

Audi 100 1991 ➤

4-Cyl. Diesel Direct Injection Engine (TDI®), Mechanical Components

Engine ID	1Z	AHU						
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Edition 12.2001



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List of Workshop Manual Repair GroupsList of Workshop Manual
Repair GroupsList of Workshop Manual Repair Groups
Audi 100 1991 ➤

**4-Cyl. Diesel Direct Injection Engine (TDI®), Mechanical
Components**

Repair Group

00 - Technical data

10 - Removing and installing engine

13 - Crankshaft group

15 - Cylinder head, Valve gear

17 - Lubrication

19 - Cooling system

21 - Charging

26 - Exhaust system

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

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Contents

00 - Technical data	1
1 Technical data	1
1.1 Technical data	1
1.2 Engine number	1
1.3 Engine data	1
10 - Removing and installing engine	3
1 Removing and installing engine	3
1.1 Removing and installing engine	3
1.2 Removing	4
1.3 Attaching engine to repair stand	12
1.4 Installing	13
1.5 Tightening torques	15
13 - Crankshaft group	17
1 Dismantling and assembling engine	17
1.1 Dismantling and assembling engine	17
1.2 Ribbed belt drive for alternator; V-belt drive for coolant pump and vane pump	17
1.3 Removing and installing V-belt	24
1.4 Tensioning V-belts	24
1.5 Removing and installing ribbed belt	25
1.6 Toothed belt drive	27
1.7 Removing and installing toothed belt	32
1.8 Checking semi automatic toothed belt tensioning roller	37
1.9 Positioning crankshaft to TDC with engine removed	38
2 Removing and installing sealing flanges and flywheel/drive plate	40
2.1 Removing and installing sealing flanges and flywheel/drive plate	40
2.2 Replacing crankshaft oil seal on pulley end	45
2.3 Removing and installing flywheel/drive plate	48
3 Removing and installing crankshaft	51
3.1 Removing and installing crankshaft	51
3.2 Removing and installing needle bearing in crankshaft	56
3.3 Crankshaft dimensions	57
4 Dismantling and assembling pistons and conrods	58
4.1 Dismantling and assembling pistons and conrods	58
4.2 Checking piston projection at TDC	66
4.3 Piston and cylinder dimensions	68
15 - Cylinder head, Valve gear	69
1 Removing and installing cylinder head	69
1.1 Removing and installing cylinder head	69
1.2 Removing and installing cylinder head cover	74
1.3 Removing and installing intake pipe	76
1.4 Removing cylinder head	78
1.5 Installing cylinder head	84
1.6 Checking compression	87
2 Servicing valve gear	89
2.1 Servicing valve gear	89
2.2 Checking camshaft axial play	96
2.3 Removing and installing camshaft	96
2.4 Checking hydraulic bucket tappets	100
2.5 Replacing valve stem seals	101
2.6 Reworking valve seats	104



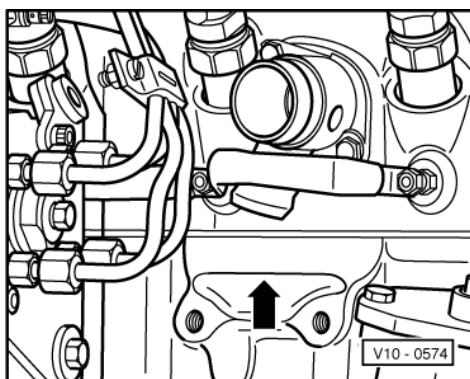
2.7	Checking valve guides	106
2.8	Checking valves	107
17	- Lubrication	108
1	Removing and installing parts of the lubrication system	108
1.1	Removing and installing parts of the lubrication system	108
1.2	Part I	109
1.3	Part II	113
1.4	Removing and installing oil pan	116
1.5	Removing and installing oil pump	119
1.6	Checking oil pressure and oil pressure switch	120
1.7	Engine oil	122
1.8	Checking oil level	122
19	- Cooling system	123
1	Removing and installing parts of the cooling system	123
1.1	Removing and installing parts of the cooling system	123
1.2	Parts of cooling system	124
1.3	Draining and filling cooling system	126
1.4	Removing and installing coolant pump	129
1.5	Removing, installing and checking coolant thermostat	131
1.6	Removing and installing radiator	133
1.7	Checking cooling system for leaks	135
21	- Charging	137
1	Checking charge air system with turbocharger	137
1.1	Checking charge air system with turbocharger	137
1.2	Test requirements for checking exhaust turbocharging	138
1.3	Effects of leaks in intake or exhaust system	138
1.4	Checking boost pressure	139
1.5	Checking boost pressure control valve linkage and vacuum unit	143
1.6	Diagram of connections for boost pressure control system	145
1.7	Check solenoid valve for boost pressure limitation -N75	146
1.8	Checking intake manifold pressure sensor	149
2	Servicing charge air system with turbocharger	151
2.1	Servicing charge air system with turbocharger	151
2.2	Rules for cleanliness	151
2.3	Removing and installing turbocharger - overview	152
2.4	Removing and installing vacuum unit for boost pressure control valve	157
2.5	Removing and installing turbocharger	158
2.6	Removing and installing parts of charge air cooling system	161
2.7	Removing and installing charge air cooler (intercooler)	164
26	- Exhaust system	167
1	Removing and installing parts of exhaust system	167
1.1	Removing and installing parts of exhaust system	167
1.2	Removing and installing exhaust manifold	170
1.3	Removing and installing front exhaust pipe with catalytic converter	171
1.4	Stress-free alignment of exhaust system	172
1.5	Checking exhaust system for leaks	172
2	Exhaust gas recirculation system	173
2.1	Exhaust gas recirculation system	173
2.2	Removing and installing exhaust gas recirculation components	173
2.3	Diagram of vacuum hose connections	175
2.4	Checking mechanical EGR valve	176
2.5	Checking EGR	176
2.6	Checking EGR valve -N18	179

00 - Technical data

1 - Technical data

1.1 - Technical data

1.2 - Engine number



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-> The engine number ("Engine code" and "Serial number") can be found on the left of the cylinder block. Additionally there is a sticker on the toothed belt guard showing the engine code and serial number. The engine code is also indicated on the vehicle data stickers.

1.3 - Engine data

Code		1Z	AHU
Capacity	l	1.9	1.9
Output	kW at rpm	66/4000	66/4000
Torque	Nm at rpm	202 1900	202 1900
Bore	øin mm	79.5	79.5
Stroke	mm	95.5	95.5
Compression		19.5	19.5
CN	at least	45	45
Firing order		1-3-4-2	1-3-4-2
Catalytic converter		x	x
Exhaust gas recirculation system		x	x
Turbocharging		x	x
Charge air cooler		x	x

Code		1Z	AHU
Valve timing			
with 1 mm valve lift and 0 mm valve play			
Inlet opens after TDC		16°	16°
Inlet closes after BDC		25°	25°



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2001

Exhaust opens before BDC	28°	28°
Exhaust closes before TDC	19°	19°

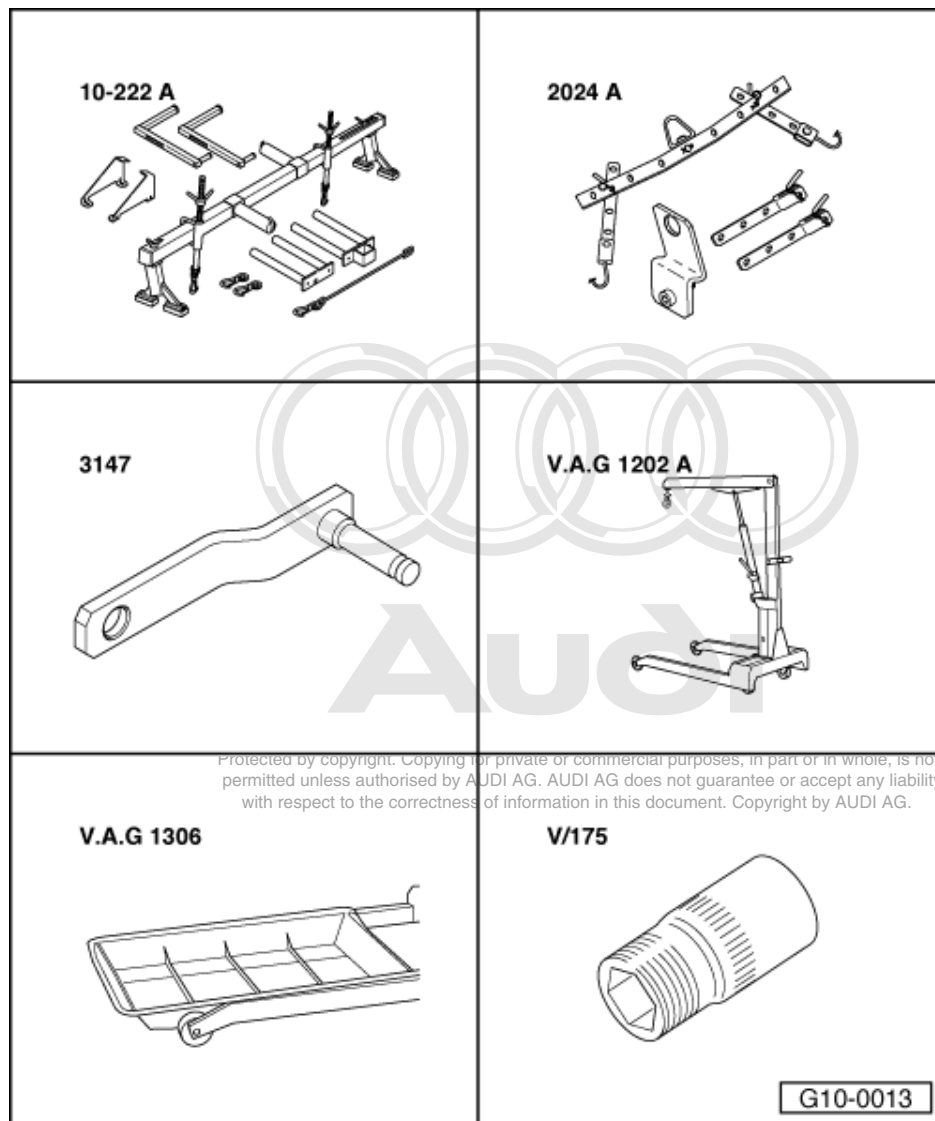


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10 - Removing and installing engine

1 - Removing and installing engine

1.1 - Removing and installing engine



Special tools and workshop equipment required

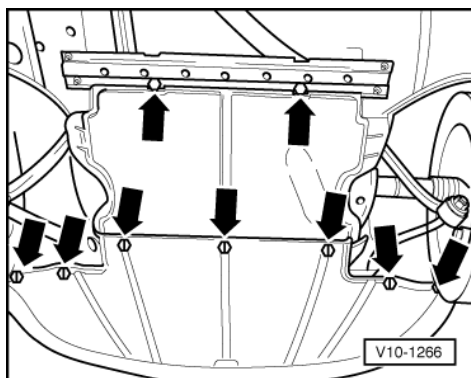
- ◆ Support bar 10-222A
- ◆ Lifting tackle 2024 A
- ◆ Special tool 3147
- ◆ V.A.G 1202 A
- ◆ V.A.G 1306
- ◆ 15 mm socket insert Matra V/175 (on vehicles with automatic gearbox)



1.2 - Removing

Notes:

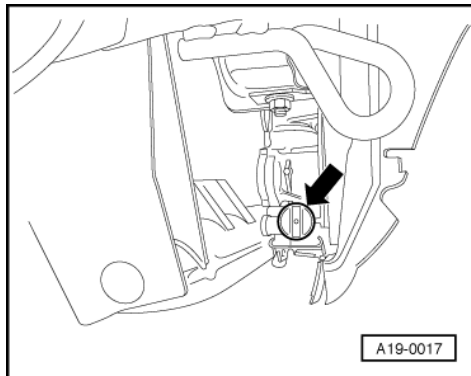
- ♦ Remove engine upwards without gearbox.
- ♦ Collect drained coolant in a clean container for re use or disposal.
- ♦ Renew all cut and defective cable ties. Refit cable ties in the same position when installing the engine.
- Observe or obtain radio code on vehicles with coded radio.
- Disconnect earth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



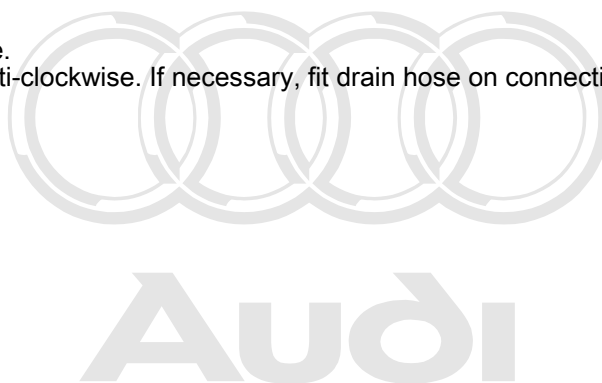
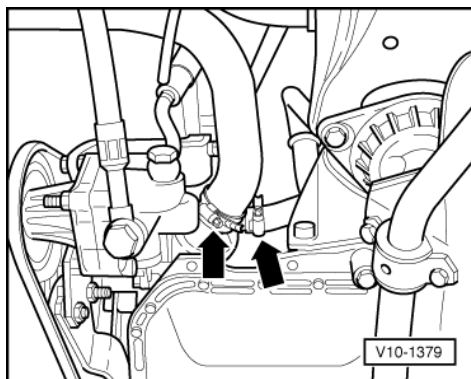
Important

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 noise insulation (two sections) -arrows-.

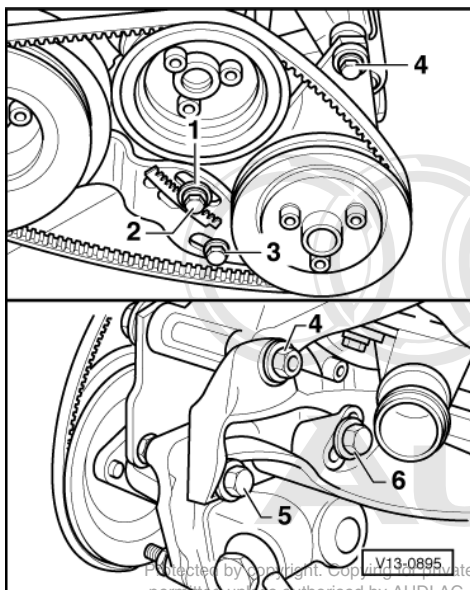


- Place drip tray V.A.G 1306 below engine.
- -> Turn drain plug -arrow- on radiator anti-clockwise. If necessary, fit drain hose on connection.

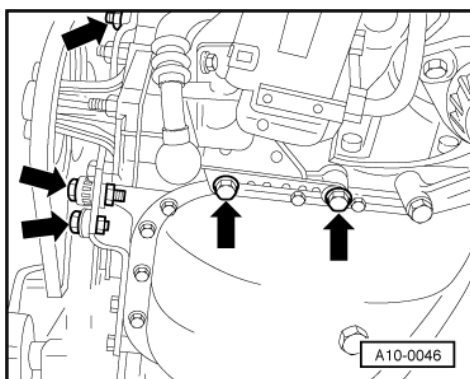


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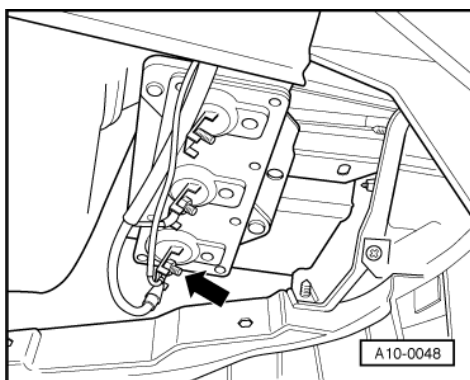
- -> Disconnect coolant hoses -arrows- to drain off remaining coolant.



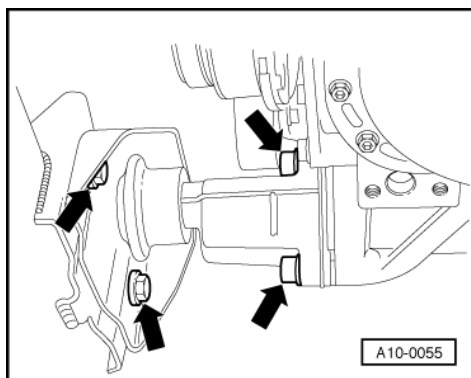
- -> Loosen bolts -2 ... 6-.
- Release belt tension on V-belt with tensioner nut -1-.
- Remove V-belt.



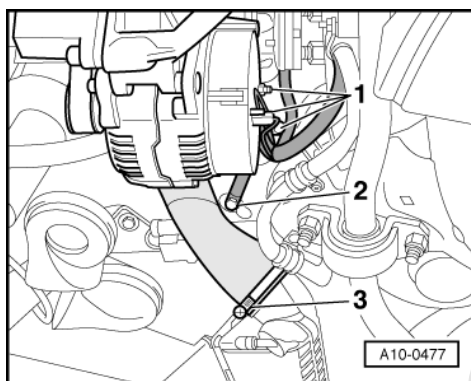
- -> Unscrew vane pump of power assisted steering with rear holder -arrows-. Do not detach hydraulic connections.
- Suspend vane pump from the body using wire so as to prevent placing load on the lines.



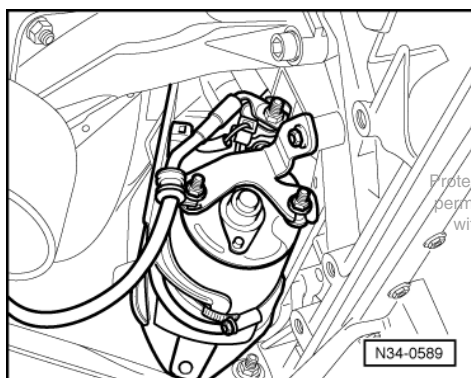
- -> Unscrew the positive wire to the fan motor at the series resistor -arrow-.
- Installation position: on left behind front bumper
- Lay wiring aside.



- -> Unbolt torque reaction support from engine and cross member -arrows-.



- -> Remove air hose -3- at bottom of charge air cooler.
- Unscrew wiring -1- at alternator.
- Unscrew earth connection -2- at longitudinal carrier.

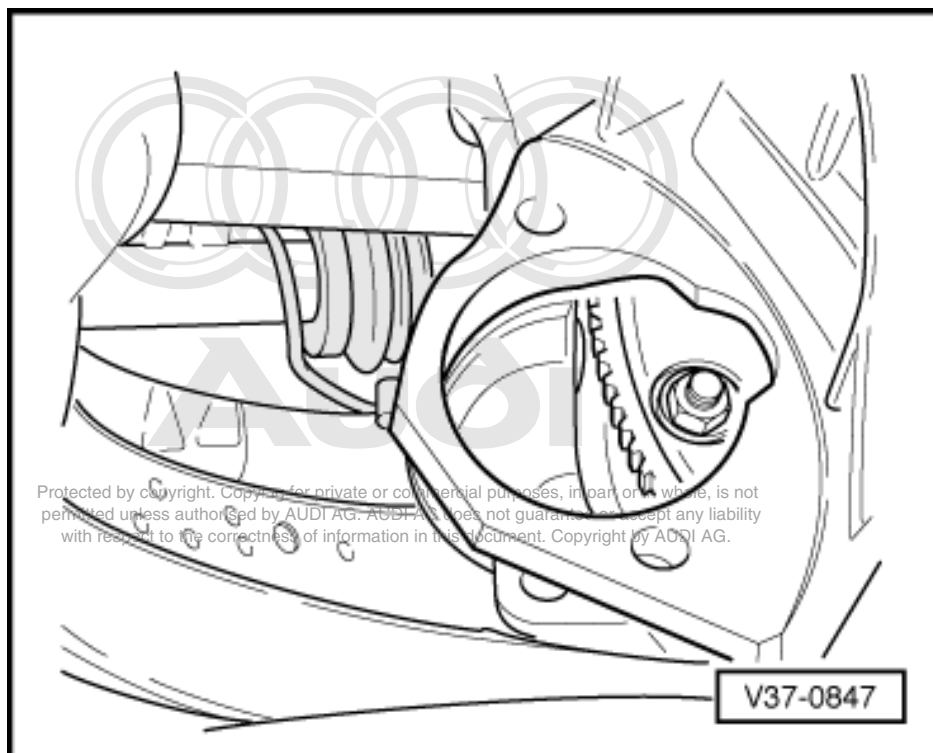


- -> Unbolt starter from engine/gearbox and secure as necessary.

Note:

Starter cables do not need to be disconnected.

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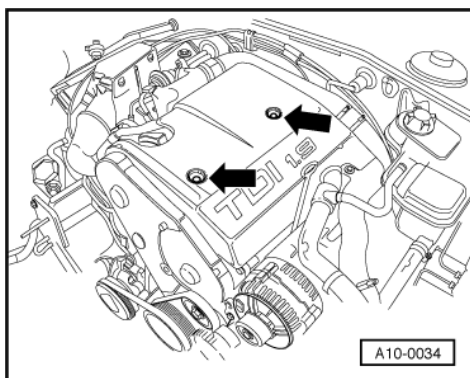


Vehicles with automatic gearbox:

- -> Use Matra V/175 socket attachment (15 mm A/F) to screw out 3 nuts of torque converter in opening in removed starter (give crankshaft 1/3 of a turn in each case).

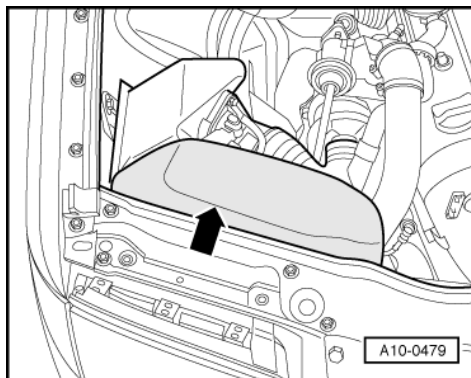
Note:

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

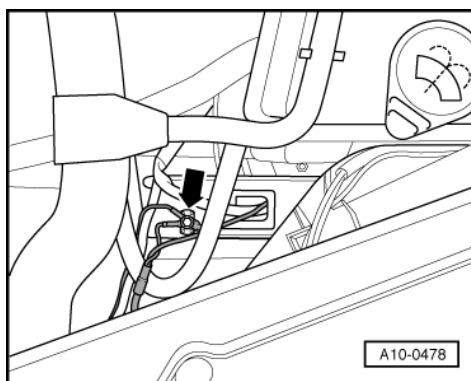


All models:

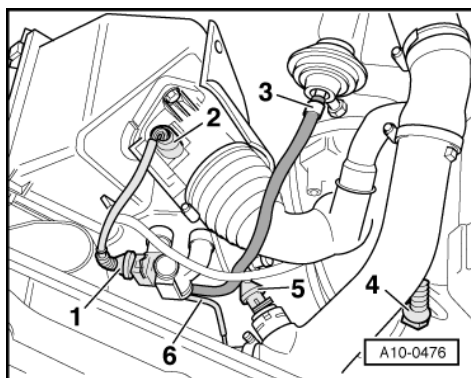
- Unscrew engine/gearbox securing bolts accessible from below.
- -> Remove engine cover -arrows-.



- -> Remove air intake pipe -arrow- between lock carrier and air cleaner housing.



- -> Unscrew earth connection to fan motor at earthing point -arrow- at front left in engine compartment.
- Unscrew radiator cowl from radiator and remove it upwards.



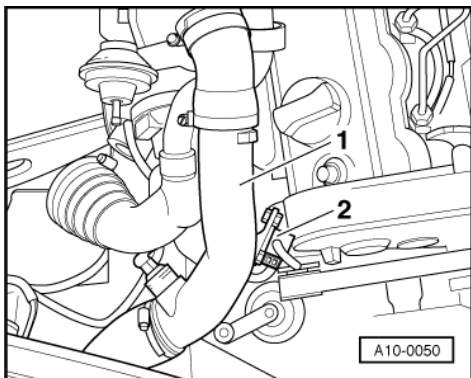
- -> Disconnect wires/unplug connectors:

- 1 - EGR valve -N18
- 2 - Air mass meter -G70
- 4 - Solenoid valve for boost pressure limitation -N75
- 5 - Intake manifold temperature sender -G72

- Disconnect vacuum hose at mechanical exhaust gas recirculation valve -3-.
- Disconnect the thin hose -6- at the bottom at the exhaust gas recirculation valve -N18.
- Lay wiring and hoses aside.
- Remove the air hose at the air mass meter.
- Remove upper section of air cleaner housing and air mass meter.



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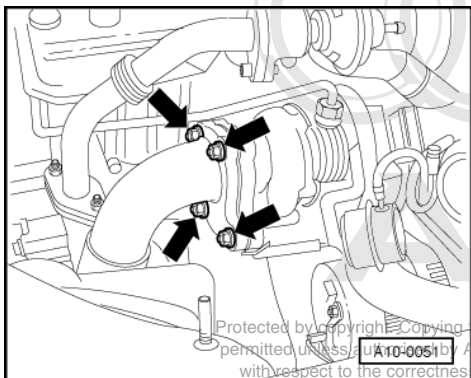
- -> Unscrew solenoid valve for boost pressure control -2- from air intake pipe -1-. Do not detach hoses.
- Remove air intake pipe -1- between charge air cooler and intake pipe.
- Remove intake air hose from charge air cooler to turbocharger.

Vehicles with air conditioner:

- Remove ribbed belt => Page 13-11.
- Remove the lower section of the air cleaner housing.
- Detach the connector from the A/C compressor.

Important
The air conditioner refrigerant circuit must not be opened.

- Detach A/C compressor and secure to body with wire.



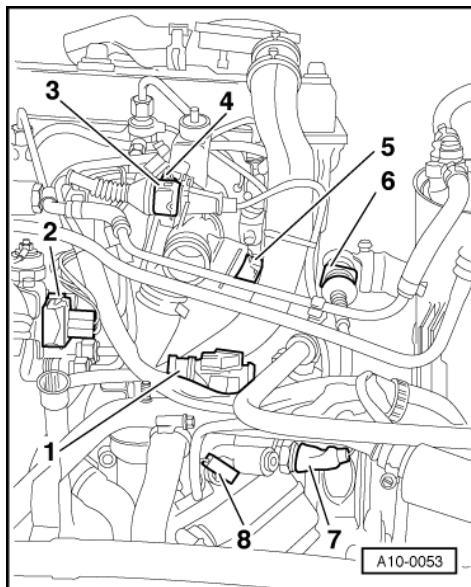
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All models:

- -> Remove the securing bolts -arrows- of the turbocharger/catalytic converter.
- Detach the front exhaust pipe with the catalytic converter from the turbocharger.

Note:

Secure flange of front exhaust pipe with wire to the right suspension strut dome. It is then not necessary to remove the front exhaust pipe.



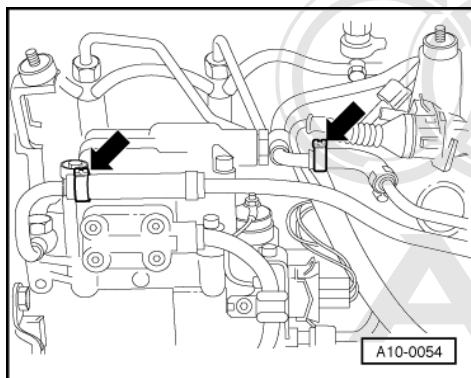
- -> Disconnect wires/unplug connectors:

- 1 - Injection pump
- 2 - Injection pump
- 3 - to the engine speed sender -G28
- 4 - Needle lift sender -G80
- 5 - Coolant temperature sensor -G62
- 6 - Electronic thermost switch -F76
- 7 - Oil pressure switch -F1
- 8 - Oil temperature sensor -G8

- Disconnect the glow plug connectors from the glow plugs.
- Detach connector from speedometer sender -G22 from left of gearbox and set the wiring aside.

Vehicles with manual gearbox:

- Detach connector for reversing light switch from gearbox, set wiring aside.



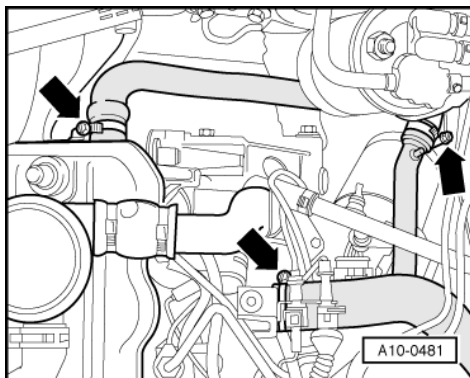
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All models:

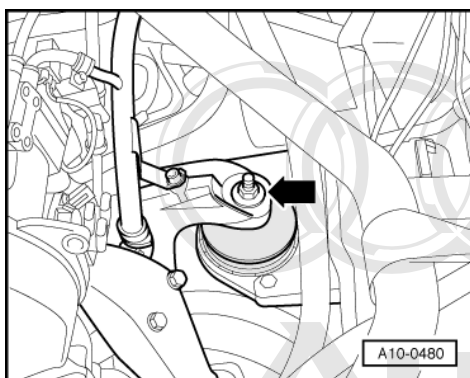
- -> Unscrew the fuel supply and return pipe -arrows- at the injection pump and lay the pump aside.

Note:

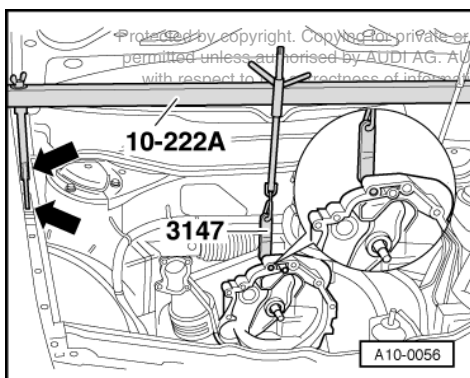
Close off pipes with a clean closure plug.



- -> Remove the coolant hoses -arrows-.
- Detach the hose with non-return valve from the exhauster.
- Unscrew upper engine/gearbox securing bolts. Leave one bolt in place (hand tight).



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



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

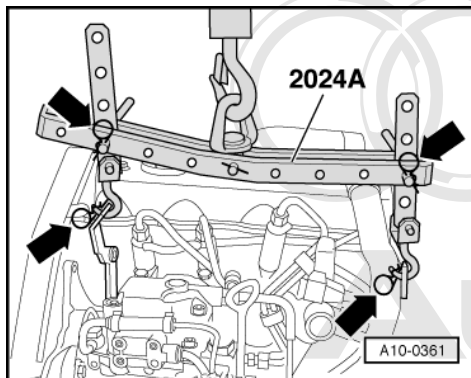
Note:

Position support bar behind gas-filled strut of bonnet with spindles pointing to front.

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

Notes:

- ◆ Height of gearbox can be adjusted using wing nut of attachment hook.
- ◆ Take care not to excessively pretension as otherwise pressure pipe to clutch operating cylinder at manual gearbox could be damaged.
- ◆ Shown in illustration with engine removed.



- -> Attach lifting tackle 2024 A to engine and workshop lifter 1202 A.
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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-.

- Remove the last securing bolt.

Note:

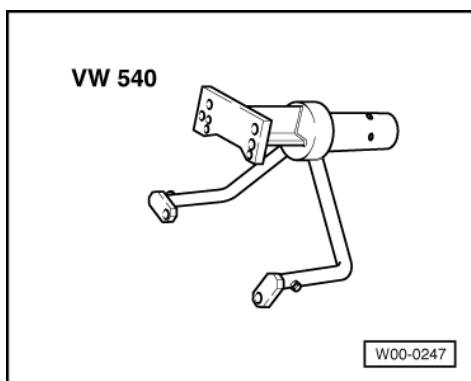
Check that all hoses and other connections between engine and body have been detached.

- Lift engine over studs of engine mounts.
- Tighten spindle of support bar 10-222 A.
- Raise engine and pull it out upwards.

Vehicles with automatic gearbox:

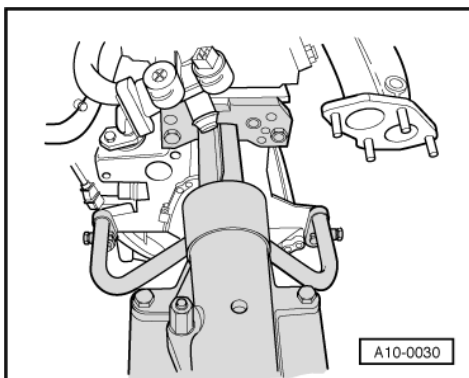
- Secure torque converter in gearbox to prevent it falling out.

1.3 - Attaching engine to repair stand



Special tools and workshop equipment required

- ♦ Engine and gearbox support VW 540



Procedure

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

1.4 - Installing

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

Notes:

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

=> Parts List

- Check whether both dowel sleeves for centring the engine and the gearbox are in the cylinder block, install if necessary.
- Fit intermediate plate onto dowel sleeves.

Vehicles with manual gearbox:

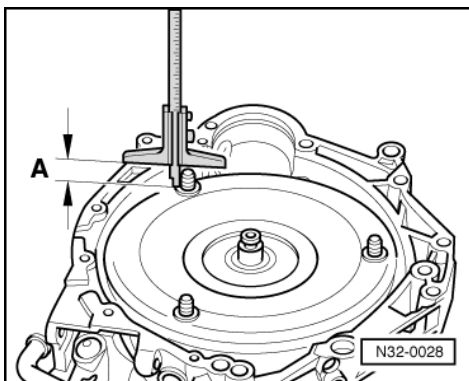
- Clean input shaft splines and (in the case of used clutch plates) the hub splines. Remove corrosion and apply only a very thin coating of grease G 000 100 to the splines. Do not grease guide sleeve.
- Check clutch release bearing for wear, renew if necessary.
- If necessary, check that clutch plate is properly centred.
- A needle bearing must be fitted in the crankshaft on vehicles with manual gearbox. Install needle bearing, if necessary => Page 13-52.

Vehicles with automatic gearbox:

- In vehicles with automatic gearbox, no needle bearing must be fitted in the crankshaft. Remove needle bearing if necessary => Page 13-52.
- To secure the torque converter on the drive plate only use the correct nuts as specified in the parts catalogue.

=> Parts List

- Secure nuts of torque converter with special tool Matra V/175.
- Before installing engine, rotate torque converter and drive plate so that one hole and one stud are level with the aperture for the starter motor.



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Checking position of torque converter

-> If the torque converter is correctly installed in the gearbox, the distance -A- 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 23 mm.

If the torque converter has not been completely inserted, this distance will be approx. 13 mm.

Important

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

- Check ATF level:

=> Automatic Gearbox 01N; Repair group 37; Checking and changing ATF; Checking ATF level and topping up ATF
Checking and changing ATF
Checking ATF level and topping up ATF

All models:

- Installing engine mounts free of stress. Ensure that engine mounts are free of stress by shaking engine to align it before tightening engine mounts.
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.
- Install ribbed belt => Page 13-12.
- Top up coolant => Page 19-7.

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.
- Stress-free alignment of exhaust system => Page 26-10
- Connecting EGR hoses and lines => Connections diagram, Page 26-15.
- Connecting boost pressure control hoses and lines => Connections diagram, Page 21-17.
- Electrical connections and routing:

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

Note:

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

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Important

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

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

=> Diesel Direct Injection and Glow Plug System (TDI 4-cylinder); Repair group 01; Interrogating and erasing fault memory
Interrogating and erasing fault memory

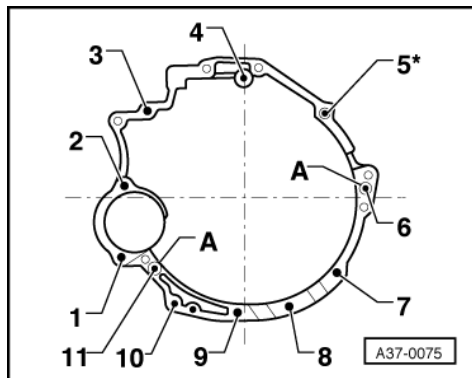
Note:

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

1.5 - Tightening torques

Notes:

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

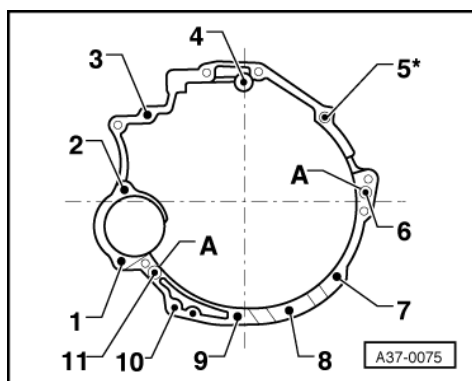


-> Engine/gearbox mountings (manual gearbox)

Item	Bolt	Nm
1, 3, 4	M12 x 67	65
2, 6	M12 x 90	65
5, 11	M12 x 110	65
7, 8, 9, 10	M10 x 45	45

1) Up to approx 07.96 Bolt M8; tightening torque: 25 Nm

A: Centring sleeves



-> Fastening engine to gearbox in vehicles with automatic gearbox

Item	Bolt	Nm
1, 8, 9, 10	M10 x 45	45
2, 3, 4, 11	M12 x 67	65



Item	Bolt	Nm
5	M12 x 110	65
6	M12 x 90	65
7	M10 x 60	45

A: Centring sleeves

Component		Nm
Bolts/nuts	M6	10
	M8	20
	M10	45
	M12	65
Except for the following:		
Engine mounting to subframe		25
Engine support to engine mount		25
Torque reaction support	M8	20
	M10	40
Drive plate to Torque converter	M10 x1	85
A/C compressor to bracket		25
Power steering pump to retainer		25
Catalytic converter to turbocharger		25
Hose clamps		2



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13 - Crankshaft group

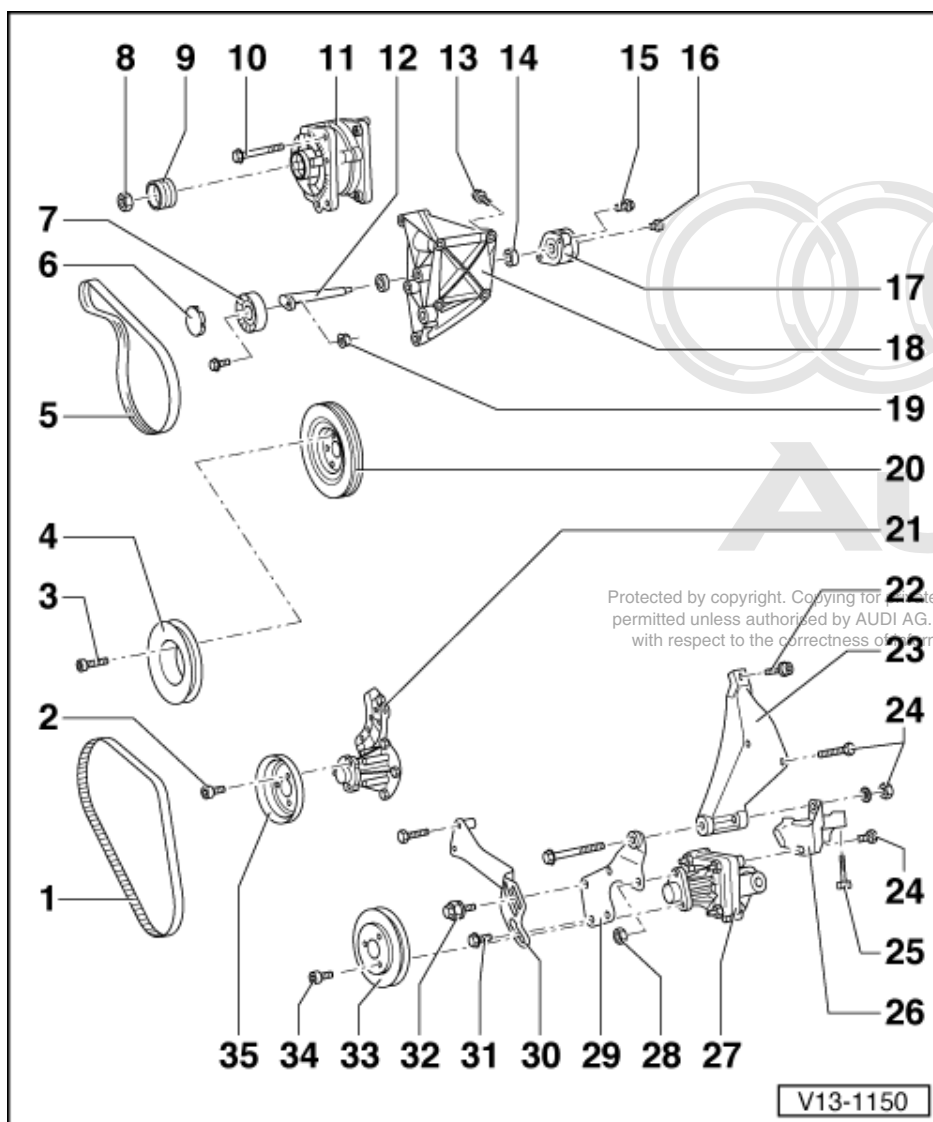
1 - Dismantling and assembling engine

1.1 - Dismantling and assembling engine

1.2 - Ribbed belt drive for alternator; V-belt drive for coolant pump and vane pump

Notes:

- ♦ The following illustration shows the belt drive on vehicles without air conditioner.
- ♦ Mark the direction of rotation 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 properly seated in the pulleys when installing.



1 V-belts

- ♦ For coolant pump
- ♦ For vane pump

- ◆ Check for wear
- ◆ Removing and installing
=>Page 13-9.

2 25 Nm

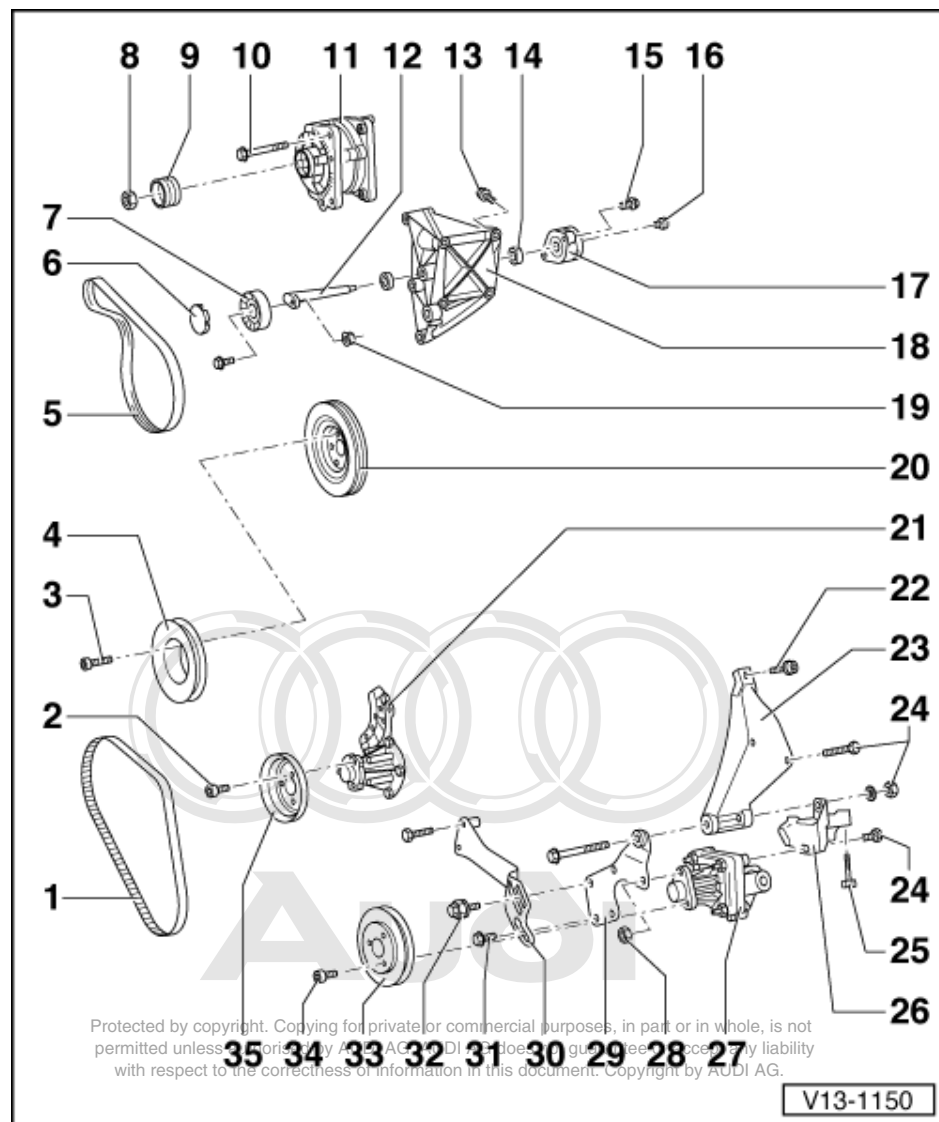
- ◆ To release and pick up pulley counterhold with oil filter strap wrench if necessary.

3 Bolt

- ◆ Bolt with strength rating 8.8: tighten to 25 Nm.
- ◆ Bolt with strength rating 10.9: tighten to 35 Nm.

=> Parts List

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



4 Belt pulley

- ◆ For vibration damper
- ◆ V-belt version

5 Ribbed belt

- ◆ Check for wear
- ◆ Removing and installing
=>Page 13-11.

6 Trim cap

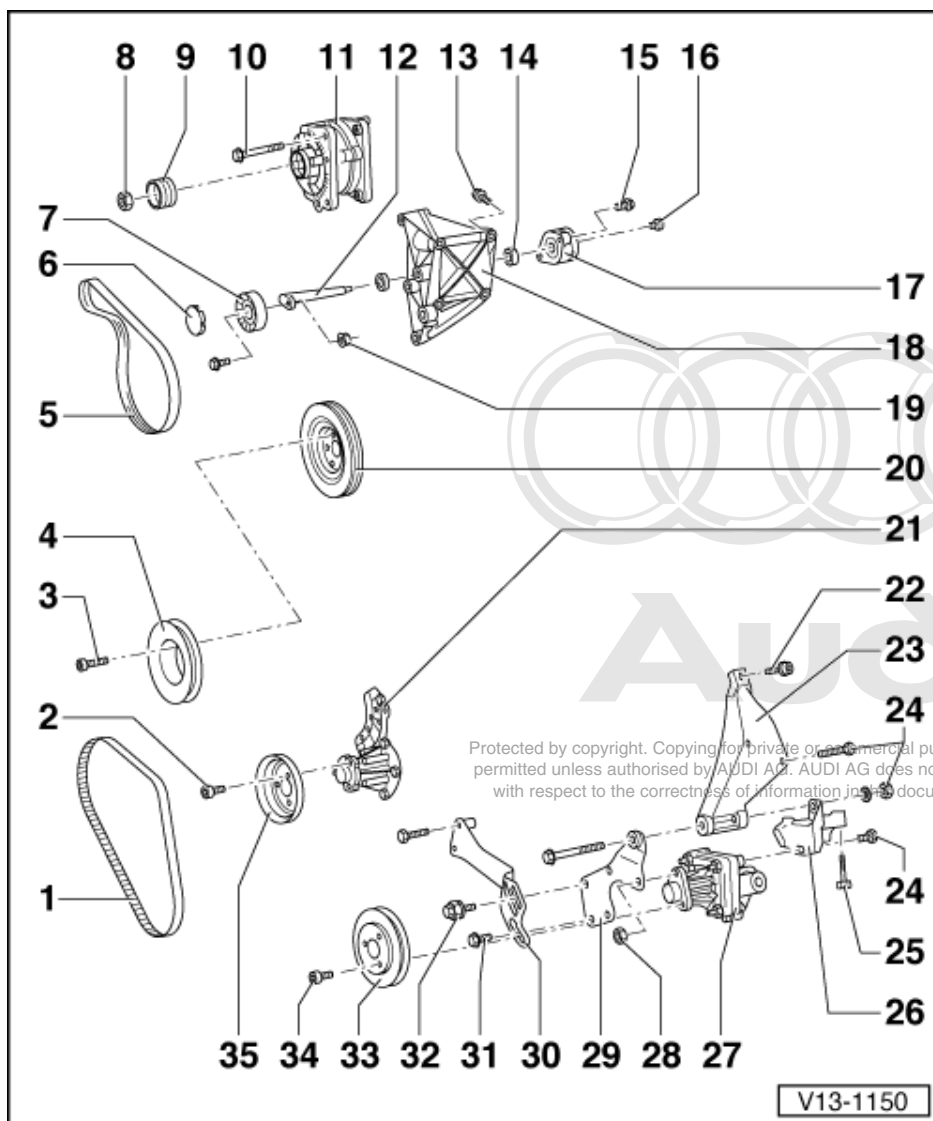
- ◆ Lever off with screwdriver

7 Tensioning roller

- ♦ For ribbed belt
- ♦ Removing and installing ribbed belt => Page 13-11

8 65 Nm

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



9 Belt pulley

- ♦ For alternator
- ♦ For ribbed belt

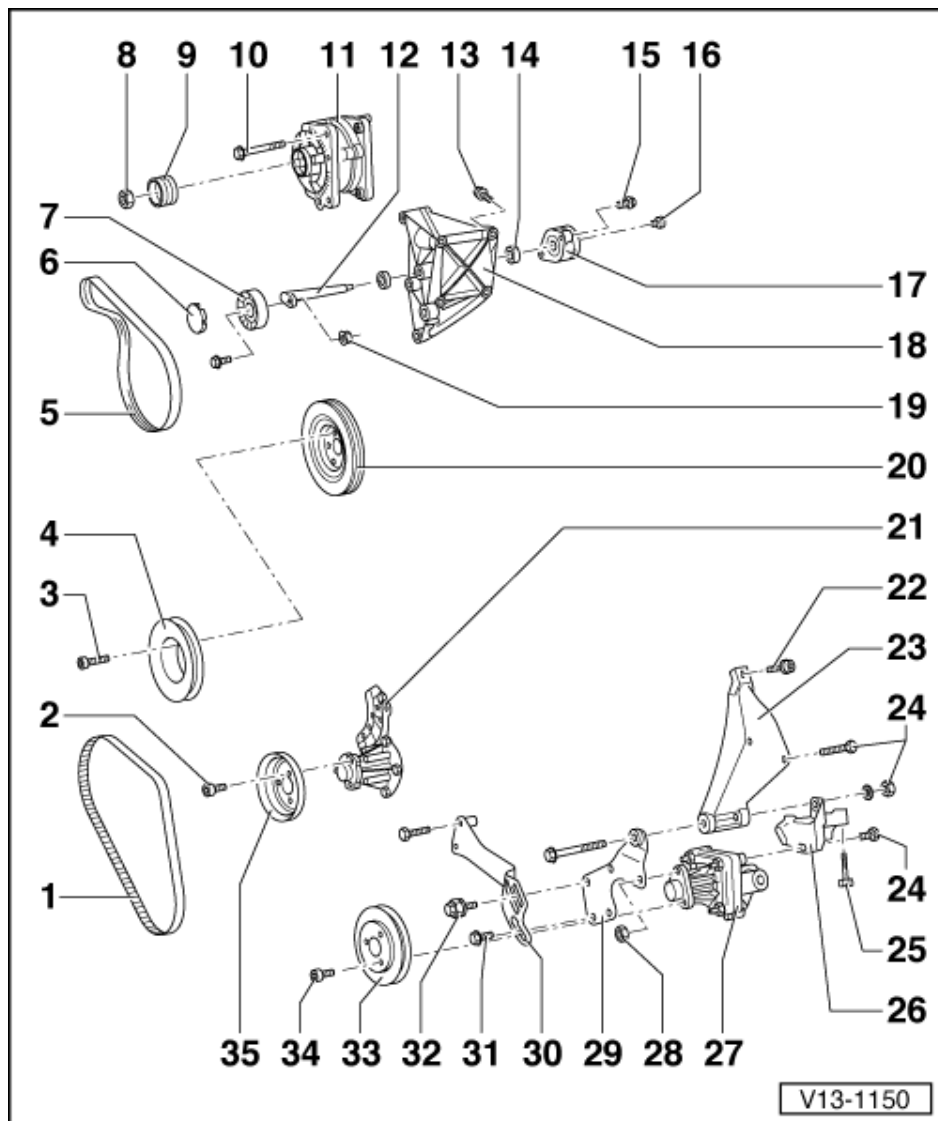
10 25 Nm

11 Alternator

- ♦ Removing:
 - Disconnect battery earth strap
 - Removing ribbed belt
=>Page 13-11.
 - Loosen bolts at top and bottom of alternator.
 - Remove alternator, unscrew lines.
- ♦ To facilitate attachment of the alternator drive back bush for lower securing bolt slightly at bracket

12 Lever

- ♦ For tensioning roller
- ♦ Insert flats at the end into tensioner -Item 17-



13 25 Nm

14 Sealing washer

15 25 Nm

16 10 Nm

17 Tensioner

- ♦ Removing:
 - Removing ribbed belt
=>Page 13-11.
- ♦ Insert into lever for tensioning roller -Item 12-. Note flats

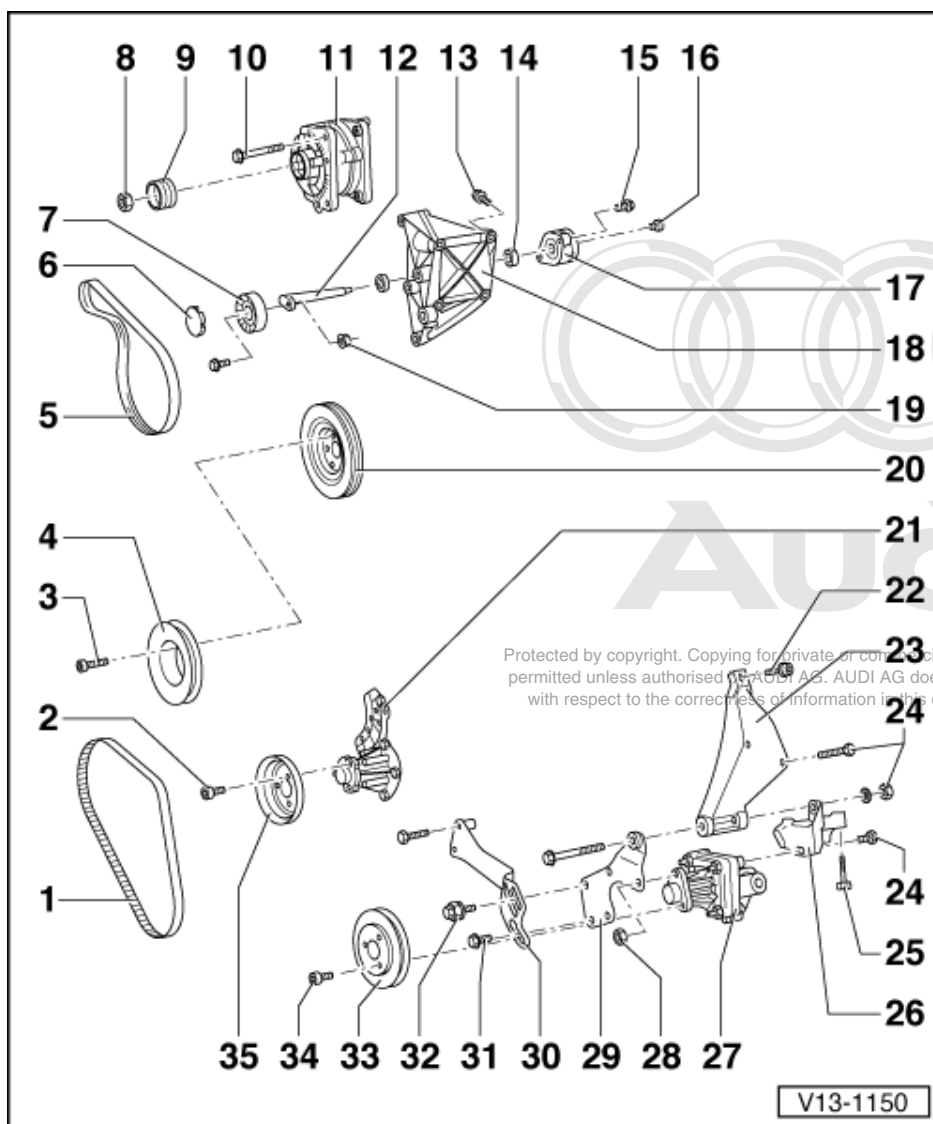
18 Bracket

- ♦ For alternator

19 25 Nm



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20 Vibration damper

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

21 Coolant pump

- ♦ Check for ease of movement
- ♦ Removing and installing
 =>Page 19-11.

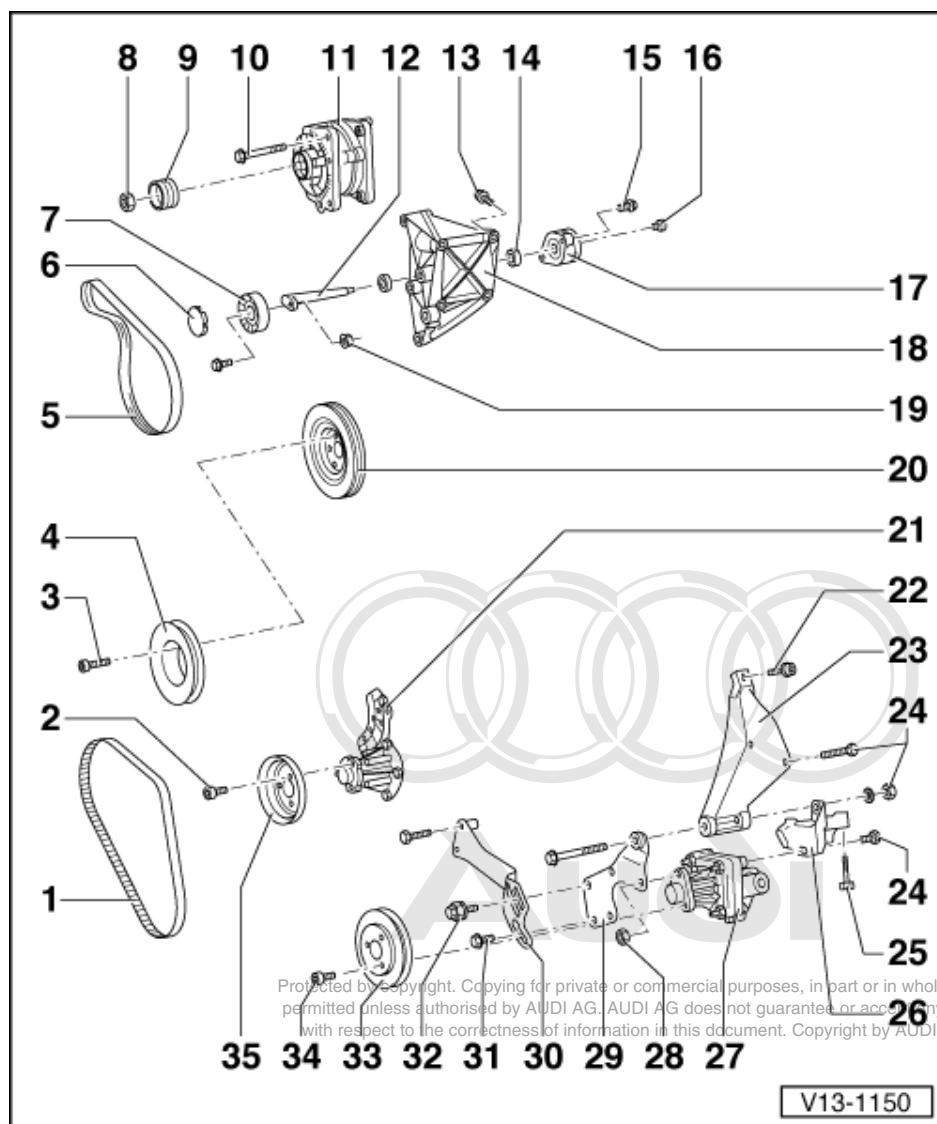
22 Bolt

- ♦ Bolt with strength rating 8.8: tighten to 25 Nm.
- ♦ Bolt with strength rating 10.9: tighten to 35 Nm.

=> Parts List

23 Bracket

- ♦ For vane pump



24 Bolt/nut

- ◆ Bolt with strength rating 8.8: tighten to 25 Nm.
- ◆ Bolt with strength rating 10.9: tighten to 35 Nm.
- ◆ Tighten nut to 25 Nm

=> Parts List

25 25 Nm

26 Rear holder

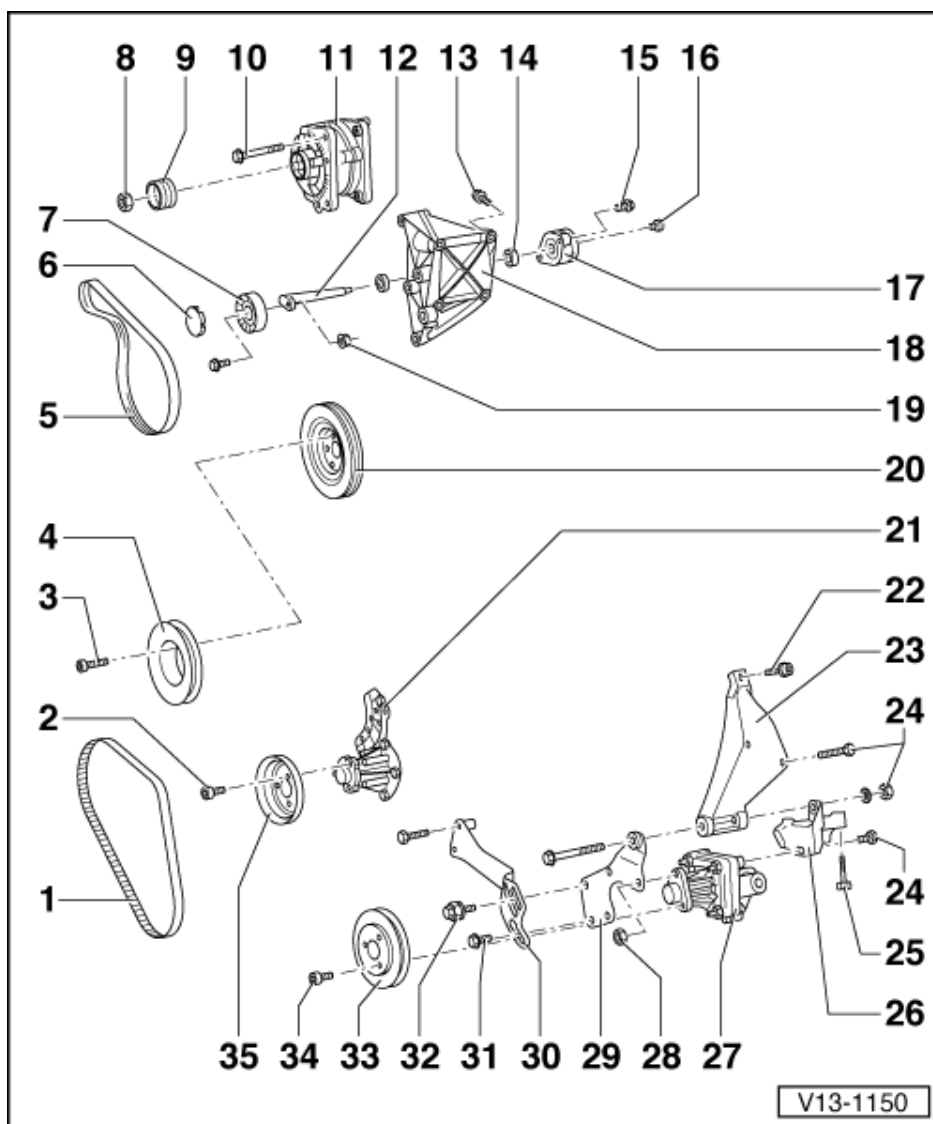
- ◆ For vane pump

27 Vane pump

- ◆ For power steering
- ◆ Removing and installing:

=> FWD and 4WD Running Gear; Repair group 48; Exploded view: Vane pump; vehicles with 4-cylinder engine
Exploded view: Vane pump vehicles with 4-cylinder engine

28 25 Nm



29 Front holder

- ♦ For vane pump

30 Retainer

31 25 Nm

32 Bolt -25 Nm

- ♦ With tensioning nut

33 Belt pulley

- ♦ For vane pump
- ♦ V-belt version

34 25 Nm

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

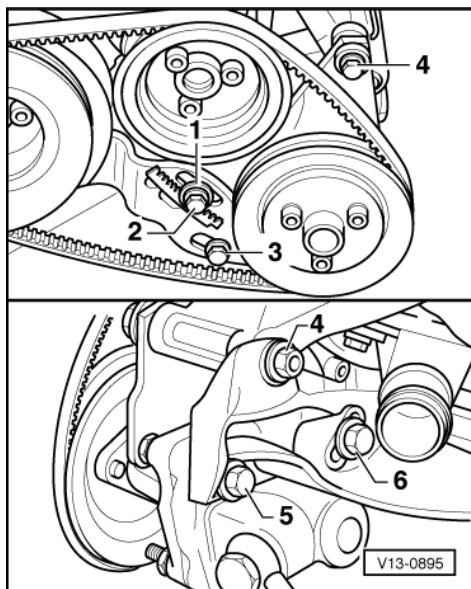
35 25 Nm

36 Belt pulley

- ♦ For coolant pump
- ♦ V-belt version

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1.3 - Removing and installing V-belt



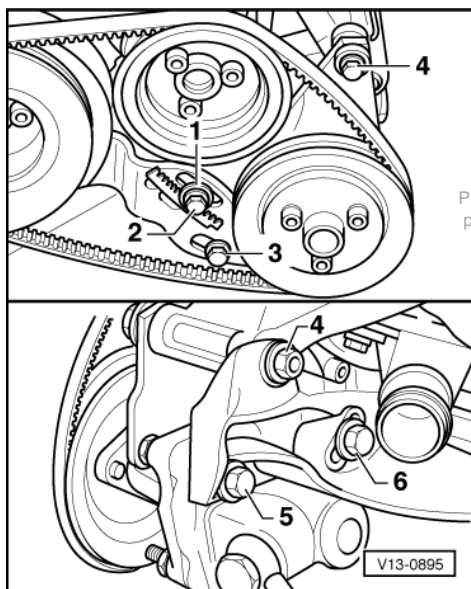
- -> Loosen bolts -2 ... 6-.
- Release belt tension on V-belt with tensioner nut -1-.
- Remove V-belt.

Installation is in reverse order.

- Check V-belt for correct fit.
- Belt routing => Page 13-13
- Tension V-belt =>Page 13-10.



1.4 - Tensioning V-belts



- -> Loosen bolts -2 ... 6-.
- Adjust belt tension with tensioner nut -1-.
- Check tension of V-belt:
- Press in the ribbed belt firmly with the thumb at a point half-way between the two pulleys which are farthest apart.

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The amount of yield should be as follows:

V-belt for coolant pump and vane pump	Belt yield (max)
- New V-belt	2 mm
- Used V-belt	5 mm

- Tighten securing bolts on vane pump.

Tightening torques

Component	Nm
Vane pump to bracket	25
Vane pump to tensioning bar	25

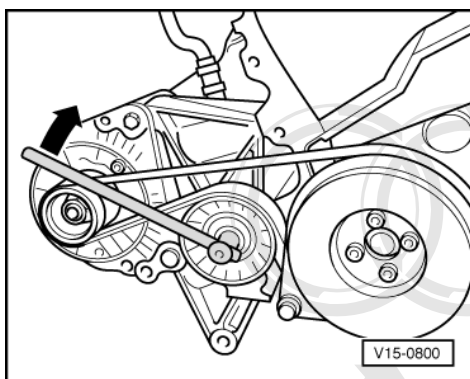
1.5 - Removing and installing ribbed belt

Removing

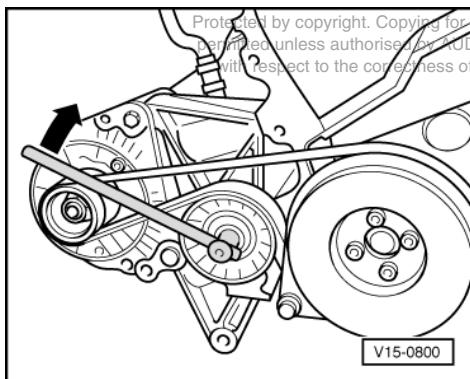
Note:

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

- Remove V-belt => Page 13-9
- Detach cover cap -Item 13-3 from tensioning roller.



- -> To release the tensioning roller for ribbed belts, position a socket 17 A/F with extension at the central nut.
- To slacken ribbed belt, turn tensioner in direction of arrow.
- Remove ribbed belt and release tensioner.





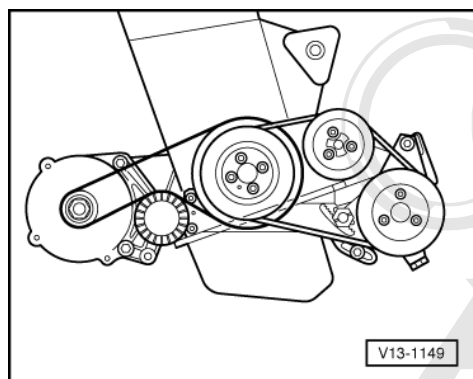
Installing

- Fit the ribbed belt onto the crankshaft and tensioner pulleys.
- -> Turn ribbed belt tensioner in direction of arrow.
- Fit ribbed belt over alternator pulley last. Release tensioner.

Note:

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

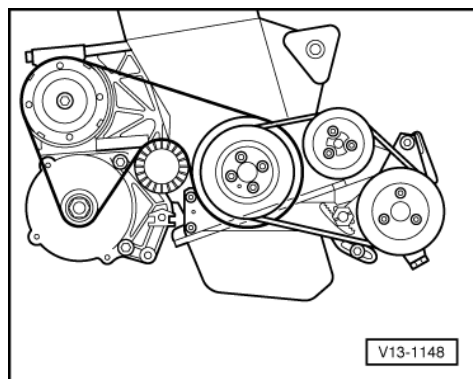
- Install V-belt => Page 13-9.
 - Belt routing => Page 13-13
- Press on cover cap -Item 13-3 for tensioning roller.
- Start engine and check belt running.



Routing of belt

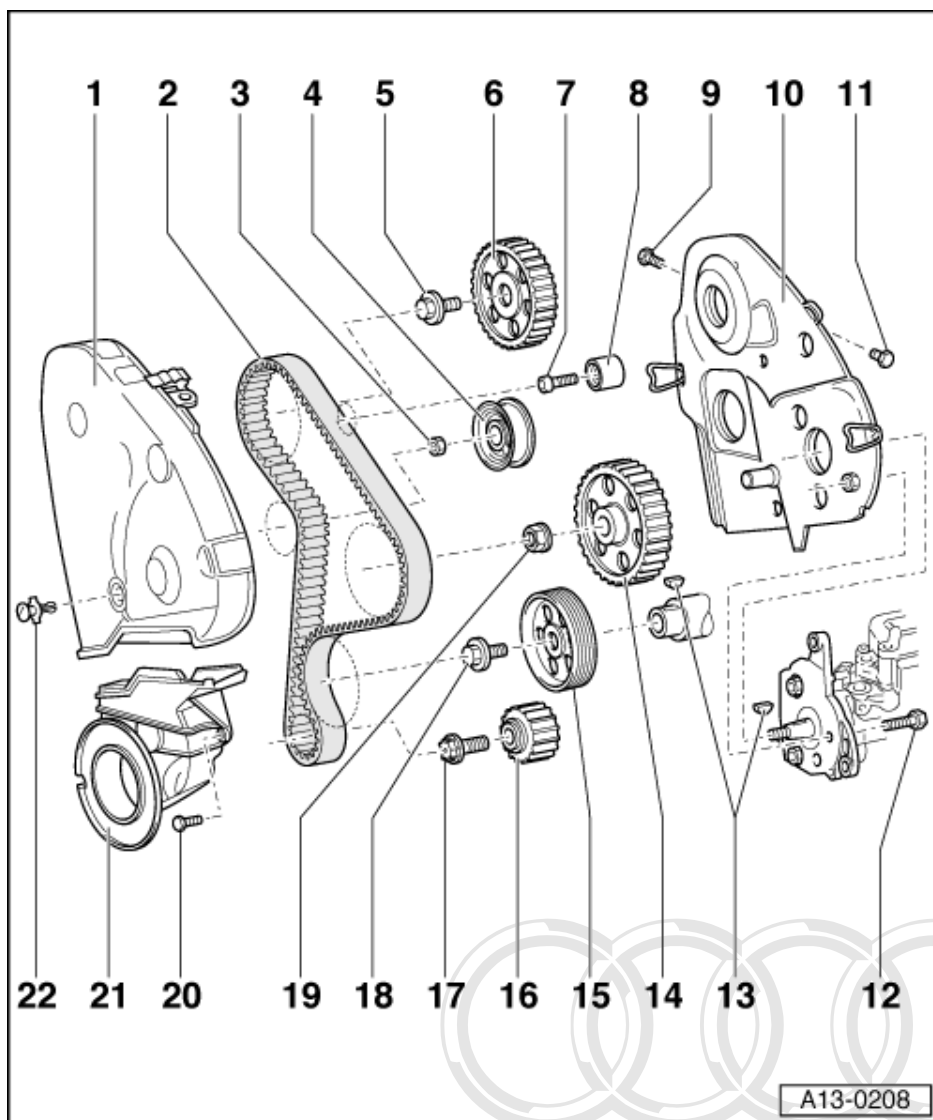
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- -> Ribbed belt routing on vehicles without air conditioner.



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

1.6 - Toothed belt drive



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.

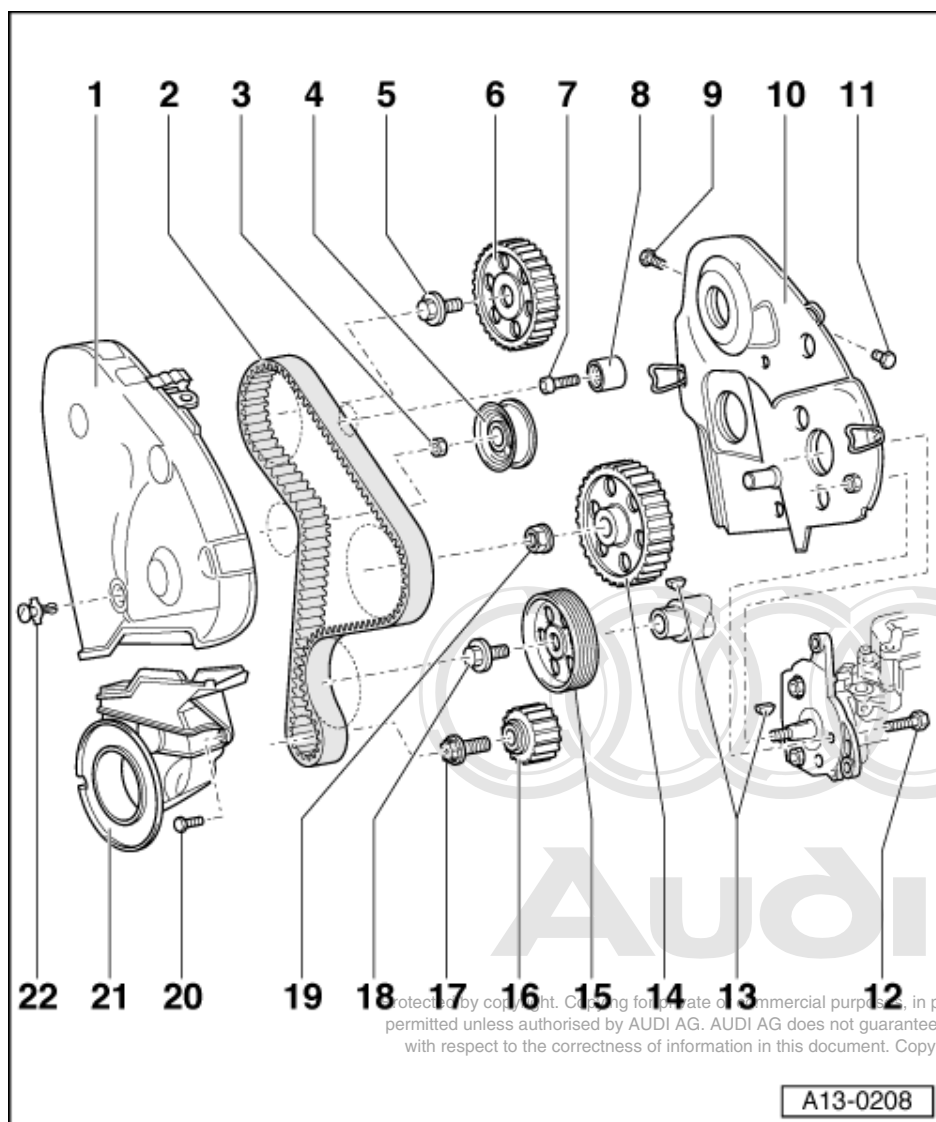
1 Toothed belt guard - top

- ♦ When installing, engage carefully in lower toothed belt guard.

2 Toothed belts

- ♦ Mark running direction with chalk or felt pen before removing
- ♦ Check for wear
- ♦ Removing => Page 13-20
- ♦ Installing => Page 13-25

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3 20 Nm

4 Tensioning roller

- ♦ Checking semi automatic toothed belt tensioning roller =>Page 13-29.
- ♦ Installation position
=> Fig.13-18

5 45 Nm

- ♦ Counter hold with 3036 to loosen and tighten

6 Camshaft sprocket

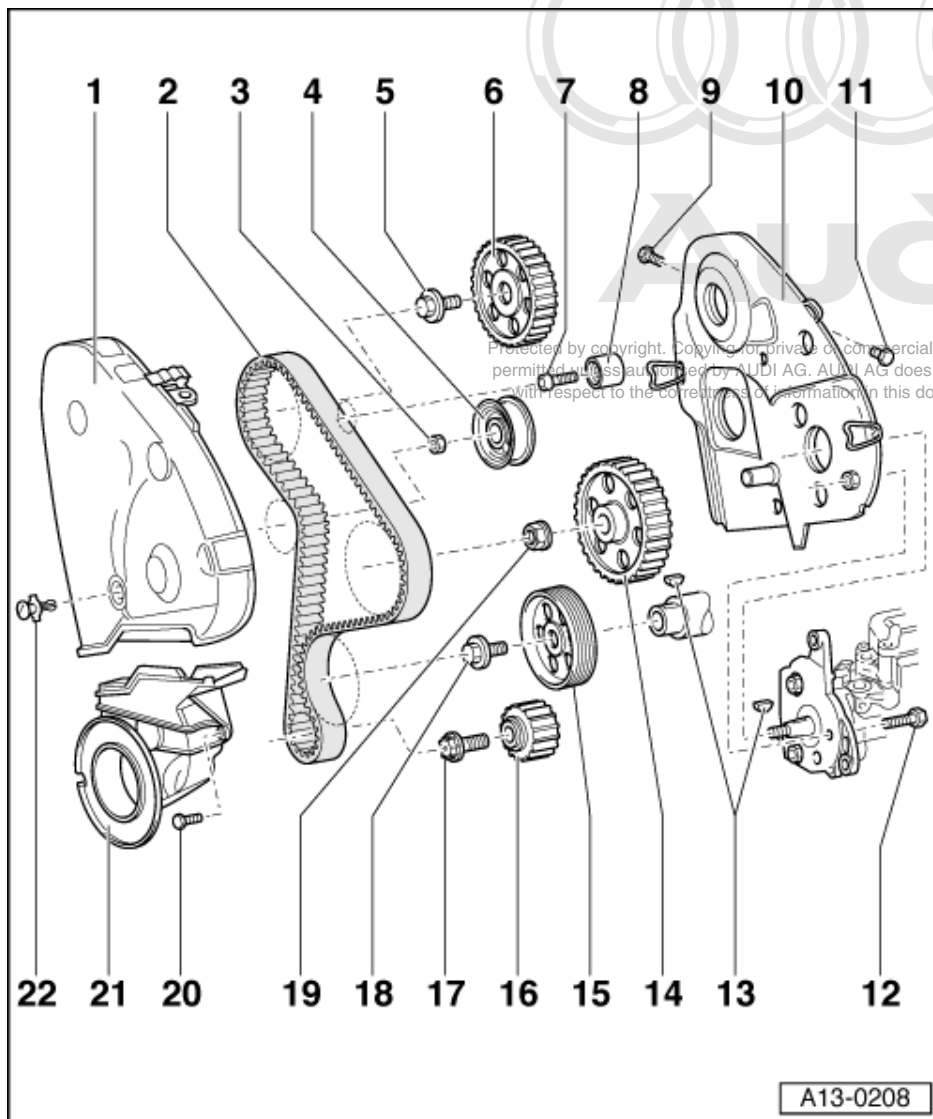
- ♦ Release from camshaft taper by tapping pin through hole on toothed belt guard using hammer

7 25 Nm

8 Idler roller

9 10 Nm

10 Toothed belt guard - rear



11 10 Nm

12 25 Nm

13 Woodruff key

- ◆ Ensure tight fit

14 Injection pump sprocket

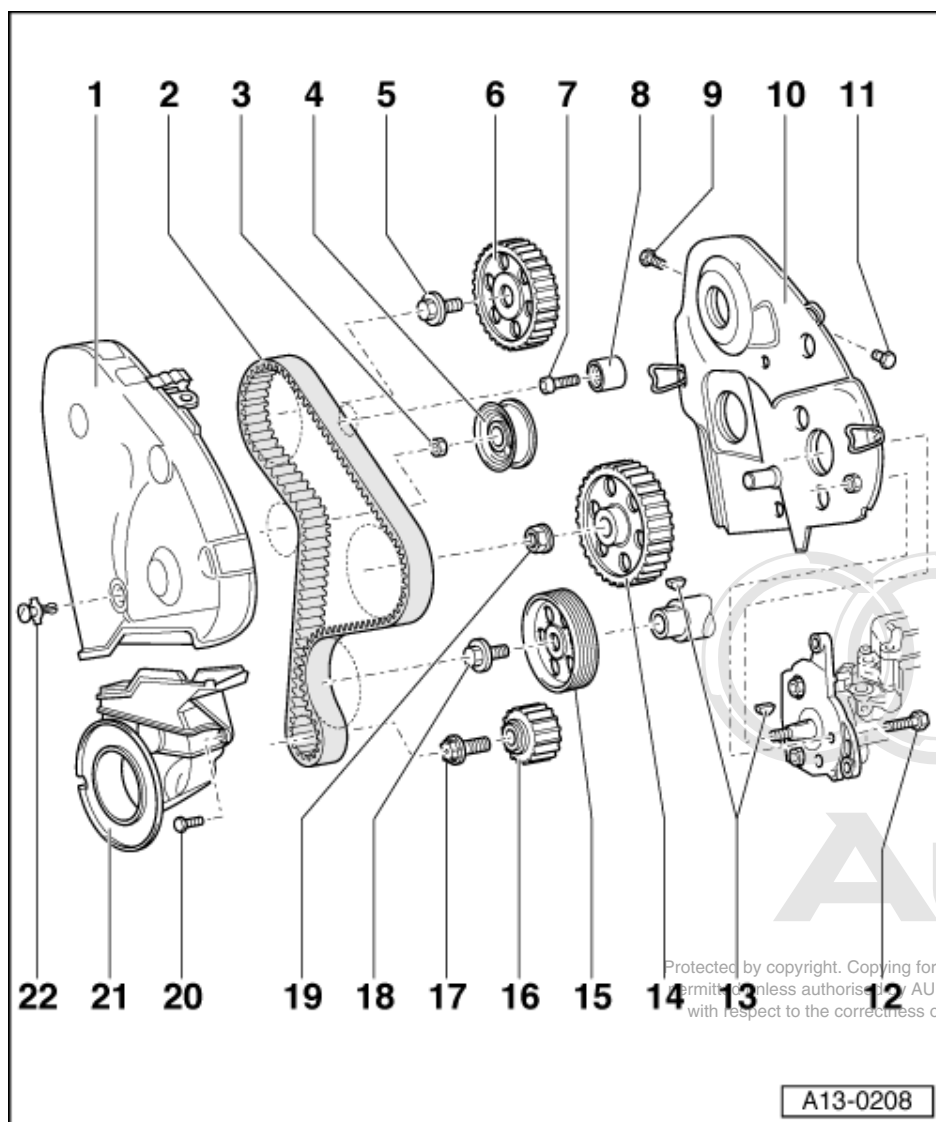
- ◆ Removing injection pump sprocket
=> Fig.13-19
- ◆ Watch position of Woodruff key

15 Intermediate shaft sprocket

- ◆ Installation position
=> Fig.13-18
- ◆ Watch position of Woodruff key

16 Crankshaft sprocket

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



17 90 Nm + 1/4 turn (90°) further

- ◆ Replace
- ◆ Do not use oil
- ◆ To loosen and tighten use counterhold 3099 or 3415
- ◆ Bolting on counterhold tool 3099 => Page 13-38

18 45 Nm

- ◆ Counter hold with 3036 to loosen and tighten

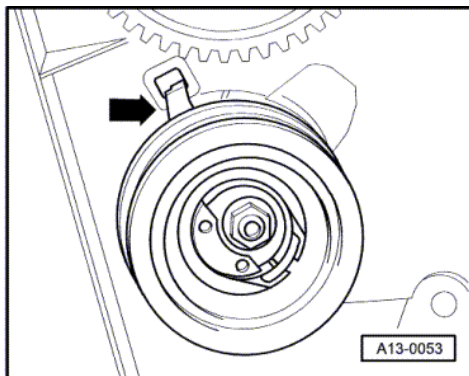
19 45 Nm

20 10 Nm

21 Toothed belt guard - lower

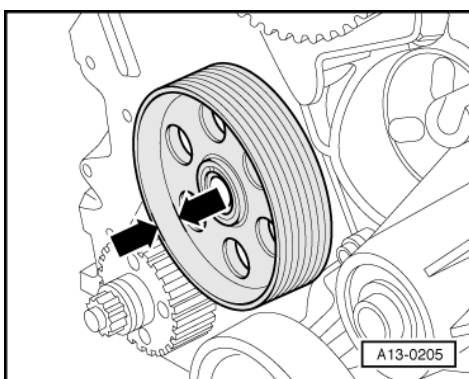
- ◆ To remove, unbolt vibration damper

22 Expanding clip



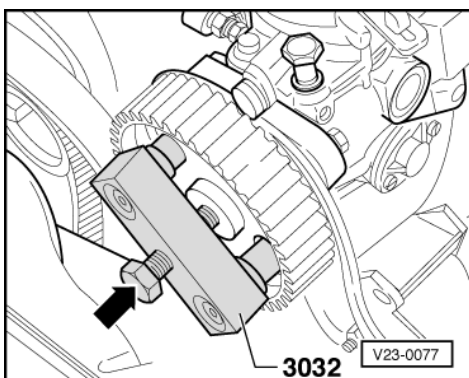
-> Fig.1 Fitting location of semi-automatic tensioner

Retaining lug -arrow- must engage in rear toothed belt guard slot.



-> Fig.2 Installation position of intermediate shaft sprocket

- ◆ Wide web -arrows- of intermediate shaft sprocket points to the front.
- ◆ Marking on sprocket points to the rear.



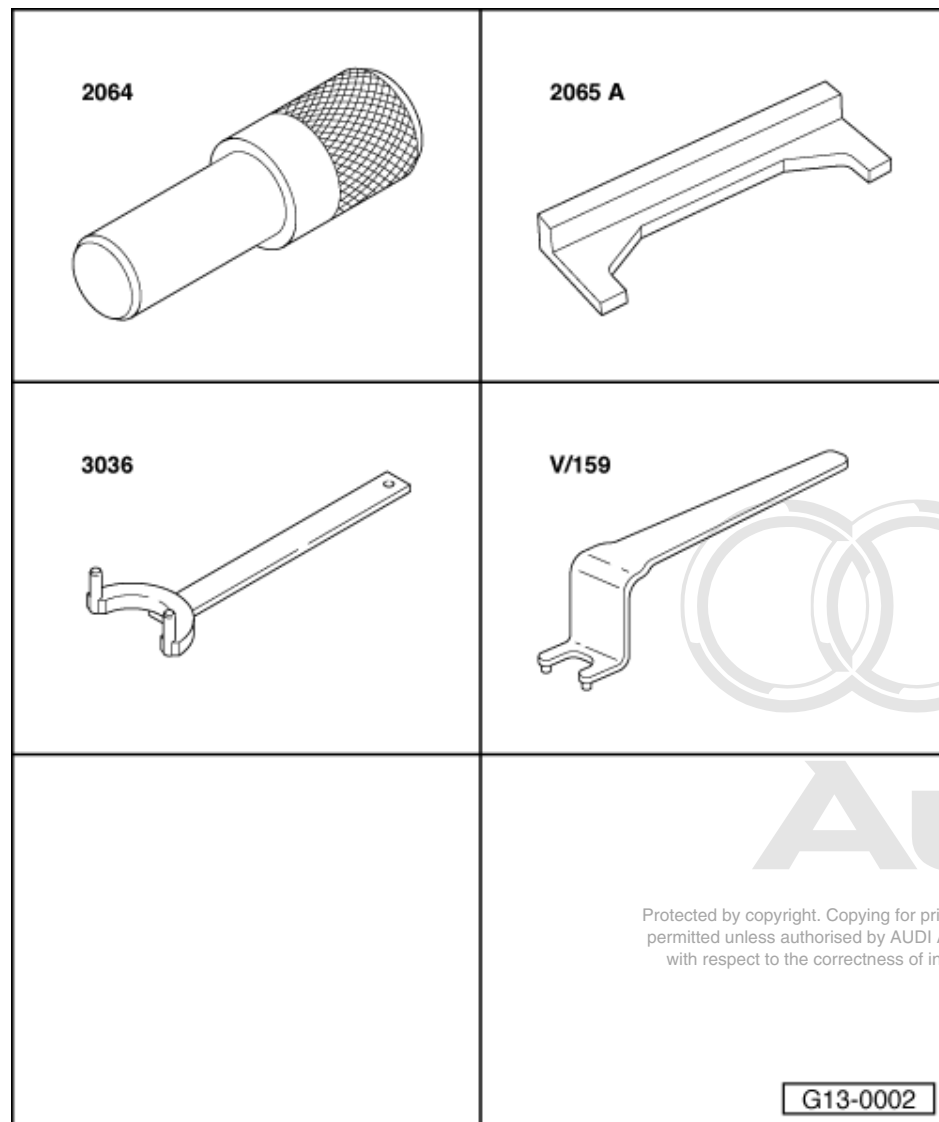
-> Fig.3 Removing injection pump sprocket

- Toothed belt removed => Page 13-20
- Unscrew nut for injection pump sprocket.
- Loosen arms of puller and place puller 3032 in position.
- Align arms with holes in injection pump gear and tighten.
- Use the puller to tension the injection pump sprocket.



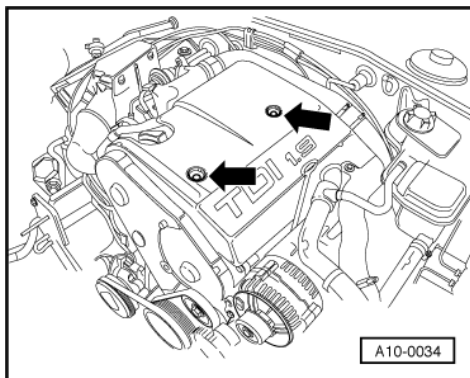
- Release the injection pump sprocket from the taper of the injection pump by gently tapping on the puller stem -arrow- (while doing so, hold the sprocket firmly to prevent it from falling).

1.7 - Removing and installing toothed belt



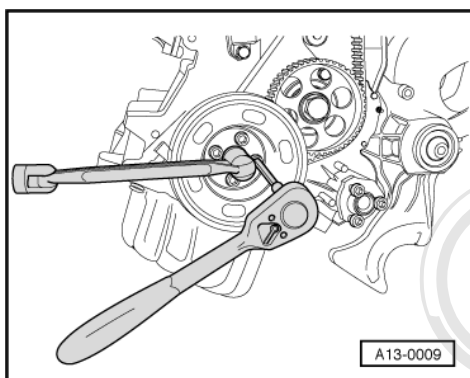
Special tools and workshop equipment required

- ♦ Mandrel 2064
- ♦ Setting bar 2065 A
- ♦ Counterhold 3036
- ♦ Pin wrench Matra V/159

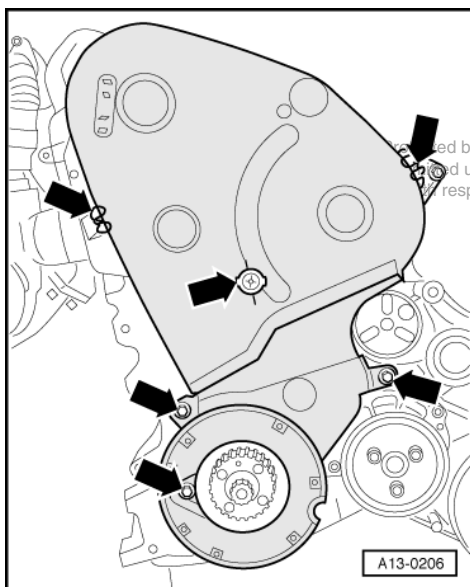


Removing

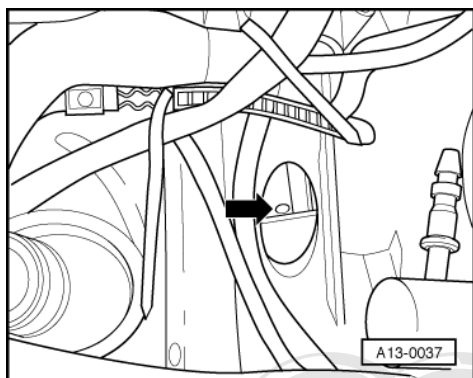
- -> Remove engine cover -arrows-.
- Remove V-belt => Page 13-9
- Remove ribbed belt => Page 13-11



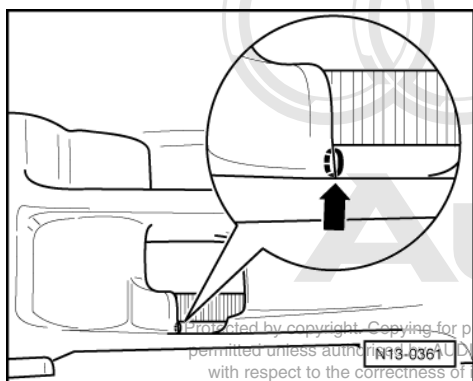
- -> Unbolt belt pulley with vibration damper.



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



- -> Turn crankshaft to TDC No. 1 cylinder -arrow- (vehicles with manual gearbox).

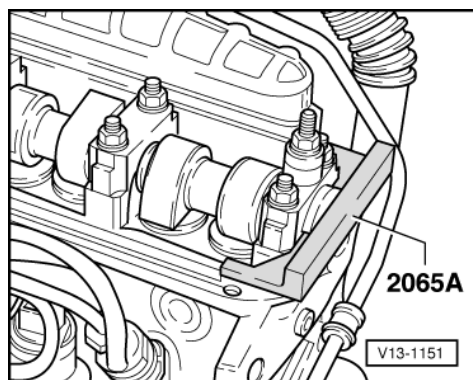


- -> Turn crankshaft to TDC No. 1 cylinder -arrow- (vehicles with automatic gearbox).

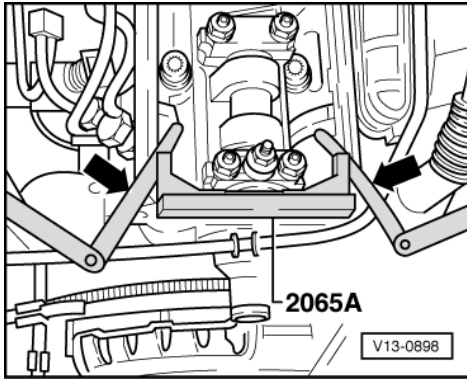
Note:

Position crankshaft to TDC for cylinder 1 with engine removed=> Page 13-30.

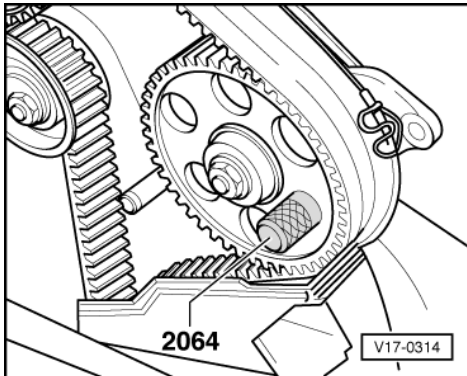
- Remove cylinder head cover => Page 15-8.



- -> Lock the camshaft with setting bar 2065 A.



- -> Centre the setting bar as follows:
Turn locked camshaft so that one end of setting bar contacts the cylinder head. Measure the gap at the other end of the setting bar using a feeler gauge. Place a feeler gauge corresponding to half the gap between the setting bar and the cylinder head. Turn camshaft until the setting bar contacts the feeler gauge. Insert a 2nd feeler gauge of the same thickness at the other end, between the setting bar and the cylinder head.



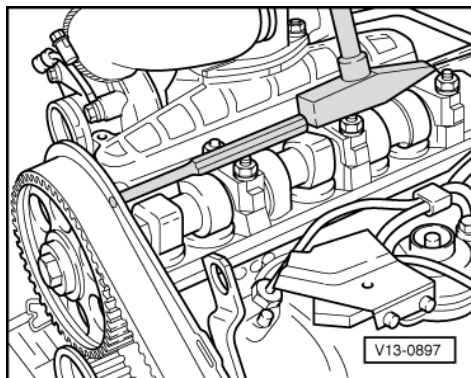
- -> Lock injection pump sprocket using mandrel 2064.
- Mark direction of rotation of toothed belt with chalk or felt pen.
- Slacken tensioning roller.
- Remove the idler wheel.
- Remove toothed belt.

Installing (adjusting valve timing)

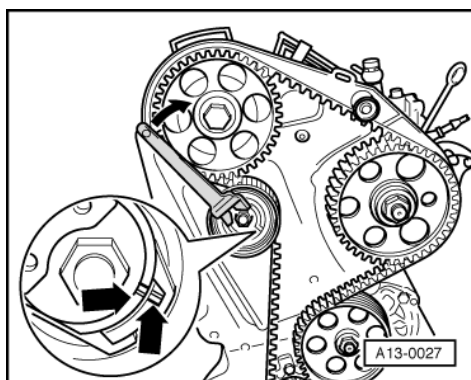
- Camshaft locked using setting bar.
- Injection pump locked using mandrel 2064.

Notes:

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



- -> Loosen the securing bolt of the camshaft sprocket 1/2 turn. Release camshaft sprocket from camshaft taper by tapping (pin through hole on rear toothed belt guard) using hammer.
- Check again whether TDC mark on flywheel and reference mark are aligned.
- Fit toothed belt on crankshaft toothed belt sprocket, intermediate shaft, injection pump sprocket and tensioning roller (note toothed belt running direction).
- Attach camshaft sprocket together with toothed belt and fasten using securing bolts (camshaft sprocket can still be turned).
- Install the idler wheel.



- -> Rotate tensioning roller eccentric cam clockwise using nut driver (e.g. Matra V/159) until notch and lug align -arrows-.

Note:

First completely release load on tensioning roller, if the eccentric cam was accidentally rotated too far clockwise while tensioning. Then again rotate the eccentric cam clockwise to tighten.

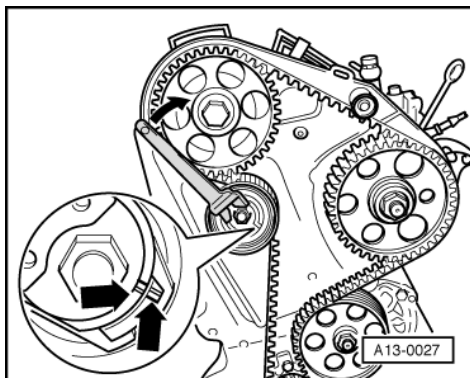
- Tighten lock nut on tensioning roller to 20 Nm.
- Check again whether TDC mark on flywheel and reference mark are aligned.
- Tighten camshaft sprocket securing bolt to 45 Nm.

Note:

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

- Remove setting bar.
- Remove mandrel 2064.
- Turn crankshaft an additional two turns in direction of engine rotation until the engine is back at TDC cylinder 1.

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- -> Check toothed belt tension.
- Marks -arrows- must align
- Re-tension toothed belt as necessary.
- Check whether injection pump sprocket can be locked using mandrel 2064.
- Check camshaft position using the setting bar.

Note:

Repeat adjustment if it is not possible to insert the setting bar/mandrel.

- Remove setting bar.
- Remove mandrel 2064.
- Install ribbed belt =>Page 13-12.
- Install V-belt =>Page 13-9.
- Perform dynamic start of injection test

=> Diesel Direct Injection and Glow Plug System (TDI 4-cylinder); Repair group 23; Servicing diesel direct injection system; Dynamically checking and adjusting commencement of injection Servicing diesel direct injection system Dynamically checking and adjusting commencement of injection

Tightening torques

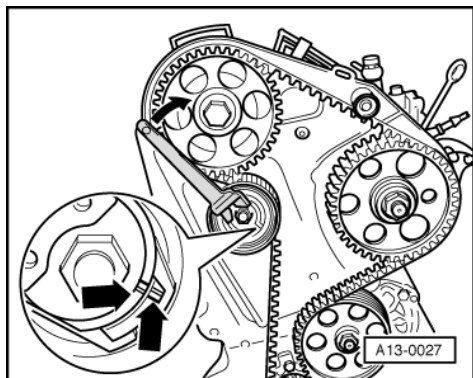
Component	Nm
Toothed belt sprocket to camshaft	45
Idler wheel to console	25
Semi-automatic tensioning roller to cylinder block	20
Lower section of toothed belt guard to cylinder block	10
Vibration damper with	8.8
belt pulley to crankshaft	10.9
	35

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1.8 - Checking semi automatic toothed belt tensioning roller

Test conditions

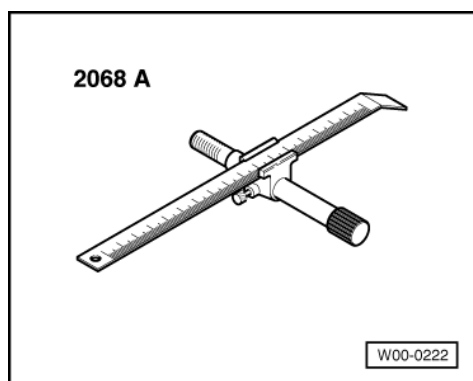
- Toothed belt in position and tensioned.



Test sequence

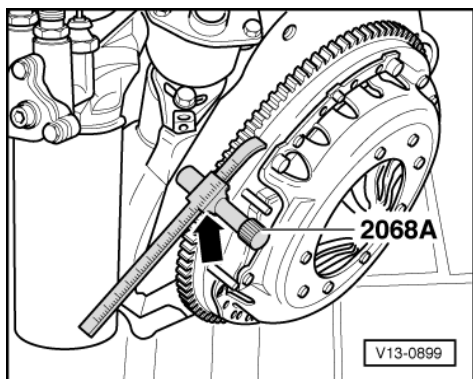
- -> Tension toothed belt with firm thumb pressure. Notch and lug -arrow- must move.
- Release thumb pressure on toothed belt. Tensioner must return to initial position.
- Marks -arrows- must align

1.9 - Positioning crankshaft to TDC with engine removed



Special tools and workshop equipment required

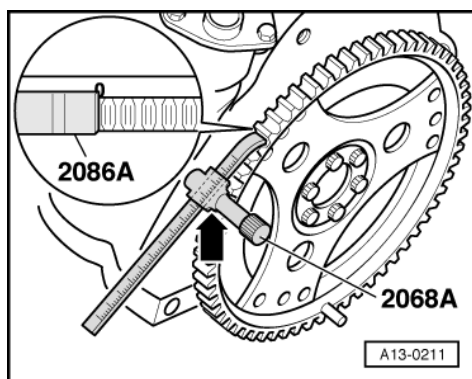
- ♦ TDC adjustment device 2068 A



Vehicles with manual gearbox:

- Oil cleaner removed.

- -> Screw in TDC adjustment device 2068 A, as shown in the illustration.
- Set adjustment device to 107 mm (the left notch on the vernier scale -arrow A- is the reference point).
- Turn crankshaft until TDC mark "0" on flywheel aligns with edge of adjustment device.



Vehicles with automatic gearbox:

- Oil cleaner removed.
- -> Screw in TDC adjustment device 2068 A, as shown in the illustration.
- Set adjustment device to 99 mm (the left notch on the vernier scale -arrow A- is the reference point).
- Turn crankshaft until TDC mark "0" on drive plate aligns with edge of adjustment device.

Note:

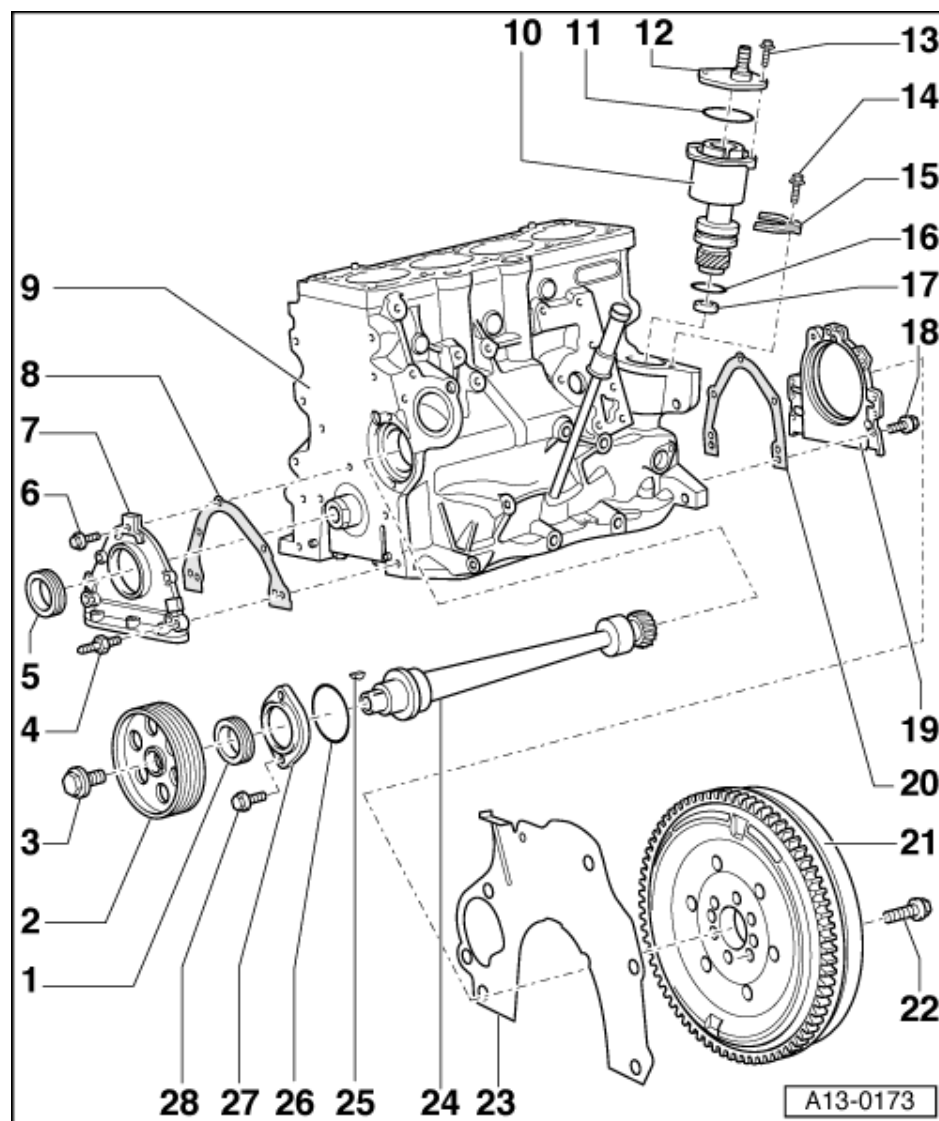
The TDC mark "0" is stamped on the side of the drive plate facing the cylinder block.



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

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



Note:

For repairs to the clutch:

=> 5-speed Manual Gearbox 012/01W, FWD; Repair group 30; Servicing clutch Servicing clutch

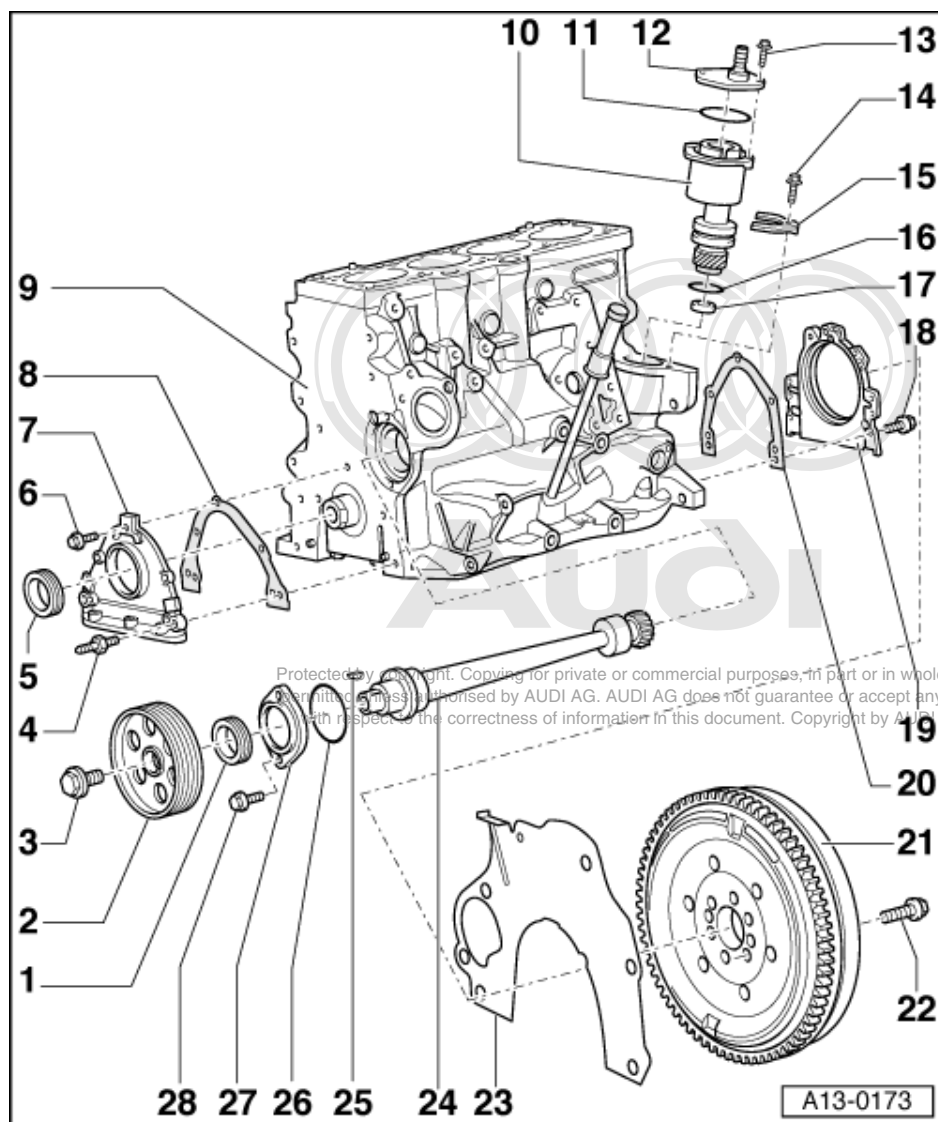
1 Sealing ring

- ◆ To remove, remove sealing flange -Item 27-
- ◆ Install with 10-203
- ◆ Lightly oil sealing lip of oil seal

2 Intermediate shaft sprocket

- ◆ Installation position
=> Fig.13-37
- ◆ Note position of Woodruff key
-Item 25-

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3 45 Nm

- ♦ Counter hold with 3036 to loosen and tighten

4 25 Nm

5 Sealing ring

- ♦ Replacing => Page 13-38.
- ♦ Lightly oil sealing lip of sealing ring

6 10 Nm

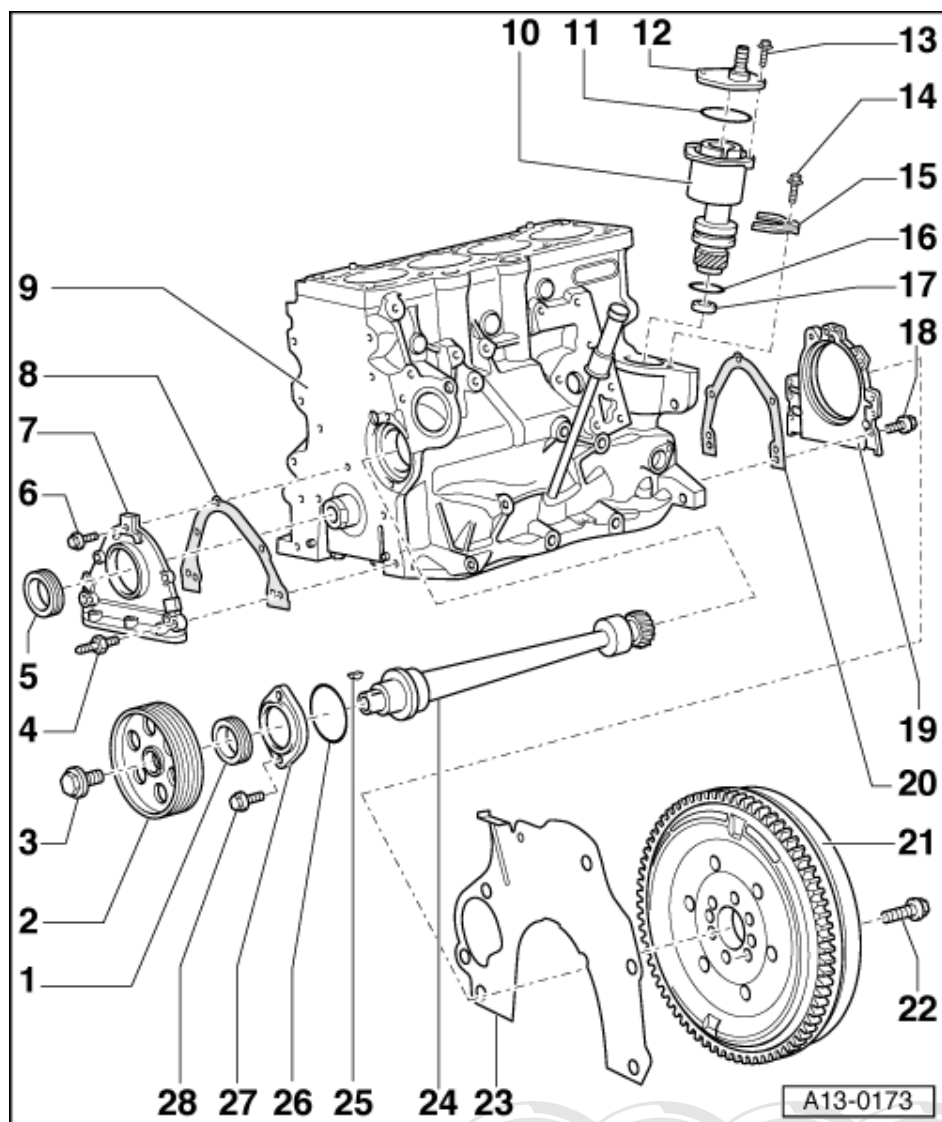
7 Sealing flange - front

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

=> Parts List

8 Seal

- ♦ Replace



9 Cylinder block

- ♦ Removing and installing crankshaft=> Page 13-47
- ♦ Dismantling and assembling pistons and conrods => Page 13-56

10 Exhauster

- ♦ For brake servo

11 O-ring

- ♦ Replace

12 Cover

13 10 Nm

14 20 Nm

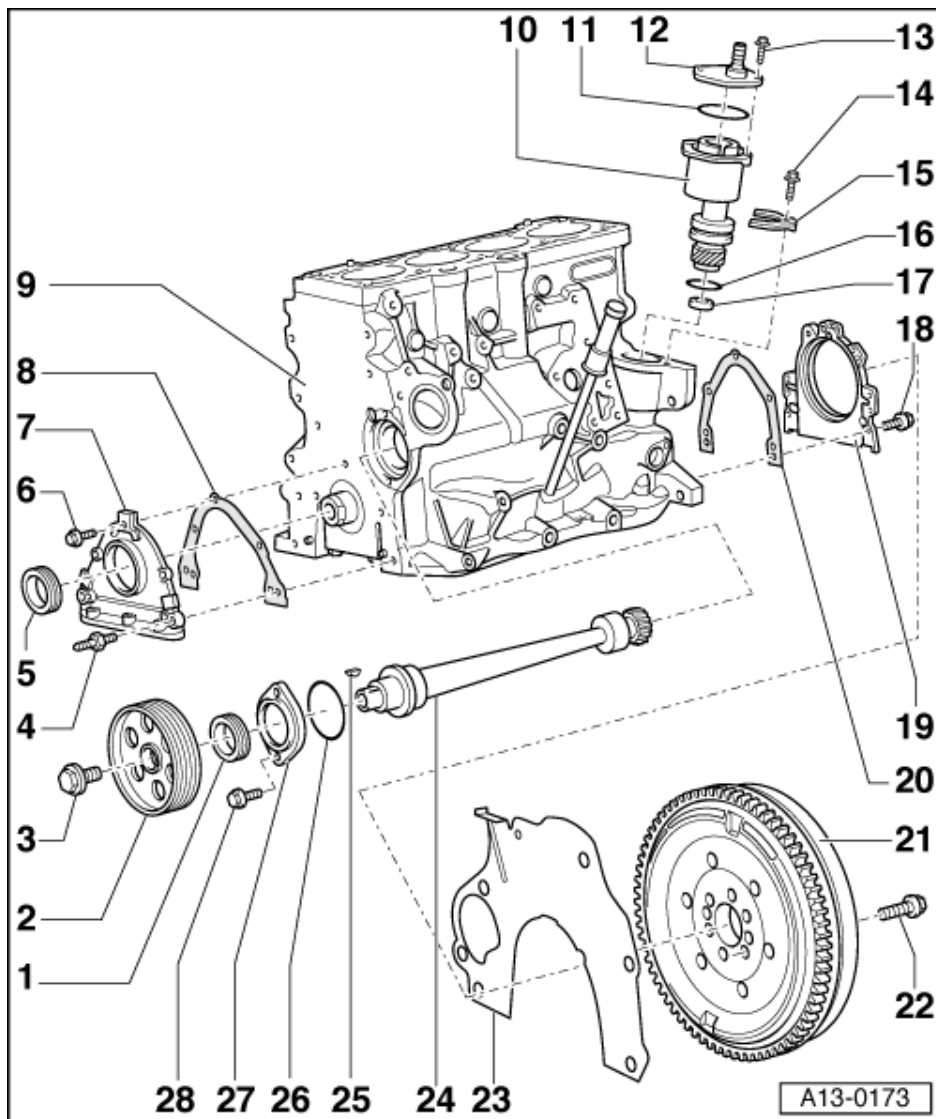
15 Bracket

- ♦ For exhauster

16 O-ring

- ♦ Replace

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17 Sealing ring

- ◆ Replace

18 10 Nm

19 Rear sealing flange

- ◆ With sealing ring
- ◆ Replace only as complete unit
- ◆ Lightly oil sealing lip of oil seal
- ◆ Before fitting sump, apply a small amount of sealant to sealing points between sealing flange and cylinder block
- ◆ Sealants

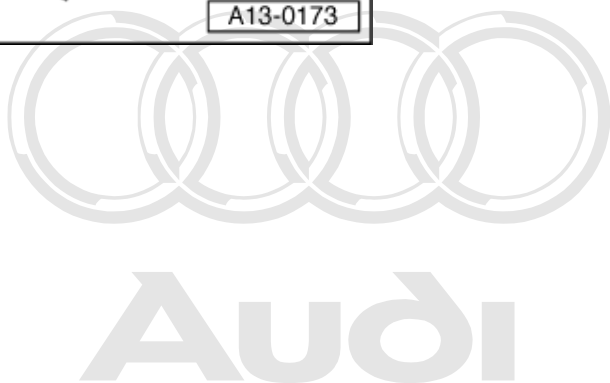
20 Seal

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

21 Flywheel or drive plate

- ◆ Removing and installing flywheel =>Page13-43
- ◆ Removing and installing drive plate => Page 13-44

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- ◆ Replace

- ◆ Must be located on dowel sleeves
- ◆ Do not damage/bend when assembling.

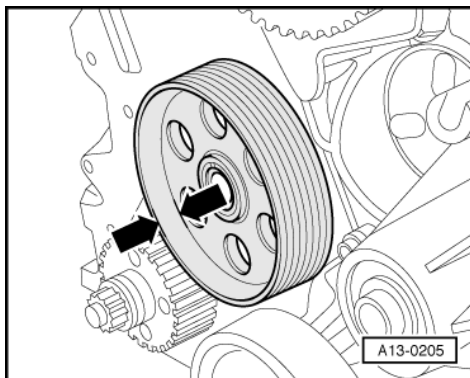
- ◆ Axial play max. 0.25 mm

- ◆ Watch position of Woodruff key

- ◆ Replace

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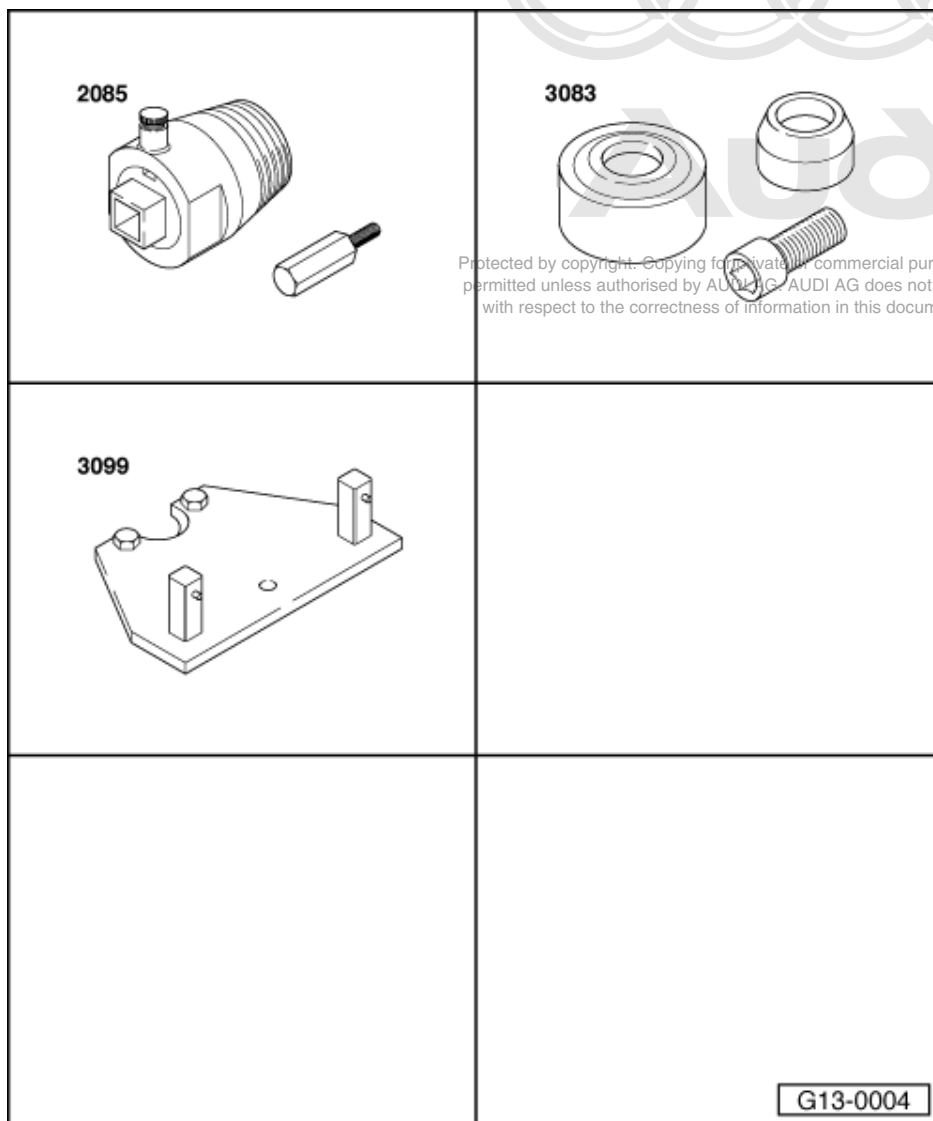
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→ Fig.1 Installation position of intermediate shaft sprocket

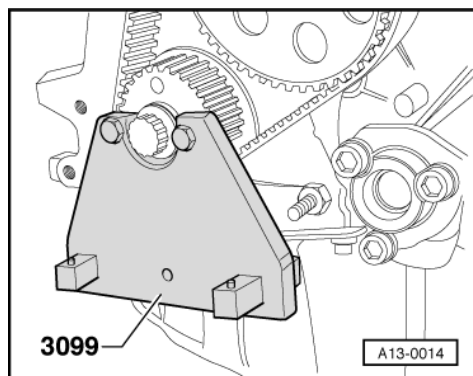
- ◆ Wide web -arrows- of intermediate shaft sprocket points to the front.
- ◆ Marking on sprocket points to the rear.

2.2 - Replacing crankshaft oil seal on pulley end



Special tools and workshop equipment required

- ♦ Oil seal extractor 2085
- ♦ Fitting tool 3083
- ♦ Counterhold 3099

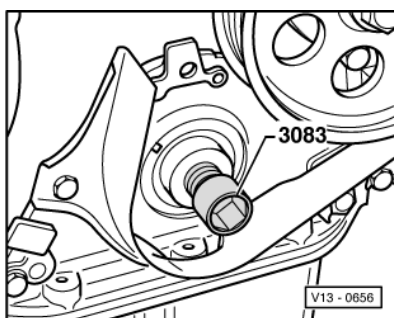


Removing

- Engine in vehicle
- Remove V-belt => Page 13-9
- Remove ribbed belt => Page 13-11
- Remove toothed belt => Page 13-20.
- -> Remove crankshaft toothed belt sprocket. Counter hold sprocket with 3099.

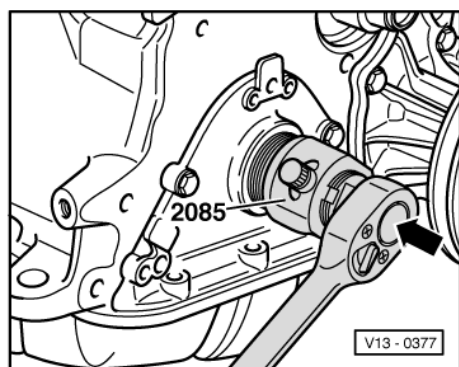
Note:

It is also possible to use special tool 3415.

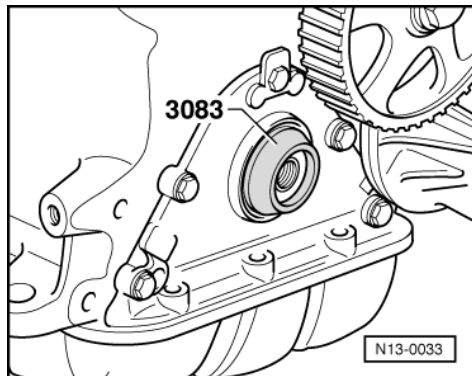


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- -> Before applying oil seal extractor, screw cheese-head bolt from 3083 into crankshaft 5...6 turns.
- Adjust inner part of oil seal extractor 2085 two turns (ca. 3 mm) from the outer part and lock in position with the knurled screw.



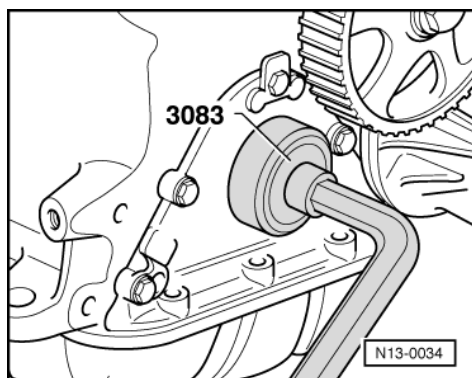
- -> Lubricate threaded head of oil seal extractor, place it in position and exerting firm pressure, screw it into oil seal as far as possible.
- Loosen knurled screw and turn inner part against crankshaft until the sealing ring is pulled out.
- Clamp flats of oil seal extractor in vice. Remove oil seal with pliers.
- Clean contact surface and sealing surface.



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Installing

- Lightly oil sealing lip of oil seal.
- -> Place guide sleeve from 3083 onto crankshaft journal.
- Push oil seal over guide sleeve.



- -> Press oil seal in until stop using press sleeve and bolt from 3083.
- Replace bolt for crankshaft sprocket.
- Install crankshaft sprocket and lock in position with retainer 3099.

Notes:

- ◆ Contact surface between sprocket and crankshaft must be free of oil.
- ◆ Do not oil bolt for toothed belt sprocket.
- Install toothed belt (adjust valve timing) => Page 13-25.
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.
- Install ribbed belt =>Page 13-12.
- Install V-belt =>Page 13-9.

Tightening torques

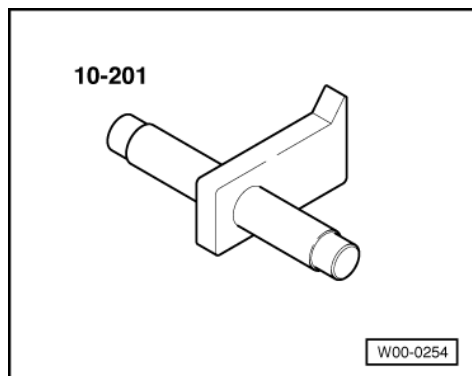
Component		Nm
Toothed belt sprocket to crankshaft		90 + 90°1)2)
Torque reaction support	M8	20



M10	40
-----	----

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

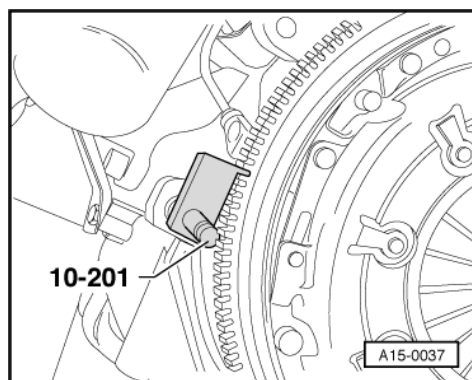
2.3 - Removing and installing flywheel/drive plate



Flywheel

Special tools and workshop equipment required

- ♦ Counterhold 10-201



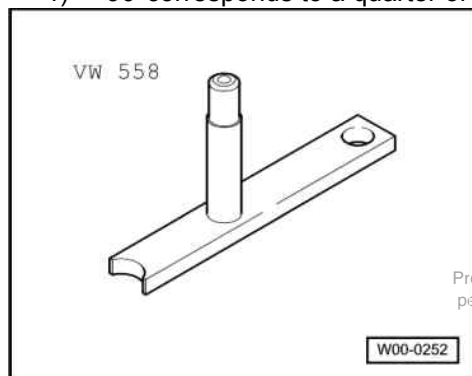
Procedure

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

Tightening torque

Component	Nm
Flywheel to crankshaft	60 + 90°1)

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

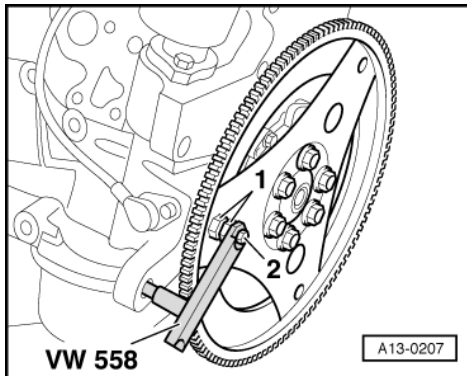


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Drive plate

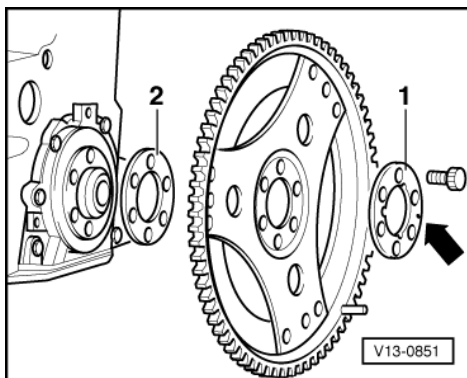
Special tools and workshop equipment required

- ◆ Counterhold VW 558
- ◆ Hexagon bolt M8 x 45 and two M10 hexagon nuts
- ◆ Depth gauge



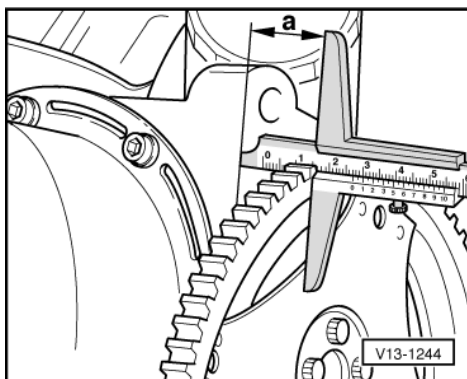
Removing

- -> Secure counterhold VW 558 to the drive plate with a hexagon bolt M8x45. Place two M10 hexagon nuts -1- between counterhold and drive plate.
- Mark position of drive plate relative to engine.
- Loosen securing bolts on drive plate.



Installing

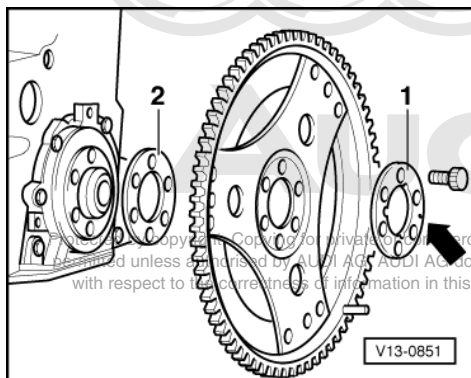
- -> Place drive plate with shim -2- and washer -1- in position. Lug -arrow- must face towards torque converter.
- Insert at least 3 of the old securing bolts and tighten to 30 Nm.



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- -> Measure dimension -a- at three points and calculate average value.
- Specification: 26...28 mm



If specification is exceeded:

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

If specification is attained:

- Only use new bolts to secure.

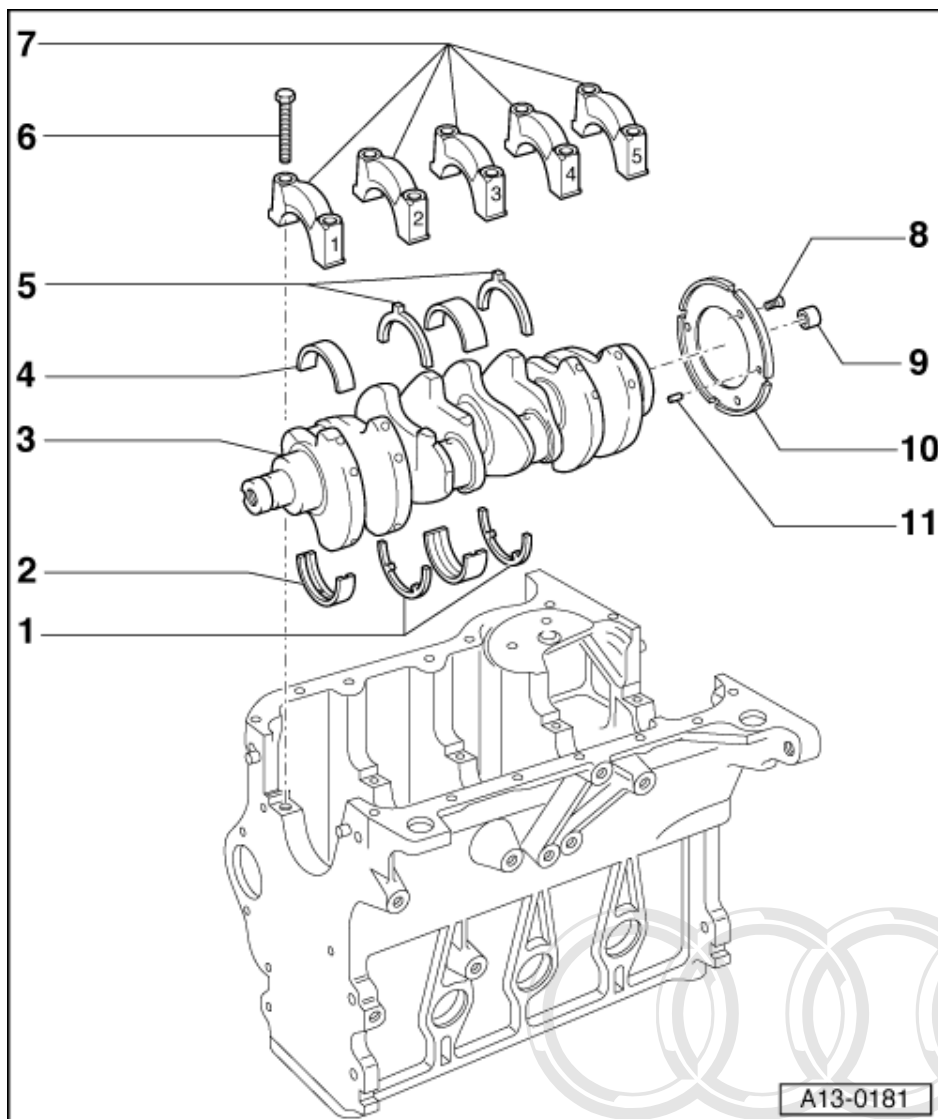
Tightening torque

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

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

3 - Removing and installing crankshaft

3.1 - Removing and installing crankshaft



Note:

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

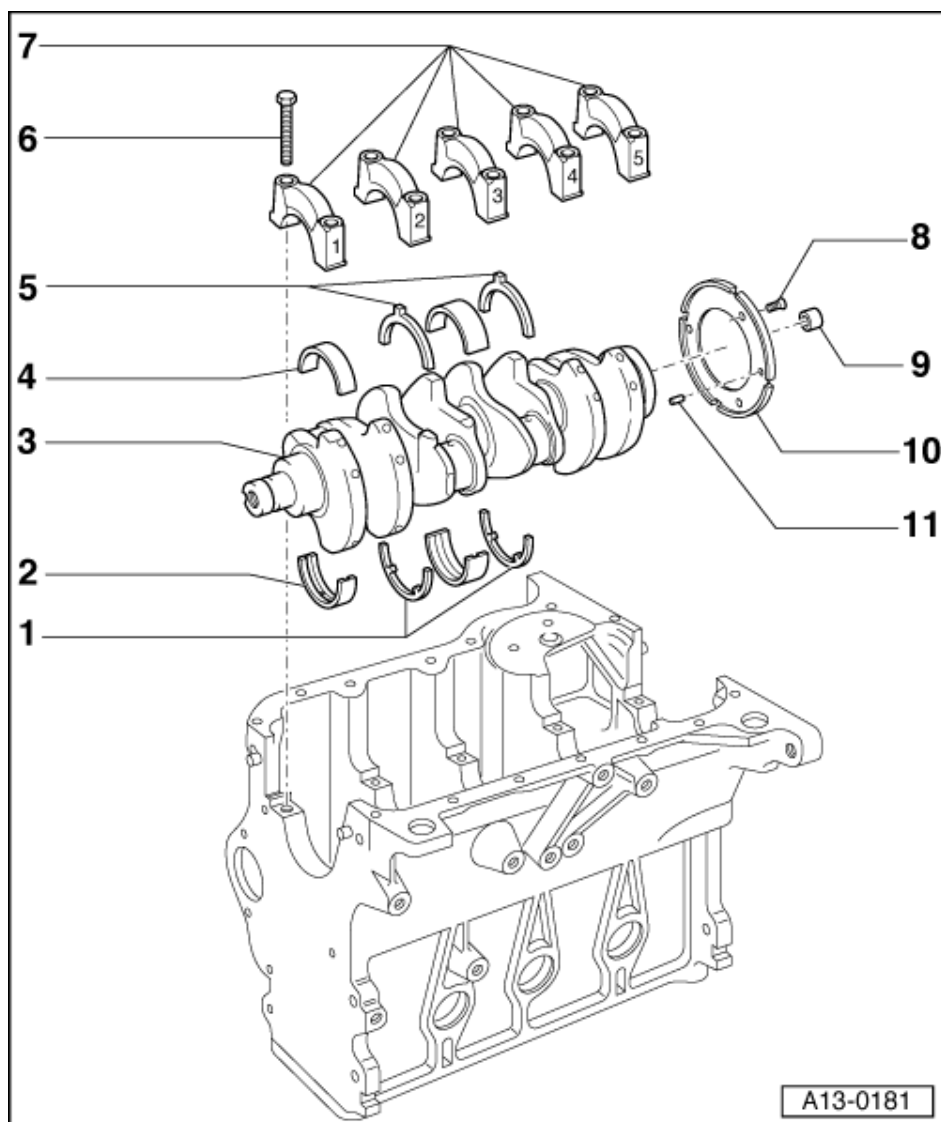
1 Thrust washers

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

2 Bearing shell

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

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3 Crankshaft

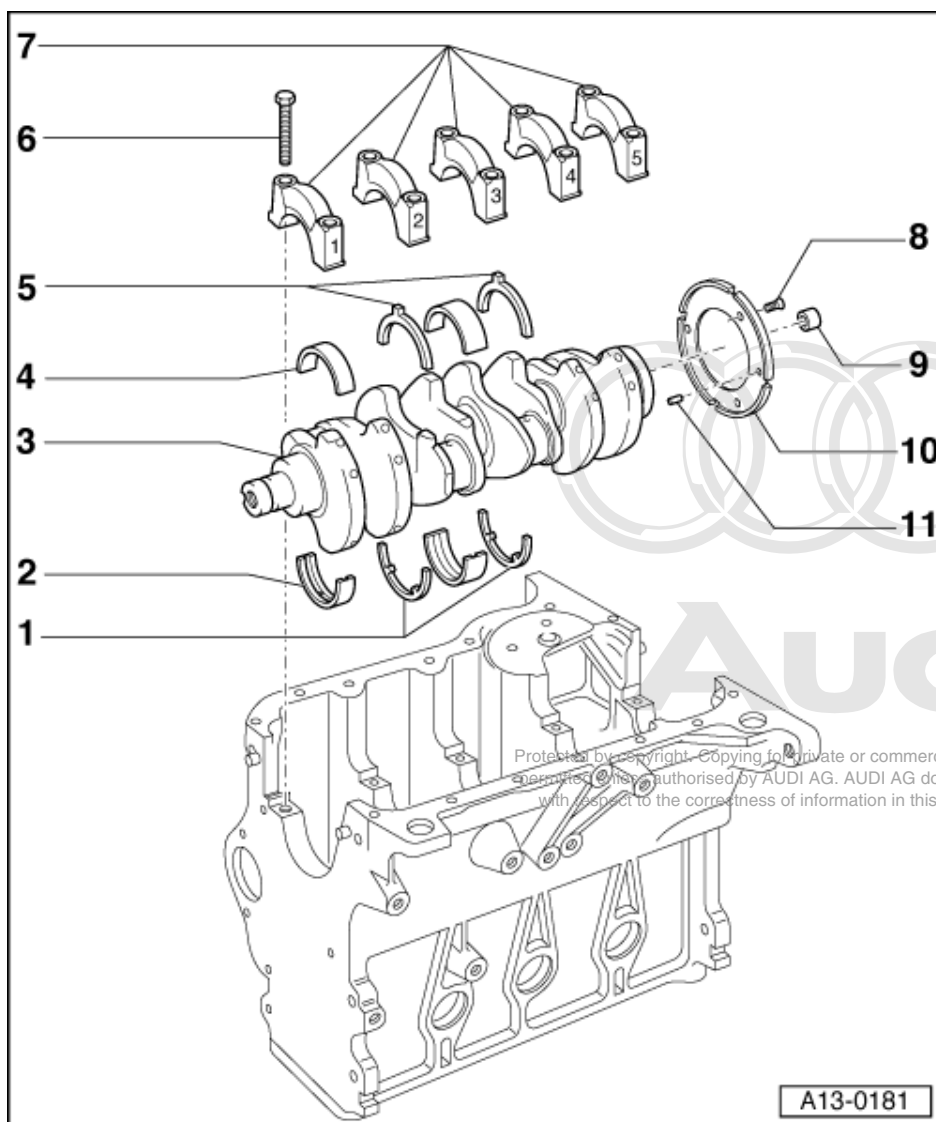
- ◆ Axial play new: 0.07...0.17 mm
Wear limit: 0.37 mm
- ◆ Check radial play with Plastigage
New: 0.03...0.08 mm
Wear limit: 0.17 mm
- ◆ Do not rotate the crankshaft when checking the radial play.
- ◆ Crankshaft dimensions
=>Page 13-55.

4 Bearing shell

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

5 Thrust washers

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



6 65 Nm + 1/4 turn (90 °) further

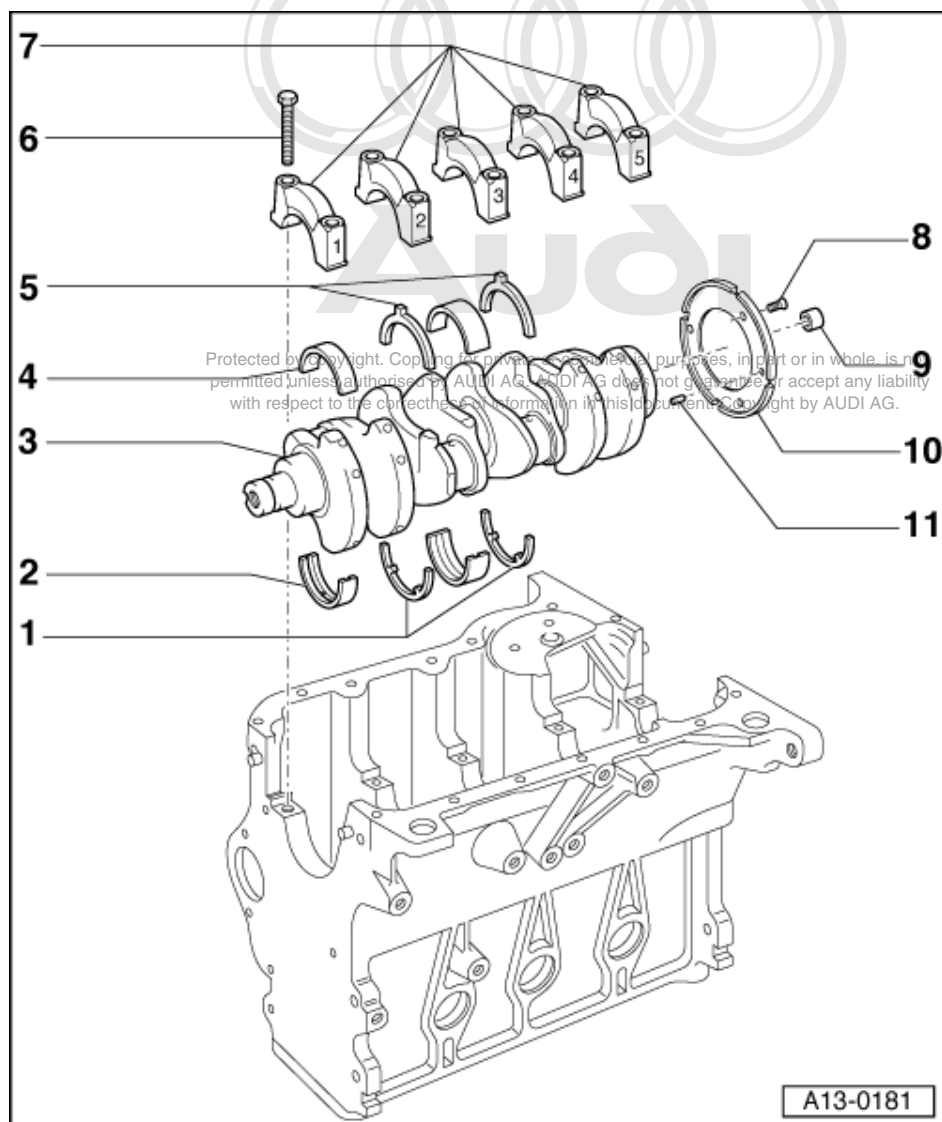
- ◆ Replace
- ◆ When measuring radial play of crankshaft, tighten to 65 Nm but do not turn further.

7 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.

8 10 Nm + 1/4 turn (90 °) further

- ◆ Replace
- ◆ After each loosening of bolts replace sender wheel => Fig.13-51



9 Needle bearing

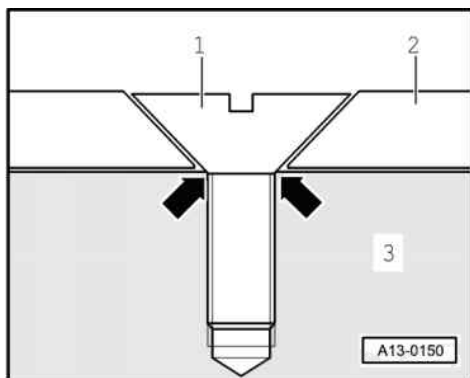
- ♦ Pulling out and driving in
=>Page 13-52.

10 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.13-51

11 Dowel pin

- ♦ Check projection from crankshaft
=> Fig.13-51



→ Fig.1 Removing and installing sender wheel

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

Notes:

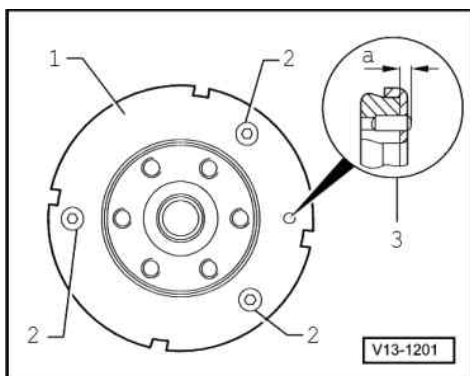
- ♦ If the securing bolts are tightened a second time, the seats for the countersunk bolt heads in the sender wheel will be distorted to such an extent that the bolt heads will come into direct contact with the crankshaft -3- (-arrows-) and the sender wheel will only fit loosely under the bolts.
- ♦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

Tightening torque

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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

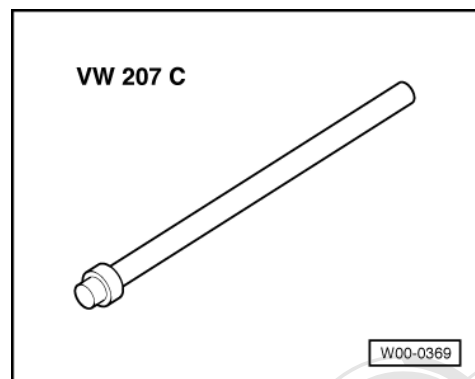
Projection of dowel sleeve -3- from crankshaft

- ♦ $a = 2.5 \dots 3.0 \text{ mm}$

3.2 - Removing and installing needle bearing in crankshaft

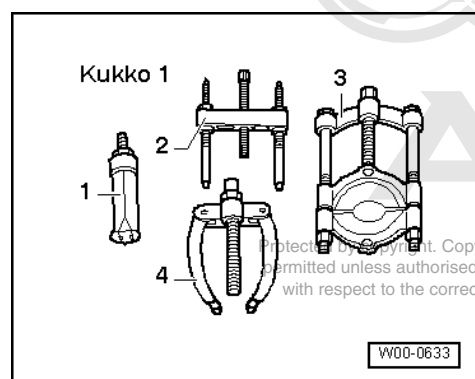
Notes:

- ♦ A needle bearing must be fitted in the crankshaft on vehicles with manual gearbox. Install needle bearing if necessary.
- ♦ The needle bearing must not be fitted in the crankshaft on vehicles with automatic gearbox. Remove needle bearing if necessary.

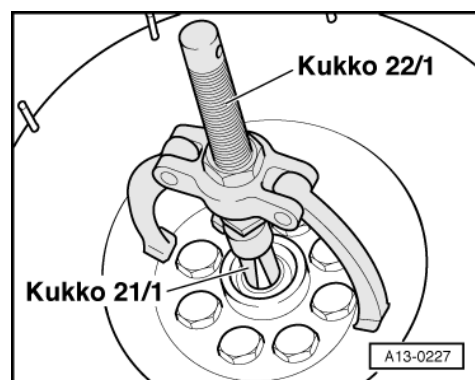


Special tools and workshop equipment required

- ♦ Drift VW 207 C

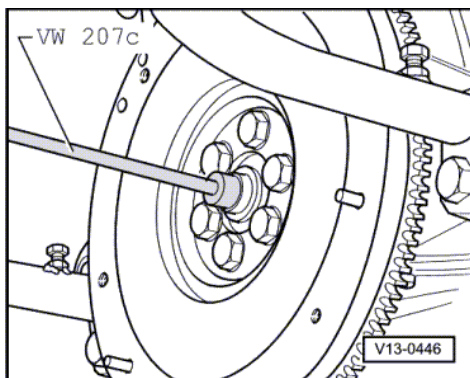


- ♦ Special tool Kukko 21/1 (Item 1) and Kukko 22/1 (Item 4)



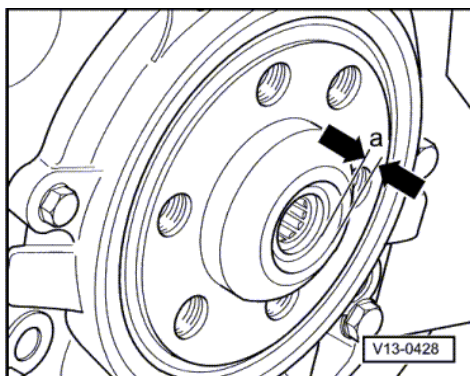
Removing

- -> Pull out needle bearing with Kukko 21/1 and Kukko 22/1.



Installing

- -> Drive in using drift VW 207C or centring drift 3176.
- Lettering on needle bearing must be visible when installed.



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-> Installation depth of needle bearing

- ◆ Dimension a = 1.5 mm

3.3 - Crankshaft dimensions

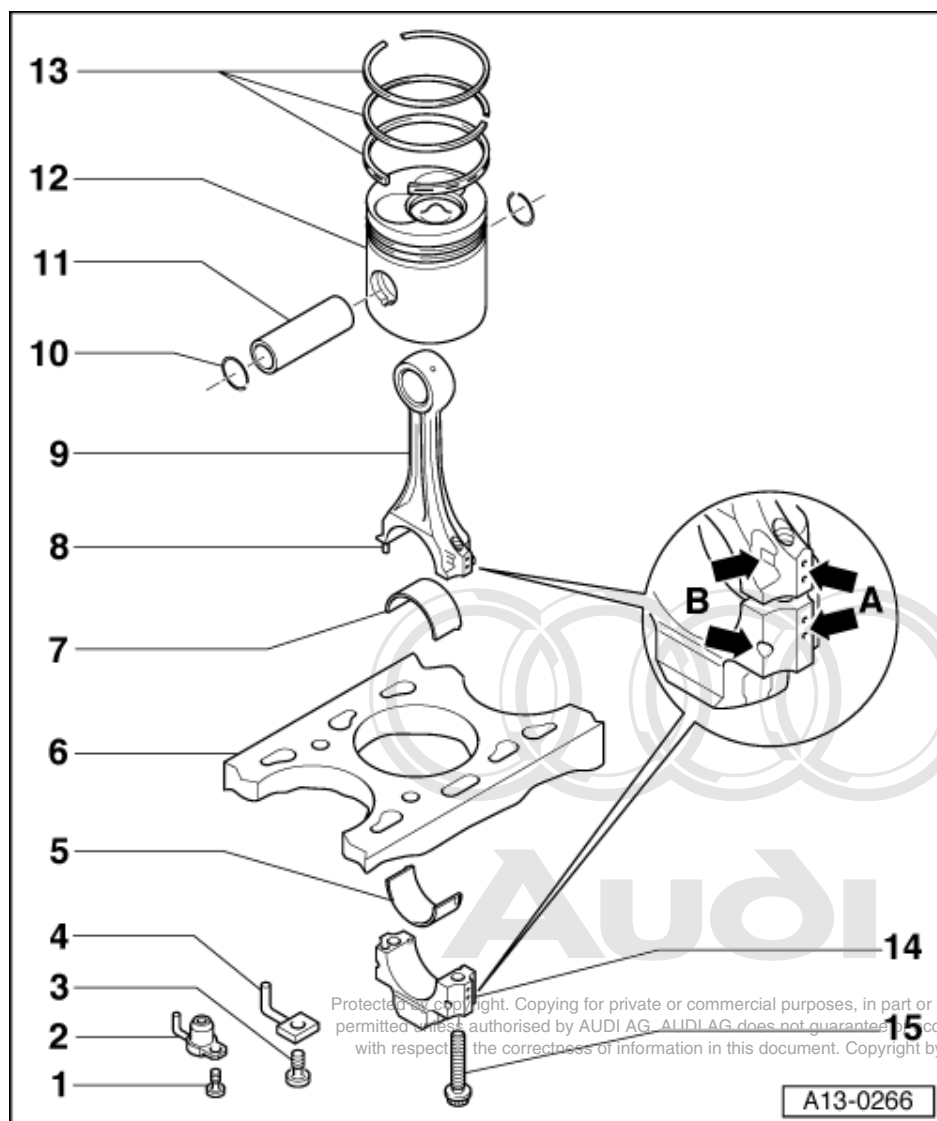
(in mm)

Honing dimension	Crankshaft bearing main journal $\varnothing$	Conrod bearing main journal $\varnothing$
Basic dimension	-0.022	-0.022
	54.00	47.80
	-0.042	-0.042
1st undersize	-0.022	-0.022
	53.75	47.55
	-0.042	-0.042
2nd undersize	-0.022	-0.022
	53.50	47.30
	-0.042	-0.042
3rd undersize	-0.022	-0.022
	53.25	47.05

	-0.042	-0.042
--	--------	--------

4 - Dismantling and assembling pistons and conrods

4.1 - Dismantling and assembling pistons and conrods



Note:

The following conrod versions are factory-installed in alternating fashion:

- ♦ Conrod with dowel pin -Item 8-. Use conrod bolts without centring feature for this type.
- ♦ Conrods without dowel pin. Use conrod bolts with centring feature (fitted bolts) for this type.

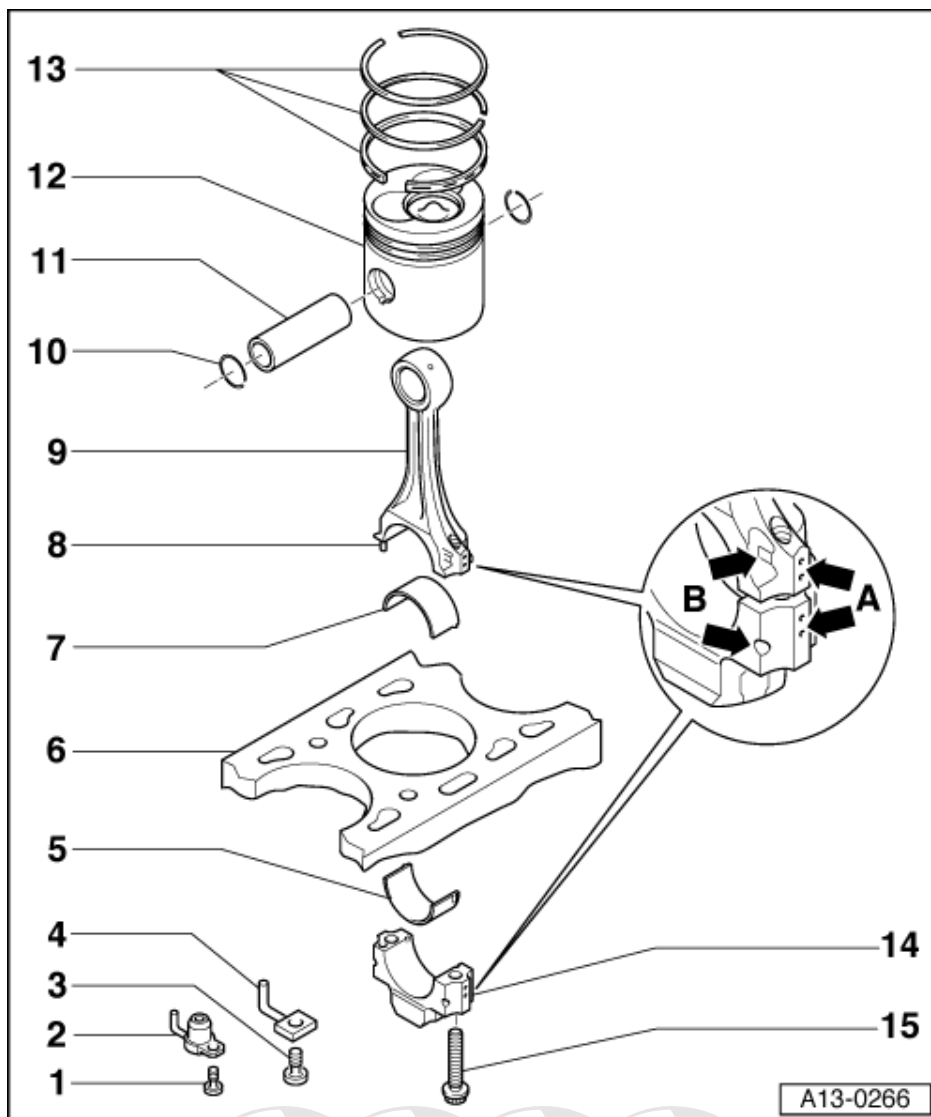
1 7 Nm

- ♦ Insert version ä 06.96
- ♦ With sealing paste
AMV 188 001 02

2 Oil spray jet

- ♦ For piston cooling
- ♦ Version ä 06.96

- ♦ With pressure relief valve, opens at 1.3 bar ... 1.6 bar



3 Pressure relief valve, 27 Nm

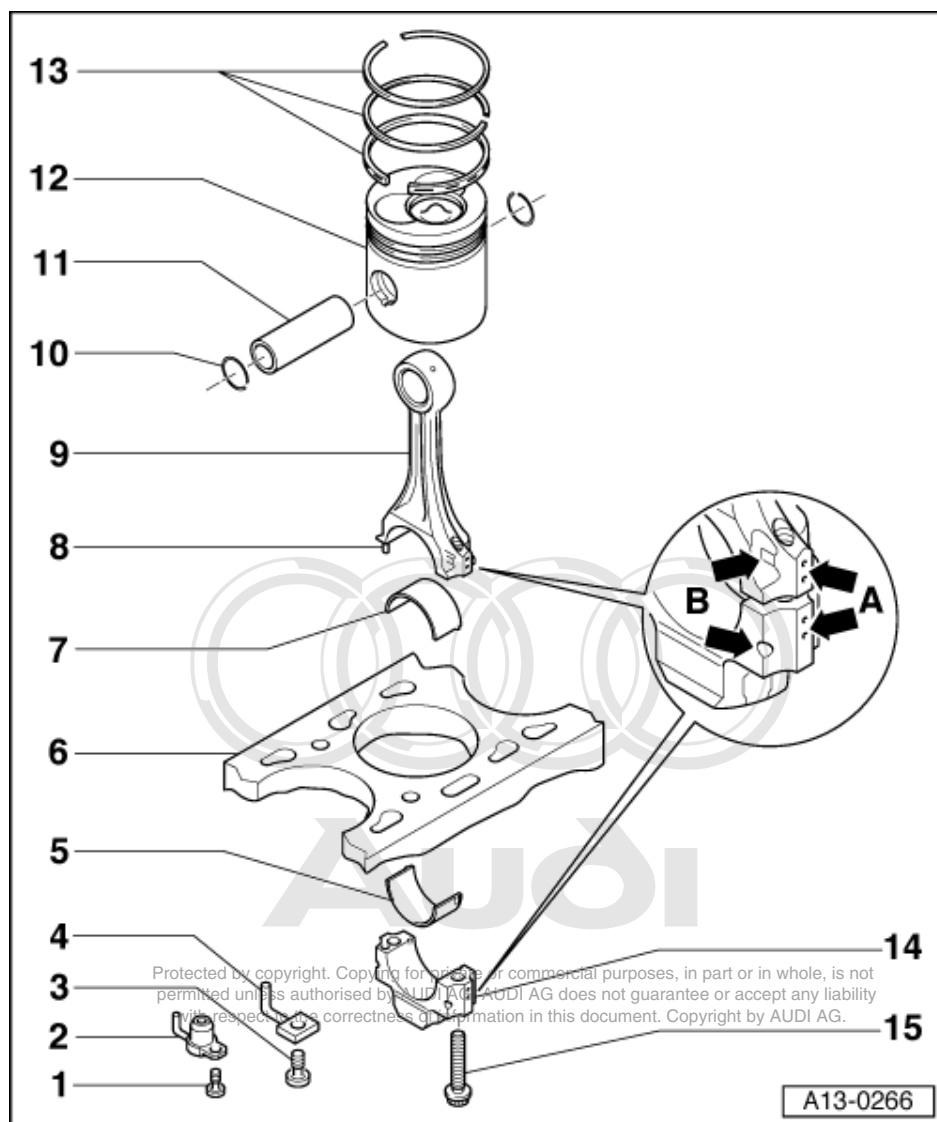
- ♦ Version 07.96 ä (gradual introduction)
- ♦ Opens at: pressure of 1.3...1.6 bar
- ♦ Insert without locking compound

4 Oil spray jet

- ♦ For piston cooling
- ♦ Version 07.96 ä (gradual introduction)

5 Bearing shell

- ♦ Note installation position
- ♦ Do not interchange used bearing shells (mark with waterproof felt pen).
- ♦ Ensure retaining lugs fit tightly in recesses.
- ♦ 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

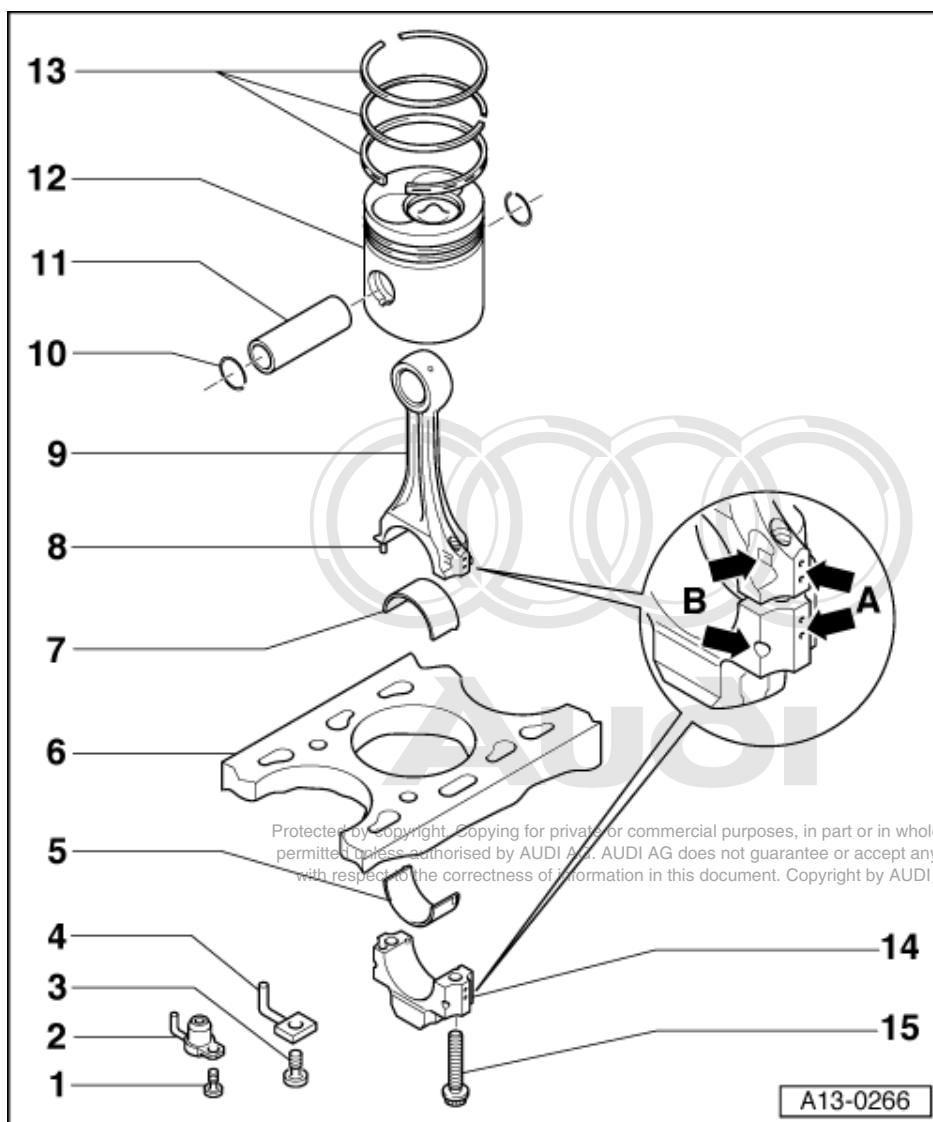


6 Cylinder block

- ♦ Checking cylinder bore
=> Fig.13-63
- ♦ Piston and cylinder dimensions
=>Page 13-67.

7 Bearing shell

- ♦ Note installation position
- ♦ Do not interchange used bearing shells (mark with waterproof felt pen).
- ♦ Ensure retaining lugs fit tightly in recesses.
- ♦ 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



8 Dowel pin

- ◆ See note=>Page 13-56.
- ◆ Must be firmly seated in conrod, not in conrod bearing cap

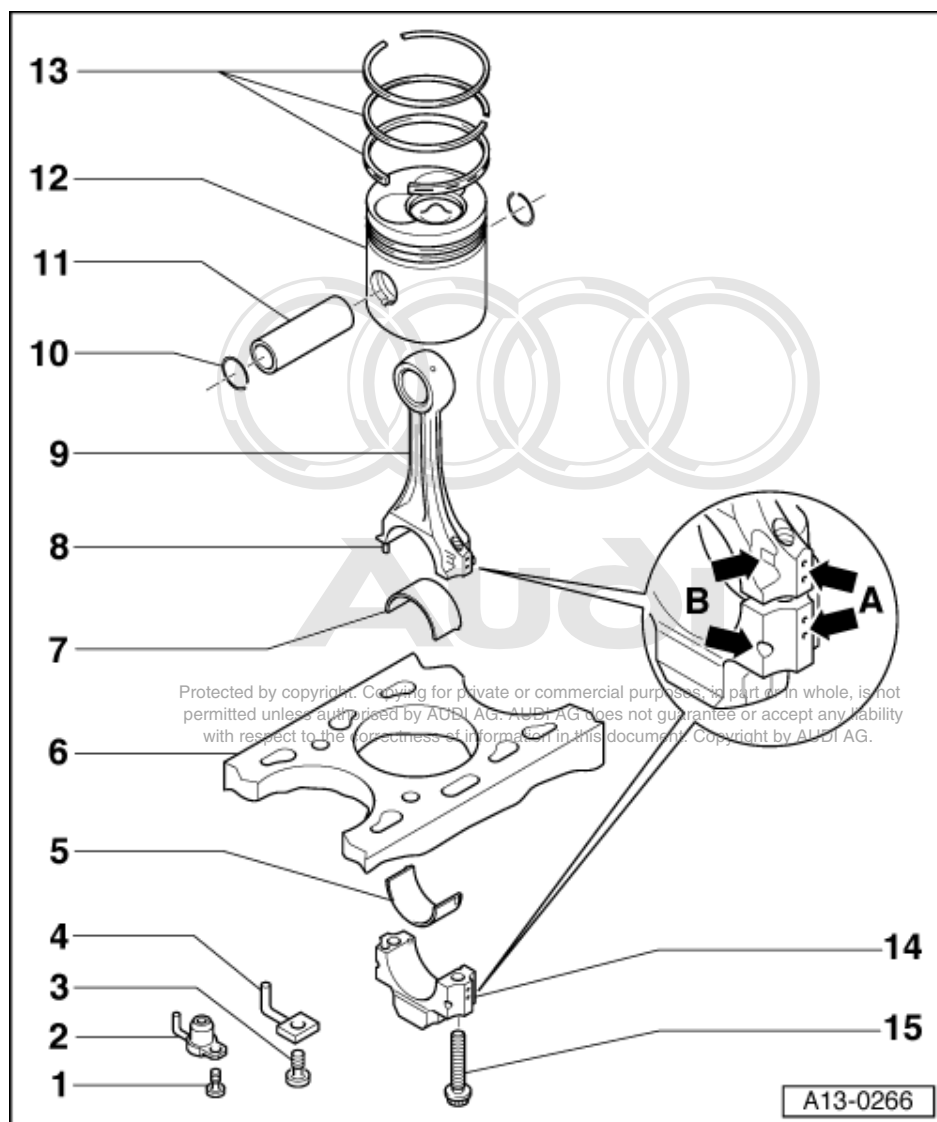
9 Conrod

- ◆ See note=>Page 13-56.
- ◆ Only renew as a set
- ◆ Mark cylinder allocation -A-
- ◆ Installation position:
Markings -B- face towards pulley side

10 Circlip

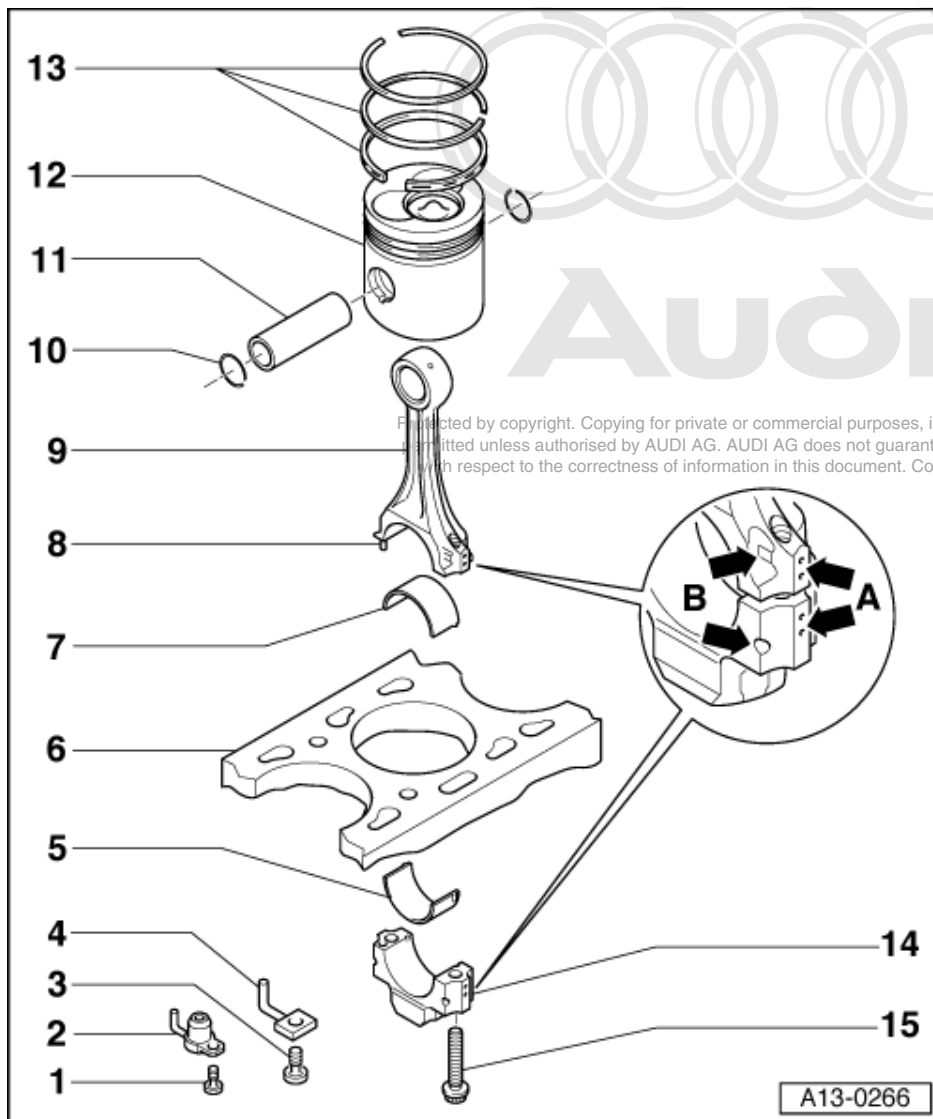
11 Piston pin

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



12 Piston

- ◆ With combustion chamber
- ◆ Mark installation position and cylinder number.
- ◆ Checking => Fig.13-63
- ◆ Installation position and arrangement of piston/cylinder => Fig.13-64
- ◆ 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 13-65
- ◆ Piston and cylinder dimensions
=>Page 13-67.



13 Piston rings

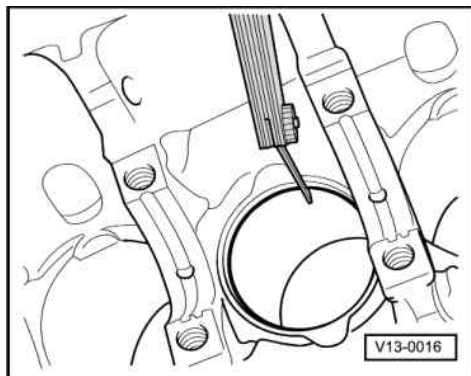
- ◆ Offset gaps by 120°
- ◆ Remove and install with piston ring pliers.
- ◆ "TOP" must face piston crown.
- ◆ Checking ring gap
 => Fig. 13-62
- ◆ Checking ring to groove play
 => Fig. 13-62

14 Conrod bearing cap

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

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

- ◆ See note=>Page 13-56.
- ◆ Replace
- ◆ Oil threads and contact surface
- ◆ To measure radial play use old bolt

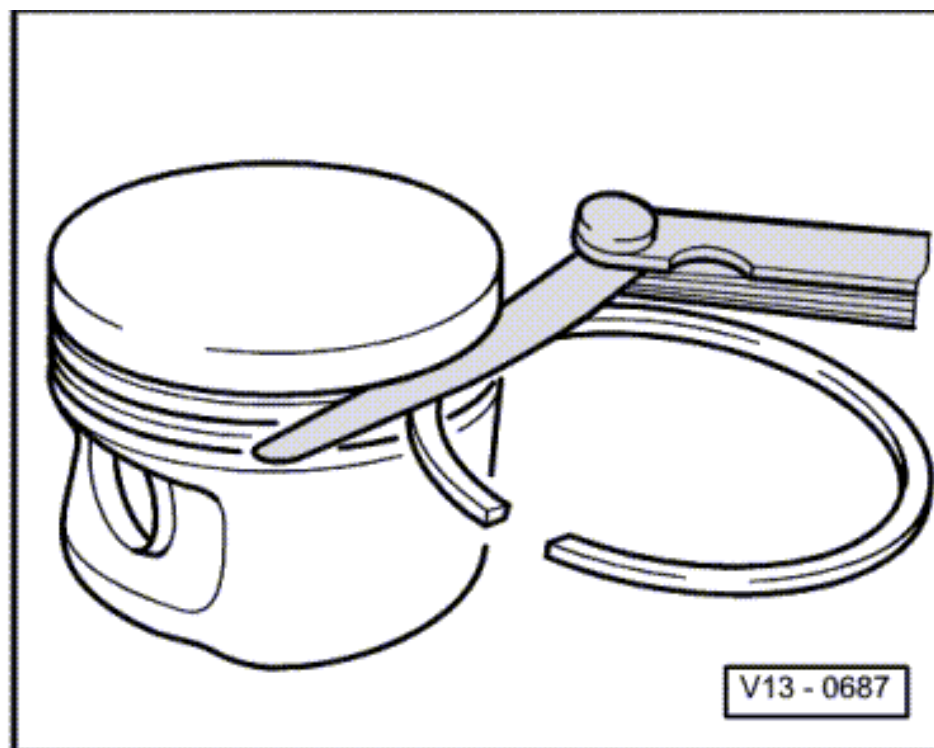


➔ Fig.1 Checking piston ring gap

- Push ring squarely from above down into the lower cylinder aperture approx. 15 mm from the cylinder edge.

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

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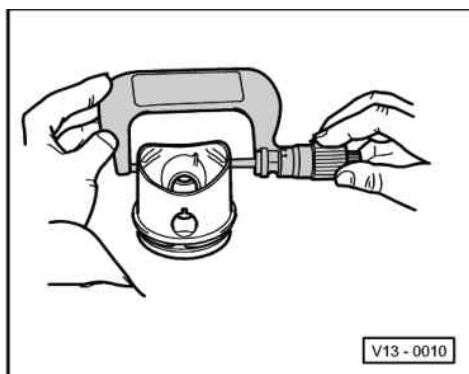


➔ Fig.2 Checking ring to groove play

- Clean groove before checking play.

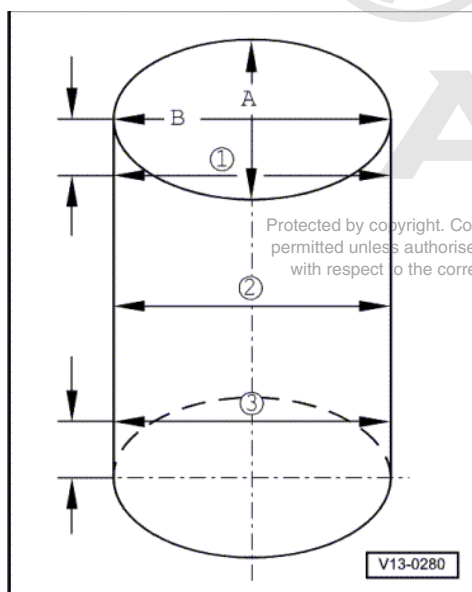
Piston ring Dimensions in mm	New	Wear limit
1st compression ring	0.06...0.09	0.25
2nd compression ring	0.05...0.08	0.25

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



→ Fig.3 Checking piston

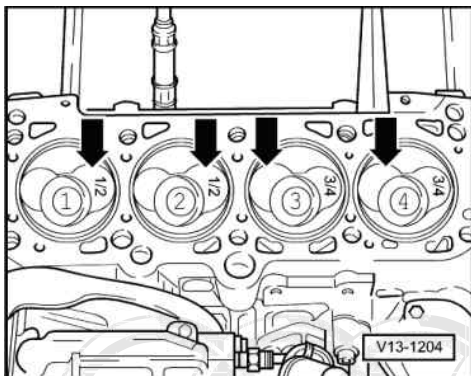
- Measure approx. 10 mm from the lower edge, offset by 90° to the piston pin axis.
- Permissible deviation from nominal dimension:
no more than 0.04 mm.



→ Fig.4 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.5 Piston installation position and arrangement of piston/cylinder

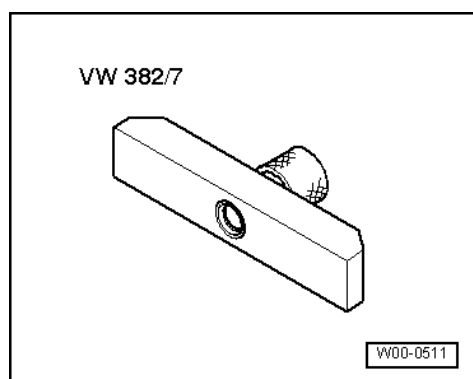
- Mark installation position and allocation on inside of piston (not on piston crown) with electric pen or felt-tip pen.
 - Pistons in cylinder 1 and 2: Large valve pocket
 - arrows- for inlet valve towards flywheel side
 - Pistons in cylinder 3 and 4: Large valve pocket
 - arrows- for inlet valve towards pulley side

Note:

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

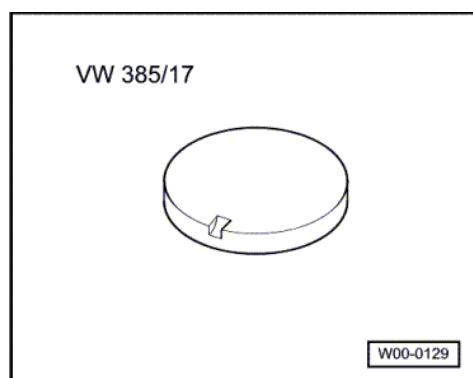
- ♦ Pistons for cylinder 1 and 2: are marked 1/2
- ♦ Pistons for cylinder 3 and 4: are marked 3/4
- ♦ Arrow on piston crown points to pulley end.

4.2 - Checking piston projection at TDC

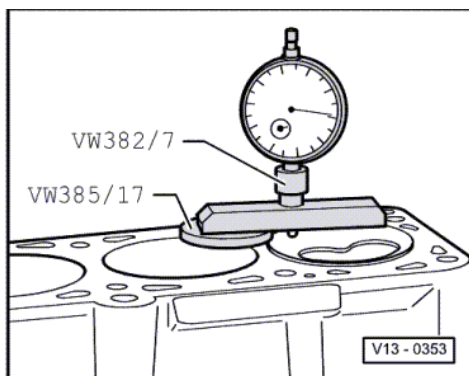


Special tools and workshop equipment required

- ♦ Special tool VW 382/7



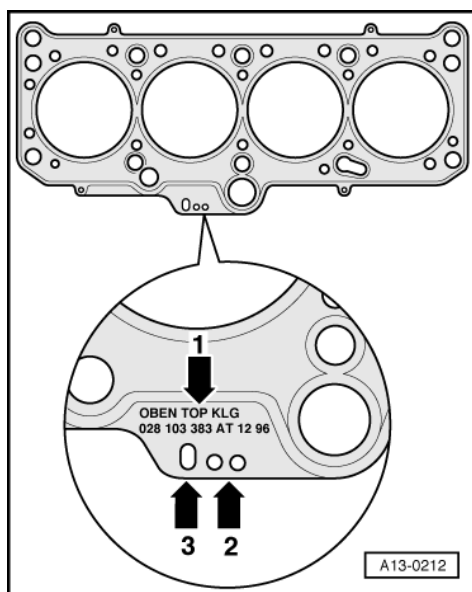
- ◆ Special tool VW 385/17



Test sequence

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

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



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-> Cylinder head gasket identification

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

Notes:

- ◆ If the measured values for piston projection are not the same for all the pistons, use the highest value to determine the correct gasket size
- ◆ Installation position: Marking "top" or part no. must face cylinder head



4.3 - 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

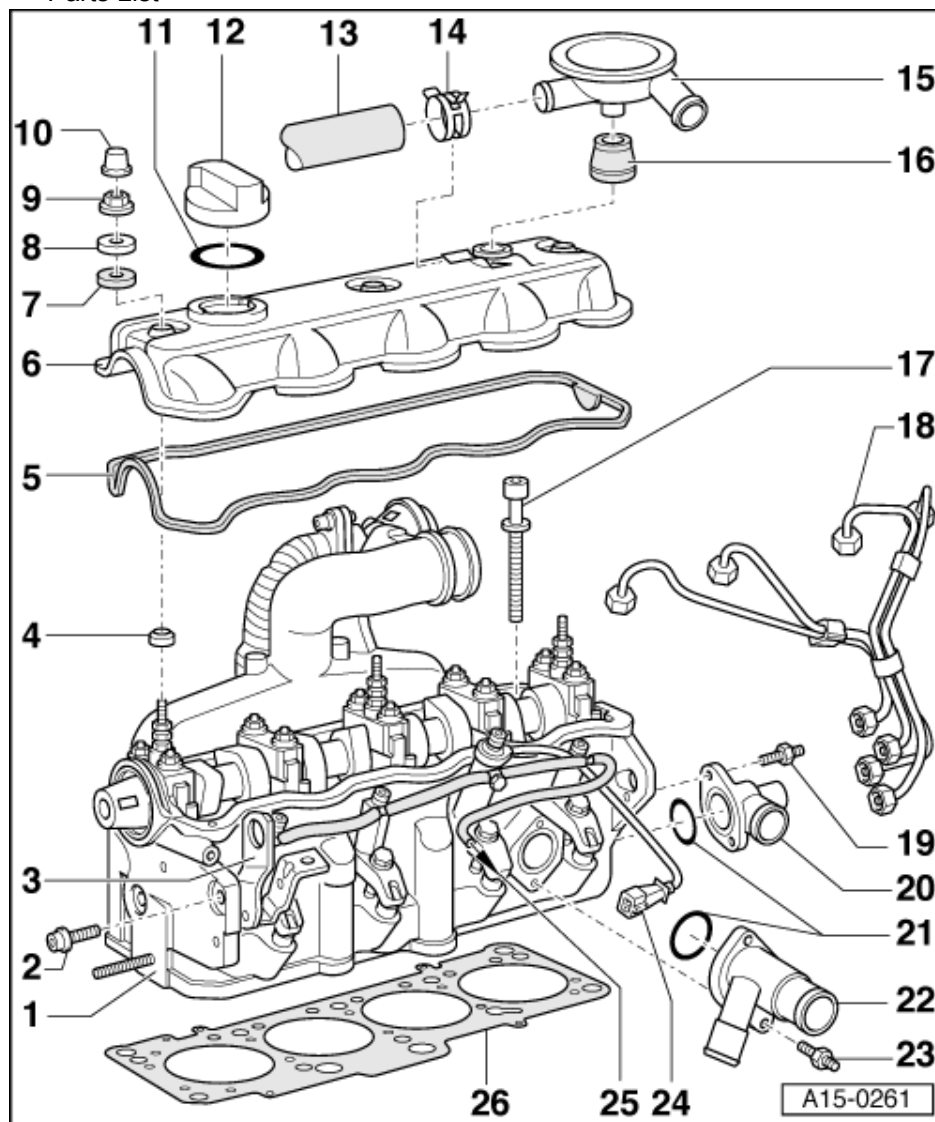
1 - Removing and installing cylinder head

1.1 - Removing and installing cylinder head

Notes:

- ◆ Cylinder heads with cracks can be used between the valve seats without reducing the service life if the cracks are slight and at the most 0.5 mm wide.
- ◆ When fitting a new cylinder head or cylinder head gasket, drain off all the old coolant and re-fill with new coolant.
- ◆ The cylinder heads on a diesel engine must not be reworked.
- ◆ When installing an exchange cylinder head with fitted camshaft, the contact surfaces between tappets and cams must be oiled after installing the head.
- ◆ The plastic protectors fitted to protect the open valves must only be removed immediately before fitting the cylinder head.
- ◆ Refer to current information when using sealant.

=> Parts List



1 Cylinder head

- ♦ Removing => Page 15-13
- ♦ Checking for distortion
=> Fig.15-6
- ♦ Installing =>Page 15-23
- ♦ After replacing, fill with fresh coolant

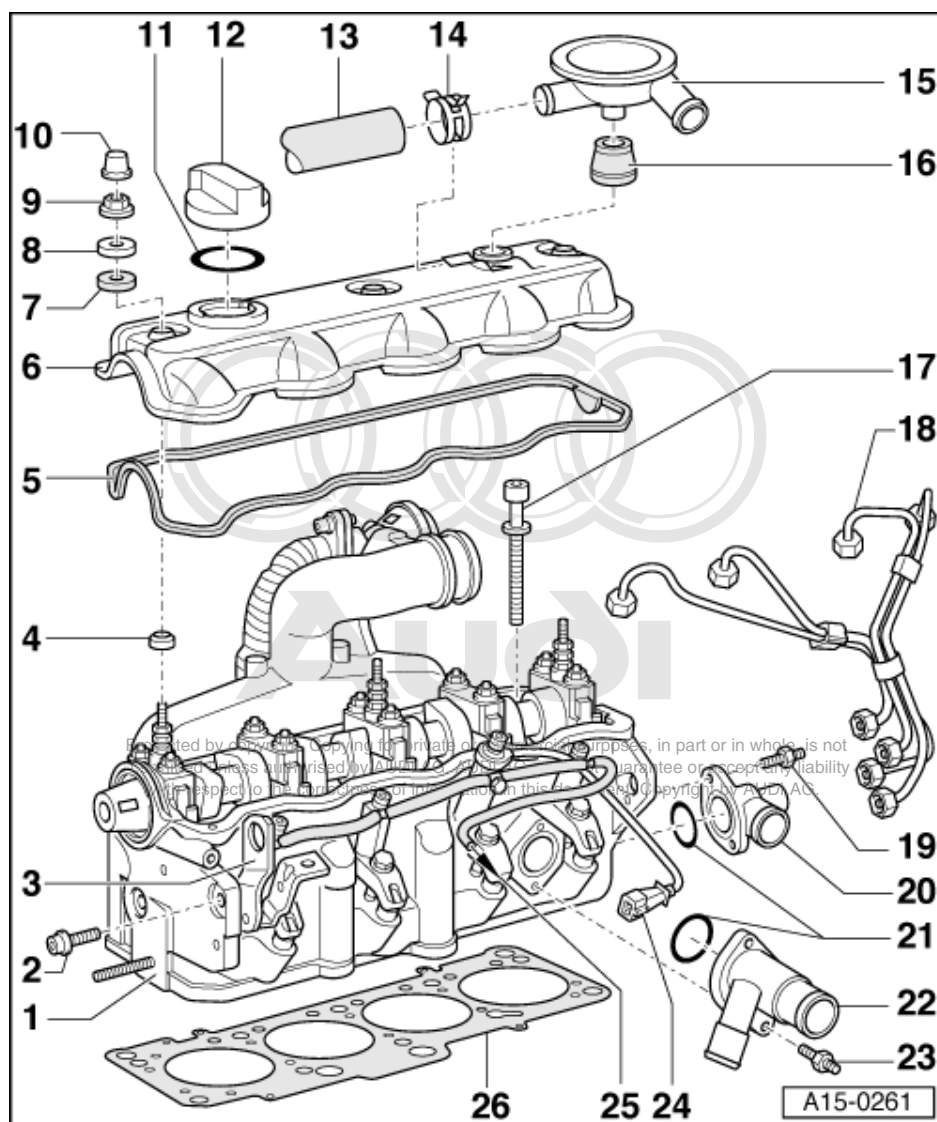
2 25 Nm

3 Lifting eye

4 Sealing cone on bottom

5 Cylinder head cover gasket

- ♦ Renew if damaged or leaking
- ♦ Before fitting gasket apply sealant at sealing points => Fig.15-7
- ♦ Install notches into bores on cylinder head



6 Cylinder head cover

- ♦ Removing and installing
=>Page 15-8.

7 Sealing washer on top

- ♦ Replace if damaged

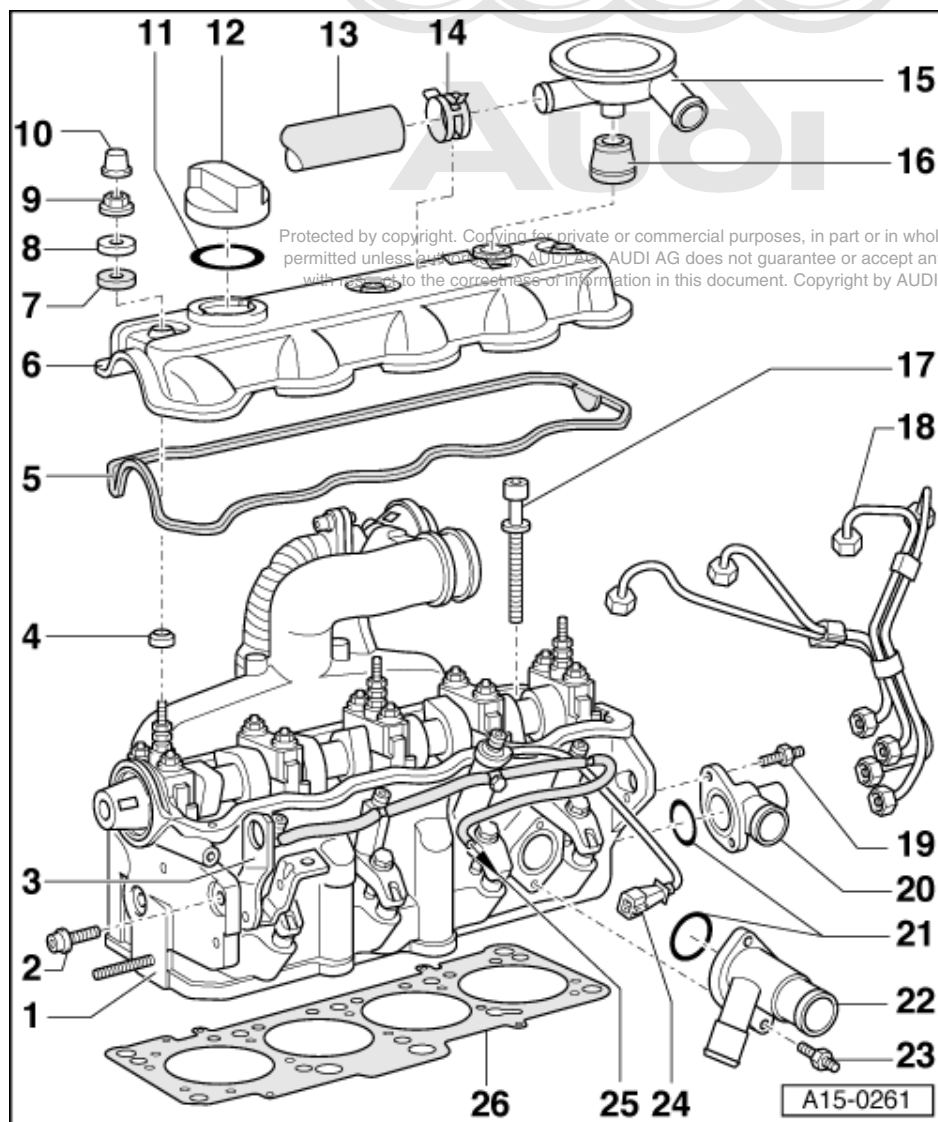
8 Disc washer

9 10 Nm

10 Trim cap

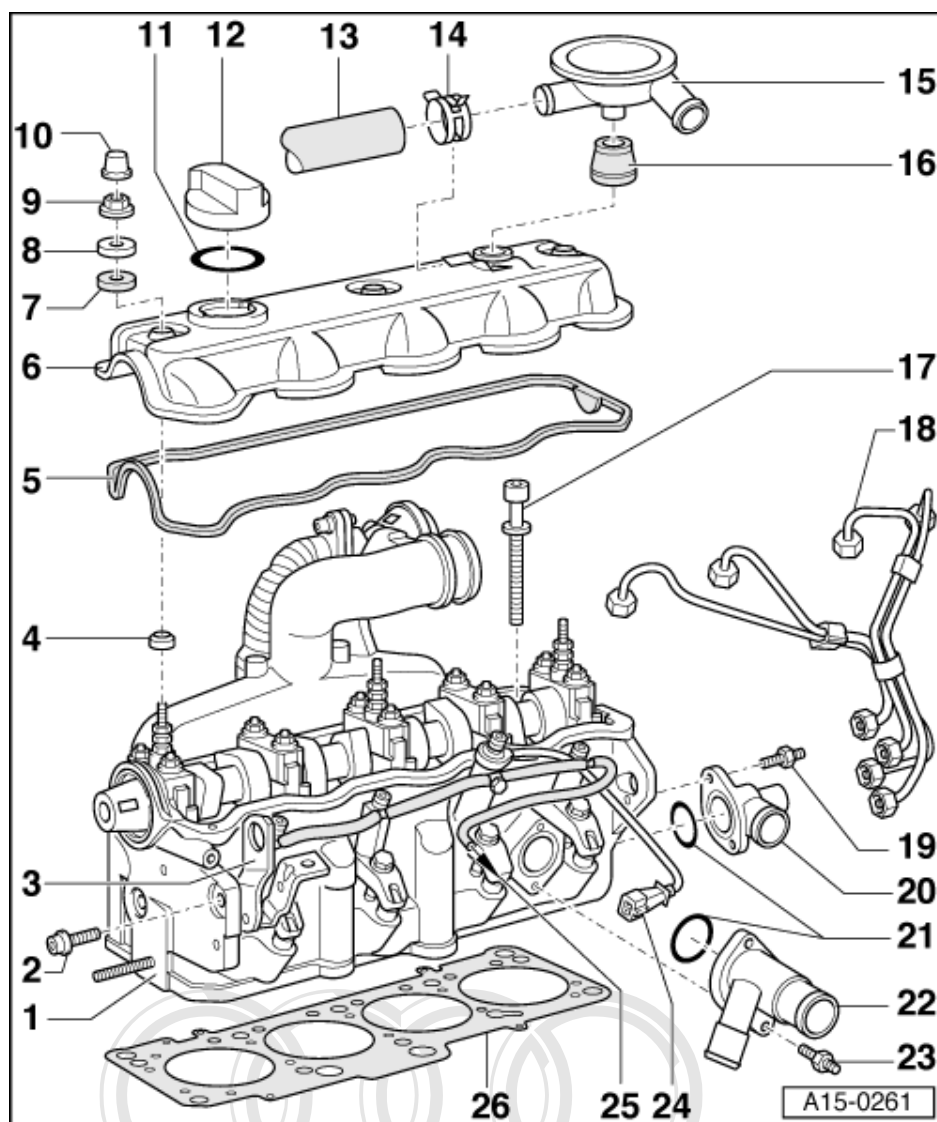
11 Seal

- ♦ Renew if damaged or leaking
- 12 Cap**
- 13 Breather hose**
- 14 Hose clamp**
 - ♦ Attach with hose to the retaining lug of the cylinder head cover



- 15 Pressure regulating valve**
 - ♦ For crankcase breather
- 16 Seal**
 - ♦ Replace if damaged
- 17 Cylinder head bolt**
 - ♦ Replace
 - ♦ Note sequence when loosening
=> Page 15-22
 - ♦ Note sequence when tightening
=> Page 15-26
- 18 Injector lines**
 - ♦ Tighten to 25 Nm
 - ♦ Remove using 3035
 - ♦ Always remove pipework as a complete unit
 - ♦ Do not alter shape
- 19 10 Nm**
- 20 Coolant flange**

- ♦ With coolant temperature sender



21 O-ring

- ♦ Replace

22 Coolant flange

23 10 Nm

24 Connector

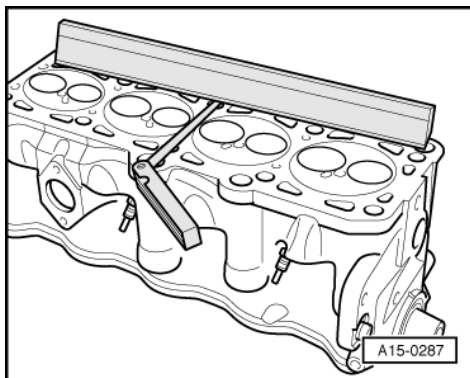
- ♦ For needle lift sender -G80

25 Return line

- ♦ To injection pump

26 Cylinder head gasket

- ♦ Different thicknesses
- ♦ Observe marking
=> Fig. 15-6
- ♦ Replace => Removing cylinder head. from Page 15-13 onwards
- ♦ Installation position: Marking "top" or part no. must face cylinder head
- ♦ After replacing, fill with fresh coolant

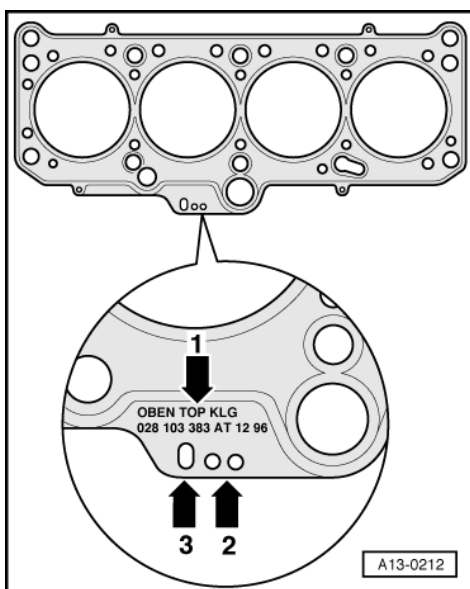


-> Fig.1 Checking cylinder head for distortion

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

Note:

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

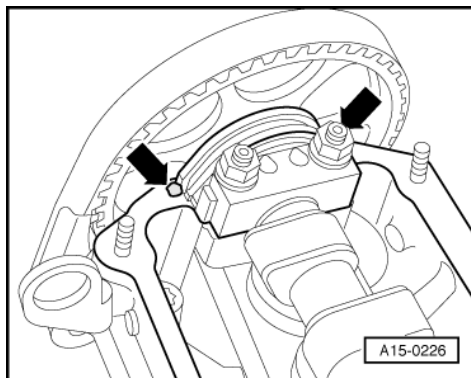


-> Fig.2 Cylinder head gasket marking

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

Notes:

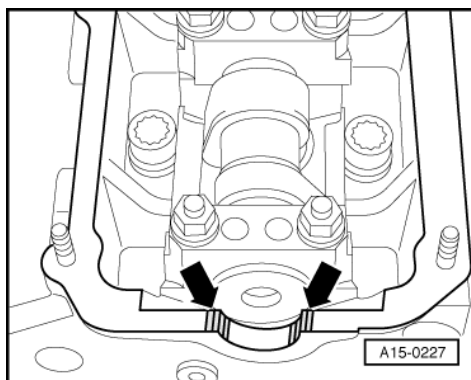
- ◆ Cylinder head gaskets of different thicknesses are fitted depending on the amount of piston projection => Page 13-65. When replacing just the gasket, the new gasket should have the same markings.
- ◆ Installation position: Marking "top" or part no. must face cylinder head



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

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

=> Parts List

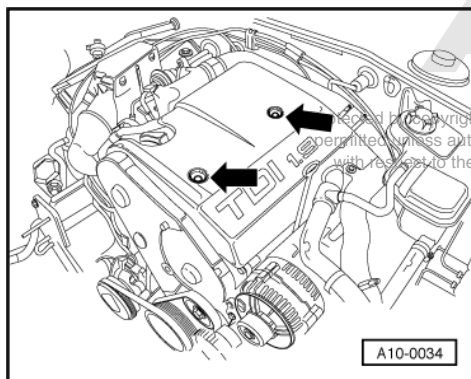


-> Fig.4 Applying sealant to sealing points

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

=> Parts List

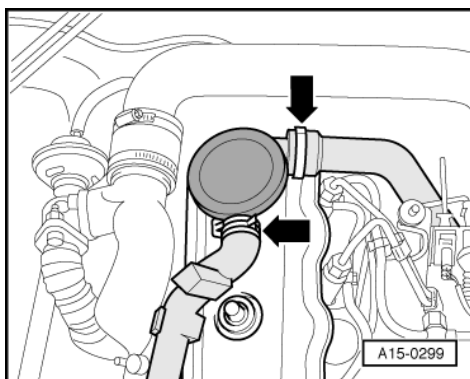
1.2 - Removing and installing cylinder head cover



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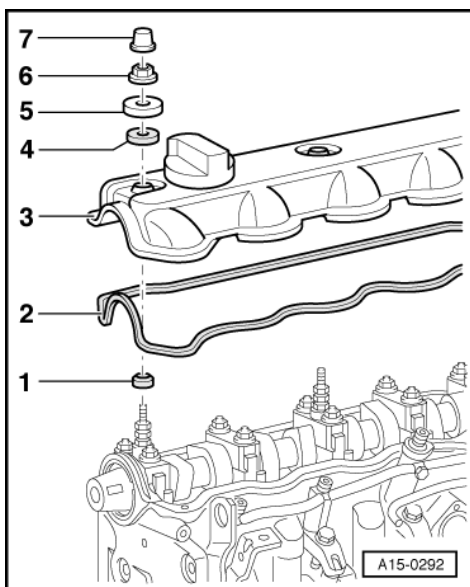
Removing

- -> Remove engine cover -arrows-.

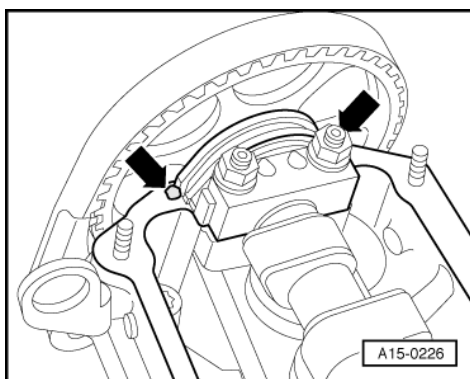


- -> Loosen hose clamps -arrows- and remove crankcase vent hoses at pressure regulating valve.

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- -> Detach trim caps -7-.
- Loosen nuts -6- on cylinder head cover.
- Remove the plate washer -5- and the upper sealing washer -4-.
- Remove the cylinder head cover -3-.
- Remove the gasket -2- and the lower sealing cone -1-.





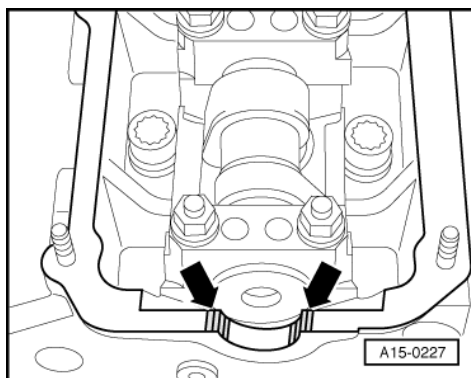
Installing

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

Note:

Replace gasket for cylinder head cover, upper sealing washer and sealing cone, if damaged.

- -> Apply a small quantity of sealant "AMV 174 004 01" to sides of joints -arrows- on upper sealing surface of cylinder head.



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

=> Parts List

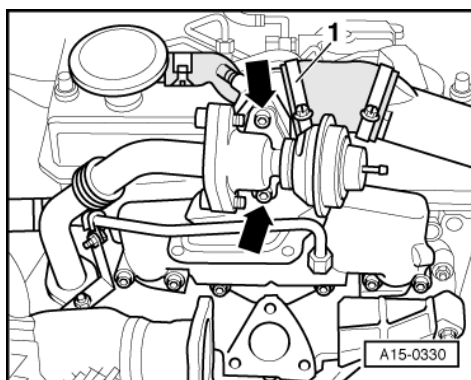
- Position cylinder head cover with parts.

Tightening torque

Component	Nm
Cylinder head cover to cylinder head	10

1.3 - Removing and installing intake pipe

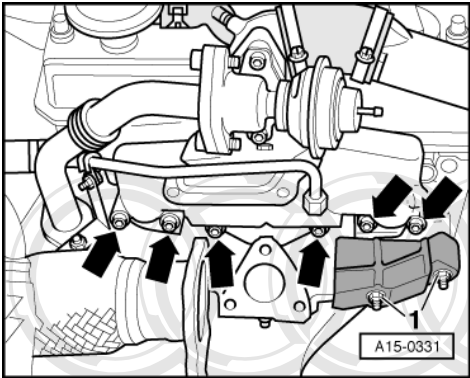
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Removing

- Remove turbocharger=> Page 21-34.
- -> Loosen hose clamp -1-.

- Unscrew bolts -arrows-.



- -> Unscrew nuts -1- and detach heat shield.
- Unscrew bolts -arrows-.
- Detach the intake pipe.

Installing

Installation is in reverse order.

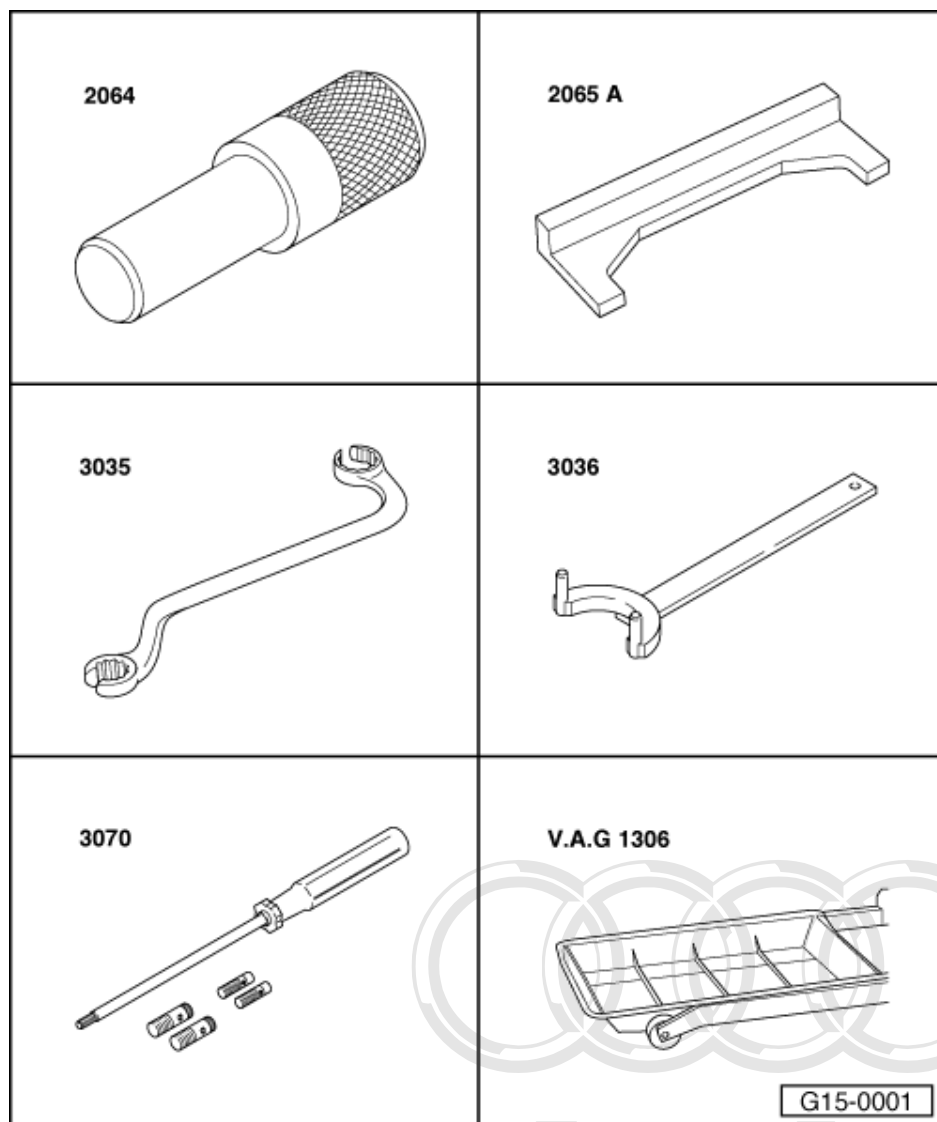
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Tightening torques

Component	Nm
Intake pipe to cylinder head	25
Heat shield to exhaust manifold	25
Mechanical exhaust gas recirculation valve to intake pipe	25



1.4 - Removing cylinder head



Special tools and workshop equipment required

- ♦ Mandrel 2064
- ♦ Setting bar 2065 A
- ♦ Ring spanner 3035
- ♦ Counterhold 3036
- ♦ Guide pin 3070
- ♦ V.A.G 1306

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Procedure

- Engine in vehicle

Note:

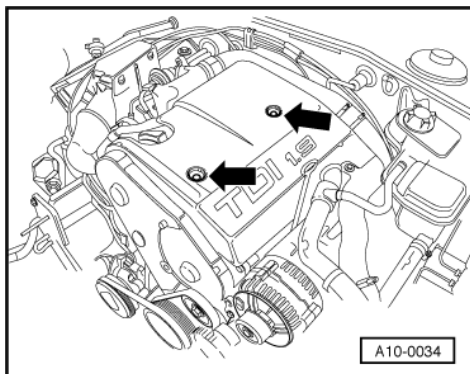
All cable ties which are released or cut open when removing must be fitted in the same position when installing.

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

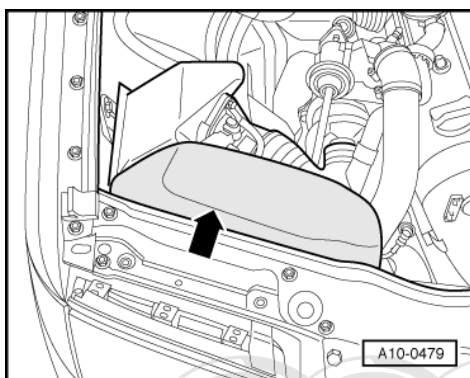
Important

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

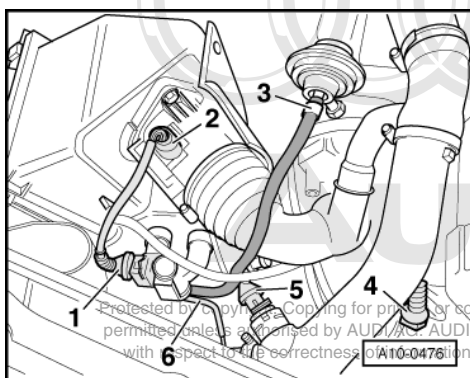
- Open the cover of the coolant expansion tank



- -> Remove engine cover -arrows-.



- -> Remove air intake pipe -arrow- between lock carrier and air cleaner housing.

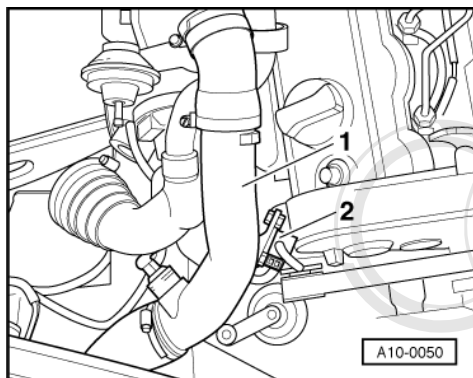


- -> Disconnect wires/unplug connectors:

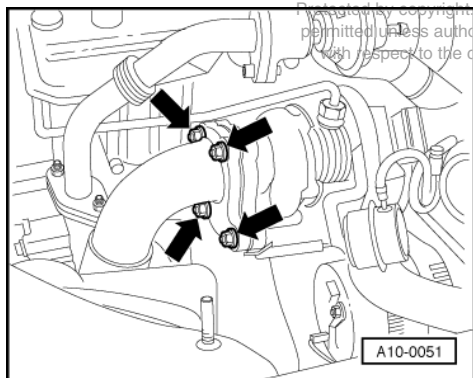
- 1 - EGR valve -N18
- 2 - Air mass meter -G70
- 4 - Solenoid valve for boost pressure limitation -N75
- 5 - Intake manifold temperature sender -G72

- Disconnect vacuum hose at mechanical exhaust gas recirculation valve -3-.
- Disconnect the thin hose -6- at the bottom at the exhaust gas recirculation valve -N18.
- Lay wiring and hoses aside.
- Remove the air hose at the air mass meter.

- Remove upper section of air cleaner housing and air mass meter.



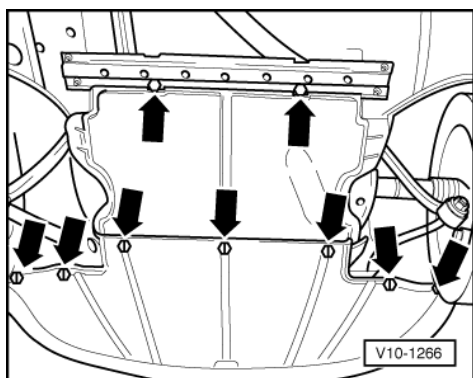
- -> Unscrew solenoid valve for boost pressure control -2- from air intake pipe -1-. Do not detach hoses.
- Remove air intake pipe -1- between charge air cooler and intake pipe.
- Remove intake air hose from charge air cooler to turbocharger.



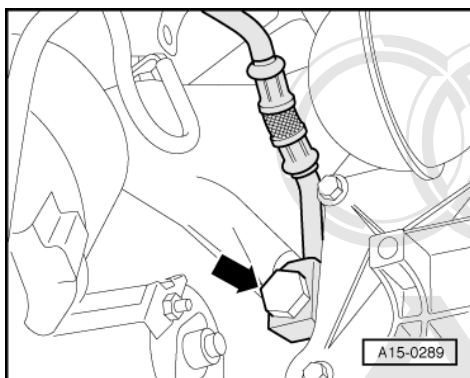
- -> Remove the securing bolts -arrows- of the turbocharger/catalytic converter.
- Detach the front exhaust pipe with the catalytic converter from the turbocharger.

Note:

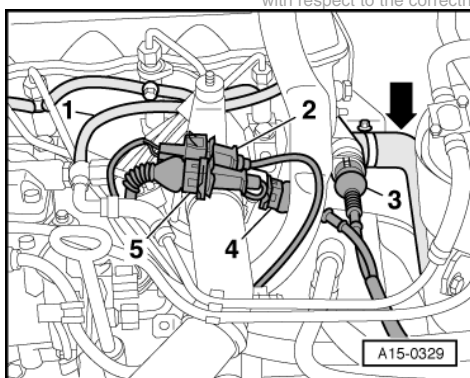
Secure flange of front exhaust pipe to the right suspension strut dome using wire. It is then not necessary to remove the front exhaust pipe.



- -> Remove noise insulation (two sections) -arrows-.



- Place drip tray underneath.
 - -> Detach the oil return line at cylinder block -arrow-.
 - Drain coolant => Page 19-4.
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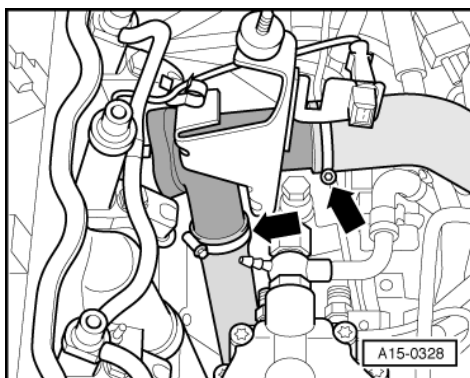


- -> Detach fuel return hose -1- for injectors/injection pump.
- Unplug connectors -2 ... 5-.
- Unplug connector for the engine speed sender at the bracket.
- Disconnect rear coolant hose from cylinder head -arrow-.
- Remove injector pipes.

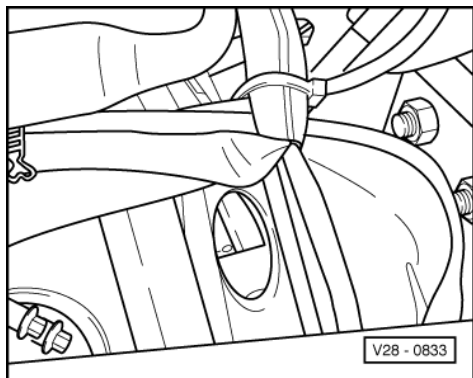
Note:

Always remove complete set of injection pipes. Use injector pipe spanner 3035.

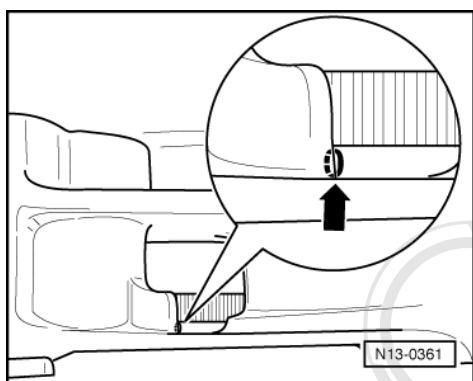
- Detach the glow plug connectors from the glow plugs.



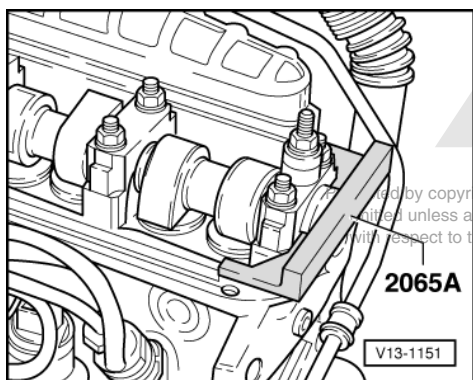
- -> Disconnect coolant hoses -arrows- from cylinder head (left side).
- Remove cylinder head cover => Page 15-8.



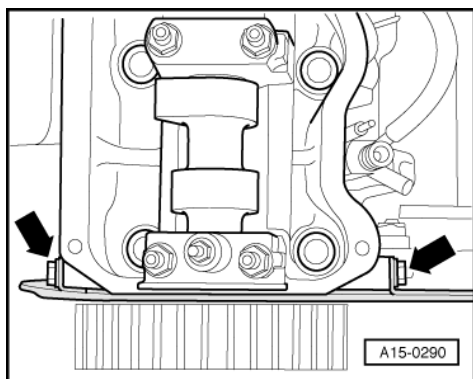
- -> Turn crankshaft to TDC No. 1 cylinder -arrow- (vehicles with manual gearbox).



- -> Turn crankshaft to TDC No. 1 cylinder -arrow- (vehicles with automatic gearbox).

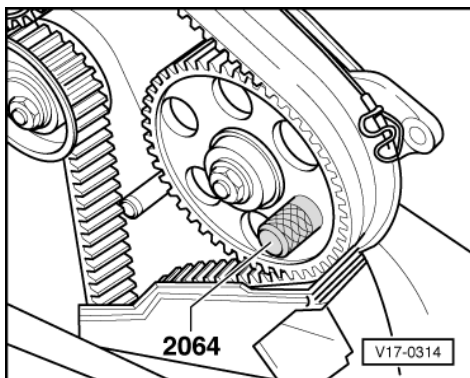


- -> Lock the camshaft with setting bar 2065 A.

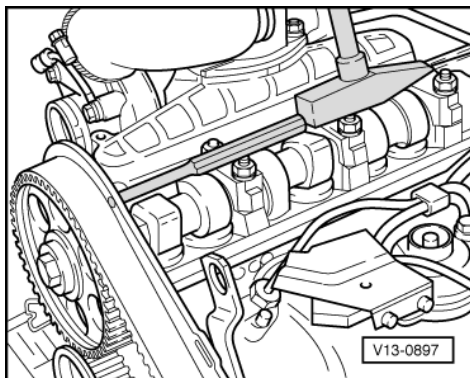


- Remove upper toothed belt protection => Page 13-14

- -> Unscrew 2 toothed belt guard bolts -arrows- at rear on both sides of the cylinder head.



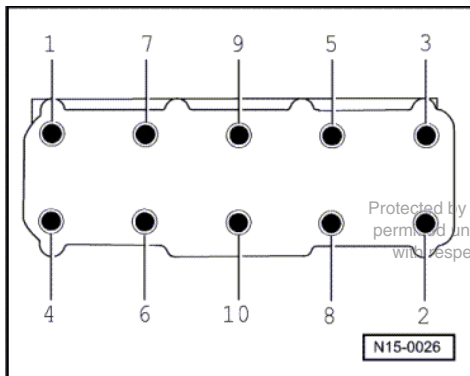
- -> Lock injection pump sprocket using mandrel 2064.
- Mark direction of rotation of toothed belt with chalk or felt pen.
- Slacken tensioning roller.
- Remove the idler wheel.
- Take toothed belt off camshaft sprocket.
- Remove toothed belt tensioning roller.



Note:

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

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

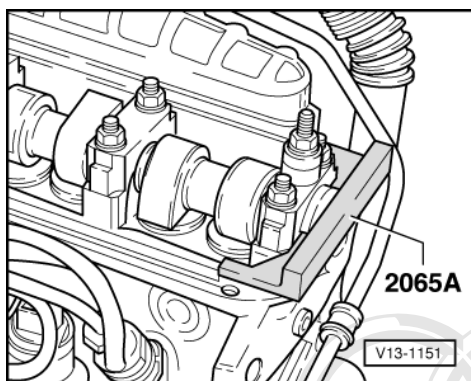


- -> Maintain sequence when loosening cylinder head bolts.
- Slightly raise the cylinder head with the aid of a second mechanic and pivot it out to the rear.

1.5 - Installing cylinder head

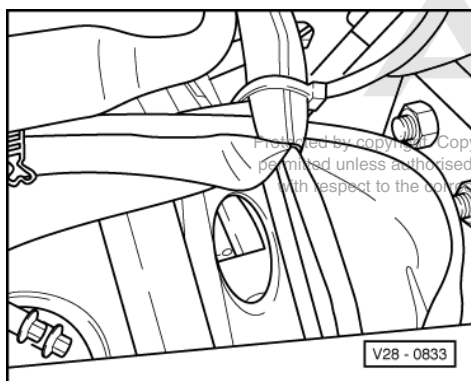
Notes:

- ♦ Replace the cylinder head bolts.
- ♦ When performing repairs, replace seals, gaskets, self-locking nuts and bolts which have a specified tightening angle.
- ♦ If repairing, carefully remove any remains of gasket material from the cylinder head and cylinder block. Make sure that no long scores or scratches are made on the surfaces.
- ♦ Carefully remove any remaining emery and abrasive material.
- ♦ No oil or coolant must be allowed to remain in the blind holes for the cylinder head bolts in the cylinder head.
- ♦ Remove new cylinder head gasket from packaging, just before installation.
- ♦ Handle gasket extremely carefully. Damaging the silicone layer or the indented area will lead to leaks.
- ♦ After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.



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

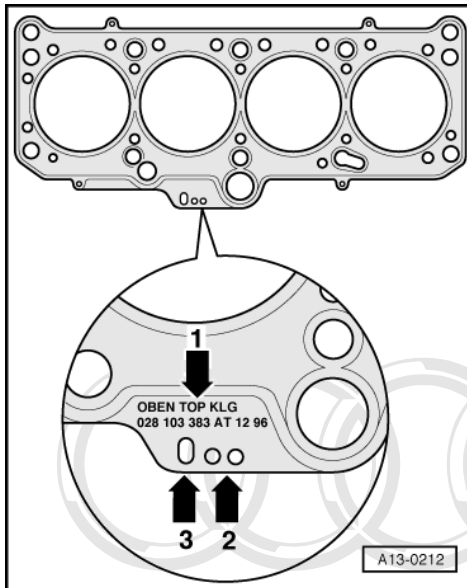
- -> Before positioning cylinder head, set crankshaft and camshaft to TDC of No. 1 cylinder. It must be possible to insert setting bar 2065 A in the camshaft ...



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

Note:

Illustration shows vehicle with manual gearbox.

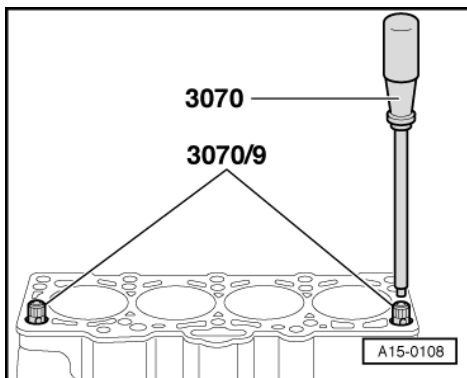


- -> Note markings on cylinder head gasket.
- Part-No. = arrow 1
- Holes = arrow 2
- Production control code = arrow 3 (can be disregarded.)

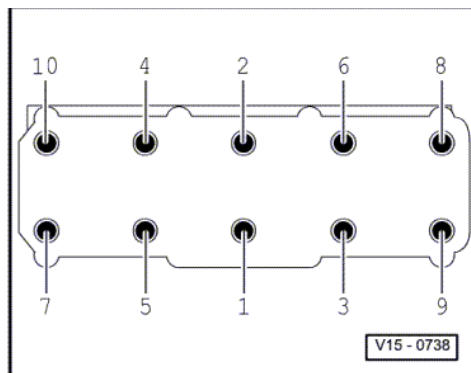
Notes:

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- ◆ 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 13-65.



- -> To centralise, screw guide pins 3070/9 from 3070 into the outer cylinder block holes.
- Place cylinder head gasket in position.
 - Note centring sleeve in cylinder block.
 - Check installation position of cylinder head gasket: mark "top" or the part No. must face cylinder head.
- Position cylinder head.
- Fit 8 cylinder head bolts and tighten by hand.
- Unscrew guide pins with removal tool from 3070 through bolt holes in cylinder head and install remaining cylinder head bolts.



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

Note:

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

- Install toothed belt (adjust valve timing) => Page 13-25.

Note:

Observe all instructions on removing and installing the toothed belt => from Page 13-20.

- Install cylinder head cover => Page 15-10.
- Stress-free alignment of exhaust system => Page 26-10
- Replace coolant => Page 19-7.

Note:

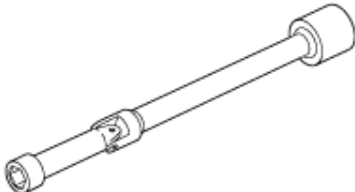
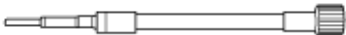
When the battery is reconnected make sure that the vehicle equipment (radio, clock, electrical window lifter) is activated according to the operating instructions.

Tightening torques

Component	Nm
Catalytic converter to turbocharger	25
Oil return line to cylinder block	30
Injector pipes to injectors/injection pump	25
Idler wheel to console	25
Toothed belt sprocket to camshaft	45
Hose clamps	2

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1.6 - Checking compression

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

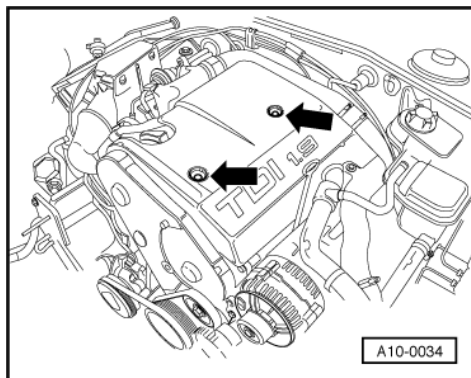
Special tools and workshop equipment required

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

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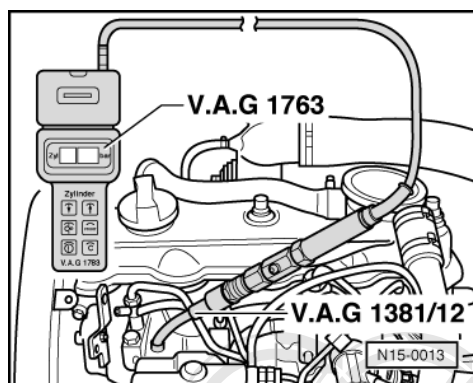
Test requirements:

- Engine oil temperature at least 30 °C
- Battery voltage at least 12 V



Test sequence

- -> Remove engine cover -arrows-.
- Detach connector for fuel cut-off valve at the injection pump.
- Detach connector at quantity adjuster of injection pump.
- Remove all glow plugs using flexible-head spanner 3220.



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

Note:

Using the compression tester

=> Operating Instructions

- Operate starter until tester shows no further pressure increase.

Compression values:

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New pressure in bar	Wear limit pressure in bar	Permissible difference between cyl. pressure in bar
25...31	19	max. 5

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

=> Diesel Direct Injection and Glow Plug System (TDI 4-cylinder); Repair group 01; Interrogating and erasing fault memory Interrogating and erasing fault memory

Note:

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

Tightening torque

Component	Nm
Glow plugs to cylinder head	15

2 - Servicing valve gear

2.1 - Servicing valve gear

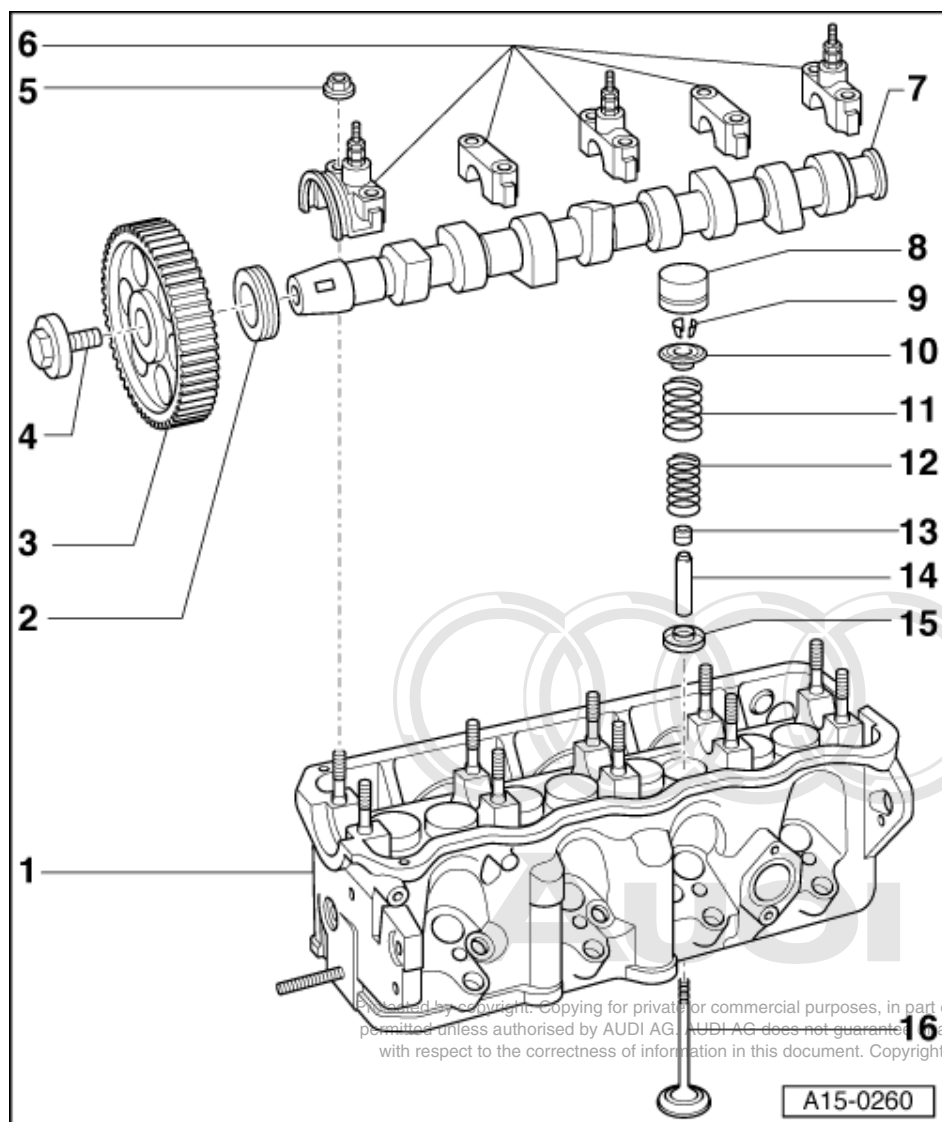
Notes:

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

=> Parts List



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1 Cylinder head

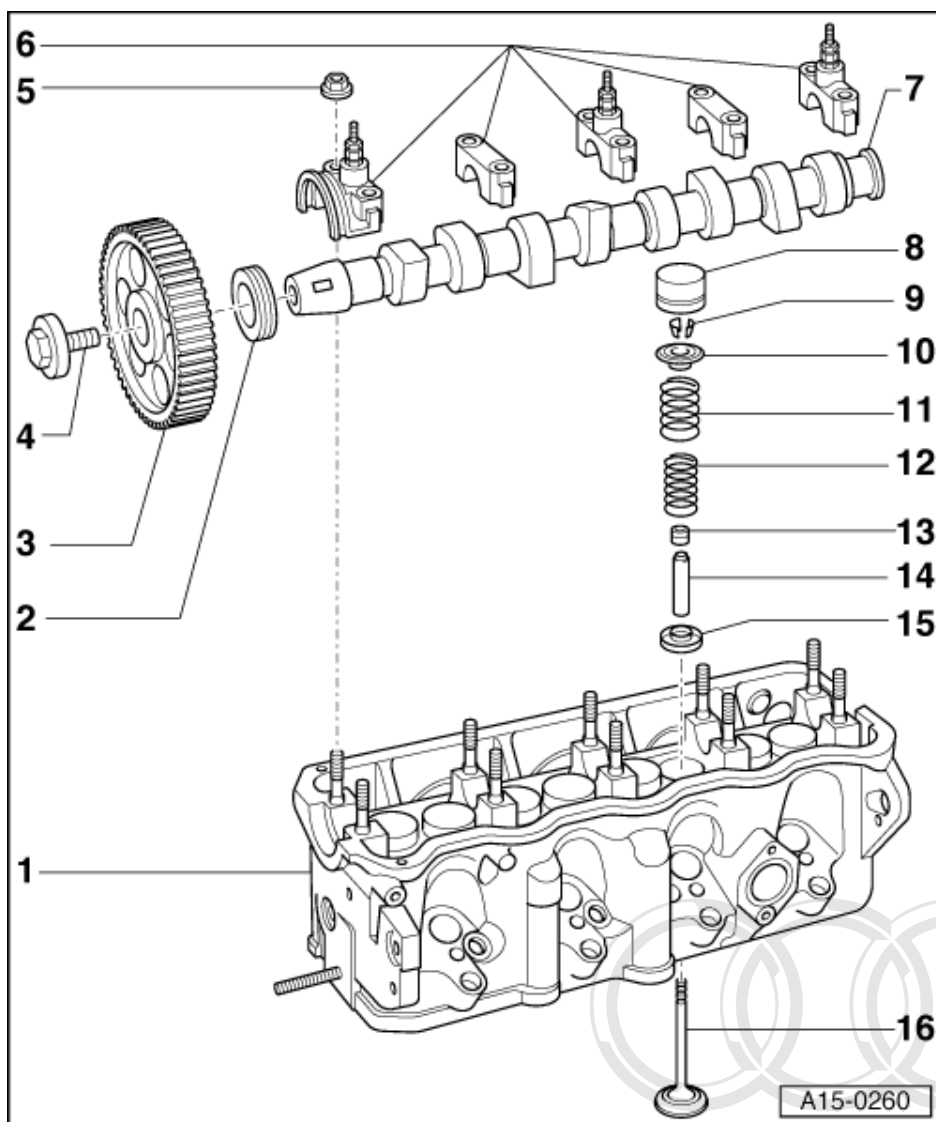
- ◆ See note =>Page 15-32.
- ◆ Checking valve guides
=>Page 15-58.
- ◆ Rework valve seats
=>Page 15-55.

2 Sealing ring

- ◆ To remove and install, remove bearing cap and camshaft sprocket
- ◆ Removing and installing toothed belt =>Page 13-25

3 Camshaft sprocket

- ◆ For removal and installation, remove toothed belt =>Page 13-25
- ◆ Release from camshaft taper by tapping pin through hole on toothed belt guard using hammer



4 45 Nm

- ♦ Counter hold with 3036 to loosen and tighten

5 20 Nm

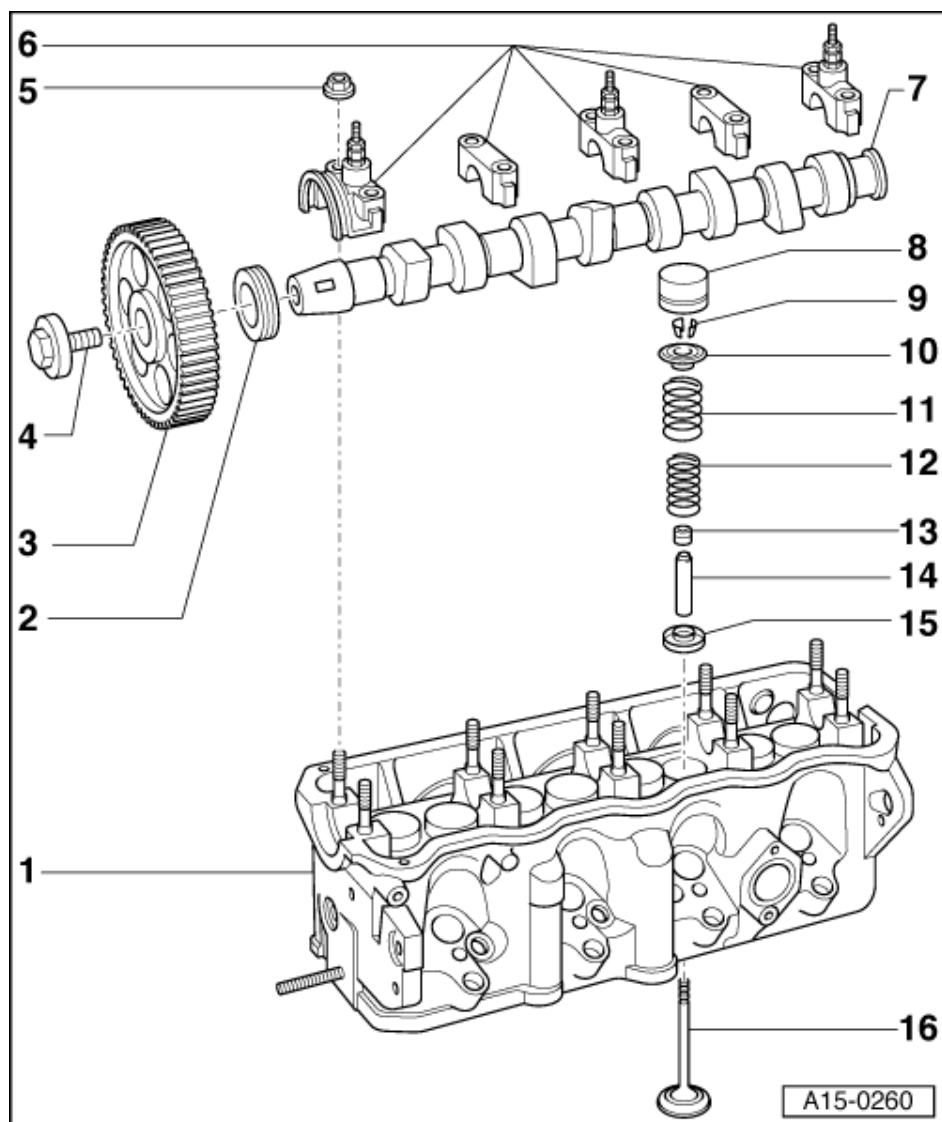
6 Bearing cap

- ♦ Installation position
=> Fig. 15-38
- ♦ Installation sequence
=> Page 15-40, Removing and installing camshaft
- ♦ Before installation, apply thin coating of sealant to contact surfaces of bearing cap no. 1
- ♦ Sealants

=> Parts List

- ♦ Applying sealant to sealing points => Fig. 15-7

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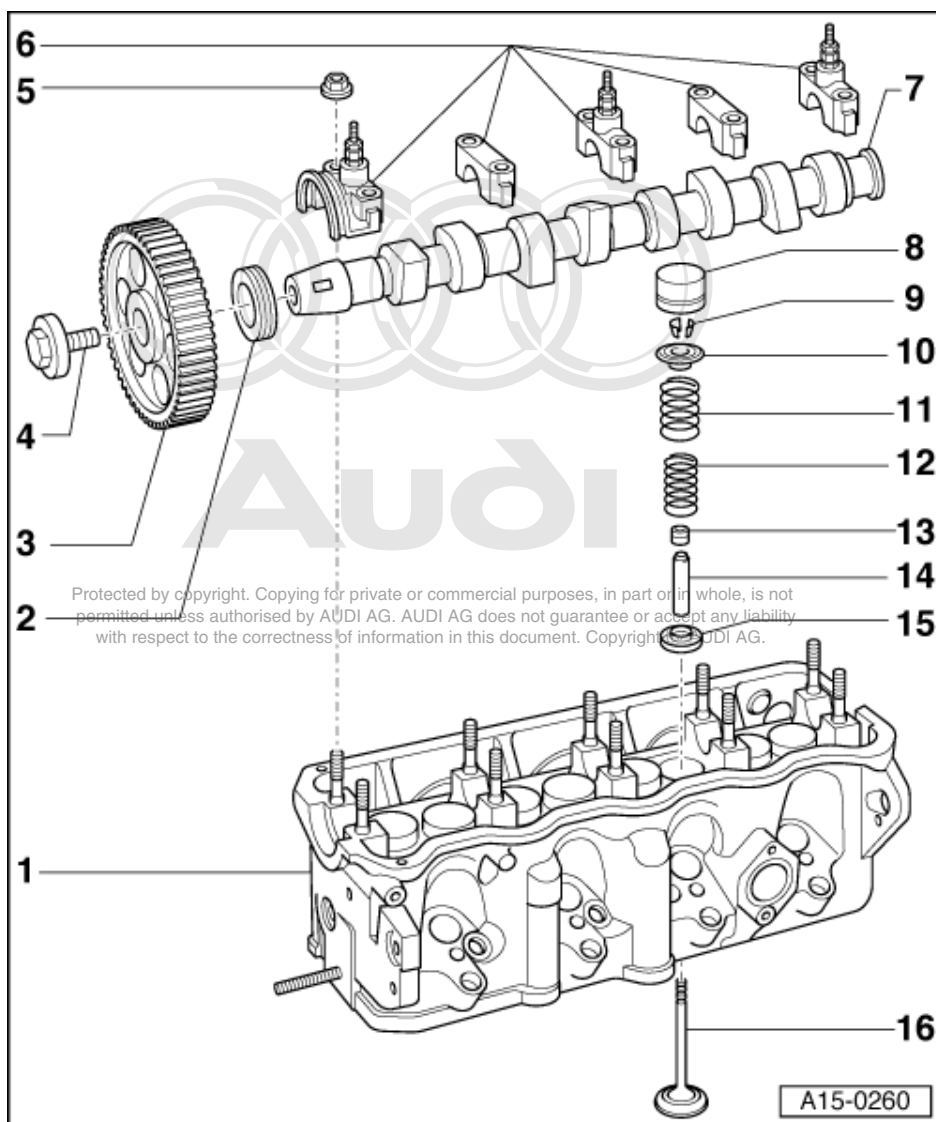
7 Camshaft

- ♦ Checking axial play
=>Page 15-39.
- ♦ Removing and installing
=>Page 15-40.
- ♦ Checking radial play with Plastigage
Wear limit: 0.11 mm
- ♦ Run-out: no more than 0.01 mm

8 Hydraulic bucket tappet

- ♦ Checking => Page 15-46
- ♦ Removing and installing
=>Page 15-48.
- ♦ Do not interchange
- ♦ Store with cam contact surface downwards
- ♦ Before installing check camshaft axial play=>Page 15-39.
- ♦ Oil contact surface

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9 Valve cotters

10 Upper valve spring bracket

11 Exterior valve spring

- ♦ Removing and installing:
 Cylinder head
 removed: with 2037
 installed: =>Page 15-48.

12 Inner valve spring

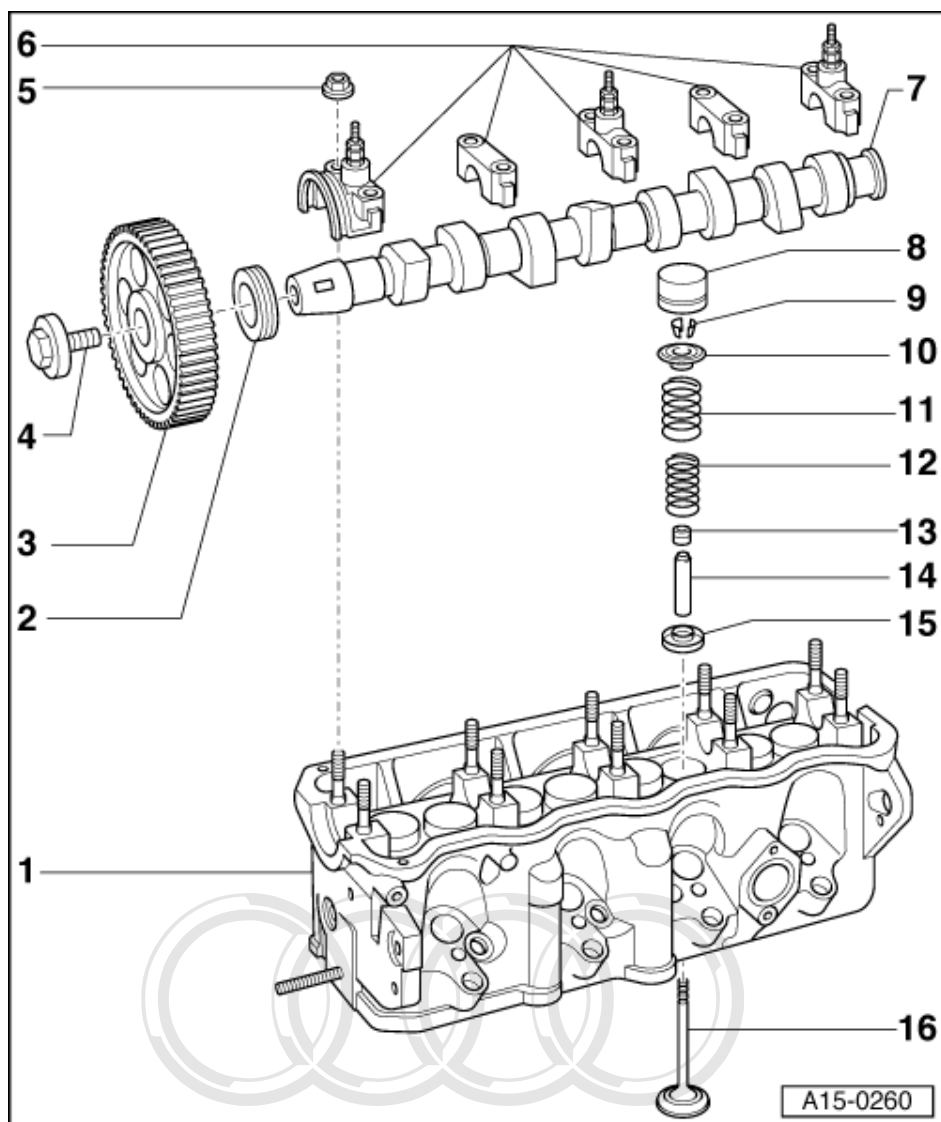
- ♦ Removing and installing:
 Cylinder head
 removed: with 2037
 installed: =>Page 15-48.

13 Valve stem seal

- ♦ Replacing => Page 15-48.

14 Valve guide

- ♦ Checking => Page 15-58
- ♦ When exceeding wear limit replace cylinder head



15 Lower valve spring retainer

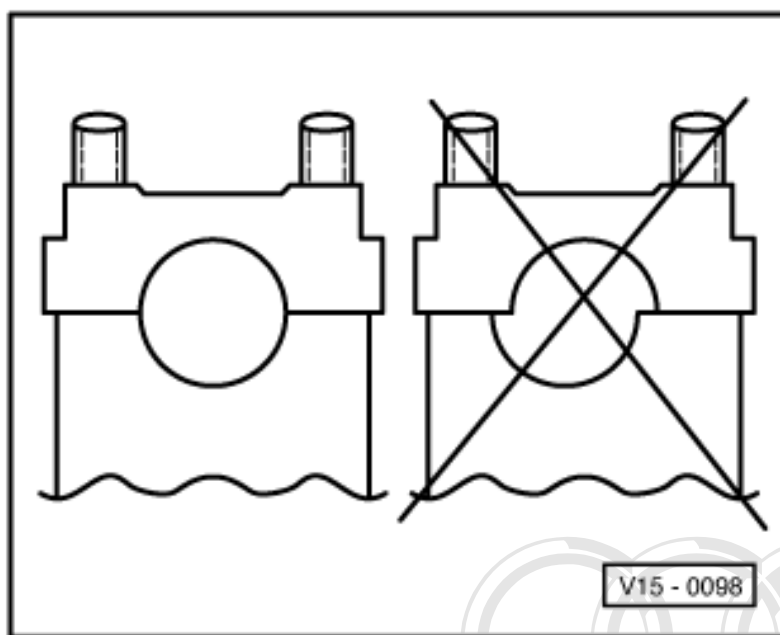
- ◆ Remove and install with puller 3047 A

16 Valve

- ◆ Do not rework only grinding in is permitted
- ◆ Valve dimensions

=> Fig.15-38

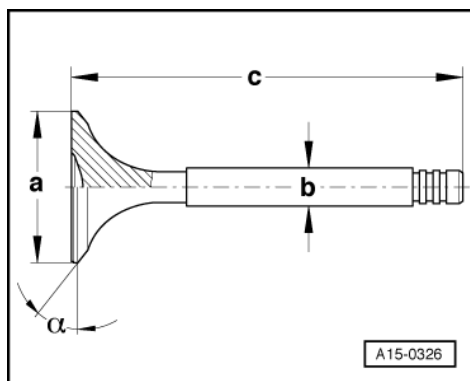
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-> Fig.1 Installation position of camshaft bearing caps

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

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-> Fig.2 Valve dimensions

Note:

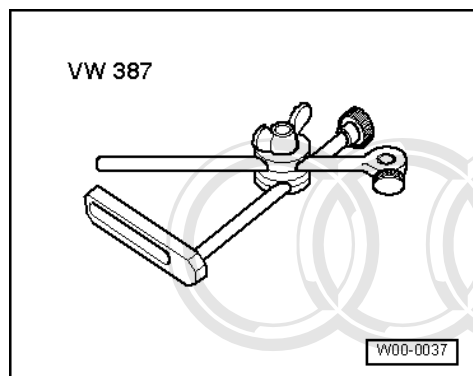
Valves must not be reworked. Only grinding in is permitted.

Dim.	Inlet valve	Exhaust valve
øa mm	35.95	31.45
øb mm	6.963	6.943
c mm	96.85	96.85



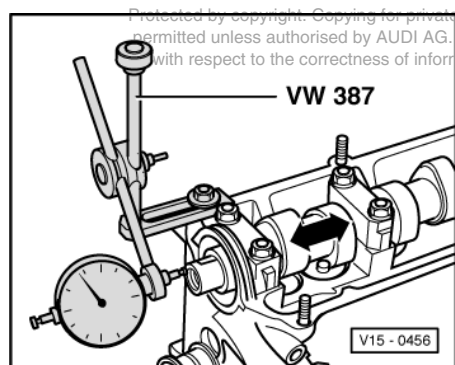
Dim.	Inlet valve	Exhaust valve
α <°	45	45

2.2 - Checking camshaft axial play



Special tools and workshop equipment required

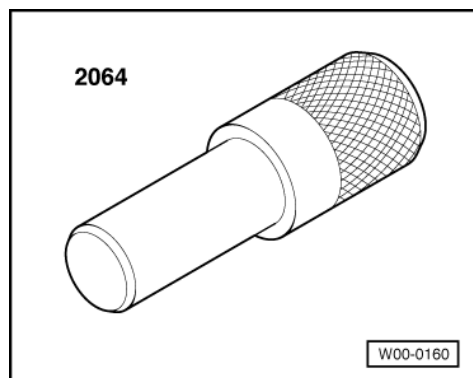
- ♦ Special tool VW 387
- ♦ Dial gauge



Test sequence

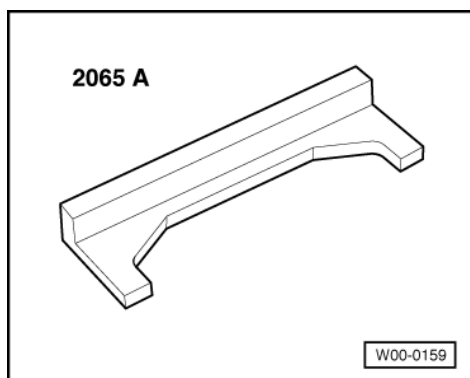
- -> Measure with bucket tappets removed and with first and last bearing caps fitted.
- Wear limit: no more than 0.15 mm

2.3 - Removing and installing camshaft

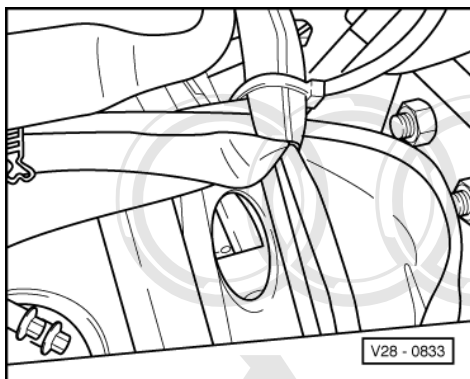


Special tools and workshop equipment required

- ♦ Mandrel 2064

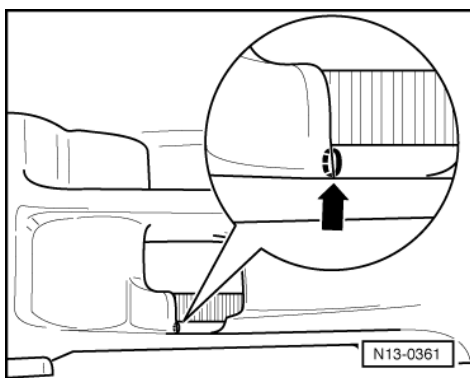


- ♦ Setting bar 2065 A

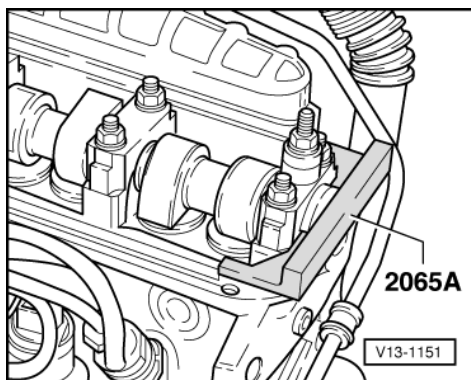


Removing

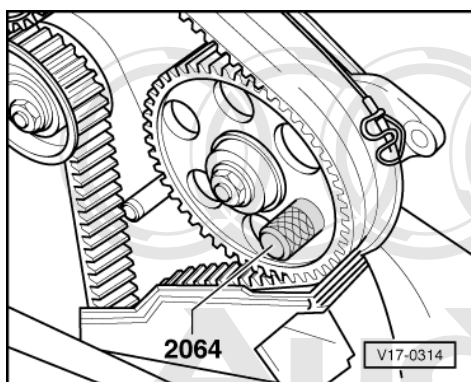
- Cylinder head installed
- Remove upper toothed belt guard => Page 13-14.
- Remove cylinder head cover => Page 15-8.
- -> Turn crankshaft to TDC No. 1 cylinder -arrow- (vehicles with manual gearbox).



- -> Turn crankshaft to TDC No. 1 cylinder -arrow- (vehicles with automatic gearbox).



- -> Lock the camshaft with setting bar 2065 A.



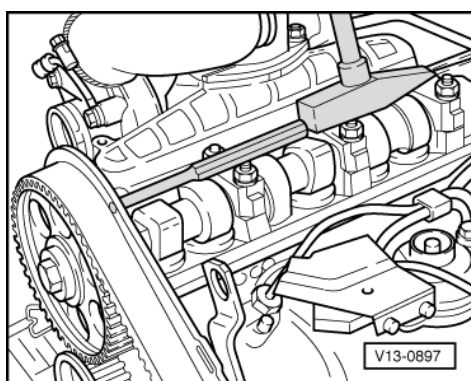
- -> Lock injection pump sprocket using mandrel 2064.
- Mark direction of rotation of toothed belt with chalk or felt pen.

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Note:

If the belt runs in the opposite direction when it is refitted, this can cause breakage.

- Slacken tensioning roller.
- Remove the idler wheel.
- Take toothed belt off camshaft sprocket.

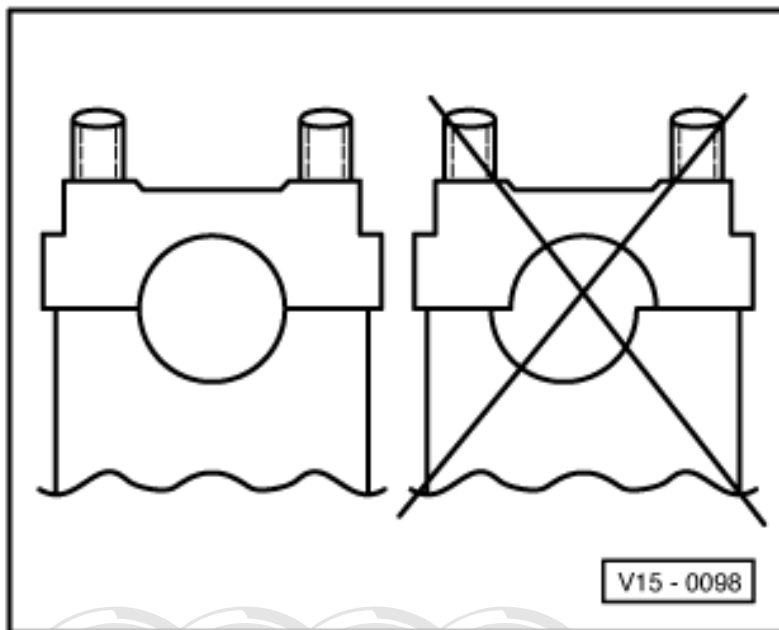


Note:

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

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

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



Installing

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

Notes:

- ◆ Renew camshaft oil seal.
 - ◆ When installing the camshaft, No. 1 cylinder cams must point upwards.
 - ◆ -> Before installing bearing caps, note bore offset and determine installation position.
- Oil camshaft running surfaces.
 - Tighten bearing caps 2 and 4 alternately and diagonally to 20 Nm.
 - Install bearing caps 5, 1 and 3 and also tighten to 20 Nm.
 - Install toothed belt (adjust valve timing) => Page 13-25.

Notes:

- ◆ Observe all instructions on removing and installing the toothed belt => from Page 13-20.
 - ◆ 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.
- Install cylinder head cover => Page 15-10.
 - Perform dynamic start of injection test

=> Diesel Direct Injection and Glow Plug System (TDI 4-cylinder); Repair group 01; Interrogating and erasing fault memory



Tightening torque

Component	Nm
Bearing cap to cylinder head	20

2.4 - Checking hydraulic bucket tappets

Special tools and workshop equipment required

- ♦ Feeler gauge
- ♦ Wood or plastic wedge

Notes:

- ♦ Hydraulic tappets cannot be adjusted or repaired.
- ♦ Irregular valve noise during starting is normal.

Test sequence

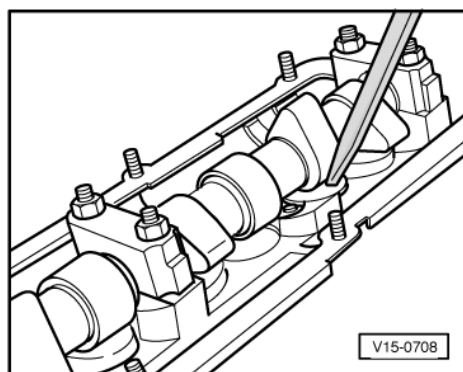
- Start engine and leave it running until coolant temperature has reached approx. 80 °C.
- Increase engine speed to about 2500 rpm for 2 minutes (perform road test if necessary).

Note:

If the irregular valve noises stop but recur repeatedly during short journeys, a new oil retention valve must be fitted. Oil retention valve fitting location: In oil filter bracket.

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

- Remove cylinder head cover => Page 15-8.
- Turn crankshaft until cams of cylinder to be checked are pointing upwards.
- Determine play between cam and tappet.



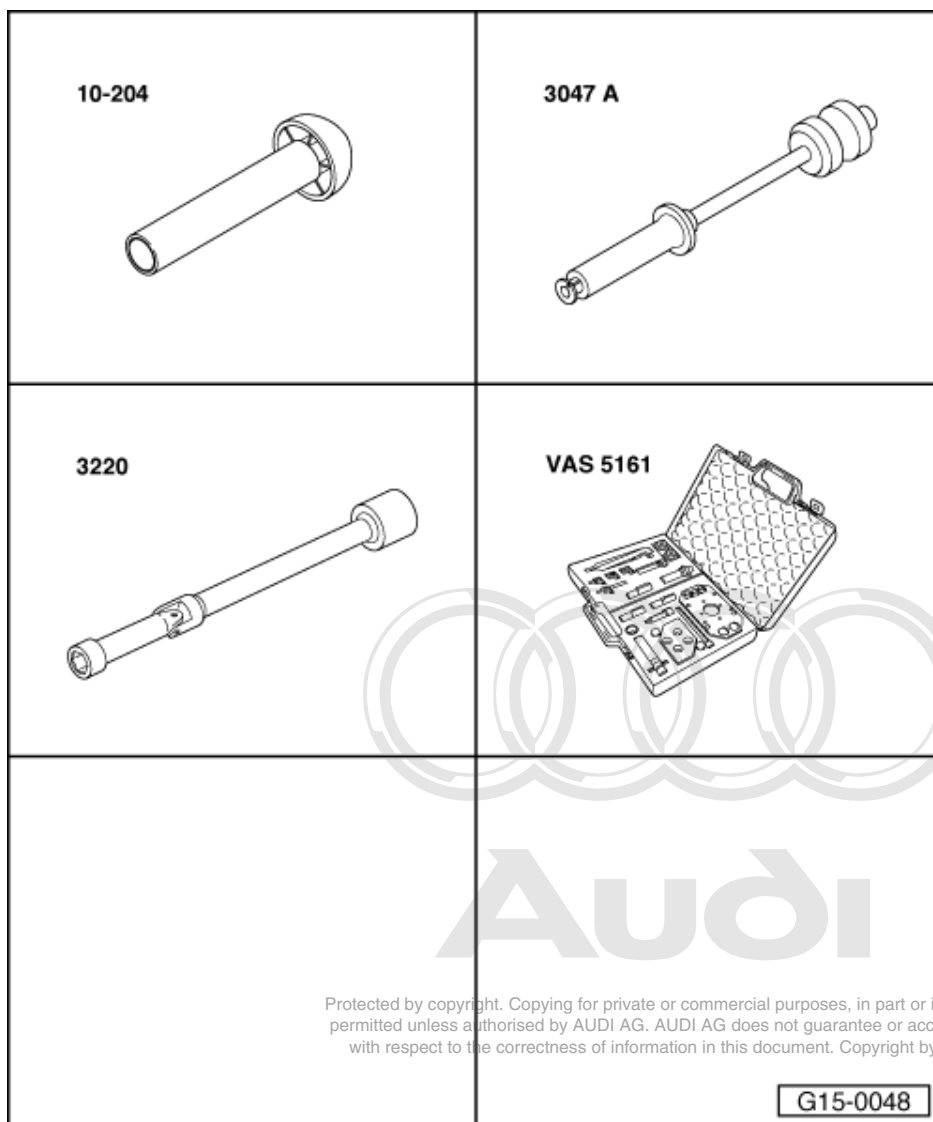
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- -> Use a wooden or plastic wedge to push down bucket tappet. If an 0.20 mm feeler gauge can be inserted between camshaft and tappet, renew tappet.
- Replacing bucket tappet => Removing camshaft, Page 15-40.

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.

2.5 - Replacing valve stem seals



Special tools and workshop equipment required

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

Removing

- Cylinder head installed

Note:

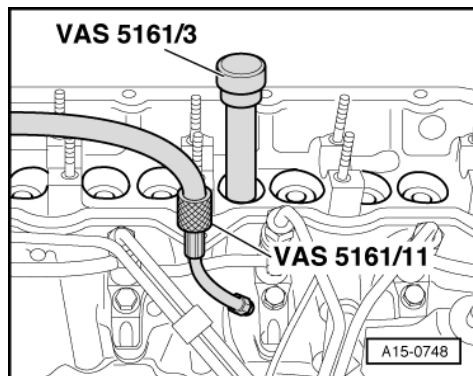
When cylinder head was removed the valve stem seals can be replaced when using special tool 2037.

- Removing camshaft => Page 15-40.

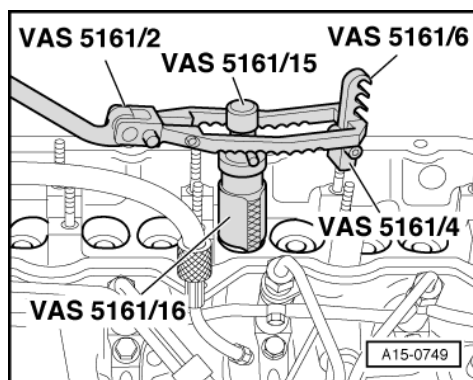
Notes:

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

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



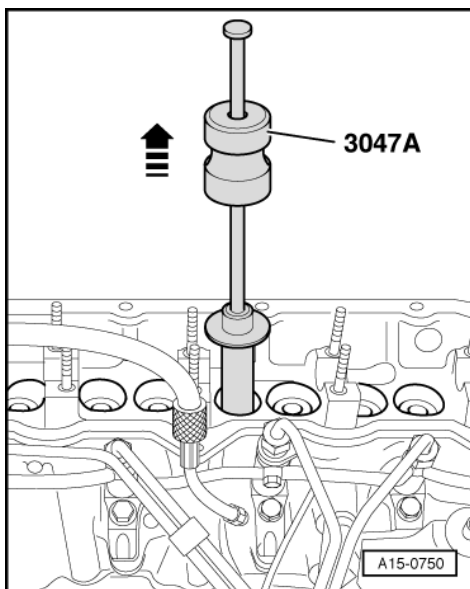
- -> Install pin VAS 5161/3 into bucket tappet guide.
- Knock valve wedges of all valves loose using a plastic hammer.
- Unplug connector console from glow plugs.
- Remove all glow plugs using flexible-head spanner 3220.
- Set piston of appropriate cylinder to "bottom dead centre".
- Screw the adapter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



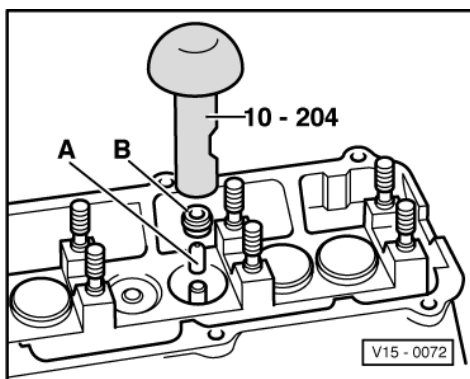
- -> Screw the catch part VAS 5161/6 with insertion fork VAS 5161/4 onto a stud on the cylinder head.
- Push guide bush VAS 5161/16 into bucket tappet guide of the valve to be removed until limit stop.
 - Installation position of guide bush: Hatched areas face driving direction
- Push assembly cartridge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



Audi



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

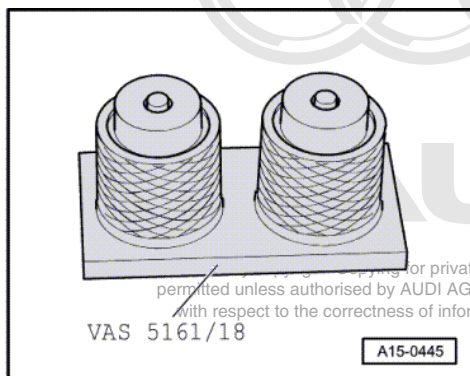


Installing

Note:

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

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



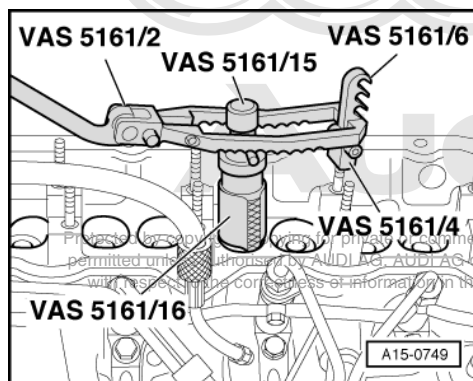
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- -> If the valve wedges were taken out of the assembly cartridge they must first be inserted into the installing tool VAS 5161/18.

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 15-44.

Notes:

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

Tightening torque

Component	Nm
Glow plugs to cylinder head	15

2.6 - Reworking valve seats

Note:

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

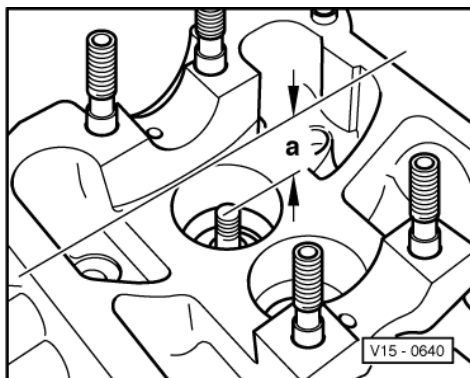
Special tools and workshop equipment required

- ♦ 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 15-58.
- ♦ Only rework the valve seats as far as is necessary to ensure a good seating pattern.
- ♦ Before starting to rework the valve seats, calculate the maximum permissible reworking dimension.

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



Calculating maximum permissible reworking dimension

- Insert valve and press firmly against valve seat.

Note:

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

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

Minimum dimensions:

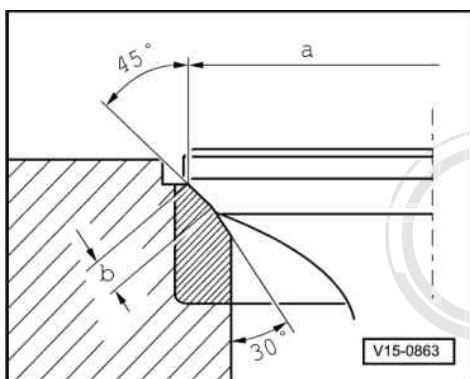
Inlet valve 35.8 mm

Exhaust valve 36.1 mm

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

Example:

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



-> Reworking inlet valve seat

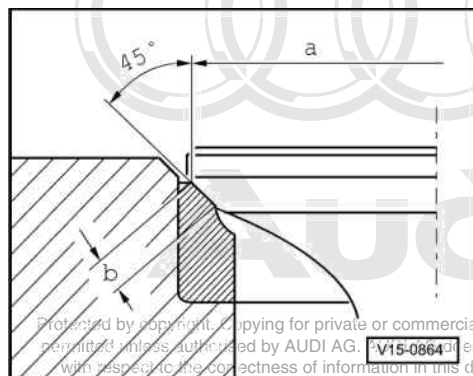
Dim.	Inlet valve seat
øa mm	35.7
b mm	1.6

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Dim.	Inlet valve seat
45°	Valve seat angle

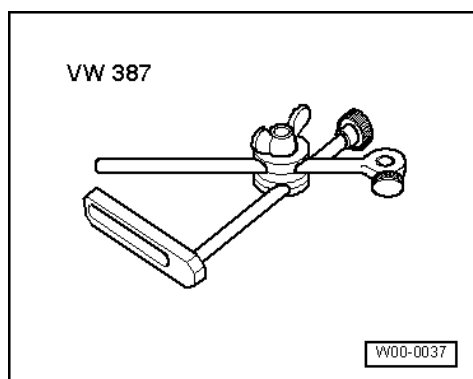
Note:

The 30° angle on the valve seat is vital for the flow characteristics in the inlet duct.

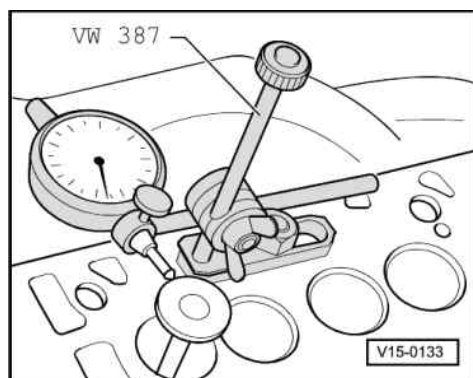

-> Reworking exhaust valve seat

Dim.	Exhaust valve seat
øa mm	31.4
b mm	2.7
45°	Valve seat angle

2.7 - Checking valve guides


Special tools and workshop equipment required

- ♦ Special tool VW 387
- ♦ Dial gauge



Test sequence

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

Wear limit

Inlet valve guide	Exhaust valve guide
1.30 mm	1.30 mm

Notes:

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

2.8 - 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.
- ♦ Refer to current information when using sealant.

=> Parts List

Viscosity grades and oil specifications:

=> Maintenance Manual

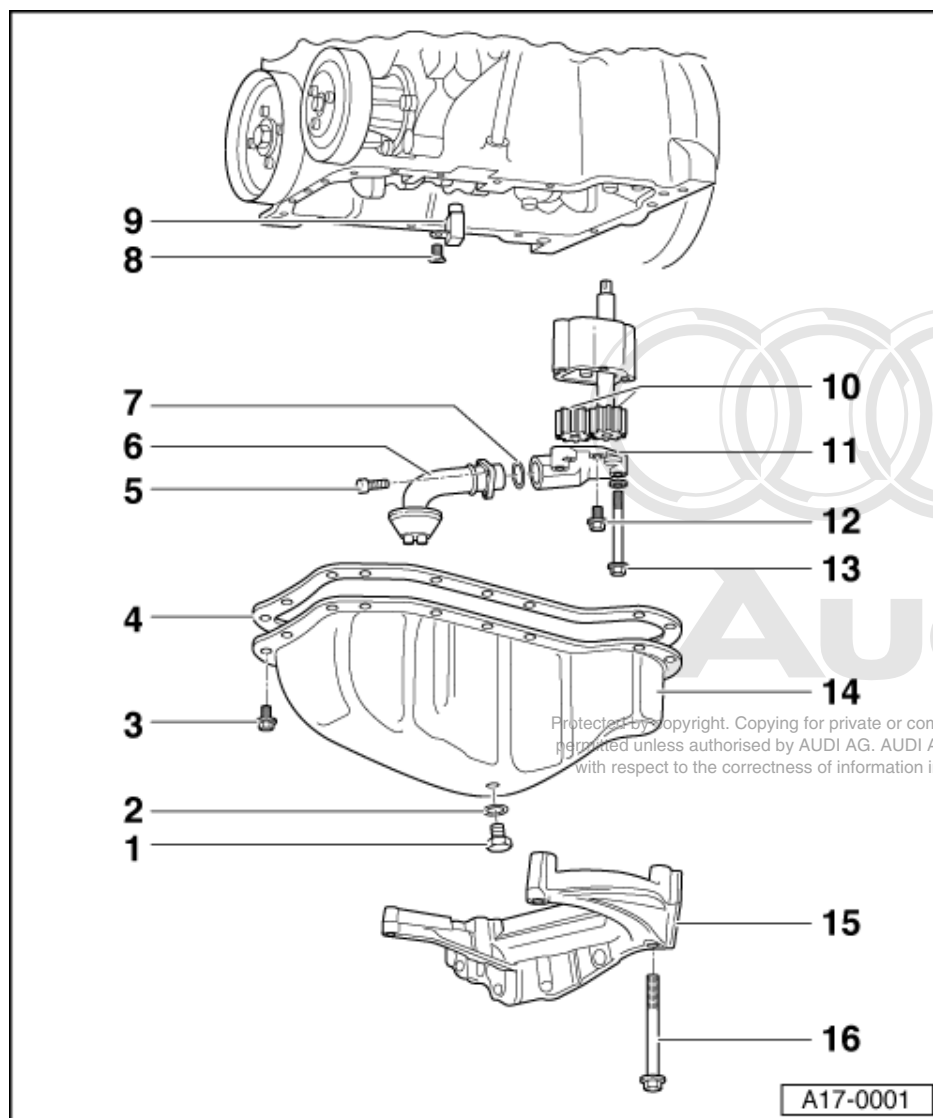
Oil system capacity:

=> Exhaust Emission Test binder



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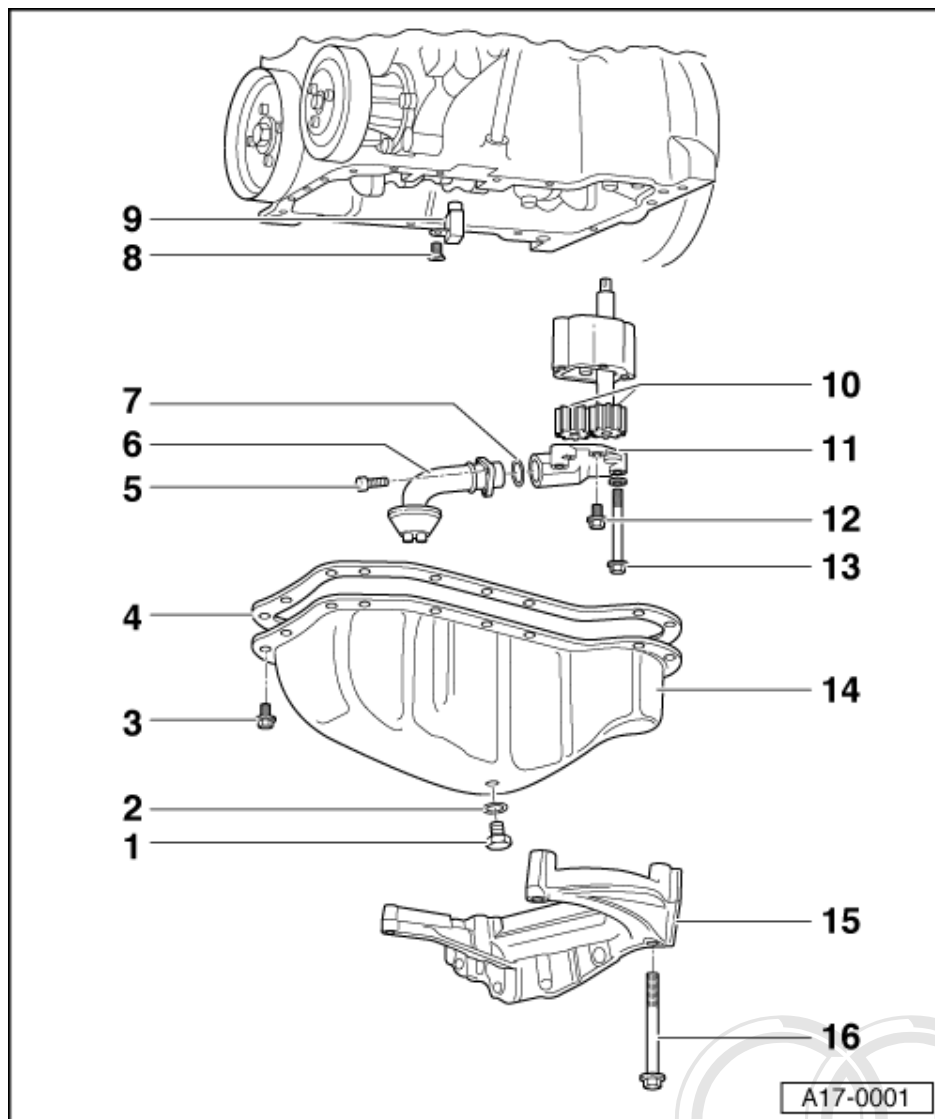
1.2 - Part I



- 1 Oil drain plug, 30 Nm
- 2 Seal
 - ◆ Replace
- 3 18 Nm
 - ◆ Tighten in stages and in diagonal sequence
- 4 Seal
 - ◆ Replace
 - ◆ Install dry
 - ◆ Apply thin coat of sealant only to sealing points between sealing flange and cylinder block (front and rear)
 - ◆ Sealants

=> Parts List

- 5 10 Nm
- 6 Suction pipe
 - ◆ Clean strainer if soiled



7 O-ring

- ◆ Replace

8 Pressure relief valve, 27 Nm

- ◆ Opens at:
pressure of 1.3...1.6 bar
- ◆ Insert without locking compound
- ◆ Version 07.96 ä
(gradual introduction)

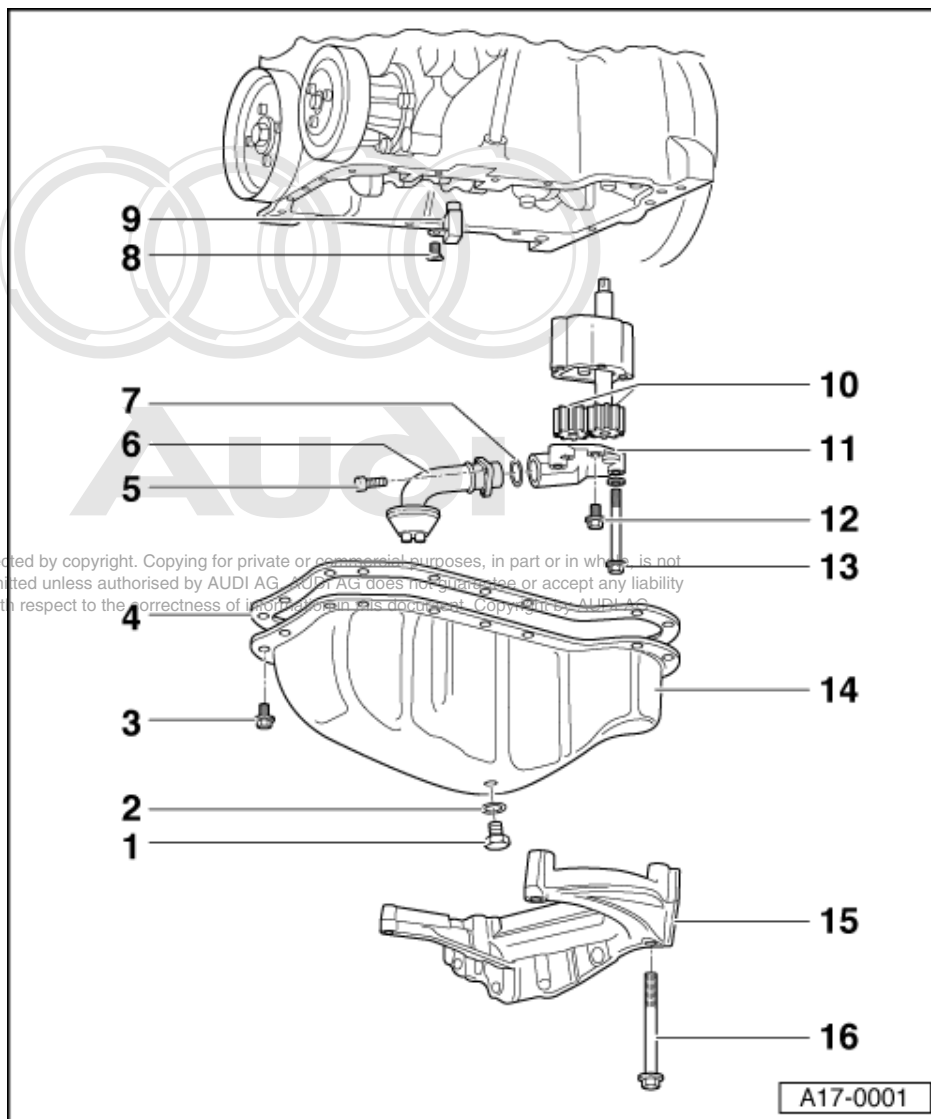
9 Oil spray jet

- ◆ For piston cooling
- ◆ Version 07.96 ä
(gradual introduction)
- ◆ Version ä 06.96
=> -Item 13-56

10 Gears

- ◆ Checking backlash
=> Fig.17-8
- ◆ Checking axial play
=> Fig.17-8

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11 Oil pump cover with pressure relief valve

- ♦ Opening pressure: 5.7 ... 6.7 bar

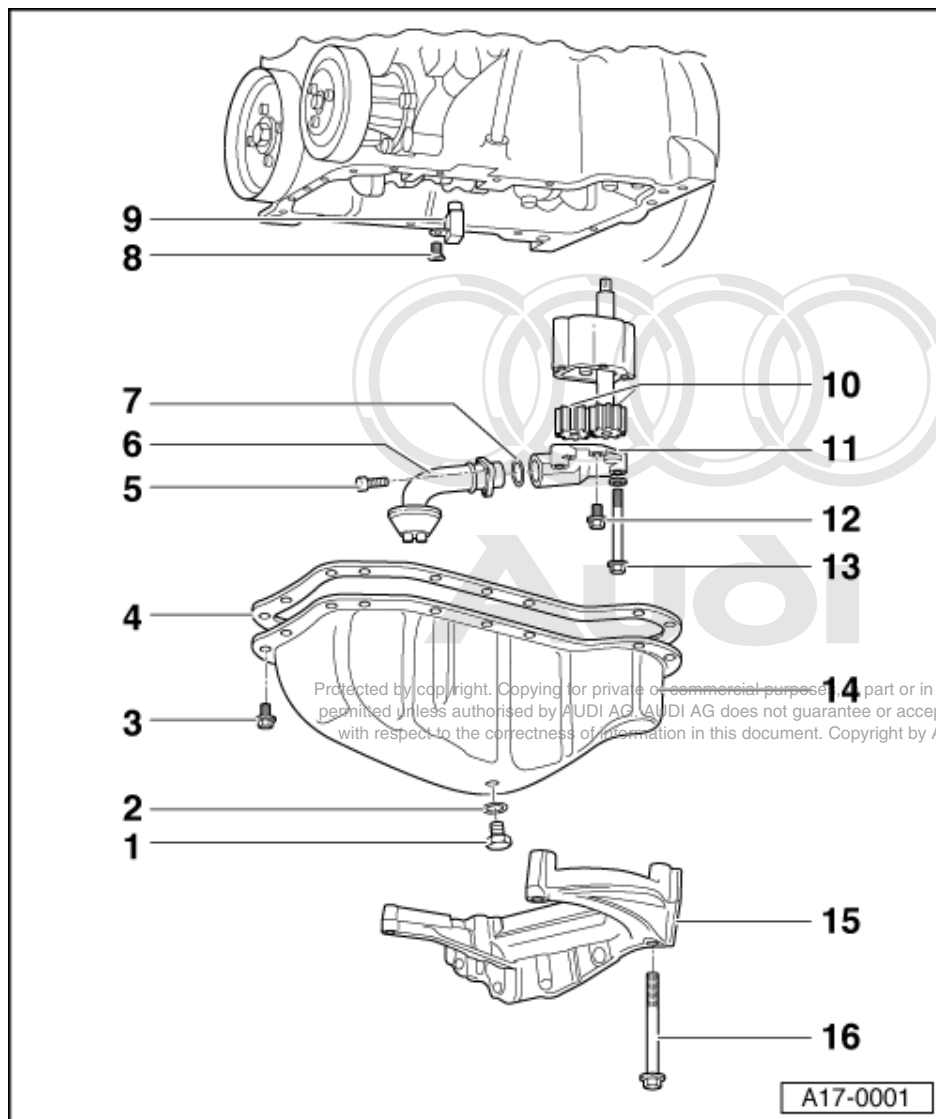
12 10 Nm

13 25 Nm

14 Oil pan

- ♦ Removing and installing
 =>Page 17-9
- ♦ Clean sealing surface before installing
- ♦ Before fitting oil pan, apply a small amount of sealant to sealing points between sealing flange and cylinder block
- ♦ Sealants

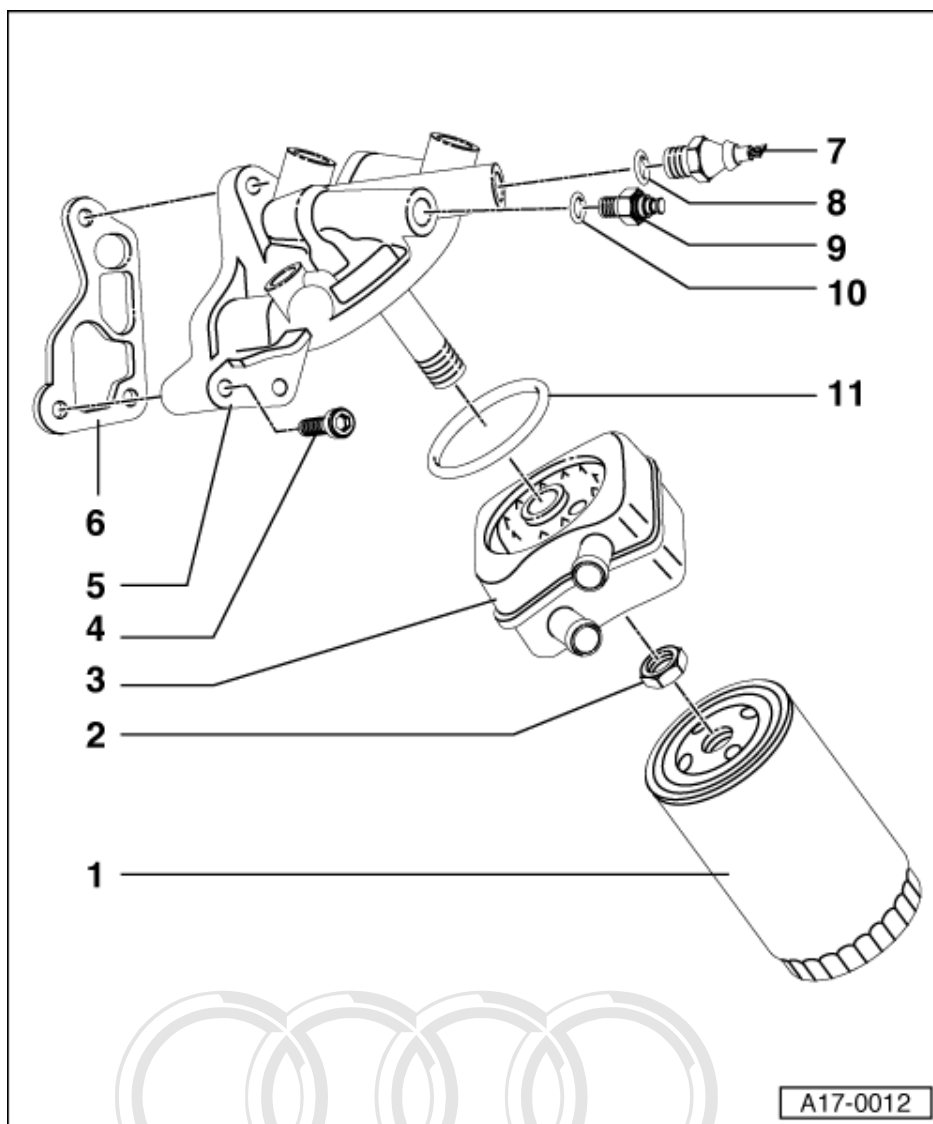
=> Parts List



15 Engine/gearbox support

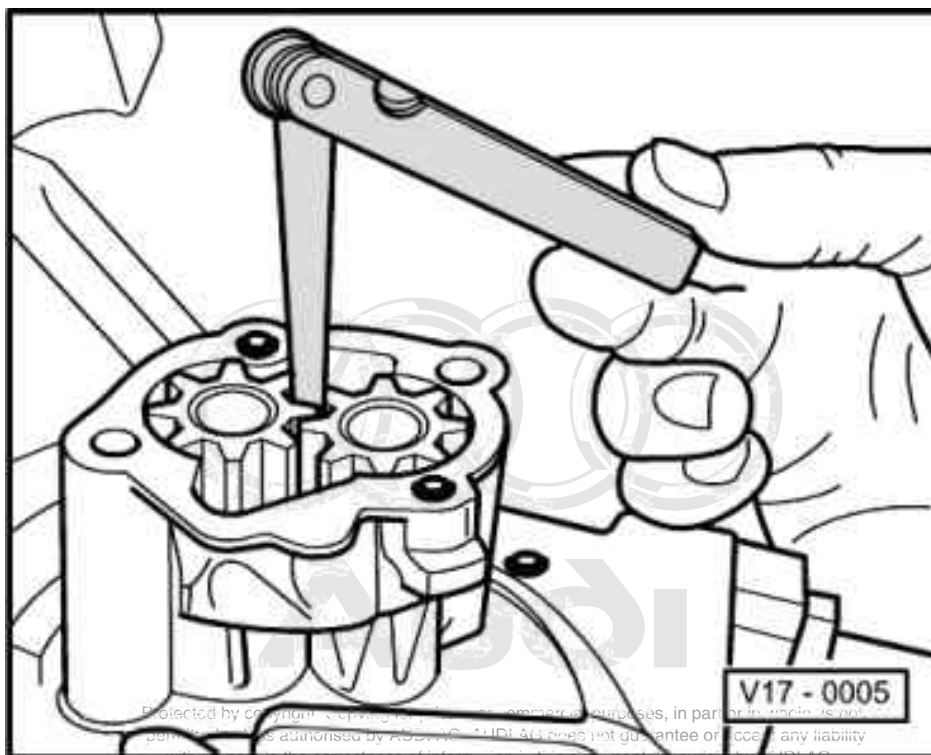
- ◆ Unbolt to remove the oil pan => Page 17-9
- ◆ When installing oil pan on engine removed from vehicle, ensure that engine/gearbox support is positioned flush with intermediate plate at flywheel side, i.e. engine/gearbox support should protrude 0.8 mm from cylinder block.

16 45 Nm





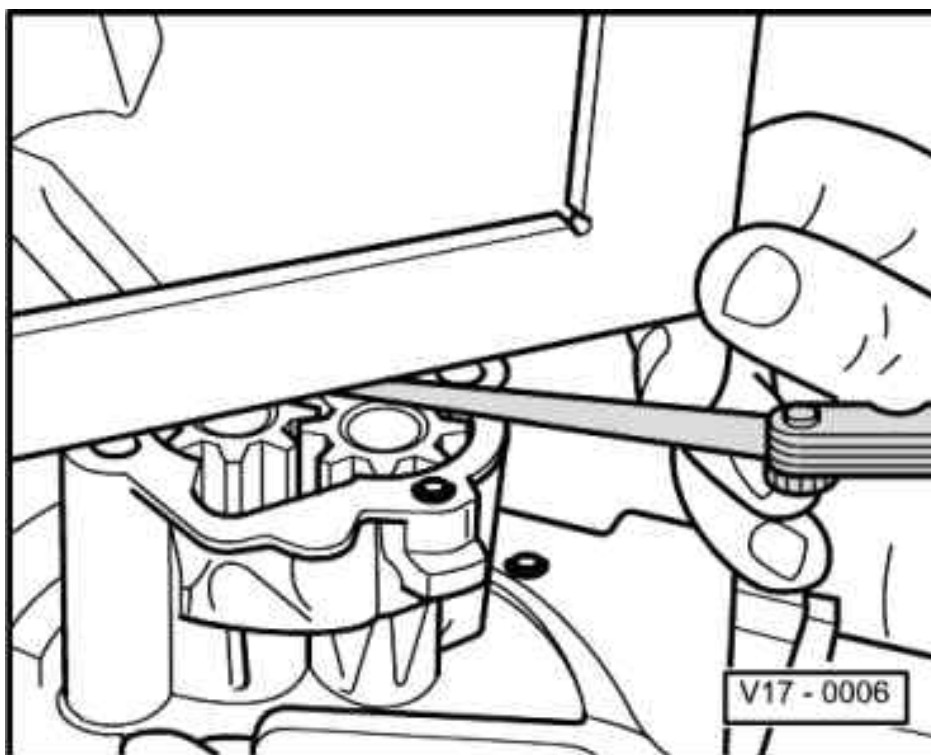
- 114 17 - Lubrication



-> Fig.1 Checking oil pump backlash

New: 0.05 mm

Wear limit: 0.20 mm

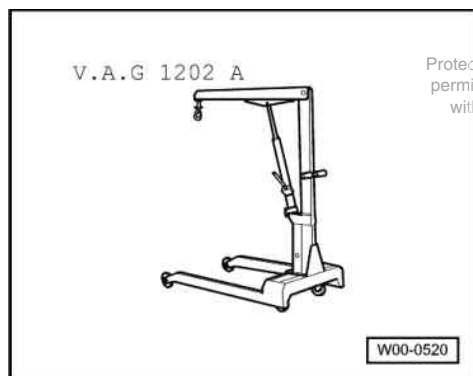




-> Fig.2 Checking oil pump axial play

Wear limit: 0.15 mm

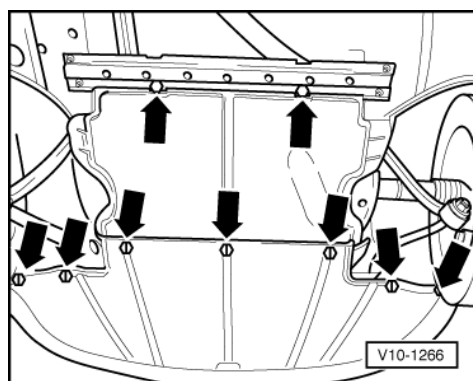
1.4 - Removing and installing oil pan



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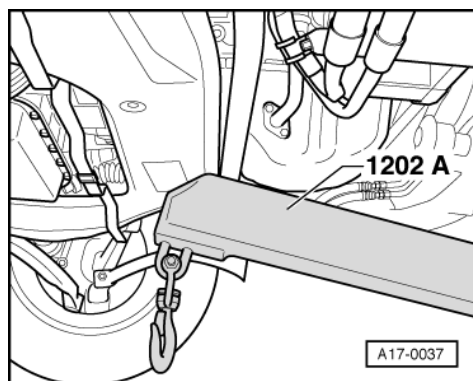
Special tools and workshop equipment required

- ♦ Workshop crane V.A.G 1202 A
- ♦ Container
- ♦ Sealant AMV174 004 01

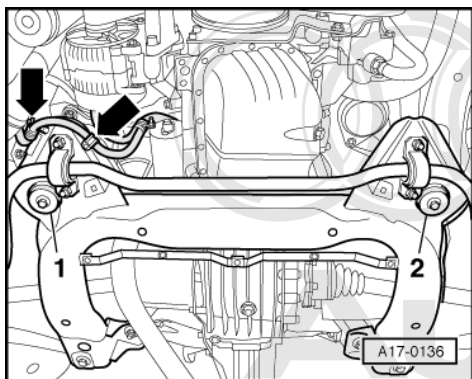


Removing

- -> Remove noise insulation (two sections) -arrows-.
- Drain engine oil.



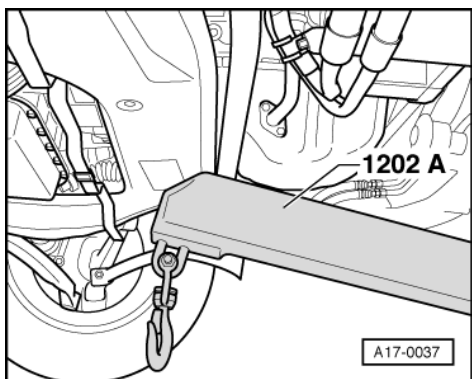
- -> Support subframe with workshop crane V.A.G 1202 A.



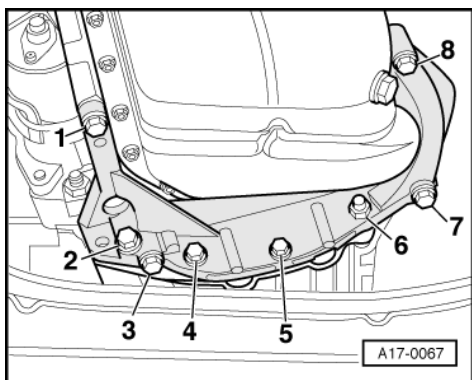
- -> Unbolt retaining clamps -arrows- for starter cable at subframe.
- Unscrew front bolts -1- and -2- of subframe.

Note:

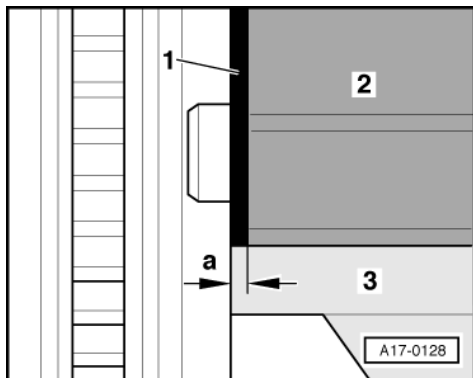
The subframe should be detached and lowered at the front only, otherwise it will be necessary to check wheel alignment.



- -> Lower subframe slowly using workshop crane 1202 A.



- -> Unscrew bolts -1 ... 8- for engine/gearbox support.
- Remove engine/gearbox support.
- Unscrew and remove oil pan, if necessary loosen it by striking lightly with a rubber hammer.



Installing

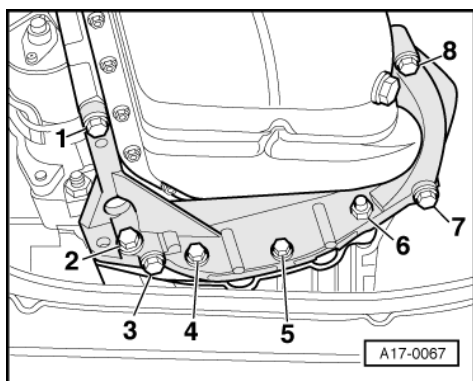
Installation is carried out in the reverse order; note the following:

Notes:

- ♦ Replace seals and gaskets.
- ♦ -> When installing engine/gearbox support with engine removed from vehicle, ensure that engine/gearbox support -3- is positioned flush with intermediate plate -1- at flywheel end, i.e. engine/gearbox support should protrude by dimension "a" = 0.8 mm from cylinder block -2-.
- Clean sealing surfaces before installing oil pan.
- Apply a thin coating of "AMV 174 004 01" to front and rear sealing flange/cylinder block sealing points at sealing surface to sump.
- Tighten bolts securing oil pan to cylinder block in two stages in diagonal sequence (final torque: 18 Nm).
- Installing subframe

=> Running Gear, Front and Four-Wheel Drive; Repair group 40; Servicing Front Suspension; Removing and installing subframe Servicing Front Suspension Removing and installing subframe

- Fill up with engine oil and check oil level.



Tightening torques

-> Fastening engine/gearbox support

Item	Bolt	Nm
1	M10 x 28	45
2, 4, 5 1)	M10 x 45	45
3, 7	M10 x 95	45
6	M10 x 50	45

Item	Bolt	Nm
8	M10 x 65	45

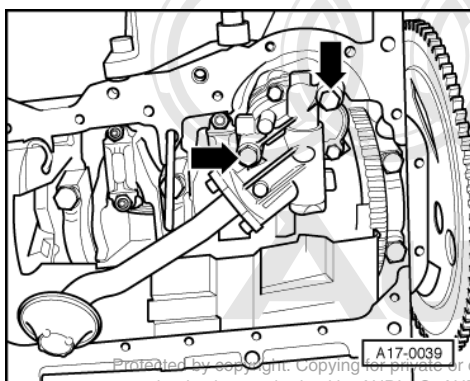
- 1) up to approx 07.96 Bolt M8; tightening torque: 25 Nm

Component	Nm
Oil pan to cylinder block 1)	18
Oil drain plug	30

- 1) Special bolts, use genuine replacement bolts only

=> Parts List

1.5 - Removing and installing oil pump



Removing

- Remove oil pan => Page 17-9.
- -> Loosen bolts -arrow-.
- Detach oil pump.

Installing

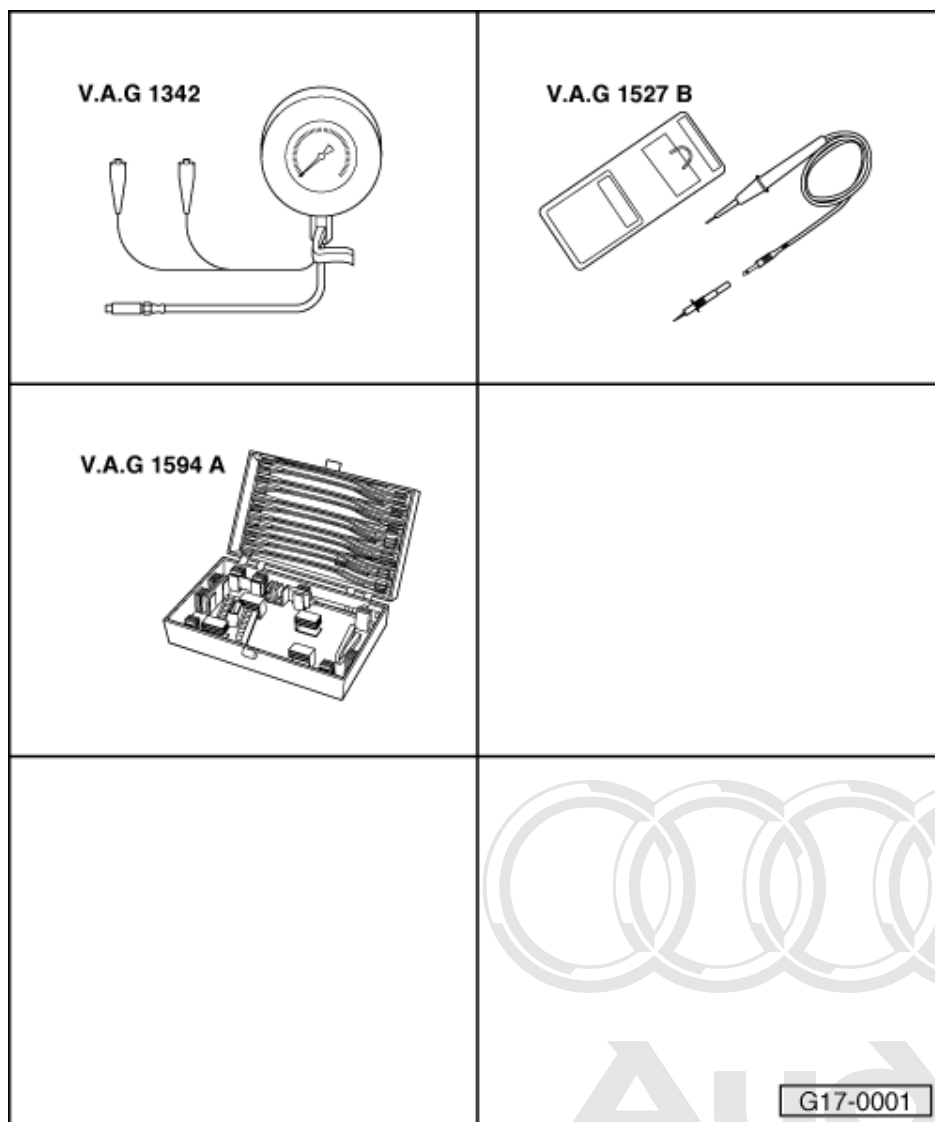
Installation is carried out in the reverse order; note the following:

- Installing oil pan => Page 17-12.

Tightening torque

Component	Nm
Oil pump to cylinder block	25

1.6 - Checking oil pressure and oil pressure switch



Special tools and workshop equipment required

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

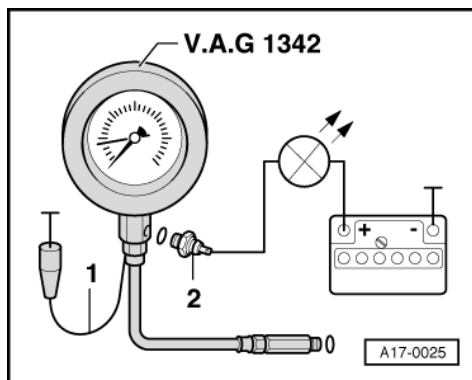
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Test requirements:

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

Checking warning lamp

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



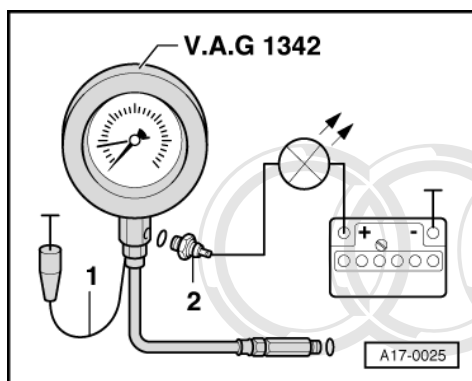
Checking oil pressure switch

- 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.

- At 0.75 ... 1.05 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 2000 rpm: at least 2.0 bar
 - Oil pressure at higher engine speeds: max. 7.0 bar

If the specifications are not obtained:

- Pressure relief valve or oil pump defective, replace oil pump => Page 17-14.

1.7 - Engine oil

Viscosity grades and oil specifications

=> Maintenance Manual

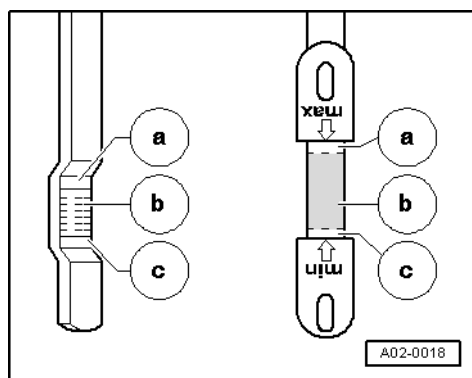
1.8 - Checking oil level

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.

Test sequence

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



-> Markings on oil dipstick:

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

Note:

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

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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:

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

=> Parts List

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

1.2 - Parts of cooling system

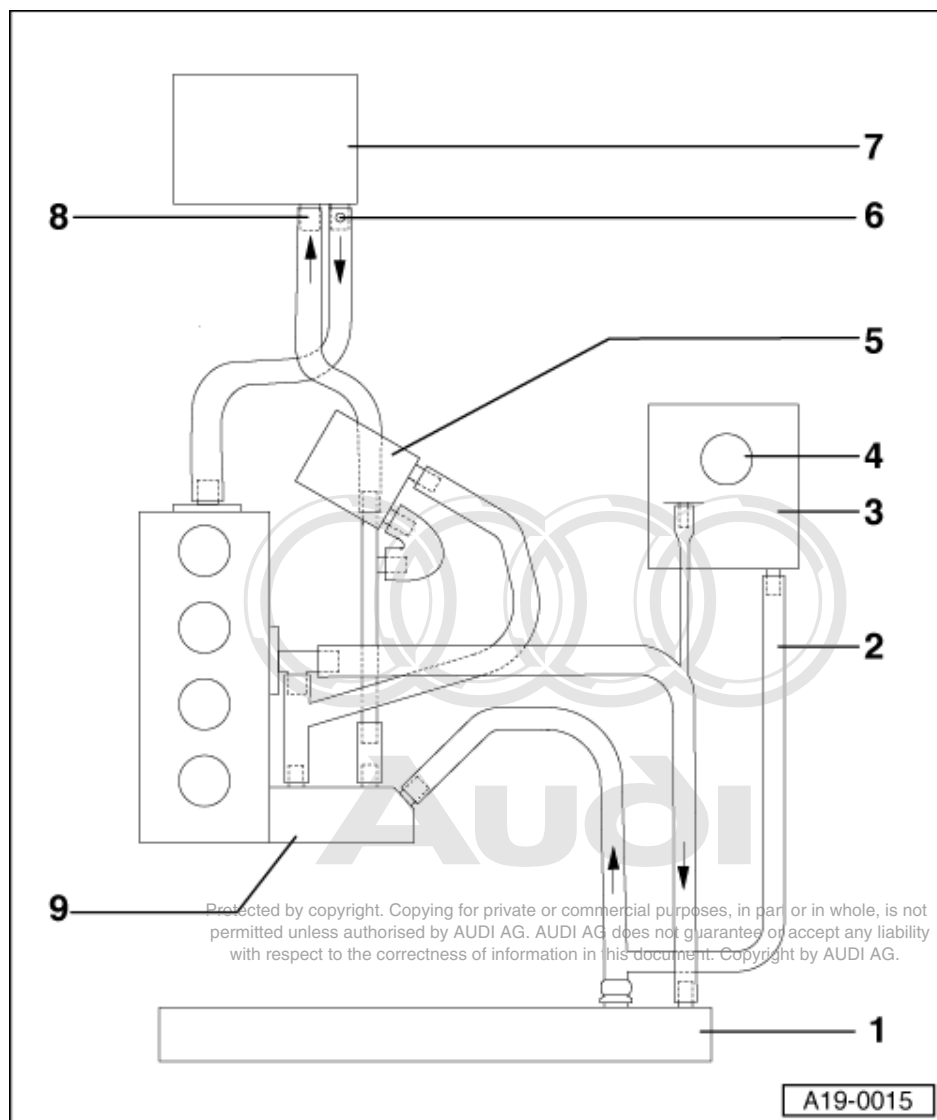


Diagram of coolant hose connections

1 Radiator

- ♦ Removing and installing
=>Page 19-17.
- ♦ After replacing, fill with fresh coolant

2 Return line

- ♦ To expansion tank

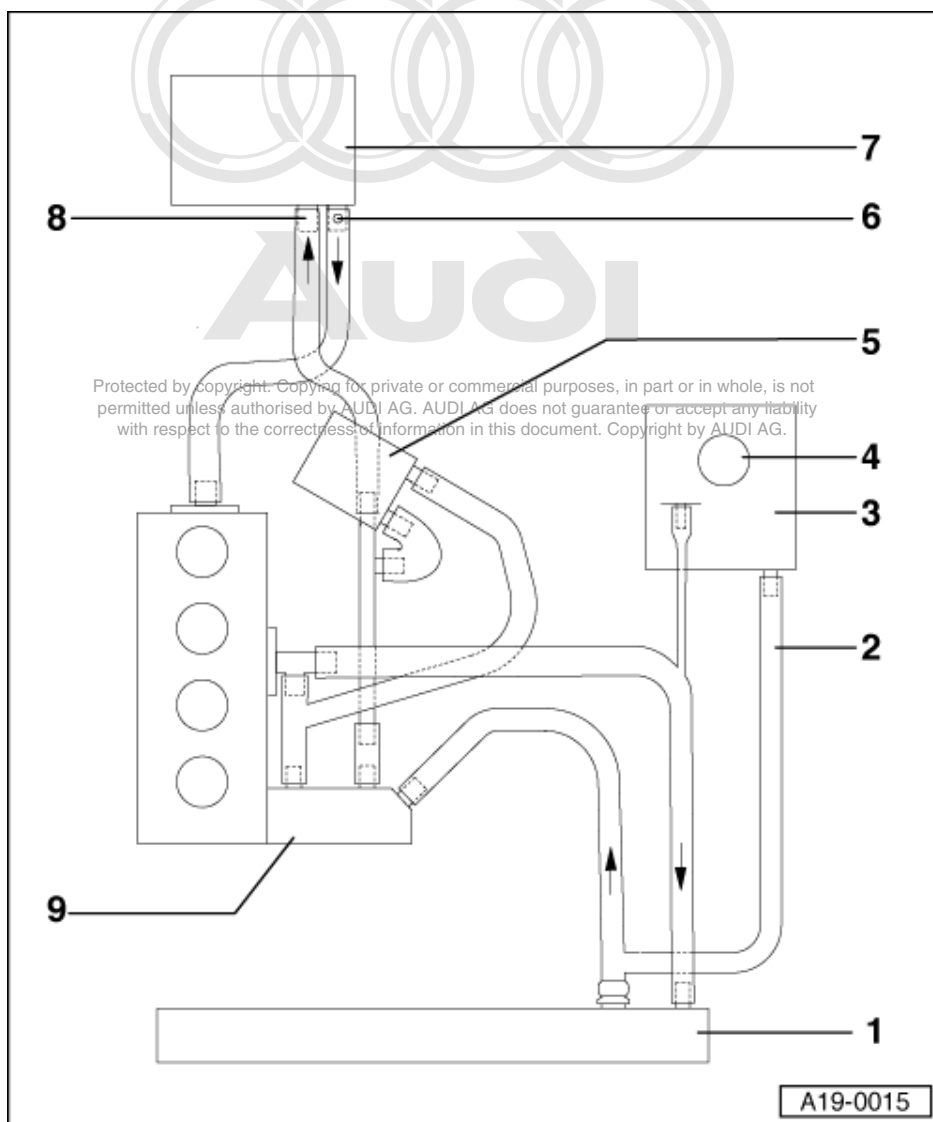
3 Expansion tank

4 Cap

- ♦ With pressure relief valve
- ♦ Checking pressure relief valve
=> Page 19-22

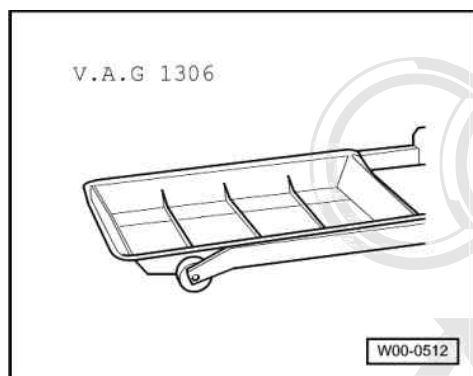
5 Fluid cooler

- ♦ Removing and installing => Item 17-6



- 6 Return line**
 ♦ From heating system heat exchanger
- 7 Heating system heat exchanger**
 ♦ After replacing, fill with fresh coolant
- 8 Supply pipe**
 ♦ To heating system heat exchanger
- 9 Coolant pump/coolant thermostat**
 ♦ Removing and installing coolant pump => Page 19-11
 ♦ Check for ease of movement
 ♦ Removing and installing thermostat => Page 19-15
 ♦ Checking => Page 19-16

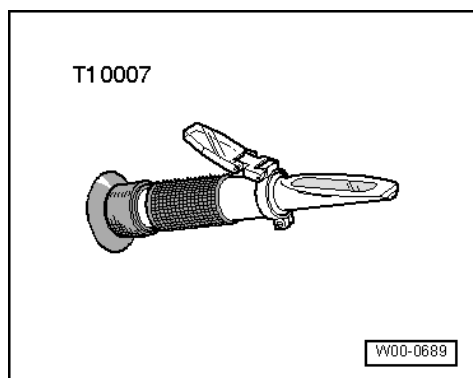
1.3 - Draining and filling cooling system



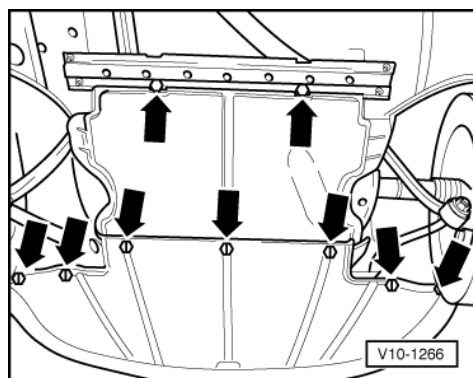
Special tools and workshop equipment required

- ♦ Drip tray V.A.G 1306

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



Draining

Note:

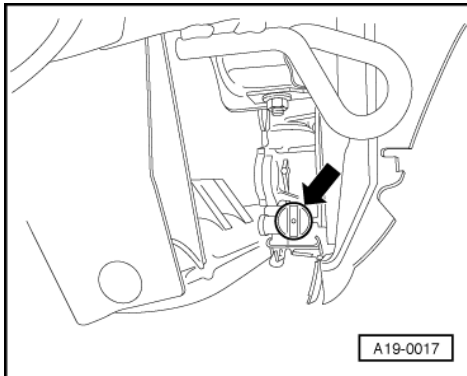
Collect drained coolant in a clean container for re use or disposal.

Important

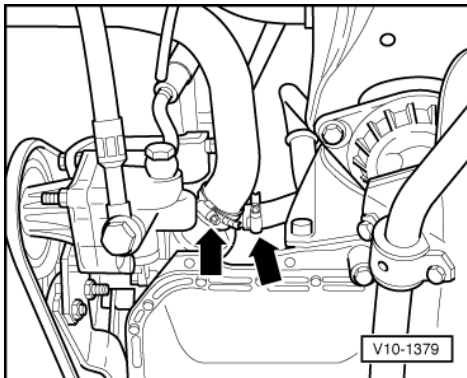
Hot steam can escape when opening cap on expansion tank: Cover cap with a cloth and open carefully.

- Open the cover of the coolant expansion tank

- -> Remove front part of noise insulation -bottom arrows-.



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



- -> Disconnect coolant hoses -arrows- to drain off remaining coolant.

Filling

Notes:

- ◆ The cooling system is filled all year round with a mixture of water and antifreeze/corrosion protection agent.
- ◆ Coolant additive G 011 A8 C (green) is used in vehicles up to 06.96.
- ◆ Only coolant additive G 012 A8 D (red) is used in vehicles from 07.96 onwards.

Important

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

- ◆ If the fluid in the expansion tank is brown, this means G 012 A8 D has been mixed with another type of coolant. In this case, flush out the cooling system and fill with fresh coolant. To flush the system, fill it with clean water and run the engine for about 2 minutes. This should remove as much of the old coolant as possible.
- ◆ G 011 A8 C and G 012 A8 D and coolant additives marked meeting specification TL VW 774 C or meeting specification TL VW 774 D prevent frost and corrosion damage, stop scaling and at the same time raise the boiling point of the coolant. For these reasons the cooling system must be filled all year round with the correct anti freeze and anti corrosion additive.
- ◆ Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.
- ◆ Protection against frost must be assured to about -25 °C (in countries with an arctic climate to about -35 °C).
- ◆ The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The anti-freeze ratio must be at least 40 %.



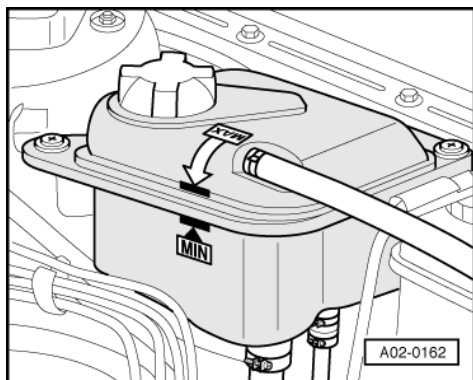
- ♦ If greater frost protection is required in very cold climates, the amount of G 012 A8 D can be increased, but only up to 60 % (this gives frost protection to about -40 °C), as otherwise frost protection is reduced again and cooling effectiveness is also reduced.
- ♦ Only use clean drinking water to mix the coolant.
- ♦ If radiator, heat exchanger, cylinder head or cylinder head gasket is replaced, do not reuse old coolant.
- ♦ Use special tool T10007 to check frost protection of coolant additive G012 A8 D in cooling system.

Recommended mixture ratios:

Frost protection to	Antifreeze concentration	G11/G12 1)	Water1)
-25 °C	40 %	2.60 l	3.90 l
-35 °C	50 %	3.25 l	3.35 l

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

- Close drain plug on radiator.



- -> Top up coolant to max. mark on expansion tank.
- Fit expansion tank cap.
- Start the engine.
- Allow engine to run at idling speed until the lower coolant hose on radiator becomes hot.
- 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.

Important

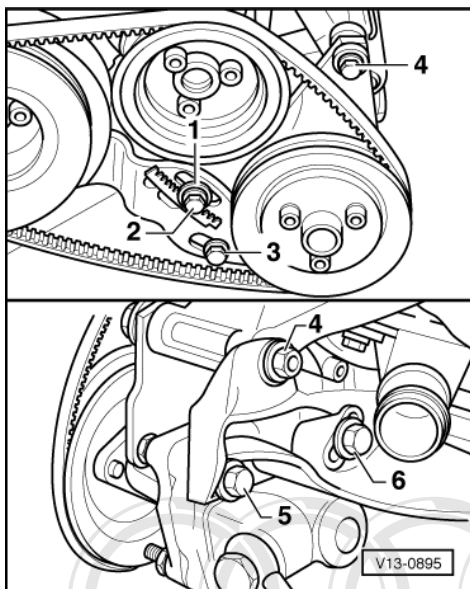
Hot steam can escape when opening cap on expansion tank: Cover cap with a cloth and open carefully.

- Stop engine.



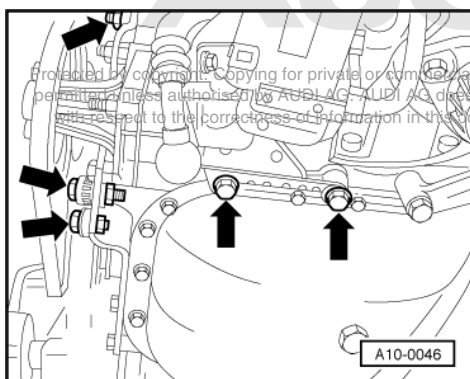
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1.4 - Removing and installing coolant pump

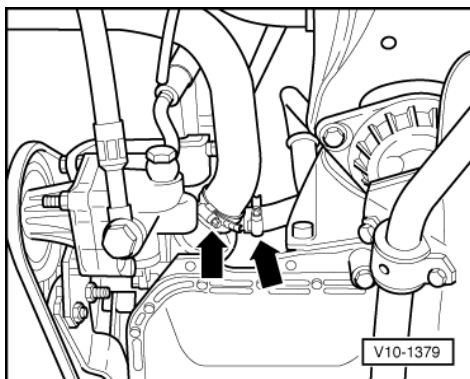


Removing

- Drain coolant => Page 19-4.
- -> Loosen bolts -2 ... 6-
- Release belt tension on V-belt with tensioner nut -1-.
- Remove V-belt.



- -> Unscrew vane pump of power assisted steering with rear holder -arrows-. Do not detach hydraulic connections.
- Suspend vane pump from the body using wire so as to prevent placing load on the lines.



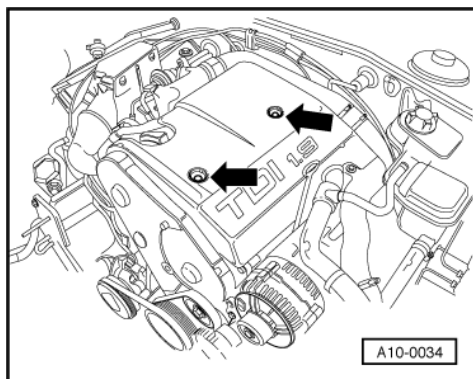


Audi 100 1991 ➤

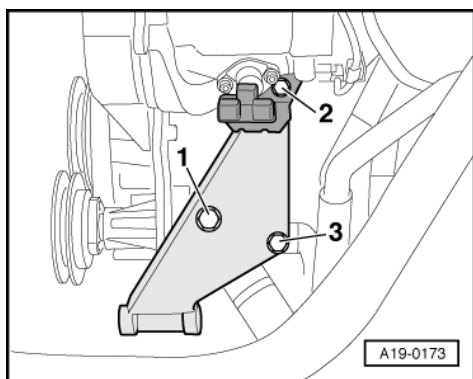
4-Cyl. Diesel Direct Injection Engine (TDI®), Mechanical Components - Edition 12.

2001

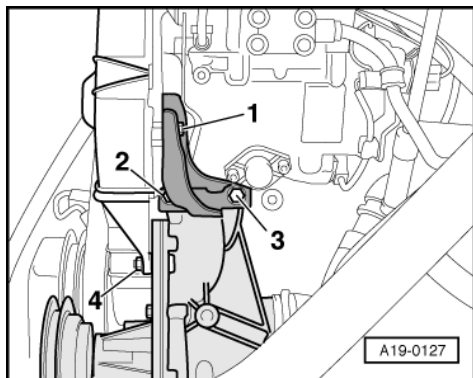
- -> Disconnect coolant hoses from coolant pump and thermostat housing -arrows-.



- -> Remove engine cover panel -arrows-.



- -> Detach engine cover bracket under the injection pump -2-.
- Unbolt bracket for vane pump -1 ... 3-.

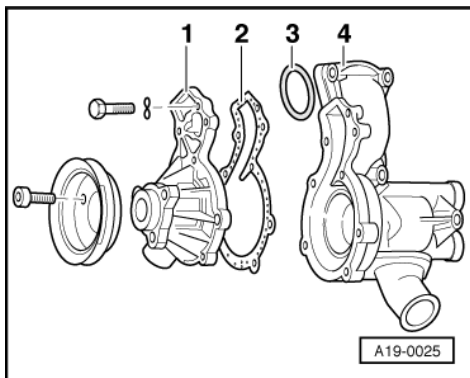


- -> Unbolt coolant pump housing from toothed belt guard -4-.
- Unbolt support for injection pump console -1 ... 3-.
- Remove coolant pump.



Audi

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- -> Unscrew bearing housing -1- from pump housing -4-.

Installing

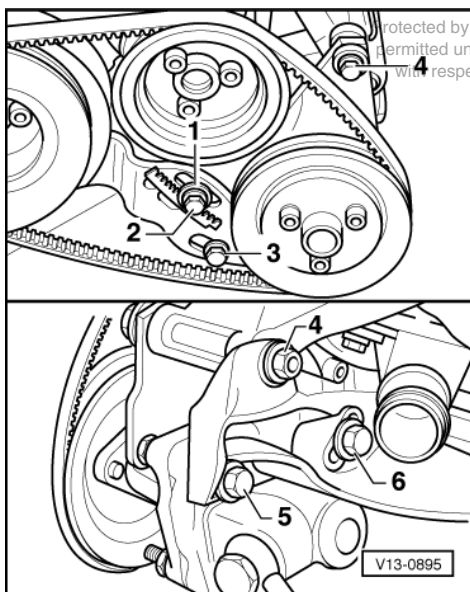
Installation is carried out in the reverse order; note the following:

- Clean sealing surfaces on both sections of housing.
- Renew gasket and O-ring.
- Insert hammer-head bolt in bore in coolant pump.
- Install V-belt => Page 13-9.
- Top up coolant => Page 19-7.

Tightening torques

Component	Nm
Bearing housing to pump housing	10
Pump housing to toothed belt guard	10
Bracket for vane pump to cylinder block	25
Bracket for engine cover	25
Hose clamps	2

1.5 - Removing, installing and checking coolant thermostat

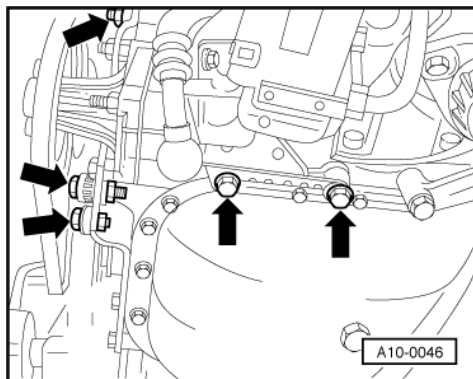


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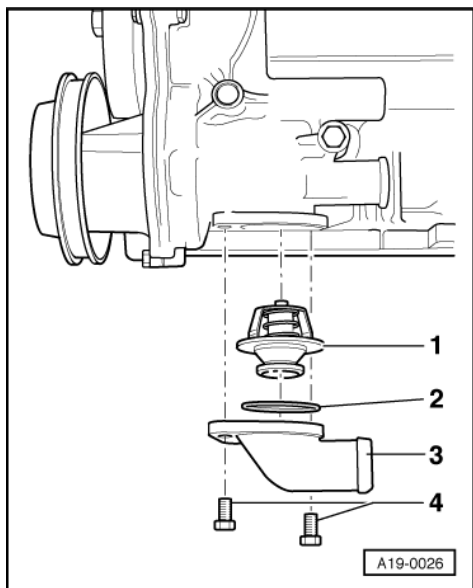


Removing

- Drain coolant => Page 19-4.
- -> Loosen bolts -2 ... 6-.
- Release belt tension on V-belt with tensioner nut -1-.



- Remove V-belt.
- -> Unscrew vane pump of power assisted steering with rear holder -arrows-. Do not detach hydraulic connections.
- Suspend vane pump from the body using wire so as to prevent placing load on the lines.



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

Installing

- Clean and smooth down sealing surface for O-ring as required.
- Insert coolant thermostat.
- Install V-belt => Page 13-9.
- Top up coolant => Page 19-7.

Tightening torques

Component	Nm
Connection to pump housing	10
Hose clamps	2



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Check coolant thermostat

- Heat thermostat in water bath.

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

- 1) cannot be tested

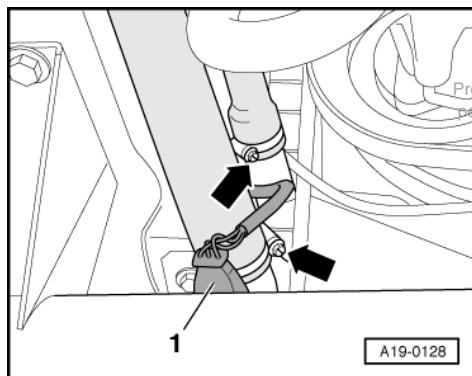
1.6 - Removing and installing radiator

Removing

- Remove the front bumper:

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

- Drain coolant from drain plug on radiator=> Page 19-4



- -> Detach both coolant hoses at bottom of radiator -arrows-.
- Unplug connector -1- from thermoswitch for radiator fan -F54.
- Detach top left coolant hose from radiator.

Vehicles with automatic gearbox:

- Removing ATF pipes/hoses from radiator:

=> Automatic gearbox 01N; Repair group 37; Dismantling and assembling gearbox; Removing and installing ATF pipes Dismantling and assembling gearbox Removing and installing ATF pipes

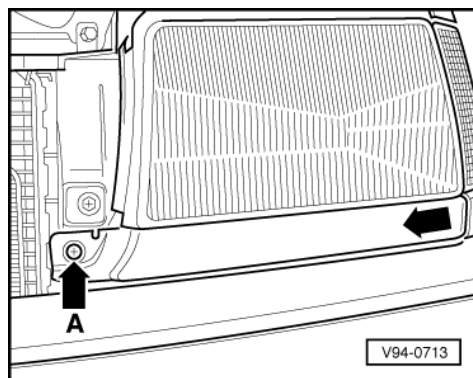
Vehicles with air conditioner:

Important
The air conditioner refrigerant circuit must not be opened.

Note:

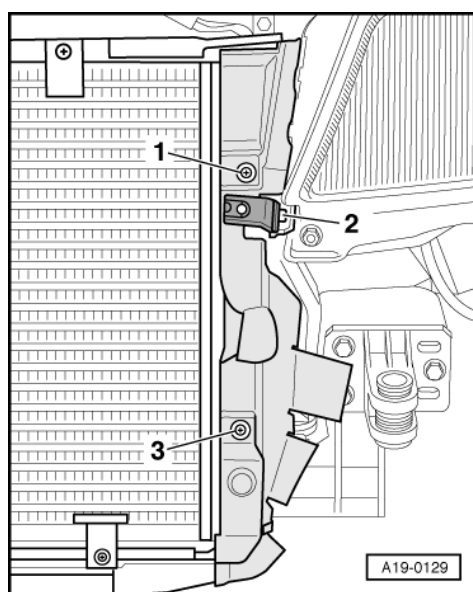
To prevent damage to the condenser and refrigerant pipes/hoses, ensure that the pipes and hoses are not stretched, kinked or bent.

- Unscrew securing bolts for the condenser.
- Pull condenser out of the bracket, pivot to the side and suspend with wire loop.

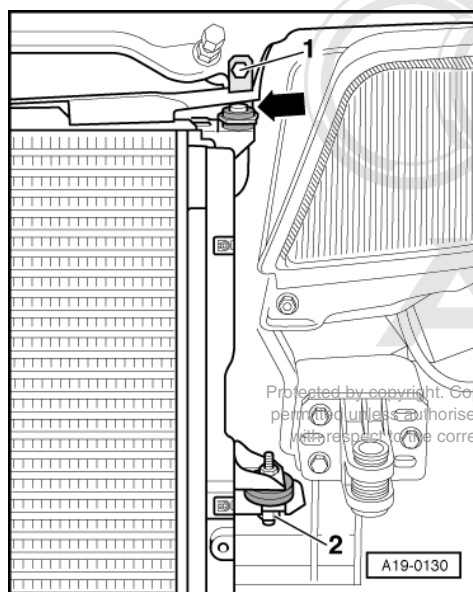


All models:

- -> Remove fastening screw -arrow A- and pull out headlight trim in direction of arrow.



- -> Unscrew securing bolt of retaining clip -2- for headlight trim at housing.
- Unscrew air ducts from radiator -1- and -3- (left and right).



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- -> Unscrew nuts -2- at bonded rubber mounting.
- Remove bottom of radiator from bonded rubber mounting support towards the front ...
- ... and top -arrow- downwards out of support (if necessary unscrew bolt -1- at radiator support).

Installing

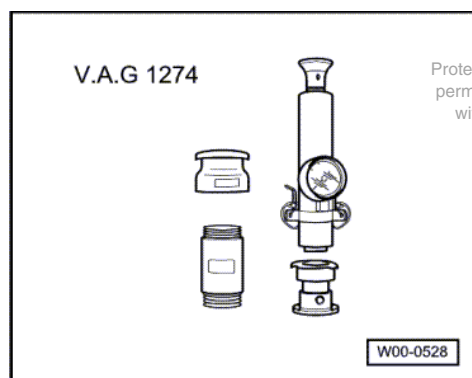
Installation is carried out in the reverse order; note the following:

- Top up coolant => Page 19-7.

Tightening torque

Component		Nm
Radiator to front	M6	10
	M8	20
Condenser to radiator		10
Hose clamps		2

1.7 - Checking cooling system for leaks



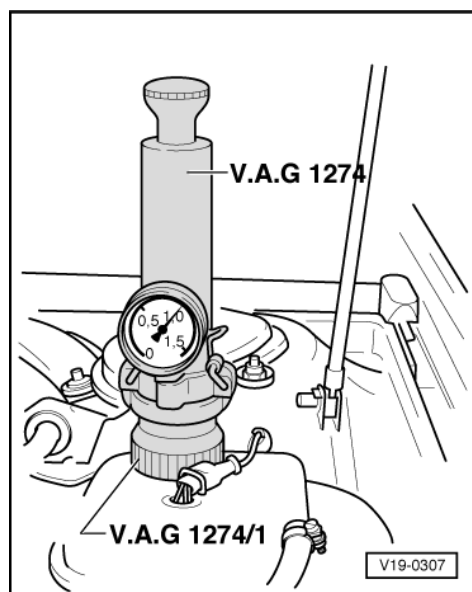
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Special tools and workshop equipment required

- ♦ V.A.G 1274 with V.A.G 1274/1

Test requirements:

- Engine at operating temperature.

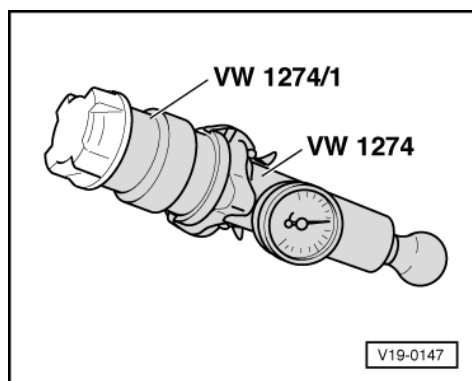


Test sequence

Important

Hot steam 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 1274/1 onto expansion tank.
- Using hand pump on tester, build up a pressure of approx. 1.0 bar.
- If this pressure is not maintained, locate and rectify leaks.



Checking pressure relief valve in filler cap.

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



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21 - Charging

1 - Checking charge air system with turbocharger

1.1 - Checking charge air system with turbocharger

Notes:

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- ♦ For cleanliness rules, see=> Page 21-26.
- ♦ Secure all hose connections with the correct hose clamps (same as original equipment):

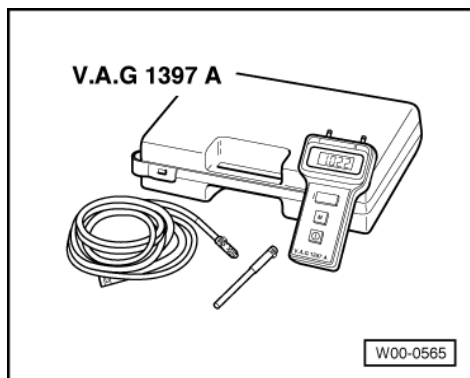
=> Parts List

Safety precautions

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

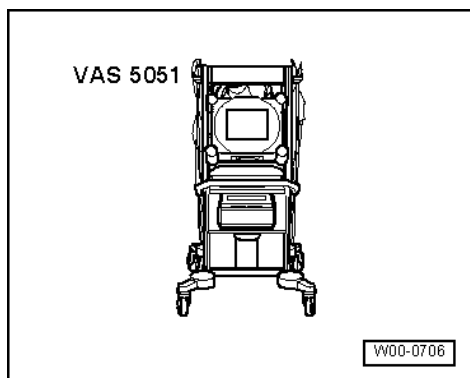
Important

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



Special tools and workshop equipment required

- ♦ Turbocharger tester V.A.G 1397 A





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

1.2 - Test requirements for checking exhaust turbocharging

1. - Coolant temperature at least 85 °C
2. - Fault memory of engine control unit interrogated.
3. - Exhaust gas recirculation OK, checking => as of Page 26-17.

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 21-4.
5. - Control hose to boost pressure regulating valve not obstructed, loose or leaking.
6. - No faults on engine or injection system, e.g. compression or injection pump or injector units, respectively.

1.3 - Effects of leaks in intake or exhaust system

A - Leaks downstream of air mass meter

Possible fault sources:

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

Effect:

- Loss of power

B - Leaks downstream of turbocharger (intake side)

Possible fault sources:

- 1 - Connection hoses between turbocharger, charge air cooler, and intake pipe
- 2 - Intercooler
- 3 - Seal underneath intake manifold pressure sender -G71/intake manifold temperature sender -G72
- 4 - Seal between intake connection and intake manifold
- 5 - Seal between intake manifold and cylinder head

Effect:

- Boost pressure too low

C - Leaks downstream of turbocharger (exhaust side)

Possible fault sources:

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

Effect:

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

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Test requirements:

- Fault memory has been interrogated.

=> Diesel Direct Injection and Glow Plug System (TDI 4-cylinder); Repair group 01; Interrogating and erasing fault memory

- Final control diagnosis has been performed

=> Diesel Direct Injection and Glow Plug System (TDI, 4-cylinder); Repair group 01; Final control diagnosis
Final control diagnosis

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

1.4 - Checking boost pressure

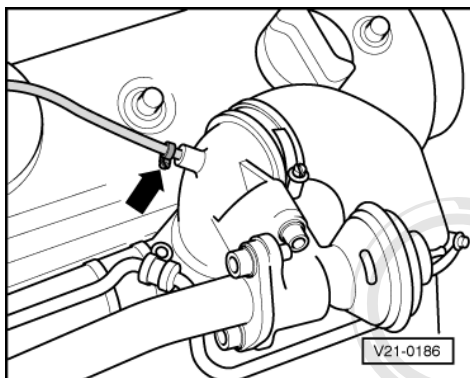
Test requirements:

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

Important

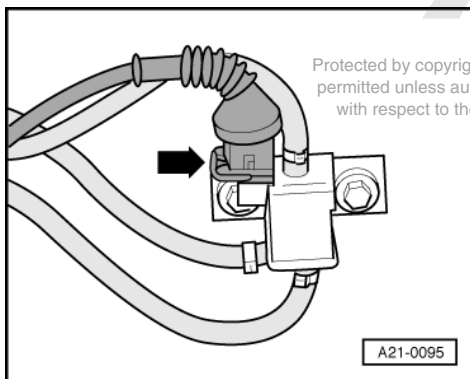
To avoid the risk of accidents when performing measurements and test drives, please observe the safety precautions =>

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



Test sequence

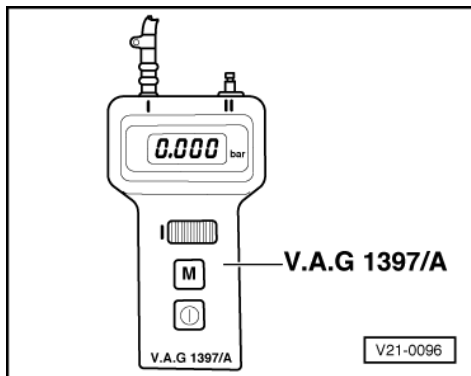
- -> Place the measuring hose of the turbocharger tester V.A.G 1397/A onto the connection pipe and secure the hose using a hose clamp -arrow-.
- Route measuring hose under rear edge of bonnet and into passenger compartment via right window.



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Checking without boost pressure control:

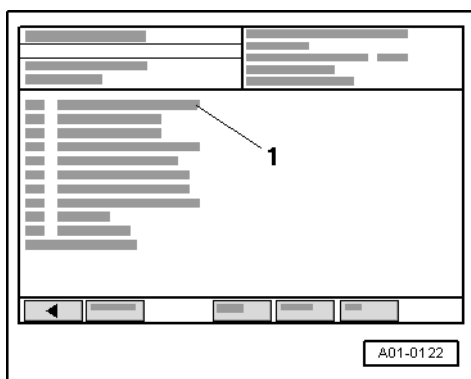
- -> Unplug the connector -arrow- from the solenoid valve for boost pressure limitation.



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

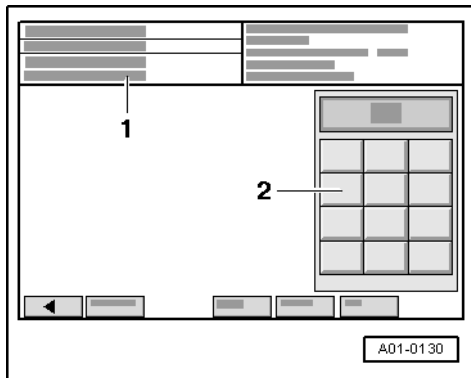
Notes:

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



-> Display on VAS 5051:

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



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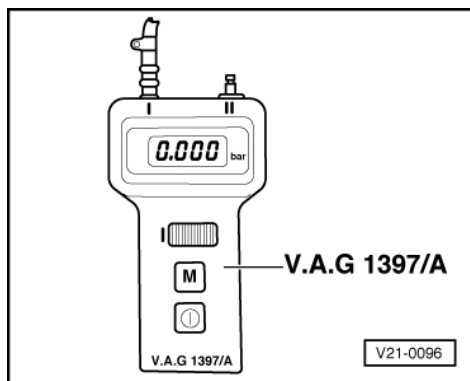
-> Display on VAS 5051:

1 - Enter display group

- Enter "011" for "display group number 011" in zone -2- and confirm the entry by pressing the Q button.
- Accelerate from 1500 rpm at full throttle in third gear (or with selector lever at position 2). and watch rev counter.
- Press "Print - Save result" key on VAS 5051 and memory key -M- on V.A.G 1397 A simultaneously at approx. 3000 rpm.

	Display zones			
	1	2	3	4
Display group 011: Intake manifold pressure (boost pressure) at 3000 rpm				
Display	xxxx rpm	xxxx mbar	xxxx mbar	xx %
Display	Engine speed	Boost pressure (specified)	Boost pressure (actual)	Actuation of boost pressure control valve -N75
Specification	3000 rpm	1550...1750 mbar	1550...1750 mbar	---

- Exit function "08 - Read measured value block" by pressing the ◀ key.



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

- ♦ 1.550...1.750 bar

Note:

The boost pressure level is measured with turbocharger tester V.A.G 1397/A. The vehicle diagnostic, measuring and information system VAS 5051 is used to check whether the boost pressure is also being registered in the control unit.

- If measured boost pressure is OK, repeat boost pressure measurement with boost pressure control => Page 21-12.

If boost pressure is not obtained:

- ♦ Leak between turbocharger and intake manifold
- ♦ Fault is in boost pressure control linkage or vacuum unit. Checking => Page 21-15
- ♦ Turbocharger defective (turbine blocked due to foreign body)

If boost pressure is exceeded:

- ♦ Boost pressure control hoses have become detached, are leaking or blocked
- ♦ Boost pressure limitation solenoid valve restricted
- ♦ Bypass valve actuator (linkage, shaft) stiff or stuck (bypass valve always closed)



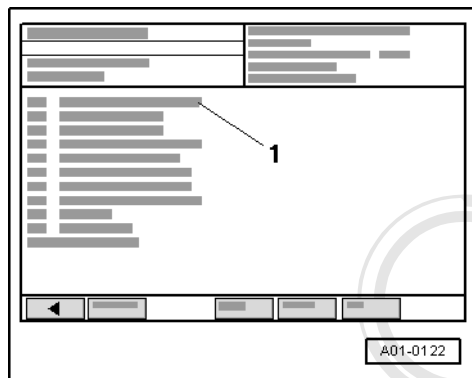
Checking with boost pressure control:

- Connect the connector to boost pressure control solenoid valve -N75.
- Erase fault memory.

=> Diesel Direct Injection and Glow Plug System (TDI 4-cylinder); Repair group 01; Interrogating and erasing fault memory Interrogating and erasing fault memory

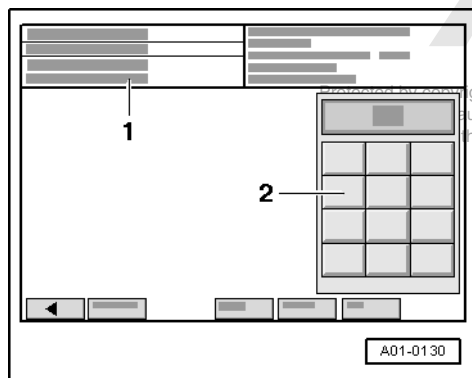
Note:

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



-> Display on VAS 5051:

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



-> Display on VAS 5051:

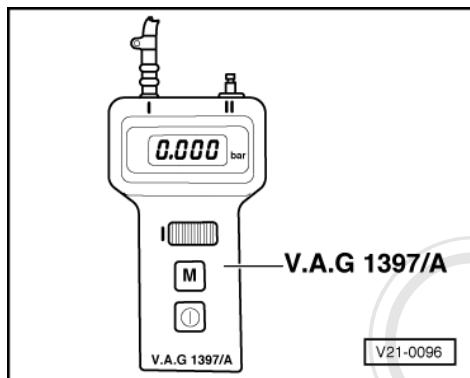
1 - Enter display group

- Enter "011" for "display group number 011" in zone -2- and confirm the entry by pressing the Q button.
- Accelerate from 1500 rpm at full throttle in third gear (or with selector lever at position 2). and watch rev counter.
- Press "Print - Save result" key on VAS 5051 and memory key -M- on V.A.G 1397 A simultaneously at approx. 3000 rpm.

	Display zones			
	1	2	3	4
Display group 011: Intake manifold pressure (boost pressure) at 3000 rpm				
Display	xxxx rpm	xxxx mbar	xxxx mbar	xx %
Display	Engine speed	Boost pressure (specified)	Boost pressure (actual)	Actuation of boost pressure control valve -N75

	Display zones			
Specification	3000 rpm	1800...2050 mbar	1800...2050 mbar	---

- Exit function "08 - Read measured value block" by pressing the ◀ key.
- Press "06 - End output".



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

- ◆ 1.800...2.050 bar

If boost pressure is not obtained:

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

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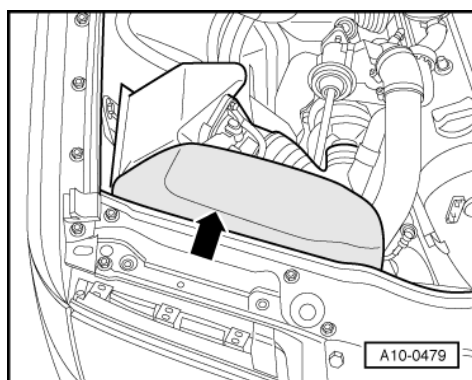
If boost pressure is exceeded:

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

1.5 - Checking boost pressure control valve linkage and vacuum unit

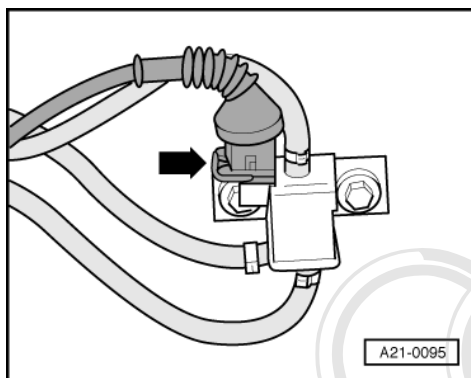
Test requirements:

- Coolant temperature at least 80 °C.

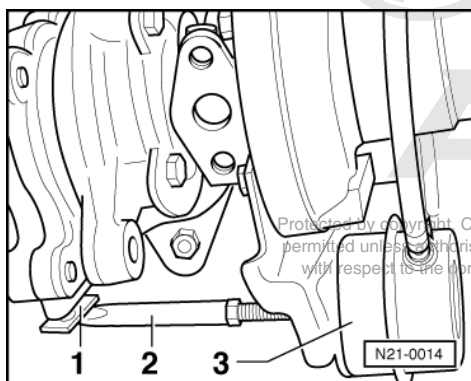


Test sequence

- -> Remove air intake pipe -arrow- between lock carrier and air cleaner housing.



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



- -> Start engine and run to maximum engine speed by sharply depressing accelerator.
- The boost pressure control valve actuating rod -2- must move

If the actuating rod does not move:

- Check boost pressure valve lever -1- for ease of operation. If rusted in place, replace turbocharger.

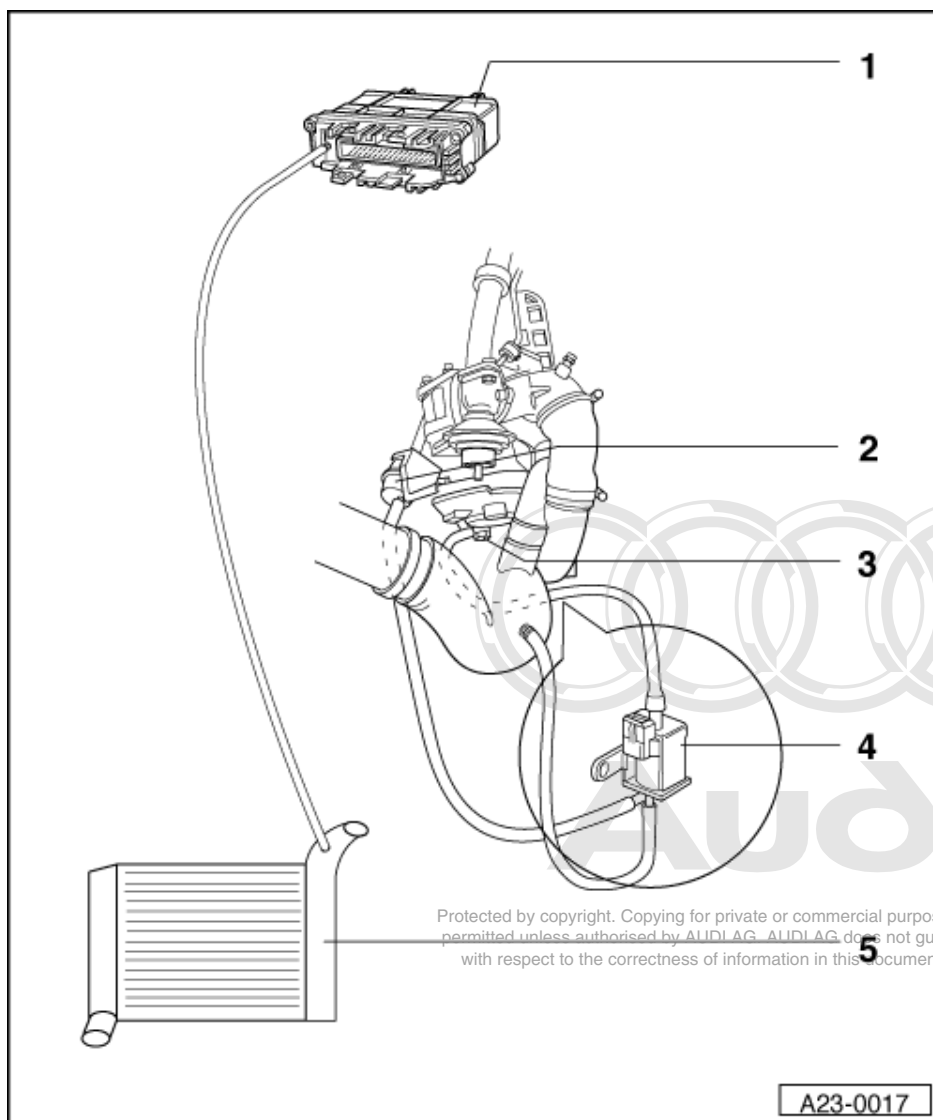
If actuating rod does not move despite ease of operation of lever:

- Replace vacuum unit for boost pressure control valve -3-.
- Erase fault memory.

Note:

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

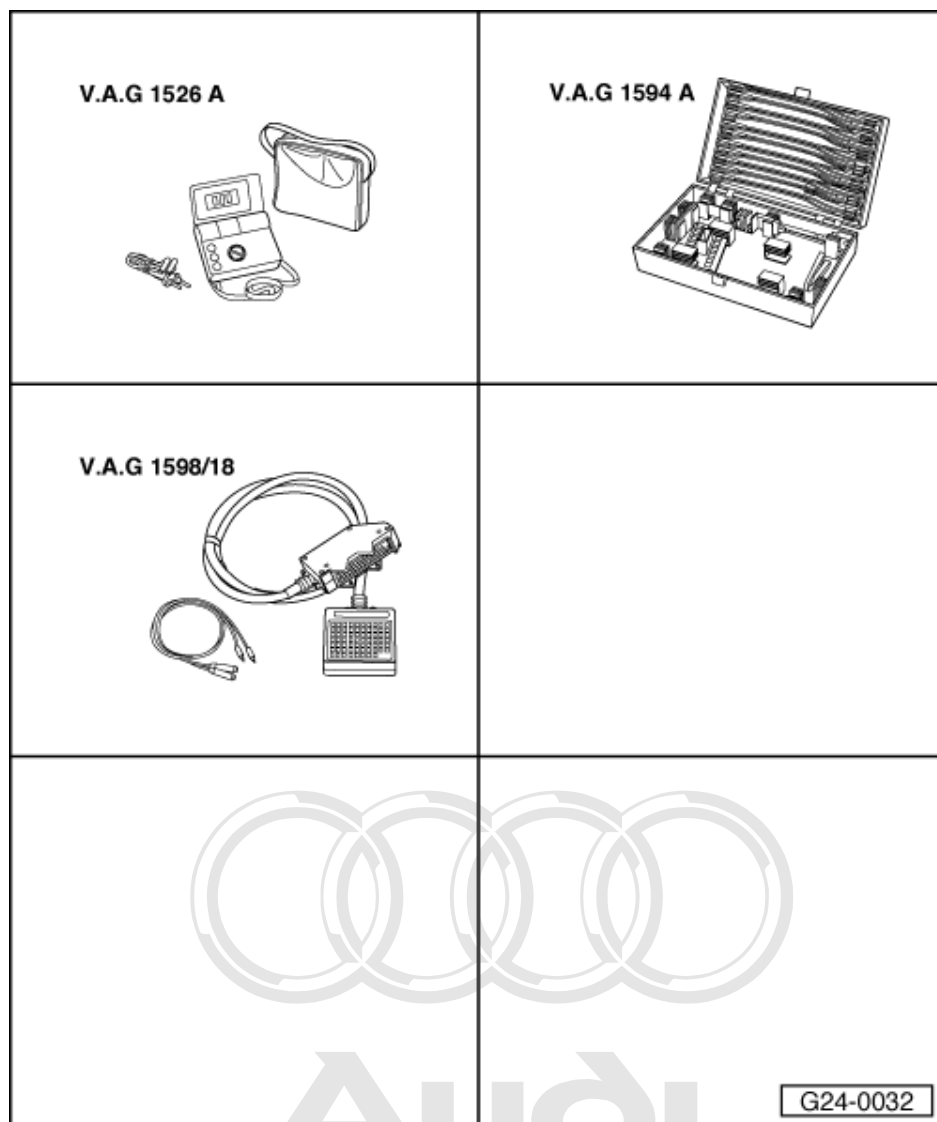
1.6 - Diagram of connections for boost pressure control system



- 1 Control unit with intake manifold pressure sender -G71
- 2 Vacuum unit
 - ♦ For boost pressure control
 - ♦ Checking => Page 21-15
- 3 Delivery connection at turbocharger
 - ♦ Pressure supply for boost pressure control system
- 4 Boost pressure control solenoid valve N75
 - ♦ Installation position: At front of engine compartment, on left
 - ♦ Checking => Page 21-18
- 5 Intercooler



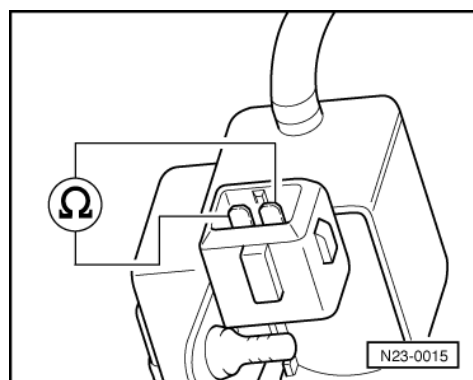
1.7 - Check solenoid valve for boost pressure limitation -N75



Special tools and workshop equipment required

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- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/18

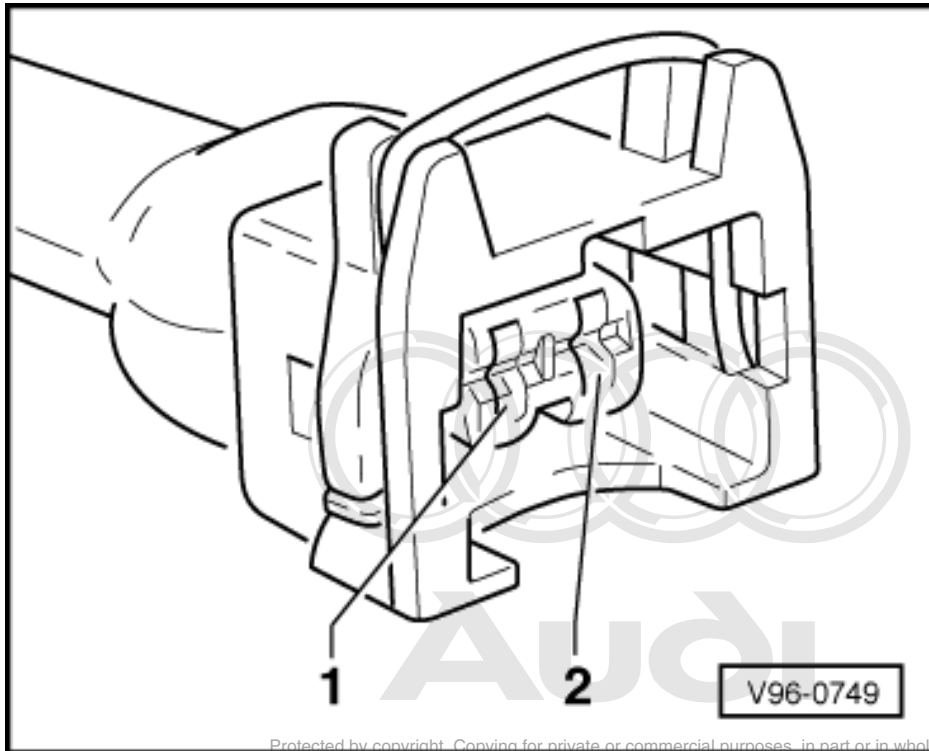


Checking internal resistance

- Switch ignition off.
- Unplug connector from solenoid valve for boost pressure control -N75.
- -> Connect multimeter to injector to measure resistance.
 - Specification: 25...45 Ω

If specification is not attained:

- Replace solenoid valve for boost pressure control -N75.



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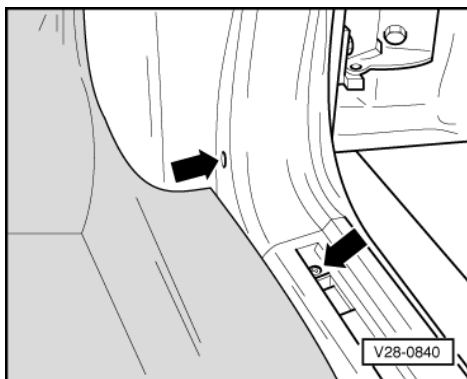
Checking power supply

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

If specification is not attained:

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

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



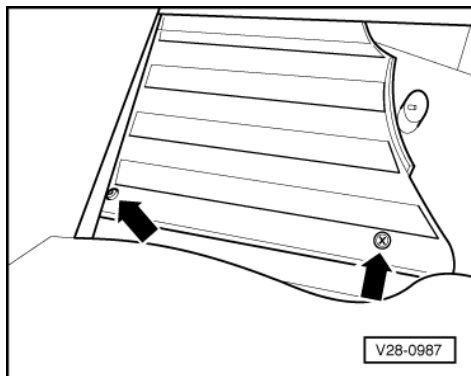


Testing control signal wiring

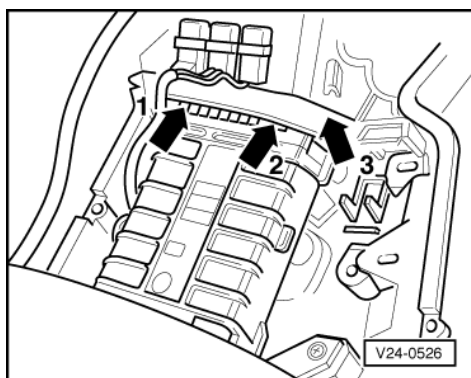
- Switch ignition off.
- -> Remove the lower part of the right A pillar trim and the front door sill panel tread strip

=> General Body Assembly; Repair group 70

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



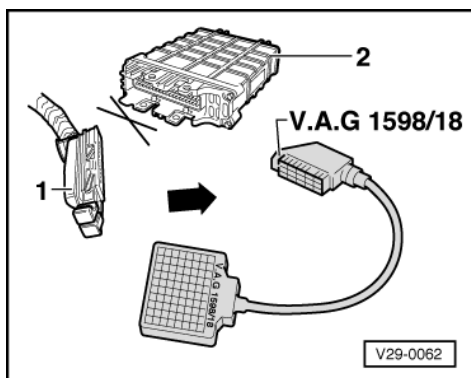
- -> Unscrew bolts -arrows- for electronics box cover.
- Carefully detach upper and lower sections of cover.



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

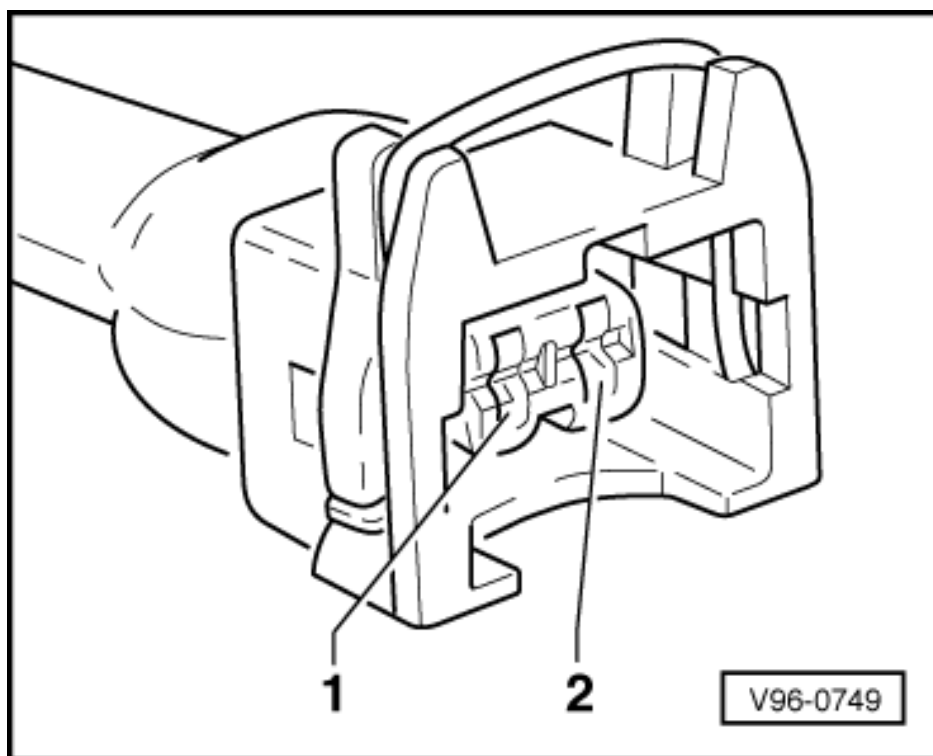
Note:

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



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- -> With the ignition switched off, connect test box V.A.G 1598/18 to connector -1- (the control unit -2- remains disconnected).



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

Connector Contact	Test box V.A.G 1598/18 Socket
1	47

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

=> Diesel Direct Injection and Glow Plug System (TDI 4-cylinder); Repair group 23; Servicing diesel direct injection system; Replacing control unit for engine electronics Servicing diesel direct injection system Replacing control unit for engine electronics

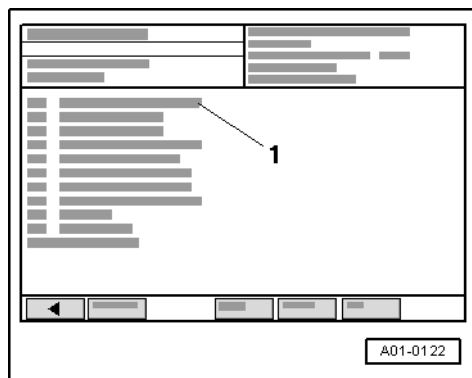
1.8 - Checking intake manifold pressure sensor

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The intake manifold pressure sender is located in the diesel direct injection system control unit.

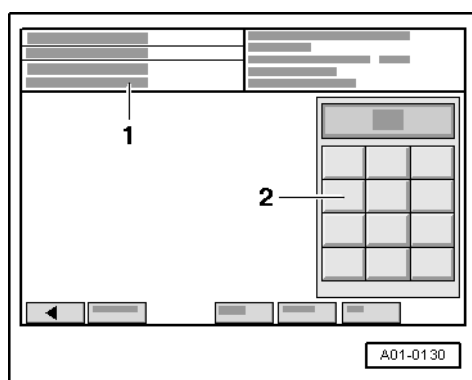
Test requirements:

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



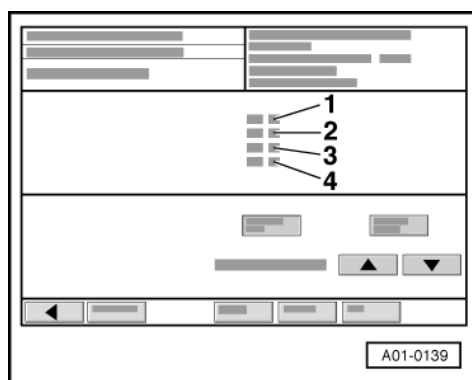
-> Display on VAS 5051:

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



-> Display on VAS 5051:

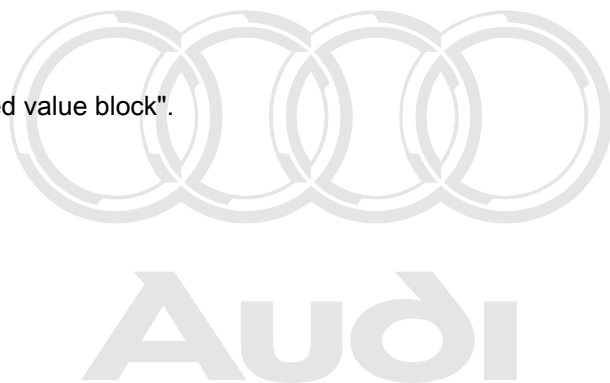
- 1 - Enter display group
- Enter "010" for "display group number 010" in zone -2- and confirm the entry by pressing the Q button.



-> Display on VAS 5051:

- Check readout in display zones -2- and -3-.
- Specification: Pressures match
Tolerance ± 30 mbar

If specification is not attained:



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- Detach the pressure hose from the engine control unit.

If the specifications are again not attained:

- Fit a new engine control unit:

=> Diesel Direct Injection and Glow Plug System (TDI 4-cylinder); Repair group 23; Servicing diesel direct injection system; Replacing control unit for engine electronics Servicing diesel direct injection system Replacing control unit for engine electronics

2 - Servicing charge air system with turbocharger

2.1 - Servicing charge air system with turbocharger

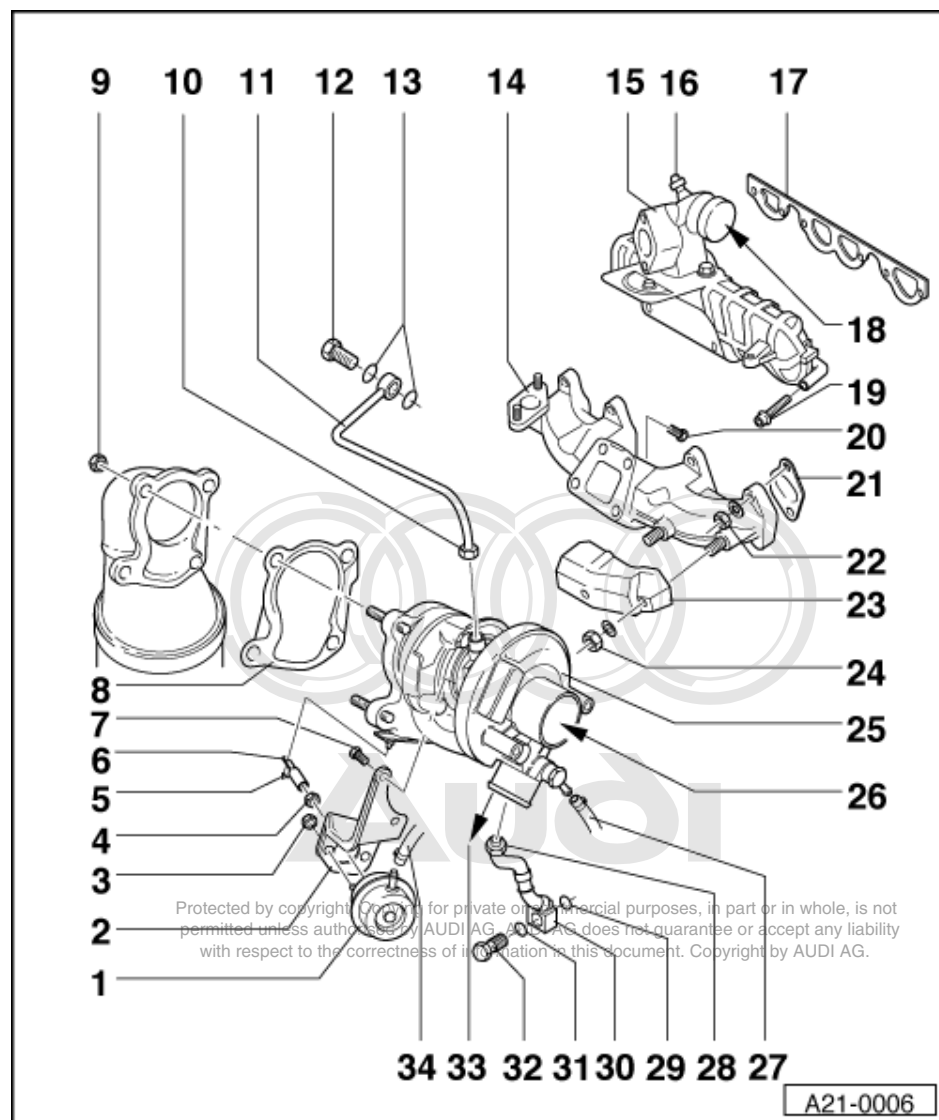
2.2 - Rules for cleanliness

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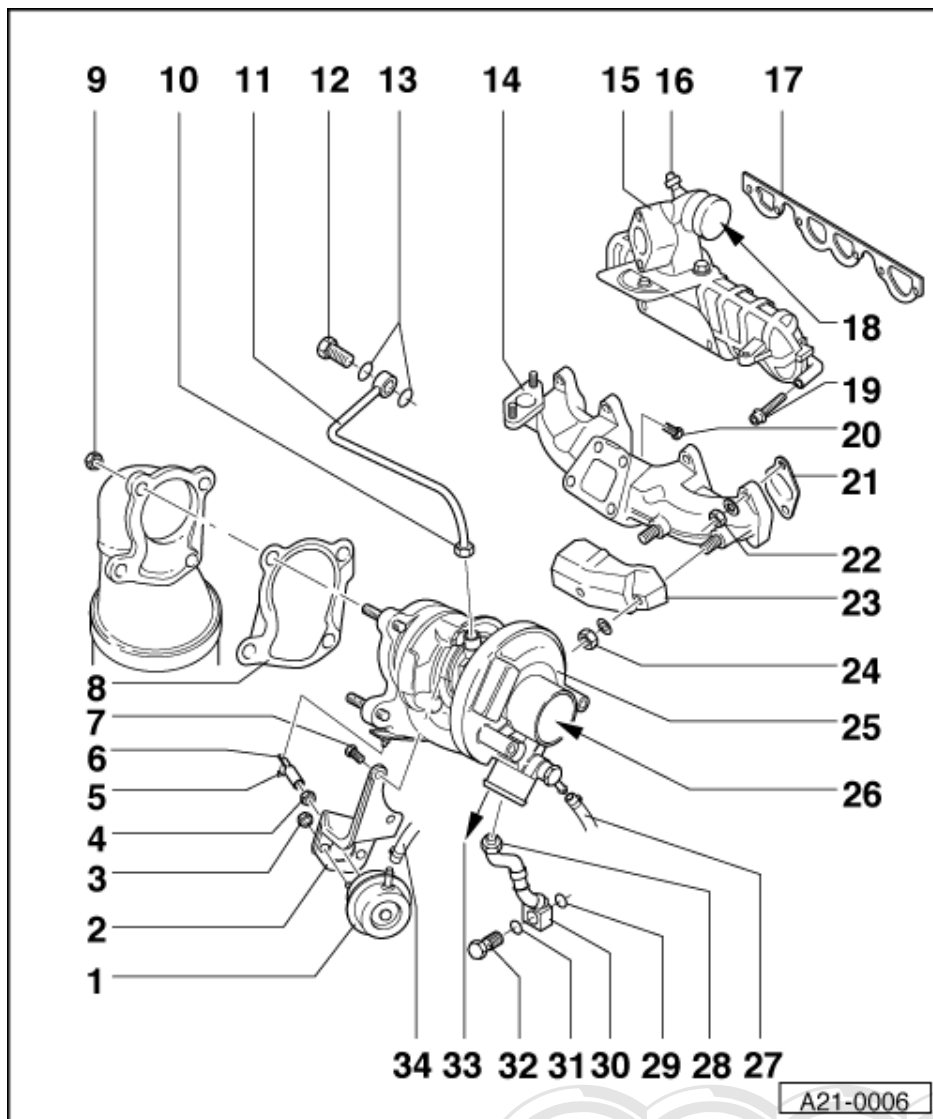
When working on the turbocharger, pay careful attention to the following "5 rules":

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

2.3 - Removing and installing turbocharger - overview



- 1 Vacuum unit
 - ♦ For boost pressure control
- 2 Bracket
- 3 10 Nm
- 4 10 Nm
 - ♦ Lock nut for actuating rod -Item 6-
 - ♦ Adjusting => Page 21-32
- 5 Retainer
- 6 Operating rod
 - ♦ For boost pressure regulating valve
 - ♦ Adjusting => Page 21-32

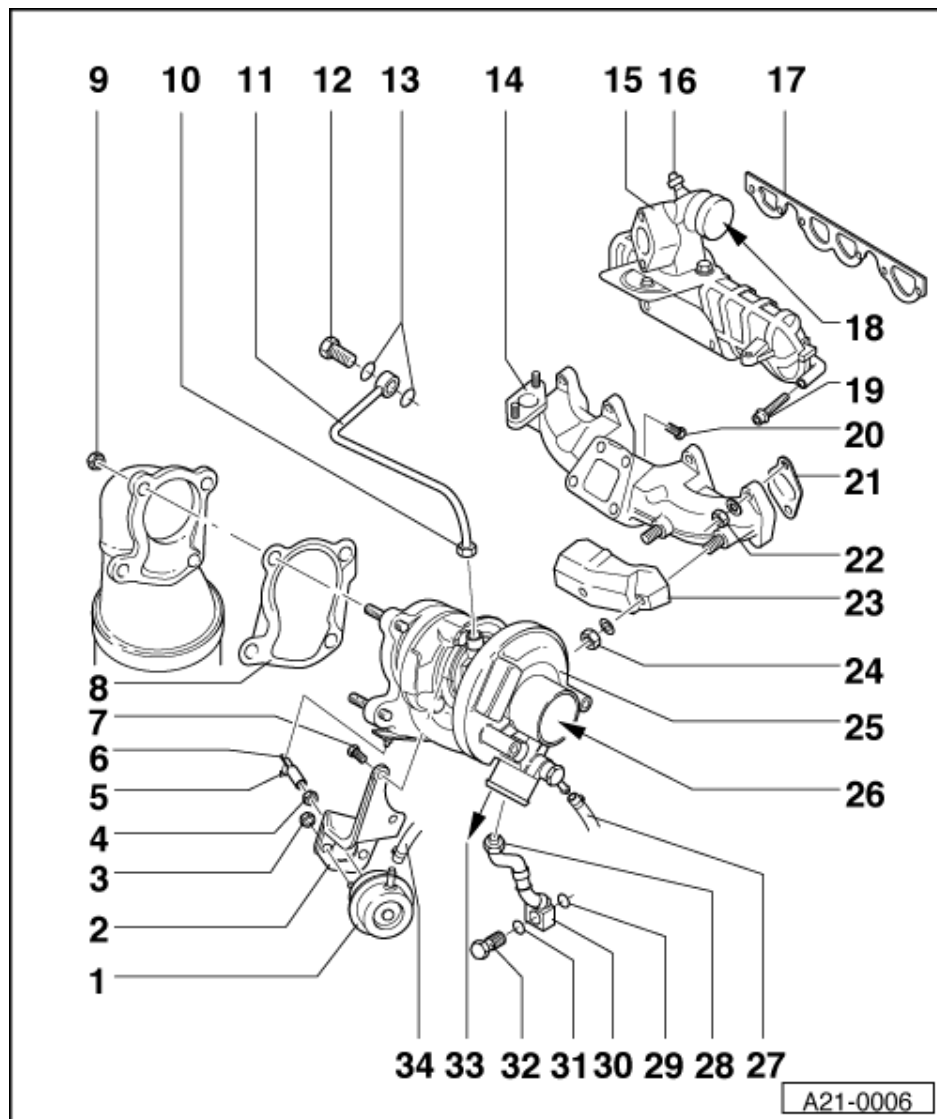


- 7 10 Nm**
- ◆ Install using locking compound
 - ◆ Locking compound

=> Parts List

- 8 Seal**
- ◆ Replace
- 9 25 Nm**
- ◆ Replace
- 10 25 Nm**
- 11 Oil supply pipe**
- ◆ From cylinder head to turbocharger
 - ◆ Tighten union nut to 25 Nm.
- 12 Banjo bolt - 25 Nm**

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13 Sealing rings

- ♦ Replace

14 Exhaust manifold

- ♦ With connection for exhaust gas recirculation

15 Intake pipe

- ♦ Removing and installing
=>Page 15-11.

16 Cap

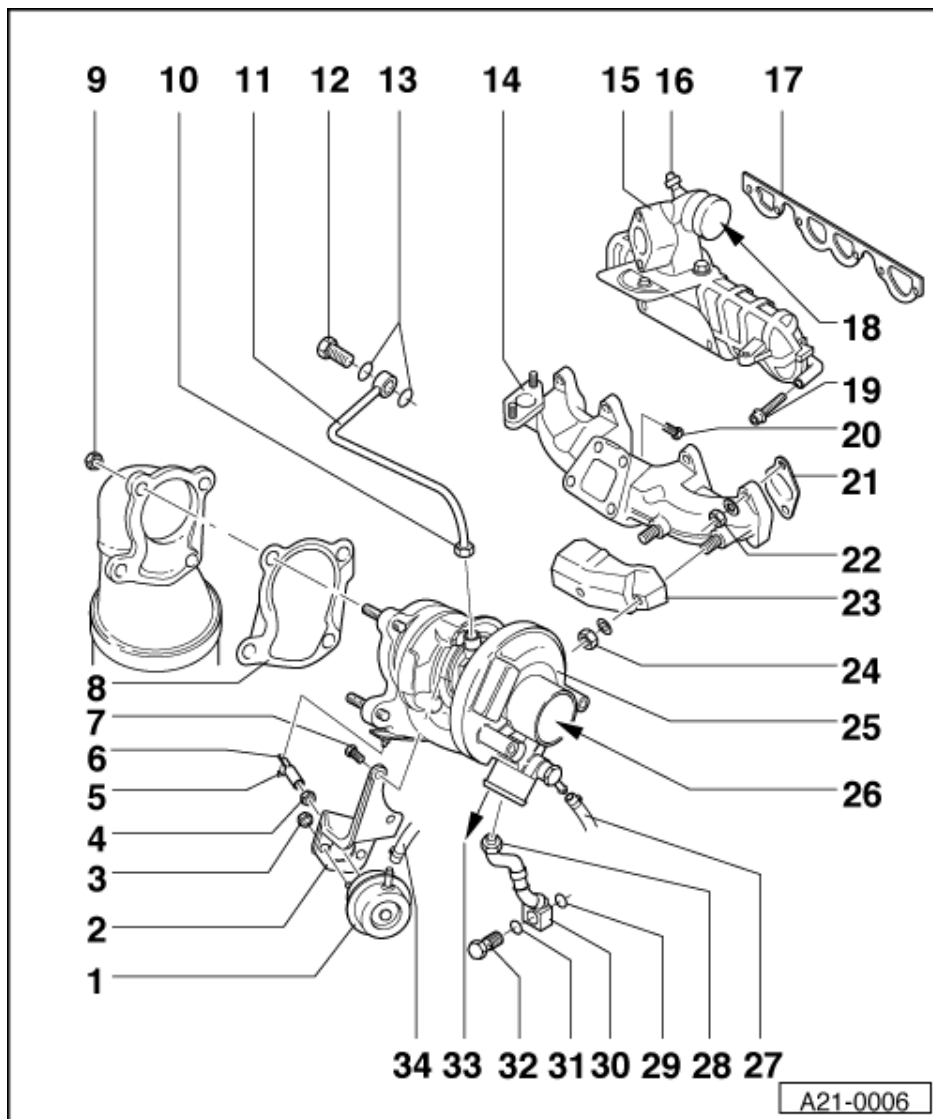
- ♦ For boost pressure test
- ♦ Secure with hose clamp

17 Seal

- ♦ Replace

18 From charge air cooler

19 25 Nm



20 30 Nm

- ◆ Replace
- ◆ Coat threads and bolt head seating surface with high-temperature lubricant
- ◆ High-temperature lubricant

=> Parts List

21 Seal

- ◆ Replace
- ◆ Note installation position

22 25 Nm

- ◆ Replace

23 Heat shield

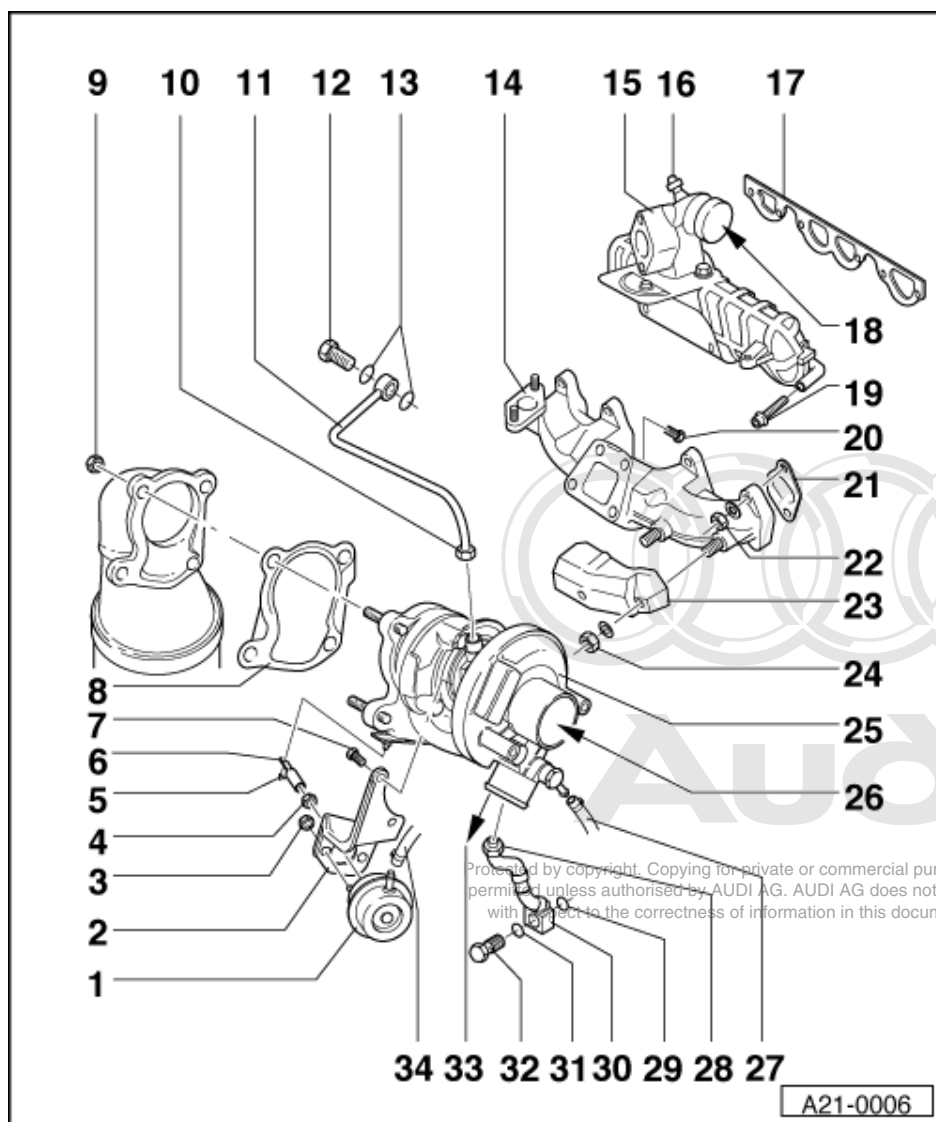
24 25 Nm

- ◆ Replace

25 Turbocharger

- ◆ Checking => as of Page 21-1
- ◆ Removing and installing
=>Page 21-34.
- ◆ Fill with engine oil via the oil supply connection

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26 From air filter

27 Charge pressure control solenoid valve -N75

- ♦ Connection diagram => Page 21-17

28 40 Nm

29 Sealing ring

- ♦ Replace

30 Oil return pipe

- ♦ To cylinder block

31 Sealing ring

- ♦ Replace

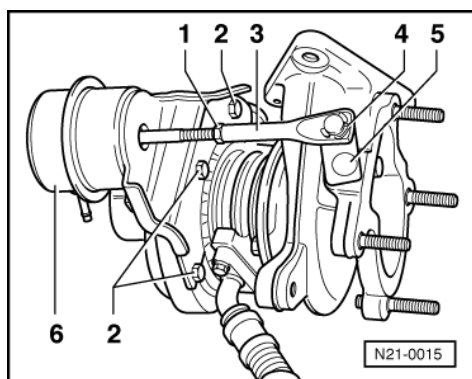
32 Banjo bolt - 30 Nm

33 To charge air cooler

34 From boost pressure control solenoid valve -N75

- ♦ Connection diagram => Page 21-17

2.4 - Removing and installing vacuum unit for boost pressure control valve



Removing

- Removing the turbocharger => Page 21-34
- -> Unclip retainer -4-.
- Remove bolts -2-.
- Remove vacuum unit -6-.

Installing

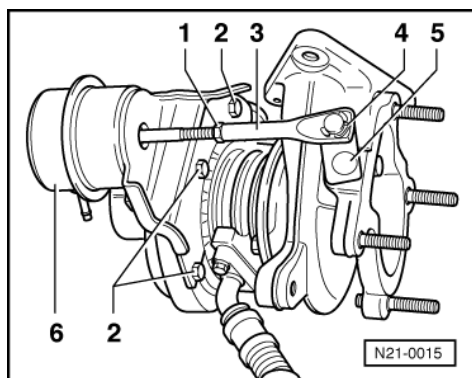
- Insert bolts -2- for vacuum unit -6- into turbocharger using liquid locking compound and tighten to 10 Nm.

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♦ Locking compound

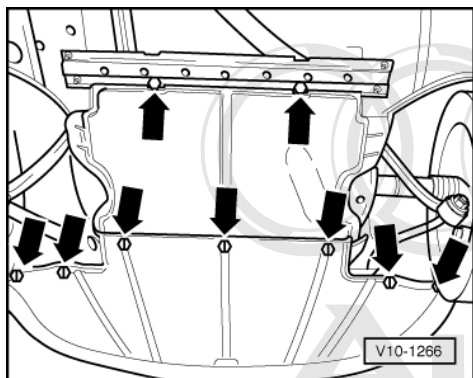
=> Parts List

- Loosen lock nut -1- for actuation rod -3-.
- Move boost pressure valve -5- up to stop towards vacuum unit and hold in place.
- Adjust actuation rod length -3- so that rod eye is easily placed over lever pin -5-. (Lever located at stop without play)



- -> Starting from this position, screw in actuating rod by 8 turns. (rod is shortened.)
- Tighten lock nut -1-.
- Position actuating rod on lever and push retainer -4- in place.
- Installing the turbocharger => Page 21-37

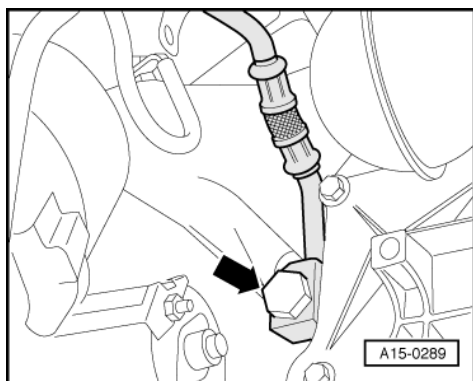
2.5 - Removing and installing turbocharger



Removing

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- -> Remove noise insulation (two sections) -arrows-



- Place drip tray underneath.
- -> Detach the oil return line at cylinder block -arrow-.

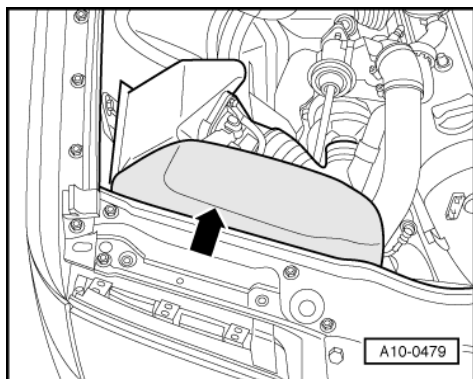
Vehicles with air conditioner:

- Remove ribbed belt => Page 13-11

Important

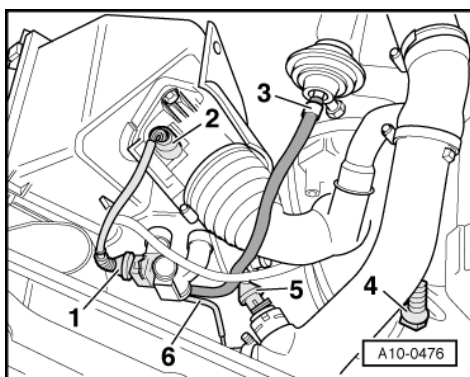
The air conditioner refrigerant circuit must not be opened.

- Detach A/C compressor and suspend from body using wire.



All models:

- -> Remove air intake pipe -arrow- between lock carrier and air cleaner housing.

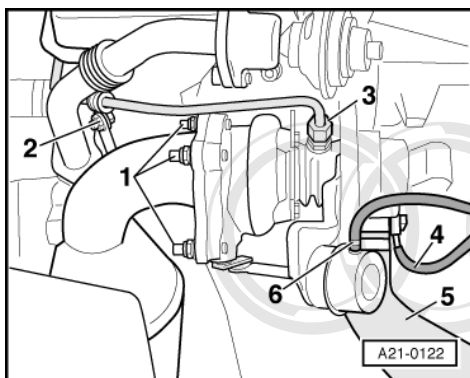


- -> Disconnect wires/unplug connectors:

- 1 - EGR valve -N18
- 2 - Air mass meter -G70
- 4 - Solenoid valve for boost pressure limitation -N75
- 5 - Intake manifold temperature sender -G72

- Disconnect vacuum hose at mechanical exhaust gas recirculation valve -3-.
- Disconnect the thin hose -6- at the bottom at the exhaust gas recirculation valve -N18.

- Lay wiring and hoses aside.
- Remove the air hose at the air mass meter.
- Remove upper section of air cleaner housing and air mass meter.
- Remove front air duct hose at turbocharger.



- -> Remove intake air hose -5- from charge air cooler to turbocharger.
- Unscrew the oil supply pipe -3- from the turbocharger.
- Unbolt bracket -2- for oil feed pipe at exhaust manifold.
- Disconnect hose -6- at vacuum unit for boost pressure control.
- Disconnect hose -4- from turbocharger.
- Unscrew turbocharger/catalytic converter nuts -1-.
- Unscrew bolts for turbocharger/exhaust manifold and detach turbocharger.

Installing

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

Notes:

- ◆ Coat threads and bolt head contact surface for turbocharger with high-temperature lubricant. High-temperature lubricant:



=> Parts List

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

=> Parts List

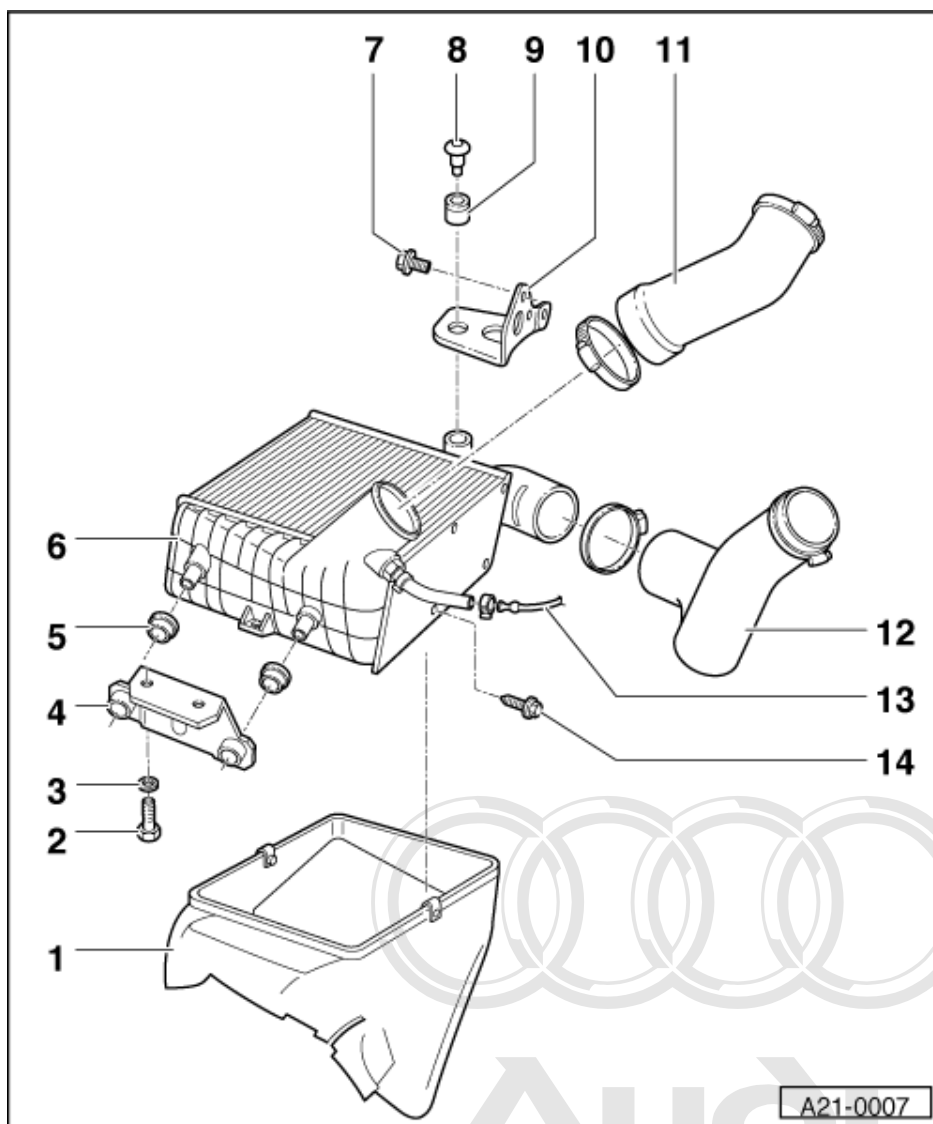
- ♦ Always replace seals, gaskets and self-locking nuts.
 - ♦ Charge air system must be free of leaks.
 - ♦ After installing the turbocharger, run engine for approx. 1 minute at idling speed; do not rev. up immediately. This ensures the turbocharger is properly lubricated.
- Check oil level => Page 17-19.

Tightening torques

Component	Nm
Turbocharger to exhaust manifold	30
Turbocharger to catalytic converter	25
Oil return line to cylinder block	30
Oil supply pipe to turbocharger	25
Hose clamps	2

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2.6 - Removing and installing parts of charge air cooling system



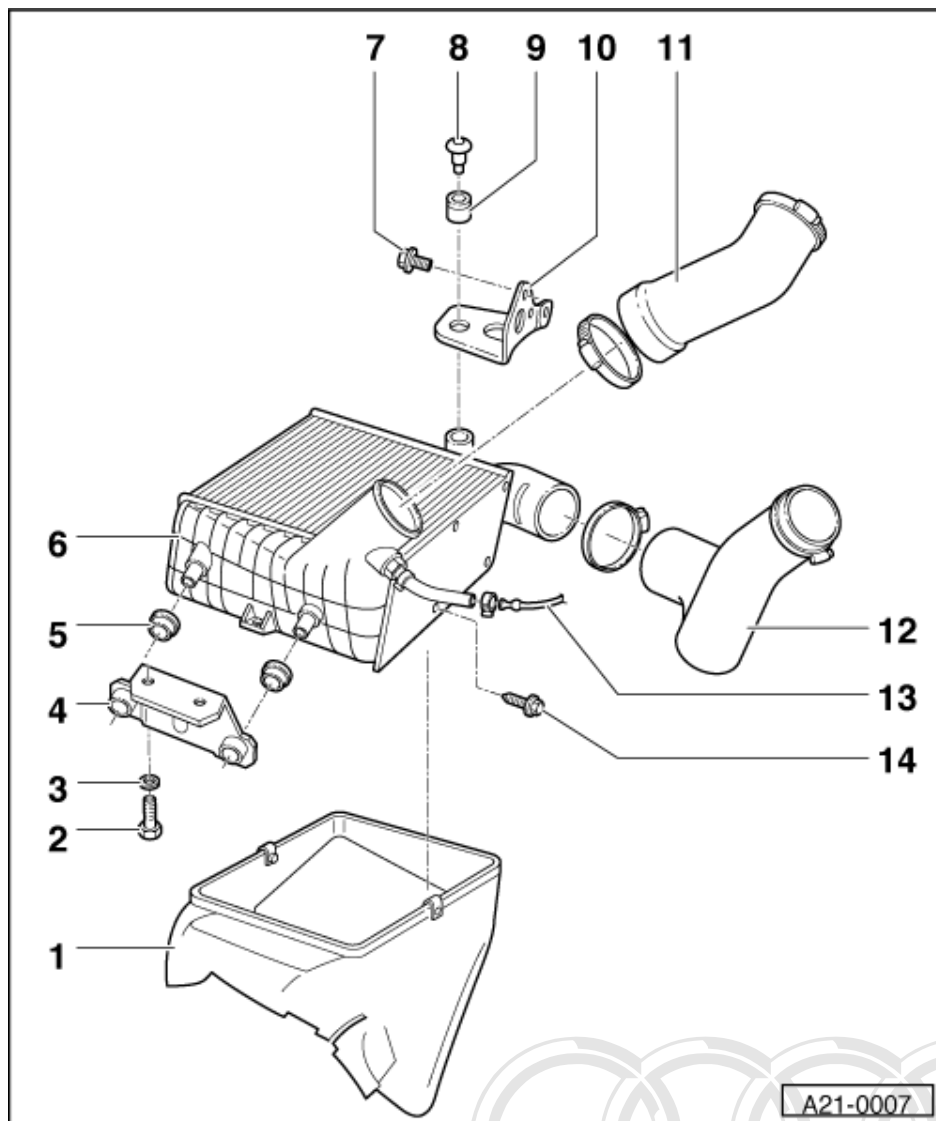
Notes:

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

=> Parts List

- ◆ Charge air system must be free of leaks.

- 1 Air duct
- 2 20 Nm
- 3 Washer
- 4 Angle bracket, front
- 5 Rubber grommet
 - ◆ For front angle bracket



6 Intercooler

- ♦ Removing and installing
=>Page 21-42.

7 20 Nm

8 Cheese-head bolt - 20 Nm

- ♦ With collar

9 Rubber grommet

- ♦ For rear angle bracket

10 Angle bracket, rear

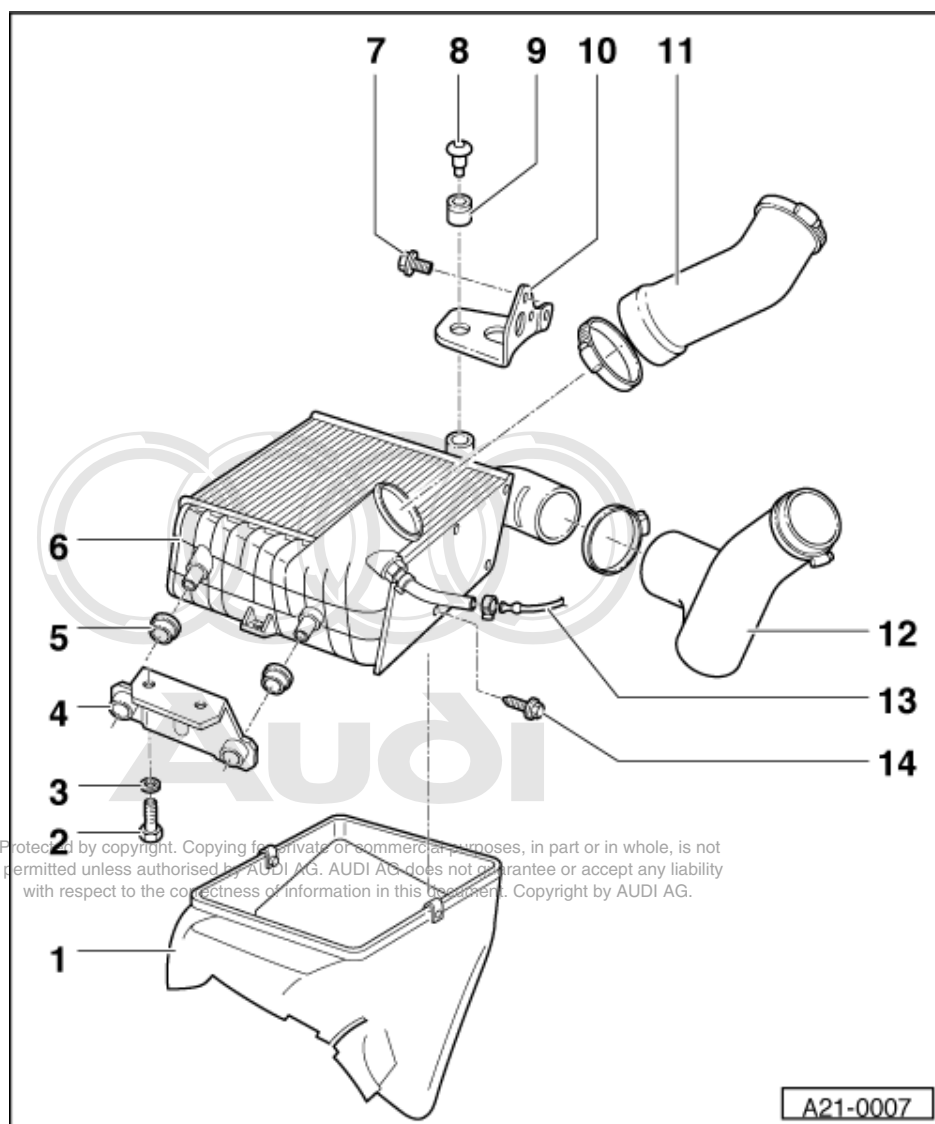
11 Air duct hose

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

12 Air duct hose

- ♦ Between charge air cooler and turbocharger

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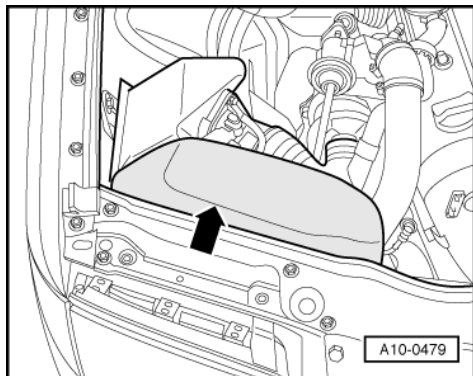
13 Vacuum line

- ◆ To engine control unit
- ◆ In engine wiring harness
- ◆ Must not be shortened or lengthened
- ◆ Use same length and internal diameter when replacing:

=> Parts List

14 Self-tapping screw

2.7 - Removing and installing charge air cooler (intercooler)

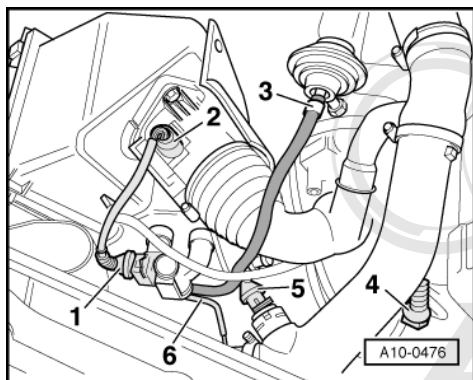


Removing

- Remove the front bumper:

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

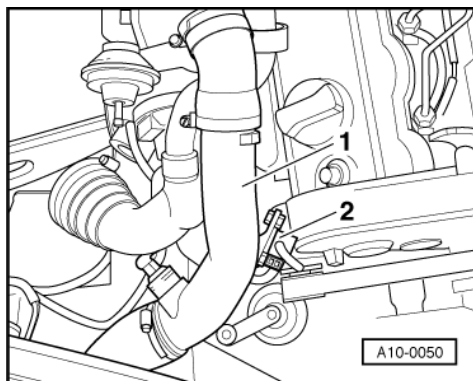
- -> Remove air intake pipe -arrow- between lock carrier and air cleaner housing.



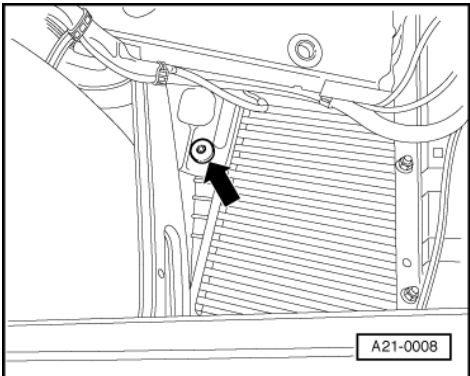
- -> Disconnect wires/unplug connectors:

- 1 - EGR valve -N18
- 2 - Air mass meter -G70
- 4 - Solenoid valve for boost pressure limitation -N75
- 5 - Intake manifold temperature sender -G72

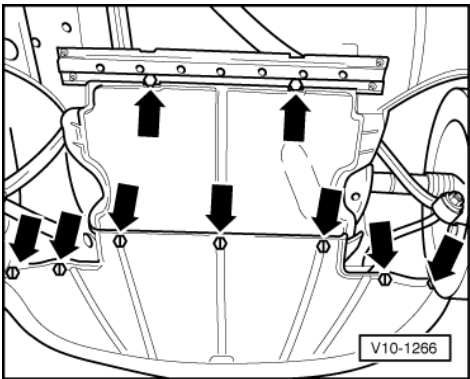
- Disconnect vacuum hose at mechanical exhaust gas recirculation valve -3-.
- Disconnect the thin hose -6- at the bottom at the exhaust gas recirculation valve -N18.
- Lay wiring and hoses aside.
- Remove the air hose at the air mass meter.
- Remove upper section of air cleaner housing and air mass meter.



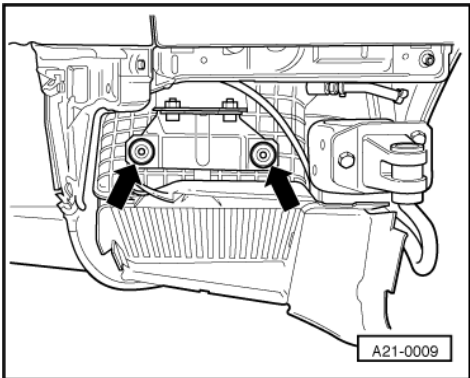
- Remove front air duct hose at turbocharger.
- -> Remove air intake pipe -1- between charge air cooler and intake pipe.
- Remove intake air hose from charge air cooler to turbocharger.
- Remove the lower section of the air cleaner housing.



- -> Unscrew bolt at rear -arrow-.



- -> Remove front part of noise insulation -bottom arrows-.



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

Installing

Installation is in reverse order.

Tightening torques

Component	Nm
Charge air cooler on bracket	20

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Audi 100 1991 ➤

4-Cyl. Diesel Direct Injection Engine (TDI®), Mechanical Components - Edition 12.
2001

Hose clamps	2
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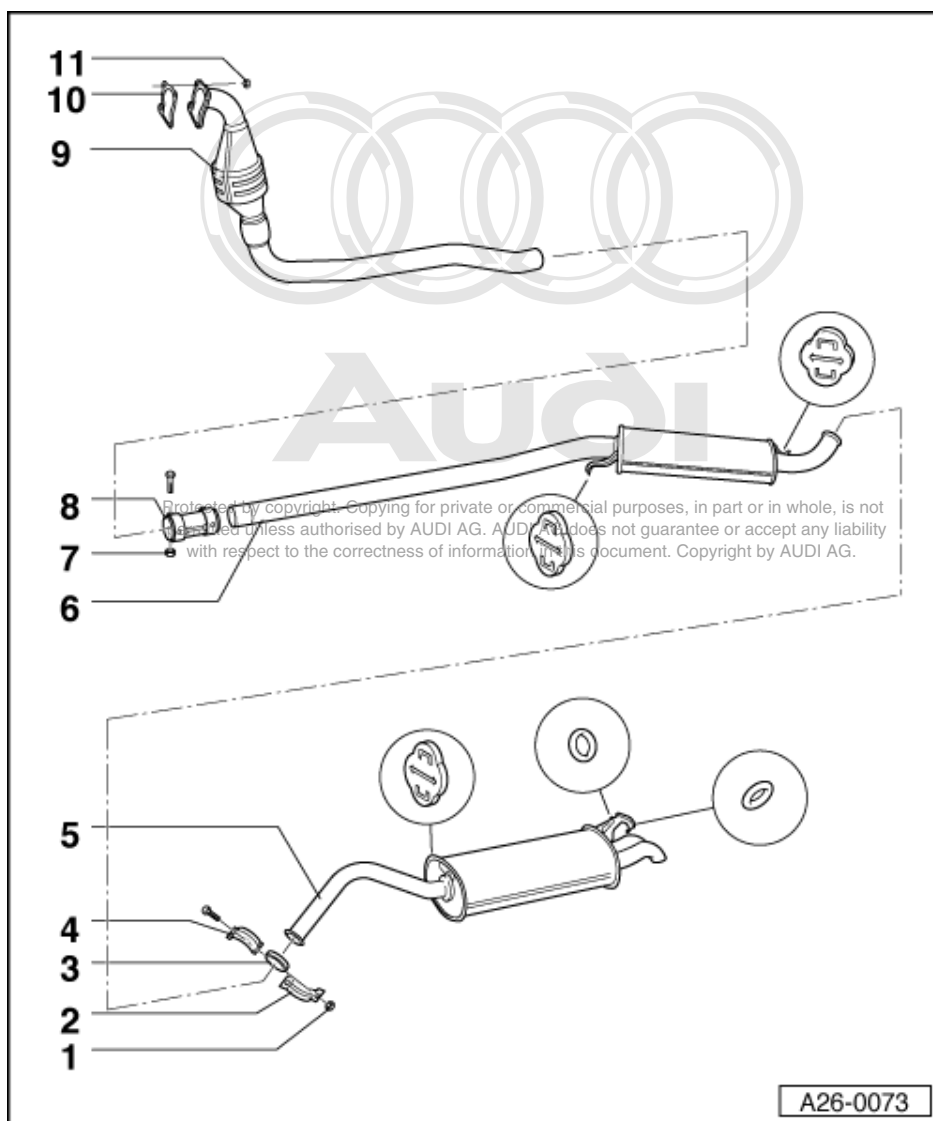
26 - Exhaust system

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.
- ♦ The isolating element in exhaust system must not be bent more than 10 °to avoid damage.
- ♦ Removing and installing floor cross member => Fig.26-5
- ♦ After installing exhaust system bend securing tabs over approx. 90° at retaining ring brackets => Fig.26-4.



1 25 Nm

- ♦ Replace

2 Clip

3 Sealing ring

- ♦ Sensitive to impact; take care not to drop

4 Clip

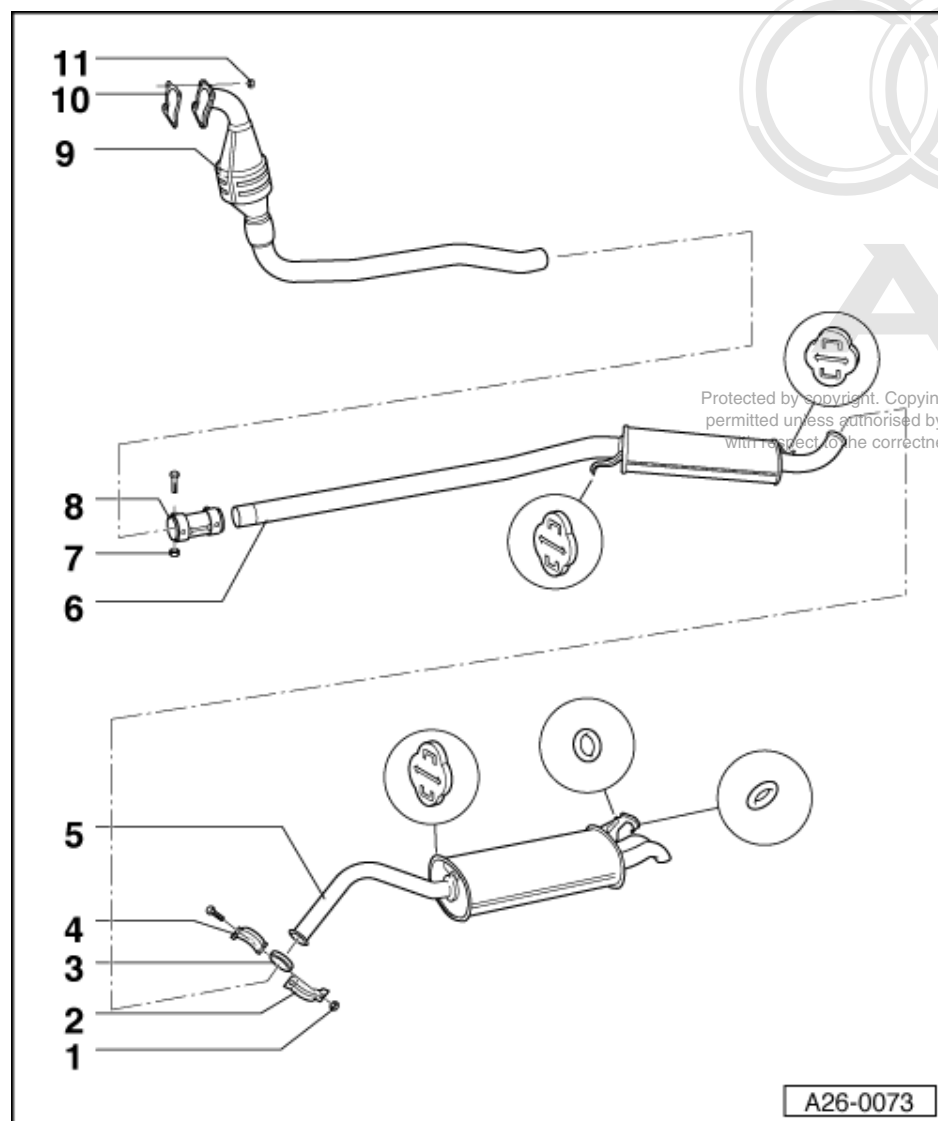
5 Rear silencer

- ♦ Align exhaust system so it is free of stress before tightening clamp
=> Page 26-10

6 Front silencer

- ♦ Align exhaust system so it is free of stress before tightening clamp
=> Page 26-10

7 40 Nm



8 Clamp

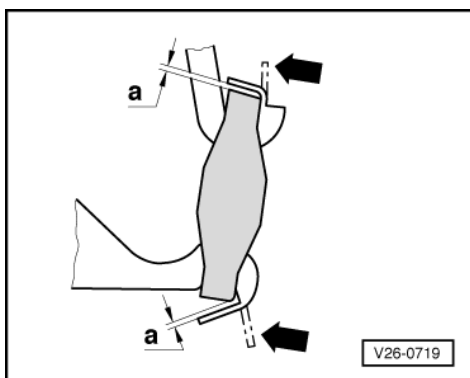
- ♦ Align exhaust system so it is free of stress before tightening clamp => Page 26-10
- ♦ Installation position: bolted connection on right
- ♦ Installation position of bolts => Fig.4
- ♦ Tighten bolted connections evenly.

9 Catalytic converter

- ♦ With flexible connection (de coupling element)
- ♦ Do not bend flexible connection more than 10° - otherwise it can be damaged.
- ♦ Protect from damage by knocks and impact
- ♦ Removing and installing
=>Page 26-8.

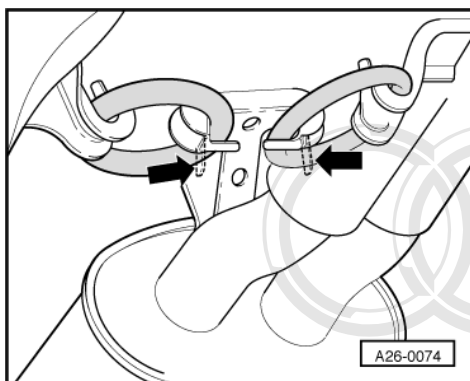
10 Seal

- ♦ Replace
- 11 25 Nm
- ♦ Replace



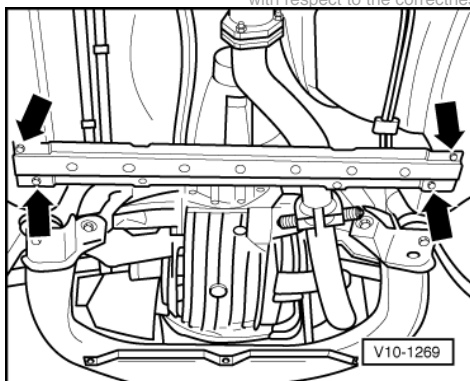
→ Fig.1 Bending over securing tabs on brackets of front mounting

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



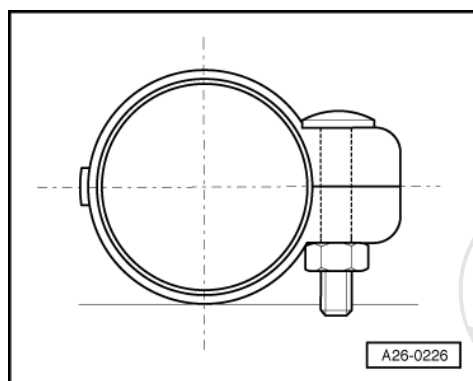
→ Fig.2 Bending over securing tabs on brackets of rear mounting

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



-> Fig.3 Removing and installing floor cross member

- ♦ Tightening torque: 20 Nm



-> Fig.4 Installation position of the clamping sleeve

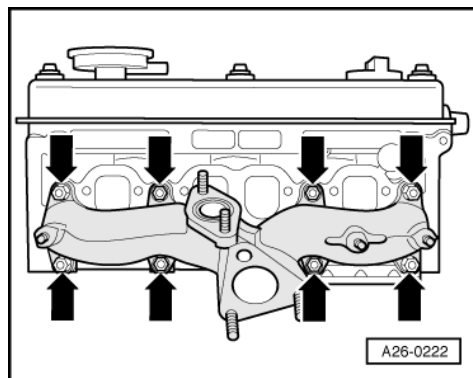
- Fit clamp in horizontal position.
- Bolted connection faces right

1.2 - Removing and installing exhaust manifold

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Removing

- Removing the turbocharger => Page 21-34
- Unbolt heat shield.
- Unscrew pipe for exhaust gas recirculation.



- -> Unscrew all nuts -arrows- on exhaust manifold.
- Remove washers and exhaust manifold.

Installing

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

Note:

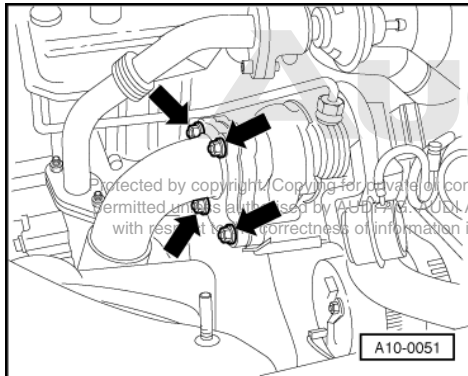
Always replace seals, gaskets and self-locking nuts.

- Installing the turbocharger => Page 21-37

Tightening torques

Component	Nm
Exhaust manifold to cylinder head	25
Heat shield to exhaust manifold	25
Exhaust gas recirculation pipe to exhaust manifold	25

1.3 - Removing and installing front exhaust pipe with catalytic converter

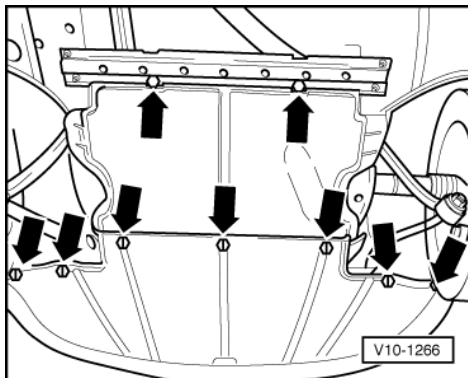


Removing

Note:

The isolating element in exhaust system must not be bent more than 10 °to avoid damage.

- -> Remove the securing bolts -arrows- of the turbocharger/catalytic converter.
- Detach the front exhaust pipe with the catalytic converter from the turbocharger.



- -> Detach noise insulation (two sections) -arrows-.
- Release the clamping sleeve for the exhaust system.
- Push clamping sleeve to the rear and detach the exhaust pipe.

Installing

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

Note:

Always replace seals, gaskets and self-locking nuts.

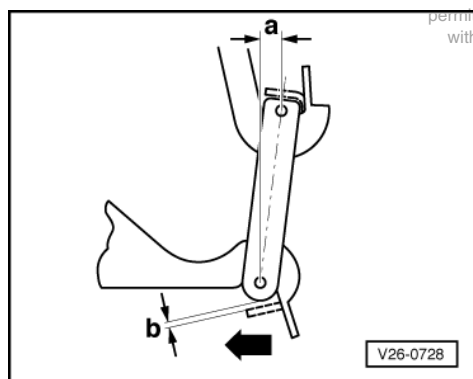
- Stress-free alignment of exhaust system => Page 26-10

Tightening torques

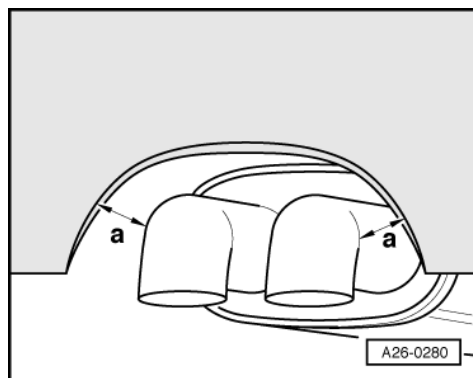
Component	Nm
Catalytic converter to turbocharger	25
Clamping sleeve for exhaust pipe	40

1.4 - Stress-free alignment of exhaust system

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- The exhaust system must be aligned when cold.
- Loosen bolted connections on clamp -Item 26-3
- -> Push exhaust system towards front of vehicle -arrow- so that rear left mounting on front silencer is pre-loaded by $a = 7 \dots 10 \text{ mm}$.
- Tighten bolted connections on clamp evenly to 40 Nm.



Aligning tailpipes

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

1.5 - 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 (cylinder head/manifold, manifold/turbocharger, turbocharger/catalytic converter, etc.) to locate any leaks.
- Rectify any leaks that are found.

2 - Exhaust gas recirculation system

2.1 - Exhaust gas recirculation system

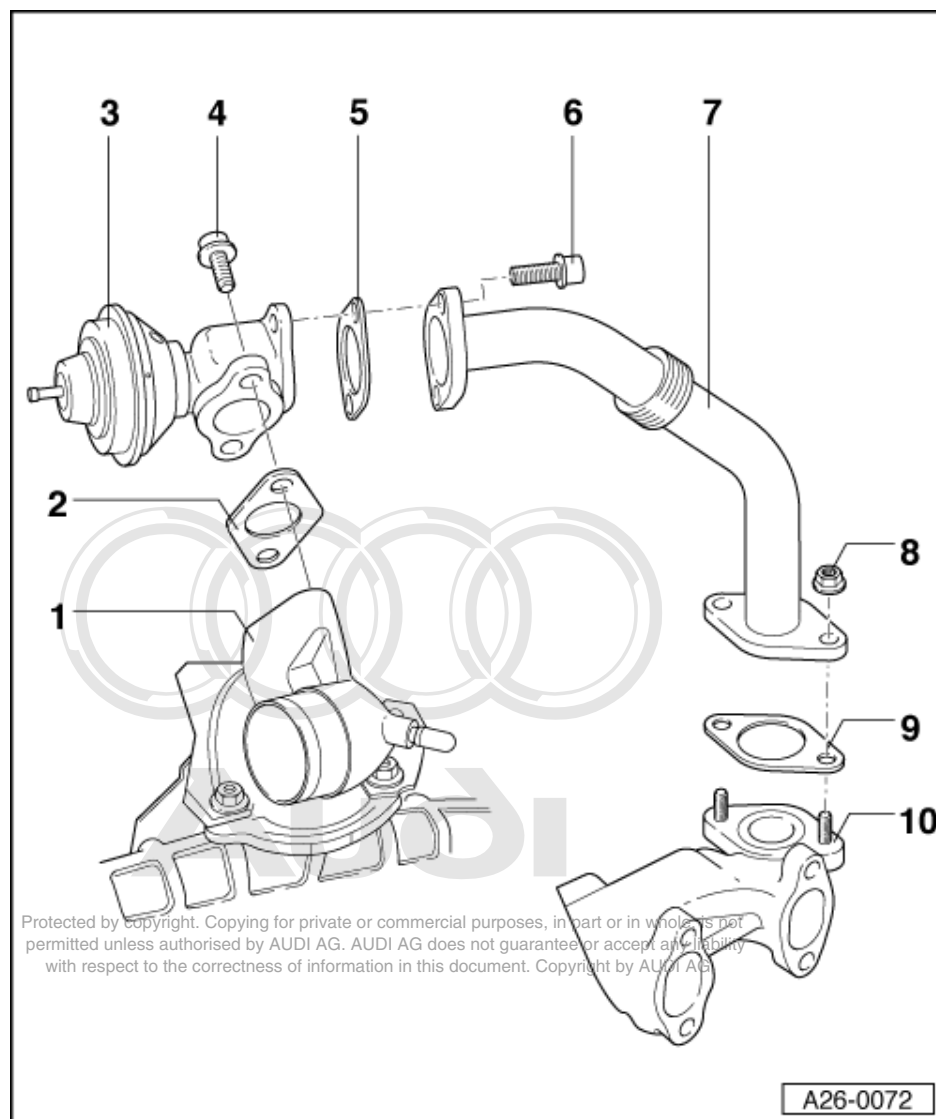
Notes:

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

=> Parts List

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

2.2 - Removing and installing exhaust gas recirculation components



1 Intake pipe

2 Seal

- ♦ Replace

3 Exhaust gas recirculation valve

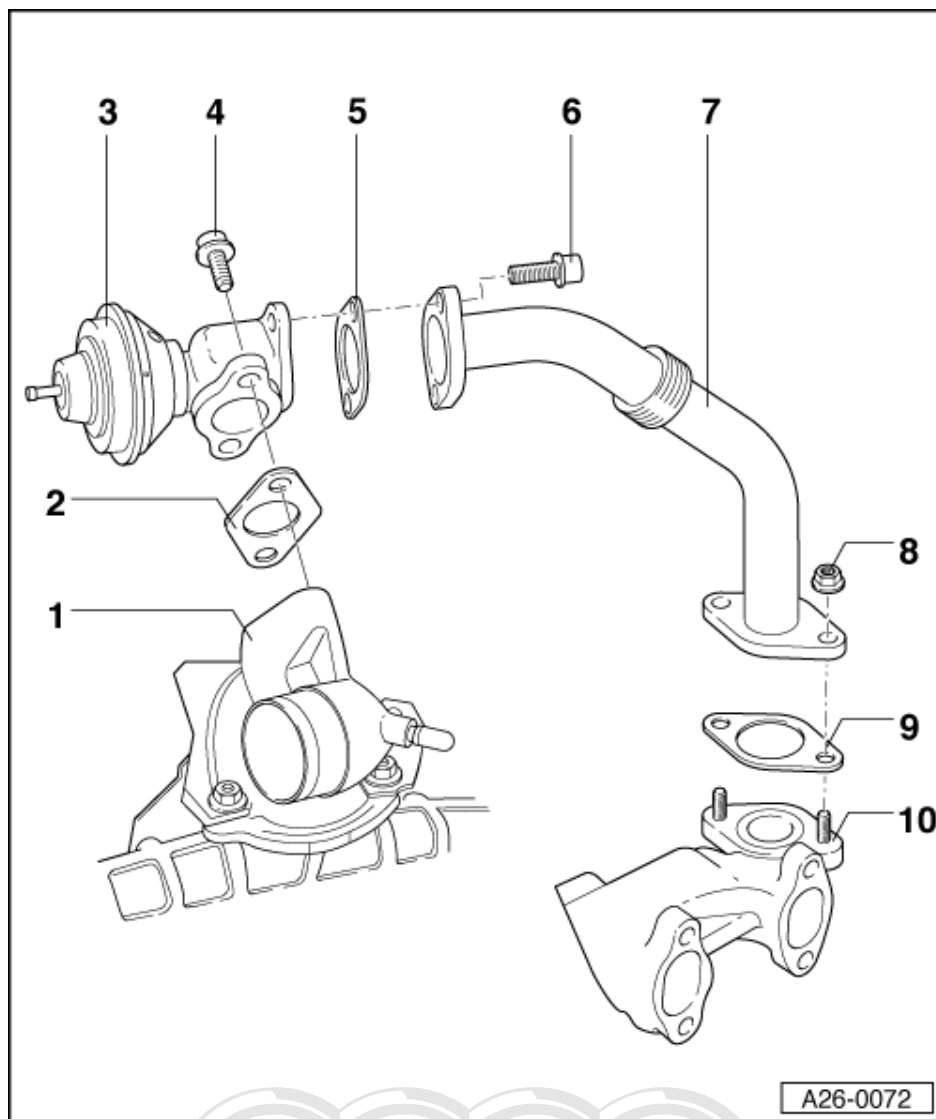
- ♦ Checking => Page 26-16

4 25 Nm

5 Seal

- ♦ Replace

6 25 Nm



7 Pipe for exhaust gas recirculation

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

8 25 Nm

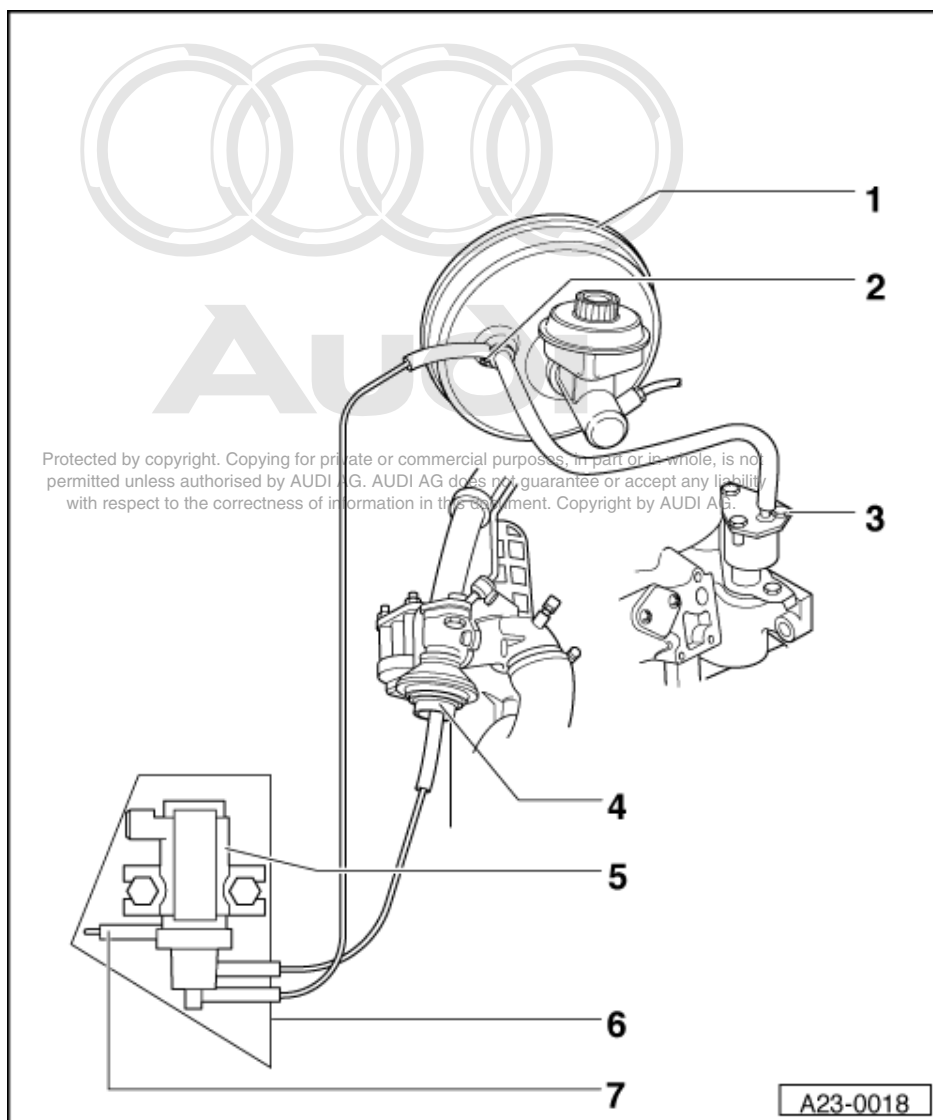
9 Seal

- ♦ Replace

10 Exhaust manifold

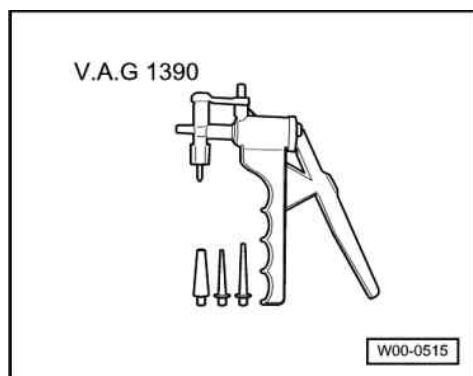
- ♦ Removing and installing =>Page 26-6.

2.3 - Diagram of vacuum hose connections



- 1 Brake servo
- 2 Vacuum connection
- 3 Exhauster
 - ♦ For brake servo
- 4 Mechanical EGR valve
- 5 EGR valve -N18
- 6 Air cleaner
- 7 Vent line
 - ♦ To air cleaner

2.4 - Checking mechanical EGR valve

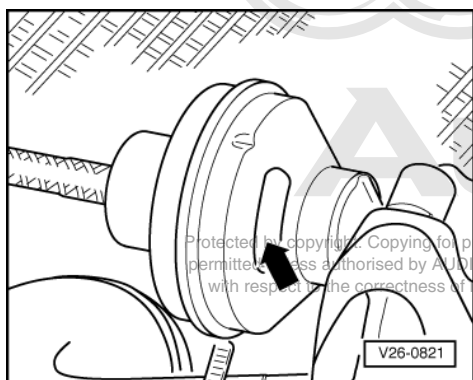


Special tools and workshop equipment required

- ♦ V.A.G 1390

Test sequence

- Disconnect vacuum hose from mechanical EGR valve.
- Connect hand vacuum pump V.A.G 1390 to valve.
- Operate pump.
 - The diaphragm rod must move towards the vacuum connection



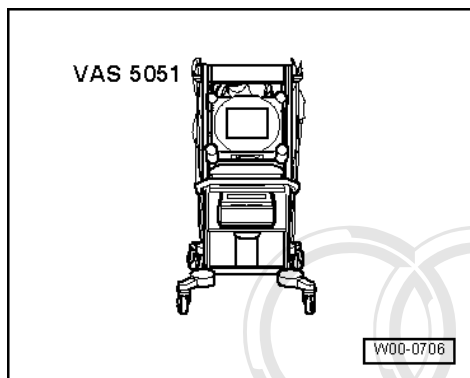
Note:

-> Observe diaphragm rod through opening -arrow-.

- Disconnect hand vacuum pump hose from exhaust gas recirculation valve.
 - The valve must be clearly heard to close. The diaphragm rod moves towards the intake manifold

2.5 - Checking EGR

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

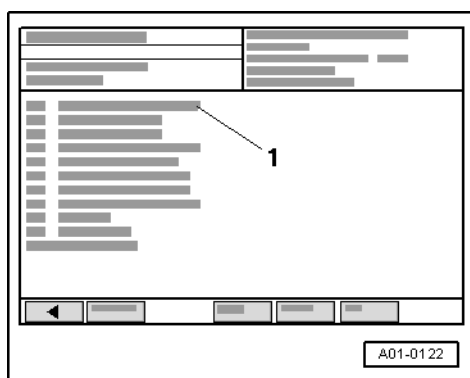


Special tools and workshop equipment required

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

Test requirements:

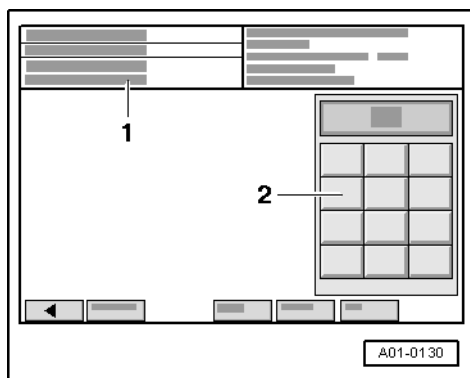
- Vehicle diagnostic testing and information system VAS 5051 connected, vehicle self-diagnosis and vehicle system "01 - Engine electronics" selected
- Engine running at idling speed
- Coolant temperature at least 80 °C=> display group 001, display zone 4.
- Final control diagnosis has been performed



Test sequence

-> Display on VAS 5051:

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





-> 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.
- Briefly depress the accelerator pedal, then allow the engine to continue running at idling speed.

	Display zones			
	1	2	3	4
Display group 003: Exhaust gas recirculation at idle				
Display	xxxx rpm	xxx mg/stroke	xxx mg/stroke	xx %
Display	Engine speed	Air mass (specified)	Air mass (actual)	Checking actuation of EGR valve -N18
Specification	780...900 rpm	230...370 mg/stroke	230...370 mg/stroke	30...80 %
Note:		If a value higher than 370 mg/stroke is displayed: Engine too cold => run until warm	If specification is not attained: Evaluation => Page 26-20	

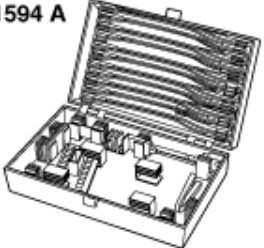
Evaluation of display group 003

Display zone: 3	Possible causes of fault	Fault remedy
Constant 425 mg/stroke	- Open circuit in wiring to air mass meter	- Check air mass meter => Diesel Direct Injection and Glow Plug System (TDI, 4-cylinder); Repair group 23
	- Air mass measured not plausible	
Over 370 mg/stroke	- Engine has been running for 10 minutes at idling speed	- Briefly depress accelerator sharply
	- Excessive exhaust gas recirculation	- Check mechanical exhaust gas recirculation valve => Page 26-21
	- Engine load from ancillaries	- Eliminate load (air conditioner system/ power steering/alternator)
	- Intake manifold temperature too high	
	- Injection pump too lean	=> Diesel Direct Injection and Glow Plug System (TDI, 4-cylinder); Repair group 23
Less than 230 mg/stroke	- Unmetered air in intake area	- Check intake area for leaks
	- Excessive exhaust gas recirculation	- Check mechanical exhaust gas recirculation valve => Page 26-21



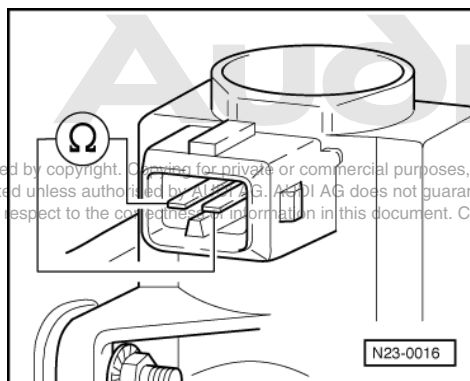
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2.6 - Checking EGR valve -N18

V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598/18 	
	G24-0032

Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/18



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Checking internal resistance

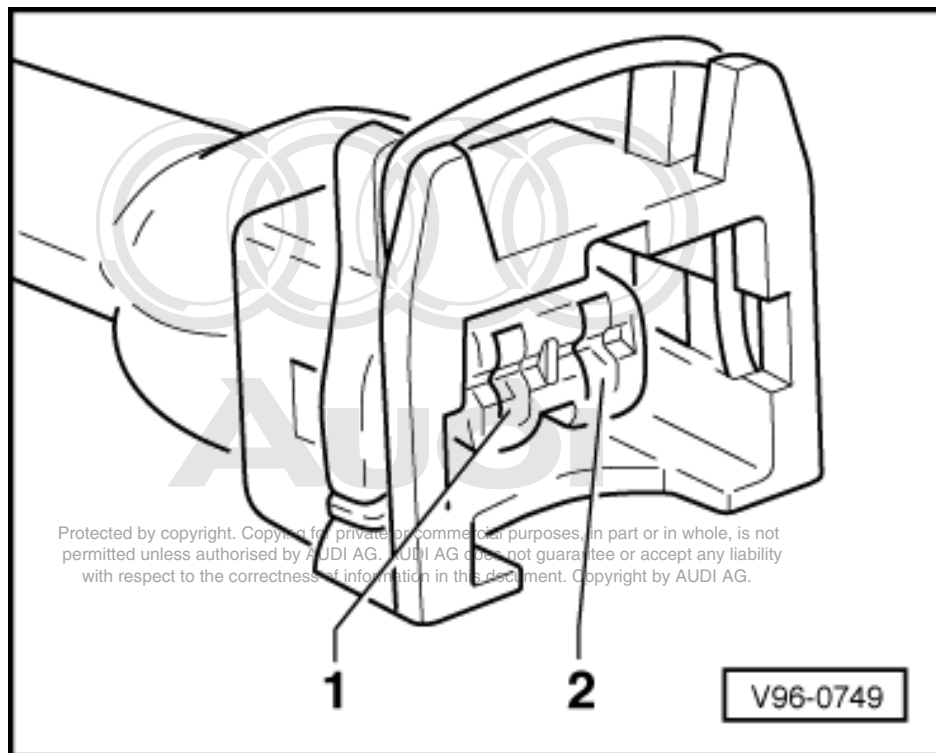
- Switch ignition off.
- Detach connector from exhaust gas recirculation valve.
- -> Connect multimeter to injector to measure resistance.
- Specification: 14...20 ω

Note:

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

If specification is not attained:

- Replace the exhaust gas recirculation valve -N18.



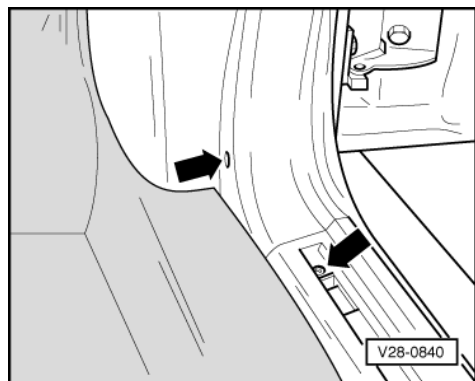
Checking power supply

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

If specification is not attained:

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

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

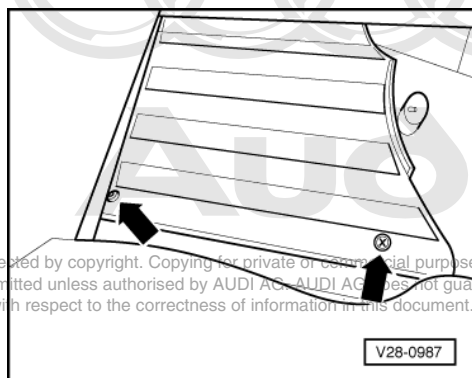


Testing control signal wiring

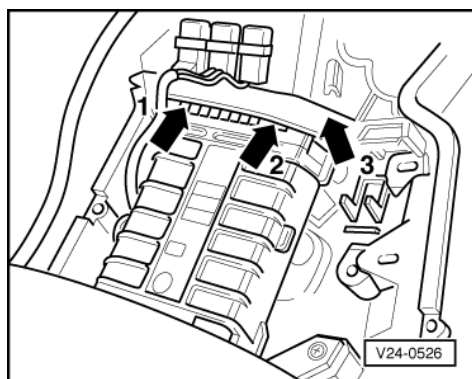
- Switch ignition off.
- -> Remove the lower part of the right A pillar trim and the front door sill panel tread strip

=> General Body Assembly; Repair group 70

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



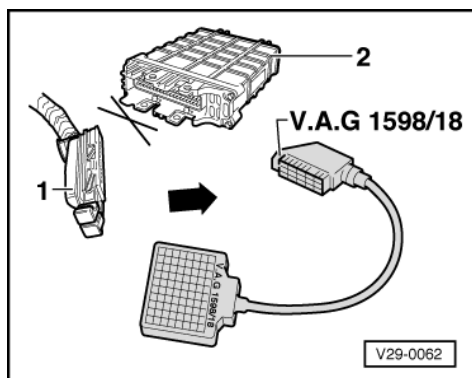
- -> Unscrew bolts -arrows- for electronics box cover.
- Carefully detach upper and lower sections of cover.



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

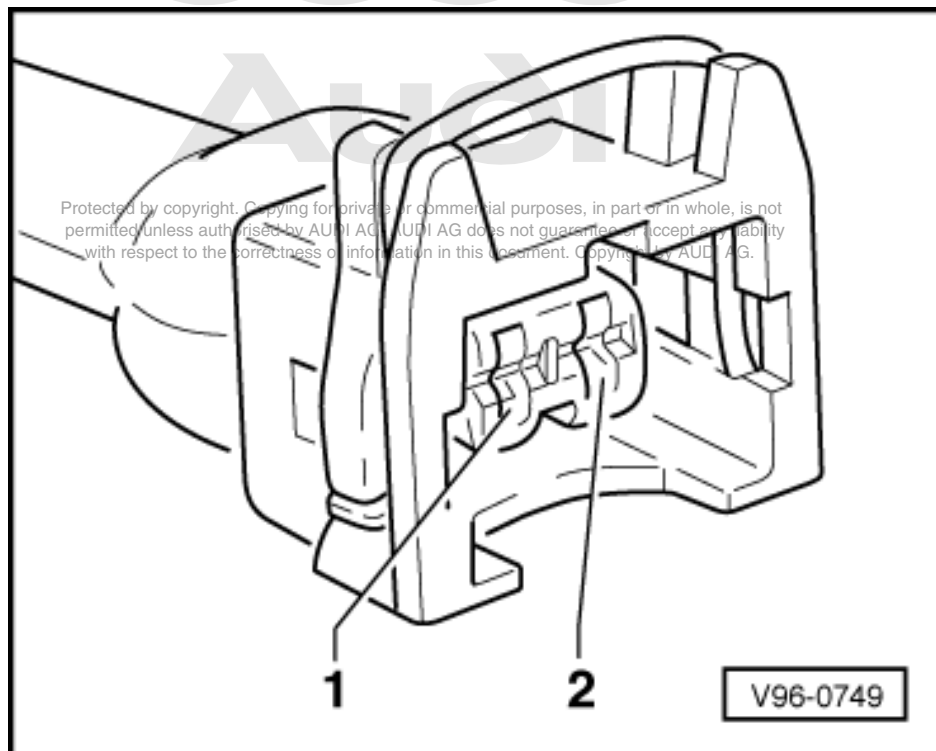
Note:

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





- -> With the ignition switched off, connect test box V.A.G 1598/18 to connector -1- (the control unit -2- remains disconnected).



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

Connector Contact	Test box V.A.G 1598/18 Socket
2	25

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

=> Diesel Direct Injection and Glow Plug System (TDI 4-cylinder); Repair group 23; Servicing diesel direct injection system; Replacing control unit for engine electronics Servicing diesel direct injection system Replacing control unit for engine electronics