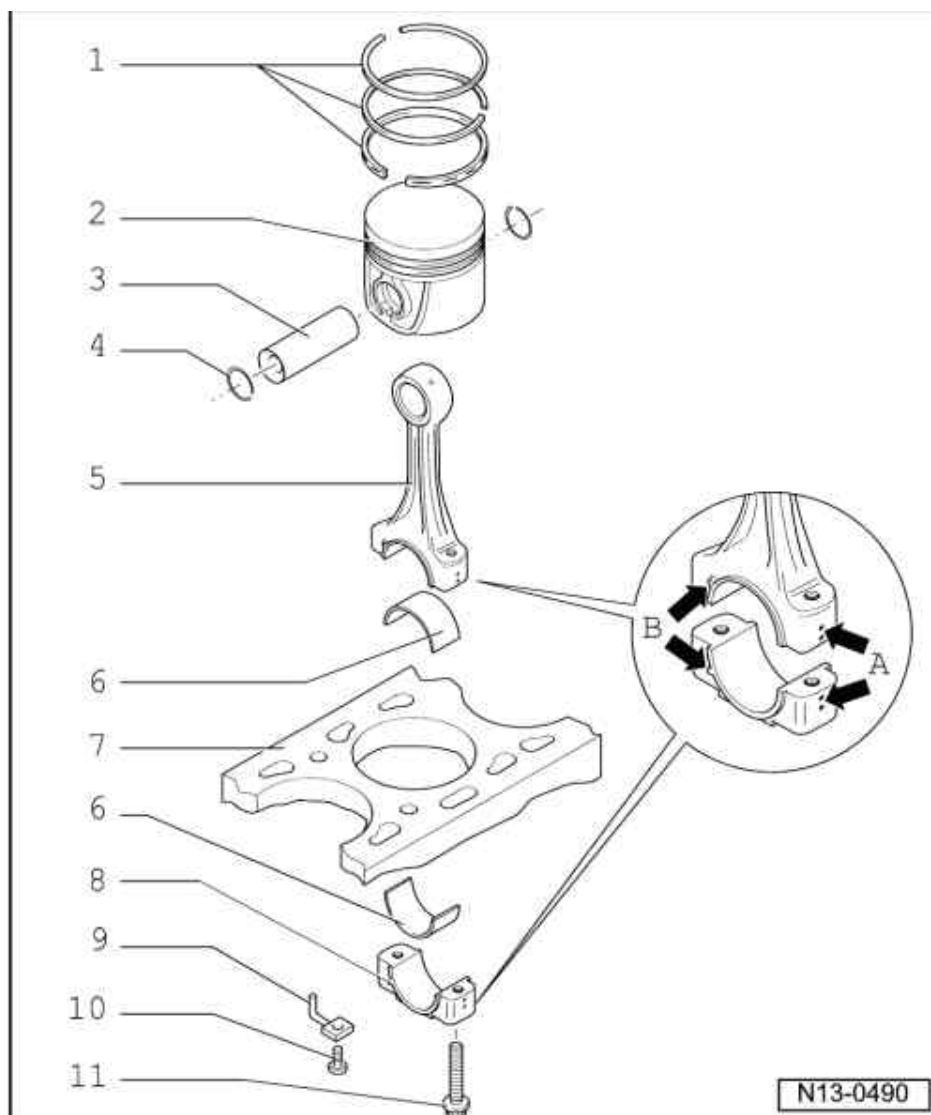
- ◆ If difficult to remove, heat piston to approx. 60 °C.
- ◆ Remove and install with VW 222a

4 Circlip

5 Conrod

- ◆ Only renew as a set
- ◆ Mark cylinder allocation -A-
- ◆ Installation position:
Markings -B- face towards pulley side

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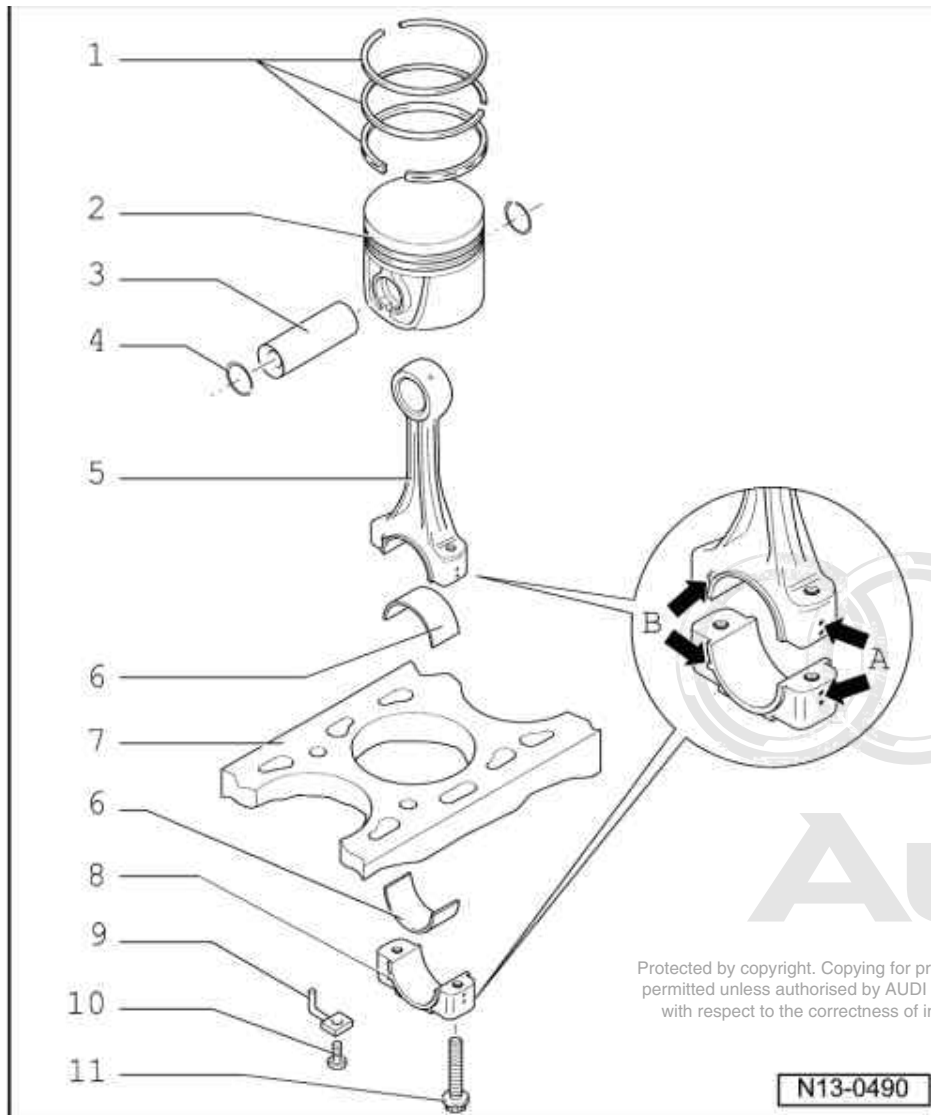


6 Bearing shell

- ◆ Installation position
=> Fig.13-116
- ◆ Do not interchange used bearing shells (mark).
- ◆ Note versions:
upper bearing shell (facing piston) made of more wear-resistant material
Characteristic with new bearing shells:
black line on running surface near cutting point
- ◆ Ensure tight fit
- ◆ Axial play:
Wear limit: 0.37 mm
- ◆ Check radial play with Plastigage:
Wear limit: 0.08 mm
Do not rotate crankshaft when checking radial play

7 Cylinder block

- ◆ Checking cylinder bore
=> Fig.13-115
- ◆ Piston and cylinder dimensions
=>Page 13-119



8 Conrod bearing cap

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

9 Oil spray jet

- ◆ For piston cooling

10 Relief valve - 27 Nm

- ◆ Opens at:
1.3...1.6 bar excess pressure
- ◆ Different versions
- ◆ Allocation

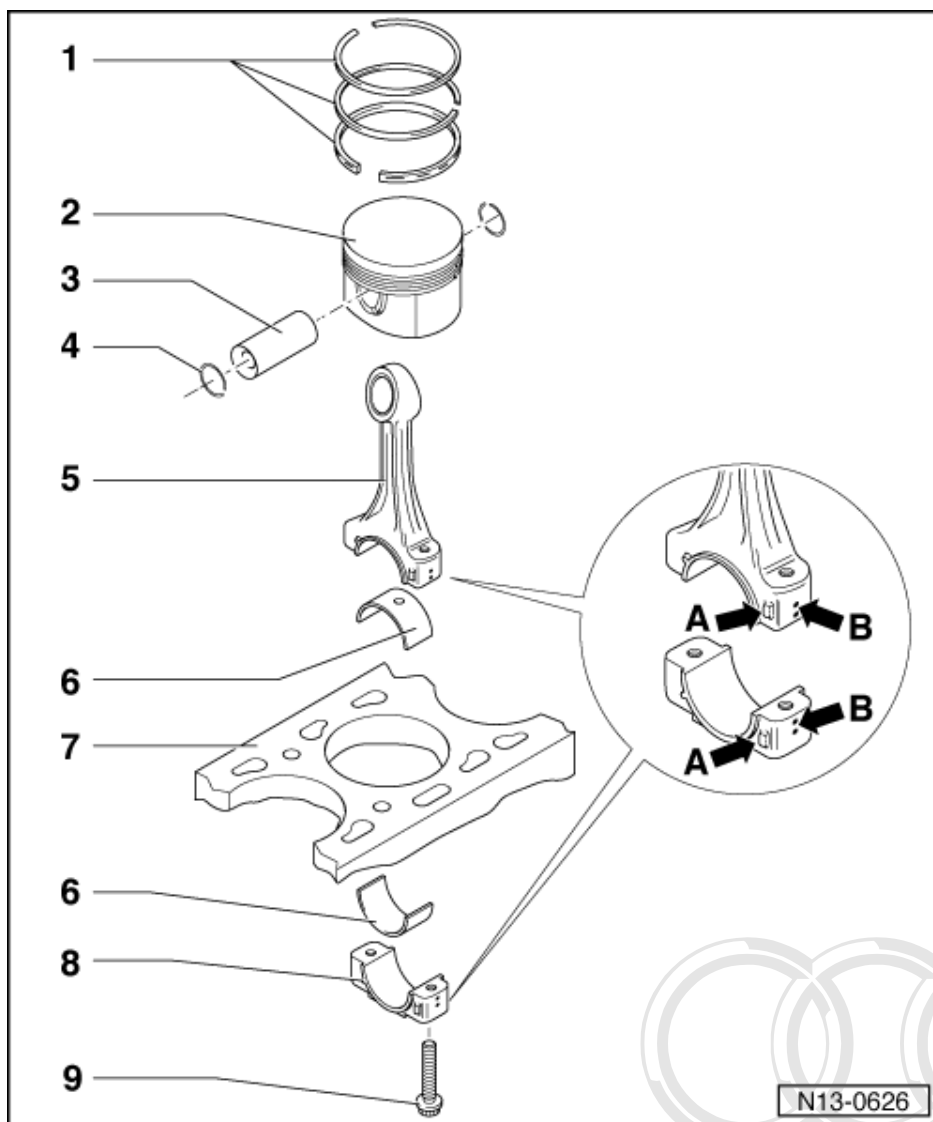
=> Parts List

- ◆ Insert without locking compound

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

- ◆ Replacing
- ◆ Oil threads and contact surface
- ◆ To measure radial clearance use old bolt

6.4 - Sawn conrods



Note:

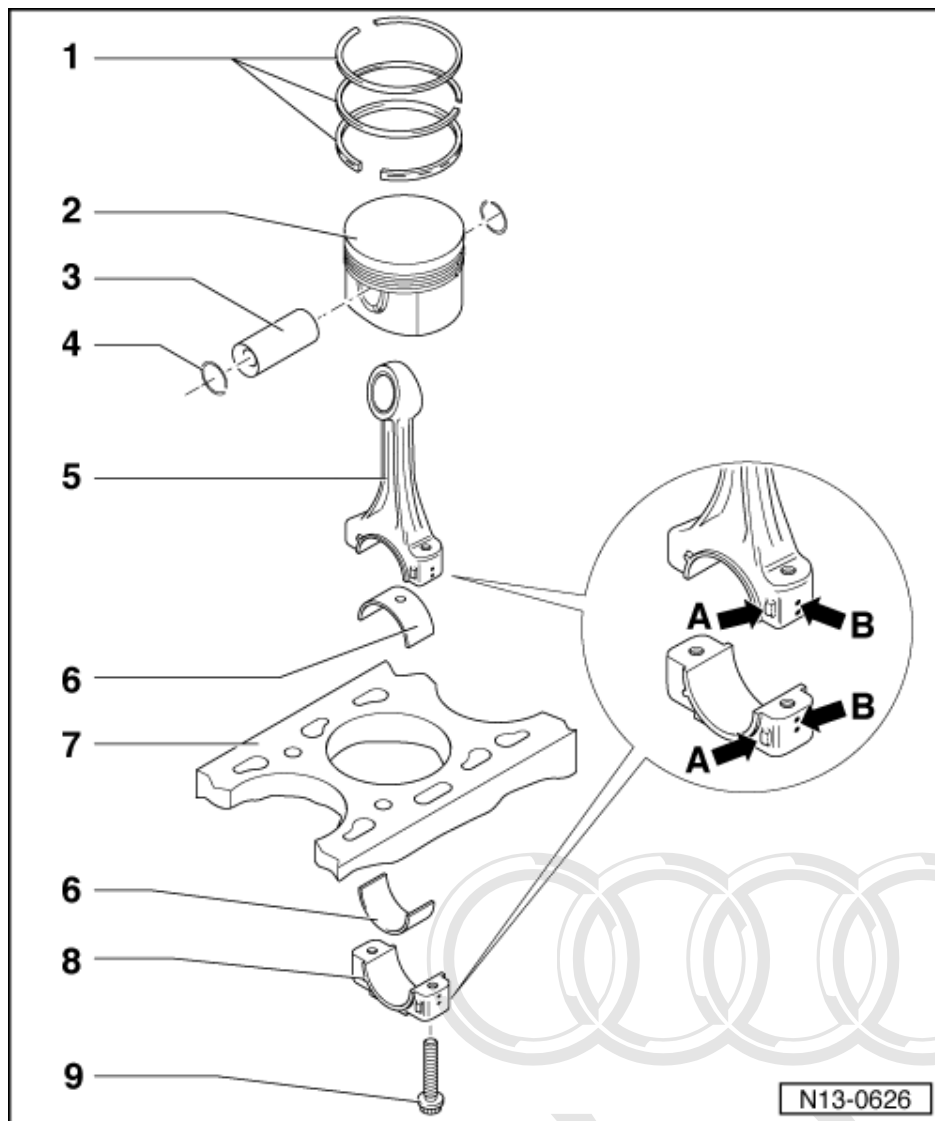
Oil spray jet and pressure relief valve

=> Fig.13-116

1 Piston rings

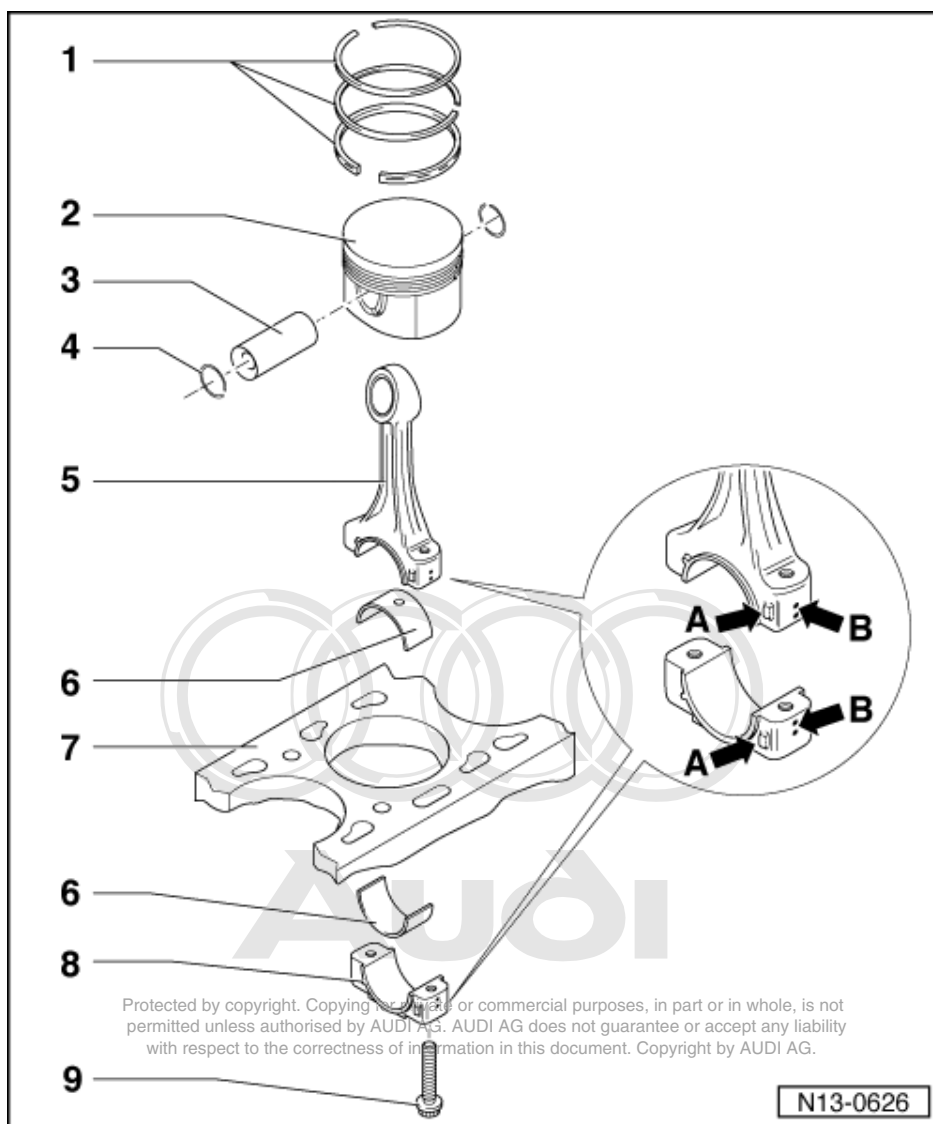
- ◆ Offset gaps by 120°
- ◆ Remove and install with piston ring pliers.
- ◆ Marking "TOP" or inscription must face piston crown.
- ◆ Checking ring gap
=> Fig.13-113
- ◆ Checking ring to groove play
=> Fig.13-113

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2 Piston

- ◆ Mark installation position and cylinder number.
- ◆ Installation position and arrangement of piston/cylinder
=> Fig.13-114
- ◆ If cracking is visible on piston skirt, replace piston.
- ◆ Arrow on piston crown points to pulley end.
- ◆ Install using piston ring clamp.
- ◆ Checking piston projection at TDC =>Page 13-117
- ◆ Piston and cylinder dimensions
=>Page 13-119
- ◆ Checking => Fig.13-115



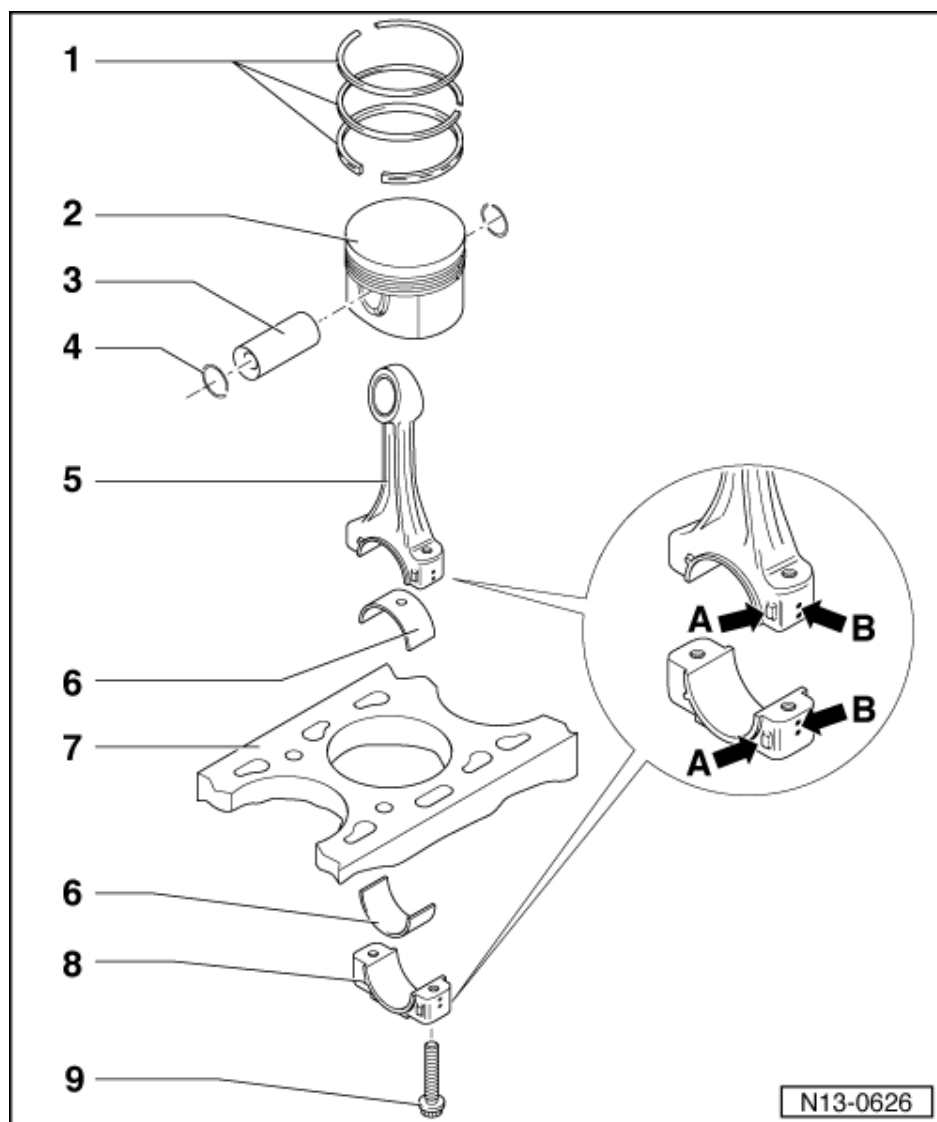
3 Piston pin

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

4 Circlip

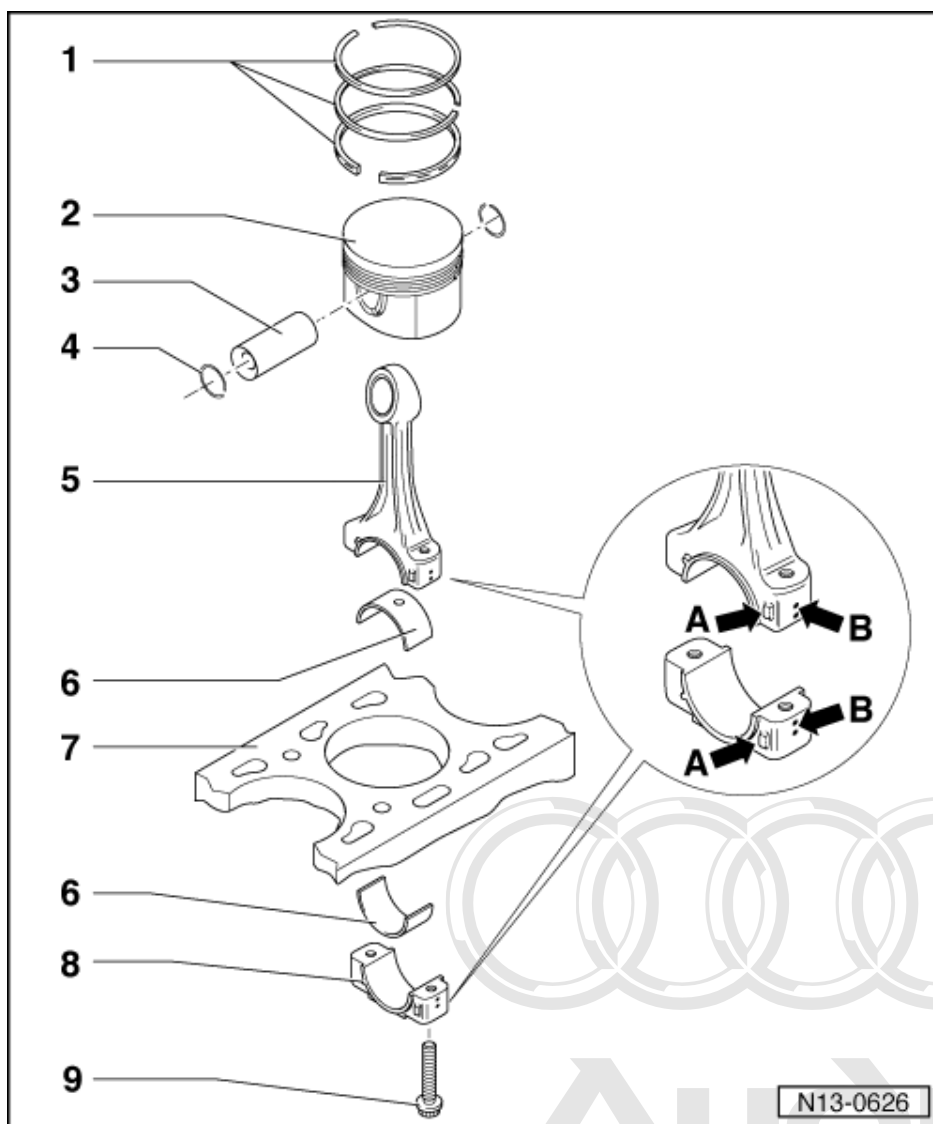
5 Conrod

- ♦ Only renew as a set
- ♦ Mark cylinder number B
- ♦ Installation position:
Markings A face towards pulley side



6 Bearing shell

- ◆ Installation position
=> Fig.13-116
- ◆ Do not interchange used bearing shells (mark).
- ◆ Note versions:
upper bearing shell (facing piston) made of more wear-resistant material
Characteristic with new bearing shells:
black line on running surface near cutting point
- ◆ Install bearing shells centrally
- ◆ Ensure tight fit
- ◆ Axial play:
Wear limit: 0.37 mm
- ◆ Check radial play with Plastigage:
Wear limit: 0.08 mm
Do not rotate crankshaft when checking radial play



7 Cylinder block

- ♦ Checking cylinder bore
=> Fig.13-115
- ♦ Piston and cylinder dimensions
=>Page 13-119

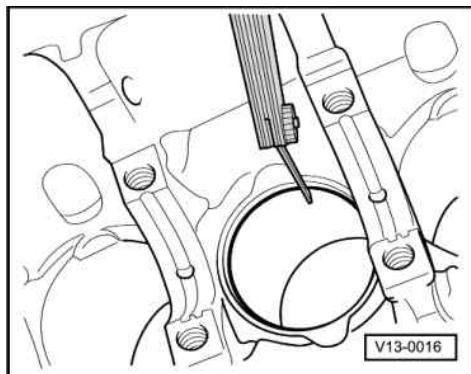
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8 Conrod bearing cap

- ♦ Mark cylinder number B
- ♦ Installation position:
Markings A face towards pulley side

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

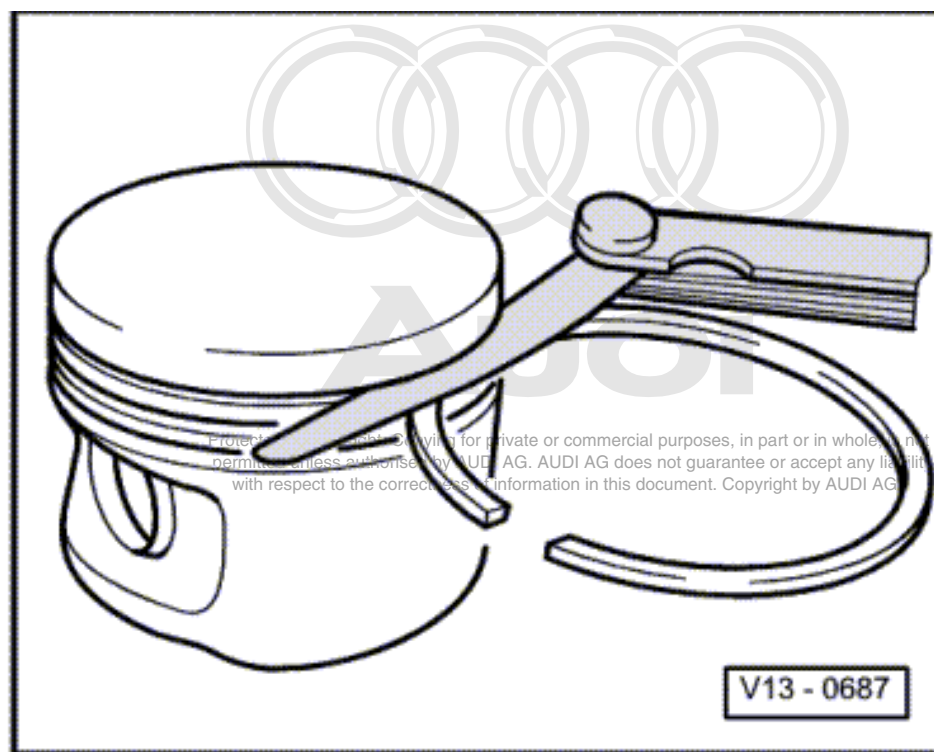
- ♦ Replacing
- ♦ Oil threads and contact surface
- ♦ To measure radial play tighten to 30 Nm but not further



-> 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...0.40	1.0
2nd compression ring	0.25...0.40	1.0
Oil scraper ring	0.25...0.50	1.0

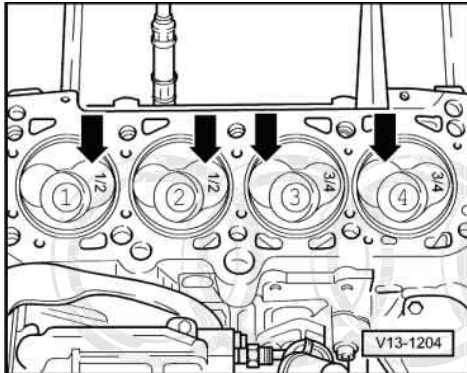


-> Fig. 2 Checking ring to groove play

- Clean groove before checking play.

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

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

Pistons in cylinder 1 and 2:
Large valve pocket for inlet valve towards flywheel side -arrows-

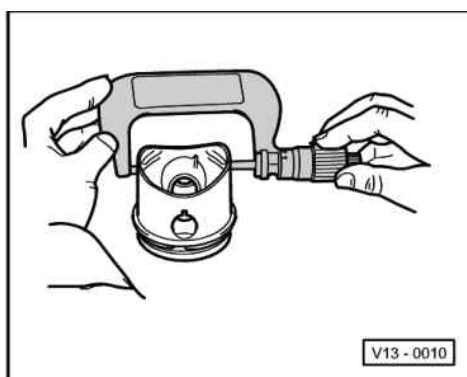
Pistons in cylinder 3 and 4:

Large valve pocket for inlet valve towards pulley side -arrows-

Note:

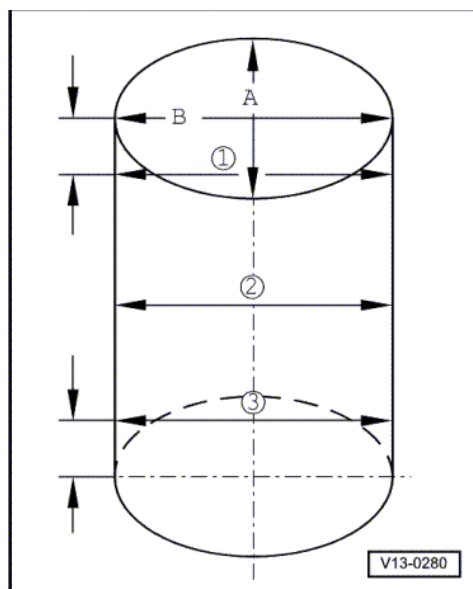
On new pistons the cylinder numbers are marked in colour on the piston crowns.

- ♦ Pistons for cylinder 1 and 2:
are marked 1/2
- ♦ Pistons for cylinder 3 and 4:
are marked 3/4



-> Fig. 4 Checking piston

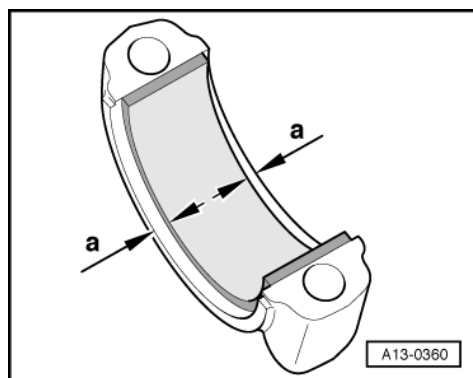
- Measure approx. 10 mm from the lower edge, offset by 90° to the piston pin axis.
 - Permissible deviation from nominal dimension:
no more than 0.04 mm.



➔ Fig. 5 Checking cylinder bores

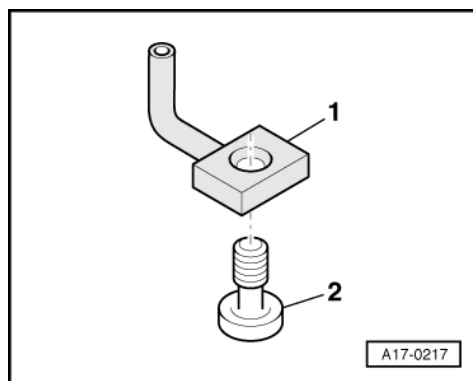
Special tools and workshop equipment required

- ◆ 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 0.10 mm.



➔ Fig.6 Installation position of bearing shell

- Install bearing shells centrally into conrod or into conrod bearing cap.
 - Dimension a = 2.5 mm

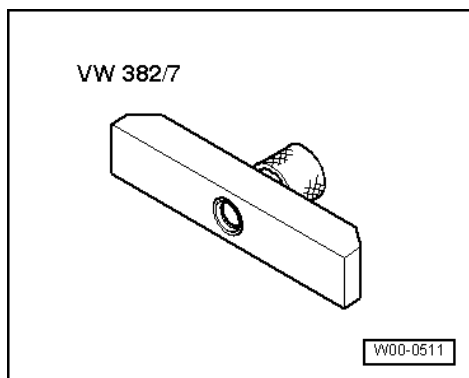


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-> Fig.7 Oil spray jet and pressure relief valve

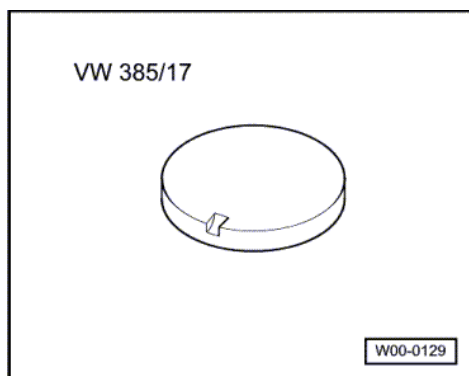
- 1 - Oil spray jet (for cooling of piston)
- 2 - Bolt with pressure relief valve - 27 Nm
- Opening pressure 1.3 ... 1.6 bar

6.5 - Checking piston projection at TDC

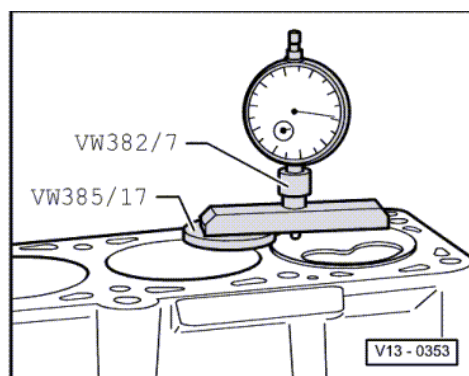


Special tools and workshop equipment required

- ♦ Special tool VW 382/7



- ♦ Special tool VW 385/17



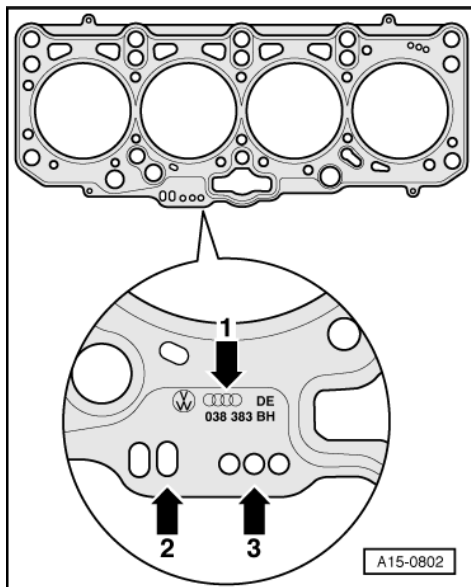
-> Piston projection at TDC must be measured when installing new pistons or a short engine. Depending on piston projection, install the relevant cylinder head gasket according to the following table.



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



-> Cylinder head gasket identification

- ♦ Part-No. = Arrow 1
- ♦ Production control code = arrow 2 (can be disregarded.)
- ♦ Holes = arrow 3

Note:

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

6.6 - Piston and cylinder dimensions

Honing dimension	Piston - ø	Cylinder bore - ø
Basic dimension mm	79.47	79.51
1st undersize mm	79.72	79.76
2nd undersize mm	79.97	80.01

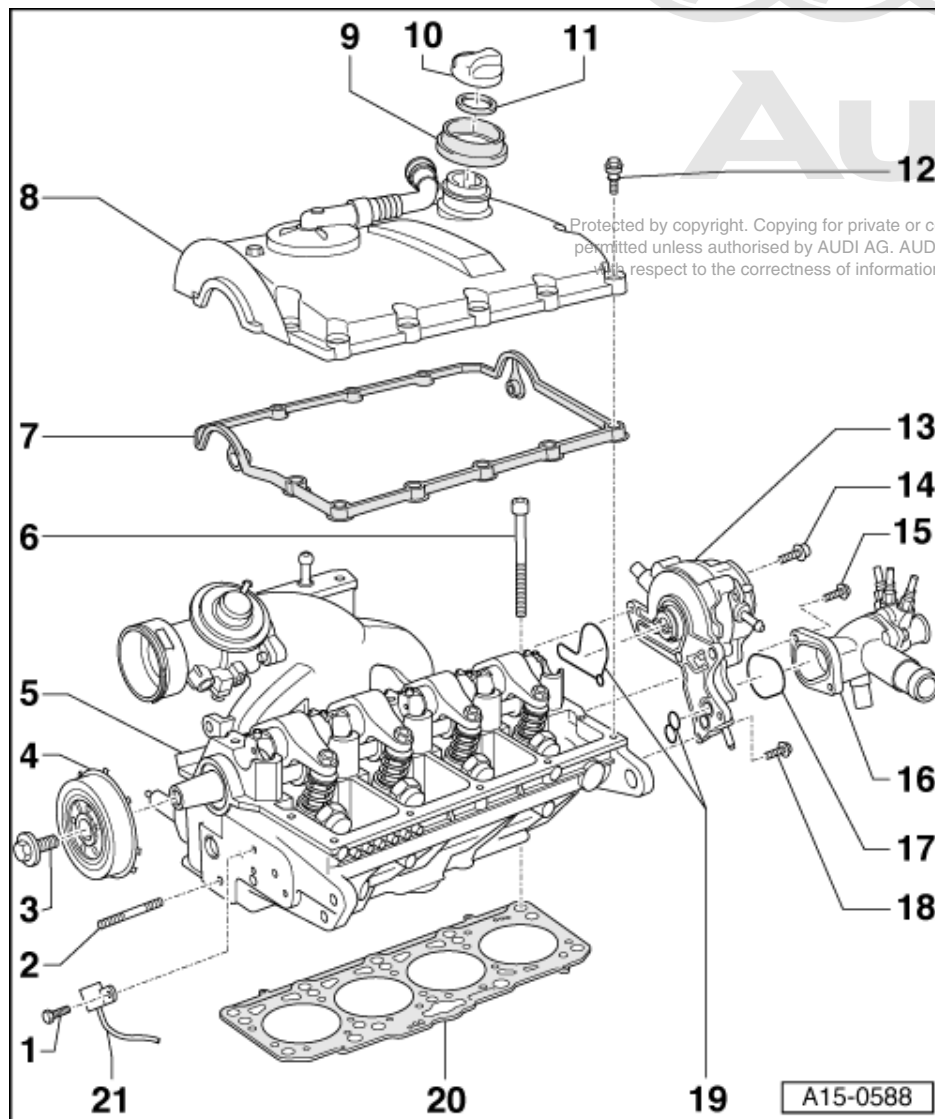


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15 - Cylinder head, Valve gear

1 - Cylinder head - overview

1.1 - Cylinder head - overview



1 10 Nm

- ◆ Install using locking compound
- ◆ Locking compound

=> Parts List

2 15 Nm

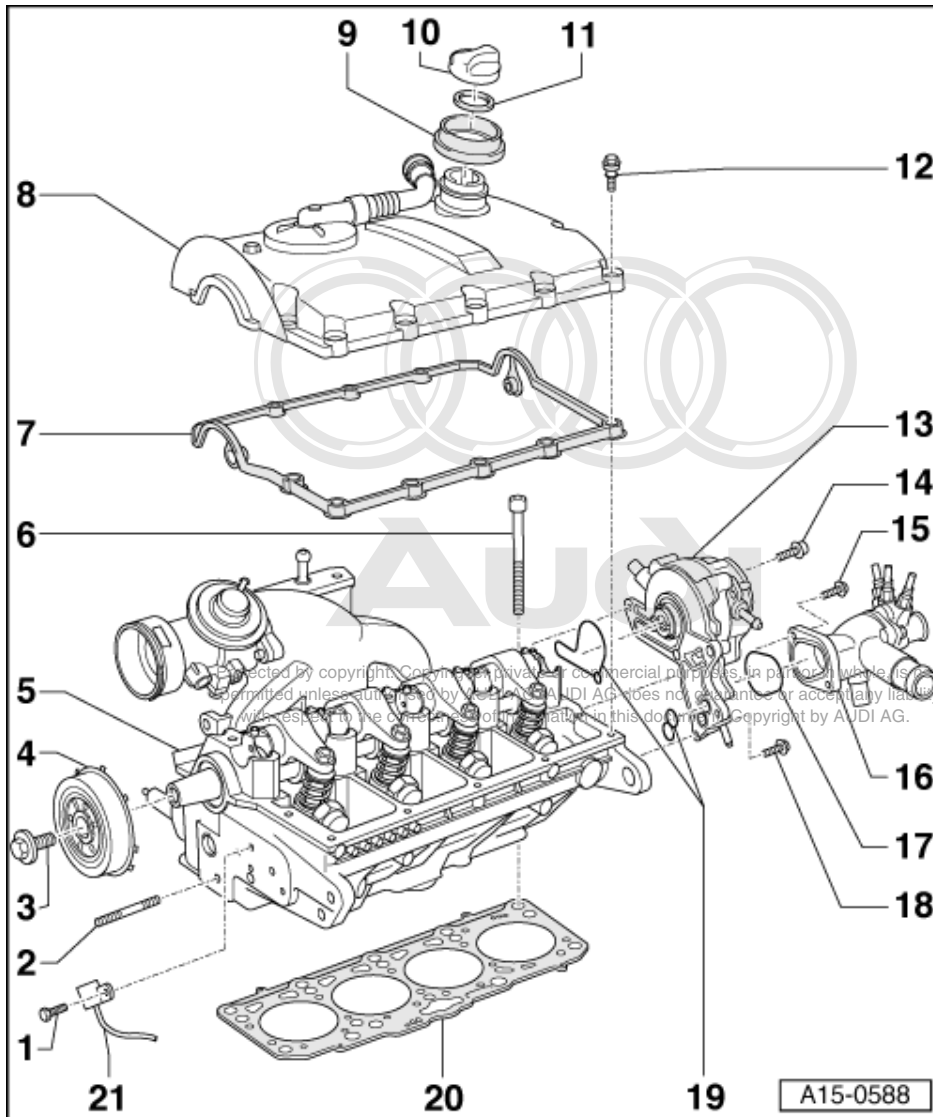
3 100 Nm

- ◆ To loosen and tighten use counterhold T10051

4 Hub

- ◆ With sender wheel for Hall sender -G40
- ◆ To loosen and tighten use counterhold T10051
- ◆ For removal use puller T10052

♦ Detaching => Page 15-28

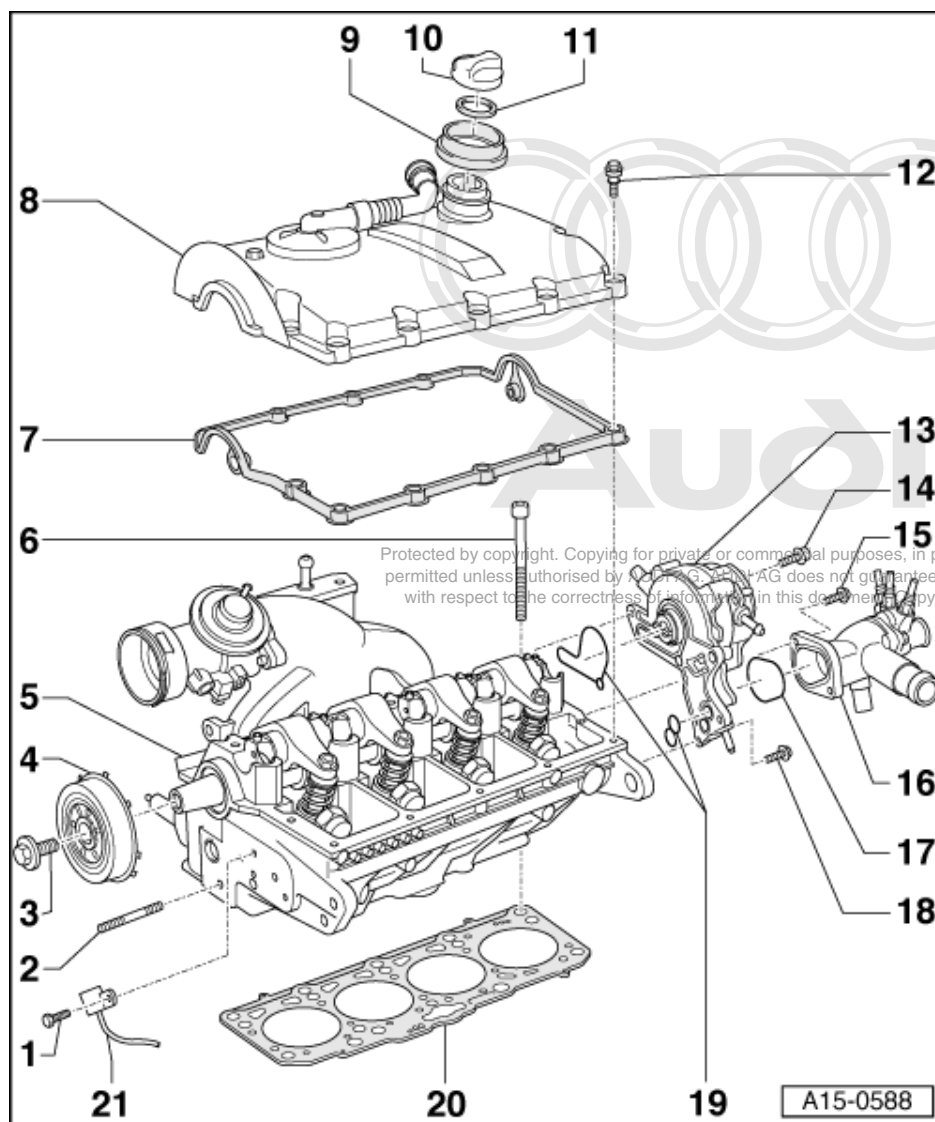


5 Removing

- ♦ Cylinder head => Pages 15-39
- ♦ Checking for distortion
=> Fig.15-6
- ♦ Installing => Pages 15-55
- ♦ After replacing, fill with fresh coolant

6 Cylinder head bolt

- ♦ Replacing
- ♦ Note sequence when loosening => Page 15-54
- ♦ Note sequence when tightening => Page 15-58
- ♦ Make sure that the plates -Item 15-88 are installed in the cylinder head



7 Cylinder head cover gasket

- ◆ Renew if damaged or leaking
- ◆ Before fitting gasket apply sealant at sealing points => Fig.15-7
- ◆ Sealants

=> Parts List

- ◆ Install notches into bores on cylinder head

8 Cylinder head cover

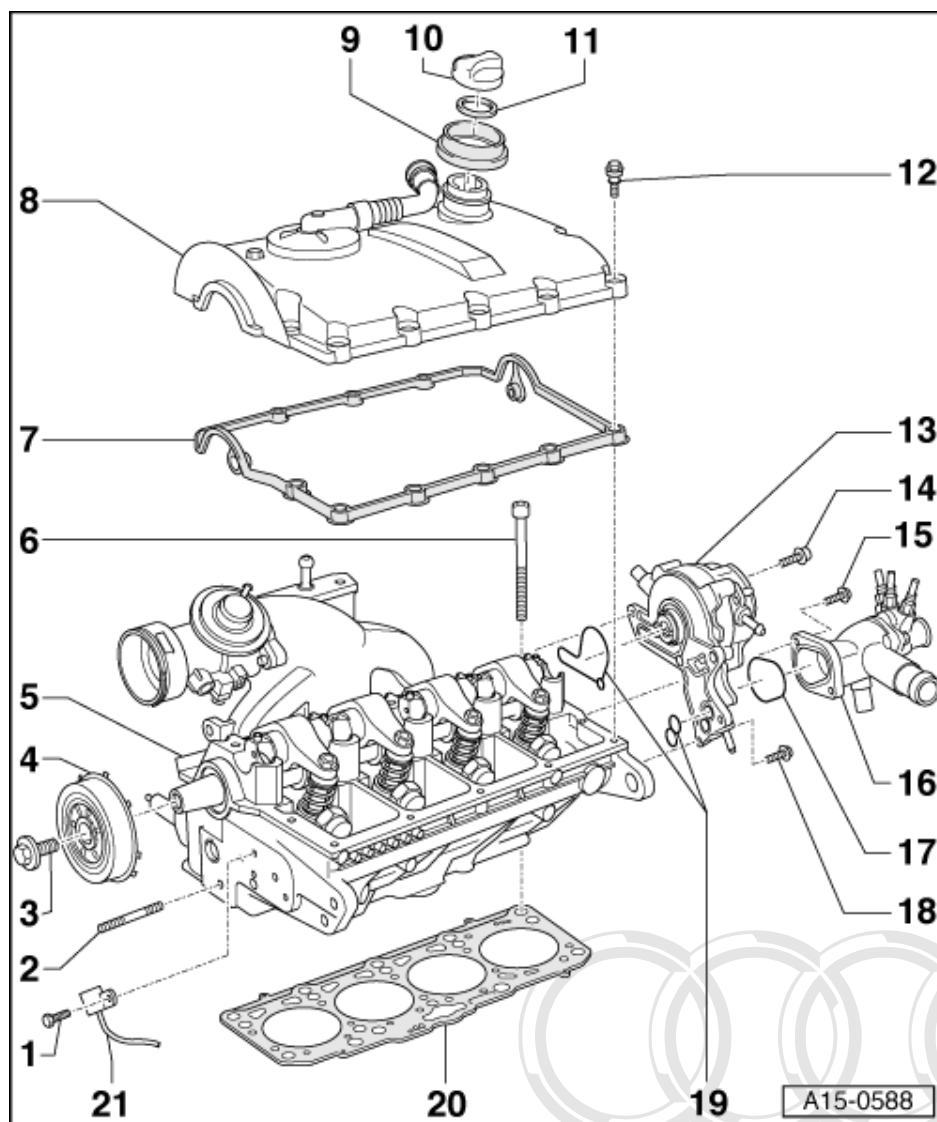
- ◆ Removing and installing
=>Page 15-8

9 Trim cap

10 Cap

11 Seal

- ◆ Renew if damaged or leaking



12 10 Nm

- ♦ Note tightening sequence =>Removing and installing cylinder head cover, Page 15-8

13 Tandem pump

- ♦ Removing and installing:

=> Fuel Supply - Diesel Engines; Repair group 20

14 20 Nm

15 10 Nm

16 Coolant flange

17 O-ring

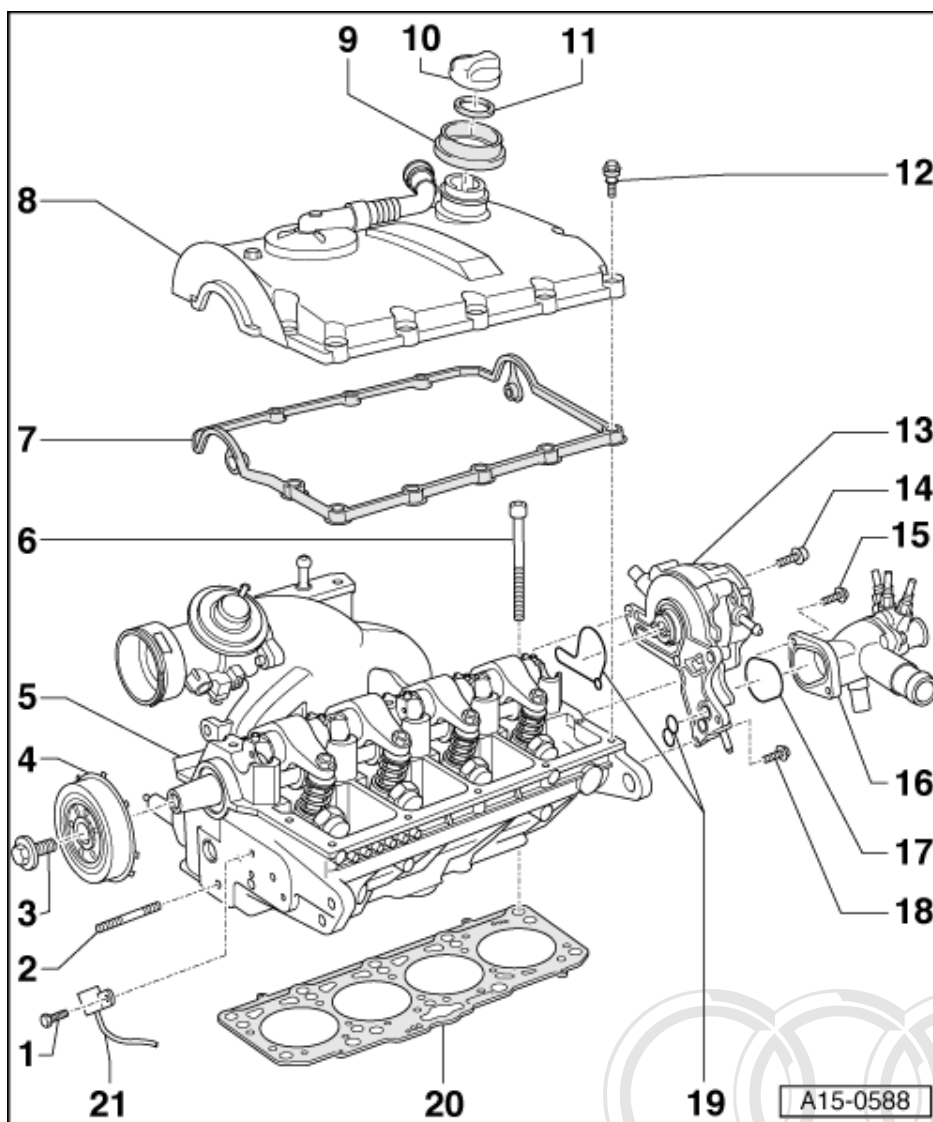
- ♦ Replacing

18 10 Nm

19 Sealing rings

- ♦ Replacing

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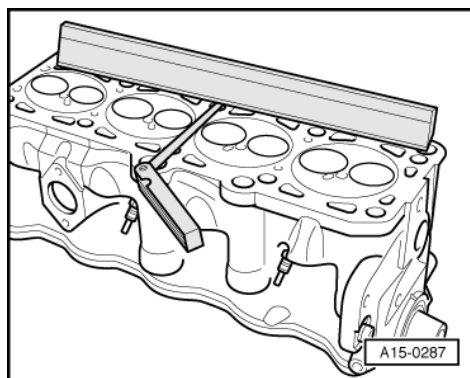


20 Cylinder head gasket

- ◆ Renew => Removing cylinder head, Page 15-14.
- ◆ Observe marking
=> Fig. 15-6
- ◆ After replacing, fill with fresh coolant

21 Hall sender -G40

- ◆ For camshaft position



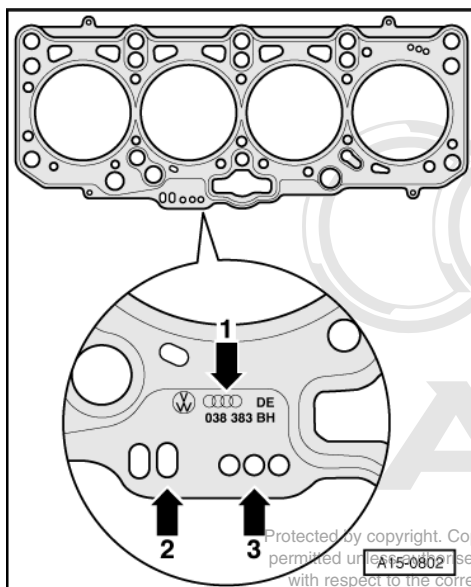
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-> Fig.1 Checking cylinder head for distortion

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

Note:

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



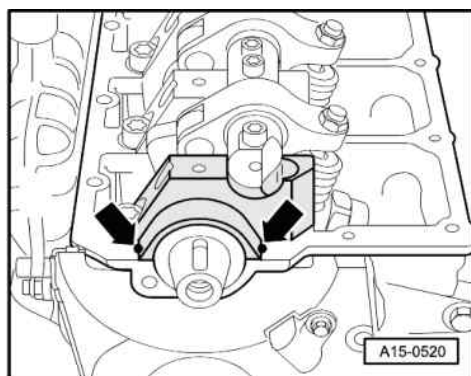
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-> Fig.2 Cylinder head gasket marking

- ♦ Part-No. = arrow 1
- ♦ Production control code = arrow 2 (can be disregarded.)
- ♦ Holes = arrow 3

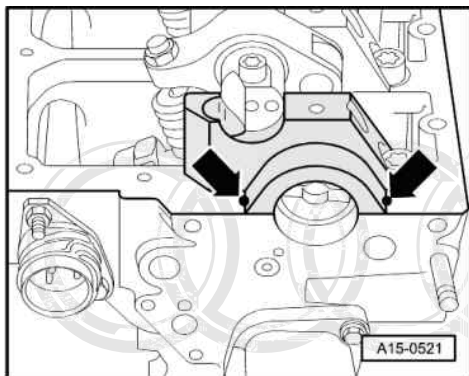
Note:

Cylinder head gaskets of different thicknesses are fitted depending on the amount of piston projection => Page 13-117. When replacing just the gasket, the new gasket should have the same markings.



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

- Coat both edges on the sealing edges of bearing cap/cylinder head -arrows- on front...

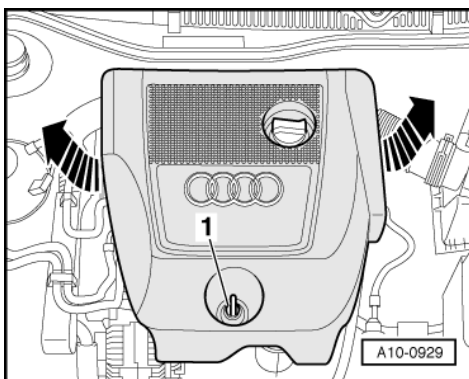


- -> ...and on rear with a drop of sealing fluid (\varnothing approx. 5 mm) -arrows-.
- Sealants

=> Parts List

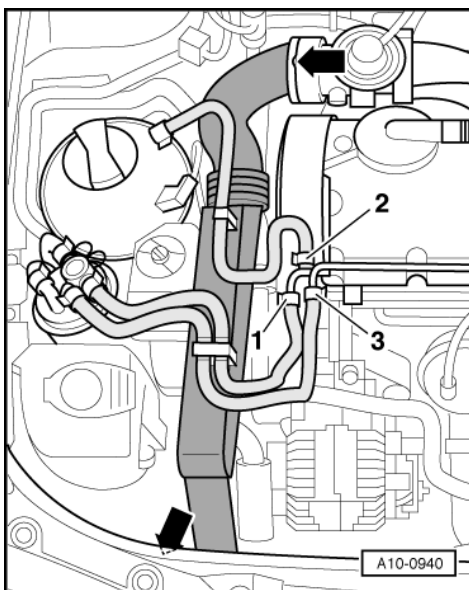
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1.2 - Removing and installing cylinder head cover



Removing

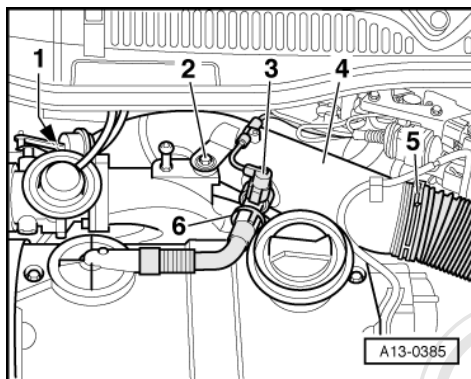
- -> Remove oil dipstick -1- from guide tube.
- Remove engine cover -arrows-.
- Reinsert dipstick in guide tube.



- -> Lay aside wiring at air duct hose.
- Where necessary, detach the housing cover at rear of right headlamp.
- Remove air duct pipe -arrows-.

Note:

The coolant hose-2- and fuel lines -1- and -3- remain connected.



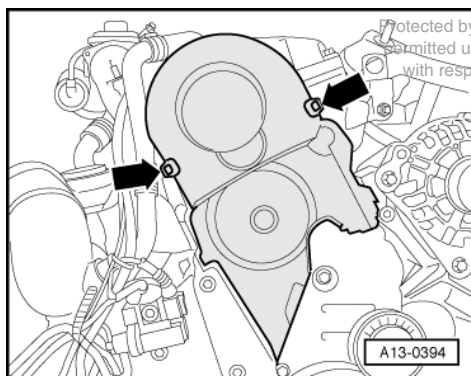
- -> Detach the crankcase vent pipe -6- from air duct pipe.

Vehicles with engine code ASZ, ATD:

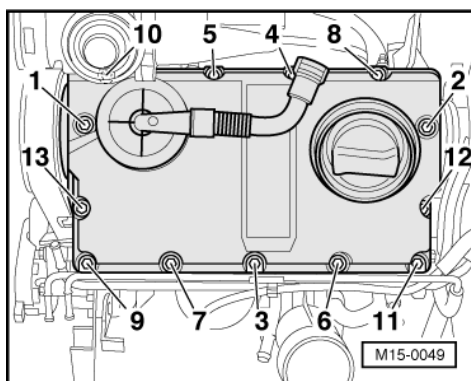
- Disconnect hose -5- to air cleaner housing.
- Unscrew bolts -1- and -2-.
- Push air duct pipe -4- towards the rear.

Note:

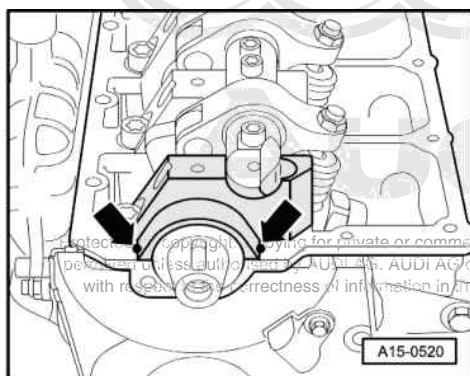
The air duct pipe remains connected to turbocharger.


All models:

- -> Remove the upper toothed belt guard -arrows-.



- -> Loosen cylinder head bolts in the sequence -13 ... 1- and remove the cylinder head cover.



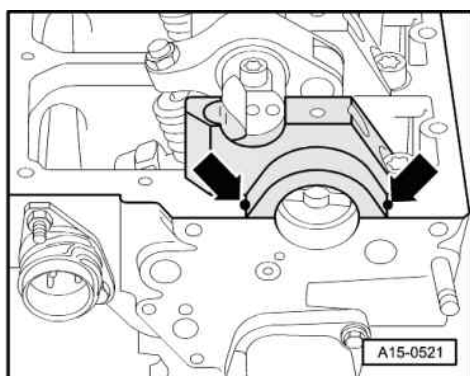
Installing

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

Note:

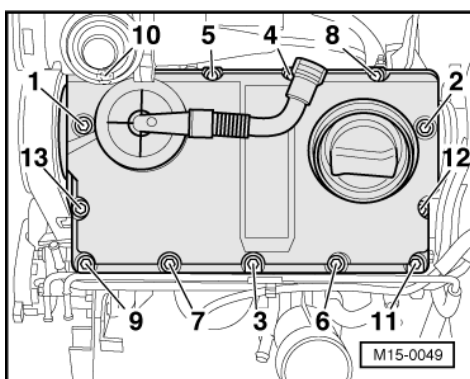
Replace sealing for cylinder head cover and sealing for bolts when damaged.

- -> Both edges on the sealing edges of bearing cap/cylinder head -arrows- on front...



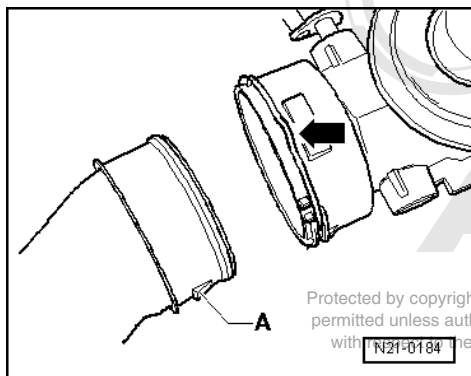
- -> ...and on rear with a drop of sealing fluid (ø approx. 5 mm) -arrows-.
- Sealants

=> Parts List



- -> Screw in cylinder head bolts in the sequence -1 ... 13- finger tight.

- Tighten bolts in sequence -1 ... 13-.



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- -> When installing air duct pipes with connectors, ensure that the securing clip -arrow- engages audibly in the retaining lug -A-.

Tightening torques

Component	Nm
Cylinder head cover to cylinder head	10
Air duct pipe on intake manifold	10

2 - Removing and installing cylinder head -vehicles with front-wheel drive-

2.1 - Removing and installing cylinder head -vehicles with front-wheel drive-

Notes:

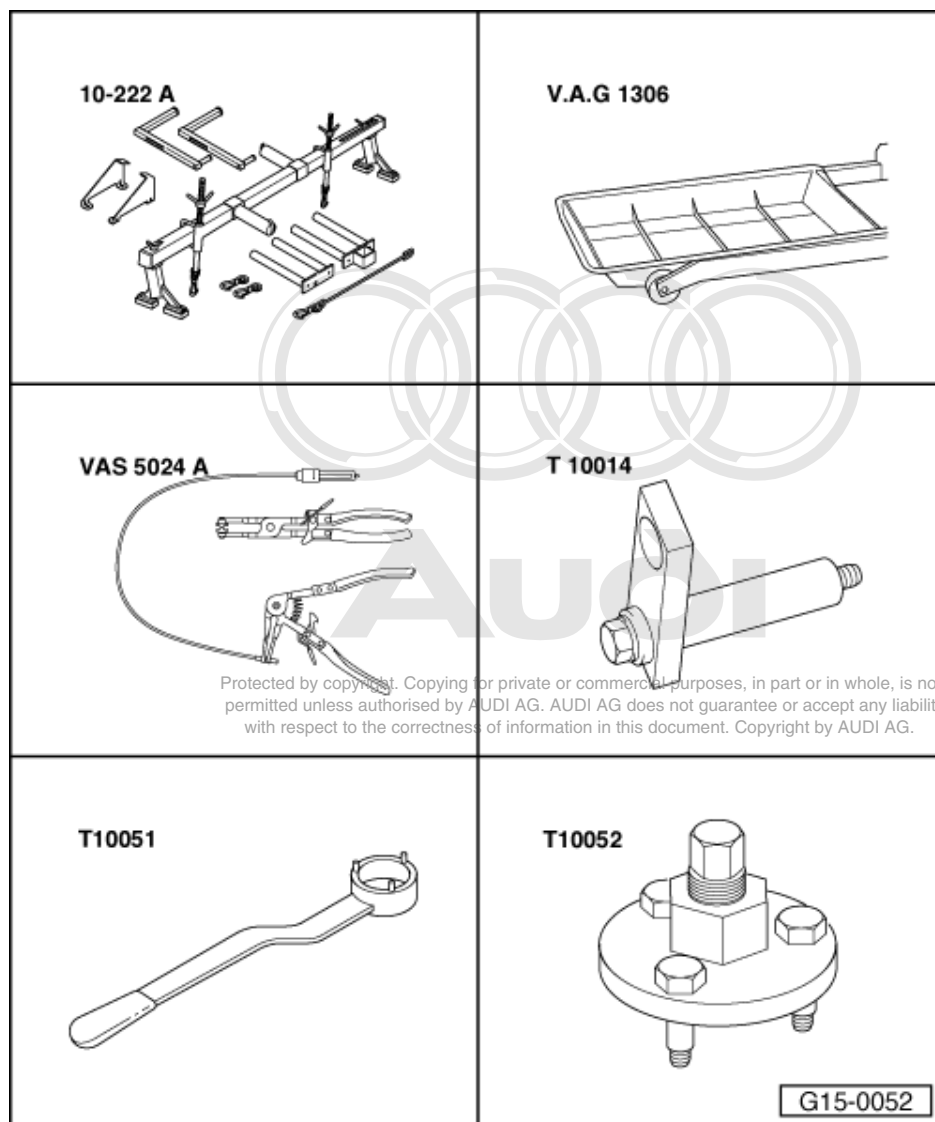
- ♦ Cylinder heads with tears can be used between the valve seats without reducing the service life if the tears are slight and at the most 0.5 mm wide.
- ♦ When fitting a new cylinder head or cylinder head gasket, drain off all the old coolant and re-fill with new coolant.
- ♦ When engine oil is contaminated perform oil change:

=> Maintenance Manual

- ♦ 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.
- ♦ Removing and installing tandem pump:

=> Fuel Supply - Diesel Engines; Repair group 20

2.2 - Removing cylinder head



Special tools and workshop equipment required

- ◆ Support bar 10-222A
- ◆ Drip tray V.A.G 1306
- ◆ VAS 5024 A
- ◆ Bracket T10014
- ◆ Counterhold T10051
- ◆ Puller T10052

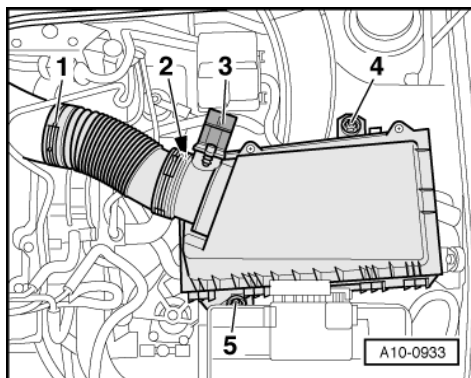
Procedure

Important

- ◆ Measures to be taken prior to disconnecting the battery: =>Electrical System; Repair group 27
- ◆ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.

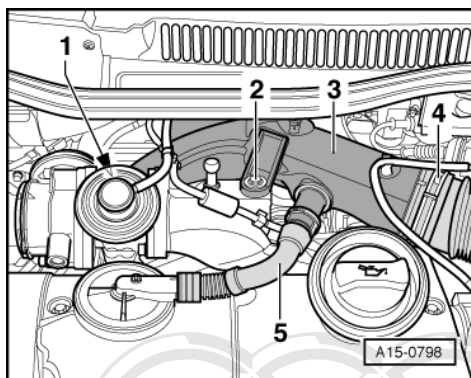
- Refer to coding on vehicles with encoded radio/radio navigation system (RNS); if necessary, interrogate.
- With the ignition switched off disconnect the battery earth strap.

- Remove ribbed belt => Page 13-10.

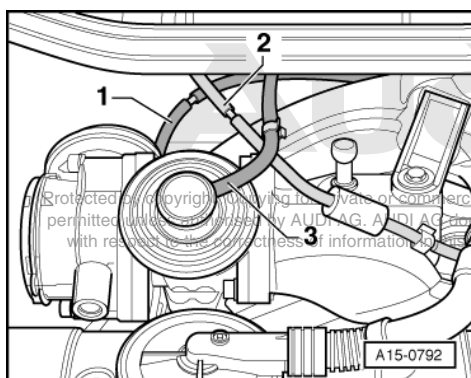


- -> Remove air duct hose -1- from air duct pipe.
- Detach connector of air mass meter -3-.
- Unscrew bolts -4- and -5-.
- Remove vent hose -2- off air cleaner housing.
- Remove air cleaner housing.

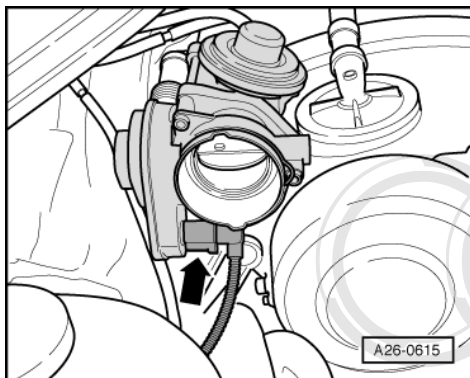
Vehicles with engine code AXR:



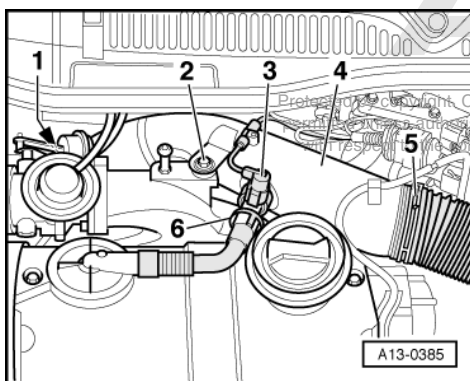
- -> Detach the crankcase vent pipe -5- from air duct pipe.
- Release spring clamp on turbocharger using VAS 5024 A.
- Set aside the vacuum hoses.
- Unscrew bolts -1- and -2- and remove air duct pipe -3-.



- -> Disconnect vacuum hoses -1 ... 3-.
- Set aside the vacuum hoses.

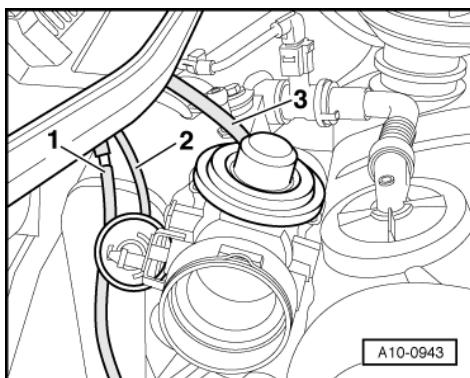


- -> Detach connector -arrow- at intake manifold flap motor.



Vehicles with engine code ASZ, ATD:

- -> Detach the crankcase vent pipe -6- from air duct pipe.
- If installed, detach connector for heating resistor (crankcase venting) -N79 -Item 3-.
- Release spring clamp on turbocharger using VAS 5024 A.
- Set aside the vacuum hoses.
- Unscrew bolts -1- and -2- and remove air duct pipe -4-.



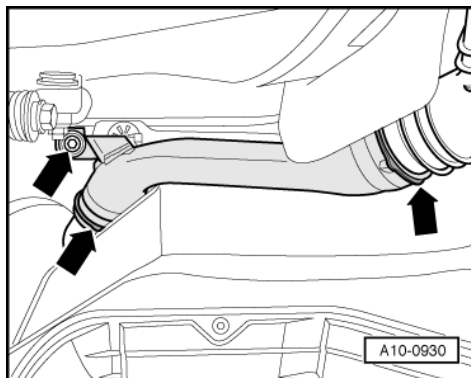
- -> Disconnect vacuum hoses -1... 3- at rear of intake manifold.

All models:

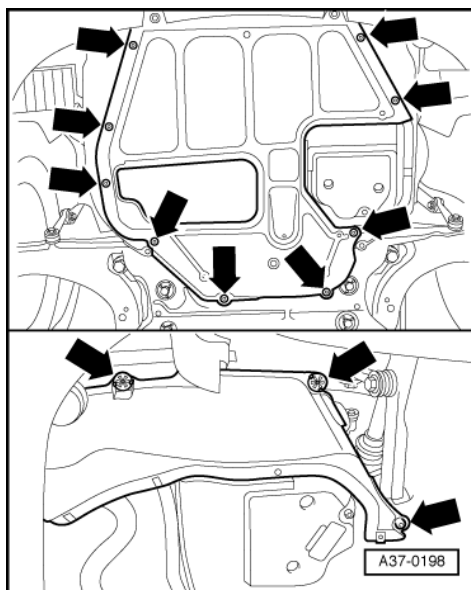
Important

Hot steam can escape when opening cap on expansion tank: Cover cap with a cloth and open carefully.

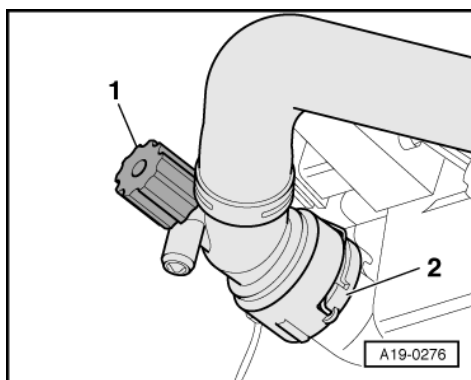
- Open the cover of the coolant expansion tank



- -> Remove air duct pipe from right longitudinal member -arrows-.



- -> Remove centre and right noise insulation -arrows-.



- Place drip tray V.A.G 1306 below engine.

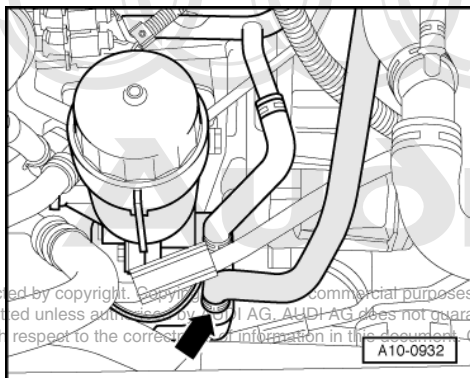
Vehicles with drain plug:

- -> Turn drain plug -1- on radiator anti-clockwise, fit auxiliary hose to connection if necessary.

Vehicles without drain plug:

- Detach retaining clip -2- for bottom coolant hose and disconnect coolant hose from radiator.

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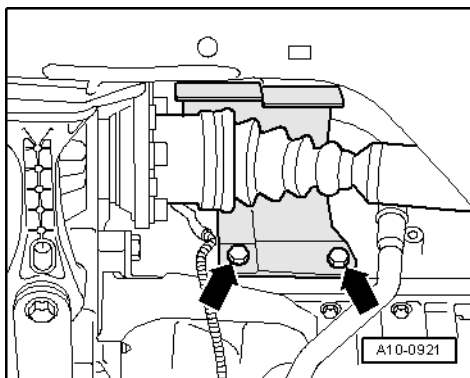
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All models:

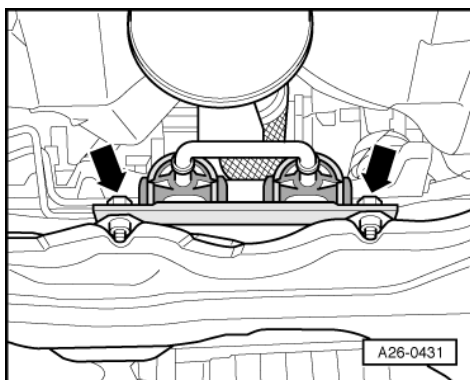
- -> Also disconnect coolant hose on oil cooler -arrow-, and drain off remaining coolant.

Note:

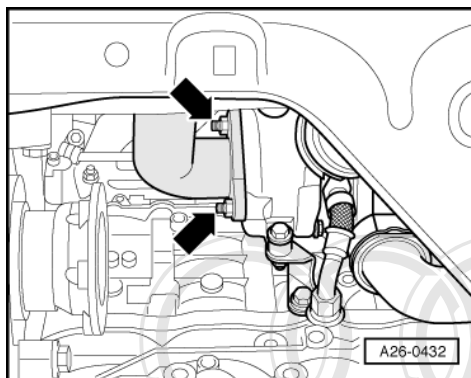
Illustration shows an engine with code ASZ.



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



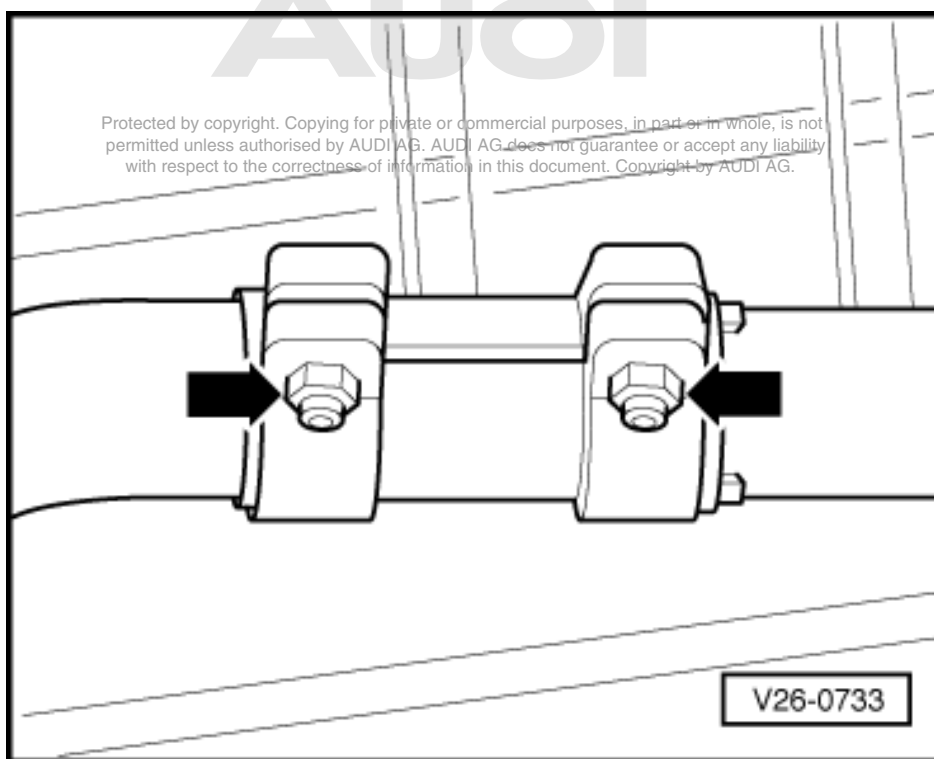
- -> Unbolt bracket for exhaust system from assembly mounting -arrows-.



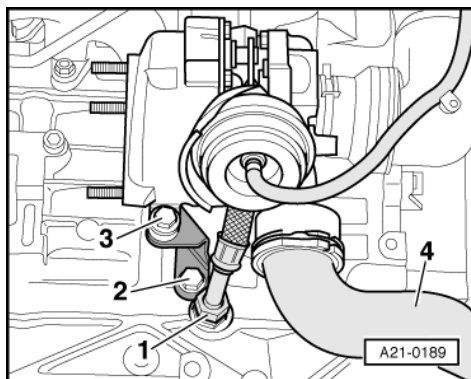
Note:

The isolating element in front exhaust pipe must not be deflected more than 10° to avoid damage.

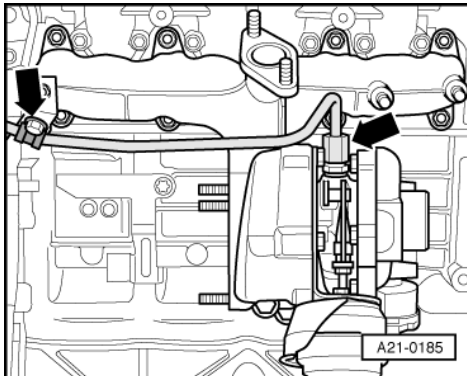
- -> Unscrew securing bolts -arrows- of front exhaust pipe/turbocharger.



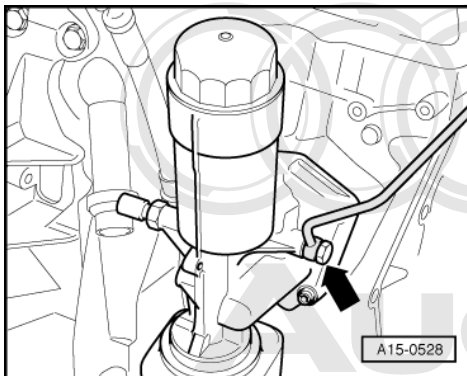
- -> Detach the exhaust system at the clamping sleeve -arrows-.
- Remove the front exhaust pipe.



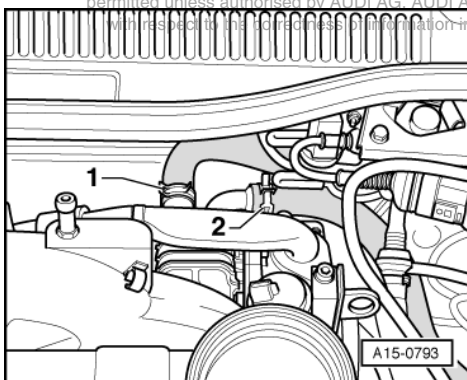
- -> Remove air duct hose -4- from turbocharger.
- Unscrew bracket -2- and -3- for turbocharger.
- Remove oil return pipe -1- at cylinder block.



- -> Unscrew oil feed line from turbocharger and exhaust manifold -arrows-.

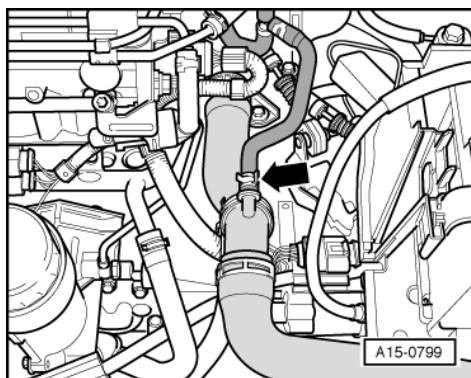


- -> Unscrew oil feed line from oil filter bracket -arrow- and also at coolant pipe and lay line aside.

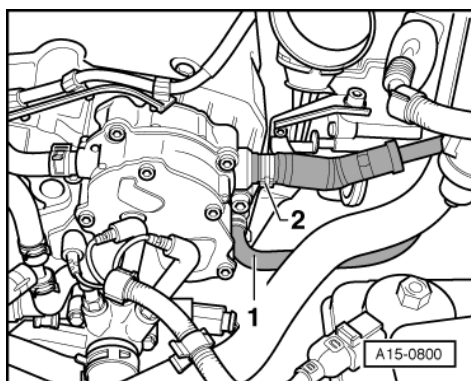


Vehicles with engine code AXR:

- -> Disconnect coolant hoses -1- and -2- at exhaust gas recirculation cooler.



- -> Disconnect coolant hose -arrow-.

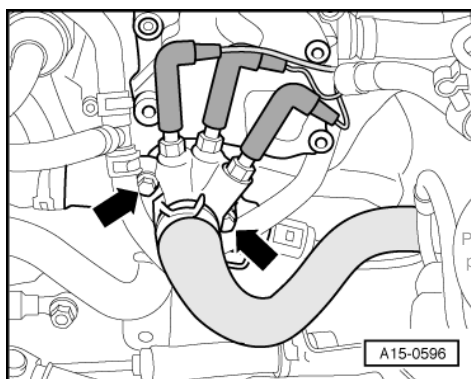


Vehicles with engine code ASZ:

- -> Disconnect coolant hose -1- at cylinder head.

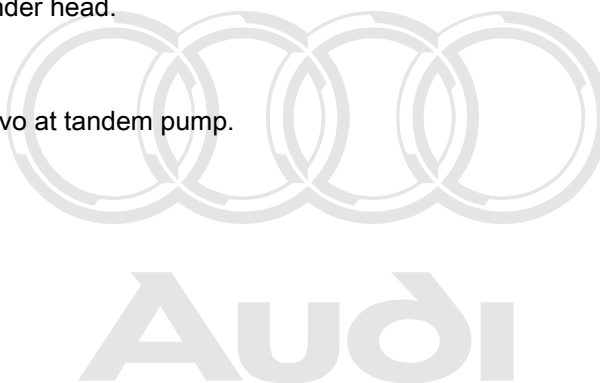
All models:

- Detach vacuum hose -2- for brake servo at tandem pump.

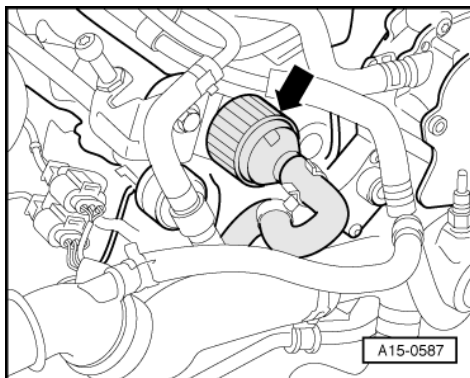


- -> Unscrew coolant connection -arrows-. Do not detach hoses.
- Before removing the cylinder head, extract fuel from the tandem pump using hand vacuum pump V.A.G 1390 => Removing and installing tandem pump.

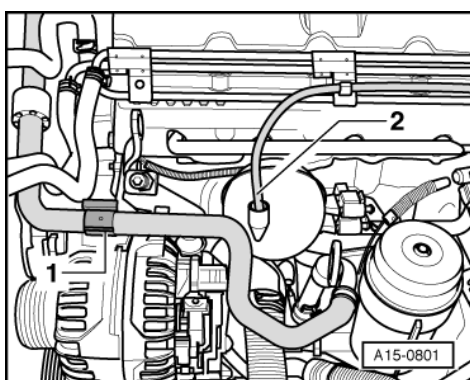
=> Fuel Supply - Diesel Engines; Repair group 20



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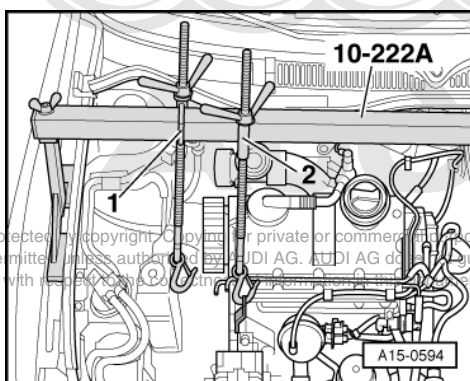
- -> Open the knurled nut -arrow- and unplug central connector.
- Unplug connector console from glow plugs.



- -> Remove the vacuum hose -2- at vacuum reservoir and lay the vacuum hose aside.
- Detach the coolant hose at the bracket -1-.

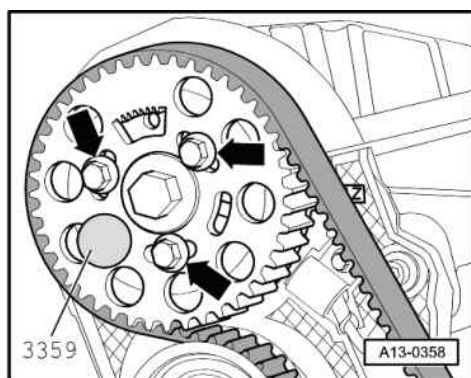
Vehicles with engine code AXR:

- Detach upper coolant hose from coolant expansion tank.

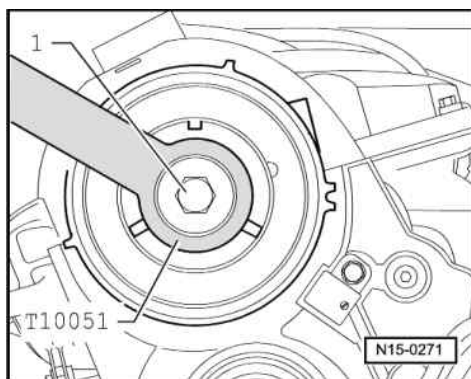


All models:

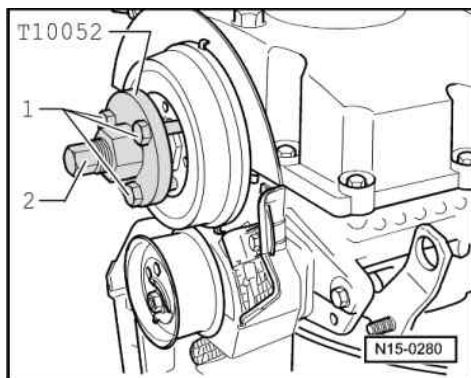
- -> Set up support bar 10-222 A on wing panel flanges.
- Spindle -1- is behind the square-section pipe
- Spindle -2- is in front of the square-section pipe
- Slightly raise engine with spindle -2- of support bar 10-222 A, spindle -1- remains free.



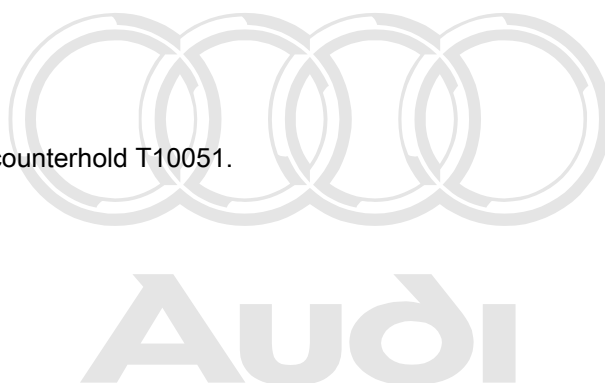
- Removing toothed belt => Page 13-51.
- Pull out mandrel 3359.
- -> Unscrew bolts -1- of camshaft sprocket.
- Remove the camshaft sprocket from hub.



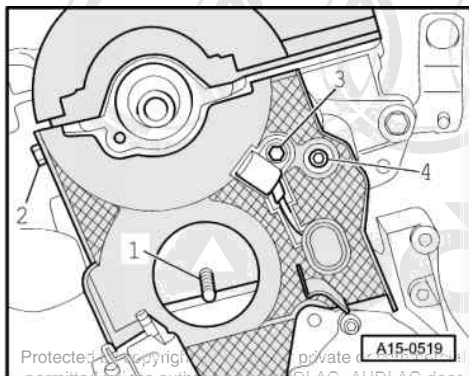
- -> Undo the securing bolts -1- on the hub. Use counterhold T10051.
- Unscrew securing bolt of hub approx. 2 turns.



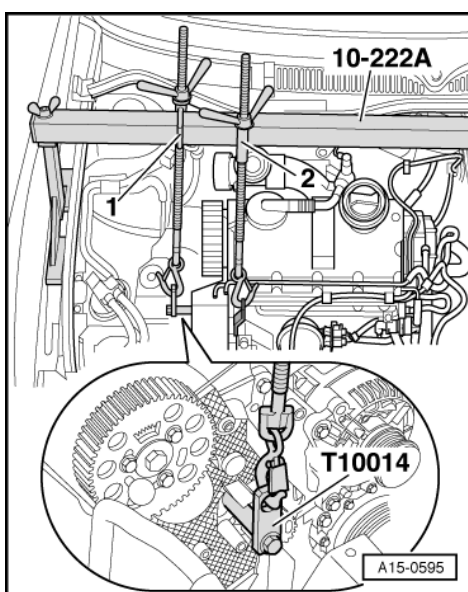
- -> Attach puller T10052 and screw bolts -1- into hub.
- Pull off hub. For this counterhold on hexagon (A/F 30) of puller and screw in bolt -2-.



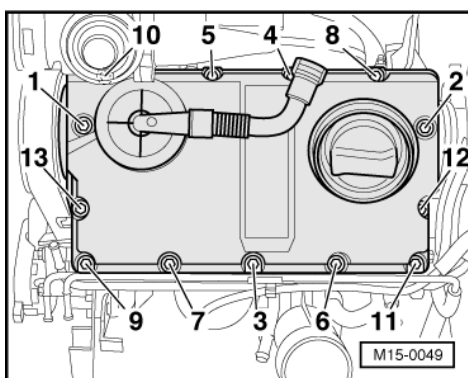
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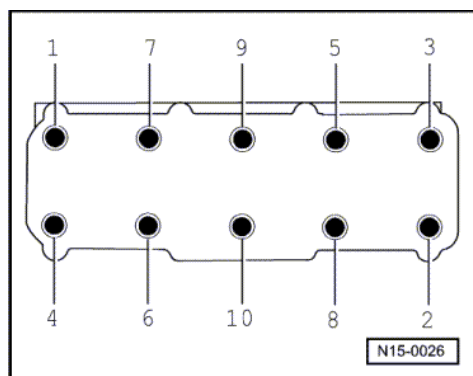
- Remove toothed belt tensioning roller.
- > Unscrew bolts -2 ... 4-.
- Unscrew stud bolt -1- with two countered M8 nuts.



- > Screw in bracket T10014 into threaded bore above coolant pump.
- Attach spindle -1- of support bar 10-222 A to bracket T10014.
- Lift engine above spindle -1- until spindle -2- has no more load.
- Remove spindle -2- from engine and push to the side.



- > Loosen cylinder head bolts in the sequence -13 ... 1- and remove the cylinder head cover.



- -> Maintain sequence when loosening cylinder head bolts.
- Lift out cylinder head with the help of a 2nd mechanic.

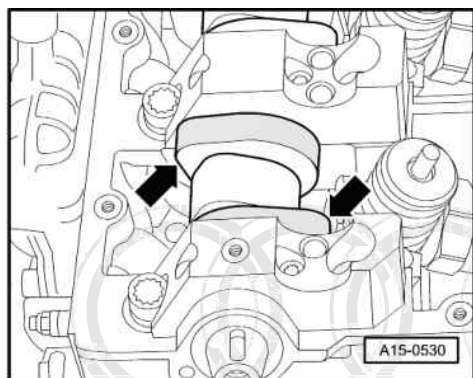
2.3 - Installing cylinder head

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.
- ♦ Hose connections and hoses for charge air system must be free of oil and grease before assembly.
- ♦ Secure all hose connections with the correct hose clamps (same as original equipment):

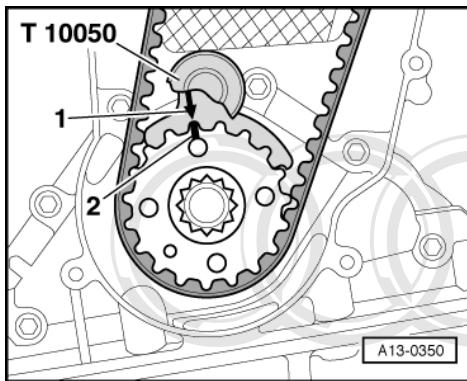
=> Parts List

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



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

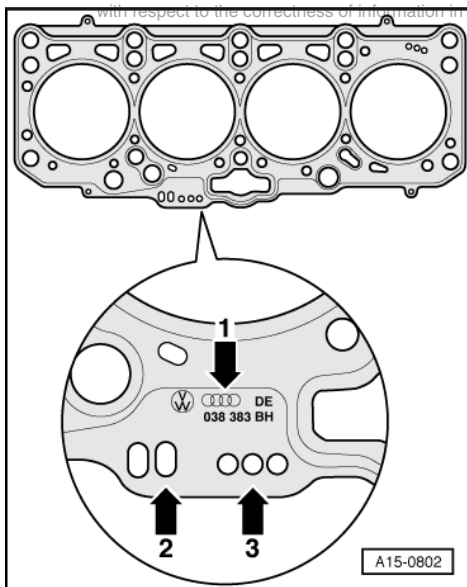
- -> The cams for cylinder 1 must point upwards evenly on camshaft -arrows-...



- -> ...and the toothed belt sprocket crankshaft must be locked with the crankshaft stop T10050.

Note:

The markings on the toothed belt sprocket -2- and crankshaft stop -1- must align. The journal of the crankshaft stop must engage in the bore of the sealing flange.

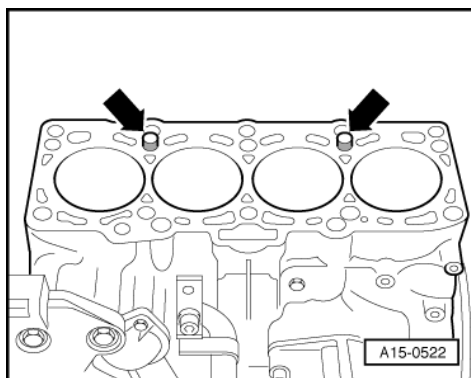


- -> Note markings on cylinder head gasket.

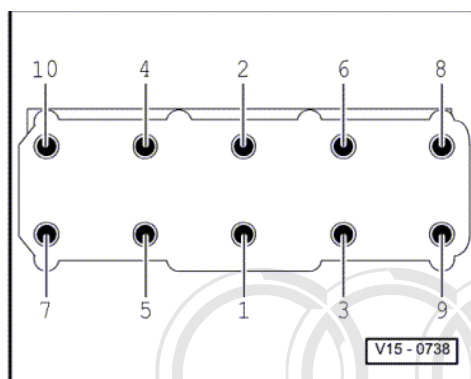
- ◆ Part-No. = arrow 1
- ◆ Production control code = arrow 2 (can be disregarded.)
- ◆ Holes = arrow 3

Notes:

- ◆ If the cylinder head gasket or the cylinder head has been replaced, select a new gasket according to the number of holes 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 13-117.



- -> Place cylinder head gasket in position.
- Note position of centring pins-arrows- in cylinder block.
- Check installation position of cylinder head gasket: mark "top" or the part No. must face cylinder head.
- Position cylinder head.
- Check that all the washers -Item 15-88 are fitted in cylinder head.
- Insert cylinder head bolts and tighten by hand.

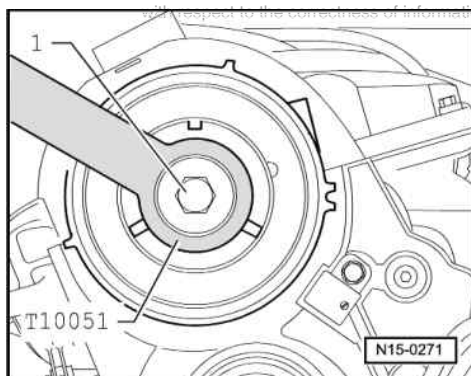


- -> Tighten cylinder head bolts in four stages in sequence shown as follows:
- Tighten using torque wrench:
 - 1. Stage: 40 Nm
 - 2. Stage: 60 Nm
- Tighten with rigid wrench:
 - 3. Stage: 90° (1/4 turn) further
 - 4. Stage: 90° (1/4 turn) further

Note:

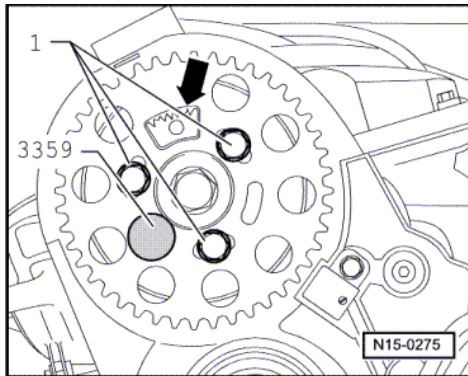
It is not necessary to retighten cylinder head bolts after repairs have been performed.

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- Attach hub to camshaft.

- -> Tighten the bolt -1- to 100 Nm. For this counterhold with T10051.



- -> Push camshaft sprocket onto hub.

Note:

The spline -arrow- of the camshaft sprocket must face upwards.

- Screw in bolts -1- loosely.
- Lock the hub with mandrel 3359.
- Install toothed belt (adjust valve timing) => Page 13-62.
- Install cylinder head cover => Page 15-10.
- Install exhaust system and align it stress-free => Page 26-13.
- Install ribbed belt => Page 13-12.

Notes:

- ♦ If the battery is reconnected, please ensure that the vehicle equipment (radio, radio/navigation system, clock, electric window lifters) is activated as described in the operating instructions.
- ♦ Deactivate the service mode of the telematics control unit.

=> Radio, Telephone and Navigation System; Repair group 91

- Check oil level => Page 17-23.

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Note:

When engine oil is contaminated perform oil change:

=> Maintenance Manual

- Replace coolant => Page 19-10.

Tightening torques

Component		Nm
Toothed belt guard - rear	M6	10 1)
to cylinder head	M8	25
Hall sender to cylinder head		10 1)
Stud bolt to cylinder head		15
Hub to camshaft		100
Oil supply pipe to turbocharger		22
Oil supply pipe to oil filter bracket		25
Oil return line to cylinder block		30
Bracket for turbocharger		



Component	Nm
to turbocharger	20
to cylinder block	40

- 1) install using locking compound;
locking compound

=> Parts List

3 - Removing and installing cylinder head -Vehicles with four-wheel drive-

3.1 - Removing and installing cylinder head -Vehicles with four-wheel drive-

Notes:

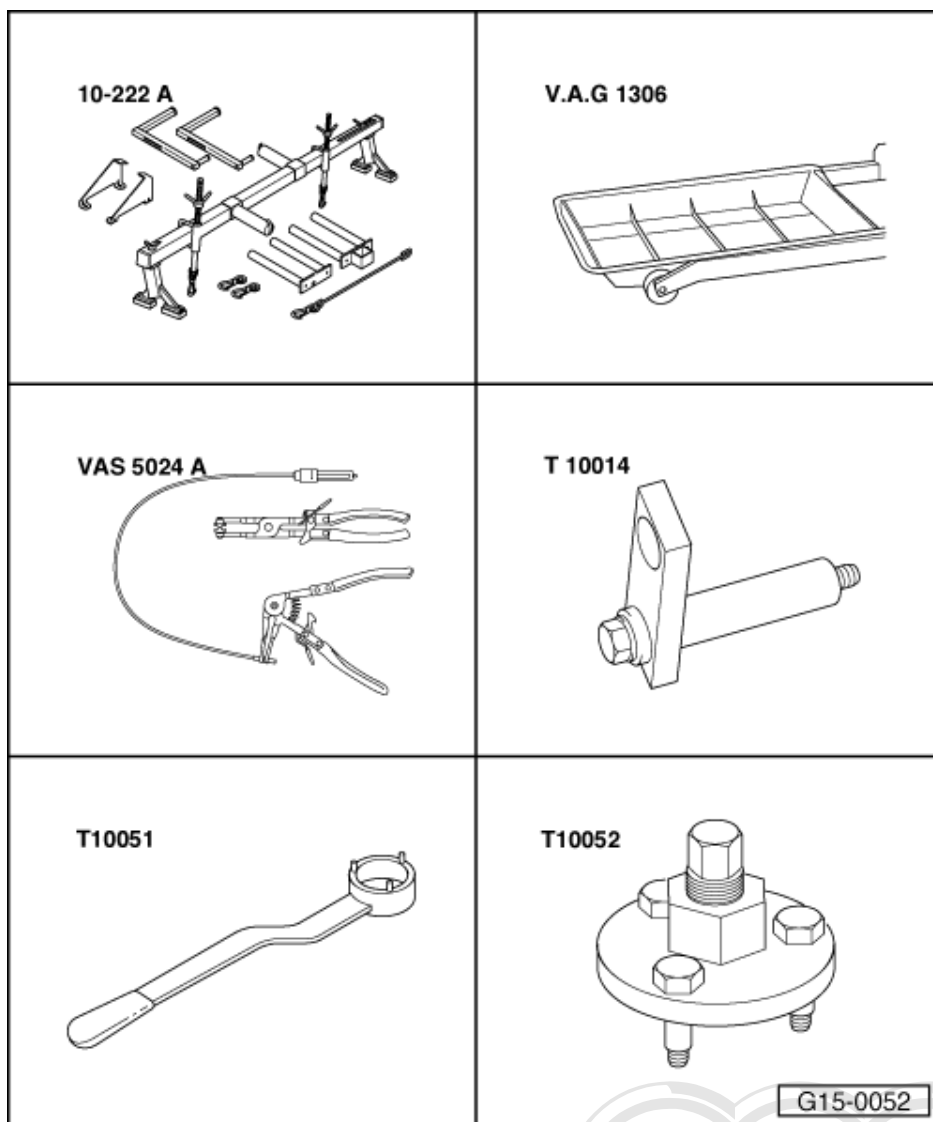
- ♦ Cylinder heads with tears can be used between the valve seats without reducing the service life if the tears are slight and at the most 0.5 mm wide.
- ♦ When fitting a new cylinder head or cylinder head gasket, drain off all the old coolant and re-fill with new coolant.
- ♦ When engine oil is contaminated perform oil change:

=> Maintenance Manual

- ♦ 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.
- ♦ Removing and installing tandem pump:

=> Fuel Supply - Diesel Engines; Repair group 20

3.2 - Removing cylinder head



Special tools and workshop equipment required

- ◆ Support bar 10-222A
- ◆ Drip tray V.A.G 1306
- ◆ VAS 5024 A

or

- ◆ Hose clamp pliers
V.A.G 1921
- ◆ Bracket T10014
- ◆ Counterhold T10051
- ◆ Puller T10052

Procedure

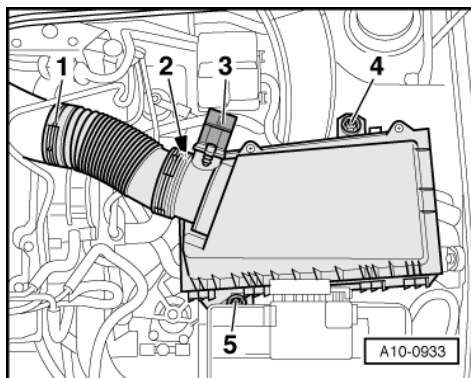
Important

- ◆ **Measures to be taken prior to disconnecting the battery: =>Electrical System; Repair group 27**
- ◆ **Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.**

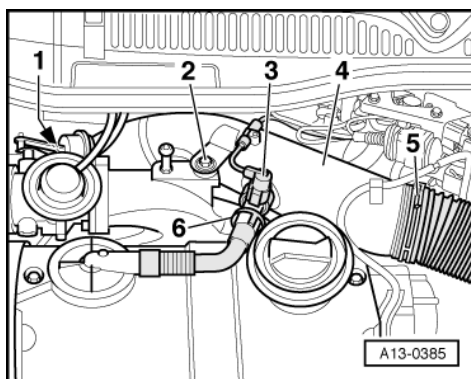
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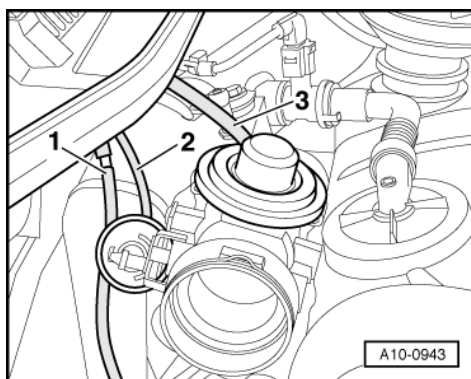
- Refer to coding on vehicles with encoded radio/radio navigation system (RNS); if necessary, interrogate.
- With the ignition switched off disconnect the battery earth strap.
- Remove ribbed belt => Page 13-10.



- -> Remove air duct hose -1- from air duct pipe.
- Detach connector of air mass meter -3-.
- Unscrew bolts -4- and -5-.
- Remove vent hose -2- off air cleaner housing.
- Remove air cleaner housing.



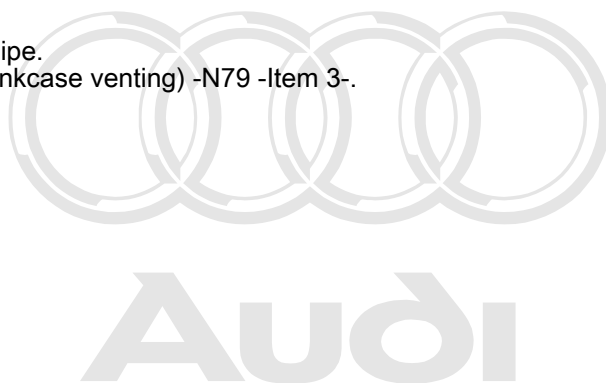
- -> Detach the crankcase vent pipe -6- from air duct pipe.
- If installed, detach connector for heating resistor (crankcase venting) -N79 -Item 3-.
- Set aside the vacuum hoses.
- Unscrew bolts -1- and -2-.



- -> Disconnect vacuum hoses -1 ... 3- at rear of intake manifold.

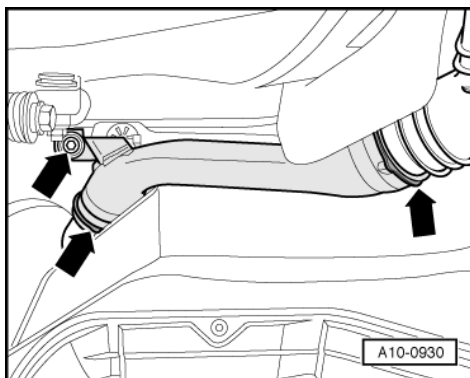
Important

Hot steam can escape when opening cap on expansion tank: Cover cap with a cloth and open carefully.

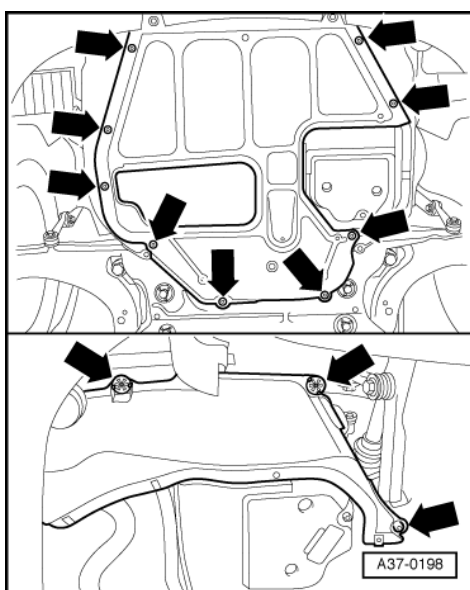


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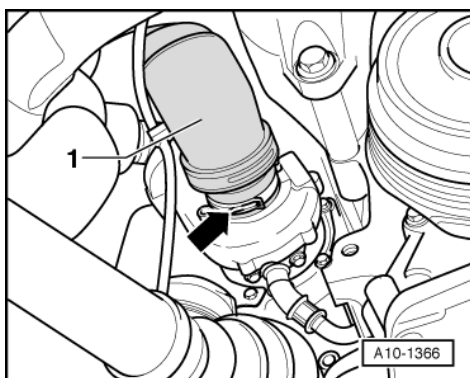
- Open the cover of the coolant expansion tank



- -> Remove air duct pipe from right longitudinal member -arrows-.



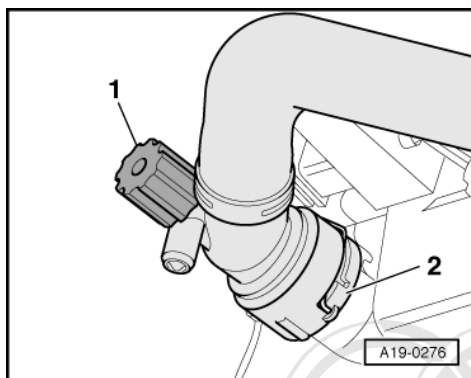
- -> Remove noise insulation in centre and on right -arrows-.



- -> Release spring clamp -arrow- at turbocharger using hose clamp pliers V.A.G 1921 or VAS 5024 A and disconnect the air duct pipe -1- from turbocharger.

Note:

The air duct pipe is removed from above at a later point.



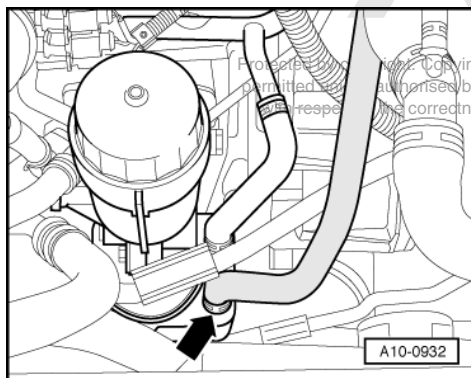
- Place drip tray V.A.G 1306 below engine.

Vehicles with drain plug:

- -> Turn drain plug -1- on radiator anti-clockwise, fit auxiliary hose to connection if necessary.

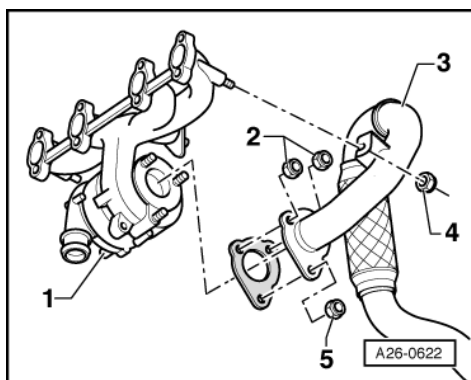
Vehicles without drain plug:

- Pull off retaining clip -2- for bottom coolant hose and detach coolant hose from radiator.



All models:

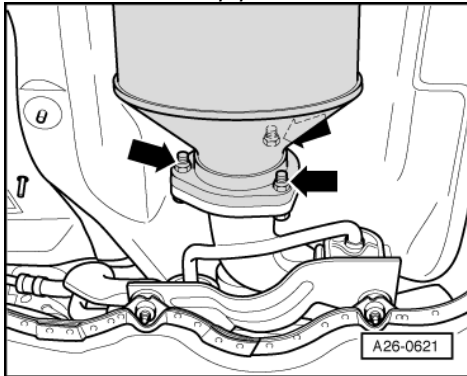
- -> Also disconnect coolant hose on oil cooler -arrow-, and drain off remaining coolant.
- Lift out the air duct pipe upwards.



- -> Unscrew nuts -2-, -4- and -5-.

Note:

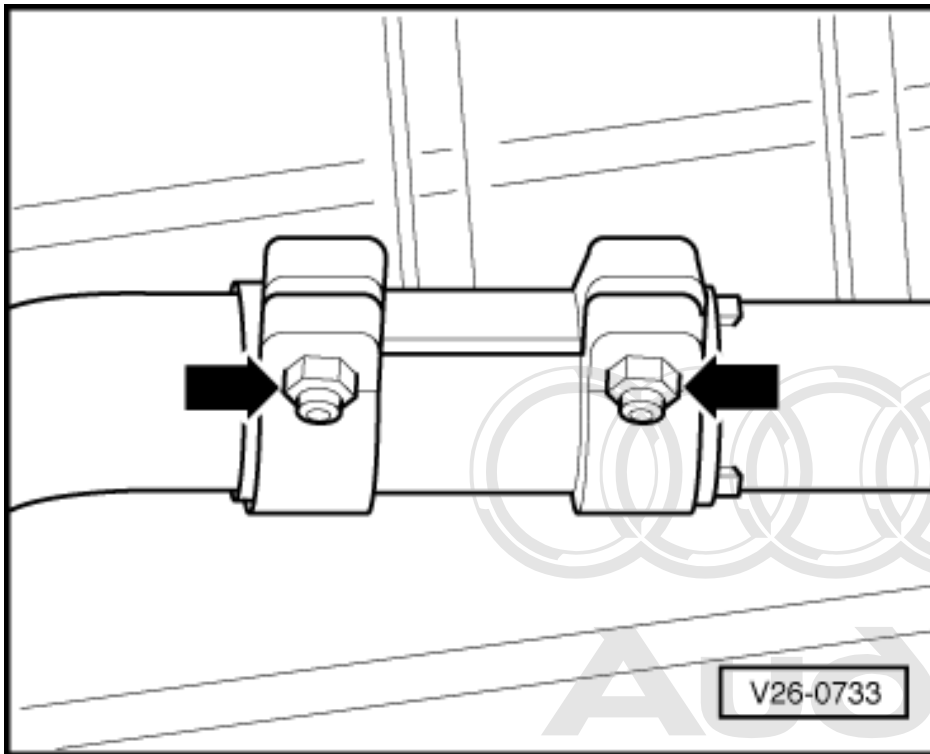
The front exhaust pipe -1- remains connected to the turbocharger -3-.



Note:

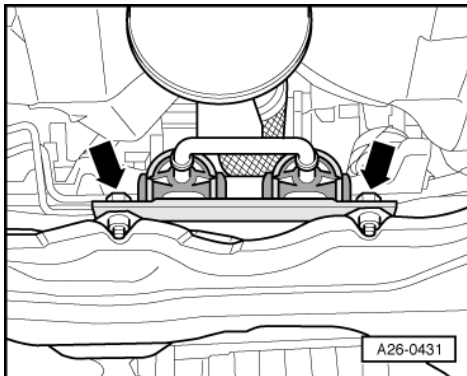
The isolating element in front exhaust pipe must not be deflected more than 10° to avoid damage.

- -> Remove bolts -arrows- at the front exhaust pipe/catalytic converter flange.

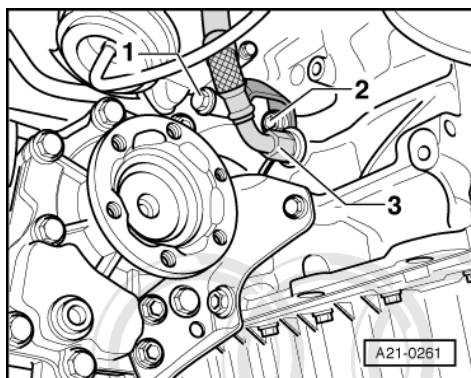


- -> Detach the exhaust system at the clamping sleeve -arrows-.
- Remove catalytic converter.

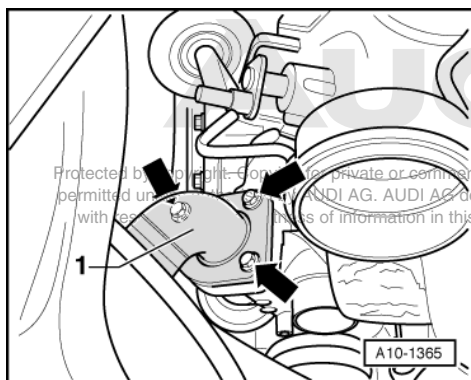
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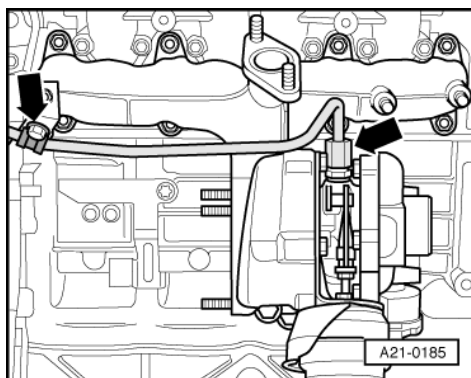
- -> Unbolt bracket for exhaust system from assembly mounting
-arrows-
- Push front exhaust pipe off turbocharger.



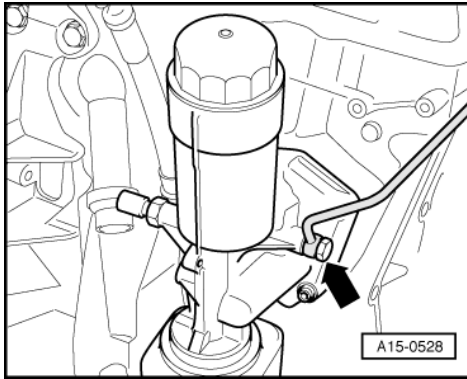
- Detach right drive shaft from gearbox flange.
- -> Remove bolts -1- and -2- and remove bracket for turbocharger.
- Remove oil return pipe -3- at cylinder block.



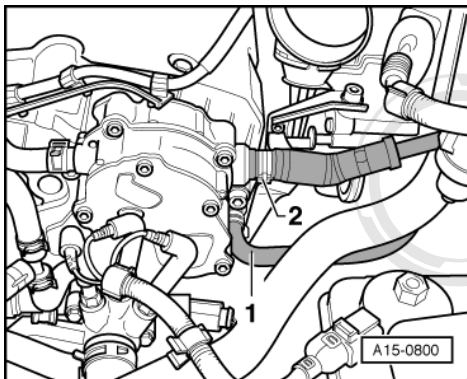
- -> Remove bolts -arrows- and remove resonator -1-.



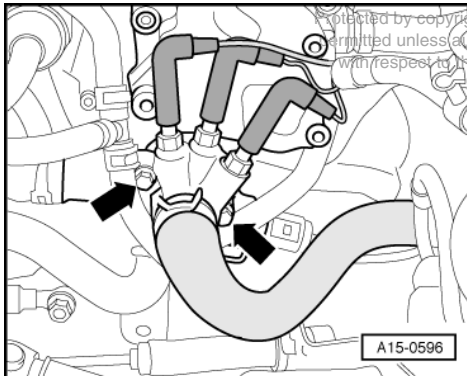
- -> Unscrew oil feed line from turbocharger and exhaust manifold
-arrows-



- -> Unscrew oil feed line from oil filter bracket -arrow- and also at coolant pipe and lay line aside.

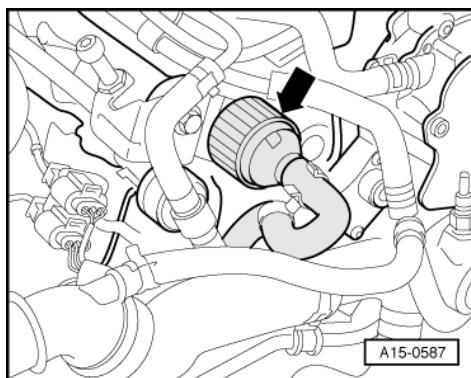


- -> Disconnect coolant hose -1- at cylinder head.
- Detach vacuum hose -2- for brake servo at tandem pump.

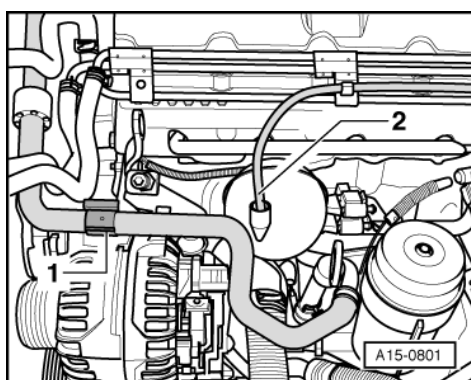


- -> Unscrew coolant connection -arrows. Do not detach hoses.
- Before removing the cylinder head, extract fuel from the tandem pump using hand vacuum pump V.A.G 1390 => Removing and installing tandem pump.

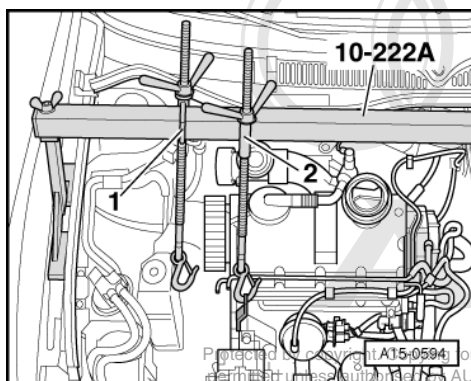
=> Fuel Supply - Diesel Engines; Repair group 20



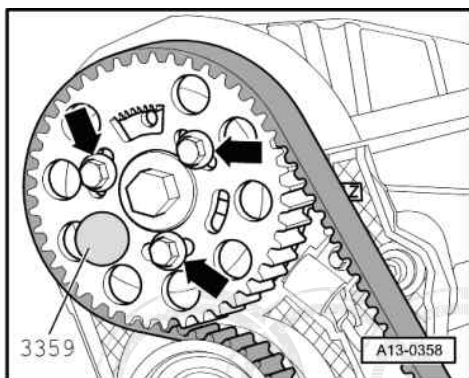
- -> Open the knurled nut -arrow- and unplug central connector.
- Unplug connector console from glow plugs.



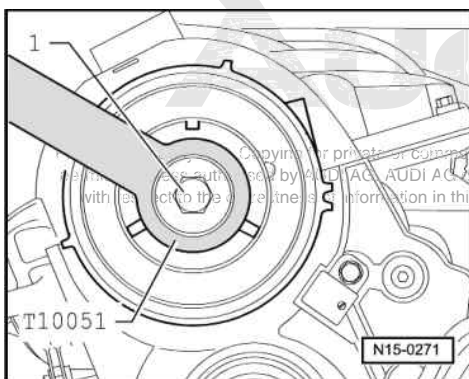
- -> Remove the vacuum hose -2- at vacuum reservoir and lay the vacuum hose aside.
- Detach the coolant hose at the bracket -1-.



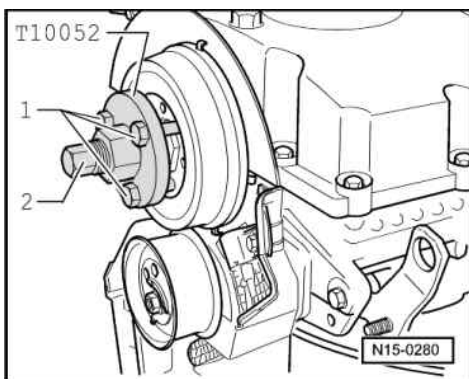
- -> Set up support bar 10-222 A on wing panel flanges.
- Spindle -1- is behind the square-section pipe
- Spindle -2- is in front of the square-section pipe
- Slightly raise engine with spindle - 2- of support bar 10-222 A, spindle -1- remains free.



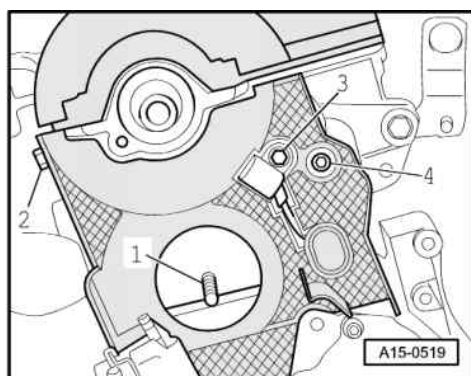
- Removing toothed belt => Page 13-51.
- Pull out mandrel 3359.
- -> Unscrew bolts of camshaft sprocket.
- Remove the camshaft sprocket from hub.



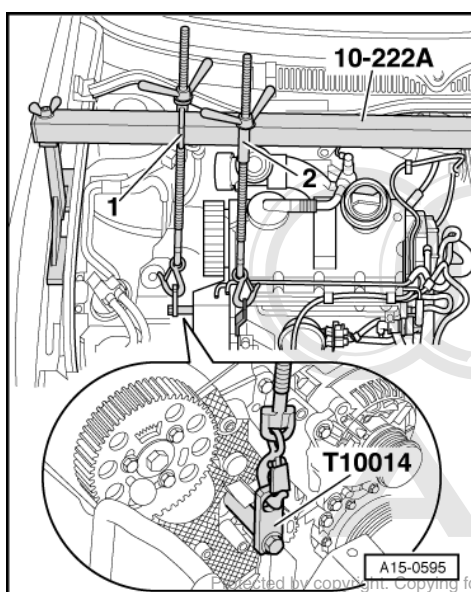
- -> Undo the securing bolts -1- on the hub. Use counterhold T10051.
- Unscrew securing bolt of hub approx. 2 turns.



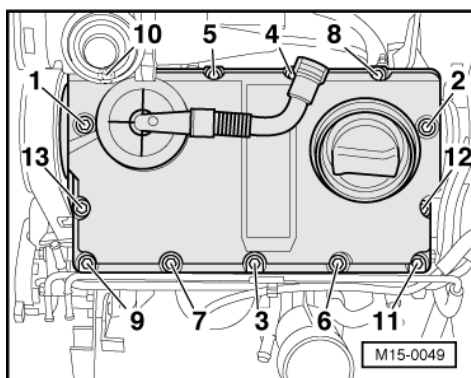
- -> Attach puller T10052 and screw bolts -1- into hub.
- Pull off hub. For this counterhold on hexagon (A/F 30) of puller and screw in bolt -2-.



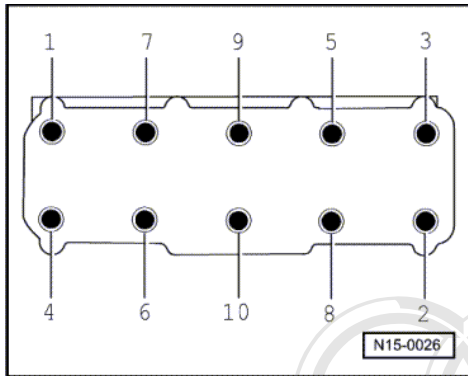
- Remove toothed belt tensioning roller.
- > Unscrew bolts -2 ... 4-
- Unscrew stud bolt -1- with two counter-sunk M8 nuts.



- > Screw in bracket T10014 into threaded bore above coolant pump.
- Attach spindle -1- of support bar 10-222 A to bracket T10014.
- Lift engine above spindle -1- until spindle-2- has no more load.
- Remove spindle -2- from engine and push to the side.



- > Loosen cylinder head bolts in the sequence -13 ... 1- and remove the cylinder head cover.



- -> Maintain sequence when loosening cylinder head bolts.
- Lift out cylinder head with the help of a 2nd mechanic.

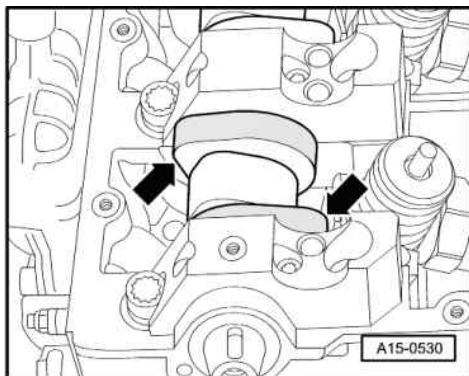
3.3 - Installing cylinder head

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.
- ◆ Hose connections and hoses for charge air system must be free of oil and grease before assembly.
- ◆ Secure all hose connections with the correct hose clamps (same as original equipment):

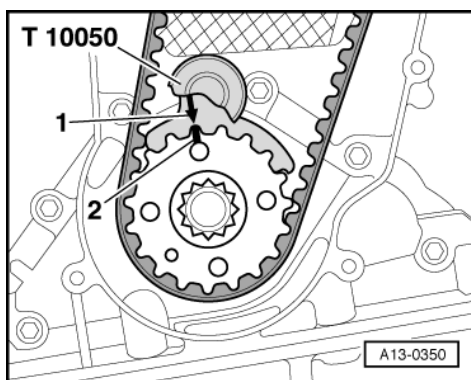
=> Parts List

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



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

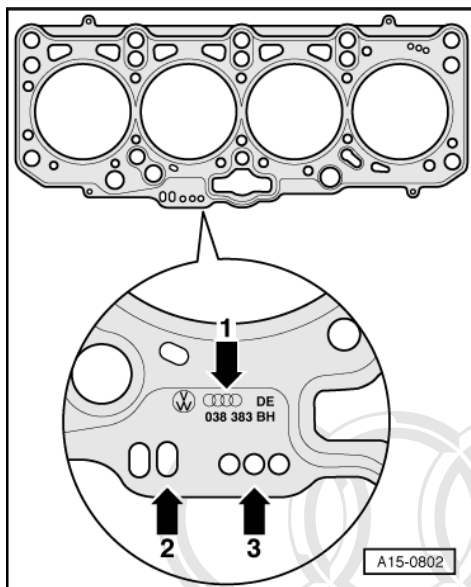
- -> The cams for cylinder 1 must point upwards evenly on camshaft -arrows-...



- -> ...and the toothed belt sprocket crankshaft must be locked with the crankshaft stop T10050.

Note:

The markings on the toothed belt sprocket -2- and crankshaft stop -1- must align. The journal of the crankshaft stop must engage in the bore of the sealing flange.

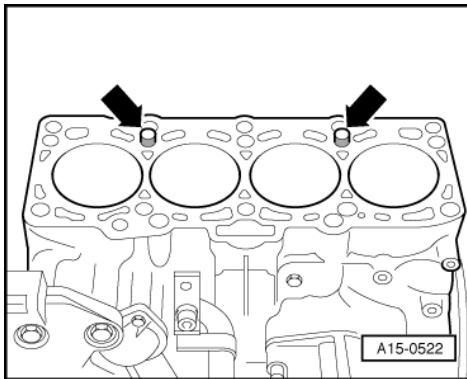


- -> Note markings on cylinder head gasket.

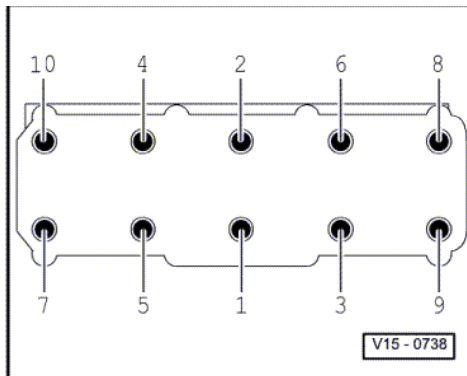
- ♦ Part-No. = arrow 1
- ♦ Production control code = arrow 2 (can be disregarded.)
- ♦ Holes = arrow 3

Notes:

- ♦ If the cylinder head gasket or the cylinder head has been replaced, select a new gasket according to the number of holes 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 13-117.



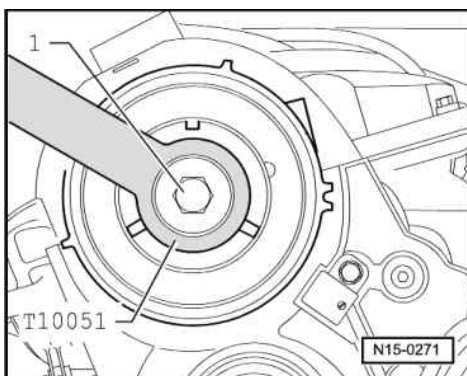
- -> Place cylinder head gasket in position.
 - Note position of centring pins-arrows- in cylinder block.
 - Check installation position of cylinder head gasket: mark "top" or the part No. must face cylinder head.
- Position cylinder head.
- Check that all the washers -15-88 are fitted in cylinder head.
- Insert cylinder head bolts and tighten by hand.



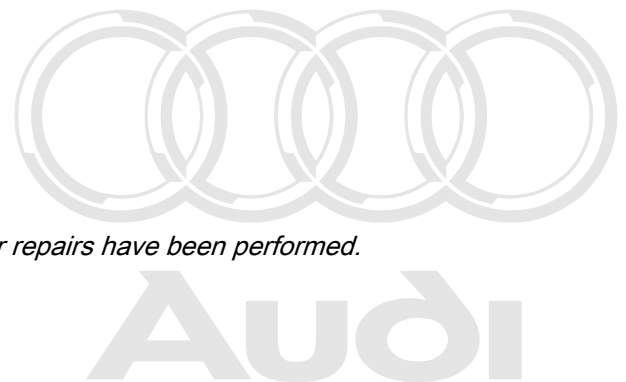
- -> Tighten cylinder head bolts in four stages in sequence shown as follows:
- Tighten using torque wrench:
 - 1st stage: 40 Nm
 - 2nd stage: 60 Nm
- Tighten with rigid wrench:
 - 3rd stage: 90°(1/4 turn) further
 - 4nd stage: 90°(1/4 turn) further

Note:

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



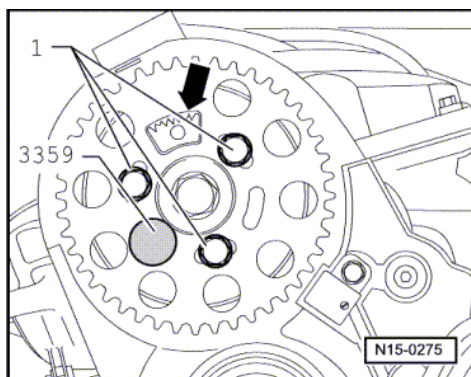
- Attach hub to camshaft.



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- -> Tighten the bolt -1- to 100 Nm. For this counterhold with T10051.



- -> Push camshaft sprocket onto hub.

Note:

The spline -arrow- of the camshaft sprocket must face upwards.

- Screw in bolts -1- loosely.
- Lock the hub with mandrel 3359.
- Install toothed belt (adjust valve timing) => Page 13-62.
- Install cylinder head cover => Page 15-10.
- Install right drive shaft:

=> Running Gear, Front and Four-wheel Drive; Repair group 40; Servicing front drive shafts Servicing front drive shafts

- Install exhaust system and align it stress-free => Page 26-35.
- Install ribbed belt => Page 13-12.

Notes:

- ♦ If the battery is reconnected, please ensure that the vehicle equipment (radio, radio/navigation system, clock, electric window lifters) is activated as described in the operating instructions.
- ♦ Deactivate the service mode of the telematics control unit.

=> Radio, Telephone and Navigation System; Repair group 91

- Check oil level => Page 17-23.

Note:

When engine oil is contaminated perform oil change:

=> Maintenance Manual

- Replace coolant => Page 19-10.

Tightening torques

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Component		Nm
Toothed belt guard - rear	M6	10 1)
to cylinder head	M8	25
Hall sender to cylinder head		10 1)
Stud bolt to cylinder head		15
Hub to camshaft		100
Resonator to turbocharger		9

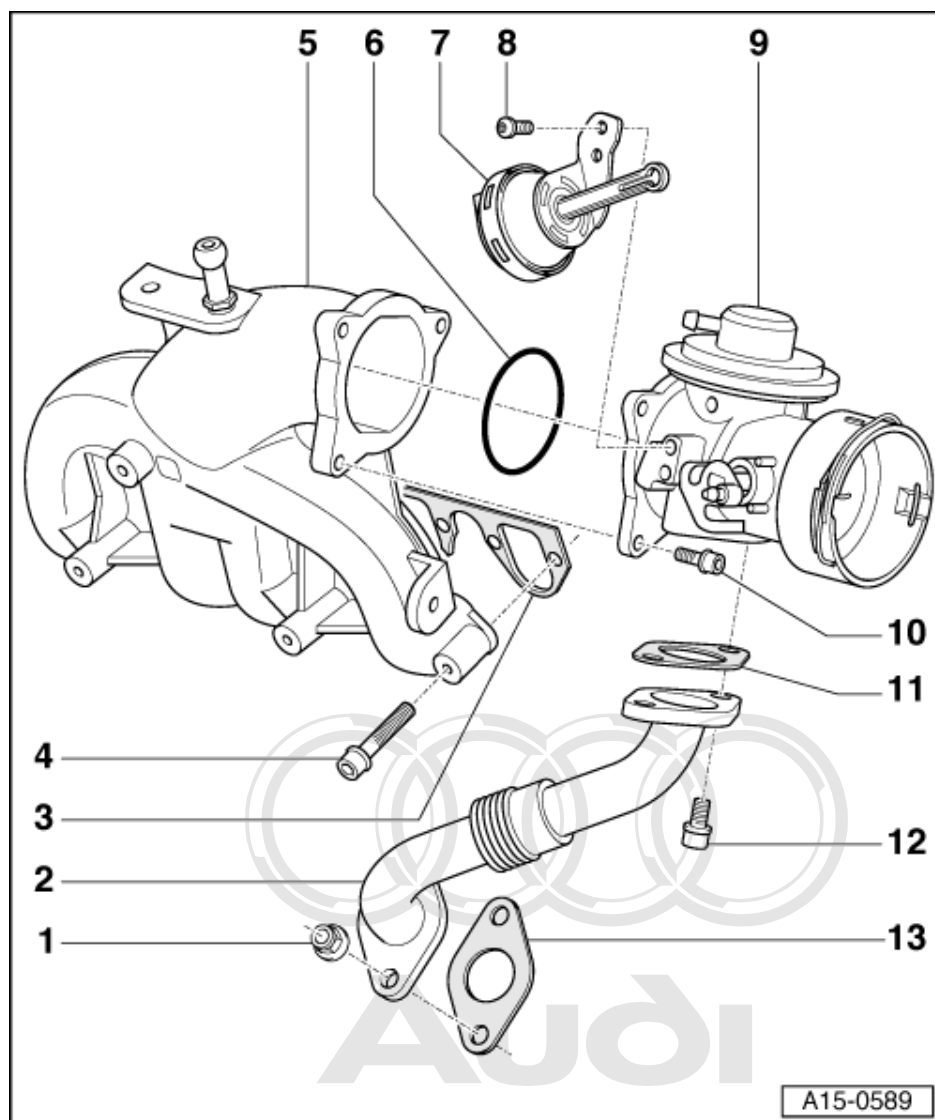
Component	Nm
Oil supply pipe to turbocharger	22
Oil supply pipe to oil filter bracket	25
Oil return line to cylinder block	30
Bracket for turbocharger to turbocharger	20
	40

- 1) install using locking compound;
locking compound

=> Parts List

4 - Removing and installing intake manifold

4.1 - Removing and installing intake manifold

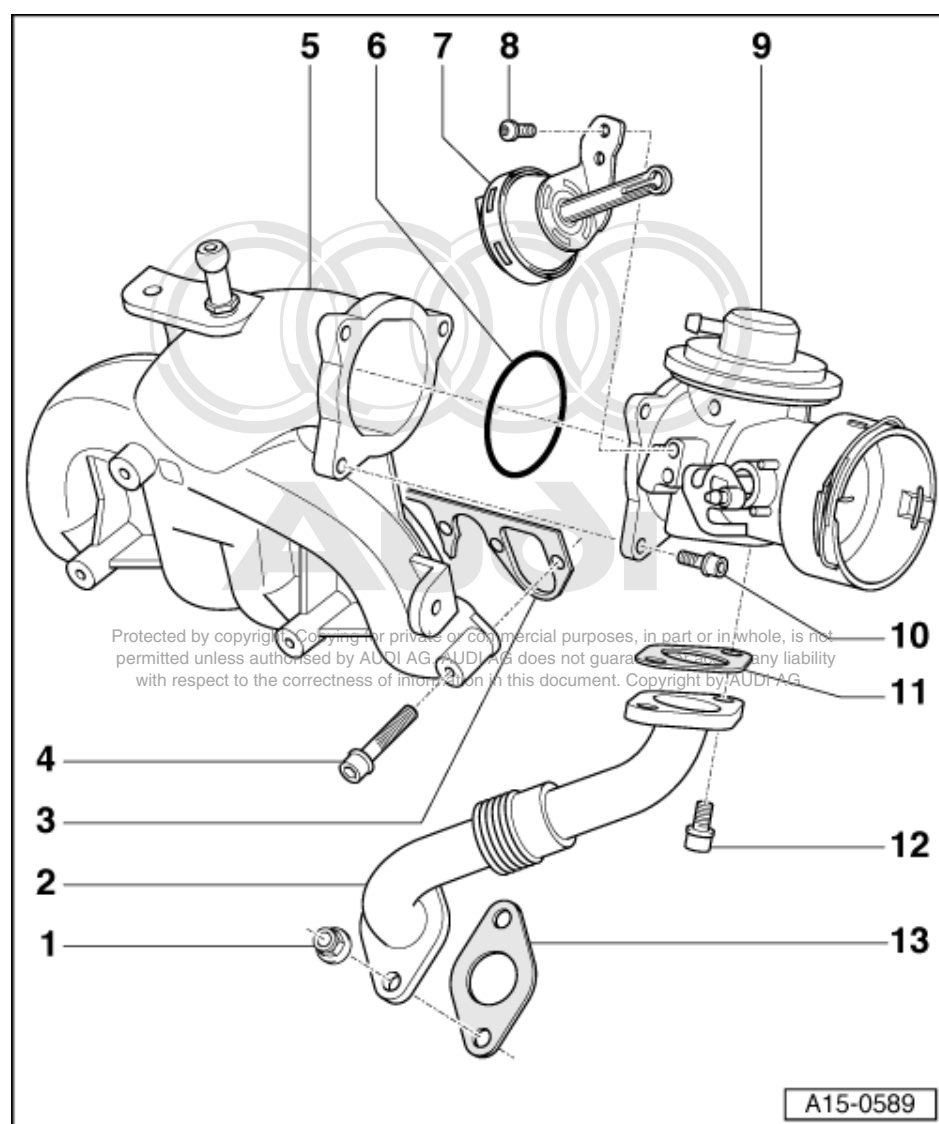


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4.2 - Intake manifold - assembly overview -engine codes ASZ, ATD-

- 1 22 Nm
 - ♦ Replacing
- 2 **Connecting pipe**
 - ♦ For exhaust gas recirculation
 - ♦ Note installation sequence:
 - First bolt on loosely.
 - Then tighten bolts to final torque.
- 3 **Seal**
 - ♦ Replacing
- 4 22 Nm
- 5 **Intake manifold**
 - ♦ Removing and installing

=>Page 15-64



- 6 **O-ring**
 - ♦ Replacing
- 7 **Vacuum unit for intake manifold flap**
- 8 5 Nm
- 9 **Intake manifold connection**
 - ♦ With mechanical exhaust gas recirculation valve
 - ♦ With intake manifold flap

10 10 Nm

11 Seal

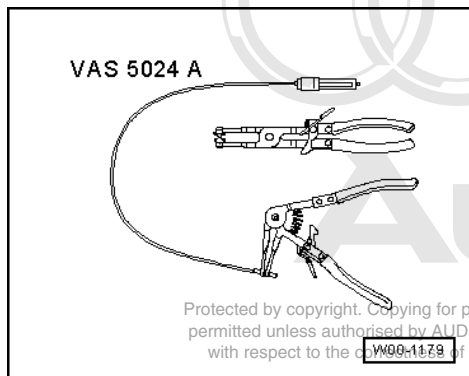
- ♦ Replacing

12 22 Nm

13 Seal

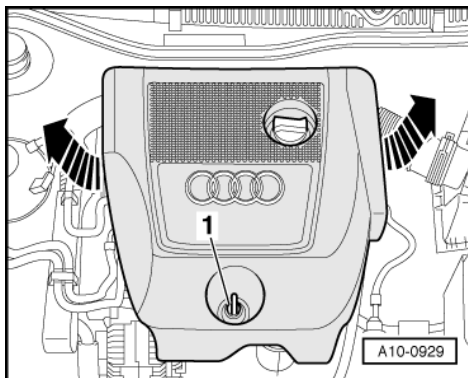
- ♦ Replacing

4.3 - Removing and installing intake manifold -engine codes ASZ, ATD-



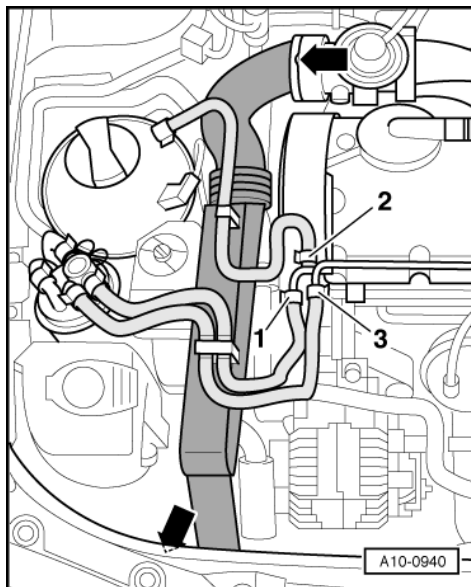
Special tools and workshop equipment required

- ♦ VAS 5024 A



Removing

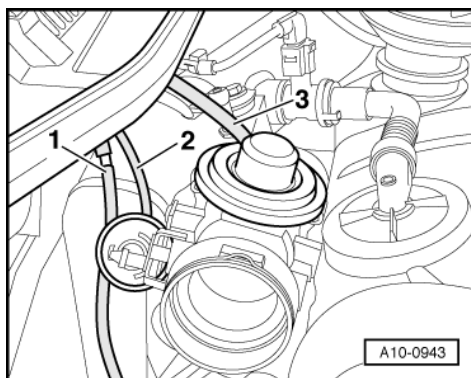
- -> Remove oil dipstick -1- from guide tube.
- Remove engine cover -arrows-.
- Reinsert dipstick in guide tube.



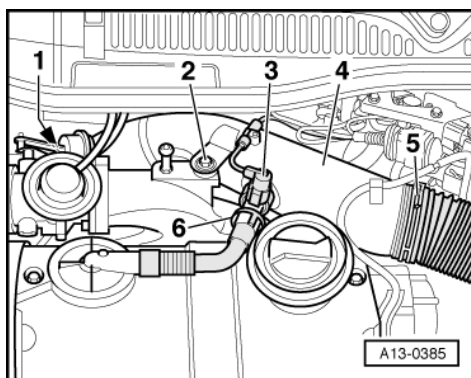
- -> Lay aside wiring at air duct pipe.
- Where necessary, detach the housing cover at rear of right headlamp.
- Remove air duct pipe -arrows-.

Note:

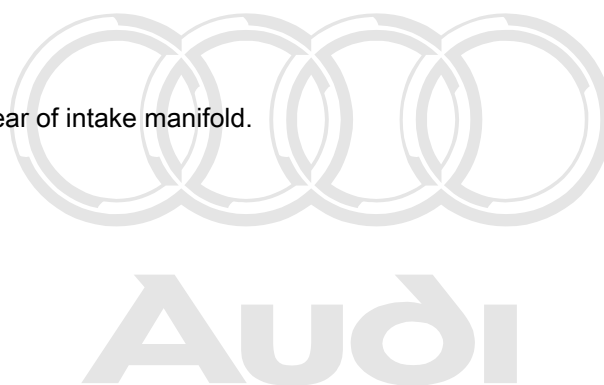
The coolant hose -2- and fuel lines -1- and -3- remain connected.



- -> Disconnect vacuum hoses -1 ... 3- at rear of intake manifold.



- -> Disconnect hose -5- to air cleaner housing.
- Disconnect crankcase vent pipe -6- from air duct hose.
- If installed, detach connector for heating resistor (crankcase venting) -N79 -Item 3-.
- Release spring clamp on turbocharger using VAS 5024 A.

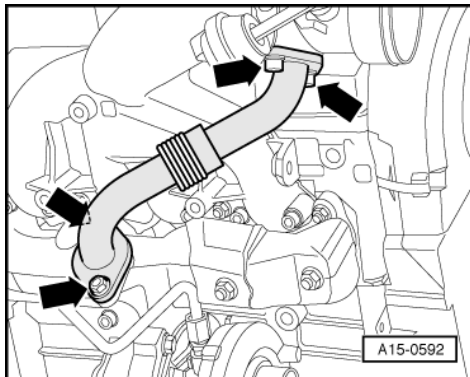


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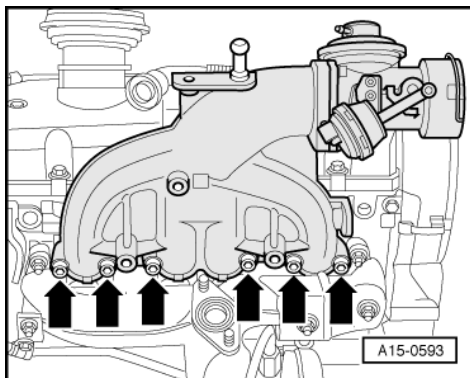
Note:

For vehicles with four-wheel drive, the spring clamp is not accessible from above. To release the spring clamp, remove the air duct pipe from the right longitudinal member and the centre and right noise insulation.

- Set aside the vacuum hoses.
- Unscrew bolts -1- and -2- and remove air duct pipe -4-.



- -> Remove connection pipe for exhaust gas recirculation -arrows-.



- -> Remove intake manifold -arrows-.

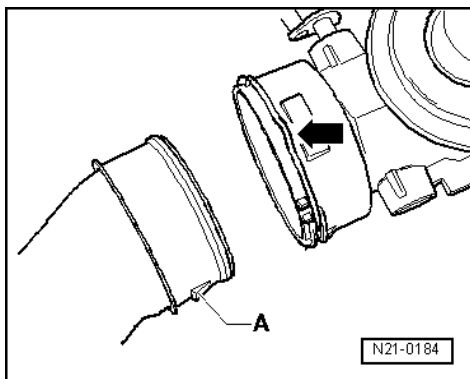
Installing

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

Notes:

- ◆ Always replace seals, gaskets and self-locking nuts.
- ◆ Note installation position of intake manifold seal.
- ◆ Hose connections and hoses for charge air system must be free of oil and grease before assembly.
- ◆ Secure all hose connections with the correct hose clamps (same as original equipment):

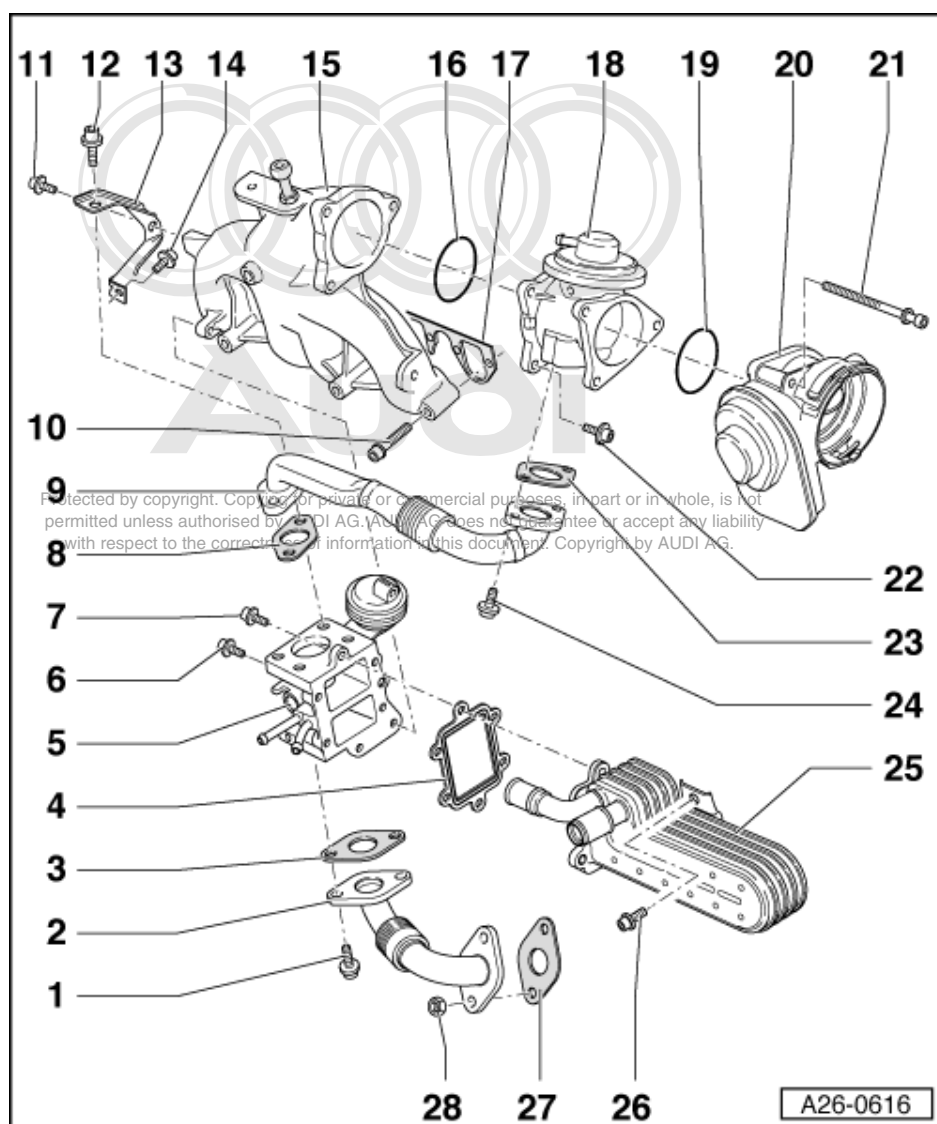
=> Parts List



- -> When installing air duct pipes with connectors, ensure that the securing clip -arrow- engages audibly in the retaining lug -A-.

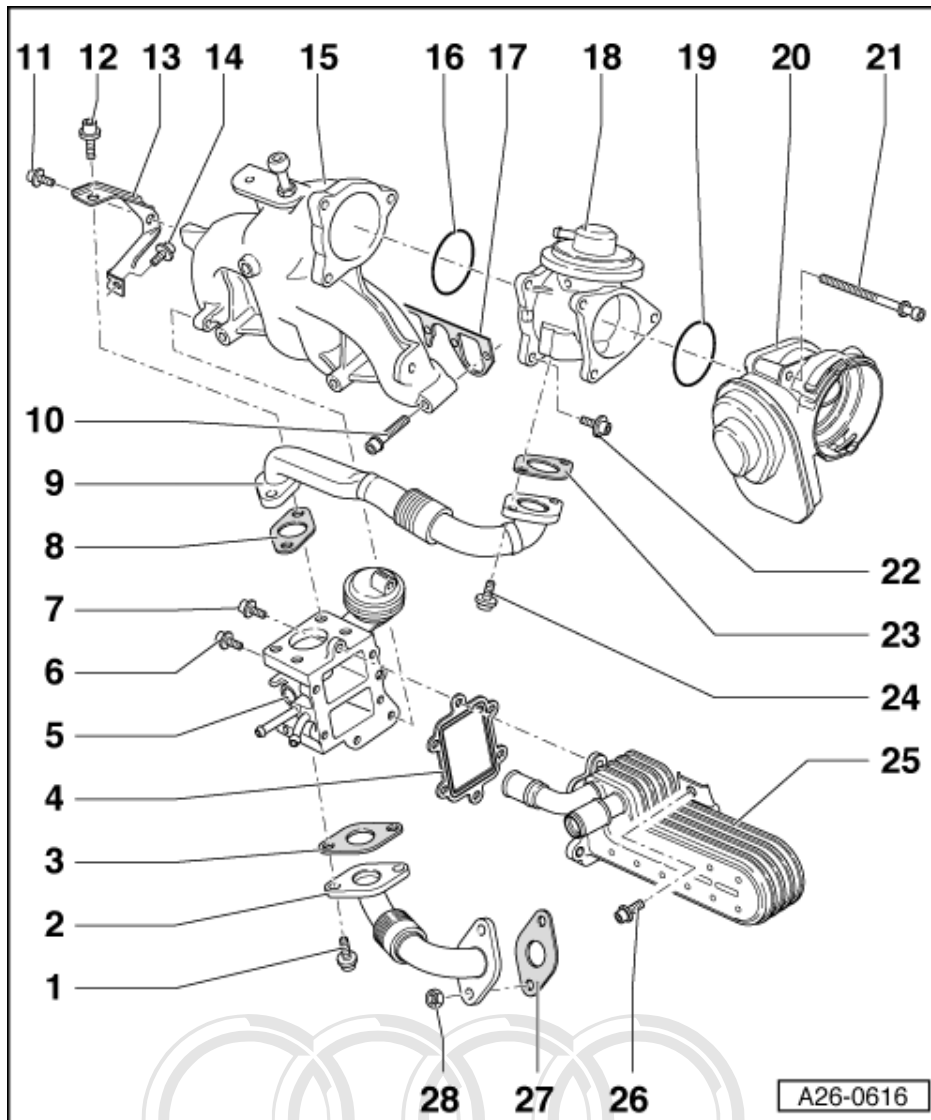
Tightening torques

Component	Nm
Intake manifold to cylinder head	22
Connection pipe for ex- Intake connection piece haust gas recirculation on	22
Exhaust manifold	22

4.4 - Intake manifold - assembly overview -engine code AXR-


- 1 22 Nm
- 2 Lower connecting pipe
 - ♦ For exhaust gas recirculation
 - ♦ Note installation sequence:
 - First bolt on loosely.
 - Then tighten bolts to final torque.
- 3 Seal

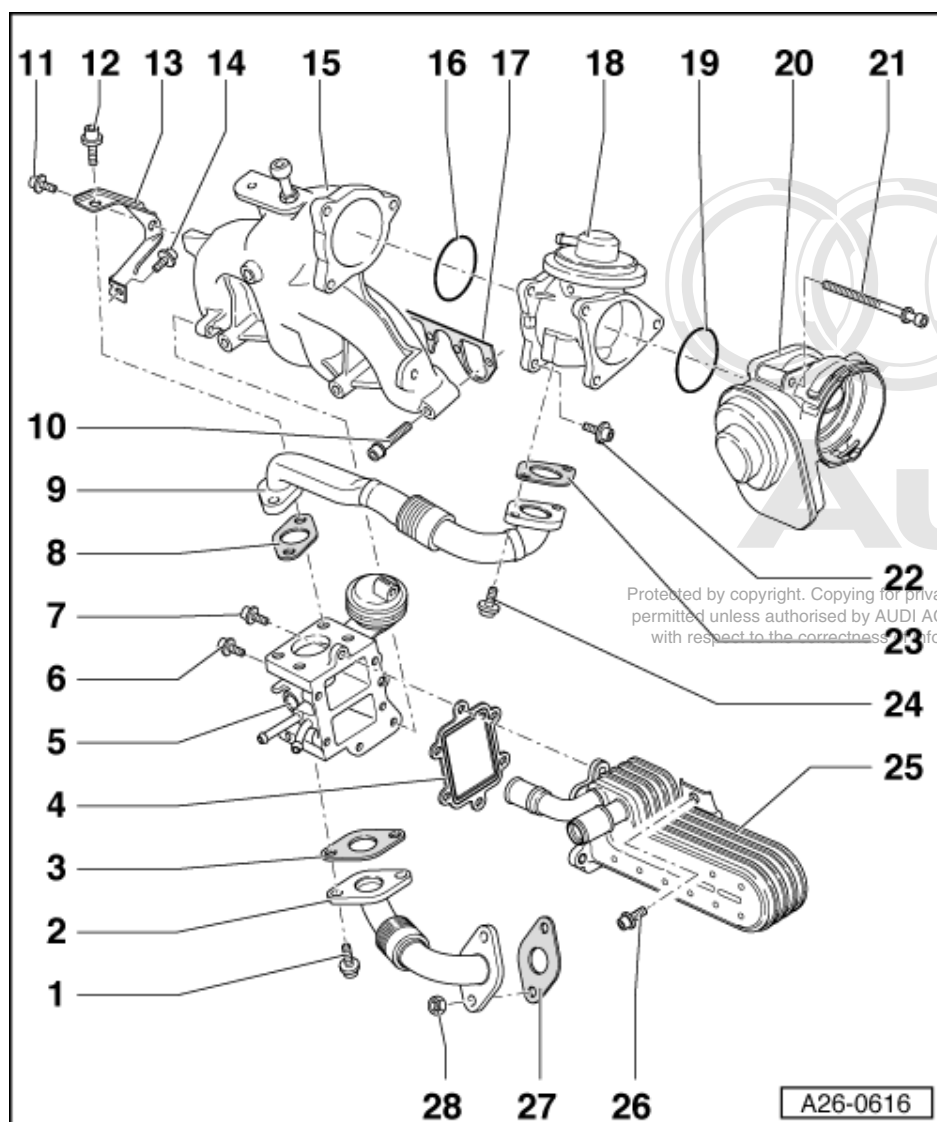
- ♦ Replacing
- 4 Seal**
 - ♦ Replacing
- 5 Changeover valve for exhaust gas recirculation**
- 6 10 Nm**



- 7 10 Nm**
- 8 Seal**
 - ♦ Replacing
- 9 Upper connecting pipe**
 - ♦ Note installation sequence:
 - First bolt on loosely.
 - Then tighten bolts to final torque.
- 10 22 Nm**
- 11 10 Nm**
- 12 22 Nm**
- 13 Bracket**
- 14 5 Nm**
- 15 Intake manifold**

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♦ Removing and installing=>Page 15-74



16 O-ring

- ♦ Replacing

17 Seal

- ♦ Replacing

18 Mechanical EGR valve

- ♦ Checking => Page 26-50

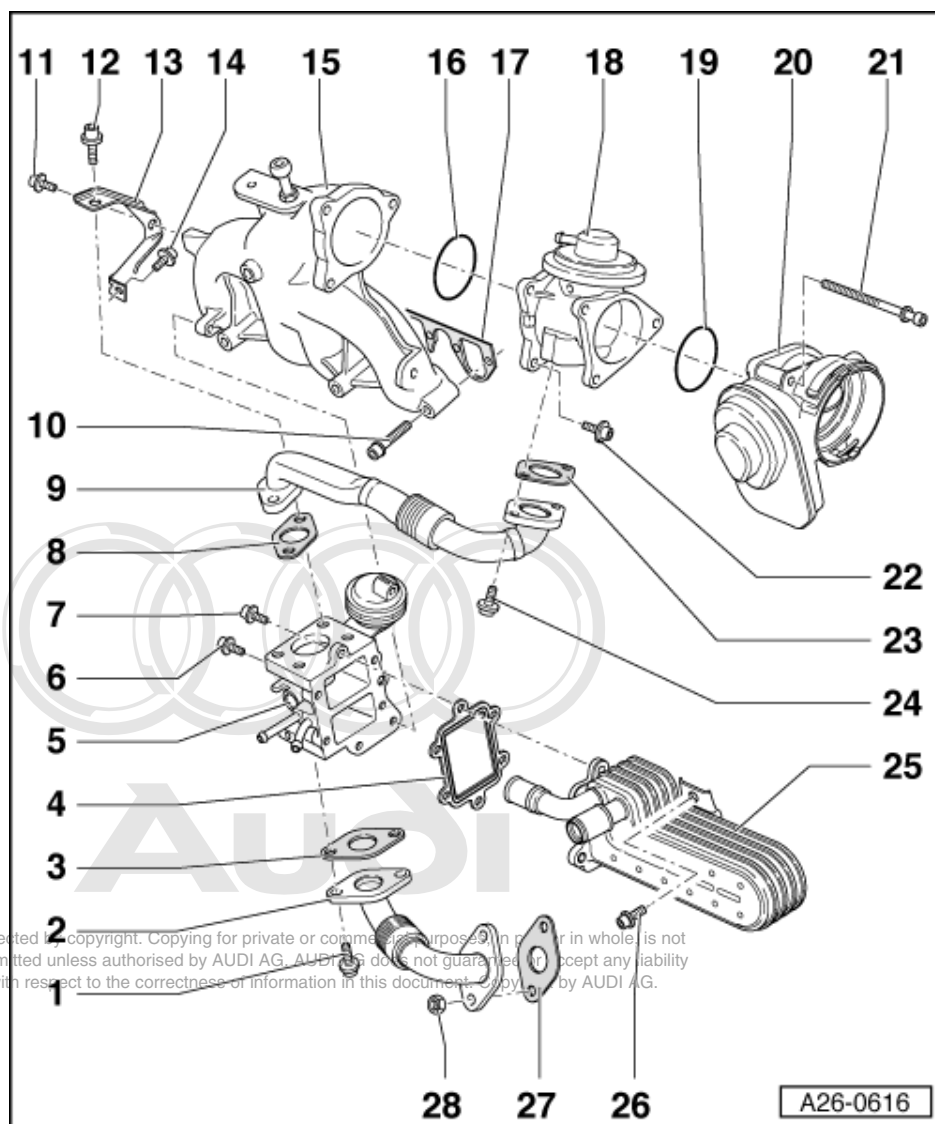
19 O-ring

- ♦ Replacing

20 Intake manifold connection

- ♦ With motor for intake manifold flap -V157

21 10 Nm



22 10 Nm

23 Seal

- ♦ Replacing

24 22 Nm

25 Radiator

- ♦ For exhaust gas recirculation

26 10 Nm

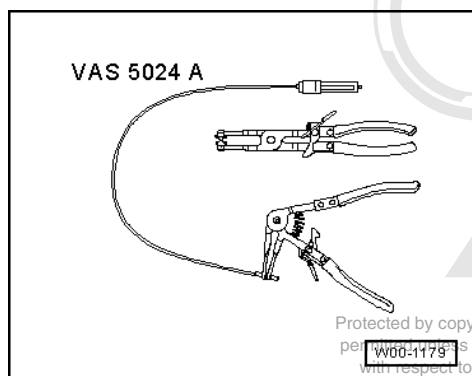
27 Seal

- ♦ Replacing

28 22 Nm

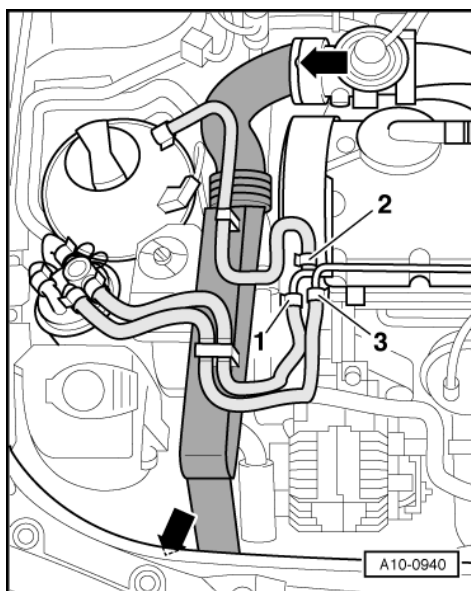
- ♦ Replacing

4.5 - Removing and installing intake manifold -engine code AXR-



Special tools and workshop equipment required

- ♦ VAS 5024 A

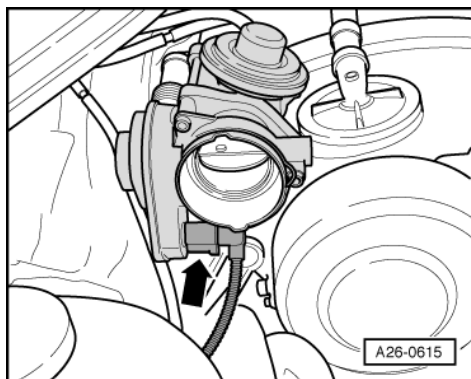


Removing

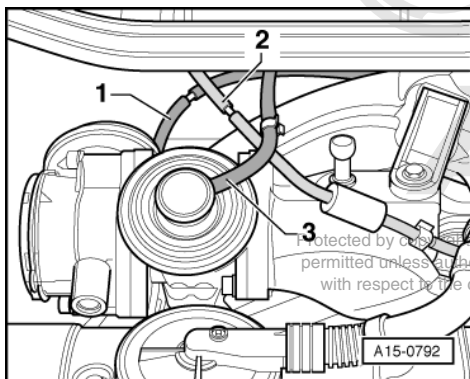
- Drain coolant => Page 19-7.
- -> Lay aside wiring at air duct hose.
- Where necessary, detach the housing cover at rear of right headlamp.
- Remove air duct pipe -arrows-.

Note:

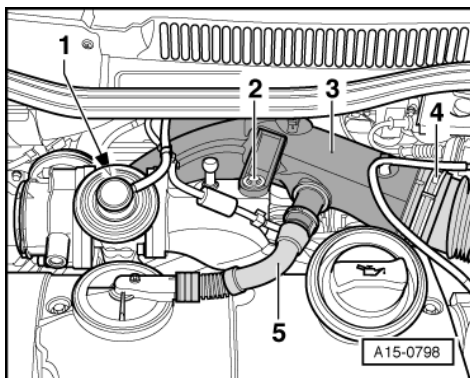
The coolant hose -2- and fuel lines -1- and -3- remain connected.



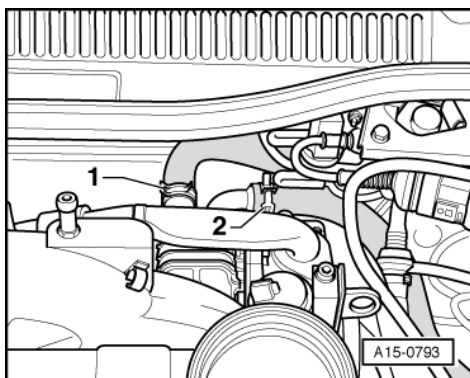
- -> Detach connector -arrow- at intake manifold flap motor.



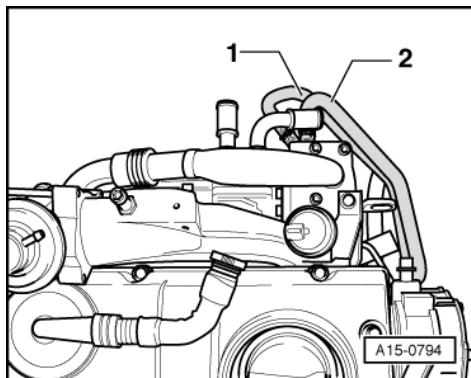
- -> Disconnect vacuum hoses -1 ... 3-.
- Set aside the vacuum hoses.



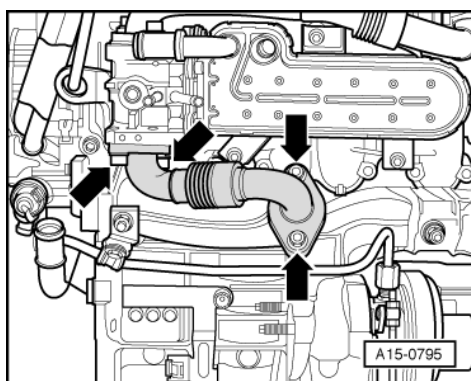
- -> Disconnect hose -4- to air cleaner housing.
- Disconnect crankcase vent pipe -5- from air duct hose.
- Release spring clamp on turbocharger using VAS 5024 A.
- Set aside the vacuum hoses.
- Unscrew bolts -1- and -2- and remove air duct pipe -3-.



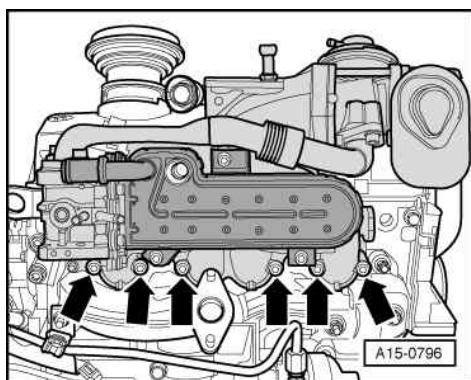
- -> Disconnect coolant hoses -1- and -2- at exhaust gas recirculation cooler.



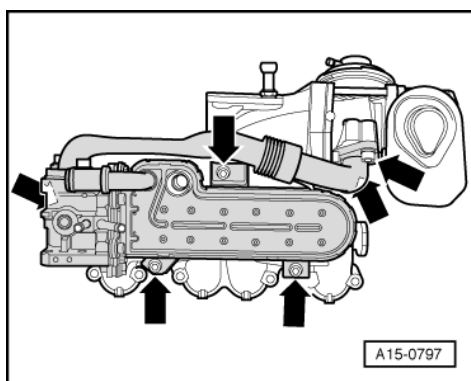
- -> Detach coolant hoses -1- and -2-.



- -> Remove connection pipe for exhaust gas recirculation -arrows-.



- -> Remove intake manifold -arrows-.



- -> Detach exhaust gas recirculation cooler at intake manifold if necessary -arrows-.



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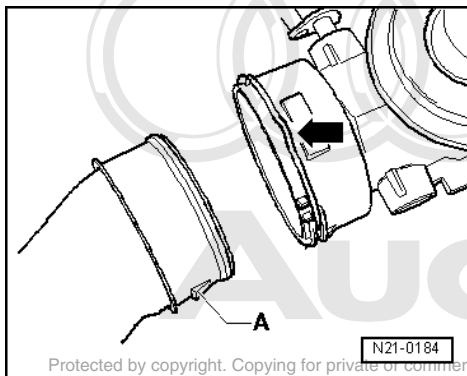
Installing

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

Notes:

- ◆ Always replace seals, gaskets and self-locking nuts.
- ◆ Note installation position of intake manifold seal.
- ◆ Hose connections and hoses for charge air system must be free of oil and grease before assembly.
- ◆ Secure all hose connections with the correct hose clamps (same as original equipment):

=> Parts List



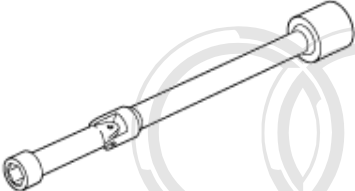


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- -> When installing air duct pipes with connectors, ensure that the securing clip -arrow- engages audibly in the retaining lug -A-.
 - Top up coolant => Page 19-10.

Tightening torques

Component	Nm
Exhaust gas recirculation cooler to intake manifold	10
Exhaust gas recirculation cooler to bracket	5
Connection pipe for exhaust gas recirculation to exhaust recirculation valve	22
Bracket to intake manifold	10
Intake manifold to cylinder head	22
Connection pipe for exhaust gas recirculation to changeover valve	22
exhaust manifold	22



4.6 - Checking compression

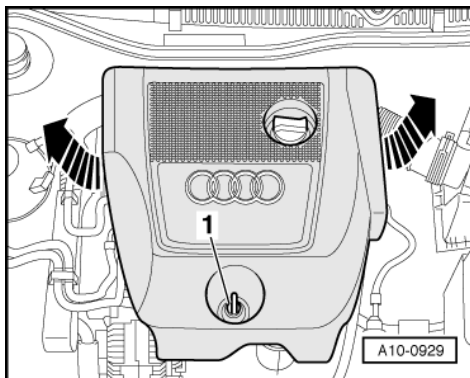
3220 	V.A.G 1763 
V.A.G 1381/12 	
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<div>G15-0002</div>	

Special tools and workshop equipment required

- ♦ Flexible-head spanner 3220
- ♦ V.A.G 1763
- ♦ V.A.G 1381/12

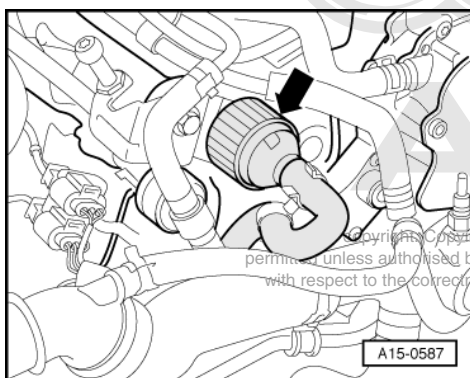
Test requirements:

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

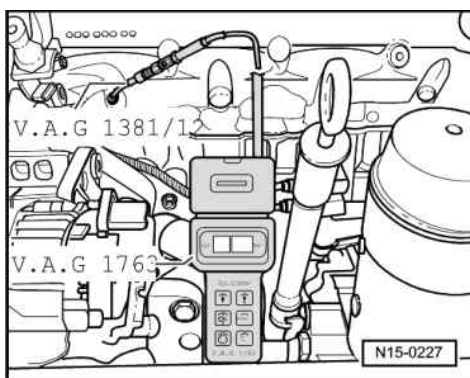


Test sequence

- -> Remove oil dipstick -1- from guide tube.
- Remove engine cover -arrows-.
- Reinsert dipstick in guide tube.



- -> Open the knurled nut -arrow- and unplug central connector.
- Unplug connector console from glow plugs.
- 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.

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 cylinders pressure in bar
25...31	19	max. 5

- Install glow plugs with flexible-head spanner 3220.

Carry out the following step after the compression test:

- Interrogate and if necessary delete the fault memory.

=> TDI Injection and Glow Plug System (4-cyl Pump Jet); 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. Interrogate and, if necessary, erase fault memory after completing the check.

Tightening torque

Component	Nm
Glow plugs to cylinder head	15

5 - Servicing valve gear

5.1 - Servicing valve gear

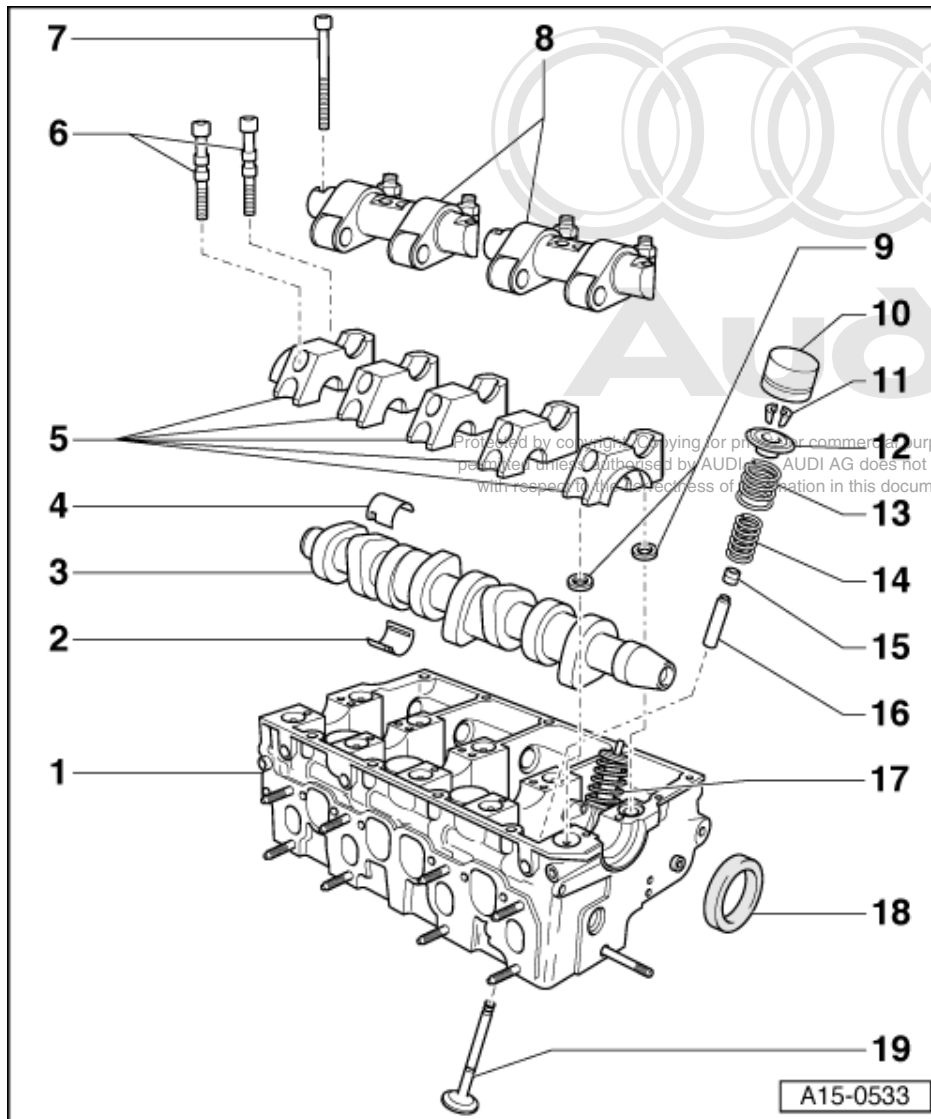
Notes:

- ♦ 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.
- ♦ Renew all gaskets and seals.
- ♦ Removing and installing tandem pump:

=> Fuel Supply - Diesel Engines; Repair group 20



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1 Cylinder head

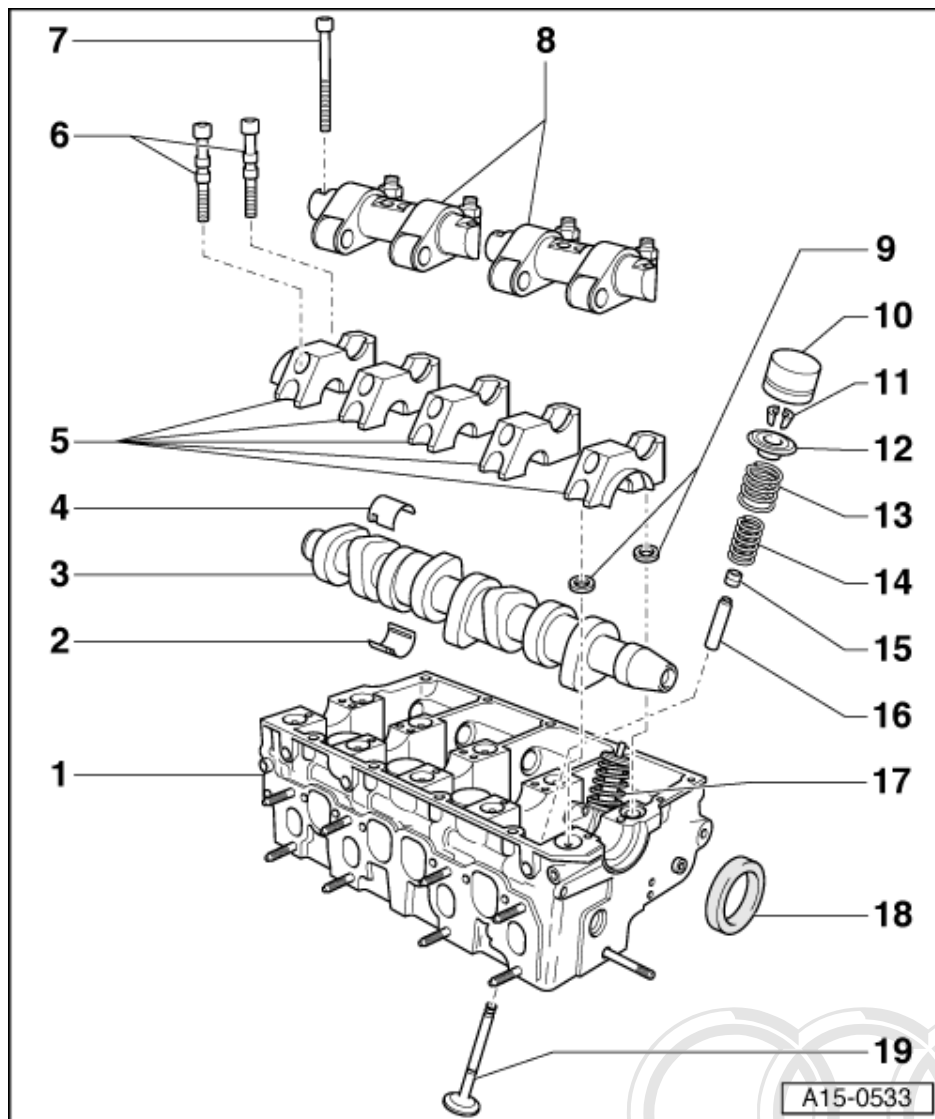
- ◆ Checking valve guides
=>Page 15-123
- ◆ Rework valve seats
=>Page 15-119

2 Bearing shell

- ◆ Note installation position
- ◆ Do not interchange used bearing shells (mark).
- ◆ Make sure that the retaining lugs are correctly seated in the bearing caps and the cylinder head

3 Camshaft

- ◆ Checking axial play
=>Page 15-93
- ◆ Removing and installing
=>Page 15-100
- ◆ Checking radial play with Plastigage
Wear limit: 0.11 mm
- ◆ Run-out: no more than 0.04 mm



4 Bearing shell

- ◆ Note installation position
- ◆ Do not interchange used bearing shells (mark).
- ◆ Make sure that the retaining lugs are correctly seated in the bearing caps and the cylinder head

5 Bearing cap

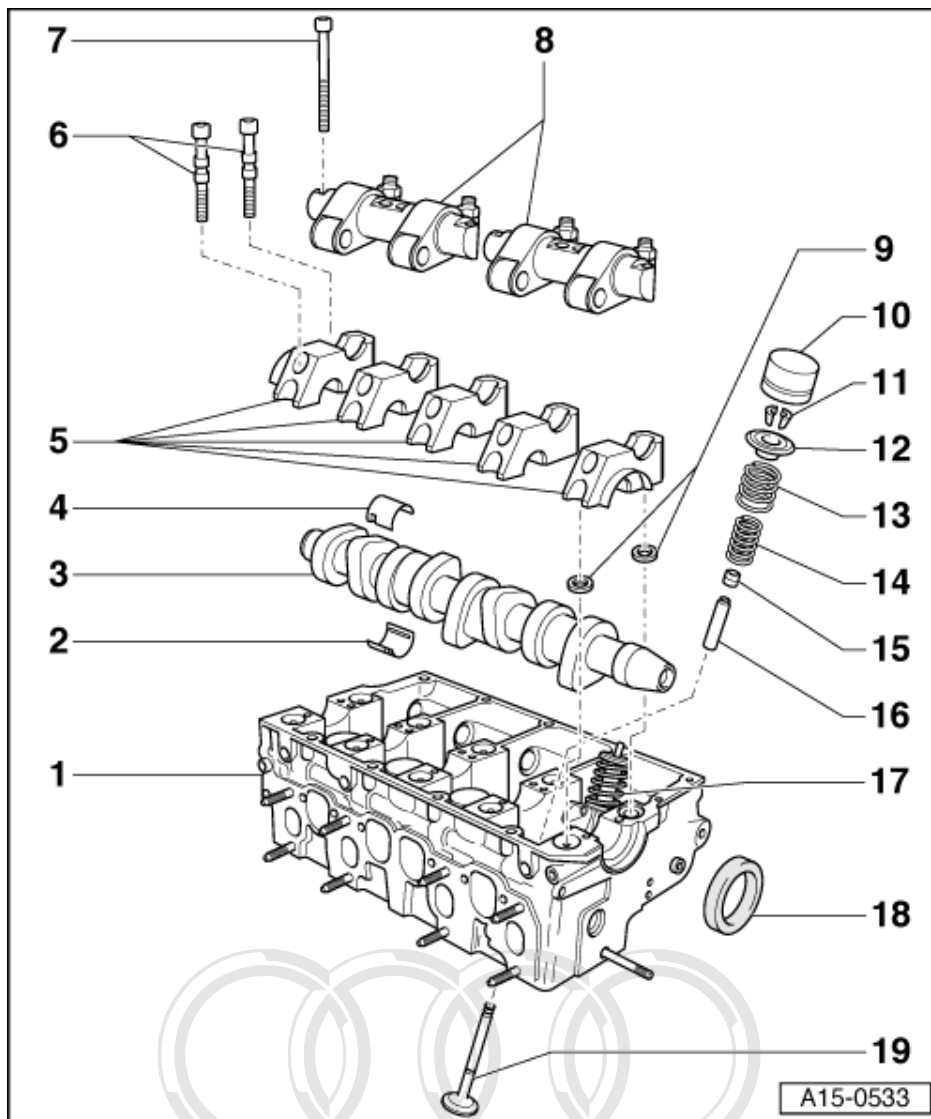
- ◆ Installation sequence => Installing camshaft, Page 15-104
- ◆ Seal bearing caps 1 and 5 with sealant => Fig.15-92
- ◆ Sealants

=> Parts List

6 8 Nm + 90° (1/4 turn) further

- ◆ Replacing

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7 20 Nm + 90° (1/4 turn) further

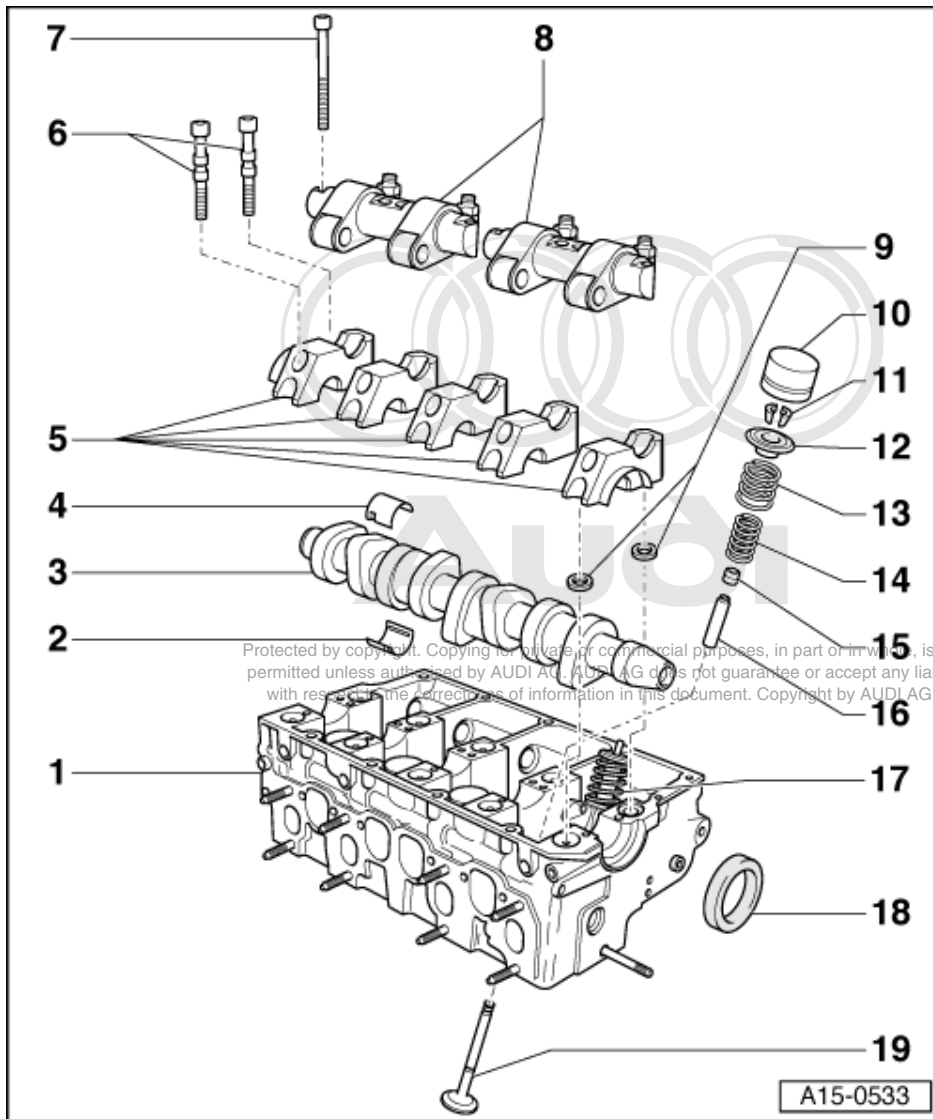
- ◆ Replacing
- ◆ Note sequence when loosening => Page 15-103
- ◆ Note sequence when tightening => Page 15-107

8 Valve lever shaft

- ◆ Mark
- ◆ Do not interchange
- ◆ Note sequence when loosening => Page 15-103
- ◆ Note sequence when tightening => Page 15-107

9 Washer

- ◆ For cylinder head bolts
- ◆ Before assembly of bearing caps insert into cylinder head



10 Hydraulic bucket tappet

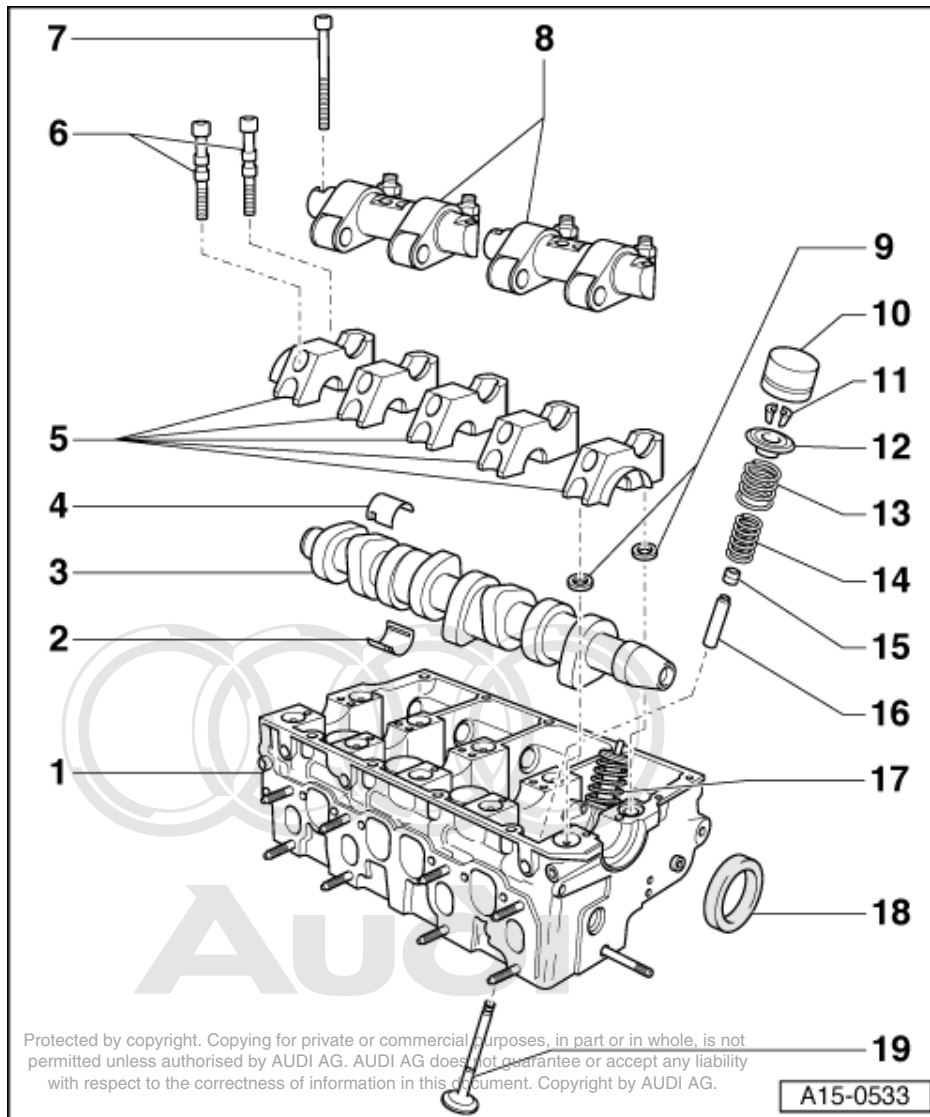
- ◆ Checking => Page 15-110
- ◆ Removing and installing
=>Page 15-112
- ◆ Do not interchange
- ◆ Store with cam contact surface downwards
- ◆ Before installing check camshaft axial play
=>Page 15-93
- ◆ Oil contact surface

11 Valve cotteners

12 Upper valve spring bracket

13 Exterior valve spring

- ◆ Removing and installing with cylinder head installed
=>Page 15-112
- ◆ Removing and installing with cylinder head removed with 2037

**14 Inner valve spring**

- ♦ Removing and installing with cylinder head installed
=>Page 15-112
- ♦ Removing and installing with cylinder head removed with 2037

15 Valve stem seal

- ♦ Replacing => Page 15-112.

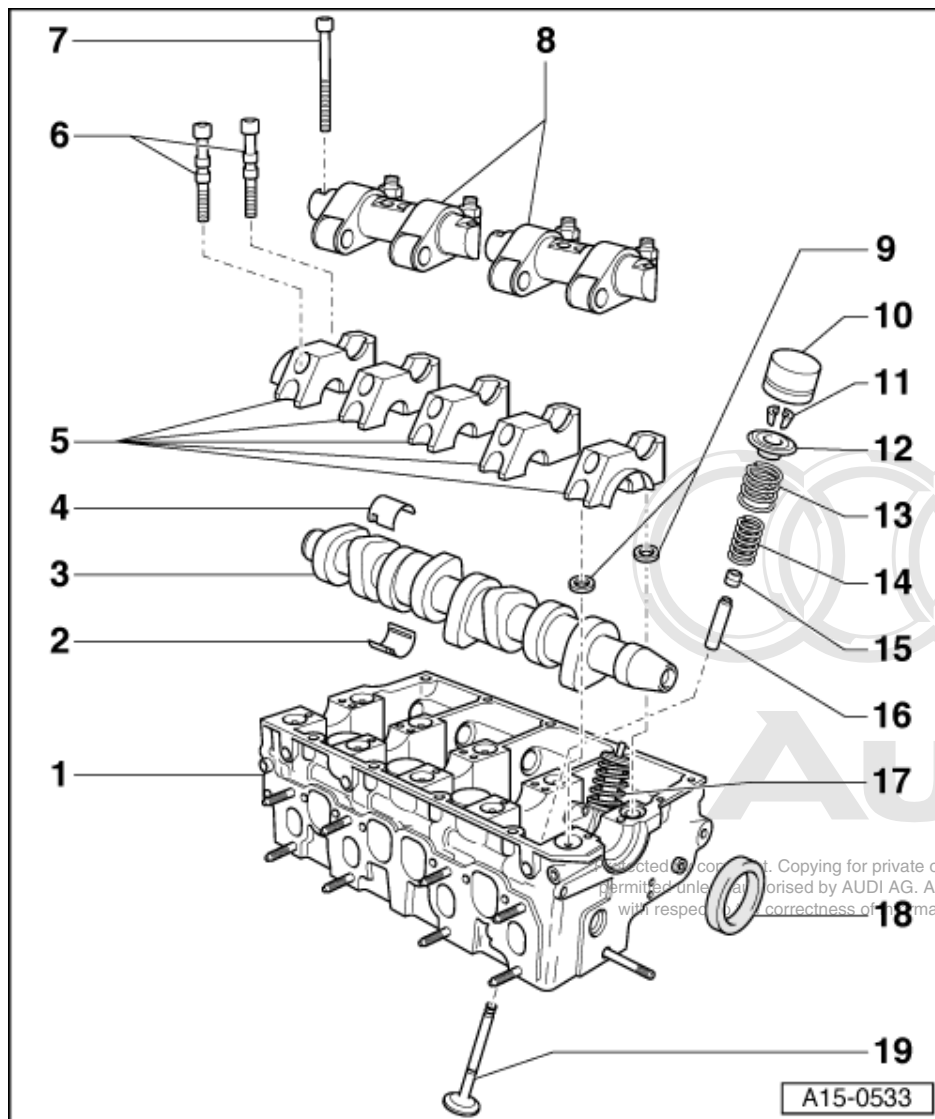
16 Valve guide

- ♦ Checking => Page 15-123
- ♦ When exceeding wear limit replace cylinder head

17 Pump jet unit

- ♦ Removing and installing:

=> TDI Injection and Glow Plug System (4-cyl Pump Jet); Repair group 23; Servicing diesel direct injection system; Removing and installing pump-jet unit Servicing diesel direct injection system Removing and installing pump-jet unit

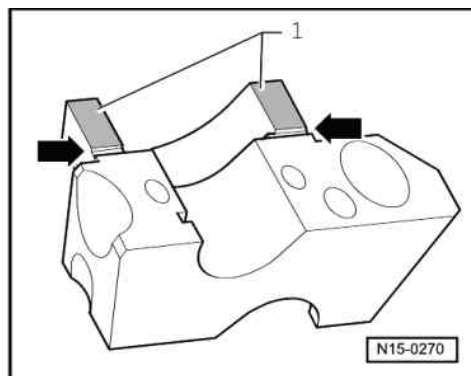


18 Sealing ring

- ♦ Removing and installing
=>Page 15-94

19 Valves

- ♦ Do not rework only grinding in is permitted
- ♦ Valve dimensions
=> Fig.15-92



-> Fig.1 Sealing bearing caps 1 and 5

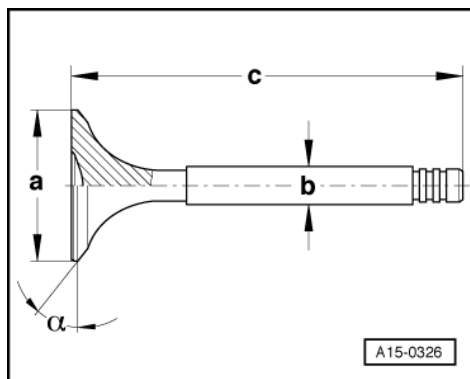
- Apply the sealant thinly and evenly to the surfaces -1-.

♦ Sealants

=> Parts List

Note:

Make sure that the sealant does not come in contact with the grooves -arrows- and the other surfaces.



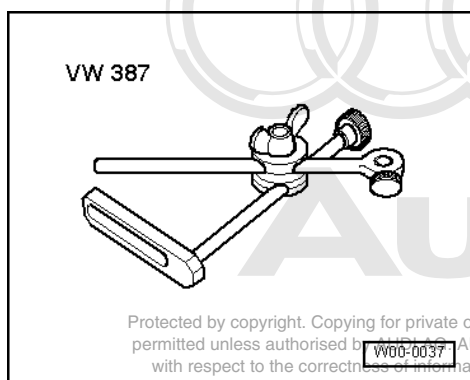
-> Fig. 2 Valve dimensions

Note:

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

Dim.	Inlet valve	Exhaust valve
øa mm	35.95	31.45
øa mm	6.980	6.956
c mm	89.95	89.95
α <°	45	45

5.2 - Checking camshaft axial play

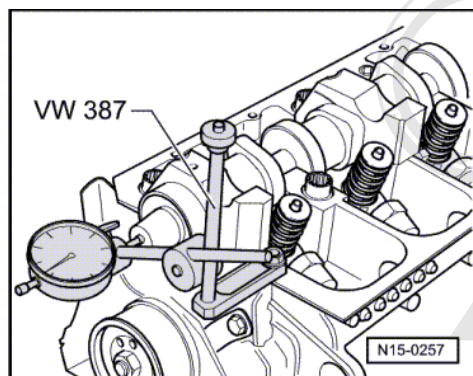


Special tools and workshop equipment required

♦ Universal dial gauge bracket VW 387



- ♦ Dial gauge

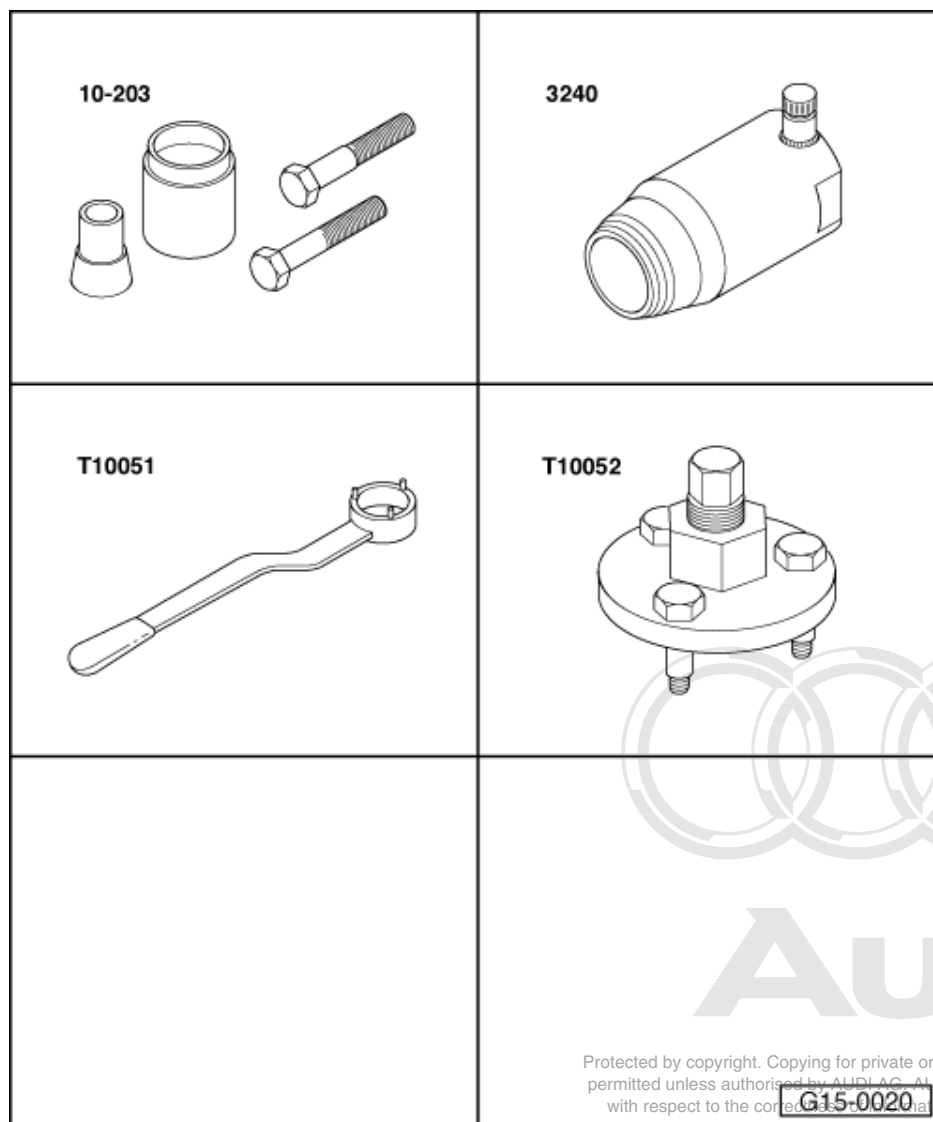


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Test sequence

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

5.3 - Removing and installing oil seal for camshaft

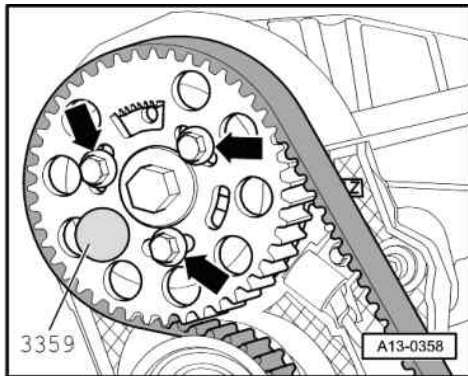


Special tools and workshop equipment required

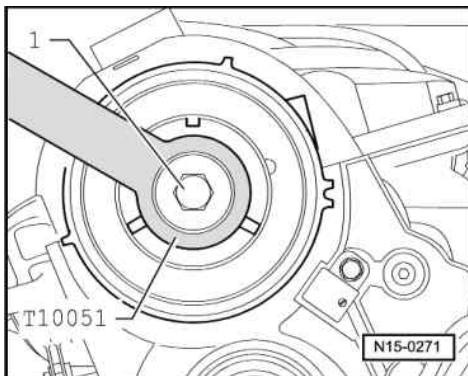
- ◆ Installing tool 10-203
- ◆ Oil seal extractor 3240
- ◆ Counterhold T10051
- ◆ Puller T10052
- ◆ Bolt M12x65

Removing

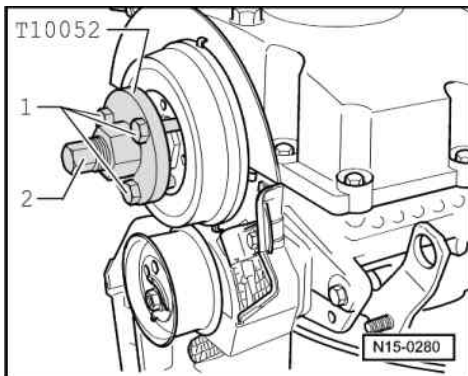
- Cylinder head installed



- Removing toothed belt => Page 13-51.
- Pull out mandrel 3359.
- -> Remove camshaft sprocket bolts -arrows-.
- Remove the camshaft sprocket from hub.



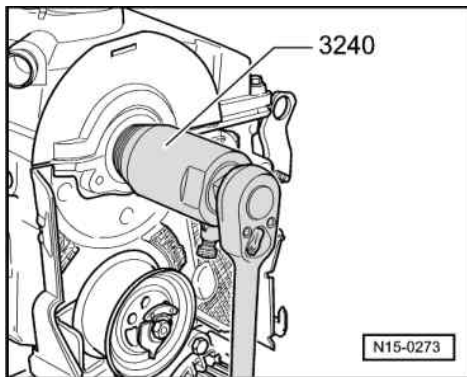
- -> Undo the securing bolts -1- on the hub. Use counterhold T10051.
- Unscrew securing bolt of hub approx. 2 turns.



- -> Attach puller T10052 and screw bolts -1- into hub.
- Pull off hub. For this counterhold on hexagon (A/F 30) of puller and screw in bolt -2-.
- Take the hub off the camshaft taper.



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- Adjust inner part of oil seal extractor 3240 until it is flush with the outer part and lock in position with knurled screw.
- -> Lubricate threaded head of oil seal extractor, place it in position and exerting firm pressure, screw it into oil seal as far as possible.
- Loosen knurled screw and turn inner part of extractor against camshaft until oil seal has been extracted.
- Clamp flats of oil seal extractor in vice. Remove oil seal with pliers.
- Clean contact surface and sealing surface.

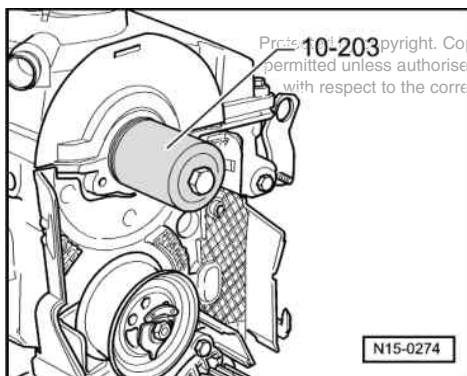
Installing

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

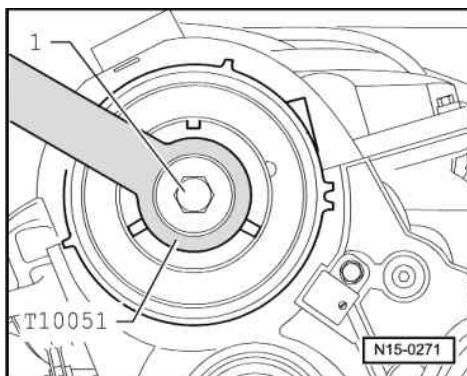
Note:

The sealing lip of the oil seal must not be additionally oiled or greased.

- Remove oil residue on camshaft journal with a clean cloth.
- Bond groove on cone of camshaft (e.g. with adhesive tape).
- Carefully attach oil seal to camshaft.

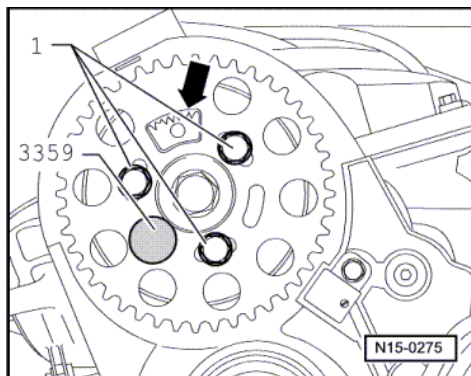


- -> Press in oil seal with the thrust pad of installing tool 10-203 and bolt M12x65 until limit stop.





- Attach hub to camshaft.
- -> Tighten the bolt -1- to 100 Nm. For this counterhold with T10051.



- -> Push camshaft sprocket onto hub.

Note:

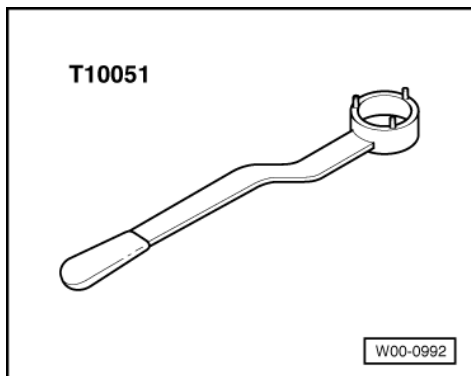
The spline -arrow- of the camshaft sprocket must face upwards.

- Screw in bolts -1- loosely.
- Lock the hub with mandrel 3359.
- Install toothed belt (adjust valve timing) => Page 13-62.

Tightening torque

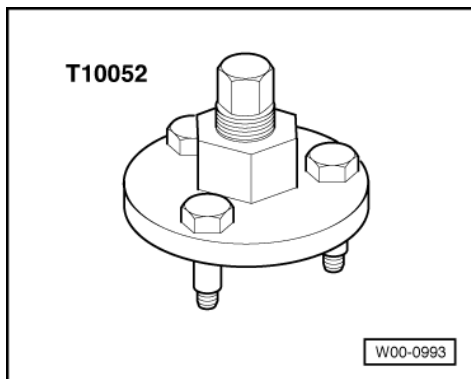
Component	Nm
Hub to camshaft	100

5.4 - Removing and installing camshaft



Special tools and workshop equipment required

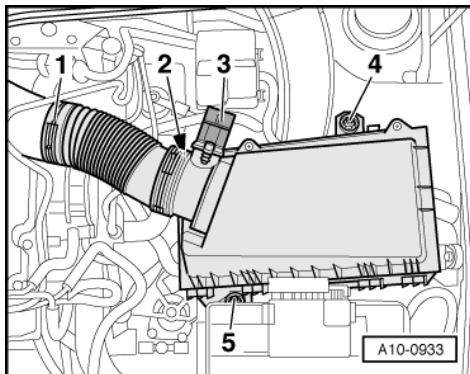
- ♦ Counterhold T10051



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- ◆ Puller T10052
- ◆ Locking compound

=> Parts List



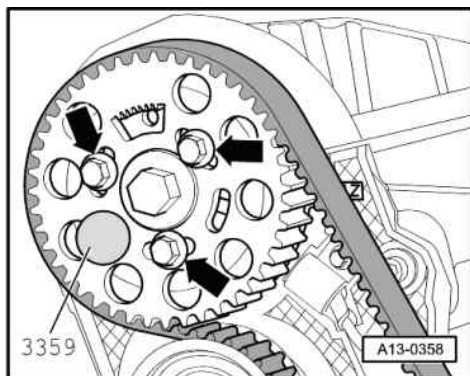
Removing

- Cylinder head installed
- Remove toothed belt => Page 13-51.
- -> Remove air duct hose-1- from air duct pipe.
- Detach connector of air mass meter-3-.
- Unscrew bolts -4- and -5-.
- Remove vent hose -2- off air cleaner housing.
- Remove air cleaner housing.
- Remove tandem pump:

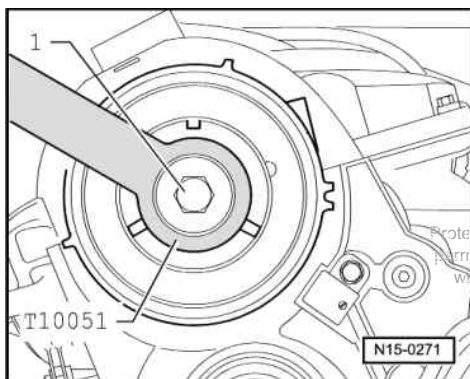
=> Fuel Supply - Diesel Engines; Repair group 20

Note:

Do not detach hoses.



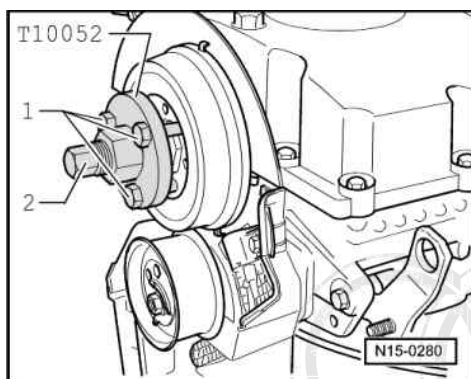
- Pull out mandrel 3359.
- -> Remove camshaft sprocket bolts -arrows-.
- Remove the camshaft sprocket from hub.



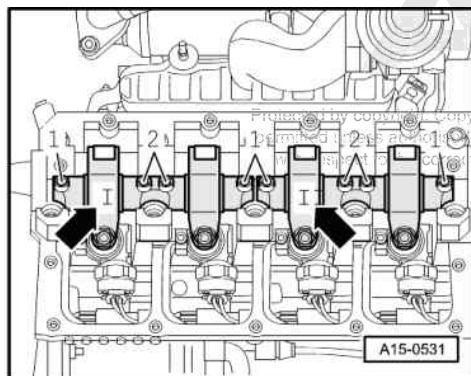
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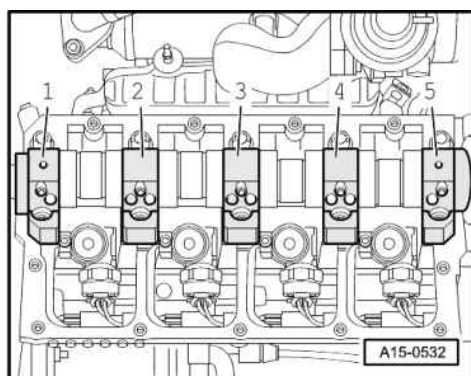
- -> Undo the securing bolts -1- on the hub. Use counterhold T10051.
- Unscrew securing bolt of hub approx. 2 turns.



- -> Attach puller T10052 and screw bolts -1- into hub.
- Pull off hub. For this counterhold on hexagon (A/F 30) of puller and screw in bolt -2-.
- Take the hub off the camshaft taper.
- Remove cylinder head cover => Page 15-8.



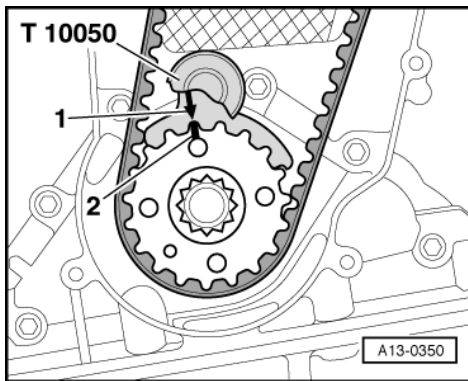
- -> Mark swivel lever axis with waterproof felt-tip pen to avoid interchanging and thus the basic setting of the pump-jet-units -arrows-.
- Loosen the exterior bolts -1- first on both swivel lever axis and then the interior bolts -2-.
- Detach swivel lever axis.



- -> First remove bearing caps 1, 3 and 5. Loosen bearing caps 2 and 4 alternately and diagonally.

Notes:

- ♦ Make sure that the camshaft bearing shells are not interchanged.
- ♦ Mark allocation of camshaft bearing shells on rear with a waterproof felt-tip pen.
- Take out camshaft.



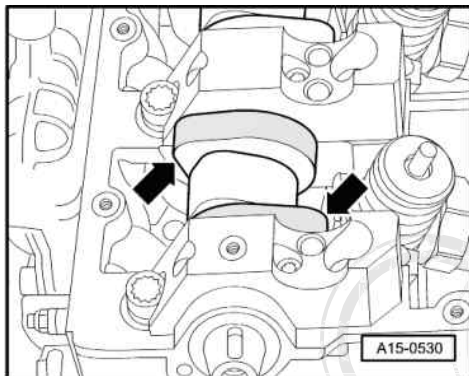
Installing

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

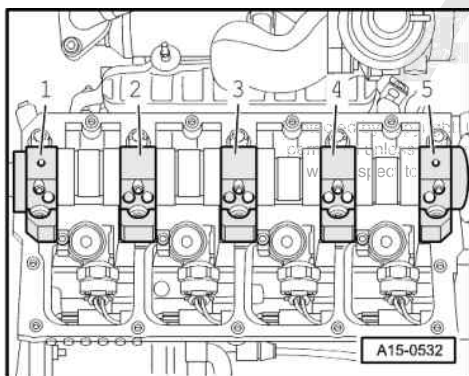
- -> Toothed belt sprocket of crankshaft with crankshaft stop T10050 locked onto TDC cylinder 1.

Notes:

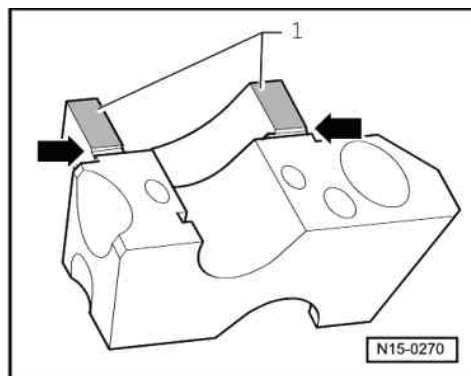
- ◆ Do not interchange used bearing shells (note marking).
- ◆ When installing the camshaft note correct seating of the retaining lugs of bearing shells in the bearing caps and the cylinder head.



- Oil camshaft running surfaces.
- Install camshaft in TDC position for cylinder 1:
 - -> The cams for cylinder 1 must point upwards evenly on camshaft -arrows-



- -> Tighten bearing caps 2 and 4 alternately and diagonally.



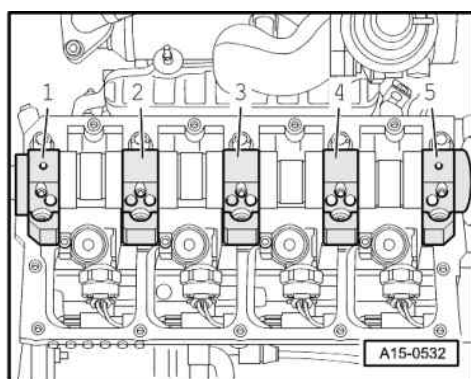
- -> Apply sealant thinly and evenly at bearing caps 1 and 5 onto the surfaces -1-.

♦ Sealants

=> Parts List

Note:

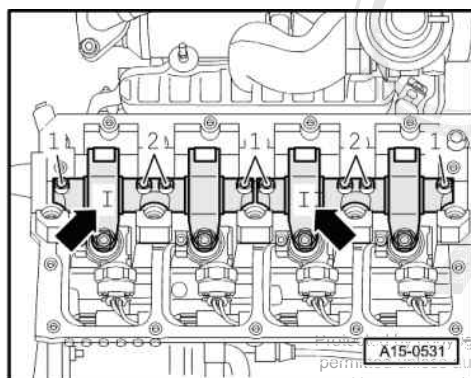
Make sure that the sealant does not come in contact with the grooves -arrows- and the other surfaces.



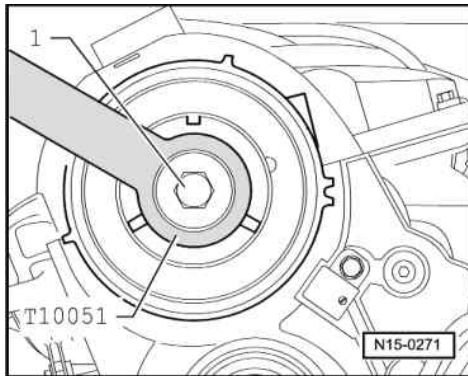
Note:

The bearing cap 5 must be flush with the outer edge of the cylinder block as this could cause leaks at the tandem pump.

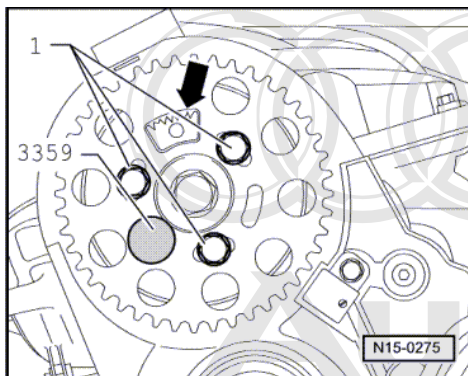
- -> Install bearing caps 1, 3 and 5 and also tighten.
- Install oil seal for camshaft => Page 15-94.



- -> Install swivel lever axis. When removing note the markings -arrows-.
- Firstly tighten the inner bolts -2- followed by the outer bolts -1- in several stages.



- Attach hub to camshaft.
- -> Tighten the bolt -1- to 100 Nm. For this purpose, counterhold with T10051.



- -> Push camshaft sprocket onto hub.

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Note:

The spline -arrow- of the camshaft sprocket must face upwards.

- Screw in bolts -1- loosely.
- Lock the hub with mandrel 3359.
- Install toothed belt (adjust valve timing) => Page 13-62.
- Install tandem pump:

=> Fuel Supply - Diesel Engines; Repair group 20

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.
- If the swivel lever axis or spherical bolts and adjusting bolts were replaced the pump jet units must be adjusted:

=> TDI Injection and Glow Plug System(4-cyl Pump Jet); Repair group 23; Servicing diesel direct injection system; Removing and installing pump jet unit Servicing diesel direct injection system Removing and installing pump jet unit

- Install cylinder head cover => Page 15-10.

Tightening torques

Component	Nm
Bearing cap to cylinder head	8 + 90°1)2)



Component	Nm
Valve lever shaft	20 + 90°1)2)
Hub to camshaft	100

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

5.5 - 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.

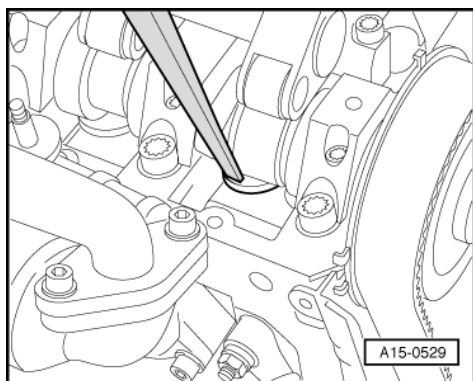
Test sequence

- 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).

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

- Remove cylinder head cover => Page 15-8.
- Rotate crankshaft until the cams of the bucket tappets to be checked are pointing upwards:
 - Vehicles with manual gearbox: push vehicle forwards with 4th gear engaged and ignition switched off.
 - Vehicles with automatic gearbox: Remove centre and right noise insulation.
 - Turn crankshaft clockwise at crankshaft toothed belt sprocket central bolt.

Determine play between cam and tappet.

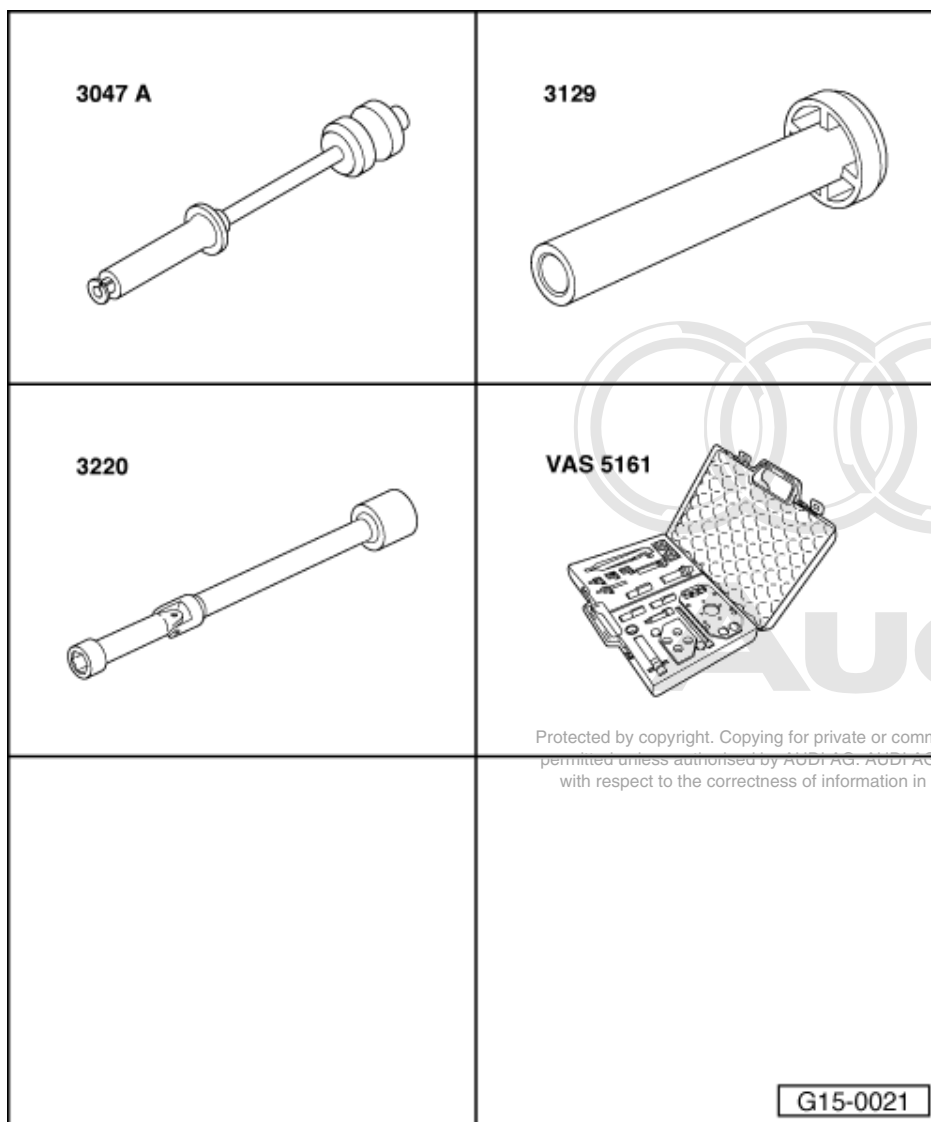


- -> Use a wooden or plastic wedge to push down bucket tappet. If an 0.20 mm feeler gauge can be inserted between camshaft and tappet, renew tappet.
- Replacing bucket tappet => Removing camshaft, Page 15-100.

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.

5.6 - Replacing valve stem seals



Special tools and workshop equipment required

- ◆ Puller 3047 A
- ◆ Fitting tool 3129
- ◆ Flexible-head spanner 3220
- ◆ Disassembly and assembly tool VAS 5161

Removing

- Cylinder head installed

Note:

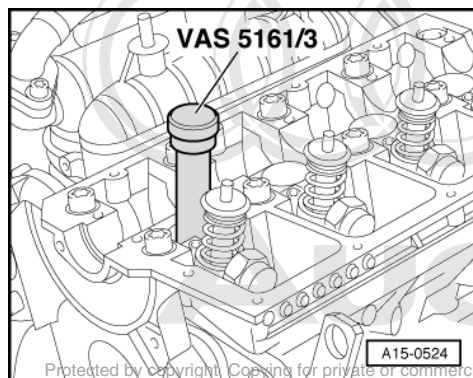
When cylinder head was removed the valve stem seals can be replaced when using special tool 2037.

- Removing camshaft => page 15-100.
- Remove camshaft bearing shells from cylinder head.

Notes:

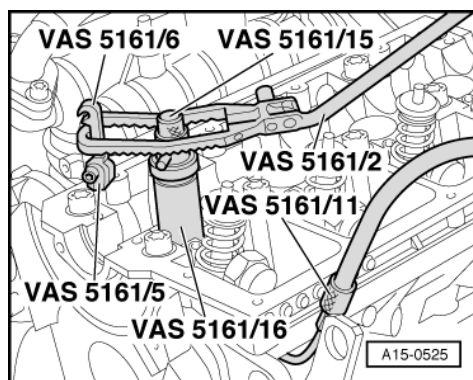
- ◆ Make sure that the camshaft bearing shells are not interchanged.
- ◆ Mark allocation of camshaft bearing shells on rear with a waterproof felt-tip pen.

- ♦ 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.

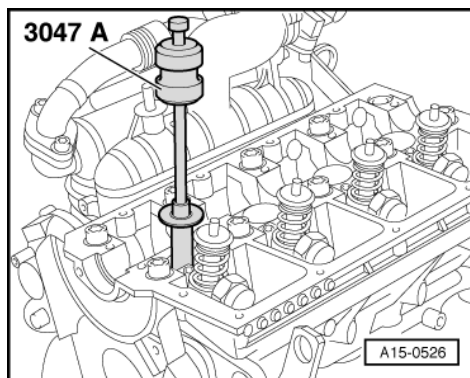


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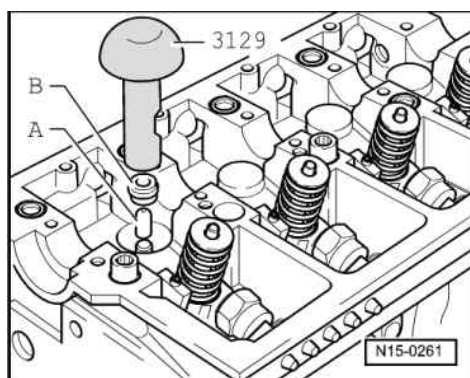
- ➔ Install pin VAS 5161/3 into bucket tappet guide.
- Knock valve wedges of all valves loose using a plastic hammer.
- Unplug connector console from glow plugs.
- Remove all glow plugs using flexible-head spanner 3220.



- ➔ Screw in adapter VAS 5161/11 into the relevant glow plug thread hand tight.
- Screw in catch part VAS 5161/6 with attachment fork (M6) VAS 5161/5 into a thread bore on 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.
- Connect adapter VAS 5161/11 via a commercially available intermediate piece to the pressure connection.
 - Minimum pressure: 6 bar
- 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.

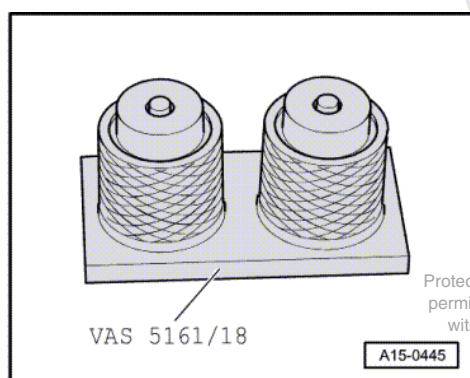


Installing

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 valve guide using press tool 3129.
- Remove plastic sleeve again.



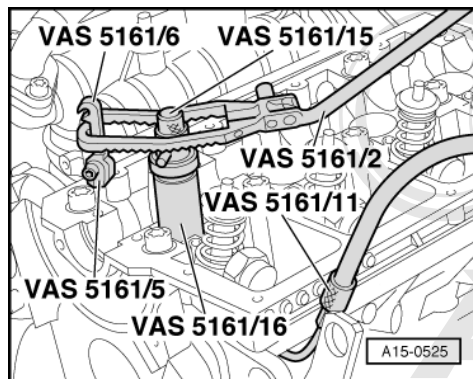
- -> If the valve wedges were taken out of the assembly cartridge they must first be inserted into the installing tool VAS 5161/18.

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Note:

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 15-104.

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

5.7 - Reworking valve seats

Note:

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

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 15-123.
- ♦ 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.

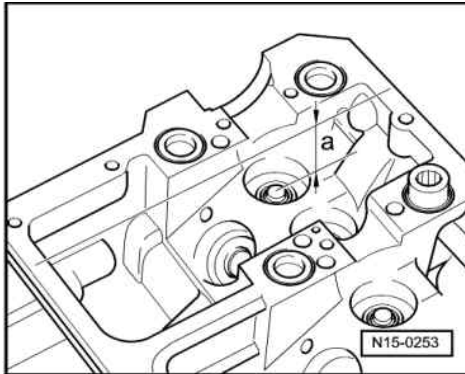
- ♦ If the maximum permissible reworking dimension is 0 mm or less than 0 mm, repeat the measurement with a new valve. If the measured result is again 0 mm or less than 0 mm, renew the cylinder head.

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 shaft end (upper edge) and upper cylinder head area with a depth gauge.
- Calculate max. permissible reworking dimension from measured distance and minimum dimension.

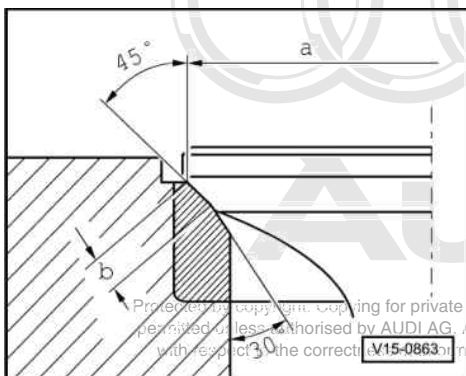
Minimum dimensions	
Inlet valve	Exhaust valve
43.4 mm	43.2 mm

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

Example for inlet valve:	
Measured distance	44.1 mm
- Minimum dimension	-43.4 mm
= Max. permissible reworking dim.	= 0.7 mm

Note:

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



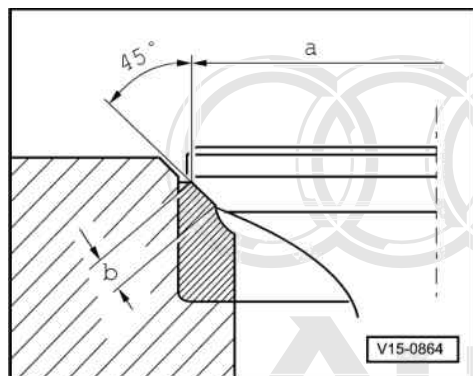
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-> Reworking inlet valve seat

Dim.		Inlet valve seat
øa	mm	35.7
b	mm	1.6
	45°	Valve seat angle

Note:

The 30 ° angle on the valve seat is vital for the flow characteristics in the inlet duct.

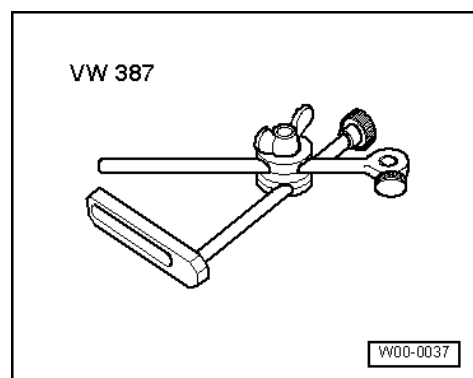


-> Reworking exhaust valve seat

Dim.		Exhaust valve seat
øa	mm	31.4
b	mm	2.7
	45°	Valve seat angle

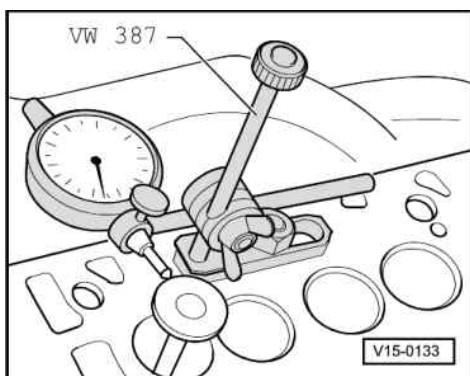
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5.8 - Checking valve guides



Special tools and workshop equipment required

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



- -> Set valve in guide. The end of the valve stem is flush with 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. The valve guides cannot be replaced.
- ♦ If the valve must be renewed as part of a repair, use a new valve for the calculation.

5.9 - Checking valves

- Visually inspect stem and seat for scoring. Replace valves in the case of severe scoring.



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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, and the oil cooler renewed in order to prevent further damage occurring later.
- ♦ The oil level must not be above max. mark on dipstick - danger of damage to catalytic converter.
- ♦ Oil spray jet and pressure relief valve
=> Fig.17-6

Viscosity grades and oil specifications:

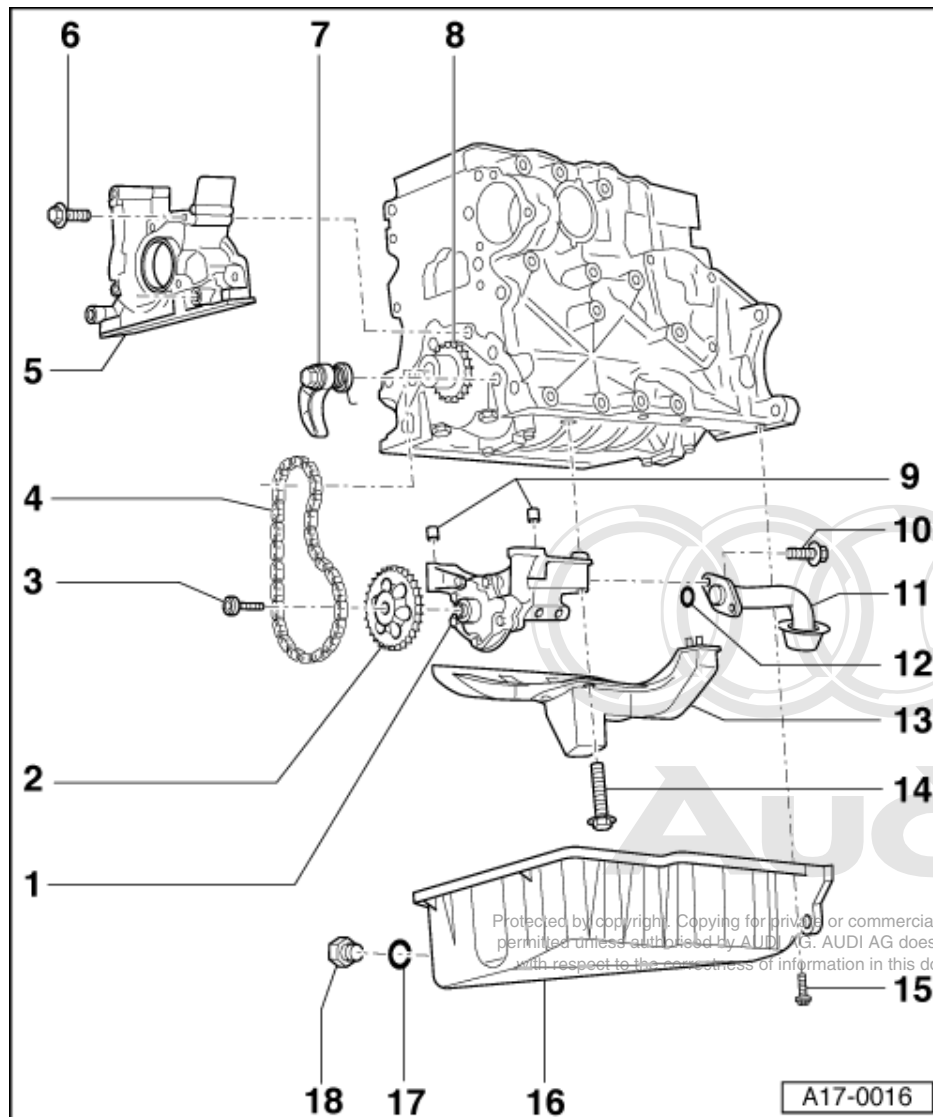
=> Maintenance Manual

Oil system capacity:

=> Exhaust Emission Test binder

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1.2 - Part I



1 Oil pump

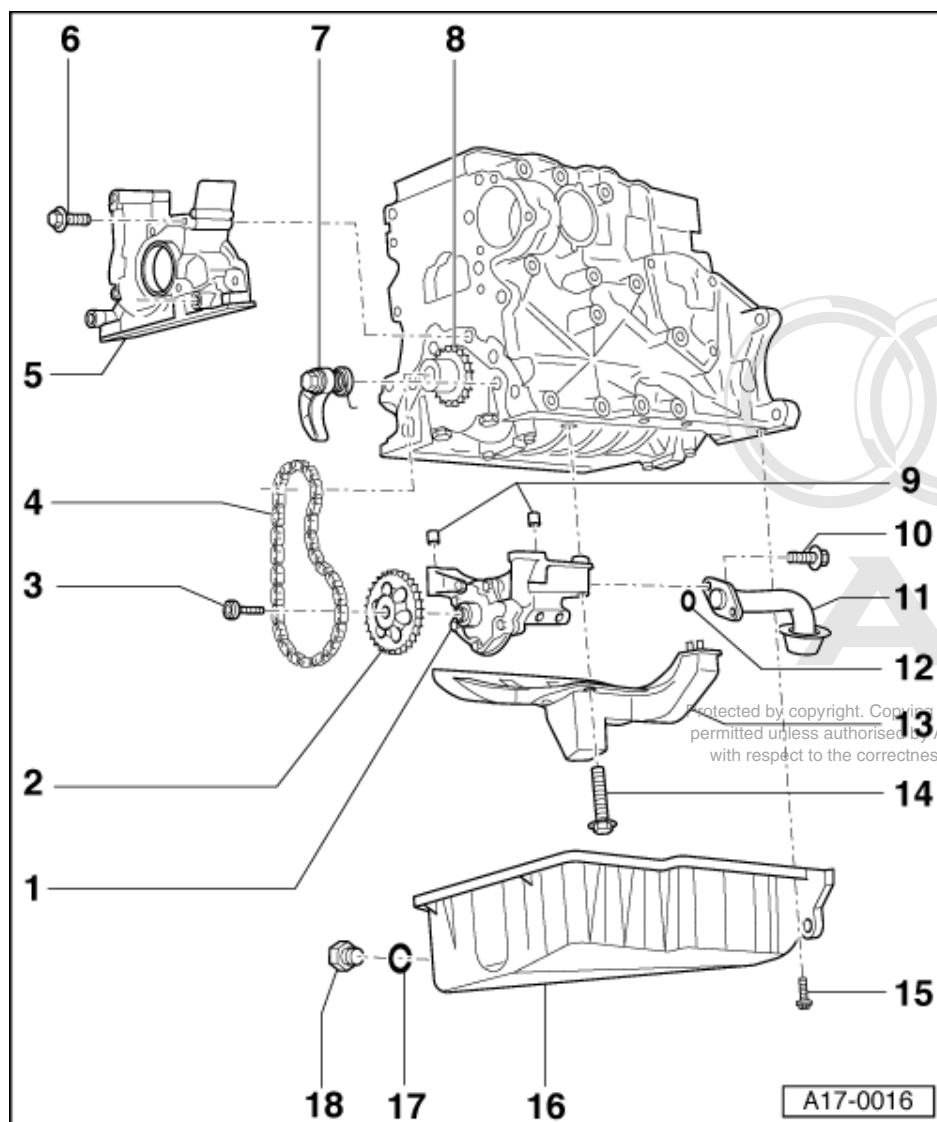
- ♦ With pressure relief valve (12 bar)
- ♦ Removing and installing
=>Page 17-17
- ♦ Prior to installation check that both dowel sleeves -Item 9- used for centring the oil pump/cylinder block are still present.
- ♦ Renew pump if there is scoring on moving surfaces and gears.
- ♦ Tightening torque for oil pump cover to oil pump housing: 10 Nm

2 Chain sprocket for oil pump

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

3 20 Nm + 90° (1/4 turn) further

- ♦ Replacing

**4 Drive chain for oil pump**

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

5 Sealing flange - front

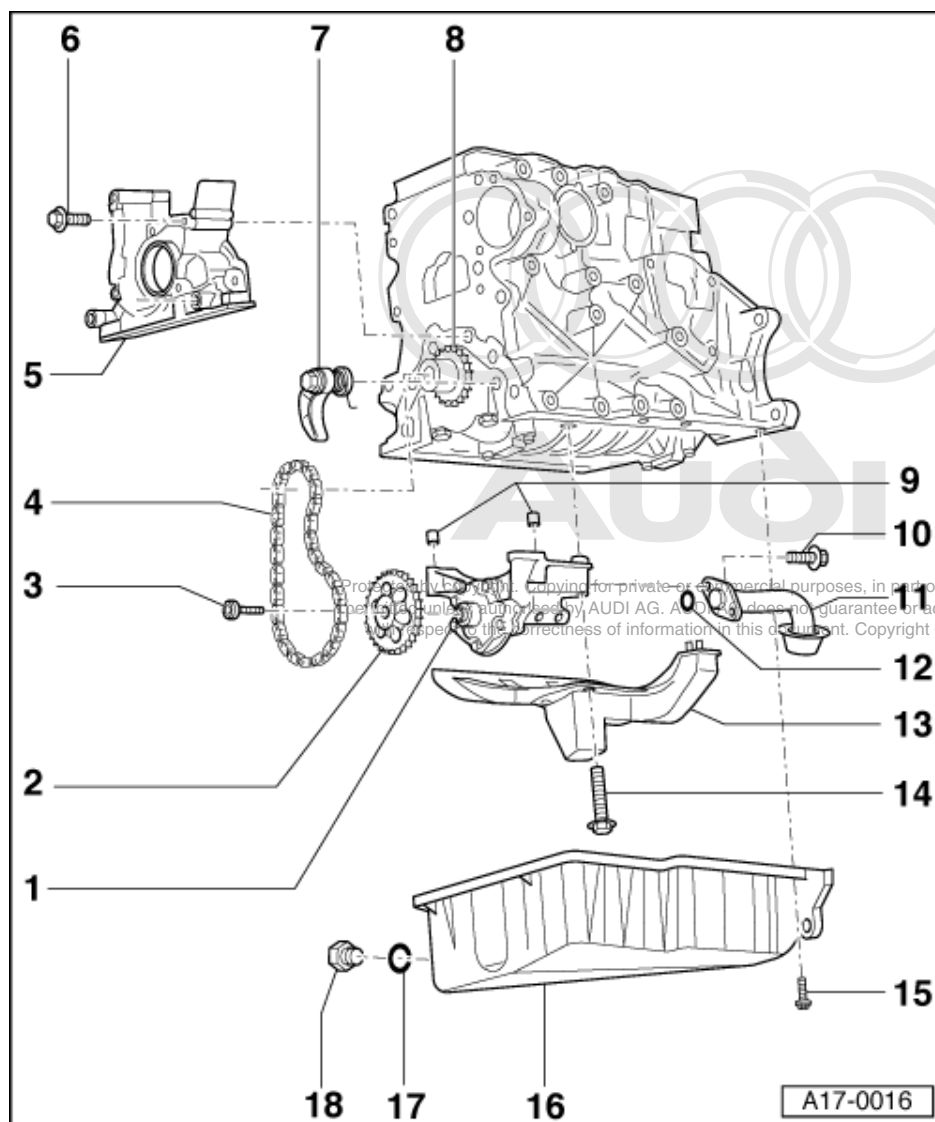
- ◆ Apply silicone sealant when installing => Page 13-79
- ◆ Sealants

=> Parts List

- ◆ Renewing crankshaft oil seal on pulley end => Page 13-74

6 15 Nm**7 Chain tensioner**

- ◆ Tighten to 16 Nm
- ◆ Do not dismantle
- ◆ Note installation position
- ◆ Pre-tension spring and engage before installing
- ◆ If the spring is broken replace chain tensioner complete

**8 Chain sprocket for oil pump**

- ♦ Removing and installing
=>Page 13-101

9 Dowel sleeves

- ♦ 2 off

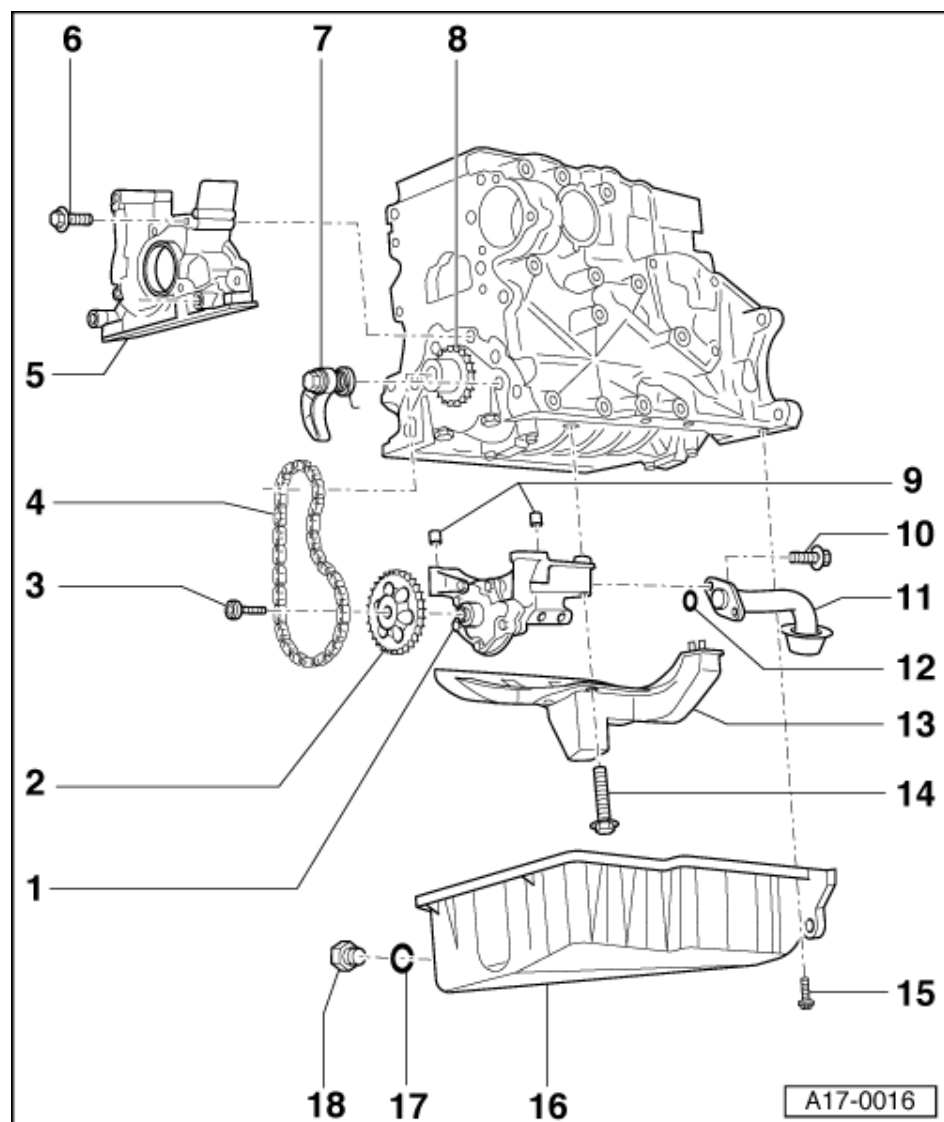
10 15 Nm**11 Suction pipe**

- ♦ Clean strainer if soiled

12 O-ring

- ♦ Replacing

13 Baffle plate**14 16 Nm****15 15 Nm**



16 Oil pan

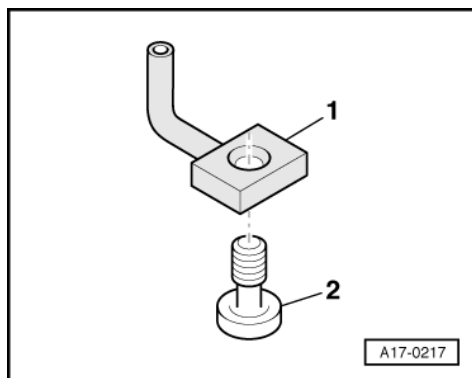
- ♦ Apply silicone sealant when installing
- ♦ Sealants

=> Parts List

17 Sealing ring

- ♦ Replacing

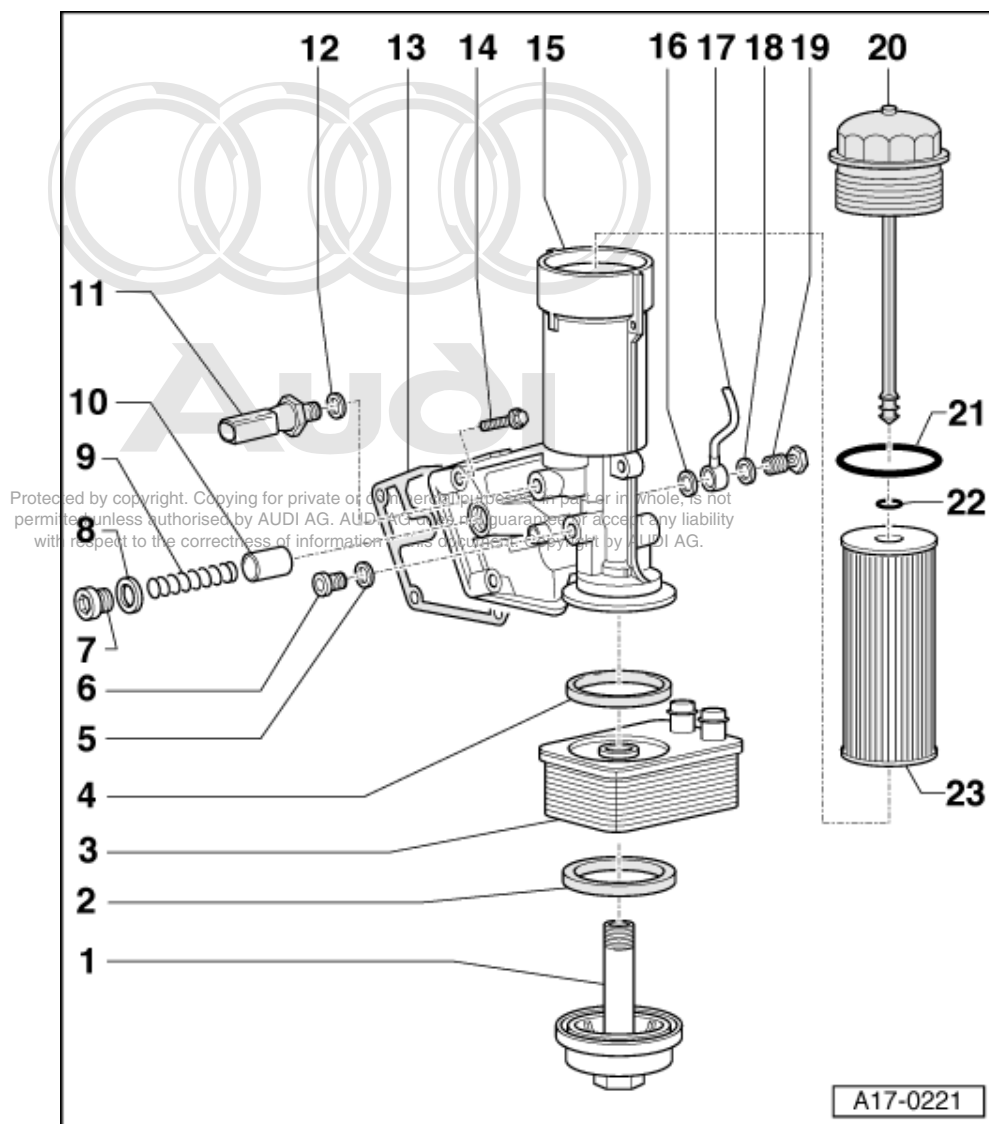
18 Oil drain plug, 30 Nm



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

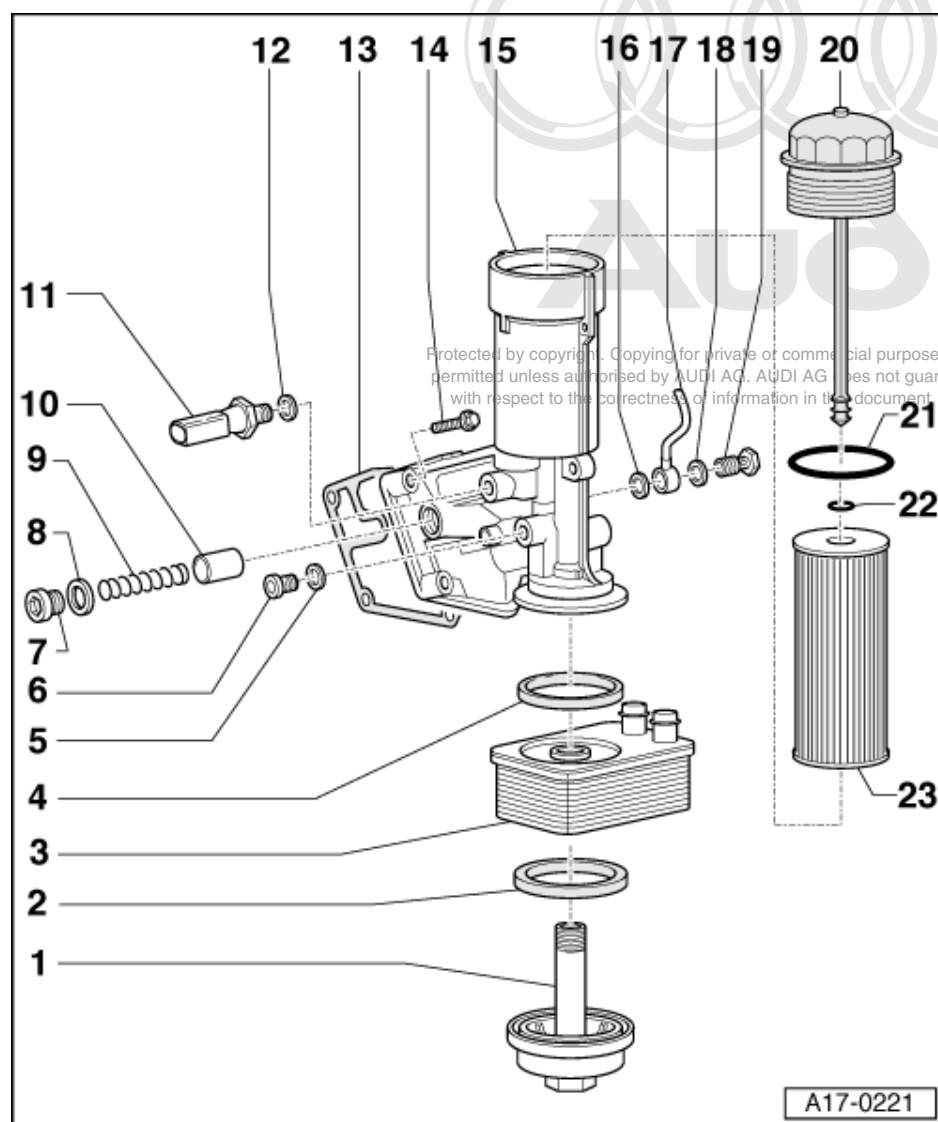
- 1 - Oil spray jet (for cooling of piston)
- 2 - Bolt with pressure relief valve - 27 Nm
- Opening pressure 1.3 ... 1.6 bar

1.3 - Part II





- 1 Screw plug - 25 Nm
- 2 Seal
- ♦ Replacing
- 3 Fluid cooler
- ♦ Different versions
- ♦ See note
=>Page 17-1
- ♦ Coolant hose connection diagram => Page 19-4
- 4 Seal
- ♦ Replacing
- 5 Sealing ring
- ♦ Replacing
- 6 Screw plug - 10 Nm
- 7 Screw plug - 40 Nm



- 8 Sealing ring
- ♦ Replacing
- 9 Spring
- ♦ For pressure relief valve approx. 5 bar
- 10 Piston
- ♦ For pressure relief valve approx. 5 bar
- 11 Oil pressure switch -F1 - 20 Nm

- ♦ 0.7 bar - brown
- ♦ Checking => Page 17-19

12 Sealing ring

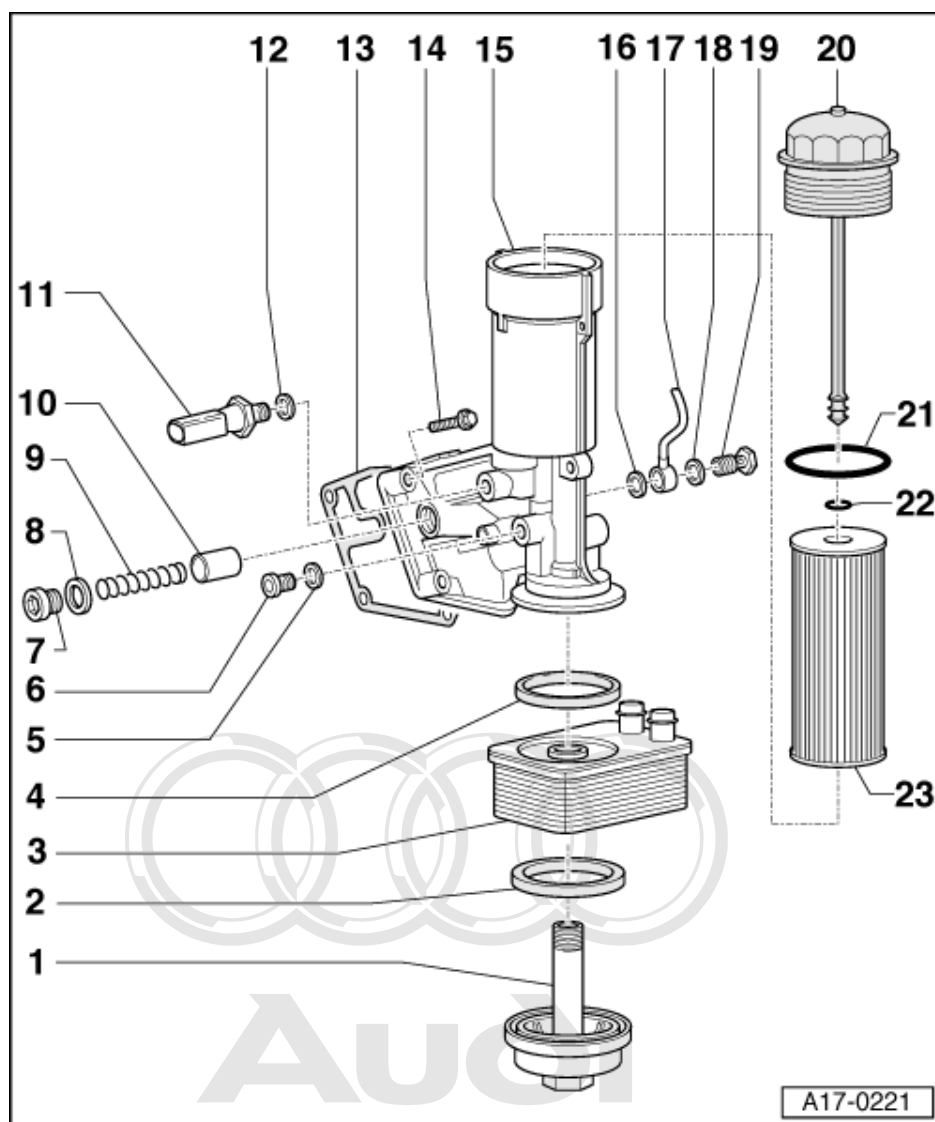
- ♦ Replacing

13 Seal

- ♦ Replacing

14 14 Nm + 90° (1/4 turn) further

- ♦ Replacing
- ♦ First attach bolt top left and right, then tighten all four bolts diagonally



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

16 Sealing ring

- ♦ Replacing

17 Oil supply pipe

- ♦ To turbocharger
- ♦ Note installation sequence:
 - First screw in both wiring ends loosely.
 - Then tighten wiring ends to final torque.
 - Lastly attach bracket.

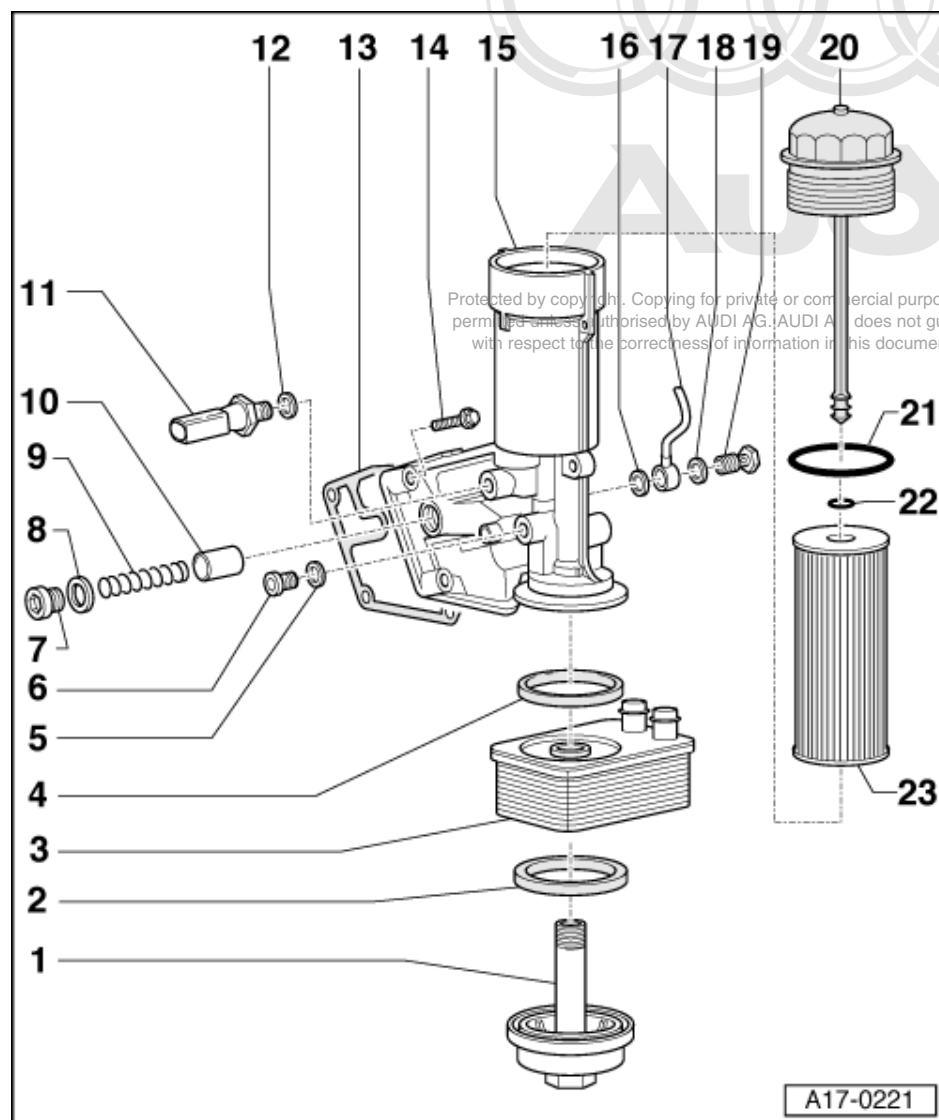
18 Sealing ring

- ♦ Replacing

19 Banjo bolt - 25 Nm

20 Sealing cap - 25 Nm

- ♦ Loosen and tighten with oil filter wrench 3417



21 O-ring

- ♦ Replacing

22 O-ring

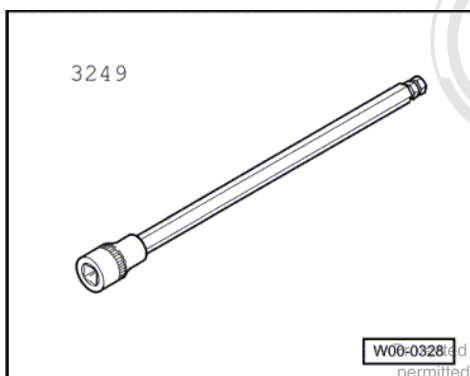
- ♦ Replacing

23 Oil filter element

- ♦ Remove from sealing cap -Item 20-.
- ♦ When changing filter, replace O-rings -Item 21- and -Item 22-
- ♦ Note correct installation position: Top
- ♦ Observe change intervals

=> Maintenance Manual

1.4 - Removing and installing oil pan

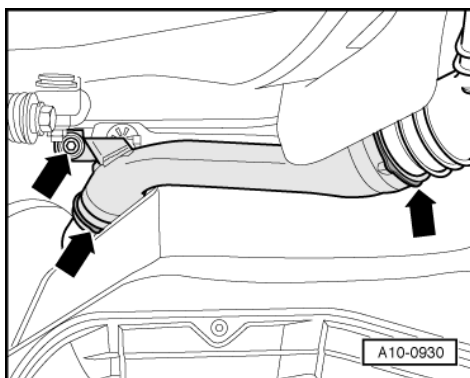


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Special tools and workshop equipment required

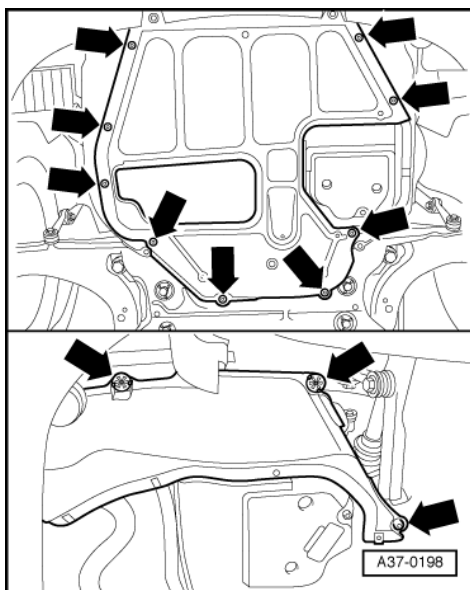
- ◆ Socket 3249
- ◆ Electric drill with plastic brush attachment
- ◆ Protective goggles
- ◆ Silicone sealant

=> Parts List



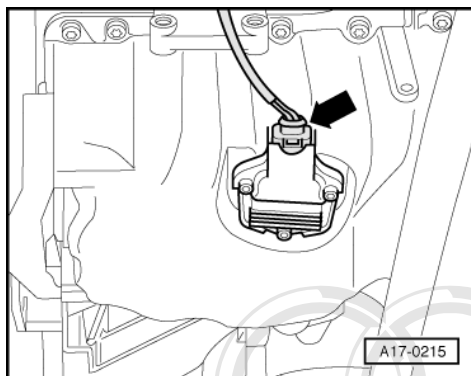
Removing

- -> Remove air duct pipe from right longitudinal member -arrows-.

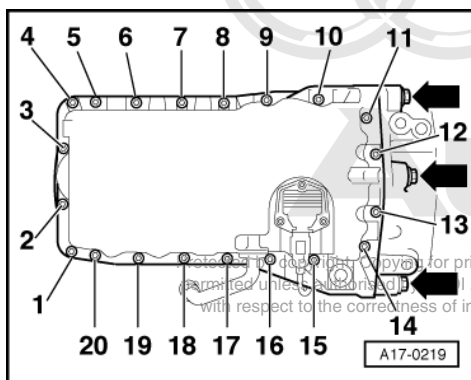




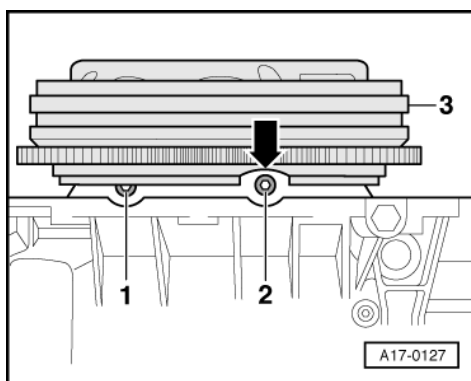
- -> Remove noise insulation in centre and on right -arrows-.
- Drain engine oil.



- -> Detach connector from oil level sender -arrow-.

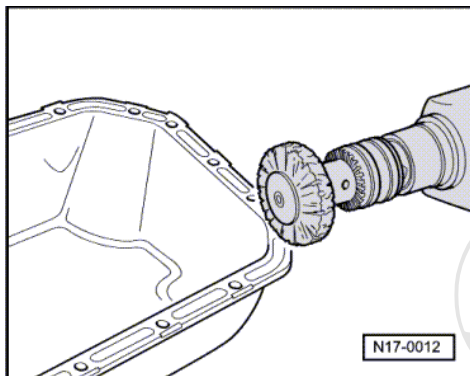


- -> Unscrew bolts of oil pan/gearbox -arrows-.
- Slacken bolts -1 ... 20- diagonally.
- Take off sump: if necessary loosen it by striking lightly with a rubber hammer.



Note:

- > The two rear oil pan bolts -1- and -2- are accessible via the recess -arrow- on the flywheel -3- (turn the flywheel as required).



Installing

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

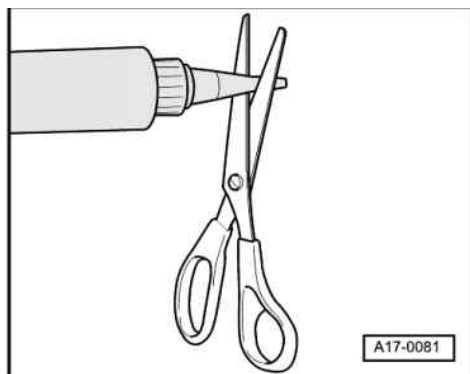
- Carefully remove sealant residues from cylinder block. For this purpose, remove baffle plate.
- -> Remove sealant residues from oil pan, e.g. with rotating plastic brush or similar.

Important

Wear protective goggles.

- Clean sealing surfaces: they must be free of oil and grease.

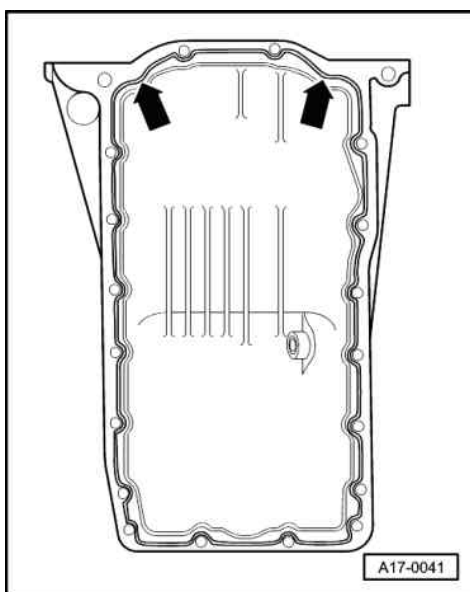
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Note:

The sump must be installed within 5 minutes after applying the silicone sealant.

- -> Cut off nozzle of tube at front marking (ø of nozzle approx. 3 mm).
- Sealant bead width - arrows-: 2 ... 3 mm



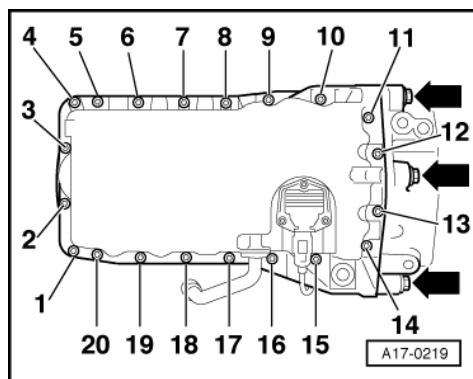
Note:

The bead of sealant must not be thicker than 3 mm, as otherwise excess sealant will enter the sump and obstruct the strainer in the oil intake manifold.

- -> Apply the bead of silicone sealant onto the clean sealing surface of the sump, as illustrated. (The illustration shows the position of the sealant bead on the cylinder block).

Note:

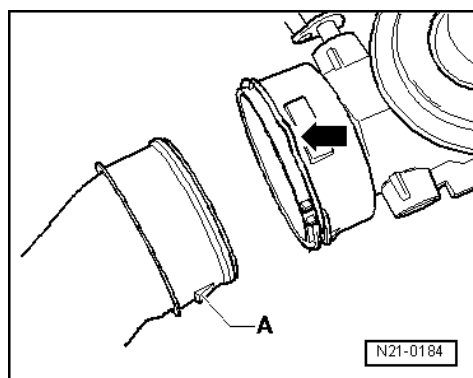
Be particularly careful when applying the bead of sealant around the rear sealing flange (arrows in illustration).



- Immediately install oil pan and tighten bolts in the sequence mentioned:
 - -> Unscrew bolts -1 ... 20- diagonally to 5 Nm.
 - Tighten bolts of oil pan/gearbox -arrows- to 45 Nm.
 - Tighten bolts -1 ... 20- diagonally to 15 Nm.

Notes:

- ♦ When installing the sump with the engine out of the vehicle, ensure that the sump is flush with the cylinder block at the flywheel end.
- ♦ After fitting sump assembly, the sealant must dry for approx. 30 minutes. Only then may the engine oil be filled.



- -> When installing air duct pipes with connectors, ensure that the securing clip -arrow- engages audibly in the retaining lug -A-.
- Fill up with engine oil and check oil level.

Tightening torques

Component	Nm
Sump to cylinder block	15
Sump to gearbox	45

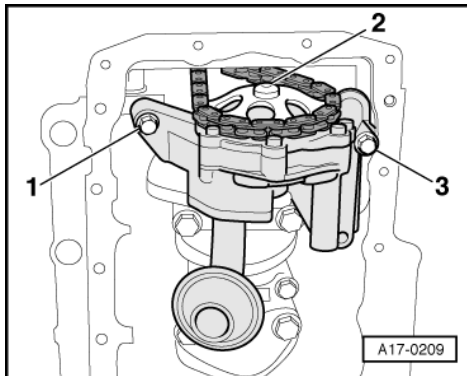
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Component	Nm
Oil drain plug	30

1.5 - Removing and installing oil pump

Removing

- Remove oil pan and baffle plate
=>Page 17-11.



- -> Unscrew bolt -2-.
- Remove chain wheel from oil pump shaft.
- Screw out bolts -1- and -3- and detach oil pump.

Installing

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

- Insert dowel sleeves -Item 17-4 on top of oil pump.
- Oil pump shaft/sprocket wheel installation position: Can only be fitted in one position.
- Installing oil pan => page 17-14

Tightening torques

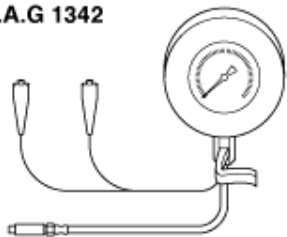
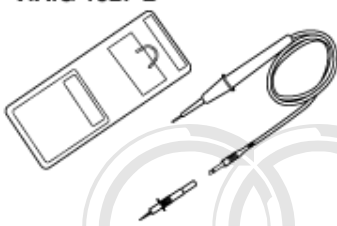

Component	Nm
Chain sprocket to oil pump shaft	20 + 90°1)2)
Oil pump to cylinder block	16

1) Replace bolt

2) 90° corresponds to a quarter of a turn

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1.6 - Checking oil pressure and oil pressure switch

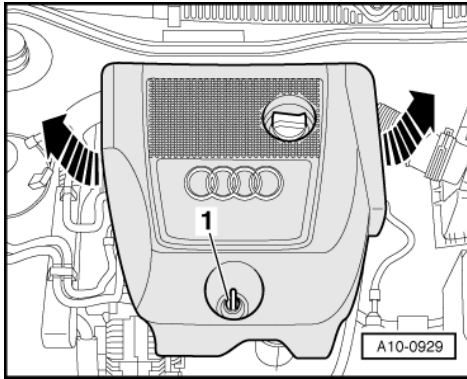
<p>V.A.G 1342</p> 	<p>V.A.G 1527 B</p> 
<p>V.A.G 1594 A</p> 	<p>Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in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

Special tools and workshop equipment required

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

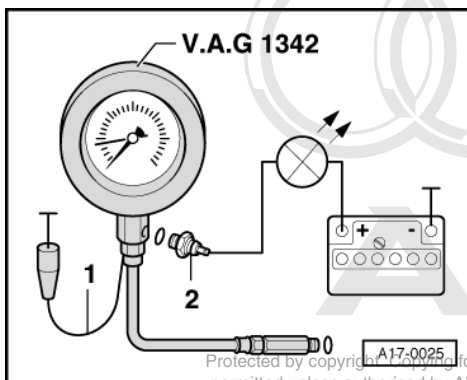
Test requirements:

- Oil level OK.
- Engine oil temperature approx. 80 °C.
- Oil pressure warning lamp K3 must come on when ignition is switched on.
- In vehicles with driver information system (DIS) the display "OK" must light up.



Test sequence

- -> Remove oil dipstick -1- from guide tube.
- Remove engine cover -arrows-.
- Reinsert dipstick in guide tube.



Checking oil pressure switch

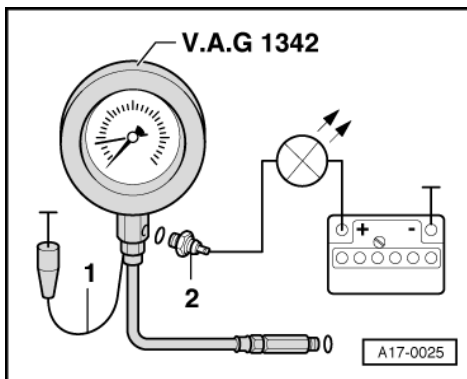
- Disconnect wire from oil pressure switch.
- -> Unscrew oil pressure switch and screw in oil pressure tester V.A.G 1342.
- Screw oil pressure switch -2- into V.A.G 1342.
- Connect brown wire 1 of tester to earth (-).
- Connect voltage tester V.A.G 1527 B to oil pressure switch and positive side of battery (+) 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.

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.

Oil pressure switch, brown:

- At 0.55... 0.85 bar.
- If the LED does not illuminate, fit a new oil pressure switch.



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 idling speed: at least 0.8 bar
 - Oil pressure at 2000 rpm: at least 2.0 bar
 - Oil pressure at higher engine speeds: max. 7.0 bar

If the specified values are not obtained:

- Pressure relief valve or oil pump defective, replace oil pump => Page 17-17.

1.7 - Engine oil

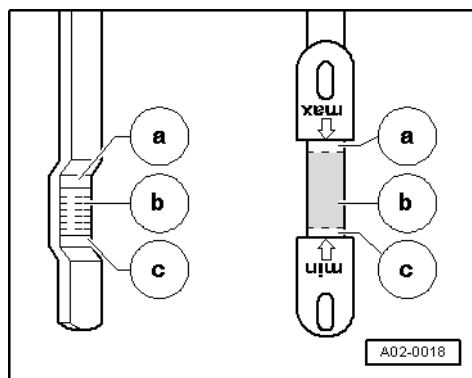
Viscosity grades and oil specifications

=> Maintenance Manual

1.8 - 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.
- 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.



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-> 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.



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19 - Cooling system

1 - Removing and installing parts of the cooling system

1.1 - Removing and installing parts of the cooling system

Important

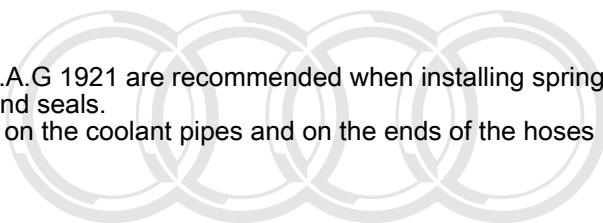
Hot steam can escape when opening cap on expansion tank: Cover cap with a cloth and open carefully.

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

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



Audi

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1.2 - Parts of the cooling system -engine codes ASZ, ATD-

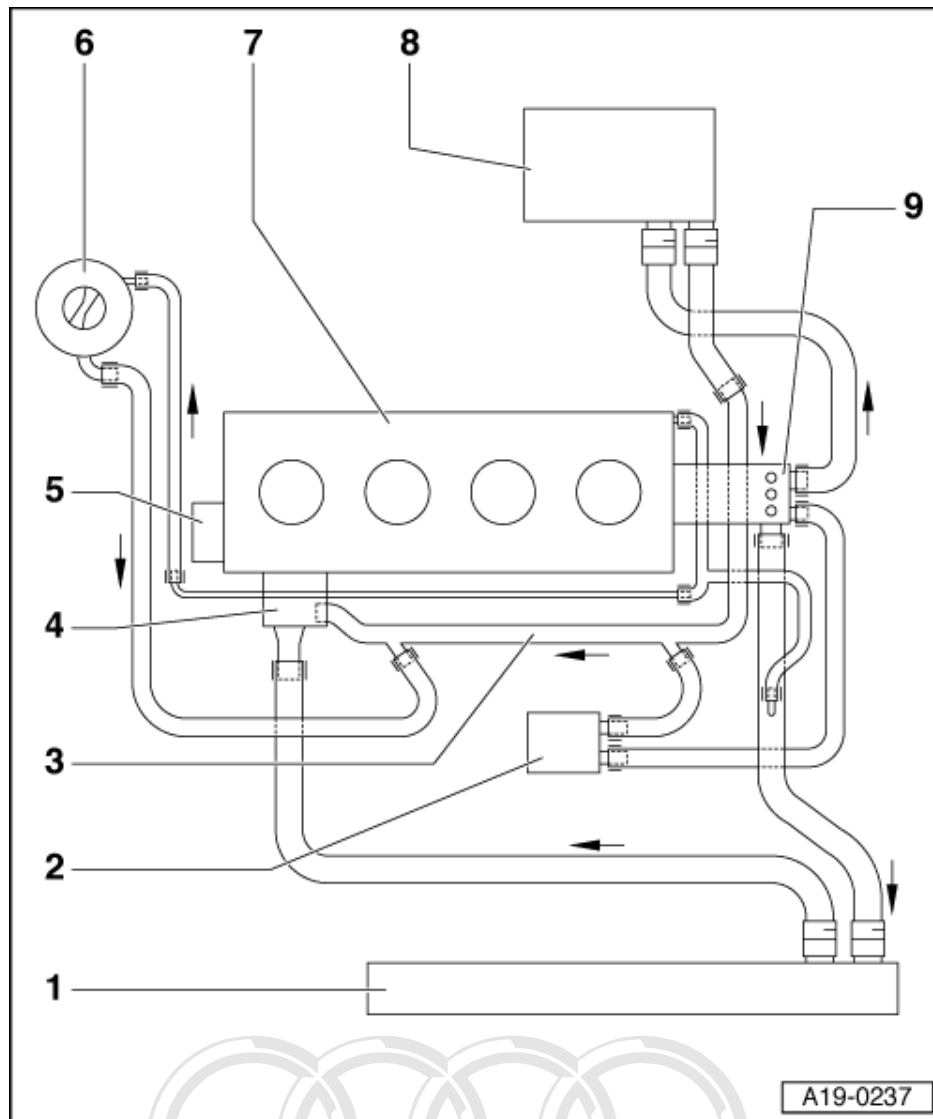


Diagram of coolant hose connections

1 Radiator

- ♦ Removing and installing
=>Page 19-31
- ♦ After replacing, fill with fresh coolant

2 Fluid cooler

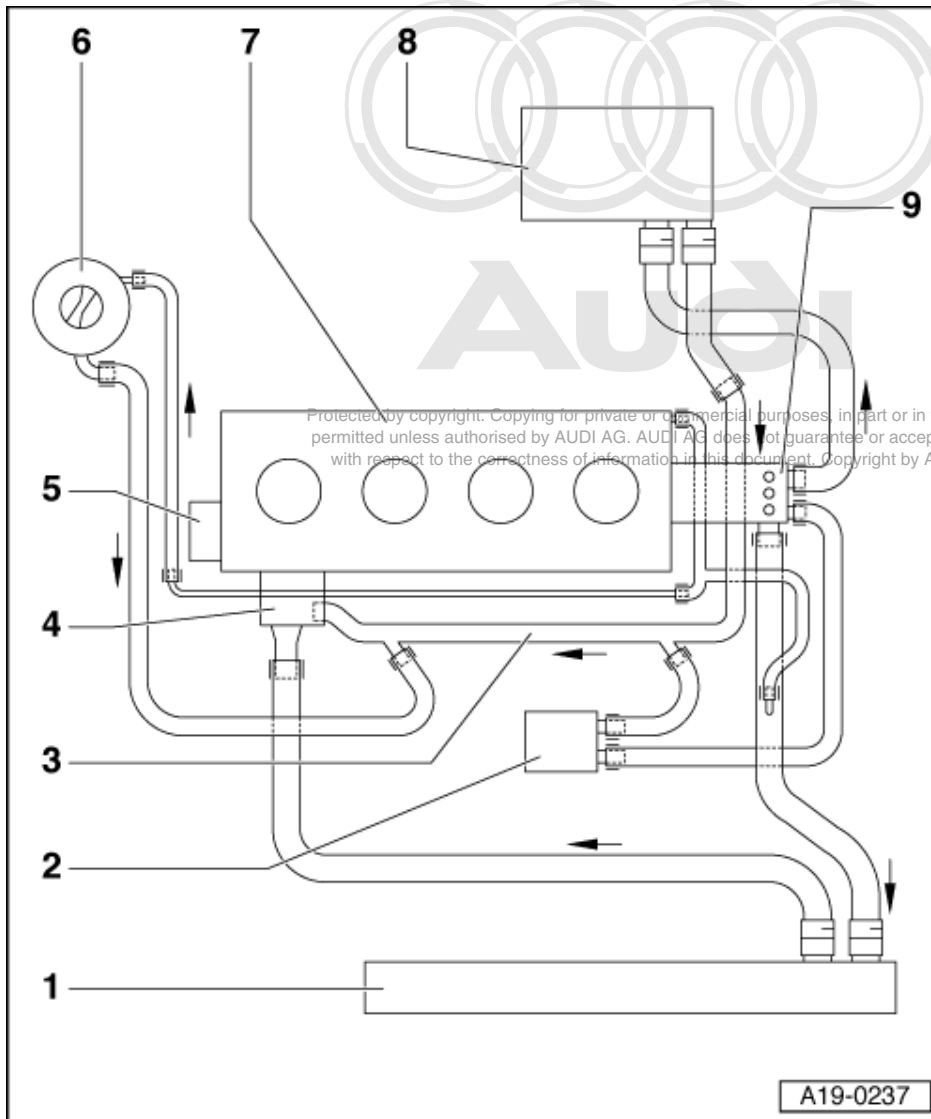
- ♦ Removing and installing => Item 17-7

3 Coolant pipe

- ♦ Removing and installing =>Page 19-21

4 Thermostat

- ♦ Removing and installing
=>Page 19-17
- ♦ Checking => Page 19-20



5 Coolant pump

- ♦ Removing and installing
=> Page 19-15
- ♦ Check for ease of movement

6 Expansion tank

- ♦ With filler cap
- ♦ Check pressure relief valve in sealing cap => Page 19-38

7 Cylinder head/cylinder block

- ♦ After replacing, fill with fresh coolant

8 Heating system heat exchanger

- ♦ After replacing, fill with fresh coolant

9 Pipe union

- ♦ In vehicles with manual gearbox with glow plugs coolant -Q7

1.3 - Parts of the cooling system -engine code AXR-

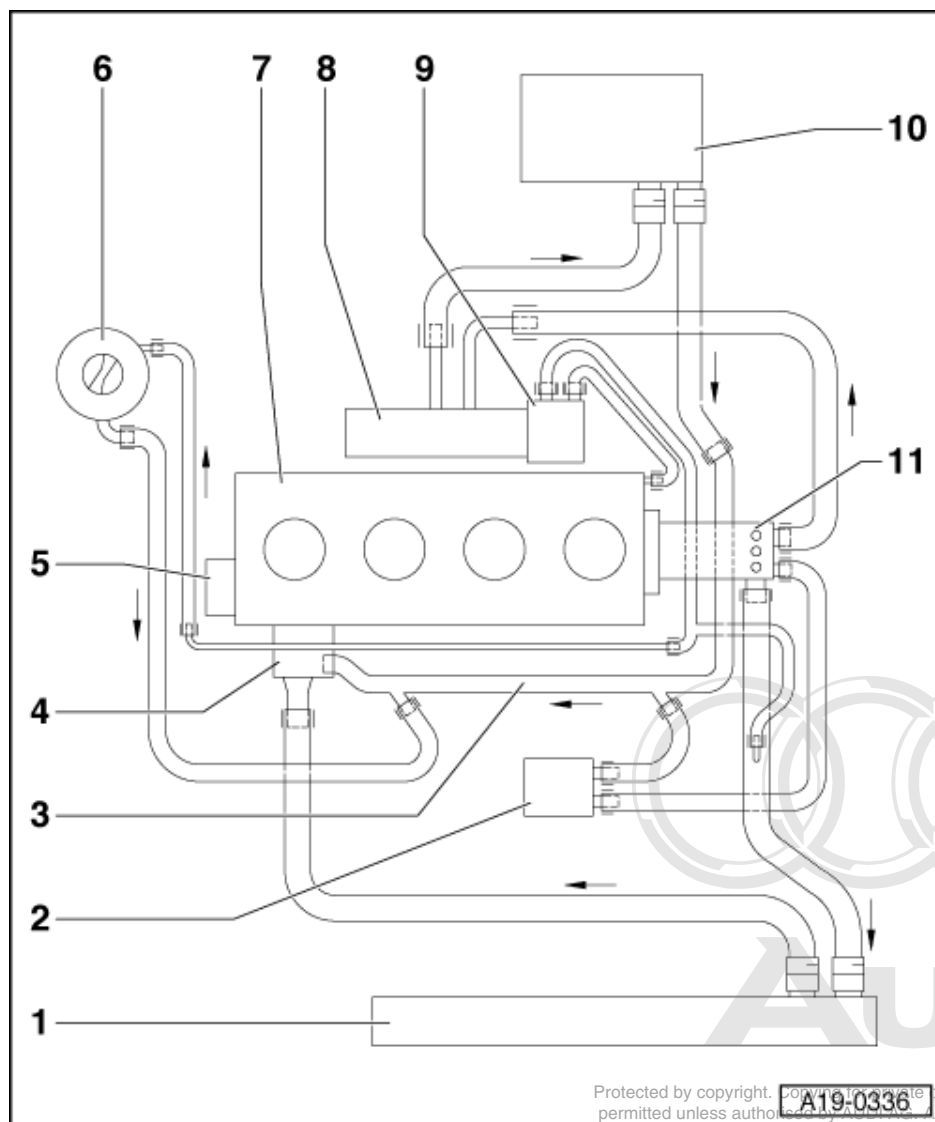


Diagram of coolant hose connections

1 Radiator

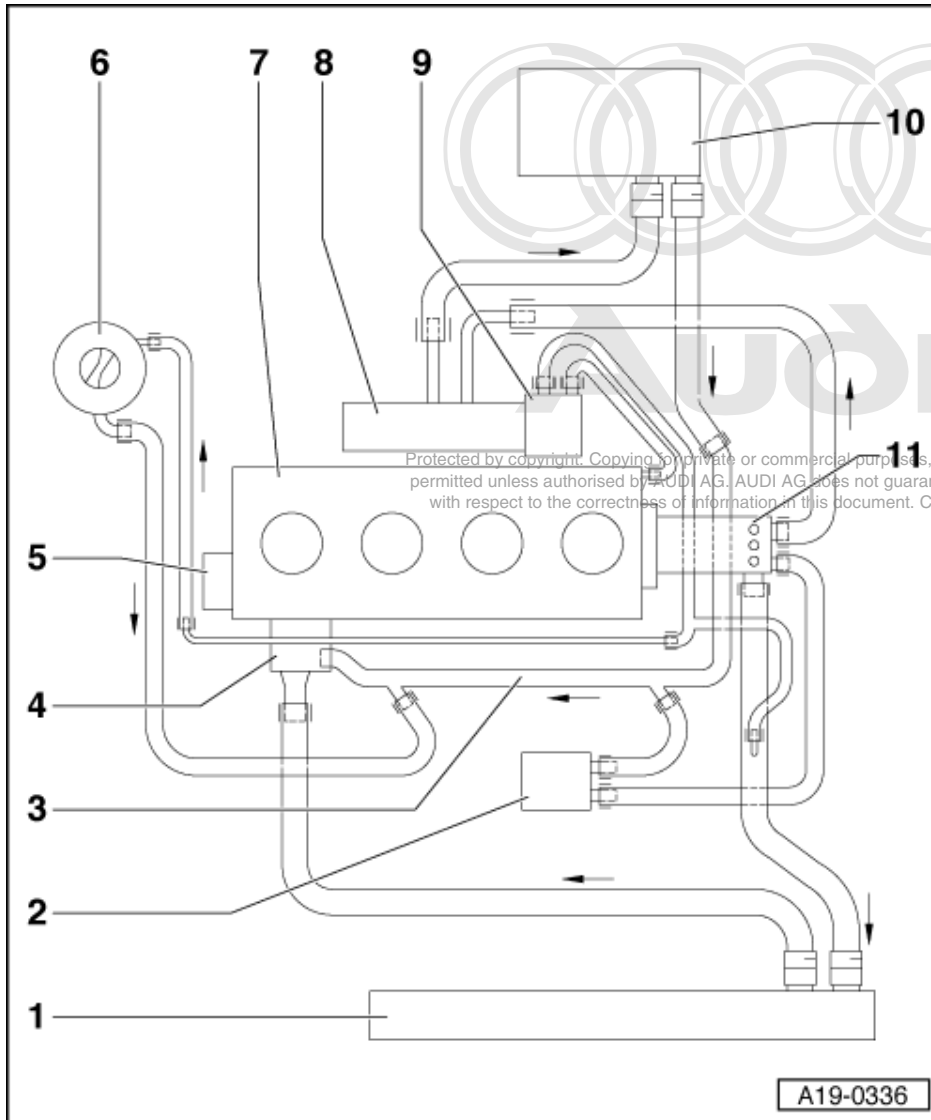
- ♦ Removing and installing
=>Page 19-31
- ♦ After replacing, fill with fresh coolant

2 Fluid cooler

- ♦ Removing and installing => Item 17-7

3 Coolant pipe

- ♦ Removing and installing =>Page 19-21



4 Thermostat

- ◆ Removing and installing
=>Page 19-17
- ◆ Checking => Page 19-20

5 Coolant pump

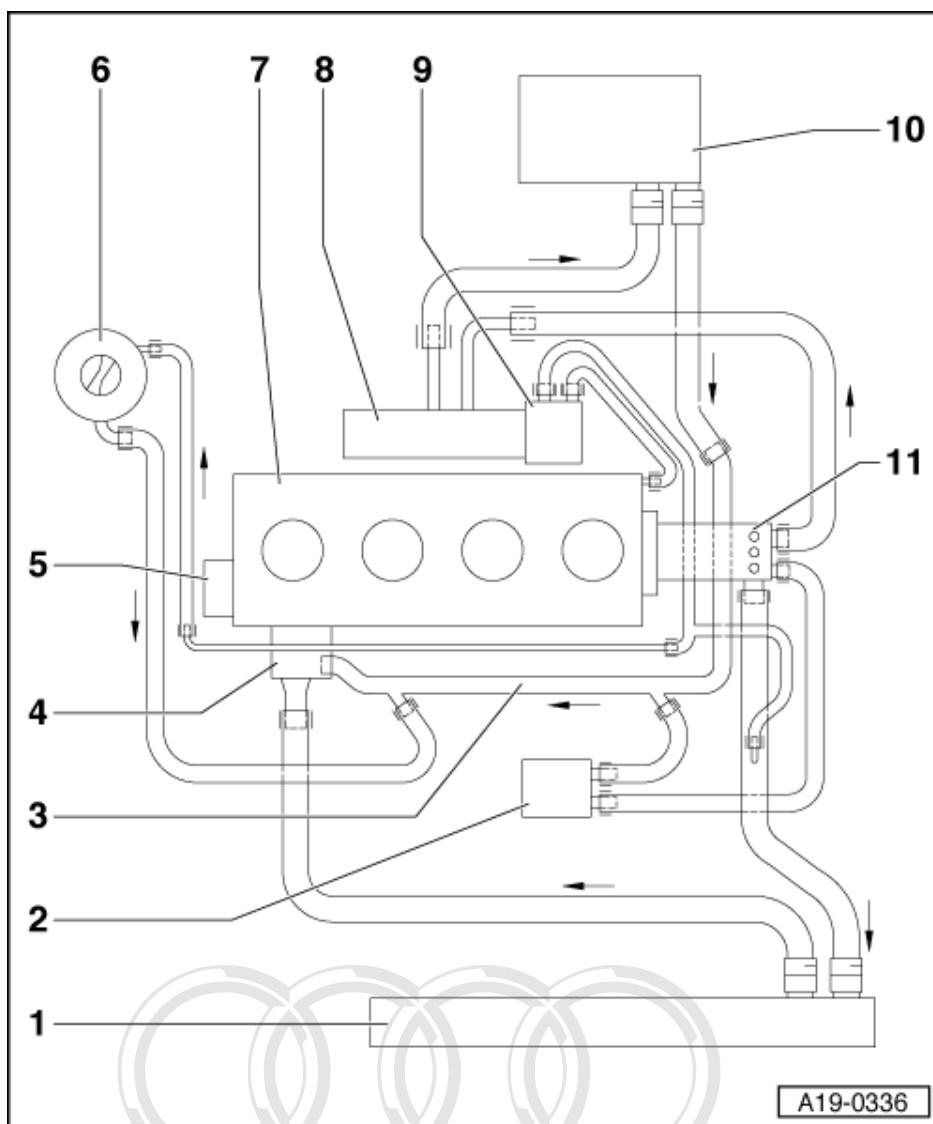
- ◆ Removing and installing
=> Page 19-15
- ◆ Check for ease of movement

6 Expansion tank

- ◆ With filler cap
- ◆ Check pressure relief valve in sealing cap => Page 19-38

7 Cylinder head/cylinder block

- ◆ After replacing, fill with fresh coolant



8 Radiator

- ♦ Installing radiator => Removing and installing intake manifold, Page 15-74

9 Housing for bypass valve

10 Heating system heat exchanger

- ♦ After replacing, fill with fresh coolant

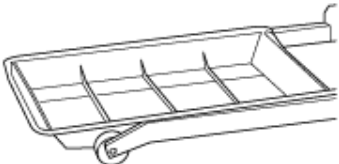
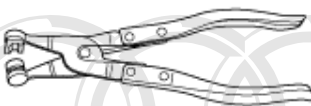
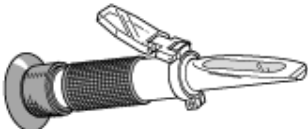
11 Pipe union

- ♦ In vehicles with manual gearbox with glow plugs coolant -Q7

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1.4 - Draining and filling cooling system

V.A.G 1306 	V.A.G 1921 
T10007 	<p>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.</p>
	G19-0008

Special tools and workshop equipment required

- ♦ Drip tray V.A.G 1306
- ♦ Hose clamp pliers V.A.G 1921
- ♦ Refractometer T10007

Draining

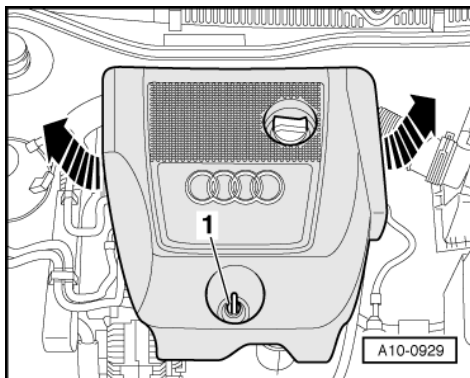
Note:

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

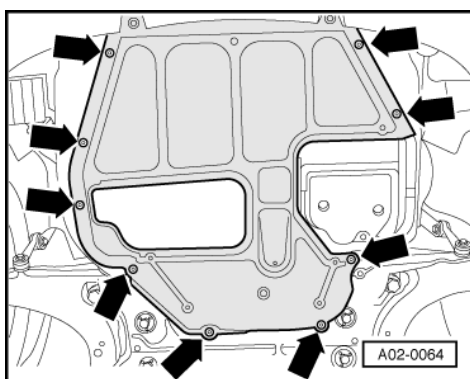
Important

Hot steam can escape when opening cap on expansion tank: Cover cap with a cloth and open carefully.

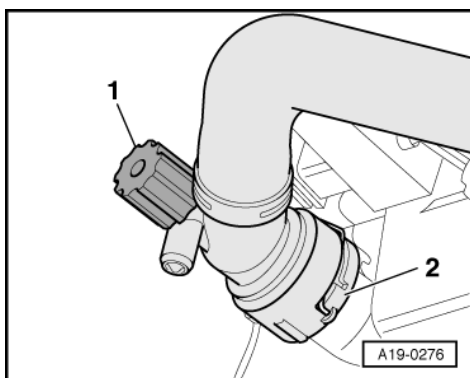
- Open the cover of the coolant expansion tank



- -> Remove oil dipstick -1- from guide tube.
- Remove engine cover -arrows-.
- Reinsert dipstick in guide tube.



- -> Remove the noise insulation -arrows-.



- Place drip tray V.A.G 1306 below engine.

Vehicles with drain plug:

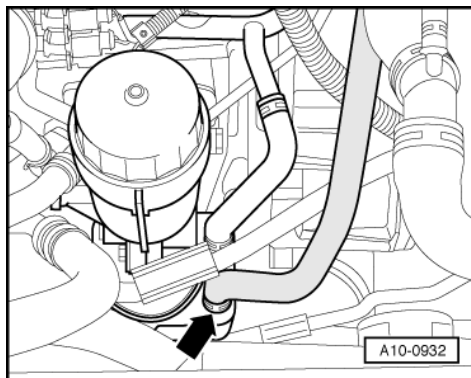
- -> Turn drain plug -1- on radiator anti-clockwise, fit auxiliary hose to connection if necessary.

Vehicles without drain plug:

- Pull off retaining clip -2- for bottom coolant hose and detach coolant hose from radiator.



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All models:

- -> Also disconnect coolant hose on oil cooler -arrow-, and drain off remaining coolant.

Note:

Illustration shows an engine with code ASZ.

Filling

Notes:

- ♦ The cooling system is filled all year round with a mixture of water and antifreeze/corrosion protection agent.
- ♦ Only use coolant additive G 012 A8 D - meeting specification TL VW 774 D.
Identification: red colour

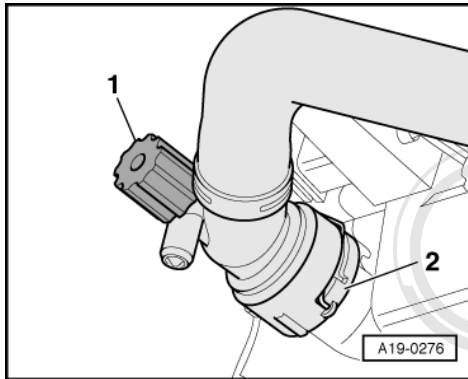
Important G

- ♦ 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 012 A8 D and coolant additives marked "meeting specification TL VW 774 D" prevent frost and corrosion damage and 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 G012 A8 D in cooling system.

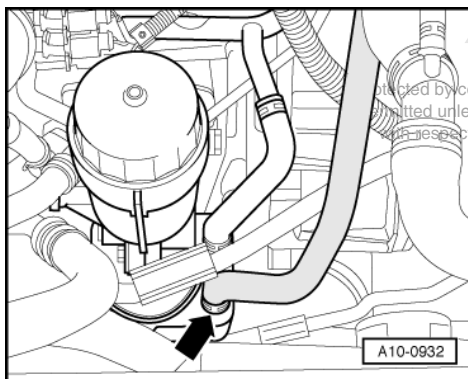
Recommended mixture ratios:

Frost protection to	Anti freeze concentration	G 012A8 D 1)	Water1)
-25 °C	40 %	2.4 l	3.6 l
-35 °C	50 %	3.0 l	3.0 l

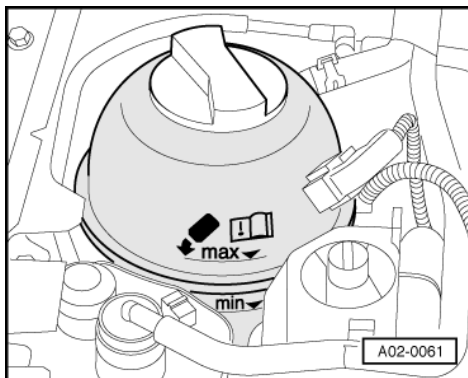
- 1) Coolant quantity: 6.0 litres (may vary depending upon the vehicle equipment)



- -> Turn drain plug -1- at radiator clockwise, or fit hose -2- at radiator.



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



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

Important

Hot steam can escape when opening cap on expansion tank: Cover cap with a cloth and open carefully.

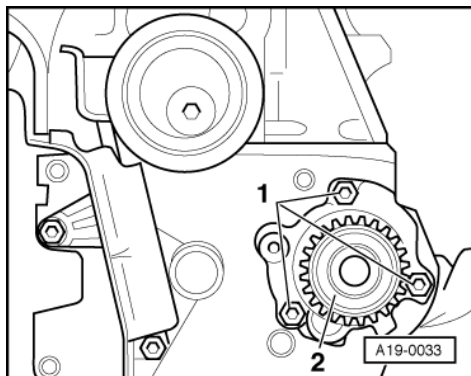
- Check coolant level and top up if necessary. If the engine is warm, coolant level must be at max. mark; if cold, between min. and max. marks.



1.5 - Removing and installing coolant pump

Removing

- Removing toothed belt => Page 13-51.
- Drain coolant => Page 19-7.



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

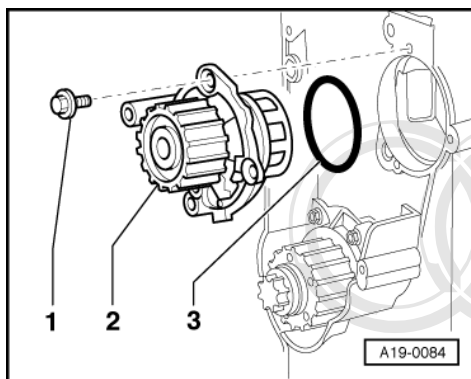
Installing

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

Note:

Always replace seals and gaskets.

- Clean and smooth down sealing surface for O-ring as required.



- -> Lightly smear new O-ring -3- with coolant G 012 A8 D.
- Fit coolant pump -2-.
- Installation position: Sealing plug in housing faces downwards.
- Tighten bolts -1- for coolant pump to 13 Nm.
- Install toothed belt (adjust valve timing) => Page 13-62.
- Install ribbed belt => Page 13-12.
- Top up coolant => Page 19-10.

Tightening torque

Component	Nm
Coolant pump to cylinder block	13

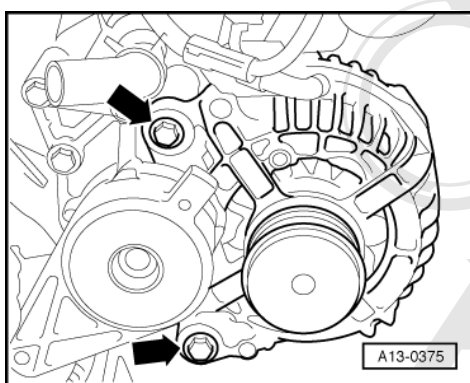
1.6 - Removing and installing, checking coolant thermostat

Removing

Important

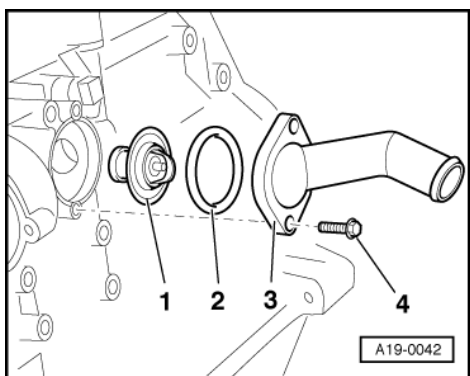
- ♦ Measures to be taken prior to disconnecting the battery: =>Electrical System; Repair group 27
- ♦ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.

- Refer to coding on vehicles with encoded radio/radio navigation system (RNS); if necessary, interrogate.
- With the ignition switched off disconnect the battery earth strap.
- Drain coolant => Page 19-7.
- Remove ribbed belt and remove from alternator pulley => Page 13-10.



- -> Unscrew alternator -arrows- and put to the front. Do not open hydraulic connections.

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- -> Remove coolant hose from connector 3.
- Remove bolt -4-, and detach connector with O-ring -2- and coolant thermostat -1-.
- Turn thermostat 90° (1/4 turn) to the left and remove from connection.

Installing

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

- Clean and smooth down sealing surface for O-ring as required.
- Insert coolant thermostat.
 - Installation position: Cross-piece on thermostat should be vertical.
- Coat new O-ring with coolant G 012 A8 D.
- Install ribbed belt =>Page 13-12.
- Top up coolant => Page 19-10.



Notes:

- ♦ If the battery is reconnected, please ensure that the vehicle equipment (radio, radio/navigation system, clock, electric window lifters) is activated as described in the operating instructions.
- ♦ Deactivate the service mode of the telematics control unit.

=> Radio, Telephone and Navigation System; Repair group 91

Tightening torques

Component	Nm
Connection to cylinder block	15
Alternator to bracket for auxiliary mechanical units	23

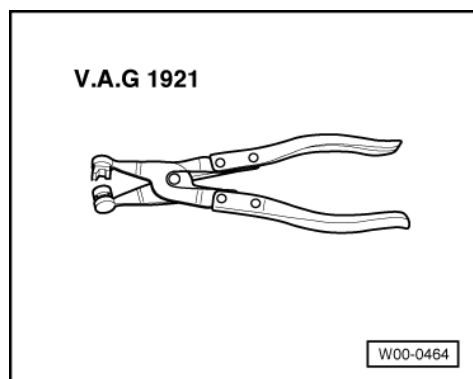
Checking coolant thermostat

- Heat thermostat in water bath.

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

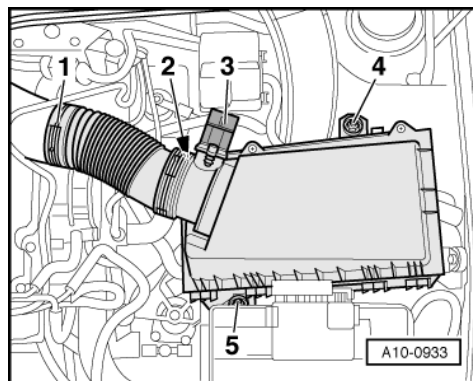
- 1) cannot be tested

1.7 - Removing and installing coolant pipe



Special tools and workshop equipment required

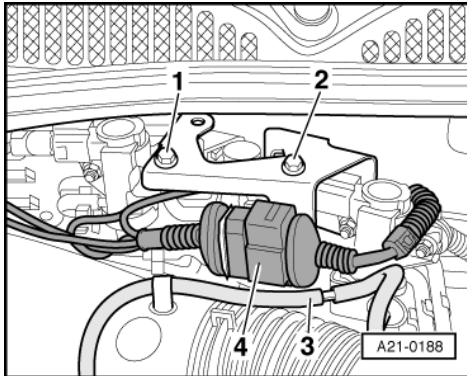
- ♦ V.A.G 1921



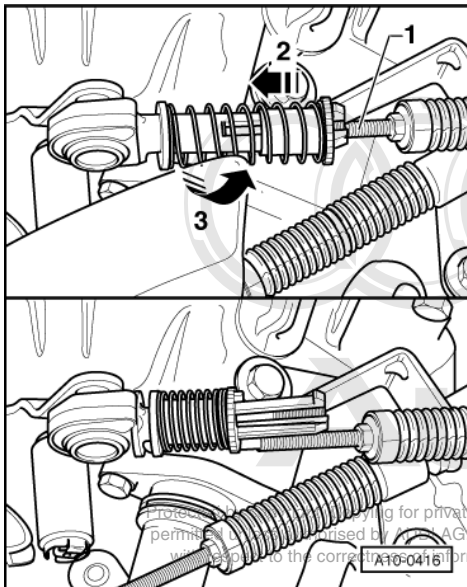
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Removing

- Drain coolant => Page 19-7.
- -> Remove air duct hose -1- from air duct pipe.
- Detach connector of air mass meter -3-.
- Unscrew bolts -4- and -5-.
- Remove vent hose -2- off air cleaner housing.
- Remove air cleaner housing.



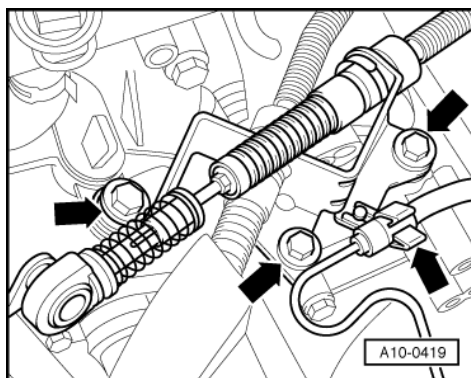
- -> Detach connector-4-.
- Detach vacuum hose -3- at cutting point.
- Unscrew bolts -1- and -2-.
- Put solenoid valve brackets to side with hoses connected.



Vehicles with manual gearbox:

Detach both gear selector cables from gearbox as follows:

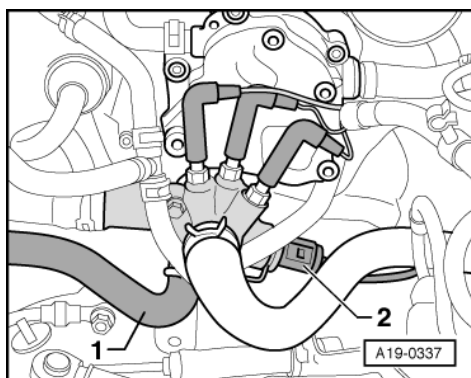
- -> Mark installation position of thread rods -1- of both gear selector cables with a waterproof felt-tip pen.
- Pull the spring with the knurled piece in direction of arrow -2- towards spherical joint and then turn knurled piece clockwise to secure in engaged position -arrow 3-.
- Detach both gear selector cables.



- -> Remove cable counterhold from gearbox and place to one side -arrows-.

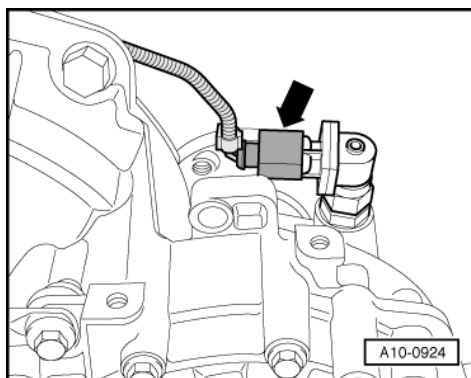
Vehicles with engine code ATD, AXR:

- Unclip the clutch slave cylinder hose at the cable support bracket.



All models:

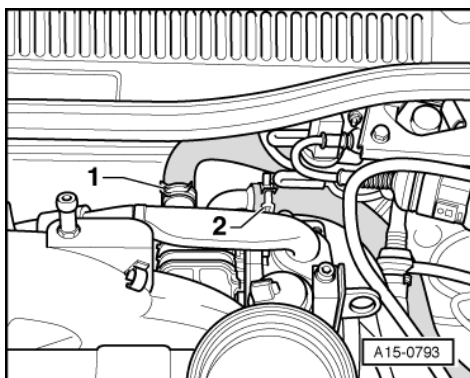
- Remove all hoses from coolant pipe.
- -> Disconnect lower coolant hose -1- at coolant connection.
- Unplug connector -2- at coolant temperature sender -G62.



- Detach the heat protection sleeve at the speedometer sender -G22.
- -> Detach connector -arrow- from speedometer sender -G22 from gearbox.
- Lay wiring aside.

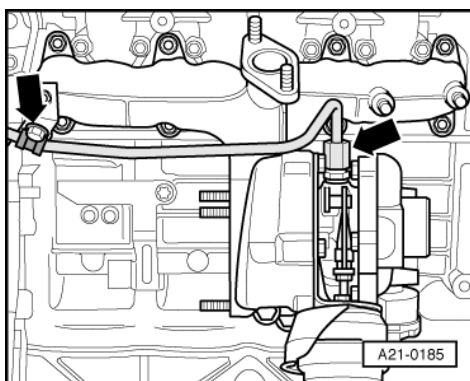


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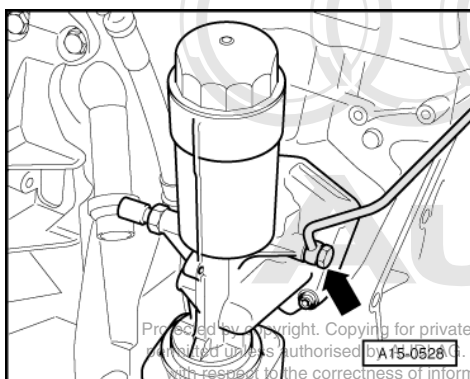
Vehicles with engine code AXR:

- -> Disconnect coolant hoses -1- and -2- at exhaust gas recirculation cooler.

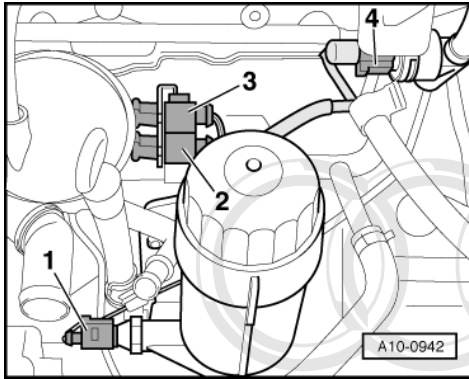


All models:

- -> Unscrew oil feed line from turbocharger and exhaust manifold -arrows-.



- -> Unscrew oil feed line from oil filter bracket -arrow- and also at coolant pipe and lay line aside.

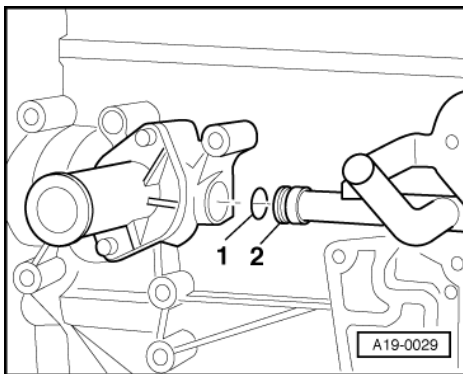


- Unplug connector console from glow plugs.
- -> Detach the following connectors:

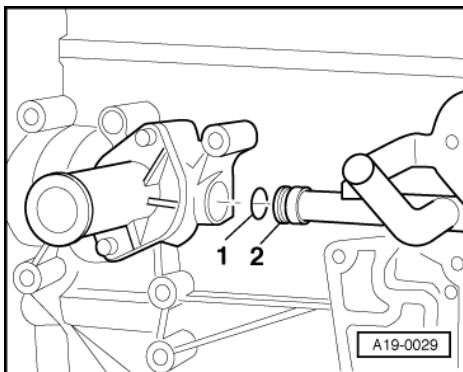
- 1 - Oil pressure switch -F1
- 2 - Hall sender -G40
- 3 - Engine speed sender -G28
- 4 - Fuel temperature sender -G81

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- Detach connectors -2- and -3- from the bracket at coolant pipe.



- Lay aside wiring at air coolant pipe.
- Remove the coolant pipe from cylinder block.
- -> Take coolant pipe -2- from connection.



Installing

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

Note:

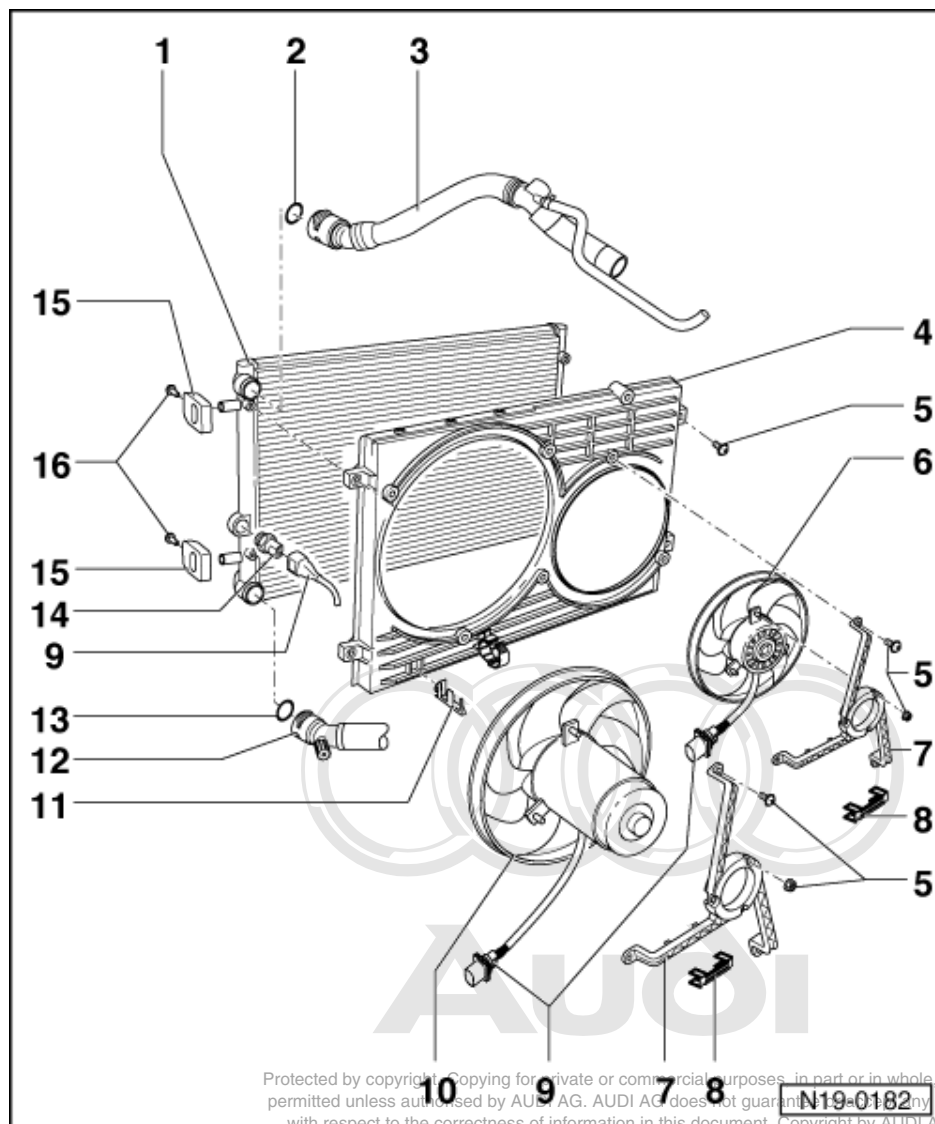
Replace seals and gaskets.

- Before installing, clean and smooth down sealing surface for O-ring.
- -> Coat new O-ring -1- with G 012 A8 D and push onto coolant pipe -2-.
- Push coolant pipe into opening in cylinder block.
- Top up coolant => Page 19-10.

Tightening torques

Component		Nm
Coolant pipe to cylinder block	M7	15
	M10	25
Oil line to oil filter flange		25
Oil supply pipe to turbocharger		30

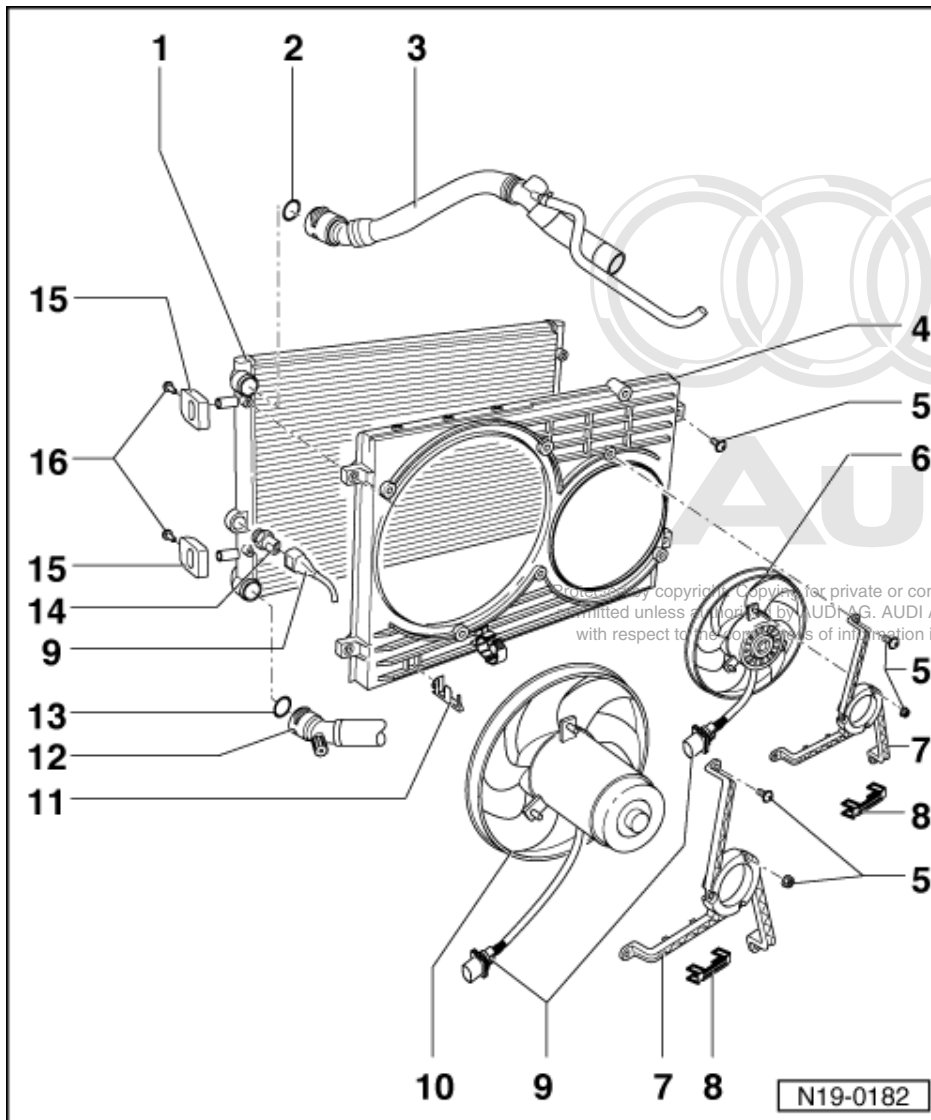
1.8 - Radiator and radiator fan - Assembly overview



1 Radiator

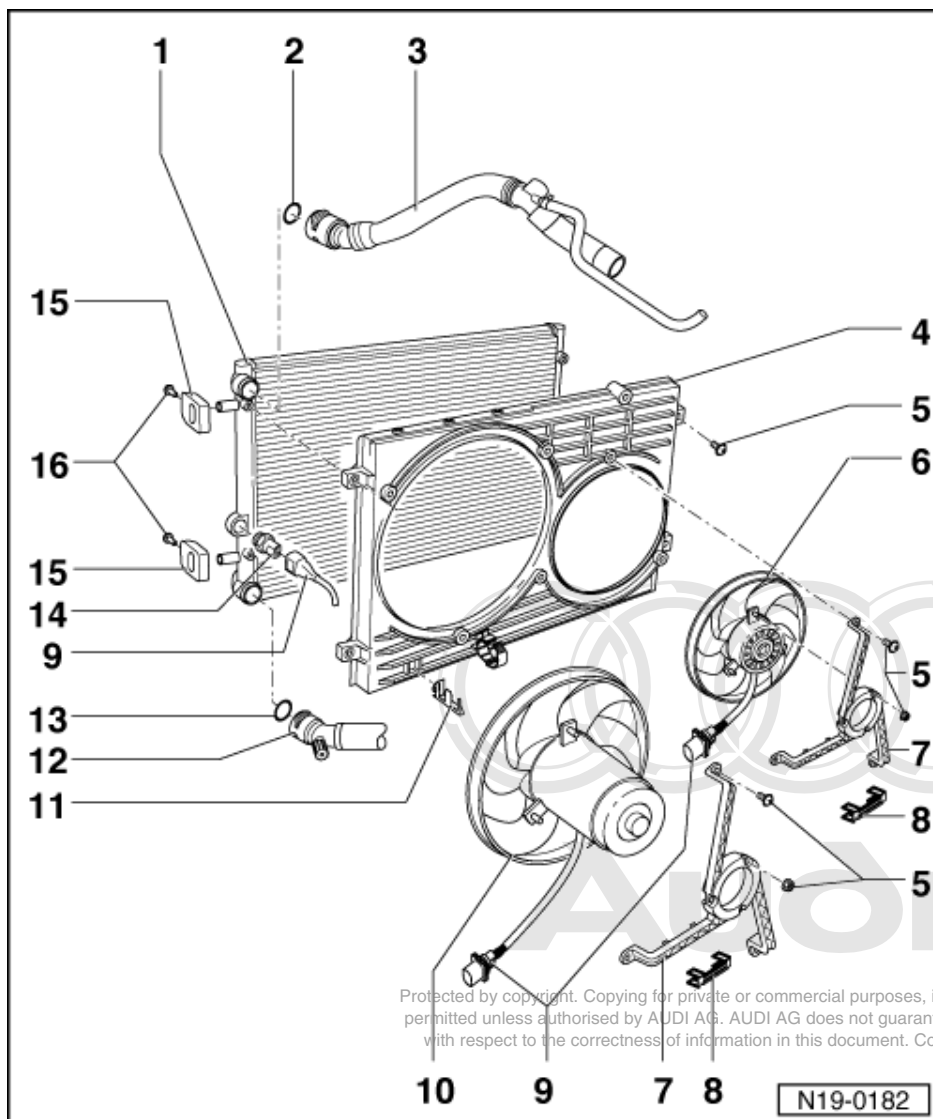
- ♦ Removing and installing
=>Page 19-31

- ♦ If replaced renew the complete coolant
- 2 O-ring**
 - ♦ Replacing
- 3 Upper coolant hose**
- 4 Radiator cowl**
- 5 10 Nm**
- 6 Additional fan**
 - ♦ Dependent on equipment level



- 7 Fan ring**
- 8 Bracket**
- 9 Connector**
- 10 Fan for coolant -V7**
- 11 Bracket**
 - ♦ For connector plug
- 12 Lower coolant hose**
 - ♦ To connection for thermostat
- 13 O-ring**

♦ Replacing



14 Thermostat for fan for coolant
-F18/-F54 - 35 Nm

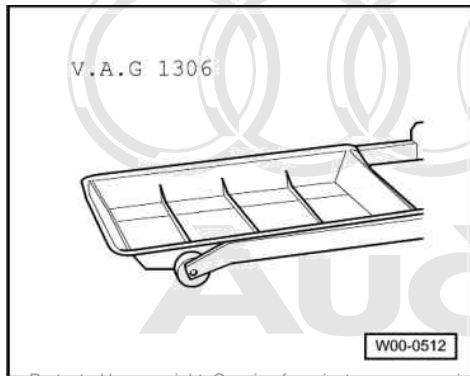
- ♦ Switching temperatures:
 - 1st stage
 - on: 92...97 °C
 - off: 84...91 °C
 - 2nd stage
 - on: 99...105 °C
 - off: 91...98 °C

15 Bracket

- ♦ For radiator
- ♦ Note installation position

16 15 Nm

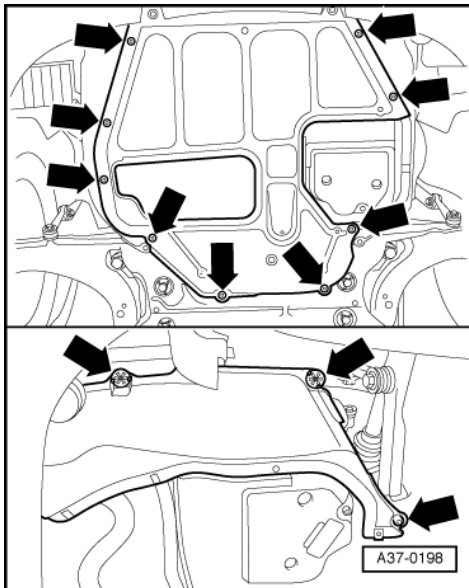
1.9 - Removing and installing radiator



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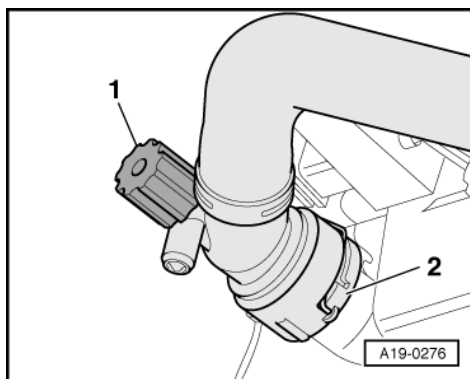
Special tools and workshop equipment required

- ♦ Drip tray V.A.G 1306



Removing

- -> Remove noise insulation from centre, left and right sides -arrows-



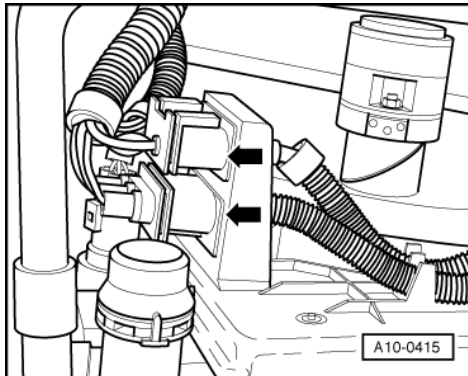
- Place drip tray V.A.G 1306 below engine.

Vehicles with drain plug:

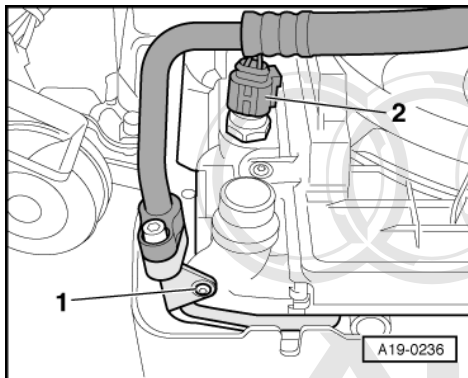
- -> Turn drain plug -1- on radiator anti-clockwise, fit auxiliary hose to connection if necessary.

All models:

- Pull off retaining clip -2- for bottom coolant hose and detach coolant hose from radiator.



- -> Detach both connectors -arrows- for radiator fan on bottom left of radiator cowl.



- -> Detach connector -2- from thermostat -F18.

Vehicles with air conditioner:

Important

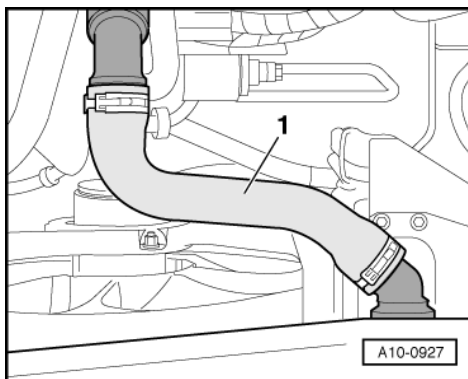
The air conditioner refrigerant circuit must not be opened.

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Note:

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

- Detach coolant pipe -1- from radiator.

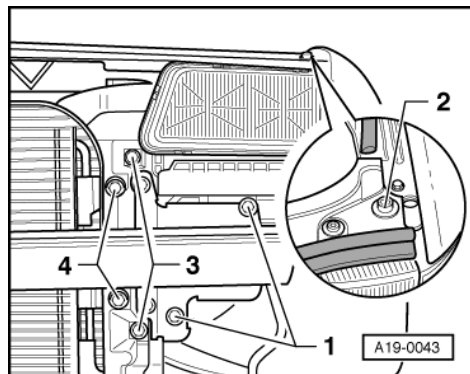




All models:

- -> Remove coolant hose -1- from top of radiator.
- Remove the front bumper cover:

=> General Body Assembly, Exterior; Repair group 63; Front bumper; Removing and installing front bumper
Front bumper Removing and installing front bumper



Vehicles with air conditioner:

Important

The air conditioner refrigerant circuit must not be opened.

Note:

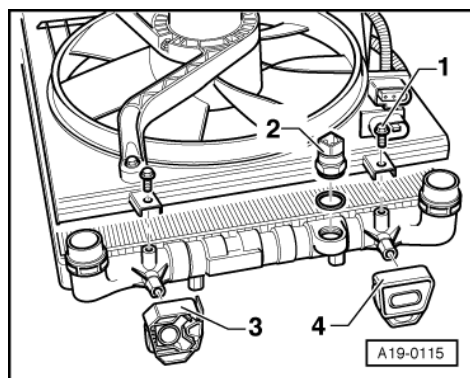
To prevent damage to the condenser and refrigerant pipes/hoses, ensure that the pipes and hoses are not stretched, kinked or bent.

- -> Unscrew securing bolts -4- of condenser.
- Tie up condenser to lock carrier using wire loop.

All models:

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

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Installing

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

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

=> General Body Assembly, Exterior; Repair group 50; Front chassis; Removing and installing lock carrier with attachments Front chassis Removing and installing lock carrier with attachments

- Top up coolant => Page 19-10.
- Adjust headlights.

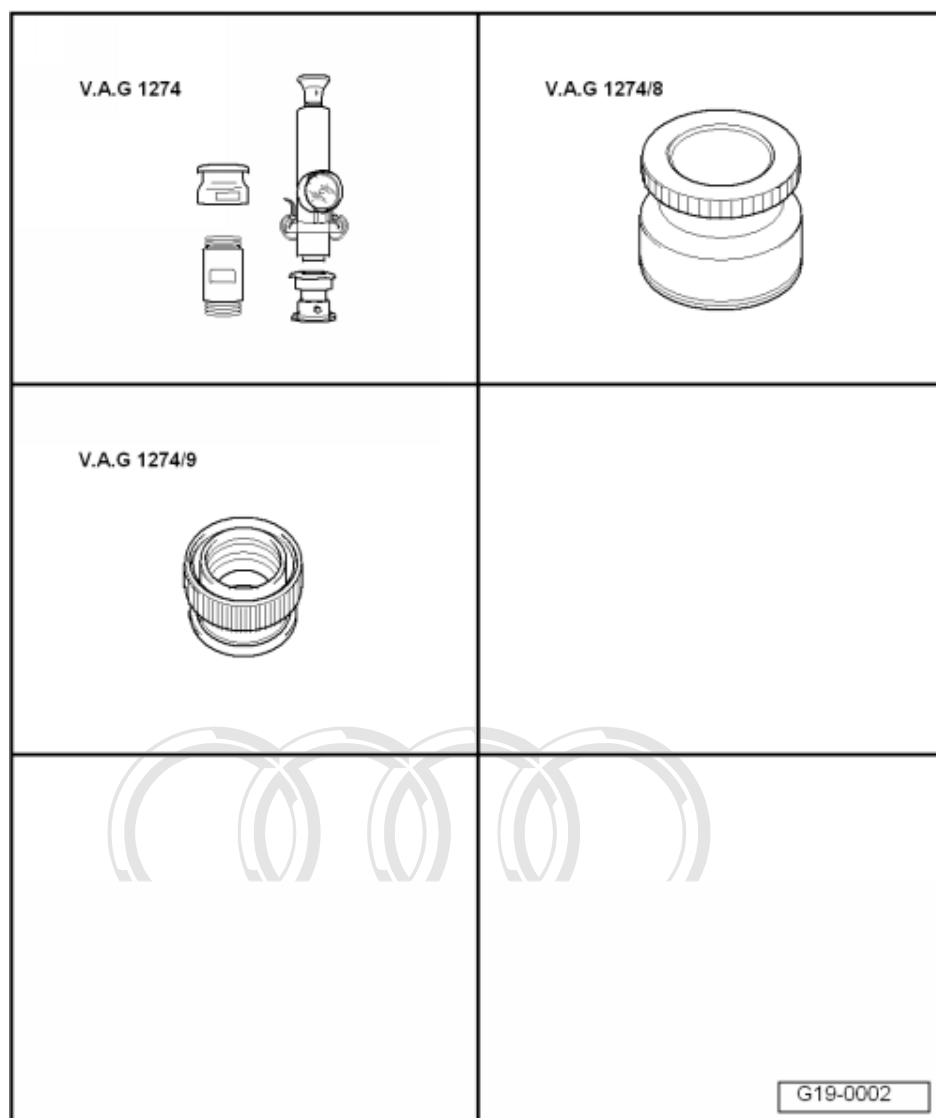
=> Electrical System; Repair group 94; Servicing headlights; Adjusting headlights Servicing headlights Adjusting headlights

Tightening torques

Component	Nm
Radiator cowl to radiator	10
Thermostat in radiator	35
Coolant pipe to radiator	10
Condenser to radiator	10
Radiator to lock carrier	15

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1.10 - Checking cooling system for leaks



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Special tools and workshop equipment required

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

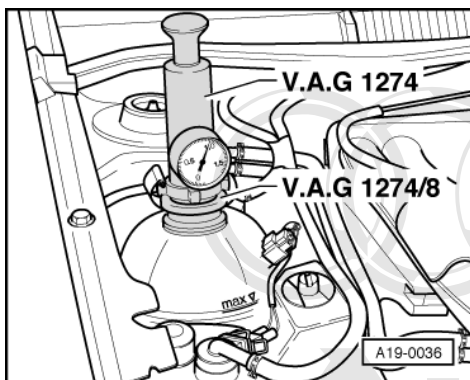
Test requirements:

- Engine at operating temperature.

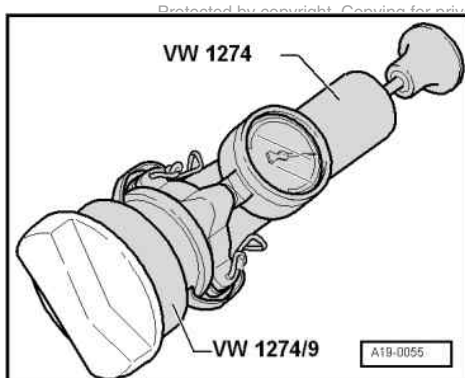
Important

Hot steam can escape when opening cap on 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 1274/8 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 1274/9 onto sealing cap.
- Operate hand pump.
 - The pressure relief valve should open at a pressure of 1.4 ... 1.6 bar.



21 - Charging

1 - Checking charge air system with turbocharger

1.1 - Checking charge air system with turbocharger

Notes:

- ♦ For cleanliness rules, see=> Page 21-34.
- ♦ Secure all hose connections with the correct hose clamps (same as original equipment):

=> Parts List

- ♦ Charge air system must be free of leaks.
- ♦ Always replace seals, gaskets and self-locking nuts.

Safety precautions

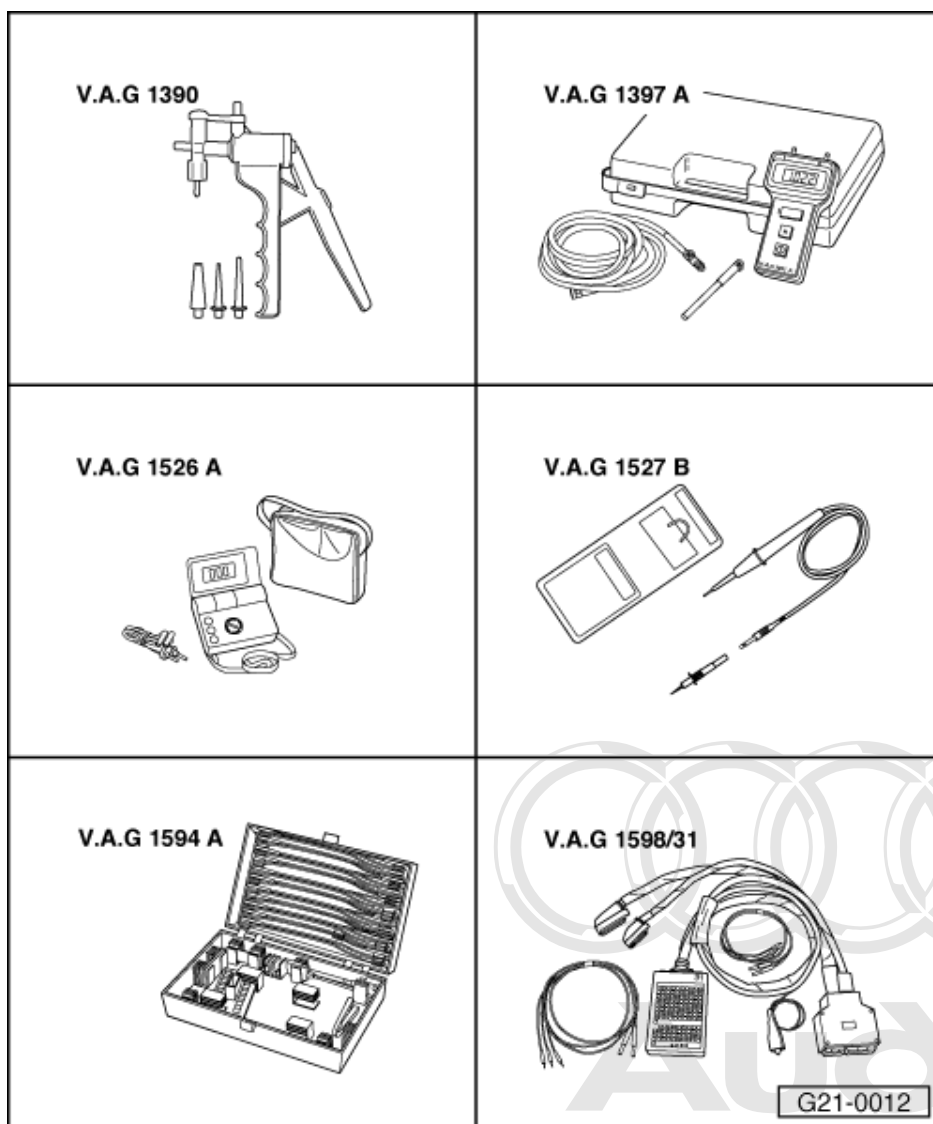
Note the following points if testers and measuring instruments have to be used during a road test:

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.**

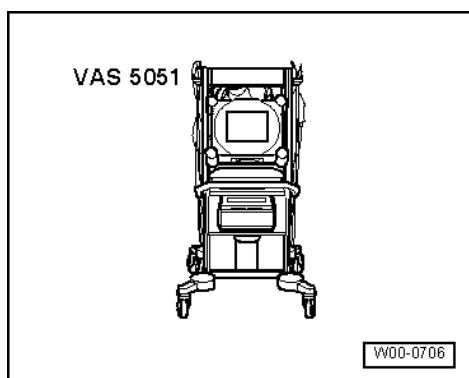


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Special tools and workshop equipment required

- ◆ V.A.G 1390
- ◆ V.A.G 1397 A
- ◆ V.A.G 1526 A
- ◆ V.A.G 1527 B
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31





- ♦ VAS 5051 with VAS 5051/1

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 26-52.

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 21-5.
- 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 pump jet units.

1.3 - Effects of leakages on charge air 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
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Effect:

- Loss of power

B - Leaks downstream of turbocharger (intake side)

Possible fault sources:

- 1 - Air duct hoses and pipes between turbocharger and charge air cooler
- 2 - Air duct hoses and pipes between intercooler and intake manifold
- 3 - Intercooler
- 4 - Seal underneath intake manifold pressure sender -G71/intake manifold temperature sender -G72
- 5 - Seal between intake connection, mechanical exhaust gas recirculation valve and intake manifold
- 6 - 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 exhaust manifold and cylinder head

Effect:

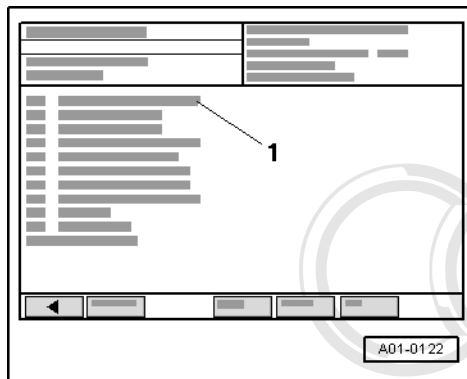
- Boost pressure too low, possibly exhaust smell, traces of soot in engine compartment

1.4 - Checking turbocharger and boost pressure control system

Test requirements:

- All hoses, pipes and wiring are checked for tight fit and leakages.
- No leaks in intake or exhaust system.
- No faults on engine or injection system, e.g. compression or pump jet units.
- Coolant temperature at least 80 °C.
- Vehicle diagnostic, testing and information system VAS 5051 connected, vehicle self-diagnosis and vehicle system "01 - Engine electronics" selected.
- Fault memory has been interrogated.

1.5 - Checking boost pressure



Test sequence

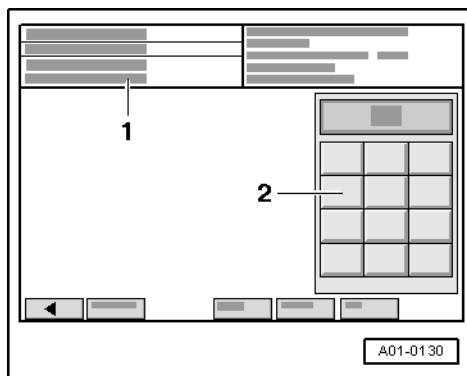
Important

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

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-> Display on VAS 5051:

- Under -1- select diagnostic function "04 - Basic setting".

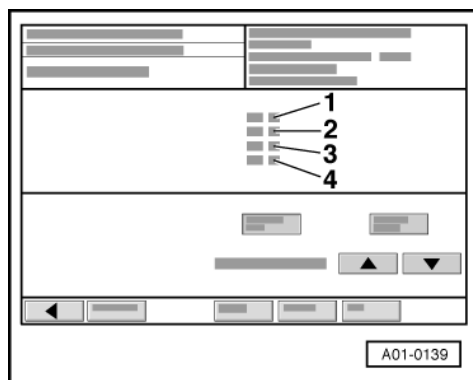


-> Display on VAS 5051:

- 1 - Enter display group
- Enter "011" for "display group number 011" in zone -2- and confirm the entry by pressing the Q button.
 - The idling speed is increased to 1380 ... 1420 rpm.



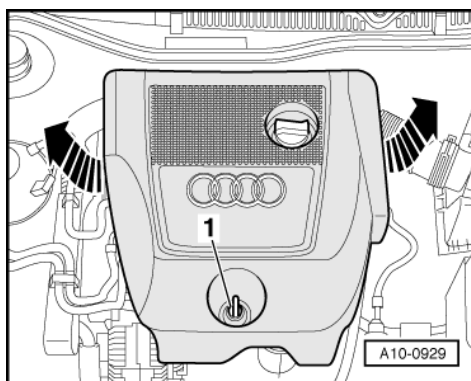
- The vacuum unit for boost pressure control is actuated in intervals.



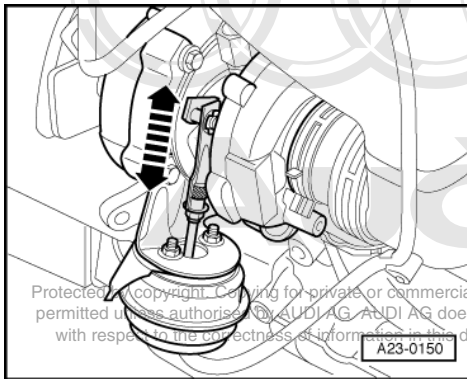
-> Display on VAS 5051:

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

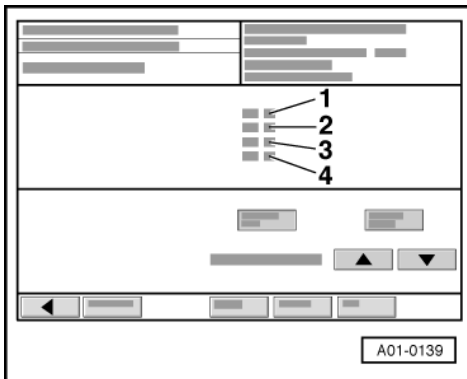
	Display zones			
	1	2	3	4
Display group 011: Boost pressure at 1400 rpm:				
Display	xxxx rpm	---	xxxx mbar	xxx %
Display	Engine speed	Actuation of boost pressure limitation solenoid valve -N75	Intake manifold pressure (boost pressure)	Signal ratio of boost pressure control solenoid valve-N75
Specified value	1400 rpm	off	Approx. atmospheric pressure (ambient air pressure)	98...100 %
		on	Approx. 100...200 mbar above atmospheric pressure	0...2 %
Note:			Upper and lower value in intervals of actuation on/off	



- -> Remove oil dipstick -1- from guide tube.
- Remove engine cover -arrows-.
- Reinsert dipstick in guide tube.



- -> Check that the operating rod moves at the turbocharger -arrow-.



-> Display on VAS 5051:

If the specified value in display zone 3 is not achieved or the operating rod on turbocharger does not move or only in stages:

- Check linkage and vacuum unit for boost pressure control => Page 21-13.
- Check vacuum actuation to turbocharger => Page 21-17.

Continue the test as follows:

- Switch over to "Read measured value block".
- Fully accelerate the vehicle from 2000 rpm in third gear or with selector lever at position 2 (without kickdown) and observe rev counter.
- At approx. 3000 rpm, press the key "Print - Save result" on the VAS 5051.

	Display zones			
	1	2	3	4
Display group 011: Intake manifold pressure (boost pressure) at 3000 rpm				
Display	xxxx rpm	xxxx mbar	xxxx mbar	xxxx mbar
Display	Engine speed	Boost pressure (specified)	Boost pressure (actual)	Atmospheric pressure
Specified value	3000 rpm	74 kW: 1900...2100 mbar 96 kW: 2200...2400 mbar	74 kW: 1850...2250 mbar 96 kW: 2100...2600 mbar	---

If boost pressure is not within the specified range:

- Check the charge air system for leaks.
- Check linkage and vacuum unit for boost pressure control => Page 21-13.
- Check boost pressure control solenoid valve N75 => Page 21-27.



If both are OK, but the boost pressure is too low:

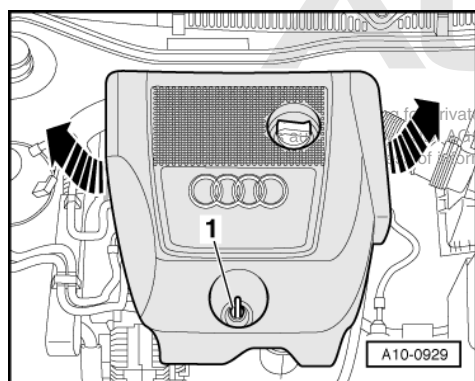
- Replace turbocharger => Page 21-42.
- End function "08 - Read measured value block" by pressing the ◀ key.
- Press "06 - End output".

1.6 - Checking linkage and vacuum unit for boost pressure control

Note:

A defect on linkage or vacuum unit for boost pressure control could cause the following faults:

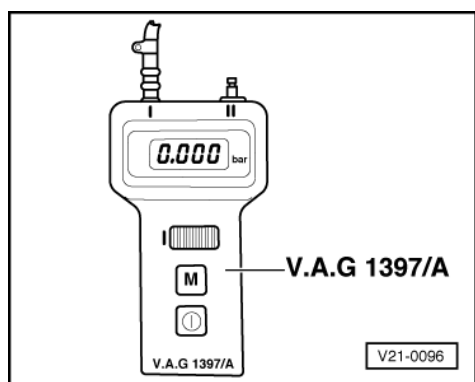
- ♦ Not achieving the specified boost pressure values.
 - ♦ Loss of power
 - ♦ Irregular power supply in partial load area.
 - ♦ Transitional juddering.
- Check all vacuum hoses are fitted and not leaking => Page 21-23.



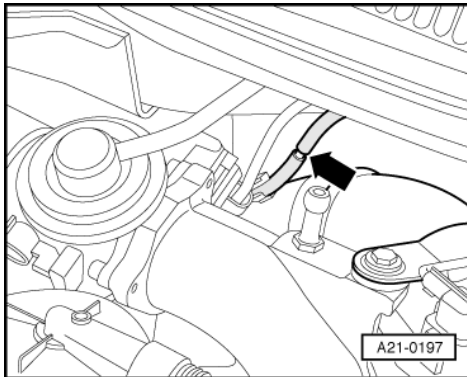
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Test sequence

- -> Remove oil dipstick -1- from guide tube.
- Remove engine cover -arrows-.
- Reinsert dipstick in guide tube.



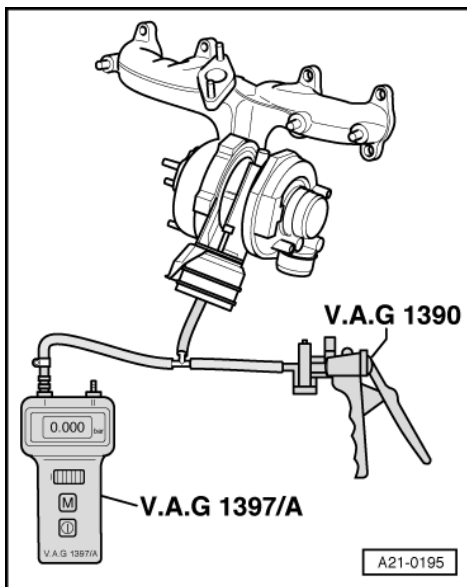
- -> Switch on turbocharger tester and set measuring range selector switch to position -I- (absolute pressure).
- Connect measuring hose to connection -I-.



- -> Disconnect hose -arrow- at vacuum unit for boost pressure control.

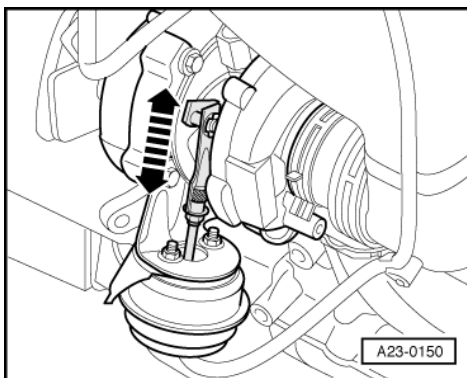
Note:

Illustration shows an engine with code ASZ, ATD.



- -> Connect hand vacuum pump V.A.G 1390 and turbocharger test unit V.A.G 1397 A with auxiliary hoses, as illustrated.
- Actuate hand vacuum pump.
- Read the vacuum pressure value on turbocharger test unit V.A.G 1397 A.

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- -> Whilst doing so observe linkage of turbocharger:
 - Specified value at 50 ... 100 mbar: The linkage must start to move upwards.



- Specified value at 550 ... 620 mbar: The linkage must be at top limit stop.

Note:

The absolute pressure displayed on V.A.G 1397 A must decrease by the specified values given.

- Vent hand vacuum pump.
 - The linkage must move downwards.

Note:

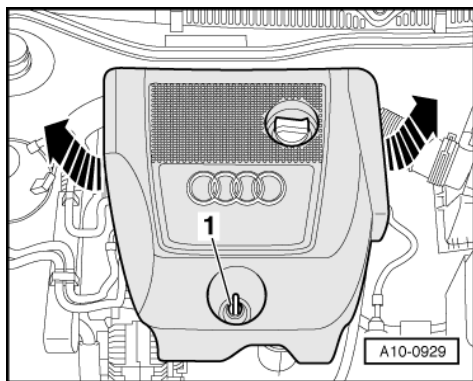
Check the movement sequence of the linkage over the entire adjustment range: It must move continuously and jolt-free.

If the specified values are not achieved or if the linkage moves :

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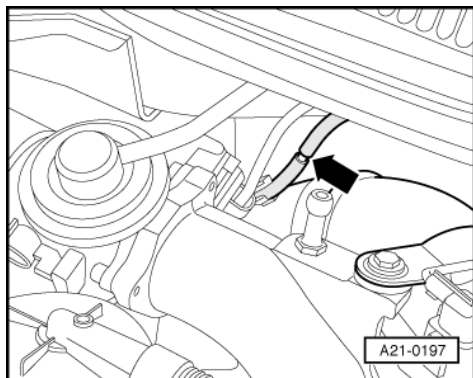
- Replace turbocharger => from Page 21-42

1.7 - Checking vacuum pressure actuation to turbocharger



Test sequence

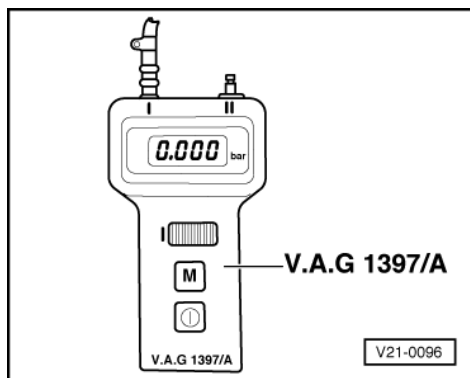
- -> Remove oil dipstick -1- from guide tube.
- Remove engine cover -arrows-.
- Reinsert dipstick in guide tube.



- -> Disconnect hose -arrow- at vacuum unit for boost pressure control.

Note:

Illustration shows an engine with code ASZ, ATD.



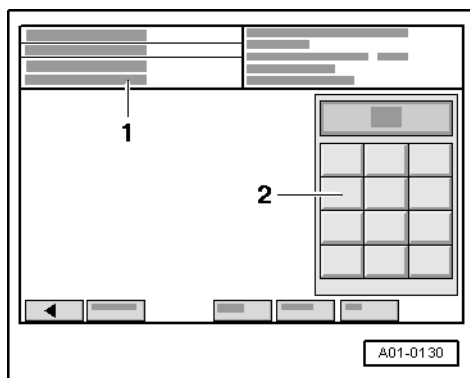
- -> Switch on turbocharger tester and set measuring range selector switch to position -I- (absolute pressure).
- Connect measuring hose to connection -I-.
- Connect the measuring hose to the disconnected vacuum hose.



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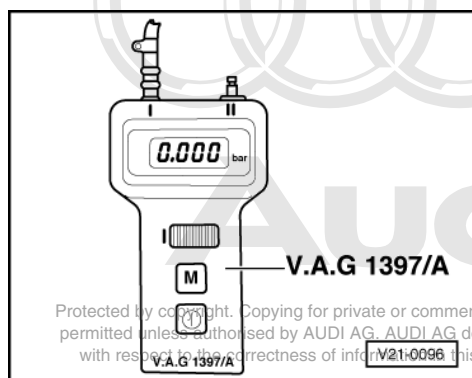
-> Display on VAS 5051:

- Under -1- select diagnostic function "04 - Basic setting".



-> Display on VAS 5051:

- 1 - Enter display group
- Enter "033" for "display group number 033" in zone -2- and confirm the entry by pressing the Q key.
 - The idling speed is increase to 1400 rpm.
 - The vacuum unit for boost pressure control is actuated in intervals.



- -> Specified value on V.A.G 1397 A:
greater than 650 mbar vacuum pressure when actuating the vacuum unit

Note:

The absolute pressure displayed on V.A.G 1397 A must decrease by the specified values given.

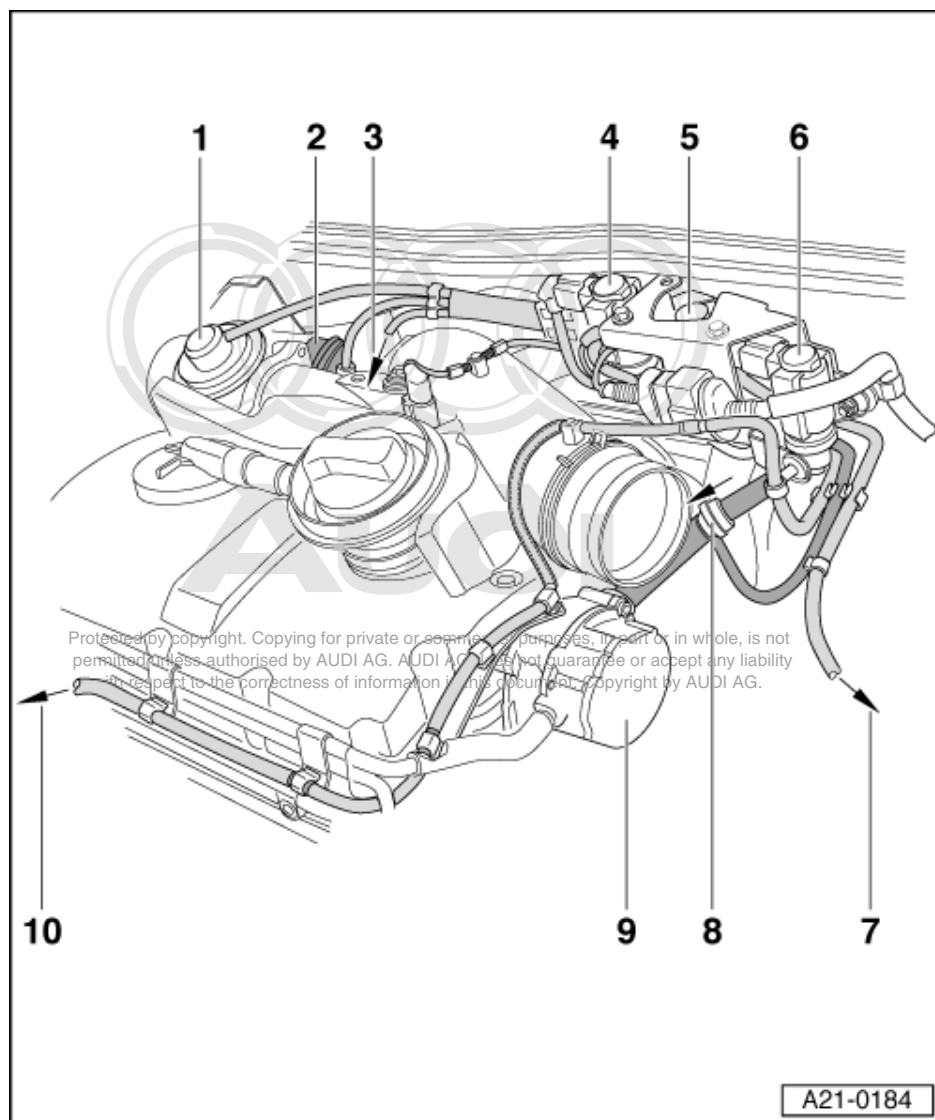
If specified value is not attained:

- Check whether the hose connections of the boost pressure actuation have become disconnected or are blocked => Page 21-21.
- Check boost pressure control solenoid valve -N75 => Page 21-27.

If the vacuum pressure does not decrease after actuation has been completed:

- Check the vent lines => Page 21-23.
- End function "04 - Basic setting" by pressing the ◀ key.
- Press "06 - End output".

1.8 - Connection diagram for boost pressure control -engine codes ASZ, ATD-



1 Intake pipe connection

- ♦ With mechanical exhaust gas recirculation valve
- ♦ With intake manifold flap

2 Vacuum unit for intake manifold flap

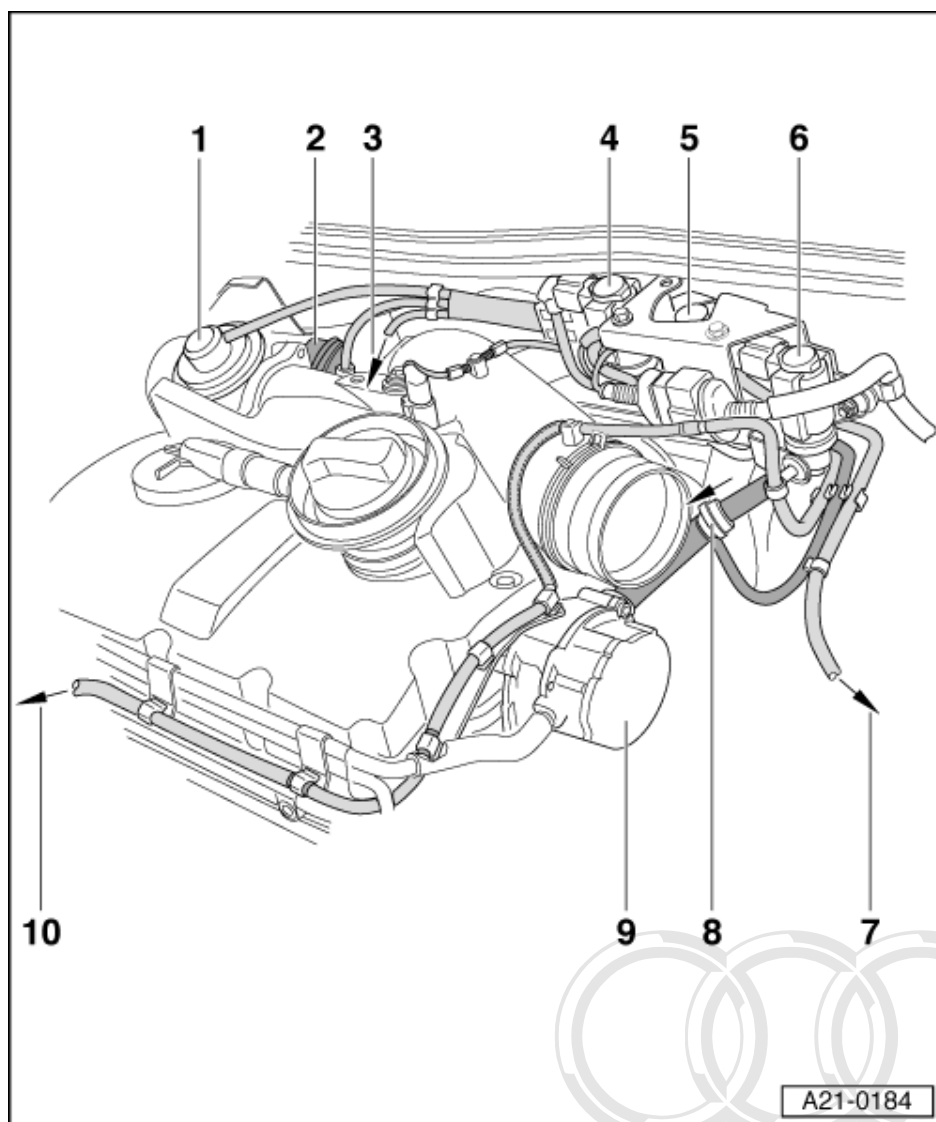
3 To the vacuum unit for boost pressure control

4 EGR valve 1 -N18

- ♦ Fitting location: On bulkhead in engine compartment
- ♦ Hose connection diagram =>Page 21-25

5 Intake manifold flap changeover valve -N239

- ♦ Fitting location: On bulkhead in engine compartment
- ♦ Hose connection diagram =>Page 21-25



6 Boost pressure control solenoid valve -N75

- ◆ Fitting location: On bulkhead in engine compartment
- ◆ Checking => Page 21-27
- ◆ Hose connection diagram =>Page 21-25

7 Breather pipe

- ◆ To air cleaner

8 To brake servo

- ◆ With deviation to vacuum pressure distributor for solenoid valves

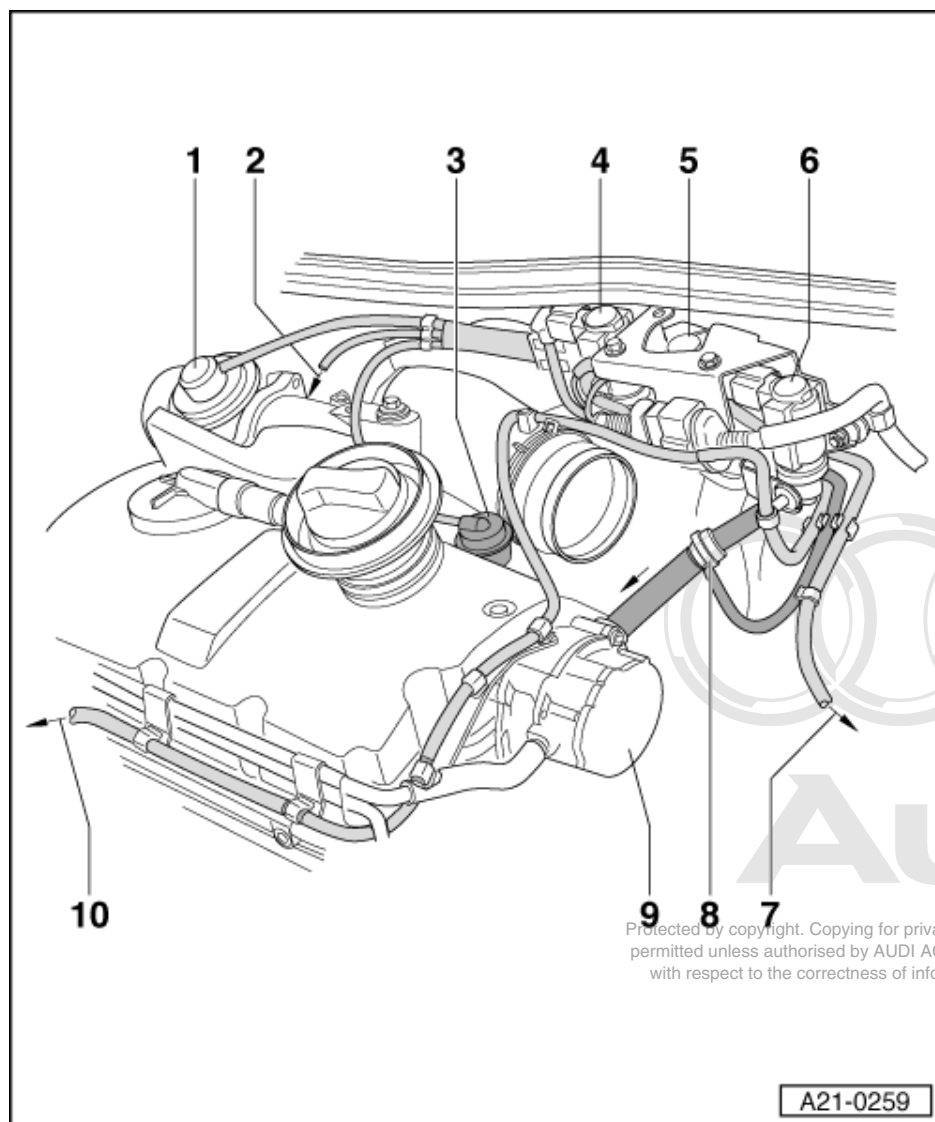
9 Tandem pump

10 Vacuum hose

- ◆ To vacuum unit

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1.9 - Connection diagram for boost pressure control -engine code AXR-



1 Intake pipe connection

- ♦ With mechanical exhaust gas recirculation valve
- ♦ With motor for intake manifold flap -V157

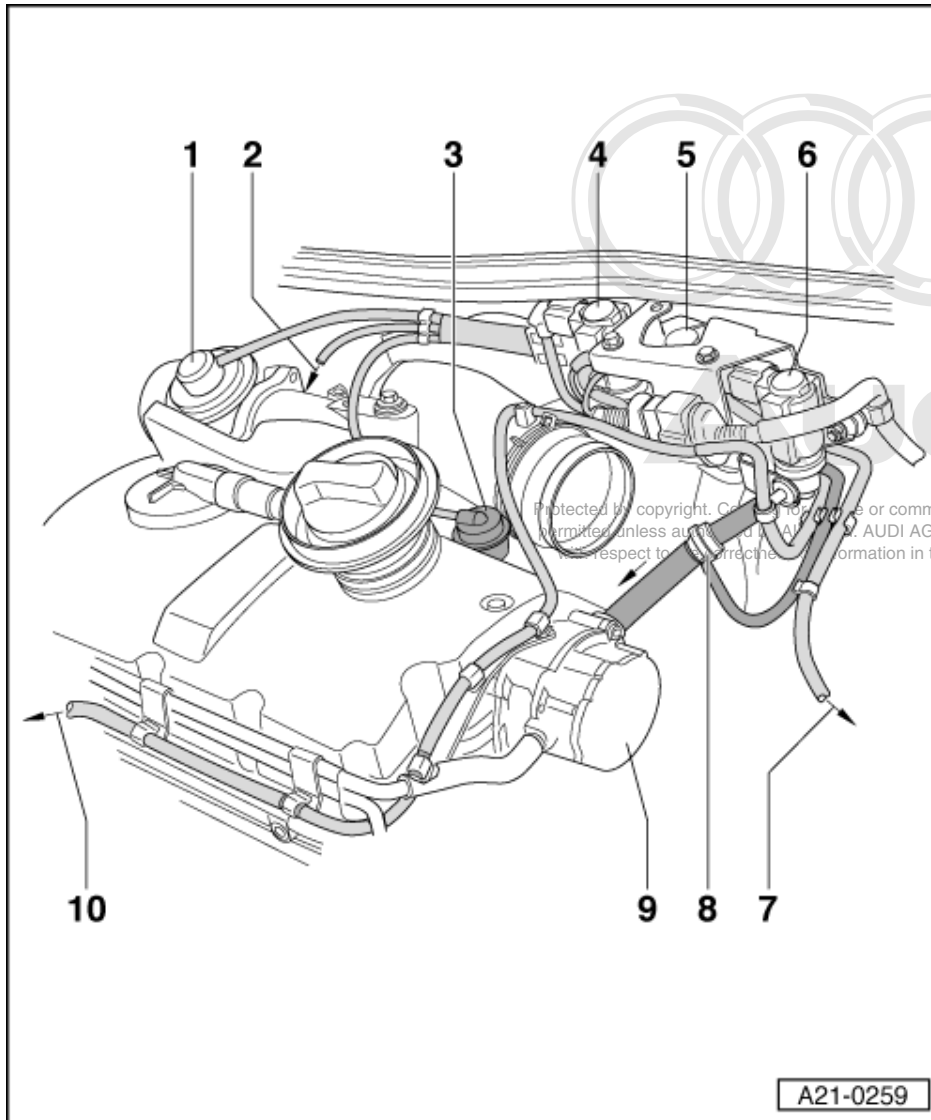
2 To the vacuum unit for boost pressure control

3 Vacuum unit

- ♦ For exhaust gas recirculation changeover

4 EGR valve 1 -N18

- ♦ Fitting location: On bulkhead in engine compartment
- ♦ Hose connection diagram
=>Page 21-25



5 Valve 2 for exhaust gas recirculation -N213

- ◆ Fitting location: On bulkhead in engine compartment
- ◆ Hose connection diagram =>Page 21-25

6 Boost pressure control solenoid valve -N75

- ◆ Fitting location: On bulkhead in engine compartment
- ◆ Checking => Page 21-27
- ◆ Hose connection diagram
=>Page 21-25

7 Breather pipe

- ◆ to air cleaner

8 To brake servo

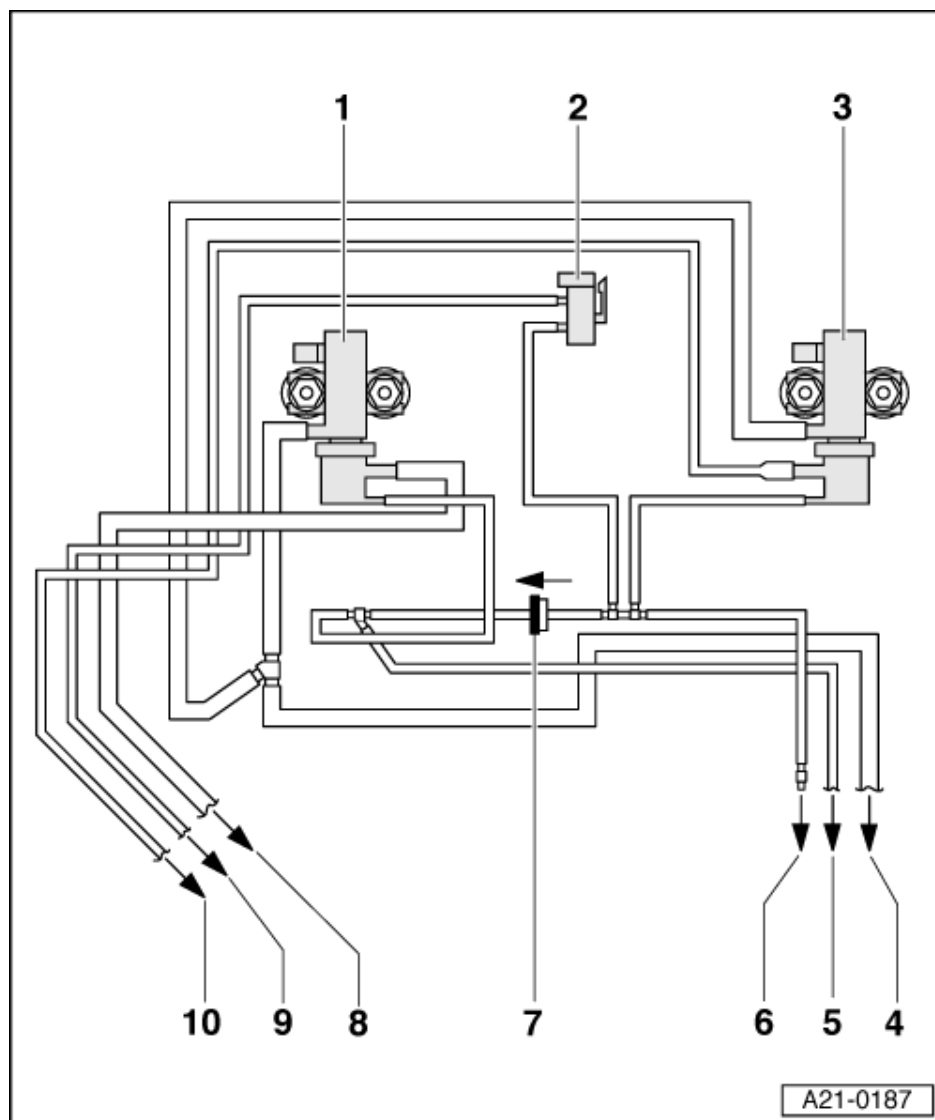
- ◆ With deviation to vacuum pressure distributor for solenoid valves

9 Tandem pump

10 Vacuum hose

- ◆ To vacuum unit

1.10 - Hose connection diagram for solenoid valves at bulkhead



1 EGR valve -N18

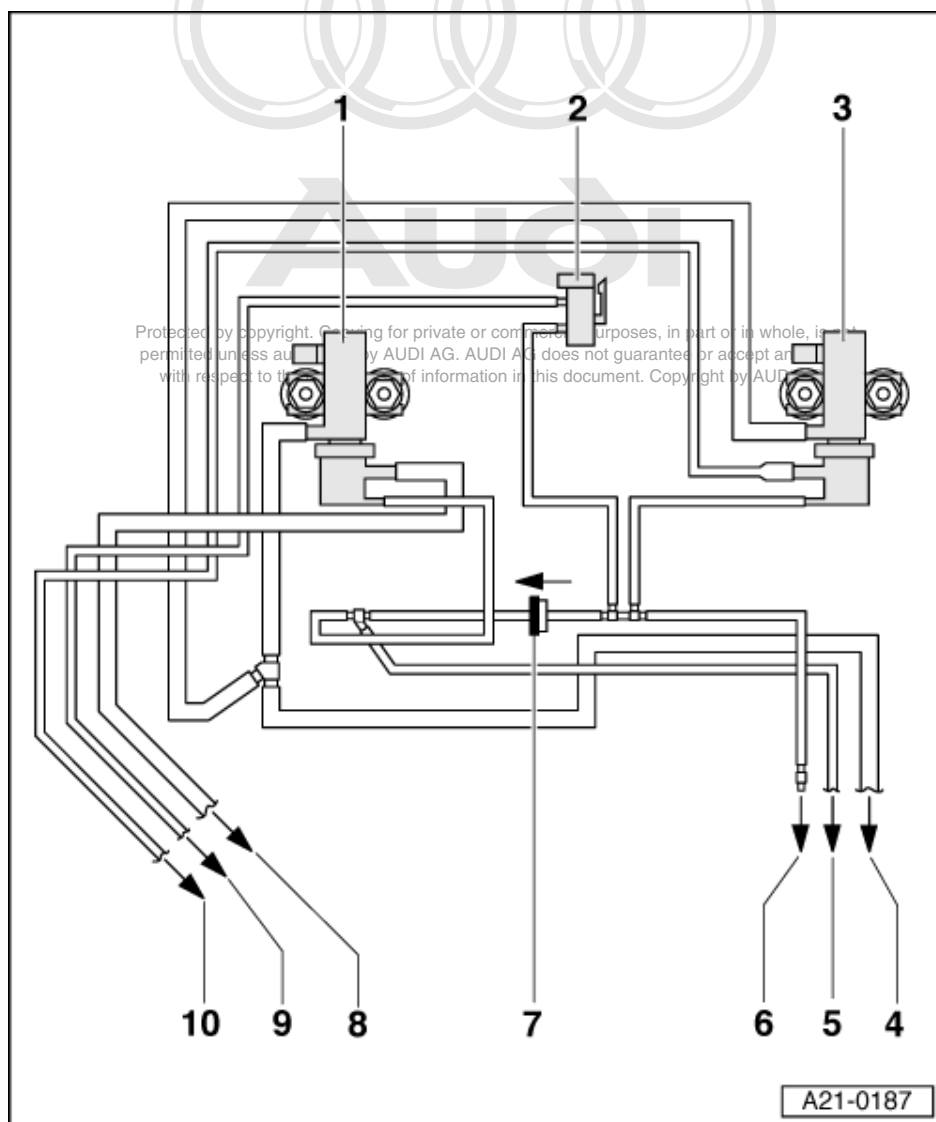
2 Changeover valve for intake manifold flap -N239 (engine codes ASZ, ATD) or valve 2 for exhaust gas recirculation -N213 (engine code AXR)

3 Boost pressure control solenoid valve -N75

4 Breather pipe

♦ To air cleaner

5 To the tandem pump



6 To vacuum reservoir

7 Non-return valve

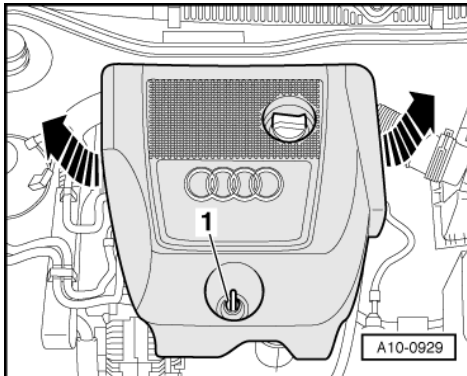
- ♦ Note installation position (light side/ dark side) as shown in Fig, arrow faces in direction of flow

8 To mechanical exhaust gas recirculation valve

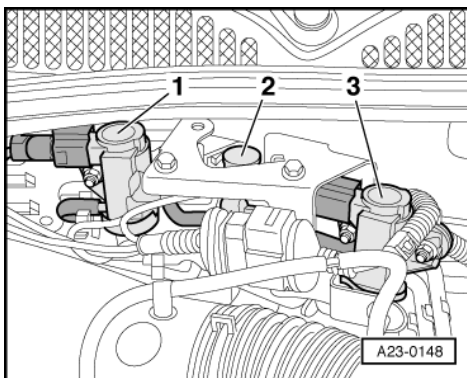
9 To vacuum unit for intake manifold flap

10 To the vacuum unit for boost pressure control

1.11 - Checking solenoid valve for boost pressure limitation -N75

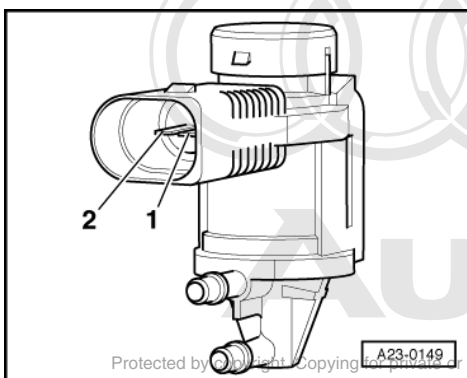


- -> Remove oil dipstick -1- from guide tube.
- Remove engine cover -arrows-.
- Reinsert dipstick in guide tube.



Checking internal resistance

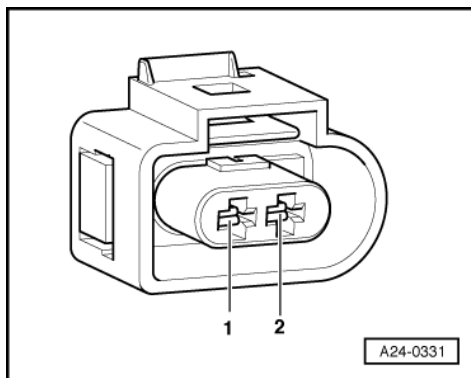
- Switch ignition off.
- -> Unplug connector from boost pressure control solenoid valve -N75 -Item 3-.



- -> Connect multimeter between contacts 1 and 2 to measure resistance.
- Specified value: 14...20 Ω

If specified value is not attained:

- Replace solenoid valve for boost pressure control -N75.

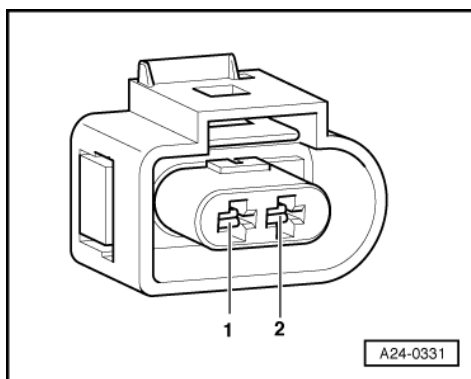


Checking power supply

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

If specified value is not attained:

- Check wiring for open circuit and service if necessary.



Checking actuation

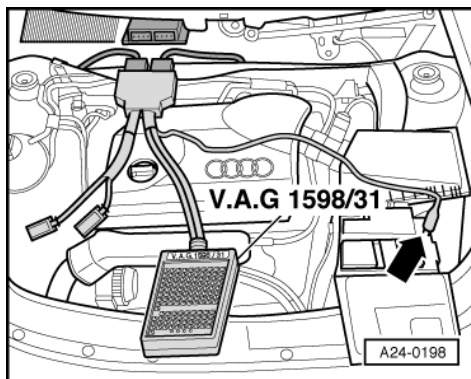
- -> Connect voltage tester V.A.G 1527 B between contacts 1 and 2.
- Start final control diagnosis and activate solenoid valve for boost pressure control -N75:

=> TDIInjection and Glow Plug System(4-cyl Pump Jet); Repair group 01; Final control diagnosis Final control diagnosis

- The LED must flash slowly.

Note:

Voltage testers with a low current consumption continue to glow faintly between actuation from the engine control unit (rather than extinguishing completely) and become much brighter when actuated.



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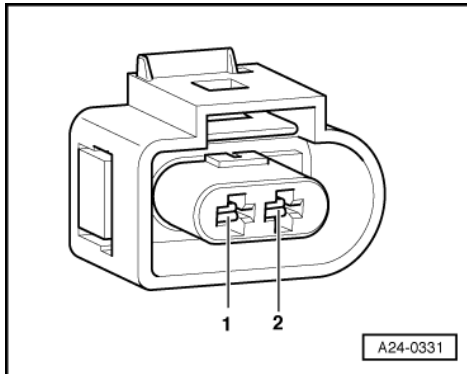
If the LED lamp does not react as described:

- Switch ignition off.
- -> Connect the V.A.G 1598/31 test box to wiring harness connectors; the engine control unit should not be connected. Attach the earth clip of test box to earth -arrow-.

=> TDIInjection and Glow Plug System(4-cyl Pump Jet); Repair group 23

Important

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



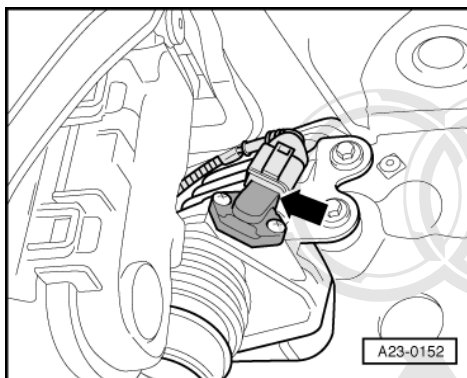
- -> Check for open circuit and short to positive or earth in the following wiring connections:

Connector Contact	Test box V.A.G 1598/31 Socket
1	62

- Rectify any open/short circuit as necessary.

1.12 - Checking intake manifold pressure sender -G71

Test sequence



Notes:

- ◆ The intake manifold pressure sender is contained in one housing together with intake manifold temperature sender.
- ◆ -> Fitting location of intake manifold pressure sender -arrow-: On charge air cooler on front right in engine compartment.

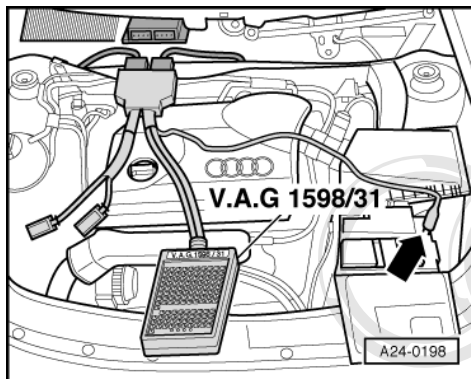
- Read measured value block, display group 010, engine stopped.

=> TDI Injection and Glow Plug System (4-cyl Pump Jet); Repair group 01; Reading measured value block
Reading measured value block

- Compare display in zones 2 and 3.
 - Specified value: Pressures match
Tolerance ± 30 mbar

If specified value is not attained:

- Check the wiring connections.



Checking wiring

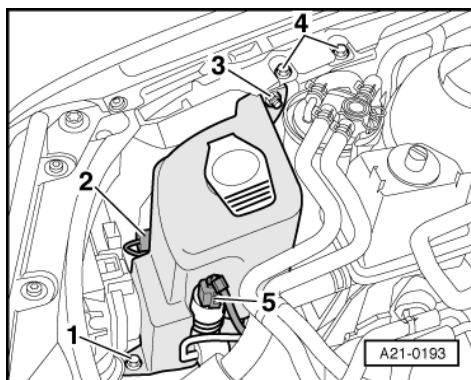
- Switch ignition off.
- -> Connect the V.A.G 1598/31 test box to wiring harness connectors; the engine control unit should not be connected. Attach the earth clip of test box to earth -arrow-.

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=> TDI Injection and Glow Plug System (4-cyl Pump Jet); Repair group 23

Important

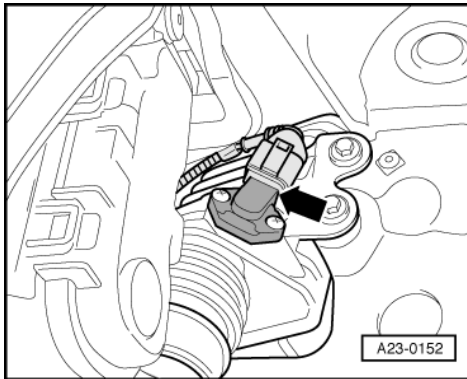
To prevent damage to the electronic components, select appropriate measuring range before connecting the measuring cables and observe the test requirements.



Vehicles with headlamp washer system:

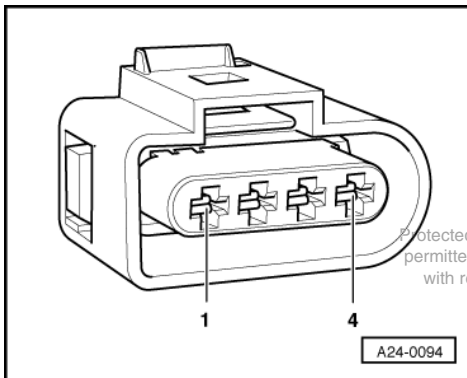
- -> Detach the bracket for fuel filter from the body -4-. Hoses remain connected to fuel filter.
- Detach connectors -2- and -5-.
- Remove bolt -1- and nut -3-.

- Move wash water reservoir to the side. Do not detach hoses.



All models:

- -> Remove the connector from the intake manifold pressure sensor
 -arrow-.



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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 1598/31 Socket
1	52
3	31
4	71

- Rectify any open/short circuit as necessary.

If no fault is found:

- Fit a new intake manifold pressure sender.



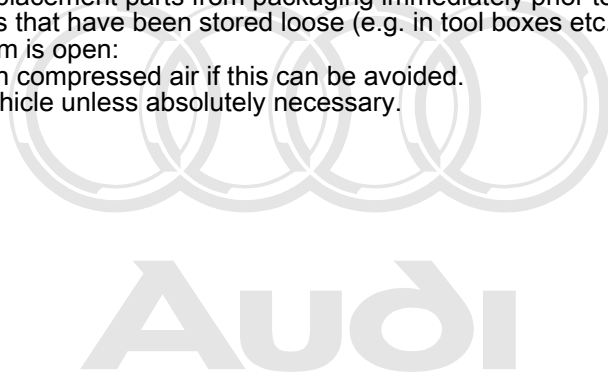
2 - Servicing charge air system with turbocharger

2.1 - Servicing charge air system with turbocharger

2.2 - Rules for cleanliness

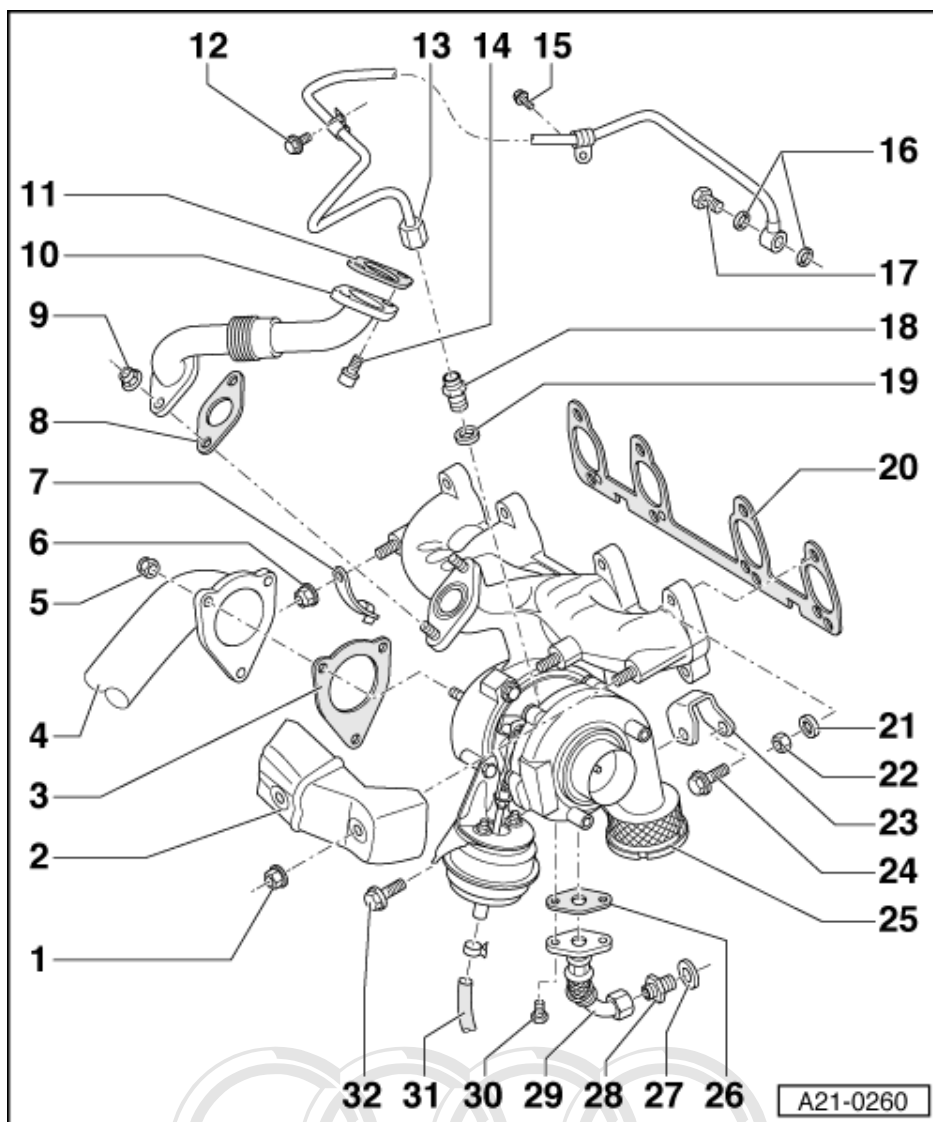
When working on the turbocharger, pay careful attention to the following "5 rules":

- ♦ 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 tool boxes etc.).
- ♦ When the system is open:
 - Do not work with compressed air if this can be avoided.
 - Do not move vehicle unless absolutely necessary.



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2.3 - Removing and installing turbocharger - overview



Notes:

- ♦ The illustration shows a turbocharger for vehicles with front-wheel drive.
- ♦ A resonator is additionally fitted to the turbocharger for vehicles with four-wheel drive => Fig.1.

1 20 Nm

- ♦ Replacing

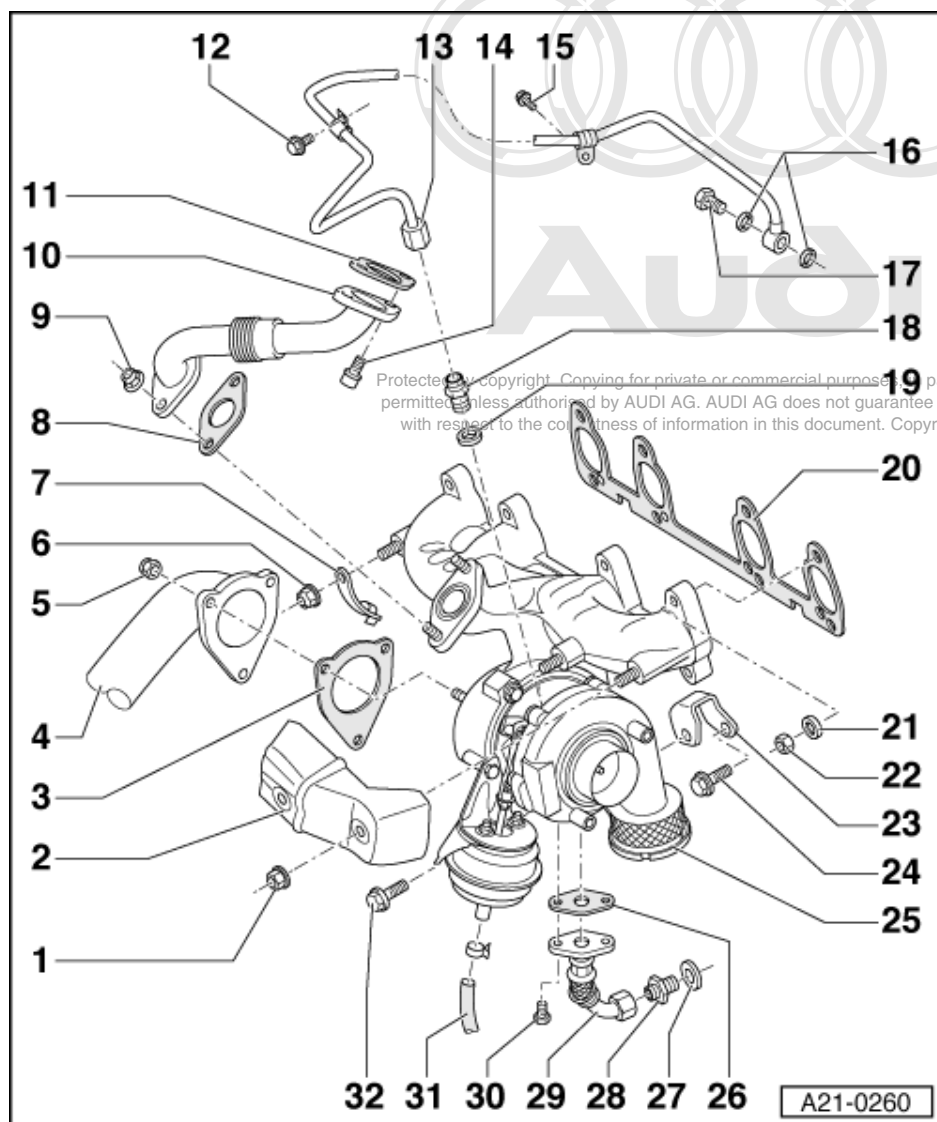
2 Heat shield

3 Seal

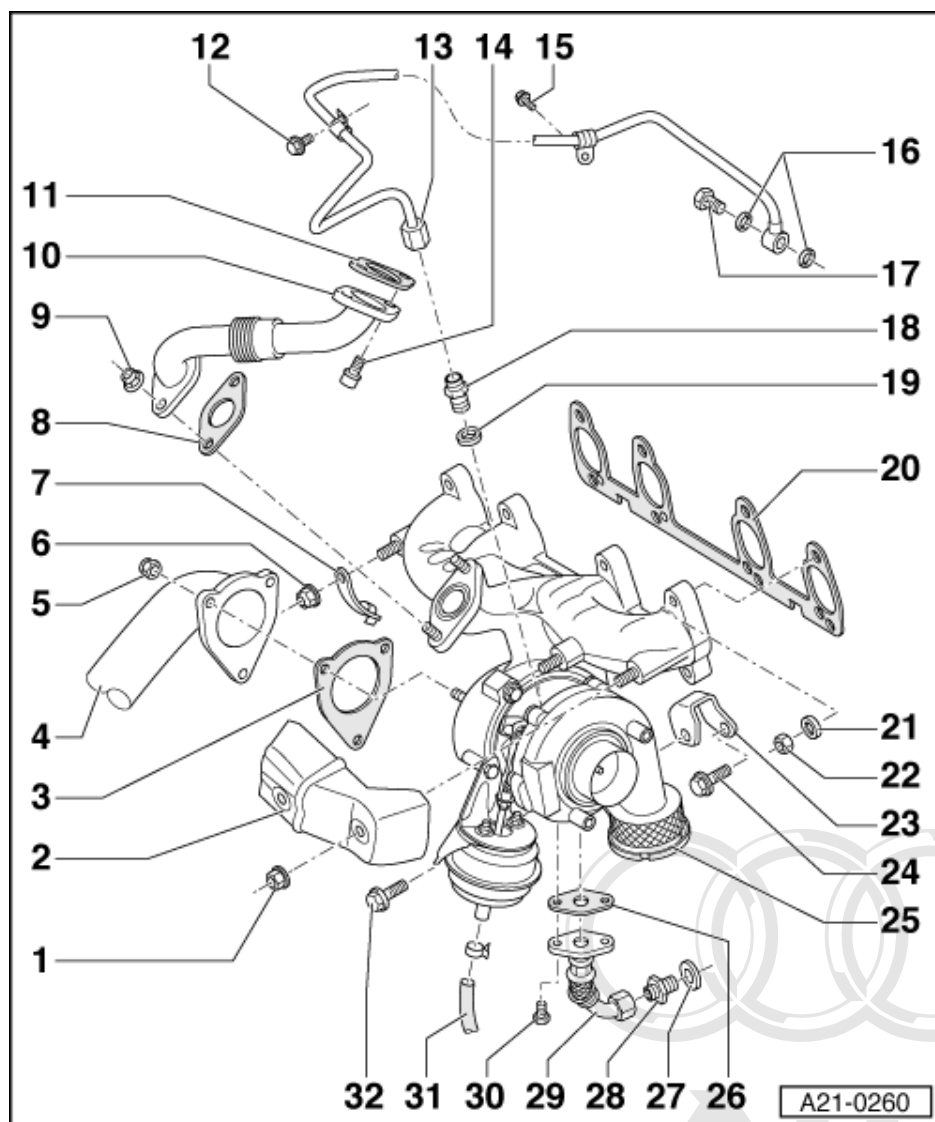
- ♦ Replacing

4 Front exhaust pipe

- ♦ With catalytic converter
- ♦ Removing and installing
=>Page 26-10



- 5 23 Nm
 - ◆ Replacing
- 6 20 Nm
 - ◆ Replacing
- 7 **Bracket**
 - ◆ For oil feed line
- 8 **Seal**
 - ◆ Replacing
- 9 22 Nm
 - ◆ Replacing
- 10 **Connecting pipe**
 - ◆ For exhaust gas recirculation
 - ◆ Note installation sequence:
 - First bolt on loosely.
 - Then tighten bolts to final torque.
- 11 **Seal**
 - ◆ Replacing



12 10 Nm

13 Oil supply pipe

- ◆ Tighten union nut to 22 Nm.
- ◆ Note installation sequence:
 - First screw in both wiring ends loosely.
 - Then tighten wiring ends to final torque.
 - Finally, attach bracket -Items 7- and -15-.

14 22 Nm

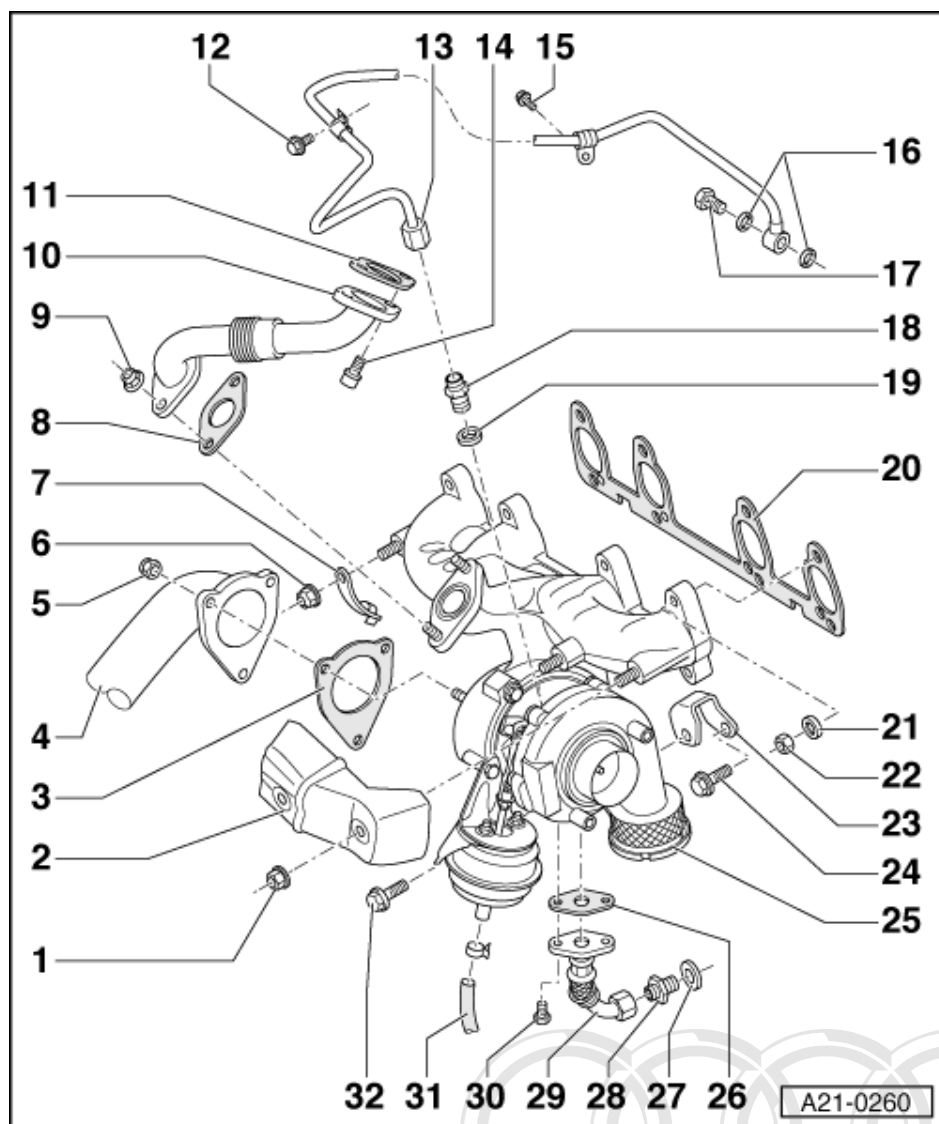
15 10 Nm

16 Sealing rings

- ◆ Replacing

17 Banjo bolt - 25 Nm

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18 30 Nm

19 Sealing ring

- ◆ Replacing

20 Seal

- ◆ Replacing
- ◆ Note installation position

21 Shim

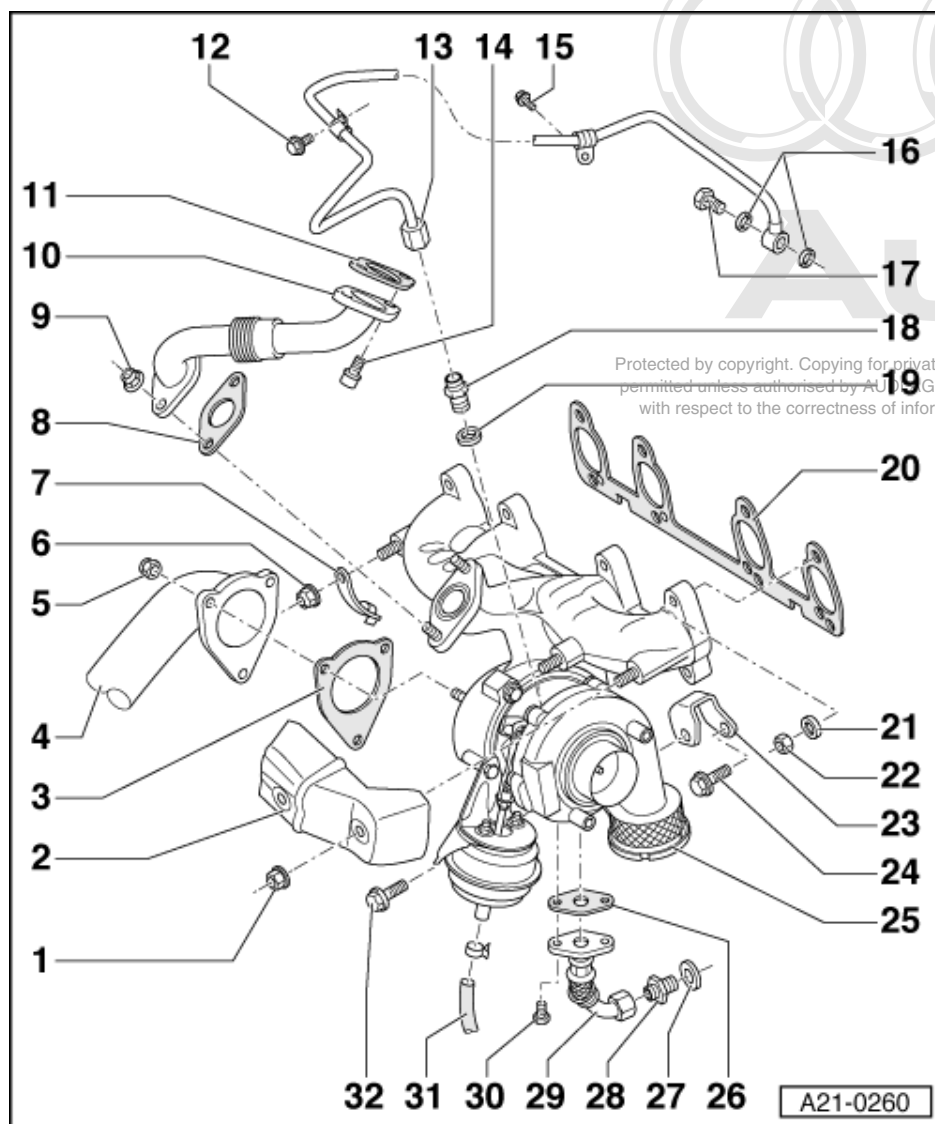
22 25 Nm

- ◆ Replacing

23 Bracket

- ◆ For turbocharger
- ◆ Note installation sequence:
 - First bolt on loosely.
 - Then tighten bolts to final torque.

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**24 40 Nm**

- ♦ Note installation sequence => -Item23-

25 Turbocharger

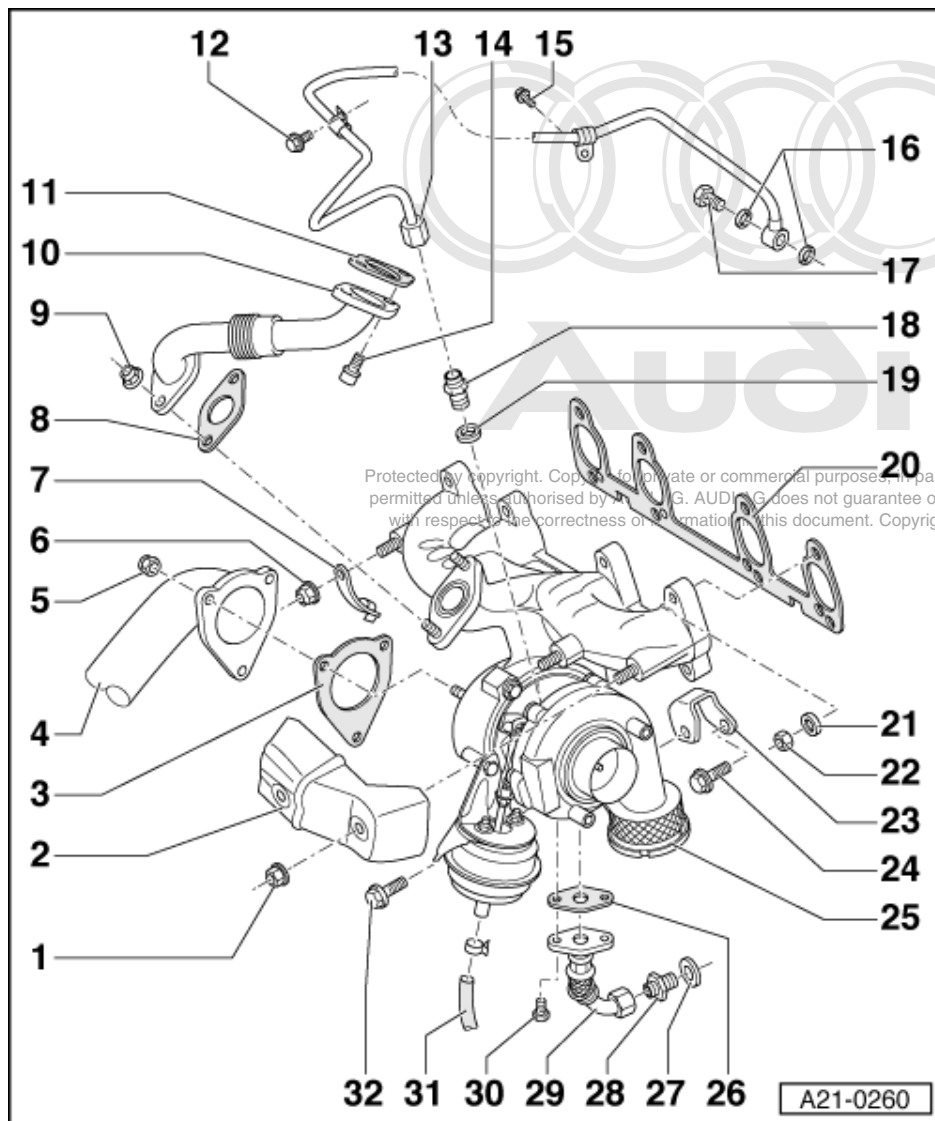
- ♦ Checking => as of Page 21-7
- ♦ Removing and installing - vehicles with front-wheel drive -engine code AXR- => Page 21-42
- ♦ Removing and installing - vehicles with front-wheel drive -engine codes ASZ, ATD- => Page 21-53
- ♦ Removing and installing - vehicles with four-wheel drive -engine code ASZ- => Page 21-62
- ♦ Do not dismantle

26 Seal

- ♦ Replacing

27 Sealing ring

- ♦ Replacing



28 Screw fitting - 40 Nm

29 Oil return pipe

- ◆ To cylinder block
- ◆ Tighten union nut to 30 Nm.

30 15 Nm

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

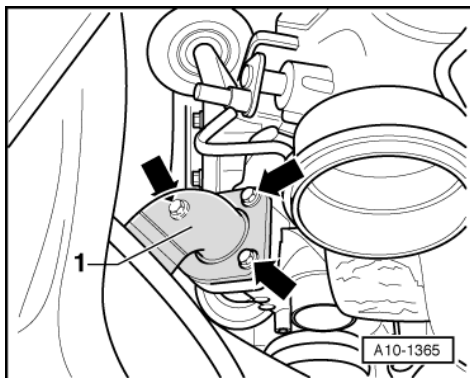
=> Parts List

31 Hose

- ◆ From boost pressure control solenoid valve -N75

32 20 Nm

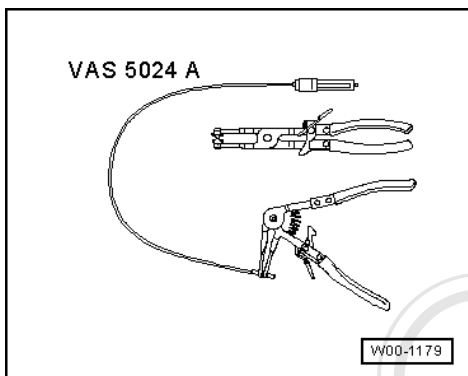
- ◆ Note installation sequence =>
-Item 23-



-> Fig.1 Fastening resonator to turbocharger - vehicles with four-wheel drive

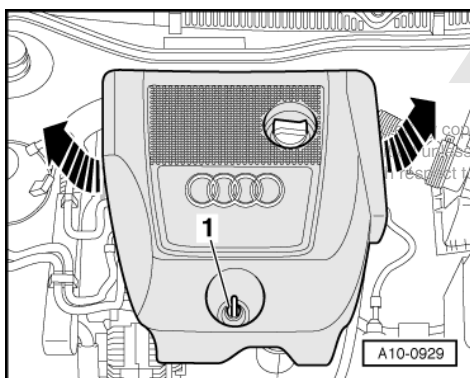
- Tighten to 9 Nm -arrows-.

2.4 - Removing and installing turbocharger - vehicles with front-wheel drive -engine code AXR-



Special tools and workshop equipment required

- ♦ VAS 5024 A

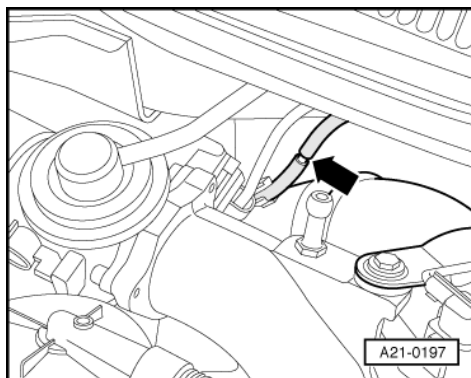


Removing

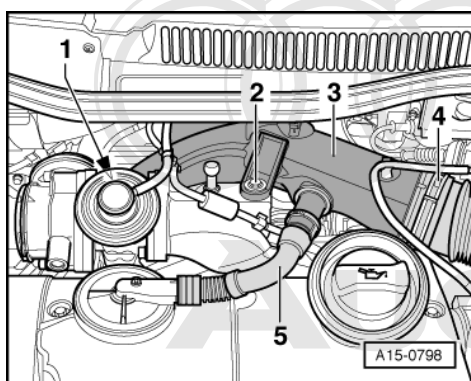
- -> Remove oil dipstick -1- from guide tube.
- Remove engine cover -arrows-.



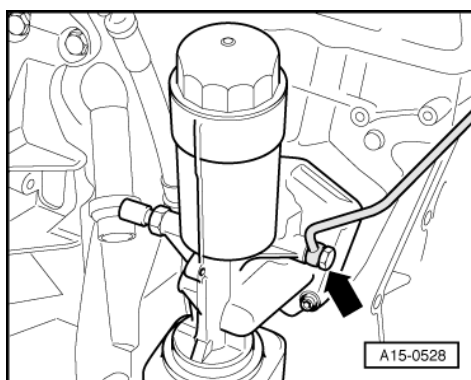
- Reinsert dipstick in guide tube.



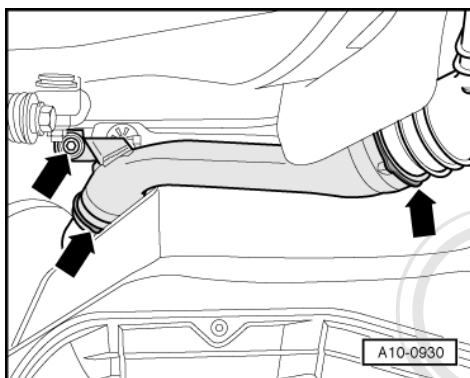
- -> Disconnect hose -arrow- at vacuum unit for boost pressure control.



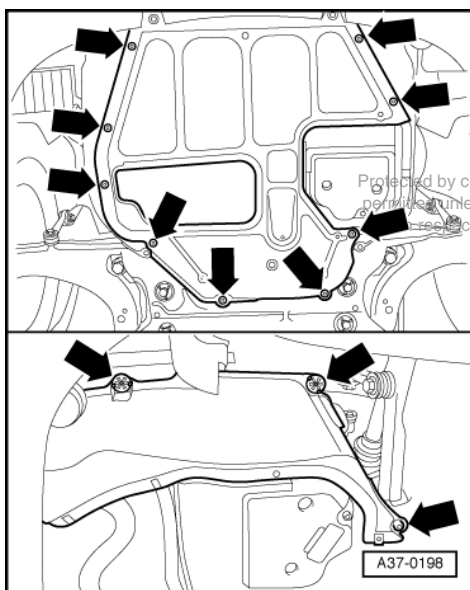
- -> Disconnect hose 4- to air cleaner housing.
- Disconnect crankcase vent pipe 5- from air duct hose.
- Release spring clamp on turbocharger using VAS 5024 A.
- Set aside the vacuum hoses.
- Unscrew bolts -1- and -2- and remove air duct pipe -3-.



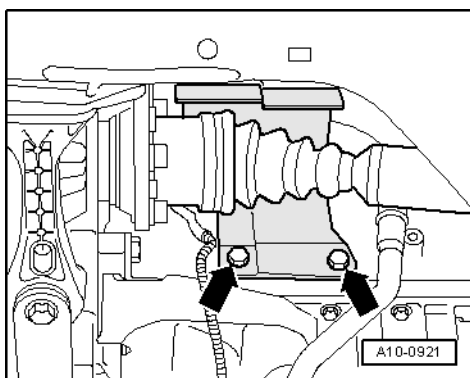
- -> Unscrew oil feed line at oil filter bracket -arrow- and also at coolant pipe.



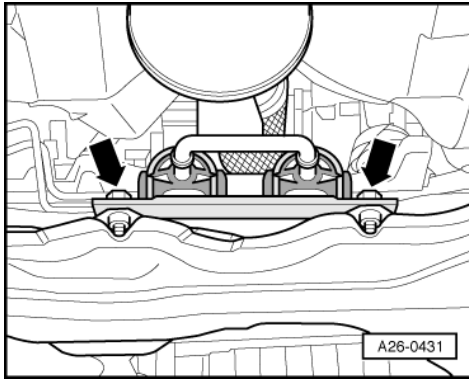
- -> Remove air duct pipe from right longitudinal member -arrows-.



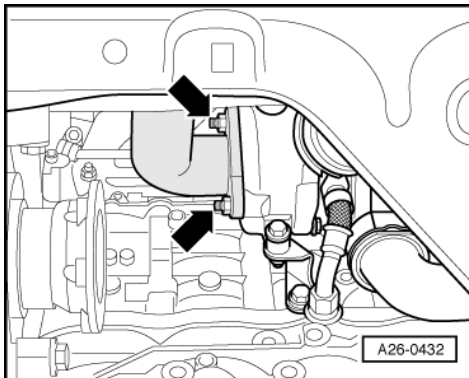
- -> Remove centre and right noise -arrows-.



- -> Unbolt heat shield for right drive shaft -arrows-.
- Detach right drive shaft from gearbox flange.



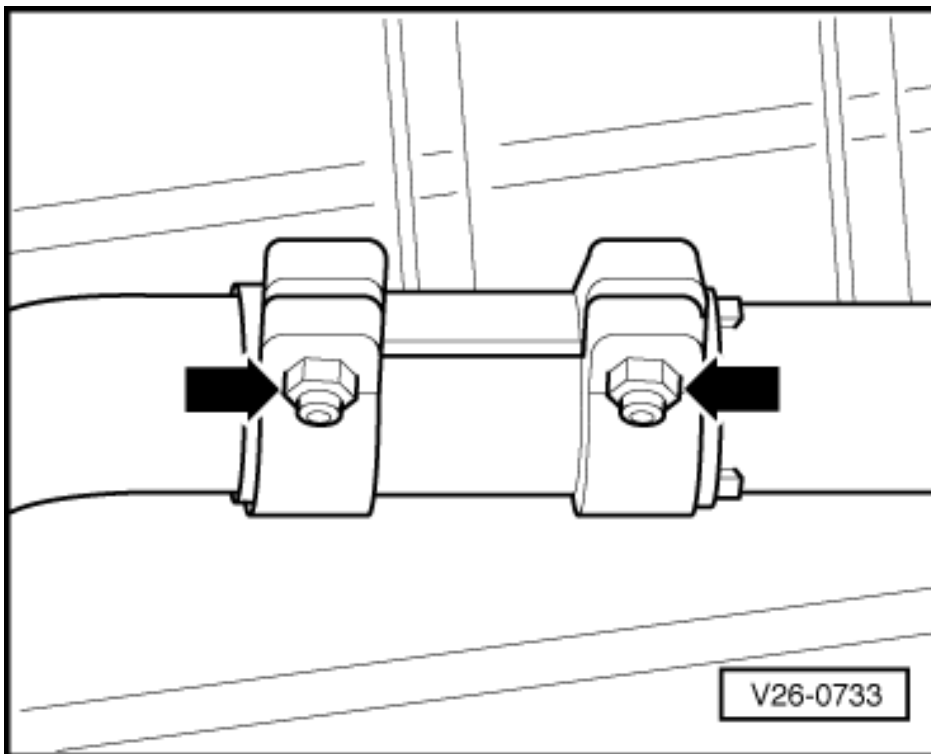
- -> Unbolt bracket for exhaust system from assembly mounting -arrows-.



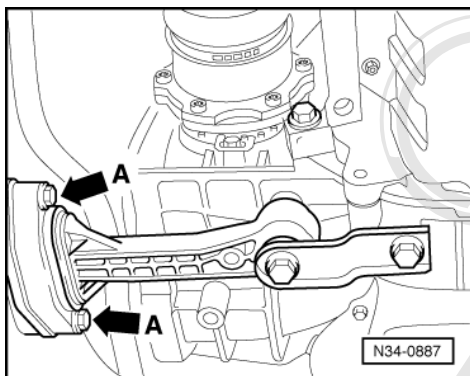
Note:

The isolating element in front exhaust pipe must not be deflected more than 10° to avoid damage.

- -> Unscrew securing bolts -arrows- of front exhaust pipe/turbocharger.

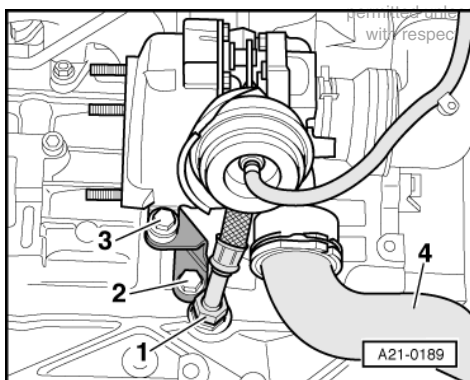


- -> Detach the exhaust system at the clamping sleeve -arrows-.
- Remove the front exhaust pipe.

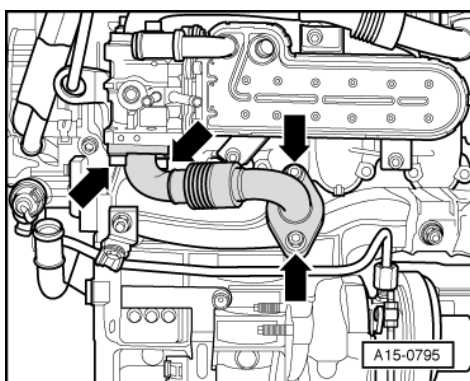


- -> Unscrew pendulum support from subframe -arrows A-.

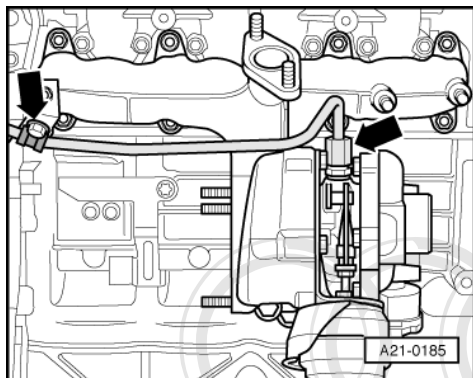
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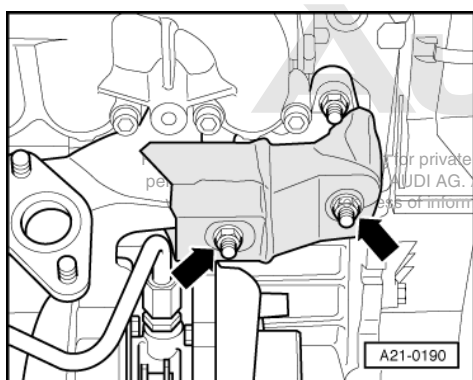
- -> Detach air duct hose -4-.
- Remove bolts -2- and -3- and detach bracket for turbocharger.
- Remove oil return pipe -1- at cylinder block.



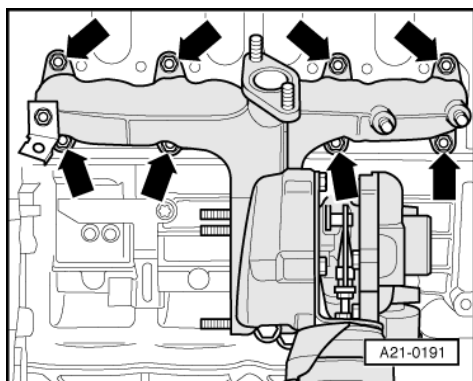
- -> Remove connection pipe for exhaust gas recirculation -arrows-.



- -> Unscrew oil feed line from turbocharger and exhaust manifold -arrows-.



- -> Remove heat shield from exhaust manifold -arrows-.



- -> Unscrew nuts -arrows-.
- Remove packing plates.
- Remove exhaust manifold/turbocharger downwards.

Installing

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

Notes:

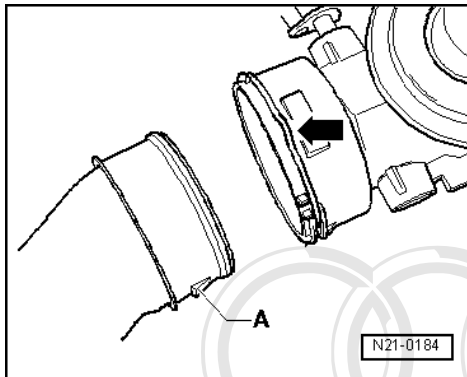
- ♦ Always replace seals, gaskets and self-locking nuts.
- ♦ Note installation position of exhaust manifold/turbocharger gaskets.
- ♦ Fill the turbocharger with engine oil via the oil supply connection.
- ♦ Hose connections and hoses for charge air system must be free of oil and grease before assembly.

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

=> Parts List

- Install exhaust system and align it stress-free => Page 26-13.
- Install right drive shaft.

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



- -> When installing air duct pipes with connectors, ensure that the securing clip -arrow- engages audibly in the retaining lug -A-.
- Check oil level => Page 17-23.

Note:

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.

Tightening torques

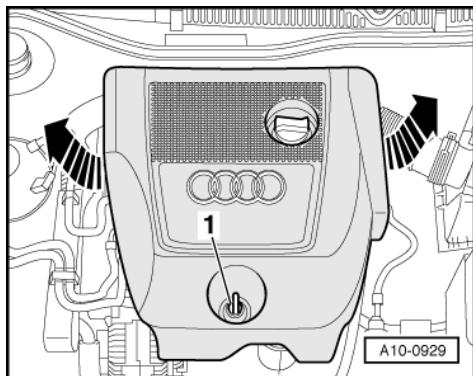
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Component	Nm
Exhaust manifold/turbocharger to cylinder head	25 1)
Heat shield to exhaust manifold/turbocharger	20 1)
Oil supply pipe to turbocharger	22
Connection pipe for exhaust changeover gas recirculation to valve	22
exhaust manifold	22
Turbocharger bracket to cylinder block	40
Turbocharger bracket to turbocharger	20
Oil return line to cylinder block	30
Drive shaft heat shield to cylinder block	35
Oil supply pipe to oil filter bracket	25
Pendulum support to subframe	20 + 90°2)3)

- 1) Replace the nuts.
- 2) Stretch bolts, replace
- 3) 90° corresponds to a quarter of a turn

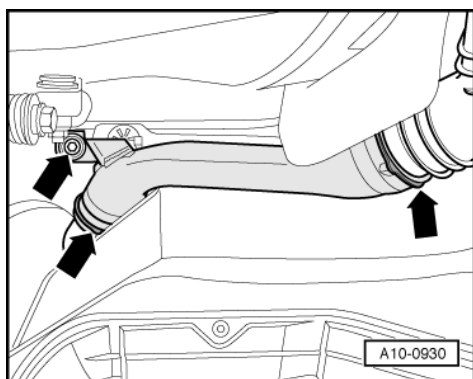


2.5 - Removing and installing turbocharger - vehicles with front-wheel drive -engine coded ASZ, ATD-

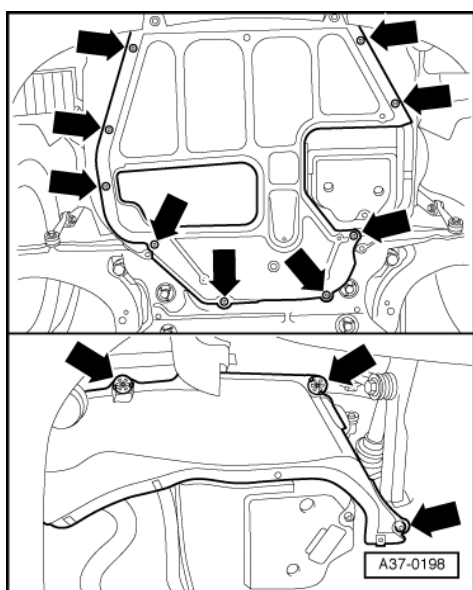


Removing

- -> Remove oil dipstick -1- from guide tube.
- Remove engine cover -arrows-.
- Reinsert dipstick in guide tube.



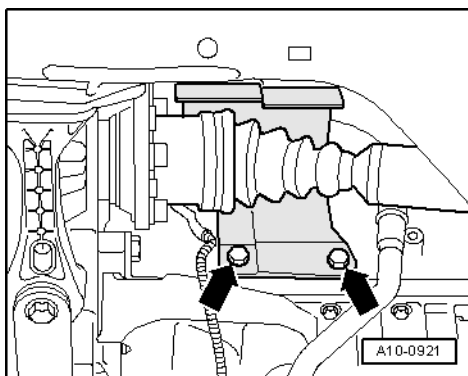
- -> Remove air duct pipe from right longitudinal member -arrows-.



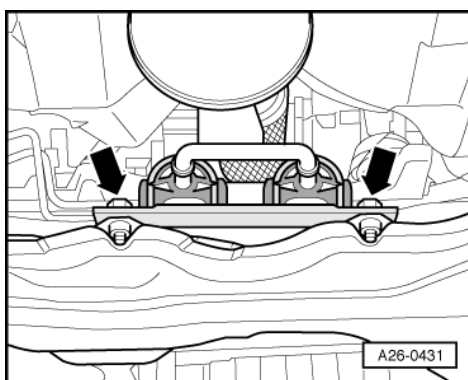
- -> Remove noise insulation in centre and on right -arrows-.



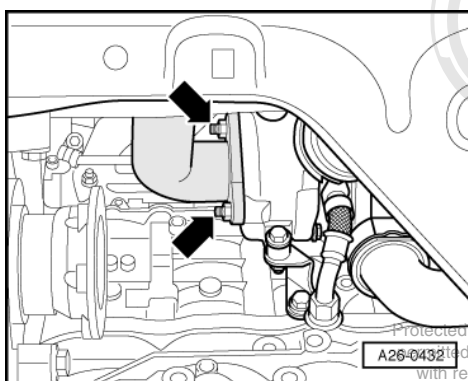
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- -> Unbolt heat shield for right drive shaft -arrows-.



- -> Unbolt bracket for exhaust system from assembly mounting -arrows-.

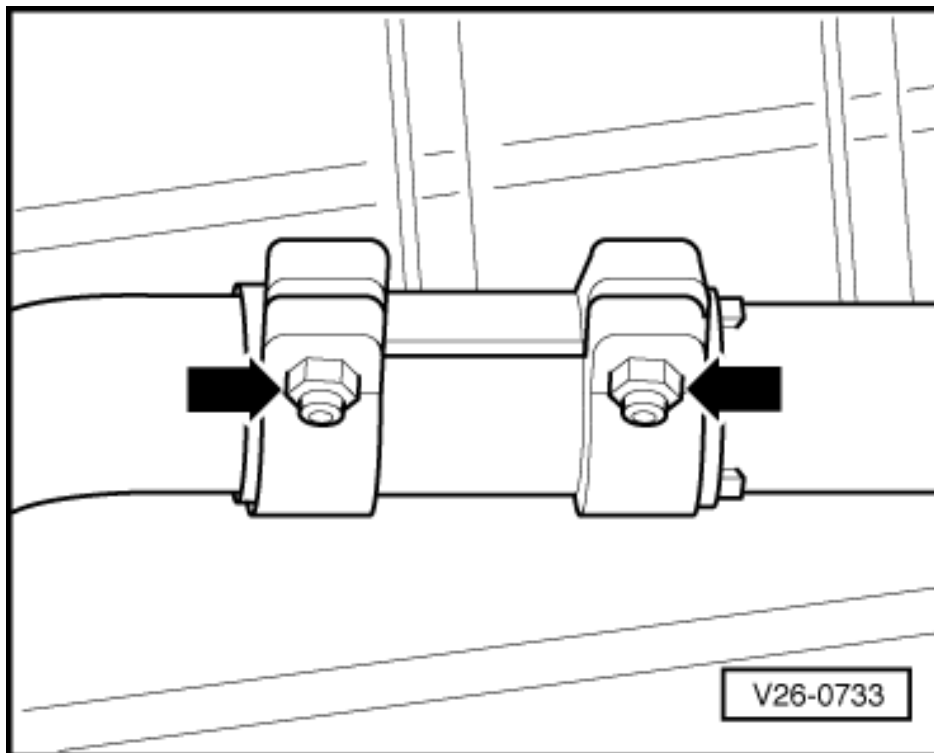


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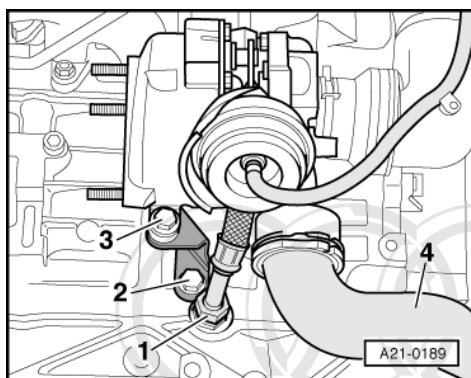
Note:

The isolating element in front exhaust pipe must not be deflected more than 10° to avoid damage.

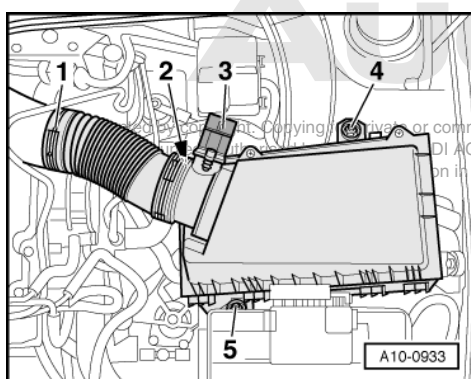
- -> Unscrew securing bolts -arrows- of front exhaust pipe/turbocharger.



- -> Detach the exhaust system at the clamping sleeve -arrows-.
- Remove the front exhaust pipe.

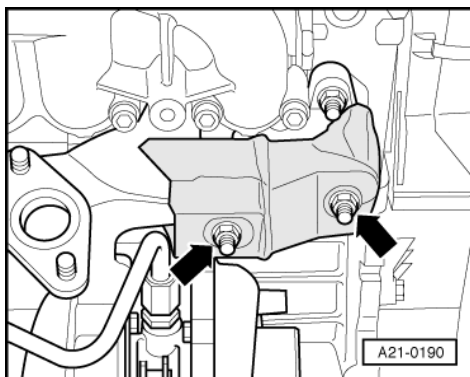


- -> Remove air duct hose -4- from turbocharger.
- Remove bolts -2- and -3- and remove bracket for turbocharger.
- Remove oil return pipe -1- at cylinder block.

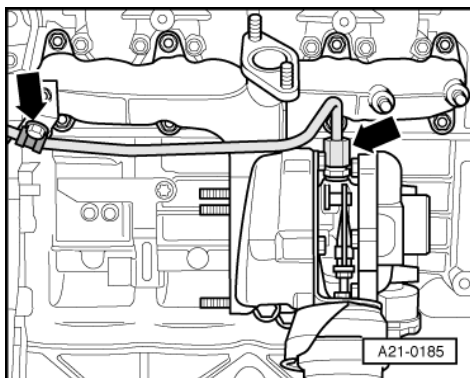


- -> Remove air duct hose -1- from air duct pipe.
- Detach connector of air mass meter -3-.
- Unscrew bolts -4- and -5-.

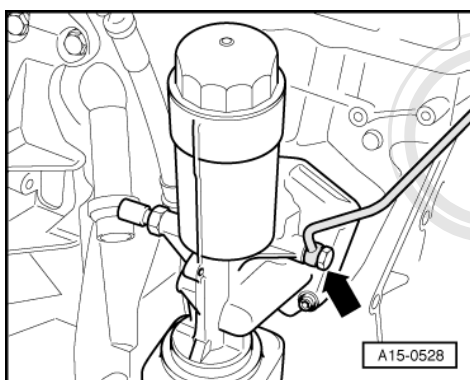
- Remove vent hose -2- off air cleaner housing.
- Remove air cleaner housing.
- Remove intake manifold => Page 15-64.
- Remove upper toothed belt guard.



- -> Remove heat shield from exhaust manifold -arrows-.

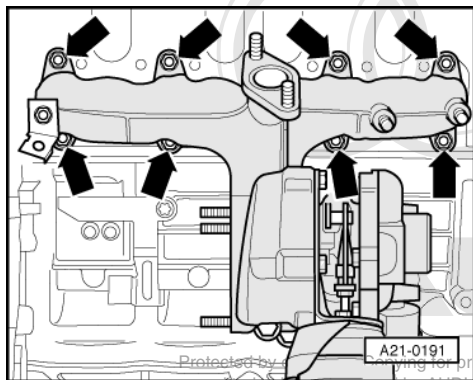


- -> Unscrew oil feed line from turbocharger and exhaust manifold -arrows-.



- -> Unscrew oil feed line from oil filter bracket -arrow- and also at coolant pipe and lay line aside.

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- -> Unscrew nuts -arrows-.
- Remove packing plates.
- Remove exhaust manifold/turbocharger upwards.

Installing

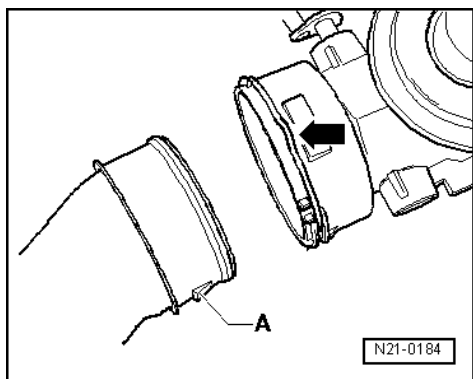
Installation is carried out in the reverse order; note the following:

Notes:

- ♦ Replace seals, gaskets and self-locking nuts.
- ♦ Note installation position of exhaust manifold/turbocharger gaskets.
- ♦ Fill the turbocharger with engine oil via the oil supply connection.
- ♦ Hose connections and hoses for charge air system must be free of oil and grease before assembly.
- ♦ Secure all hose connections with the correct hose clamps (same as original equipment):

=> Parts List

- Install intake manifold => Page 15-68.
- Install exhaust system and align it stress-free => Page 26-13.



- -> When installing air duct pipes with connectors, ensure that the securing clip -arrow- engages audibly in the retaining lug -A-.
- Check oil level => Page 17-23.

Note:

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.

Tightening torques

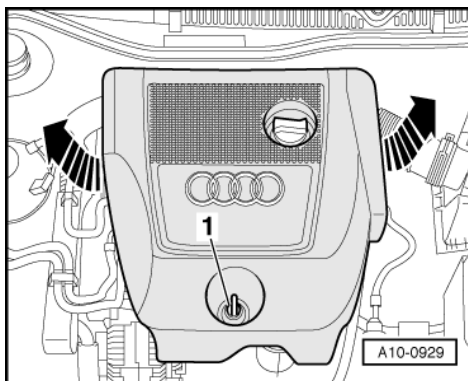
Component	Nm
Exhaust manifold/turbocharger to cylinder head	25 1)
Heat shield to exhaust manifold/turbocharger	20 1)

Component	Nm
Oil supply pipe to oil filter bracket	25

- 1) Replace the nuts.

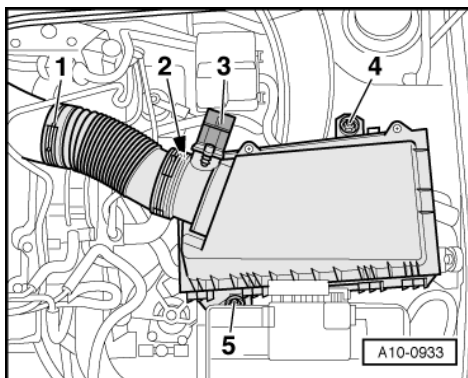
Component	Nm
Oil supply pipe to turbocharger	22
Turbocharger bracket to cylinder block	40
Turbocharger bracket to turbocharger	20
Oil return line to cylinder block	30
Drive shaft heat shield to cylinder block	35

2.6 - Removing and installing turbocharger - vehicles with four-wheel drive -engine code ASZ-



Removing

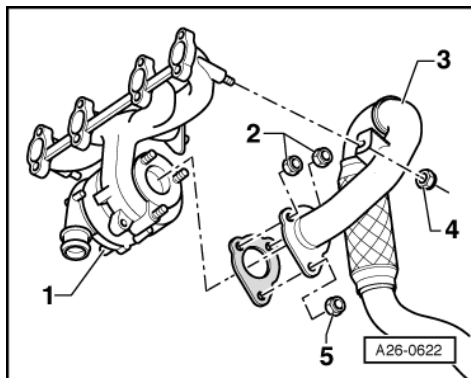
- -> Remove oil dipstick -1- from guide tube.
- Remove engine cover -arrows-.
- Reinsert dipstick in guide tube.



- -> Remove air duct hose -1- from air duct pipe.
- Detach connector of air mass meter -3-.
- Unscrew bolts -4- and -5-.
- Remove vent hose -2- off air cleaner housing.
- Remove air cleaner housing.
- Remove intake manifold => Page 15-64.



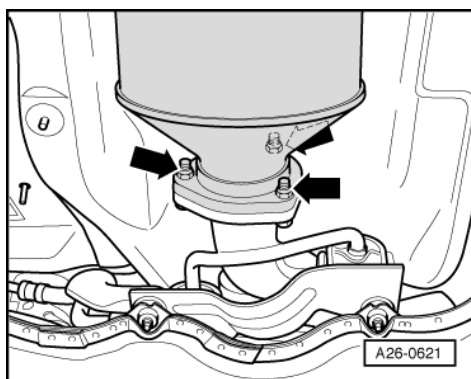
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- -> Unscrew nuts -2-, -4- and -5-.

Note:

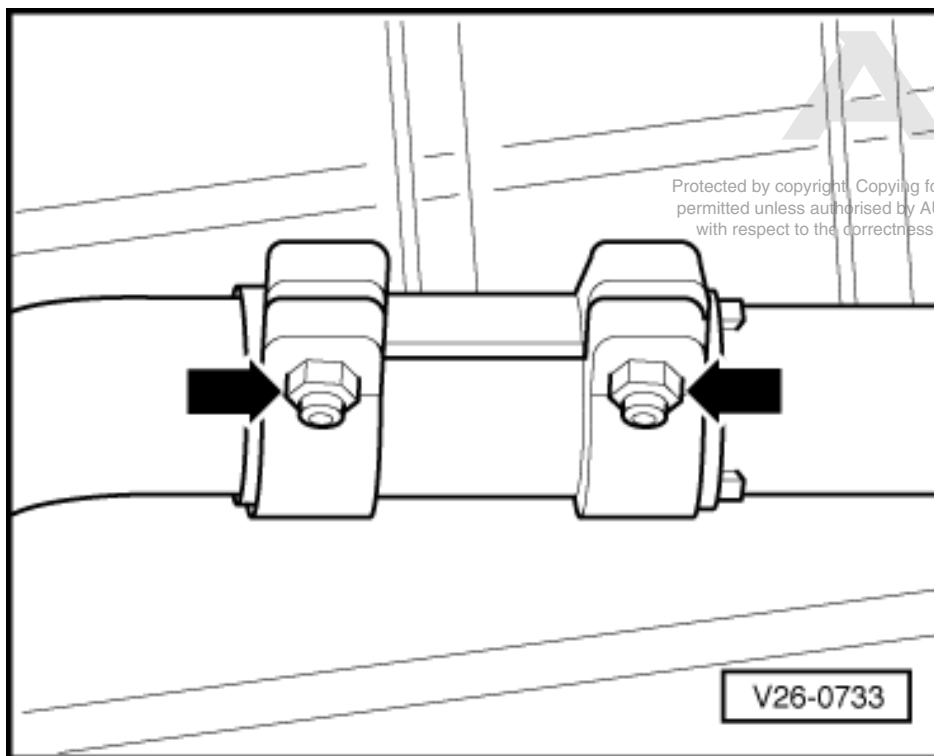
The front exhaust pipe -1- remains connected to the turbocharger -3-.



Note:

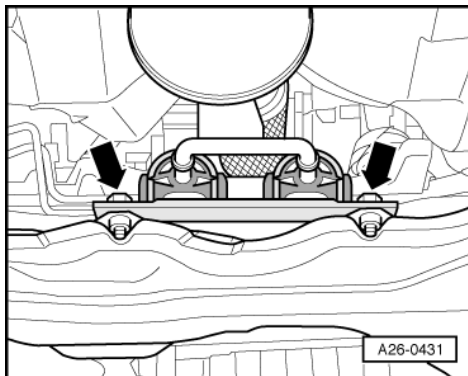
The isolating element in front exhaust pipe must not be deflected more than 10° to avoid damage.

- -> Remove bolts -arrows- at the front exhaust pipe/catalytic converter flange.

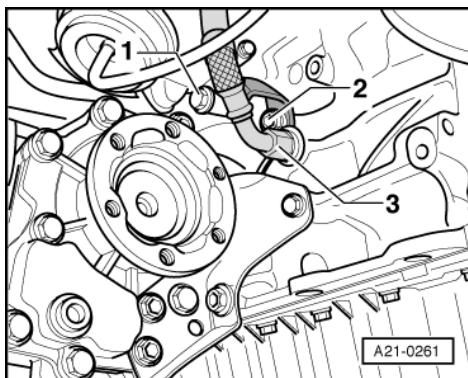


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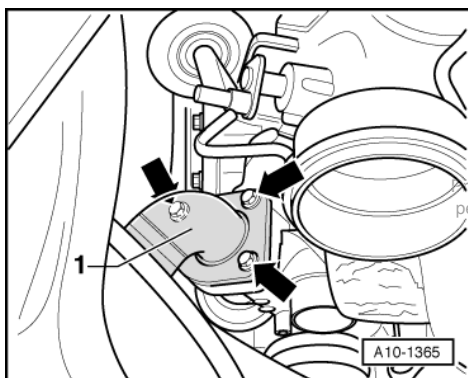
- -> Detach the exhaust system at the clamping sleeve -arrows-.
- Remove catalytic converter.



- -> Unbolt bracket for exhaust system from assembly mounting -arrows-.
- Press front exhaust pipe off turbocharger.

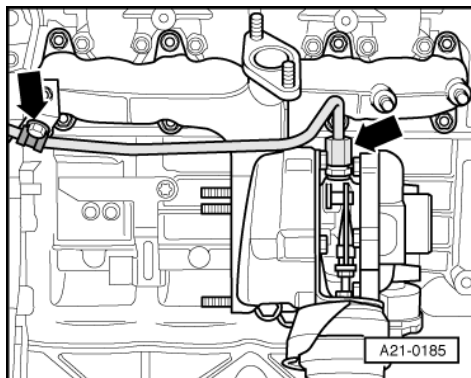


- Detach right drive shaft from gearbox flange.
- Remove bolts -1- and -2- and remove bracket for turbocharger.
- Remove oil return pipe -3- at cylinder block.

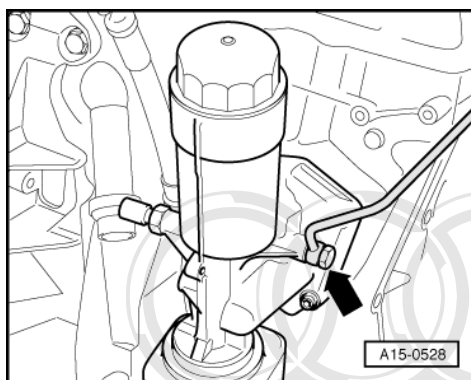


- -> Remove bolts -arrows- and remove resonator -1-.

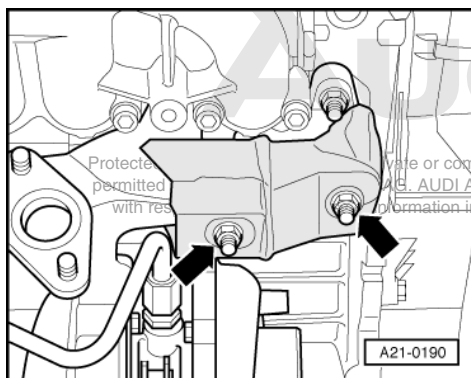
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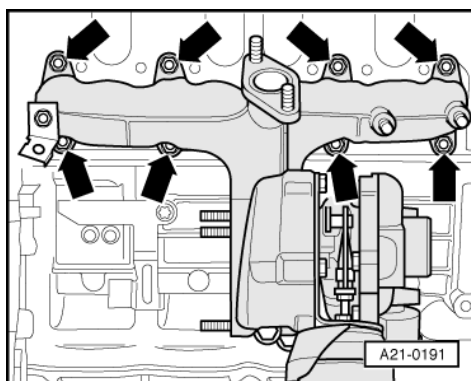
- -> Unscrew oil feed line from turbocharger and exhaust manifold -arrows-.



- -> Unscrew oil feed line from oil filter bracket -arrow- and also on coolant pipe and lay line to one side.



- Remove upper toothed belt guard.
- -> Remove heat shield from exhaust manifold -arrows-.



- -> Unscrew nuts -arrows-.
- Remove packing plates.
- Remove exhaust manifold/turbocharger upwards.

Installing

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

Notes:

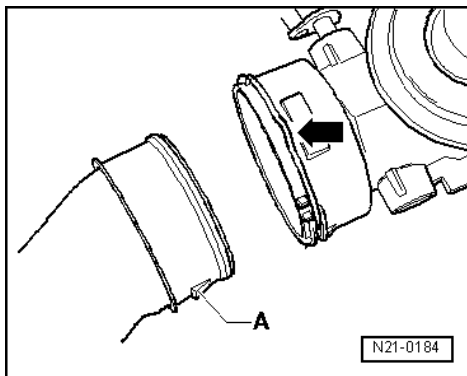
- ◆ Replace seals, gaskets and self-locking nuts.
- ◆ Note installation position of exhaust manifold/turbocharger gaskets.
- ◆ Fill the turbocharger with engine oil via the oil supply connection.
- ◆ Hose connections and hoses for charge air system must be free of oil and grease before assembly.
- ◆ Secure all hose connections with the correct hose clamps (same as original equipment):

=> Parts List

- Install right drive shaft.

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

- Install intake manifold => Page 15-68.
- Install exhaust system and align it stress-free => Page 26-35.



- -> When installing air duct pipes with connectors, ensure that the securing clip -arrow- engages audibly in the retaining lug -A-.
- Check oil level => Page 17-23.

Note:

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.

Tightening torques

Component	Nm
Exhaust manifold/turbocharger to cylinder head	25 1)
Heat shield to exhaust manifold/turbocharger	20 1)
Oil supply pipe to oil filter bracket	25
Oil supply pipe to turbocharger	22
Turbocharger bracket to cylinder block	40

- 1) Replace the nuts.

Component	Nm
Turbocharger bracket to turbocharger	20

Component	Nm
Oil return line to cylinder block	30

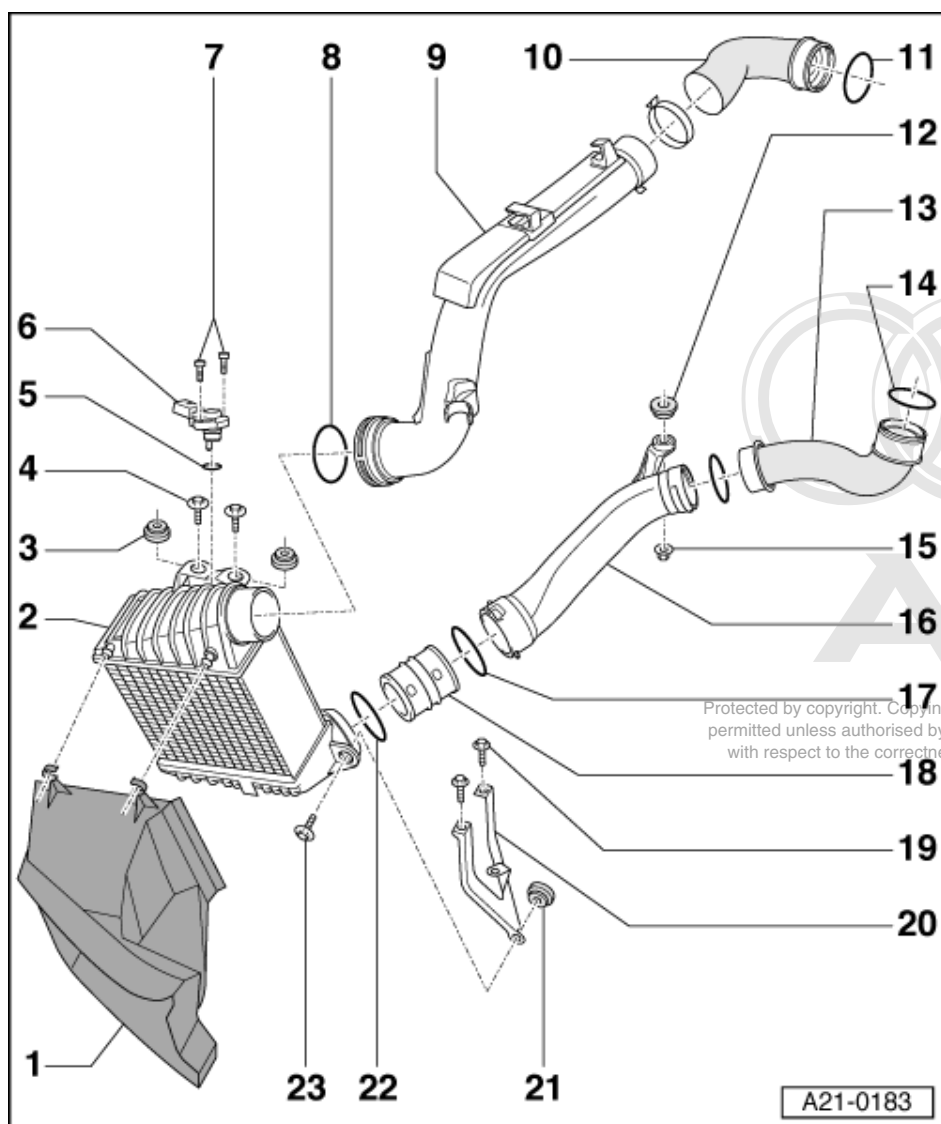
2.7 - Removing and installing parts of charge air cooling system

Notes:

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

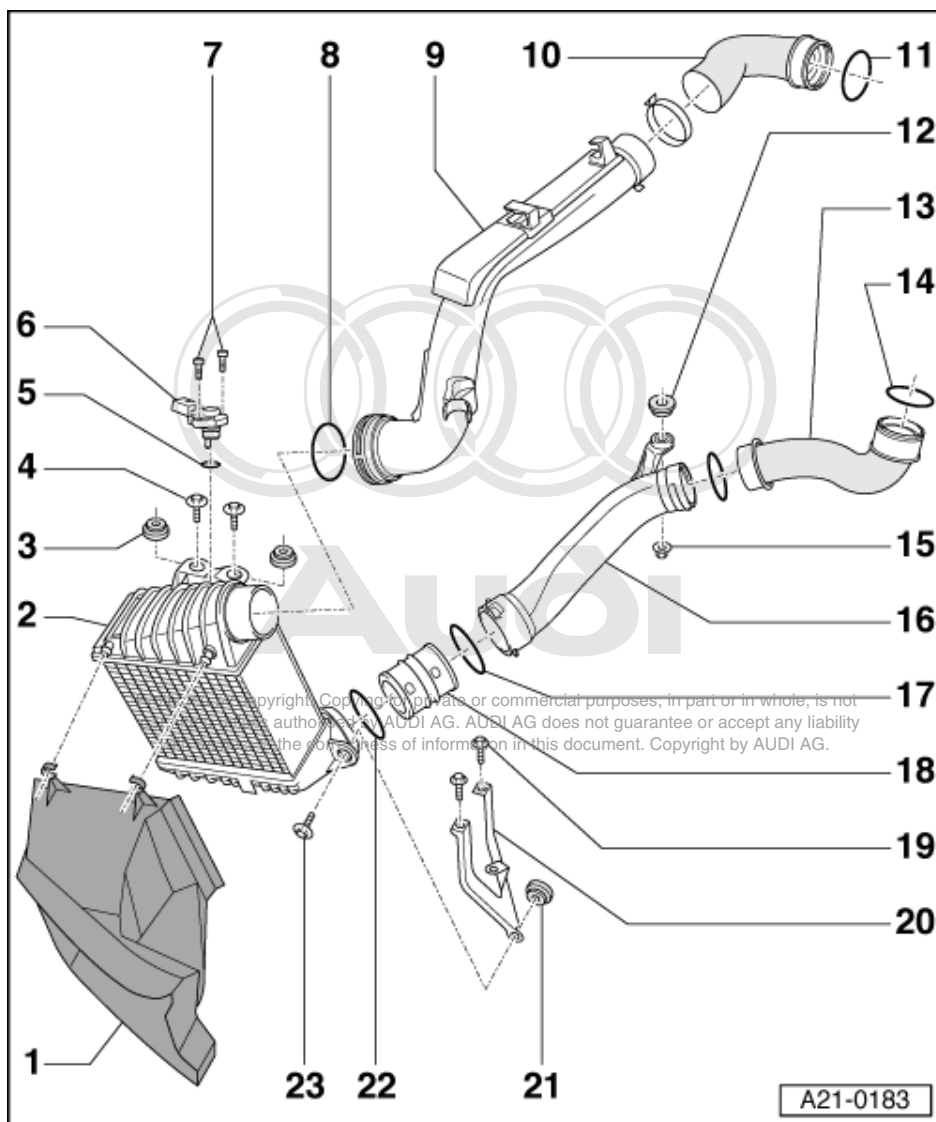
=> Parts List

- Hose connections and hoses for charge air system must be free of oil and grease before assembly.
- Before a test or a repair is performed all hoses and wiring must be checked for tight fit and leakages.
- Installing air vent pipes with connectors => Fig.1
- A resonator is additionally fitted to the turbocharger for vehicles with four-wheel drive => Fig.2.



- Air duct
- Intercooler
 - Removing and installing
=>Page 21-76
- Rubber grommet

- ♦ With sleeve
- 4 10 Nm
- 5 O-ring
 - ♦ Replace if damaged
- 6 Boost pressure sender -G31
- 7 3 Nm
- 8 O-ring
 - ♦ Replace if damaged
- 9 Air guide pipe right
 - ♦ Between intake manifold and charge air cooler (intercooler)



- 10 Hose
 - ♦ Between intake manifold and right air duct pipe
- 11 O-ring
 - ♦ Replace if damaged
- 12 Rubber grommet
 - ♦ With sleeve
- 13 Hose
 - ♦ Between lower air duct pipe and turbocharger
- 14 O-ring
 - ♦ Replace if damaged

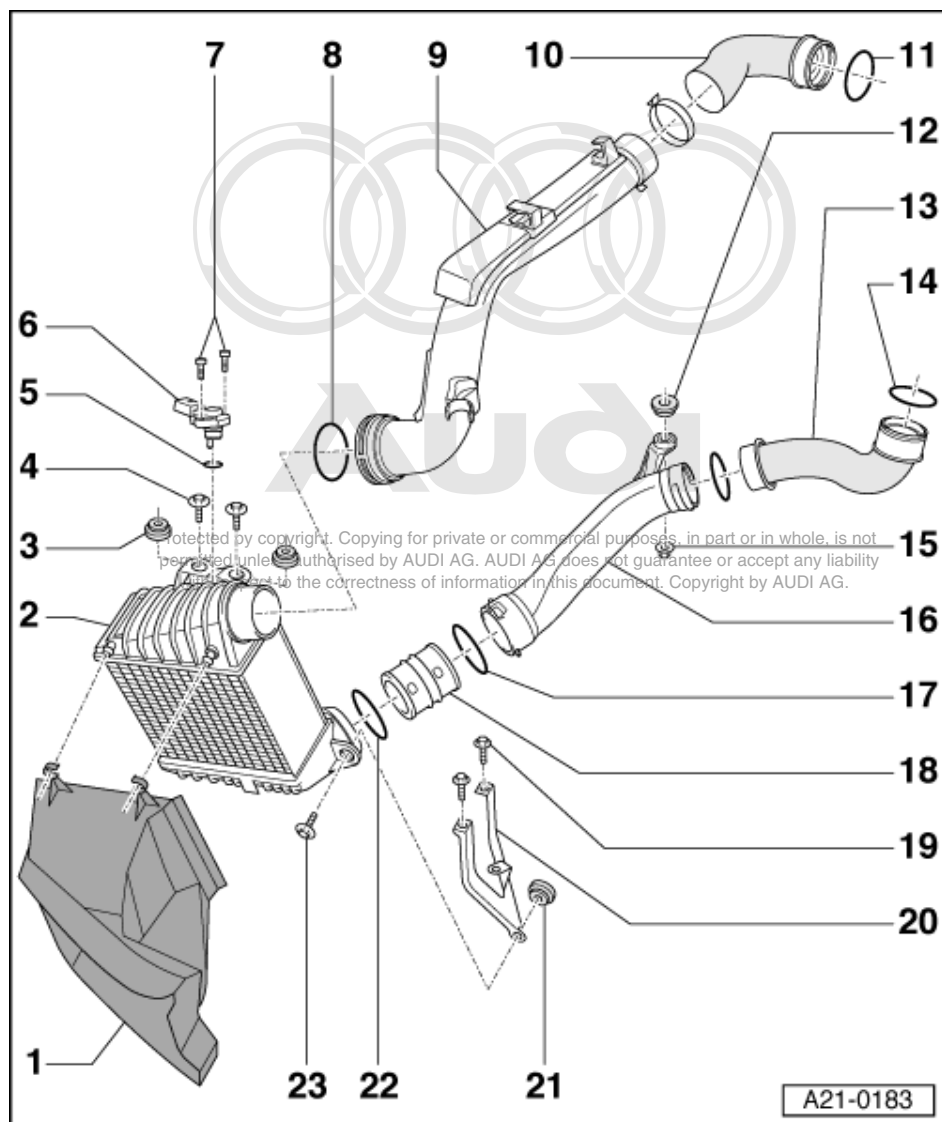


15 10 Nm

16 Lower air duct pipe

17 O-ring

- ♦ Replace if damaged



18 Pipe connection

19 10 Nm

20 Bracket

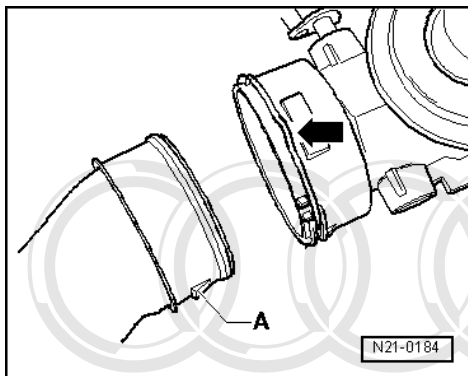
21 Rubber grommet

- ♦ With sleeve

22 O-ring

- ♦ Replace if damaged

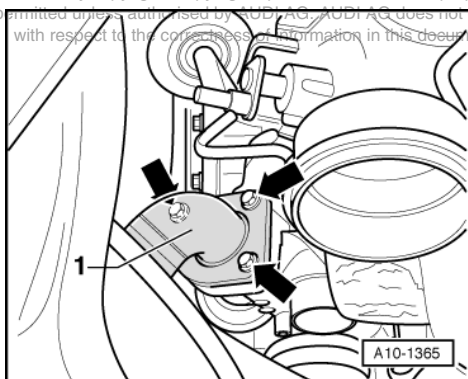
23 10 Nm



-> Abb.1 Installing air vent guide with connector

- When installing air duct pipes with connectors, ensure that the securing clip -arrow- engages audibly in the retaining lug -A-.

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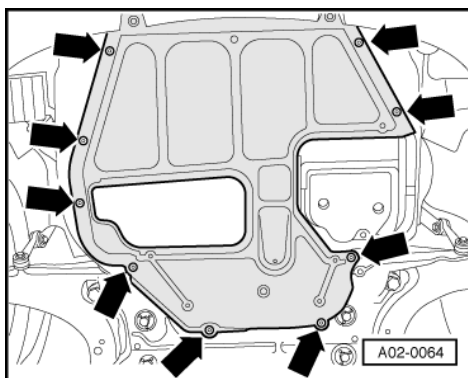


-> Fig.2 Fastening resonator to turbocharger - vehicles with four-wheel drive

- Tighten to 9 Nm -arrows-.

2.8 - Removing and installing charge air cooler (intercooler)

Removing

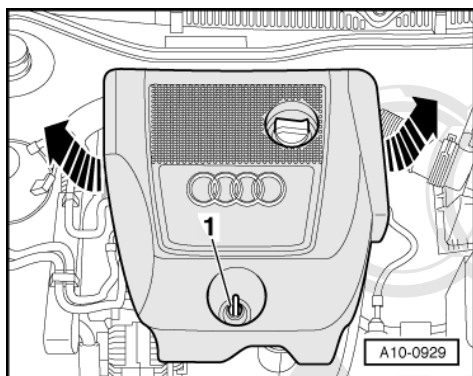


- Remove the front bumper cover:

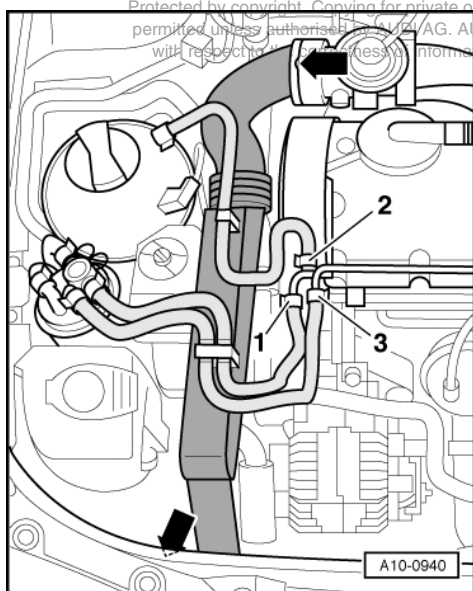


=> General Body Assembly, Exterior; Repair group 63; Front bumper; Removing and installing front bumper
Front bumper Removing and installing front bumper

- -> Remove centre noise insulation -arrows-.



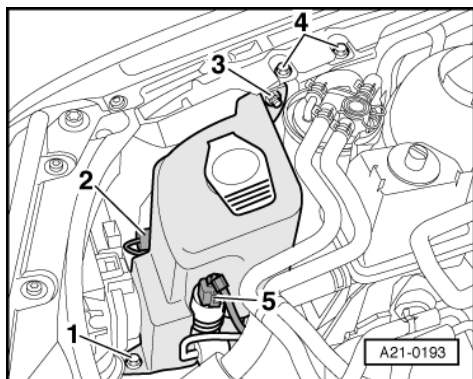
- -> Remove oil dipstick -1- from guide tube.
- Remove engine cover -arrows-.
- Reinsert dipstick in guide tube.



- -> Lay aside wiring at air duct hose.
- Where necessary, detach the housing cover at rear of right headlamp housing.
- Remove air duct pipe -arrows-.

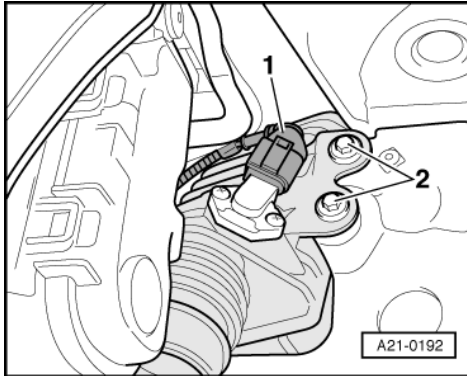
Note:

The coolant hose -2- and fuel lines -1- and -3- remain connected.



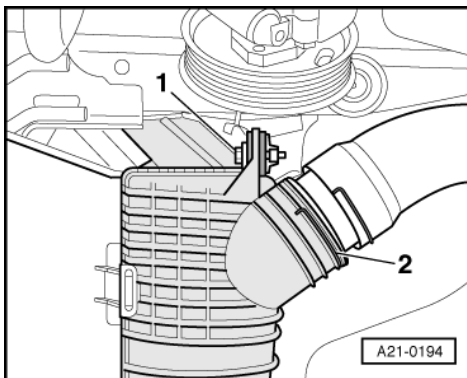
Vehicles with headlamp washer system:

- -> Detach the bracket for fuel filter from the body -4-. Hoses remain connected to fuel filter.
- Detach connectors -2- and -5-.
- Remove bolt -1- and nut -3-.
- Move wash water reservoir to the side. Do not detach hoses.



All models:

- -> Remove the connector from the intake manifold pressure sensor -1-.
- Unscrew bolts -2- for charge air cooler.



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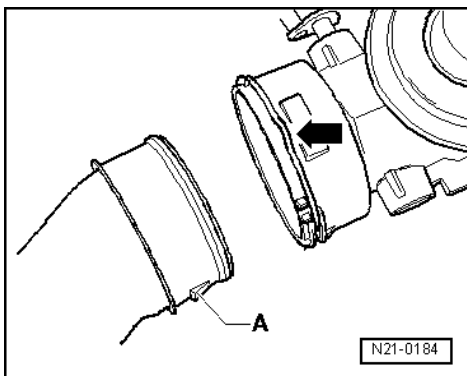
- -> Remove lower securing bolt -1- for charge air cooler.
- Disengage retaining clip -2-.
- Remove charge air cooler from air duct pipe and remove downwards.

Installing

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

Notes:

- ◆ Hose connections and hoses for charge air system must be free of oil and grease before assembly.
- ◆ Fit new O-rings when damaged.





- -> When installing air duct pipes with connectors, ensure that the securing clip -arrow- engages audibly in the retaining lug -A-.
- Install the front bumper cover:

=> General Body Assembly, Exterior; Repair group 63; Front bumper; Removing and installing front bumper
Front bumper Removing and installing front bumper

Tightening torques

Component		Nm
Intercooler to	Longitudinal member	10
	Bracket	10



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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:

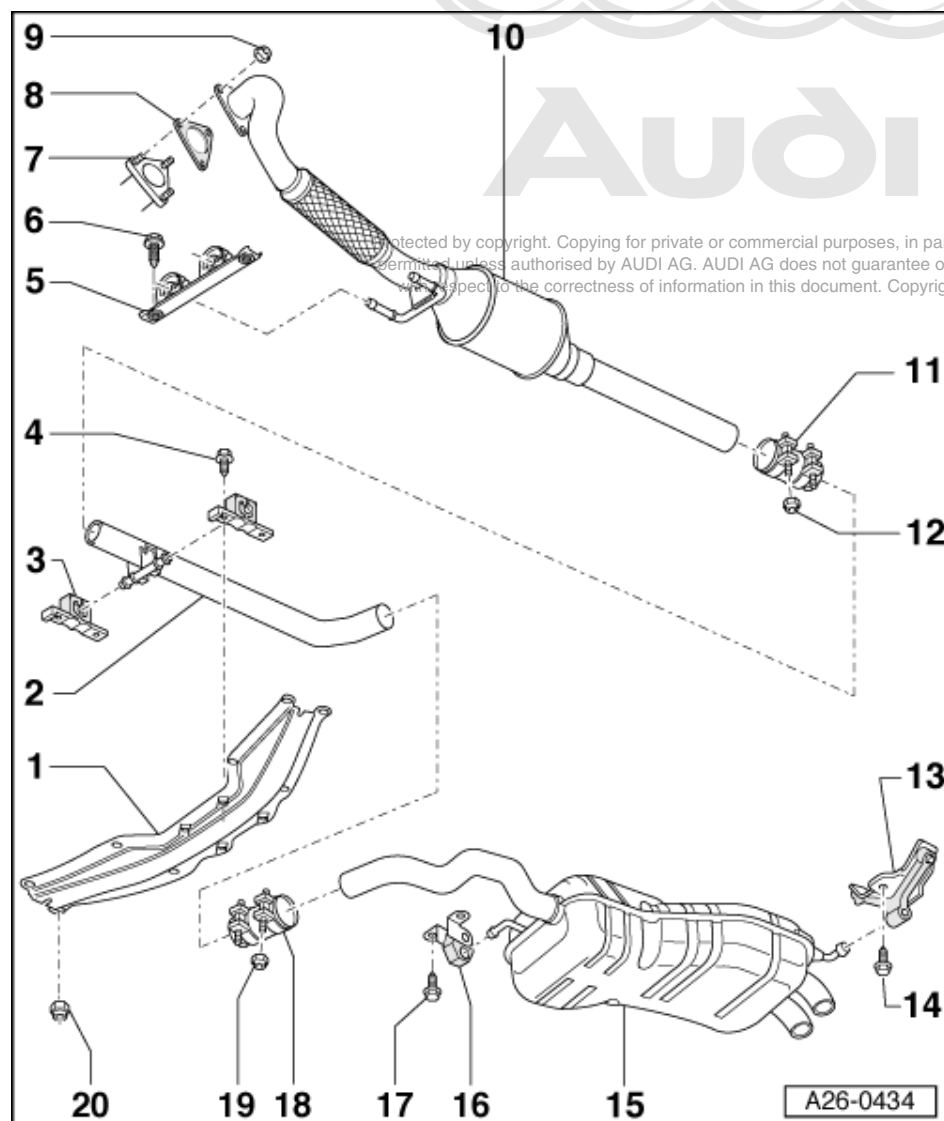
- ◆ Always replace seals, gaskets and self-locking nuts.
- ◆ After working on the exhaust system ensure that the system is not under stress, and that it has sufficient clearance from the body. If necessary, loosen clamping sleeve and align silencers and exhaust pipe so that sufficient clearance is maintained to the body at all points and the mountings are evenly loaded.
- ◆ Slacken and tighten clamping plates for heat shields with a screwdriver.
Tightening torque: 2 Nm
- ◆ The isolating element in front exhaust pipe must not be deflected more than 10° to avoid damage.



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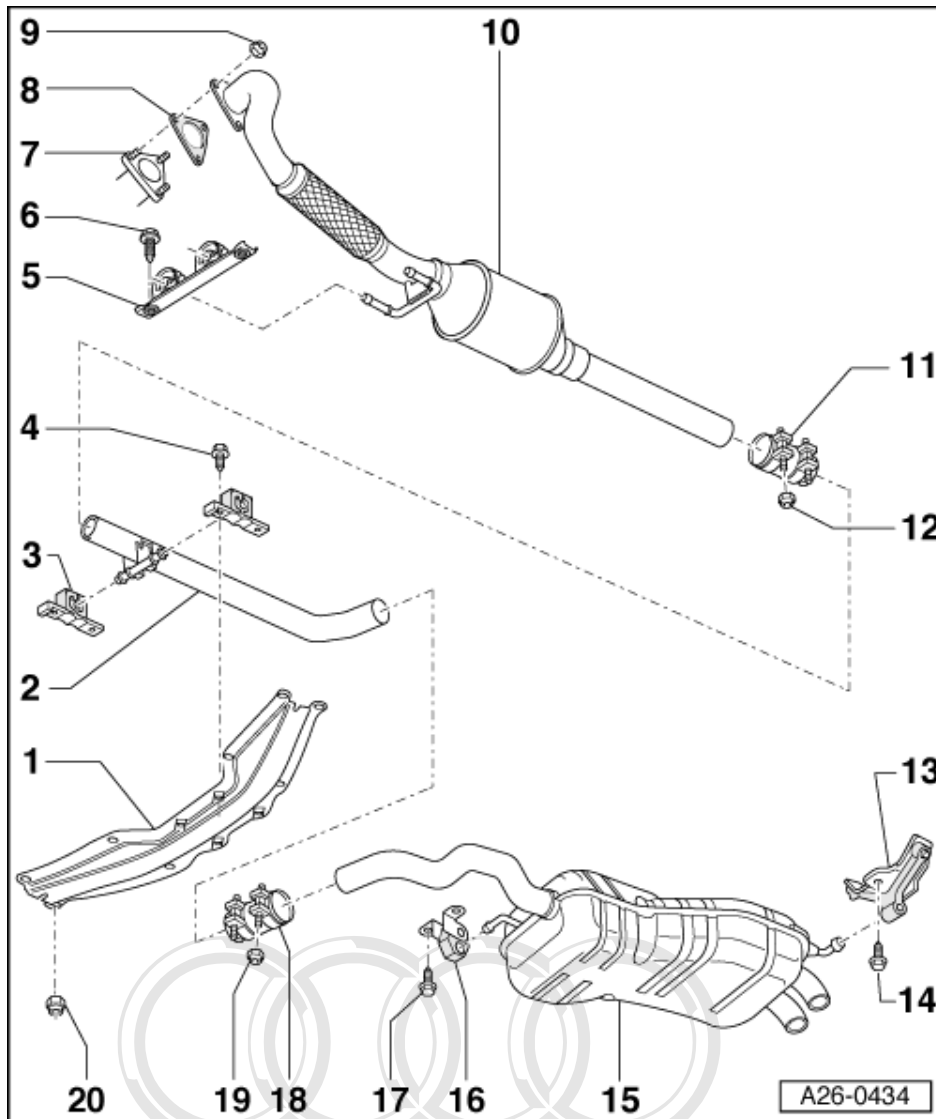
2 - Exhaust system -vehicles with front-wheel drive-

2.1 - Exhaust system -vehicles with front-wheel drive-



2.2 - Assembly overview

- 1 **Tunnel cross piece**
 - ♦ With bore for aligning exhaust system => Page 26-13
- 2 **Intermediate pipe**
 - ♦ Centre and rear silencers are one unit as original equipment. In cases of repair renew individually
 - ♦ Cutting point => Page 26-8
 - ♦ Align exhaust system so it is free of stress before tightening clamp => Page 26-13
- 3 **Mounting**
 - ♦ Installation position
=> Fig.26-7
- 4 **23 Nm**
- 5 **Mounting**



6 23 Nm

7 Turbocharger

- ♦ With exhaust manifold
- ♦ Removing and installing -engine code AXR- => Page 21-42
- ♦ Removing and installing -engine code ASZ, ATD- => Page 21-53

8 Seal

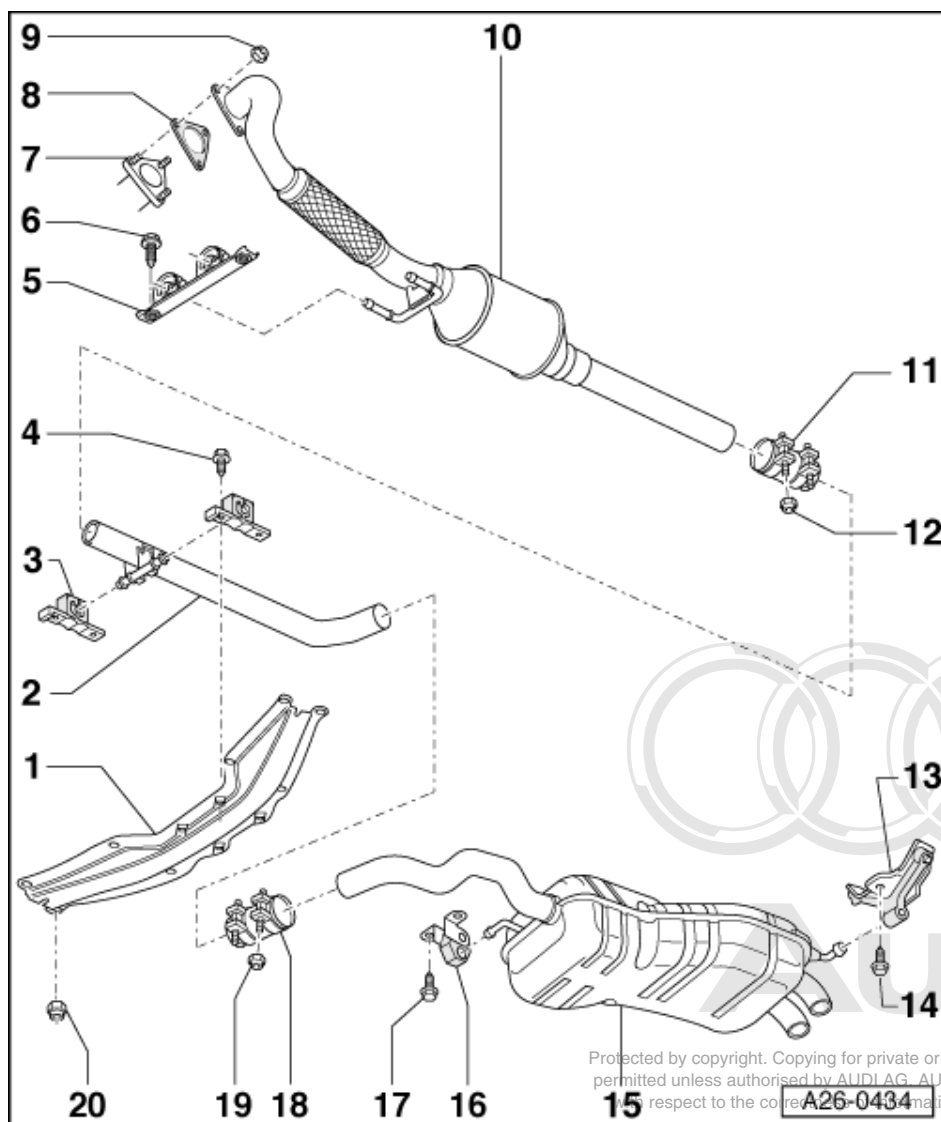
- ♦ Replacing

9 25 Nm

- ♦ Replacing

10 Front exhaust pipe

- ♦ With oxidising catalytic converter
- ♦ Protect from damage by knocks and impact
- ♦ With flexible connection (de coupling element)
- ♦ Do not bend flexible connection more than 10° - otherwise it can be damaged.
- ♦ Removing and installing
=>Page 26-10
- ♦ Align exhaust system so it is free of stress before tightening clamp => Page 26-13



11 Front clamping sleeve

- ♦ Align exhaust system so it is free of stress before tightening clamp => Page 26-13
- ♦ Installation position => Fig. 26-6
- ♦ Tighten bolted connections evenly.

12 40 Nm

13 Mounting

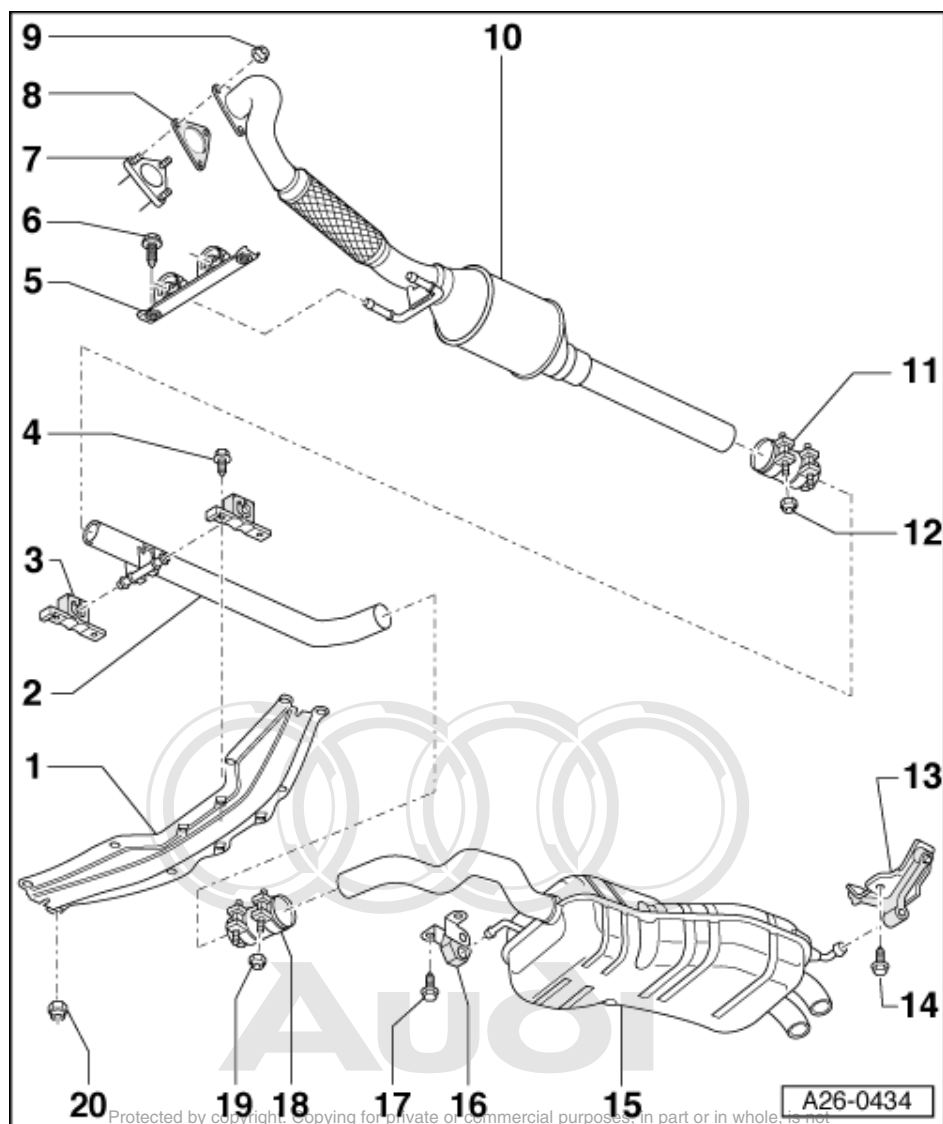
14 23 Nm

15 Rear silencer

- ♦ Intermediate pipe is one unit as original equipment. In cases of repair renew individually
- ♦ Cutting point => Page 26-8
- ♦ Align exhaust system so it is free of stress before tightening clamp => Page 26-13

16 Mounting

17 23 Nm

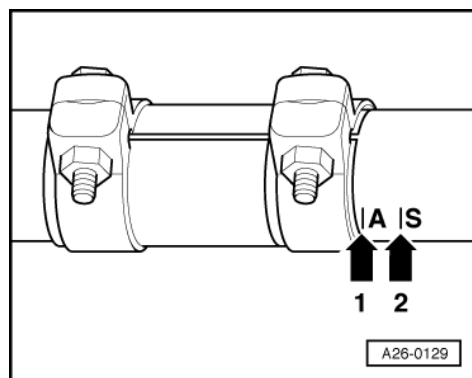


18 Rear clamping sleeve

- ♦ For separate replacement of intermediate pipe and rear silencer
- ♦ Align exhaust system so it is free of stress before tightening clamp => Page 26-13
- ♦ Installation position
=> Fig.26-7
- ♦ Tighten bolted connections evenly.

19 40 Nm

20 23 Nm



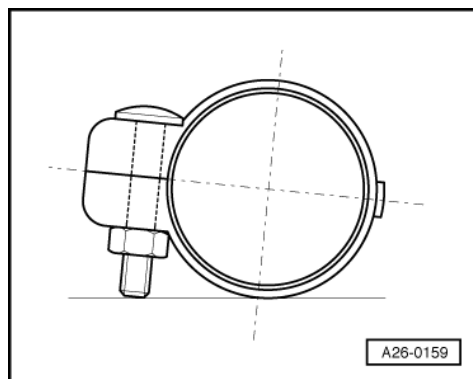


-> Fig.1 Installation position of front clamp

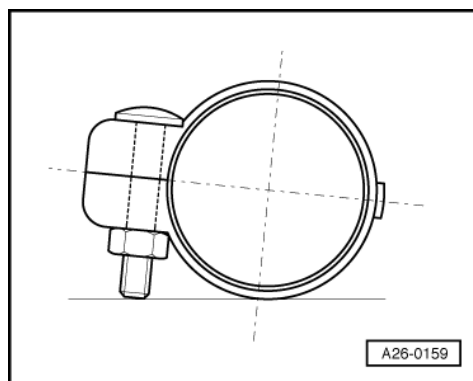
- Position clamp about 5 mm away from relevant marking "A"
-arrow 1- and tighten to 40 Nm.

Note:

Do not use marking "S" -arrow 2-

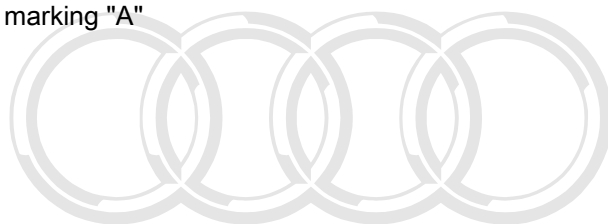
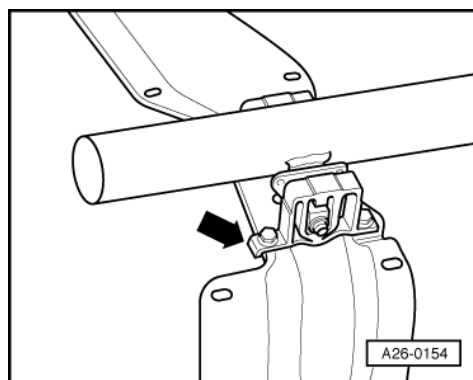


- -> Install the clamps so that the ends of the bolts do not protrude over the lower edge of the clamping sleeve.
- Bolted connection facing to the left



-> Fig.2 Installation position of rear clamp

- Install the clamping sleeve so that the ends of the bolts do not protrude over the lower edge of the clamping sleeve.
- Bolted connection facing to the front



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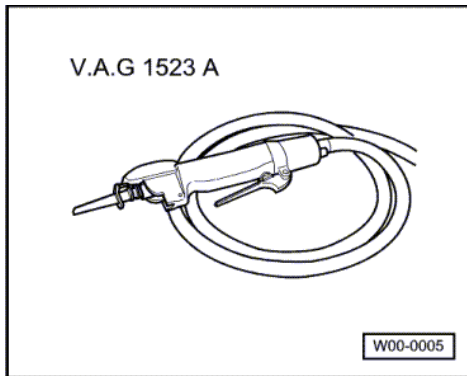
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➔ Fig. 3 Installation position of mounting

Angled end at base of mounting -arrow- faces in direction of travel.

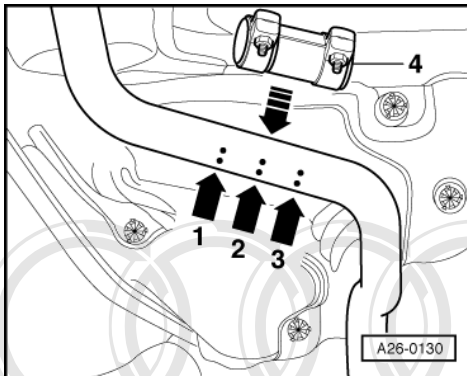
2.3 - Separating intermediate pipe and rear silencer

- ♦ 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



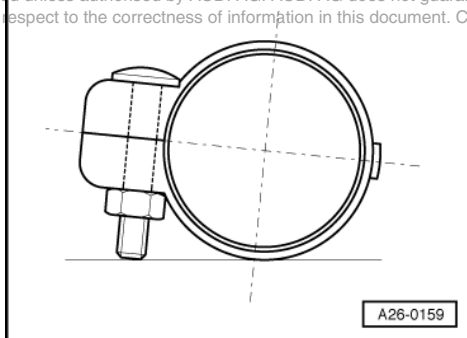
Procedure

- ➔ Cut through exhaust pipe at right angles with body saw, e.g. V.A.G 1523 A at cutting point -arrow 2-.

Important
Wear protective goggles.

- Position clamp 4 between side markings -arrows 1 and 3- when installing.

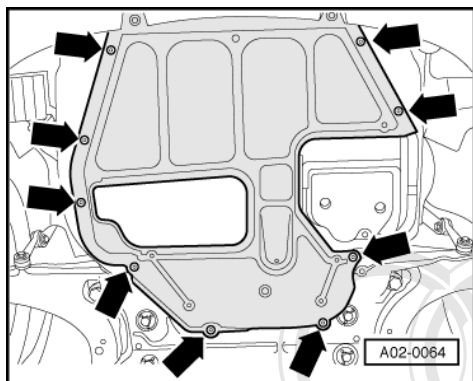
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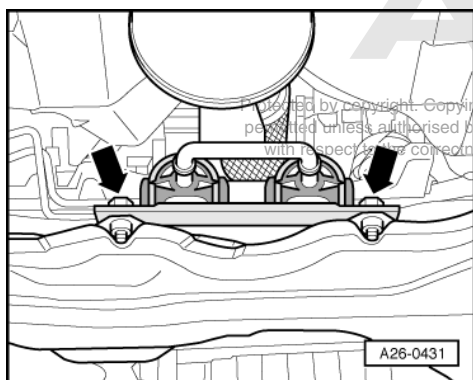
- -> Install the clamping sleeve so that the ends of the bolts do not protrude over the lower edge of the clamping sleeve.
- Bolted connection facing to the front
- Stress-free alignment of exhaust system => Page 26-13

2.4 - Removing and installing front exhaust pipe with catalytic converter

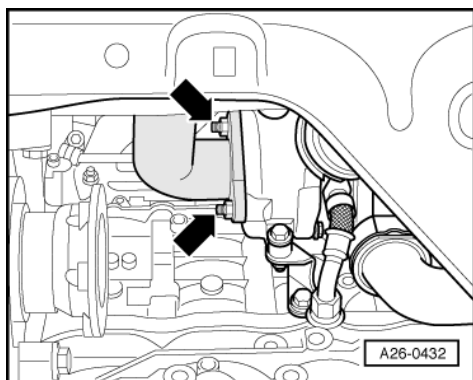


Removing

- -> Remove centre noise insulation -arrows-.



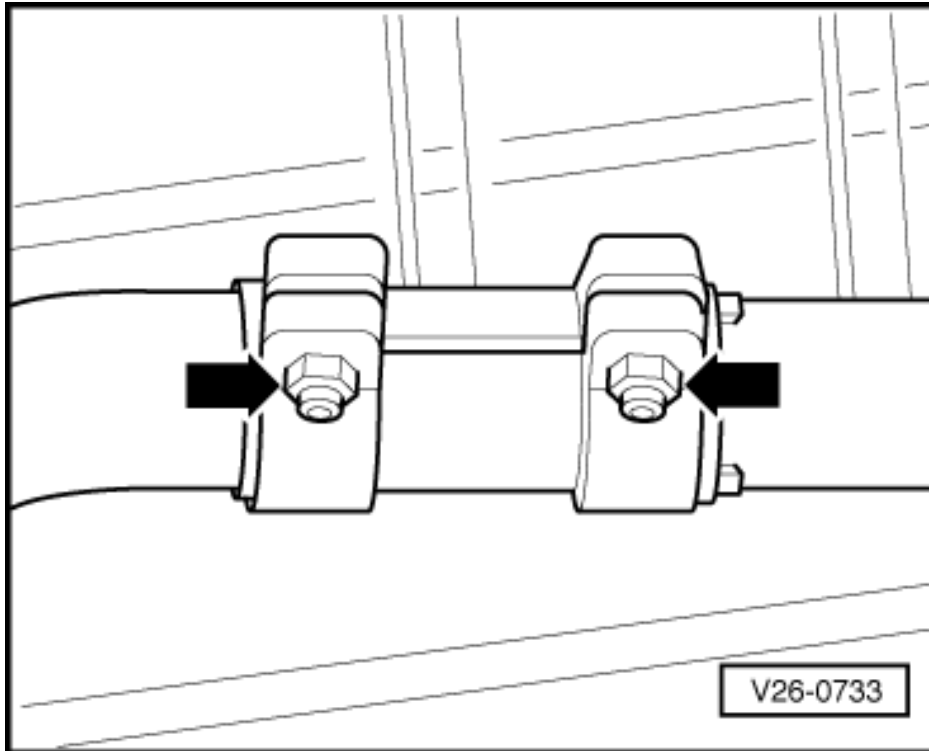
- -> Unbolt bracket for exhaust system from assembly mounting -arrows-.



Note:

The isolating element in front exhaust pipe must not be deflected more than 10° to avoid damage.

- -> Unscrew securing bolts -arrows- of front exhaust pipe/turbocharger.



- -> Detach the exhaust system at the clamping sleeve -arrows-.
- Remove front exhaust pipes with catalytic converters.

Installing

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

Note:

Always replace seals, gaskets and self-locking nuts.

- Stress-free alignment of exhaust system => Page 26-13

Tightening torques

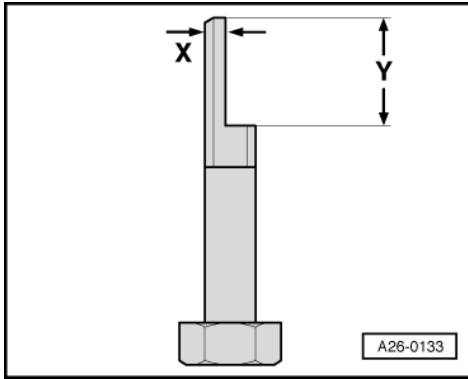
Component	Nm
Front exhaust pipe on turbocharger	25 1)
Mounting to subframe	23
Nuts for clamp	40

- 1) Replace the nuts.

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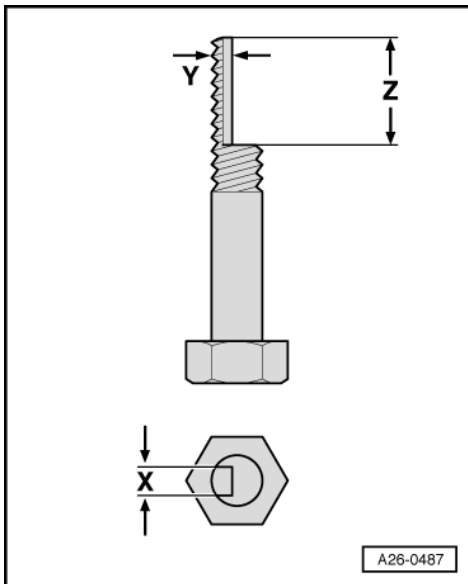
2.5 - Stress free alignment of exhaust system

- The exhaust system must be aligned when cold.
- Depending on vehicle version, a make-shift tool must be fashioned from an M10 or M14 bolt, respectively, in order to adjust the exhaust system position.



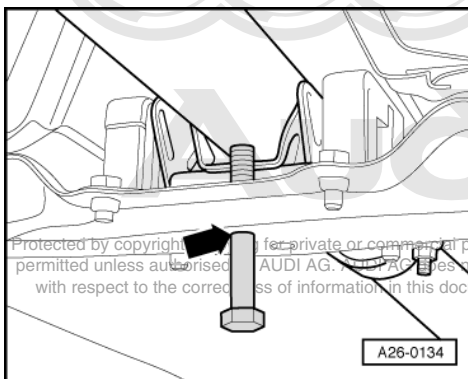
Vehicles with hole $\varnothing 10.5$ mm in rear of tunnel cross piece:

- -> Modify an M10 bolt according to the dimensions given to use as a tool for aligning the exhaust system.
- Dimension x = 4 mm
- Dimension y = 25 mm



Vehicles with $\varnothing 14.5$ mm bore in rear of tunnel cross piece:

- -> Modify an M14 bolt according to the dimensions given to use as a tool for aligning the exhaust system.
- Dimension X = 10 mm
- Dimension Y = 6 mm
- Dimension Z = 25 mm



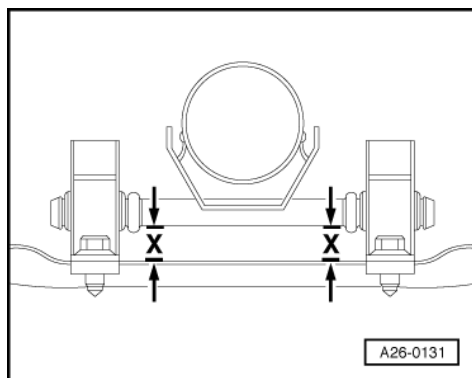
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All models:

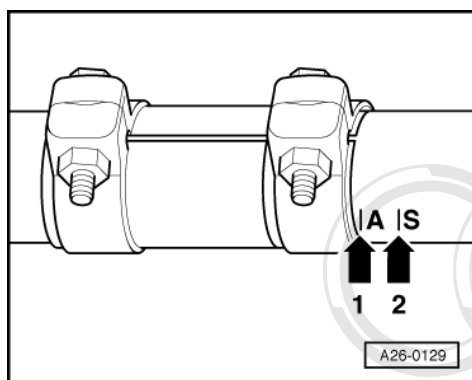
- Slacken bolted connections on front clamping sleeve -Item26-4.
- -> Insert modified bolt (aligning tool) through rear bore -arrow- in tunnel cross piece, with flat part of bolt facing towards mounting pin on exhaust system.

Note:

With bolt inserted, exhaust system is pre tensioned in the direction of travel.



- Align rear silencer horizontally with intermediate pipe:
 - -> The attachment bolt on exhaust pipe must be parallel to tunnel cross piece
 - Dimension x = Dimension x



- -> Position clamp about 5 mm away from marking "A" -arrow 1-, check for horizontal alignment and tighten to 40 Nm.

Note:

Do not use marking "S" -arrow 2-

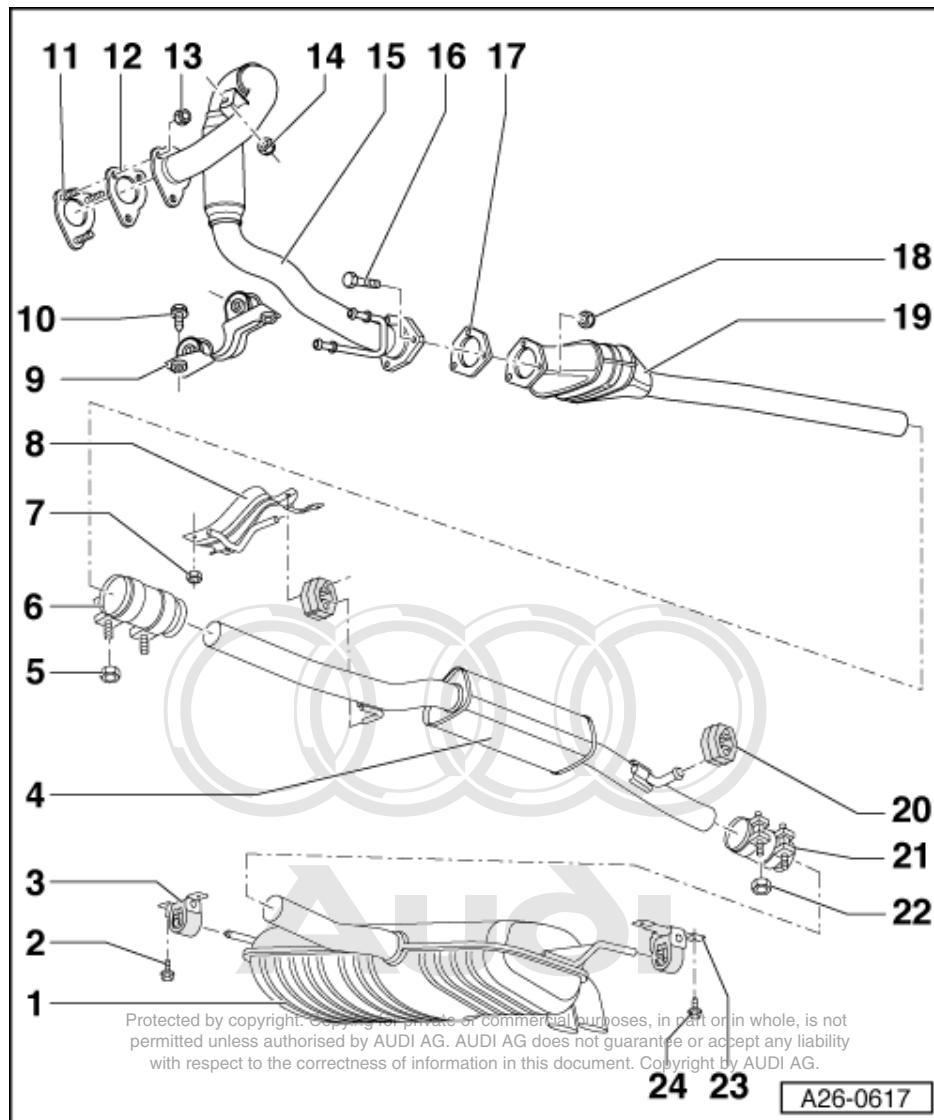
- ◆ Installation position of clamping sleeve => Fig. 26-6
- Tighten bolted connections on clamp evenly to 40 Nm.

2.6 - Checking exhaust system for leaks

- Start engine and run at idling speed.
- Plug tailpipes with cloths or stoppers until check is completed.
- Listen for noise at the connection points of cylinder head/exhaust manifold; turbocharger/front exhaust pipe etc. to locate any leaks.
- Rectify any leaks that are found.

3 - Exhaust system -vehicles with four-wheel drive-

3.1 - Exhaust system -vehicles with four-wheel drive-



3.2 - Assembly overview

1 Rear silencer

- ♦ Rear and centre silencer are one unit as original equipment. In cases of repair renew individually
- ♦ Cutting point => Page 26-23
- ♦ Align exhaust system so it is free of stress before tightening clamp => Page 26-35

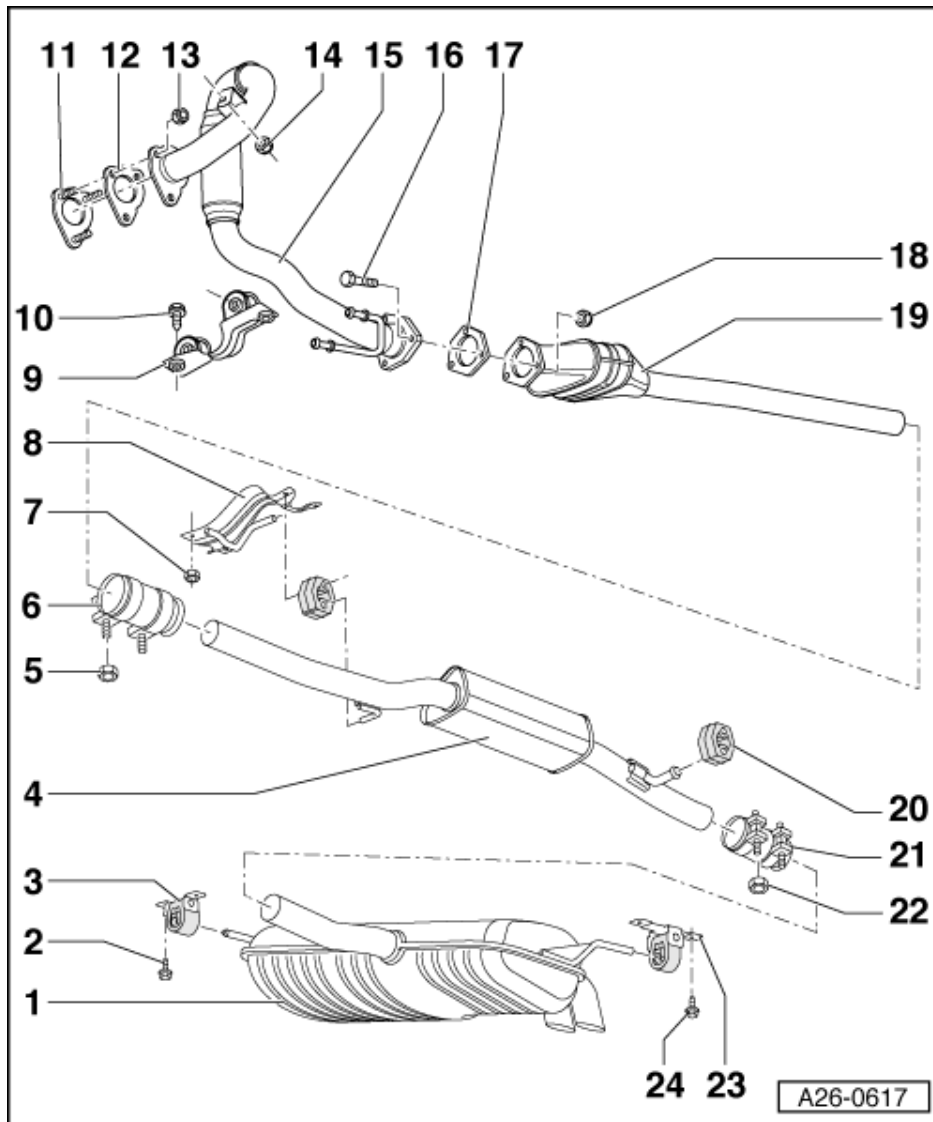
2 23 Nm

3 Mounting

- ♦ Replace if damaged

4 Centre silencer

- ♦ Centre and rear silencers are one unit as original equipment. In cases of repair renew individually
- ♦ Cutting point => Page 26-23
- ♦ Align exhaust system so it is free of stress before tightening clamp => Page 26-35



5 40 Nm

6 **Front clamping sleeve**

- ◆ Align exhaust system so it is free of stress before tightening clamp => Page 26-35
- ◆ Installation position
=> Fig.26-21
- ◆ Tighten bolted connections evenly.

7 23 Nm

8 **Bracket**

- ◆ For mounting in exhaust system in propshaft tunnel

9 **Mounting**

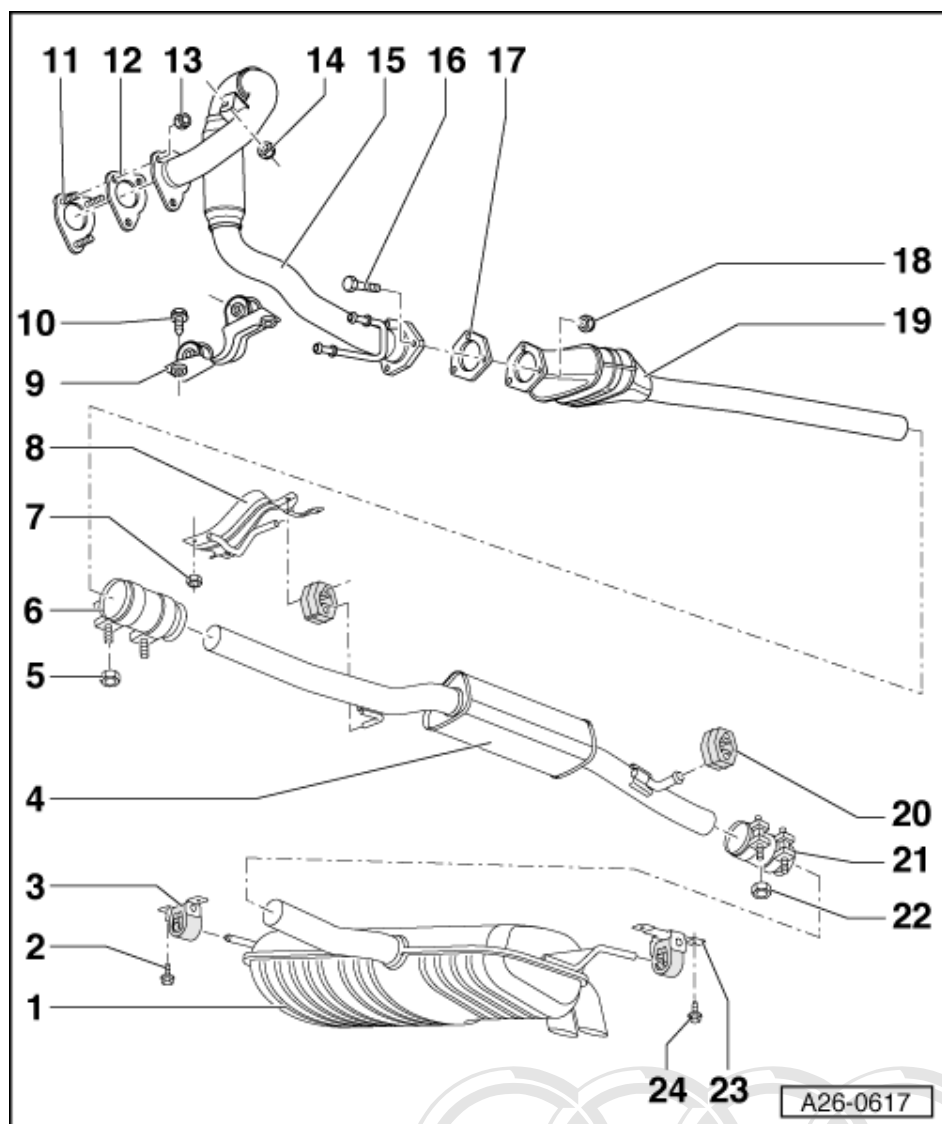
- ◆ Replace if damaged

10 23 Nm

11 **Turbocharger**

- ◆ With exhaust manifold
- ◆ Removing and installing - vehicles with four-wheel drive -engine code ASZ- => Page 21-53

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12 Seal

- ♦ Replacing

13 25 Nm

- ♦ Replacing

14 25 Nm

- ♦ Replacing

15 Front exhaust pipe

- ♦ With flexible connection (de coupling element)
- ♦ Do not bend flexible connection more than 10° - otherwise it can be damaged.
- ♦ Removing and installing
=>Page 26-25
- ♦ Align exhaust system so it is free of stress before tightening clamp => Page 26-35

16 Bolt

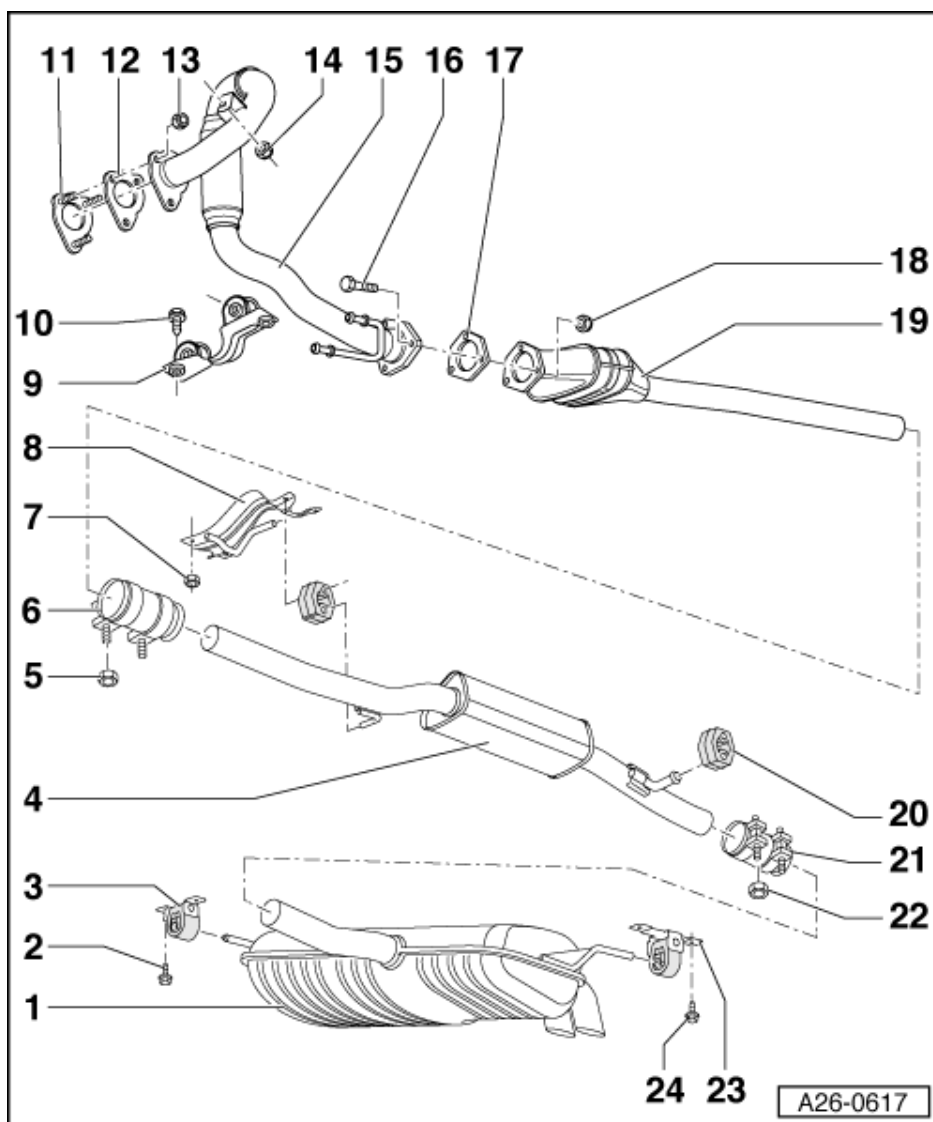
17 Seals

- ♦ Replacing

18 23 Nm

- ♦ Replacing

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19 Catalytic converter

- ◆ Protect from damage by knocks and impact

20 Retainer

- ◆ Replace if damaged

21 Rear clamping sleeve

- ◆ For separate replacement of centre and rear silencers
- ◆ Align exhaust system so it is free of stress before tightening clamp => Page 26-35
- ◆ Installation position
=> Fig.26-21
- ◆ Tighten bolted connections evenly.

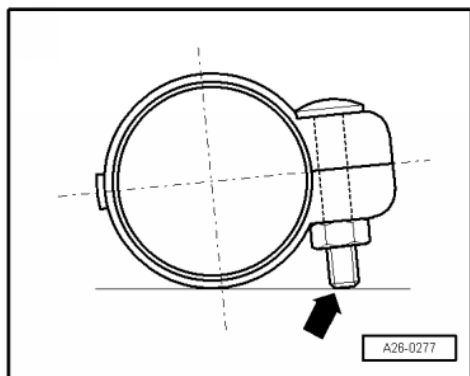
22 40 Nm

23 Mounting

- ◆ Replace if damaged

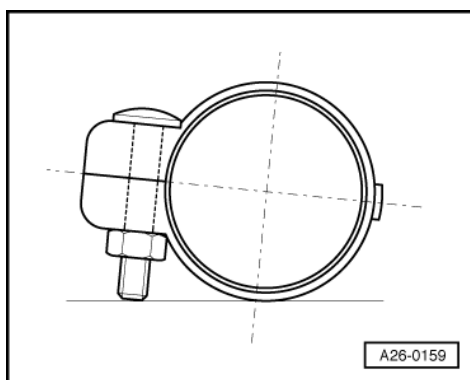
24 23 Nm

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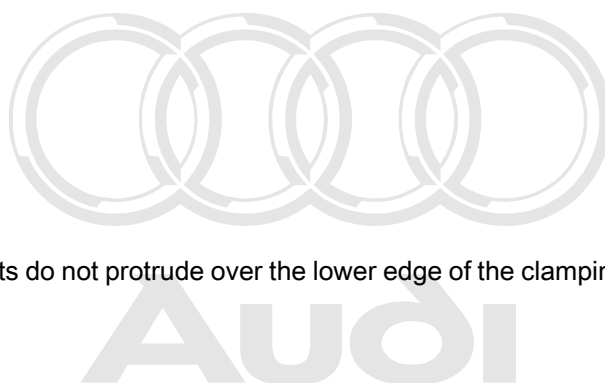
-> Fig.1 Installation position of front clamp

- Install the clamping sleeve so that the ends of the bolts do not protrude over the lower edge of the clamping sleeve.
 - Bolted connection faces right



-> Fig.2 Installation position of rear clamp

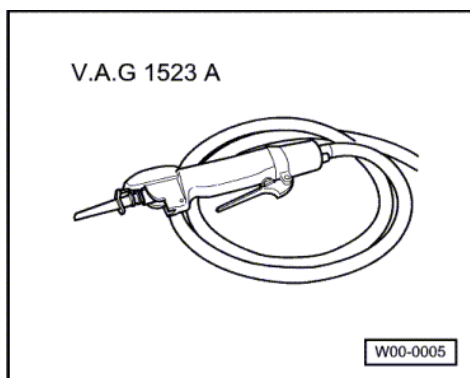
- Install the clamping sleeve so that the ends of the bolts do not protrude over the lower edge of the clamping sleeve.
 - Bolted connection facing to the left



3.3 - Separating centre and rear silencers

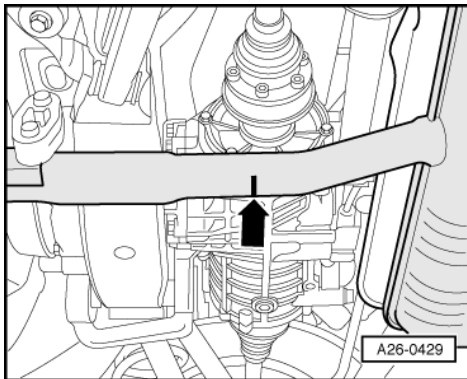
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- ♦ The connecting pipe can be separated at the cutting point in order to replace the centre and rear silencers separately.
- ♦ The cutting point is marked with an indentation on the outside of the exhaust pipe.



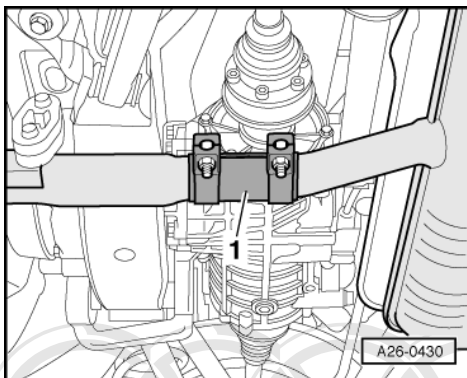
Special tools and workshop equipment required

- ◆ Body saw V.A.G 1523 A
- ◆ Protective goggles

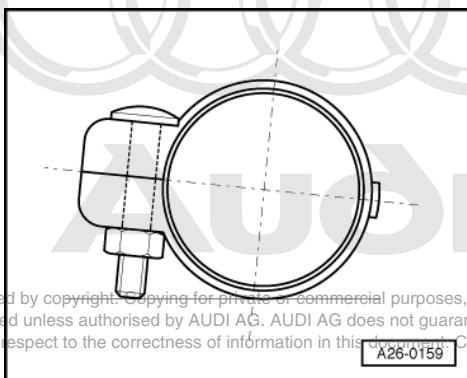


- -> Cut through exhaust pipe at right angles with body saw e.g. V.A.G 1523 A at position marked -arrow-.

Important
Wear protective goggles.



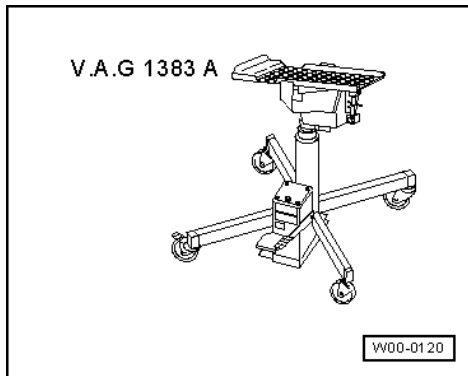
- -> When installing, position clamp -1- centrally over saw cut.



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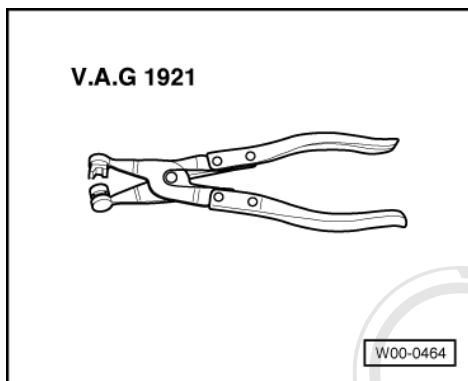
- -> Install the clamps so that the ends of the bolts do not protrude over the lower edge of the clamping sleeve.
- Screw thread points to left rear wheel
- Stress-free alignment of exhaust system => Page 26-35

3.4 - Removing and installing front exhaust pipe

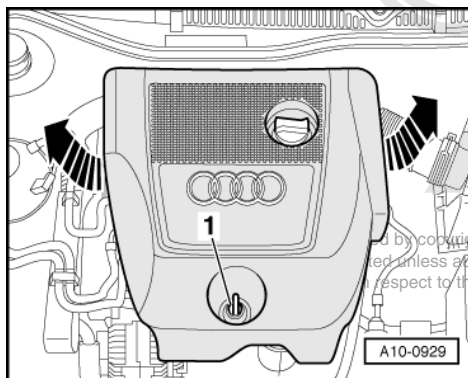


Special tools and workshop equipment required

- ♦ Engine/gearbox lifter V.A.G 1383 A

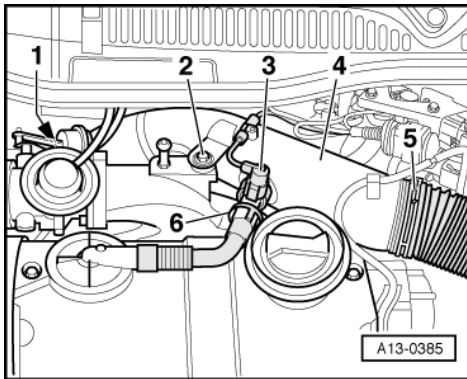


- ♦ Hose clamp pliers V.A.G 1921

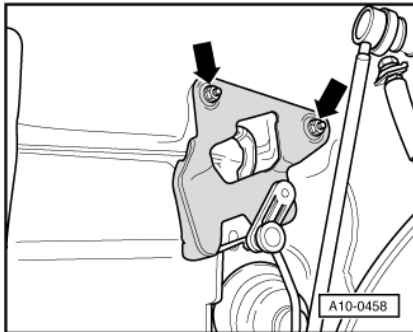


Removing

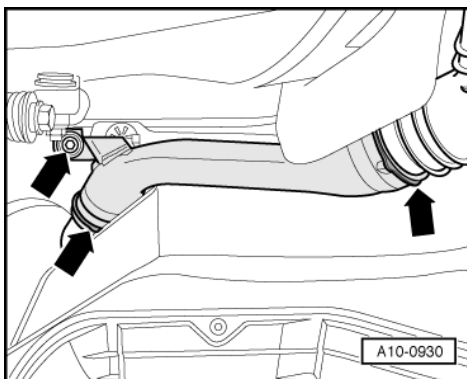
- -> Remove oil dipstick -1- from guide tube.
- Remove engine cover -arrows-.
- Reinsert dipstick in guide tube.



- -> Detach the crankcase vent pipe -6- from air duct pipe.
- If installed, detach connector for heating resistor (crankcase venting) -N79 -Item 3-.
- Set aside the vacuum hoses.
- Unscrew bolts -1- and -2-.

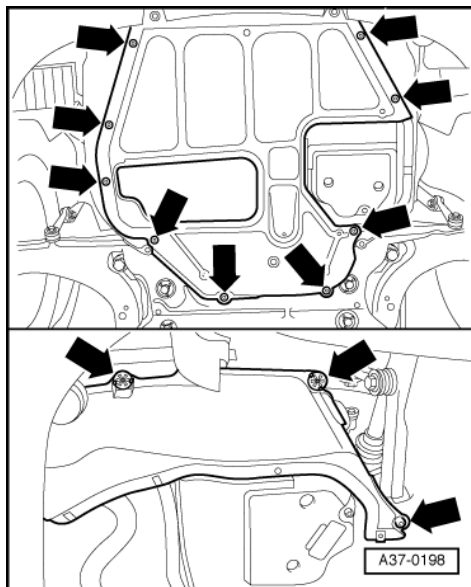


- Detach both front wheels.
- -> If installed, remove the headlight range control bracket in top right of wheel housing -arrows-.
- Detach linkage for headlight range control from the wishbone and unplug connector.



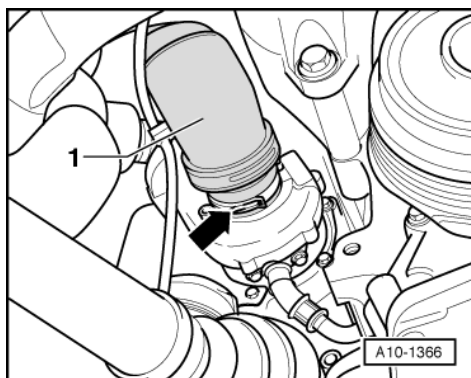
- -> Remove air duct pipe from right longitudinal member -arrows-.

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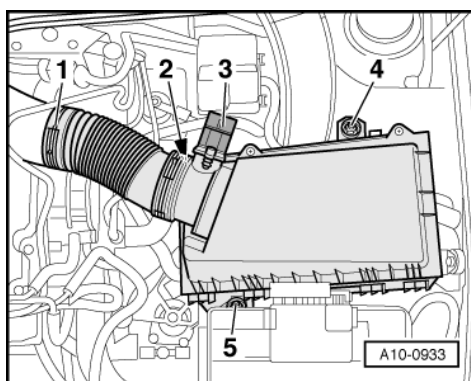


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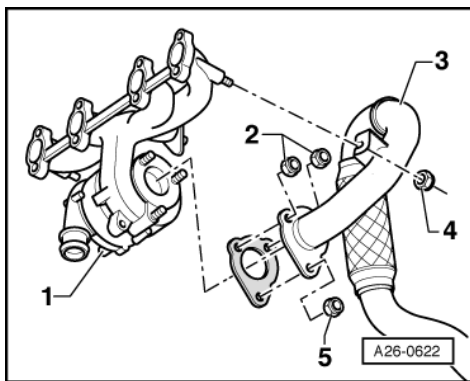
- -> Remove noise insulation in centre and on right -arrows-



- -> Release spring clamp -arrow- at turbocharger using hose clamp pliers V.A.G 1921 or VAS 5024 A and disconnect the air duct pipe -1- from turbocharger.
- Lift out the air duct pipe upwards.



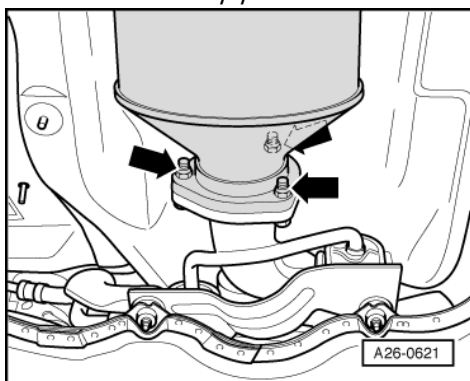
- -> Unplug connectors for air mass meter -3-.
- Unscrew bolts -4- and -5-.
- Remove vent hose -2- off air cleaner housing.
- Remove air cleaner housing.



- -> Unscrew nuts -2-, -4- and -5-.

Note:

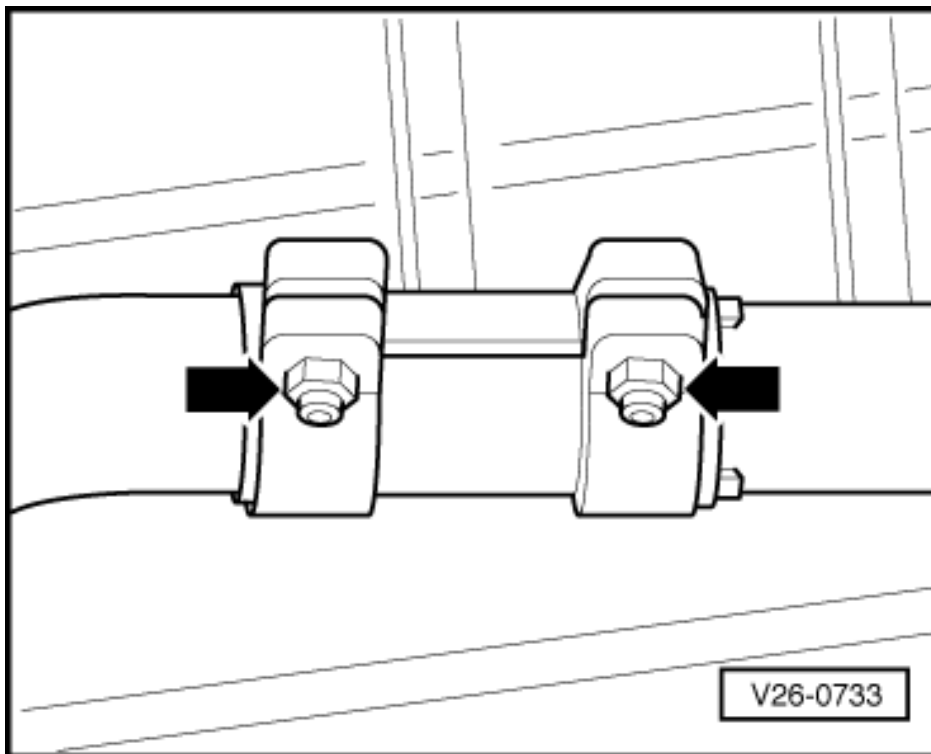
The front exhaust pipe -1- remains connected to the turbocharger -3-.



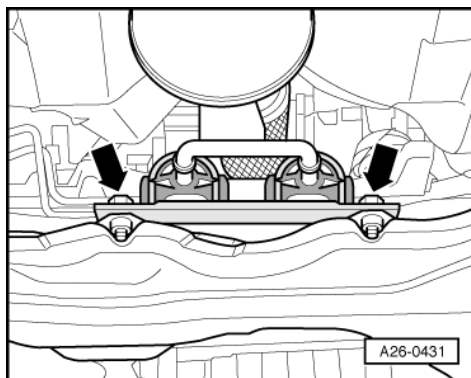
Note:

The isolating element in front exhaust pipe must not be deflected more than 10° to avoid damage.

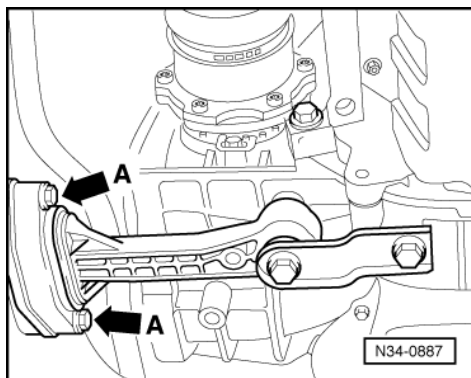
- -> Remove bolts -arrows- at the front exhaust pipe/catalytic converter flange.



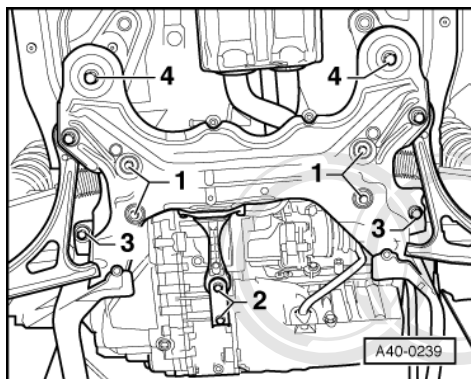
- -> Detach the exhaust system at the clamping sleeve -arrows-.
- Remove catalytic converter.



- -> Unbolt bracket for exhaust system from assembly mounting -arrows-.



- -> Unscrew pendulum support from subframe -arrows A-.



- -> Remove bolts -2- and detach pendulum support.
- Remove bolts -1- for steering box.
- Lever steering box off subframe (dowel sleeve) and detach power-steering pressure line at subframe.
- Position gearbox lifter V.A.G 1383 A with universal mount 1359/2 underneath subframe.
- Unscrew bolts -3- and -4- for subframe.
- Carefully lower subframe, leave attached at the wishbones and connecting rods, while pressing steering box upwards.
- Remove front exhaust pipe.

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Installing

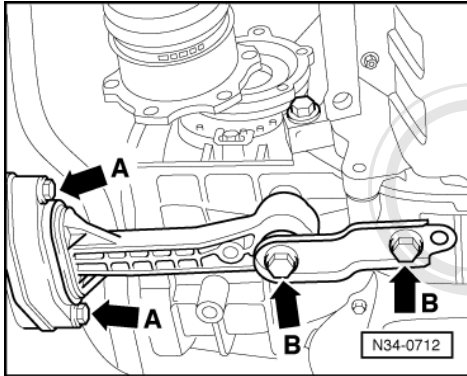
Installation is carried out in the reverse order; note the following:

Note:

Always replace seals, gaskets and self-locking nuts.

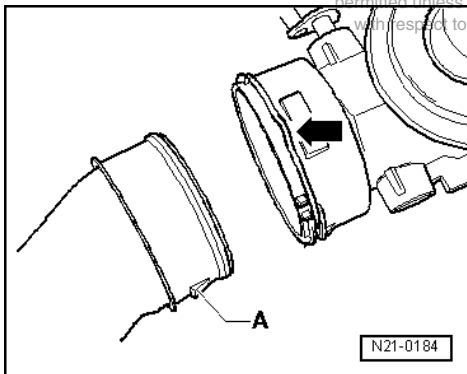
- Fit front exhaust pipe to turbocharger and secure with nut.
- Installing subframe

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



- -> First attach pendulum support to gearbox -arrows B- and then to subframe -arrows A-.
- Only use new bolts to secure.
- Install catalytic converter.
- Stress-free alignment of exhaust system => Page 26-35

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- -> When installing air duct pipes with connectors, ensure that the securing clip -arrow- engages audibly in the retaining lug -A-.

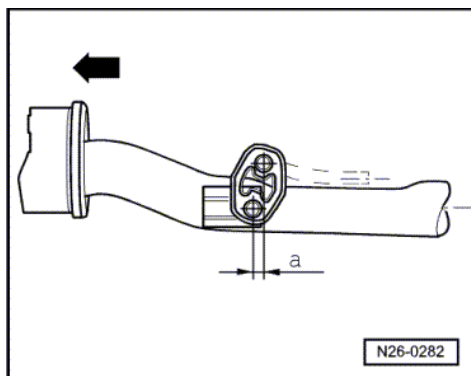
Tightening torques

Component	Nm
Bracket for exhaust system to subframe	23
Pendulum support to gearbox	40 + 90° 1)2)
Pendulum support to subframe	20 + 90°1)2)
Catalytic converter to front exhaust pipe	23 3)
Front exhaust pipe on turbocharger	253)

- 1) Stretch bolts, replace
- 2) 90° corresponds to a quarter of a turn
- 3) Replace the nuts.

3.5 - Stress free alignment of exhaust system

- The exhaust system must be aligned when cold.



- Loosen bolted connections on clamp -Item 26-18
- -> Push front part of exhaust system towards front of vehicle -arrow- so that rear left mounting on centre silencer is preloaded by $a = 5 \dots 11 \text{ mm}$.
- ♦ Installation position of clamp =>Fig.26-21
- Tighten bolted connections on clamp evenly to 40 Nm.

3.6 - Check exhaust system for leaks

- Start engine and run at idling speed.
- Plug tailpipes with cloths or stoppers until check is completed.
- Listen for noise at the connection points of cylinder head/exhaust manifold; turbocharger/front exhaust pipe etc. to locate any leaks.
- Rectify any leaks that are found.

4 - Exhaust gas recirculation system

4.1 - Exhaust gas recirculation system

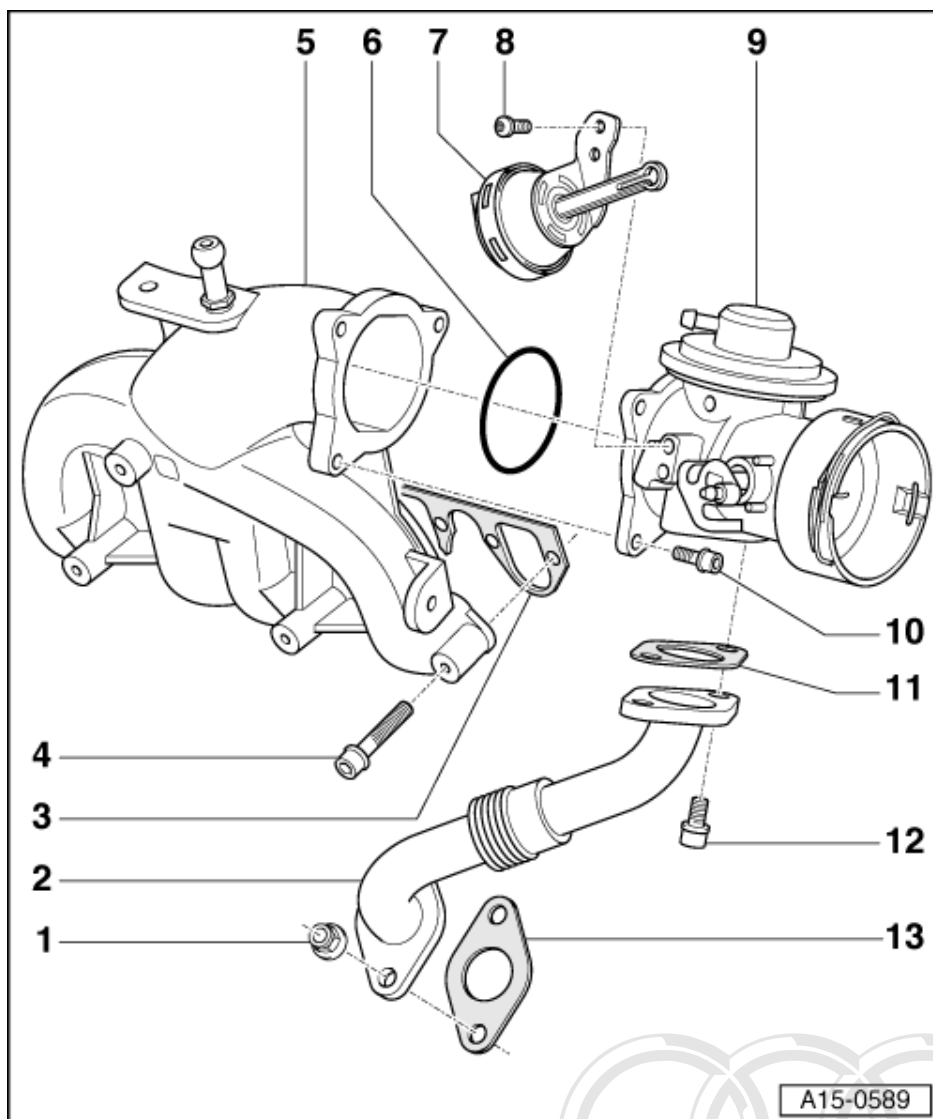
Notes:

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- ♦ The function/control 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 control.
- ♦ The exhaust gas recirculation is switched off after approx. 2 minutes at idling speed.
- ♦ Restart engine or briefly increase engine speed above 1500 rpm when longer checks are necessary. Then repeat checks.
- ♦ Secure all hose connections with the correct hose clamps (same as original equipment):

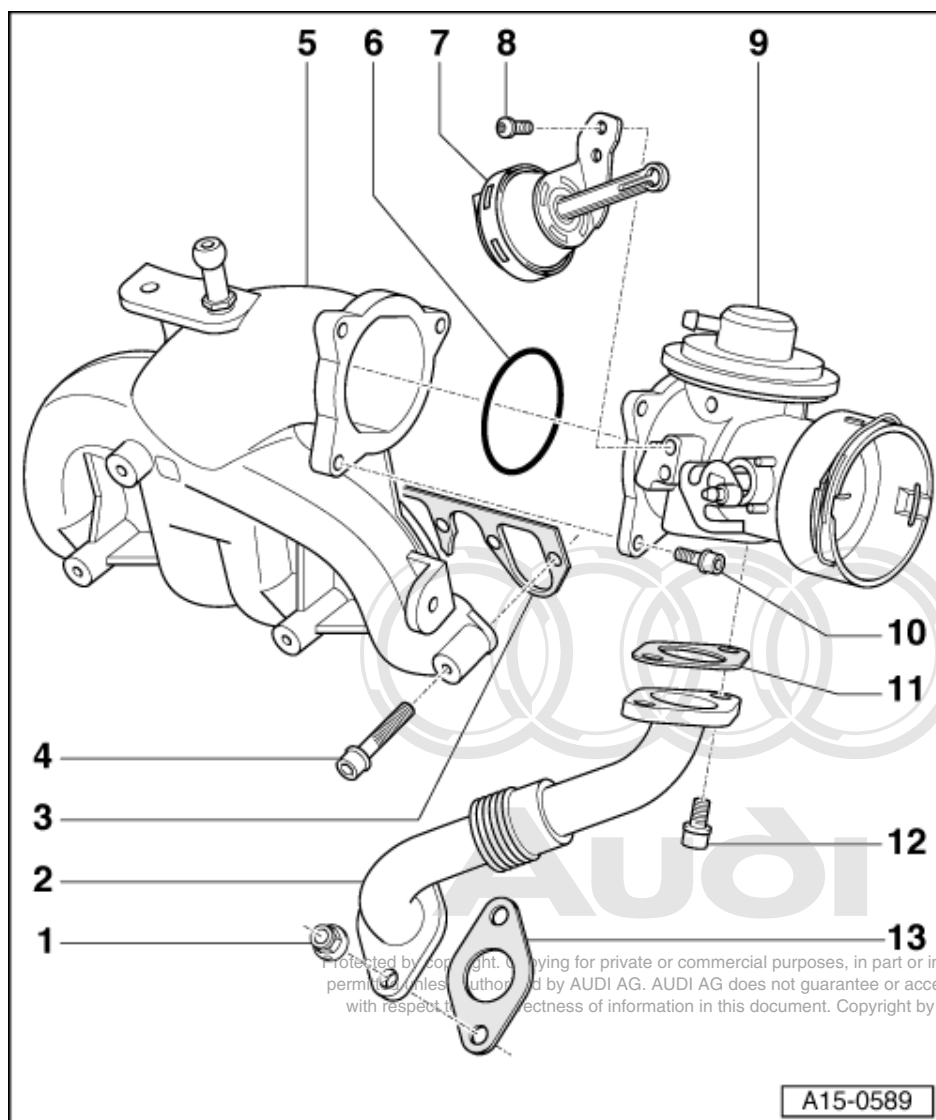
=> Parts List

4.2 - Parts of the exhaust gas recirculation system - assembly overview -engine codes ASZ, ATD-



- 1 22 Nm
 - ♦ Replace
- 2 **Connecting pipe**
 - ♦ For exhaust gas recirculation
 - ♦ Note installation sequence:
 - First bolt on loosely.
 - Then tighten bolts to final torque.
- 3 **Seal**
 - ♦ Replace
 - ♦ Note installation position
- 4 25 Nm
- 5 **Intake manifold**
 - ♦ Removing and installing
=>Page 15-64

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6 O-ring

- ♦ Replace

7 Vacuum unit for intake manifold flap

8 5 Nm

9 Intake pipe connection

- ♦ With mechanical exhaust gas recirculation valve
- ♦ With intake manifold flap
- ♦ Checking mechanical exhaust gas recirculation valve => Page 26-50

10 10 Nm

11 Seal

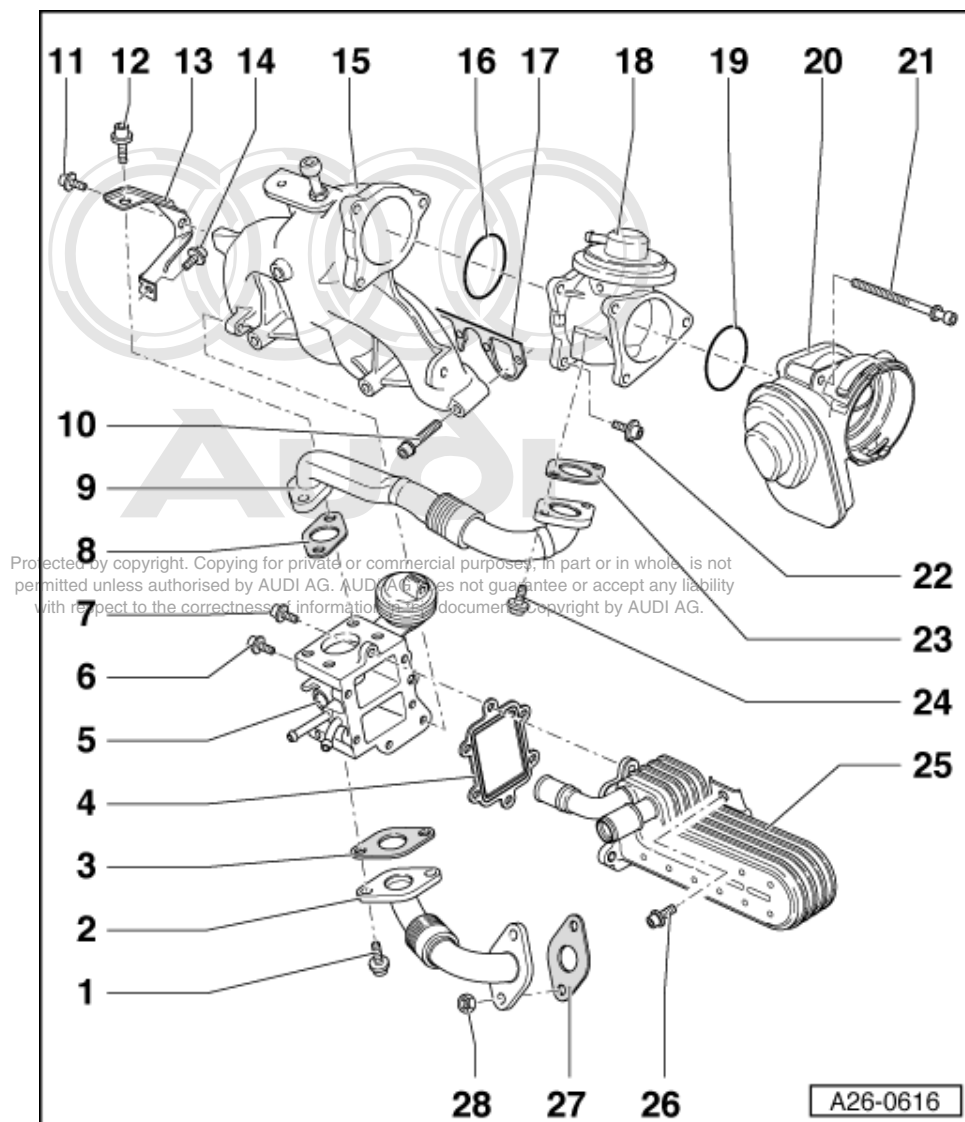
- ♦ Replace

12 22 Nm

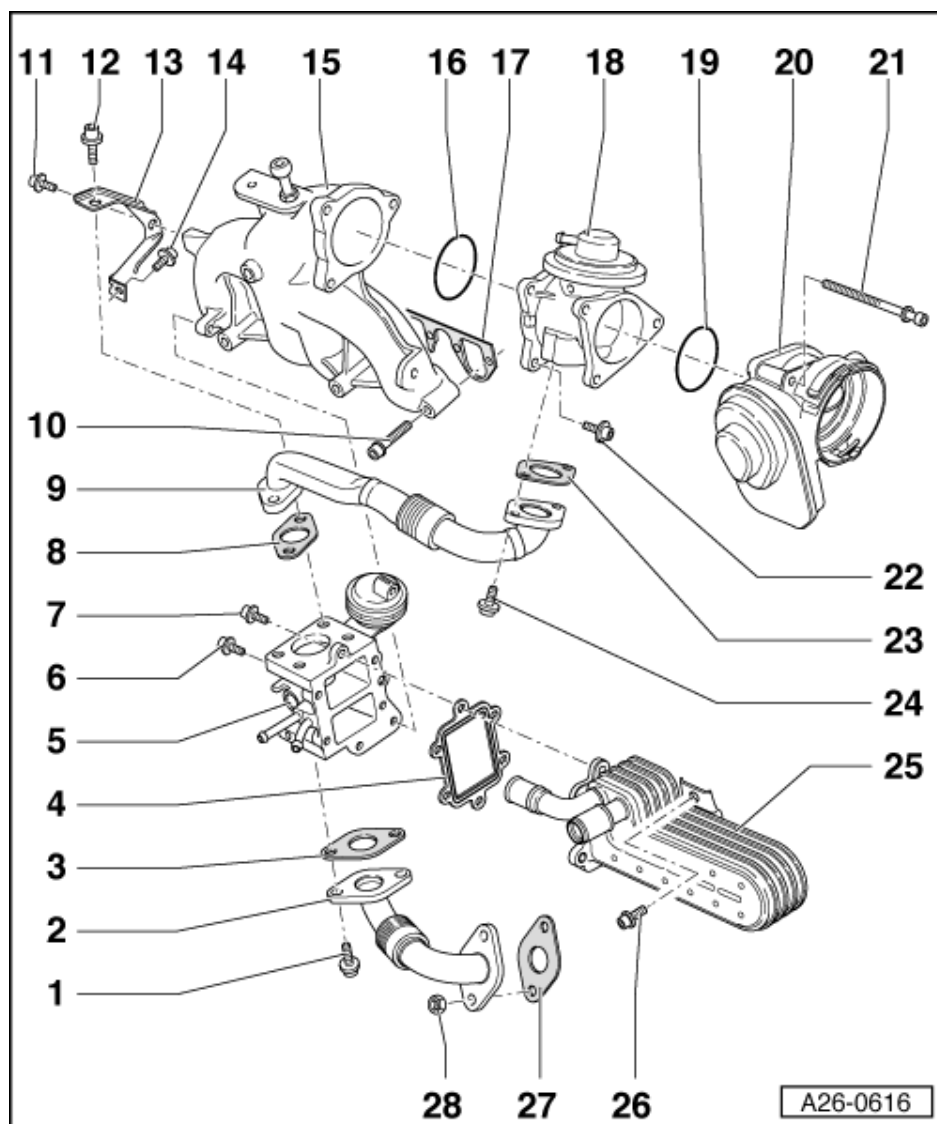
13 Seal

- ♦ Replace

4.3 - Parts of the exhaust gas recirculation system - assembly overview -engine code AXR-



- 1 22 Nm
- 2 Lower connecting pipe
 - ♦ For exhaust gas recirculation
 - ♦ Note installation sequence:
 - First bolt on loosely.
 - Then tighten bolts to final torque.
- 3 Seal
 - ♦ Replace
- 4 Seal
 - ♦ Replace
- 5 Changeover valve for exhaust gas recirculation
- 6 10 Nm



7 10 Nm

8 Seal

- ♦ Replace

9 Upper connecting pipe

- ♦ For exhaust gas recirculation
- ♦ Note installation sequence:
 - First bolt on loosely.
 - Then tighten bolts to final torque.

10 22 Nm

11 10 Nm

12 22 Nm

13 Bracket

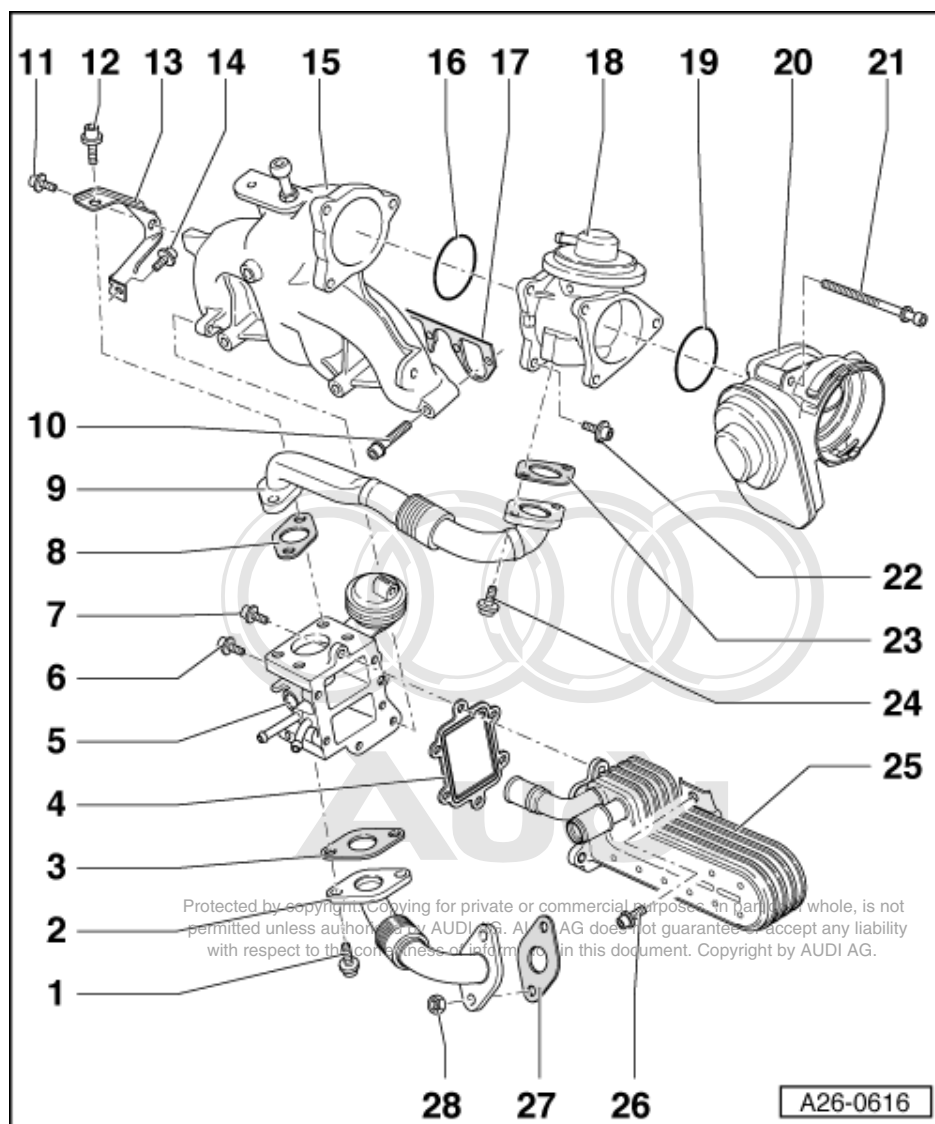
14 5 Nm

15 Intake manifold

- ♦ Removing and installing=>Page 15-74



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**16 O-ring**

- ♦ Replace

17 Seal

- ♦ Replace
- ♦ Note installation position

18 Mechanical EGR valve

- ♦ Checking => Page 26-50

19 O-ring

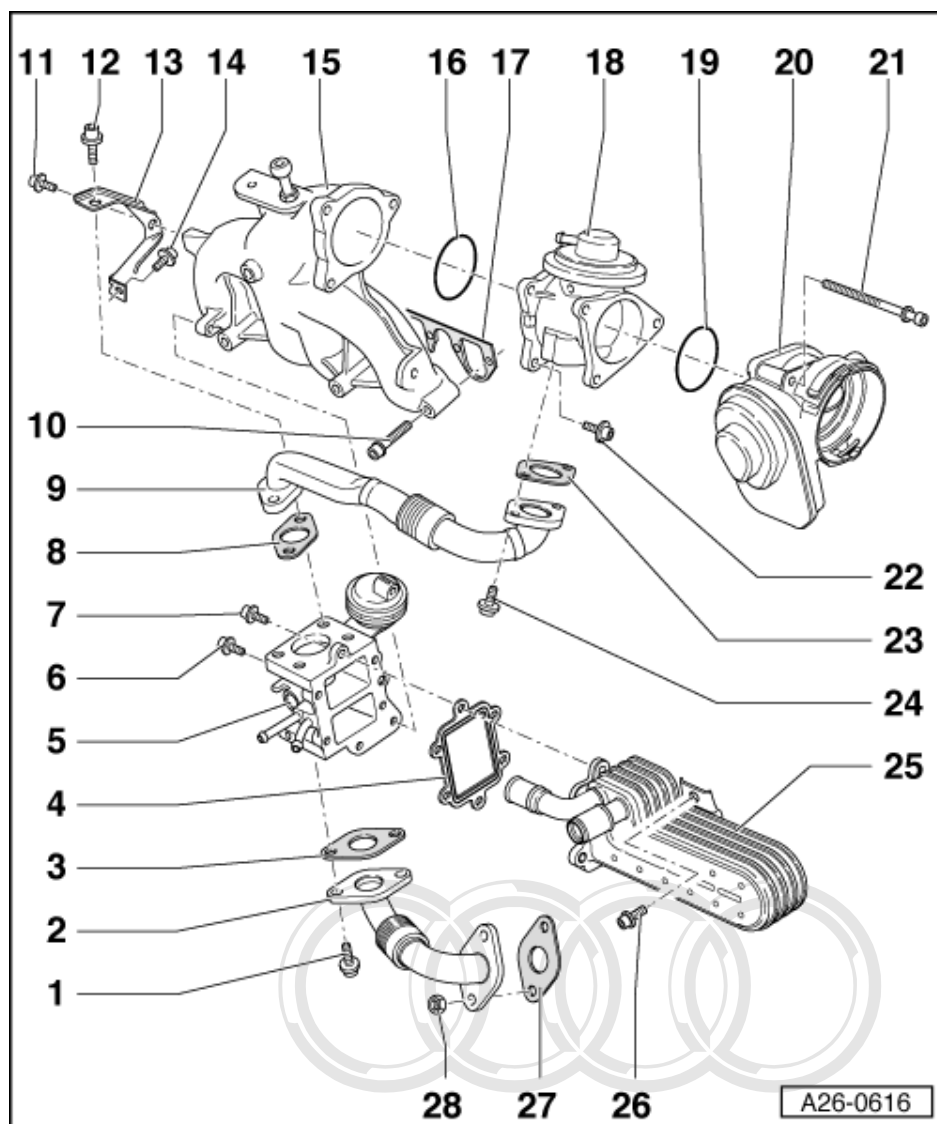
- ♦ Replace

20 Intake pipe connection

- ♦ With motor for intake manifold flap -V157
- ♦ Checking motor for intake manifold flap -V157:

=> TDI Injection and Glow Plug System (4-cyl Pump Jet); Repair group 01

21 10 Nm



22 10 Nm

23 Seal

- ♦ Replace

24 22 Nm

25 Removing and installing

- ♦ For exhaust gas recirculation
- ♦ Removing and installing => Removing and installing intake manifold, Page 15-74

26 10 Nm

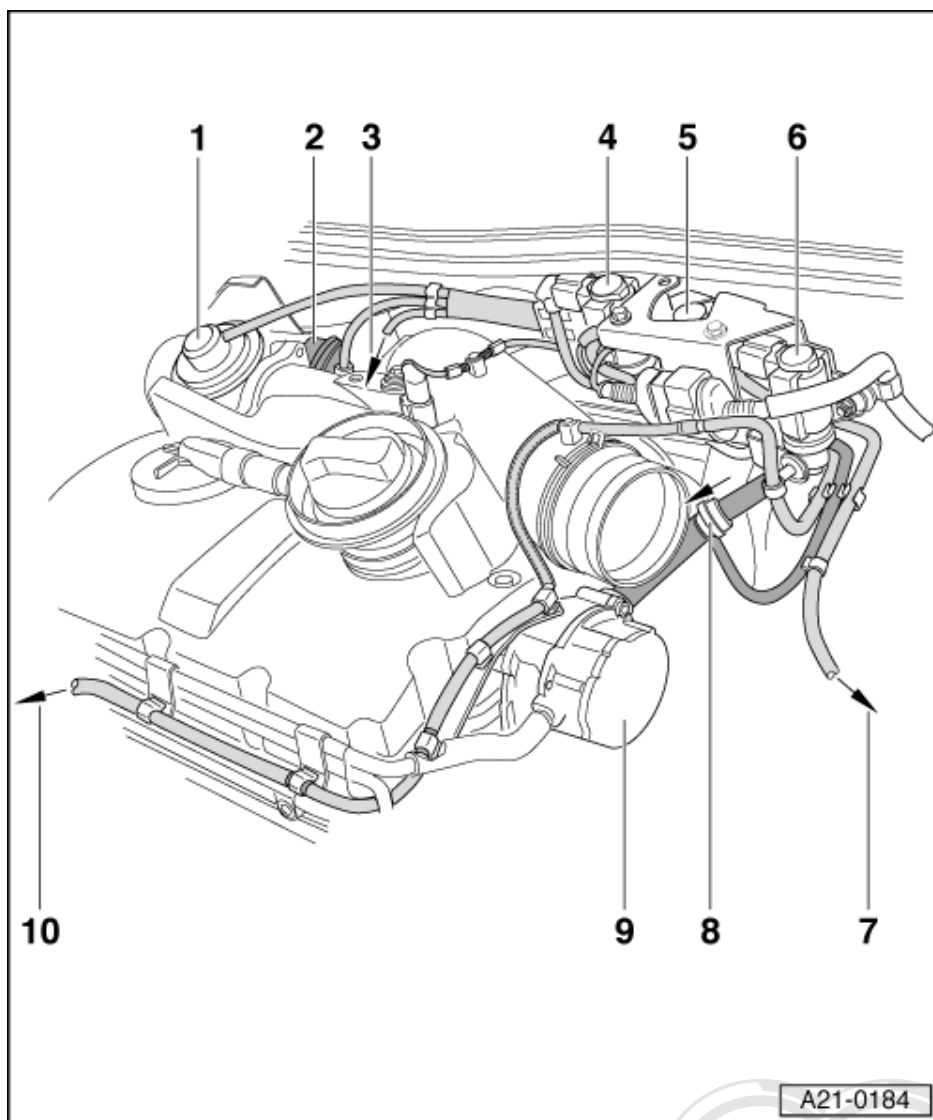
27 Seal

- ♦ Replace

28 22 Nm

- ♦ Replace

4.4 - Connection diagram for exhaust gas recirculation -engine codes ASZ, ATD-



1 Intake pipe connection

- ◆ With intake manifold flap
- ◆ With mechanical exhaust gas recirculation valve
- ◆ Checking mechanical exhaust gas recirculation valve => Page 26-50

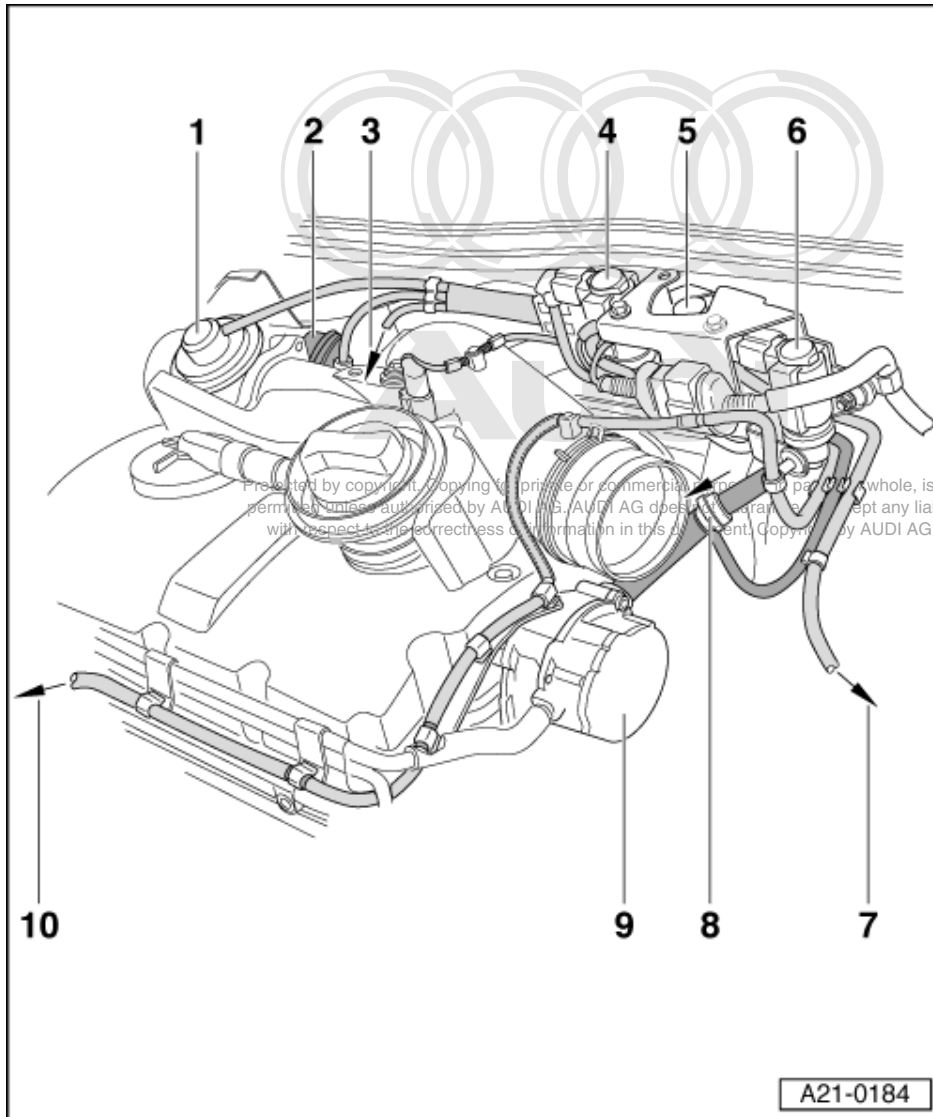
2 Vacuum unit for intake manifold flap

3 To the vacuum unit for boost pressure control

4 EGR valve 1 -N18

- ◆ Fitting location: On bulkhead in engine compartment
- ◆ Checking => Page 26-56
- ◆ Hose connection diagram =>Page 26-48

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5 Intake manifold flap changeover valve -N239

- ◆ Fitting location: On bulkhead in engine compartment
- ◆ Hose connection diagram =>Page 26-48

6 Boost pressure control solenoid valve -N75

- ◆ Fitting location: On bulkhead in engine compartment
- ◆ Hose connection diagram =>Page 26-48

7 Breather pipe

- ◆ To air cleaner

8 To brake servo

- ◆ With deviation to vacuum pressure distributor for solenoid valves

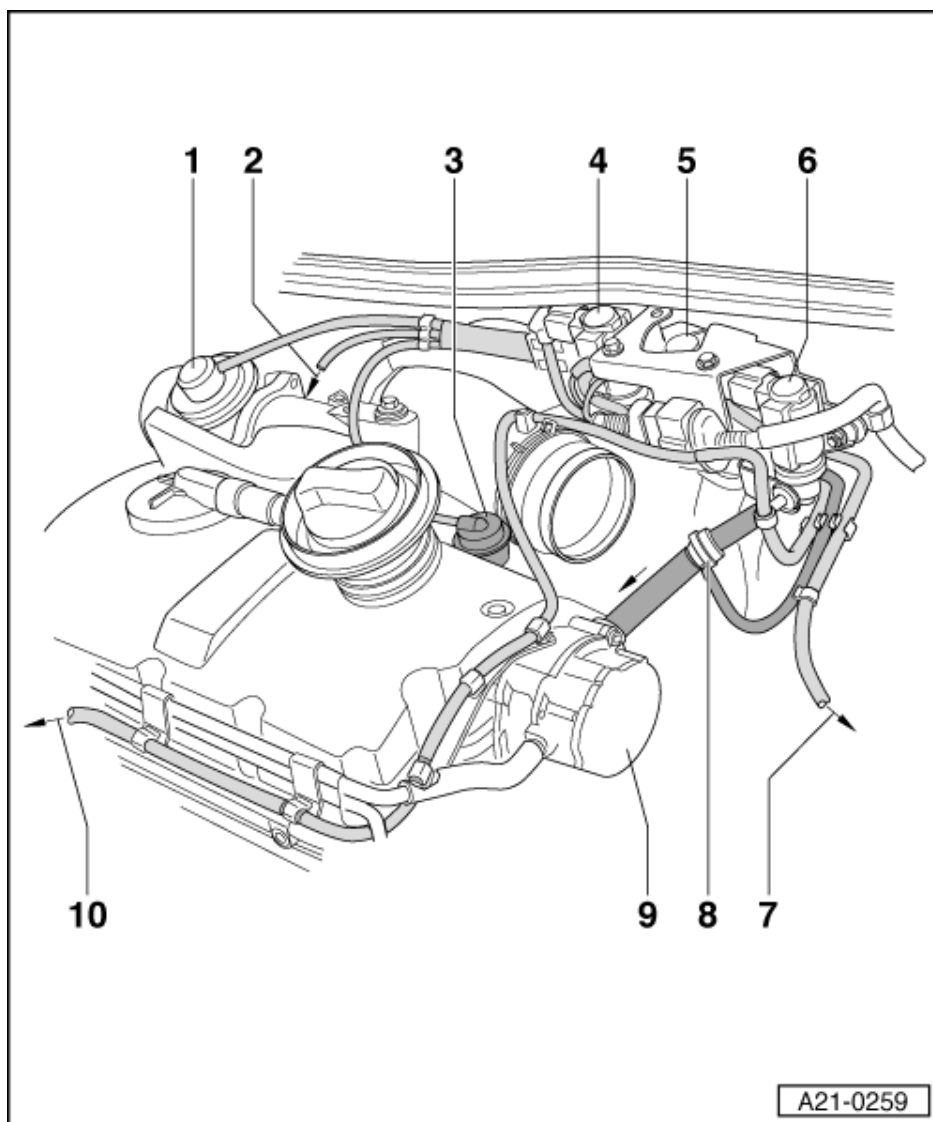
9 Tandem pump

- ◆ Generates vacuum for brake servo and solenoid valves

10 Vacuum hose

- ◆ To vacuum unit

4.5 - Connection diagram for exhaust gas recirculation -engine code AXR-



1 Intake pipe connection

- ♦ With motor for intake manifold flap -V157
- ♦ Checking motor for intake manifold flap -V157:

=> TDI Injection and Glow Plug System (4-cyl Pump Jet); Repair group 01

- ♦ With mechanical exhaust gas recirculation valve
- ♦ Checking => Page 26-50

2 To the vacuum unit for boost pressure control

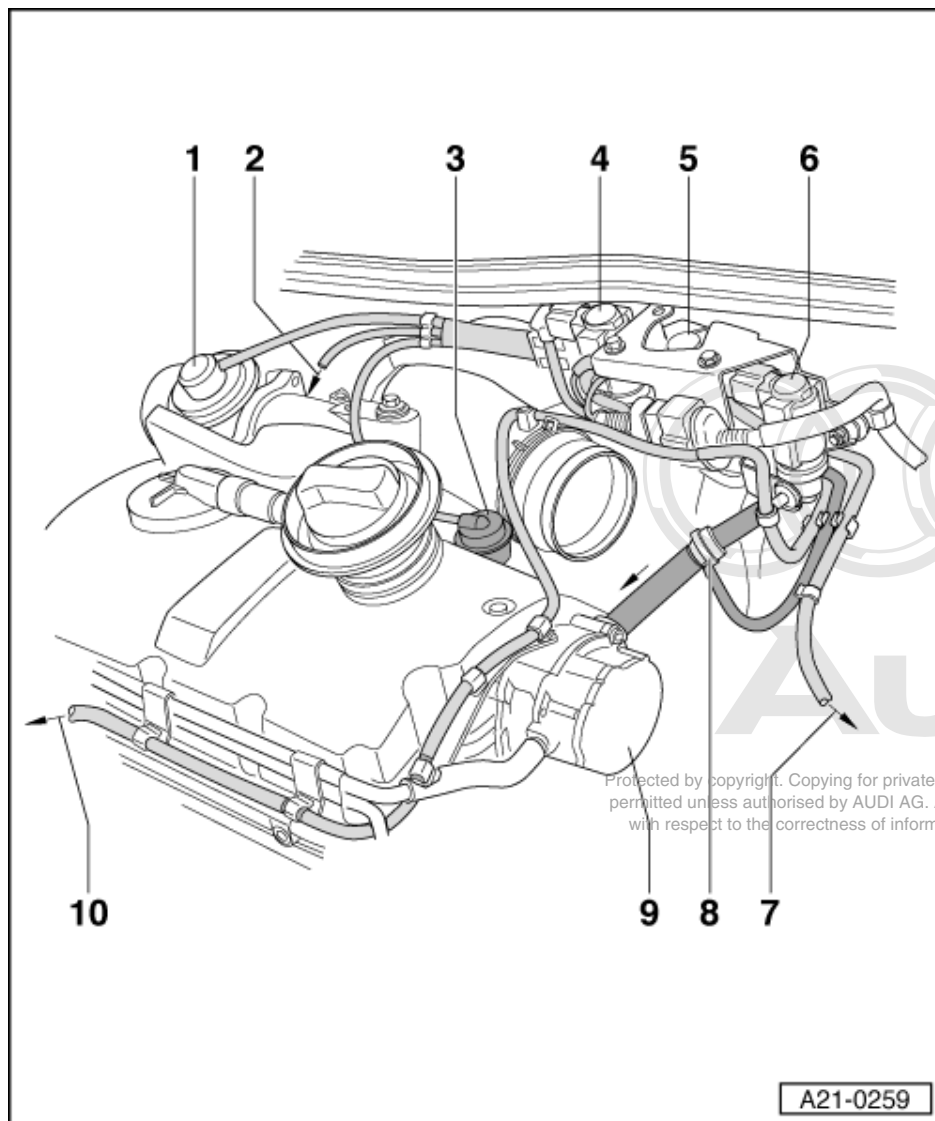
3 Vacuum unit

- ♦ For exhaust gas recirculation changeover

4 EGR valve 1 -N18

- ♦ Fitting location: On bulkhead in engine compartment
- ♦ Checking => Page 26-56
- ♦ Hose connection diagram => Page 26-48

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5 Valve 2 for exhaust gas recirculation -N213

- ◆ Fitting location: On bulkhead in engine compartment
- ◆ Checking => Page 26-65
- ◆ Hose connection diagram =>Page 26-48

6 Boost pressure control solenoid valve -N75

- ◆ Fitting location: On bulkhead in engine compartment
- ◆ Hose connection diagram =>Page 26-48

7 Breather pipe

- ◆ To air cleaner

8 To brake servo

- ◆ With deviation to vacuum pressure distributor for solenoid valves

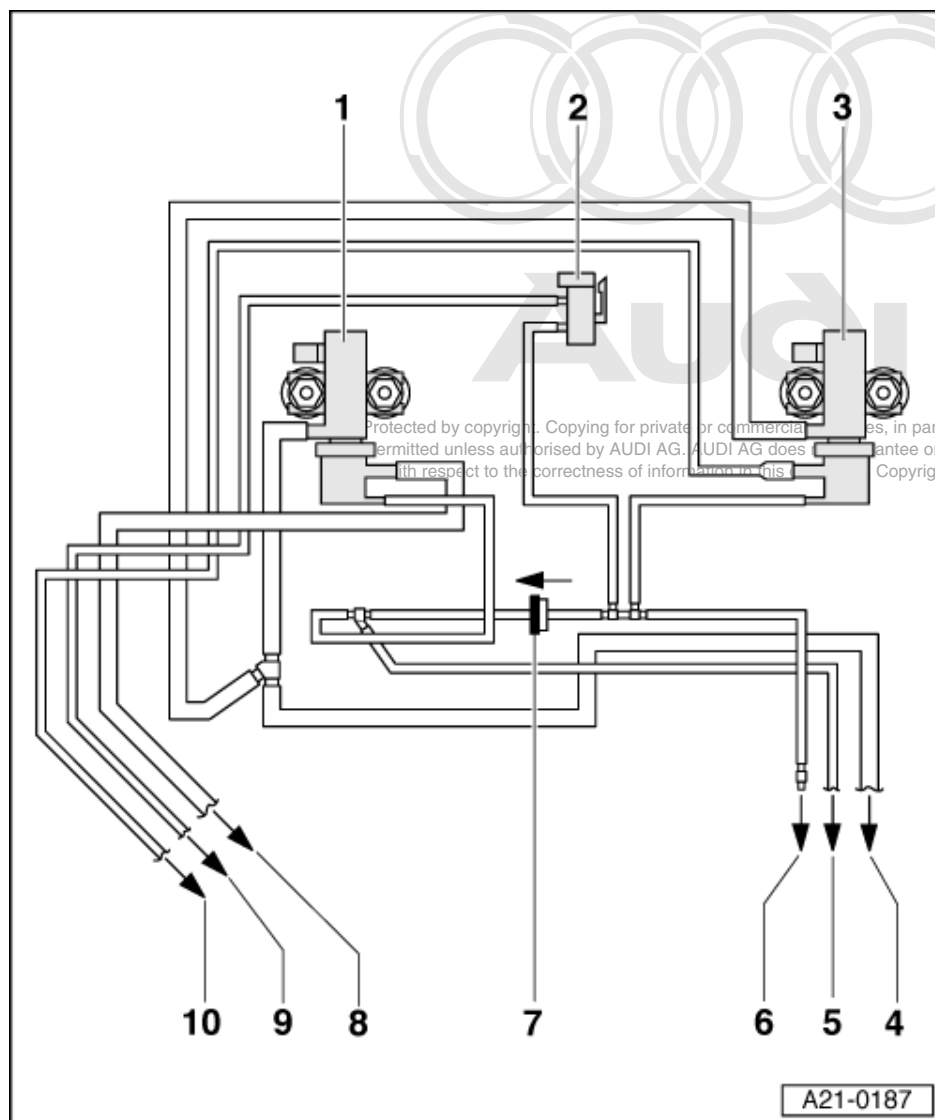
9 Tandem pump

- ◆ Generates vacuum for brake servo and solenoid valves

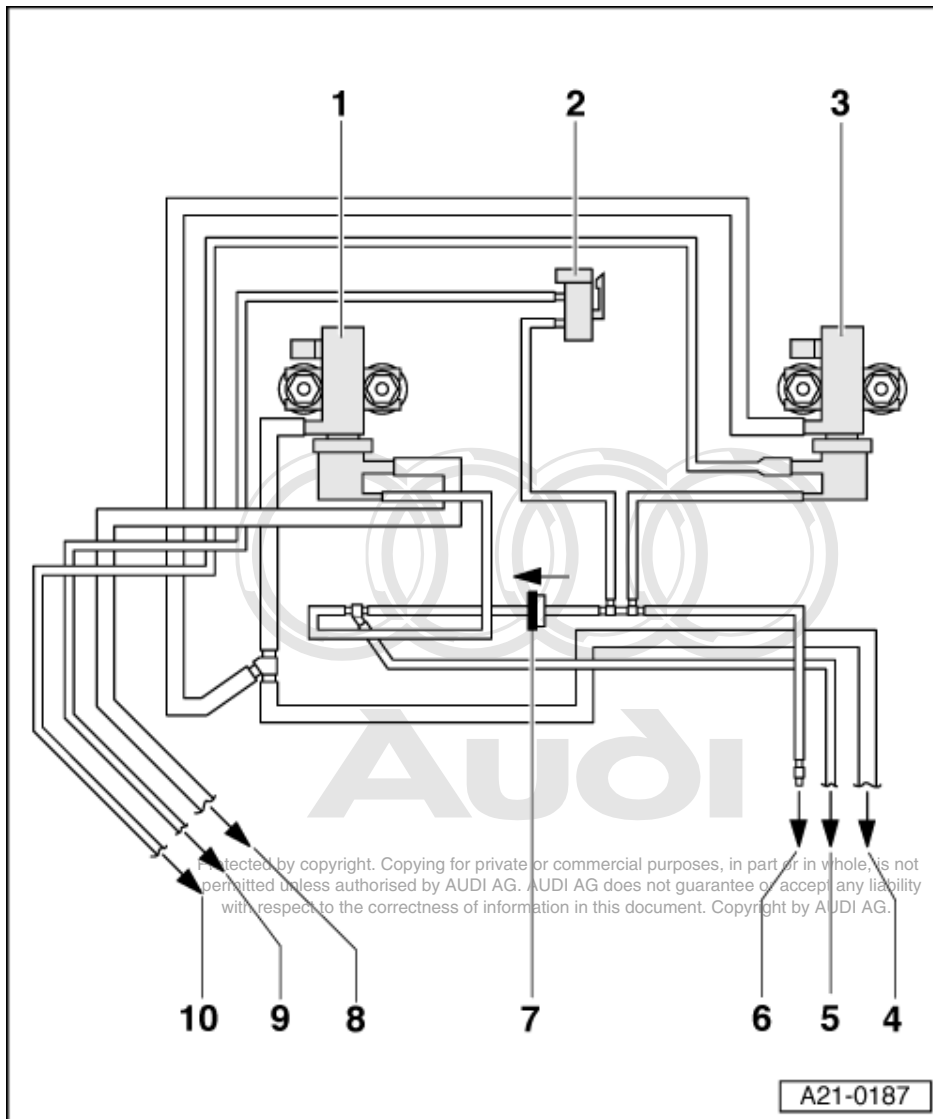
10 Vacuum hose

- ◆ To vacuum unit

4.6 - Hose connection diagram for solenoid valves at bulkhead



- 1 EGR valve -N18
- 2 Changeover valve for intake manifold flap -N239 (engine codes ASZ, ATD) or valve 2 for exhaust gas recirculation -N213 (engine code AXR)
- 3 Boost pressure control solenoid valve -N75
- 4 Breather pipe
 - ♦ To air cleaner
- 5 To the tandem pump



6 To vacuum reservoir

7 Non-return valve

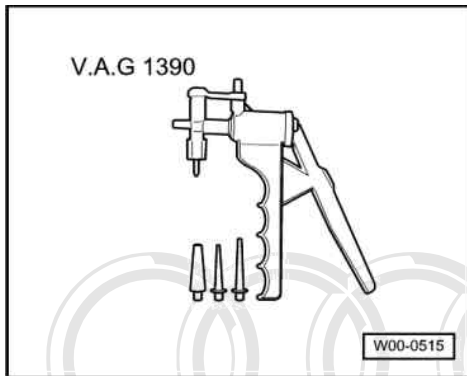
- ♦ Note installation position (light side/ dark side) as shown in Fig, arrow faces in direction of flow

8 To mechanical exhaust gas recirculation valve

9 To vacuum unit for intake manifold flap

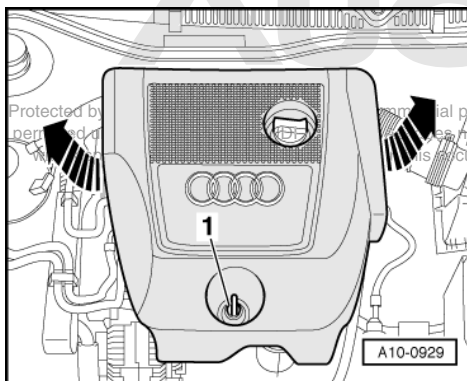
10 To the vacuum unit for boost pressure control

4.7 - Checking mechanical EGR valve



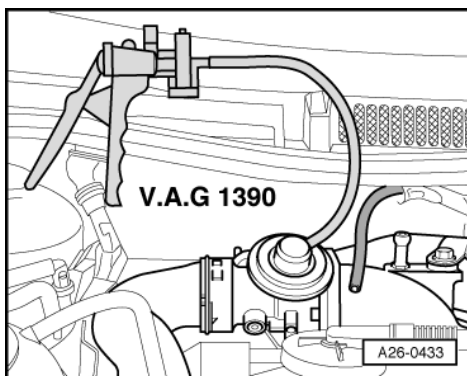
Special tools and workshop equipment required

- ◆ Vacuum hand pump V.A.G 1390

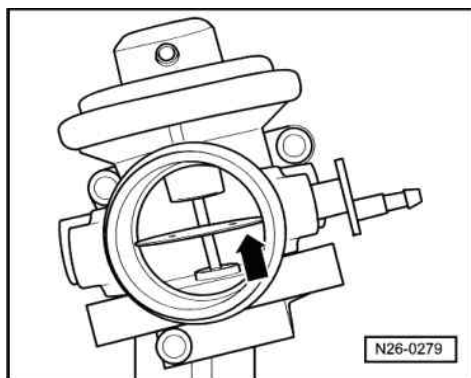


Test sequence

- Final control diagnosis has been performed.
- -> Remove oil dipstick -1- from guide tube.
- Remove engine cover -arrows-.
- Reinsert dipstick in guide tube.



- Disconnect vacuum hose from mechanical EGR valve.
- -> Connect hand vacuum pump V.A.G 1390 to valve.
- Actuate hand vacuum 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

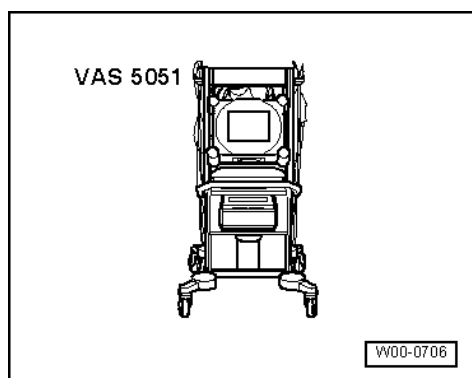


Note:

-> When air duct hose is removed the movement of the diaphragm rod in the intake manifold can be observed.

4.8 - Checking exhaust gas recirculation

Checking the exhaust gas recirculation function is carried out in function "Basic setting". With this procedure the valve for the exhaust gas recirculation is pulsed every 10 seconds so that the extreme values for the exhaust gas recirculation (air mass meter) can be read in the display group 003.

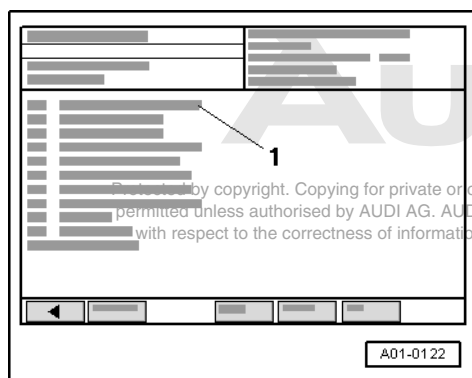


Special tools and workshop equipment required

- ♦ VAS 5051

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.

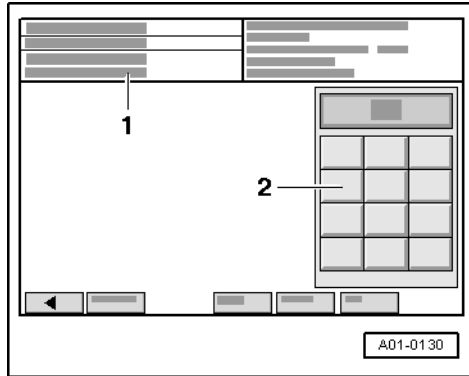


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Test sequence

-> Display on VAS 5051:

- Under -1- select diagnostic function "04 - Basic setting".

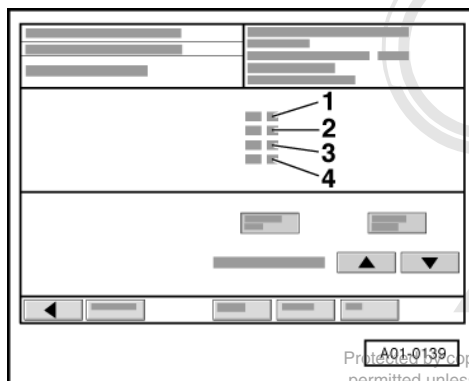


-> Display on VAS 5051:

1 - Enter display group

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

- ♦ The idling speed is increased to 1380 ... 1420 rpm.



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-> Display on VAS 5051:

- Check display in zones 2 to 4.

	Display zones			
	1	2	3	4
Display group 003: Exhaust gas recirculation at 1400 rpm				
Display	xxxx rpm	---	xxxx mbar	xxx %
Display	Engine speed	Checking actuation of EGR valve -N18	Taken Air mass	Signal ratio of EGR valve -N18
Specified value	1400 rpm	EGR not active	Display alternating every 10 seconds	18...22%
		EGR active	Difference at least 150 mg/stroke	63...67%


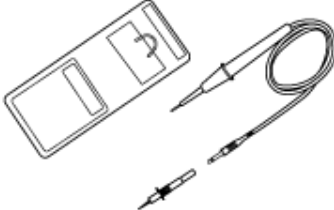
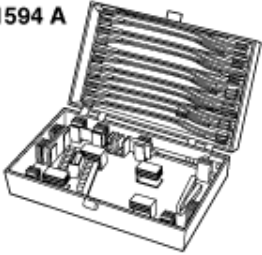

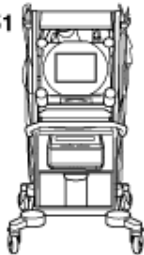


If the specified values are not obtained:

- Check the mechanical EGR valve => Page 26-50.
- Check vacuum pressure hose connection => Page 26-46.
- Checking exhaust gas recirculation valve -N18 => Page 26-56
- End function "04 - Basic setting" by pressing the ◀ key.
- Press "06 - End output".

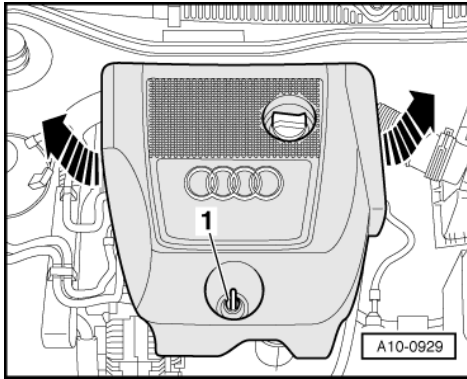
4.9 - Checking EGR valve -N18

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V.A.G 1526 A 	V.A.G 1527 B 
V.A.G 1594 A 	V.A.G 1598/31 
VAS 5051 	<div>G24-0023</div>

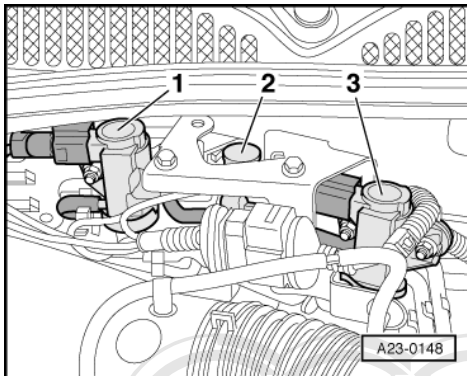
Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/31
- ♦ VAS 5051 with VAS 5051/1

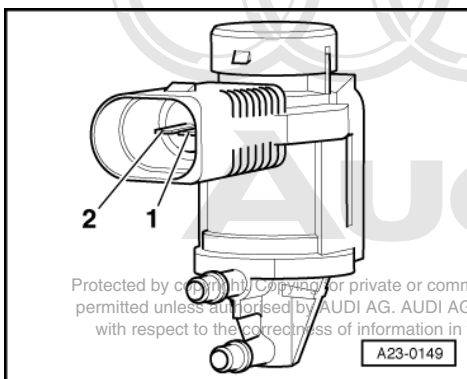


Checking internal resistance

- -> Remove oil dipstick -1- from guide tube.
- Remove engine cover -arrows-.
- Reinsert dipstick in guide tube.



- Switch ignition off.
- -> Detach connector for exhaust gas recirculation valve -N18 -1-.



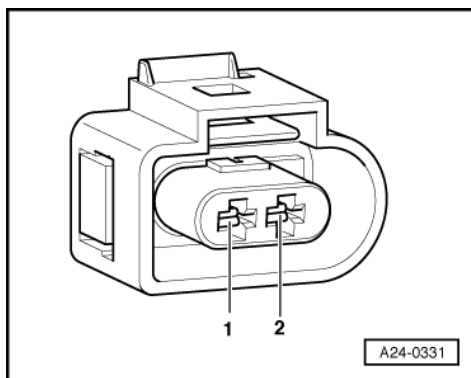
- -> Connect multimeter to injector to measure resistance.
- Specified value: 14 ... 20 Ω

Note:

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

If specified value is not attained:

- Replace the exhaust gas recirculation valve -N18.

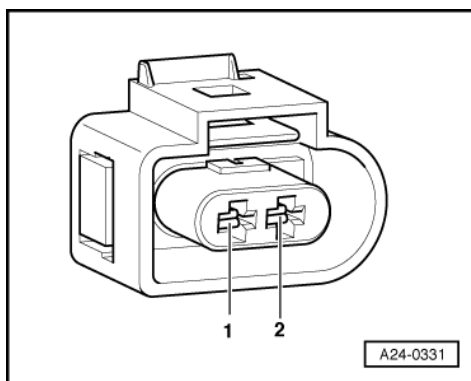


Checking power supply

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

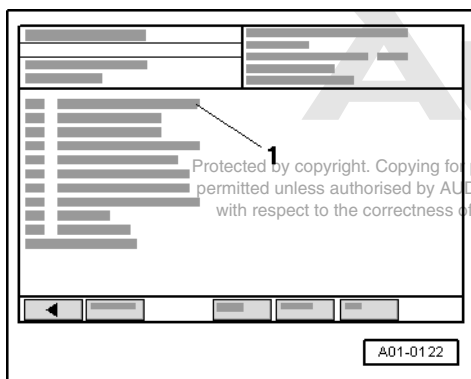
If specified value is not attained:

- Check wiring for open circuit and service if necessary.



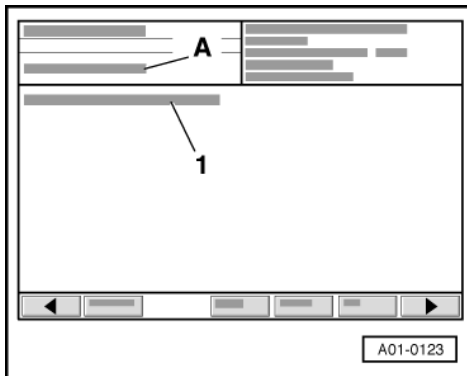
Checking actuation

- Vehicle diagnostic, testing and information system VAS 5051 connected, vehicle self-diagnosis and vehicle system "01 - Engine electronics" selected.
- -> Connect voltage tester V.A.G 1527 B between contacts 1 and 2.



-> Display on VAS 5051:

- Under -1- select the diagnostic function "03 - Final control diagnosis".



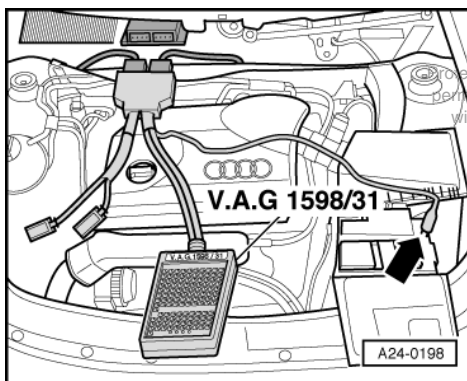
-> Display on VAS 5051:

- A - 1st control element in test
- 1 - EGR valve -N18
- The LED must flash slowly.

Note:

Voltage testers with a low current consumption continue to glow faintly between actuation from the engine control unit (rather than extinguishing completely) and become much brighter when actuated.

- End function "03 - Final control diagnosis" by pressing the ◀ key.
- Press "06 - End output".



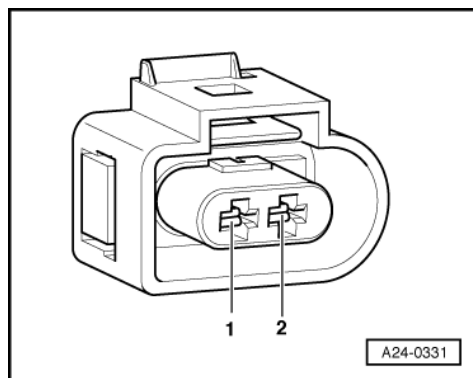
If the LED lamp does not react as described:

- -> Connect the V.A.G 1598/31 test box to wiring harness connectors; the engine control unit should not be connected. Attach the earth clip of test box to earth -arrow-.

=> TDIInjection and Glow Plug System(4-cyl Pump Jet); Repair group 23

Important

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



- -> Test for open circuit in the following wiring connections.

Connector Contact	Test box V.A.G 1598/31 Socket
1	1 or 2
2	61

- Rectify any open/short circuit as necessary.

4.10 - Cooling for exhaust gas recirculation -engine code AXR-

Function

Vehicles with engine code AXR are equipped with an exhaust gas recirculation cooler, through which coolant flows.

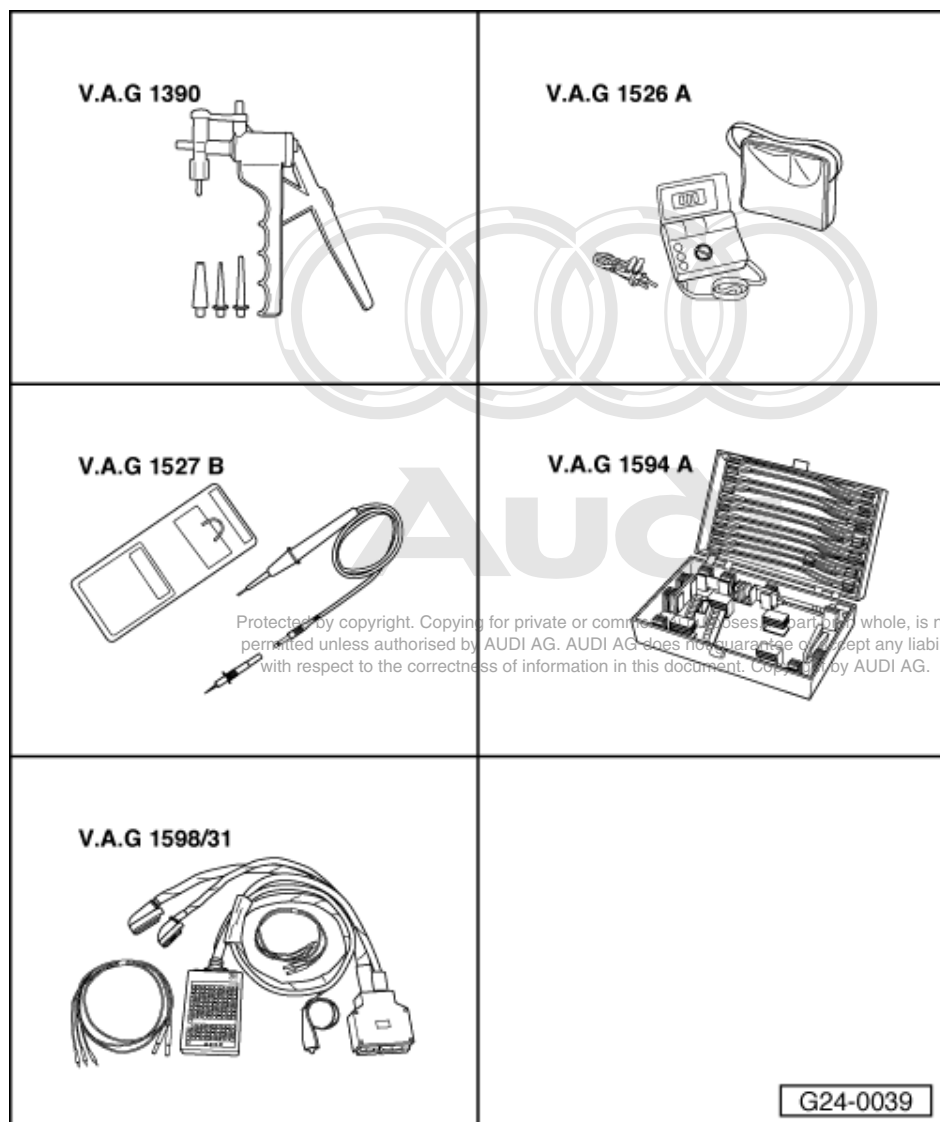
Under certain operating conditions, the flow of exhaust gas recirculated to the combustion chamber is routed via this cooler. The exhaust gas temperature is reduced thereby, further lowering the combustion temperature and improving the exhaust emission values.

The engine control unit determines when the recirculated exhaust gas is routed via the cooler. Via valve 2 for exhaust gas recirculation -N213, the control unit actuates a vacuum unit, which in turn operates the exhaust gas recirculation changeover valve.



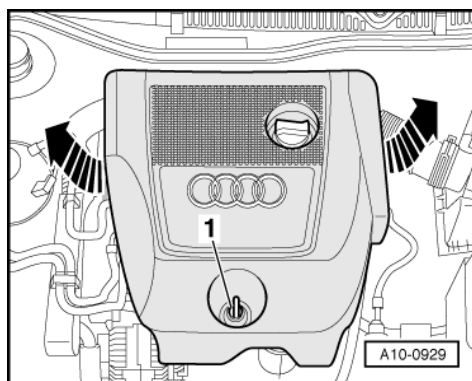
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4.11 - Checking exhaust gas recirculation changeover



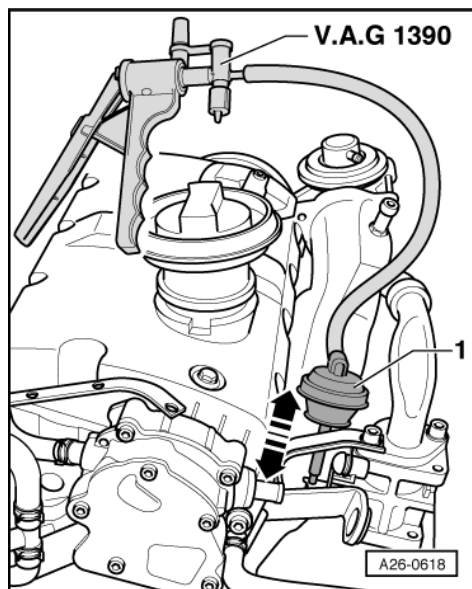
Special tools and workshop equipment required

- ◆ V.A.G 1390
- ◆ V.A.G 1526 A
- ◆ V.A.G 1527 B
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31



Test sequence

- Final control diagnosis has been performed.
- -> Remove oil dipstick -1- from guide tube.
- Remove engine cover -arrows-.
- Reinsert dipstick in guide tube.

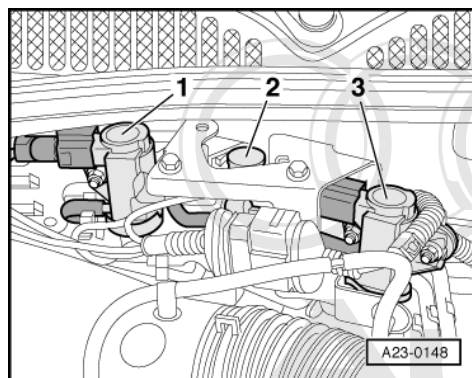


- -> Detach vacuum hose from vacuum unit -1- for exhaust gas recirculation.
- Connect hand vacuum pump V.A.G 1390 to valve.
- Actuate hand vacuum pump.
 - The linkage of the exhaust gas recirculation changeover must move -arrow-

If the linkage does not move or only moves jerkily:

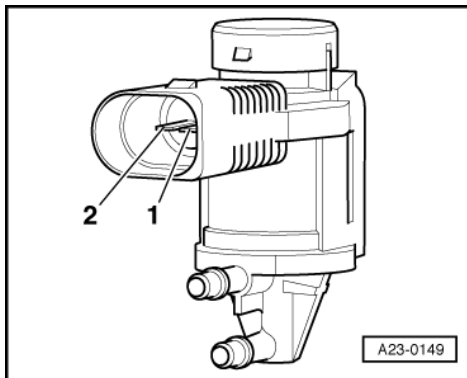
- ♦ The vacuum unit is defective
- ♦ If the changeover valve for exhaust gas recirculation is stiff

4.12 - Checking valve 2 for exhaust gas recirculation -N213



If no fault is detected in the mechanical components:

- -> Detach the connector at valve 2 for exhaust gas recirculation -N213 -Item 2-.

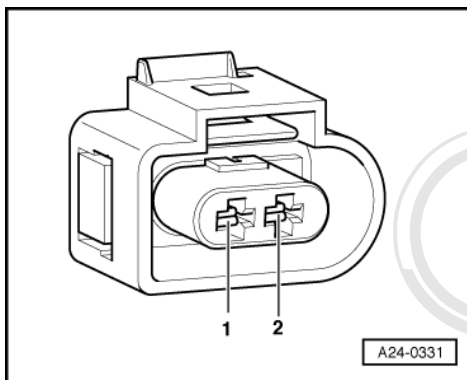


Checking internal resistance

- Connect multimeter between contacts 1 and 2 to measure resistance.
- Specified value: 25 ... 45 ω

If specified value is not attained:

- Replace valve 2 for exhaust gas recirculation.



Checking power supply

Test requirements:

- Fuse for valve 2 for exhaust gas recirculation OK.

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

- Relay for diesel direct injection OK; check.

=> TDIInjection and Glow Plug System(4-cyl Pump Jet); Repair group 23

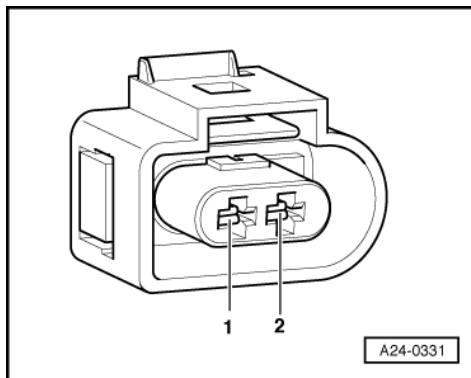
- -> Connect multimeter as follows to measure voltage.

Connector Contact	Measure to
1	Engine earth

- Switch the ignition on.
- Specified value: approx. battery voltage

If specified value is not attained:

- Check wiring for open circuit and service if necessary.



Checking actuation

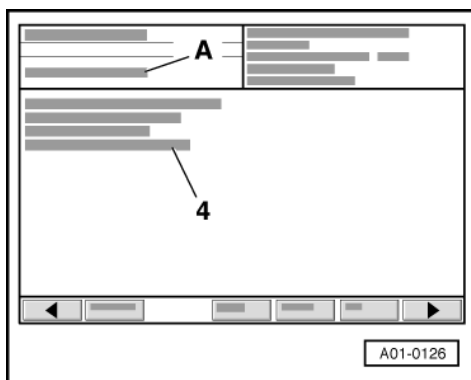
- Vehicle diagnostic, testing and information system VAS 5051 connected, vehicle self-diagnosis and vehicle system "01 - Engine electronics" selected.
- -> Connect voltage tester V.A.G 1527 B between contacts 1 and 2.



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-> Display on VAS 5051:

- Under -1- select the diagnostic function "03 - Final control diagnosis".
- Start final control diagnosis and actuate valve 2 for exhaust gas recirculation -N213:



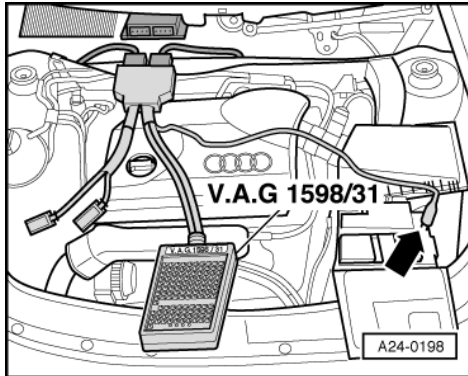
-> Display on VAS 5051:

- A - 4th control element in test
- 4 - Valve 2 for exhaust gas recirculation-N213
- The LED must flash slowly.

Note:

Voltage testers with a low current consumption continue to glow faintly between actuation from the engine control unit (rather than extinguishing completely) and become much brighter when actuated.

- End function "03 - Final control diagnosis" by pressing the ◀ key.
- Press "06 - End output".
- Switch ignition off.



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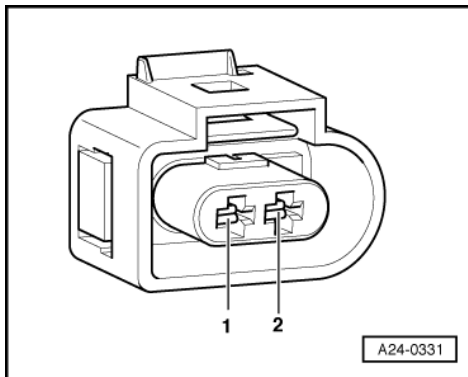
If the LED lamp does not react as described:

- Switch ignition off.
- -> Connect the V.A.G 1598/31 test box to wiring harness connectors; the engine control unit should not be connected. Attach the earth clip of test box to earth -arrow-.

=> TDIInjection and Glow Plug System(4-cyl Pump Jet); Repair group 23

Important

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



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

Connector Contact	Test box V.A.G 1598/31 Socket
2	59

- Rectify any open/short circuit as necessary.