

Workshop Manual Audi A4 1995 ➤

4-cylinder engine (2-valve, roller rocker fingers),
mechanics

Engine ID

ALZ

Edition 08.2005



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List of Workshop Manual Repair Groups

Repair Group

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- 13 - Crankshaft group
- 15 - Cylinder head, valve gear
- 17 - Lubrication
- 19 - Cooling
- 26 - Exhaust system



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

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Audi A4 1995 ►

4-cylinder engine (2-valve, roller rocker fingers), mechanics - Edition 08.2005



Audi

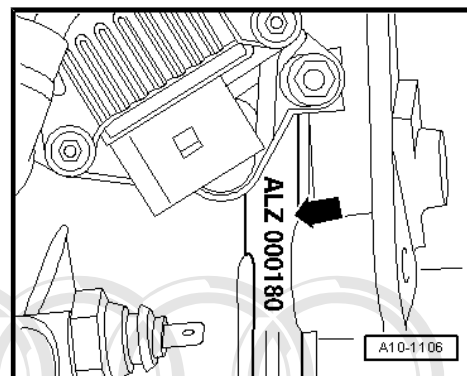
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00 – Technical data

1 Technical data

1.1 Engine number

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



1.2 Engine data

Code letters		ALZ
Capacity	ltr.	1.595
Power output	kW at rpm	75/5600
Torque	Nm at rpm	148/3800
Bore	Ø in mm	81.0
Stroke	mm	77.4
Compression ratio		10.3
RON		95 ¹⁾
Injection/ignition system		Simos
Firing order		1-3-4-2
Turbocharging/supercharging		no
Exhaust gas recirculation system		yes
Knock control		yes
Variable valve timing		no
Intake manifold change-over		yes
Secondary air system		yes
• ¹⁾ Unleaded petrol RON 91 can also be used, but results in reduced power		

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2 General repair instructions

2.1 Rules for cleanliness when working on the injection system

Even small amounts of dirt can cause faults in the injection system. When working on the fuel supply/injection system, pay careful attention to the following basic rules:

- ◆ Carefully clean connection points and the surrounding area with engine cleaner or brake cleaner and allow to dry thoroughly before opening.
- ◆ Plug open lines and connections with suitable protective caps immediately.
- ◆ Place parts that have been removed on a clean surface and cover them over. Use only lint-free cloths.
- ◆ Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have been previously unpacked and stored away loose (e.g. in toolboxes, etc.).
- ◆ When the system is open: Do not work with compressed air. Do not move the vehicle unless absolutely necessary.

2.2 Checking for leaks in the fuel system

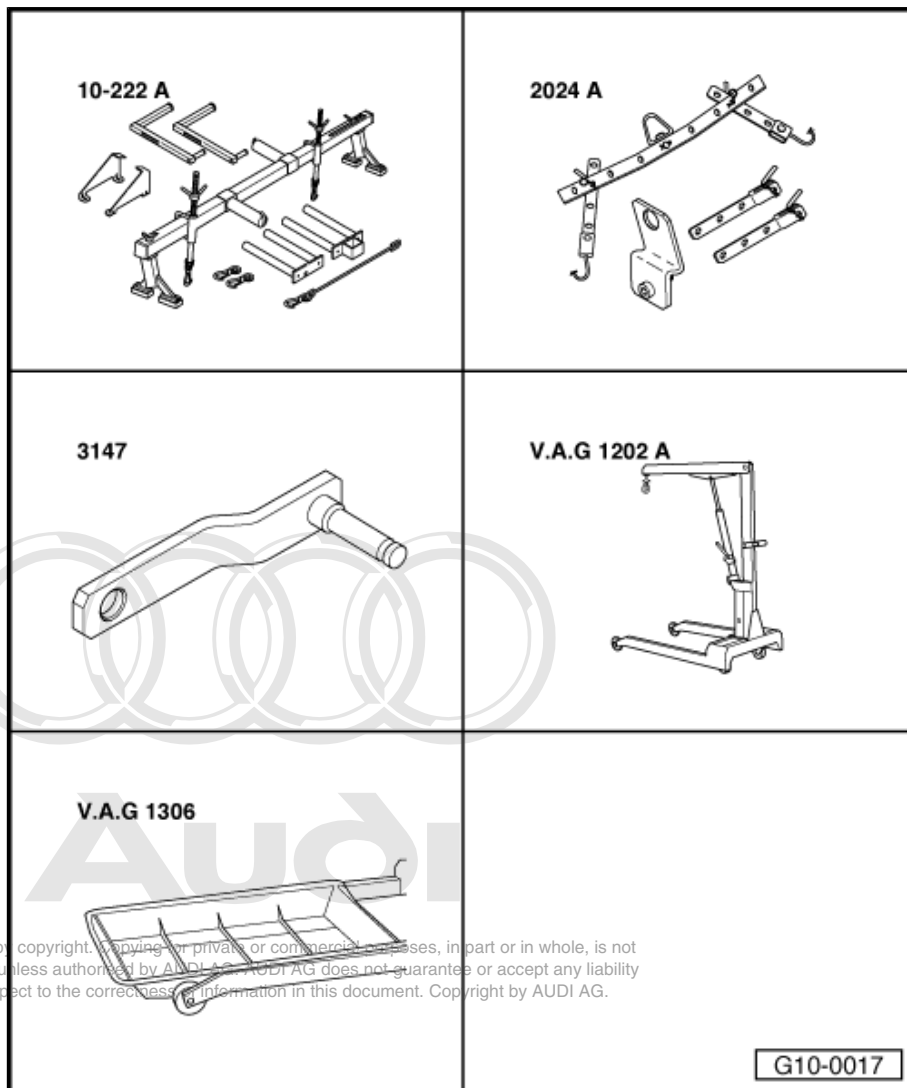
- Start the engine and let it run at medium speed for a few minutes.
- Switch off ignition.
- Check the entire fuel system for leaks.
- If leaks are found although the connections have been tightened to the correct torque, the relevant component must be renewed.
- Then carry out a test drive with at least one full-power acceleration.
- Then again check the pressurised areas in the system for leaks.

10 – Removing and installing engine

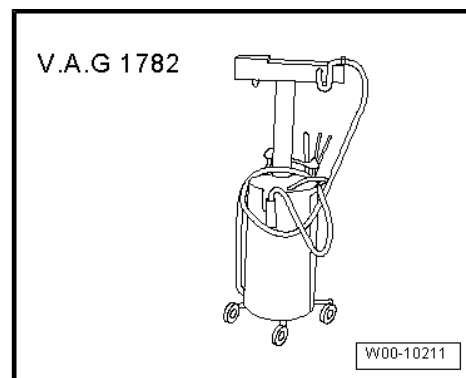
1 Removing and installing engine

Special tools and workshop equipment required

- ◆ Support bracket -10-222 A-
- ◆ Lifting tackle -2024 A-
- ◆ Gearbox support -3147-
- ◆ Workshop hoist -VAS 6100- or -V.A.G 1202 A-
- ◆ Drip tray for workshop hoist -VAS 6208- or -V.A.G 1306-



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



1.1 Removing engine



Note

- ◆ *The engine is removed from the front without the gearbox after removing the lock carrier.*
- ◆ *Collect drained coolant in a clean container for re-use or disposal.*
- ◆ *Fit all heat insulation sleeves in the original position when installing.*
- ◆ *All cable ties which are released or cut open when removing must be fitted in the same position when installing.*

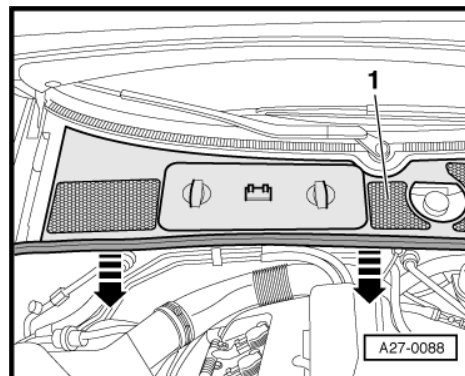
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Caution

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

- Run windscreen wipers to the vertical position.
- Detach rubber seal from plenum chamber cover in direction of -arrow-.
- Detach plenum chamber cover -1- towards the front.



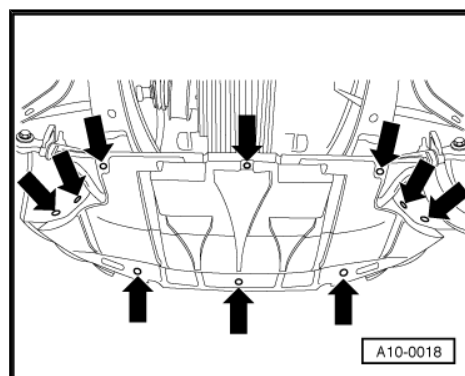
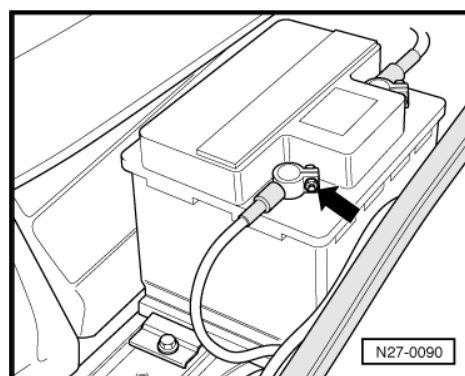
- With ignition switched off, disconnect battery earth cable -arrow-.



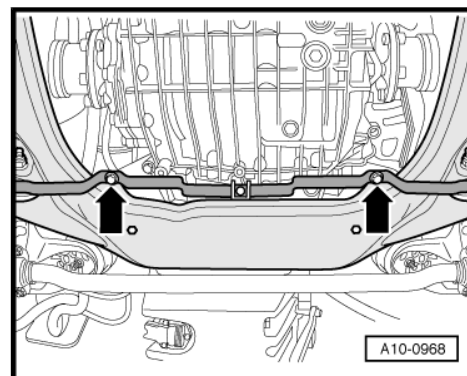
WARNING

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

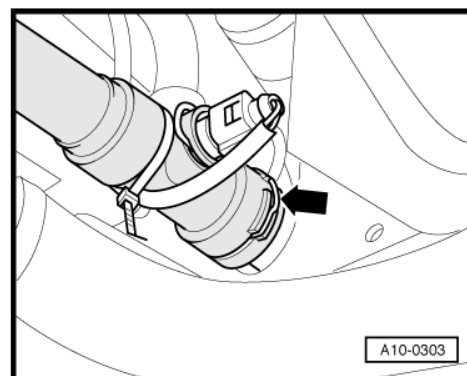
- Open filler cap on coolant expansion tank.
- Remove noise insulation -arrows-.



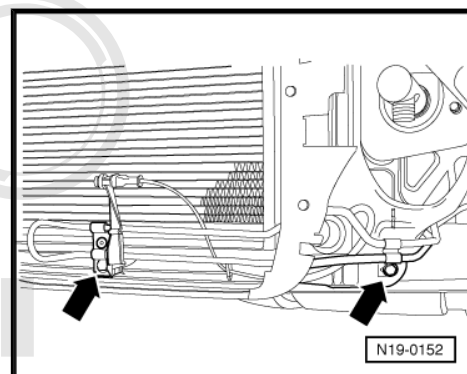
- Unbolt bracket for noise insulation -arrows-.



- Remove front bumper ⇒ Rep. Gr. 63 .
- Place drip tray for workshop hoist -VAS 6208- under engine.
- Detach coolant hose (bottom) from radiator by releasing retaining clip -arrow-.



- Unscrew cooling pipe for power steering hydraulic fluid -arrows- and move clear to side; do not open hydraulic fluid circuit.



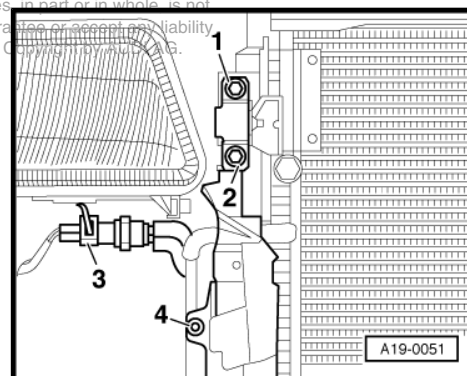
Vehicles with air conditioning:

- Remove air ducts -4- (left and right) from radiator.
- Unplug electrical connector -3- at air conditioner pressure switch -F129- .
- Unscrew securing bolts -1- and -2- for condenser.



WARNING

The air conditioner refrigerant circuit must not be opened.



Note

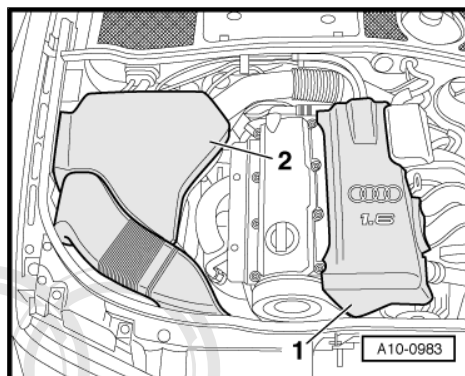
To prevent damage to the refrigerant lines, ensure that the pipes and hoses are not stretched, kinked or bent.

- Pivot condenser downwards with pipes/hoses attached.

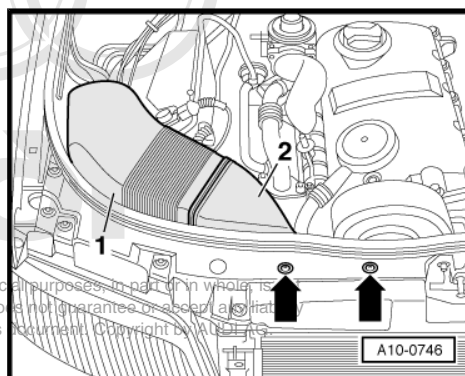


All vehicles:

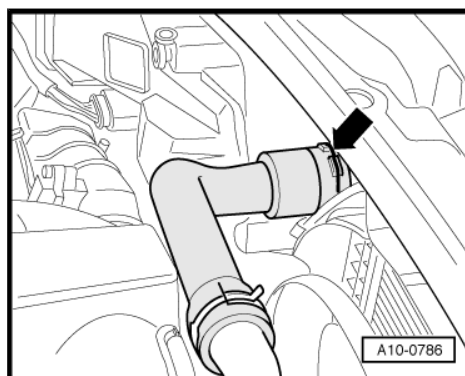
- Remove engine cover panel -1-.
- Remove air cleaner cover -2-.



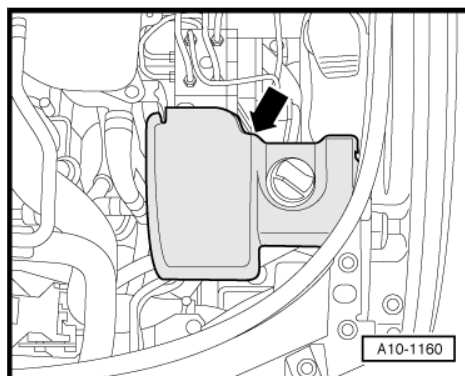
- Unscrew bolts -arrows-.
- Remove air ducts -1- and -2-.



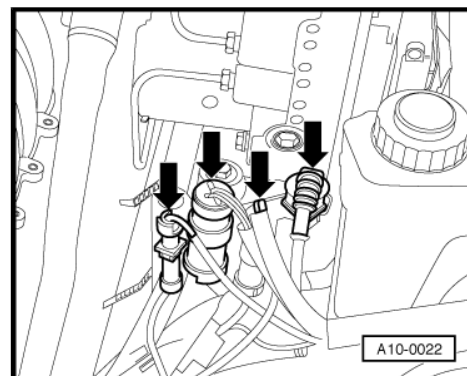
- Detach coolant hose (top) from radiator by releasing retaining clip -arrow-.



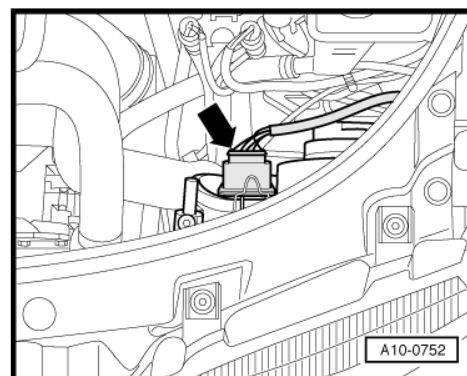
- Remove cover -arrow- at power steering fluid reservoir.



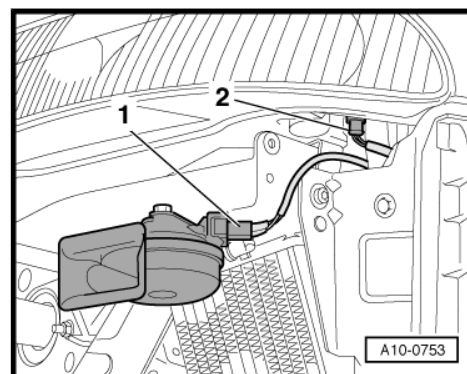
- Unplug electrical connectors -arrows-.
- Move wiring harness clear.
- Unplug electrical connector for anti-theft alarm on lock carrier (top left) and move wiring clear.



- Unplug electrical connector -arrow- for headlights on both sides.



- Unplug electrical connector -2- for indicator lights on both sides.
- Unplug electrical connector -1- on both horns.
- Move wire clear.

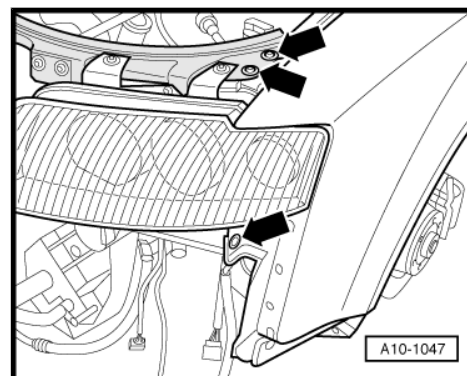


- Pull bonnet seals away from lock carrier and wing panels.

**Note**

Protect wing panels from damage.

- Remove bolts (left and right) -arrows-.
- Disconnect bonnet lock cable at bonnet lock.



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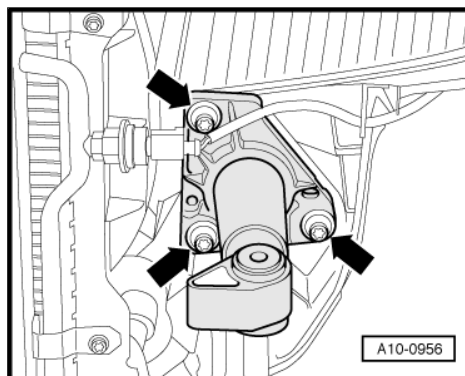
- Unscrew bolts -arrows- from impact dampers (left and right).



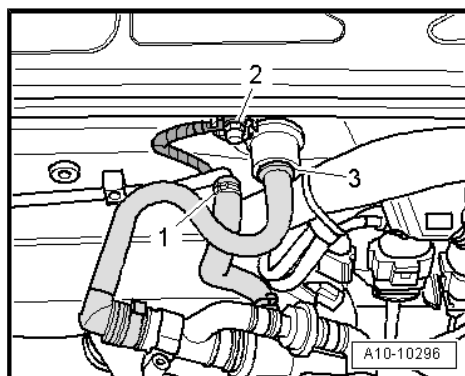
Note

A second mechanic is required for removing the lock carrier.

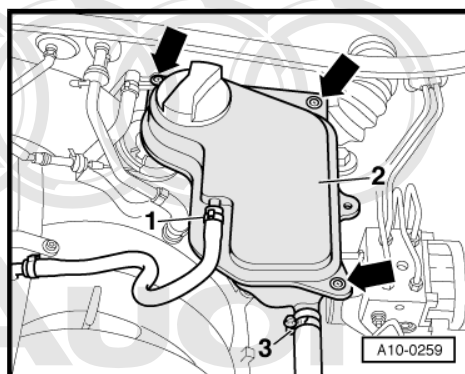
- Remove lock carrier and place down in a secure position.



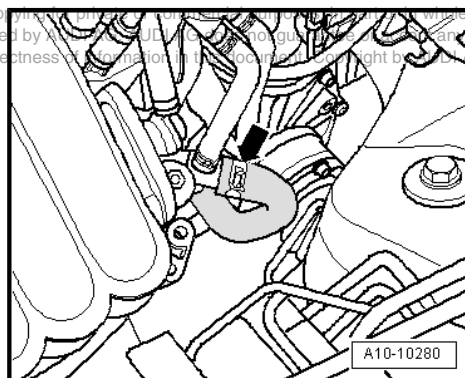
- Detach vacuum hose -3- leading to brake servo at bulkhead.
- Detach vacuum hose -1- leading to solenoid valve 1 for activated charcoal filter system -N80- .
- Unscrew earth connection -2- from bulkhead.



- Detach coolant hoses -1- and -3- and unfasten coolant expansion tank -2- -arrow-.
- Unplug electrical connector for coolant shortage indicator switch -F66- at bottom of coolant expansion tank.



- Place drip tray for workshop hoist -VAS 6208- under engine.
- Disconnect coolant hose leading to oil cooler -arrow-, and drain off remaining coolant.

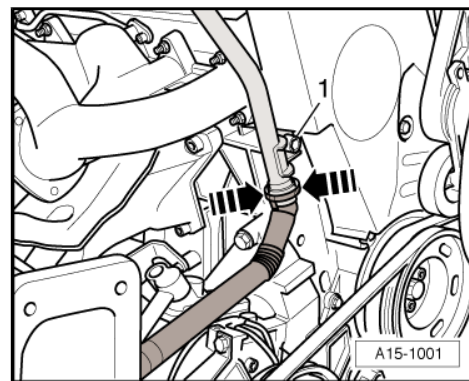


- Pull back heat insulation sleeve and disconnect hose from secondary air pipe by pressing release tabs -arrows-.

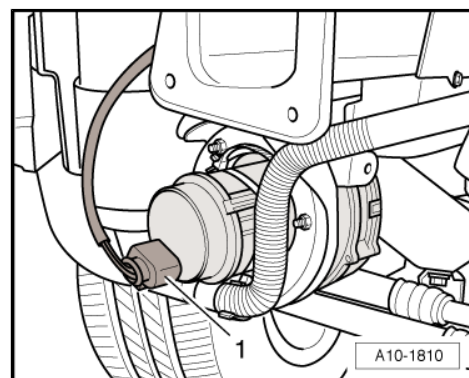


Note

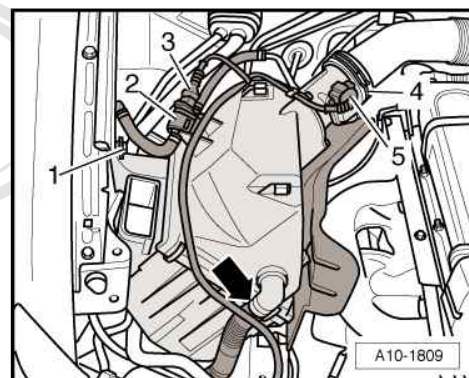
Disregard -item 1-.



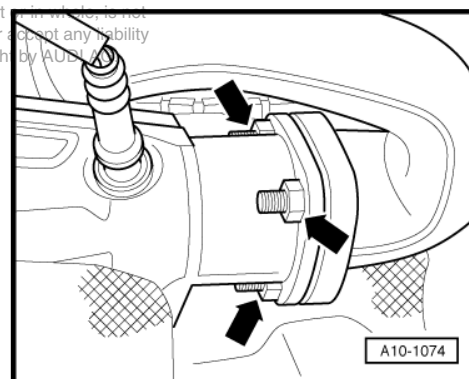
- Unplug electrical connector -1- at secondary air pump motor - V101- .



- Unplug electrical connectors -3- and -5- for active charcoal filter system solenoid valve 1 -N80- and air mass meter -G70- .
- Detach active charcoal filter system solenoid valve 1 -N80- -item 2- from air cleaner housing.
- Disconnect hose connection going to secondary air pump -arrow-.
- Release hose clip -4- for air pipe at air mass meter -G70- .
- Unscrew bolt -1- and remove air cleaner housing.



- Unscrew nuts -arrows- securing exhaust manifold/catalytic converter.



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- Detach hose -2- leading to exhaust gas recirculation valve - N18- .
- Detach crankcase breather hose -4- from air pipe.
- Loosen hose clip -3- to remove air pipe.



Note

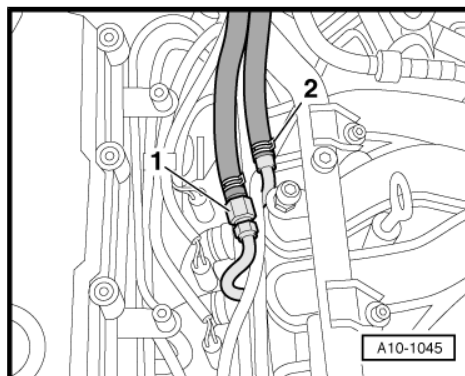
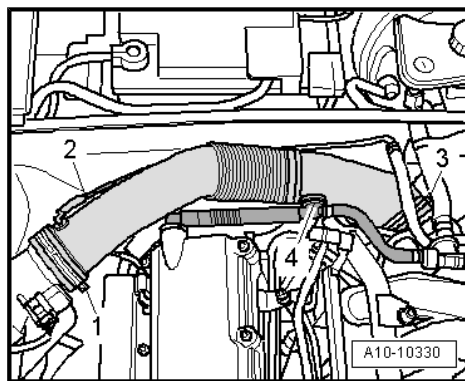
Disregard -item 1-.



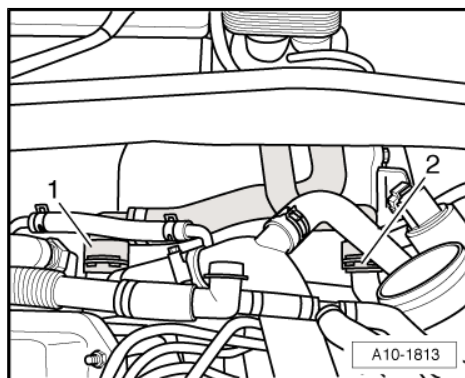
WARNING

The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then dissipate pressure by carefully unfastening the connection.

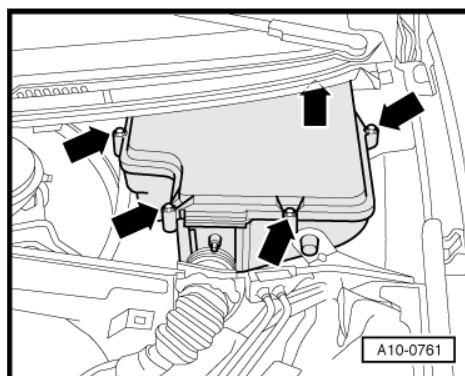
- Disconnect fuel supply pipe -1- and fuel return pipe -2-.



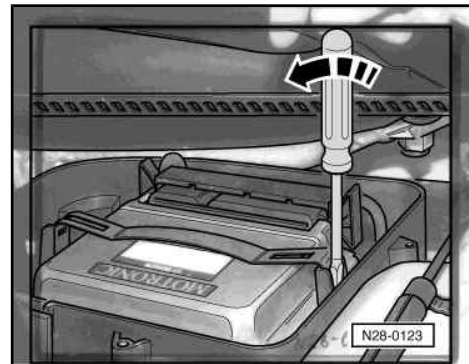
- Disconnect coolant hose (right-side) -1- leading to heat exchanger from cylinder head connection.
- Disconnect coolant hose (left-side) -2- leading to heat exchanger from coolant pipe.



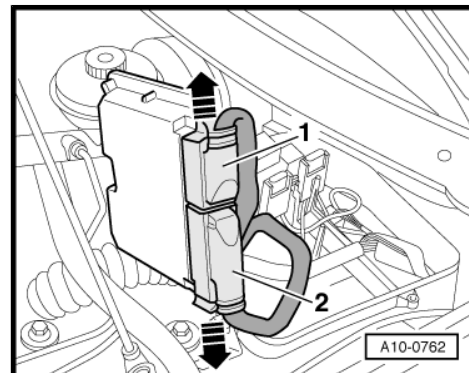
- Remove cover for electronics box in plenum chamber -arrows-.



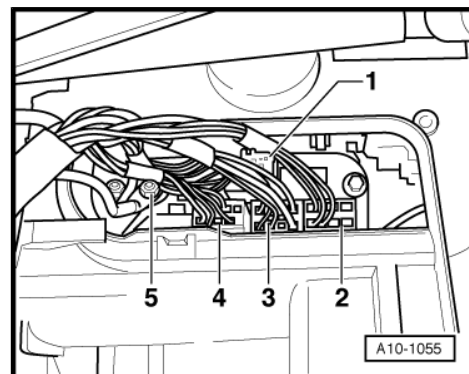
- Carefully lever off retaining strap with a screwdriver -arrow-.



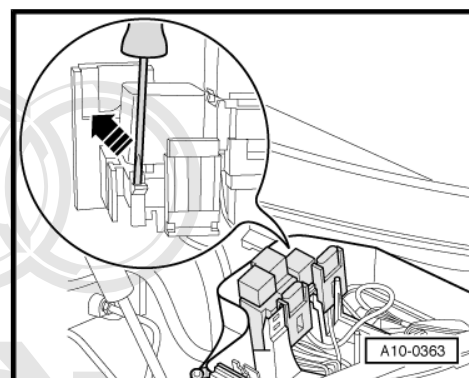
- Release retainer catches -arrows- and unplug electrical connectors -1- and -2- from engine control unit.



- Unplug electrical connectors -1 ... 4- at connector console.
- Unscrew electrical wiring -5-.

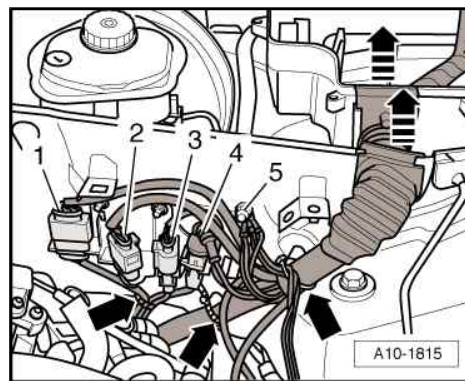


- Release retainer -arrow- and pull auxiliary relay carrier in electronics box upwards to remove.



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- Unscrew earth connection -5-.
- Detach electrical connectors -1 ... 4- from retainer.
- Detach electrical connectors -1- and -2- for Lambda probes.
- Move wiring clear -arrows- and lay on top of engine.



Vehicles with air conditioning:



Note

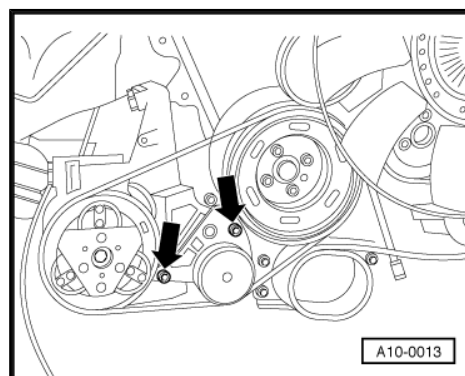
Before removing, mark direction of rotation of poly V-belt with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

- Loosen securing bolts of tensioning roller for air conditioner compressor poly V-belt -arrows- and remove poly V-belt.



WARNING

The air conditioner refrigerant circuit must not be opened.



- Unbolt air conditioner compressor from bracket.



Note

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

- Tie up air conditioner compressor to vehicle, with lines attached.

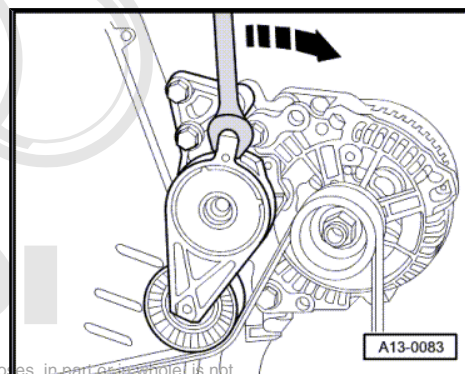
All vehicles:



Note

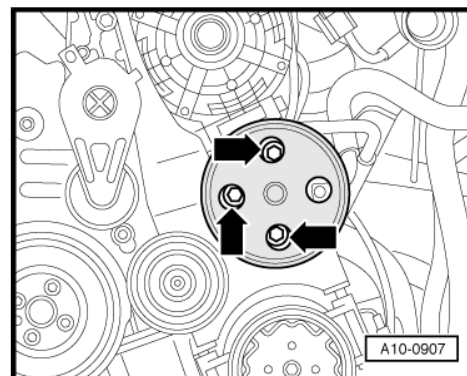
Before removing, mark direction of rotation of poly V-belt with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

- Turn the tensioner in the direction of the -arrow- to slacken the poly V-belt.
- Remove poly V-belt.

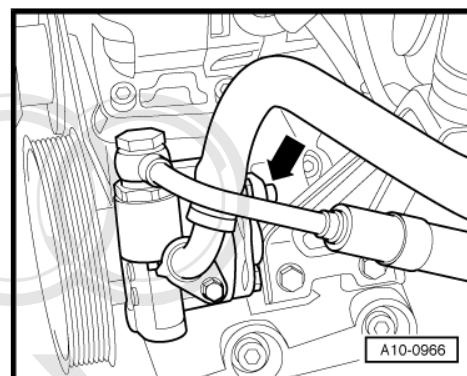


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- Unscrew front bolts -arrows- for power steering pump.

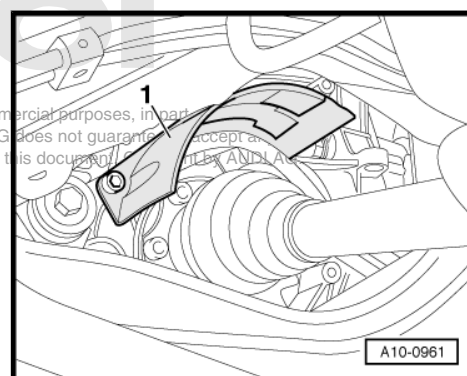


- Unscrew rear bolt -arrow- for power steering pump.
- Move power steering pump aside and place onto longitudinal member. Leave hoses connected.

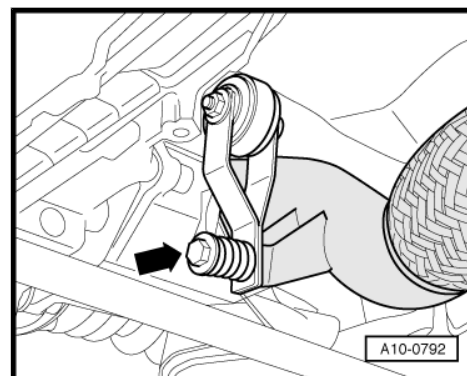


- Unbolt heat shield -1- for drive shaft (right-side).

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- Unbolt bracket for exhaust system -arrow-.



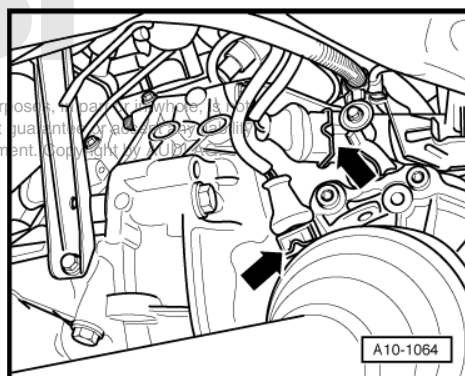
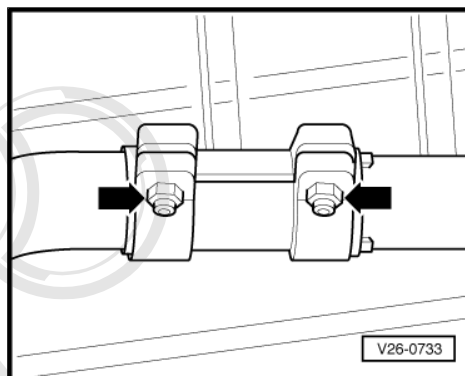
- Loosen bolt connections of front clamp -arrows-.
- Push the clamp back in order to separate the exhaust system.



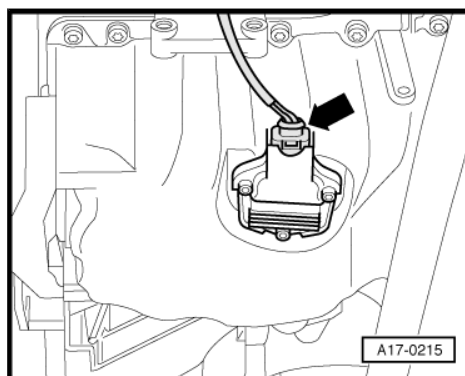
Note

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

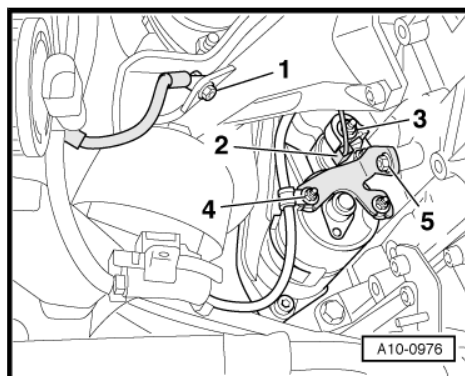
- Detach exhaust system from exhaust manifold.
- Unplug electrical connector at speedometer sender -G22- at left of gearbox -bottom arrow-.
- Unplug electrical connector at reversing light switch -F4- on gearbox -top arrow-.
- Move wiring clear.



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

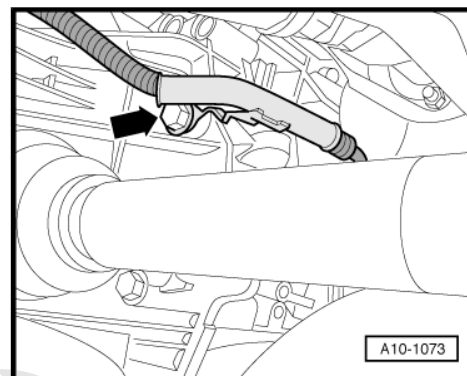


- Unscrew earth wire -1- at engine support (right-side).
- Detach electrical wires -2- and -3- at starter.
- Detach insulator at positive connection of starter.
- Unscrew clamp -4-.
- Unbolt bracket -5- for starter.
- Unbolt starter from gearbox and remove.



**Note**

The cable duct for positive wire to starter is secured with engine/gearbox connecting bolt -arrow-.

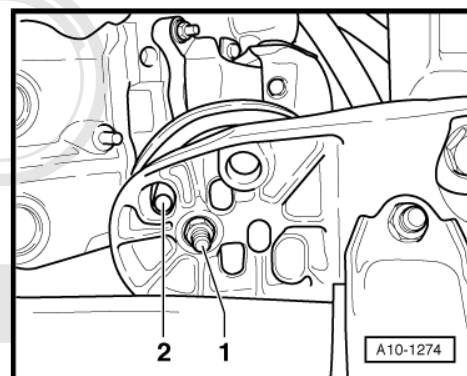


- Mark positions of bolt connections -1- and locating sleeves -2- on bottom of engine mountings (left and right).

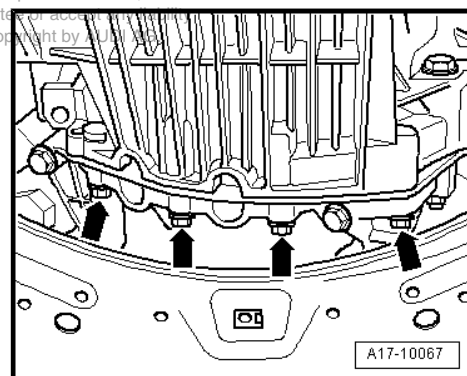
**Note**

Different mounting holes are provided for the different engine versions.

- Unscrew nuts -1- (bottom) at engine mountings (left and right).



- Unscrew engine/gearbox securing bolts that are accessible from below -arrows-.



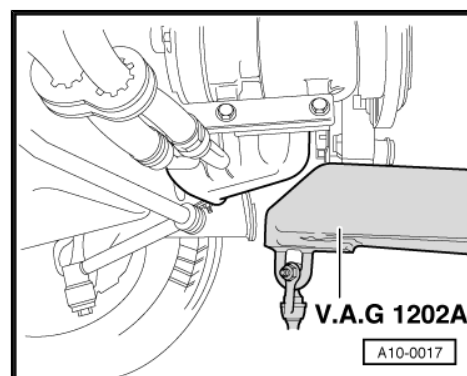
If bottom engine/gearbox securing bolts cannot be unscrewed:

- Lift engine/gearbox assembly using workshop hoist - VAS 6100- at torque reaction support.
- Make sure no wires/pipes are damaged at the top on the bulk-head.

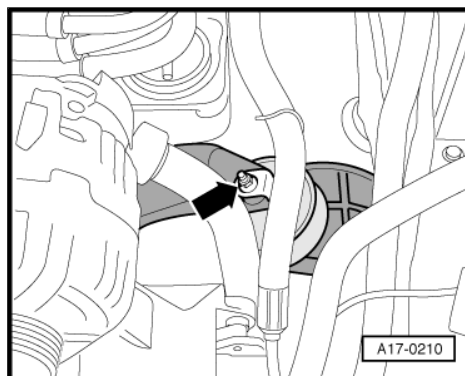
**WARNING**

To avoid injury, ensure adequate support.

- Lower the engine back down.



- Unscrew nut -arrow- at top of engine mounting (left-side).
- Unscrew top engine/gearbox securing bolts; leave one bolt in place (finger-tight).



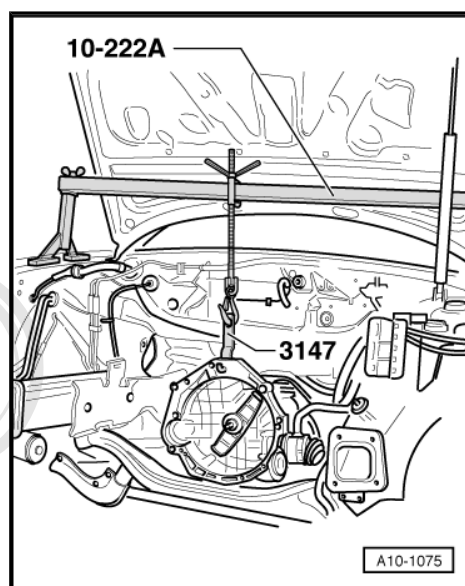
- Set up support bracket -10-222 A- behind gas-filled strut on wing panel flanges. The spindle is located at front.
- Engage gearbox support -3147- in bolt holes at top of bell housing as shown in illustration.
- Connect gearbox support -3147- with spindle of support bracket -10-222 A- .



Note

Shown in illustration with engine removed.

- Take up weight of engine using spindle of support bracket -10-222 A- .



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- Hook lifting tackle -2024 A- onto engine and workshop hoist - VAS 6100- .

 Note

To adjust to the centre of gravity of the assembly, the perforated rails of the support hooks must be positioned as shown.



WARNING

The support hooks and retaining pins on the lifting tackle must be secured with locking pins -arrows-.

- Unscrew remaining engine/gearbox securing bolt.

 Note

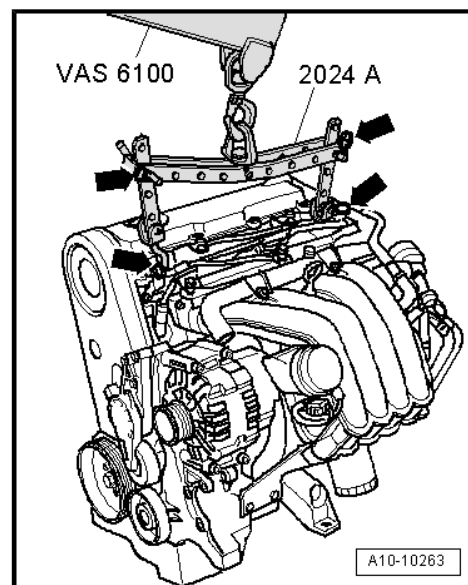
Check that all hoses and other connections between engine and body have been detached.

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

 Note

Make sure no wires/pipes are damaged at the top on the bulk-head.

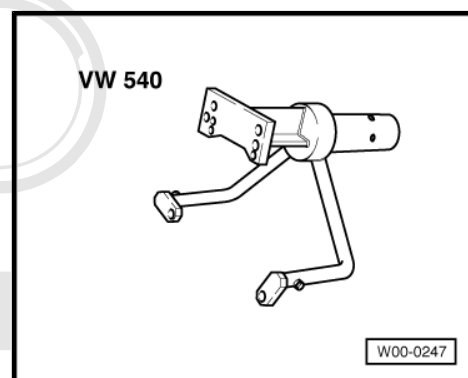
- Remove engine mounting (left-side).
- Detach engine from gearbox and lift engine forwards out of engine compartment.



1.2 Securing engine to assembly stand

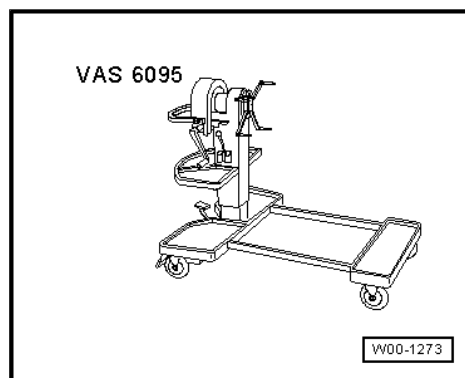
Special tools and workshop equipment required

- ◆ Engine and gearbox support -VW 540-



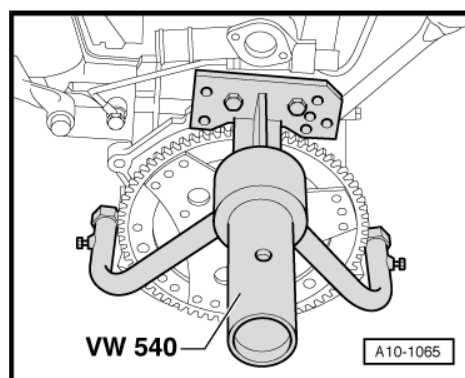
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◆ Engine and gearbox support -VAS 6095-



Procedure

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



1.3 Installing engine



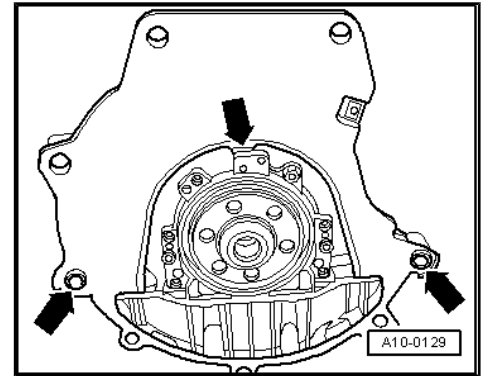
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- ◆ *Renew self-locking nuts and bolts when performing assembly work.*
- ◆ *Renew bolts which are tightened to a specified angle as well as oil seals and gaskets.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- ◆ *Fit all heat insulation sleeves in the original position when installing.*
- ◆ *Fit all cable ties in the original positions when installing.*
- Check clutch release bearing for wear; renew if necessary.
- 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 for clutch plate splines -G 000 100- to the splines. Do not lubricate guide sleeve.
- Check that clutch plate is correctly centred.
- A needle bearing must be fitted in the crankshaft. If necessary, install needle bearing ⇒ [page 62](#).
- Check whether dowel sleeves for centring the engine/gearbox assembly are fitted in the cylinder block; install if necessary.

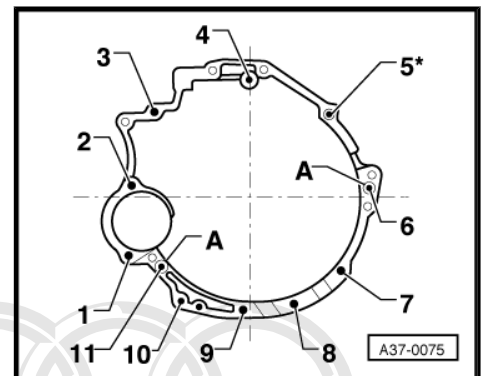
- Ensure that the intermediate plate is engaged on the sealing flange and pushed onto the dowel sleeves -arrows-.
- Attach engine to gearbox and screw in one bolt finger-tight.
- Install engine mounting (left-side).
- Release spindle of support bracket -10-222 A- .
- Lower engine, inserting studs of engine mountings into consoles for engine mountings as you do so.

**Note**

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

**Securing engine to gearbox**

Item	Bolt	Nm
1, 3, 4	M12x67	65
2, 6	M12x90	65
5, 11	M12x110	65
7 ... 10	M10x45	45
A	Dowel sleeves for centralising	
• 1) Renew bolts.		



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

- Install engine mountings free of stress. To do so, shake engine before tightening engine mountings.
- Install exhaust system and align free of stress $\Rightarrow$ [page 160](#) .
- Install air conditioner compressor $\Rightarrow$ Rep. Gr. 87 .
- Install power steering pump $\Rightarrow$ Rep. Gr. 48 .
- Install poly V-belt $\Rightarrow$ [page 24](#) .

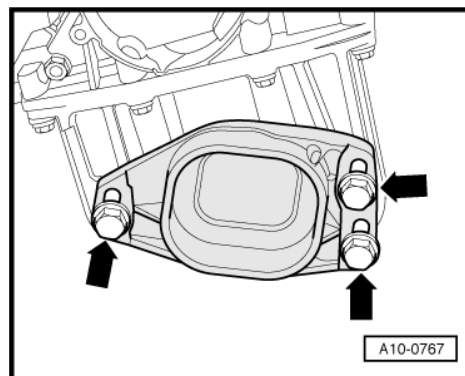
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- Install lock carrier with attachments ⇒ Rep. Gr. 50 .
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten bolts -arrows-.
- Install front bumper ⇒ Rep. Gr. 63 .
- Electrical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



Caution

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



- Check oil level ⇒ [page 124](#) .
- Check fluid level of power steering ⇒ Rep. Gr. 48 .
- Fill cooling system ⇒ [page 130](#) .



Note

- ◆ *Drained-off coolant may only be used again if the original cylinder head and cylinder block are re-installed.*
- ◆ *Contaminated or dirty coolant must not be used again.*
- Check headlight adjustment ⇒ Maintenance ; Booklet 802 .

Tightening torques



Note

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

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Component		Nm
Bolts/nuts	M6	10
	M8	20
	M10	45
	M12	65
Except for the following:		
Engine mounting to engine console		23
Engine mounting to engine support		23
Terminal B+ to starter		16
Drive shaft heat shield to gearbox		23
Fuel line to fuel rail		22
Stop for torque reaction support to sump		28
Hose clips for coolant hoses		2



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13 – Crankshaft group

1 Servicing work on pulley end

1.1 Poly V-belt drive for power steering pump, alternator and viscous fan - exploded view of components

1 - 11 Nm

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

2 - Fan wheel for viscous fan

- ☐ Removing and installing ⇒ [page 143](#)

3 - Retaining ring for viscous fan bearing

- ☐ Removing and installing ⇒ [page 143](#)

4 - Poly V-belt

- ☐ Check for wear
- ☐ Do not kink
- ☐ Before removing, mark direction of rotation with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.
- ☐ Removing and installing ⇒ [page 24](#)
- ☐ Routing of poly V-belt ⇒ [page 26](#)

5 - Bolt (special type) ⇒ [Parts catalogue](#)

- ☐ If bolt strength rating is 8.8: renew and tighten to 10 Nm + 90° further
- ☐ If bolt strength rating is 10.9: tighten to 40 Nm

6 - Pulley for poly V-belt

- ☐ Can only be installed in one position
- ☐ Removing and installing ⇒ [page 27](#)

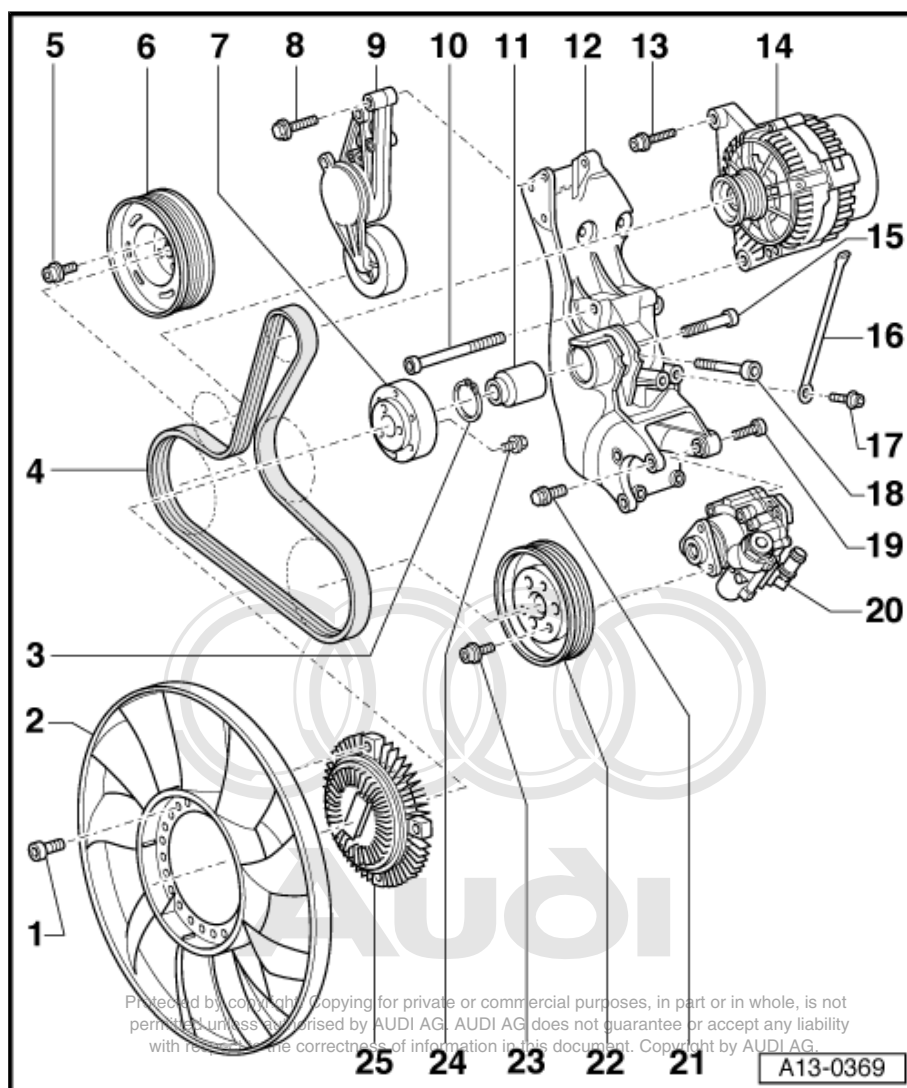
7 - Pulley for viscous fan

- ☐ Removing and installing ⇒ [page 143](#)

8 - 23 Nm

9 - Tensioner for poly V-belt

- ☐ Pivot with open-end spanner to slacken poly V-belt
- ☐ Lock with locking pin -T10060 A- or -T10060-



10 - 46 Nm

11 - Bearing for viscous fan

- ☐ Removing and installing ⇒ [page 143](#)

12 - Bracket for ancillaries

- ☐ Removing and installing ⇒ [page 28](#)

13 - 23 Nm

14 - Alternator

- ☐ Removing and installing ⇒ [Rep. Gr. 27](#)
- ☐ To facilitate attachment of alternator, knock back threaded bushes for alternator securing bolts slightly

15 - 45 Nm

16 - Support for intake manifold

17 - 20 Nm

18 - 45 Nm

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

19 - 23 Nm

20 - Power steering pump

- ☐ Removing and installing ⇒ [Rep. Gr. 48](#)
- ☐ To facilitate positioning of power steering pump, drive back threaded bush for securing bolt slightly at bracket

21 - 23 Nm

22 - Pulley for power steering pump

23 - 23 Nm

24 - 10 Nm

25 - Viscous coupling

- ☐ Removing and installing ⇒ [page 143](#)

1.2 Poly V-belt drive for air conditioner - exploded view of components



WARNING

The air conditioner refrigerant circuit must not be opened.

1 - Bracket

2 - Air conditioner compressor

- ☐ After removing compressor from mountings, secure it to longitudinal member with wire or similar. Do not leave it suspended from refrigerant pipes.
- ☐ Do not unscrew or disconnect refrigerant hoses or pipes.

3 - Dowel sleeve

- ☐ Check for correct seating in bracket

4 - 33 Nm

5 - Bracket for air conditioner compressor

6 - Tensioning roller for poly V-belt

7 - Washer

8 - 23 Nm

9 - Poly V-belt

- ☐ Check for wear
- ☐ Do not kink
- ☐ Before removing, mark direction of rotation with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

- ☐ Removing and installing ⇒ [page 24](#)

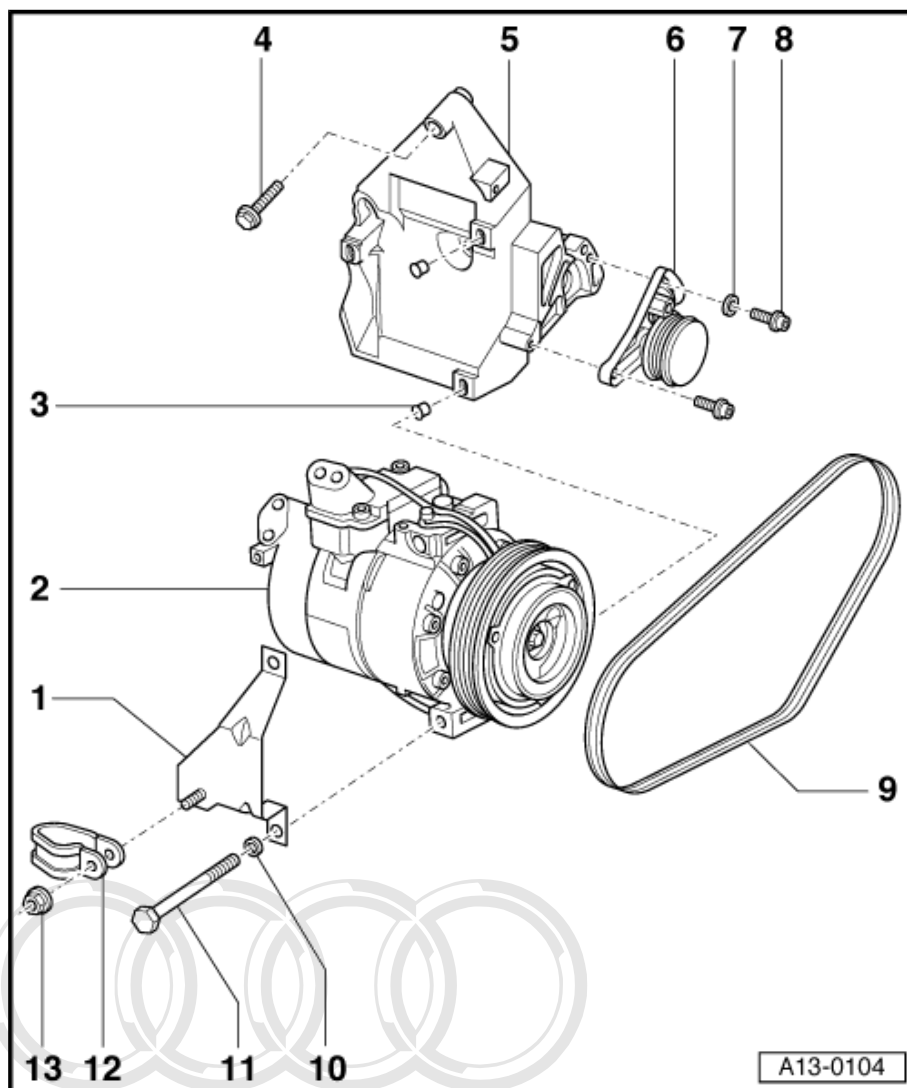
- ☐ Routing of poly V-belt ⇒ [page 27](#)

10 - Washer

11 - 25 Nm

12 - Retaining clamp

13 - 6 Nm



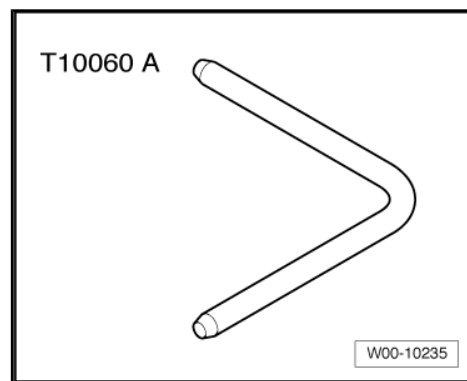
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1.3 Removing and installing poly V-belt

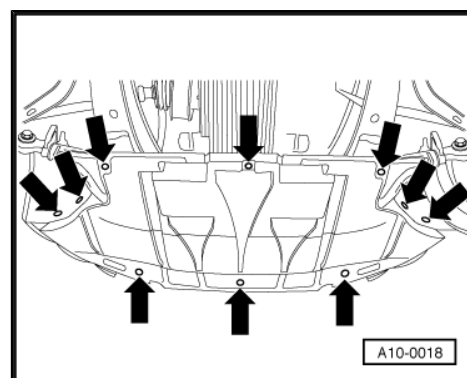
Special tools and workshop equipment required

- ◆ Locking pin -T10060 A- or -T10060-



Removing

- Remove noise insulation -arrows-.



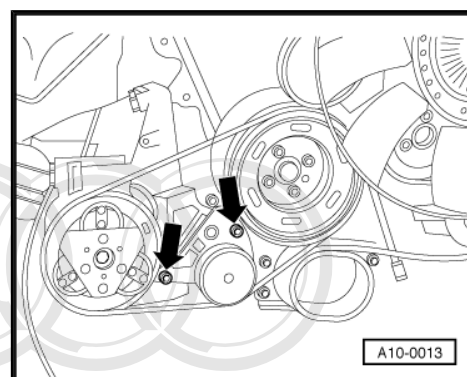
Vehicles with air conditioning:



Note

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

- Loosen securing bolts of tensioning roller for air conditioner compressor poly V-belt -arrows- and remove poly V-belt.



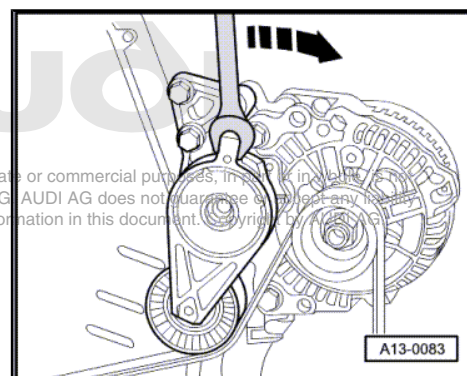
All vehicles:



Note

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

- Turn the tensioner in the direction of the -arrow- to slacken the poly V-belt.
- Remove poly V-belt.





Note

Poly V-belt tensioner can be locked by inserting locking pin - T10060 A- or -T10060- or an appropriate Allen key -arrow- in locating holes.

Installing

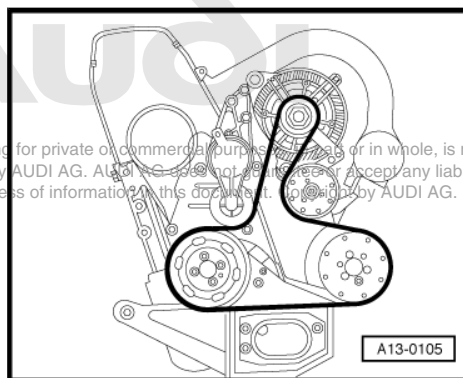
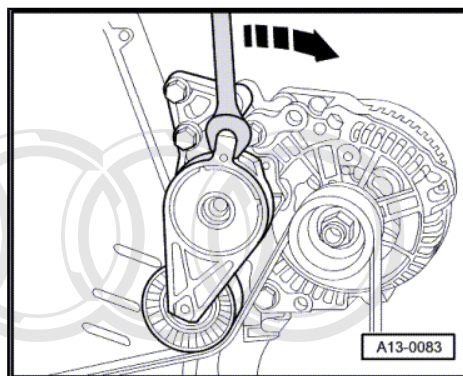
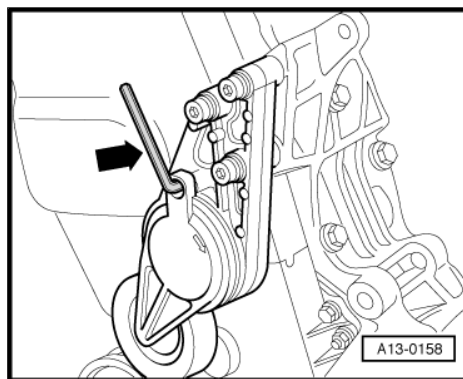
- Installation is carried out in the reverse order; note the following:



Note

- Before fitting poly V-belt, make sure all mechanical units (alternator, air conditioner compressor, power steering pump, viscous fan) are firmly in position.
- Make sure poly V-belt is properly positioned and correctly routed.
- Position poly V-belt on pulleys of crankshaft, power steering pump and viscous fan; pull upwards with suitable tool if necessary.
- Turn the tensioner in the direction of the -arrow- to install the poly V-belt.
- Then position poly V-belt on alternator pulley and release tensioner.

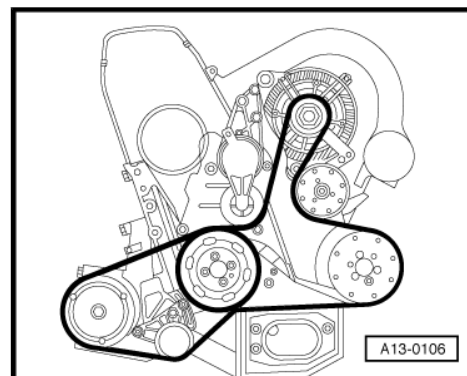
- Check for proper position of poly V-belt and make sure it is correctly seated on pulleys.



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Vehicles with air conditioning:

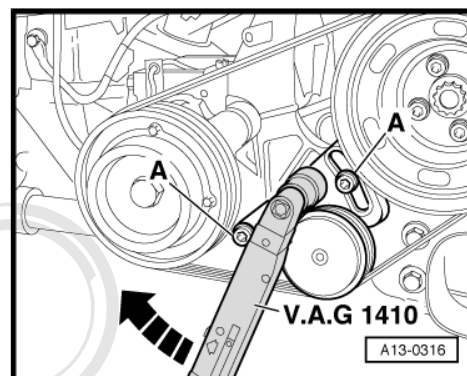
- Fit poly V-belt for air conditioner compressor.



- Apply torque wrench to hexagon flats on tensioning roller in “seven o'clock” position as shown and tension with a torque of 30 Nm in direction of -arrow-.
- At the same time tighten bolts -A- to 23 Nm.

All vehicles:

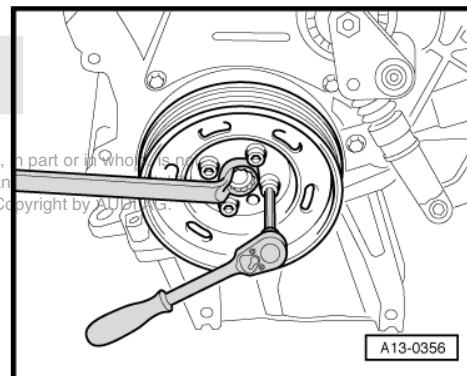
- Start engine and check that belt runs properly.



1.4 Removing and installing pulley

Removing

- Move lock carrier to service position ⇒ Rep. Gr. 50 .
- Remove poly V-belt ⇒ [page 24](#) .
- Unbolt pulley; counterhold on centre bolt with ring spanner.



Installing

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



Note

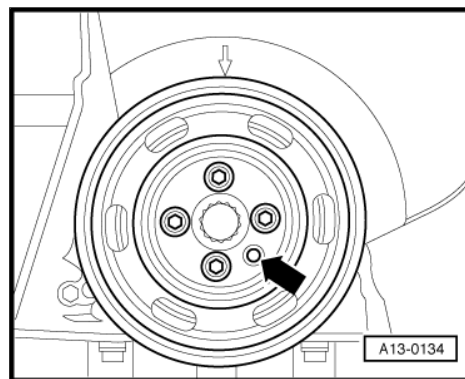
Assembly is only possible in one position: The hole -arrow- in the pulley must fit over the projection on the camshaft toothed belt sprocket.

- Install poly V-belt ⇒ [page 24](#) .
- Install lock carrier with attachments ⇒ Rep. Gr. 50 .

Tightening torques

Component		Nm
Pulley to toothed belt sprocket	Bolt strength rating 8.8	10 + 90° 1) 2)
	Bolt strength rating 10.9	40

- 1) Renew bolts.
- 2) 90° = one quarter turn.



1.5 Removing and installing bracket for ancillaries

Removing

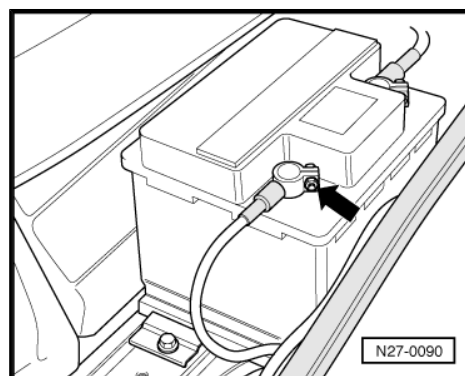
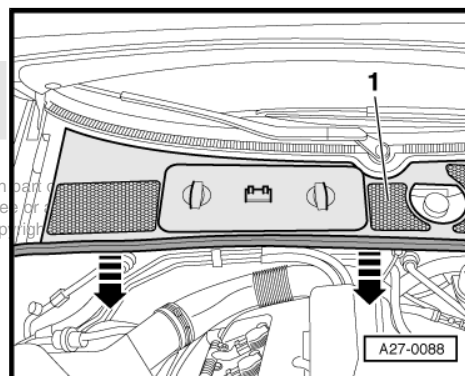


Caution

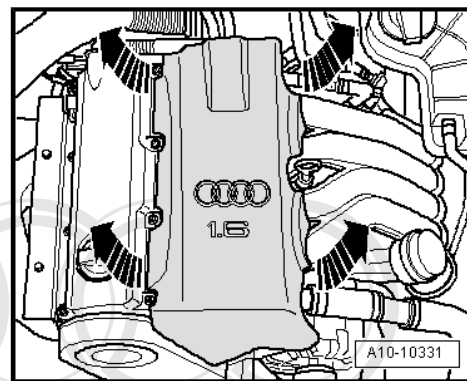
Observe notes on procedure for disconnecting the battery ⇒ Rep. Gr. 27.

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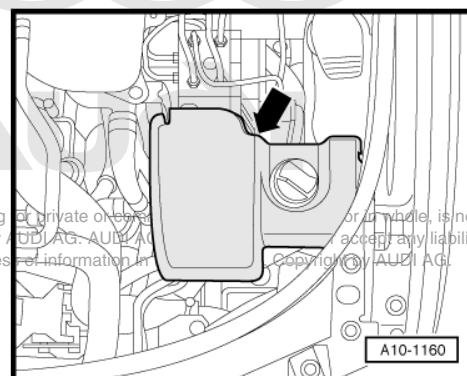
- Detach rubber seal from plenum chamber cover in direction of -arrow-.
- Detach plenum chamber cover -1- towards the front.
- With ignition switched off, disconnect battery earth cable -arrow-.



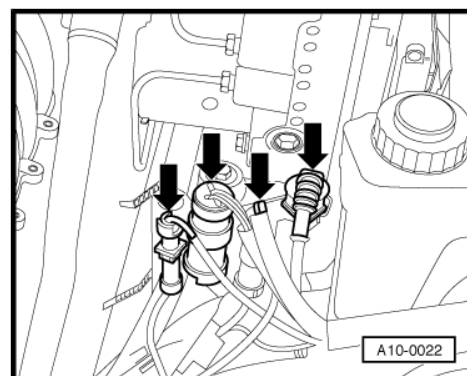
- Lift off engine cover -arrows-.



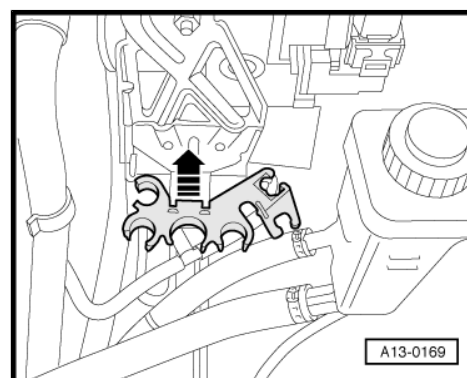
- Remove cover -arrow- at power steering fluid reservoir.



- Remove all electrical connectors from the bracket -arrows-.

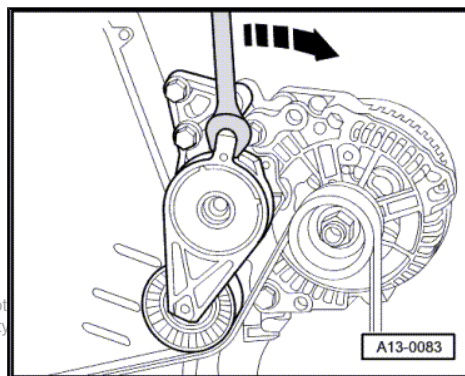


- Unclip bracket for connectors from console for ABS unit and pull upwards -arrow-.

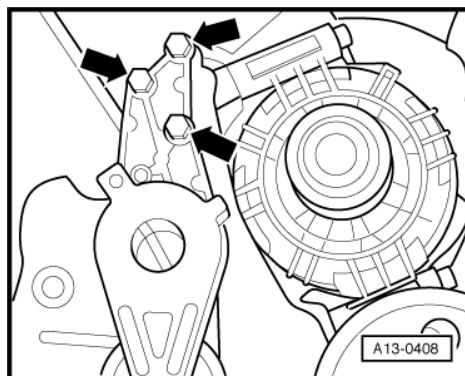


- Move lock carrier to service position ⇒ Rep. Gr. 50 .
- Turn the tensioner in the direction of the -arrow- to slacken the poly V-belt.
- Remove poly V-belt from alternator pulley and release pressure from the tensioner.

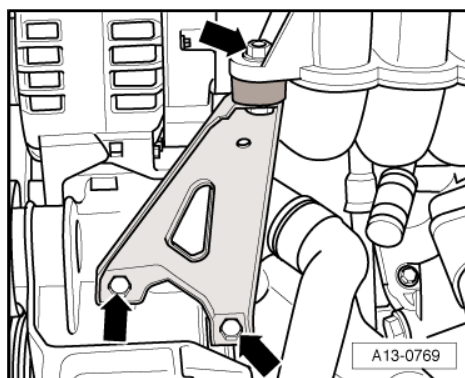
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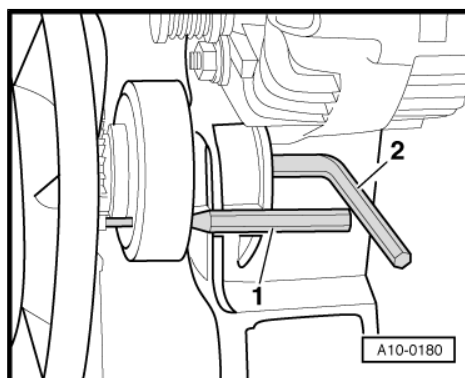
- Unscrew poly V-belt tensioner -arrows-.



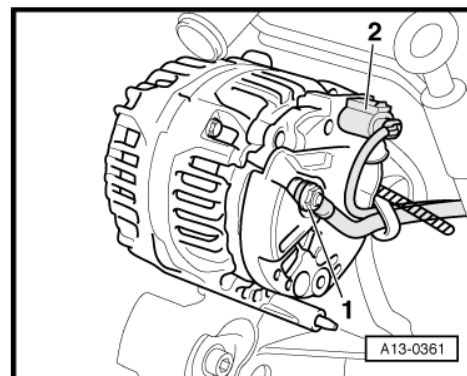
- Remove intake manifold support -arrows-.



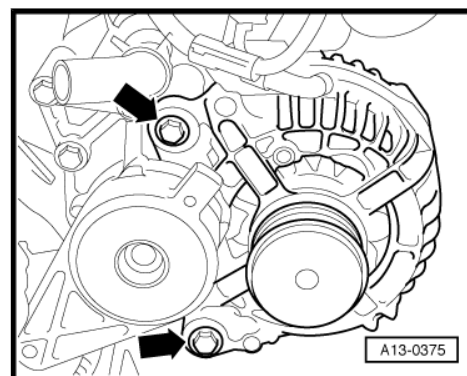
- Unscrew viscous fan pulley using Allen key -2- and at the same time counterhold with roll-pin drift -1-.
- Detach viscous fan from bearing and lay it forwards in radiator cowl.



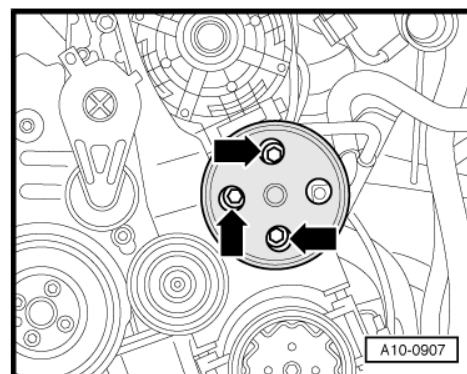
- Unplug electrical connector -2-.
- Unscrew electrical wire -1- from alternator.
- Unscrew clamp and move electrical wiring clear.



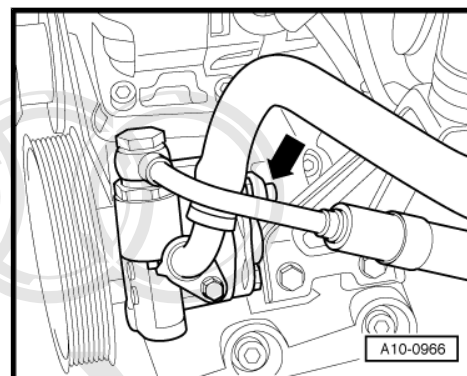
- Unscrew bolts -arrows-.
- Detach alternator and guide it towards left out of engine compartment.



- Remove front bolts -arrows- for power steering pump.



- Remove rear bolt -arrow- for power steering pump.
- Move power steering pump aside and place onto longitudinal member. Leave pipes connected.



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- Remove bolts -1 ... 6- on bracket for ancillaries.

Installing

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

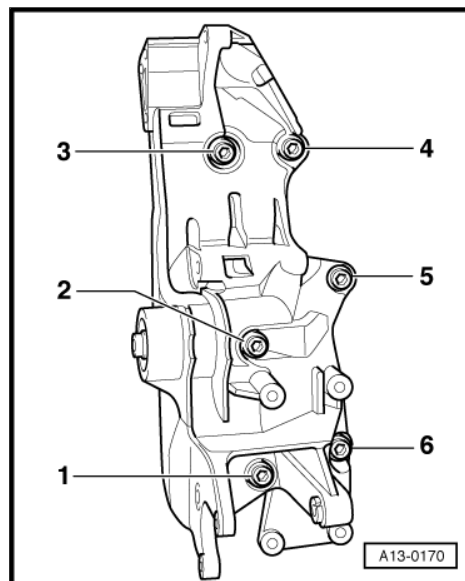


Note

- ◆ *Always remove remaining locking fluid from the tapped holes in the cylinder block prior to assembly. Otherwise the new bolts can seize when screwed in, and then shear off if they have to be subsequently removed.*
- ◆ *This can be done by using a thread tap.*
- Insert bolts securing bracket for ancillaries with locking fluid; Locking fluid ⇒ Parts catalogue .
- Tighten bolts in the sequence -1 ... 6-.
- To facilitate positioning of power steering pump, drive back bush for securing bolt slightly.
- Install power steering pump ⇒ Rep. Gr. 48 .
- Install alternator ⇒ Rep. Gr. 27 .
- Install viscous fan ⇒ [page 143](#) .
- Install poly V-belt ⇒ [page 24](#) .
- Install lock carrier with attachments ⇒ Rep. Gr. 50 .
- Observe notes on procedures required after connecting battery ⇒ Rep. Gr. 27 .

Tightening torques

Component	Nm
Bracket for ancillaries to cylinder block	45 ¹⁾
Tensioner for poly V-belt to bracket for ancillaries	23
Support for intake manifold to intake manifold	20
engine	20
• ¹⁾ Install using locking fluid; locking fluid ⇒ Parts catalogue .	



1.6 Toothed belt drive - exploded view of components

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1 - 10 Nm

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

2 - Toothed belt cover (centre)

3 - Not fitted

4 - Not fitted

5 - Toothed belt cover (top)

- ☐ Engage carefully in centre toothed belt cover when installing

6 - 23 Nm

7 - Washer

8 - Semi-automatic tensioning roller

- ☐ Checking ⇒ [page 44](#)

9 - 100 Nm

- ☐ Use counterhold tool -3415- when loosening and tightening

10 - Camshaft sprocket

- ☐ Removing and installing ⇒ ["1.8 Removing toothed belt from camshaft sprocket", page 40](#)

- ☐ Installation position: fixed by parallel key ⇒ [Item 14 \(page 33\)](#)

11 - 10 Nm

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

12 - 23 Nm

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

13 - Toothed belt cover (rear)

14 - Parallel key

- ☐ Check for firm attachment

15 - O-ring

- ☐ Renew

16 - Coolant pump

- ☐ Removing and installing ⇒ [page 133](#)

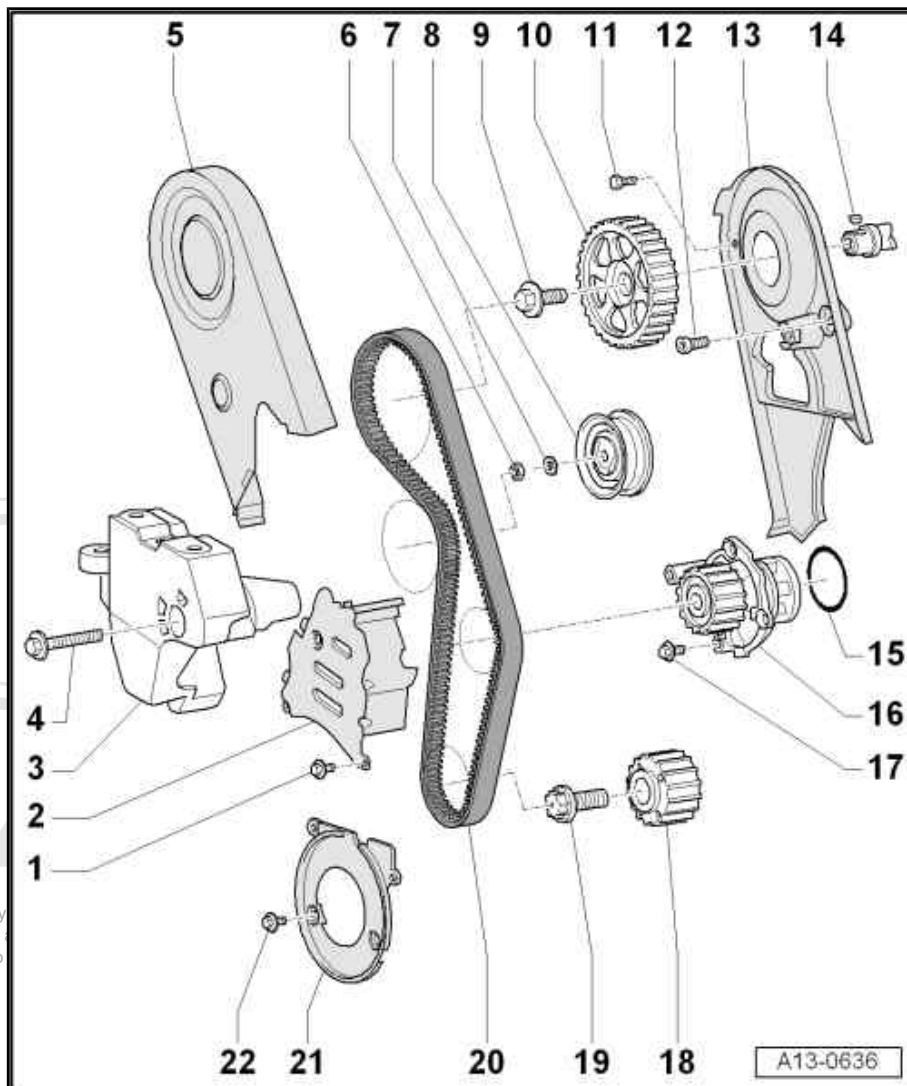
17 - 15 Nm

18 - Crankshaft sprocket

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

19 - 90 Nm + 90° (1/4 turn) further

- ☐ Renew
- ☐ Do not lubricate with oil
- ☐ Use counterhold tool -3415- when loosening and tightening



20 - Toothed belt

- ☐ Before removing, mark direction of rotation with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.
- ☐ Check for wear
- ☐ Do not kink
- ☐ Removing and installing ⇒ [page 34](#)
- ☐ Detaching from camshaft sprocket ⇒ [page 40](#)

21 - Toothed belt cover (bottom)

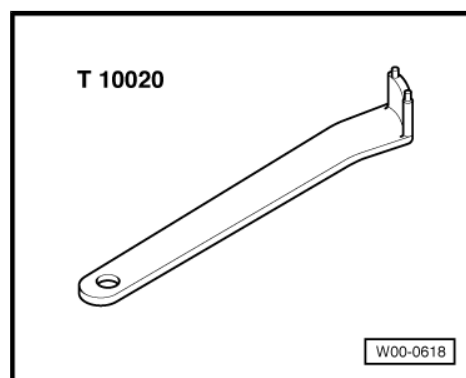
22 - 10 Nm

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

1.7 Removing and installing toothed belt

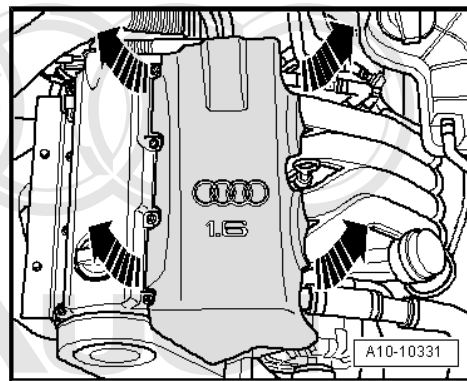
Special tools and workshop equipment required

- ◆ 2-hole pin wrench -T10020-



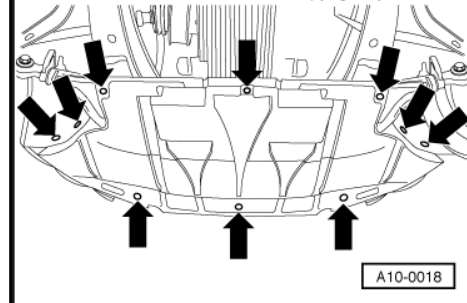
Removing

- Engine in vehicle.
- Lift off engine cover -arrows-.



- Remove noise insulation -arrows-.

- Move lock carrier to service position ⇒ Rep. Gr. 50.



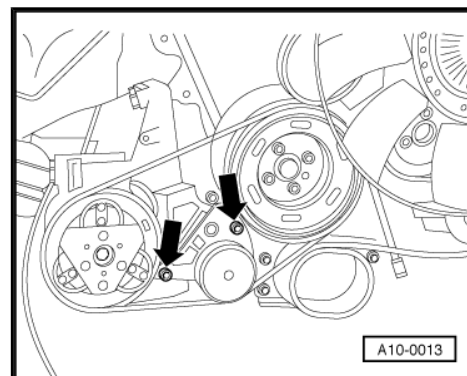
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Vehicles with air conditioning:

Note

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

- Loosen securing bolts of tensioning roller for air conditioner compressor poly V-belt -arrows- and remove poly V-belt.

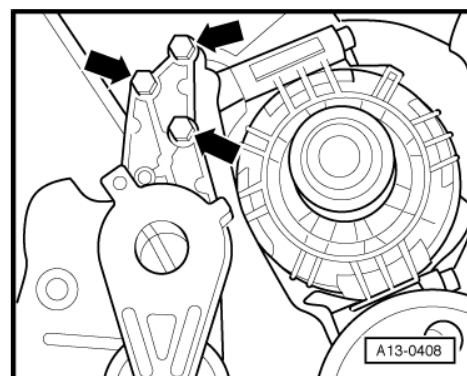
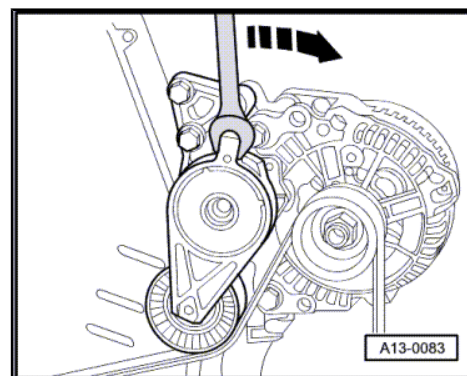


All vehicles:

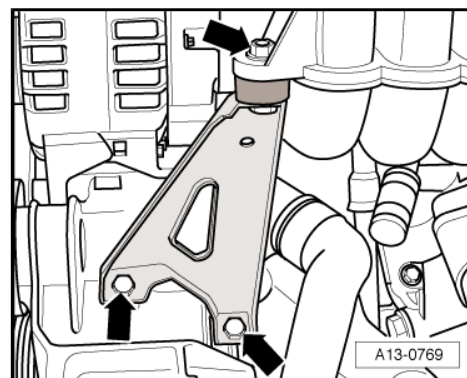
Note

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

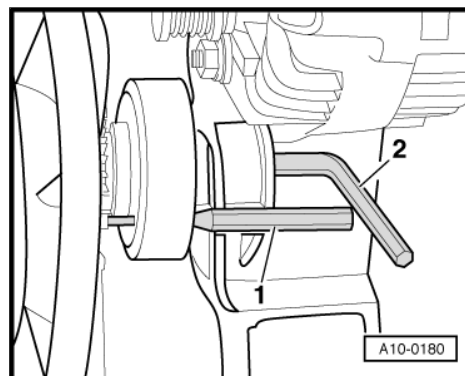
- Turn the tensioner in the direction of the -arrow- to slacken the poly V-belt.
- Remove poly V-belt and release pressure from the tensioner.
- Unscrew poly V-belt tensioner -arrows-.



- Remove intake manifold support -arrows-.



- Unscrew viscous fan pulley using Allen key -2- and at the same time counterhold with roll-pin drift -1-.
- Remove viscous fan from bearing.

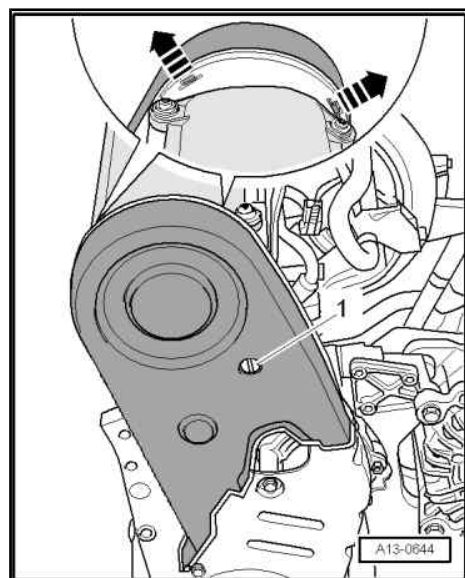


- Turn quick-release fastener -item 1- 90° clockwise.
- Raise retaining tabs -arrows- and detach top toothed belt cover.

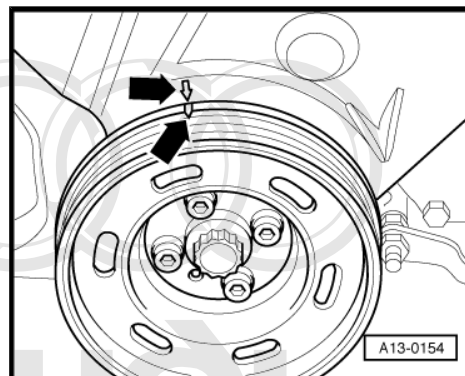


Caution

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

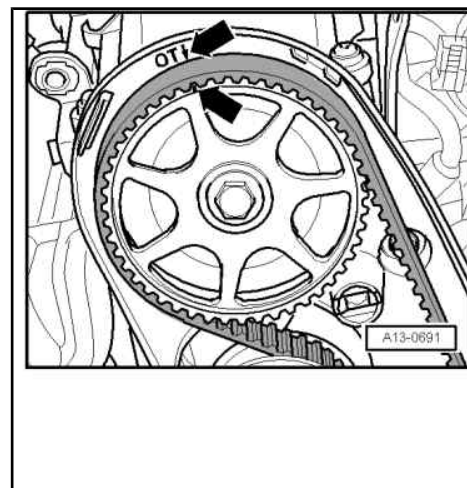


- Turn crankshaft at central bolt on crankshaft sprocket in direction of engine rotation to “TDC mark” -arrows-.

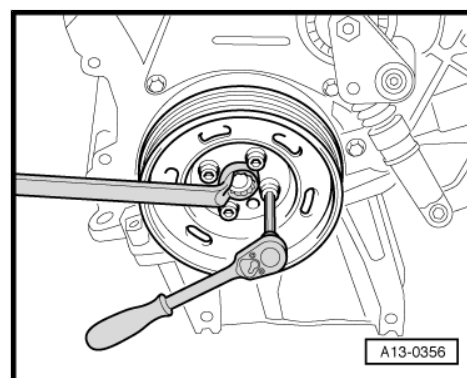


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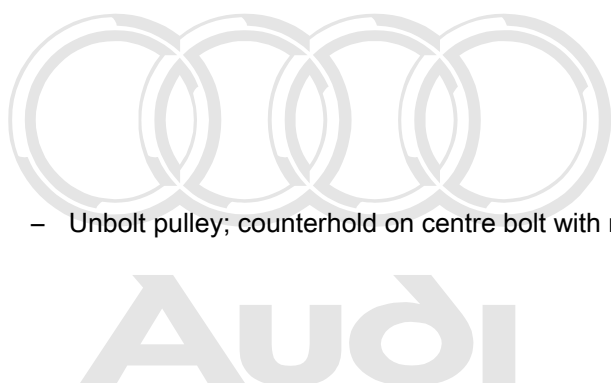
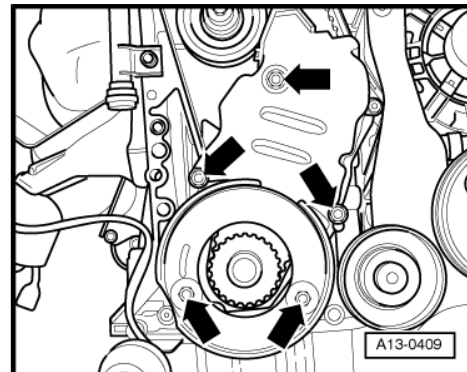
- At the same time the marking on front of the camshaft sprocket must align with the marking on the rear toothed belt cover -arrows-.
- If necessary, turn crankshaft one turn further.



- Unbolt pulley; counterhold on centre bolt with ring spanner.



- Remove toothed belt cover (centre and bottom) -arrows-.



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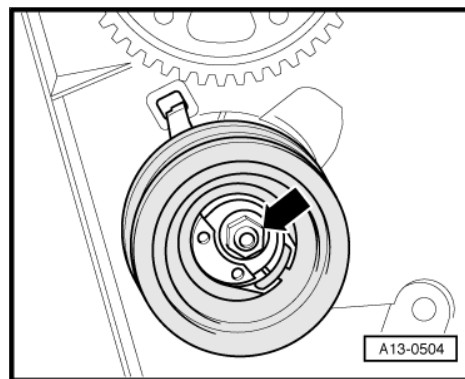
- Mark the rotation direction of toothed belt with chalk or a felt-tipped pen.
- Loosen nut on tensioning roller -arrow- several turns.
- Remove toothed belt.

Installing (adjusting valve timing)



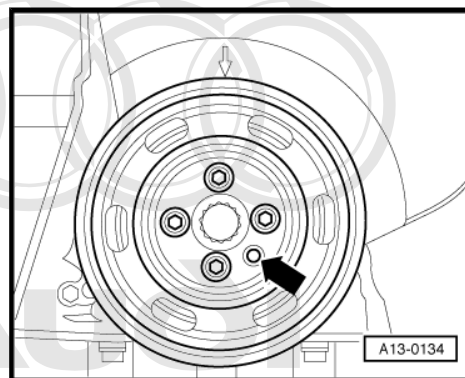
Note

- ◆ *The toothed belt adjustment must also be performed as described below, even if the toothed belt has only been removed from the camshaft sprocket.*
- ◆ *The crankshaft must not be at "TDC" at any cylinder when the camshaft is turned. Otherwise, there is a risk of damage to valves and piston crowns.*
- Fit toothed belt on crankshaft sprocket (note rotation direction).
- Install bottom toothed belt cover.

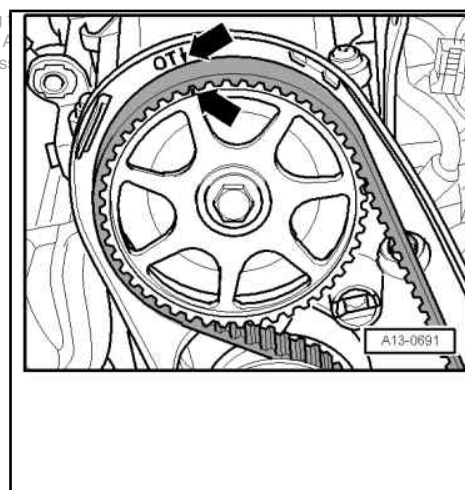


Note

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



- Align mark on camshaft sprocket with mark on toothed belt cover -arrows-.



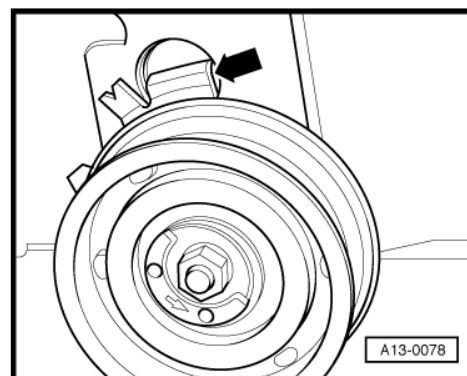
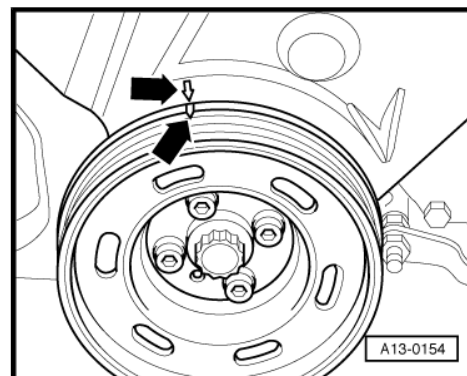
- Check again whether the crankshaft is positioned at “TDC” -arrows-.



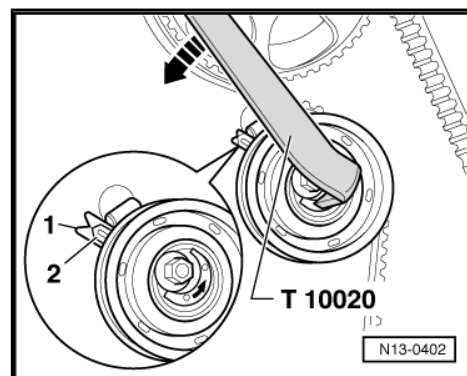
- Fit toothed belt in the sequence: coolant pump, tensioning roller, camshaft sprocket.

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- **Note correct position of semi-automatic tensioning roller:**
 - Retaining lug -arrow- must engage in slot on cylinder head.



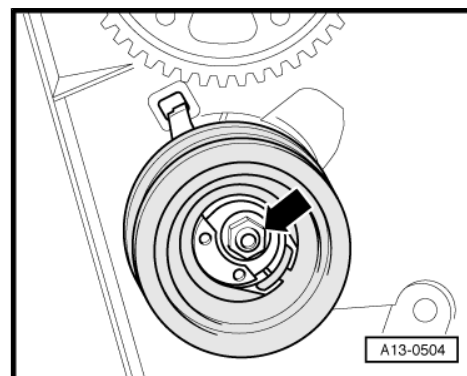
- Turn tensioning roller at eccentric adjuster to stop in -direction of arrow- using 2-hole pin wrench -T10020- .
- Slacken tensioning roller until pointer -2- is approx. 10 mm below the notch -1-.
- Again, turn tensioning roller at eccentric adjuster to stop in -direction of arrow-.
- Slacken tensioning roller again until pointer -2- is approx. 10 mm below the notch -1-.
- Then tension tensioning roller until pointer -2- and notch -1- are back in line.



Note

Check the position of notch and pointer on tensioning roller using a mirror.

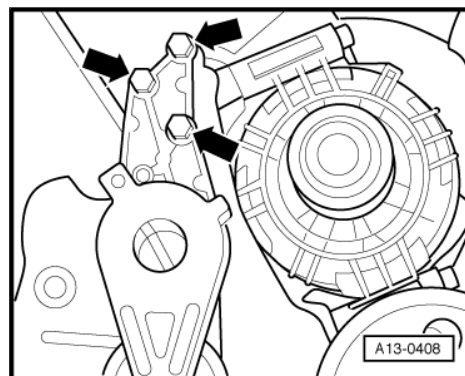
- Tighten securing nut -arrow-.
- Turn crankshaft at central bolt on toothed belt sprocket two revolutions in direction of engine rotation and check whether camshaft and crankshaft markings align at “TDC” with their respective reference points.
- Check again whether toothed belt is tensioned properly, repeat adjustment procedure if necessary.
- Install centre section of toothed belt cover.
- Install top section of toothed belt cover (make sure it engages securely on centre section of toothed belt cover).



- Install tensioner for poly V-belt -arrows-.
- Install viscous fan ⇒ [page 143](#) .
- Install poly V-belt ⇒ [page 24](#) .
- Install lock carrier with attachments ⇒ Rep. Gr. 50 .

Tightening torques

Component		Nm
Tensioning roller to cylinder head		23
Toothed belt cover (bottom and centre section) to cylinder block		10 ¹⁾
Pulley to toothed belt sprocket	Bolt strength rating 8.8	10 + 90° ²⁾³⁾
	Bolt strength rating 10.9	40
Tensioner for poly V-belt to bracket for ancillaries		23
Support for intake manifold to	intake manifold	20
	bracket	20
• 1) Install using locking fluid ⇒ Parts catalogue . • 2) Renew bolts. • 3) 90° = one quarter turn.		

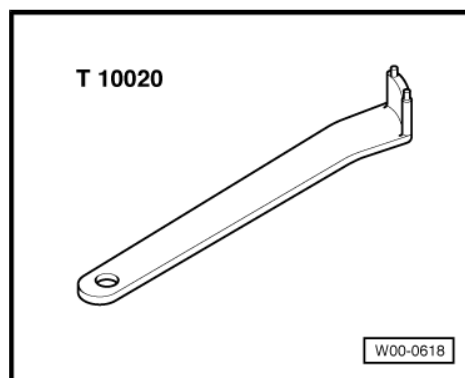


1.8 Removing toothed belt from camshaft sprocket

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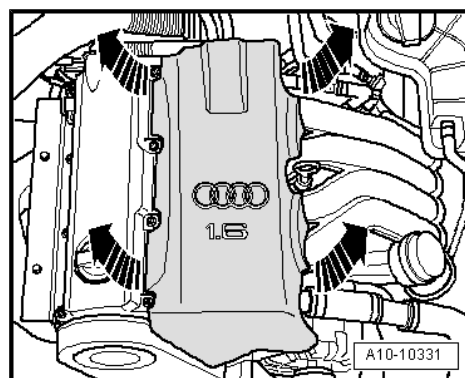
Special tools and workshop equipment required

- ◆ 2-hole pin wrench -T10020-

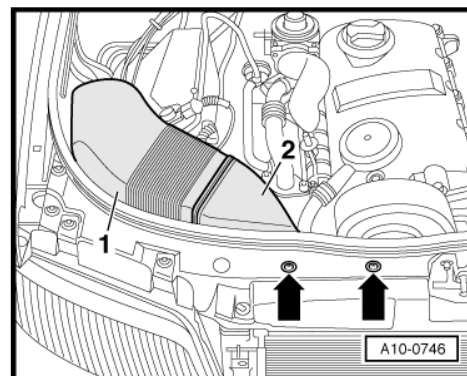


Removing

- Lift off engine cover -arrows-.



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

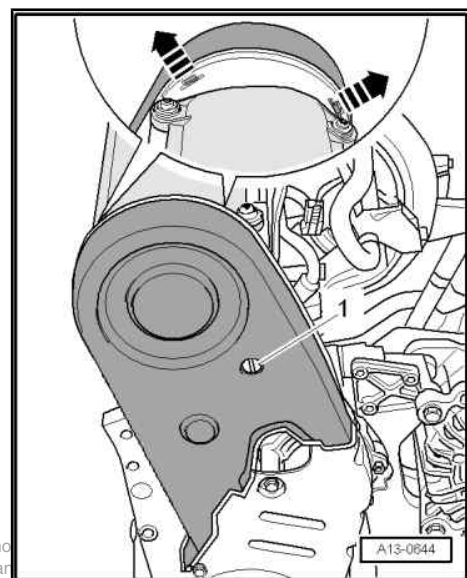


- Turn quick-release fastener -item 1- 90° anti-clockwise.
- Raise retaining tabs -arrows- and detach top toothed belt cover.

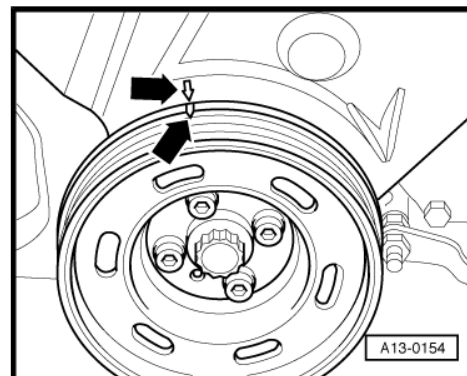


Caution

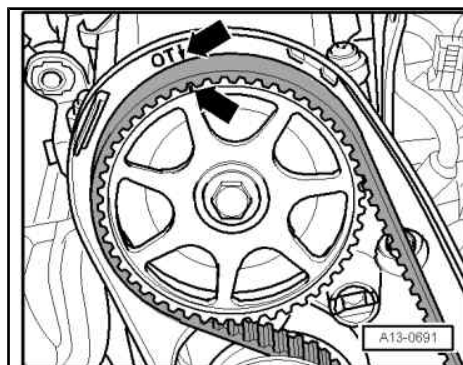
The engine must only be turned at the crankshaft, in the direction of normal engine rotation (clockwise).



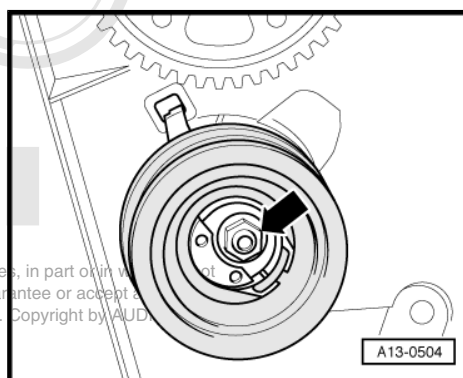
- Turn crankshaft at central bolt on crankshaft sprocket in direction of engine rotation to "TDC mark" -arrows-.



- At the same time the marking on front of the camshaft sprocket must align with the marking on the rear toothed belt cover -arrows-.
- If necessary, turn crankshaft one turn further.



- Loosen nut on tensioning roller -arrow- several turns.
- Remove toothed belt from camshaft sprocket.



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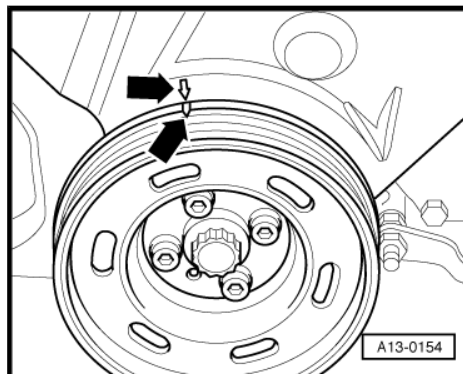
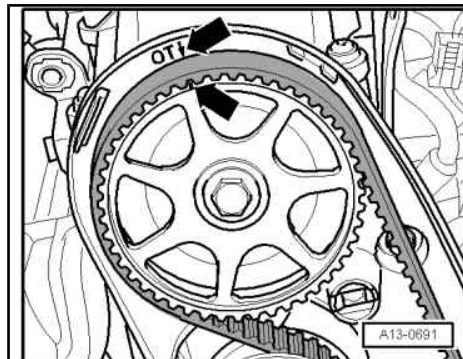
Installing (adjusting valve timing)



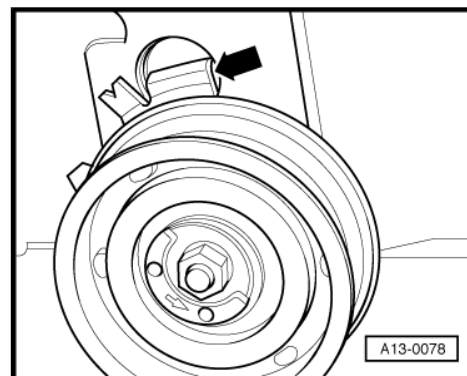
Note

The crankshaft must not be at "TDC" at any cylinder when the camshaft is turned. Otherwise, there is a risk of damage to valves and piston crowns.

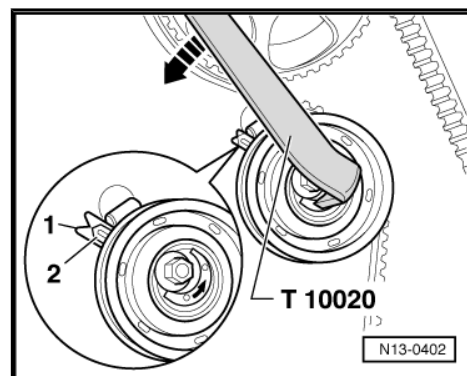
- Align mark on camshaft sprocket with mark on toothed belt cover -arrows-.
- Check again whether the crankshaft is positioned at "TDC" -arrows-.



- Fit toothed belt in the sequence: coolant pump, tensioning roller, camshaft sprocket.
- Note correct position of semi-automatic tensioning roller:
 - Retaining lug -arrow- must engage in slot on cylinder head.



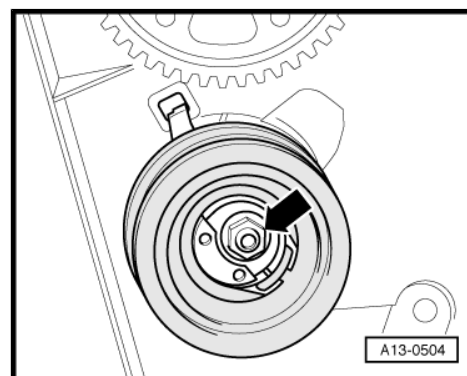
- Turn tensioning roller at eccentric adjuster to stop in -direction of arrow- using 2-hole pin wrench -T10020- .
- Slacken tensioning roller until pointer -2- is approx. 10 mm below the notch -1-.
- Again, turn tensioning roller at eccentric adjuster to stop in -direction of arrow-.
- Slacken tensioning roller again until pointer -2- is approx. 10 mm below the notch -1-.
- Then tension tensioning roller until pointer -2- and notch -1- are back in line.



Note

Check the position of notch and pointer on tensioning roller using a mirror.

- Tighten securing nut -arrow-.
- Turn crankshaft at central bolt on toothed belt sprocket two revolutions in direction of engine rotation and check whether camshaft and crankshaft markings align at TDC with their respective reference points.
- Check again whether toothed belt is tensioned properly, repeat adjustment procedure if necessary.
- Install top section of toothed belt cover (make sure it engages securely on centre section of toothed belt cover).



Tightening torque

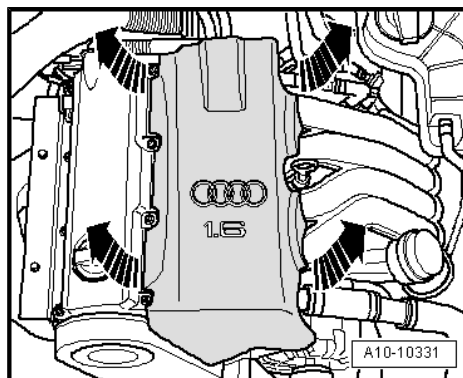
Component	Nm
Tensioning roller for toothed belt to cylinder head	23

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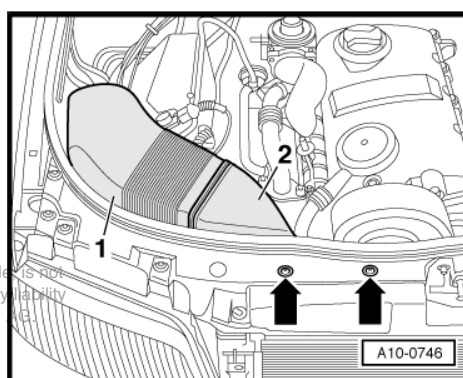
1.9 Checking semi-automatic tensioning roller for toothed belt

Procedure

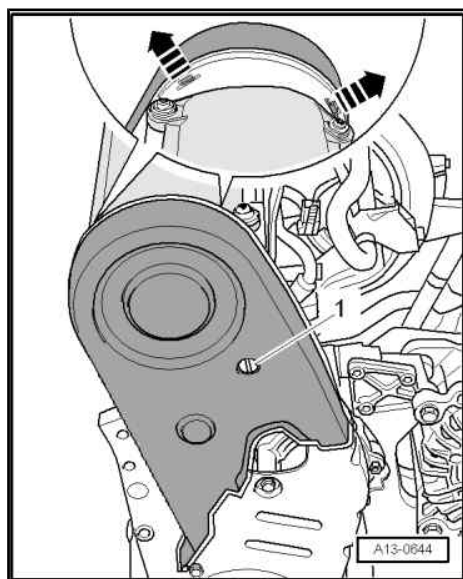
- Toothed belt fitted and tensioned.
- Lift off engine cover -arrows-.



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



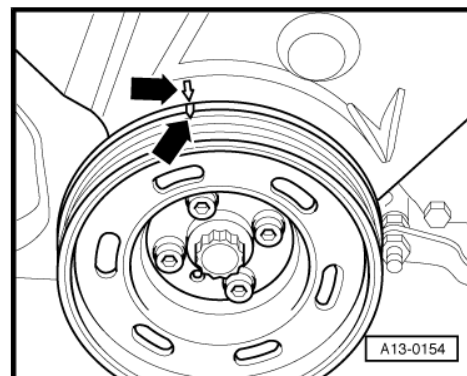
- Turn quick-release fastener -item 1- 90° anti-clockwise.
- Raise retaining tabs -arrows- and detach top toothed belt cover.



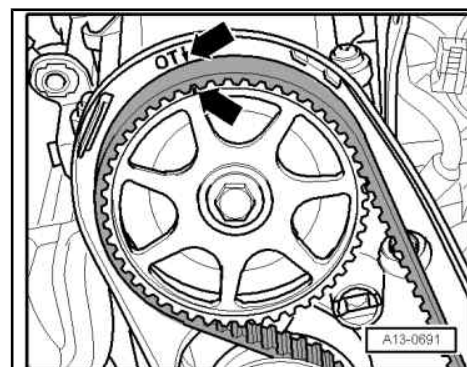
Caution

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

- Turn crankshaft at central bolt on crankshaft sprocket in direction of engine rotation to “TDC mark” -arrows-.



- At the same time the marking on front of the camshaft sprocket must align with the marking on the rear toothed belt cover -arrows-.
- If necessary, turn crankshaft one turn further.



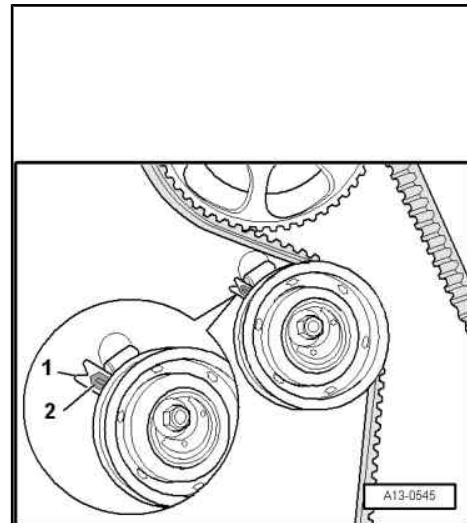
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- Push in toothed belt with firm thumb pressure.
- The pointer -2- should move to side.
- Release thumb pressure on toothed belt.
- Tensioner should return to initial position. (Pointer back in line with notch -1-).



Note

Check the position of notch and pointer on tensioning roller using a mirror.



2 Removing and installing sealing flanges and dual-mass flywheel



Note

Servicing clutch ⇒ Rep. Gr. 30

1 - 15 Nm

2 - Oil seal

- ☐ Renewing ⇒ [page 47](#)
- ☐ Do not lubricate with oil

3 - Sealing flange (front)

- ☐ Must be positioned on dowel sleeves
- ☐ Removing and installing ⇒ [page 50](#)
- ☐ Install using sealant; sealant ⇒ Parts catalogue

4 - Cylinder block

- ☐ Removing and installing crankshaft ⇒ [page 59](#)
- ☐ Dismantling and assembling pistons and con-rods ⇒ [page 65](#)

5 - Securing bolt for dual-mass flywheel

- ☐ Renew
- ☐ Tightening torque ⇒ [page 56](#)

6 - Dual-mass flywheel

- ☐ Removing and installing ⇒ [page 54](#)

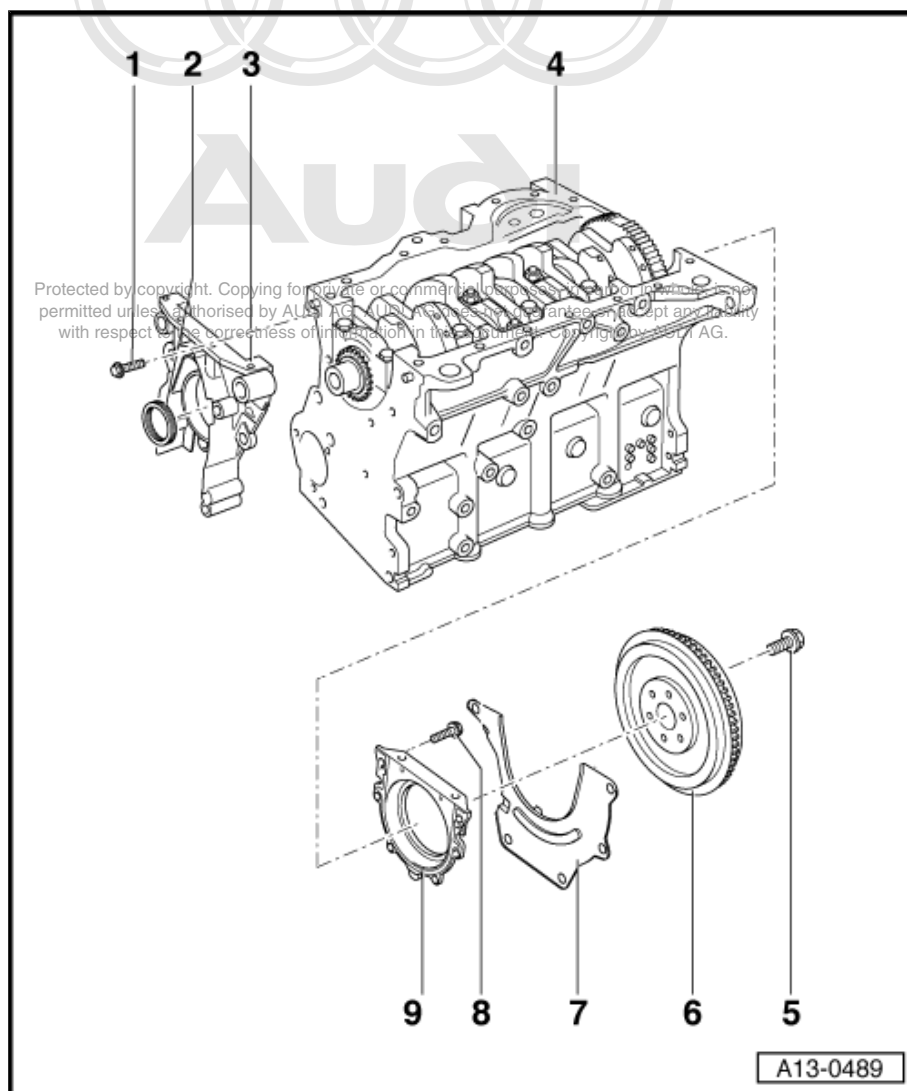
7 - Intermediate plate

- ☐ Must be positioned on dowel sleeves
- ☐ Do not damage/bend when assembling
- ☐ Is fitted on sealing flange ⇒ [page 47](#)

8 - 15 Nm

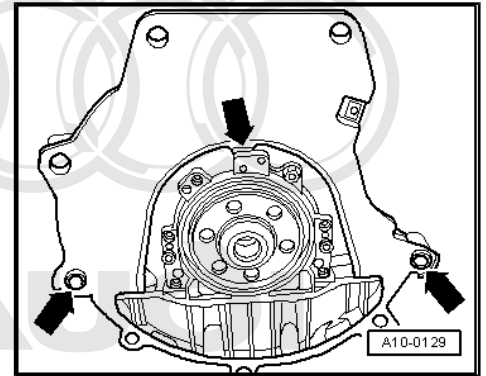
9 - Sealing flange (rear) with oil seal

- ☐ Renew only as complete unit ⇒ [page 56](#)
- ☐ Use guide sleeve provided when fitting
- ☐ Do not lubricate/grease sealing lip of oil seal
- ☐ Before installing, remove oil remains from crankshaft journal with a clean cloth
- ☐ Guide sleeve is not to be removed until sealing flange has been slipped onto crankshaft journal



Installing intermediate plate

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

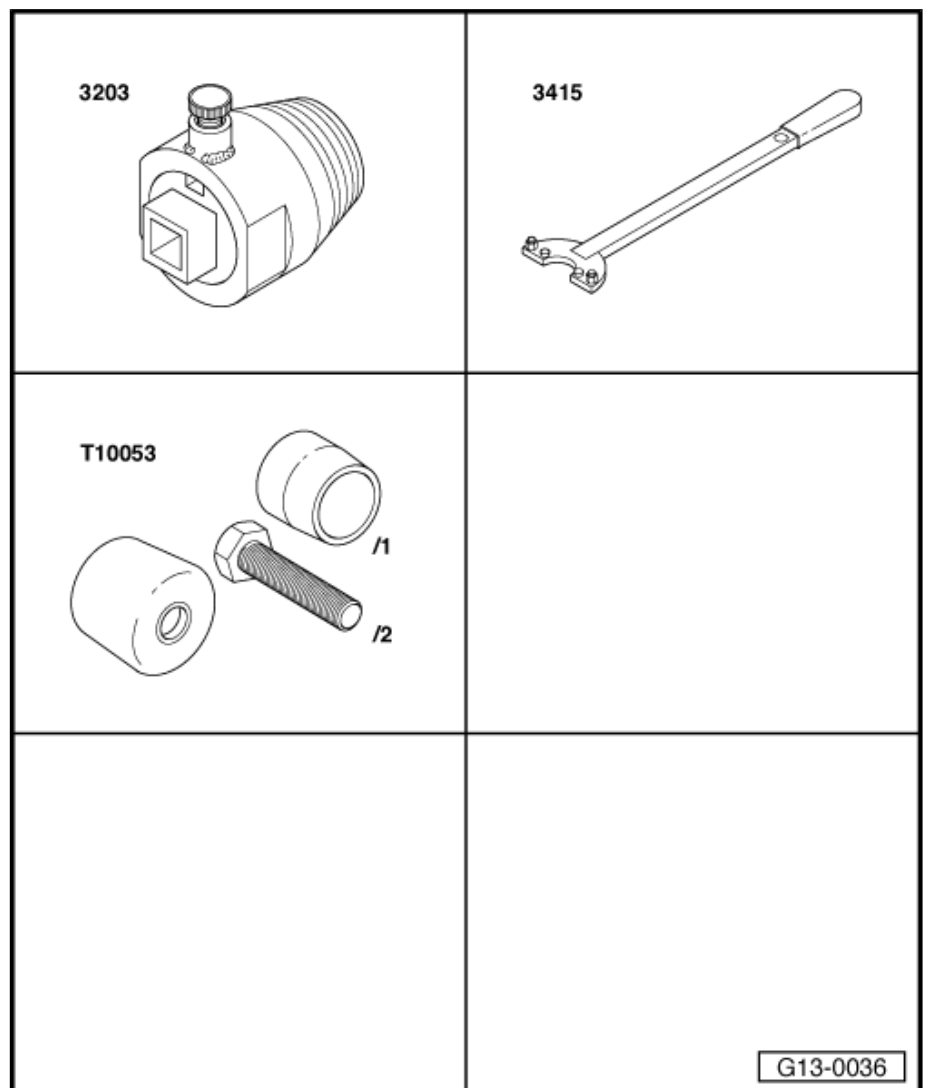


2.1 Renewing crankshaft oil seal (pulley end)

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Special tools and workshop equipment required

- ◆ Oil seal extractor -3203-
- ◆ Counterhold tool -3415-
- ◆ Assembly tool -T10053-



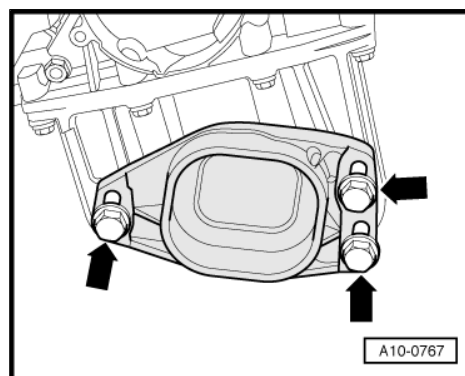
Procedure



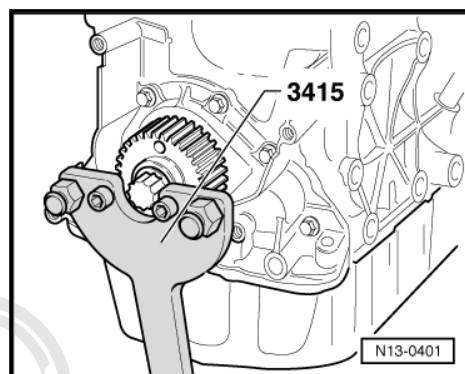
Note

- ◆ *Gradual introduction of PTFE oil seals (identification: without ring spring and with a wider sealing lip).*
- ◆ *The sealing lip of these oil seals must not be oiled or greased.*
- ◆ *An old-type radial oil seal (with spring ring) may be replaced with a PTFE oil seal – but not vice versa.*

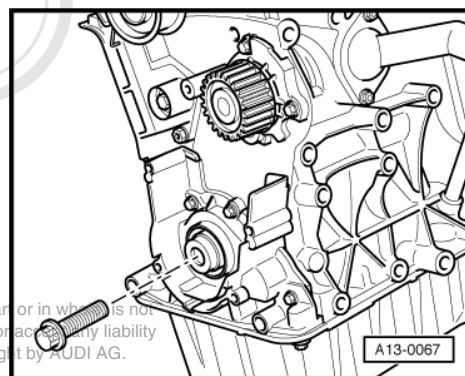
- Remove toothed belt ⇒ [page 34](#) .
- Unbolt stop for torque reaction support -arrows-.



- Remove crankshaft sprocket; use counterhold tool -3415- to lock sprocket in place.

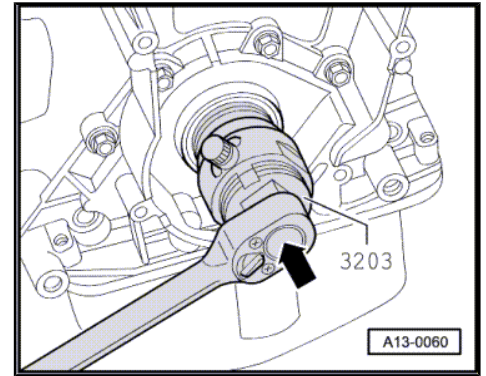


- Before fitting oil seal extractor, fully screw in centre bolt for sprocket into crankshaft.
- Unscrew inner part of oil seal extractor -3203- nine turns (approx. 20 mm) from the outer part and lock in position with the knurled screw.



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

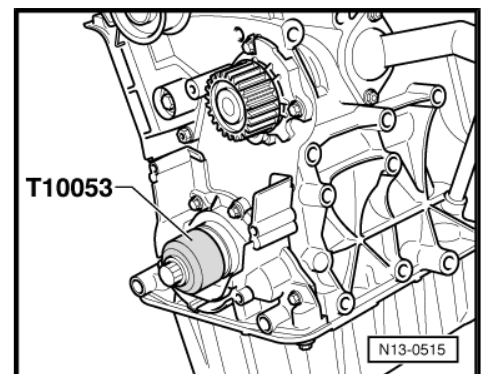
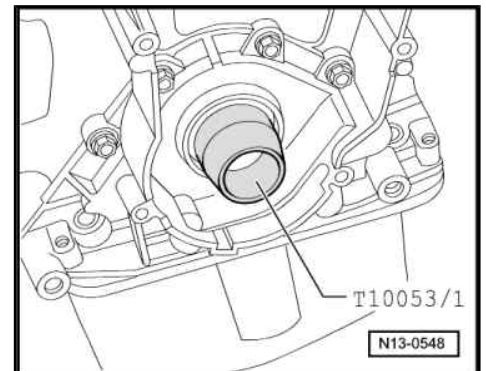


- Clean running surface and sealing surface.
- Remove oil residue from crankshaft journal with a clean cloth.

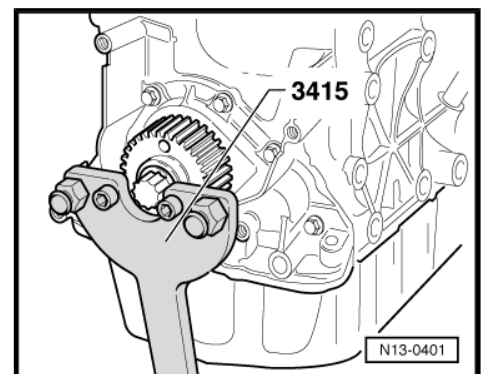
i Note

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

- Place guide sleeve -T10053/1- onto crankshaft journal.
- Slide oil seal over guide sleeve onto crankshaft journal.
- Press oil seal on as far as the stop using assembly tool -T10053- and bolt -T10053/2-.



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

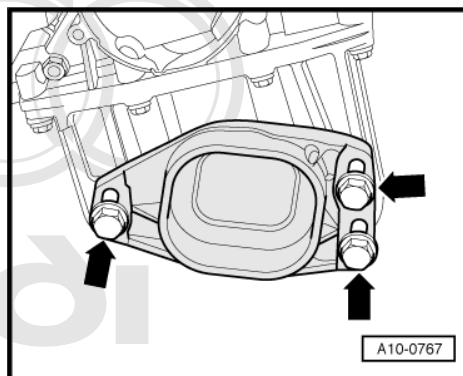


Remaining installation steps are carried out in reverse sequence; note the following:

- Fit toothed belt (adjust valve timing) ⇒ [page 38](#) .
- Install pulley ⇒ [page 27](#) .
- Install poly V-belt ⇒ [page 24](#) .
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten bolts -arrows-.

Tightening torque

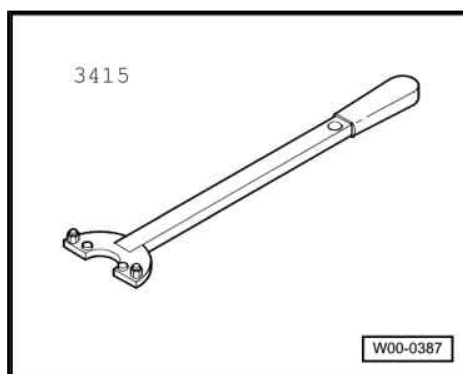
Component	Nm
Toothed belt sprocket to crankshaft	$90 + 90^\circ$ 1) 2)
Stop for torque reaction support to sump	28
• 1) Renew bolt. • 2) 90° = one quarter turn.	



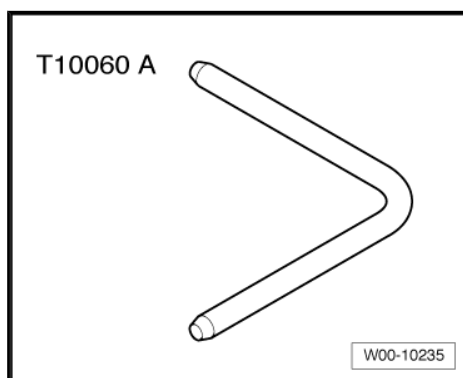
2.2 Removing and installing sealing flange (front)

Special tools and workshop equipment required

- ◆ Counterhold tool -3415-



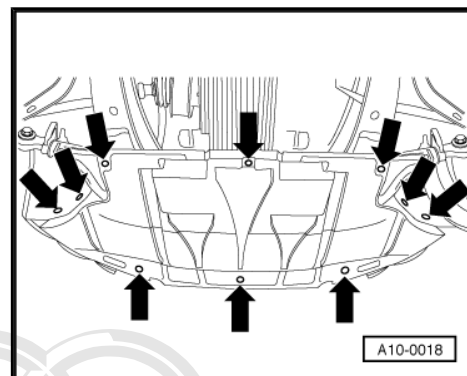
- ◆ Locking pin -T10060 A- or -T10060-



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

Removing

- Remove noise insulation -arrows-.
- Move lock carrier to service position ⇒ Rep. Gr. 50 .



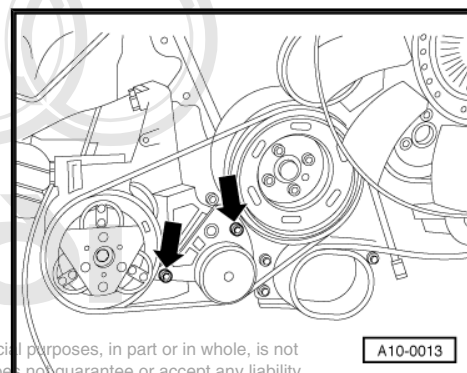
Vehicles with air conditioning:



Note

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

- Loosen securing bolts of tensioning roller for air conditioner compressor poly V-belt -arrows- and remove poly V-belt.



WARNING

The air conditioner refrigerant circuit must not be opened.

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- Detach air conditioner compressor from bracket and secure to body with wire.
- Unbolt bracket for air conditioner compressor
⇒ [Item 5 \(page 24\)](#) .

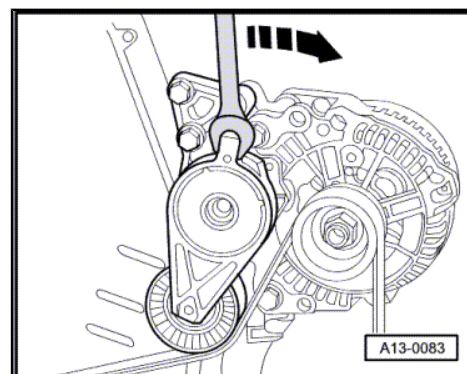
All vehicles:



Note

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

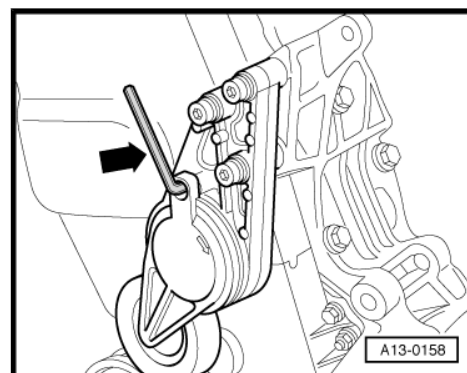
- Turn the tensioner in the direction of the -arrow- to slacken the poly V-belt.
- Remove poly V-belt.



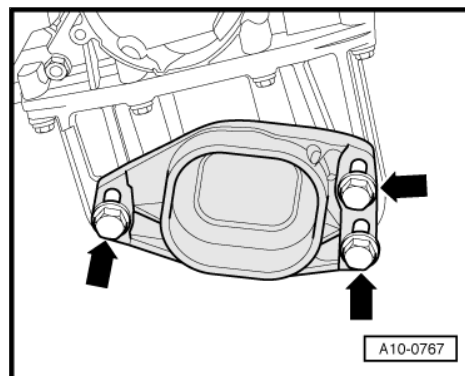
Note

Poly V-belt tensioner can be locked by inserting locking pin - T10060 A- or -T10060- or an appropriate Allen key -arrow- in locating holes.

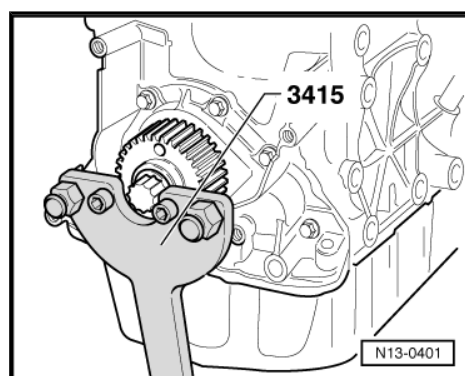
- Remove toothed belt ⇒ [page 34](#) .



- Unbolt stop for torque reaction support -arrows-.



- Remove crankshaft sprocket; use counterhold tool -3415- to lock sprocket in place.



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

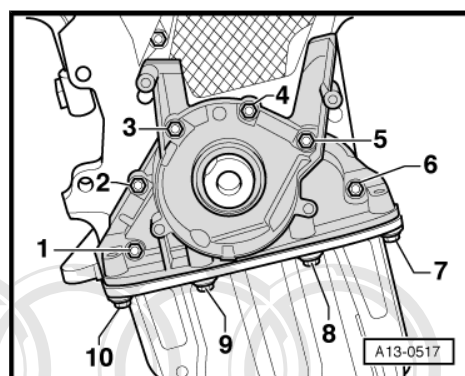
Installing



Note

Place a cloth over the exposed section of the sump.

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

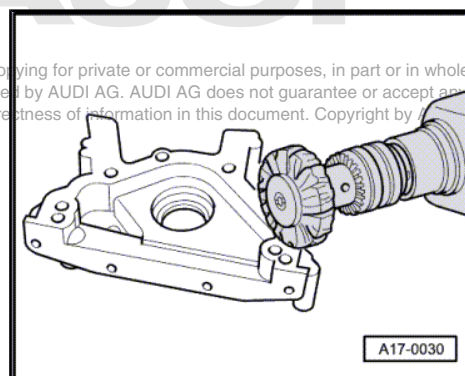


WARNING

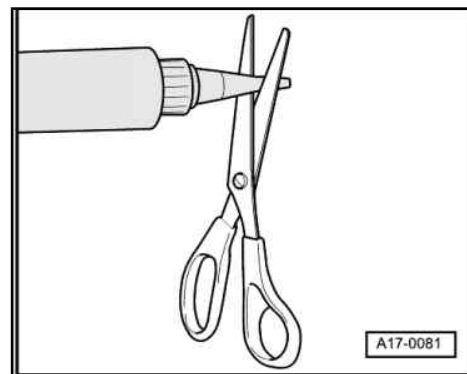
Wear safety goggles.

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

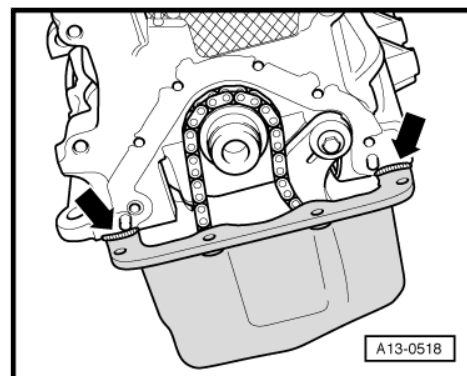
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- Cut off tube nozzle at front marking (nozzle approx. 2 mm $\varnothing$).



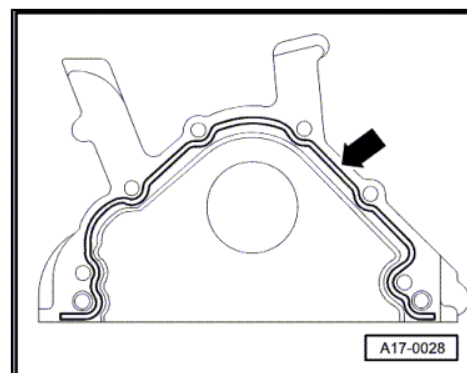
- Apply a thin bead of sealant at the edge of the joint between the cylinder block and the sump -arrows-.



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

**Note**

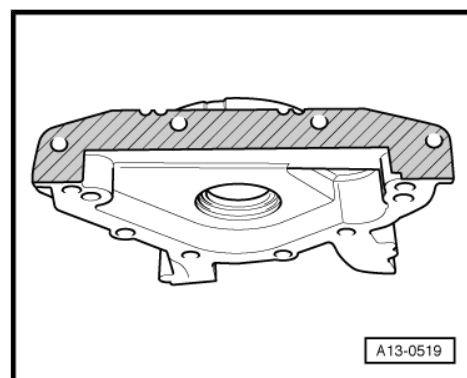
The sealant bead must not be thicker than specified, otherwise excess sealant could enter the sump and clog the strainer in the oil pump.



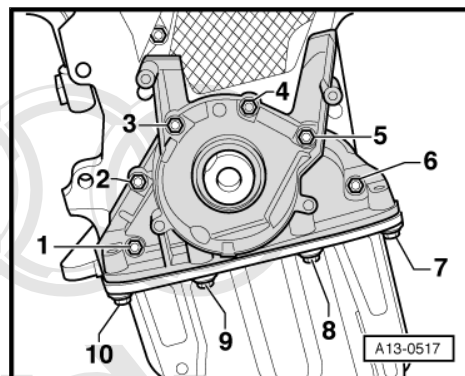
- Coat the lower sealing surface on the sealing flange lightly with sealant -hatched area-.

**Note**

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

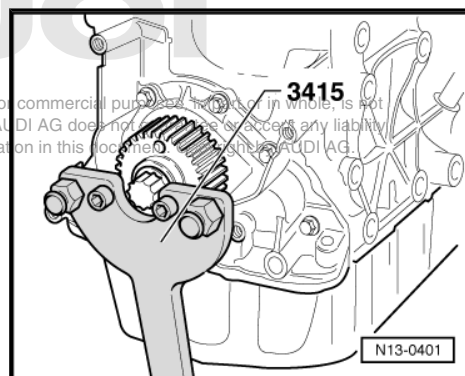


- Push the sealing flange carefully onto the dowel sleeves on the cylinder block.
- Tighten bolts in the specified sequence:
 1. Tighten bolts -1 ... 6-.
 2. Tighten bolts -7 ... 10-.
- Install crankshaft oil seal (pulley end) ⇒ [page 47](#) .



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

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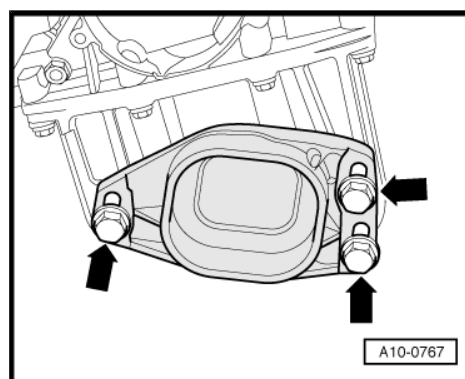


Remaining installation steps are carried out in reverse sequence; note the following:

- Fit toothed belt (adjust valve timing) ⇒ [page 38](#) .
- Install pulley ⇒ [page 27](#) .
- Install bracket for air conditioner compressor ⇒ [Item 5 \(page 24\)](#)
- Install air conditioner compressor ⇒ Rep. Gr. 87 .
- Install poly V-belt ⇒ [page 24](#) .
- Install lock carrier with attachments ⇒ Rep. Gr. 50 .
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten bolts -arrows-.

Tightening torques

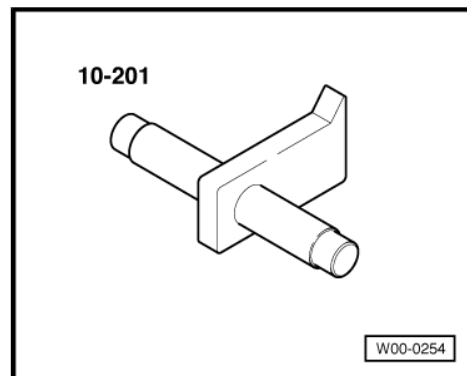
Component	Nm
Sealing flange to cylinder block	15
Toothed belt sprocket to crankshaft	90 + 90° 1) 2)
Bracket for air conditioner compressor to cylinder block	33
Stop for torque reaction support to sump	28
• 1) Renew bolt. • 2) 90° = one quarter turn.	



2.3 Removing and installing dual-mass fly-wheel

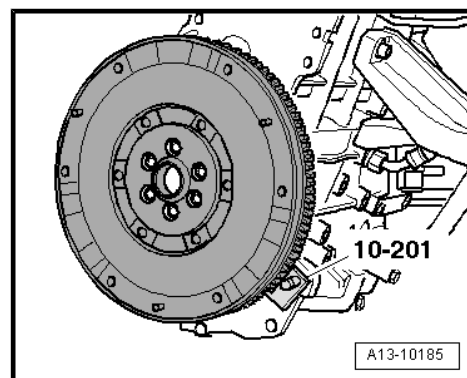
Special tools and workshop equipment required

◆ Counterhold tool -10-201-



Removing

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



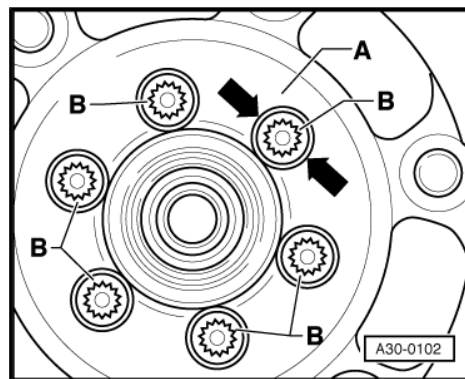
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Note

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

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



Installing

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

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

Tightening torque

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

2.4 Removing and installing sealing flange (rear)

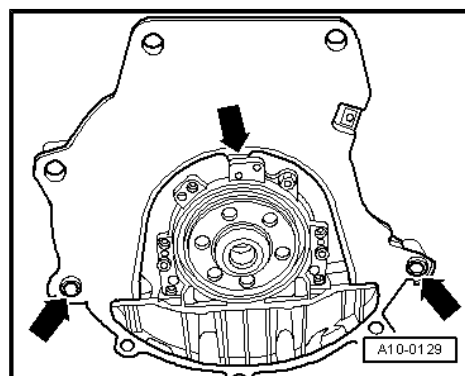
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Special tools and workshop equipment required

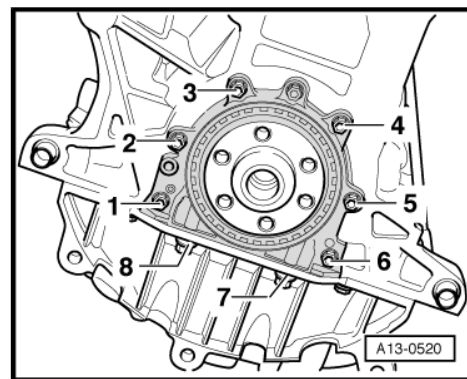
- ◆ Electric drill with plastic brush attachment
- ◆ Safety goggles
- ◆ Sealant ⇒ Parts catalogue

Removing

- Engine or gearbox removed.
- Remove dual-mass flywheel ⇒ [page 54](#) .
- Detach intermediate plate at sealing flange and dowel sleeves -arrows-.



- Unscrew bolts -1 ... 8-.
- Pull off sealing flange (rear).



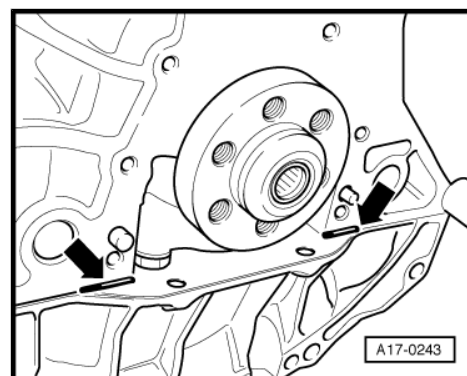
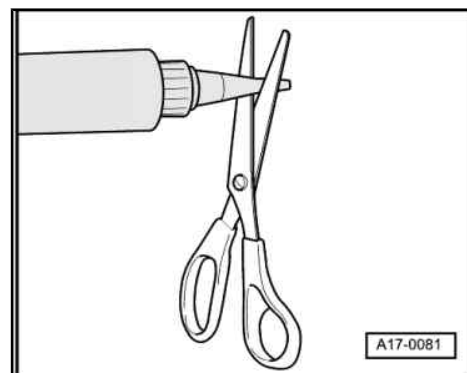
Installing



Note

Place a cloth over the exposed section of the sump.

- Carefully remove any sealant residue on the cylinder block and sump.
- Clean sealing surfaces; they must be free of oil and grease.
- Cut off tube nozzle at front marking (nozzle approx. 2 mm Ø).
- Apply a thin bead of sealant at the edge of the joint between the cylinder block and the sump -arrows-.

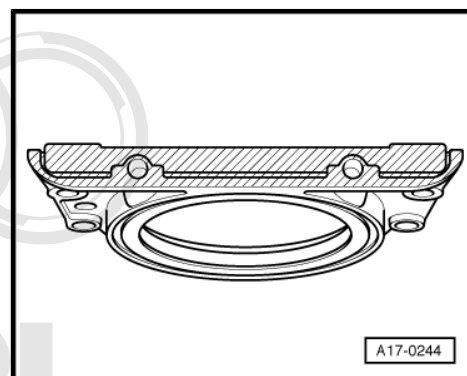


- Coat the lower sealing surface on the sealing flange lightly with sealant -hatched area-.



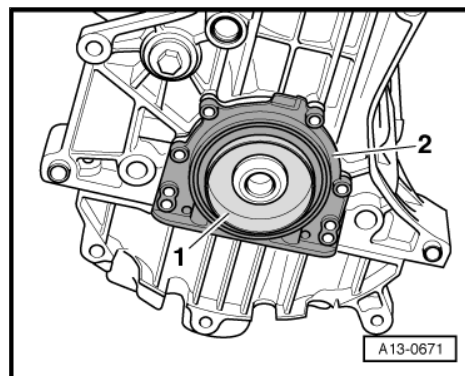
Note

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



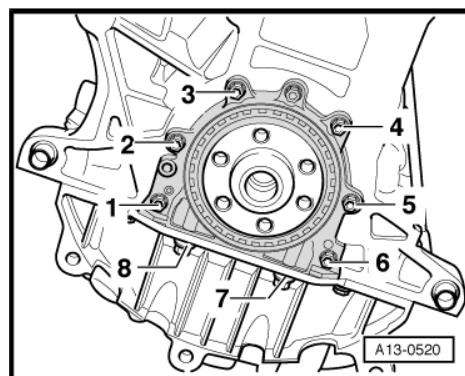
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- Carefully push sealing flange -2- together with guide sleeve -1- (fitted on replacement part) onto crankshaft when installing.
- Then push the sealing flange carefully onto the dowel sleeves on the cylinder block.



- Tighten bolts in the specified sequence:

1. Tighten bolts -1 ... 6-.
2. Tighten bolts -7- and -8-.

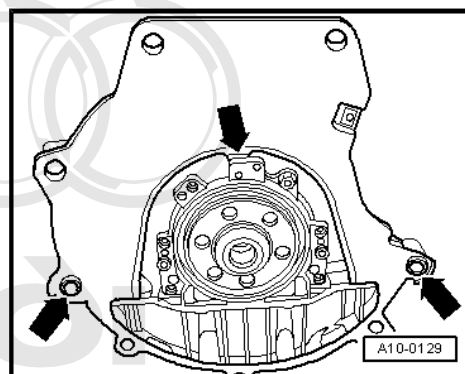


Remaining installation steps are carried out in reverse sequence; note the following:

- Fit intermediate plate to sealing flange and push onto dowel sleeves -arrows-.
- Install dual-mass flywheel ⇒ [page 54](#) .

Tightening torque

Component	Nm
Sealing flange to cylinder block	15



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3 Removing and installing crankshaft



Note

- ◆ When carrying out repairs, secure engine with engine and gearbox support -VW 540- to engine stand -VAS 6095-
⇒ [page 17](#).
- ◆ If large quantities of metal shavings or particles are found in the engine oil when repairing the engine, the oil passages must be cleaned carefully, and the oil cooler must be renewed in order to prevent further damage occurring later.

3.1 Crankshaft - exploded view of components

1 - Bearing shell for cylinder block

- ☐ With oil groove
- ☐ Do not interchange used bearing shells (mark positions)
- ☐ Inserting bearing shells for cylinder block with correct colour-coding
⇒ [page 61](#)

2 - Drive chain sprocket for oil pump

- ☐ Removing and installing
⇒ [page 63](#)

3 - Bearing shell for bearing cap

- ☐ Without oil groove
- ☐ Do not interchange used bearing shells (mark positions)
- ☐ Inserting bearing shells for cylinder block with correct colour-coding
⇒ [page 61](#)

4 - Thrust washers for bearing No. 3

- ☐ Note location

5 - 40 Nm + 90° (1/4 turn) further

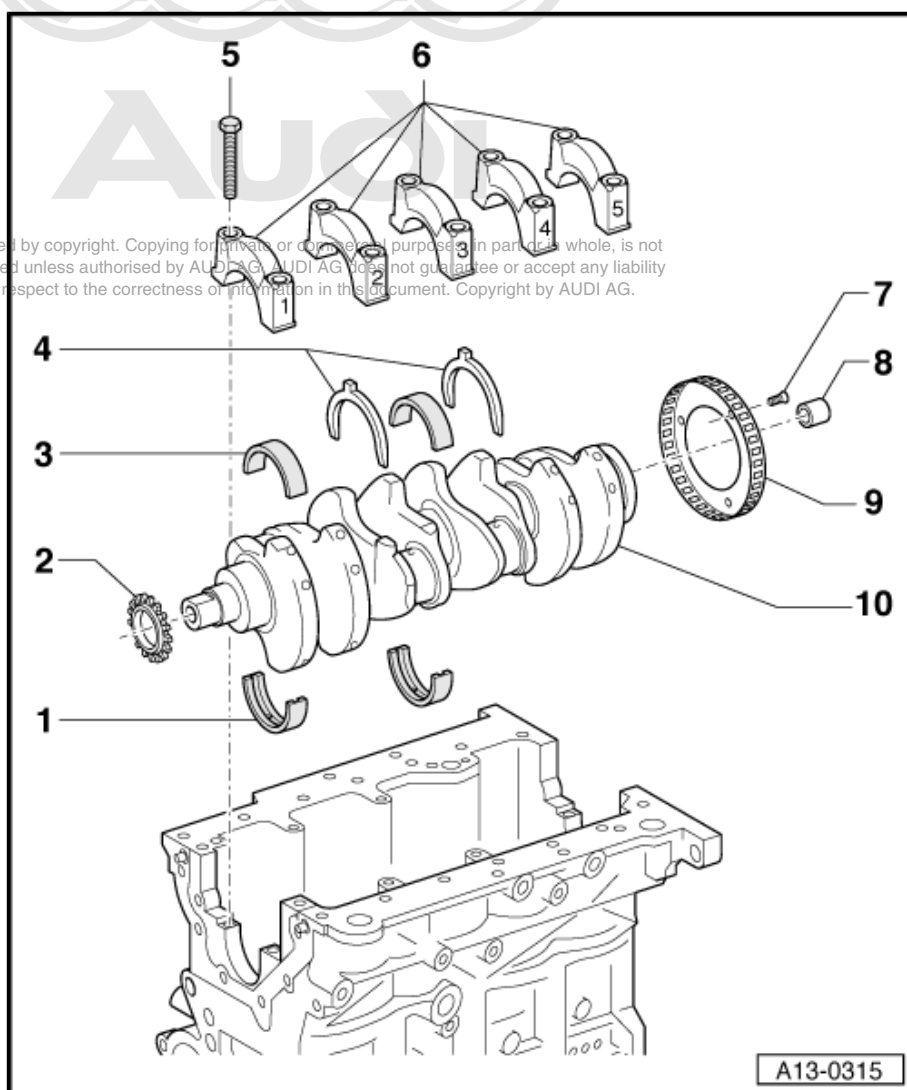
- ☐ Renew
- ☐ For measuring radial clearance of crankshaft tighten to 40 Nm, but not further

6 - Bearing caps

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

7 - 10 Nm + 90° (1/4 turn) further

- ☐ Renew



- ☐ Sender wheel must be renewed if bolts are loosened ⇒ [page 60](#)

8 - Needle bearing

- ☐ Extracting and driving in ⇒ [page 62](#)

9 - Sender wheel

- ☐ For engine speed sender -G28-
- ☐ Can only be installed in one position (holes are off-set)
- ☐ Sender wheel must be renewed if bolts are loosened
- ☐ Removing and installing ⇒ [page 60](#)

10 - Crankshaft

- ☐ Axial clearance when new: 0.07 ... 0.23 mm; wear limit: 0.30 mm
- ☐ Measuring radial clearance ⇒ [page 61](#)
- ☐ Do not rotate the crankshaft when checking the radial clearance
- ☐ Crankshaft dimensions ⇒ [page 61](#)

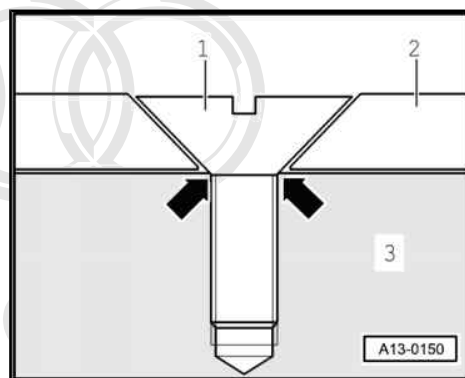
Removing and installing sender wheel

- Sender wheel -2- must always be renewed after slackening off bolts -1-.



Note

- ◆ *If the countersunk bolts are tightened a second time, the seats for the bolt heads in the sender wheel will be deformed to such an extent that the bolt heads make contact with the crankshaft -3- -arrows- and the sender wheel beneath the bolts will be loose.*
- ◆ *Sender wheel can only be installed in one position. Holes are off-set.*



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Tightening torque

Component	Nm
Sender wheel to crankshaft	10 + 90° 1)2)
• 1) Renew bolts. • 2) 90° = one quarter turn.	

Matching crankshaft bearing shells to bearings in cylinder block

Bearing shells of the correct thickness are assigned to the cylinder block at the factory. Coloured dots are used to identify the thickness of the bearing shells.

Note

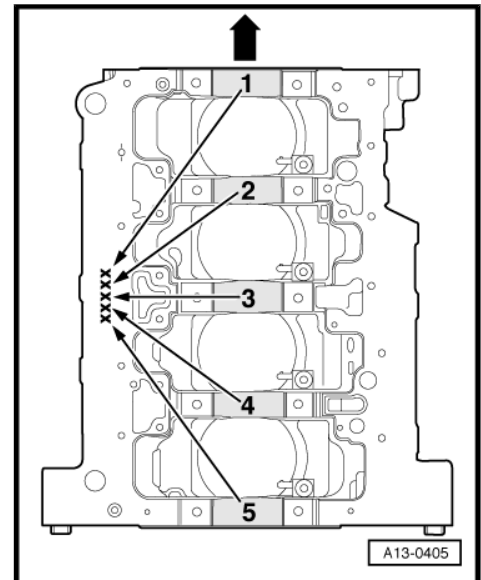
The -arrow- points in direction of travel.

Letter codes on lower sealing surface of cylinder block indicate which bearing shell is to be fitted at each location.

Letter on cylinder block	Colour coding of bearing
B =	Blue
R =	Red
G =	Yellow

Note

The crankshaft bearing shells in the bearing caps are only supplied as spare parts with "yellow" coloured markings.



3.2 Crankshaft dimensions

Honing dimension (in mm)	Crankshaft main bearing journal Ø	Conrod bearing journal Ø
Basic dimension	48.00 -0.017 -0.037	42.00 -0.022 -0.042
1st undersize	47.75 -0.017 -0.037	41.75 -0.022 -0.042
2nd undersize	47.50 -0.017 -0.037	41.50 -0.022 -0.042
3rd undersize	47.25 -0.017 -0.037	41.25 -0.022 -0.042

3.3 Measuring radial clearance of crankshaft

Special tools and workshop equipment required

- ◆ Plastigage

Procedure

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Note

Do not interchange used bearings.

- Remove crankshaft bearing cap and clean bearing cap and journal.
- Place a length of Plastigage corresponding to the width of the bearing on the bearing journal or bearing shell.
- The Plastigage must be positioned in the centre of the bearing shell

- Fit crankshaft bearing caps and tighten to 40 Nm. Do not rotate crankshaft.
- Remove crankshaft bearing cap again.
- Compare width of Plastigage with measurement scale:

Radial clearance:

- New: 0.017 ... 0.037 mm.
- Wear limit: 0.07 mm.

3.4 Extracting and driving in needle bearing for crankshaft



Note

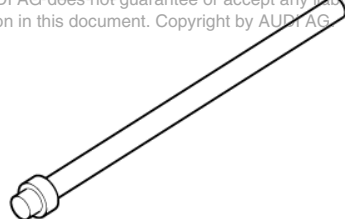
A needle bearing must be fitted in the crankshaft on vehicles with manual gearbox; insert needle bearing if not yet fitted.

Special tools and workshop equipment required

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

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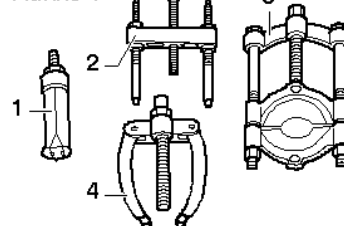
VW 207 C



W00-0369

- ◆ -1- Internal puller -Kukko 21/1-

Kukko 1

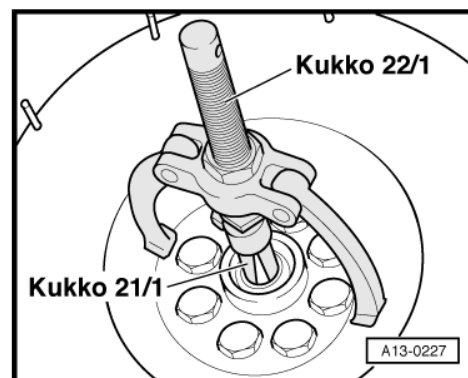


W00-0633

- ◆ -4- Counter-support -Kukko 22/1-
- ◆ Depth gauge

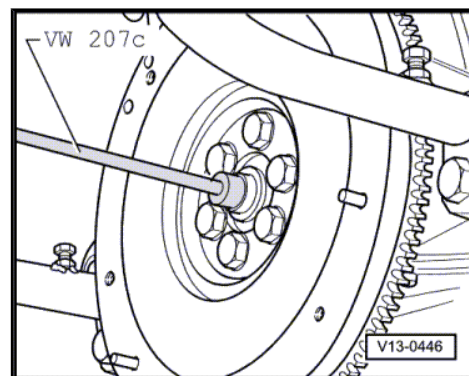
Pulling out

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



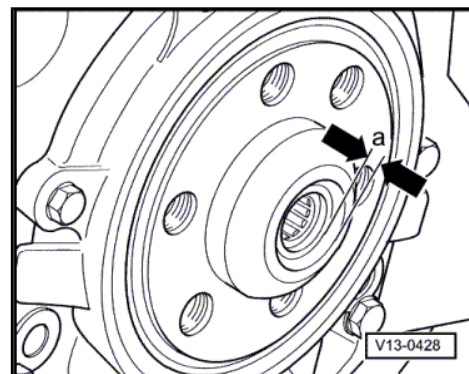
Driving in

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



Installation depth of needle bearing

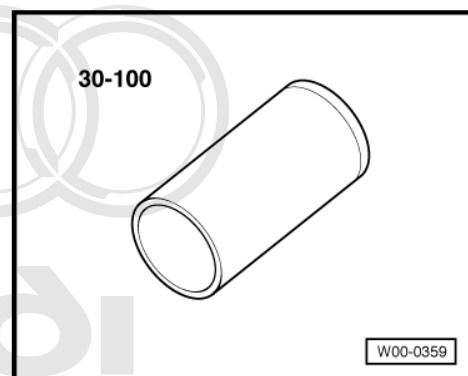
- Dimension -a- = 1.5 mm.



3.5 Removing and installing drive chain sprocket for oil pump

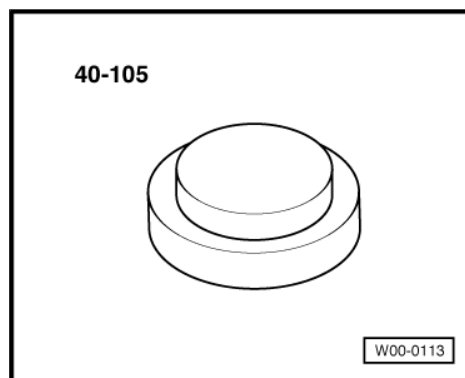
Special tools and workshop equipment required

- ◆ Drift sleeve -30-100-



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◆ Thrust plate -40-105-

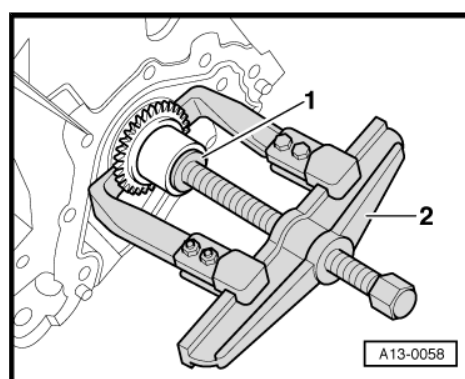


◆ Two-arm puller, commercially available

◆ Protective gloves

Removing

- Remove sump ⇒ [page 109](#) .
- Remove sealing flange (front) ⇒ [page 50](#) .
- Remove drive chain for oil pump ⇒ [Item 7 \(page 108\)](#) and chain tensioner ⇒ [Item 10 \(page 108\)](#) .
- Pull off crankshaft drive chain sprocket using e.g. claw-type puller -Kukko 44/1- -item 2- (protect end of crankshaft with thrust plate -40-105- -item 1-).



Installing

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

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

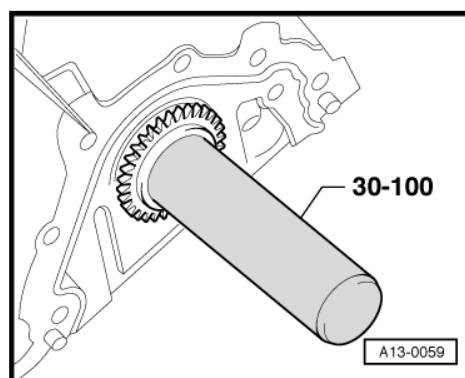
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WARNING

Wear protective gloves.

- Using pliers, locate drive chain sprocket on end of crankshaft.
- Installation position: wider collar on drive chain sprocket faces engine.
- Push drive chain sprocket onto crankshaft as far as the stop using fitting sleeve -30-100- .



4 Dismantling and assembling pistons and conrods

4.1 Pistons and conrods - exploded view of components



Oil spray jet and pressure relief valve ⇒ [page 67](#)

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

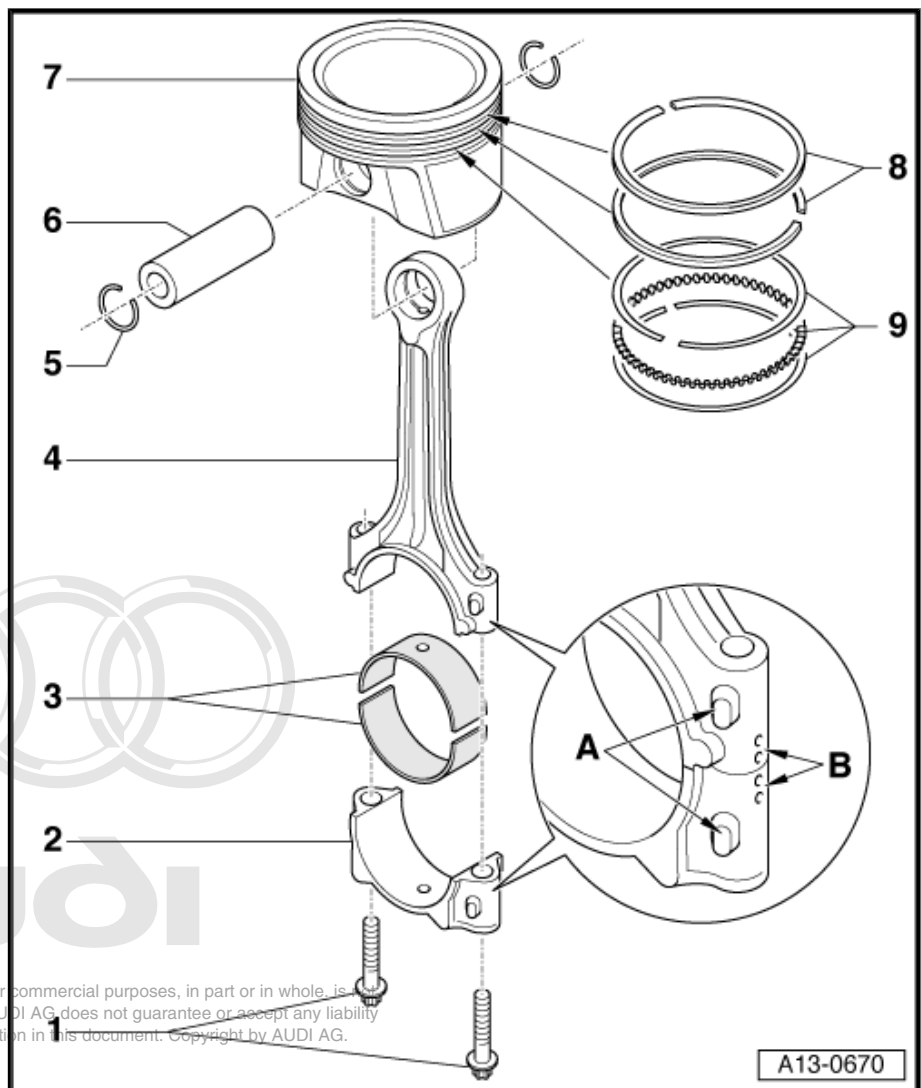
- ☐ Renew
- ☐ Lubricate threads and contact surface
- ☐ Use old bolt for measuring radial clearance
- ☐ To measure radial clearance, tighten to 30 Nm but do not turn further

2 - Conrod bearing cap

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

3 - Bearing shells

- ☐ Upper bearing shell with oil hole for piston pin lubrication
- ☐ Installation position ⇒ [page 67](#)
- ☐ Do not interchange used bearing shells (mark positions)
- ☐ Axial clearance when new: 0.09 ... 0.35 mm; wear limit: 0.40 mm
- ☐ Measuring radial clearance ⇒ [page 68](#)
- ☐ To measure radial clearance, tighten bolts ⇒ [Item 1 \(page 65\)](#) to 30 Nm but not further



4 - Conrod

- ☐ Only renew as a complete set
- ☐ Mark cylinder allocation -B-
- ☐ Installation position: Markings -A- face towards pulley side
- ☐ With oil passage for piston pin lubrication

5 - Circlip

6 - Piston pin

- ☐ If difficult to move, heat piston to approx. 60 °C
- ☐ Remove and install using drift -VW 222 A-

7 - Piston

- ☐ Checking ⇒ [page 67](#)
- ☐ Mark installation position and cylinder allocation
- ☐ Arrow on piston crown points to pulley end
- ☐ Install using piston ring clamp
- ☐ Piston and cylinder dimensions ⇒ [page 68](#)
- ☐ Checking cylinder bore ⇒ [page 67](#)

8 - Piston rings

- ☐ Compression ring
- ☐ Offset gaps by 120°
- ☐ Remove and install using piston ring clamp
- ☐ "TOP" must face towards piston crown
- ☐ Checking ring gap ⇒ [page 66](#)
- ☐ Checking ring-to-groove clearance ⇒ [page 66](#)

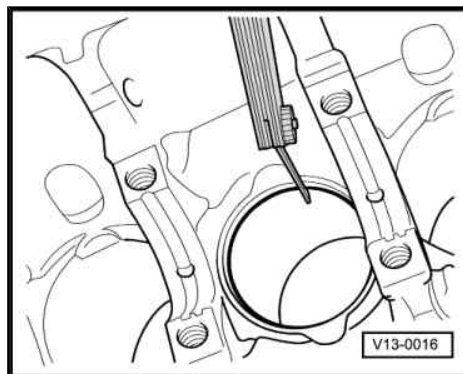
9 - Piston ring

- ☐ Oil scraper ring
- ☐ 3 pieces
- ☐ Offset gap of top steel element of piston ring by 120° to next compression ring
- ☐ Offset gaps of individual parts of oil scraper ring
- ☐ Checking ring gap ⇒ [page 66](#)
- ☐ Checking ring-to-groove clearance ⇒ [page 66](#)

Checking piston ring gap

- Insert ring at right angle to cylinder wall from above and push down into lower cylinder opening approx. 15 mm from bottom of cylinder. To do so, use a piston without rings.

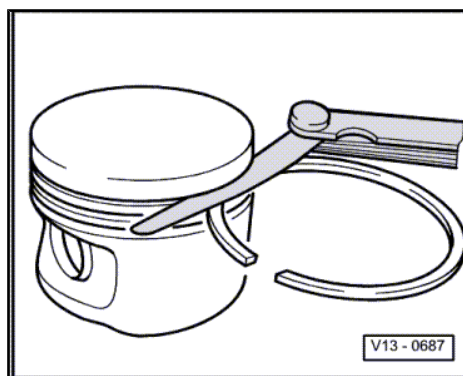
Piston ring Dimensions in mm	New	Wear limit
Compression rings	0.20 ... 0.40	0.80
Steel elements of oil scraper ring	0.20 ... 0.60	0.90



Checking ring-to-groove clearance

- Clean groove in piston before checking clearance.

Piston ring Dimensions in mm	New	Wear limit
Compression rings	0.06 ... 0.09	0.20
Oil scraper rings	0.04 ... 0.12	0.20

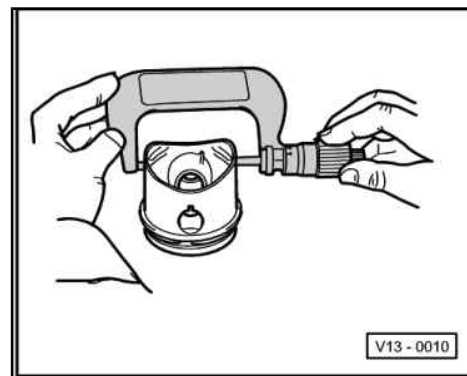


Checking piston

- Measure approx. 10 mm from the bottom edge, perpendicular to the piston pin axis.
- Difference between measured value and nominal value: max. 0.04 mm.

Nominal dimension

⇒ [“4.2 Piston and cylinder dimensions”, page 68](#).

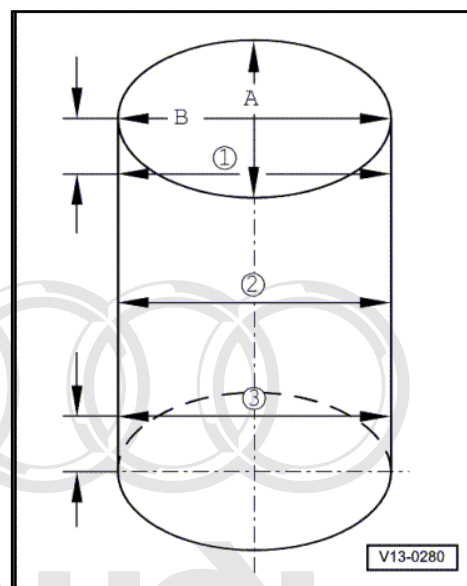


Checking cylinder bore

- Use 50 ... 100 mm internal dial gauge to take measurements at 3 points in transverse direction -A- and longitudinal direction -B-.
- Difference between measured value and nominal value: max. 0.08 mm.

Nominal dimension

⇒ [“4.2 Piston and cylinder dimensions”, page 68](#).



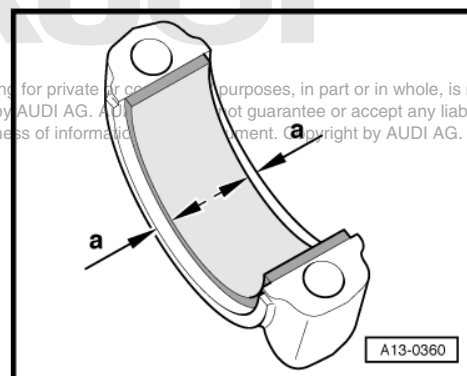
Installation position of bearing shells in conrods

- Insert bearing shells in centre of conrod/conrod bearing cap.
- Dimension -a- = 3.0 mm.



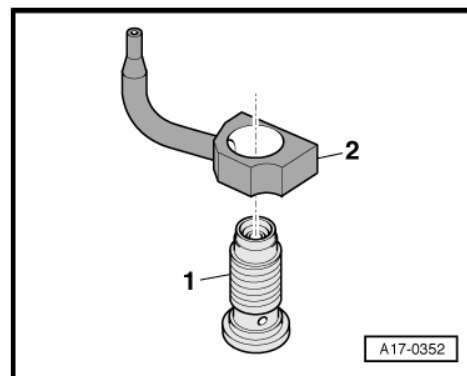
Note

The bearing shell with the oil bore must be inserted in the conrod.



Oil spray jet and pressure relief valve

- 1 - Bolt with pressure relief valve, 27 Nm
- 2 - Oil spray jet for piston cooling



4.2 Piston and cylinder dimensions

Honing dimension (in mm)	Piston Ø mm	Cylinder bore Ø mm
Basic dimension	80.965 ¹⁾	81.010
1st oversize	81.465 ¹⁾	81.510
• ¹⁾ Dimension not including graphite coating (thickness 0.02 mm). The graphite coating wears down in service.		

4.3 Checking radial clearance of conrod bearings

Special tools and workshop equipment required

- ◆ Plastigage

Procedure

- Remove conrod bearing caps.
- Clean bearing caps and bearing journals.
- Place Plastigage onto bearing journal or into bearing shells corresponding to width of bearing.
- The Plastigage must be positioned in the centre of the bearing shell
- Fit conrod bearing cap and tighten to 30 Nm. Do not rotate crankshaft.
- Remove conrod bearing caps once more.
- Compare width of Plastigage with measurement scale:

Radial clearance:

- New: 0.020 ... 0.061 mm.
- Wear limit: 0.091 mm.
- Renew bolts for conrod bearings.



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15 – Cylinder head, valve gear

1 Removing and installing cylinder head

1.1 Cylinder head - exploded view of components

1 - 23 Nm

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

2 - Camshaft sprocket

- ☐ Removing and installing:
⇒ ["1.8 Removing toothed belt from camshaft sprocket", page 40](#)
- ☐ Installation position fixed by parallel key
⇒ [Item 6 \(page 69\)](#)

3 - 100 Nm

- ☐ Use counterhold tool -3415- when loosening and tightening

4 - 10 Nm

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

5 - Toothed belt cover (rear)

6 - Parallel key

- ☐ Check for firm attachment

7 - Cylinder head bolt

- ☐ Renew
- ☐ Note correct sequence when loosening
⇒ [page 78](#)
- ☐ Note correct sequence when tightening
⇒ [page 80](#)

8 - Gasket for cylinder head cover

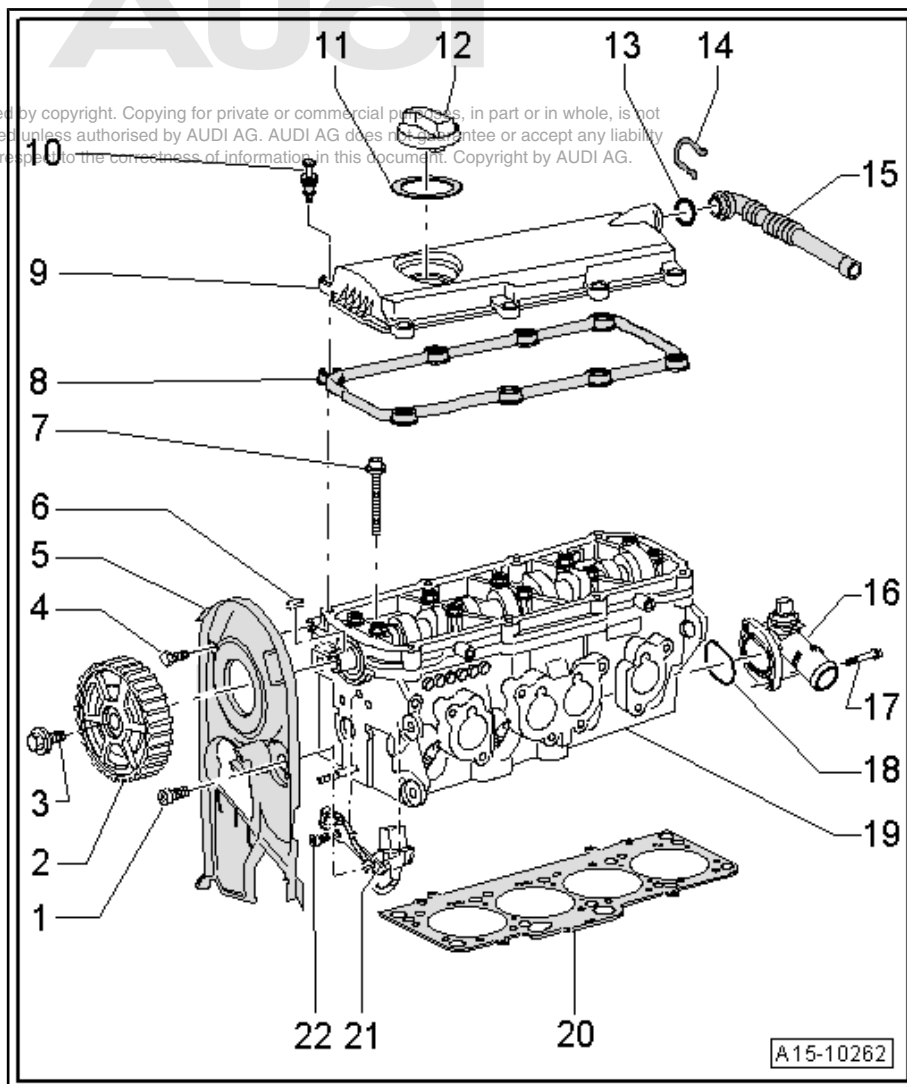
- ☐ Renew if damaged or leaking
- ☐ Engage in spacer sleeves of ⇒ [Item 10 \(page 69\)](#)

9 - Cylinder head cover

- ☐ Removing and installing ⇒ [page 71](#)

10 - Special bolt, 10 Nm

- ☐ Renew if damaged or leaking
- ☐ Note correct sequence when loosening ⇒ [page 71](#)
- ☐ Note correct sequence when tightening ⇒ [page 71](#)



11 - Seal

- ☐ Renew if damaged or leaking

12 - Filler cap

13 - O-ring

- ☐ Renew

14 - Securing clip

15 - Crankcase breather hose

16 - Connection

17 - 10 Nm

18 - Gasket

- ☐ Renew

19 - Cylinder head

- ☐ Removing and installing ⇒ [page 71](#)
- ☐ Checking for distortion ⇒ [page 70](#)
- ☐ Machining limit ⇒ [page 70](#)
- ☐ If renewed, refill system with fresh coolant

20 - Cylinder head gasket

- ☐ Renewing ⇒ [“1.3 Removing and installing cylinder head”, page 71](#)
- ☐ Installation position: Part No. towards cylinder head
- ☐ If renewed, refill system with fresh coolant

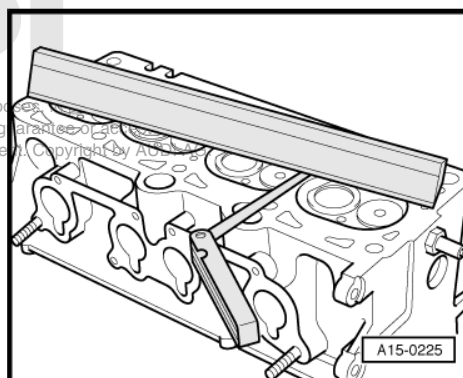
21 - Hall sender -G40-

22 - 10 Nm

Checking cylinder head for distortion

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

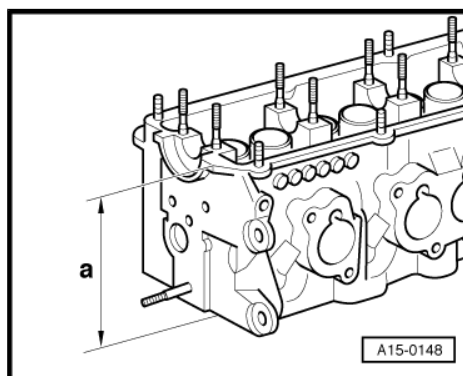
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Cylinder head machining limit

Machining of the cylinder head (surface grinding) is only permissible down to the minimum dimension -a-.

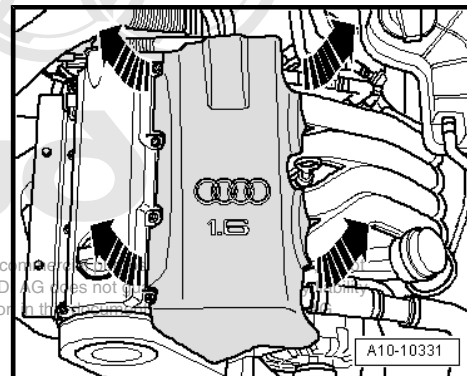
- Minimum dimension: -a- = 132.6 mm



1.2 Removing and installing cylinder head cover

Removing

- Lift off engine cover -arrows-.



- Remove crankcase breather hose from cylinder head cover.
- Unscrew cylinder head cover bolts in the sequence -8 ... 1-.
- Remove cylinder head cover.

Installing

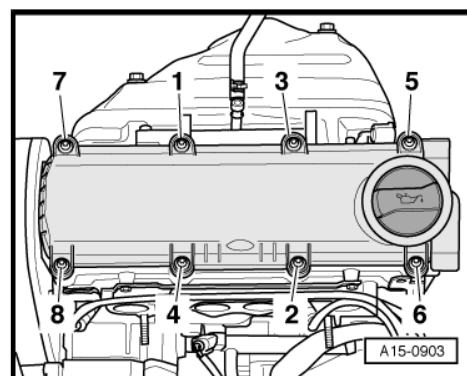
Installation is carried out in the reverse order; note the following:



Note

- ◆ *Renew gasket for cylinder head cover if damaged.*
- ◆ *Renew cylinder head cover bolts if gasket is damaged.*
- ◆ *Renew O-ring.*

- Tighten bolts for cylinder head cover in the sequence -1 ... 8-.



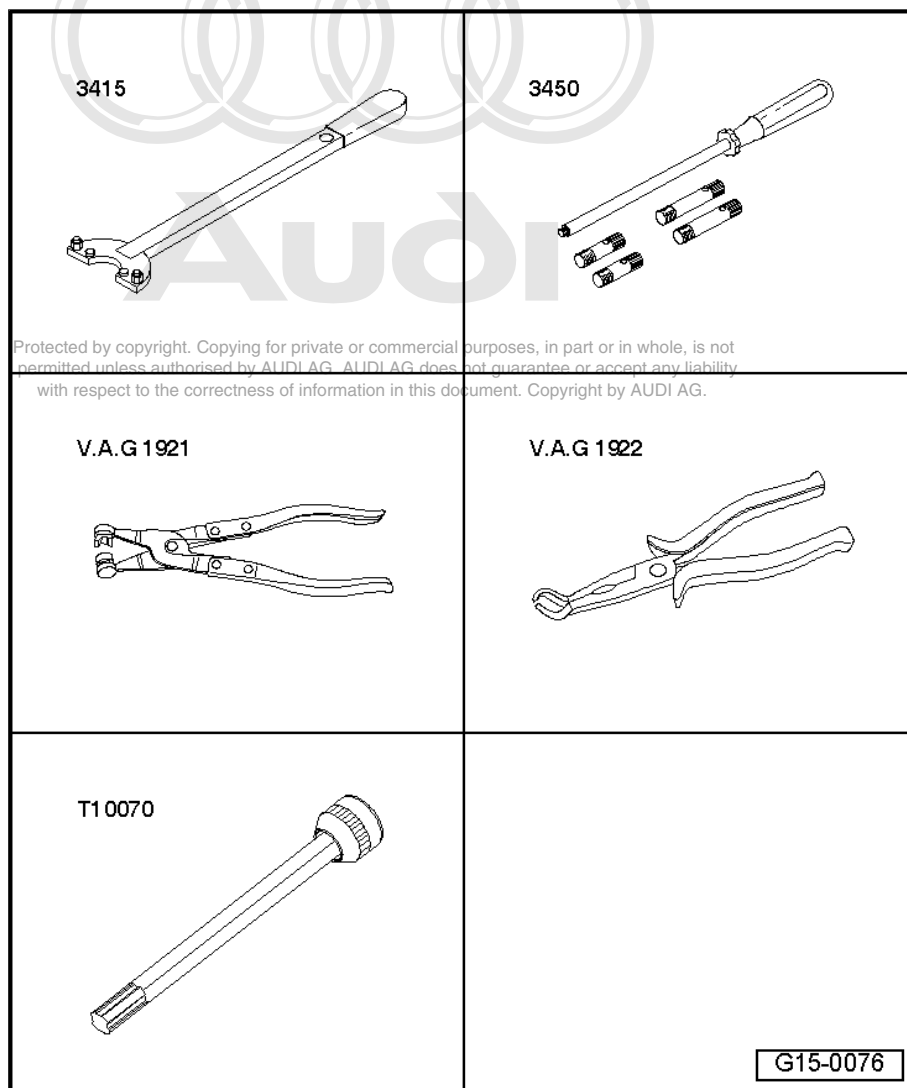
Tightening torque

Component	Nm
Cylinder head cover to cylinder head	10

1.3 Removing and installing cylinder head

Special tools and workshop equipment required

- ◆ Counterhold tool -3415-
- ◆ Guide pin -3450-
- ◆ Hose clip pliers -V.A.G 1921-
- ◆ Spark plug connector pliers -V.A.G 1922-
- ◆ Special wrench, long reach -T10070-



Removing



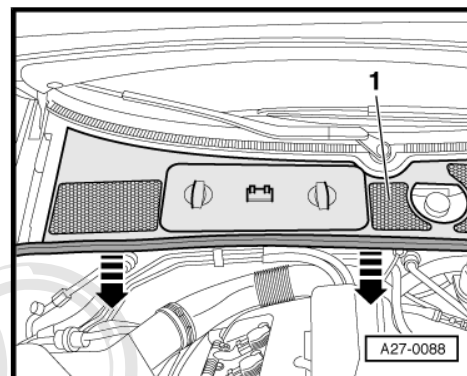
Note

- ◆ *Fit all heat insulation sleeves in the original position when installing.*
- ◆ *All cable ties which are released or cut open when removing must be fitted in the same position when installing.*
- ◆ *If engine oil is contaminated, perform oil change.*

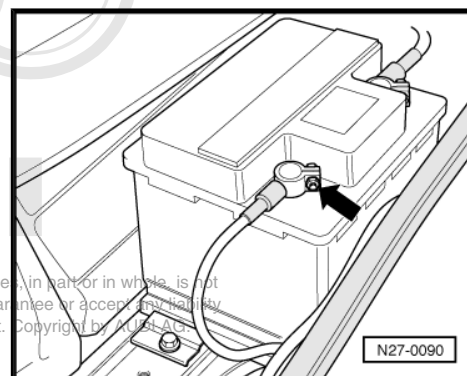
- Detach rubber seal from plenum chamber cover in direction of -arrow-.
- Detach plenum chamber cover -1- towards the front.

**Caution**

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

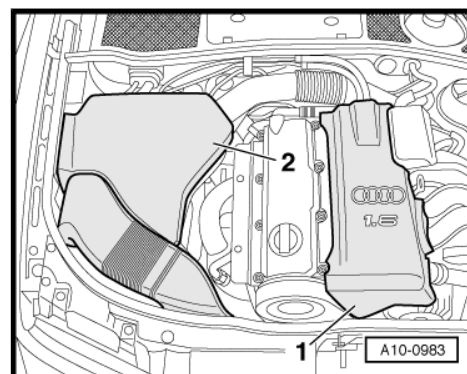


- With ignition switched off, disconnect battery earth cable -arrow-.

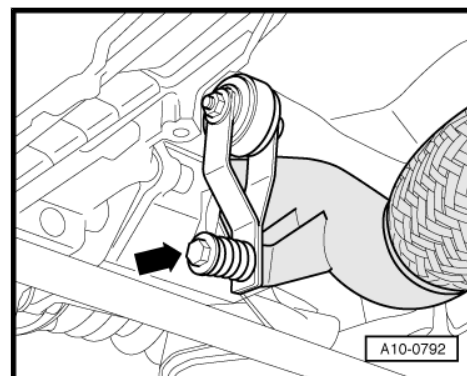


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- Remove engine cover panel -1-.
- Remove air cleaner cover -2-.
- Move lock carrier to service position ⇒ Rep. Gr. 50 .
- Remove poly V-belt ⇒ [page 24](#) .
- Drain off coolant ⇒ [page 127](#) .



- Unbolt bracket for exhaust system -arrow-.

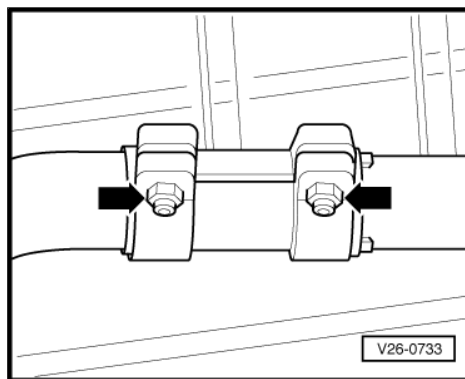




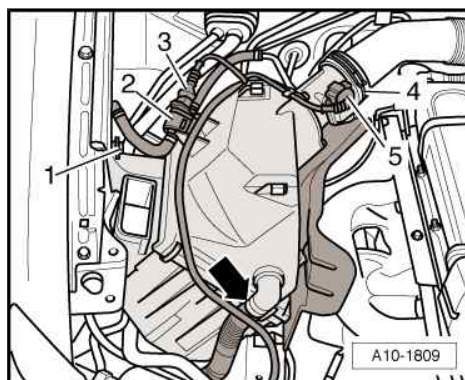
Note

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

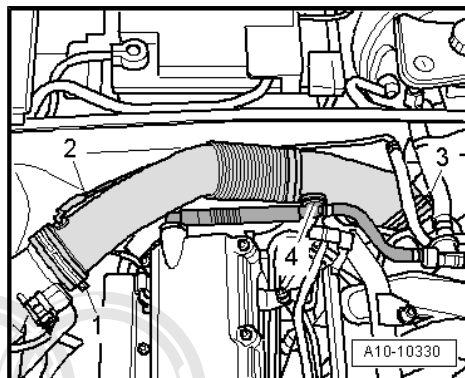
- Loosen bolt connections of front clamp -arrows-.
- Push the clamp back in order to separate the exhaust system.



- Unplug electrical connectors -3- and -5- for active charcoal filter system solenoid valve 1 -N80- and air mass meter -G70- .
- Detach active charcoal filter system solenoid valve 1 -N80- -item 2- from air cleaner housing.
- Disconnect hose connection going to secondary air pump -arrow-.
- Release hose clip -4- for air pipe at air mass meter -G70- .
- Unscrew bolt -1- and remove air cleaner housing.



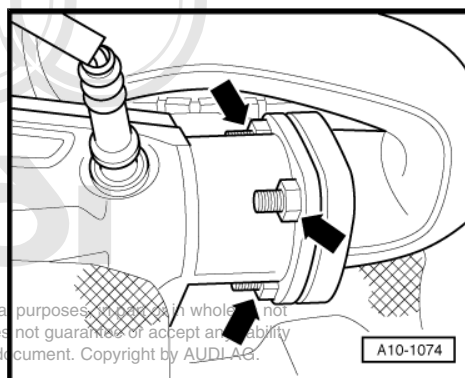
- Detach hose -2- leading to exhaust gas recirculation valve -N18- .
- Detach crankcase breather hose -4- from air pipe.
- Loosen hose clip -3- to remove air pipe.



Note

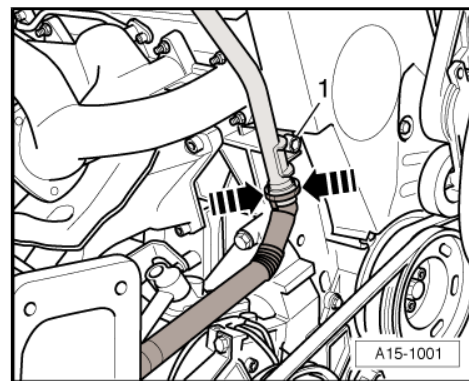
Disregard -item 1-.

- Unscrew nuts -arrows- securing exhaust manifold/catalytic converter.
- Detach exhaust system from exhaust manifold.



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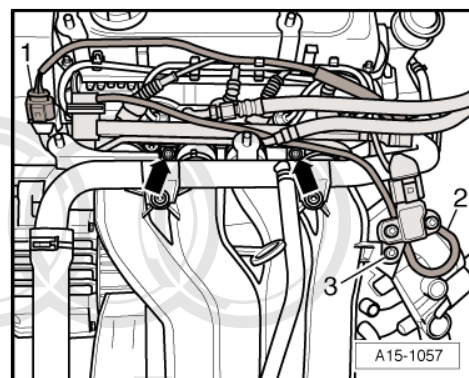
- Pull back heat insulation sleeve and disconnect hose from secondary air pipe by pressing release tabs -arrows-.
- Remove bolt -1-.



- Unplug electrical connector -1- at Hall sender -G40-.

**Note**

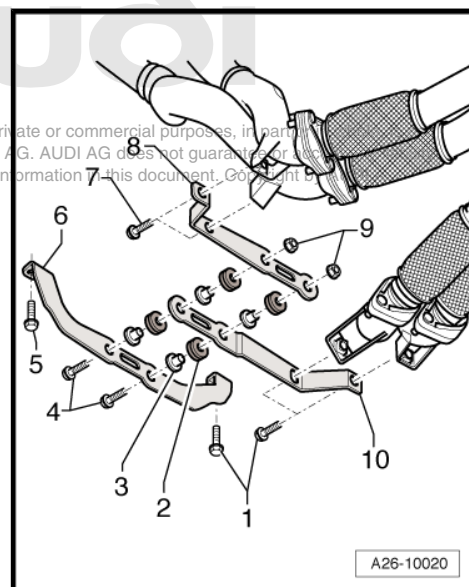
Disregard items marked -2-, -3- and -arrows-.



- Unplug electrical connector -3- at exhaust gas recirculation valve -N18- and move wiring harness clear.
- Remove bolts -1- and -4-.
- Detach exhaust gas recirculation valve -N18-.

**Note**

- ◆ *Disregard -item 2-.*
- ◆ *Shown from rear with engine removed for illustration purposes.*



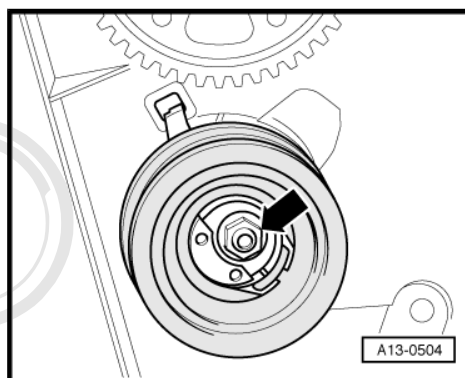
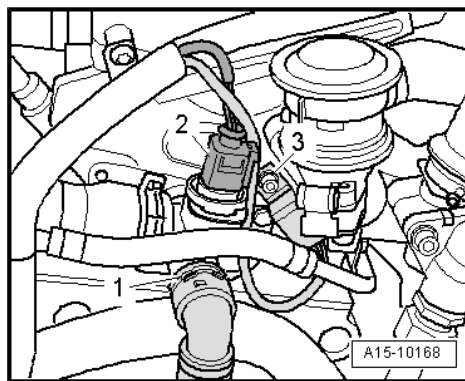
- Detach rear coolant hose -1- from cylinder head.
- Unplug electrical connector -2- at coolant temperature sender -G62- .
- Remove bolt -3-.
- Move wiring harness clear.



Note

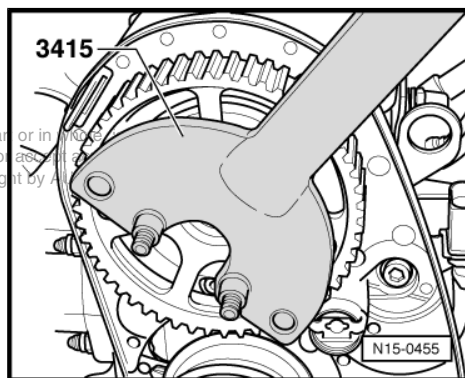
Shown from rear with engine removed for illustration purposes.

- Remove coolant pipe (top) ⇒ [page 135](#) .
- Remove intake manifold (top section) ⇒ [page 83](#) .
- Detach spark plug connectors using spark plug connector pliers -V.A.G 1922- .
- Remove toothed belt from camshaft sprocket ⇒ [page 40](#) .
- Unscrew nut -arrow- for tensioning roller.
- Remove washer and tensioning roller.

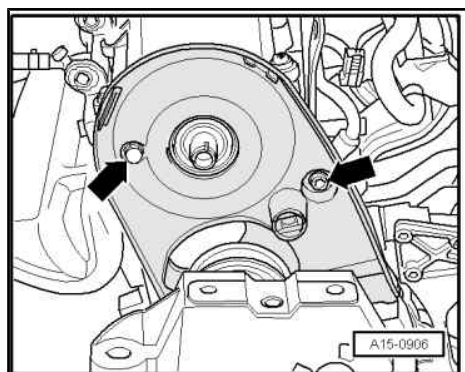


- Loosen camshaft sprocket using counterhold -3415- .
- Detach camshaft sprocket.
- Remove parallel key from camshaft.

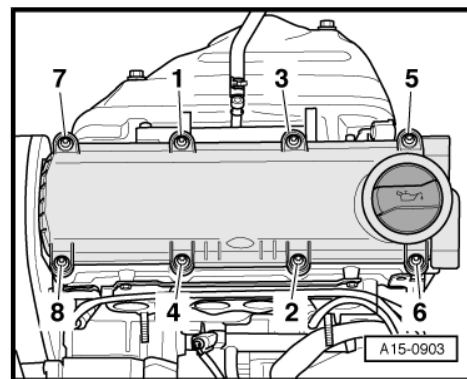
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- Unbolt toothed belt cover (rear) from cylinder head -arrows-.



- Remove crankcase breather hose from cylinder head cover.
- Unscrew cylinder head cover bolts in the sequence: -8 ... 1-.
- Remove cylinder head cover.



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



Note

Use special wrench, long reach -T10070- to remove cylinder head bolts.

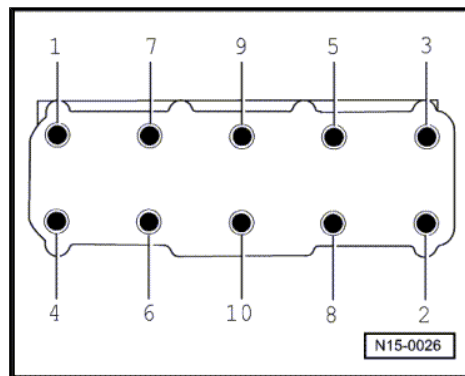
- Remove the cylinder head with the assistance of a 2nd mechanic.

Installing

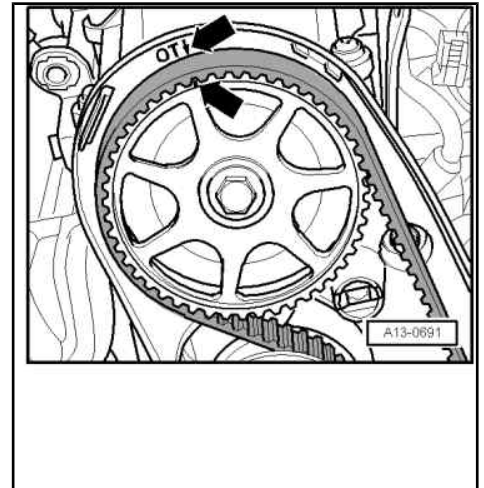


Note

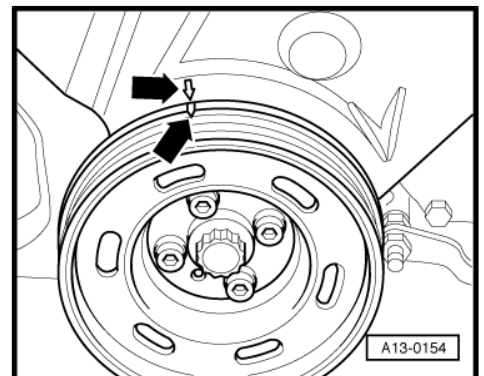
- ◆ Renew the cylinder head bolts.
- ◆ Renew self-locking nuts and bolts when performing assembly work.
- ◆ Renew bolts which are tightened to a specified angle as well as oil seals and gaskets.
- ◆ If repairing, carefully remove any remaining gasket material from the cylinder head and cylinder block. Ensure that no long scores or scratches are made on the surfaces.
- ◆ Carefully remove any remaining emery and abrasive material.
- ◆ No oil or coolant must be allowed to remain in the blind holes for the cylinder head bolts in the cylinder block.
- ◆ Do not remove new cylinder head gasket from packaging until it is ready to be fitted.
- ◆ Handle gasket very carefully. Damage to the silicone coating or the indented area will lead to leaks.
- ◆ Cylinder heads which have cracks between the valve seats or between a valve seat insert and the spark plug thread can be re-installed without reducing service life, provided the cracks are only slight and do not exceed a maximum of 0.3 mm in width, and no more than the first 4 turns of the spark plug threads are cracked.
- ◆ When installing an exchange cylinder head with fitted camshaft, the contact surfaces between roller rocker fingers and cams must be oiled after installing the head.
- ◆ The plastic protectors fitted to protect the open valves should not be removed until the cylinder head is ready to be fitted.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.
- ◆ Fit all heat insulation sleeves in the original position when installing.
- ◆ Fit all cable ties in the original positions when installing.
- ◆ After working on the valve gear, turn the engine carefully at least 2 rotations by hand to ensure that none of the valves make contact when the starter is operated.
- ◆ When fitting a new cylinder head or cylinder head gasket, drain off all the old coolant and refill with new coolant.



- Align mark on camshaft sprocket with mark on toothed belt cover -arrows-.



- Check again whether the crankshaft is positioned at “TDC” -arrows-.

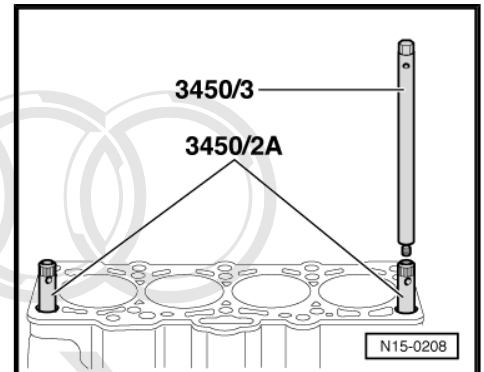


- To centralize cylinder head gasket and cylinder head, screw guide pins -3450/2 A- into the outer bores on the intake side using fitting tool -3450/3- .



Note

- ◆ The maximum permissible diameter for the centering bores (outer holes on the intake side) in the cylinder head was restricted in the upper section.
- ◆ Check before tightening whether the guide pins can be pushed through the bores in the cylinder head. If necessary, grind down the knurled surface of the guide pins slightly.



- Fit new cylinder head gasket.
- Check installation position of cylinder head gasket. Part number points towards cylinder head, and must be legible from the inlet side.

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Note

Two mechanics are needed to install the cylinder head.

- Fit cylinder head onto cylinder block.
- Insert 8 cylinder head bolts and tighten finger-tight.
- Unscrew guide pins through bolt holes in cylinder head using fitting tool -3450/3- and install remaining cylinder head bolts.

– Tighten cylinder head bolts in three stages in the sequence shown:

1. Tighten with torque wrench to 40 Nm.
2. Turn 90° ($\frac{1}{4}$ turn) further using a rigid wrench.
3. Turn 90° ($\frac{1}{4}$ turn) further using a rigid wrench.



Note

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

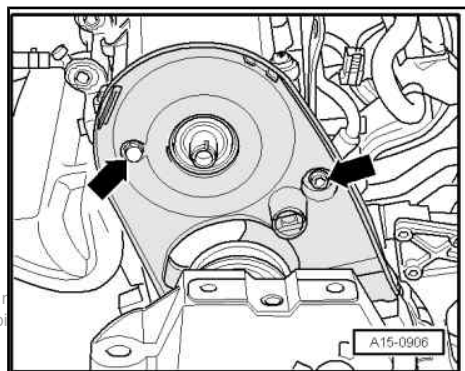
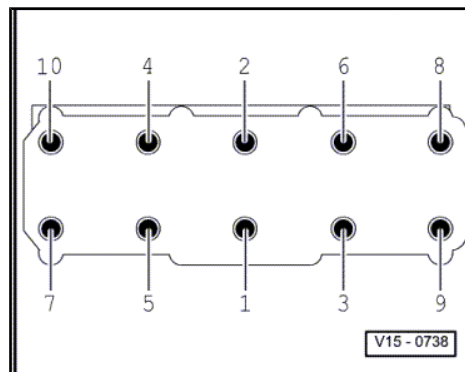
- Install toothed belt cover (rear) -arrows-.
- Insert parallel key into camshaft.



Caution

If a piston is at TDC the valves could strike the piston when turning the camshaft. Pistons must therefore not be at TDC. This could otherwise result in damage to valves and pistons.

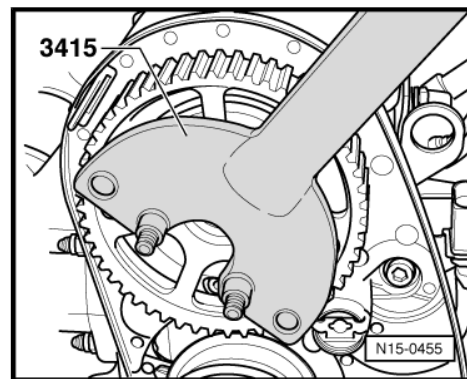
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- Tighten camshaft sprocket using counterhold -3415- .

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

- Install cylinder head cover ⇒ [page 71](#) .
- Fit toothed belt (adjust valve timing) ⇒ [page 42](#) .
- Install poly V-belt ⇒ [page 24](#) .
- Install intake manifold (top section) ⇒ [page 83](#) .
- Install coolant pipe (top) ⇒ [page 135](#) .
- Install front exhaust pipe together with catalytic converter ⇒ [page 154](#) .
- Align exhaust system free of stress ⇒ [page 160](#) .
- Observe notes on procedures required after connecting battery ⇒ Rep. Gr. 27 .
- Check oil level ⇒ [page 124](#) .



Note

If engine oil is contaminated, perform oil change.

- Fill cooling system with fresh coolant ⇒ [page 130](#) .

Tightening torques

Component		Nm
Rear toothed belt cover to cylinder head	M6	10 ¹⁾
	M8	23 ¹⁾
Camshaft sprocket to camshaft		100
Connecting pipe to exhaust gas recirculation valve -N18-		22
• ¹⁾ Install using locking fluid; locking fluid ⇒ Parts catalogue .		



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2 Removing and installing intake manifold

2.1 Intake manifold - exploded view

1 - Intake manifold (top section)

- ☐ Removing and installing
⇒ [page 83](#)

2 - Connecting hose

- ☐ Renew if damaged

3 - 20 Nm

4 - 20 Nm

5 - Seal

- ☐ Renew

6 - Bottom section of intake manifold

- ☐ Removing and installing
⇒ [page 86](#)

7 - Fuel rail

- ☐ With injectors

8 - 10 Nm

9 - O-ring

- ☐ For injectors
- ☐ Renew
- ☐ Lubricate lightly with clean engine oil

10 - 10 Nm

11 - Coolant pipe (top)

12 - Throttle valve module - J338-

13 - 10 Nm

14 - Seal

- ☐ Renew

15 - 20 Nm

16 - Bonded rubber bush

17 - Support for intake manifold

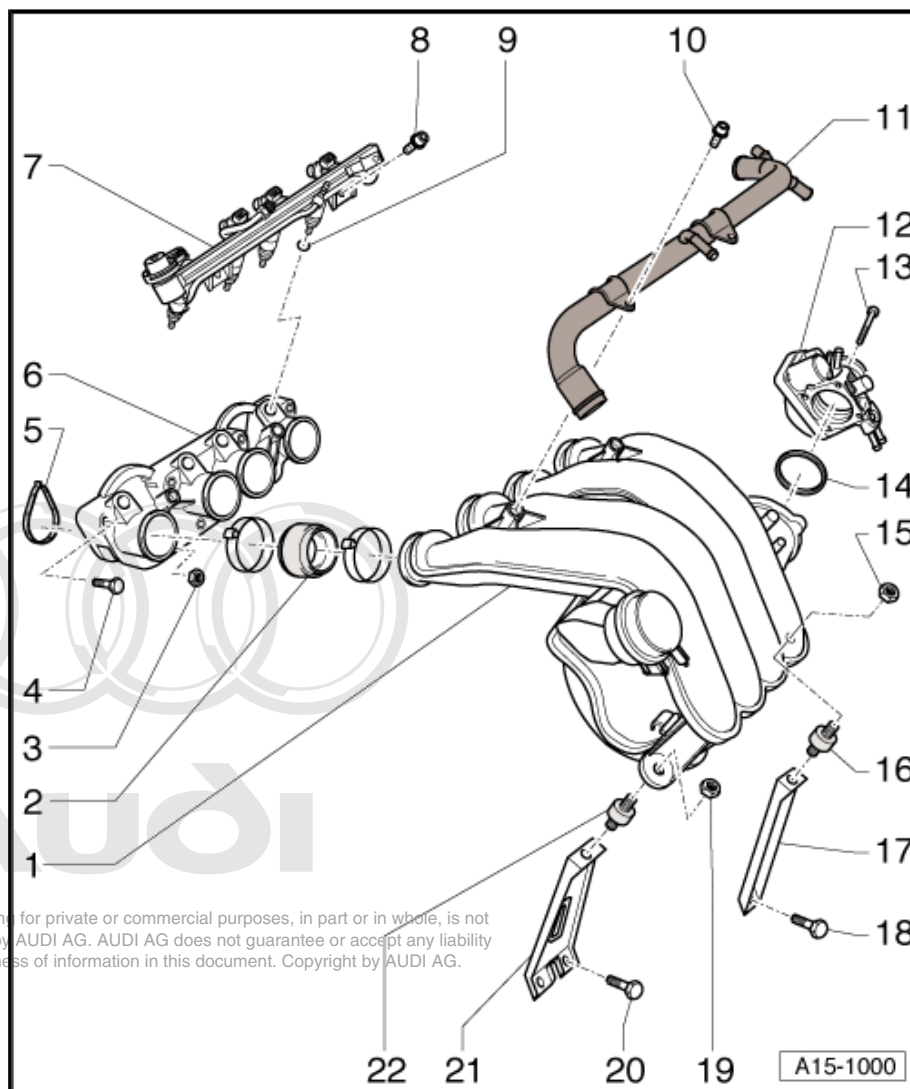
18 - 23 Nm

19 - 20 Nm

20 - 20 Nm

21 - Support for intake manifold

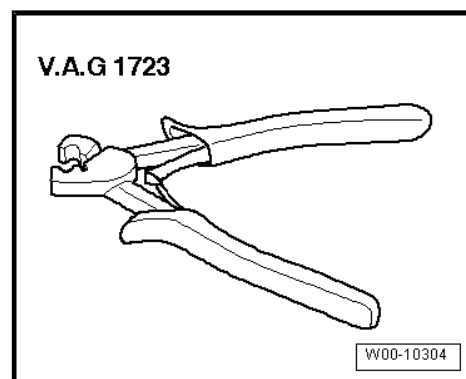
22 - Bonded rubber bush



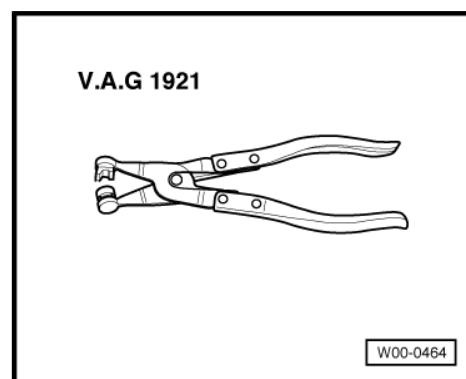
2.2 Removing and installing intake manifold (top section)

Special tools and workshop equipment required

- ◆ CLIC hose clip pliers -V.A.G 1723-



- ◆ Hose clip pliers -V.A.G 1921-



Removing

- Detach rubber seal from plenum chamber cover in direction of -arrow-.
- Detach plenum chamber cover -1- towards the front.

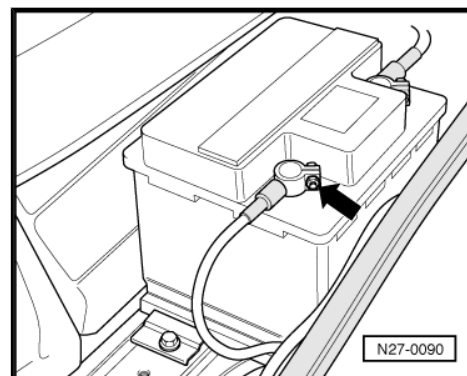
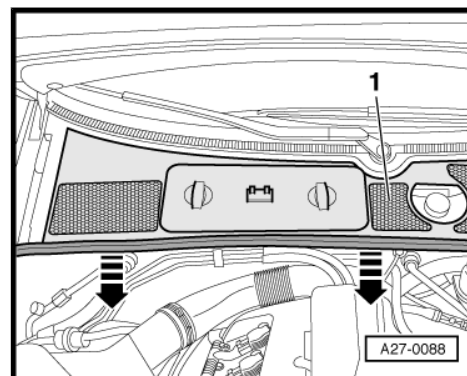


Caution

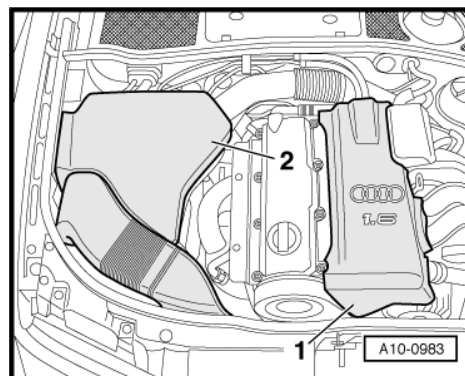
Observe notes on procedure for disconnecting the battery ⇒ Rep. Gr. 27.

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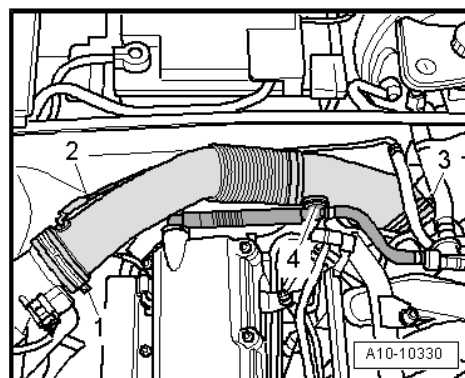
- With ignition switched off, disconnect battery earth cable -arrow-.



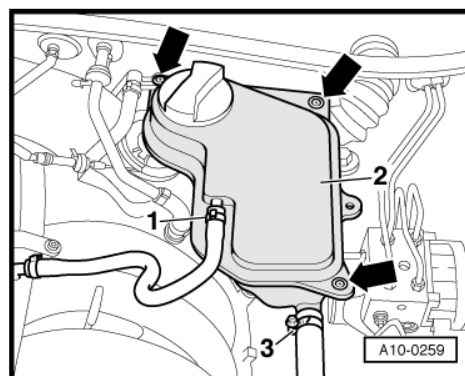
- Remove engine cover panel -1-.
- Remove air cleaner cover -2-.



- Detach hose -2- leading to exhaust gas recirculation valve - N18- .
- Detach crankcase breather hose -4- from air pipe.
- Remove air pipe by releasing hose clips -1- and -3-.

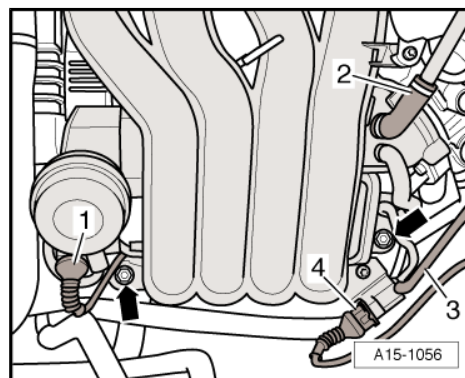


- Unbolt coolant expansion tank -2- -arrows-.
- Unplug electrical wire for coolant shortage indicator switch - F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -3- attached.



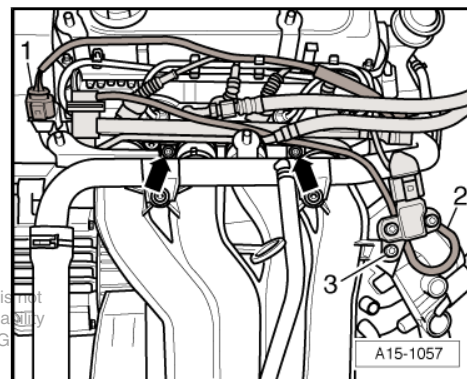
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- Detach vacuum hose -2- going to brake servo at intake manifold.
- Detach vacuum hose -3-.
- Unplug electrical connectors -1- and -4-.
- Unscrew nuts -arrows-.



- Unplug electrical connector -1- at Hall sender -G40- .
- Detach vacuum hose -2-.
- Remove bolt -3-.
- Unscrew securing bolts for fuel rail -arrows-.
- Pull fuel rail off intake manifold together with injectors and set it down on a clean cloth at rear of engine compartment.

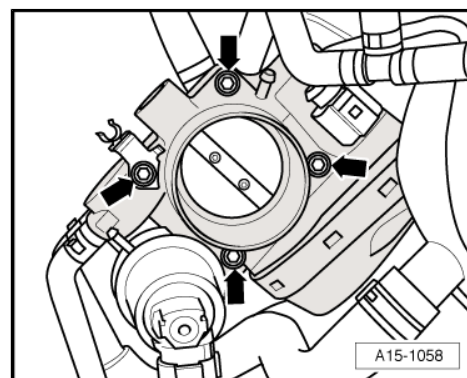
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- Unbolt throttle valve housing from intake manifold -arrows-.

**Note**

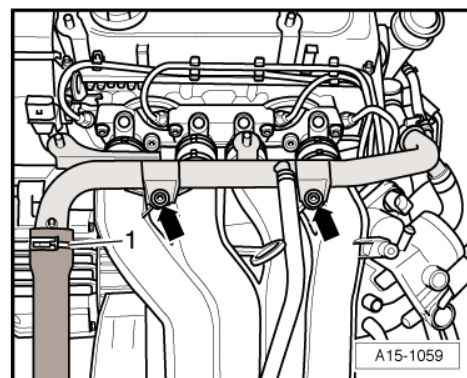
Illustration shows engine removed.



- Unscrew coolant pipe (top) -arrows-.

**Note**

Disregard -item 1-.

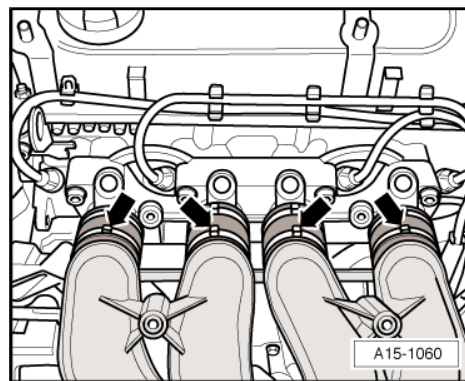


- Loosen the clips at the connections -arrows-. To do this, use CLIC hose clip pliers -V.A.G 1723- .
- Pull out oil dipstick.
- Remove top section of intake manifold.



Note

Block off the intake ports of the intake manifold (lower section) with clean cloths.



Installing

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



Note

- ◆ Renew gaskets and seals.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.
- Insert top section of intake manifold into connecting hoses and secure clips -arrows- using CLIC hose clip pliers -V.A.G 1723- .
- Observe notes on procedures required after connecting battery ⇒ Rep. Gr. 27 .

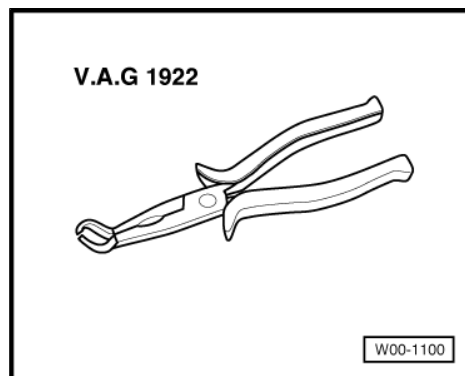
Tightening torques

Component	Nm
Support for intake manifold to intake manifold	20
engine	20
Throttle valve module to intake manifold	10
Fuel rail to intake manifold	10
Coolant pipe to intake manifold	10

2.3 Removing and installing intake manifold (bottom section)

Special tools and workshop equipment required

- ◆ Spark plug connector pliers -V.A.G 1922-



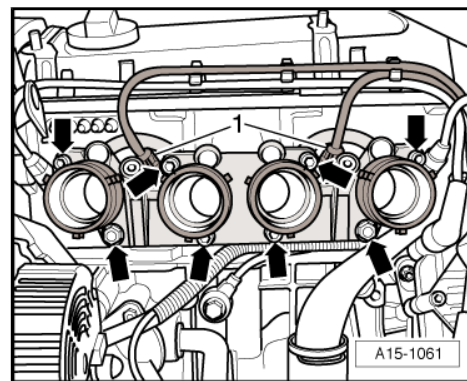
Removing

- Remove intake manifold (top section) ⇒ [page 83](#) .
- Detach spark plug connectors -1- for cylinders 2 and 3 using spark plug connector pliers -V.A.G 1922- .
- Unscrew bolts and nuts -arrows- and remove bottom section of intake manifold.



Note

Block off intake ports in cylinder head with clean cloths.



Installing

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



Note

Renew seals and gaskets.

- Install intake manifold (top section) ⇒ [page 83](#) .

Tightening torque

Component	Nm
Intake manifold (bottom section) to cylinder head	20

2.4 Checking compression



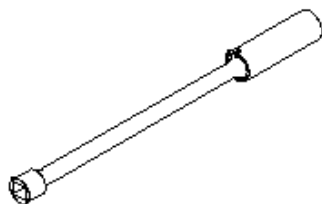
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Special tools and workshop equipment required

- ◆ Spark plug socket and extension -3122 B-
- ◆ Compression tester -V.A.G 1763-
- ◆ Spark plug connector pliers -V.A.G 1922-

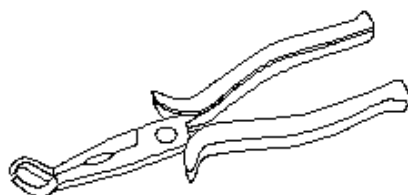
3122 B



V.A.G 1763



V.A.G 1922

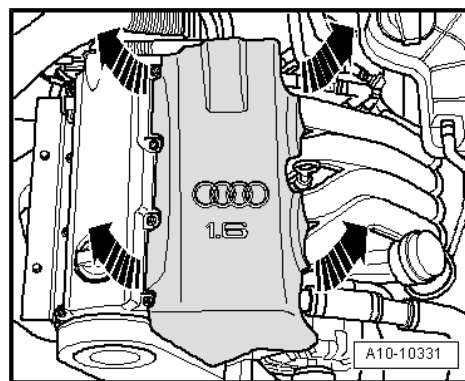


G15-10005

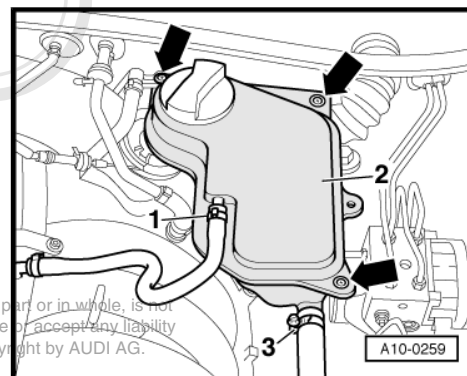
Procedure

- Engine oil temperature at least 30 °C
- Battery voltage at least 12.5 V
- Switch off ignition.
- Lift off engine cover -arrows-.

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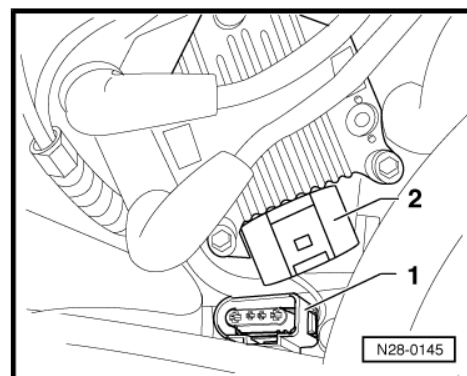


- Unbolt coolant expansion tank -2- -arrows-.
- Unplug electrical wire for coolant shortage indicator switch - F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -3- attached.



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- Unplug electrical connector -1- at output stage -N122- -item 2-.
- Detach electrical connectors at injectors.
- Detach spark plug connectors using spark plug connector pliers -V.A.G 1922- .
- Remove spark plugs with spark plug socket -3122 B- .
- Test the compression pressure with the compression tester - V.A.G 1763- .



Note

Using the compression tester ⇒ operating instructions .

- Have a 2nd mechanic press down the accelerator pedal completely and simultaneously operate the starter until the pressure no longer increases on the tester display.

Compression pressure	bar
When new	10.0 ... 13.0
Wear limit	7.0
Difference between cylinders	3.0 (maximum)

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

- Install spark plugs ⇒ Rep. Gr. 28 .
- Interrogate and erase the fault memory for engine control unit, as faults are stored when the connectors are unplugged ⇒ Vehicle diagnosis, testing and information system VAS 5051.

3 Servicing valve gear



Note

- ◆ *Cylinder heads which have cracks between the valve seats or between a valve seat insert and the spark plug thread can be re-installed without reducing service life, provided the cracks are only slight and do not exceed a maximum of 0.3 mm in width, and no more than the first 4 turns of the spark plug threads are cracked.*
- ◆ *After installing the camshaft, the engine must NOT be started for about 30 minutes. 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 gaskets and seals.*

3.1 Valve gear - exploded view of components

1 - 100 Nm

- ☐ Use counterhold tool -3415- when loosening and tightening

2 - Camshaft sprocket

- ☐ Installation position fixed by parallel key
⇒ [Item 4 \(page 90\)](#)

3 - Oil seal

- ☐ Renewing ⇒ [page 92](#)

4 - Parallel key

- ☐ Check for firm attachment

5 - 23 Nm

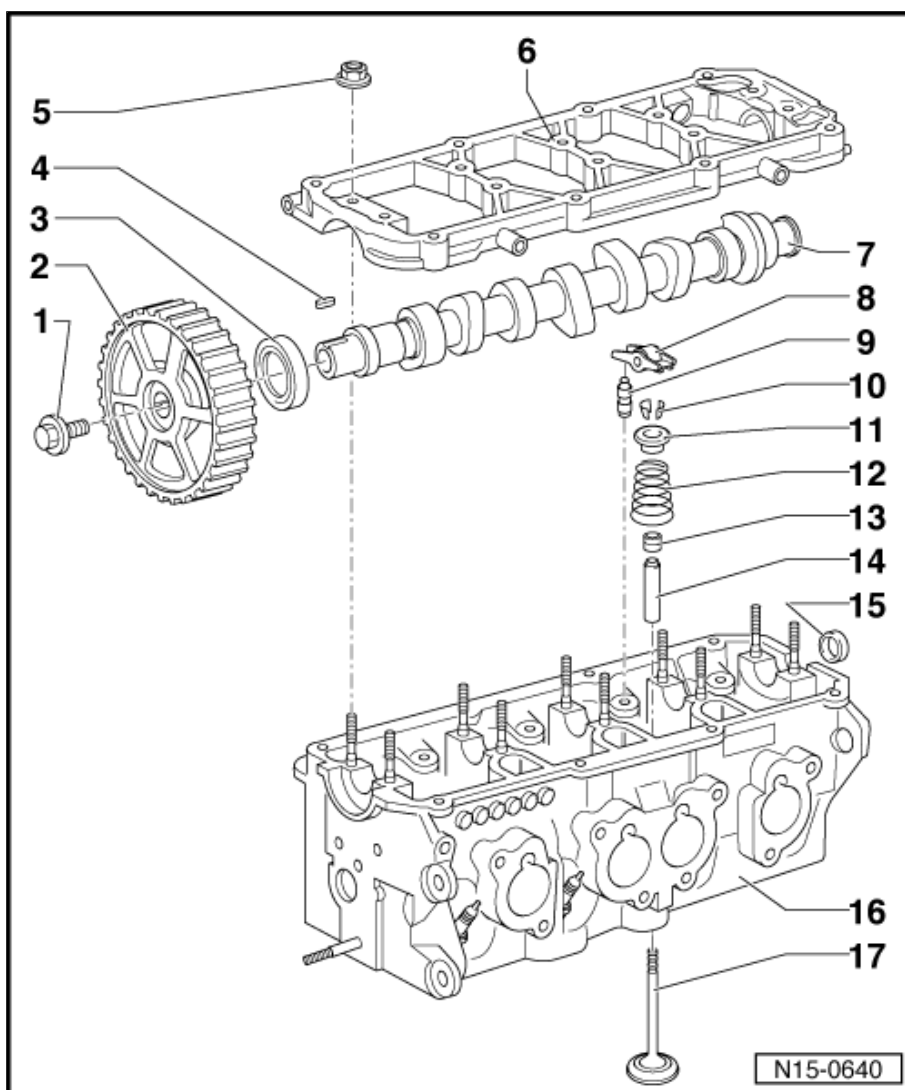
- ☐ Tightening sequence
⇒ [page 97](#)

6 - Retaining frame

- ☐ With integrated camshaft bearings
- ☐ Bearing 1 at pulley end
- ☐ Removing and installing
⇒ ["3.4 Removing and installing camshaft", page 94](#)
- ☐ Sealing surface must not be machined

7 - Camshaft

- ☐ Check radial clearance with Plastigage (rocker fingers not installed), Wear limit: 0.1 mm
- ☐ Runout: max. 0.04 mm
- ☐ Checking axial clearance ⇒ [page 91](#)



- ☐ Removing and installing ⇒ [page 94](#)

8 - Roller rocker finger

- ☐ Do not interchange
- ☐ Check roller bearing
- ☐ Lubricate contact surface
- ☐ Use retaining clip to clip onto supporting element when installing

9 - Supporting element

- ☐ With hydraulic valve clearance compensation
- ☐ Checking hydraulic valve play compensation ⇒ [page 98](#)
- ☐ Do not interchange
- ☐ Lubricate contact surface

10 - Valve cotters

11 - Valve spring plate

12 - Valve spring

- ☐ Removing and installing with cylinder head installed ⇒ [“3.6 Renewing valve stem oil seals”, page 99](#)
- ☐ Remove and install with cylinder head removed using valve spring compressor -2037-

13 - Valve stem oil seal

- ☐ Renewing ⇒ [page 99](#)

14 - Valve guide

- ☐ Checking ⇒ [page 103](#)

15 - Sealing cap

- ☐ Insert flush
- ☐ Punch hole in centre using a screwdriver and lever off for removal

16 - Cylinder head

- ☐ See note ⇒ [page 90](#)
- ☐ Checking valve guides ⇒ [page 103](#)
- ☐ Machining valve seats ⇒ [page 104](#)
- ☐ Sealing surface on camshaft side must not be machined.

17 - Valve

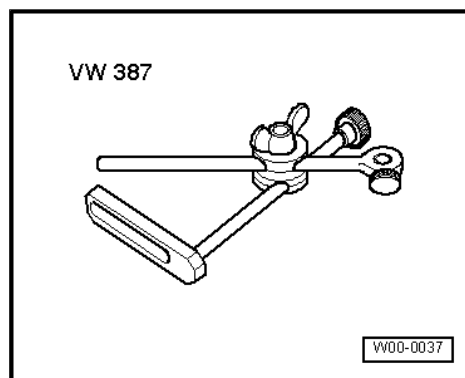
- ☐ Must not be machined: only grinding-in is permissible
- ☐ Remove and install with cylinder head removed using valve spring compressor -2037-
- ☐ Valve dimensions ⇒ [page 103](#)
- ☐ Checking valve guides ⇒ [page 103](#)
- ☐ Machining valve seats ⇒ [page 104](#)

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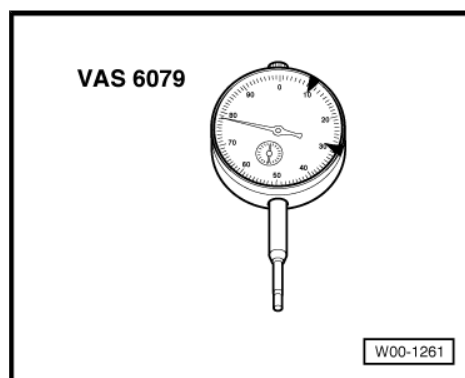
3.2 Checking axial clearance of camshaft

Special tools and workshop equipment required

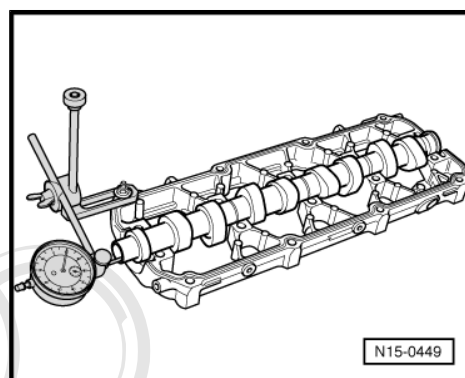
◆ Universal dial gauge bracket -VW 387-



◆ Dial gauge -VAS 6079-

**Procedure**

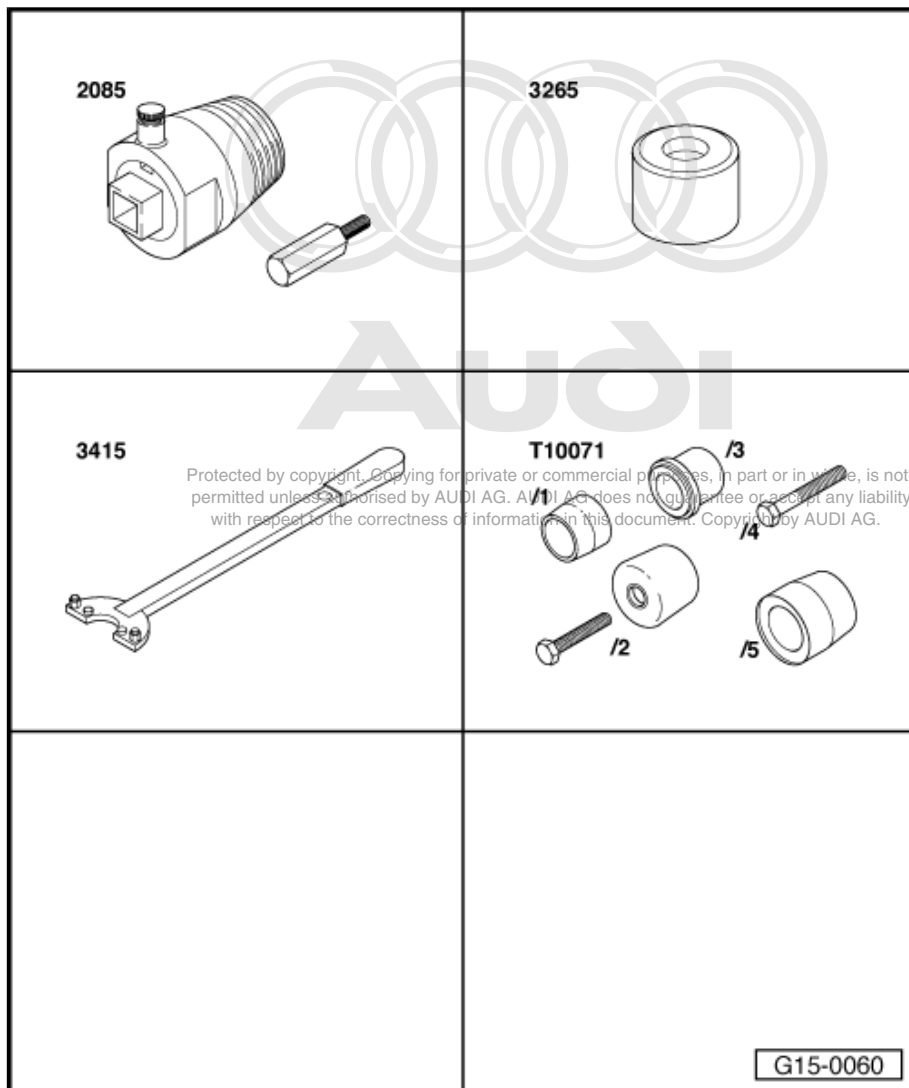
- Perform measurement with retaining frame removed.
- Secure universal dial gauge bracket -VW 387- with dial gauge -VAS 6079- to retaining frame as shown in illustration.
- Determine axial clearance.
- Wear limit: 0.17 mm.

**3.3 Renewing camshaft oil seal**

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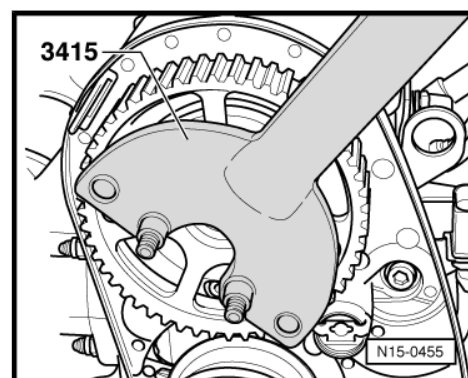
Special tools and workshop equipment required

- ◆ Oil seal extractor -2085-
- ◆ Fitting sleeve -3265-
- ◆ Counterhold tool -3415-
- ◆ Assembly tool -T10071-

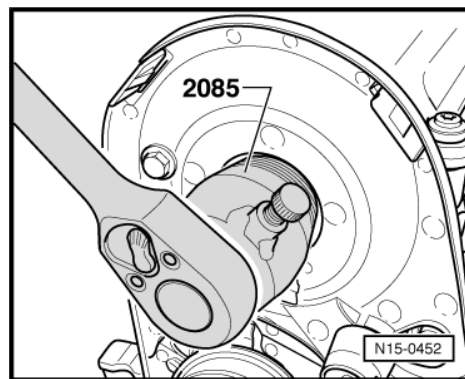


Procedure

- Cylinder head installed.
- Remove toothed belt from camshaft sprocket ⇒ [page 40](#) .
- Loosen camshaft sprocket using counterhold -3415- .
- Detach camshaft sprocket.
- Remove Woodruff key from camshaft.



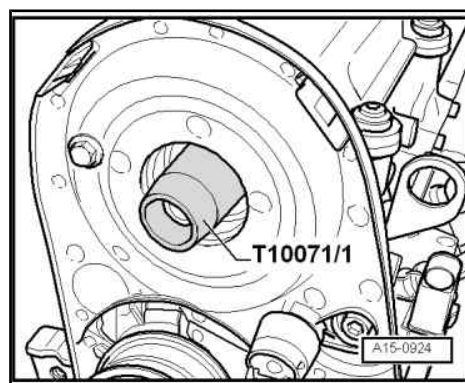
- To guide oil seal extractor, screw securing bolt for camshaft sprocket into camshaft as far as it will go until finger-tight.
- Adjust inner part of oil seal extractor -2085- so that it is level with the outer part and lock in position with knurled screw.
- Lubricate threaded head of oil seal extractor -2085- , place it in position and, exerting firm pressure -arrow-, screw it into oil seal as far as possible.
- Loosen knurled screw and turn inner section against camshaft until oil seal is pulled out.
- Clamp flats of oil seal extractor in vice.
- Remove oil seal with pliers.
- Clean running surface and sealing surface.



Note

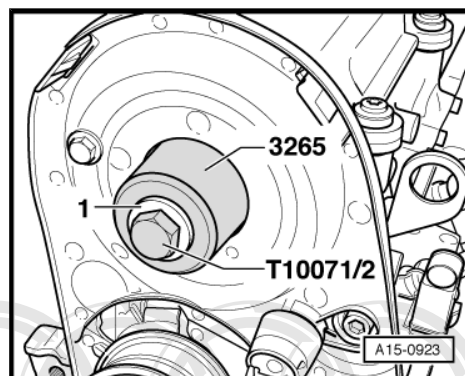
Do not lubricate sealing lip of oil seal.

- Slide oil seal over guide sleeve -T10071/1- .
- Detach guide sleeve.
- Press in oil seal all the way using fitting sleeve -3265- and bolt -T10071/2- .



Note

Place a large, commercially available M12 washer -item 1- below bolt to prevent wear on the press sleeve.



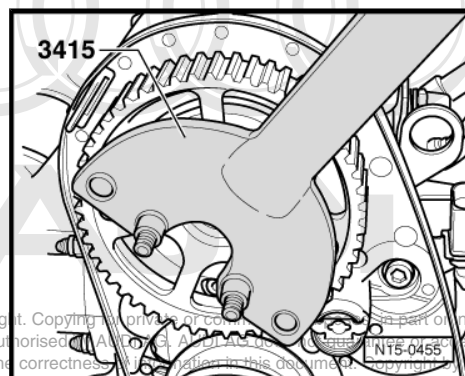
- Insert Woodruff key into camshaft.
- Tighten camshaft sprocket using counterhold -3415- .



Note

If a piston is at TDC the valves could strike the piston when turning the camshaft. Pistons must therefore not be at TDC This could otherwise result in damage to valves and pistons.

- Fit toothed belt (adjust valve timing) ⇒ [page 42](#) .



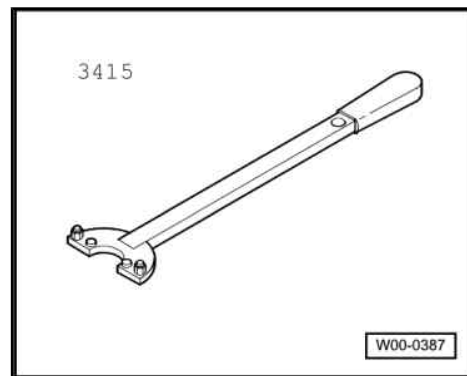
Tightening torque

Component	Nm
Camshaft sprocket to camshaft	100

3.4 Removing and installing camshaft

Special tools and workshop equipment required

- ◆ Counterhold tool -3415-



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

Removing

- Cylinder head installed.

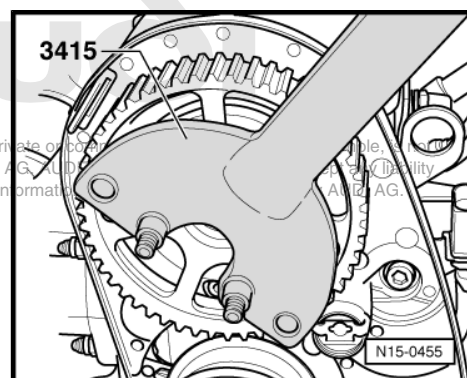


Note

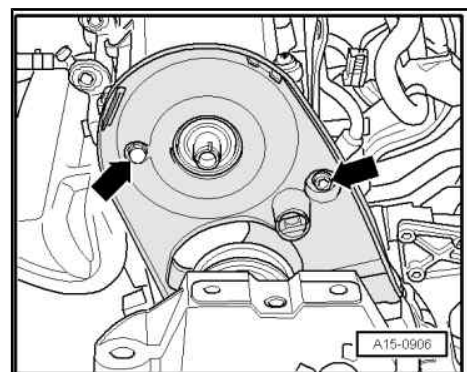
- ◆ *Sealing surfaces at retaining frame and cylinder head may be cleaned but not machined.*
- ◆ *Camshaft bearings are integrated into cylinder head/retaining frame.*
- ◆ *Renew camshaft oil seal and sealing cap at rear if retaining frame has been unfastened.*

- Remove toothed belt from camshaft sprocket ⇒ [page 40](#).
- Loosen camshaft sprocket using counterhold -3415-.
- Detach camshaft sprocket.
- Remove parallel key from camshaft.

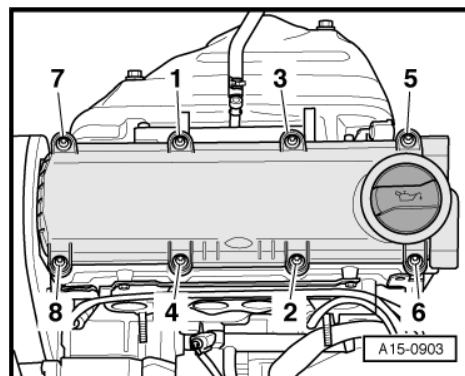
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- Unbolt toothed belt cover (rear) from cylinder head -arrows-.



- Remove crankcase breather hose from cylinder head cover.
- Unscrew cylinder head cover bolts in the sequence: -8 ... 1-.
- Remove cylinder head cover.



- Unscrew nuts -1-, -2- and -7 ... 10-.
- Unscrew nuts -3 ... 6- in several stages and in diagonal sequence.
- Remove retaining frame.
- Remove camshaft.
- Ensure that the rocker fingers and the supporting elements are not interchanged.

Installing



Note

Renew gaskets and seals.

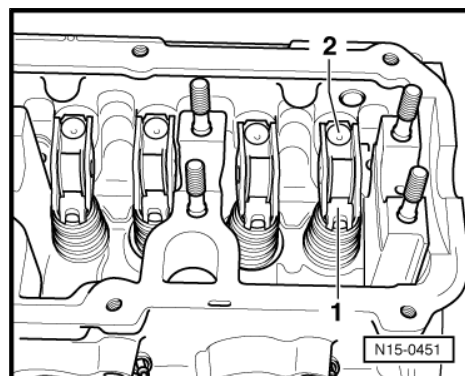
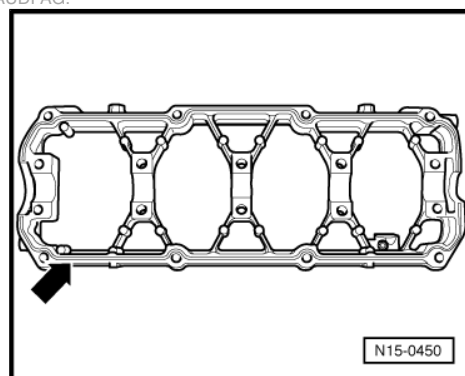
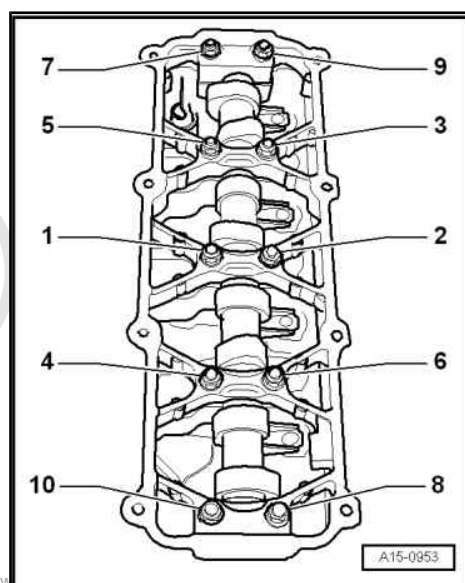
- Pistons must not be at TDC.
- Make sure dirt and remnants of sealant do not drop into cylinder head.
- Remove old sealant from groove in retaining frame -arrow- and from sealing surfaces.
- Remove sealant residues from cylinder head, e.g. with rotating plastic brush or similar.



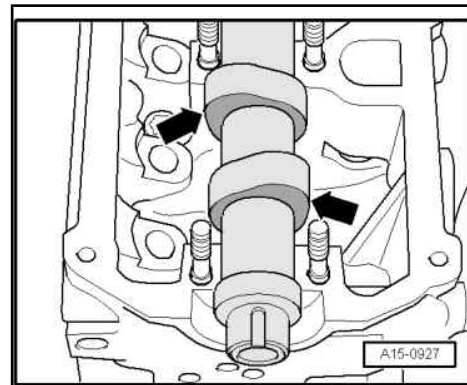
WARNING

Wear safety goggles.

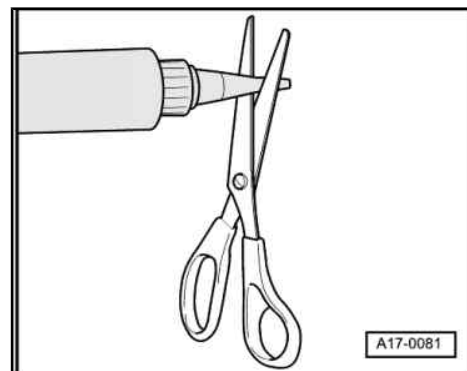
- Clean sealing surfaces; they must be free of oil and grease.
- Ensure all roller rocker fingers contact the valve ends -1- correctly and are clipped into their respective support elements -2-.



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



- Cut off tube nozzle at front marking (nozzle approx. 1 mm Ø).

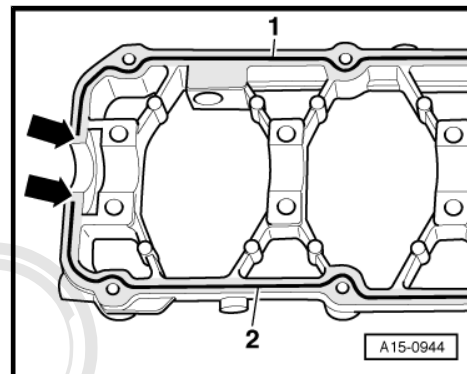


- Apply an even bead of sealant -1- and -2- onto the clean groove of the retaining frame (slightly projecting from the groove).
- Apply a thin coat of sealant onto the sealing surface in front of the ends of the beads of sealant -arrows-.



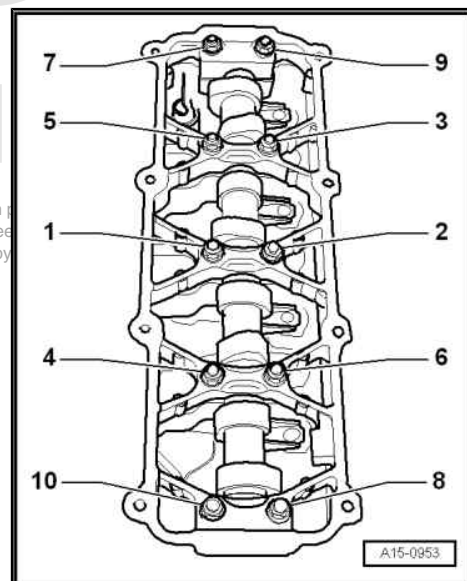
Note

- ◆ Do not apply the sealant thicker than prescribed. If necessary remove excess sealant with a lint-free cloth.
- ◆ The retaining frame must be installed within 5 minutes after applying sealant.



- Insert rear sealing cap ⇒ [Item 15 \(page 91\)](#) so that it is flush.
- Fit retaining frame and tighten nuts as follows:
- 1. Slightly tighten nuts -3 ... 6- in several stages and in diagonal sequence.
- 2. Also slightly tighten nuts -1-, -2- and -7 ... 10-.
- 3. Tighten nuts in the **sequence 1 ... 10**.

- Install cylinder head cover ⇒ [page 71](#).
- Renew camshaft oil seal ⇒ [page 92](#).

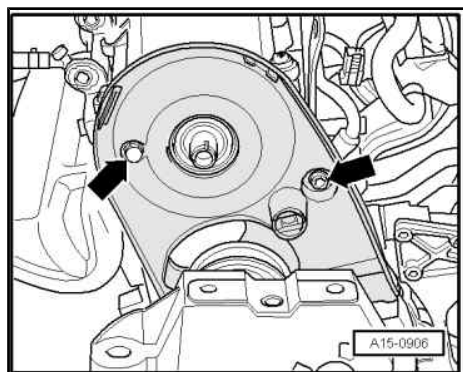


- Install toothed belt cover (rear) -arrows-.
- Insert parallel key into camshaft.



Caution

If a piston is at TDC the valves could strike the piston when turning the camshaft. Pistons must therefore not be at TDC. This could otherwise result in damage to valves and pistons.

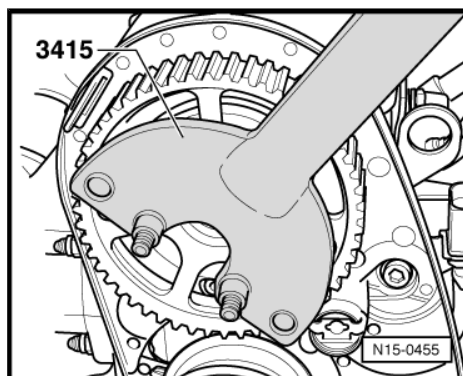


- Tighten camshaft sprocket using counterhold -3415- .
- Fit toothed belt (adjust valve timing) ⇒ [page 42](#) .



Note

- ◆ After fitting retaining frame and cylinder head cover, allow sealant to dry for approx. 30 minutes.
- ◆ After installing the camshaft, the engine must NOT be started for about 30 minutes. 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
Retaining frame to cylinder head	23
Camshaft sprocket to camshaft	100

3.5 Checking supporting elements with hydraulic clearance compensation

Special tools and workshop equipment required

- ◆ Feeler gauge

Procedure



Note

- ◆ It is not possible to service the supporting elements with hydraulic clearance compensation.
- ◆ Irregular valve noises when starting engine are normal.
- Start engine and let it run until the radiator fan has switched on once.
- Increase engine speed to approx. 2500 rpm for 2 minutes (perform road test if necessary).

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Note

If the irregular valve noises stop but recur repeatedly during short trips, renew the oil retention valve. The oil retention valve is located in the oil filter bracket ⇒ [Item 6 \(page 118\)](#).

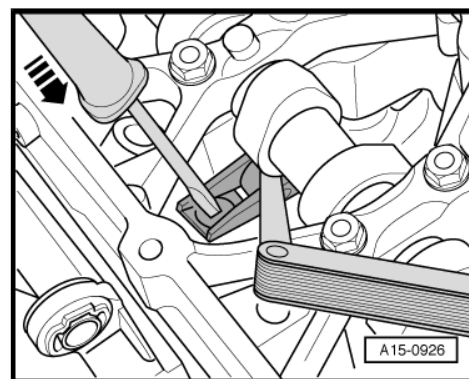
If the supporting elements with hydraulic clearance compensation are still noisy, proceed as follows to determine defective supporting element:

- Remove cylinder head cover ⇒ [page 71](#).
- Turn crankshaft until cam of the supporting element to be checked is at the top (push vehicle in direction of travel with fourth gear engaged and ignition switched off).

- Push roller rocker finger down using a screwdriver -arrow- to determine clearance between roller rocker finger and cam.

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

- Renew supporting element
⇒ ["3.4 Removing and installing camshaft", page 94](#).
- Install cylinder head cover ⇒ [page 71](#).



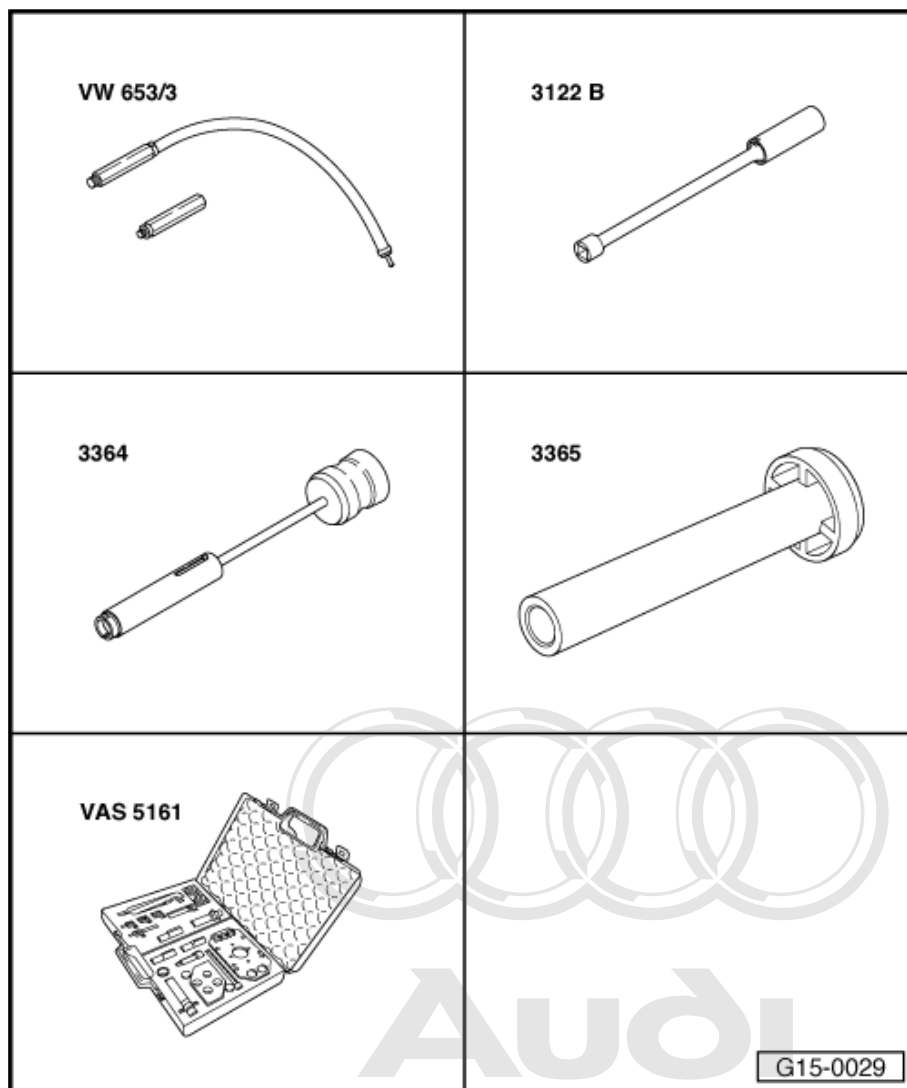
3.6

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Renewing valve stem oil seals

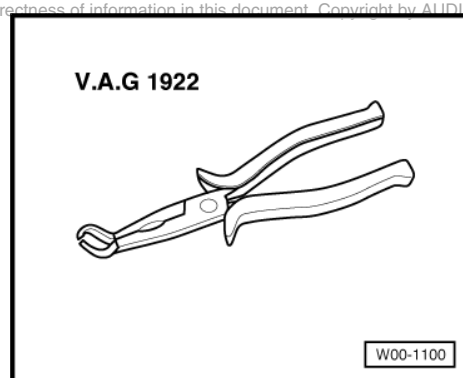
Special tools and workshop equipment required

- ◆ Pressure hose -VW 653/3-
- ◆ Spark plug socket and extension -3122 B-
- ◆ Valve stem seal puller -3364-
- ◆ Valve stem seal fitting tool -3365-
- ◆ Assembly and removal device for valve cotters -VAS 5161- with guide plate for 1.6 ltr. 2-valve engine -VAS 5161/20- and knurled spacer ring (height: 8.4 mm) -VAS 5161/21-5-



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- ◆ Spark plug connector pliers -V.A.G 1922-



Procedure

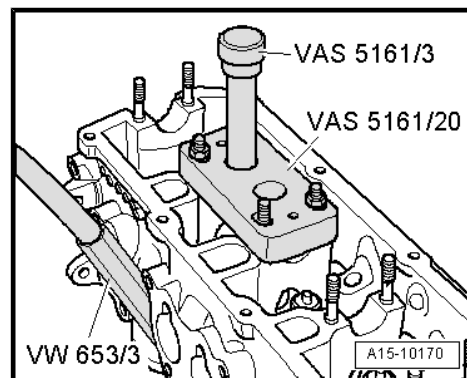
- Remove the camshaft ⇒ [page 94](#) .



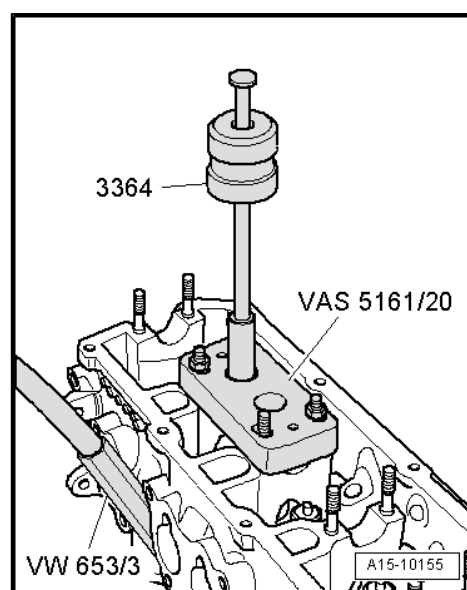
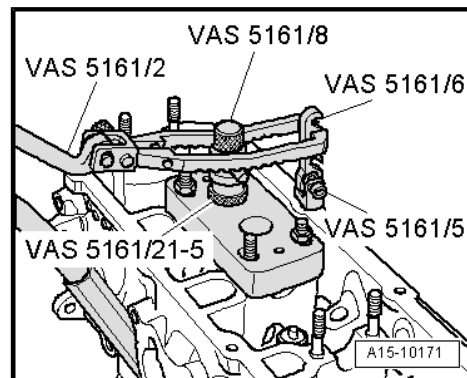
Note

Use waterproof felt-tip pen to mark the assignment of the roller rocker fingers.

- Remove roller rocker fingers and place onto a clean surface. When doing so, make sure that roller rocker fingers are not interchanged.
- Detach spark plug connectors using spark plug connector pliers -V.A.G 1922- .
- Remove spark plugs with spark plug socket -3122 B- .
- Set piston of the respective cylinder to "bottom dead centre".
- Fit guide plate -VAS 5161/20- onto cylinder head.
 - The marking "OBEN" (TOP) faces upwards.
- Secure guide plate with two nuts.
- Screw pressure hose -VW 653/3- into spark plug hole and connect to compressed air supply.
 - Air pressure: at least 6 bar
- Insert drift -VAS 5161/3- into guide plate and knock valve cot-
ters loose using a plastic hammer.



- Screw snap-in device -VAS 5161/6- with engaging fork -
VAS 5161/5- into guide plate.
- Slide knurled spacer ring (height 8.4 mm) -VAS 5161/21-5-
onto assembly cartridge -VAS 5161/8- .
- Attach pressure fork -VAS 5161/2- to snap-in device and push
assembly cartridge down.
- At the same time, turn knurled screw of assembly cartridge
clockwise until tips engage in valve cotters.
- Move knurled screw back and forth slightly; the valve cotters
are thus forced apart and taken up by the cartridge.
- Release the pressure fork.
- Take off assembly cartridge with knurled spacer ring.
- Remove valve spring plate and valve spring.
- Remove valve stem oil seals using the valve stem seal puller
-3364- .



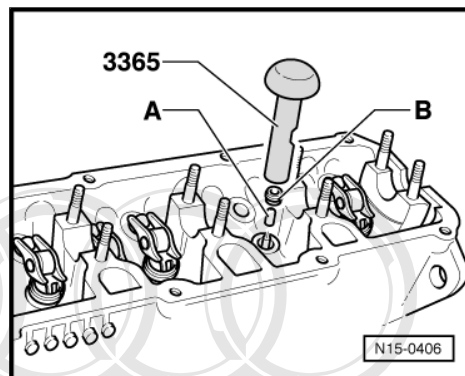
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Note

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

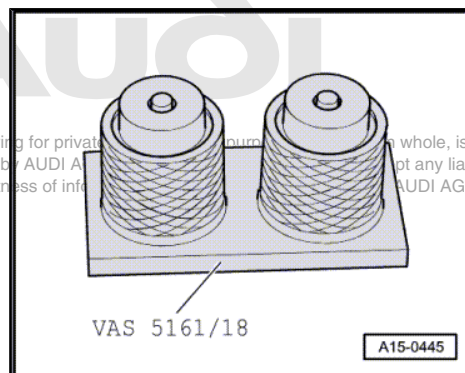
- Fit plastic sleeve -A- onto the valve stem to prevent damage to the new valve stem oil seal -B-.
- Lightly lubricate sealing lip of valve stem oil seal.
- Slip valve stem oil seal over plastic sleeve.
- Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool -3365-.
- Remove the plastic sleeve.



- If valve cotters have been removed from assembly cartridge, they need to be put into insertion device -VAS 5161/18- first.

• Larger diameter of valve cotters faces upwards.

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



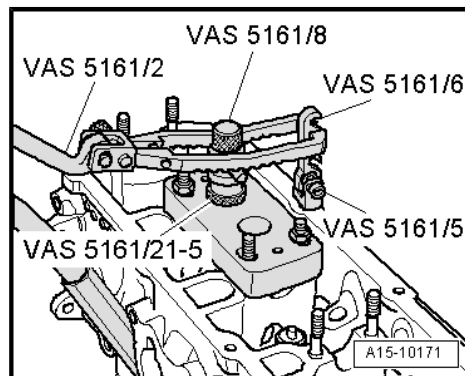
- Insert valve spring and valve spring plate.

- Re-insert assembly cartridge with knurled spacer ring (height: 8.4 mm) into guide plate.

- Push pressure fork down and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.

- Release the pressure fork with knurled screw still in pulled position.

- Install roller rocker fingers.



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

- Install spark plugs ⇒ Rep. Gr. 28 .
- Install camshaft ⇒ [page 94](#) .



Note

- ◆ After installing the camshaft, the engine must NOT be started for about 30 minutes. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).
- ◆ After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.

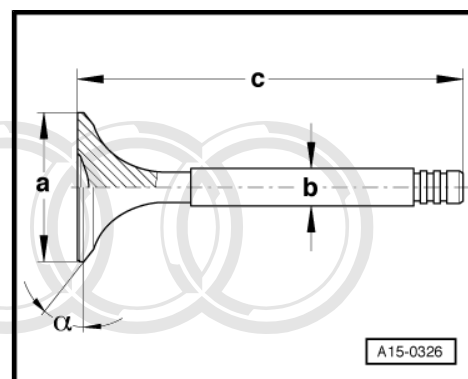
3.7 Valve dimensions



Note

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

Dimension		Inlet valve	Exhaust valve
$\varnothing a$	mm	39.5 ± 0.15	32.9 ± 0.15
$\varnothing b$	mm	5.980 ± 0.007	5.965 ± 0.007
c	mm	93.85	93.85
α	$^{\circ}$	45	45



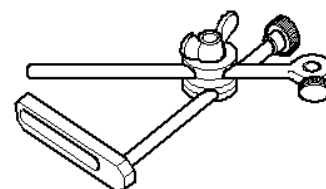
3.8 Checking valve guides

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket -VW 387-

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VW 387



- ◆ Dial gauge -VAS 6079-

VAS 6079



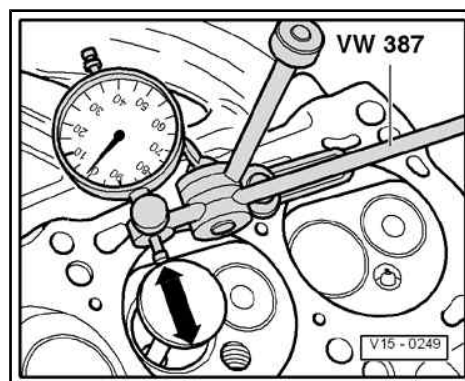
Procedure

- Insert valve into valve guide.
- End of valve stem must be flush with guide.
- Determine amount of sideways play:
- Wear limit: 0.6 mm.



Note

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



3.9 Machining valve seats

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

Special tools and workshop equipment required

- ◆ Depth gauge
- ◆ Valve seat machining tool



Note

- ◆ When servicing engines with leaking valves, it is not sufficient to machine (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 103](#).
- ◆ Valve seats should only be machined to the extent required to give a proper seating pattern.
- ◆ Calculate the maximum permissible machining dimension before machining.
- ◆ If the machining dimension is exceeded, the function of the hydraulic valve clearance compensation can no longer be ensured and the cylinder head must be renewed.

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Calculating maximum permissible machining dimension

- Insert valve and press firmly against valve seat.



Note

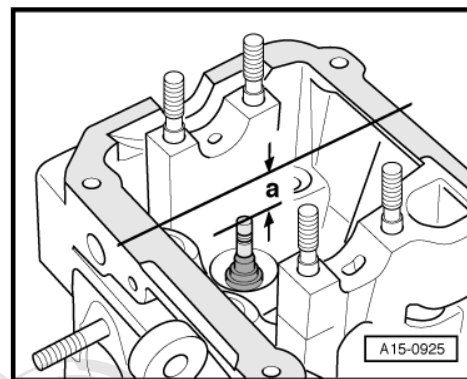
If the valve has to be renewed as part of a repair, use a new valve for the measurement.

- Measure distance -a- between top end of valve stem and upper surface of cylinder head with a depth gauge.
- Calculate max. permissible machining dimension from measured distance and minimum dimension.
- Minimum dimension for inlet valve and exhaust valve: 31.2 mm.

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

Example:

Measured gap -a-	31.5 mm
Minimum dimension	– 31.2 mm
max. permissible machining dimension	= 0.3 mm



Note

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

Machining inlet valve seat

a - $\varnothing$ 39.2 mm

b - Maximum permissible machining dimension

c - 1.8 ... 2.2 mm

Z - Bottom surface of cylinder head

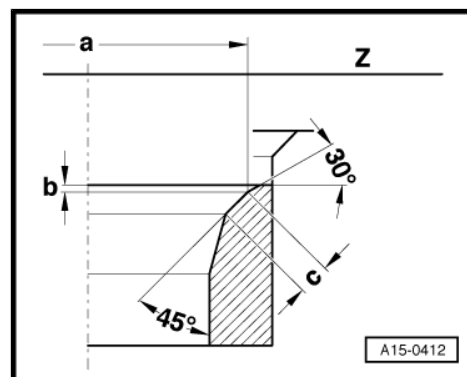
45° - Valve seat angle

30° - Correction angle (top)



Note

*Calculating maximum permissible machining dimension
⇒ [page 105](#).*



Machining exhaust valve seat

a - $\varnothing$ 32.4 mm

b - Maximum permissible machining dimension

c - 2.2 ... 2.6 mm

Z - Bottom surface of cylinder head

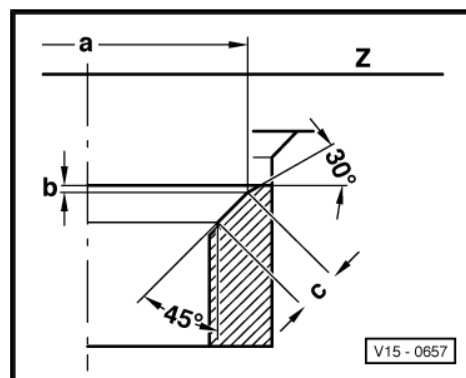
45° - Valve seat angle

30° - Correction angle (top)



Note

- ◆ *Calculating maximum permissible machining dimension
⇒ [page 105](#).*
- ◆ *Exhaust valve seat inserts also have an additional constriction. When machining, it is essential to ensure that the radius of the constriction is not damaged.*



3.10 Checking valves

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



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17 – Lubrication

1 Removing and installing parts of lubrication system



Note

- ◆ *If large quantities of metal shavings or particles are found in the engine oil when repairing the engine, the oil passages must be cleaned carefully, and the oil cooler must be renewed in order to prevent further damage occurring later.*
- ◆ *The oil level must not be above max. mark on dipstick – danger of damage to catalytic converter.*
- ◆ *Oil spray jet and pressure relief valve ➔ [page 108](#)*

Viscosity grades and oil specifications ➔ Maintenance ; Booklet 802 .

Oil capacities ➔ Maintenance tables .

1.1 Sump and oil pump - exploded view of components

1 - 28 Nm

2 - Stop for torque reaction support

3 - Sump

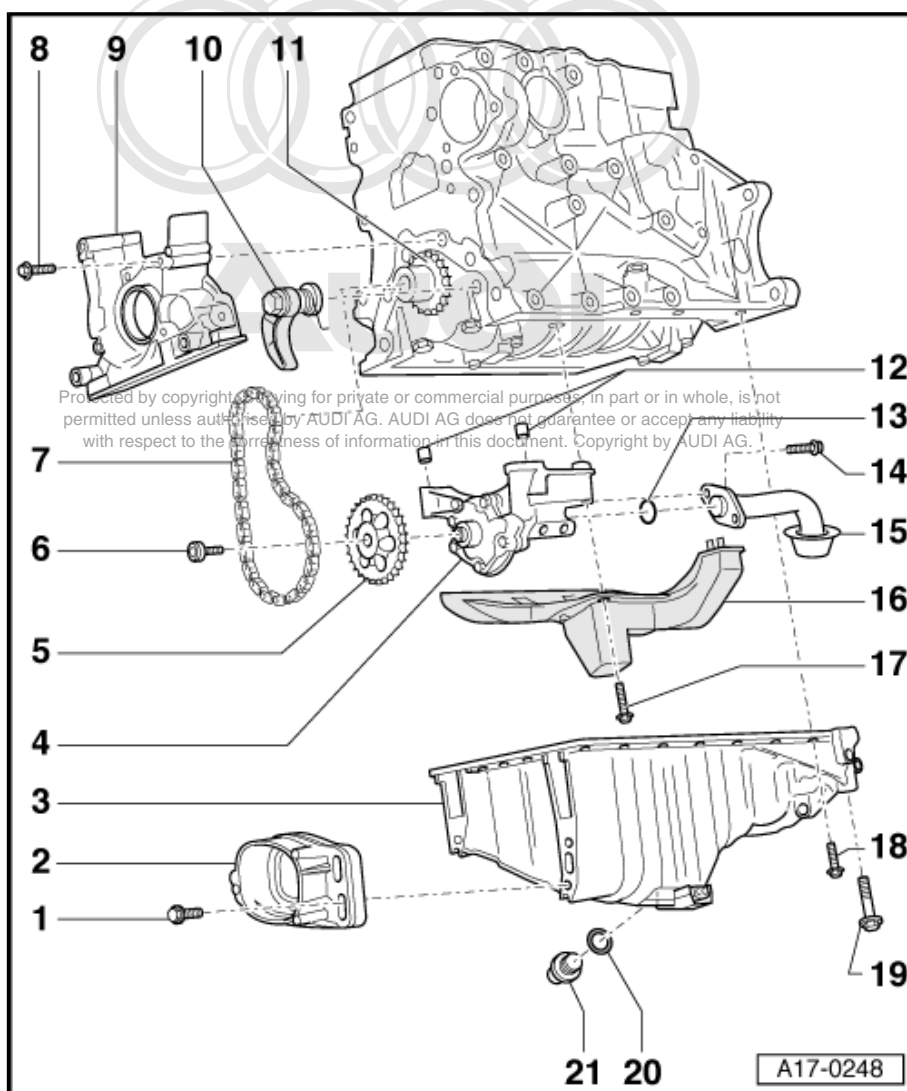
- ☐ Removing and installing ➔ [page 109](#)
- ☐ Install using sealant; sealant ➔ Parts catalogue
- ☐ Removing and installing oil level and oil temperature sender -G266- ➔ [page 109](#)

4 - Oil pump

- ☐ With pressure relief valve (12 bar)
- ☐ Removing and installing ➔ [page 117](#)
- ☐ Before installing, check that the two dowel sleeves ➔ [Item 12 \(page 108\)](#) for centring oil pump/ cylinder block are fitted.
- ☐ Renew if running surfaces and gears are scored
- ☐ Tightening torque for oil pump cover to oil pump housing: 10 Nm

5 - Chain sprocket for oil pump

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



6 - 22 Nm**7 - Drive chain for oil pump**

- ☐ Mark direction of rotation before removing
- ☐ Check for wear

8 - 15 Nm**9 - Sealing flange (front)**

- ☐ Must be positioned on dowel sleeves
- ☐ Removing and installing ⇒ [page 50](#)
- ☐ Install using sealant; sealant ⇒ Parts catalogue
- ☐ Renewing crankshaft oil seal on pulley end ⇒ [page 47](#)

10 - Chain tensioner

- ☐ Tighten to 16 Nm
- ☐ Do not dismantle
- ☐ Note installation position
- ☐ When installing, pre-tension spring and engage
- ☐ If the spring is broken, renew chain tensioner as complete unit

11 - Drive chain sprocket for oil pump

- ☐ Removing and installing ⇒ [page 63](#)

12 - Dowel sleeves

- ☐ 2 x

13 - O-ring

- ☐ Renew

14 - 16 Nm**15 - Intake pipe**

- ☐ Clean strainer if dirty

16 - Baffle plate**17 - 16 Nm****18 - 15 Nm**

- ☐ Tighten in stages and in diagonal sequence
- ☐ Observe correct tightening sequence ⇒ [page 116](#)

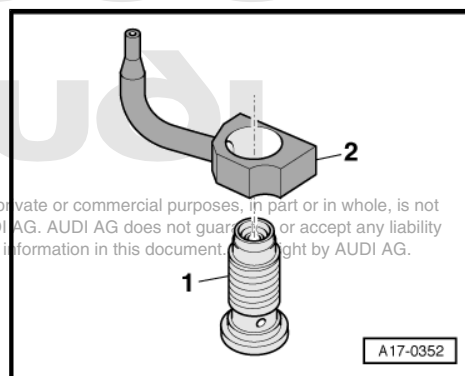
19 - 40 Nm**20 - Seal**

- ☐ Renew

21 - Oil drain plug, 30 Nm**Oil spray jet and pressure relief valve**

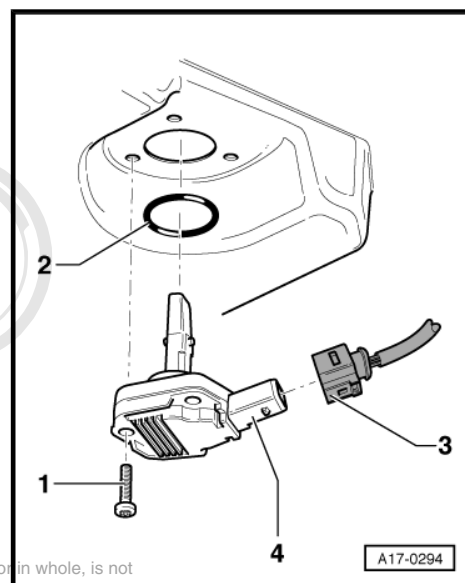
- 1 - Oil spray jet (for cooling of pistons)
- 2 - Bolt with pressure relief valve, 27 Nm

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

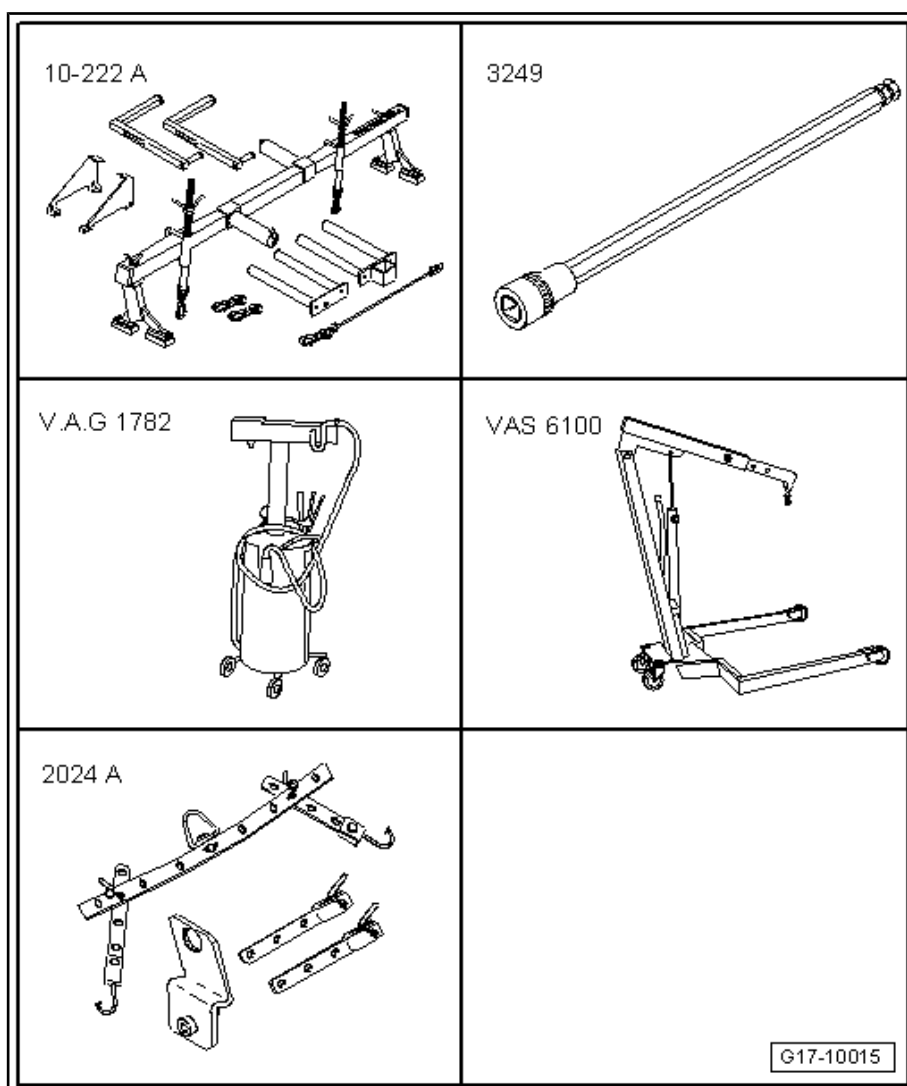
- 1 - Bolt, 10 Nm (self-locking); renew
- 2 - Seal; renew
- 3 - Electrical connector
- 4 - Oil level and oil temperature sender -G266-



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

- ◆ Support bracket -10-222 A-
- ◆ Socket -3249- or -T10058-
- ◆ Used oil collection and extraction unit -V.A.G 1782-
- ◆ Workshop hoist -VAS 6100- or -V.A.G 1202 A-
- ◆ Lifting tackle -2024 A-
- ◆ Electric drill with plastic brush attachment
- ◆ Safety goggles



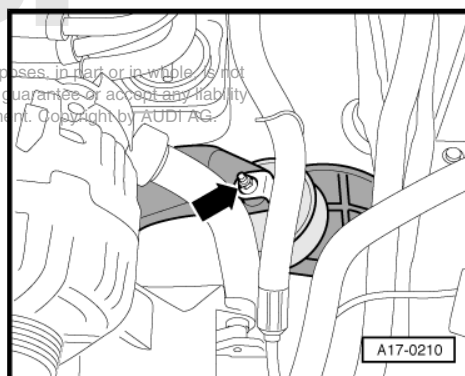
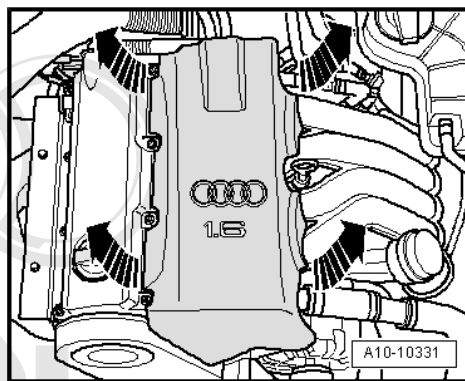
Removing



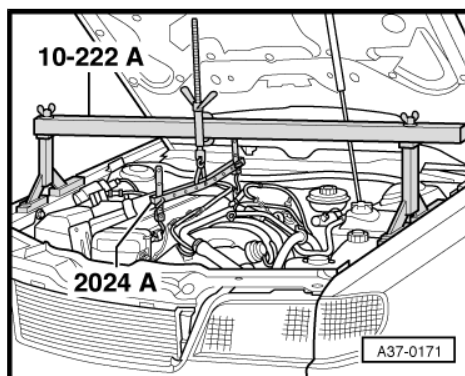
Note

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

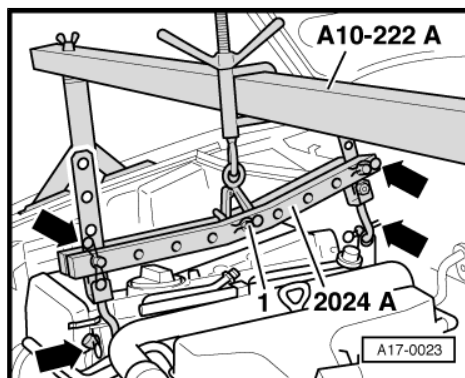
- Lift off engine cover -arrows-.
- Unscrew nut -arrow- at top of engine mounting (left-side).



- Set up support bracket -10-222 A- on wing panel flanges.



- Remove eyelets of lifting tackle -2024 A- .
- Re-insert pin -1- in centre hole of lifting tackle and secure with split pin.
- Hang the pin of lifting tackle -2024 A- onto the spindle of support bracket -10-222 A- .
- Engage lifting tackle -2024 A- in front and rear lifting eyes on engine.

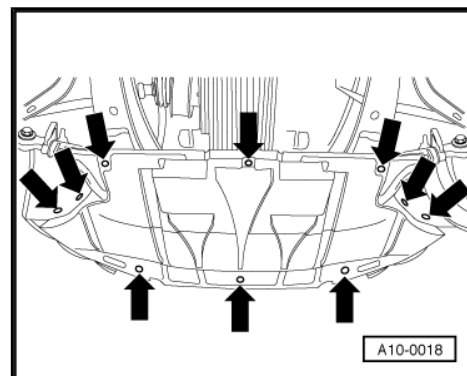


WARNING

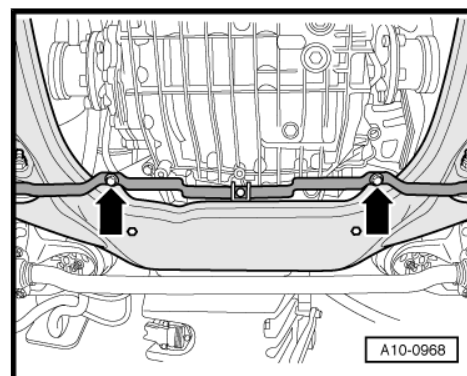
The support hooks and retaining pins on the lifting tackle must be secured with locking pins -arrows-.

- Take up weight of engine using support bracket spindle (do not raise).

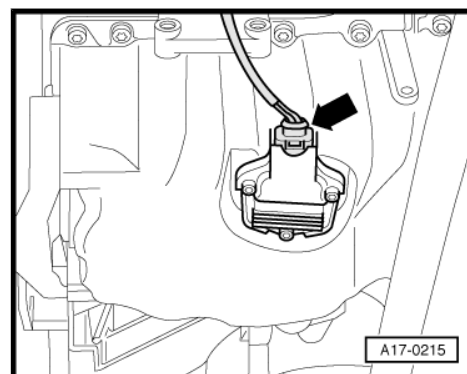
- Remove noise insulation -arrows-.



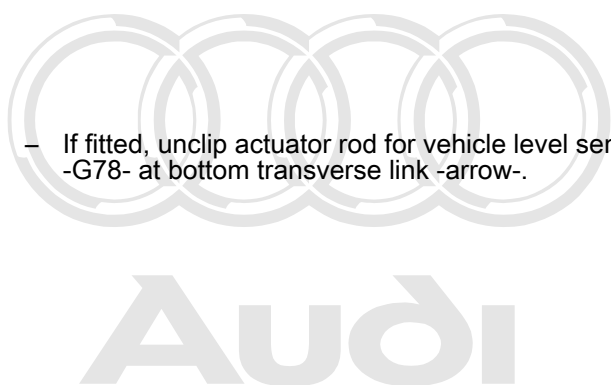
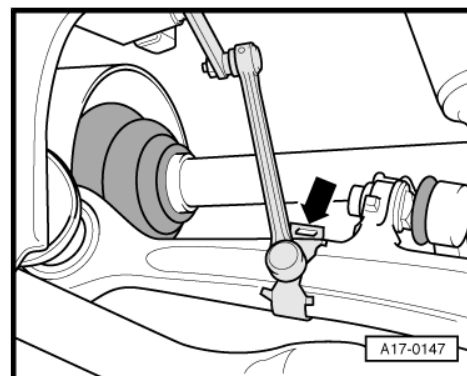
- Unbolt bracket for noise insulation -arrows-.



- Unplug electrical connector -arrow- at oil level and oil temperature sender -G266- .
- Place used oil collection and extraction unit -V.A.G 1782- under engine and drain engine oil.

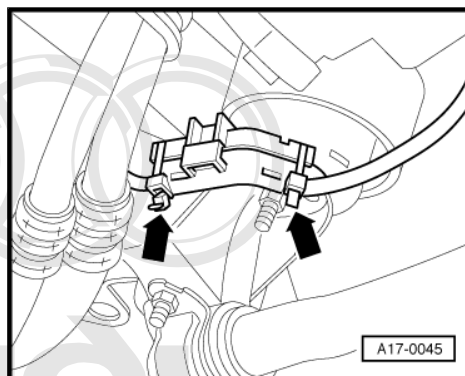


- If fitted, unclip actuator rod for vehicle level sender (front left) -G78- at bottom transverse link -arrow-.



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- Cut open the cable ties -arrows-, open bracket for starter wire and take out the electrical wire.



- Mark positions of bolt connections -1- and locating sleeves -2- on bottom of engine mounts (left and right).

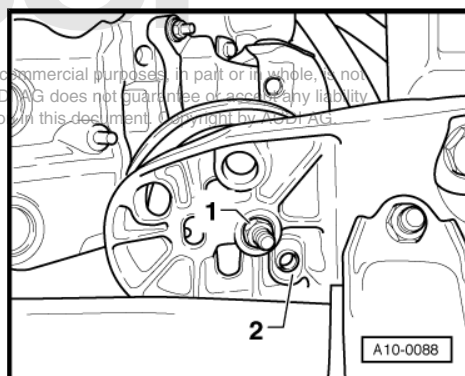
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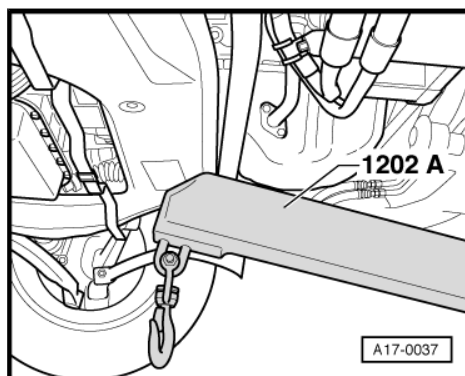
Note

Different mounting holes are provided for the different engine versions.

- Unscrew nut -1- at bottom of engine mounting (right-side).
- Remove engine mounting (left-side).



- Support subframe using workshop hoist -VAS 6100- .

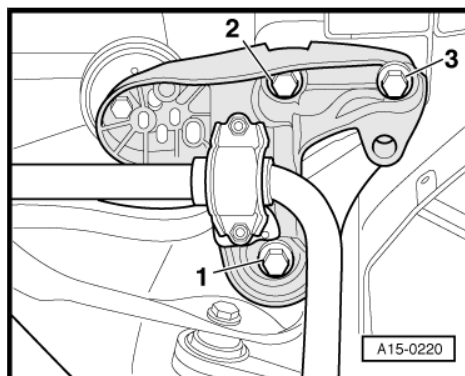


- First remove front subframe bolts -2- and -3- (left and right). Then unscrew bolts -1-.

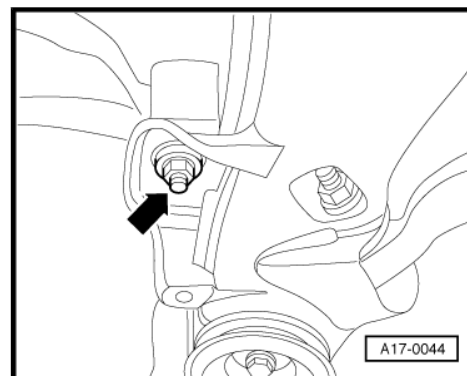


Note

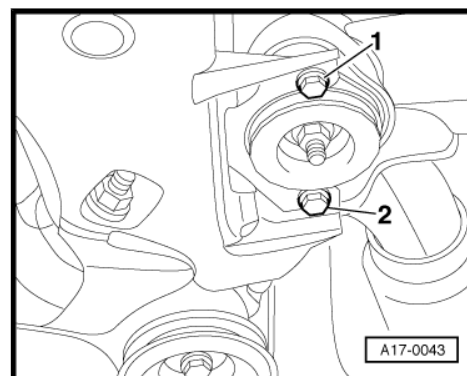
To avoid having to check and adjust wheel alignment, only loosen the front subframe mountings and lower the subframe at the front.



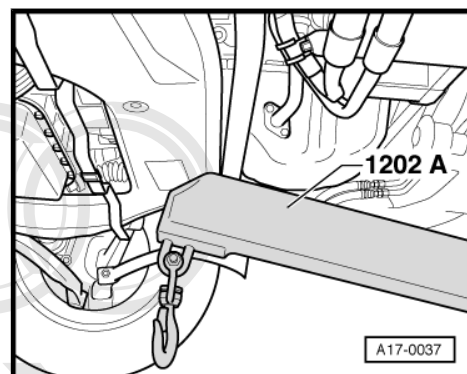
- Loosen nut -arrow- for gearbox mounting (left-side) until it aligns with the lower end of the bolt (turned approx. 4 threads).



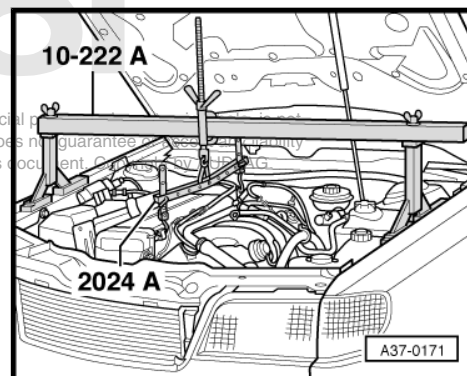
- Loosen rear bolt -2- for gearbox mounting (right-side) a few turns, then remove front bolt -1-.



- Carefully lower subframe using workshop hoist -VAS 6100- .

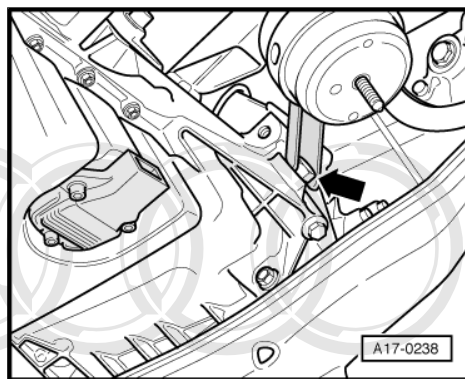


- Lift engine up slightly using spindle of support bracket -10-222 A- ; make sure there is clearance for exhaust system.

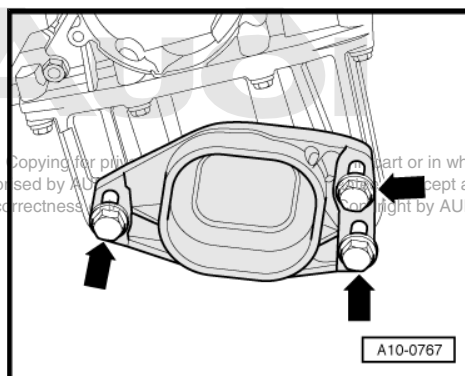


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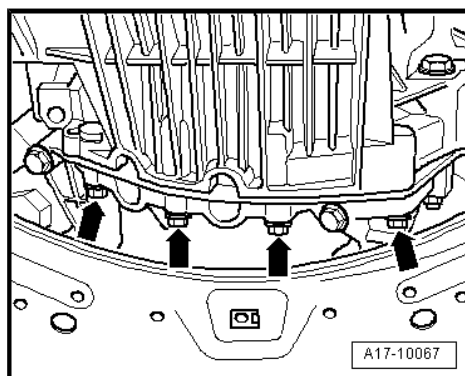
- Unscrew bolt -arrow- at support for intake manifold.



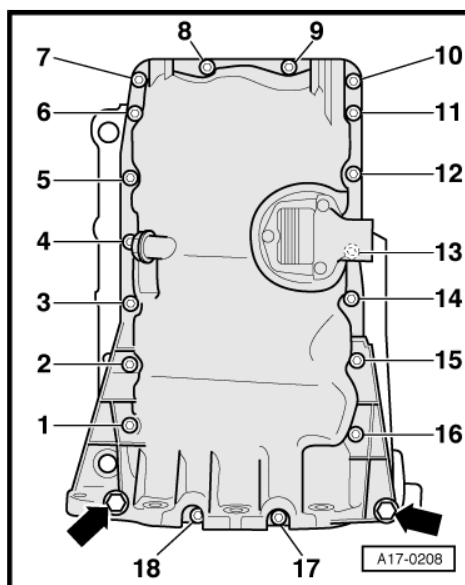
- Unbolt stop for torque reaction support -arrows-.



- Unscrew gearbox/sump bolts -arrows-.



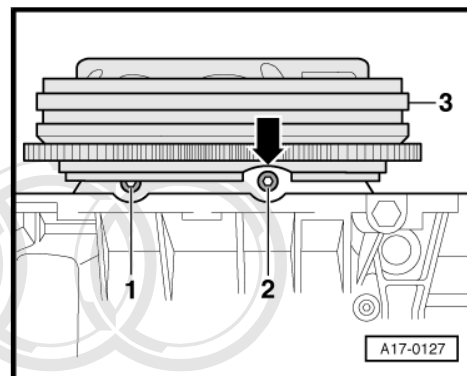
- Unscrew M10 bolts -arrows-.
- Slacken bolts -1 ... 18- in diagonal sequence.



i Note

Use hexagon key extension -3249- or -T10058- to unscrew the two rear sump bolts -1- and -2-. For this purpose, turn the dual-mass flywheel -3- until the recess -arrow- is aligned with the bolt.

- Remove all bolts and take off sump; if necessary loosen it by striking lightly with a rubber hammer.

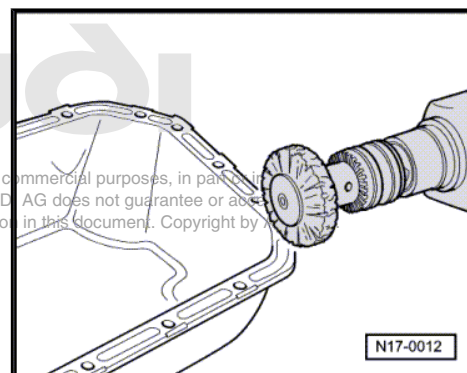


Installing

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

i Note

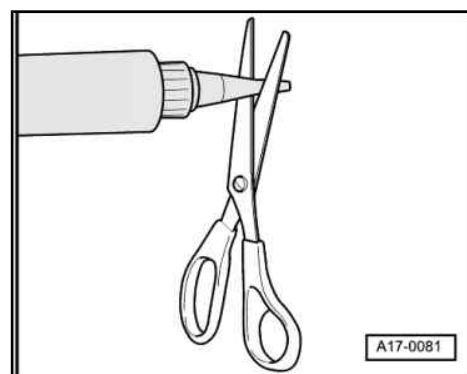
- ◆ *Renew gaskets and seals.*
- ◆ *Fit all cable ties in the original positions when installing.*
- Carefully remove sealant residue from cylinder block. For this purpose, remove baffle plate.
- Remove sealant residue from sump, e.g. with rotating plastic brush or similar.



WARNING

Wear safety goggles.

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



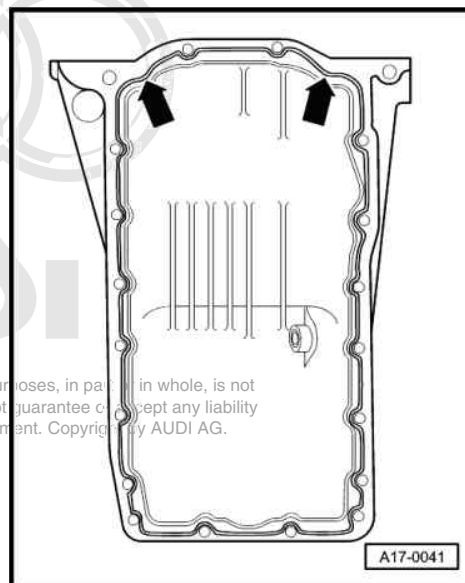
- Apply bead of sealant onto the clean sealing surface of the sump as shown in the illustration.
- Thickness of sealant bead: 2 ... 3 mm



Note

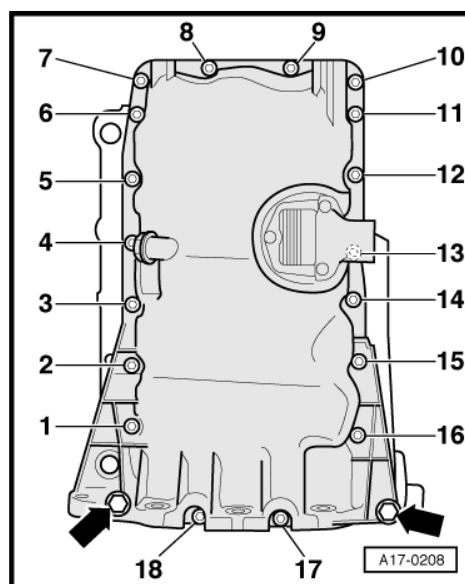
- ◆ The sealant bead must not be thicker than specified, otherwise excess sealant could enter the sump and clog the strainer in the oil pump.
- ◆ Take particular care when applying sealant bead in area of rear sealing flange -arrows-.
- ◆ The sump must be installed **within 5 minutes after applying sealant**.

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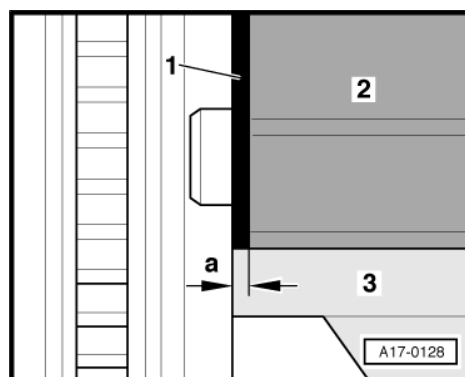
- Immediately install sump and tighten bolts in the sequence indicated:

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



Note

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

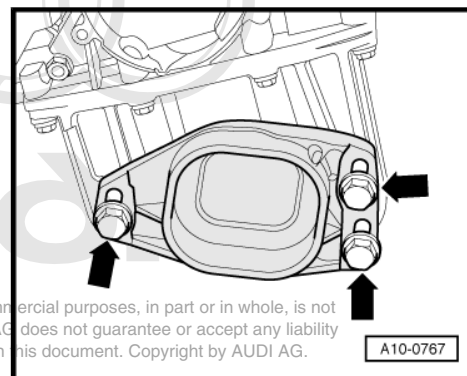


- Install subframe ⇒ Rep. Gr. 40 .
- Install anti-roll bar ⇒ Rep. Gr. 40 .

- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten bolts -arrows-.
- Fill up with engine oil and check oil level ⇒ [page 124](#) .

Tightening torques

Component		Nm
Sump to cylinder block	M7	15
	M10	40
Sump to gearbox		45
Stop for torque reaction support to sump		28
Engine mounting to subframe		23
Intake manifold support to sump		20
Gearbox mounting to subframe		23
Oil drain plug		30



1.3 Removing and installing oil pump

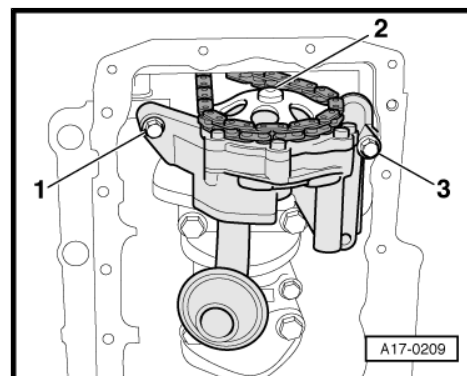
Removing

- Remove sump and baffle plate ⇒ [page 109](#) .
- Remove bolt -2-.
- Pull chain sprocket off oil pump shaft.
- Unscrew bolts -1- and -3- and remove oil pump.

Installing

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

- Insert dowel sleeves ⇒ [Item 12 \(page 108\)](#) at top of oil pump.
- Chain sprocket can only be fitted in one position on oil pump shaft.
- Install sump ⇒ [page 115](#) .



Tightening torques

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

1.4 Oil filter and oil cooler - exploded view of components

1 - Screw plug, 40 Nm

2 - Seal

- ❑ Not available as separate replacement part

3 - Spring

- ❑ For pressure relief valve, approx. 4 bar
- ❑ Not available as separate replacement part

4 - Piston

- ❑ For pressure relief valve, approx. 4 bar
- ❑ Not available as separate replacement part

5 - Gasket

- ☐
- Renew

6 - Oil retention valve. 8 Nm

- ☐ Integrated into oil filter bracket
- ☐ Not available as separate replacement part

7 - O-ring

- ☐ Renew
- ☐ Slip on as far as collar of pipe
⇒ Item 8 (page 118)

8 - Crankcase breather pipe

9 - Retaining clip

10 - Screw plug, 15 Nm

11 - Seal

- ❑ If seal is leaking, cut open and renew

12 - Oil pressure switch -F1- , 1.4 bar

- ☐ Black insulation
- ☐ Checking ⇒ page 120
- ☐ Tighten to 25 Nm

13 - Seal

- ❑ If seal is leaking, cut open and renew

14 - 15 Nm + 90° (1/4 turn) further

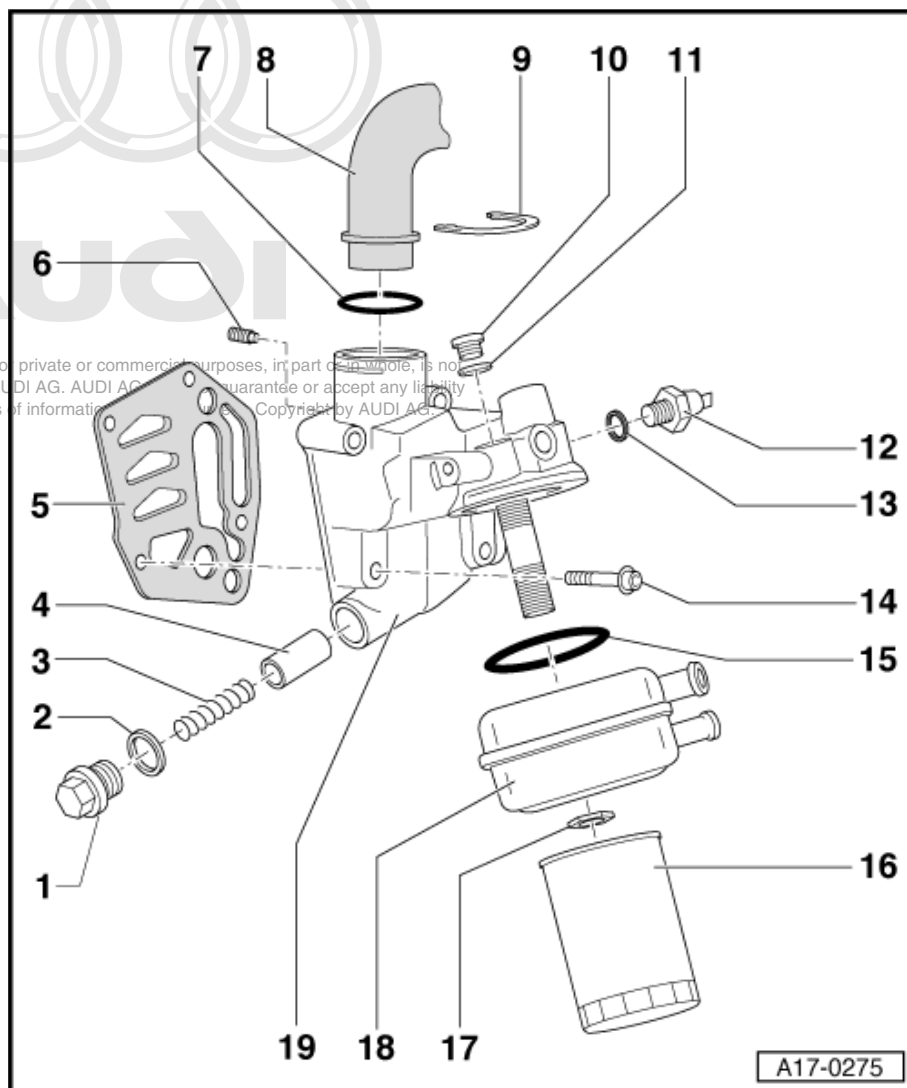
- ☐
- Renew

15 - Seal

- ☐ Renew
- ☐ Engage in lugs on oil cooler

16 - Oil filter

- ☐ Observe change intervals $\Rightarrow$ Maintenance ; Booklet 802
- ☐ Observe installation instructions on oil filter
- ☐ Tighten to 20 Nm



17 - 25 Nm

18 - Oil cooler

- ☐ See note ⇒ [page 107](#)
- ☐ Ensure clearance from surrounding components
- ☐ Diagram of coolant hose connections ⇒ [page 125](#)

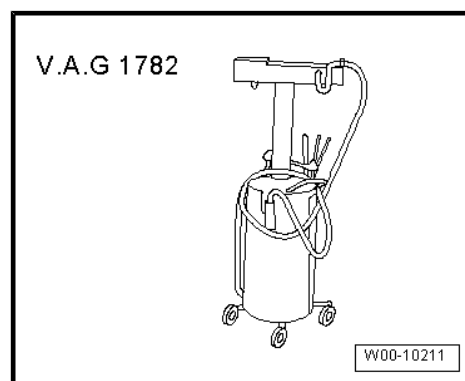
19 - Oil filter bracket

- ☐ With pressure relief valve, approx. 4 bar
- ☐ Removing and installing ⇒ [page 119](#)

1.5 Removing and installing oil filter bracket

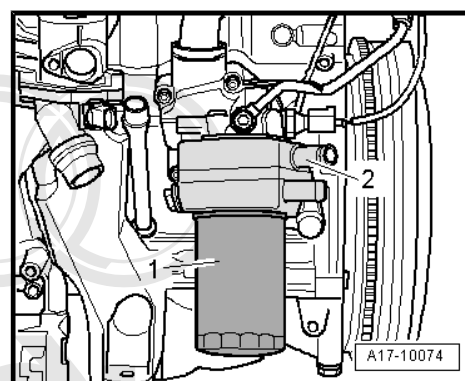
Special tools and workshop equipment required

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



Removing

- Drain off coolant ⇒ [page 127](#) .
- Remove coolant pipe (bottom) ⇒ [page 136](#) .
- Place used oil collection and extraction unit -V.A.G 1782- under engine and remove oil filter -1-.
- Note installation position and remove oil cooler -2-.



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- Unplug electrical connector -3-.
- Detach clip -2- and remove crankcase breather pipe.
- Unscrew bolts -arrows- and remove oil filter bracket.



Note

Disregard -item 1-.

Installing

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



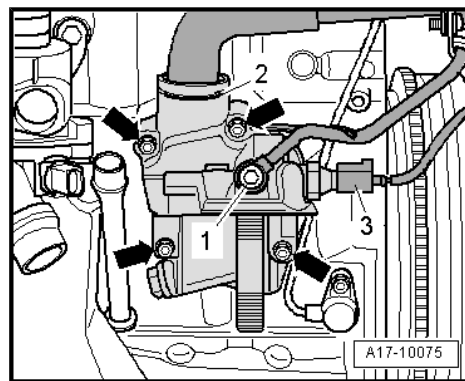
Note

Renew gaskets, seals and O-rings.

- Install coolant pipe (bottom) ⇒ [page 135](#) .
- Check oil level ⇒ [page 124](#) .
- Fill cooling system ⇒ [page 130](#) .

Tightening torques

Component	Nm
Oil filter bracket to cylinder block	15 + 90° 1)2)
Oil cooler to oil filter bracket	25
Oil filter to oil cooler	20
• 1) Renew bolts. • 2) 90° = one quarter turn.	



1.6 Checking oil pressure and oil pressure switch -F1-

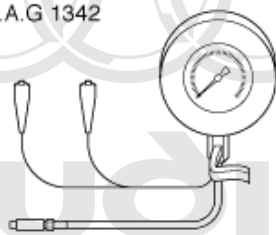


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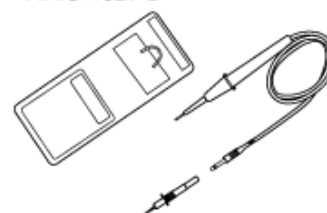
Special tools and workshop equipment required

- ◆ Oil pressure tester - V.A.G 1342-
- ◆ Voltage tester -V.A.G 1527 B-
- ◆ Auxiliary measuring set - V.A.G 1594 C-

V.A.G 1342



V.A.G 1527 B



V.A.G 1594 C

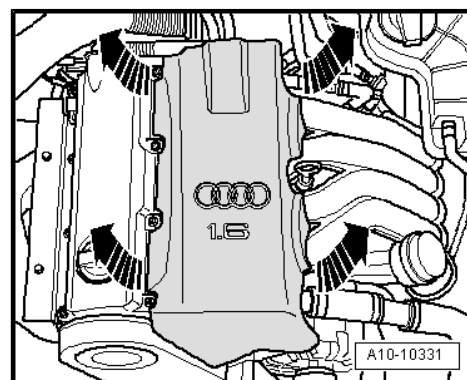


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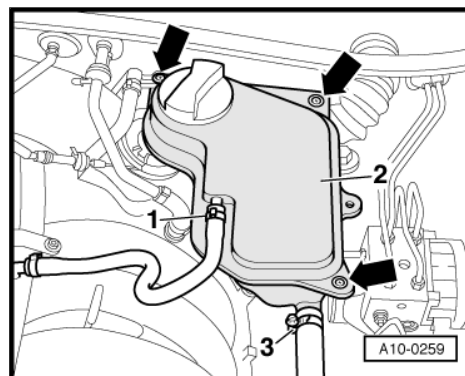
G17-0023

Procedure

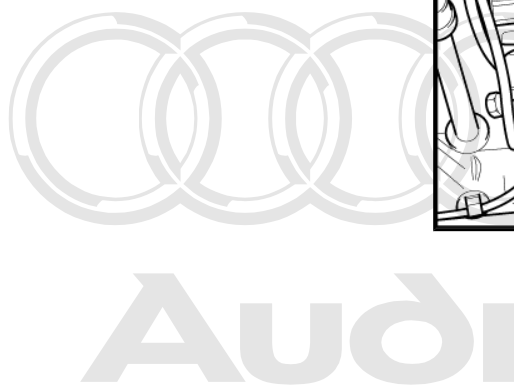
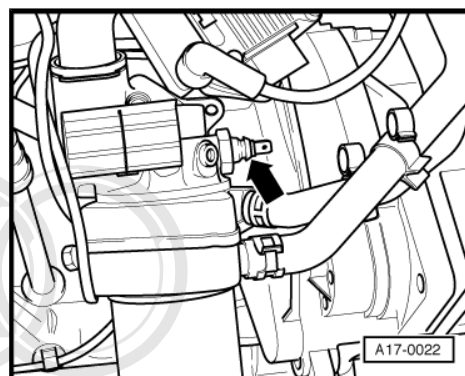
- Oil level OK
- Engine oil temperature approx. 80 °C
- Oil pressure warning lamp -K3- should come on when ignition is switched on.
- On vehicles with driver information system (DIS), the message "OK" should light up in the display.
- Lift off engine cover -arrows-.



- Unbolt coolant expansion tank -2- -arrows-.
- Unplug electrical wire for coolant shortage indicator switch - F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -3- attached.



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



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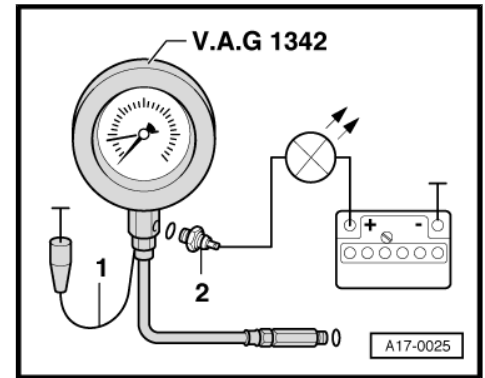
- Connect oil pressure tester -V.A.G 1342- with adapter -V.A.G 1342/14- to bore for oil pressure switch.
- Screw oil pressure switch -2- into oil pressure tester -V.A.G 1342- .
- Connect brown wire -1- of oil pressure tester to earth (“-”).

Checking oil pressure switch

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

If the LED lights up:

- Renew oil pressure switch.
- Start engine.



Note

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

- LED should light up at 1.2 ... 1.6 bar.

If LED does not light up:

- Renew oil pressure switch.

Checking oil pressure

- Start engine.
- Minimum oil pressure at idling speed: 1.2 bar.
- Minimum oil pressure at 2000 rpm: 3.5 bar.

The pressure relief valve or oil pump is defective if the specifications are not attained.

- Renew oil pump ⇒ [page 117](#) .

Assembling

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



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Renew seal when installing oil pressure switch.

Tightening torque

Component	Nm
Oil pressure switch to oil filter housing	25

1.7 Engine oil

Viscosity grades and oil specifications ⇒ Maintenance ; Booklet 802 .

1.8 Checking oil level



Note

The oil level must not be above max. mark on dipstick - danger of damage to catalytic converter.

Procedure

- Engine oil temperature at least 60 °C.
- Vehicle must be level (horizontal).
- Wait a few minutes after switching off the engine to allow the oil to flow back into the sump.
- Pull out the dipstick, wipe off with a clean cloth and insert it again as far as it will go.
- Pull out the dipstick again and read off the oil level.

Markings on oil dipstick:

a - Do not top up oil.

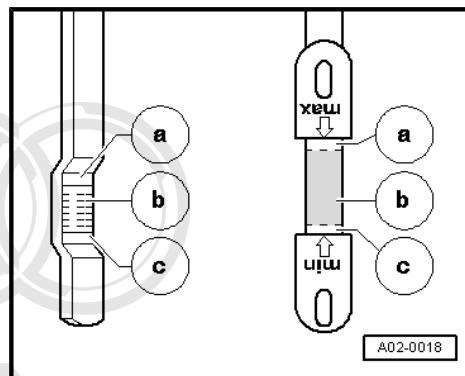
b - Oil may be topped up.

c - Oil must be topped up. It is sufficient if the oil level is somewhere in area -b- (grooved area on dipstick) after topping up.



Note

The oil level must not be above the MAX marking -a- and not below the MIN marking -c-.



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19 – Cooling

1 Removing and installing parts of cooling system



WARNING

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



Note

- ◆ *The cooling system is under pressure when the engine is hot. If necessary, relieve pressure before commencing repair work.*
- ◆ *Renew gaskets and seals.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- ◆ *The arrow markings on coolant pipes and on ends of hoses must align.*
- ◆ *Removing and installing viscous fan ⇒ [page 143](#).*

1.1 Diagram of coolant hose connections

1 - Heat exchanger

- ❑ If renewed, refill system with fresh coolant

2 - Coolant pipe (bottom)

- ❑ Removing and installing
⇒ **page 136**

3 - Heating for throttle valve housing

4 - Expansion tank

- ☐ With filler cap
- ☐ Checking pressure relief valve in filler cap
⇒ page 148

5 - Oil cooler

6 - Intake manifold

7 - Coolant hose (bottom)

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8 - Coolant hose (top)

- ❑ Removing and installing
⇒ page 135

9 - Radiator

- ❑ Removing and installing
⇒ page 140
- ❑ If renewed, refill system
with fresh coolant

10 - Coolant pipe (top)

11 - Coolant pump, thermostat

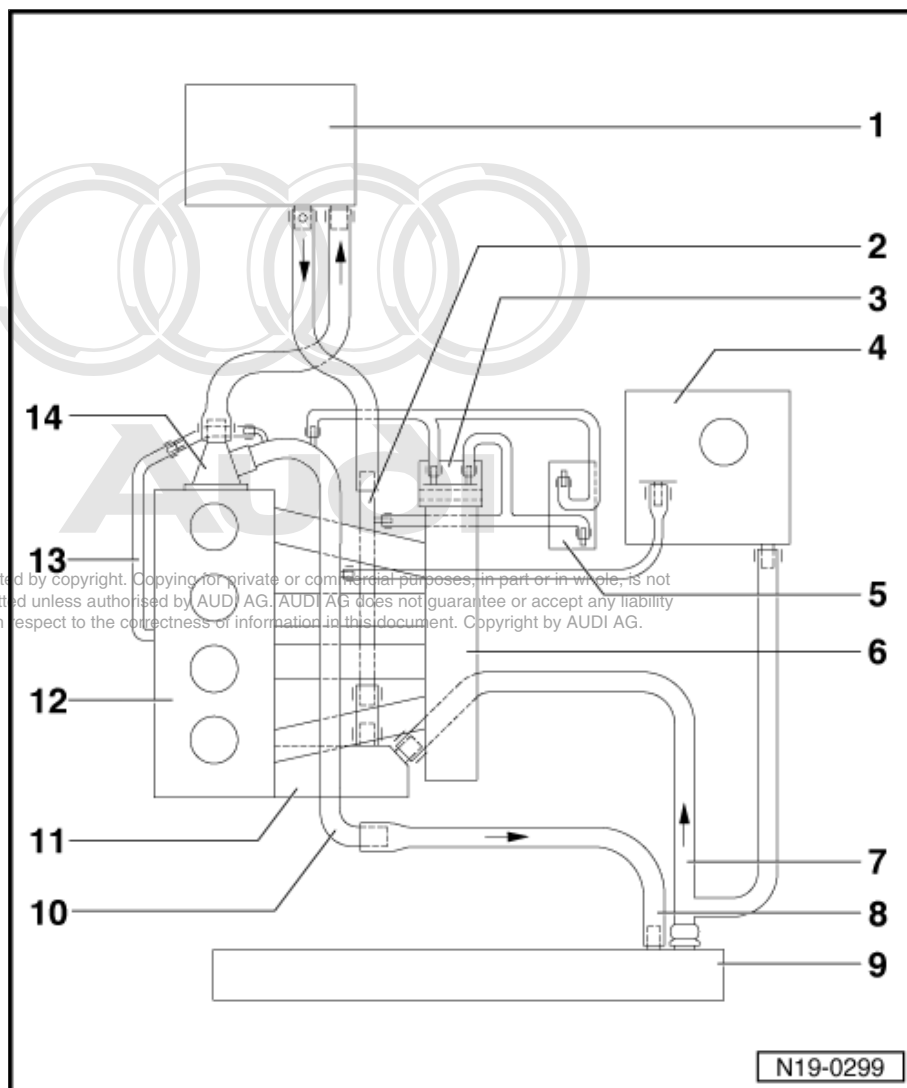
- ❑ Removing and installing coolant pump ⇒ [page 133](#)
- ❑ Removing and installing thermostat ⇒ [page 137](#)
- ❑ Checking thermostat ⇒ [page 139](#)

12 - Cylinder head/cylinder block

- ☐ If renewed, refill system with fresh coolant

13 - Coolant pipe

14 - Connection

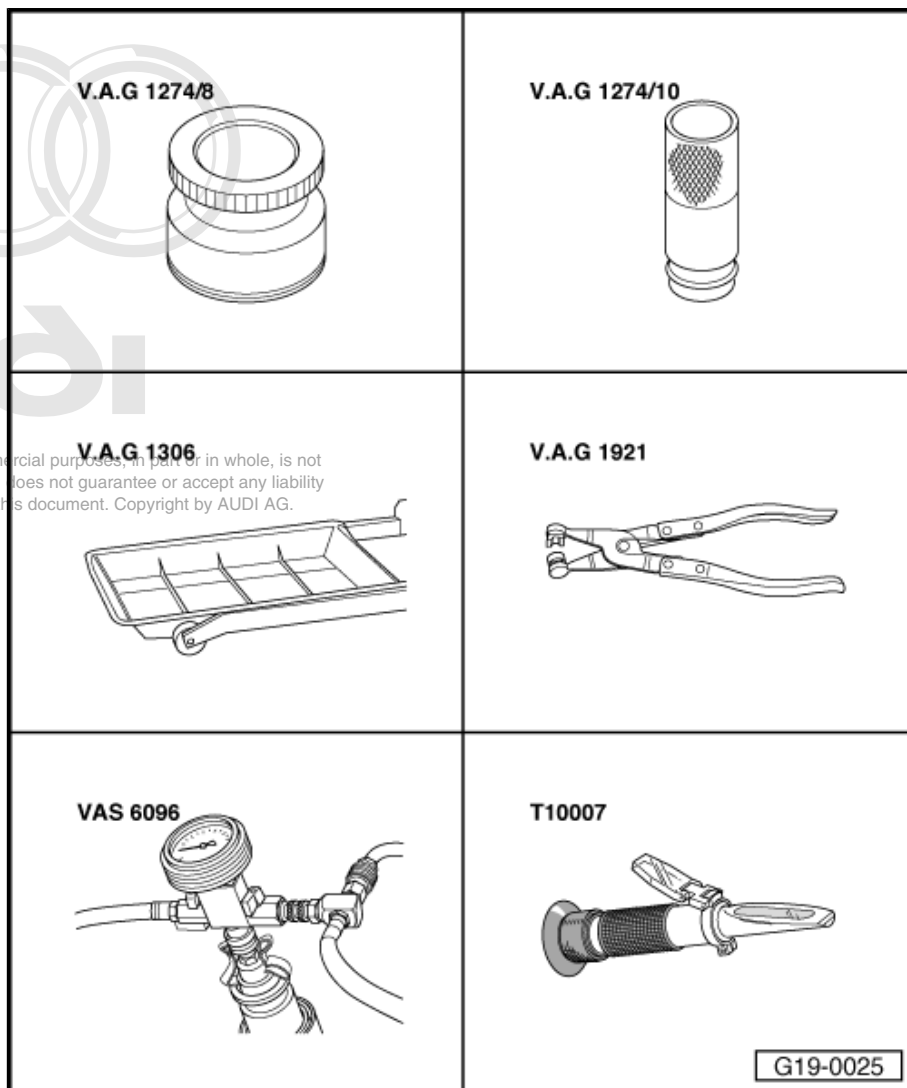


1.2 Draining and filling cooling system

Special tools and workshop equipment required

- ◆ Adapter -V.A.G 1274/8-
- ◆ Pipe -V.A.G 1274/10-
- ◆ Drip tray for workshop hoist -VAS 6208- or -V.A.G 1306-
- ◆ Hose clip pliers - V.A.G 1921-
- ◆ Cooling system charge unit -VAS 6096-
- ◆ Refractometer -T10007-

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Draining



Note

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

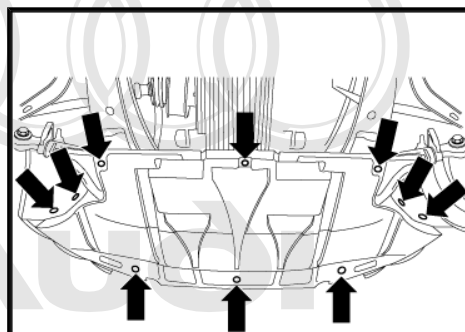


WARNING

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

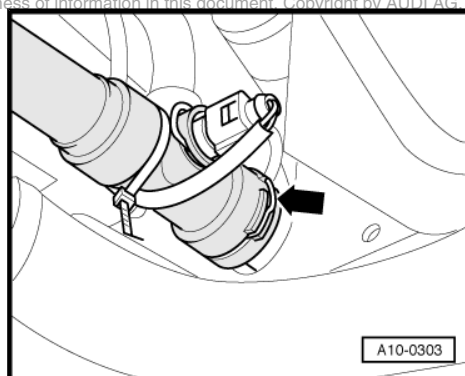
- Open filler cap on coolant expansion tank.

- Remove noise insulation -arrows-.



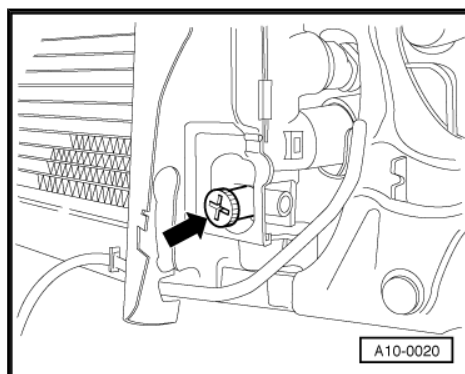
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- Place drip tray for workshop hoist -VAS 6208- under engine.
- Detach coolant hose (bottom) from radiator by releasing retaining clip -arrow-.
- Drain off coolant.

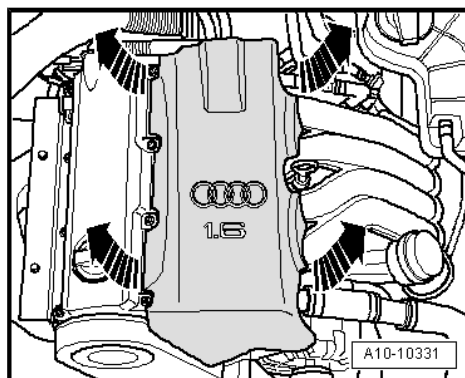


Note

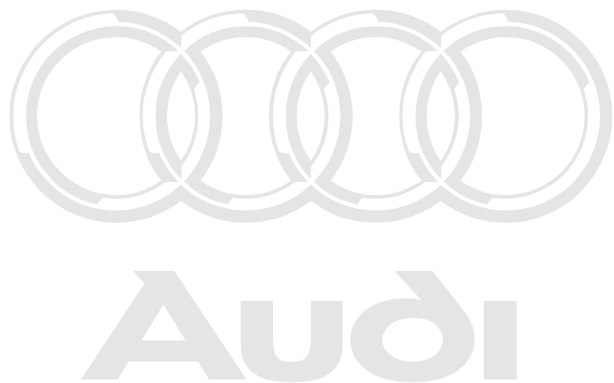
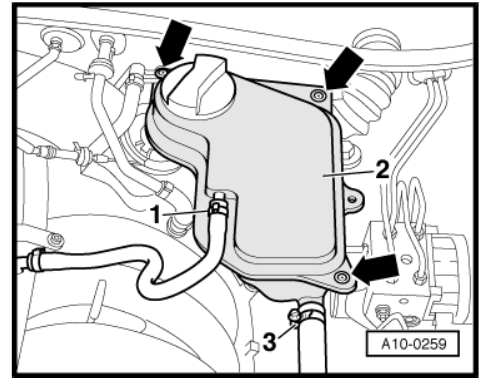
When the bumper is removed the coolant can also be drained from the radiator via the drain plug -arrow-.



- Lift off engine cover -arrows-.



- Unbolt coolant expansion tank -2- -arrows-.
- Unplug electrical wire for coolant shortage indicator switch - F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -3- attached.



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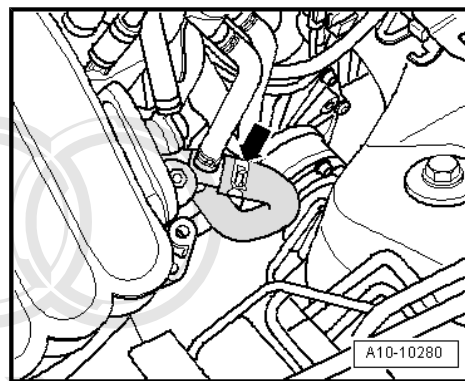
- Disconnect coolant hose leading to oil cooler at the location marked with an -arrow-, and drain off remaining coolant.

Filling



Note

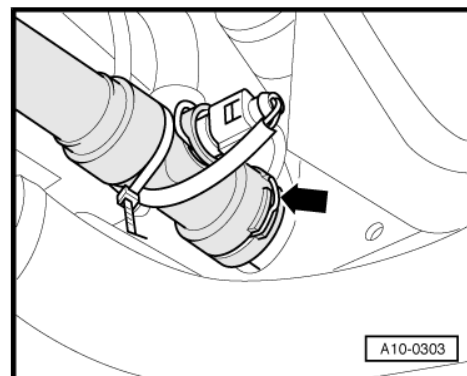
- ◆ The cooling system is filled all year round with a mixture of water and radiator antifreeze/anti-corrosion agent.
- ◆ It is important to use only coolant additive Plus -G 012 A8F A1- (also designated as "G12+") "meeting specification TL VW 774 F". Other coolant additives could seriously impair in particular the anticorrosion properties. The resulting damage could lead to loss of coolant and consequently to serious engine damage.
- ◆ Coolant additive "G12+" may be mixed with additives "G11" and "G12".
- ◆ "G12+" and coolant additives marked "Conforming with specification TL VW 774 F" prevent frost and corrosion damage and stop scale from forming. Such additives also raise the boiling point of the coolant. For these reasons the cooling system must be filled all year round with the correct antifreeze and anticorrosion additive.
- ◆ Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.
- ◆ Frost protection is required down to about -25°C (in countries with arctic climate: down to about -35°C).
- ◆ The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The antifreeze percentage must be at least 40 %.
- ◆ If greater frost protection is required in very cold climates, the proportion of "G12+" can be increased, however only up to 60 % (giving frost protection to about -40°C). If antifreeze concentration exceeds 60%, frost protection is reduced again and cooling efficiency is also impaired.
- ◆ Use only clean tap water for mixing coolant.
- ◆ If radiator, heat exchanger, cylinder head, cylinder head gasket or cylinder block have been renewed, do not re-use old coolant.
- ◆ Contaminated or dirty coolant must not be used again.
- ◆ To check frost protection level of coolant additive "G12+" you must use a refractometer -T10007-.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.



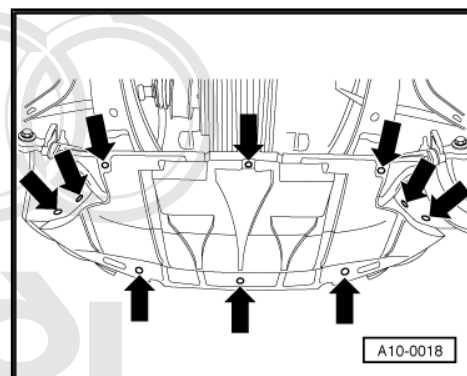
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Procedure

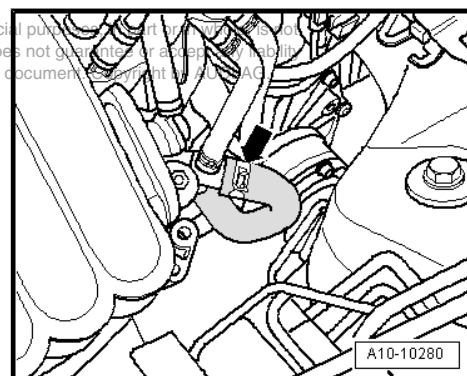
- Connect coolant hose (bottom right) to radiator; retaining clip -arrow- should engage audibly.
- If necessary, close coolant drain plug at coolant hose (bottom) on radiator.



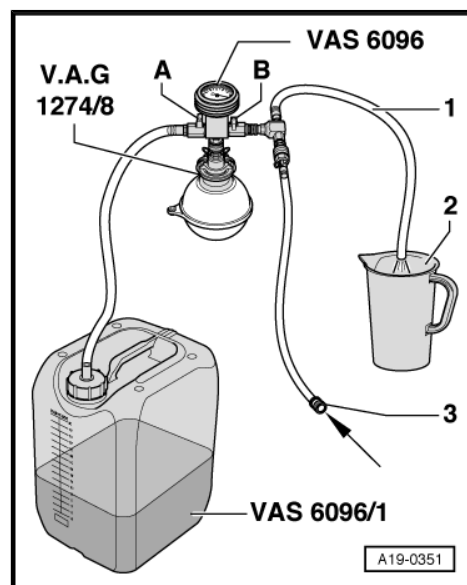
- Install noise insulation -arrows-.



- Connect coolant hose going to oil cooler at the location marked with an -arrow-.
- Install coolant expansion tank.



- Fill reservoir of cooling system charge unit -VAS 6096- with at least 10 litres of premixed coolant (based on recommended ratio):
 - “G12+” (40 %) and water (60 %) for frost protection to –25 °C.
 - “G12+” (50 %) and water (50 %) for frost protection to –35 °C.
 - “G12+” (60 %) and water (40 %) for frost protection to –40 °C.
- Screw adapter for cooling system tester -V.A.G 1274/8- onto coolant expansion tank.
- Attach cooling system charge unit -VAS 6096- onto adapter -V.A.G 1274/8-.
- Run vent hose -1- into a small container -2-. (The vented air draws along a small amount of coolant, which should be collected.)
- Close the two valves -A- and -B- by setting lever at right angle to direction of flow.
- Connect hose -3- to compressed air.
- Pressure: 6 ... 10 bar.



- Open valve -B- by setting lever in direction of flow.

The suction jet pump generates a partial vacuum in the cooling system.

- The needle on the gauge should move into the green zone.
- Also briefly open valve -A- (turn lever in direction of flow) so that hose on charge unit can fill with coolant.
- Close valve -A- again.
- Leave valve -B- open for another 2 minutes.
- The suction jet pump will continue generating a vacuum in the cooling system.
- The needle on the gauge should remain in the green zone.
- Close valve -B-.
- The needle on the gauge should stop in the green zone. The vacuum level in the cooling system is then sufficient for subsequent filling.

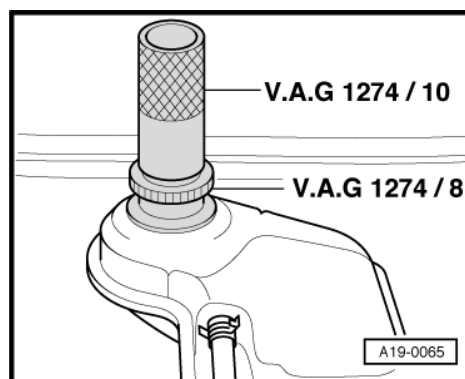
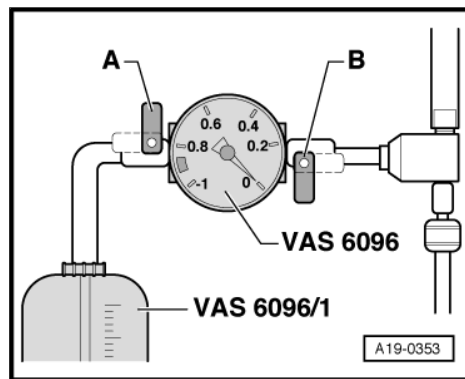
If the needle does not reach the green zone, repeat the process.

If the vacuum level drops, there is a leak in the cooling system.

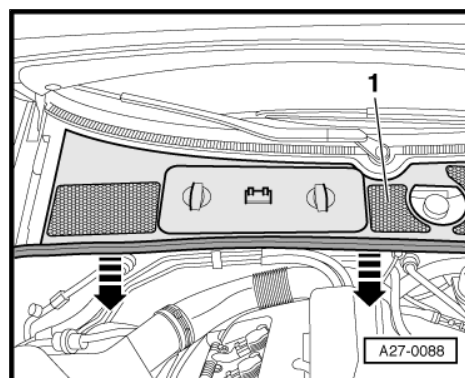
- Detach compressed air hose.
- Open valve -A-.

The vacuum in the cooling system causes the coolant to be drawn out of the cooling system charge unit -VAS 6096- ; the cooling system is then filled.

- Detach cooling system charge unit -VAS 6096- from expansion tank.
- Fit pipe -V.A.G 1274/10- onto adapter -V.A.G 1274/8- .

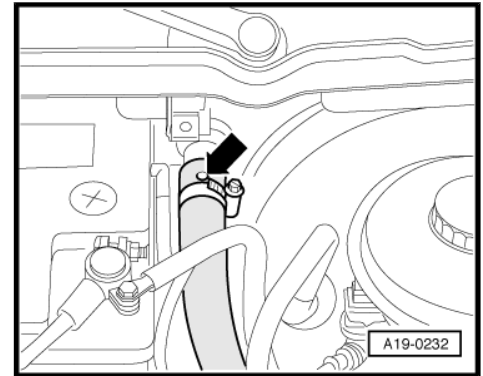


- Detach rubber seal from plenum chamber cover in direction of -arrow-.
- Detach plenum chamber cover -1-.



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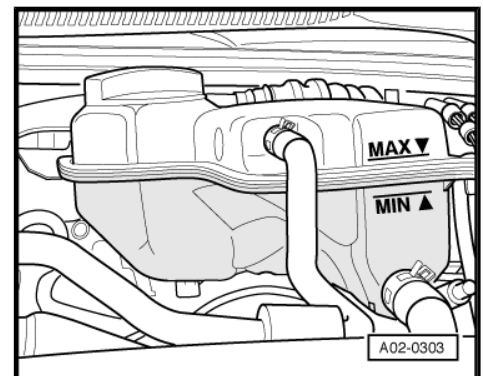
- Loosen coolant hose going to heat exchanger and pull back hose until bleeder hole in hose -arrow- is no longer blocked by the connection.
- Fill up with coolant until it flows out at bleeder hole in coolant hose.
- Push coolant hose onto connection and secure with hose clip.
- On vehicles with auxiliary heater, switch heater on (for about 30 seconds) and then off again.
- Tighten filler cap on expansion tank.
- Start engine.
- Set heater/air conditioner to "HI".
- Run the engine for 3 minutes at 2000 rpm.
- Allow the engine to run at idling speed until the two large coolant hoses at main radiator become warm.
- Run the engine for 1 minute at 2000 rpm.
- Switch off ignition and allow to cool down.



WARNING

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

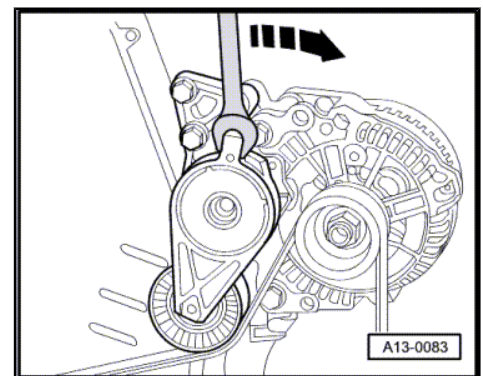
- Check coolant level.
- The coolant level must be at the MAX marking when the engine is cold.
- The coolant level can be above the MAX marking when the engine is warm.



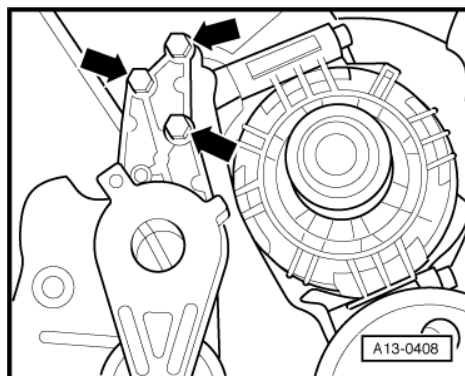
1.3 Removing and installing coolant pump

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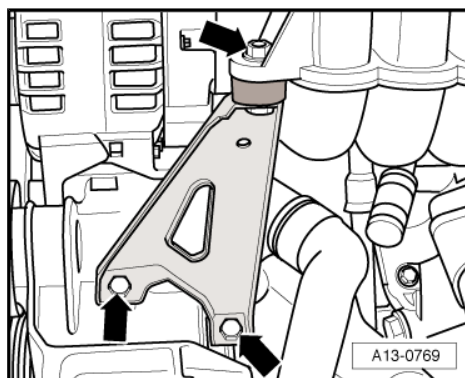
- Drain off coolant → [page 127](#)
- Turn the tensioner in the direction of the -arrow- to slacken the poly V-belt.
- Remove poly V-belt from alternator pulley and release pressure from the tensioner.



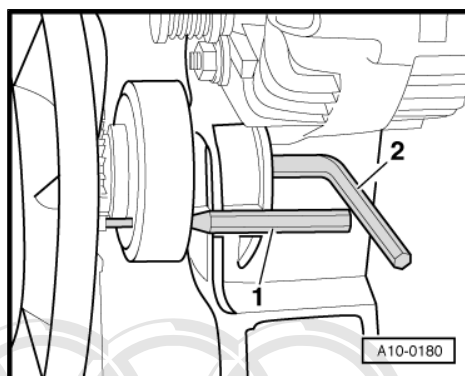
- Unscrew poly V-belt tensioner -arrows-.



- Remove intake manifold support -arrows-.



- Unscrew viscous fan pulley using Allen key -2- and at the same time counterhold with roll-pin drift -1-.
- Detach viscous fan from bearing and lay it forwards in radiator cowl.



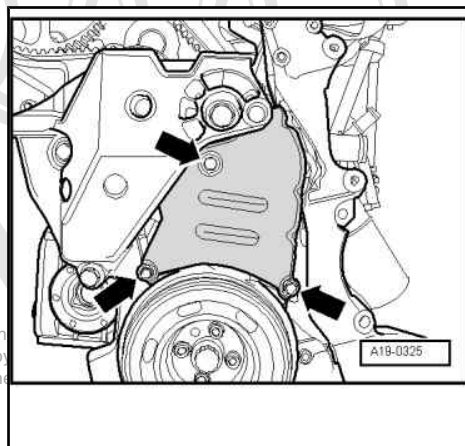
- Remove toothed belt from camshaft sprocket ⇒ [page 40](#) .
- Remove toothed belt cover (centre) -arrows-.



Note

- ◆ The belt pulley and toothed belt cover (bottom) do not have to be removed.
- ◆ The toothed belt should be left in position on the crankshaft sprocket.
- ◆ Before removing coolant pump, cover toothed belt with a cloth to protect against coolant.

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- Remove bolts -1- and detach coolant pump -2-.
- Remove O-ring -3-.

Installing

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



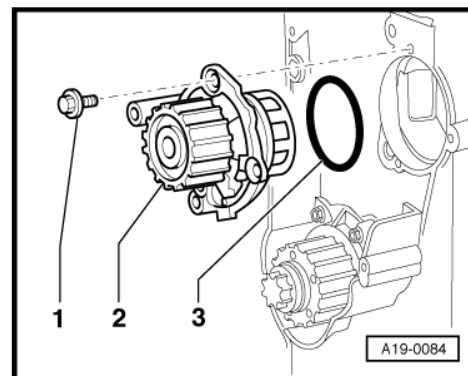
Note

Renew O-ring.

- Clean and smoothen sealing surface for O-ring as required.
- Lubricate new O-ring -3- with coolant additive “G12+”.
- Fit coolant pump -2-.
- Installation position: Sealing plug in housing faces downwards.
- Fit toothed belt (adjust valve timing) ⇒ [page 42](#) .
- Install poly V-belt ⇒ [page 24](#) .
- Fill cooling system ⇒ [page 130](#) .

Tightening torques

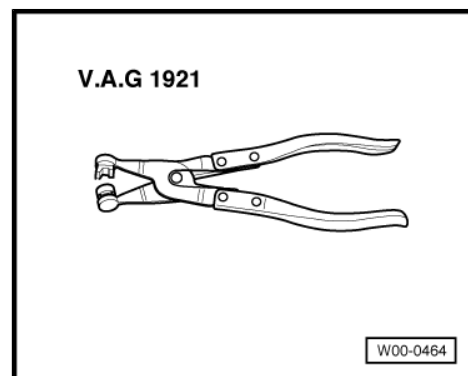
Component	Nm
Coolant pump to cylinder block	15
Toothed belt cover (centre) to cylinder block	10 ¹⁾
Tensioner for poly V-belt to bracket for ancillaries	23
Support for intake manifold to intake manifold	20
engine	20
Viscous fan to bearing	45
• ¹⁾ Install using locking fluid; locking fluid ⇒ Parts catalogue .	



1.4 Removing and installing coolant pipe (top)

Special tools and workshop equipment required

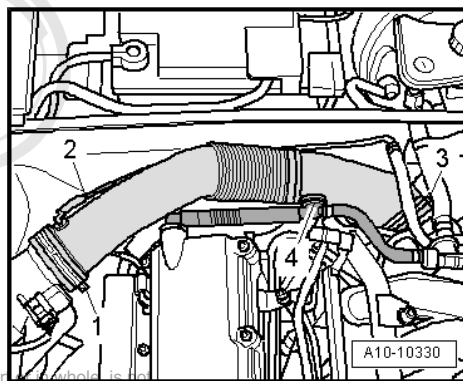
- ◆ Hose clip pliers -V.A.G 1921-



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Removing

- Drain off coolant ⇒ [page 127](#) .
- Detach hose -2- leading to exhaust gas recirculation valve - N18- .
- Detach crankcase breather hose -4- from air pipe.
- Remove air pipe by releasing hose clips -1- and -3-.



- Move electrical wiring clear of coolant pipe (top).
- Unscrew bolts -1- and -2- and remove coolant pipe (top) from coolant hoses -arrows-.

Installing

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



Note

Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ *Parts catalogue*.

- Fill cooling system ⇒ [page 130](#) .

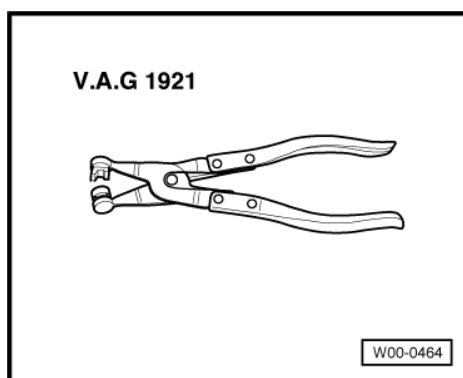
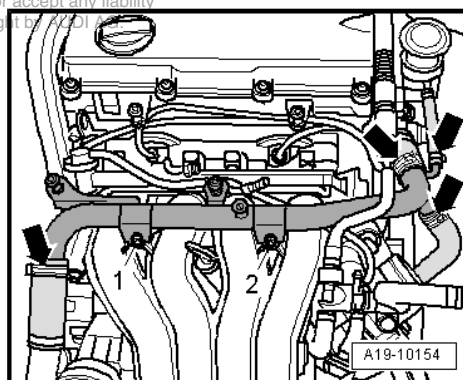
Tightening torque

Component	Nm
Coolant pipe (top) to intake manifold	10

1.5 Removing and installing coolant pipe (bottom)

Special tools and workshop equipment required

- ◆ Hose clip pliers -V.A.G 1921-



Removing

- Drain off coolant ➔ [page 127](#) .
- Remove intake manifold (top section) ➔ [page 83](#) .
- Move wiring clear of bottom coolant pipe.
- Disengage retaining clip on connecting flange to detach coolant hose going to heat exchanger at rear of coolant pipe -2-.
- Detach coolant hose -4- going to oil cooler from coolant pipe.
- Remove bolt -3-.
- Push coolant pipe to rear and detach.
- Remove plug -5- if necessary.

Installing

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



Note

- ◆ *Renew O-rings.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ➔ Parts catalogue.*
- Clean and smoothen sealing surface for O-ring as required.
- Moisten new O-ring with coolant additive "G12+".
- Push coolant pipe into bore on cylinder block.
- Install intake manifold (top section) ➔ [page 83](#) .
- Fill cooling system ➔ [page 130](#) .

Tightening torques

Component	Nm
Coolant pipe to oil filter bracket	20
Screw-type clips for coolant hoses	2

1.6 Removing and installing thermostat

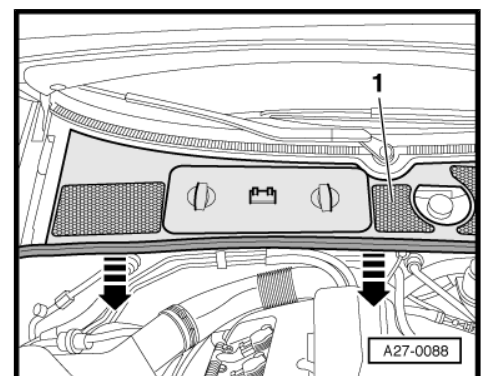
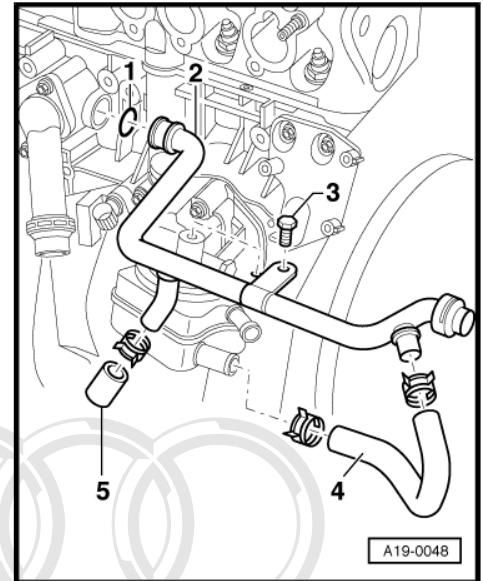
Removing



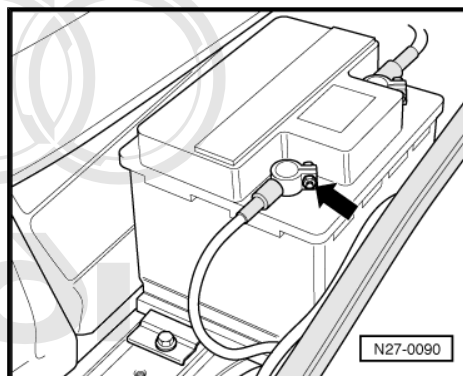
Caution

Observe notes on procedure for disconnecting the battery ➔ Rep. Gr. 27.

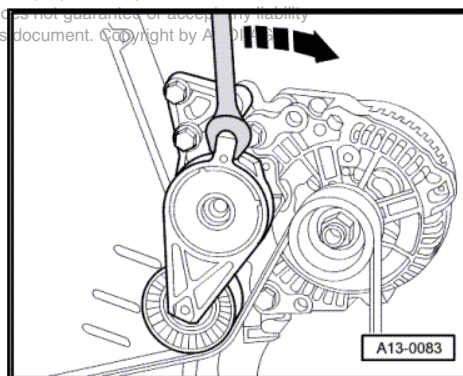
- Detach rubber seal from plenum chamber cover in direction of -arrow-.
- Detach plenum chamber cover -1- towards the front.



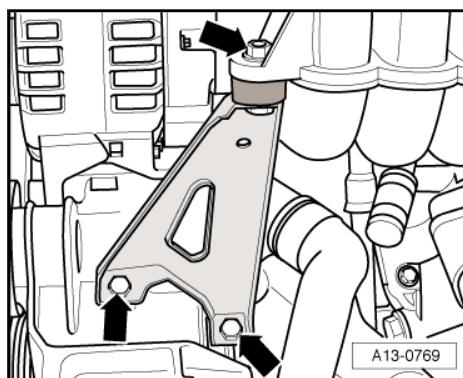
- With ignition switched off, disconnect battery earth cable -arrow-.



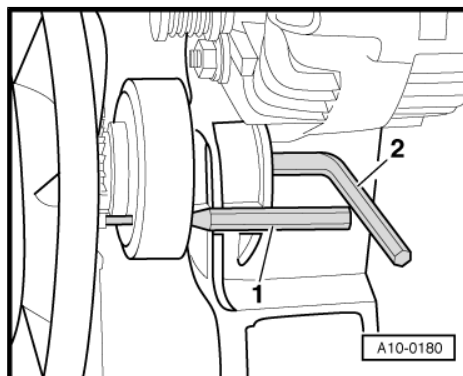
- Turn the tensioner in the direction of the arrow to slacken the poly V-belt.
- Remove poly V-belt from alternator pulley and release pressure from the tensioner.



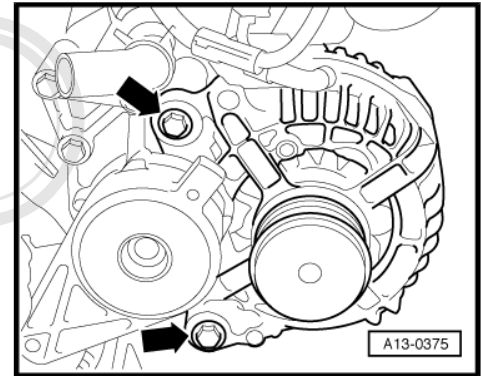
- Remove intake manifold support -arrows-.



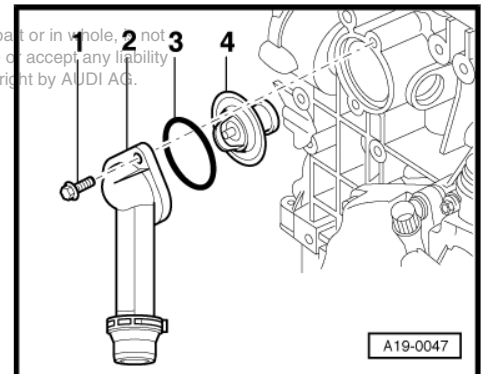
- Unscrew viscous fan pulley using Allen key -2- and at the same time counterhold with roll-pin drift -1-.
- Detach viscous fan from bearing and lay it forwards in radiator cowl.



- Unscrew bolts -arrows-.
- Detach alternator and move it clear to the front. Leave wiring connected.



- Drain off coolant ➔ [page 127](#).
- Release retaining clip and detach coolant hose from connection -2-.
- Remove bolts -1- and detach hose connection -2-, O-ring -3- and thermostat -4-.



Installing

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



Renew O-ring.

- Clean and smoothen sealing surface for O-ring as required.
- Insert thermostat.
- Installation position: Cross-piece on thermostat should be vertical.
- Moisten new O-ring with coolant additive "G12+".
- Install alternator ➔ Rep. Gr. 27.
- Observe notes on procedures required after connecting battery ➔ Rep. Gr. 27.
- Fill cooling system ➔ [page 130](#).

Tightening torques

Component	Nm
Hose connection to cylinder block	15
Support for intake manifold to intake manifold	20
engine	20
Viscous fan to bearing	45

1.7 Checking thermostat

- Heat up the removed thermostat in hot water.

Starts to open	Fully open	Opening travel
approx. 87 °C	approx. 102 °C ¹⁾	at least 8 mm
• ¹⁾ Cannot be tested.		

1.8 Radiator and radiator fan - exploded view of components

1 - Radiator

- ☐ Removing and installing
⇒ [page 140](#)
- ☐ If renewed, change
coolant in entire system

2 - Clip

3 - Mounting for radiator

- ☐ Note installation position

4 - Coolant hose (top)

5 - Rubber washer

6 - Radiator fan -V7-

- ☐ Depending on equipment

7 - Fan ring

8 - 10 Nm

9 - 10 Nm

10 - Electrical connector

11 - Coolant hose (bottom)

- ☐ Going to hose connection for thermostat and coolant expansion tank

12 - O-ring

- ☐ Renew

13 - Electrical connector

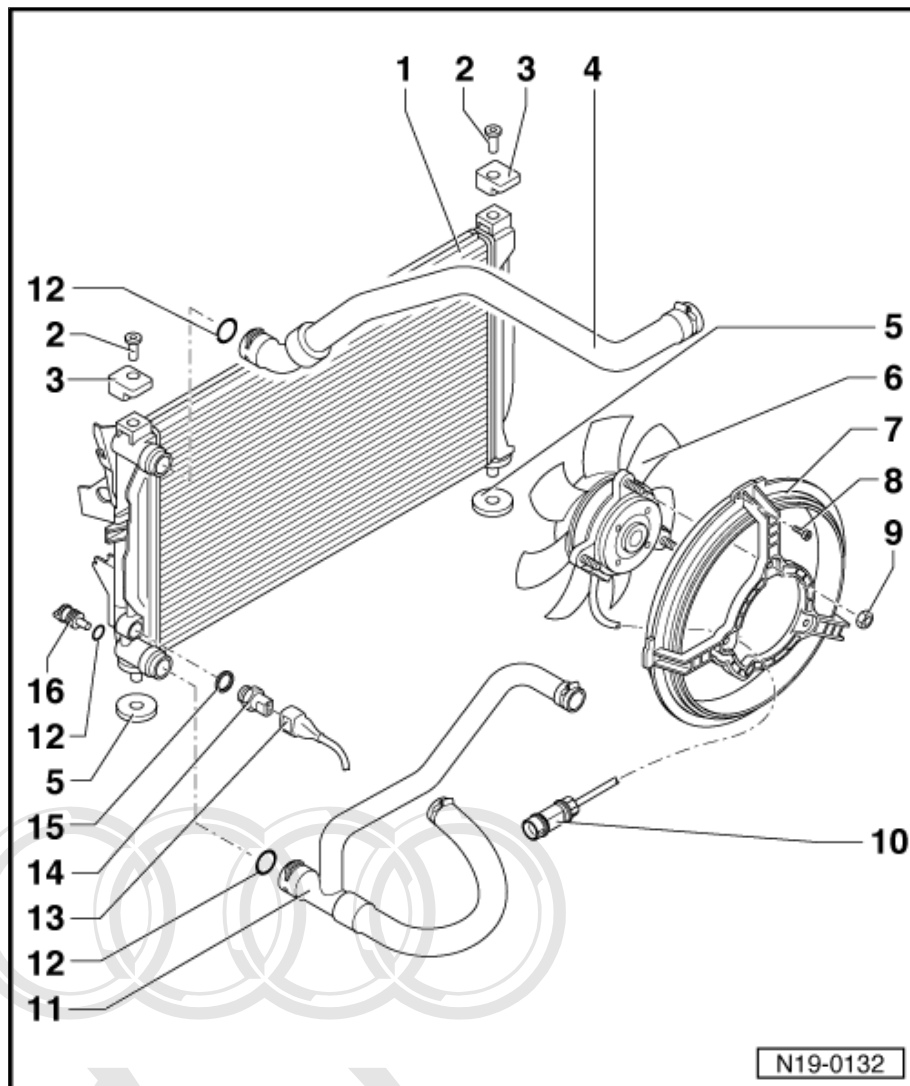
14 - Radiator fan thermal switch -F18-

- ☐ Switching temperatures: Stage 1 on: 92 ... 97 °C/ off: 84 ... 91 °C
- ☐ Switching temperatures: Stage 2 on: 99 ... 105 °C/ off: 91 ... 98 °C
- ☐ Tighten to 35 Nm

15 - Seal

- ☐ Renew

16 - Drain plug, 10 Nm

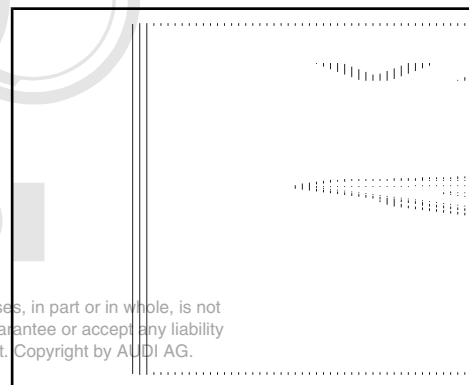


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1.9 Removing and installing radiator

Special tools and workshop equipment required

◆ Drip tray for workshop hoist -VAS 6208-



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Removing



Note

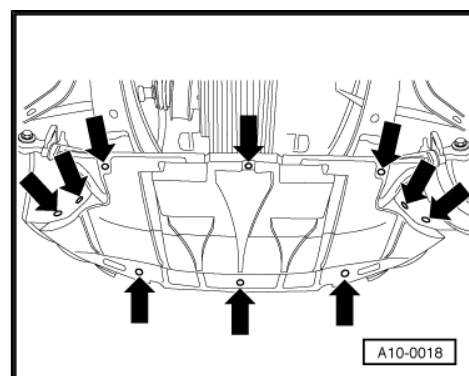
Collect drained coolant in a clean container for re-use or disposal.



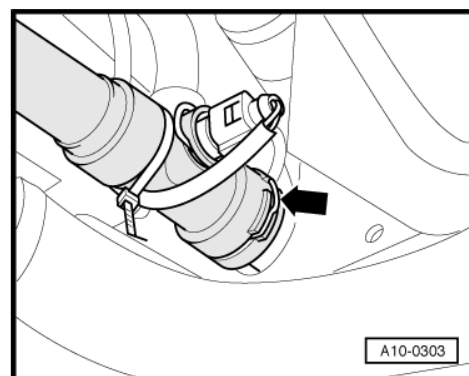
WARNING

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

- Open filler cap on coolant expansion tank.
- Remove noise insulation -arrows-.
- Remove front bumper ⇒ Rep. Gr. 63 .



- Place drip tray for workshop hoist -VAS 6208- under engine.
- Detach coolant hose (bottom) from radiator by releasing retaining clip -arrow-.



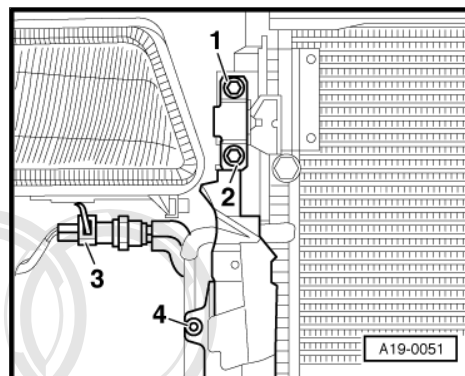
Vehicles with air conditioning:

- Remove air ducts -4- (left and right) from radiator.
- Unplug electrical connector -3- at air conditioner pressure switch -F129- .
- Unscrew securing bolts -1- and -2- for condenser.



WARNING

The air conditioner refrigerant circuit must not be opened.



Note

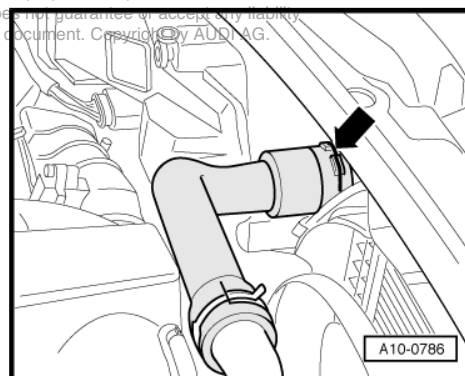
To prevent damage to the refrigerant lines, ensure that the pipes and hoses are not stretched, kinked or bent.

- Pivot condenser downwards with pipes/hoses attached.

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All vehicles:

- Detach coolant hose (top) from radiator by releasing retaining clip -arrow-.

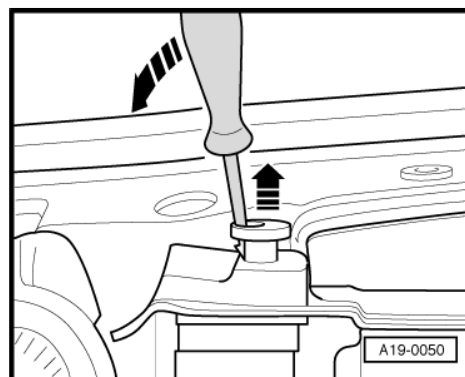


- Release two retaining pins for radiator and pull out upwards -arrows-.
- Swivel radiator forwards and lift off.

Installing

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

- Install front bumper ⇒ Rep. Gr. 63 .
- Fill cooling system ⇒ [page 130](#) .



Note

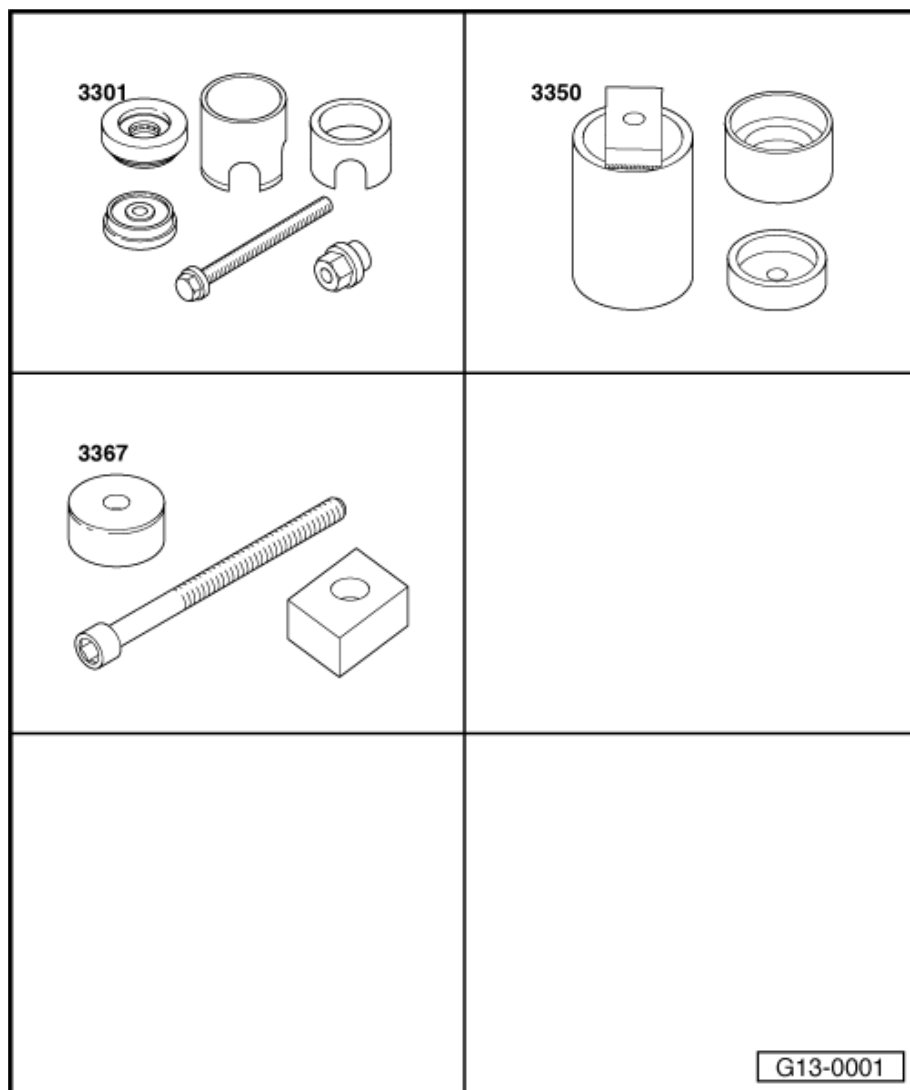
The coolant in the entire system must be changed if the radiator is renewed.

Tightening torques

Component	Nm
Condenser to lock carrier	4
Power steering cooling pipe to lock carrier	9

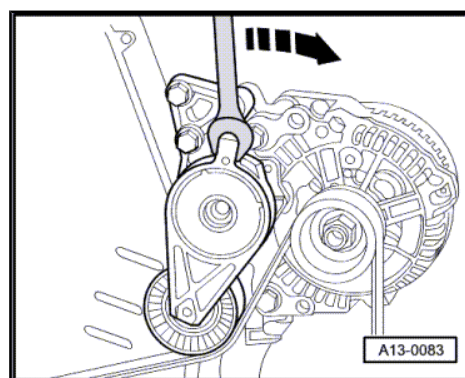
Special tools and workshop equipment required

- ◆ Assembly tool -3301-
- ◆ Assembly tool -3350-
- ◆ Viscous fan fitting tool -3367-



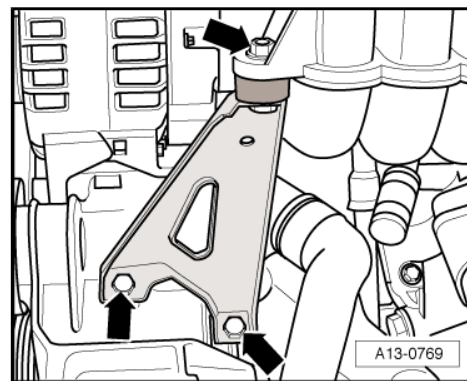
Removing

- Move lock carrier to service position ⇒ Rep. Gr. 50 .
- Turn the tensioner in the direction of the -arrow- to slacken the poly V-belt.
- Remove poly V-belt from alternator pulley and release pressure from the tensioner.

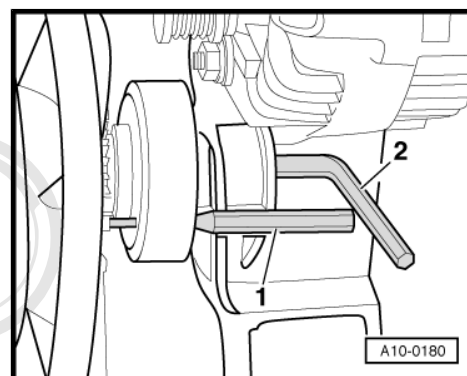


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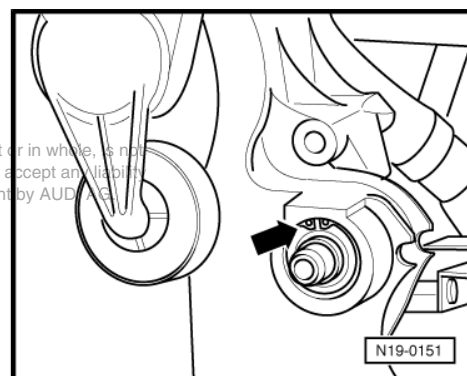
- Remove intake manifold support -arrows-.



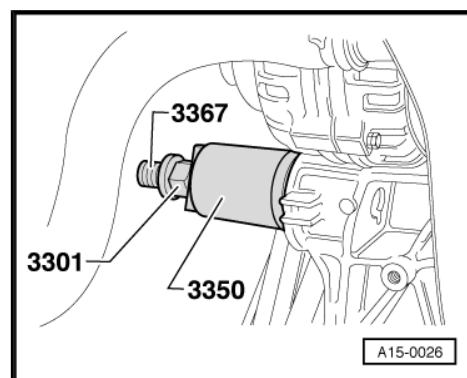
- Unscrew viscous fan pulley using Allen key -2- and at the same time counterhold with roll-pin drift -1-.
- Take out viscous fan.



- Use angled circlip pliers to remove circlip -arrow- from bearing bush.



- Pull bearing out of bush using nut from assembly tool -3301- , bolt from viscous fan fitting tool -3367/3- and assembly tool -3350- .

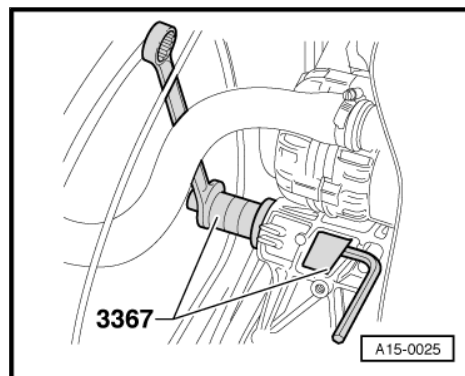


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Installing

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

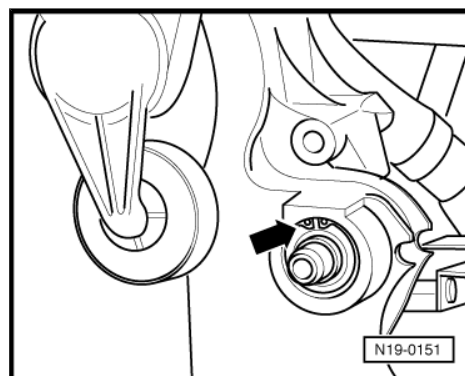
- Press bearing in, using viscous fan fitting tool -3367- and nut from assembly tool -3301- .



- Use angled circlip pliers to install circlip -arrow- in bracket for viscous fan.
- Install poly V-belt ⇒ [page 24](#) .
- Install lock carrier with attachments ⇒ Rep. Gr. 50 .

Tightening torques

Component		Nm
Support for intake manifold to	intake manifold	20
	engine	20
Viscous fan to bearing		45

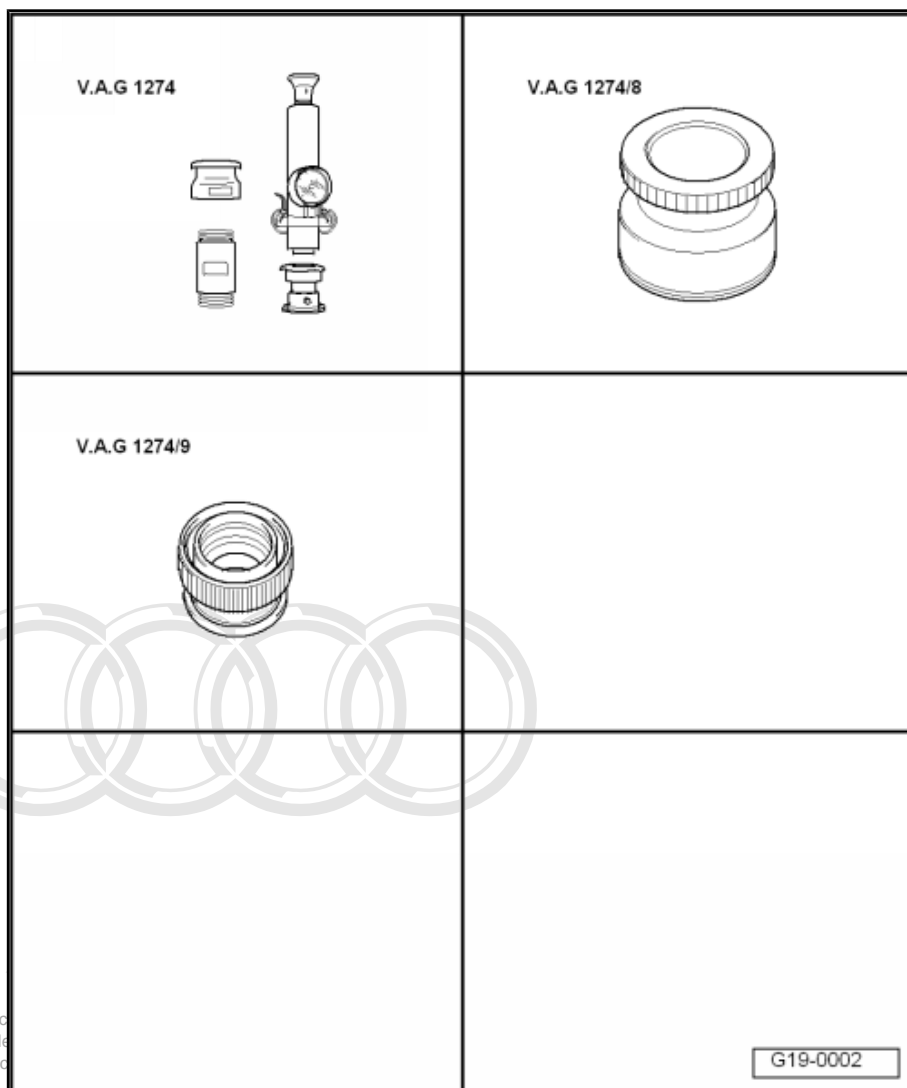


1.12 Checking cooling system for leaks

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Special tools and workshop equipment required

- ◆ Cooling system tester - V.A.G 1274-
- ◆ Adapter for cooling system tester -V.A.G 1274/8-
- ◆ Adapter for cooling system tester -V.A.G 1274/9-



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G19-0002

Procedure

- Engine must be warm.

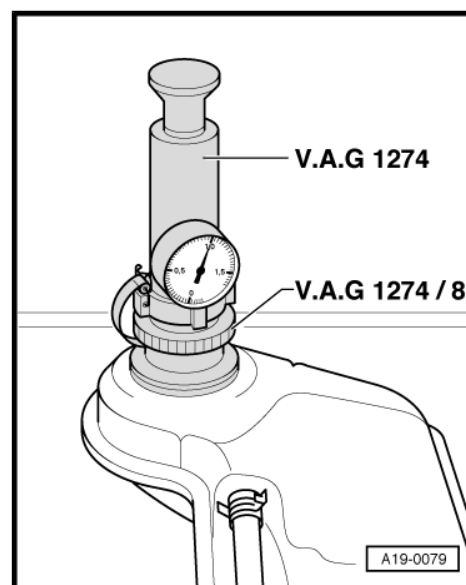
**WARNING**

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

- Open filler cap on coolant expansion tank.
- Attach cooling system tester -V.A.G 1274- with adapter - V.A.G 1274/8- to expansion tank.
- Use hand pump on cooling system tester to create a pressure of approx. 1.0 bar.

If the pressure drops:

- Trace leak and repair.

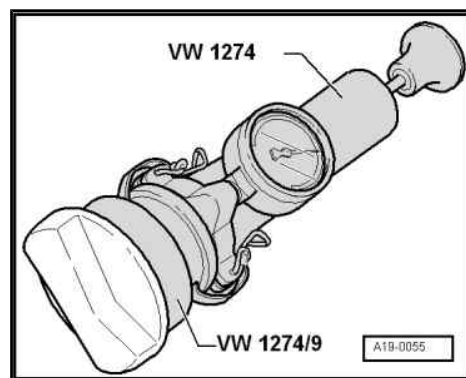


Checking pressure relief valve in filler cap

- Attach cooling system tester -V.A.G 1274- with adapter - V.A.G 1274/9- to filler cap.
- Use hand pump on cooling system tester to create pressure.
- The pressure relief valve should open at a pressure of 1.4 ... 1.6 bar.

If the relief valve does not open as described:

- Renew filler cap.



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26 – Exhaust system

1 Removing and installing parts of exhaust system

Note

- ◆ Renew gaskets and self-locking nuts.
- ◆ After working on the exhaust system, ensure that the system is not under stress and that it has sufficient clearance from the body. If necessary, loosen clamp and align silencers and exhaust pipe so that sufficient clearance is maintained to the body at all points and the mountings are evenly loaded.
- ◆ To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.

1.1 Exhaust system - exploded view of components

1 - 40 Nm

2 - Clamp (rear)

- ☐ For separate replacement of centre and rear silencers
- ☐ Before tightening, align exhaust system so it is free of stress
⇒ [page 160](#)
- ☐ Installation position of bolts ⇒ [page 151](#)
- ☐ Tighten bolt connections evenly

3 - 25 Nm

4 - Mounting

- ☐ Renew if damaged

5 - Stop plate

6 - 25 Nm

7 - 25 Nm

- ☐ Renew

8 - 30 Nm

- ☐ Renew

9 - Gasket

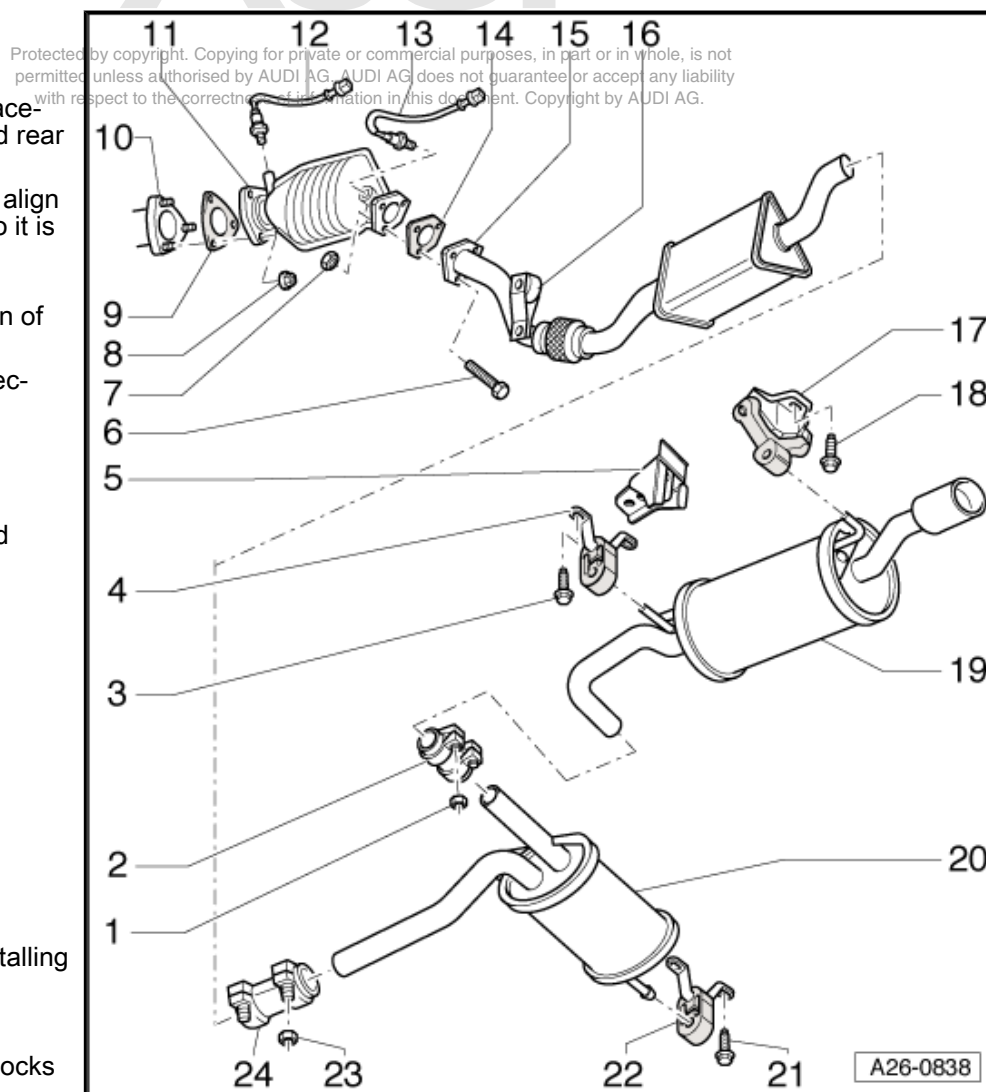
- ☐ Renew

10 - Exhaust manifold

- ☐ Removing and installing
⇒ [page 157](#)

11 - Catalytic converter

- ☐ Protect against knocks and impact
- ☐ Removing and installing ⇒ [page 154](#)



12 - Lambda probe -G39- (before catalytic converter)

- ☐ Threads of new Lambda probes are already greased with assembly paste; the paste must not get into the slots on the probe body
- ☐ When re-using the old Lambda probe, grease thread with high-temperature lubricant; the paste must not get into the slots of the probe body; High-temperature lubricant ⇒ Parts catalogue
- ☐ Removing and installing ⇒ Rep. Gr. 24
- ☐ Tighten to 55 Nm

13 - Lambda probe after catalytic converter -G130-

- ☐ Threads of new Lambda probes are already greased with assembly paste; the paste must not get into the slots on the probe body
- ☐ When re-using the old Lambda probe, grease thread with high-temperature lubricant; the paste must not get into the slots of the probe body; High-temperature lubricant ⇒ Parts catalogue
- ☐ Removing and installing ⇒ Rep. Gr. 24
- ☐ Tighten to 55 Nm

14 - Gasket

- ☐ Renew

15 - Front exhaust pipe with front silencer

- ☐ With flexible joint
- ☐ Do not bend flexible joint more than 10° - otherwise it can be damaged
- ☐ Removing and installing ⇒ [page 153](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 160](#)

16 - Mounting

- ☐ Mounting components ⇒ [page 151](#)

17 - Mounting

- ☐ Renew if damaged

18 - 25 Nm**19 - Rear silencer**

- ☐ Combined in one unit with centre silencer as original equipment. Can be renewed individually for repair purposes
- ☐ Cutting point ⇒ [page 152](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 160](#)

20 - Centre silencer

- ☐ Combined in one unit with rear silencer as original equipment. Can be renewed individually for repair purposes
- ☐ Cutting point ⇒ [page 152](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 160](#)

21 - 25 Nm**22 - Mounting**

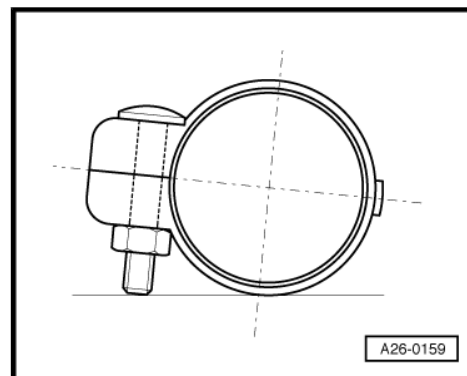
- ☐ Renew if damaged

23 - 40 Nm**24 - Clamp (front)**

- ☐ Before tightening, align exhaust system so it is free of stress ⇒ [page 160](#)
- ☐ Installation position of bolts ⇒ [page 151](#)
- ☐ Tighten bolt connections evenly

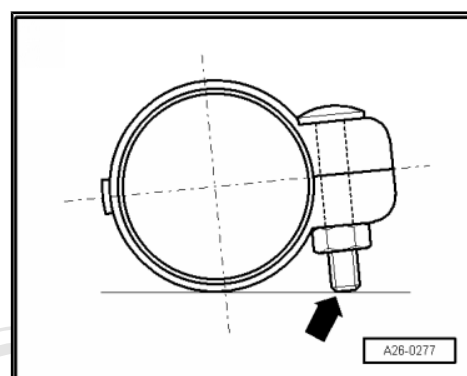
Installation position of front clamp

- Install clamp so that ends of bolts do not protrude beyond bottom of clamp.
- Bolt connection faces to left.



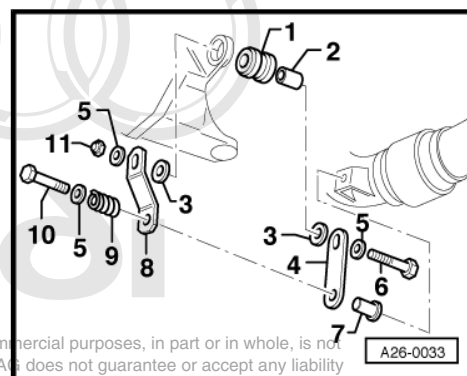
Installation position of rear clamp

- When fitting clamp, make sure ends of bolts do not project below bottom of clamp -arrow-.
- Bolt connection faces to rear



Mounting components

- 1 - Buffer
- 2 - Spacer
- 3 - Washer
- 4 - Bracket (right-side)
- 5 - Washer
- 6 - Bolt, 25 Nm
- 7 - Spacer sleeve
- 8 - Bracket (left-side)
- 9 - Compression spring
- 10 - Bolt, 25 Nm
- 11 - Nut, self-locking, 25 Nm



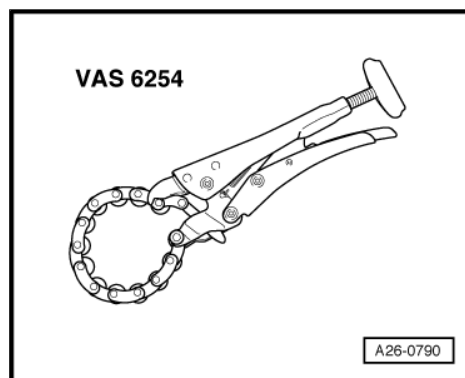
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1.2 Separating centre and rear silencers

- ◆ The connecting pipe can be cut through at the cutting point provided in order to renew the centre and rear silencers separately.
- ◆ Cutting location is marked by an indentation on circumference of exhaust pipe.

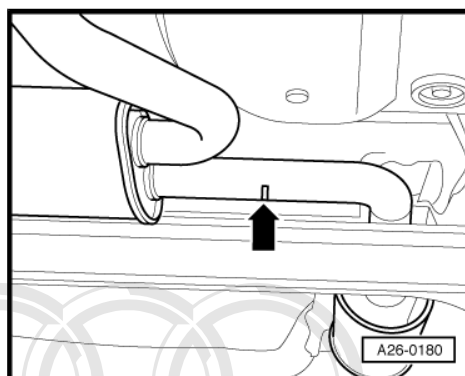
Special tools and workshop equipment required

◆ Chain-type pipe cutter -VAS 6254-

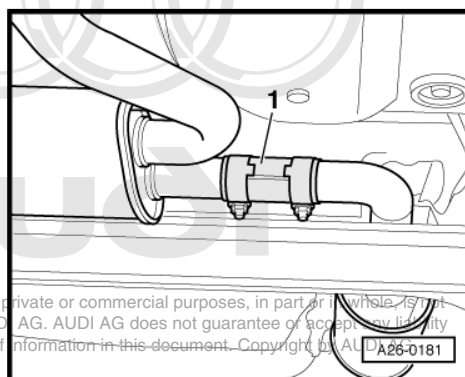


Procedure

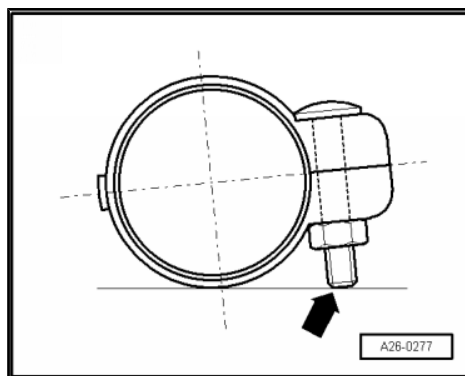
- Cut through exhaust pipe at a right angle at cutting point -arrow- using chain-type pipe cutter -VAS 6254- .



- When reassembling, position the clamp -1- centrally over the cutting point.



- When fitting clamp, make sure ends of bolts do not project below bottom of clamp -arrow-.
- Bolt connection faces to rear
- Align exhaust system free of stress ⇒ [page 160](#) .



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1.3 Removing and installing front exhaust pipe

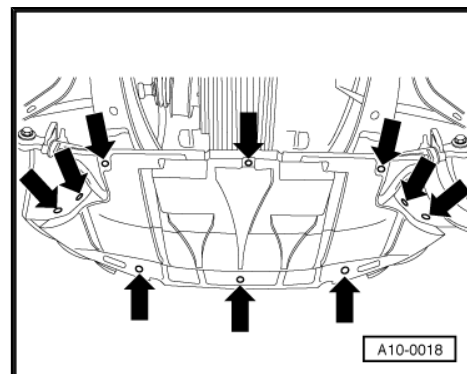
Removing



Note

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

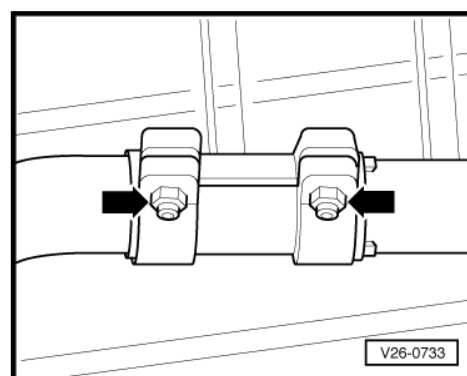
- Remove noise insulation -arrows-.



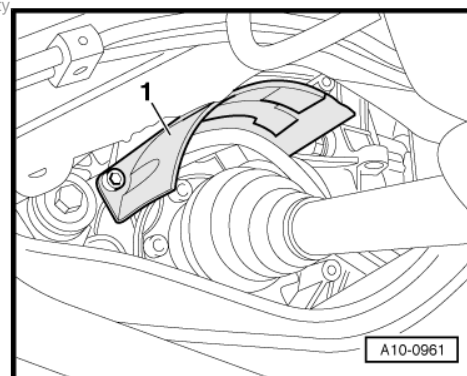
Note

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

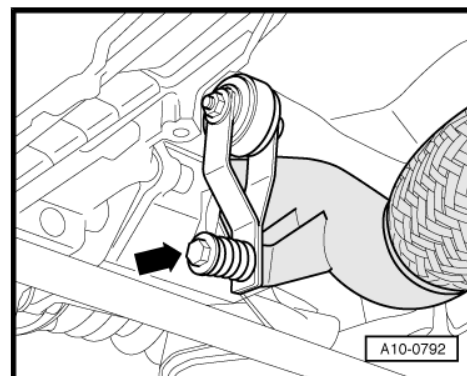
- Separate exhaust system at clamp -arrows-.



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



- Unbolt bracket for exhaust system -arrow-.



- Remove bolts -arrows- securing front exhaust pipe to catalytic converter.
- Detach front exhaust pipe from catalytic converter.

Installing

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



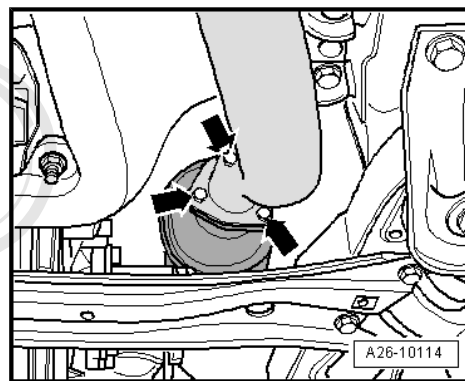
Note

Renew gaskets and self-locking nuts.

- Align exhaust system free of stress ⇒ [page 160](#).

Tightening torques

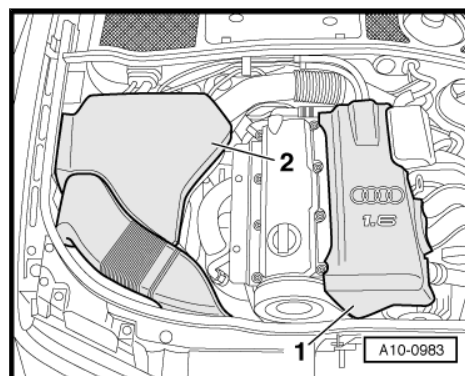
Component		Nm
Front exhaust pipe to	catalytic converter	25 ¹⁾
	bracket for front exhaust pipe	25
Drive shaft heat shield to gearbox		23
• ¹⁾ Renew self-locking nuts.		



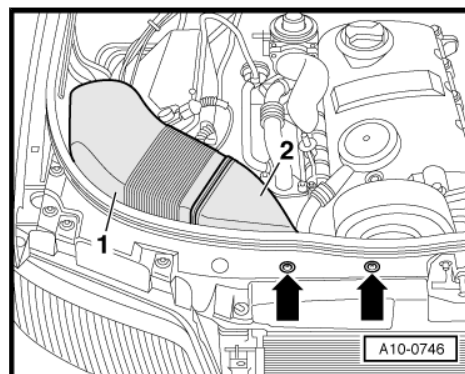
1.4 Removing and installing front exhaust pipe with catalytic converter

Removing

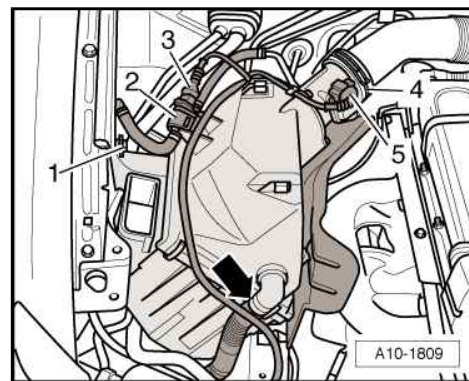
- Remove engine cover panel -1-.
- Remove air cleaner cover -2-.



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



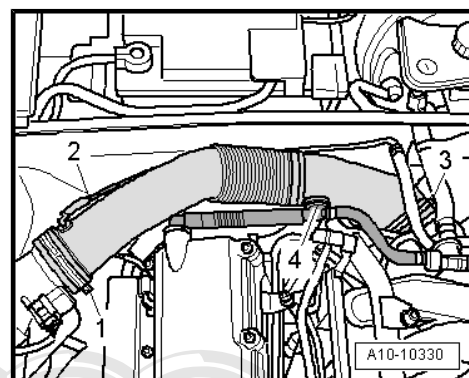
- Unplug electrical connectors -3- and -5- for active charcoal filter system solenoid valve 1 -N80- and air mass meter -G70- .
- Detach active charcoal filter system solenoid valve 1 -N80- -item 2- from air cleaner housing.
- Disconnect hose connection going to secondary air pump -arrow-.
- Release hose clip -4- for air pipe at air mass meter.
- Unscrew bolt -1- and remove air cleaner housing.



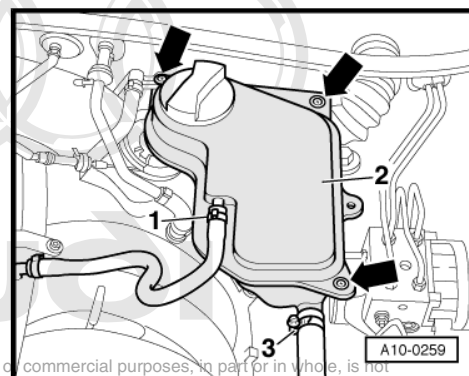
- Detach hose -2- leading to exhaust gas recirculation valve - N18- .
- Detach crankcase breather hose -4- from air pipe.
- Loosen hose clip -3- to remove air pipe.

**Note**

Disregard -item 1-.



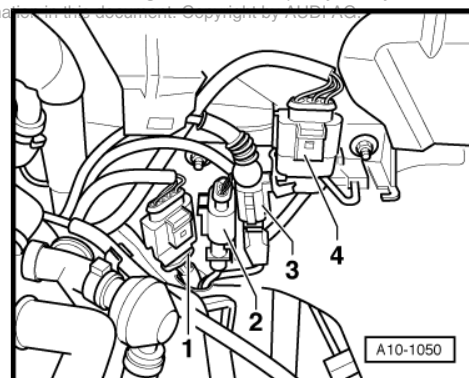
- Unbolt coolant expansion tank -2- -arrows-.
- Unplug electrical wire for coolant shortage indicator switch - F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -3- attached.



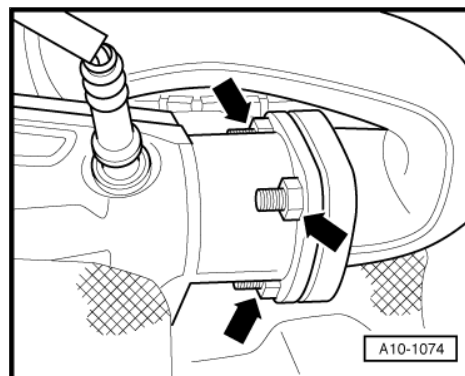
- Unplug electrical connectors -1- for Lambda probe after catalytic converter -G130- and -4- for Lambda probe -G39- .
- Move wires clear towards bottom of vehicle.

**Note**

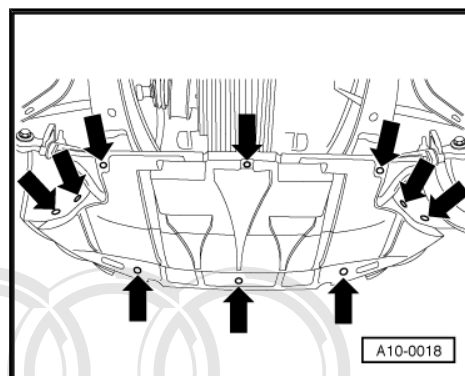
Disregard items marked -2- and -3-.



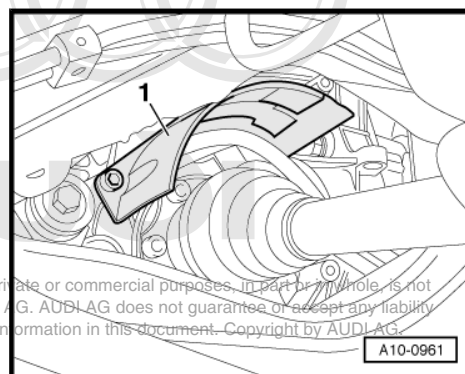
- Unscrew nuts -arrows- of bolt connection at catalytic converter/exhaust manifold.



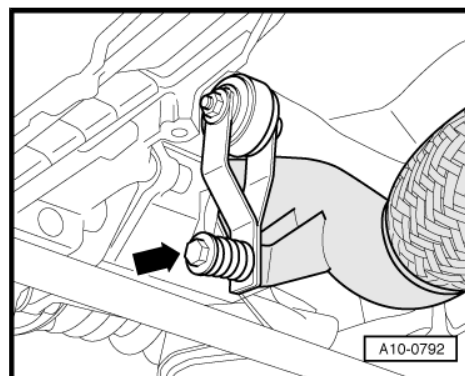
- Remove noise insulation -arrows-.



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



- Unbolt bracket for exhaust system -arrow-.



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 Note

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

- Separate exhaust system at clamp -arrows-.
- Remove front exhaust pipe with catalytic converter.

Installing

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

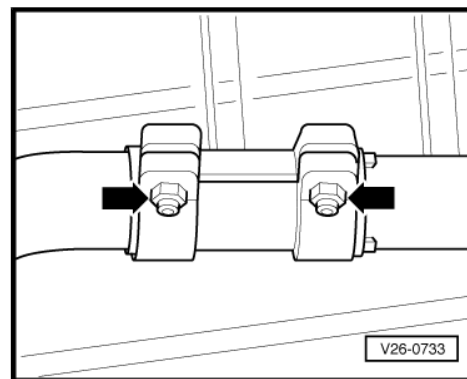
 Note

- ◆ *Renew seals and gaskets.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- ◆ *Fit all cable ties in the original positions when installing.*

- Align exhaust system free of stress ⇒ [page 160](#) .

Tightening torques

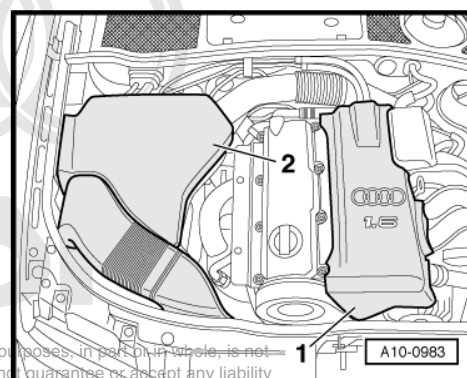
Component	Nm
Front exhaust pipe to catalytic converter	25 ¹⁾
bracket for front exhaust pipe	25
Catalytic converter to exhaust manifold	40 ¹⁾
Drive shaft heat shield to gearbox	23
• ¹⁾ Renew nuts.	



1.5 Removing and installing exhaust manifold

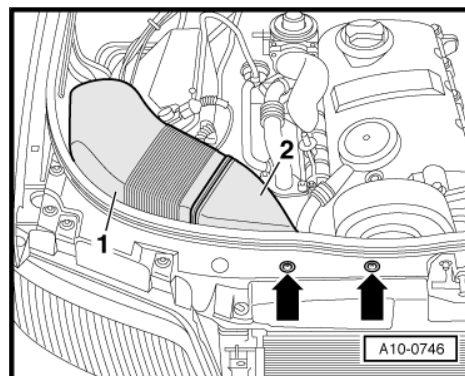
Removing

- Remove engine cover panel -1-.
- Remove air cleaner cover -2-.

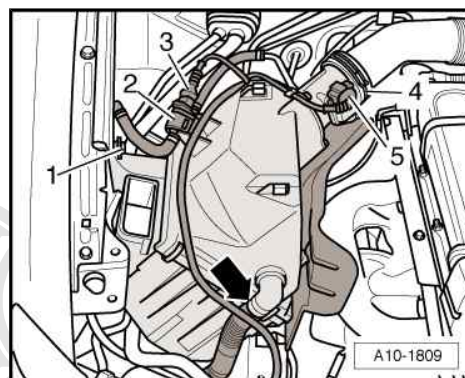


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- Unscrew bolts -arrows-.
- Remove air ducts -1- and -2-.



- Unplug electrical connectors -3- and -5- for active charcoal filter system solenoid valve 1 -N80- and air mass meter -G70- .
- Detach active charcoal filter system solenoid valve 1 -N80- item 2- from air cleaner housing.
- Disconnect hose connection going to secondary air pump -arrow-.
- Release hose clip -4- for air pipe at air mass meter.
- Unscrew bolt -1- and remove air cleaner housing.



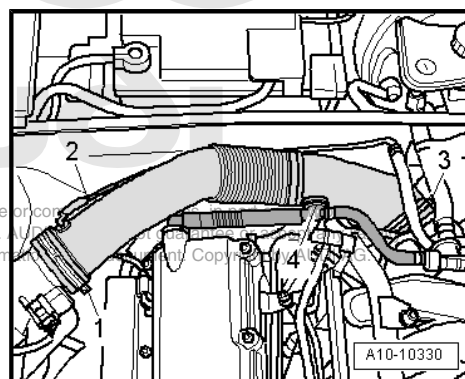
- Detach hose -2- leading to exhaust gas recirculation valve -N18- .
- Detach crankcase breather hose -4- from air pipe.
- Loosen hose clip -3- to remove air pipe.



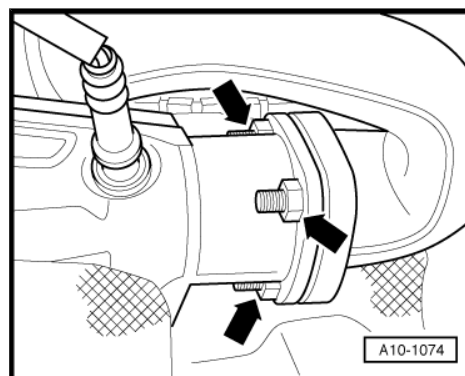
Note

Disregard -item 1-.

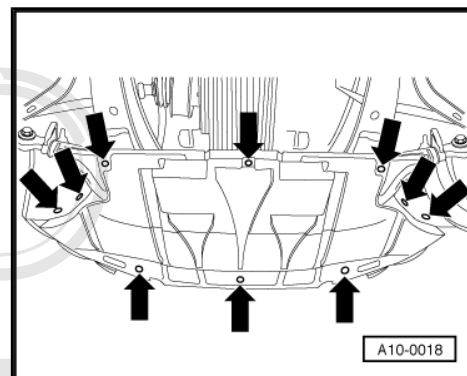
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- Unscrew nuts -arrows- of bolt connection at catalytic converter/exhaust manifold.

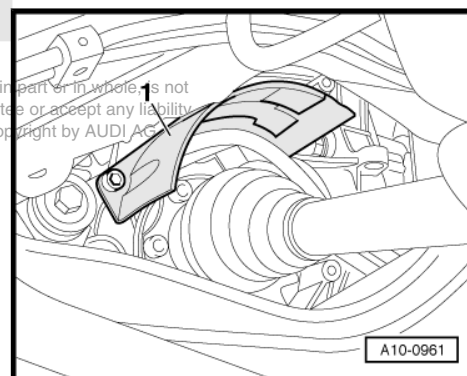


- Remove noise insulation -arrows-.

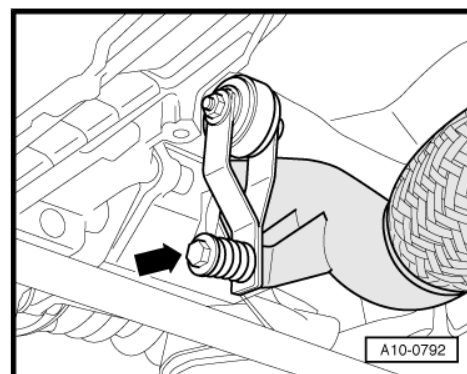


- Unbolt heat shield -1- for drive shaft (right-side).

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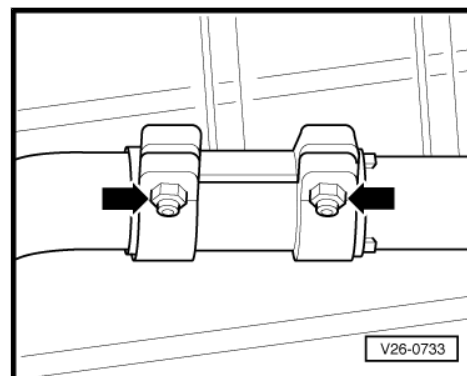
- Unbolt bracket for exhaust system -arrow-.



Note

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

- Separate exhaust system at clamp -arrows-.
- Detach catalytic converter from exhaust manifold.



- Remove connecting pipe for exhaust gas recirculation by unscrewing connections -1- and -2-.
- Unscrew nuts -arrows- and remove exhaust manifold.

Installing

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



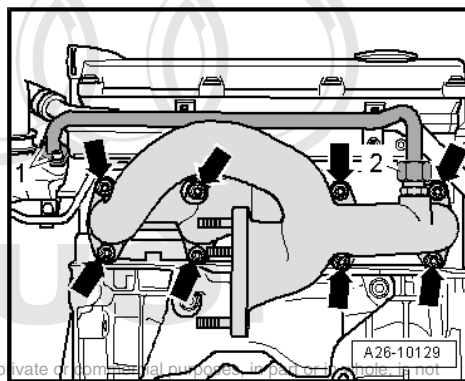
Note

Renew gaskets and self-locking nuts.

- Install front exhaust pipe together with catalytic converter
⇒ [page 154](#) .
- Align exhaust system free of stress ⇒ [page 160](#) .

Tightening torques

Component	Nm
Exhaust manifold to cylinder head	25 ¹⁾²⁾
EGR connecting pipe to exhaust manifold	30
connection	10
• 1) Renew self-locking nuts. • 2) Coat with high-temperature paste; refer to ⇒ Parts catalogue .	



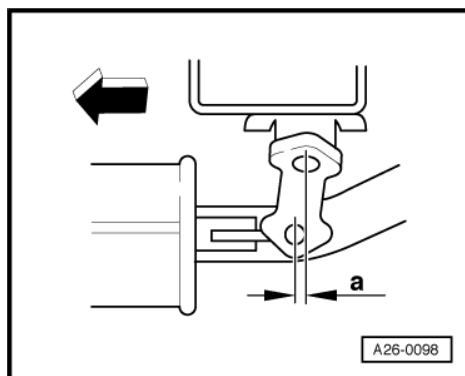
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1.6 Stress-free alignment of exhaust system

- The exhaust system must be aligned when it is cool.

Vehicles without clamp between centre silencer and rear silencer

- Loosen bolt connections of front clamp
⇒ [Item 24 \(page 150\)](#) .
- Push exhaust system towards front of vehicle -arrow-, so that rubber mountings for rear silencer are preloaded by dimension -a- = 7 ... 9 mm.
- Tighten bolts on front clamp ⇒ [Item 24 \(page 150\)](#) evenly to 40 Nm.
- Align the tailpipe ⇒ [page 161](#) .



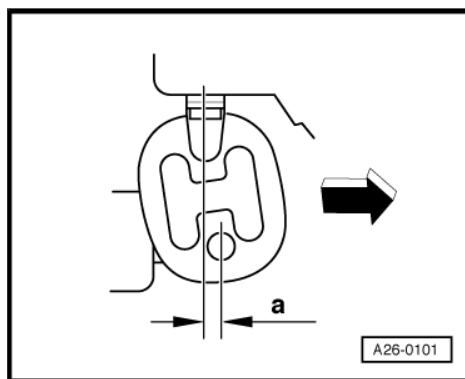
Vehicles with clamp between centre silencer and rear silencer



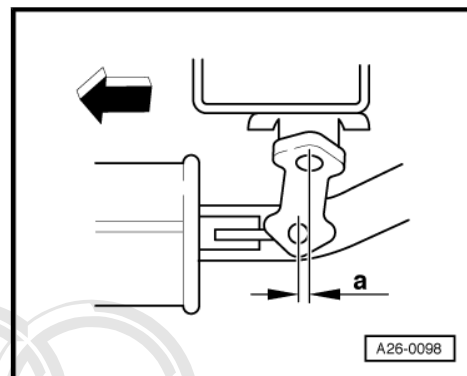
Note

On vehicles with clamp fitted between centre silencer and rear silencer, it is also necessary to align the centre silencer.

- Loosen bolts on front clamp ⇒ [Item 24 \(page 150\)](#) and rear clamp ⇒ [Item 2 \(page 149\)](#) .
- Push front section of exhaust system towards front of vehicle -arrow- so that rubber mountings for centre silencer are preloaded by dimension -a- = 7 ... 9 mm.
- Tighten bolts on front clamp ⇒ [Item 24 \(page 150\)](#) evenly to 40 Nm.



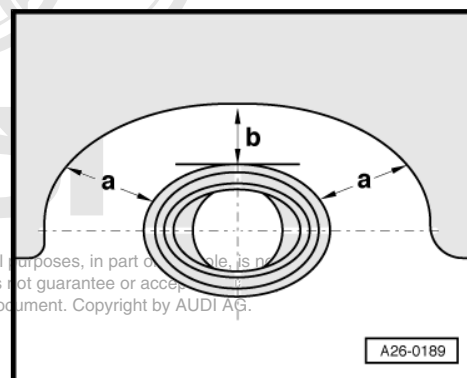
- Push rear section of exhaust system towards front of vehicle -arrow-, so that rear rubber mountings for rear silencer are preloaded by dimension -a- = 7 ... 9 mm.
- Align rear silencer horizontally.
- Tighten bolts on rear clamp $\Rightarrow$ [Item 2 \(page 149\)](#) evenly to 40 Nm.
- Align the tailpipe $\Rightarrow$ [page 161](#) .



1.7 Tailpipe alignment

Procedure

- Align rear silencer so that distances -a- and -b- between bumper cut-out and tailpipe are equal.
- Distances -a- and -b- = 33 ... 39 mm
- If necessary, check whether the exhaust system is aligned free of stress $\Rightarrow$ [page 160](#) .



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1.8 Checking exhaust system for leaks

- Start engine and run at idling speed.
- Plug tailpipe with cloth or plug, etc. while checking for leaks.
- Listen at joints between cylinder head/exhaust manifold, exhaust manifold/front exhaust pipe etc. to check for leaks.
- Repair any leaks that are found.

2 Exhaust gas recirculation system



Note

- ◆ *Under certain operating conditions, exhaust gas is fed into the intake air via the exhaust gas recirculation valve -N18-. By means of this mixture, a lowering of the combustion temperature and consequently an improvement of the exhaust gas composition is achieved.*
- ◆ *The exhaust gas recirculation valve -N18- is activated by the engine control unit.*
- ◆ *Pulsed actuation makes it possible to obtain any required valve position.*
- ◆ *The exhaust gas recirculation potentiometer -G212- signals the current position of the exhaust gas recirculation valve -N18- to the engine control unit. The valve and the potentiometer are integrated in a single component.*
- ◆ *If the exhaust gas recirculation valve -N18- is blocked in the open position, this is noticeable due to poor idling characteristics.*

2.1 Exhaust gas recirculation system - exploded view of components

1 - Gasket

- ☐ Renew

2 - Exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer - G212-

- ☐ Removing and installing
⇒ [page 171](#)
- ☐ Adapt to engine control unit after renewing
⇒ Vehicle diagnosis, testing and information system VAS 5051
- ☐ Checking adaption of zero position
⇒ [page 164](#)
- ☐ Checking (electrical test) ⇒ [page 165](#)

3 - Breather hose

- ☐ Leading to air intake hose

4 - Electrical connector

5 - Connecting flange

6 - 22 Nm

7 - Threaded connection, 35 Nm

8 - Union nut, 30 Nm

9 - Connecting pipe for exhaust gas recirculation

10 - 10 Nm

11 - Throttle valve module - J338-

12 - 10 Nm

13 - Connection

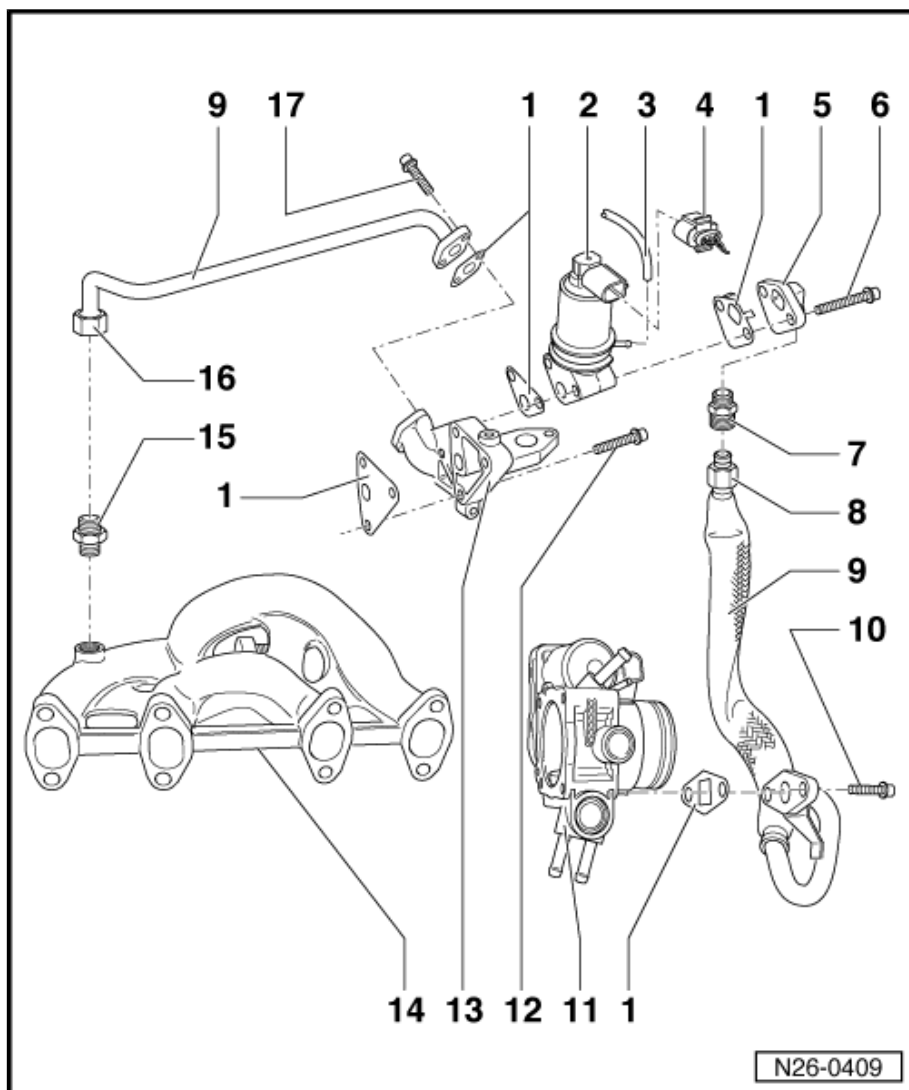
- ☐ For combination valve for secondary air and exhaust gas recirculation valve -N18-

14 - Exhaust manifold

15 - Threaded connection, 35 Nm

16 - Union nut, 30 Nm

17 - 10 Nm



2.2 Checking adaption of zero position for exhaust gas recirculation valve -N18-

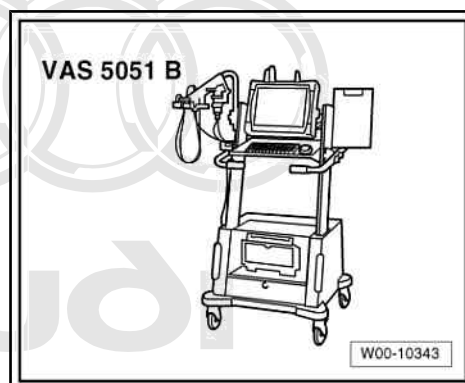


Note

- ◆ After replacing the engine control unit or the exhaust gas recirculation valve -N18-, the engine control unit and the exhaust gas recirculation valve must be adapted to one another
⇒ Vehicle diagnosis, testing and information system VAS 5051.
- ◆ Check the adaption status and the zero position before performing repair measures.

Special tools and workshop equipment required

- ◆ Vehicle diagnostic, testing and information system -VAS 5051-



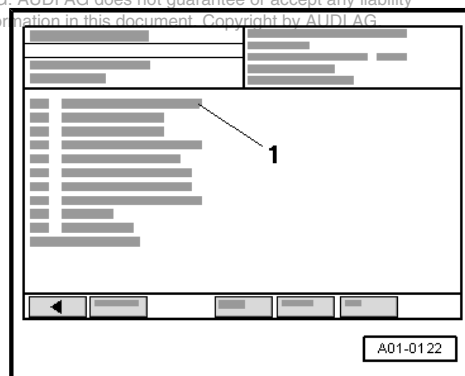
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Procedure

- Connect vehicle diagnostic, testing and information system -VAS 5051- and select vehicle system "01 - Engine electronics" from list. Engine must be idling.

Display on -VAS 5051-

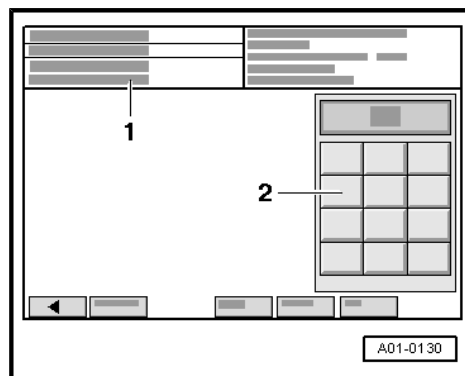
- From the selection menu -1- select diagnostic function "04 - Basic setting".



Display on -VAS 5051-

1 - Enter display group

- Enter "74" on keypad -2- for "display group 074" and confirm your entry by pressing the key.

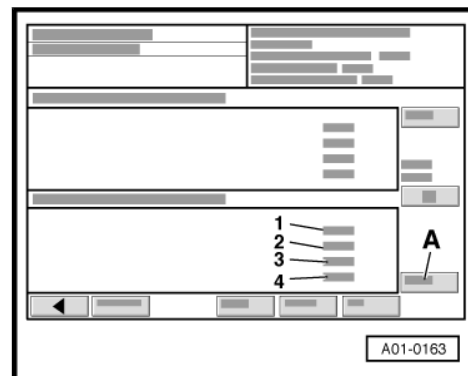


- Activate basic setting by touching **Activate** key -A-.

Display on -VAS 5051-

- Check display in zones -1- and -4-.

Display zones		Explanatory notes
1	x,x V	Zero position • Specification: 0.3 ... 1.2 V ¹⁾
4	...	Adaption status “ADP. runs” “ADP. O.K.” “ERROR” • Specification: “ADP. O.K.” ²⁾
• ¹⁾ If the specification is not attained, check the exhaust gas recirculation valve -N18- for dirt and foreign objects; renew valve if necessary. • ²⁾ If the specification is not attained: Perform electrical check of exhaust gas recirculation valve -N18- .		



Note

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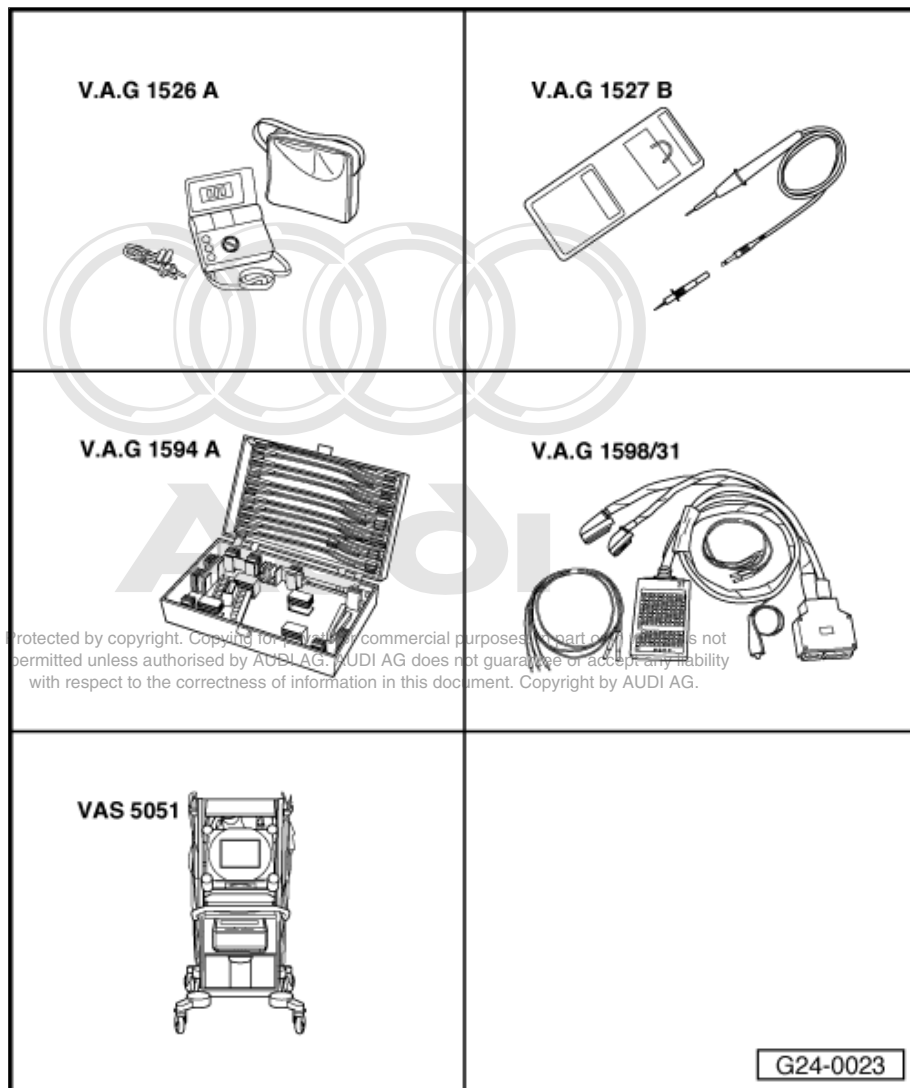
The abbreviation “ADP” in display zone 4 stands for “Adaption”.

- Exit function “04 - Basic setting” by pressing the  key.
- Press “06 - End output”.
- Switch off ignition.

2.3 Performing electrical check of exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer -G212-

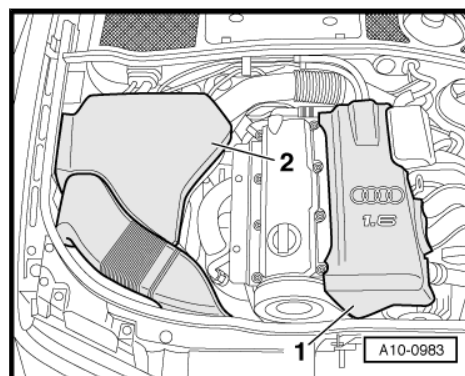
Special tools and workshop equipment required

- ◆ Hand-held multimeter - V.A.G 1526 B- or -V.A.G 1526 A-
- ◆ Voltage tester -V.A.G 1527 B-
- ◆ Auxiliary measuring set - V.A.G 1594 C- or -V.A.G 1594 B-
- ◆ Adapter cable -V.A.G 1598/31- (test box)
- ◆ Vehicle diagnosis, testing and information system - VAS 5051-

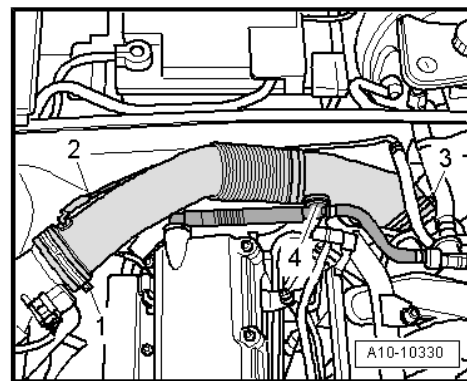


Checking internal resistance

- Remove engine cover panel -1-.
- Remove air cleaner cover -2-.



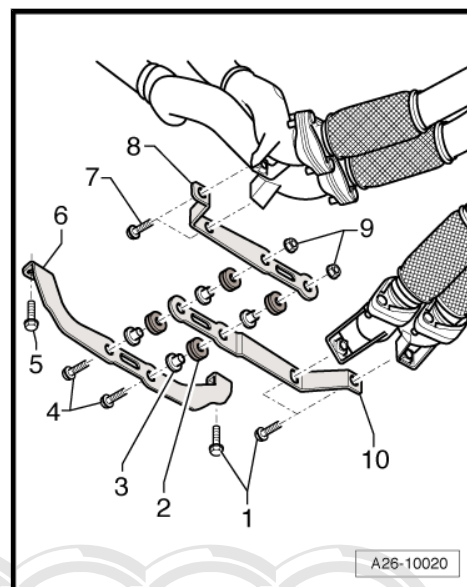
- Detach hose -2- leading to exhaust gas recirculation valve -N18- .
- Detach crankcase breather hose -4- from air pipe.
- Remove air pipe by releasing hose clips -1- and -3-.



- Unplug electrical connector -3- at exhaust gas recirculation valve -N18- .

**Note**

Ignore items marked -1-, -2- and -4-.



- Connect up multimeter for resistance measurement as follows.

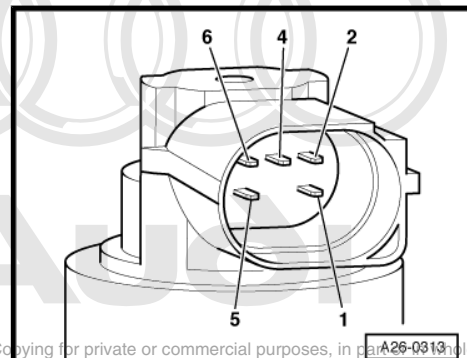
Component	Connector Contact	Specification at room temperature
Exhaust gas recirculation valve -N18-	-1- + -5-	7.5 ... 8.5 Ω
Potentiometer for exhaust gas recirculation -G212-	-2- + -4- -2- + -6-	2.6 ... 4.8 Ω 0.5 ... 6.3 Ω

If the specifications are not obtained:

- Renew exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer -G212- [⇒ page 171](#) .

If the specifications are obtained:

- Check voltage supply for exhaust gas recirculation valve -N18- .



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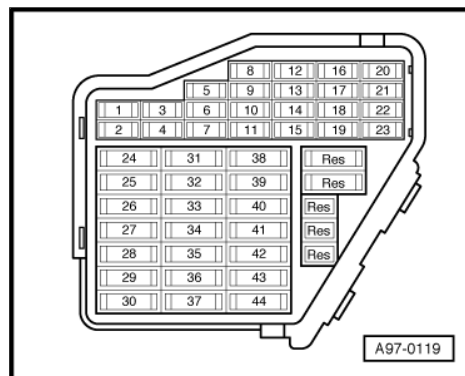
Checking voltage supply for exhaust gas recirculation valve -N18-

- Fuse in fuse holder -S243- (position 43) OK.



Note

The voltage supply for the exhaust gas recirculation valve is taken from fuse in fuse holder -S243- .



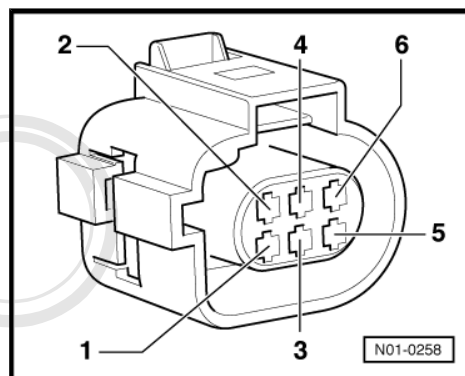
- Connect voltage tester -V.A.G 1527 B- between contact -1- and earth.
- Switch on ignition.
- The LED should light up.
- Switch off ignition.

If LED does not light up:

- Use current flow diagram to check for open circuit in wiring leading from contact -1- of connector.
- Repair wiring connection if necessary.

If the LED lights up:

- Check voltage supply of exhaust gas recirculation potentiometer -G212- .

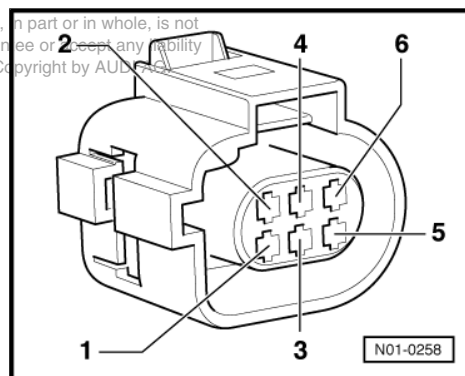


Checking voltage supply for exhaust gas recirculation potentiometer -G212-

- Connect multimeter between contacts -2- and -4- of connector to measure voltage.
- Switch on ignition.
- Specification: 4.5 ... 5.5 V
- Switch off ignition.

If specification is not obtained:

- Connect adapter cable -V.A.G 1598/31- (test box) to connectors of wiring harness; do not connect engine control unit. Connect earth clip of test box to earth ⇒ Rep. Gr. 24 .



Caution

To avoid damage to the electronic components, select the required measuring range and observe test conditions before connecting the test leads.

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

Connector Contact	Adapter cable -V.A.G 1598/31- (test box) Socket
-2-	96
-4-	84

- Repair wiring connection if necessary.

If wiring is OK:

- Renew engine control unit.

Checking signal wire between exhaust gas recirculation potentiometer -G212- and engine control unit

- Connect adapter cable -V.A.G 1598/31- (test box) to connectors of wiring harness; do not connect engine control unit. Connect earth clip of test box to earth ⇒ Rep. Gr. 24. .



Caution

To avoid damage to the electronic components, select the required measuring range and observe test conditions before connecting the test leads.

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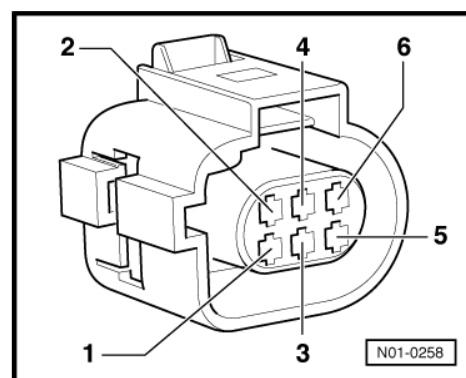
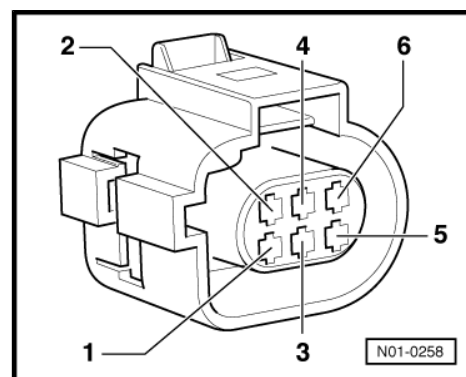
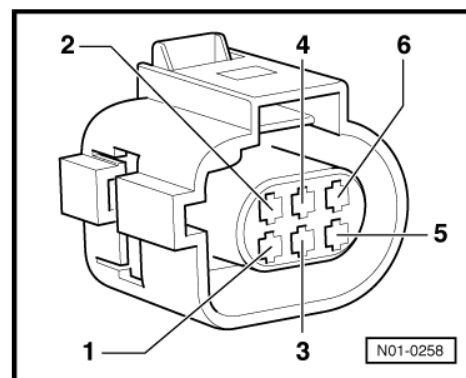
- Check for open circuit and short to positive or earth in the following wiring:

Connector Contact	Adapter cable -V.A.G 1598/31- (test box) Socket
-6-	108

- Repair wiring connection if necessary.

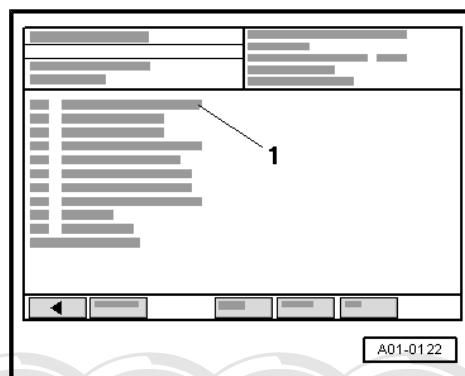
Checking activation of exhaust gas recirculation valve -N18-

- Voltage supply OK.
- Connect voltage tester -V.A.G 1527 B- to contacts -1- and -5- of the connector.
- Connect vehicle diagnostic, testing and information system -VAS 5051- and select vehicle system "01 - Engine electronics" from list. When doing this, the ignition must be switched on.



Display on -VAS 5051-

- From the menu -1- select the diagnostic function "03 - Final control diagnosis".



Display on -VAS 5051-

- Press the button repeatedly until the exhaust gas recirculation valve -N18- is activated.
- LED should flash slowly.



Note

Voltage testers with a low current draw do not go out completely between activation signals from engine control unit, but continue to glow slightly and become distinctly brighter on activation.

- Exit function "03 - Final control diagnosis" by pressing the .
- Press "06 - End output".
- Switch off ignition.

If the LED does not flash:

- Connect adapter cable -V.A.G 1598/31- (test box) to connectors of wiring harness; do not connect engine control unit. Connect earth clip of test box to earth ⇒ Rep. Gr. 24 .



Caution

To avoid damage to the electronic components, select the required measuring range and observe test conditions before connecting the test leads.

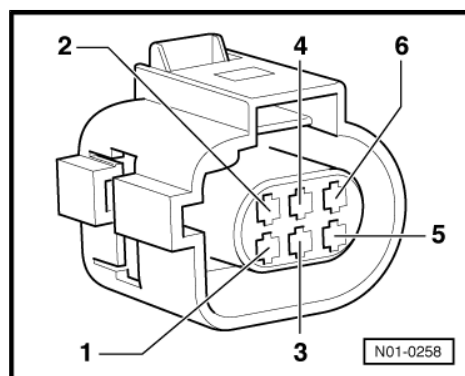
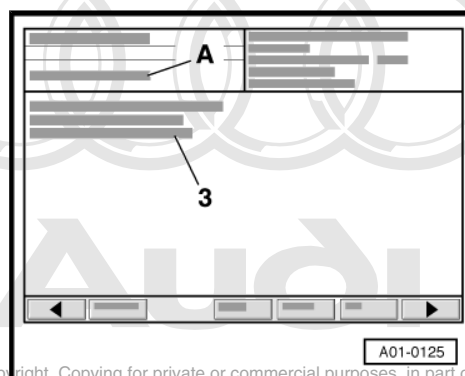
- Check for open circuit and short to positive or earth in the following wiring:

Connector Contact	Adapter cable -V.A.G 1598/31- (test box) Socket
-5-	115

- Repair wiring connection if necessary.

If wiring is OK:

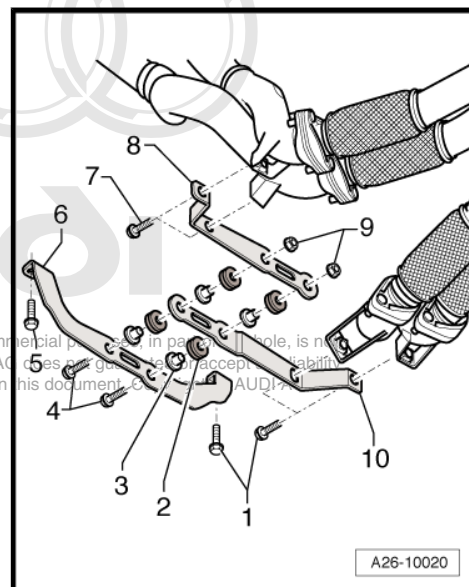
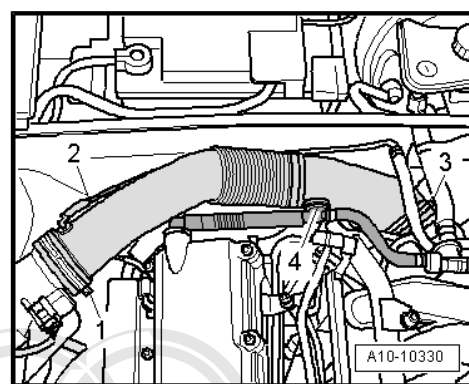
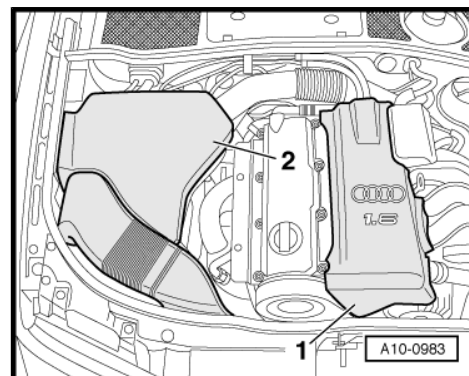
- Renew engine control unit.



2.4 Removing and installing exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer -G212-

Removing

- Remove engine cover panel -1-.
- Remove air cleaner cover -2-.
- Detach hose -2- leading to exhaust gas recirculation valve -N18-.
- Detach crankcase breather hose -4- from air pipe.
- Remove air pipe by releasing hose clips -1- and -3-.
- Unplug electrical connector -3- at exhaust gas recirculation valve -N18-.
- Remove bolts -1- and -4-.
- Detach exhaust gas recirculation valve -N18-.



Note

Disregard -item 2-.

Installing

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



Note

- ◆ Renew seals and gaskets.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.
- If a new exhaust gas recirculation valve -N18- is fitted, perform adaption of zero position ⇒ [page 164](#).

Tightening torque

Component	Nm
Exhaust gas recirculation valve -N18- to connecting piece	22

3 Secondary air system

The secondary air system is designed to enable the catalytic converter to heat up and reach its operating temperature more quickly after a cold start.

3.1 Principle and function

Principle

The over-enrichment of the mixture in the cold start phase produces a higher proportion of unburnt hydrocarbons in the exhaust gas. The secondary air system improves the afterburning (oxidation) process in the catalytic converter, and thus reduces toxic emissions. The heat generated by oxidation accelerates the "light off" of the catalytic converter and significantly improves exhaust gas quality during warm-up.

Function

The engine control unit activates the secondary air pump motor - V101- via the secondary air pump relay -J299-. The stream of air from the secondary air pump opens the combination valve for secondary air and permits air to flow into the exhaust system upstream of the catalytic converter.

1 - Secondary air pump motor -V101-

- ☐ Fitting location
⇒ [page 173](#)

2 - Air cleaner

3 - Combination valve for secondary air system

- ☐ Fitting location
⇒ [page 173](#)
- ☐ Removing and installing
⇒ [page 183](#)

4 - Throttle valve module - J338-

5 - Secondary air pump relay - J299-

- ☐ Fitting location
⇒ [page 173](#)

6 - Simos control unit -J361-

- ☐ Fitting location
⇒ [page 173](#)

7 - Non-return valve

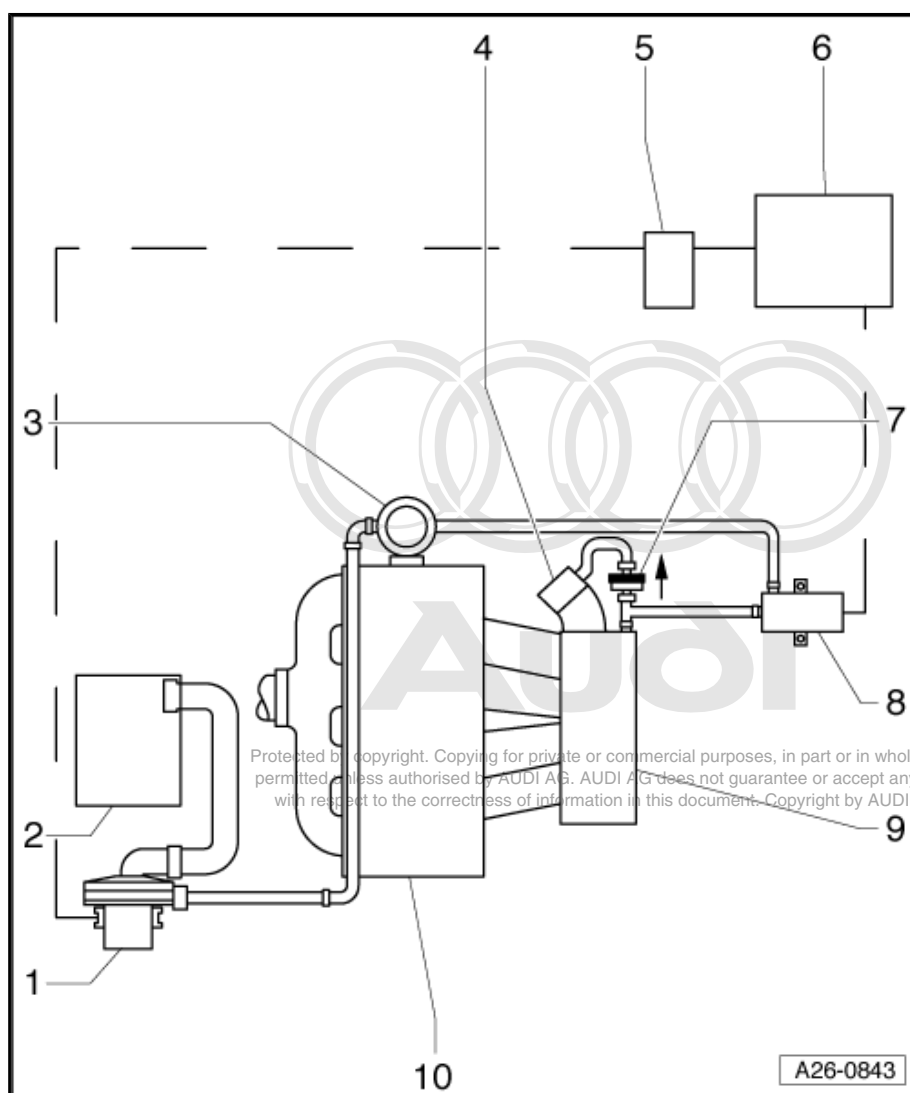
- ☐ Installation position: as shown in illustration, the arrow points in direction of flow

8 - Secondary air inlet valve - N112-

- ☐ Fitting location
⇒ [page 173](#)
- ☐ Checking ⇒ [page 173](#)

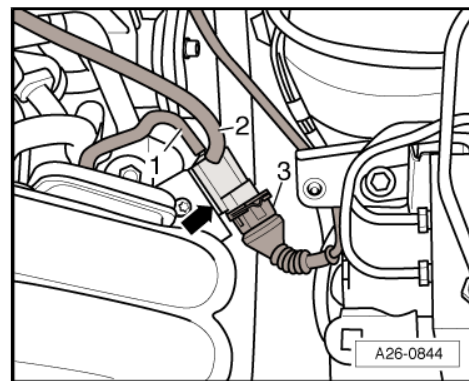
9 - Intake manifold

10 - Cylinder head

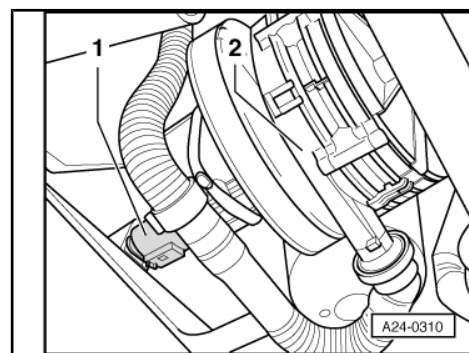


Fitting location of secondary air inlet valve -N112-

- ◆ At rear left of intake manifold, below coolant expansion tank -arrow-.

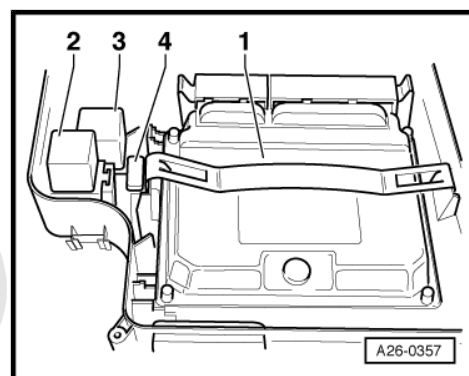
**Fitting location of secondary air pump motor -V101-**

- ◆ At front right in engine compartment below longitudinal member

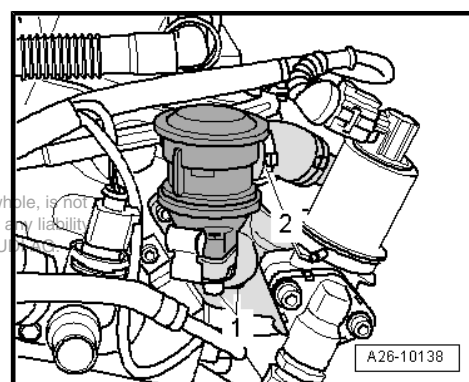
**Fitting location of secondary air pump relay -J299-**

- ◆ In electronics box (plenum chamber).

- 1 - Simos control unit -J361-
- 2 - Secondary air pump relay -J299-
- 4 - Secondary air pump fuse -S130-

**Fitting location of combination valve for secondary air**

- ◆ At rear right of cylinder head, below intake hose.



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3.2 Checking secondary air inlet valve -N112-

Special tools and workshop equipment required

- ◆ Hand-held multimeter - V.A.G 1526 A- or -V.A.G 1526 B-
- ◆ Voltage tester - V.A.G 1527 B-
- ◆ Auxiliary measuring set - V.A.G 1594 A- or -V.A.G 1594 C-
- ◆ Adapter cable -V.A.G 1598/31- (test box)
- ◆ Vehicle diagnosis, testing and information system - VAS 5051-

V.A.G 1526 A 	V.A.G 1527 B
V.A.G 1594 A 	V.A.G 1598/31
VAS 5051 	

G24-0023

Procedure

- Vehicle diagnostic, testing and information system -VAS 5051- is connected; vehicle self-diagnosis and vehicle system "01 - Engine electronics" is selected. When doing this, the ignition must be switched on.
- Fault memory of engine control unit interrogated.

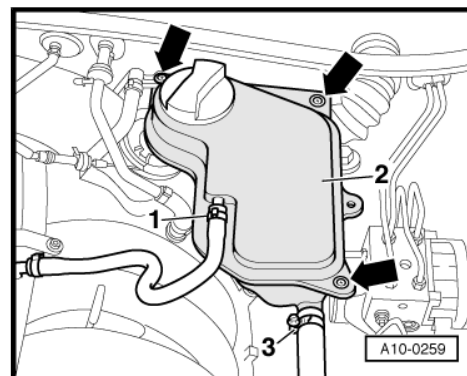


Note

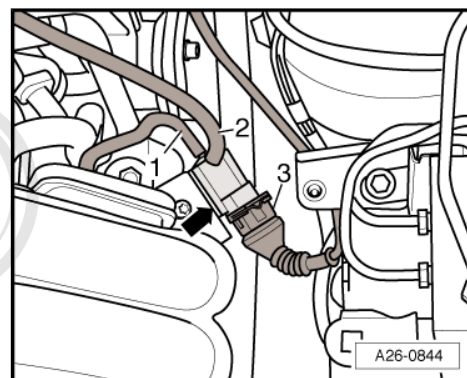
The secondary air inlet valve -N112- and the wiring connections are monitored by the engine control unit.

If a fault relating to secondary air inlet valve -N112- is displayed:

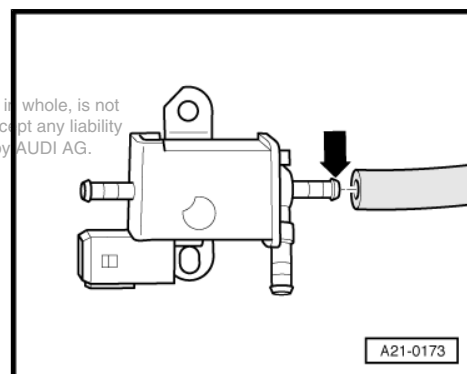
- Unbolt coolant expansion tank -2- -arrows-.
- Unplug electrical wire for coolant shortage indicator switch - F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -3- attached.



- Disconnect hoses -1- and -2- from secondary air inlet valve; leave electrical connector -3- attached.



- Connect test hose to the valve connector marked with an -arrow-.



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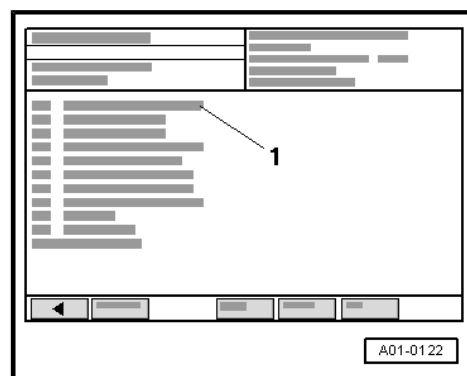
Display on -VAS 5051-

- From the menu -1- select the diagnostic function "03 - Final control diagnosis".
- Press the  button several times until the secondary air inlet valve -N112- is activated.
- The valve should click and open and close (check by blowing into the test hose).
- Exit function "03 - Final control diagnosis" by pressing the  key, and switch off the ignition.

If valve does not open or close correctly:

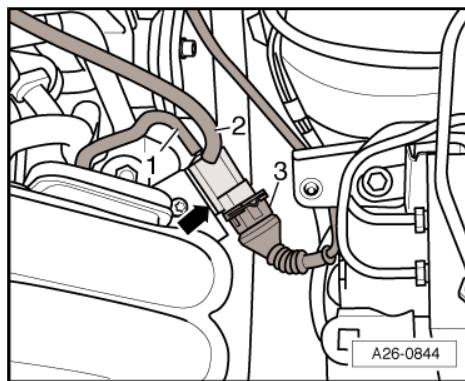
- Renew secondary air inlet valve -N112- .

If valve does not click during final control diagnosis:



Checking internal resistance

- Unplug electrical connector -3- at secondary air inlet valve -N112- .

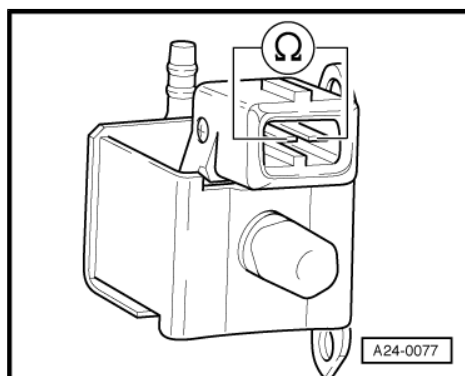


- Connect multimeter (resistance measuring range) to valve.
- Specification: 25 ... 35 Ω .

If the specification is not attained:

- Renew secondary air inlet valve -N112- .

If the specification is obtained:



Checking voltage supply

- Fuse for secondary air inlet valve OK.
- Fuel pump relay -J17- OK.



Note

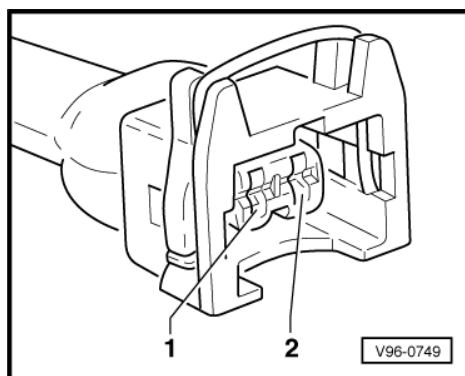
The secondary air inlet valve -N112- is supplied with power via the fuel pump relay.

- Connect voltage tester -V.A.G 1527 B- between contact -1- and earth.
- Operate the starter briefly.
- The LED should light up.

If LED does not light up:

- Repair wiring from contact -1- of connector, via fuse, to fuel pump relay (refer to current flow diagram).

If the LED lights up:



Checking activation

- Connect voltage tester -V.A.G 1527 B- between contacts -1- and -2-.
- Repeat function “03 - Final control diagnosis”.
- Press the  button several times until the secondary air inlet valve -N112- is activated.
- The LED should flash.
- Exit function “03 - Final control diagnosis” by pressing the  key, and switch off the ignition.

If the LED does not flash:

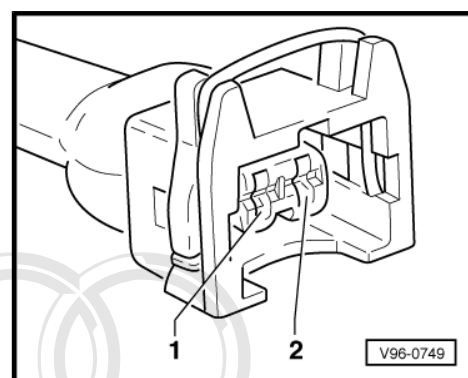
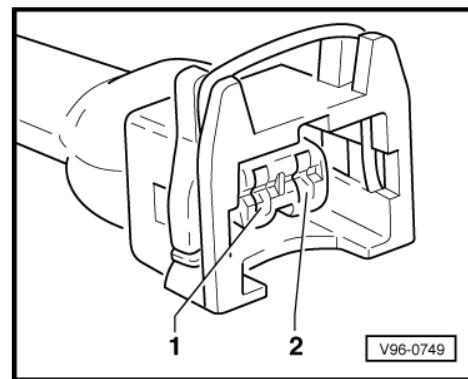
- Connect adapter cable -V.A.G 1598/31- (test box) to wiring harness for engine control unit, but do not connect the engine control unit itself ⇒ Rep. Gr. 24 .
- Check for open circuit and short to positive or earth in the following wiring:

Connector Contact	Adapter cable -V.A.G 1598/31- (test box) Socket
-2-	71

- Repair wiring connection if necessary.

If no fault in wire is detected:

- Renew engine control unit.



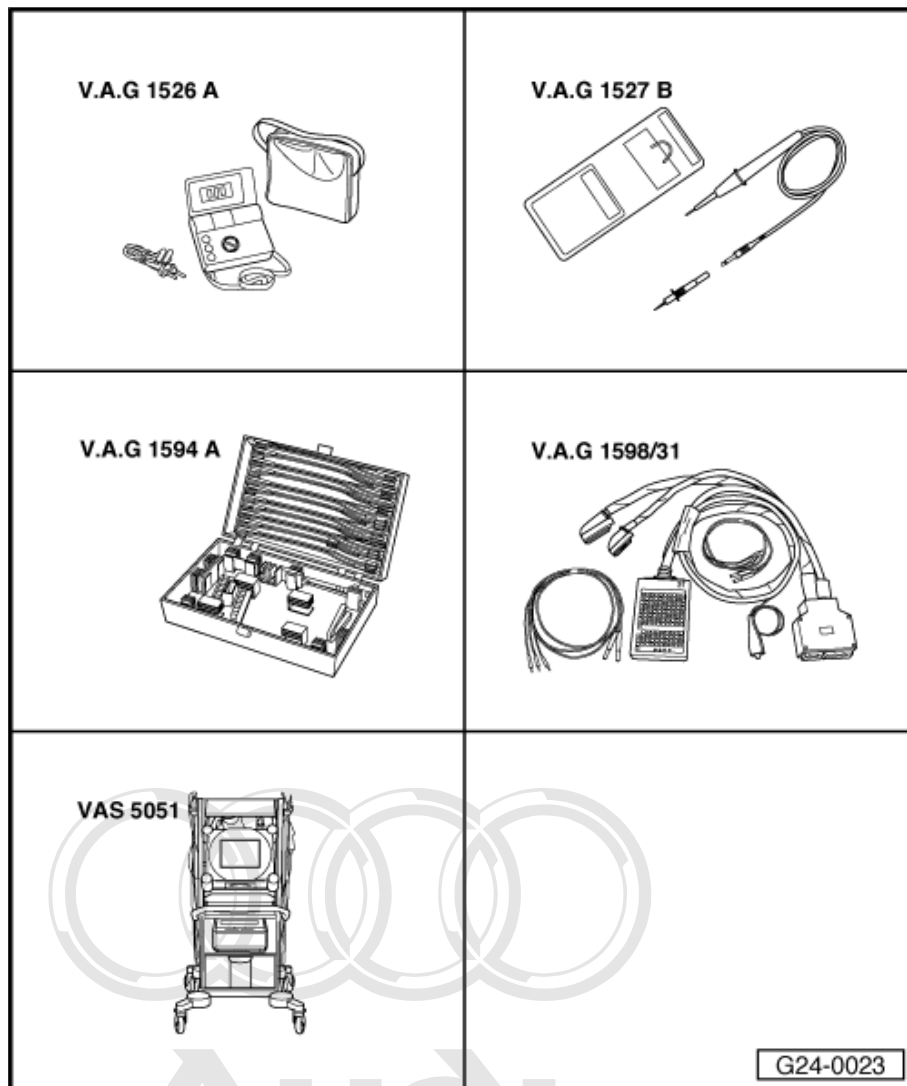
3.3 Checking secondary air pump relay -J299- and activation



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Special tools and workshop equipment required

- ◆ Hand-held multimeter - V.A.G 1526 A- or -V.A.G 1526 B-
- ◆ Voltage tester - V.A.G 1527 B-
- ◆ Auxiliary measuring set - V.A.G 1594 A- or -V.A.G 1594 C-
- ◆ Adapter cable -V.A.G 1598/31- (test box)
- ◆ Vehicle diagnosis, testing and information system - VAS 5051-



Procedure

- Vehicle diagnostic, testing and information system-VAS 5051- is connected; vehicle self-diagnosis and vehicle system "01 - Engine electronics" is selected. When doing this, the ignition must be switched on.
- Fault memory of engine control unit interrogated.

Display on -VAS 5051-

- From the menu -1- select the diagnostic function "03 - Final control diagnosis".
- Press the button until the secondary air pump relay -J299- is activated.



- The secondary air pump relay -J299- -item 2- (located in electronics box in plenum chamber) should pick up and the secondary air pump motor -V101- should start up intermittently.
- Exit function “03 - Final control diagnosis” by pressing the  key, and switch off the ignition.

A - If the relay does not pick up:

- Check voltage supply of secondary air pump relay -J299-
⇒ [page 179](#) .
- Check activation of secondary air pump relay -J299-
⇒ [page 180](#) .

B - If the relay picks up but the secondary air pump motor -V101- does not run:

- Check voltage supply for secondary air pump motor -V101-
⇒ [page 181](#) .

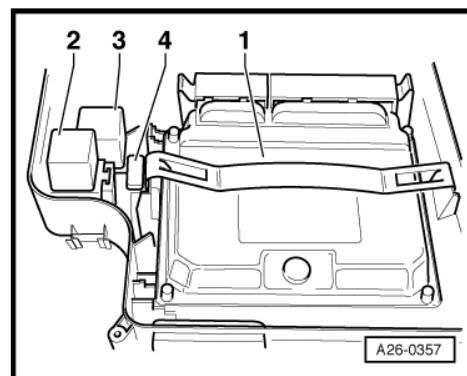
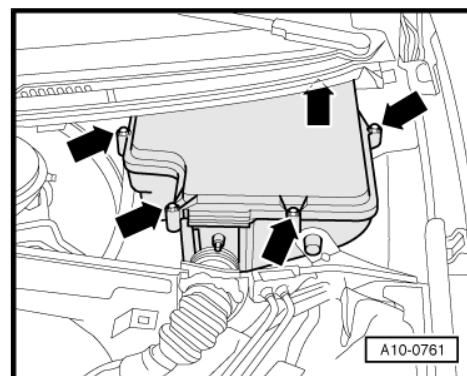
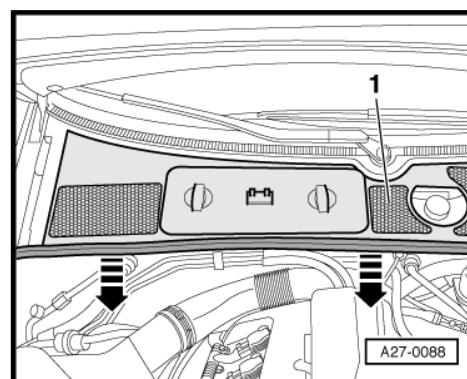
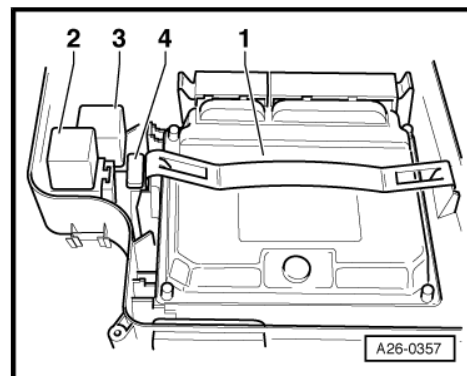
Checking voltage supply for secondary air pump relay -J299-

- Run windscreen wipers to the vertical position.
- Detach rubber seal from plenum chamber cover in direction of -arrow-.
- Detach plenum chamber cover -1- towards the front.

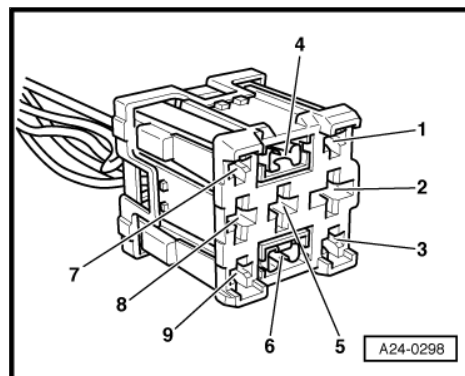
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- Remove cover for electronics box in plenum chamber -arrows-.

- Disconnect secondary air pump relay -J299- -Item 2-.

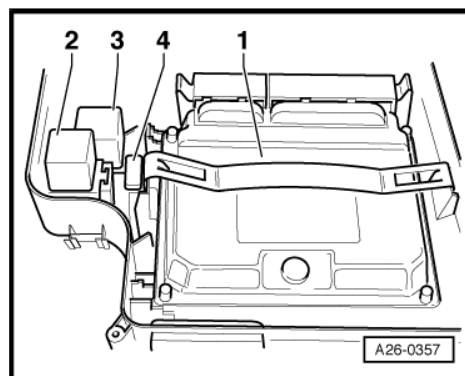


- Connect multimeter (voltage measuring range) between relay socket, contact -8- and earth.
- Specification: approx. battery voltage



If specification is not obtained:

- Check secondary air pump fuse -S130- -item 4-.
- Check for open circuit in wiring from battery “+” (terminal 30), via secondary air pump fuse -S130- -item 4- to secondary air pump relay -J299- -item 2-.



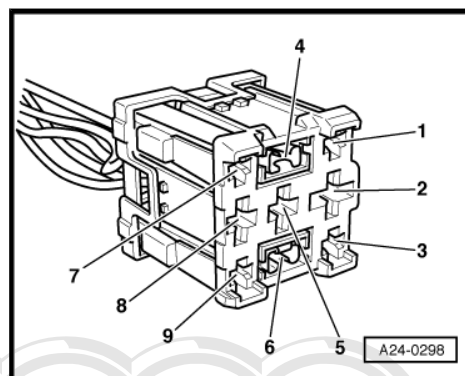
- Connect multimeter (voltage measuring range) between relay socket, contact -4- and earth.
- Operate the starter briefly.
- Specification: approx. battery voltage

If specification is not obtained:

- Repair wiring harness according to current flow diagram.

Checking activation of secondary air pump relay -J299-

- Switch off ignition.
- Disconnect secondary air pump relay -J299- .



- Connect up voltage tester -V.A.G 1527 B- between relay socket contact -6- and battery positive.
- Repeat function "03 - Final control diagnosis".
- Press the  button until the secondary air pump relay -J299- is activated.
- The LED should flash.
- Exit function "03 - Final control diagnosis" by pressing the  key, and switch off the ignition.

If the LED does not flash:

- Connect adapter cable -V.A.G 1598/31- (test box) to wiring harness for engine control unit, but do not connect the engine control unit itself ⇒ Rep. Gr. 24 .
- Check for open circuit and short to positive or earth in the following wiring:

Relay socket contact	Adapter cable -V.A.G 1598/31- (test box) Socket
-6-	72

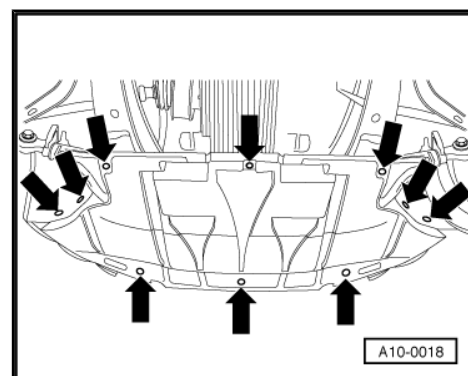
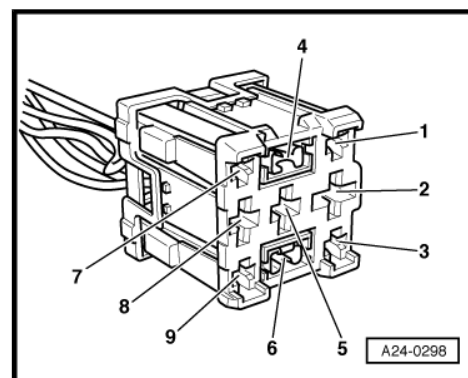
- Repair wiring connection if necessary.

If no fault in wire is detected:

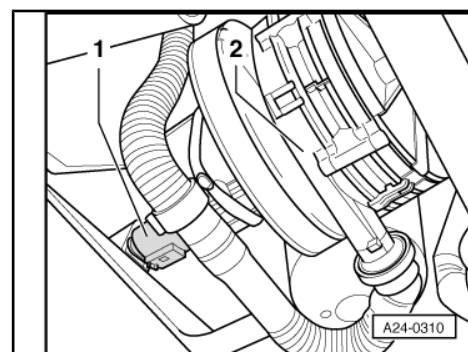
- Renew secondary air pump relay -J299- .

Checking voltage supply for secondary air pump motor -V101-

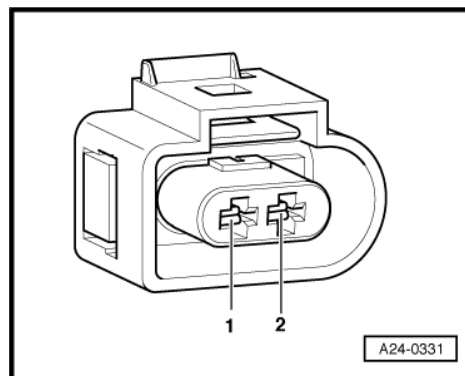
- Remove noise insulation -arrows-.



- Unplug electrical connector -1- at secondary air pump motor -V101- -item 2-.



- Connect voltage tester -V.A.G 1527 B- between contacts -1- and -2-.
- Repeat function “03 - Final control diagnosis”.
- Press the button until the secondary air pump relay -J299- is activated.
- The LED should flash.
- Exit function “03 - Final control diagnosis” by pressing the key, and switch off the ignition.

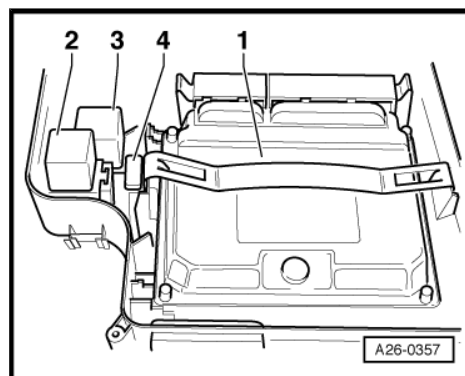


If the LED does not flash:

- Use current flow diagram to check for open circuit in wiring between connector at secondary air pump motor -V101- and secondary air pump relay -J299- -item 2- (in electronics box in plenum chamber).
- Use current flow diagram to check for open circuit in wiring between connector at secondary air pump motor -V101- and earth.

If no fault is found:

- Renew secondary air pump.



3.4 Checking combination valve for secondary air system for proper operation and leakage

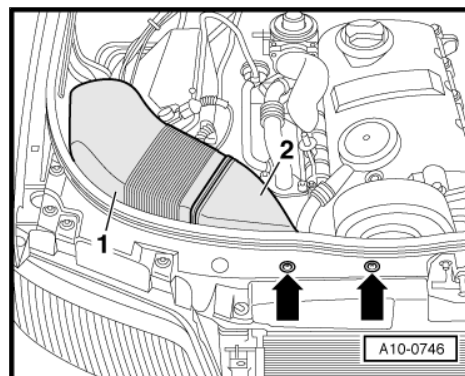
Procedure



Note

Fit all heat insulation sleeves in the original position when installing.

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



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- Pull back heat insulation sleeve and disconnect hose at secondary air pipe by pressing release tabs -arrows-.

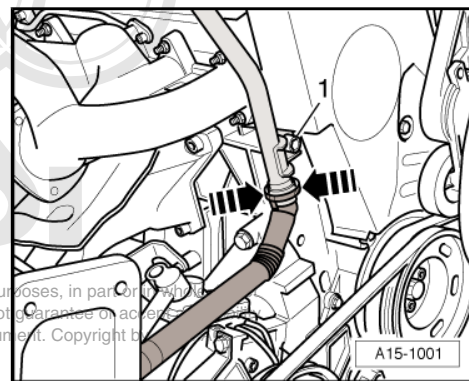
**Note**

Disregard -item 1-.

- Connect an auxiliary hose to pipe leading to combination valve for secondary air and blow **lightly** into pipe with your mouth (do not use compressed air).
- The combination valve for secondary air should be closed; it should not be possible to blow through the hose.
- Blow into pipe with your mouth using more pressure (do not use compressed air).
- The combination valve for secondary air should open; it should now be possible to blow through the hose.

If combination valve for secondary air does not open:

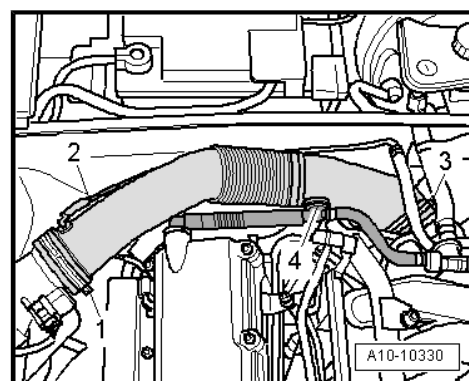
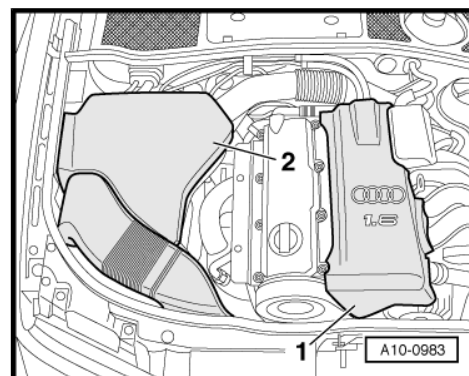
- Renew secondary air combination valve => [page 183](#) .



3.5 Removing and installing combination valve for secondary air system

Removing

- Remove engine cover panel -1-.
- Remove air cleaner cover -2-.
- Detach hose -2- leading to exhaust gas recirculation valve - N18- .
- Detach crankcase breather hose -4- from air pipe.
- Remove air pipe by releasing hose clips -1- and -3-.



- Remove bolts -1-.
- Disconnect hose -2- from combination valve for secondary air.
- Detach combination valve for secondary air.



Note

Shown from rear with engine removed for illustration purposes.

Installing

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

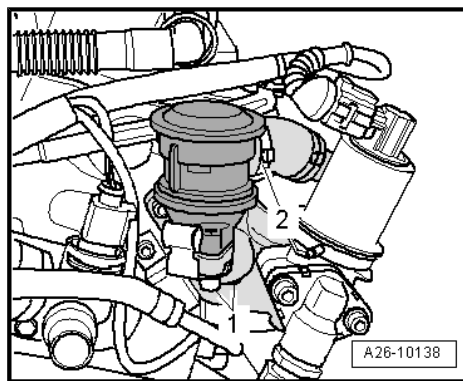


Note

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

Tightening torque

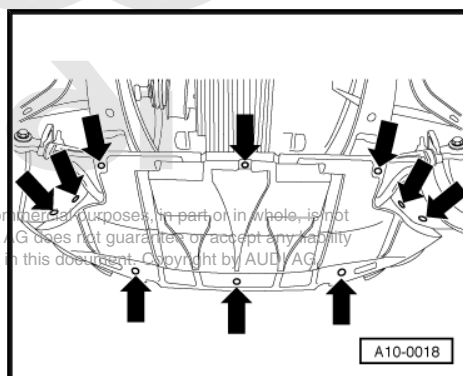
Component	Nm
Combination valve for secondary air to flange	10



3.6 Removing and installing secondary air pump

Removing

- Remove noise insulation -arrows-.



- Unplug electrical connector -1-.
- Disconnect hoses -2- and -3- from secondary air pump.
- Detach secondary air pump -4- from bracket.

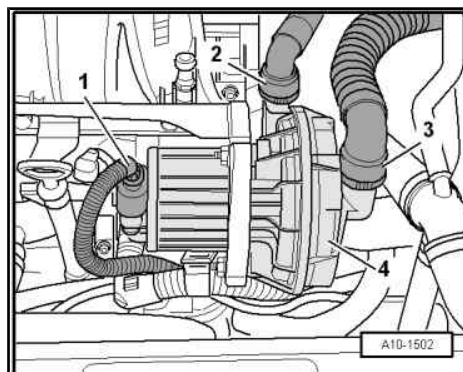
Installing

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



Note

Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.



Tightening torque

Component	Nm
Secondary air pump to bracket	10